

# ***IASI Level 1 Product Format Specification***

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EUMETSAT  
Eumetsat-Allee1, D-64295 Darmstadt, Germany  
Tel: +49 6151 807-7  
Fax: +49 6151 807 555  
<http://www.eumetsat.int>

## Document Change Record

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2.0	25/5/99		<ul style="list-style-type: none"> <li>• First Issue</li> </ul>
2 Draft B	23/07/99		<ul style="list-style-type: none"> <li>• Addressed RIDs</li> </ul>
2	10/07/00		<ul style="list-style-type: none"> <li>• Incorporate change in EPS Generic Product Specification, Issue 3, and IASI Level 1 product content (IA-TN-2100-9469-CNE, issue 2 draft, 08/06/00)</li> </ul>
3.0	18/07/00		
4 Draft A	15/11/00		<ul style="list-style-type: none"> <li>• Add GTS Product section</li> <li>• Simplified document layout</li> <li>• Editorial changes</li> <li>• Incorporated changes in [RD-1]</li> </ul>
4 Draft B	22/05/01		LEO/C/TP <ul style="list-style-type: none"> <li>• Made [AD-2] "IASI Level 1 Product Contents", IA-TN-2100-9469-CNE into a reference document, [RD-1]. Renumbered other documents accordingly</li> <li>• Incorporated changes from [RD-1] (See also change notice in Annex)</li> <li>• Removed GTS Section and all references to GTS products.</li> <li>• Updated text in Section 1.1</li> <li>• Incorporated changes to [AD-1] GPFS</li> <li>• Removed references to product footer records</li> <li>• Removed idea of "datasets" within a product as per updated GPFS</li> </ul>
4 Draft C	28/05/01		LEO/C/TP <ul style="list-style-type: none"> <li>• Removed requirement in Level 1a SPHR section</li> <li>• Updated all sections in line with GPFS changes</li> <li>• Removed items redundant with GPFS</li> </ul>
5.0	01/06/01		CGS PDR Issue
5.1	13/06/01		Revised issue for CGS PDR <ul style="list-style-type: none"> <li>• Updated signature table</li> </ul>
5.2			<ul style="list-style-type: none"> <li>• Reference corrected from EPS/MIS/SPE/990003 to EUM.EPS.SYS.SPE.990003</li> </ul>
6.0 Draft A	13/02/02		<ul style="list-style-type: none"> <li>• Updated document template</li> <li>• Updated to correspond to updated IASI L1 Product Contents Document, IA.TN.2100.9469.CNE, Ed. 5, Rev 2 (01/02/02)</li> <li>• Changed [AD-2] from Product Convention Document to Mission Convention Document.</li> <li>• Updated in line with [AD-1] Issue 6.0 Draft B</li> </ul>

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6.1	5/4/02		<ul style="list-style-type: none"> <li>• Updated document template again</li> <li>• Updated document in line with revised [AD-1]</li> <li>• Added V-INTEGGER types to product specification</li> </ul>
6.2	13/06/02		<ul style="list-style-type: none"> <li>• Updated Annex to allow spectral data in each MDR to be divided into up to 10 bands each with its own scale factor. This allows data size to be reduced from 3 bytes to integer2.</li> <li>• Added new GIADR to include this scale factor information</li> </ul>
6.3	13/06/02	EUM.EPS.SYS.DCR.02.129	<ul style="list-style-type: none"> <li>• Updated Table 1 Product IDs to be compatible with IDs defined in Core Ground Segment Requirements Document</li> <li>• Updated WBS number and corrected document reference in header</li> </ul>
6.4	1/12/02	EUM.EPS.SYS.DCR.02.175	<ul style="list-style-type: none"> <li>• Corrected name of bit 76 in Section 3.4.1.3 (typo)</li> <li>• Added text to MDR-VIADR description in Section 7.3 to describe contents of VIADR-MDR</li> <li>• Updated Section 6.6.1.4 GccsConfAvhrrChannel</li> <li>• Added Section 3.4.1.3 IDefCcsMode</li> <li>• Added sub sections to Section 2 detailing computation of wavenumbers, interpolation on the spectral database, referencing of AVHRR co-ordinates and general quality indices for the product.</li> <li>• Added Record Format Version Control - section 9.</li> <li>• Updated occurrence tables</li> <li>• See also DCR in Annex</li> </ul>
6.5	17/01/03	EUM.EPS.SYS.DCR.02.251	Annex modified – See DCR in Annex
	11/02/03	EUM.EPS.SYS.DCR.03.042	Inserted new Section 8 with corrected subclass numbering for GIADRs and added subclass numbering for MDRs.
6.6	23/03/04	EUM.EPS.SYS.DCR.04.009	<ul style="list-style-type: none"> <li>• Added Section 2.7 describing differences between external calibration and normal operations products</li> <li>• Added Section 2.8 describing decoding of IASI spectra and images</li> <li>• Added Section 2.9 describing start/stop time of IASI lines</li> <li>• Added Section 2.10 describing IASI Integrated Imager sub-grid</li> <li>• Added Section 2.11 describing radiance analysis in IASI FOV</li> <li>• Section 3.4.1.3 GEPSIdConf extended</li> </ul>

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			definition of bits in bitstring <ul style="list-style-type: none"> <li>• Clarified setting of GqisFlagQual in Section 3.6</li> <li>• Update table of Record Subclass Version Numbers</li> <li>• See also changes in Document Change Record of Annex</li> </ul>
6.7	18/10/05	EUM.EPS.SYS.DCR.05.0253	<ul style="list-style-type: none"> <li>• Add IASI IMVD as reference document</li> <li>• Section 3.4.1.1 Add details of Instrument Mode (word # 19) from IASI IMVD to reflect CNES Change Request CR-1000-271.</li> </ul>
V7A	23/07/08		Migrated into Hummingbird. Body contents copied into standard template. Editorial updates – formatting etc. Signature table updated.
V7B	23/07/08		<ul style="list-style-type: none"> <li>• Added Appendix A with hyperlink referring to Annex.</li> <li>• Editorial edits – typos, standardisation, use of auto referencing for document and section references.</li> </ul>
V7C	22/08/08	EPS_AB_DCR_EUM_73	Update of : <ul style="list-style-type: none"> <li>• Section 2.10 Figure 1 added to clarify orientation of IIS (first and second dimension named IMCO and IMLI).</li> <li>• Section 2.11.3 Correct unit description added to <b>GccsRadAnalMean</b> and <b>GccsRadAnalStd</b> for channel 1,2 and 3a</li> </ul>
V8	14/10/08	EPS_AB_DCR_EUM_74	<ul style="list-style-type: none"> <li>• Update of PFS for IASI L1 Day-2 product format:               <ol style="list-style-type: none"> <li>1. Add or change of IASI LA/B                   <ol style="list-style-type: none"> <li>a. GQisFlagQual (change)</li> <li>b. GQisFlagQualDetailed</li> </ol> </li> <li>2. Add or change of IASI L1C                   <ol style="list-style-type: none"> <li>a. GQisFlagQual (change)</li> <li>b. GQisFlagQualDetailed</li> <li>c. GlacVarImaglIS</li> <li>d. GlacAvgImaglIS</li> <li>e. GEUMAvhrr1BCIdFrac</li> <li>f. GEUMAvhrr1BLandFra</li> <li>g. GEUMAvhrr1BQual</li> </ol> </li> <li>3. Add or change of ENG-MDR:                   <ol style="list-style-type: none"> <li>a. GQisFlagQual (change)</li> <li>b. GlacAvgImaglIS</li> <li>c. NZPDInterpixelEW</li> <li>d. NZPDInterpixelBB</li> <li>e. NZPDInterpixelCS</li> </ol> </li> </ol> </li> </ul>

Issue / Revision	Date	DCN. No	Changed Pages / Paragraphs
			<ul style="list-style-type: none"> <li>f. GSsdConverFlag</li> <li>g. GQisFlagDetailed</li> <li>h. GEUMAvhrr1BCldFrac</li> <li>i. GEUMAvhrr1BLandFrac</li> <li>j. GEUMAvhrr1BQual</li> <li>k. GCcsAvhrrPseudoChn</li> <li>l. GCcsAvhrrPsCh4FlagQual</li> <li>m. GCcsAvhrrPsCh5FlagQual</li> <li>n. DATA_PX (change)</li> </ul> <ul style="list-style-type: none"> <li>• Section 3.4.1.5 <b>GQisFlagQualDetailed</b> added</li> <li>• Section 5.4.1.5 <b>GEUMAvhrr1BQual</b> added</li> <li>• Section 6.6.1.7 Description of <b>GCcsAvhrrPseudoChn</b> added</li> <li>• Section 10 updated to add new record version numbers.</li> </ul>
V9	27/01/09	ODT_DCR_17	<ul style="list-style-type: none"> <li>• Further update of PFS for IASI L1 Day-2 product format:</li> </ul> <ol style="list-style-type: none"> <li>1. IASI L1A/B/C             <ol style="list-style-type: none"> <li>a. Change of GQisFlagDetailed content</li> </ol> </li> <li>2. IASI ENG             <ol style="list-style-type: none"> <li>a. Change of GQisFlagDetailed content</li> <li>b. Remove GCcsAvhrrPSCh4FlagQual</li> <li>c. Remove GCcsAvhrrPSCh5FlagQual</li> <li>d. Remove NZPDInterPixelEW</li> <li>e. Remove NZPDInterPixelBB</li> <li>f. Remove NZPDInterPixelCS</li> <li>g. Add MHipNZpdInterPixel</li> <li>h. Add MHipFlagInterPixNZpdNonQual</li> <li>i. Split Data_IP into Data_IP and Equalization Counter</li> <li>j. Add Equalization Counter</li> </ol> </li> </ol>
V9A	25/02/09		Typo: References to "GQisFlagDetailed" above for Versions 8 & 9 should read "GQisFlagQualDetailed"
v9B	13/10/10	ODT_DCR_155	<ul style="list-style-type: none"> <li>• Added record subclass info.</li> <li>• Corrected two names in Sec. 2.8 to agree with spellings in Giadr-Scalefactors table: IDefSondScaleFactor --&gt; IDef<b>Scale</b>SondScaleFactor and</li> </ul>

<i>Issue / Revision</i>	<i>Date</i>	<i>DCN. No</i>	<i>Changed Pages / Paragraphs</i>
			IDefScaleIIIScaleFactor --> IDefScaleIISScaleFactor <ul style="list-style-type: none"> <li>• Updates to description in table for GEUMAvhrr1BQual including adding footnote (EUM/EPS/NCR/12303).</li> <li>• (Internal use) Replacement of two names in Signature Table.</li> </ul>
v9C	07/12/10		<ul style="list-style-type: none"> <li>• Annex: GEUMAvhrr1BQual description update.</li> </ul>
v9D	01/12/11	STM_DOCET_1 10	Annex only: <ul style="list-style-type: none"> <li>• Unit correction for GEPSLocIASIAvhrr_lasi GEPSLocIASIAvhrr_IIS: from Avhrr pixel to ms (milliseconds) in MDR-1a, 1b and 1c.</li> <li>• Same thing for GCcsImageClassifiedFirstLin in the MDR-1c.</li> </ul>
v9E	14/12/11		Annex only: Correction to previous update to units (see Annex for full details).

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# 1 INTRODUCTION

## 1.1 Purpose and Scope

This document is the Infrared Atmospheric Sounding Interferometer (IASI) Level 1 (1a, 1b and 1c) EPS Product Format Specification. It also includes the specification of the IASI Engineering and Verification products.

The generic product format specification used by this document is defined in the EPS Generic Product Format Specification (GPFS) [AD 1]. The conventions used by this document are defined in [AD 1] and in the EPS Mission Conventions Document [AD 2].

*Note:* The use of the term “database” in [RD 2] shall not constrain the implementation of the storage of the datasets referred to in this document.

## 1.2 Structure of the Document

The document is organised in the following sections, including the introduction:

Section 1	Provides the scope of the document.
Section 2	details the product formats for Level 1 products
Sections 3-8	describe the instrument and level specific records for Level 1 products
Section 9	details the occurrence rates of the various records within Level 1 products
Sections Appendix A	provides a history of version numbers for the records defined within the document
Appendix A	links to detailed tables describing the record formats

## 1.3 Applicable Documents

<i>AD 1</i>	EPS Generic Product Format Specification	EPS/GGS/SPE/96167
<i>AD 2</i>	EPS Mission Convention Document	EPS/SYS/SPE/990002

## 1.4 Reference Documents

TF '3	IASI Level 1 Product Contents	IA-TN-2100-9469-CNE Edition 5, Revision 2
TF '4	IASI Measurement and Verification Data	IA-ID-1000-6477-AER Issue 3.1

## 1.5 Array Sizing Parameters

The values of parameters used for the dimensioning of arrays for the product fields in the annex to this document can be found in Section 2.1 of [RD 1].

## 1.6 PPS Produced Product Content

The product content for IASI Level 1 products that is generated by the IASI Level 1 PPS is described in [RD 1].

## 2 FORMAT OF IASI LEVEL 1 PRODUCTS

### 2.1 Overview

The EPS format products which are generated by the IASI Level 1 PPS encompasses Level 1a, 1b and 1c products, verification products and engineering products. describes the contents of the Level 1 products, verification and engineering products.

<i>Product Name</i>	<i>Product ID</i>	<i>Content</i>
<b>Level 1a</b>	IASI_XXX_1A	Decoded spectral and image data after additional radiometric calibration corrections, spectral calibration appended, location and co-location with AVHRR/3 images.
<b>Level 1b</b>	IASI_XXX_1B	Re-sampled spectrum.
<b>Level 1c</b>	IASI_XXX_1C	Re-sampled spectrum with apodisation
<b>Verification Product</b>	IASI_VER_01	Verification data: raw interferogram and calibration coefficients used on-board.
<b>Engineering Product</b>	IASI_ENG_01	All parameters: output of IASI SW used by the TEC for evaluation.

*Table 1: List of IASI Level 1 Products*

The product format for all IASI Level 1 products is based on the generic product format as described in [AD 2]. This document details the instrument- and level-specific additions required for IASI Level 1 products.

### 2.2 Generic Record Header Fields

All generic record header fields of the instrument/level specific records defined in this document shall have an INSTRUMENT\_GROUP value of IASI [RD 2].

### 2.3 Computation of Wavenumbers

#### 2.3.1 IASI Integrated Imager

The description of the IASI Integrated Imager (IIS) Spectral Response Function (SRF) is provided in the IASI Level 1 products as an array that can contain up to 100 samples.

The wave number associated with the sample k is given by the formula:

$$w(k) = \text{IDefIISrfdWn} * (\text{IDefIISrffNsf} + k - 2)$$

For example, the wavenumber associated with the first sample (k=1) is equal to:

$$w(1) = \text{IDefIISrfdWn} * (\text{IDefIISrfffirst} - 1)$$

The data **IDefIISrffNslast** determines the actual size of the SRF description ( $(\text{IDefIISrfffirst} + k - 1) \leq \text{IDefIISrfflast}$ ).

### 2.3.2 Level 1a

The wavenumber of Level 1a spectra sample number  $k$  is computed by the following:

$$w(k) = \text{IDefSpectrDwn} * (\text{IDefNsfirst} + k - 2) * \text{fcs}(k)$$

where the spectral calibration function  $\text{fcs}()$  must be computed from information extracted from the IASI spectral database provided to the users (see Section Appendix A)

### 2.3.3 Level 1b/c

Level 1b and 1c spectra are provided with the same constant sampling. Only the useful part of the spectra is provided. The wave number associated with the sample  $k$  is given by the formula:

$$w(k) = \text{IDefSpectDwn1b} * (\text{IDefNsfirst1b} + k - 2)$$

For example, the wavenumber associated with the first sample ( $k=1$ ) is equal to the following:

$$w(1) = \text{IDefSpectDwn1b} * (\text{IDefNsfirst1b} - 1)$$

The data  $\text{IDefNsLast1b}$  determines the actual size of the spectrum ( $(\text{IDefNsfirst1b} + k - 1) \leq \text{IDefNsLast1b}$ ).

## 2.4 Interpolation in the sounder spectral database

Level 1a and 1b products usage will imply the knowledge of the current

- spectral calibration function :  $\text{fcs}(w, p, \text{CCD})$ ,
- instrument spectral response function :  $\text{ISRF}(w, p, \text{CCD})$

defined for the four pixels ( $p=1,2,3,4$ ) and the two cube corner directions ( $\text{CCD}=0$  or  $1$ ) and the wavenumber,  $w$ .

These functions are computed from the following data:

- $\text{ISdbGridFcs}$  and  $\text{ISdbGridIsrf}$  extracted from the IASI spectral database provided to the users
- $\text{GIsfPds1}$ ,  $\text{GIsfPds2}$ ,  $\text{GIsfPds3}$ ,  $\text{GIsfPds4}$ ,  $\text{GIsfLinOrigin}$ ,  $\text{GIsfColOrigin}$  extracted from the product itself

using the following formula.

$$\begin{aligned} i0 &= \text{GIsfLinOrigin}, j0 = \text{GIsfColOrigin} \\ p1 &= \text{GIsfPds1}, \text{fcs1} = \text{ISdbGridFcs}(k, p, \text{CCD}, i0, j0) \\ p2 &= \text{GIsfPds2}, \text{fcs2} = \text{ISdbGridFcs}(k, p, \text{CCD}, i0, j0+1) \\ p3 &= \text{GIsfPds3}, \text{fcs3} = \text{ISdbGridFcs}(k, p, \text{CCD}, i0+1, j0+1) \\ p4 &= \text{GIsfPds4}, \text{fcs4} = \text{ISdbGridFcs}(k, p, \text{CCD}, i0+1, j0) \\ \text{fcs}(k, p, \text{CCD}) &= p1 * \text{fcs1} + p2 * \text{fcs2} + p3 * \text{fcs3} + p4 * \text{fcs4} \end{aligned}$$

The same computations can be used to derive the correct ISRF.

This computation provides an undersampled spectral calibration function (typically every 15 cm<sup>-1</sup>). The wave number associated with fcs(k) is given by the following:

$$w(k) = \text{IDefSafDwn} * (\text{IDefSafNsfirst} + k - 2)$$

This (smooth) function can now be oversampled to every wavenumber where it is needed.

## 2.5 AVHRR Coordinates Referenced in IASI Products

Localisation of some reference points is given in AVHRR pixels units (fractional) in order to help the collocation of IASI products with AVHRR products (e.g. **GEPSLocIasiAvhrr\_IASI** and **GEPSLocIasiAvhrr\_IIS**).

Columns pose no problem of definition but avoiding ambiguity in row identification is more difficult. Generally, the time of the line is used as a unique identifier for each AVHRR line and the duration of the AVHRR line is used to be able to represent fractional lines. The row position in the AVHRR raster is therefore represented as a time given in milliseconds (relative to a reference time of the current IASI product).

More precisely, given:

- a line numbered **u** in some AVHRR 1b product
- a fraction of AVHRR line **x** ( $0 < x < 1$ )
- the reference time of the current IASI line : **T<sub>0</sub>**
- the start time of this AVHRR line : **T<sub>start(u)</sub>**
- the end time of this AVHRR line : **T<sub>end(u)</sub>**

where **T<sub>0</sub>** is **GEPS\_IasiDatIasi(SN=1)** and **T<sub>start(u)</sub>** and **T<sub>end(u)</sub>** are respectively the **RECORD\_START\_TIME** and **RECORD\_END\_TIME** extracted from the Generic Record Header of the AVHRR **MDR\_1B\_FULL** record, then the encoded value of the fractional line **u+x** is given by:

$$\Delta t (u+x) = T_{\text{start}(u)} + x * (T_{\text{end}(u)} - T_{\text{start}(u)}) - T_0$$

where duration, computed as the difference between two times, is converted into milliseconds. The users can then compute the line number **u** in any AVHRR product from the values **T<sub>0</sub>** and **Δt** extracted from the IASI product.

## 2.6 Quality indices description

Quality of the IASI Level 1 products is characterised by the following items:

- **GQisFlagQual** : general quality flag which indicates, when it is set to TRUE (=1), that some anomaly has been detected at some step in the Level 0 or Level 1 IASI Processing. The products should not be used if this occurs.
- **GQisFlagQualDetailed** : The flag provides detailed information about the Level 0 (on-board) or Level 1 processing. The bits are set to 1 if an error has been detected (see Section Appendix A for details).

- **GQisQualIndex** : is the general quality index for the sounder spectra. It is defined as a ratio:  $NeDT\_estimated / NeDT\_expected$ .
- **GQisQualIndexRad** : radiometric quality index for the sounder product. It is defined as a ratio:  $NeDT\_estimated / NeDT\_expected$  where the  $NeDT\_estimated$  takes into account only the elementary quality indices related to the radiometric performance.
- **GQisQualIndexSpect** : spectral quality index for the sounder product. It is defined as a ratio ( $NeDT\_estimated/NeDT\_expected$ ) where the  $NeDT\_estimated$  takes into account only the elementary quality indices related to the spectral performance.
- **GQisQualIndexIIS** : quality index for the IIS image. It is defined as a ratio:  $NeDT\_estimated / NeDT\_expected$ .
- **GQisQualIndexLoc**. It is defined as the uncertainty of the coregistration between IIS and AVHRR.

## 2.7 IASI instrument “EXTERNAL CALIBRATION” mode

During the IASI instrument mode “EXTERNAL CALIBRATION” the data corresponding to SN=1, SN=2 and SN=30 are not relevant. As a matter of fact, the transmission of the instrument packets is the same as in NORMAL OPERATION mode except for the sub cycle SN = 1,2, 30 where there is no transmission for the spectrum and image packets.

1	2	3....	...29	30	31	32	33	34	35	36	37
Scan Moving	Scan Moving	One specific target		Scan Moving	Scan Moving	Blackbody		Scan Moving	First Cold Space		Scan Moving

From the sub cycle SN = 3 to the sub cycle SN = 29, the scan mirror points at one specific target among all possible targets of the instrument.

On the last seven sub cycles, the calibration process is exactly the same as in NORMAL OPERATION MODE.

## 2.8 Decoding of IASI Spectra and Images

### 2.8.1 Introduction

IASI spectra radiances are coded with several scaling factors (up to 10 scaling factors for one spectra). Though configurable, these factors will probably not evolve during the time span of the Metop mission.

IASI images are coded with a single scaling factor. Though configurable, this factor will probably not evolve during the time span of the Metop mission.

As a consequence, a dedicated GIADR has been created (GIADR-SCALEFACTORS) in order to provide this information to the users.

**Note 1:** The scale factors found in GIADR from Level 1a shall be used only for Level 1a data (neither 1b, nor 1c). The scale factors from Level 1b are to be applied to Level 1b. The scale factors from Level 1c shall be exclusively applied to Level 1c data.

**Note 2:** In this section, the indices of tables start at 1 (not 0).

### **2.8.2 Decoding of spectra**

FOR numScale=1 to IDefScaleSondNbScale DO

SF = IDefScaleSondScaleFactor(numScale)

FOR(chanNb=IDefScaleSondNsfirst(numScale) TO IDefScaleSondNslast(numScale) DO

w=chanNb - IDefNsfirst + 1

SpectDecoded(w) = Spect(w).10-SF

where Spect=GSmcSpect in the case of Level 1a, Spect=GS1bSpect in the case of Level 1b and Spect=GS1cSpect in the case of Level 1c.

### **2.8.3 Decoding of images**

There is one single scale factor to be applied to all pixels of one image, with SF=IDefScaleIISScaleFactor.

## **2.9 Start/Stop time of IASI lines**

### **2.9.1 RECORD\_START\_TIME and RECORD\_STOP\_TIME**

For all Level 1 products (1a, 1b, 1c, Engineering, Verification):

- RECORD\_START\_TIME field in each MDR is the start time of the corresponding line in the product (see §Appendix A and §Appendix A).
- RECORD\_STOP\_TIME field in each MDR is the stop time of the corresponding line in the product (see §Appendix A and §Appendix A).
- RECORD\_START\_TIME field in the MPHR is the start time of the first line in the product.
- RECORD\_STOP\_TIME field in the MPHR is the stop time of the last line in the product.

### **2.9.2 In NORMAL instrument mode**

- IASI start time is the time of the spectra packets for SN (Scan Number) = 1
- IASI stop time is the time of the packet IP36

### **2.9.3 In EXTERNAL CALIBRATION instrument mode**

- IASI start time is the time of the spectra packets for SN (Scan Number) = 3
- IASI stop time is the time of the packet IP36

## **2.10 IASI Integrated Imager sub-grid**

The IASI Integrated Imager (IIS) is sub-sampled in a 5 × 5 sub-grid.

This sub-grid corresponds to the IIS pixels with column and line number indices from the set {1, 16, 32, 48, 64}.

The dimension of the sub-grid is specified as SGI (=25) in the PFS annex. This SGI corresponds to a dual-dimension array (for which DIM1=IIS columns and DIM2=IIS lines). The orientation of the IIS imager and the line and column is indicated in the following figure together with the numbering of the IASI sounder pixel (1-4).

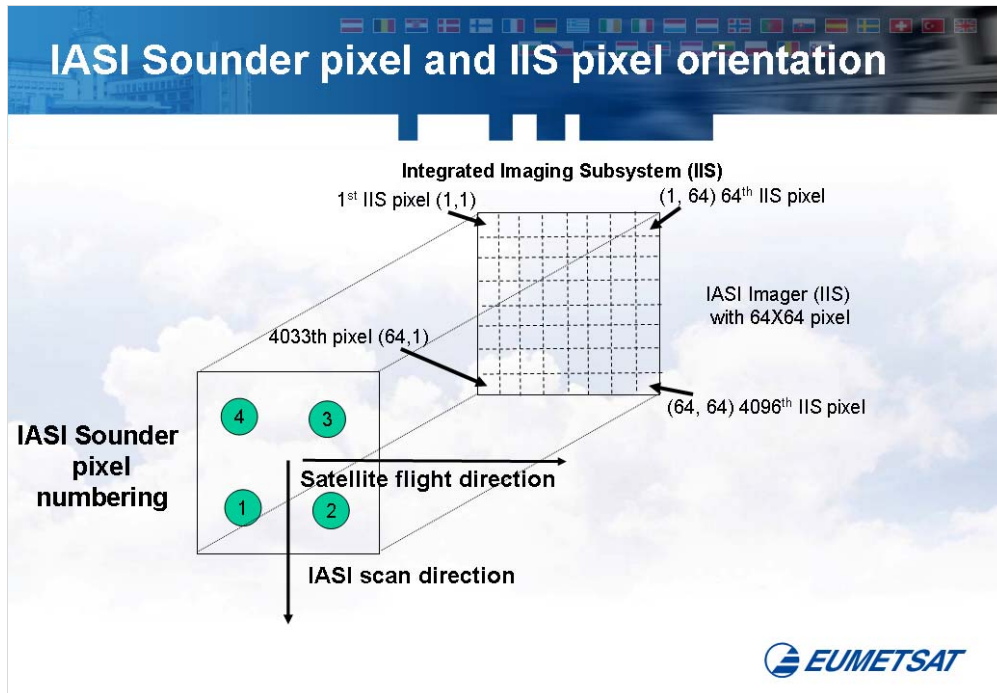


Figure 1: IASI sounder pixel and IIS pixel orientation

## 2.11 Radiance analysis in IASI Field of View

### 2.11.1 Introduction

Data named **GCcsxxxx** in MDR-1C provide a description of the radiance spatial distribution in the IASI sounder Field Of View (FOV). This information can be used in many ways when processing IASI L1 data (e.g. for spectral correction in the case of non-uniform radiance distribution in IASI FOV).

The radiances used for this analysis are nominally AVHRR measured radiances. IIS radiances can also be used as a backup. The case is identified by the data **IDefCcsMode** (value: 0 or 1, cf. §Appendix A).

When using AVHRR radiances, only a small part of the AVHRR raster is used (typically less than  $100 \times 100$  pixels, covering the four pixels of the sounder). When using IIS radiances, the full IIS image is used.

Three levels of information are provided. These are described in the next subsection:

- Classified image at the full imager resolution
- Classes characteristics (synthesis in term of radiance, position in IASI FOV)

- Fraction of pixel sounders covered by each class

### 2.11.2 Classified image

The classified image is stored in table **GCcsImageClassified**.

Each pixel of this image corresponds exactly to one pixel of the AVHRR (or IIS) image. Image size is variable with SN and is defined by line number **GCcsImageClassifiedNbLin** and columns number **GCcsImageClassifiedNbCol**.

*Note:* In the case of IIS image classification, the classified image is of size  $62 \times 62$ .

Position of this image in AVHRR raster is defined by the position of Line 1 and Column 1 in the AVHRR raster: **GCcsImageClassifiedFirstLin** and **GCcsImageClassifiedFirstCol**. This detailed information can be used to map the individual imager pixels into the FOV of the IASI sounder pixels, however this should not be necessary because synthetic information is already computed by the Level 1 processor. See Section Appendix A.

Class number is limited to 6. The numbering is from 1 to the actual class number found by the algorithm (variable). The special number 7 is reserved for pixels which have not been assigned to a class by the algorithm (non-classified pixels).

### 2.11.3 Class description

A synthesis of the classes spatial distribution is provided by the position in IASI FOV of the geometrical centre of gravity for each class (data: **GCcsRadAnalY** and **GCcsRadAnalZ**).

Class properties, in the radiances space, is given by the characteristics of the cluster containing all the pixels which belong to the class:

- **GCcsRadAnalMean** : mean value of imager channel data (either radiance or local variance for the IIS pseudo-channel). The units of **GCcsRadAnalMean** depends on AVHRR channel. It is  $W/(m^2 * sr)$  for channel 1,2,3a and  $W/(m^2*sr*m^{-1})$  for 3b,4,5.
- **GCcsRadAnalStd** : standard deviation of the data (which provides information about the compactness of the cluster). The units of **GCcsRadAnalMean** depends on AVHRR channel. It is  $W/(m^2 * sr)$  for channel 1,2,3a and  $W/(m^2*sr*m^{-1})$  for 3b,4,5.

The data are, for each class, a vector of fixed dimension (6) which are always stored in the same order:

- { ch 1, ch 2, ch 3a, ch 3b, ch 4, ch 5 } if **IDefCcsMode= 0 (AVHRR)**,
- { Brightness Temperature, local variance } if **IDefCcsMode= 1 (IIS)**

When imager data are not available for a given channel (e.g. for visible AVHRR channels during night) then the corresponding position is filled with 0.

### 2.11.4 Class projection in IASI pixels

Synthetic description of the classes present in each sounder pixel FOV is given by:

- **IDefCcsRadAnalNbClass** : Number of classes actually present in the FOV of sounder pixel PN (including class 7 if any pixels are assigned to this class),
- **IDefCcsRadAnalWgt** : Fraction of the FOV of sounder pixel PN covered by class NCL. Sum over all the classes (including class 7) for a given (PN,SN) is equal to 1.



### 3 LEVEL 1A RECORDS

#### 3.1 Secondary Product Header Record

There is no SPHR defined for the IASI Level 1 products.

#### 3.2 Global and Variable External Auxiliary Data Records

There are no GEADRs or VEADRs defined for the IASI Level 1a product.

#### 3.3 Global Internal Auxiliary Data Record

There are two subclasses of GIADR for the Level 1a product.

<i>Subclass Name</i>	<i>Description</i>	<i>Subclass ID</i>
GIADR-QUALITY	Contains quality information for the product	0
GIADR-SCALE-FACTORS	Contains the scale factors used to scale the spectral data in the MDR	1

#### 3.4 Variable Internal Auxiliary Data Record

There are no VIADRs in the IASI Level 1a product.

#### 3.5 Measurement Data Records

There is one subclass of MDR for the Level 1a product, MDR-1A.

<i>Subclass Name</i>	<i>Description</i>	<i>Subclass ID</i>
MDR-1A	IASI L1A radiance product	0

The MDR is detailed in 0 to this document.

##### 3.5.1 MDR Fields

###### 3.5.1.1 *GEPSIasiMode*

<i>Bit</i>	<i>Meaning</i>
0 – 15	Instrument mode: word 19 of instrument packet
16 – 23	During external calibration mode, scan position SP (see word 12 of instrument packet). 00 if not during external calibration mode
24 – 31	Not used

The following table shows details of instrument packet word #19 from IASI IMVD. See also [RD 2], Section 12.2.

<b>Instrument Mode (Word #19)</b>	
B0 to B7	0 (not used)
B8	0: transition to the mode in progress 1: established mode

B9 to B15	0100001: Normal operation 0100010: External calibration 1111000: Auxiliary Op
-----------	---

During the first line following mode transition, the bit B8 will be set to zero by the instrument for the four or five first step numbers. After this short period of time, the bit B8 will be set to one.

### 3.5.1.2 *GEPSOPSProcessingMode*

<i>Bit</i>	<i>Meaning</i>
0 – 1	Input data level ( 00 = Level 0, 01 = Level 1, 11 = Level 2)
2	0 = normal/auxiliary instrument mode, 1 = external calibration mode
3	Debug mode (0 = debug mode off)
4	Interface mode (0 = granule per granule, 1 = dump per dump)
5	Target type during external calibration mode ( 0 = Earth, 1 = not Earth)
6 – 31	Not used

### CNES:

In the §Appendix A of PFS correct the bit 76 of GEPSIdConf to GOPSFItImgCSMiss (typo).

### 3.5.1.3 *GEPSIdConf*

<i>Bit</i>	<i>Meaning</i>
0 - 31	PTSI (word 16 and 17 of the instrument packet)
32 – 63	IDefIDConf: ID of the algorithm configuration
64	Normal processing mode ( 0 = off, 1 = On)
65	Backlog processing mode ( 0 = off, 1 = On)
66	Re-processing mode ( 0 = off, 1 = On)
67	Parallel validation ( 0 = off, 1 = On)
68	In-plane satellite manoeuvre ( 0 = no manoeuvre, 1 = manoeuvre)
69 – 81	Degraded cases at line level. If the bit is set (= 1), then the corresponding flag below has been raised
69	GOPSFlaPixMiss
70	GOPSFlaDataGap
71	GOPSFItIsrfemOff
72	GOPSFItBandMiss
73	GOPSFItBBTMiss
74	GOPSFItImgEWMiss
75	GOPSFItImgBBMiss
76	GOPSFItImgCSMiss
77	GOPSFflagPacketVPMiss
78	GOPSFflagPacketAPMiss
79	GOPSFflagPacketPXMiss
80	GOPSFflagPacketIPMiss
81	GOPSFlaGeoAvhrrMiss

### 3.5.1.4 *IDefCcsMode*

<i>Bit</i>	<i>Meaning</i>
31 - 1	unused
0	0 = AVHRR 1 = IIS

### 3.5.1.5 *GQisFlagQualDetailed*

<i>Bit</i>	<i>Meaning</i>
0	Hardware (BIMSCSQ, BIMSSQ1, BIMSSQ2)
1	Band 1 affected by Spikes (BspkFlagSpik B1)
2	Band 2 affected by Spikes (BspkFlagSpik B2)
3	Band 3 affected by Spikes (BspkFlagSpik B3)
4	NZPD and complex calibration error <ul style="list-style-type: none"> <li>• BZpdFlagNZpdNonQual</li> <li>• BArcFlagCalSpectNonQual</li> </ul>
5	On-board general quality flag (BBofFlagSpectNonQual)
6	Overflow/Underflow (GDocFlagUnderOverFlow)
7	Spectral calibration error: <ul style="list-style-type: none"> <li>• GFaxFlagAxeNonQual</li> <li>• GIsfFlagPdsNonValid</li> <li>• GOPSFItIsrfemOff</li> </ul>
8	Radiometric post-calibration error: <ul style="list-style-type: none"> <li>• GFtbFlagBBTNonQual</li> <li>• GHecFlagDateNonOK</li> </ul>
9	GQisFlagQual summary flag for all bands (old flag)
10	Missing sounder data (GOPSFflagPixMiss, GOPSFflagBandMiss)
11	Missing IIS data (GOPSFItImgEWMiss)
12	Missing AVHRR data (GOPSFItRadAvhrrMiss)
13	SPARE
14	SPARE
15	SPARE

## 4 LEVEL 1B RECORDS

### 4.1 Secondary Product Header Record

There is no SPHR defined for the IASI Level 1 products.

### 4.2 Global and Variable External Auxiliary Data Records

There are no GEADRs or VEADRs defined for the IASI Level 1b product.

### 4.3 Global Internal Auxiliary Data Record

The Level 1b product uses the same subclasses of GIADR as the Level 1a product.

### 4.4 Variable Internal Auxiliary Data Record

There are no VIADRs in the IASI Level 1b product.

### 4.5 Measurement Data Records

There is one subclass of MDR for the Level 1b product, MDR-1B.

<i>Subclass Name</i>	<i>Description</i>	<i>Subclass ID</i>
MDR-1B	IASI L1B radiance product	1

The MDR is detailed in the Annex (0) to this document.

#### 4.5.1 MDR Fields

##### 4.5.1.1 *GEPSIasiMode*

See Section Appendix A.

##### 4.5.1.2 *GEPSOPSProcessingMode*

See Section Appendix A.

##### 4.5.1.3 *GEPSIdConf*

See Section Appendix A.

##### 4.5.1.4 *GQisFlagQualDetailed*

See Section Appendix A.

## 5 LEVEL 1C RECORDS

### 5.1 Secondary Product Header Record

There is no Secondary Product Header Record (SPHR) defined for the IASI Level 1 products.

### 5.2 Global and Variable External Auxiliary Data Records

There are no GEADRs or VEADRs defined for the IASI Level 1c product.

### 5.3 Global Internal Auxiliary Data Record

The Level 1c product uses the same subclasses of GIADR as the Level 1a product.

### 5.4 Variable Internal Auxiliary Data Record

There are no VIADRs in the IASI Level 1c product.

### 5.5 Measurement Data Records

There is one subclass of MDR for the Level 1c product, MDR-1C.

<i>Subclass Name</i>	<i>Description</i>	<i>Subclass ID</i>
MDR-1C	IASI L1C radiance product	2

The MDR is detailed in Appendix A of this document.

#### 5.5.1 MDR Fields

##### 5.5.1.1 *GEPSIASiMode*

See Section Appendix A.

##### 5.5.1.2 *GEPSOPSProcessingMode*

See Section Appendix A.

##### 5.5.1.3 *GEPSIdConf*

See Section Appendix A.

##### 5.5.1.4 *GQisFlagQualDetailed*

See Section Appendix A.

##### 5.5.1.5 *GEUMAvhrr1BQual*

<i>Bit</i>	<i>Meaning</i>
0-6	If Bit7 = 0: Fraction in % (0-100) of weighted AVHRR pixels in IASI FOV covered with snow/ice. If Bit7 = 1: Number of missing, bad or failed AVHRR pixels (0-127)
7	0 = no missing or bad AVHRR pixels 1 = missing/bad AVHRR pixel(s)

When all bits are set to 1, this means that 127 or more AVHRR pixels are missing, failed or bad.

## 6 ENGINEERING RECORDS

### 6.1 Notation

The Engineering product is for the use of the IASI-TEC, which requires that a certain number of IEEE real type values be stored within the product, contrary to [AD 1]. The IEEE real values are stored within a bit string type of the correct length (64 bits for a real\*8 and 32 bits for a real\*4). This is indicated within the Annex table defining the Engineering product using the notation: bitst(64)[real\*8] and bitst(32)[real\*4] respectively.

### 6.2 Secondary Product Header Record

There is no SPHR defined for the IASI Level 1 products.

### 6.3 Global and Variable External Auxiliary Data Records

There are no GEADRs or VEADRs defined for the IASI Engineering product.

### 6.4 Global Internal Auxiliary Data Record

There is one subclass of GIADR for the Engineering Product, GIADR-ENGINEERING. This is detailed in 0 of this document.

<i>Subclass Name</i>	<i>Description</i>	<i>Subclass ID</i>
GIADR-ENGINEERING	IASI L1 engineering-data product	2

### 6.5 Variable Internal Auxiliary Data Record

There is one subclass of VIADR defined for Engineering products, VIADR-ENGINEERING. This is detailed in the Annex to this document.

<i>Subclass Name</i>	<i>Description</i>	<i>Subclass ID</i>
VIADR-ENGINEERING	IASI L1 engineering-data product	0

### 6.6 Measurement Data Records

There is one subclass of MDR for the Engineering product, MDR-ENGINEERING. This is detailed in the Annex to this document.

<i>Subclass Name</i>	<i>Description</i>	<i>Subclass ID</i>
MDR-ENGINEERING	IASI L1 engineering-data product	3

#### 6.6.1 MDR Fields

##### 6.6.1.1 *GEPSIasiMode*

See Section Appendix A.

##### 6.6.1.2 *GEPSOPSProcessingMode*

See Section Appendix A.

### **6.6.1.3 *GEPSIdConf***

See Section Appendix A.

### **6.6.1.4 *GccsConfAvhrrChannel***

<b>Bit</b>	<b>Meaning</b>
7 - 2	Unused
0 - 1	00 = AVHRR channels not available; 10 = AVHRR channels available; 01 = AVHRR channels transition between available and not available channels. Synthesis of the AVHRR lines overlaying IIS image.

### **6.6.1.5 *GQisFlagQualDetailed***

See Section Appendix A.

### **6.6.1.6 *GEUMAvhrrIBQual***

See Section Appendix A.

### **6.6.1.7 *GCcsAvhrrPseudoChn***

The variable “GCcsAvhrrPseudoChn” contains the radiance values of four AVHRR pseudo-channels (first dimension (DIM1)) for every pixel (DIM2) and step number (DIM3). The relationship between the pseudo-channels and the array position of the first dimension is as follows:

- GCcsAvhrrPseudoChn(0) is the AVHRR ch4 pseudo-channel radiance,
- GCcsAvhrrPseudoChn(1) is the AVHRR ch5 pseudo-channel radiance,
- GCcsAvhrrPseudoChn(2) is the IASI-based AVHRR ch4 pseudo-channel radiance,
- GCcsAvhrrPseudoChn(3) is the IASI-based AVHRR ch5 pseudo-channel radiance.

## 7 VERIFICATION RECORDS

### 7.1 Secondary Product Header Record

There is no SPHR defined for the IASI Level 1 products.

### 7.2 Global and Variable External Auxiliary Data Records

There are no GEADRs or VEADRs defined for the IASI Verification product.

### 7.3 Global and Variable Internal Auxiliary Data Records

There are no GIADRs or VIADRs in the IASI Verification product.

### 7.4 Measurement Data Records

There is one subclass of MDR for the Verification product, MDR-VERIFICATION. It contains verification and auxiliary data in the order composed of concatenated IASI instrument source packets (ISPs) in the following order: AP-VPA-VPB-VPC-VPD-VPE. These are pure ISPs without the header added in the Level 0 MDR.

<i>Subclass Name</i>	<i>Description</i>	<i>Subclass ID</i>
MDR-VERIFICATION	Verification and auxiliary data	4

The MDR is detailed in 0 of this document.



## 8 RECORD SUBCLASSES

The tables below summarise the subclass name and ID information already provided in the preceding chapters.

### 8.1 GIADR

<i>Subclass</i>	<i>Name</i>
0	GIADR-QUALITY
1	GIADR-SCALE-FACTORS
2	GIADR-ENGINEERING

### 8.2 VIADR

<i>Subclass</i>	<i>Name</i>
0	VIADR-ENGINEERING

### 8.3 MDR

<i>Subclass</i>	<i>Name</i>
0	MDR-1A
1	MDR-1B
2	MDR-1C
3	MDR-ENGINEERING
4	MDR-VERIFICATION

## 9 OCCURRENCE INFORMATION

### 9.1 Level 1a

<i>Record</i>	<i>Occurrence</i>
MPHR	Once per product
SPHR	Deleted
GIADRs	Once per product
MDR-1A	Once per scan line

### 9.2 Level 1b

<i>Record</i>	<i>Occurrence</i>
MPHR	Once per product
SPHR	Deleted
GIADRs	Once per product
MDR-1B	Once per scan line

### 9.3 Level 1c

<i>Record</i>	<i>Occurrence</i>
MPHR	Once per product
SPHR	Deleted
GIADRs	Once per product
MDR-1C	Once per scan line

### 9.4 Engineering

<i>Record</i>	<i>Occurrence</i>
MPHR	Once per product
SPHR	Deleted
GIADR-ENGINEERING	Once per product
VIADR-ENGINEERING	Once every 10 scan lines
MDR-ENGINEERING	Once per scan line

### 9.5 Verification

<i>Record</i>	<i>Occurrence</i>
MPHR	Once per product
SPHR	Deleted
MDR-VERIFICATION	Once per scan line

## 10 RECORD FORMAT VERSION CONTROL

This section provides version numbers for the records defined within this document.

<i>Record Subclass</i>	<i>Format Version Number</i>	<i>Issue Defined</i>
<b>SPHR</b>	<b>DELETED</b>	<b>6.4</b>
	1	6.3 (CDR)
<b>GIADR-QUALITY</b>	<b>2</b>	<b>6.4</b>
	1	6.3 (CDR)
<b>GIADR-SCALEFACTORS</b>	<b>2</b>	<b>6.4</b>
	1	6.3 (CDR)
<b>MDR-1A</b>	<b>5</b>	<b>8</b>
	4	6.6
	3	6.5
	2	6.4
	1	6.3 (CDR)
<b>MDR-1B</b>	<b>5</b>	<b>8</b>
	4	6.6
	3	6.5
	2	6.4
	1	6.3 (CDR)
<b>MDR-1C</b>	<b>5</b>	<b>8</b>
	4	6.6
	3	6.5
	2	6.4
	1	6.3 (CDR)
<b>GIADR-ENGINEERING</b>	<b>3</b>	<b>6.5</b>
	2	6.4
	1	6.3 (CDR)
<b>VIADR-ENGINEERING</b>	<b>3</b>	<b>6.6</b>
	2	6.4
	1	6.3 (CDR)
<b>MDR-ENGINEERING</b>	<b>6</b>	<b>9</b>
	5	8
	4	6.6
	3	6.5
	2	6.4
	1	6.3 (CDR)

<i>Record Subclass</i>	<i>Format Version Number</i>	<i>Issue Defined</i>
<b>MDR-VERIFICATION</b>	<b>3</b>	<b>6.5</b>
	2	6.4
	1	6.3 (CDR)

*Table 2: Record Format Version Numbers*

## **APPENDIX A      DETAILED SPECIFICATION OF IASI LEVEL 1 DATA RECORDS**

In the following Annex, detailed format specifications for all the Variable Internal and Measurement Data Records in IASI Level 1 products are included, i.e.:

- GIADR-QUALITY
- GIADR-SCALEFACTORS
- MDR-1A
- MDR-1B
- MDR-1C
- GIADR-ENGINEERING
- VIADR-ENGINEERING
- MDR-ENGINEERING
- MDR-VERIFICATION

The Annex is available as a separate spreadsheet, with Document Reference:  
EUM.EPS.SYS.SPE.990003.ANX .

This Document	
Title	IASI LEVEL 1 PRODUCT FORMAT SPECIFICATION TABLES
Reference Number	EPS/MIS/SPE/990003
Change Record	
Issue 4 Draft A	Added Version Control Worksheet (LEO/C/TP)
	Removed detailed navigation section from all VIADRs (LEO/C/TP)
Issue 4 Draft B	Updated layout to allow automatic calculation of sizes
Issue 4 Draft C	Removed VIADR and VEADR because there were no specified contents
	Moved MDR and ADR for Levels 1a,b and c onto separate worksheets for clarity
	Updated contents in line with revised version of IASI-TN-2100-9469-CNE
	Increased parameter NBK from 5 to 6
	Increased parameter NCL from 6 to 7
	Added temporary field names to those fields that were still named with a "?" after revised version updates.
	Divided ADR field GEPSLoclasiAvhrr into two fields, GEPSLoclasiAvhrr_IASI and GEPSLoclasiAvhrr_IIS
	MDR field GSmcSpect moved from byte*3 to byte type in line with GPFS. Extra array dimension added to compensate
	ADR verification Verification_Data field changed from integer8 to bytetype for flexibility - total size not changed
Issue 5 Revision 0	Issue for CGS PDR
Issue 5 Revision 1	Revised Issue for CGS PDR
	Corrected some formula errors that resulted in incorrect reocrd size calculations
Issue 6 Revision 0	Removed ADRS. ADR contents moved to relevant MDR.
Draft A	Updated PFS in line with revised version of IASI Level1 Product Content version 5.2
	Updated SPHR
	- Removed CDA Status
	- Removed Processing Mode Status Change field
	Reduced number of classes for FOV sounder analysis parameter (NCL) from 7 to 6
	Introduced new notation - bitsr(64)[real*8] and bitst(32)[real*4] for the engineering product to show a bitst field that is used to store a binary dump of an IEEE real type of 8 and 4 bytes, respectively.

<b>Draft B</b>	Added EARTH_SATELLITE_DISTANCE field to Level 1a/1b/1c MDRs as this info is available at Level 1a and is required again at Level 2 processing
<b>Issue 6 Revision 1</b>	Introduced V-INTEGER types in line with Issue 6.1 of GPFS [AD-1]
<b>Issue 6 Revision 2</b>	Size of spectral data in all three MDRs reduced from 3*byte to integer2. This is possible by using a number of scale factors in a number of spectral bands New GIADR-SCALEFACTORS added to include scaling factors for up to 10 spectral bands to accommodate scaling of spectral data Original GIADR renamed to GIADR-QUALITY to avoid confusion
<b>Issue 6 Revision 3</b>	Modifications to Word document
<b>Issue 6 Rev 4</b>	<b>EUM.EPS.SYS.DCR.02.175</b> GIADR_QUALITY: Deleted GEPSIdConf_product Updated IDefPsfSondY/Z fields - scale factors, units, array definition and field type Changed array ordering for IDefIISNeDT and IDefDptIISDeadPix GIADR.SCALE_FACTORS: Renamed NUMBER_OF_SPECTRAL_BANDS to IDefScaleSondNbScale Added IDefScaleSondNsfirst Renamed SPECTRAL_BAND_END_CHANNEL to IDefScaleSondNslast Renamed SCALE_FACTORS to IDefScaleSondScaleFactor Added IDefScaleIISScaleFactor MDR-1A/1B/1C Changed array size and field type for GEPSIdConf GlsfLinOrigin and GlsfColOrigin units deleted GlsfPds1-4 units removed, scale factor of 6 added IDefSpecDWN, IDefNsfirst and IDefNslast moved to 1a/1b/1c specific areas in MDR and renamed for MDR-1b/1c Array ordering of GIsrImage changed MiscOffsetSondIIS deleted Added field GQisFlagQual GQisSysTecIISQual and GQisSysTecSondQual field types changed from V-integer4 to u-integer4 Angle fields and location fields changed from V-integer4 to u-integer4 and given scale factor of 6 GSmcSpect array order changed. Data type made unsigned

	IDefCovarMatEigenVal1 name changed to IDefCovarMatEigenVal11b for MDR-1a/1b and to IDefCovarMatEigenVal11c for MDR-1c. Description updated
	MDR-1C:
	IDefCcsChannelId array size increased
	GCcsRadAnalWgt, GCcsRadAnalY, GCcsRadAnalZ array order changed
	GCcsRadAnalY, GCcsRadAnalZ data type changed to integer4. Units and scale factor added
	Image classification fields added at end of MDR
	General: Cloud Analysis phrase replaced by more accurate Radiance Analysis
	GIADR ENGINEERING:
	GEPSDatProcessing array size reduced
	GEPSIdConf_Product deleted
	OBT to UTC fields added
	VIADR-ENGINEERING
	MDptIISBadHealthPix and MDptIISinHomPix arrays order changed
	MDR ENGINEERING
	Made changes requested by CNES (as detailed in DCR)
	MDR VERIFICATION
	Made changes requested by CNES (as detailed in DCR)
	The following fields are defined to be in the order (zenith, azimuth) :
	GGeoSondAnglesMETOP
	GGeoIISAnglesMETOP
	GGeoSondAnglesSUN
	GGeoIISAnglesSUN fields
	Added Parameters AMCO, AMLI
	Updated Parameter NCL from 6 to 7
	Updated size calculations and offset calculations
<b>Issue 6 Rev 5</b>	<b>EUM.EPS.SYS.DCR.02.251</b>
	MDR 1C: Fields GCcsRadAnalY and GCcsRadAnalZ. Changed array size from [NCL,PN,SNOT,2] to [NCL,PN,SNOT,1] and changed data types from V-INTEG4 to integer4
	MDR 1C : Fields GCcsImageClassifiedNbLin, GCcsImageClassifiedNbCol, GCcsImageClassifiedFirstLin and GCcsImageClassifiedFirstCol changed array ordering from [1,1,SNOT,1] to [SNOT,1,1,1]
	MDR-ENGINEERING changed field name CGeoSubSatellitePosition to GGeoSubSatellitePosition
	MDR-ENGINEERING changed field name CGCcsRadAnalNbClass to GCcsRadAnalNbClass



	MDR-ENGINEERING. Corrected formula that calculates field sizes for all fields. Requires updated of Parameters worksheet as well. This results in updated field sizes, offsets and record size for MDR-ENGINEERING.
	Added DCR reference to this table for issue 6.4
<b>Issue 6 Rev 6</b>	<b>EUM.EPS.SYS.DCR.04.009</b>
	MDR-1a, 1b, 1c - Change GQisFlagQual from scalar to array of PN x SNOT
	MDR-1A, 1b, 1c - Add clarification of ordering to flag GEPSLoClasiAvhrr_IASI
	MDR-1a - Change data type of field GSmcSpect from unsigned integer2 to signed integer2
	MDR-1b - Change data type of field GS1bSpect from unsigned integer2 to signed integer2
	MDR-1c - Change data type of field GS1cSpect from unsigned integer2 to signed integer2
	MDR-1c - Add units and update description for GCcsImageClassifiedFirstLin
	MDR-1c - Add units and update description for GCcsImageClassifiedFirstCol
	MDR-1c - Change datatype of field GCsImageClassified
	MDR-Engineering - Correct calculation of field size for field MMcxNoiseCalRad
	MDR-Engineering - Correct calculation of field size for field MMcxBiasCalRad
	MDR-Engineering - Field GOPSFItIsrfemOff array size changed from PN x SNOT to PN
	MDR-Engineering - Field GOPSFlagPacketIPMiss array size changed from SNOT to SNOT+4
	MDR-Engineering - Added field GOPSFlaGeoAVHRRMiss
	MDR-Engineering - Deleted field SPARE
	MDR-Engineering - Added units for field GlacPosMaxQual
	MDR-Engineering - add units to field GlacVarImagIIS
	MDR-Engineering - change units for field GCOffsetSondAvhrr
	MDR-Engineering - Add units to field GlaxAxeRes
	MDR-Engineering - Add units to field GIFaxAxeRes
	MDR-Engineering - Change units of field GlccRadCalOffsetImag
	MDR-Engineering - Change datatype of field GlccRadCalOffsetImag
	MDR-Engineering - Add units to field GlccRadCalSlopeImag
	MDR-Engineering - Add ScaleFactor to field GlccRadCalSlopeImag
	MDR-Verification - Added typical size for record and reference to Section 7.3 for order of contents
	MDR-Verification - Change datatype for field VERIFICATION_DATA
	VIADR-Engineering - Change datatype from byte to u-byte for fields MExsSmin, MExsSmax and MDptIISinHomPix
	Parameters - Added N to provide typical MDR-Verification size
	Parameters - Added description of SNOT+4 parameter
<b>Issue 6 Rev 7</b>	<b>EUM.EPS.SYS.DCR.05.0253</b>

	See document table in main text - no changes to this Annex
<b>Version 7A 23/07/08</b>	Migrated into Hummingbird. Contents identical with issue 6.7.
<b>Version 7B 23/07/08</b>	No changes to annex.
<b>Version 7C 22/08/08</b>	<b>EPS_AB_DCR_EUM_73</b>
	MDR-L1C - Change of units description of GCcsRadAnalMean
	MDR-L1C - Change of units description of GCcsRadAnalStd
<b>Version 8 14/10/08</b>	<b>EPS_AB_DCR_EUM_74</b>
	MDR-1a - change of dimension of GQisFlagQual
	MDR-1a - Add field GQisFlagQualDetailed
	MDR-1b - change of dimension of GQisFlagQual
	MDR-1b - Add field GQisFlagQualDetailed
	MDR-1c - change of dimension of GQisFlagQual
	MDR-1c - Add field GQisFlagQualDetailed
	MDR-1c - Add field GlacVarImagIIS
	MDR-1c - Add field GlacAvgImagIIS
	MDR-1c - Add field GEUMAvhrr1BCIdFrac
	MDR-1c - Add field GEUMAvhrr1BLandFrac
	MDR-1c - Add field GEUMAvhrr1BQual
	MDR-Engineering Add field GlacAvgImagIIS
	MDR-Engineering Add field NZPDInterpixelEW
	MDR-Engineering Add field NZPDInterpixelBB
	MDR-Engineering Add field NZPDInterpixelCS
	MDR-Engineering Add field GSsdConverFlag
	MDR-Engineering Add field GQisFlagDetailed
	MDR-Engineering Add field GEUMAvhrr1BCIdFrac
	MDR-Engineering Add field GEUMAvhrr1BLandFrac
	MDR-Engineering Add field GEUMAvhrr1BQual
	MDR-Engineering Add field GCcsAvhrrPseudoChn
	MDR-Engineering Add field GCcsAvhrrPsCh4FlagQual
	MDR-Engineering Add field GCcsAvhrrPsCh5FlagQual
	MDR-Engineering change of DATA_PX (add BARclmagRMS form L0 word 32 to 149)

	MDR-Engineering change of dimension of GQisFlagQual
<b>Version 9 27/01/09</b>	<b>ODT_DCR_17</b>
	MDR-1a change content of GQisFlagQualDetailed
	MDR-1b change content of GQisFlagQualDetailed
	MDR-1c change content of GQisFlagQualDetailed
	MDR-Engineering change content of field GQisFlagDetailed
	MDR-Engineering remove GCcsAvhrrPSch4FlagQual
	MDR-Engineering remove GCcsAvhrrPSch5FlagQual
	MDR-Engineering remove NZPDInterPixelEW
	MDR-Engineering remove NZPDInterPixelBB
	MDR-Engineering remove NZPDInterPixelCS
	MDR-Engineering add MHipNZpdInterPixel
	MDR-Engineering add MHipFlagInterPixNZpdNonQual
	MDR-Engineering split Data_IP into Data_IP (word 4 to 22) and
	MDR-Engineering add EqualizationCounter
<b>Version 9A 25/02/09</b>	Typo: References to "GQisFlagDetailed" above for Versions 8 & 9 should read "GQisFlagQualDetailed".
<b>Version 9B 13/10/10</b>	<b>ODT_DCR_155 &amp; EUM/EPS/NCR/12303</b>
	See Document Change Record in main document - no changes to this Annex.
<b>Version 9C 07/12/10</b>	GEUMAvhrr1BQual description update (in MDR-1C & MDR ENGINEERING).
	[To stay as Draft update for now; no DCR produced yet.]
<b>Version 9D 01/12/11</b>	<b>STM_DOCET_110</b>
	Unit correction for GEPSLocIASIAvhrr_iasi & GEPSLocIASIAvhrr_IIS: from Avhrr pixel to ms (milliseconds) in MDR-1a, 1b and 1c.
	Same thing for GCcsImageClassifiedFirstLin in the MDR-1c.
<b>Version 9E 14/12/11</b>	<b>STM_DOCET_110 revision</b>
	The above-mentioned unit correction for GEPSLocIASIAvhrr_iasi & GEPSLocIASIAvhrr_IIS from Avhrr pixel to ms in MDR-1a, 1b and 1c in fact applies for the line only. Column stays in Avhrr pixels.





Doc Ref: EUM.EPS.SYS.SPE.990003.ANX  
IASI\_Level\_1\_Product\_Format\_Specification\_-\_Annex[1].xls  
Worksheet: MDR-1A

FIELD	DESCRIPTION	SF	UNITS	DIM1	DIM2	DIM3	DIM4	TYPE	TYPE SIZE	FIELD SIZE	OFFSET
RECORD_HEADER	Generic Record Header	0		1	1	1	1	REC_HEAD	20	20	0
	<b>GENERIC QUALITY INDICATORS</b>										
DEGRADED_INST_MDR	Quality of MDR has been degraded from nominal due to an instrument degradation			1	1	1	1	boolean	1	1	20
DEGRADED_PROC_MDR	Quality of MDR has been degraded from nominal due to a processing degradation			1	1	1	1	boolean	1	1	21
<b>Level 1 Data</b>											
GEPSIasiMode	Instrument mode			1	1	1	1	bitst(32)	4	4	22
GEPSOPSProcessingMode	Processing mode			1	1	1	1	bitst(32)	4	4	26
GEPSIdConf	System configuration at line level: PTSI, TEC conf file ID,.....			1	1	1	1	bitst(256)	32	32	30
GEPSLocIasiAvhrr_IASI	Measure positioning relatively to AVHRR: position of 4 IASI sounder pixels in AVHRR raster with DIM1 equal to 2 corresponding to (line, column)		ms in line, Avhrr pixels in column	2	PN	SNOT	1	V-INTEG4	5	1200	62
GEPSLocIasiAvhrr_IIS	Measure positioning relatively to AVHRR: position of IIS pixels for a subgrid 5*5 of IIS with DIM1 equal to 2 corresponding to (line, column)		ms in line, Avhrr pixels in column	2	SGI	SNOT	1	V-INTEG4	5	7500	1262
OBT	On Board Time (Coarse time + Fine time)			SNOT	1	1	1	bitst(48)	6	180	8762
OnboardUTC	Date of IASI measure (on board UTC): Number of Days since 1 January 2000; Number of ms in the day			SNOT	1	1	1	short cds time	6	180	8942
GEPSDatIasi	Date of IASI measure (Corrected UTC): Number of Days since 1 January 2000; Number of ms in the day		UTC	SNOT	1	1	1	short cds time	6	180	9122
GlsfLinOrigin	Zero point in line in the interpolation grid of the spectral database			CCD	1	1	1	integer4	4	8	9302
GlsfColOrigin	Zero point in column in the interpolation grid of the spectral database			CCD	1	1	1	integer4	4	8	9310

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Worksheet: MDR-1A

<b>GlsfPds1</b>	Weight of interpolation point 1	6		CCD	1	1	1	integer4	4	8	9318
<b>GlsfPds2</b>	Weight of interpolation point 2	6		CCD	1	1	1	integer4	4	8	9326
<b>GlsfPds3</b>	Weight of interpolation point 3	6		CCD	1	1	1	integer4	4	8	9334
<b>GlsfPds4</b>	Weight of interpolation point 4	6		CCD	1	1	1	integer4	4	8	9342
<b>GEPS_CCD</b>	Corner Cube Direction for all observational targets			SNOT	1	1	1	boolean	1	30	9350
<b>GEPS_SP</b>	Scan position for all observational targets			SNOT	1	1	1	integer4	4	120	9380
<b>GlrcImage</b>	Calibrated IASI images		W/m2/sr/m-1	IMCO	IMLI	SNOT	1	u-integer2	2	245760	9500
<b>GQisFlagQual</b>	Quality flag for the system			SB	PN	SNOT	1	boolean	1	360	255260
<b>GQisFlagQualDetailed</b>	Detailed quality flag for the system			PN	SNOT	1	1	bitst(16)	2	240	255620
<b>GQisQualIndex</b>	System-IASI general quality index			1	1	1	1	V-INTEG4	5	5	255860
<b>GQisQualIndexIIS</b>	IIS imager quality index inside 1c [product			1	1	1	1	V-INTEG4	5	5	255865
<b>GQisQualIndexLoc</b>	Geometric quality index for sounder product			1	1	1	1	V-INTEG4	5	5	255870
<b>GQisQualIndexRad</b>	Radiometric quality index for sounder product			1	1	1	1	V-INTEG4	5	5	255875
<b>GQisQualIndexSpect</b>	Spectral quality index for sounder product			1	1	1	1	V-INTEG4	5	5	255880
<b>GQisSysTecIISQual</b>	System -TEC quality index for IIS			1	1	1	1	u-integer4	4	4	255885
<b>GQisSysTecSondQual</b>	System -TEC quality index for sounder			1	1	1	1	u-integer4	4	4	255889
<b>GGeoSondLoc</b>	Location of pixel centre in geodetic coordinates (long, lat) for each sounder pixel	6	degrees	2	PN	SNOT	1	integer4	4	960	255893
<b>GGeoSondAnglesMETOP</b>	Measurement angles for each sounder pixel (zenith, azimuth)	6	degrees	2	PN	SNOT	1	integer4	4	960	256853
<b>GGeoIISAnglesMETOP</b>	Measurement angles for a subgrid of IASI imager (zenith, azimuth)	6	degrees	2	SGI	SNOT	1	integer4	4	6000	257813
<b>GGeoSondAnglesSUN</b>	Solar angles at the surface for each sounder pixel (zenith, azimuth)	6	degrees	2	PN	SNOT	1	integer4	4	960	263813
<b>GGeoIISAnglesSUN</b>	Solar angles at the surface for a subgrid (5x5) of IASI imager (zenith, azimuth)	6	degrees	2	SGI	SNOT	1	integer4	4	6000	264773
<b>GGeoIISLoc</b>	Location of pixel centre in geodetic coordinates for a sub grid (5x5) of the imager pixels	6	degrees	2	SGI	SNOT	1	integer4	4	6000	270773

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IASI\_Level\_1\_Product\_Format\_Specification\_-\_Annex[1].xls  
Worksheet: MDR-1A

<b>EARTH_SATELLITE_DISTANCE</b>	Distance of satellite from Earth centre		m	1	1	1	1	u-integer4	4	4	276773
<b>Level 1a Specific Data</b>											
<b>IDefSpectrDWn</b>	Sample width of IASI spectra		m-1	1	1	1	1	V-INTEGER4	5	5	276777
<b>IDefNsfirst</b>	Number of the first sample of IASI spectra			1	1	1	1	integer4	4	4	276782
<b>IDefNslast</b>	Number of the last sample of IASI spectra			1	1	1	1	integer4	4	4	276786
<b>GSmcSpect</b>	Level 1a spectra		W/m2/sr/m-1	SS	PN	SNOT	1	integer2	2	2088000	276790
<b>IDefCovarMatEigenVal1b</b>	Level 1a noise variance-covariance matrix index. (IDefCovarMatEigenVal1b is the same for Level 1a and 1b.)			CCD	100		1	V-INTEGER4	5	1000	2364790
<b>TOTAL SIZE</b>											<b>2365790</b>



Doc Ref: EUM.EPS.SYS.SPE.990003.ANX  
IASI\_Level\_1\_Product\_Format\_Specification\_-\_Annex[1].xls  
Worksheet: MDR-1B

FIELD	DESCRIPTION	SF	UNITS	DIM1	DIM2	DIM3	DIM4	TYPE	TYPE SIZE	FIELD SIZE	OFFSET
RECORD_HEADER	Generic Record Header	0		1	1	1	1	REC_HEAD	20	20	0
	<b>GENERIC QUALITY INDICATORS</b>										
DEGRADED_INST_MDR	Quality of MDR has been degraded from nominal due to an instrument degradation			1	1	1	1	boolean	1	1	20
DEGRADED_PROC_MDR	Quality of MDR has been degraded from nominal due to a processing degradation			1	1	1	1	boolean	1	1	21
<b>Level 1 Data</b>											
GEPSIasiMode	Instrument mode			1	1	1	1	bitst(32)	4	4	22
GEPSOPSProcessingMode	Processing mode			1	1	1	1	bitst(32)	4	4	26
GEPSIdConf	System configuration at line level: PTSI, TEC conf file ID,.....			1	1	1	1	bitst(256)	32	32	30
GEPSLocIasiAvhrr_IASI	Measure positioning relatively to AVHRR: position of 4 IASI sounder pixels in AVHRR raster with DIM1 equal to 2 corresponding to (line, column)		ms in line, Avhrr pixels in column	2	PN	SNOT	1	V-INTEGER4	5	1200	62
GEPSLocIasiAvhrr_IIS	Measure positioning relatively to AVHRR: position of IIS pixels for a subgrid 5*5 of IIS with DIM1 equal to 2 corresponding to (line, column)		ms in line, Avhrr pixels in column	2	SGI	SNOT	1	V-INTEGER4	5	7500	1262
OBT	On Board Time (Coarse time + Fine time)			SNOT	1	1	1	bitst(48)	6	180	8762
OnboardUTC	Date of IASI measure (on board UTC): Number of Days since 1 January 2000; Number of ms in the day			SNOT	1	1	1	short cds time	6	180	8942
GEPSDatIasi	Date of IASI measure (Corrected UTC): Number of Days since 1 January 2000; Number of ms in the day		UTC	SNOT	1	1	1	short cds time	6	180	9122
GlsfLinOrigin	Zero point in line in the interpolation grid of the spectral database			CCD	1	1	1	integer4	4	8	9302

Doc Ref: EUM.EPS.SYS.SPE.990003.ANX  
IASI\_Level\_1\_Product\_Format\_Specification\_-\_Annex[1].xls  
Worksheet: MDR-1B

<b>GlsfColOrigin</b>	Zero point in column in the interpolation grid of the spectral database			CCD	1	1	1	integer4	4	8	9310
<b>GlsfPds1</b>	Weight of interpolation point 1	6		CCD	1	1	1	integer4	4	8	9318
<b>GlsfPds2</b>	Weight of interpolation point 2	6		CCD	1	1	1	integer4	4	8	9326
<b>GlsfPds3</b>	Weight of interpolation point 3	6		CCD	1	1	1	integer4	4	8	9334
<b>GlsfPds4</b>	Weight of interpolation point 4	6		CCD	1	1	1	integer4	4	8	9342
<b>GEPS_CCD</b>	Corner Cube Direction for all observational targets			SNOT	1	1	1	boolean	1	30	9350
<b>GEPS_SP</b>	Scan position for all observational targets			SNOT	1	1	1	integer4	4	120	9380
<b>GIrclImage</b>	Calibrated IASI images		W/m2/sr/m-1	IMCO	IMLI	SNOT	1	u-integer2	2	245760	9500
<b>GQisFlagQual</b>	Quality flag for the system			SB	PN	SNOT	1	boolean	1	360	255260
<b>GQisFlagQualDetailed</b>	Quality flag for the system			PN	SNOT	1	1	bitst(16)	2	240	255620
<b>GQisQualIndex</b>	System-IASI general quality index			1	1	1	1	V-INTEGER4	5	5	255860
<b>GQisQualIndexIIS</b>	IIS imager quality index inside 1c [product			1	1	1	1	V-INTEGER4	5	5	255865
<b>GQisQualIndexLoc</b>	Geometric quality index for sounder product			1	1	1	1	V-INTEGER4	5	5	255870
<b>GQisQualIndexRad</b>	Radiometric quality index for sounder product			1	1	1	1	V-INTEGER4	5	5	255875
<b>GQisQualIndexSpect</b>	Spectral quality index for sounder product			1	1	1	1	V-INTEGER4	5	5	255880
<b>GQisSysTecIISQual</b>	System -TEC quality index for IIS			1	1	1	1	u-integer4	4	4	255885
<b>GQisSysTecSondQual</b>	System -TEC quality index for sounder			1	1	1	1	u-integer4	4	4	255889
<b>GGeoSondLoc</b>	Location of pixel centre in geodetic coordinates (long, lat) for each sounder pixel	6	degrees	2	PN	SNOT	1	integer4	4	960	255893
<b>GGeoSondAnglesMETOP</b>	Measurement angles for each sounder pixel (zenith, azimuth)	6	degrees	2	PN	SNOT	1	integer4	4	960	256853
<b>GGeoIISAnglesMETOP</b>	Measurement angles for a subgrid of IASI imager (zenith, azimuth)	6	degrees	2	SGI	SNOT	1	integer4	4	6000	257813
<b>GGeoSondAnglesSUN</b>	Solar angles at the surface for each sounder pixel (zenith, azimuth)	6	degrees	2	PN	SNOT	1	integer4	4	960	263813
<b>GGeoIISAnglesSUN</b>	Solar angles at the surface for a subgrid (5x5) of IASI imager (zenith, azimuth)	6	degrees	2	SGI	SNOT	1	integer4	4	6000	264773

Doc Ref: EUM.EPS.SYS.SPE.990003.ANX  
IASI\_Level\_1\_Product\_Format\_Specification\_-\_Annex[1].xls  
Worksheet: MDR-1B

<b>GGeoILoc</b>	Location of pixel centre in geodetic coordinates for a sub grid (5x5) of the imager pixels	6	degrees	2	SGI	SNOT	1	integer4	4	6000	270773
<b>EARTH_SATELLITE_DISTANCE</b>	Distance of satellite from Earth centre		m	1	1	1	1	u-integer4	4	4	276773
<b>Level 1b Specific Data</b>											
<b>IDefSpectDwn1b</b>	Sample width of IASI 1B spectra		m-1	1	1	1	1	V-INTEGER4	5	5	276777
<b>IDefNsfirst1b</b>	Number of the first sample of IASI 1B spectra			1	1	1	1	integer4	4	4	276782
<b>IDefNsIast1b</b>	Number of the last sample of IASI 1B spectra			1	1	1	1	integer4	4	4	276786
<b>GS1bSpect</b>	Level 1B spectra		W/m2/sr/m-1	SS	PN	SNOT	1	integer2	2	2088000	276790
<b>IDefCovarMatEigenVal1b</b>	Level 1b noise variance-covariance matrix index (IDefCovarMatEigenVal1b is the same for Level 1a and 1b.)			CCD	100	1	1	V-INTEGER4	5	1000	2364790
<b>TOTAL SIZE</b>											<b>2365790</b>

Doc Ref: EUM.EPS.SYS.SPE.990003.ANX  
IASI\_Level\_1\_Product\_Format\_Specification\_-\_Annex[1].xls  
Worksheet: MDR-1C

FIELD	DESCRIPTION	SF	UNITS	DIM1	DIM2	DIM3	DIM4	TYPE	TYPE SIZE	FIELD SIZE	OFFSET
RECORD_HEADER	Generic Record Header	0		1	1	1	1	REC_HEAD	20	20	0
	<b>GENERIC QUALITY INDICATORS</b>										
DEGRADED_INST_MDR	Quality of MDR has been degraded from nominal due to an instrument degradation			1	1	1	1	boolean	1	1	20
DEGRADED_PROC_MDR	Quality of MDR has been degraded from nominal due to a processing degradation			1	1	1	1	boolean	1	1	21
<b>Level 1 Data</b>											
GEPSIasiMode	Instrument mode			1	1	1	1	bitst(32)	4	4	22
GEPSOPSProcessingMode	Processing mode			1	1	1	1	bitst(32)	4	4	26
GEPSIdConf	System configuration at line level: PTSI, TEC conf file ID,.....			1	1	1	1	bitst(256)	32	32	30
GEPSLocIasiAvhrr_IASI	Measure positioning relatively to AVHRR: position of 4 IASI sounder pixels in AVHRR raster with DIM1 equal to 2 corresponding to (line, column)		ms in line, Avhrr pixels in column	2	PN	SNOT	1	V-INTEGGER4	5	1200	62
GEPSLocIasiAvhrr_IIS	Measure positioning relatively to AVHRR: position of IIS pixels for a subgrid 5*5 of IIS with DIM1 equal to 2 corresponding to (line, column)		ms in line, Avhrr pixels in column	2	SGI	SNOT	1	V-INTEGGER4	5	7500	1262
OBT	On Board Time (Coarse time + Fine time)			SNOT	1	1	1	bitst(48)	6	180	8762
OnboardUTC	Date of IASI measure (on board UTC): Number of Days since 1 January 2000; Number of ms in the day			SNOT	1	1	1	short cds time	6	180	8942
GEPSDatIasi	Date of IASI measure (Corrected UTC): Number of Days since 1 January 2000; Number of ms in the day		UTC	SNOT	1	1	1	short cds time	6	180	9122
GIsfLinOrigin	Zero point in line in the interpolation grid of the spectral database			CCD	1	1	1	integer4	4	8	9302

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<b>GlsfColOrigin</b>	Zero point in column in the interpolation grid of the spectral database			CCD	1	1	1	integer4	4	8	9310
<b>GlsfPds1</b>	Weight of interpolation point 1	6		CCD	1	1	1	integer4	4	8	9318
<b>GlsfPds2</b>	Weight of interpolation point 2	6		CCD	1	1	1	integer4	4	8	9326
<b>GlsfPds3</b>	Weight of interpolation point 3	6		CCD	1	1	1	integer4	4	8	9334
<b>GlsfPds4</b>	Weight of interpolation point 4	6		CCD	1	1	1	integer4	4	8	9342
<b>GEPS_CCD</b>	Corner Cube Direction for all observational targets			SNOT	1	1	1	boolean	1	30	9350
<b>GEPS_SP</b>	Scan position for all observational targets			SNOT	1	1	1	integer4	4	120	9380
<b>GrIcImage</b>	Calibrated IASI images		W/m2/sr/m-1	IMCO	IMLI	SNOT	1	u-integer2	2	245760	9500
<b>GQisFlagQual</b>	Quality flag for the system			SB	PN	SNOT	1	boolean	1	360	255260
<b>GQisFlagQualDetailed</b>	Quality flag for the system			PN	SNOT	1	1	bits(16)	2	240	255620
<b>GQisQualIndex</b>	System-IASI general quality index			1	1	1	1	V-INTEGER4	5	5	255860
<b>GQisQualIndexIIS</b>	IIS imager quality index inside 1c [product			1	1	1	1	V-INTEGER4	5	5	255865
<b>GQisQualIndexLoc</b>	Geometric quality index for sounder product			1	1	1	1	V-INTEGER4	5	5	255870
<b>GQisQualIndexRad</b>	Radiometric quality index for sounder product			1	1	1	1	V-INTEGER4	5	5	255875
<b>GQisQualIndexSpect</b>	Spectral quality index for sounder product			1	1	1	1	V-INTEGER4	5	5	255880
<b>GQisSysTecIISQual</b>	System -TEC quality index for IIS			1	1	1	1	u-integer4	4	4	255885
<b>GQisSysTecSondQual</b>	System -TEC quality index for sounder			1	1	1	1	u-integer4	4	4	255889
<b>GGeoSondLoc</b>	Location of pixel centre in geodetic coordinates (long, lat) for each sounder pixel	6	degrees	2	PN	SNOT	1	integer4	4	960	255893
<b>GGeoSondAnglesMETOP</b>	Measurement angles for each sounder pixel (zenith, azimuth)	6	degrees	2	PN	SNOT	1	integer4	4	960	256853
<b>GGeoIISAnglesMETOP</b>	Measurement angles for a subgrid of IASI imager (zenith, azimuth)	6	degrees	2	SGI	SNOT	1	integer4	4	6000	257813
<b>GGeoSondAnglesSUN</b>	Solar angles at the surface for each sounder pixel (zenith, azimuth)	6	degrees	2	PN	SNOT	1	integer4	4	960	263813
<b>GGeoIISAnglesSUN</b>	Solar angles at the surface for a subgrid (5x5) of IASI imager (zenith, azimuth)	6	degrees	2	SGI	SNOT	1	integer4	4	6000	264773

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<b>GGeoILoc</b>	Location of pixel centre in geodetic coordinates for a sub grid (5x5) of the imager pixels	6	degrees	2	SGI	SNOT	1	integer4	4	6000	270773
<b>EARTH_SATELLITE_DISTANCE</b>	Distance of satellite from Earth centre		m	1	1	1	1	u-integer4	4	4	276773
<b>Level 1c Specific Data</b>											
<b>IDefSpectDwn1b</b>	Sample width of IASI 1C spectra (same as 1B)		m-1	1	1	1	1	V-INTEGER4	5	5	276777
<b>IDefNsfirst1b</b>	Number of the first sample of IASI 1C spectra (same as 1B)			1	1	1	1	integer4	4	4	276782
<b>IDefNslast1b</b>	Number of the last sample of IASI 1C spectra (same as 1B)			1	1	1	1	integer4	4	4	276786
<b>GS1cSpect</b>	Level 1C spectra		W/m2/sr/m-1	SS	PN	SNOT	1	integer2	2	2088000	276790
<b>IDefCovarMatEigenVal1c</b>	Level 1c noise variance-covariance matrix index			CCD	100	1	1	V-INTEGER4	5	1000	2364790
<b>IDefCcsChannelId</b>	Radiance Analysis: Identification of the AVHRR channel or pseudo-channels used for Radiance Analysis			NBK	1	1	1	integer4	4	24	2365790
<b>GCcsRadAnalNbClass</b>	Radiance Analysis: Number of identified classes in the sounder FOV			PN	SNOT	1	1	integer4	4	480	2365814
<b>GCcsRadAnalWgt</b>	Radiance Analysis: sounder FOV Radiance Analysis (% covered by each class)			NCL	PN	SNOT	1	V-INTEGER4	5	4200	2366294
<b>GCcsRadAnalY</b>	Radiance Analysis: Y Angular position of the centre of gravity	6	degrees	NCL	PN	SNOT	1	integer4	4	3360	2370494
<b>GCcsRadAnalZ</b>	Radiance Analysis: Z Angular position of the centre of gravity	6	degrees	NCL	PN	SNOT	1	integer4	4	3360	2373854
<b>GCcsRadAnalMean</b>	Radiance Analysis: Mean AVHRR radiances (all channels) of the sounder FOV classes		W/(m <sup>2</sup> * sr) for channel 1,2,3a and W/(m <sup>2</sup> *sr*m <sup>-1</sup> ) for 3b,4,5	NBK	NCL	PN	SNOT	V-INTEGER4	5	25200	2377214
<b>GCcsRadAnalStd</b>	Radiance Analysis: Standard deviation AVHRR radiances (all channels) of the sounder FOV classes		W/(m <sup>2</sup> * sr) for channel 1,2,3a and W/(m <sup>2</sup> *sr*m <sup>-1</sup> ) for 3b,4,5	NBK	NCL	PN	SNOT	V-INTEGER4	5	25200	2402414







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Worksheet: VIADR-ENGINEERING

FIELD	DESCRIPTION	SF	UNITS	DIM1	DIM2	DIM3	TYPE	TYPE SIZE	FIELD SIZE	OFFSET
<b>RECORD_HEADER</b>	Generic Record Header	0		1	1	1	REC_HEAD	20	20	0
<b>QUALITY PARAMETERS</b>										
<b>MExsSmin</b>	Minimum pf Earth view spectra		K	550	1	1	u-byte	1	550	20
<b>MESsSmax</b>	Maximum of Earth view Spectra		K	550	1	1	u-byte	1	550	570
<b>MDptlISBadHealthPix</b>	Bad health image pixels table		N/A	IMCO	IMLI	1	boolean	1	4096	1120
<b>MDptlISinHomPix</b>	Table of inhomogeneity counter per pixel		N/A	IMCO	IMLI	1	u-byte	1	4096	5216
<b>TOTAL SIZE</b>										<b>9312</b>

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Worksheet: MDR ENGINEERING

FIELD	DESCRIPTION	SF	UNITS	DIM1	DIM2	DIM3	DIM4	TYPE	TYPE SIZE	FIELD SIZE	OFFSET
RECORD_HEADER	Generic Record Header	0		1	1	1	1	REC_HEAD	20	20	0
<b>ASSOCIATED DATA</b>											
BIMSSBBT	Black Body temperature		K	1	1	1	1	bitst(64)[real*8]	8	8	20
GFtbFilteredBBT	Filtered Black Body temperature		K	1	1	1	1	bitst(64)[real*8]	8	8	28
GEPSIdConf_Line	System Configuration: PTSTI, TEC conf file ID, ...			1	1	1	1	bitst(256)	32	32	36
GEPSIasiMode	Instrument mode			1	1	1	1	bitst(32)	4	4	68
GCcsConfAvhrrChannel	Avhrr channel configuration			NBK	SNOT	1	1	bitst(32)	4	720	72
GEPSGranulNumber	Granule Number			1	1	1	1	integer4	4	4	792
GEPSDatIasi	Date of IASI measure (corrected UTC) - number of days since 1 January 2000 - number of ms in the day (TBC)			SNOT	1	1	1	short cds time	6	180	796
GEPSOPSProcessingMode	Processing mode			1	1	1	1	bitst(32)	4	4	976
GEPS_SP	Scan position for all observational targets			SNOT	1	1	1	integer4	4	120	980
GEPS_CCD	Corner cube direction for all observational targets			SNOT	1	1	1	boolean	1	30	1100
GGeoSubSatellitePosition	Geodetic position of the centre of IIS at image number 15 ( approximation of subsatellite position)		degrees	2	1	1	1	bitst(64)[real*8]	8	16	1130
GEPSOPSFlagNan	This flag is raised when a Nan error has occurred during the processing			1	1	1	1	boolean	1	1	1146
GEPSEndEclipseTime	Date of the end of the previous satellite eclipse		UTC	1	1	1	1	short cds time	6	6	1147
GSmeTScan	Estimated temperature of the scanning mirror		K	1	1	1	1	bitst(64)[real*8]	8	8	1153
GSmeFlagDateNOK	Flag for inconsistency between current date and ascending node			1	1	1	1	boolean	1	1	1161
GFtbBBTRes	Quality index for the filtering of the black-body temperature			1	1	1	1	bitst(64)[real*8]	8	8	1162
GFtbFlagBBTNonQual	Quality flag of the black-body temperature			1	1	1	1	boolean	1	1	1170
GEPS_LN	Number of the IASI line since the beginning of the dump			1	1	1	1	integer4	4	4	1171
GDocFlagUnderOverflow	Indicates that there is an under or an overflow			PN	SNOT	1	1	boolean	1	120	1175
GDocNbUnderFlow	Number of underflow occurred during spectra decoding			PN	SNOT	1	1	integer4	4	480	1295

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<b>GDocNbOverFlow</b>	Number of overflow occurred during spectre decoding			PN	SNOT	1	1	integer4	4	480	1775
<b>GDocPosUnderFlow</b>	Buffer of 3 positions of underflow occurred during spectra decoding			3	PN	SNOT	1	integer4	4	1440	2255
<b>GDocPosOverFlow</b>	Buffer of 3 positions of overflow occurred during spectre decoding			3	PN	SNOT	1	integer4	4	1440	3695
<b>BCodSpecVerif</b>	Full bit stream of IASI coded level 0 data (I;e full spectra) data corresponding to VDS (verification data selection)		W/m <sup>2</sup> /sr/m-1	4320	1	1	1	integer2	2	8640	5135
<b>GlacOffsetIISAvhrr</b>	IASI imager AVHRR imager coregistration offset		AVHRR pixels	2	SNOT	1	1	bitst(64)[real*8]	8	480	13775
<b>GlacCorrelQual</b>	Correlation quality index			SNOT	1	1	1	bitst(64)[real*8]	8	240	14255
<b>GlacPosMaxQual</b>	Quality index of maximum correlation position		AVHRR pixels	SNOT	1	1	1	bitst(64)[real*8]	8	240	14495
<b>GlacFlagCoregNonValid</b>	Flag for imagers IASI/AVHRR non coregistration			SNOT	1	1	1	boolean	1	30	14735
<b>GlacFlagCoregNonQual</b>	Flag for imagers IASI/AVHRR non coregistration			SNOT	1	1	1	boolean	1	30	14765
<b>GlacVarImagIIS</b>	Variance of IIS image		W/m <sup>2</sup> /sr/m <sup>-1</sup>	SNOT	1	1	1	bitst(64)[real*8]	8	240	14795
<b>GlacAvgImagIIS</b>	Average of IIS image		W/m <sup>2</sup> /sr/m <sup>-1</sup>	SNOT	1	1	1	bitst(64)[real*8]	8	240	15035
<b>GEUMAvhrr1BCldFrac</b>	Cloud fraction in IASI FOV from AVHRR 1B in IASI FOV		%	PN	SNOT	1	1	u-byte	1	120	15275
<b>GEUMAvhrr1BLandFrac</b>	Land and Coast fraction in IASI FOV from AVHRR 1B		%	PN	SNOT	1	1	u-byte	1	120	15395
<b>GEUMAvhrr1BQual</b>	Quality indicator. If the quality is good, it gives the coverage of snow/ice.			PN	SNOT	1	1	bitst(8)	1	120	15515
<b>GCcsOffsetSondAvhrr</b>	IASI sounder/AVHRR coregistration offset		degrees	2	PN	SNOT	1	bitst(64)[real*8]	8	1920	15635
<b>GCcsOffsetSondIIS</b>	IASI sounder/imager coregistration offset		degrees	2	PN	SNOT	1	bitst(64)[real*8]	8	1920	17555
<b>GQisCcsQualIndex</b>	FOV sounder radiances analysis quality index			SNOT	1	1	1	bitst(64)[real*8]	8	240	19475
<b>GCcsFlagDateNOK</b>	Flag for inconsistency between current date and ascending node			1	1	1	1	boolean	1	1	19715
<b>GCcsAvhrrPseudoChn</b>	Radiance from AVHRR pseudo ch 4 and 5 and IASI based AVHRR pseudo ch 4 and 5		W/m <sup>2</sup> /sr/m-1	4	PN	SNOT	1	bitst(32)[real*4]	4	1920	19716

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<b>GCcsRadAnalNbClass</b>	Number of classes in the sounder FOV			PN	SNOT	1	1	integer4	4	480	21636
<b>GCcsFlagPostProcessing</b>	Post-processing flag			SNOT	1	1	1	integer4	4	120	22116
<b>GCcsNonClassifRate</b>	Rate of unclassified points			SNOT	1	1	1	bitst(64)[real*8]	8	240	22236
<b>GCcsVarianceRate</b>	Standard deviation ( $\tau$ ) of the classified image			SNOT	1	1	1	bitst(64)[real*8]	8	240	22476
<b>GSsdConverFlag</b>	Flag for the convergence of the spectral shift algorithm			PN	SNOT	1	1	boolean	1	120	22716
<b>GSsdWnShift</b>	Spectral shift calculated for the spectral window		m-1	PN	SNOT	1	1	bitst(64)[real*8]	8	960	22836
<b>GSsdWnShiftQual</b>	Quality index of calculated spectral shift			PN	SNOT	1	1	bitst(64)[real*8]	8	960	23796
<b>GSsdFlagSpectralShiftNonQual</b>	Quality flag of spectral shift determination			PN	SNOT	1	1	boolean	1	120	24756
<b>GSssWnShiftMean</b>	Mean spectral shift for 1 pixel during 1 IASI line		m-1	PN	CCD	1	1	bitst(64)[real*8]	8	64	24876
<b>GSssWnShiftMeanQual</b>	Quality index of mean spectral shift for each PN and CCD			PN	CCD	1	1	bitst(64)[real*8]	8	64	24940
<b>GSssFlagNonSelPix</b>	Flag for pixel not selected			PN	CCD	1	1	boolean	1	8	25004
<b>GSssFlagDateNOK</b>	Flag for inconsistency between current date and ascending node			1	1	1	1	boolean	1	1	25012
<b>GlaxAxeY</b>	Y coordinates of interferometric axis		degrees	CCD	1	1	1	bitst(64)[real*8]	8	16	25013
<b>GlaxAxeZ</b>	Z coordinates of interferometric axis		degrees	CCD	1	1	1	bitst(64)[real*8]	8	16	25029
<b>GlaxFlagAxeNonQual</b>	Interferometric axis determination quality flag			CCD	1	1	1	boolean	1	2	25045
<b>GlaxAxeQual</b>	Interferometric axis position quality flag			CCD	1	1	1	bitst(64)[real*8]	8	16	25047
<b>GlaxAxeRes</b>	Verisimilitude index of the measure/model shift		degrees	CCD	1	1	1	bitst(64)[real*8]	8	16	25063
<b>GFaxAxeY</b>	Y filtered coordinates of interferometric axis		degrees	CCD	1	1	1	bitst(64)[real*8]	8	16	25079
<b>GFaxAxeZ</b>	Z filtered coordinates of interferometric axis		degrees	CCD	1	1	1	bitst(64)[real*8]	8	16	25095
<b>GFaxFlagAxeNonQual</b>	Interferometric axis filtered position quality flag			CCD	1	1	1	boolean	1	2	25111
<b>GFaxAxeRes</b>	Filtering quality index		degrees	CCD	1	1	1	bitst(64)[real*8]	8	16	25113
<b>GlsfFlagPdsNonValid</b>	Interpolation weight validity flag			CCD	1	1	1	boolean	1	2	25129
<b>GlccRadCalOffsetImag</b>	Offset coefficient of image radiometric calibration		counts	IMCO	IMLI	1	1	integer2	2	8192	25131
<b>GlccRadCalSlopelmag</b>	Slope coefficient of image radiometric calibration	14	W/m <sup>2</sup> /sr/m <sup>-1</sup> /count	IMCO	IMLI	1	1	integer4	4	16384	33323

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<b>GlccFlagInit</b>	Indicator of the initialisation of the radiometric calibration			1	1	1	1	boolean	1	1	49707
<b>GQisFlagQual</b>	Quality flag for the system			SB	PN	SNOT	1	boolean	1	360	49708
<b>GQisFlagQualDetailed</b>	Detailed Quality flag for the system			PN	SNOT	1	1	bits(16)	2	240	50068
<b>GQisQualIndex</b>	Quality index for the sounder products			PN	SNOT	1	1	bitst(64)[real*8]	8	960	50308
<b>GQisQualIndexIIS</b>	Quality index for the IIS imager products			SNOT		1	1	bitst(64)[real*8]	8	240	51268
<b>GQisQualIndexLoc</b>	Geometric Quality index for the sounder products			PN	SNOT	1	1	bitst(64)[real*8]	8	960	51508
<b>GQisQualIndexRad</b>	Radiometric Quality index for the sounder products			PN	SNOT	1	1	bitst(64)[real*8]	8	960	52468
<b>GQisQualIndexSpect</b>	Spectral Quality index for the sounder products			PN	SNOT	1	1	bitst(64)[real*8]	8	960	53428
<b>MHipNZpdInterPixel</b>	NZPD position differences			PN	SNOT+4	1	1	integer2	2	272	54388
<b>MHipFlagInterPixNzpdNonQual</b>	NZPD position differences quality flag			PN	SNOT+4	1	1	integer2	2	272	54660
<b>MMcxNoiseCalRad</b>	Noise of complex radiometric calibration	K		NIM	PN	SNOT	1	bitst(32)[real*4]	4	13440	54932
<b>MMcxBiasCalRad</b>	Bias of complex radiometric calibration	K		NIM	PN	SNOT	1	bitst(32)[real*4]	4	13440	68372
<b>MMcxFlagNoiseCalRad</b>	Flag for radiometric calibration noise threshold crossing			PN	SNOT	1	1	boolean	1	120	81812
<b>MMcxFlagBiasCalRad</b>	Flag for radiometric calibration bias threshold crossing			PN	SNOT	1	1	boolean	1	120	81932
<b>MMcxCoeffCalRad</b>	Error coefficient for radiometric calibration			SB	PN	SNOT	1	bitst(64)[real*8]	8	2880	82052
<b>MDptVarImagMax</b>	Maximum value of the pseudo-variance in the IIS image			1	1	1	1	bitst(64)[real*8]	8	8	84932
<b>MDptVarImagMean</b>	Mean value of the pseudo-variance in the IIS image			1	1	1	1	bitst(64)[real*8]	8	8	84940
<b>MDptPixQual</b>	Quality Index for the imager			1	1	1	1	bitst(64)[real*8]	8	8	84948
<b>GHecFlagDateNOK</b>	Flag for inconsistency between current date and ascending node			1	1	1	1	boolean	1	1	84956
<b>Data_PX</b>	Words 4 to 151 of PX packet			PN	SNOT	148	1	integer2	2	35520	84957
<b>Data_IP</b>	Words 4 to 22			PN	SNOT+4	19	1	integer2	2	5168	120477
<b>EqualizationCounter</b>	32 bits for the equalization counter			PN	SNOT+4	2	1	integer2	2	544	125645
<b>GOPSFlaPixMiss</b>	Flag for degraded mode: sounder-pixel is temporarily missing			PN	SNOT	1	1	boolean	1	120	126189
<b>GOPSFlaDataGap</b>	Flag for degraded mode: spectral gap			1	1	1	1	boolean	1	1	126309
<b>GOPSFItlsrfemOff</b>	Flag for degraded mode: ISRFEM chain not activated for this SN number			SNOT		1	1	boolean	1	30	126310





Name	Size	Description
1	1	
2	2	
3	3	
4	4	
5	5	
6	6	
10	10	
16	16	
19	19	
21	21	
30	30	
32	32	
40	40	
64	64	
100	100	
148	148	
550	550	
4319	4319	
4320	4320	
10000	10000	
12500	12500	
AMCO	100	Number of columns for AVHR image pixel
AMLI	100	Number of lines for AVHRR image pixel
CCD	2	Number of corner cube directions
IMCO	64	Number of columns for IASi imager pixel
IMLI	64	Number of lines for IASi imager pixel
MAXBA	3600	Maximum number of samples in one IASi band
N	221000	Typical size of packets stored in MDR-Verification
NBK	6	Number of AVHRR channels
NCL	7	Number of classes for FOV sounder analysis
NIM	28	Number of samples used to represent the imaginary part of the IASi spectrum
PN	4	Number of sounder pixels
SB	3	Number of spectral bands
SGI	25	5 x 5 - Number of pixels of the subgrid imager

Parameters used in the IASi array sizing  
From IA-TN-2100-9469-CNE, Edition 5, Rev 1, 20/11/01



SNOT	30	Number of steps for observational target
SNOT+4	34	Number of steps for observational and calibration targets
SS	8700	Number of samples in an IASI spectrum
VP	1	Number of verification packets per IASI line

Field Type	Size in Bytes
bitst(8)	1
boolean	1
byte	1
char(1)	1
e-char(1)	1
enumerated	1
u-byte	1
bitst(16)	2
char(2)	2
e-char(2)	2
integer2	2
u-integer2	2
V-BYTE	2
VU-BYTE	2
bitst(24)	3
char(3)	3
e-char(3)	3
V-INTEGGER2	3
VU-INTEGGER2	3
bitst(32)	4
bitst(32)[real*4]	4
char(4)	4
integer4	4
u-integer4	4
V-INTEGGER4	5
VU-INTEGGER4	5
bitst(48)	6
short cds time	6
bitst(64)	8
bitst(64)[real*8]	8
integer8	8
long cds time	8
u-integer8	8
V-INTEGGER8	9

NOTE: Table must be sorted into ascending order

VU-INTEGER8	9
general time	15
bitst(128)	16
REC HEAD	20
bitst(256)	32
char(40)	40
char(88)	88

Doc Ref: EUM.EPS.SYS.SPE.990003.ANX  
IASI\_Level\_1\_Product\_Format\_Specification\_-\_Annex[1].xls  
Worksheet: SPHR-DELETED

FIELD	DESCRIPTION	SF	UNITS	TYPE	ENCODE CHARS	FIELD SIZE	OFFSET
RECORD_HEADER	Generic Record Header	0		REC_HEAD	20	20	0
SPARES							
Nothing defined for SPHR							
TOTAL SIZE							0