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JERS/SEASAT SAR Products
CEOS FORMAT SPECIFICATIONS

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1 INTRODUCTION

1.1 Purpose of This Document

This document defines the format of the SAR RAW, PRI, IMM and SLC products generated from JERS-1 and SEASAT SAR sensor data by the ESA JERS and SEASAT SAR Instrument Processing Facilities (IPFs).

1.2 Background

The SEASAT L0 RAW product is not available as CEOS, but is provided in a historical MDA format, for reasons of compatibility and interoperability. The format is documented here for ease of reference.

The CEOS formats adopted for the JERS RAW L0 (unfocussed signal data) and for the processed JERS/SEASAT L1 PRI and SLC products have significantly different “flavours”.

The JERS RAW CEOS format is derived from that used by JAXA with the objective of providing immediate compatibility with pre-existing software that accesses JAXA JERS SAR L0 data. The PRI and SLC CEOS product format is however derived from that used by ESA for ERS-1 and ERS-2 PRI and SLC products [RD-3], with the objective of ensuring compatibility with tools developed for analysis of ESA ERS SAR image products.

In the interests of compatibility, both the L0 and L1 ESA JERS CEOS products are generated to be structurally compatible with the corresponding JAXA JERS L0 and ESA ERS L1 products, in terms of file and record types, file and record sizes, and the CEOS record sentinels used. However, not all fields and records are fully populated.

The JAXA JERS SAR L0 product contain a number of records and fields whose contents are available only to JAXA or are otherwise inaccessible; such records and fields have been retained to ensure structural compatibility but are blank or null-filled as appropriate. The ESA ERS L1 CEOS specifications contain some fields specific to ERS, and these fields are also blank or null-filled as appropriate.

None of the information in these voided fields or records is thought to be relevant to users interested in generating images from the unfocussed L0 data or analyzing the L1 products.

The product sizes are not fixed. Standard JERS products have nominal scene dimensions of 80 by 80 Km; standard SEASAT products have nominal scene dimensions of 100 by 100 Km, corresponding to the swath widths illuminated by the platforms.

The L0 product structures are described below in sections 3.2 (JERS) and 3.3 (SEASAT); these sections also contain some technical notes relevant to the processing of the JERS/SEASAT raw data. The L1 product structures are described in section 3.4.

Details of the individual CEOS files, records and fields are provided in section 4 (JERS L0) and section 5 (JERS/SEASAT L1) of this document; formatting abbreviations used in are defined below in section 2.3.

2 Documentation

2.1 Applicable Documents

[AD-1] Products Naming Standard Convention GMGT-MMAN-EOPG-TN-13-0005

2.2 Reference Documents

[RD-1] Japanese JERS-1 to Ground Station Interface Description (revision 2, October 1990)

[RD-2] JERS SAR Image Data – Data Format [First Issue], RESTEC, Japan, November 1996

[RD-3] ERS SAR Products Computer Compatible Tape Format Specifications ER-IS-EPO-GS-5902.4 Issue 3 August 1998

[RD-4] JERS/SEASAT SAR Level 1 Products ENVISAT and GEOTIFF/TIFF Format Specification, JSIPF-E-G-SPEC v1.0 May 2014

[RD-5] RS EO ESRIN 2010-55 Seasat 1 SAR Spec (EARTHNET)

[RD-6] EO SIP Packaging for SEASAT, ESA tbd

[RD-7] EO SIP Packaging for JERS, ESA tbd

[RD-8] SEASAT SAR IPF - SEASAT Data and Processing Issues, Phoenix technical note C-2014-02-01-TN-01 May 2014.

[RD-9] Jordon, R “The SEASAT-A Synthetic Aperture Radar System”, 0364-9059/80/0400-0154 IEEE 1980

2.3 Acronyms and Abbreviations

| <i>Acronym</i> | <i>Description</i> |
|----------------|--|
| ADC | Analog to Digital Conversion |
| ASF | Alaska SAR Facility |
| CCT | Computer Compatible Tape |
| CEOS | Committee on Earth Observation Satellites |
| ESA | European Space Agency |
| GEC | SAR Ellipsoid Geo-Coded Products. |
| IPF | Instrument Processor Facility |
| MDA | MacDonald Dettweiler Associates |
| PRF | Pulse Repetition Frequency |
| PRI | SAR Precision Image Product <i>or</i> Pulse Repetition Interval (i.e. 1/PRF) |
| RAW | Formatted Raw Data Product. |
| SAR | Synthetic Aperture Radar |
| SHF | SAR Header File |
| SLC | Single Look Complex Product. |
| SWST | Sampling Window Start Time |

UHF Universal Header File
UTC Universal Time Code

2.4 Format Abbreviations

The tables in sections 4 and 5 below refer to various formats; the significance of the format abbreviations is as follows:

| FORMAT DESCRIPTOR | SIGNIFICANCE |
|-------------------|--|
| An | ASCII (text) field of n characters |
| Bn | BINARY number of n bytes. Data is in “big-endian” order. |
| In | Integer of field width n characters, formatted as text e.g. “1234” |
| Fn.m | Floating point number with a field width of n characters and a decimal precision of m characters e.g. 123.456 |
| En.m | Floating point number in scientific notation with a field width of n characters and a decimal precision of m characters e.g. -0.123456E+07 |
| Dn.m | Floating point number in scientific notation with a field width of n characters and a decimal precision of m characters e.g. -0.123456D+07 |

2.5 Document Overview

This document is presented with three principal sections.

In section 3 we describe the JERS/SEASAT SAR products available, the overall structure of the products and details on the products naming and packaging. We include some notes concerning technical details relating to the focusing of JERS and SEASAT image data from the L0 raw products.

In section 4 we present tables detailing the L0 JERS.SAR.RAW CEOS files and records.

In section 5 we present tables detailing the L1 SAR.PRI/IMM and SLC CEOS files and records.

3 PRODUCT DETAILS

3.1 Product Naming Convention and Packaging

All products are named with a filename according to [AD-1]. All product filenames have a name stub with the format:

Product_namestub = <Platform>_<OPER>_<product_ID>_<Start_time>_<End_time>_<abs_orbit>_<track_number>_<frame_node_number>_<crc_code>

with a filename extension varying according to the file type, and where the fields in the name stub have the following significance:

| Field | Size in Characters | Description |
|---------------------|--------------------|--|
| <platform> | 3 | JE1 (JERS-1) or SE1 (SEASAT) |
| <product_ID> | 10 | product code JSA_RAW_0P |
| <Start_time> | 15 | YYYYMMDDTHHMMSS |
| <End_time> | 15 | YYYYMMDDTHHMMSS |
| <abs_orbit> | 6 | Absolute orbit number |
| <track_number> | 4 | Track number |
| <frame_node_number> | 4 | Node number at centre of image frame |
| <crc_code> | 4 | 4-digit random hex string as unique identifier |

For example a JERS L0 product might have the name stub JE1_OPER_JSA_RAW_0P_1998022T101733_1998022T101747_001234_0123_4567_E1DE

All ESA JERS and SEASAT products are packaged according to ESA EOSIP specifications [RD-06], [RD-07].

The EOSIP packaging provides:

- The L0 or L1 product as a tarfile (.TAR)

The tarfile contains a directory; for SEASAT L0 this contains a MDA formatted data and the directory has the extension “.MDA”; all other products are in CEOS format and the directory has the extension “.CEOS”.

- Metadata and, for L1 image data, a quicklook Browse Product, as a zipfile (.ZIP)

Metadata is provided in XML format in accordance with the schemas defined in [RD-06], [RD-07].

Metadata comprises :

- SIPInfo (with the filename extension “.SI.XML”)
- EarthObservation metadata (with the filename extension “.MD.XML”)
- qualityReport metadata (with the filename extension “.QR.XML”)
- browseReport (with the filename extension “.BI.XML) (for L1 image data products)

For L1 image products a browse image is supplied as a North-oriented PNG file (with the filename extension “.BI.png”)

3.2 JERS Level 0 RAW CEOS Product

3.2.1 Product Type

The level 0 product JERS.SAR.RAW is a CEOS formatted transcript of a selected window of the unfocussed JERS signal data from the ESA WILMA archives.

The primary parameters allowing the data to be focused are provided in the header of the signal data record file.

The level 0 products is not generated to a fixed size. A “standard” scene is nominally ~ 80 by 80 Km in extent; the JERS SAR swath width is ~ 80Km wide, with 6144 echo samples in range and ~19904 echoes along track.

3.2.2 Product Structure

Table 3-1 below summarizes the outline structure of the ESA JERS SAR RAW product. The product is provided as five separate split CEOS files, following the JAXA CEOS naming convention.

Table 3-1 JERS SAR RAW Product Structure

| | CEOS Codes | No of records, size | Comment |
|--------------------------------------|-------------------|----------------------------|----------------|
| Volume Directory File | | | |
| VOLUME DESCRIPTOR RECORD | 192,192,18,18 | 1*360 Bytes | |
| LEADER FILE POINTER RECORD | 219,192,18,18 | 1*360 Bytes | |
| IMAGERY OPTIONS FILE POINTER RECORD | 219,192,18,18 | 1*360 Bytes | |
| TRAILER FILE PONTER RECORD | 219,192,18,18 | 1*360 Bytes | |
| TEXT RECORD | 18,63,18,18 | 1*360 Bytes | |
| Leader File | | | |
| FILE DESCRIPTOR RECORD | 11,192,18,18 | 1*720 Bytes | |
| DATA SET SUMMARY RECORD | 18,10,18,20 | 1*4096 Bytes | |
| PLATFORM POSITION DATA RECORD | 18,30,18,20 | 1*4680 Bytes | |
| PLATFORM ATTITUDE DATA RECORD | 18,40,18,20 | 1*8192 Bytes | Dummy record |
| RANGE SPECTRA RECORD | 18,80,18,20 | 1*8600 Bytes | Dummy record |
| DETAILED PROCESSING PARAMETER RECORD | 18,120,18,70 | 1*9216 Bytes | Dummy record |
| FACILITY RELATED DATA RECORD | 18,200,18,70 | 1*2048 Bytes | Dummy record |
| SAR Data File | | | |
| FILE DESCRIPTOR RECORD | 50,192,18,18 | 1*720 Bytes. | |
| UNPROCESSED SIGNAL DATA RECORDS | 50,10,18,20 | M records of 12700 Bytes | |
| SAR Trailer File | | | |
| FILE DESCRIPTOR RECORD | 91,192,18,18 | 1*720 Bytes | |
| Null Volume File | | | |
| NULL VOLUME DESCRIPTOR RECORD | 192,192,63,18 | 1*360 Bytes | |

The product is supplied in the following directory structure:

Directory <Product_namestub>.CEOS, containing files:

VOLD.DAT (CEOS SAR volume file)
 SARL_01.DAT (CEOS SAR leader file)
 IMOP_01.DAT (CEOS SAR data file)
 SART_01.DAT (CEOS SAR trailer file)
 NULL.DAT (CEOS SAR null file)

3.2.3 Technical notes relating to JERS L0 data and data focussing

3.2.3.1 Introduction

The ESA JERS SAR RAW product has some special features reflecting the design of the platform and its related telemetry, and some peculiarities. We summarize the main points below, with reference, where relevant, to [RD-1] and [RD-2].

3.2.3.2 Data Error Policy

The ESA JERS SAR RAW product has been generated with the policy that data errors are not smoothed or corrected and the signal data record contents are a direct transcript from the high rate telemetry data in the WILMA archives. Users should adopt their own strategies to identify and compensate for e.g. missing range lines or bit errors in telemetry parameters.

3.2.3.3 State Vectors (Platform Position Data Record)

The JAXA JERS SAR L0 product has the “convention” that state vectors are provided in Earth Centred Rotating (ECR) coordinates, but the corresponding velocity vectors remain in an inertial frame, with their Cartesian components referred to the ECR unit vectors at the epoch of the state vector.

Given a state vector [\underline{r}_{ecr} , \underline{v}_{eci}] the ECR velocity components can be readily calculated from:

$$\underline{v}_{ecr} = \underline{v}_{eci} - \underline{\omega} \wedge \underline{r}_{ecr}$$

where $\underline{\omega}$ is the Earth spin vector through true North with a magnitude of the Earth angular rotation rate.

This convention has been maintained in the platform position record to provide compatibility between ESA and JAXA JERS SAR L0 products.

3.2.3.4 Attitude Data

The JERS platform was equipped with attitude sensors and the raw attitude data is in principle available in a low-rate PCM data stream multiplexed with the high rate telemetry; however, this attitude data is relatively inaccessible and is not well documented in [RD-1]. Fortunately the attitude of the JERS satellite was well-maintained to an inertial pointing law ('fine-pointing'), such that the SAR boresight is at right angles to the inertial platform velocity vector; the typical magnitudes of pitch and yaw angle corrections defined by the attitude record provided in JAXA JERS SAR L0 products are almost invariably small, corresponding typically to a few tens of Hz in Doppler. As a consequence no attitude data is provided in the ESA JERS SAR RAW product and users should operate a suitable Doppler tracking algorithm to provide a detailed pointing correction to the a priori inertial pointing of the platform, if required.

As an L-band sensor the JERS SAR is substantially less sensitive to attitude control errors than, for example RADARSAT-1. We are unaware of *any* JERS SAR dataset where the a priori Doppler centre frequency is ambiguous (in error by greater than the PRF/2 relative to that expected on the basis of the 'fine-pointing' attitude control law), and as a consequence Doppler ambiguity analysis is unnecessary for JERS SAR data.

3.2.3.5 HK Data

All critical telemetry data relating to the JERS SAR subsystem is provided as a bit-packed field of 69 bits, termed "HouseKeeping" or HK data, in the high rate telemetry. This source data is provided unmodified in the signal data record headers. The structure of the HK bit fields is defined by [RD-1]. Most of the critical telemetry parameters are however extracted from the HK data and provided as formatted fields in the ESA JERS SAR RAW record header. We provide a description of the physical organization of the HK data and the important fields after the description of the signal data record.

3.2.3.6 AGC

The JERS SAR sensor operated with a 3 bit Analog to Digital Convertor (ADC); the limited dynamic range of the echo data was enhanced by use of an Automatic Gain Control (AGC). The AGC is agile and dynamically scales the echo data by up to 31dB of attenuation. The AGC level is set by received echo levels, although these are measured in a narrow range window and this can have adverse effects in some observation scenarios.

Substantial AGC gain variations can occur and it is important for these to be suitably compensated during data focusing.

The AGC level is stored in the relevant field (bytes 93-96) of the signal data record header (as a gain value that has been applied to the data by the sensor). However, this field does not appear to be populated by JAXA in their JERS SAR L0 products and users wishing full compatibility with the JAXA CEOS format should access the relevant 5-bit field in the HK data.

3.2.3.7 STC

The JERS SAR sensor also enhanced the echo dynamic range through application of Sensitivity Time Control (STC). The STC provided a stepped attenuation of 0 to 5dB in 1 dB increments to the received echo data, approximately adjusting for the elevation beam pattern. The STC pattern has been estimated from the hand drawn graph in [RD-1] and is tabulated below.

Table 3-2 JERS SAR STC Attenuation Pattern

| Time (microseconds) | 0-49 | 50-59 | 60-79 | 80-109 | 110-149 | 150-259 | 260-299 | 300-329 | 330-349 | 350-369 | 370-430 |
|----------------------|------|-------|-------|--------|---------|---------|---------|---------|---------|---------|---------|
| STC attenuation (dB) | 0 | 1 | 2 | 3 | 4 | 5 | 4 | 3 | 2 | 1 | 0 |

The STC pattern is not applied from the start of the receive window; it is applied to the receive window from an origin offset into it (STC OFFSET). This parameter varies; unfortunately there is no field defined for it in the signal data record header, and it has to be retrieved from the HK data.

3.2.3.8 JERS Antenna Patterns

No information on antenna patterns is provided in the ESA JERS SAR RAW product. The JERS antenna patterns are reasonably represented by unweighted sinc patterns, with a peak to first null width of 6.2 degrees in elevation and 1.13 degrees in azimuth.

3.2.3.9 Signal Data Format

JERS SAR signal data is provided as 3 bit data samples, I and Q, with each 3 bit sample provided in a byte (i.e. with 5 leading null bits). These samples are to be interpreted as unsigned bytes with an offset of 3.5 i.e. the numbers represented from binary 000 (zero) to 111 (seven) represent signal values running from -3.5 to +3.5.

3.2.3.10 Echo rank, trigger bias

The JERS satellite orbit and swath geometry is such that echoes have a rank of 7, that is there are seven transmit cycles between the transmission of a pulse and the receipt of the corresponding radar echo. The trigger delay (time to first sample) is thus given by $(7/PRF + \text{the sampling window start time offset} - \text{trigger bias})$. We estimate the JERS SAR trigger bias at ~6.9 microseconds.

3.3 SEASAT Level 0 RAW MDA Format Product

3.3.1 Background

The ESA SEASAT products are derived from data acquired over Europe and downlinked to the Oakhanger receiving station in the UK. The data was historically transcribed from HDDR to CCT and subsequently preserved as disc files at some later date. The historic ESA archive consists of ~1800 data files in MDA format with each file corresponding to one reel of 1600 bpi CCT containing 4096 echoes and with typically 5 reels spanning a transcribed scene.

This data was not immediately processable because the historic archive did not retain associated orbit and attitude data. In addition there are a number of technical issues with the transcribed SEASAT data, notably problems with missing and erroneous echoes, large dataset timing errors and SWST errors and associated georeferencing errors.

The ESA SEASAT raw data archive has been rehabilitated with the echo sequencing and timing/SWST errors corrected, with raw datasets regenerated, re-framed on a nodal basis and correctly populated with accurate orbit and attitude data.

Refer to [RD-8] for further details.

3.3.2 Product Type

The level 0 product SEAS.SAR.RAW is a transcript in MDA format of a selected window of the unfocussed SEASAT signal data from the ESA archives.

Where feasible the level 0 products are generally generated to an approximately fixed size with 13680 echo samples in range and ~27560 echoes along track (~16.8 secs).

A “standard” raw data scene nominally allows a full resolution image of ~ 100 by 100 Km to be generated spanning the SEASAT SAR swath width.

3.3.3 Product Structure

Table 3-3 below summarizes the outline structure of the MDA SEAS SAR RAW product. The product is provided as three files, a Universal Header File (UHF), a SAR Header File (SHF) and a data file (DATA). The structure is documented in [RD-5], but summarized here for ease of reference.

The UHF contains no information of interest for processing and is provided solely for the purposes of software compatibility. It contains historical information relevant to CCT transcription (reel number, recording density etc) together with a number of fixed SEASAT parameters (number of range samples, bits per sample etc). It is formatted in EBCDIC and is 3060 bytes in size. Comprehensive documentation on the UHF is no longer available; it is roughly documented in [RD-05].

The SHF provides an ASCII formatted set of orbit state vectors and platform attitude data records.

The DATA file contains packed echo data, with one record per echo with a short header containing critical telemetry parameters.

Table 3-3 SEAS SAR RAW Product Structure (MDA format)

| Universal Header File (UHF) – 3060 bytes | | |
|--|------------|---|
| Historic CCT transcription parameters - irrelevant for processing. Refer to [RD-5] | | |
| SAR Header File (SHF) – 24660 bytes | | |
| Item | Bytes | Description |
| 1 | 1-1440 | 18*80 lines of text. Historic content unknown, is void in ASF example. |
| 2 | 1-720 | Orbit data (see Table 3-4 below) |
| 3 | 721-3240 | 49 Attitude data records (see Table 3-5 below) |
| 4 | 3241-24660 | Blank fill |
| Data File (DATA) – N(9360) bytes | | |
| Sequence of 9360-byte echo data records, comprising a 180 byte header, 13680 5-bit data samples packed into 9120 two-byte words and a 60 byte filler to 9360 bytes (see Table 3-6 below). The useful information in the header is limited to a few parameters discussed further below. | | |

Table 3-4 Orbit Data - Header + 5 orbit data records

| Bytes | Description | Format |
|---------|--|------------|
| 1-4 | Year of first state vector | I4 |
| 5-8 | Month of first state vector | I4 |
| 9-12 | Day of first state vector | I4 |
| 13-16 | Day of year of first state vector | I4 |
| 17-38 | Seconds of day of first state vector | D22.15 |
| 39-60 | Time interval between state vectors | D22.15 |
| 61-126 | First position vector(X, Y, Z) | 3(D22.15) |
| 127-192 | First velocity vector(V_x, V_y, V_z) | 3(D22.15) |
| 193-720 | 4 more state vectors | 24(D22.15) |

Table 3-5 Attitude Data

| Bytes | Description | Format |
|---------|--------------------|--------------------|
| 1-4 | Day of year | I4 |
| 5-12 | Millisecond of day | I8 |
| 13-16 | Pitch quality flag | I4 |
| 17-20 | Roll quality flag | I4 |
| 21-24 | Yaw quality flag | I4 |
| 25-38 | Pitch (degrees) | E14.6 |
| 39-52 | Roll (degrees) | E14.6 |
| 53-66 | Yaw (degrees) | E14.6 |
| 67-3234 | | 48 further records |

Table 3-6 MDA DATA Echo Data Record Format Specification¹

| Bytes | Description | Format | Comment |
|---------|-------------------------|--------|--|
| 1-2 | Record number | B2 | Not used (always 1!) |
| 3-6 | 10s of millisecs of day | B4 | This field serves no useful purpose additional to the “Millisec of day” field below at byte 133. Note that there are prospective compiler word boundary alignment issues with this field. |
| 7-70 | Not used/unknown | 32B2 | |
| 71-72 | Echo counter | B2 | (unsigned) 16-bit Cyclic counter, see footnote ² . |
| 73-118 | Not used/unknown | 23B2 | |
| 119 | Spare | B1 | |
| 120 | Status | B1 | Status is kept in bits 4-7. These flags are generally reliable and should be monitored; if set they indicate that the echo data quality is unreliable – or null. |
| 121-122 | Day of year | B2 | If used, caution with prospective bit errors |
| 123-124 | Clock drift | B2 | Unreliable/not used |
| 125 | Spare | B1 | |
| 126 | Bits per sample | B1 | Value is held in bits 0-2. This is a fixed system parameter – there are 5 bits per sample. This field need not be used, caution with prospective bit errors |
| 127 | Spare | B1 | |

¹ Parameters critical to data processing are highlighted in red.

| | | | |
|-----------|--|--------|--|
| 128 | PRF code | B1 | PRF code is held in bits 0-2. The PRF code was held fixed for the mission with a constant value of 4. See notes further below. If used, caution with prospective bit errors. |
| 129 | Spare | B1 | |
| 130 | Sampling Window Start Time code | BCD | Defines the time delay to first echo sample. See notes further below |
| 131 | Spare | B1 | |
| 132 | SDF/SCU and DEMOD status | B1 | DEMOD status in bits 0-3, SDF/SCU in bits 4-7. Significance unknown, not used |
| 133-136 | Milliseconds of day | B4 | See notes further below |
| 137-180 | Spare | 22B2 | |
| 181-9300 | Packed echo data | 4560B2 | 3 successive 5-bit samples packed in bits 0-14; bit 15 unused |
| 9301-9360 | Spare | 30B2 | |

3.3.4 Technical notes relating to SEASAT L0 data and data focussing

3.3.4.1 Introduction

As noted above and detailed in [RD-8], the historic ESA SEASAT RAW archive exhibits a number of inherent data problems, and critical ones have been “cleaned” in the ESA SEAS.SAR.RAW products.

There are a number of points that users of the ESA SEASAT RAW data product should be aware of. The raw data product does not contain any key engineering parameters (frequency, PRF etc); these are also detailed here.

3.3.4.2 Byte Ordering

The RAW product is written in “big-endian” format, such that byte reversal is required for interpretation of B2 and B4 data fields on e.g. pc architectures.

3.3.4.3 Echo Sequencing Errors

The historic source SEASAT transcribed raw data is prone to echo sequencing errors, with both missing and erroneous pulses². Echo sequencing has been subjected to careful analysis, and echoes have been inserted or deleted accordingly in the cleaned raw product to maintain azimuth timing integrity.

² The cyclic echo counter at byte 71 is just a sequential record number generated at transcription and does not contain any useful information concerning dropped or surplus echoes. On historic data the wrap-around may not necessarily be 65535, but be reel oriented. For ESA SEASAT L0 MDA data this wraps after 65535, but the counter serves no useful purpose.

It should be noted that any echoes inserted into the dataset to maintain azimuth timing have *not* been null-filled – the SEASAT raw data format is 5-bit (0-31) with a bias offset of 15.5, such that a null sample represents a saturating (low) raw data pixel. Any echoes inserted are simply copies of the previous valid echo; the echo status field (bits 4-7 of byte 118) has however been rewritten to record an error status for any such inserted echoes.

3.3.4.4 Echo Timing

The echo timing field (bytes 133-136) in the historic data has a number of idiosyncracies, compounded by bit errors. The noisy and inaccurate timing data has been rewritten for each echo to contain an accurate (precision of the field is 1 msec) and smoothly evolving UTC timestamp incorporating estimated georeferencing timing corrections.

The echo timing field in the “cleaned” raw data product uses the accurate PRI such that the recorded time of echo N is: $\text{start_time} + (N-1)\text{PRI}$. The (inaccurate) timing field in the historic source data is derived from a terrestrial clock, and the cleaned raw data is subtly different in this respect.

3.3.4.5 SWST and Range Time Origin

The SWST is defined by byte 130, in BCD³, in units of the PRI/64. The SWST code reported is usually accurate, but on one orbital acquisition held in the ESA archive the SWST clearly changes, as evidenced by inspection of the data and the image range georeference, but the SWST field remains static (this phenomenon is also reported by the ASF). This field has been rewritten to incorporate estimated SWST corrections as relevant.

3.3.4.6 Bit Errors

In comparison with more recent orbital SAR systems the SEASAT raw data frequently has a high bit error rate – sometimes hundreds of errors within a given echo record. These bit errors are not thought to have been inherent in the satellite design – indeed, the data was downlinked in analog form and digitized at the groundstation – but are a result of physical degradation of media, either the source HDDTs, or the secondary transcribed archive of CCTs, or both, prior to transfer of data to disc storage.

Bit errors in the echo data cannot be recovered but the SAR imaging process is robust against such problems, which at worst elevate the image noise floor slightly. However users should be aware that, with the exception of critical fields which have been cleanly rewritten (or flagged via the status field as erroneous echoes) by the ESA SEASAT-IPF, all fields in the header are prone to bit errors. If used, particular care should be taken to ensure that reported values are consistent over an adequate number of echoes for fields defining e.g. the day of year, the PRF and the number of bits per sample - although all of the data in these fields can be safely replaced with static values or inferred from other data.

3.3.4.7 State Vectors

The orbit state vectors are defined in true-of-date ECI (Earth Centred Inertial) coordinates. A suitable Earth rotation model is required to calculate the angular offset of the Greenwich meridian at the state vector epoch to allow rotation of the ECI state vector coordinates into Earth Centred Rotating (ECR) coordinates.

The state vector units are non-standard:

Position is defined in units of 10^7 metres, velocity is defined in units of 10^9 metres per Julian Day (86400 seconds) i.e.
 conventional position vector in m = $X \cdot 10^7$
 conventional velocity vector in ms^{-1} = $V \cdot 10^4 / 0.864$

³ Binary Compressed Decimal uses successive 4-bit fields for successive decimal units – thus e.g. decimal 27 = 2 tens + 7 ones would be represented by $2 \cdot 16 + 7 = 39$ in BCD.

where X and V are state vector components extracted from the SHF.

3.3.4.8 Platform Attitude

The attitude of the SEASAT satellite was reasonably well-maintained to an inertial pointing law ('fine-pointing'), such that the SAR boresight plane is approximately at right angles to the inertial platform velocity vector and contains the vector between the geocentre and the platform; the antenna boresight is elevated from the vertical by ~20.5 degrees with a corresponding central incidence angle of ~23 degrees.

The Doppler centroid thus systematically varies round orbit by of order +/- 1500Hz.

The attitude data contained in the SHF relates to small perturbations relative to this attitude control law; for the ESA SEASAT raw data products this attitude data derives from historic round-orbit Doppler tracking undertaken by Oakhangar. We estimate that there is a small additional antenna yaw bias angle of -0.29 degrees, with the sense such that the effective yaw angle (in degrees) is given by the SHF yaw values - 0.29.

The sense of the pitch, roll and yaw corrections is that the nominal fine pointing mode spacecraft coordinate axes are pitched, then rolled about the pitched coordinates, then yawed about the pitched and rolled coordinates, but the angles involved are sufficiently small that the rotations effectively commute.

As an L-band sensor SEASAT is substantially less sensitive to attitude control errors than, for example RADARSAT-1, sufficient that further Doppler tracking is thought unnecessary if pointing estimates are based on a fine pointing attitude law and incorporating these attitude corrections.

3.3.4.9 AGC

SEASAT was equipped with an AGC although no related telemetry is available in the MDA transcribed raw data. There is however no evidence of AGC related variation within any of the images generated from the ESA archive and it is possible that it was not activated during the unexpectedly short mission.

3.3.4.10 STC

The SEASAT SAR sensor reduced the echo dynamic range prior to downlink through application of Sensitivity Time Control (STC). However we have no accurate STC engineering data. On the basis of a comment made by Jordan [RD-9] the STC pattern applied approximates a simple "V" shape (assumed linear in dB) covering 9dB from the centre of the pattern to its edges.

There is some doubt concerning the accurate relative location of the STC pattern within the receive window. In JERS-1 for example the SWST and STC origins could be adjusted independently. Unfortunately any data concerning the STC origin is not represented in the transcribed echo headers; reasonable results are however generally obtained by assuming that the STC and SWST origins coincide.

3.3.4.11 SEASAT Antenna Patterns

We do not have accurate data for the SEASAT antenna patterns but we assume them to be approximately unweighted sinc functions with a peak to null width of ~6.2 degrees in elevation and ~1.3 degrees in azimuth.

3.3.4.12 Signal Data Format

SEASAT SAR signal data is provided as 5 bit data samples with three 5 bit samples packed into successive 16-bit words (i.e. with bit 15 unused in each short word). These samples are to be interpreted as unsigned with an offset of 15.5 i.e. the numbers from binary 00000 (zero) to 11111 (31) represent signal values running from -15.5 to +15.5.

The SEASAT data is not complex, data samples are real. The echo data was not quadrature demodulated to baseband, but simply heterodyned down to an offset video frequency of half the ADC rate; the ADC rate is slightly greater than twice the video bandwidth. The data video spectrum thus has two sidebands (one being the complex conjugate of the other). A conventional baseband complex SAR signal sampled at the ADC/2 is obtained by e.g. N-point Fourier transform, select the first N/2 spectral samples, N/2-point inverse transform and multiply alternate samples by -1 (or equivalently baseband the N/2 point spectrum in the frequency domain by an explicit cyclic rotation to map the sideband centre to DC).

3.3.4.13 Key SEASAT Parameters

All frequency parameters are derived from a stable local oscillator (STALO) running at 91.058742 MHz

Centre frequency

This is given by $STALO * 14 = 1.274822388 \text{ GHz}$

ADC rate

This is given by $STALO / 2 = 45.52936179495$

PRF

There was a choice of 4 PRF options indexed by the PRF code, which in practice was held fixed at 4 for the mission.

Available PRF options were:

1. $STALO / (3 * 256 * 81)$
2. $STALO / (3 * 256 * 77)$
3. $STALO / (3 * 256 * 75)$
4. $STALO / (3 * 256 * 72)$

The 4th option has a PRF = 1646.7509765625 Hz

Trigger bias

We estimate the trigger bias empirically as : 7.41 microseconds.

The SEASAT swath is such that it has a rank of 9 (there are 9 PRI between pulse transmission and echo reception).

The time offset to first echo sample is thus given by: $(9/PRF) + SWST_CODE/(64*PRF) - 7.41 \cdot 10^{-6}$ seconds.

Range chirp parameters

The chirp bandwidth and duration are nominal; the critical parameter is the chirp FM rate.

The SEASAT chirp is an upswept FM glide with a bandwidth of: ~19077225 Hz and a duration of ~33.9277 microseconds.

An accurate estimate of the chirp FM rate is: $19077225.0/33.9277 = +562290.54725195$ MHz/sec.

There is however a small non-linearity in the FM rate. This has the effect of distorting the range sidelobe levels, with an elevated first sidelobe at far range. A correction for this has been estimated empirically. We characterise the cubic phase term in the (video) frequency domain:

If f is the single sideband video frequency and f_{ADC} is the ADC sampling rate, then the cubic phase correction is approximately given, for the complex baseband signal, by:

$$-2\pi \cdot 0.015 \cdot (4 \cdot f / f_{ADC})^3 \text{ for } -f_{ADC}/4 < f < +f_{ADC}/4 \text{ radians (i.e. -0.015 cycles cubic phase error at the edges of the (single sideband) sampling bandwidth).}$$

3.4 Level 1 PRI/IMM and SLC CEOS Products

3.4.1 Data Processing Background

The JERS SAR level 1 products are generated directly from focusing of low-level datasets extracted from ESA WILMA JERS telemetry archives, using archived satellite orbit state vectors and time correlation records.

The SEASAT L1 products are derived from a “cleaned” version of a secondary MDA transcribed raw data archive, using historic orbit and attitude data from the UK Oakhanger groundstation.

SAR focusing is undertaken using a range-Doppler processing architecture adapted to allow generation of scenes of extended size along track without loss of focus or georeferencing precision. The IMM product (only available for JERS-1) is generated from averaging and decimating the PRI image.

3.4.2 Product Types

Three product types are available as CEOS formatted products

Level 1 Precision Image (JSA/SEA PRI 1P)

The JSA_PRI_1P product is comparable to the ESA PRI/IMP images generated for ASAR and ERS platforms. It is a ground range projected detected image in zero-Doppler SAR coordinates, with a 12.5 metre pixel spacing. It has four overlapping looks in Doppler covering a total bandwidth of 1000Hz, with each look covering a 300Hz bandwidth. Sidelobe reduction is applied to achieve a nominal PSLR of less than -21dB.

The SEA_PRI_1P is generated to a slightly different specification. It is a ground range projected detected image in zero-Doppler SAR coordinates, with a 12.5 metre pixel spacing, but with 6 overlapping looks in Doppler covering a total bandwidth of 1200Hz, with each look covering a 250Hz bandwidth. Sidelobe reduction is applied to achieve a nominal PSLR of less than -21dB.

Ellipsoid geocoded products are not available as CEOS formatted products. Corresponding ellipsoid geocoded products are available in GEOTIFF format, refer to [RD-4].

Level 1 Single Look Complex Image (JSA/SEA SLC 1P)

The JSA_SLC_1P product is comparable to the ESA SLC/IMS images generated for ASAR and ERS platforms. It is a slant-range projected complex image in zero-Doppler SAR coordinates. The data is sampled in natural units of time in range and along track, with the range pixel spacing corresponding to the reciprocal of the platform ADC rate and the along track spacing to the reciprocal of the PRF. Data is processed to an unweighted Doppler bandwidth of 1000Hz, without sidelobe reduction. The product is suitable for interferometric, calibration and quality analysis applications.

The SEA_SLC_1P product has the same basic specification but is processed to an unweighted Doppler bandwidth of 1200Hz.

Level 1 Medium Resolution Image (JSA IMM 1P)

The JSA_IMM_1P product is comparable to the ESA IMM images generated for the ASAR platforms. It is a ground range projected detected image in zero-Doppler SAR coordinates, with a 75 metre pixel spacing and enhanced radiometric resolution. The image is generated by power averaging blocks of 6*6 pixels of a product generated to JSA_PRI_1P specification, and has an effective number of looks > 75. The reduced data volume and high contrast make this an attractive product for many applications.

Table 3-7 JERS SAR Level 1 products available in CEOS format

| Product ID | Product Type | Parameter | Value |
|------------|---------------------------------|----------------------|---|
| JSA_PRI_1P | Level 1 Precision Image | Pixel size | 12.5 * 12.5 m |
| | | Projection | Ground range in SAR coordinates |
| | | Processing Bandwidth | 4 * 300 Hz overlapped looks, covering a total 1000Hz Doppler bandwidth. |
| | | Side-lobe reduction | Hanning Weighting = 0.75 (<-21dB PSLR) |
| JSA_SLC_1P | Level 1 Single Look Complex | Pixel size | As determined per ADC rate and PRF |
| | | Projection | Slant range in SAR coordinates |
| | | Processing Bandwidth | 1000 Hz Doppler bandwidth single look. |
| | | Side-lobe reduction | Not Applied |
| JSA_IMM_1P | Level 1 Medium Resolution Image | Pixel size | 75 * 75m |
| | | Projection | Ground range in SAR coordinates |
| | | Resolution | Derived from PRI by spatial averaging and decimation by factors of 6 in range and azimuth respectively. Spatial resolution ~150m, ENL>75 |

Table 3-8 SEASAT SAR Level 1 products available in CEOS format

| Product ID | Product Type | Parameter | Value |
|------------|-----------------------------|----------------------|---|
| SEA_PRI_1P | Level 1 Precision Image | Pixel size | 12.5 * 12.5 m |
| | | Projection | Ground range in SAR coordinates |
| | | Processing Bandwidth | 6 * 250 Hz overlapped looks, covering a total 1200Hz Doppler bandwidth. |
| | | Side-lobe reduction | Hanning Weighting = 0.75 (<-21dB PSLR) |
| SEA_SLC_1P | Level 1 Single Look Complex | Pixel size | As determined per ADC rate and PRF |
| | | Projection | Slant range in SAR coordinates |
| | | Processing Bandwidth | 1200 Hz Doppler bandwidth single look. |
| | | Side-lobe reduction | Not Applied |

Note. ESA “NEST” compatibility. At the time of preparation of this document, NEST does not support an import filter for SEASAT CEOS products. SEASAT products may however be imported using the NEST JERS import filter, if bytes 61-64 of the Volume Descriptor Record are manually edited using e.g. “vi” to read “JERS” rather than “SEAS”.

3.4.3 Product Structure

Table 3-9 below summarizes the outline structure of the ESA JERS SAR PRI, IMM and SLC products. Products are provided as four separate split CEOS files, following the ESA CEOS naming convention. The JERS L0 product structure and naming convention is slightly different for reasons of compatibility; the JERS L0 structure is discussed further above.

Table 3-9 JERS/SEASAT SAR PRI, IMM and SLC Product Structure

| | CEOS Codes | No of records, size |
|---|---------------|--|
| Volume Directory File | | |
| VOLUME DESCRIPTOR RECORD | 192,192,18,18 | 1*360 Bytes |
| FILE POINTER RECORD | 219,192,18,18 | 2*360 Bytes |
| TEXT RECORD | 18,63,18,18 | 1*360 Bytes |
| Leader File | | |
| FILE DESCRIPTOR RECORD | 63,192,18,18 | 1*720 Bytes |
| DATA SET SUMMARY RECORD | 10,10,31,20 | 1*1886 Bytes |
| MAP PROJECTION DATA RECORD | 10,20,31,20 | 1*1620 bytes |
| PLATFORM POSITION DATA RECORD | 10,30,31,20 | 1*1046 Bytes |
| FACILITY RELATED DATA RECORD GENERAL TYPE | 10,200,31,50 | 1*12288 Bytes |
| FACILITY RELATED DATA RECORD PCS QUALITY TYPE | 10,200,31,50 | 1*12288 Bytes (Blank filled) |
| SAR Data File | | |
| FILE DESCRIPTOR RECORD | 63,192,18,18 | 1*N Bytes. The record length N is the same as the processed data records for compatibility with some CEOS interpretation software. |
| PROCESSED DATA RECORD | 50,11,31,20 | M records of N Bytes |
| Null Volume File | | |
| NULL VOLUME DESCRIPTOR RECORD | 192,192,63,18 | 1*360 Bytes |

3.4.4 L1 products are supplied in the following directory structure:

Directory <Product_namestub>.CEOS, containing files:

VDF_DAT.001 (CEOS SAR volume file)

LEA_01.001 (CEOS SAR leader file)

DAT_01.001 (CEOS SAR data file)

NUL_DAT.001 (CEOS SAR null file)

3.4.5 Quick-Look Browse Products

Associated with any Level 1 product is a quick-look browse product. The browse image is provided in PNG format. The browse image is a power averaged and decimated representation of the main product. The thumbnails are presented with a filename of the form : <Product_namestub>.BI.PNG, and the product ID in the namestub takes the form “JSA_PRI_BP or SEA_PRI_BP”

4 JERS SAR RAW Product CEOS FORMAT

4.1 VOLUME DIRECTORY FILE FORMAT DEFINITION

Table 4-1 VOLUME DESCRIPTOR RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|---------|--------|--|---------------|-------|
| 1 | 1-4 | B4 | Record sequence number | 1 | |
| 2 | 5-5 | B1 | 1st record sub-type code | 192 | |
| 3 | 6-6 | B1 | Record type code | 192 | |
| 4 | 7-7 | B1 | 2nd record sub-type code | 18 | |
| 5 | 8-8 | B1 | 3rd record sub-type code | 18 | |
| 6 | 9-12 | B4 | Length of this record | 360 | |
| 7 | 13-14 | A2 | ASCII/EBCDIC Flag | A | |
| 8 | 15-16 | A2 | Blanks | | |
| 9 | 17-28 | A12 | Format control document | CCB-CCT-0002 | |
| 10 | 29-30 | A2 | Superstructure format control document | A | |
| 11 | 31-32 | A2 | Superstructure record format revision | A | |
| 12 | 33-44 | A12 | Logical volume generating facility software release and revision level | JERSIPF.01.03 | |
| 13 | 45-60 | A16 | ID of physical volume containing this volume descriptor | S11 | |
| 14 | 61-76 | A16 | Logical volume identifier | J1S00YYDDD | |
| 15 | 77-92 | A16 | Volume set identifier | JERS-1 SAR | |
| 16 | 93-94 | I2 | Total number of physical volumes in the logical volume | 1 | |
| 17 | 95-96 | I2 | Physical volume sequence number of the first tape within the logical volume | 1 | |
| 18 | 97-98 | I2 | Physical volume sequence number of the last tape within the logical volume | 1 | |
| 19 | 99-100 | I2 | Physical volume sequence number of current tape within the logical volume | 1 | |
| 20 | 101-104 | I4 | First referenced file number in this physical volume within the logical volume | 4 | |
| 21 | 105-108 | I4 | Logical volume number within volume set | 1 | |
| 22 | 109-112 | I4 | Logical volume number within physical volume | 1 | |
| 23 | 113-120 | A8 | Logical volume creation date (YYYYMMDD) | 20080319 | |
| 24 | 121-128 | A8 | Logical volume creation time (HHMMSSDD, DD=deci-seconds) (DD not provided) | 22264900 | |

| | | | | | |
|----|---------|------|---|--------------------|--|
| 25 | 129-140 | A12 | Logical volume generation country (GERMANY, ENGLAND, ITALY) | ITALY | |
| 26 | 141-148 | A8 | Logical volume generating agency | ESA | |
| 27 | 149-160 | A12 | Logical volume generating facility (D-PAF,UK-PAF, IPAF(ASI), ES, ,MS, KS, FS) | PAM | |
| 28 | 161-164 | I4 | Number of file pointer records in volume directory | 3 | |
| 29 | 165-168 | I4 | Number of text records in volume directory | 1 | |
| 30 | 169-260 | A92 | Spare | (Not used – blank) | |
| 31 | 261-360 | A100 | Local use segment | (Not used – blank) | |

Table 4-2 LEADER FILE POINTER RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|---------|--------|---|------------------------|-------|
| 1 | 1-4 | B4 | Record number | 2 | |
| 2 | 5 | B1 | 1st record subtype code | 219 | |
| 3 | 6 | B1 | Record type code | 192 | |
| 4 | 7 | B1 | 2nd subtype code | 18 | |
| 5 | 8 | B1 | 3rd subtype code | 18 | |
| 6 | 9-12 | B4 | Length of this record | 360 | |
| 7 | 13-14 | A2 | ASCII/EBCDIC flag for referenced file | A | |
| 8 | 15-16 | A2 | Blank | | |
| 9 | 17-20 | I4 | Referenced file number | 1 | |
| 10 | 21-36 | A16 | Referenced file name | JE1 S ASARL | |
| 11 | 37-64 | A28 | Referenced file class | SARLEADER FILE | |
| 12 | 65-68 | A4 | Referenced file class code | SARL | |
| 13 | 69-96 | A28 | Referenced file data type | MIXED BINARY AND ASCII | |
| 14 | 97-100 | A4 | Referenced file data type code | MBAA | |
| 15 | 101-108 | I8 | Number of records in referenced file (variable) | 7 | |
| 16 | 109-116 | I8 | Referenced file 1st record length | 720 | |
| 17 | 117-124 | I8 | Referenced file maximum record length | 9216 | |
| 18 | 125-136 | A12 | Referenced file record length type | VARIABLE LEN | |
| 19 | 137-140 | A4 | Referenced file record length type code | VARE | |
| 20 | 141-142 | I2 | Referenced file physical volume start number | 1 | |

| | | | | | |
|----|---------|------|---|--------------------|--|
| 21 | 143-144 | I2 | Referenced file physical volume end number | 1 | |
| 22 | 145-152 | I8 | Referenced file portion start, 1-st record number for this physical volume | 1 | |
| 23 | 153-160 | I8 | Referenced file portion end, last record number for this physical volume (variable) | 1 | |
| 24 | 161-260 | A100 | File pointer spare segment | (Not used – blank) | |
| 25 | 261-360 | A100 | Local use segment | (Not used – blank) | |

Table 4-3 DATA FILE POINTER RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|---------|--------|---|---------------------------|-------|
| 1 | 1-4 | B4 | Record number | 3 | |
| 2 | 5 | B1 | 1st record subtype code | 219 | |
| 3 | 6 | B1 | Record type code | 192 | |
| 4 | 7 | B1 | 2nd subtype code | 18 | |
| 5 | 8 | B1 | 3rd subtype code | 18 | |
| 6 | 9-12 | B4 | Length of this record | 360 | |
| 7 | 13-14 | A2 | ASCII/EBCDIC flag for referenced file | A | |
| 8 | 15-16 | A2 | Blank | | |
| 9 | 17-20 | I4 | Referenced file number | 2 | |
| 10 | 21-36 | A16 | Referenced file name | JE1 S AIMOP | |
| 11 | 37-64 | A28 | Referenced file class | IMAGERY OPTIONS FILE | |
| 12 | 65-68 | A4 | Referenced file class code | IMOP | |
| 13 | 69-96 | A28 | Referenced file data type | MIXED BINARY AND ASCII | |
| 14 | 97-100 | A4 | Referenced file data type code | MBAA | |
| 15 | 101-108 | I8 | Number of records in referenced file (variable) | 6529 | |
| 16 | 109-116 | I8 | Referenced file 1st record length | 720 | |
| 17 | 117-124 | I8 | Referenced file maximum record length | 12700 | |
| 18 | 125-136 | A12 | Referenced file record length type | VARIABLE LEN | |
| 19 | 137-140 | A4 | Referenced file record length type code | VARE | |
| 20 | 141-142 | I2 | Referenced file physical volume start number | 1 | |
| 21 | 143-144 | I2 | Referenced file physical volume end number | 1 | |
| 22 | 145-152 | I8 | Referenced file portion start, 1st record number for this physical volume | 1 | |

| | | | | | |
|----|---------|------|---|--------------------|--|
| 23 | 153-160 | I8 | Referenced file portion end, last record number for this physical volume (variable) | 6529 | |
| 24 | 161-260 | A100 | File pointer spare segment | (Not used – blank) | |
| 25 | 261-360 | A100 | Local use segment | | |

Table 4-4 SAR TRAILER FILE POINTER RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|---------|--------|---|------------------------|-------|
| 1 | 1-4 | B4 | Record number | 4 | |
| 2 | 5 | B1 | 1st record subtype code | 219 | |
| 3 | 6 | B1 | Record type code | 192 | |
| 4 | 7 | B1 | 2nd subtype code | 18 | |
| 5 | 8 | B1 | 3rd subtype code | 18 | |
| 6 | 9-12 | B4 | Length of this record | 360 | |
| 7 | 13-14 | A2 | ASCII/EBCDIC flag for referenced file | A | |
| 8 | 15-16 | A2 | Blank | | |
| 9 | 17-20 | I4 | Referenced file number | 1 | |
| 10 | 21-36 | A16 | Referenced file name | JE1 S ASART | |
| 11 | 37-64 | A28 | Referenced file class | SARTRAILER FILE | |
| 12 | 65-68 | A4 | Referenced file class code | SART | |
| 13 | 69-96 | A28 | Referenced file data type | MIXED BINARY AND ASCII | |
| 14 | 97-100 | A4 | Referenced file data type code | MBAA | |
| 15 | 101-108 | I8 | Number of records in referenced file (variable) | 1 | |
| 16 | 109-116 | I8 | Referenced file 1st record length | 720 | |
| 17 | 117-124 | I8 | Referenced file maximum record length | 720 | |
| 18 | 125-136 | A12 | Referenced file record length type | FIXED LENGTH | |
| 19 | 137-140 | A4 | Referenced file record length type code | FIXD | |
| 20 | 141-142 | I2 | Referenced file physical volume start number | 1 | |
| 21 | 143-144 | I2 | Referenced file physical volume end number | 1 | |
| 22 | 145-152 | I8 | Referenced file portion start, 1st record number for this physical volume | 1 | |
| 23 | 153-160 | I8 | Referenced file portion end, last record number for this physical volume (variable) | 1 | |
| 24 | 161-260 | A100 | File pointer spare segment | (Not used – blank) | |

| | | | | | |
|----|---------|------|-------------------|--------------------|--|
| 25 | 261-360 | A100 | Local use segment | (Not used – blank) | |
|----|---------|------|-------------------|--------------------|--|

Table 4-5 **TEXT RECORD**

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|---------|--------|--|---|-------|
| 1 | 1-4 | B4 | Record sequence number | 5 | |
| 2 | 5-5 | B1 | 1st record sub-type code | 18 | |
| 3 | 6-6 | B1 | Record type code | 63 | |
| 4 | 7-7 | B1 | 2nd record sub-type code | 18 | |
| 5 | 8-8 | B1 | 3rd record sub-type code | 18 | |
| 6 | 9-12 | B4 | Length of this record | 360 | |
| 7 | 13-14 | A2 | ASCII/EBCDIC Flag | A | |
| 8 | 15-16 | A2 | Continuation flag | (Not used – blank) | |
| 9 | 17-56 | A40 | Product type specifier | PRODUCT:JERS1SAR0000 00YYDDD A | |
| 10 | 57-116 | A60 | Location and date/time of product creation | PROCESS:ESA-JERS-IPF YYYYMMDDHHMMSS | |
| 11 | 117-156 | A40 | Physical volume identification | (Not used – blank) | |
| 12 | 157-196 | A40 | Scene identification | ORBIT 18001 DATE:26-FE B-1998 10:17:39 | |
| 13 | 197-236 | A40 | Scene location | SP, FRAME CENTRE N 69.02 E 17.03 | |
| 14 | 237-256 | A20 | Spares | (Not used – blank) | |
| 15 | 257-360 | A104 | Spares | (Not used – blank) | |

4.2 LEADER FILE FORMAT DEFINITION

Table 4-6

SAR - LEADER FILE, FILE DESCRIPTOR RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|---------|--------|--|--------------------|-------|
| 1 | 1-4 | B4 | Record Sequence Number | 1 | |
| 2 | 5 | B1 | 1st record sub-type code | 11 | |
| 3 | 6 | B1 | Record type code | 192 | |
| 4 | 7 | B1 | 2nd record sub-type code | 18 | |
| 5 | 8 | B1 | 3rd record sub-type code | 18 | |
| 6 | 9-12 | B4 | Length of this record | 720 | |
| 7 | 13-14 | A2 | ASCII/EBCDIC Flag | A | |
| 8 | 15-16 | A2 | Blanks | | |
| 9 | 17-28 | A12 | Format control document ID for this data file format | CEOS-SAR-CCT | |
| 10 | 29-30 | A2 | Format control document revision level | B | |
| 11 | 31-32 | A2 | File design descriptor revision letter | B | |
| 12 | 33-44 | A12 | Generating software release and revision level | JERSIPF 01.03 | |
| 13 | 45-48 | I4 | File number | 1 | |
| 14 | 49-64 | A16 | File name | JE1 S ASARL | |
| 15 | 65-68 | A4 | Record sequence and location type flag | FSEQ | |
| 16 | 69-76 | I8 | Sequence number location | 1 | |
| 17 | 77-80 | I4 | Sequence number field length | 4 | |
| 18 | 81-84 | A4 | Record code and location type flag | FTYP | |
| 19 | 85-92 | I8 | Record code location | 5 | |
| 20 | 93-96 | I4 | Record code field length | 4 | |
| 21 | 97-100 | A4 | Record length and location type flag | FLGT | |
| 22 | 101-108 | I8 | Record length location | 9 | |
| 23 | 109-112 | I4 | Record length field length | 4 | |
| 24-27 | 113-116 | A1 | Reserved | (Not used – blank) | |
| 28 | 117-180 | A64 | Reserved segment | (Not used – blank) | |
| 29 | 181-186 | I6 | Number of data set summary records | 1 | |

| | | | | | |
|-------|---------|----|--|------|--|
| 30 | 187-192 | I6 | Data set summary record length | 4096 | |
| 31 | 193-198 | I6 | Number of map projection data records | 0 | |
| 32 | 199-204 | I6 | Map projection record length | 0 | |
| 33 | 205-210 | I6 | Number of platform pos. data records | 1 | |
| 34 | 211-216 | I6 | Platform position record length | 4680 | |
| 35 | 217-222 | I6 | Number of attitude data records | 1 | |
| 36 | 223-228 | I6 | Attitude data record length | 8192 | |
| 37 | 229-234 | I6 | Number of radiometric data records | 0 | |
| 38 | 235-240 | I6 | Radiometric record length | 0 | |
| 39 | 241-246 | I6 | Number of rad. compensation records | 0 | |
| 40 | 247-252 | I6 | Radiometric compensation rec. length | 0 | |
| 41 | 253-258 | I6 | Number of data quality summary records | 0 | |
| 42 | 259-264 | I6 | Data quality summary record length | 0 | |
| 43 | 265-270 | I6 | Number of data histograms records | 0 | |
| 44 | 271-276 | I6 | Data histogram record length | 0 | |
| 45 | 277-282 | I6 | Number of range spectra records | 1 | |
| 46 | 283-288 | I6 | Range spectra record length | 8600 | |
| 47 | 289-294 | I6 | Number of DEM descriptor records | 0 | |
| 48 | 295-300 | I6 | DEM descriptor record length | 0 | |
| 49 | 301-306 | I6 | Number of radar par. update records | 0 | |
| 50 | 307-312 | I6 | Radar par. update record length | 0 | |
| 51 | 313-318 | I6 | Number of annotation data records | 0 | |
| 52 | 319-324 | I6 | Annotation data record length | 0 | |
| 53 | 325-330 | I6 | Number of det. processing records | 1 | |
| 54 | 331-336 | I6 | Det. processing record length | 9216 | |
| 55 | 337-342 | I6 | Number of calibration records | 0 | |
| 56 | 343-348 | I6 | Calibration record length | 0 | |
| 57 | 349-354 | I6 | Number of GCP records | 0 | |
| 58 | 355-360 | I6 | GCP record length | 0 | |
| 59-68 | 361-420 | I6 | Spare | | |
| 69 | 421-426 | I6 | Number of facility data records | 1 | |
| 70 | 427-432 | I6 | Facility data record maximum length | 2048 | |

| | | | | | |
|----|---------|----|--------|--|--|
| 71 | 433-720 | A2 | Blanks | | |
|----|---------|----|--------|--|--|

Table 4-7 DATA SET SUMMARY RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|-------|--------|---|---------|-------|
| 1 | 1 - 4 | B4 | Record sequence number | 2 | |
| 2 | 5 | B1 | 1st record sub-type code | 18 | |
| 3 | 6 | B1 | Record-type code | 10 | |
| 4 | 7 | B1 | 2nd record sub-type code | 18 | |
| 5 | 8 | B1 | 3rd record sub-type code | 20 | |
| 6 | 9-12 | B4 | Length of this record | 4096 | |
| 7 | 13-16 | I4 | Data Set Summary Record sequence number (starts at 1) | 1 | |

SCENE PARAMETERS

| | | | | | |
|----|---------|-------|---|--------------------|---------------------|
| 8 | 17-20 | I4 | SAR channel indicator | 1 | |
| 9 | 21-52 | A16 | Reserved | (Not used – blank) | |
| 10 | 53-68 | A32 | Scene reference number | Not Used | |
| 11 | 69-100 | A32 | Scene centre time (UTC) <YYYYMMDDhhmmss<> | 19980226101739000 | |
| 12 | 101-116 | A16 | Spare | (Not used – blank) | |
| 13 | 117-132 | F16.7 | Processed scene centre geodetic latitude (positive for North latitude, negative for South latitude) | 69.0228420 | degrees |
| 14 | 133-148 | F16.7 | Processed scene centre geodetic longitude (negative for West longitude) | 17.0369700 | degrees |
| 15 | 149-164 | F16.7 | Processed scene centre true heading as calculated relative to North | -166.8998000 | degrees |
| 16 | 165-180 | A16 | Ellipsoid designator | WGS84 | |
| 17 | 181-196 | F16.7 | Ellipsoid semimajor axis | 6378.137 | Km |
| 18 | 197-212 | F16.7 | Ellipsoid semiminor axis | 6356.752 | Km |
| 19 | 213-228 | F16.7 | Earth mass | 5.9742000E+24 | kg |
| 20 | 229-244 | F16.7 | Earth mass * Gravitational constant | 3.9865837E+14 | kg.m/s ² |
| 21 | 245-260 | F16.7 | Ellipsoid J2 parameter | 0.0010826 | |

| | | | | | |
|----|---------|-------|--|--------------------|----|
| 22 | 261-276 | F16.7 | Ellipsoid J3 parameter | 0.0000025 | |
| 23 | 277-292 | F16.7 | Ellipsoid J4 parameter | -0.0000017 | |
| 24 | 293-308 | A16 | Spare | (Not used – blank) | |
| 25 | 309-324 | F16.7 | Reserved | (Not used – blank) | |
| 26 | 325-332 | I8 | Scene centre line number | 9000 | |
| 27 | 333-340 | I8 | Scene centre pixel number (the pixel number at the scene centre including zero fill) (nominal) | 3072 | |
| 28 | 341-356 | F16.7 | Processed scene length including zero fill (nominal) | 75 | km |
| 29 | 357-372 | F16.7 | Processed scene width including zero fill (nominal) | 75 | km |
| 30 | 373-388 | A16 | Spare | (Not used – blank) | |

GENERAL MISSION / SENSOR PARAMETERS

| | | | | | |
|----|---------|-------|--|--------------------|---------|
| 31 | 389-392 | I4 | Number of SAR channels | 1 | |
| 32 | 393-396 | A4 | Spare | (Not used – blank) | |
| 33 | 397-412 | A16 | Sensor platform mission identifier | JERS1 | |
| 34 | 413-444 | A32 | Sensor ID and mode of operation for this channel <AAAAAA-BB-CC-DD-EF> where : AAAAAA = sensor identifier BB = SAR band CC = resolution mode code DD = imaging mode code E = transmit polarisation F = receiver polarisation | JERS-1-L-HR-IM-HH | |
| 35 | 445-452 | A8 | Orbit number | 123 | |
| 36 | 453-460 | F8.3 | Not Used | (Not used – blank) | |
| 37 | 461-468 | F8.3 | Not Used | (Not used – blank) | |
| 38 | 469-476 | F8.3 | Not Used | (Not used – blank) | degrees |
| 39 | 477-484 | F8.3 | Sensor clock angle as measured relative to sensor platform flight direction | 90.0000 | degrees |
| 40 | 485-492 | F8.3 | Incidence angle at scene centre as derived from sensor platform orientation | 35.0 | degrees |
| 41 | 493-500 | F8.3 | Radar frequency | 1.25 | GHz |
| 42 | 501-516 | F16.7 | Radar wavelength | 0.2351313 | metres |
| 43 | 517-518 | A2 | Motion compensation indicator | 00 | |

| | | | | | |
|-------|---------|---------|---|---------------------------|----------|
| | | | "00" = no compensation, "01" = on board compensation, "10" = in processor compensation, | | |
| 44 | 519-534 | A16 | Range pulse code specifier | LINEAR FM CHIRP | |
| 45 | 535-550 | E16.7 | Chirp start frequency | 0.748247E+7 | Hz |
| 46 | 551-566 | E16.7 | Chirp linear FM rate | -0.42757E+12 ⁴ | Hz sec-1 |
| 47 | 567-582 | E16.7 | Chirp frequency quadratic coefficient | 0.0 | Hz sec-2 |
| 48 | 583-598 | E16.7 | Chirp frequency cubic coefficient | 0.0 | Hz sec-3 |
| 49 | 599-614 | E16.7 | Chirp frequency quartic coefficient | 0.0 | Hz sec-4 |
| 50 | 615-630 | E16.7 | Not Used | | |
| 51 | 631-646 | E16.7 | Not Used | | |
| 52 | 647-662 | E16.7 | Not Used | | |
| 53 | 663-678 | E16.7 | Not Used | | |
| 54 | 679-694 | E16.7 | Not Used | | |
| 55 | 695-702 | I8 | Not Used | | |
| 56 | 703-710 | A8 | Spare | | |
| 57 | 711-726 | F16.7 | Range sampling rate | 17.0760000 | MHz |
| 58 | 727-742 | F16.7 | Range gate delay at early edge (in time) at the start of the image | 4722.7760000 | microsec |
| 59 | 743-758 | F16.7 | Range pulse length | 35.0000000 | microsec |
| 60 | 759-762 | A4 | Baseband conversion flag | NOT | |
| 61 | 763-766 | A4 | Range compressed flag (YES = range compressed data) | NOT | |
| 62-63 | 767-798 | 2 F16.7 | Reserved | | |
| 64 | 799-806 | I8 | Quantization per channel I & Q (5I 5Q/6I 6Q for OGRC/OBRC) | 3 | bits |
| 65 | 807-818 | A12 | Quantizer descriptor | UNIFORM I Q | |
| 66 | 819-834 | F16.7 | DC Bias for I-component (Not Used) | 0 | |
| 67 | 835-850 | F16.7 | DC Bias for Q-component (Not Used) | 0 | |
| 68 | 851-866 | F16.7 | Gain imbalance for I & Q (Not Used) | 0 | dB |
| 69-70 | 867-898 | F16.7 | Spare | | |

⁴ In other CEOS formats the chirp FM parameters are found in fields 50-54 and amplitude coefficients found in fields 45-49.

| | | | | | |
|-------|-----------|-------|---|----------------------------|---------|
| 71 | 899-914 | F16.7 | Reserved | | |
| 72 | 915-930 | F16.7 | Antenna mechanical boresight angle relative to platform vertical axis at the start of the image positive to the right, negative to the left | 35.0 | |
| 73 | 931-934 | A4 | Echo Tracker flag | OFF | |
| 74 | 935-950 | F16.7 | Pulse Repetition Frequency (PRF) (actual value) | 1555.1716309 | Hz |
| 75-76 | 951-966 | F16.7 | Elevation beamwidth | 6.0 | Degrees |
| 76 | 967-982 | F16.7 | Azimuth beamwidth | 1.1 | Degrees |
| 77 | 983-998 | I16 | Not Used | | |
| 78 | 999-1030 | A32 | Not Used | | |
| 79 | 1031-1038 | I8 | Not Used | | |
| 80 | 1039-1046 | A8 | Spare | | |
| 81 | 1047-1062 | A16 | Processing facility identifier | PAM | |
| 82 | 1063-1070 | A8 | Processing system identifier | JERS-IPF | |
| 83 | 1071-1078 | A8 | Processing version identifier | 8.6.4 | |
| 84 | 1079-1094 | A16 | Reserved | | |
| 85 | 1095-1110 | A16 | Product code | L0.0-00.0M-1LOOK | |
| 86 | 1111-1142 | A32 | Product type specifier | UNPROCESSED SIGNAL DATA | |
| 87 | 1143-1174 | A32 | Not Used | | |
| 88 | 1175-1190 | F16.7 | Not Used | | |
| 89 | 1191-1206 | F16.7 | Not Used | | |
| 90 | 1207-1222 | F16.7 | Not Used | | |
| 91 | 1223-1238 | F16.7 | Not Used | | |
| 92 | 1239-1254 | F16.7 | Not Used | | |
| 93 | 1255-1270 | F16.7 | Not Used | | |
| 94 | 1271-1302 | A32 | Not Used | | |
| 95 | 1303-1334 | A32 | Not Used | | |
| 96 | 1335-1350 | A16 | Data input source | DLT | |
| 97 | 1351-1366 | F16.7 | Not Used | | |
| 98 | 1367-1382 | F16.7 | Not Used | | |
| 99 | 1383-1398 | F16.7 | Reserved | | |

| | | | | | |
|-----|-----------|-------|--|----------|--|
| 100 | 1399-1414 | F16.7 | Reserved | | |
| 101 | 1415-1430 | F16.7 | Not Used | | |
| 102 | 1431-1446 | F16.7 | Not Used | | |
| 103 | 1447-1462 | F16.4 | Not Used | | |
| 104 | 1463-1478 | A16 | Not Used | | |
| 105 | 1479-1494 | F16.7 | Not Used | | |
| 106 | 1495-1510 | F16.7 | Not Used | | |
| 107 | 1511-1526 | F16.4 | Not Used | | |
| 108 | 1527-1534 | A8 | Time direction indicator along pixel direction | INCREASE | |
| 109 | 1535-1542 | A8 | Time direction indicator along line direction | INCREASE | |
| 110 | 1543-1558 | F16.7 | Not Used | | |
| 111 | 1559-1574 | F16.7 | Not Used | | |
| 112 | 1575-1590 | F16.7 | Not Used | | |
| 113 | 1591-1606 | A16 | Not Used | | |
| 114 | 1607-1622 | F16.7 | Not Used | | |
| 115 | 1623-1638 | F16.7 | Not Used | | |
| 116 | 1639-1654 | F16.4 | Not Used | | |
| 117 | 1655-1670 | A16 | Not Used | | |
| 118 | 1671-1678 | A8 | Line Content Indicator | RANGE | |
| 119 | 1679-1682 | A4 | Not Used | | |
| 120 | 1683-1686 | A4 | Not Used | | |
| 121 | 1687-1702 | F16.7 | Not Used | | |
| 122 | 1703-1718 | F16.7 | Not Used | | |
| 123 | 1719-1734 | A16 | Not Used | | |
| 124 | 1735-4096 | A2362 | Spare | | |

Table 4-8 PLATFORM POSITION DATA RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|--------|--------|---|-----------------------|--------|
| 1 | 1 - 4 | B4 | Record sequence number | 3 | |
| 2 | 5 | B1 | 1st record sub-type code | 18 | |
| 3 | 6 | B1 | Record-type code | 30 | |
| 4 | 7 | B1 | 2nd record sub-type code | 18 | |
| 5 | 8 | B1 | 3rd record sub-type code | 20 | |
| 6 | 9-12 | B4 | Length of this record | 4680 | |
| 7 | 13-44 | A32 | Orbital elements designator | ECR | |
| 8-10 | 45-92 | 3F16.7 | First Position vector (X,Y,Z) (in ECR) | -0.1051104...D+07 | metres |
| 11-13 | 93-140 | 3F16.7 | First Velocity vector (X,Y,Z) (see 3.2.3.3) | -0.8515032...D+03 etc | m/s |

POSITIONAL DATA POINTS

| | | | | | |
|-------|---------|---------|---|---------------------------------|---------|
| 14 | 141-144 | I4 | Number of data points | 5 | |
| 15 | 145-148 | I4 | Year of data point <YYYY> | 1998 | |
| 16 | 149-152 | I4 | Month of data point <\$\$MM> | 2 | |
| 17 | 153-156 | I4 | Day of data point <\$\$DD> | 26 | |
| 18 | 157-160 | I4 | Day in the year <GMT> (1st January = Day 1) | 56 | |
| 19 | 161-182 | D22.15 | Seconds of day of data | 37020.0000000000000000 | sec |
| 20 | 183-204 | D22.15 | Time interval between data points | 60.0000000000000000 | sec |
| 21 | 205-268 | A64 | Reference coordinate system | EARTH FIXED REFERENCE SYSTEM | |
| 22 | 269-290 | D22.15 | Greenwich mean hour angle (Not Used) | | degrees |
| 23 | 291-306 | F16.7 | Along track position error (Not Used) | | metres |
| 24 | 307-322 | F16.7 | Across track position error (Not Used) | | metres |
| 25 | 323-338 | F16.7 | Radial position error (Not Used) | | metres |
| 26-28 | 339-386 | F16.7 | Reserved | | |
| 29 | 387-452 | 3D22.15 | Position vector (X,Y,Z) (in ECR) | -0.105110487569652D+07 ... | metres |
| 30 | 453-518 | 3D22.15 | Velocity vector (X,Y,Z) (see section 3.2.3.3) | -0.851503263939225D+03 | m/s |

Fields 29,30 repeat to end of record at a time spacing given by field 20

Table 4-9 PLATFORM ATTITUDE DATA RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|--------------|--------------|---------------|--------------------------|----------------|--------------|
| 1 | 1-4 | B4 | Record sequence number | 4 | |
| 2 | 5 | B1 | 1st record sub-type code | 18 | |
| 3 | 6 | B1 | Record sub-type code | 40 | |
| 4 | 7 | B1 | 2nd record sub-type code | 18 | |
| 5 | 8 | B1 | 3rd record sub-type code | 20 | |
| 6 | 9-12 | B4 | Length of this record | 8192 | |
| 7 | 13-16 | I4 | Number of data points | 0 | |
| 8 | 17-8192 | | blank | | |

Table 4-10 RANGE SPECTRA RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|--------------|--------------|---------------|--------------------------|----------------|--------------|
| 1 | 1-4 | B4 | Record sequence number | 5 | |
| 2 | 5 | B1 | 1st record sub-type code | 18 | |
| 3 | 6 | B1 | Record sub-type code | 80 | |
| 4 | 7 | B1 | 2nd record sub-type code | 18 | |
| 5 | 8 | B1 | 3rd record sub-type code | 20 | |
| 6 | 9-12 | B4 | Length of this record | 8600 | |
| 7 | 13-16 | I4 | Number of data points | 0 | |
| 8 | 17-8600 | | blank | | |

Table 4-11 **DETAILED PROCESSING PARAMETER RECORD**

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|--------------|--------------|---------------|--------------------------|----------------|--------------|
| 1 | 1-4 | B4 | Record sequence number | 6 | |
| 2 | 5 | B1 | 1st record sub-type code | 18 | |
| 3 | 6 | B1 | Record sub-type code | 120 | |
| 4 | 7 | B1 | 2nd record sub-type code | 18 | |
| 5 | 8 | B1 | 3rd record sub-type code | 70 | |
| 6 | 9-12 | B4 | Length of this record | 9216 | |
| 7 | 13-9216 | | Not Used | | |

Table 4-12 **FACILITY RELATED DATA RECORD**

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|--------------|--------------|---------------|--------------------------|----------------|--------------|
| 1 | 1-4 | B4 | Record sequence number | 7 | |
| 2 | 5 | B1 | 1st record sub-type code | 18 | |
| 3 | 6 | B1 | Record sub-type code | 200 | |
| 4 | 7 | B1 | 2nd record sub-type code | 18 | |
| 5 | 8 | B1 | 3rd record sub-type code | 70 | |
| 6 | 9-12 | B4 | Length of this record | 2048 | |
| 7 | 13-2048 | | Not Used | | |

4.3 DATA SET FILE FORMAT DEFINITION

Table 4-13 SAR DATA FILE, FILE DESCRIPTOR RECORD (FIXED SEGMENT)

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|---------|--------|--|---------------|-------|
| 1 | 1-4 | B4 | Record sequence number | 1 | |
| 2 | 5 | B1 | 1st record sub-type code | 50 | |
| 3 | 6 | B1 | Record sub-type code | 192 | |
| 4 | 7 | B1 | 2nd record sub-type code | 18 | |
| 5 | 8 | B1 | 3rd record sub-type code | 18 | |
| 6 | 9-12 | B4 | Length of this record | 720 | |
| 7 | 13-14 | A2 | ASCII/EBCDIC flag | A | |
| 8 | 15-16 | A2 | Blanks | | |
| 9 | 17-28 | A12 | Format control document ID for this data file format | CEOS-SAR-CCT | |
| 10 | 29-30 | A2 | Format control document revision level | B | |
| 11 | 31-32 | A2 | File design descriptor revision letter | A | |
| 12 | 33-44 | A12 | Generating software release and revision level | JERSIPF 01.03 | |
| 13 | 45-48 | I4 | File number | 2 | |
| 14 | 49-64 | A16 | File name | JE1 S AIMOP | |
| 15 | 65-68 | A4 | Record sequence and location type flag | FSEQ | |
| 16 | 69-76 | I8 | Sequence number location | 1 | |
| 17 | 77-80 | I4 | Sequence number field length | 1 | |
| 18 | 81-84 | A4 | Record code and location type flag | FTYP | |
| 19 | 85-92 | I8 | Record code location | 1 | |
| 20 | 93-96 | I4 | Record code field length | 4 | |
| 21 | 97-100 | A4 | Record length and location type flag | FLGT | |
| 22 | 101-108 | I8 | Record length location | 9 | |
| 23 | 109-112 | I4 | Record length field length | 4 | |
| 24-27 | 113-116 | A1 | Reserved | | |
| 28 | 117-180 | A64 | Reserved segment | | |

| | | | | | |
|----|---------|-----|--|-------|-------|
| 29 | 181-186 | I6 | Number of SAR DATA records (nominal) | 6528 | |
| 30 | 187-192 | I6 | SAR DATA record length | 12700 | bytes |
| 31 | 193-216 | A24 | Reserved | | |
| 32 | 217-220 | I4 | Number of bits per sample | 8 | |
| 33 | 221-224 | I4 | Number of samples per data group (or pixels) | 2 | |
| 34 | 225-228 | I4 | Number of bytes per data group(or pixels) | 2 | |
| 35 | 229-232 | A4 | Justification and order of samples within data group | | |

SAR DATA FILE, FILE DESCRIPTOR RECORD (VARIABLE SEGMENT)

SAMPLE GROUP DATA

| | | | | | |
|----|---------|----|--|------|--|
| 36 | 233-236 | I4 | Number of SAR channels in this file | 1 | |
| 37 | 237-244 | I8 | Number of lines per data set (nominal) | 6528 | |
| 38 | 245-248 | I4 | Number of left border pixels per line | 0 | |
| 39 | 249-256 | I8 | Total number of data groups per line per SAR channel | 6144 | |
| 40 | 257-260 | I4 | Number of right border pixels per line | 0 | |
| 41 | 261-264 | I4 | Number of top border lines | 0 | |
| 42 | 265-268 | I4 | Number of bottom border lines | 0 | |
| 43 | 269-273 | A4 | Interleaving indicator | BSQ | |

RECORD DATA IN THE FILE

| | | | | | |
|-------|---------|------|--|-------------------|--|
| 44 | 273-274 | I2 | Number of physical records per line | 1 | |
| 45 | 275-276 | I2 | Number of physical records per multi-channel line | 1 | |
| 46 | 277-280 | I4 | Number of bytes of prefix data per record | 400 | |
| 47 | 281-288 | I8 | Number of bytes of SAR data(or pixel data) per record(nominal) | 12288 | |
| 48 | 289-292 | I4 | Number of bytes of suffix data per record | 0 | |
| 49-55 | 293-340 | A48 | Reserved | | |
| 56 | 341-368 | A28 | Blanks | | |
| 57-60 | 369-400 | A32 | Reserved | | |
| 61 | 401-428 | A28 | SAR Data format type identifier | COMPLEX INTEGER*2 | |
| 62 | 429-432 | A4 | SAR Data format type code | CI*2 | |
| 63 | 433-436 | I4 | Number of left fill bits within pixel | 5 | |
| 64 | 437-440 | I8 | Number of right fill bits within pixel | 0 | |
| 65 | 441-448 | I8 | Maximum data range of pixel | 7 | |
| 66 | 449-720 | A372 | Spare | | |

Table 4-14

SAR DATA IMAGERY OPTIONS FILE, SIGNAL DATA RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|-------|--------|--------------------------|---------|-------|
| 1 | 1-4 | B4 | Record sequence number | 2 | |
| 2 | 5 | B1 | 1st record sub-type code | 50 | |
| 3 | 6 | B1 | Record sub-type code | 10 | |
| 4 | 7 | B1 | 2nd record sub-type code | 18 | |
| 5 | 8 | B1 | 3rd record sub-type code | 20 | |
| 6 | 9-12 | B4 | Length of this record | 12700 | |

PREFIX DATA – GENERAL INFORMATION

| | | | | | |
|----|-------|----|--|------------|---------|
| 7 | 13-16 | B4 | SAR echo data line number | 1234 | |
| 8 | 17-20 | B4 | SAR echo data line index (record sequence number in the image line) | (always) 1 | |
| 9 | 21-24 | B4 | Not Used | | |
| 10 | 25-28 | B4 | Count of echo samples | 6144 | |
| 11 | 29-32 | B4 | Not Used | | |
| 12 | 33-36 | B4 | Not Used | | |
| 13 | 37-40 | B4 | Acquisition year | 1995 | |
| 14 | 41-44 | B4 | Acquisition day-of-year | 213 | |
| 15 | 45-48 | B4 | Acquisition msec of day | 3175000 | |
| 16 | 49-50 | B2 | Channel ID | 1 | |
| 17 | 51-52 | B2 | Channel code | 0 | |
| 18 | 53-54 | B2 | TX Polarisation (H=0,V=1) | 0 | |
| 19 | 55-56 | B2 | RX Polarisation (H=0,V=1) | 0 | |
| 20 | 57-60 | B4 | PRF | 1555200000 | microHz |
| 21 | 61-64 | B4 | Not Used | | |
| 22 | 65-66 | B2 | OBRC flag | 0 | |

PREFIX DATA – SENSOR PARAMETERS

| | | | | | |
|----|--------|----|--|--------|--------------------------|
| 23 | 67-68 | B2 | Chirp type | 0 | |
| 24 | 69-72 | B4 | Chirp length | 35000 | nanosecs |
| 25 | 73-76 | B4 | Chirp centre offset freq | 0 | KHz |
| 26 | 77-80 | B4 | Chirp FM rate | 427570 | Hz/microsec |
| 27 | 81-84 | B4 | Chirp quadratic coefficient | 0 | Hz/microsec ² |
| 28 | 85-92 | B8 | Not Used | | |
| 29 | 93-96 | B4 | Receiver Gain (= - AGC attenuation) | -7 | dB |
| 30 | 97-100 | B4 | Defective line indicator (Not populated) | 0 | |

| | | | | | |
|----|---------|-----|---|----------|--------------|
| 31 | 101-104 | B4 | Electronic antenna elevation angle from nadir (nominal) | 35000000 | microdegrees |
| 32 | 105-108 | B4 | Mechanical antenna elevation angle from nadir (nominal) | 35000000 | microdegrees |
| 33 | 109-112 | B4 | Electronic squint angle (Not populated) | 0 | microdegrees |
| 34 | 113-116 | B4 | Mechanical squint angle (Not populated) | 0 | microdegrees |
| 35 | 117-120 | B4 | Slant range to first sample in metres | 708143 | metres |
| 36 | 121-124 | B4 | Sample window start time | 4724223 | nanosecs |
| 37 | 125-128 | B4 | Not Used | | |
| 38 | 129-192 | A64 | Not Used | | |

PREFIX DATA – SENSOR AUXILIARY DATA

| | | | | | |
|----|-----------|---------------------------------|--|---|--|
| 39 | 193-284 | A92 | Not Used | | |
| 40 | 285-285 | B1 | SAR synchronous information flag | 1 | |
| 41 | 286-292 | N14 (14 Nybbles of 4 bits each) | Ground time as BCD code: N0 = 0 N1 = 100's of days N2 = 10's of days N3 = 1's of days N4/N5 = 10's, 1's of hours N6/N7 = 10's, 1's of minutes N8/N9 = 10's, 1's of seconds N10 = 100's of msec N11 = 10's of msec N12 = 1's of msec N13 = 0 | i.e. 0,2,7,1,1,7,3,5,4,5,6,0,1,0 would mean 271 days, 17 hours, 35 mins, 45.601 seconds, | |
| 42 | 293-299 | N14 | Satellite time as BCD code (as field 41). Fields 41 and 42 are identically populated by the JERS-IPF. Data in JAXA formatted L0 products is erratic. | | |
| 43 | 300-300 | B1 | Satellite time quality flag – set to 3 | 3 | |
| 44 | 301-323 | B24 | H/K data (refer to table Table 4-15 below) | | |
| 45 | 324-331 | B8 | 24-bit echo frame number (as packed telemetry, as per H/K data described below) | | |
| 46 | 332-412 | A81 | Not Used | | |
| 47 | 413-12700 | 6144B2 | Signal data, successive I and Q bytes | | |

Table 4-15 HouseKeeping (“H/K” data)

The H/K (and other) telemetry is duplicated on I and Q channels by the JERS platform, and as a consequence of the ground segment unpacking (3 bit samples into 4 bit nybbles), the H/K data is presented in the bottom 3 bits of successive bytes (actually the bottom 3 bits of the byte are duplicated in the top nybble). The 69-bit HK data packet thus occupies 23 bytes, and to extract the 69 bit packet it is necessary to “and” each successive byte with 7, and then to concatenate the resulting 3-bit fields together.

The logical contents of the H/K data fields of interest are summarized below (for full details refer to [RD-1]). The bit ordering given is from the most significant bit to the least significant.

| Bit position | Item | Definition/significance | | Comment |
|--------------|--|---------------------------------|--|--|
| 1 | PRF ON/OFF | 1 2 | ON OFF | |
| 2-4 | PRF Code | 000 001 010 011 100 | 1505.8 1530.1 1555.2 1581.1 1606.0 | Invariably 1555.2 |
| 5 | CALIBRATION MODE | 1 0 | ON OFF | Always 1 |
| 6 | OBSERVATION MODE | 1 0 | ON OFF | Always ON |
| 7-11 | STC START TIME PATTERN | 1 to 24 | 24 predefined patterns | Not relevant |
| 12-17 | INITIAL STC START TIME (AKA INITIAL SAMPLING WINDOW START TIME) | 0 to 30 | Time = (value+1)*10 microsecs | Not relevant |
| 17-21 | STC START TIME (AKA SAMPLING WINDOW START TIME) | 0 to 30 | Time = (value+1)*10 microsecs | Gives current SWST, used to populate range timing fields. |
| 22-24 | STC OFFSET TIME | 0-7 | Time = value*10 microsecs | Gives time offset of first echo sample in the pulse relative to the start of the STC attenuation pattern (table 2-2) |
| 25 | AGC/MGC | 1 0 | AGC MGC (Manual Gain Control) | Invariably AGC |
| 26 | AGC TIME CONSTANT | 1 0 | 128 pulses 64 pulses | Not relevant |

| | | | | |
|-------|---------------------|---------|---------------------------|-------------------------------|
| 27-31 | AGC DATA | 0 to 31 | 0 to 31 dB of attenuation | Used to populate SDR field 29 |
| 32-36 | GAIN CONTROL STATUS | 0 to 31 | 0 to 31 dB of attenuation | Only relevant to MGC |
| 37-69 | MISCELLANEOUS | | | Not relevant |

4.4 TRAILER FILE FORMAT DEFINITION

Table 4-16

SAR - TRAILER FILE, FILE DESCRIPTOR RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|--------------|--------------|---------------|--|----------------|--------------|
| 1 | 1-4 | B4 | Record Sequence Number | 1 | |
| 2 | 5 | B1 | 1st record sub-type code | 91 | |
| 3 | 6 | B1 | Record type code | 192 | |
| 4 | 7 | B1 | 2nd record sub-type code | 18 | |
| 5 | 8 | B1 | 3rd record sub-type code | 18 | |
| 6 | 9-12 | B4 | Length of this record | 720 | |
| 7 | 13-14 | A2 | ASCII/EBCDIC Flag | A | |
| 8 | 15-16 | A2 | Blanks | | |
| 9 | 17-28 | A12 | Format control document ID for this data file format | CEOS-SAR-CCT | |
| 10 | 29-30 | A2 | Format control document revision level | B | |
| 11 | 31-32 | A2 | File design descriptor revision letter | B | |
| 12 | 33-44 | A12 | Generating software release and revision level | JERSIPF 01.03 | |
| 13 | 45-48 | I4 | File number | 1 | |
| 14 | 49-64 | A16 | File name | JE1 S ASART | |
| 15 | 65-68 | A4 | Record sequence and location type flag | FSEQ | |
| 16 | 69-76 | I8 | Sequence number location | 1 | |
| 17 | 77-80 | I4 | Sequence number field length | 4 | |
| 18 | 81-84 | A4 | Record code and location type flag | FTYP | |
| 19 | 85-92 | I8 | Record code location | 5 | |
| 20 | 93-96 | I4 | Record code field length | 4 | |
| 21 | 97-100 | A4 | Record length and location type flag | FLGT | |
| 22 | 101-108 | I8 | Record length location | 9 | |
| 23 | 109-112 | I4 | Record length field length | 4 | |
| 24-27 | 113-116 | A1 | Reserved | | |

| | | | | | |
|----|---------|-----|--|------|--|
| 28 | 117-180 | A64 | Reserved segment | | |
| 29 | 181-186 | I6 | Number of data set summary records | 1 | |
| 30 | 187-192 | I6 | Data set summary record length | 4096 | |
| 31 | 193-198 | I6 | Number of map projection data records | 0 | |
| 32 | 199-204 | I6 | Map projection record length | 0 | |
| 33 | 205-210 | I6 | Number of platform pos. data records | 1 | |
| 34 | 211-216 | I6 | Platform position record length | 4680 | |
| 35 | 217-222 | I6 | Number of attitude data records | 1 | |
| 36 | 223-228 | I6 | Attitude data record length | 8192 | |
| 37 | 229-234 | I6 | Number of radiometric data records | 0 | |
| 38 | 235-240 | I6 | Radiometric record length | 0 | |
| 39 | 241-246 | I6 | Number of rad. compensation records | 0 | |
| 40 | 247-252 | I6 | Radiometric compensation rec. length | 0 | |
| 41 | 253-258 | I6 | Number of data quality summary records | 0 | |
| 42 | 259-264 | I6 | Data quality summary record length | 0 | |
| 43 | 265-270 | I6 | Number of data histograms records | 0 | |
| 44 | 271-276 | I6 | Data histogram record length | 0 | |
| 45 | 277-282 | I6 | Number of range spectra records | 1 | |
| 46 | 283-288 | I6 | Range spectra record length | 8600 | |
| 47 | 289-294 | I6 | Number of DEM descriptor records | 0 | |
| 48 | 295-300 | I6 | DEM descriptor record length | 0 | |
| 49 | 301-306 | I6 | Number of radar par. update records | 0 | |
| 50 | 307-312 | I6 | Radar par. update record length | 0 | |
| 51 | 313-318 | I6 | Number of annotation data records | 0 | |
| 52 | 319-324 | I6 | Annotation data record length | 0 | |
| 53 | 325-330 | I6 | Number of det. processing records | 1 | |
| 54 | 331-336 | I6 | Det. processing record length | 9216 | |
| 55 | 337-342 | I6 | Number of calibration records | 0 | |
| 56 | 343-348 | I6 | Calibration record length | 0 | |
| 57 | 349-354 | I6 | Number of GCP records | 0 | |

| | | | | | |
|-------|---------|----|-------------------------------------|------|--|
| 58 | 355-360 | I6 | GCP record length | 0 | |
| 59-68 | 361-420 | I6 | Spare | | |
| 69 | 421-426 | I6 | Number of facility data records | 1 | |
| 70 | 427-432 | I6 | Facility data record maximum length | 2048 | |
| 71 | 433-720 | A2 | Blanks | | |

4.5 NULL VOLUME FORMAT DEFINITION

Table 4-17

NULL VOLUME DESCRIPTOR RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|---------|--------|--|---------------|-------|
| 1 | 1-4 | B4 | Record sequence number | 1 | |
| 2 | 5 | B1 | 1st record sub-type code | 192 | |
| 3 | 6 | B1 | Record sub-type code | 192 | |
| 4 | 7 | B1 | 2nd record sub-type code | 63 | |
| 5 | 8 | B1 | 3rd record sub-type code | 18 | |
| 6 | 9-12 | B4 | Length of this record | 360 | |
| 7 | 13-14 | A2 | ASCII/EBCDIC flag | A | |
| 8 | 15-16 | A2 | Blanks | | |
| 9 | 17-28 | A12 | Format control document | CCB-CCT-0002 | |
| 10 | 29-30 | A2 | Superstructure document | E | |
| 11 | 31-32 | A2 | Superstructure record format revision | A | |
| 12 | 33-44 | A12 | Logical volume generating facility software release and revision level | JERSIPF 01.03 | |
| 13 | 45-60 | A16 | ID of physical volume containing this volume descriptor | S11 | |
| 14 | 61-76 | A16 | Logical volume identifier | blank | |
| 15 | 77-92 | A16 | Volume set identifier | blank | |
| 16 | 93-94 | I2 | Total number of physical volumes in the logical volume | 1 | |
| 17 | 95-96 | I2 | Physical volume sequence number of the first tape within the logical volume | 1 | |
| 18 | 97-98 | I2 | Physical volume sequence number of the last tape in the logical volume | 1 | |
| 19 | 99-100 | I2 | Physical volume sequence number of the current tape within the logical volume | blank | |
| 20 | 101-104 | I4 | First referenced file number in this physical volume within the logical volume | 1 | |
| 21 | 105-108 | I4 | Logical volume within a volume set | 2 | |
| 22 | 109-112 | I4 | Logical volume number within physical volume | 2 | |
| 23 | 113-360 | A248 | Not used | blank | |

5 JERS/SEASAT SAR PRI, IMM and SLC Products CEOS FORMAT

5.1 VOLUME DIRECTORY FILE FORMAT DEFINITION

Table 5-1

VOLUME DESCRIPTOR RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|---------|--------|---|---------------|-------|
| 1 | 1-4 | B4 | Record sequence number | 1 | |
| 2 | 5-5 | B1 | 1st record sub-type code | 192 | |
| 3 | 6-6 | B1 | Record type code | 192 | |
| 4 | 7-7 | B1 | 2nd record sub-type code | 18 | |
| 5 | 8-8 | B1 | 3rd record sub-type code | 18 | |
| 6 | 9-12 | B4 | Length of this record | 360 | |
| 7 | 13-14 | A2 | ASCII/EBCDIC Flag | A | |
| 8 | 15-16 | A2 | Blanks | | |
| 9 | 17-28 | A12 | Format control document | CCB-CCT-0002 | |
| 10 | 29-30 | A2 | Superstructure format control document | E | |
| 11 | 31-32 | A2 | Superstructure record format revision | A | |
| 12 | 33-44 | A12 | Logical volume generating facility software release and revision level | JERSIPF 01.03 | |
| 13 | 45-60 | A16 | ID of physical volume containing this volume descriptor | UPC99999R1C1 | |
| 14 | 61-76 | A16 | Logical volume identifier | JERS.SAR.PRI | |
| 15 | 77-92 | A16 | Volume set identifier | UPC99999 | |
| 16 | 93-94 | I2 | Total number of physical volumes in the logical volume | 1 | |
| 17 | 95-96 | I2 | Physical volume sequence number of the first tape within the logical volume | 1 | |
| 18 | 97-98 | I2 | Physical volume sequence number of the last tape within the logical volume | 1 | |
| 19 | 99-100 | I2 | Physical volume sequence number of current tape within the logical volume | 1 | |
| 20 | 101-104 | I4 | First referenced file number in this physical volume within the logical volume. | 1 | |
| 21 | 105-108 | I4 | Logical volume number within volume set | 1 | |
| 22 | 109-112 | I4 | Logical volume number within physical volume | 1 | |
| 23 | 113-120 | A8 | Logical volume creation date (YYYYMMDD) | 20080319 | |
| 24 | 121-128 | A8 | Logical volume creation time (HHMMSSDD, DD=deci-seconds) (DD not provided) | 22264900 | |

| | | | | | |
|----|---------|------|--|-------|--|
| 25 | 129-140 | A12 | Logical volume generation country(GERMANY, ENGLAND, ITALY) | ITALY | |
| 26 | 141-148 | A8 | Logical volume generating agency | ESA | |
| 27 | 149-160 | A12 | Logical volume generating facility(D-PAF,UK-PAF, IPAF(ASI), ES, ,MS, KS, FS) | PAM | |
| 28 | 161-164 | I4 | Number of file pointer records in volume directory | 2 | |
| 29 | 165-168 | I4 | Number of records in volume directory | 4 | |
| 30 | 169-172 | I4 | Total number of logical volume set | 1 | |
| 31 | 173-260 | A88 | Volume descriptor spare segment (always blank filled) | | |
| 32 | 261-360 | A100 | Local use segment | | |

Table 5-2

LEADER FILE POINTER RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|---------|--------|---|---------------------------|-------|
| 1 | 1-4 | B4 | Record number | 2 | |
| 2 | 5 | B1 | 1st record subtype code | 219 | |
| 3 | 6 | B1 | Record type code | 192 | |
| 4 | 7 | B1 | 2nd subtype code | 18 | |
| 5 | 8 | B1 | 3rd subtype code | 18 | |
| 6 | 9-12 | B4 | Length of this record | 360 | |
| 7 | 13-14 | A2 | ASCII/EBCDIC flag for referenced file | A | |
| 8 | 15-16 | A2 | Blank | | |
| 9 | 17-20 | I4 | Referenced file number | 1 | |
| 10 | 21-36 | A16 | Referenced file name | JERS.SAR.PRILEAD | |
| 11 | 37-64 | A28 | Referenced file class | SARLEADER FILE | |
| 12 | 65-68 | A4 | Referenced file class code | SARL | |
| 13 | 69-96 | A28 | Referenced file data type | MIXED BINARY AND ASCII | |
| 14 | 97-100 | A4 | Referenced file data type code | MBAA | |
| 15 | 101-108 | I8 | Number of records in referenced file (variable) | 6 | |
| 16 | 109-116 | I8 | Referenced file 1st record length | 720 | |
| 17 | 117-124 | I8 | Referenced file maximum record length | 12288 | |
| 18 | 125-136 | A12 | Referenced file record length type | VARIABLE LEN | |
| 19 | 137-140 | A4 | Referenced file record length type code | VARE | |

| | | | | | |
|----|---------|------|---|--------------------|--|
| 20 | 141-142 | I2 | Referenced file physical volume start number | 1 | |
| 21 | 143-144 | I2 | Referenced file physical volume end number | 1 | |
| 22 | 145-152 | I8 | Referenced file portion start, 1st record number for this physical volume | 1 | |
| 23 | 153-160 | I8 | Referenced file portion end, last record number for this physical volume (variable) | 6 | |
| 24 | 161-260 | A100 | File pointer spare segment | (Blank – Not Used) | |
| 25 | 261-360 | A100 | Local use segment | | |

Table 5-3

DATA FILE POINTER RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|---------|--------|---|------------------------|-------|
| 1 | 1-4 | B4 | Record number | 3 | |
| 2 | 5 | B1 | 1st record subtype code | 219 | |
| 3 | 6 | B1 | Record type code | 192 | |
| 4 | 7 | B1 | 2nd subtype code | 18 | |
| 5 | 8 | B1 | 3rd subtype code | 18 | |
| 6 | 9-12 | B4 | Length of this record | 360 | |
| 7 | 13-14 | A2 | ASCII/EBCDIC flag for referenced file | A | |
| 8 | 15-16 | A2 | Blank | | |
| 9 | 17-20 | I4 | Referenced file number | 2 | |
| 10 | 21-36 | A16 | Referenced file name | JERS.SAR.PRIIMGY | |
| 11 | 37-64 | A28 | Referenced file class | IMAGERY OPTIONS FILE | |
| 12 | 65-68 | A4 | Referenced file class code | IMOP | |
| 13 | 69-96 | A28 | Referenced file data type | MIXED BINARY AND ASCII | |
| 14 | 97-100 | A4 | Referenced file data type code | MBAA | |
| 15 | 101-108 | I8 | Number of records in referenced file (variable) | 6529 | |
| 16 | 109-116 | I8 | Referenced file 1st record length | 12428 | |
| 17 | 117-124 | I8 | Referenced file maximum record length | 12428 | |
| 18 | 125-136 | A12 | Referenced file record length type | FIXED LENGTH | |
| 19 | 137-140 | A4 | Referenced file record length type code | FIXD | |
| 20 | 141-142 | I2 | Referenced file physical volume start number | 1 | |
| 21 | 143-144 | I2 | Referenced file physical volume end number | 1 | |

| | | | | | |
|----|---------|----|---|---|--|
| 22 | 145-152 | I8 | Referenced file portion start, 1st record number for this physical volume | 1 | |
|----|---------|----|---|---|--|

| | | | | | |
|----|---------|------|---|------|--|
| 23 | 153-160 | I8 | Referenced file portion end, last record number for this physical volume (variable) | 6529 | |
| 24 | 161-260 | A100 | File pointer spare segment | | |
| 25 | 261-360 | A100 | Local use segment | | |

Table 5-4

TEXT RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|---------|--------|--|---|-------|
| 1 | 1-4 | B4 | Record sequence number | 4 | |
| 2 | 5-5 | B1 | 1st record sub-type code | 18 | |
| 3 | 6-6 | B1 | Record type code | 63 | |
| 4 | 7-7 | B1 | 2nd record sub-type code | 18 | |
| 5 | 8-8 | B1 | 3rd record sub-type code | 18 | |
| 6 | 9-12 | B4 | Length of this record | 360 | |
| 7 | 13-14 | A2 | ASCII/EBCDIC Flag | A | |
| 8 | 15-16 | A2 | Continuation flag | Blank | |
| 9 | 17-56 | A40 | Product type specifier | PRODUCT:JERS.SAR.PRI, or JERS.SAR.IMM or JERS.SAR.SLC | |
| 10 | 57-116 | A60 | Location and date/time of product creation | GENERATED AT PAM 2008-03-19 22:26 | |
| 11 | 117-156 | A40 | Physical volume identification | Tape 1/1 VOL-ID 1 | |
| 12 | 157-196 | A40 | Scene identification | ORBIT 18001 DATE:26-FE B-1998 10:17:39 | |
| 13 | 197-236 | A40 | Scene location | FRAME 184 LAT: 69.023 LONG: 17.037 | |
| 14 | 237-256 | A20 | Spares | | |
| 15 | 257-360 | A104 | Spares | | |

5.2 LEADER FILE FORMAT DEFINITION

Table 5-5

SAR - LEADER FILE, FILE DESCRIPTOR RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|---------|--------|--|---|-------|
| 1 | 1-4 | B4 | Record Sequence Number | 1 | |
| 2 | 5 | B1 | 1st record sub-type code | 63 | |
| 3 | 6 | B1 | Record type code | 192 | |
| 4 | 7 | B1 | 2nd record sub-type code | 18 | |
| 5 | 8 | B1 | 3rd record sub-type code | 18 | |
| 6 | 9-12 | B4 | Length of this record | 720 | |
| 7 | 13-14 | A2 | ASCII/EBCDIC Flag | A | |
| 8 | 15-16 | A2 | Blanks | | |
| 9 | 17-28 | A12 | Format control document ID for this data file format | CEOS-SAR-CCT | |
| 10 | 29-30 | A2 | Format control document revision level | B | |
| 11 | 31-32 | A2 | File design descriptor revision letter | B | |
| 12 | 33-44 | A12 | Generating software release and revision level | JERSIPF 01.03 | |
| 13 | 45-48 | I4 | File number | 1 | |
| 14 | 49-64 | A16 | File name | JERS.SAR.PRILEA or JERS.SAR.IMMLEA or JERS.SAR.SLCLEA | |
| 15 | 65-68 | A4 | Record sequence and location type flag | FSEQ | |
| 16 | 69-76 | I8 | Sequence number location | 1 | |
| 17 | 77-80 | I4 | Sequence number field length | 4 | |
| 18 | 81-84 | A4 | Record code and location type flag | FTYP | |
| 19 | 85-92 | I8 | Record code location | 5 | |
| 20 | 93-96 | I4 | Record code field length | 4 | |
| 21 | 97-100 | A4 | Record length and location type flag | FLGT | |
| 22 | 101-108 | I8 | Record length location | 9 | |
| 23 | 109-112 | I4 | Record length field length | 4 | |
| 24-27 | 113-116 | A1 | <i>Reserved</i> | | |
| 28 | 117-180 | A64 | <i>Reserved segment</i> | | |

| | | | | | |
|-------|---------|----|--|------|--|
| 29 | 181-186 | I6 | Number of data set summary records | 1 | |
| 30 | 187-192 | I6 | Data set summary record length | 1886 | |
| 31 | 193-198 | I6 | Number of map projection data records | 1 | |
| 32 | 199-204 | I6 | Map projection record length | 1620 | |
| 33 | 205-210 | I6 | Number of platform pos. data records | 1 | |
| 34 | 211-216 | I6 | Platform position record length | 1046 | |
| 35 | 217-222 | I6 | Number of attitude data records | 0 | |
| 36 | 223-228 | I6 | Attitude data record length | 0 | |
| 37 | 229-234 | I6 | Number of radiometric data records | 0 | |
| 38 | 235-240 | I6 | Radiometric record length | 0 | |
| 39 | 241-246 | I6 | Number of rad. compensation records | 0 | |
| 40 | 247-252 | I6 | Radiometric compensation rec. length | 0 | |
| 41 | 253-258 | I6 | Number of data quality summary records | 0 | |
| 42 | 259-264 | I6 | Data quality summary record length | 0 | |
| 43 | 265-270 | I6 | Number of data histograms records | 0 | |
| 44 | 271-276 | I6 | Data histogram record length | 0 | |
| 45 | 277-282 | I6 | Number of range spectra records | 0 | |
| 46 | 283-288 | I6 | Range spectra record length | 0 | |
| 47 | 289-294 | I6 | Number of DEM descriptor records | 0 | |
| 48 | 295-300 | I6 | DEM descriptor record length | 0 | |
| 49 | 301-306 | I6 | Number of radar par. update records | 0 | |
| 50 | 307-312 | I6 | Radar par. update record length | 0 | |
| 51 | 313-318 | I6 | Number of annotation data records | 0 | |
| 52 | 319-324 | I6 | Annotation data record length | 0 | |
| 53 | 325-330 | I6 | Number of det.processing records | 0 | |
| 54 | 331-336 | I6 | Det.processing record length | 0 | |
| 55 | 337-342 | I6 | Number of calibration records | 0 | |
| 56 | 343-348 | I6 | Calibration record length | 0 | |
| 57 | 349-354 | I6 | Number of GCP records | 0 | |
| 58 | 355-360 | I6 | GCP record length | 0 | |
| 59-68 | 361-420 | I6 | <i>Spare</i> | | |
| 69 | 421-426 | I6 | Number of facility data records | 2 | |

| | | | | | |
|----|---------|----|-------------------------------------|-------|--|
| 70 | 427-432 | I6 | Facility data record maximum length | 12288 | |
| 71 | 433-720 | A2 | Blanks | | |

Table 5-6

DATA SET SUMMARY RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|-------|--------|---|---------|-------|
| 1 | 1 - 4 | B4 | Record sequence number | 2 | |
| 2 | 5 | B1 | 1st record sub-type code | 10 | |
| 3 | 6 | B1 | Record-type code | 10 | |
| 4 | 7 | B1 | 2nd record sub-type code | 31 | |
| 5 | 8 | B1 | 3rd record sub-type code | 20 | |
| 6 | 9-12 | B4 | Length of this record | 1886 | |
| 7 | 13-16 | I4 | Data Set Summary Record sequence number (starts at 1) | 1 | |

SCENE PARAMETERS

| | | | | | |
|----|---------|-------|---|----------------------------|---------------------|
| 8 | 17-20 | I4 | SAR channel indicator | 1 | |
| 9 | 21-36 | A16 | Reserved | | |
| 10 | 37-68 | A32 | Scene reference number (e.g. orbit - frame number) | ORBIT=12345- FRAME=184 | |
| 11 | 69-100 | A32 | Scene centre time (UTC)<YYYYMMDDhhmmsstt> | 19980226101739000 | |
| 12 | 101-116 | A16 | Acquisition | ASCENDING or DESCENDING | |
| 13 | 117-132 | F16.7 | Processed scene centre geodetic latitude (positive for North latitude, negative for South latitude) | 69.0228420 | degrees |
| 14 | 133-148 | F16.7 | Processed scene centre geodetic longitude (negative for West longitude) | 17.0369700 | degrees |
| 15 | 149-164 | F16.7 | Processed scene centre true heading as calculated relative to North | -166.8998000 | degrees |
| 16 | 165-180 | A16 | Ellipsoid designator | WGS84 | |
| 17 | 181-196 | F16.7 | Ellipsoid semimajor axis | 6378.144 | km |
| 18 | 197-212 | F16.7 | Ellipsoid semiminor axis | 6356.759 | Km |
| 19 | 213-228 | F16.7 | Earth mass times gravitational constant (M. G) | 3.9860044 | kg.m/s ² |
| 20 | 229-244 | A16 | Spare | | |

| | | | | | |
|----|---------|-------|--|------------|----|
| 21 | 245-260 | F16.7 | Ellipsoid J2 parameter | 0.0010826 | |
| 22 | 261-276 | F16.7 | Ellipsoid J3 parameter | 0.0000025 | |
| 23 | 277-292 | F16.7 | Ellipsoid J4 parameter | -0.0000017 | |
| 24 | 293-308 | A16 | Spare | | |
| 25 | 309-324 | F16.7 | Reserved | | |
| 26 | 325-332 | I8 | Scene centre line number (the line number at the scene centre including zero fill) (variable) | 3264 | |
| 27 | 333-340 | I8 | Scene centre pixel number (the pixel number at the scene centre including zero fill) (nominal) | 3104 | |
| 28 | 341-356 | F16.7 | Processed scene length including zero fill (nominal) | 81.5875010 | km |
| 29 | 357-372 | F16.7 | Processed scene width including zero fill (nominal) | 7.5875100 | km |
| 30 | 373-388 | A16 | Spare | | |

GENERAL MISSION / SENSOR PARAMETERS

| | | | | | |
|----|---------|-----|--|-------------------|--|
| 31 | 389-392 | I4 | Number of SAR channels | 1 | |
| 32 | 393-396 | A4 | Spare | | |
| 33 | 397-412 | A16 | Sensor platform mission identifier | JERS1 | |
| 34 | 413-444 | A32 | Sensor ID and mode of operation for this channel <AAAAAA-BB-CC-DD-EF> where : AAAAAA = sensor identifier BB = SAR band CC = resolution mode code DD = imaging mode code E = transmit polarisation F = receiver polarisation | JERS-1-L-HR-IM-HH | |
| 35 | 445-452 | A8 | Orbit number | 123 | |

| | | | | | |
|----|---------|-------|--|-----------------|---------------------|
| 36 | 453-460 | F8.3 | Not Used | | |
| 37 | 461-468 | F8.3 | Not Used | | |
| 38 | 469-476 | F8.3 | Sensor platform heading at nadir corresponding to scene centre(clockwise positive from North) | -166.900 | degrees |
| 39 | 477-484 | F8.3 | Sensor clock angle as measured relative to sensor platform flight direction | 90.0000 | degrees |
| 40 | 485-492 | F8.3 | Incidence angle at scene centre as derived from sensor platform orientation | 39.306 | degrees |
| 41 | 493-500 | F8.3 | Radar frequency | 1.25 | GHz |
| 42 | 501-516 | F16.7 | Radar wavelength | 0.2351313 | metres |
| 43 | 517-518 | A2 | Motion compensation indicator "00" = no compensation, "01" = on board compensation, "10" = in processor compensation, | 00 | |
| 44 | 519-534 | A16 | Range pulse code specifier | LINEAR FM CHIRP | |
| 45 | 535-550 | E16.7 | Nominal range pulse (chirp) amplitude coefficient constant term | 0.1000000E+01 | |
| 46 | 551-566 | E16.7 | Nominal range pulse (chirp) amplitude coefficient linear term | 0.0000000E+00 | sec-1 |
| 47 | 567-582 | E16.7 | Nominal range pulse (chirp) amplitude coefficient quadratic term | 0.0000000E+00 | sec-2 |
| 48 | 583-598 | E16.7 | Nominal range pulse (chirp) amplitude coefficient cubic term | 0.0000000E+00 | sec-3 |
| 49 | 599-614 | E16.7 | Nominal range pulse (chirp) amplitude coefficient quartic term | 0.0000000E+00 | sec-4 |
| 50 | 615-630 | E16.7 | Nominal range pulse (chirp) phase coefficient constant term | 0.0000000E+00 | cycles |
| 51 | 631-646 | E16.7 | Nominal range pulse (chirp) phase coefficient linear term | 0.0000000E+00 | Hz |
| 52 | 647-662 | E16.7 | Nominal range pulse (chirp) phase coefficient quadratic term | 0.4275700E+12 | Hz/sec |
| 53 | 663-678 | E16.7 | Nominal range pulse (chirp) phase coefficient cubic term | 0.0000000E+00 | Hz/sec ² |
| 54 | 679-694 | E16.7 | Nominal range pulse (chirp) phase coefficient quartic term | 0.0000000E+00 | Hz/sec ³ |
| 55 | 695-702 | I8 | Not Used | | samples |
| 56 | 703-710 | A8 | Spare | | |
| 57 | 711-726 | F16.7 | Range sampling rate | 17.0760000 | MHz |
| 58 | 727-742 | F16.7 | Range gate delay at early edge (in time) at the start of the image | 4722.7760000 | microsec |
| 59 | 743-758 | F16.7 | Range pulse length | 35.0000000 | microsec |
| 60 | 759-762 | A4 | Reserved | | |

| | | | | | |
|-------|-----------|---------|---|-------------------|---------|
| 61 | 763-766 | A4 | Range compressed flag (YES = range compressed data) | YES | |
| 62-63 | 767-798 | 2 F16.7 | Reserved | | |
| 64 | 799-806 | I8 | Quantization per channel I & Q (5I 5Q/6I 6Q for OGRC/OBRC) | 3 | bits |
| 65 | 807-818 | A12 | Quantizer descriptor | UNIFORM I Q | |
| 66 | 819-834 | F16.7 | DC Bias for I-component (actual value) | 1.5272150 | |
| 67 | 835-850 | F16.7 | DC Bias for Q-component (actual value) | 1.6617610 | |
| 68 | 851-866 | F16.7 | Gain imbalance for I & Q (actual value) | -0.0062169 | dB |
| 69-70 | 867-898 | F16.7 | Spare | | |
| 71 | 899-914 | F16.7 | Reserved | | |
| 72 | 915-930 | F16.7 | Antenna mechanical boresight angle relative to platform vertical axis at the start of the image positive to the right, negative to the left | 35.4832773 | |
| 73 | 931-934 | A4 | Reserved | | degrees |
| 74 | 935-950 | F16.7 | Pulse Repetition Frequency (PRF) (actual value) | 1555.1716309 | Hz |
| 75-76 | 951-966 | F16.7 | Reserved | | |
| 77 | 983-998 | I16 | Satellite encoded binary time code | 68033796 | |
| 78 | 999-1030 | A32 | Satellite clock time (UTC) <YYYYMMDDhhmmsstt> | 19980226101733134 | |
| 79 | 1031-1038 | I8 | Satellite clock step length (microseconds) | 999998 | |
| 80 | 1039-1046 | A8 | Spare | | |
| 81 | 1047-1062 | A16 | Processing facility identifier | PAM | |
| 82 | 1063-1070 | A8 | Processing system identifier | JERS-IPF | |
| 83 | 1071-1078 | A8 | Processing version identifier | 8.6.4 | |
| 84 | 1079-1094 | A16 | Reserved | | |
| 85 | 1095-1110 | A16 | Reserved | | |
| 86 | 1111-1142 | A32 | Product type specifier | PRI or IMM or SLC | |
| 87 | 1143-1174 | A32 | Processing algorithm identifier | RANGE DOPPLER | |
| 88 | 1175-1190 | F16.7 | Nominal number of looks processed in azimuth | 4 (or 1) | looks |
| 89 | 1191-1206 | F16.7 | Nominal number of looks processed in range | 1 | looks |
| 90 | 1207-1222 | F16.7 | Bandwidth per look in azimuth (null-to-null) | 300 (or 1000) | Hz |
| 91 | 1223-1238 | F16.7 | Bandwidth per look in range | 14.96495 | MHz |

GENERAL PROCESSING PARAMETERS

| | | | | | |
|-----|-----------|-------|--|----------------|----------------|
| 92 | 1239-1254 | F16.7 | Total processor bandwidth in azimuth | 1000 | Hz |
| 93 | 1255-1270 | F16.7 | Total processor bandwidth in range | 1.496495 | MHz |
| 94 | 1271-1302 | A32 | Weighting function designator in azimuth | HANNING | |
| 95 | 1303-1334 | A32 | Weighting function designator in range | HANNING | |
| 96 | 1335-1350 | A16 | Data input source (Not Used) | | |
| 97 | 1351-1366 | F16.7 | Nominal resolution in range (3-dB width) | 15.8282830 | m |
| 98 | 1367-1382 | F16.7 | Nominal resolution in azimuth (3-dB width) | 23.3359300 | m |
| 99 | 1383-1398 | F16.7 | Reserved | | |
| 100 | 1399-1414 | F16.7 | Reserved | | |
| 101 | 1415-1430 | F16.7 | Along track Doppler frequency centroid at early edge of image constant term | 745.2219200 | Hz |
| 102 | 1431-1446 | F16.7 | Along track Doppler frequency centroid at early edge of image linear term | 6.5589604 | Hz/sec |
| 103 | 1447-1462 | F16.4 | Along track Doppler frequency centroid at early edge of image quadratic term | -0.0001556 | Hz/sec/sec |
| 104 | 1463-1478 | A16 | Spare | | |
| 105 | 1479-1494 | F16.7 | Cross track Doppler frequency centroid at early edge of image constant term(Doppler centroid) | 745.2219200 | Hz |
| 106 | 1495-1510 | F16.7 | Cross track Doppler frequency centroid at early edge of image linear term(Slope of Doppler centroid) | 229850.4000000 | Hz/sec |
| 107 | 1511-1526 | F16.4 | Cross track Doppler frequency centroid at early edge of image quadratic term | -31230712.1234 | Hz/sec/sec |
| 108 | 1527-1534 | A8 | Time direction indicator along pixel direction | INCREASE | |
| 109 | 1535-1542 | A8 | Time direction indicator along line direction | INCREASE | |
| 110 | 1543-1558 | F16.7 | Along track Doppler frequency rate at early edge of image constant term | -637.5415000 | Hz/sec |
| 111 | 1559-1574 | F16.7 | Along track Doppler frequency rate at early edge of image linear term | -0.0023465 | Hz/sec/sec |
| 112 | 1575-1590 | F16.7 | Along track Doppler frequency rate at early edge of image quadratic term | -0.0000007 | Hz/sec/sec/sec |
| 113 | 1591-1606 | A16 | Spare | | |
| 114 | 1607-1622 | F16.7 | Cross track Doppler frequency rate at early edge of image constant term(Azimuth FM rate) | -637.5415000 | Hz/sec |
| 115 | 1623-1638 | F16.7 | Cross track Doppler frequency rate at early edge of image linear term(Slope of Az. FM rate) | 139737.6000000 | Hz/sec/sec |
| 116 | 1639-1654 | F16.4 | Cross track Doppler frequency rate at early edge of image quadratic term | -14062500.1234 | Hz/sec/sec/sec |
| 117 | 1655-1670 | F16.7 | Estimated RFI level (%of raw data power) | 5 | %Power |

| | | | | | |
|-----|-----------|-------|--|-----------------|---|
| 118 | 1671-1678 | A8 | Line content indicator | RANGE | |
| 119 | 1679-1682 | A4 | Clutterlock applied flag | NOT | |
| 120 | 1683-1686 | A4 | Autofocussing applied flag | NOT | |
| 121 | 1687-1702 | F16.7 | Line spacing | 12.5 | m |
| 122 | 1703-1718 | F16.7 | Pixel spacing | 12.5 | m |
| 123 | 1719-1734 | A16 | Processor range compression designator | SYNTHETIC CHIRP | |
| 124 | 1735-1750 | A16 | Spare | | |
| 125 | 1751-1766 | A16 | Spare | | |

SENSOR SPECIFIC LOCAL USE SEGMENT

| | | | | | |
|-------|-----------|-------|---|--------------------------|----------|
| 126/1 | 1767-1782 | F16.7 | Zero-doppler range time (two-way) of first range pixel | 4.7227760 | millisec |
| 126/2 | 1783-1798 | F16.7 | Zero-doppler range time (two-way) of centre range pixel | 4.8814344 | millisec |
| 126/3 | 1799-1814 | F16.7 | Zero-doppler range time (two-way) of last range pixel | 5.0495620 | millisec |
| 126/4 | 1815-1838 | A24 | Zero-doppler azimuth time of first azimuth pixel (UTC) <dd-MMM-yyyy\$hh:mm:ss.ttt> | 26-FEB-1998 10:17:33.992 | |
| 126/5 | 1839-1862 | A24 | Zero-doppler azimuth time of centre azimuth pixel (UTC) <dd-MMM-yyyy\$hh:mm:ss.ttt> | 26-FEB-1998 10:17:39.875 | |
| 126/6 | 1863-1886 | A24 | Zero-doppler azimuth time of last azimuth pixel (UTC) <dd-MMM-yyyy\$hh:mm:ss.ttt> | 26-FEB-1998 10:17:45.757 | |

Table 5-7

MAP PROJECTION DATA RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|---------|--------|--|-------------------------|---------|
| 1 | 1 - 4 | B4 | Record sequence number | 3 | |
| 2 | 5 | B1 | 1st record sub-type code | 18 | |
| 3 | 6 | B1 | Record-type code | 20 | |
| 4 | 7 | B1 | 2nd record sub-type code | 18 | |
| 5 | 8 | B1 | 3rd record sub-type code | 20 | |
| 6 | 9-12 | B4 | Length of this record | 1620 | |
| 7 | 13-28 | A16 | Spare | | |
| 8 | 29-60 | A32 | Map projection descriptor (SLANT RANGE, GROUND RANGE, GEOCODED) | SLANT RANGE | |
| 9 | 61-76 | I16 | Number of pixels per line of image | 6208 | pixels |
| 10 | 77-92 | I16 | Number of lines (variable) | 6528 | lines |
| 11 | 93-108 | F16.7 | Nominal inter-pixel distance in output scene | 12.5 | m |
| 12 | 109-124 | F16.7 | Nominal inter-line distance in output scene | 12.5 | m |
| 13 | 125-140 | F16.7 | Orientation at output scene centre [for geocoded products this is simply the convergence of the meridians, i.e.: the angle between geographic north and map grid north (Angle of projection axis from true North)] | -166.8998000 | degrees |
| 14 | 141-156 | F16.7 | Nominal platform orbital inclination | 98.16 | degrees |
| 15 | 157-172 | F16.7 | Actual ascending node (longitude at Equator) | -165.0442300 | degrees |
| 16 | 173-188 | F16.7 | Geocentre to platform distance at input scene centre | 7067329 | m |
| 17 | 189-204 | F16.7 | Platform geodetic altitude over the ellipsoid | 702359 | m |
| 18 | 205-220 | F16.7 | Ground speed at nadir at input scene centre time | | m/s |
| 19 | 221-236 | F16.7 | Platform heading at nadir corresponding to scene centre | -166.8998000 | degrees |
| 20 | 237-268 | A32 | Name of reference ellipsoid | WGS84 | |
| 21 | 269-284 | F16.7 | Semimajor axis of ref.ellipsoid | 6378137 | m |
| 22 | 285-300 | F16.7 | Semiminor axis of ref.ellipsoid | 6356752 | m |
| 23 | 301-412 | A412 | Not used | | |
| 24 | 413-444 | A32 | Map Projection – NONE, UTM-PROJECTION or UPS-PROJECTION | UTM-PROJECTION | |
| 25 | 445-476 | A32 | UTM descriptor (for UTM, blank otherwise) | UNIVERSAL TRANSVERSE | |

| | | | | | |
|----|-----------|---------|---|----------------------------------|---------|
| | | | | MERCATOR | |
| 26 | 477-480 | I4 | UTM Zone ID (only longitude) (for UTM, blank otherwise) | 0012 | |
| 27 | 481-496 | F16.5 | False Easting (for UTM, blank otherwise) | 500000.0 | |
| 28 | 497-512 | F16.5 | False Northing (for UTM, blank otherwise) | 0.0 | |
| 29 | 513-528 | F16.7 | Projection centre longitude (for UTM, blank otherwise) | 17,12345 | degrees |
| 30 | 529-544 | F16.7 | Projection centre latitude (for UTM, blank otherwise) | 68.56789 | Degrees |
| 31 | 545-576 | A32 | Not Used | | |
| 32 | 577-592 | F16.7 | Scale Factor (for UTM, blank otherwise) | 0.9996000 | |
| 33 | 593-624 | A32 | UPS descriptor (for UPS, blank otherwise) | UNIVERSAL POLAR STEREOGRAPHIC | |
| 34 | 625-640 | F16.7 | Projection centre longitude (for UPS, blank otherwise) | | |
| 35 | 641-656 | F16.7 | Projection centre latitude (for UPS, blank otherwise) | | |
| 36 | 657-672 | F16.7 | Scale Factor (for UPS, blank otherwise) | 0.9940000 | |
| 37 | 673-944 | A272 | Not Used | | |
| 38 | 945-960 | F16.7 | 1st line 1st pixel Northing | | Km |
| 39 | 961-976 | F16.7 | 1st line 1st pixel Easting | | Km |
| 40 | 977-992 | F16.7 | 1st line last pixel Northing | | Km |
| 41 | 993-1008 | F16.7 | 1st line last pixel Easting | | Km |
| 42 | 1009-1024 | F16.7 | Last line last pixel Northing | | Km |
| 43 | 1025-1040 | F16.7 | Last line last pixel Easting | | Km |
| 44 | 1041-1056 | F16.7 | Last line 1st pixel Northing | | Km |
| 45 | 1057-1072 | F16.7 | Last line 1st pixel Easting | | Km |
| 46 | 1073-1088 | F16.7 | 1st line 1st pixel geodetic latitude (positive for North latitude) | 69.295150 | degrees |
| 47 | 1089-1104 | F16.7 | 1st line 1st pixel longitude (negative for West longitude) | 18.2548100 | degrees |
| 48 | 1105-1120 | F16.7 | 1st line last pixel geodetic latitude | 69.4528700 | degrees |
| 49 | 1121-1136 | F16.7 | 1st line last pixel longitude | 16.3344800 | degrees |
| 50 | 1137-1152 | F16.7 | Last line last pixel geodetic latitude | 68.7388500 | degrees |
| 51 | 1153-1168 | F16.7 | Last line last pixel longitude | 15.9030100 | degrees |
| 52 | 1169-1184 | F16.7 | Last line 1st pixel geodetic latitude | 68.5846100 | degrees |
| 53 | 1185-1200 | F16.7 | Last line 1st pixel longitude | 17.7636640 | degrees |
| 54 | 1201-1264 | A64 | Not Used | | |
| 55 | 1265-1424 | 8E20.10 | Eight coefficients (A11, A12, ..., A24) to convert a line (L) and pixel (P) position to | | |

| | | | | | |
|----|-----------|---------|---|--|--|
| | | | <p>the map projection frame of reference, say (E, N) where: $E = A11 + A12*L + A13*P + A14*L*P$ $N = A21 + A22*L + A23*P + A24*L*P$ (in the order A11, A12, A13, ..., A24)</p> | | |
| 56 | 1425-1584 | 8E20.10 | <p>Eight coefficients (B11, B12, ..., B24) to convert from the map projection (E, N) to line (L) and pixel (P) position in the image, say (L, P) where: $L = B11 + B12*E + B13*N + B14*E*N$ $P = B21 + B22*E + B23*N + B24*E*N$ (in the order B11, B12, B13, ..., B24)</p> | | |
| 57 | 1585-1620 | A36 | Not Used | | |

Table 5-8

PLATFORM POSITION DATA RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|---------|--------|--------|--|---------|-------|
| 1 | 1 - 4 | B4 | Record sequence number | 4 | |
| 2 | 5 | B1 | 1st record sub-type code | 10 | |
| 3 | 6 | B1 | Record-type code | 30 | |
| 4 | 7 | B1 | 2nd record sub-type code | 31 | |
| 5 | 8 | B1 | 3rd record sub-type code | 20 | |
| 6 | 9-12 | B4 | Length of this record (not fixed length) | 1046 | |
| 7 to 13 | 13-140 | A128 | Reserved | | |

POSITIONAL DATA POINTS

| | | | | | |
|-------|---------|---------|---|---------------------------------|---------|
| 14 | 141-144 | I4 | Number of data points | 5 | |
| 15 | 145-148 | I4 | Year of data point <YYYY> | 1998 | |
| 16 | 149-152 | I4 | Month of data point <\$\$MM> | 2 | |
| 17 | 153-156 | I4 | Day of data point <\$\$DD> | 26 | |
| 18 | 157-160 | I4 | Day in the year <GMT> (1st January = Day 1) | 56 | |
| 19 | 161-182 | D22.15 | Seconds of day of data | 37020.000000000000000 | sec |
| 20 | 183-204 | D22.15 | Time interval between data points | 60.000000000000000 | sec |
| 21 | 205-268 | A64 | Reference coordinate system | EARTH FIXED REFERENCE SYSTEM | |
| 22 | 269-290 | D22.15 | Greenwich mean hour angle (Not Used) | | degrees |
| 23 | 291-306 | F16.7 | Along track position error (Not Used) | | metres |
| 24 | 307-322 | F16.7 | Across track position error (Not Used) | | metres |
| 25 | 323-338 | F16.7 | Radial position error (Not Used) | | metres |
| 26-28 | 339-386 | F16.7 | Reserved | | |
| 29 | 387-452 | 3D22.15 | Position vector (X,Y,Z) | -0.105110487569652D+07 ... | metres |

| | | | | | |
|--|---------|---------|-------------------------|-------------------------------|-----|
| 30 | 453-518 | 3D22.15 | Velocity vector (X,Y,Z) | -0.851503263939225D+03 ... | m/s |
| Fields 29,30 repeat to end of record at a time spacing given by field 20 | | | | | |

Table 5-9 FACILITY RELATED DATA RECORD [GENERAL TYPE]

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|-------|--------|---|---|-------|
| 1 | 1 - 4 | B4 | Record sequence number | 5 | |
| 2 | 5 | B1 | 1st record sub-type code | 10 | |
| 3 | 6 | B1 | Record-type code | 200 | |
| 4 | 7 | B1 | 2nd record sub-type code | 31 | |
| 5 | 8 | B1 | 3rd record sub-type code | 50 | |
| 6 | 9-12 | B4 | Length of this record | 12288 | |
| 7 | 13-76 | A64 | Name of this facility related data record | FACILITY RELATED DATA RECORD [ESA GENERAL TYPE] | |

SIGNAL DATA QUALITY

| | | | | | |
|----|---------|-------|--|-------------------------------|---------|
| 8 | 77-82 | A6 | Date of last release of QC software <YYMMDD> | Not Used | |
| 9 | 83-84 | A2 | Spare | | |
| 10 | 85-90 | A6 | Date of the last calibration update <YYMMDD> | 960505 | |
| 11 | 91-94 | I4 | Overall QA summary flag (Sum of the next 9 following flags) | 1 | |
| 12 | 95-98 | I4 | PRF code change flag (0 = PRF constant in scene) | 0 | |
| 13 | 99-102 | I4 | Sampling window start time change flag (0 = SWST constant) | 1 | |
| 14 | 103-106 | I4 | Cal. system & receiver gain change flag (0 = Cal/Rx gain constant) | 1 | |
| 15 | 107-110 | I4 | Chirp replica quality flag (0 = Replica XCF in limits) | 0 | |
| 16 | 111-114 | I4 | Input data statistics flag (0 = Raw data mean & sd in limits) | 0 | |
| 17 | 115-118 | I4 | Doppler centroid confidence measure flag (0 = in limits) | 0 | |
| 18 | 119-122 | I4 | Doppler centroid value (0 = Dopp-centroid less than PRF/2) | 0 | |
| 19 | 123-126 | I4 | Doppler ambiguity confidence measure flag (0 = in limits) | 0 | |
| 20 | 127-130 | I4 | Output data mean flag (0 = Image mean or sd in limits) | 0 | |
| 21 | 131-134 | I4 | On ground / on board range compressed flag (0 = OGRC,1=OBRC) | 0 | |
| 22 | 135-138 | I4 | Number of PRF code changes | 0 | |
| 23 | 139-142 | I4 | Number of sampling window time changes | 1 | |
| 24 | 143-146 | I4 | Number of calibration subsystems gain changes | 0 | |
| 25 | 147-150 | I4 | Number of missing lines (i.e. raw data input lines) | 0 | |
| 26 | 151-154 | I4 | Number of receiver gain changes | 0 | |
| 27 | 155-170 | F16.7 | 3-dB pulse width of (first) Chirp Replica Cross Correlation Function (Not Used) | -999.9999999 | samples |
| 28 | 171-186 | F16.7 | First side lobe level of chirp CCF (Not Used) | -999.9999999 | dB |
| 29 | 187-202 | F16.7 | ISLR of chirp CCF function (Not Used) | -999.9999999 | dB |
| 30 | 203-218 | F16.7 | Doppler centroid confidence measure (processor specific) (value normalized such that it takes a value of one for the best case and a value of zero for the worst case) | 0.95 | |
| 31 | 219-234 | F16.7 | Doppler ambiguity confidence measure (Not Used) | -999.9999999 | |
| 32 | 235-250 | F16.7 | Estimated mean of I input data (relative to nominal DC ADC offset) | 1.5272150 | |
| 33 | 251-266 | F16.7 | Estimated mean of Q input data (relative to nominal DC ADC offset) | 1.6617610 (n/a for SEASAT) | |
| 34 | 267-282 | F16.7 | Estimated standard deviation of I input data | 0.7075980 | |
| 35 | 283-298 | F16.7 | Estimated standard deviation of Q input data | 0.7120246 | |
| 36 | 299-314 | F16.7 | Calibration system gain of first processed line (telemetry value) | 0 | |

| | | | | | |
|----|---------|-------|---|-------------|--|
| 37 | 315-330 | F16.7 | Receiver gain of first processed line (telemetry value) | -3.0 | dB |
| 38 | 331-346 | F16.7 | Doppler ambiguity number (Not Used) | | |
| 39 | 347-362 | 2F8.3 | Raw data saturation (I + Q channels) | 1.034 0.912 | % of samples in saturating bins (0 and 2**(nbits)-1) |

CALIBRATION INFORMATION

| | | | | | |
|----|---------|-------|---|------------------------|---------|
| 40 | 363-378 | F16.7 | Mean bias correction applied to raw data (I channel) | | |
| 41 | 379-394 | F16.7 | Mean bias correction applied to raw data (Q channel) | n/a for SEASAT | |
| 42 | 395-410 | F16.7 | Gain imbalance correction applied to raw data (I channel) | 1.0 | |
| 43 | 411-426 | F16.7 | Gain imbalance correction applied to raw data (Q channel) | 1.15 (n/a for SEASAT) | |
| 44 | 427-442 | F16.7 | I/Q channel raw data cross-correlation coefficient | n/a for SEASAT | |
| 45 | 443-458 | A16 | Spare | | |
| 46 | 459-474 | F16.7 | Not Used | | |
| 47 | 475-490 | I16 | Not Used | | |
| 48 | 491-494 | I4 | Not Used | | |
| 49 | 495-498 | I4 | Not Used | | |
| 50 | 499-502 | I4 | Not Used | | |
| 51 | 503-518 | F16.7 | Not Used | | |
| 52 | 519-534 | F16.7 | Not Used | | |
| 53 | 535-550 | F16.7 | Not Used | | |
| 54 | 551-566 | F16.7 | Not Used | | |
| 55 | 567-582 | F16.7 | Not Used | 1.0 | |
| 56 | 583-598 | F16.7 | Incidence angle at first range pixel (at mid-azimuth) | 36.4108200 | degrees |
| 57 | 599-614 | F16.7 | Incidence angle at centre range pixel (at mid-azimuth) | 39.3060600 | degrees |
| 58 | 615-630 | F16.7 | Incidence angle at last range pixel (at mid-azimuth) | 41.8197210 | degrees |
| 59 | 631-646 | F16.7 | Slant range reference (for range spreading loss compensation) | 720.0000000 | Km |
| 60 | 647-658 | A12 | Spare | | |
| 61 | 659-662 | I4 | Antenna pattern correction flag (0 = no correction) | 1 | |
| 62 | 663-678 | F16.7 | Absolute calibration constant K (scalar) | 465533.5300000 | |

| | | | | | |
|----------|-----------|----------|--|----------------|----|
| 63 | 679-694 | F16.7 | Upper bound calibration constant K (+ 0.75 dB) | 510447.3100000 | |
| 64 | 695-710 | F16.7 | Lower bound calibration constant K (- 0.75 dB) | 424571.7000000 | |
| 65 | 711-726 | F16.7 | Estimated noise equivalent σ_0 | -20 | dB |
| 66 | 727-732 | A6 | Date on which K was generated as YYMMDD | 951031 | |
| 67 | 733-736 | A4 | K version number as XXYY, | 1 | |
| 68 | 737-740 | I4 | Not used | | |
| 69 | 741-756 | F16.7 | Not used | | |
| 70 | 757-768 | A12 | Spare | | |
| 71 | 769-784 | F16.7 | Output image mean | 220.6898000 | |
| 72 | 785-800 | F16.7 | Output image standard deviation | 179.8818300 | |
| 73 | 801-816 | F16.7 | Output image maximum value | 66502.8400000 | |
| 74 | 817-840 | A24 | Not used | | |
| 75 | 841-864 | A24 | Not used | | |
| 76 to 81 | 865-996 | 6 D22.15 | Not used | | |
| 82 | 997-1000 | I4 | Output pixel bit length | 16 | |
| 83 | 1001-1016 | F16.7 | Processor gain #1. This defines the Thermal Noise gain; it is the ratio of the mean square thermal noise power in the image to that in the raw echo data (in dB) | 36.009 | |
| 84 | 1017-1032 | F16.7 | Processor gain #2. This defines the processing gain; it is the ratio of the mean square clutter power in the image to that in the raw echo data (in dB) | 44.145 | |
| 85 | 1033-1048 | F16.7 | Processor gain #3. This defines the ratio of the peak power of an ideal point target in the image to the slant range area integral of the corresponding energy in the raw echo data (in dB). | 19.872 | |
| 86 | 1049-1052 | I4 | Not used | | |
| 87 | 1053-1068 | F16.7 | Not used | | |
| 88 | 1069-1084 | F16.7 | Not used | | |
| 89 | 1085-1100 | F16.7 | Not used | | |
| 90 | 1101-1104 | I4 | Not used | | |
| 91 | 1105-1108 | I4 | Not used | | |
| 92 | 1109-1112 | I4 | Raw data correction flag | 0 | |
| 93 | 1113-1116 | I4 | Look detection flag (1 = power detected and summed) | 1 | |
| 94 | 1117-1120 | I4 | Doppler ambiguity estimation flag (0 = no estimation done) | 0 | |

VARIOUS PARAMETERS

| | | | | | |
|-----|-----------|---------|---|--------------------------|---------|
| 95 | 1121-1124 | I4 | Azimuth baseband conversion flag (0 = no conversion done) | 0 | |
| 96 | 1125-1128 | I4 | Not used | | samples |
| 97 | 1129-1132 | I4 | Not used | | lines |
| 98 | 1133-1156 | A24 | Time of input state vector (UTC) used to processed the image <dd-MMM-yyyy\$hh:mm:ss.ttt> | 26-FEB-1998 10:17:00.000 | |
| 99 | 1157-1178 | D22.15 | Input state vector - Position vector X | 0.205738743000000D+07 | m |
| 100 | 1179-1200 | D22.15 | Input state vector - Position vector Y | 0.117329455000000D+07 | m |
| 101 | 1201-1222 | D22.15 | Input state vector - Position vector Z | 0.652524557000000D+07 | m |
| 102 | 1223-1244 | D22.15 | Input state vector - Velocity vector X | 0.725172492000000D+04 | m/s |
| 103 | 1245-1266 | D22.15 | Input state vector - Velocity vector Y | 0.497768310000000D+03 | m/s |
| 104 | 1267-1288 | D22.15 | Input state vector - Velocity vector Z | -0.237101799000000D+04 | m/s |
| 105 | 1289-1292 | I4 | Input state vector type flag (0 = ascending node state vectors, i.e. predicted orbit, 1 = near scene state vectors, i.e. restituted, preliminary or precise orbit) | 0 | |
| 106 | 1293-1308 | F16.7 | Window coefficient for range-matched filter | 0.75 | |
| 107 | 1309-1324 | F16.7 | Window coefficient for azimuth-matched filter | 0.75 | |
| 108 | 1325-1328 | I4 | Not used | | chirps |
| 109 | 1329-1456 | 8 F16.7 | Not used | | |
| 110 | 1457-1460 | I4 | Sampling window start time bias | 6888 | nanosec |
| 111 | 1461-1482 | D22.15 | Doppler centroid cubic coefficient | 0.567370293856313D+11 | Hz/sec3 |
| 112 | 1483-1486 | I4 | Not used | | |
| 113 | 1487-1490 | I4 | Not used | | |
| 114 | 1491-1494 | I4 | Not used | | |
| 115 | 1495-1498 | I4 | Not used | | |
| 116 | 1499-1502 | I4 | Not used | | |
| 117 | 1503-1506 | I4 | Not used | | |
| 118 | 1507-1510 | I4 | First processed range sample | 1 | |
| 119 | 1511-1514 | I4 | Not used | | |
| 120 | 1515-1518 | I4 | Not used | | |
| 121 | 1519-1526 | I8 | Number of input raw data lines (variable) | 20219 | lines |
| 122 | 1527-1530 | I4 | Not used | | |

| | | | | | |
|-----|-----------|---------|--|----------|---------|
| 123 | 1531-1578 | 3 F16.7 | Not used | | |
| | 1579-1642 | 4F16.7 | Not used | | |
| | 1643-1674 | 2F16.7 | Not used | | |
| | 1675-1706 | 2F16.7 | Not used | | |
| 124 | 1707-1722 | I16 | Satellite binary time of first range line (telemetry value) | 68033796 | |
| 125 | 1723-1726 | I4 | Not used | | |
| 126 | 1727-1730 | I4 | Not used | | |
| 127 | 1731-1746 | F16.7 | Not used | | degrees |
| 128 | 1747-1762 | F16.7 | Not used | | degrees |
| 129 | 1763-1778 | F16.7 | Not used | | degrees |
| 130 | 1779-1794 | F16.7 | Not used | | degrees |
| 131 | 1795-1810 | F16.7 | 3-dB look bandwidth | 300 | Hz |
| 132 | 1811-1826 | F16.7 | 3-dB processed Doppler bandwidth | 300 | Hz |
| 133 | 1827-1830 | I4 | Range spreading loss compensation flag (0 = no compensation) | 1 | |
| 134 | 1831-1831 | I1 | Not used | | |
| 135 | 1832-1838 | I7 | Not used | | |
| 136 | 1839-1844 | I7 | Not used | | |
| 137 | 1845-1846 | I1 | Not used | | |
| 138 | 1847-1850 | I4 | Not used | | |

| | | | | | |
|-----|------------|----------|---|--|--|
| 139 | 1851-1854 | I4 | Not used | | |
| 140 | 1855-1934 | 4 E20.10 | <p>4 coefficients of the ground range to slant range conversion polynomial.</p> <p>The coefficients can be used to calculate the range time of the output range sample as follows :</p> $T_n = (C_0 + C_1 \cdot G_n + C_2 \cdot G_n^2 + C_3 \cdot G_n^3) / F_r + T_0$ <p>where :</p> <p>G_n is ground range of sample n from first range sample in metres</p> <p>F_r is the range sampling rate in Hz (field DSS 57)</p> <p>T_0 is the range time of the first output range sample (field DSS 126/1)</p> | <p>0.0000000000E+00</p> <p>0.6761082000E-01</p> <p>0.5922266000E-07</p> <p>-0.4726439000E-13</p> | |
| 141 | 1935-2034 | 5 E20.10 | Not used | | |
| 142 | 2035-2050 | E16.7 | Not used | | |
| 143 | 2051-12288 | A10238 | Spare | | |

Table 5-10

FACILITY RELATED DATA RECORD PCS TYPE

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|--------------|--------------|---------------|---|---|--------------|
| 1 | 1-4 | B4 | Record sequence number | 6 | |
| 2 | 5 | B1 | 1st record sub-type code | 10 | |
| 3 | 6 | B1 | Record sub-type code | 200 | |
| 4 | 7 | B1 | 2nd record sub-type code | 31 | |
| 5 | 8 | B1 | 3rd record sub-type code | 50 | |
| 6 | 9-12 | B4 | Length of this record | 12288 | |
| 7 | 13-76 | A64 | Name of this facility related data record | FACILITY RELATED DATA RECORD [ESA PCS QUALITY TYPE] | |
| 8 | 77-12288 | B | ESA reserved | | |

5.3 DATA SET FILE FORMAT DEFINITION

Table 5-11

SAR DATA FILE, FILE DESCRIPTOR RECORD (FIXED SEGMENT)

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|---------|--------|--|------------------|-------|
| 1 | 1-4 | B4 | Record sequence number | 1 | |
| 2 | 5 | B1 | 1st record sub-type code | 63 | |
| 3 | 6 | B1 | Record sub-type code | 192 | |
| 4 | 7 | B1 | 2nd record sub-type code | 18 | |
| 5 | 8 | B1 | 3rd record sub-type code | 18 | |
| 6 | 9-12 | B4 | Length of this record | 12428 | |
| 7 | 13-14 | A2 | ASCII/EBCDIC flag | A | |
| 8 | 15-16 | A2 | Blanks | | |
| 9 | 17-28 | A12 | Format control document ID for this data file format | CEOS-SAR-CCT | |
| 10 | 29-30 | A2 | Format control document revision level | B | |
| 11 | 31-32 | A2 | File design descriptor revision letter | B | |
| 12 | 33-44 | A12 | Generating software release and revision level | JERSIPF 01.03 | |
| 13 | 45-48 | I4 | File number | 2 | |
| 14 | 49-64 | A16 | File name | JERS.SAR.PRIIMGY | |
| 15 | 65-68 | A4 | Record sequence and location type flag | FSEQ | |
| 16 | 69-76 | I8 | Sequence number location | 1 | |
| 17 | 77-80 | I4 | Sequence number field length | 4 | |
| 18 | 81-84 | A4 | Record code and location type flag | FTYP | |
| 19 | 85-92 | I8 | Record code location | 5 | |
| 20 | 93-96 | I4 | Record code field length | 4 | |
| 21 | 97-100 | A4 | Record length and location type flag | FLGT | |
| 22 | 101-108 | I8 | Record length location | 9 | |
| 23 | 109-112 | I4 | Record length field length | 4 | |
| 24-27 | 113-116 | A1 | Reserved | | |

| | | | | | |
|----|---------|-----|--------------------------------------|-------|-------|
| 28 | 117-180 | A64 | Reserved segment | | |
| 29 | 181-186 | I6 | Number of SAR DATA records (nominal) | 6528 | |
| 30 | 187-192 | I6 | SAR DATA record length | 12428 | bytes |
| 31 | 193-216 | A24 | Reserved | | |

SAR DATA IMAGERY OPTIONS FILE, FILE DESCRIPTOR RECORD (VARIABLE SEGMENT)

| | | | | | |
|----|---------|----|--|-----------------------|--|
| 32 | 217-220 | I4 | Number of bits per sample | 16 (PRI/IMM)/ 32(SLC) | |
| 33 | 221-224 | I4 | Number of samples per data group (or pixels) | 1 | |
| 34 | 225-228 | I4 | Number of bytes per data group(or pixels) | 2 (PRI/IMM) /4 (SLC) | |
| 35 | 229-232 | A4 | Justification and order of samples within data group | | |

SAMPLE GROUP DATA

| | | | | | |
|----|---------|----|---|------|--|
| 36 | 233-236 | I4 | Number of SAR channels in this file | 1 | |
| 37 | 237-244 | I8 | Number of lines per data set (nominal) | 6528 | |
| 38 | 245-248 | I4 | Number of left border pixels per line | 0 | |
| 39 | 249-256 | I8 | Total number of data groups per line per SAR channel (variable) | 6208 | |
| 40 | 257-260 | I4 | Number of right border pixels per line (variable) | 0 | |
| 41 | 261-264 | I4 | Number of top border lines | 0 | |
| 42 | 265-268 | I4 | Number of bottom border lines | 0 | |
| 43 | 269-273 | A4 | Interleaving indicator | BSQ | |

RECORD DATA IN THE FILE

| | | | | | |
|-------|---------|---------|--|--|--|
| 44 | 273-274 | I2 | Number of physical records per line | 1 | |
| 45 | 275-276 | I2 | Number of physical records per multi-channel line | 0 | |
| 46 | 277-280 | I4 | Number of bytes of prefix data per record | 0 | |
| 47 | 281-288 | I8 | Number of bytes of SAR data(or pixel data) per record(nominal) | 12416 | |
| 48 | 289-292 | I4 | Number of bytes of suffix data per record | 0 | |
| 49-55 | 293-340 | A48 | Reserved | | |
| 56 | 341-368 | A28 | Blanks | | |
| 57-60 | 369-400 | A32 | Reserved | | |
| 61 | 401-428 | A28 | SAR Data format type identifier | UNSIGNED INTEGER*2(PRI/IMM)/ COMPLEX INTEGER*4(SLC) | |
| 62 | 429-432 | A4 | SAR Data format type code | IU2 | |
| 63 | 433-436 | I4 | Number of left fill bits within pixel | 0 | |
| 64 | 437-440 | 437-440 | Number of right fill bits within pixel | 0 | |
| 65 | 441-448 | 441-448 | Maximum data range of pixel | 65535 | |
| 66 | 449-EOR | 449-EOR | Spare | | |

Table 5-12

SAR DATA IMAGERY OPTIONS FILE, SIGNAL DATA RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|-------|--------|--|---------|-------|
| 1 | 1-4 | B4 | Record sequence number | 2 | |
| 2 | 5 | B1 | 1st record sub-type code | 50 | |
| 3 | 6 | B1 | Record sub-type code | 11 | |
| 4 | 7 | B1 | 2nd record sub-type code | 31 | |
| 5 | 8 | B1 | 3rd record sub-type code | 20 | |
| 6 | 9-12 | B4 | Length of this record | 12428 | |
| 7 | 13-14 | B2 | First sample of image line (PRI) or Real (I) component of first sample (SLC) | | |
| 8 | 15-16 | B2 | Second sample of image line (PRI) or Imaginary (Q) component of first sample (SLC) | | |
| ... | ... | ... | | | |
| N+6 | | B2 | Last sample /Last sample Q component of image line | | |

5.4 NULL VOLUME FORMAT DEFINITION

Table 5-13

NULL VOLUME DESCRIPTOR RECORD

| FIELD | BYTES | FORMAT | DESCRIPTION | EXAMPLE | UNITS |
|-------|---------|--------|--|---|-------|
| 1 | 1-4 | B4 | Record sequence number | 1 | |
| 2 | 5 | B1 | 1st record sub-type code | 192 | |
| 3 | 6 | B1 | Record sub-type code | 192 | |
| 4 | 7 | B1 | 2nd record sub-type code | 18 | |
| 5 | 8 | B1 | 3rd record sub-type code | 18 | |
| 6 | 9-12 | B4 | Length of this record | 360 | |
| 7 | 13-14 | A2 | ASCII/EBCDIC flag | A | |
| 8 | 15-16 | A2 | Blanks | | |
| 9 | 17-28 | A12 | Format control document | CCB-CCT-0002 | |
| 10 | 29-30 | A2 | Superstructure document | E | |
| 11 | 31-32 | A2 | Superstructure record format revision | A | |
| 12 | 33-44 | A12 | Logical volume generating facility software release and revision level | JERSIPF 01.03 | |
| 13 | 45-60 | A16 | ID of physical volume containing this volume descriptor | 1 | |
| 14 | 61-76 | A16 | Logical volume identifier | JERS.SAR.PRI1 or JERS.SAR.IMM1 or JERS.SAR.SLC1 | |
| 15 | 77-92 | A16 | Volume set identifier | UPC99999 | |
| 16 | 93-94 | I2 | Total number of physical volumes in the logical volume | 1 | |
| 17 | 95-96 | I2 | Physical volume sequence number of the first tape within the logical volume | 1 | |
| 18 | 97-98 | I2 | Physical volume sequence number of the last tape in the logical volume | 1 | |
| 19 | 99-100 | I2 | Physical volume sequence number of the current tape within the logical volume | 1 | |
| 20 | 101 | I4 | First referenced file number in this physical volume within the logical volume | 1 | |
| 21 | 105-108 | I4 | Logical volume within a volume set | 2 | |

| | | | | | |
|----|---------|------|--|----------|--|
| 22 | 109-112 | I4 | Logical volume number within physical volume | 2 | |
| 23 | 113-120 | A8 | Logical volume creation date (YYYYMMDD) | 20080319 | |
| 24 | 121-128 | A8 | Logical volume creation time (hhmmssdd, dd-deci-seconds) (dd not provided) | 22283000 | |
| 25 | 129-140 | A12 | Logical volume generation country(GERMANY, UK, ITALY) | ITALY | |
| 26 | 141-148 | A8 | Logical volume agency | ESA | |
| 27 | 149-160 | A12 | Logical volume generating facility | PAM | |
| 28 | 161-164 | A8 | Number of file pointer records in volume directory | 2 | |
| 29 | 165-168 | A12 | Number of records in volume directory | 4 | |
| 30 | 169-172 | I4 | Total number of logical volume set | 1 | |
| 31 | 173-260 | I4 | Volume descriptor spare segment (always blanks filled) | | |
| 32 | 261-360 | A100 | Local use segment | | |