Ref: PX-SP-50-9105
Issue/Revision: 3/1
Date: OCT. 3, 2006

Product Specification for ERS Products within ENVISAT Format

Prepared By:	Rachel Barstow	R. Barstow Oct. 3, 2006 (signature / date)
Checked By:	Andrew Kult	Andrew Kult Oct. 4, 2006
Quality Assurance:	for Dennis Ramsbottom	Oct. 5, 2006
Project Manager:	Graham Peake	Oct 5, 2006

Summary: This document gives the format specifications for ERS products that follow the ENVISAT product specifications.

MDA™
13800 Commerce Parkway
Richmond, B.C., Canada, V6V 2J3
Telephone (604) 278-3411
Fax (604) 278-2117

THIS PAGE INTENTIONALLY LEFT BLANK

CHANGE RECORD

ISSUE	DATE	PAGE(S)	DESCRIPTION	RELEASE
1/0	Feb. 13, 1998	All	SCR #2, CR #2 First Issue	SRR
2/0	Mar. 27, 1998	All	SCR #13, CR #13 Second Issue Reason for Changes: Address RIDs: SRR-2.10, Section 5 SRR-3.1, all SRR-3.2, p. 1-4 SRR-3.3, p. 3-1 SRR-3.4.1, Section 4.1.1 SRR-3.4.2, Section 4.1.1 SRR-3.4.3, Table 4-1 SRR-3.4.4, Section 4.1.1 SRR-3.4.5, Section 4.1.3 Increase level of detail throughout. Add specifications for Level 1 products.	ADR
2/1	Sept. 4, 1998	All	SCR #30, CR #30 Second Issue, First Revision Reason for Changes: Address ADR RIDs: RID 3-2, p. 3-15 to 3-17 RID 3-3, p. 4-11 RID 3-4, p. 5-1 RID 3-5, p. 5-3 RID 3-6, p. 5-6 RID 3-7, p. 5-15 RID 3-8, p. 5-22 RID 3-9, p. 5-40 RID 3-10, p. 5-48 RID 3-11, p. 5-55 RID 3-12, p. 5-55 RID 3-13, p. 5-64 RID 3-14, p. 5-67	

ISSUE	DATE	PAGE(S)	DESCRIPTION	RELEASE
			Other minor error corrections. Added description of format for Exabyte tape and CD ROM. Added example MPH. Added Appendix A.	
2/2	Jan. 29, 1999	All	SCR #44, CR #44 Second Issue, Second Revision Update in response to ESA comments contained in email of Sept. 28, 1998. Updates to agree with the ENVISAT Products Specification release 3/K. Other minor updates and corrections.	post-OSAT
2/3	Feb. 23, 2000	All	SCR # 47, CR # 47 Second Issue, Third Revision Update document to include simulated AP-mode products. In Wave Mode SPH change unit of Look Separation back to seconds from Hz.	
3/0	Oct. 31, 2001	All	Third Issue Updated document to bring it up to date with the ENVISAT ASAR product spec, Issue 3 Revision G. This including the addition of the Wave Mode Level 2 product.	Stand-Alone PF-ASAR/ERS
3/1	Oct. 03, 2006	All	Third Issue, First Revision Updated document to bring it up to date with ENVISAT Product Specification, Volume 8 ASAR, Issue 4 Revision A. Also updated for PGS-ERS.	PF-ASAR v4.03, PGS-ERS v1.05

TABLE OF CONTENTS

LIST OF FIGURES

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF TABLES

1 INTRODUCTION

1.1 Purpose of the Document

The purpose of this document is to provide the specifications for ERS SAR products within the ENVISAT format. These products are very similar in format to the ENVISAT ASAR products. They are generated by the Stand-Alone PF-ERS (also called PF-ERS) processor or the PGS-ERS processor.

This document applies when using the combined Stand-alone PF-ASAR/ERS to process ERS data only (the format of ASAR data processed by the Stand-alone PF-ASAR/ERS is described in Document R-1). Where noted, some formats and products described are only supported by either PGS-ERS or the Stand-Alone PF-ASAR/ERS.

1.2 Scope of the Document

This document contains the specifications for ERS SAR products using the ENVISAT format. It describes how the ENVISAT product formats are tailored to accommodate ERS SAR data. It focuses on the Level 0 and Level 1 ERS products which are:

- generated by the Stand-Alone PF-ASAR/ERS facility, or
- generated by the PGS-ERS facility within the ERS PDS.

The details of the product structures and contents are provided. It does not describe how the structures and contents of ERS products in other formats can be converted to those described by this document.

This document only gives enough information about ENVISAT product formats to produce and use ERS products. It is not the complete reference document for ENVISAT format products.

1.3 Definitions, Acronyms and Abbreviations

ADS	Annotated Data Set
ADSR	Annotated Data Set Record
AISP	Annotated Instrument Source Packet
AMI	Active Microwave Instrument
AP	Alternating Polarisation
ASAR	Advanced Synthetic Aperture Radar
ASCII	American Standard Code for Information Interchange
BRW	Browse
CCT	Computer-Compatible Tape
CD-ROM	Compact Disk—Read Only Memory
CEOS	Committee on Earth Observations Satellites
COTS	Commercial Off-The-Shelf
CRC	Cyclical Redundancy Check
CW	Continuous Wave
DLT	Digital Linear Tape
DS	Data Set
DSD	Data Set Descriptor
DSR	Data Set Record
ECMWF	European Center for Mid-range Weather Forecasts
EIC	Extracted Image Calibration
ERS	European Remote Sensing Satellite
ESA	European Space Agency
EWAC	Extracted Wave Mode Calibration
FBAQ	Flexible Block Adaptive Quantization
FEP	Front End Processor
GADS	Global Annotation Data Set
GEC	Geocoded Ellipsoid Corrected (product)
GM	Global Monitoring
GMT	Greenwich Mean Time
H/H	Horizontal/Horizontal

H/V	Horizontal/Vertical
Hz	Hertz
IDHT	Instrument Data Handling and Transmission
IM	Image Mode
I	In-Phase Channel
ID	Identification
IDHT	Instrument Data Handling and Transmission
IEEE	Institute of Engineering and Electronic Engineers
ISLR	Integrated Side Lobe Ratio
ISO	International Standards Organization
ISP	Instrument Source Packet
LADS	Location ADS
LUT	Look-Up Table
m	metre
MDS	Measurement Data Set
MDSR	Measurement Data Set Record
MJD	Modified Julian Date
mm	millimetre
MR	Medium Resolution
MPH	Main Product Header
MR	Medium Resolution
PCD	Product Confidence Data
PCF	Product Control File
PDS	Payload Data Segment
PF	Processing Facility
PF-ERS	Processing Facility European Remote Sensing Satellite
PF-HS	Processing Facility—Host Structure
PGS-ERS	Product Generation System-Synthetic Aperture Radar
PRI	Precision Image (product)
Q	Quadrature Channel
RMS	Root Mean Square
SAR	Synthetic Aperture Radar

SBT	Satellite Binary Time
SLC	Single-Look Complex (product)
SPECAN	Spectral Analysis
SPH	Specific Product Header
SQ	Summary Quality
SR/GR	Slant Range to Ground Range
SWST	Sampling Window Start Time
UTC	Universal Time Coordinated
V/H	Vertical/Horizontal
V/V	Vertical/Vertical
WS	Wide Swath
WSS	Wide Swath SLC
WV	Wave Mode (level 0)
WVI	Wave Mode SLC Imagette and Imagette Cross Spectra
WVS	Wave Mode Imagette Cross Spectra
WVW	Wave Mode Imagette Ocean Wave Spectra

1.4 Applicable and Reference Documents

1.4.1 Applicable Documents

A-1	ES-SOW-RS-PM-HL10	Statement of Work for the Procurement of a Pre-Processing Reference Chain for ESA SAR Missions. Issue 1.1.

1.4.2 Reference Documents

R-1	PO-RS-MDA-GS-2009	ENVISAT-1 Product Specifications. Volume 8, Issue 4, Revision A.
R-2	ER-IS-DSF-SY-0010	Satellite to Ground Segment Interface Specification. Issue 8.
R-3	ER-IS-MDA-GS-0010	ERS-1 Kiruna Station User Interface Specifications. Issue 7/0.

R-4 PH-MA-65-7393 (MDA internal number) Transcribed Data Format on DLT. Version 1.0.

R-5 ER-IS-EPO-GS-5902 ERS-2 SAR Products Computer- Compatible Tape Format Specifications. Issue 2.1. (contains the ERS CEOS Spec.)

1.5 Audience

This document is intended to provide information to the European Space Agency (ESA) and MacDonald Dettwiler engineering staff for design and implementation purposes. It is also intended for users of ERS output products.

1.6 Document Overview

This document is comprised of the following sections:

- **Section 1, Introduction:** provides the purpose and scope of the document, the list of applicable and reference documents, the intended audience of the document, and an overview of the document.
- **Section 2, Product Terms and Definitions:** provides a description of the various ERS products.
- **Section 3, Product Structure:** describes the product structures.
- **Section 4, Level 0 Product Specifications:** provides the specifications for Level 0 ERS products.
- **Section 5, Level 1 Product Specifications:** provides the specifications for Level 1 ERS products.
- **Appendix A, Product Data Conventions:** describes the Product Data Conventions.

THIS PAGE INTENTIONALLY LEFT BLANK

2 PRODUCT TERMS AND DEFINITIONS

The types of standard products generated by PGS-ERS and the Stand-Alone PF-ERS for ERS data are given in Table 2-1.

Table 2-1 ERS Product Types

Product Name	Description	Product ID	Produced by
IM Level 0	Image mode level 0	SAR_IM__0P	Stand-Alone PF-ERS and PGS-ERS
SLC / IMS	Image mode single-look complex image	SAR_IMS_1P	Stand-Alone PF-ERS and PGS-ERS
PRI / IMP	Image mode precision image	SAR_IMP_1P	Stand-Alone PF-ERS and PGS-ERS
GEC / IMG	Image mode geocoded image	SAR_IMG_1P	Stand-Alone PF-ERS and PGS-ERS
MR / IMM	Image mode medium resolution image (stripline)	SAR_IMM_1P	Stand-Alone PF-ERS and PGS-ERS
BRW / IMB	Image mode browse image (stripline)	SAR_IM__BP	Stand-Alone PF-ERS and PGS-ERS
APS	Simulated alternating polarisation single-look complex image	SAR_APS_1P	Stand-Alone PF-ERS only
APP	Simulated alternating polarisation precision image	SAR_APP_1P	Stand-Alone PF-ERS only
APG	Simulated alternating polarisation geocoded image	SAR_APG_1P	Stand-Alone PF-ERS only
APM	Simulated alternating polarisation medium resolution image (stripline)	SAR_APM_1P	Stand-Alone PF-ERS only

Product Name	Description	Product ID	Produced by
APB	Simulated alternating polarisation browse image (stripline)	SAR_AP__BP	Stand-Alone PF-ERS only
WV Level 0	Wave mode level 0	SAR_WV__0P	Stand-Alone PF-ERS and PGS-ERS
WVI	Wave mode SLC imagette and imagette cross spectra	SAR_WVI_1P	Stand-Alone PF-ASAR/ERS and PGS-ERS
WVS	Wave mode imagette cross spectra	SAR_WVS_1P	Stand-Alone PF-ASAR/ERS and PGS-ERS
WVW	Wave mode imagette ocean wave spectra	SAR_WVW_2P	Stand-Alone PF-ASAR/ERS and PGS-ERS

All of the products above, with the exception of Image mode and Wave mode Level 0 products and the Wave mode WVW product (which is Level 2), belong to the Level 1 product class. See the ENVISAT Product Specifications (Document R-1) for a description of product classes.

Image Mode products are also known as high-rate products whereas Wave Mode products are also known as low-rate products.

Simulated Alternating Polarisation (AP) mode products are products generated by the Stand-Alone PF-ERS from ERS image mode data using the same algorithms as are used for ASAR AP Mode. The ERS image mode data is processed as if it consisted of bursts from different polarisations. Since ERS only has one polarisation the output products contain multiple images but they are both from the same polarisation (V/V). The products follow the same format as the ASAR AP mode products.

ASAR Wide Swath (WS) and Global Monitoring (GM) mode products may be referenced in the product descriptions, but are not applicable to ERS.

3 PRODUCT STRUCTURE

3.1 General Product Structure

All products following the ENVISAT format follow the same basic structure. This structure consists of the following parts:

1. The Main Product Header (MPH). The MPH is in ASCII format and contains information which is common to all products.
2. A Specific Product Header (SPH). The SPH is in ASCII format and contains information which describes the specific product as a whole. It will vary between different products. The SPH also contains Data Set Descriptors (DSDs), which are used to point to and describe the various Data Sets which make up a product.
3. One or more Data Sets (DSs). Data Sets are in mixed-binary format and each consist of one or more Data Set Records (DSRs).

A diagram of the ENVISAT Product structure is shown in Figure 3-1. More background information on the generalized product structures is given in the ENVISAT Product Specifications (Document R-1). The sections that follow detail how the general ENVISAT product structures are tailored for ERS products.

ERS specific deviations from the ENVISAT Product Specifications are marked by an asterisk in the right-hand margin of the product structure tables.

3.1.1 ASCII and Binary Structures

The following convention has been defined for ENVISAT format products:

- MPH and SPH (including DSDs) headers are produced in ASCII format using a keyword-value-terminator approach. The purpose of this method is to create header structures that are self-documenting, understandable, and easily readable by the user.
- Data Sets which follow the MPH and SPH are in mixed ascii-binary format. The purpose of using this format is to reduce the size of the detailed data contained in the data sets. Note that ASCII strings may occur in the Data Sets, but they are not surrounded by quotation marks as in the MPH and SPH structures.

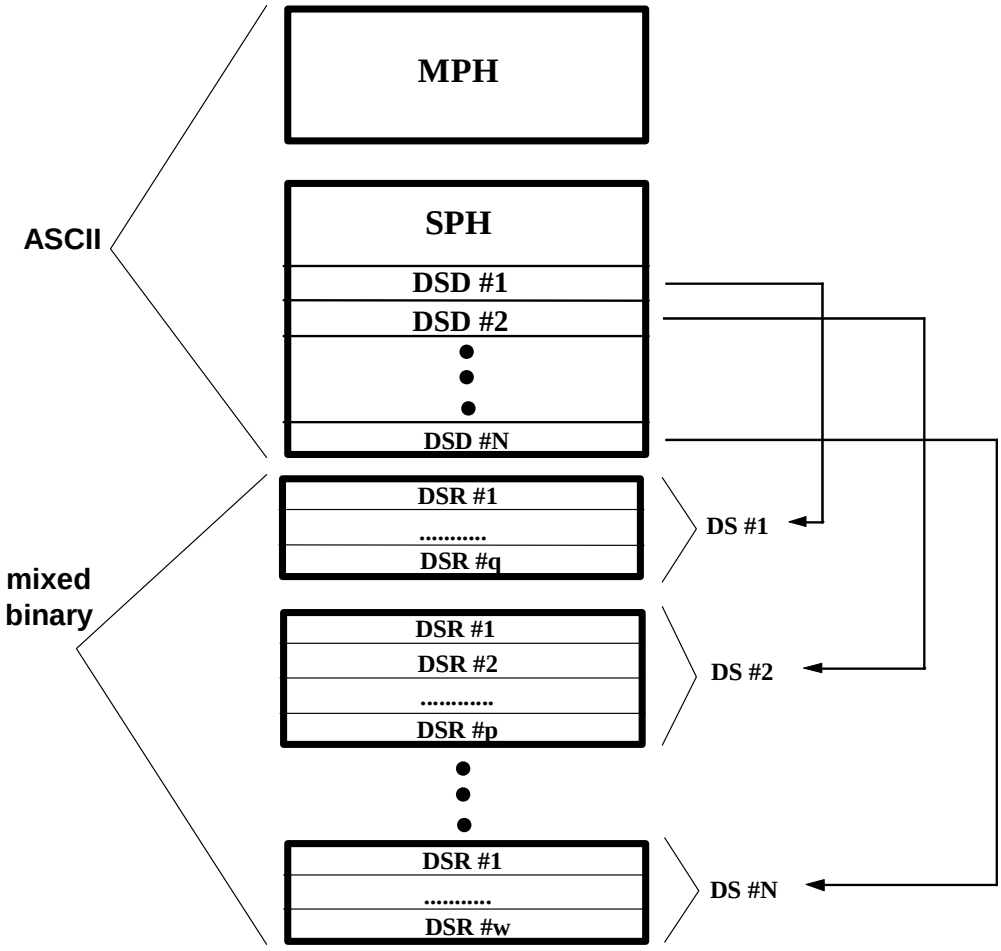

Figure 3-1 Generalized Product Structure

3.2 Main Product Header

The Main Product Header (MPH) identifies the product and its main characteristics. The Main Product Header is an ASCII structure containing information needed for all ENVISAT sensors. It is of fixed length and format for all products. The fields of the MPH are presented in Table 3-1.

ERS specific deviations from the ENVISAT Product Specifications are marked by an asterisk in the right-hand margin.

Table 3-1 Main Product Header

Fld.	Contents	Units	Byte length	Data Type	
	Product Identification Information				
1	**PRODUCT=**	keyword	8	8*uc	
	quotation mark (“)		1	uc	
	Product File name (Note 1)		62		
	The following fields describe the product naming convention for products. For Auxiliary data files these fields will be different.				
	10 character Product ID (including underscoring)	-	10	10*uc	*
	See Section 2 for the product IDs used for ERS				
	Processing stage flag (see field 2 below)	-	1	uc	
	Originator ID	-	3	3*uc	*
	For ERS this is based on the ORIGINATOR_ID field in the PRM_Site.dat file.				
	start_day (YYYYMMDD UTC of first MDSR, or file creation date for auxiliary files)	-	8	8*uc	
	underscore character	-	1	uc	
	start_time (HHMMSS UTC of first MDSR, or file creation time for auxiliary files)	-	6	6*uc	
	underscore character	-	1	uc	
	duration (seconds of product coverage, or 00000000 if not relevant)	sec.	8	8*uc	
	phase identifier	-	1	uc	
	cycle number within the phase	-	3	3*uc	
	underscore character	-	1	uc	
	relative orbit # within the cycle (at start of product)	-	5	5*uc	
	underscore character	-	1	uc	
	absolute orbit # (at start of product)	-	5	5*uc	
	underscore character	-	1	uc	
	product type file counter (0000 to 9999, then wraps to 0000)	-	4	4*uc	

Fld.	Contents	Units	Byte length	Data Type	
	period	-	1	uc	
	satellite ID (ENVISAT-1=N1, E1 = ERS1, E2 =ERS2)	-	2	2*uc	
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
2	**PROC_STAGE=**	keyword	11	11*uc	
	Processing Stage Flag N = Near Real Time, T = test product, V= fully validated (fully consolidated) product, S = special product. Letters between N and V (with the exception of T and S) indicate steps in the consolidation process, with letters closer to V meaning higher levels of consolidation. If not used, set to X. For ERS this is set to X.	-	1	uc	*
	newline character	terminator	1	uc	
3	**REF_DOC=**	keyword	8	8*uc	
	quotation mark (“)	-	1	uc	
	Reference Document Describing Product AA-BB-CCC-DD-EEEE_VO_IR (23 characters, including blank space characters) where AA-BB-CCC-DD-EEEE is the ESA standard document no, VO is the Volume, and IR is the Issue/Revision. If not used, set to ØØØØØØØØØØØØØØØØØØØØØØØ For ERS this is set to PX-SP-50-9105_I/RØØØØØØ (this document)	-	23	23*uc	*
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
4	**Spare (blank characters (Ø))**	-	40	40*uc	
	newline character	terminator	1	uc	
	Information with regard to Data Acquisition and Processing				
5	**ACQUISITION_STATION=**	keyword	20	20*uc	
	quotation mark (“)	-	1	uc	
	Acquisition Station ID For the Stand-Alone PF-ASAR/ERS, this field is filled with the value from line 25 of the Product Control File (PCF). For PGS-ERS, this field is filled with the POH order <AcquisitionStationName> field, or in batch mode the value is extracted from the WILMA or EWAC data headers.	-	20	20*uc	*
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	

Fld.	Contents	Units	Byte length	Data Type	
6	**PROC_CENTER=**	keyword	12	12*uc	
	quotation mark (“)	-	1	uc	
	Processing Center ID which generated current product For ERS this is set based on the PROCESSING_CENTER field in the PRM_Site.dat file.	-	6	6*uc	*
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
7	**PROC_TIME=**	keyword	10	10*uc	
	quotation mark (“)	-	1	uc	
	UTC Time of Processing (product generation time) UTC Time format. If not used, set to ØØØØØØØØØØØØØØØØØØØØØØØØØØØØ.	UTC	27	27*uc	
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
8	**SOFTWARE_VER=**	keyword	13	13*uc	
	quotation mark (“)	-	1	uc	
	Software Version number of processing software Format: Name of processor (up to 10 characters)/ version number (4 characters) -- left justified (any blanks added at end). If not used, set to ØØØØØØØØØØØØØØ. For ERS this is set to ASAR/V.VVPXXØØ for PGS-ERS, or ASAR/V.VVSXXØØ for the Stand-Alone PF-ASAR/ERS. e.g. ASAR/1.00P00ØØ	-	14	14*uc	*
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
9	**Spare (blank characters (Ø))**	-	40	40*uc	
	newline character	terminator	1	uc	
	Information on Time of Data				
10	**SENSING_START=**	keyword	14	14*uc	
	quotation mark (“)	-	1	uc	
	UTC start time of data sensing (Note 2) (first measurement in first data record) UTC Time format. If not used, set to ØØØØØØØØØØØØØØØØØØØØØØØØØØØØ.	UTC	27	27*uc	
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	

Fld.	Contents	Units	Byte length	Data Type
11	**SENSING_STOP=**	keyword	13	13*uc
	quotation mark (“)	-	1	uc
	UTC stop time of data sensing (Note 2) (last measurements last data record) UTC Time format. If not used, set to ØØØØØØØØØØØØØØØØØØØØØØØØØØØØ.	UTC	27	27*uc
	quotation mark (“)	-	1	uc
	newline character	terminator	1	uc
12	**Spare (blank characters (Ø))**	-	40	40*uc
	newline character	terminator	1	uc
	Information on Envisat Orbit and Position			
13	**PHASE=**	keyword	6	6*uc
	Phase phase letter. If not used, set to X.	-	1	uc
	newline character	terminator	1	uc
14	**CYCLE=**	keyword	6	6*uc
	Cycle Cycle number. If not used, set to +000.	-	4	Ac
	newline character	terminator	1	uc
15	**REL_ORBIT=**	keyword	10	10*uc
	Start relative orbit number (Note 3). If not used, set to +00000	-	6	As
	newline character	terminator	1	uc
16	**ABS_ORBIT=**	keyword	10	10*uc
	Start absolute orbit number (Note 3). If not used, set to +00000.	-	6	As
	newline character	terminator	1	uc
17	**STATE_VECTOR_TIME=**	keyword	18	18*uc
	quotation mark (“)	-	1	uc
	UTC of ENVISAT state vector UTC time format. If not used, set to ØØØØØØØØØØØØØØØØØØØØØØØØØØØØ.	UTC	27	27*uc
	quotation mark (“)	-	1	uc
	newline character	terminator	1	uc

Fld.	Contents	Units	Byte length	Data Type
18	**DELTA_UT1=**	keyword	10	10*uc
	DUT1=UT1-UTC If not used, set to +.000000.	s	8	Ado06
	<s>	units	3	3*uc
	newline character	terminator	1	uc
19	**X_POSITION=**	keyword	11	11*uc
	X Position in Earth-Fixed reference If not used, set to +0000000.000.	m	12	Ado73
	<m>	units	3	3*uc
	newline character	terminator	1	uc
20	**Y_POSITION=**	keyword	11	11*uc
	Y Position in Earth-Fixed reference If not used, set to +0000000.000.	m	12	Ado73
	<m>	units	3	3*uc
	newline character	terminator	1	uc
21	**Z_POSITION=**	keyword	11	11*uc
	Z Position in Earth-Fixed reference If not used, set to +0000000.000.	m	12	Ado73
	<m>	units	3	3*uc
	newline character	terminator	1	uc
22	**X_VELOCITY=**	keyword	11	11*uc
	X velocity in Earth fixed reference If not used, set to +0000.000000.	m/s	12	Ado46
	<m/s>	units	5	5*uc
	newline character	terminator	1	uc
23	**Y_VELOCITY=**	keyword	11	11*uc
	Y velocity in Earth fixed reference If not used, set to +0000.000000.	m/s	12	Ado46
	<m/s>	units	5	5*uc
	newline character	terminator	1	uc
24	**Z_VELOCITY=**	keyword	11	11*uc
	Z velocity in Earth fixed reference If not used, set to +0000.000000.	m/s	12	Ado46
	<m/s>	units	5	5*uc
	newline character	terminator	1	uc

Fld.	Contents	Units	Byte length	Data Type	
25	**VECTOR_SOURCE=**	keyword	14	14*uc	
	quotation mark (“)	-	1	uc	
	Source of Orbit Vectors PF-ERS uses: PD = predicted (ascending node) RS = restituted PL = preliminary PC = precise This is filled in based on the value on line 14 of the PCF supplied to PF-ERS, or based on the type of orbit state vector provided for PGS-ERS.	-	2	2*uc	*
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
26	**Spare (blank characters (Ø))**	-	40	40*uc	
	newline character	terminator	1	uc	
	SBT to UTC Conversion Information				
27	**UTC_SBT_TIME=**	keyword	13	13*uc	
	quotation mark (“)	-	1	uc	
	UTC time corresponding to SBT below If not used, set to ØØØØØØØØØØØØØØØØØØØØØØØØØØØØ.	UTC	27	27*uc	
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
28	**SAT_BINARY_TIME=**	keyword	16	16*uc	
	Satellite Binary Time (SBT) 32bit integer time of satellite clock. If not used, set to +0000000000. (This value is unsigned, i.e., to be interpreted)	-	11	Al	
	newline character	terminator	1	uc	
29	**CLOCK_STEP=**	keyword	11	11*uc	
	Clock Step Size clock step in picoseconds. If not used, set to +0000000000. (This value is unsigned, i.e., to be interpreted)	psec.	11	Al	
	<ps>	units	4	4*uc	
	newline character	terminator	1	uc	
30	**Spare (blank characters (Ø))**	-	32	32*uc	
	newline character	terminator	1	uc	

Fld.	Contents	Units	Byte length	Data Type	
	Leap Second Information				
31	**LEAP_UTC=**	keyword	9	9*uc	
	quotation mark (“)	-	1	uc	
	UTC time of the occurrence of the Leap Second For ERS this is set to ØØØØØØØØØØØØØØØØØØØØØØØØØØØØ since it is not used.	UTC	27	27*uc	*
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
32	**LEAP_SIGN=**	keyword	10	10*uc	
	Leap second sign (+001 if positive Leap Second, -001 if negative) For ERS this is set to +000 since it is not used.	s	4	Ac	*
	newline character	terminator	1	uc	
33	**LEAP_ERR=**	keyword	9	9*uc	
	Leap second error if leap second occurs within processing segment = 1, otherwise = 0 For ERS this is set to 0 since it is not used.	-	1	uc	*
	newline character	terminator	1	uc	
34	**Spare (blank characters (Ø))**	-	40	40*uc	
	newline character	terminator	1	uc	
	Product Confidence Data Information				
35	**PRODUCT_ERR=**	keyword	12	12*uc	
	1 or 0. If 1, errors have been reported in the product. User should then refer to the SPH or Summary Quality ADS of the product for details of the error condition. If not used, set to 0.		1	uc	
	newline character	terminator	1	uc	
	Product Size Information				
36	**TOT_SIZE=**	keyword	9	9*uc	
	Total Size Of Product	bytes	21	Ad	
	<bytes>	units	7	7*uc	
	newline character	terminator	1	uc	
37	**SPH_SIZE=**	keyword	9	9*uc	
	Length Of SPH (# bytes in SPH)	bytes	11	Al	
	<bytes>	units	7	7*uc	
	newline character	terminator	1	uc	

Fld.	Contents	Units	Byte length	Data Type
38	**NUM_DSD=**	keyword	8	8*uc
	Number of DSDs This number includes the Spare DSDs and all other types of DSDs.	-	11	Al
	newline character	terminator	1	uc
39	**DSD_SIZE=**	keyword	9	9*uc
	Length of Each DSD (# bytes for each DSD, all DSDs shall have the same length)	-	11	Al
	<bytes>	units	7	7*uc
	newline character	terminator	1	uc
40	**NUM_DATA_SETS=**	keyword	14	14*uc
	Number of DSs attached (not all DSDs have a DS attached)	-	11	Al
	newline character	terminator	1	uc
41	**Spare (blank characters (Ø))**	-	40	40*uc
	newline character	terminator	1	uc
TOTAL		**-**	**1247**	

MPH Notes:

1. The product identifier is a unique string which may be used as a file name when storing a product. The format is presented in detail in the section on product identification scheme in Annex A. The duration of a product is frequently not an integer number of seconds. When it is not, the duration field of the product file name shall be reported as the nearest whole integer (e.g. 4.6 seconds duration is reported as 00000005 in the product file name. For Auxiliary Data files, the filename will follow the format described in Volume 16 of the ENVISAT Products Specifications (Document R-1).
2. This is the start time and stop time in UTC format when the data sensing occurred on board the satellite, as calculated from the Satellite Binary Time counter for the first and last MDSR in the Level 0 product.
3. The satellite orbit number is specified in two ways: absolute number and relative to a specific orbit cycle. The orbit numbers given are those current at the Sensing Start Time of the product.

An example of an MPH is shown in Figure 3-2.

```
PRODUCT="SAR_IMP_1PTPDE19951221_103430_00000015A000_00000_00001_0005.E1"
PROC_STAGE=X
REF_DOC="PX-SP-50-9105_3/1 "

ACQUISITION_STATION="KS                    "
PROC_CENTER="ESRIN "
PROC_TIME="25-AUG-1998 13:37:31.000000"
SOFTWARE_VER="ASAR/4.03P00  "

SENSING_START="21-DEC-1995 10:34:29.993407"
SENSING_STOP="21-DEC-1995 10:34:45.989531"

PHASE=A
CYCLE=+000
REL_ORBIT=+00000
ABS_ORBIT=+00001
STATE_VECTOR_TIME="21-DEC-1995 09:59:30.353000"
DELTA_UT1=+.000000<s>
X_POSITION=-7101146.000<m>
Y_POSITION=-0956396.312<m>
Z_POSITION=-0000004.190<m>
X_VELOCITY=-0209.243973<m/s>
Y_VELOCITY=+1617.445435<m/s>
Z_VELOCITY=+7377.420898<m/s>
VECTOR_SOURCE="PD"

UTC_SBT_TIME="21-DEC-1995 16:58:46.470000"
SAT_BINARY_TIME=+1448758094
CLOCK_STEP=+3906250000<ps>

LEAP_UTC="                              "
LEAP_SIGN=+000
LEAP_ERR=0

PRODUCT_ERR=1
TOT_SIZE=+00000000000132656529<bytes>
SPH_SIZE=+0000006099<bytes>
NUM_DSD=+0000000018
DSD_SIZE=+0000000280<bytes>
NUM_DATA_SETS=+0000000008
```

Figure 3-2 Example MPH

3.3 Specific Product Header

The Specific Product Header is included with every product. It contains information specific to the product itself. This information may include PCD information applying to the whole product, and/or relevant processing parameters. At a minimum, each SPH includes an SPH descriptor, and at least one DSD.

The SPH follows an ASCII keyword-value<units>-terminator format identical to that of the MPH. The detailed SPH structure and contents are given in the sections where each specific product is described.

3.4 Data Set Descriptors

The Data Set Descriptor (DSD) are used to describe an attached Data Set or to provide references to external files relevant to the current product (e.g., auxiliary data used in processing but not included with the product). There must be one DSD per Data Set or per reference to an external file. The DS may be a Measurement Data Set (MDS), an Annotation Data Set (ADS) or a Global Annotation Data Set (GADS).

3.4.1 Contents

All DSDs have the same format. The Data Set Descriptor is contained within the SPH as shown in Figure 3-1. As such, the DSD is also in ASCII format. The DSD contains information specific to a given Data Set within the product. The general contents of a DSD are shown in Table 3-2.

3.4.2 Format

The structure of the DSDs will be the same for all products and all instruments. The ASCII format conventions are the same as those used for the MPH and SPH. This structure is referred to as "dsd" throughout this document. The general format is shown in Table 3-2.

Table 3-2 General DSD Format

Field #	Description	Units	Byte length	Data Type
1	**DS_NAME=**	keyword	8	8*uc
	quotation mark (")	-	1	uc
	Data Set Name Name describing the data set. Characters not used are blanked.	-	28	28*uc
	quotation mark (")	-	1	uc
	newline character	terminator	1	uc
2	**DS_TYPE=**	keyword	8	8*uc
	DS Type = M if a Measurement DS is attached. = A if an Annotation DS is attached = G if a Global ADS is attached = R if no DS is attached (reference DSD only)	-	1	uc
	newline character	terminator	1	uc

Field #	Description	Units	Byte length	Data Type
3	**FILENAME=**	keyword	9	9*uc
	quotation mark (“)	-	1	uc
	External Product Reference If the DS Attachment flag was set to R this field contains the name of the referenced product using the standard naming convention (as defined in Document R-1, Annex A or Volume 16 for auxiliary data) of the MPH. If the DS Attachment Flag was set to A, M, or G, this field may contain the name of the file from which the Data Set was copied, or it may be blank (set to ascii blank space characters). For a product which was supposed to contain a data set or reference to one, but the file was unavailable, the first 7 characters of this field may be set to MISSING and the rest blanked. If space for a DSD has been set aside in the SPH, but the DSD is not used in the current product, this field may be set to NOT USED.	-	62	62*uc
	quotation mark (“)	-	1	uc
	newline character	terminator	1	uc
4	**DS_OFFSET=**	keyword	10	10*uc
	DS Offset in bytes Gives the position of the first byte of the corresponding DS with respect to the whole product. Set to 0 if no DS is attached.	bytes	21	Ad
	<bytes>	units	7	7*uc
	newline character	terminator	1	uc
5	**DS_SIZE=**	keyword	8	8*uc
	Total Size of DS in bytes Length in bytes of the Data Set. Set to zero if no DS is attached.	bytes	21	Ad
	<bytes>	units	7	7*uc
	newline character	terminator	1	uc
6	**NUM_DSR=**	keyword	8	8*uc
	Number of DSRs within the DS Number of Data Set Records within the DS, set to zero if no DS is attached.	-	11	Al
	newline character	terminator	1	uc
7	**DSR_SIZE=**	keyword	9	9*uc
	Length of the DSRs in bytes Length of each DSR if DSR length is constant within the Data Set. 0 = no DSRs attached (i.e. no DS attached) -1 = DSR length is variable.	bytes	11	Al
	<bytes>	units	7	7*uc
	newline character	terminator	1	uc

Field #	Description	Units	Byte length	Data Type
8	**Spare (blanks)**	ascii	32	32*uc
	newline character	terminator	1	uc
	TOTAL		280	

3.4.3 Example DSDs

All DSDs must be the same size. In order to clarify the use of DSDs within the product structure, the 5 possible DSD contents are shown explicitly below. All DSDs should fall into one of the following categories. Note that the symbol Ø is used to denote the ASCII blank space character (ASCII character 32). Values given in the following examples are for illustrative purposes only and may not correspond to the true values.

3.4.3.1 DSD Pointing to a Data Set

If the DSD points to a Data Set actually contained within the current product, the contents of the DSD will follow the example given below. The example given below assumes that the ERS SR/GR ADS is being described, however the same format would be used for any other ADS, MDS or GADS.

DS_NAME="SR/GRØADSØØØØØØØØØØØØØØØØØØØØØØØ"
DS_TYPE=A
FILENAME="ØØ
ØØØØØØØØØØØØØØØØØØØØØØØØØØØ"
DS_OFFSET=+00000000000000012345<bytes>
DS_SIZE=+00000000000000006788<bytes>
NUM_DSR=+0000000002
DSR_SIZE=+0000003394<bytes>
ØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØ

3.4.3.2 DSD Referencing a File

If the DSD is referencing a file external to the current product, the contents of the DSD will follow the example given below. The example below assumes that the ASAR/ERS Processor Configuration file is being referenced; however, the same format would be used with any other file.

DS_NAME="ASARØProcessorØConfig.ØFileØ"
DS_TYPE=R
FILENAME="ERI_CON_AXVPDK19990324_150411_19990325_123000_20001231 _101413Ø"
DS_OFFSET=+00000000000000000000<bytes>
DS_SIZE=+00000000000000000000<bytes>

```
NUM_DSR=+0000000000
DSR_SIZE=+0000000000<bytes>
ØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØ
```

3.4.3.3 DSD Not Used

In some cases, space may be allocated to a DSD in an SPH, but the DSD is not used during normal processing of the current product either due to the nature of the product or due to operator selected options during product processing. For example, room may be allocated for an ADS, but the ADS is not included normally in the current product. In such cases, the DS_NAME and DS_TYPE fields are filled as they normally would be, but the FILENAME entry is set to NOT USED as shown in the example below. The remaining fields are set to values of zero.

The example below is for the ERS SR/GR ADS and assumes that we are describing an ERS Single Look Complex product. This ADS is not included in the ERS SLC products, however, space for it is included in the ERS Image Products SPH. Therefore, this is a good example of a DSD which is not used for a certain product. In this case, the DSD would have the following format:

```
DS_NAME="SR/GRØADSØØØØØØØØØØØØØØØØØØØ"
DS_TYPE=A
FILENAME="NOTØUSEDØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØ
ØØØØØØØØØØØØØØØØØØØØØØ"
DS_OFFSET=+00000000000000000000<bytes>
DS_SIZE=+00000000000000000000<bytes>
NUM_DSR=+0000000000
DSR_SIZE=+0000000000<bytes>
ØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØ
```

3.4.3.4 Spare DSD

A spare DSD is simply 279 blank space characters (Ø) followed by a newline character. This structure is referred to as "dsd_sp" throughout this document

3.4.3.5 DSD for a Missing Data Set or File

If a Data Set was *supposed* to be included in the product or an external file was *supposed* to be referenced, but for some reason was not, the DSD indicates this by setting the FILENAME field to MISSING. Note that this is different from the NOT USED DSD. The MISSING DSD indicates that something unexpected has happened, and a reference or Data Set that was supposed to be included has not been. In contrast, the NOT USED DSD indicates that a file or Data Set is simply not used for this product - nothing unexpected has happened.

Note that for most products, if an auxiliary file could not be read or a Data Set produced then the entire product will not be produced. Thus the MISSING DSD will only be used in special situations which warrant its use.

The example below assumes the ERS Chirp Parameter ADS was supposed to be in the product, but was not produced for some reason. The following DSD would thus be produced:

```
DS_NAME="CHIRPØPARAMSØADSØØØØØØØØØØØØ"
DS_TYPE=A
FILENAME="MISSINGØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØ
ØØØØØØØØØØØØØØØØØØØØØØØ"
DS_OFFSET=+00000000000000000000<bytes>
DS_SIZE=+00000000000000000000<bytes>
NUM_DSR=+0000000000
DSR_SIZE=+0000000000<bytes>
ØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØ
```

3.5 The Data Set

The Data Set contains the actual data of interest. It is composed of Data Set Records (DSRs). The number of Data Sets within a product depends on the product type, and the size of Data Sets within a product may vary. Two types of Data Sets have been defined: Measurement Data Sets (MDS) consisting of MDSRs containing instrument/processed data, and Annotation Data Sets (ADS) which consist of ADSRs containing auxiliary data. In addition, ADSs may exist in two forms. The basic ADS contains time stamped ADSRs, which can be used to relate the information to the correspondingly time stamped MDSRs. Global Annotation Data Sets (GADS), however, contain information which pertains to the full product and thus each GADSR may not be time stamped.

3.6 Physical Delivery Medium

This section describes the format of the products when they are stored on a physical delivery medium (for the Stand-Alone PF-ERS only). Two media types are covered: Exabyte (8 mm) tape and CD ROM.

3.7 Exabyte Tape

ENVISAT format products are written to tape using the UNIX (AIX) tar command. A single product file cannot be split between tapes. Each tape contains at least a tape header file, a directory file and a collection of product files as shown in the table below.

Table 3-3 ENVISAT Product Format on Tape

Tar file	File	File Contents
Header Tape Archive (TAR)	LABEL Tape Label File (ASCII)	ASCII String <CR> (see Section)
	DIRECTORY Tape Directory File (ASCII)	Contains multiple lines with the following format: Filename,tar_file_number For example: LABEL,1 <CR> DIRECTORY,1 <CR> other_file_name,1 Name of 1st Product File (62 characters) comma tar file number (starting at 2) <CR> ...
	Other files	E.g. a script to read files from the tape
EOF		
Product Tape Archive (TAR)	One or more ENVISAT format product files of the same kind.	
EOF		
...	...	
EOF		
Utilities Tape Archive (TAR) (optional)	Utilities necessary to read the products on the tape.	
EOF		

Each group of files is written to tape using the Unix tar command.

3.7.1 CD ROM

ENVISAT formatted CD-ROMs have a directory structure composed of several levels.

- The first level gives the instrument identification (e.g., /SAR for ERS-1 and 2, /ASA for ASAR)
- The second level gives the mode or product type (e.g., /SAR/WV for ERS-1 and 2 wave)
- The third level gives the product level (e.g., /SAR/WV/0P, /SAR/WV/1P, etc.)

  The product files, with their full filenames, will exist under this level.

Many instruments / product types / levels can be merged onto the same CD-ROM, but with a global size limited to 640 MB.

At the top level (at the same level as the instrument directories) there are also LABEL and DIRECTORY ASCII files. These files have the same format as the corresponding files on Exabyte tape (see Section 3.7.2 for the LABEL file) except that the DIRECTORY file only contains the complete pathnames for all the products on the CD-ROM.

If utilities are needed for the products, they are available on a special top level directory called '/utilities'.

The CD-ROM writer COTS tool must use the ISO 9600 standard with the Rockridge extension so that long filenames will be recognized when moving between operating systems. Note that an automatic translation table is generated by the tool on each CD directory, giving an ASCII correspondence between source long names (e.g., product filenames with 62 characters) and derived unique short names (8.3 characters for ISO 9660 compatibility). The translation table allows a user to map the automatically generated short filenames to the long product filenames even if the user only has an OS compatible with ISO 9660 (DOS, Windows, MAC).

An example of the directory structure of a CD-ROM produced by PF-ERS is shown below:

Root directory: \ LABEL
\DIRECTORY
\SAR\IMG\1P\PRODUCT_NAME
\SAR\IM_\BP\PRODUCT_NAME
\SAR\IMS\1P\PRODUCT_NAME

Note that "PRODUCT_NAME" is named according to the ENVISAT product naming convention. The contents of the DIRECTORY file is as follows:

./LABEL<CR>
./DIRECTORY<CR>
./SAR/IMG/1P/PRODUCT_NAME<CR>
./SAR/IM_/1P/PRODUCT_NAME<CR>
./SAR/IMS/1P/PRODUCT_NAME<CR>

3.7.2 LABEL File

The ENVISAT LABEL file written on the tape and the CD-ROM is made up of four fields and its contents originate in the ARF instruction used to generate the products:

*The ORIGIN_CENTRE (where the user made his request)

*The MPID (User Identification)

*The AAC_ID (A number to identify the order)

*The number of CD

An example is:

PHDS-E_USFM_0000101_01

where

ORIGIN_CENTRE:”PHDS-E”

MPID=”USFM’

AAC_ID=”0000101”

And it is the first CD

PF-ERS fills the LABEL file with:

ESRIN_XXXX_0000001_01

where

ORIGIN_CENTER: “ESRIN”

MPID=”XXXX”

AAC_ID=Order Number (the last 7 characters of the order number from line 1 of the PCF)

the CD number is always 1

THIS PAGE INTENTIONALLY LEFT BLANK

4 LEVEL 0 ERS PRODUCTS SPECIFICATION

4.1 Level 0 Format

A summary of the general structure of the Level 0 ERS product is shown in Table 4-1.

Table 4-1 Level 0 Product Structure

Main Product Header (see Table 3-1)
Specific Product Header (see Table 4-2) Data Set Descriptor for MDS (see Section 3.4) Data Set Descriptor for ADS (for low-rate products only) (see Section 3.4) Data Set Descriptor for Level 0 Processor Configuration file (see Section 3.4) Data Set Descriptor for Orbit State Vectors File (see Section 3.4) Data Set Descriptor – Spare
Measurement Data Set
MDSR #1 (see Table 4-5)
...
Last MDSR (see Table 4-5)
Annotation Data Set (for low-rate products only)

As shown, each Level 0 ERS product consists of an MPH, an SPH, and an MDS. In the case of low-rate (wave) products, an ADS is added.

4.1.1 Level 0 SPH Format

A standard SPH format has been defined for all ENVISAT Level 0 data. The format follows the same ASCII format conventions of the MPH. The Level 0 SPH used for ERS products is described in Table 4-2. This format is identical to the normal ENVISAT one with the addition of a DSD for the low-rate ADS.

ERS specific deviations from the ENVISAT Product Specification are marked by an asterisk in the right-hand margin.

Table 4-2 Level 0 SPH

Field #	Description	units	Byte length	Data Type	Dim.	
1	**SPH_DESCRIPTOR=**	keyword	15	uc	15	
	quotation mark (“)	-	1	uc	1	
	SPH Descriptor ASCII string describing the product. (e.g. ASARØImageØModeØLevelØ0ØØØØØ) If needed, blanks are located to the right of the last character in the text string. For ERS data this is set to: ERSØImageØModeØLevelØ0ØØØØØØØor ERSØWaveØModeØLevelØ0ØØØØØØØØ	-	28	uc	28	*
	quotation mark (“)	-	1	uc	1	
	newline character	terminator	1	uc	1	
	Product Location Information					
2	**START_LAT=**	keyword	10	uc	10	
	WGS84 latitude of first satellite nadir point at the Sensing Start time of the MPH (positive north)	10-6 degrees	11	Al	1	
	<10-6degN>	units	10	uc	10	
	newline character	terminator	1	uc	1	
3	**START_LONG=**	keyword	11	uc	11	
	WGS84 longitude of first satellite nadir point at the Sensing Start time of the MPH (positive East, 0 = Greenwich)	10-6 degrees	11	Al	1	
	<10-6degE>	units	10	uc	10	
	newline character	terminator	1	uc	1	
4	**STOP_LAT=**	keyword	9	uc	9	
	WGS84 latitude of first satellite nadir point at the Sensing Stop time of the MPH (positive north)	10-6 degrees	11	Al	1	
	<10-6degN>	units	10	uc	10	
	newline character	terminator	1	uc	1	

Field #	Description	units	Byte length	Data Type	Dim.	
5	**STOP_LONG=**	keyword	10	uc	10	
	WGS84 longitude of first satellite nadir point at the Sensing Stop time of the MPH (positive East, 0 = Greenwich)	10-6 degrees	11	Al	1	
	<10-6degE>	units	10	uc	10	
	newline character	terminator	1	uc	1	
6	**SAT_TRACK=**	keyword	10	uc	10	
	Sub-satellite track heading at the Sensing Start time in the MPH.	degrees	15	Afl	1	
	<deg>	units	5	uc	5	
	newline character	terminator	1	uc	1	
7	**Spare (blank characters (Ø))**	-	50	uc	50	
	newline character	terminator	1	uc	1	
	Product Confidence Data Information					
8	**ISP_ERRORS_SIGNIFICANT=**	keyword	23	uc	23	
	1 or 0. 1 if number of ISPs with CRC errors exceeds threshold For ERS, always set to a default value taken from PRM_Level0SphDefaults.dat parameter file.		1	uc	1	*
	newline character	terminator	1	uc	1	
9	**MISSING_ISPS_SIGNIFICANT=**	keyword	25	uc	25	
	1 or 0. 1 if number of missing ISPs exceeds threshold For ERS, always set to a default value taken from PRM_Level0SphDefaults.dat parameter file.		1	uc	1	*
	newline character	terminator	1	uc	1	
10	**ISP_DISCARDED_SIGNIFICANT=**	keyword	26	uc	26	
	1 or 0. 1 if number of ISPs discarded by the PF-HS exceeds threshold For ERS, always set to a default value taken from PRM_Level0SphDefaults.dat parameter file.		1	uc	1	*
	newline character	terminator	1	uc	1	

Field #	Description	units	Byte length	Data Type	Dim.	
11	**RS_SIGNIFICANT=**	keyword	15	uc	15	
	1 or 0. 1 if number of ISPs with Reed Solomon corrections exceeds threshold For ERS, always set to a default value taken from PRM_Level0SphDefaults.dat parameter file.		1	uc	1	*
	newline character	terminator	1	uc	1	
12	**Spare (blank characters (Ø))**	-	50	uc	50	
	newline character	terminator	1	uc	1	
	Other Product Quality Information					
13	**NUM_ERROR_ISPS=**	keyword	15	uc	15	
	Number of ISPs containing CRC errors. For ERS, always set to a default value taken from PRM_Level0SphDefaults.dat parameter file.	ISPs	11	Al	1	*
	newline character	terminator	1	uc	1	
14	**ERROR_ISPS_THRESH=**	keyword	18	uc	18	
	Threshold at which number of ISPs containing CRC errors is considered significant. For ERS, this is set to the value in the Level 0 Processor Configuration File.	percent	15	Afl	1	*
	<%>	units	3	uc	3	
	newline character	terminator	1	uc	1	
15	**NUM_MISSING_ISPS=**	keyword	17	uc	17	
	Number of missing ISPs. For ERS, always set to a default value taken from PRM_Level0SphDefaults.dat parameter file.	ISPs	11	Al	1	*
	newline character	terminator	1	uc	1	
16	**MISSING_ISPS_THRESH=**	keyword	20	uc	20	
	Threshold at which number of ISPs missing is considered significant For ERS this is set to the value in the Level 0 Processor Configuration File.	percent	15	Afl	1	*
	<%>	units	3	uc	3	
	newline character	terminator	1	uc	1	
17	**NUM_DISCARDED_ISPS=**	keyword	19	uc	19	
	Number of ISPs discarded by PF-HS. For ERS, always set to a default value taken from PRM_Level0SphDefaults.dat parameter file.	ISPs	11	Al	1	*
	newline character	terminator	1	uc	1	

Field #	Description	units	Byte length	Data Type	Dim.	
18	**DISCARDED_ISPS_THRESH=**	keyword	22	uc	22	
	Threshold at which number of ISPs discarded by PF-HS is considered significant For ERS, this is set to the value in the Level 0 Processor Configuration File.	percent	15	Afl	1	*
	<%>	units	3	uc	3	
	newline character	terminator	1	uc	1	
19	**NUM_RS_ISPS=**	keyword	12	uc	12	
	Number of ISPs with Reed Solomon corrections For ERS, always set to a default value taken from PRM_Level0SphDefaults.dat parameter file.	ISPs	11	Al	1	*
	newline character	terminator	1	uc	1	
20	**RS_THRESH=**	keyword	10	uc	10	
	Threshold at which number of ISPs with Reed Solomon corrections is considered significant For ERS, this is set to the value in the Level 0 Processor Configuration File.	percent	15	Afl	1	*
	<%>	units	3	uc	3	
	newline character	terminator	1	uc	1	
21	**Spare (blank characters (Ø))**	-	100	uc	100	
	newline character	terminator	1	uc	1	
	ASAR Specific Information					
22	**TX_RX_POLAR=**	keyword	12	uc	12	
	quotation mark (“)	-	1	uc	1	
	Polarisation (used for ASAR only) HV/HV, H/HVØ, V/VHØ, H/HØØ, H/VØØ, or V/VØØ, or V/HØØ The letter(s) to the left of the ‘/’ indicates the transmitter polarisation. The letter(s) to the right of the ‘/’ indicates the receiver polarisation. ØØØØØ for non-ASAR products. Always set to V/VØØ for ERS	ascii	5	uc	5	*
	quotation mark (“)	-	1	uc	1	
	newline character	terminator	1	uc	1	

Field #	Description	units	Byte length	Data Type	Dim.	
23	**SWATH=**	keyword	6	uc	6	
	quotation mark (“)	-	1	uc	1	
	Swath Number (used for ASAR only) codes: IS1, IS2, IS3, IS4, IS5, IS6, IS7, WSØ -- WS is used for WS mode and GM mode. For ASA_EC__OP and ASA_MS__OP, the field is set to EC0 and MC0, respectively. ØØØ for non-ASAR products. Always set to IS2 for ERS	ascii	3	uc	3	*
	quotation mark (“)	-	1	uc	1	
	newline character	terminator	1	uc	1	
24	**Spare (blank characters (Ø))**	-	41	uc	41	
	newline character	terminator	1	uc	1	
	Data Set Descriptors					
25	**DSD (M) for MDS** Contents as defined in Section 3.4.	-	280	dsd	1	
26	**DSD (R) pointing to Configuration file** Contents as defined in Section 3.4.	-	280	dsd	1	
27	**DSD (R) pointing to the Orbit State Vector file used** Contents as defined in Section 3.4. Contains the name of the ERS Orbit State Vector file if available.	-	280	dsd	1	*
28	For High Rate: **DSD - Spare (279 blank space characters followed by 1 newline character)** For Low Rate: **DSD (A) - for ADS** Contents as defined in Section 3.4.	-	280	dsd_sp dsd	1	
	TOTAL	-	1956			

4.1.1.1 Level 0 DSD Format

There are 4 DSDs in the Level 0 SPH. The first DSD describes the MDS (the source packets) the second is a reference DSD which contains the name of the Level 0 Processor Configuration File used to create the product, and the third is a reference DSD which contains the name of the Orbit State Vector file used to create the product. Finally, the fourth is a spare DSD for high-rate data or for low-rate data it is a DSD pointing to the low-rate level 0 ADS.

A general DSD structure has been defined in Section 3.4. The fields of the DSD are filled as follows:

DSD for the MDS:

DS_NAME="ERS_SOURCE_PACKETSØØØØØØØØØØ"
DS_TYPE =M
FILENAME="ØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØ
ØØØØØØØØØØØØØØØØØØØØØØØ"
DS_OFFSET= (MPH length + SPH length including DSDs)<bytes>
DS_SIZE= (number of MDSRs · MDSR length)<bytes>
NUM_DSR= (number of MDSRs: data dependent)
DSR_SIZE= (MDSR length: data dependent)<bytes>
ØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØ

DSD Referencing the Level 0 Config. file, or the Orbit State Vector file:

DS_NAME="LEVEL_0_CONFIGURATION_FILEØØ" or
"ORBIT_STATE_VECTOR_FILEØØØØØ"
DS_TYPE=R
FILENAME="(filename)"[2]
DS_OFFSET=+00000000000000000000<bytes>
DS_SIZE=+00000000000000000000<bytes>
NUM_DSR=+0000000000
DSR_SIZE=+0000000000<bytes>
ØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØ

DSD - Spare

This DSD is simply 279 ASCII blank space characters followed by 1 ASCII newline character

DSD - ADS

DS_NAME="LOWØRATEØLEVELØ0ØADSØØØØØØØØ"
DS_TYPE=A
FILENAME="ØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØ
ØØØØØØØØØØØØØØØØØØØØØØØ"
DS_OFFSET= (MPH length + SPH length including DSDs + MDS size)<bytes>
DS_SIZE= (number of ADSRs · ADSR length)<bytes>
NUM_DSR= (number of ADSRs: data dependent)
DSR_SIZE=+0000004493<bytes>
ØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØ

[2] Refer to Volume 16 of Document R-1 for Auxiliary Data file naming details. Note the filename is left justified within the quotation marks, with any blank spaces added before the closing quote.

The fields DS_OFFSET, DS_SIZE, and NUM_DSR are filled with the appropriate values.

4.1.2 Low-Rate Level 0 ADS Format

Low-rate ERS products contains platform and ephemeris data which are not found in high-rate ERS products. These data will be added to the Level 0 ERS low-rate product in the form of an ADS. Each ADSR in the ADS pertains to one wave cell.

The contents of each ADSR are identical to the SPH of the low-rate ERS raw data in EWAC format as shown in Table 4-3.

Table 4-3 Low-rate Level 0 ADSR

Field #	ADSR Contents	Units	Byte Length	Data Type
1	**Time at which information applies**	MJD	12	mjd
2	**Attachment Flag (always set to zero for this ADSR)**	-	1	uc
3	**PF Data** Contains 16 frames each of 256 bytes of the "Source Data Field" of the General IDHT Header Source Packet, see Document. The first 256 bytes correspond to the start of platform data, frame count of 0, and the last 256 bytes to the end of platform data, frame count of 15.	-	4096	uc
4	**Ephemeris Data** Identical to the subcommutated 24 bytes of Ephemeris Data of the "Source Data Field" of 16 General IDHT Header Source Packets, see Document R-2. The first 24 bytes correspond to the start of ephemeris data, ephemeris ID of 1, and the last 24 bytes to the end of ephemeris data, ephemeris ID of 16.	-	384	uc
	TOTAL		4493	

Table 4-4 Low-rate ADS Structure

ADSR #1 (for first wave cell)
...
ADSR #n (for last wave cell)

4.1.3 Level 0 MDS Format

The exact content of the Level 0 MDSRs is mode specific. However, each MDSR will follow the common structure as shown in Table 4-5. The Level 0 Measurement Data Set (MDS) will consist of a series of Annotated Instrument Source Packets (AISPs). The annotation consists of the sensing time added to the ISP by the Level 0 processor (as converted from the On Board Time counter embedded in each ISP). This stamp allows for later extraction of specific regions of the MDS.

Table 4-5 Level 0 MDSR Structure

Annotations		**Instrument Source Packet**
Level 0 Processor Annotation	**FEP Annotations**	**Packet Data Field**
ISP Sensing Time (MJD)	See Table 4-6	ERS Product Data Set Record
12 bytes	20 bytes	11466 bytes for high-rate packets, 4332 bytes for low-rate packets

Table 4-6 gives the structure of the FEP annotations. Most of these are blank since they are intended for ENVISAT use (the FEP is a part of the ENVISAT processing chain).

Table 4-6 FEP Header

Field #	**Description**	**Units**	**Byte length**	**Data Type**
1	Blank (set to FFFF...)	-	12	2*uc
2	**Length of ISP = (length of source packet) - 1**	bytes	2	us
3	Blank (set to zero)	-	2	2*uc
4	Blank (set to zero)	-	2	2*uc
5	Spare (set to zero)	-	2	2*uc
	TOTAL		20	

Table 4-7 and Table 4-8 provide a summarized description of the Packet Data Field for both high-rate and low-rate products. The descriptions are adapted from the ERS EIC and EWAC format structures in Document R-3.

Table 4-7 Summary for High-Rate Packet Data Field

Field Description	Length in Bytes	Notes
Data Record Number	4	Starts from 1 and increments by 1 for each new MDSR in the MDS.
IDHT Header	10	Identical to the "IDHT GEN. HEADER" described in the high-rate format structure in Document R-2.
Auxiliary Data and Replica/Calibration Pulses	220	Identical to the "Auxiliary Data Field" in the high-rate format structure in Document R-2.
Measurement Data	11232	Noise and echo data, this field contains 5616 complex data samples. Each data sample is unsigned extended from the downlink format to 8-bit I and 8-bit Q.

Table 4-8 Summary for Low-Rate Packet Data Field

Field Description	Length in Bytes	Notes
	4	Data records are numbered 1 to 299 for each wave cell. Depending on whether there are missing data records for a wave cell, this number may not reach 299. This number is reset to 1 for each new wave cell.
Primary Header	6	Identical to the packet "Primary Header" described in Document R-2.
Secondary Header	98	Identical to the packet "Secondary Header" described in Document R-2.
Measurement Data	4224	Identical to the "Measurement Data Field" described in Document R-2.

ERS raw data from CEOS Raw, DLT Transcribed, EIC, EWAC formats can be converted into its Level 0 ERS equivalent following the above specifications.

4.2 Level 0 Auxiliary Data Files

The auxiliary data files used for level 0 product creation are the orbit state vectors file, the SBT to UTC time conversion file, and the level 0 processor configuration file. The format of these files is specified in the ENVISAT Products Specification (Volume 6 of Document R-1).

5 LEVEL 1 ERS PRODUCTS SPECIFICATION

This section gives the Level 1 ERS products specifications. The contents are based on the ASAR portion of the ENVISAT Products Specification (Volume 8 of Document R-1) and adapted for ERS products.

In the format tables, ERS specific notations or deviations from the ENVISAT Product Specification are marked by an asterisk in the right-hand margin.

5.1 ERS Image Products

ERS Products produced from the Level 0 data can be classified as Image Products or Wave Mode Products. Wave Mode Products are discussed in Section 5.3. Further, the ERS Image Products can be grouped into those produced as stand-alone products, and those produced as stripline products. All ERS Image Products are stored in time-increasing order, except the geocoded products which are oriented such that the first pixel of the first line is the most north-west pixel.

5.2 Stand-alone (non-stripline) Image Products

Stand-alone image products are ordered as a scene. The scene size is 100 km along track by the swath width for the swath from which the data is acquired (100 km wide). All of these products share a common format which is described in the following subsections.

5.2.1.1 Product Types

5.2.1.1.1 Image Mode Single Look Complex

This is a Single Look, Complex (SLC), phase preserved, slant range image generated from the Level 0 Image Mode product using the Range/Doppler algorithm. The SLC product is generated upon request and is intended for use in SAR quality assessment, calibration, and interferometric applications. A minimum number of corrections and interpolations are performed on the data. Absolute calibration parameters (when available) shall be provided in the product annotation.

5.2.1.1.2 Image Mode Precision Image

This is a multi-look, ground range, digital image generated from the Level 0 Image Mode Product using the Range/Doppler algorithm. The processing uses up to date (at time of processing) auxiliary parameters and corrects for antenna elevation gain, and range spreading loss. The product is generated upon request and is intended for users wishing to perform applications oriented analysis, as well as for multi-temporal imaging and to derive backscatter coefficients. Absolute calibration parameters (when available) shall be provided in the product annotation.

5.2.1.1.3 Image Mode Ellipsoid Geocoded Image

The Image Mode Geocoded SAR image is generated from the Level 0 Image Mode product using the Range/Doppler algorithm with the best available instrument corrections, and is systematically located and resampled on to a map projection. Product is generated upon request, and is intended for mapping applications and other uses requiring map projection images. Absolute calibration parameters (when available) shall be provided in the product annotation. All processing information in the geocoded product corresponds to the intermediate product created during processing. Only the Geolocation Grid ADS and Map Projection ADS are updated to reflect the map projection information.

5.2.1.1.4 Simulated Alternating Polarisation Mode Single Look Complex

This is a complex, slant range image generated from the Level 0 Image Mode product using the Range Doppler algorithm. The product contains two co-registered images to simulate the polarisation combinations available in ASAR. This product is intended for use in quality assessment, calibration, and interferometric applications. Absolute calibration parameters (when available) shall be provided in the product annotation.

5.2.1.1.5 Simulated Alternating Polarisation Mode Precision Image

This is a multi-look, ground range, digital image generated from the Level 0 Image Mode product using the SPECAN algorithm. Engineering corrections and relative calibration (antenna elevation gain, range spreading loss) are applied. The product contains two co-registered images to simulate the polarisation combinations available in ASAR. Absolute calibration parameters (when available) shall be provided in the product annotation.

5.2.1.1.6 Simulated Alternating Polarisation Ellipsoid Geocoded Image

This is a multi-look geocoded SAR image generated from the Level 0 Image Mode Product using the SPECAN algorithm. Engineering corrections and relative calibration (antenna elevation gain, range spreading loss) are applied and the image is systematically geolocated and resampled to a map projection. The product contains two co-registered images to simulate the polarisation combinations available in ASAR. Absolute calibration parameters (when available) shall be provided in the product annotation. All processing information in the geocoded product corresponds to the intermediate product created during processing. Only the Geolocation Grid ADS and Map Projection ADS are updated to reflect the map projection information.

5.2.1.2 Input Data

The input for all the stand-alone products is the Level 0 data corresponding to the particular mode and auxiliary data.

5.2.1.3 Auxiliary Data Used

The auxiliary data required to create the stand-alone products is listed in the table below. Auxiliary data formats are described in Section 5.4.

Table 5-1 ASAR Auxiliary Data for Image Product Processing

Description	Auxiliary Data ID
External Calibration data file	ASA_XCA_AX
Instrument Characterization file	ASA_INS_AX
PF-ASAR Processor Configuration file	ASA_CON_AX

These files follow the same format as the ASAR auxiliary data files. The same files are used for ERS processing but contain ERS-specific data.

5.2.1.4 Processing Performed

This document is not the applicable document for ERS algorithms. The following is intended only as a high level summary of the processing performed.

The following processing steps are applied to the Level 0 data to form the SAR image:

- replica extraction and power estimation;
- raw data correction (I/Q bias removal, I/Q gain imbalance correction, I/Q non-orthogonality correction);
- antenna elevation pattern compensation (not applied for SLC images);
- image formation (SPECAN or Range/Doppler);
- geolocation;
- conversion to map projection (geocoded products only).

The image formation algorithm used is either the Range Doppler Algorithm or the SPECAN algorithm, depending upon the product requested. The following table lists the type of image formation algorithm applied to the various stand-alone products.

Table 5-2 Image Formation Algorithms for Stand-alone (non-stripline) Products

Product ID	Algorithm Applied
SAR_IMS_1P	Range/Doppler
SAR_IMP_1P	Range/Doppler
SAR_IMG_1P	Range/Doppler
SAR_APS_1P	Range/Doppler
SAR_APP_1P	SPECAN
SAR_APG_1P	SPECAN

5.2.1.5 Product Structure

All ERS Image products follow a standard structure as described in Figure 5-1.

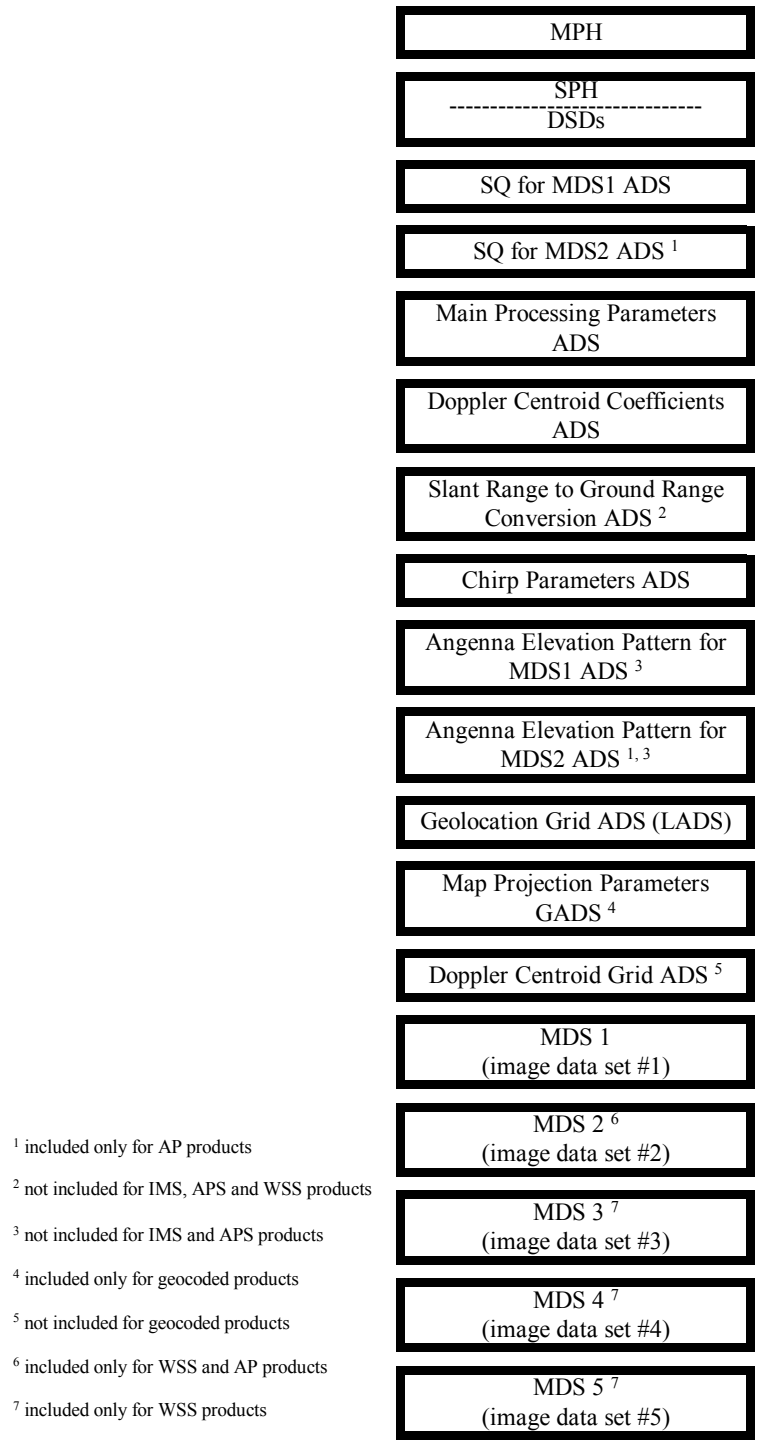

Figure 5-1 ERS Image Product Structure

5.2.1.6 Main Product Header

The MPH is of the same format as that given in Section 3.2.

5.2.1.7 Specific Product Header

The philosophy of the ERS SPH is to provide only basic information needed to evaluate the product, and only information which applies to both an individual stand-alone product or a full stripline product. Thus, the SPH contents (other than positioning information and some minor DSD values) will not need to be updated during stripline formation or child product extraction. The format will be identical for all ERS image products, whether they are stand-alone, slice, archived stripline, or child products extracted from a stripline.

The SPH is an ASCII header.

Table 5-3 ERS Image Products SPH Content

Field #	Description	Units	Byte Length	Data Type
1	**SPH_DESCRIPTOR=**	keyword	15	15*uc
	quotation mark (“)	-	1	uc
	SPH Descriptor ASCII string describing the product.	-	28	28*uc
	quotation mark (“)	-	1	uc
	newline character	terminator	1	uc
2	**STRIPLINE_CONTINUITY_INDICATOR=**	keyword	31	31*uc
	Value: 0= No stripline continuity, the product is a complete segment Other: Stripline Counter	-	4	Ac
	newline character	terminator	1	uc
3	**SLICE_POSITION=**	keyword	15	15*uc
	Value: +001 to NUM_SLICES Default value if no stripline continuity = +001	-	4	Ac
	newline character	terminator	1	uc
4	**NUM_SLICES=**	keyword	11	11*uc
	Number of slices in this stripline Default value if no continuity = +001	-	4	Ac
	newline character	terminator	1	uc

Field #	Description	Units	Byte Length	Data Type
	Product Time Information			
5	**FIRST_LINE_TIME=**	keyword	16	16*uc
	quotation mark (“)	-	1	uc
	First Zero Doppler Azimuth time of product UTC Time of first range line in the MDS of this product.	UTC	27	27*uc
	quotation mark (“)	-	1	uc
	newline character	terminator	1	uc
6	**LAST_LINE_TIME=**	keyword	15	15*uc
	quotation mark (“)	-	1	uc
	Last Zero Doppler Azimuth time of product Time of last range line in the MDS of this product.	UTC	27	27*uc
	quotation mark (“)	-	1	uc
	newline character	terminator	1	uc
	Product Positioning Information			
7	**FIRST_NEAR_LAT=**	keyword	15	15*uc
	Geodetic Latitude of the first sample of the first line A negative value denotes south latitude, a positive value denotes North latitude	10^{-6} degrees	11	Al
	<10-6degN>	units	10	10*uc
	newline character	terminator	1	uc
8	**FIRST_NEAR_LONG=**	keyword	16	16*uc
	East geodetic longitude of the first sample of the first line. Positive values East of Greenwich, negative values west of Greenwich.	10^{-6} degrees	11	Al
	<10-6degE>	units	10	10*uc
	newline character	terminator	1	uc
9	**FIRST_MID_LAT=**	keyword	14	14*uc
	Geodetic Latitude of the middle sample of the first line A negative value denotes south latitude, a positive value denotes North latitude	10^{-6} degrees	11	Al
	<10-6degN>	units	10	10*uc
	newline character	terminator	1	uc
10	**FIRST_MID_LONG=**	keyword	15	15*uc
	East geodetic longitude of the middle sample of the first line. Positive values East of Greenwich, negative values west of Greenwich.	10^{-6} degrees	11	Al

Field #	Description	Units	Byte Length	Data Type
	<10-6degE>	units	10	10*uc
	newline character	terminator	1	uc
11	**FIRST_FAR_LAT=**	keyword	14	14*uc
	Geodetic Latitude of the last sample of the first line A negative value denotes south latitude, a positive value denotes North latitude	10^{-6} degrees	11	Al
	<10-6degN>	units	10	10*uc
	newline character	terminator	1	uc
12	**FIRST_FAR_LONG=**	keyword	15	15*uc
	East geodetic longitude of the last sample of the first line. Positive values East of Greenwich, negative values west of Greenwich.	10^{-6} degrees	11	Al
	<10-6degE>	units	10	10*uc
	newline character	terminator	1	uc
13	**LAST_NEAR_LAT=**	keyword	14	14*uc
	Geodetic Latitude of the first sample of the last line A negative value denotes south latitude, a positive value denotes North latitude	$^{10\ -6}$ degrees	11	Al
	<10-6degN>	units	10	10*uc
	newline character	terminator	1	uc
14	**LAST_NEAR_LONG=**	keyword	15	15*uc
	East geodetic longitude of the first sample of the last line. Positive values East of Greenwich, negative values west of Greenwich.	10^{-6} degrees	11	Al
	<10-6degE>	units	10	10*uc
	newline character	terminator	1	uc
15	**LAST_MID_LAT=**	keyword	13	13*uc
	Geodetic Latitude of the middle sample of the last line A negative value denotes south latitude, a positive value denotes North latitude	10^{-6} degrees	11	Al
	<10-6degN>	units	10	10*uc
	newline character	terminator	1	uc
16	**LAST_MID_LONG=**	keyword	14	14*uc
	East geodetic longitude of the middle sample of the last line. Positive values East of Greenwich, negative values west of Greenwich.	10^{-6} degrees	11	Al

Field #	Description	Units	Byte Length	Data Type	
	<10-6degE>	units	10	10*uc	
	newline character	terminator	1	uc	
17	**LAST_FAR_LAT=**	keyword	13	13*uc	
	Geodetic Latitude of the last sample of the last line A negative value denotes south latitude, a positive value denotes North latitude	10^{-6} degrees	11	Al	
	<10-6degN>	units	10	10*uc	
	newline character	terminator	1	uc	
18	**LAST_FAR_LONG=**	keyword	14	14*uc	
	East geodetic longitude of the last sample of the last line. Positive values East of Greenwich, negative values west of Greenwich.	10^{-6} degrees	11	Al	
	<10-6degE>	units	10	10*uc	
	newline character	terminator	1	uc	
19	**Spare (blank characters)**	-	35	35*uc	
	newline character	terminator	1	uc	
	Additional Product Information				
20	**SWATH=**	keyword	6	6*uc	
	quotation mark (“)	-	1	uc	
	Swath number IS1, IS2, IS3, IS4, IS5, IS6, or IS7 for IM, and AP modes. Set to “WSØ” for WS and GM modes. Set to “IS2” for ERS data.	-	3	3*uc	*
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
21	**PASS=**	keyword	5	5*uc	
	quotation mark (“)	-	1	uc	
	Ascending or descending orbit designator (defined at start of time pass) ASCENDINGØ, DESCENDING or FULLØORBIT	-	10	10*uc	
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
22	**SAMPLE_TYPE=**	keyword	12	12*uc	
	quotation mark (“)	-	1	uc	
	Detected or complex sample type designator DETECTED or COMPLEXØ	-	8	8*uc	

Field #	Description	Units	Byte Length	Data Type	
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
23	**ALGORITHM=**	keyword	10	10*uc	
	quotation mark (“)	-	1	uc	
	Processing Algorithm Used RAN/DOP or SPECANØ	-	7	7*uc	
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
24	**MDS1_TX_RX_POLAR=**	keyword	17	17*uc	
	quotation mark (“)	-	1	uc	
	Transmitter / Receiver Polarisation for MDS 1 H/V or H/H or V/H or V/V Set to V/V for ERS data.	-	3	3*uc	*
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
25	**MDS2_TX_RX_POLAR=**	keyword	17	17*uc	
	quotation mark (“)	-	1	uc	
	Transmitter/ Receiver Polarisation for MDS2 H/V or H/H or V/H or V/V or blank (ØØØ) for all modes with only one MDS. Set to ØØØ for ERS data or V/V for simulated AP ERS data.	-	3	3*uc	*
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
26	**COMPRESSION=**	keyword	12	12*uc	
	quotation mark (“)	-	1	uc	
	Compression algorithm used on echo data on-board the satellite FBAQ2, FBAQ3, FBAQ4 (FBAQ: 8 bits reduced to 2, 3, and 4 bits respectively) others: S&M4Ø, and NONEØ Set to NONE for ERS data.	-	5	5*uc	*
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
27	**AZIMUTH_LOOKS=**	keyword	14	14*uc	
	Number of Looks in Azimuth	looks	4	Ac	
	newline character	terminator	1	uc	

Field #	Description	Units	Byte Length	Data Type
28	**RANGE_LOOKS=**	keyword	12	12*uc
	Number of Looks in Range	looks	4	Ac
	newline character	terminator	1	uc
29	**RANGE_SPACING=**	keyword	14	14*uc
	Range sample spacing in meters	m	15	Afl
	<m>	units	3	3*uc
	newline character	terminator	1	uc
30	**AZIMUTH_SPACING=**	keyword	16	16*uc
	Nominal azimuth sample spacing in meters	m	15	Afl
	<m>	units	3	3*uc
	newline character	terminator	1	uc
31	**LINE_TIME_INTERVAL=**	keyword	19	19*uc
	Azimuth sample spacing in time (Line Time Interval)	s	15	Afl
	<s>	units	3	3*uc
	newline character	terminator	1	uc
32	**LINE_LENGTH=**	keyword	12	12*uc
	Number of samples per output line (includes zero filled samples) if a complex product, 1 sample = 1 I,Q pair, for a detected product, 1 sample = 1 pixel. -1 indicates the length varies between each MDS (WSS products only). The actual length per MDS is reflected in the DSR_SIZE in each MDS DSD.	samples	6	As
	<samples>	units	9	9*uc
	newline character	terminator	1	uc
33	**DATA_TYPE=**	keyword	10	10*uc
	quotation mark (“)	-	1	uc
	Output data type SWORD, UWORD, or UBYTE The definition of a word here is a 16-bit integer.	-	5	5*uc
	quotation mark (“)	-	1	uc
	newline character	terminator	1	uc
34	**Spare (blank characters)**	-	50	50*uc
	newline character	terminator	1	uc
	Data Set Descriptors for Data included with the product[3]			
35	**DSD (A) for SQ for MDS1 ADS**	-	280	dsd

[3] DSD format is described in Section 3.4.

Field #	Description	Units	Byte Length	Data Type
36	**DSD (A) for SQ for MDS2 ADS** (filled only for AP products, set to NOT USED otherwise as described in Volume 5)	-	280	dsd
37	**DSD (A) for Main Processing Parameters ADS**	-	280	dsd
38	**DSD (A) for Doppler Centroid Coefficients ADS**	-	280	dsd
39	**DSD (A) for Slant Range to Ground Range Conversion ADS** (set to NOT USED for IM and AP SLC products and geocoded products as described in Volume 5)	-	280	dsd
40	**DSD (A) for Chirp Parameters ADS**	-	280	dsd
41	**DSD (A) for Antenna Elevation Pattern for MDS 1 ADS** (set to NOT USED for IM and AP SLC products as described in Volume 5)	-	280	dsd
42	**DSD (A) for Antenna Elevation Pattern for MDS 2 ADS** (filled only for AP products, set to NOT USED otherwise as described in Volume 5. Also, set to NOT USED for IM and APl SLC products as described in Volume 5)	-	280	dsd
43	**DSD (A) for the Geolocation Grid ADS (LADS)**	-	280	dsd
44	**DSD (G) for Map Projection Parameters GADS** (filled only for geocoded products, set to NOT USED otherwise as described in Volume 5) or **DSD (A) for Doppler Centroid Grid ADS** (for non-geocoded products where Doppler Centroid Grid estimation has been requested)	-	280	dsd
45	**DSD (M) for MDS1 (image data 1)** (for all IM and AP products)	-	280	dsd
46	**DSD (M) for MDS2 (image data 2)** (filled only for simulated AP products, set to NOT USED for IM products)	-	280	dsd
	Data Set Descriptors for referenced files[4]			
47	**DSD referencing the Level 0 product from which this product was created**	-	280	dsd
48	**DSD referencing PF-ASAR Processor Configuration file** (contains software parameters used by the processor and threshold values for PCD information)	-	280	dsd

[4] DSD format is described in Section 3.4.

Field #	Description	Units	Byte Length	Data Type	
49	**DSD referencing Instrument Characterization file used** Contains LUTs for ADC and data decompression, antenna elevation patterns, and other static instrument characteristics	-	280	dsd	
50	**DSD referencing External Characterization file used** Set to NOT USED for ERS data since the contents of this file are not applicable for ERS.	-	280	dsd	*
51	**DSD referencing External Calibration file used**	-	280	dsd	
52	**DSD referencing the Orbit State Vectors file used**	-	280	dsd	*
TOTAL		6099			

5.2.1.8 Data Set Names

The following Data Set Names may appear in the Image Product SPH Data Set Descriptors:

Table 5-4 Image Products Data Set Descriptor Names

Data Set Type	Data Set Name
SQ for MDS 1 ADS	"MDS1 SQ ADS"
SQ for MDS 2 ADS	"MDS2 SQ ADS"
Main Processing Parameters ADS	"MAIN PROCESSING PARAMS ADS"
Doppler Centroid Parameters ADS	"DOP CENTROID COEFFS ADS"
Slant Range to Ground Range Conversion ADS	"SR GR ADS"
Chirp Parameters ADS	"CHIRP PARAMS ADS"
Antenna Elevation Pattern for MDS 1 ADS	"MDS1 ANTENNA ELEV PATT ADS"
Antenna Elevation Pattern for MDS 2 ADS	"MDS2 ANTENNA ELEV PATT ADS"
Geolocation Grid ADS (LADS)	"GEOLOCATION GRID ADS"
Map Projection Parameters GADS	"MAP PROJECTION GADS"
Measurement Data Set 1	"MDS1"
Measurement Data Set 2	"MDS2"
Measurement Data Set 3	"MDS3"
Measurement Data Set 4	"MDS4"
Measurement Data Set 5	"MDS5"
DSD referencing the Level 0 product from which this product was created	"LEVEL 0 PRODUCT"

Data Set Type	Data Set Name
DSD referencing PF-ASAR Processor Configuration file	"ASAR PROCESSOR CONFIG"
DSD referencing Instrument Characterization file used	"INSTRUMENT CHARACTERIZATION"
DSD referencing External Characterization file used	"EXTERNAL CHARACTERIZATION"
DSD referencing External Calibration file used	"EXTERNAL CALIBRATION"
DSD referencing the Orbit State Vectors file used	"ORBIT STATE VECTOR 1"

5.2.1.9 Data Sets

The data sets which make up the ERS Image product structure are defined in the following sections. Data Sets are in mixed-binary format. ASCII values may be included in the Data Sets, but they do not follow the Keyword-value format of the MPH and SPH, nor are they contained within quotation marks.

5.2.1.9.1 Summary Quality ADSs

There are two Summary Quality (SQ) ADSs. For all Image Products except WSS, the first contains information pertaining to MDS 1. For AP Products, the second ADS contains information pertaining to MDS 2.

For WSS Image Products, the SQ ADS for MDS1 actually contains 5 ADSRs, one for each of the five MDSs for the product. The format of each SQ ADS is identical, however the values may differ as each describes a separate MDS.

The information contained in the Summary Quality (SQ) ADS is a summary of parameters used to establish the quality of the product. This includes PCD flags, the thresholds used to evaluate the flags, and numerical quality parameters.

For the basic image product, the SQ information ADS is updated once per product (i.e., updated once per slice for stripline). Each ADSR is time stamped with the zero Doppler time at which it was issued. The SQ ADS is included in the inventory so that the user may evaluate the quality of the product prior to ordering.

The product statistics which are evaluated at each time stamp (each ADSR) are shown in Table 5-5.

Table 5-5 SQ ADSR

Field #	ADSR Contents	Units	Byte Length	Data Type
1	**Zero doppler time at which SQ information applies**	MJD	12	mjd
2	**Attachment Flag (set to 1 if all MDSRs corresponding to this ADSR are zero, set to zero otherwise).** Note: in practice for ERS products, this flag will always be zero since this ADSR is updated once per slice or scene. Therefore, if there are no MDSRs, this ADSR is not produced at all.	-	1	uc
	PCD Flags			
3	**Input data mean outside nominal range flag** 0 = mean of I and Q input values are both within specified range from expected mean. For expected mean of x, the measured mean must fall between x-threshold to x+threshold. 1 = otherwise	-	1	uc
4	**Input data standard deviation outside nominal range flag** 0 = standard deviation values of I and Q input values are both within specified range of expected standard deviation. For expected std. dev. x, the measured std. dev. must fall between x-threshold to x+threshold. 1 = otherwise	-	1	uc
5	**Significant gaps in the input data flag** An input data gap is defined as a contiguous block of N missing lines (the value of N is predefined for each product) 0 = number of input gaps <= threshold value 1 = number of input data gaps > threshold value	-	1	uc
6	**Missing lines significant flag** 0 = percentage of missing lines <= threshold value 1 = percentage of missing lines > threshold value The number of missing lines is the number of lines missing from the input data excluding data gaps.	-	1	uc
7	**Doppler Centroid Uncertain flag** 0 = confidence measure >= specified value 1 = confidence measure < specified value (note: if more than one Doppler centroid estimation is performed in a slice the flag is set if any confidence measure is less than the threshold).	-	1	uc
8	**Doppler ambiguity estimate uncertain flag** 0 = confidence measure >= specified value 1 = confidence measure < specified value	-	1	uc

Field #	ADSR Contents	Units	Byte Length	Data Type
9	**Output data mean outside nominal range flag** 0 = mean of I and Q output values for SLC image or mean of detected pixels for a detected product, are both within specified range from expected mean. For expected mean of x, the measured mean must fall between x-threshold to x+threshold. 1 = otherwise	-	1	uc
10	**Output data standard deviation outside nominal range flag** 0 = std. dev. of I and Q output values for SLC image or std. dev. of detected pixels for a detected product, are both within specified range from expected std. dev. For expected std. dev. of x, the measured std. dev. must fall between x-threshold to x+threshold. 1 = otherwise	-	1	uc
11	**Chirp extraction failed or is of low quality flag** 0 = able to reconstruct all chirps or chirp reconstruction not requested (nominal chirp used) AND all quality measures were acceptable. 1 = usable to reconstruct a chirp during processing and chirp reconstruction was requested or the quality is below the acceptable levels. If this is the case PF-ERS/PGS-ERS uses the nominal range pulse for processing and a nominal elevation beam scaling factor.	-	1	uc
12	**Data sets missing flag** 0 = all data sets which are supposed to be in the product are present 1 = any data sets (including ADSs) are missing from the product which are supposed to be included under normal circumstances. Which data sets are missing can be determined by an examination of the DSDs in the SPH.	-	1	uc
13	**Invalid downlink parameters flag** 0 = all parameters read from the downlinked data were valid 1 = displayed if any downlink parameter is out of range and therefore a default value has been used during processing.	-	1	uc
14	**Spare**	-	7	7*uc
	Threshold Information			
15	**Threshold for setting the chirp quality flag - Maximum percentage broadening permitted in cross-correlation pulse width compared to theoretical width.**	%	4	fl
16	**Threshold for setting the chirp quality flag - First sidelobe of the chirp cross correlation function**	dB	4	fl
17	**Threshold for setting the chirp quality flag - ISLR of the chirp cross correlation function**	dB	4	fl

Field #	ADSR Contents	Units	Byte Length	Data Type
18	**Threshold for setting the mean of input data quality flag - For an expected mean value of x, this is the value T, such that the measured mean must fall between the x-T and x+T.**	-	4	fl
19	**Expected mean input value for this product for both I and Q.**	-	4	fl
20	**Threshold for setting the standard deviation of input data quality flag - For an expected std. dev. value of y, this is the value D, such that the measured std. dev. must fall between the y-D and y+D.**	-	4	fl
21	**Expected input std. dev. for this product for both I and Q.**	-	4	fl
22	**Threshold for setting the Doppler Centroid quality flag - Threshold for Doppler Centroid confidence**	-	4	fl
23	**Threshold for setting the Doppler Centroid ambiguity quality flag - Threshold for setting the Doppler Centroid ambiguity confidence flag**	-	4	fl
24	**Threshold for setting the mean of output data quality flag - For an expected mean value of x, this is the value T, such that the measured mean must fall between the x-T and x+T.**	-	4	fl
25	**Expected mean output value for this product. For an SLC product this is the expected mean of both the I and Q values.**	-	4	fl
26	**Threshold for setting the standard deviation of output data quality flag - For an expected std. dev. value of y, this is the value D, such that the measured std. dev. must fall between the y-D and y+D.**	-	4	fl
27	**Expected output std. dev. for this product. For an SLC product this is the expected output std. dev. for both I and Q values.**	-	4	fl
28	**Threshold for setting the missing lines quality flag - maximum percentage of missing lines to total lines.**	%	4	fl
29	**Threshold for setting the missing gaps quality flag - maximum number of missing gaps allowed.**	-	4	fl
30	**Number of missing lines which constitute a gap**	lines	4	ul
31	**Spare**	-	15	15*uc
	Other Quality Information			
32	**Input data mean (i channel, then q channel)**	-	8	2*fl
33	**Input data standard deviation (i channel, then q channel)**	-	8	2*fl
34	**Number of gaps (composed of a predetermined number of consecutive missing lines)**	-	4	fl
35	**Number of missing lines (excluding gaps)**	-	4	fl
36	**Output data mean- for SLC products, first value is for the i channel, second is for the q channel. For detected products, second value is set to zero.**	-	8	2*fl

Field #	ADSR Contents	Units	Byte Length	Data Type
37	**Output data standard deviation- for SLC products, first value is for the i channel, second is for the q channel. For detected products, second value is set to zero.**	-	8	2*fl
38	**Total number of errors detected in ISP headers**	-	4	ul
39	**Swath Number** IS1, IS2, IS3, IS4, IS5, IS6, or IS7 for IM, WV and AP modes. SS1, SS2, SS3, SS4, or SS5 for WSS products. WSØ for WS and GM modes where only one ADSR for the whole scene is provided. Set to "IS2" for ERS data.		3	3*uc *
40	**Spare**		13	13*uc
	TOTAL		170	

5.2.1.9.2 Main Processing Parameters ADS

The Main Processing Parameters ADS contains a summary of the parameters used to process a product that are constant over the length of the product (i.e., over the length of the slice in stripline processing). As such, one ADSR containing these parameters, preceded by a time stamp is issued per output product (per slice for stripline). For WSS products, one ADSR is provided per sub swath, each reflecting constant processing parameters for the sub swath in question, which may be different from other sub swaths.

The contents of each ADSR is shown in Table 5-6.

Table 5-6 Main Processing Parameters ADSR

Field #	ADSR Contents	Units	Byte Length	Data Type
	General Summary			
1	**First Zero Doppler Azimuth time of MDS which this data set describes** Time of first range line in the MDS described by this data set	MJD	12	mjd
2	**Attachment Flag (always set to zero for this ADSR)**	-	1	uc
3	**Last Zero Doppler Azimuth time of MDS which this data set describes** Time of last range line in the MDS described by this data set	MJD	12	mjd

Field #	ADSR Contents	Units	Byte Length	Data Type	
4	**Work Order ID (left-justified)** PF-ERS fills this with the product order from line 1 of the PCF. PGS-ERS fills this with an internal product order ID based on the POH or batch product ID.	-	12	12*uc	*
5	**Time difference between sensing time of first input line and zero Doppler time of first output image line (t_{delta}).** May be used during child product extraction from a stripline product	s	4	fl	
6	**Swath number** IS1, IS2, IS3, IS4, IS5, IS6, or IS7 for IM, WV and AP modes. SS1, SS2, SS3, SS4, and SS5 for WSS products. WSØ for WS and GM modes where only one ADSR for the whole scene is provided. Set to IS2 for ERS data.	**ascii**	**3**	**3*uc**	*****
7	**Range sample spacing**	m	4	fl	
8	**Azimuth sample spacing at image center**	m	4	fl	
9	**Azimuth sample spacing in time (Line Time Interval)**	s	4	fl	
10	**Number of output range lines in the image described by this ADSR** For WSS products, this number may vary for each sub swath.	lines	4	ul	
11	**Number of samples per output range line (includes zero filled samples) in the image described by this ADSR** For WSS products, this number may vary for each sub swath.	samples	4	ul	
12	**Output data type** SWORD, UWORD, or UBYTE	ascii	5	5*uc	
13	**Number of output range lines per burst** Not used for single-beam products	lines	4	ul	
14	**Time difference between zero Doppler time and acquisition time of output image lines**	s	4	fl	
15	**Spare**	-	43	43*uc	
	Image Processing Summary				
16	**Raw Data Analysis used for Raw Data Correction** 0 = correction done using default parameters 1 = correction done using raw data analysis results	-	1	uc	
17	**Antenna Elevation Pattern Correction Applied** 0 = no correction applied 1 = correction applied	-	1	uc	

Field #	ADSR Contents	Units	Byte Length	Data Type	
18	**Reconstructed Chirp to be used (if reconstruction successful)** 0 = nominal chirp replica to be used 1 = reconstructed chirp to be used	-	1	uc	
19	**Slant Range to Ground Range Conversion Applied** 0 = no conversion applied 1 = conversion applied	-	1	uc	
20	**Doppler Centroid Estimation Performed** 0 = no estimation done 1 = estimation done	-	1	uc	
21	**Doppler Ambiguity Estimation Performed** 0 = no estimate done 1 = estimate done	-	1	uc	
22	**Range-spreading loss compensation Applied** 0 = no compensation applied 1 = compensation applied	-	1	uc	
23	**Detection Applied** 0 = output product is complex 1 = output product was detected	-	1	uc	
24	**Look Summation Performed** 0 = product is single look 1 = product is multi-looked	-	1	uc	
25	**RMS Equalization Performed** 0 = RMS equalization was not performed during FBAQ decoding 1 = RMS equalization was performed during FBAQ decoding Not applicable for ERS: always set to 0	-	1	uc	*
26	**Antenna Elevation Gain Scaling Factor Applied** 0 = no scaling factor applied 1 = scaling factor applied Not applicable for ERS: always set to 0	-	1	uc	*
27	**Receive Gain Droop Compensation Applied to Echo Data** 0 = no compensation applied 1 = compensation applied Not applicable for ERS: always set to 0	-	1	uc	*

Field #	ADSR Contents	Units	Byte Length	Data Type	
28	**Receive Gain Droop Compensation Applied to Calibration Pulse P2** 0 = no compensation applied 1 = compensation applied Not applicable for ERS: always set to 0		1	uc	*
29	**Receive Gain Droop Compensation for Calibration Pulse P2 Order Zero: Nominal Time Delay Applied** 0 = do not use nominal time delay (compensation depends on P2 time delay with respect to the end of the echo window) 1 = use nominal time delay (compensation is constant) Not applicable for ERS: always set to 0		1	uc	*
30	**Inverse Filter used for range compression (GM Mode only)** 0 = matched filter used for range compression 1 = inverse filter used for range compression Not applicable for ERS: always set to 0	-	1	uc	*
31	**Spare**		6	6*uc	
	Raw Data Analysis Information				
32	**The following 26 parameters form a structure which is repeated twice, once for MDS 1 and once for MDS 2. If MDS 2 is not included with the product, or if the product is WSS, the second set of values is blanked (all values set to zero).**				
	Number of input data gaps (a gap is defined as a predetermined number of range lines)	gaps	4	ul	
	Number of missing lines, excluding data gaps	lines	4	ul	
	Range sample skipping factor for raw data analysis	samples	4	ul	
	Range lines skipping factor for raw data analysis	lines	4	ul	
	Calculated I channel bias	-	4	fl	
	Calculated Q channel bias	-	4	fl	
	Calculated I channel standard deviation	-	4	fl	
	Calculated Q channel standard deviation	-	4	fl	
	Calculated I/Q gain imbalance	-	4	fl	
	Calculated I/Q quadrature departure	-	4	fl	
	I bias upper bound	-	4	fl	
	I bias lower bound	-	4	fl	
	Q bias upper bound	-	4	fl	
	Q bias lower bound	-	4	fl	
	I/Q gain lower bound	-	4	fl	
	I/Q gain upper bound	-	4	fl	

Field #	ADSR Contents	Units	Byte Length	Data Type	
	I/Q quadrature departure lower bound	-	4	fl	
	I/Q quadrature departure upper bound	-	4	fl	
	I bias significance	-	1	uc	
	0 = I bias falls within acceptable range				
	1 = I bias falls outside acceptable range				
	Q bias Significance	-	1	uc	
	0 = Q bias falls within acceptable range				
	1 = Q bias falls outside acceptable range				
	I/Q Gain Significance	-	1	uc	
	0 = Gain falls within acceptable range				
	1 = Gain falls outside acceptable range				
	I/Q Quadrature Departure Significance	-	1	uc	
	0 = Quadrature departure falls within acceptable range				
	1 =Quadrature departure falls outside acceptable range				
	I channel bias used for correction	-	4	fl	
	(may be different from measured value)				
	Q channel bias used for correction	-	4	fl	
	(may be different from measured value)				
	I/Q gain imbalance used for correction	-	4	fl	
	(may be different from measured value)				
	I/Q quadrature departure used for correction	-	4	fl	
	(may be different from measured value)				
33	**Spare**	-	32	32*uc	
	Information derived from Downlink Header				
34	**The following 2 parameters form a structure which is repeated twice. Once for values pertaining to MDS 1 and once for values pertaining to MDS 2. If MDS 2 is not included in the product, or if the product is a WSS, the fields in the second group are blanked (all values are set to zero).**				
	On-board time of first input line processed	-	8	2*ul	*
	For ASAR, LSB accurate to 15.26 μs. (Contained in two long integers)				
	For ERS, LSB accurate to 3.90625 ms. (Contained in two long integers: the first contains the on-board time, the second is set to zero)				
	Sensing time (MJD format) of first input line processed	MJD	12	mjd	
	converted from satellite binary time				

Field #	ADSR Contents	Units	Byte Length	Data Type	
35	**Following fields each contain room for 5 values. Only one value is filled for each for IM and WV modes. Two values are filled for AP mode (for MDS1 and MDS2). Five values are filled for WS and GM modes (for SS1 to SS5, respectively). Unused values are set to zero:**				
	Sampling Window Start time code of first processed line	code	10	5*us	
	Sampling Window Start time code of last processed line	code	10	5*us	
	Pulse Repetition Interval code	code	10	5*us	
	Tx pulse length Not applicable for ERS: always set to 0	code	10	5*us	*
	Tx pulse bandwidth Not applicable for ERS: always set to 0	code	10	5*us	*
	Echo Window Length Not applicable for ERS: always set to 0	code	10	5*us	*
	Upconverter Level For ASAR: Upconverter gain set on the instrument. For ERS: Attenuation setting of the calibration subsystem.	code	10	5*us	*
	Downconverter Level For ASAR: Downconverter gain set on the instrument. For ERS: Gain setting of the receive chain.	code	10	5*us	*
	Resampling factor for echo data Not applicable for ERS: always set to 0	code	10	5*us	*
	Beam adjustment delta Not applicable for ERS: always set to 0	code	10	5*us	*
	Antenna Beam Set Number Not applicable for ERS: always set to 0	code	10	5*us	*
	Auxiliary Tx Monitor Level Not applicable for ERS: always set to 0	code	10	5*us	*
36	**Spare**	-	60	60*uc	
37	**Error counters. Each input line is analyzed for errors in the header using a majority polling technique. Errors are logged for each field of the header in the fields below.**				
	Number of errors detected in Sampling Window start time field.	-	4	ul	
	Number of errors detected in PRI code field	-	4	ul	
	Number of errors detected in Tx pulse length field Not applicable for ERS: always set to 0	-	4	ul	*
	Number of errors detected in Tx pulse bandwidth field. Not applicable for ERS: always set to 0	-	4	ul	*
	Number of errors detected in Echo Window Length field. Not applicable for ERS: always set to 0	-	4	ul	*

Field #	ADSR Contents	Units	Byte Length	Data Type	
	Number of errors detected in Calibration Subsystem Attenuation Select field (for ERS).	-	4	ul	*
	or				
	Number of errors detected in Upconverter Level field (for ASAR).				
	Number of errors detected in Downconverter Level field (for ASAR).	-	4	ul	*
	or				
	Number of errors detected in RF Subsystem Gain Select (for ERS).				
	Number of errors detected in Resampling factor for echo data field.	-	4	ul	*
	Not applicable for ERS: always set to 0				
	Number of errors detected in Beam adjustment delta field.	-	4	ul	*
	Not applicable for ERS: always set to 0				
	Number of errors detected in Antenna Beam Set Number field.	-	4	ul	*
	Not applicable for ERS: always set to 0				
38	**Spare**	-	26	26*uc	
39	**Following fields each contain room for 5 values. Only one value is filled for each for IM and WV modes. Two values are filled (MDS1 and MDS2) if 2 MDSs are included in the product. Five values are filled for WS and GM modes (for SS1 to SS5, respectively). Unused values are set to zero:**				
	Sampling Window Start time of first processed line	s	20	5*fl	
	Sampling Window Start time of last processed line	s	20	5*fl	
	Number of Sample Window Start Time changes within a beam	-	20	5*ul	
	Pulse Repetition Frequency	Hz	20	5*fl	
	Tx pulse length	s	20	5*fl	
	Tx pulse bandwidth	Hz	20	5*fl	
	Echo Window Length	s	20	5*fl	
	Upconverter Level	dB	20	5*fl	*
	For ASAR: Upconverter gain set on the instrument.				
	For ERS: Attenuation setting of the calibration subsystem.				
	Downconverter Level	dB	20	5*fl	*
	For ASAR: Downconverter gain set on the instrument				
	For ERS: Gain setting of the receive chain.				
	Resampling factor	-	20	5*fl	*
	Not applicable for ERS: always set to 0				

Field #	ADSR Contents	Units	Byte Length	Data Type	
	Beam adjustment delta Not applicable for ERS: always set to 0	deg.	20	5*fl	*
	Antenna Beam Set Number Not applicable for ERS: always set to 0	-	10	5*us	*
	Auxiliary Tx Monitor Level Not applicable for ERS: always set to 0	-	20	5*fl	*
	Rank The number of PRI between transmitted pulse and return echo. Not applicable for ERS: always set to 0				
40	**Spare**	-	62	62*uc	
	Range Processing Information				
41	**First processed input range sample, first sample is 1**	samples	4	ul	
42	**Range spreading loss reference range**	m	4	fl	
43	**Range sampling rate**	Hz	4	fl	
44	**Radar Frequency**	Hz	4	fl	
45	**Number of range looks**	looks	2	us	
46	**Matched filter window type:** HAMMING or KAISERØ or NONEØØØ	ascii	7	7*uc	
47	**Window coefficient for range-matched filter**	-	4	fl	
48	**Following fields each contain room for 5 values. Only one value is filled for each for AP, IM, and WV modes. Five values are filled for WS and GM modes (for SS1 to SS5, respectively). Unused values are set to zero:**				
	Range Look Bandwidth (null to null)	Hz	20	5*fl	
	Total processed range bandwidth (null to null)	Hz	20	5*fl	
49	**Nominal chirp: Following 2 parameters form a structure which is repeated 5 times (one set for each WS beam, SS1 first, to SS5 last -- only one set of values given for narrow swath images):**				
	4 nominal chirp amplitude coefficients	-, s^{-1}, s^{-2}, s^{-3}	16	4*fl	
	4 nominal chirp phase coefficients	cycles, Hz, Hz/s, Hz/s^2	16	4*fl	
50	**Spare**	-	60	60*uc	
	Azimuth Processing Information				
51	**Number of input lines processed**	lines	4	ul	

Field #	ADSR Contents	Units	Byte Length	Data Type	
52	**Number of Azimuth Looks**	looks	2	us	
53	**Azimuth Look Bandwidth (null to null)**	Hz	4	fl	
54	**Processed Azimuth bandwidth (null to null)**	Hz	4	fl	
55	**Matched filter window type:** HAMMING or KAISERØ or NONEØØØ	ascii	7	7*uc	
56	**Window coefficient for azimuth-matched filter**	-	4	fl	
57	**3 co-efficients for Azimuth FM rate:** **Azimuth FM rate = C0 + C1(t_{SR}-t_0) + C2(t_{SR} - t_0)^2** **t_{SR} = 2 way slant range time**	Hz/s Hz/s^2 Hz/s^3	12	3*fl	
58	**2 way slant range time origin (t_0) for Azimuth FM rate calculation**	ns	4	fl	
59	**Doppler Centroid Ambiguity Confidence Measure** Value between 0 and 1, 0 = poorest confidence, 1= highest confidence	-	4	fl	
60	**Spare**	-	68	68*uc	
	Calibration Information				
61	**The following 2 parameters form a structure which is repeated twice. Once for values pertaining to MDS 1 and once for values pertaining to MDS 2. If MDS 2 is not included in the product, or if the product is WSS, the fields in the second group are set to zero.**				
	Processor scaling factor (factor units are linear when using the Range/ Doppler algorithm, dB when Specan is used)	-	4	fl	
	External Calibration Scaling Factor (mode/swath/polarisation dependent)	-	4	fl	
62	**Following fields each contain room for 5 values. Five values are filled for WS and GM modes (for SS1 to SS5, respectively). Up to 5 values may be provided for IM mode, each one is a separate noise estimate. For AP mode, up to 4 values may be provided in the order: first estimate for MDS1, second estimate for MDS1, first estimate for MDS2, second estimate for MDS2. For WV, there is one estimate provided.**				
	Noise power correction factor Not applicable for ERS: always set to 0	-	20	5*fl	*
	Number of noise lines used to calculate correction factors Not applicable for ERS: always set to 0	-	20	5*ul	*
63	**Spare**	-	64	64*uc	
	Other Processing Information				
64	**Spare**	-	12	12*uc	

Field #	ADSR Contents	Units	Byte Length	Data Type	
65	**The following 4 parameters form a structure which is repeated twice. Once for values pertaining to MDS 1 and once for values pertaining to MDS 2. If MDS 2 is not included in the product the fields in the second group are set to zero.**				
	Output data mean Magnitude for detected products, real sample mean for SLC products	-	4	fl	
	Output imaginary data mean Used for SLC products only (set to zero otherwise)	-	4	fl	
	Output data standard deviation Magnitude std. dev. for detected products, real sample std. dev. for SLC products	-	4	fl	
	Output imaginary data standard deviation Used for SLC products only (set to zero otherwise)	-	4	fl	
66	**Average scene height above ellipsoid used for processing**	m	4	fl	
67	**Spare**	-	48	48*uc	
	Data Compression Information				
68	**Compression Method used for echo samples** FBAQ, S&MØ, NONE Not applicable for ERS: always set to NONE	ascii	4	4*uc	*
69	**Compression Ratio for echo samples** 8/4, 8/3, 8/2, or 8/8 Not applicable for ERS: always set to ØØØ	ascii	3	3*uc	*
70	**Compression Method used for initial calibration samples** FBAQ, S&MØ, NONE Not applicable for ERS: always set to NONE	ascii	4	4*uc	*
71	**Compression Ratio for initial calibration samples** 8/4, 8/3, 8/2, or 8/8 Not applicable for ERS: always set to ØØØ	ascii	3	3*uc	*
72	**Compression Method used for periodic calibration samples** FBAQ, S&MØ, NONE Not applicable for ERS: always set to NONE	ascii	4	4*uc	*
73	**Compression Ratio for periodic calibration samples** 8/4, 8/3, 8/2, or 8/8 Not applicable for ERS: always set to ØØØ	ascii	3	3*uc	*
74	**Compression Method used for noise samples** FBAQ, S&MØ, NONE Not applicable for ERS: always set to NONE	ascii	4	4*uc	*

Field #	ADSR Contents	Units	Byte Length	Data Type	
75	**Compression Ratio for noise samples** 8/4, 8/3, 8/2, or 8/8 Not applicable for ERS: always set to ØØØ	ascii	3	3*uc	*
76	**Spare**	-	64	64*uc	
	ScanSAR Specific Information				
77	**Number of slant range samples in beam merging, one value per merge region (1-2, 2-3, 3-4, 4-5)** This parameter is equivalent to N in the following beam merging formula: $xmerged(n) = (1 - (n/N))^P * xnear(n) + (n/N)^P * xfar(n)$ These fields are set to zero for single beam and WSS products.	-	16	4*ul	
78	**Beam merge algorithm parameter used for beam merging, one value per merge region (1-2, 2-3, 3-4, 4-5)** This parameter is equivalent to P in the above beam merging forumla, and different values have the following affect: P = 1, linear weighting of the two beams (near and far) P = -1, (which represents infinity in the beam merging formula) only near beam contributes to the merged one P = 0, only far beam contributes to the merged one P > 1, near beam is favoured 0 < P < 1, far beam is favoured These fields are set to zero for single beam and WSS products.	-	16	4*fl	
79	**Number of lines per burst for this image** 5 values for beams SS1 to SS5 in WS and GM modes. Two values for AP mode, all others set to zero.	lines	20	5*ul	
80	**Time of first SS1 Echo Source Packet**	mjd	12	mjd	
81	**Spare**	-	28	28*uc	
	Orbit State Vectors Information				
82	**The following 7 parameters form a structure which is repeated 5 times, thus allowing the inclusion of up to 5 orbit state vectors which span the scene (or slice) to which this ADSR pertain.**				
	Time of state vector	mjd	12	mjd	
	X position in Earth fixed reference frame	10^{-2}m	4	sl	
	Y position in Earth fixed reference frame	10^{-2}m	4	sl	
	Z position in Earth fixed reference frame	10^{-2}m	4	sl	
	X velocity relative to Earth fixed reference frame	10^{-5}m/s	4	sl	
	Y velocity relative to Earth fixed reference frame	10^{-5}m/s	4	sl	

Field #	ADSR Contents	Units	Byte Length	Data Type
	Z velocity relative to Earth fixed reference frame	10^{-5}m/s	4	sl
83	**Spare**	-	64	64*uc
	TOTAL		**2009**	

5.2.1.9.3 Doppler Centroid Coefficients ADS

The Doppler centroid of the image is estimated once for stand-alone products, and is hence reported once. For stripline, however, a Doppler centroid estimate is performed at least at the start and end of a slice. To ensure the user is given a complete record of the Doppler parameters used during processing, the Doppler Centroid Coefficients ADS is updated with a new ADSR at every granule[5] for stripline processing. Each update is time stamped with the zero Doppler time to which the update applies. The Doppler centroid coefficients used on range lines between two updates are found by linear interpolation between the updated and previous values. The contents of each update (each update is a single ADSR within the ADS) are shown in Table 5-7.

For Wide Swath products, a different Doppler polynomial will be used for each sub-swath. These five polynomials will differ only in the constant term. The slant range times corresponding to each sub swath can be found in the Geolocation Grid ADS.

Table 5-7 Doppler Centroid Coefficients ADSR

Field #	ADSR Contents	Units	Byte Length	Data Type
1	**Zero Doppler azimuth time at which estimate applies**	MJD	12	mjd
2	**Attachment Flag (always set to zero for this ADSR)**	-	1	uc
3	**2-way slant range time origin (t_0)** When Delta Doppler coefficients are provide per swath, t_0 is the slant range time origin corresponding to SS1	ns	4	fl
4	**Doppler centroid coefficients as a function of slant range time: D0, D1, D2, D3, and D4.** where Doppler Centroid = $D0 + D1(t_{SR}-t_0) + D2(t_{SR}-t_0)^2 + D3(t_{SR}-t_0)^3 + D4(t_{SR}-t_0)^4$ For WS produts, these are the Doppler Centroid coefficients for SS1.	Hz Hz/s Hz/s^2 Hz/s^3 Hz/s^4	20	5*fl
5	**Doppler Centroid Confidence Measure** Value between 0 and 1, 0 = poorest confidence, 1= highest confidence If multiple Doppler Centroid estimates were performed, this value is the lowest confidence value attained.	-	4	fl

[5] Granule is defined in Section 5.1.1.9.7.

Field #	ADSR Contents	Units	Byte Length	Data Type
6	**Doppler Confidence Below Threshold Flag** 0 = confidence above threshold, Doppler Centroid calculated from data 1 = confidence below threshold, Doppler Centroid calculated from orbit parameters	-	1	uc
7	**Delta Doppler Coefficients: ΔD0(SS1), ΔD0(SS2), ΔD0(SS3), ΔD0(SS4), ΔD0(SS5)** Constant Doppler Centroid coefficients for each swath to be added to D0 for reconstructing a different Doppler polynomial per swath. Only applicable to WS products, all values set to 0 for IM, AP, GM and WV products. Doppler Centroid polynomial for SSi = $\Delta D0(SSi) + D0 + D1(t_{SR}-t_0) + D2(t_{SR}-t_0)^2 + D3(t_{SR}-t_0)^3 + D4(t_{SR}-t_0)^4$ Where SSi equals SS1, SS2, SS3, SS4, or SS5. The slant range times to the other sub swaths can be found in the Geolocation Grid ADS.	Hz Hz Hz Hz Hz	10	5*ss
8	**Spare**	-	3	3*uc
	TOTAL		55	

5.2.1.9.4 Slant Range to Ground Range Conversion ADS

The SR/GR conversion coefficients may be updated more than once per product (or slice). Each update is time stamped with the zero Doppler time to which the update applies. For stripline products, the updates occur once for each granule. The SR/GR coefficients used on range lines between two updates are found by linear interpolation between the updated and previous values. The contents of each update (each update is a single ADSR within the ADS) are shown in Table 5-8. This ADS is not included for SLC products for which SR/GR conversion is not performed, and for Geocoded products.

Table 5-8 SR/GR Conversion ADSR

Field #	ADSR Contents	Units	Byte Length	Data Type
1	**Zero Doppler Time in azimuth from which parameters apply**	MJD	12	mjd
2	**Attachment Flag (always set to zero for this ADSR)**	-	1	uc
3	**2 way slant range time to first range sample**	ns	4	fl
4	**Ground range origin of the polynomial (GR_0) measured from the first pixel of the line**	m	4	fl

Field #	ADSR Contents	Units	Byte Length	Data Type
5	**The coefficients S0, S1, S2, S3, and S4 of the ground range to slant range conversion polynomial.** Slant range = S0 + S1(GR-GR_0) + S2 (GR-GR_0)^2 + S3(GR-GR_0)^3 + S4(GR-GR_0)^4 where GR is the ground range distance from the first pixel of the range line	m, m^{-1}, m^{-2}, m^{-3}, m^{-4}	20	5*fl
6	**Spare**	-	14	14*uc
	TOTAL		55	

5.2.1.9.5 Chirp Parameters ADS

Chirp handling for ERS differs from ASAR. For ASAR, the chirps are derived from the calibration pulses. For ERS, the chirps are extracted from the downlink data. In ASAR products there may be multiple chirp updates per product. However in ERS products there is only one chirp annotated per product.

The contents of each chirp update (each update is a single ADSR within the ADS) are given Table 5-9.

Table 5-9 Chirp Parameters ADSR

Field #	ADSR Contents	Units	Byte Length	Data Type
1	**Zero Doppler azimuth time in azimuth at which estimate applies**	MJD	12	mjd
2	**Attachment Flag (always set to zero for this ADSR)**	-	1	uc
3	**Beam ID** SS1, SS2, SS3, SS4, or SS5 for WS and GM images. Set to NSØ for AP, IM, and WV images.	ascii	3	3*uc
4	**Tx/Rx polarisation** H/H, H/V, V/V, or V/H Always set to V/V for ERS	ascii	3	3*uc
5	**3-dB pulse width of chirp replica cross-correlation function between reconstructed chirp and nominal chirp**	samples	4	fl
6	**First side lobe level of chirp replica cross-correlation function between reconstructed chirp and nominal chirp**	dB	4	fl
7	**ISLR of chirp replica cross-correlation function between reconstructed chirp and nominal chirp**	dB	4	fl
8	**Peak location of cross-correlation function between reconstructed chirp and nominal chirp**	samples	4	fl
9	**Reconstructed chirp power**	dB	4	fl

Field #	ADSR Contents	Units	Byte Length	Data Type	
10	**Equivalent chirp power**	dB	4	fl	
11	**Reconstructed chirp exceeds quality thresholds** 0 = reconstructed chirp does not meet quality thresholds, chirp is invalid 1 = reconstructed chirp does meet quality thresholds		1	uc	
12	**Reference chirp power**	dB	4	fl	
13	**Normalisation source** REPLICA REFØØØØ EQVØØØØ or NONEØØØ	ascii	7	7*uc	
14	**Spare**	-	4	4*uc	
	Calibration pulse Reconstruction Information				
15	**The following 4 parameters form a structure which is repeated 32 times (once for each row). Each repetition consists of a total of 11 measurements of 4 different types as described below. The row order is row 1 to row 32.**		1408		
	Max of Cal pulses 1, 2, and 3 amplitude Not applicable for ERS: always set to 0	-	12	3*fl	*
	Average of Cal pulse 1, 2, and 3 amplitude over the 3 dB on either side of the max amplitude Not applicable for ERS: always set to 0	-	12	3*fl	*
	Average of Cal pulse 1A over the sample window Not applicable for ERS: always set to 0	-	4	fl	*
	Extracted phase for calibration pulse 1, 1A, 2, and 3 Not applicable for ERS: always set to 0	degrees	16	4*fl	*
17	**Spare**	-	16	16*uc	
TOTAL			1483		

5.2.1.9.6 Antenna Elevation Pattern ADS

There are two Antenna Elevation Pattern ADSs. The first contains information pertaining to MDS 1 and the second contains information pertaining to MDS 2. The format of each ADS is identical, however the values may differ as each describes a separate MDS.

The antenna elevation pattern values are updated several times along the azimuth direction. Each update is time stamped with the zero Doppler time to which the update applies. The values continue to apply until a new update is made, and new values added to the ADS with a new time stamp. The contents of each update (each update is a single

ADSR within the ADS) are shown in Table 5-10. This ADS is not included for IM and AP SLC products where the antenna elevation pattern is not applied. It is included for WS SLC products, as for those product the antenna elevation pattern may be applied.

Table 5-10 Antenna Elevation Pattern ADSR

Field #	ADSR Contents	Units	Byte Length	Data Type
1	**Zero Doppler azimuth time at which pattern applies**	MJD	12	mjd
2	**Attachment Flag (always set to zero for this ADSR)**	-	1	uc
3	**Beam ID to which pattern applies SS1 to SS5 or NSØ** Not applicable for ERS: always set to NSØ	ascii	3	3*uc *
4	**The following fields each contain 11 values spaced evenly across the image:**		132	132
	2 way slant range times	ns	44	11*fl
	Corresponding elevation angles	degrees	44	11*fl
	Corresponding two-way antenna elevation pattern values	dB	44	11*fl
5	**Spare**	-	14	14*uc
TOTAL			162	

5.2.1.9.7 Geolocation Grid ADS (or LADS)

The Geolocation Grid is a table which lists the slant range time, incidence angle, and geodetic latitude and longitude positions at various range/azimuth positions within the image. The location of each tie point (or grid point) in the image is specified by a line and sample co-ordinate system. Tie point locations in azimuth are specified using the Zero Doppler Time stamp found at the start of each range line in the MDS. The location in range is specified by the number of range samples. Tie points must be placed at points corresponding to an integer number of range samples, and tie points must be located at least the following 3 points within those reported: the first range sample of the range line, the mid swath range sample, and the last range sample of the range line.

For Geocoded products, the Zero Doppler Time stamp does not apply. Therefore, it is set to zero, and only the range line number is used to index the grid entries.

The grid spacing in azimuth defines the granule size of the ASAR product. That is, a grid line provides tie points for the first line and last line of a granule. There will be 11 grid updates in range per ADSR. In azimuth, a new ADSR will be added to the ADS nominally every:

- 10 km in azimuth for IM and AP;
- 40 km in azimuth for WS and GM.

For WS SLC products, the grid described by each ADSR applies to a single burst within a sub swath, and a new ADSR will be added to the ADS for every Nth burst within each sub swath. Since for WS SLC products there are separate ADSRs for each beam, these ADSRs are ordered according to their time stamps. If the time stamps of several ADSRs are identical, the ADSRs are ordered by beam number from SS1 to SS5.

The contents of a Geolocation Grid ADSR are shown in Table 5-11.

Table 5-11 Geolocation Grid ADSR

Field #	ADSR Contents	Units	Byte Length	Data Type
1	**Zero Doppler Time in azimuth of first line of the granule** Gives azimuth location of grid line for first line of the granule	MJD	12	mjd
2	**Attachment Flag (set to 1 if all MDSRs for this granule are set to zero, set to 0 otherwise)**	-	1	uc
3	**Range line number corresponding to the first line of the granule within the slice** Warning: 1) This is not always the record number of the corresponding image MDSR. Use the number of lines per granule field to determine the image MDS record corresponding to each record of tie points. 2) For a stripline product, which may consist of multiple slices in a single MDS, this number is reset to 1 at the beginning of each slice. 3) For child products, which are subsets of a full product, the range line number in the first record may not be 1.	-	4	ul
4	**Number of output lines in this granule**	lines	4	ul
5	**Subsatellite track heading (relative to North) for first line of granule** This is the heading on the ground (includes Earth rotation)	deg.	4	fl
6	**The following fields each contain 11 values corresponding to 11 tie points in the first line of the granule:**		220	
	Range sample number Gives the range location of the grid points. First range sample is 1, last is M. Zero filled samples are included.	-	44	11*ul
	2 way slant range time to range sample	ns	44	11*fl
	Incidence Angle at range sample	deg.	44	11*fl
	geodetic latitude (positive north)	$1x10^{-6}$ deg.	44	11*sl
	geodetic longitude (positive east)	10^{-6} deg.	44	11*sl
7	**Spare**	-	22	22*uc
8	**Zero doppler time for the last line of the granule**	MJD	12	mjd

Field #	ADSR Contents	Units	Byte Length	Data Type
9	**The following fields each contain 11 values corresponding to 11 tie points in the last line of the granule:**		220	
	Range sample number Gives the range location of the first grid point. First range sample is 1, last is M	-	44	11*ul
	2 way slant range time to range sample	ns	44	11*fl
	Incidence Angle at range sample	deg.	44	11*fl
	geodetic latitude (positive north)	$1x10^{-6}$ deg.	44	11*sl
	geodetic longitude (positive east)	$1x10^{-6}$ deg.	44	11*sl
10	**Swath number** **IS1, IS2, IS3, IS4, IS5, IS6, or IS7 for IM, WV and AP modes.** **SS1, SS2, SS3, SS4 or SS5 for WSS products.** **WS**Ø for WS and GM modes where only one ADSR for the whole scene is provided.	ascii	3	3*uc
11	**Spare**	-	19	19*uc
	TOTAL		521	

5.2.1.9.8 Map Projection GADS

If geocoding of the data set is performed (i.e., data is resampled to a map projection), a GADS containing all necessary information to describe the map projection used is included. Geocoding is only performed for stand-alone products. The PF-ASAR/ERS processor supports 6 map projections:

1. Universal Transverse Mercator
2. Universal Polar Stereographic
3. Lambert Conformal Conic
4. Transverse Mercator
5. Mercator
6. Polar Stereographic

The contents of the Map Projection Parameters GADS is shown in Table 5-12.

Table 5-12 Map Projection Parameters GADS

Field #	GADS Contents	Units	Byte Length	Data Type
	General Information			
1	**Map projection descriptor** one of: UNIVERSAL_TRANSVERSE_MERCATORØØØ UNIVERSAL_POLAR_STEREOGRAPHICØØØ LAMBERT_CONFORMAL_CONICØØØØØØØØØ TRANSVERSE_MERCATORØØØØØØØØØØØØØ MERCATORØØØØØØØØØØØØØØØØØØØØØØØØ POLAR_STEREOGRAPHICØØØØØØØØØØØØØ	ascii	32	32*uc
2	**Number of samples per line**	-	4	ul
3	**Number of lines**	-	4	ul
4	**Nominal inter-sample distance**	m	4	fl
5	**Nominal inter-line distance**	m	4	fl
6	**Output scene centre orientation**	deg	4	fl
7	**Spare**	-	40	40*uc
8	**Platform heading, degrees**	deg	4	fl
	Reference Ellipsoid Parameters			
9	**Reference ellipsoid name**	ascii	32	32*uc
10	**Ellipsoid semi-major axis, metres**	m	4	fl
11	**Ellipsoid semi-minor axis, metres**	m	4	fl
12	**Datum shift parameter referenced to Greenwich: dx (metres)**	m	4	fl
13	**Datum shift parameter perpendicular to Greenwich: dy (metres)**	m	4	fl
14	**Datum shift parameter direction of the rotation axis: dz (metres)**	m	4	fl
15	**Average scene height above ellipsoid used for geocoding**	m	4	fl
16	**Spare**	-	12	12*uc
	Map Projection Designator			
17	**Map projection alphanumeric description**	ascii	32	32*uc
	UTM Projection (first default)			
18	**UTM descriptor** UNIVERSAL_TRANSVERSE_MERCATORØØØ	ascii	32	32*uc
19	**UTM zone signature**	ascii	4	4*uc
20	**Map origin, false easting**	m	4	fl
21	**Map origin, false northing**	m	4	fl
22	**Projection centre longitude, deg**	$1x10^{-6}$ deg	4	sl

Field #	GADS Contents	Units	Byte Length	Data Type
23	**Projection centre latitude, deg**	$1x10^{-6}$ deg	4	sl
24	**1st standard parallel, deg**	deg	4	fl
25	**2nd standard parallel, deg**	deg	4	fl
26	**Scale factor**	-	4	fl
	UPS projection (second default)			
27	**UPS descriptor**	ascii	32	32*uc
28	**Projection centre longitude, deg**	$1x10^{-6}$ deg	4	sl
29	**Projection centre latitude, deg**	$1x10^{-6}$ deg	4	sl
30	**Scale factor**	-	4	fl
	National Systems Projection (any others)			
31	**NSP descriptor**	ascii	32	32*uc
32	**Map origin, false easting**	m	4	fl
33	**Map origin, false northing**	m	4	fl
34	**Projection centre longitude, deg**	$1x10^{-6}$ deg	4	sl
35	**Projection centre latitude, deg**	$1x10^{-6}$ deg	4	sl
36	**Standard parallels parameters:**		16	
	Standard parallel1, deg Latitude of first standard parallel (for Lambert Conformal conic projection only otherwise 0)	deg	4	fl
	Standard parallel2, deg Latitude of second standard parallel (for Lambert Conformal conic projection only, otherwise 0)	deg	4	fl
	Spare	-	8	8*uc
37	**Central Meridian parameters:**		12	
	Central meridian1, deg Longitude of the central meridian or Longitude down below pole of map for Polar Sterographic	deg	4	fl
	Spare	-	8	8*uc
38	**Projection dependent parameters:**		16	
	Projection dependent1 Scale factor at central meridian (for Transverse Mercator Projection, otherwise 0)	-	4	fl
	Spare	-	12	12*uc

Field #	GADS Contents	Units	Byte Length	Data Type
	Positioning Information			
39	**Positioning Information in meters:**		32	
	Top left corner northing, meters;	m	4	fl
	Top left corner easting, meters;	m	4	fl
	Top right corner northing, meters;	m	4	fl
	Top right corner easting, meters;	m	4	fl
	Bottom right corner northing, meters;	m	4	fl
	Bottom right corner easting, meters;	m	4	fl
	Bottom left corner northing, meters;	m	4	fl
	Bottom left corner easting, meters;	m	4	fl
40	**Positioning Information in degrees:**		32	
	Top left corner latitude	$1x10^{-6}$ deg	4	sl
	Top left corner longitude	$1x10^{-6}$ deg	4	sl
	Top right corner latitude	$1x10^{-6}$ deg	4	sl
	Top right corner longitude	$1x10^{-6}$ deg	4	sl
	Bottom right corner latitude	$1x10^{-6}$ deg	4	sl
	Bottom right corner longitude	$1x10^{-6}$ deg	4	sl
	Bottom left corner latitude	$1x10^{-6}$ deg	4	sl
	Bottom left corner longitude	$1x10^{-6}$ deg	4	sl
41	**Spare**	-	32	32*uc
	Co-efficients for image to map conversion			
42	**8 coefficients to convert a line(L) and sample (S) position to the map projection frame of reference, say (E,N)** **E = A11 + A12*L + A13 *S + A14 *L*S** **N = A21 + A22*L + A23 *S + A24 *L*S**	-	32	8*fl
	Co-efficients for map to image conversion			
43	**8 coefficients to convert from the map projection (E,N) to line (L) and sample(S) position in the image** **L = B11 + B12*E + B13 *N + B14 *E*N** **S = B21 + B22*E + B23 *N + B24 *E*N**	-	32	8*fl
44	**Spare**	-	35	35*uc
	TOTAL		591	

5.2.1.9.9 Doppler Centroid Grid ADS

The Doppler Centroid Grid is a table which lists the slant range time and fine Doppler frequencies at various range/azimuth positions within the image.

There are typically 20 tie points equally spaced per sub swath, with different spacing within each sub swath. Therefore, for ScanSAR products, there will be typically 100 tie points in range per ADSR, distributed across the full range extent. In azimuth, a new ADSR will be added to the ADS every N seconds, where N is typically 1 second.

The location in range is specified by the slant range time and the location in azimuth is specified by the zero Doppler azimuth time.

The presence of this ADS for each product type is configurable. It will be included by default only for WS products. It is not currently available for ERS products.

The contents of the Doppler Centroid Grid are shown in Table 5-13.

Table 5-13 Doppler Centroid Grid ADSR

Field #	ADSR Contents	Units	Byte Length	Data Type
1	**Zero Doppler azimuth time at which estimate applies**	MJD	12	mjd
2	**Attachment Flag (always set to zero for this ADSR)**	-	1	uc
3	**The following fields each contain 100 values across the image**		800	
	2 way slant range times This time covers from SS1 to SS4 and there is therefore an overlap between consecutive sub-swaths	ns	400	100*fl
	Fine Doppler Centroid frequency estimate This is the original estimated Doppler centroid frequency, before and polynomial fitting is applied.	Hz	400	100*fl
8	**Spare**	-	400	400*uc
	TOTAL		1213	

5.2.1.9.10 Measurement Data Set

The MDS consists of several MDSRs. Each MDSR contains the processed SAR data for one range line. The number of MDSRs within a given product depends on the number of range lines contained within the data set. The length of each MDSR depends on the product, the swath, and the data format used to represent the samples.

Each MDSR consists of a small header, followed by the processed SAR data. Note that for the Geocoded products there is no correlation between the MDSR and zero Doppler time, so the time entry is set to zeros. Zero Doppler times in the ADSs of the geocoded product refer to those of the intermediate image created before geocoding. For detected images the SAR data consists of real valued samples. For Single-Look Complex images, however, the samples are complex and arranged in real, imaginary complex pairs.

Table 5-14 Measurement Data Set Record

Field #	MDSR Contents	Units	Byte Length	Data Type
1	**Zero Doppler Time in azimuth** MJD format	MJD	12	mjd
2	**Quality Indicator** For non-WSS products, this field is a signed character, where: Set to -1 if all entries in MDSR are zero Set to zero if the MDSR contains imagery For WSS products, this field is an unsigned character, where: Set to 255 if all entries in MDSR are zero Set to 0-254, which indicates the number of zero samples to the first valid sample in the MDSR imagery	-	1	sc or uc
3	**Range line number** Numbered sequentially, for each product (or slice) first range line in MDS is 1 Warning: 1) For a stripline product, which may consist of multiple slices in a single MDS, this number is reset to 1 at the beginning of each slice. 2) For child products, which are subsets of a full product, the range line number in the first record may not be 1. 3) For WSS products, range lines are numbered according to their position within a processed burst. Each MDS will contain many bursts.	-	4	ul
4	**SAR Processed Data** Either real samples (detected products), or complex samples arranged as real part, imaginary part, real part, imaginary part...	Depends on product type		
	TOTAL		variable	

5.2.2 Stripline Processed Image Products

Stripline image products contain image data for an entire segment, up to a maximum size of 10 minutes per product for IM and AP mode. The Stand-alone PF-ERS or the PGS-ERS concatenates together several sub-images called “slices” that were processes separately on a data set by data set basis in order to form the entire stripline image.

Stripline product formation is further described in the ENVISAT Products Specification (Document R-1).

5.2.2.1 Product Types

5.2.2.1.1 Image Mode Medium Resolution Image

This ERS product is generated from the Image Mode Level 0 Product. The product is processed to approximately 150 m resolution and contains radiometric resolution good enough for ice applications.

5.2.2.1.2 Simulated Alternating Polarisation Medium Resolution Image

This product is generated from the Image Mode Level 0 Product. The product is processed to approximately 150 m resolution using the SPECAN algorithm and contains radiometric resolution good enough for ice applications. The product may contain one image or two co-registered images that simulate the polarisation combinations available in ASAR.

5.2.2.2 Input Data

The input for all the on-request products is the Level 0 data and auxiliary data.

5.2.2.3 Auxiliary Data Used

The same data used for On-request products is required for the production of stripline products. Auxiliary data formats are described in Section 5.4.

5.2.2.4 Processing Performed

This is not the applicable document for ASAR and ERS algorithms. The following is intended only as a high level summary of the processing performed.

The same processing steps are applied to stripline products as for stand-alone products. In addition a final concatenation step and MPH/SPH update step is performed by the PF-ASAR/ERS or PGS-ERS. The following image formation algorithms are used.

Table 5-15 Image Formation Algorithms for Stripline Products

Product ID	Algorithm Applied
SAR_IMM_1P	SPECAN
SAR_APM_1P	SPECAN

5.2.2.5 Product Structure

The product structure and contents for stripline products is identical to the on-request products. The stripline image product structure is shown in Figure 5-2. For a detailed description of the contents of the data sets refer to the sections for stand-alone products (5.2.1.6 to 5.2.1.9).

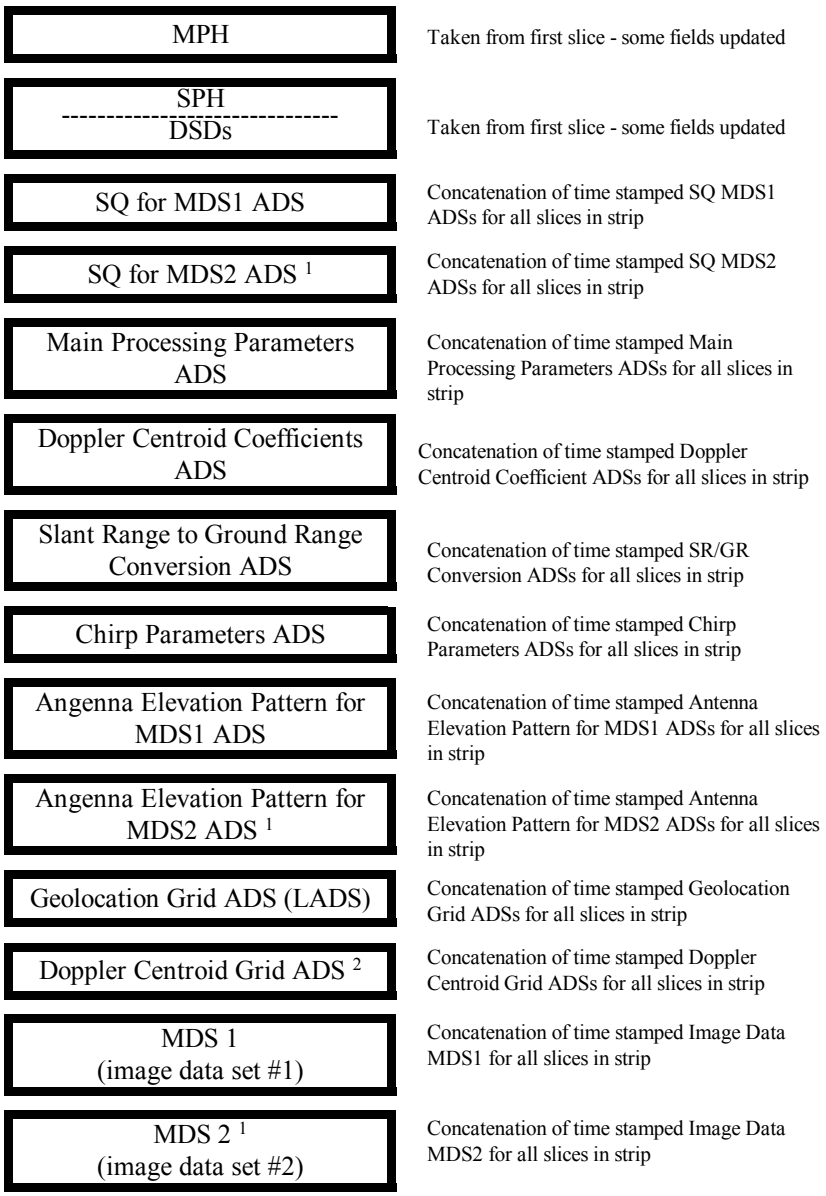

Figure 5-2 Stripline Image Product Structure

5.2.3 Browse Products

Browse products are a special form of stripline products. Browse products are also created as individual slices and then concatenated together by the Stand-Alone PF-ERS and PGS-ERS. However, browse products are intended only as a user aid when ordering data. Thus, many of the ADSs pertaining to detailed processing records may be discarded for the browse product.

5.2.3.1 Product Types

5.2.3.1.1 Image Mode Browse Image

This low resolution product will be produced systematically together with the Image Mode Medium Resolution Product. The image is intended for browse purposes only (pixel spacing is approximately 225 m). This product is suitable for provision via electronic link in near real time.

5.2.3.1.2 Simulated Alternating Polarisation Browse Image

This low resolution product will be produced systematically together with the Simulated ERS AP Medium Resolution Product. The image is intended for browse purposes only (pixel spacing is approximately 225 m). This product is suitable for provision via electronic link in near real time. The product will contain only one of the polarisation options rather than two. The polarisation used will be that of the MDS1 of the APM product.

5.2.3.2 Input Data

Medium resolution images.

5.2.3.3 Auxiliary Data Used

No further auxiliary data is required for the creation of a browse product.

5.2.3.4 Processing Performed

This is not the applicable document for ASAR algorithms. The following is intended only as a high level summary of the processing performed.

The following processing steps are applied after the medium resolution slice has been created:

- block averaging of medium resolution slice
- concatenation of browse slices

5.2.3.5 Product Structure

The structure of the browse product is the same as for the regular stripline products except that some data sets have been removed. The structure of the product is shown in Figure 5-3. For a detailed description of the contents of the data sets refer to the sections for on-request products (5.2.1.6 to 5.2.1.9).

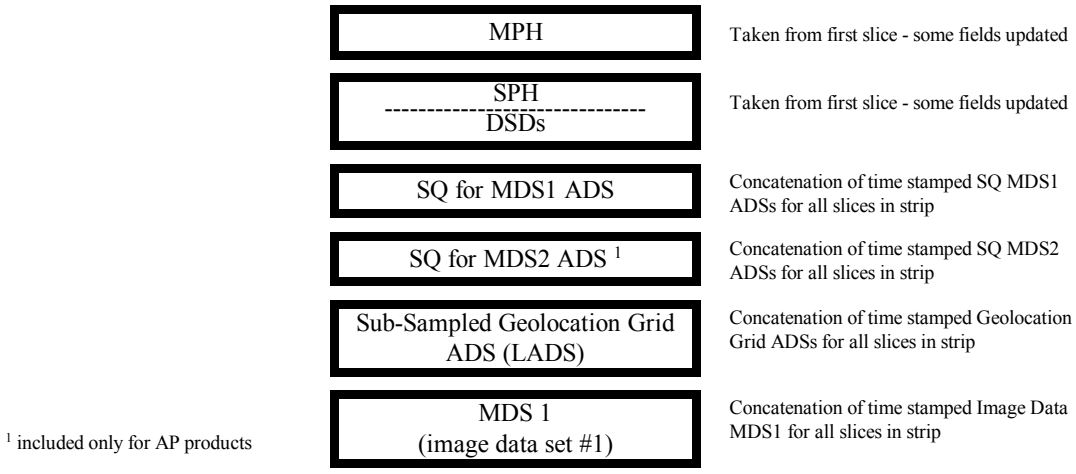

Figure 5-3 Browse Image Product Structure

5.2.3.5.1 Browse SQ ADS

The SQ ADS for the browse product is simply the SQ for the medium resolution image from which the browse was created. No fields are updated or changed during the formation of the browse product.

5.2.3.5.2 Sub-sampled Geolocation Grid ADS

During the formation of the browse product, the Geolocation Grid from the corresponding Medium Resolution Image is reduced approximately by a factor of 10 (i.e., approximately every 10th grid entry is left in the ADS, the rest are discarded. However, the last granule must remain to document the last line of the product.

5.2.3.5.3 Browse MDS

The browse product MDS is a sub-sampled version of the corresponding Medium resolution product.

5.3 ERS Wave Products

Wave Mode products are those products produced from data acquired while the ERS AMI is operating in Wave Mode. During Wave Mode operation, the SAR instrument acquires small measurements called wave cells which are approximately 5 km along track by (up to) 10 km in across track. The wave cells are acquired at intervals of approximately 200 to 300 km. Each wave cell is processed into a small SLC image called an imagette and each imagette is further processed using the cross-spectra methodology to produce the cross spectra of the imagette. In addition, each imagette can be processed to generate the level 2 ocean wave spectra product.

5.3.1 Product Types

5.3.1.1 Wave Mode SLC Imagette and Imagette Cross Spectra

This is the basic Wave Mode product. The product includes up to 400 single look, complex, slant range, imagettes generated from Level 0 data and up to 400 imagette power spectra computed using the cross-spectra methodology. A minimum number of corrections and interpolations are performed. Absolute calibration parameters (when available) shall be provided in the product annotations.

5.3.1.2 Wave Mode Imagette Cross Spectra

This product contains up to 400 cross spectra extracted from the SLC Imagette and Imagette Cross Spectra product. It contains only the cross spectra derived using cross-spectra methodology.

5.3.1.3 Wave Mode Ocean Wave Spectra

This is the highest level Wave Mode product. It is produced from the SLC Imagette product. This is achieved by inverting the cross spectra computed from inter-look processing of the SLC imagettes to derive the directional ocean product ocean wave spectra. Auxiliary ADSs included with the product remain the same as for the Cross Spectra product.

5.3.2 Input Data

For the SLC Image and Cross Spectra product, the input data is the Level 0 Wave Mode product plus auxiliary data. The Cross Spectra product is simply an extraction of the Cross Spectra MDS and all ADSs from the SLC Image and Cross Spectra Product. The Ocean Wave Spectra product is derived directly from the SLC Imagette product (i.e., it is not derived from the Cross Spectra product).

5.3.3 Auxiliary Data Used

The auxiliary data used to create the Wave Mode products is the same as that used to create the on-request SLC Image Mode product (see Section 5.2). Auxiliary data formats are described in Section 5.3. An additional auxiliary data file may be used for the generation of Ocean Wave Level 2 products, and is listed in the following table. The data format for this auxiliary file is described in Volume 16, Section 16.3.6.

Table 5-16 Additional Auxiliary Data for Wave Product Processing

Description	Auxiliary Data ID
ECMWF forecast data file, or	AUX_ECF_AX
ECMWF analysis data file	AUX_ECA_AX

5.3.4 Processing Performed

The processing steps applied to create the SLC imagette are the same as those used to create the on-request SLC Image Mode product (see Section 5.2.1.4). The processing steps required to create the Cross Spectra products include:

- Look extraction;
- Slant range to ground range conversion;
- Cross covariance estimation;
- Azimuth cut-off;
- Cross spectra calculation;
- Cartesian to polar grid transformation;
- Spectral peak parameter extraction.

The processing steps required to create the Ocean Wave Spectra products include:

- Multi-look extraction;

- Cross covariance and cross spectra estimation;
- Azimuth cutoff;
- Fitting non-linear part to the observed data;
- Clutter noise estimation;
- Estimation of the RAR modulation transfer function;
- Retrieval of swell spectrum;
- Cartesian to polar grid transformation;
- Spectral peak parameter estimation.

5.3.4.1 Wave Mode Error Handling

If PF-ASAR/ERS or PGS-ERS is unable to produce an imagette or cross spectra, the following method is used to indicate the error and the location of the error within the product:

- CASE 1: PF-ERS is able to produce the imagette but not the cross / wave spectra:
  - The MDSR containing the cross spectra is given the correct time stamp (corresponding to the first line of the imagette), the Quality Flag is set to -1, and all entries pertaining to the cross spectra are set to zero.
  - Fields in all ADSRs pertaining to the cross/wave spectra are set to zero.
  - The Attachment Flags of the SQ ADSR and the Geolocation ADSR corresponding to the wave cell are set to 1.
  - The SPECTRA_FAILED counter in the SPH is incremented.
- CASE 2: PF-ERS is unable to produce neither the imagette nor the cross / wave spectra:
  - The MDS which was supposed to hold the imagette is still created. It contains only 1 MDSR which consists only of the time stamp corresponding to the estimated location of where the imagette would have been located, a range line number of 1, and the Quality flag set to -1. If it is not possible to determine the approximate time stamp for the MDSR, the time stamp may be set to zeros.
  - The MDSR which was to have held the cross / wave spectra is still produced, but it is zero filled and the Quality Flag set to -1 (as in CASE 1). The time stamp is identical to that used in the single MDSR of the imagette MDS.
  - Information in all ADSRs is set to zeros, and the Attachment flag of each ADSR is set to 1. The time stamp for each ADSR is identical to that of the single MDSR of the imagette MDS.

- The SPECTRA_FAILED and IMAGETTES_FAILED counters in the SPH are incremented.

The rationale for the error handling described above is that:

1. PF-ERS should not fail completely just because one imagette or cross / wave spectra in a series could not be produced;
2. for extraction purposes, the number of MDSs containing imagettes and the number of DSRs in the other data sets must be the same;
3. by setting the MDSRs and ADSRs (if appropriate) to zero, a placeholder is inserted in the product which allows one to identify unambiguously which wave cell failed, in both the WVI product and in further extracted products.

5.3.5 Product Structure

The standard Wave Mode product structure is shown in Figure 5-4.

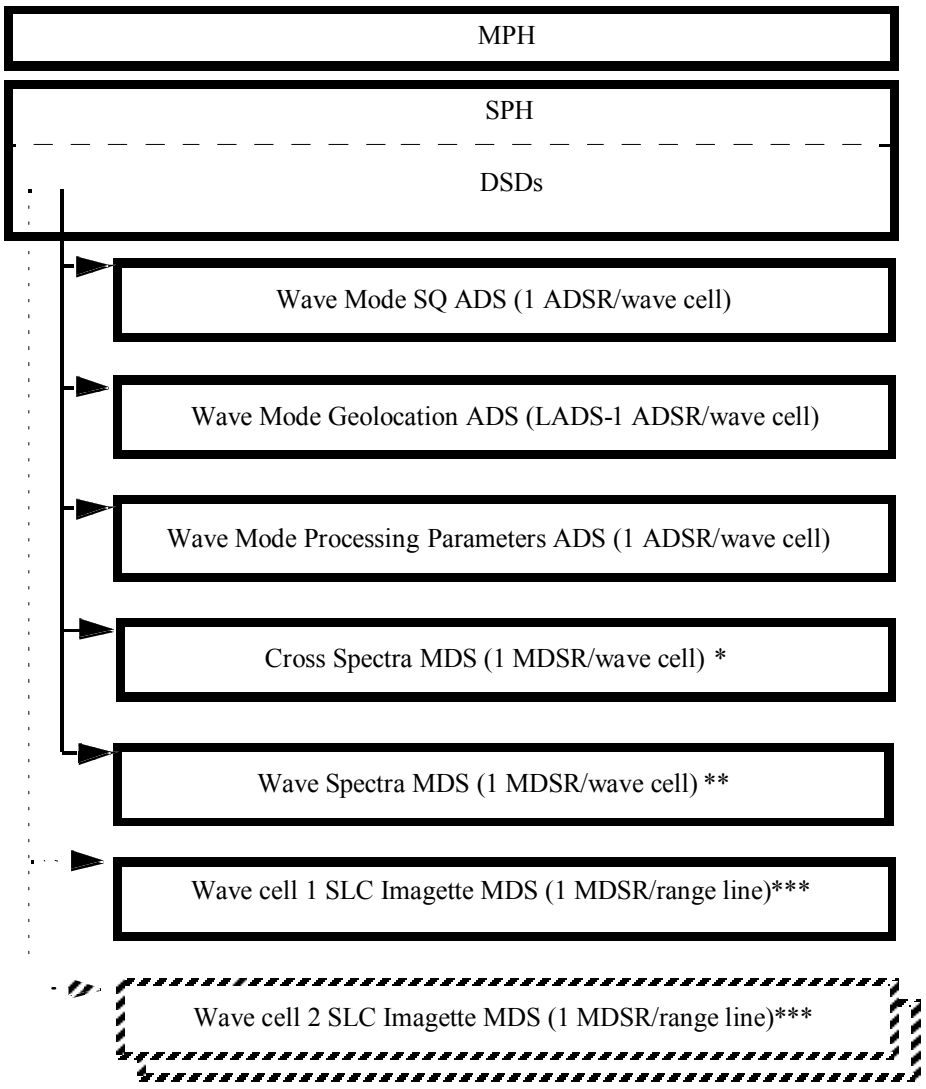

Figure 5-4 Wave Mode Products Structure

5.3.5.1 Main Product Header

The MPH will be the same as described in Section 3.

5.3.5.2 Specific Product Header

The wave mode SPH provides only the information which applies to all wave cells within a product file. The format will be identical for all ERS wave products, except for the DSD sections. The format of the SPH is described below:

Table 5-17 Wave Mode Products SPH Content

Field #	Description	Units	Byte Length	Data Type	
1	**SPH_DESCRIPTOR=**	keyword	15	15*uc	
	quotation mark (“)	-	1	uc	
	SPH Descriptor ASCII string describing the product.	-	28	28*uc	
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
	Product Time Information				
2	**FIRST_CELL_TIME=**	keyword	16	16*uc	
	quotation mark (“)	-	1	uc	
	First Zero Doppler Azimuth time of first line of first imagette UTC Time of first range line in the MDS containing the first imagette used to produce product.	UTC	27	27*uc	
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
3	**LAST_CELL_TIME=**	keyword	15	15*uc	
	quotation mark (“)	-	1	uc	
	Last Zero Doppler Azimuth time of first line of last imagette UTC Time of the first range line in the MDS containing the last imagette used to produce this product.	UTC	27	27*uc	
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
4	**Spare (blank characters (Ø))**	-	50	50*uc	
	newline character	terminator	1	uc	
	Imagette Information				
5	**SWATH_1=**	keyword	8	8*uc	
	quotation mark (“)	-	1	uc	
	First sub-cycle swath number IS1, IS2, IS3, IS4, IS5, IS6, or IS7. Set to IS2 for ERS data.	-	3	3*uc	*
	quotation mark (“)	-	1	uc	

Field #	Description	Units	Byte Length	Data Type	
	newline character	terminator	1	uc	
6	**SWATH_2=**	keyword	8	8*uc	
	quotation mark (“)	-	1	uc	
	Second sub-cycle swath number IS1, IS2, IS3, IS4, IS5, IS6, or IS7. Set to IS2 for ERS data.	-	3	3*uc	*
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
7	**PASS=**	keyword	5	5*uc	
	quotation mark (“)	-	1	uc	
	Ascending or descending orbit designator (defined at start of time pass) ASCENDINGØ, DESCENDING or FULLØORBIT	-	10	10*uc	
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
8	**TX_RX_POLAR=**	keyword	12	12*uc	
	quotation mark (“)	-	1	uc	
	Transmitter / Receiver Polarisation for MDS 1 H/V or H/H or V/H or V/V Set to V/V for ERS data.	-	3	3*uc	*
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
9	**COMPRESSION=**	keyword	12	12*uc	
	quotation mark (“)	-	1	uc	
	Compression algorithm used on echo data on-board the satellite FBAQ2, FBAQ3, FBAQ4 (FBAQ: 8 bits reduced to 2, 3, and 4 bits respectively) others: S&MØ, and NONEØ Set to NONE for ERS data.	-	5	5*uc	*
	quotation mark (“)	-	1	uc	
	newline character	terminator	1	uc	
10	**Spare (blank characters)**	-	50	50*uc	
	newline character	terminator	1	uc	
	Spectra Size Information *(NOTE: these fields do not pertain to the SLC Imagette in any way)*				

Field #	Description	Units	Byte Length	Data Type
11	**NUM_DIR_BINS=**	keyword	13	13*uc
	Number of Directional Bins	-	4	Ac
	newline character	terminator	1	uc
12	**NUM_WL_BINS=**	keyword	12	12*uc
	Number of Wavelength Bins	-	4	Ac
	newline character	terminator	1	uc
13	**FIRST_DIR_BIN=**	keyword	14	14*uc
	First Directional Bin	degrees	15	Afl
	<degrees>	units	9	9*uc
	newline character	terminator	1	uc
14	**DIR_BIN_STEP=**	keyword	13	13*uc
	Directional Bin Step	degrees	15	Afl
	<degrees>	units	9	9*uc
	newline character	terminator	1	uc
15	**FIRST_WL_BIN=**	keyword	13	13*uc
	First Wavelength Bin (Longest Wavelength)	m	15	Afl
	<m>	units	3	3*uc
	newline character	terminator	1	uc
16	**LAST_WL_BIN=**	keyword	12	12*uc
	Last Wavelength Bin (Shortest Wavelength) (NOTE: Logarithmic steps)	m	15	Afl
	<m>	units	3	3*uc
	newline character	terminator	1	uc
17	**Spare (blank characters (Ø))**	-	50	50*uc
	newline character	terminator	1	uc
	Spectra Processing Information *(NOTE: these fields do not pertain to the SLC Imagette in any way)*			
18	**LOOK_SEP=**	keyword	9	9*uc
	Look Separation period in seconds For the Ocean Wave Spectra product, this is the time period between the first and last looks	s	15	Afl
	<s>	units	3	3*uc
	newline character	terminator	1	uc
19	**LOOK_BW=**	keyword	8	8*uc
	Look bandwidth used during spectra processing	Hz	15	Afl
	<Hz>	units	4	4*uc
	newline character	terminator	1	uc

Field #	Description	Units	Byte Length	Data Type
20	**FILTER_ORDER=**	keyword	13	13*uc
	Order of Butterworth filter used during cross-spectra processing If set to zero, a Gaussian filter was applied	-	4	Ac
	newline character	terminator	1	uc
21	**TREND_REMOVAL=**	keyword	14	14*uc
	Trend Removal applied during cross spectra computation 0 = trend removal not applied 1 = trend removal applied	ascii flag	1	uc
	newline character	terminator	1	uc
22	**ANTENNA_CORR=**	keyword	13	13*uc
	Antenna gain correction applied during cross spectra computation (note: this field does not pertain to the SLC imagette. Antenna Elevation gain correction is never applied to the SLC imagette) 0 = not applied 1 = applied	ascii flag	1	uc
	newline character	terminator	1	uc
23	**SR_GR=**	keyword	6	6*uc
	Slant range to ground range conversion applied during cross spectra computation (note: this field does not pertain to the SLC imagette. Slant range to ground range conversion is never applied to the SLC imagette) 0 = not applied 1 = applied	ascii flag	1	uc
	newline character	terminator	1	uc
24	**CC_WINDOW=**	keyword	10	10*uc
	Cross covariance window function was applied during cross spectra computation 0 = not applied 1 = applied	ascii flag	1	uc
	newline character	terminator	1	uc
25	**Spare (blank characters (Ø))**	-	29	29*uc
	newline character	terminator	1	uc
26	**NUM_LOOK_PAIRS=**	keyword	15	15*uc
	Number of look pairs in cross spectrum processing	-	4	Ac
	newline character	terminator	1	uc

Field #	Description	Units	Byte Length	Data Type
27	**CC_RANGE_BINS=**	keyword	14	14*uc
	Range bins in Cross covariance estimation	-	11	Al
	newline character	terminator	1	uc
28	**CC_AZIMUTH_BINS=**	keyword	16	16*uc
	Azimuth bins in Cross covariance estimation	-	11	Al
	newline character	terminator	1	uc
29	**CC_HALF_WIDTH=**	keyword	14	14*uc
	Half-width of the cross-covariance window function	m	15	Afl
	<m>	units	3	3*uc
	newline character	terminator	1	uc
	Number of imagettes and spectra			
30	**IMAGETTES_FAILED=**	keyword	17	17*uc
	Number of imagettes PF-ERS failed to produce in this product	-	4	Ac
	newline character	terminator	1	uc
31	**SPECTRA_FAILED=**	keyword	15	15*uc
	Number of cross spectra or ocean wave spectra PF-ERS failed to produce in this product	-	4	Ac
	newline character	terminator	1	uc
32	**IMAGETTES_MADE=**	keyword	15	15*uc
	Number of imagettes successfully produced by PF-ERS in this product	-	4	Ac
	newline character	terminator	1	uc
33	**SPECTRA_MADE=**	keyword	13	13*uc
	Number of cross spectra or ocean wave spectra successfully produced by PF-ERS in this product	-	4	Ac
	newline character	terminator	1	uc
34	**Spare (blank characters (Ø))**	-	9	9*uc
	newline character	terminator	1	uc
	Data Set Descriptors for referenced filesa			
35	**DSD referencing the Level 0 product from which this product was created**	-	280	dsd
36	**DSD referencing PF-ERS Processor Configuration file** (contains software parameters used by the processor and threshold values for PCD information)	-	280	dsd
37	**DSD referencing Instrument Characterization file used** Contains LUTs for ADC and data decompression, antenna elevation patterns, and other static instrument characteristics	-	280	dsd

Field #	Description	Units	Byte Length	Data Type
38	**DSD referencing External Characterization file used** Not used by PF-ERS since the contents of this file are not applicable for ERS.	-	280	dsd *
39	**DSD referencing External Calibration file used**	-	280	dsd
40	**DSD referencing the Orbit State Vectors file used**	-	280	dsd
41	**DSD referencing the ECMWF file used**	-	280	dsd
	Data Set Descriptors for Data included with the product			
42	**DSD for SQ ADS**	-	280	dsd
43	**DSD Geolocation ADS (LADS)**	-	280	dsd
44	**DSD for Processing Parameters ADS**	-	280	dsd
45	**DSD for the Cross Spectra or Ocean Wave Spectra MDS**	-	280	dsd
46	**DSD for SLC Imagettes** There are up to 400 DSDs.The actual number is determined at run time and can be derived as the sum of Fields 32 and 30 above (i.e., the sum of Imagettes_Made and Imagettes_Failed respectively). Each DSD describes one MDS. Each MDS contains 1 imagette. These DSDs are included only for the WVI product.	-	N*280 where N is an integer up to 400	N*dsd
	TOTAL **For WVS and WVW products:** **For WVI product:**	 **3981** **up to max of 115981**		

The SAR_WVI product SPH contains up to a maximum of 411 DSDs. The actual number of SLC Imagette DSDs is determined at run time and can be derived from the SPH as the sum of Fields 32 and 30 (i.e. as the sum of the number of Imagettes_Made and the number of Imagettes Failed respectively).

Note that the SLC Imagette MDS size and number of MDSRs may differ from cell to cell.

Fields 15 and 16 of the SPH give the wavelengths, λ_0 and λ_{N_k-1}, of the first and last wavelength bins. The formula for reconstructing the wavelengths, , for each wavelength bin, m, from these first and last values is as follows:

$$\lambda_m = \frac{\lambda_0}{\left(\frac{\lambda_0}{\lambda_{N_k-1}}\right)^{\frac{m}{N_k-1}}} \qquad \text{for} \qquad m \in [0, N_k - 1]$$

5.3.5.3 Data Set Names

The following Data Set Names may appear in the Wave Product SPH Data Set Descriptors:

Table 5-18 Wave Products Data Set Descriptor Names

Data Set Type	Data Set Name
DSD referencing the Level 0 product from which this product was created	"LEVEL 0 PRODUCT"
DSD referencing PF-ASAR Processor Configuration file	"ASAR PROCESSOR CONFIG"
DSD referencing Instrument Characterization file used	"INSTRUMENT CHARACTERIZATION"
DSD referencing External Characterization file used	"EXTERNAL CHARACTERIZATION"
DSD referencing External Calibration file used	"EXTERNAL CALIBRATION"
DSD referencing the Orbit State Vectors file used	"ORBIT STATE VECTOR 1"
DSD referencing the ECMWF file used	"ECMWF"
Wave Mode SQ ADS	"SQ ADS"
Wave Mode Geolocation ADS (LADS)	"GEOLOCATION ADS"
Wave Mode Processing Parameters ADS	"PROCESSING PARAMS ADS"
Cross Spectra MDS	"CROSS SPECTRA MDS"
Ocean Wave Spectra MDS	"OCEAN WAVE SPECTRA MDS"
Wave Cell SLC Imagette MDS	"SLC IMAGETTE MDS XXX" where XXX is a counter value from 000 to 999 indicating the cell number corresponding to the given imagette

5.3.5.4 Data Sets

The data sets which make up the ERS Wave product structure are defined in the following sections. Data Sets are of mixed-binary format. ASCII strings may be included, but are not contained within quotes like for the MPH and SPH.

5.3.5.4.1 Wave Mode SQ ADS

There is one Wave Mode SQ ADSR per wave cell. The ADSR contains information pertaining to both the imagette and the spectrum. This consists of the image SQ information previously defined in Section 5.2.1.9.1, plus new information pertaining to the cross spectra. The contents and format of the ADSR are shown below.

Table 5-19 Wave Mode SQ ADSR

Field #	ADSR Contents	Units	Byte Length	Data Type
	SQ pertaining to the Imagette:			
1-39	**Exact contents of the Image Product SQ ADSR (see Table 5-5).** Note: the attachment flag is set to 1 if PF-ERS was unable to produce an imagette for the wave cell.	-	170	-
	SQ pertaining to the Spectra:			
40	**Land Flag** 0 = no land in imagette 1 = land in imagette	flag	1	uc
41	**Look image statistics confidence parameter flag** 1 = The ratio of the standard deviation to the mean of the first look image is outside the range given by a minimum and a maximum threshold. 0 =otherwise	flag	1	uc
42	**Inter-look confidence statistics confidence parameter flag** 1 = The normalised deviation of the two inter-look sub-images is greater than a maximum threshold. 0 = otherwise	flag	1	uc
43	**Azimuth cut-off convergence measure flag** 1 = The normalised RMS error between the fitted co-variance profile is greater than a maximum threshold. 0 = otherwise	flag	1	uc
44	**Azimuth cut-off Iteration count overflow flag** 1 = The Azimuth cut-off fit did not converge within a minimum number of iterations. 0 = otherwise	flag	1	uc
45	**Phase information confidence measure flag** 1 = The imaginary spectral peak is less than a minimum threshold, or the zero lag shift is greater than a minimum threshold. 0 = otherwise	flag	1	uc
46	**Spare**	-	4	4*uc
47	**Look image statistics confidence parameter thresholds (minimum and maximum)**	-	8	2*fl

Field #	ADSR Contents	Units	Byte Length	Data Type
48	**Inter-look confidence statistics confidence parameter threshold**	-	4	fl
49	**Azimuth cut-off convergence measure threshold**	-	4	fl
50	**Azimuth cut-off Iteration count overflow threshold**	-	4	ul
51	**Phase information confidence measure threshold for the spectral peak**	-	4	fl
52	**Phase information confidence measure threshold for cross covariance peak offset**	m	4	fl
53	**Spare**	-	12	12*uc
54	**Look image statistics confidence parameter** The ratio of the standard deviation to the mean of the first look image	-	4	fl
55	**Inter-look confidence statistics confidence parameter** The normalised deviation of the two inter-look sub-images	-	4	fl
56	**Azimuth cut-off convergence measure** The normalised RMS error between the fitted co-variance profile	-	4	fl
57	**Phase information confidence measure for the spectral peak** The imaginary spectral peak	-	4	fl
58	**Phase information confidence measure for cross covariance peak offset**	m	4	fl
59	**Spare**	-	12	12*uc
TOTAL			252	

5.3.5.4.2 Wave Mode Geolocation Grid ADS (or LADS)

Due to the reduced size of the imagettes compared to normal ERS images, each Wave Mode Geolocation ADSR contains only the geodetic latitude and longitude of the center point of the imagette. One ADSR is produced for each wave cell.

The center point given in the Geolocation ADSR corresponds to the ground range center point of the wave cell. This will not correspond exactly to the latitude and longitude of the center sample of the SLC imagette (in slant range) but provides a more accurate positioning of the location of the cross spectra center point.

Note that the imagettes do not cover a contiguous region geographically. Thus, Wave Mode Geolocation ADS entries may differ substantially for different imagettes.

5.3.5.4.3 Wave Mode Processing Parameters ADS

The Wave Mode Processing parameters ADS details all the parameters used to create the imagette and other parameters specific to Wave Mode Imagette processing. These consist of those found in the Main Processing Parameters ADS of the Image Products format, plus Doppler Centroid parameters, Chirp Parameters, Antenna Elevation Patterns, Slant Range to Ground Range (SR/GR) parameters, Geolocation Grid Tie points, and parameters specific to Wave Mode. Note that the imagette is an SLC image. Therefore the SR/GR parameters and Antenna Elevation parameters pertain to the cross-spectra creation process, not the imagette itself.

There is one ADSR per wave cell. The format of each ADSR is shown below:

Table 5-20 Wave Mode Processing Parameters ADSR

Field #	Description	Units	Byte Length	Data Type
	PROCESSING PARAMETERS PERTAINING TO THE CREATION OF THE SLC IMAGETTE: ***(the following parameters pertain to the SLC imagette. They are a complete record of the processing parameters and values used during image formation)***			
	Main Processing Parameters			
1-83	**Exact contents of the Image Product Main Processing Parameters ADSR (see Table 5-6).**	-	2009	-
	Doppler Centroid Parameters: (computed at mid-cell)			
84	**2-way slant range time origin (t_0)**	ns	4	fl
856	**Doppler centroid coefficients as a function of slant range time: D0, D1, D2, D3, and D4.** where Doppler Centroid = D0 + D1(t_{SR}-t_0) + D2(t_{SR}-t_0)^2 + D3(t_{SR}-t_0)^3 + D4(t_{SR}-t_0)^4	Hz Hz/s Hz/s^2 Hz/s^3 Hz/s^4	20	5*fl
86	**Doppler Centroid Confidence Measure** Value between 0 and 1, 0 = poorest confidence, 1= highest confidence	-	4	fl
	Doppler Confidence Below Threshold Flag 0 = confidence above threshold, Doppler Centroid calculated from data 1 = confidence below threshold, Doppler Centroid calculated from orbit parameters	-	1	uc
87	**Spare**	-	13	13*uc
	Chirp Parameters:			

Field #	Description	Units	Byte Length	Data Type	
88	**3-dB pulse width of chirp replica cross-correlation function between reconstructed chirp and nominal chirp**	samples	4	fl	
89	**First side lobe level of chirp replica cross-correlation function between reconstructed chirp and nominal chirp**	dB	4	fl	
90	**ISLR of chirp replica cross-correlation function between reconstructed chirp and nominal chirp**	dB	4	fl	
91	**Peak location of cross-correlation function between reconstructed chirp and nominal chirp**	samples	4	fl	
92	**Reconstructed chirp power**	dB	4	fl	
93	**Equivalent chirp power**	dB	4	fl	
94	**Reconstructed chirp exceeds quality thresholds** 0 = reconstructed chirp does not meet quality thresholds, chirp is invalid 1 = reconstructed chirp does meet quality thresholds	-	1	uc	
95	**Reference chirp power**	dB	4	fl	
96	**Normalisation source** REPLICA REFØØØØ EQVØØØØ or NONEØØØØ (if normalisation not applied)	ascii	7	7*uc	
97	**Spare**	-	16	16*uc	
98	**This following 4 parameters form a structure that is repeated 32 times (once for each row). Each repetition consists of a total of 11 measurements of 4 different types as described below.**		1408		
	Max of Cal pulses 1, 2, and 3 amplitude Not applicable for ERS: always set to 0	-	12	3*fl	*
	Average of Cal pulse 1, 2, and 3 amplitude above the predetermined threshold relative to the max amplitude (Nominal threshold is 0.707 of max amplitude) Not applicable for ERS: always set to 0	-	12	3*fl	*
	Average of Cal pulse 1A over the sample window Not applicable for ERS: always set to 0	-	4	fl	*
	Extracted phase for calibration pulse 1, 1A, 2, and 3 Not applicable for ERS: always set to 0	-	16	4*fl	*
99	**Spare**	-	16	16*uc	
	Geolocation Grid:				
100	**Zero Doppler Time at first line of imagette**	mjd	12	mjd	

Field #	Description	Units	Byte Length	Data Type
101	**Tie points of first line for first, mid and last range samples** A Tie point consists of:	-		
	Range sample number Gives the range location of the grid points. First range sample is 1, last is M (includes zero filled samples)	-	12	3*ul
	2 way slant range time to range sample	ns	12	3*fl
	Incidence Angle at range sample	deg.	12	3*fl
	geodetic latitude of range sample (positive north)	10^{-6} deg.	12	3*sl
	geodetic longitude of range sample (positive east)	10^{-6} deg.	12	3*sl
102	**Zero Doppler Time at centre line of imagette**	mjd	12	mjd
103	**Range line number of the center range line**	-	4	ul
104	**Tie points of centre line at first, mid, and last range samples**	-	60	-
105	**Zero Doppler Time at last line of imagette**	mjd	12	mjd
106	**Range line number of the last range line**	-	4	ul
107	**Tie points of last line at first, mid, and last range samples**	-	60	-
	Other Imagette Parameters:			
108	**Wave cell SWST offset** from center of the sub-swath to start of imagette. 208 ns increments	ns	4	fl
109	**Wave cell Ground range bias** from centre of the Sub-Swath to the centre of the imagette (Ground range, km)	km	4	fl
110	**Wave cell Elevation angle bias** from centre of the Sub-Swath elevation to the centre of the imagette (deg)	deg	4	fl
111	**Imagette length in range** (m)	m	4	fl
112	**Imagette length in azimuth** (m)	m	4	fl
113	**Nominal Imagette resolution in slant range** (m)	m	4	fl
114	**Nominal resolution in ground range**	m	4	fl
115	**Nominal Imagette resolution in azimuth** (m)	m	4	fl
116	**Altitude (platform to ellipsoid) in metres** (centre of wave cell)	m	4	fl
117	**Ground Velocity** (m/s) w.r.t moving earth	m/s	4	fl
118	**Range to centre of imagette** (m) from platform to target	m	4	fl
119	**CW signal drift**	-	4	fl
120	**Wave sub-cycle** (1 or 2) of this wave cell	-	2	us

Field #	Description	Units	Byte Length	Data Type
	PROCESSING PARAMETERS PERTAINING TO THE CREATION OF THE CROSS SPECTRA: ***(The following parameters pertain to slant range to ground range conversion and antenna elevation correction. These operations have NOT been applied to the SLC imagette contained within the WVI product. They are applied during the computation of the cross spectra).***			
	SR/GR Parameters:			
121	**Earth Radius at imagette center sample**	m	4	fl
122	**Satellite distance to earth center**	m	4	fl
123	**Distance from satellite to first range pixel in the full SLC image**	m	4	fl
124	**Spare**	-	12	12*uc
	Antenna Elevation Parameters:			
125	**The following fields each contain 11 values spaced evenly across the imagette**			
	2 way slant range times	ns	44	11*fl
	Corresponding elevation angles	deg.	44	11*fl
	Corresponding two-way antenna elevation pattern values	dB	44	11*fl
126	**Spare**	-	14	14*uc
TOTAL			**3959**	

5.3.5.4.4 Cross-Spectrum MDS

This MDS contains the cross spectrum of the imagette. There is one MDSR per wave cell. The format of each MDSR is described below:

Table 5-21 Cross-Spectrum MDSR

Field	Description	Units	Byte Length	Data Type
1	**First Zero Doppler Azimuth time of the wave cell** Time of first range line in the SLC Imagette MDS described by this data set	mjd	12	mjd
2	**Quality Indicator** (set to -1 if all values in MDSR are zero, set to 0 otherwise)	-	1	sc
	Processing Parameters			
3	**Range bin size of the cartesian cross spectrum**	-	4	fl

Field	Description	Units	Byte Length	Data Type
4	**Azimuth bin size of the cartesian cross spectrum**	-	4	fl
5	**Azimuth re-sampling factor in look extraction** (Swath specific)	-	4	fl
	Detected Spectrum Statistics			
6	**Spectrum Total Energy**	-	4	fl
7	**Spectrum Max Energy**	-	4	fl
8	**Direction of Spectrum Max** (deg) on higher resolution grid. Direction is couner-clockwise from satellite track heading	deg	4	fl
9	**Wavelength of Spectrum Max** (m) on higher resolution grid	m	4	fl
10	**Clutter Noise**	-	4	fl
11	**Azimuthal Clutter Cut-off length** (m)	m	4	fl
12	**Number of iterations to compute Azimuthal Clutter Cut-off**	-	4	fl
	Cross Covariance function			
13	**Range offset of peak of cross covariance function** (m)	m	4	fl
14	**Azimuth offset of peak of cross covariance function** (m)	m	4	fl
15	**Range bin size of cross covariance function** (m)	m	4	fl
16	**Azimuth bin size of cross covariance function** (m)	m	4	fl
	Sub-look Statistics			
17	**1st and last Sub-look Image Means**	-	8	2*fl
18	**1st and last Sub-look Image Variance**	-	8	2*fl
19	**1st and last Sub-look Image Skewness**	-	8	2*fl
20	**1st and last Sub-look Image Kurtosis**	-	8	2*fl
21	**1st and last Sub-look de-trend coefficient in range**	-	8	2*fl
22	**1st and last Sub-look de-trend coefficient in azimuth**	-	8	2*fl
	Polar Spectrum scaling			
23	**Min value of Imaginary part of cross spectrum**	-	4	fl
24	**Max value of Imaginary part of cross spectrum**	-	4	fl
25	**Min value of Real part of cross spectrum**	-	4	fl
26	**Max value of Real part of cross spectrum**	-	4	fl
	Additional Statistic fields			
27	**Spare**	-	64	64*uc
	Complex Cross-Spectra			

Field	Description	Units	Byte Length	Data Type
28	**Real part of cross spectra polar grid** Number of bins in wavelength and direction defined in SPH (nominally 24 by 36). However, only 0 to 180 degree of the spectrum need be supplied (24 by 18). Arranged as: 24 wavelength values for [-5,5] deg. sector, 24 values for [5,15] deg. sector, ..., 24 values for [165,175]– deg. sector, in the clounter-clockwise direction. The 24 values for each sector are given in order from longest to shortest wavelength.	-	432	18*24 *uc
29	**Complex part of cross spectra polar grid** Number of bins in wavelength and direction defined in SPH (nominally 24 by 36). However, only 0 to 180 degree of the spectrum need be supplied (24 by 18). Arranged as: 24 wavelength values for [-5,5] deg. sector, 24 values for [5,15] deg. sector, ..., 24 values for [165,175]– deg. sector, in the counter-clockwise direction. The 24 values for each sector are given in order from longest to shortest wavelength.	-	432	18* 24 *uc
TOTAL			**1061**	

The cross spectrum is given in the MDS in complex form on a polar grid. The size of the cross spectrum grid is given in the SPH. Typically this will be 24 by 36 bins in wavelength and direction respectively. As the real part of the polar spectrum is symmetric, and the imaginary part is anti-symmetric, only 0° to 180° need to be given in order to reconstruct the entire spectrum (i.e., only 18 directional bins).

The cross spectrum values shall be stored in an unsigned integer format, each part linearly scaled to the maximum and minimum values of the representation (e.g., 0 to 255). The original maximum and minimum values for each part is reported.

The cross spectrum statistics are derived from a high resolution polar spectrum, prior to encoding for output to the product, or at other intermediate stages of the processing.

The de-trend coefficients may be used to derive long wavelength information in the sub-looks.

If the processor is unable to produce the cross spectra for a given wave cell, the MDSR is time stamped with the time that the cross spectra would have corresponded to, the Quality Flag is set to -1, and the MDSR data fields are all set to zero.

The format of the Wave Mode cross spectrum product is shown in Figure 5-5.

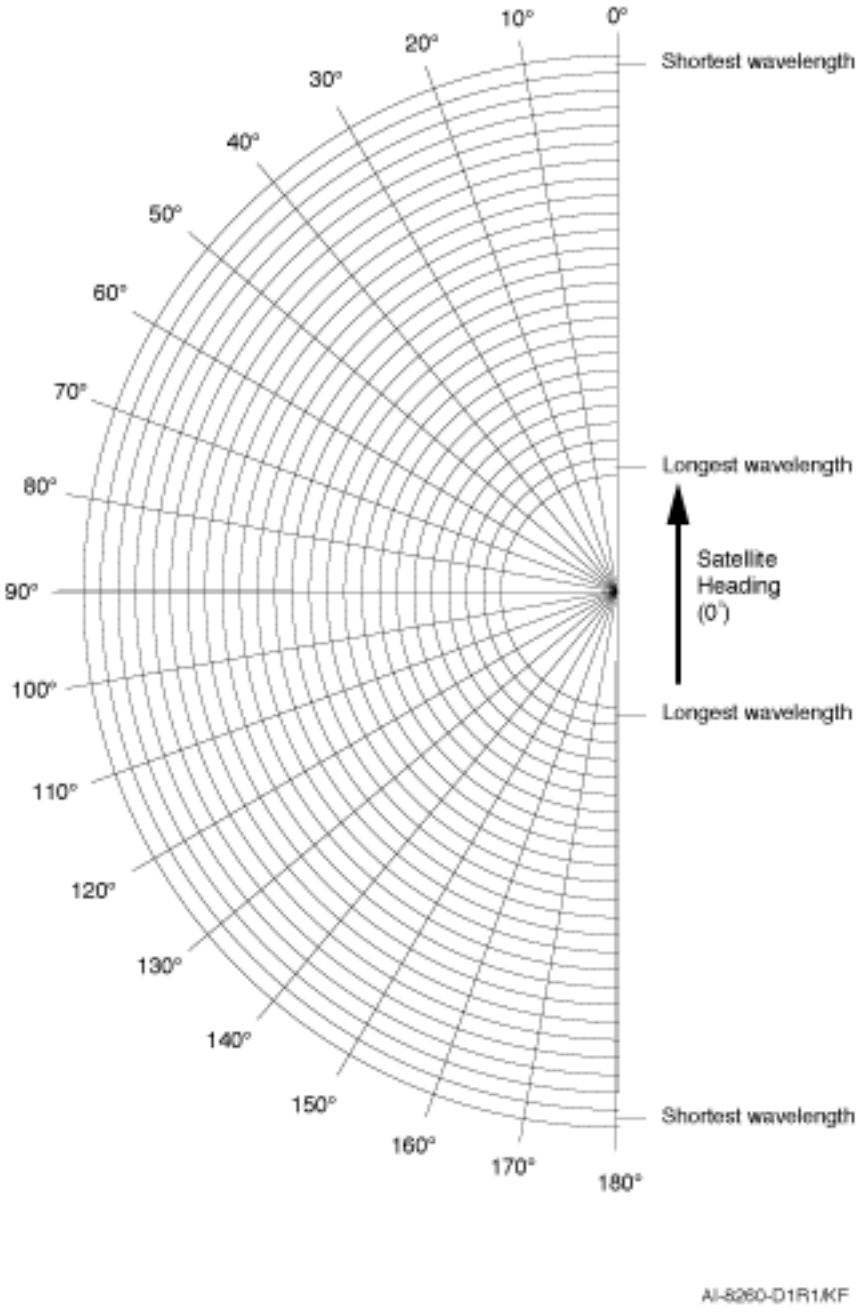

Figure 5-5 Wave Mode Cross Spectra Format

The method for reconstructing the entire spectrum from that stored in the MDS is shown in the figure below.

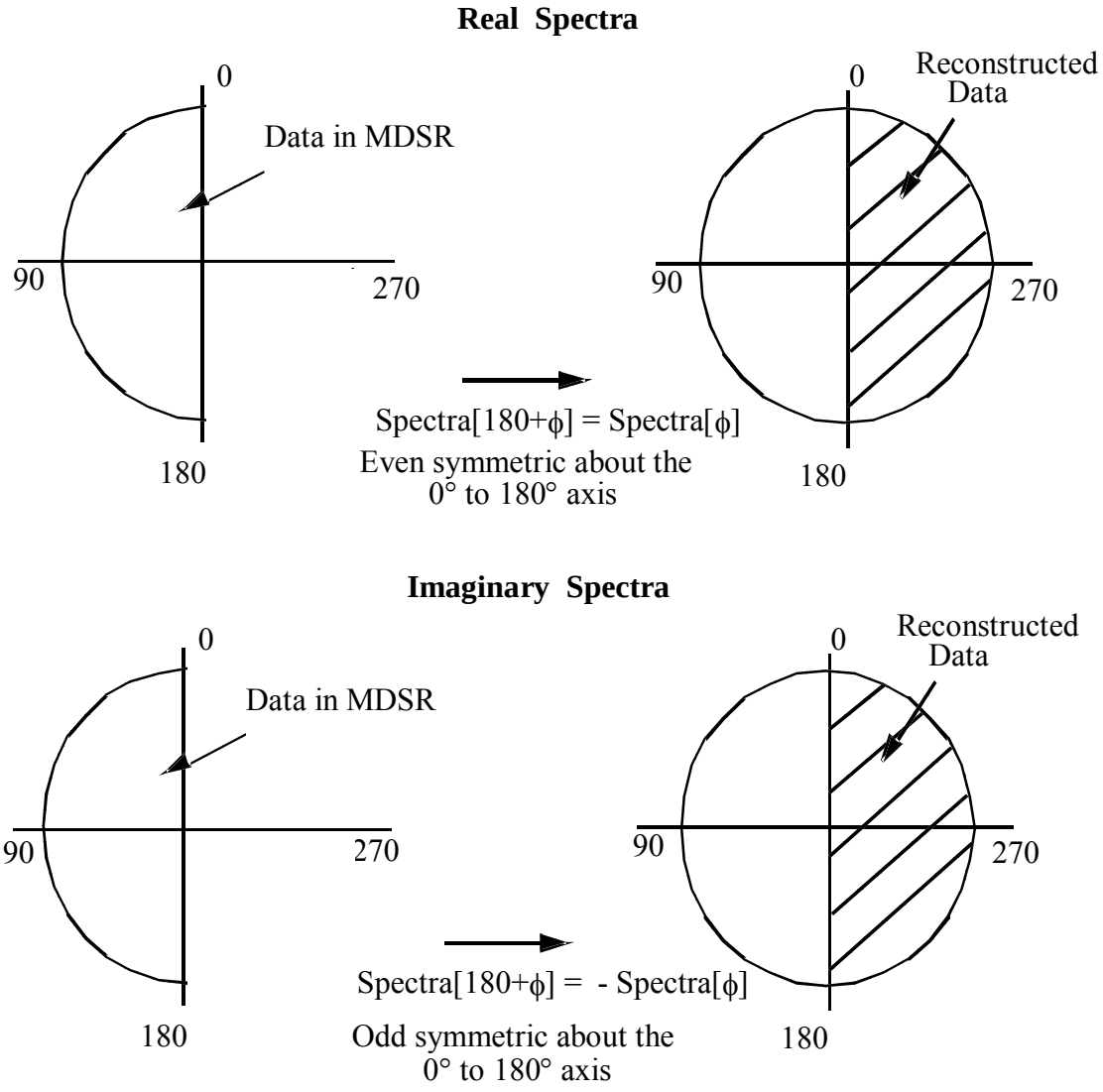

Figure 5-6 Method to reconstruct full spectra from product spectra

5.3.5.4.5 Ocean Wave-Spectrum MDS

This MDS contains the ocean wave spectrum of the imagette. There is one MDSR per wave cell. The format of the wave-spectrum MDS closely matches that of the cross spectrum MDS where some fields in the cross-spectrum MDS are substituted by new values pertaining to the ocean wave spectrum product. Each ocean wave spectrum MDSR is described below:

Table 5-22 Ocean Wave-Spectrum MDSR

Field #	Description	Units	Byte Length	Data Type
1	**First Zero Doppler Azimuth time of the wave cell** Time of first range line in the SLC Imagette MDS described by this data set	mjd	12	mjd
2	**Quality Indicator** (set to -1 if all values in MDSR are zero, set to 0 otherwise)	-	1	sc
	Processing Parameters			
3	**Range spectral resolution of the cartesian cross spectrum**	-	4	fl
4	**Azimuth spectral resolution of the cartesian cross spectrum**	-	4	fl
5	**Azimuth re-sampling factor in look extraction** (Swath specific)	-	4	fl
	Detected Spectrum Statistics			
6	**Spectrum Total Energy**	-	4	fl
7	**Spectrum Max Energy**	-	4	fl
8	**Direction of Spectrum Max** (deg) Direction is given clockwise from north in the direction the wave propogates	deg	4	fl
9	**Wavelength of Spectrum Max** (m)	m	4	fl
10	**Variance of the azimuth image shift caused by the orbital velocity** (m^2)	m^2	4	fl
11	**Azimuthal Clutter Cut-off wavelength** (m)	m	4	fl
12	**Spectral width of non-linear part of the corss spectra**		4	fl
	Image Statistics			
13	**Image Intensity**		4	fl
14	**Normalized Image Variance**		4	fl
15	**Spare**		–56	56*uc
	Polar Spectrum scaling			
16	**Min value of ocean wave spectrum**	m^4	4	fl
17	**Max value of ocean wave spectrum**	m^4	4	fl
18	**Spare**		8	f8*uc
	Additional Product Parameter fields			
19	**Wind speed used in wave spectra retrieval** (m/s)	m/s	4	fl
20	**Wind direction used in the wave spectra retrieval (clockwise from north from where the wind from if confidence is 0, relative to range otherwise** (deg)	deg	4	fl
21	**Normalized inverse wave age**	-	4	fl

Field #	Description	Units	Byte Length	Data Type
22	**SAR sell wave height**	m	4	fl
23	**Variance of azimuth shift computed from the SAR swell wave spectra**	m2	4	fl
24	**Radar backscatter cross section**	dB	4	fl
25	**Confidence measure of the swell inversion** 0 = inversion successful- a unique spectrum in terms of propogation direction can be given 1 = inversion not succesful – symmetric spectrum	-	2	us
26	**Average signal-to-noise ratio**	-	4	fl
27	**Radar velocity offset corretion**	m/s	4	fl
28	**Geophysical calibration constant (CMOD)**	-	4	fl
29	**Confidence measure of the wind retrieval** 0 = external wind direction used during inversion 1 = external wind directionnot used during inversion	-	2	us
30	**Spare**	-	24	24*uc
	Ocean Wave Swell Spectra			
31	**Ocean Wave Swell spectra polar grid** Number of bins in wavelength and direction defined in SPH (nominally 24 by 36). Arranged as: 24 wavelength values for 0 deg., 24 values for 10 deg, ..., 24 values for 350 deg. The 24 values for each sector are given in order from longest to shortest wavelength in the clockwise direction.	-	864	36*24 *uc
	TOTAL		**1061**	

The ocean wave spectrum is given in the MDS as real samples distributed on a polar grid. The size of the ocean wave spectrum grid is given in the SPH. Typically this will be 24 by 36 bins in wavelength and direction respectively.

The ocean wave spectrum values shall be stored in an unsigned integer format, each part linearly scaled to the maximum and minimum values of the representation (e.g., 0 to 255). The original maximum and minimum values are reported.

The detected spectrum statistics are derived from a high resolution polar spectrum, prior to encoding for output to the product, or at other intermediate stages of the processing.

If the processor is unable to produce the ocean wave spectra for a given wave cell, the MDSR is time stamped with the time that the ocean wave spectra would have corresponded to, the Quality Flag is set to -1, and the MDSR data fields are all set to zero.

5.3.5.4.6 MDS Containing Imagettes

The structure of the MDS containing an imagette will be identical to that specified in Section 5.1.1.9.9. There is one MDS per imagette. There are up to 400 MDSs per product. The MDSs are not included for WVS and WVW products.

If the Stand-Alone PF-ERS or PGS-ERS processor is unable to produce an imagette, the MDS will consist of only one MDSR with the time stamp corresponding to what the first line of the imagette would have been, a range line number of 1, and the quality flag set to -1.

5.4 Auxiliary Data Files

Refer the ENVISAT Products Specifications (Document R-1) for the format of Auxiliary Data files. The files used for ERS processing follow the same format as the ASAR auxiliary data files but contain ERS-specific data.

A PRODUCT DATA CONVENTIONS

This appendix summarizes the product conventions used in this document.

A1 PRODUCT FILE NAMING

The first field of the Main Product Header contains the product name. The naming convention for products is described below.

filename = **<product_ID> <processing_stage_flag> <originator_ID><start_day> <"_"> <start_time> <"_"> <duration> <phase> <cycle> <"_"> <relative_orbit> <"_"> <absolute_orbit> <"_"><counter> <"."> <satellite_ID> <.extension>**

The naming convention for auxiliary data files is described in Volume 16 of Document R-1.

Table A-1 Product Name Fields

Field	Size in Characters	Description
Product_ID	10	10 character string identifies sensor, mode and processing level. See Section 2 for details. Characters not used are replaced with an underscore character.
Processing Stage flag	1	Set to "N" for Near Real Time product Set to "V" for fully validated (consolidated) product Set to "T" for Test product Set to "S" for a special product. Letters between N and V are assigned in order of level of consolidation (i.e., closer to V = better consolidated)

Field	Size in Characters	Description
originator ID	3	Identification of the center which generated the file. The 3 character code may be one of the following: PDK = PDHS-K PDE = PDHS-E LRA = LRAC PDC = PDCC FOS = FOS-ES PDA = PDAS-F U-P = UK-PAC D-P = D-PAC I-P = I-PAC F-P = F-PAC S-P = S-PAC E-P = E-PAC ECM = ECMWF all codes are TBC by ESA.
start_day	8	In the case of instrument products it corresponds to the start day of the product from the UTC time of the first DSR. The format is YYYYMMDD. For Auxiliary files it may correspond to file creation date.
start_time	6	In the case of instrument products it corresponds to the start time of the product from the UTC time of the first DSR. The format is HHMMSS. For Auxiliary files it may corresponds to file creation time.
duration	8	Time coverage of the product expressed in seconds. If the duration of a product is not relevant information it will be set to “00000000”.
phase	1	Mission phase identifier
cycle	3	Cycle number within the mission phase
relative_orbit	5	Relative orbit number within the cycle at the beginning of the product
absolute_orbit	5	Absolute orbit at the beginning of the product
counter	4	Numerical wrap-around counter for quick file identification. For a given product type the counter is incremented by 1 for each new product generated by the product originator.
satellite ID	2	E1 = ERS-1, E2 = ERS-2, N1 = ENVISAT-1
.extension	variable	Optional field. Used only for distribution to users to indicate common archiving and compression standards if used (e.g., .gz, .Z, .tar, .tarZ, .gif, .jpeg, etc.)

For example, a level 1 ERS-1 IMP product which contains data starting on Dec. 21, 1995 at 10:34:30 covering 15 seconds, from data acquired during mission phase "G", cycle 13, relative orbit 239, absolute orbit 26000, generated at ESRIN (PDE) would have the name:

SAR_IMP_1PXPDE19951221_103430_00000015G013_00239_26000_0002.E1

This file naming convention assumes the use of an operating system that allows long filenames. Platforms which use operating systems that do not support long filenames must use a subdirectory tree. The maximum length of a subdirectory name is eight characters.

For example, an MS-DOS file system (name limited to 12 characters with a period on the ninth) would use a subdirectory structured as:

<first 8 characters of Product ID> \ <last 2 characters of Product_ID><Processing_Stage_Flag> <originator_ID>\ <start_day> \ <start_time> \ <duration> \ <phase> <cycle> \ <relative_orbit> \<absolute_orbit>\ <counter> <satellite_ID><.extension>

e.g., MIP_NL__\0PVD-P\19990210\133254\00006040\A031\00067\15598\0324N1.gz

A2 DATA REPRESENTATION

The eligible data types for product structures are listed in Table A-2.

Table A-2 Data Types

Variable Type	C Type	Abbreviation	Range
Character	char	sc: signed char	-128 to 127 (2's comp.)
		uc: unsigned char	0 to 255
2-byte integer	short	ss: signed short integer	-32768 to 32767 (2's comp)
		us: unsigned short integer	0 to 65535
4-byte integer	long	sl: signed long integer	-2147483648 to 2147483647
		ul: unsigned long integer	0 to 4294967295
8-byte integer	long long	sd: signed long long integer	-9223372036854775808 to 9223372036854775807
		ud: unsigned long long integer	0 to 18446744073709551615
4-byte single precision floating point	float	fl	3.4028e+38 (max) 1.17549e-38 (min)
8-byte double precision floating point	double	do	1.79e+308 (max) 2.22e-308 (min)

The IEEE 754-1985 is the chosen standard for storing real numbers.

For header structures which use ASCII values, the following methods for representing binary data types in ASCII are followed:

Table A-3 ASCII Equivalent Formats

Variable Type	Binary Abbreviation	ASCII format	ASCII Abbreviation
Character	uc: unsigned char	Single ASCII character	uc
	sc: signed char	(if designated a 1 byte number in original MPH or SPH format will be SXXX[6]	Ac
2-byte integer	ss: signed short integer	SXXXXX	As
	us: unsigned short integer	(6 bytes)	
4-byte integer	sl: signed long integer	SXXXXXXXXXX	Al
	ul: unsigned long integer	(11 bytes)	
8-byte integer	sd: signed long long integer	SXXXXXXXXXXXXXXXXXXXX	Ad
	ud: unsigned long long integer	(21 bytes)	
4-byte single precision floating point	fl	SX.XXXXXXXXESXX (15 bytes)	Afl
8-byte double precision floating point	do	SX.XXXXXXXXXXXXXXXXXXESXXX (25 bytes)	Ado
		S.XXXXXX (8 bytes)	Ado06
		SXXXX.XXXXXX (12 bytes)	Ado46
		SXXXXXXX.XXX (12 bytes)	Ado73

Note that the sign is always included, even for positive numbers, and unused positions are set to zero. E.g. the number 1.435E12 is represented as +1.43500000E+12; the long integer 123456789 is represented as +0123456789.

[6] S = sign (+ or -), X = a single number in ASCII format between 0 and 9

A2.1 ASCII Character Set

The standard ASCII character code set used for ENVISAT Products is the first 128 characters of the 8-bit ISO8859 - 1 character code, which is identical to the long established US-ASCII 7-bit character code. For the sake of clarity, the complete list of ASCII codes used for products is given below. The rules used to create ASCII header structures are given in Volume 5 of Document R-1. When ASCII character strings are included in binary data sets, the string is left-justified within the field. ASCII blank-space characters are added to the right of the string to fill the field. Note the symbol Ø is used in the documentation to indicate the position of an ASCII blank-space character (character 32) in .

Table A-4 Decimal Value and corresponding ASCII character

0 NUL	1 SOH	2 STX	3 ETX	4 EOT	5 ENQ	6 ACK	7 BEL
8 BS	9 HT	10 NL	11 VT	12 NP	13 CR	14 SO	15 SI
16 DLE	17 DC1	18 DC2	19 DC3	20 DC4	21 NAK	22 SYN	23 ETB
24 CAN	25 EM	26 SUB	27 ESC	28 FS	29 GS	30 RS	31 US
32 SP	33 !	34 “	35 #	36 $	37 %	38 &	39 ’
40 (	41)	42 *	43 +	44 ,	45 -	46 .	47 /
48 0	49 1	50 2	51 3	52 4	53 5	54 6	55 7
56 8	57 9	58 :	59 ;	60 <	61 =	62 >	63 ?
64 @	65 A	66 B	67 C	68 D	69 E	70 F	71 G
72 H	73 I	74 J	75 K	76 L	77 M	78 N	79 O
80 P	81 Q	82 R	83 S	84 T	85 U	86 V	87 W
88 X	89 Y	90 Z	91 [	92 \	93]	94 ^	95 _
96 ‘	97 a	98 b	99 c	100 d	101 e	102 f	103 g
104 h	105 i	106 j	107 k	108 l	109 m	110 n	111 o
112 p	113 q	114 r	115 s	116 t	117 u	118 v	119 w
120 x	121 y	122 z	123 {	124 |	125 }	126 ~	127 DEL

A2.2 Logical Values

Logical values are values which may be either true or false. The following convention is followed:

Table A-5 Logical Values

Logical	Value	Ascii Representation [a.]
True	1	ascii code 49
False	0	ascii code 48

[a.] See Table A-4.

A2.3 Unused Fields

In cases where a field is not fully filled by the value which it contains, placeholder values are used. For ASCII strings, the placeholder character is the ASCII blank-space character (ASCII character 32). For numerical-values, the placeholder value is zero unless otherwise stated. For ASCII numerics (defined in above) an ASCII numeric of 0 (in the appropriate format) may be used if specified.

A3 BIT / BYTE NUMBERING

For the purpose of identifying bits within a multi-byte structure, the numbering convention shown below is used. Byte 0 is the most significant byte. It is transmitted before byte 1. Within a byte, bit 0 is the least significant bit.

1 byte structure:

Bytes	BYTE 0							
Bits	7	6	5	4	3	2	1	0

2 byte structure

Bytes	BYTE 0								BYTE 1							
Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

3 byte structure:

Bytes	BYTE 0								BYTE 1								BYTE 2							
Bits	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

4 byte structure:

Bytes	BYTE 0								BYTE 1								BYTE 2								BYTE 3					
Bits	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	210

A4 TIME

Within the PDS time is used with an accuracy of 1 microsecond, expressed as:

- **UTC** (Universal Time Coordinate) almost equivalent to GMT (Greenwich Meridian Time) presented as a string of 27 significant characters with the format:

  DD-MMM-YYYYØhh:mm:ss.tttttt

  where

DD	:	day	[1:31]
MMM	:	month	[JAN, FEB....NOV, DEC]
YYYY	:	year	[1950:2050]
Ø	:	blank character	
hh	:	hour	[00:23]
mm	:	minutes	[00:59]
ss	:	second	[00:59]
tttttt	:	ms	[000000:999999] may be blanked by spaces if irrelevant

e.g., December 29, 1999 at 10:00 is coded as

29-DEC-1999 10:00:00.000000 or 29-DEC-1999 10:00:00

- **MJD 2000** (Modified Julian Day 2000) is the decimal number of day since January 1, 2000 at 00:00 hours. It is represented by 3 long integers (4 bytes each, 12 bytes total) as follows:

Table A-6 MJD format

N	Description	Units	Byte Length	Data Type	Dim
1	**Number of days elapsed since the 1st of January 2000 at 0:0 hour. It may be negative, and is thus a signed long integer**	days	4	sl	1
2	**Number of seconds elapsed since the beginning of that day**	s	4	ul	1
3	**Number of microseconds elapsed since the last second**	μs	4	ul	1
	TOTAL		**12**		

e.g., December 29, 1999 at 10:00 is coded as

{-3, 36000, 0}

As a general rule, UTC time format is used in the MPH and SPH, while MJD format will be used when time stamps are required for DSRs within a DS.

A5 GEOLOCATION INFORMATION

The WGS84 co-ordinate system is used for all latitude/longitude geolocation.

Geolocation information is expressed within ENVISAT products using the following convention:

latitude: 4 byte signed long integer

units = 10^{-6} degrees

positive north (-90 = south pole, +90 = north pole)

longitude: 4 byte signed long integer

units = 10^{-6} degrees

positive east, 0 = Greenwich meridian, range: [-180, 180) i.e., west direction includes -180, east does not include +180

Latitude is always listed prior to longitude.

A6 SIZES

All sizes provided in this document follow the following convention:

- 1 kilobyte = $1x10^3$ bytes = 1 kB or 1 kByte
- 1 megabyte = $1x10^6$ bytes = 1 MB or 1 MByte

A7 ALIGNMENT IN STRUCTURES

All sizes listed in the Product Specifications assume byte aligned structures. However, the IBM RS6000 and SGI Origin align structures in memory according to the table below.

Table A-7 Type Size and Alignment for the RISC System/6000

Type	Alignment of Member	Size (Bytes)
char	byte aligned	1
short	2-byte aligned	2
(long) int	4-byte aligned	4
long long int	8-byte aligned	8
pointer	4-byte aligned	4
float	4-byte aligned	4
double	8-byte aligned if -qalign=natural. Otherwise, word aligned.	8
long double with -qlongdouble or -qldb1128 option.	16-byte aligned if -qalign=natural. Otherwise, word aligned.	16

This means that if data is stored as structures, the sizes listed in the Product Specifications may not correspond exactly to the size of memory the IBM RS6000 or SGI Origin allocates to store them.

For example, suppose an ADSR consisted of 5 characters followed by a float:

e.g., unsigned char data1[5];
float data2;

Since a float is 4 bytes and a char is 1 byte, the size of this data would be listed as 9 bytes.

However, suppose this data was declared as a structure (as in the DDT):

e.g., struct st
{
unsigned char data1[5];
float data2;
};

According to R-1, the IBM will only store a float in memory beginning on a 4-byte boundary. Therefore, it will add 3 bytes of padding to the unsigned character array

before storing the float. Thus, the actual size of the structure in memory becomes 5 bytes + 3 bytes padding + 4 byte float = 12 bytes.

Obviously, this padding is not desirable as it tends to bloat the size of products and causes the byte alignment to differ from that of the Product Specifications. *Output products must have the same size and alignment as specified within this document*.

There are two possible solutions to this problem:

1. The IBM C++ compiler has a flag which can be set to force the use of byte aligned structures.
2. Elements of a structure may be copied individually to ensure proper alignment and size of data members.

THIS PAGE INTENTIONALLY LEFT BLANK