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SMOS DPGS

SMOS Level 1 and Auxiliary Data Products Specifications

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Document Change Log

Iss./Rev.	Date	Section / Page	Change Description
1/0	18-Jan-2006	All	First edition of the document
1/1	17-Feb-2006	All	"Counter" field name added
		All	Type, Precision, C format and Comments columns in tables reviewed
		All	Specific Product Header fields reviewed
		All	New fields proposed for Specific Product Header, as per RID DPGS-PDR-NW-54
		All	Scientific descriptions of products included from L1PP documents to make this document stand-alone, as per RID DPGS-PDR-RC-019.
		All	Calculation of DSR size for each table, as per RID DPGS-PDR-RC-018.
		All	SPH numbering made consistent along all sub-elements, as per RID DPGS-PDR-NW-53.
		Section 1.4	References updated
		Section 2.1	Section added to highlight differences between this specifications and L1PP's.
		Section 2.1.1	Section added to introduce the conventions used in the document, as per RID DPGS-PDR-RC-018.
		Section 2.2.1	Figure 2-1 updated to subtract reference to .EEF extension, as per RID DPGS-PDR-NW-50.
		Section 2.2.1	Correct text "one data block containing one dataset" to make clear that there can be several datasets, as per RID DPGS-PDR-NW-39.
		Section 3.1.1	Fixed Header specified here to make the document stand-alone, as per RID DPGS-PDR-RC-019. This also covers DPGS-PDR-NW-51.



Iss./Rev.	Date	Section / Page	Change Description
		Section 4.1.1	Main Product Header specified here to make the document stand-alone, as per RID DPGS-PDR-RC-019. This also covers RID DPGS-PDR-NW-52.
		Section 4.1.2	Clarification on L1 Measurement Products' SPH structure added, as per RID DPGS-PDR-NW-53
		Sections 4.2.1.1, 4.2.4.1.1	Product_Consolidation structure in SPH added to highlight product edges, as per RID DPGS-PDR-SS-88.
		Section 5.1.2	Clarification on L1 Auxiliary Data Products' SPH structure added, as per RID DPGS-PDR-NW-53
1/2	24-Feb-2006	All	Minor error corrections
1/3	18-Apr-2006	All	Major update to align operational products specifications with L1PP's new release.
		1.4	Update of reference documents
		3.1.1	Minor corrections in Fixed Header concerning sizes of strings and time format
		4.1.1/5.1.2.1	Product_schema changed to only Datablock_Schema and moved to SPH. Header schema is given in the first node of the header files.
		4.1.1	Change of Phase field according to L1PP new specifications
		4.1.2	Change of SPH Descriptors for external products as Ext instead of Tar, according to L1PP new specifications
		4.1.2.1	Clarified definitions of Start/Stop_Time_ANX_T from L1PP new specs.
		4.1.2.1	Datablock_Schema moved to SPH
		4.1.2.1 / 5.1.2.1	Byte_Order from List_of_Data_Sets structure moved to higher level in SPH (applies to the whole product, not differently to each dataset)
		4.1.2.2	Byte_Order moved to 4.1.2.1
		4.1.2.2	RFI and BSCAT included in RDS list
		4.2.1.2	NIR_Brightness_Temp deleted to align it with L1PP new specs.
		4.2.1.2	Physical_Temperatures units change
		4.2.1.2	Specification of Physical_Temperatures matrix format
		4.2.2.1.2	Receiver_Temp units change
		4.2.2.2.2	Temperature units change



Iss./Rev.	Date	Section / Page	Change Description
		4.2.2.3.2	FWF different for each polarization; size of product nearly duplicates
		4.2.2.4.2	Clarification on use of NIR_External dataset
		4.2.3.2.2/4.2.3.3.2	Temperature fields format change
		4.2.4.1.2 / 4.2.4.2.2	Confusion on format of Scene_BT_Fourier clarified; product size reviewed
		4.2.4.1.2 / 4.2.4.2.2	Temperature fields units change
		4.2.4.1.2 / 4.2.4.2.2	Flags field specification included
		4.2.5.1.1 / 4.2.5.3.1	Scale specification fields included so as to make the scaling configurable, accordingly also to L1PP new specs.
		4.2.5.1.2 / 4.2.5.2.2 / 4.2.5.3.2	Details on snapshot dataset included
		4.2.5.1.2 / 4.2.5.2.2 /4.2.5.3.2	Radiometric accuracy and Footprint Axes fields changed so as to make its scaling configurable
		4.2.5.1.2 / 4.2.5.2.2 /4.2.5.3.2	Flags specification included
		5.2.1	Format of PMS_ID aligned with L1PP new specs.
		5.2.2	L_DC_V and L_DC_H fields deleted accordingly to L1PP new specs
		5.2.4	Format of Switch_ID aligned with L1PP new specs.
		5.2.4	S_LU magnitude and phase deleted accordingly to L1PP new specs
		5.2.7	Format of LICEF_ID, NIR_ID and PMS_ID aligned with L1PP new specs.
		5.2.8	Format of angles aligned with L1PP new specs.
		5.2.11	Format of galactic maps changes accordingly to L1PP new specs.
		5.2.12 / 5.2.13	Format of Sun/Moon brightness temperatures changes accordingly to L1PP new specs; cross-pol terms added, size reviewed.
		5.2.15	Source of VTEC clarified accordingly to L1PP new specifications
		5.2.17	Strip adaptive apodisation coefficients format specified separately
		5.2.20	RFI mask organisation aligned with L1PP
		5.2.21	FTT product aligned with L1PP new specs; size reviewed



Iss./Rev.	Date	Section / Page	Change Description
		5.2.21	FTT product changed to allow including more than 1 DSR (list)
		5.2.22	New product from L1PP's new specs.
		6	Product size estimations reviewed
1/4	17-May-2006	All	As per RIDs SP-01 and SP-02 at L1P-PDR, renaming of repeated field to avoid confusions
		4.2.5.1.1 and 4.2.5.3.1	Add Sensing_Time to L1C SPH
2/0	26-Jun-2006	All	Minor units corrections for alignment with last L1PP Specifications
		1.3 / 1.4	References updated
		2.1	Website reference updated
		2.1	Update of description of work performed in the document
		2.2.1	Products will not be delivered to Processors as ZIP files.
		2.2.2	Specification of how file counter is obtained
		2.2.3	Presentation of the schemas and XML R/W API repositories, and the schemas versions corresponding to the products specified in this document
		3.1.1	Update of File_Description field table
		3.2	Further clarification that Reference Data Sets are not included in the product
		4.1.1	Update of MPH after harmonisation with other processing levels
		4.1.2	Simplification of SPH naming convention
		4.1.2.1	Update of SPH Main Info after harmonisation between products levels
		4.1.2.2	MDS and RDS separated in two different structures to avoid filling with null values
		4.1.2.2	Update of RDS names
		4.2.1.1	Attitude and NIR Calibration Flags added to support orchestration
		4.2.2.1 / 4.2.2.2	Change of MIR_UNC1A product to MIR_UNCN1A containing individual meas. and MIR_UAVE1A containing average, to support orchestration. Internal calib. with external attitude also considered



Iss./Rev.	Date	Section / Page	Change Description
		4.2.2.3 / 4.2.2.4	Change of MIR_CORN1A product to MIR_CORN1A containing individual meas. and MIR_CORS1A containing short calibration curve, to support orchestration. Internal calib. with external attitude also considered
		4.2.2.5 / 4.2.2.6	Change of MIR_FWAS1A product to MIR_FWAS1A containing individual meas. and MIR_AVFW1A containing average of FWF estimations, to support orchestration. Internal calib. with external attitude also considered
		4.2.2.7	NIR Calibration module receives several L1A HKTM to consolidate all NIR Calibration in one MIR_NIR_1A product
		4.2.3.2	RDS changed for L1A Calibrated Visibilities
		4.2.5.1.1	RSC flag eliminated, as RSC Module is not to be implemented in L1OP
		5.1.1	MPH not included in ADFs
		5.1.2	SPH descriptors simplified
		5.1.2.1	SPH Main Info structure changed accordingly to harmonisation of ADF products (to include info from former MPH)
		5.2.4	Fields renamed to avoid repeating names
		5.2.6 / 5.2.7	Antenna Patterns Coordinates in a different product than Antenna Patterns
		5.2.19	G Matrix RDS changed to include MIR_AVFW1A and not MIR_FWAS1A, and also patterns coordinates product
		5.2.23	BSCAT datablock's structure correction (missing dataset hierarchy)
		5.2.24	Added Time Correlation auxiliary data product
		6	Review of product sizes
2/1	28-Jul-2006	All	Update after L1OP-CDR
		All	Review of all document with proper corrections
		All	Changing naming convention of all internal calibration products, as per Josep Closa's e-mail of 19-Jul-06
		All	Removed the Overlap information (Product_Consolidation structure) provided in the SPHs, as per L1OP-CDR RID JC-27
		All	Gap_Info removed from Headers, as per RID JC-29



Iss./Rev.	Date	Section / Page	Change Description
		All	New fields added to identify missing epochs and maximum gap between measurements in SPH as quality information, as suggested by Josep Closa through e-mail on 28-Jul-2006
		All	Attitude_Flag kept in some products headers to allow detecting external and transition manoeuvres pointing, although not in all of them, as now products attitude are identified by their name; at EADS-CASA petition.
		2.1	Update of section presenting the work performed and highlighting the differences with L1PP specifications
		2.2.1	Review of L1 File Structure.
		2.2.2	Defined a File class for Reprocessing, as per L1OP-CDR RID NW-92
		2.2.2	Validity definition clarified as per L1OP-CR RID RC-84
		2.2.2	Clarification on ccc as per L1OP-CDR RID NW-93
		2.2.3	Update of products schemas version information accordingly to new products list
		3.1.1	Clarification on Validity Period meaning for MIRAS and auxiliary products, as per L1OP-CDR RID RC-63
		3.1.1	Fixed Header "Creator" completed as per L1OP-CDR RID RC-65
		3.1.1	Table 3-2 updated accordingly to new products list
		4.1.1	Value for Acquisition Station specified to harmonise with L0 specifications
		4.1.1	ID code of the Logical Processing Centre added, as per RID SP-01
		4.1.1	Product Confidence eliminated as conclusion of L1OP-CDR
		4.1.1	Clarification on tag of Job Order that is used to specify this field, as per L1OP-CDR RID RC-67
		4.1.1	Added explanation to clarify that the state vector is given at the ascending crossing node, as per L1OP-CDR RIDs RC-68 and SP-02
		4.1.1	Leap_Second field added to the MPH, as per RID DM-02
		4.1.1	Total_Size units specified, as per L1OP-CDR RID SP-03



Iss./Rev.	Date	Section / Page	Change Description
		4.1.2.1	Endianness for L1 products is fixed to little-endian.
		4.2.1	Clarification of UTC format used in L0 and L1.
		4.2.1.1	Clarification on NIR Calibration product usage, given current situation (NIR baseline recently changed, not consolidated in L1PP, not to be implemented in L1OP-V1 but in L1OP-V2)
		4.2.1.1	Decision tree to assign Attitude_Flag values specified, as per L1OP-CR RC-70
		4.2.1.1	Reference data sets of L1 HKTM updated
		4.2.2	Clarifications on usage on internal calibration data accordingly to its attitude, as per L1OP-CDR RID JC-34
		4.2.2.2.1	Uncorrelated noise injection quality data fields specified, as per L1OP-CDR RID JC-29.
		4.2.2.3	MIR_CORN1A product suppressed, following new consolidation baseline (measurements included in MIR_CRSD1A and MIR_CRSU1A)
		4.2.2.3.2	Location data set added to avoid latitude, time, temperature repetitions, as per L1OP-CDR RID JC-33
		4.2.2.4	FWF individual products to contain only quadrature corrected correlations measured at C-plane, as per L1OP-CDR RID JC-35
		4.2.2.5	Clarifications included on Average FWF product, as per L1OP-CDR RID JC-35
		4.2.2.5.2	FWF measured at C-plane and obtained later at antenna polarization planes, clarification added as answer to L1OP-CDR RID JC-35
		4.2.2.6	Clarification on NIR Calibration product usage for L1OP-V1
		4.2.3.1	Correction of L1A Calib_Visib diagonal contents as per L1OP-CDR RID JC-37
		4.2.3.2.1	A field to indicate if the U -noise correction is applied to the visibilities has been added to the product, as per RID JC-39
		4.2.3.2.1	Attitude_Flag reformatted to a list of flags, allowing indication of changes of attitude modes in the same product.
		4.2.4.2.1.1	Reduced info on gaps included in SPH as conclusion of discussion with J. Closa by e-mail on 28-Jul-2006
		4.2.4.2.1.1	Direct Moon Correction Type removed as per L1OP-CDR RID JC-38



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		4.2.3.4 / 4.2.3.5 / 4.2.3.6	G and J matrix and Flat Target transformation products moved from chapter 5 to chapter 4
		4.2.5.1 / 4.2.5.2	Explanation about the overlap land/ Sea has been added, as per RID S.P-04
		4.2.5.1.1	New fields (Mid_Lat, Mid_Lon) added to the product location structure in order to express correctly the swath location, following S. Delwart suggestion by e-mail on 18-Jul-2006.
		4.2.5.1.1	Gaps removed and missing points added as conclusion of discussion with J. Closa by e-mail on 28-Jul-2006
		4.2.5.1.1	Sensing Time information redundant with Fixed Header's; removed.
		4.2.5.1.1	Most of Mixed Pixels quality indicators removed, as per 24-Jul-2006 R.C. e-mail.
		4.2.5.1.1. 4.2.5.3.1	Different Apodisation windows added for land and Sea in table 4-57: Level 1 C Browse Brightness Temperatures Quality SPH
		4.2.5.1.2 / 4.2.5.2.2	Description of Polarisation flags corrected, as per 24-Jul-2006 R.C. e-mail.
		5.1.2	List of SPH_Descriptor updated following document changes
		5.1.2.1	Validity info already provided in Fixed Header.
		5.1.2.1	Endianness defined for L1 products generated/stored/distributed by DPGS; all to be little-endian.
		5.1.2.3	Time information added to Auxiliary Products SPH in order to allow providing info on data measurement, apart from the validity time info provided in the Fixed Header.
		5.2.6	Antenna Pattern products merged in only one, as per L1OP-CDR RID JC-26
		5.2.11.1.1	Grid limits and spacing info added on header, as per L1OP-CDR RID SP-10
		5.2.11.1.2	Expected_NIR_BT_H corrected as per L1OP-CDR RID AG-15
		5.2.15	VTEC specification added, following Deimos assessment of what it should be contained in it.
		5.2.16	Geomagnetic data not considered as an ADF, but as part of the IGRF software distribution
		5.2.17	Apodisation function names and header changed accordingly to L1OP-CDR RID DM-01
		5.2.18	Description of possible strategy to update RFI product, as per L1OP-CDR RID SP-11.



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		5.2.19	Following harmonisation effort between L0, L1 and L2, this product is specified in L2 and shall not be repeated here, as per L1OP-CDR RID RC-71.
		5.2.20	Origin of Time Correlation contents specified
		6	Sizes calculations updated and table reformatted
2/2	25-Aug-2006	All	FTT product name changed to distinguish dual and full pol contents, as agreed in e-mail conversation with ESA, L1PP and L1OP teams on 21-Aug-2006
		All	IEEE floats cannot be unsigned, corrected thorough all the document.
		4.1.1	Orbit information given in start sensing time instead of ANX time, as agreed with ESA and L1PP team in e-mail conversation in early August 2006
		4.2.4.2	L1B product specification changed to include the average system temperature, needed as input by L1C
		4.2.5	L1C reference data sets do not contain anymore the L1A HKTM, as all information is now in L1B product
		5.2.17	Apodisation_Coefficient_Counter removed and product changed to ASCII XML
2/3	10-Oct-2006	All	References Updated
		All	Mentions to Split and Merge removed, as per DPGS-CDR RID NW-24
		All	SPH reorganized for all the products, as per DPGS-CDR RID RC-25
		All	DSD moved to the end of the SPH, as per DPGS CDR RID NW-31
		All	Free length of strings limited to 200 char, as per DPGS-CDR RID RC-16
		All	Changed Long /Lat format from ineteger to float in the Headers, as per DPGS CDR RID RC-35
		All	Type, Precision and C Format columns in binary datablocks changed to Type, Element Precision and Variable Format, and systematically defined consistently all along the document. As per DPGS-CDR RID RC-17
		All	Column width optimized in order to reduce the number of pages, as per DPGS-CDR RID NW-32



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		All	Origin column reviewed, as per NW-32 and RC-26
		All	Scientific explanations reduced, as per DPGS-CDR MoM resolution to eventually put them in a Product Handbook
		3.1.1	Changed Validity start/ stop accuracy to seconds in Fixed Header, as per DPGS CDR RID NW-26
		3.1.1	Correction of Calibration types definition in order to descope them from operational procedures, as per DPGS-CDR RID MZ-17
		3 & 4	The string fields limited to 200 characters, as per RID RV-13
		4	Described the format of the OBET time and the EE CFI transport time, as per DPGS-CDR RID RC-19
		4.1.1	Corrected Acquisition_Station ID to ESAC, as per DPGS CDR RID NW-32
		4.1.1	MPH harmonized between L0, L1 and L2 products, as per DPGS-CDR RID NW-27
		4.1.1	Changed Logical_Processing format from a number to characters, as DPGS-CDR RID NW-27
		4.1.1	Type_of_Processing field removed from the MPH, as per DPGS-CDR RID NW-27
		4.1.1	Reason_for_Reprocessing field removed, as per DPGS-CDR RID NW-27
		4.1.2.1	For the SPH_Descriptor field, the 28-character string corrected to 14 char, as per DPGS-CDR RID NW-28
		4.1.2.1	Precise Validity Start/ Stop times, in microsecond resolution, added in the SPH of all products and ADFs, as per DPGS CDR RID NW-26
		4.1.2.2	Byte_Order field moved from SPH Main Info to DSD, as per DPGS-CDR RID NW-31
		4.1.2.2	List_of_Reference_File_Structs opening and closing tags removed, as per RID RV-05
		4.2.1.1	Clarified that attitude flag will be set at Sensing_Start_time, as per DPGS-CDR RID RC-18
		4.2.2.2.1	N_Averaged_Measuremet comment corrected, as per DPGS-CDR RID RC-21
			In the field number 5 the reference to field #2 corrected to #4, as per DPGS-CDR RID RC-24



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		4.2.4.2.1	Only 1 byte used for the description of the code to identify the image reconstruction algorithm, as per DPGS CDR RID RC-29
		4.2.4.2.1.2	Averaged physical temperature per snapshot included in the L1b, as per DPGS CDR RID RC-38
		5	Two different SPH considered for the Auxiliary Data Products, attending to the Data Blocks
		5.2.1.3	Table 5-2 (Additional Information for Auxiliary data products) removed, as per DPGS CDR RID NW-31
		5.2.11	References to SEPS removed
		5.2.13	Corrected **Sun** by **Moon** , as per DPGS CDR RID RC-29
		5.2.15	Field #1 description corrected, as per DPGS CDR RID RC-35
		5.2.17	Apodization window represented only by one field, as per DPGS CDR RID RC-27
		5.2.21	L1 Configuration ADF added as result of L1OP Delta CDR and DPGS CDR
2/4	23-Oct-2006	All	Minor corrections after DPGS-CDR update delivery
		2.2.3	Table with products schema versions updated
		4.1.2.1, 5.1.2.1, 5.2.11.1.1	Checksum shall be a 10 bytes number, not 4
		4.2.2.2.1	Uncorrelated Product SPH does not include Quaility_Info, but just specific Uncorrelated_Quality_Information
		4.2.2.3.1	Reference to a section corrected
		4.2.2.3.1	Quality_Information added to table
		4.2.2.6.1	Added Specific_Product_Header tag
		4.2.3.1.1	Field numbering changed after including Specific_Product_Header tag
		4.2.4.1.1	Added table to specify SPH for L1B calibration products
		5.2.11 / 5.2.12	Added new specification of L-Band Galaxy Maps (Original and NIR-Convolved), as proposed by ESA in [AD.4][RD.15]
		5.2.16	Added new specification for VTEC, as proposed by ESA in [AD.4][RD.16]
3/0	24-Nov-2006	All	Final document for DPGS-V1 issued after meeting between ESA, GMV and Indra.



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4/0	04-Sep-2007	4.2.2.2.2	"Samples" field has been added to the Data block.
		4.2.3.1.2	"Receiver_Noise_Temp" field as been added to the Data block.
		4.2.3.2.2	"Receiver_Noise_Temp" field as been added to the Data block.
		4.2.4.1.2	The number of Data Set records contained in the Data Set has been changed from 16008 to 15996.
		4.2.4.1.3	Numgber of rows has been changed from 16008 to 15996.
		4.2.4.1.5	The array's length for "Ideal_Sky_Visib_HV", "Averaged_FTT_Visib_HV" and "Ideal_Uniform_Visib_HV" have been modified.
		4.2.4.2.1.2	The followinf fields have been added to the Data block: "Foreign_Sources_Flags", "Average_System_Temperatures", "Direct_Moon_Pos" and "Constant_Earth_BT".
4/1	21-Sep-2007	All	Release of draft previous to the meeting to freeze the L1 Product Specifications
4/2	05-Oct-2007	All	Final release of document, baseline for DPGS-V2
4/3	29-Oct-2007	All	Final release of document, baseline for DPGS-V2, implementing comments to v4.2 from ESA, Deimos and GMV.
		All	Orbit scenario file definition updated, according to Deimos comment.
		All	L0_FILE reference data sets changed to L0_CORRELATIONS_FILE
		All	"_" tags typos corrected to "_", according to ESA comment
		1.4	References updated
		4.1.1	Clarification in MPH Position fields on the state vector used (resulting from L2 Specs meeting)
		4.1.2.3	Clarification in Data_Set structure on DS_Name and DSR_Size being computed internally but not from schemas (resulting from L2 Specs meeting)
		4.2.1.1	NIR_Calibration_Flag added back to TLM_MIRA1A SPH
		4.2.2.2.2	PMS_ID definition modified to clarify the identifier convention.
		4.2.2.2.2	PMS_Sensitivities and FWF_Sensitivities naming typo corrected
		4.2.2.3.2	Con_FWF_Coefficients naming typo corrected



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		4.2.3.1.2 4.2.3.2.2 4.2.4.2.1.2 4.2.4.2.2.2	The reference system in Antenna_Boreesight coordinates in case of MIR_TARD1A, MIR_TARF1A, MIR_TARD1B, MIR_TARF1B is specified.
		4.2.4.2.1.1	Backlobe_Contribution_Removed typo corrected
		4.2.4.2.2.1	MPL_ORBSCT added as reference data set to full pol L1B products
		5.1.2.1	Header_Schema in pure xml ADFs must be obtained from CNF.
		5.2.2	NIR_ID identifier convention clarified
		5.2.4	List_of_Switchs typo corrected
		5.2.7	List_of_LICEF_Datas
		5.2.19.1.1	Tags names reviewed to follow EEF Convention
		5.2.23	Tags names reviewed to follow EEF Convention
		6	AUX_SGLINT size calculation added
4/4	04-Jan-2008	All	The Dependencies have been updated to match SO-ID-IDR-GS-0008 v3.1 (containing the updates after L1OP-V2 CDR), as per RID AM-003.
		All	MPL_ORBSCT has been removed from the Lists of Reference Data Sets.
		4.2.1.2	XBAND_Status description updated following GMV proposal agreed with Deimos.
		4.2.4.1,	References to Table 4-34 corrected to reference Table 4-28.
		4.2.5.1.2 / 4.2.5.2.2	Grid_Point_Mask origin clarified, after CDR conclusions.
		4.5	AUX_LSMASK removed from the List of Reference Data Sets.
		5.2.3	X, Y, Z C Format changed from %+010.5f to %+011.5f
		5.2.22	AUX_SGLINT content has been updated following Deimos suggestions
		6	Product sizes updated with AUX_SGLINT new specification
		7	An Appendix detailing the L1C products consolidation has been added.
5/0	26-May-2008	All	L1OP-V3 product specification update
		1.4	Update of references.
		2.1	Updated with current L1PP website.
		2.1	Comment on L1OP-V1 status of AUX_SGLINT removed. Now renamed to AUX_BSCAT_.
		2.1.1	Beginning and End of Mission convention clarified.



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		3.1.1 (Table 3-1) 4.1.2.2 (Table 4-4)	Clarification on Fixed Header and Specific Product Header tags origin, according to S. Pinori's TN (see e-mail from 23-April-2008 17:41)
		4.2.2.1.1 (Table 4-13)	AUX_PMS__ added as reference data set of MIR_UAVD1A / MIR_UAVU1A
		4.2.2.2 6 (Table 6-1)	MIR_CRSD1A / MIR_CRSU1A format and descriptions modified according to new baseline including Local Oscillator correction algorithm.
		4.2.4.1.3.2	AUX_JMAT is transposed wrt L1OP-V2 specifications, following L1PP and L1OP needs.
		4.2.5.1.1 (Table 4-42)	Clarification on how Percentage_of_Mixed_Pixels and Total_Num_Grid_Points must be computed.
		3.1.1 (Table 3-2) 4.1.2.3 (Table 4-6) 4.2.1.1 (Table 4-8) 4.2.2.1.1 (Table 4-13) 4.2.2.2.1 (Table 4-16) 4.2.2.3.1 (Table 4-19) 4.2.2.4.1 (Table 4-22) 4.2.3.1.1 (Table 4-25) 4.2.4.1.4.1 (Table 4-33) 4.2.4.1.5.1 (Table 4-35) 4.2.4.2.1.1 (Table 4-38) 4.2.4.2.2.1 (Table 4-40) 4.2.5.1.1 (Table 4-43) 4.2.5.2.1 (Table 4-45) 4.2.5.3.1 (Table 4-48) 5.1.2 (Table 5-1) 6 (Table 6-1)	Addition of MPL_ORBSCT as input ADF to the processing of several L1OP tasks.
		3.1.1 (Table 3-2) 5.1.2 (Table 5-1)	Separation of description for Land and Sea apodisation functions, to avoid confusions.
		5.2.2	AUX_NIR precisions changed for fields with 2 decimal digits to 3 decimal digits (see e-mail from A. Gutiérrez 14-May-2008 at 13:40)
		5.2.4	Changes of units from dB to Linear in some fields of AUX_SPAR__



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		4.1.2.3 (Table 4-6) 4.2.5.1.1 (Table 4-43) 4.2.5.2.1 (Table 4-45) 4.2.5.3.1 (Table 4-48) 5.1.2 (Table 5-1) 5.2.19 6 (Table 6-1)	AUX_VTEC_R added as new data type for TEC data obtained from IGRG files, according to [RD.16]
		5.2.19.1.1 (Table 5-23)	Solar Flux added to AUX_VTEC header according to [RD.16] new release.
		5.2.19.1.1 (Table 5-23)	VTEC_PCD field updated with new definition from [RD.16]
		5.2.22	AUX_BSCAT specification changed to be aligned with L1PP product specification.
		3.1.1 (Table 3-2) 4.1.2.3 (Table 4-6) 4.2.4.2.1.1 (Table 4-38) 4.2.4.2.2.1 (Table 4-40) 4.2.5.3.1 (Table 4-48) 5.1.2 (Table 5-1) 5.2.22 6 (Table 6-1)	AUX_SGLINT renamed back to AUX_BSCAT, in order to avoid conflicts with L2 sun glint LUT file type.
		5.2.23	AUX_CNFL1P updated with GMV inputs
5/1	16-Jun-2008	All	Changes after 1 st review from ESA, Deimos and GMV.
		3.1.1 (Table 3-1) 4.1.1 (Table 4-1)	Explanations on usage of L1C FH and MPH tags according to S. Pinori TN send on 23-Apr-08
		4.1.2.2 (Table 4-4)	Sentence "NOT USED" removed from <i>L1_Quality</i> description
		4.2.2.4.1 (Table 4-22)	MIR_ANIR1A Reference DS updated.
		4.2.3.1.1 (Table 4-24)	Comment for <i>U_Correction_Applied</i> updated to match the definition in AUX_CNFL1P
		4.2.4.1.4.2 (Table 4-34) 4.2.4.1.5.2 (Table 4-36)	<i>Number_of_Epochs</i> field added to inform on the number of samples averaged in each FTT segment.
		4.2.4.2.1.1 (Table 4-37)	Update of L1B algorithms tags in L1B products headers and AUX_CNFL1P
		4.2.4.2.1.2 (Table 4-39) 4.2.4.2.2.2 (Table 4-41)	Removed sentence "NOT USED for DPGS V2 (filled with 0)" from fields <i>Constant_Sky_BT</i> , <i>Constant_Land_BT</i> , <i>Constant_Sea_BT</i> , <i>Derivative_Land_BT</i> , <i>Derivative_Sea_BT</i>
		4.2.5.1.2 (Table 4-4) 4.2.5.2.2 (Table 4-6) 4.2.5.3.2 (Table 4-9)	Grid_Point_Mask origin is updated (now filled with data from AUX_LSMASK)
		5.1.2.1 (Table 5-3)	Removed sentence "NOT USED for DPGS V2 (filled with 0)" from field <i>Header_Size</i>



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		5.2.2 (Table 5-5)	Precisions for some fields changed from %10.3e to %11.3e (<i>C_A_V</i> , <i>D_A_V</i> , <i>U_A_V</i> , <i>A_H</i> , <i>B_H</i> , <i>C_R_V</i> , <i>D_R_V</i> , <i>U_R_V</i> , <i>C_A_H</i> , <i>D_A_H</i> , <i>U_A_H</i> , <i>A_H</i> , <i>B_H</i> , <i>C_R_H</i> , <i>D_R_H</i> , <i>U_R_H</i>)
		5.2.14.1.1 (Table 5-17)	Removed sentence "NOT USED for DPGS V2 (filled with 0)" from fields <i>Min_RA</i> , <i>Max_RA</i> , <i>Mind_DEC</i> , <i>Max_DEC</i> , <i>Delta_RA</i> , <i>Delta_DEC</i>
		5.2.23 (Table 5-30)	Update of AUX_CNFL1P file to latest input from GMV delivered by Irene Mas on 13-Jun-08, according to the agreements reached with ESA and Deimos.
		6 (Table 6-1)	Size for MIR_FTTD/F__ updated
5/2	30-Jul-2008	All	Release of the document after comments from ESA / Deimos / GMV.
		All	Harmonisation of Origin column in tables: all INT changed to "Generated by L1 Processor"
		All	Clarification of Origin column in tables: when origin is ADF, the specific file is identified
		1.4 (Table 1.4-1)	References updated
		2.1.1	Conventions for Origin column modified according to changes above
		3.1.1 (Table 3-2)	Reference to MPL_ORBSCT specification added
		4.1.1 (Table 4-1)	Phase tag is further described as requested by ESA/RC.
		4.1.1 (Table 4-1)	Abs_Orbit value is obtained by LOP for absolute orbit 1 using MPL_ORBSCT, as specified by ESA/RC.
		4.1.1 (Table 4-1)	Leap_Second is obtained from a EE CFI function by LOP.
		4.1.1 (Table 4-1)	Product_Confidence modified according to Annex B
		4.1.2.1 (Table 4-3)	Stop_Time_ANX_T description changed to refer to Precise_VValidity_Stop instead of start.
		4.1.2.1 (Table 4-3)	Explanation of orbit_id meaning for Abs_Orbit_Start, Start_Time_ANX_T, Abs_Orbit_Stop, Stop_Time_ANX_T, UTC_at_ANX and Long_at_ANX.
		4.2.2 (Table 4-4)	Modification of L1 Quality Information structure according to Annex B.
		4.1.2.3 (Table 4-6) 4.2.2.1.1 (Table 4-13) 4.2.2.2.1 (Table 4-16) 4.2.2.4.1 (Table 4-22) 4.2.3.1.1 (Table 4-25)	Description of L1A_ORBIT_AMPL_PHASE_FILE changed to remove references to orbital bins.
		4.1.2.3 (Table 4-6)	APODISATION typo corrected.
		4.2.1.1 (Table 4-7)	NIR_Calibration_Flag removed in DPGS-V3.
		4.2.2.1.1 (Table 4-12)	Unc_Averaged_Measurements_Threshold description modified to specify the origin is in AUX_CNFL1P.



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		4.2.2.1.1 4.2.2.2.1 4.2.2.3.1 4.2.2.4.1 4.2.3.1.1 4.2.4.1.2.1 4.2.4.1.3.1 4.2.4.1.4.1 4.2.4.2.1.1 4.2.4.2.2.1 4.2.5.1.1 4.2.5.2.1	Added specification of rules to fill SPH General Quality Information structure, according to Annex B
		4.2.2.2.1 (Table 4-15)	Removed fields N_Bins_Updated and N_Bins_Removed, and added fields Cons_Long_PMS_DSR_New, Cons_Long_PMS_DSR_Removed, Cons_Ampl_FWF_Origin_New, Cons_Ampl_FWF_Origin_Removed, Cons_Long_Ampl_FWF_Origin_New, Cons_Long_Ampl_FWF_Origin_Removed
		4.2.2.1.2 (Table 4-14) 4.2.2.2.2 (Table 4-17) 4.2.2.4.2 (Table 4-23) 4.2.4.1.4.2 (Table 4-34) 4.2.4.1.5.2 (Table 4-36)	Quality_Information structure added for all datasets.
		4.2.2.3.1 (Table 4-18)	FWF_Averaged_Measurements_Threshold description modified to specify the origin is in AUX_CNFL1P.
		4.2.3.1.1 (Table 4-24)	U_Correction_Applied description modified to specify the origin is in AUX_CNFL1P.
		4.2.3.1.1 (Table 4-25)	AUX_MISP__ added as reference data set.
		4.2.3.1.2 (Table 4-26) 4.2.3.2.2 (Table 4-27)	Max_Mkj_module, X-Band and Quality_Information structure according to Annex B
		4.2.4.1.4.2 (Table 4-34)	Fields Number_of_Epochs_HH and Number_of_Epochs_VV added
		4.2.4.1.5.2 (Table 4-34)	Fields Number_of_Epochs_HH, Number_of_Epochs_VV and Number_of_Epochs_HV added
		4.2.4.2	L1B description updated with ESA/RC new text
		4.2.4.2.1.1 (Table 4-37)	Origin is AUX_CNFL1P for the different algorithm fields.
		4.2.4.2.1.1 (Table 4-38) 4.2.4.2.2.1 (Table 4-40)	Added AUX_MISP__ as reference data set.
		4.2.4.2.1.2 (Table 4-39) 4.2.4.2.2.1 (Table 4-41)	Field Flags changed type to unsigned integer 2 bytes, to make room for more flags to be defined
		4.2.4.2.1.2 (Table 4-39) 4.2.4.2.2.1 (Table 4-41)	X-Band and Quality_Information structure added, according to Annex B.
		4.2.4.2.1.2 (Table 4-39) 4.2.4.2.2.1 (Table 4-41)	Derivative_Land_BT and Derivative_Sea_BT are not used in DPGS-V3
		4.2.4.2.1.2	SUN GLINT FOV flag description completed
		4.2.4.2.1.2	FTT flag description updated



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		4.2.4.2.1.2	New RFI flag defined, according to Annex B
		4.2.5	L1C description updated with ESA/RC new text
		4.2.5.1.1 (Table 4-42)	Percentage_of_Mixed_Pixels description updated with ESA/RC new text
		4.2.5.1.1 (Table 4-42)	Origin of Geometric_Correction_Type changed to AUX_CNFL1P
		4.2.5.1.1 (Table 4-42)	Origin of Apodisation_Window changed to AUX_APDS_ and AUX_APDL_
		4.2.5.1.1 Table (4-43) 4.2.5.2.1 Table (4-45)	Added AUX_MISP_ as reference data set.
		4.2.5.1.1 Table (4-44) 4.2.5.2.1 Table (4-46)	TEC description completed to clarify that TEC is corrected for SMOS altitude.
		4.2.5.1.1 Table (4-44) 4.2.5.2.1 Table (4-46)	Ionosphere and Geomagnetic information description updated to clarify the models used
		4.2.5.1.1 Table (4-44) 4.2.5.2.1 Table (4-46)	X-Band and Quality_Information structure added to Swath_Snapshot_List dataset
		4.2.5.1.1 Table (4-44) 4.2.5.2.1 Table (4-46)	BT_Data_Counter changes its type to unsigned integer 2 bytes
		4.2.5.1.1 Table (4-44) 4.2.5.2.1 Table (4-46)	Faraday_Rotation_Angle and Geometric_Rotation origin changed according to ESA/RC comments
		4.2.5.1.1	SUN GLINT FOV flag description completed according to ESA/RC comments
		4.2.5.1.1	FTT flag description completed according to ESA/RC comments
		4.2.5.1.1	New RFI flag defined, according to Annex B
		4.2.5.3	L1C Browse description changed with ESA/RC new text
		5	Origin of ADF fields modified according to ESA/RC comments
		5.2.7	AUX_FAIL update procedure described, according to ESA/Deimos comments
		5.2.12	Definition of Min and Max Sea-Ice flags updated to be filled with AUX_DISTAN info from [RD.28]
		5.2.14	The precision of the AUX_GALAXY map is 0.05K instead of 0.5K
		5.2.14.2 (Table 5-18)	Added reference to N. Flourey data set
		5.2.15.1	Reference to 5.2.14.1 updated
		5.2.15.2 (Table 5-20)	Field 01 Underscore typo corrected
		5.2.18	AUX_ERTHT_ removed as requested by ESA
		5.2.19	AUX_VTEC description updated with new ESA/RC text
		5.2.18.1 (Table 5-23)	Solar_Flux origin changed according to ESA/RC TN
		5.2.19 (Table 5-26)	Origin is L1 ESL
		5.2.19	Strip Adaptive specification removed



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		5.2.20 (Table 5-28)	RFI_Flag set to 0 in DPGS-V3
		5.2.22 (Table 5-30)	Units of RMS_Threshold for FTT are K, not %.
		5.2.22 (Table 5-30)	RMS_Threshold_for_NIR field added
5/3	01-Aug-2008	All	Final release of the document for DPGS-V3
		1.4	References updated: DPMs have not yet been released
		4.1.1 (Table 4-1)	Definition of Phase open waiting for CNES inputs. In any case, L1OP copies the field from L0 header.
		4.1.1 (Table 4-1)	Field 10 (Abs_Orbit) calculated by L0P, but the procedure is not clear. Removed the reference to MPL_ORBSCT usage.
		4.1.2.1 (Table 4-3)	L2 usage specified according to [RD.29]
		4.2.2.2.1 (Table 4-15)	Counters for Cons_Ampl_FWF_Origin removed and added for Cons_Phase_FWF_Origin
		4.2.4.2.1.2 (Table 4-39) 4.2.4.2.2.2 (Table 4-41)	Added a sentence in Description of Flags field to clarify that the first byte is just a placeholder for future definition of flags and is not to be filled in DPGS-V3
		4.2.5.1.1 (Table 4-42)	L2 usage specified according to [RD.29]
		4.2.5.1.1 (Table 4-42) 4.2.5.3.1 (Table 4-47)	Geometric_Correction_Type removed. The geometric correction is always applied using AUX_BFP__ and AUX_MISP__, therefore there is no purpose to have it configurable
		4.2.5.1.2 (Table 4-44) 4.2.5.2.2 (Table 4-46)	Removed info on maximum number of BT_Data structures per grid point, as it is no more valid.
		4.2.5.1.2 (Table 4-44) 4.2.5.2.2 (Table 4-46)	L2 usage specified according to [RD.29]
		5.2.1 (Table 5-4)	AUX_PMS specification updated with new tags from [RD.2]
		5.2.9 (Table 5-12)	AUX_BFP__ specification updated with new tags from [RD.2]
		5.2.10 (Table 5-13)	AUX_MISP__ specification updated with new tags from [RD.2]
		5.2.22 (Table 5-29)	Geometric_Correction_Type removed. The geometric correction is always applied using AUX_BFP__ and AUX_MISP__, therefore there is no purpose to have it configurable
		6	Products Sizes reviewed
5/4	05-Sep-2008	All	Final release of the document for DPGS-V3
		4.2.2.4.1 (Table 4-22)	AUX_BPF__, MIR_TARD0_ and MIR_TARF0_ added as reference dataset of MIR_ANIR1A.
		4.2.5.1.2 (Table 4-44)	Field number added for Grid_Point_Altitude.
		5.2.21 (Table 5-28)	Clarification included stating that the product has 76 DSRs and not 1.



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		5.2.22 (Table 5-29)	Geometric_Correction_Type added back to the generic section of AUX_CNFL1P, as requested by ESA/RC.
5/5	13-Jan-2009	All	L1OP-V3 CDR clean-up release
		1.4	L0 Product Specification reference updated, as per L1OP-V3 CDR RID IMM-28
		2.2.2, 3.1.1	The Validity_Stop shall be the same as the Validity_Start in case Precise_VValidity_Stop equals Precise_VValidity_Stop, following N. Wright comment on DPGS-V2 documentation.
		3.1.1, 4.1.2.3, 5.1.2,	Removal of all references to AUX_ERTHT, as per L1OP-V3 CDR RID RC019
		4.1.1, 4.1.2.3, 4.2.4.1.2, 4.2.4.2.1.2, 4.2.4.2.2.2, 5.2.1, 5.2.3, 5.2.4, 5.2.16, 5.2.18.1	Clean-up of all TBD and TBC, as per L1OP-V3 CDR RID MJB-8
		4.1.2	Reference datasets definition reworded following N. Wright proposal on DPGS-V2 documentation.
		4.1.2.1	Field Correlator_Layer origin corrected (copied from L0 instead of generated by L1P), as per L1OP-V3 CDR RID RC017
		4.1.2.2	N_Invalid_Blocks and N_Missing_Packets description modified to highlight that overflow can occur, as per L1OP-V3 CDR RID AG-007
		4.2.2.3.2	Quality_Information structure added to MIR_AFW1A binary datasets Cons_FWF_Measurements and Cons_FWF_Coefficients, as per L1OP-V3 CDR RID AG-008
		4.2.2.4.1	Added AUX_MISP__ as reference dataset to MIR_ANIR1A, as per L1OP-V3 CDR RID IMM-29
		4.2.2.4.1	Added AUX_FAIL__ as reference dataset to MIR_ANIR1A, as per L1OP-V3 CDR RID IMM-47 (file not needed by GMV executable, but it is by DMS executable)
		4.2.3.1.1	Changed reference number of field in AUX_CNFL1P
		4.2.3.1.2	Changed reference number of field Pol_Mode in field Sys_Temp description, as per L1OP-V3 CDR RID RC020
		4.2.4.1.1	Added Quality_Information structure (according to the schemas already corrected), as per L1OP-V3 CDR RID IMM-36
		4.2.4.1.4.1, 4.2.4.1.5.1	AUX_MISP__ added as reference dataset of MIR_FTTx products, as per L1OP-V3 CDR RID IMM-30
		4.2.4.1.4.1, 4.2.4.1.5.1	AUX_GALAXY and MIR_GMATD removed as reference datasets of MIR_FTTx products, as per L1OP-V3 CDR RIDs AG-009 and AG-010



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		4.2.4.1.4.1, 4.2.4.1.5.1	AUX_BWGHT removed as reference dataset of MIR_FTTx products, as per L1OP-V3 CDR RID IMM-31
		4.2.4.1.4.1, 4.2.4.1.5.1	MIR_FTTx added as reference datasets of MIR_FTTx products, as per L1OP-V3 CDR RID IMM-32
		4.2.4.2.1.1	0 added for Ideal_Reconstruction, as per L1OP-V3 CDR RID AG-011
		4.2.4.2.1.1, 4.2.4.2.2.1	AUX_GALNIR removed as reference dataset of MIR_SC_D/F1B/MIR_TARD/F1B products, as per L1OP-V3 CDR RID IMM-33
		4.2.4.2.1.1, 4.2.4.2.2.1	AUX_GALAXY added as reference dataset of MIR_SC_D/F1B / MIR_TARD/F1B, as per L1OP-V3 CDR RID IMM-34
		4.2.4.2.1.1, 4.2.4.2.2.1	MIR_GMATU_ and MIR_JMATU_ added as reference dataset of MIR_SC_D/F1B / MIR_TARD/F1B, as per L1OP-V3 CDR RID RC076
		4.2.4.2.1.1, 4.2.4.2.2.1	AUX_DGG_ added as reference dataset of MIR_SC_D/F1B / MIR_TARD/F1B, as per L1OP-V3 CDR RID IMM-35
		4.2.4.2.1.1, 4.2.4.2.2.1	AUX_LSMASK added as reference dataset of MIR_SC_D/F1B / MIR_TARD/F1B, in order to be aligned with SO-MA-DMS-GS-0101 L1B SUM v1.2
		4.2.4.2.1.1, 4.2.4.2.2.1	AUX_FAIL_ added as reference dataset of MIR_SC_D/F1B / MIR_TARD/F1B, as per conclusion of L1OP-V3 CDR RID IMM-47
		4.2.4.2.1.2, 4.2.4.2.2.2	Constant_Earth_BT description corrected, as per L1OP-V3 CDR RID RC-021
		4.2.4.2.1.2	Constant_Land_BT and Constant_Sea_BT description text modified, as per L1OP-V3 CDR RID RC022
		4.2.4.2.1.2	RFI flag are computed in DPGS-V3, as per L1OP-V3 CDR RID RC023
		4.2.4.2.2.2	Added that value is 0 in case of x-polarisation, as per L1OP-V3 CDR RID RC024
		4.2.4.2.2.2	Constant_Land_BT and Constant_Sea_BT description text modified, as per L1OP-V3 CDR RID RC025
		4.2.5.1.1, 4.2.5.2.1, 4.2.5.3.1	Removed AUX_FAIL_ as reference dataset to L1C products, as per L1OP-V3 CDR RID IMM-37
		4.2.5.1.1, 4.2.5.2.1, 4.2.5.3.1	AUX_LSMASK added as reference dataset to L1C products, as per L1OP-V3 CDR RID IMM-38
		4.2.5.1.2, 4.2.5.2.2	TEC field description modified to specify the altitude correction applied, as per L1OP-V3 CDR RIDs RC027 and RC029
		4.2.5.1.2, 4.2.5.2.2, 4.2.5.3.2	“Coded as 2’s complement” reworded as “Coded as”, as per L1OP-V3 CDR RID RC-IMM-27
		4.2.5.1.2	RFI flags redefined, as per L1OP-V3 CDR RID RC-028



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		4.2.5.2.2	Added that BT_Value Real and Imag are obtained by DFT interpolation from L1B data, as per L1OP-V3 CDR RIDs RC029 and RC030
		4.2.5.2.2	Description of polarisation flags for HV-pol case improved, as per L1OP-V3 CDR RIDs RC032 and AG-012
		4.2.5.3.2	Browse product polarisation flags description modified, as per L1OP-V3 CDR RID RC-033 and e-mail discussion between J. Barbosa and R. Crapolicchio
		5.2.1	Temperature field format aligned with corrected schema, as per L1OP-V3 CDR RID IMM-39
		5.2.2	Amplitude_Dicke_Switch fields format aligned with corrected schema, as per L1OP-V3 CDR RID IMM-40
		5.2.3	AUX_PLM__ format aligned with corrected schema, as per L1OP-V3 CDR RID RC018
		5.2.21	Table name modified, as per L1OP-V3 CDR RID MJB-9
		5.2.22	Attitude field removed, as per L1OP-V3 CDR RID IMM-42
		5.2.22	Reconstruction_Image_Algorithm modified to support Ideal_Reconstruction, as per L1OP-V3 CDR RID AG-011
		5.2.22	Max_Mkj_RFI_Threshold added , as per L1OP-V3 CDR RIDs AG-013, IMM-41 and RC023
		5.2.22	Attitude_Correction for VTEC generation renamed as Altitude_Correction
		6	MIR_AFWD/U1A sizes re-calculated following format change.
5/6	10-Mar-2009	All	Release to correct problems found during integration of L1P-V3 in DPGS
		4.2.4.1.3.1	MIR_JMATD generation does not strt from MIR_GMATD_, but from MIR_AFWD1A
		4.2.4.1.5.2	DSR size reviewed
		4.2.4.1.4.2 4.2.4.1.5.2	Table 4-34 and 4-36, Ideal fields are set to 0 in DPGS-V3, according to A. Gutierrez e-mail "Usage of G/J matrix for the FTT generation" from 27-Feb-2009 13:12
		4.2.5.3	Browse products generation method specified, to clarify that eventually it is possible that the browse product is not generated, if no browse values result for the grid points from the MIR_SCS/LD/F1C products.
		4.2.5.3.1	Table 4-48, AUX_MISP__ added to browse product reference datasets, as browse have the same references that science L1C products.
		5.2.3	AUX_PLM format update accodirng to DME inputs provided by A. Gutierrez in his e-mail on 09-Mar-2009 13:21.
		5.2.18.1	Reference data sets for AUX_VTEC files specified, as requeste by NW in this e-mail 09-Mar-2009 09:55.



Iss./Rev.	Date	Section / Page	Change Description
		5.2.22	L1B algorithm flags added to have different set of flags for nominal and external pointing.
		5.2.22	Maximum BT thresholds in L1C products added for SPQC reference.
5/7	02-Apr-2009	All	Release to correct problems found during integration of L1P-V3 in DPGS
		4.2.1.2	NIR_Error description modified as requested by ESA in e-mail from R. Crapolicchio 24-Mar-2009 13:23
		4.2.4.1.2.1	AUX_CNFL1P added as reference data set to MIR_GMATD/U_
		4.2.4.1.3.1	AUX_CNFL1P, AUX_PLM_ and AUX_PATT_ added as reference data set to MIR_JMATD/U_
		4.2.4.2.1.2	Updated description of Polarisation and RFI flags, according to R. Crapolicchio e-mail on 26-Mar-2009 19:46
		4.2.5.1.2	Size of each DSR is 162 and not 161.
		4.2.5.1.2	Clarification added to warn that the SUN_GLINT_AREA flag is not computed and therefore L2 does not use it.
		5.2.3	AUX_PLM format changed following DME inputs: Time_Delay_Licef parameters are different for nominal and redundant chains.
		5.2.18.1	VTEC_PCD format modified to allow fitting the described values.
5/8	22-Apr-2009	All	Release to correct problems found during integration of L1P-V3 in DPGS
		4.1.1	Acquisition_Station value aligned with L0 Products Specifications v3.2, as requested by NW (DPGS-PR-1511).
		4.1.2.1	Clarification that Long_at_ANX values are in the range [0°,360°], as requested by NW (DPGS-PR-1508)
		4.2.5.1.2	Clarification added to EAF-FOV definition to highlight that this flag is always set.
		5.2.18.1	FTP_Server tag removed, following e-mail from A. Martinez 20-Apr-2009 17:11
		5.2.18.2	VTEC_Value units clarified, from TECU to 10^Scale_Factor TECU
5/9	04-May-2009	All	Release to correct problems found during integration of L1P-V3 in DPGS
		2	References updated
		4.1.2.3	Added table specifying the Measurement data sets for each product and binary ADF, as requested by NW by e-mail 04-May-2009 10:38
		4.2.5.1.1 4.2.5.3.1	Description and Origin columns of Percentage_of_Mixed_Pixels are corrected, following NW request by e-mail 28-Apr-2009 11:15



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		5.2.22	Clarification that Cross-polar contribution flag is not used by L1OP SW in DPGS-V3, but the contribution is always applied, as requested by RC by e-mail 23-Apr-2009 09:54.
5/10	29-May-2009	All	Addition of AUX_FARA_P, AUX_FARA_R, AUX_FARA_C and AUX_CNFFAR ADFs for Faraday Post-Processor
		4.1.2.1	Stop_Time_ANX_T description changed to refer to Precise_Vailidity_Start instead of stop, to align with L0 and L2 Specifications documents (as per email from R.Crapolicchio on 13-Mar-2009 12:51). The field is computed by L0P and subsequently copied to all upper levels.
		4.2.4.2.1.2 4.2.4.2.3.2	Correction that MIR_SC_D1B and MIR_SC_F1B contain 2 DS instead of 1
		4.2.5.1.2 4.2.5.2.2	Clarification that if no VTEC file is available and the model is not used, the TEC and Faradar_Rotation_Angle values are 0 (as per email from R.Crapolicchio on 07-May-2009 14:58)
		4.2.5.1.1 4.2.5.1.2 4.2.5.2.2 4.2.5.3.1 4.2.5.3.2	Added specific clarification of latitude and longitude fields ranges.
		5.2.23	Add clarification that UNC/FWF_Averaged_Measurements_Threshold shall be consistent with Minimum_Epochs_per_Step in the corresponding Calibration_Sequence.
5/11	15-Jun-2009	All	Faraday Post-Processor CDR close-up document
		4.2.4.2.2.2	Polarisation information corrected following ESA/RC comment in e-mail on 05/06/2009 18:25
		5.2.22.1	AUX_FARA_x header format modified following I.Mas e-mail on 08/06/2009 16:27
		5.2.22.2	Snapshot_Time removed following ESA/RC comment in e-mail on 05/06/2009 18:25 and XSMS-GSEG-EOPG-RD-09-0006 v2.0 update
		5.2.22.2	Faraday_Rotation_Angle description modified following ESA/RC comment in e-mail on 05/06/2009 18:25 and XSMS-GSEG-EOPG-RD-09-0006 v2.0 update
		5.2.22.2	Faraday_Rotation_Angle_Specular_Ray field added, following ESA/RC comment in e-mail on 05/06/2009 18:25 and XSMS-GSEG-EOPG-RD-09-0006 v2.0 update
		5.2.22.2	VTEC and VTEC_Specular_Ray fields added, following ESA/RC comment in e-mail on 05/06/2009 18:25 and XSMS-GSEG-EOPG-RD-09-0006 v2.0 update



Iss./Rev.	Date	Section / Page	Change Description
		5.2.23	Added a comment on Unc_Averaged_Measurements_Threshold suggested by I .Mas by e-mail on 03/06/2009 16:46
		5.2.23	PMS_Voltage_Second_Order_Correction description modified according to inputs from A. Mora by e-mail on 15/06/2009 14:58
		5.2.24	AUX_CNFFAR field Snapshot_Time_Sampling format modified following I.Mas e-mail on 08/06/2009 16:27
		6	AUX_FARA_x files size calculation corrected.
5/12	08-Jul-2009	All	DPGS-V3 Update
		4.1.2.1	UTC_at_ANX, Long_at_ANX, Abs_Orbit_Start, Start_Time_ANX_T computation description modified to take into account the case in which MPL_ORBSCT does not cover the start time period of the product to be generated, following conclusions from discussion with A. Gutierrez and R. Crapolichio by e-mail on 30-Jul-2009 ("L1b Problem calculating ANX and Abs_Orbit info")
		4.1.2.3	AUX_FARA_x removed from the table because they are not reference data sets of any L1 product (mail from M. Zapata to R. Crapolichio on 30-Jun-2009 10:06).
		4.2.4.2.1.2	Polarisation flags modified following ESA's new definition, e-mail from R. Crapolichio to M. Zapata 24-Jun-2009 17:42
		4.2.2.2.1	Time extent of each dataset added to MIR_CRsx1A SPH, following e-mail from R. Crapolichio to M. Zapata 29-Jun-2009 18:49:
		5.2.23	RMS_Threshold_for_NIR and RMS_Threshold_for_FTT format modified to accept non-integer figures (following e-mail discussion between M.H. Sarmiento and M. Zapata concerning the appropriate value of this field, on 02-Jul-2009)
5/13	18-Sep-2009	All	Removed references to RD.23. Set all quality indicators to use as reference RD.24 in order to remove ambiguities.
		4.2.2.2.1	Removed CRS_Datasets_Time_Extent tag from MIR_CRsx1A Header
		4.2.2.2.2	Added T_Noise_Ref_Hot/Warm to MIR_CRsx1A Cons_Long_PMS_Coefficients dataset
		4.2.2.3.2	Added units to FWF Shape coefficients
		4.2.4.1.3.1	Added references to BWGHT and FAIL ADF inside JMAT Specific Product Header
		4.2.4.2.1.1	Updated Reflected_Sun_Correction_Type in L1B SPH with new values
		4.2.4.2.1.2 4.2.4.2.2.2	Changed L1B Flags field size to 1 byte to be compliant with DPGS V3 schemas



Iss./Rev.	Date	Section / Page	Change Description
		4.2.5.1 4.2.5.2	Added BSCAT ADF as input to L1C products for computation of the Sun Glint Area L1c flag Clarified Sun Glint Area L1c flag content
		5.2.1	Updated AUX_PMS dataset with new parameter fields for second order correction and PMS Heater correction
		5.2.4	Corrected Temperature units in AUX_SPAR from Celsius to Kelvin
		5.2.23	Updated Reflected_Sun_Correction_Type in AUX_CNFL1P with new values Added Max_Sunlint_Threshold in L1c parameters
		4.2.4.2	Added provision to set Antenna Boresight to 0 in case no pointing information is retrieved during slew manouever
		2.2.2	Updated Site IDs according to the Master ICD
5/14	10-Feb-2010	4.2.2.2.2	Corrected T_Noise_Ref_Hot/Warm into MIR_CRSx1A Cons_Long_PMS_Coefficients dataset
		4.2.2.2.2	Added radian units to FWF Phase at the origin
		5.2.23	Corrected clarification in Cross-polar flag usage in L1OP
		5.2.23	Added Reference_Temperature_Level field to CNF product
5/15	26-Mar-2010	4.2.5.1.2	Size of Swath_Snapshot_List DSR corrected from 162 to 166 bytes
		4.2.2.3.2	Corrected units for FWF Shape coefficients D and E
		5.2.23	Added clarification to Sun Removal flag behaviour
5/16	31-May-2010	4.2.1.1	Added PMS ADF as Reference dataset in L1a HKTM products
		4.2.2.2.1	Changed precision of new and removed fields from 2 to 4 digits
		5.2.1	Added Trec_CIP_Sensitivity field to PMS ADF format
		5.2.4	Added UPC_Cold_Sky_Correction to SPAR ADF format
		5.2.23	Added unnoise RFI threshold in CNF ADF Updated format of calibration configuration parameters from 4 to 5 digits Corrected available calibration sequence description types post KP3.
		4.2.5.1.2, 4.2.5.2.2	Changed Faraday rotation angle definition to represent the rotation from surface to antenna (direct angle)
		All	Removed references to MIR_CRSU1A, MIR_UAVU1A, MIR_AFWU1A, MIR_GMATU_ and MIR_JMATU_ product types as they are no longer used after the end of the commissioning phase.



Iss./Rev.	Date	Section / Page	Change Description
5/18	23-Dec-2010	2.1	Update of L1PP website link
		2.2.3	Update of schemas and XML RW API FTP links
		3.1.1	Addition of AUX_BULL_B File_Description
		4.1.2.3	Addition of Bulletin B related Reference and Measurements Data Sets
		4.2.2.4.1	Added new fields to ANIR1A product header
		4.2.2.4.2	Added Averaged NIR-A and NIR-R sequences to ANIR1A datablock
		5.2.23	Added NIR consolidation calibration sequence in CNF ADF
		5.2.24	Table title is corrected
		5.2.25	Added SMOS Bulletin B format as new ADF
		6	Size of MIR_ANIR1A is updated, size of AUX_BULL_B is added
5/19	16-Feb-2011	3.1.1	Table 3-2 updated with AUX_RFILST
		4.1.2.3	Table 4-7 updated with new MIR_CRSD1A dataset
		4.2.1.2	TLM_MIRA1A datablock updated with new LO fields
		4.2.2.2.2	Addition of the fifth dataset Cons_LO_Unlock
		4.2.4.2.1.1	Update of Table 4-39 with AUX_RFILST
		4.2.4.2.1.2	Average_System_Temperatures description Comment changed
		4.2.4.2.1.2	RFI flags modified
		4.2.4.2.2	Update of Table 4-41 with AUX_RFILST
		4.2.4.2.2.2	Average_System_Temperatures description Comment changed
		4.2.5.1.2	Update of Table 4-44 with AUX_RFILST
		4.2.5.1.2	RFI flags modified, EAF FOV flags removed
		4.2.5.2	Update of Table 4-46 with AUX_RFILST
		4.2.5.3.2	Update of Table 4-49 with AUX_RFILST
		5	Correction of references to pure XML SPH table.
		5.1.2	Table 5-1 updated with AUX_RFILST
		5.2.2	AUX_NIR specification modified
		5.2.26	Added new section for AUX_RFILST specification
		6	AUX_RFILST estimated size added to Table 6-1



Iss./Rev.	Date	Section / Page	Change Description
5/20	09-May-2011	1.4	Reviewed applicable and reference documents
		2.2.2	Updated Site IDs according to the Master ICD
		5.2.5	Updated format of AUX_LCF to consider new antenna model
		4.2.2.2.1 4.2.2.2.2	Updated CRSD1A format with new PMS Offset datasets
		4.2.4.2.1.2	Expanded description of L1B flags related to RFI flagging options (RFI Mitigation and RFI Corrupted)
		4.2.5.1.2	Expanded description of L1C flags to clarify meanings of Border, Sun and RFI flags
		5.2.24	Updated format of AUX_CNFL1P to reflect new common approach for all L1 processors (L1PP, L1OP and NRTP)
		6	Updated product sizes for AUX_LCF and MIR_CRSx1A
5/21	20-May-2011	2.2.2, 4.1.1	Updated Instance_ID in filenames and Logical_Processing_Centre in accordance to latest Master ICD document
		5.2.18.1	Updated Solar_Flux format from 2 to 3 digits
5/22	20-Nov-2011	4.2.2.2 4.2.2.3	Split CRSD1A products into long term (CRSD1A) and short term (CSTD1A) calibration products. Major update of document to split references in header files accordingly.
5/23	24-Feb-2012	5.2.18.1	Update AUX_TEC definitions (Max TEC resolution and TEC values originators).
		7	Update of Appendix A to clarify that in stop time, one pure polarisation additional snapshot is needed.
5/24	20-May-2012	1.4	References updated with new DPMS. Quality Flag TN removed as it is incorporated in new annexes. Antenna Pattern Re-Normalization TN added.
		4.1.2.1	Added disclaimer on accuracy of orbital time parameters in SPH, as they can be used for information but not for algorithm input.
		4.1.2.3	Defined new reference data sets in the product headers
		4.2.1.1	Specified new inherited reference data sets for HKTM products
		4.2.3.1.1	Specified new inherited reference data sets for L1a Science products
		4.2.4.2.1	Specified new inherited reference data sets for L1b Science products
		4.2.5.1.1	Specified new inherited reference data sets for L1c Science products
		4.2.2.2	Updated PMS_ID field numbering from 1 to 72 to 0 to 71 (corrects L1P-PR-0513) Added new Cons_L1_Coefficients and Cons_External_L1_Coefficients datasets to CRSx1A products



Iss./Rev.	Date	Section / Page	Change Description
		4.2.2.4.1	Updated MIR_AFWD1A SPH with added references to AUX_PLM. AUX_NIR and AUX_LCF (corrects GJMAT-PR-0048)
		4.2.4.1.4, 4.2.4.1.5	Updated FTT format with new individual values per LICEF in order to apply it per baseline.
		4.2.3.1.2 4.2.3.2.2	Updated text on usability tips of T3 and T4 as zero baseline for image reconstruction
		4.2.3.1.2 4.2.4.2.1.2 4.2.5.1.2	Updated RFI flags in L1a, L1b and L1c products
		5.2.1	Added Trec_CIP field to PMS ADF from MIER on-ground characterisation database
		5.2.3	Changed PLM ADF to hold the weights and correction factors to be applied to the Antenna Patterns for G and J+ Generation
		5.2.23	Added Consolidate_PMS_Calibration_External to CNFL1P for consolidation of new L1 records obtained in external calibration. Changed Validity_Period field from 6 decimal digits to 5. Removed obsolete RFI Flag fields from L1b and introduced new thresholds in L1a RFI detection.
		8, 9, 10, 11	Added information from Quality Flags TN
5/25	25-July-2013	4.2.4.1.4.1 4.2.4.1.5.1	Added AUX_GALAXY to the list of Reference Data Sets for FTDD and FTTF products
		8	Updated section to reflect latest Quality Flags TN (v3.2 from 15/09/2012)
		8.4	Rephrased PMS External conditions to note that the start and stop times of the calibrated L1 sequence data are not meaningful in case Fixed L1 calibration strategy is in place (current baseline)
5/26	10-Sep-2013	4.2.4.1.4.1 4.2.4.1.5.1	Removed AUX_GALAXY from the list of Reference Data Sets for FTDD and FTTF products
5/27	25-Mar-2014	4.2.4.1.4.1 4.2.4.1.5.1	Re-added AUX_GALAXY to the list of Reference Data Sets for FTDD and FTTF products.
		5.2.5	Added clarification on the usage of L1 from AUX_LCF for the NIR channels
		4.2.3.1.2	Added clarification on the RFI L1a filtering only done for NIR CA channels
		4.2.4.12, 6	Updated text for new Hexagonal G-Matrix size
		All sections	Replaced obsolete reference to Quality Flags document (RD.24) by Annex B of this document
		8.4	Added NIR Pulse Length saturation condition to Instrument Error Flag conditions in HKTM products
		5.2.23	Added new L1c flagging configuration fields in CNF Aux file
5/28	09-Apr-2014	4.2.4.1.2.2 Table 4-35 Table 6-1	Updated with comments by ESA (corrected typos)



Iss./Rev.	Date	Section / Page	Change Description
5/29	10-Apr-2014	5.2.23	Corrected schema types for variables: Estimated_RFI_Radius_Constant_A, Estimated_RFI_Radius_Constant_B, Maximum_RFI_Radius_Threshold
5/30	11-April-2014	4.2.5.1.2	Clarified that RFI BT is estimated from snapshot measurements
5/31	29-Aug-2014	4.2.2.2.2 and 6	Updated DSR size for L1_Coefficients Datasets
		8.4.1	Added clarification on correlator layer mode applicability (only for CRS and UAV data)
		8.5.1	Added clarification on how incomplete scene pairs are taken discarded
		4.2.3.1.2 and 4.2.3.2.2	Corrected field naming from "flags" to "RFI_flags"
		All	Reference to [RD.24] changed to Appendix B.
6/0	31-Aug-2015	All	New release for v7xx processing baseline.
		4.2.1.1	Removed "Ancillary File" from the list of reference dataset for HKTM L1a HDR (closing SPR 578)
		4.2.2.1.2	Added ALL-LICEF Gains to DSR description and detailed specification
		4.2.2.2.1	Changed L1 to LFE in CRSD1A SPH description
		4.2.2.2.2	Changed L1 to LFE in CRSD1A datablock description
		4.2.2.5.2	Clarified the meanings of Observed_BT for NIR-A and NIR-R datasets, along with the other parameters
		4.2.3.1.2	Added LICEF Brightness Temperature to SC_D1A/TARD1A datablock description
		4.2.3.2.2	Added LICEF Brightness Temperature to SC_F1A/TAR_F1A datablock description
		4.2.4.1.4.1 4.2.4.1.5.1	Added AUX_PLM to the list of Reference Data Sets for FTTD and FTTF products
		5.2.3	Added TA_flag fields to AUX_PLM description
		5.2.5	Added LFE and TA_flag fields to AUX_LCF description
		5.2.5	Removed TA_flag field and added Gkj correction factor to AUX_LCF
		5.2.23	Added ALL-LICEF configuration flag to CNFL1P description
		6	Products Sizes Estimations updated for MIR_UAVD1A, and MIR_SC_F1A / MIR_TARF1A.



Iss./Rev.	Date	Section / Page	Change Description
		8.4	Updated conditions to discard L1a scenes (when full CMN thermistor are in failure)
		8.5	Added new condition for calibration error for L1b scenes, when an orphan scene is processed without a neighbor in the opposite polarization and in ALL-LICEF mode. This event will force the usage of the NIR BT for the unavailable polarization.
6/1	20-Jul-2016	All	New release for v710 processing baseline.
		4.2.4.2.1.2 4.2.4.2.2.2	Inserted clarification that Sun BT is set to 0 when in eclipse
		4.2.2.2	Table 4-18: Set AUX_FAIL as a Reference Data Set in the AUX_CRSD1A product
		4.2.2.3	Table 4-21: Set AUX_FAIL as a Reference Data Set in AUX_CSTD1A product
		4.2.5.1	Table 4-49: Added "Flags" field to the List_of_Snapshot_Information in Level 1C Dual polarization product data block Updated description of the pixel measurement RFI flags field Set description for the new "Flags" field added to the List_of_Snapshot_Information
		4.2.5.2	Table 4-51: Added "Flags" field to the List_of_Snapshot_Information in Level 1C Full polarization product data block
		5.2.1	Added the following parameters to the AUX_PMS characterization product data block: <ul style="list-style-type: none"> - PMS_Heater_Alpha_ON - PMS_Heater_Tau_1_ON - PMS_Heater_Beta_ON - PMS_Heater_Tau_2_ON - PMS_Heater_Alpha_OFF - PMS_Heater_Tau_1_OFF - PMS_Heater_Beta_OFF - PMS_Heater_Tau_2_OFF
		5.2.2.3	Table 5-36: Added the following fields to the AUX_CNFL1P product data block: <ul style="list-style-type: none"> - Max_Snapshot_RFI_Threshold_01 - Max_Snapshot_RFI_Threshold_02 - Max_Snapshot_RFI_Threshold_03 - RFI_Contamination_Level_01 - RFI_Contamination_Level_02 - RFI_Contamination_Level_03
		6	Table 6-1: Updated the product estimated sizes for: <ul style="list-style-type: none"> - MIR_SCLD1C / MIR_SCSD1C - MIR_SCLF1C / MIR_SCSF1C - AUX_PMS - AUX_CNFL1P
		8.3	Corrected LICEF Physical temperature nominal range to [15, 29]°C



Iss./Rev.	Date	Section / Page	Change Description
6/2	19-Aug-2016	Section 4.2.4.2.1.1:	Updated L1b Header Definitions to new Gibbs implementation, including new fields for Frresnel model reporting.
		Section 4.2.5.1.2:	Improved sentence describing the new RFI flag bitfield.
		Section 4.2.5.2.2:	Fixed Error! Reference source not found. in new L1C snapshot flag description
		Section 5.2.23:	Updated CNF_L1P definitions to support new Gibbs implementation
		Section 8:	Added condition for Software Error when Tsys are negative
		Section 12:	Added Appendix F with more detailed description of the new RFI flags (and added reference to it)
6/3	31-Jan-2017	Section 5.2.23	Reconstruction_Image_Algorithm description modified to be coherent with the Earth_Contribution_Correction_Type configuration flag
		Section 4.2.4.2.1	Table4-43: Added MIR_AFWD1A to the Reference Data Sets
		Section 4.2.4.2.2	Table4-45: Added MIR_AFWD1A to the Reference Data Sets
		Sections 4.2.4 and 4.2.5	Added clarification that Direct Sun removal flag is applied to pixels when Sun is in the front
6/4	25-May-2018	Section 3.1.1	Addition of AUX_FRSNEL to the Product Types File description table 3-2
		Section 4.2.2.1.1	Addition of AUX_LCF__ and AUX_NIR__ as MIR_UAVD1A Reference Data Sets in Table 4-15
		Section 4.2.4.2.1 Section 4.2.4.2.2	SC_D1B, SC_F1B, SC_TARD1B, SC_TARF_1B: - Addition of WGS84 data to SPH - Incorporation of Matrix_BFP2EF (9 double values) to DBL
		Section 4.2.2.1.1 Section 4.2.2.5.1 Section 4.2.4.1.1 Section 4.2.4.2.1.1 Section 4.2.5.1.1 Section 4.2.5.3.1 Section 5.2.14.1 Section 5.2.18.1 Section 5.2.22.1	Data_Sets table references corrected
		Section 4.2.4.1.4.1	Removal of MIR_FTTD__ as MIR_FTTD__ Reference Data Sets in Table 4-38
		Section 4.2.4.1.5.1	Removal of MIR_FTTF__ as MIR_FTTF__ Reference Data Sets in Table 4-40
		Section 4.2.4.2.1.1	Addition of AUX_FRSNEL as MIR_SC_D1B/MIR_TARD1B Reference Data Sets in Table 4-43
		Section 4.2.4.2.1.1	Added option 4 for Enhanced Sun in the L1b product header description



Iss./Rev.	Date	Section / Page	Change Description
		Section 4.2.4.2.1.2 Section 4.2.4.2.2.2	Added clarification on contents and format of new BFP-EF rotation matrix in L1b products
		Section 4.2.4.2.2.1	Addition of AUX_FRSNEL as MIR_SC_F1B/MIR_TARF1B Reference Data Sets in Table 4-45
		Section 4.2.4.2.1.2 Section 4.2.4.2.2.2	Clarified the meaning and setting of Constant_Earth_BT fields.
		Section 4.2.5.1.2	Removed extra threshold in detailed description of RFI tails flag (level 4 not used)
		Section 5.2.2	AUX_NIR: - Added fixed Tna0 values - Added "L_P_H" and "L_P_V" parameters for Tp7 latency correction
		Section 5.2.5	AUX_LCF: Added G_kj correction factor for NIR and ALL-LICEF modes independently C Format specification corrected.
		Section 5.2.6	AUX_PATT: Changed antenna patterns data. AP are now in the instrument frame grid of 196x196, and front and back lobes are distinguished
		Section 5.2.12	Changed the LSMask file from fixed to dynamic, and clarified that the Water Fraction will depend on seasonal Ice content
		Section 5.2.23	AUX_CNFL1P: - Corrected Reference_Temperature_Level and Earth_Contribution_Correction types in Prod. Spec. to Integer (were Flag type) - Added fixed TP7 correction flag (Tp7_Correction_Flag) - Added fixed Tna flag (Fixed_Tna_Flag) - Added Sun Removal option for new improved Sun estimation
		Section 5.2.27	Added new AUX file for Static Fresnel Model Sea brightness temperature at L-band (AUX_FRSNEL)
		Section 6	Product Sizes updated according to modifications in section 4 and 5.
6/5	09-Dec-2021	Section 4.2.5.1.2	RFI flags description updated in accordance with the information provided by ESA (R.Crapolicchio) by e-mails under subject "L1 Prod Spec amend", date 15/10/2021 11:10 and "RE: [SMOS] L1 Product Format Specification v6.5 document delivery", date 03/12/2021 16:22.



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1. INTRODUCTION

1.1 OBJECTIVE

The purpose of this document is to present the structure, syntax, file naming and use of the different L1 SMOS operational Products.

1.2 SCOPE

The scope of this document is the DPGS Phase C/D/E1 project, affecting to all the DPGS subsystems that produce, archive, analyse or disseminate L1 products.

1.3 APPLICABLE DOCUMENTS

The applicable documents are approved by ESA and represent the current project baseline in terms of requirements and/or technical/administrative specifications and mandatory practices. The specifications contained in the applicable documents have to be considered as mandatory; in the case that these specifications can not be met or a discrepancy is found, a report shall be prepared and sent to ESA.

Ref.	Title	Code	Ver.	Date
[AD.1]	SMOS System Requirements Document	SO-RS-ESA-SYS-0555	4.1	28-Sep-04
[AD.2]	Earth Explorer CFI Software Mission Conventions Document	CS-MA-DMS-GS-0001	1.3	15-Jul-03
[AD.3]	Earth Explorer Ground Segment File Format Standard	PE-TN-ESA-GS-0001	1.4	13-Jun-03
[AD.4]	Removed			

Table 1-1 Applicable documents

1.4 REFERENCE DOCUMENTS

The reference documents contain useful information related to the subject of the project. The reference documents complement the applicable documents. The list of reference documents is included in the following table.

Ref.	Title	Code	Version	Date
[RD.1]	SMOS L1 Product Format Specification	SO-IS-DME-L1PP-0002	2.3	26-Nov-07
[RD.2]	SMOS L1 Auxiliary Data Specification Format	SO-IS-DME-L1PP-0003	2.4	31-Mar-08
[RD.3]	SMOS L1 Processor L0 to L1a Data Processing Model	SO-DS-DME-L1OP-0007	2.22	28-Nov-17
[RD.4]	SMOS L1 Processor L1a to L1b Data Processing Model	SO-DS-DME-L1OP-0008	2.23	28-Nov-17
[RD.5]	SMOS L1 Processor L1c Data Processing Model	SO-DS-DME-L1OP-0009	2.17	28-Nov-17
[RD.6]	Technical Note on SMOS DPGS Products Consolidation	SO-TN-IDR-GS-0004	2.0	12-Nov-07
[RD.7]	EE XML and Binary Schema Standard	PE-TN-ESA-GS-121	1.0	01-Jul-05
[RD.8]	EE XML/Binary File Handling Library User Manual	SO-UM-DME-L1PP-0005	1.5	02-May-05
[RD.9]	XML Guidelines	SO-MA-IDR-GS-0004	2.1	9-Jul-10
[RD.10]	SMOS DPGS Acronyms	SO-TN-IDR-GS-0010	1.11	13-Jun-08
[RD.11]	SMOS XML Read/Write Software Users Manual	SO-ID-IDR-GS-0009	2.1	29-Apr-07
[RD.12]	L0 Product Specification	SO-TN-IDR-GS-0003	3.5	2-Feb-10
[RD.13]	SMOS L1 Full Polarisation Data Processing	SO-TN-DME-L1PP-0024	1.6	16-Jul-07
[RD.14]	Removed			
[RD.15]	Galaxy Map Usage For SMOS-DPGS	XSMS-GSEG-EOPG-TN-06-0023	1.1	08-Nov-06
[RD.16]	VTEC usage for the SMOS Level 1 Operational Processor (L1-OP)	XSMS-GSEG-EOPG-TN-06-0019	3.1	13-May-2008
[RD.17]	DPGS Master Interface Control Document	SO-ID-IDR-GS-0016	3.4	10-Dec-10
[RD.18]	Level 1 Processor ICD and Operational Constraints	SO-ID-IDR-GS-0008	5.0	26-Apr-18
[RD.19]	Ancillary Packet Description	SO-TN-CASA-PLM-0594	3.1	13-Feb-07
[RD.20]	PDPC-Core Generic IPF ICD	SO-ID-IDR-GS-1001	1.10	31-May-07

Ref.	Title	Code	Version	Date
[RD.21]	EE Mission CFI SW Explorer Data Handling SUM	EE-MA-DMS-GS-0007	3.7.3	7-May-10
[RD.22]	SMOS DPGS V3 Calibration Baseline	SO-TN-DME-GS-0167	1.0	16-Apr-08
[RD.23]	Removed			
[RD.24]	Deleted			
[RD.25]	PLPC-SOGS Interface Control Document	SO-ICD-ESA-GS-0966	1.6	09-Nov-06
[RD.26]	VTEC Usage for SMOS L1OP	XSMS-GSEG-EOPG-TN-06-0019	3.0	05-May-08
[RD.27]	Generation of a sky map to be used in Lvl1 and Lvl2 processors	N/A	1.0	21-Apr-06
[RD.28]	L2Products Specifications document	SO-TN-IDR-GS-0006	TBD	TBD
[RD.29]	Usage of L1c and Auxiliary data in L2 processing Technical Note	XSMS-GSEG-EOPG-TN-08-0008	1.1	11-Apr-08
[RD.30]	SMOS Faraday Correction ADF Requirements Definition	XSMS-GSEG-EOPG-RD-09-0006	2.0	09-Jun-09
[RD.31]	Antenna pattern re-normalization	SO-TN-UPC-PLM-0151	1.0	28-Sep-12
[RD.32]	TN on the L1OP RFI Flags	SM-TN-AURO-L1OP-0001	2.1	12-Sep-17

Table 1-2 Reference documents

1.5 ACRONYMS AND TERMS

The acronyms used in this document are compiled in the following document: DPGS Acronyms [RD.10].

1.6 DOCUMENT STRUCTURE

The L1 Product and Specification Document is structured as follows:

- Chapter 1 is the introduction you are currently reading.
- Chapter 2 introduces the conventions of this document and specifies the work done to adapt L1PP products formats to the operational environment. It also details the products files structures, names and references the document stating the XML schema guidelines
- Chapter 3 describes the generic structure of the L1 Products headers, specifying the common features to all products



- Chapter 4 provides a formal Specification for all types of Level 1 Products derived from instrument in-orbit measurements, including the particularities for each product's specific product header
- Chapter 5 provides a formal Specification for all the Auxiliary Data Products types needed to perform the processing of L1 Products, including the particularities for each product's specific product header
- Chapter 6 provides estimations of the sizes of each Level 1 and Auxiliary Data Products, based on the typical number of dataset records in each product

2. SMOS L1 PRODUCTS

2.1 GENERAL CONSIDERATIONS ON THIS DOCUMENT

This document is based mainly in the Level 1 Processor Prototype's SMOS and auxiliary product format documents (see [RD.1] and [RD.2]), and also in L1PP the products examples and schemas found in URL http://www.smos.com.pt/project_docs.html. Most of the specifications and scientific explanations included here are based on what is contained in those documents and examples, but has been kept instead of referencing it in order to have a stand-alone reference for L1 operational products formats.

Work has been done in order to fit the L1 specifications in the operational environment and the requirements put to the DPGS and more specifically to Level 1 Operational Processor. The main difference between L1PP and L1OP is that the L1PP is a stand-alone SW that is fed with inputs provided interactively by the user, while the L1OP is integrated in a very much automated system, interfacing the DPGS PDPC-Core that delivers inputs and receives outputs to/from L1OP. This means that work needs to be done to make the products contain the information necessary to be handled automatically in a proper way.

The work done in this document includes:

- Checking fulfilment of ESA requirements (mainly asking to follow the Earth Explorer Ground Segment File Format Standard –see [AD.3]- and its ESA's adaptation to the SMOS Mission needs –see [AD.4]-) on DPGS Products, as their specifications are inherited from L1PP Prototype's, which is not necessarily fulfilling the standard.
- Adding a column with Source or Origin of data to be printed in each field (e.g. specific L1 module internal processing, specific L0 product's header or datablock, specific auxiliary data product, etc.)
- Adaptation of tables to XML standards for clarification purposes. That is, tables follow the hierarchical tagging based in the format of an XML file.
- As L1PP products examples & schemas and the L1PP format documents do not fit in some aspects, work has been done to detect the differences between them and to take decisions on which of them prevail when inspiring the L1OP Specifications.
- Define a convention on the C format and precision used to print the fields, and apply it to each of the fields in the L1OP Specifications, based on what has been defined in L1PP documents. Whenever there is a doubt, the policy followed has been being conservative and forcing more precision than the one specified in the L1PP Specifications.
- Adaptation to "variable array of variable array" concept from L1PP to L1OP Products, as explained in [RD.9].
- Refinement and proposal of several new fields in Products' headers regarding what is needed to fit the Products in an automated operational environment that shall be using the header information as metadata to be stored in databases for consultancy.
- Calculation of data set record sizes, and estimation of operational Products sizes, based on assumptions on the number of data set records in each of the datasets of Products.



- Generation of the corresponding operational Products schemas and some product examples, which scientific contents are fully based on what is contained in the L1PP products examples.
- Generation of new L1A products to support consolidation of calibration sequences in the operational timeline (synthetic curve of correlated noise injection measurements; averaged uncorrelated noise injection; individual FWF containing calibrated correlations instead of FWF shape estimation; and averaged FWF shape estimation).
- Removal of one L1A product: individual correlated noise injection (MIR_CORN1A), as its measurements are already contained in the synthetic curve product. In this way, this intermediate processing step is saved simplifying the processing model and reducing the storage needs.
- Harmonisation of specifications with L0 and L2.
 - MPH has been set common to all SMOS products resulting from MIRAS measurements, and has been removed from all auxiliary data products.
 - SPH contains more fields that have been removed from MPH.
- Addition of VTEC product specification in operational EEF format, as proposed by ESA in [RD.16].
- Removal of IGRF data product specification. From now on it is to be considered a configuration file part of the IGRF model software distribution, and data product is not to be considered as an ADF that can be updated independently.
- Naming convention changed to have different product names for different nominal/external attitudes.
- Merging of all antenna pattern products in only one containing all the information.
- Updating Galactic Maps specification, as proposed by ESA in [RD.15].
- The endianness of the products has been defined:
 - L0 products are all big-endian. This is due to the fact that the L0P simply gathers the packets as they come out from Front-End Processor, applying no change on their structure. As the packets are available from FEP as big-endian, so they are the L0 products.
 - L1 products are defined all as little-endian, and will always be distributed as such –i.e. DPGS will not perform the byte swapping at User's demand-. This is due to the fact that the most widely available computer processor vendors, Intel and AMD, both use little endian. Other platforms, such as Apple, will have to apply byte swapping when reading the L1 products, using the functionality that the DPGS XML R/W API provides to the SMOS products Users.



2.1.1 Conventions

This section contains lists of conventions used in these specifications:

- The tables for headers start and end with a **Fixed_Header**, **Main_Product_Header** and **Specific_Product_Header** tags to make clear which are the fields enclosed within. The same applies for datablocks, which are enclosed within **Data_Block** tags.
- Binary data blocks are specified following the XML syntax, although obviously they are not in XML format. The Field#, Type, Unit, Precision, C format and Origin columns for the pseudo-XML tags are in gray colour, so as to make clear that they are not fields contained in the product. A note has been added in any case in the Comments column highlighting this issue.
- A wider line specifies which is the beginning and the end of a dataset. Adjacent datasets are then separated by this wider line, but this also applies to Header/DataBlock tags that are separated from datasets by this wider line.

The tables have the following columns:

- Field #: numbering applied to each field appearing in the table.
- Field Name: tag used in the schemas to identify the field
- Type: variable type, this is the concept of the variable instead of its actual implementation in the product. It can be either Tag (enclosing XML structures), string, integer, identifier, real value, matrix of complex values, etc.
- Unit: specification of the unit type according to EEF convention. N/A is applied to unitless fields.
- The following column is different for binary and ASCII XML structures:
 - Element Precision: this column specifies the implementation of an element of the field, in C-like specification (float, unsigned integer, etc.), specifying also the element's size in bytes.
 - String Length (ASCII XML): number of bytes in which the field value is written
- The following column is different for binary and ASCII XML structures:
 - C Format (ASCII XML): specifies in C language fwrite function the format in which field is written to a file. Note that %+08.3f means that the number has always 8 digits, one of which is the sign, another is the dot and 3 of them are decimals, being the remaining digits at the left of the dot.
 - Variable Format (Binary): specifies the format of the variable from the elements defined in the previous column (number of elements, sorting, etc.).
- Comments: clarifications on the meaning of the product's field.
- Origin: this column specifies which is the origin of the information filling the product field
 - [ICNF]: L1OP internal configuration file (CNF_L1OP__, see specification in [RD.18])
 - [Generated by L1 Processor]



- [AUX_XXXXXX]: data coming from auxiliary data files
- [Copied from L1x product]: data coming from a lower level CORR-TM input product
- [Copied from L1A HKTKM product]: data coming from a lower level HKTM input product

Regarding the validity period, the following convention must be considered: any file that is intended to be valid throughout all Mission, regardless of SMOS sensing time (e.g. static auxiliary data files that can be used to process any SMOS data measured in the past or the future), shall have as validity start time the 00:00:00.000000 hours of January 1st 2005 and shall have as validity stop time the 00:00:00.000000 hours of January 1st 2050.

Files coming from elements outside DPGS (e.g. L1PP) following other conventions for Mission validity (e.g. from 00:00:00 of January 1st 2007 to 23:59:59 of December 31st 2078 in L1PP), shall be adapted to the convention specified in the paragraph above before being put into operation in DPGS.

2.2 L1 FILE STRUCTURE

2.2.1 Logical File vs Physical File

A SMOS Level 1 Product Logical File is compliant with [AD.3] and [AD.4]; its structure, shown in Figure 2-1, comprises

- An ASCII XML Fixed Header, whose structure is identical for all file types.
- An ASCII XML Variable Header, which allows to define and structure different information for each file type, and is split into:
 - a Main Product Header (MPH)
 - a Specific Product Header (SPH).

It must be noticed that SMOS measurements products' headers (i.e. those specified in Chapter 4 of this document) follow the structure described above, while the auxiliary data products (specified in Chapter 5) do not have MPH, as most of that information does not make sense in these products. Whenever a field is still needed, it has been moved to the SPH.

- A Data Block, containing one or more Data Sets. Each Data Set contains a number of identical Data Set Records.

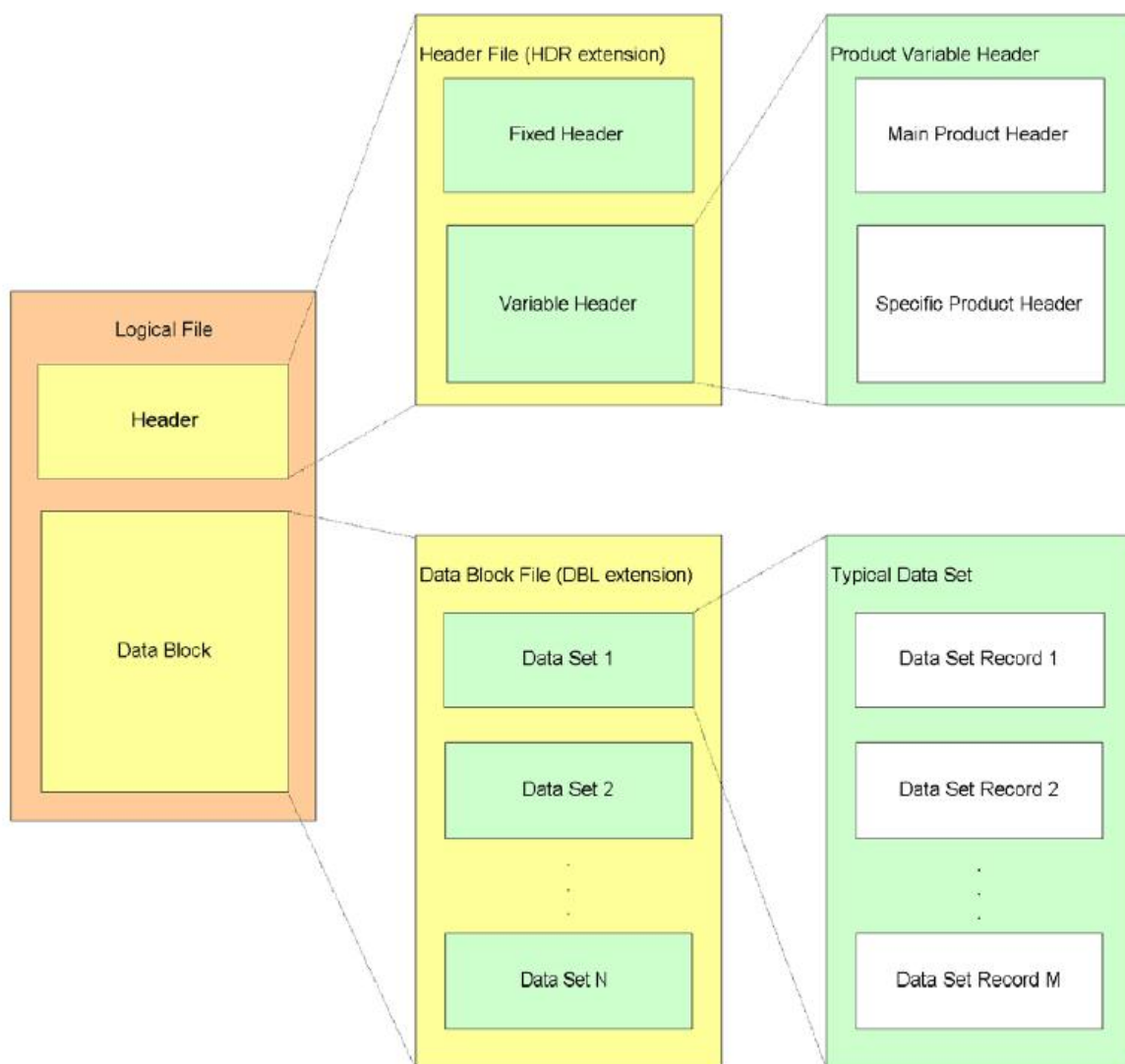


Figure 2-1 Level 1 Product Structure (taken from Deimos Eng., L1PP Product format)

In terms of computer 'Physical Files', the L1 Logical File can be structured in one of the following two ways:

- when Data Block is binary, it is structured as two separate Physical Files:
 - a Header file (XML ASCII), with .HDR extension
 - a Data Block file (binary), with .DBL extension
- when Data Block is XML, it is structured as one unique Physical File, all in XML ASCII format following EEF convention, with .EEF extension.

The L1 Physical files related to the same Logical File shall share the file name, only differentiating each Physical File using a different extension, as specified above.

The high level file syntax for these files is as defined in [AD.3], i.e.

```
Header File (file_name.HDR):
<?xml version="1.0" ?>
<Earth_Explorer_Header Validation-Schema-Reference>
  <Fixed_Header>
    Fixed Header contents
  </Fixed_Header>
  <Variable_Header>
    Variable Header contents
  </Variable_Header>
</Earth_Explorer_Header>

Data Block File (file_name.DBL): ad-hoc ASCII syntax
```

Table 2-1 Non-XML ASCII File Syntax

The packaging mechanism for users external to the DPGS is the .ZIP one, as described in [RD.9]. For internal users, it is as described in [RD.17].

The "Validation-Schema-Reference" field is to be filled as specified in [RD.9] section 3.2.1. In the operational processor, this field is filled by the XML R/W library.

2.2.2 L1 File Names

The Logical File Name of the SMOS L1 Product consists of 60 characters, with the following layout:

MM_CCCC_TTTTTTTTTT_<instance_ID>

Where each field of the filename is as follows:

- **MM**: is the Mission identifier, for the SMOS case it shall be always **SM**
- **CCCC**: is the File Class, which has three alternatives:
 - **TEST** : for internal testing purposes only (e.g. products generated as input to or output from acceptance testing, GSOV, etc.)
 - **OPER** : for all files generated in automated processing during mission operation phases
 - **REPR**: for all the reprocessed files.
- **TTTTTTTTTT**: is the File Type, consisting of two sub-fields:

TTTTTTTTTT=FFFFDDDDDD

Where:

- **FFFF** : is the File Category.
 - For the L1 HKTM product, this shall be always **TLM_**.



- For all other MIRAS measurement product, this shall be always **MIR_**.
 - For auxiliary data products, this shall be always **AUX_**.
 - **DDDDDD**: is the Semantic Descriptor, described in Table 4-5 for L1 measurements products and auxiliary data products.
- **<instance_ID>**: the instance ID for the L1 product matches Shape 1 defined in [AD.4]:

<instance_ID>= yyyymmddThhmmss_YYYYMMDDTHHMMSS_vvv_ccc_s

- **yyymmddThhmmss** :
 - in case of MIRAS measurements products (including calibration ones) it is the SMOS sensing start time of the data contained in the product, in CCSDS compact format. As SMOS sensing time values will typically have greater precision than a second, the sensing start time shall be rounded up (this way the period specified in the filename is completely covered by the time period of the data actually contained in it). The origin for this time is the **Precise_VValidity_Start_time** specified in the Specific Product Header.
 - in case of auxiliary data products it is the start time of the period in which the product is valid –i.e. it can be used as supporting product in the processing of a SMOS measurement product to an upper level-. As possibly the values will typically have greater precision than a second, the start time shall be rounded up (this way the period specified in the filename is completely covered by the time period of the data actually contained in it)
- **YYYYMMDDTHHMMSS** :
 - in case of MIRAS measurements products (including calibration ones) it is the SMOS sensing stop time of the data contained in the product, in CCSDS compact format. As SMOS sensing time values will typically have greater precision than a second, the sensing stop time shall be rounded down (this way the period specified in the filename is completely covered by the time period of the data actually contained in it). The origin for this time is the **Precise_VValidity_Stop_time** specified in the Specific Product Header. In the case that the **Precise_VValidity_Stop** equals the **Precise_VValidity_Start**, the **Validity_Stop** in the fixed header and filename shall be set equal to the **Validity_Start**.



- in case of auxiliary data products it is the stop time of the period in which the product is valid –i.e. it can be used as supporting product in the processing of a SMOS measurement product to an upper level-. As possibly the values will typically have greater precision than a second, the stop time shall be rounded down (this way the period specified in the filename is completely covered by the time period of the data actually contained in it).
- **vvv** : is the version number of the processor generating the product.
- **ccc** : is the file counter (used to make distinction among products having all other filename identifiers identical). The counter shall start at 001 and not 000.
- **s** : is the site instance ID, where
 - 0: Test data generated outside the SMOS operational ground segment (e.g. test data)
 - 1: SMOS DPGS Fast Processing / Fast Reprocessing Centre @ ESAC
 - 2: SMOS DPGS LTA @ ESRANGE in Kiruna
 - 3: SMOS DPGS Calibration & Expertise Centre @ ESAC
 - 4: SMOS DPGS Integration and Maintenance Platform @ Indra
 - 5: Grid on-demand Processing Centre (G-POD)
 - 6: NRTP
 - 7: L1 Expert Support Laboratory
 - 8: L2 OS Expert Support Laboratory
 - 9: L2 SM Expert Support Laboratory

2.2.3 L1 XML Schemas Guidelines

L1 XML schema Guidelines will follow the conventions and format indicated in [RD.9].

The schemas of the L1 products specified in this document can be found in URL:

<ftp://131.176.251.166/smos/schemas/>

The XML Read/Write API tool implemented by DPGS Prime to read, write and modify the SMOS products, using the BinX recommendation to deal with binary data, is available in URL:

ftp://131.176.251.166/smos/software/XML_RW_API/

The L1OP Product Format Specifications document release that describes the products received by the user is identified by reading the **Ref_Doc** field in SMOS products headers.



3. LEVEL 1 PRODUCTS GENERIC STRUCTURE

3.1 LEVEL 1 HEADERS

The Level 1 Headers will be an XML file and as any other Earth Explorer File will have a common structure divided in two main parts:

- a Fixed Header (FH), with identical structure for all files
- a Variable Header (VH), which allows to define and structure different information for each file type.

Further information about Headers is specified in the following sections.

3.1.1 Level 1 Earth Explorer Fixed Header

The **Fixed Header** is common to all Earth Explorer Mission products, therefore it is compliant with [AD.3] and [AD.4].

The following table specifies the fields in the Fixed Header.



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
01	Fixed_Header	Tag				Tag starting the Fixed Header of all SMOS products.	
02	File_Name	String	N/A	60 bytes	%60s	It is a repetition of the Logical File Name, i.e. the File Names excluding the extension. The origin of this field is INT because it is generated from several sources (dates from DSR in Datablock; File Class from Job Order Phase tag; File Type from L1P code; file counter from Job Order). The dates from L1C File_Name are copied as is by L2P.	Generated by L1 Processor
03	File_Description	String	N/A	Variable (limited to 300 bytes)	%s	A 1-line description of the File Type. Each Mission shall define the list of official file descriptions (per File Type). See text below the tables to find a complete list of the descriptions. L2Ps do not obtain this tag from same tag in L1C products.	Hard-coded value in the Processor, according to Table 3-2
04	Notes	String	N/A	Variable (limited to 300 bytes)	%s	Multi-lines free text. This can be used for any type of comment, relevant that instance of the file. The Operational Processor generates no notes and this field remains always empty. L2Ps do not obtain this tag from same tag in L1C products.	If filed, generated by User
05	Mission	String	N/A	4 bytes	%4s	A 1-word description of the Mission, coherent with the Mission element in the File Name. For this Mission, this string shall be always "SMOS" in upper case letters. L2Ps do not obtain this tag from same tag in L1C products.	Hard-coded
06	File_Class	String	N/A	4 bytes	%4s	A 1-line description of the file class, coherent with the File Class element in the File Name. Each Mission shall define the list of official file classes. For the SMOS Mission, this string shall be obtained from job order. The product shall have File_Class according to Job Order Phase tag, i.e. it shall be "TEST" for testing purposes and "OPER" for products generated during Satellite orbiting. Note that at LTA it shall be "REPR" for all products reprocessed. See [RD.20] for details on the job order. All in upper case letters. L2Ps do not obtain this tag from same tag in L1C products.	Job Order



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
07	File_Type	String	N/A	Variable	%10s	It is a repetition of the File Type element in the File Name, including File Category and Semantic Descriptor. L2Ps do not obtain this tag from same tag in L1C products.	Generated by L1 Processor
08	Validity_Period	Tag				Tag starting a structure to specify the period of time during which the file contents are valid	
09	Validity_Start	String	N/A	23 bytes	%23s	This is the UTC Validity Start Time, coherent with the Validity Start Time in the File Name, but in CCSDS ASCII format with time reference. Note that this can have the special value indicating "beginning of mission" (without an absolute time specified) as defined in Tailoring of EEFF Standard for SMOS GS [AD.4]. "UTC=yyyy-mm-ddThh:mm:ss" The Validity Start Time shall be the start time of the period in which the product is valid –i.e. can be used as supporting input to the processing– in case the product is an auxiliary file. L1C Validity_Start is copied as is by L2P.	Generated by L1 Processor
10	Validity_Stop	String	N/A	23 bytes	%23s	This is the UTC Validity Stop Time, coherent with the Validity Stop Time in the File Name, but in CCSDS ASCII format with time reference. Note that this can have the special value indicating "end of mission" (without an absolute time specified) as defined in Tailoring of EEFF Standard for SMOS GS [AD.4]. "UTC=yyyy-mm-ddThh:mm:ss" The Validity Stop Time shall be the stop time of the period in which the product is valid –i.e. can be used as supporting input to the processing– in case the product is an auxiliary file. In the case that the Precise_VValidity_Stop equals the Precise_VValidity_Start, the Validity_Stop in the fixed header and filename shall be set equal to the Validity_Start. L1C Validity_Stop is copied as is by L2P.	Generated by L1 Processor
11	Validity_Period	Tag				Tag starting a structure to specify the period of time during which the	



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
						file contents are valid	
12	File_Version	Integer	N/A	4 bytes	%04d	<p>It is a repetition of the File Counter element in the File Name instance ID, plus 1 additional digit (most significant, always set to 0 to be the same as file counter in filename; it appears here as 4 digits for compliancy with EEFF convention –see [AD.3]-).</p> <p>Must start at 0001 (not 0000), only digits allowed.</p> <p>The origin is the Job Order tag List_Of_Outputs. Output.File_Counter.</p> <p>L2Ps do not obtain this tag from same tag in L1C products.</p>	Job Order for products (CEC for ADF)
13	Source	Tag				Tag starting a structure to specify the GS element that has created the product	
14	System	String	N/A	4 bytes	%s	<p>Name of the Ground Segment element creating the file. For the Data Processing Ground Segment, this string shall be “DPGS”.</p> <p>L2Ps do not obtain this tag from same tag in L1C products.</p>	CNF_L1OP__
15	Creator	String	N/A	4 bytes	%s	<p>Name of the tool, within the Ground Segment element, creating the file . For L1 Operational Processor measurements product (File Class = MIR), this string shall be “L1OP”.</p> <p>For the auxiliary data products, this string can be “RPC” for Reference Processing Centre, “CEC” for Calibration & Expertise Centre, “L1PP” for L1P Prototype Development Team, “L2PP” for L2P Prototypes Development Teams.</p> <p>L2Ps do not obtain this tag from same tag in L1C products.</p>	ICNF
16	Creator_Version	Integer	N/A	3 bytes	%03d	Version of the tool. This shall be the same as version number in Filename’s instance ID “vvv”. Only digits allowed	CNF_L1OP__
17	Creation_Date	String	N/A	23 bytes	%23s	<p>This is the UTC Creation Date, in CCSDS ASCII format with time reference, as defined in Mission Conventions Document [AD.2].</p> <p>“UTC=yyyy-mm-ddThh:mm:ss.”</p>	Generated by L1 Processorfrom machine’s clock



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
						The Creation Date is the date obtained from machine's clock when the product header is being written. L2Ps do not obtain this tag from same tag in L1C products.	
18	Source	Tag				Tag ending the structure to specify the GS element that has created the product	
19	Fixed_Header	Tag				Tag ending the Fixed Header of all SMOS products.	

Table 3-1 Fixed Header particularized for L1OP

The following table contains a list of the strings to be used for the **File_Description** field, for each product type.

Product Type	File_Description
TLM_MIRA1A	Level 1A Housekeeping Telemetry product
MIR_CRSD1A	Level 1A containing N Correlated Noise Injection averaged sequences (long term calibration)
MIR_CSTD1A	Level 1A containing N Correlated Noise Injection sequences distributed in different times to be used in the interpolation of the FWF phase at the origin
MIR_AFWU1A	Level 1A calibration containing the average of all Fringe Washing Function estimates in one or more MIR_FWAS1A products generated with the instrument pointing to the Sky (NO LONGER USED IN DPGS)
MIR_AFWD1A	Level 1A calibration containing the average of all Fringe Washing Function estimates in one or more MIR_FWAS1A products
MIR_ANIR1A	Level 1A Noise Injection Radiometer consolidated calibration product
MIR_UAVU1A	Level 1A Uncorrelated Noise Injection product containing an average of all individual uncorrelated noise injection measurements in a calibration campaign. Consolidation is the whole campaign, no matter if they are in the same semi-orbit or not generated with the instrument pointing to the Sky (NO LONGER USED IN DPGS)
MIR_UAVD1A	Level 1A Uncorrelated Noise Injection product containing an average of all individual uncorrelated noise injection measurements in a calibration campaign. Consolidation is the whole campaign, no matter if they are in the same semi-orbit or not



Product Type	File_Description
MIR_GMATU_	G Matrix (MIRAS' System Response Function) used in image reconstruction generated with the instrument pointing to the Sky (NO LONGER USED IN DPGS)
MIR_GMATD_	G Matrix (MIRAS' System Response Function) used in image reconstruction
MIR_JMATU_	Inverted J Matrix used in image reconstruction generated with the instrument pointing to the Sky (NO LONGER USED IN DPGS)
MIR_JMATD_	Inverted J Matrix used in image reconstruction
MIR_TARD1A	Level 1A Dual Polarization External Target measurements product
MIR_TARF1A	Level 1A Full Polarization External Target measurements product
MIR_SC_D1A	Level 1A Dual Polarization Science (Earth observation) measurements product
MIR_SC_F1A	Level 1A Full Polarization Science (Earth observation) measurements product
MIR_TARD1B	Level 1B Dual Polarization External Target measurements product
MIR_TARF1B	Level 1B Full Polarization External Target measurements product
MIR_SC_D1B	Level 1B Dual Polarization Science (Earth observation) measurements product
MIR_SC_F1B	Level 1B Full Polarization Science (Earth observation) measurements product
MIR_FTTD__	Level 1B Flat Target Transformation product in dual polarization
MIR_FTTF__	Level 1B Flat Target Transformation product in full polarization
MIR_SCSD1C	Level 1C Dual Polarization Sea Science measurements product
MIR_SCSF1C	Level 1C Full Polarization Sea Science measurements product
MIR_SCLD1C	Level 1C Dual Polarization Land Science measurements product
MIR_SCLF1C	Level 1C Full Polarization Land Science measurements product
MIR_BWSD1C	Level 1C Browse Dual Polarization Sea Science measurements product
MIR_BWLD1C	Level 1C Browse Full Polarization Sea Science measurements product
MIR_BWSF1C	Level 1C Browse Dual Polarization Land Science measurements product



Product Type	File_Description
MIR_BWLF1C	Level 1C Browse Full Polarization Land Science measurements product
AUX_PMS__	PMS Characterisation Table
AUX_NIR__	Noise Injection Radiometer (NIR) Characterisation parameters
AUX_PLM__	MIRAS Payload configuration parameters
AUX_SPAR__	MIRAS Switches' and Noise Distribution Network's S-parameters
AUX_LCF__	MIRAS LICEFs Characterisation parameters
AUX_PATT__	Antenna pattern of all LICEF in amplitude and phase in different MIRAS pass band frequencies, plus the coordinates and the patterns' average
AUX_FAIL__	MIRAS elements in failure status
AUX_BWGHT_	Weight vector to be multiplied element by element with the calibrated visibilitie
AUX_BFP__	Best Fit Plane used in geolocation
AUX_MISP__	Mispointing angles between the Body Frame referenced in the Proteus quaternions and the Antenna Plane defined by the MIRAS instrument
AUX_DGG__	ISEA4-9 Discrete Global Grid used in geolocation
AUX_LSMASK	Land/Sea mask of pixels in the DGG
AUX_MASK__	Mask with flagging of pixels for use in L1c land or sea products
AUX_GALAXY	L-Band Galactic Brightness Temperature Map
AUX_GALNIR	L-Band Galactic Brightness Temperature Map Convolved with the NIR Antenna Pattern
AUX_SUNT__	Measured Sun Brightness Temperatures
AUX_MOONT_	Measured Moon Brightness Temperatures
AUX_VTEC_P	Predicted Vertical Total Electron Content used in ionospheric effects correction (created from data retrieved from the COPG file)
AUX_VTEC_R	Analysis Rapid Vertical Total Electron Content used in ionospheric effects correction (created from data retrieved from the IGRG file)



Product Type	File_Description
AUX_VTEC_C	Consolidated Vertical Total Electron Content used in ionospheric effects correction (created from data retrieved from the IGSG file)
AUX_APDL__	Apodisation Window used in geolocation for Land.
AUX_APDS__	Apodisation Window used in geolocation for Sea.
AUX_RFI__	Radio Frequency Interference in MIRAS bandwidth on the Discrete Global Grid
AUX_BSCAT_	Bistatic Scattering Coefficients Look Up Table used in Sun glint correction
AUX_CNFL1P	Processor Algorithm Configuration Parameters and Constants for L1OP
MPL_ORBSCT	Mission planning file used to initialise the EE CFI orbit_id and/or time_id. It is read and used by the EE CFI (format defined in [RD.25])
AUX_FARA_P	Predicted Faraday Rotation ADF used by L2P in correction of ionospheric effects (created from AUX_VTEC_P data)
AUX_FARA_R	Analysis Rapid Faraday Rotation ADF used by L2P in correction of ionospheric effects (created from AUX_VTEC_R data)
AUX_FARA_C	Analysis Consolidated Faraday Rotation ADF used by L2P in correction of ionospheric effects (created from AUX_VTEC_C data)
AUX_BULL_B	IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation
AUX_RFILST	Global RFI Position list
AUX_FRSNEL	Brightness temperature of the Fresnel model for every possible pixel to be observed by the instrument

Table 3-2 File Description field depending on the Product Type, for L1OP



3.1.2 Level 1 Earth Explorer Variable Header

The Variable Header is specific to each File Type. It is written in XML ASCII format and it is constituted by two structures, Main Product Header (MPH) and a Specific Product Header (SPH). Further information will be handled in next chapters.

3.2 LEVEL 1 DATA BLOCK

The Data Block content for L1 products consist of one or several Measurement Data Sets. However, the possible several Reference Data Sets are not included in the Data_Block but instead their filenames and dataset names are referenced in the header.

Each Measurement Data Set should contain a number of Data set Records, preferably of identical structure. However, variable arrays are contemplated for L1 C Products (i.e. level 1c).



4. LEVEL 1 PRODUCT TYPES SPECIFICATIONS

4.1 LEVEL 1 PRODUCTS COMMON HEADER

Different Level 1 Products share common information for the Header. This common information will be presented in the following sections and reference from the different sections in the document.

4.1.1 Main Product Header:

The Main Product Header of any SMOS Product Level 1 will be written in XML ASCII. It contains the information about:

- Product and Creator identification
- Orbit information
- Product Confidence Data (PCD)

The Main Product Header is defined as in [RD.12] Chapter 3.2.1, although some fields redundant with Fixed Header have been suppressed. The following table shows the specification of the Main Product Header.



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
01	Main_Product_Header	Tag				Tag starting the Main Product Header structure	
02	Ref_Doc	string	N/A	17 bytes	%17s	Name of the document containing the specifications for the current product (this document for L1 products): SO-TN-IDR-GS-0005 L2Ps do not obtain this tag from same tag in L1C products.	Hard coded
03	Acquisition_Station	string	N/A	4 bytes	%4s	Acquisition Station ID. Left justified with trailing blanks. Currently, the possible values are: <ul style="list-style-type: none"> “ESAC” : acquisition station for SMOS at ESAC “SVLD” : acquisition station for SMOS at Svalbard “ES-S”: the product contains data from ESAC (first segment of data) and Svalbard (latest segment of data) “SV-E”: the product contains data from Svalbard (first segment of data) and ESAC (latest segment of data) In L1OP processing, the value in this field shall be obtained from the lower level input product (the origin for L1 being the L0 products). L2Ps copy this tag from same tag in L1C MPH.	Copied from same field in input product
04	Processing_Centre	string	N/A	4 bytes	%4s	ID code of the Processing Centre that has generated the product {ESAC, others TBD –e.g. LTA location-}. This is the physical location where the product is generated. L2Ps do not obtain this tag from same tag in L1C products.	CNF_L1OP__



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
05	Logical_Proc_Centre	string	N/A	3 bytes	%3s	<p>ID code of the Logical Processing Centre that has generated the product. The Logical Processing Centre is the group of subsystems within the Processing Centre working co-ordinately to generate the product. Possible values are:</p> <p>{FPC}: SMOS DPGS Fast Processing Centre @ ESAC; {RPC}: SMOS DPGS Fast Reprocessing Centre @ ESAC; {LTA}: SMOS DPGS LTA @ ESRANGE in Kiruna; {CEC}: SMOS DPGS Calibration & Expertise Centre @ESAC; {IMP}: SMOS DPGS Integration and Maintenance Platform @ Indra ; {GPC}: Grid on-demand Processing Centre; {NRT}: NRTTP; {L1E}: L1 Expert Support Laboratory; {OSE}: L2 OS Expert Support Laboratory; {SME}: L2 SM Expert Support Laboratory</p> <p>L2Ps do not obtain this tag from same tag in L1C products.</p>	CNF_L1OP__
06	Orbit_Information	Tag				Tag starting an Orbit Information structure.	
07	Phase	integer	N/A	4 byte	%+04d	<p>Phase number, associated to the Mission phase in which the measurements are obtained, at sensing start time of the first packet in the corresponding Level 0 product. If not used set to +000. The update procedure in L0 processing is yet to be clarified.</p> <p>L2Ps copy this tag from same tag in L1C MPH.</p>	Copied from same field in input product
08	Cycle	Integer	N/A	4 bytes	%+04d	<p>Cycle number, at sensing start time of the first packet in the corresponding Level 0 product. If not used set to +000</p> <p>L2Ps copy this tag from same tag in L1C MPH.</p>	Copied from same field in input product



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
09	<i>Rel_Orbit</i>	Integer	N/A	6 bytes	%+06d	Relative orbit, at sensing start time of the first packet in the corresponding Level 0 product. If not used set to +00000 L2Ps copy this tag from same tag in L1C MPH.	Copied from same field in input product
10	<i>Abs_Orbit</i>	Integer	N/A	6 bytes	%+06d	Absolute orbit, at sensing start time of the first packet in the corresponding Level 0 product. If not used set to +00000. First crossing of ascending node after launch determines the beginning of absolute orbit 1 (obtained by L0P). L2Ps copy this tag from same tag in L1C MPH.	Copied from same field in input product
11	<i>OSV_TAI</i>	string	Tag TAI	30 bytes	%30s	TAI date and time of vector from field 15 to 20 TAI=yyyy-mm-ddThh:mm:ss.uuuuuu L2Ps copy this tag from same tag in L1C MPH.	Copied from same field in input product
12	<i>OSV_UTC</i>	string	Tag UTC	30 bytes	%30s	UTC date and time of vector from field 15 to 20 UTC=yyyy-mm-ddThh:mm:ss.uuuuuu L2Ps copy this tag from same tag in L1C MPH.	Copied from same field in input product
13	<i>OSV_UT1</i>	string	Tag (UT1)	30 bytes	%30s	UT1 date and time of vector from field 15 to 20 UT1=yyyy-mm-ddThh:mm:ss.uuuuuu L2Ps copy this tag from same tag in L1C MPH.	Copied from same field in input product
14	<i>Leap_Second</i>	string	Tag (s)	30	%30s	UTC time of the occurrence of the leap second. If the leap second occurred in the corresponding L0 product window, the field is set by a devoted function in the EE CFI library by L0P. Otherwise it is set to 30 blanks. It corresponds to the time of the Leap Second occurrence (i.e. midnight of the day after the leap second) UTC=yyyy-mm-ddThh:mm:ss.uuuuuu	Copied from same field in input product



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
						L2Ps copy this tag from same tag in L1C MPH.	
15	<i>X_Position</i>	Real	m	12 bytes	%+012.3f	X Position in Earth Fixed Reference corresponding to the last vector in the POF before the sensing start time in L0. L2Ps copy this tag from same tag in L1C MPH.	Copied from same field in input product
16	<i>Y_Position</i>	Real	m	12 bytes	%+012.3f	Y Position in Earth Fixed Reference corresponding to the last vector in the POF before the sensing start time in L0. L2Ps copy this tag from same tag in L1C MPH.	Copied from same field in input product
17	<i>Z_Position</i>	Real	m	12 bytes	%+012.3f	Z Position in Earth Fixed Reference corresponding to the last vector in the POF before the sensing start time in L0. L2Ps copy this tag from same tag in L1C MPH.	Copied from same field in input product
18	<i>X_Velocity</i>	Real	m/s	12 bytes	%+012.6f	X Velocity in Earth Fixed Reference L2Ps copy this tag from same tag in L1C MPH.	Copied from same field in input product
19	<i>Y_Velocity</i>	Real	m/s	12 bytes	%+012.6f	Y Velocity in Earth Fixed Reference L2Ps copy this tag from same tag in L1C MPH.	Copied from same field in input product
20	<i>Z_Velocity</i>	Real	m/s	12 bytes	%+012.6f	Z Velocity in Earth Fixed Reference L2Ps copy this tag from same tag in L1C MPH.	Copied from same field in input product
21	<i>Vector_Source</i>	string	N/A	2 bytes	%2s	Source of the Orbit State Vector record: FP = FOS predicted L2Ps copy this tag from same tag in L1C MPH.	Copied from same field in input product



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
22	<i>Orbit_Information</i>	Tag				Tag ending an Orbit Information structure	
23	<i>Product_Confidence</i>	string	N/A	Variable (limited to 200 bytes)	%s	Product confidence value. Enumerated: <ul style="list-style-type: none"> • "NOMINAL": all the counters in the SPH Quality information structure are set to zero • "DEGRADED SW ERR" • "DEGRADED INST ERR" • "DEGRADED ADF ERR" • "DEGRADED CAL ERR" • Or any combination of the above strings depending on the value of the counters in the SPH Quality information structure L2Ps do not obtain this tag from same tag in L1C products.	Generated by L1 Processor
24	<i>Main_Product_Header</i>	Tag				Tag ending a Main Product Header structure	

Table 4-1 Specification of the Main Product Header

4.1.2 Specific Product Header:

The Specific Product Header of any SMOS Product Level 1 will be written in XML ASCII. The SPH is composed of several structures depending on the product type. The following two sub-elements are common to all Level 1 Measurement products:

- XML Specific Product Header Product Main Info
- XML Specific Product Header Data Sets

While the SPH Product Main Info contains generic information about the Product, the SPH Data Sets contains the list of names of Data Sets either of Reference or of Measurement.

The Reference Data Sets each contain a reference to a file that is input and there after used by the processor to generate the product. There shall be a Reference Data Set for each input such that the product could be regenerated unambiguously using this set of inputs, the processor version, and the referenced schemas. In all cases, the SPH will be enclosed between the ***Specific_Product_Header*** Tag.

Amongst the fields in the Specific Product Header Main Info section, its second Field, the ***SPH_Descriptor*** will be different for every type of Level 1 Products. All the accepted types and names are presented in the following table:

Accepted Name	Description
TLM_MIR1A_SPH	Calibrated L1 product generated from MIRAS and Proteus ancillary data output
MIR_UAVD1A_SPH	Calibration L1 product generated from averaging the MIRAS uncorrelated Noise injection individual measurements in different semi-orbits
MIR_CRSD1A_SPH	Calibration L1 product generated from gathering long term MIRAS correlated noise injection calibration individual measurements in a synthetic curve with measurements at different latitudes
MIR_CSTD1A_SPH	Calibration L1 product generated from gathering short term MIRAS correlated noise injection calibration individual measurements in a synthetic curve with measurements at different latitudes
MIR_AFWD1A_SPH	Calibration L1 product generated from averaging the MIRAS FWF individual measurements in different semi-orbits
MIR_GMATD__SPH	G Matrix (MIRAS' System Response Function) generated from MIR_AFWD1A
MIR_JMATD__SPH	Inverted J Matrix used in image reconstruction generated from MIR_GMATD__
MIR_ANIR1A_SPH	Consolidated Calibration L1 product generated from MIRAS output during an external target calibration pertaining NIR calibration parameters
MIR_SC_D1A_SPH	Nominal L1a product generated from MIRAS output in Dual polarisation mode and combined with relevant Calibration L1 data, in nominal Earth observation pointing
MIR_SC_F1A_SPH	Nominal L1a product generated from MIRAS output in Full polarisation mode and combined with relevant Calibration L1 data, in nominal Earth observation pointing
MIR_TARD1A_SPH	Nominal L1a product generated from MIRAS output in Dual polarisation mode and combined with relevant Calibration L1 data when performing external target observation

Accepted Name	Description
MIR_TARF1A_SPH	Nominal L1a product generated from MIRAS output in Full polarisation mode and combined with relevant Calibration L1 data when performing external target observation
MIR_SC_D1B_SPH	Nominal L1b product generated from MIRAS output in Dual polarisation mode, in nominal Earth observation pointing
MIR_SC_F1B_SPH	Nominal L1b product generated from MIRAS output in Full polarisation mode, in nominal Earth observation pointing
MIR_TARD1B_SPH	Nominal L1b product generated from MIRAS output in Dual polarisation mode when performing external target observation
MIR_TARF1B_SPH	Nominal L1b product generated from MIRAS output in Full polarisation mode when performing external target observation
MIR_FTTD___SPH	Flat Target Transformation product generated from MIRAS output mode when pointing to a flat external target (Deep Sky), in dual polarisation mode
MIR_FTTF___SPH	Flat Target Transformation product generated from MIRAS output mode when pointing to a flat external target (Deep Sky), in full polarisation mode
MIR_SCLD1C_SPH	Nominal L1c product generated from MIRAS output in Dual polarisation mode and apodised for Soil Moisture applications
MIR_SCLF1C_SPH	Nominal L1c product generated from MIRAS output in Full polarisation mode and apodised for Soil Moisture applications
MIR_SCSD1C_SPH	Nominal L1c product generated from MIRAS output in Dual polarisation mode and apodised for Ocean Salinity applications
MIR_SCSF1C_SPH	Nominal L1c product generated from MIRAS output in Full polarisation mode and apodised for Ocean Salinity applications
MIR_BWLD1C_SPH	Browse L1c product generated from MIRAS output in Dual polarisation mode and apodised for Soil Moisture applications
MIR_BWLF1C_SPH	Browse L1c product generated from MIRAS output in Full polarisation mode and apodised for Soil Moisture applications
MIR_BWSD1C_SPH	Browse L1c product generated from MIRAS output in Dual polarisation mode and apodised for Ocean Salinity applications
MIR_BWSF1C_SPH	Browse L1c product generated from MIRAS output in Full polarisation mode and apodised for Ocean Salinity applications

Table 4-2 Level 1 SPH Accepted Names

Additionally, there shall be other structures specific for each data product type, informing about algorithms used, main statistics, etc. See SPH description in each product type's SPH specification section.



4.1.2.1 SPH Product Info

The XML SPH Product Main Info described in the following table contains the information about:

- Product Description and Identification Information
- Product Time Information
- Schema, Size and Checksum information
- Identifier of HW generating the product



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
02	Main_Info	Starting Tag				Tag starting a Main_Info structure	
03	SPH_Descriptor	String	N/A	14 bytes	%14uc	Name describing SPH, as per Table 4-2.	Hard-coded
04	Time_Info	Starting Tag				Tag starting a Time_Information structure	
05	Precise_Validity_Start	String	N/A	Variable	%30s	This is the UTC Validity Start Time, coherent with the Validity Start Time in the File Name, but in CCSDS ASCII format with time reference and microseconds. It is a repetition of the time of the first DSR. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" L2Ps copy this tag from same tag in L1C SPH	Generated by L1 Processor
06	Precise_Validity_Stop	String	N/A	Variable	%30s	This is the UTC Validity Stop Time, coherent with the Validity Stop Time in the File Name, but in CCSDS ASCII format with time reference and microseconds. It is a repetition of the time of the last DSR. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" L2Ps copy this tag from same tag in L1C SPH	Generated by L1 Processor
07	Abs_Orbit_Start	Integer	N/A	6 bytes	%+06d	Absolute orbit of the Precise_Validity_Start. Output of xo_time_to_orbit using orbit_id (EE_CFI structure initialised using MPL_ORBSCT) and field #5. L2Ps copy this tag from same tag in L1C SPH	Generated by L1 Processor
08	Start_Time_ANX_T	Real	s	11 bytes	%011.6f	Time in seconds between Precise_Validity_Start and closest previous crossing of the ascending node. Output of xo_time_to_orbit using orbit_id (EE_CFI structure initialised using MPL_ORBSCT) and field #5.	Generated by L1 Processor



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
						(Note: Due to the fact that the reference orbit is being used for this time computation, there can be an accumulated error of several minutes with respect to the actual time from ANX. This field should only be used for information purposes and not for algorithmic computations) L2Ps copy this tag from same tag in L1C SPH	
09	Abs_Orbit_Stop	Integer	N/A	6 bytes	%+06d	Absolute orbit of the Precise_VValidity_Stop. Output of xo_time_to_orbit using orbit_id (EE_CFI structure initialised using MPL_ORBSCT) and field #6. (Note: Due to the fact that the reference orbit is being used for this time computation, there can be an accumulated error of several minutes with respect to the actual time from ANX. This field should only be used for information purposes and not for algorithmic computations) L2Ps copy this tag from same tag in L1C SPH	Generated by L1 Processor
10	Stop_Time_ANX_T	Real	s	11 bytes	%011.6f	Time in seconds between Precise_VValidity_Stop and closest previous crossing of the ascending node from the Precise_VValidity_Start. Output of xo_time_to_orbit using orbit_id (EE_CFI structure initialised using MPL_ORBSCT) and field #6. L2Ps copy this tag from same tag in L1C SPH	Copied from input product (computed by L0P)
11	UTC_at_ANX	string	N/A	30 bytes	%30s	UTC time of the ascending node of the orbit containing the Precise_VValidity_Start. Output of xo_orbit_info using orbit_id (EE_CFI structure initialised using MPL_ORBSCT) and field #5. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" (Note: Due to the fact that the reference orbit is being used for this time computation, there can be an accumulated error of several minutes with respect to the actual time from ANX. This field should only be used for information purposes and not for algorithmic computations)	Generated by L1 Processor



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
						L2Ps copy this tag from same tag in L1C SPH. SM uses this tag to check ECMWF compatibility.	
12	Long_at_ANX	real	deg	12 bytes	%+012.6f	Longitude of the ascending node of the orbit containing the Precise_Velocity_Start (positive if east of Greenwich). Output of xo_orbit_info using orbit_id (EE_CFI structure initialised using MPL_ORBSCT) and field #5. The values are in the range [0,360]. (Note: Due to the fact that the reference orbit is being used for this time computation, there can be an accumulated error with respect to the actual time from ANX. This field should only be used for information purposes and not for algorithmic computations) L2Ps copy this tag from same tag in L1C SPH	Generated by L1 Processor
13	Ascending_Flag	String	N/A	1 byte	%c	Orbit orientation along product. A for ascending, D for descending L2Ps copy this tag from same tag in L1C SPH.	Copied from same field in input product
14	Semiorbit_Start	Date	N/A	Variable	%30s	This is the UTC Start Time of the semiorbit in which the product is contained, in CCSDS ASCII format with time reference and microseconds. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" L2Ps do not use this tag from L1C SPH.	Copied from same field in input product
15	Semiorbit_Stop	Date	N/A	Variable	%30s	This is the UTC Stop Time of the semiorbit in which the product is contained, in CCSDS ASCII format with time reference and microseconds. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" L2Ps do not use this tag from L1C SPH.	Copied from same field in input product
16	Time_Info	Closing Tag				Tag closing Time_Info structure	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
17	Correlator_Layer	Identifier	N/A	1 byte	%01c	Field reporting the layer of correlators used in the averages, taken from the first DSR with valid Correlator_Layer value. It shall be N for Nominal, R for Redundant. L2Ps do not use this tag from L1C SPH.	Copied from L0 product
18	Checksum	Integer	N/A	10 bytes	%010d	Checksum of the datablock, obtained from the algorithm in the IEEE Std 1003.1.2004, using function cksum in POSIX. L2Ps do not use this tag from L1C SPH.	Generated by L1 Processor
19	Header_Schema	string	N/A	31 bytes	%31s	Name of the XSD to be used for the validation of the product header. The format is as specified in [RD.9]. In the operational processor, the value will be provided by an XML R/W API method. L2Ps do not use this tag from L1C SPH.	CNF_L1OP__
20	Datablock_Schema	string	N/A	42 bytes	%42s	Name of the validation xml schema for the binary product's datablock Name of the binX schema for the validation of the product datablock. The format is as specified in [RD.9]. In the operational processor, the value will be provided by an XML R/W API method. L2Ps do not use this tag from L1C SPH.	CNF_L1OP__
21	Header_Size	Integer	bytes	6 bytes	%06d	Size of the Header of the product L2Ps do not use this tag from L1C SPH.	Generated by L1 Processor
22	Datablock_Size	Integer	Bytes	11 bytes	%011d	Size of the product Datablock L2Ps do not use this tag from L1C SPH.	Generated by L1 Processor



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
23	<i>HW_Identifier</i>	String	N/A	4 bytes	%4s	Unique identifier of the hardware involved in the processing. “nnnn” where n are digits or characters L2Ps do not use this tag from L1C SPH.	CNF_L1OP__
24	<i>Main_Info</i>	Closing Tag				Tag closing a Main_Info structure	

Table 4-3 Level 1 Main Info SPH

4.1.2.2 SPH Quality Information structure

This structure contains the statistics on the quality checks performed during processing on the generated L1 data. Following table specifies the contents for this structure, which is common to all MIRAS products.



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
M+01	Quality_Information	structure	N/A	N/A	N/A	Tag starting of a Quality_Information structure	
M+02	Software_Error_Counter	Unsigned Integer	N/A	5 char	%05d	<p>Number of snapshot used to generate the product affected by software error. The error could be generated in the current stage of the processing or could be heredity from the previous stage of the processing (incremental counter).</p> <p>In that category fall errors like: Division by zero, Non-converging iterations, NaN detection, unsuccessful matrix inversion.</p> <p>The detailed list of sw error detected by the L1OP V3 for each of the generated products is given in Annex B .</p>	Generated by L1 Processor
M+03	Instrument_Error_Counter	Unsigned Integer	N/A	5 char	%05d	<p>Number of snapshot used to generate the product affected by instrument error. The instrument error could be detected in the current stage of the processing or could be heredity from the previous stage of the processing (incremental counter).</p> <p>The detailed list of instrument error detected by the L1OP V3 for each stage of the processing is given in Annex B</p>	Generated by L1 Processor



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
M+04	ADF_Error_Counter	Unsigned Integer	N/A	5 char	%05d	<p>Number of snapshot used to generate the product affected by ADF error. ADF error occurs when the snapshot is processed by using an ADF with a validity time outside the acquisition time of the snapshot or when the ADF is missing (e.g. usage of the IRI model in the L1c processing instead of the VTEC auxiliary file.) The ADF error could be detected in the current stage of the processing or could be heredity from the previous stage of the processing (incremental counter).</p> <p>The detailed list of ADF error detected by the L1OP V3 for each stage of the processing is given in Annex B</p>	Generated by L1 Processor
M+05	Calibration_Error_Counter	Unsigned Integer	N/A	5 char	%05d	<p>Number of snapshot used to generate the product affected by calibration file error. Calibration file error occurs when the snapshot is processed by using a calibration file with a validity time outside the acquisition time of the snapshot or when the calibration file is missing (e.g. usage of the on-ground NIR characterization in the AUX_PLM file instead of the on-flight NIR data from MIR_ANIR calibration file).</p> <p>The calibration file error could be detected in the current stage of the processing or could be heredity from the previous stage of the processing (incremental counter).</p> <p>The detailed list of ADF error detected by the L1OP V3 for each stage of the processing is given in Annex B</p>	Generated by L1 Processor
M+06	N_Discarded_Scenes	Integer	scenes	5 bytes	%05d	<p>Number of scenes discarded from the corresponding L0 up to this product.</p> <p>The criteria to discard scenes are defined in Annex B according to each type of L1 Product.</p>	Generated by L1 Processor considering MIR/TLM inputs values



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
M+07	<i>N_Invalid_Blocks</i>	Integer	blocks	6 bytes	%06d	<p>Number of blocks of 24 packets in the corresponding L0 product that have at least one invalid packet.</p> <p>It can happen that SMOS DPGS receives less than 24 packets corresponding to a block. The valid packets in these blocks have to be included in the L0 product because L0 is the only copy of MIRAS raw data kept in SMOS DPGS. When they are written in the L0 product, the gaps corresponding to the missing packets in the 24-packets-blocks are filled with dummy data. Invalid blocks in the L0 are then discarded during the L1a processing.</p> <p>This statistic is computed only during L0 product generation, and is copied in all subsequent levels from the SPH of the input, for user information. Potentially overflow of this field could occur in case instrument fails above 80% of the time. In that case the L1 field shall contain the maximum possible value for this format.</p>	Copied from same field in input product
M+08	<i>N_Missing_Packets</i>	Integer	packets	6 bytes	%06d	<p>Number of packets that have been inserted in the corresponding L0 product to complete blocks of 24 packets that have at least one missing/invalid packet.</p> <p>Note that no dummy packets are inserted if the complete set of 24 packets are missing (i.e. L0 Processor is not filling gaps corresponding to missing data set records).</p> <p>This statistic is computed only during L0 product generation, and is copied in all subsequent levels from the SPH of the input, for user information. Potentially overflow of this field could occur in case instrument fails above 80% of the time. In that case the L1 field shall contain the maximum possible value for this format.</p>	Copied from same field in input product



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
M+09	Quality_Information	Closing Tag					

Table 4-4 Level 1 Quality Information structure in SPH

4.1.2.3 SPH Data Sets

The fields in the SPH Data Sets table are present in all Level 1 products. They present the data sets that are related to the content of the product, either they are physically contained in it or they are referenced from other product used as input to the generation of this product.

Some other fields are included before the SPH Data Sets fields, i.e. the SPH Data Sets structures shall be the last ones in the product's header.

The Data Block content for L1 Products consists of a Measurement Data Sets (containing binary contents as described in its associated XML schema) and a Reference Data Set (containing filename linking the product to a reference supporting file used as input to generate this product).

The following table presents the XML specification of the Data Sets:

Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
N+01	List_of_Data_Sets	Starting Tag		2	%02d	List containing the number of Data_Set structures, with "count" field as attribute. It is an XML structure containing a number of the Data_Set structures	
N+02	Data_Set	Start of block				Tag starting a Data_Set structure	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
N+03	DS_Name	String	N/A	30 bytes	%30s	Name describing the Data Set	Generated by L1 Processor
N+04	DS_Type	Char	N/A	1	%c	Type of Data Set: M for measurement R for reference	Generated by L1 Processor
N+05	DS_Size	Integer	N/A	10 bytes	%010d	Size in bytes of the Data Set. Filled with zeroes for Reference Data Sets	Generated by L1 Processor
N+06	DS_Offset	Integer	N/A	10 bytes	%010d	Offset in bytes since the beginning of Data Block file until the beginning of the data set. Filled with zeroes for Reference Data Sets	Generated by L1 Processor
N+07	Ref_Filename	String	N/A	60 bytes	%60s	Name of reference file if Data_Set_Type is R. Otherwise blanks	Generated by L1 Processor using Job Order information
N+08	Num_DSR	Integer	N/A	10	%010d	Number of measurement records in the Data Set (filled only for Measurement Data Sets). Filled with zeroes for Reference Data Sets	Generated by L1 Processor
N+09	DSR_Size	Integer	N/A	8	%08d	Size in bytes of each binary measurement data set record. For variable size DSR, the value is -1. Filled with zeroes for Reference Data Sets	Generated by L1 Processor
N+10	Byte_Order	String	N/A	4	%4s	Type of ordering of the binary data. <ul style="list-style-type: none"> For Data Sets contained in the product's datablock, the Order will be "0123" (little-endian) For referenced data Sets, the order will be "0000" 	Generated by L1 Processor



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
N+11	Data_Set	Ending Tag				Tag ending a Data_Set structure	
N+12	List_of_Data_Sets	Ending Tag				End of list containing the number of Data_Set structures	

Table 4-5 Level 1 SPH Data Set List

As seen above, there may be more than one file of each type in the Reference Data Set structure, depending for example on how many files of that type are needed to cover the sensing period of the current product. The following table provides a summary of the possible References used in Level 1.

Reference Data Set Name	File Type (File Category + Semantic Descriptor)	Description
L0_CORRELATIONS_FILE	MIR_SC_D0_, MIR_SC_F0_, MIR_TARD0_, MIR_TARF0_, MIR_UNCD0_, MIR_CORD0_, MIR_UNCU0_, MIR_CORU0_	L0 Product filename from which the current L1a was created
L0_HKTM_FILE	TLM_MIRA0_	L0 HKTM Product filename from which the current L1a HKTM was created
L1A_AVER_OFFSET_FILE	MIR_UAVD1A	L1A offset filename containing the average of the uncorrelated noise injection measurements used to calibrate the L1a visibilities
L1A_ORBIT_AMPL_FILE	MIR_CRSD1A	L1a Calibration filename containing several sets of parameters obtained during correlated noise injection calibration, used to calibrate the L1a visibilities
L1A_ORBIT_PHASE_FILE	MIR_CSTD1A	L1a Calibration filename containing several sets of parameters obtained during short term calibration (i.e. Local Oscillator), used to calibrate the L1a visibilities
L1A_AVER_NIR_CAL_FILE	MIR_ANIR1A	Averaged NIR calibrated parameters filename used to calibrate L1a visibilities
L1A_HKTM_FILE	TLM_MIRA1A	HKTM filename containing the S/C position and attitude for the snapshots in the current product
L1A_AVER_FWF_CAL_FILE	MIR_AFWD1A	L1a Calibration filename of the file containing the average Fringe Washing Function estimated coefficients used in the computation of the reconstruction G Matrix
L1A_G_MATRIX_FILE	MIR_GMATD_	G Matrix filename used in the Image reconstruction process of the current L1b product.



Reference Data Set Name	File Type (File Category + Semantic Descriptor)	Description
L1A_J_MATRIX_FILE	MIR_JMATD__	Matrix filename used in the Image reconstruction process of the current L1b product.
L1A_FLAT_TARGET_FILE	MIR_FTTD__, MIR_FTF__	L1a Calibrated Visibilities filename obtained during external target observation of the Deep Sky, to be used in the Flat Target Response, in dual and full polarization
L1A_FILE	MIR_SC_D1A, MIR_SC_F1A, MIR_TARD1A, MIR_TARF1A	L1a Calibrated Visibilities filename used to create the current L1b product
L1B_FILE	MIR_SC_D1B, MIR_SC_F1B, MIR_TARD1B, MIR_TARFF1B	L1b Product filename used to create the current L1c product
APODISATION_FILE	AUX_APDL__, AUX_APDS__	Apodisation window definition filename used in the current L1c product
DGG_FILE	AUX_DGG__	Fixed Earth Grid filename used in the current L1c product
TEC_FILE	AUX_VTEC_P , AUX_VTEC_R, AUX_VTEC_C	TEC filename used in the current L1c products
GALAXY_FILE	AUX_GALAXY	Original Galaxy Map
GALAXY_NIR_FILE	AUX_GALNIR	Galaxy Map used for reconstruction and NIR calibration
PMS_FILE	AUX_PMS__	Auxiliary file with PMS characterisation used for L1a calibration
NIR_FILE	AUX_NIR__	Auxiliary file with NIR characterisation used for L1a calibration (defined externally)
PLM_FILE	AUX_PLM__	Auxiliary file with PLM characterisation, defining time lags and intermediate frequency
S_PARAM_FILE	AUX_SPAR__	Auxiliary file with S-parameters characterisation used for L1a calibration
LICEF_FILE	AUX_LCF__	Auxiliary file with receivers' characterisation (ohmic efficiency and absolute antenna phase) used for L1a calibration
ANTENNA_PATTERNS_FILE	AUX_PATT__	Auxiliary file with receivers' amplitude and phase pattern characterisation used for generation of the G reconstruction matrix, their coordinates and average as well.
FAILURES_FILE	AUX_FAIL__	Auxiliary file with failure of components to be taken into account during L1 processing
BEST_FIT_PLANE_FILE	AUX_BFP__	Auxiliary file with definition of Best Fit Plane to be used during geolocation in L1c
L1C_PIXEL_MASK_FILE	AUX_MASK__	Auxiliary file with the flagging of pixels for use in L1c land or sea products
LAND_SEA_MASK_FILE	AUX_LSMASK	Auxiliary file containing the Land/Sea mask of pixels in the DGG
RFI_FILE	AUX_RFI__	Auxiliary file with RFI flagged pixels in the same grid as the DGG
SUN_BT_FILE	AUX_SUNT__	Auxiliary file with definition of Sun Brightness Temperatures used for correction before L1b processing
MOON_BT_FILE	AUX_MOONT__	Auxiliary file with definition of Moon Brightness Temperatures used for correction before L1b processing



Reference Data Set Name	File Type (File Category + Semantic Descriptor)	Description
BISTATIC_SCAT_FILE	AUX_BSCAT_	Auxiliary file with Bistatic Scattering Coefficients
ALGORITHM_CONFIG_FILE	AUX_CNFL1P	Processor Configuration Parameters and Constants for L1OP
MISPOINTING_ANGLES_FILE	AUX_MISP__	Auxiliary product containing the mispointing angles between the Body Frame referenced in the Proteus quaternions and the Antenna Plane defined by the MIRAS instrument
WEIGHT_VECTOR_FILE	AUX_BWGHT_	Auxiliary product containing the weight vector to be multiplied element by element with the calibrated visibilities
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Mission planning file used to initialise the EE CFI orbit_id and/or time_id. It is read and used by the EE CFI.
ALGORITHM_FARA_CONFIG_FILE	AUX_CNFFAR	Post-processor Configuration Parameters and Constants for FARADA
BULLETIN_B_FILE	AUX_BULL_B	IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation
IERS_BULL_B_RAW_FILE	bulletinb.xxx	File containing raw data values of IERS Bulletin B in plain text for generation of AUX_BULL_B file.
RFI_LIST_FILE	AUX_RFILST	Global RFI position list used in the RFI mitigation and/or flagging algorithms

Table 4-6 L1 Data Set Reference List

The Measurement Data Set names that have to be included in List_of_Data_Sets.Data_Set.DS_Name of the products and binary ADFs, are obtained from their dataset names as specified in the datablock tables. They are detailed in the next table for each product type:

Product Type	Valid DS_Names for Measurements datasets
TLM_MIRA1A	HKTM_Data
MIR_UAVD1A	Mean_Offset
MIR_CRSD1A	Cons_PMS_Coefficients Cons_Long_PMS_Coefficients Cons_Ampl_FWF_Origin Cons_Long_Ampl_FWF_Origin
MIR_CSTD1A	Cons_Phase_FWF_Origin Cons_LO_Unlock
MIR_AFWD1A	Cons_FWF_Measurements Cons_FWF_Coefficients



Product Type	Valid DS_Names for Measurements datasets
MIR_ANIR1A	Cons_NIR_A_External Cons_NIR_R_External Avg_NIR_A_External Avg_NIR_R_External
MIR_SC_D1A MIR_TARD1A	Calibrated_Visib_Dual
MIR_SC_F1A MIR_TARF1A	Calibrated_Visib_Full
MIR_GMATD	G_Matrix
MIR_JMATD	J_Matrix
MIR_FTTD	Flat_Target_Transformation
MIR_FTTF	Flat_Target_Transformation
MIR_SC_D1B MIR_TARD1B	Temp_Snapshot_Dual Scene_Bias_Correction
MIR_SC_F1B MIR_TARF1B	Temp_Snapshot_Full Scene_Bias_Correction
MIR_SCSD1C MIR_SCLD1C	Swath_Snapshot_List Temp_Swath_Dual
MIR_SCSF1C MIR_SCLF1C	Swath_Snapshot_List Temp_Swath_Full
MIR_BWSD1C MIR_BWLD1C MIR_BWSF1C MIR_BWLF1C	Temp_Browse
AUX_PATT__	Antenna_Pattern_Coordinates Average_Antenna_Pattern Antenna_Pattern
AUX_DGG	Discrete_Global_Grid
AUX_LSMASK	Land_Sea_Mask
AUX_MASK	L1C_Pixel_Mask
AUX_GALAXY	Original_Galaxy_Map
AUX_GALNIR	NIR_BT_Galaxy_Map
AUX_SUNT	Sun_Measured_Temperatures
AUX_MOONT	Moon_Measured_Temperatures



Product Type	Valid DS_Names for Measurements datasets
AUX_VTEC_C AUX_VTEC_P AUX_VTEC_R	VTEC_Info
AUX_RFI	RFI_Mask
AUX_BSCAT	Bistatic_Scattering_Coefficients
AUX_FARA_C AUX_FARA_R AUX_FARA_P	Grid_Point_List
AUX_BULL_B	IERS_BULL_B_FILE

Table 4-7 L1 Measurement Data Set List

In addition to each product reference data sets, an inherited list of reference data sets will be present for HKTM and science data products. The full filename reference structure will be as follows:

- HKTM products
 - List_of_Reference_Data_Sets_L0_HKTM
- L1a science products
 - List_of_Reference_Data_Sets_L0
- L1b science products
 - List_of_Reference_Data_Sets_L0
 - List_of_Reference_Data_Sets_L1a
- L1c science products
 - List_of_Reference_Data_Sets_L0
 - List_of_Reference_Data_Sets_L1a
 - List_of_Reference_Data_Sets_L1b

The references to be inherited from previous products will not include the measurement data sets.



4.2 LEVEL 1 DATA TYPES SPECIFICATIONS

4.2.1 HKTM Data Specification (TLM MIRA1A)

The TLM_MIRA1A data is generated from the data contained in the ancillary packets of the TLM_MIRA0_ product. A dataset record is generated for each integration time (every 1.2 seconds). The TLM_MIRA1A product acts as a supporting product presenting a single source for the instrument status monitoring measurements and spacecraft position and attitude data, so that it is not replicated in all products. This product does not contain information extracted from the PUS HKTM X-Band packets or PUS S-band packets.

The measurements in this product are obtained in parallel with MIRAS correlation measurements, i.e. there shall be one data set record of TLM_MIRA1A for each integration time, captured in parallel with correlation measurements whichever the type (correlated noise injection, uncorrelated noise injection, dual polarization and full polarization measurements).

4.2.1.1 Specific Product Header

The Specific Product Header Format for TLM_MIRA1A products follows the format described in section 4.1.2, including:

- Level 1 SPH Main Info (see Table 4-3)
- Quality Information structure (see Table 4-4)
- Level 1 SPH Data Sets (see Table 4-5)

Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	<i>Specific_Product_Header</i>	Starting Tag				Tag starting the Specific Product Header structure	
02-19	<i>Main_Info</i>	structure	N/A	N/A	N/A	Main Product Info structure's fields as defined in in Table 4-3	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
20-26	Quality_Information	structure	N/A	N/A	N/A	Quality_Information structure's fields as defined in Table 4-4	
27	Time_Delay_Flag	flag	N/A	1 byte	%01d	Flag warning about the existence of DSR that are suitable to be used for FWF shape estimation: <ul style="list-style-type: none"> 1 when at least one DSR in the file contains FWF_Step field with value 1 or 2 0 otherwise 	Generated by L1 Processor
29-40	Data_Sets	structure	N/A	N/A	N/A	Data Sets structure's fields as defined in Table 4-5	
41	List_of_Reference_Data_Sets_L0_HKTM	Starting Tag	N/A	N/A	N/A	Reference Data Sets inherited from HKTM L0	
42-49	Reference_Filename	string	N/A	60 bytes	%60s	Filename of input files as described in table 4-10	Copied from HKTM L0 header
50	List_of_Reference_Data_Sets_L0_HKTM	Closing Tag	N/A	N/A	N/A	Reference Data Sets inherited from HKTM L0	
51	Specific_Product_Header	Closing Tag				Tag ending the Specific Product Header structure	

Table 4-8 Level 1A HTKM SPH



The specific valid Reference Data Sets for Level1A HKTM Products are:

Reference Data Set Name	Product Type	Description
L0_HKTM_FILE	TLM_MIRA0_	L0 Ancillary data Product filename from which the current HKTM L1a was created
PLM_FILE	AUX_PLM_	Auxiliary file with PLM characterisation, defining thermistor ground calibrated coefficients
FAILURES_FILE	AUX_FAIL_	Auxiliary file with failure of components to be taken into account during L1 processing
ALGORITHM_CONFIG_FILE	AUX_CNFL1P	Processor Configuration Parameters and Constants for L1OP
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Mission planning file used to initialise the EE CFI orbit_id and/or time_id. It is read and used by the EE CFI.
PMS_FILE	AUX_PMS_	Auxiliary file with PMS characterisation used for L1a calibration
BULLETIN_B_FILE	AUX_BULL_B	IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation

Table 4-9 Level 1A HKTM Reference Data Sets

The valid HKTM L0 Reference Data Sets for Level1A HKTM Products are:

Reference Data Set Name	Product Type	Description
L0P_LOCAL_PARTICULAR_CONFIG	CNF_L0P1	L0 Processor local particular config
L0P_LOCAL_GENERAL_CONFIG	CNF_L0PGEN	L0 Processor local general config
L0P_PROCESSING_CONFIG	AUX_CNFL0P_	L0 Processing config file
PREDICTED_ORBIT_FILE	AUX_ORBPRES	Predicted orbit file
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Orbit scenario file
ACQUISITION_REPORT	REP_ACQREX	Acquisition reports
INSTRUMENT_SOURCE_PACKET_FILE	TLM	ISP data files

Table 4-10 Level 1A HKTM L0 Reference Data Sets



The following are the rules to update the SPH General Quality Information structure from the resulting Quality_Information flags for each data set record:

Counter Name	Condition
<i>Software_Error_Counter</i>	Count all the snapshots that have the Software_Error_flag set
<i>Instrument_Error_Counter</i>	Count all the snapshots that have the Instrument_Error_flag set plus the snapshots that have the following flag set: LAST_CMD_OK field_50 Last_Executed_Command_Error any bit from 0 to 11 set X_B_ERROR_FLAG field_39 X_Band_Error set
<i>ADF_Error_Counter</i>	Count all the snapshots that have the ADF_Error_flag set
<i>Calibration_Error_Counter</i>	Count all the snapshots that have the Calibration_Error_flag set
<i>N_Discarded_Scenes</i>	Count all the snapshot discarded during the HKTM L0 processing (see Annex B for details)

4.2.1.2 Data Block

The TLM_MIRA1A binary Data Block consists of one Measurement dataset with specific information on the Housekeeping Telemetry. The dataset consists of a unique type of data set record repeated for each integration time of 1.2 seconds, preceded by a counter of dataset records actually contained in the product.

The Snapshot is identified by means of the Snapshot_OBET. The OBET Format, defined by the Agency, is as follows:



SMOS OBET TIME FORMAT									
P-FIELD								T-FIELD	
Extension Flag	Time Code Identification			Details Bits for the information on the code				Coarse Time	Fine Time Note
0 (MSB)	1	2	3	4	5	6	7(LSB)	32 bits	24 bits
1 Bit	3 bits			4 bits					
0	1	1	0	0	1	1	0	Seconds from epoch	2 ⁻²⁴ seconds
1 byte								4 bytes	3 bytes

Table 4-11 OBET Time Format

Note: 3 bytes are sent for fine time, which means a resolution of about 60 nanoseconds, but the real resolution is 2⁻¹⁶ seconds. Therefore, this last byte will not have meaning information. It is sent due to alignment matters.

The following table describes the XML schema used to decode the binary contents of this type of record. The first field in the datablock is the counter of the dataset records contained in the dataset. The tag element used to describe the DSR structure name in the XML schema shall be ***HKTM_Data***. The size of each DSR is fixed and equal to 1685 bytes.

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>Data_Block</i>					Init of binary Data Block in the product.	
	<i>HKTM_Data</i>					Init of binary Data Set containing the <i>HKTM_Data</i> records.	
01	<i>HKTM_Sample_Counter</i>	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of <i>HKTM_Sample</i> data set record structures.	Generated by L1 Processor



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>List_of_HKTM_Samples</i>					Init of list of HKTM_Sample data set record structures, repeated Counter times. There are as many DSR as integration periods in the product.	
	<i>HKTM_Sample</i>					Init of HKTM_Sample data set record structure.	
02	Snapshot_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the scene was taken. Start of integration time period, and also start of validity for HKTM measurements. Expressed in EE CFI transport time format	Generated by L1 Processor. Based in L0 ancillary packet UTC at PPS, corrected with PPS information to get the time in UTC format
03	Snapshot_OBET	Time counter	N/A	bit stream (8 bytes) declared as unsigned long	1 element (OBET Format is specified in section 4.2.1.2)	Unique identifier for the snapshot. Formed by the OBET at T_SYNC extracted from L0. Represents start of integration time in OBET format.	Generated by L1 Processor. Based in L0 ancillary packet,'s secondary header
04	OBET_PPS	Time counter	N/A	bit stream (8 bytes) declared as unsigned long	1 element	OBET measured value at PPS as extracted from L0 ancillary packet. Time in PLM format	Generated by L1 Processor. Based in L0 ancillary packet, first 8-byte field in source data



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
05	<i>UTC_PPS</i>	Date	N/A	signed/unsigned integer (4 bytes)	Vector array of 3 elements First element (weeks) is signed integer, remaining two (seconds and fractions of seconds) are unsigned	UTC measured value at PPS as extracted from L0 ancillary packet. Time in Proteus platform. Expressed in EE CFI transport time format	Copied from L0 ancillary packet
06	<i>X_Position</i>	Real number	m	Double (8 bytes)	1 element	Orbit State Vector X Position in Earth Fixed Reference at corresponding UTC SNAPSHOT_TIME	Generated by L1 Processor. Based in PVT data from L0 ancillary packetpropagated with CFI to the Snapshot_time
07	<i>Y_Position</i>	Real number	m	Double (8 bytes)	1 element	Orbit State Vector Y Position in Earth Fixed Reference at corresponding UTC SNAPSHOT_TIME	Generated by L1 Processor. Based in PVT data from L0 ancillary packetpropagated with CFI to the Snapshot_time
08	<i>Z_Position</i>	Real number	m	Double (8 bytes)	1 element	Orbit State Vector Z Position in Earth Fixed Reference at corresponding UTC SNAPSHOT_TIME	Generated by L1 Processor. Based in PVT data from L0 ancillary packetpropagated with CFI to the Snapshot_time



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
09	<i>X_Velocity</i>	Real number	m/s	Double (8 bytes)	1 element	Orbit State Vector X Velocity in Earth Fixed Reference at corresponding UTC SNAPSHOT_TIME	Generated by L1 Processor. Based in PVT data from L0 ancillary packetpropagated with CFI to the Snapshot_time
10	<i>Y_Velocity</i>	Real number	m/s	Double (8 bytes)	1 element	Orbit State Vector Y Velocity in Earth Fixed Reference at corresponding UTC SNAPSHOT_TIME	Generated by L1 Processor. Based in PVT data from L0 ancillary packet, propagated with CFI to the Snapshot_time
11	<i>Z_Velocity</i>	Real number	m/s	Double (8 bytes)	1 element	Orbit State Vector Z Velocity in Earth Fixed Reference at corresponding UTC SNAPSHOT_TIME	Generated by L1 Processor. Based in PVT data from L0 ancillary packetpropagated with CFI to the Snapshot_time
12	<i>Nadir_Latitude</i>	Real number	Deg	Float (4 bytes)	1 element	Latitude of the satellite nadir point at corresponding UTC SNAPSHOT_TIME	Generated by L1 Processor.
13	<i>Nadir_Longitude</i>	Real number	deg	Float (4 bytes)	1 element	Longitude of the satellite nadir point at corresponding UTC SNAPSHOT_TIME	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
14	Vector_Solution	Identifier	N/A	Char (1 byte)	1 element	Source of the Orbit State Vector record: <ul style="list-style-type: none"> SOLUTION_NULL = 0 SOLUTION_INITIALISATION = 1 SOLUTION_PVT_FROZEN = 2 SOLUTION_NKF_SOLUTION = 3 SOLUTION_SPS_SOLUTION = 4 SOLUTION_PREDICTED = 5 (not used) SOLUTION_RESTITUTED = 6 (not used) 	Generated by L1 Processor.
15	Q0	Real number	N/A	Double (8 bytes)	1 element	Quaternion real element at corresponding UTC SNAPSHOT_TIME. Measured from J2000 inertial reference frame to body frame	Generated by L1 Processor. Based in AOCS data from L0 ancillary packet propagated with CFI to the Snapshot_time
16	Q1	Real number	N/A	Double (8 bytes)	1 element	Quaternion first imaginary element at corresponding UTC SNAPSHOT_TIME. Measured from J2000 inertial reference frame to body frame	Generated by L1 Processor. Based in AOCS data from L0 ancillary packet propagated with CFI to the Snapshot_time



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
17	Q2	Real number	N/A	Double (8 bytes)	1 element	Quaternion second imaginary element at corresponding UTC SNAPSHOT_TIME. Measured from J2000 inertial reference frame to body frame	Generated by L1 Processor. Based in AOCS data from L0 ancillary packet propagated with CFI to the Snapshot_time
18	Q3	Real number	N/A	Double (8 bytes)	1 element	Quaternion third imaginary element at corresponding UTC SNAPSHOT_TIME. Measured from J2000 inertial reference frame to body frame	Generated by L1 Processor. Based in AOCS data from L0 ancillary packet propagated with CFI to the Snapshot_time
19	X_Ang_Velocity	Real number	Rad/s	Double (8 bytes)	1 element	X Angular Velocity in Body Frame Reference	Generated by L1 Processor. Format-converted from L0 ancillary packet value
20	Y_Ang_Velocity	Real number	Rad/s	Double (8 bytes)	1 element	Y Angular Velocity in Body Frame Reference	Generated by L1 Processor. Format-converted from L0 ancillary packet value
21	Z_Ang_Velocity	Real number	Rad/s	Double (8 bytes)	1 element	Z Angular Velocity in Body Frame Reference	Generated by L1 Processor. Format-converted from L0 ancillary packet value



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
22	PMS_Voltages	Array of real numbers	mV	double (8 bytes)	Vector array of 72 elements, following the same order as the signals for correlations, beginning with arm A and ending in arm C	PMS Voltages measured for each of the CMNs.	Generated by L1 Processor. Based in PMS_YYY_XX_## fields in the L0 ancillary packet, where YYY is NIR or LCF, XX is the arm/s to which it belongs and ## is the number of the NIR/LICEF to which it is associated
23	NIR_Mode	Array of identifiers	N/A	byte-8	Vector array of 3 elements, following order AB, BC, CA	NIR modes in operation.	Generated by L1 Processor. Based in L0 ancillary packet, Op-Mode fields in NIR_XY_01 sections, where XY identifies the arms around NIR unit.
24	NIR_Avg_Samples	counter	N/A	byte-8	Vector array of 3 elements, following order AB, BC, CA	NIR number of averaged samples in last cycle.	Generated by L1 Processor. Based in L0 ancillary packet, their byte positions are 290, 302, 315



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
25	<i>NIR_Error</i>	Array of flags	N/A	byte-8	3 elements, following order AB, BC, CA	<p>NIR measurement error indicator. If different from 0, values measured in that NIR are not suitable for reconstruction. The meaning of each bit in each of the 3 elements is:</p> <p>BIT0(MSB) to BIT5</p> <ul style="list-style-type: none"> 0 success, 1 link busy, 2 link problem, 4 parameter error, 5 data overrun, 6 frame error <p>BIT6</p> <ul style="list-style-type: none"> 0 success, 1 no response <p>BIT7(LSB)</p> <ul style="list-style-type: none"> 0 Acquisition enabled, 1 Acquisition disabled 	Generated by L1 Processor. Based in L0 ancillary packet, their byte positions are 282, 294, 306.
26	<i>NIR_Pulse_Length</i>	Array of real values	N/A	double (8 bytes)	6 elements, order followed is AB-H, AB-V, BC- H, BC-V, CA-H and CA-V.	NIR measurements in operation. Normalised pulse length value, between [0,1].	Generated by L1 Processor. Based in L0 ancillary packet in NIR_XY_01 sections, where XY identifies the arms around NIR unit



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
27	Physical_Temperatures	Matrix of real numbers	K	float (4 bytes)	Matrix array of [12][14] elements	Thermistor temperatures received for each CMN and consolidated for all receiving thermistor channels, leading to a 12*14 matrix. 24 new values are received in each ancillary packet, calibrated and converted to K here.	Generated by L1 Processor. Coming from the characterisation of the thermistors, and the calibration parameters computed from two references loads on each CMN unit (ref_temps). Values are based in L0 ancillary packet's TEMP1 and TEMP2 in each CMN_X_# section, where X is the arm and # is the number of CMN.
28	M_Fly	Array of real values	V/K	float (4 bytes)	Vector array of 12 elements	Thermistor calibration coefficient recovered from voltages on two reference channels. Recovered independently for each CMN, it must be combined with Mcal value measured on ground to calibrate the thermistors voltage outputs.	Generated by L1 Processor. Based in L0 ancillary packet, fields TEMP1 and TEMP2, and field Pair_Temp_ID in each CMN section



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
29	<i>Q_Fly</i>	Array of real values	V	float (4 bytes)	Vector array of 12 elements	Thermistor calibration coefficient recovered from voltages on two reference channels. Recovered independently for each CMN, it must be combined with Qcal value measured on ground to calibrate the thermistors voltage outputs.	Generated by L1 Processor. Based in L0 ancillary packet, fields TEMP1 and TEMP2, and field Pair_Temp_ID in each CMN section
30	<i>LICEF_Status</i>	Array of flags	N/A	byte-8 (8 flags contained)	2 arrays, one for each polarisation (H and V), of 9 elements each, with totally 72 bit-flags in each array. Field size is then 18 bytes	Status of each LICEF by polarisation H, V (0=No error, 1=Error). Obtained from single failure and correlator failure identification.	Generated by L1 Processor. Value taken from Elements Failure Computation



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
31	CMN_NIR_Status	Array of flags	N/A	Unsigned short (2 bytes)	Array of 12+3 status bit-flags contained in 2 bytes. Order is first CMN status, then NIR status	<p>Status of each CMN and NIR (0=No error, 1=Error). Obtained from single failure identification.</p> <ul style="list-style-type: none"> • Bit 0 (LSB): CMN H1 • Bit 1: CMN H2 • Bit 2: CMN H3 • Bit 3: CMN A1 • Bit 4: CMN A2 • Bit 5: CMN A3 • Bit 6: CMN B1 • Bit 7: CMN B2 • Bit 8: CMN B3 • Bit 9: CMN C1 • Bit 10: CMN C2 • Bit 11: CMN C3 • Bit 12: NIR AB • Bit 13: NIR BC • Bit 14: NIR CA 	Generated by L1 Processor. Value taken from Elements Failure Computation



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
32	NS_Status	Array of flags	N/A	Unsigned short (2 bytes)	Array of 10 bit-flags	<p>Status of each Noise Source (0=No error, 1=Error). Obtained from single failure identification.</p> <ul style="list-style-type: none"> • Bit 0 (LSB): NS H • Bit 1: NS A1 • Bit 2: NS A2 • Bit 3: NS A3 • Bit 4: NS B1 • Bit 5: NS B2 • Bit 6: NS B3 • Bit 7: NS C1 • Bit 8: NS C2 • Bit 9: NS C3 	Generated by L1 Processor. Value taken from Elements Failure Computation
33	TSYNC_Error	Flag	N/A	unsigned byte	1 element	Status of Tsync signal information (0=No error, 1=Error). Obtained from single failure identification	Generated by L1 Processor. Based in L0ancillary packet, field starting in byte position 318 of source data.
34	Arm_Pol_Mode	Array of flags	N/A	unsigned byte	Vector array of 3 elements. Order followed is A, B and C	Polarisation mode in each arm (HHH=000, HVV=011, VHV=101, VVH=110, VVV=111, VHH=100, HVH=010, HHV=001).	Generated by L1 Processor. Based in the processing the TSYNC shape data and return each arm polarisation mode.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
35	Arm_Redundancy_Config	Array of flags	N/A	unsigned byte	Vector array of 3 elements. Order followed is A, B and C	Redundancy configuration in each arm for the noise source and thermistors (0 NOMINAL, 1 REDUNDANT)	Generated by L1 Processor. Based in L0 ancillary packet ARM_RED_CONF starting in byte 17
36	ASIC_Mode	Array of identifiers	N/A	unsigned byte	Vector array of 9 elements. Order followed is ASIC0, ASIC1... ASIC8 (nominal layer), or ASIC9, ASIC10... ASIC17 (redundant layer)	<ul style="list-style-type: none"> ASIC operation mode. The list of possibles values is: READOUT (0x0C): nominal IDLE (0x00): instrument active but no correlations are being read MAX_COUNT (0x0D): produced only during correlator test mode LFSR (0x0F): linear feedback shift register. Produced only during correlator test mode OCTG (0x0E): on chip test generator. Produced only during correlator test mode 	Generated by L1 Processor. Based in L0 ancillary packet fields ASIC# starting in byte 405 and ending in byte 413
37	CCU_Error	Flag	N/A	unsigned byte	1 element	Status of CCU information (0=No error, 1=Error). Obtained from single failure identification	Generated by L1 Processor. Based in L0 ancillary packet, byte position 402
38	PPS_Error	Flag	N/A	unsigned byte	1 element	Status of PPS information (0=No error, 1=Error). Obtained from single failure identification	Generated by L1 Processor. Based in L0 ancillary packet, byte position 16



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
39	<i>XBAND_Error</i>	Flag	N/A	unsigned byte	1 element	Status of XBAND information (0=No error, 1=Error). Obtained from single failure identification	Generated by L1 Processor. Based in L0 ancillary packet, byte position 395. The X-band data is coded as 8-bit 2's complement in the ancillary source packets, so it must be transformed into engineering units.
40	<i>Correlators_Op_Mode</i>	Identifier	N/A	unsigned byte	1 element	Operating mode of ALL correlators (0=STOP, 1=DUAL, 2=FULL)	Generated by L1 Processor. Based in L0 ancillary packet, byte position 403
41	<i>Correlators_Redundancy_Config</i>	Identifier	N/A	unsigned byte	1 element	Redundancy configuration of correlators layer (0=NONE, 1=NOMINAL, 2=REDUNDANT, 3=BOTH)	Generated by L1 Processor. Based in L0 ancillary packet, byte position 418
42	<i>Memory_Redundancy_Config</i>	Identifier	N/A	unsigned byte	1 element	Redundancy configuration of mass memory unit (0=NOMINAL, 2=REDUNDANT)	Generated by L1 Processor. Based in L0 ancillary packet, byte position 419



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
43	<i>Instrument_Mode</i>	Identifier	N/A	unsigned byte	1 element	Instrument mode as reported by ancillary packet (see section 2.2.8 of [RD.19]) <ul style="list-style-type: none"> ASW_INIT = 0 INSTRUMENT_INIT= 1 DUAL_POLARISATION = 2 FULL_POLARISATION = 3 CALIBRATION = 4 TEST = 5 	Generated by L1 Processor. Based in L0 ancillary packet, byte position 420
44	<i>Correlated_Noise_Mode</i>	Identifier	N/A	unsigned byte	1 element	Correlated Noise Injection operation mode, computed from CMN executed commands combination (codes available at DPM L1A, table 16 [RD.3])	Generated by L1 Processor. Based in L0 ancillary packet, the fields called LAST_EXECUTED_COMMAND in the different sections are considered together to detect C.N.I mode
45	<i>FWF_Step</i>	Identifier	N/A	unsigned byte	1 element	Time lag of FWF (0=NO_LAG, 1=-T, 2=+T)	Generated by L1 Processor. Based in L0 ancillary packet, byte position 404
46	<i>Corrupted_Data</i>	Flag	N/A	unsigned byte	1 element	Indicator of snapshot validity for reconstruction. If set to 1, some operation was performed that invalidates the correlators accumulation or NIR measurements	Generated by L1 Processor. Based in L0 ancillary packet, byte position 421



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
47	<i>TSYNC_CMN_Error</i>	Array of flags	N/A	unsigned byte	Vector array of 12 elements	Status of TSYNC signal at each CMN (0=No error, 1=Error). Obtained from single failure identification.	Generated by L1 Processor. Based in L0 ancillary packet, bit 15 for field TSYNC_HEALTH in each CMN HOUSEKEEPING section
48	<i>Heater_Status</i>	Array of flags	N/A	unsigned byte	Vector array of 12 elements	Status of heater at each CMN (0=OFF, 1=ON).	Generated by L1 Processor. Based in L0 ancillary packet, bit 1 for field HEATER_SWITCH in each CMN HOUSEKEEPING section
49	<i>Last_Executed_Command</i>	Identifier	N/A	unsigned short (2 bytes)	Vector array of 12 elements	Command executed on each CMN.	Generated by L1 Processor. Based in L0 ancillary packet, the fields called LAST_EXECUTED_COMMAND in the different sections
50	<i>Last_Executed_Command_Error</i>	Array of flags	N/A	unsigned byte	Vector array of 12 elements	Status flag of the last executed command on each CMN (0=No error, 1=Error). Obtained from single failure identification.	Generated by L1 Processor. Based in L0 ancillary packet, the fields called LAST_CMD_OK in the different sections



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
51	LO_Locking	Array of flags	N/A	unsigned byte	Vector array of 12 elements	Status flag of the Local Oscillator Locking status on each CMN (0=Error – LO is not phase-locked, 1=OK – LO is phase-locked).	Generated by L1 Processor. Based in L0 ancillary packet, the fields called LO_Locking in the different CMN sections
52	LO_Output_Power	Array of flags	N/A	unsigned byte	Vector array of 12 elements	Status flag of the Local Oscillator Power status on each CMN (0=OK – LO power is within requirements, 1=Error – LO power is not within requirements).	Generated by L1 Processor. Based in L0 ancillary packet, the fields called LO_Output_Power in the different CMN sections
53	Last_APID	Identifier	N/A	unsigned short (2 bytes)	1 element	Last APID received by the correlators	Generated by L1 Processor. Based in L0 ancillary packet, byte position 414
54	XBAND_Status	Flag	N/A	unsigned byte	1 element	Status flag for Xband system: - OFF:0 - NOMINAL:1 - REDUNDANT:2 - BOTH:3	Generated by L1 Processor. Based in L0 ancillary packet, byte position 396
55	RF_Level	Real value	mV	Float (4 bytes)	1 element	Power RF Signal Level	Generated by L1 Processor. Based in L0 ancillary packet, byte position 397



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
56	<i>VCO_TM</i>	Real value	mV	Float (4 bytes)	1 element	DC Level of the VCO	Generated by L1 Processor. Based in L0 ancillary packet, byte position 398
57	<i>Num_Alim_TM</i>	Real value	mV	Float (4 bytes)	1 element	Voltage of the digital parts supply	Generated by L1 Processor. Based in L0 ancillary packet, byte position 399
58	<i>SSPA_Alim_TM</i>	Real value	mV	Float (4 bytes)	1 element	Voltage of the solid state RF power amplifier	Generated by L1 Processor. Based in L0 ancillary packet, byte position 400
59	<i>Temp_TM</i>	Real value	K	Float (4 bytes)	1 element	Xband System temperature	Generated by L1 Processor. Based in L0 ancillary packet, byte position 401
60	<i>PM_Nominal</i>	Flag	N/A	unsigned byte	1 element	Processing Module Nominal or Redundant mode (0= NOMINAL, 1=REDUNDANT)	Generated by L1 Processor. Based in L0 ancillary packet, byte position 416 bit 0
61	<i>EEPROM_Selected</i>	Flag	N/A	unsigned byte	1 element	EEPROM Bank selected (0=Bank #0, 1=Bank #1)	Generated by L1 Processor. Based in L0 ancillary packet, byte position 416 bit 2
62	<i>Reset_Source</i>	Flag	N/A	unsigned byte	1 element	(0=Reset Source SW, 1=Reset Source Power-on)	Generated by L1 Processor. Based in L0 ancillary packet, byte position 416 bit 4



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
63	EEPROM_Write	Flag	N/A	unsigned byte	1 element	EEPROM Write status (0=ENABLED, 1=DISABLED)	Generated by L1 Processor. Based in L0 ancillary packet, byte position 416 bit 6
	Quality_Information					Init of Quality_Information structure.	
64	Software_Error_flag	Flag	N/A	unsigned byte	1 element	<ul style="list-style-type: none"> 0 if no software errors were detected during the processing of the snapshot 1 if a software error was detected see Annex B for details. 	Generated by L1 Processor.
65	Instrument_Error_flag	Flag	N/A	unsigned byte	1 element	<ul style="list-style-type: none"> 0 if no instrument errors were detected during the processing of the snapshot 1 if an instrument error is detected see Annex B for details 	Generated by L1 Processor.
66	ADF_Error_flag	Flag	N/A	unsigned byte	1 element	<ul style="list-style-type: none"> 0 if no ADF error occurs when the snapshot is processed 1 if one or more ADF used to process the snapshot had a validity time outside the acquisition time of the snapshot or the ADF is missing <p>The detailed list of ADF error detected by the L1OP V3 for the telemetry stage of the processing is given in Annex B.</p>	Generated by L1 Processor.
67	Calibration_Error_flag	Flag	N/A	unsigned byte	1 element	<p>NOT USED set to zero.</p> <p>N/A no Calibration file is used for the Telemetry processing</p>	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>Quality_Information</i>					End of <i>Quality_Information</i> structure.	
	<i>HKTM_Sample</i>					End of <i>HKTM_Sample</i> data set record structure.	
	<i>List_of_HKTM_Samples</i>					End of list of <i>HKTM_Sample</i> data set record structures.	
	<i>HKTM_Data</i>					End of binary Data Set containing the <i>Grid_Points</i> records.	
	<i>Data_Block</i>					End of binary Data Block in the product.	

Table 4-12 Level 1A Housekeeping Telemetry Product Data Block



The following table shows the contents of the physical temperatures data. CMN ordering is as usual: H1, H2, H3, A1, A2, A3, B1, B2, B3, C1, C2 and C3. Temperature ordering is shown in the table.

	CMN H1	CMN H2	CMN H3	CMN X 1/2/3 (X=A,B or C)
Ch. 1	LICEF_AB_03	LICEF_BC_03	LICEF_CA_03	LICEF_X_04/10/16
Ch. 2	LICEF_NIR_AB_01_H	LICEF_NIR_BC_01_H	LICEF_NIR_CA_01_H	LICEF_X_05/11/17
Ch. 3	LICEF_NIR_AB_01_V	LICEF_NIR_BC_01_V	LICEF_NIR_CA_01_V	LICEF_X_06/12/18
Ch. 4	LICEF_A_01	LICEF_B_01	LICEF_C_01	LICEF_X_07/13/19
Ch. 5	LICEF_A_02	LICEF_B_02	LICEF_C_02	LICEF_X_08/14/20
Ch. 6	LICEF_A_03	LICEF_B_03	LICEF_C_03	LICEF_X_09/15/21
Ch. 7	NIR_A_T3 (NS_1H)	NIR_A_T3 (NS_2H)	NIR_A_T3 (NS_3H)	NS_X_1/2/3
Ch. 8	NIR_A_T5 (Lref_1H)	NIR_A_T5 (Lref_2H)	NIR_A_T5 (Lref_3H)	Hinge_n
Ch. 9	NIR_A_T7 (AntennaPatch_1H)	NIR_A_T7 (AntennaPatch_2H)	NIR_A_T7 (AntennaPatch_3H)	Not used
Ch. 10	NIR_A_T11 (NS_1V)	NIR_A_T11 (NS_2V)	NIR_A_T11 (NS_3V)	Not used
Ch. 11	NIR_A_T13 (Lref_1V)	NIR_A_T13 (Lref_2V)	NIR_A_T13 (Lref_3V)	Not used
Ch. 12	NIR_A_T15 (AntennaInterm_1H)	NIR_A_T15 (AntennaInterm_2H)	NIR_A_T15 (AntennaInterm_3H)	Not used
Ch. 13	NS_H_Internal	Not used	Not used	Not used
Ch. 14	PD_H1_n	PD_H2_n	PD_H3_n	PD_X_1/2/3

Table 4-13 Physical Temperatures Data Fomat



4.2.2 L1A Calibration Data Specification

L1a Calibration Data shall be formed by the calibration parameters and offsets extracted after noise injection, and the estimated coefficients of the Fringe Washing function.

The Specific Product Header Format for all Level 1A Calibration products follows the format described in section 4.1.2, including:

- Level 1 Main Info SPH (see Table 4-3)
- Level 1 Quality Information (see Table 4-4)
- Level1 SPH Data Sets (see Table 4-5)

4.2.2.1 Average Uncorrelated Noise Injection Data Type (MIR_UAVD1A)

The uncorrelated noise injection measurements are MIRAS correlation measurements obtained when the input ports of the LICEFs are switched to their internal reference loads, allowing the estimation of visibility offsets after the conversion of raw correlations into visibilities and the corresponding calibration.

This product is the actual uncorrelated input to L1A Visibilities processing, as it contains only the average of all uncorrelated noise injection measurements made during a given time period, i.e. it is made by averaging the individual measurements for each epoch contained in the Uncorrelated Noise Injection data type. This period needs not to be obtained from a pole-to-pole segment, but it can be several semi-orbits long. The product contains only one average, corresponding to a whole calibration campaign (which extent is decided backwards and onwards by checking if the gaps between uncorrelated noise measurements are larger than a defined threshold).

The average shall be performed by combining the previously existing MIR_UAVD1A consolidated product (if any) with the result of processing the half-orbit MIR_UNCD0_ / MIR_UNCU0_ product containing additional individual measurements. The distance in time from the previous MIR_UAVD1A stop time and the new MIR_UNCD0_/U0_ start time shall be smaller than a configured maximum acceptable gap. The average values shall be presented along with the number of measurements used and the time period where the samples were gathered. This time shall be used to further consolidate additional data in an existing average, or to discard the previous average and recompute a new one.



This product type contains the average of the uncorrelated noise injection measurements of a calibration campaign obtained either when the instrument is pointing in nominal attitude (from MIR_UNCD0_ products) or when the instrument is pointing with external attitude (from MIR_UNCU0_ products). The resulting product shall be named MIR_UAVD1A

4.2.2.1.1 Specific Product Header

The Specific Product Header Format for MIR_UAVD1A products follows the format described in table below:

Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	<i>Specific_Product_Header</i>	Starting Tag				Tag starting the Specific Product Header structure	
02-19	<i>Main_Info</i>	structure	N/A	N/A	N/A	Main Product Info structure's fields as defined in Table 4-3	
20	<i>Quality_Information</i>	structure	N/A	N/A	N/A	Quality_Information structure's fields as defined in Table 4-4.	
21	<i>Uncorrelated_Quality_Information</i>	Starting Tag				Tag starting of an <i>Uncorrelated_Quality_Information</i> structure	
22	<i>N_Averaged_Measurements</i>	Integer	N/A	4 bytes	%04s	Number of averaged uncorrelated noise injection measurements	Generated by L1 Processor.
23	<i>Unc_Averaged_Measurements_Threshold</i>	Integer	N/A	4 bytes	%04s	Field indicating the threshold for the acceptable minimum number of averaged individual uncorrelated measurements, set as configuration value during the generation of this product. The origin is field 11 in AUX_CNFL1P (Unc_Averaged_Measurements_Threshold)	AUX_CNFL1P



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
24	<i>Uncorrelated_Quality</i>	Flag	N/A	1 byte	%01d	Flag indicating that the average contained in the product as used less epochs than the number specified as threshold in the configuration file. The possible values are: <ul style="list-style-type: none"> • 1 if number of averaged measurements is under the threshold • 0 if it is greater 	Generated by L1 Processor.
25	<i>Uncorrelated_Quality_Information</i>	Closing Tag				Tag closing an <i>Uncorrelated_Quality_Information</i> structure	
25-36	<i>Data_Sets</i>	structure	N/A	N/A	N/A	Data Sets structure's fields as defined in Table 4-5	
37	<i>Specific_Product_Header</i>	Closing Tag				Tag closing the Specific Product Header structure	

Table 4-14 Level 1A MIR_UAVD1A SPH

The reference data sets for MIR_UAVD1A Data Type are:

Reference Data Set Name	Product Type	Description
L0_CORRELATIONS_FILE	MIR_UNCD0 MIR_UNCU0	L0 Product filename from which the current L1a Aux file was created
L1A_ORBIT_AMPL_FILE	MIR_CRSD1A	L1a Calibration filename containing several sets of parameters obtained during correlated noise injection calibration, used to calibrate the L1a visibilities
L1A_ORBIT_PHASE_FILE	MIR_CSTD1A	L1a Calibration filename containing several sets of parameters obtained during short term calibration (i.e. Local Oscillator), used to calibrate the L1a visibilities
L1A_AVER_OFFSET_FILE	MIR_UAVD1A	L1a Offset filename containing individual measurements of uncorrelated noise injection



Reference Data Set Name	Product Type	Description
L1A_HKTM_FILE	TLM_MIRA1A	HKTM filename containing the physical temperatures for the snapshots in the current product
ALGORITHM_CONFIG_FILE	AUX_CNFL1P	Processor Configuration Parameters and Constants for L1OP
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Mission planning file used to initialise the EE CFI orbit_id and/or time_id. It is read and used by the EE CFI.
PMS_FILE	AUX_PMS	Auxiliary file with PMS characterisation used for L1a calibration
BULLETIN_B_FILE	AUX_BULL_B	IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation
LICEF_FILE	AUX_LCF	Auxiliary file with absolute phase characterisation used for plane translation of L1A calibration data
NIR_FILE	AUX_NIR	Auxiliary file with NIR characterisation used for L1a calibration (defined externally)

Table 4-15 Level 1A Uncorrelated Noise Injection Reference Data Sets

The following are the rules to update the SPH General Quality Information structure from the resulting Quality_Information flags for each data set record:

Counter Name	Condition
Software_Error_Counter	Copied from the same field in the data set record.
Instrument_Error_Counter	Copied from the same field in the data set record.
ADF_Error_Counter	Copied from the same field in the data set record.
Calibration_Error_Counter	Copied from the same field in the data set record.
N_Discarded_Scenes	Count all the L0 uncorrelated noise snapshot discarded due to missing corresponding HKTM L1a snapshots



4.2.2.1.2 Data Block

The binary Data Block of the MIR_UAVD1A data product consists of one dataset giving the mean average of all the individual measurements obtained by processing the contents of the MIR_UNCD0_/MIR_UNCU0_ product. The sequence in which the data is presented is the same as for nominal L1A Products, and can be seen in Figure 4-1.

The following table describes the XML schema used to decode the binary contents of these types of datasets:

- The **Mean_Offset** dataset shall contain a list of **Mean_Offsets_Data** Data Set Record (with 1 DSR being the baseline), spanning all continuous or semi-continuous integration times spent in Uncorrelated Noise Injection during the consolidation period. This data record shall contain the complete set of averaged offsets for every pair of receivers, expressed as a visibility offset, together with the number of samples used for the average. Total amount of offsets is then $72 \times 71/2$, as the LICEF_NIR are correlated in both polarisations during the integration time. The origin of the offset is presented (Nominal or Redundant) layer, in case they were to be applied to measurements from the opposite layer. The size of each DSR is fixed and equal to 41229 bytes.
- The **All_LICEF** dataset shall contain a list of **All_LICEF_Data** Data Set Record, which consist on PMS data retrieved in each U-noise epoch. Each data record shall contain the complete set of PMS gains for all 72 receivers. The origin of the gain is presented (Nominal or Redundant) layer, in case they were to be applied to measurements from the opposite layer. The size of each DSR is fixed and equal to 1533 bytes.
- The **Cons_All_LICEF** dataset shall contain a list of **Cons_All_LICEF_DATA** Data Set Record (with 1 DSR being the baseline), spanning all continuous or semi-continuous integration times spent in Uncorrelated Noise Injection during the consolidation period. This data record shall consist on a complete set of averaged gains for all 72 receivers, expressed as a PMS gain, together with the number of samples used for the average. In a long calibration event, the total of valid epochs dedicated to measure U-noise is 795. The origin of the gain is presented (Nominal or Redundant) layer, in case they were to be applied to measurements from the opposite layer. The size of each DSR is fixed and equal to 2133 bytes.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Mean_Offset					Init of binary Data Set containing the list of Mean_Offset_Data records.	
01	Mean_Offset_Data_Counter	Integer	N/A	Unsigned integer (4 bytes)	1 element	Number of Mean_Offset_Data data set record structure in the following list.	Generated by L1 Processor.
	List_of_Mean_Offset_Datas					Tag starting a list of Mean_Offset_Data	
	Mean_Offset_Data					Init of Mean_Offset_Data record structure.	
02	Start_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the Uncorrelated Noise Injection calibration campaign was started. Expressed in EE CFI transport time format	Generated by L1 Processor.
03	Stop_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the Uncorrelated Noise Injection calibration campaign was finished. Expressed in EE CFI transport time format	Generated by L1 Processor.
04	Correlator_Layer	Character	N/A	char (1 byte)	1 element	Correlator layer from which the data was taken (NOMINAL='N' or REDUNDANT='R')	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
05	Samples	Integer Value	N/A	Unsigned integer (4 bytes)	1 element	Number of samples taken to perform the average. Typically it shall be the number of U-noise epochs used.	Generated by L1 Processor.
06	Offset	Array of complex values	N/A	Double (real part) + double (imag part), totally 16 bytes	71*36 elements. Order followed s depicted in Figure 4-1	Complex mean offset values (for real and imaginary term of V_{kj}) in all baselines.	Generated by L1 Processor.
07	Receiver_Temp	Array of real values	K	Float (4 bytes)	Vector array of 72 elements (order followed is described in last paragraph of 4.2.3.1)	Average physical temperature of receivers in Kelvin, during uncorrelated noise injection. One value per receiver.	Generated by L1 Processor.
	Quality_Information					Init of Quality_Information structure.	
08	Software_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for sw error in the uncorrelated processing are given in details in Appendix B.	Generated by L1 Processor.
09	Instrument_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for instrument error in the uncorrelated processing are given in details in Appendix B	Generated by L1 Processor.
10	ADF_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for ADF error in the uncorrelated processing are given in details in Appendix B.	Generated by L1 Processor.
11	Calibration_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for calibration error in the uncorrelated processing are given in details in Appendix B	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Quality_Information					End of Quality_Information structure.	
	List_of_Mean_Offset_Datas					Tag ending the list of Mean_Offset_Data	
	Mean_Offset					End of binary Data Set containing the list of Mean_Offset_Data records.	
	All_LICEF					Init of binary Data Set containing the list of All_LICEF_Data records.	
12	All_LICEF_Data_Counter	Integer	N/A	Unsigned integer (4 bytes)	1 element	Number of All_LICEF_Data data set record structure in the following list.	Generated by L1 Processor.
	All_LICEF_Datas					Tag starting a list of All_LICEF_Data	
	All_LICEF_Data					Init of All_LICEF_Data record structure.	
13	Snapshot_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the scene was taken. Middle of integration time period, propagated from UTC at start of integration provided in ancillary packet. Expressed in EE CFI transport time format.	Copied from L1A HKTM product
14	Snapshot_OBET	Time counter	N/A	bit stream (8 bytes) declared as unsigned long	1 element (OBET Format is specified in section 4.2.1.2)	Unique identifier for the snapshot. Formed by the OBET at T_SYNC extracted from L0. Represents start of integration time in OBET format.	Copied from secondary header in scene packets
15	Correlator_Layer	Character	N/A	char (1 byte)	1 element	Correlator layer from which the data was taken (NOMINAL='N' or REDUNDANT='R')	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
16	PMS_ID	Identifier	N/A	Unsigned byte	72 elements	<p>PMS Unique identifier (from 0 to 71). The equivalence with PMS_ID in AUX_PMS is as follows:</p> <ul style="list-style-type: none"> 0 to 23 for arm A (AB_03, ABH_01, ABV_01, A_01, A_02.... A_21) 24 to 47 for arm B (BC_03, BCH_01, BCV_01, B_01, B_02.... B_21) 48 to 71 for arm C (CA_03, CAH_01, CAV_01, C_01, C_02.... C_21) 	Generated by L1 Processor.
17	Phys_Temp	Array of real values	K	Float (4 bytes)	Vector array of 72 elements (order followed is described in last paragraph of 4.2.3.1)	The physical temperature of the U-load at the specified epoch in Kelvin during uncorrelated noise injection. One value per receiver.	Generated by L1 Processor.
18	Receiver_Temp_CIP	Array of real values	K	Double (8 bytes)	Vector array of 72 elements (order followed is described in last paragraph of 4.2.3.1)	The receiver noise temperature at CIP for the specified epoch in Kelvin, during uncorrelated noise injection. One value per receiver.	Generated by L1 Processor.
19	Gain	Array of real values	K	Double (8 bytes)	Vector array of 72 elements (order followed is described in last paragraph of 4.2.3.1)	The PMS gain of the specified epoch during the uncorrelated noise injection. One value per receiver.	Generated by L1 Processor.
	List_of_All_LICEF_Datas					Tag ending the list of All_LICEF_Data	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	All_LICEF					End of binary Data Set containing the list of All_LICEF_Data records.	
	Cons_All_LICEF					Init of binary Data Set containing the list of Cons_All_LICEF_Data records.	
20	Cons_All_LICEF_Data_Counte r	Integer	N/A	Unsigned integer (4 bytes)	1 element	Number of Cons_All_LICEF_Data data set record structure in the following list.	Generated by L1 Processor.
	List_Cons_All_LICEF_Datas					Tag starting a list of Cons_All_LICEF_Data	
	Cons_All_LICEF_Data					Init of Cons_All_LICEF_Data record structure.	
21	Start_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the Uncorrelated Noise Injection calibration campaign was started. Expressed in EE CFI transport time format	Generated by L1 Processor.
22	Stop_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the Uncorrelated Noise Injection calibration campaign was finished. Expressed in EE CFI transport time format	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
23	Correlator_Layer	Character	N/A	char (1 byte)	1 element	Correlator layer from which the data was taken (NOMINAL='N' or REDUNDANT='R')	Generated by L1 Processor.
24	Samples	Integer Value	N/A	Unsigned integer (4 bytes)	1 element	Number of samples taken to perform the average. Typically it shall be the number of U-noise epochs used.	Generated by L1 Processor.
25	PMS_ID	Identifier	N/A	Unsigned byte	72 elements	<p>PMS Unique identifier (from 0 to 71). The equivalence with PMS_ID in AUX_PMS is as follows:</p> <ul style="list-style-type: none"> 0 to 23 for arm A (AB_03, ABH_01, ABV_01, A__01, A__02.... A__21) 24 to 47 for arm B (BC_03, BCH_01, BCV_01, B__01, B__02.... B__21) 48 to 71 for arm C (CA_03, CAH_01, CAV_01, C__01, C__02.... C__21) 	Generated by L1 Processor.
26	Phys_Temp	Array of real values	K	Float (4 bytes)	Vector array of 72 elements (order followed is described in last paragraph of 4.2.3.1)	The average physical temperature of the U-load in Kelvin during uncorrelated noise injection. One value per receiver.	Generated by L1 Processor.
27	Receiver_Temp_CIP	Array of real values	K	Double (8 bytes)	Vector array of 72 elements (order followed is described in last paragraph of 4.2.3.1)	The average receiver noise temperature at CIP in Kelvin, during uncorrelated noise injection. One value per receiver.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
28	Gain_Sens	Array of real values	K	Double (8 bytes)	Vector array of 72 elements (order followed is described in last paragraph of 4.2.3.1)	Sensitivity of PMS gain with temperature SG, computed from linear regression between the average PMS gain and the average physical temperature.	Generated by L1 Processor.
29	Gain	Array of real values	K	Double (8 bytes)	Vector array of 72 elements (order followed is described in last paragraph of 4.2.3.1)	The PMS gain of the specified epoch during the uncorrelated noise injection. One value per receiver.	Generated by L1 Processor.
	Quality_Information					Init of Quality_Information structure.	
30	Software_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for SW error in the uncorrelated processing are given in details in [RD.24]	Generated by L1 Processor.
31	Instrument_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for instrument error in the uncorrelated processing are given in details in [RD.24]	Generated by L1 Processor.
32	ADF_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for ADF error in the uncorrelated processing are given in details in [RD.24].	Generated by L1 Processor.
33	Calibration_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for calibration error in the uncorrelated processing are given in details in [RD.24]	Generated by L1 Processor.
	Quality_Information					End of Quality_Information structure.	
	List_of_Cons_All_LICEF_Data s					Tag ending the list of Cons_All_LICEF_Data s	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Cons_All_LICEF					End of binary Data Set containing the list of Cons_All_LICEF_Data records.	
	Data_Block					End of binary Data Block in the product.	

Table 4-16 Level 1A Average Uncorrelated Noise Injection Product Data Block

4.2.2.2 Long Term Synthetic Curve of Correlated Noise Injection (MIR_CRSD1A)

The correlated noise injection measurements are MIRAS correlation measurements obtained when the input ports of the LICEFs are switched to the C-ports (measuring first from odd noise sources and then from even noise sources), transformed to raw correlations, allowing the estimation of the Fringe Washing Function at the origin and the calibration of PMS.

The correlated noise injection measurements used by the L1OP to calibrate the visibilities are not based in only one L0 product but in the measurements obtained from several MIR_CORD0 / MIR_CORU0, i.e. they are not consolidated in a pole-to-pole basis. The individual measurements performed in each semi-orbit are processed to L1A and directly included in the Consolidated Correlated Noise Injection product MIR_CRSD1A (containing measurements processed from MIR_CORD0 or MIR_CORU0). The number of past orbits –along with the new measurement- to be included in the MIR_CRSD1A product is a configurable parameter.

Correlated noise injection (combined in odd and even sources) produces the calibration parameters (amplitude value of the FWF at the origin, representing the correction factors in amplitude) that need to be applied to calibrate the instrument measurements, as well as the calibrated coefficients for the PMS.

4.2.2.2.1 Specific Product Header

The Specific Product Header Format for Level 1 Correlated Noise Injection Short Calibration Curve products follows the format described in table below.



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	<i>Specific_Product_Header</i>	Starting Tag				Tag starting the Specific Product Header structure	
02-19	<i>Main_Info</i>	structure				Main Product Info structure's fields as defined in Table 4-3	
20-26	<i>Quality_Information</i>	structure				Quality_Information structure's fields as defined in Table 4-4	
27	<i>Cons_Long_PMS_DSR_New</i>	integer	N/A	4 bytes	%04d	Number of Cons_Long_PMS_Coefficients new data set added in the file during the processing.	Generated by L1 Processor.
28	<i>Cons_Long_PMS_DSR_Removed</i>	Integer	N/A	4 bytes	%04d	Number of obsolete Cons_Long_PMS_Coefficients data set removed in the file during the processing.	Generated by L1 Processor.
29	<i>Cons_Long_Ampl_FWF_Origin_New</i>	Integer	N/A	4 bytes	%04d	Number of Cons_Long_Ampl_FWF_Origin new data set added in the file during the processing.	Generated by L1 Processor.
30	<i>Cons_Long_Ampl_FWF_Origin_Removed</i>	Integer	N/A	4 bytes	%04d	Number of obsolete Cons_Long_Ampl_FWF_Origin data set removed in the file during the processing.	Generated by L1 Processor.
31	<i>Cons_Short_PMS_Offset_DSR_New</i>	integer	N/A	4 bytes	%04d	Number of Cons_Short_PMS_Offset new data set added in the file during the processing.	Generated by L1 Processor.
32	<i>Cons_Short_PMS_Offset_DSR_Removed</i>	Integer	N/A	4 bytes	%04d	Number of obsolete Cons_Short_PMS_Offset data set removed in the file during the processing.	Generated by L1 Processor.
33	<i>Cons_External_LFE_DSR_New</i>	integer	N/A	4 bytes	%04d	Number of Cons_External_LFE new data set added in the file during the processing.	Generated by L1 Processor.



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
34	Cons_External_LFE_DSR_Removed	Integer	N/A	4 bytes	%04d	Number of obsolete Cons_External_LFE data set removed in the file during the processing.	Generated by L1 Processor.
35	Cons_PMS_Start	String	N/A	30 bytes	%30s	UTC Start Time of the Consolidated PMS Coefficients dataset, in CCSDS ASCII format with time reference and microseconds. "UTC=yyyy-mm-ddThh:mm:ss.aaaaaa" This time shall coincide with the start time of the older dataset record of this dataset in the binary datablock.	Generated by L1 Processor.
36	Cons_PMS_Stop	String	N/A	30 bytes	%30s	UTC Stop Time of the Consolidated PMS Coefficients dataset, in CCSDS ASCII format with time reference and microseconds. "UTC=yyyy-mm-ddThh:mm:ss.aaaaaa" This time shall coincide with the stop time of the most recent dataset record of this dataset in the binary datablock.	Generated by L1 Processor.
37	Cons_Long_PMS_Start	String	N/A	30 bytes	%30s	UTC Start Time of the Consolidated Long PMS Coefficients dataset, in CCSDS ASCII format with time reference and microseconds. "UTC=yyyy-mm-ddThh:mm:ss.aaaaaa" This time shall coincide with the start time of the older dataset record of this dataset in the binary datablock.	Generated by L1 Processor.



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
38	<i>Cons_Long_PMS_Stop</i>	String	N/A	30 bytes	%30s	<p>UTC Stop Time of the Consolidated Long PMS Coefficients dataset, in CCSDS ASCII format with time reference and microseconds.</p> <p>“UTC=yyyy-mm-ddThh:mm:ss.uuuuuu”</p> <p>This time shall coincide with the stop time of the most recent dataset record of this dataset in the binary datablock.</p>	Generated by L1 Processor.
39	<i>Cons_Ampl_FWF_Origin_Start</i>	String	N/A	30 bytes	%30s	<p>UTC Start Time of the Consolidated Amplitude of FWF Origin dataset, in CCSDS ASCII format with time reference and microseconds.</p> <p>“UTC=yyyy-mm-ddThh:mm:ss.uuuuuu”</p> <p>This time shall coincide with the start time of the older dataset record of this dataset in the binary datablock.</p>	Generated by L1 Processor.
40	<i>Cons_Ampl_FWF_Origin_Stop</i>	String	N/A	30 bytes	%30s	<p>UTC Stop Time of the Consolidated Amplitude of FWF Origin dataset, in CCSDS ASCII format with time reference and microseconds.</p> <p>“UTC=yyyy-mm-ddThh:mm:ss.uuuuuu”</p> <p>This time shall coincide with the stop time of the most recent dataset record of this dataset in the binary datablock.</p>	Generated by L1 Processor.



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
41	<i>Cons_Long_Ampl_FWF_Origin_Start</i>	String	N/A	30 bytes	%30s	<p>UTC Start Time of the Consolidated Long Amplitude of FWF Origin dataset, in CCSDS ASCII format with time reference and microseconds.</p> <p>“UTC=yyyy-mm-ddThh:mm:ss.uuuuuu”</p> <p>This time shall coincide with the start time of the older dataset record of this dataset in the binary datablock.</p>	Generated by L1 Processor.
42	<i>Cons_Long_Ampl_FWF_Origin_Stop</i>	String	N/A	30 bytes	%30s	<p>UTC Stop Time of the Consolidated Long Amplitude of FWF Origin dataset, in CCSDS ASCII format with time reference and microseconds.</p> <p>“UTC=yyyy-mm-ddThh:mm:ss.uuuuuu”</p> <p>This time shall coincide with the stop time of the most recent dataset record of this dataset in the binary datablock.</p>	Generated by L1 Processor.
43	<i>Cons_PMS_Offset_Start</i>	String	N/A	30 bytes	%30s	<p>UTC Start Time of the Consolidated PMS Coefficients dataset, in CCSDS ASCII format with time reference and microseconds.</p> <p>“UTC=yyyy-mm-ddThh:mm:ss.uuuuuu”</p> <p>This time shall coincide with the start time of the older dataset record of this dataset in the binary datablock.</p>	Generated by L1 Processor.



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
44	Cons_PMS_Offset_Stop	String	N/A	30 bytes	%30s	<p>UTC Stop Time of the Consolidated PMS Coefficients dataset, in CCSDS ASCII format with time reference and microseconds.</p> <p>“UTC=yyyy-mm-ddThh:mm:ss.uuuuuu”</p> <p>This time shall coincide with the stop time of the most recent dataset record of this dataset in the binary datablock.</p>	Generated by L1 Processor.
45	Cons_Short_PMS_Offset_Start	String	N/A	30 bytes	%30s	<p>UTC Start Time of the Consolidated Long PMS Coefficients dataset, in CCSDS ASCII format with time reference and microseconds.</p> <p>“UTC=yyyy-mm-ddThh:mm:ss.uuuuuu”</p> <p>This time shall coincide with the start time of the older dataset record of this dataset in the binary datablock.</p>	Generated by L1 Processor.
46	Cons_Short_PMS_Offset_Stop	String	N/A	30 bytes	%30s	<p>UTC Stop Time of the Consolidated Long PMS Coefficients dataset, in CCSDS ASCII format with time reference and microseconds.</p> <p>“UTC=yyyy-mm-ddThh:mm:ss.uuuuuu”</p> <p>This time shall coincide with the stop time of the most recent dataset record of this dataset in the binary datablock.</p>	Generated by L1 Processor.



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
47	Cons_LFE_Start	String	N/A	30 bytes	%30s	UTC Start Time of the Consolidated LFE Coefficients dataset, in CCSDS ASCII format with time reference and microseconds. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" This time shall coincide with the start time of the older dataset record of this dataset in the binary datablock.	Generated by L1 Processor.
48	Cons_LFE_Stop	String	N/A	30 bytes	%30s	UTC Stop Time of the Consolidated LFE Coefficients dataset, in CCSDS ASCII format with time reference and microseconds. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" This time shall coincide with the stop time of the most recent dataset record of this dataset in the binary datablock.	Generated by L1 Processor.
49	Cons_External_LFE_Start	String	N/A	30 bytes	%30s	UTC Start Time of the Consolidated External LFE Coefficients dataset, in CCSDS ASCII format with time reference and microseconds. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" This time shall coincide with the start time of the older dataset record of this dataset in the binary datablock.	Generated by L1 Processor.



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
50	<i>Cons_External_LFE_Stop</i>	String	N/A	30 bytes	%30s	UTC Stop Time of the Consolidated External LFE Coefficients dataset, in CCSDS ASCII format with time reference and microseconds. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" This time shall coincide with the stop time of the most recent dataset record of this dataset in the binary datablock.	Generated by L1 Processor.
51-52	<i>Data_Sets</i>	structure	N/A	N/A	N/A	Data Sets structure's fields as defined in Table 4-5	
53	<i>Specific_Product_Header</i>	Closing Tag				Tag closing the Specific Product Header structure	

Table 4-17 Level 1A Synthetic Curve of Correlated Noise Injection SPH

The reference data sets for MIR_CRSD1A Data Type are:

Reference Data Set Name	Product Type	Description
L0_CORRELATIONS_FILE	MIR_CORD0_ , MIR_CORU0_	L0 Product filename from which the current L1a was created
L1A_ORBIT_AMPL_FILE	MIR_CRSD1A	L1a Calibration filename containing several sets of parameters obtained during correlated noise injection calibration, used to calibrate the L1a visibilities
L1A_HKTM_FILE	TLM_MIRA1A	HKTM filename containing thermistors temperature information for the snapshots in the current product
L1A_AVER_NIR_CAL_FILE	MIR_ANIR1A	Average NIR calibrated parameters filename used to calibrate L1a visibilities
NIR_FILE	AUX_NIR__	Auxiliary file with NIR characterisation used for L1a calibration (defined externally)
PMS_FILE	AUX_PMS__	Auxiliary file with PMS characterisation used for L1a calibration
S_PARAM_FILE	AUX_SPAR__	Auxiliary file with S-parameters characterisation used for L1a calibration
LICEF_FILE	AUX_LCF__	Auxiliary file with absolute phase characterisation used for plane translation



Reference Data Set Name	Product Type	Description
		of L1A calibration data
ALGORITHM_CONFIG_FILE	AUX_CNFL1P	Processor Configuration Parameters and Constants for L1OP
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Mission planning file used to initialise the EE CFI orbit_id and/or time_id. It is read and used by the EE CFI.
BULLETIN_B_FILE	AUX_BULL_B	IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation
ANTENNA_PATTERNS_FILE	AUX_PATT__	Auxiliary file with receivers' amplitude and phase pattern characterisation used for convolution of the Sky Brightness Temperatures
GALAXY_FILE	AUX_GALAXY	Original Galaxy Map used for convolution of the Sky Brightness Temperatures
BEST_FIT_PLANE_FILE	AUX_BFP__	Auxiliary file with definition of Best Fit Plane to be used during Sky map convolution
MISPOINTING_ANGLES_FILE	AUX_MISP__	Auxiliary product containing the mispointing angles between the Body Frame referenced in the Proteus quaternions and the Antenna Plane defined by the MIRAS instrument
FAILURES_FILE	AUX_FAIL__	Auxiliary file with failure of components to be taken into account during L1 processing

Table 4-18 Level 1A Synthetic Curve of Correlated Noise Injection Reference Data Sets

The following are the rules to update the SPH General Quality Information structure from the resulting Quality_Information flags for each data set record:

Counter Name	Condition
Software_Error_Counter	Sum for all the data set the software error counters in the quality information structure
Instrument_Error_Counter	Sum for all the data set the instrument error counters in the quality information structure
ADF_Error_Counter	Sum for all the data set the ADF error counters in the quality information structure
Calibration_Error_Counter	Sum for all the data set the Calibration error counters in the quality information structure
N_Discarded_Scenes	Count all the L0 correlated noise snapshot discarded in the generation of all the data set due to missing



corresponding HKTM L1a snapshots

4.2.2.2.2 Data Block

The binary Data Block consists of six Measurement datasets.

The following table describes the XML schema used to decode the binary contents of these type of datasets.

- the **Cons_PMS_Coefficients** dataset shall consist of 1 data record containing the consolidated averaged PMS Calibration parameters. The DSR shall contain information for all 72 PMS. The data with the Receiver Noise Temperature of the LICEF_NIR units shall also be included, as it is required to compute the System Temperatures of the mixed baselines. The size of each DSR is fixed and equal to 2756 bytes.
- The **Cons_Long_PMS_Coefficients** dataset consists of a number of data records representing all the Long PMS calibration sequences available that have not been declared obsolete. Each of this data records shall contain the PMS coefficients (gain and offset) plus temperatures fields obtained after correlated noise injection with odd and even sources. The size of each data set record is fixed and equal to 2760 bytes.
- The **Cons_Ampl_FWF-Origin** dataset contains the fields related to the consolidated averaged FWF Origin amplitude, and shall consist of 1 data set record. This structure shall contain the complete set of calibration parameters for every pair of receivers, expressed as a real value (FWF Origin amplitude only). The size of the DSR is fixed and equal to 23337 bytes.
- The **Cons_Long_Ampl_FWF-Origin** structure consists of a number of data set records with the parameters related to the FWF Origin amplitude representing all the Long FWF Origin sequences available that have not been declared obsolete. The size of each DSR is fixed and equal to 23341 bytes.
- the **Cons_PMS_Offsets** dataset shall consist of 1 data record containing the consolidated averaged PMS Offset parameters. The DSR shall contain information for all 72 PMS. The size of each DSR is fixed and equal to 980 bytes.



- The **Cons_Short_PMS_Offsets** dataset consists of a number of data records representing all the Short PMS Offset calibration sequences available that have not been declared obsolete. Each of this data records shall contain the PMS offsets plus temperatures fields obtained after correlated noise injection with odd and even sources. The size of each data set record is fixed and equal to 984 bytes.
- the **Cons_LFE_Coefficients** dataset shall consist of 1 data record containing the consolidated averaged LFE parameters calibrated through the Sky view. The DSR shall contain information for all 72 LICEF. The size of each DSR is fixed and equal to 3884 bytes.
- The **Cons_External_LFE_Coefficients** dataset consists of a number of data records representing all the External L1 calibration sequences available that have not been declared obsolete. Each of this data records shall contain the LFE coefficients plus temperatures fields obtained in the sequence. The size of each data set record is fixed and equal to 3884 bytes.

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Cons_PMS_Coefficients					Init of <i>Cons_PMS_Coefficients</i> binary Data set . There shall be 1 DSR.	
	Cons_PMS_Coefficients_Data					Init of <i>Cons_PMS_Coefficients_Data</i> DSR structure.	
01	Sequence_Start_Time	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the calibration sequence was started. Start of integration time period for the first event in the sequence, and also start of validity for calibration matrices. Expressed in EE CFI transport time format.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
02	Sequence_Stop_Time	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the calibration sequence was closed. Start of integration time period for last event in the sequence. Expressed in EE CFI transport time format	Generated by L1 Processor.
03	Samples	Real value	N/A	Float (4 bytes)	1 element	Number of epochs averaged to perform each calibration step. Typically it shall be the average of all calibration steps.	Generated by L1 Processor.
04	PMS_ID	Identifier	N/A	Unsigned byte	72 elements	PMS Unique identifier (from 0 to 71). The equivalence with PMS_ID in AUX_PMS is as follows: <ul style="list-style-type: none"> 0 to 23 for arm A (AB_03, ABH_01, ABV_01, A__01, A__02.... A__21) 24 to 47 for arm B (BC_03, BCH_01, BCV_01, B__01, B__02.... B__21) 48 to 71 for arm C (CA_03, CAH_01, CAV_01, C__01, C__02.... C__21) 	Generated by L1 Processor.
05	Temperature	Real value	K	Float (4 bytes)	72 elements	Temperature at which the PMS coefficients were obtained.	Generated by L1 Processor.
06	Gain	Real value	mV/K	Double (8 bytes)	72 elements	Gain coefficient for PMS identified before and at previous temperature.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
07	<i>Offset</i>	Real value	mV	Double (8 bytes)	72 elements	Offset coefficient for PMS identified before and at previous temperature.	Generated by L1 Processor.
08	<i>T_Rec_Ref_H</i>	Real value	K	Double (8 bytes)	3 elements	Reference NIR Receiver Temperature $T_{rec_k}^{LH-CIP}$ One measurement per NIR. Order followed is AB, BC, CA. Vector array of [3] double elements	Generated by L1 Processor.
09	<i>T_Rec_Ref_V</i>	Real value	K	Double (8 bytes)	3 elements	Reference NIR Receiver Temperature $T_{rec_k}^{LV-CIP}$ One measurement per NIR. Order followed is AB, BC, CA. Vector array of [3] double elements	Generated by L1 Processor.
10	<i>T_Rec_Ref_LICEF_H</i>	Real value	K	Double (8 bytes)	72 elements	LICEF Receiver Noise Temperature at HAP, measured by U-noise injection. One measurement per LICEF Order followed is AB_03, AB_01_H, AB_01_V, A_01, ..., A_21, BC_03, BC_01_H, BC_01_V, B_01, ..., B_21, CA_03, CA_01_H, CA_01_V, C_01, ..., and C_21	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
11	<i>T_Rec_Ref_LICEF_V</i>	Real value	K	Double (8 bytes)	72 elements	LICEF Receiver Noise Temperature at VAP, measured by U-noise injection. One measurement per LICEF Order followed is AB_03, AB_01_H, AB_01_V, A_01, ..., A_21, BC_03, BC_01_H, BC_01_V, B_01, ..., B_21, CA_03, CA_01_H, CA_01_V, C_01, ..., and C_21.	Generated by L1 Processor.
	<i>Quality_Information</i>					Init of <i>Quality_Information</i> structure.	
12	<i>Software_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for sw error in the correlated processing are given in details in Appendix B.	Generated by L1 Processor.
13	<i>Instrument_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for instrument error in the correlated processing are given in details in Appendix B.	Generated by L1 Processor.
14	<i>ADF_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for ADF error in the correlated processing are given in details in Appendix B.	Generated by L1 Processor.
15	<i>Calibration_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for calibration error in the correlated processing are given in details in Appendix B.	Generated by L1 Processor.
	<i>Quality_Information</i>					End of <i>Quality_Information</i> structure.	
	<i>Cons_PMS_Coefficients_Data</i>					End of <i>Cons_PMS_Coefficients_Data</i> DSR structure.	
	<i>Cons_PMS_Coefficients</i>					End of <i>Cons_PMS_Coefficients</i> binary Data set	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>Cons_Long_PMS_Coefficients</i>					Init of <i>Cons_Long_PMS_Coefficients</i> binary Data set	
16	<i>Cons_Long_PMS_Coefficients_Counter</i>	Counter	N/A	Unsigned integer (4 bytes)	1 element	Number of <i>Cons_Long_PMS_Coefficients_Data</i> DSR structures.	Generated by L1 Processor.
	<i>List_of_Cons_Long_PMS_Coefficients_Datas</i>					Init of List of <i>Cons_Long_PMS_Coefficients_Datas</i> repeated <i>Cons_Long_PMS_Coefficients_Counter</i> times.	
	<i>Cons_Long_PMS_Coefficients_Data</i>					Init of <i>Cons_Long_PMS_Coefficients_Data</i> structure	
17	<i>Sequence_Start_Time</i>	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the calibration sequence was started. Start of integration time period for the first event in the sequence, and also start of validity for calibration matrices. Expressed in EE CFI transport time format	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
18	Sequence_Stop_Time	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the calibration sequence was closed. Start of integration time period for last event in the sequence. Expressed in EE CFI transport time	Generated by L1 Processor.
19	Samples	Real value	N/A	float (4 bytes)	1 element	Number of epochs averaged to perform each calibration step. Typically it shall be the average of all calibration steps.	Generated by L1 Processor.
20	Time_From_ANX	Real value	N/A	float (4 bytes)	1 element	Relative time within orbit since Ascending Node Crossing computed by using the orbit scenario file, output of xo_time_to_orbit using orbit_id and field #24.	Generated by L1 Processor.
21	PMS_ID	Identifier	N/A	Unsigned byte	72 elements	PMS Unique identifier.	Generated by L1 Processor.
22	Temperature	Real Value	K	Float (4 bytes)	72 elements	Temperature at which the PMS coefficients were obtained.	Generated by L1 Processor.
23	Gain	Real Value	mV/K	Double (8 bytes)	72 elements	Gain coefficient for PMS identified before and at previous temperature.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
24	<i>Offset</i>	Real Value	mV	Double (8 bytes)	72 elements	Offset coefficient for PMS identified before and at previous temperature.	Generated by L1 Processor.
25	<i>T_Rec_Ref_H</i>	Real Value	K	Double (8 bytes)	3 elements	Reference NIR Receiver Temperature $T_{rec_k}^{LH-CIP}$ One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
26	<i>T_Rec_Ref_V</i>	Real Value	K	Double (8 bytes)	3 elements	Reference NIR Receiver Temperature $T_{rec_k}^{LV-CIP}$ One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
27	<i>T_Rec_Ref_LICEF_H</i>	Real Value	K	Double (8 bytes)	72 elements	LICEF Receiver Noise Temperature at HAP, measured by U-noise injection. One measurement per LICEF Order followed is AB_03, AB_01_H, AB_01_V, A_01, ..., A_21, BC_03, BC_01_H, BC_01_V, B_01, ..., B_21, CA_03, CA_01_H, CA_01_V, C_01, ..., and C_21.	Generated by L1 Processor.
28	<i>T_Rec_Ref_LICEF_V</i>	Real Value	K	Double (8 bytes)	72 elements	LICEF Receiver Noise Temperature at VAP, measured by U-noise injection. One measurement per LICEF Order followed is AB_03, AB_01_H, AB_01_V, A_01, ..., A_21, BC_03, BC_01_H, BC_01_V, B_01, ..., B_21, CA_03, CA_01_H, CA_01_V, C_01, ..., and C_21.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
29	<i>T_Noise_Ref_Hot</i>	Real value	K	Double (8 bytes)	6 elements	CAS Hot Noise Injection Temperature, measured by the NIR-R sequence within the PMS calibration sequence. One measurement per NIR channel. Order followed is AB-H, AB-V, BC-H, BC-V, CA-H and CA-V. Vector array of [6] double elements	Generated by L1 Processor.
30	<i>T_Noise_Ref_Warm</i>	Real value	K	Double (8 bytes)	6 elements	CAS Warm Noise Injection Temperature, measured by the NIR-R sequence within the PMS calibration sequence. One measurement per NIR channel. Order followed is AB-H, AB-V, BC-H, BC-V, CA-H and CA-V. Vector array of [6] double elements	Generated by L1 Processor.
	<i>Quality_Information</i>					Init of <i>Quality_Information</i> structure.	
31	<i>Software_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for sw error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
32	<i>Instrument_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for instrument error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
33	<i>ADF_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for ADF error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
34	Calibration_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for calibration error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
	Quality_Information					End of Quality_Information structure.	
	Cons_Long_PMS_Coefficients_Data					End of Cons_Long_PMS_Coefficients_Data structure	
	List_of_Cons_Long_PMS_Coefficients_Datas					End of List of Cons_Long_PMS_Coefficients_Datas	
	Cons_Long_PMS_Coefficients					End of Cons_Long_PMS_Coefficients binary Data set	
	Cons_Ampl_FWF_Origin					Init of Cons_Ampl_FWF_Origin binary Data set	
	Cons_Ampl_FWF_Origin_Data					Init of Cons_Ampl_FWF_Origin_Data DSR structure.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
35	Sequence_Start_Time	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the calibration sequence was started. Start of integration time period for the first event in the sequence, and also start of validity for calibration matrices. Expressed in EE CFI transport time format	Generated by L1 Processor.
36	Sequence_Stop_Time	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the calibration sequence was closed. Start of integration time period for last event in the sequence. Expressed in EE CFI transport time	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
37	Correlator_Layer	string	N/A	char (1 byte)	1 element	Correlator layer from which the data was taken (NOMINAL='N' or REDUNDANT='R')	Generated by L1 Processor.
38	Samples	Real value	N/A	Float (4 bytes)	1 element	Number of epochs averaged to perform each calibration step. Typically it shall be the average of all calibration steps.	Generated by L1 Processor.
39	FWF_Origin_Amplitude	Array of real values	N/A	Double (8 bytes)	71*36 elements. Order followed is depicted in Figure 4-1	Amplitude value in all baselines (including redundant). It is the Fringe Washing Function at the origin for port C.	Generated by L1 Processor.
40	FWF_Origin_Quality	integer	N/A	Unsigned byte	71*36 elements. Order followed is depicted in Figure 4-1	One value per baseline (including redundant). It indicates if the baseline was measured during Correlated Noise Injection (1), if it was estimated by closures relationship (2), if it was estimated by average amplitude and phase difference (3) or if it was not measured at all (0).	Generated by L1 Processor.
41	Receiver_Temp	real value	K	Float (4 bytes)	72 elements	Physical temperature of receivers in Kelvin. Ordering has been described previously.	Generated by L1 Processor.
	Quality_Information					Init of Quality_Information structure.	
42	Software_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for sw error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
43	<i>Instrument_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for instrument error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
44	<i>ADF_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for ADF error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
45	<i>Calibration_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for calibration error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
	<i>Quality_Information</i>					End of <i>Quality_Information</i> structure.	
	<i>Cons_Ampl_FWF_Origin_Data</i>					End of <i>Cons_Ampl_FWF_Origin_Data</i> DSR structure.	
	<i>Cons_Ampl_FWF_Origin</i>					End of <i>Cons_Ampl_FWF_Origin</i> binary Data set	
	<i>Cons_Long_Ampl_FWF_Origin</i>					Init of <i>Cons_Long_Ampl_FWF_Origin</i> binary Data Set	
46	<i>Cons_Long_Ampl_FWF_Origin_Counter</i>	Counter	N/A	Unsigned integer (4 bytes)	1 Element	Number of <i>Cons_Long_Ampl_FWF_Origin_Data</i> DSRs.	Generated by L1 Processor.
	<i>List_of_Cons_Long_Ampl_FWF_Origin_Datas</i>					Init of list of <i>Cons_Long_Ampl_FWF_Origin_Datas</i> structures repeated <i>Cons_Long_Ampl_FWF_Origin_Counter</i> times.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Cons_Long_Ampl_FWF_Origin_Data					Init of <i>Cons_Long_Ampl_FWF_Origin_Data</i> structure.	
47	Sequence_Start_Time	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the calibration sequence was started. Start of integration time period for the first event in the sequence, and also start of validity for calibration matrices. Expressed in EE CFI transport time format.	Generated by L1 Processor.
48	Sequence_Stop_Time	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the calibration sequence was closed. Start of integration time period for last event in the sequence. Expressed in EE CFI transport time format	Generated by L1 Processor.
49	Correlator_Layer	string	N/A	char (1 byte)	1 element	Correlator layer from which the data was taken (NOMINAL='N' or REDUNDANT='R')	Generated by L1 Processor.
50	Samples	Real value	N/A	Float (4 bytes)	1 element	Number of epochs averaged to perform each calibration step. Typically it shall be the average of all calibration steps.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
51	<i>Time_From_ANX</i>	Date	s	Float (4 bytes)	1 element	Relative time within orbit since Ascending Node. Crossing computed by using the orbit scenario file, output of xo_time_to_orbit using orbit_id and field #02 .	Generated by L1 Processor.
52	<i>FWF_Origin_Amplitude</i>	Array of real values	N/A	Double (8 bytes)	71*36 elements. Order followed is depicted in Figure 4-1	Amplitude value in all baselines (including redundant). It is the Fringe Washing Function at the origin for port C	Generated by L1 Processor.
53	<i>FWF_Origin_Quality</i>	integer	N/A	Unsigned byte	71*36 elements. Order followed is depicted in Figure 4-1	One value per baseline (including redundant). It indicates if the baseline was measured during Correlated Noise Injection (1), if it was estimated by closures relationship (2), if it was estimated by average amplitude and phase difference (3) or if it was not measured at all (0).	Generated by L1 Processor.
54	<i>Receiver_Temp</i>	real value	K	Float (4 bytes)	72 elements	Physical temperature of receivers in Kelvin. Ordering has been described previously	Generated by L1 Processor.
	<i>Quality_Information</i>					Init of Quality_Information structure.	
55	<i>Software_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for sw error in the correlated processing are given in details in Appendix B.	Generated by L1 Processor.
56	<i>Instrument_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for instrument error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
57	<i>ADF_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for ADF error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
58	<i>Calibration_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for calibration error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
	<i>Quality_Information</i>					End of <i>Quality_Information</i> structure.	
	<i>Cons_Long_Ampl_FWF_Origin_Data</i>					End of <i>Cons_Long_FWF_Origin_Data</i> structure.	
	<i>List_of_Cons_Long_Ampl_FWF_Origin_Datas</i>					End of list of <i>Cons_Long_FWF_Origin_Datas</i> structures.	
	<i>Cons_Long_Ampl_FWF_Origin</i>					End of <i>Cons_Long_FWF_Origin</i> binary Data Set	
	<i>Cons_PMS_Offsets</i>					Init of <i>Cons_PMS_Offsets</i> binary Data set . There shall be 1 DSR.	
	<i>Cons_PMS_Offsets_Data</i>					Init of <i>Cons_PMS_Offsets_Data</i> DSR structure.	
59	<i>Sequence_Start_Time</i>	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the calibration sequence was started. Start of integration time period for the first event in the sequence, and also start of validity for calibration matrices. Expressed in EE CFI transport time format.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
60	Sequence_Stop_Time	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the calibration sequence was closed. Start of integration time period for last event in the sequence. Expressed in EE CFI transport time format	Generated by L1 Processor.
61	Samples	Real value	N/A	Float (4 bytes)	1 element	Number of epochs averaged to perform each calibration step. Typically it shall be the average of all calibration steps.	Generated by L1 Processor.
62	PMS_ID	Identifier	N/A	Unsigned byte	72 elements	PMS Unique identifier (from 0 to 71). The equivalence with PMS_ID in AUX_PMS is as follows: <ul style="list-style-type: none"> 0 to 23 for arm A (AB_03, ABH_01, ABV_01, A__01, A__02.... A__21) 24 to 47 for arm B (BC_03, BCH_01, BCV_01, B__01, B__02.... B__21) 48 to 71 for arm C (CA_03, CAH_01, CAV_01, C__01, C__02.... C__21) 	Generated by L1 Processor.
63	Temperature	Real value	K	Float (4 bytes)	72 elements	Temperature at which the PMS coefficients were obtained.	Generated by L1 Processor.
64	Offset	Real value	mV	Double (8 bytes)	72 elements	Offset coefficient for PMS identified before and at previous temperature.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Quality_Information					Init of Quality_Information structure.	
65	Software_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for sw error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
66	Instrument_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for instrument error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
67	ADF_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for ADF error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
68	Calibration_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for calibration error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
	Quality_Information					End of Quality_Information structure.	
	Cons_PMS_Offsets_Data					End of Cons_PMS_Offsets_Data DSR structure.	
	Cons_PMS_Offsets					End of Cons_PMS_Offsets binary Data set	
	Cons_Short_PMS_Offsets					Init of Cons_Short_PMS_Offsets binary Data set	
69	Cons_Short_PMS_Offsets_Counter	Counter	N/A	Unsigned integer (4 bytes)	1 element	Number of Cons_Short_PMS_Offsets_Data DSR structures.	Generated by L1 Processor.
	List_of_Cons_Short_PMS_Offsets_Datas					Init of List of Cons_Short_PMS_Offsets_Datas repeated Cons_Short_PMS_Offsets_Counter times.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Cons_Short_PMS_Offsets_Data					Init of <i>Cons_Short_PMS_Offsets_Data</i> structure	
70	Sequence_Start_Time	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the calibration sequence was started. Start of integration time period for the first event in the sequence, and also start of validity for calibration matrices. Expressed in EE CFI transport time format	Generated by L1 Processor.
71	Sequence_Stop_Time	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the calibration sequence was closed. Start of integration time period for last event in the sequence. Expressed in EE CFI transport time	Generated by L1 Processor.
72	Samples	Real value	N/A	float (4 bytes)	1 element	Number of epochs averaged to perform each calibration step. Typically it shall be the average of all calibration steps.	Generated by L1 Processor.
73	Time_From_ANX	Real value	N/A	float (4 bytes)	1 element	Relative time within orbit since Ascending Node Crossing computed by using the orbit scenario file, output of <i>xo_time_to_orbit</i> using <i>orbit_id</i> and field #24.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
74	PMS_ID	Identifier	N/A	Unsigned byte	72 elements	PMS Unique identifier.	Generated by L1 Processor.
75	Temperature	Real Value	K	Float (4 bytes)	72 elements	Temperature at which the PMS coefficients were obtained.	Generated by L1 Processor.
76	Offset	Real Value	mV	Double (8 bytes)	72 elements	Offset coefficient for PMS identified before and at previous temperature.	Generated by L1 Processor.
	Quality_Information					Init of Quality_Information structure.	
77	Software_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for sw error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
78	Instrument_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for instrument error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
79	ADF_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for ADF error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
80	Calibration_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for calibration error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
	Quality_Information					End of Quality_Information structure.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>Cons_Short_PMS_Offsets_Data</i>					End of <i>Cons_Short_PMS_Offsets_Data</i> structure	
	<i>List_of_Cons_Short_PMS_Offsets_Datas</i>					End of List of <i>Cons_Short_PMS_Offsets_Datas</i>	
	<i>Cons_Short_PMS_Offsets</i>					End of <i>Cons_Short_PMS_Offsets</i> binary Data set	
	<i>Cons_LFE_Coefficients</i>					Init of <i>Cons_LFE_Coefficients</i> binary Data set . There shall be 1 DSR.	
	<i>Cons_LFE_Coefficients_Data</i>					Init of <i>Cons_LFE_Coefficients_Data</i> DSR structure.	
81	<i>Sequence_Start_Time</i>	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the calibration sequence was started. Start of integration time period for the first event in the sequence, and also start of validity for calibration matrices. Expressed in EE CFI transport time format.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
82	Sequence_Stop_Time	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the calibration sequence was closed. Start of integration time period for last event in the sequence. Expressed in EE CFI transport time format	Generated by L1 Processor.
83	Samples	Real value	N/A	Float (4 bytes)	1 element	Number of epochs averaged to perform each calibration step. Typically it shall be the average of all calibration steps.	Generated by L1 Processor.
84	PMS_ID	Identifier	N/A	Unsigned byte	72 elements	PMS Unique identifier (from 0 to 71). The equivalence with PMS_ID in AUX_PMS is as follows: <ul style="list-style-type: none"> 0 to 23 for arm A (AB_03, ABH_01, ABV_01, A__01, A__02.... A__21) 24 to 47 for arm B (BC_03, BCH_01, BCV_01, B__01, B__02.... B__21) 48 to 71 for arm C (CA_03, CAH_01, CAV_01, C__01, C__02.... C__21) 	Generated by L1 Processor.
85	Temperature	Real value	K	Float (4 bytes)	72 elements	Temperature at which the LFE coefficients were obtained.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
86	<i>T_Phys_Tp7</i>	Real value	K	Double (8 bytes)	3 elements	Reference Physical Temperature of the antenna patch (Tp7). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
87	<i>T_Sky_H</i>	Real value	K	Double (8 bytes)	72 elements	H pol sky temperature measured during external maneuver per LICEF.	Generated by L1 Processor.
88	<i>T_Sky_V</i>	Real value	K	Double (8 bytes)	72 elements	V pol sky temperature measured during external maneuver per LICEF.	Generated by L1 Processor.
89	<i>T_Sky_Expected_H</i>	Real value	K	Double (8 bytes)	72 elements	Expected H pol sky temperature calculated by convolution of the observed Sky map and the antenna patterns during the external maneuver per LICEF.	Generated by L1 Processor.
90	<i>T_Sky_Expected_V</i>	Real value	K	Double (8 bytes)	72 elements	Expected V pol sky temperature calculated by convolution of the observed Sky map and the antenna patterns during the external maneuver per LICEF.	Generated by L1 Processor.
91	<i>LFE_H</i>	Real value	K	Double (8 bytes)	72 elements	H pol LFE coefficients.	Generated by L1 Processor.
92	<i>LFE_V</i>	Real value	K	Double (8 bytes)	72 elements	V pol LFE coefficients.	Generated by L1 Processor.
	<i>Quality_Information</i>					Init of Quality_Information structure.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
93	Software_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for sw error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
94	Instrument_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for instrument error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
95	ADF_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for ADF error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
96	Calibration_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for calibration error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
	Quality_Information					End of Quality_Information structure.	
	Cons_LFE_Coefficients_Data					End of Cons_LFE_Coefficients_Data DSR structure.	
	Cons_LFE_Coefficients					End of Cons_LFE_Coefficients binary Data set	
	Cons_External_LFE_Coefficients					Init of Cons_External_LFE_Coefficients binary Data set	
97	Cons_External_LFE_Coefficients_Counter	Counter	N/A	Unsigned integer (4 bytes)	1 element	Number of Cons_External_LFE_Coefficients_Data DSR structures.	Generated by L1 Processor.
	List_of_Cons_External_LFE_Coefficients_Datas					Init of List of Cons_External_LFE_Coefficients_Datas repeated Cons_External_LFE_Coefficients_Counter times.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Cons_External_LFE_Coefficients_Data					Init of <i>Cons_External_LFE_Coefficients_Data</i> structure	
98	Sequence_Start_Time	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the calibration sequence was started. Start of integration time period for the first event in the sequence, and also start of validity for calibration matrices. Expressed in EE CFI transport time format	Generated by L1 Processor.
99	Sequence_Stop_Time	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the calibration sequence was closed. Start of integration time period for last event in the sequence. Expressed in EE CFI transport time	Generated by L1 Processor.
100	Samples	Real value	N/A	float (4 bytes)	1 element	Number of epochs averaged to perform each calibration step. Typically it shall be the average of all calibration steps.	Generated by L1 Processor.
101	PMS_ID	Identifier	N/A	Unsigned byte	72 elements	PMS Unique identifier.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
102	<i>Temperature</i>	Real Value	K	Float (4 bytes)	72 elements	Temperature at which the PMS coefficients were obtained.	Generated by L1 Processor.
103	<i>T_Phys_Tp7</i>	Real value	K	Double (8 bytes)	3 elements	Reference Physical Temperature of the antenna patch (Tp7). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
104	<i>T_Sky_H</i>	Real value	K	Double (8 bytes)	72 elements	H pol sky temperature measured during external maneuver per LICEF.	Generated by L1 Processor.
105	<i>T_Sky_V</i>	Real value	K	Double (8 bytes)	72 elements	V pol sky temperature measured during external maneuver per LICEF.	Generated by L1 Processor.
106	<i>T_Sky_Expected_H</i>	Real value	K	Double (8 bytes)	72 elements	Expected H pol sky temperature calculated by convolution of the observed Sky map and the antenna patterns during the external maneuver per LICEF.	Generated by L1 Processor.
107	<i>T_Sky_Expected_V</i>	Real value	K	Double (8 bytes)	72 elements	Expected V pol sky temperature calculated by convolution of the observed Sky map and the antenna patterns during the external maneuver per LICEF.	Generated by L1 Processor.
108	<i>LFE_H</i>	Real value	K	Double (8 bytes)	72 elements	H pol LFE coefficients.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
109	<i>LFE_V</i>	Real value	K	Double (8 bytes)	72 elements	V pol LFE coefficients.	Generated by L1 Processor.
	<i>Quality_Information</i>					Init of <i>Quality_Information</i> structure.	
110	<i>Software_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for sw error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
111	<i>Instrument_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for instrument error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
112	<i>ADF_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for ADF error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
113	<i>Calibration_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for calibration error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
	<i>Quality_Information</i>					End of <i>Quality_Information</i> structure.	
	<i>Cons_External_LFE_Coefficients_Data</i>					End of <i>Cons_External_LFE_Coefficients_Data</i> structure	
	<i>List_of_Cons_External_LFE_Coefficients_Datas</i>					End of List of <i>Cons_External_LFE_Coefficients_Datas</i>	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>Cons_External_LFE_Coefficients</i>					End of <i>Cons_External_LFE_Coefficients</i> binary Data set	
	<i>Datablock</i>					End of binary Data Block in the product	

Table 4-19 Level 1A Consolidated Correlated Noise Injection Product Data Block



4.2.2.3 Short Term Synthetic Curve of Correlated Noise Injection (MIR_CSTD1A)

The short term correlated noise injection measurements are MIRAS correlation measurements obtained when the input ports of the LICEFs are switched to the C-ports (measuring first from odd noise sources and then from even noise sources), transformed to raw correlations, allowing the estimation of the Fringe Washing Function phase at the origin.

The correlated noise injection measurements used by the L1OP to calibrate the visibilities are not based in only one L0 product but in the measurements obtained from several MIR_CORD0 / MIR_CORU0, i.e. they are not consolidated in a pole-to-pole basis. The individual measurements performed in each semi-orbit are processed to L1A and directly included in the Short Term Consolidated Correlated Noise Injection product MIR_CSTD1A (containing measurements processed from MIR_CORD0 or MIR_CORU0). The number of past orbits –along with the new measurement- to be included in the MIR_CSTD1A product is a configurable parameter.

Correlated noise injection (combined in odd and even sources) produces the calibration parameters (phase of the FWF at the origin, representing the correction factors in phase) that need to be applied to calibrate the instrument measurements.

4.2.2.3.1 Specific Product Header

The Specific Product Header Format for Level 1 Short Term Correlated Noise Injection Short Calibration Curve products follows the format described in table below.

Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
02	<i>Specific_Product_Header</i>	Starting Tag				Tag starting the Specific Product Header structure	
02-19	<i>Main_Info</i>	structure				Main Product Info structure's fields as defined in Table 4-3	
20-26	<i>Quality_Information</i>	structure				Quality_Information structure's fields as defined in Table 4-4	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
51	<i>Cons_Phase_FWF_Origin_New</i>	Integer	N/A	4 bytes	%04d	Number of Cons_Phase_FWF_Origin new data set added in the file during the processing.	Generated by L1 Processor.
52	<i>Cons_Phase_FWF_Origin_Removed</i>	Integer	N/A	4 bytes	%04d	Number of Cons_Phase_FWF_Origin_coefficients data set removed in the file during the processing.	Generated by L1 Processor.
53	<i>Cons_Phase_FWF_Origin_Start</i>	String	N/A	30 bytes	%30s	UTC Start Time of the Consolidated Phase of FWF Origin dataset, in CCSDS ASCII format with time reference and microseconds. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" This time shall coincide with the start time of the older dataset record of this dataset in the binary datablock.	Generated by L1 Processor.
54	<i>Cons_Phase_FWF_Origin_Stop</i>	String	N/A	30 bytes	%30s	UTC Stop Time of the Consolidated Phase of FWF Origin dataset, in CCSDS ASCII format with time reference and microseconds. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" This time shall coincide with the stop time of the most recent dataset record of this dataset in the binary datablock.	Generated by L1 Processor.
49-50	<i>Data_Sets</i>	structure	N/A	N/A	N/A	Data Sets structure's fields as defined in Table 4-5	
51	<i>Specific_Product_Header</i>	Closing Tag				Tag closing the Specific Product Header structure	

Table 4-20 Level 1A Synthetic Curve of Correlated Noise Injection SPH



The reference data sets for MIR_CSTD1A Data Type are:

Reference Data Set Name	Product Type	Description
L0_CORRELATIONS_FILE	MIR_CORD0_, MIR_CORU0_	L0 Product filename from which the current L1a was created
L1A_ORBIT_PHASE_FILE	MIR_CSTD1A	L1a Calibration filename containing several sets of parameters obtained during short term calibration, used to calibrate the L1a visibilities
L1A_HKTM_FILE	TLM_MIRA1A	HKTM filename containing thermistors temperature information for the snapshots in the current product
L1A_AVER_NIR_CAL_FILE	MIR_ANIR1A	Average NIR calibrated parameters filename used to calibrate L1a visibilities
NIR_FILE	AUX_NIR__	Auxiliary file with NIR characterisation used for L1a calibration (defined externally)
PMS_FILE	AUX_PMS__	Auxiliary file with PMS characterisation used for L1a calibration
S_PARAM_FILE	AUX_SPAR__	Auxiliary file with S-parameters characterisation used for L1a calibration
LICEF_FILE	AUX_LCF__	Auxiliary file with absolute phase characterisation used for plane translation of L1A calibration data
ALGORITHM_CONFIG_FILE	AUX_CNFL1P	Processor Configuration Parameters and Constants for L1OP
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Mission planning file used to initialise the EE CFI orbit_id and/or time_id. It is read and used by the EE CFI.
BULLETIN_B_FILE	AUX_BULL_B	IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation
FAILURES_FILE	AUX_FAIL__	Auxiliary file with failure of components to be taken into account during L1 processing

Table 4-21 Level 1A Short Term Synthetic Curve of Correlated Noise Injection Reference Data Sets

The following are the rules to update the SPH General Quality Information structure from the resulting Quality_Information flags for each data set record:

Counter Name	Condition
Software_Error_Counter	Sum for all the data set the software error counters in the quality information structure
Instrument_Error_Counter	Sum for all the data set the instrument error counters in the quality information structure
ADF_Error_Counter	Sum for all the data set the ADF error counters in the quality information structure



Counter Name	Condition
Calibration_Error_Counter	Sum for all the data set the Calibration error counters in the quality information structure
N_Discarded_Scenes	Count all the L0 correlated noise snapshot discarded in the generation of all the data set due to missing corresponding HKTM L1a snapshots

4.2.2.3.2 Data Block

The binary Data Block consists of two Measurement datasets.

The following table describes the XML schema used to decode the binary contents of these type of datasets.

- The **Cons_Phase_FWF-Origin** structure consists a number of data set records with parameters obtained after correlated noise injection in odd and even sources during FWF Origin or Local Oscillator Calibration Sequences. There shall be as many Data Set Records as LO Phase Tracking events plus FWF Origin Sequences. The size of each DSR is fixed and equal to 23341 bytes.
- The **Cons_LO_Unlock** structure consists a number of data set records with parameters obtained after detecting time periods in which the Local Oscillator is not properly locked. There shall be as many Data Set Records as LO Unlock events. The size of each DSR is fixed and equal to 25 bytes.

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Cons_Phase_FWF-Origin					Init of <i>Cons_Phase_FWF-Origin</i> binary Data Set	
01	Cons_Phase_FWF-Origin_Counter	Counter	N/A	Unsigned integer (4 bytes)	1 Element	Number of <i>Cons_Phase_FWF-Origin_Data</i> DSRs.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>List_of_Cons_Phase_FWF_Origin_Datas</i>					Init of list of <i>Cons_Phase_FWF_Origin_Datas</i> structures repeated <i>Cons_Phase_FWF_Origin_Counter</i> times.	
	<i>Cons_Phase_FWF_Origin_Data</i>					Init of <i>Cons_Phase_FWF_Origin_Data</i> structure.	
02	<i>Sequence_Start_Time</i>	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the FWF0 Phase calibration sequence was started. Start of first sequence consolidated, and also start of validity for data. Expressed in EE CFI transport time format.	Generated by L1 Processor.
03	<i>Sequence_Stop_Time</i>	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the FWF0 Phase calibration sequence was closed. Stop time for last event in the sequence. Expressed in EE CFI transport time format	Generated by L1 Processor.
04	<i>Correlator_Layer</i>	string	N/A	char (1 byte)	1 element	Correlator layer from which the data was taken (NOMINAL='N' or REDUNDANT='R')	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
05	Samples	Real value	N/A	Float (4 bytes)	1 element	Number of epochs averaged to perform each calibration step. Typically it shall be the average of all calibration steps.	Generated by L1 Processor.
06	Time_From_ANX	Date	s	Float (4 bytes)	1 element	Relative time within orbit since Ascending Node Crossing computed by using the orbit scenario file, output of xo_time_to_orbit using orbit_id and field #02 .	Generated by L1 Processor.
07	FWF_Origin_Phase	Array of real values	rad	Double (8 bytes)	71*36 elements. Order followed is depicted in Figure 4-1	Phase value in all baselines (including redundant). It is the Fringe Washing Function at the origin for port C	Generated by L1 Processor.
08	FWF_Origin_Quality	integer	N/A	Unsigned byte	71*36 elements. Order followed is depicted in Figure 4-1	One value per baseline (including redundant). It indicates if the baseline was measured during Correlated Noise Injection (1), if it was estimated by closures relationship (2), if it was estimated by average amplitude and phase difference (3) or if it was not measured at all (0).	Generated by L1 Processor.
09	Receiver_Temp	real value	K	Float (4 bytes)	72 elements	Physical temperature of receivers in Kelvin. Ordering has been described previously	Generated by L1 Processor.
	Quality_Information					Init of Quality_Information structure.	
10	Software_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for sw error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
11	<i>Instrument_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for instrument error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
12	<i>ADF_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for ADF error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
13	<i>Calibration_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for calibration error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
	<i>Quality_Information</i>					End of <i>Quality_Information</i> structure.	
	<i>Cons_Phase_FWF_Origin_Data</i>					End of <i>Cons_Phase_FWF_Origin_Data</i> structure.	
	<i>List_of_Cons_Phase_FWF_Origin_Datas</i>					End of list of <i>Cons_Phase_FWF_Origin_Data</i> structures.	
	<i>Cons_Phase_FWF_Origin</i>					End of <i>Cons_Phase_FWF_Origin</i> binary Data Set	
	<i>Cons_LO_Unlock</i>					Init of <i>Cons_LO_Unlock</i> binary Data Set	
14	<i>Cons_LO_Unlock_Counter</i>	Counter	N/A	Unsigned integer (4 bytes)	1 Element	Number of <i>Cons_LO_Unlock_Data</i> DSRs.	Generated by L1 Processor.
	<i>List_of_Cons_LO_Unlock_Datas</i>					Init of list of <i>Cons_LO_Unlock_Datas</i> structures repeated <i>Cons_LO_Unlock_Counter</i> times.	
	<i>Cons_LO_Unlock_Data</i>					Init of <i>Cons_LO_Unlock_Data</i> structure.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
15	Sequence_Start_Time	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the LO Unlock event was started. Expressed in EE CFI transport time format.	Generated by L1 Processor.
16	Sequence_Stop_Time	Date	N/A	signed/unsigned integer (4 bytes)	array of 3 elements First element (days) is signed integer, remaining two unsigned integer.	UTC Time at which the LO Unlock event was closed. Expressed in EE CFI transport time format	Generated by L1 Processor.
17	CMN_Id	integer	N/A	Unsigned char (1 byte)	1 element	CMN indicative in which the LO Unlock event was registered (0: CMN H1, 1: CMN A1, 2: CMN A2, 3: CMN A3, 4: CMN H2, 5: CMN B1, 6: CMN B2, 7: CMN B3, 8: CMN H3, 9: CMN C1, 10: CMN C2, 11: CMN C3)	Generated by L1 Processor.
	Cons_LO_Unlock_Data					End of <i>Cons_LO_Unlock_Data</i> structure.	
	List_of_Cons_LO_Unlock_Datas					End of list of <i>Cons_LO_Unlock_Data</i> structures.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>Cons_LO_Unlock</i>					End of <i>Cons_LO_Unlock</i> binary Data Set	
	<i>Datablock</i>					End of binary Data Block in the product	

Table 4-22 Level 1A Consolidated Correlated Noise Injection Product Data Block

4.2.2.4 Average Fringe Wash Function Data Type (MIR_AFWD1A)

This product allows using an averaged version of the FWF shape estimated along several semi-orbits (typically 2, which may not necessarily be contained in 2 products as they can be started at the middle of an orbit). The algorithm shall be gathering all consecutive individual FWF from MIR_CORD0_ -obtained either when the instrument is pointing in nominal attitude- or from MIR_CORU0_ – the instrument is pointing with external attitude. Then the average of the calibrated correlations contained in them is performed, and the coefficients of the fringe-washing function in each antenna polarization plane from the resulting averaged calibrated correlations is computed.

The product contains only one set of FWF coefficients at different time delays, corresponding to a whole calibration campaign (which extent is decided backwards and onwards by checking if the gaps between FWF estimations are larger than a defined threshold). Knowing those three values for every pair of receivers, the FWF of each baseline may be approximated by any known function, so that a refined estimate is obtained. This estimate should be in turn used in the reconstruction process for computing the system response. This product contains the FWF measurements for every baseline (including redundant ones), so that the choice for the function for approximation may still be done outside of L1 automated processing. The product shall contain the FWF shape coefficients computed accordingly to the baseline shown in the In-Orbit Calibration Plan.

This product type contains the FWF coefficients of the average of the calibrated correlations obtained in correlated noise injection measurements of a calibration campaign, obtained either when the instrument is pointing in nominal attitude (from MIR_CORD0_ products) or when the instrument is pointing with external attitude (from MIR_CORU0_ products). The resulting product shall be named MIR_AFWD1A



4.2.2.4.1 Specific Product Header

The Specific Product Header Format for Level MIR_AFWD1A products follows the format described in table below:

Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
02	<i>Specific_Product_Header</i>	Starting Tag				Tag starting the Specific Product Header structure	
02-19	<i>Main_Info</i>	structure	N/A	N/A	N/A	Main Product Info structure's fields as defined in in Table 4-3	
20-26	<i>Quality_Information</i>	structure	N/A	N/A	N/A	Quality_Information structure's fields as defined in Table 4-4	Generated by L1 Processor.
27	<i>FWF_Quality_Information</i>	Starting Tag				Tag starting of an <i>FWF_Quality_Information</i> structure	
28	<i>FWF_Averaged_Measurements_Threshold</i>	Integer	N/A	4 bytes	%04s	Field indicating the threshold for the acceptable minimum number of averaged individual FWF measurements, set as configuration value during the generation of this product The origin is field 12 in AUX_CNFL1P (FWF_Averaged_Measurements_Threshold)	AUX_CNFL1P
29	<i>N_Averaged_Measurements</i>	Real	N/A	1 byte	%uc	Number of averaged FWF measurements	Generated by L1 Processor.
30	<i>FWF_Quality</i>	Flag	N/A	1 byte	%+01d	Flag indicating that the average contained in the product as used less epochs than the number specified as threshold in the configuration file. The possible values are: <ul style="list-style-type: none"> • 1 if number of averaged measurements is under the threshold • 0 if it is greater 	Generated by L1 Processor.



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
31	<i>FWF_Quality Information</i>	Closing Tag				Tag ending an <i>Uncorrelated_Quality_Information</i> structure	
36-47	<i>Data_Sets</i>	structure	N/A	N/A	N/A	Data Sets structure's fields as defined in Table 4-5	
48	<i>Specific_Product_Header</i>	Closing Tag				Tag ending the Specific Product Header structure	

Table 4-23 Level 1A Average FWF Shape product SPH

The SPH Data Sets structures are also needed. The reference data sets for MIR_AFWD1A Data Type are:

Reference Data Set Name	Product Type	Description
L0_CORRELATIONS_FILE	MIR_CORD0_, MIR_CORU0_	L0 Product filename from which the current L1a was created
L1A_FWF_CAL_FILE	MIR_AFWD1A	Previous consolidated MIR_AFWD1A calibration product
L1A_HKTM_FILE	TLM_MIRA1A	HKTM filename containing the S/C position and attitude for the snapshots in the current product
L1A_AVER_NIR_CAL_FILE	MIR_ANIR1A	Average NIR calibrated parameters filename used to calibrate L1a visibilities
S_PARAM_FILE	AUX_SPAR__	Auxiliary file with S-parameters characterisation used for L1a calibration
PMS_FILE	AUX_PMS__	Auxiliary file with PMS characterisation used for L1a calibration
NIR_FILE	AUX_NIR__	Auxiliary file with NIR characterisation used for L1a calibration (defined externally)
LICEF_FILE	AUX_LCF__	Auxiliary file with absolute phase characterisation used for plane translation of L1A calibration data
PLM_FILE	AUX_PLM__	Auxiliary file with PLM characterisation, defining receiver's on-ground measured delays
ALGORITHM_CONFIG_FILE	AUX_CNFL1P	Processor Configuration Parameters and Constants for L1OP
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Mission planning file used to initialise the EE CFI orbit_id and/or time_id. It is read and used by the EE CFI.
BULLETIN_B_FILE	AUX_BULL_B	IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation

Table 4-24 Level 1A Averaged FWF Reference Data Sets



The following are the rules to update the counters in the SPH General Quality Information structure:

Counter Name	Condition
Software_Error_Counter	Sum the software error counter of the previous input MIR_AFWx1A product (if used) with the number of correlated noise snapshot affected by software error. A sw error could be heredity also from the corresponding HKTM L1 snapshot used in the processing of the correlated noise data. Conditions for sw error in the correlated processing are given in details in Appendix B
Instrument_Error_Counter	Sum the instrument error counter of the previous input MIR_AFWx1A product (if used) with the number of instrument error snapshot in the HKTM affected by instrument error. Conditions for instrument error in the correlated processing are given in details in Appendix B
ADF_Error_Counter	Sum the ADF error counter of the previous input MIR_AFWx1A product (if used) with the number of correlated noise snapshot affected by ADF error. An ADF error could be heredity also from the corresponding HKTM L1 snapshot used in the processing of the correlated noise data. Conditions for ADF error in the correlated processing are given in details in Appendix B
Calibration_Error_Counter	Sum the Calibration error counter of the previous input MIR_AFWx1A product (if used) with the number of correlated noise snapshot affected by Calibration error. Conditions for Calibration error in the correlated processing are given in details in Appendix B
N_Discarded_Scenes	Sum the number of discarded scene counter of the previous input MIR_AFWx1A product (if used) with the correlated noise snapshot discarded in the consolidation due to missing corresponding HKTM L1a snapshots.

4.2.2.4.2 Data Block

The binary Data Block of the MIR_AFWD1A products consists of two Measurement datasets.

The following table describes the XML schema used to decode the binary contents of this type of dataset.

- The **Cons_FWF_Measurements** data set shall consist of the averaged FWF values for the three delays, for every pair of receivers (72x71/2 elements, as contained in nominal L1a products). There shall be then only three DSR. The size of each DSR is fixed and equal to 40929 bytes.



- The **Cons_FWF_Coefficients** data set shall consist of the FWF Shape coefficients derived from those previous averaged measurements. This shall be the FWF Shape used in the G Matrix computation. The FWF shape coefficients are obtained by approximating its amplitude by a sinc function, and its phase by a quadratic function.

$$\hat{r}_{kj}(\tau) \approx A \cdot \text{sinc}(B \cdot (\tau - C)) \cdot e^{i(D\tau^2 + E\tau + F)}$$

The size of each DSR is fixed and equal to 104825 bytes.

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Cons_FWF_Measurements					Init of binary Data Set containing the list of FWF_Measurements_Delay records.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
01	<i>FWF_Measurements_Delay_Counter</i>	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of <i>FWF_Measurements_Delay</i> data set record structures.	Generated by L1 Processor.
	<i>List_of_FWF_Measurements_Delay</i>					Init of list of <i>FWF_Measurements_Delay</i> data set record structures, repeated <i>FW_Coefficients_Delay_Counter</i> times.	
	<i>FWF_Measurements_Delay</i>					Init of <i>FWF_Measurements_Delay</i> data set record structure.	
02	<i>Sequence_Start_Time</i>	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the calibration sequence was started. Start of integration time period for the first event in the sequence, and also start of validity for calibration matrices. Expressed in EE CFI transport time format (Array of 3 integer elements)	Generated by L1 Processor.
03	<i>Sequence_Stop_Time</i>	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the calibration sequence was closed. Start of integration time period for last event in the sequence. Expressed in EE CFI transport time format (Array of 3 integer elements)	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
04	Correlator_Layer	Character	N/A	char (1 byte)	1 element	Correlator layer from which the data was taken (NOMINAL='N' or REDUNDANT='R')	Copied from L1A HKTM
05	Samples	Real value	N/A	Float (4 bytes)	1 element	Number of total epochs averaged to perform each calibration step. Typically it shall be the average of all calibration steps.	Generated by L1 Processor.
06	Time_Delay	Real value	N/A	Float (4 bytes)	1 element	Time delay applied for measuring FWF in this integration time. Accepted values shall be: 0, 1/55.84MHz and -1/55.84MHz.	Read from AUX_PLM____
07	FWF_Measurements	Array of complex values	N/A	Double (real part) + double (imag part), totally 16 bytes	71*36 elements. Order followed s depicted in Figure 4-1	FWF measured values at C port at time delay expressed in field #06 in all baselines (including redundant). FWF measured values at C port at time delay expressed in field #5 in all baselines (including redundant).	Generated by L1 Processor.
	Quality_Information					Init of Quality_Information structure.	
08	Software_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for sw error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
09	Instrument_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for instrument error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
10	<i>ADF_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for ADF error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
11	<i>Calibration_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for calibration error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
	<i>Quality_Information</i>					End of Quality_Information structure.	
	<i>FWF_Measurements_Delay</i>					End of FWF_Measurements_Delay data set record structure.	
	<i>List_of_FWF_Measurements_Delay</i>					End of list of FWF_Measurements_Delay data set record structures	
	<i>Cons_FWF_Measurements</i>					End of binary Data Set containing the list of FWF_Measurements_Delay records.	
	<i>Cons_FWF_Coefficients</i>					Init of binary Data Set containing the list of FWF_Coefficients_Data records.	
12	<i>FWF_Coefficients_Datas_Counter</i>	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of FWF_Coefficients_Data data set record structures.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>List_of_FWF_Coefficients_Datas</i>					Init of list of FWF_Coefficients_Data data set record structures, repeated FW_Coefficients_Counter times.	
	<i>FWF_Coefficients_Data</i>					Init of FWF_Coefficients data set record structure.	
13	<i>Sequence_Start_Time</i>	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the calibration sequence was started. Start of integration time period for the first event in the sequence, and also start of validity for calibration matrices. Expressed in EE CFI transport time format (Array of 3 integer elements).	Generated by L1 Processor.
14	<i>Sequence_Stop_Time</i>	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the calibration sequence was closed. Start of integration time period for last event in the sequence. Expressed in EE CFI transport time format (Array of 3 integer elements)	Generated by L1 Processor.
15	<i>Correlator_Layer</i>	Character	N/A	char (1 byte)	1 element	Correlator layer from which the data was taken (NOMINAL='N' or REDUNDANT='R')	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
16	<i>Samples</i>	Real value	N/A	Float (4 bytes)	1 element	Number of total epochs averaged to perform each calibration step. Typically it shall be the average of all calibration steps.	Generated by L1 Processor.
17	<i>A</i>	Array of real values	N/A	Double (8 bytes)	71*36 elements. Order followed s depicted in Figure 4-1	FWF Shape A coefficient for amplitude sinc approximation.	Generated by L1 Processor.
18	<i>B</i>	Array of real values	MHz	Double (8 bytes)	71*36 elements. Order followed s depicted in Figure 4-1	FWF Shape B coefficient for amplitude sinc approximation.	Generated by L1 Processor.
19	<i>C</i>	Array of real values	μ s	Double (8 bytes)	71*36 elements. Order followed s depicted in Figure 4-1	FWF Shape C coefficient for amplitude sinc approximation.	Generated by L1 Processor.
20	<i>D</i>	Array of real values	rad/ μ s ²	Double (8 bytes)	71*36 elements. Order followed s depicted in Figure 4-1	FWF Shape D coefficient for phase quadratic approximation.	Generated by L1 Processor.
21	<i>E</i>	Array of real values	rad/ μ s	Double (8 bytes)	71*36 elements. Order followed s depicted in Figure 4-1	FWF Shape E coefficient for phase quadratic approximation.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
22	<i>FWF_Shape_Quality</i>	Array of integer values	N/A	Unsigned integer (1 byte)	71*36 elements. Order followed s depicted in Figure 4-1	One value per baseline (including redundant). It indicates if the FWF shape was measured during Correlated Noise Injection (1), if it was estimated by closures <i>relationship</i> (2), if it was estimated by average amplitude and phase difference (3) or if it was not measured at all (0).	Generated by L1 Processor.
	<i>Quality_Information</i>					Init of <i>Quality_Information</i> structure.	
23	<i>Software_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for sw error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
24	<i>Instrument_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for instrument error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
25	<i>ADF_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for ADF error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
26	<i>Calibration_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for calibration error in the correlated processing are given in details in Appendix B	Generated by L1 Processor.
	<i>Quality_Information</i>					End of <i>Quality_Information</i> structure.	
	<i>FWF_Coefficients_Data</i>					End of <i>FWF_Coefficients_Data</i> data set record structure.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>List_of_FWF_Coefficients_Datas</i>					End of list of FWF_Coefficients_Data data set record structures	
	<i>Cons_FWF_Coefficients</i>					End of binary Data Set containing the list of FWF_Coefficients records.	
	<i>FWF_Coefficients_Data</i>					Init of FWF_Coefficients data set record structure.	

Table 4-25 Level 1A Fringe Wash Function Product Data Block

4.2.2.5 Averaged NIR Calibration Data Type (MIR_ANIR1A)

Consolidated NIR Calibration data is by combining the new NIR calibration measurements obtained from TLM and external targets observations with a previously existing (if any) consolidation product. The objective is to consolidate all NIR calibration data which is not older than a configurable time into a unique product file.

NIR Calibration data is produced several times during the orbit, whenever the NIR elements are working in other modes different than NIR-A (nominal measurement). These calibrations may usually require a S/C manoeuvre in order to point to the sky.

4.2.2.5.1 Specific Product Header

The Specific Product Header Format for MIR_ANIR1A products follows the format described in table below.



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	<i>Specific_Product_Header</i>	Starting Tag				Tag starting the SPH structure	
02-19	<i>Main_Info</i>	structure	N/A	N/A	N/A	Main Product Info structure's fields as defined in fields #01 to #16 in Table 4-3	
20-26	<i>Quality_Information</i>	structure	N/A	N/A	N/A	Quality_Information structure defined as specified in Table 4-4	
27	<i>Cons_NIR_A_External_Start</i>	String	N/A	30 bytes	%30s	UTC Start Time of the Consolidated NIR-A external dataset, in CCSDS ASCII format with time reference and microseconds. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" This time shall coincide with the start time of the older dataset record of this dataset in the binary datablock.	Generated by L1 Processor.
28	<i>Cons_NIR_A_External_Stop</i>	String	N/A	30 bytes	%30s	UTC Stop Time of the Consolidated NIR-A external dataset, in CCSDS ASCII format with time reference and microseconds. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" This time shall coincide with the stop time of the most recent dataset record of this dataset in the binary datablock.	Generated by L1 Processor.
29	<i>Cons_NIR_R_External_Start</i>	String	N/A	30 bytes	%30s	UTC Start Time of the Consolidated NIR-R external dataset, in CCSDS ASCII format with time reference and microseconds. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" This time shall coincide with the start time of the older dataset record of this dataset in the binary datablock.	Generated by L1 Processor.



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
30	Cons_NIR_R_External_Stop	String	N/A	30 bytes	%30s	UTC Stop Time of the Consolidated NIR-R external dataset, in CCSDS ASCII format with time reference and microseconds. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" This time shall coincide with the stop time of the most recent dataset record of this dataset in the binary datablock.	Generated by L1 Processor.
31	Averaged_NIR_A_External_Start	String	N/A	30 bytes	%30s	UTC Start Time of the Averaged NIR-A external dataset, in CCSDS ASCII format with time reference and microseconds. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" This time shall coincide with the start time of the older dataset record of this dataset in the binary datablock.	Generated by L1 Processor.
32	Averaged_NIR_A_External_Stop	String	N/A	30 bytes	%30s	UTC Stop Time of the Averaged NIR-A external dataset, in CCSDS ASCII format with time reference and microseconds. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" This time shall coincide with the stop time of the most recent dataset record of this dataset in the binary datablock.	Generated by L1 Processor.
33	Averaged_NIR_R_External_Start	String	N/A	30 bytes	%30s	UTC Start Time of the Averaged NIR-R external dataset, in CCSDS ASCII format with time reference and microseconds. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" This time shall coincide with the start time of the older dataset record of this dataset in the binary datablock.	Generated by L1 Processor.



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
34	<i>Averaged_NIR_R_External_Stop</i>	String	N/A	30 bytes	%30s	UTC Stop Time of the Averaged NIR-R external dataset, in CCSDS ASCII format with time reference and microseconds. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" This time shall coincide with the stop time of the most recent dataset record of this dataset in the binary datablock.	Generated by L1 Processor.
35-46	<i>Data_Sets</i>	structure	N/A	N/A	N/A	Data Sets structure's fields as defined in Table 4-5	
47	<i>Specific_Product_Header</i>	Closing Tag				Tag ending the SPH structure	

Table 4-26 Level 1A Averaged NIR Measurements product SPH

The reference data sets MIR_ANIR1A Data Type are:

Reference Data Set Name	Product Type	Description
L1A_HKTM_FILE	TLM_MIRA1A	HKTM filename containing the S/C position and attitude for the snapshots in the current product
L1A_NIR_FILE	MIR_ANIR1A	Previously consolidated NIR in-orbit calibration file
L1A_AVER_OFFSET_FILE	MIR_UAVD1A	L1a Offset filename containing individual measurements of uncorrelated noise injection
L1A_ORBIT_AMPL_FILE	MIR_CRSD1A	L1a Calibration filename containing several sets of parameters obtained during correlated noise injection calibration, used to calibrate the L1a visibilities
L1A_ORBIT_PHASE_FILE	MIR_CSTD1A	L1a Calibration filename containing several sets of parameters obtained during short term calibration (i.e. Local Oscillator), used to calibrate the L1a visibilities
NIR_FILE	AUX_NIR__	Auxiliary file with external NIR characterisation
S_PARAM_FILE	AUX_SPAR__	Auxiliary file with S-parameters characterisation used for L1a calibration
PMS_FILE	AUX_PMS__	Auxiliary file with external PMS characterisation
ANTENNA_PATTERNS_FILE	AUX_PATT__	Auxiliary file with receivers' amplitude and phase pattern characterisation used



Reference Data Set Name	Product Type	Description
		for generation of the G reconstruction matrix
AUX_GALAXY_FILE	AUX_GALAXY	Original galaxy map
GALAXY_NIR_FILE	AUX_GALNIR	Galaxy Map convoluted with NIR used for generation of the Ideal Sky visibilities
LICEF_FILE	AUX_LCF___	Auxiliary file with absolute phase characterisation used for plane translation of L1A calibration data
ALGORITHM_CONFIG_FILE	AUX_CNFL1P	Processor Configuration Parameters and Constants for L1OP
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Mission planning file used to initialise the EE CFI orbit_id and/or time_id. It is read and used by the EE CFI.
BEST_FIT_PLANE_FILE	AUX_BFP___	Auxiliary file with definition of Best Fit Plane to be used during geolocation in L1c
L0_CORRELATIONS_FILE	MIR_TARD0 , MIR_TARF0	L0 Product filename from which the current L1a was created
MISPOINTING_ANGLES_FILE	AUX_MISP__	Auxiliary product containing the mispointing angles between the Body Frame referenced in the Proteus quaternions and the Antenna Plane defined by the MIRAS instrument
FAILURES_FILE	AUX_FAIL__	Auxiliary file with failure of components to be taken into account during L1 processing
BULLETIN_B_FILE	AUX_BULL_B	IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation

Table 4-27 Level 1A Averaged NIR Reference Data Sets

The following are the rules to update the counters in the SPH General Quality Information structure:

Counter Name	Condition
Software_Error_Counter	Sum for all the data set the software error counters in the quality information structure
Instrument_Error_Counter	Sum for all the data set the instrument error counters in the quality information structure.
ADF_Error_Counter	Sum for all the data set the ADF error counters in the quality information structure.
Calibration_Error_Counter	Sum for all the data set the Calibration error counters in the quality information structure.
N_Discarded_Scenes	Count all the snapshot discarded in the generation of all the data set due to missing corresponding HKTM L1a snapshot.



4.2.2.5.2 Data Block

As it is written in section 4.6.8.3 in [RD.1], the binary Data Block of the MIR_ANIR1A_ product consists of four Measurement datasets, containing different NIR Reference values along the orbit. Each of the first two data sets consists of a number of data set records, measuring different NIR reference values along the orbit. The last two data sets contain a unique data set record with the averaged NIR reference values to be used.

The following table describes the XML schema used to decode the binary contents of this type of datasets.

- The **Cons_NIR_A_External** data set consists of in-orbit measured parameters on the calibrated NIR system, which shall be used as input in the NIR BT computation. There shall be as many Data Set Records for each product as complete sequences spent in NIR-A and NIR-LA mode, whose validity period has not expired. The size of each data set record is fixed and equal to 461 bytes.
- The **Cons_NIR_R_External** data set consists of in-orbit measured parameters on the calibrated CAS system, which shall be used as input in the NIR-R calibration while processing Correlated Noise Injection data. There shall be as many Data Set Records for each product as complete sequences spent in NIR-A and NIR-AR mode, whose validity period has not expired. The size of each DSR is fixed and equal to 316 bytes.
- The **Avg_NIR_A_External** data set consists of in-orbit measured parameters on the calibrated NIR system, which shall be used as input in the NIR BT computation. There shall be one Data Set Record for each product containing the averaged NIR parameters coming from the sequences spent in NIR-A and NIR-LA mode, whose validity period has not expired. The size of the data set record is fixed and equal to 461 bytes.
- The **Avg_NIR_R_External** data set consists of in-orbit measured parameters on the calibrated CAS system, which shall be used as input in the NIR-R calibration while processing Correlated Noise Injection data. There shall be one Data Set Record for each product containing the averaged NIR parameters coming from the sequences spent in NIR-A and NIR-AR mode, whose validity period has not expired. The size of the DSR is fixed and equal to 316 bytes.

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Cons_NIR_A_External					Init of binary Data Set containing the list of NIR_A_External_Sample records.	
01	Cons_NIR_A_External_Counter	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of NIR_A_External data set record structures.	Generated by L1 Processor.
	List_of_Cons_NIR_A_External_Datas					Init of list of List_of_Cons_NIR_A_External_Datas data set record structures, repeated Counter times.	
	Cons_NIR_A_External_Data					Init of NIR_A_External_Data data set record structure.	
02	Sequence_Start_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the calibration sequence was started. Start of integration time period for the first event in the sequence. Expressed in EE CFI transport time format (Array of 3 integer elements)	Copied from L1A HKTM
03	Sequence_Stop_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the calibration sequence was closed. Start of integration time period for last event in the sequence. Expressed in EE CFI transport time format (Array of 3 integer elements)	Copied from L1A HKTM



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
04	Correlator_Layer	Identifier	N/A	char (1 byte)	1 element	Correlator layer from which the data was taken (NOMINAL='N' or REDUNDANT='R')	Generated by L1 Processor.
05	Samples	Real value	N/A	Float (4 bytes)	1 element	Number of epochs averaged to perform the calibration.	Generated by L1 Processor.
06	NIR_Expected_BT_H	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Expected NIR temperature obtained by convolving the Sky Map with the NIR Antenna Pattern, T'_{A0} One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
07	NIR_Expected_BT_V	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Expected NIR temperature obtained by convolving the Sky Map with the NIR Antenna Pattern, T'_{A0} One measurement per NIR. Order followed is AB, BC, CA	Generated by L1 Processor.
08	NIR_Observed_Antenna_BT_H	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Reference input power from the antenna, T'''_{A0} One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
09	NIR_Observed_Antenna_BT_V	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Reference input power from the antenna, T'''_{A0} One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
10	<i>T_Noise_Cal_H</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Antenna noise Injection Temperature, T_{NA0} One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
11	<i>T_Noise_Cal_V</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Antenna noise Injection Temperature, T_{NA0} One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
12	<i>T_Phys_Tpu_H</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of NIR_LICEF_H (Tpu). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
13	<i>T_Phys_Tpu_V</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of NIR_LICEF_V (Tpu). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
14	<i>T_Phys_Tp6</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the antenna intermediate layer (Tp6). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
15	<i>T_Phys_Tp7</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the antenna patch (Tp7). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
16	<i>T_Phys_Tp3_H</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the reference attenuator (Tp3h). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA	Generated by L1 Processor.
17	<i>T_Phys_Tp3_V</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the reference attenuator (Tp3v). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
18	<i>T_Phys_Tp1_H</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the NIR diode (Tp1h). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
19	<i>T_Phys_Tp1_V</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the NIR diode (Tp1v). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
20	Cross_Coupling_Factor	Real value	N/A	Double (8 bytes)	Vector array of 3x2 elements.	Cross-coupling factor (χ). One value for II correlations, and another for QI correlations per NIR (for Redundant Correlator layer, it is QQ and IQ).	Generated by L1 Processor.
21	Leakage_Factor	Real value	N/A	Double (8 bytes)	Vector array of 3x2 elements.	Leakage factor(Θ). One value for II correlations, and another for QI correlations per NIR (for Redundant Correlator layer, it is QQ and IQ).	Generated by L1 Processor.
	Quality_Information					Init of Quality_Information structure.	
22	Software_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Count the number of software error in the data block of the quality information of the input products and make the sum. There is no additional sw error in Appendix B to be detected in this stage of the processing.	Generated by L1 Processor.
23	Instrument_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Count the number of instrument error in the data block quality information of the input products and make the sum. There is no additional instrument error in Appendix B to be detected in this stage of the processing.	Generated by L1 Processor.
24	ADF_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Count the number of ADF error in the data block of quality information of the input products and add the error generated in the current stage of the processing.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
25	Calibration_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Count the number of Calibration error in the data block of quality information of the input products and add the error generated in the current stage of the processing.	Generated by L1 Processor.
	Quality_Information					End of Quality_Information structure.	
	Cons_NIR_A_External_Data					End of Cons_NIR_A_External_Data data set record structure.	
	List_of_Cons_NIR_A_External_Datas					End of list of Cons_NIR_A_External_Data data set record structures.	
	Cons_NIR_A_External					End of binary Data Set containing the list of Cons_NIR_A_External_Sample records.	
	Cons_NIR_R_External					Init of binary Data Set containing the list of NIR_External_Sample records.	
26	Cons_NIR_R_External_Counter	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of Cons_NIR_R_External data set record structures.	Generated by L1 Processor.
	List_of_Cons_NIR_R_External_Datas					Init of list of Cons_NIR_R_External_Datas data set record structures, repeated Counter times. The list contains as many DSR as integration times spent in NIR-R mode in the product.	
	Cons_NIR_R_External_Data					Init of Cons_NIR_R_External_Data data set record structure.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
27	Sequence_Start_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the calibration sequence was started. Start of integration time period for the first event in the sequence. Expressed in EE CFI transport time format	Copied from L1A HKTM
28	Sequence_Stop_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the calibration sequence was closed. Start of integration time period for last event in the sequence. Expressed in EE CFI transport time format (Array of 3 integer elements)	Copied from L1A HKTM
29	Samples	Real value	N/A	Float (4 bytes)	1 element	Number of epochs averaged to perform the calibration.	Generated by L1 Processor. Based on L1 HKTM
30	NIR_Observed_BT_H	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Input power of the antenna branch at C-port, $T_{A_ON0}^{CIP}$ One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor. Based on L1 HKTM
31	NIR_Observed_BT_V	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Input power of the antenna branch at C-port, $T_{A_ON0}^{CIP}$ One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor. Based on L1 HKTM



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
32	<i>T_Noise_Cal_Ref_H</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Calibrated NIR Noise Source Temperature in the reference branch T_{NR0} One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
33	<i>T_Noise_Cal_Ref_V</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Calibrated NIR Noise Source Temperature in the reference branch, T_{NR0} One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
34	<i>T_Phys_Tpu_H</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of NIR_LICEF_H (Tpu). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
35	<i>T_Phys_Tpu_V</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of NIR_LICEF_V (Tpu). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
36	<i>T_Phys_Tp6</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the antenna intermediate layer (Tp6). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
37	<i>T_Phys_Tp7</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the antenna patch (Tp7). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
38	<i>T_Phys_Tp3_H</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the reference attenuator (Tp3h). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
39	<i>T_Phys_Tp3_V</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the reference attenuator (Tp3v). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
40	<i>T_Phys_Tp1_H</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the NIR diode (Tp1h). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
41	<i>T_Phys_Tp1_V</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the NIR diode (Tp1v). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Quality_Information					Init of Quality_Information structure.	
42	Software_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Count the number of software error in the data block of the quality information of the input products and make the sum. There is no additional sw error in Appendix B to be detected in this stage of the processing.	Generated by L1 Processor.
43	Instrument_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Count the number of instrument error in the data block quality information of the input products and make the sum. There is no additional instrument error in Appendix B to be detected in this stage of the processing.	Generated by L1 Processor.
44	ADF_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Count the number of ADF error in the data block of quality information of the input products and add the error generated in the current stage of the processing.	Generated by L1 Processor.
45	Calibration_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Count the number of Calibration error in the data block of quality information of the input products and add the error generated in the current stage of the processing.	Generated by L1 Processor.
	Quality_Information					End of Quality_Information structure.	
	Cons_NIR_R_External_Data					End of Cons_NIR_R_External_Data data set record structure.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>List_of_Cons_NIR_R_External_Samples</i>					End of list of Cons_NIR_R_External_Sample data set record structures, repeated Counter times. The list contains as many DSR as integration times spent in NIR-R mode in the product.	
	<i>Cons_NIR_R_External</i>					End of binary Data Set containing the list of Cons_NIR_R_External_Sample records.	
	<i>Avg_NIR_A_External</i>					Init of binary Data Set containing the average of NIR_A_External_Sample records.	
46	<i>Sequence_Start_Time</i>	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the calibration sequence was started. Start of integration time period for the first averaged event in the sequence. Expressed in EE CFI transport time format (Array of 3 integer elements)	Copied from L1A HKTM
47	<i>Sequence_Stop_Time</i>	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the calibration sequence was closed. Start of integration time period for last event averaged in the sequence. Expressed in EE CFI transport time format (Array of 3 integer elements)	Copied from L1A HKTM



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
48	Correlator_Layer	Identifier	N/A	char (1 byte)	1 element	Correlator layer from which the data was taken (NOMINAL='N' or REDUNDANT='R')	Generated by L1 Processor.
49	Samples	Real value	N/A	Float (4 bytes)	1 element	Number of epochs averaged to perform the calibration.	Generated by L1 Processor.
50	NIR_Expected_BT_H	Real value	K	Double (8 bytes)	Vector array of 3 elements.	NIR Expected Brightness Temperature in H polarisation $T'_{A0,h}$ One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
51	NIR_Expected_BT_V	Real value	K	Double (8 bytes)	Vector array of 3 elements.	NIR Expected Brightness Temperature in V polarisation $T'_{A0,v}$ One measurement per NIR. Order followed is AB, BC, CA	Generated by L1 Processor.
52	NIR_Observed_Antenna_BT_H	Real value	K	Double (8 bytes)	Vector array of 3 elements.	NIR Observed Brightness Temperature in H polarisation $T'''_{A0,h}$ at antenna plane during calibration One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
53	NIR_Observed_Antenna_BT_V	Real value	K	Double (8 bytes)	Vector array of 3 elements.	NIR Observed Brightness Temperature in V polarization $T'''_{A0,v}$ at antenna plane during calibration One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
54	<i>T_Noise_Cal_H</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Calibrated NIR Noise Source Temperature $T_{NA0,h}$ One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
55	<i>T_Noise_Cal_V</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Calibrated NIR Noise Source Temperature $T_{NA0,v}$ One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
56	<i>T_Phys_Tpu_H</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of NIR_LICEF_H (Tpu). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
57	<i>T_Phys_Tpu_V</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of NIR_LICEF_V (Tpu). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
58	<i>T_Phys_Tp6</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the antenna intermediate layer (Tp6). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
59	<i>T_Phys_Tp7</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the antenna patch (Tp7). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
60	<i>T_Phys_Tp3_H</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the reference attenuator (Tp3h). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA	Generated by L1 Processor.
61	<i>T_Phys_Tp3_V</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the reference attenuator (Tp3v). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
62	<i>T_Phys_Tp1_H</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the NIR diode (Tp1h). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
63	<i>T_Phys_Tp1_V</i>	Real value	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the NIR diode (Tp1v). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
64	Cross_Coupling_Factor	Real value	N/A	Double (8 bytes)	Vector array of 3x2 elements.	Cross-coupling factor (χ). One value for II correlations, and another for QI correlations per NIR (for Redundant Correlator layer, it is QQ and IQ).	Generated by L1 Processor.
65	Leakage_Factor	Real value	N/A	Double (8 bytes)	Vector array of 3x2 elements.	Leakage factor (Θ). One value for II correlations, and another for QI correlations per NIR (for Redundant Correlator layer, it is QQ and IQ).	Generated by L1 Processor.
	Quality_Information					Init of Quality_Information structure.	
66	Software_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Count the number of software error in the data block of the quality information of the input products and make the sum. There is no additional sw error in Appendix B to be detected in this stage of the processing.	Generated by L1 Processor.
67	Instrument_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Count the number of instrument error in the data block quality information of the input products and make the sum. There is no additional instrument error in Appendix B to be detected in this stage of the processing.	Generated by L1 Processor.
68	ADF_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Count the number of ADF error in the data block of quality information of the input products and add the error generated in the current stage of the processing.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
69	Calibration_Error_Counter	Integer	N/A	unsigned integer (4 bytes)	1 element	Count the number of Calibration error in the data block of quality information of the input products and add the error generated in the current stage of the processing.	Generated by L1 Processor.
	Quality_Information					End of Quality_Information structure.	
	Avg_NIR_A_External					End of binary Data Set containing the Avg_NIR_A_External_Sample record.	
	Avg_NIR_R_External					Init of binary Data Set containing the Avg_NIR_R_External_Sample record.	
70	Sequence_Start_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the calibration sequence was started. Start of integration time period for the first event averaged in the sequence. Expressed in EE CFI transport time format	Copied from L1A HKTM
71	Sequence_Stop_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the calibration sequence was closed. Start of integration time period for last event averaged in the sequence. Expressed in EE CFI transport time format (Array of 3 integer elements)	Copied from L1A HKTM



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
72	<i>Samples</i>	Real value	N/A	Float (4 bytes)	1 element	Number of epochs averaged to perform the calibration.	Generated by L1 Processor. Based on L1 HKTM
73	<i>NIR_Observed_BT_H</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	NIR Observed Brightness Temperature in H polarisation $T_{A_ON0,h}^{CIP}$ during calibration One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor. Based on L1 HKTM
74	<i>NIR_Observed_BT_V</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	NIR Observed Brightness Temperature in V Polarisation $T_{A_ON0,v}^{CIP}$ during calibration One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor. Based on L1 HKTM
75	<i>T_Noise_Cal_Ref_H</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Calibrated NIR Noise Source Temperature $T_{NR0,h}$ in the reference branch One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
76	<i>T_Noise_Cal_Ref_V</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Calibrated NIR Noise Source Temperature $T_{NR0,v}$ in the reference branch One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
77	<i>T_Phys_Tpu_H</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of NIR_LICEF_H (Tpu). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
78	<i>T_Phys_Tpu_V</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of NIR_LICEF_V (Tpu). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
79	<i>T_Phys_Tp6</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the antenna intermediate layer (Tp6). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
80	<i>T_Phys_Tp7</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the antenna patch (Tp7). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
81	<i>T_Phys_Tp3_H</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the reference attenuator (Tp3h). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
82	<i>T_Phys_Tp3_V</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the reference attenuator (Tp3v). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA	Generated by L1 Processor.
83	<i>T_Phys_Tp1_H</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the NIR diode (Tp1h). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
84	<i>T_Phys_Tp1_V</i>	Real values	K	Double (8 bytes)	Vector array of 3 elements.	Reference Physical Temperature of the NIR diode (Tp1v). Obtained as an average during the whole calibration sequence. One measurement per NIR. Order followed is AB, BC, CA.	Generated by L1 Processor.
	<i>Quality_Information</i>					Init of Quality_Information structure.	
85	<i>Software_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Count the number of software error in the data block of the quality information of the input products and make the sum. There is no additional sw error in Appendix B to be detected in this stage of the processing.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
86	<i>Instrument_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Count the number of instrument error in the data block quality information of the input products and make the sum. There is no additional instrument error in Appendix B to be detected in this stage of the processing.	Generated by L1 Processor.
87	<i>ADF_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Count the number of ADF error in the data block of quality information of the input products and add the error generated in the current stage of the processing.	Generated by L1 Processor.
88	<i>Calibration_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Count the number of Calibration error in the data block of quality information of the input products and add the error generated in the current stage of the processing.	Generated by L1 Processor.
	<i>Quality_Information</i>					End of Quality_Information structure.	
	<i>Avg_NIR_R_External</i>					End of binary Data Set containing the list of Cons_NIR_R_External_Sample records.	
	<i>Data_Block</i>					End of binary Data Block in the product.	

Table 4-28 Level 1A NIR Calibration Product Data Block



4.2.3 L1A Data Specification

L1A Data are the products obtained in science measurement mode (either pointing to the earth –nominal- or to external sources - i.e. deep Sky, Moon...-) in both dual and full polarisation, converted to raw correlations and calibrated using MIRAS calibration data (see section 4.2).

There is a unique type of product, as it contains the calibrated visibilities between receivers, before any reconstruction is applied. These products present these calibrated visibilities in a known array, detailed in Figure 4-1, so that the reconstruction process may re-order and apply the reconstruction algorithm as needed.

4.2.3.1 Dual Polarization Calibrated Visibilities (MIR_SC_D1A / MIR_TARD1A)

The dual polarization calibrated visibilities are obtained after converting the dual polarization L0 science packets into raw correlations and calibrating them.

MIR_SC_D1A products contain reformatted, unpacked and calibrated complex correlations coming from L0 data, combined per integration time and including all redundant visibilities. The basic distribution of calibrated visibilities within the binary structure shall be the one shown in Figure 4-1, based on the same distribution found in the ASICs correlations matrix. This time, the data being provided is complex calibrated visibilities, so only the elements above the diagonal are needed. The reconstruction module shall extrapolate elements below the diagonal, by simply doing the complex conjugate, or any other approach. The elements in the diagonal (zero baseline) shall be the cross-correlation of the I and Q channels of the same LICEF, and provided in a separate structure.

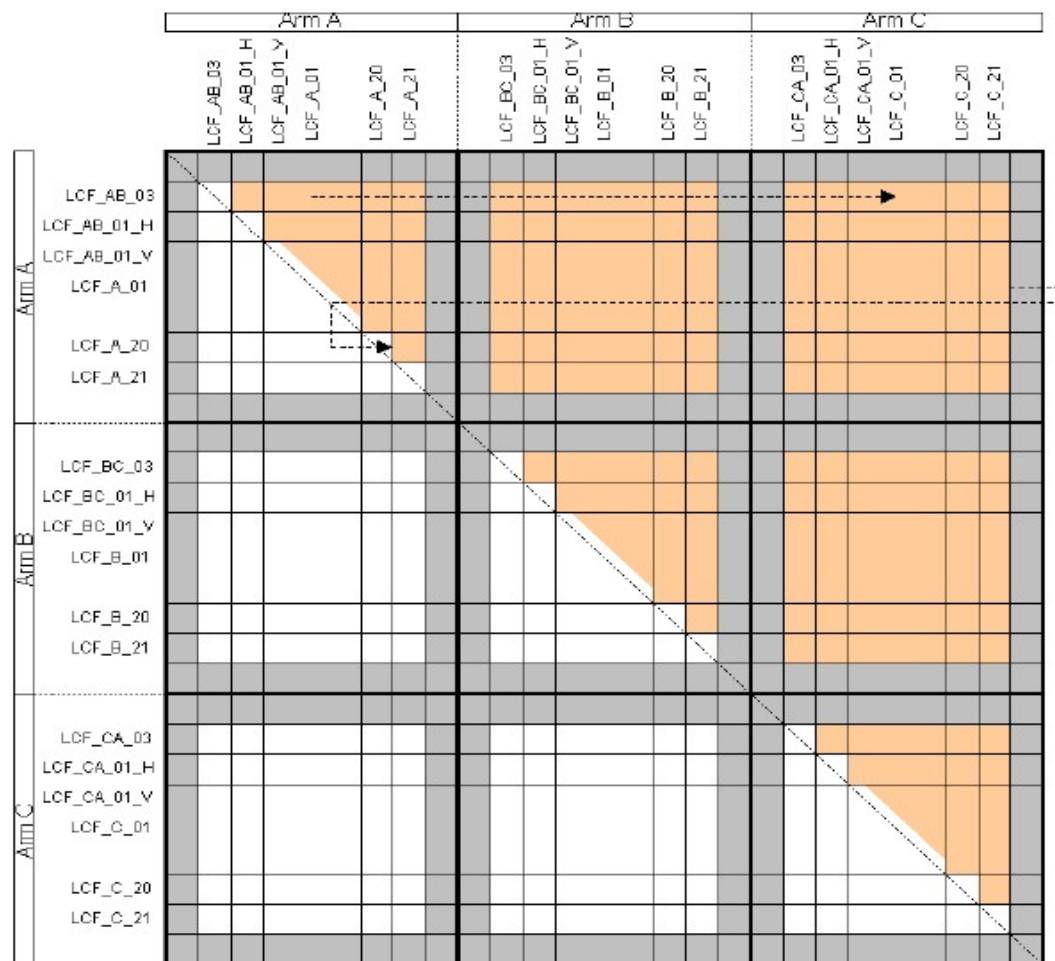


Figure 4-1 Visibilities array order (taken from Deimos Eng., L1PP Product format)



Depending on the polarisation mode, correlation from the baselines with a LICEF_NIR shall be chosen by the reconstruction module, as both H and V signals are correlated simultaneously. In case of dual polarisation, cross-correlations shall be mostly unused, but for full polarisation they may be needed as they provide additional baselines.

Additionally, whenever temperature measurements are given for all 69 receivers, the ordering of those values shall follow the standard baseline, using the 72 signals i.e. LCF_AB_03, LCF_AB_01_H (NIR), LCF_AB_01_V (NIR), LCF_A_01, LCF_A_02...LCF_A_21, LCF_BC_03, LCF_BC_01_H (NIR), LCF_BC_01_V (NIR), LCF_B_01...LCF_B_21, LCF_CA_03, LCF_CA_01_H (NIR), LCF_CA_01_V (NIR), LCF_C_01...LCF_C_21.

4.2.3.1.1 Specific Product Header

The Specific Product Header for MIR_SC_D1A product shall follow the format described in table below:

Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
03	<i>Specific_Product_Header</i>	Starting Tag				Tag starting the Specific Product Header structure	
02-19	<i>Main_Info</i>	structure	N/A	N/A	N/A	Main Product Info structure's fields as defined in in Table 4-3	
20-26	<i>Quality_Information</i>	structure	N/A	N/A	N/A	Quality_Information structure's fields as defined in Table 4-4	
27	<i>U_Correction_Applied</i>	Flag	N/A	1 byte	%d	Flag indicating if the uncorrelated noise injection correction has been applied on the calibrated visibilities. 0 means No offset correction to be applied 1 means Offset correction to ALL baselines applied	AUX_CNFL1P



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
						2 means Offset correction ONLY to baselines fed by the same local oscillator This tag is filled with field 08 in AUX_CNFL1P (UNCN_Correction).	
28-39	<i>Data_Sets</i>	structure	N/A	N/A	N/A	Data Sets structure's fields as defined in Table 4-5	
50	<i>List_of_Reference_Data_Sets_L0</i>	Starting Tag	N/A	N/A	N/A	Reference Data Sets inherited from HKTM L0	
51-59	<i>Reference_Filename</i>	string	N/A	60 bytes	%60s	Filename of input files as described in table 4-10	Copied from Science L0 header
60	<i>List_of_Reference_Data_Sets_L0</i>	Closing Tag	N/A	N/A	N/A	Reference Data Sets inherited from Science L0	
61	<i>Specific_Product_Header</i>	Closing Tag				Tag ending the Specific Product Header structure	

Table 4-29 Level 1A MIR_SC_D1A/MIR_TARD1A SPH

The reference data sets for L1 A Products are:

Reference Data Set Name	Product Type	Description
L0_CORRELATIONS_FILE	MIR_SC_D0_, MIR_SC_F0_, MIR_TARD0_, MIR_TARF0_	L0 Product filename from which the current L1a was created
L1A_AVER_OFFSET_FILE	MIR_UAVD1A	L1A offset filename containing the average of the uncorrelated noise injection measurements used to calibrate the L1a visibilities



Reference Data Set Name	Product Type	Description
L1A_ORBIT_AMPL_FILE	MIR_CRSD1A	L1a Calibration filename containing several sets of parameters obtained during correlated noise injection calibration, used to calibrate the L1a visibilities
L1A_ORBIT_PHASE_FILE	MIR_CSTD1A	L1a Calibration filename containing several sets of parameters obtained during short term calibration (i.e. Local Oscillator), used to calibrate the L1a visibilities
L1A_AVER_NIR_CAL_FILE	MIR_ANIR1A	Consolidated NIR calibrated parameters filename used to calibrate L1A visibilities
L1A_HKTM_FILE	TLM_MIRA1A	HKTM filename containing the S/C position and attitude for the snapshots in the current product
BEST_FIT_PLANE_FILE	AUX_BFP__	Auxiliary file with definition of Best Fit Plane to be used during geolocation in L1c
PMS_FILE	AUX_PMS__	Auxiliary file with external PMS characterisation
S_PARAM_FILE	AUX_SPAR__	Auxiliary file with S-parameters characterisation used for plane translation of calibration data
LICEF_FILE	AUX_LCF__	Auxiliary file with absolute phase characterisation used for plane translation of L1A calibration data
NIR_FILE	AUX_NIR__	Auxiliary file with NIR characterisation used for L1a calibration (defined externally)
ALGORITHM_CONFIG_FILE	AUX_CNFL1P	Processor Configuration Parameters and Constants for L1OP
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Mission planning file used to initialise the EE CFI orbit_id and/or time_id. It is read and used by the EE CFI.
MISPOINTING_ANGLES_FILE	AUX_MISP__	Auxiliary product containing the mispointing angles between the Body Frame referenced in the Proteus quaternions and the Antenna Plane defined by the MIRAS instrument
BULLETIN_B_FILE	AUX_BULL_B	IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation

Table 4-30 Level 1A Calibrated Visibilities Reference Data Sets

The valid L0 Reference Data Sets for Level1A Calibrated Visibilities Products are the same as for L0 HKTM reference files in table 4-10.

The following are the rules to update the SPH General Quality Information structure from the resulting Quality_Information flags for each data set record:



Counter Name	Condition
Software_Error_Counter	Count all the snapshots that have the Software_Error_flag set
Instrument_Error_Counter	Count all the snapshots that have the Instrument_Error_flag set
ADF_Error_Counter	Count all the snapshots that have the ADF_Error_flag set
Calibration_Error_Counter	Count all the snapshots that have the Calibration_Error_flag set
N_Discarded_Scenes	Count all the snapshot discarded due to missing L1a snapshots

4.2.3.1.2 Data Block

The binary Data Block of the MIR_SC_D1A product consists of one Measurement datasets, containing the calibrated visibilities and other supporting parameters. There is one DSR for each integration time, either in HHH or VVV polarization modes. This Data Set will contain as many Data Set Records as snapshots measured by the instrument in [RD.1] for more specific details on this data block.

The following table describes the XML schema used to decode the binary contents of this type of record. The tag element used to describe the DSR structure name in the XML schema shall be **Calibrated_Visib_Dual**.

- The **Calibrated_Visib_Dual** data set consists of the complete set of calibrated visibilities obtained by processing Level 0 dual polarization products. There shall be as many Data Set Records for each product as integration times spent in dual polarization measurement mode pointing in the same direction during the half orbit (i.e. dual-pol measurements shall be separated in different products if they are observing the earth surface –nominal- or external sources –Moon, deep sky, etc.-). The first field in the dataset, **Counter**, specifies the number of DSR contained in it, while the following fields are **Counter** repetitions of the **Calib_Data** dataset record structure. The size of each DSR is fixed and equal to 41904 bytes.

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Calibrated_Visib_Dual					Init of binary Data Set containing the list of Calib_data records.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
01	Calib_Data_Counter	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of Calib_data data set record structures.	Generated by L1 Processor.
	List_of_Calib_Datas					Init of list of Calib_data data set record structures, repeated Counter times. There are as many DSR as integration times spent in the product.	
	Calib_Data					Init of Calib_Data data set record structure.	
02	Snapshot_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the scene was taken. Middle of integration time period, propagated from UTC at start of integration provided in ancillary packet. Expressed in EE CFI transport time format.	Copied from L1A HKTM product
03	Snapshot_ID	Identifier	N/A	unsigned integer (4 bytes)	1 element	Unique identifier for the snapshot. Formed by aggregation of orbit and time within orbit. Contents of this field are formed by: Absolute_orbit_number*10000 + Seconds_from_ANX	Generated by L1 Processor.
04	Snapshot_OBET	Time counter	N/A	bit stream (8 bytes) declared as unsigned long	1 element (OBET Format is specified in section 4.2.1.2)	Unique identifier for the snapshot. Formed by the OBET at T_SYNC extracted from L0. Represents start of integration time in OBET format.	Copied from secondary header in scene packets
05	Correlator_Layer	Character	N/A	char (1 byte)	1 element	Correlator layer from which the data was taken (NOMINAL='N' or REDUNDANT='R')	Copied from L1A HKTM product
06	Snapshot_Order	Identifier	N/A	char (1 byte)	1 element	Order within the same integration time (OBET) in which this scene was taken ('0' for HHH or VVV, '1', '2', or '3' for the combined polarisations). Set always to '0' for DSR Calib_Visib_Dual	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
07	<i>Receiver_Temp</i>	Array of real values	K	Float (4 bytes)	Vector array of 72 elements (order followed is described in last paragraph of 4.2.3.1)	Physical temperature of receivers in Kelvin. One value per receiver.	Copied from L1A HKTM product
08	<i>Sys_Temp</i>	Array of real values	K	Float (4 bytes)	Vector array of 72 elements (order followed is described in last paragraph of 4.2.3.1)	System temperature of receivers in respective polarisation (field #11), used for de-normalisation of visibilities, expressed in Kelvin. One value per receiver.	Generated by L1 Processor.
09	<i>Receiver_Noise_Temp</i>	Array of real values	K	Float (4 bytes)	Vector array of 72 elements (one value per receiver, order followed is described in last paragraph of 4.2.3.1)	LICEF Noise Temperature in respective polarisation (field #11), expressed in Kelvin.	Generated by L1 Processor.
10	<i>NIR_Brightness_Temp</i>	Real value	K	Double (8 bytes)	Vector array of 12 elements. Four values (H, V, T3 and T4) per receiver.. Order followed is AB-H, AB-V, AB-T3, AB-T4, BC-H, BC-V, BC-T3, BC-T4, CAH, CA-V, CA-T3 and CA-T4.	Brightness temperatures measured at NIR elements in Kelvin. To be used as "zero baseline" for reconstruction process. (Please note that T3 and T4 are Stokes parameters in XY basis, so they should be divided by 2 if used as zero baseline)	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
11	LICEF_Brightness_Temp	Real value	K	Double (8 bytes)	Vector array of 72 elements (order followed is described in last paragraph of 4.2.3.1)	Brightness temperatures measured at LICEF elements in Kelvin. To be used in the reconstruction process.	Generated by L1 Processor.
12	Pol_Mode	Set of flags	N/A	unsigned byte	1 element (3 bits are used)	Polarisation mode in receivers (HHH or VVV).	Generated by L1 Processor. Based on L1A HKTM product
13	Calib_Visib	Array of complex values	N/A	Double (real part) + double (imag part), totally 16 bytes	71*36 elements. Order followed s depicted in Figure 4-1	Complex calibrated visibilities in all measured baselines (including redundant).	Generated by L1 Processor.
14	Antenna_Boresight	Array of real values	deg	Float (4bytes)	2 elements	<p>In case of MIR_SC_D1A:</p> <ul style="list-style-type: none"> First element is Latitude of Earth surface point in the snapshot's boresight direction. Second element is Longitude of Earth surface point in the snapshot's boresight direction. <p>In case of MIR_TARD1A:</p> <ul style="list-style-type: none"> First element is Right Ascension in the snapshot's boresight direction (coordinates reference system is B1950). 	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
						<ul style="list-style-type: none"> Second element is Declination in the snapshot's boresight direction (coordinates reference system is B1950). 	
15	<i>Max_Mkj_module</i>	Double	N/A	8 bytes	1 element	Maximum value of the module of the Normalised QuadratureCorrected Correlation	Generated by L1 Processor.
16	<i>X -Band</i>	Integer	N/A	Unsigned 1 byte	1 element	<ul style="list-style-type: none"> 0 if X-Band Transmitter OFF 1 if X-Band Transmitter ON (Nominal side) if X-Band Transmitter ON (Redundant side) 3 if X-Band Transmitter ON (Nominal and Redundant side) 	Generated by L1 Processor.
17	<i>RFI_Flags</i>	Set of flags	N/A	unsigned byte	1 element	<p>L1a flags applicable to the scene for this particular integration time.</p> <p>The complete flags in the available byte are specified below this table.</p>	Generated by L1 Processor.
	<i>Quality_Information</i>					Init of <i>Quality_Information</i> structure.	
18	<i>Software_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See Appendix B for details.	Generated by L1 Processor.
19	<i>Instrument_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See Appendix B for details.	Generated by L1 Processor.
20	<i>ADF_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See Appendix B for details.	Generated by L1 Processor.
21	<i>Calibration_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See Appendix B for details.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Quality_Information					End of Quality_Information structure.	
	Calib_Data					End of Calib_Data data set record structure.	
	List_of_Calib_dats					End of list of Calib_data data set record structures.	
	Calibrated_Visib_Dual					End of binary Data Set containing the list of Calib_data records.	
	Data_Block					End of binary Data Block in the product.	

Table 4-31 Level 1A Dual Polarization Calibrated Visibilities Product Data Block

The Flags field #16 shall be used to report the results on the quality analysis of the data performed by the L1a module, such as RFI analysis. Since L1OP v6.20, the L1a RFI analysis is only done for the NIR CA channels. The flags are contained in an 8-bit counter, each bit representing a status, and they shall be described using the following order convention:

[MSB:X X X X:X X X X:LSB]

This fields contains the following flags:

- H pol RFI flag:
 - [X X X X:X X X 0] means that **no** RFI has been detected in the snapshot upon analysis of the NIR Brightness Temperatures or System Temperatures Standard Deviation in H polarisation
 - [X X X X:X X X 1] means that analysis of the NIR Brightness Temperatures or System Temperatures Standard Deviation has reported this snapshot as an outlier of the expected trend, which is a clear indicator of the presence of one or more RFI sources in the data



- H pol saturation RFI flag:
 - [X X X X:X X 0 X] means that **no** continuous RFI saturation has been detected in the snapshot upon analysis of the NIR Brightness Temperatures or System Temperatures Standard Deviation in H polarisation
 - [X X X X:X X 1 X] means that analysis of the NIR Brightness Temperatures or System Temperatures Standard Deviation has reported this snapshot as saturated in a sequence of more than 10 continuous snapshots
- H pol saturation gap RFI flag:
 - [X X X X:X 0 X X] means that this snapshot is **not** in the vicinity of a continuous RFI saturation in H polarisation
 - [X X X X:X 1 X X] means that this snapshot is in the range of ± 3 minutes from a continuous RFI saturation in H polarisation, and no RFI detection is possible in that range
- V pol RFI flag:
 - [X X X X:0 X X X] means that **no** RFI has been detected in the snapshot upon analysis of the NIR Brightness Temperatures or System Temperatures Standard Deviation in V polarisation
 - [X X X X:1 X X X] means that analysis of the NIR Brightness Temperatures or System Temperatures Standard Deviation has reported this snapshot as an outlier of the expected trend, which is a clear indicator of the presence of one or more RFI sources in the data
- V pol saturation RFI flag:
 - [X X X 0:X X X X] means that **no** continuous RFI saturation has been detected in the snapshot upon analysis of the NIR Brightness Temperatures or System Temperatures Standard Deviation in V polarisation
 - [X X X 1:X X X X] means that analysis of the NIR Brightness Temperatures or System Temperatures Standard Deviation has reported this snapshot as saturated in a sequence of more than 10 continuous snapshots
- V pol saturation gap RFI flag:
 - [X X 0 X:X X X X] means that this snapshot is **not** in the vicinity of a continuous RFI saturation in V polarisation
 - [X X 1 X:X X X X] means that this snapshot is in the range of ± 3 minutes from a continuous RFI saturation in V polarisation, and no RFI detection is possible in that range



4.2.3.2 Full Polarization Calibrated Visibilities (MIR_SC_F1A / MIR_TARF1A)

The full polarization calibrated visibilities are obtained after converting the full polarization L0 science packets into raw correlations and calibrating them.

Full polarisation products contain one set of complete visibilities for each snapshot.

4.2.3.2.1 Specific Product Header

The Specific Product Header for MIR_SC_F1A / MIR_TARF1A products are identical to the MIR_SC_D1A / MIR_TARD1A products (section 4.2.3.1.1).

4.2.3.2.2 Data Block

The binary Data Block of the MIR_SC_F1A product consists of one Measurement datasets, containing the calibrated visibilities and other supporting parameters. There is one DSR for the first integration time, either in HHH or VVV polarization modes; and three more DSR dedicated to the measurements obtained during second integration time (HVV, VHV and VVH; or VHH, HVH and HHV). This structure is applicable to any scene produced in [RD.1] full-polarisation, the only difference with regard to the dual-polarisation structure is that it includes a byte to determine the order of the scenes captured in the same integration time. It includes the System Temperatures for all receivers in the appropriate polarisations, as they all are used for de-normalisation.

The following table describes the XML schema used to decode the binary contents of this type of record. The tag element used to describe the DSR structure name in the XML schema shall be ***Calibrated_Visib_Full***.

- The ***Calibrated_Visib_Full*** data set consists of the complete set of calibrated visibilities obtained by processing Level 0 full polarization products. There shall be a complete Data Set Record for each complete snapshot, i.e. one per integration time for the pure polarisation acquisition and three per integration time for the combined polarisation acquisition, when pointing in the same direction during the half orbit (i.e. dual-pol measurements shall be separated in different products if they are observing the earth surface –nominal- or external sources –Moon, deep sky, etc.-). The first field in the dataset, ***Counter***, specifies the number of DSR contained in it, while the following fields are ***Counter*** repetitions of the ***Calib_Data*** dataset record structure. The size of each DSR is fixed and equal to 42481 bytes.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Calibrated_Visib_Full					Init of binary Data Set containing the list of Calib_data records.	
01	Calib_Data_Counter	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of Calib_data data set record structures.	Generated by L1 Processor.
	List_of_Calib_Datas					Init of list of Calib_data data set record structures, repeated Counter times. The number of DSR is twice the number of integration periods (one DSR for the first integration period, three DSR for the second integration period; all four DSR can be gathered in a full polarization scene).	
	Calib_Data					Init of Calib_Data data set record structure.	
02	Snapshot_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the scene was taken. Middle of integration time period, propagated from UTC at start of integration provided in ancillary packet. Expressed in EE CFI transport time format.	Copied from L1A HKTM product
03	Snapshot_ID	Identifier	N/A	unsigned integer (4 bytes)	1 element	Unique identifier for the snapshot. Formed by aggregation of orbit and time within orbit. Contents of this field are formed by: Absolute_orbit_number*10000 + Seconds_from_ANX	Generated by L1 Processor.
04	Snapshot_OBET	Time	N/A	bit stream (8	1 element (OBET	Unique identifier for the snapshot. Formed	Copied from



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
		counter		bytes) declared as unsigned long	Format is specified in section 4.2.1.2)	by the OBET at T_SYNC extracted from L0. Represents start of integration time in OBET format.	secondary header in input scene
05	Correlator_Layer	Character	N/A	char (1 byte)	1 element	Correlator layer from which the data was taken (NOMINAL='N' or REDUNDANT='R')	Copied from L1A HKTM product
06	Snapshot_Order	Identifier	N/A	Char (1 byte)	1 element	Order within the same integration time (OBET) in which this scene was taken ('0' for HHH or VVV, '1', '2', or '3' for the combined polarisations).	Generated by L1 Processor.
07	Receiver_Temp	Array of real values	K	Float (4 bytes)	Vector array of 72 elements (order followed is described in last paragraph of 4.2.3.1)	Physical temperature of receivers in Kelvin. One value per receiver.	Generated by L1 Processor. Based on L1A HKTM product
08	Sys_Temp	Array of real values	K	Float (4 bytes)	Vector array of 72 elements (order followed is described in last paragraph of 4.2.3.1)	System temperature of receivers in respective polarisation (field #11), used for de-normalisation of visibilities, expressed in Kelvin. One value per receiver.	Generated by L1 Processor.
09	Receiver_Noise_Temp	Array of real values	K	Float (4 bytes)	Vector array of 72 elements (one value per receiver, order followed is described in last paragraph of 4.2.3.1)	LICEF Noise Temperature in respective polarisation (field #11), expressed in Kelvin.	Generated by L1 Processor.
10	NIR_Brightness_Temp	Real value	K	Double (8 bytes)	Vector array of 12 elements. Four values (H, V, T3 and T4) per receiver.. Order followed is AB-H, AB- V, AB-T3, AB-T4, BC-H, BC-V, BC-T3, BC-T4, CAH, CA-V, CA-T3 and CA-T4.	Brightness temperatures measured at NIR elements in mKelvin. To be used as "zero baseline" for reconstruction process. (Please note that T3 and T4 are Stokes parameters in XY basis, so they should be divided by 2 if used as zero baseline)	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
11	LICEF_Brightness_Temp	Real value	K	Double (8 bytes)	Vector array of 72 elements (order followed is described in last paragraph of 4.2.3.1)	Brightness temperatures measured at LICEF elements in mKelvin. To be used in the reconstruction process.	Generated by L1 Processor.
12	Pol_Mode	Set of flags	N/A	unsigned byte	1 element (3 bits are used)	Polarisation mode in receivers, as described in field #11 of CALIBRATED_VISIB_DUAL (HHH=000, HVV=011, VHV=101, VVH=110, VVV=111, VHH=100, HVH=010, HHV=001)	Generated by L1 Processor. Based on L1A HKTM product
13	Calib_Visib	Array of complex values	N/A	Double (real part) + double (imag part), totally 16 bytes	71*36 elements. Order followed s depicted in Figure 4-1	Complex calibrated visibilities in all measured baselines (including redundant).	Generated by L1 Processor.
14	Antenna_Boresight	Array of real values	deg	Float (4bytes)	2 elements	<p>In case of MIR_SC_F1A:</p> <ul style="list-style-type: none"> First element is Latitude of Earth surface point in the snapshot's boresight direction. Second element is Longitude of Earth surface point in the snapshot's boresight direction. <p>In case of MIR_TARF1A:</p> <ul style="list-style-type: none"> First element is Right Ascension in the snapshot's boresight direction (coordinates reference system is B1950). Second element is Declination in the snapshot's boresight direction (coordinates reference system is B1950). 	Generated by L1 Processor.
15	Max_Mkj_module	Double	N/A	8 bytes	1 element	Maximum value of the module of the Normalised QuadratureCorrected Correlation	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
16	<i>X-Band</i>	Integer	N/A	Unsigned 1 byte	1 element	0 if X-Band Transmitter OFF 1 if X-Band Transmitter ON (Nominal side) 2 if X-Band Transmitter ON (Redundant side) 3 if X-Band Transmitter ON (Nominal and Redundant side)	Generated by L1 Processor.
17	<i>RFI_Flags</i>	Set of flags	N/A	unsigned byte	1 element	L1a flags applicable to the scene for this particular integration time. The complete flags in the available byte are specified in the previous section	Generated by L1 Processor.
	<i>Quality_Information</i>					Init of <i>Quality_Information</i> structure.	
18	<i>Software_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See Appendix B for details.	Generated by L1 Processor.
19	<i>Instrument_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See Appendix B for details.	Generated by L1 Processor.
20	<i>ADF_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See Appendix B for details.	Generated by L1 Processor.
21	<i>Calibration_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See Appendix B for details.	Generated by L1 Processor.
	<i>Quality_Information</i>					End of <i>Quality_Information</i> structure.	
	<i>Calib_Data</i>					End of <i>Calib_Data</i> data set record structure.	
	<i>List_of_Calib_Datas</i>					End of list of <i>Calib_data</i> data set record structures.	
	<i>Calibrated_Visib_Full</i>					End of binary Data Set containing the list of <i>Calib_data</i> records.	
	<i>Data_Block</i>					End of binary Data Block in the product.	

Table 4-32 Level 1A Full Polarization Calibrated Visibilities Product Data Block



4.2.4 L1B Data Specification

L1B Data are the products obtained in science measurement mode (either pointing to the earth –nominal- or to external sources), starting from L1A calibrated visibilities and performing a correction for contamination sources and an image reconstruction.

To perform the corrections and reconstruction, the L1B processors need supporting calibration data derived from MIRAS measurements (presented in section 4.2.4.1): the G Matrix or Instrument System Response, its mathematical reduction the J+ Matrix, and the Flat Target Transformation product.

4.2.4.1 L1B Calibration products

4.2.4.1.1 Specific Product Header

The Specific Product Header for Level 1B Calibration products shall follow the format described in section 4.1.2 and shall include the following information:

- Level 1 Main Info SPH
- Level1 SPH Data Sets

Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	<i>Specific_Product_Header</i>	Starting Tag				Tag starting the Specific Product Header structure	
02-19	<i>Main_Info</i>	structure	N/A	N/A	N/A	Main Product Info structure's fields as defined in fields 01 to 16 in Table 4-3	
20-26	<i>Quality_Information</i>	structure	N/A	N/A	N/A	Quality_Information structure's fields as defined in Table 4-4	
27-38	<i>Data_Sets</i>	structure	N/A	N/A	N/A	Data Sets structure's fields as defined in Table 4-5	N/A



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
39	<i>Specific_Product_Header</i>	Closing Tag				Tag ending the Specific Product Header structure	

Table 4-33 Level 1B Calibration Products SPH

4.2.4.1.2 G Matrix (MIR_GMATD_)

The MIR_GMATD_ product consists of 1 dataset containing the instrument's system response values, with 15996 data set record (the rows of the G Matrix), each DSR with 153664 values. The binary format of the matrix is specified in 4.20 in [RD.2].

Initially the **G-matrix** shall be defined as the mathematical operator required to transform the complex calibrated visibilities plus the zero frequency value measured through the NIR elements, into reconstructed Brightness Temperature values.

The complete system can be described by a unique G matrix, which takes as input the data produced in all polarisations (H, V and HV). This unique G matrix includes the effect of cross-polarisation antenna patterns into the reconstruction. This G matrix format is the same for all reconstruction methods; the only difference between reconstruction approaches lies in the external elements used to construct it.

The purpose of this matrix (or matrices) is to be used for computation of the J+ matrix operator, which is described in the next chapter.

4.2.4.1.2.1 Specific Product Header

The header of the MIR_GMATD_ product contains the FH, MPH and the SPH as defined in Table 4-29

The reference data sets for MIR_GMATD_Data Type are:



Reference Data Set Name	Product Type	Description
L1A_AVER_FWF_CAL_FILE	MIR_AFWD1A	L1a Average Fringe Washing Function estimated coefficients used in the computation of the reconstruction G Matrix
PLM_FILE	AUX_PLM___	Auxiliary file with PLM characterisation, defining receiver's physical coordinates
ANTENNA_PATTERNS_FILE	AUX_PATT__	Auxiliary file with receivers' amplitude and phase pattern characterisation used for generation of the G reconstruction matrix
ALGORITHM_CONFIG_FILE	AUX_CNFL1P	Processor Configuration Parameters and Constants for L1OP

Table 4-34 G Matrix Reference Data Sets

The following are the rules to update the counters in the SPH General Quality Information structure:

Counter Name	Condition
Software_Error_Counter	Copy the Software_Error_Counter from the input MIR_AFWx1A file. No additional software error condition are defined in Appendix B for this product.
Instrument_Error_Counter	Copy the Instrument_Error_Counter from the input MIR_AFWx1A file. No additional instrument error condition are defined in Appendix B for this product
ADF_Error_Counter	Add one to the ADF error counter of the input MIR_AFWx1A product in case an ADF error is detected during the G-matrix generation. Conditions for ADF error in the correlated processing are given in details in Appendix B
Calibration_Error_Counter	Add one to the Calibration error counter of the input MIR_AFWx1A product in case a Calibration error is detected during the G-matrix generation. Conditions for ADF error in the correlated processing are given in details in Appendix B
N_Discarded_Scenes	Copy the N_Discarded_Scenes from the input MIR_AFWx1A file.



4.2.4.1.2.2 Data Block

As written in 4.22 in [RD.2], the MIR_GMATD_product consists of 1 dataset containing the instrument's system response values, with 15996 data set record (the rows of the G Matrix), each DSR with 153664 values.

The binary format of the matrix is specified following. Rows in the G matrix shall be ordered as follows:

- The first $2346 \times 2 + 3$ rows shall correspond to H polarisation calibrated visibilities
- The next $2346 \times 2 + 3$ rows shall correspond to V polarisation calibrated visibilities
- The final 3303×2 rows shall correspond to HV polarisation calibrated visibilities

Going into further detail:

- The first 3 rows shall correspond to the zero baselines as measured from the NIR for H polarisation. Order shall be first NIR_AB, then NIR_BC and last NIR_CA
- The next 2346 rows shall correspond to the real values of the H polarisation calibrated visibilities as received from the L1a products, and ordered in the same approach as shown in Figure 4-1, i.e. first element shall be calibrated visibility of LICEF_AB_03 against LICEF_AB_01_H, next shall be LICEF_AB_03 against LICEF_A_01, etc... until the sixty ninth element LICEF_AB_03 against LICEF_C_21. The next element shall then be LICEF_AB_01_H against LICEF_A_01, and so on until LICEF_AB_01 against LICEF_C_21. The next shall be LICEF_A_01 against LICEF_A_02, etc. until LICEF_A_02 against LICEF_C_21. This ordering shall continue until all LICEF correlations have been inserted, and not including correlations with LICEF_NIR in V polarisation (i.e. correlations with receivers LICEF_AB_01_V, LICEF_BC_01_V and LICEF_CA_01_V).
- The next 2346 rows shall correspond to the imaginary values of the H polarisation calibrated visibilities, following the same order as above.
- The next 3 rows shall correspond to the zero baselines as measured from the NIR for V polarisation. Order shall be first NIR_AB, then NIR_BC and last NIR_CA



- The next 2346 rows shall correspond to the real values of the V polarisation calibrated visibilities as received from the L1a products, and ordered in the same approach as shown in Figure 4-1, i.e. first element shall be calibrated visibility of LICEF_AB_03 against LICEF_AB_01_V, next shall be LICEF_AB_03 against LICEF_A_01, etc... until the sixty ninth element LICEF_AB_03 against LICEF_C_21. The next element shall then be LICEF_AB_01_V against LICEF_A_01, and so on until LICEF_AB_01 against LICEF_C_21. The next shall be LICEF_A_01 against LICEF_A_02, etc. until LICEF_A_02 against LICEF_C_21. This ordering shall continue until all LICEF correlations have been inserted, and not including correlations with LICEF_NIR in H polarisation (i.e. correlations with receivers LICEF_AB_01_H, LICEF_BC_01_H and LICEF_CA_01_H). Please refer to Figure 4-1 for a visual representation of the order followed.
- The next 2346 rows shall correspond to the imaginary values of the V polarisation calibrated visibilities, following the same order as above.
- The next 3303 rows shall correspond to the real values of the HV polarisation calibrated visibilities as received from the L1a products, and ordered in the following approach. Please refer to Figures 10 and 11 of [RD.13] (orange cells) for a visual representation of the description:
 - First 528 rows with calibrated visibilities of elements in Arm A in H polarisation against elements in Arm B in V polarisation. I.e. first LICEF_AB_03 against LICEF_BC_03, then LICEF_AB_03 against LICEF_BC_01_V, then LICEF_AB_03 against LICEF_B_01, until the 23rd element LICEF_AB_03 against LICEF_B_21. Next is LICEF_AB_01_H against LICEF_BC_03, then LICEF_AB_01_H against LICEF_B_01, and so on until all elements in arm B are correlated with LICEF_AB_01_H (please note that this row does not include the correlation against LICEF_BC_01_V). This ordering continues until the last element correlated is LICEF_A_21 against LICEF_B_21.
 - Next 528 rows with calibrated visibilities of elements in arm A in H polarisation against elements in arm C in V polarisation. Same order as above, i.e. first LICEF_AB_03 against LICEF_CA_03, then LICEF_AB_03 against LICEF_CA_01_V, then LICEF_AB_03 against LICEF_C_01, until the 23rd element LICEF_AB_03 against LICEF_C_21. Next is LICEF_AB_01_H against LICEF_CA_03, then LICEF_AB_01_H against LICEF_C_01, and so on until all elements in arm C are correlated with LICEF_AB_01_H (please note that this row does not include the correlation against LICEF_CA_01_V). This ordering continues until the last element correlated is LICEF_A_21 against LICEF_C_21.



- Next 528 rows with calibrated visibilities of elements in arm B in H polarisation against elements in arm A in V polarisation. Same order as above, i.e. first LICEF_BC_03 against LICEF_AB_03, then LICEF_BC_03 against LICEF_AB_01_V, then LICEF_BC_03 against LICEF_A_01, until the 23rd element LICEF_BC_03 against LICEF_A_21. Next is LICEF_BC_01_H against LICEF_AB_03, then LICEF_BC_01_H against LICEF_A_01, and so on until all elements in arm A are correlated with LICEF_BC_01_H (please note that this row does not include the correlation against LICEF_AB_01_V). This ordering continues until the last element correlated is LICEF_B_21 against LICEF_A_21.
- Next 528 rows with calibrated visibilities of elements in arm B in H polarisation against elements in arm C in V polarisation. Same order as above, i.e. first LICEF_BC_03 against LICEF_CA_03, then LICEF_BC_03 against LICEF_CA_01_V, then LICEF_BC_03 against LICEF_C_01, until the 23rd element LICEF_BC_03 against LICEF_C_21. Next is LICEF_BC_01_H against LICEF_CA_03, then LICEF_BC_01_H against LICEF_C_01, and so on until all elements in arm C are correlated with LICEF_BC_01_H (please note that this row does not include the correlation against LICEF_CA_01_V). This ordering continues until the last element correlated is LICEF_B_21 against LICEF_C_21.
- Next 528 rows with calibrated visibilities of elements in arm C in H polarisation against elements in arm A in V polarisation. Same order as above, i.e. first LICEF_CA_03 against LICEF_AB_03, then LICEF_CA_03 against LICEF_AB_01_V, then LICEF_CA_03 against LICEF_A_01, until the 23rd element LICEF_CA_03 against LICEF_A_21. Next is LICEF_CA_01_H against LICEF_AB_03, then LICEF_CA_01_H against LICEF_A_01, and so on until all elements in arm A are correlated with LICEF_CA_01_H (please note that this row does not include the correlation against LICEF_AB_01_V). This ordering continues until the last element correlated is LICEF_C_21 against LICEF_A_21.
- Next 528 rows with calibrated visibilities of elements in Arm C in H polarisation against elements in Arm B in V polarisation. Same order as above, i.e. first LICEF_CA_03 against LICEF_BC_03, then LICEF_CA_03 against LICEF_BC_01_V, then LICEF_CA_03 against LICEF_B_01, until the 23rd element LICEF_CA_03 against LICEF_B_21. Next is LICEF_CA_01_H against LICEF_BC_03, then LICEF_CA_01_H against LICEF_B_01, and so on until all elements in arm B are correlated with LICEF_CA_01_H (please note that this row does not include the correlation against LICEF_BC_01_V). This ordering continues until the last element correlated is LICEF_C_21 against LICEF_B_21.
- Next 23 rows with calibrated visibilities of LICEF_AB_01_H against all other receivers in arm A in V polarisation. I.e. LICEF_AB_01_H against LICEF_AB_03, LICEF_AB_01_H against LICEF_AB_01_V, LICEF_AB_01_H against LICEF_A_01, etc... until LICEF_AB_01_H against LICEF_A_21



- Next 22 rows with calibrated visibilities of all receivers in arm A in H polarisation against LICEF_AB_01_V, excluding LICEF_AB_01_H against LICEF_AB_01_V, whose equation is presented in the point above. I.e. LICEF_AB_03 against LICEF_AB_01_V, LICEF_A_01 against LICEF_AB_01_V, etc... until LICEF_A_21 against LICEF_AB_01_V
- Next 23 rows with calibrated visibilities of LICEF_BC_01_H against all other receivers in arm B in V polarisation. I.e. LICEF_BC_01_H against LICEF_BC_03, LICEF_BC_01_H against LICEF_BC_01_V, LICEF_BC_01_H against LICEF_B_01, etc... until LICEF_BC_01_H against LICEF_B_21
- Next 22 rows with calibrated visibilities of all receivers in arm B in H polarisation against LICEF_BC_01_V, excluding LICEF_BC_01_H against LICEF_BC_01_V, whose equation is presented in the point above. I.e. LICEF_BC_03 against LICEF_BC_01_V, LICEF_B_01 against LICEF_BC_01_V, etc... until LICEF_B_21 against LICEF_BC_01_V
- Next 23 rows with calibrated visibilities of LICEF_CA_01_H against all other receivers in arm C in V polarisation. I.e. LICEF_CA_01_H against LICEF_CA_03, LICEF_CA_01_H against LICEF_CA_01_V, LICEF_CA_01_H against LICEF_C_01, etc... until LICEF_CA_01_H against LICEF_C_21
- Next 22 rows with calibrated visibilities of all receivers in arm C in H polarisation against LICEF_CA_01_V, excluding LICEF_CA_01_H against LICEF_CA_01_V, whose equation is presented in the point above. I.e. LICEF_CA_03 against LICEF_CA_01_V, LICEF_C_01 against LICEF_CA_01_V, etc... until LICEF_C_21 against LICEF_CA_01_V
- The following and last 3303 rows shall correspond to the imaginary values of the HV polarisation calibrated visibilities as received from the L1a products, and ordered in the approach that has been just described.

Columns in the G matrix shall be ordered in the following way:

- The first 196x196 columns shall correspond to H polarisation Brightness Temperatures
- The next 196x196 columns shall correspond to V polarisation Brightness Temperatures
- The next 196x196 columns shall correspond to the real components of the HV polarisation Brightness Temperatures
- The final 196x196 columns shall correspond to the imaginary components of the HV polarisation Brightness Temperatures

Going into more detail, each distribution of 196x196 elements shall correspond to the SMOS natural hexagonal grid represented in a rectangular matrix. The centre (0,0) shall be the first element of the distribution. The following figures show the resulting xi-eta distribution of values for a 196x196 Brightness Temperature scene using steering 30° of MIRAS instrument:

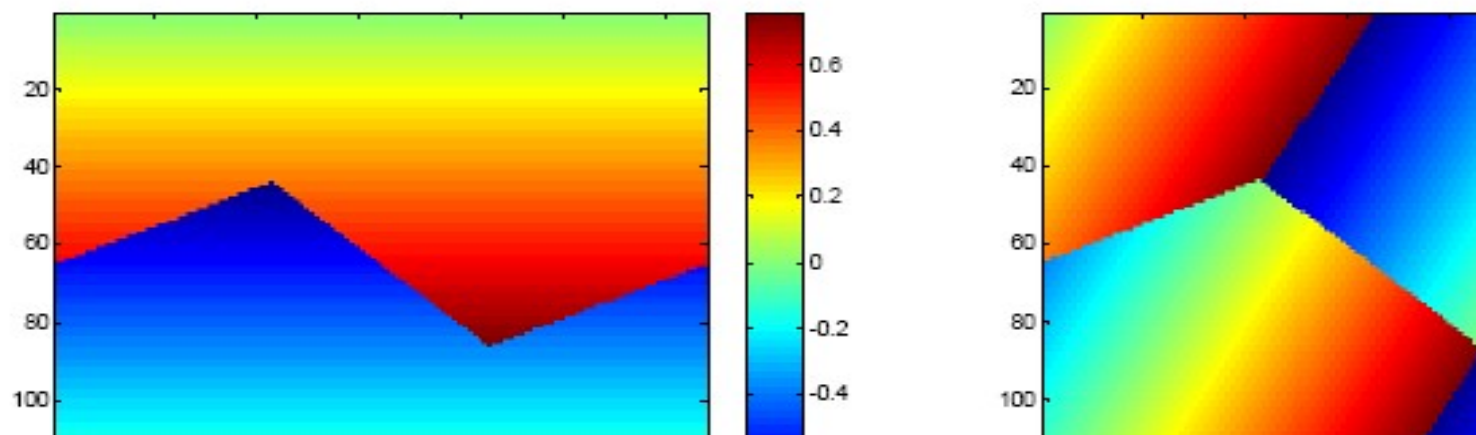


Figure 4-2 XI (left image) and ETA (right image) coordinates proposed for the G Matrix format (taken from Deimos Eng., L1PP ADF format)

The distribution of 196x196 elements shall be arranged in a vector form of 38416 elements, placing elements row after row, as opposed to Matlab that represents them column after column.

The size of the **MIR_GMATD_** product data block is then $15996 \times 153664 \times 8 = 19664074752$, about 18.31 GB. The following table describes the binary format of the **MIR_GMATD_** data block.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>Data_Block</i>					Init of binary Data Block in the product.	
	<i>G_Matrix</i>					Init of binary Data Set containing the G-Matrix elements.	
	<i>List_of_GMatrix_Rows</i>					Init of list of GMatrix_Row structures. There shall be 15996 DSR.	
	<i>GMatrix_Row</i>					Init of GMatrix_Row DSR structure.	
01	<i>G_Coefficients</i>	Array of real values	N/A	Double (8 bytes)	65536 elements	Individual coefficients for the G Matrix row contained in a 153664real valued vector.	Generated by L1 Processor.
	<i>GMatrix_Row</i>					End of GMatrix_Row DSR structure.	
	<i>List_of_GMatrix_Rows</i>					End of list of GMatrix_Row structures.	
	<i>G_Matrix</i>					End of binary Data Set containing the G-Matrix elements.	
	<i>Data_Block</i>					End of binary Data Block in the product.	

Table 4-35 G Matrix Product Data Block

4.2.4.1.3 J+ Matrix (MIR_JMATD_)

As is written in section 4.23 in [RD.2], this matrix shall represent the mathematical reduction of the previous G matrix in order to obtain Brightness Temperatures frequencies. It represents the System Response Function of the instrument transforming Calibrated Visibilities plus the zero frequency value measured through the NIR elements into Brightness Temperature Frequencies.



This is the matrix that shall be inverted to complete the Image Reconstruction process. Regardless of how the G matrix is built, the size of the Brightness Temperature grid, or what modelling it has used, its reduction into the J matrix shall always have the same format and size.

The data that shall be stored in this product format shall be the inverted J, which is called J+.

However, the number of columns is now dependant on the u,v frequency domain, and is restricted to the number of non-redundant correlations that the instrument shall be measuring. For MIRAS, the number of nonredundant visibilities is 2791, forming a star shape in the u,v plane, and is only dependant on the number of receivers per arm and the Y shape of the instrument.

Thus, the number of columns for this matrix shall be 11164. This number comes from 1395 complex elements plus one real element that is measured for H or V polarisation, plus 2791 complex elements measured for HV polarisation. Again, the total size of the matrix is dependant on the level of coupling between polarisations through the cross-polarisation antenna patterns. If they can be considered negligible, the J matrix can be split into three separate and independent matrices, one for each polarisation.

4.2.4.1.3.1 Specific Product Header

The header of the MIR_JMATD_ product contains the FH, MPH and the SPH as defined in Table 4-29.

The reference data sets for MIR_JMATD_ Data Type are:

Reference Data Set Name	Product Type	Description
L1A_AVER_FWF_CAL_FILE	MIR_AFWD1A	L1a Average Fringe Washing Function estimated coefficients used in the computation of the reconstruction G Matrix
PLM_FILE	AUX_PLM____	Auxiliary file with PLM characterisation, defining receiver's physical coordinates
ANTENNA_PATTERNS_FILE	AUX_PATT__	Auxiliary file with receivers' amplitude and phase pattern characterisation used for generation of the G reconstruction matrix
WEIGHT_VECTOR_FILE	AUX_BWGHT_	Auxiliary product containing the weight vector to be used in the J+ generation
FAILURES_FILE	AUX_FAIL__	Auxiliary file with failure of components to be taken into account during J+ generation
ALGORITHM_CONFIG_FILE	AUX_CNFL1P	Processor Configuration Parameters and Constants for L1OP

Table 4-36 J Matrix Reference Data Sets



The following are the rules to update the counters in the SPH General Quality Information structure:

Counter Name	Condition
Software_Error_Counter	Copy the Software_Error_Counter from the input MIR_GMATx file. No additional software error condition are defined in Appendix B for this product.
Instrument_Error_Counter	Copy the Instrument_Error_Counter from the input MIR_GMATx file. No additional instrument error condition are defined in Appendix B for this product.
ADF_Error_Counter	Copy the ADF_Error_Counter from the input MIR_GMATx file.
Calibration_Error_Counter	Copy the Calibration_Error_Counter from the input MIR_GMATx file.
N_Discarded_Scenes	Copy the N_Discarded_Scenes from the input MIR_GMATx file.

4.2.4.1.3.2 Data Block

The **MIR_JMATD**_ product consists of 1 dataset **J_Matrix** containing the mathematical reduction of the G matrix, with 11164 data set record (the rows of the J+ Matrix), each DSR with 15996 values.

Therefore the total size of the **MIR_JMATD**_ product is $11164 \times 15996 \times 8 = 1428634752$, about 1.33 GB. The following table describes the binary format of the **MIR_JMATD**_ data block.

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	J_Matrix					Init of binary Data Set containing the J-Matrix elements.	
	List_of_JMatrix_Rows					Init of list of JMatrix_Row structures. There shall	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
						be 11164 DSR.	
	<i>JMatrix_Row</i>					Init of <i>JMatrix_Row</i> DSR structure.	
01	<i>J_Coefficients</i>	Array of real values	N/A	Double (8 bytes)	15996 elements	Individual coefficients for the J^+ Matrix row, contained in a 15996 real valued vector.	Generated by L1 Processor.
	<i>JMatrix_Row</i>					End of <i>JMatrix_Row</i> DSR structure.	
	<i>List_of_JMatrix_Rows</i>					End of list of <i>JMatrix_Row</i> structures.	
	<i>J_Matrix</i>					End of binary Data Set containing the J-Matrix elements.	
	<i>Data_Block</i>					End of binary Data Block in the product.	

Table 4-37 J Matrix Product Data Block

4.2.4.1.4 Flat Target Transformation in Dual Polarization (MIR_FTTD__)

As is written in section 4.26 of [RD.2], this product simply contains the averaged correlations measured for H and V polarisations during deep sky observation. These correlations shall be subtracted from any L1a measurement product in order to apply the Flat Target Transformation before Image Reconstruction.



4.2.4.1.4.1 Specific Product Header

The header of the MIR_FTTD__ product contains the FH, MPH and the SPH as defined in Table 4-29.

The specific reference data sets for MIR_FTTD__ Data Type are:

Reference Data Set Name	Product Type	Description
L1A_HKTM_FILE	TLM_MIRA1A	HKTM filename containing the S/C position and attitude for the snapshots
L1A_FILE	MIR_TARD1A	L1a Calibrated Visibilities filename obtained in External Target Observation
PLM_FILE	AUX_PLM__	Auxiliary file with PLM characterisation, defining receiver's physical coordinates
GALAXY_NIR_FILE	AUX_GALNIR	Galaxy Map convoluted with NIR used for generation of the Ideal Sky visibilities
GALAXY_FILE	AUX_GALAXY	Original Galaxy Map used for generation of the Ideal Sky visibilities
MISPOINTING_ANGLES_FILE	AUX_MISP__	Auxiliary product containing the mispointing angles between the Body Frame referenced in the Proteus quaternions and the Antenna Plane defined by the MIRAS instrument
BEST_FIT_PLANE_FILE	AUX_BFP__	Auxiliary file with definition of Best Fit Plane to be used during geolocation in L1c
ALGORITHM_CONFIG_FILE	AUX_CNFL1P	Processor Configuration Parameters and Constants for L1OP
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Mission planning file used to initialise the EE CFI orbit_id and/or time_id. It is read and used by the EE CFI.
BULLETIN_B_FILE	AUX_BULL_B	IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation

Table 4-38 Flat Target Transformation Reference Data Sets



The following are the rules to update the counters in the SPH General Quality Information structure:

Counter Name	Condition
Software_Error_Counter	Sum for all the FTT_data set the software error counters in the quality information structure.
Instrument_Error_Counter	Sum for all the FTT data set the instrument error counters in the quality information structure.
ADF_Error_Counter	Sum for all the FTT data set the ADF error counters in the quality information structure.
Calibration_Error_Counter	Sum for all the FTT data set the Calibration error counters in the quality information structure.
N_Discarded_Scenes	Count all the L1a external target snapshot discarded in the generation of all the FTT data set due to missing corresponding HKTM L1a snapshots or L1a snapshot discarded in the case of missing sequences in the Full polarization mode.

4.2.4.1.4.2 Data Block

This MIR_FTTD__ product's binary datablock shall contain a unique data set **Flat_Target_Transformation** with several data set records. The information in these DSR shall be defined as the complete set of correlation values averaged in the external target observation interval. The order of the visibilities vectors presented above shall be the same as the one presented for the rows of the G matrix in section 4.2.4.1.2.2.

The size of a DSR is 225410 bytes. There may be several DSR in the dataset, and here we assume 10 in order to make size calculations, so the datablock would have 2,15 MB. The **MIR_FTTD__** product's data block specification is as follows.

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Flat_Target_Transformation					Init of binary Data Set containing the Flat Target Transformation data.	
01	FTT_Data_Counter	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of FTT_Data data set record structures.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	List_of_FTT_Datas					Start of list of FTT_Data structures.	
	FTT_Data					Start of FTT_Data structure.	
02	Start_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the Sky Observation sequence was started. Expressed in EE CFI transport time format	Copied from L1A product Snapshot_time field for first DSR used in the generation of FTT product
03	Stop_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the Sky Observation sequence was finished. Expressed in EE CFI transport time format	Copied from L1A product Snapshot_time field for last DSR used in the generation of FTT product
04	Number_of_Epochs	Integer	Epochs	Unsigned integer (2 bytes)	1 element	Number of epochs used in the average statistics below.	Generated by L1 Processor.
05	Number_of_Epochs_HH	Integer	Epochs	Unsigned integer (2 bytes)	1 element	Number of epochs used in the average statistics below for data measured in HH polarization only.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
06	<i>Number_of_Epochs_VV</i>	Integer	Epochs	Unsigned integer (2 bytes)	1 element	Number of epochs used in the average statistics below for data measured in VV polarization only.	Generated by L1 Processor.
07	<i>Averaged_Receiver_Temp</i>	Real value	K	Float (4 bytes)	1 element	Averaged physical temperature of receivers during whole period, expressed in Kelvin.	Generated by L1 Processor. Averaging of physical temperatures matrix obtained from L1 HKTM
08	<i>Receiver_Temp</i>	Array of real values	K	Double (8 bytes)	Vector array of 72 elements (order followed is described in last paragraph of 4.2.3.1)	Physical temperature of receivers in Kelvin. One value per receiver.	Generated by L1 Processor. Based on L1A HKTM product
09	<i>Averaged_NIR_Brightness_Temp</i>	Real value	K	Double (8 bytes)	Vector array of 6 elements ordered like [NIR_AB_H, NIR_AB_V, NIR_BC_H, NIR_BC_V, NIR_CA_H, NIR_CAV]	Averaged Brightness Temperatures measured at each NIR element, expressed in Kelvin. Two values (H and V) per receiver. Averaging is performed only over each NIR element.	Generated by L1 Processor, by averaging the NIR brightness temperatures obtained from the L1 HKTM



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
10	<i>Averaged_FTT_Visib_H</i>	Array of complex values	N/A	Double (real part) + double (imag part), totally 16 bytes	Vector array of 69*34 elements	Averaged complex calibrated correlations in H polarisation for all baselines (including redundant, but excluding LICEF-NIR correlations in cross-polarisation).	Generated by L1 Processor, by averaging the L1A product H-pol Calibrated Visibilities
11	<i>Averaged_FTT_Visib_V</i>	Array of complex values	N/A	Double (real part) + double (imag part), totally 16 bytes	Vector array of 69*34 elements	Averaged complex calibrated correlations in V polarisation for all baselines (including redundant, but excluding LICEF-NIR correlations in cross-polarisation).	Generated by L1 Processor, by averaging the L1A product V-pol Calibrated Visibilities
12	<i>Sky_Brightness_Temp_H</i>	Real value	K	Double (8 bytes)	1 element	Sky Expected Temperature in respective polarisation expressed in Kelvin and computed as the average in the front unit circle	Generated by L1 Processor.
13	<i>Sky_Brightness_Temp_V</i>	Real value	K	Double (8 bytes)	1 element	Sky Expected Temperature in respective polarisation expressed in Kelvin and computed as the average in the front unit circle	Generated by L1 Processor.
14	<i>Ideal_Sky_NIR_Brightness_Temp</i>	Real value	K	Double (8 bytes)	Vector array of 6 elements (ordered like [NIR_AB_H, NIR_AB_V, NIR_BC_H, NIR_BC_V, NIR_CA_H, NIR_CAV])	Brightness temperatures measured at each NIR element for an ideal Sky scene, expressed in Kelvin. Two values (H and V) per receiver. This field is set to 0 in DPGS-V3 baseline.	AUX_GALNIR



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
15	<i>Ideal_Sky_Visib_H</i>	Array of complex values	N/A	Double (real part) + double (imag part), totally 16 bytes	Vector array of 69*34 elements	Ideal Instrument visibilities of the Sky in H polarisation for all baselines (including redundant, but excluding LICEF-NIR correlations in cross-polarisation). This field is set to 0 in DPGS-V3 baseline.	Generated by L1 Processor.
16	<i>Ideal_Sky_Visib_V</i>	Array of complex values	N/A	Double (real part) + double (imag part), totally 16 bytes	Vector array of 69*34 elements	Ideal Instrument visibilities of the Sky in V polarisation for all baselines (including redundant, but excluding LICEF-NIR correlations in cross-polarisation). This field is set to 0 in DPGS-V3 baseline.	Generated by L1 Processor.
17	<i>Ideal_Uniform_NIR_Brightness_Temp</i>	Real value	K	Double (8 bytes)	Vector array of 6 elements (ordered like [NIR_AB_H, IR_AB_V, NIR_BC_H, NIR_BC_V, NIR_CA_H, NIR_CAV])	Brightness temperatures measured at each NIR element for a uniform 1K scene, expressed in Kelvin. Two values (H and V) per receiver. This field is set to 0 in DPGS-V3 baseline.	Generated by L1 Processor.
18	<i>Ideal_Uniform_Visib_H</i>	Array of complex values	N/A	Double (real part) + double (imag part), totally 16 bytes	Vector array of 69*34 elements	Ideal Instrument visibilities of a uniform 1Kelvin scene in H polarisation for all baselines (including redundant, but excluding LICEF-NIR correlations in cross-polarisation). This field is set to 0 in DPGS-V3 baseline.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
19	<i>Ideal_Uniform_Visib_V</i>	Array of complex values	N/A	Double (real part) + double (imag part), totally 16 bytes	Vector array of 69*34 elements	Ideal Instrument visibilities of a uniform 1Kelvin scene in V polarisation for all baselines (including redundant, but excluding LICEF-NIR correlations in cross-polarisation). This field is set to 0 in DPGS-V3 baseline.	Generated by L1 Processor.
	<i>Quality_Information</i>					Init of <i>Quality_Information</i> structure.	
20	<i>Software_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for sw error in the FTT processing are given in details in Appendix B	Generated by L1 Processor.
21	<i>Instrument_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for instrument error in the FTT processing are given in details in Appendix B	Generated by L1 Processor.
22	<i>ADF_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	The detailed list of ADF error detected by the L1OP V3 for the FTT processing stage is given in Appendix B	Generated by L1 Processor.
23	<i>Calibration_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	The detailed list of Calibration error detected by the L1OP V3 for the FTT processing stage is given in Appendix B	Generated by L1 Processor.
	<i>Quality_Information</i>					End of <i>Quality_Information</i> structure.	
	<i>FTT_Data</i>					End of <i>FTT_Data</i> structure.	
	<i>List_of_FTT_Datas</i>					End of list of <i>FTT_Data</i> structures.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>Flat_Target_Transformation</i>					End of binary Data Set containing the Flat Target Transformation data.	
	<i>Data_Block</i>					End of binary Data Block in the product.	

Table 4-39 Flat Target Transformation Dual Polarization Product Data Block

4.2.4.1.5 Flat Target Transformation in Full Polarization (MIR_FTTF__)

As is written in section 4.26 of [RD.2], this product simply contains the averaged correlations measured for all polarisations during deep sky observation. These correlations shall be subtracted from any L1a measurement product in order to apply the Flat Target Transformation before Image Reconstruction.

4.2.4.1.5.1 Specific Product Header

The header of the MIR_FTTF__ product contains the FH, MPH and the SPH as defined in Table 4-29.

The specific reference data sets for MIR_FTTF_ Data Type are:

Reference Data Set Name	Product Type	Description
L1A_HKTM_FILE	TLM_MIRA1A	HKTM filename containing the S/C position and attitude for the snapshots
L1A_FILE	MIR_TARF1A	L1a Calibrated Visibilities filename obtained in External Target Observation
PLM_FILE	AUX_PLM__	Auxiliary file with PLM characterisation, defining receiver's physical coordinates



Reference Data Set Name	Product Type	Description
GALAXY_NIR_FILE	AUX_GALNIR	Galaxy Map convoluted with NIR used for generation of the Ideal Sky visibilities
GALAXY_FILE	AUX_GALAXY	Original Galaxy Map used for generation of the Ideal Sky visibilities
MISPOINTING_ANGLES_FILE	AUX_MISP__	Auxiliary product containing the mispointing angles between the Body Frame referenced in the Proteus quaternions and the Antenna Plane defined by the MIRAS instrument
BEST_FIT_PLANE_FILE	AUX_BFP__	Auxiliary file with definition of Best Fit Plane to be used during geolocation in L1c
ALGORITHM_CONFIG_FILE	AUX_CNFL1P	Processor Configuration Parameters and Constants for L1OP
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Mission planning file used to initialise the EE CFI orbit_id and/or time_id. It is read and used by the EE CFI.
BULLETIN_B_FILE	AUX_BULL_B	IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation

Table 4-40 Flat Target Transformation Reference Data Sets

4.2.4.1.5.2 Data Block

This MIR_FTTF_ product's binary datablock shall contain a unique data set ***Flat_Target_Transformation*** with several data set records. The information in these DSR shall be defined as the complete set of correlation values averaged in the external target observation interval.

The size of a DSR is 383954 bytes. There may be several DSR in the dataset, and here we assume 10 in order to make size calculations, so the datablock would have 3,66 MB. The ***MIR_FTTF_*** product's data block specification is as follows.

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>Data_Block</i>					Init of binary Data Block in the product.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Flat_Target_Transformation					Init of binary Data Set containing the Flat Target Transformation data.	
01	FTT_Data_Counter	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of FTT_Data data set record structures.	Generated by L1 Processor.
	List_of_FTT_Datas					Start of list of FTT_Data structures.	
	FTT_Data					Start of FTT_Data structure.	
02	Start_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the Sky Observation sequence was started. Expressed in EE CFI transport time format	Copied from L1A product Snapshot_time field for first DSR used in the generation of FTT product
03	Stop_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the Sky Observation sequence was finished. Expressed in EE CFI transport time format	Copied from L1A product Snapshot_time field for last DSR used in the generation of FTT product



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
04	<i>Number_of_Epochs</i>	Integer	Epochs	Unsigned integer (2 bytes)	1 element	Number of epochs used in the average statistics below.	Generated by L1 Processor.
05	<i>Number_of_Epochs_HH</i>	Integer	Epochs	Unsigned integer (2 bytes)	1 element	Number of epochs used in the average statistics below for data measured in HH polarization only.	Generated by L1 Processor.
06	<i>Number_of_Epochs_VV</i>	Integer	Epochs	Unsigned integer (2 bytes)	1 element	Number of epochs used in the average statistics below for data measured in VV polarization only.	Generated by L1 Processor.
07	<i>Number_of_Epochs_HV</i>	Integer	Epochs	Unsigned integer (2 bytes)	1 element	Number of epochs used in the average statistics below for data measured in HV polarization only.	Generated by L1 Processor.
08	<i>Averaged_Receiver_Temp</i>	Real value	K	Float (4 bytes)	1 element	Averaged physical temperature of receivers during whole period, expressed in Kelvin.	Generated by L1 Processor. Averaging of physical temperatures matrix obtained from L1 HKTM
09	<i>Receiver_Temp</i>	Array of real values	K	Double (8 bytes)	Vector array of 72 elements (order followed is described in last paragraph of 4.2.3.1)	Physical temperature of receivers in Kelvin. One value per receiver.	Generated by L1 Processor. Based on L1A HKTM product



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
10	<i>Averaged_NIR_Brightness_Temp</i>	Real value	K	Double (8 bytes)	Vector array of 6 elements ordered like [NIR_AB_H, NIR_AB_V, NIR_BC_H, NIR_BC_V, NIR_CA_H, NIR_CAV]	Averaged Brightness Temperatures measured at each NIR element, expressed in Kelvin. Two values (H and V) per receiver. Averaging is performed only over each NIR element.	Generated by L1 Processor, by averaging the NIR brightness temperatures obtained from the L1 HKTM
11	<i>Averaged_FTT_Visib_H</i>	Array of complex values	N/A	Double (real part) + double (imag part), totally 16 bytes	Vector array of 69*34 elements	Averaged complex calibrated correlations in H polarisation for all baselines (including redundant, but excluding LICEF-NIR correlations in cross-polarisation).	Generated by L1 Processor, by averaging the L1A product H-pol Calibrated Visibilities
12	<i>Averaged_FTT_Visib_V</i>	Array of complex values	N/A	Double (real part) + double (imag part), totally 16 bytes	Vector array of 69*34 elements	Averaged complex calibrated correlations in V polarisation for all baselines (including redundant, but excluding LICEF-NIR correlations in cross-polarisation).	Generated by L1 Processor, by averaging the L1A product V-pol Calibrated Visibilities
13	<i>Averaged_FTT_Visib_HV</i>	Array of complex values	N/A	Double (real part) + double (imag part), totally 16 bytes	Vector array of 3303 elements	Averaged complex calibrated correlations in HV polarisation for all baselines (including redundant).	Generated by L1 Processor, by averaging the L1A product HV-pol Calibrated Visibilities
14	<i>Sky_Brightness_Temp_H</i>	Real value	K	Double (8 bytes)	1 element	Sky Expected Temperature in respective polarisation expressed in Kelvin and computed as the average in the front unit circle	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
15	<i>Sky_Brightness_Temp_V</i>	Real value	K	Double (8 bytes)	1 element	Sky Expected Temperature in respective polarisation expressed in Kelvin and computed as the average in the front unit circle	Generated by L1 Processor.
16	<i>Ideal_Sky_NIR_Brightness_Temp</i>	Real value	K	Double (8 bytes)	Vector array of 6 elements (ordered like [NIR_AB_H, IR_AB_V, NIR_BC_H, NIR_BC_V, NIR_CA_H, NIR_CAV])	Brightness temperatures measured at each NIR element for an ideal Sky scene, expressed in Kelvin. Two values (H and V) per receiver. This field is set to 0 in DPGS-V3 baseline.	AUX_GALNIR
17	<i>Ideal_Sky_Visib_H</i>	Array of complex values	N/A	Double (real part) + double (imag part), totally 16 bytes	Vector array of 69*34 elements	Ideal Instrument visibilities of the Sky in H polarisation for all baselines (including redundant, but excluding LICEF-NIR correlations in cross-polarisation). This field is set to 0 in DPGS-V3 baseline.	Generated by L1 Processor.
18	<i>Ideal_Sky_Visib_V</i>	Array of complex values	N/A	Double (real part) + double (imag part), totally 16 bytes	Vector array of 69*34 elements	Ideal Instrument visibilities of the Sky in V polarisation for all baselines (including redundant, but excluding LICEF-NIR correlations in cross-polarisation). This field is set to 0 in DPGS-V3 baseline.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
19	<i>Ideal_Sky_Visib_HV</i>	Array of complex values	N/A	Double (real part) + double (imag part), totally 16 bytes	Vector array of 3303 elements	Ideal Instrument visibilities of the Sky in HV polarisation for all baselines (including redundant). This field is set to 0 in DPGS-V3 baseline.	Generated by L1 Processor.
20	<i>Ideal_Uniform_NIR_Brightness_Temp</i>	Real value	K	Double (8 bytes)	Vector array of 6 elements (ordered like [NIR_AB_H, IR_AB_V, NIR_BC_H, NIR_BC_V, NIR_CA_H, NIR_CAV])	Brightness temperatures measured at each NIR element for a uniform 1K scene, expressed in Kelvin. Two values (H and V) per receiver. This field is set to 0 in DPGS-V3 baseline.	Generated by L1 Processor.
21	<i>Ideal_Uniform_Visib_H</i>	Array of complex values	N/A	Double (real part) + double (imag part), totally 16 bytes	Vector array of 69*34 elements	Ideal Instrument visibilities of a uniform 1Kelvin scene in H polarisation for all baselines (including redundant, but excluding LICEF-NIR correlations in cross-polarisation). This field is set to 0 in DPGS-V3 baseline.	Generated by L1 Processor.
22	<i>Ideal_Uniform_Visib_V</i>	Array of complex values	N/A	Double (real part) + double (imag part), totally 16 bytes	Vector array of 69*34 elements	Ideal Instrument visibilities of a uniform 1Kelvin scene in V polarisation for all baselines (including redundant, but excluding LICEF-NIR correlations in cross-polarisation). This field is set to 0 in DPGS-V3 baseline.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
23	<i>Ideal_Uniform_Visib_HV</i>	Array of complex values	N/A	Double (real part) + double (imag part), totally 16 bytes	Vector array of 3303 elements	Ideal Instrument visibilities of a uniform 1Kelvin scene in HV polarisation for all baselines (including redundant). This field is set to 0 in DPGS-V3 baseline.	Generated by L1 Processor.
	<i>Quality_Information</i>					Init of <i>Quality_Information</i> structure.	
24	<i>Software_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for sw error in the FTT processing are given in details in [RD.24].	Generated by L1 Processor.
25	<i>Instrument_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	Conditions for instrument error in the FTT processing are given in details in [RD.24].	Generated by L1 Processor.
26	<i>ADF_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	The detailed list of ADF error detected by the L1OP V3 for the FTT processing stage is given in [RD.24].	Generated by L1 Processor.
27	<i>Calibration_Error_Counter</i>	Integer	N/A	unsigned integer (4 bytes)	1 element	The detailed list of Calibration error detected by the L1OP V3 for the FTT processing stage is given in [RD.24].	Generated by L1 Processor.
	<i>Quality_Information</i>					End of <i>Quality_Information</i> structure.	
	<i>FTT_Data</i>					End of <i>FTT_Data</i> structure.	
	<i>List_of_FTT_Datas</i>					End of list of <i>FTT_Data</i> structures.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>Flat_Target_Transformation</i>					End of binary Data Set containing the Flat Target Transformation data.	
	<i>Data_Block</i>					End of binary Data Block in the product.	

Table 4-41 Flat Target Transformation Full Polarization Product Data Block

4.2.4.2 L1B Measurement Products

The L1B products consist of two measurements data set presented by snapshot and order by time stamp. The first measurement data set contains the values of the Fourier Components of the Brightness Temperature relative to the scene with lowest contrast. The second measurements data set contains the Brightness temperature biases which shall be added back to the lowest contrast scene in the L1c processing. The format structure proposed for these L1b products is presented in [RD.1].the following figure:

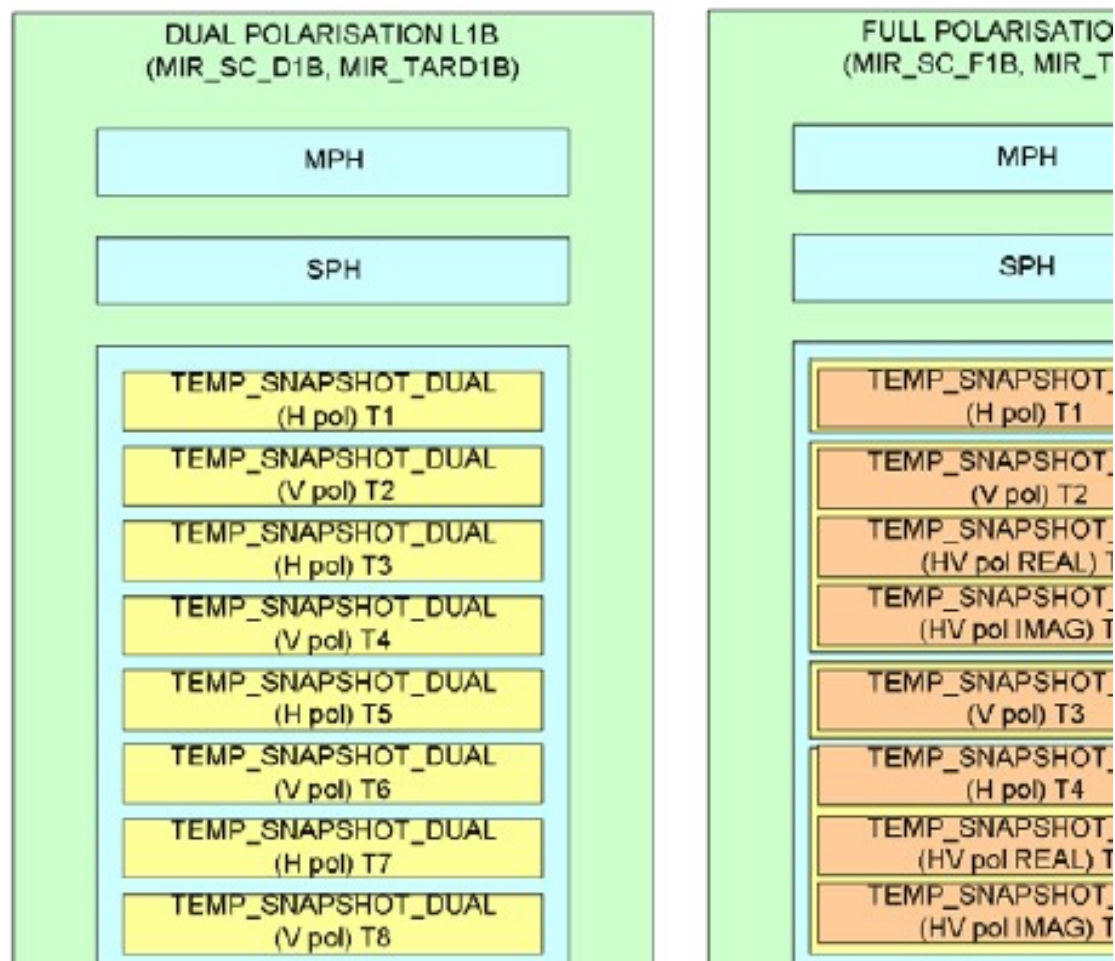


Figure 4-3 SMOS L1B product structure (taken from Deimos Eng., L1PP Product format)



Different L1b products are generated depending on the polarisation mode of the instrument (dual or full polarimetric), and their contents change from mode to mode. In dual-pol, one data set record is generated per integration time (1.2s), containing H or V polarisation measurements. In full-pol every alternate integration time generates a data set record (H or V), and the next one generates two data set records (HV and V or HV and H).

Also, different products are generated when the satellite has nominal attitude, i.e. MIRAS is pointing towards Earth surface (hence the products shall be named MIR_SC_D1B in case of dual polarization and MIR_SC_F1B in case of full polarization), and when the satellite is pointing with external attitude to other targets than Earth (hence the products names are MIR_TARD1B in case of dual polarization and MIR_TARF1B in case of full polarization).

Products are arranged on a pole-to-pole time interval according to ascending and descending passes and grouped according to multiples of the integration time (time sorted and arranged with respect to the originating L1A product).

The Scene Brightness Temperature frequencies are complex numbers ordered according to the diagram shown in the following figure. In H or V polarisation, only the baselines shaded in blue in the figure mentioned shall be represented. If values are applicable to cross-polarisation scene (HV_real or HV_imag) as in full polarization mode, they are real values representing real or imaginary components in the complete star domain.

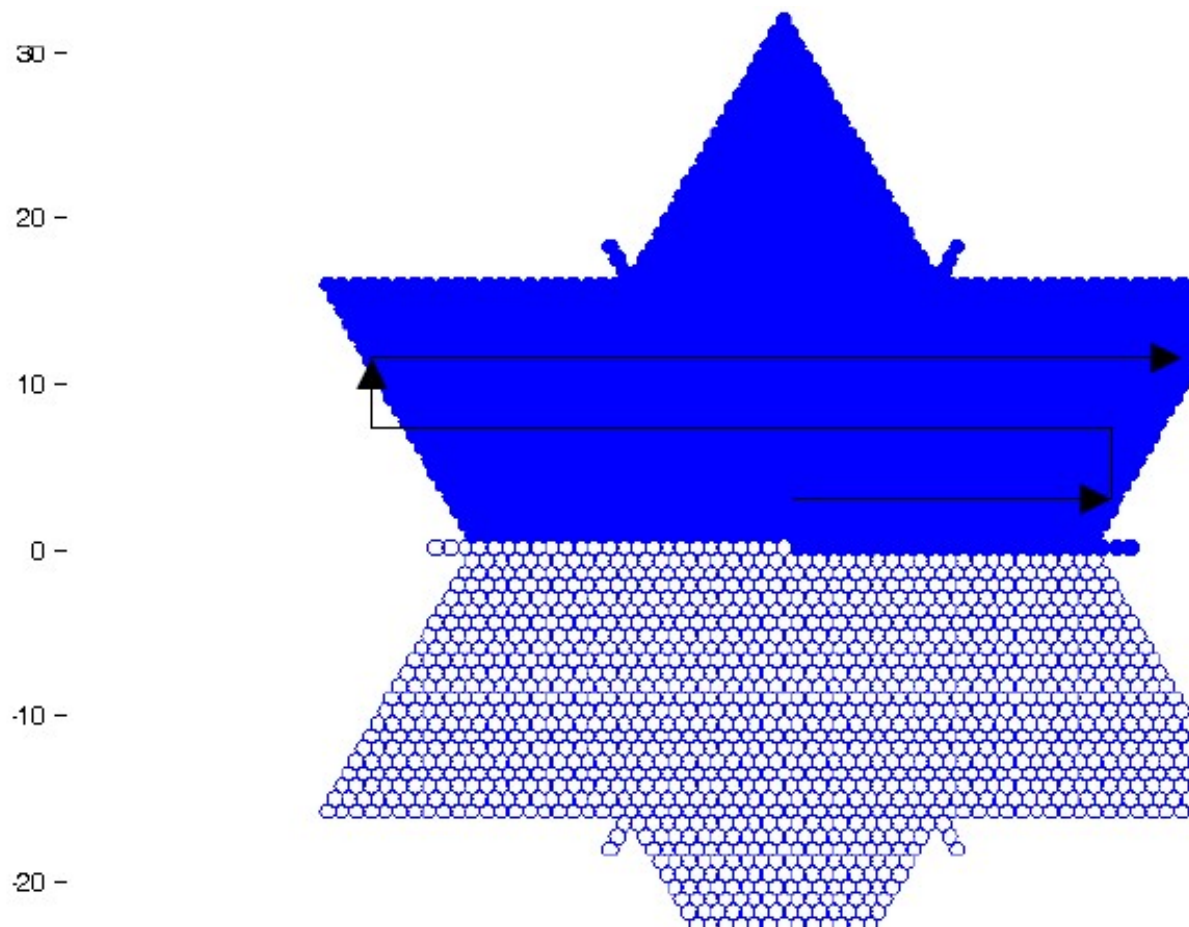


Figure 4-4 Brightness Temperatures Scene Fourier Components sorting (taken from Deimos Eng., L1PP ATBD)



4.2.4.2.1 Dual Polarization Reconstructed \check{T}_B Fourier Components (MIR_SC_D1B / MIR_TARD1B)

The dual polarization reconstructed brightness temperature Fourier components are obtained by correcting and reconstructing the L1A calibrated visibilities in dual polarization.

4.2.4.2.1.1 Specific Product Header

The Specific Product Header for MIR_SC_D1B / MIR_TARD1B shall follow the format described in section 4.1.2 and shall include the following information:

- Level 1 Main Info SPH (see Table 4-3 for description)
- Quality Information (see Table 4-4 for description)
- Image_Retrieval_Algorithm (see Table below for description)
- Foreign_Source_Correction structure (see Table below for description)
- Level1 SPH Data Sets (see Table 4-5 for description)



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	<i>Specific_Product_Header</i>					Init of Specific Product Header structure	
02-19	<i>Main_Info</i>	structure	N/A	N/A	N/A	Main Product Info structure's fields as defined in fields 01 to 16 in Table 4-3	
20-26	<i>Quality_Information</i>	structure				Quality_Information structure defined as specified in Table 4-4	
27	<i>Reconstruction_Image_Algorithm</i>	Integer	N/A	1 byte	%01d	This field can have one of the following values: <ul style="list-style-type: none"> 0 for "Gibbs Level: 0" 1 for "Gibbs Level: 1" 2 for "Gibbs Level: 2" 	AUX_CNFL1P
28	<i>Foreign_Sources_Correction</i>	Starting Tag				Tag starting a structure specifying details on methods for correcting the contributions of non-desired sources of radiation	
29	<i>Flat_Correction_Type</i>	Integer	N/A	1 byte	%01d	Method used to correct the contribution from flat target. This field can have one of the following values: <ul style="list-style-type: none"> 0 for "FTT Not Applied" 1 for "FTT Applied" This tag is filled with field 25 in AUX_CNFL1P (Flat_Correction_Type)	AUX_CNFL1P



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
30	<i>Direct_Sun_Correction_Type</i>	Integer	N/A	2 bytes	%+02d	<p>Method used to correct the contribution from direct Sun into the snapshot. This field can have one of the following values:</p> <ul style="list-style-type: none"> • 4 for "Correction by Measurements. BT Self-estimation with improved Sun Position Estimate Technique". • 3 for "Correction by Measurements Self-estimation Technique" • 2 for "Correction Based on Sun Auxiliary Data" • 1 for "Correction Based on Default Sun BT Value (110.000K)" • 0 for correction not applied <p>This tag is filled with field 16 in AUX_CNFL1P (Direct_Sun_Correction_Type)</p>	AUX_CNFL1P
31	<i>Reflected_Sun_Correction_Type</i>	Integer	N/A	2 bytes	%+02d	<p>This field can have one of the following values:</p> <ul style="list-style-type: none"> • 3 for "Correction with first order forward model (fixed wind) using Sun BT Self-estimated value" • 2 for "Correction with first order forward model (fixed wind) using Sun BT Auxiliary Data" • 1 for "Correction with first order forward model (fixed wind) using Sun BT default value (110.000K)" 0 for correction not applied <p>This tag is filled with field 18 in AUX_CNFL1P (Reflected_Sun_Correction_Type)</p>	AUX_CNFL1P



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
32	<i>Direct_Moon_Correction_Type</i>	Integer	N/A	2 bytes	%+02d	<p>This field can have one of the following values:</p> <ul style="list-style-type: none"> 2 for "Correction Based on Moon Auxiliary Data" 1 for "Correction by Default Moon BT Value (250K)" 0 for correction not applied <p>This tag is filled with field 17 in AUX_CNFL1P (Direct_Moon_Correction_Type)</p>	AUX_CNFL1P
33	<i>Earth_Contribution_Removed</i>	Flag	N/A	2 bytes	%+02d	<p>This field can have one of the following values:</p> <ul style="list-style-type: none"> 4 for "Correction Based on Measured Land+Ocean BT Values (only applicable for reprocessing)" 3 for "Correction Based on Constant Land and Fresnel modelled Ocean (removal of Earth-Sky limb and second order coastlines)" 2 for "Correction Based on Constant Land and Default Ocean BT value (removal of Earth-Sky limb and first order coastlines)" 1 for "Correction Based on Constant Earth estimation (removal of Earth-Sky limb)" 0 for correction not applied <p>This tag is filled with field 42 in AUX_CNFL1P (Earth_Contribution_Correction_Type)</p>	AUX_CNFL1P
34	<i>Sky_Contribution_Removed</i>	Flag	N/A	2 bytes	%+02d	<p>This field can have one of the following values:</p> <ul style="list-style-type: none"> 1 for correction applied 0 for correction not applied <p>This tag is filled with field 20 in AUX_CNFL1P (Sky_Contribution_Removed)</p>	AUX_CNFL1P



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
35	Backlobe_Contribution_Removed	Flag	N/A	2 bytes	%+02d	<p>This field can have one of the following values:</p> <ul style="list-style-type: none"> 1 for correction applied (only on NIR values) 0 for correction not applied <p>This tag is filled with field 26 in AUX_CNFL1P (Backlobe_Contribution_Removed)</p>	AUX_CNFL1P
36	Foreign_Sources_Correction	Closing Tag				Tag closing the structure specifying details on methods for correcting the contributions of non-desired sources of radiation	
37	Ocean_Fresnel_Parameters	Starting Tag				Tag starting a structure specifying the Fresnel modeled Ocean parameters for correcting the contributions of non-desired aliased regions bias and antenna patterns uncertainties.	
38	Central_Frequency	Real	MHz	11 bytes	%011.6f	The SMOS L-band sensitivity	
39	Sea_Surface_Temp	Real	K	11 bytes	%011.6f	The sea water surface temperature used to model the Ocean Fresnel temperature distribution in the Gibbs-2 technique	
40	Sea_Surface_Salinity	Real	psu	11 bytes	%011.6f	The sea water salinity used to model the Ocean Fresnel temperature distribution in the Gibbs-2 technique	
41	WGS84_Semi_Major_Axis	Real	meter	15 bytes	%015.4f	The Earth Semi-Major Axis as defined in the WGS84 Model.	EO-CFI documentation
42	WGS84_Flattening	Real		18 bytes	%018.16f	The Earth globe flattening factor as defined in the WGS84 Model.	EO-CFI documentation
43	WGS84_First_Eccentricity	Real		18 bytes	%018.16f	The Earth globe eccentricity as defined in the WGS84 Model.	EO-CFI documentation



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
44	<i>WGS84_Semi_Minor_Axis</i>	Real	meter	15 bytes	%015.4f	The Earth Semi-Minor Axis as defined in the WGS84 Model.	EO-CFI documentation
45	<i>Ocean_Fresnel_Parameters</i>	Closing Tag				Tag closing the structure specifying the Fresnel modeled Ocean parameters for correcting the contributions of non-desired aliased regions bias and antenna patterns uncertainties.	
46-57	<i>Data_Sets</i>	structure	N/A	N/A	N/A	Data Sets structure's fields as defined in Table 4-5	
58	<i>List_of_Reference_Data_Sets_L0</i>	Starting Tag	N/A	N/A	N/A	Reference Data Sets inherited from Science L0	
59	<i>Reference_Filename</i>	string	N/A	60 bytes	%60s	Filename of input files as described in table 4-10	Copied from Science L0 header
60	<i>List_of_Reference_Data_Sets_L0</i>	Closing Tag	N/A	N/A	N/A	Reference Data Sets inherited from Science L0	
61	<i>List_of_Reference_Data_Sets_L1a</i>	Starting Tag	N/A	N/A	N/A	Reference Data Sets inherited from Science L1a	
62	<i>Reference_Filename</i>	string	N/A	60 bytes	%60s	Filename of input files as described in table 4-30	Copied from Science L1a header
63	<i>List_of_Reference_Data_Sets_L1a</i>	Closing Tag	N/A	N/A	N/A	Reference Data Sets inherited from Science L1a	
64	<i>Specific_Product_Header</i>					End of Specific Product Header structure	

Table 4-42 Level 1 B SPH



The valid L0 Reference Data Sets for Level1B Science Products are the same as for L0 HKTM reference files in table 4-10.

The valid L1A Reference Data Sets for Level1B Science Products are the ones in table 4-30.

The specific valid Reference Data Sets for MIR_SC_D1B Products are:

Reference Data Set Name	Product Type	Description
L1A_HKTM_FILE	TLM_MIR1A	HKTM filename containing the S/C position and attitude for the snapshots in the current product
L1A_FILE	MIR_SC_D1A, MIR_TARD1A	L1a Dual Polarization Calibrated Visibilities filename used to create the current L1b product
L1A_G_MATRIX_FILE	MIR_GMATD_	G Matrix filename used in the Image reconstruction process of the current L1b product
L1A_J_MATRIX_FILE	MIR_JMATD_	J Matrix filename used in the purely mathematical Image reconstruction process of the current L1b product
L1A_FLAT_TARGET_FILE	MIR_FTTD_	Flat Target Transformation file obtained in Dual Polarization mode
L1A_AVER_FWF_CAL_FILE	MIR_AFWD1A	L1a Calibration filename of the file containing the average Fringe Washing Function estimated coefficients used in the computation of the reconstruction G Matrix
ANTENNA_PATTERNS_FILE	AUX_PATT_	Auxiliary data file containing the NIR antenna patterns to be used for convolution with the original galaxy map
GALAXY_FILE	AUX_GALAXY	Original Galaxy Map used for generation of the Ideal Sky visibilities
PLM_FILE	AUX_PLM_	Auxiliary file with PLM characterisation, defining time lags and intermediate frequency
SUN_BT_FILE	AUX_SUNT_	Auxiliary file with definition of Sun Brightness Temperatures used for correction before L1b processing
MOON_BT_FILE	AUX_MOONT_	Auxiliary file with definition of Moon Brightness Temperatures used for correction before L1b processing
BEST_FIT_PLANE_FILE	AUX_BFP_	Auxiliary file with definition of Best Fit Plane to be used during geolocation in L1c
WEIGHT_VECTOR_FILE	AUX_BWGHT_	Auxiliary product containing the weight vector to be multiplied element by element with the calibrated visibilities
BISTATIC_SCAT_FILE	AUX_BSCAT_	Auxiliary file with Bistatic Scattering Coefficients (only used in nominal pointing processing)
ALGORITHM_CONFIG_FILE	AUX_CNFL1P	Processor Configuration Parameters and Constants for L1OP
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Mission planning file used to initialise the EE CFI orbit_id and/or time_id. It is read and used by the EE CFI.
MISPOINTING_ANGLES_FILE	AUX_MISP_	Auxiliary product containing the mispointing angles between the Body Frame referenced in the Proteus quaternions and the Antenna Plane defined by the MIRAS instrument
DGG_FILE	AUX_DGG_	Fixed Earth Grid filename used in the current L1c product
LAND_SEA_MASK_FILE	AUX_LSMASK	Auxiliary file containing the Land/Sea mask of pixels in the DGG



Reference Data Set Name	Product Type	Description
FAILURES_FILE	AUX_FAIL	Auxiliary file with failure of components to be taken into account during L1 processing
BULLETIN_B_FILE	AUX_BULL_B	IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation
RFI_LIST_FILE	AUX_RFILST	Global RFI position list used in the RFI mitigation algorithms
FRESNEL_FILE	AUX_FRSNEL	Brightness temperature of the Fresnel model for every possible pixel to be observed by the instrument

Table 4-43 Level 1 B Dual Polarization Reconstructed Brightness Temperatures Fourier Components Reference Data Sets

The following are the rules to update the SPH General Quality Information structure from the resulting Quality_Information flags for each data set record:

Counter Name	Condition
Software_Error_Counter	Count all the snapshots that have the Software_Error_flag set
Instrument_Error_Counter	Count all the snapshots that have the Instrument_Error_flag set
ADF_Error_Counter	Count all the snapshots that have the ADF_Error_flag set
Calibration_Error_Counter	Count all the snapshots that have the Calibration_Error_flag set
N_Discarded_Scenes	Add to the counter in the L1a input product the number of L1a snapshot discarded during the processing. Currently L1a snapshot are discarded in the case of missing sequences in the Full polarization mode.

4.2.4.2.1.2 Data Block

The binary Data Block of the MIR_SC_D1B product consists of two Measurement datasets, containing the components of the FFT of the reconstructed image and the scene bias correction data for each DSR. There is one DSR for the first integration time, in HHH polarization mode, and one DSR for the second integration time, in VVV polarization mode.

The following table describes the XML schema used to decode the binary contents of this type of record. The tag element used to describe the DSR structure name in the XML schema shall be **Temp_Snapshot_Dual**.



- The **Temp_Snapshot_Dual** data set consists of the complete set of brightness temperatures Fourier components obtained by processing MIR_SC_D1A products. All data is referenced to the time described in the field **Snapshot_Time** expressed in UTC format. **Snapshot_OBET** is still referred to the start of the integration time, but it is kept as it provides an extra unique reference to the snapshot. There shall be a complete Data Set Record for each integration time, when pointing in the same direction during the half orbit (i.e. dual-pol measurements shall appear in separate products if they are observing the earth surface –nominal- or external sources –Moon, deep sky, etc.-). The first field in the dataset, **Counter**, specifies the number of DSR contained in it, while the following fields are **Counter** repetitions of the **Reconstructed_BT_Snapshot** dataset record structure. The size of each DSR is fixed and equal to 22515 bytes.
- The **Scene_Bias_Correction** data set contains specific data computed during Image Reconstruction, which must be added later during geolocation in order to obtain the complete Brightness Temperature distribution. The data computed is used to correct for the Scene Dependent Bias detected in simulation tests. There shall be a complete Data Set Record for each integration time. All data is referenced to the time described in the field **Snapshot_Time** expressed in UTC format. **Snapshot_OBET** is still referred to the start of the integration time, but it is kept as it provides an extra unique reference to the snapshot available in other Data Sets. The first field in the dataset, **Scene_Bias_Counter**, specifies the number of DSR contained in it, while the following fields are **Counter** repetitions of the **Scene_Bias** dataset record structure. The size of each DSR is fixed and equal to 64 bytes.

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Temp_Snapshot_Dual					Init of binary Data Set containing the Reconstructed_BT_Snapshot data set records.	
01	Reconstructed_BT_Snapshot_Counter	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of Reconstructed_BT_Snapshot data set record structures.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	List_of_Reconstructed_BT_Snapshots					Init of list of Reconstructed_BT_Snapshot data set record structures, repeated Counter times. The list contains as many DSR as integration times are contained in the product.	
	Reconstructed_BT_Snapshot					Init of Reconstructed_BT_Snapshot data set record structure.	
02	Snapshot_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the scene was taken. <u>Start of integration time period</u> . Expressed in EE CFI transport time format.	Copied from L1A product
03	Snapshot_ID	Identifier	N/A	unsigned integer (4 bytes)	1 element	Unique identifier for the snapshot. Formed by aggregation of orbit and time within orbit. Contents of this field are formed by: $Absolute_orbit_number * 10000 + Seconds_from_ANX$	Copied from L1A product
04	Snapshot_OBET	Time counter	N/A	bit stream (8 bytes) declared as unsigned long	1 element (OBET Format is specified in section 4.2.1.2)	Unique identifier for the snapshot. Formed by the OBET at T_SYNC extracted from L0. Represents start of integration time in OBET format.	Copied from L1A product
05	X_Position	Real value	m	Double (8 bytes)	1 element	Orbit State Vector X Position in Earth Fixed Reference at snapshot_Time (field 02)	Copied from TLM_MIRA1A product



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
06	Y_Position	Real value	m	Double (8 bytes)	1 element	Orbit State Vector Y Position in Earth Fixed Reference at snapshot_Time (field 02)	Copied from TLM_MIRA1A product
07	Z_Position	Real value	m	Double (8 bytes)	1 element	Orbit State Vector Z Position in Earth Fixed Reference at snapshot_Time (field 02)	Copied from TLM_MIRA1A product
08	X_Velocity	Real value	m/s	Double (8 bytes)	1 element	Orbit State Vector X Velocity in Earth Fixed Reference at snapshot_Time (field 02)	Copied from TLM_MIRA1A product
09	Y_Velocity	Real value	m/s	Double (8 bytes)	1 element	Orbit State Vector Y Velocity in Earth Fixed Reference at snapshot_Time (field 02)	Copied from TLM_MIRA1A product
10	Z_Velocity	Real value	m/s	Double (8 bytes)	1 element	Orbit State Vector Z Velocity in Earth Fixed Reference at snapshot_Time (field 02)	Copied from TLM_MIRA1A product
11	Vector_Source	Identifier	N/A	unsigned byte	1 element	Source of the Orbit State Vector record: <ul style="list-style-type: none"> SOLUTION_NULL = 0 SOLUTION_INITIALISATION = 1 SOLUTION_PVT_FROZEN = 2 SOLUTION_NKF_SOLUTION = 3 SOLUTION_SPS_SOLUTION = 4 SOLUTION_PREDICTED = 5 (not used) SOLUTION_RESTITUTED = 6 (not used) 	Copied from TLM_MIRA1A product



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
12	<i>Q0</i>	Real value	N/A	Double (8 bytes)	1 element	Real number component of quaternion obtained rotating from the J2000 inertial reference frame to the satellite body frame	Copied from TLM_MIRA1A product
13	<i>Q1</i>	Real value	N/A	Double (8 bytes)	1 element	First component of quaternion obtained rotating from the J2000 inertial reference frame to the satellite body frame	Copied from TLM_MIRA1A product
14	<i>Q2</i>	Real value	N/A	Double (8 bytes)	1 element	Second component of quaternion obtained rotating from the J2000 inertial reference frame to the satellite body frame	Copied from TLM_MIRA1A product
15	<i>Q3</i>	Real value	N/A	Double (8 bytes)	1 element	Third component of quaternion obtained rotating from the J2000 inertial reference frame to the satellite body frame	Copied from TLM_MIRA1A product
16	<i>Flags</i>	Set of flags	N/A	unsigned byte	1 element	L1b flags applicable to the scene for this particular integration time. The complete flags in the available byte are specified below this table.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
17	Antenna_Boresight	Array of real values	deg	Float (4bytes)	2 elements	<p>In case of MIR_SC_D1B:</p> <ul style="list-style-type: none"> First element is Latitude of Earth surface point in the snapshot's boresight direction. Second element is Longitude of Earth surface point in the snapshot's boresight direction. Should be set to 0 in case geolocation is not possible due to data acquired during a slew manoeuvre <p>In case of MIR_TARD1B:</p> <ul style="list-style-type: none"> First element is Right Ascension in the snapshot's boresight direction (coordinates reference system is B1950). Second element is Declination in the snapshot's boresight direction (coordinates reference system is B1950). 	Copied from L1A product



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
18	Scene_BT_Fourier	Array of complex values	N/A	Double (8 bytes). Element is only real <u>or</u> imaginary part	Vector array of 2791 values (see order in Figure 4-3; first one double for the zero baseline, then 1395 doubles for the real parts of the upper baselines of the star domain, then 1395 doubles for the imaginary parts of the same baselines)	Complex Fourier Domain components of the reconstructed scene	Generated by L1 Processor after reconstruction of calibrated visibilities
19	Accuracy	Real value	K	Float (4 bytes)	1 element	Snapshot overall accuracy measurement, based on Corbella equation and computed as the difference of the mean snapshot Brightness Temperature and the averaged physical temperature of the LICEF receivers	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
20	Physical_Temperatures_STD	Real value	K	Float (4 bytes)	1 element	Standard deviation of the physical temperature of the LICEF receivers at the integration time	Generated by L1 Processor, based in physical temperature matrix in L1A HKTM
21	Average_System_Temperatures	Real value	K	Float (4 bytes)	1 element	Average of the system temperatures computed in the L1A product for the corresponding integration time using pure LICEF units (i.e. not considering NIR-LICEF units)	Generated by L1 Processor based on L1A product
22	LICEF_Status	Array of flags	N/A	byte-8 (8 flags contained)	2 arrays, one for each polarisation (H and V), of 9 elements each, with totally 72 bit-flags in each array, Field size is then 18 bytes	Status of each LICEF by polarisation H, V (0=No error, 1=Error). Obtained from single failure and correlator failure identification.	Copied from L1A HKTM
23	CMN_NIR_Status	Array of flags	N/A	Unsigned short (2 bytes)	Array of 12+3 status bit-flags contained in 2 bytes. Order is first CMN status, then NIR status	Status of each CMN and NIR (0=No error, 1=Error). Obtained from single failure identification.	Copied from L1A HKTM
24	Foreign_Sources_Flags	Flags	N/A	Byte-8	1 element	Characteristics of the Foreign Sources involved in each integration time (Sun eclipsed, in the front/back of the instrument,...). The complete flags are specified below this table.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
25	<i>Direct_Sun_Pos</i>	Vector of real values	N/A	Float (4 bytes)	Vector array of 2 elements (first xi, then eta)	Position in antenna reference frame of Sun position (xi-eta coordinates).	Generated by L1 Processor.
26	<i>Reflected_Sun_Pos</i>	Real value	N/A	Float (4 bytes)	Vector array of 2 elements (first xi, then eta)	Position in antenna reference frame of reflected Sun position (xi-eta coordinates). Set to (-1,-1) no reflection is possible. Reflected Sun is always out of Extended alias-free FOV, but as complete unit circle is represented, it is significative.	Generated by L1 Processor.
27	<i>Direct_Moon_Pos</i>	Real value	N/A	Float (4 bytes)	Vector array of 2 elements (first xi, then eta)	Position in antenna reference frame of Moon position (xi-eta coordinates).	Generated by L1 Processor.
28	<i>Direct_Sun_BT</i>	Real value	K	Double (8 bytes)	1 element	Magnitude of Direct Sun Brightness Temperature as derived during reconstruction process and subtracted. Set to 0 if Sun is in Eclipse.	Generated by L1 Processor.
29	<i>Constant_Earth_BT</i>	Real value	K	Double (8 bytes)	1 element	Magnitude of Constant Earth Brightness Temperature as derived during reconstruction process and subtracted. This value is only meaningful for X and Y-pol scenes, when processing is done in Gibbs 1 mode. In all other cases it is set to 0 as the artificial scene in Gibbs 2 is not constant.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
30	<i>X-Band</i>	Integer	N/	Unsigned 1 byte	1 element	<ul style="list-style-type: none"> 0 if X-Band Transmitter OFF 1 if X-Band Transmitter ON (Nominal side) if X-Band Transmitter ON (Redundant side) 3 if X-Band Transmitter ON (Nominal and Redundant side) 	Generated by L1 Processor.
31	<i>Matrix_BFP2EF</i>	Real value		Double (8 bytes)	9 elements	<ul style="list-style-type: none"> Rotation matrix from Best Fit Plane to Earth Fixed frame. Data is stored as 1D vector with 9 values, rowwise (row1 – row2 – row3). 	Generated by L1 Processor.
	<i>Quality_Information</i>					Init of <i>Quality_Information</i> structure.	
32	<i>Software_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See [RD.24] for details.	Generated by L1 Processor.
33	<i>Instrument_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See [RD.24] for details.	Generated by L1 Processor.
34	<i>ADF_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See [RD.24] for details.	Generated by L1 Processor.
35	<i>Calibration_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See [RD.24] for details.	Generated by L1 Processor.
	<i>Quality_Information</i>					End of <i>Quality_Information</i> structure.	
	<i>Reconstructed_BT_Snapshot</i>					End of <i>Reconstructed_BT_Snapshot</i> data set record structure	
	<i>List_of_Reconstructed_BT_Snapshots</i>					End of list of <i>Reconstructed_BT_Snapshot</i> data set record structures.	
	<i>Temp_Snapshot_Dual</i>					End of binary Data Set containing the <i>Reconstructed_BT_Snapshot</i> data set records.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Scene_Bias_Correction					Init of binary Data Set containing the Scene_Bias data set records.	
36	Scene_Bias_Counter	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of Reconstructed_BT_Snapshot data set record structures.	Generated by L1 Processor.
	List_of_Scene_Bias					Init of list of List_of_Scene_Bias data set record structures	
	Scene_Bias					Init of Scene_Bias data set record structure	
37	Snapshot_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the scene was taken. <u>Start of integration time period</u> . Expressed in EE CFI transport time format.	Copied from L1A product
38	Snapshot_ID	Identifier	N/A	unsigned integer (4 bytes)	1 element	Unique identifier for the snapshot. Formed by aggregation of orbit and time within orbit. Contents of this field are formed by: Absolute_orbit_number*10000 + Seconds_from_ANX	Copied from L1A product
39	Snapshot_OBET	Time counter	N/A	bit stream (8 bytes) declared as unsigned long	1 element (OBET Format is specified in section 4.2.1.2)	Unique identifier for the snapshot. Formed by the OBET at T_SYNC extracted from L0. Represents start of integration time in OBET format.	Copied from L1A product



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
40	<i>Constant_Sky_BT</i>	Real Value	K	Double (8 bytes)	1 element	Magnitude of Constant Sky Brightness Temperature as derived during reconstruction process (scene bias correction) and subtracted from the L1b output data.	Generated by L1 Processor.
41	<i>Constant_Land_BT</i>	Real Value	K	Double (8 bytes)	1 element	Constant_Land in case of L1b processing with Gibss-1 represents the constant Earth Brightness temperature as derived during reconstruction process and subtracted from the L1b output data (same value as in field 29). In case of L1b processing with Gibss-2 represents the constant Land Brightness temperature as derived during reconstruction process and subtracted from the L1b output data.	Generated by L1 Processor.
42	<i>Constant_Sea_BT</i>	Real Value	K	Double (8 bytes)	1 element	NOT USED for DPGS-V3 (filled with 0)	Generated by L1 Processor.
43	<i>Derivative_Land_BT</i>	Real Value	K	Double (8 bytes)	1 element	NOT USED for DPGS-V3 (filled with 0) Magnitude of First Derivative of Land Brightness Temperature against incidence angle, as derived during reconstruction process (scene bias correction) and subtracted from the L1b output data.	
44	<i>Derivative_Sea_BT</i>	Real Value	K	Double (8 bytes)	1 element	NOT USED for DPGS-V3 (filled with 0) Magnitude of First Derivative of Sea Brightness Temperature against incidence angle, as derived during reconstruction process (scene bias correction) and subtracted from the L1b output data.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Scene_Bias					End of Scene_Bias data set record structure	
	List_of_Scene_Bias					End of list of List_of_Scene_Bias data set record structures	
	Scene_Bias_Correction					End of binary Data Set containing the Scene_Bias data set records.	
	Data_Block					End of binary Data Block in the product.	

Table 4-44 Level 1 B Dual Polarization Reconstructed Brightness Temperatures Fourier Components Product Data Block

The Flags field #16 shall be used to report polarisation of the data inside the data set record, as well as corrections performed on the reconstructed scene by the Image Reconstruction Algorithms. The flags are contained in an 8-bit counter, each bit representing a status, and they shall be described using the following order convention:

[MSB:X X X X:X X X X:LSB]

This fields contains the following flags:

- Polarisation flags:
 - [X X X X:X X 0 0] Represents the real and Imaginary part of the BT Fourier components for the HH polarisation
 - [X X X X:X X 0 1] Represents the real and Imaginary part of the BT Fourier components for the VV polarisation
 - [X X X X:X X 1 0] represents the Real part of the BT Fourier components for the HV polarization when the instrument was in VHH+HVH+HHV or HVV+VHV+VVH arm configuration
 - [X X X X:X X 1 1] represents the Imaginary part of the BT Fourier components for the HV polarization when the instrument was in VHH+HVH+HHV or HVV+VHV+VVH arm configuration



- SUN FOV flag:
 - [X X X X:X 0 X X] means that no Direct Sun correction has been performed during image reconstruction
 - [X X X X:X 1 X X] means that Direct Sun correction for the Sun in the front of the FOV has been performed during image reconstruction
- SUN GLINT_FOV flag:
 - [X X X X:0 X X X] means that no Reflected Sun correction has been performed during image reconstruction
 - [X X X X:1 X X X] means that Reflected Sun correction has been performed during image reconstruction. Sun correction is based on the Sea bistatic coefficients defined in the AUX_BSCAT ADF and computed for a fixed wind speed of 7 m/s and wind direction of 0 deg North.
- MOON FOV flag:
 - [X X X 0:X X X X] means that no Direct Moon correction has been performed during image reconstruction
 - [X X X 1:X X X X] means that Direct Moon correction has been performed during image reconstruction
- SINGLE_SNAPSHOT flag:
 - [X X 0 X:X X X X] means that this scene has been combined with an adjacent scene in opposite polarisation during image reconstruction to account for cross-polarisation leakage
 - [X X 1 X:X X X X] means that this scene has not been combined with an adjacent scene in opposite polarisation during image reconstruction to account for cross-polarisation leakage (it has been processed with only co-polar antenna patterns information)
- H pol RFI flag (inherited from L1a):
 - [X 0 X X:X X X X] means that **no** RFI has been detected in the snapshot upon analysis of the NIR Brightness Temperatures or System Temperatures Standard Deviation in H polarisation
 - [X 1 X X:X X X X] means that analysis of the NIR Brightness Temperatures or System Temperatures standard deviation in H polarisation has reported this snapshot as an outlier of the expected trend, which is a clear indicator of the presence of one or more RFI sources in the data; that the Temperatures were saturated or in the vicinity of such saturation and there is a high probability that the measurement is affected



- V pol RFI flag (inherited from L1a):
 - [0 X X X:X X X X] means that **no** RFI has been detected in the snapshot upon analysis of the NIR Brightness Temperatures or System Temperatures Standard Deviation in V polarisation
 - [1 X X X:X X X X] means that analysis of the NIR Brightness Temperatures or System Temperatures standard deviation in V polarisation has reported this snapshot as an outlier of the expected trend, which is a clear indicator of the presence of one or more RFI sources in the data; that the Temperatures were saturated or in the vicinity of such saturation and there is a high probability that the measurement is affected

The Flags field #24 shall be used to report specific situations of the Foreign Sources Data inside the data set record. The flags are contained in an 8-bit counter, each bit representing a status, and they shall be described using the following order convention:

[MSB:X X X X:X X X X:LSB]

This fields contains the following flags:

- SUN Position flag:
 - [X X X X:X X X 0] means that the Sun is situated in front of the instrument array.
 - [X X X X:X X X 1] means that the Sun is situated in the back of the instrument array.
- SUN Eclipsed flag:
 - [X X X X:X X 0 X] means that the Sun is not eclipsed
 - [X X X X:X X 1 X] means that the Sun is eclipsed and not visible from the instrument array
- MOON Position flag:
 - [X X X X:X 0 X X] means that the Moon is situated in front of the instrument array.
 - [X X X X:X 1 X X] means that the Moon is situated in the back of the instrument array.
- MOON Eclipsed flag:
 - [X X X X:0 X X X] means that the Moon is not eclipsed
 - [X X X X:1 X X X] means that the Moon is eclipsed and not visible from the instrument array

4.2.4.2.2 Full Polarization Reconstructed \tilde{B} Fourier Components (MIR_SC_F1B / MIR_TARF1B)

The full polarization reconstructed brightness temperature Fourier components are obtained by correcting and reconstructing the L1A calibrated visibilities in full polarization.

4.2.4.2.2.1 Specific Product Header

The Specific Product Header for MIR_SC_F1B / MIR_TARF1B products shall be identical to the one described for MIR_SC_D1B / MIR_TARD1B products.

The specific valid Reference Data Sets for Level 1B Full Polarization Reconstructed Brightness Temperatures Fourier Components Products are:

Reference Data Set Name	Product Type	Description
L1A_HKTM_FILE	TLM_MIRA1A	HKTM filename containing the S/C position and attitude for the snapshots in the current product
L1A_FILE	MIR_SC_F1A, MIR_TARF1A	L1a Full Polarization Calibrated Visibilities filename used to create the current L1b product
L1A_G_MATRIX_FILE	MIR_GMATD_	G Matrix filename used in the Image reconstruction process of the current L1b product
L1A_J_MATRIX_FILE	MIR_JMATD_	J Matrix filename used in the purely mathematical Image reconstruction process of the current L1b product
L1A_FLAT_TARGET_FILE	MIR_FTTF_	Flat Target Transformation file obtained in Full Polarization mode
L1A_AVER_FWF_CAL_FILE	MIR_AFWD1A	L1a Calibration filename of the file containing the average Fringe Washing Function estimated coefficients used in the computation of the reconstruction G Matrix
ANTENNA_PATTERNS_FILE	AUX_PATT_	Auxiliary data file containing the NIR antenna patterns to be used for convolution with the original galaxy map
GALAXY_FILE	AUX_GALAXY	Original Galaxy Map used for generation of the Ideal Sky visibilities
PLM_FILE	AUX_PLM_	Auxiliary file with PLM characterisation, defining time lags and intermediate frequency
BEST_FIT_PLANE_FILE	AUX_BFP_	Auxiliary file with definition of Best Fit Plane to be used during geolocation in L1c
SUN_BT_FILE	AUX_SUNT_	Auxiliary file with definition of Sun Brightness Temperatures used for correction before L1b processing
MOON_BT_FILE	AUX_MOONT_	Auxiliary file with definition of Moon Brightness Temperatures used for correction before L1b processing
WEIGHT_VECTOR_FILE	AUX_BWGHT_	Auxiliary product containing the weight vector to be multiplied element by element with the calibrated visibilities
BISTATIC_SCAT_FILE	AUX_BSCAT_	Auxiliary file with Bistatic Scattering Coefficients (only used in nominal pointing processing)
ALGORITHM_CONFIG_FILE	AUX_CNFL1P	Processor Configuration Parameters and Constants for L1OP



Reference Data Set Name	Product Type	Description
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Mission planning file used to initialise the EE CFI orbit_id and/or time_id. It is read and used by the EE CFI.
MISPOINTING_ANGLES_FILE	AUX_MISP__	Auxiliary product containing the mispointing angles between the Body Frame referenced in the Proteus quaternions and the Antenna Plane defined by the MIRAS instrument
DGG_FILE	AUX_DGG__	Fixed Earth Grid filename used in the current L1c product
LAND_SEA_MASK_FILE	AUX_LSMASK	Auxiliary file containing the Land/Sea mask of pixels in the DGG
FAILURES_FILE	AUX_FAIL__	Auxiliary file with failure of components to be taken into account during L1 processing
BULLETIN_B_FILE	AUX_BULL_B	IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation
RFI_LIST_FILE	AUX_RFILST	Global RFI position list used in the RFI mitigation algorithms
FRESNEL_FILE	AUX_FRSNEL	Brightness temperature of the Fresnel model for every possible pixel to be observed by the instrument

Table 4-45 Level 1 B Full Polarization Reconstructed Brightness Temperatures Fourier Components Reference Data Sets

The following are the rules to update the SPH General Quality Information structure from the resulting Quality_Information flags for each data set record:

Counter Name	Condition
Software_Error_Counter	Count all the snapshots that have the Software_Error_flag set
Instrument_Error_Counter	Count all the snapshots that have the Instrument_Error_flag set
ADF_Error_Counter	Count all the snapshots that have the ADF_Error_flag set
Calibration_Error_Counter	Count all the snapshots that have the Calibration_Error_flag set
N_Discarded_Scenes	Add to the counter in the L1a input product the number of L1a snapshot discarded during the processing. Currently L1a snapshot are discarded in the case of missing sequences in the Full polarization mode.



4.2.4.2.2.2 Data Block

The binary Data Block of the MIR_SC_F1B / MIR_TARF1B product consists of two Measurement datasets, containing the components of the FFT of the reconstructed image and the scene bias correction data for each DSR. There is one DSR for the first integration time, in HHH or VVV polarization mode, and three DSR for the second integration time (HH, HV_Real, HV_Imag; or VV, HV_Real, HV_Imag).

The following table describes the XML schema used to decode the binary contents of this type of record. The tag element used to describe the DSR structure name in the XML schema shall be **Temp_Snapshot_Full**.

- The **Temp_Snapshot_Full** data set consists of the complete set of brightness temperatures Fourier components obtained by processing Level 1A full polarization products. There shall be a complete Data Set Record for each complete scene, i.e. one DSR per integration time for the pure polarisation acquisition and three DSR per integration time for the combined polarisation acquisition. The first field in the dataset, **Counter**, specifies the number of DSR contained in it, while the following fields are **Counter** repetitions of the **Reconstructed_BT_Snapshot** dataset record structure. The size of each DSR is fixed and equal to 22515 bytes.
- The **Scene_Bias_Correction** data set contains specific data computed during Image Reconstruction, which must be added later during geolocation in order to obtain the complete Brightness Temperature distribution. The data computed is used to correct for the Scene Dependent Bias detected in simulation tests. There shall be a complete Data Set Record for each integration time. All data is referenced to the time described in the field Snapshot_Time expressed in UTC format. Snapshot_OBET is still referred to the start of the integration time, but it is kept as it provides an extra unique reference to the snapshot available in other Data Sets. The first field in the dataset, **Scene_Bias_Counter**, specifies the number of DSR contained in it, while the following fields are **Counter** repetitions of the **Scene_Bias** dataset record structure. The size of each DSR is fixed and equal to 64 bytes.

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Temp_Snapshot_Full					Init of binary Data Set containing the Reconstructed_BT_Snapshot data set records.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
01	Reconstructed_BT_Snapshot_Counter	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of Reconstructed_BT_Snapshot data set record structures.	Generated by L1 Processor.
	List_of_Reconstructed_BT_Snapshots					Init of list of Reconstructed_BT_Snapshot data set record structures, repeated Counter times. The number of DSR is twice the number of integration times.	
	Reconstructed_BT_Snapshot					Init of Reconstructed_BT_Snapshot data set record structure.	
02	Snapshot_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the scene was taken. Start of integration time period. Expressed in EE CFI transport time format.	Copied from L1A product
03	Snapshot_ID	Identifier	N/A	unsigned integer (4 bytes)	1 element snapshot within orbit)	Unique identifier for the snapshot. Formed by aggregation of orbit and time within orbit. Contents of this field are formed by: $\text{Absolute_orbit_number} * 10000 + \text{Seconds_from_ANX}$	Copied from L1A product
04	Snapshot_OBET	Time counter	N/A	bit stream (8 bytes) declared as unsigned long	1 element (OBET Format is specified in section 4.2.1.2)	Unique identifier for the snapshot. Formed by the OBET at T_SYNC extracted from L0. Represents start of integration time in OBET format.	Copied from L1A product



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
05	<i>X_Position</i>	Real value	m	Double (8 bytes)	1 element	Orbit State Vector X Position in Earth Fixed Reference at snapshot_Time (field 02)	Copied from TLM_MIRA1A product
06	<i>Y_Position</i>	Real value	m	Double (8 bytes)	1 element	Orbit State Vector Y Position in Earth Fixed Reference at snapshot_Time (field 02)	Copied from TLM_MIRA1A product
07	<i>Z_Position</i>	Real value	m	Double (8 bytes)	1 element	Orbit State Vector Z Position in Earth Fixed Reference at snapshot_Time (field 02)	Copied from TLM_MIRA1A product
08	<i>X_Velocity</i>	Real value	m/s	Double (8 bytes)	1 element	Orbit State Vector X Velocity in Earth Fixed Reference at snapshot_Time (field 02)	Copied from TLM_MIRA1A product
09	<i>Y_Velocity</i>	Real value	m/s	Double (8 bytes)	1 element	Orbit State Vector Y Velocity in Earth Fixed Reference at snapshot_Time (field 02)	Copied from TLM_MIRA1A product
10	<i>Z_Velocity</i>	Real value	m/s	Double (8 bytes)	1 element	Orbit State Vector Z Velocity in Earth Fixed Reference at snapshot_Time (field 02)	Copied from TLM_MIRA1A product
11	<i>Vector_Source</i>	Identifier	N/A	unsigned byte	1 element	Source of the Orbit State Vector record: <ul style="list-style-type: none"> • SOLUTION_NULL = 0 • SOLUTION_INITIALISATION = 1 • SOLUTION_PVT_FROZEN = 2 • SOLUTION_NKF_SOLUTION = 3 • SOLUTION_SPS_SOLUTION = 4 • SOLUTION_PREDICTED = 5 (not used) • SOLUTION_RESTITUTED = 6 (not used) 	Copied from TLM_MIRA1A product



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
12	<i>Q0</i>	Real value	N/A	Double (8 bytes)	1 element	Real number component of quaternion obtained rotating from the J2000 inertial reference frame to the satellite body frame	Copied from TLM_MIRA1A product
13	<i>Q1</i>	Real value	N/A	Double (8 bytes)	1 element	First component of quaternion obtained rotating from the J2000 inertial reference frame to the satellite body frame	Copied from TLM_MIRA1A product
14	<i>Q2</i>	Real value	N/A	Double (8 bytes)	1 element	Second component of quaternion obtained rotating from the J2000 inertial reference frame to the satellite body frame	Copied from TLM_MIRA1A product
15	<i>Q3</i>	Real value	N/A	Double (8 bytes)	1 element	Third component of quaternion obtained rotating from the J2000 inertial reference frame to the satellite body frame	Copied from TLM_MIRA1A product
16	<i>Flags</i>	Set of flags	N/A	unsigned byte	1 element	L1b flags applicable to the scene for this particular integration time. The complete set of flags in the available byte are specified in section 4.2.4.2.1.2.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
17	Antenna_Boresight	Array of real values	deg	Float (4bytes)	2 elements	<p>In case of MIR_SC_D1B:</p> <ul style="list-style-type: none"> First element is Latitude of Earth surface point in the snapshot's boresight direction. Second element is Longitude of Earth surface point in the snapshot's boresight direction. Should be set to 0 in case geolocation is not possible due to data acquired during a slew manoeuvre <p>In case of MIR_TARD1B:</p> <ul style="list-style-type: none"> First element is Right Ascension in the snapshot's boresight direction (coordinates reference system is B1950). Second element is Declination in the snapshot's boresight direction (coordinates reference system is B1950). 	Copied from L1A product



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
18	Scene_BT_Fourier	Array of components of complex values	N/A	Double (8 bytes). Element is only real or imaginary part	Vector array of 2791 values. If pure polarization (HH or VV) scene, see order in Figure 4-3; first one double for the zero baseline, then 1395 doubles for the real parts of the upper baselines of the star domain, then 1395 doubles for the imaginary parts of the same baselines) If cross-polarisation (HV_real or HV_imag) scene they represent real or imaginary components, respectively, in the complete star domain. Order is described in Figure 4-3, for the complete star domain.	Complex Fourier Domain components of the reconstructed scene. If FTT is not applied, the scene does not contain a constant Earth bias over the Earth within unit circle.	Generated by L1 Processor after reconstruction of calibrated visibilities



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
19	Accuracy	Real value	K	Float (4 bytes)	1 element	Snapshot overall accuracy measurement, based on Corbella equation and computed as the difference of the mean snapshot Brightness Temperature and the averaged physical temperature of the LICEF receivers	Generated by L1 Processor.
20	Physical_Temperatures_STD	Real value	K	Float (4 bytes)	1 element	Standard deviation of the physical temperature of the LICEF receivers at the integration time	Generated by L1 Processor, based in physical temperature matrix in L1A HKTM
21	Average_System_Temperatures	Real value	K	Float (4 bytes)	1 element	Average of the system temperatures computed in the L1A product for the corresponding integration time and polarisation using pure LICEF units (i.e. not considering NIR-LICEF units)	Generated by L1 Processor based on L1A product
22	LICEF_Status	Array of flags	N/A	byte-8 (8 flags contained)	2 arrays, one for each polarisation (H and V), of 9 elements each, with totally 72 bit-flags in each array. Field size is then 18 bytes	Status of each LICEF by polarisation H, V (0=No error, 1=Error). Obtained from single failure and correlator failure identification.	Copied from L1A HKTM
23	CMN_NIR_Status	Array of flags	N/A	Unsigned short (2 bytes)	Array of 12+3 status bit-flags contained in 2 bytes. Order is first CMN status, then NIR status	Status of each CMN and NIR (0=No error, 1=Error). Obtained from single failure identification.	Copied from L1A HKTM
24	Foreign_Sources_Flags	Flags	N/A	Byte-8	1 element	Characteristics of the Foreign Sources involved in each integration time (Sun eclipsed, in the front/back of the instrument,...) (see section 4.2.4.2.1.2)	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
25	<i>Direct_Sun_Pos</i>	Real value	N/A	Float (4 bytes)	Vector array of 2 elements (first xi, then eta)	Position in antenna reference frame of Sun position (xi-eta coordinates). Vector array of [2] float elements	Generated by L1 Processor.
26	<i>Reflected_Sun_Pos</i>	Real value	N/A	Float (4 bytes)	Vector array of 2 elements (first xi, then eta)	Position in antenna reference frame of reflected Sun position (xi-eta coordinates). Reflected Sun is always out of Extended alias-free FOV, but as complete unit circle is represented, it is significative.	Generated by L1 Processor.
27	<i>Direct_Moon_Pos</i>	Real value	N/A	Float (4 bytes)	Vector array of 2 elements (first xi, then eta)	Position in antenna reference frame of Moon position (xi-eta coordinates).	Generated by L1 Processor.
28	<i>Direct_Sun_BT</i>	Real value	K	Double (8 bytes)	1 element	Magnitude of Direct Sun Brightness Temperature as derived during reconstruction process and subtracted. Set to 0 if Sun is in Eclipse.	Generated by L1 Processor.
29	<i>Constant_Earth_BT</i>	Real value	K	Double (8 bytes)	1 element	Magnitude of Constant Earth Brightness Temperature as derived during reconstruction process and subtracted. This value is only meaningful for X and Y-pol scenes, when processing is done in Gibbs 1 mode. In all other cases it is set to 0 as no temperature is removed for cross-polarization in Gibbs 1 and the artificial scene in Gibbs 2 value is not constant.	Generated by L1 Processor.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
30	<i>X -Band</i>	Integer	N/A	Unsigned 1 byte	1 element	<ul style="list-style-type: none"> 0 if X-Band Transmitter OFF 1 if X-Band Transmitter ON (Nominal side) if X-Band Transmitter ON (Redundant side) 3 if X-Band Transmitter ON (Nominal and Redundant side) 	Generated by L1 Processor.
31	<i>Matrix_BFP2EF</i>	Real value		Double (8 bytes)	9 elements	<ul style="list-style-type: none"> Rotation matrix from Best Fit Plane to Earth Fixed frame. Data is stored as 1D vector with 9 values, rowwise (row1 – row2 – row3). 	Generated by L1 Processor.
	<i>Quality_Information</i>					Init of <i>Quality_Information</i> structure.	
32	<i>Software_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See [RD.24] for details.	Generated by L1 Processor.
33	<i>Instrument_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See [RD.24] for details.	Generated by L1 Processor.
34	<i>ADF_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See [RD.24] for details.	Generated by L1 Processor.
35	<i>Calibration_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See [RD.24] for details.	Generated by L1 Processor.
	<i>Quality_Information</i>					End of <i>Quality_Information</i> structure.	
	<i>Reconstructed_BT_Snapshot</i>					End of <i>Reconstructed_BT_Snapshot</i> data set record structure.	
	<i>List_of_Reconstructed_BT_Snapshots</i>					End of list of <i>Reconstructed_BT_Snapshot</i> data set record structures.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>Temp_Snapshot_Full</i>					End of binary Data Set containing the Reconstructed_BT_Snapshot data set records.	
	<i>Scena_Bias_Correction</i>					Init of binary Data Set containing the Scene_Bias data set records.	
36	<i>Scene_Bias_Counter</i>	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of Reconstructed_BT_Snapshot data set record structures.	Generated by L1 Processor.
	<i>List_of_Scene_Bias</i>					Init of list of List_of_Scene_Bias data set record structures	
	<i>Scene_Bias</i>					Init of Scene_Bias data set record structure	
37	<i>Snapshot_Time</i>	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the scene was taken. <u>Start of integration time period</u> . Expressed in EE CFI transport time format.	Copied from L1A product
38	<i>Snapshot_ID</i>	Identifier	N/A	unsigned integer (4 bytes)	1 element	Unique identifier for the snapshot. Formed by aggregation of orbit and time within orbit. Contents of this field are formed by: Absolute_orbit_number*10000 + Seconds_from_ANX	Copied from L1A product



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
39	Snapshot_OBET	Time counter	N/A	bit stream (8 bytes) declared as unsigned long	1 element (OBET Format is specified in section 4.2.1.2)	Unique identifier for the snapshot. Formed by the OBET at T_SYNC extracted from L0. Represents start of integration time in OBET format.	Copied from L1A product
40	Constant_Sky_BT	Real Value	K	Double (8 bytes)	1 element	Magnitude of Constant Sky Brightness Temperature as derived during reconstruction process (scene bias correction) and subtracted from the L1b output data.	Generated by L1 Processor.
41	Constant_Land_BT	Real Value	K	Double (8 bytes)	1 element	Constant_Land in case of L1b processing with Gibss-1 represents the constant Earth Brightness temperature as derived during reconstruction process and subtracted from the L1b output data (same value as in field 29). In case of L1b processing with Gibss-2 represents the constant Land Brightness temperature as derived during reconstruction process and subtracted from the L1b output data. In case of x-polarization scene the value is zero.	Generated by L1 Processor.
42	Constant_Sea_BT	Real Value	K	Double (8 bytes)	1 element	NOT USED for DPGS-V3 (filled with 0) In case of x-polarization scene the value is zero.	Generated by L1 Processor.
43	Derivative_Land_BT	Real Value	K	Double (8 bytes)	1 element	NOT USED for DPGS-V3 (filled with 0) Magnitude of First Derivative of Land Brightness Temperature against incidence angle, as derived during reconstruction process (scene bias correction) and subtracted from the L1b output data.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
44	<i>Derivative_Sea_BT</i>	Real Value	K	Double (8 bytes)	1 element	NOT USED for DPGS-V3 (filled with 0) Magnitude of First Derivative of Sea Brightness Temperature against incidence angle, as derived during reconstruction process (scene bias correction) and subtracted from the L1b output data.	
	<i>Scene_Bias</i>					End of Scene_Bias data set record structure	
	<i>List_of_Scene_Bias</i>					End of list of List_of_Scene_Bias data set record structures	
	<i>Scena_Bias_Correction</i>					End of binary Data Set containing the Scene_Bias data set records.	
	<i>Data_Block</i>					End of binary Data Block in the product.	

Table 4-46 Level 1 B Full Polarization Reconstructed Brightness Temperatures Fourier Components Product Data Block

4.2.5 L1C Data Specification

L1C Data contains multi-angle Top of Atmosphere Brightness Temperature geolocated on a Discrete grid as defined in the AUX_DGG ADF file. The products are obtained in science measurement mode when pointing to the earth in nominal mode, starting from L1B brightness temperatures Fourier components, performing an inverse FFT (including the apodization function), adding back the constant term subtracted during the previous L1b processing and geolocating them in pole-to-pole swaths according to ascending and descending passes.

The products include values for Faraday rotation and geometrical rotation corrections. Geophysical information available are the USGS land and sea mask, the minimum and maximum Ice extension and coast distance as derived from the AUX_LSMASK ADF.

There are two types of L1c product: Land for Soil Moisture retrieval and Sea for Sea Surface Salinity retrieval. The split of the grid points within the two files is done in agreement with the information contained in the AUX_MASK ADF.

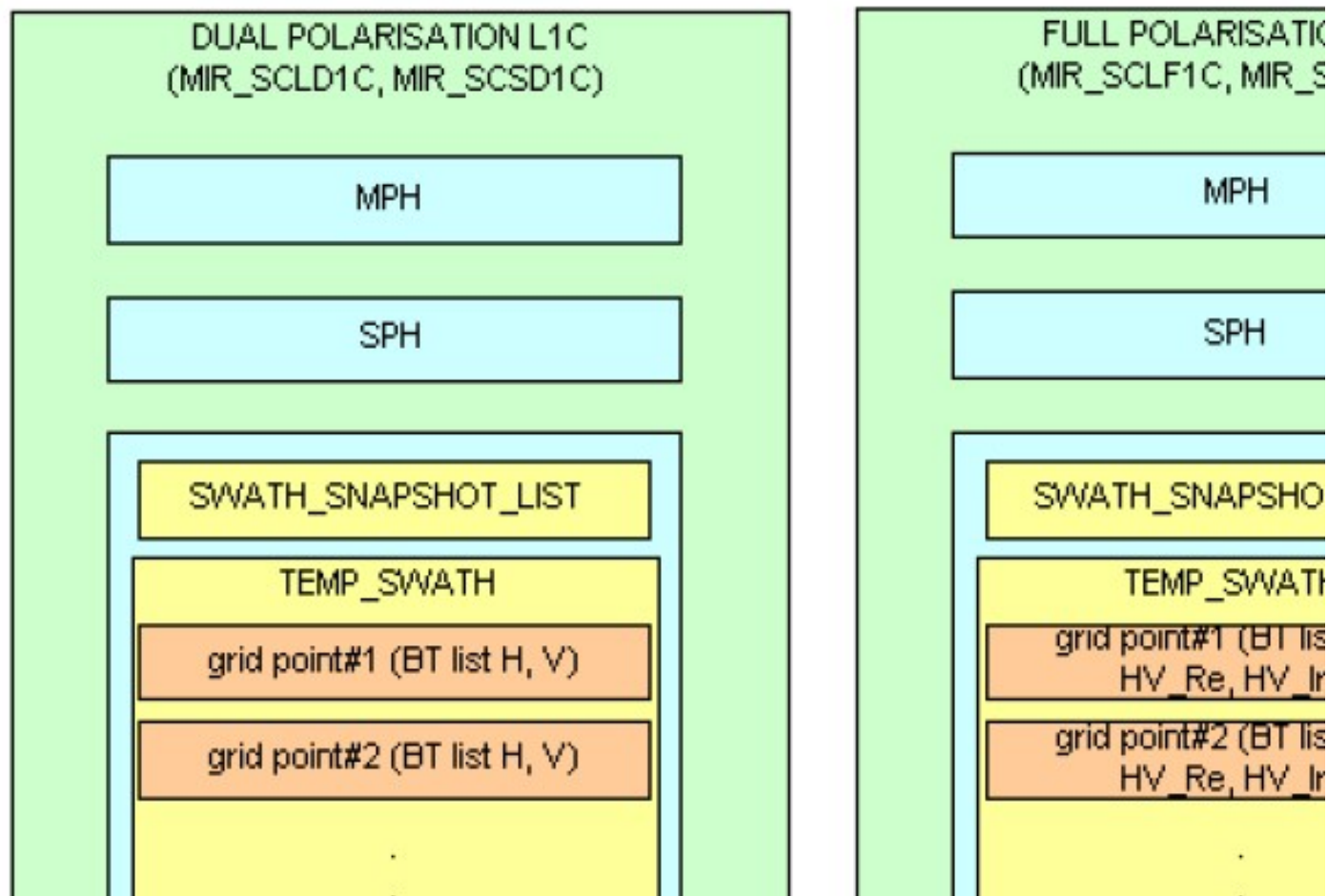


Figure 4-5 SMOS L1C product structure (taken from Deimos Eng., L1PP Product format)



4.2.5.1 Dual Polarization Reconstructed \bar{T}_B Swath (MIR_SCSD1C / MIR_SCLD1C)

The dual polarization reconstructed brightness temperature swath are L1C products obtained from MIR_SC_D1B products when pointing to the earth. It is organized in grid points (these belonging to the Digital Global Grid DGG, organized in equal-area cells corresponding to $2.7 \cdot 10^6$ points), each point containing several brightness temperature samples TOA (on top of the atmosphere, at the antenna reference frame), and also a number of geophysical parameters allowing geophysical corrections in upper processing levels.

4.2.5.1.1 Specific Product Header

The Specific Product Header for Level 1C MIR_SCLD1C/MIR_SCSD1C Products shall follow the format described in table below.

Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	<i>Specific_Product_Header</i>					Init of Specific Product Header structure	
02-19	<i>Main_Info</i>	structure	N/A	N/A	N/A	Main Product Info structure's fields as defined in fields 01 to 16 in Table 4-3	
20-26	<i>Quality_Information</i>	structure	N/A	N/A	N/A	Quality_Information structure defined as specified in Table 4-4	
27	<i>Product_Location</i>	Starting Tag					
28	<i>Start_Lat</i>	real	deg	11 bytes	%+011.6f	WGS84 geodetic latitude of the subsatellite point of the first snapshot in the product (positive to North). The range is [-90°,90°]. L2Ps copy this field from L1C SPH.	Generated by L1 Processor.



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
29	<i>Start_Lon</i>	real	deg	11 bytes	%+011.6f	WGS84 longitude of the subsatellite point of the first snapshot in the product (positive to East, from Greenwich). The range is [-180°, +180°]. L2Ps copy this field from L1C SPH.	Generated by L1 Processor.
30	<i>Stop_Lat</i>	real	deg	11 bytes	%+011.6f	WGS84 geodetic latitude of the subsatellite point of the last snapshot in the product (positive to North). The range is [-90°, 90°]. L2Ps copy this field from L1C SPH.	Generated by L1 Processor.
31	<i>Stop_Lon</i>	real	deg	11 bytes	%+011.6f	WGS84 longitude of the subsatellite point of the last snapshot in the product (positive to East, from Greenwich). The range is [-180°, +180°]. L2Ps copy this field from L1C SPH.	Generated by L1 Processor.
32	<i>Mid_Lat</i>	real	deg	11 bytes	%+011.6f	Geodetic latitude of satellite nadir point of the snapshot in the middle (rounded down) of the list used in the generation of the product. The range is [-90°, 90°]. L2Ps copy this field from L1C SPH.	Generated by L1 Processor.
33	<i>Mid_Lon</i>	real	deg	11 bytes	%+011.6f	Longitude of satellite nadir point of the snapshot in the middle (rounded down) of the list used in the generation of the product. The range is [-180°, +180°]. L2Ps copy this field from L1C SPH.	Generated by L1 Processor.



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
34	Product_Location	Closing Tag					
35	Radiometric_Accuracy_Scale	Integer	K	3 bytes	%03d	Scale used in the normalisation to 2s complement of the Pixel Radiometric Accuracy (default 50K) L2Ps use this field during its processing.	AUX_CNFL1P
36	Pixel_Footprint_Scale	Integer	km	3 bytes	%03d	Scale used in the normalisation to 2s complement of the Pixel Footprint size (default 100km) L2Ps use this field during its processing.	AUX_CNFL1P
37	Geolocation_Information	Starting tag				Tag starting a structure specifying information on the geolocation input parameters and the results statistics as well	
38	Percentage_of_Mixed_Pixels	Real	N/A	7 bytes	%07.3f	Percentage of grid point defined as mixed in the USGS classification.	Generated by L1 Processor based on AUX_LSMASK
39	Apodisation_Window	integer	N/A	3 bytes	%03d	Constant Apodisation function used to generate the product. Numerical value representing the apodisation function applied (coherent with the filename Reference Data Set) 000=Rectangular window 001=Blackman window 002=Barlett window 003=Hamming window 004=Hanning window	AUX_APDS__ / AUX_APDL__ (field Apodisation_Window)



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
						... 100=Kaiser window with alpha 1.20 101=Kaiser window with alpha 1.21 ... (user defined and agreed windows) 999=Strip Adaptive window L2Ps do not use this field from L1C SPH.	
40	Total_Num_Grid_Points	integer	N/A	6 bytes	%06d	Total number of grid points covered by L1C product. It is expected that this value is identical to datablock Grid_Point_Counter. L2Ps do not use this field from L1C SPH.	Generated by L1 Processor.
41	Geolocation_Information	Closing Tag				Tag ending the structure specifying information on the geolocation input parameters and the results statistics as well	
43-54	Data_Sets	structure	N/A	N/A	N/A	Data Sets structure's fields as defined in Table 4-5	
65	List_of_Reference_Data_Sets_L0	Starting Tag	N/A	N/A	N/A	Reference Data Sets inherited from Science L0	
66-74	Reference_Filename	string	N/A	60 bytes	%60s	Filename of input files as described in table 4-10	Copied from Science L0 header
75	List_of_Reference_Data_Sets_L0	Closing Tag	N/A	N/A	N/A	Reference Data Sets inherited from Science L0	
76	List_of_Reference_Data_Sets_L1a	Starting Tag	N/A	N/A	N/A	Reference Data Sets inherited from Science L1a	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
77-93	<i>Reference_Filename</i>	string	N/A	60 bytes	%60s	Filename of input files as described in table 4-30	Copied from Science L1a header
94	<i>List_of_Reference_Data_Sets_L1a</i>	Closing Tag	N/A	N/A	N/A	Reference Data Sets inherited from Science L1a	
95	<i>List_of_Reference_Data_Sets_L1b</i>	Starting Tag	N/A	N/A	N/A	Reference Data Sets inherited from Science L1b	
96-117	<i>Reference_Filename</i>	string	N/A	60 bytes	%60s	Filename of input files as described in table 4-43 and 4-45	Copied from Science L1b header
118	<i>List_of_Reference_Data_Sets_L1b</i>	Closing Tag	N/A	N/A	N/A	Reference Data Sets inherited from Science L1b	
119	<i>Specific_Product_Header</i>					End of Specific Product Header structure	

Table 4-47 Level 1C SPH

The specific valid Reference Data Sets for MIR_SCLD1C/MIR_SCSD1C products are:

Reference Data Set Name	Product Type	Description
L1B_FILE	MIR_SC_D1B	L1b Product filename used to create the current L1c product
DGG_FILE	AUX_DGG	Fixed Earth Grid filename used in the current L1c product
TEC_FILE	AUX_VTEC_P, AUX_VTEC_R, AUX_VTEC_C	TEC filename used in the current L1b and L1c products
PLM_FILE	AUX_PLM	Auxiliary file with PLM characterisation, defining time lags and intermediate frequency
RFI_FILE	AUX_RFI	Auxiliary file with RFI flagged pixels in the same grid as DGG
ANTENNA_PATTERNS_FILE	AUX_PATT	Auxiliary data file containing the NIR antenna patterns to be used for convolution with the original galaxy map
BEST_FIT_PLANE_FILE	AUX_BFP	Auxiliary file with definition of Best Fit Plane to be used during geolocation in L1c
L1C_PIXEL_MASK_FILE	AUX_MASK	Auxiliary file with the flagging of pixels for use in L1c land or sea products
APODISATION_FILE	AUX_APDL, AUX_APDS	Auxiliary file with definition and coefficients of the apodisation applied from L1b to L1c



Reference Data Set Name	Product Type	Description
ALGORITHM_CONFIG_FILE	AUX_CNFL1P	Processor Configuration Parameters and Constants for L1OP
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Mission planning file used to initialise the EE CFI orbit_id and/or time_id. It is read and used by the EE CFI.
MISPOINTING_ANGLES_FILE	AUX_MISP__	Auxiliary product containing the mispointing angles between the Body Frame referenced in the Proteus quaternions and the Antenna Plane defined by the MIRAS instrument
BISTATIC_SCAT_FILE	AUX_BSCAT__	Auxiliary file with Bistatic Scattering Coefficients (only used in nominal pointing processing)
LAND_SEA_MASK_FILE	AUX_LSMASK	Auxiliary file containing the Land/Sea mask of pixels in the DGG
BULLETIN_B_FILE	AUX_BULL_B	IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation
RFI_LIST_FILE	AUX_RFILST	Global RFI position list used in the RFI mitigation algorithms

Table 4-48 Level 1 C Dual Polarization Reconstructed Brightness Temperatures Swath Reference Data Sets

The valid L0 Reference Data Sets for Level1C Science Products are the same as for L0 HKTM reference files in table 4-10.

The valid L1A Reference Data Sets for Level1C Science Products are the ones in table 4-30

The valid L1B Reference Data Sets for Level1C Science Products are the ones in table 4-43.

The following are the rules to update the SPH General Quality Information structure from the resulting Quality_Information flags for each data set record:

Counter Name	Condition
Software_Error_Counter	Count all the snapshots that have the Software_Error_flag set
Instrument_Error_Counter	Count all the snapshots that have the Instrument_Error_flag set
ADF_Error_Counter	Count all the snapshots that have the ADF_Error_flag set
Calibration_Error_Counter	Count all the snapshots that have the Calibration_Error_flag set
N_Discarded_Scenes	Add to the counter in the L1b input product the number of L1b snapshot discarded during the processing. Currently L1b snapshot are discarded in the case the geolocation is not possible.



4.2.5.1.2 Data Block

The binary Data Block of the MIR_SCLD1C/MIR_SCSD1C product consists of two Measurement datasets, the first one containing the list of snapshots and associated information in the swath, and the second one containing the list of brightness temperature samples and associated geophysical information for each grid points sensed by the MIRAS instrument.

The following table describes the XML schema used to decode the binary contents of this type of record. The tag element used to describe the first DSR structure name in the XML schema shall be **Swath_Snapshot_List**, and the second one is **Temp_Swath_Dual**.

- The **Swath_Snapshot_List** data set consists of a list of the snapshots along with the parameters that characterise them. All data is referenced to the time described in the field **Snapshot_Time** expressed in UTC format. **Snapshot_OBET** is still referred to the start of the integration time, but it is kept as it provides an extra unique reference to the snapshot. There shall be a complete Data Set Record for each integration time. The first field in the dataset, Counter, specifies the number of DSR contained in it, while the following fields are **Counter** repetitions of the **Snapshot_Information** dataset record structure. The size of each DSR is fixed and equal to 166 bytes.
- The **Temp_Swath_Dual** data set shall contain a list of Brightness Temperatures and their incidence angles for every point in the Earth Fixed grid covered by the product. There shall be a complete Data Set Record for each grid point within the product. The first field in the dataset, **Counter**, specifies the number of pixels structures **Grid_Point_Data** contained in it. This dataset differs with the rest of the datasets in L1 in that it contains an intermediate hierarchical level, consisting **Grid_Point_Data** in a variable list of brightness temperature samples **BT_Data**, falling over the same DGG pixel. The size of each **BT_Data** is fixed and equal to 24 bytes, while the size of **Grid_Point_Data** is variable and depends on the number of **BT_Data** actually contained in it (18+Nx24 bytes; where N is the number of **BT_Data** over that grid point, specified by field #30 **BT_Data_Counter**). This concept is referred to as variable array of variable array.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Swath_Snapshot_List					Init of binary Data Set containing a number of Snapshot_Information data set records.	
01	Snapshot_Counter	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of Snapshot_Information data set record structures. L2Ps use this field from L1C product in its processing.	Generated by L1 Processor.
	List_of_Snapshot_Information					Init of list of Snapshot_Information data set record structures, repeated Counter times. There are as many DSR as snapshots are present in the product.	
	Snapshot_Information					Init of Snapshot_Information data set record structure.	
02	Snapshot_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the scene was taken. Start of integration time period. This reference time is applicable to all PVT and AOCS data contained in the "Auxiliary data" part. Expressed in EE CFI transport time format. L2Ps use this field from L1C product in its processing.	Copied from L1B product
03	Snapshot_ID	Identifier	N/A	unsigned integer (4 bytes)	1 element	Unique identifier for the snapshot. Formed by aggregation of orbit and time within orbit. Contents of this field are formed by: $Absolute_orbit_number * 10000 + Seconds_from_ANX$	Copied from L1B product



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
						L2Ps use this field from L1C product in its processing.	
04	Snapshot_OBET	Time counter	N/A	bit stream (8 bytes) declared as unsigned long	1 element (OBET Format is specified in section 4.2.1.2)	Unique identifier for the snapshot. Formed by the OBET at T_SYNC extracted from L0. Represents start of integration time in OBET format. L2Ps use this field from L1C product in its processing.	Copied from L1B product
05	Flags	Set of flags	N/A	Unsigned byte	1 element	L1c flags applicable to the scene for this particular integration time. Flags identified below can be retrieved: <ul style="list-style-type: none"> • L1C_FLAG_RFI_POL_H • L1C_FLAG_RFI_POL_V • L1C_FLAG_RFI_ABOVE_THRES_HOLD_01 • L1C_FLAG_RFI_ABOVE_THRES_HOLD_02 • L1C_FLAG_RFI_ABOVE_THRES_HOLD_03 Detailed information follows in this section.	Generated by L1 Processor
06	X_Position	Real value	m	Double (8 bytes)	1 element	Orbit State Vector X Position in Earth Fixed Reference at snapshot_Time (field 02) L2Ps use this field from L1C product in its processing.	Copied from L1B product
07	Y_Position	Real value	m	Double (8 bytes)	1 element	Orbit State Vector Y Position in Earth Fixed Reference at snapshot_Time (field 02) L2Ps use this field from L1C product in its processing.	Copied from L1B product
08	Z_Position	Real value	m	Double (8 bytes)	1 element	Orbit State Vector Z Position in Earth Fixed Reference at snapshot_Time (field 02)	Copied from L1B product



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
						L2Ps use this field from L1C product in its processing.	
09	X_Velocity	Real value	m/s	Double (8 bytes)	1 element	Orbit State Vector X Velocity in Earth Fixed Reference at snapshot_Time (field 02) L2Ps use this field from L1C product in its processing.	Copied from L1B product
10	Y_Velocity	Real value	m/s	Double (8 bytes)	1 element	Orbit State Vector Y Velocity in Earth Fixed Reference at snapshot_Time (field 02) L2Ps use this field from L1C product in its processing.	Copied from L1B product
11	Z_Velocity	Real value	m/s	Double (8 bytes)	1 element	Orbit State Vector Z Velocity in Earth Fixed Reference at snapshot_Time (field 02) L2Ps use this field from L1C product in its processing.	Copied from L1B product
12	Vector_Source	Identifier	N/A	Unsigned 1 byte	1 element	Source of the Orbit State Vector record: <ul style="list-style-type: none"> SOLUTION_NULL = 0 SOLUTION_INITIALISATION = 1 SOLUTION_PVT_FROZEN = 2 SOLUTION_NKF_SOLUTION = 3 SOLUTION_SPS_SOLUTION = 4 SOLUTION_PREDICTED = 5 (not used) SOLUTION_RESTITUTED = 6 (not used) 	Copied from L1B product



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
13	Q0	Real value	N/A	Double (8 bytes)	1 element	Real number component of quaternion obtained rotating from the J2000 inertial reference frame to the satellite body frame OS L2P uses this field from L1C product in its processing.	Copied from L1B product
14	Q1	Real value	N/A	Double (8 bytes)	1 element	First component of quaternion obtained rotating from the J2000 inertial reference frame to the satellite body frame OS L2P uses this field from L1C product in its processing.	Copied from L1B product
15	Q2	Real value	N/A	Double (8 bytes)	1 element	Second component of quaternion obtained rotating from the J2000 inertial reference frame to the satellite body frame OS L2P uses this field from L1C product in its processing.	Copied from L1B product
16	Q3	Real value	N/A	Double (8 bytes)	1 element	Third component of quaternion obtained rotating from the J2000 inertial reference frame to the satellite body frame OS L2P uses this field from L1C product in its processing.	Copied from L1B product
17	TEC	Real value	TECU (10^{16} Electron /m ²)	Double (8 bytes)	1 element	Total Electron Count content applicable to snapshot data. TEC value is corrected for SMOS altitude as in [RD.26]. If field #59 in the AUX_CNFL1P is set otherwise original data from IGS is used. If model is used no correction is applied for the SMOS altitude. L2Ps use this field from L1C product in its processing. In case no VTEC file is available (ADF flag set) and the model is not used, the value is 0.	Generated by L1 Processor based on AUX_VTEC_P/R/C or IRI-2001 model



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
18	Geomag_F	Real value	nT	Double (8 bytes)	1 element	Full or Total Intensity (F) of Geomagnetic field vector applicable to snapshot data, obtained mixing PVT and IGRF model OS L2P uses this field from L1C product in its processing.	Generated by L1 Processor, using IGRF-10 model
19	Geomag_D	Real value	Deg	Double (8 bytes)	1 element	Declination (D) of Geomagnetic field vector applicable to snapshot data, obtained mixing PVT and IGRF model. Magnetic declination is the angle between magnetic north and true north. D is considered positive when the angle measured is east of true north and negative when west. Positive in eastward direction OS L2P uses this field from L1C product in its processing.	Generated by L1 Processor, using IGRF-10 model
20	Geomag_I	Real value	Deg	Double (8 bytes)	1 element	Inclination (I) of Geomagnetic field vector applicable to snapshot data, obtained mixing PVT and IGRF model. Magnetic inclination is the angle between the horizontal plane and the total field vector, measured positive into Earth. Positive in downward (towards Earth Surface) direction. OS L2P uses this field from L1C product in its processing.	Generated by L1 Processor, using IGRF-10 model
21	Sun_RA	Real value	deg	Float (4 bytes)	1 element	Right Ascension of Sun illumination direction in Earth Fixed Reference	Generated by L1 Processor from Sun-related fields in L1B product



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
22	<i>Sun_DEC</i>	Real value	deg	Float (4 bytes)	1 element	Declination of Sun illumination direction in Earth Fixed Reference	Generated by L1 Processor from Sun-related fields in L1B product
23	<i>Sun_BT</i>	Real value	K	Float (4 bytes)	1 element	Direct Sun estimated Brightness Temperature that has been removed from snapshot	Generated by L1 Processor from Sun-related fields in L1B product
24	<i>Accuracy</i>	Real value	K	Float (4 bytes)	1 element	Snapshot overall accuracy measurement, based on Corbella equation and computed as the difference of the mean snapshot Brightness Temperature and the averaged physical temperature of the LICEF receivers SM L2P uses this field from L1C product in its processing.	Generated by L1 Processor, starting from L1B product
25	<i>Radiometric_Accuracy</i>	Array of real values	K	Float (4 bytes)	2 elements	Error accuracy measurement in the Brightness Temperature value at boresight: <ul style="list-style-type: none"> First one is the pure polarisation Second one is the cross-polarization The second element is only used to store the boresight accuracy for full pol snapshots, set to 0 in all other cases.	Generated by L1 Processor
26	<i>X-Band</i>	Integer	N/A	Unsigned 1 byte	1 element	<ul style="list-style-type: none"> 0 if X-Band Transmitter OFF 1 if X-Band Transmitter ON (Nominal side) if X-Band Transmitter ON (Redundant side) 3 if X-Band Transmitter ON (Nominal and Redundant side) 	Generated by L1 Processor



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Quality_Information					Init of Quality_Information structure.	
27	Software_Error_flag	Flag	N/A	unsigned byte	1 element	See [RD.24] for details.	Generated by L1 Processor
28	Instrument_Error_flag	Flag	N/A	unsigned byte	1 element	See [RD.24] for details.	Generated by L1 Processor
29	ADF_Error_flag	Flag	N/A	unsigned byte	1 element	See [RD.24] for details.	Generated by L1 Processor
30	Calibration_Error_flag	Flag	N/A	unsigned byte	1 element	See [RD.24] for details.	Generated by L1 Processor
	Quality_Information					End of Quality_Information structure.	
	Snapshot_Information					End of Snapshot_Information data set record structure.	
	List_of_Snapshot_Information					End of list of Snapshot_Information data set record structures.	
	Swath_Snapshot_List					End of Swath_Snapshot_List binary Data Set.	
	Temp_Swath_Dual					Init of Temp_Swath_Dual binary Data Set.	
31	Grid_Point_Counter	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of Grid_Point_Data data set record structures. L2Ps use this field from L1C product in its processing	Generated by L1 Processor
	List_of_Grid_Point_Datas					Init of list of Grid_Point_Data data set record structures, repeated Counter times. There are as many DSR as pixels are present in the product. The order in the product is according to Grid_Point_Latitude .	



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Type	Unit	Element Precision	Variable Format	Comment	Origin
				Init of Grid_Point_Data data set record structure.	
Identifier	N/A	Unsigned integer (4 bytes)	1 element	Unique identifier for Earth fixed grid point, linking it to Auxiliary Earth Grid file. For ISEA 4-9, maximum of 2.7M pixels L2Ps use this field from L1C product in its processing	Copied from AUX_DGG
Real value	deg	Float (4 bytes)	1 element	Latitude of the DGG cell's center identified by Grid_Point_ID. The range is [-90°, +90°]. L2Ps use this field from L1C product in its processing	Copied from AUX_DGG
Real value	deg	Float (4 bytes)	1 element	Longitude of the DGG cell's center identified by Grid_Point_ID. The range is [-180°, +180°]. L2Ps use this field from L1C product in its processing	Copied from AUX_DGG
Real value	m	Float (4 bytes)	1 element	Altitude of the DGG cell's center identified by Grid_Point_ID SM-Core V4 uses this field from L1C product in its processing	Copied from AUX_DGG
Set of flags	N/A	unsigned byte	1 element	Flag indicating land/sea USGS content, coastline distance, and Ice content. OS L2P uses this field from L1C product in its processing	AUX_LSMASK
		unsigned		Counter of Brightness Temperature Data values for current point (variable number depending on point across track position)	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	List_of_BT_Datas					Init of list of BT_Datas data structures repeated Counter times.	
	BT_Data					Init of BT_Data data set record structure.	
38	Flags	Set of flags	N/A	unsigned short integer (2 bytes)	1 element	L1c flags applicable to the pixel for this particular integration time. Flags identified below this table. L2Ps use this field from L1C product in its processing (AF_FOV flag (only OS), EAF_FOV flag, BORDER_FOV, polarization, RFI flag (only OS), SUN_FOV, SUN_GLINT_AREA, SUN_GLINT_FOV, SUN_POINT, SUN_TAILS)	Generated by L1 Processor
39	BT_Value	Real value	K	Float (4 bytes)	1 element	Brightness temperature value over current Earth fixed grid point, obtained by DFT interpolation from L1b data. L2Ps use this field from L1C product in its processing	Generated by L1 Processor, starting from L1B product
40	Pixel_Radiometric_Accuracy	Real value (coded as integer)	K	unsigned short (2 bytes)	1 element	Error accuracy measurement in the Brightness Temperature presented in the previous field, extracted in the direction of the pixel. Coded as $LSB = X/2^{16}$. Meaning that $value = (unsigned\ short) * X/2^{16}K$, where X is Radiometric_Accuracy_Scale given in SPH L2Ps use this field from L1C product in its processing	Generated by L1 Processor, starting from L1B product
41	Incidence_Angle	Real value (code as integer)	deg	unsigned short (2 bytes)	1 element	Incidence angle value corresponding to the measured BT value over current Earth fixed grid point. Measured as angle from pixel to S/C with respect to the pixel local normal	Generated by L1 Processor, from satellite's position and attitude in



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
						(0° if vertical) Coded as $LSB=90/2^{16}$. Meaning that $value=(unsigned\ short)*90/2^{16}$ degrees L2Ps use this field from L1C product in its processing	L1B, DGG point location.
42	<i>Azimuth_Angle</i>	Real value (code as integer)	deg	unsigned short (2 bytes)	1 element	Azimuth angle value corresponding to the measured BT value over current Earth fixed grid point. Measured as angle in pixel local tangent plane from projected pixel to S/C direction with respect to the local North (0° if local North) Coded as $LSB=360/2^{16}$. Meaning that $value=(unsigned\ short)*360/2^{16}$ degrees L2Ps use this field from L1C product in its processing	Generated by L1 Processor, from satellite's position and attitude in L1B, DGG point location.
43	<i>Faraday_Rotation_Angle</i>	Real value (code as integer)	deg	unsigned short (2 bytes)	1 element	Faraday rotation angle value corresponding to the measured BT value over current Earth fixed grid point. It is computed as the rotation from surface to antenna (i.e. direct angle) Coded as $LSB=360/2^{16}$. Meaning that $value=(unsigned\ short)*360/2^{16}$ degrees In case no VTEC file is available (ADF flag set) and the model is not used, the value is 0. L2Ps use this field from L1C product in its processing	Generated by L1c Processor by using VTEC and geomagnetic field from IGRF-10 model
44	<i>Geometric_Rotation_Angle</i>	Real value (code as integer)	deg	unsigned short (2 bytes)	1 element	Geometric rotation angle value corresponding to the measured BT value over current Earth fixed grid point. It is computed as the rotation from surface to antenna (i.e. direct angle)	Generated by L1 Processor



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
						Coded as $LSB=360/2^{16}$. Meaning that $value=(unsigned\ short)*360/2^{16}$ degrees L2Ps use this field from L1C product in its processing	
45	Snapshot_ID_of_Pixel	Identifier	N/A	Unsigned integer (4 bytes)	1 element	Unique identifier for the snapshot. Formed by aggregation of orbit and time within orbit. Contents of this field are formed by: $Absolute_orbit_number*10000 + Seconds_from_ANX$ L2Ps use this field from L1C product in its processing	Copied from L1B
46	Footprint_Axis1	Real value (code as integer)	km	unsigned short (2 bytes)	1 element	Elliptical footprint major semi-axis value. Coded as $LSB=X/2^{16}$. Meaning that $value=(unsigned\ short)*X/2^{16}$ km, where X is Pixel_Footprint_Scale given in SPH L2Ps use this field from L1C product in its processing	Generated by L1 Processor, using satellite's position and attitude in L1B
47	Footprint_Axis2	Real value (code as integer)	km	unsigned short (2 bytes)	1 element	Elliptical footprint minor semi-axis value. Coded as $LSB=X/2^{16}$. Meaning that $value=(unsigned\ short)*X/2^{16}$ km, where X is Pixel_Footprint_Scale given in SPH L2Ps use this field from L1C product in its processing	Generated by L1 Processor, using satellite's position and attitude in L1B
	BT_Data					End of BT_Data data set record structure.	
	List_of_BT_Datas					End of list of BT_Datas data structures, repeated Counter times.	
	Grid_Point_Data					End of Grid_Point_Data data set record structure.	
	List_of_Grid_Point_Datas					End of list of Grid_Point_Data data set	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
						record structures.	
	<i>Temp_Swath_Dual</i>					End of <i>Temp_Swath_Dual</i> binary Data Set.	
	<i>Data_Block</i>					End of binary Data Block in the product.	

Table 4-49 Level 1 C Dual Polarization Reconstructed Brightness Temperatures Swath Product Data Block

The Flags field #38 shall be used to report polarisation of the pixel measurement data, as well as quality values applicable to the measurement. The flags are contained in an 16-bit counter, each bit representing a status, and they shall be described using the following order convention:

[MSB:X X X X:X X X X:X X X X:X X X X:LSB]

This fields contains the following flags:

- Polarisation flags:
 - [X X X X:X X X X:X X X X:X X 0 0] represents HH polarisation
 - [X X X X:X X X X:X X X X:X X 0 1] represents VV polarisation
- SUN FOV flag:
 - [X X X X:X X X X:X X X X:X 0 X X] means that no Direct Sun correction has been performed during image reconstruction of this pixel
 - [X X X X:X X X X:X X X X:X 1 X X] means that Direct Sun correction for the Sun in the front of the FOV has been performed during image reconstruction of this pixel



- SUN GLINT FOV flag:
 - [X X X X:X X X X:X X X X:0 X X X] means that no Reflected Sun correction has been performed during image reconstruction of this pixel
 - [X X X X:X X X X:X X X X:1 X X X] means that Reflected Sun correction has been performed during image reconstruction of this pixel. Sun correction is based on the Sea bistatic coefficients defined in the AUX_BSCAT ADF and computed for a fixed wind speed of 7 m/s and wind direction of 0 deg North
- MOON FOV flag:
 - [X X X X:X X X X:X X X 0:X X X X] means that no Direct Moon correction has been performed during image reconstruction of this pixel
 - [X X X X:X X X X:X X X 1:X X X X] means that Direct Moon correction has been performed during image reconstruction of this pixel
- SINGLE_SNAPSHOT flag:
 - [X X X X:X X X X:X X 0 X:X X X X] means that this scene has been combined with an adjacent scene in opposite polarisation during image reconstruction to account for crosspolarisation leakage
 - [X X X X:X X X X:X X 1 X:X X X X] means that this scene has not been combined with an adjacent scene in opposite polarisation during image reconstruction to account for crosspolarisation leakage (it has been processed with only co-polar antenna patterns information)
- SUN POINT flag:
 - [X X X X:X X X X:0 X X X:X X X X] means that this pixel is **not** located in a zone (see below) where a Sun alias was reconstructed
 - [X X X X:X X X X:1 X X X:X X X X] means that this pixel is located in a zone (circle around Sun alias position with radius configurable through *Sun_Point_Flag_Size* field in AUX CNFL1P) where a Sun alias was reconstructed (if Sun removal is active, measurement may be degraded)
- SUN GLINT_AREA flag:
 - [X X X X:X X X 0:X X X X:X X X X] means that this pixel is located in a zone where no Sun reflection has been detected



- [X X X X:X X X 1:X X X X:X X X X] means that this pixel is located in a zone where Sun reflection has been detected using the bi-static scattering coefficient threshold defined in the configuration file.
- MOON POINT flag:
 - [X X X X:X X 0 X:X X X X:X X X X] means that this pixel is located in a zone where no Moon alias was reconstructed
 - [X X X X:X X 1 X:X X X X:X X X X X] means that this pixel is located in a zone where a Moon alias was reconstructed (after Moon removal, measurement may be degraded)
- AF FOV flag:
 - [X X X X:X 0 X X:X X X X:X X X X X] means that the pixel is not inside the exclusive zone of Alias free (delimited by the six aliased unit circles)
 - [X X X X:X 1 X X:X X X X:X X X X X] means that the pixel is inside the exclusive zone of Alias free (delimited by the six aliased unit circles)
- BORDER FOV flag:
 - [X X X 0:X X X X:X X X X:X X X X X] means that the pixel is far from the border delimiting the Extended Alias free zone and from the unit circle replicas borders (also known as “suspenders and belts”)
 - [X X X 1:X X X X:X X X X:X X X X X] means that the pixel is close to the border delimiting the Extended Alias free zone or to the unit circle replicas borders (also known as “suspenders and belts”). Distance threshold is configurable through *FOV_Border_Flag_Size* field in AUX CNFL1P
- SUN TAILS flag:
 - [X X 0 X:X X X X:X X X X:X X X X X] means that this pixel is located in a zone with no potential problems with Sun aliases
 - [X X 1 X:X X X X:X X X X:X X X X X] means that this pixel is located in the hexagonal alias directions centred on a Sun alias (if Sun is not removed, measurement may be degraded in these directions)
- RFI flags:
 - [X X X X:X X X X:X 0 X X:X X X X X] means that the measurement is not affected by any point source RFI as identified in the AUX RFI list and it does not exceed the threshold defined in *BT_Dual/Full_RFI_Pixel_Flag_Threshold* fields in AUX CNFL1P



- [X X X X:X X X X:X 1 X X:X X X X] means that the measurement is affected by point source RFI as identified in the AUX RFI list (flag is set in a circle around the RFI position, with a radius dependant on the RFI expected BT defined in the AUX RFILST), or it has exceeded the threshold defined in *BT_Dual/Full_RFI_Pixel_Flag_Threshold* fields in AUX CNFL1P, is negative for Dual Polarisation values, or is in a region affected by a very strong RFI source that saturated the NIR
- [X X X X:0 X X X:X X X X:X X X X] means that the pixel is not affected by any tails from point source RFI as identified in the AUX RFILST ADF
- [X X X X:1 X X X:X X X X:X X X X] means that the measurement is affected by the tails of a point source RFI as identified in the AUX RFI list (tail width is dependant on the RFI estimated BT (from each snapshot measurements) , corresponding to 0.16 of the radius of the RFI circle flagged), or is in a region affected by a very strong RFI source that saturated the NIR
- [0 1 X X:X X X X:X X X X:X X X X] means that the measurement is affected by a point source RFI identified in the AUX RFI list whose contribution generates a contamination in BT above a certain level defined in the AUX CNFL1P file or is in a region affected by a very strong RFI source that saturated the NIR
- [1 0 X X:X X X X:X X X X:X X X X] means that the measurement is affected by a point source RFI identified in the AUX RFI list whose contribution generates a contamination in BT above a certain level defined in the AUX CNFL1P file or is in a region affected by a very strong RFI source that saturated the NIR
- [1 1 X X:X X X X:X X X X:X X X X] means that the measurement is affected by a point source RFI identified in the AUX RFI list whose contribution generates a contamination in BT above a certain level defined in the AUX CNFL1P file or is in a region affected by a very strong RFI source that saturated the NIR

The Flags field #05 shall be used to report possible RFI contamination of the pixel measurement data, as well as quality values applicable to the measurement. The flags are contained in an 08-bit counter, each bit representing a status, and they shall be described using the following order convention:

- [MSB:X X X X:X X X X:LSB]

This fields contains the following flags:



- [X X X X:X X X 0] means that no RFI has been detected in the snapshot upon analysis of the NIR Brightness Temperatures or System Temperatures Standard Deviation in H polarisation [X X X X:X X X 1] means that analysis of the NIR Brightness Temperatures or System Temperatures standard deviation in H polarisation has reported this snapshot as an outlier of the expected trend, which is a clear indicator of the presence of one or more RFI sources in the data; that the Temperatures were saturated or in the vicinity of such saturation and there is a high probability that the measurement is affected
- [X X X X:X X 0 X] means that no RFI has been detected in the snapshot upon analysis of the NIR Brightness Temperatures or System Temperatures Standard Deviation in V polarisation
- [X X X X:X X 1 X] means that analysis of the NIR Brightness Temperatures or System Temperatures standard deviation in V polarisation has reported this snapshot as an outlier of the expected trend, which is a clear indicator of the presence of one or more RFI sources in the data; that the Temperatures were saturated or in the vicinity of such saturation and there is a high probability that the measurement is affected
- [X X X X:X 0 X X] means that the snapshot from that integration time is not affected by an RFI source point whose intensity exceeds the threshold 01 defined in the AUX_CNFL1P file.
- [X X X X:X 1 X X] means that the snapshot from that integration time is affected by an RFI source point whose intensity exceeds the threshold 01 defined in the AUX_CNFL1P file.
- [X X X X:0 X X X] means that the snapshot from that integration time is not affected by an RFI source point whose intensity exceeds the threshold 02 defined in the AUX_CNFL1P file.
- [X X X X:1 X X X] means that the snapshot from that integration time is affected by an RFI source point whose intensity exceeds the threshold 02 defined in the AUX_CNFL1P file.
- [X X X 0:X X X X] means that the snapshot from that integration time is not affected by an RFI source point whose intensity exceeds the threshold 03 defined in the AUX_CNFL1P file.
- [X X X 1:X X X X] means that the snapshot from that integration time is affected by an RFI source point whose intensity exceeds the threshold 03 defined in the AUX_CNFL1P file.

For more information on how these flags are set and their effect, please refer to Appendix F, in Section 12.



4.2.5.2 Full Polarization Reconstructed \tilde{T}_B Swath (MIR_SCSF1C / MIR_SCLF1C)

The MIR_SCLF1C/MIR_SCSF1C products obtained from MIR_SC_F1B products when pointing to the earth. It is organized in grid points (these belonging to the Digital Global Grid DGG, organized in equal-area cells corresponding to $2.7 \cdot 10^6$ points), each point containing several brightness temperature samples TOA (on top of the atmosphere, at the antenna reference frame), and also a number of geophysical parameters allowing geophysical corrections in upper processing levels.

As is specified for the dual polarization mode, the MIR_SCSF1C product will contain 200km of land, and the MIR_SCLF1C with contain 200km of sea.

4.2.5.2.1 Specific Product Header

The Specific Product Header for MIR_SCLF1C/ MIR_SCSF1C Products shall follow the format described in section 4.2.5.1.1.

The specific valid Reference Data Sets for MIR_SCLF1C/ MIR_SCSF1C Products are:

Reference Data Set Name	Product Type	Description
L1B_FILE	MIR_SC_F1B	L1b Product filename used to create the current L1c product
DGG_FILE	AUX_DGG__	Fixed Earth Grid filename used in the current L1c product
TEC_FILE	AUX_VTEC_P, AUX_VTEC_R, AUX_VTEC_C	TEC filename used in the current L1b and L1c products
PLM_FILE	AUX_PLM__	Auxiliary file with PLM characterisation, defining time lags and intermediate frequency
RFI_FILE	AUX_RFI__	Auxiliary file with RFI flagged pixels in the same grid as DGG
ANTENNA_PATTERNS_FILE	AUX_PATT__	Auxiliary data file containing the NIR antenna patterns to be used for convolution with the original galaxy map
BEST_FIT_PLANE_FILE	AUX_BFP__	Auxiliary file with definition of Best Fit Plane to be used during geolocation in L1c
L1C_PIXEL_MASK_FILE	AUX_MASK__	Auxiliary file with the flagging of pixels for use in L1c land or sea products
APODISATION_FILE	AUX_APDL__, AUX_APDS__	Auxiliary file with definition and coefficients of the apodisation applied from L1b to L1c
ALGORITHM_CONFIG_FILE	AUX_CNFL1P	Auxiliary file with definition and coefficients of the apodisation applied from L1b to L1cProcessor Configuration Parameters and Constants for L1OP
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Mission planning file used to initialise the EE CFI orbit_id and/or time_id. It is read and used by the EE CFI.
MISPOINTING_ANGLES_FILE	AUX_MISP__	Auxiliary product containing the mispointing angles between the Body Frame referenced in the



Reference Data Set Name	Product Type	Description
		Proteus quaternions and the Antenna Plane defined by the MIRAS instrument
BISTATIC_SCAT_FILE	AUX_BSCAT	Auxiliary file with Bistatic Scattering Coefficients (only used in nominal pointing processing)
LAND_SEA_MASK_FILE	AUX_LSMASK	Auxiliary file containing the Land/Sea mask of pixels in the DGG
BULLETIN_B_FILE	AUX_BULL_B	IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation
RFI_LIST_FILE	AUX_RFILST	Global RFI position list used in the RFI mitigation algorithms

Table 4-50 Level 1 C Full Polarization Reconstructed Brightness Temperatures Swath Reference Data Sets

The valid L1B Reference Data Sets for Level1C Science Products are the ones in table 4-45.

The following are the rules to update the SPH General Quality Information structure from the resulting Quality_Information flags for each data set record:

Counter Name	Condition
Software_Error_Counter	Count all the snapshots that have the Software_Error_flag set
Instrument_Error_Counter	Count all the snapshots that have the Instrument_Error_flag set
ADF_Error_Counter	Count all the snapshots that have the ADF_Error_flag set
Calibration_Error_Counter	Count all the snapshots that have the Calibration_Error_flag set
N_Discarded_Scenes	Add to the counter in the L1b input product the number of L1b snapshot discarded during the processing. Currently L1b snapshot are discarded in the case the geolocation is not possible.

4.2.5.2.2 Data Block

The binary Data Block of the MIR_SCLF1C/ MIR_SCSF1C product consists of two Measurement datasets, the first one containing the list of snapshots and associated information in the swath, and the second one containing the list of brightness temperature samples and associated geophysical information for each grid points sensed by the MIRAS instrument.

The following table describes the XML schema used to decode the binary contents of this type of record. The tag element used to describe the first DSR structure name in the XML schema shall be **Swath_Snapshot_List**, and the second one is **Temp_Swath_Full**.



- The **Swath_Snapshot_List** data set consists of a list of the snapshots along with the parameters that characterise them. All data is referenced to the time described in the field **Snapshot_Time** expressed in UTC format. **Snapshot_OBET** is still referred to the start of the integration time, but it is kept as it provides an extra unique reference to the snapshot. There shall be a complete Data Set Record for each integration time. The first field in the dataset, **Counter**, specifies the number of DSR contained in it, while the following fields are **Counter** repetitions of the **Snapshot_Information** dataset record structure. The size of each DSR is fixed and equal to 161 bytes.
- The **Temp_Swath_Full** data set shall contain a list of Brightness Temperatures and their incidence angles for every point in the Earth Fixed grid covered by the product. There shall be a complete Data Set Record for each grid point within the product. The first field in the dataset, **Counter**, specifies the number of pixels structures **Grid_Point_Data** contained in it. This dataset differs with the rest of the datasets in L1 in that it contains an intermediate hierarchical level, consisting **Grid_Point_Data** in a variable list of brightness temperature samples **BT_Data**, falling over the same DGG pixel. The size of each **BT_Data** is fixed and equal to 28 bytes, while the size of **Grid_Point_Data** is variable and depends on the number of **BT_Data** actually contained in it (18+Nx28 bytes; where N is the number of **BT_Data** over that grid point, specified by field #30 **Counter**). This concept is referred to as variable array of variable array.

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Swath_Snapshot_List					Init of binary Data Set containing a number of Snapshot_Information data set records.	
01	Snapshot_Counter	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of Snapshot_Information data set record structures. L2Ps use this field from L1C product in its processing	Generated by L1 Processor
	List_of_Snapshot_Information					Init of list of Snapshot_Information data set record structures, repeated Counter times. There are as many DSR as snapshots are present in the product	
	Snapshot_Information					Init of Snapshot_Information data set	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
						record structure.	
02	Snapshot_Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC Time at which the scene was taken. Start of integration time period. This reference time is applicable to all PVT and AOCS data contained in the "Auxiliary data" part. Expressed in EE CFI transport time format. L2Ps use this field from L1C product in its processing	Copied from L1B product
03	Snapshot_ID	Identifier	N/A	unsigned integer (4 bytes)	1 element	Unique identifier for the snapshot. Formed by aggregation of orbit and time within orbit. Contents of this field are formed by: $Absolute_orbit_number * 10000 + Seconds_from_ANX$ L2Ps use this field from L1C product in its processing	Copied from L1B product
04	Snapshot_OBET	Time counter	N/A	bit stream (8 bytes) declared as unsigned long	1 element (OBET Format is specified in section 4.2.1.2)	Unique identifier for the snapshot. Formed by the OBET at T_SYNC extracted from L0. Represents start of integration time in OBET format.	Copied from L1B product
05	Flags	Set of flags	N/A	Unsigned byte	1 element	L1c flags applicable to the scene for this particular integration time. Flags identified below can be retrieved: <ul style="list-style-type: none"> • L1C_FLAG_RFI_POL_H • L1C_FLAG_RFI_POL_V • L1C_FLAG_RFI_ABOVE_THRESH_OLD_01 • L1C_FLAG_RFI_ABOVE_THRESH_OLD_02 • L1C_FLAG_RFI_ABOVE_THRESH 	Generated by L1 Processor



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
						OLD_03 Detailed information can be found in Section 4.2.5.1.2.	
06	<i>X_Position</i>	Real value	m	Double (8 bytes)	1 element	Orbit State Vector X Position in Earth Fixed Reference at snapshot_Time (field 1) L2Ps use this field from L1C product in its processing	Copied from L1B product
07	<i>Y_Position</i>	Real value	m	Double (8 bytes)	1 element	Orbit State Vector Y Position in Earth Fixed Reference at snapshot_Time (field 1) L2Ps use this field from L1C product in its processing	Copied from L1B product
08	<i>Z_Position</i>	Real value	m	Double (8 bytes)	1 element	Orbit State Vector Z Position in Earth Fixed Reference at snapshot_Time (field 1) L2Ps use this field from L1C product in its processing	Copied from L1B product
09	<i>X_Velocity</i>	Real value	m/s	Double (8 bytes)	1 element	Orbit State Vector X Velocity in Earth Fixed Reference at snapshot_Time (field 1) L2Ps use this field from L1C product in its processing	Copied from L1B product
10	<i>Y_Velocity</i>	Real value	m/s	Double (8 bytes)	1 element	Orbit State Vector Y Velocity in Earth Fixed Reference at snapshot_Time (field 1) L2Ps use this field from L1C product in its processing	Copied from L1B product
11	<i>Z_Velocity</i>	Real value	m/s	Double (8 bytes)	1 element	Orbit State Vector Z Velocity in Earth Fixed Reference at snapshot_Time (field 1) L2Ps use this field from L1C product in its processing	Copied from L1B product
12	<i>Vector_Source</i>	Identifier	N/A	Unsigned 1 byte	1 element	Source of the Orbit State Vector record: <ul style="list-style-type: none"> SOLUTION_NULL = 0 SOLUTION_INITIALISATION = 1 	Copied from L1B product



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
						<ul style="list-style-type: none"> SOLUTION_PVT_FROZEN = 2 SOLUTION_NKF_SOLUTION = 3 SOLUTION_SPS_SOLUTION = 4 SOLUTION_PREDICTED = 5 (not used) SOLUTION_RESTITUTED = 6 (not used) 	
13	Q0	Real value	N/A	Double (8 bytes)	1 element	Real number component of quaternion obtained rotating from the J2000 inertial reference frame to the satellite body frame OS L2P uses this field from L1C product in its processing	Copied from L1B product
14	Q1	Real value	N/A	Double (8 bytes)	1 element	First component of quaternion obtained rotating from the J2000 inertial reference frame to the satellite body frame OS L2P uses this field from L1C product in its processing	Copied from L1B product
15	Q2	Real value	N/A	Double (8 bytes)	1 element	Second component of quaternion obtained rotating from the J2000 inertial reference frame to the satellite body frame OS L2P uses this field from L1C product in its processing	Copied from L1B product
16	Q3	Real value	N/A	Double (8 bytes)	1 element	Third component of quaternion obtained rotating from the J2000 inertial reference frame to the satellite body frame OS L2P uses this field from L1C product in its processing	Copied from L1B product
17	TEC	Real value	TECU (10^{16} Electron /m ²)	Double (8 bytes)	1 element	Total Electron Count content applicable to snapshot data. TEC value is corrected for SMOS altitude as in [RD.26]. If field #59 in the AUX_CNFL1P is set otherwise original	Generated by L1 Processor from AUX_VTEC_P/R/C or IRI-2001 model



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
						data from IGS is used. If model is used no correction is applied for the SMOS altitude. L2Ps use this field from L1C product in its processing In case no VTEC file is available (ADF flag set) and the model is not used, the value is 0.	
18	Geomag_F	Real value	nT	Double (8 bytes)	1 element	Full or Total Intensity (F) of Geomagnetic field vector applicable to snapshot data, obtained mixing PVT and IGRF model OS L2P uses this field from L1C product in its processing	Generated by L1 Processor, using IGRF-10 model
19	Geomag_D	Real value	Deg	Double (8 bytes)	1 element	Declination (D) of Geomagnetic field vector applicable to snapshot data, obtained mixing PVT and IGRF model. Magnetic declination is the angle between magnetic north and true north. D is considered positive when the angle measured is east of true north and negative when west. Positive in eastward direction OS L2P uses this field from L1C product in its processing	Generated by L1 Processor, using IGRF-10 model
20	Geomag_I	Real value	Deg	Double (8 bytes)	1 element	Inclination (I) of Geomagnetic field vector applicable to snapshot data, obtained mixing PVT and IGRF model. Magnetic inclination is the angle between the horizontal plane and the total field vector, measured positive into Earth. Positive in downward (towards Earth Surface) direction.	Generated by L1 Processor, using IGRF-10 model



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
						OS L2P uses this field from L1C product in its processing	
21	Sun_RA	Real value	deg	Float (4 bytes)	1 element	Right Ascension of Sun illumination direction in Earth Fixed Reference	Generated by L1 Processor from Sun-related fields in L1B product
22	Sun_DEC	Real value	deg	Float (4 bytes)	1 element	Declination of Sun illumination direction in Earth Fixed Reference	Generated by L1 Processor from Sun-related fields in L1B product
23	Sun_BT	Real value	K	Float (4 bytes)	1 element	Direct Sun estimated Brightness Temperature that has been removed from snapshot	Generated by L1 Processor from Sun-related fields in L1B product
24	Accuracy	Real value	K	Float (4 bytes)	1 element	Snapshot overall accuracy measurement, based on Corbella equation and computed as the difference of the mean snapshot Brightness Temperature and the averaged physical temperature of the LICEF receivers SM L2P uses this field from L1C product in its processing	Generated by L1 Processor, starting from L1B product
25	Radiometric_Accuracy	Array of real values	K	Float (4 bytes)	2 elements	Error accuracy measurement in the Brightness Temperature value at boresight: <ul style="list-style-type: none"> First one is the pure polarisation Second one is the cross-polarization The second element is only used to store the boresight accuracy for full pol snapshots, set to 0 in all other cases.	Generated by L1 Processor



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
26	<i>X-Band</i>	Integer	N/A	Unsigned 1 byte	1 element	<ul style="list-style-type: none"> 0 if X-Band Transmitter OFF 1 if X-Band Transmitter ON (Nominal side) if X-Band Transmitter ON (Redundant side) 3 if X-Band Transmitter ON (Nominal and Redundant side) 	Generated by L1 Processor
	<i>Quality_Information</i>					Init of <i>Quality_Information</i> structure.	
27	<i>Software_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See [RD.24] for details.	Generated by L1 Processor
28	<i>Instrument_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See [RD.24] for details.	Generated by L1 Processor
29	<i>ADF_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See [RD.24] for details.	Generated by L1 Processor
30	<i>Calibration_Error_flag</i>	Flag	N/A	unsigned byte	1 element	See [RD.24] for details.	Generated by L1 Processor
	<i>Quality_Information</i>					End of <i>Quality_Information</i> structure.	
	<i>Snapshot_Information</i>					End of <i>Snapshot_Information</i> data set record structure.	
	<i>List_of_Snapshot_Informations</i>					End of list of <i>Snapshot_Information</i> data set record structures.	
	<i>Swath_Snapshot_List</i>					End of <i>Swath_Snapshot_List</i> binary Data Set.	
	<i>Temp_Swath_Full</i>					Init of <i>Temp_Swath_Full</i> binary Data Set.	
31	<i>Grid_Point_Counter</i>	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of <i>Grid_Point_Data</i> data set record structures. L2Ps use this field from L1C product in its processing	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	List_of_Grid_Point_Data s					Init of list of Grid_Point_Data data set record structures, repeated Counter times. There are as many DSR as pixels are present in the product. The order in the product is according to Grid_Point_Latitude.	
	Grid_Point_Data					Init of Grid_Point_Data data set record structure.	
32	Grid_Point_ID	Identifier	N/A	Unsigned integer (4 bytes)	1 element	Unique identifier for Earth fixed grid point, linking it to Auxiliary Earth Grid file. For ISEA 4-9, maximum of 2.7M pixels L2Ps use this field from L1C product in its processing	Copied from AUX_DGG
33	Grid_Point_Latitude	Real value	deg	Float (4 bytes)	1 element	Latitude of the DGG cell's center identified by Grid_Point_ID. The range is [-90°, +90°]. L2Ps use this field from L1C product in its processing	Copied from AUX_DGG
34	Grid_Point_Longitude	Real value	deg	Float (4 bytes)	1 element	Longitude of the DGG cell's center identified by Grid_Point_ID. The range is [-180°, +180°]. L2Ps use this field from L1C product in its processing	Copied from AUX_DGG
35	Grid_Point_Altitude	Real value	m	Float (4 bytes)	1 element	Altitude of the DGG cell's center identified by Grid_Point_ID SM L2P uses this field from L1C product in its processing	Copied from AUX_DGG
36	Grid_Point_Mask	Set of flags	N/A	unsigned byte	1 element	Flag indicating land/sea USGS content, coastline distance, and Ice content. OS L2P uses this field from L1C product in its processing	AUX_LSMASK



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
37	BT_Data_Counter	Counter	N/A	unsigned integer (2 bytes)	1 element	Counter of Brightness Temperature Data values for current point (variable number depending on point across track position). Size of array to be read with data. L2Ps use this field from L1C product in its processing	Generated by L1 Processor
	List_of_BT_Datas					Init of list of BT_Datas data structures, repeated Counter times.	
	BT_Data					Init of BT_Data data set record structure.	
38	Flags	Set of flags	N/A	unsigned short integer (2 bytes)	1 element	L1c flags applicable to the pixel for this particular integration time. Flags identified are the same as in section 4.2.5.1.2, with the exception coming following this table. L2Ps use this field from L1C product in its processing (AF_FOV flag (only OS), EAF_FOV flag, BORDER_FOV, polarization, RFI flag (only OS), SUN_FOV, SUN_GLINT_AREA, SUN_GLINT_FOV, SUN_POINT, SUN_TAILS)	Generated by L1 Processor
39	BT_Value_Real	Real value	K	Float (4 bytes)	1 element	Brightness temperature value over Earth fixed grid point, obtained by DFT interpolation from L1b data. Contains real components of HH, HV or VV polarisation measurements. L2Ps use this field from L1C product in its processing	Generated by L1 Processor, starting from L1B product



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
40	BT_Value_Imag	Real value	K	Float (4 bytes)	1 element	Brightness temperature value over current Earth fixed grid point, obtained by DFT interpolation from L1b data. Contains imaginary components of HH, HV or VV polarisation measurements. For the pure polarizations the imaginary part should be always 0. L2Ps use this field from L1C product in its processing	Generated by L1 Processor, starting from L1B product
41	Pixel_Radiometric_Accuracy	Real value (coded as integer)	K	unsigned short (2 bytes)	1 element	Error accuracy measurement in the Brightness Temperature presented in the previous field, extracted in the direction of the pixel. Coded as $LSB = X/2^{16}$. Meaning that $value = (unsigned\ short) * X/2^{16}K$ where X is Radiometric_Accuracy_Scale given in SPH L2Ps use this field from L1C product in its processing	Generated by L1 Processor, starting from L1B product
42	Incidence_Angle	Real value (code as integer)	deg	unsigned short (2 bytes)	1 element	Incidence angle value corresponding to the measured BT value over current Earth fixed grid point. Measured as angle from pixel to S/C with respect to the pixel local normal (0° if vertical) Coded as $LSB = 90/2^{16}$. Meaning that $value = (unsigned\ short) * 90/2^{16}degrees$ L2Ps use this field from L1C product in its processing	Generated by L1 Processor, from satellite's position and attitude in L1B, DGG point location.
43	Azimuth_Angle	Real value (code as integer)	deg	unsigned short (2 bytes)	1 element	Azimuth angle value corresponding to the measured BT value over current Earth fixed grid point. Measured as angle in pixel local tangent plane from projected pixel to S/C direction with respect to the local North (0° if	Generated by L1 Processor, from satellite's position and attitude in L1B, DGG point



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
						local North) Coded as $LSB=360/2^{16}$. Meaning that value=(unsigned short)* $360/2^{16}$ degrees L2Ps use this field from L1C product in its processing	location.
44	Faraday_Rotation_Angle	Real value (code as integer)	deg	unsigned short (2 bytes)	1 element	Faraday rotation angle value corresponding to the measured BT value over current Earth fixed grid point. It is computed as the rotation from surface to antenna (i.e. direct angle) Coded as $LSB=360/2^{16}$. Meaning that value=(unsigned short)* $360/2^{16}$ degrees L2Ps use this field from L1C product in its processing. In case no VTEC file is available (ADF flag set) and the model is not used, the value is 0.	Generated by L1c Processor by using VTEC and geomagnetic field from IGRF-10 model
45	Geometric_Rotation_Angle	Real value (code as integer)	deg	unsigned short (2 bytes)	1 element	Geometric rotation angle value corresponding to the measured BT value over current Earth fixed grid point. It is computed as the rotation from surface to antenna (i.e. direct angle) Coded in 2's complement. $LSB=360/2^{16}$. Meaning that value=(unsigned short)* $360/2^{16}$ degrees L2Ps use this field from L1C product in its processing	Generated by L1 Processor
46	Snapshot_ID_of_Pixel	Identifier	N/A	Unsigned integer (4 bytes)	1 element	Unique identifier for the snapshot. Formed by aggregation of orbit and time within orbit. Contents of this field are formed by: Absolute_orbit_number*10000 + Seconds_from_ANX L2Ps use this field from L1C product in its processing	Copied from L1B product



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
47	Footprint_Axis1	Real value (code as integer)	km	unsigned short (2 bytes)	1 element	Elliptical footprint major semi-axis value. Coded as $LSB=X/2^{16}$. Meaning that $value=(unsigned\ short)*X/2^{16}$ km, where X is Pixel_Footprint_Scale given in SPH. L2Ps use this field from L1C product in its processing	Generated by L1 Processor, using satellite's position and attitude in L1B
48	Footprint_Axis2	Real value (code as integer)	km	unsigned short (2 bytes)	1 element	Elliptical footprint minor semi-axis value. Coded as $LSB=X/2^{16}$. Meaning that $value=(unsigned\ short)*X/2^{16}$ km, where X is Pixel_Footprint_Scale given in SPH. L2Ps use this field from L1C product in its processing	Generated by L1 Processor, using satellite's position and attitude in L1B
	BT_Data					End of BT_Data data set record structure.	
	List_of_BT_Datas					End of list of BT_Datas data structures, repeated Counter times.	
	Grid_Point_Data					End of Grid_Point_Data data set record structure.	
	List_of_Grid_Point_Data s					End of list of Grid_Point_Data data set record structures.	
	Temp_Swath_Dual					End of Temp_Swath_Dual binary Data Set.	
	Data_Block					End of binary Data Block in the product.	

Table 4-51 Level 1 C Full Polarization Reconstructed Brightness Temperatures Swath Product Data Block



The Flags field #38 shall be used to report polarisation of the pixel measurement data, as well as quality values applicable to the measurement. The flags are contained in an 16-bit counter, each bit representing a status, and they shall be described using the following order convention:

[MSB:X X X X:X X X X:X X X X:X X X X:LSB]



This fields contains the flags as specified in section 4.2.5.1.2, except for the polarisation flags that in this case shall be:

- Polarisation flags:
 - [X X X X:X X X X:X X X X:X X 0 0] represents HH polarisation (the BT_Value_Imag in the corresponding DSR should be equal to 0)
 - [X X X X:X X X X:X X X X:X X 0 1] represents VV polarisation (the BT_Value_Imag in the corresponding DSR should be equal to 0)
 - [X X X X:X X X X:X X X X:X X 1 0] represents the Real part and Imaginary part of the HV polarization when the instrument was in VHH+HVH+HHV arm configuration
 - [X X X X:X X X X:X X X X:X X 1 1] represents the Real part and Imaginary part of the HV polarization when the instrument was in HVV+VHV+VVH arm configuration

4.2.5.3 Browse \check{T}_B in Dual and Full Polarization (MIR_BWSD1C / MIR_BWLD1C / MIR_BWSF1C / MIR_BWLF1C)

The Browse Brightness Temperature L1 data products are arranged in pole-to-pole swaths according to ascending and descending passes. Each grid point contains a brightness temperature sample interpolated from MIRAS measurements at an incidence angle of 42.5° as default (configurable value).

In L1OP the browse generation algorithm has been aligned with L1PP: for each grid point the algorithm gathers all the pixels with the same grid point Id for which its incidence angle is in the range [*Browse_Lower_Angle*, *Browse_Higher_Angle*]. Where *Browse_Incidence_Angle*, *Browse_Lower_Angle*, *Browse_Higher_Angle* are read from the configuration file and its nominal value is 42.5°. Then if there are at least one measurement below and one measurement above this angle, interpolation is performed for all parameters at an angle indicated by *BrowseIncidenceAngle*. The interpolation method is cubic splines. The flags are calculated as the binary AND of all flags in the same range.

Grid points that lack the necessary incidence angles to compute the browse value following the method described above, will not be written in the product. In case no grid point browse value results from this computation for a complete semiorbit + overlap, the browse product will not be generated.

The format is as provided in the following figure:

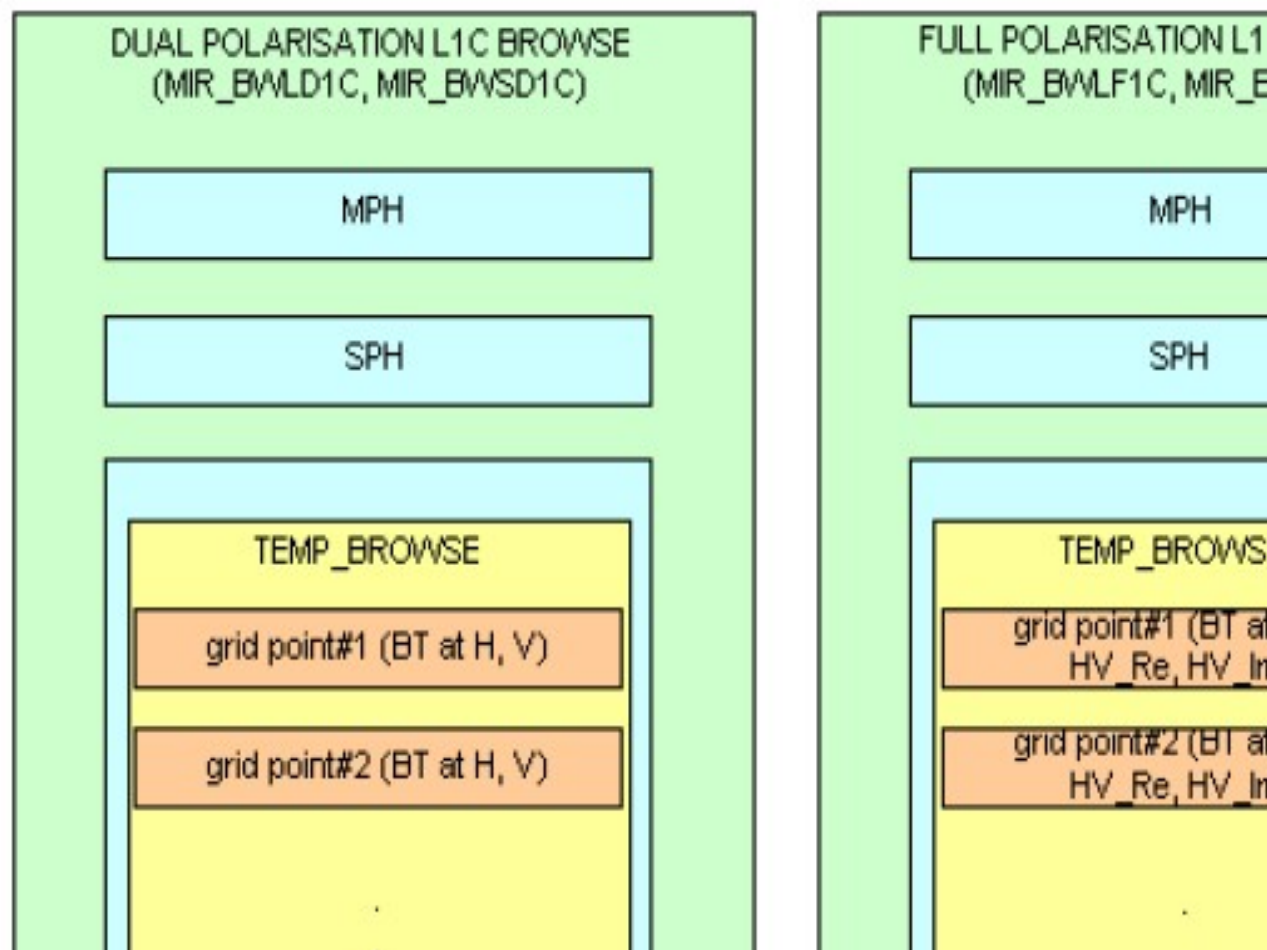


Figure 4-6 SMOS Browse Swath product structure (taken from Deimos Eng., L1PP Product format)



4.2.5.3.1 Specific Product Header

The Specific Product Header for Level 1C Browse Brightness Temperatures products shall follow the format described in table below:

Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	<i>Specific_Product_Header</i>					Init of Specific Product Header structure	
02-19	<i>Main_Info</i>	structure	N/A	N/A	N/A	Main Product Info structure's fields as defined in fields 01 to 16 in Table 4-3	
20-26	<i>Quality_Information</i>	structure	N/A	N/A	N/A	Quality_Information structure defined as specified in Table 4-4	
27	<i>Product_Location</i>	Starting Tag					
28	<i>Start_Lat</i>	real	deg	11 bytes	%+011.6f	WGS84 geodetic latitude of the subsatellite point of the first snapshot in the product (positive to North) .The range is [-90°, +90°].	Generated by L1 Processor
29	<i>Start_Lon</i>	real	deg	11 bytes	%+011.6f	WGS84 longitude of the subsatellite point of the first snapshot in the product (positive to East, from Greenwich). The range is [-180°, +180°].	Generated by L1 Processor
30	<i>Stop_Lat</i>	real	deg	11 bytes	%+011.6f	WGS84 geodetic latitude of the subsatellite point of the last snapshot in the product (positive to North). The range is [-90°, +90°].	Generated by L1 Processor
31	<i>Stop_Lon</i>	real	deg	11 bytes	%+011.6f	WGS84 longitude of the subsatellite point of the last snapshot in the product (positive to East, from Greenwich). The range is [-180°, +180°].	Generated by L1 Processor



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
32	<i>Mid_Lat</i>	real	deg	11 bytes	%+011.6f	Geodetic latitude of satellite nadir point of the snapshot in the middle (rounded down) of the list used in the generation of the product . The range is [-90°, +90°].	Generated by L1 Processor
33	<i>Mid_Lon</i>	real	deg	11 bytes	%+011.6f	Longitude of satellite nadir point of the snapshot in the middle (rounded down) of the list used in the generation of the product. The range is [-180°, +180°].	Generated by L1 Processor
34	<i>Product_Location</i>	Closing Tag					
35	<i>Incidence_Angle</i>	real	deg	7 bytes	%+07.3f	Incidence angle of Brightness Temperature measurements presented in Browse product. Set to 42.500	AUX_CNFL1P
36	<i>Radiometric_Accuracy_Scale</i>	Integer	K	3 bytes	%03d	Scale used in the normalisation to 2s complement of the Pixel Radiometric Accuracy (default 50K)	AUX_CNFL1P
37	<i>Pixel_Footprint_Scale</i>	Integer	km	3 bytes	%03d	Scale used in the normalisation to 2s complement of the Pixel Footprint size (100km)	AUX_CNFL1P
38	<i>Geolocation_Information</i>	Starting tag				Tag starting a structure specifying information on the geolocation input parameters and the results statistics as well	
39	<i>Percentage_of_Mixed_Pixels</i>	Real	N/A	7 bytes	%07.3f	Percentage of grid point defined as mixed in the USGS classification.	Generated by L1 Processor based on AUX_LSMASK
40	<i>Apodisation_Window</i>	integer	N/A	3 bytes	%03d	Constant Apodisation function used to generate the product. Numerical value representing the apodisation function applied (coherent with the filename	AUX_APDS__ / AUX_APDL__ (field Apodisation_Window)



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
						Reference Data Set) 000=Rectangular window 001=Blackman window 002=Barlett window 003=Hamming window 004=Hanning window ... 100=Kaiser window with alpha 1.20 101=Kaiser window with alpha 1.21 ... (user defined and agreed windows) 999=Strip Adaptive window	
41	Geolocation_Information	Closing Tag				Tag ending the structure specifying information on the geolocation input parameters and the results statistics as well	
44-55	Data_Sets	structure	N/A	N/A	N/A	Data Sets structure's fields as defined in Table 4-5	
56	List_of_Reference_Data_Sets_L0	Starting Tag	N/A	N/A	N/A	Reference Data Sets inherited from Science L0	
56-64	Reference_Filename	string	N/A	60 bytes	%60s	Filename of input files as described in table 4-10	Copied from Science L0 header
65	List_of_Reference_Data_Sets_L0	Closing Tag	N/A	N/A	N/A	Reference Data Sets inherited from Science L0	
66	List_of_Reference_Data_Sets_L1a	Starting Tag	N/A	N/A	N/A	Reference Data Sets inherited from Science L1a	
67-83	Reference_Filename	string	N/A	60 bytes	%60s	Filename of input files as described in table 4-30	Copied from Science L1a header
84	List_of_Reference_Data_Sets_L1a	Closing Tag	N/A	N/A	N/A	Reference Data Sets inherited from Science L1a	
85	List_of_Reference_Data_Sets_L1b	Starting Tag	N/A	N/A	N/A	Reference Data Sets inherited from Science L1b	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
86-107	<i>Reference_Filename</i>	string	N/A	60 bytes	%60s	Filename of input files as described in table 4-43/4-45	Copied from Science L1b header
108	<i>List_of_Reference_Data_Sets_L1b</i>	Closing Tag	N/A	N/A	N/A	Reference Data Sets inherited from Science L1b	
109	<i>Specific_Product_Header</i>					End of Specific Product Header structure	

Table 4-52 Level 1 C Browse Brightness Temperatures SPH

The specific valid Reference Data Sets for Level 1 C Browse Brightness Temperatures Products are:

Reference Data Set Name	Product Type	Description
L1B_FILE	MIR_SC_D1B, MIR_SC_F1B	L1b Product filename used to create the current L1c product
DGG_FILE	AUX_DGG	Fixed Earth Grid filename used in the current L1c product
TEC_FILE	AUX_VTEC_P, AUX_VTEC_R, AUX_VTEC_C	TEC filename used in the current L1b and L1c products
PLM_FILE	AUX_PLM	Auxiliary file with PLM characterisation, defining time lags and intermediate frequency
RFI_FILE	AUX_RFI	Auxiliary file with RFI flagged pixels in the same grid as DGG
ANTENNA_PATTERNS_FILE	AUX_PATT	Auxiliary data file containing the NIR antenna patterns to be used for convolution with the original galaxy map
BEST_FIT_PLANE_FILE	AUX_BFP	Auxiliary file with definition of Best Fit Plane to be used during geolocation in L1c
L1C_PIXEL_MASK_FILE	AUX_MASK	Auxiliary file with the flagging of pixels for use in L1c land or sea products
APODISATION_FILE	AUX_APDL, AUX_APDS	Auxiliary file with definition and coefficients of the apodisation applied from L1b to L1c
ALGORITHM_CONFIG_FILE	AUX_CNFL1P	Processor Configuration Parameters and Constants for L1OP
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Mission planning file used to initialise the EE CFI orbit_id and/or time_id. It is read and used by the EE CFI.
MISPOINTING_ANGLES_FILE	AUX_MISP	Auxiliary product containing the mispointing angles between the Body Frame referenced in the Proteus quaternions and the Antenna Plane defined by the MIRAS instrument
LAND_SEA_MASK_FILE	AUX_LSMASK	Auxiliary file containing the Land/Sea mask of pixels in the DGG
BULLETIN_B_FILE	AUX_BULL_B	IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation
RFI_LIST_FILE	AUX_RFILST	Global RFI position list used in the RFI mitigation algorithms

Table 4-53 Level 1 C Browse Brightness Temperatures Reference Data Sets



The valid L0 Reference Data Sets for Level1C Browse Products are the same as for L0 HKTM reference files in table 4-10.

The valid L1A Reference Data Sets for Level1C Browse Products are the ones in table 4-30

The valid L1B Reference Data Sets for Level1C Browse Products are the ones in table 4-43 and 4-45.

4.2.5.3.2 Data Block

The binary Data Block of the L1C Browse Brightness Temperatures data product consists of one Measurement dataset, containing the list of points with the associated brightness temperature sample at each polarization (2 in dual polarization products, 4 in full polarization products) at one single incidence angle (42.5°), and associated information for each grid point sensed by the MIRAS instrument.

The following table describes the XML schema used to decode the binary contents of this type of record. The tag element used to describe the DSR structure name in the XML schema shall be **Temp_Browse**.

- The **Temp_Browse** data set shall contain a fixed number of brightness temperatures samples in different polarizations (2 or 4 depending on the product being dual or full polarisation) for every point in the Earth Fixed grid covered by the product. There shall be a complete Data Set Record for each grid point within the product. The first field in the dataset, **Counter**, specifies the number of pixels structures **Grid_Point_Data** contained in it. This dataset differs with the rest of the L1C datasets in that it contains a fixed number of **BT_Data** structures for each **Grid_Point_Data** DSR. The size of each **BT_Data** is fixed and equal to 14 bytes, while the size of **Grid_Point_Data** depends on the polarisation mode (14+2x14= 42 bytes for dual polarisation; 14+4x14= 70 bytes for full polarisation). Field #06 specifies the number of **BT_Data** in each **Grid_Point_Data**.

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Temp_Browse					Init of Temp_Browse binary Data Set.	
01	Grid_Point_Counter	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of Grid_Point_Data data set record structures.	Generated by L1 Processor



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	List_of_Grid_Point_Datas					Init of list of Grid_Point_Data data set record structures, repeated Counter times. There are as many DSR as pixels are present in the product. The order in the product is according to Grid_Point_Latitude.	
	Grid_Point_Data					Init of Grid_Point_Data data set record structure.	
02	Grid_Point_ID	Identifier	N/A	Unsigned integer (4 bytes)	4 bytes (for ISEA 4-9, maximum of 2.7M pixels)	Unique identifier for Earth fixed grid point, linking it to Auxiliary Earth Grid file	Copied from L1C product
03	Grid_Point_Latitude	Real value	deg	Float (4 bytes)	1 element	Latitude of the DGG cell's center identified by Grid_Point_ID. The range is [-90°, +90°].	Copied from L1C product
04	Grid_Point_Longitude	Real value	deg	Float (4 bytes)	1 element	Longitude of the DGG cell's center identified by Grid_Point_ID. The range is [-180°, +180°].	Copied from L1C product
05	Grid_Point_Altitude	Real value	m	Float (4 bytes)	1 element	Altitude of the DGG cell's center identified by Grid_Point_ID	Copied from L1C product
06	Grid_Point_Mask	Set of flags	N/A	unsigned byte	1 element	Flag indicating land/sea USGS content, coastline distance, and Ice content.	AUX_LSMASK
07	BT_Data_Counter	Counter	N/A	unsigned byte	1 element	Counter of Brightness Temperature Data values for current point (fixed number in Browse products, 2 for dual polarisation products, 4 for full polarisation products)	Generated by L1 Processor
	List_of_BT_Datas					Init of list of BT_Datas data structures repeated Counter times.	
	BT_Data					Init of BT_Data data set record structure.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
08	Flags	Set of flags	N/A	unsigned short integer (2 bytes)	1 element	Following flags identified in section 4.2.5.1.2. For full polarisation case, the description below this table applies.	Generated by L1 Processor
09	BT_Value	Real value	K	Float (4 bytes)	1 element	Brightness temperature value over current Earth fixed grid point, obtained by interpolation from L1c data over the grid point.	Generated by L1 Processor
10	Radiometric_Accuracy_of_Pixel	Real value (coded as integer)	K	unsigned short (2 bytes)	1 element	Error accuracy measurement in the Brightness Temperature presented in the previous field, extracted in the direction of the pixel. Coded as $LSB=X/2^{16}$. Meaning that value=(unsigned short)* $X/2^{16}$ K, where X is Radiometric_Accuracy_Scale given in SPH	Generated by L1 Processor
11	Azimuth_Angle	Real value (coded as integer)	deg	unsigned short (2 bytes)	1 element	Elliptical footprint angle between major semi-axis direction and North direction, obtained by interpolation from L1c data over the grid point. Coded as $LSB=360/2^{16}$. Meaning that value=(unsigned short)* $360/2^{16}$ degrees	Generated by L1 Processor
12	Footprint_Axis1	Real value (coded as integer)	km	unsigned short (2 bytes)	1 element	Elliptical footprint major semi-axis value, obtained by interpolation from L1c data over the grid point. Coded as $LSB=X/2^{16}$. Meaning that value=(unsigned short)* $X/2^{16}$ km where X is Pixel_Footprint_Scale given in SPH	Generated by L1 Processor
13	Footprint_Axis2	Real value (coded as integer)	km	unsigned short (2 bytes)	1 element	Elliptical footprint minor semi-axis value, obtained by interpolation from L1c data over the grid point. Coded as $LSB=X/2^{16}$. Meaning that value=(unsigned short)* $X/2^{16}$ km where X is Pixel_Footprint_Scale given in SPH	Generated by L1 Processor
	BT_Data					End of BT_Data data set record structure	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>List_of_BT_Datas</i>					End of list of BT_Datas data structures, repeated Counter times.	
	<i>Grid_Point_Data</i>					End of Grid_Point_Data data set record structure.	
	<i>List_of_Grid_Point_Datas</i>					End of list of Grid_Point_Data data set record structures.	
	<i>Temp_Browse</i>					End of Temp_Browse binary Data Set.	
	<i>Data_Block</i>					End of binary Data Block in the product.	

Table 4-54 Level 1 C Browse Brightness Temperatures Product Data Block

The Flags field #08 shall be used to report polarisation of the pixel measurement data, as well as quality values applicable to the measurement. The flags are contained in an 16-bit counter, each bit representing a status, and they shall be described using the following order convention:

[MSB:X X X X:X X X X:X X X X:X X X X:LSB]

This fields contains the flags as specified in section 4.2.5.1.2, except for the polarisation flags that in case of full polarisation shall be:

- Polarisation flags:
 - [X X X X:X X X X:X X X X:X X 0 0] represents HH polarisation (interpolation of BT HH measurements derived from snapshot acquired in pure polarization and cross-polarization (HHH and HHV))



- [X X X X:X X X X:X X X X:X X 0 1] represents VV polarisation (interpolation of BT VV measurements derived from snapshot acquired in pure polarization and cross-polarization (VVV and VVH))
- [X X X X:X X X X:X X X X:X X 1 0] represents the HV_Re (interpolation of the real part of BT measurements derived from snapshot acquired in cross-polarization (HHV and VVH))
- [X X X X:X X X X:X X X X:X X 1 1] represents the HV_Im (interpolation of the Imaginary part of BT measurements derived from snapshot acquired in cross-polarization (HHV and VVH))



5. LEVEL 1 AUXILIARY DATA PRODUCT TYPES SPECIFICATIONS

5.1 AUXILIARY DATA PRODUCTS COMMON HEADER

5.1.1 Main Product Header:

ADF only have Fixed Header and Specific Product Header.

Only the MPH fields Ref_Doc and Total_Size are needed in ADF, so they are moved to the ADF's Specific Product Header.

5.1.2 Specific Product Header:

The Specific Product Header for ADF with binary data blocks has the following structure:

- Main_SPH as defined in Table 5-1
- ADF particular SPH (optionally defined for each product, see the corresponding section for each ADF)
- Data_Sets as defined in Table 4-5

The Reference Data Sets contain the reference to any file containing relevant information for the Product. The Measurement Data Sets contain relevant information about the information linked directly to the product (Binary or XML).

Amongst the fields in the Specific Product Header Main Info section, its second Field, the *SPH_Descriptor* will be different for every type of Level 1 Auxiliary Products. All the accepted types and names are presented in the following table:



Accepted Name	Description
AUX_PMS__SPH	SPH for Auxiliary product containing on-ground characterisation of PMS, including sensitivity of parameters to physical temperature
AUX_NIR__SPH	SPH for Auxiliary product generated from on-ground (initially) and external (in-flight) characterization of the NIR, using MIRAS output during an external target calibration (Not part of L1 Processing, this type of calibration is to be performed out of PLPC)
AUX_PLM__SPH	SPH for Auxiliary product generated from on-ground characterisation of the PLM, including thermistor parameters, receiver's exact position, Xband parameters, etc.
AUX_SPAR__SPH	SPH for Auxiliary product containing on-ground characterisation of the S-parameters
AUX_LCF__SPH	SPH for Auxiliary product containing on-ground characterisation of receivers' efficiencies
AUX_PATT__SPH	SPH for Auxiliary product containing on-ground characterisation of receivers' amplitude and phase patterns and maximum directivity
AUX_FAIL__SPH	SPH for Auxiliary product containing default failures to be taken into account on nominal L1 processing
AUX_BWGHT_SPH	SPH for Auxiliary product containing the weight vector to be multiplied element by element with the calibrated visibilities
AUX_BFP__SPH	SPH for Auxiliary product containing receivers' derived Best Fit Plane
AUX_MISP__SPH	SPH for Auxiliary product containing the mispointing angles between the Body Frame referenced in the Proteus quaternions and the Antenna Plane defined by the MIRAS instrument
AUX_DGG__SPH	SPH for Auxiliary product containing the Earth Fixed Grid on which L1c products shall be expressed
AUX_VTEC_P_SPH	SPH for Auxiliary product containing Predicted Total Electron Content values to compute Faraday rotation angle
AUX_VTEC_R_SPH	SPH for Auxiliary product containing Analysis Rapid Total Electron Content values to compute Faraday rotation angle
AUX_VTEC_C_SPH	SPH for Auxiliary product containing Consolidated Total Electron Content values to compute Faraday rotation angle
AUX_GALAXY_SPH	SPH for Auxiliary product containing the L-band measurements of the Sky
AUX_GALNIR_SPH	SPH for Auxiliary product containing the L-band measurements of the Sky convoluted with the NIR pattern
AUX_MASK__SPH	SPH for Auxiliary product containing the flagging of pixels for use in L1c land or sea products
AUX_LSMASK_SPH	SPH for Auxiliary product containing the Land/Sea mask of pixels in the DGG
AUX_SUNT__SPH	SPH for Auxiliary products containing the measured evolution of Sun Brightness Temperature along time
AUX_MOONT_SPH	SPH for Auxiliary products containing the measured evolution of Moon Brightness Temperature along time
AUX_RFI__SPH	SPH for Auxiliary products containing known sources of Radio Frequency Interference in MIRAS bandwidth, in the same grid as the auxiliary grid being used
AUX_BSCAT_SPH	SPH for Auxiliary product containing the look-up tables needed to apply the sung glint correction algorithm
AUX_APDL__SPH	SPH for Auxiliary products containing the element-by- element definition of the Apodisation Window for Land in the u,v plane.
AUX_APDS__SPH	SPH for Auxiliary products containing the element-by- element definition of the Apodisation Window for Sea in the u,v plane.
AUX_CNFL1P_SPH	SPH for Auxiliary product containing configuration values and constant s to be used during L1 processing
AUX_CNFFAR_SPH	SPH for Auxiliary product containing configuration values by the Faraday Rotation Post-processor
AUX_FARA_P_SPH	SPH for Auxiliary product containing Predicted Faraday Rotation values to correct for ionospheric effects
AUX_FARA_R_SPH	SPH for Auxiliary product containing Analysis Rapid Faraday Rotation values to correct for ionospheric effects
AUX_FARA_C_SPH	SPH for Auxiliary product containing Consolidated Faraday Rotation values to correct for ionospheric effects
AUX_BULL_B_SPH	SPH for Auxiliary product containing IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation
AUX_RFILST_SPH	SPH for Auxiliary product containing global RFI positions

Table 5-1 Level 1 Auxiliary SPH Accepted Names



The Specific Product Header for ADF with XML ASCII data blocks has the following structure:

- Main_SPH_for_XML as defined in Table 5-3
- ADF particular SPH (optionally defined for each product, see the corresponding section for each ADF)

5.1.2.1 XML Specific Product Header

The following table presents the parameters for the Specific Product Header Main_SPH structure, to be used for all ADFs with binary datablock.

Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	Main_SPH	Tag				Init of Main_SPH structure	
02	SPH_Descriptor	string		14 bytes	%14s	Name describing SPH.	Hard-coded
03	Ref_Doc	string	N/A	17 bytes	%17s	Name of the document containing the specifications for the current product (this document) , with the shape: SO-TN-ID-IDR-GS-0005	Hard-coded
04	Precise_Validity_Start	String	N/A	30 bytes	%30s	This is the UTC Validity Start Time, coherent with the Validity Start Time in the File Name, but in CCSDS ASCII format with time reference and microseconds. Note that this can have the special value indicating “beginning of mission” (without an absolute time specified) as defined in Tailoring of EEFF Standard for SMOS GS [AD.4]. “UTC=yyyy-mm-ddThh:mm:ss.uuuuu” The Precise_Validity_Start Time shall be the start time of the period in which the product is valid –i.e. can be used as supporting input to the processing- in case the product is an auxiliary file.	CEC
05	Precise_Validity_Stop	String	N/A	30 bytes	%30s	This is the UTC Validity Stop Time, coherent with the Validity Stop Time in the File Name, but in CCSDS ASCII format with time reference and microseconds.	CEC



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
						Note that this can have the special value indicating "end of mission" (without an absolute time specified) as defined in Tailoring of EEFF Standard for SMOS GS [AD.4]. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" The Precise_VValidity_Stop Time shall be the stop time of the period in which the product is valid –i.e. can be used as supporting input to the processing- in case the product is an auxiliary file.	
06	Checksum	Integer	N/A	10 bytes	10*uc	Checksum of the datablock, obtained from the algorithm in the IEEE Std 1003.1.2004 , using function cksum in POSIX.	CEC
07	Header_Schema	string	N/A	31 bytes	%31s	Name of the XSD to be used for the validation of the product header. The format is as specified in [RD.9]. In the operational processor, the value will be provided by an XML R/W API method.	CNF
08	Datablock_Schema	string	N/A	42 bytes	%42s	Name of the validation xml schema for the product's datablock Name of the binX schema for the validation of the product datablock. The format is as specified in [RD.9]. In the operational processor, the value will be provided by an XML R/W API method.	CNF
09	Header_Size	Integer	bytes	6 bytes	%06d	Size of the Header of the product	CEC
10	Datablock_Size	Integer	Bytes	11 bytes	%011d	Size of the product Datablock	CEC
11	HW_Identifier	String	N/A	4 bytes	%4s	Identifier of the machine that has generated this ADF.	CNF_L1OP__
23	Main_SPH	Tag				End of Specific Product Header structure	

Table 5-2 Level 1 Auxiliary Data Main_SPH for products with Binary Datablock

The ADFs with binary data block will contain also, at the end of the SPH, the list of data sets as defined in Table 4-5.

For the pure XML ASCII ADFs, the following Main_SPH_for_XML structure will be used (note that these files do not contain the list of data sets):



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	Main_SPH_for_XML	Tag				Init of Main_SPH_for_XML structure	
02	SPH_Descriptor	string		14 bytes	%14s	Name describing SPH.	Hard-coded
03	Ref_Doc	string	N/A	17 bytes	%17s	Name of the document containing the specifications for the current product (this document) , with the shape: SO-TN-ID-IDR-GS-0005	Hard-coded
04	Precise_Validity_Start	String	N/A	30 bytes	%30s	This is the UTC Validity Start Time, coherent with the Validity Start Time in the File Name, but in CCSDS ASCII format with time reference and microseconds. Note that this can have the special value indicating "beginning of mission" (without an absolute time specified) as defined in Tailoring of EEFF Standard for SMOS GS [AD.4]. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" The Precise_Validity_Start Time shall be the start time of the period in which the product is valid –i.e. can be used as supporting input to the processing- in case the product is an auxiliary file.	CEC
05	Precise_Validity_Stop	String	N/A	30 bytes	%30s	This is the UTC Validity Stop Time, coherent with the Validity Stop Time in the File Name, but in CCSDS ASCII format with time reference and microseconds. Note that this can have the special value indicating "end of mission" (without an absolute time specified) as defined in Tailoring of EEFF Standard for SMOS GS [AD.4]. "UTC=yyyy-mm-ddThh:mm:ss.uuuuuu" The Precise_Validity_Stop Time shall be the stop time of the period in which the product is valid –i.e. can be used as supporting input to the processing- in case the product is an auxiliary file.	CEC
06	Header_Schema	string	N/A	31 bytes	%31s	Name of the XSD to be used for the validation of the product header. The format is as specified in [RD.9]. In the operational processor, the value will be provided by an XML R/W API method.	CNF



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
07	Datablock_Schema	string	N/A	31 bytes	%31s	Name of the validation xml schema for the product's datablock Name of the XSD schema for the validation of the product datablock. The format is as specified in [RD.9]. In the operational processor, the value will be provided by an XML R/W API method.	CNF
08	Header_Size	Integer	bytes	6 bytes	%06d	Size of the Header of the product	CEC
09	Datablock_Size	Integer	Bytes	11 bytes	%011d	Size of the physical file (including header and datablock)	CEC
10	HW_Identifier	String	N/A	4 bytes	%4s	Identifier of the machine that has generated this ADF.	CNF_L1OP__
10	Main_SPH_for_XML	Tag				End of Main_SPH_for_XML structure	

Table 5-3 Level 1 Auxiliary Data Main SPH for XML for products with XML ASCII Datablock

5.2 AUXILIARY DATA TYPES BLOCKS SPECIFICATIONS

5.2.1 PMS Characterisation Table (AUX PMS)

As is written in section 4.3 in [RD.2], conversion tables are used to convert PMS voltage telemetry values into power units. These shall be the measured System Temperatures used to normalise the calibrated visibilities. There is one of such voltage measurements per LICEF, which needs to be converted appropriately.

During MIRAS operation, it is possible to characterise again the PMS response, using correlated Noise Injection. This calibration produces as intermediate output the calibrated measurements of gain and offset of each PMS, to be used for System Temperature computation. This data shall be consolidated into the MIR_CRSD1A product containing the PMS calibration coefficients.



This file contains a unique data set that shall contain the gain and offset information for all PMS, under different thermal conditions. Its contents shall be referred in ASCII XML format. The data set is formed by 1 Data Set Record with all the information.

The SPH contains only the Main_SPH_for_XML structure as defined in Table 5-3.

The Data Block of the AUX_PMS___ Auxiliary Data Product is in XML ASCII format, and contains each PMS gains and offsets measured at different physical temperatures, the sensitivity of offsets and gains to temperature drifts and the PMS linearity. There is 1 dataset **PMS_Characterisation** consisting of 1 data set record. The total size of the **PMS_Characterisation_Table** product is 57 KB (measured as the size in hard disk of one sample of the product containing both header and datablock). The following table describes the XML format of the **PMS Characterisation Table** product's data block.

Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	Data_Block	Starting Tag				Init of Data Block in the product.	
02	PMS_Characterisation	Starting Tag				Initial Data Set definition tag. Start of Data Set XML structure containing the variables described below	
03	List_of_PMS_Datas	Starting Tag	N/A	2 bytes		Tag starting a list of identical PMS_Data structures. Tag contains an attribute " <i>count</i> " which is always "72"	CASA Attribute " <i>count</i> " is fixed
04	PMS_Data	Starting Tag				Tag starting a structure with all variables needed to identify a PMS device and characterise it at different physical temperatures	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
05	PMS_ID	String	N/A	5 bytes	%5c	<p>PMS unique identifier</p> <p>Format is XXYZZ, where:</p> <ul style="list-style-type: none"> XX indicates the arm location (A_, AB, B_, BC, C_ or CA) Y indicates polarisation for NIR elements (H, V or _) ZZ indicates LICEF number in arm location (01, 02, 03,... 21) <p>For example AB_03, CAH01, B__18</p>	CASA
06	List_of_PMS_Characterisation_Datas	Starting Tag	N/A	2 bytes		<p>Tag starting a list of identical PMS_Characterisation_Data structures.</p> <p>Tag contains an attribute “count” which is always “01”, the number of on-ground characterisations at different physical temperatures</p>	
07	PMS_Characterisation_Data	Starting Tag				<p>Tag starting a PMS_Characterisation_Data structure</p>	
08	Temperature	String	K	7 bytes	%07.3f	<p>Temperature at which the PMS coefficients were obtained.</p> <p>Tag contains attribute “unit” always set to the string specified in Unit column.</p>	<p>CASA</p> <p>Attribute “unit” is fixed</p>
09	Gain	String	mV/K	10 bytes	%+010.4f	<p>Gain coefficient for PMS identified before and at previous temperature.</p> <p>Tag contains attribute “unit” always set to the string specified in Unit column.</p>	<p>CASA</p> <p>Attribute “unit” is fixed</p>



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
10	Offset	String	mV	10 bytes	%+010.4f	Offset coefficient for PMS identified before and at previous temperature. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
11	Trec_HAP	String	K	8 bytes	%08.3f	Receiver Noise temperature in HAP plane for PMS identified before and at previous temperature	CASA Attribute "unit" is fixed
12	Trec_VAP	String	K	8 bytes	%08.3f	Receiver Noise temperature in VAP plane for PMS identified before and at previous temperature	CASA Attribute "unit" is fixed
13	Trec_CIP	String	K	8 bytes	%08.3f	Receiver Noise temperature in CIP plane for PMS identified before and at previous temperature	CASA Attribute "unit" is fixed
14	PMS_Characterisation_Data	Closing Tag				End of PMS_Characterisation_Data structure	
15	List_of_PMS_Characterisation_Datas	Closing Tag				End of list of PMS_Characterisation_Data structures	
16	Gain_Sensitivity	String	mV/K ²	11 bytes	%+011.3e	Gain sensitivity coefficient for PMS gain against PMS physical temperature drifts. Tag contains attribute "unit" always set to the string "mV/K ² ".	CASA Attribute "unit" is fixed
17	Gain_Sensitivity_Sec_Order	String	mV/K ³	11 bytes	%+011.3e	Gain second order sensitivity coefficient for PMS gain against PMS physical temperature drifts. Tag contains attribute "unit" always set to the string "mV/K ³ ".	CASA Attribute "unit" is fixed



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
18	Offset_Sensitivity	String	mV/K	9 bytes	%+09.5f	Offset sensitivity coefficient for PMS offset against PMS physical temperature drifts. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
19	Offset_Sensitivity_Sec_Order	String	mV/K ²	9 bytes	%+09.5f	Offset second order sensitivity coefficient for PMS offset against PMS physical temperature drifts. Tag contains attribute "unit" always set to the string "mV/K ² ".	CASA Attribute "unit" is fixed
20	PMS_Linearity	String	mV/K ²	11 bytes	%+011.3e	Term used to correct 2 nd order response of each PMS (Flink). Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed
21	PMS_Linearity_C	String	V	8 bytes	%08.3f	PMS Voltage used to correct 2 nd order response of each PMS (alternative method) Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed
22	Trec_HAP_Sensitivity	String	K/K	8 bytes	%+08.5f	Receiver Noise temperature sensitivity in HAP plane for PMS identified before and at previous temperature Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed
23	Trec_HAP_Sensitivity_Sec_Order	String	K/K ²	8 bytes	%+08.5f	Receiver Noise temperature second order sensitivity in HAP plane for PMS identified before and at previous temperature Tag contains attribute "unit" always set to the string "K/K ² ".	CASA Attribute "unit" is fixed



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
24	<i>Trec_VAP_Sensitivity</i>	String	K/K	8 bytes	%+08.5f	Receiver Noise temperature sensitivity in VAP plane for PMS identified before and at previous temperature Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed
25	<i>Trec_VAP_Sensitivity_Sec_Order</i>	String	K/K ²	8 bytes	%+08.5f	Receiver Noise temperature second order sensitivity in VAP plane for PMS identified before and at previous temperature Tag contains attribute "unit" always set to the string "K/K^2".	CASA Attribute "unit" is fixed
26	<i>Trec_CIP_Sensitivity</i>	String	K/K	8 bytes	%+08.5f	Receiver Noise temperature sensitivity in CIP plane for PMS identified before and at previous temperature Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed
27	<i>PMS_Heater_CMN_Assignment</i>	String	N/A	2 bytes	%2c	CMN Section identifier holding the Heater which influences the PMS voltage of the PMS identified before	CASA
28	<i>PMS_Heater_Offset_Correction</i>	String	mV	8 bytes	%+08.5f	PMS Voltage Offset to be subtracted from the PMS measurement when the Heater of the CMN above is active	CASA Attribute "unit" is fixed
29	<i>PMS_Heater_Time_Delay</i>	String	S	8 bytes	%+08.5f	Time delay in seconds since the CMN Heater is toggled on/off until its effects are felt on the PMS identified	CASA Attribute "unit" is fixed
30	<i>PMS_Heater_Alpha_ON</i>	String	N/A	20 bytes	%+20.7f	Fixed constant applied to the double exponential correction function in case the CMN Heater is toggled ON.	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
31	<i>PMS_Heater_Tau_1_ON</i>	String	N/A	20 bytes	%+20.7f	Number of epochs since the CMN Heater was turned ON to be applied to the double exponential correction function.	
32	<i>PMS_Heater_Beta_ON</i>	String	N/A	20 bytes	%+20.7f	Fixed constant applied to the double exponential correction function in case the CMN Heater is toggled ON.	
33	<i>PMS_Heater_Tau_2_ON</i>	String	N/A	20 bytes	%+20.7f	Number of epochs since the CMN Heater was turned ON to be applied to the double exponential correction function.	
34	<i>PMS_Heater_Alpha_OFF</i>	String	N/A	20 bytes	%+20.7f	Fixed constant applied to the double exponential correction function in case the CMN Heater is toggled OFF.	
35	<i>PMS_Heater_Tau_1_OFF</i>	String	N/A	20 bytes	%+20.7f	Number of epochs since the CMN Heater was turned OFF to be applied to the double exponential correction function.	
36	<i>PMS_Heater_Beta_OFF</i>	String	N/A	20 bytes	%+20.7f	Fixed constant applied to the double exponential correction function in case the CMN Heater is toggled OFF.	
37	<i>PMS_Heater_Tau_2_OFF</i>	String	N/A	20 bytes	%+20.7f	Number of epochs since the CMN Heater was turned OFF to be applied to the double exponential correction function.	
38	<i>PMS_Data</i>	Closing Tag				End of <i>PMS_Data</i> structure	
39	<i>List_of_PMS_Datas</i>	Closing Tag				End of list of <i>PMS_Data</i> structures	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
40	<i>PMS_Characterisation</i>	Closing Tag				End of Data Set structure	
41	<i>Data_Block</i>	Closing Tag				End of Data Block in the product	

Table 5-4 PMS Characterisation Table Product Data Block

5.2.2 NIR Characterisation Table (AUX NIR)

As is written in section 4.4 in [RD.2], conversion tables are used to convert NIR pulse length telemetry values into Brightness Temperature units and noise temperature whenever the LICEF-NIRs are operating like a nominal LICEF and providing correlations.

The SPH contains only the Main_SPH_for_XML structure as defined in Table 5-3.

The Data Block of the NIR Characterisation auxiliary data product is in XML ASCII format, with 1 dataset ***NIR_Characterisation*** containing 1 single dataset record. The product data block contains the attenuations of all 3 NIR devices measured at different physical temperatures, the noise temperatures, the corrections to NIR response and to sensitivity. The total size of the ***AUX_NIR*** product is 14 KB (measured as the size in hard disk of one sample of the product containing both header and datablock). The following table describes the XML format of the ***AUX_NIR*** product's data block.

Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	<i>Data_Block</i>	Starting Tag				Init of Data Block in the product.	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
02	NIR_Characterisation	Starting Tag				Initial Data Set definition tag. Start of Data Set XML structure containing the variables described below	
03	List_of_NIR_Datas	Starting Tag	N/A	2 bytes		Tag starting a list of identical NIR_Data structures. Tag contains an attribute " <i>count</i> " which is always "03" (the number of NIR devices in the MIRAS instrument)	CASA Attribute " <i>count</i> " is fixed
04	NIR_Data	Starting Tag				Tag starting a structure with all variables needed to identify a NIR device and characterise it at different physical temperatures	
05	NIR_ID	String	N/A	2 bytes	%2s	NIR unique identifier. It shall follow the format XY X=First arm identifier {A,B,C} Y=Second arm identifier {A,B,C} Possible values = {AB, BC, CA}	CASA Fixed identifiers
06	L_1_V	String	dB	5 bytes	%05.3f	Attenuation (losses) between VAP and VAP2 (radiator of the antenna) at specified temperature. Tag contains attribute " <i>unit</i> " always set to the string specified in Unit column.	CASA Attribute " <i>unit</i> " is fixed
07	dL_1_V	String	linear	10bytes	%+010.3e	Attenuation (losses) measured error between VAP and VAP2 (radiator of the antenna) at specified temperature. Tag contains attribute " <i>unit</i> " always set to the string specified in Unit column.	CASA Attribute " <i>unit</i> " is fixed



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
08	<i>L_1_V_Alpha</i>	String	Linear/K	10bytes	%+010.3e	Attenuation (losses) long term drift coefficient between VAP and VAP2 (radiator of the antenna) at specified temperature. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
09	<i>L_1_V_Beta</i>	String	Linear/K	10bytes	%+010.3e	Attenuation (losses) short term drift coefficient between VAP and VAP2 (radiator of the antenna) at specified temperature. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
10	<i>L_1_V_Tp7</i>	String	K	8 bytes	%08.4	Reference Temperature at which the drift coefficients were characterised Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
11	<i>L_2_V</i>	String	dB	5 bytes	%05.3f	Attenuation (losses) between VAP2 and VIP (feed network of the antenna) at specified temperature. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
12	<i>L_NC_V</i>	String	dB	5 bytes	%05.3f	Attenuation (losses) between VIP and V- OPV (output connector) at specified temperature. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
13	<i>L_A_V</i>	String	dB	5 bytes	%05.3f	Attenuation (losses) between V-OPV and LV-VIP (input connector) at specified temperature. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
14	<i>L_DA_V</i>	String	dB	5 bytes	%05.3f	Attenuation (losses) between LV-VIP and LV-LCIP (switch output) at specified temperature. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
15	<i>L_DR_V</i>	String	dB	5 bytes	%05.3f	Attenuation (losses) between LV-RIP and LV-LCIP (switch attenuation between reference channel at switch plane and common input plane) at specified temperature Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
16	<i>L_DC_V</i>	String	dB	5 bytes	%05.3f	Attenuation (losses) between LV-CIP and LV-LCIP (switch attenuation between calibration channel at switch plane and common input plane) at specified temperature. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
17	<i>L_R_V</i>	String	dB	5 bytes	%05.3f	Attenuation (losses) between V-OPR and LV-RIP (input connector) at specified temperature. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
18	<i>L_P_V</i>	String	1/sec	7 bytes	%07.4f	Factor to take into account Tp7 latency.	HARP
19	<i>L_1_H</i>	String	dB	5 bytes	%05.3f	Attenuation (losses) between HAP and HAP2 (radiator of the antenna) at specified temperature. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
20	<i>dL_1_H</i>	String	linear	10bytes	%+010.3e	Attenuation (losses) measured error between HAP and HAP2 (radiator of the antenna) at specified temperature. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
21	<i>L_1_H_Alpha</i>	String	Linear/K	10bytes	%+010.3e	Attenuation (losses) long term drift coefficient between HAP and HAP2 (radiator of the antenna) at specified temperature. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
22	<i>L_1_H_Beta</i>	String	Linear/K	10bytes	%+010.3e	Attenuation (losses) short term drift coefficient between HAP and HAP2 (radiator of the antenna) at specified temperature. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
23	<i>L_1_H_Tp7</i>	String	K	8 bytes	%08.4	Reference Temperature at which the drift coefficients were characterised Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
24	<i>L_2_H</i>	String	dB	5 bytes	%05.3f	Attenuation (losses) between HAP2 and HIP (feed network of the antenna) at specified temperature. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
25	<i>L_NC_H</i>	String	dB	5 bytes	%05.3f	Attenuation (losses) between HIP and H-OPV (output connector) at specified temperature. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
26	<i>L_A_H</i>	String	dB	5 bytes	%05.3f	Attenuation (losses) between H-OPV and LH-VIP (input connector) at specified temperature Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
27	<i>L_DA_H</i>	String	dB	5 bytes	%05.3f	Attenuation (losses) between H-OPV and LH-VIP (input connector) at specified temperature. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
28	<i>L_DR_H</i>	String	dB	5 bytes	%05.3f	Attenuation (losses) between LV-RIP and LV-LCIP (switch attenuation between reference channel at switch plane and Tag contains attribute "unit" always set to the string specified in Unit column.common input plane) at specified temperature	CASA Attribute "unit" is fixed
29	<i>L_DC_H</i>	String	dB	5 bytes	%05.3f	Attenuation (losses) between LV-CIP and LV-LCIP (switch attenuation between calibration channel at switch plane and common input plane) at specified temperature Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
30	<i>L_R_H</i>	String	dB	5 bytes	%05.3f	Attenuation (losses) between H-OPR and LH-RIP (input connector) at specified temperature. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
31	<i>L_P_H</i>	String	1/sec	7 bytes	%07.4f	Factor to take into account Tp7 latency.	HARP



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
32	C_A_V		K/K	11 bytes	%+011.3e	Correction to NIR response (in mode A). First order correction. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
33	D_A_V		K	11 bytes	%+011.3e	Correction to NIR response (in mode A). Second order correction. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
34	U_A_V		K/K	11 bytes	%+011.3e	Correction to temperature sensitivity (in mode A). Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
35	A_V		K/K	11 bytes	%+011.3e	Temperature sensitivity correction (in mode A). First order correction. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
36	B_V		K/K	11 bytes	%+011.3e	Temperature sensitivity correction (in mode A). Second order correction. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
37	C_R_V		K/K	11 bytes	%+011.3e	Correction to NIR response (in mode R). First order correction. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
38	<i>D_R_V</i>		K	11 bytes	%+011.3e	Correction to NIR response (in mode R) Second order correction. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
39	<i>U_R_V</i>		K/K	11 bytes	%+011.3e	Correction to NIR response (in mode A). First order correction. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
40	<i>C_A_H</i>		K/K	11 bytes	%+011.3e	Correction to NIR response (in mode A). Second order correction. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
41	<i>D_A_H</i>		K	11 bytes	%+011.3e	Correction to NIR response (in mode A). Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
42	<i>U_A_H</i>		K/K	11 bytes	%+011.3e	Correction to temperature sensitivity (in mode A) Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
43	<i>A_H</i>		K/K	11 bytes	%+011.3e	Temperature sensitivity correction (in mode A). First order correction. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
44	<i>B_H</i>		K/K	11 bytes	%+011.3e	Temperature sensitivity correction (in mode A). Second order correction. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
45	<i>C_R_H</i>		K/K	11 bytes	%+011.3e	Correction to NIR response (in mode R). First order correction. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
46	<i>D_R_H</i>		K	11 bytes	%+011.3e	Correction to NIR response (in mode R). Second order correction. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
47	<i>U_R_H</i>		K/K	11 bytes	%+011.3e	Correction to temperature sensitivity (in mode R). Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
48	<i>List_of_Dicke_Switch_Values_Datas</i>	Starting Tag				Tag starting a List containing the Dicke Switch data structures, with "count" field (count=3)	CASA Attribute "count" is fixed
49	<i>Dicke_Switch_Values_Data</i>	Starting Tag				Tag starting the structure containing the Dicke Switch Values.	
50	<i>Temperature</i>	String	K	7 bytes	%07.3f	Temperature at which the Dicke Switch values were obtained Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
51	<i>Amplitude_Dicke_Switch_V</i>	String	dB	6 bytes	%+05.2f	Dicke Switch Isolation Module for V polarisation	CASA Attribute "unit" is fixed
52	<i>Phase_Dicke_Switch_V</i>	String	Deg	8 bytes	%+08.3f	Dicke Switch Isolation Phase for V polarisation	CASA Attribute "unit" is fixed



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
53	<i>Amplitude_Dicke_Switch_H</i>	String	dB	6 bytes	%+05.2f	Dicke Switch Isolation Module for H polarisation	CASA Attribute "unit" is fixed
54	<i>Phase_Dicke_Switch_H</i>	String	Deg	8 bytes	%+08.3f	Dicke Switch Isolation Phase for H polarisation	CASA Attribute "unit" is fixed
55	<i>Dicke_Switch_Values_Data</i>	Ending Tag				Tag ending the structure containing the Dicke Switch Values.	
56	<i>List_of_Dicke_Switch_Values_Datas</i>	Ending Tag				Tag ending a List containing the Dicke Switch data structures, with "count" field (count=3)	
57	<i>NIR_Data</i>	Ending Tag				Tag ending a structure with all variables needed to identify a NIR device and characterise it at different physical temperatures	
58	<i>List_of_NIR_Datas</i>	Ending Tag	N/A			Tag ending a list of identical NIR_Data structures.	
59	<i>List_of_NIR_Default_Datas</i>	Starting Tag				Tag starting the List containing the NIR default data structures, with "count" field (count=3)	Attribute "count" is fixed
60	<i>NIR_Default_Data</i>	Starting Tag				Tag starting the NIR Default Data structure	
61	<i>NIR_ID</i>	String	N/A	2 bytes	%2s	NIR unique identifier. It shall follow the format XY X=First arm identifier {A,B,C} Y=Second arm identifier {A,B,C} Possible values = {AB, BC, CA}	CASA Fixed identifiers



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
62	<i>NIR_Expected_BT_H</i>		K	12 bytes	%+012.6f	NIR-A Expected Brightness Temperature in H polarisation $T'_{A0,h}$	CASA Attribute "unit" is fixed
63	<i>NIR_Expected_BT_V</i>		K	12 bytes	%+012.6f	NIR-A Expected Brightness Temperature in V polarisation $T'_{A0,v}$	CASA Attribute "unit" is fixed
64	<i>T_Noise_Cal_H</i>		K	12 bytes	%+012.6f	NIR-A antenna noise injection temperature during calibration $T_{NA0,h}$	CASA Attribute "unit" is fixed
65	<i>T_Noise_Cal_V</i>		K	12 bytes	%+012.6f	NIR-A antenna noise injection temperature during calibration $T_{NA0,v}$	CASA Attribute "unit" is fixed
66	<i>NIR_Observed_BT_H</i>		K	12 bytes	%+012.6f	NIR-R observed brightness temperature + injected temperature in H polarization at LH-HIP $T_{A_ON0,h}^{CIP}$	CASA Attribute "unit" is fixed
67	<i>NIR_Observed_BT_V</i>		K	12 bytes	%+012.6f	NIR-R observed brightness temperature + injected temperature in V polarization at LH-VIP $T_{A_ON0,v}^{CIP}$	CASA Attribute "unit" is fixed
68	<i>T_Noise_Cal_Ref_H</i>		K	12 bytes	%+012.6f	NIR-R noise injection temperature in the reference branch during calibration $T_{NR0,h}$	CASA Attribute "unit" is fixed
69	<i>T_Noise_Cal_Ref_V</i>		K	12 bytes	%+012.6f	NIR-R noise injection temperature in the reference branch during calibration $T_{NR0,v}$	CASA Attribute "unit" is fixed



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
70	<i>T_Phys_Tp6</i>		K	12 bytes	%+012.6f	Reference Physical Temperature of the antenna intermediate layer (Tp6).	CASA Attribute "unit" is fixed
71	<i>T_Phys_Tp7</i>		K	12 bytes	%+012.6f	Reference Physical Temperature of the antenna patch (Tp7).	CASA Attribute "unit" is fixed
72	<i>T_Phys_Tp1_H</i>		K	12 bytes	%+012.6f	Reference Physical Temperature of the NIR diode (Tp1h).	CASA Attribute "unit" is fixed
73	<i>T_Phys_Tp1_V</i>		K	12 bytes	%+012.6f	Reference Physical Temperature of the NIR diode (Tp1v).	CASA Attribute "unit" is fixed
74	<i>T_NA_0_Fixed_H</i>		K	12 bytes	%+012.6f	Fixed value for H-pol Antenna BT measured during calibration sequence. To be used instead of calibration procedure when "Fixed Tna0" Flag is active.	CASA Attribute "unit" is fixed
75	<i>T_NA_0_Fixed_V</i>		K	12 bytes	%+012.6f	Fixed value for V-pol Antenna BT measured during calibration sequence. To be used instead of calibration procedure when "Fixed Tna0" Flag is active.	CASA Attribute "unit" is fixed
76	<i>NIR_Default_Data</i>	Ending Tag				Tag ending the NIR Default Data structure	
77	<i>List_of_NIR_Default_Datas</i>	Ending Tag				Tag ending the List containing the NIR default data structures	
78	<i>Data_Block</i>	Closing Tag				End of Data Block in the product	

Table 5-5 NIR Characterisation Table Product Data Block



5.2.3 PLM Characterisation Table (AUX PLM)

As is written in section 4.5 in [RD.2], this product contains all parameters calibrated on-ground referent to elements of the PLM, as well as operational parameters like the intermediate frequency where the instrument is operating. It also contains the correction factors used to average the Antenna Patterns for the G and J+ Matrices generation as specified in [RD 31].

The SPH contains only the Main_SPH_for_XML structure as defined in Table 5-3.

The Data Block of the PLM Characterisation auxiliary data product is in XML ASCII format, with 1 dataset **PLM_Parameters** containing 1 single dataset record. The product data block contains the thermistor on-ground calibrated parameters, per each CMN unit. The total size of the **AUX_PLM** product is 22 KB (measured as the size in hard disk of one sample of the product containing both header and datablock). The following table describes the XML format of the **AUX_PLM** product's data block.

Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	Data_Block	Starting Tag				Init of Data Block in the product.	
02	PLM_Parameters	Starting Tag				Initial Data Set definition tag. Start of Data Set XML structure containing the variables described below	
03	Intermediate_Frequency_Nominal		MHz	12 bytes	%+012.6f	Central frequency of operation in L-band, at which the instrument operates in the nominal correlator layer (1413.5 MHz)	CASA Attribute "unit" is fixed
04	Intermediate_Frequency_Redundant		MHz	12 bytes	%+012.6f	Central frequency of operation in L-band, at which the instrument operates in the redundant correlator layer (1413.5 MHz)	CASA Attribute "unit" is fixed



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
05	<i>Low_Frequency</i>		MHz	12 bytes	%+012.6f	Lower end of bandwidth frequency in L-band at which the instrument operates (1403.5 MHz)	CASA Attribute "unit" is fixed
06	<i>Local_Oscillator_Frequency</i>		MHz	12 bytes	%+012.6f	Local Oscillator Frequency, used in the computation of phase parameters in the FWF shape (1396.0 MHz)	CASA Attribute "unit" is fixed
07	<i>Time_Delay_Minus_T</i>		μs	15 bytes	%+015.9f	Time delay applied for measuring FWF at -t. Shall be constant and set to -1/55.84MHz.	CASA Attribute "unit" is fixed
08	<i>Time_Delay_Plus_T</i>		μs	15 bytes	%+015.9f	Time delay applied for measuring FWF at +t. Shall be constant and set to +1/55.84MHz.	CASA Attribute "unit" is fixed
09	<i>Time_Delay_Licef_ABH01_Nominal</i>		μs	15 bytes	%+015.9f	Additional time delay applied for measuring FWF Shape baselines containing LICEF-NIR ABH01 in nominal chain.	Value measured during instrument on-ground characterisation
10	<i>Time_Delay_Licef_ABV01_Nominal</i>		μs	15 bytes	%+015.9f	Additional time delay applied for measuring FWF Shape baselines containing LICEF-NIR ABV01 in nominal chain.	Value measured during instrument on
11	<i>Time_Delay_Licef_BCH01_Nominal</i>		μs	15 bytes	%+015.9f	Additional time delay applied for measuring FWF Shape baselines containing LICEF-NIR BCH01 in nominal chain.	Value measured during instrument on



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
12	<i>Time_Delay_Licef_BCV01_Nominal</i>		μs	15 bytes	%+015.9f	Additional time delay applied for measuring FWF Shape baselines containing LICEF-NIR BCV01 in nominal chain.	Value measured during instrument on
13	<i>Time_Delay_Licef_CAH01_Nominal</i>		μs	15 bytes	%+015.9f	Additional time delay applied for measuring FWF Shape baselines containing LICEF-NIR CAH01 in nominal chain.	Value measured during instrument on
14	<i>Time_Delay_Licef_CAV01_Nominal</i>		μs	15 bytes	%+015.9f	Additional time delay applied for measuring FWF Shape baselines containing LICEF-NIR CAV01 in nominal chain.	Value measured during instrument on
15	<i>Time_Delay_Licef_ABH01_Redundant</i>		μs	15 bytes	%+015.9f	Additional time delay applied for measuring FWF Shape baselines containing LICEF-NIR ABH01 in redundant chain.	Value measured during instrument on-ground characterisation
16	<i>Time_Delay_Licef_ABV01_Redundant</i>		μs	15 bytes	%+015.9f	Additional time delay applied for measuring FWF Shape baselines containing LICEF-NIR ABV01 in redundant chain.	Value measured during instrument on
17	<i>Time_Delay_Licef_BCH01_Redundant</i>		μs	15 bytes	%+015.9f	Additional time delay applied for measuring FWF Shape baselines containing LICEF-NIR BCH01 in redundant chain.	Value measured during instrument on



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
18	<i>Time_Delay_Licef_BCV01_Redundant</i>		μs	15 bytes	%+015.9f	Additional time delay applied for measuring FWF Shape baselines containing LICEF-NIR BCV01 in redundant chain.	Value measured during instrument on
19	<i>Time_Delay_Licef_CAH01_Redundant</i>		μs	15 bytes	%+015.9f	Additional time delay applied for measuring FWF Shape baselines containing LICEF-NIR CAH01 in redundant chain.	Value measured during instrument on
20	<i>Time_Delay_Licef_CAV01_Redundant</i>		μs	15 bytes	%+015.9f	Additional time delay applied for measuring FWF Shape baselines containing LICEF-NIR CAV01 in redundant chain.	Value measured during instrument on
21	<i>DICOS_Sampling</i>		N/A	5 bytes	%05d	Normalisation value for DICOS correlations. It represents the sampling length of each sample interval Default value is 65438	CASA Attribute "unit" is fixed
22	<i>NIR_Sampling</i>		N/A	5 bytes	%05d	Normalisation value for NIR pulse length ancillary measurements. It represents the sampling length of each sample interval Default value is 65535	CASA Attribute "unit" is fixed
23	<i>LICEF_Directivity_H</i>		N/A	8 bytes	%+08.5f	Averaged directivity value to be used in radiometric accuracy computation for H polarisation. Default value is 8.5	CASA Attribute "unit" is fixed
24	<i>LICEF_Directivity_V</i>		N/A	8 bytes	%+08.5f	Averaged directivity value to be used in radiometric accuracy computation for V polarisation. Default value is 8.5	CASA Attribute "unit" is fixed



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
25	<i>Xband_Range</i>	Real	mV	8 bytes	%+08.4f	Linear conversion range for X-band telemetry voltages used in conversion from 2's complement. Default value is 39.0625mV. Tag contains attribute " <i>unit</i> " always set to the string specified in Unit column.	CASA Attribute " <i>unit</i> " is fixed
26	<i>Xband_Ref_Temp</i>	Real	K	8 bytes	%+08.3f	Reference temperature for X-band temperature telemetry voltages conversion to Kelvin. Default value is 293K. Tag contains attribute " <i>unit</i> " always set to the string specified in Unit column.	CASA Attribute " <i>unit</i> " is fixed
27	<i>Xband_Ref_Resist</i>	Real	Ohm	8 bytes	%+08.1f	Reference resistance for X-band temperature telemetry voltages conversion to Kelvin. Default value is 15 KOhm. Tag contains attribute " <i>unit</i> " always set to the string specified in Unit column.	CASA Attribute " <i>unit</i> " is fixed
28	<i>Xband_Ref_B</i>	Real	K	8 bytes	%+08.2f	Reference B parameter for X-band telemetry voltages used in conversion from 2's complement. Default value is 4150K. Tag contains attribute " <i>unit</i> " always set to the string specified in Unit column.	CASA Attribute " <i>unit</i> " is fixed
29	<i>List_of_CMN_Units</i>	Starting Tag	N/A	2 bytes		Tag starting a list of identical CMN_Unit structures. It contains an attribute " <i>count</i> " which is always "12", the number of CMN units in the instrument	CASA Attribute " <i>unit</i> " is fixed



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
30	CMN_Unit	Starting Tag				Tag starting a CMN_Unit structure	
31	CMN_ID	string	N/A	2 bytes	%2s	Unique ID defining correlator unit to which the parameters are applicable: H1-H3, A1-A3, B1-B3, C1-C3	CASA Fixed identifiers
32	M_Cal_Nom		V/K	9 bytes	%+09.6f	Calibration coefficient relating dV/dT for nominal layer thermistors	CASA Attribute "unit" is fixed
33	Q_Cal_Nom		V	9 bytes	%+09.6f	Calibration coefficient relating dV for nominal layer thermistors	CASA Attribute "unit" is fixed
34	M_Cal_Red		V/K	9 bytes	%+09.6f	Calibration coefficient relating dV/dT for redundant layer thermistors	CASA Attribute "unit" is fixed
35	Q_Cal_Red		V/K	9 bytes	%+09.6f	Calibration coefficient relating dV for redundant layer thermistors	CASA Attribute "unit" is fixed
36	T_Low	Real	°C	9 bytes	%+09.5f	Lowest reference temperature (constant in time) . Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed
37	T_High	Real	°C	9 bytes	%+09.5f	Highest reference temperature (constant in time). Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
38	G1G2VC	Real	V	18 bytes	%+018.14f	Term in the Resistance computation equation. Default value is - 19.68503937007874. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
39	G2VC	Real	V	18 bytes	%+018.14f	Term in the Resistance computation equation. Default value is - 15.15748031496063. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
40	R1	Real	Ohm	19 bytes	%+019.13f	Term in the Resistance computation equation. Default value is 3010. Tag contains attribute "unit" always set to the string specified in Unit column.	CASA Attribute "unit" is fixed
41	A	Real	K ⁻¹	12 bytes	%+012.9f	Steinhart and Hart equation term characterising the thermistor in the current CMN. Default value is 0.001400531. Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed
42	B	Real	K ⁻¹	12 bytes	%+012.9f	Steinhart and Hart equation term characterising the thermistor in the current CMN. Default value is 0.000237737. Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
43	C	Real	K ⁻¹	12 bytes	%+012.9f	Steinhart and Hart equation term characterising the thermistor in the current CMN. Default value is 0.000000098. Tag contains attribute " <i>unit</i> " always set to the string specified in Unit column.	CASA Attribute " <i>unit</i> " is fixed
44	PMS_Range	integer	V	2 bytes	%02d	Linear conversion range for PMS voltages used in conversion from 2's complement. Default value is 5V. Tag contains attribute " <i>unit</i> " always set to the string specified in Unit column.	CASA Attribute " <i>unit</i> " is fixed
45	CMN_Unit	Closing Tag				End of CMN_Unit structure	
46	List_of_CMN_Units	Closing Tag				End of list of CMN_Unit structures	
47	List_of_LICEF_Positions	Starting Tag	N/A	2 bytes		Tag starting a list of identical LICEF_Position structures. It contains an attribute " <i>count</i> " which is always "69", the number of LICEF devices	CASA Attribute " <i>count</i> " is fixed
48	LICEF_Position	Starting Tag				Tag starting a LICEF_Position structure	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
49	LICEF_ID	String	N/A	5 bytes	%5c	Format is XXYZ, where: <ul style="list-style-type: none"> XX indicates the arm location (A_, AB, B_, BC, C_ or CA) Y indicates polarisation for NIR elements (H, V or _) ZZ indicates LICEF number in arm location (01, 02, 03,... 21) For example AB_03, CAH01, B__18	CASA Fixed identifiers
50	X	Real	mm	11 bytes	%+011.5f	X horizontal position of the LICEF on a reference frame centred on the Hub and positive in the direction LICEF NIR BC 03 to LICEF BC 01. Tag contains attribute " <i>unit</i> " always set to the string specified in Unit column.	CASA Attribute " <i>unit</i> " is fixed
51	Y	Real	mm	11 bytes	%+011.5f	Y vertical position of the LICEF on a reference frame centred on the Hub and positive in the direction of the axis contained between arms A and B. Tag contains attribute " <i>unit</i> " always set to the string specified in Unit column.	CASA Attribute " <i>unit</i> " is fixed
52	Z	Real	mm	11 bytes	%+011.5f	Z off-plane position of the LICEF on a reference frame centred on the Hub and positive in the direction formed by the natural normal vector to the XY plane. Tag contains attribute " <i>unit</i> " always set to the string specified in Unit column.	CASA Attribute " <i>unit</i> " is fixed
53	LICEF_Position	Closing Tag				End of LICEF_Position structure	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
54	<i>List_of_LICEF_Positions</i>	Closing Tag				End of list of LICEF_Position structures	
55	<i>AntennaPattern_Corrections</i>	Starting Tag				Tag starting the corrections to apply to the Antenna Patterns for G and J+ Matrix Generation.	
56	<i>Frequency_Weights</i>	Starting Tag				Tag starting the weights per frequency of the Antenna Patterns.	Current values taken from [RD 31]
57	<i>Weight_Frequency_Low</i>	Real	N/A	10 bytes	%+010.6f	Weight to apply to Antenna Patterns measured at Low Frequency	
58	<i>Weight_Frequency_Centre</i>	Real	N/A	10bytes	%+010.6f	Weight to apply to Antenna Patterns measured at Centre Frequency	
59	<i>Weight_Frequency_High</i>	Real	N/A	10 bytes	%+010.6f	Weight to apply to Antenna Patterns measured at High Frequency	
60	<i>Frequency_Weights</i>	Closing Tag				End of Frequency_Weights .	
61	<i>List_of_Corrections_per_LICEF</i>	Starting Tag				Tag starting a list of identical Corrections_per_LICEF structures. It contains an attribute "count" which is always "69", i.e, the number of LICEFs.	
62	<i>Corrections_per_LICEF</i>	Starting Tag					Current values taken from [RD 31]



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
63	LICEF_ID	String	N/A	5 bytes	%5c	Format is XXYZ, where: <ul style="list-style-type: none"> XX indicates the arm location (A_, AB, B_, BC, C_ or CA) Y indicates polarisation for NIR elements (H, V or _) ZZ indicates LICEF number in arm location (01, 02, 03,... 21) For example AB_03, CAH01, B__18	CASA Fixed identifiers
64	Correction_Factor_H	Real	N/A	8 bytes	%+08.6f	Correction factor to be applied to the Weighted Frequency Averaged Antenna Pattern of the current LICEF in H-pol.	Current values taken from [RD 31]
65	Correction_Factor_V	Real	N/A	8 bytes	%+08.6f	Correction factor to be applied to the Weighted Frequency Averaged Antenna Pattern of the current LICEF in H-pol.	Current values taken from [RD 31]
66	LICEF_TA_Flag	Integer	N/A	1 byte	%01d	This field can have one of the following values: <ul style="list-style-type: none"> 0, meaning that the corresponding LICEF is NOT to be included to the antenna temperature average. 1, meaning that the corresponding LICEF is to be included to the antenna temperature average. 	CASA
67	Corrections_per_LICEF	Closing Tag				End of Corrections_per_LICEF structures	
68	List_of_Corrections_per_LICEF	Closing Tag				End of List_of_Corrections_per_LICEF .	
69	AntennaPattern_Corrections	Closing Tag				End of the AntennaPatterns_Corrections .	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
70	<i>PLM_Parameters</i>	Closing Tag				End of Data Set structure	
71	<i>Data_Block</i>	Closing Tag				End of Data Block in the product	

Table 5-6 PLM Characterisation Table Product Data Block

5.2.4 S-Parameters of MIRAS (AUX SPAR)

As is written in section 4.6 in [RD.2], for calibration purposes, all S-parameters of the connections inside MIRAS shall be measured by the manufacturer of MIRAS in its full implementation, and provided as an initial auxiliary file.

The Scattering Parameters from the noise source to the j and k receivers relevant at this stage are:

- Transfer parameters S_{jk} and S_{kj} , a measure of the complex insertion gain;
- Driving point parameters S_{jj} and S_{kk} , a measure of the input and output mismatch loss

The SPH contains only the Main_SPH_for_XML structure as defined in Table 5-3.

The Data Block of the S-Parameters auxiliary data product is in XML ASCII format, with 3 datasets **NDN_S_Parameters**, **Switch_S_Parameters** and **UPC_Cold_Sky_Correction** containing 1 single dataset record each. The first data set gives the S-parameters of the Noise Distribution Network measured at different physical temperatures for each noise source, and also with values for the power dividers and cables.

The second data set contains the S-parameters of the switches in all receivers in all instrument sections. The third dataset contains in-orbit correction factors computed with a specific UPC tool during the Cold Sky manouver.

The total size of the **AUX_SPAR__** product is 1417 KB (measured as the size in hard disk of one sample of the product containing both header and datablock). The following table describes the XML format of the **AUX_SPAR__** product's data block, with the **NDN_S_Parameters** dataset, the **Switch_S_Parameters** dataset and the **UPC_Cold_Sky_Correction** dataset.



- The **NDN_S_Parameters** dataset contains the S-parameters for the NDN, in the hub and all arm sections. Its contents shall be referred in ASCII XML format. This data set is formed by 1 Data Set Record with all the information.
- The **Switch_S_Parameters** dataset contains the S-parameters for the switches, in all receivers in all sections. Its contents shall be referred in ASCII XML format. Each data set is formed by 1 Data Set Record with all the information. It is not known currently whether information on switch U shall be measured or not, as well as the number of characterisations needed for the LICEF-NIR elements.
- The **UPC_Cold_Sky_Correction** dataset contains the CAS path correction factors per Noise Source and LICEF pairs. Its contents shall be referred in ASCII XML format..

Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	Data_Block	Starting Tag				Init of Data Block in the product.	
02	NDN_S_Parameters	Starting Tag				Initial Data Set definition tag. Start of Data Set XML structure containing the variables described below	
03	Hub_NS	Starting Tag				Tag starting a Hub_NS structure	
04	Hub_NS_ID	String	N/A	4 bytes	%4s	Unique ID defining Noise Source unit to which the parameters are applicable: "NS_H"	CASA Fixed identifier
05	List_of_Hub_NS_Values	Starting Tag		2 bytes		Tag starting a list of identical S-parameters values structures. It contains an attribute " <i>count</i> " which is by default 5	CASA Attribute " <i>count</i> " is fixed
06	Hub_NS_Value	Starting Tag				Tag starting a Value structure	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
07	Temperature	real	K	7 bytes	%+07.3f	Temperature at which the S-parameters were obtained, in Kelvin. Tag contains attribute “unit” always set to the string specified in Unit column	CASA Attribute “unit” is fixed
08	S_{jk} Magnitude (where j and k range from 1 to 5)	real	linear	11 bytes	%+011.8f	S parameter relating connection between the 5 port networks in the hub Noise Source. Forms a matrix of 5x5 values defining amplitude. Tag contains attribute “unit” always set to the string specified in Unit column	CASA Attribute “unit” is fixed
09	S_{kj} Phase (where j and k range from 1 to 5)	real	deg	10 bytes	%+010.5f	S parameter relating connection between the 5 port networks in the hub Noise Source. Forms a matrix of 5x5 values defining phase. Tag contains attribute “unit” always set to the string specified in Unit column	CASA Attribute “unit” is fixed
10	Hub_NS_Value	Closing Tag				End of Value structure	
11	List_of_Hub_NS_Values	Closing Tag				End of list of Value structures	
12	Hub_NS	Closing Tag				End of Hub_NS structures	
13	List_of_Arm_NSs	Starting Tag		2 bytes		Tag starting a list of identical Arm_NS (Arm Noise Sources) data structures structures. It contains an attribute “count” which is always “09”	CASA Attribute “count” is fixed
14	Arm_NS	Starting Tag				Tag starting an Arm_NS structure	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
15	<i>Arm_ID</i>	String	N/A	5 bytes	5 bytes	Unique ID defining Noise Source unit to which the parameters are applicable: NS_A1, NS_A2, NS_A3, NS_B1, NS_B2, NS_B3, NS_C1, NS_C2, NS_C3	CASA Fixed string
16	<i>List_of_Arm_NS_Values</i>	Starting Tag		2 bytes		Tag starting a list of identical S-parameters values structures. It contains an attribute " <i>count</i> " which is by default 5	CASA Attribute " <i>count</i> " is fixed
17	<i>Arm_NS_Value</i>	Starting Tag				Tag starting a Value structure	
18	<i>Temperature</i>	Tag	K	7 bytes	%+07.3f	Temperature at which the S-parameters were obtained in Kelvin. Tag contains attribute " <i>unit</i> " always set to the string specified in Unit column	CASA Attribute " <i>unit</i> " is fixed
19	<i>S_jk_Magnitude</i> (where <i>j</i> and <i>k</i> range from 1 to 4)	Real	linear	11 bytes	%+011.8f	S parameter relating connection between the 4 port networks in each of the arms Noise Sources. Forms a matrix of 4x4 values defining amplitude. Tag contains attribute " <i>unit</i> " always set to the string specified in Unit column	CASA Attribute " <i>unit</i> " is fixed
20	<i>S_kj_Phase</i> (where <i>j</i> and <i>k</i> range from 1 to 4)	Real	deg	10 bytes	%+010.5f	S parameter relating connection between the 4 port networks in each of the arms Noise Sources. Forms a matrix of 4x4 values defining phase. Tag contains attribute " <i>unit</i> " always set to the string specified in Unit column	CASA Attribute " <i>unit</i> " is fixed
21	<i>Arm_NS_Value</i>	Closing Tag				End of Value structure	
22	<i>List_of_Arm_NS_Values</i>	Closing Tag				End of list of Value structures	
23	<i>Arm_NS</i>	Closing Tag				End of Arm_NS structure	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
24	<i>List_of_Arm_NSs</i>	Closing Tag				End of list of Arm_NS structures	
25	<i>List_of_Power_Dividers</i>	Starting Tag		2 bytes		Tag starting a list of identical Power_Divider data structures. It contains an attribute "count" which is always "12"	CASA Attribute "count" is fixed
26	<i>Power_Divider</i>	Starting Tag				Tag starting a Power_Divider structure	
27	<i>Power_Divider_ID</i>	String	N/A	5 bytes	%5s	Unique ID defining Power Divider unit to which the parameters are applicable: PD_H1, PD_H2, PD_H3, PD_A1, PD_A2, PD_A3, PD_B1, PD_B2, PD_B3, PD_C1, PD_C2, PD_C3	CASA Fixed identifier
28	<i>List_of_Power_Divider Values</i>	Starting Tag		2 bytes		Tag starting a list of identical S-parameters values structures. It contains an attribute "count" which is by default 5.	CASA Attribute "count" is fixed
29	<i>Power_Divider Value</i>	Starting Tag				Tag starting a Value structure	
30	<i>Temperature</i>	Real	K	7 bytes	%+07.3f	Temperature at which the S-parameters were obtained, in Kelvin. Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed
31	<i>S_jk_Magnitude</i> (where j and k range from 1 to 8)	Real	linear	11 bytes	%+011.8f	S parameter relating connection between the 8 port networks in each of the Power Dividers. Forms a matrix of 8x8 values defining amplitude. Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
32	<i>S_kj_Phase</i> (where <i>j</i> and <i>k</i> range from 1 to 8)	Real	deg	10 bytes	%+010.5f	S parameter relating connection between the 8 port networks in each of the Power Dividers. Forms a matrix of 8x8 values defining phase. Tag contains attribute " <i>unit</i> " always set to the string specified in Unit column	CASA Attribute " <i>unit</i> " is fixed
33	<i>Power_Divider_Value</i>	Closing Tag				End of <i>Value</i> structure	
34	<i>List_of_Power_Divider_Values</i>	Closing Tag				End of list of <i>Value</i> structures	
35	<i>Power_Divider</i>	Closing Tag				End of <i>Power_Divider</i> structure	
36	<i>List_of_Power_Dividers</i>	Closing Tag				End of list of <i>Power_Divider</i> structures	
37	<i>List_of_Cables</i>	Starting Tag				Tag starting a list of identical <i>Cable</i> data structures. It contains an attribute " <i>count</i> " which is always "96"	CASA Attribute " <i>count</i> " is fixed
38	<i>Cable</i>	Starting Tag				Tag starting a <i>Cable</i> structure	
39	<i>Cable_ID</i>	string	N/A	6 bytes	%6s	Unique ID defining Cable unit to which the parameters are applicable. There are 8 cables per arm or hub section, naming convention is C_ " <i>section_name</i> "_ " <i>cable_number</i> ": Where <i>section_name</i> can be H1, H2, H3, A1, A2, A3, B1, B2, B3, C1, C2 or C3, and <i>cable_number</i> goes from 1 to 8. (e.g. C_C1_3)	CASA Fixed string



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
40	List_of_Cable_Values	Starting Tag		2 bytes		Tag starting a list of identical S-parameters values structures. It contains an attribute " <i>count</i> " which is by default 10	CASA Attribute " <i>count</i> " is fixed
41	Cable_Value	Starting Tag				Tag starting a Value structure	
42	Temperature	Real	K	7 bytes	%+07.3f	Temperature at which the S-parameters were obtained, in Kelvin. Tag contains attribute " <i>unit</i> " always set to the string specified in Unit column	CASA Attribute " <i>unit</i> " is fixed
43	S_jk_Magnitude (where j and k range from 1 to 2)	Real	linear	11 bytes	%+011.8f	S parameter relating connection between the 2 port networks in each of the cables. Forms a matrix of 2x2 values defining amplitude. Tag contains attribute " <i>unit</i> " always set to the string specified in Unit column	CASA Attribute " <i>unit</i> " is fixed
44	S_kj_Phase (where j and k range from 1 to 2)	Real	deg	10 bytes	%+010.5f	S parameter relating connection between the 2 port networks in each of the cables. Forms a matrix of 2x2 values defining phase. Tag contains attribute " <i>unit</i> " always set to the string specified in Unit column	CASA Attribute " <i>unit</i> " is fixed
45	Cable_Value	Closing Tag				End of Value structure	
46	List_of_Cable_Values	Closing Tag				End of list of Value structures	
47	Cable	Closing Tag				End of Cable structure	
48	List_of_Cables	Closing Tag				End of list of Cable structures	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
49	NDN_S_Parameters	Closing Tag				End of NDN_S_Parameters Data Set structure	
50	Switch_S_Parameters	Starting Tag				Initial Data Set definition tag. Start of Data Set structure containing the variables described below	
51	List_of_Switchs	Starting Tag				Tag starting a list of identical Switch data structures. It contains an attribute " <i>count</i> " which is always "72"	CASA Attribute " <i>count</i> " is fixed
52	Switch	Starting Tag				Tag starting a Switch structure	
53	Switch_ID	String	N/A	5 bytes	%5c	Unique ID defining LICEF or NIR-LICEF to which the measurements are applicable (from 1 to 69) Format is XXYZ, where: <ul style="list-style-type: none"> XX indicates the arm location (A_, AB, B_, BC, C_ or CA) Y indicates polarisation for NIR elements (H, V or _) ZZ indicates LICEF number in arm location (01, 02, 03,... 21) For example AB_03, CAH01, B__18	CASA Fixed string for each device
54	List_of_Switch_Values	Tag				Tag starting a list of identical Switch S-parameters values structures. It contains an attribute " <i>count</i> " which is by default 10.	CASA Attribute " <i>count</i> " is fixed
55	Switch_Value	Starting Tag				Tag starting a Value structure	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
56	Temperature	Real	K	7 bytes	%07.3f	Temperature at which the S-parameters were measured, in Kelvin. Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed
57	S_LH_Magnitude	Real	linear	10 bytes	%+010.7f	S parameter relating connection between the antenna H-pol Input plane and TRF Output plane normalized with the S parameter relating connection between the Calibration Input plane and TRF Output plane Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed
58	S_LH_Phase	Real	deg	10 bytes	%+010.5f	S parameter relating connection between the antenna H-pol Input plane and TRF Output plane normalized with the S parameter relating connection between the Calibration Input plane and TRF Output plane Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed
59	S_LV_Magnitude	Real	linear	10 bytes	%+010.7f	S parameter relating connection between the antenna V-pol Input plane and TRF Output plane normalized with the S parameter relating connection between the Calibration Input plane and TRF Output plane Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed
60	S_LV_Phase	Real	deg	10 bytes	%+010.5f	S parameter relating connection between the antenna V-pol Input plane and TRF Output plane normalized with the S parameter relating connection between the Calibration Input plane and TRF Output plane Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
61	S_{LC}Magnitude	Real	linear	10 bytes	%+010.7f	S parameter relating connection between the Calibration Input plane and TRF Output plane normalized with the S parameter relating connection between the Calibration Input plane and TRF Output plane The switch in U position is not measured. Losses between CIP and U are assumed negligible, so it is assumed to be 1. Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed
62	S_{LC}Phase	Real	deg	10 bytes	%+010.5f	S parameter relating connection between the Calibration Input plane and TRF Output plane normalized with the S parameter relating connection between the Calibration Input plane and TRF Output plane The switch in U position is not measured. Losses between CIP and U are assumed negligible, so it is assumed to be 1. Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed
63	S_{LU}Magnitude	Real	linear	10 bytes	%+010.7f	S parameter relating connection between the Unoise Input plane and TRF Output plane. The switch in U position is not measured. Losses between CIP and U are assumed negligible, so this value is assumed to be 1. Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed
64	S_{LU}Phase	Real	deg	10 bytes	%+010.5f	S parameter relating connection between the Unoise Input plane and TRF Output plane. The switch in U position is not measured. Losses between CIP and U are assumed negligible, so this value is assumed to be 1. Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
65	Switch_Value	Closing Tag				End of Value structure	
66	List_of_Switch_Values	Closing Tag				End of list of Value structures	
67	Switch	Closing Tag				End of Switch structure	
68	List_of_Switches	Closing Tag				End of list of Switch structures	
69	Switch_S_Parameters	Closing Tag				End of Switch_S_Parameters Data Set structure	
70	UPC_Cold_Sky_Correction	Starting Tag				Initial Data Set definition tag. Start of Data Set structure containing the variables described below	
71	Hub_NS_Receiver_Path	Starting Tag				Initial Data Set definition tag. Start of Data Set structure containing the variables described below	
72	Hub_NS_Receiver_Path_ID	String	N/A	4 bytes	%4c	Hub NS ID. Always equal to "NS_H"	CASA Fixed string for each device
73	List_of_Hub_Receiver_Path_Values	Starting Tag				Tag starting a list of identical Hub_Receiver_Path_Value data structures. It contains an attribute "count" which is always "18"	CASA Attribute "count" is fixed
74	Hub_Receiver_Path_Value	Starting Tag				Tag starting a Hub_Receiver_Path_Value structure	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
75	Receiver_Path_ID	String	N/A	5 bytes	%5c	<p>Unique ID defining LICEF or NIR-LICEF to which the measurements are applicable (from 1 to 72)</p> <p>Format is XXYZ, where:</p> <ul style="list-style-type: none"> XX indicates the arm location (A_, AB, B_, BC, C_ or CA) Y indicates polarisation for NIR elements (H, V or _) ZZ indicates LICEF number in arm location (01, 02, 03,... 21) <p>For example AB_03, CAH01, B__18</p>	CASA Fixed string for each device
76	Receiver_Path_Value	Real	linear	12 bytes	%+012.9f	<p>CAS Correction factor from NS to LICEF identified previously.</p> <p>Tag contains attribute "unit" always set to the string specified in Unit column</p>	CASA Attribute "unit" is fixed
77	Hub_Receiver_Path_Value	Closing Tag				End of Hub_Receiver_Path_Value structure	
78	List_of_Hub_Receiver_Path_Values	Closing Tag				End of list of Hub_Receiver_Path_Value data structures.	
79	Hub_NS_Receiver_Path	Closing Tag				End of Hub_NS_Receiver_Path structure	
80	List_of_Arm_NS_Receiver_Path_s	Starting Tag				<p>Tag starting a list of identical Arm_NS_Receiver_Path data structures.</p> <p>It contains an attribute "count" which is always "9"</p>	CASA Attribute "count" is fixed
81	Arm_NS_Receiver_Path	Starting Tag				Tag starting a Arm_NS_Receiver_Path structure	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
82	Arm_NS_Receiver_Path_ID	String	N/A	5 bytes	%5c	Unique ID defining Arm Noise Source to which the measurements are applicable (from 1 to 9) Format is NS_XY, where: <ul style="list-style-type: none"> • X indicates the arm location (A, B or C) • Y indicates NS number within arm (1, 2 or 3) For example NS_A1, NS_B3...	CASA Fixed string for each device
83	List_of_Arm_Receiver_Path_Values	Starting Tag				Tag starting a list of identical Arm_Receiver_Path_Value data structures. It contains an attribute "count" which is always "12"	CASA Attribute "count" is fixed
84	Arm_Receiver_Path_Value	Starting Tag				Tag starting a Arm_Receiver_Path_Value structure	
85	Receiver_Path_ID	String	N/A	5 bytes	%5c	Unique ID defining LICEF or NIR-LICEF to which the measurements are applicable (from 1 to 72) Format is XXYZ, where: <ul style="list-style-type: none"> • XX indicates the arm location (A_, AB, B_, BC, C_ or CA) • Y indicates polarisation for NIR elements (H, V or _) • ZZ indicates LICEF number in arm location (01, 02, 03,... 21) For example AB_03, CAH01, B__18	CASA Fixed string for each device
86	Receiver_Path_Value	Real	linear	12 bytes	%+012.9f	CAS Correction factor from NS to LICEF identified previously. Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed
87	Arm_Receiver_Path_Value	Closing Tag				End of Arm_Receiver_Path_Value structure	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
88	<i>List_of_Arm_Receiver_Path_Values</i>	Closing Tag				End of list of <i>Arm_Receiver_Path_Value</i> data structures.	
89	<i>Arm_NS_Receiver_Path</i>	Closing Tag				End of <i>Arm_NS_Receiver_Path</i> structure	
90	<i>List_of_Arm_NS_Receiver_Paths</i>	Closing Tag				End list of <i>Arm_NS_Receiver_Path</i> data structures.	
91	<i>Data_Block</i>	Closing Tag				End of Data Block in the product	

Table 5-7 S-Parameters of MIRAS Product Data Block

5.2.5 Receivers Characterisation (AUX_LCF__)

This ADF is aimed to contain the Antenna Ohmic Efficiency (η) for each LICEF, and the receivers' pattern absolute phase to translate the phase of calibrated visibilities from the input planes to the antenna planes.

The SPH contains only the Main_SPH_for_XML structure as defined in Table 5-3.

The Data Block of the **AUX_LCF__** auxiliary data product is in XML ASCII format, with 1 dataset **LICEF_Characterisation** containing 1 single dataset record. The data set provides the LICEF ohmic efficiency and the receiver's absolute phase, for each LICEF in the instrument. The total size of the **AUX_LCF__** product is 74 KB (measured as the size in hard disk of one sample of the product containing both header and datablock). The following table describes the XML format of the **AUX_LCF__** product's data block.



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	Data_Block	Starting Tag				Init of Data Block in the product.	
02	LICEF_Characterisation	Starting Tag				Initial Data Set definition tag. Start of Data Set XML structure containing the variables described below	
01	Tp_7	Real	K	11 bytes	%011.7f	Reference physical temperature for L_1, L_2, B_Long and B_Short coefficients	CASA
02	L_2	Real	dB	7 bytes	%+07.4f	Attenuation (losses) between AP2 (radiator of the antenna) and IP (feed network of the antenna) at specified temperature	CASA
03	G_kj_NIR_Mode_Real_Correction_Factor	Real	N/A	9 bytes	%09.7f	Scale factor to apply to Real part of the FWF at the origin, to account for correlation losses, in NIR mode.	UPC
04	G_kj_NIR_Mode_Imag_Correction_Factor	Real	N/A	9 bytes	%09.7f	Scale factor to apply to Imaginary part of the FWF at the origin, to account for correlation losses, in NIR mode.	UPC
05	G_kj_All_Licef_Real_Correction_Factor	Real	N/A	9 bytes	%09.7f	Scale factor to apply to Real part of the FWF at the origin, to account for correlation losses, in ALL-LICEF mode.	UPC
06	G_kj_All_Licef_Imag_Correction_Factor	Real	N/A	9 bytes	%09.7f	Scale factor to apply to Imaginary part of the FWF at the origin, to account for correlation losses, in ALL-LICEF mode.	UPC



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
07	<i>List_of_LICEF_Datas</i>	Starting Tag	N/A	2 bytes		Tag starting a list of identical LICEF_Data structures. Tag contains an attribute "count" which is always "72"	CASA Attribute "count" is fixed
08	<i>LICEF_Data</i>	Starting Tag				Tag starting a LICEF_Data structure	
09	<i>LICEF_ID</i>	String	N/A	5 bytes	%5c	Unique ID defining LICEF or NIR-LICEF to which the measurements are applicable (from 1 to 69). Format is XXYZ, where: <ul style="list-style-type: none"> XX indicates the arm location (A_, AB, B_, BC, C_ or CA) Y indicates polarisation for NIR elements (H, V or _) ZZ indicates LICEF number in arm location (01, 02, 03,... 21) For example AB_03, CAH01, B_18	CASA Fixed identifiers for each device
10	<i>List_of_Efficiency_Datas</i>	Starting Tag		2 bytes		Tag starting a list of identical Efficiency_Data structures. Tag contains an attribute "count" which is always "2"	
11	<i>Efficiency_Data</i>	Starting Tag				Tag starting a Efficiency_Data structure	
12	<i>Polarisation</i>	Flag	N/A	1 byte	%1d	H or V polarisation value where the Efficiency was measured	CASA Fixed identifiers for each device



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
13	<i>L_1</i>	Real	N/A	11 bytes	%011.9f	Attenuation (losses) between Antenna Plane (AP) and AP2 (radiator of the antenna) at specified temperature. The values of L1 for the NIR channels are used only when NIRs are in LICEF mode.	CASA
14	<i>B_Long</i>	Real	N/A	16 bytes	%+011.8E	Attenuation long term drift coefficient at specified temperature.	CASA
15	<i>B_Short</i>	Real	N/A	12 bytes	%+08.5E	Attenuation short term drift coefficient at specified temperature.	CASA
16	<i>LFE</i>	Real	N/A	11 bytes	%011.9f	Total front-end loss of each receiver. It is derived as the ratio between the gain at CIP and the external PMS gain obtained during the "Cold Sky Calibration".	CASA
17	<i>Efficiency_Data</i>	Closing Tag				End of <i>Efficiency_Data</i> structure	
18	<i>List_of_Efficiency_Datas</i>	Closing Tag				End of list of <i>Efficiency_Data</i> structures	
19	<i>List_of_Abs_Phase_Datas</i>	Starting Tag		2 bytes		Tag starting a list of identical <i>Abs_Phase_Data</i> structures. Tag contains an attribute "count" which is always "2"	
20	<i>Abs_Phase_Data</i>	Starting Tag				Tag starting a <i>Abs_Phase_Data</i> structure	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
21	Polarisation	Flag	N/A	1 byte	%1d	H or V polarisation value where the Absolute Phase was measured	CASA Fixed identifiers for each device
22	Mean_Abs_Phase	Real	deg	10 bytes	+010.5f	Mean absolute antenna pattern phase value for LICEF and polarisation. Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed
23	Std_Abs_Phase	Real	deg	10 bytes	+010.5f	Standard deviation of absolute antenna pattern phase value for LICEF and polarisation. Tag contains attribute "unit" always set to the string specified in Unit column	CASA Attribute "unit" is fixed.
24	Abs_Phase_Data	Closing Tag				End of Abs_Phase_Data structure	
25	List_of_Abs_Phase_Datas	Closing Tag				End of list of Abs_Phase_Data structures	
26	LICEF_Data	Closing Tag				End of LICEF_Data structure	
27	List_of_LICEF_Datas	Closing Tag				End of list of LICEF_Data structures	
28	LICEF_Characterisation	Closing Tag				End of Data Set structure	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
29	<i>Data_Block</i>	Closing Tag				End of Data Block in the product	

Table 5-8 Receivers Characterisation Product Data Block

5.2.6 Normalised amplitude and phase patterns of all antennas (AUX_PATT__)

This product contains the LICEFs antenna patterns information needed during the characterisation of the instrument to be used in the inversion process to generate the MIRAS brightness temperature images.

The SPH contains the Main_SPH structure as defined in Table 5-2, plus the list of Data Sets as defined in Table 4-5.

The Data Block **AUX_PATT__** product consists of 3 datasets:

- **Antenna_Pattern_Coordinates** containing two 2D arrays with the (ξ, η) values in which the antenna patterns are given. The dataset shall consist of 1 single data set record, and shall have a size of 614.656 bytes (615 KB).
- **Average_Antenna_Pattern** containing the average of all antenna pattern's amplitude and phase for co-polar and cross-polar patterns for each polarisation (H and V). The dataset shall consist of 8 data set records, and shall have a size of 4917256 bytes (5 MB).
- **Antenna_Pattern** consists of the antenna pattern's amplitude and phase for co-polar and cross-polar patterns for each polarisation (H and V) of each antenna, in the (ξ, η) cosines domain coordinates specified by dataset **Antenna_Pattern_Coordinates**. Each of these dataset records products contains the values at lowest, centre and highest frequency in the L-band pass frequency of the instrument, at one of the 4 polarisations, for the front and back lobes. The dataset consists of with 72 antennas x 8 data set records each, one per each type of polarisation combination, and shall have a size of 1062140544 bytes (1.06 GB).

The following table describes the binary format of the **AUX_PATT__** product's data block.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Antenna_Pattern_Coordinates					Init of binary Data Set containing the Antenna_Pattern_Coordinates .	
01	XI_Value	Real value	N/A	Double (8 bytes)	Matrix array of 196x196 elements	Xi axis coordinate matrices (Minimum sampling space to be 196x196, the more samples the better)	CASA
02	ETA_Value	Real value	N/A	Double (8 bytes)	Matrix array of 196x196 elements	Eta axis coordinate matrices (Minimum sampling space to be 196x196, the more samples the better)	CASA
	Antenna_Pattern_Coordinates					End of binary Data Set containing the Antenna_Pattern_Coordinates .	
	Average_Antenna_Pattern					Init of binary Data Set containing the Average_Antenna_Pattern .	
	List_of_Average_Pattern_Records					Start of list of 8 Average_Pattern_Record structures.	
	Average_Pattern_Record					Start of Average_Pattern_Record structure.	
03	Average_Measurement	Identifier	N/A	unsigned byte	1 element	Enumerated value for Horizontal co-polar and cross-polar, or Vertical polarisation co-polar and cross-polar, and front or back patterns. (X_COPL='1', X_CRPL='2', Y_COPL='3', Y_CRPL='4', X_COPL_BACK='5', X_CRPL_BACK='6', Y_COPL_BACK='7', Y_CRPL_BACK='8').	CASA
04	Average_Pattern_Amplitude	Matrix of real values	linear	Double (8 bytes)	Matrix array of 196x196 elements	Average antenna pattern amplitude in linear units, measured in known points of the cosines domain plane at the centre frequency (Minimum sampling space to be 196x196, the more samples the better)	CASA
05	Average_Pattern_Phase	Matrix of real	deg	Double (8 bytes)	Matrix array of 196x196	Antenna pattern phase in known points of the cosines domain plane measured at the centre	CASA



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
		values			elements	frequency (Minimum sampling space to be 196x196, the more samples the better).	
	Average_Pattern_Record					End of Average_Pattern_Record structure.	
	List_of_Average_Pattern_Records					End of list Average_Pattern_Record structures.	
	Average_Antenna_Pattern					End of binary Data Set containing the Average_Antenna_Pattern .	
	Antenna_Patterns					Init of binary Data Set containing the list of Antenna_Pattern_Records .	
	List_of_Antenna_Pattern_Records					Start of list of 72x4 Antenna_Pattern_Record structures.	
	Antenna_Pattern_Record					Start of Antenna_Pattern_Record structure.	
06	Antenna_ID	Identifier	N/A	Unsigned byte	1 element	Identifier of the antenna characterized by this DSR patterns	CASA
07	Measurement	Identifier	N/A	unsigned byte	1 element	Enumerated value for Horizontal co-polar and cross-polar, or Vertical polarisation co-polar and cross-polar for the front and back lobes of the antenna. (X_COPL='1', X_CRPL='2', Y_COPL='3', Y_CRPL='4', X_COPL_BACK=5, X_CRPL_BACK=6, Y_COPL_BACK=7, Y_CRPL_BACK=8).	CASA
08	Frequency_Low	Real value	MHz	Double (8 bytes)	1 element	Lowest frequency value at which the pattern was measured (1404MHz).	CASA
09	Frequency_Centre	Real value	MHz	Double (8 bytes)	1 element	Centre frequency value at which the pattern was measured (1413MHz).	CASA
10	Frequency_High	Real value	MHz	Double (8 bytes)	1 element	Highest frequency value at which the pattern was measured (1423MHz).	CASA
11	Pattern_Low_Amplitude	Matrix of	linear	Double (8	Matrix array of	Antenna pattern amplitude in linear units, measured in known points of the cosines domain plane at the	CASA



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
		real values		bytes)	196x196 elements	highest frequency (Minimum sampling space to be 196x196, the more samples the better)	
12	Pattern_Low_Phase	Matrix of real values	deg	Double (8 bytes)	Matrix array of 196x196 elements	Antenna pattern phase in known points of the cosines domain plane measured at the lowest frequency (Minimum sampling space to be 196x196, the more samples the better).	CASA
13	Pattern_Centre_Amplitude	Matrix of real values	linear	Double (8 bytes)	Matrix array of 196x196 elements	Antenna pattern amplitude in linear units, measured in known points of the cosines domain plane at the highest frequency (Minimum sampling space to be 196x196, the more samples the better)	CASA
14	Pattern_Centre_Phase	Matrix of real values	deg	Double (8 bytes)	Matrix array of 196x196 elements	Antenna pattern phase in known points of the cosines domain plane measured at the centre frequency (Minimum sampling space to be on 196x196, the more samples the better).	CASA
15	Pattern_High_Amplitude	Matrix of real values	linear	Double (8 bytes)	Matrix array of 196x196 elements	Antenna pattern amplitude in linear units, measured in known points of the cosines domain plane at the highest frequency (Minimum sampling space to be 196x196, the more samples the better)	CASA
16	Pattern_High_Phase	Matrix of real values	deg	Double (8 bytes)	Matrix array of 196x196 elements	Antenna pattern phase in known points of the cosines domain plane measured at the highest frequency (Minimum sampling space to be 196x196, the more samples the better)	CASA
	Antenna_Pattern_Record					End of Antenna_Pattern_Record structure.	
	List_of_Antenna_Pattern_Records					End of list of Antenna_Pattern_Record structures.	
	Antenna_Pattern					End of binary Data Set containing the Antenna_Pattern measurements records.	
	Data_Block					End of binary Data Block in the product.	



Table 5-9 Normalised Amplitude and Phase Pattern of Antennas Product Data Block

5.2.7 Failing Components (AUX_FAIL__)

As is written in section 4.10 in [RD.2] this file contains the failure status for all LICEF receivers, in the hub and all arm sections, correlator units and NIR units. This file will be updated everytime a new failure is detected, modifying the validity start time to the time since the new failure is applicable, and keeping the validity stop as end-of-Mission.

The SPH contains only the Main_SPH_for_XML structure as defined in Table 5-3.

The Data Block of the **AUX_FAIL__** auxiliary data product is in XML ASCII format, with 1 dataset **Failing_Components** containing 1 single dataset record. The data set provides the failure status of each LICEF, correlator and NIR units. The total size of the **AUX_FAIL__** product is 43 KB (measured as the size in hard disk of one sample of the product containing both header and datablock). The following table describes the XML format of the **AUX_FAIL__** product's data block.

Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	Data_Block	Starting Tag				Init of Data Block in the product.	
02	Failing_Components	Starting Tag				Initial Data Set definition tag. Start of Data Set XML structure containing the variables described below	
03	List_of_LICEF_Datas	Starting Tag		2 bytes		List containing the LICEF_Data structures for LICEF status information. Tag contains an attribute "count" which is always "72"	Attribute "count" is fixed
04	LICEF_Data	Starting Tag				Tag starting a LICEF_Data structure	
05	LICEF_ID	String	N/A	5	%5c	Unique ID defining LICEF or NIR-LICEF to which the measurements are applicable (from 1 to 72 considering that the LICEF_NIR are composed by two LICEF) Format is XXYZZ, where:	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
						<ul style="list-style-type: none"> XX indicates the arm location (A_, AB, B_, BC, C_ or CA) Y indicates polarisation for NIR elements (H, V or _) ZZ indicates LICEF number in arm location (01, 02, 03,... 21) For example AB_03, CAH01, B__18	
06	H_Failure	Integer flag	N/A	1 byte	%1c	If set to 1, the signal provided by the LICEF in H polarisation is incorrect. To be taken into account with correlations performed with this LICEF.	Value generated at CEC
07	V_Failure	Integer flag	N/A	1 byte	%1c	If set to 1, the signal provided by the LICEF in V polarisation is incorrect. To be taken into account with correlations performed with this LICEF.	Value generated at CEC
08	LICEF_Data	Closing Tag				End of LICEF_Data structure	
09	List_of_LICEF_Datas	Closing Tag				End of list of LICEF_Data structures	
10	List_of_CMN_Units	Starting Tag		2 bytes		Tag starting a list of identical CMN_Unit structures. Tag contains an attribute "count" which is always "12"	Attribute "count" is fixed
11	CMN_Unit	Starting Tag				Tag starting a CMN_Unit structure	
12	CMN_ID	string	N/A	2 bytes	%2s	Unique ID defining correlator unit to which the parameters are applicable: H1-H3, A1-A3, B1-B3, C1-C3	Fixed identifiers (L1OP SW)
13	Failure	Integer flag	N/A	1 byte	%1c	Correlations performed for those receivers contained within the CMN shall be ignored if set to 1	Value generated at CEC
14	List_of_Thermistor_Datas	Tag		2 bytes		List containing the Thermistor status data. Tag contains an attribute "count" which is always "16"	Attribute "count" is fixed
15	Thermistor_Data	Starting Tag				Tag starting a Thermistor_Data structure	
16	Thermistor_ID	string	N/A	4 bytes	%04s	Unique ID defining the thermistor unit to which the failures are	Fixed identifiers



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
						applicable (TH01 to TH14, RE01 and RE02)	(L1OP SW)
17	Failure	Integer flag	N/A	1 byte	%1c	Physical temperature measurements performed with this thermistor shall be disregarded if set to 1	Value generated at CEC
18	Thermistor_Data	Closing Tag				End of Thermistor_Data structure	
19	List_of_Thermistor_Datas	Closing Tag				End of list of Thermistor_Data structures	
20	CMN_Unit	Closing Tag				End of CMN_Unit structure	
21	List_of_CMN_Units	Closing Tag				End of list of CMN_Unit structures	
22	List_of_NIR_Datas	Tag		2 bytes		List containing the NIR status data Tag contains an attribute "count" which is always "3"	Attribute "count" is fixed
23	NIR_data	Starting Tag				Tag starting a NIR_data structure	
24	NIR_ID	String	N/A	2 bytes	%2s	Unique ID defining NIR unit to which the failures are applicable. Valid values are AB, BC and CA. It shall follow the format XY X=First arm identifier {A,B,C} Y=Second arm identifier {A,B,C} Possible values = {AB, BC, CA}	Fixed identifiers (L1OP SW)
25	H_Failure	Integer flag	N/A	1 byte	%1c	Brightness temperature measurements in H polarisation performed for the current NIR shall be ignored if set to 1	Value generated at CEC
26	V_Failure	Integer flag	N/A	1 byte	%1c	Brightness temperature measurements in V polarisation performed for the current NIR shall be ignored if set to 1	Value generated at CEC
27	NIR_Data	Closing Tag				End of NIR_Data structure	
28	List_of_NIR_Datas	Closing Tag				End of list of NIR_Data structures	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
29	<i>List_of_PMS_Datas</i>	Tag		2 bytes		List containing the PMS status data Tag contains an attribute " <i>count</i> " which is always "72"	Attribute " <i>count</i> " is fixed
30	<i>PMS_Data</i>	Starting Tag				Tag starting a PMS_data structure	
31	<i>PMS_ID</i>	String	N/A	5 bytes	%5c	Unique ID defining PMS to which the measurements are applicable (from 1 to 72) Format is XXYZ, where: <ul style="list-style-type: none"> XX indicates the arm location (A_, AB, B_, BC, C_ or CA) Y indicates polarisation for NIR elements (H, V or _) ZZ indicates LICEF number in arm location (01, 02, 03,... 21) For example AB_03, CAH01, B_18	Fixed identifiers (L1OP SW)
32	<i>Failure</i>	integer	N/A	1 byte	%1d	System Temperatures computed with this PMS shall be discarded if set to 1	Value generated at CEC
33	<i>PMS_Data</i>	Closing Tag				End of PMS_Data structure	
34	<i>List_of_PMS_Datas</i>	Closing Tag				End of list of PMS_Data structures	
35	<i>Failing_Components</i>	Closing Tag				End of Failing_Components Data Set structure	
36	<i>Data_Block</i>	Closing Tag				End of Data Block in the product	

Table 5-10 Failing Components Product Data Block

5.2.8 Baseline Weights (AUX BWGHT)

This file contains a unique data set that contains the weights for all 2556 baselines. Parameters defined in this auxiliary file shall be used to establish a weight vector to be multiplied element by element with the calibrated visibilities, prior to the Image Reconstruction process (i.e. multiplication with J+ matrix).

The data set is formed by 1 Data Set Record with all the information. Its contents shall be referred in ASCII XML format. The following table describes the content of AUX_BWGHT_ Data block:



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	Data_Block	Starting Tag				Init of Data Block in the product.	
02	Baseline_Weights	Starting Tag				Initial Data Set definition tag. Start of Data Set XML structure containing the variables described below	
03	List_of_Baseline_Datas	Starting Tag				List containing the Baseline data structures, with "count" field (count=2556)	L1 ESL - CEC
04	Baseline_Data	Starting Tag				Init of Baseline_ Data structure	
05	Baseline_ID	string	N/A	11 bytes	%011s	Unique ID defining the baseline to which the measurements are applicable Format is XX_YYxZZ_WW, where: XX and ZZ indicate the arm location (A_, AB, B_, BC, C_ or CA) YY and WW indicate LICEF number in arm location (01, 02, 03,... 21) For example AB_03xCAH01, B_18xC_05	L1 ESL - CEC
	Weight	Integer	N/A	5 bytes	%05.3d	Decimal weight to be applied to each baseline. Default value should be 1 for all baselines.	L1 ESL - CEC
06	Baseline_Data	Closing Tag				End of Baseline_ Data structure	
07	List_of_Baseline_Datas	Closing Tag				End of list of Baseline Data structures	
08	Baseline_Weights	Tag				End of Data Set structure	
09	Data_Block	Closing Tag				End of Data Block in the product	

Table 5-11 Baseline Weight Product Data Block



5.2.9 Best Fit Plane (AUX BFP)

As is written in section 4.12 in [RD.2], the Best Fit Plane describes the ideal antenna plane over which the visibilities are assumed to have been measured. Any deviation of the antenna positions from it translates into an error in the visibilities. The Best Fit Plane is the plane that best describes, in a least-square sense, the estimated position of the antenna phase geometrical centres.

The information from the Best Fit Plane shall be used as an addition to the nominal attitude to obtain the real instrument attitude, needed to project onto the Earth surface with the minimum geolocation error the image reconstructed in the antenna plane. This auxiliary file shall take precedence over any instrument-pointing attitude for geolocation purposes.

The Best Fit Plane shall be described by the Euler angles (in sequence 321) from the Antenna Plane pointing direction.

There shall also be a placeholder for future updates of the BFP, which may be calibrated in-orbit by matching known coastlines and pointing accuracy.

The SPH contains only the Main_SPH_for_XML structure as defined in Table 5-3.

The Data Block of the **AUX_BFP** auxiliary data product is in XML ASCII format, with 2 datasets containing 1 single dataset record each. **Best_Fit_Plane** contains the ideal antenna plane over which the visibilities are assumed to have been measured on-ground, while **Best_Fit_Plane_Clibration** contains the same fields as a placeholder for future updates of the BFP, which may be calibrated in-orbit by matching known coastlines and pointing accuracy. The total size of the **AUX_BFP** product is 6 KB (measured as the size in hard disk of one sample of the product containing both header and datablock). The following table describes the XML format of the **AUX_BFP** product's data block.

Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	Data_Block	Starting Tag				Init of Data Block in the product.	
02	Best_Fit_Plane	Starting Tag				Initial Data Set definition tag. Start of Data Set XML structure containing the variables described below	
03	Yaw_Angle	Real	deg	10 bytes	%+010.5f	Angle to be rotated centred on Z axis of Antenna Plane (pointing direction). Tag contains attribute "unit" always set to the string specified in Unit column	L1 ESL - CEC Attribute "unit" is fixed



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
04	Pitch_Angle	Real	deg	10 bytes	%+010.5f	Angle to be rotated centred on Y axis. Tag contains attribute "unit" always set to the string specified in Unit column	L1 ESL - CEC Attribute "unit" is fixed
05	Roll_Angle	Real	deg	10 bytes	%+010.5f	Angle to be rotated centred on X axis. Tag contains attribute "unit" always set to the string specified in Unit column	L1 ESL - CEC Attribute "unit" is fixed
06	Best_Fit_Plane	Closing Tag				End of Data Set structure	
07	Best_Fit_Plane_Calibration	Starting Tag				Initial Data Set definition tag. Start of Data Set XML structure containing the variables described below	
08	Yaw_Angle	Real	deg	10 bytes	%+010.5f	Angle to be rotated centred on Z axis of Best Fit Plane (pointing direction). Tag contains attribute "unit" always set to the string specified in Unit column	L1 ESL - CEC Attribute "unit" is fixed
09	Pitch_Angle	Real	deg	10 bytes	%+010.5f	Angle to be rotated centred on Y axis. Tag contains attribute "unit" always set to the string specified in Unit column	L1 ESL - CEC Attribute "unit" is fixed
10	Roll_Angle	Real	deg	10 bytes	%+010.5f	Angle to be rotated centred on X axis. Tag contains attribute "unit" always set to the string specified in Unit column	L1 ESL - CEC Attribute "unit" is fixed
11	Best_Fit_Plane_Calibration	Closing				End of Data Set structure	



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
		Tag					
12	<i>Data_Block</i>	Closing Tag				End of Data Block in the product	

Table 5-12 Best Fit Plane Product Data Block

5.2.10 Mispointing Angles (AUX MISP)

The current ADF describes the mispointing angles between the Body Frame referenced in the Proteus quaternions and the Antenna Plane defined by the MIRAS instrument. The information from the mispointing shall be used as an addition to the Best Fit Plane and nominal attitude to obtain the real instrument attitude, needed to project onto the Earth surface with the minimum geolocation error the image reconstructed in the antenna plane. The mispointing shall be described by the Euler angles (in sequence 321) from the nominal Body Frame instrument pointing direction. There shall be three rotation matrix (i.e. their equivalent euler angles) contained in this ADF.

This file contains 3 datasets with one dataset record each. Its contents shall be referred in ASCII XML format.

The first rotation matrix shall cover the change of reference between Proteus quaternion axes, and the S/C axes. In short, it shall handle the axes conversion that is needed from Proteus reference to EE-CFI reference.

The second rotation matrix shall cover the rotation matrix measured on-ground between the S/C axes and the Antenna plane.

Finally, the last rotation matrix shall handle any possible future calibration (in-orbit or on-ground) which may measure mispointing errors in the transformation from Proteus to Antenna frame.

The table attached below defines the content of the AUX_MISP__ Data block:



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	Data_Block	Starting Tag				Init of Data Block in the product.	
02	Proteus_To_Body	Starting Tag				Initial Data Set definition tag. Start of Data Set XML structure containing the variables described below	
03	Yaw_Angle		deg	10	%+010.5f	Angle to be rotated centred on Z axis of Proteus Frame (pointing direction)Tag contains attribute "unit" always set to the string specified in Unit column	CNES
04	Pitch_Angle		deg	10	%+010.5f	Angle to be rotated centred on Y axisTag contains attribute "unit" always set to the string specified in Unit column	CNES
05	Roll_Angle		deg	10	%+010.5f	Angle to be rotated centred on X axis. Tag contains attribute "unit" always set to the string specified in Unit column.	CNES
06	Proteus_To_Body	Ending Tag				End of Mispointing Data set structure.	
07	Body_To_Antenna	Starting Tag				Initial Data Set definition tag. Start of Data Set XML structure containing the variables described below	
08	Yaw_Angle		deg	10	%+010.5f	Angle to be rotated centred on Z axis of Body Frame (pointing direction) Tag contains attribute "unit" always set to the string specified in Unit column	CNES
09	Pitch_Angle		deg	10	%+010.5f	Angle to be rotated centred on Y axis Tag contains attribute "unit" always set to the string specified in Unit column	CNES



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
10	Roll_Angle		deg	10	%+010.5f	Angle to be rotated centred on X axis Tag contains attribute "unit" always set to the string specified in Unit column	CNES
11	Body_To_Antenna	Ending Tag				End of Mispointing Data set structure.	
12	Mispointing_Calibration	Starting Tag				Initial Data Set definition tag. Start of Data Set XML structure containing the variables described below	
13	Yaw_Angle		deg	10	%+010.5f	Angle to be rotated centred on Z axis of Body Frame (pointing direction) Tag contains attribute "unit" always set to the string specified in Unit column	CNES
14	Pitch_Angle		deg	10	%+010.5f	Angle to be rotated centred on Y axis Tag contains attribute "unit" always set to the string specified in Unit column	CNES
15	Roll_Angle		deg	10	%+010.5f	Angle to be rotated centred on X axis Tag contains attribute "unit" always set to the string specified in Unit column	CNES
16	Mispointing_Calibration	Ending Tag				End of Mispointing Data set structure.	
17	Data_Block	Closing Tag				End of Data Block in the product	

Table 5-13 Mispointing Angles Product Data Block



5.2.11 Discrete Global Grid (AUX_DGG__)

The AUX_DGG__ product consists of a unique data set **Discrete_Global_Grid** that contains the Fixed Earth Grid coordinates of the ISEA 4-9 hexagonal grid centres. The data set is formed by 10 Data Set Records each one corresponding to an ISEA 4-9 zones.

The DSRs are ordered by increasing zone ID. Within a DSR appears a list of points ordered by increasing grid ID. These zones are used to allow a fast indexing of the data for search algorithms.

The SPH contains only the Main_SPH structure as defined in Table 5-2, and the List of Data Sets as defined in Table 4-5.

The total size of the **AUX_DGG__** product Data Block is about 40 MB (assuming no dummy grid points, the exact size would be 41.943.192 bytes). The following table describes the binary format of the **AUX_DGG__** product's data block.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Discrete_Global_Grid					Init of binary Data Set containing the Grid_Points records organized in zones.	
	List_of_Zones					Start of list of 10 Zones structures in which the DGG is subdivided.	
	Zone					Start of Zone structure.	
01	Zone_ID	Identifier	N/A	Unsigned long integer (8 bytes)	1 element	Unique ID defining the zone where the points are contained. An initial approach has 10 zones formed by two adjacent triangles of the main ISEA decomposition	L1 ESL
02	Grid_Point_Counter	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of points contained within the zone (if not used, refer to whole file). (For ISEA 4-9, maximum of 2.7M pixels)	L1 ESL
	List_of_Grid_Point_Datas					Start of list of Num_Points Grid_Point_Data structures.	
	Grid_Point_Data					Start of Grid_Point_Data structure.	
03	Grid_Point_ID	Identifier	N/A	Unsigned integer (4 bytes)	1 element	Unique identifier for Earth fixed grid point. For ISEA 4-9, maximum of 2.7M pixels	L1 ESL
04	Latitude	Real value	deg	Float (4 bytes)	1 element	Latitude value of grid point over the ellipsoid. Positive above equator (North) Range [-90, 90]	L1 ESL
05	Longitude	Real value	deg	Float (4 bytes)	1 element	Longitude value of grid point over the ellipsoid. Positive west of Greenwich meridian. Range [-180, 180]	L1 ESL
06	Altitude	Real value	m	Float (4 bytes)	1 element	Local altitude of grid point taken from GETASSE30. (http://www.brockmann-consult.de/beam/doc/help/visat/GETASSE30ElevationModel.html) Range goes from [-407, 8752] m	L1 ESL



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>Grid_Point_Data</i>					End of <i>Grid_Point_Data</i> structure..	
	<i>List_of_Grid_Point_Datas</i>					End of list of <i>Grid_Point_Data</i> structures.	
	<i>Zone</i>					End of <i>Zone</i> structure.	
	<i>List_of_Zones</i>					End of list of <i>Zones</i> structures.	
	<i>Discrete_Global_Grid</i>					End of binary Data Set containing the <i>Grid_Points</i> records.	
	<i>Data_Block</i>					End of binary Data Block in the product.	

Table 5-14 Discrete Global Grid Product Data Block

5.2.12 Land/Sea Mask (AUX LSMASK)

Due to the much different requirements for Soil Moisture and Ocean Salinity not only different apodisation windows are needed to separately process the two products, but also a land-sea mask to differentiate the areas of the globe to be processed with each one of them.

This Land/Sea Mask ADF shall be a dynamic file - the water fraction for each pixel will be computed seasonally, taking into account its ice content - from which the L1c Pixel Mask ADF will be extracted. The purpose of the Land/Sea Mask ADF is to contain the different flags and water content percentage of the DGG pixels. The auxiliary data is extracted from the USGS Land-Sea mask (10/05/96). In this file, each cell is assigned to either land, water or interrupted area based on the dominant area of a cell, according to the following nomenclature:

- 0=Land
- 1=Water
- 2=Interrupted area (meaning black zones in Figure 5-1)

Its contents and projection type are shown in the following image:

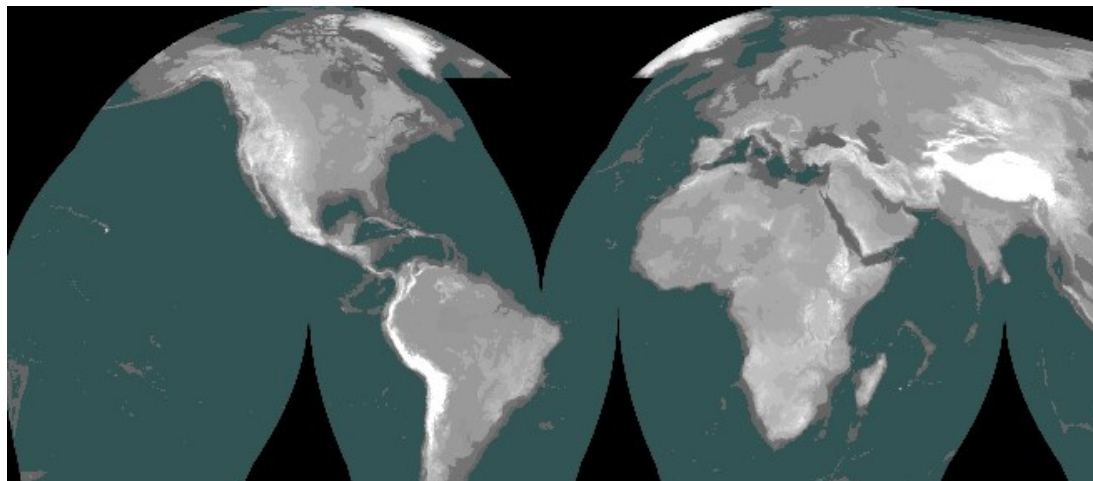


Figure 5-1 USGS Land-Sea mask (taken from Deimos Eng., L1PP Product format)

The USGS Land/Sea mask is a Binary Data Set representing a 1-km grid cell in an 8-bit raster image in the interrupted Goode's homolosine map projection. The image, as shown above, is comprised of 17347 lines by 40031 samples with 662Mb in size.

The Interrupted Goode Homolosine projection, developed by J.P. Goode in 1923, is an equal-area pseudo-cylindrical composite map projection which is interrupted to reduce distortion in the major land masses. This projection merges the Mollweide projection for higher latitudes (also called the Homolographic projection) and the Sinusoidal projection for lower latitudes (Goode 1925). The two projections join at 40° 44' 11.8" North and South; this is where the linear scale of the two projections match. All the major continents, with the exception of Antarctica, are intact. The projection is often presented with repeated sections so that Greenland and the eastern tip of Siberia are not interrupted.

There are C libraries available in order to search for the line and sample in the projection corresponding to a given latitude and longitude. Within each sample, the value for Land or Water can be obtained immediately. The ISEA grid proposed in the previous section has been used to perform a binning of the USGS land/sea mask, in order to compute the water fraction of each ISEA cell. The result has been used to define the flags presented below.

Additionally, the coastline map used in MERIS processing (MERIS uncertainty map for Envisat) and the SW associated to its handling was provided by Brockmann Consult, in order to compute the sea pixels beyond the expanded coastlines (40, 100 and 200km).

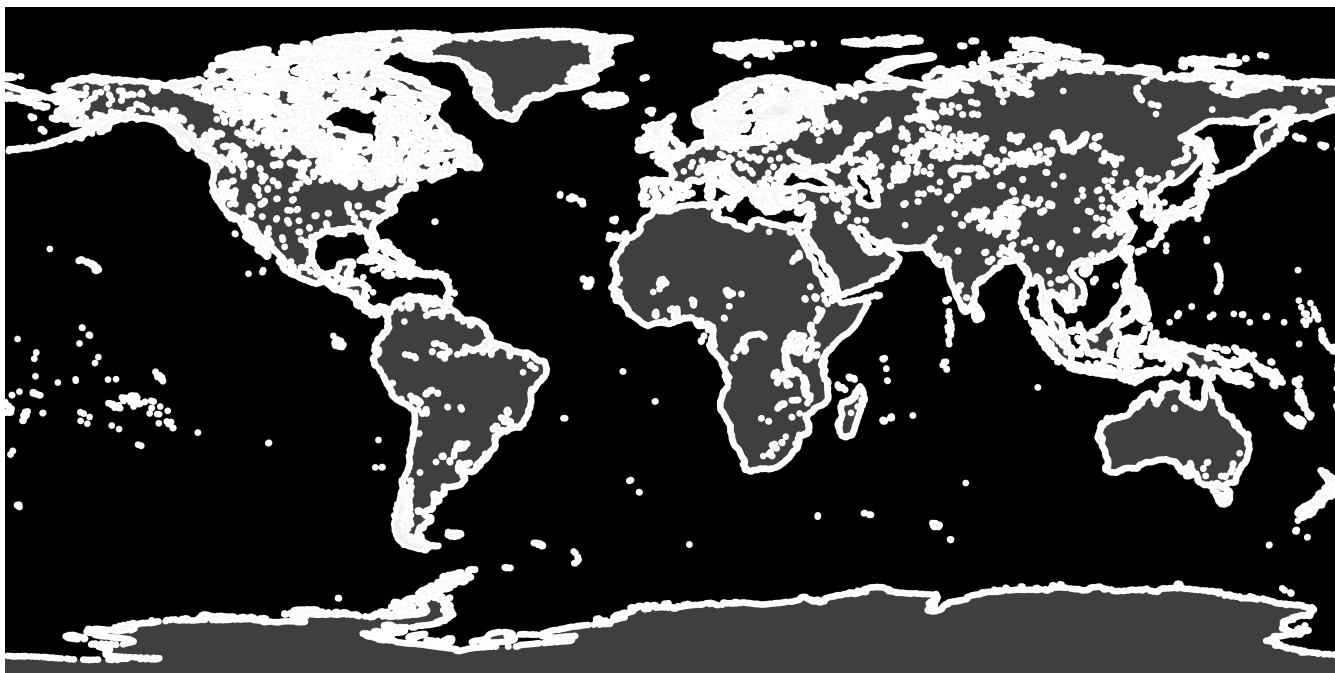


Figure 5-2 MERIS Uncertainty map for 100km (taken from Deimos Eng., L1PP Product format)

The AUX_LSMASK auxiliary data product consists of 1 dataset with $2.7 \cdot 10^6$ data set records, one for each pixel. The product consists of a set of flags for each pixel in the grid, the format of which is described in section 4.12 of [RD.2].

The SPH contains only the Main_SPH structure as defined in Table 5-2, and the List of Data Sets as defined in Table 4-5.



The AUX_LSMASK product Data Block contains a unique data set **Land_Sea_Mask** with $2.7 \cdot 10^6$ data set records, one for each pixel. In the same approach as in the DGG, the data set shall be formed by 10 Data Set Records corresponding to the same number of zones, each one with a list of grid points. Each grid point infor consists of a set of masking flags.

The dynamic pixel water content percentage is computed by taking into account the shape of the ISEA pixels, the number of land/sea pixels from USGS that fall inside each cell and the seasonal ice content. This field will be computed by CESBIO and provided to the operational team on a regular basis.

The total size of the **AUX_LSMASK** product is about 15 MB (assuming no dummy points included, the exact size is 15728652 bytes). The following table describes the binary format of the **AUX_LSMASK** product's data block.

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Land_Sea_Mask					Init of binary Data Set containing the mask identifying land and sea grid points, organized in zones.	
	List_of_Zones					Start of list of 10 Zones structures in which the DGG is subdivided.	
	Zone					Start of Zone structure.	
01	Zone_ID	Identifier	N/A	Unsigned long integer (8 bytes)	1 element	Unique ID defining the zone where the points are contained. Same as the one proposed for ISEA grid.	L1 ESL
02	Grid_Point_Mask_Counter	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of points contained within the zone (if not used, refer to whole file). For ISEA 4-9, maximum of 2.7M pixels	L1 ESL
	List_of_Grid_Point_Mask_Datas					Start of list of Num_Points Grid_Point_Mask_Data structures.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>Grid_Point_Mask_Data</i>					Start of <i>Grid_Point_Mask_Data</i> structure.	
03	<i>Grid_Point_ID</i>	Identifier	N/A	Unsigned integer (4 bytes)	1 element	Unique identifier for Earth fixed grid point. For ISEA 4-9, maximum of 2.7M pixels	L1 ESL
04	<i>Mask</i>	Set of flags	N/A	unsigned byte	1 element	Flag indicating land/sea USGS content, coastline distance, and Ice content. The flags definition is attached below this table.	L1 ESL
05	<i>Water_Fraction</i>	Percentage	N/A	unsigned byte	1 element	Percentage of Water and Ice content in the DGG cell, expressed in 0,5% units. Range is [0 to 200]	L1 ESL (CESBIO)
	<i>Grid_Point_Mask_Data</i>					End of <i>Grid_Point_Mask_Data</i> structure.	
	<i>List_of_Grid_Point_Mask_Datas</i>					End of list of <i>Grid_Point_Mask_Data</i> structures.	
	<i>Zone</i>					End of <i>Zone</i> structure.	
	<i>List_of_Zones</i>					End of list of <i>Zones</i> structures.	
	<i>Land_Sea_Mask</i>					End of binary Data Set containing mask identifying the land an sea grid points.	
	<i>Data_Block</i>					End of binary Data Block in the product.	

Table 5-15 Land/Sea Mask Product Data Block

The Mask flag is contained in an 8-bit counter, each bit representing a particular condition for that pixel, and they shall be described using the following convention: [MSB:X X X X:X X X X:LSB]

- USGS Sea Flag:



- [X X X X:X X X 0] means that the pixel is not considered Sea in the USGS Land-Sea mask (water fraction below 95%)
- [X X X X:X X X 1] means that the pixel is considered Sea in the USGS Land-Sea mask (water fraction above 95%)
- USGS Land Flag:
 - [X X X X:X X 0 X] means that the pixel is not considered Land in the USGS Land-Sea mask (water fraction above 10%)
 - [X X X X:X X 1 X] means that the pixel is considered Land in the USGS Land-Sea mask (water fraction below 10%)
- USGS Mixed Flag:
 - [X X X X:X 0 X X] means that the pixel is not considered Mixed in the USGS Land-Sea mask (water fraction below 10% OR above 95%)
 - [X X X X:X 1 X X] means that the pixel is considered Mixed in the USGS Land-Sea mask (water fraction above 10% AND below 95%)
- 200km Coastal flag:
 - [X X X X:0 X X X] means that the pixel has a distance from the coast of more than 200 Km (using the MERIS uncertainty map with its coasts extended to 200km)
 - [X X X X:1 X X X] means that the pixel has a distance from the coast of less than 200 Km (using the MERIS uncertainty map with its coasts extended to 200km)
- 100km Coastal flag:
 - [X X X 0:X X X X] means that the pixel has a distance from the coast of more than 100 Km (using the MERIS uncertainty map with its coasts extended to 100km) e.g. black and grey areas in figure 4
 - [X X X 1:X X X X] means that the pixel has a distance from the coast of less than 100 Km (using the MERIS uncertainty map with its coasts extended to 100km) e.g. white area in figure 4
- 40km Coastal flag:
 - [X X 0 X:X X X X] means that the pixel has a distance from the coast of more than 40 Km (using the MERIS uncertainty map with its coasts extended to 40km)



- [X X 1 X:X X X X] means that the pixel has a distance from the coast of less than 40 Km (using the MERIS uncertainty map with its coasts extended to 40km)
- Min Sea-Ice flag:
 - [X 0 X X:X X X X] means that the pixel does not have the full 12 months bit ICE set in the ice mask defined in the L2 AUX_DISTAN ADF (see [RD.28])
 - [X 1 X X:X X X X] means that the pixel have the full 12 months bit ICE set in the ice mask defined in the L2 AUX_DISTAN ADF (see [RD.28])
- Max Sea-Ice flag:
 - [0 X X X:X X X X] means that the pixel does not have any 12 months bit ICE set in the ice mask defined in the L2 AUX_DISTAN ADF (see [RD.28])
 - [1 X X X:X X X X] means that the pixel does have any 12 months bit ICE set in the ice mask defined in the L2 AUX_DISTAN ADF (see [RD.28])

5.2.13 L1c Pixel Mask (AUX MASK)

This ADF shall be used for configuring the L1 Processor about the DGG pixels that will be computed for Land or Sea products

The data set shall assign to each pixel in the DGG grid a flag marking it as “to be processed as land” and/or “to be processed as sea”. Both values are cumulative, meaning that the pixel will be processed for land and sea. The only categories that will be available now will be land or sea.

This file contains a unique data set with the pixel information. In the same approach as in the DGG, the data set shall be formed by 10 Data Set Records.

The Mask flag is contained in an 8-bit counter, each bit representing a particular condition for that pixel, and they shall be described using the following convention: [MSB:X X X X:X X X X:LSB]

- L1c Land Flag:
 - [X X X X:X X X 0] means that the pixel shall not be processed in the L1c Land products
 - [X X X X:X X X 1] means that the pixel shall be processed in the L1c Land products



- L1c Sea flag:
 - [X X X X:X X 0 X] means that the pixel shall not be processed in the L1c Sea products
 - [X X X X:X X 1 X] means that the pixel shall be processed in the L1c Sea products

The following table describes the binary content of the AUX_MASK__:

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	L1C_Pixel_Mask					Name describing the Data Set. XML structure containing the variables described below	
	List_of_Zones					Start of list of 10 Zones structures in which the DGG is subdivided.	
	Zone					Start of Zone structure.	
01	Zone_ID	Identifier	N/A	Unsigned long integer (8 bytes)	1 element	Unique ID defining the zone where the points are contained. Same as the one proposed for ISEA grid.	Copied from AUX_DGG
02	Num_Points	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of points contained within the zone (if not used, refer to whole file). For ISEA 4-9, maximum of 2.7M pixels	Copied from AUX_DGG
	List_of_Grid_Point_Datas					Start of list of Num_Points Grid_Point_Data structures.	
	Grid_Point_Data					Start of Grid_Point_Data structure.	
03	Grid_Point_ID	Identifier	N/A	Unsigned integer (4 bytes)	1 element	Unique identifier for Earth fixed grid point. For ISEA 4-9, maximum of 2.7M pixels	Copied from AUX_DGG
04	Mask		N/A	1	1 byte	Flag indicating whether pixel is to be processed as	L1 ESL



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
						land and/or sea.	
	<i>Grid_Point_Data</i>					End of <i>Grid_Point_Data</i> structure.	
	<i>List_of_Grid_Point_Datas</i>					End of list of Num_Points <i>Grid_Point_Data</i> structures.	
	<i>Zone</i>					End of <i>Zone</i> structure.	
	<i>List_of_Zones</i>					End of list of <i>Zones</i> structures.	
	<i>L1C_Pixel_Mask</i>					Name describing the Data Set. XML structure containing the variables described above.	
	<i>Data_Block</i>					End of binary Data Block in the product.	

Table 5-16 L1cPixel Mask Product Data Block

5.2.14 Original L-Band Galaxy Map (AUX GALAXY)

As is written in section 4.17 in [RD.2], for correcting the Sky contribution to the reconstruction process, the emission line of the neutral interstellar hydrogen at 1420 MHz should be computed as auxiliary data, as it can reach values over 50 K. The effects can be predicted with a considerable accuracy by calculating the noise temperature arriving to each radiometer's diagram pixel using available maps of the galactic emission at 1420 MHz.

As written in [RD.15], the Galaxy Map specified in this section is the original map generated by N. Floury. It is the reference to derive the L1 and L2 OS and SM galaxy radiation maps, obtained after applying a different weighting function to the original map. It is composed of the three following components:

- Hydrogen HI line: this strong emitting line at 1420.4058 MHz (+/- additional Doppler) is usually rejected by a band-stop filter in surveys of the continuum and must be reintroduced,



- Continuum (~1.4 GHz with a rejection of the HI line when required): combination of a variety of emission mechanisms (other lines, synchrotron, free-free, thermal, blended emission of discrete radio sources)
- Cosmic background (quasi constant value of 2.725 K)

The equatorial system of coordinates (right ascension, declination) is used here to define the domain covered by existing surveys. The reference system used here is B1950.

At present, only I Stoke component is computed (the other elements may be updated during the mission to reflect polarimetric measurements) and it is a sum of the following elements:

- Reich & Testori continuum
- Effelsberg survey for Cassiopeia region
- HI (K)

The precision of the map is set at 0.05 K.

5.2.14.1 Specific Product Header

The AUX_GALAXY Product Specific Product Header includes the following fields:

Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
01	<i>Specific_Product_Header</i>	Tag				Init of Specific Product Header for L-Band Galaxy Map auxiliary data product	
02	<i>Main_SPH</i>	structure	N/A	N/A	N/A	Main_SPH for binary products structure, as specified in fields 02 to 09 in Table 5-2 .	
03	<i>Coordinates_Info</i>	Starting Tag				Init of SPH in the product.	
04	<i>Min_RA</i>	Real	deg	8 bytes	%+08.3f	Minimum Right Ascension of Sky contribution direction in Earth Fixed Reference	CEC



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
05	<i>Max_RA</i>	Real	deg	8 bytes	%+08.3f	Maximum Right Ascension of Sky contribution direction in Earth Fixed Reference	CEC
06	<i>Min_DEC</i>	Real	deg	8 bytes	%+08.3f	Minimum Declination of Sky contribution direction in Earth Fixed Reference	CEC
07	<i>Max_DEC</i>	Real	deg	8 bytes	%+08.3f	Maximum Declination of Sky contribution direction in Earth Fixed Reference	CEC
08	<i>Delta_RA</i>	Real	deg	8 bytes	%+08.3f	Difference between Maximum and Minimum Declination of Sky contribution direction in Earth Fixed Reference	CEC
09	<i>Delta_DEC</i>	Real	deg	8 bytes	%+08.3f	Difference Maximum Declination of Sky contribution direction in Earth Fixed Reference	CEC
10	<i>Coordinates_Info</i>	Ending Tag				End of Coordinates_Info structure	
11	<i>Reference_Epoch</i>	Starting Tag				Init of Reference_Epoch structure	
12	<i>Epoch</i>	String	N/A	5 bytes	%5s	Reference system used to compute the sky map	CEC
13	<i>Reference_Epoch</i>	Closing Tag				End of Reference_Epoch structure	
14-25	<i>Data_Sets</i>	structure				Data Sets structure's fields as defined in Table 4-5	
26	<i>Specific_Product_Header</i>	Tag				End of Specific Product Header for L-Band Galaxy Map auxiliary data product	

Table 5-17 L-band Galaxy Map Auxiliary Data Product SPH



5.2.14.2 Data Block

The **AUX_GALAXY** auxiliary data product consists of 1 dataset **Original_Galaxy_Map** with values of galactic noise for each element of a Right Ascension and Declination equally spaced grid. Its contents shall be in binary format, and will consist on discrete measurements of Sky brightness temperature in a Right Ascension and Declination grid. This is a rectangular grid spaced 0.25° in each direction. The data set shall be formed by several fields, each one of them representing a matrix of values in the Galaxy map grid. Each row in the matrix will correspond to a fixed Declination (starting at $+90^\circ$ for the first row and ending at -90° for the last row). In turn, every row will be formed by 1441 individual elements, each of them corresponding to one Right Ascension coordinate, starting at 360° and ending at 0° .

The size of the L-Band Galaxy Map is 16.623.376 bytes, about 15,85 MB. The following table describes the binary format of the **AUX_GALAXY** data block.

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Original_Galaxy_Map					Init of binary Data Set containing the L-Band galactic noise values for each cell of Right Ascension and Declination.	
01	I	Matrix of real values	K	Float (4 bytes)	Matrix of 721x1441 elements	Total Intensity (first Stokes parameter).	ESTEC N. Flourey data set (see [RD.27])
02	Q	Matrix of real values	K	Float (4 bytes)	Matrix of 721x1441 elements	Phase difference (second Stokes parameter).	ESTEC N. Flourey data set (see [RD.27])
03	U	Matrix of real values	K	Float (4 bytes)	Matrix of 721x1441 elements	Polarisation semi-major axis (third Stokes parameter).	ESTEC N. Flourey data set (see [RD.27])
04	Error	Matrix of real values	K	Float (4 bytes)	Matrix of 721x1441 elements	Total Error in the measurements.	ESTEC N. Flourey data set (see [RD.27])
	Original_Galaxy_Map					End of binary Data Set containing galactic noise matrix.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>Data_Block</i>					End of binary Data Block in the product.	

Table 5-18 Original L-Band Galaxy Map Product Data Block

5.2.15 L1 L-Band Galaxy Map (AUX GALNIR)

The Galaxy Map **AUX_GALNIR** specified in this section is the actual one used by L1OP. It is based on the **AUX_GALAXY** map defined in previous section, but as written in [RD.15] the expected NIR Brightness Temperatures are obtained by convoluting the Galactic Map in the respective polarizations with the averaged NIR antenna radiation pattern. The antenna boresight is pointed in each of the grid coordinates directions, and the result of the integral is assigned to that coordinate. EADS CASA Espacio has computed an initial version of the values.

The RMS value is computed in a similar manner to the NIR BT, except that the Galactic Map is convoluted with a –3dB beam. The antenna boresight is pointed in each of the grid coordinates directions, and only the pixels within the 3dB cone around boresight are considered. Pixels are first filtered down to the resolution of the PLM, using an ISEA grid to achieve a constant resolution for the entire sphere. EADS CASA Espacio has also computed an initial version of the values.

5.2.15.1 Specific Product Header

See SPH specified in section 5.2.14.1.

The Reference Data Sets in the AUX_GALNIR product are specified in table below:

Reference Data Set Name	Product Type	Description
GALAXY_FILE	AUX_GALAXY	Original Galaxy Map



Reference Data Set Name	Product Type	Description
ANTENNA_PATTERNS_FILE	AUX_PATT__	Auxiliary data file containing the NIR antenna patterns to be used for convolution with the original galaxy map

Table 5-19 Galactic Map Convolved with NIR Pattern Reference Data Sets

5.2.15.2 Data Block

The **AUX_GALNIR** auxiliary data product consists of 1 dataset **NIR_BT_Galaxy_Map** with values of galactic noise convoluted with the NIR antenna radiation pattern for each element of a Right Ascension and Declination equally spaced grid. Its contents shall be in binary format, and will consist on discrete measurements of Sky brightness temperature in a Right Ascension and Declination grid. This is a rectangular grid spaced 0.25° in each direction. The data set shall be formed by several fields, each one of them representing a matrix of values in the Galaxy map grid. Each row in the matrix will correspond to a fixed Declination (starting at +90° for the first row and ending at -90° for the last row). In turn, every row will be formed by 1441 individual elements, each of them corresponding to one Right Ascension coordinate, starting at 360° and ending at 0°.

The size of the L-Band Galaxy Map is 8311688 bytes, about 7.93 MB. The following table describes the binary format of the **AUX_GALNIR** data block.

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	NIR_BT_Galaxy_Map					Init of binary Data Set containing the L-Band galactic noise values for each cell of Right Ascension and Declination.	
01	Expected_NIR_BT	Matrix of real values	K	Float (4 bytes)	Matrix of 721x1441 elements	Average NIR polarisation Brightness Temperature expected from the instrument when it is pointing in the coordinates of each matrix element.	L1 ESL



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
02	RMS	Matrix of real values	K	Float (4 bytes)	Matrix of 721x1441 elements	Flatness of the Galaxy map, expressed as the RMS at – 3dB in all points in the grid. It shall be used as an index of the suitability of the instrument pointing for FTT or G matrix calibration.	L1 ESL
	NIR_BT_Galaxy_Map					End of binary Data Set containing galactic noise matrix.	
	Data_Block					End of binary Data Block in the product.	

Table 5-20 L1 L-Band Galaxy Map Product Data Block

5.2.16 Sun Auxiliary Brightness Temperature Maps (AUX_SUNT__)

A typical value for the **Sun**'s brightness temperature (T_{SUN}) at L-Band would be 218,000 K, but this value can vary considerably with the solar cycles, making it very difficult to perform an absolute calibration.. As is written in section 4.14 in [RD.2], this file contains brightness temperature model for the Sun which shall be used in the Foreign Sources correction if they are available at the time of processing. The changes in brightness temperature of the sun can be quite big and can be taken into account either through radio telescope measurements or through analytical estimation. UPC has developed a technique to derive the sun's brightness temperature at a given point in time through the data itself. This approach is the one adopted in SEPS and is explained in its Architectural and Detailed Design Document [RD.01] in pages 162-164 of version 4.1. The AUX_SUNT__ map auxiliary data product consists of 1 dataset with a number of data set records containing discrete measurements of Sun brightness temperature against time. This data set contains the Brightness Temperature values for Sun for the validity period defined in the SPH.

The SPH contains only the Main_SPH structure as defined in Table 5-2, and the List of Data Sets as defined in Table 4-5.

The size of the **AUX_SUNT__** product Data Block is depending on the number of measurements included. The samples are assumed to be provided inhomogenously in time. The following table describes the binary format of the **AUX_SUNT__** data block.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Sun_Measured_Temperatures					Init of binary Data Set containing the L-Band Sun emission values and the time at which they were measured.	
01	Sun_BT_Measurement_Counter	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of Sun_BT_Measurement_Data data set record structures.	L1 ESL
	List_of_Sun_BT_Measurement_Datas					Init of list of Sun_BT_Measurement_Data data set record structures, repeated Counter times.	
	Sun_BT_Measurement_Data					Tag starting a Sun_BT_Measurement_Data data set record structure.	
02	Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC time of Brightness Temperature measurement. Expressed in EE CFI transport time format	L1 ESL
03	Sun_BT_H	Real value	K	Float (4 bytes)	1 element	Brightness Temperature of the Sun in H polarisation	L1 ESL
04	Sun_BT_V	Real value	K	Float (4 bytes)	1 element	Brightness Temperature of the Sun in V polarisation	L1 ESL
05	Sun_BT_HV_real	Real value	K	Float (4 bytes)	1 element	Brightness Temperature of the Sun in HV polarisation (real part)	L1 ESL
06	Sun_BT_HV_imag	Real value	K	Float (4 bytes)	1 element	Brightness Temperature of the Sun in HV polarisation (imaginary part)	L1 ESL



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>Sun_BT_Measurement_Data</i>					End of <i>Sun_BT_Measurement_Data</i> data set record structure.	
	<i>List_of_Sun_BT_Measurement_Datas</i>					End of list of <i>Sun_BT_Measurement_Data</i> data set record structures.	
	<i>Sun_Measured_Tempertures</i>					End of binary Data Set containing the L-Band Sun emission temperatures.	
	<i>Data_Block</i>					End of binary Data Block in the product.	

Table 5-21 Sun Brightness Temperatures Product Data Block

5.2.17 Moon Auxiliary Brightness Temperature Maps (AUX_MOONT)

The **Moon**'s solid angle is approximately the same as the Sun, but its brightness temperature is much lower than that of the Sun, estimated in around 250 Kelvin at L-band. The measured visibility samples when pointing to the Moon will produce an increase of the brightness temperature of just 0.01 K.

This Auxiliary File shall contain a model for the Moon as well as empirical measurements, if possible. It shall be used to compute contributions to be removed at L1. Applicability shall be nominally during reprocessing, as this auxiliary information shall not be available in real time. Its contents shall be in binary format, and will consist on discrete measurements of brightness temperature against time.

The AUX_MOONT_ Map auxiliary data product consists of 1 dataset with a number of data set records containing discrete measurements of Moon brightness temperature against . In the near future this external source shall be modelled as a set of coefficients, expressing the BT value as a function of time. These models are still, so the initial definition is done providing discrete measurements.

The SPH contains only the Main_SPH structure as defined in Table 5-2. and the List of Data Sets as defined in Table 4-5. The size of the **AUX_MOONT_** product Data Block is depending on the number of measurements included. The samples are assumed to be provided inhomogenously in time. The following table describes the binary format of the **AUX_MOONT_** data block.



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Moon_Measured_Temperatures					Init of binary Data Set containing the L-Band Moon emission values and the time at which they were measured.	
01	Moon_BT_Measurement_Counter	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of Moon_BT_Measurement_Data data set record structures.	L1 ESL
	List_of_Moon_BT_Measurement_Datas					Init of list of Moon_BT_Measurement_Data data set record structures, repeated Counter times.	
	Moon_BT_Measurement_Data					Tag starting a Moon_BT_Measurement_Data data set record structure.	
02	Time	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	UTC time of Brightness Temperature measurement. Expressed in EE CFI transport time format	L1 ESL
03	Moon_BT_H	Real value	K	Float (4 bytes)	1 element	Brightness Temperature of the Moon in H polarisation	L1 ESL



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
04	<i>Moon_BT_V</i>	Real value	K	Float (4 bytes)	1 element	Brightness Temperature of the Moon in V polarisation	L1 ESL
05	<i>Moon_BT_HV_real</i>	Real value	K	Float (4 bytes)	1 element	Brightness Temperature of the Moon in HV polarisation (real part)	L1 ESL
06	<i>Moon_BT_HV_imag</i>	Real value	K	Float (4 bytes)	1 element	Brightness Temperature of the Moon in HV polarisation (imaginary part)	L1 ESL
	<i>Moon_BT_Measurement_Data</i>					End of <i>Moon_BT_Measurement_Data</i> data set record structure.	
	<i>List_of_Moon_BT_Measurement_Datas</i>					End of list of <i>Moon_BT_Measurement_Data</i> data set record structures.	
	<i>Moon_Measured_Tempertures</i>					End of binary Data Set containing the L-Band Moon emission temperatures.	
	<i>Data_Block</i>					End of binary Data Block in the product.	

Table 5-22 Moon Brightness Temperatures Product Data Block

5.2.18 VTEC Maps (AUX VTEC C / AUX VTEC P / AUX VTEC R)

As is written in section 4.19 in [RD.2], the VTEC (Vertical Total Electron Content) is the content of electrons in a vertical column of 1 m² and is expressed in TEC units (1 TECU = 1e+16 e-/m²).



As written in [RD.16], in the SMOS DPGS three VTEC ADF will be available: one for the forecast (AUX_VTEC_P, generated from COPG files), one for the rapid analysis files (AUX_VTEC_R, generated from IGRG files) and other one for the consolidated analysis (AUX_VTEC_C, generated from IGSG files). The AUX_VTEC_P is used in the fast processing centre and for the Near real time processing. The AUX_VTEC_R and AUX_VTEC_C will be used in the context of the SMOS data reprocessing. They both share the same ADF specification. Each ADF is generated from one input file and therefore contains the 13 applicable IONEX maps and shall contain a Header file, consisting in FH and the SPH specified in Table 5-18, in XML, and a Data Block file (see Table 5-19) in binary.

5.2.18.1 Specific Product Header

The Specific Product Header for both AUX_VTEC_P, AUX_VTEC_R and AUX_VTEC_C includes the following fields:

Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
01	<i>Specific_Product_Header</i>	Tag				Init of Specific Product Header for L-Band Galaxy Map auxiliary data product	
02	<i>Main_SPH</i>	structure	N/A	N/A	N/A	Main_SPH structure as defined in Table 5-2.	
03	<i>IONEX_Descriptor</i>	Starting Tag				Structure containing information on the Native IONEX format	
04	<i>IONEX_version</i>	string	n/a	8 bytes	%8c	Format version of the IONEX data	IONEX data
05	<i>Type</i>	string		1 bytes	%c	Type of maps 'I' for Ionosphere maps	IONEX data
06	<i>Source</i>	string		3 bytes	%3c	Satellite system or theoretical model used to derive the map	IONEX data
07	<i>SW_Version</i>	string		20 bytes	%20c	Name of the program creating the current Maps	IONEX data
08	<i>Institute</i>	string		20 bytes	%20c	Name of the Agency/Institute creating the Maps	IONEX data



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
09	Creation_Date	string		30 bytes	%30c	Date and time of Maps creation UTC=Yyyy-mm-ddThh:mm:ss.uuuuuu	IONEX data
10	Epoch_First_Map	string		30 bytes	%30c	Epoch of first TEC Map UTC=Yyyy-mm-ddThh:mm:ss.uuuuuu	IONEX data
11	Epoch_Last_Map	string		30 bytes	%30c	Epoch of first TEC Map UTC=Yyyy-mm-ddThh:mm:ss.uuuuuu	IONEX data
12	Interval	integer	sec	5 Bytes	%05d	Time interval between TEC Maps. If '0' interval may be variable	IONEX data
13	Number_of_Maps	integer		3 bytes	%03d	Total number of maps in the current file	IONEX data
14	Mapping_Function	string		4 bytes	%4c	Mapping function adopted for TEC determination	IONEX data
15	Elevation_Cutoff	Real	deg	8 bytes	%+08.3f	Minimum elevation angle	IONEX data
16	Observables_Used	string		60 bytes	%60c	Specification of the observable used in TEC computation (or blank line for theoretical model)	IONEX data
17	Number_of_Station	integer		4 bytes	%04d	Number of contributing stations. Set to -1 if missing	IONEX data (option)
18	Number_of_Satellite	integer		2 bytes	%02d	Number of contributing satellites. Set to -1 if missing	IONEX data (option)
19	Base_Radius	Real	Km	12 Bytes	%012.6f	Mean Earth radius or bottom of height grid	IONEX data
20	Map_Dimension	Integer		2 bytes	%02d	Dimension of TEC maps	IONEX data
21	Height_Vector	Starting Tag				Tag starting the Height_Vector defining the equidistant grid in height	



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
22	<i>Height_Vector_1st</i>	Real	Km	8 bytes	%08.3f	First element to define the equidistant grid in height	IONEX data
23	<i>Height_Vector_2nd</i>	Real	Km	8 bytes	%08.3f	Second element to define the equidistant grid in height	IONEX data
24	<i>Height_Vector_Increment</i>	Real	Km	8 bytes	%08.3f	Increment to define the equidistant grid in height	IONEX data
25	<i>Height_Vector</i>	Closing Tag				Tag closing the Height_Vector defining the equidistant grid in height	
26	<i>Latitude_Vector</i>	Starting Tag				Tag starting the Latitude_Vector defining the equidistant grid in height	
27	<i>Latitude_Vector_1st</i>	Real	deg	7 bytes	%+07.3f	First element to define the equidistant grid in latitude	IONEX data
28	<i>Latitude_Vector_2nd</i>	Real	deg	7 bytes	%+07.3f	Second element to define the equidistant grid in latitude	IONEX data
29	<i>Latitude_Vector_Increment</i>	Real	deg	7 bytes	%+07.3f	Increment to define the equidistant grid in latitude	IONEX data
30	<i>Latitude_Vector</i>	Closing Tag				Tag closing the Latitude_Vector defining the equidistant grid in height	
31	<i>Longitude_Vector</i>	Starting Tag				Tag starting the Longitude_Vector defining the equidistant grid in height	
32	<i>Longitude_Vector_1st</i>	Real	deg	8 bytes	%+08.3f	First element to define the equidistant grid in Longitude	IONEX data
33	<i>Longitude_Vector_2nd</i>	Real	deg	8 bytes	%+08.3f	Second element to define the equidistant grid in Longitude	IONEX data
34	<i>Longitude_Vector_Increment</i>	Real	deg	8 bytes	%+08.3f	Increment to define the equidistant grid in Longitude	IONEX data
35	<i>Longitude_Vector</i>	Closing Tag				Tag closing the Longitude_Vector defining the equidistant grid in Longitude	



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
36	<i>Scale_Factor</i>	integer	N/A	3 Bytes	%+03d	Exponent defining the unit of the VTEC values in the Maps. Default value is -1 which correspond to a scale factor of 10^{-1} . Set to -1 if missing.	IONEX data (option)
37	<i>IONEX_Descriptor</i>	StopTag				End of the structure containing information on the Native IONEX format	
38	<i>List_of_QC_Data_Sets</i>	Starting Tag				List containing QC information on VTEC maps	
39	<i>QC_Data_Set</i>	Starting Tag				Tag starting QC information	
40	<i>Mean_TEC</i>	integer	0.1 TECU	3 Bytes	%03d	Map average VTEC value	ADF pre-processor
41	<i>STD_TEC</i>	integer	0.1 TECU	3 Bytes	%03d	Map std VTEC value	ADF pre-processor
42	<i>Max_TEC</i>	integer	0.1 TECU	4 Bytes	%04d	Maximum value in VTEC map, set to 9999 if above 999.8 TECu.	ADF pre-processor
43	<i>Min_TEC</i>	integer	0.1 TECU	3 Bytes	%03d	Minimum value in VTEC map	ADF pre-processor
44	<i>Solar_flux</i>	Integer	10^{-22} W/m ² /Hz	3 Bytes	%03d	10.7 cm wavelength Solar flux unit as derived from the RSGA file	ADF pre-processor, based on RSGA input file



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
45	VTEC_PCD	Set of flags	N/A	8 Bytes	%08d	<p>Quality control flags</p> <p>Digit 1 (MSB left) if set mean value below conf. threshold specified by AUX_CNFL1P field Mean_Min_Threshold</p> <p>Digit 2 if set mean value above conf. threshold specified by AUX_CNFL1P field Mean_Max_Threshold</p> <p>Digit 3 if set std value above conf. threshold specified by AUX_CNFL1P field Std_Threshold</p> <p>Digit 4 if set Maximum value above conf. threshold specified by AUX_CNFL1P field Max_Threshold</p> <p>Digit 5 if set Minimum value below conf. threshold specified by AUX_CNFL1P field Min_Threshold</p> <p>Digit 6 if set altitude correction applied (field Altitude_Correction in AUX_CNFL1P)</p> <p>Digit 7 if set up to 3 days predicted solar flux used</p> <p>Digit 8 (LSB right) if set 90 day average solar flux applied</p>	CEC
46	QC_Data_Set	StopTag					
47	List_of_QC_Data_Sets	Closing Tag				List containing QC information on VTEC maps	
50-61	Data_Sets	structure				Data Sets structure's fields as defined in Table 4-5	
62	Specific_Product_Header	Tag				End of Specific Product Header for L-Band Galaxy Map auxiliary data product	

Table 5-23 VTEC Auxiliary Data Products SPH



The specific valid Reference Data Sets for AUX_VTEC_P / AUX_VTEC_C / AUX_VTEC_R ADFs are:

Reference Data Set Name	Product Type	Description
ALGORITHM_CONFIG_FILE	AUX_CNFL1P	Processor Configuration Parameters and Constants for L1OP
TEC_RAW_FILE	COPG, IGRG, IGSG	File containing raw data values of Total Electron Content for generation of AUX_VTEC_x Predicted, Rapid and Consolidated TEC files, respectively.
ALTITUDE_TEC_CORRECTION_FILE	RSGA	File containing solar flux raw data supporting AUX_VTEC_x generation

Table 5-24 Vertical Total Electron Content Reference Data Sets

5.2.18.2 Data Block

The **AUX_VTEC_P**, **AUX_VTEC_R** and **AUX_VTEC_C** auxiliary data products both consist of 1 dataset **VTEC_Info** with values of Vertical Total Electron Content, respectively forecasts and consolidated analysis.

The Data Block is organised as a 3D multidimensional variable array, where the first dimension is the number of maps (1 in the current baseline), the second dimension is the definition of grid according to the delta Latitude quantization of the IAAC files (current baseline in the IAAC products is delta latitude of 2.5 deg) and the Longitude quantization of the IACC files (the current baseline is a delta longitude of 5.0 deg. and therefore a vector of 73 elements -Longitude ranges between -180 and 180 deg-). The third dimension is the list of VTEC values for the specified grid. The current baseline in the IAAC data is 13 maps per day centered at 00H, 02H, 22H, 00H so 13 files has to be generated from one input IONEX file.

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	VTEC_Info					Init of binary Data Set containing the list of VTEC maps for different time of one day.	
01	VTEC_Maps_Counter	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of VTEC_Maps_Measurement_Data data set record structures.	Set by TEC pre-processor, counting #DSR



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>List_of_VTEC_Maps</i>					Init of list of VTEC_Map data set record structures, repeated VTEC_Maps_Counter times.	
	<i>VTEC_Map</i>					Tag starting a VTEC_Map data set record structure.	
02	<i>Map_Number</i>	Identifier	N/A	Short integer (2 bytes)	1 element	Internal number of current Map. '1' for the first Map	IONEX data
03	<i>Epoch_Current_Map</i>	Date	N/A	signed /unsigned integer (4 bytes)	Vector array of 3 elements First element (days) is signed integer, remaining two (seconds and microseconds) are unsigned	Epoch of current Map in EE CFI transport time format	IONEX data and ADF pre-processor
04	<i>VTEC_Record_Counter</i>	Counter	N/A	Short integer (2 bytes)	1 element	Number of data set record contained in the Map	IONEX data and ADF pre-processor
	<i>List_of_VTEC_Records</i>					Init of list of VTEC_Record structures, repeated VTEC_Record_Counter times.	
	<i>VTEC_Record</i>					Tag starting a VTEC_Record structure.	
05	<i>Latitude</i>	Real value	Deg	Float (4 bytes)	1 element	Data set record for "latitude"	IONEX data
06	<i>Longitude_start</i>	Real value	Deg	Float (4 bytes)	1 element	Start Longitude for the Data set record	IONEX data



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
07	Longitude_stop	Real value	deg	Float (4 bytes)	1 element	Stop Longitude for the Data set record	IONEX data
08	Delta_Longitude	Real value	Deg	Float (4 bytes)	1 element	Increment in Longitude	IONEX data
09	Height	Real value	Km	Float (4 bytes)	1 element	Data set record for 'height'	IONEX data
10	VTEC_Record_Elements	Counter	N/A	Short integer (2 bytes)	1 element	Number of elements contained in this data set record	IONEX data and ADF pre-processor
	List_of_VTEC_Datas					Init of list of VTEC_Data structures, repeated VTEC_Record_Elements times.	
	VTEC_Data					Tag starting a VTEC_Data structure.	
11	VTEC_value	Integer value	10 ^{Scale_Factor} TECU	Short integer (2 bytes)	1 element	VTEC values for 'Latitude' and 'Height' from 'Longitude_start' to 'Longitude_stop' with increment 'Delta_longitude'. Scale factor defined in Field#36 in table 5-23 If value not available set to 9999	IONEX data
	VTEC_Data					Tag ending a VTEC_Data structure.	
	List_of_VTEC_Datas					End of list of VTEC_Data structures	
	VTEC_Record					Tag ending a VTEC_Record structure.	
	List_of_VTEC_Records					End of list of VTEC_Record structures.	
	VTEC_Map					Tag ending a VTEC_Map data set record structure.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	<i>List_of_VTEC_Maps</i>					End of list of VTEC_Map data set record structures.	
	<i>VTEC_Info</i>					End of binary Data Set containing the list of VTEC maps for different time of one day.	
	<i>Data_Block</i>					End of binary Data Block in the product.	

Table 5-25 VTEC Products Data Block

5.2.19 Apodisation Function (AUX_APDS / AUX_APDL)

As written in section 4.21 in [RD.2], the auxiliary file defining the apodisation function applied contains the discretisation of the apodisation values over the frequency domain coordinates. In this way any apodisation can be expressed as a function of U and V values.

There will be 2 apodisation functions, one for Land (AUX_APDL__) and another for Sea (AUX_APDS__). The following fields in the header allow identifying the type and definition of the apodisation window contained in the product.



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
18	<i>Specific_Product_Header_</i>	Starting Tag				Init of Specific Product Header for Apodisation Window auxiliary data product	
19	<i>Main_SPH_for_XML</i>	Structure	N/A	N/A	N/A	Main_SPH_for_XML structure as specified in Table 5-3	
20	<i>Apodisation_Window</i>	Integer	N/A	3 bytes	%03d	Constant Apodisation function used to generate the product. Numerical value representing the apodisation function applied (coherent with the filename Reference Data Set) 000=Rectangular window 001=Blackman window 002=Barlett window 003=Hamming window 004=Hanning window ... 100=Kaiser window with alpha 1.20 101=Kaiser window with alpha 1.21 ... (user defined and agreed windows) 999=Strip Adaptive window	Generated at CEC
21	<i>Specific_Product_Header</i>	Closing Tag				End of Specific Product Header for Apodisation Window auxiliary data product	

Table 5-26 Apodisation Window specific fields in SPH

The AUX_APDL_/AUX_APDS__auxiliary data product consists of 1 dataset with 1 data set record. This data set contains the expression of the apodisation function, and its values for each pair of (u,v) coordinates. Its contents shall be referred in ASCII XML format.

The size of the Apodisation Function product is about 275 KB. The following table describes the binary format of the **AUX_APDL_/AUX_APDS__** data block.



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	Data_Block	Starting Tag				Init of Data Block in the product.	
02	Apodisation_Function	Starting Tag				Initial Data Set definition tag. Start of Data Set XML structure containing the variables described below	
03	Expression	String	N/A	256 bytes	256 chars	ASCII representation of the formula used to compute the apodisation coefficients as a function of u,v values. Shall be useful for simple apodisation windows.	L1 ESL
04	Contour_Radius_3dB	Real	N/A	12 bytes	%012.8f	Radius of the -3dB contour of the main lobe in the antenna plane (range from 0 to 1 in the unit circle)	L1 ESL
05	List_of_Apodisation_Coefficients	Starting Tag				Init of list of 1396 Apodisation_Coefficient structures.	
06	Apodisation_Coefficient	Starting Tag				Tag starting a Apodisation_Coefficient structure.	
07	U	Real	N/A	10 bytes	%+010.5f	U baseline coordinate value	L1 ESL Obtained from LICEF positions measured on-ground
08	V	Real	N/A	10 bytes	%+010.5f	V baseline coordinate value	L1 ESL Obtained from LICEF positions measured on-ground



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
09	<i>W</i>	Real	N/A	10 bytes	%+010.7f	Apodisation coefficient obtained for the previous baseline coordinates	L1 ESL
10	<i>Apodisation_Coefficient</i>	Closing Tag				End of <i>Apodisation_Coefficient</i> structure.	
11	<i>List_of_Apodisation_Coefficients</i>	Closing Tag				End of list of <i>Apodisation_Coefficient</i> structures.	
12	<i>Apodisation_Function</i>	Closing Tag				End of <i>Apodisation_Function</i> Data Set structure.	
13	<i>Data_Block</i>	Closing Tag				End of Data Block in the product.	

Table 5-27 Apodisation Function Product Data Block

5.2.20 RFI Mask (AUX RFI)

As is written in section 4.24 of [RD.2], this auxiliary product shall be based on a mask containing TRUE values for those pixels that are expected to be affected by RFI. It is also possible that this file may be generated as a by-product of the L1c SMOS product files, after analysing the RFI flag in those files. This file shall be used to fill the information referring to the RFI flag in the L1c products. The mask shall be expressed in the same Earth Fixed grid as the one used for L1c products, identifying the pixels by their unique identifier. All pixels shall be represented within the mask, even those ones not affected by RFI. This file shall be a binary file.

The SPH contains only the Main_SPH structure as defined in Table 5-2, and the List of Data Sets as defined in Table 4-5.



The **AUX_RFI** auxiliary data product Data Block consists of 1 dataset with information for about $2.7 \cdot 10^6$ pixels organised in 10 DSR. The product consists of a flag for each pixel in the grid indicating where radio frequency interference exists. In the same style as the **AUX_DGG**, this file shall consist of a unique Data Set containing 10 Data Set Records, each one containing a list of points within a zone. These zones are used to allow a fast indexing of the data for search algorithms. They come from the natural decomposition of the icosahedron used in the ISEA projection.

The total size of the **AUX_RFI** product is about 12.5 MB (assuming no dummy grid points, the exact size would be 13.107.330 bytes). The following table describes the binary format of the **AUX_RFI** product's data block.

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	RFI_Mask					Init of binary Data Set containing the mask identifying grid points affected by RF interference, organized in zones.	
	List_of_Zones					Start of list of 10 Zones structures in which the DGG is subdivided.	
	Zone					Start of Zone structure.	
01	Zone_ID	Identifier	N/A	Unsigned long integer (8 bytes)	1 element	Unique ID defining the zone where the points are contained. An initial approach has 10 zones formed by two adjacent triangles of the main ISEA decomposition. Same as the one proposed for ISEA grid.	AUX_DGG
02	Grid_Point_RFI_Counter	Counter	N/A	unsigned integer (4 bytes)	1 element	Number of points contained within the zone (if not used, refer to whole file). For ISEA 4-9, maximum of 2.7M pixels	AUX_DGG
	List_of_Grid_Point_RFI_Mask_Datas					Start of list of Num_Points Grid_Point_RFI_Mask_Data structures.	
	Grid_Point_RFI_Mask_Data					Start of Grid_Point_RFI_Mask_Data structure.	



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
03	Grid_Point_ID	Identifier	N/A	Unsigned integer (4 bytes)	1 element	Unique identifier for Earth fixed grid point. For ISEA 4-9, maximum of 2.7M pixels	Copied from AUX_DGG
04	RFI_Flag	Flag	N/A	unsigned byte	1 element	NOT USED FOR DPGS-V3 (filled with 0) RFI value of grid point over the ellipsoid. 0 for "No RFI", 1 for "RFI detected"	N/A
	Grid_Point_RFI_Mask_Data					End of Grid_Point_RFI_Mask_Data structure.	
	List_of_Grid_Point_RFI_Mask_Datas					End of list of Grid_Point_RIF_Mask_Data structures.	
	Zone					End of Zone structure.	
	List_of_Zones					End of list of Zones structures.	
	RFI_Mask					End of binary Data Set containing mask identifying the grid points affected by RF interference.	
	Data_Block					End of binary Data Block in the product.	

Table 5-28 RFI Mask Product Data Block

5.2.21 Bistatic Scattering Coefficients (AUX BSCAT)

As is written in section 4.27 of [RD.2], the auxiliary file used to correct Sun glint effect consists of a look-up table for the bistatic scattering coefficients as a function of incoming radiation incidence angle (θ_o , theta_o), relative azimuth between incoming radiation and radiometer look direction (ϕ_s , phi_s), radiometer incidence angle (θ_s , theta_s), and wind speed (W).

The LUT is only function of the input parameters as given in the following table:



Input parameter	Range	Increment
Sun incidence angle θ_o [deg, 0=nadir]	0°->90°	5°
Relative azimuth angle between sun and MIRAS observation angle ϕ_s [deg]. This is defined as: phi_radiometer - phi_incoming_sunradiation + 180	0°->360°	5°
MIRAS observation incidence angle θ_s [deg, 0=nadir]	0°->90°	5°
Wind speed [m/s]	7	N/A

Wind speed is currently considered as 7m/s and not supposed to change, although the LUT can be expanded to contain different values for different wind speed values.

This data set shall be comprised of 76 Data Set Records, each one of them containing the Bistatic Scattering Coefficients against a fixed polarisation, wind speed and radiometer incidence angle (θ_s theta_s).

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Bistatic_Scattering_Coefficient_s					Init of binary Data Set containing the bistatic scattering coefficients to be used for Sun Glint correction. There are 76 DSR (19 DSR in each of 4 polarizations) in this fixed array.	
01	Polarisation	Identifier	N/A	Signed integer (2 bytes)	1 element	Polarisation value of the Bistatic Scattering Coefficients for the MDR: 0=HH, 1=VV, 2=HV, 3=VH	L1 ESL
02	Windspeed	Integer	m/s	Signed integer (2 bytes)	1 element	Wind speed value of the Bistatic Scattering Coefficients for the MDR	L1 ESL



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
03	MIRAS_Incidence_Angle	Real value	deg	Float (4 bytes)	1 element	Radiometer incidence angle (qs theta_s) value of the bistatic Scattering Coefficients for the MDR	L1 ESL
04	Scattering_Coefficients	Matrix of real values	N/A	Double bytes)	(8 Matrix of 19x72 elements	Bistatic Scattering Coefficients array for a fixed set of qo and fs angles	L1 ESL
	Bistatic_Scattering_Coefficients					End of dataset	
	Data_Block					End of binary Data Block in the product.	

Table 5-29 Bistatic Scattering Coefficients Product Data Block

5.2.22 Faraday Rotation (AUX_FARA_C, AUX_FARA_P, AUX_FARA_R)

The main purpose of this ADF is to provide the L2OP with a more precise computation of the Faraday angle based on algorithm improvements and refined VTEC background field (i.e the combined VTEC). In addition the Faraday rotation auxiliary file can be used in any of the DPGS sub/system, and allows de-coupling L1 reprocessing activity for algorithm upgrades and availability of a more precise Faraday rotation (i.e. VTEC combined, usage of refined geomagnetic model).

Operationally the Faraday processor is triggered by the availability of the TLM_MIRA1A and the overlapping AUX_VTEC_x. The outcome of the processing is an AUX_FARA_x ADF, where the x is determined by the AUX_VTEC_x used as input. As such, it can be generated from predicted VTEC data (P), rapid analysis data (R) or consolidated analysis data (C).

As standalone executable the Faraday Processor shall be able to generate also ADF without TLM_MIRA1A input (simulated orbit has to be used for the simulation time provided as input) and without VTEC ADFs (the IRI model has to be used).

The AUX_FARA_x ADFs contain data in all the DGG grid points of the SMOS L1C swath, without distinguishing between land and ocean areas. The swath is determined reusing the same approach as L1C Processor, therefore it is expected that all L1C product grid points have their match in the AUX_FARA_x ADF.



The size of the AUX_FARA_x file is estimated considering that each swath with 120,000 grid points. Assuming that a maximum of 95x2 Faraday_Data are obtained for each 2 snapshots, the ADF data size would be $120,000 \times (18\text{Bytes} + 190 \times 21\text{Bytes}) = 480,960,000\text{Bytes} = 459\text{ MB}$. This is a worst-case estimation, and it is expected that it can be significantly reduced depending on the post-processor configuration (e.g. only one out of 10 snapshots used to generate Faraday_Data).

5.2.22.1 Specific Product Header

The Specific Product Header for the AUX_FARA_X Products shall follow the format described in table below.

Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
01	<i>Specific_Product_Header</i>					Init of Specific Product Header structure	
02-19	<i>Main_Info</i>	structure	N/A	N/A	N/A	Main Product Info structure's fields as defined in fields 01 to 16 in Table 4-3	
20.	<i>FARA_Algorithm_Configuration</i>	structure	N/A	N/A	N/A	Tag starting a structure specifying information about the configuration used to get the product.	
21.	<i>Snapshot_Time_Sampling</i>	Integer	N/A	3 bytes	%03d	This field can have one of the following values: <ul style="list-style-type: none"> 001 all the input snapshots have been used in the computation "nnn" only 1 snapshot every "nnn" has been used in the computation 	Copied from the AUX_CNFFRA
22.	<i>Magnetic_Model_ID</i>	Integer	N/A	1 byte	%01d	This field can have one of the following values: <ul style="list-style-type: none"> 1 if IGRF 10 used 2 tbd 3 tbd 	Copied from the AUX_CNFFRA



Field #	Tag Name	Type	Unit	String Length	C Format	Comment	Origin
23.	<i>Faraday_Computation_Method</i>	Integer	N/A	1 byte	%01d	This field can have one of the following values: • 0 Simplified computation method used • 1 Precise computation method used	Copied from the AUX_CNFFRA
24.	<i>VTEC_Model</i>	Integer	N/A	1 byte	%01d	This field can have one of the following values: • 0 VTEC background files used in the computation • 1 no VTEC background file available. IRI model is used	Faraday ADF Processor
25.	<i>Simulated_Orbit</i>	Integer	N/A	1 byte	%01d	This field can have one of the following values: • 0 TLM_MIRA1A used as input for PVT data • 1 MPL_ORBSCT used as input to propagate PVT data	Faraday ADF Processor
26.	<i>FARA_Algorithm_Configuration</i>	structure	N/A	N/A	N/A	Tag ending the <i>FARA_Algorithm_Configuration</i> structure.	
27.	<i>FARA_Quality_Information</i>					Init of FARADAY Quality Information in the product header	
28.	<i>SW_Error_Counter</i>	Integer	N/A	5 bytes	%05d	Total number of measurements affected by SW error	Faraday ADF Processor
29.	<i>ADF_Error_Counter</i>	Integer	N/A	5 bytes	%05d	Total number of measurements affected by ADF error	Faraday ADF Processor
30.	<i>FARA_Quality_Information</i>					End of FARADAY Quality Information in the product header	
28-39	<i>Data_Sets</i>	structure	N/A	N/A	N/A	Data Sets structure's fields as defined in Table 4-5	
40	<i>Specific_Product_Header</i>					End of Specific Product Header structure	

Table 5-30 Faraday Product SPH

The specific valid Reference Data Sets for the AUX_FARA_C products are:

Reference Data Set Name	Product Type	Description
TEC_FILE	AUX_VTEC_C	Consolidated Vertical Total Electron Content used in ionospheric effects correction (created from data retrieved from the IGSG file). This file is optional input to the Post-processor.
DGG_FILE	AUX_DGG_	ISEA4-9 Discrete Global Grid used in geolocation
BEST_FIT_PLANE_FILE	AUX_BFP_	Best Fit Plane used in geolocation
MISPOINTING_ANGLES_FILE	AUX_MISP_	Mispointing angles between the Body Frame referenced in the Proteus quaternions and the Antenna Plane defined by the MIRAS instrument
L1A_HKTM_FILE	TLM_MIRA1A	Level 1A Housekeeping Telemetry product. This file is optional input to the Post-processor.
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Mission planning file used to initialise the EE CFI orbit_id and/or time_id. It is read and used by the EE CFI (format defined in [RD.25])
ALGORITHM_FARA_CONFIG_FILE	AUX_CNFFAR	Post-processor Configuration Parameters and Constants for FARADA
BULLETIN_B_FILE	AUX_BULL_B	IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation

Table 5-31 AUX_FARA_C Reference Data Sets

The specific valid Reference Data Sets for the AUX_FARA_R products are:

Reference Data Set Name	Product Type	Description
TEC_FILE	AUX_VTEC_R	Analysis Rapid Vertical Total Electron Content used in ionospheric effects correction (created from data retrieved from the IGRG file). This file is optional input to the Post-processor.
DGG_FILE	AUX_DGG_	ISEA4-9 Discrete Global Grid used in geolocation
BEST_FIT_PLANE_FILE	AUX_BFP_	Best Fit Plane used in geolocation
MISPOINTING_ANGLES_FILE	AUX_MISP_	Mispointing angles between the Body Frame referenced in the Proteus quaternions and the Antenna Plane defined by the MIRAS instrument
L1A_HKTM_FILE	TLM_MIRA1A	Level 1A Housekeeping Telemetry product. This file is optional input to the Post-processor.



Reference Data Set Name	Product Type	Description
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Mission planning file used to initialise the EE CFI orbit_id and/or time_id. It is read and used by the EE CFI (format defined in [RD.25])
ALGORITHM_FARA_CONFIG_FILE	AUX_CNFFAR	Post-processor Configuration Parameters and Constants for FARADA
BULLETIN_B_FILE	AUX_BULL_B	IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation

Table 5-32 AUX_FARA_R Reference Data Sets

The specific valid Reference Data Sets for the AUX_FARA_P products are:

Reference Data Set Name	Product Type	Description
TEC_FILE	AUX_VTEC_P	Predicted Vertical Total Electron Content used in ionospheric effects correction (created from data retrieved from the COPG file). This file is optional input to the Post-processor.
DGG_FILE	AUX_DGG_	ISEA4-9 Discrete Global Grid used in geolocation
BEST_FIT_PLANE_FILE	AUX_BFP_	Best Fit Plane used in geolocation
MISPOINTING_ANGLES_FILE	AUX_MISP_	Mispointing angles between the Body Frame referenced in the Proteus quaternions and the Antenna Plane defined by the MIRAS instrument
L1A_HKTM_FILE	TLM_MIRA1A	Level 1A Housekeeping Telemetry product. This file is optional input to the Post-processor.
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Mission planning file used to initialise the EE CFI orbit_id and/or time_id. It is read and used by the EE CFI (format defined in [RD.25])
ALGORITHM_FARA_CONFIG_FILE	AUX_CNFFAR	Post-processor Configuration Parameters and Constants for FARADA
BULLETIN_B_FILE	AUX_BULL_B	IERS Bulletin B file used by the EE CFI to get very precise computations of geolocation

Table 5-33 AUX_FARA_P Reference Data Sets



5.2.22.2 Data Block

The datablock of the AUX_FARA_x files consists of only 1 dataset, the Faraday Rotation **Grid_Point_List**, with as many dataset records as grid points are in a SMOS L1C swath. Each grid point structure contains a number of Faraday_Data structures each of them providing information on the Faraday Rotation value for a given incidence angle at a given time. Each of the structures has wquality flag descriptor informing about ADF or SW errors detected during the generation of the file. These flags are summarized in the specific product header of the file.

The AUX_FARA_x format is as follows:

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Grid_Point_List					Init of binary Data Set containing the list of grid points containing Faraday rotation info	
01	Grid_Point_Counter	Counter	N/A	Unsigned Integer 4 Bytes	1 Element	Number of Grid_Point_Faraday_Data set record structure	Faraday ADF Processor
	Grid_Point_Faraday_Data					Init of Grid_Point_Faraday_Data data set record structure	
02	Grid_Point_ID	Identifier	N/A	Unsigned Integer 4 Bytes	1 Element	Unique identifier for Earth fixed grid point, linking it to Auxiliary Earth Grid file. For ISEA 4-9, maximum of 2.7M pixels	Copied from the AUX_DGG
03	Grid_Point_Latitude	Real	deg	Float 4 Bytes	1 Element	Latitude of the DGG cell's centre identified by Grid_Point_ID	Copied from the AUX_DGG
04	Grid_Point_Longitude	Real	deg	Float 4 Bytes	1 Element	Longitude [-180, 180] deg of the DGG cell's centre identified by Grid_Point_ID	Copied from the AUX_DGG



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
05	Grid_Point_Altitude	Real	m	Float 4 Bytes	1 Element	Altitude of the DGG cell's centre identified by Grid_Point_ID	Copied from the AUX_DGG
06	Faraday_Data_Counter	Counter	N/A	Unsigned Short 2 Bytes	1 Element	Counter of Faraday rotation data values for the current grid point	Faraday ADF Processor
	List_of_Faraday_Data					Init of list Faraday_Data data structure repeated Faraday_Data_Counter times	
	Faraday_Data					Init of Faraday_Data data set record structure	
07	Snapshot_ID_of_Pixel	Identifier	N/A	Unsigned Integer 4 Bytes	1 Element	Unique identifier for the snapshot. Formed by aggregation of orbit and time within orbit. Contents of this field are formed by: Absolute_orbit_number*10000 + Seconds_from_ANX	Copied from the input TLM_MIRA1A or generated by the Faraday ADF Processor
08	Faraday_Rotation_Angle	Real (coded as integer)	deg	Unsigned Short 2 Bytes	1 Element	Faraday rotation angle value along the direction S/C to Earth fixed grid point for snapshot equal to Snapshot_ID. It is computed as the rotation from antenna to surface. Coded as $LSB=360/2^{16}$. Meaning that value=(unsigned short)* $360/2^{16}$ degrees	Faraday ADF Processor
09	Faraday_Rotation_Angle_Specular_Ray	Real	deg	Unsigned	1 Element	Faraday rotation angle value	Faraday ADF



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
		(coded as integer)		Short 2 Bytes		along the specular direction S/C to Earth fixed grid point for snapshot equal to Snapshot_ID. It is computed as the rotation from sky to surface. Coded as $LSB=360/2^{16}$. Meaning that value=(unsigned short)* $360/2^{16}$ degrees	Processor
10	Incidence_Angle	Real (coded as integer)	deg	Unsigned Short 2 Bytes	1 Element	Incidence angle value for snapshot equal to Snapshot_ID over current Earth fixed grid point. Measured as angle from pixel to S/C with respect to the pixel local normal (0° if vertical) Coded as $LSB=90/2^{16}$. Meaning that value=(unsigned short)* $90/2^{16}$ degrees	Faraday ADF Processor
11	VTEC	Real	TECU (10^{16} Electron/m ²)	Float (4 bytes)	1 Element	Vertical Total Electron count content interpolated for a point along the direction S/C on ground pixel at 450 Km altitude.	Faraday ADF Processor
12	VTEC_Specular_Ray	Real	TECU (10^{16} Electron/m ²)	Float (4 bytes)	1 Element	Vertical Total Electron count content interpolated for a point along the specular direction S/C on ground pixel at 450 Km altitude.	Faraday ADF Processor



Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
13	Quality_Flags	Bit-flag	N/A	Unsigned 1 byte	1 Element	See Quality flag description table	Faraday ADF Processor
	Faraday_Data					End of Faraday_Data data set record	
	List_of_Faraday_Data					End of List_of_Faraday_Data data set record structure	
	Grid_Point_Faraday_Data					End of Grid_Point_Faraday_Data data set record structure	
	Grid_Point_List					End of Grid_Point_List binary data set	
	Data_Block					End of binary Data Block in the product.	

Table 5-34 Faraday Rotation Auxiliary Product Data Block

The **Quality_Flags** field is specified at bit-level and has the following meaning:

Quality Flags description	
LSb Number	
Bit 1	Software error 0 if no SW errors were detected during the processing of the measurement (i.e. NaN, division by zero) 1 if a SW error was detected
Bit 2	ADF error 0 if no ADF errors were detected during the processing of the measurement 1 if a ADF error was detected
Bit 2 – 8	Spare

Table 5-35 AUX_FARA_x Quality_flags format specification



5.2.23 L1 Configuration Parameters (AUX CNFL1P)

The AUX_CNFL1P ADF contains a list of parameters needed to specify the values of the configurable algorithms. This ADF is updated manually by the DPGS operators.

The SPH contains only the Main_SPH_for_XML structure as defined in Table 5-3.

The product Data Block contains four data sets, **Science_Algorithm_Configuration**, **Calibration_Algorithm_Configuration**, **VTEC_Algorithm_Configuration** and **Quality_Parameters**, with one DSR each. The ADF is specified in XML ASCII. The ADF header is formed by the Fixed Header and the Specific Product Header as specified in Table 5-2.

The AUX_CNFL1P data block specification is as follows:

Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
01	Data_Block	Tag				Tag starting the datablock of the product.	
02	Science_Algorithm_Configuration	Starting Tag				Tag starting the Algorithm_Parameters dataset	
03	Level1A					Tag starting the Level1A structure	
04	Raw_Number_of_Iterations	Integer	N/A	4 bytes	%04d	Maximum number of iterations in the raw correlation convergence criteria	CEC Team / L1 ESL
05	Raw_Thresholds_Residue_Limit	Real	N/A	10 bytes	%010.8g	Threshold residue limit for the solution using the Newton-Raphson method	CEC Team / L1 ESL (default from L1OP Installation)



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
06	<i>UNoise_Correction</i>	Flag	N/A	1 byte	%01d	Optional flag to perform offset correction: <ul style="list-style-type: none"> 0 means No offset correction to be applied 1 means Offset correction to ALL baselines applied 2 means Offset correction ONLY to baselines fed by the same local oscillator 	CEC Team / L1 ESL (default from L1OP Installation)
07	<i>PMS_Linearity_Correction</i>	Integer	N/A	1 byte	%01d	This field can have one of the following values: <ul style="list-style-type: none"> 0 if Tsys is computed using PMS gains and offsets which are always corrected with temperature using an on-ground measured sensitivity (ADF). 1 if Tsys is computed as above, but in a two-iteration approach where PMS voltages (from TLM) are corrected using the first Tsys estimation. 	CEC Team / L1 ESL
08	<i>NIR_RFI_Detection_Sigma_Threshold</i>	Real	K	6 bytes	%06.3f	Sets the 3 sigma threshold for outlier detection in the spline based filtering performed on NIR Brightness temperature processed in L1a data	CEC Team / L1 ESL
09	<i>Tsys_RFI_Detection_Sigma_Threshold</i>	Real	K	6 bytes	%06.3f	Sets the 3 sigma threshold for outlier detection in the spline based filtering performed on Tsys standard deviation processed in L1a data	CEC Team / L1 ESL



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
10	<i>All_LICEF_Flag</i>	Integer	N/A	1 byte	%01d	This field can have one of the following values: <ul style="list-style-type: none"> 0 for "NIR computation mode" 1 for "All-LICEF computation mode" 	
11	<i>Tp7_Correction_Flag</i>	Integer	N/A	1 byte	%01d	This field can have one of the following values: <ul style="list-style-type: none"> 0 for "Tp7 Latency Correction OFF" 1 for "Tp7 Latency Correction ON" 	
12	<i>Fixed_Tna_Flag</i>	Integer	N/A	1 byte	%01d	This field can have one of the following values: <ul style="list-style-type: none"> 0 for "Fixed Tna0 OFF" 1 for "Fixed Tna0 ON" 	
13	<i>Level1A</i>	Closing Tag				Tag closing the Level1A structure	
14	<i>Level1B</i>	Starting Tag				Tag starting the Level1B structure	
15	<i>Reconstruction_Image_Algorithm</i>	Integer	N/A	1 byte	%01d	This field can have one of the following values: <ul style="list-style-type: none"> 0 for "Gibbs Level: 0" 1 for "Gibbs Level: 1" 2 for "Gibbs Level: 2" 	CEC Team / L1 ESL



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
16	<i>Reference_Temperature_Level</i>	Integer	N/A	1 byte	%01d	<p>This field can have one of the following values:</p> <ul style="list-style-type: none"> 3 for "Reference Temperature equal to the LICEF Average Physical Temperature" 2 for "Reference Temperature equal to the average of NIR Brightness Temperature in both polarisations" 1 for " Reference Temperature equal to the average of NIR Brightness Temperature in the same polarisation as the snapshot" 0 for " Reference Temperature equal to 0" 	CEC Team / L1 ESL
17	<i>Copolar_Processing</i>	Flag	N/A	1 byte	%01d	<p>Flag for activating/deactivating the contribution of the co/cross-polar antenna patterns in the J matrix production.</p> <ul style="list-style-type: none"> 0 for "cross-polar contribution applied" 1 for "co-polar contribution applied" <p>Note: This flag is used by the processor that generates the J matrix; the flag it is not used by the processor generating the Level 1B science products.</p>	CEC Team / L1 ESL (default from l1op installation)



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
18	<i>Direct_Sun_Correction_Type</i>	Integer	N/A	1 byte	%01d	<p>Method used to correct the contribution from direct Sun into the snapshot. This field can have one of the following values:</p> <ul style="list-style-type: none"> 4 for "Correction by Measurements. BT Self-estimation with improved Sun Position Estimate Technique". If improved sun estimation is not possible then this field shall be interpreted as option 3. 3 for "Correction by Measurements Self-estimation Technique". If no self-estimation is possible (eclipse, sun in the back...), then this field shall be interpreted as option 2. 2 for "Correction Based on Sun Auxiliary Data". If no Sun ADF is available, then this field shall be interpreted as option 1. 1 for "Correction Based on Default Sun BT Value (110.000K)" 0 for correction not applied 	CEC Team / L1 ESL



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
19	<i>Direct_Moon_Correction_Type</i>	Integer	N/A	1 byte	%01d	<p>This field can have one of the following values:</p> <ul style="list-style-type: none"> • 2 for "Correction Based on Moon Auxiliary Data". If no Moon ADF is available, then this field shall be interpreted as option 1. • 1 for "Correction by Default Moon BT Value (250K)" • 0 for correction not applied 	CEC Team / L1 ESL
20	<i>Reflected_Sun_Correction_Type</i>	Integer	N/A	1 byte	%01d	<p>This field can have one of the following values:</p> <ul style="list-style-type: none"> • 3 for "Correction with first order forward model (fixed wind) using Sun BT Self-estimated value" • 2 for "Correction with first order forward model (fixed wind) using Sun BT Auxiliary Data" • 1 for "Correction with first order forward model (fixed wind) using Sun BT default value (110.000K)" • 0 for correction not applied 	CEC Team / L1 ESL



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
21	<i>Earth_Contribution_Correction_Type</i>	Integer	N/A	1 byte	%01d	This field can have one of the following values: <ul style="list-style-type: none">0 for "Gibbs Level: 0"1 for "Gibbs Level: 1"2 for "Gibbs Level: 2"	CEC Team / L1 ESL
22	<i>Sky_Contribution_Correction_Type</i>	Flag	N/A	1 byte	%01d	This field can have one of the following values: <ul style="list-style-type: none">1 for correction applied0 for correction not applied	CEC Team / L1 ESL



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
23	<i>Direct_Sun_Correction_Type_External</i>	Integer	N/A	1 byte	%01d	<p>Method used to correct the contribution from direct Sun into the snapshot, to be applied only to the processing of external pointing data. This field can have one of the following values:</p> <ul style="list-style-type: none"> • 4 for "Correction by Measurements. BT Self-estimation with improved Sun Position Estimate Technique". If improved sun estimation estimation is not possible then this field shall be interpreted as option 3. • 3 for "Correction by Measurements Self-estimation Technique". If no self-estimation is possible (eclipse, sun in the back...), then this field shall be interpreted as option 2. • 2 for "Correction Based on Sun Auxiliary Data". If no Sun ADF is available, then this field shall be interpreted as option 1. • 1 for "Correction Based on Default Sun BT Value (110.000K)" • 0 for correction not applied 	CEC Team / L1 ESL



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
24	<i>Direct_Moon_Correction_Type_External</i>	Integer	N/A	1 byte	%01d	<p>This field can have one of the following values (to be applied only to the processing of external pointing data):</p> <ul style="list-style-type: none">• 2 for "Correction Based on Moon Auxiliary Data". If no Moon ADF is available, then this field shall be interpreted as option 1.• 1 for "Correction by Default Moon BT Value (250K)"• 0 for correction not applied	CEC Team / L1 ESL



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
25	<i>Earth_Contribution_Correction_Type_External</i>	Flag	N/A	1 byte	%01d	<p>This field can have one of the following values (to be applied only to the processing of external pointing data):</p> <ul style="list-style-type: none"> • 4 for "Correction Based on Measured Land+Ocean BT Values (only applicable for reprocessing)" • 3 for "Correction Based on Constant Land+Ice estimation and Fresnel modelled Ocean (removal of Earth-Sky limb and second order coastlines)" • 2 for "Correction Based on Constant Land+Ice estimation and Default Ocean BT value (removal of Earth-Sky limb and first order coastlines)" • 1 for "Correction Based on Constant Earth estimation (removal of Earth-Sky limb)" • 0 for correction not applied 	CEC Team / L1 ESL
26	<i>Sky_Contribution_Correction_Type_External</i>	Flag	N/A	1 byte	%01d	<p>This field can have one of the following values (to be applied only to the processing of external pointing data):</p> <ul style="list-style-type: none"> • 1 for correction applied • 0 for correction not applied 	CEC Team / L1 ESL



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
27	<i>Flat_Target_Correction_Type</i>	Flag	N/A	1 byte	%01d	Method used to correct the ontribution from flat target. This field can have oneof the following values: <ul style="list-style-type: none"> 1 for FTT applied 0 for FTT not applied	CEC Team / L1 ESL
28	<i>Backlobes_Correction_Type</i>	Flag	N/A	1 byte	%01d	This field can have one of the following values: <ul style="list-style-type: none"> 1 for correction applied (only on NIR values) 0 for correction not applied 	CEC Team / L1 ESL
29	<i>Earth_Background_Temperature</i>	Real	K	6 bytes	%6.2f	Constant Earth temperature used in the computation of backlobes contribution.	CEC Team / L1 ESL (default from l1op installation)
30	<i>Sky_Background_Temperature</i>	Real	K	6 bytes	%6.2f	Constant Sky temperature used in the computation of backlobes contribution.	CEC Team / L1 ESL (default from l1op installation)
31	<i>Level1B</i>	Closin g Tag				Tag closing the <i>Level1B</i> structure	
32	<i>Level1C</i>	Startin g Tag				Tag starting the <i>Level1C</i> structure	



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
33	<i>Radiometric_Accuracy_Scale</i>	Integer	K	3 bytes	%03d	Scale used in the normalisation to 2s complement of the Pixel Radiometric Accuracy (default 50K)	CEC Team / L1 ESL (default from L1OP Installation)
34	<i>Pixel_Footprint_Scale</i>	Integer	Km	3 bytes	%03d	Scale used in the normalisation to 2s complement of the Pixel Footprint size (100km)	CEC Team / L1 ESL (default from L1OP Installation)
35	<i>FOV_Border_Flag_Size</i>	Real	N/A	5 bytes	%05.3f	Maximum distance in director cosines domain (xi-eta) from a DGG point to the EAF-FOV contour or the "suspenders and belts" contours in order to raise the BORDER FOV flag.	CEC Team / L1 ESL
36	<i>Sun_Point_Flag_Size</i>	Real	N/A	5 bytes	%05.3f	Circle radius in director cosines domain (xi-eta) around the Sun alias location used to raise the SUN_POINT flag.	CEC Team / L1 ESL
37	<i>Browse_Incidence_Angle</i>	Real	degree s	5 bytes	%+05.1f	Incidence angle selected to compute browse products	CEC Team / L1 ESL (default from L1OP Installation)
38	<i>Browse_Higher_Angle</i>	Real	degree s	5 bytes	%+05.1f	Higher angle useful for interpolation of browse values	CEC Team / L1 ESL (default from L1OP Installation)



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
39	Browse_Lower_Angle	Real	degrees	5 bytes	%+05.1f	Lower angle useful for interpolation of browse values	CEC Team / L1 ESL (default from L1OP Installation)
40	Analytic_Footprint_Flag	Flag	N/A	1 byte	%01d	Method used to compute the pixel footprint size. This field can have one of the following values: <ul style="list-style-type: none"> 1 for Analytic computation applied (faster and used in NRTP) 0 for Empirical computation applied (slightly more precise but slower) 	CEC Team / L1 ESL (default from L1OP Installation)
41	Max_Sunlint_Threshold	Real	N/A	20 bytes	%+019.15g	Sets the threshold for activating the Sunlint flag in L1c scenes based on the Bi-static scattering coefficients	CEC Team / L1 ESL (default from L1op installation)
42	BT_Dual_RFI_Pixel_Flag_Threshold	Real	K	7 bytes	%07.3f	Sets the threshold for activating the pixel and circle RFI flag in L1c dual pol measurements if the pixel measurement value is higher than this threshold	CEC Team / L1 ESL
43	BT_Full_RFI_Pixel_Flag_Threshold	Real	K	7 bytes	%07.3f	Sets the threshold for activating the pixel and circle RFI flag in L1c full pol measurements if the pixel measurement value is higher than this threshold (in modulus)	CEC Team / L1 ESL
44	BT_Dual_RFI_Tail_Flag_Threshold	Real	K	7 bytes	%07.3f	Sets the threshold for activating the tails RFI flag in L1c dual pol measurements if the pixel measurement value is higher than this threshold (in modulus)	CEC Team / L1 ESL



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
45	<i>BT_Full_RFI_Tail_Flag_Threshold</i>	Real	K	7 bytes	%07.3f	Sets the threshold for activating the tails RFI flag in L1c full pol measurements if the pixel measurement value is higher than this threshold (in modulus)	CEC Team / L1 ESL
46	<i>Estimated_RFI_Radius_Constant_A</i>	Real	K	6 bytes	%+06.3f	Parameter for RFI circle flag radius computation	CEC Team / L1 ESL
47	<i>Estimated_RFI_Radius_Constant_B</i>	Real	K	6 bytes	%+06.3f	Parameter for RFI circle flag radius computation	CEC Team / L1 ESL
48	<i>Maximum_RFI_Radius_Threshold</i>	Real	K	5 bytes	%05.3f	Parameter for maximum circle radius allowed	CEC Team / L1 ESL
49	<i>Max_Snapshot_RFI_Threshold_01</i>	Real	K	8 bytes	%08.3f	Sets a threshold for activating the RFI snapshot flag if in the L1C scene there is a value higher than this threshold (in modulus)	CEC Team / L1 ESL
50	<i>Max_Snapshot_RFI_Threshold_02</i>	Real	K	8 bytes	%08.3f	Sets a threshold for activating the RFI snapshot flag if in the L1C scene there is a value higher than this threshold (in modulus)	CEC Team / L1 ESL
51	<i>Max_Snapshot_RFI_Threshold_03</i>	Real	K	8 bytes	%08.3f	Sets a threshold for activating the RFI snapshot flag if in the L1C scene there is a value higher than this threshold (in modulus)	CEC Team / L1 ESL
52	<i>RFI_Contamination_Level_01</i>	Real	K	8 bytes	%08.3f	Sets a threshold for activating the RFI snapshot flag whenever the level of the RFI contamination in the scene is higher than this threshold (in modulus)	CEC Team / L1 ESL
53	<i>RFI_Contamination_Level_02</i>	Real	K	8 bytes	%08.3f	Sets a threshold for activating the RFI snapshot flag whenever the level of the RFI contamination in the scene is higher than this threshold (in modulus)	CEC Team / L1 ESL



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
54	<i>RFI_Contamination_Level_03</i>	Real	K	8 bytes	%08.3f	Sets a threshold for activating the RFI snapshot flag whenever the level of the RFI contamination in the scene is higher than this threshold (in modulus)	CEC Team / L1 ESL
55	<i>Level1C</i>	Closing Tag				Tag closing the Level1C structure	
56	<i>Science_Algorithm_Configuration</i>	Closing Tag				Tag closing the Science_Algorithm_Parameters dataset	
57	<i>Calibration_Algorithm_Configuration</i>	Starting Tag				Tag starting the Calibration_Algorithm_Configuration dataset	
58	<i>Raw_Number_of_Iterations</i>	Integer	N/A	4 bytes	%04d	Maximum number of iterations in the raw correlation convergence criteria	CEC Team / L1 ESL
59	<i>Raw_Thresholds_Residue_Limit</i>	Real	N/A	10 bytes	%010.8g	Threshold residue limit for the solution using the Newton-Raphson method	CEC Team / L1 ESL (default from L1OP Installation)
60	<i>PMS_Linearity_Correction</i>	Integer	N/A	1 byte	%01d	<p>This field can have one of the following values:</p> <ul style="list-style-type: none"> 0 if Tsys is computed using PMS gains and offsets which are always corrected with temperature using an on-ground measured sensitivity (ADF). 1 if Tsys is computed as above, but in a two-iteration approach where PMS voltages (from TLM) are corrected using the first Tsys estimation. 	CEC Team / L1 ESL



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
61	<i>RFI_Filter_Unoise_Threshold</i>	Real	c.u.	9 bytes	%9.6f	Maximum Mkj module allowed during unoise processing. If value is surpassed, unoise epoch needs to be discarded.	CEC Team / L1 ESL
62	<i>Long_Term_Calibration-Sequences</i>	Starting Tag				Tag starting the Long_Term_Calibration-Sequences group	
63	<i>PMS_Calibration</i>	Starting Tag				Tag starting the PMS_Calibration sequence definition	
64	<i>Min_Epochs_Per_Step</i>	Integer	Epochs	4 bytes	%04d	Smallest number of valid data in a given PLM configuration (step), that is necessary in order to obtain calibration data of sufficient quality and recognize a sequence. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
65	<i>Max_Separation_Within_Step</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for all the data gathered in the same PLM configuration (step) that is to be used in a given calibration event. Normally, several epochs are assigned to each step and are averaged, and this parameter ensures that they are not gathered under very different conditions. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
66	<i>Max_Gap_Within_Sequence</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for the separation between two consecutive steps of a sequence. It is used to split a sequence in two if there is a gap in the data. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
67	<i>Max_Sequence_Duration</i>	Integer	Epochs	5 bytes	%05d	Largest amount of time that a calibration sequence can last. Starting from the first epoch of the first calibration step, when the max sequence duration has elapsed, no more data is gathered for that sequence. If there is sufficient data to proceed with the calibration computation, processing should start. If not enough data has been gathered, the data shall be discarded. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
68	<i>PMS_Calibration</i>	Closing Tag				Tag closing the PMS_Calibration sequence definition	
69	<i>PMS_Offset_Calibration</i>	Starting Tag				Tag starting the PMS_Offset_Calibration sequence definition	
70	<i>Min_Epochs_Per_Step</i>	Integer	Epochs	4 bytes	%04d	Smallest number of valid data in a given PLM configuration (step), that is necessary in order to obtain calibration data of sufficient quality and recognize a sequence. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
71	<i>Max_Separation_Within_Step</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for all the data gathered in the same PLM configuration (step) that is to be used in a given calibration event. Normally, several epochs are assigned to each step and are averaged, and this parameter ensures that they are not gathered under very different conditions. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
72	<i>Max_Gap_Within_Sequence</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for the separation between two consecutive steps of a sequence. It is used to split a sequence in two if there is a gap in the data. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
73	Max_Sequence_Duration	Integer	Epochs	5 bytes	%05d	Largest amount of time that a calibration sequence can last. Starting from the first epoch of the first calibration step, when the max sequence duration has elapsed, no more data is gathered for that sequence. If there is sufficient data to proceed with the calibration computation, processing should start. If not enough data has been gathered, the data shall be discarded. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
74	PMS_Offset_Calibration	Closing Tag				Tag closing the PMS_Offset_Calibration sequence definition	
75	PMS_Calibration_External	Starting Tag				Tag starting the PMS_Calibration_External sequence definition	
76	Min_Epochs_Per_Step	Integer	Epochs	4 bytes	%04d	Smallest number of valid data in a given PLM configuration (step), that is necessary in order to obtain calibration data of sufficient quality and recognize a sequence. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
77	Max_Separation_Within_Step	Integer	Epochs	5 bytes	%05d	Maximum time allowed for all the data gathered in the same PLM configuration (step) that is to be used in a given calibration event. Normally, several epochs are assigned to each step and are averaged, and this parameter ensures that they are not gathered under very different conditions. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
78	Max_Gap_Within_Sequence	Integer	Epochs	5 bytes	%05d	Maximum time allowed for the separation between two consecutive steps of a sequence. It is used to split a sequence in two if there is a gap in the data. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
79	Max_Sequence_Duration	Integer	Epochs	5 bytes	%05d	Largest amount of time that a calibration sequence can last. Starting from the first epoch of the first calibration step, when the max sequence duration has elapsed, no more data is gathered for that sequence. If there is sufficient data to proceed with the calibration computation, processing should start. If not enough data has been gathered, the data shall be discarded. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
80	PMS_Calibration_External	Closing Tag				Tag closing the PMS_Calibration_External sequence definition	
81	Consolidate_PMS_Calibration	Starting Tag				Tag starting the Consolidate_PMS_Calibration sequence definition	
82	Min_Epochs_Per_Step	Integer	Epochs	4 bytes	%04d	Smallest number of valid data in a given PLM configuration (step), that is necessary in order to obtain calibration data of sufficient quality and recognize a sequence. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
83	<i>Max_Separation_Within_Step</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for all the data gathered in the same PLM configuration (step) that is to be used in a given calibration event. Normally, several epochs are assigned to each step and are averaged, and this parameter ensures that they are not gathered under very different conditions. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
84	<i>Max_Gap_Within_Sequence</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for the separation between two consecutive steps of a sequence. It is used to split a sequence in two if there is a gap in the data. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
85	Max_Sequence_Duration	Integer	Epochs	5 bytes	%05d	<p>Largest amount of time that a calibration sequence can last. Starting from the first epoch of the first calibration step, when the max sequence duration has elapsed, no more data is gathered for that sequence. If there is sufficient data to proceed with the calibration computation, processing should start. If not enough data has been gathered, the data shall be discarded.</p> <p>Referred to Table 9 in applicable L1a DPM.</p>	DPM section 3.11 Table 9
86	Validity_Period	Real	Days	10 bytes	%10.5f	<p>Validity of the data. Each type of calibration data will be considered valid for a given amount of time.</p> <p>Used to raise the calibration error flag during science processing if any science epoch is calibrated using PMS data older than this period in the nominal processing, or if it is older/newer than this period in the reprocessing case. The information regarding this flagging is described in rd.22</p> <p>Referred to Table 9 in applicable L1a DPM.</p>	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
87	<i>Min_Number_Sub_Events</i>	Integer	N/A	2 byte	%02d	Minimum number of sub-events that must be detected in order for the event (sequence) to be identified. An event can be defined by the occurrence of a series of other sub-events. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
88	<i>Consolidate_PMS_Calibration</i>	Closing Tag				Tag closing the Consolidate_PMS_Calibration sequence definition	
89	<i>Consolidate_PMS_Offset_Calibration</i>	Starting Tag				Tag starting the Consolidate_PMS_Offset_Calibration sequence definition	
90	<i>Min_Epochs_Per_Step</i>	Integer	Epochs	4 bytes	%04d	Smallest number of valid data in a given PLM configuration (step), that is necessary in order to obtain calibration data of sufficient quality and recognize a sequence. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
91	<i>Max_Separation_Within_Step</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for all the data gathered in the same PLM configuration (step) that is to be used in a given calibration event. Normally, several epochs are assigned to each step and are averaged, and this parameter ensures that they are not gathered under very different conditions. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
92	<i>Max_Gap_Within_Sequence</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for the separation between two consecutive steps of a sequence. It is used to split a sequence in two if there is a gap in the data. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
93	Max_Sequence_Duration	Integer	Epochs	5 bytes	%05d	<p>Largest amount of time that a calibration sequence can last. Starting from the first epoch of the first calibration step, when the max sequence duration has elapsed, no more data is gathered for that sequence. If there is sufficient data to proceed with the calibration computation, processing should start. If not enough data has been gathered, the data shall be discarded.</p> <p>Referred to Table 9 in applicable L1a DPM.</p>	DPM section 3.11 Table 9
94	Validity_Period	Real	Days	10 bytes	%10.5f	<p>Validity of the data. Each type of calibration data will be considered valid for a given amount of time.</p> <p>Used to raise the calibration error flag during science processing if any science epoch is calibrated using PMS offset data older than this period in the nominal processing, or if it is older/newer than this period in the reprocessing case. The information regarding this flagging is described in rd.22</p> <p>Referred to Table 9 in applicable L1a DPM.</p>	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
95	<i>Min_Number_Sub_Events</i>	Integer	N/A	2 byte	%02d	Minimum number of sub-events that must be detected in order for the event (sequence) to be identified. An event can be defined by the occurrence of a series of other sub-events. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
96	<i>Consolidate_PMS_Offset_Calibration</i>	Closing Tag				Tag closing the Consolidate_PMS_Offset_Calibration sequence definition	
97	<i>Consolidate_PMS_Calibration_External</i>	Starting Tag				Tag starting the Consolidate_PMS_Calibration_External sequence definition	
98	<i>Min_Epochs_Per_Step</i>	Integer	Epochs	4 bytes	%04d	Smallest number of valid data in a given PLM configuration (step), that is necessary in order to obtain calibration data of sufficient quality and recognize a sequence. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
99	<i>Max_Separation_Within_Step</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for all the data gathered in the same PLM configuration (step) that is to be used in a given calibration event. Normally, several epochs are assigned to each step and are averaged, and this parameter ensures that they are not gathered under very different conditions. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
100	<i>Max_Gap_Within_Sequence</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for the separation between two consecutive steps of a sequence. It is used to split a sequence in two if there is a gap in the data. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
101	Max_Sequence_Duration	Integer	Epochs	5 bytes	%05d	<p>Largest amount of time that a calibration sequence can last. Starting from the first epoch of the first calibration step, when the max sequence duration has elapsed, no more data is gathered for that sequence. If there is sufficient data to proceed with the calibration computation, processing should start. If not enough data has been gathered, the data shall be discarded.</p> <p>Referred to Table 9 in applicable L1a DPM.</p>	DPM section 3.11 Table 9
102	Validity_Period	Real	Days	10 bytes	%10.5f	<p>Validity of the data. Each type of calibration data will be considered valid for a given amount of time.</p> <p>Used to raise the calibration error flag during science processing if any science epoch is calibrated using PMS data older than this period in the nominal processing, or if it is older/newer than this period in the reprocessing case. The information regarding this flagging is described in rd.22</p> <p>Referred to Table 9 in applicable L1a DPM.</p>	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
103	<i>Min_Number_Sub_Events</i>	Integer	N/A	2 byte	%02d	Minimum number of sub-events that must be detected in order for the event (sequence) to be identified. An event can be defined by the occurrence of a series of other sub-events. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
104	<i>Consolidate_PMS_Calibration_External</i>	Closing Tag				Tag closing the Consolidate_PMS_Calibration_External sequence definition	
105	<i>Consolidate_FWF_Origin_Calibration</i>	Starting Tag				Tag starting the Consolidate_FWF_Origin_Calibration sequence definition	
106	<i>Min_Epochs_Per_Step</i>	Integer	Epochs	4 bytes	%04d	Smallest number of valid data in a given PLM configuration (step), that is necessary in order to obtain calibration data of sufficient quality and recognize a sequence. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
107	<i>Max_Separation_Within_Step</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for all the data gathered in the same PLM configuration (step) that is to be used in a given calibration event. Normally, several epochs are assigned to each step and are averaged, and this parameter ensures that they are not gathered under very different conditions. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
108	<i>Max_Gap_Within_Sequence</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for the separation between two consecutive steps of a sequence. It is used to split a sequence in two if there is a gap in the data. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
109	Max_Sequence_Duration	Integer	Epochs	5 bytes	%05d	<p>Largest amount of time that a calibration sequence can last. Starting from the first epoch of the first calibration step, when the max sequence duration has elapsed, no more data is gathered for that sequence. If there is sufficient data to proceed with the calibration computation, processing should start. If not enough data has been gathered, the data shall be discarded.</p> <p>Referred to Table 9 in applicable L1a DPM.</p>	DPM section 3.11 Table 9
110	Validity_Period	Real	Days	10 bytes	%10.5f	<p>Validity of the data. Each type of calibration data will be considered valid for a given amount of time.</p> <p>Used to raise the calibration error flag during science processing if any science epoch is calibrated using FWF at the origin data older than this period in the nominal processing, or if it is older/newer than this period in the reprocessing case. The information regarding this flagging is described in rd.22</p> <p>Referred to Table 9 in applicable L1a DPM.</p>	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
111	<i>Min_Number_Sub_Events</i>	Integer	N/A	2 byte	%02d	Minimum number of sub-events that must be detected in order for the event (sequence) to be identified. An event can be defined by the occurrence of a series of other sub-events. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
112	<i>Consolidate_FWF_Origin_Calibration</i>	Closing Tag				Tag closing the Consolidate_FWF_Origin_Calibration sequence definition	
113	<i>Unoise_Calibration</i>	Starting Tag				Tag starting the Unoise_Calibration sequence definition	
114	<i>Min_Epochs_Per_Step</i>	Integer	Epochs	4 bytes	%04d	Smallest number of valid data in a given PLM configuration (step), that is necessary in order to obtain calibration data of sufficient quality and recognize a sequence. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
115	<i>Max_Separation_Within_Step</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for all the data gathered in the same PLM configuration (step) that is to be used in a given calibration event. Normally, several epochs are assigned to each step and are averaged, and this parameter ensures that they are not gathered under very different conditions. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
116	<i>Max_Gap_Within_Sequence</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for the separation between two consecutive steps of a sequence. It is used to split a sequence in two if there is a gap in the data. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
117	Max_Sequence_Duration	Integer	Epochs	5 bytes	%05d	<p>Largest amount of time that a calibration sequence can last. Starting from the first epoch of the first calibration step, when the max sequence duration has elapsed, no more data is gathered for that sequence. If there is sufficient data to proceed with the calibration computation, processing should start. If not enough data has been gathered, the data shall be discarded.</p> <p>Referred to Table 9 in applicable L1a DPM.</p>	DPM section 3.11 Table 9
118	Validity_Period	Real	Days	10 bytes	%10.5f	<p>Validity of the data. Each type of calibration data will be considered valid for a given amount of time.</p> <p>Used to raise the calibration error flag during science processing if any science epoch is calibrated using Unoise data older than this period in the nominal processing, or if it is older/newer than this period in the reprocessing case. The information regarding this flagging is described in rd.22</p> <p>Referred to Table 9 in applicable L1a DPM.</p>	DPM section 3.11 Table 9
119	Unoise_Calibration	Closing Tag				Tag closing the Unoise_Calibration sequence definition	



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
120	<i>FWF_Shape</i>	Starting Tag				Tag starting the FWF_Shape sequence definition	
121	<i>Min_Epochs_Per_Step</i>	Integer	Epochs	4 bytes	%04d	Smallest number of valid data in a given PLM configuration (step), that is necessary in order to obtain calibration data of sufficient quality and recognize a sequence. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
122	<i>Max_Separation_Within_Step</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for all the data gathered in the same PLM configuration (step) that is to be used in a given calibration event. Normally, several epochs are assigned to each step and are averaged, and this parameter ensures that they are not gathered under very different conditions. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
123	<i>Max_Gap_Within_Sequence</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for the separation between two consecutive steps of a sequence. It is used to split a sequence in two if there is a gap in the data. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
124	Max_Sequence_Duration	Integer	Epochs	5 bytes	%05d	Largest amount of time that a calibration sequence can last. Starting from the first epoch of the first calibration step, when the max sequence duration has elapsed, no more data is gathered for that sequence. If there is sufficient data to proceed with the calibration computation, processing should start. If not enough data has been gathered, the data shall be discarded. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
125	FWF_Shape	Closing Tag				Tag closing the FWF_Shape sequence definition	
126	Consolidate_FWF_Shape	Starting Tag				Tag starting the Consolidate_FWF_Shape sequence definition	
127	Min_Epochs_Per_Step	Integer	Epochs	4 bytes	%04d	Smallest number of valid data in a given PLM configuration (step), that is necessary in order to obtain calibration data of sufficient quality and recognize a sequence. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
128	<i>Max_Separation_Within_Step</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for all the data gathered in the same PLM configuration (step) that is to be used in a given calibration event. Normally, several epochs are assigned to each step and are averaged, and this parameter ensures that they are not gathered under very different conditions. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
129	<i>Max_Gap_Within_Sequence</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for the separation between two consecutive steps of a sequence. It is used to split a sequence in two if there is a gap in the data. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
130	Max_Sequence_Duration	Integer	Epochs	5 bytes	%05d	<p>Largest amount of time that a calibration sequence can last. Starting from the first epoch of the first calibration step, when the max sequence duration has elapsed, no more data is gathered for that sequence. If there is sufficient data to proceed with the calibration computation, processing should start. If not enough data has been gathered, the data shall be discarded.</p> <p>Referred to Table 9 in applicable L1a DPM.</p>	DPM section 3.11 Table 9
131	Validity_Period	Real	Days	10 bytes	%10.5f	<p>Validity of the data. Each type of calibration data will be considered valid for a given amount of time.</p> <p>Used to raise the calibration error flag during science processing if any science epoch is calibrated using GMAT or JMAT data older than this period in the nominal processing, or if it is older/newer than this period in the reprocessing case. The information regarding this flagging is described in rd.22</p> <p>Referred to Table 9 in applicable L1a DPM.</p>	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
132	<i>Min_Number_Sub_Events</i>	Integer	N/A	2 byte	%02d	Minimum number of sub-events that must be detected in order for the event (sequence) to be identified. An event can be defined by the occurrence of a series of other sub-events. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
133	<i>Consolidate_FWF_Shape</i>	Closing Tag				Tag closing the Consolidate_FWF_Shape sequence definition	
134	<i>NIR_Calibration</i>	Starting Tag				Tag starting the NIR_Calibration sequence definition	
135	<i>Min_Epochs_Per_Step</i>	Integer	Epochs	4 bytes	%04d	Smallest number of valid data in a given PLM configuration (step), that is necessary in order to obtain calibration data of sufficient quality and recognize a sequence. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
136	<i>Max_Separation_Within_Step</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for all the data gathered in the same PLM configuration (step) that is to be used in a given calibration event. Normally, several epochs are assigned to each step and are averaged, and this parameter ensures that they are not gathered under very different conditions. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
137	<i>Max_Gap_Within_Sequence</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for the separation between two consecutive steps of a sequence. It is used to split a sequence in two if there is a gap in the data. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
138	Max_Sequence_Duration	Integer	Epochs	5 bytes	%05d	Largest amount of time that a calibration sequence can last. Starting from the first epoch of the first calibration step, when the max sequence duration has elapsed, no more data is gathered for that sequence. If there is sufficient data to proceed with the calibration computation, processing should start. If not enough data has been gathered, the data shall be discarded. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
139	Max_Sky_RMS	Real	K	7 bytes	%07.3f	Maximum RMS for a sky scene to be useful in NIR calibration.	CEC Team / L1 ESL
140	NIR_Calibration	Closing Tag				Tag closing the NIR_Calibration sequence definition	
141	Consolidate_NIR_Calibration	Starting Tag				Tag starting the Consolidate_NIR_Calibration sequence definition	
142	Min_Epochs_Per_Step	Integer	Epochs	4 bytes	%04d	Smallest number of valid data in a given PLM configuration (step), that is necessary in order to obtain calibration data of sufficient quality and recognize a sequence. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
143	<i>Max_Separation_Within_Step</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for all the data gathered in the same PLM configuration (step) that is to be used in a given calibration event. Normally, several epochs are assigned to each step and are averaged, and this parameter ensures that they are not gathered under very different conditions. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
144	<i>Max_Gap_Within_Sequence</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for the separation between two consecutive steps of a sequence. It is used to split a sequence in two if there is a gap in the data. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
145	<i>Max_Sequence_Duration</i>	Integer	Epochs	5 bytes	%05d	<p>Largest amount of time that a calibration sequence can last. Starting from the first epoch of the first calibration step, when the max sequence duration has elapsed, no more data is gathered for that sequence. If there is sufficient data to proceed with the calibration computation, processing should start. If not enough data has been gathered, the data shall be discarded.</p> <p>Referred to Table 9 in applicable L1a DPM.</p>	DPM section 3.11 Table 9
146	<i>Validity_Period</i>	Real	Days	10 bytes	%10.5f	<p>Validity of the data. Each type of calibration data will be considered valid for a given amount of time.</p> <p>Used to raise the calibration error flag during science processing if any science epoch is calibrated using NIR data older than this period in the nominal processing, or if it is older/newer than this period in the reprocessing case. The information regarding this flagging is described in rd.22</p> <p>Referred to Table 9 in applicable L1a DPM.</p>	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
147	Min_Number_Sub_Events	Integer	N/A	2 byte	%02d	Minimum number of sub-events that must be detected in order for the event (sequence) to be identified. An event can be defined by the occurrence of a series of other sub-events. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
148	Consolidate_NIR_Calibration	Closing Tag				Tag closing the Consolidate_NIR_Calibration sequence definition	
149	FTT_Calibration	Starting Tag				Tag starting the FTT_Calibration sequence definition	
150	Min_Epochs_Per_Step	Integer	Epochs	4 bytes	%04d	Smallest number of valid data in a given PLM configuration (step), that is necessary in order to obtain calibration data of sufficient quality and recognize a sequence. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
151	<i>Max_Separation_Within_Step</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for all the data gathered in the same PLM configuration (step) that is to be used in a given calibration event. Normally, several epochs are assigned to each step and are averaged, and this parameter ensures that they are not gathered under very different conditions. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
152	<i>Max_Gap_Within_Sequence</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for the separation between two consecutive steps of a sequence. It is used to split a sequence in two if there is a gap in the data. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
153	<i>Max_Sequence_Duration</i>	Integer	Epochs	5 bytes	%05d	<p>Largest amount of time that a calibration sequence can last. Starting from the first epoch of the first calibration step, when the max sequence duration has elapsed, no more data is gathered for that sequence. If there is sufficient data to proceed with the calibration computation, processing should start. If not enough data has been gathered, the data shall be discarded.</p> <p>Referred to Table 9 in applicable L1a DPM.</p>	DPM section 3.11 Table 9
154	<i>Max_Sky_RMS</i>	Real	K	7 bytes	%07.3f	Maximum RMS for a sky scene to be useful in FTT calibration.	CEC Team / L1 ESL
155	<i>Validity_Period</i>	Real	Days	10 bytes	%10.5f	<p>Validity of the data. Each type of calibration data will be considered valid for a given amount of time.</p> <p>Used to raise the calibration error flag during science processing if any science epoch is calibrated using FTT data older than this period in the nominal processing, or if it is older/newer than this period in the reprocessing case. The information regarding this flagging is described in rd.22</p> <p>Referred to Table 9 in applicable L1a DPM.</p>	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
156	<i>FTT_Calibration</i>	Closing Tag				Tag closing the FTT_Calibration sequence definition	
157	<i>Long_Term_Calibration_Sequences</i>	Closing Tag				Tag closing the Long_Term_Calibration_Sequences group	
158	<i>Short_Term_Calibration_Sequences</i>	Starting Tag				Tag starting the Short_Term_Calibration_Sequences group	
159	<i>FWF_Origin_Calibration</i>	Starting Tag				Tag starting the FWF_Origin_Calibration sequence definition	
160	<i>Min_Epochs_Per_Step</i>	Integer	Epochs	4 bytes	%04d	Smallest number of valid data in a given PLM configuration (step), that is necessary in order to obtain calibration data of sufficient quality and recognize a sequence. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
161	<i>Max_Separation_Within_Step</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for all the data gathered in the same PLM configuration (step) that is to be used in a given calibration event. Normally, several epochs are assigned to each step and are averaged, and this parameter ensures that they are not gathered under very different conditions. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
162	<i>Max_Gap_Within_Sequence</i>	Integer	Epochs	5 bytes	%05d	Maximum time allowed for the separation between two consecutive steps of a sequence. It is used to split a sequence in two if there is a gap in the data. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
163	<i>Max_Sequence_Duration</i>	Integer	Epochs	5 bytes	%05d	Largest amount of time that a calibration sequence can last. Starting from the first epoch of the first calibration step, when the max sequence duration has elapsed, no more data is gathered for that sequence. If there is sufficient data to proceed with the calibration computation, processing should start. If not enough data has been gathered, the data shall be discarded. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
164	Consolidation_Period	Real	Days	10 bytes	%10.6f	Time threshold to be used in the consolidation and storage of FWF Origin Phase calibration events inside CSTD1A products. Used to maintain a list of events with enough projection in the past as to ensure an adequate interpolation range. Referred to Table 9 in applicable L1a DPM.	DPM section 3.11 Table 9
165	FWF_Origin_Calibration	Closing Tag				Tag closing the FWF_Origin_Calibration sequence definition	
166	Short_Term_Calibration-Sequences	Closing Tag				Tag closing the Short_Term_Calibration-Sequences group	
167	Calibration_Algorithm_Configuration	Closing Tag				Tag closing the Calibration_Algorithm_Parameters dataset	
168	VTEC_Algorithm_Configuration	Starting Tag				Tag starting the VTEC_Parameters dataset	
169	VTEC_Parameters	Starting Tag				Tag starting the VTEC_Parameters structure	
170	Altitude_Correction	Flag	N/A	1 byte	%01d	This field can have one of the following values: <ul style="list-style-type: none">1 for correction applied0 for correction not applied	VTEC TN



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
171	<i>A_Coefficient_AM</i>	Real	N/A	12 bytes	%+012.8g	Morning coefficient (A) for the correction factor NeQuick(800Km)/NeQuick(20000Km) applied to the raw TEC. Morning coefficients are centered at 6 a.m.	VTEC TN
172	<i>B_Coefficient_AM</i>	Real	N/A	12 bytes	%+012.8g	Morning coefficient (B) for the correction factor NeQuick(800Km)/NeQuick(20000Km) applied to the raw TEC. Morning coefficients are centered at 6 a.m.	VTEC TN
173	<i>C_Coefficient_AM</i>	Real	N/A	12 bytes	%+012.8g	Morning coefficient (C) for the correction factor NeQuick(800Km)/NeQuick(20000Km) applied to the raw TEC. Morning coefficients are centered at 6 a.m.	VTEC TN
174	<i>D_Coefficient_AM</i>	Real	N/A	12 bytes	%+012.8g	Morning coefficient (D) for the correction factor NeQuick(800Km)/NeQuick(20000Km) applied to the raw TEC. Morning coefficients are centered at 6 a.m.	VTEC TN



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
175	<i>A_Coefficient_PM</i>	Real	N/A	12 bytes	%+012.8g	Afternoon coefficient (A) for the correction factor NeQuick(800Km)/NeQuick(20000Km) applied to the raw TEC. Afternoon coefficients are centered at 6 p.m.	VTEC TN
176	<i>B_Coefficient_PM</i>	Real	N/A	12 bytes	%+012.8g	Afternoon coefficient (B) for the correction factor NeQuick(800Km)/NeQuick(20000Km) applied to the raw TEC. Afternoon coefficients are centered at 6 p.m.	VTEC TN
177	<i>C_Coefficient_PM</i>	Real	N/A	12 bytes	%+012.8g	Afternoon coefficient (C) for the correction factor NeQuick(800Km)/NeQuick(20000Km) applied to the raw TEC. Afternoon coefficients are centered at 6 p.m.	VTEC TN
178	<i>D_Coefficient_PM</i>	Real	N/A	12 bytes	%+012.8g	Afternoon coefficient (D) for the correction factor NeQuick(800Km)/NeQuick(20000Km) applied to the raw TEC. Afternoon coefficients are centered at 6 p.m.	VTEC TN
179	<i>VTEC_Parameters</i>	Closing Tag				Tag closing the <i>VTEC_Parameters</i> structure	
180	<i>Algorithm_Configuration</i>	Closing Tag				Tag closing the <i>Algorithm_Parameters</i> dataset	



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
181	Quality_Parameters	Startin g Tag				Tag starting the Quality_Parameters structure	
182	VTEC_PCD_Thresholds	Startin g Tag				Tag starting the VTEC_PCD_Thresholds structure	
183	Mean_Min_Threshold	integer	0.1 TECU	3 Bytes	%03d	Threshold to compute digit 1 (LSB) Flag inside VTEC_PCD: mean value below conf. threshold	CEC Team / L1 ESL
184	Mean_Max_Threshold	integer	0.1 TECU	3 Bytes	%03d	Threshold to compute digit 2 Flag inside VTEC_PCD: mean value above conf. threshold	CEC Team / L1 ESL
185	Std_Threshold	integer	0.1 TECU	3 Bytes	%03d	Threshold to compute digit 3 Flag inside VTEC_PCD: std value above conf. threshold	CEC Team / L1 ESL
186	Max_Threshold	integer	0.1 TECU	3 Bytes	%03d	Threshold to compute digit 4 Flag inside VTEC_PCD: Maximum value above conf. threshold	CEC Team / L1 ESL
187	Min_Threshold	integer	0.1 TECU	3 Bytes	%03d	Threshold to compute digit 5 (MSB) Flag inside VTEC_PCD: Minimum value above conf. threshold	CEC Team / L1 ESL
188	VTEC_PCD_Thresholds	Closin g Tag				Tag closing the VTEC_PCD_Thresholds structure	
189	Quality_Parameters	Closin g Tag				Tag closing the Quality_Parameters structure	
190	Data_Block	Tag				Tag ending the datablock of the product.	

Table 5-36 L1 Configuration File Product Data Block



5.2.24 Faraday Rotation Post-Processor Configuration Parameters (AUX_CNFFAR)

The AUX_CNFFAR ADF contains a list of parameters needed to specify the values of the configurable algorithms for FARADA Post-Processor. This ADF is updated manually by the DPGS operators.

The ADF header is formed by the Fixed Header and the Specific Product Header. The SPH contains only the Main_SPH_for_XML structure as defined in Table 5-3.

The product Data Block contains only one structure, **Algorithm_Configuration**, with one DSR. The ADF is specified in XML ASCII.

The AUX_CNFFAR datablock specification is as follows:

Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
01	Data_Block	Tag				Tag starting the datablock of the product.	
02	Algorithm_Configuration	Starting Tag				Tag starting the Algorithm_Parameters dataset	
03	Difference_GPS_TAI	Integer	s	4bytes	%04d	Difference in seconds between GPS and TAI Times. It is used to initialize Time structures. Its default value should be -19.	CEC Team / L1 ESL
04	Geometric_Correction_Type	Integer	NA	1byte	%01d	This field specifies the method used to geolocate the pixels: <ul style="list-style-type: none"> • 1 for "S/C Attitude Only" • 2 for "Best Fit Plane Correction Applied" • 3 for "Best Fit Plane and Mispointing Correction Applied" 	CEC Team / L1 ESL
05	Snapshot_Time_Sampling	Integer	NA	3 bytes	%03d	This field can have one of the following values:	CEC Team / L1 ESL



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
						<ul style="list-style-type: none"> 1- all the input snapshots will be used to compute the Faraday rotation or SMOS satellite PVT is simulated every 1.2 sec in case the MPL_ORBSCT is used N- in this case only 1 snapshot every N will be used to compute the Faraday rotation or SMOS satellite PVT is simulated every 1.2*N sec in case the MPL_ORBSCT is used 	
06	Magnetic_Model_ID	Integer	NA	1byte	%1d	<p>This field can have one of the following values:</p> <ul style="list-style-type: none"> 1 The magnetic model used in the computation of the Faraday rotation is the IGRF 10 2 GeoMagnetic-1 user defined Magnetic model (interface as provided in the SUM) 3 GeoMagnetic-2 user defined Magnetic model (interface as provided in the SUM) 	CEC Team / L1 ESL
07	Faraday_Computation_Method	Integer	NA	1byte	%1d	<p>This field can have one of the following values:</p> <ul style="list-style-type: none"> 0 Simplified computation method used 1 Precise computation method used 	CEC Team / L1 ESL
08	Simulated_Acq_Start_Time	string	N/A	22 bytes	%22s	<p>Simulated Acquisition Start time for orbit propagation. Only used if no input telemetry file. Format is (yyyymmddThmmss.dddddd)</p>	CEC Team / L1 ESL



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
09	<i>Simulated_Acq_Duration</i>	Date (float)	second s	Float (4bytes)	1 element	Simulated Acquisition Duration for orbit propagation. Only used if no input telemetry file.	CEC Team / L1 ESL
10	<i>Algorithm_Configuration</i>	Closing Tag				Tag closing the Algorithm_Parameters dataset	
11	<i>Data_Block</i>	Tag				Tag ending the datablock of the product.	

Table 5-37 Faraday Rotation Post-processor Configuration File Product Data Block

5.2.25 Bulletin B File (AUX BULL B)

5.2.25.1 Specific Product Header

The Fixed Header in the HDR file will follow the structure and values detailed in table 5.1, taking into account next rules:

- **Validity_Period/Validity_Start:** Beginning of the first date in “Final values” section of the native file. Normally is the second day of the second previous month to the month for which the bulletin is applicable. I. e., for the file of May 2010 is “2010 3 2”, but in format:

Validity_Start = ‘UTC=2010-03-02T00:00:00’

Precise_VValidity_Start = ‘UTC=2010-03-02T00:00:00.000000’

- **Validity_Period/Validity_Stop:** Midnight of the last day in “Final values” section of the native file.. Normally is the second day of the month after the bulletin file is applicable. I. e., for the file of May 2010 is “2010 4 2”, but in format:

Validity_Stop = ‘UTC=2010-04-01T23:59:59’

Precise_VValidity_Stop = ‘UTC=2010-04-01T23:59:59.999999’



The Variable_Header/Specific_Product_Header/Main_SPH in the HDR file will follow the structure and values detailed in table 5-2. The specific valid Reference Data Sets for the AUX_BULL_B products are:

Reference Data Set Name	Product Type	Description
IERS_BULL_B_RAW_FILE	bulletinb.xxx	File containing raw data values of IERS Bulletin B in plain text for generation of AUX_BULL_B file.

Table 5-38 AUX_BULL_B Reference Data Sets

5.2.25.2 Data Block

The data block of the AUX_BULL_B ADF contains the International Earth Rotation and Reference System Service (IERS) Bulletin B file. The IERS Bulletin B file can be found in two formats:

- Up to Jan 2010 in the file and format described in <ftp://hpiers.obspm.fr/iers/bul/bulb/BULLETINB.html>. The files can be found in URL <ftp://hpiers.obspm.fr/iers/bul/bulb/>.
- Since Feb 2010 to the present in the file and format described in ftp://hpiers.obspm.fr/iers/bul/bulb_new/bulletinb.pdf. The files can be found in URL ftp://hpiers.obspm.fr/iers/bul/bulb_new/.

The values contained in the Bulletin B are the final ones over one month (2 months before the month in which the file is released) and provisional extension over the next month.

The XML R/W API is not able to read the data block of this file due the plain text content.

5.2.26 RFI Positions List (AUX_RFILST)

The Global RFI Positions List ADF provides a list of locations in which RFI has been detected.

The SPH contains only the Main_SPH_for_XML structure as defined in Table 5-3.



The data block of the AUX_RFILST ADF contains a list of RFI locations, with the following fields in the following table. It is expected that the number of global RFI sources will not exceed 1000-2000 elements at maximum, so the formatting of the ADF is set to XML ASCII.

Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
01	<i>Data_Block</i>	Tag				Tag starting the datablock of the product.	
02	<i>RFI_List</i>	Starting Tag				Tag starting the RFI List dataset	
03	<i>List_of_RFI_Sources</i>	Starting Tag				List containing the RFI_Source data structures, , with "count" field (count=number of RFI sources)	
04	<i>RFI_Source</i>	Starting Tag				Init of RFI_Source structure	
05	<i>RFI_Name</i>	char	N/A	20	%20s	With the purpose of coordination with foreign telecommunication ministries, a common name to know whether an existing RFI has been disconnected is considered helpful.	
06	<i>Latitude</i>	double	deg	6bytes	%+03.2f	Latitude of the RFI source [-90, 90]	
07	<i>Longitude</i>	double	deg	7bytes	%+04.2f	Longitude of the RFI source [-180, 180]	



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
08	<i>RFI_Flagging</i>	Integer	N/A	1 byte	%01d	<p>RFI flagging condition of grid point over the ellipsoid. The possible values are:</p> <ul style="list-style-type: none"> 0 – No action for current RFI pixel. For the future, this value shall be the default action to take. 1 – Flag the RFI position using all pixels within a circle of radius r_n in cosines domain (ξ-η) around RFI position 2 – Flag all pixels within a circle of radius r_n in cosines domain (ξ-η) around RFI position, as well as its tails 3 – Flag the snapshot as corrupted without any mitigation 	
09	<i>RFI_Mitigation</i>	integer	N/A	1 byte	%01d	<p>RFI mitigation condition of RFI Source over the ellipsoid. The possible values are:</p> <ul style="list-style-type: none"> 0 – No action for current RFI pixel. For the future, this value shall be the default action to take. 1 – Apply RFI Mitigation Algorithm 	
10	<i>RFI_BT_XX</i>	double	K	9 bytes	%09.2f	<p>T_B of the RFI computed in XX pol based on observational data. Field used to classify the source as W, S or VS RFI and act accordingly.</p> <p>Note: This value (or a fraction of it) is used to compute the circle radius for the flagging algorithm.</p>	



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
11	<i>RFI_BT_YY</i>	double	K	9 bytes	%09.2f	<p>T_B of the RFI computed in $-YY$ pol based on observational data. Field used to classify the source as Weak (W), Strong (S) or Very Strong (VS) RFI and act accordingly.</p> <p>Note: This value (or a fraction of it) is used to compute the circle radius for the flagging algorithm.</p>	
12	<i>RFI_BT_XY_Real</i>	double	K	9 bytes	%+08.2f	<p>T_B of the RFI computed in XY pol based on observational data. Field used to classify the source as W, S or VS RFI and act accordingly.</p> <p>Note: For the current release, this field is not used.</p>	
13	<i>RFI_BT_XY_Imag</i>	double	K	9 bytes	%+08.2f	<p>T_B of the RFI computed in XY pol based on observational data. Field used to classify the source as W, S or VS RFI and act accordingly.</p> <p>Note: For the current release, this field is not used</p>	
14	<i>RFI_Mode</i>	Char	N/A	10 bytes	%10s	<p>The possible values are:</p> <ul style="list-style-type: none"> • Permanent • Pulsed • Scanning • Unknown 	



Field #	Field Name	Type	Unit	String Length	C Format	Comment	Origin
15	<i>RFI_Algorithm</i>	integer	N/A	1 byte	%01d	The possible values are: <ul style="list-style-type: none"> 0 – Use default algorithm (currently DEIMOS' one) 1 – Use DEIMOS's algorithm 2 – Use Algorithm #2 (TBD) 3 – Use Algorithm #3 (TBD) 	
16	<i>RFI_Source</i>	Ending Tag				End of RFI_Source structure	
17	<i>List_of_RFI_Sources</i>	Ending Tag				End of List containing the RFI_Source data structures,	
18	<i>RFI_List</i>	Ending Tag				Tag ending the RFI List dataset	
19	<i>Data_Block</i>	Ending Tag				Tag ending the Data_Block	

Table 5-39 Global RFI Positions List Product Data Block

5.2.27 Static Fresnel Model (AUX_FRSNEL_)

The auxiliary file contains the brightness temperature of the Fresnel model for every possible pixel to be observed by the instrument. The model is computed inside a maximum Earth ellipse in antenna frame (xi-eta coordinates) and is used in the computation of the artificial Gibbs 2 scene for each snapshot.

The AUX_FRSNEL_ auxiliary data product consists of 4 datasets, each one corresponding to the 4 polarisation (item 1 is for X pol, 2 item for Y pol, 3 item for Re(XY) and 4 item for Im(XY)). Each item has a "Fresnel_BT" dataset record with 38416 double-64 values.



During image reconstruction, the **AUX_FRSNEL_** will be used in the computation of the Gibbs 2 artificial scene for each snapshot. All the pixels in each snapshot will be classified according to their water fraction. Each xi-eta pixel containing water will retrieve the brightness temperature from the corresponding pixel in this file and will use it to compute the water contribution to the artificial temperature.

The size of the Static Fresnel product is about 1230 KB. The following table describes the binary format of the **AUX_FRSNEL_** data block.

Field #	Field Name	Type	Unit	Element Precision	Variable Format	Comment	Origin
	Data_Block					Init of binary Data Block in the product.	
	Sea_Fresnel_Temperatures				List of 4 Scene_Fresnel_BT	Init of binary Data Set containing the Fresnel Model for each polarisation	
01	Scene_Fresnel_BT	Matrix of real values	K	double-64 (8 bytes)	Vector of 4x38416 elements	Fresnel model sea brightness temperature at L-band for X, Y, Re(XY) and Img(XY) polarization on antenna frame	CESBIO
	Sea_Fresnel_Temperatures					End of binary Data Set containing Fresnel Model.	
	Data_Block					End of binary Data Block in the product.	

Table 5-40 Static Fresnel Model Product Data Block



6. PRODUCTS SIZES ESTIMATIONS

The following is a list of the size of each of the products specified in this document. The headers sizes can be approximated by 4 KB each, considering both FH and VH. For the data blocks, their sizes have been obtained following two procedures:

- The binary products are obtained after counting the size of each DataSet Record and assuming a certain typical number of data set records, including the overlap as defined in [RD.6] (assumed to consist of 100 scenes).
- The XML ASCII products sizes have been obtained after creating examples of each product and looking at its size in the disk.

PRODUCT SIZE ESTIMATIONS					
Type of Data		Fixed fields	Size of data set record (DSR)	Typical number of DSR in a product	Total size of product
Product	Data Set				
TLM_MIRA1A	HKTM_Data	4 bytes	1717 bytes	2700	4549504 ≈4,34 MB
MIR_UAVD1A	Mean_Offset	4 bytes	41229 bytes	1	5501272 ≈ 1.3MB
	All_LICEF	4 bytes	1533 bytes	844	
	Cons_All_LICEF	4 bytes	2133 bytes	1	
MIR_CRSD1A	Cons_PMS_Coefficients	0 bytes	2756 bytes	1	
	Cons_Long_PMS_Coefficients	4 bytes	2856 bytes	48	
	Cons_Ampl_FWF_Origin	0 bytes	23337 bytes	1	



PRODUCT SIZE ESTIMATIONS

Type of Data		Fixed fields	Size of data set record (DSR)	Typical number of DSR in a product	Total size of product
Product	Data Set				
	Cons_Long_Ampl_FWF_Origin	4 bytes	23341 bytes	48	1345085≈1.3MB
	Cons_PMS_Offsets	0 bytes	980	1	
	Cons_Short_PMS_Offsets	4 bytes	984	26	
	Cons_LFE_Coefficients	0 bytes	3884	1	
	Cons_External_LFE_Coefficients	4 bytes	3884	8	
MIR_CSTD1A	Cons_Phase_FWF_Origin	4 bytes	23341 bytes	40	933665 ≈1 MB
	Cons_LO_Unlock	4 bytes	25	1	
MIR_AFWD1A	Cons_FWF_Measurements	4 bytes	40945 bytes	3	227684 ≈0.217 MB
	Cons_FWF_Coefficients	4 bytes	104841 bytes	1	
MIR_ANIR1A	Cons_NIR_A_External	4 bytes	477 bytes	6	5671≈05.6KB
	Cons_NIR_R_External	4 bytes	332 bytes	6	
	Avg_NIR_A_External	0 bytes	477 bytes	1	
	Avg_NIR_R_External	0 bytes	332 bytes	1	



PRODUCT SIZE ESTIMATIONS

Type of Data		Fixed fields	Size of data set record (DSR)	Typical number of DSR in a product	Total size of product
Product	Data Set				
MIR_SC_D1A / MIR_TARD1A	Calibrated_Visib_Dual	4 bytes	41904 bytes	2x1350	113140804≈107.9 MB
MIR_SC_F1A / MIR_TARF1A	Calibrated_Visib_Full	4 bytes	42481 bytes	5330	226423734 ≈216MB
MIR_GMATD_	G_Matrix				19664074752 bytes ≈ 18.31 GB
MIR_JMATD_	J_Matrix				1428634752 bytes ≈ 1.33 GB
MIR_FTTD__	Flat_Target_Transformation	4 bytes	225410	10	2254104bytes ≈2,15 MB
MIR_FTTF__	Flat_Target_Transformation	4 bytes	383958	10	3839584bytes ≈3,66 MB
MIR_SC_D1B / MIR_TARF1B	Temp_Snapshot_Dual	4 bytes	22521 bytes	2x1350	60979508≈58.15 MB
	Scene_Bias_Correction	4 bytes	64 bytes	2x1350	
MIR_SC_F1B / MIR_TARF1B	Temp_Snapshot_Full	4 bytes	22521 bytes	4x1350	121786208 ≈116.144 MB
	Scene_Bias_Correction	4 bytes	64 bytes	2x1350	
MIR_SCLD1C / MIR_SCSD1C	Swath_Snapshot_List	4 bytes	167 bytes	2700	311490923≈297.06 MB
	Temp_Swath_Dual	19 bytes	24 bytes	2x1350x4800	
MIR_SCLF1C /	Swath_Snapshot_List	4 bytes	167 bytes	2700	544770923≈519.53M



PRODUCT SIZE ESTIMATIONS

Type of Data		Fixed fields	Size of data set record (DSR)	Typical number of DSR in a product	Total size of product
Product	Data Set				
MIR_SCSF1C	Temp_Swath_Full	19 bytes	28 bytes	3x1350x4800	B
MIR_BWLD1C / MIR_BWSD1C	Temp_Browse	4 bytes	46 bytes	100000	4600004 ≈4.38 MB
MIR_BWLD1C / MIR_BWSD1C	Temp_Browse	4 bytes	74 bytes	100000	7400004 ≈7.06 MB
AUX_PMS__	PMS_Characterisation				163 KB
AUX_NIR__	NIR_Characterisation				14 KB
AUX_PLM__	PLM_Parameters				46 KB
AUX_SPAR__	NDN_S_Parameters Switch_S_Parameters				1396 KB
AUX_LCF__	LICEF_Characterisation				92 KB
AUX_PATT__	Antenna_Pattern_Coordinates	0 bytes	614656	1	1067672456 bytes = 1.06 GB
	Average_Antenna_Patterns	0 bytes	614657 bytes	8	
	Antenna_Patterns	0 bytes	1843994 bytes	72x8	
AUX_FAIL__	Failing_Components				450 KB
AUX_BWGHT	Baseline_Weights				329 kB
AUX_BFP__	Best_Fit_Plane				4KB



PRODUCT SIZE ESTIMATIONS

Type of Data		Fixed fields	Size of data set record (DSR)	Typical number of DSR in a product	Total size of product
Product	Data Set				
AUX_MISP__	Mispointing				10 kB
AUX_DGG__	Discrete_Global_Grid	0 bytes	12+ 2621422/10x16 bytes	10	41942872 ≈40 MB
AUX_LSMASK	Land_Sea_Mask	0 bytes	12+ 2621422/10x6 bytes	10	15728652 ≈15 MB
AUX_MASK__	L1C_Pixel_Mask	0 bytes	12+ 2621422/10x5 bytes	10	13107230 ≈12.5 MB
AUX_GALAXY	Original_Galaxy_Map	0 bytes	16x721x1441	1	16623376 bytes ≈ 15.85 MB
AUX_GALNIR	NIR_BT_Galaxy_Map	0 bytes	8x721x1441	1	8311688bytes ≈ 7.93 MB
AUX_SUNT__	Sun_Measured_Temperatures	4 bytes	28 bytes	100?	2804? Bytes
AUX_MOONT_	Moon_Measured_Temperatures	4 bytes	28 bytes	100?	2804? bytes
AUX_VTEC_P AUX_VTEC_R AUX_VTEC_C	VTEC_Info	4	1x16+73x[22+2x73]= 12280 bytes	13	159640 ≈ 155.89 kB
AUX_APDS__ / AUX_APDL__	Apodisation_Function				275 kB



PRODUCT SIZE ESTIMATIONS

Type of Data		Fixed fields	Size of data set record (DSR)	Typical number of DSR in a product	Total size of product
Product	Data Set				
AUX_RFI__	RFI_Mask	120 bytes	12+ 2621422/10x5 bytes	10	13107230 ≈12,5 MB
AUX_BSCAT_	Bistatic_Scattering_Coefficients	0 bytes	10952	1	10952 bytes
AUX_FARA_P AUX_FARA_R AUX_FARA_C	Grid_Points_List	4 bytes	18Bytes+ 190x19Bytes = 3628 Bytes	120,000	435360004≈ 415,2 MB
AUX_CNFL1P	Algorithm_Configuration_L1_Constants				~16 kB
AUX_CNFFAR	Algorithm_Configuration_Faraday				~10 kB
MPL_ORBSCT	N/A				~3kB
AUX_BULL_B	N/A				~20 kB
AUX_RFILST	N/A				~200 kB
AUX_FRSNEL	Sea_Fresnel_Temperatures	8 bytes	8*38415=153660 Bytes	4	~1230 kB

Table 6-1 Products sizes

7. APPENDIX A: L1C PRODUCTS CONSOLIDATION

This appendix overviews how the L1C products are consolidated.

The L1C consolidation concept is based on including enough information in the L1B product to allow L1OP determining the snapshots that are used as reference to filter IN and OUT the grid points that are consolidated in the L1C products.

The main idea is that the L0, L1A and L1B MIR_SC_XYZ products contain, apart from the data stream contained between the semi-orbit boundaries (at T_0 and at T_1), the following additional data:

- Before the starting boundary of the semi-orbit, a number of snapshots filling the extent of the time overlap. This time overlap is determined at the end by the last snapshot of the previous semi-orbit (T_{-1}), and at the beginning (i.e. backwards in time) by $T_{-2} = T_{-1} - N \times 1.2$ seconds, where N is a configurable number for each APID in Level 0 Processor.
- After the ending boundary of the semi-orbit, a snapshot at time T_2 of the same APID from the next semi-orbit. Note that the interval between T_1 and T_2 is nominally 1.2 seconds, but can be higher if there is data of other APIDs in between. No difference shall be made for this last case, i.e. the snapshot at T_2 shall be included in the product.

All this additional data can be differentiated from the semi-orbit inner data stream from the sign of the Z velocity component in the corresponding ancillary data.

Given the above characteristics in the L1B product, the L1OP shall consolidate the L1C products following the next procedure:

- The first snapshot at the starting boundary of the semi-orbit, T_0 (that is the first snapshot with Z_Velocity sign matching the Ascending / Descending flag in the L1B product), shall be used to filter IN the grid points in the L1C product.
- The last snapshot after the ending boundary of the semi-orbit, T_2 , whenever its Z_Velocity sign changes from the Ascending / Descending flag of the L1B product, shall be used to filter OUT the grid points from the L1C product. In the case of a Full Pol product, this snapshot must be a pure polarisation snapshot, to allow a proper consolidation of the data.

Note that in the second bullet, if there is no change in the last snapshot wrt the inner semi-orbit data stream in the Z_Velocity sign, no filtering shall be applied, and all resulting grid points shall be included in the L1C products (i.e. it shall be assumed that no packets of this APID have been measured during the next semi-orbit).

The following figure shows the parameters defined above and the specific relations among them for consecutive semi-orbits, leading to consecutive L1C consolidated products fitting their shapes without geographical overlap. Note that the snapshot at T_2 in the first semi-orbit is the same snapshot at T_0 in the second semi-orbit.

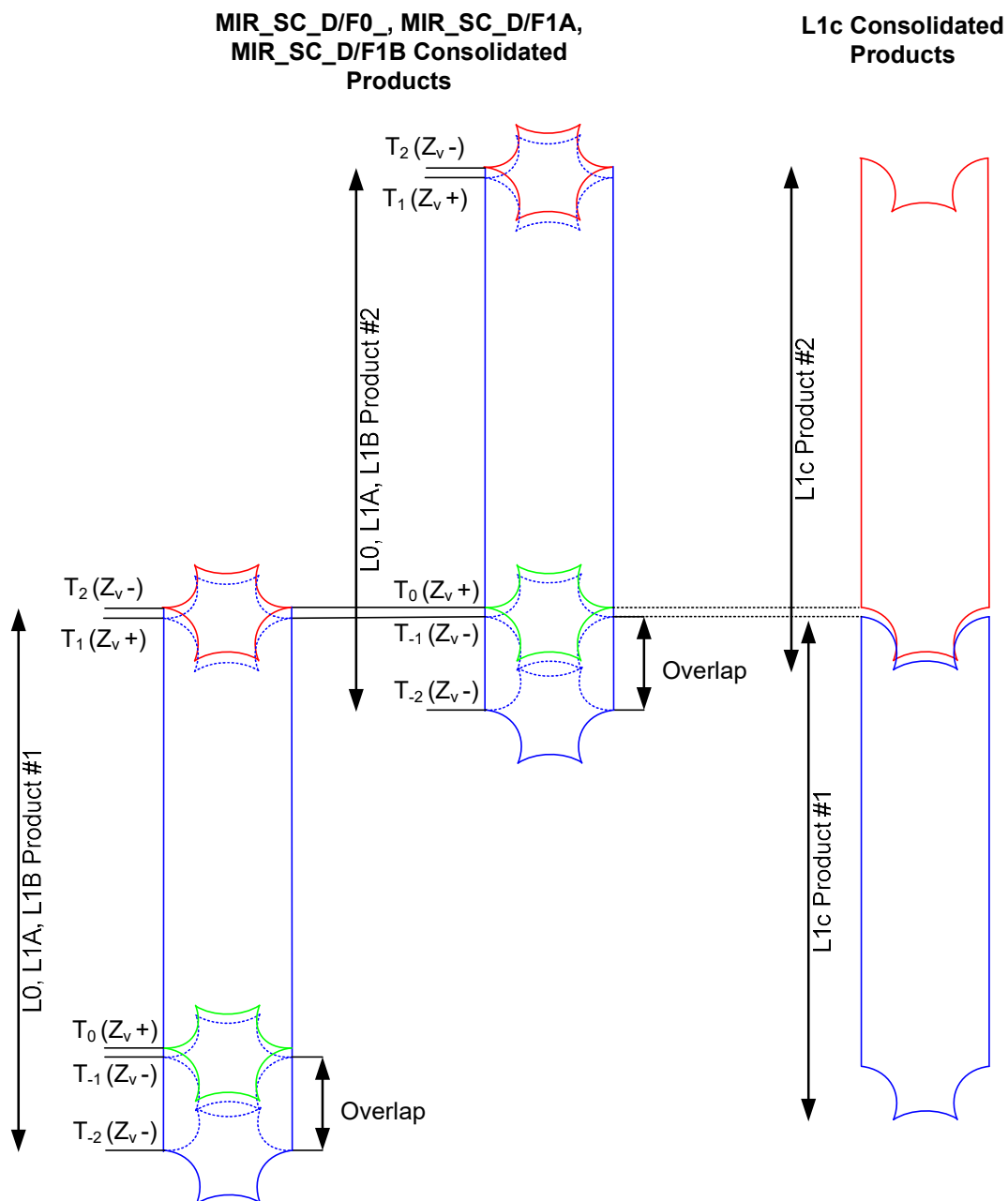


Figure 7-1 Identification of Snapshots Used as Filters in L1C Products Consolidation



8. APPENDIX B: QUALITY INFORMATION APPROACH IN THE SMOS L1 PRODUCTS

The approach followed in the design of the quality flags was to propagate the information from the lowest product level up to the L1c products. In that way the final user is warned about any potential degradation that could affect the measurement. The quality flags are grouped in four main categories: software errors, instrument errors, calibration files error and auxiliary data file errors. Quality information is provided as “general information” in the SPH as a counter of the snapshots affected by the errors and as “detailed information” as a flag associated to each snapshot. In case of products that do not have snapshots in the data block (e.g the calibration file) the counters are also provided at the level of the data block.

Information regarding the X-band status is also added in the scientific product at the level of snapshot. This will allow the detection of potentially degraded measurement when the X-band transmitter (nominal or redundant side) is activated to download the data on ground.

Information regarding the maximum value of the Quadrature corrected correlation is added in the L1a product at the level of each snapshot.

Information regarding detection of RFI is also added in the scientific product at the level of snapshot for the L1b product. The algorithm to detect RFI at the level of L1a processing is based on a configurable threshold approach.

The product size overhead is estimated as 5 bytes per snapshot roughly 12.5 KB per semiorbit. This figure corresponds to an increase of 0.3% in the case of HKTM data product and 0.005% in case of L1c product. That increase is negligible for the overall DPGS performance budget.



8.1 MPH L1 PRODUCT CONFIDENCE (VALID FOR ALL THE L1 PRODUCTS)

The definition of the field 23 in the MPH has to be as: ç

Field #	Tag Name	Type	Unit	String Length	Comment	Origin
23	Product_Confidence	string	N/A	Variable limited to 200 bytes)	"NOMINAL" all the counters in the SPH Quality information structure are set to zero " DEGRADED SW ERR" " DEGRADED INST ERR" " DEGRADED ADF ERR" " DEGRADED CAL ERR" any combination of the above strings depending on the value of the counters in the SPH Quality information structure	INT



8.2 SPH L1 GENERAL QUALITY INFORMATION (VALID FOR ALL THE L1 PRODUCTS)

The following table defines the format specification for the General Quality Information in the SPH of ALL the SMOS L1OP products.

Field #	Tag Name	Type	Unit	String Length	Comment	Origin
M+01	<i>Quality_Information</i>	structure	N/A	N/A	Tag starting of a <i>Quality_Information</i> structure	
M+02	<i>Software_Error_Counter</i>	Unsigned Integer	N/A	5 char	Number of snapshot used to generate the product affected by software error. The error could be generated in the current stage of the processing or could be inherited from the previous stage of the processing (incremental counter) In that category fall errors like: Division by zero, Non-converging iterations, NaN detection, unsuccessful matrix inversion. The detailed list of sw error detected by the L1OP V3 for each of the generated products is given in the next tables. Maximum value for the counter is limited to 99999 snapshots	INT
M+03	<i>Instrument_Error_Counter</i>	Unsigned Integer	N/A	5 char	Number of snapshot used to generate the product affected by instrument error. The instrument error could be detected in the current stage of the processing or could be inherited from the previous stage of the processing (incremental counter). The detailed list of instrument error detected by the L1OP V3 for each stage of the processing is given in the next tables. Maximum value for the counter is limited to 99999 snapshots	INT



Field #	Tag Name	Type	Unit	String Length	Comment	Origin
M+04	ADF_Error_Counter	Unsigned Integer	N/A	5 char	Number of snapshot used to generate the product affected by ADF error. ADF error occurs when the snapshot is processed by using an ADF with a validity time outside the acquisition time of the snapshot or when the ADF is missing (e.g. usage of the IRI model in the L1c processing instead of the VTEC auxiliary file.) The ADF error could be detected in the current stage of the processing or could be inherited from the previous stage of the processing (incremental counter). The detailed list of ADF error detected by the L1OP V3 for each stage of the processing is given in the next tables. Maximum value for the counter is limited to 99999 snapshots	INT
M+05	Calibration_Error_Counter	Unsigned Integer	N/A	5 char	Number of snapshot used to generate the product affected by calibration file error. Calibration file error occurs when the snapshot is processed by using a calibration file or a consolidated calibration sequence data with a validity time outside the acquisition time of the snapshot or when the calibration file is missing (e.g. usage of the on-ground NIR characterization in the AUX_PLM file instead of the on-flight NIR data from MIR_ANIR calibration file). The calibration file error could be detected in the current stage of the processing or could be inherited from the previous stage of the processing (incremental counter). The detailed list of ADF error detected by the L1OP V3 for each stage of the processing is given in the next tables. Maximum value for the counter is limited to 99999 snapshots	INT
M+06	N_Discarded_Scenes	Unsigned Integer	N/A	5 char	Number of scenes discarded from the corresponding L0 up to this product. The criteria to discard scenes a the level of single data type is defined in the next chapters That strategy could be revised during the commissioning phase Maximum value for the counter is limited to 99999 snapshots	INT



Field #	Tag Name	Type	Unit	String Length	Comment	Origin
M+07	<i>N_Invalid_Blocks</i>	Unsigned Integer	blocks	6 char	<p>Number of blocks of 24 packets in the corresponding L0 product that have at least one invalid packet.</p> <p>It can happen that SMOS DPGS receives less than 24 packets corresponding to a block. The valid packets in these blocks have to be included in the L0 product because L0 is the only copy of MIRAS raw data kept in SMOS DPGS. When they are written in the L0 product, the gaps corresponding to the missing packets in the 24-packets-blocks are filled with dummy data. Invalid blocks in the L0 are then discarded during the L1a processing.</p> <p>This statistic is computed only during L0 product generation, and is copied in all subsequent levels from the SPH of the input, for user information</p> <p>Maximum value for the counter is limited to 999999 blocks</p>	MIR / TLM
M+08	<i>N_Missing_Packets</i>	Unsigned Integer	packets	6 char	<p>Number of packets that have been inserted in the corresponding L0 product to complete blocks of 24 packets that have at least one missing/invalid packet.</p> <p>Note that no dummy packets are inserted if the complete set of 24 packets are missing (i.e. L0 Processor is not filling gaps corresponding to missing data set records).</p> <p>This statistic is computed only during L0 product generation, and is copied in all subsequent levels from the SPH of the input, for user information</p> <p>Maximum value for the counter is limited to 999999 packets</p>	MIR / TLM
M+09	<i>Quality_Information</i>	Closing				



8.3 L1A HKTM PRODUCT QUALITY FIELDS (TLM_MIRA1A)

The following table defines the Quality flags for the HKTM Product.

Field #	Tag Name	Type	Unit	Precision	Comment	Origin
	Quality_Information				Tag starting the list of the quality information	
M+01	Software_Error_flag	flag	N/A	Unsigned 1 byte	<p>0 no software errors were detected during the processing of the snapshot</p> <p>1 a software error was detected in the following cases:.</p> <ul style="list-style-type: none"> Reference voltages are zero in eq 110 (DPM L1a) and default value from AUX_PLM are used for Mcal and Qcal in eq 111 Computed Mfly from eq 110 is zero. Thermistor voltage is set to zero in eq 111. Computed Thermistor voltage Rth in eq 111 DPM L1a is zero. Division by zero in Steinhart & Hart equation solution (eq 111 DPM L1a) Thermistor temperature is set to zero. 	<p>Internal Processing</p> <p>Log level WARNING</p>



Field #	Tag Name	Type	Unit	Precision	Comment	Origin
M+02	<i>Instrument_Error_flag</i>	flag	N/A	Unsigned 1 byte	<p>A detailed table explaining the flag strategy is provided in annex-1 based on analysis of input L0 ancillary packet. In addition, the flag is set to 1 in the following cases:</p> <ul style="list-style-type: none"> • EE CFI return error upon PVT orbit propagation • Invalid arm nominal/redundant settings • LICEF and NIR-LICEF physical temperature exceed the range [15, 29]°C • NIR pulse length is larger than 1 	<p>Internal Processing</p> <p>Log level WARNING</p>
M+03	<i>ADF_Error_flag</i>	flag	N/A	Unsigned 1 byte	<p>0 No ADF error occurs when the snapshot is processed</p> <p>1 One or more ADF used to process the snapshot had a validity time outside the acquisition time of the snapshot or the ADF is missing</p>	<p>Internal Processing</p> <p>Log level WARNING</p>
M+04	<i>Calibration_Error_flag</i>	flag	N/A	Unsigned 1 byte	<p>0 No Calibration error occurs when the snapshot is processed</p> <p>1 PMS correction for heater delay cannot be applied due to no sufficient overlap and/or data gap. Detailed implementation in annex-2</p>	Internal Processing
	<i>Quality_Information</i>				Tag closing the list of the quality information	



8.3.1 SPH General Quality Information for HKTM

The following are the rules to update the counters in the SPH General Quality information structure. Log Level for discarded scene is DEBUG.

Counter Name	Condition
Software_Error_Counter	Count all the snapshots that have the Software_Error_flag set
Instrument_Error_Counter	Count all the snapshots that have the Instrument_Error_flag set plus the snapshots that have the following flag set: LAST_CMD_OK field_50 Last_Executed_Command_Error any bit from 0 to 11 set X_B_ERROR_FLAG field_39 X_Band_Error set
ADF_Error_Counter	Count all the snapshots that have the ADF_Error_flag set
Calibration_Error_Counter	Count all the snapshots that have the Calibration_Error_flag set
N_Discarded_Scenes	Count all the snapshot discarded during the HKTM L0 processing. Condition to discard HKTM L0 snapshot: <ul style="list-style-type: none">• Initialisation packet detected (G1 vector solution is 1, or PPS data is empty)• Duplicated packet detected (same OBET)



8.4 L1A SCIENCE DATA QUALITY FIELDS (MIR_SCYX1A/MIR_TARX1A)

The following table defines the Quality flags for the MIR_SCYX1A and MIR_TARX1A Products

Field #	Tag Name	Type	Unit	Precision	Comment	Origin
	<i>Quality_Information</i>				Tag starting the list of the quality information	
M+01	Software_Error_flag	flag	N/A	Unsigned 1 byte	<p>0 no software errors were detected during the processing of the snapshot</p> <p>1 a software error was detected in the corresponding HKTM snapshot OR/AND a software error was detected during the L1a scientific processing OR/AND the software error counter in the calibration data DSR used for the processing is not zero.</p> <p>The Conditions for the generation of a sw error in the L1a scientific processing are:</p> <ul style="list-style-type: none"> • Denominator in eq 26 is zero. LICEF system temperature in field 8 is set to zero. • The FWF(0) in the origin is zero in eq 6 and visibility are not divided by FWF(0). • The system temperatures in eq 6 are negative. The System temperature is set to zero. • Arcsin argument in eq. 9 not inside [-1,1] interval. Θ_{qk} is set to zero and M_{kj} in eq. 7 is set to zero • S-parameter interpolation error • G_{kj} is zero and T3 and T4 are set to zero in eq 53 • The system temperatures in eq 53 are negative. The System temperature is set to zero. 	<p>Internal Processing</p> <p>Log level DEBUG</p>



Field #	Tag Name	Type	Unit	Precision	Comment	Origin
M+02	Instrument_Error_flag	flag	N/A	Unsigned 1 byte	<p>0 no instrument errors were detected during the processing of the snapshot</p> <p>1 An instrument error was detected in the corresponding HKTM snapshot. OR/AND an instrument errors are detected in the L1a science processing OR/AND the instrument error counter in the calibration data DSR used for the processing is not zero. The conditions for an instrument error in the L1a science processing are:</p> <ul style="list-style-type: none"> Maximum number of Counts in eq 1 is zero. The Ckj is computed with Maximum number of counts set to 1 Derivative in eq 2 is zero and the computed Mukj is set to the value obtained during the previous iteration step.. Number of iteration to solve eq 2 (with ii) has reached the maximum value defined in the AUX_CNFL1P. Use the last available value for the real part of the complex correlation Number of iteration to solve eq 2 (with iq) has reached the maximum value defined in the AUX_CNFL1P. Use the last available value for the imaginary part of the complex correlation 	<p>Internal Processing</p> <p>Log level WARNING</p>
M+03	ADF_Error_flag	flag	N/A	Unsigned 1 byte	<p>0 No ADF error occurs when the snapshot is processed</p> <p>1 ADF_error_flag set in the HKTM data AND/OR one or more ADF used to process the L0 scientific snapshot had a validity time outside the acquisition time of the snapshot or the ADF is missing</p>	<p>Internal Processing</p> <p>Log level WARNING</p>
M+04	Calibration_Error_flag	flag	N/A	Unsigned 1 byte	<p>0 No Calibration error occurs when the snapshot is processed</p> <p>1 The flag is set based on the following conditions: One or more consolidated Calibration sequences used to process the snapshot had a validity coverage period outside the acquisition time of the snapshot</p>	<p>Internal Processing</p> <p>For the calibration sequence</p>



Field #	Tag Name	Type	Unit	Precision	Comment	Origin
					<p>The validity coverage period for a sequences is defined as:</p> <p>In case the snapshot acquisition time is in the future wrt the calibration sequence acquisition start and stop time the calibration sequence validity is [calibration_sequence_start_time calibration_sequence_stop_time + Validity_period]</p> <p>In case the snapshot acquisition time is in the past wrt the calibration sequence acquisition start and stop time the calibration sequence validity is [calibration_sequence_start_time - Validity_period, calibration_sequence_stop_time]</p> <p>The relevant calibration sequence Validity period are defined in the AUX_CNFL1P configuration file.</p> <p>The relevant consolidated calibration sequences and the associated validity parameters in the CNFL1P auxiliary file are:</p> <ul style="list-style-type: none"> · Avg NIR-A, (from ANIR1A), <Consolidate_NIR_Calibration> Validity Period · Unoise (from UAVx1A), <Unoise_Calibration> Validity Period · FWF0 amplitude (From CRSx1A), <Consolidate_FWF_Origin_Calibration> Validity Period · PMS (From CRSx1A), <Consolidate_PMS_Calibration> Validity Period · L1 Coefficients (From CRSx1A), <Consolidate_L1_External> Validity Period. Condition used only in case the L1 coefficients are not set to zero. <p>In case more than one record is available in the product the selected sequence is the one with the sensing start time closer to the snapshot sensing time</p> <p>For the LO calibration (FWF0 phase from the MIR_CSTD1A data type) the flag is raised in the following cases:</p>	<p>Log level DEBUG</p> <p>For the calibration files Log level WARNING</p>



Field #	Tag Name	Type	Unit	Precision	Comment	Origin
					<p>science data is outside the coverage of the LO sequence and the closest LO data is used (i.e. its validity is by definition zero)</p> <p>FWF(0) phase is not interpolated between two Local Oscillator (LO) calibration due to L0 unlock event</p> <p>FWF(0) phase is interpolated between two adjacent Local Oscillator (LO) calibration separated more than 660 sec</p> <p>In case of different correlation layer between ANIR1A and the science snapshot the leakage and cross-coupling factor from the NIR1A are assumed set to zero and the calibration flag is raised in the science data</p> <p>One or more Calibration file is missing. A default pre-launch value from the ADF was used</p> <p>The corresponding HKTLM 1A snapshot has the flag set.</p>	
	<i>Quality_Information</i>				Tag closing the list of the quality information	

The following Mkj information for the Calib_Data data set record in the L1a scientific Data block provides input information for the RFI detection implemented in the L1b processor..

Field #	Tag Name	Type	Unit	Precision	Comment	Origin
14	<i>Max_Mkj_module</i>	Double		4 bytes	Maximum value of the module of the Normalised Quadrature Corrected Correlation	Internal Processing



The following record in the L1a scientific Data block provides X-band status Information for each snapshot in nominal and external pointing.

Field #	Tag Name	Type	Unit	Precision	Comment	Origin
15	<i>X -Band</i>	Integer	N/A	Unsigned 1 byte	0 X-Band Transmitter OFF 1 X-Band Transmitter ON (Nominal side) 2 X-Band Transmitter ON (Redundant side) 3 X-Band Transmitter ON (Nominal and Redundant side)	Internal Processing

8.4.1 SPH General Quality Information for L1a Scientific products

The following are the rules to update the counters in the SPH General Quality information structure. Log Level for discarded scene is DEBUG

Counter Name	Condition
<i>Software_Error_Counter</i>	Count all the snapshots that have the <i>Software_Error_flag</i> set
<i>Instrument_Error_Counter</i>	Count all the snapshots that have the <i>Instrument_Error_flag</i> set
<i>ADF_Error_Counter</i>	Count all the snapshots that have the <i>ADF_Error_flag</i> set



Counter Name	Condition
Calibration_Error_Counter	Count all the snapshots that have the Calibration_Error_flag set
N_Discarded_Scenes	<p>Count all the snapshot discarded during the L1a processing. The following are the rules used to discard the processing of a science snapshots:</p> <ul style="list-style-type: none">• Missing corresponding HKTM L1a snapshots• Corrupted data (field 47) flag set in the corresponding HKTM L1a snapshot• Invalid Polarization mode (field 34) in the corresponding HKTM L1a snapshot• Duplicate L0 science snapshot (same OBET)• Snapshot instrument layer NOT in agreement with the one annotated in the calibration file (only for UAVD1A, CRSD1A and CSTD1A products – see Calibration Error Flag notes above for ANIR product data handling)• Cross-polarization snapshots without two neighbor with opposite pure polarization (only applicable for Full polarization data)• At least one full CMN thermistors in failure (6 thermistors with readings at 0)

8.5 L1B SCIENCE DATA QUALITY FIELDS (MIR_SCYX1B/MIR_TARX1B)

The following table defines the Quality flags for the MIR_SCYX1B and MIR_TARX1B Products

Field #	Tag Name	Type	Unit	Precision	Comment	Origin
	<i>Quality_Information</i>				Tag starting the list of the quality information	
M+01	Software_Error_flag	flag	N/A	Unsigned 1 byte	0 no software errors were detected during the processing of the snapshot 1 a software error was detected in the corresponding HKTM / L1a snapshot OR/AND a software error was detected during the L1b scientific processing Conditions for SW error in the L1b scientific processing: <ul style="list-style-type: none"> SW error from the EE CFI Library 	Internal Processing Log level WARNING
M+02	Instrument_Error_flag	flag	N/A	Unsigned 1 byte	0 no instrument errors were detected during the processing of the snapshot 1 An instrument error was detected in the processing of the L1a snapshot. Currently there is no identification of instrument error in the processing of L1b science data.	Internal Processing



Field #	Tag Name	Type	Unit	Precision	Comment	Origin
M+03	ADF_Error_flag	flag	N/A	Unsigned 1 byte	<p>0 No ADF error occurs when the snapshot is processed</p> <p>1 ADF_error_flag set in the L1a data AND/OR one or more ADF used to process the L1a scientific snapshot had a validity time outside the acquisition time of the snapshot or the ADF is missing</p>	<p>Internal Processing</p> <p>Log level WARNING</p>
M+04	Calibration_Error_flag	flag	N/A	Unsigned 1 byte	<p>0 No Calibration error occurs when the snapshot is processed</p> <p>1 The flag is set based of the following conditions:</p> <p>One or more Calibration files (FTTx G and J Matrix) used to process the snapshot had a validity coverage period outside the acquisition time of the snapshot</p> <p>The validity coverage period for a calibration file is defined as: In case the snapshot acquisition time is in the future wrt the calibration sequence acquisition start and stop time the calibration sequence validity is [calibration_sequence_start_time calibration_sequence_stop_time + Validity_period]</p> <p>In case the snapshot acquisition time is in the past wrt the calibration sequence acquisition start and stop time the calibration sequence validity is [calibration_sequence_start_time - Validity_period, calibration_sequence_stop_time]</p> <p>The relevant calibration sequence Validity_period are defined in the AUX_CNFL1P configuration files and are the following: for the G Matrix <Consolidate_FWF_Shap> validity period for the J matrix <Consolidate_FWF_Shap> validity period for the FTTx <FTTx_Calibration> validity period</p>	<p>Internal Processing</p> <p>For the calibration sequence</p> <p>Log level DEBUG</p> <p>For the calibration files</p> <p>Log level WARNING</p>



Field #	Tag Name	Type	Unit	Precision	Comment	Origin
					<p>In case more than one record is available in the product the selected sequence is the one with the sensing start time closer to the snapshot sensing time</p> <p>One or more Calibration file is missing. A default pre-launch value from the ADF was used.</p> <p>This error will also be set when an orphan scene is processed without a neighbor in the opposite polarization and in ALL-LICEF mode. This event will force the usage of the NIR BT for the unavailable polarization, a warning will be logged and the quality flag set for this scene.</p>	
	<i>Quality_Information</i>				Tag closing the list of the quality information	

The following X-band status Information structure is present in the L1b scientific Data block for each snapshot (copied from the L1a snapshot).

Field #	Tag Name	Type	Unit	Precision	Comment	Origin
30	<i>X-Band</i>	Integer	N/A	Unsigned 1 byte	<p>0 X-Band Transmitter OFF</p> <p>1 X-Band Transmitter ON (Nominal side)</p> <p>2 X-Band Transmitter ON (Redundant side)</p> <p>3 X-Band Transmitter ON (Nominal and Redundant side)</p>	Internal Processing



8.5.1 SPH General Quality Information for L1b Scientific products

The following are the rules to update the counters in the SPH General Quality information structure. Log Level for discarded scene is DEBUG

Counter Name	Condition
Software_Error_Counter	Count all the snapshots that have the Software_Error_flag set
Instrument_Error_Counter	Count all the snapshots that have the Instrument_Error_flag set
ADF_Error_Counter	Count all the snapshots that have the ADF_Error_flag set
Calibration_Error_Counter	Count all the snapshots that have the Calibration_Error_flag set
N_Discarded_Scenes	<p>Add to the counter in the L1a input product the number of L1a snapshot discarded during the L1b processing. Conditions to discard L1a snapshots are:</p> <ul style="list-style-type: none">• Missing corresponding HKTM L1a snapshots• Invalid Polarization mode (field 34) in the corresponding HKTM L1a snapshot• Snapshot instrument layer NOT in agreement with the one annotated in the calibration file• Missing complete sequence of VHH, HVH, HHV or HVV, VHV, VVH snapshots in the input L1a data (or same internal value for the NRTP). Only for the Full polarization product• Scenes not belonging to a pair HHH-HHV or V-VVH (In Full Pol mode image processing only a pair of Pure Pol scena + Mixed Pol scene can be processed).



8.6 L1C SCIENCE DATA QUALITY FIELDS (MIR_SCYX1C)

The following table defines the Quality flags for the MIR_SCYX1C

Field #	Tag Name	Type	Unit	Precision	Comment	Origin
	<i>Quality_Information</i>				Tag starting the list of the quality information	
M+01	Software_Error_flag	flag	N/A	Unsigned 1 byte	0 no software errors were detected during the processing of the snapshot 1 a software error was detected in the corresponding L1b snapshot OR/AND a software error was detected during the L1c scientific processing Conditions for SW error in the L1c scientific processing: <ul style="list-style-type: none"> IGRF magnetic model returned an error code. In that case a default zero value is used IRI electron model returned an error code. In that case a default zero value is used 	Internal Processing Log level DEBUG
M+02	Instrument_Error_flag	flag	N/A	Unsigned 1 byte	0 no instrument errors were detected during the processing of the snapshot 1 An instrument error was inherited from the corresponding L1b snapshot. Currently there is no identification of instrument error in the processing of L1b science data.	Internal Processing



Field #	Tag Name	Type	Unit	Precision	Comment	Origin
M+03	ADF_Error_flag	flag	N/A	Unsigned 1 byte	0 No ADF error occurs when the snapshot is processed 1 ADF_error_flag set in the L1b data AND/OR <ul style="list-style-type: none"> one or more ADF used to process the L1c scientific snapshot had a validity time outside the acquisition time of the snapshot or the ADF is missing (e.g. VTEC) IGRF magnetic model returned a warning (out of validity). IGRF computation is extrapolated. 	Internal Processing Log level WARNING
M+04	Calibration_Error_flag	flag	N/A	Unsigned 1 byte	0 No Calibration file error occurs when the snapshot is processed 1 Calibration_error_flag set in the corresponding L1b data.	Internal Processing
	Quality_Information				Tag closing the list of the quality information	

The following X-band status Information structure is present in the L1c scientific Data block for each snapshot (copied from the L1b snapshot).

Field #	Tag Name	Type	Unit	Precision	Comment	Origin
25	X-Band	Integer	N/A	Unsigned 1 byte	0 X-Band Transmitter OFF 1 X-Band Transmitter ON (Nominal side) 2 X-Band Transmitter ON (Redundant side) 3 X-Band Transmitter ON (Nominal and Redundant side)	Internal Processing



8.6.1 SPH General Quality Information for L1c Scientific products

The following are the rules to update the counters in the SPH General Quality information structure. Log Level for discarded scene is DEBUG

Counter Name	Condition
<i>Software_Error_Counter</i>	Count all the snapshots that have the <i>Software_Error_flag</i> set
<i>Instrument_Error_Counter</i>	Count all the snapshots that have the <i>Instrument_Error_flag</i> set
<i>ADF_Error_Counter</i>	Count all the snapshots that have the <i>ADF_Error_flag</i> set
<i>Calibration_Error_Counter</i>	Count all the snapshots that have the <i>Calibration_Error_flag</i> set
<i>N_Discarded_Scenes</i>	<p>Add to the counter in the L1b input product the number of L1b snapshot discarded during the L1C processing.</p> <p>NaN detected during BT computation. The associated snapshot is discarded and measurements are NOT provided at grid point level.</p> <p>Geolocation is not possible for the Extended Alias Free Field of View The associated snapshot is discarded and measurements are NOT provided at grid point level.</p>



8.7 L1C BROWSE DATA QUALITY FIELDS (MIR_BWYX1C)

The L1c Browse product contains Quality information only at the level of the SHP header (see chapter 10.1)

8.7.1 SPH General Quality Information for L1c Browse products

The following are the rules to update the counters in the SPH General Quality information structure.

Counter Name	Condition
<i>Software_Error_Counter</i>	Copied from the corresponding L1c science product
<i>Instrument_Error_Counter</i>	Copied from the corresponding L1c science product
<i>ADF_Error_Counter</i>	Copied from the corresponding L1c science product
<i>Calibration_Error_Counter</i>	Copied from the corresponding L1c science product
<i>N_Discarded_Scenes</i>	Copied from the corresponding L1c science product

8.8 L1A AVERAGE UNCORRELATED NOISE QUALITY FIELDS (MIR_UAVX1A)

The following table defines the Quality flags for the MIR_UAVX1A file

Field #	Tag Name	Type	Unit	Precision	Comment	Origin
	<i>Quality_Information</i>				Tag starting the list of the quality information	
M+01	Software_Error_Counter	Integer	N/A	Unsigned 4 bytes	<p>Count the number of L0 uncorrelated snapshot processed with software error. A sw error could be inherited also from the corresponding HKTM L1 snapshot used in the processing.</p> <p>If the L0 uncorrelated snapshots has to be consolidated with the input offset data set the value of the existing counter has to be added to the number of errors detected at this stage of the processing. a software error was detected in the corresponding HKTM snapshot OR/AND a software error was detected during the uncorrelated noise processing OR/AND the software error counter CRSx1A calibration DSR used to process the uncorrelated noise is not zero.</p> <p>The Software errors detected during the uncorrelated noise processing are the same as reported for the L1a science processing (see chapter 7).</p>	<p>Internal Processing</p> <p>Log level DEBUG</p>
M+02	Instrument_Error_Counter	Integer	N/A	Unsigned 4 bytes	<p>Count the number of L0 uncorrelated snapshot processed with Instrument error.</p> <p>An instrument error was detected in the corresponding HKTM snapshot OR/AND an instrument error was detected during the uncorrelated noise processing OR/AND the instrument error counter in the CRSx1A calibration DSR used to process the uncorrelated noise is not zero.</p> <p>The Instrument errors detected during the uncorrelated noise processing are the same as reported for the L1a science processing (see chapter 7)</p>	Internal Processing



Field #	Tag Name	Type	Unit	Precision	Comment	Origin
M+03	ADF_Error_Counter	Integer	N/A	Unsigned 4 bytes	Count the number of L0 uncorrelated snapshot processed with ADF error. An ADF error could be inherited also from the corresponding HKTM L1 snapshot used in the processing. ADF error is when an ADF used to process the L0 uncorrelated noise snapshot had a validity time outside the acquisition time of the snapshot or the ADF is missing	Internal Processing Log level WARNING
M+04	Calibration_Error_Counter	Integer	N/A	Unsigned 4 bytes	Count the number of L0 uncorrelated noise snapshot processed with Calibration errors. The condition for a calibration error are: One or more Calibration sequences used to process the snapshot had a validity coverage period outside the acquisition time of the snapshot The validity coverage period for a sequences is defined as: In case the snapshot acquisition time is in the future wrt the calibration sequence acquisition start and stop time the calibration sequence validity is [calibration_sequence_start_time calibration_sequence_stop_time + Validity_period] In case the snapshot acquisition time is in the past wrt the calibration sequence acquisition start and stop time the calibration sequence validity is [calibration_sequence_start_time - Validity_period, calibration_sequence_stop_time] The calibration sequences used in the uncorrelated noise processing is the: Consolidated PMS <ul style="list-style-type: none"> FWF0 Phase The relevant consolidated calibration sequences and the associated validity parameters in the CNFL1P auxiliary file are:	IFor the calibration sequence Log level DEBUG For the calibration files Log level WARNING



Field #	Tag Name	Type	Unit	Precision	Comment	Origin
					<p>PMS (From CRSx1A), <Consolidate_PMS_Calibration> Validity Period</p> <p>For the LO calibration (FWF0 phase from MIR_CSTD1A data type) the flag is raised in the following cases:</p> <ul style="list-style-type: none">u-noise data is outside the coverage of the LO sequence and the closest LO data is used (i.e. its validity is by definition zero)FWF(0) phase is not interpolated between two Local Oscillator (LO) calibration due to L0 unlock eventFWF(0) phase is interpolated between two adjacent Local Oscillator (LO) calibration separated more than 660 sec <p>One or more Calibration file is missing. A default pre-launch value from the ADF was used.</p> <p>The corresponding HKTLM 1A snapshot has the flag set.</p>	
	Quality_Information				Tag closing the list of the quality information	



8.8.1 SPH General Quality Information for L1a uncorrelated noise products

The following are the rules to update the counters in the SPH General Quality information structure. Log Level for discarded scene is DEBUG

Counter Name	Condition
<i>Software_Error_Counter</i>	Copied from the same field in the data set record.
<i>Instrument_Error_Counter</i>	Copied from the same field in the data set record.
<i>ADF_Error_Counter</i>	Copied from the same field in the data set record.
<i>Calibration_Error_Counter</i>	Copied from the same field in the data set record.
<i>N_Discarded_Scenes</i>	<p>Count all the L0 uncorrelated noise snapshot discarded</p> <p>The condition to discard the snapshot are as defined for the L1a science processing (see chapter 7)</p> <p>L0 u-noise snapshots acquired with the attenuator active (i.e. calibration step different from 7). Those snapshots are not used for the computation of the visibility offset</p> <p>L1a u-noise snapshot with M_{kj} amplitude above a defined threshold (for any baseline) is discarded and not used for the averaging. The threshold is defined in the AUX_CNFL1P) with the scope to filter out potential RFI</p>



8.9 L1A CONSOLIDATED CORRELATED NOISE QUALITY FIELDS (MIR_CR SX1A)

The following table defines the Quality flags for the MIR_CR SX1A file. The quality flags are defined for each of the data set:

Cons_PMS_Coefficients, Cons_Long_PMS_Coefficients, Cons_Ampl_FWF_Origin, Cons_Long_Ampl_FWF_Origin,

Field #	Tag Name	Type	Unit	Precision	Comment	Origin
	Quality_Information				Tag starting the list of the quality information	
M+01	Software_Error_Counter	Integer	N/A	Unsigned 4 bytes	<p>Count the number of L0 correlated snapshot processed with software error. A sw error could be inherited also from the corresponding HKTM L1 snapshot used in the processing.</p> <p>Conditions for SW error in the L0 correlated noise processing:</p> <ul style="list-style-type: none"> • Interpolation error in the S-parameter • Processor was not able to compute the PMS offset in eq 14. PMS offset is set to 0. • Denominator of the PMS gain eq 14 is zero. Denominator used in the gain is set to 1. • FWF(0) computation: Denominator of equation 18 is zero. The denominator is set to 1 • Arcsin argument in eq. 9 not inside [-1,1] interval. Θ_{qk} is set to zero and M_{kj} in eq. 7 is set to zero 	<p>Internal Processing</p> <p>Log level DEBUG</p>
M+02	Instrument_Error_Counter	Integer	N/A	Unsigned 4 bytes	Count the number of L0 correlated noise snapshot processed with Instrument error.	Internal Processing



Field #	Tag Name	Type	Unit	Precision	Comment	Origin
					<p>An instrument error was detected in the corresponding HKTM snapshot OR/AND an instrument error was detected during the correlated noise processing</p> <p>The Instrument errors detected during the correlated noise processing are the same as reported for the L1a science processing (see chapter 7)</p>	
M+03	<i>ADF_Error_Counter</i>	Integer	N/A	Unsigned 4 bytes	<p>Count the number of L0 correlated snapshot processed with ADF error. An ADF error could be inherited also from the corresponding HKTM L1 snapshot used in the processing.</p> <p>ADF error is when an ADF used to process the L0 correlated noise snapshot had a validity time outside the acquisition time of the snapshot or the ADF is missing</p>	<p>Internal Processing</p> <p>Log level WARNING</p>
M+04	<i>Calibration_Error_Counter</i>	Integer	N/A	Unsigned 4 bytes	<p>Count the number of L0 correlated noise snapshot processed with Calibration errors.</p> <p>The condition for a calibration error are: One or more Calibration sequences used to process the snapshot had a validity coverage period outside the acquisition time of the snapshot</p> <p>The validity coverage period for a sequences is defined as: In case the snapshot acquisition time is in the future wrt the calibration sequence acquisition start and stop time the calibration sequence validity is [calibration_sequence_start_time calibration_sequence_stop_time + Validity_period]</p> <p>In case the snapshot acquisition time is in the past wrt the calibration sequence acquisition start and stop time the calibration sequence validity is [calibration_sequence_start_time - Validity_period, calibration_sequence_stop_time]</p>	<p>Internal Processing</p> <p>For the calibration sequence</p> <p>Log level DEBUG</p> <p>For the calibration files</p> <p>Log level WARNING</p>



Field #	Tag Name	Type	Unit	Precision	Comment	Origin
					<p>The relevant calibration sequence for the correlated noise processing are:</p> <ul style="list-style-type: none">• Avg ANIR-R <p>In case more than one record is available in the product the selected sequence is the one with the sensing start time closer to the snapshot sensing time</p> <p>The relevant consolidated calibration sequences and the associated validity parameters in the CNFL1P auxiliary file are:</p> <p>Avg NIR-R, (from ANIR1A), <Consolidate_NIR_Calibration> Validity Period</p> <p>One or more Calibration file is missing. A default pre-launch value from the ADF was used.</p> <p>The corresponding HKTLM 1A snapshot has the flag set.</p>	
	Quality_Information				Tag closing the list of the quality information	



8.10L1A SHORT TERM SYNTHETIC CURVE CORRELATED NOISE INJECTION QUALITY FIELDS (MIR_CSTD1A)

The following table defines the Quality flags for the MIR_CSTD1A file. The quality flags are defined for the data set: Cons_Phase_FWF_Origin,

Field #	Tag Name	Type	Unit	Precision	Comment	Origin
	Quality_Information				Tag starting the list of the quality information	
M+01	Software_Error_Counter	Integer	N/A	Unsigned 4 bytes	<p>Count the number of L0 correlated snapshot processed with software error. A sw error could be inherited also from the corresponding HKTM L1 snapshot used in the processing.</p> <p>Conditions for SW error in the L0 correlated noise processing:</p> <ul style="list-style-type: none"> • Interpolation error in the S-parameter • Processor was not able to compute the PMS offset in eq 14. PMS offset is set to 0. • Denominator of the PMS gain eq 14 is zero. Denominator used in the gain is set to 1. • FWF(0) computation: Denominator of equation 18 is zero. The denominator is set to 1 • Arcsin argument in eq. 9 not inside [-1,1] interval. Θ_{kj} is set to zero and M_{kj} in eq. 7 is set to zero 	<p>Internal Processing</p> <p>Log level DEBUG</p>
M+02	Instrument_Error_Counter	Integer	N/A	Unsigned 4 bytes	Count the number of L0 correlated noise snapshot processed with Instrument error.	Internal Processing



Field #	Tag Name	Type	Unit	Precision	Comment	Origin
					<p>An instrument error was detected in the corresponding HKTM snapshot OR/AND an instrument error was detected during the correlated noise processing</p> <p>The Instrument errors detected during the correlated noise processing are the same as reported for the L1a science processing (see chapter 7)</p>	
M+03	ADF_Error_Counter	Integer	N/A	Unsigned 4 bytes	<p>Count the number of L0 correlated snapshot processed with ADF error. An ADF error could be inherited also from the corresponding HKTM L1 snapshot used in the processing.</p> <p>ADF error is when an ADF used to process the L0 correlated noise snapshot had a validity time outside the acquisition time of the snapshot or the ADF is missing</p>	<p>Internal Processing</p> <p>Log level WARNING</p>
M+04	Calibration_Error_Counter	Integer	N/A	Unsigned 4 bytes	<p>Count the number of L0 correlated noise snapshot processed with Calibration errors.</p> <p>The condition for a calibration error are:</p> <p>One or more Calibration sequences used to process the snapshot had a validity coverage period outside the acquisition time of the snapshot</p> <p>The validity coverage period for a sequences is defined as:</p> <p style="padding-left: 20px;">In case the snapshot acquisition time is in the future wrt the calibration sequence acquisition start and stop time the calibration sequence validity is [calibration_sequence_start_time calibration_sequence_stop_time + Validity_period]</p> <p style="padding-left: 20px;">In case the snapshot acquisition time is in the past wrt the calibration sequence acquisition start and stop time the calibration sequence validity is [calibration_sequence_start_time - Validity_period, calibration_sequence_stop_time]</p>	<p>Internal Processing</p> <p>For the calibration sequence</p> <p>Log level DEBUG</p> <p>For the calibration files</p> <p>Log level WARNING</p>



Field #	Tag Name	Type	Unit	Precision	Comment	Origin
					<p>The relevant calibration sequence for the correlated noise processing are:</p> <ul style="list-style-type: none"> Avg ANIR-R <p>In case more than one record is available in the product the selected sequence is the one with the sensing start time closer to the snapshot sensing time</p> <p>The relevant consolidated calibration sequences and the associated validity parameters in the CNFL1P auxiliary file are:</p> <p>Avg NIR-R, (from ANIR1A), <Consolidate_NIR_Calibration> Validity Period</p> <p>One or more Calibration file is missing. A default pre-launch value from the ADF was used.</p> <p>The corresponding HKTLM 1A snapshot has the flag set.</p>	
	Quality_Information				Tag closing the list of the quality information	



8.10.1 SPH General Quality Information for L1a correlated noise products

The following are the rules to update the counters in the SPH General Quality information structure. Log Level for discarded scene is DEBUG

Counter Name	Condition
<i>Software_Error_Counter</i>	Sum for all the data set the software error counters in the quality information structure
<i>Instrument_Error_Counter</i>	Sum for all the data set the instrument error counters in the quality information structure
<i>ADF_Error_Counter</i>	Sum for all the data set the ADF error counters in the quality information structure
<i>Calibration_Error_Counter</i>	Sum for all the data set the Calibration error counters in the quality information structure
<i>N_Discarded_Scenes</i>	Count all the L0 correlated noise snapshot discarded in the generation of all the data set The condition to discard the snapshot are as defined for the L1a science processing (see chapter 7) <ul style="list-style-type: none">• Missing corresponding HKTM L1a snapshots• Corrupted data (field 47) flag set in the corresponding HKTM L1a snapshot• Duplicate L0 science snapshot (same OBET)



8.11 L1A AVERAGED FWF QUALITY FIELDS (MIR_AFWX1A)

The following table defines the Quality Counters for the MIR_AFWX1A file. The counters are defined for the FWF measurements data set and FWF Coefficients data set. The counters in the FWF Coefficients data set are obtained as the sum of the error counters of the measurements **used to derive the FWF Coefficients**.

Field #	Tag Name	Type	Unit	Precision	Comment	Origin
	Quality_Information				Tag starting the list of the quality information	
M+01	Software_Error_Counter	Integer	N/A	Unsigned 4 bytes	<p>Count the number of L0 correlated snapshot processed with software error. A SW error could be inherited also from the corresponding HKTM L1 snapshot used in the processing.</p> <p>Conditions for SW error in the L0 correlated noise (with time delay) processing:</p> <ul style="list-style-type: none"> As for the CRSx1A processing (see chapter 11) 	<p>Internal Processing</p> <p>Log level DEBUG</p>
M+02	Instrument_Error_Counter	Integer	N/A	Unsigned 4 bytes	<p>Count the number of L0 correlated snapshot processed with instrument error. An instrument error could be inherited also from the corresponding HKTM L1 snapshot used in the processing.</p> <p>Conditions for Instrument error in the L0 correlated noise (with time delay) processing:</p> <ul style="list-style-type: none"> As for the CRSx1A processing (see chapter 11) 	Internal Processing



Field #	Tag Name	Type	Unit	Precision	Comment	Origin
M+03	ADF_Error_Counter	Integer	N/A	Unsigned 4 bytes	Count the number of L0 correlated snapshot with time delay processed with ADF error. An ADF error could be inherited also from the corresponding HKTM L1 snapshot used in the processing. ADF error is when an ADF used to process the L0 correlated noise with time delay snapshot had a validity time outside the acquisition time of the snapshot or the ADF is missing	Internal Processing Log level WARNING
M+04	Calibration_Error_Counter	Integer	N/A	Unsigned 4 bytes	Count the number of L0 correlated noise snapshot (with time delay) processed with Calibration errors. The relevant consolidated calibration sequences and the associated validity parameters in the CNFL1P auxiliary file are: Avg NIR-R, (from ANIR1A), <Consolidate_NIR_Calibration> Validity Period	Internal Processing For the calibration sequence Log level DEBUG For the calibration files Log level WARNING
	Quality_Information				Tag closing the list of the quality information	



8.11.1 SPH General Quality Information for L1a Averaged FWF

The following are the rules to update the counters in the SPH General Quality information structure. Log Level for discarded scene is DEBUG

Counter Name	Condition
<i>Software_Error_Counter</i>	Sum the corresponding counter for all the FWF Coefficients data set available in the new output file
<i>Instrument_Error_Counter</i>	Sum the corresponding counter for all the FWF Coefficients data set available in the new output file
<i>ADF_Error_Counter</i>	Sum the corresponding counter for all the FWF Coefficients data set available in the new output file
<i>Calibration_Error_Counter</i>	Sum the corresponding counter for all the FWF Coefficients data set available in the new output file
<i>N_Discarded_Scenes</i>	<p>Sum the number of discarded scene counter of the previous input MIR_AFWx1A product (if used) with the correlated noise snapshot discarded during the processing.</p> <p>Condition to discard a L0 correlated noise (with time delay) snapshots are:</p> <ul style="list-style-type: none">• Missing corresponding HKTM L1a snapshots.• Corresponding HKTM L1a snapshot with data corrupted flag ON• Duplicated noise correlator L0 input snapshot



8.12L1A NIR QUALITY FIELDS (MIR_ANIR1A)

8.12.1 L1a Consolidated NIR Quality fields (MIR_ANIR1A)

The following table defines the Quality information for the MIR_ANIR1A file.. This structure is present in each of the following data set record:

Cons_NIR_A_External and Cons_NIR_R_External

Field #	Tag Name	Type	Unit	Precision	Comment	Origin
	Quality_Information				Tag starting the list of the quality information	
M+01	Software_Error_Counter	Integer	N/A	Unsigned 4 bytes	<p>Count the number of software error detected during the processing of the input L0 data.</p> <p>A software error was detected in the corresponding HKTM snapshot OR/AND a software error was detected during the NIR-NIR correlated noise processing</p> <p>The software error detected for the NIR-NIR correlation processing are as the one defined for the L1a science processing (see Chapter 7)</p>	<p>Internal Processing</p> <p>Log level DEBUG</p>



Field #	Tag Name	Type	Unit	Precision	Comment	Origin
M+02	<i>Instrument_Error_Counter</i>	Integer	N/A	Unsigned 4 bytes	Count the number of instrument error detected during the processing of the input L0 data. An instrument error was detected in the corresponding HKTM snapshot OR/AND an instrument error was detected during the NIR-NIR correlated noise processing The instrument error detected for the NIR-NIR correlation processing are as the one defined for the L1a science processing (see Chapter 7)	Internal Processing Log level DEBUG
M+03	<i>ADF_Error_Counter</i>	Integer	N/A	Unsigned 4 bytes	Count the number of ADF error in the data block of quality information of the input products and add the error generated in the current stage of the processing.	Internal Processing Log level WARNING
M+04	<i>Calibration_Error_Counter</i>	Integer	N/A	Unsigned 4 bytes	Count the number of NIR-NIR correlations processed with Calibration errors. Same as the L1a science processing (see Chapter 7)	Internal Processing Log level WARNING
	<i>Quality_Information</i>				Tag closing the list of the quality information	



8.12.2 L1a Averaged Consolidated NIR Quality fields (MIR ANIR1A)

The following table defines the Quality information for the MIR_ANIR1A file. This structure is present in each of the following data set record: Avg_NIR_A_External and Avg_NIR_R_External

Field #	Tag Name	Type	Unit	Precision	Comment	Origin
	Quality_Information				Tag starting the list of the quality information	
M+01	Software_Error_Counter	Integer	N/A	Unsigned 4 bytes	Sum the Software error counter of the Cons_NIR_x_External DSRs used to compute the Averaged DSR	Internal Processing Log level DEBUG
M+02	Instrument_Error_Counter	Integer	N/A	Unsigned 4 bytes	Sum the Software error counter of the Cons_NIR_x_External DSRs used to compute the Averaged DSR	Internal Processing Log level DEBUG
M+03	ADF_Error_Counter	Integer	N/A	Unsigned 4 bytes	Sum the Software error counter of the Cons_NIR_x_External DSRs used to compute the Averaged DSR	Internal Processing Log level WARNING
M+04	Calibration_Error_Counter	Integer	N/A	Unsigned 4 bytes	Sum the Software error counter of the Cons_NIR_x_External DSRs used to compute the Averaged DSR	Internal Processing Log level WARNING
	Quality_Information				Tag closing the list of the quality information	

8.12.3 SPH General Quality Information for L1a averaged NIR products

The following are the rules to update the counters in the SPH General Quality information structure.

Counter Name	Condition
<i>Software_Error_Counter</i>	Sum for all the Avg_NIR_x-External data set the software error counters in the quality information structure
<i>Instrument_Error_Counter</i>	Sum for all the Avg_NIR_x-External data set the instrument error counters in the quality information structure
<i>ADF_Error_Counter</i>	Sum for all the Avg_NIR_x-External data set the ADF error counters in the quality information structure
<i>Calibration_Error_Counter</i>	Sum for all the Avg_NIR_x-External data set the Calibration error counters in the quality information structure
<i>N_Discarded_Scenes</i>	Count all the snapshot discarded in the generation of the Cons_NIR_x_External data set due to: <ul style="list-style-type: none">• as defined for the L1a science processing (see chapter 7)• Error returned from the EE-CFI in computing the Sky pointing• Error returned from the Sky convolution computation



8.13L1B G-MATRIX QUALITY FIELDS (MIR_GMATX)

There is no specific field in the data block.

8.13.1 SPH General Quality Information for L1b G-matrix

The following are the rules to update the counters in the SPH General Quality information structure.

Counter Name	Condition
<i>Software_Error_Counter</i>	Copy the Software_Error_Counter from the input MIR_AFWFx1A file
<i>Instrument_Error_Counter</i>	Copy the Instrument_Error_Counter from the input MIR_AFWFx1A file
<i>ADF_Error_Counter</i>	Add one to the ADF error counter of the input MIR_AFWx1A product in case an ADF error is detected during the G-matrix generation.
<i>Calibration_Error_Counter</i>	Add one to the Calibration error counter of the input MIR_AFWx1A product in case a Calibration error is detected during the G-matrix generation.
<i>N_Discarded_Scenes</i>	Copy the N_Discarded_Scenes from the input MIR_AFWFx1A file



8.14L1B J-MATRIX QUALITY FIELDS (MIR_JMATX)

There is no specific field in the data block.

8.14.1 SPH General Quality Information for L1b J-matrix

The following are the rules to update the counters in the SPH General Quality information structure.

Counter Name	Condition
<i>Software_Error_Counter</i>	Copy the Software_Error_Counter from the input MIR_GMATx file If an error was generated during the matrix inversion add 1 to the one copied from the input MIR_GMATx file
<i>Instrument_Error_Counter</i>	Copy the Instrument_Error_Counter from the input MIR_GMATx file
<i>ADF_Error_Counter</i>	Copy the ADF_Error_Counter from the input MIR_GMATx file
<i>Calibration_Error_Counter</i>	Copy the Calibration_Error_Counter from the input MIR_GMATx file
<i>N_Discarded_Scenes</i>	Copy the N_Discarded_Scenes from the input MIR_GMATx file



8.15L1B FTT QUALITY FIELDS (MIR_FTTX_)

The following table defines the Quality information for the MIR_FTTX product..

Field #	Tag Name	Type	Unit	Precision	Comment	Origin
	Quality_Information				Tag starting the list of the quality information	
M+01	Software_Error_Counter	Integer	N/A	Unsigned 4 bytes	Count the number of L1a external target snapshot processed with software error. A SW error could be inherited also from the corresponding external target L1a snapshot used in the consolidation processing The additional conditions for sw error in the FTT processing are: <ul style="list-style-type: none"> SW error from the EE CFI library. 	Internal Processing Log level DEBUG
M+02	Instrument_Error_Counter	Integer	N/A	Unsigned 4 bytes	Count the number of L1a external target snapshot processed with instrument error. An instrument error could be inherited also from the corresponding external target L1a snapshot used in the processing. Currently there is no additional identification of instrument error in the processing of FTT data.	Internal Processing Log level DEBUG
M+03	ADF_Error_Counter	Integer	N/A	Unsigned 4 bytes	Count the number of L1a external target snapshot processed with ADF error. An ADF error could be inherited also from the corresponding external target L1a snapshot used in the consolidation processing. ADF error is when an ADF used to process the L1a external target snapshot had a validity time outside the acquisition time of the snapshot or the ADF is missing	Internal Processing Log level WARNING



Field #	Tag Name	Type	Unit	Precision	Comment	Origin
M+04	Calibration_Error_Counter	Integer	N/A	Unsigned 4 bytes	Count the number of L1a external target snapshot processed with Calibration errors. A Calibration error could be inherited also from the corresponding external target L1a snapshot used in the consolidation processing. Currently there is no additional identification of calibration error in the processing of FTT data	Internal Processing For the calibration files Log level WARNING
	Quality_Information				Tag closing the list of the quality information	



8.15.1 SPH General Quality Information for L1b FTT products

The following are the rules to update the counters in the SPH General Quality information structure. Log Level for discarded scene is DEBUG

Counter Name	Condition
<i>Software_Error_Counter</i>	Sum for all the FTT_data set the software error counters in the quality information structure
<i>Instrument_Error_Counter</i>	Sum for all the FTT data set the instrument error counters in the quality information structure
<i>ADF_Error_Counter</i>	Sum for all the FTT data set the ADF error counters in the quality information structure
<i>Calibration_Error_Counter</i>	Sum for all the FTT data set the Calibration error counters in the quality information structure
<i>N_Discarded_Scenes</i>	<p>Count all the L1a external snapshot discarded during the FTT consolidation processing (Sum for all the FTT data set)</p> <p>The following are the rules used to discard the L1a external snapshots:</p> <ul style="list-style-type: none">• NIR mode different from NIR-A mode• Threshold for FTT processing not reached (tilt angle or SKY TB RMS)• Invalid Polarization mode (field 34) in the corresponding HKTM L1a snapshot• Missing complete sequence of VHH, HVH, HHV or HVV, VHV, VVH snapshots in the input L1a data (or same internal value for the NRTP). Only for the Full polarization product

9. APPENDIX C: QUALITY FLAGS IN TLM1A FILES

The next table provides the detailed information to set the instrument quality flag in the TLM1A data.

HKTL L0 SO-TN-CASA-PLM-0279 v2.5 & SO-TN-CASA-PLM-0594 v3.1		HKTL L1A SO-TN-IDR-GS-0005 v5.13		
			Instrument Error Flag set	Corrupted Data flag set
	PPS_ERROR_FLAG 0= NO ERROR 1 byte	PPS_ERROR copied from PPS_ERROR_FLAG	yes if set to 1	no
CMN_X (1 x 12)	CMN_ERROR_FLAG 0= NO ERROR 1 byte	CMN_NIR_STATUS CMN status copied from CMN_ERROR_FLAG NIR status extracted from NIR_ERROR_FLAG Additional information derived also from AUX_FAIL for permanent failure	yes only for dynamic information coming from the CMN_ERROR_FLAG and NIR_ERROR_FLAG	yes only for dynamic information and if error is in the CMN
	CMN_ID Address 1 byte			
	PMS1 2 bytes			
	PMS2 2 bytes			
	PMS3 2 bytes			
	PMS4 2 bytes			
	PMS5 2 bytes			
	PMS6 2 bytes			
	Temperature meas.1 2 of 14 per CMN 2 bytes			
	Temperature meas.2 2 of 14 per CMN 2 bytes			



	TSYNC health (1bit)	TSYNC_CMN_Error copied from TSYNC health for each element connected to the CMN	yes	yes
	LCL (7 bits) one bit for each element connected to the CMN including NIR	LICEF_Status extracted from LCL including also the NIR. Additional information derived also from AUX_FAIL for permanent failure	yes only for dynamic information coming from the LCL	no
	LastCmd_OK (1bit)			
	Heater Switch (1bit)			
	Per Temp Id (3 bit)			
	LO out pow(1bit)		no	no
	LO locking (1bit)		yes if value is 0 (not phase locked)	no
	Last_Executed_CMD. Last set command executed by CMN 2 byte			
LICEF_NIR (1x3)	NIR_ERROR_FLAG 0= NO ERROR 1 byte	NIR_ERROR copied from NIR_ERROR_FLAG	yes	no
	LICEF_NIR_ID 1 byte			
	Op_Mode 1 bytes			
	V_Temp 3 bytes	NIR_Pulse_Lenght	yes if value above 1 is set to default "1"	no
	H_Temp 3 byte			
	Av_Samples 1 byte	NIR_Avg_Samples	yes if value is zero it is set to default "36"	no



	Last_Issued_CMD Last set command sent 2 bytes			
	T_SYNC_ERROR_FLAG 0= NO ERROR 1 byte	TSYNC_Error copied from T_SYNC_ERROR_FLAG	yes	yes
	T_SYNC_shape	ARM_Pol_Mode derived from T_SYNC_Shape	yes if value is not valid and Data Corrupted flag is not set	no
	T_SYNC_shape arm A			
	T_SYNC_shape arm B			
	T_SYNC_shape arm C			
Platform HK (PVT and AOCS)	AOCS 16 Words	Vector_Solution extracted from AOCS word 13 PPS status	yes if lower or equal to 1 (PVT Initialisation)	no
	PVT 18 Words			
	X-B ERROR_FLAG 0= NO ERROR 1 byte	XBAND_Error copied from X-B ERROR_FLAG	no	no
	X-B RF_level_TM 1 byte			
	X-B VCO_TM 1 byte			
	X-B Num_alim_TM 1 byte			
	X-B SSPA_alim_TM 1 byte			
	X-B Temp_TM 1 byte			
	CCU ERROR_FLAG 0= NO ERROR 1 byte	CCU_Error copied from CCU ERROR_FLAG	yes	no



	Data Corrupted (1 byte) 0=Not Corrupted 1=Corrupted	Corrupted_Data copied from Data Corrupted	no	yes
		NS_Status derived from LCF	no	no



10. APPENDIX D: SETTING QUALITY FLAG ACCORDING TO HEATER DELAY STATUS

The next table provides the detailed information to set the calibration quality flag in the TLM1A data in case the PMS cannot be corrected for the heater delay.



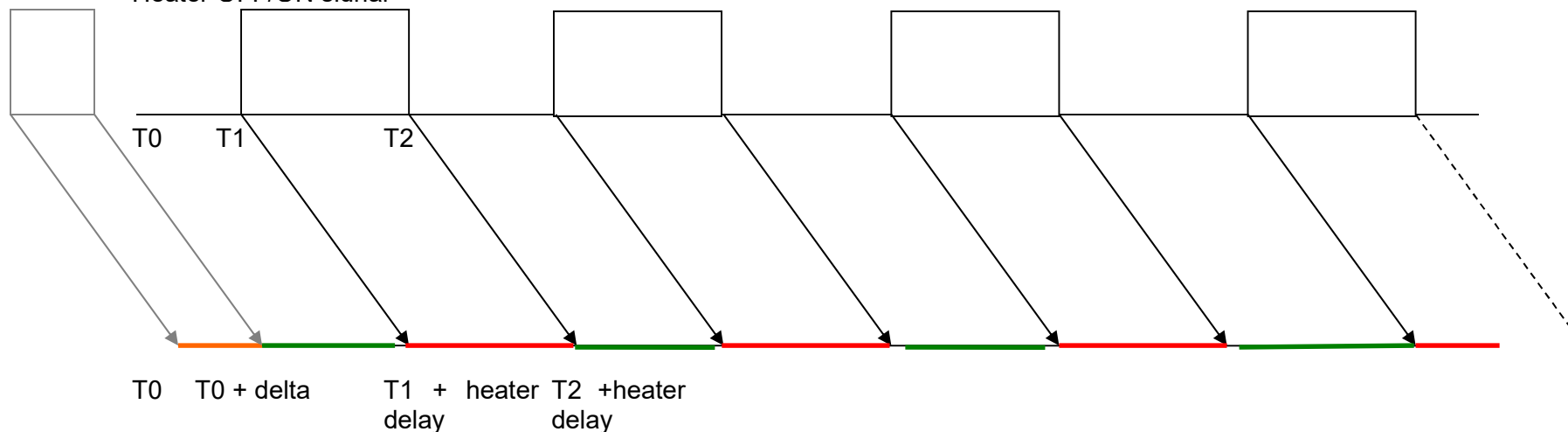
CASE-A

The initial TLM1A data $[T0, T0+\delta]$ will be flagged because PMS correction is unknown

If there is a proper overlap, data between $T0$ and $T0+\delta$ will never be used by the calibration processor (e.g. CORD0 will start always after $T0+\delta$) and Calibration file will be okay. If this is not the case, a quality flag will be set in the Calibration file (get from TLM1A) to warn the user that no correction was applied in the PMS up to $T0+\delta$

HK TLM1A

Heater OFF/ON signal



$\delta = \max(\text{heater delay})$

PMS to be corrected in red
PMS not corrected in green
PMS correction unknown orange:

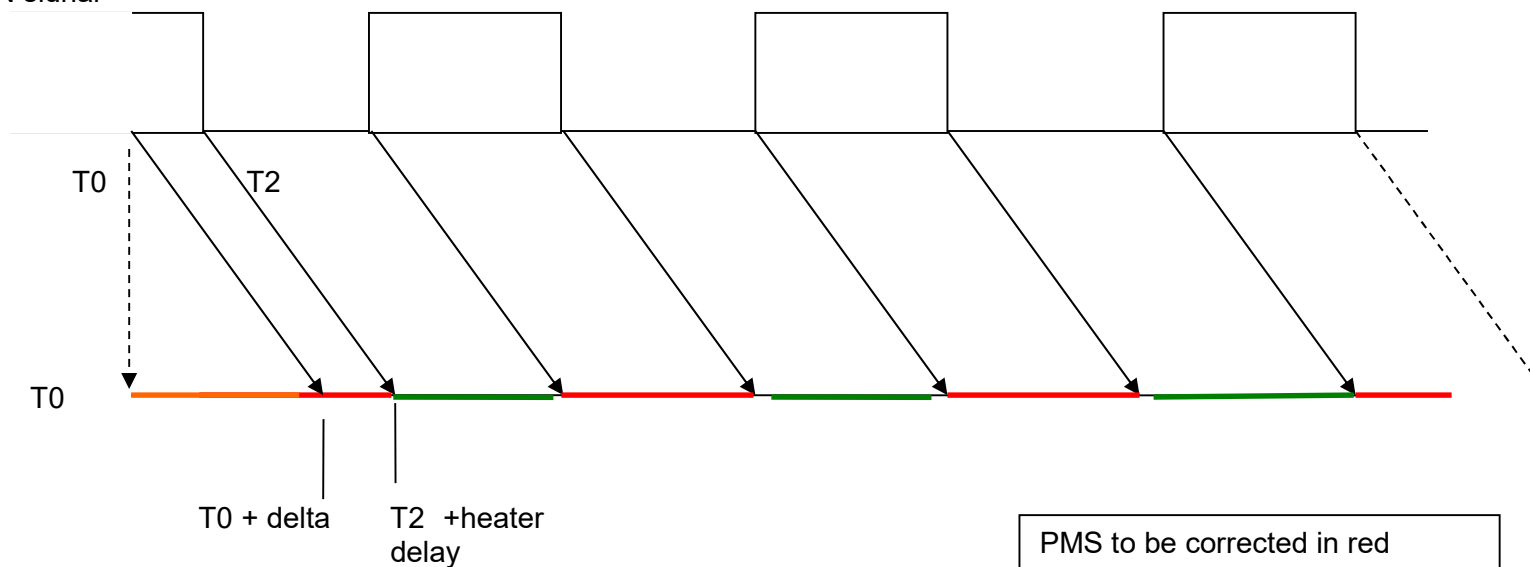
CASE-B

The initial TLM1A data $[T0, T0 + \delta]$ will be flagged because PMS correction is unknown

If there is a proper overlap, data between $T0$ and $T0 + \delta$ will never be used by the calibration processor (e.g. CORD0 will start always after $T0 + \delta$) and Calibration file will be okay. If this is not the case, a quality flag will be set in the Calibration file (get from TLM1A) to warn the user that no correction was applied in the PMS up to $T0 + \delta$

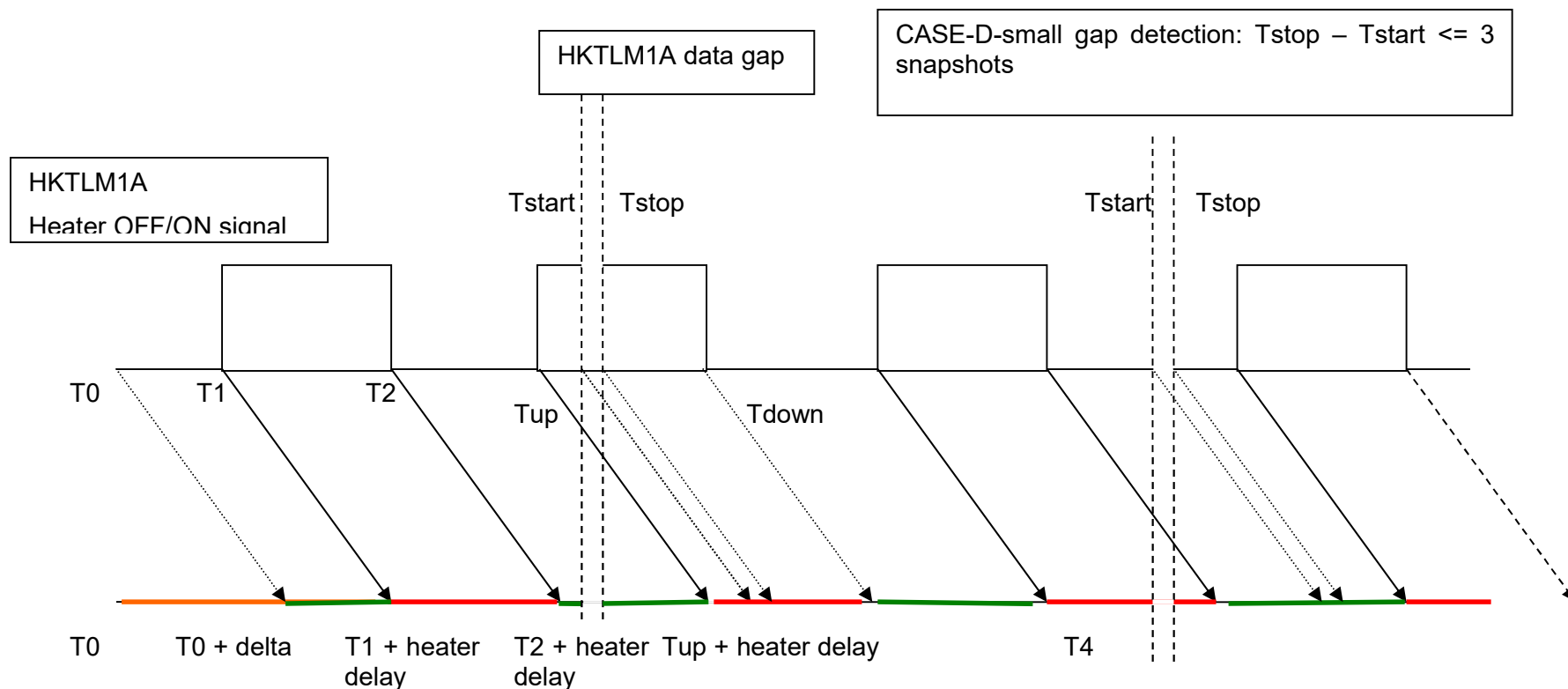
HKTLM1A

Heater OFF /ON signal



$\delta = \max(\text{heater delay})$

PMS to be corrected in red
PMS not corrected in green
PMS correction unknown orange:



PMS to be corrected in red between $[T1 + \delta, T2 + \delta]$ in nominal condition

Once small gap detected:

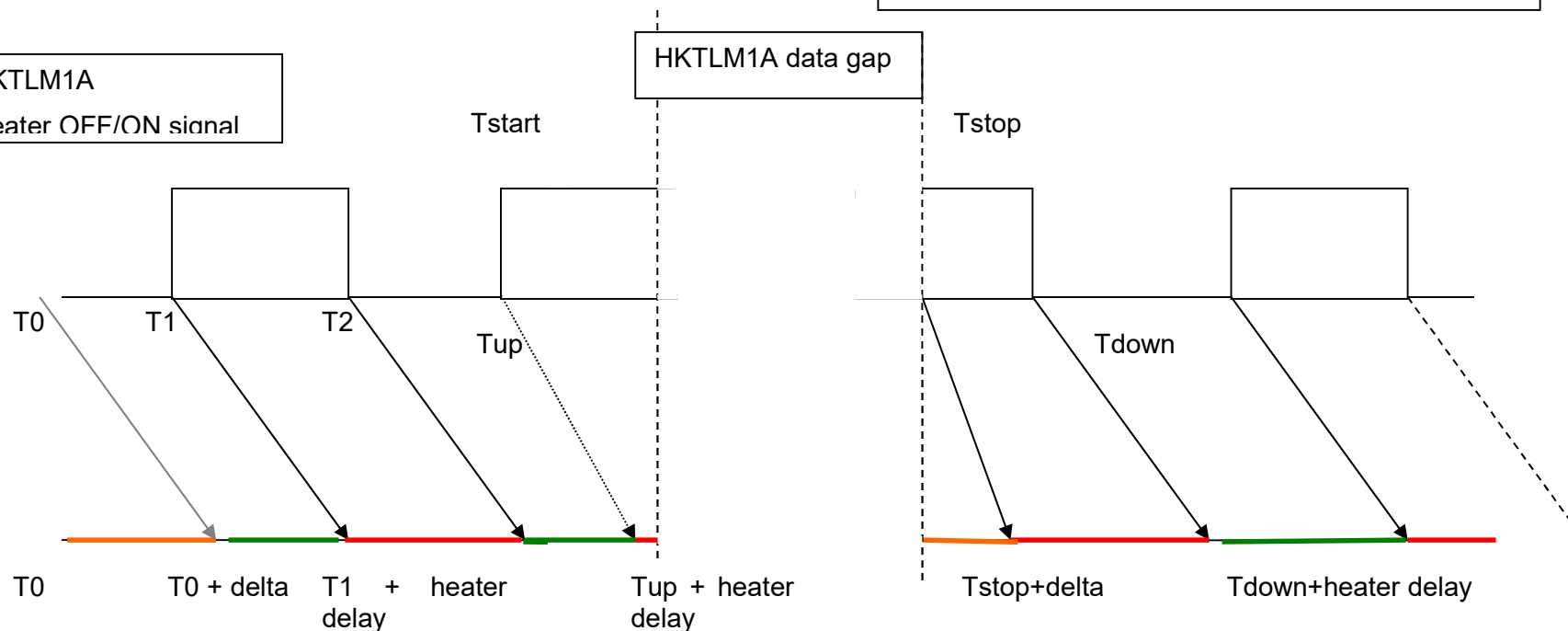
PMS to be corrected in red between $[Tup + \delta, Tdown + \delta]$ if Tdown or Tup does not exist (gap around the transition) it is assumed Tdown or $Tup = 1/2(T_{stop} - T_{start})$ (closer value approach) This means that in case of uncertainty we assume the heater switches in the middle of the gap

PMS not corrected in green.

$\delta = \max(\text{heater delay})$

CASE-D-big gap detection: $T_{\text{stop}} - T_{\text{start}} > 3$ snapshot

HKTLM1A
Heater OFF/ON signal



PMS to be corrected in red between $[T1 + \text{heater delay}, T2 + \text{heater delay}]$ in nominal condition

Once big gap detected:

PMS to be corrected in red between $[Tup + \text{heater delay}, Tstart]$ and between $[Tstop + \delta, Tdown + \text{heater delay}]$

PMS not corrected in green

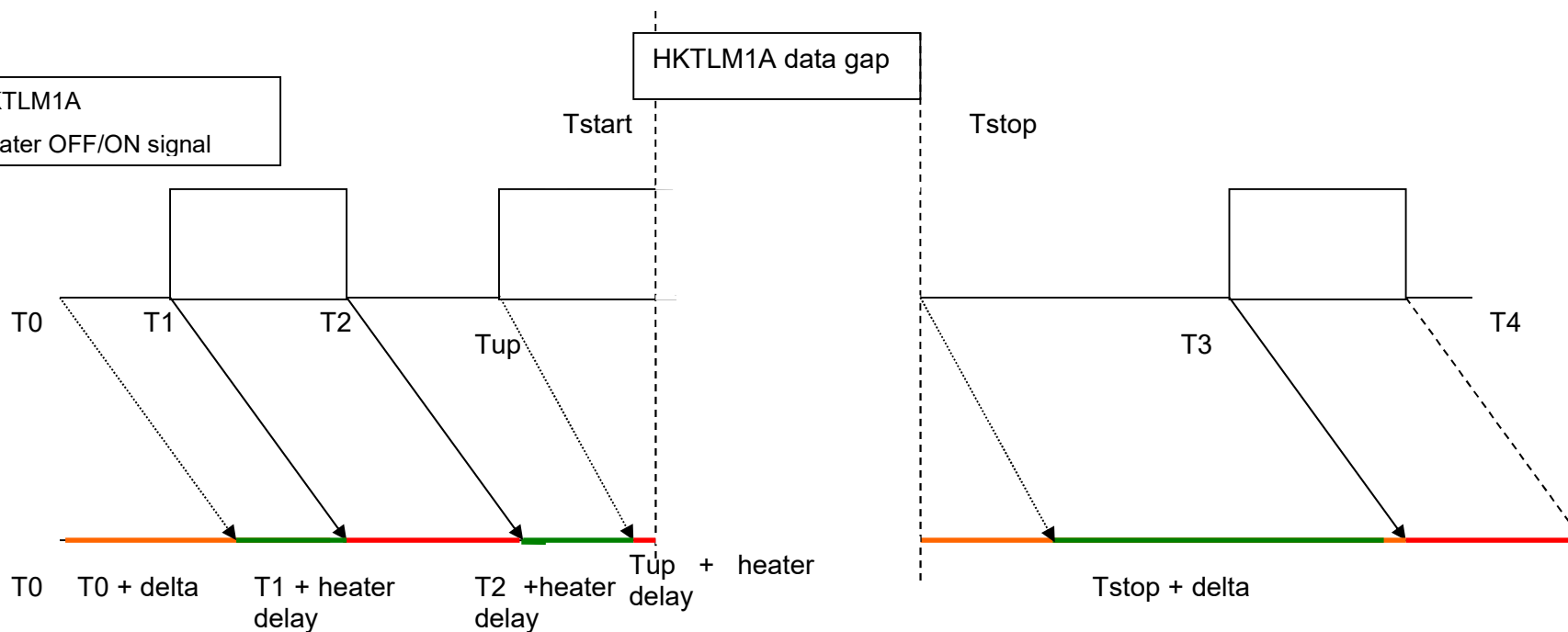
PMS correction unknown orange:

No correction applied flag ON

$\delta = \max(\text{heater delay})$

CASE-D-big gap detection: $T_{\text{stop}} - T_{\text{start}} > 3 \text{ snapshot}$

HKTLM1A
Heater OFF/ON signal



PMS to be corrected in red between $[T_1 + \text{heater delay}, T_2 + \text{heater delay}]$ in nominal condition

Once big gap detected:

PMS to be corrected in red between $[T_{up} + \text{heater delay}, T_{\text{start}}]$

PMS not corrected in green

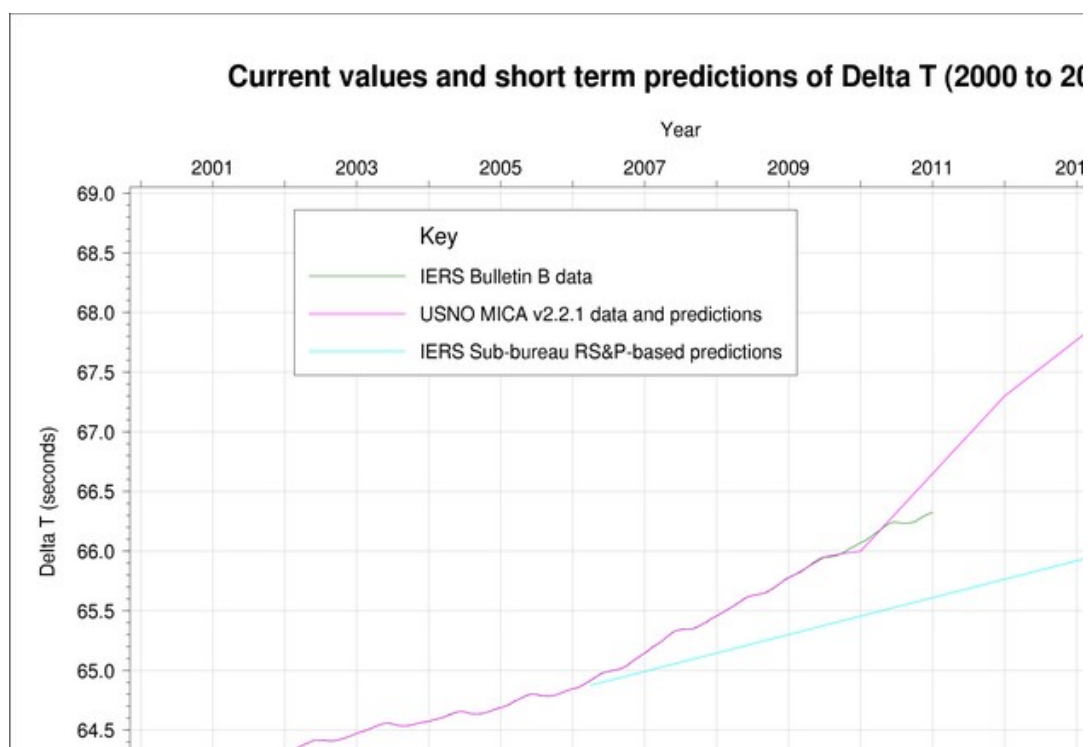
PMS correction unknown orange: No correction applied flag ON

11. APPENDIX E: BULLETIN B ADF VALIDITY PERIOD DEFINITION

The purpose of this section is to establish the rationale followed for the selection of the validity period of Bulletin B in SMOS L1 Processing. This validity period shall be used to set the ADF quality flag of all snapshots which have been processed using a Bulletin B ADF whose last deltaUT1 record is older than the time of the snapshot minus the validity period.

Given that deltaUT1 represents the mismatch between the expected Earth's rotation period and the actual rotation period, an error of 0.1s in deltaUT1 would translate into an extra rotation of about $0.1 * 40000 / 86400 \approx 50\text{m}$ over the equator (being 86400 the standard daily rotation period, and 40000 the Earth perimeter over the equator).

On the following image, the short term trend of deltaUT1 can be observed, both measured and predicted for the period of 2000-2015. Following the worst case prediction for our case (pink line) there will be a 3s increase in deltaUT1 from the year 2010 to 2015 (although the variation between 2000 and 2010 was just slightly above 2s)



(Image taken from <http://asa.usno.navy.mil/SecK/DeltaT.html>)

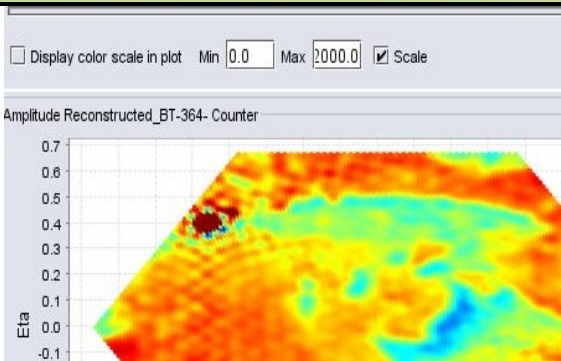
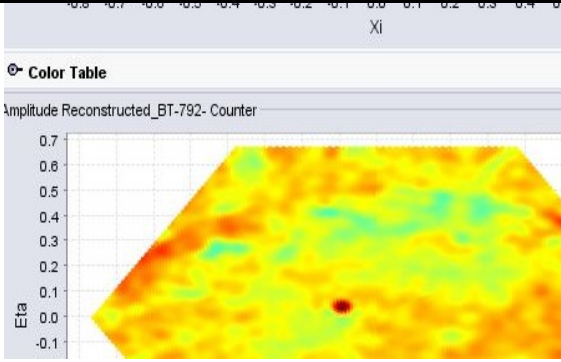
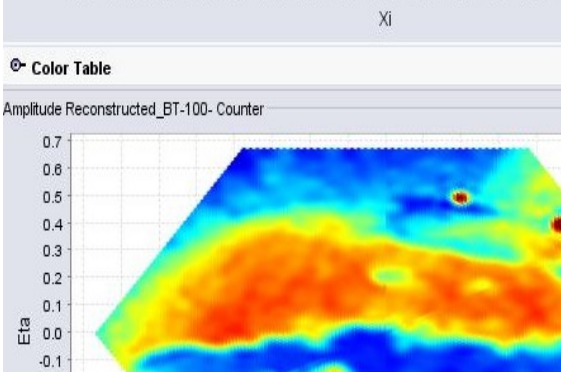
For the period of 2010-2015, it is safe to assume then a constant rate of 0.3s deltaUT1 increase every 6 months, which translates into an error of about 150m, well inside the 400m geolocation accuracy requirement mandatory for SMOS data.

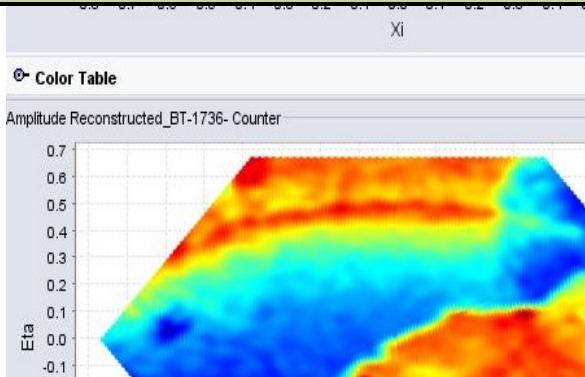
It is then suggested to establish the validity period for Bulletin B ADF for SMOS L1 Processing purposes to **6 months**, to ensure an adequate quality flagging of data in case the Bulletin B files available as input are older than this time.

12. APPENDIX F: DESCRIPTION OF RFI FLAGS IN L1B AND L1C PRODUCTS

The presence of RFI tails are fallged even when the source is not observed in the EAFFOV region provided at L1c. 4 flags at snapshot level will warn the users of presence of RFI above (for example) 350K, 500K, 1000K and 2000K in the image. The algorithm uses the BT images of the hexagon at L1b to look for the most powerful pixel in every snapshot and set any of the flags that exceed the thresholds.

Examples for specific snapshots on the presence of theses flags.

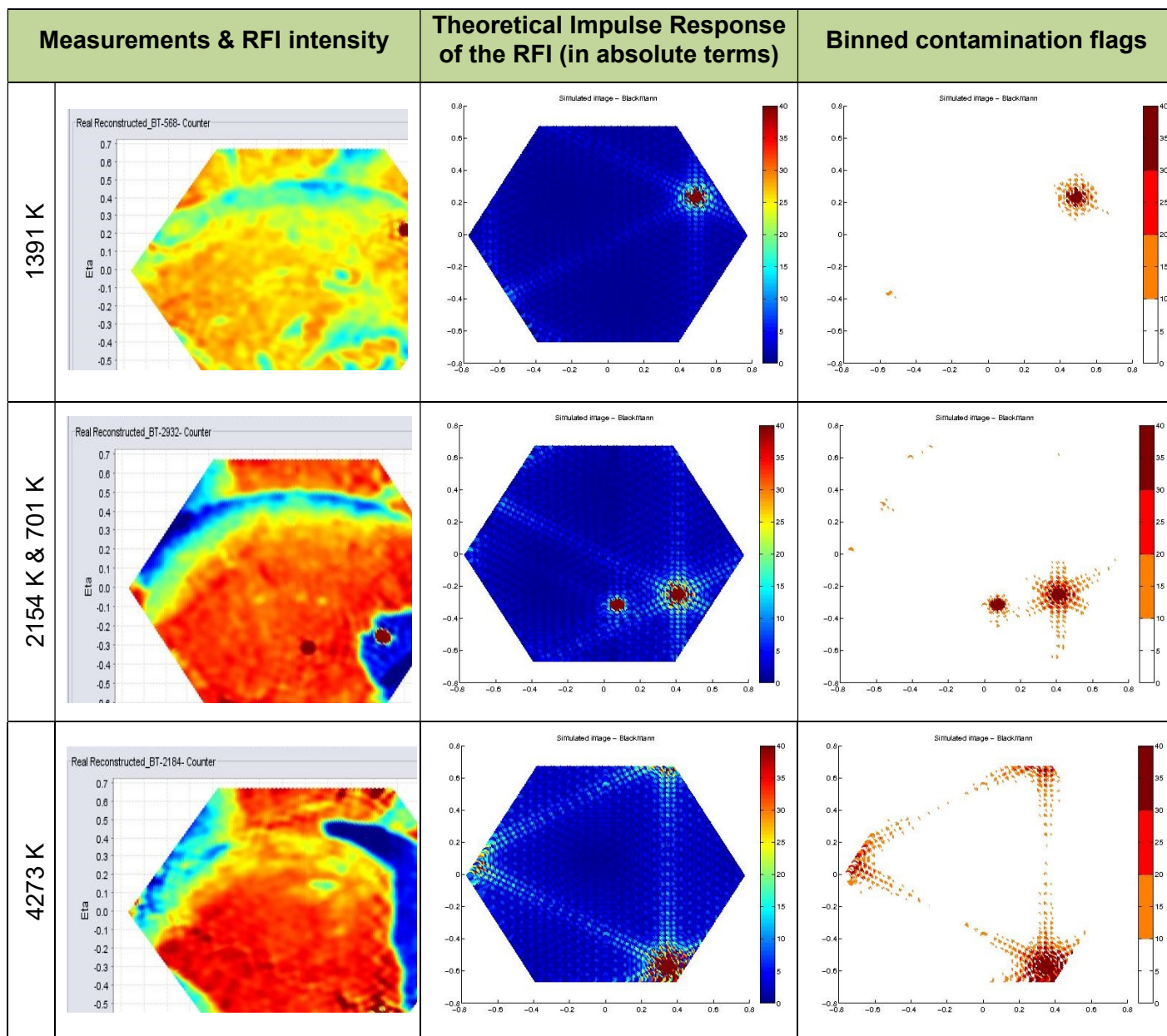
SMOS Snapshot in the Fundamental Hexagon	RFI flags	Flag status	Description
	RFI 500 K	ON	A source of 2150 K is present in the top-left part of this image, outside the region of the extended alias-free field of view. The entire snapshot will be flagged with all three flags since the source exceeds all three thresholds.
	RFI 1000 K	ON	
	RFI 2000 K	ON	
	RFI 500 K	ON	A source of 585 K is present at the central part of this image. The entire snapshot will be flagged with the 500K flag only.
	RFI 1000 K	OFF	
	RFI 2000 K	OFF	
	RFI 500 K	ON	Two RFI sources are present in this image, one source is 1504 K and the other one is 890 K. The algorithm only focuses on the most powerful source. Therefore, both the 500 and 1000K flags will be set since the most powerful source exceeds these two thresholds.
	RFI 1000 K	ON	
	RFI 2000 K	OFF	

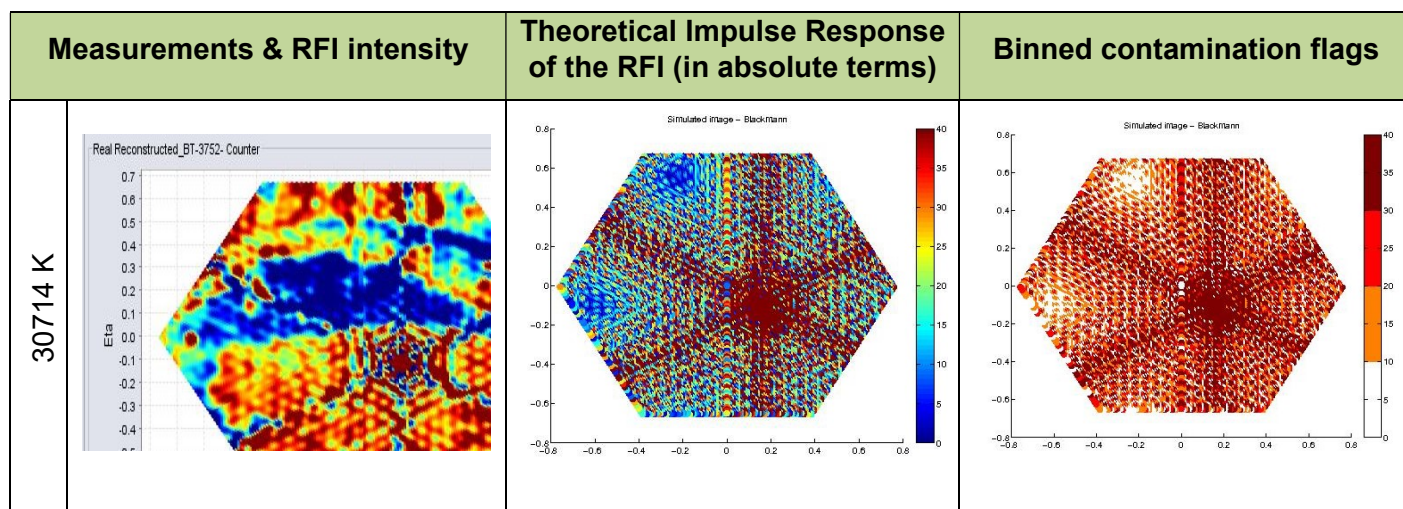
SMOS Snapshot in the Fundamental Hexagon	RFI flags	Flag status	Description
	RFI 500 K	OFF	A low-level RFI source of 318 K is present in the central part of this image. No flags will be raised, because the RFI does not reach the 500 K minimum threshold.
	RFI 1000 K	OFF	
	RFI 2000 K	OFF	

Example illustrating the application of the proposed algorithm in different cases. Left column shows a SMOS real measurement in the fundamental hexagon. The central columns indicate whether the RFI flags at 500K, 1000K and 2000K (for this example) would set with this proposed algorithm. Right column explains the rationale on the activation of the flags.

12.1 LEVEL OF CONTAMINATION OF REPORTED RFIS

This flag has levels indicating the expected order of magnitude of the RFI contamination at each pixel due to the different RFI sources present in a particular snapshot.





Example illustrating the application of the second proposed algorithm in four different cases. Left image shows a SMOS measurement in the fundamental hexagon. The power intensity of the RFIs present in that snapshot is indicated in the left column. Central image shows the absolute of the theoretical impulse response for a point-source signal located at the position of the RFI, and scaled to the intensity detected in the real measurement. Right image shows the different flags that would be raised in this snapshot using the contamination levels above 10K, 20K and 30K.

12.2 FLAG DISTRIBUTION

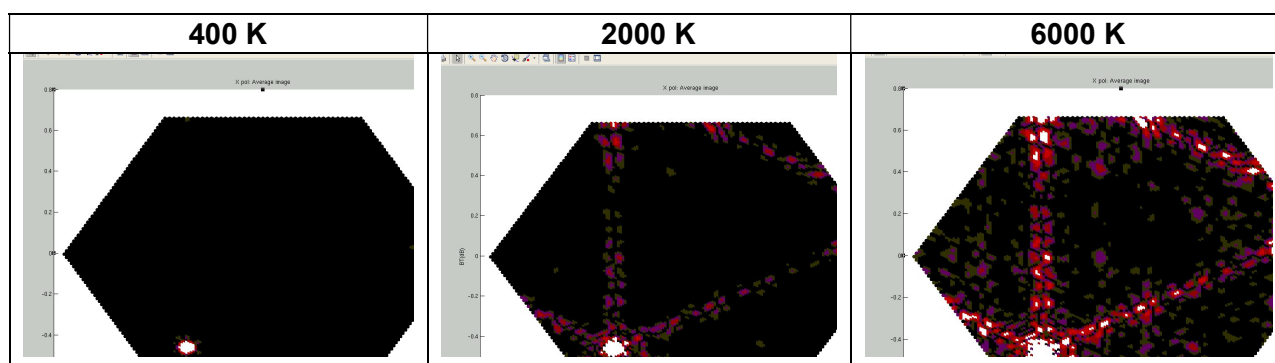
As a consequence the proposed list of flags in the new L1c v710 products is presented below:



List of RFI related flags in the current L1c v620 products (left) and in the new v720 L1c products (right). In blue refers to the new flags proposed in this document. The structure presented here follows the L1c product structure, with two main fields, a snapshot information, and the pixel information for every grid-point.

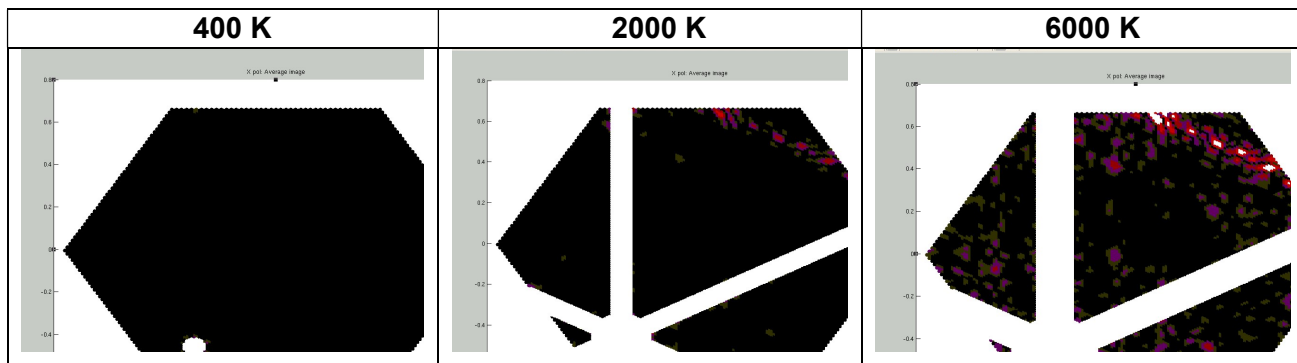
The areas around the RFI sources should be configurable, in case the L2 users have stringent requirements on the amount of contamination they would accept in their products.

The following images show (when different from black) the contribution from only a synthetic point-source signal, when is above 10 K.



Synthetic images in dB showing the areas where the effects of one RFI is above 10 K, for sources at different intensities. Left: 400 K, Middle: 2000K, Right: 6000K

These following images show how the tails appear when the intensity of the RFI is around 2000K.



The white area corresponds to the regions being flagged for different intensities of RFI

It must be noted that there are areas when the intensity is around 6000 K that exceed the 10 K limit and are not being flagged. But in order to flag those areas, the entire snapshot should be considered as corrupted.