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Ref.: SO-TN-IDR-GS-0003
Iss./Rev.: 3/5
Date: 02-Feb-2010

SMOS DPGS

L0 Product Specifications

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File: SO-TN-IDR-GS-0003 L0 Spec v3.5 2010-02-02.doc

Document classification	☑ Class A	☐ Class R	☐ Class I
ESA Signature, N. Wright:		*Not needed*	*Not needed*

Distribution List

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Document Change Log

Iss./Rev.	Date	Section / Page	Change Description
0/1	30-Sep-2005	All	First edition of the document
1/0	09-Nov-2005		New release including ESA RIDs from DPGS-SRR.
		1.2	Reference to new section 5.
		1.3	Addition of "Tailoring of EEFF" as applicable document.
			New version of "SMOS L1 Product Format Specification"
		1.4	Addition of "XBAS-L0P ICD", "SMOS Payload Technical Description", "In Orbit Calibration Plan IOCP" and "TN on Products Consolidation" as reference documents
		2	Details on consolidation are replaced by references to a technical note on "Product Consolidation".
			Description of L0 configuration file.
		2.1.1	Section rewritten. References to the "Tailoring of EEFF" added.
		2.1.2	References to the "Tailoring of EEFF" added.
			Valid file classes are TEST and OPER.
			Addition of semantic description MIRA.
			Correction of typos in table 2-3.

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Iss./Rev.	Date	Section / Page	Change Description
		3.1	Typo corrected: "3.1.1" should read "3.1"
			First paragraph removed.
			Table 3-1 contains only the specifics requested in the "Tailoring of EEFF".
			The example is revised.
		3.2	Addition of "Source" column in header tables.
		3.2.1	Tag names format revised.
			Format values revised.
			Vector_Time, Delta_UT1, Leap_UTC and spare fields are removed.
			Header_Size, Acquisition_Chain, Checksum are added.
			Format for string types with variable length is %s.
			The example is revised.
		3.2.2	Table "SPH Names" is removed.
		3.2.2.1	Tag names format revised.
			Format values revised.
			L0_Gaps_Flag, L0_Gaps_Num and spare fields are removed.
			Addition of Missing_ISP-, Discarded_ISP- and RS_ISP-related fields.
			Format for string types with variable length is %s.
			Descriptions modified in "Product Time Information".
		3.2.2.2	Tag names format revised.
			Format values revised.
			Spare fields are removed.
			DSD_List and Num_DSD replaced by List_of_Data_Set.
			MDR_Size and Num_MDR swapped.
			Format for string types with variable length is %s.
			The example is revised.
		4.1	Full pol processing scheme.
		4.2	Unique id used instead of name of product.
			Table 4.1 replaced by references to the applicable documents.
		4.3	Tables replaced by references to the applicable documents.
		5	Products sizes estimations.

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Iss./Rev.	Date	Section / Page	Change Description
1/1	18-Jan-2006		New release for DPGS-PDR.
		1.2	Insertion of new chapter 5.
		1.4	Document “General Software Library ICD” changed to “SMOS XML Read-Write API ICD”.
			Versions and dates revised.
		5	New chapter on auxiliary data.
		6	Old chapter 5 renumbered.
		All	Rewording: references to Level 0 Products.
		3.1	Reference update in Fixed Header
1/2	17-Feb-2006		Changes after DPGS PDR
		1.3	List of applicable documents is updated.
		1.4	List of reference documents is updated.
		1.5	Reference to acronyms document.
		2.1.2	File name detailled.
		3.2.1	Adding non-overlapped interval in MPH.
			MPH: contents of some fields are more detailed.
			MPH example is updated.
		3.2.2.2	SPH: contents of some fields are more detailed.
		5.1	Reference for the POF is updated.
1/3	12-May-2006		Changes for DPGS-CDR
		1.3	List of applicable documents is updated
			EE CFI Explorer_Data_Handling SUM added.
		1.4	List of reference documents is updated.
			DPGS-SPGF ICD added.
		1.5	Reference to the acronyms list.
		2	Typo corrected and clarification on CORR_TM in table 2-1.
			Using reference to CASA document in table 2-1.
			Section rewritten. Tables enhanced.
			Added references to new APIDs 57 and 58.
		2.1.1	Figure 2-2: Binary Data Block is more detailed.

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		2.1.2	Minor rewords through the section.
			Table 2-3 updated with latest changes from Master ICD.
			Table 2-4 enhanced.
			Added references to new APIDs 57 and 58.
		3	Minor rewording in the introduction.
			NW-18: An indication is provided in the source field when the value is not copied, but derived.
		3.1	EE Fixed Header TBDs are now removed.
			Example updated accordingly.
		3.2	Adding reference to Orbit Scenario File, for Phase, Cycle and Rel_Orbit.
			Adding reference to FEP acquisition log.
			Phase is a numeric field (phase number).
			Precision on contents of SPH.
		3.2.1	MPH structure is updated: BinX_Schema is removed, values for Proc_Stage_Code and Acquisition_Chain are modified.
			Example updated accordingly.
			Source for some fields is revised.
		3.2.2	Minor rewording in the introduction.
			Source for some fields is revised.
		3.2.2.1	Changes in the SPH.
		3.2.2.2	Table 3-4: Addition of ANCILLARY_PACKETS.
			Tables 3-4 and 3-5: Descriptions revised.
			Change in the SPH: Byte_Order moved to MPH.
			Example is updated.
		4.2	Rewording for clarification.
			Figure added.
			MIR_TEST0, MIR_UNCU0 and MIR_CORU0 added to the list of products.
		4.3	Rewording for clarification.
			Figure added.
		5	Addition of reference to the Orbit Scenario File.
		5.2	New section on Orbit Scenario File.
		5.3	This is former section 5.2
1.4	13-Jun-2006		Changes after L0P-CDR

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Iss./Rev.	Date	Section / Page	Change Description
		1.4	The list of reference documents is updated.
		2.1.1	SS-06: rephrasing the reference to the packaging mechanism.
		2.1.2	SS-07: "s" in the name will not contain the L0P id.
		3.2	NW-46: Phase/Cycle/Rel_Orbit calculated using the EE CFI.
		3.2.1	NW-46: "Acquisition_Station" value for ESAC is provided. Pos and vel vectors refer to the first one after the sensing start time. Details on checksum.
			SS-08: "Header_Size" is removed.
			SS-10: Phase/Cycle/Rel_Orbit/Abs_Orbit of first packet in the product.
			SS-11: Description of "Abs_Orbit" is corrected.
			SS-12: Addition of vector time and UT correction.
			SS-09: Sensing times moved from MPH to SPH.
		3.2.2.1	SS-13: "SPH_Descriptor" will contain the file type.
			SS-14: Start_Time_ANX_T is now Rel_Time_ANX_Start.
			SS-16: Endianness fixed to little-endian.
			NW-49: Pass start/end times are added.
			SS-17: Addition of Total_N_Packets.
			NW-48: The per-pass information is removed, except N_Missing_24packet_Blocks.
			SS-09: Sensing times moved from MPH to SPH.
		3.2.2.2	NW-50, NW-51: Some files are added to the list of reference data sets.
			SS-18: Fields renamed in the SPH. MDR_Offset removed. DS_Size, DS_Offset and DSR_Num added.
		5	NW-50, NW-51: Some files are added to the set of auxiliary data files.
		7	NW-45: New section contains information on the overlap and on the cutting strategy.
1.5	26-Jun-2006		Changes from product specs harmonisation and from follow-up meeting with GMV.
		1.4	List of reference documents is updated.
		1.5	Clarification: sensing time is overlapped sensing time.
		3.2	[LOG] is no longer used.

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Iss./Rev.	Date	Section / Page	Change Description
		3.2.1	MPH: some fields are removed, as thery are already in the fixed header; Acquisition_Chain and Checksum are taken to the SPH; TAI, UT1 are added; Type_of_Processing, Reason_for_Reprocessing are added for harmonisation with other processors.
			NW-46/SS-24: added reason for DEGRADED condition.
			Example updated.
		3.2.2.1	SPH: some descriptions are improved; set of values for Mode is updated; Acquisition_Chain, Semiorbit_Start_Time, Semiorbit_Stop_Time, Header_Schema added; Byte_Order relocated.
		3.2.2.2	Table 3-5: ACQ_LOG_NAME removed.
		3.2.2.2	Fields renumbered
			Example updated.
		5.4	References to ACQ_LOG removed.
1.6	28-Jul-2006		Changes after exchanging information with GMV.
		1.3	The list of documents is updated.
		1.4	The list of documents is updated.
		3.2.1	"Product" field removed from the example.
			For Product_Confidence, valid values are {NOMINAL, DEGRADED}.
			Position and velocity vectors correspond to the last vector from the POF before the sensing time.
		3.2.2.1	Byte_Order is big-endian.
			A PCD block exists per pass contributing to the product.
		3.2.2.2	Removal of "(integration time)" in the description of Num_DSR.
			The example is updated.
			Changes after L1P-CDR
		2	NW-70: the definition of "pole-crossing" is added.
		3	NW-60: list of sources is moved from section 3.2 to section 3.
		3.1	NW-60: system is DPGS.

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Iss./Rev.	Date	Section / Page	Change Description
		3.2	NW-60: list of sources is moved from section 3.2 to section 3.
			NW-61: Clarification added on the scope of source=ISP.
			NW-62: CNF refers to the General L0P Configuration file.
			NW-66: new source "REP"
		3.2.1	NW-66: new source "REP" for Type_of_Processing and Reason_for_Reprocessing.
			NW-63: old Proc_Centre replaced by new Proc_Centre (ESAC) and Logical_Proc_Centre.
			NW-67: The table contains the block and list start/end tags.
		3.2.2.1	NW-71: addition of source for the XML information.
			NW-72: ranges for latitude/longitude provided.
			NW-73: Byte_Order moved from SPH/Main to SPH/Datasets.
			NW-68: new field "Total_Sensed_Time"
			NW-72: ranges for latitude/longitude provided.
			JC-19: removal of references to overlap.
			NW-67: the table contains the block and list start/end tags.
			JC-20: addition of N_RS_Corrected_Bytes.
		3.2.2.2	NW-75: table 3-5 includes the ISP file and an indication of the number of each DSD for every type.
			NW-73: Byte_Order moved from SPH/Main to SPH/Datasets.
			NW-67: the table contains the block and list start/end tags.
		5.3	NW-78: added reference to the document where the generation of the config files is described.
		6	NW-79: the assumptions are revised; table 6-1 is updated
			JC-21: correction in size of external cal product
			JC-22: using point as the decimal separator
		7.2	NW-70: the definition of "pole-crossing" is added.
1.7	09-Oct-2006		Changes after DPGS-CDR
		All	RC-20: Harmonized the name convention between L0 and L1

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Iss./Rev.	Date	Section / Page	Change Description
		2	NW-17: Clarified that the origin for the sensing start/stop times is the Validity_Start/Stop_time specified in the Fixed Header.
		2.1.2	SS-24: The “s” parameter included in the L0 product filename corrected to identify the processing chain number
		3	NW-18: Header schema examples removed
		3.1	NW-17: Fixed Header (Table 3-1) detailed.
			Clarified that Phase and Cycle fields are given at sensing start time
			Removed Header examples
			NW-27: MPH harmonization between L0, L1 and L2
		3.2.2	NW-20: Removed Fields #34, #34 and #40 from the SPH
		3.2.2.1	NW-19: Added a clarification about State Vector Time
			NW-27: Orbit information structured as a subheading tag.
			NW-28: SPH Descriptor format changed from 28-character string to 14 character-string
			SS-26: Stop_Time_ANX_T renamed as Rel_Time_ANX_Stop
			SS-26: Rel_Time_ANX_Start and Rel_Time_ANX_Stop descriptions corrected.
			RC-37: Lat/ Long format changed from %+011d to %+011.6f
		3.2.2.2	NW-20: Clarified CNF reference for Mode field.
			NW-20: Clarified that the Byte order for science data sets is big-endian.
			NW-26: Precise_Validity_Start and Precise_Validity_Stop fields, in microsecond resolution, added to the SPH
		5.5	NW-16: Several parameters moved from the L0P General Configuration file to the General Auxiliary Data File
		7.1	NW-17: Second paragraph removed
		7.2	NW-22: Clarified how Z max and Z min are determined
		All	Tables columns names changed according to the new baseline from L0 to L2.
1.8	27-Oct-2006		Changes after comments by GMV and ESA.
		1.4	The list of reference documents is updated.

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Iss./Rev.	Date	Section / Page	Change Description
		3.1	Table 3-1: Corrected duplication of starting tag; addition of ending tag. Correction in format of Validity_Start, Validity_Stop and Creation_Date.
		3.2.1	Table 3.2: Changing comment in Orbit_Information; Datablock_Schema is removed.
		3.2.2	Table 3.3: Filled gap in Field #; the comments for Precise_Validity_Start and Stop are valid for all L0 products. Removing non-L0P-specific notes from Comments to Validity_Start, Validity_Stop, File_Name and File_Class.
		5	Level 0 General ADF is added to the list of ADFs.
		5.4	Reference to acquisition log is removed.
		5.5.1	Name for the Level 0 General ADF is provided.
		5.5.2.2	Table 5.2: the overlap information is redefined.
1.8	14-Nov-2006		Changes after comments by ESA.
		1.1	Merging purpose and scope of the document.
		1.2	Section title changed.
		1.3	The list of applicable documents is updated.
		1.4	The list of reference documents is updated.
		2	Typo in table 2-2.
		2.1.1	XML high level structure provided.
		2.1.2	How to set the File Class.
			Descriptions for times in the instance ID are improved.
			Description of the s field in the instance ID.
			Behaviour for APID 4 included.
		3	10-chars file ID added
			Removal of unused [REP]
		3.1	Table 3-1: max size for File_Name; contents of File_Description; string lengths revised; values for Creator revised; description for Creation_Date;
			New table for File Descriptions
		3.2.1	Table 3-3: description for Leap_Second revised; string lengths revised; typo in Product_Confidence corrected; Datablock_Schema recovered.
		3.2.2.1	Table 3-4: precision on length for SPH_Descriptor; descriptions for Precise_Validity_Start and Stop; units for angles are not microdeg, but deg; description and size for Acquisition_Chain; DSD structure and SPH end tag added

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Iss./Rev.	Date	Section / Page	Change Description
		3.2.2.2	Table 3-5: DS_Names specified for each type of product.
			Table 3-6: specification on which POF is used; the general config file is no longer referenced; DS_Names revised.
			Table 3-7: the "List_of_Data_Set" flags are moved to table 3-4, and changed to "List_of_Data_Sets"; string lengths revised; Ref_Filename does not include extension; DSR_Num is removed.
		4.3	List of products (there is only one) containing Ancillary Data Sets.
		5	Reference to ISP file added.
			The 10-char ID is added in the section titles.
		5.3	Reference to the general config file is removed.
		5.5.1	ADF file name changes to CNFL0P.
		5.5.2	XML high level structure added
		5.5.2.1	Fixed Header detailed.
		5.5.2.2	SPH detailed, including explanations on how to fill the fields.
		5.5.2.3	Table 5-6: The hierarchy is now APID and then sequence; addition of a statement that "the order in which APID appears is the order for processing".
		5.6	New section for ISP file.
		7.2	Precision on the used POF.
2.0	24-Nov-2006		Changes during meeting with ESA and GMV.
		1.4	List of reference documents is revised.
		2.1.1	Clarification on packaging mechanism.
			Clarification of "Validation-Schema-Reference".
		2.1.2	Table 2-4: start time is rounded.
			Note on who ingests the PUS Housekeeping files.
			"CORN" is now "CORD".
		3	New elements AUX and ICNF in the list of "sources".
		3.1	Table 3-1: revision of some comments, string lengths and origins.
			Table 3-2: the values in the first column are used as dataset names; "CORN" is now "CORD".

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Iss./Rev.	Date	Section / Page	Change Description
		3.2.1	Table 3-3: revision of some comments, string lengths, formats and origins; field name changes (Processing_Centre, OSV_TAI, OSV_UTC, OSV_UT1), fields removed (Datablock_Schema, Total_Size).
		3.2.2.1	Table 3-4: revision of some comments and origins; fields removed (Instrument_Config, Mode, Acquisition_Chain), fields added (DAS_HW_Identifier, L0P_HW_Identifier, N_Invalid_Blocks, Datablock_Schema, Header_Size, Datablock_Size), field name changes (List_of_Passes)
		3.2.2.2	Former table 3-5 (Measurement Data Set Names) is removed, as the contents are already included in table 3-2.
			Table 3-4: addition of Header_Schema.
			Table 3-5: data set names revised, descriptions revised, addtion of new elements (L0P_LOCAL_GENERAL_CONFIG and ANCILLARY_FILE).
			Table 3-6: clarification in comments for DS_Name; zero-filling for DS_Size, DS_Offset, Num_DSR and DSR_Size; length in Ref_Filename; DSR_Size for variable size DSRs.
		4.1	The counter range is not [1, 24], but [0, 23]
		4.2	Figure 4-1 and text revised to account for the DSR_PCD.
			Note on filling strategy in the case of missing packets.
			"CORN" is now "CORD".
		4.3	Note on filling strategy in the case of missing packets.
		5	List of auxiliary data: some file references are revised; the local general config file is added
		5.3	File reference is revised.
		5.4	New section on the local general config file.
		5.6	File reference is revised.
		5.6.2.1	Table 5-2: descriptions, string lengths and formats are revised; the column on "origin" is removed.
		5.6.2.2	Table 5-4: fields removed (Total_Size, Data_Set), fields added (Precise_Validity_Start, Preceise_Validity_Stop, Header_Schema, Datablock_Schema, Header_Size, Datablock_Size, HW_Identifier); the column on "origin" is removed.
			Former table 5-5 is removed.

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Iss./Rev.	Date	Section / Page	Change Description
		5.6.2.3	Table 5-5: Tags modified (L0P_Configuration_Aux_Data, Overlap_Time); fields removed (Acquisition_Station, Processing_Centre, Logical_Processing_Centre); comments, string lengths and formats are revised; the column on "origin" is removed.
		7.1	Section on Overlap is rewritten.
2.1	14-Sep-2007		Changes for DPGS-V2.
		1.3	List of applicable documents is revised.
		1.4	List of reference documents is revised.
		2.1.1	Figure 2-2 updated to include 3-byte status.
		3.2.2.1	L0P-FAT INDRA-AI-6: N_Invalid_Blocks for ancillary data.
3.0	15-Oct-2007	7	Release of the document baseline for DPGS-V2 L0 products format specifications.
3.1	23-May-2008		Changes for NRT.
		1.4	The list of reference documents is updated.
		2.1.2	s is 1 or 2 in nominal mode, and 5 or 6 in NRT mode.
		3.1	Notes field filled when in NRT mode. And length modified to 300, to align with the other processors..
		3.2.1	"Source" field when data is coming from two stations.
		3.2.2.1	Addition of field "Correlator_Layer_Info".
			Format for Rel_Time_ANX_Start and _Stop changes from %011.6f to %013.6f.
		5.6.2.3	Addition of fields "Cutting_Strategy" and "Extra_Snapshot".
			Block duplication for Nominal and NRT modes.
			Some values are fixed in the NRT mode.
3.2	19-Sep-2008		Changes for NRT.
		3.2.2.1	Update of descriptions for Precise_Validity_Start, Precise_Validity_Stop, Ascending_Flag, Semiorbit_Start_Time, Semiorbit_Stop_Time, Correlation_Layer_Info.
			Format for N_Missing_24packet_Blocks, N_RS_Corrected_Bytes, N_Valid_Packets, N_Missing_Packets and N_Invalid_Blocks changes to %09d.
3.3	19-SDec-2008		Changes after ESA comments for V2 documentation.
		1.4	The list of reference documents is updated.

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Iss./Rev.	Date	Section / Page	Change Description
		2	NW6: Number 3 in the last set of points addresses the NRT mode as well.
		4.2	NW1: removing reference to XML RW API.
		4.3	NW2: removing reference to XML RW API.
		7	The section title is changed to make clear it applies only to the Nominal mode.
		7.1	NW5: clarifying that the cutting algorithm is based on the information from the predicted orbit files.
3.4	29-Apr-2009		CCN-059
		2.1.2	Special case for validity start/end when the file contains a single sensing time.
3.5	02-Feb-2010	All	Release to fix L0P-PR-0186, as agreed in e-mail from R.Craplicchio on 02-Feb-2010 10:41
		4.2	Update description of Status field as agreed.

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Contents

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List of Figures

List of Tables

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1. INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this guideline is to present the structure, syntax, file naming and use of the different L0 SMOS Products.

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 L0 products.

1.2 DOCUMENT STRUCTURE

The L0 Product Specification Document is structured as follows:

- Chapter 1 is the introduction you are currently reading.
- Chapter 2 introduces the different L0 Product types that will be considered.
- Chapter 3 provides a formal Specification for the Level 0 Product EE Headers.
- Chapter 4 provides a formal Specification for the Level 0 Product Binary Data Sets.
- Chapter 5 addresses the auxiliary data.
- Chapter 6 provides estimations on product sizes.
- Chapter 7 provides information on the management of the product boundaries.

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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]	Earth Explorer Ground Segment File Format Standard	PE-TN-ESA-GS-0001	1.4	13-Jun-03
[AD.2]	SMOS System Requirements Document	SO-RS-ESA-SYS-0555	4.1	28-Sep-04
[AD.3]	Earth Explorer CFI Software Mission Conventions Document	CS-MA-DMS-GS-0001	1.3	15-Jul-03
[AD.4]	EE XML and Binary Schema Standard	PE-TN-ESA-GS-121	1.0	01-Jul-05
[AD.5]	EE XML/Binary File Handling Library User Manual	SO-UM-DME-L1PP-0005	1.8	27-Jul-06
[AD.6]	SMOS PLM Commands and Control	SO-TN-CASA-PLM-0279	2.5	12-Feb-07
[AD.7]	N/A			
[AD.8]	N/A			
[AD.9]	SMOS Tailoring of the Earth Explorer File Format Standard for the SMOS Ground Segment	XSMS-GSEG-EOPG-TN-05-0006	1.0	30-Jun-05
[AD.10]	Earth Explorer CFI Explorer_Data_Handling Software User Manual	CS-MA-DMS-GS-0007	3.7	13-Jul-07

Table 1-1 Applicable Documents

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1.4 REFERENCE DOCUMENTS

The reference documents contain useful information related to the subject of the project. The reference documents complement the applicable documents. However, these sources shall be treated as informative rather than contractually binding. The list of reference documents is included in the following table.

Ref.	Title	Code	Version	Date
[RD.1]	SMOS Product Definition Baseline	SO-TN-ESA-GS-1250	1.6	29-Sep-05
[RD.2]	SMOS DPGS Acronyms	SO-TN-IDR-GS-0010	1.11	13-Jun-08
[RD.3]	SMOS XML Read-Write API Software User Manual	SO-ID-IDR-GS-0009	2.1	29-Apr-08
[RD.4]	SMOS L1 Product Format Specification	SO-IS-DME-L1PP-0002	2.2	15-Jul-07
[RD.5]	SMOS L1 Processor L0 to L1a Data Processing Model	SO-DS-DME-L1PP-0007	2.3	16-Jul-07
[RD.6]	SMOS DPGS XBAS-L0P ICD	SO-ID-IDR-GS-0017	2.5	29-Apr-09
[RD.7]	SMOS Payload Technical Description	SO-TN-CASA-PLM-0017	05	30-Sep-05
[RD.8]	In Orbit Calibration Plan IOCP	SO-TN-UPC-PLM-0019	1.5	17-Jan-07
[RD.9]	Technical Note on SMOS DPGS Products Consolidation	SO-TN-IDR-GS-0004	1.0	16-Dec-05
[RD.10]	DPGS Master Interface Control Document	SO-ID-IDR-GS-0016	3.0	06-Mar-09
[RD.11]	PLPC-DPGS Interface Control Document	SO-ICD-ESA-GS-1735	2.12	07-Nov-08
[RD.12]	DPGS-SPGF ICD and Operational Constraints	SO-ID-IDR-GS-0005	2.1	19-Dec-08
[RD.13]	SMOS DPGS L0P-Core ICD	SO-ID-IDR-GS-0019	2.5	03-Nov-08
[RD.14]	DPGS SUMOP Volume I - User Manual	SO-MA-IDR-GS-0001	3.5	13-Feb-09
[RD.15]	Earth Explorer CFI Explorer_Orbit Software User Manual	CS-MA-DMS-GS-0004	3.7	07-Jul-07
[RD.16]	XML Schema Guidelines	SO-MA-IDR-GS-0004	2.0	19-Nov-07
[RD.17]	L0P External and Internal ICD	SO-ID-GMV-GS-4101	1.6	25-Feb-08

Table 1-2 Reference Documents

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1.5 ACRONYMS AND TERMS

The acronyms used in this document are compiled in [RD.2].

When a reference to a sensing time is done, without specifying if it is overlapped or non-overlapped, it is meant "overlapped time".

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2. SMOS LEVEL 0 PRODUCTS

The X-Band Acquisition Station (XBAS) will ensure the acquisition of the TM (Telemetry) information, the scientific and associated in-orbit data.

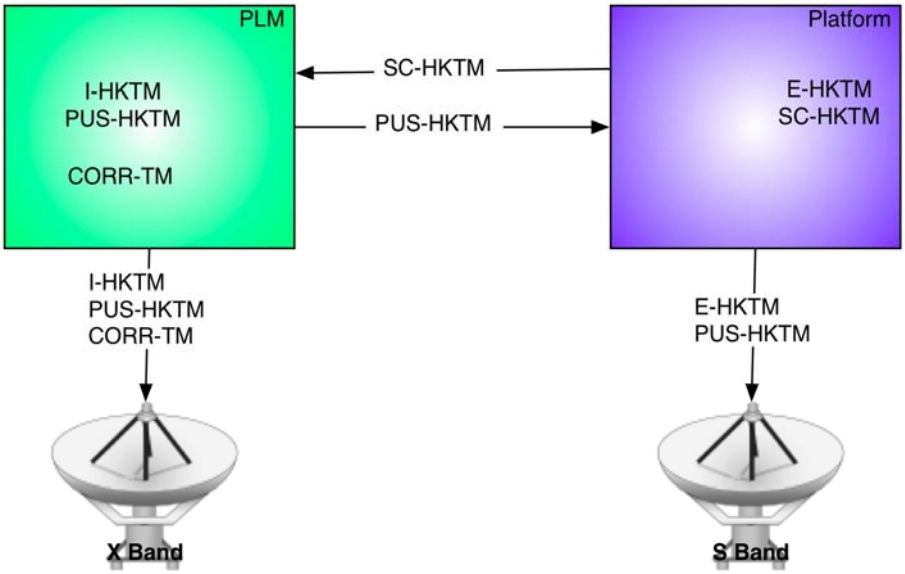

Figure 2-1 SMOS TM Context

The different TM data streams shown in the figure are described in the following table.

Acronym	Name	Content	Format
I-HKTM	PLM Housekeeping TM	Engineering parameters: temperatures, voltages, flags, NIR, PMS... This TM is called “Ancillary” in [AD.6] and in subsequent discussions within this document.	NON PUS
CORR-TM	Science Telemetry	Generated by PLM and containing the output of correlators. Its contents depend on the instrument mode.	NON PUS
PUS-HKTM	PUS Housekeeping TM	PLM TC Ack, execution status and all that is generated according to implemented PLM PUS Services.	PUS
SC-HKTM	Proteus Generated Ancillary TM	Bulletin sent by Proteus to PLM via 1553 and containing Time, Position and Attitude info.	NON PUS
E-HKTM	External PLM HKTM	Telemetry regarding PLM and acquired by Proteus Platform (Voltages, Temperature, etc).	NON PUS

Table 2-1 SMOS TM Data Streams

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The XBAS is receiving data packets belonging to these types:

- I-HKTM (Ancillary)
- CORR-TM (Science)
- PUS-HKTM (PUS Housekeeping)

Within CORR-TM, there are a number of "sub-types", defined in [AD.6], each one of them identifying the instrument mode while the data was being obtained.

Each data packet contains an "Application Process Identifier" (APID) to identify the type and sub-type of this data packet. The current list of APIDs is provided in [AD.6] and is summarised in the table below. Note that the list can be modified: new APIDs may be added, and others could be removed.

Source Packet Type				APID Name	APID Value
PLM Housekeeping Data (Ancillary Data)				APID_A	3
PUS Housekeeping Data				APID_X	4
Science Data	Measurement Mode	Full Polarisation		APID_FULL	52
		Dual Polarisation		APID_DUAL	50
	Calibration Mode	External Target	Full Polarisation	APID_EXC_FULL	53
			Dual Polarisation	APID_EXC_DUAL	51
		Internal Target	Uncorrelated Noise Injection	APID_U_CAL	54
			Correlated Noise Injection	APID_C_CAL	55
			Uncorrelated Noise Injection (Pointing Upwards)	APID_EXT_U_CAL	57
			Correlated Noise Injection (Pointing Upwards)	APID_EXT_C_CAL	58
	Correlator Test			APID_TEST	56

Table 2-2 SMOS X-Band TM Packets

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The FEP performs a preliminary processing of this information, and creates output files, each one comprising data on a single APID, and sorted by source packet counter.

In order to generate the L0 products, the L0P retrieves the files containing information on

- Science packets
- Ancillary packets

and uses also

- FEP product confidence data
- Orbit prediction files
- L0 configuration files.

The L0 configuration file shall define the operating directories where the input and output files are located, the time sort mechanism (FIFO or LIFO), the thresholds that define if error flags must be raised, and any other configurable information needed for the L0 product generation. All this information shall be defined in [RD.6].

The L0 Processor will ensure that:

1. Packets are sorted by source packet type.
2. Packets are reconstructed in chronological and source sequence count order.
3. Packets are consolidated into time-based segments. Depending on the configured mode, these segments will contain the data from a semiorbit (pole-to-pole), or from a full orbit, or all the data downloaded in an acquisition, with any duplicated packets removed. The pole crossing happens when the spacecraft's Z is a maximum or a minimum.
4. An ASCII XML header is added to each of the resulting products.

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2.1 L0 PRODUCT FILE STRUCTURE

2.1.1 Logical File vs Physical File

A SMOS Level 0 Product Logical File is compliant with [AD.9]; its structure, shown in Figure 2-2, comprises

- An ASCII XML Fixed Header, whose structure is identical for all files.
- An ASCII XML Variable Header, which allows to define and structure different information for each file type, and is splitted into
  - a Main Product Header (MPH)
  - a Specific Product Header (SPH).
- A Data Block, containing one Data Set.

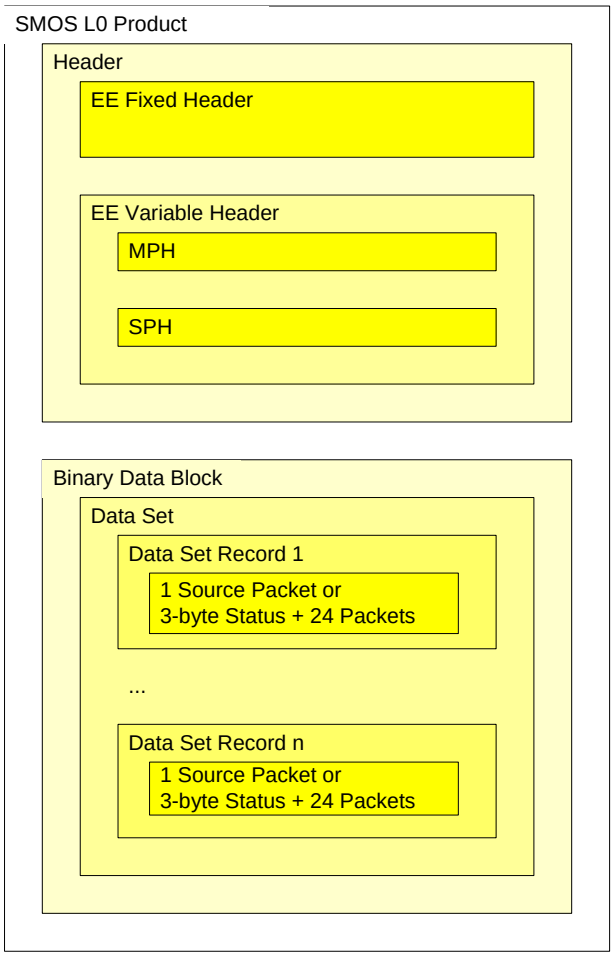

Figure 2-2 Level 0 Product Structure

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In terms of computer "Physical Files", the Logical File is structured as two separate Physical Files:

- a Header file
- a Data Block file

The L0 Physical files related to the same Logical File shall share the file name, only differentiating each Physical File using a different extension:

- .HDR for the Header file.
- .DBL for the Data Block file.

The high level file syntax for these files is as defined in [AD.1], 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 2-3 Non-XML ASCII File Syntax

The packaging mechanism for users external to the DPGS is the .ZIP one, as described in [AD.9]. For internal users, it is as described in [RD.10].

The "Validation-Schema-Reference" field is to be filled as specified in [RD.16] section 3.2.1. In the operational processor, this field is filled by the XML R/W library.

2.1.2 L0 Product File Names

The Logical File Name is compliant with [RD.10], i.e.:

MM_CCCC_TTTTTTTTTT_<Instance ID>

Where:

- MM is the Mission ID. For the SMOS mission this shall be "**SM**"
- CCCC is the File Class, identifying the type of activity for which the file is to be used, namely which phase of the ground segment development or operations cycle. A complete list is provided in [RD.10]. The L0P must use the value specified in the CNF_L0PGEN file.
- TTTTTTTTTT are 10 characters with the File Type to uniquely define the file structure. These should include:
    - File Category: the first 4 characters (3 characters plus underscore) define the type of file. For L0 Products, the values are

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  - "**MIR**_" for products derived from science (measurement, calibration or test) data
  - "**TLM**_" for products derived from ancillary data
- Semantic Description: 4 characters following the File Category to describe the type of data represented:
  - "**SC_D**" for Science Data at Dual polarisation
  - "**SC_F**" for Science Data at Full polarisation
  - "**TARD**" for external Target Data at Dual Polarisation
  - "**TARF**" for external Target Data at Full Polarisation
  - "**UNCD**" for uncorrelated Noise Injection, pointing downwards
  - "**CORD**" for correlated Noise Injection, pointing downwards
  - "**UNCU**" for uncorrelated Noise Injection, pointing upwards
  - "**CORU**" for correlated Noise Injection, pointing upwards
  - "**TEST**" for test data
  - "**MIRA**" for ancillary data
- Product Level. "**0**_" is used for L0 Products.

- <Instance ID> is used to identify the file uniquely and avoid file name duplicates.

yyyymmddThhmmss_YYYYMMDDTHHMMSS_vvv_ccc_s

It will follow the rules from [RD.10], the "shape" being Shape 1 (Sensing Period):

Instance element	Description	Comment
yyyymmddThhmmss	SMOS sensing start time of the data contained in the file. The value is the result of rounding up the Precise_Validity_Start time in the Specific Product Header. If only a single sensing time value is contained in the file (i.e. a point value) then the time shall be rounded down and used as both the sensing start time and the sensing stop time.	8+6 digits, separated by "T" CCSDS Compact Format
YYYYMMDDTHHMMSS	SMOS sensing stop time of the data contained in the file. The value is the result of truncating the Precise_Validity_Stop time in the Specific Product Header. If only a single sensing time value is contained in the file (i.e. a point value) then the time shall	8+6 digits, separated by "T" CCSDS Compact Format

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	be rounded down and used as both the sensing start time and the sensing stop time.	
vvv	Version number of the system generating the file.	3 digits, as described in [RD.10].
ccc	Sequential counter. It shall be increased if a previous "version" of the file was created.	3 digits from 001 to 999
s	Digit indicating the Level 0 Processor identifier, depending on what is specified in the CNF_L0P1(2)__ file: • if 1, then s=1 if running in nominal mode and s=5 if running in NRT mode. • if 2, then s=2 if running in nominal mode and s=6 if running in NRT mode.	1: L0P1 2: L0P2

Table 2-4 Shape 1 Instance ID

The following table lists the types of L0 products that have been considered, along with the naming convention. Note that the L0P does not ingest ISP files with PUS Housekeeping data. These PUS Housekeeping files are being ingested by the PXMF.

Source Packet Type				APID Name	APID Val	L0 Product Name
Ancillary Data				APID_A	3	SM_xxxx_TLM_MIRA0_
PUS Housekeeping Data				APID_X	4	N/A
Science Data	Measurement Mode	Full Polarisation		APID_FULL	52	SM_xxxx_MIR_SC_F0_
		Dual Polarisation		APID_DUAL	50	SM_xxxx_MIR_SC_D0_
	Calibration Mode	External Target	Full Polarisation	APID_EXC_FULL	53	SM_xxxx_MIR_TARF0_
			Dual Polarisation	APID_EXC_DUAL	51	SM_xxxx_MIR_TARD0_
		Internal Target	Uncorrelated Noise Injection	APID_U_CAL	54	SM_xxxx_MIR_UNCD0_
			Correlated Noise Injection	APID_C_CAL	55	SM_xxxx_MIR_CORD0_

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			Uncorrelated Noise Injection (Pointing Upwards)	APID_EXT_U_CAL	57	SM_xxxx_MIR_UNCU0_
			Correlated Noise Injection (Pointing Upwards)	APID_EXT_C_CAL	58	SM_xxxx_MIR_CORU0_
	Correlator Test			APID_TEST	56	SM_xxxx_MIR_TEST0_

Table 2-5 SMOS TM Data Streams

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3. LEVEL 0 PRODUCT HEADERS SPECIFICATION

A Level 0 Product Header will be an XML file and will be composed of two sections:

- 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.

In the tables below, the "source" field is one of the following:

- [ISP] Raw (Source Packet) data, without further processing
- [FEP] FEP acquisition report (REP_ACQREP)
- [ORB] Orbit prediction files (AUX_ORBPRE)
- [SCE] Orbit scenario file through usage of the EE CFI library (MPL_ORBSCT)
- [PCNF] Particular L0 configuration file (CNF_L0P1__ / CNF_L0P2__)
- [CNF] General L0 configuration file (CNF_L0PGEN)
- [AUX] General L0 auxiliary data file (AUX_CNFL0P)
- [ICNF] L0P Internal configuration file, defined in [RD.17]
- [INT] Internal processing

In order to distinguish what is copied of what is derived, an indication "(derived)" is provided when applicable.

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3.1 L0 PRODUCT EARTH EXPLORER FIXED HEADER

The **Fixed Header** is compliant with [AD.9]. The specific information left open in section 7.1 is specified here:

Field #	Field name	Comment	Unit	String length	C Format	Origin
01	Fixed_Header	Tag starting the Fixed Header of all SMOS products.	Tag			
02	File_Name	It is a repetition of the Logical File Name, i.e. the File Name excluding the extension.	Tag	60	%s	INT
03	File_Description	A 1-line description of the File Type. See the table below to find a complete list of the descriptions.	Tag	Variable (limited to 300 bytes)	%s	Hard-coded
04	Notes	Multi-lines free text. This can be used for any type of comment, relevant that instance of the file. For the operational processor, when the mode is NRT, the contents will be "NRT mode", otherwise, this field is empty.	Tag	Variable (limited to 300 bytes)	%s	Generated by the User
05	Mission	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.	Tag	4	%4s	Hard-coded
06	File_Class	A 1-line description of the file class, coherent with the File Class element in the File Name.	Tag	4	%4s	CNF
07	File_Type	It is a repetition of the File Type element in the File Name, including File Category and Semantic Descriptor.	Tag	10	%10s	First 8 chars, in the CNF (File_Category and Description).

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Field #	Field name	Comment	Unit	String length	C Format	Origin
						Last two chars are hardcoded.
08	Validity_Period	Tag starting a structure to specify the period of time during which the file contents are valid	Tag			
09	Validity_Start	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.	Tag	23	%23s UTC=yyyy-mm-ddThh:mm:ss	INT
10	Validity_Stop	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.	Tag	23	%23s UTC=yyyy-mm-ddThh:mm:ss	INT
11	Validity_Period	Tag ending a structure to specify the period of time during which the file contents are valid	Tag			
12	File_Version	It is a repetition of the File Counter element in the File Name instance ID. Must start at 0001 (not 0000), only digits allowed. The first digit is always 0.	Tag	4	%04d	INT
13	Source	Tag starting a structure to specify the GS element that has created the product	Tag			
14	System	Name of the Ground Segment element creating the file.	Tag	4	%s	ICNF
15	Creator	Either L0P1 or L0P2 chain.	Tag	4	%s	PCNF/L0P_Id (derived)
16	Creator_Version	Version of the tool. This shall be the same as version number in Filename's instance ID "vvv". Only digits allowed	Tag	3	%03d	ICNF
17	Creation_Date	UTC time at which the generation of the product was completed	Tag	23	%23s	INT

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Field #	Field name	Comment	Unit	String length	C Format	Origin
		(with the seconds truncated), in CCSDS ASCII format with time reference, as defined in Mission Conventions Document [AD.3]			UTC=yyyy-mm-ddThh:mm:ss	
18	Source	Tag ending the structure to specify the GS element that has created the product	Tag			
19	Fixed_Header	Tag ending the Fixed Header of all SMOS products.	Tag			

Table 3-1 Level 0 Fixed Header

Product Type / Dataset Name	File Description
TLM_MIRA0_	Level 0 Housekeeping Telemetry product
MIR_SC_F0_	Level 0 Full Polarization Science (Earth observation) measurements product
MIR_SC_D0_	Level 0 Dual Polarization Science (Earth observation) measurements product
MIR_TARF0_	Level 0 Full Polarization External Target measurements product
MIR_TARD0_	Level 0 Dual Polarization External Target measurements product
MIR_UNCD0_	Level 0 Uncorrelated Noise Injection product containing an uncorrelated noise injection measurement per epoch, consolidated in a pole-to-pole (plus configurable overlap) basis generated with the instrument pointing to the Earth
MIR_CORD0_	Level 0 Correlated Noise Injection product containing a correlated noise injection measurement per epoch, consolidated in a pole-to-pole (plus configurable overlap) basis generated with the instrument pointing to the Earth
MIR_UNCU0_	Level 0 Uncorrelated Noise Injection product containing an uncorrelated noise injection measurement per epoch, consolidated in a pole-to-pole (plus configurable overlap) basis generated with the instrument pointing to the sky
MIR_CORU0_	Level 0 Correlated Noise Injection product containing a correlated noise injection measurement per epoch, consolidated in a pole-to-pole (plus configurable overlap) basis generated with the instrument pointing to the sky
MIR_TEST0_	Level 0 Correlator Test product

Table 3-2 File Descriptions for Level 0 Products

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3.2 L0 PRODUCT EARTH EXPLORER VARIABLE HEADER

The Variable Header will also have an identical structure for all SMOS Level 0 Products. It will contain:

- a Main Product Header (MPH)
- a Specific Product Header (SPH)

3.2.1 Main Product Header

The Main Product Header of any SMOS Level 0 Product will be written in XML ASCII. It contains the information about:

- Product identification
- Processing information
- Orbit information
- Product Confidence Data (PCD) and Size Information

It will have the following format:

Field #	Field name	Comment	Unit	String Length	C Format	Origin
01	Main_Product_Header	Tag starting the Main Product Header structure	Tag			
Product Identification Information						
02	Ref_Doc	Reference doc describing the product (the Level 0 Product Specifications Document)	Tag	17	%17s	CNF/Ref_Document
Processing Information						
03	Acquisition_Station	Acquisition Station ID. Left justified with trailing blanks. If the product comprises data from a single station, then the value from the acquisition reports is copied.	Tag	4	%s	FEP

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Field #	Field name	Comment	Unit	String Length	C Format	Origin
		If the product comprises data from two stations (oldest data from station 1 and newest data from station 2), then the value is "cd-e", where • "cd" are the two first characters from station 1 • "e" is the first character from station 2. Example: if oldest data comes from "ESAC" and newest data come from "SVLD", then the value is "ES-S".				
04	Processing_Centre	ID code of the Physical Location where the product has been generated	Tag	4	%s	ICNF
05	Logical_Proc_Centre	ID code of the Logical Processing Centre that has generated the product {FPC}	Tag	3	%s	Hard-coded
Orbit Information						
06	Orbit_Information	Tag starting an Orbit Information structure.	Tag			
07	Phase	Phase number at sensing start time of first packet. If not used set to +000.	Tag	4	%+04d	SCE
08	Cycle	Cycle number at sensing start time of first packet. If not used set to +000	Tag	4	%+04d	SCE
09	Rel_Orbit	Relative orbit at sensing start time of first packet. If not used set to +00000	Tag	6	%+06d	SCE

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Field #	Field name	Comment	Unit	String Length	C Format	Origin
10	Abs_Orbit	Absolute orbit at sensing start time of first packet. If not used set to +00000	Tag	6	%+06d	ORB
11	OSV_TAI	TAI date and time of vector defined from field #15 to field #20	Tag	30	%30s TAI=yyyy-mm-ddThh:mm:ss.uuuuuu	ORB
12	OSV_UTC	UTC date and time of vector defined from field #15 to field #20	Tag	30	%30s UTC=yyyy-mm-ddThh:mm:ss.uuuuuu	ORB
13	OSV_UT1	UT1 date and time of vector defined from field #15 to field #20	Tag	30	%30s UT1=yyyy-mm-ddThh:mm:ss.uuuuuu	ORB
14	Leap_Second	UTC time of the occurrence of the leap second. If the leap second occurred in the product window the field is set by a devoted function in the CFI EXPLORER_library (see [RD.15] for details). Otherwise it is set to 30 blanks.	Tag	30	%30s UTC=yyyy-mm-ddThh:mm:ss.uuuuuu	INT, with info from ORB
15	X_Position	X Position in Earth Fixed Reference (last vector in the POF before the sensing start time)	Tag (m)	12	%+012.3f	ORB
16	Y_Position	Y Position in Earth Fixed Reference (last vector in the POF before the sensing start time)	Tag (m)	12	%+012.3f	ORB
17	Z_Position	Z Position in Earth Fixed Reference (last vector in the POF before the sensing start time)	Tag (m)	12	%+012.3f	ORB

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Field #	Field name	Comment	Unit	String Length	C Format	Origin
18	X_Velocity	X Velocity in Earth Fixed Reference (last vector in the POF before the sensing start time)	Tag (m/s)	12	%+012.6f	ORB
19	Y_Velocity	Y Velocity in Earth Fixed Reference (last vector in the POF before the sensing start time)	Tag (m/s)	12	%+012.6f	ORB
20	Z_Velocity	Z Velocity in Earth Fixed Reference (last vector in the POF before the sensing start time)	Tag (m/s)	12	%+012.6f	ORB
21	Vector_Source	Source of the Orbit State Vector record: FP = FOS predicted	Tag	2	%2s	Hard coded
22	Orbit_Information	Tag ending an Orbit Information structure.	Ending Tag			
Product Confidence Data (PCD), Datablock Schema and Size Information						
23	Product_Confidence	Product confidence value. Enumerated (NOMINAL for no errors, DEGRADED for minor errors reported) Minor errors: the percentage of missing packets exceeds the value in the configuration file The threshold to consider a product degraded or not shall be the Missing_ISP_Threshold included in the SPH	Tag	7 or 8	%s	INT
27	Main_Product_Header	Tag ending a Main Product Header structure	Tag			

Table 3-3 Level 0 Main Product Header

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3.2.2 Specific Product Header

The Specific Product Header will have the same structure for all the Level 0 Products considering that the Data set List could change from one Product to another. The Specific Product Header comprises two sections:

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

3.2.2.1 XML Specific Product Header Main Info

The XML Specific Product Header Main Info contains the information about:

- Product Description and Identification Information
- Product Time Information
- Instrument Configuration
- Product Confidence Data
- Product Location Information

The following table presents the parameters in the Specific Product Header. (Note: At the end of the section a complete example of an Specific Product Header in XML is presented).

Field#	Field name	Comment	Unit	String Length	C Format	Origin
01	Specific_Product_Header	Opening Tag	Tag			
Product Description and Identification Information						
02	SPH_Descriptor	Name describing SPH. The format is <filetype>_SPH, where the filetype is as described in section 2.1.2.	Tag	14	%14s	Hard-coded
Product Time Information						
03	Time_Info	Tag starting the Time_Info structure	Tag			

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Field#	Field name	Comment	Unit	String Length	C Format	Origin
04	Precise_Validity_Start	This is the UTC Validity Start Time, in CCSDS ASCII format with time reference and microseconds. The Precise_Validity_Start Time shall be the Sensing Start Time (OBET at T_SYNC time of measurement of the oldest data set record in the product).	N/A	30	%30s UTC=yyyy-mm-ddThh:mm:ss.uuuuuu	INT
05	Precise_Validity_Stop	This is the UTC Validity Stop Timein CCSDS ASCII format with time reference and microseconds. The Precise_Validity_Stop Time shall be the Sensing Stop Time (OBET at T_SYNC time of measurement of the youngest data set record in the product).	N/A	30	%30s UTC=yyyy-mm-ddThh:mm:ss.uuuuuu	INT
06	Abs_Orbit_Start	Absolute orbit of the first record (integration time) in the binary Data Set of this product	Tag	6	%+06d	ORB, ISP
07	Rel_Time_ANX_Start	Time between the last ANX prior to the sensing start time and the sensing start time.	Tag (s)	11	%013.6f	ORB, ISP (derived)
08	Abs_Orbit_Stop	Absolute orbit of the last record (integration time) in the binary Data Set of this product	Tag	6	%+06d	ORB, ISP
09	Rel_Time_ANX_T_Stop	Time between the last ANX prior to the sensing start time and the sensing stop time.	Tag (s)	11	%013.6f	ORB, ISP (derived)
10	UTC_at_ANX	UTC time of the ascending node of the orbit containing the sensing start time	Tag	30	%30s UTC=yyyy-mm-ddThh:mm:ss.uuuuuu	ORB, ISP (derived)
11	Long_at_ANX	Longitude of the ascending node of the orbit containing the sensing start time (positive if east of Greenwich). Range (-180, 180] deg.	Tag (deg)	11	%011.6f	ORB, ISP (derived)

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Field#	Field name	Comment	Unit	String Length	C Format	Origin
12	Ascending_Flag	A for ascending, D for descending. Nominal L0 mode: Orbit orientation at the Precise_Validity_Start less any configured overlap. NRT L0 mode: If 25 minutes < Rel_Time_ANX_Start < 75 minutes, then D; otherwise, A.	Tag	1	%c	ORB, ISP (derived)
13	Semiorbit_Start_Time	Nominal L0 mode: Time of the pole crossing that marks the start of the semiorbit NRT L0 mode: Precise_Validity_Start less any configured overlap.	Tag UTC	30	%30s UTC=yyyy-mm-ddThh:mm:ss.uuuuuu	ORB, ISP (derived)
14	Semiorbit_Stop_Time	Nominal L0 mode: Time of the pole crossing that marks the end of the semiorbit NRT L0 mode: Precise_Validity_Stop.	Tag UTC	30	%30s UTC=yyyy-mm-ddThh:mm:ss.uuuuuu	ORB, ISP (derived)
15	Total_Sensed_Time	Sum of the lengths of all the intervals contributing to this product.	Tag (s)	11	%011.3f	ISP, INT

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Field#	Field name	Comment	Unit	String Length	C Format	Origin
16	Correlation_Layer_Info	Information of correlation layer active at the first packet of each product type. For ancillary data, the value of this field depends on the value in the CORR_NOM_RED field in the source data: - 1 => N - 2 => R - 0 or 3 => I For science data, the value of this field depends on the value in the ASIC_00_INFO in the header before correlator data: - 0 => N - 1 => R	Tag	1	%c	ISP (derived)
17	Time_Info	Tag ending the Time Info structure	Tag			
Origin of Data						
18	Origin_of_Data	Tag starting the Origin of Data structure	Tag			
19	DAS_HW_Identifier	Unique identifier of the DAS hardware generating the ISP files.	Tag	4	%4s "nnnn" where n are digits or characters	FEP
20	L0P_HW_Identifier	Unique identifier of the L0P hardware involved in the processing	Tag	4	%4s "nnnn" where n are digits or characters	ICNF
21	Origin_of_Data	Tag ending the origin of data structure	Tag			

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Field#	Field name	Comment	Unit	String Length	C Format	Origin
Pass Confidence Data						
22	List_of_Passes	Level 0 (Pass-oriented) Confidence Data, with "count" field as attribute. It is an XML list containing a number of Pass structures	Tag	2	%02d	INT
23	Pass	Tag starting the Pass Confidence Data structure	Tag			INT
24	Pass_Start_Time	UTC Start Time of pass	Tag	30	%30s UTC=yyyy-mm-ddThh:mm:ss.uuuuuu	FEP
25	Pass_Stop_Time	UTC Stop Time of pass	Tag	30	%30s UTC=yyyy-mm-ddThh:mm:ss.uuuuuu	FEP
26	N_Missing_24packet_Blocks	Number of missing full 24-packet blocks in the pass	Tag	9	%09d	FEP
27	N_RS_Corrected_Bytes	Number of Reed-Solomon corrected bytes	Tag	9	%09d	FEP
28	Pass	Tag ending the Pass Confidence Data structure	Tag			
29	List_of_Passes	List end	Tag			
Product Confidence Data						
30	L0_Product_Confidence_Data	Tag starting the Product Confidence Data	Tag			
31	N_Valid_Packets	Number of valid packets in the product	Tag	9	%09d	INT
32	N_Missing_Packets	Number of missing packets inserted in the product (not including 24-packet blocks missing in the pass).	Tag	9	%09d	INT

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Field#	Field name	Comment	Unit	String Length	C Format	Origin
33	N_Invalid_Blocks	Number of 24-packet blocks in the product with at least one missing packet. For ancillary products, the value will be 000000000.	Tag	9	%09d	INT
34	L0_Product_Confidence_Data	Tag ending the Product Confidence Data	Tag			
Product Derived Confidence Data						
35	L0_Product_Derived_Confidence_Data	Tag starting the Product Derived Confidence Data	Tag			
36	Missing_ISP_Threshold	Maximum acceptable threshold of missing ISP against total ISP	Tag (10^{-2}%)	6	%06d	AUX
37	L0_Product_Derived_Confidence_Data	Tag ending the Product Derived Confidence Data structure	Tag			
Product Location Information						
38	Product_Location	Tag starting the Product Location structure	Tag			
39	Start_Lat	Latitude of satellite nadir point at the Sensing_Start time (positive North). Range [-90, 90] deg.	Tag (deg)	11	%+011.6f	ISP, ORB (derived)
40	Start_Long	Longitude of satellite nadir point at the Sensing_Start time (positive East of Greenwich). Range (-180, 180] deg.	Tag (deg)	11	%+011.6f	ISP, ORB (derived)
41	Stop_Lat	Latitude of satellite nadir point at the Sensing_Stop time (positive North). Range [-90, 90] deg.	Tag (deg)	11	%+011.6f	ISP, ORB (derived)
42	Stop_Long	Longitude of satellite nadir point at the Sensing_Stop time (positive East of Greenwich) . Range (-180, 180] deg.	Tag (deg)	11	%+011.6f	ISP, ORB (derived)
43	Product_Location	Tag ending the Product Location structure	Tag			

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Field#	Field name	Comment	Unit	String Length	C Format	Origin
Product Information						
44	Product_Information	Tag starting the Product Information structure	Tag			
45	Header_Schema	Name of the XSD to be used for the validation of the product header. The format is as specified in [RD.16]. In the operational processor, the value will be provided by an XML R/W API method.	Tag	31	%31s	INT
46	Datablock_Schema	Name of the binX schema for the validation of the product datablock. The format is as specified in [RD.16]. In the operational processor, the value will be provided by an XML R/W API method.	Tag	42	%42s	INT
47	Header_Size	Number of bytes in the header.	Tag (bytes)	6	%06d	INT
48	Datablock_Size	Number of bytes in the datablock.	Tag (bytes)	11	%011d	INT
49	Checksum	Of the data block, as defined in IEEE Std. 1003.1-2004. It is the POSIX cksum.	Tag	10	%010d	INT
50	Product_Information	Tag ending the Product Information structure	Tag			
List of Data Sets						

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Field#	Field name	Comment	Unit	String Length	C Format	Origin
51	List_of_Data_Sets	Tag starting the 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. The measurement data sets will be first. For the reference data sets, the order will be the one in table 3.5.	Tag			INT
52	Data_Set	Data_Set description, as specified in section 3.2.2.2.				
53	List_of_Data_Sets	Tag ending the list.				
Closing Tag						
54	Specific_Product_Header	Closing Tag	Tag			

Table 3-4 Level 0 Specific Product Header

3.2.2.2 XML Specific Product Header Data Sets

The Data Block content for L0 products consists of a Measurement data set comprised of all the Source packets gathered for the specific APID, and several Reference data sets with the L0 configuration and auxiliary data files names. As a result of this, we should consider two types of data sets for L0, the Measurements data sets and the Reference data sets.

The following tables present the different possible Data Set Names. For the Level 0 we will only consider one name for each Data Set type.

Data Set Name	Type	Description	Number of DSD of this Type
L0P_LOCAL_PARTICULAR_CONFIG	CNF_L0P1__ CNF_L0P2__	Local Configuration file used to create the L0 Product, including parameters which are specific to one instance of the L0P.	1
L0P_LOCAL_GENERAL_CONFIG	CNF_L0PGEN	Local Configuration file used to create the L0 Product, including parameters which are not L0P instance-dependent.	1
L0P_PROCESSING_CONFIG	AUX_CNFL0P	Level 0 processing parameters configuration.	1

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Data Set Name	Type	Description	Number of DSD of this Type
PREDICTED_ORBIT_FILE	AUX_ORBPRE	Predicted Orbit File used in the generation of the L0 Product.	1; it is the latest POF received covering the whole L0 product interval.
ORBIT_SCENARIO_FILE	MPL_ORBSCT	Orbit Scenario File used in the generation of the L0 Product.	1
ACQUISITION_REPORT	REP_ACQREP	FEP Acquisition Report used in the generation of the L0 Product.	1 or 2. 2 if the L0 product interval contains ISP downlinked in two passes.
INSTRUMENT_SOURCE_PACKET_FILE	TLM_nnnnnn	CORR_TM or I_HKTM file used in the generation of the L0 Product.	1 or 2. 2 if the L0 product interval contains ISP downlinked in two passes.
ANCILLARY_FILE	TLM_nnnnnn	I_HKTM file used for the time correlation in the generation of the MIR L0 Product. It is not applicable in the case of TLM L0 Products.	0 (for TLM products), 1 or 2. 2 if the L0 product interval contains ISP downlinked in two passes

Table 3-5 Reference Data Set Names

The Data_Set description in the XML Specific Product Header is presented in the following table:

Field #	Field name	Comment	Unit	String Length	C Format	Origin
N	Data_Set	Start of block	Tag			INT
N+1	DS_Name	Name describing the Data Set, as specified in tables 3.2 and 3.5.	Tag	30	%30s	INT
N+2	DS_Type	Type of Dataset: M for measurement R for reference	Tag	1	%c	INT
N+3	DS_Size	Size in bytes of the data set. Filled with zeroes for the Reference Data Sets.	Tag	10	%010d	INT
N+4	DS_Offset	Offset in bytes since the beginning of the data block file until the begginning of the data set. Filled with zeroes for the Reference Data Sets.	Tag	10	%010d	INT
N+5	Ref_Filename	Name of reference file, without extension, if Data_Set_Type is R; otherwise, blanks	Tag	60	%60s	INT

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N+6	Num_DSR	Number of measurement records in the Data Set (filled only for Measurement Data Sets). Filled with zeroes for the Reference Data Sets.	Tag	10	%010d	INT
N+7	DSR_Size	Size in bytes of each binary measurement data set record. For variable size DSRs, the value is -1. It is filled with zeroes for Reference Data Sets.	Tag	8	%08d	INT
N+8	Byte_Order	Type of ordering of the binary data. ▪ For Data Sets contained in the product's datablock, the Order will be "3210" (big-endian) ▪ For referenced data Sets, the order will be "0000"	Tag	4	%4s	INT
N+9	Data_Set	End of block	Tag			

Table 3-6 Level 0 Specific Product Header. Datasets Description

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4. DATA SETS SPECIFICATION

4.1 INTRODUCTION

The consolidation in the L0 Processor is accomplished in Groups of 24 source packets that will be ordered by time (OBET), and within the same OBET they will be ordered from packet 0 (first) to packet 23 (last), according to the Packet Sequence Control counter.

For example, in full-pol mode, there shall be 4 snapshots in each scene measured in 2,4 seconds, each of the snapshots consisting of 24 packets with all the correlations. The first period of 1,2 seconds provides the correlations for one snapshot, while during the second period of 1,2 seconds three snapshots are measured consecutively (each of them integrating the signals every 0,4 seconds).

In any case, each 1,2 seconds integration period is identified by an OBET counter at the TSYNC signal arrival (only TSYNC_X informs about RF switching allowing to change from one polarization to another every 0,4 seconds in the second integration period; however TSYNC_X is not received in the packets' header, but only TSYNC marking each 1,2 seconds integration period; see page 88 in [RD.7].

The way to order the packets is first grouping them according to their OBET_TSYNC (the OBET counter value at the TSYNC received just before the data has been correlated). Once they are ordered by time, the Packet Sequence Count is used. There are two fields in this 14-bit word:

- The lower 5 bits allow making a word ranging from 0 to 23, that allows ordering the 24 packets in the same snapshot
- The higher 9 bits make a word ranging from 0 to 511, which is incremented every time a complete 24 packets sequence is obtained, and is reset after the maximum value is reached. It does not make any distinction on APIDs.

For the first integration period in the full polarization scene, only the lower 5-bits word in the Packet Sequence Count is needed to order packets with the same OBET_TSYNC.

However, in the second integration period the higher 9-bit word is also needed, as there are 3 sequences of 24 packets (i.e. snapshots) with the same OBET_TSYNC. The packets are ordered from lower to higher consecutively; an exception arises if the 9-bit word counter reaches 511 and starts again, in that case the lowest values would be the most recent ones.

For ancillary measurement APID, there shall be one source packet for the same integration time (snapshot), holding all the relevant information for the processor on instrument and S/C HKTM. Ordering shall be per OBET at T_SYNC, as each packet shall contain a different integration time.

No matter how the consolidation is performed, all the SMOS Level 0 Products are based on 2 binary structures that are specified in the following chapters:

- L0 Correlation Measurements data sets
- L0 Ancillary data sets

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4.2 L0 CORRELATION MEASUREMENTS DATA SETS

The Correlation Measurement Data Set (Science Data Set) consists of the concatenation of a number of Science Measurement Data Set Records (MDR), each one of them containing

- A 3-bytes long stream, with the status (0=valid, 1=missing) of each source packet, codified in one bit. The least significant bit (which is the last bit when read from left to right -big-endian-) refers to the first source packet in the data set record. The fields in the schemas are presented as Status_00_07, Status_08_15 and Status_16_23, where packet 24 is identified by id 00, packet 23 by id 01,... and packet 1 by id 23..
- A group of 24 scientific source packets.

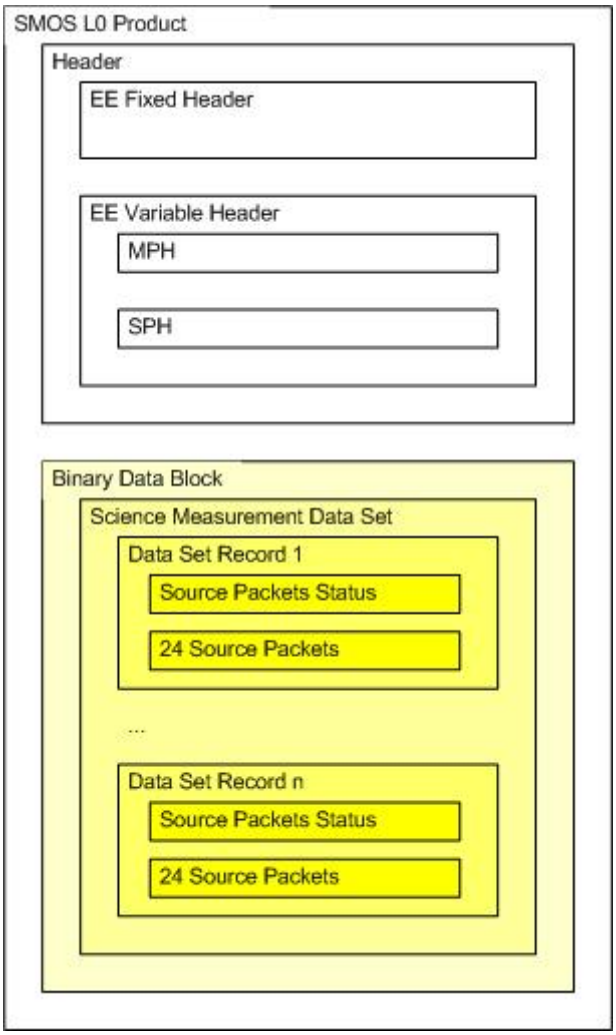

Figure 4-1 Detail on Science Data Sets

The binary structure for each scientific source packet is described in [AD.6] Table 3.6.A, where the Source Data field is as defined in [AD.6] Table A2.

In the case of missing packets, the L0P will create a packet fill of zeroes.

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The correlation Measurements Data Sets will be used in the following L0 products:

- MIR_SC_D0
- MIR_SC_F0
- MIR_TARD0
- MIR_TARF0
- MIR_UNCD0
- MIR_CORD0
- MIR_UNCU0
- MIR_CORU0
- MIR_TEST0

A common binary schema could then be used for all this products.

BinX requests that the data set be preceeded by an unsigned int 32-byte value, containing the number of data set records in the datablock, in big-endian format.

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4.3 L0 ANCILLARY DATA SETS

The Ancillary Data Set consists of a number of Ancillary Measurement Data Set records, each one of them containing a single Ancillary source packet, as described in [AD.6] Table 3.5.A, the Source Data field being as defined in [AD.6] Table A1. In the case of missing packets, the L0P will create a packet fill of zeroes.

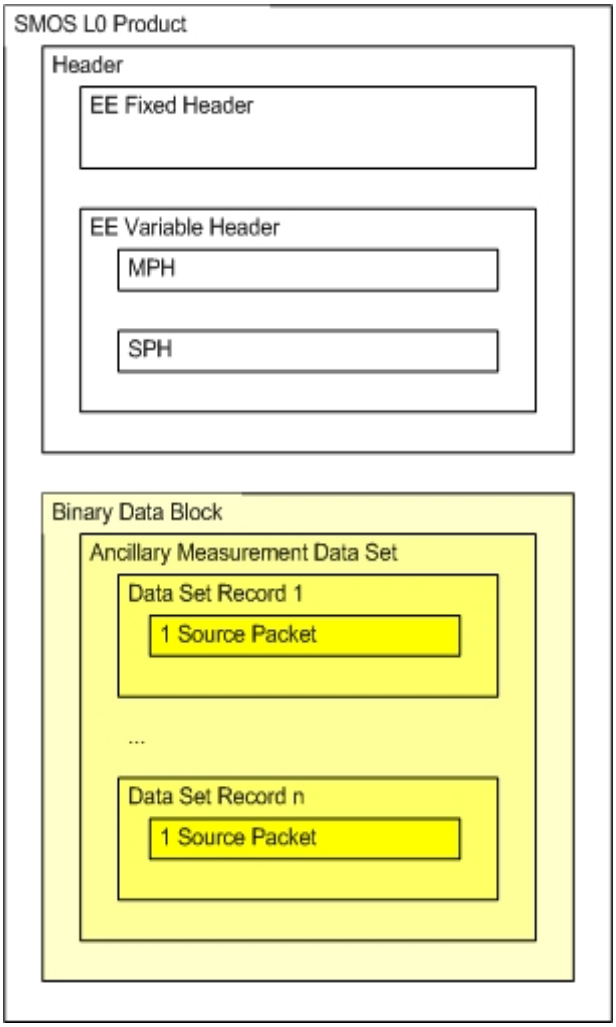

Figure 4-2 Detail on Ancillary Data Sets

The Ancillary Data Sets will be used in the TLM_MIRA0 L0 product.

BinX requests that the data set be preceeded by an unsigned int 32-byte value, containing the number of data set records in the datablock, in big-endian format.

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5. LEVEL 0 AUXILIARY DATA FILES

The auxiliary data required for the generation of the Level 0 products are:

- Orbit prediction files
- Orbit scenario files
- Level 0 local particular configuration file
- Level 0 local general configuration file
- Acquisition report
- Level 0 configuration auxiliary data file
- Instrument source packet files

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5.1 PREDICTED ORBIT FILE (AUX_ORBPRE)

The file name, contents and format of this file are provided in [RD.11] (PLPC::DPGS..FD_OUTPUT.PREDICTED_ORBIT).

5.2 ORBIT SCENARIO FILE (MPL_ORBSCT)

The details on this file are provided in [RD.12] (SPGF::CORE..SMC_PLANNING.ORBIT_SCENARIO).

5.3 LEVEL 0 LOCAL PARTICULAR CONFIGURATION FILE (CNF_L0P1__/CNF_L0P2__)

The file names, contents and formats of this file are provided in [RD.13] (CORE::L0P..CONTROL.L0P_PART_CONFIG). The generation of this file shall be detailed in [RD.14].

5.4 LEVEL 0 LOCAL GENERAL CONFIGURATION FILE (CNF_L0PGEN)

The file names, contents and formats of this file are provided in [RD.13] (CORE::L0P..CONTROL.L0P_GEN_CONFIG). The generation of this file shall be detailed in [RD.14].

5.5 ACQUISITION REPORT (REP_ACQREP)

The file name, contents and format of this file are provided in [RD.6] (XBAS/TIS::L0P..REPORT.ACQ_REPORT).

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5.6 CONFIGURATION AUXILIARY DATA FILE (AUX_CNFL0P)

5.6.1 File Name

The file name format is compliant with [RD.10]:

MM_CCCC_FFFFDDDDDD_yyyymmddThhmmss_YYYYMMDDTHHMMSS_vvv_ccc_s

with:

- MM = SM
- CCCC = OPER
- FFFF = AUX_
- DDDDDD = CNFL0P
- yyyymmddThhmmss = start of validity
- YYYYMMDDTHHMMSS = 20500101T000000
- vvv = generator version number
- ccc = file counter (default is 001)
- s = origin of data

5.6.2 Contents

ADF only have Fixed Header and Specific Product Header. The high level file syntax for this file is as defined in [AD.1], taking into account that it has not a "Main Product Header", i.e.

```
<?xml version="1.0" ?>
<Earth_Explorer_File>
     <Earth_Explorer_Header Validation-Schema-Reference>
          <Fixed_Header>
               Fixed Header contents
          </Fixed_Header>
          <Variable_Header>
               <Specific_Product_Header>
                    Variable Header contents
               </Specific_Product_Header>
          </Variable_Header>
     </Earth_Explorer_Header>
     <Data_Block type="xml" Validation-Schema-Reference>
          <data_set_name_1>
               Data Set 1 Contents
          </data_set_name_1>
     </Data_Block>
</Earth_Explorer_File>
```

Table 5-1. XML ASCII File Syntax

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5.6.2.1 Fixed Header

The **Fixed Header** is compliant with [AD.9]. The specific information left open in section 7.1 is specified here:

Field #	Field name	Comment	Unit	String length	C Format
01	Fixed_Header	Tag starting the Fixed Header.	Tag		
02	File_Name	It is a repetition of the Logical File Name, i.e. the File Name excluding the extension.	Tag	60	%s
03	File_Description	A 1-line description of the File Type. See the table below to find a complete list of the descriptions.	Tag	Variable (limited to 300 bytes)	%s
04	Notes	Multi-lines free text. This can be used for any type of comment, relevant that instance of the file.	Tag	Variable (limited to 200 bytes)	%s
05	Mission	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.	Tag	4	%4s
06	File_Class	A 1-line description of the file class, coherent with the File Class element in the File Name.	Tag	4	%4s
07	File_Type	It is a repetition of the File Type element in the File Name, including File Category and Semantic Descriptor.	Tag	10	%10s "AUX_CNFL0P"
08	Validity_Period	Tag starting a structure to specify the period of time during which the file contents are valid	Tag		
09	Validity_Start	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.	Tag	23	%23s UTC=yyyy-mm-ddThh:mm:ss
10	Validity_Stop	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.	Tag	23	%23s UTC=yyyy-mm-ddThh:mm:ss
11	Validity_Period	Tag ending a structure to specify the period of time during which the file contents are valid	Tag		
12	File_Version	It is a repetition of the File Counter element in the File Name instance ID. Must start at 0001 (not 0000), only digits allowed. The first digit	Tag	4	%04d

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Field #	Field name	Comment	Unit	String length	C Format
		is always 0.			
13	Source	Tag starting a structure to specify the GS element that has created the product	Tag		
14	System	Name of the Ground Segment element creating the file. For the Data Processing Ground Segment, this string shall be “DPGS”	Tag	4	%s
15	Creator	The value is "CEC "	Tag	4	%s
16	Creator_Version	Version of the tool. This shall be the same as version number in Filename’s instance ID “vvv”. Only digits allowed	Tag	3	%03d
17	Creation_Date	UTC time at which the generation of the product was completed (with the seconds truncated), in CCSDS ASCII format with time reference, as defined in Mission Conventions Document [AD.3]	Tag	23	%23s UTC=yyyy-mm-ddThh:mm:ss
18	Source	Tag ending the structure to specify the GS element that has created the product	Tag		
19	Fixed_Header	Tag ending the Fixed Header of all SMOS products.	Tag		

Table 5-2 Level 0 General Auxiliary Data File. Fixed Header

Product Type	File Description
AUX_CNFL0P	Level 0 General Auxiliary Data File

Table 5-3 File Descriptions for Level 0 Auxiliary Data Files

5.6.2.2 Specific Product Header

The following table presents the parameters for the Specific Product Header:

Field#	Field name	Comment	Unit	String Length	C Format
01	Specific_Product_Header	Opening Tag	Tag		
02	SPH_Descriptor	Name describing SPH.	Tag	14	%14s "AUX_CNFL0P_SPH"
03	Ref_Doc	Reference doc describing the product (the Level 0 Product Specifications Document)	Tag	17	%17s SO-TN-IDR-GS-0003

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Field#	Field name	Comment	Unit	String Length	C Format
04	Precise_Validity_Start	Start time of the SMOS sensing time period in which the file data are valid. It is coherent with the "validity start time" in the filename, but in CCSDS ASCII format, with time reference and microseconds. Note that, as defined in [AD.9], a special value should be used if the file were intended to be valid regardless of SMOS sensing start time.	Tag	30	%30s UTC=yyyy-mm-ddThh:mm:ss.uuuuuu
05	Precise_Validity_Stop	Stop time of the SMOS sensing time period in which the file data are valid. It is coherent with the "validity stop time" in the filename, but in CCSDS ASCII format, with time reference and microseconds. Note that, as defined in [AD.9], a special value should be used if the file were intended to be valid regardless of SMOS sensing stop time.	Tag	30	%30s UTC=yyyy-mm-ddThh:mm:ss.uuuuuu
06	Header_Schema	Name of the XSD to be used for the validation of the product header. The format is as specified in [RD.16]. In the operational processor, the value will be provided by an XML R/W API method.	Tag	31	%31s
07	Datablock_Schema	Name of the schema for the validation of the product datablock. The format is as specified in [RD.16]. In the operational processor, the value will be provided by an XML R/W API method.	Tag	31	%31s
08	Header_Size	Number of bytes in the header.	Tag (bytes)	6	%06d
09	Datablock_Size	Number of bytes in the datablock.	Tag (bytes)	11	%011d
10	HW_Identifier	Identifier of the machine that has generated this ADF.	Tag	4	%4s
11	Specific_Product_Header	Closing Tag	Tag		

Table 5-4 Level 0 General Auxiliary Data File. Specific Product Header

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5.6.2.3 Data Block

The Data Block of the AUX_CNFL0P Auxiliary Data Product is in XML ASCII format. It is composed of two subblocks, in the following table:

Field #	Field name	Comment	Unit	String length	C Format
01	L0P_Nominal_Configuration_Aux_Data	Tag starting the Nominal section of the General Auxiliary Data structure	Tag		
02	Aux_Data_Structure	Aux_Data_Structure, as specified in next table			
03	L0P_Nominal_Configuration_Aux_Data	Tag ending the Nominal section of the General Auxiliary Data structure	Tag		
04	L0P_NRT_Configuration_Aux_Data	Tag starting the NRT section of the General Auxiliary Data structure	Tag		
05	Aux_Data_Structure	Aux_Data_Structure, as specified in next table			
06	L0P_NRT_Configuration_Aux_Data	Tag ending the NRT section of the General Auxiliary Data structure	Tag		

Table 5-5 Level 0 General Auxiliary Data File. Data Block

Field #	Field name	Comment	Unit	String length	C Format
01	L0_Processing	Tag starting the L0_Processing structure	Tag		
02	List_of_APIDs	Tag starting the list of applicable APIDs. It has a "count" field as attribute.	Tag		%02d
03	APID	Tag starting the APID structure. For scientific APIDs, the order in which the APIDs appear in this list is the order in which the L0 processing occurs. The ancillary packets are always processed first.	Tag		
04	APID_Number	APID value; e.g. 3, 50, 51, 52, etc.	Tag	3	%03d
05	Generation_Sequence	Whether older or newer products shall be generated first. Either “FIFO” or “LIFO”. "FIFO" is the only valid value for NRT.	Tag	4	%s
06	Overlap_Time	Number of 1.2 second interval. See the explanation in section 7.1.	Tag	3	%03d
07	Cutting_Strategy	Cutting strategy defining the product boundaries. Either "HALF_ORBIT" or "NPX_TO_NPX" or "SPX_TO_SPX" or "NOT_APPLIC". "NOT_APPLIC" is valid only (and it is the only valid value) for NRT.	Tag	10	%10s

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Field #	Field name	Comment	Unit	String length	C Format
08	APID	Tag ending the APID structure.	Tag		
09	List_of_APIDs	Tag ending the List_of_APIDs.	Tag		
10	L0_Processing	Tag ending the L0_Processing structure.	Tag		
11	L0_Parameters	Tag starting the L0_Parameters structure.	Tag		
12	Extra_Snapshot	Flag indication the addition of an extra snapshot at the end of the ancillary products. Either "OFF" or " ON" or "N/A". "N/A" is valid only (and it is the only valid value) for NRT.	Tag	3	%3s
13	Facility	Facility where the data are generated 1: SMOS DPGS Fast Processing Centre @ ESAC 2: SMOS DPGS LTA @ TBD 3: SMOS DPGS Calibration & Expertise Centre @ ESAC 4: Indra 5: GMV 6: INSA 7: VEGA	Tag	2	%02d
14	PCD_Thresholds	Tag starting the PCD_Thresholds structure	Tag		
15	Missing_Packets	Maximum percentage of missing packets considered as acceptable, given with two decimals (max. 10000). This is used to declare the product as "Degraded".	Tag (%)	5	%5.2d
16	PCD_Thresholds	Tag ending the PCD_Thresholds structure	Tag		
17	L0_Parameters	Tag ending the L0_Parameters structure	Tag		

Table 5-6 Level 0 General Auxiliary Data File. Aux_Data_Structure

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5.7 INSTRUMENT SOURCE PACKETS FILENAME

The file names, contents and formats of these files are provided in [RD.6] (XBAS/TIS::L0P..PLM_MONITORING.CORR_HKTM).

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6. PRODUCTS SIZES ESTIMATIONS

The Housekeeping Telemetry product consists of ancillary packets, one for each 1.2 seconds integration period. All other products are Correlation products, consisting each of them of scenes of a certain number (depending on the type of data) of 24-packets groups (snapshots). Each packet has 476 bytes, with 14 bytes in the packet header and 462 bytes in the source data field.

The following is a list of assumptions on the typical measurement situations for each type of MIRAS data, based on the timeline provided by [RD.8]:

- → Full polarization nominal measurement scene: typical situation is continuous measurements with internal short correlated noise injection calibration gaps (about 2 x 8 epochs each), then typically the number of scenes in a product is *Maximum – 16*
- → Dual polarization nominal measurement scene: typical situation is the same as for full polarization.
- → Full polarization external target scene: possible situation is dedicating one complete orbit to measure external targets, with internal calibrations as for nominal measurements, therefore the figure is Maximum - 16. Current baseline is to perform this every 2 weeks.
- → Dual polarization external target scene: the same as for target full polarization external target
- → Correlated Noise Injection scene:
  - Long Calibration: typically one measurement each 4 weeks (following IOCP figure), therefore in a product 1 scene only.
  - Short Calibration: typically one measurement each 1.25 orbits, therefore 1 scene at most in a half-orbit product (worst case with this baseline).
- → Uncorrelated Noise Injection scene: typically one measurement each 4 weeks (following IOCP figure)
- → Housekeeping Telemetry: there is always one HKTM measurement each 1.2 seconds integration period.

Using the information above, the following table details the sizes of products' data blocks in their most extreme situations (the product contains a continuous records of the same type for that half-an-orbit segment) and their nominal situations (following IOCP figures); the product's header must be added to this figure in order to have the total product's size:

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Type of Data		Packets in a snapshot	Size of snapshot	Snapshots in 1 scene	Size of scene	Maximum# scenes in product	Maximum size of product data block	Assumptions on generation frequency	Typical # scenes in product when operating in this mode	Typical size of product's data block
Dual polarization nominal measurement	**With overlap**	24	11,424	2	22,848	1,348	30.799.104	Every half-orbit, if instrument mode baseline is Dual Pol.	1,328	**30,342,144**
	Without overlap					1,251	28.582.848		1,231	**28,125,888**
Full polarization nominal measurement	**With overlap**	24	11,424	4	45,696	1,348	61.598.208	Every half-orbit, if instrument mode baseline is Full Pol.	1,328	**60,684,288**
	Without overlap					1,251	57.165.696		1,231	**56,251,776**
Dual polarization external target measurement		24	11,424	2	22,848	1,251	28,582,848	Once every 2 weeks, if instrument mode baseline is Dual Pol.	1,231	**28,125,888**
Full polarization external target measurement		24	11,424	4	45,696	1,251	57,165,696	Once every 2 weeks, if instrument mode baseline is Full Pol.	1,231	**56,251,776**
Correlated Noise Injection	**Long Calibration**	24	11,424	232	685,440	10	26,503,680	Once every month, 20 long calibration segments per full orbit (hence 10 in a semi-orbit)	10	**26,503,680**
	Short Calibration	24	11,424	16	91,392	156	28.605.696	Every 1.25 orbits	1	**182,784**
Uncorrelated Noise Injection		24	11,424	18	205,632	139	28,582,848	Once every month, 20 long calibration segments per full orbit (hence 10 in a semi-orbit)	10	**2,056,320**
Housekeeping Telemetry		1	476	1	476	2,696	1,283,296	Every half-orbit	2,696	**1,283,296**

Table 6-1 Products Sizes

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7. NOMINAL MODE LEVEL 0 PRODUCT BOUNDARIES

7.1 DETERMINATION OF HALF-ORBIT BOUNDARIES

The pole crossing is defined as the epoch in which the spacecrat's Z velocity changes its sign. To determine the Z velocity change, data from the predicted orbit files are used.This epoch will be included both in past and current product.

This method has to be applied only to the HKTM processing. Half-orbit boundaries for other L0 science products should be taken from the L0 HKTM results.

A half orbit boundary is considered when a Z velocity sign change is detected or when the time between 2 consecutive epochs is greater than 50 minutes.

7.1.1 Product Boundaries for TLM_MIRA0_ Products

In the beginning of the product, the first meaningful epoch is considered to be the one with the velocity sign change (positive for ascending products and negative for descending products). The overlap is added including N epochs in the past (i.e. with opposite Z velocity sign), N being the “Overlap_Time” configurable parameter for TLM_MIRA0_ APID from AUX_CNFL0P.

For the end of the product, the last epoch within the L0 product shall be again the one where the Z velocity sign changes (or in absence of this, the very last in the pass).

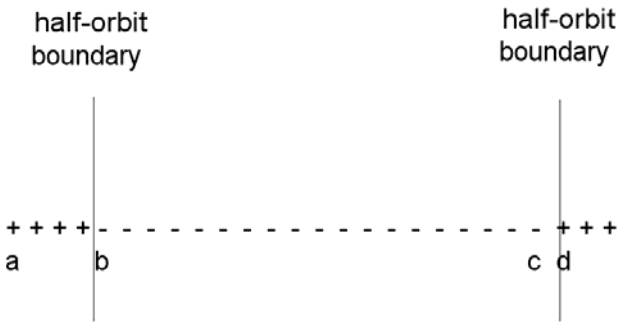

Figure 7-1 Half-Orbit Boundaries Calculation for TLM_MIRA0_

Either the L0 product:

- Nominal case: contains epochs from **a** to **d**
- or contains epochs from **a** to **c** (instrument switch off)
- or contains epochs from **b** to **d** (instrument switch on)

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The period a to b is the overlap as defined by the longest overlap of the rest APIDs + 8 epochs.

7.1.2 All other product boundaries

The overlap for each APID is defined as a number of epochs in the AUX_CNFL0P. The difference between HKTM overlap and the APID overlap is removed from the HKTM boundary to form the APID boundary. All epochs for the APID on or inside these boundaries shall be consolidated into 1 single L0 product of this APID.

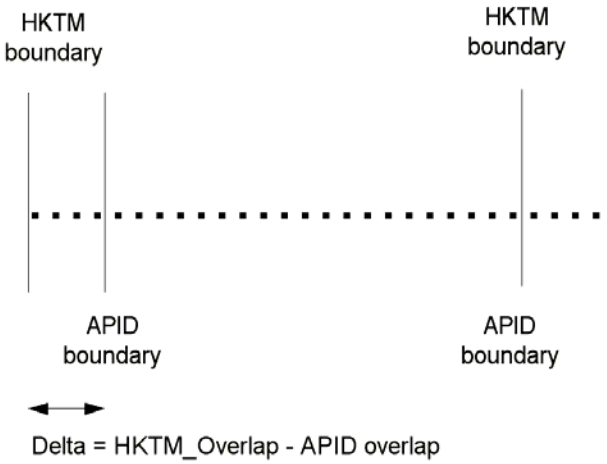

Figure 7-2 Half-Orbit Boundaries Calculation for All Other L0 Products

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