IASI MEASUREMENT & VERIFICATION DATA

Rédigé par	Responsabilité-Société	Date	Signature
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ENREGISTREMENT DES EVOLUTIONS

ISSUE	DATE	§ : DESCRIPTION DES EVOLUTIONS	REDACTEUR
1.0	21 jan 98	First issue	G.Vissio
2.0	31 oct 99	Totally rewritten following the issuing of the document IA-SP-1520-227-AER (DPS Specification) issue 4.4	G.Vissio
2.1	7 jan 00	Updated following DD/R of DPS SW held on Dec 99, the 16th & 17th. The changes are minor and indicated by change bars on the right hand-side	G.Vissio
2.2	23 feb 00	Updated following System evolution (OTM definition). Opportunity is also taken to add information meaningful for METOP & CNES. No change bars are put because of Winword problems	G.Vissio
2.3	26 jul 00	Remodelled by CNES to include information specifically relevant for CNES & EUMETSAT	T.Carlier
2.4	29 may 01	The synthesis of formats is included in appendix D The BdcoFlagErrorInterf generation is modified in order to integrate the request for deviation IA-WR-1520-0029-SES BzpdFlagNzpdNonQual in Spectrum Verification ancillary info field modified in BzpdFlagNzpdNonQualXX BZpdNzpdQualIndex In Spectrum Verification ancillary info field modified in BzpdNzpdQualIndexXX Modification of the VPA and VPB lengths due to DPS specification modification (issue 4.8). BzpdNzpdQualIndex in Auxiliary application data field modified in BzpdNzpdQualIndexXX meaning of flag Err_StepNum modified	G.Vissio T.Carlier
2.5	28 feb 02	§1.2.3 clarification of 21020 floating point coding format §12.3 clarification of Spectrum ADF decoding §6.1+8 typo corrections : IdefBranch instead of IDefBranch) §10 typo correction : Packet Seq Count stands for Source Seq. Count (SSC) §12.2 clarification of OD_NV flags setting significance and on-board monitoring §12.2 default value of PTSI defined §12.2 AUXILIARY mode replaced by AUX_OP mode (TBC removed) §12.2 SQIS Default value defined + clarification of SW Parameter Setting MCMD to be used for modification §12.4 SQII Default value defined + clarification of SW Parameter Setting MCMD to be used for modification §12.2 correction of typo BDcoNSInsterf instead of BdcoNbReceivedWords §12.2 erroneously remaining BdcoFlagMasErrorNbwords error in definition of BdcoFlagErrorInterf for Band B1 and B3 §12.2 precisions on the LN counter value observed in the first packets after transition into NORMAL OPERATION (resp. EXTERNAL calibration) mode. §12.4 correction of typo System Quality Index for Image instead of Number of IIS Samples §12.5 clarification of IEQ_NV flag behaviour §12.6 typo correction : image packet instead of spectrum verification packets §12.6 P-IASI-RFW-0031-SE has been reflected : some simplification of verification packets ancillary info field content §12.8 clarification of OTM_NV flags behaviors	P.Arberet

ISSUE	DATE	§ : DESCRIPTION DES EVOLUTIONS	REDACTEUR
		§12.8 SPTSI Default value defined + clarification of SW Parameter Setting MCMD to be used for modification §12.8 Modification of ELT entries size and filtering of errors in order to report only medium B errors §12.9 precision added on flag BbofFlagSrdInit §17 typo correction in anomaly description EID 500 (DVL instead of VLN)	
2.6	8th april 03	a/ §5.1.2 definition of IIS images pixel numbering added(cf.CR170 CNES) b/ §8 IMS reaction to DPS errors added (cf. DR 1520 0046 SES) c/ §11 UTC special setting added (cf. IA-NC-1520-0081-AAE) d/ §12.1 OBT special setting added (cf. IA-NC-1520-0081-AAE) e/ §12.3 physical coded values reconstruction algorithm corrected f/ §12.6 relationship between the number of MAS frames counted by the DPS and the IMS NS datum defined (cf. FA 1471 AER) g/ §12.6 invalid data in AP packets if VDS selected to 1,2,30 in EXTERNAL CALIBRATION MODE (cf FA 19294) h/ §12.8 reporting of ELT errors in AP corrected (cf. CR 4228 AER) i/ §12.8 polarity of ELT CD in case of IIS errors given (cf. DR 0049 SES) j/ §19.8 AP AIF structure completed k/ §14 completed with indications on packets sizes & data rates to give a clearer picture on the FMU output side l/ appendix D up-dated (cf to here above modifications) m/ appendix E Impacts of errors & DPS configuration on packets transmission added n/ appendix F (packets structure when the DPS is in TEST mode) added	G.Vissio D. Siméoni
2.7	25/01/2005	§8. Typo correction §10.3 Clarifications §12.2 Typo correction §12.5 IEQ / IEQ_NV management §12.6 and §19.7 Invalidity of *BZpdNzpd and BzpdNzpdQualIndexXX cf P-IASI-RFW-0054* §12.8 ELT management clarification, DPC managament clarification § 16 Transfer Functions transferred in the “FM Calibration Report”. § 20 Correction of “DPS error management” tables, from PFM and FM2 OVT IA-AR-1000-9707-AER and IA-AR-1000-10151-AER	D. Siméoni
2.8	25/11/2005	§12.7 B8 indicates “Mode transition” in first line only	D. Siméoni
2.9	21/02/2006	§ 8 IdefBranchStatus parameter setting : not used bits (B12 to B15) set at 0 or 1. To be in accordance with the FOM and the TOP loaded in DPS EEPROM at instrument deliveries.	P. Astruc
2.10	06/12/06	§ 19.5 (VPC packet structure) Detail of IMS OD data set to 0 when VDS target is relative to SN 35 or 36.	P. Astruc
3.0	07/10/2009	Document update now taken into account by CNES. CNES.AR.0000.022= EUM.EPS.NCR.3245.4 = EUM.EPS.AR.7934.1: “when error DPS LNR-Rx VLN (EID13) arrives, we found in ELT INFO table fields Pixel and Bande to 0 This case was not described in IMVD and so was not correctly taken into account by TEC.” EUM-EPS-AR-6705-8 “DMC counter overflow (arithmetic error)” → Modified monitoring strategy under consideration for Metop A	J. Chinaud

ISSUE	DATE	§ : DESCRIPTION DES EVOLUTIONS	REDACTEUR
3.1	19/08/2010	§12.8 SPTSI value defined in AP.aif §20 (appendix E, impacts of errors & DPS configuration on packets transmission) : clarification of branch status §12.3 Spectrum application data field : ADF value in case of mode transition	J. Chinaud

TABLE OF CONTENTS

1. Introduction

1.1. Purpose

This document is the ICD between the IASI instrument and the IASI ground segment for what concern the scientific data.

The purpose of this document is to define the layouts & contents of all the packets produced by the IASI instrument towards the METOP Formatting Unit (FMU), and then transmitted to the ground segment for data processing.

This document will be applicable to the ground segment development, and used during instrument testing.

1.2. Definitions, Conventions, Acronyms & Abbreviations, TBC's & TBD's

1.2.1. Definitions

– **Array disposition convention in the packets:**

Let T(N1..N2) be an array of (N2-N1+1) elements elaborated by IASI then the elements of this array are put in the packets in the following order: { T(N1) (*), T(N1+1), ..., T(N2-1), T(N2) }

(*): first transmitted element in case of message transmission

– **Complex number disposition convention in the packets:**

let Z be a complex number elaborated by IASI then the real part Re(Z) & the imaginary part Im(Z) are put in the packets in the following order: { Re(Z) (*), Im(Z) }

(*): first transmitted element in case of message transmission

When a complex array is transmitted with a 16-bit words mode, the words are sent in the following order on the FMU bus:

T	MSB of Real part (value n)
T+δ(t)	LSB of Real part (value n)
T+2δ(t)	MSB of Imaginary part (value n)
T+3δ(t)	LSB of Imaginary part (value n)
T+4δ(t)	MSB of Real part (value n+1)
T+5δ(t)	LSB of Real part (value n+1)
T+6δ(t)	MSB of Imaginary part (value n+1)
T+7δ(t)	LSB of Imaginary part (value n+1)

1.2.2. Convention on digital data

Number which occupies a byte, a word or a bits field shall have a right alignment.

Negative integer number is in 2's complement.

Bit which represents a state or a flag have the following meaning:

Bit = 1	**Bit = 0**
Relay closed	Relay open
Correct state	Failure
Selected	No selected
ON	OFF
Set	Reset
Enabled	Inhibited
Moving	Stopped
Go	NoGo
Nominal	Redundant
Connected	Disconnected
Presence	Absence
Forward	Backward
Used	Not used
Minus (numeric)	Plus (numeric)
Valid	No valid
Armed	Disarmed
Active	Non active

When a parameter value requires more than one word, the first word is always the MSW and the last one the LSW.

The MSB is B0 (first bit transmitted in case of message transmission), and the LSB shall be B7 in a byte or B15 in a word (16 bits).

MSB LSB

B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15

All bits defined as "not used" or "spare" are generally set to 0 (unless otherwise specifically stated) but may have undefined state in failures cases.

Values in hexadecimal are noted: $XXXX_h$ (X = 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F)

Value in binary are noted: $XXXXXXXX_b$ (X = 0,1)

Any number not followed by a **b** or by a **h** is expressed in decimal base.

1.2.3. Format floating point 21020

32 bit Single precision Floating-Point data consists of a sign bit *s*, a 24-bit significand and an 8-bit unsigned-magnitude exponent *e*. The significand consists of a 23-bit fraction *f* and a "hidden" bit of 1 that is implicitly presumed to precede f22 in the significand. The significand of all numbers is greater than or equal to 1 and less than 2.

The unsigned exponent *e* can range between $1 \leq e \leq 254$ for normal numbers. This exponent is biased by +127:

$$FP = (-1)^s [1.0 + f_{22}*2^{-1} + f_{21}*2^{-2} + .. + f_0*2^{-23}] * 2^{e-127} \qquad \text{where } e = e_7 2^7 + e_6 2^6 + ... + e_0$$

The special numbers are coded as follows:

- Zero (0.0) is coded e = 0 and f = 0, s = +/- 1
- NAN (Not a number – corresponds to the result of non valid operations such as Infinity * 0) is coded e = 255 and f <> 0
- Infinity is coded e = 255, f = 0, s=+/- 1

The processing implemented in the IASI DPS should never lead to the production of such special numbers (unless a major arithmetic failure) - except 0.

s	e_7						e_1	e_0	f_{22}	f_{21}																			f_0
B0	B1						B7	B8	B9	B10																			B31

1.2.4. Spectral Sample numbering convention

The spectral sample corresponding to the i x Dv, Dv being the spectral sampling (in cm^{-1}), is stamped with the number i.

The spectral sample corresponding to the null wavenumber is therefore the number zero.

1.2.5. Acronyms & Abbreviations

The following acronyms and abbreviations are or may be used:

ADF	Application Data Field
AIF	Ancillary Information Field
AP	Auxiliary Packet
APID	Application Process Identifier
ASE	Acquisition Start End signal
BBS	Black Body Subsystem
CBS	Cold Box Subsystem
CD	Cube Direction
com.	Comment
CRC	Cyclic Redundancy Code

DPS	Data Processing Subsystem
DSP	Digital Signal Processing
ECT	Errors Control Table
ELT	Errors Log Table
FMU	Formatting and Multiplexing Unit
IIS	Integrated Imaging Subsystem
IP	Image Packet
I/F	Interface
LN	Line Number
LSB	Least Significant Bit or Byte
LSW	Least Significant Word
MAS	Main Acquisition Subsystem
MSB	Most Significant Bit or Byte
MSW	Most Significant Word
NS	Number of Samples
N/A	Not Applicable
NZPD	Number of Zero Path Difference
OD	Operational Data
ODNV	Operational Data Non Valid
OBT	On Board Time
OTM	Operational Telemetry
OTM_NV	Operational Telemetry Non Valid
PEC	Packet Error Control
PXi	Spectrum Packet relative to pixel 'i' (i = 1,2,3 or 4)
RPD	Reference path difference
SCS	SCan Subsystem
SN	Step Number
SP	Scan Position
UTC	Universal Time Count
VP	Verification Packet
w.r.t	with respect to
ZPD	Zero Path Difference

1.2.6. TBC and TBD

In this document the following TBC (To Be Confirmed) and TBD (To Be Defined) are recorded:

§12.2 PTSI (words 16 and 17) and SQIS (word 20)

§12.4 SQII (word 20)

§12.8 IFPT range and accuracy, FPT transfer function and SPTSI

1.3. Applicable & Reference Documents

1.3.1. Applicable Documents

None

1.3.2. Reference Documents

The following documents have been used for the elaboration of this document:

Label	**Title & Reference**
[DPS]	Data Processing Subsystem Specification reference IA-SP-1520-227-AER, issue **4.8**
[SCOS]	Subsystems Commandability & Observability Specification reference IA-SP-1000-6323-AER, issue 3.0
[MASDPS]	DPS/MAS & DPS/IIS Interface Requirements Document reference IA-SP-1000-6367-AER, issue 2.4

The following documents have been applied for the elaboration of this document:

Label	**Title & Reference**
[IASI]	IASI Instrument Specification reference IA-SP-1000-201-CNE, issue 6.0
[METOP]	IASI ICD reference MO-IC-MMT-IA-0001, issue 4.0
[VERIF]	Verification Data Specification Reference IA-ID-1000/2000-216-CNE, issue 5.0
[CALIB]	FM2 Calibration report Reference IA-OP.1000.9576-AER, issue 1.0
[ICCI]	Internal Command and Control Interfaces Reference IA-ID-1000-6693-AER, issue 7.2

2. IASI Mission

IASI instrument, Infrared Atmospheric Sounding Interferometer, is a Fourier Transform Spectrometer based on a Michelson Interferometer coupled to an integrated imaging system which will fly on the 3 METOP platforms. The IASI main objective is to provide improved infrared soundings of the temperature and moisture profiles in the troposphere and the lower stratosphere as well as some of the chemical components playing a key role in the tropospheric chemistry and the additional greenhouse effect.

IASI measures the emission spectra of the atmosphere in the spectral range which is divided into three spectral bands:

- band 1: 645 to 1240 cm-1
- band 2: 1200 to 2400 cm-1
- band 3: 1960 to 2760 cm-1

The field of view is a square seen under an angle of 3°20' x 3°20', and is sampled by a matrix of 2x2 circular pixels. In this field of view, there is also an infrared broad-band radiometer in the 10.3 to 12.5 µm spectral range which provides image data from the build in imager with 64x64 pixels.

3. IASI Architecture

Electrical architecture of IASI is depicted in figure 3.2-1. IASI is composed of the following subsystems or units:

- IMS Instrument Management Subsystem
- DPS Data Processing Subsystem
- CCM Cube Corner Mechanism
- SCS Scan Subsystem
- MAS Main Acquisition Subsystem
- IIS Integrated Imager Subsystem
- LAS Laser unit
- RAU Receiver Assembly Unit
- BBS Black Body Subsystem
- CBS Cold Box Subsystem

IMS is in charge of the command and control of the instrument.

DPS is in charge of the processing of the MAS interferograms as well as the IIS images. The DPS sends the spectum and image data to Metop (to the FMU equipment).

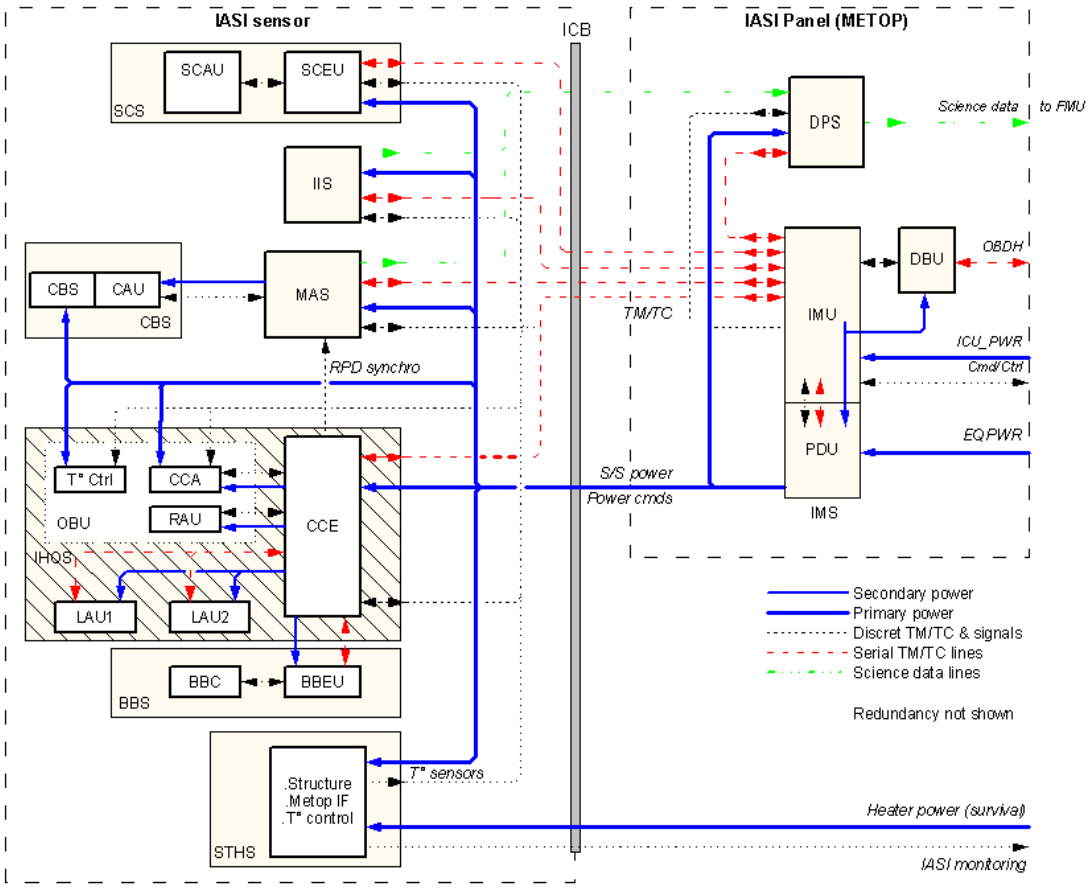
CCM, thank to its cube corner mechanism motion, creates the inverse Fourier function of the observed spectra and delivers the synchronisation signals ASE and RPD to the other equipments. The RPD is used by the MAS for the data sampling. The Acquisition Start / End (ASE) signal corresponds to the IASI internal Clock (216 ms). The IASI instrument cycle is 8 s divided into 37 ASE.

SCS is in charge to control the mirror to scan the earth and the calibration targets. The scan sequence is synchronised by the ASE signal, the scan mirror pointing the different targets during the 8 s cycle.

MAS is in charge to amplify and to numerise the analog signal from the CBS. The MAS starts the sampling on the interferogram when the ASE signal level is high and therefore transmits the data to DPS during this cycle.

IIS is an infrared broad band radiometer in charge to provide images to DPS.

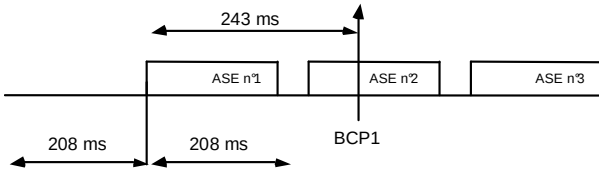
BBS is used for the on-board calibration of the processed spectra.



4. IASI internal synchronization

The instrument internal operations are based on a 8 seconds period, called a line (LN). This 8 seconds period is equally divided into 37 steps, called IASI subcycle (SN, Step Number) and is maintained synchronized with the BCP1 reference pulse broadcast by the METOP satellite in order to meet the IPG-9 requirement of [IASI].

The IASI subcycle is determined by an internal clock (ASE) generated by the CCM equipment.



Relative synchronization between IASI internal Clock (ASE) and BCP1 pulse

During the high level of ASE signal, except when the scan is moving, the instrument acquires and processes interferograms and images data. During the low level, the scan mirror reaches the next target position, when needed.

The 8 seconds period is subdivided into two main phases:

The “observation phase” corresponds to the 30 first subcycles for the acquisition of the measurement data (Earth views acquisition).

The “calibration phase” corresponds to the last 7 subcycles devoted to acquisition of calibration sources (Blackbody and Deep space views).

8 seconds period					
SN #1	…	SN #30	SN #31	…	SN #37
Observation phase			Calibration phase		

5. General Description

5.1. Types of packets generated by IASI

The IASI instrument generates to the FMU the following types of packets:

- The Spectrum Packets (PX1 for pixel 1, PX2 for pixel 2, PX3 for pixel 3, PX4 for pixel 4)
- The Image Packets (IP)
- The Verification Packets (VPA, VPB, VPC & VPD)
- The Auxiliary Packets (AP)

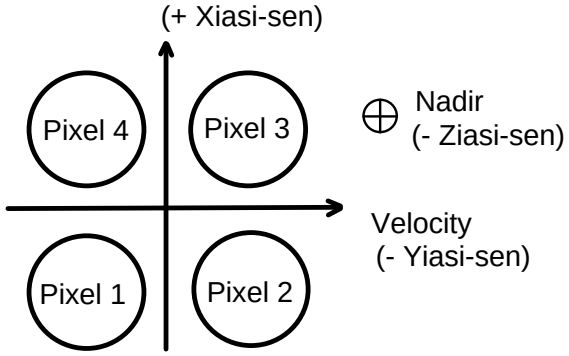
5.1.1. Spectrum packet (PX)

One spectrum packet is generated for each pixel. The spectrum packet corresponds to the calibrated atmospheric data processed from raw interferograms acquired for the bands B1, B2 & B3.

Each spectrum packet is self consistent (i.e. there is no need to know the content of the spectrum packet of the pixel i to process the spectrum packet of the pixel j).

The pixel Identifier is defined both by the Application Process Identifier (APID) of the primary header and by the Pixel Identifier field in the ancillary info field.

The definition of the pixel numbering is given here below (pixels image on ground):

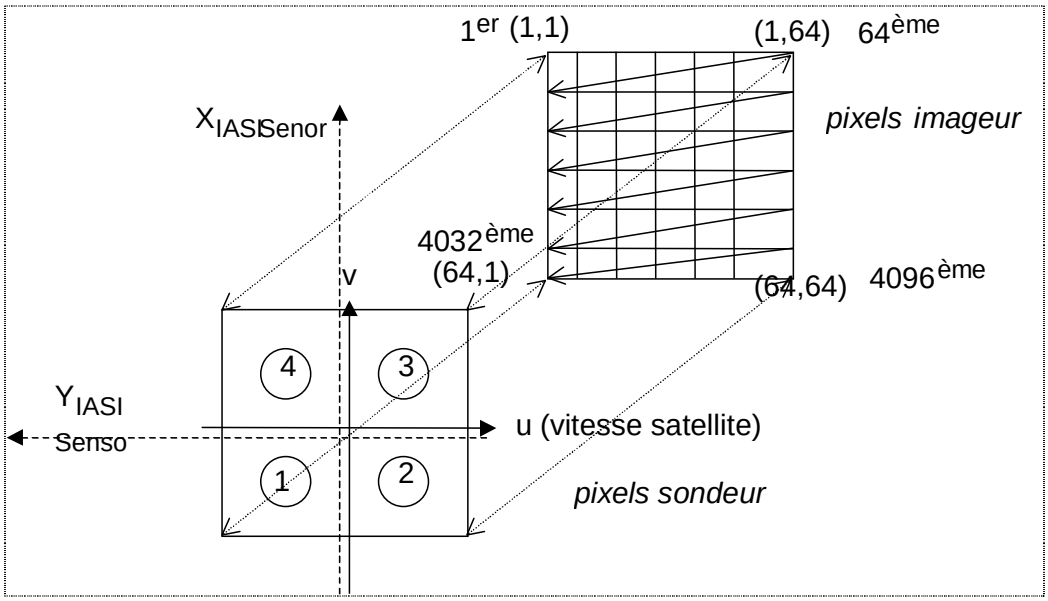


5.1.2. Image packets (IP)

The image packets correspond to the data acquired from the infrared imager implemented for the co-registration with AVHRR imager.

There is no on board digital processing on the acquired images except data truncation/encoding before transmission.

The definition of the image pixel numbering is given here below (imager pixels location on ground)



The imager pixels transmission on the downlink is defined in §12.5

5.1.3. Verification packet (VP)

The verification packet corresponds to the data generated by the instrument in order to check the on board processing system and to give access to information on the behaviour of the instrument which are no longer present in the calibrated spectra (c.f. [VERIF]).

Each 8 seconds, the verification data of one specific band of one pixel for a determined subcycle are collected and transferred to the FMU.

For transmission data rate constraints, verification data are segmented by the instrument, resulting in the transmission of five types of verification data:

- the raw interferograms data samples are equally partitioned in the VPA and VPB verification packets,
- The VPC packet contains the current complex reduced filtered NZPD spectra and the current complex filtered calibration coefficients,
- The VPD packet contains the instantaneous complex calibration coefficients,
- The VPE packet contains the spectral samples of overlapping spectral intervals for band B1/B2 and B2/B3.

The verification packet type is identified by the Verification Packet Identifier field in the ancillary info field. The different verification packets have the same APID.

5.1.4. Auxiliary packet (AP)

The auxiliary packet contains all additional information from the instrument needed for the ground algorithms processing not included in the other packets.

The data mainly consist in temperature data, flags processed when performing the processing of calibration data during the calibration phase, and error log table (ELT) identifying the error report detected during the IASI current line.

6. Instrument mode w.r.t data transmission

The nominal modes dedicated to the transmission of science data to the FMU are the *NORMAL OPERATION* and *EXTERNAL CALIBRATION* modes.

Science data may be generated and transmitted during *AUXILIAR*Y mode but are declared non valid for system test purposes (the instrument mode is defined by the "Instrument mode" parameter in the ancillary info field of each packet, and in case the mode = AUXILIARY, then the data are declared non valid). In this case, the transmission of science data is the same as in OPERATIONAL mode.

In addition, a test mode is available for ground test purposes which allow the transmission of a fixed predetermined pattern for the packet data field, the primary header and the trailer (PEC) being handled nominally.

6.1. Science data transmission during NORMAL OPERATION mode

The normal operation scan sequence is depicted below:

<table>
<tr><th colspan="2">1 2 3 ...</th><th colspan="2">... 29 30</th><th>31</th><th>32 33</th><th>34</th><th>35 36</th><th>37</th></tr>
<tr><td colspan="4">Earth Targets</td><td>Scan Moving</td><td>Blackbody</td><td>Scan Moving</td><td>First cold space</td><td>Scan Moving</td></tr>
<tr><td colspan="4">Observational Targets (Spectr. +Images)</td><td colspan="5">Calibration</td></tr>
</table>

During the 30 first steps, the scan mirror points sequentially the 30 earth targets.

On the last 7 steps, the calibration process is undertaken. The scan mirror points the blackbody and the first cold deep space successively.

For nominal situation, the packet transmission over one IASI line is described here below:

- The spectrum data are only transmitted during the observation phase. Every eight seconds, there are 30 * 4 spectrum source packets sent to the FMU corresponding to the earth targets,
- The image data are generated during observational and calibration phases. Every eight seconds, there are 30 image packets sent to the FMU corresponding to the earth targets. In addition, the images of the calibration targets are broadcast in order to allow the ground calibration. The number of images transmitted during the calibration phase can be modified by the parameter setting macrocommand with the parameter IDefIISConf.

IDefIISConf															
B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15
SIZE		n/a		S32	S33	S35	S36	n/a							

The SIZE parameter determines the number of bit for the coding of images

B0	B1	
0	1	IIS_SIZE = 8
1	0	IIS_SIZE = 10
1	1	IIS_SIZE = 12

	B4	B5	B6	B7
0	No image packet sent for SN = 32	No image packet sent for SN = 33	No image packet sent for SN = 35	No image packet sent for SN = 36
1	Image packet for SN = 32	Image packet for SN = 33	Image packet for SN = 35	Image packet for SN = 36

Every eight seconds, the verification packets are transmitted to the FMU (VPA, VPB, VPC, VPD and VPE).

Every eight seconds, there is one Auxiliary packet transmitted to the FMU.

Due to the processing delay, there is a fixed offset in time between the acquisition of the data and the transmission of the associated processed packets as depicted in Figure 1.

Subcycle number	1	2	3	4	5	28	29	30	Moving 31	BB dir 2 32	BB dir 1 33	Moving 34	CS dir 1 35	CS dir 2 36	Moving 37	1	2	3	4	5
Input transfer	Normal 1 / Verif. B1-3						Normal 29 / Verif. B1-3	Normal 30 / Verif. B1-3		Normal BB / Verif. B1-3	Normal BB / Verif. B1-3		Normal CS / Verif. B1-3	Normal CS / Verif. B1-3		Normal 1 / Verif. B1-3				
Transfer to FMU	VPB data RAW 2	EMPTY	VPD data NEW CALIB COEF	VPE AUX data Image 32 Image 33 Image 35 image 36	Spectra Data packet 1 + Image 1					Spectra Data Packet 28 + Image 28	Spectra Data Packet 29 + Image 29	Spectra Data Packet 30 + Image 30	VPC data OLD CALIB COEF	EMPTY	VPA data RAW 1	VPA data RAW 2	EMPTY	VPD data NEW CALIB COEFF	VPE AUX data Image 32 Image 33 Image 35 image 36	Spectra Data Packet 1 + Image 1

Figure 1

The packets scheduling transmission is described in Figure 2

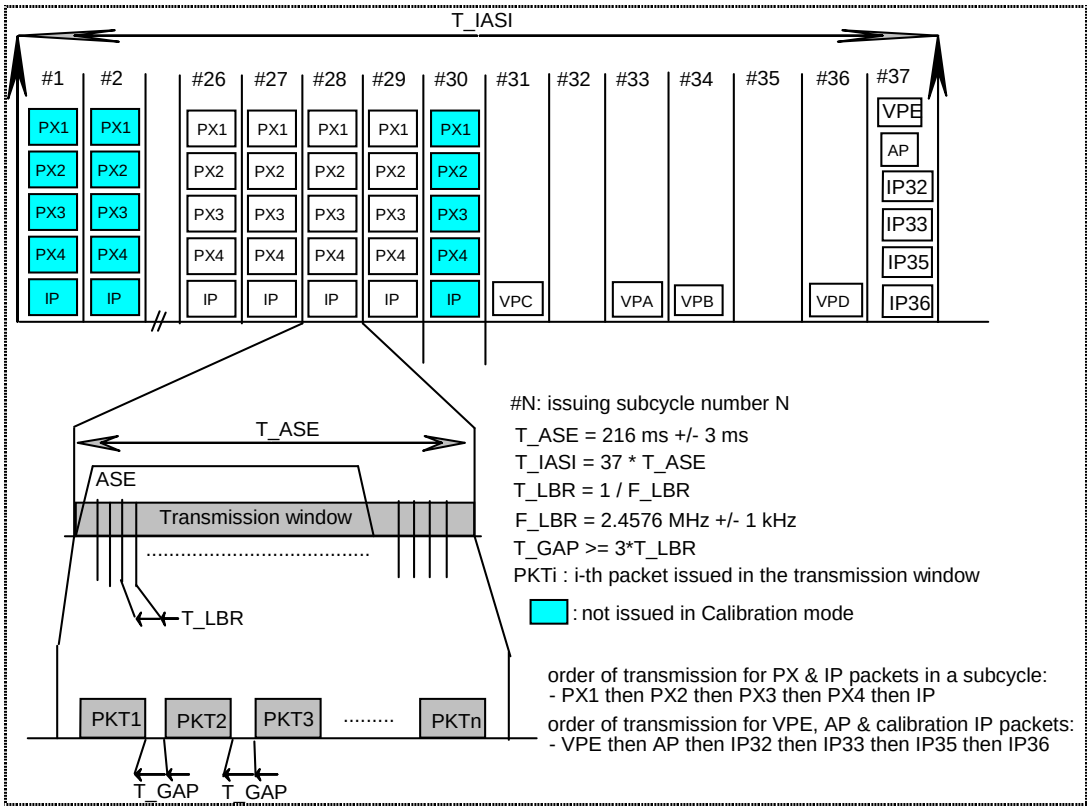


Figure 2

6.2. Science data transmission during EXTERNAL CALIBRATION mode

The external calibration scan sequence is depicted below:

1	2	3…. …29	30	31	32 33	34	35 36	37
SCanMOving	**ScanMoving**	One specific target	**ScanMoving**	**ScanMoving**	Blackbody	**ScanMoving**	First Cold Space	**SCanMOving**

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

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

The transmission of the instrument packets is the same as in NORMAL OPERATION mode except for the subcycle SN = 1, 2, 30 where there is no transmission for the spectrum and image packets (cf. Figure 2).

6.3. Science data during AUXILIARY mode

The transmission of packet during the AUXILIARY mode is the same as in the NORMAL OPERATION mode.

As indicated in the introduction of §6, the science data is declared non valid by means of the "instrument mode" parameter.

6.4. Science data during Test mode

The transmission of packets during the test mode of the instrument is the same as in the NORMAL OPERATION mode.

This mode is dedicated to ground test purposes and is not activated during in orbit operations.

7. Datation of the IASI packets

Each type of IASI source packet contains the time stamp calculated thanks to the On Board Time (OBT) coded on 32 bits with a resolution of 1/256 second.

The OBT correspond to the on board time value when receiving the rising edge of the ASE signal which activates a software function for the OBT register acquisition.

The datation accuracy is 15 msec.

For the spectrum and image packets, the OBT corresponds to the ASE rising edge of the measurement acquisition.

For the verification packet, the OBT corresponds to the ASE rising edge for the subcycle when the data was selected, i.e. according to the Verification Data Selection (VDS).

For the auxiliary packet, the OBT corresponds to the subcycle SN = 32.

In addition, the OBT is transformed by the on board software in order to elaborate the UTC time stamp for each packet (c.f. §11).

8. Management of errors and packets transmission

This section makes an overview of the error management and modifications of the packets transmission. The exhaustive list of errors, description of their management by the DPS and the impacts on packets transmission is done in appendix B and E.

The various errors monitored by the instrument at DPS equipment are classified as follows:

- Major errors, which lead to an automatic transition of the DPS to its WAIT mode. The packets transmission is therefore stopped, for all type of packets.

  Nota: in case of major errors the IMS puts the instrument in HEATER_REFUSE.

- Medium A errors, which lead to an automatic transition of one or several DPC to its SUSPEND mode. The spectrum packets transmission associated to this suspended DPC is therefore stopped. The Verification and Auxiliary Packets are transmitted, but the fields corresponding to the suspended DPC is filled with zero. There is no medium A errors for the image packets. It is possible to recover from this situation thanks to the control ground segment.

  Nota: in case of medium A the IMS puts the instrument in HEATER_REFUSE.

- Medium B errors, which lead to an automatic abortion of the current processing for one or several bands. The field of the spectrum packets corresponding to the aborted band(s) is filled with zero. The inputs for the band merging corresponding to the faulty band are set to zero in order not to alter the remaining bands. The Verification and Auxiliary packets fields for the faulty band(s) are filled with zero. If all the bands are aborted, the spectrum packets is not transmitted except if the bands abortion results from a ZPD error affecting all the bands (in such a case the spectrum packets are issued with ADF filled with zero).

  When a process is suspended, the flags shall remain in their “no error” status, except the flags which allow to detect the errors.

  There is no medium B error for the image packets. This kind of error is limited to the subcycle (for observational phase) or to the 8 seconds period (for calibration phase) where the error is detected.

  Nota: the IMS does not monitor the medium B errors issued by the DPS except a given programmable limited set (*). Therefore the Ground is responsible for tracking such errors from the DPS packets and takes the appropriate measures in case they are persistent.

  (*) the following medium B errors are monitored (current baseline):
  - error 1 : ‘NS different from number of frames counted by DPS’
  - error 500 : ‘DPS LNR-Rx DVL flag raised’
  - error 501 : ‘IMS OD data not received by DPS’
  - error 2 : ‘IMS SN not valid’
  - error 3 : ‘IMS CD not valid’
  - error 4 : ‘IMS SP not valid’
  - error 5 : ‘IMS NS not valid’
  - error 13 : ‘DPS LNR-Rx VLN flag raised’
  - error 496 : ‘IMS SN not equal to DPS SN’
  - error 497 : ‘IIS data not received by DPS’
  - error 498 : ‘MAS data not received by DPS’

If the medium B errors monitored by the IMS are persistent then the IMS puts the instrument in HEATER_REFUSE therefore packets issuing by the DPS is stopped

- Minor errors, which lead to raise flags within the ancillary info field of the spectrum, verification and auxiliary packets. The processing is not interrupted in these cases. There are minor errors for the image reception and transmission, handled in the same way as the data from the interferometer.

  Nota: the IMS does not monitor the minor errors issued by the DPS. Therefore the Ground is responsible for tracking such errors from the DPS packets and takes the appropriate measures in case they are persistent.

The errors are handled at band level, but in case one error is detected on the band selected for the NZPD processing, this detected error is extended to the other bands since the error detected alters the NZPD determination.

These errors are managed either for observational phase or calibration phase. The impact of the various errors detection on the calibration processing is given by the following table (which is valid when the selected band for NZPD determination is band B3):

Error	A1	A2	A3	C1	C2	C3	CS	BB
Medium B System Error	X	X	X	X	X	X	X	X
Minor System Error				X	X	X	X	X
Medium B MAS Error on all bands	X	X	X	X	X	X	X	X
Medium B MAS Error on band B1	X			X				
Medium B MAS Error on band B2		X			X			
Medium B MAS Error on band B3	X	X	X	X	X	X	X	X
Minor MAS Error on all bands				X	X	X	X	X
Minor MAS Error on band B1				X				
Minor MAS Error on band B2					X			
Minor MAS Error on band B3				X	X	X	X	X
Medium B NLC Error on band B1	X			X				
Medium B NLC Error on band B2		X			X			
Medium B NLC Error on band B3	X	X	X	X	X	X	X	X
Medium B ZPD Error	X	X	X	X	X	X	X	X
Medium B ISI Error on band B1	X			X				
Medium B ISI Error on band B2		X			X			
Medium B ISI Error on band B3			X			X		
Minor SPK Error on band B1				X				
Minor SPK Error on band B2					X			
Minor SPK Error on band B3				X	X	X	X	X
Minor IRS error on BB target or on CS target							X	X
Minor RCI error on band B1				X				
Minor RCI error on band B2					X			
Minor RCI error on band B3						X		

Where:

- Ak (k = 1, 2 or 3) == abortion of band k processing in the faulthy subcycle
- Ck (k = 1, 2 or 3) == non-update of band k FRC filtered coefficients
- CS == non-update of CS target FRS filtered coefficients
- BB == non-update of BB target FRS filtered coefficients
- X == corrective action

In Observation Phase, the corrective actions are limited to A1,A2,A3.

Nota: a similar table can be constructed if the selected ZPD band is band 1 or 2.

In addition to the DPS error management, it is possible for the command and control ground segment to disable the processing of one particular band for one particular pixel thanks to the parameter IDefBranchStatus via the parameter setting macrocommand.

IDefBranchStatus															
B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15
Px1/ B1	Px1/ B2	Px1/ B3	Px2/ B1	Px2/ B2	Px2/ B3	Px3/ B1	Px3/ B2	Px3/ B3	Px4/ B1	Px4/ B2	Px4/ B3	0 or 1	0 or 1	0 or 1	0 or 1

With the following coding: 0 = disable, 1 = enable.

Note: if the NZPD selected band processing is disabled, the whole pixel processing is disabled (i.e. the two remaining bands are automatically disabled).

The field of the spectrum packets corresponding to the disabled band(s) is filled with zero. The inputs for the band merging corresponding to the disabled band (s) are set to zero in order not to alter the remaining bands. The Verification and Auxiliary packets fields for the faulty band(s) are filled with zero. The flags for the disabled band (s) are set to no error.

The parameter PTSI, defined in §12.2, allows to know the processing configuration (enable/disable band/pixel) of the instrument.

9. Measurement data source packet format

Each source packet structure consists of two major fields as defined by [METOP] :

- The source packet primary header, with a fixed length of 6 octets,
- The source packet data field with a variable length.

<table>
<tr><th colspan="6">PACKET PRIMARY HEADER
(6 Octets)</th><th colspan="5">PACKET DATA FIELD</th></tr>
<tr><th colspan="4">Packet Identification

(2 octets)</th><th colspan="2">Packet Sequence Control

(2 octets)</th><th>Packet Length

(2 octets)</th><th>Secon-dary Header

(8 oct.)</th><th colspan="4">Source Data</th></tr>
<tr><th colspan="7"></th><th colspan="3">User Data</th><th>Packet Error Control</th></tr>
<tr><td>Version Number

3 bits</td><td>Type Indic.

1 bit</td><td>Sec. Header Flag

1 bit</td><td>APID

11 bits</td><td>Seq. Flag

2 bits</td><td>Source Seq. Count

14 bits</td><td></td><td>UTC Time Stamp</td><td colspan="2">Ancillary Data</td><td>Applicat ion Data</td><td></td></tr>
<tr><td colspan="4">16 bits</td><td colspan="2">16 bits</td><td>16 bits</td><td>64 bits</td><td>OBT 48 bits</td><td>Ancillary Info Field
(aif)</td><td>Variable

(adf)</td><td>16 bits</td></tr>
</table>

10. Packet Primary Header Definition

The primary header definition is common to all packets.

10.1. Packet identification

This field allows to identify the type of packet transmitted by IASI.

Packet Identification		(word #1)
Version Number	B0 to B2	000_b
Type	B3	0_b
Secondary Header flag	B4	1_b
Application Process ID	B5 to B15	

The application process for each type of packet is defined in the following table:

Type of packet	APID	APID in hexa
Spectrum packet Pixel 1 (PX1)	130	08 82
Spectrum packet Pixel 2 (PX2)	135	08 87
Spectrum packet Pixel 3 (PX3)	140	08 8C
Spectrum packet Pixel 4 (PX4)	145	08 91
Image packet	150	08 96
Verification packet (*)	160	08 A0
Auxiliary packet	180	08 B4

(*) nota: there is only one APID for the VPA, VPB, VPC, VPD and VPE packets.

10.2. Packet sequence control

The packet sequence control consists of the Segmentation flag and the packet sequence count.

Packet Sequence Control		(word #2)
Segmentation flag	B0 to B1	11_b (Unsegmented)
Source sequence count	B2 to B15	

The packet sequence control allows to count the number of generated packet by the instrument thanks to the Source Sequence Count (SSC) 14 bits wrap around counter.

There is one individual counter per type of packet (for a given APID), incremented by the instrument each time one packet is generated.

At initialization of the DPS (i.e. At DPS power On or DPS reset), the SSC is set in such a way that the first packet issued is marked with SSC = 0 for each APID.

The segmentation field indicates if the packet source is segmented or not. IASI packets are unsegmented.

10.3. Packet Length

The Packet length shall reflect the number of bytes minus one of the data field from the first byte of the data field secondary header to the last byte of the source data field including the packet error control field. The packet length is the **word#3** of the packet.

11. Packet Secondary Header definition

In addition to the OBT defined in §7, the instrument calculates, from the OBT and the parameters transmitted via the DELTATIME MCMD, the time stamp in the Universal Time Code (UTC). This UTC Time Stamp is inserted in the words 4 to 7 of each packet.

UTC Time stamp		(word #4 to #7)
Word #4	B0 to B15	Number of Days (since 1 January 2000)
Word #5	B0 to B15	Number of ms in the day (MSW)
Word #6	B0 to B15	Number of ms in the day (LSW)
Word #7	B0 to B15	0000h

nota: the UTC is set to 0 in the VPC packets in case the Verification Data Selector target is relative to SN=35 or SN=36

The secondary header is common to all packets.

12. User Data definition

The user data consists of the three following fields:

- The On Board Time Stamp
- The Ancillary Info Field
- The Application data

The On Board Time stamp definition is common to all packets, whereas the ancillary Info field and application data are specific to each individual packet.

12.1. On Board Time stamp

The OBT field contains the ICU On Board Time (c.f. §7).

On Board Time		(word #8 to #10)
Word #8	B0 to B7	00h
	B8 to B15	Coarse Time (MSB)
Word #9	B0 to B15	Coarse Time (LSW, LSB = 1s)
Word#10	B0 to B7	Fine Time (LSB = 1/256s)
	B8 to B15	00h

nota: the OBT is set to 0 in the VPC packets in case the Verification Data Selector target is relative to SN=35 or SN=36

12.2. Spectrum ancillary info field (PX.aif)

The spectrum ancillary info field contains information data which allows the on-ground processing of the spectrum contained in the application data field. The Ancillary Info Field represents the words #11 to #160 of the spectrum packet.

- The words #11 to #13 contain the Operational Data (OD) generated each and every subcycle by the equipments and checked by the IMS in order to generate the corresponding Operational Data Non Valid (OD_NV) flags. This Operational Data are used internally by the DPS for the algorithmic processing.

Operational data word 1		**(word #11)**
Word #11	B0 to B15	Number of samples (NS)

The number of samples (NS) is the total number of RPD pulses counted by the Cube Corner Mechanism (CCM) during the high level of ASE signal. NS is an unsigned 8 bits integer.

Operational data word 2		**(word #12)**
Word #12	B0 to B7	Step Number (SN)
	B8 to B15	Scan Position (SP)

The Step Number is defined in §4. SN is an unsigned 8 bits integer.

The Scan Position (SP) is defined by the following table:

Target	**Scan position**
Earth targets	SP = 1 to 30
First deep space	SP = 31
Hot Blackbody	SP = 32
Second deep space	SP = 33
Nadir	SP = 34
Scan mirror back to the sounder	SP = 35
Parked position	SP = 36
Scan moving	SP = 0

SP is an unsigned 8 bits integer.

Operational data word 3			**(word #13)**
Word#13	B0	CD	Cube direction
	B1	CSQ	Cube Speed Quality
	B2	SQ1	Scan Alpha angle quality
	B3	SQ2	Scan Beta angle quality
	B4	IEQ	Imager equalisation (1 = equalisation performed) – See §12.5
	B5 to B7	000_b	
	B8	SN_NV	Step Number Non Valid (reset if Step Number <> Scan Internal Counter)
	B9	CD_NV	Cube Direction Non Valid (reset if CD not toggling each ASE subcycle)

Operational data word 3			(word #13)
	B10	CSQ_NV	Cube corner Speed Quality Non Valid (reset if CSQ = 0)
	B11	SP_NV	Scan Position Non Valid (reset if Scan Position <> expected one on the ASE subcycles where the verification shall be performed – Mode and Step Number dependant)
	B12	SQ1_NV	Scan Quality 1 Non Valid (reset if SQ1 = 0 on the ASE subcycles where Scan Position verification shall be performed)
	B13	SQ2_NV	Scan Quality 2 Non Valid (reset if SQ2 = 0 on the ASE subcycles if Scan Position is lower than 30 and if Scan Position verification shall be performed)
	B14	NS_NV	Number of Samples Non Valid Reset if NS is out of range (w.r.t thresholds uploaded by SW parameter Setting MCMD)
	B15	IEQ_NV	Imager Equalisation Non Valid (reset if IEQ = 0 on SN=32 of each IASI cycle where equalisation shall be performed (the period of equalisation is uploaded by SW parameter setting MCMD). See §12.5

Nota: The field {B8, B9, B10, B11, B12, B13, B14, B15} is called the 'OD_NV' field. The CD and CSQ operational data are generated by the Cube Corner Mechanism. The CSQ is obtained by comparison of the speed control loop errors to thresholds which could be modified by macrocommands.

The SQ1 & SQ2 flags are generated by the Scan Mechanism, by comparison of the Alpha and Beta control loop errors to thresholds which can be modified by macrocommands.

The IEQ flag is generated by the imager equipment (IIS).

The flags inserted in bits 8 to 15 of word #13 are generated by the IMS when monitoring the Operational Data. When one OD_NV flag is reset (=0), the associated OD shall be considered as non valid and therefore not used for further processing.

At DPS level, the resetting of OD_NV flags will provoke the following immediate effect:

In case CD_NV, SN_NV, SP_NV or NS_NV are reset: corresponding Medium B errors will be generated and reported in the ELT table (Ref. §12.8). As a consequence spectrum packets will no longer be produced if such errors appear in an observation subcycle. In case the errors appear in a calibration subcycle the filtered calibration coefficients & filtered reduced ZPD spectra will not be updated (the non-update events are traced by the flags BBofFlagSrdNonUpdate & BBofFlagCoefCalInit in AP packet).

In case SQ1_NV, SQ2_NV or CSQ_NV are reset: corresponding Minor errors will be generated and reported in the ELT table (Ref. §12.8) with no other effects in the spectrum packets. If such errors appear in an observation subcycle the PX packets will contain flags set to ERROR. If such errors appear in a calibration subcycle the filtered calibration coefficients & filtered reduced ZPD

spectra will not be updated (cf. flags BBofFlagSrdNonUpdate & BBofFlagCoefCalInit in AP packet).

In addition at IMS level, the two following mechanisms are implemented:

The related OD_NV flags are reset in case of communication failure to the subsystem on which the acquisition of the OD has been performed (CCM, SCS or IIS).

The IMS performs cyclically (each two seconds) a monitoring of all OD_NV flags (except IEQ_NV): the monitoring triggers in case one of the flags has been reset, ie one of the parameters is not valid (at least once among 2 seconds) and this has been repeated consecutively three times (ie over a period of 8 seconds).

In both cases depicted before, the IMS will generate a corrective action leading to DPS switch to Wait Mode (mode in which the packets are no longer generated by the DPS). Therefore the resetting of OD_NV flags will be seen only transitorily before packets completely disappear.

- The words #14 and #15 contain the IASI configuration words which allow the processing ground segment to determine which configuration is currently selected by the command and control ground segment.

IASI Configuration word 1			**(word #14)**
Word#14	B0 to B2	000_b (spare)	
	B3	IASI Chain	1_b = Nominal 0_b = Redundant
	B4 to B6	000_b (spare)	
	B7	not used	0_b (spare)
	B8	MAS HAU1 Power Status	
	B9	MAS HAU2 Power Status	
	B10	MAS HAU3 Power Status	
	B11	MAS HAU4 Power Status	
	B12 to B14	000_b(spare)	
	B15	Laser identifier	1_b = laser 1 0_b = Laser 2

IASI Configuration word 2			**(word #15)**
Word#15	B0	RC	RAM check during any DPC INIT Mode (1_b = Enabled, 0_b = Inhibited)
	B1	LNR	LNR input select (1_b = MAS data, 0_b = Test)
	B2	ASE	ASE in test mode (1_b = external, 0_b = internal)
	B3	LBR	LBR output select (1_b = FMU A, 0_b = FMU B)
	B4 to B6	PIXEL 1	
	B7 to B9	PIXEL 2	
	B10 to B12	PIXEL 3	
	B13 to B15	PIXEL 4	

The PIXEL I (I= 1, 2, 3, 4) fields allow to determine to which DPC the MAS pixel acquisition chain is affected.

PIXEL I = 001_b	HAU I connected to DPC 1
PIXEL I = 010_b	HAU I connected to DPC 2
PIXEL I = 011_b	HAU I connected to DPC 3
PIXEL I = 100_b	HAU I connected to DPC 4
PIXEL I = 101_b	HAU I connected to DPC 5

Nota: these inter-connections between MAS acquisition chains and the DPC's determine the instrument hardware configuration.

For the modification of the on-board processing parameters, the "Parameter setting macrocommand" allows to modify the parameters of the various pixel without taken into account this hardware organization by addressing directly the pixel.

- The words #16 and 17 contain the Parameter Table Set Identifier which allows the processing ground segment to determine the processing configuration to select. This data is handled by the ground segment thanks to macrocommands. A mode transition is required to modify this parameter in the source packets (e.g. from NORMAL OPERATION or EXTERNAL CALIBRATION to AUXILIARY mode). The default value equals to 1.

Parameter Table Set Identifier		**(word #16 & 17)**
Word#16	B0 to B15	PTSI (MSW), SW Version and Revision are given on 2 decimal digits and are stored in one word without any conversion as in the following example : Version 2.12 is coded in hexadecimal : 020C
Word#17	B0 to B15	PTSI (LSW), Parameters Identifier is given on 5 decimal digit and is stored in one word (16 bits unsigned integer)

- The Word #18 contains the Line Number data which allows to determine the number of 8 seconds period since the DPS is commanded to switch to its operational mode. Each time the DPS leaves its operational mode, the LN is reset to zero.

Line Number		**(word #18)**
Word#18	B0 to B15	LN

In case of transition between NORMAL OPERATION and EXTERNAL CALIBRATION, the LN is reset to zero. This also applies when in AUXILIARY mode the DPS is in its operational mode, and when a transition to the NORMAL OPERATION or EXTERNAL CALIBRATION is activated.

Note that the IMS reset the LN counter on ASE N°35/CD=1 whereas the DPS switches into NORMAL OPERATION (resp. EXTERNAL calibration) on next ASE N°1. Therefore the LN counter of the first DPS produced packets after the transition into NORMAL OPERATION (resp. EXTERNAL calibration) is systematically equals 1.

LN is an unsigned 16 bits integer.

❖ The word #19 contains the instrument mode identifier.

Instrument mode		(word #19)
Word#19	B0 to B7	Not used (always at 0)
	B8	Transition status (0 = mode transition in progress, 1 = established mode)
	B9 to B15	Instrument sub mode Established modes: $00F8_h$ = AUX_OP $00A1_h$ = NORMAL OPERATION $00A2_h$ = EXTERNAL CALIBRATION Transition modes in progress: 0072_h = OPERATION (Normal or Ext.Cal.) to AUX ASE SYNC transition 0021_h= AUX to NORMAL MODE transition * 0022_h = AUX to EXT CAL MODE transition *

Nota: other instrument modes are not possible since transmission of measurement data is only authorized in these modes.

* MODE TRANSITION only in the first line (B8=0: 21_h and $A1_h$ have the same B9 to B15, only B8 changed. It's the same for 21_h and $A2_h$).

❖ The word #20 contains the System Quality Index for Spectra which allows the processing ground segment to stamp the spectrum packets with a system quality flag. This data is handled by the ground segment thanks to SW Parameter Setting macrocommand. There is no need to perform an instrument transition to modify this data with macrocommand. The default value equals to 0.

System Quality Index for Spectra		(word #20)
Word#20	B0 to B15	SQIS (detail of this is TBD)

❖ The word #21 contains the pixel identifier.

Pixel Identifier		(word #21)
Word#21	B0 to B15	0001_h = Pixel 1 0002_h = Pixel 2 0003_h = Pixel 3 0004_h = Pixel 4

- The word #22 contains the number of MAS frames counted by the DPS. The frame represents the data generated by the MAS at each RPD pulse, and it is composed of the three bands of the four pixels. The relation between this data and the Number of Samples will depend on the final IASI design..

Number of MAS frames counted by the DPS		**(word #22)**
Word#22	B0 to B15	BdcoNbReceivedWords

BdcoNbReceivedWords is an unsigned 16 bits integer.

- The words #23 to #28 contain the mean value of interferogram after the non linearity correction for the three bands of one pixel. These data are 32 bit Single precision Floating-Point numbers.

Mean value of interferogram after non linearity correction		**(words #23 to 28)**
Word#23	B0 to B15	BNlcAnaMV for Band B1_MSW
Word#24	B0 to B15	BNlcAnaMV for Band B1_LSW
Word#25	B0 to B15	BNlcAnaMV for Band B2_MSW
Word#26	B0 to B15	BNlcAnaMV for Band B2_LSW
Word#27	B0 to B15	BNlcAnaMV for Band B3_MSW
Word#28	B0 to B15	BNlcAnaMV for Band B3_LSW

- The word #29 contains the NZPD value for the NZPD selected Band (Band B3 is used by default).

NZPD value for the NZPD selected Band		**(word #29)**
Word#29	B0 to B15	BZpdNzpd

BZpdNzpd is an unsigned 16 bits integer.

- The words #30 and #31 contain the NZPD quality Index determined by the NZPD algorithm. This data is a 32 bit Single precision Floating-Point number.

NZPD quality Index		**(words #30 and 31)**
Word#30	B0 to B15	BzpdNzpdQualIndexEW (MSW)
Word#31	B0 to B15	BzpdNzpdQualIndexEW (LSW)

- The words #32 to 87 contain the mean value of imaginery part of the calibrated spectrum over the spectral interval constituted by 400 spectral samples (i.e. ≈100 cm^{-1}) for Band B1, B2 and B3. The maximum spectral intervals of 400 samples are 8 for band B1 and 10 for band B2 & B3. The first spectral interval begins at the first spectral sample of the band (i.e. $IUsbNsfirst_{b=1}$ in case of band B1). In case the number of spectral intervals time the number of samples is higher than the last spectral sample of the band (i.e. $IUsbNslast_{b=1}$ in case of band B1), the data associated to the spectral intervals higher than $IUsbNslast_{b=1}$ are fulfilled with zero. These data are a 32 bit Single precision Floating-Point numbers.

Mean value of imag. part of the calibrated spectrum over the spectral interval of 100 cm^{-1} for Band B1		**(words # 32 to 47)**
Word#32	B0 to B15	BArcImagMean_ Band B1_ spectral interval #1 (MSW)
Word#33	B0 to B15	BArcImagMean_ Band B1_ spectral interval #1 (LSW)
…	…	…
Word#46	B0 to B15	BArcImagMean_ Band B1_ spectral interval #8 (MSW)
Word#47	B0 to B15	BArcImagMean_ Band B1_ spectral interval #8 (LSW)

Mean value of imag. part of the calibrated spectrum over the spectral interval of 100 cm^{-1} for Band B2		**(word # 48 to 67)**
Word#48	B0 to B15	BArcImagMean_ Band B2_ spectral interval #1 (MSW)
Word#49	B0 to B15	BArcImagMean_ Band B2_ spectral interval #1 (LSW)
…	…	…
Word#66	B0 to B15	BArcImagMean_ Band B2_ spectral interval #10 (MSW)
Word#67	B0 to B15	BArcImagMean_ Band B2_ spectral interval #10 (LSW)

Mean value of imag. part of the calibrated spectrum over the spectral interval of 100 cm^{-1} for Band B3		**(word # 68 to 87)**
Word#68	B0 to B15	BArcImagMean_ Band B3_ spectral interval #1 (MSW)
Word#69	B0 to B15	BArcImagMean_ Band B3_ spectral interval #1 (LSW)
…	…	…
Word#86	B0 to B15	BArcImagMean_ Band B3_ spectral interval #10 (MSW)
Word#87	B0 to B15	BArcImagMean_ Band B3_ spectral interval #10 (LSW)

- The words 88 to 143 contain the Mean value of square of imaginery part of the calibrated spectrum over the spectral interval constituted by 400 spectral samples (i.e. ≈100 cm^{-1}) for Band B1, B2 and B3. The maximum spectral intervals of 400 samples are 8 for band B1 and 10 for band B2 & B3. The first spectral interval begins at the first spectral sample of the band (i.e. $IUsbNsfirst_{b=1}$ in case of band B1). In case the number of spectral intervals time the number of samples is higher than the last spectral sample of the band (i.e. $IUsbNslast_{b=1}$ in case of band B1), the data associated to the spectral intervals higher than $IUsbNslast_{b=1}$ are fulfilled with zero. These data are a 32 bit Single precision Floating-Point numbers.

Mean value of square of imaginery part of the calibrated spectrum over the spectral interval of 100 cm^{-1} for Band B1		**(word # 88 to 103)**
Word#88	B0 to B15	BArcImagRMS_Band B1_spectral interval #1 (MSW)
Word#89	B0 to B15	BArcImagRMS_Band B1_spectral interval #1 (LSW)
…	…	…
Word#102	B0 to B15	BArcImagRMS_Band B1_spectral interval #8 (MSW)
Word#103	B0 to B15	BArcImagRMS_Band B1_spectral interval #8 (LSW)

Mean value of square of imaginery part of the calibrated spectrum over the spectral interval of 100 cm^{-1} for Band B2		**(word # 104 to 123)**
Word#104	B0 to B15	BArcImagRMS_ Band B2_spectral interval #1 (MSW)
Word#105	B0 to B15	BArcImagRMS_ Band B2_spectral interval #1 (LSW)
…	…	…
Word#122	B0 to B15	BArcImagRMS_ Band B2_spectral interval #10 (MSW)
Word#123	B0 to B15	BArcImagRMS_ Band B2_spectral interval #10 (LSW)

Mean value of square of imaginery part of the calibrated spectrum over the spectral interval of 100 cm^{-1} for Band B3		**(word # 124 to 143)**
Word#124	B0 to B15	BArcImagRMS_Band B3_spectral interval #1 (MSW)
Word#125	B0 to B15	BArcImagRMS_Band B3_spectral interval #1 (LSW)
…	…	…
Word#142	B0 to B15	BArcImagRMS_Band B3_spectral interval #10 (MSW)
Word#143	B0 to B15	BArcImagRMS_Band B3_spectral interval #10 (LSW)

- The words #144 and #145 contain the Mean value of mean values of square of imaginery parts of the calibrated spectrum over the spectral intervals for Band B1. This datum is a 32 bit Single precision Floating-Point number.

Mean value of mean value of square of imaginery part of the calibrated spectrum over the spectral intervals for Band B1		**(word #144 and 145)**
Word#144	B0 to B15	BArcImagMeanRMS_Band B1 (MSW)
Word#145	B0 to B15	BArcImagMeanRMS_Band B1 (LSW)

- The words #146 and #147 contain the Mean value of mean values of square of imaginery parts of the calibrated spectrum over the spectral intervals for Band B2. This datum is a 32 bit Single precision Floating-Point number.

Mean value of mean value of square of imaginery part of the calibrated spectrum over the spectral intervals for Band B2 (word #146 and 147)		
Word#146	B0 to B15	BarcImagMeanRMS_Band B2 (MSW)
Word#147	B0 to B15	BarcImagMeanRMS_Band B2 (LSW)

- The words #148 and #149 contain the Mean value of mean values of square of imaginery parts of the calibrated spectrum over the spectral intervals for Band B3. This datum is a 32 bit Single precision Floating-Point number.

Mean value of mean value of square of imaginery part of the calibrated spectrum over the spectral intervals for Band B3 (word #148 and 149)		
Word#148	B0 to B15	BArcImagMeanRMS_Band B3 (MSW)
Word#149	B0 to B15	BArcImagMeanRMS_Band B3 (LSW)

- The words #150 to #154 contain the Spectrum Status Area which allows the processing ground segment to know the flags raised by the instrument in order, in one hand, to monitor the on board processing and, in other hand, to give quality factors for some of the on processing steps.

Status_area_word #1 (word #150)		
Word#150	B0	DPS LNR-Rx DVL flag
	B1	DPS LNR-Rx VLN flag
	B2	flag BBofFlagSpectNonQual
	B3	flag BDcoFlagMasErrorPath for band B1
	B4	flag BDcoFlagMasErrorPath for band B2
	B5	flag BDcoFlagMasErrorPath for band B3
	B6	flag BDcoFlagMasOverflow for band B1
	B7	flag BDcoFlagMasOverflow for band B2
	B8	flag BDcoFlagMasOverflow for band B3
	B9	flag BDcoFlagMasEcret for band B1
	B10	flag BDcoFlagMasEcret for band B2
	B11	flag BDcoFlagMasEcret for band B3
	B12	flag BdcoFlagMasErrorNbWords
	B13 to B15	spare (set to 0)

Status_area_word #2		**(word #151)**
Word#151	B0	flag BSpkFlagSpik for band B1
	B1	flag BSpkFlagSpik for band B2
	B2	flag BSpkFlagSpik for band B3
	B3	flag BzpdFlagNzpdNonQualEW
	B4	flag BIsiFlagErrorFft for band B1
	B5	flag BIsiFlagErrorFft for band B2
	B6	flag BIsiFlagErrorFft for band B3
	B7	Flag BArcFlagCalSpectNonQual for band B1
	B8	Flag BArcFlagCalSpectNonQual for band B2
	B9	Flag BArcFlagCalSpectNonQual for band B3
	B10	flag BCodFlagFlood
	B11	flag BDcoFlagErrorInterf for band B1
	B12	flag BDcoFlagErrorInterf for band B2
	B13	flag BDcoFlagErrorInterf for band B3
	B14 to B15	spare (set to 0)

Status Area words 3 to 5 (spare)		**(words #152 to 154)**
Word#152	B0 to B15	Spare (set to 0)
Word#153	B0 to B15	Spare (set to 0)
Word#154	B0 to B15	Spare (set to 0)

The following table gives the meaning of the different flags elaborated by the on board processing and the error severity for the corrective actions identification (cf § 12.8 for definition of error severity).

Error / flag	**Error severity**	**Definition**
DPS LNR-Rx DVL flag	2B	Error detected on MAS / DPS interface which alter the content of the raw interferogram data for all bands and all pixels (LNR command word unexpected)
DPS LNR-Rx VLN flag	2B	Error detected on MAS / DPS interface which alter the content of the raw interferogram data for all bands and all pixels (LNR code rule violation)
flag BbofFlagSpectNonQual	-	This flag is a summary of the medium B or minor errors detected for the pixel (i.e. if one medium B or minor error occurs on one band of the pixel).
flag BdcoFlagMasErrorPath	2B	Error detected on the raw interferogram sample which corresponds to an erroneous digital numeriser amplification gain data for a given band.
flag BdcoFlagMasOverflow	1	Error detected on the raw interferogram sample which corresponds to the overflow indication of the ADC for a given band.
flag BdcoFlagMasEcret	1	Error detected on the raw interferogram sample which corresponds to the detection by the analog chain of one spike on the acquired signal for a given band.

Error / flag	Error severity	Definition
Flag BdcoFlagMasErrorNbWords	2B	Flag set to error in case of the number of raw interferogram samples received by the DPS differs from the Number of Samples (NS) counted by the CCM more than ± IdefMASNbwordsShift. Applicable to all bands and all pixels.
flag BspkFlagSpik	1	Flag set to error by the spike algorithm which corresponds to the detection of one spike detected on the digitalized raw interferogram raw samples for a given band.
flag BzpdFlagNzpdNonQualEW	2B	Flag set to error by the ZPD algorithm when one error is detected on the processing (NZPD determined sample equals to one of the limits of the NZPD searching windows) or in case of the quality index BzpdNzpdQualIndexEW exceeds the threshold IdefZpdQualIndexCutoff
flag BisiFlagErrorFft	2B	Flag set to error in case of the number of samples for the FFT computation is not sufficient (compared to the needed one: IdefFftNsFFT = 51200) for a given band.
flag BarcFlagCalSpectNonQual	1	Flag set to error in case of the parameter BarcImagMeanRMS exceeds the threshold IDefArcImagMeanRMSCutoff for a given band.
flag BcodFlagFlood	1	Flag raised when it is not possible to encode all spectrum samples due to limit exceeding of the maximum of coding bits allowed for the transmission (IdefCodNbBitMax)
flag BdcoFlagErrorInterf for band B1	-	This flag is a summary for band B1(i.e. set to error if one error is detected) of the following errors: - BdcoFlagMasErrorPath (status area word #1, B3) - BdcoFlagMasOverflow (status area word #1, B6) - BdcoFlagMasEcret (status area word #1, B9)
flag BdcoFlagErrorInterf for band B2	-	This flag is a summary for band B2 (i.e. set to error if one error is detected) of the following errors: - BdcoFlagMasErrorPath (status area word #1, B4) - BdcoFlagMasOverflow (status area word #1, B7) - BdcoFlagMasEcret (status area word #1, B10)
flag BdcoFlagErrorInterf for band B3	-	This flag is a summary for band B3 (i.e. set to error if one error is detected) of the following errors: - BdcoFlagMasErrorPath (status area word #1, B5) - BdcoFlagMasOverflow (status area word #1, B8) - BdcoFlagMasEcret (status area word #1, B11)

- The words #155 and #156 contain the Maximum number of bit allowed for the spectrum coding (determined from the processing ground segment) and allow the ground segment to determine the length of the spectrum application data field. This data is an unsigned 16 bits integer.

Maximum number of bits allowed for the spectrum coding		**(words #154 and 155)**
Word#155	B0 to B15	IDefCodNbBitMax (MSW)
Word#156	B0 to B15	IDefCodNbBitMax (LSW)

- The words #157 to #160 are spare words (set to 0).

12.3. Spectrum application data field (PX.adf)

The spectrum application data field contains the calibrated spectrum corresponding to the outputs of the "COD" algorithm. The resulting spectrum samples are packed into a consecutive binary data stream divided into 16 bits words.

To be noted that the calibrated spectrum are coded differently according to the CTN value:

CTN = 0 when SP = 1..30 (Earth views)

CTN = 1 when SP = 32 (Blackbody view)

CTN = 2 when SP = 31, 33 (Cold space views)

CTN = 3 when SP = 0, 34, 35, 36 (Other views)

If the parameter IDefCodNbBitMax modulo 16 ≠0, 0b will be added by the DPS to fulfill the remaining 16 bits word.

The ADF will be structured as follows (v_k = BCodSpect(k), n = IDefCodNbBitMax & n mod 16 =0)

00	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**
v_{15}	v_{14}	v_{13}	v_{12}	v_{11}	v_{10}	v_{09}	v_{08}	v_{07}	v_{06}	v_{05}	v_{04}	v_{03}	v_{02}	v_{01}	v_{00}
v_{31}	v_{30}	v_{29}	v_{28}	v_{27}	v_{26}	v_{25}	v_{24}	v_{23}	v_{22}	v_{21}	v_{20}	v_{19}	v_{18}	v_{17}	v_{16}
.....															
v_{n-1}	v_{n-2}	v_{n-3}	v_{n-4}	v_{n-5}	v_{n-6}	v_{n-7}	v_{n-8}	v_{n-9}	v_{n-10}	v_{n-11}	v_{n-12}	v_{n-13}	v_{n-14}	v_{n-15}	v_{n-16}

If n mod 16 ≠ 0 then the ADF will be completed by null values in order to have a word-alignment

For example if n = 18 we will have the following structure:

00	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**
v_{15}	v_{14}	v_{13}	v_{12}	v_{11}	v_{10}	v_{09}	v_{08}	v_{07}	v_{06}	v_{05}	v_{04}	v_{03}	v_{02}	v_{01}	v_{00}
0	0	0	0	0	0	0	0	0	0	0	0	0	0	v_{17}	v_{16}

During the first line following a mode transition, the ADF value for the spectrum are set to zero since the calibration coefficients are initialized to zero on mode transition.

Here we give an algorithm that reconstructs the physical coded values (B_k) from the PX ADF words (in italic a procedure to go from the ADF words to the bit array v):

```
LET P = 0 -- bit array pointer
-- determining the number of words, say Nw, to decode ('div' is the integer division):
if IDefCodNbBitMax mod 16 = 0
then Nw = (IDefCodNbBitMax div 16)
else Nw = 1 + (IDefCodNbBitMax div 16)
end if
-- decoding:
for M in 0.. Nw -1 loop
   for N in 0..16-1 loop
      LET v(P) = ( W(M) / 2**N ) mod 2; LET P = P+1;
   end loop
end loop
-- reconstructing the coded physical values, say B_firstB1 … B_lastB3:
LET P = 0
for K in IUsbNsFirst_B1 .. IUsbNsLast_B3 loop
   -- NbBit_k is the number of bits that codes sample B_k
```

LET B_k = v(P) + (2^1)*v(P+1) + ... + ($2^{NbBit(K)-1}$)*v(P+ $NbBit_k$ -1)
LET P = P + $NbBit_k$
end loop

12.4. Image ancillary info field (IP.aif)

The image ancillary info field contains information data which allows the on-ground processing of the image contained in the application data field. The Ancillary Info Field represents the words #11 to #25 of the image packet.

- The **words #11 to #19** are the same as the words #11 to 19 of the spectrum ancillary info field.

- The word #20 contains the System Quality Index For Image which allows the processing ground segment to stamp the image packets with a system quality flag. This data is handled by the ground segment thanks to SW Parameter Setting macrocommand. There is no need to perform an instrument transition to modify this data with macrocommand. The default value equals to 0.

System Quality Index for Image		**(word #20)**
Word#20	B0 to B15	SQII, the content is TBD

- The word #21 contains the Image status area which allows the processing ground segment to know the type of coding used for the images and the flags raised by the instrument.

Image status area		**(word #21)**
Word#21	B0 to B7	Value IIS_SIZE
	B8	IIS ADC Overflow flag
	B9	Flag raised if (Number of IIS samples ≠ 4100)
	B10 to B15	spare (set to 0)

Value IIS_SIZE determines the number of bits allowed for the encoding of the image pixels (can take the value 8, 10 and 12).

The flag “IIS ADC Overflow” is raised when one overflow indication is detected on the raw data coming form the imager.

The flag “(Number of IIS samples ≠ 4100)” is raised when the number of image pixels received by the DPS is different from the expected one i.e. 4100 samples.

- The word #22 contains the Number of IIS Samples counted by the DPS which allows the processing ground segment to determine the length of the image application data field.

Number of IIS Samples		**(word #22)**
Word#22	B0 to B15	IIS_COUNT

- The **words #23 to 25** are spare words (set to 0).

12.5. Image application data field (IP.adf)

The image samples coming from the IIS are transformed by extracting the 8, 10, 12 bits Most Significant Bits out of the 12 bits. The transformed image samples are packed into a consecutive binary data stream divided into 16 bits words. In case the number of coded bits for the whole image is not modulo 16, then the remaining bits in the last 16 bits word are fulfilled with zero.

The data stream coming from the IIS and received by the DPS consists of two parts:

- The equalization data (the first four received samples)
- The images samples (4096 images samples).

The first four received samples correspond to the data which will allow the ground processing segment to reconstruct the equalization counter handled by the IIS. These four data are coded exactly in the same way as the image samples before being packed. The equalization counter is distributed among the four "equalization counter part" 1 to 4.

This 32 bits counter can be reconstructed on ground by extracting the most significant byte among the X coded bits (X = 8, 10, 12 bits) as depicted hereafter:

- In case the number of coded bit is 8 bits per image sample:

B0							B7	B8							B16
Equalization counter part 1								Equalization counter part 2							
Equalization counter part 3								Equalization counter part 4							
First image sample								Second image sample…							

- In case the number of coded bit is 10 bits per image sample:

B0							B7	B8	B9						B16
Equalization counter part 1								Not used	Not used	Equalization counter part 2					
		Not used	Not used	Equalization counter part 3								Not used	Not used	Equalization	
Counter part 4						Not used	Not used	First image sample							
	Second image sample							…							

- In case of the number of coded bit is 12 bits per image sample:

B0							B7	B8			B11				B16
Equalization counter part 1								Not used	Not used	Not used	Not used	Equalization			
Counter part 2				Not used	Not used	Not used	Not used	Equalization counter part 3							
Not used	Not used	Not used	Not used	Equalization counter part 4								Not used	Not used	Not used	Not used
First image sample												Second image			
Sample								…							

In addition to this equalization counter, the flags IEQ (Bit B4 of word #13 of image packet) and IEQ_NV (bit 15 of word # 13) shall be handled by the processing ground segment.

IEQ and IEQ_NV flags (IEQ always equal to IEQ_NV), while set to zero, indicates an error in the equalization process handled by the on-board management subsystem.

IEQ	IEQ_NV	Meaning
0	0	The equalization commanded by the IMS is not successfully executed by the imager. A new equalization process is prepared for the next 8 second period (automatic retry).
1	1	No equalization requested or equalization requested by the IMS and correctly performed by the imager.

The IIS equalization operation shall be monitored through the incrementation of the equalization counter. When IEQ and IEQ_NV equal to zero an automatic retry is performed by the IMSS.

The image sample organization within the image packet is the following :

(Row01, Column01); (Row01, Columm02); (Row01, Column03); ….. ; (Row64, Column63); (Row64, Column 64).

12.6. Spectrum verification ancillary info field (VP.aif)

The spectrum verification ancillary info field contains information data which allows the on-ground processing of the verification data contained in the application data field. The Ancillary Info Field represents the words #11 to #25 of the spectrum verification packets.

The ancillary info field is the same for all type of verification packets.

As a general rule, the flags contained in the verification packets are already introduced in the definition of the spectrum packets (§12.2 and 12.3).

The words #11 to #19 are the same as the words #11 to 19 of the spectrum and image ancillary info field.

- The word #20 contains the Verification data selection which allows the ground segment to determine the selected verification data in terms of pixel identifier, band identifier and Step Number identifier. The verification data sampling is determined via macrocommands.

Verification Data Selection, VDS		**(word #20)**
Word#20	B0 to B3	P
	B4 to B7	B
	B8 to B15	S

Where P represents the pixel Identifier (P=1 to 4), B the band identifier (B = 1 to 3) and S the Step Number (see §4).

Warning:

Ground segment has to take care to not select VDS_S = 1, 2, 30 when IASI is in EXTERNAL_CALIBRATION mode. Indeed, data coresponding to these step numbers are meaningless (scan mirror is moving) and DPS does not process any interferograms in such subcycles:

To be noted that if VDS_S = 1,2,30 is selected when IASI is in EXTERNAL_CALIBRATION mode then:

1/ data are put in VPA VPB packets (even if there are meaningless)

2/ and in AP packets the NO-MAS-INFO and NO-IIS-INFO are set to 0 for SN 1, 2, 30 in (no check performed on this subcycle)

- The word #21 contains the Verification status area which allows the ground segment to firstly identify the type of verification data inserted in the application data field and then to determine the flags raised by the instrument when processing the associated spectrum.

Verification Status Area		(word #21)
Word#21	B0 to B7	Verification packet identifier 01_h : VPA 02_h : VPB 03_h : VPC 04_h : VPD 05_h : VPE
	B8 to B15	Status Area : B8 : BZpdFlagNzpdNonQual XX related to the VDS-selected SN & pixel (XX = EW if SN in 1..30, BB if SN in 32..33, CS if SN in 35..36 B9 : BdcoFlagMasErrorNbWords B10 to B15 : spare (set to 0)

Note that the Status Area B8-B15 is valid only for VPE packets. For VPA, VPB, VPC and VPD packets the Status Area is filled with zeros.

- The word #22 contains the NZPD value for the NZPD selected Band related to the selected VDS

NZPD value for the NZPD selected band related to the selected VDS		(word # 22)
Word#22	B0 to B15	BZpdNzpd

BZpdNzpd is an unsigned 16 bits integer.

Note that BZpdNzpd is filled with zeros for VPA, VPB, VPC, VPD, for VPE packets BZpdNzpd is invalid when SN 32, 33, 35, 36 is selected by VDS (confer to AUXILIARY packet for these SN).

- The words #23 and #24 contain the NZPD quality Index determined by the NZPD algorithm for the selected VDS. This data is a 32 bit Single precision Floating-Point number.

NZPD quality Index		(word #23 and 24)
Word#23	B0 to B15	BzpdNzpdQualIndexXX related to the VDS-selected SN & pixel (XX = EW if SN in 1..30, BB if SN in 32..33, CS if SN in 35..36) (MSW)
Word#24	B0 to B15	BzpdNzpdQualIndex XX related to the VDS-selected SN & pixel (XX = EW if SN in 1..30, BB if SN in 32..33, CS if SN in 35..36) (LSW)

Note that BzpdNzpdQualIndexXX is filled with zeros for VPA, VPB, VPC, VPD. For VPE packets BzpdNzpdQualIndexXX is invalid when SN 32, 33, 35, 36 is selected by VDS (confer to AUXILIARY packet for these SN).

- The word #25 contains the number of MAS frames counted by the DPS (M). The frame represents the data generated by the MAS at each RPD pulse, and it is composed of the three bands of the four pixels. The relation between this data and the Number of Samples (NS) is the following one: | NS – M | <= Delta where Delta is a parameter set at DPS level, equal to IDefMasNbWordsShift.

Number of MAS frames counted by the DPS		**(word #25)**
Word#25	B0 to B15	BdcoNbReceivedWords

Nota: this data determines the length of the VPA and VPB application data field. For VPC packets BdcoNbReceivedWords is filled with zeros.

- The word #26 contains the ZPD first sample for the selected VDS which determines the number of the first sample of the NZPD searching window. This data is an unsigned 16 bits integer.

ZPD first sample		**(word #26)**
Word#26	B0 to B15	IZsbNsfirstSrd

- The word #27 contains the ZPD last sample for the selected VDS which determines the number of the last sample of the NZPD searching window. This data is an unsigned 16 bits integer.

ZPD last sample		**(word #27)**
Word#27	B0 to B15	IZsbNslastSrd

- The word #28 contains the First spectral sample for the selected VDS which determines the number of the first spectral sample of the selected band. This data is an unsigned 16 bits integer.

First spectral sample		**(word #28)**
Word#28	B0 to B15	IUsbNsfirst

- The word #29 contains the Last spectral sample for the selected VDS which determines the number of the larst spectral sample of the selected band. This data is an unsigned 16 bits integer.

Last spectral sample		**(word #29)**
Word#29	B0 to B15	IUsbNslast

- The word #30 contains the First spectral sample of B1/B2 overlapping interval which corresponds to the first spectral sample of the overlapping interval between B1 & B2. This data is an unsigned 16 bits integer.

First B1&B2 overlapping spectral sample		**(word #30)**
Word#30	B0 to B15	IOsbNsFirstMb1b2

- The word #31 contains the Last spectral sample of B1/B2 overlapping interval which corresponds to the first spectral sample of the overlapping interval between B1 & B2. This data is an unsigned 16 bits integer.

Last B1&B2 overlapping spectral sample		**(word #31)**
Word#31	B0 to B15	IOsbNsLastMb1b2

- The word #32 contains the First spectral sample of B2/B3 overlapping interval which corresponds to the first spectral sample of the overlapping interval between B2 & B3. This data is an unsigned 16 bits integer.

First B2&B3 overlapping spectral sample		**(word #30)**
Word#32	B0 to B15	IOsbNsFirstMb2b3

- The word #33 contains the Last spectral sample of B2/B3 overlapping interval which corresponds to the first spectral sample of the overlapping interval between B1 & B2. This data is an unsigned 16 bits integer.

Last B2&B3 overlapping spectral sample		**(word #31)**
Word#33	B0 to B15	IOsbNsLastMb2b3

- The words #34 to 40 are spare words (set to 0).

12.7. Spectrum verification application data field (VP.adf)

12.7.1. Spectrum verification application data field / Type A

The application data for the VPA packet corresponds to the first half part of the raw interferograms acquired by the instrument. The maximum number of raw interferograms is equal to 55000.

The length of the application data field is determined by the BdcoNbReceivedWords parameter of the ancillary info field by applying the following formula:

. (BdcoNbReceivedWords + BdcoNbReceivedWords ***mod 2) / 2***

The raw interferograms received from the MAS is divided into two distinct data frame:

- the “MAS Header Frames”
- the “MAS Interferogram Frames”.

The “MAS Header Frames” contain 100 special samples used for the on-board processing and transmitted by the MAS with the following organization:

Frame	**MAS entity**	**Label**
F(1)	Gain 1 Numeriser Offset With Inputs Set to 0	BDcoRawOffset1
F(2)	Gain 4 Numeriser Offset With Inputs Set to 0	BDcoRawOffset2
F(3)	Gain 16 Numeriser Offset With Inputs Set to 0	BDcoRaxOffset3
F(4) to F(25)	Auxiliary Values Set 1	-
F(26)	Gain 1 Baseline Value Before Coarse Compensation	BDcoRawMVcoarse
F(27) to F(62)	Auxiliary Values Set 2	-
F(63)	Gain 16 Baseline Value Before Fine Compensation	BDcoRawMVfine
F(64) to F(92)	Auxiliary Values Set 3	-
F(93)	Gain 16 Baseline Value After Fine Compensation	BDcoRawMV3
F(94)	Gain 4 Baseline Value After Fine Compensation	BDcoRawMV2
F(95)	Gain 1 Baseline Value After Fine Compensation	BDcoRawMV1
F(96) to F(100)	Auxiliary Values Set 4	-

Each sample of the “MAS Header Frames” has the same format as the Mas interferogram sample.

Each MAS interferogram sample is a 16 bits word with the following format:

MAS interferogram sample	
B0	Spike detection Flag
B1	ADC Overflow Flag
B2 to B3	Amplification path, 01_b : amplification path 1 10_b : amplification path 4 11_b : amplification path 16
B4 to B15	Interferogram sample value

12.7.2. Spectrum verification application data field / Type B

The application data for the VPB packet corresponds to the second part of the raw interferograms acquired by the instrument.

The length of the application data field is determined by the BdcoNbReceivedWords parameter of the ancillary info field field by applying the following formula:

(BdcoNbReceivedWords **-** BdcoNbReceivedWords ***mod 2) / 2***.

12.7.3. Spectrum verification application data field / Type C

The application data field for the VPC packet corresponds to the current complex NZPD reduced spectra and filtered calibration coefficients. These data are a 32 bit Single precision Floating-Point numbers.

The length of the NZPD reduced spectra is determined by the IZsbNsfirstSrd and IZsbNslastSrd parameters.

The length of the calibration coefficients arrays is determined by the IUsbNsfirst and IUsbNslast parameters.

These coefficients are complex coefficients, therefore the format convention of §0 for the complex array is applicable.

The application data field is arranged in the following order:

array BFrsSrdCS
array BFrsSrdBB
array BFrcOffset
array BFrcSlope

12.7.4. Spectrum verification application data field / Type D

The application data field for the VPD packet corresponds to the instantaneous complex calibration coefficients. These data are a 32 bit Single precision Floating-Point numbers.

The length of the calibration coefficients arrays is determined by the IUsbNsfirst and IUsbNslast parameters.

These coefficients are complex coefficients, therefore the format convention of §0 for the complex array is applicable.

The application data field is arranged in the following order:

array BcrcOffset
array BcrcSlope

12.7.5. Spectrum verification application data field / Type E

The application data field for the VPE packet corresponds to the spectral samples of overlapping spectral intervals for band B1/B2 and B2/B3. Therefore, the calibrated spectrum samples for each band (B1 & B2 then B2 & B3) are collected. These data are a 32 bit Single precision Floating-Point numbers.

The length of the application data field is determined with the IOsbNsFirstMb1b2, IOsbNsLastMb1b2, IOsbNsFirstMb2b3 and IOsbNsLastMb2b3 parameters.

The application data field is arranged in the following order:

array $BArcSpect_{b=1}$
array $BArcSpect_{b=2}$
array $BArcSpect_{b=2}$
array $BArcSpect_{b=3}$

12.8. Auxiliary ancillary info field (AP.aif)

- The words #11 and 12 are the same as words #14 and 15 of the spectrum ancillary info field, and contain the IASI configuration words.
- The words #13 and 14 are the same as words #16 and 17 of the spectrum ancillary info field, and contain the PTSI parameter.
- The words #15 to 32 contain the Operational TeleMetry (OTM) generated every 8 seconds by the instrument and checked by the IMS in order to generate the corresponding Operational TeleMetry Non Valid (OTM_NV) flags.

OTM data		**(word #15 to 32)**
Word #15	B0 to B15	Blackbody Temperature (BBT) (MSW)
Word #16	B0 to B15	Blackbody Temperature (BBT) (LSW)
Word #17	B0 to B15	Instrument Mode
Word #18	B0 to B15	Line Number
Word #19	B0 to B15	SQIS
Word #20	B0 to B15	SQII
Word #21	B0 to B15	RTS
Word #22	B0 to B15	RTL
Word #23	B0 to B15	IFPT
Word #24	B0 to B15	FPT
Word #25	B0 to B15	HAUT
Word #26	B0 to B15	OPBT
Word #27	B0 to B15	spare (set to 0)
Word #28	B0 to B15	OTM_NV
Word #29	B0 to B15	SPTSI (MSW)
Word #30	B0 to B15	SPTSI (LSW)
Word #31	B0 to B15	Spare (set to 0)
Word #32	B0 to B15	Spare (set to 0)

The Blackbody temperature (BBT) is a 32 bits unsigned integer, the LSB being equal to 1 mK.

The Relative Time Synchronization (RTS) parameter corresponds to the difference in time between the BCP1 pulse broadcast by the payload and the internal first ASE rising edge as described in §4. The RTS is a 16 signed integer, the LSB of RTS is 1/256 second.

The Reversal Time Law (RTL) corresponds to the selected speed law of the CCM for the **preceeding** 8 seconds period.

RTL selection	Speed control loop
01_h	ASE nominal + 1 ms
02_h	ASE nominal
04_h	ASE nominal - 1 ms

The following parameters correspond to temperatures acquired by the IMS. These parameters are unsigned 12 bits integers.

IFPT corresponds to the Imager Focal Plane Temperature.

FPT corresponds to the Focal Plane Temperature.

HAUT corresponds to the MAS temperature.

OPBT correspond to the OPtical Bench Temperature.

The relation between the coding of these parameters and the physical temperature comes from (REF [ICCI]) and it is given in the following table:

	Type	Transfer function	Temperature range	Accuracy
IFPT	Ana	Raw(12 bits) = f[T(°C)] - y = f(x) = (Vo +K*x)/5.12*4096 - x = f^{-1}(y) = (5.12*y/4096-Vo)/K Vo = 0±0.1V; K = 0.1±0.01	TBD	TBD
FPT	Ana	TBD	TBD	TBD
HAUT	Therm-3	Raw(12 bits) = f[T(°C)] - y = f(x) = -2E-05*x4 + 0.0053*x3 + 0.1049*x2 - 52.117*x + 1975.8 - x = f^{-1}(y) = -7E-16*y5 + 7E-12*y4 - 3E-08*y3 + 5E-05*y2 - 0.0732*y + 60.551	[-60°C;+60°C]	±0.5°C @20°C
OPBT	Therm-2	Raw(12 bits) = f[T(°C)] - y = f(x) = -1E-04*x4 + 0.0135*x3 - 0.1473*x2 - 71.242*x + 2867.1 - x = f-1(y) = -7E-17*y5 + 8E-13*y4 - 4E-09*y3 + 1E-05*y2 - 0.0302*y + 50.61	[-20°C;+50°C]	±0.28°C @20°C

Note: the calibration curves for the different temperatures are given in appendix A.

The OTM_NV field gives IASI 'health' indications and is structured as follows:

- bit 00: BBT validity flag (1: valid, 0: not valid). The BBT_NV is reset (not valid) by the IMS:
  - if the communication with the CCM fails when acquiring the data,
  - if the acquisitions performed on the CCM of the 2 Blackbody temperatures and the voltage reference have an unexpected BBT address (4 MSB = respectively 0x9, 0xA, 0xB for the first, second and third acquisition)
- bit 01: FPT validity flag (always = 1)
- bit 02: HAUT validity flag (always = 1)
- bit 03: IFPT validity flag (always = 1)
- bit 04: OPBT validity flag (always = 1)

- bit 05: CCAT validity flag (always = 1)
- bit 06 to bit 15: not used (set to 0)

In the case one of the flags has been reset ie one of the parameters is not valid consecutively during 24 seconds (3 complete IASI cycles), the IMS will generate a corrective action leading to DPS switch to Wait Mode (mode in which the packets are no longer generated by the DPS). Therefore the resetting of OTM_NV flags will be seen only transitorily before packets disappear.

The System Parameter Table Set Identifier data allows the ground segment to determine the overall system processing configuration and can be modified by SW Parameter Setting macrocommand. In opposite to the PTSI parameter, it is possible to modify the SPTSI parameter on the fly, i.e. without instrument mode transition.

The SPTSI LSW value is equal to the IDefBranchStatus (refer to §8 for IDefbranchStatus definition). The default value equals to 0.

Supprimé : is
Supprimé : TBD
Supprimé : D

- The word #33 corresponds to the DPS Status which allows the ground segment to determine the internal configuration of the DPS and the results of initialization.

DPS Status (word #33)		
Word #33	B0 to B7	DPS_Power_Status : B0 : DPC1 ON/OFF status B1 : DPC2 ON/OFF status B2 : DPC3 ON/OFF status B3 : DPC4 ON/OFF status B4 : DPC5 ON/OFF status B5 : FMU I/F N status B6 : FMU I/F R status B7 : LNR Input status (1 = MAS input, 0 = test input)
	B8 to B15	DPS_INIT_Status : B8 : PX1A/PX1B init status (1: init OK for both halves) B9 : PX2B/PX2B init status B10 : PX3A/PX3B init status B11 : PX4B/PX4B init status B12 : spare (set to 0) B13 : DPS DMC SW init status (1: init OK) B14 : DPS EEPROM to RAM transfert status (1: transfer OK) B15 : DPS DMC RAM check status (1: RAM check OK)

Nota: PX1A and PX1B represent respectively one half part of each DPC board.

- The word #34 contains the DPS mode information.

DPS mode		**(word #34)**
Word #34	B0 to B2	P1_MODE
	B3 to B5	P2_MODE
	B6 to B8	P3_MODE
	B9 to B11	P4_MODE
	B12 to B15	OP_MODE

The P1_MODE to P4_MODE determine the DPC current mode with the following coding:

- 000_b: OFF or SUSPEND
- 111_b: OPERATIONAL mode

It shall be noted that it is very important to monitor this field in order to detect that the pixel has been suspended automatically by the software after error detection and therefore the transmission for this pixel has been interrupted. This comment is only applicable if the automatic interruption action performed by IMS sofwtare is disabled (c.f. §8).

The OP_MODE corresponds to the DPS operational mode with the following coding:

OP_MODE = 1111_b, DPS is in operational/oper mode which is in fact the NORMAL OPERATION mode of the instrument.

OP_MODE = 0000_b, DPS is in operational/Calib mode which is in fact the EXTERNAL CALIBRATION mode of the instrument.

- The word #35 contains the Verification Data Selection as the word #20 of verification ancillary info field.
- The words #36 and 37 contain the NO_OD_INFO report which allows the processing ground segment to know that the OD are missing for a specific Step Number.

NO_OD_INFO		**(word #36 and 37)**
Word #36	B0 to B15	Bit #I = 1 if the OD data are missing for the Step Number = I+1
Word #37	B0 to B13	Bit #I = 1 if the OD data are missing for the Step Number = I + 17
	B14	= 1 if the OD data are missing for the Step Number 32 or 33
	B15	= 1 if the OD data are missing for the Step Number 35 or 36

- The words #38 and 39 contain the NO_IIS_INFO report which allows the processing ground segment to know that the image data is missing for a specific Step Number.

NO_IIS_INFO		**(word #38 and 39)**
Word #38	B0 to B15	Idem to word #36 (i.e. same bit polarity coding)
Word #39	B0 to B15	Idem to word #37 (i.e. same bit polarity coding)

- The words #40 and 41 contain the NO_MAS_INFO report which allows the processing ground segment to know that the data from the MAS is missing for a specific Step Number.

NO_MAS_INFO		**(word #40 and 41)**
Word #40	B0 to B15	Idem to word #36 (i.e. same bit polarity coding)
Word #41	B0 to B15	Idem to word #37 (i.e. same bit polarity coding)

Nota 1: the NO_OD_INFO and NO_MAS_INFO errors are classified as medium B errors and NO_IIS_INFO as minor errors.

Nota 2: the error NO_IIS_INFO does not affect the algorithmic processing.

Note that No_MAS_INFO and NO-IIS-INFO are set to 0 for SN 1, 2, 30 in EXTERNAL CALIBRATION mode (no check performed on this subcycle).

- The words #42 to 53 contain ELT_INFO report which correspond to Error Log Table entries relative to the first four occurred medium B and minor errors until last ELT reset (ELT is read by IMSS and consequentely reset on ASE 34). All data inserted in the various fields of the ELT are relative to the moment when the error is detected. The first entry (ELT entry #1) is the oldest one.

ELT1		**(word #42 and 44)**
Word #42	B0	CD, (0_b = backward, 1_b = forward) Warning: in case of IIS errors the CD value is inverted (DPS SW implementation limitation)
	B1 to B9	Error
	B10 to B15	Step Number (6 LSB of SN OD defined in §12.2)
Word #43	B0 to B16	Line Number (see §12.2)
Word #44	B0 to B2	Pixel: 000_b for error not pixel dependant 001_b for pixel 1 010_b for pixel 2 011_b for pixel 3 100_b for pixel 4
	B3 to B4	Band: 00_b for error not band dependent 01_b for band B1 10_b for band B2 11_b for band B3
	B5 to B7	Severity: 000_b for minor error 001_b for medium A error (*) 010_b for medium B error 011_b for major error (*)
	B8 to B15	00_h

The Error field and the severity field allow the ground segment to identify the error detected by the instrument. The cross-relation between the Error field and the error identification is given in appendix B. In case of no error, the Error field is equal to zero.

In case of medium B and minor error, the error identification is given in table 2 of appendix B, and the error field corresponds to the EID column data.

(*): Note that such anomalies (Major and Medium A) are never reported within this table because provided to the ground segment by the C&C channel (those anomalies lead to switching the DPS into Wait mode). Therefore the Severity field will never be seen with the values 001_b or 011_b.

It shall be noted that the coding used for the severity field to be inserted in the packet is not the same than the severity convention used in appendix B for error description.

The relation between the severity code of the packet and the severity convention of appendix B tables is defined by the following table:

Severity field of the packet	Convention in appendix B tables	Meaning
011_b	3	Major
001_b	2A	Medium A
010_b	2B	Medium B
000_b	1	Minor

The words #45 to #47 correspond to the second entry with the same definition as words #42 to #44.

The words #48 to #50 correspond to the second entry with the same definition as words #42 to #44.

The words #51 to #53 correspond to the second entry with the same definition as words #42 to #44.

- The words #54 to #70 are spare words (set to 0).

12.9. Auxiliary application data field (AP.adf)

The application data field of the auxiliary packet contains all the data relative to the processing of calibration targets during the last seven subcycles of the 8 seconds period, including update of NZPD and calibration coefficients.

The Auxiliary Application Data field has a fixed length equal to 640 bytes.

The ADF is structured as follows:

Auxiliary Application Data Field	**(words #71 to #390)**
Words #71 to #130	Main Data Area for pixel 1
Words #131 to #190	Main Data Area for pixel 2
Words #191 to #250	Main Data Area for pixel 3
Words #251 to #310	Main Data Area for pixel 4
Words #311 to #330	Main Status Area for pixel 1
Words #331 to #350	Main Status Area for pixel 2
Words #351 to #370	Main Status Area for pixel 3
Words #371 to #390	Main Status Area for pixel 4

- The Auxiliary Main Data Area for pixel 1 is structured as follows:

Main Data Area for pixel 1	**(words #71 to #130)**
Words #71 to #85	Data Area for SN = 32, size = 15 words
Words #86 to #100	Data Area for SN = 33, size = 15 words
Words #101 to #115	Data Area for SN = 35, size = 15 words
Words #116 to #130	Data Area for SN = 36, size = 15 words

Nota: The same structure applied to pixel 2 to 4.

- The Data Area contain information relative to the processing of the calibration targets and are similar to the data included in the ancillary info field of the spectrum packet.

The Data Area for SN = 32 is structured as follows:

Data Area for SN = 32	**(words #71 to #85)**
Words #71	Operational data word 1 (same as word #11 of spectrum packet)
Words #72	Operational data word 2 (same as word #12 of spectrum packet)
Words #73	Operational data word 3 (same as word #13 of spectrum packet)
Words #74	BDcoNbReceivedWords (same as word #22 of spectrum packet)
Words #75	BNlcAnaMV for Band B1_MSW (same as word #23 of spectrum packet)
Words #76	BNlcAnaMV for Band B1_LSW (same as word #24 of spectrum packet)
Words #77	BNlcAnaMV for Band B2_MSW (same as word #25 of spectrum packet)
Words #78	BNlcAnaMV for Band B2_LSW (same as word #26 of spectrum packet)
Words #79	BNlcAnaMV for Band B3_MSW (same as word #27 of spectrum packet)
Words #80	BNlcAnaMV for Band B3_LSW (same as word #28 of spectrum packet)
Words #81	BZpdNzpd (same as word #29 of spectrum packet)
Words #82	BzpdNzpdQualIndexXX (XX = BB if SN in 32..33, CS if SN in 35..36) (MSW) (same as word #30 of spectrum packet)
Words #83	BzpdNzpdQualIndexXX (XX = BB if SN in 32..33, CS if SN in 35..36) (LSW) (same as word #31 of spectrum packet)
Words #84	Spare (set to 0)
Words #85	Spare (set to 0)

Nota: The same structure applied to SN = 33, 35and 36.

- The Main Status Area for pixel 1 is structured as follows:

Main Status Area for pixel 1	**(words #311 to #330)**
Words #311 to #314	Status Area for SN = 32
Words #315 to #318	Status Area for SN = 33
Words #319 to #322	Status Area for SN = 35
Words #323 to #326	Status Area for SN = 36
Words #327 to #330	Extra Status Area

Note: The same structure applied to pixel 2 to 4.

- The Status Area is very similar to the Spectrum Status Area included in the Spectrum ancillary info field (words #150 to 154) and allows the ground segment to know the flags raised by the instrument in order, in one hand, to monitor the on board processing and, in other hand, to give quality factors for some of the on processing steps during the calibration phase.

The Status Area for SN = 32 is structured as follows:

Status Area for SN = 32	**(words #311 to #314)**
Word#311	Status_Area_Word #1
Word#312	Status_Area_Word #2
Word#313	Status_Area_Word #3
Word#314	Status_Area_Word #4

Note: the same structure applied to SN = 33, 35 and 36.

Status_Area_Word #1		**(word #311)**
Word#311	B0	DPS LNR-Rx DVL flag
	B1	DPS LNR-Rx VLN flag
	B2	flag BBofFlagSpectNonQual for Calibration Views
	B3	flag BdcoFlagMasErrorPath for band B1
	B4	flag BdcoFlagMasErrorPath for band B2
	B5	flag BdcoFlagMasErrorPath for band B3
	B6	flag BdcoFlagMasOverflow for band B1
	B7	flag BdcoFlagMasOverflow for band B2
	B8	flag BdcoFlagMasOverflow for band B3
	B9	flag BdcoFlagMasEcret for band B1
	B10	flag BdcoFlagMasEcret for band B2
	B11	flag BdcoFlagMasEcret for band B3
	B12	flag BdcoFlagMasErrorNbWords
	B13	flag BdcoFlagErrorInterf for band B1
	B14	flag BdcoFlagErrorInterf for band B2
	B15	flag BdcoFlagErrorInterf for band B3

Status_Area_Word #2		**(word #312)**
Word#312	B0	flag Bnlcflagintegrity for band B1
	B1	flag Bnlcflagintegrity for band B2
	B2	flag Bnlcflagintegrity for band B3
	B3	flag BSpkFlagSpik for band B1
	B4	flag BSpkFlagSpik for band B2
	B5	flag BSpkFlagSpik for band B3
	B6	flag BZpdFlagNzpdNonQualXX (XX =BB if SN in 32..33, CS if SN in 35..36)
	B7	flag BIrsFlagSrdNonIntegrity
	B8	flag BIsiFlagErrorFft for band B1
	B9	flag BIsiFlagErrorFft for band B2
	B10	flag BIsiFlagErrorFft for band B3
	B11 to B15	spare (set to 0)

Status_Area_Word #3		**(word #313)**
Word#313	B0 to B15	spare (set to 0)

Status_Area_Word #4		**(word #314)**
Word#314	B0 to B15	spare (set to 0)

- The Extra Status Area allows the ground segment processing to know the operations performed during the update of the NZPD and calibration coefficients in terms of re-initialization, update and quality factor. There is one Extra Status Area per pixel each 8 seconds. These data are specific to the calibration phase.

The Extra Status Area is structured as follows:

Extra Status Area_Pixel 1		**(words #327 to #330)**
Word#327	Extra_Status_Area_Word #1	
Word#328	Extra_Status_Area_Word #2	
Word#329	Extra_Status_Area_Word #3	
Word#330	Extra_Status_Area_Word #4	

Extra_Status_Area_Word #1		
Word#327	B0	flag BBofFlagSrdInit for CD = 0
	B1	flag BBofFlagSrdInit for CD = 1
	B2	flag BBofFlagSrdNonUpdate for CD = 0
	B3	flag BBofFlagSrdNonUpdate for CD = 1
	B4	flag BBofFlagCoefCalInit for band B1 & CD = 0
	B5	flag BBofFlagCoefCalInit for band B2 & CD = 0
	B6	flag BBofFlagCoefCalInit for band B3 & CD = 0
	B7 to B15	spare (set to 0)

Extra_Status_Area_Word #2		
Word#328	B0	flag BBofFlagCoefCalInit for band B1 & CD = 1
	B1	flag BBofFlagCoefCalInit for band B2 & CD = 1
	B2	flag BBofFlagCoefCalInit for band B3 & CD = 1
	B3	flag BBofFlagCoefCalNonUpdate for band B1 & CD=0
	B4	flag BBofFlagCoefCalNonUpdate for band B2 & CD=0
	B5	flag BBofFlagCoefCalNonUpdate for band B3 & CD=0
	B6	flag BBofFlagCoefCalNonUpdate for band B1 & CD=1
	B7	flag BBofFlagCoefCalNonUpdate for band B2 & CD=1
	B8	flag BBofFlagCoefCalNonUpdate for band B3 & CD=1
	B9	flag BRciFlagNonIntegritySlope for band B1 & CD=0
	B10	flag BRciFlagNonIntegritySlope for band B2 & CD=0
	B11	flag BRciFlagNonIntegritySlope for band B3 & CD=0
	B12	flag BRciFlagNonIntegritySlope for band B1 & CD=1
	B13	flag BRciFlagNonIntegritySlope for band B2 & CD=1
	B14	flag BRciFlagNonIntegritySlope for band B3 & CD=1
	B15	spare (set to 0)

Extra_Status_Area_Word #3		
Word#329	B0	flag BRciFlagNonIntegrityOffset for band B1 & CD=0
	B1	flag BRciFlagNonIntegrityOffset for band B2 & CD=0
	B2	flag BRciFlagNonIntegrityOffset for band B3 & CD=0
	B3	flag BRciFlagNonIntegrityOffset for band B1 & CD=1
	B4	flag BRciFlagNonIntegrityOffset for band B2 & CD=1
	B5	flag BRciFlagNonIntegrityOffset for band B3 & CD=1
	B6 to B15	spare (set to 0)

Extra_Status_Area_Word #4		
Word#330	B0 to B15	Spare (set to 0)

The following table gives the meaning of the different flags elaborated by the on board processing during calibration phase and the error severity for the corrective actions identification and contained in the Main status Area of each pixel

Some flags are already defined in §12.2 and not repeated here below.

Error / flag	**Error severity**	**Definition**
flag BNlcflagintegrity	2B	Flag set to error by the NLC algorithm in case of Non linearity Look Up Table addressing error, for a given band.
flag BIrsFlagSrdNonIntegrity	1	Flag set to error by the IRS algorithm when the distance between the filtered NZPD coefficients (for cold space and blackbody) and the instantaneous coefficients is higher than the threshold IDefSrdDistCuttoffCS (for cold space) and IDefSrdDistCuttoffBB (for blackboby).
flag BBofFlagSrdInit	-	Set to ERROR if the NZPD filtered reduced BB & CS spectra, for a given CD, have been set to the NZPD reduced_initialization spectra (i.e IRshSrd, IRscSrd)
flag BBofFlagSrdNonUpdate	-	Set to ERROR if the NZPD reduced filtered BB & CS spectra have not been updated, for a given CD
flag BBofFlagCoefCalInit	-	Set to ERROR if the filtered calibration coefficients have been set to 0, for a given band & CD
flag BBofFlagCoefCalNonUpdate		Set to ERROR if the filtered calibration coefficients have not been updated, for a given band & CD
flag BRciFlagNonIntegritySlope	1	Set to error by the RCI algorithm when the distance between the filtered calibration slope coefficients and the instantaneous coefficients is higher than the threshold IDefRCICutoffSlope for a given band & CD.
flag BRciFlagNonIntegrityOffset	1	Set to error by the RCI algorithm when the distance between the filtered calibration offset coefficients and the instantaneous coefficients is higher than the threshold IDefRCICutoffOffset for a given band & CD.

13. Packet Error Control

Packet Error Control (PEC) field is included in the IASI measurement packets. Packet error control is identical for all types of packets.

The polynomial generator is $X^{16} + X^{12} + X^5 + 1$.

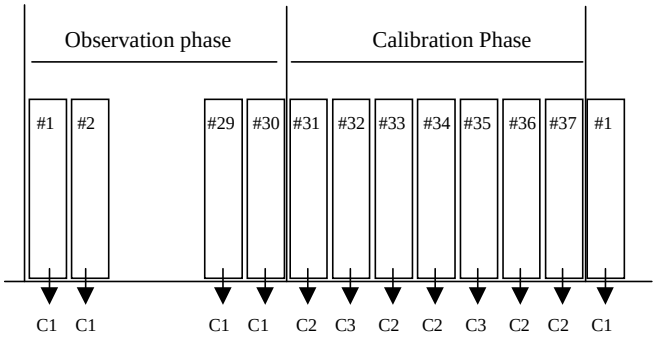
The PEC is computed on the whole packet except the CRC field itself.

Both encoder and decoder is initialized with $FFFF_h$.

14. Constraints on Packet size

All the different IASI packets have variable lengths depending on the paramtrization made by the ground segment and depending on the MAS and IIS dynamic behavior. The ground segment can modify the length of the packet thanks to the parameter setting macrocommands.

The ground segment shall respect some constraints when defining the various parameters which determine the length of the packet. These constraints are due to data rate transmission constraints with the FMU as indicated hereafter:



#N: issuing subcycle number N (N in 1... 37)
Constraint C1: amount of data <= 336 336 bit = **21 021 words**
Constraint C2: amount of data <= 2 200 000 bps x 0.213 s = 468 600 bit = **29287 words**
Constraint C3: amount of data = 0 bit
Constraint C4: amount of data <= 1 541 000 bps x 37 subcycles x 0.213 s = 12 144 621 bit = **759 039 words**

Nota: the figures 21 021 words and 759 039 words are extracted from CNES fax ref: IASI/03/026

The following constraints on the packets sizes have to be noted (s(**X**) is the size in words of packet **X** and N_C is the number of Image packets produced in Calibration Phase):

*4*s(PX) + s(IP) <= 21 021 words*

s(VPC) <= 29 287 words

s(VPA) <= 29 287 words

s(VPB) <= 29 287 words

s(VPD) <= 29 287 words

*s(VPE) + s(AP) + N_C*s(IP) <= 29 287 words*

30(4*s(PX) + s(IP)) + s(VPC) + s(VPA) + s(VPB) + s(VPD) + s(VPE) + s(AP) + N_C*s(IP) <= 759 039 words*

Nc: number of IIS acquisition of reference sources (to be selected between 2 or 4 IIS acquisitions)

This set of inequalities will be called the "*data rates constraints*"

Important nota on packets sizes & related data rates:

We remind herebelow the relationships that exist between the parameters & the packets sizes (all figures are given in words of 16 bit):

- size(PX) = 161 + IDefCodNbBitMax / 16
- size(IP) = 26 + IIS_Nb * IIS_Size / 16
- size(VPA) = 41 + (M + M mod 2) / 2
- size(VPB) = 41 + (M – M mod 2) / 2
- size(VPC) = 41 + 8*IZsbNsDeltaSrd + 8*IUsbNsDelta
- size(VPD) = 41 + 8*IUsbNsDelta
- size(VPE) = 41 + 4*IOsbNsDeltaMb1b2 + 4*IOsbNsDeltaMb2b3
- size(AP) = 391

where ‘IIS_Nb’ is the number of IIS samples and ‘M’ is the number of MAS frames.

Nota: the DPS does not handle more than 4100 IIS samples & more than 55000 MAS frames

The following constraints must not be violated (DPS design constraints to avoid SW crash or SW unpredictable behaviour):

- IDefCodNbBitMax <= 4319*16
- IIS_Size <= 12
- IZsbNsDeltaSrd <= 45
- IUsbNsDelta <= 3600
- IOsbNsDeltaMb1b2 <= 240
- IOsbNsDeltaMb2b3 <= 400

If the Ground selects the max values then the DPS will issue packets such that:

- size(PX) = 4480
- size(IP) = 3101 (IIS_Nb = 4100)
- size(VPA) = 27541 (M = 55000)
- size(VPB) = 27541
- size(VPC) = 29201
- size(VPD) = 28841
- size(VPE) = 2601

Nota: Delta means ‘Last - First + 1’

Taken into account the DPS output bit rate (R = **2 457 600** bps) we can see that:

- a PX packet is issued in 4480 x 16 / R s ≈ 29.2 ms
- an IP packet is issued in 3101 x 16 / R s ≈ 20.2 ms
- a VPA or a VPB packet is issued in 27541 x 16 / R s ≈ 179.3 ms
- a VPC packet is issued in 29201 x 16 / R s ≈ 190.1 ms
- a VPD packet is issued in 28841 x 16 / R s ≈ 187.8 ms
- a VPE packet is issued in 2601 x 16 / R s ≈ 16.9 ms
- an AP packet is issued in 391 x 16 / R s ≈ 2.5 ms

Therefore:

- 4 PX + 1 IP packets are issued in less than 4 x 29.2 + 1 x 20.2 ≈ **137** ms
- 1 VPE + 1 AP + 4 IP packets are issued in less than 1x 16.9 + 1 x 2.5 + 4 x 20.2 ≈ **100.2** ms

The worst case being the VPC packet duration (**190** ms)

These figures do favorably compare with the shortest ASE duration (213 ms).

At last we can deduce the so-called ‘data rates’ for an ASE:

- in a 4PX+IP subcycle : 21021 x 16 ≈ 336 336 bit / ASE
- in a VPA subcycle : 27541 x 16 ≈ 440 656 bit / ASE
- in a VPB subcycle : 27541 x 16 ≈ 440 656 bit / ASE
- in a VPC subcycle : 29201 x 16 ≈ 467 216 bit / ASE
- in a VPD subcycle : 28841 x 16 ≈ 461 456 bit / ASE
- in a VPE+AP+4IP subcycle : 15396 x 16 ≈ 246 336 bit / ASE

And so we have the following figure for a IASI line:

30 x 336 336 + 440 656 + 440 656 + 467 216 + 461 456 + 246 336 bit ≈ 12 146 400 bit / LINE.

Considering the worst case (37x0.213 s) we get an averaged figure of about **1.541** Mbit / second.

Nota: the here above data rate has been calculated with 4 IIS acquistions of reference sources (Nc = 4) and 12 bits (IIS_Size).

15. Determination of the packets sizes

The primary packet header has a fixed length of 6 octets.

The UTC Time stamp (8 bytes) and the ancillary info fields of each packets have fixed lengths for each individual packets.

The OBT length is 6 bytes.

The Packet Error Control field has a fixed length of 2 octets.

The following table determines all the variables which set the length of the application data field for each type of packet. A summary of packet length is given in appendix C.

Packet type	*Spectrum packet*
Ancillary info field length (16 bits words)	150 x 16 bits words
Application data field	The following parameters determine the length of the application data field: - First spectral sample of band B1 (IUsbNsfirstb=1) - Last spectral samples of band B3 (IUsbNslastb=3) - Number of spectral intervals (ICtcNbSegCTN) - Number of samples per spectral intervals (IdefCtcNbNsSegCTN), fixed to 16 bits, - Number of bits for the coding of each sample of the associated spectral intervals (ICtcTabNbBitCTN)
Constraints	
All the parameters defined here above shall be adjusted in order to obtain a maximum number of 16 bits words equal to 4319 (i.e. the maximum length for the application data field is 4319 * 2 octets).	
Maximum total length	
Max Spectrum packet length = 8960 octets	

Packet type	*Image packet*
Ancillary info field length (16 bits words)	15 x 16 bits words
Application data field	The following parameters determine the length of the application data field: - Number of bits for the image encoding (IIS_SIZE = 8, 10, 12 bits) - Number of samples per image (4096 + 4 = 4100)
Constraints	
The IIS_SIZE parameters shall be determined in conjunction with the parameters of the spectrum coding in order to meet the data rate constraints identify in §12.2.	
Maximum total length	
Max Image packet length = 6202 octets	

Packet type	*Verification packet, type VPA and VPB*
Ancillary info field length (16 bits words)	30 x 16 bits words
Application data field	The following parameter determines the length of the VPA & VPB application data field: - Number of raw interferogram samples received BDcoNbReceivedWords by the DPS (included header frames)
Constraints	
The maximum value for the BDcoNbReceivedWords is 55000 samples (with this limitation, the data rate constraint for VPA & VPB packets is automatically fulfilled).	

Packet type	*Verification packet, type VPC*
Ancillary info field length (16 bits words)	30 x 16 bits words
Application data field	The following parameters determine the length of the VPC application data field: - ZPD reduced-resolution FFT size (IDefZpdNSrdFT) - First spectral sample of selected band for NZPD determination (B3) for the reduced resolution FFT (IZsbNsFirstSrd) - Last spectral sample of selected band for NZPD determination (B3) for the reduced resolution FFT (IZsbNsLastSrd) - First spectral sample for the selected band for the verification data (IusbNsfirstb=VDS_band number) - Last spectral sample for the selected band for the verification data (IusbNslastb=VDS_band number)
Constraints	
1) the maximum value for the quantity (IZsbNsLastSrd - IZsbNsFirstSrd + 1) = 45, **2) the maximum value for the quantity (**IUsbNslast -IUsbNsfirst + 1) = 2500 for Band B1, 3500 for band B2, 3600 for band B3, ***Nota: With these limitations, the constraint on the data rate for VPC is automatically fulfilled.***	

Packet type	*Verification packet, type VPD*
Ancillary info field length (16 bits words)	30 x 16 bits words
Application data field	The following parameters determine the length of the VPD application data field: - First spectral sample for the selected band for the verification data (IusbNsfirstb=VDS_band number) - Last spectral sample for the selected band for the verification data (IusbNslastb=VDS_band number)
Constraints	
The maximum value for the quantity (IUsbNslast -IUsbNsfirst + 1) = 2500 for Band B1, 3500 for band B2, 3600 for band B3, ***Nota: With these limitations, the constraint on the data rate for VPD is automatically fulfilled.***	

Packet type	*Verification packet, type VPE*
Ancillary info field length (16 bits words)	30 x 16 bits words
Application data field	The following parameters determine the length of the VPE application data field: - first spectral sample of band B1 / B2 overlapping interval (IOsbNsfirstMb1b2) - last spectral sample of band B1 / B2 overlapping interval (IOsbNslastMb1b2) - first spectral sample of band B2 / B3 overlapping interval (IOsbNsfirstMb2b3) - last spectral sample of band B2 / B3 overlapping interval (IOsbNslastMb2b3)
Constraints	
1) The maximum value for the quantity (IOsbNslastMb1b2 - IOsbNsfirstMb1b2 + 1) = 240	
2) The maximum value for the quantity (IOsbNslastMb2b3 - IOsbNsfirstMb2b3 + 1) = 400.	
3) **The length of the VPE packet shall be adjusted in conjunction with the Auxiliary packet length, the Image packet length and the number of calibration images issued during the calibration phase.**	

Packet type	*Auxiliary packet*
Ancillary info field length (16 bits words)	60 x 16 bits words
Application data field	Fixed length of 640 octets
Constraints	
1) The length of the VPE packet shall be adjusted in conjunction with the Auxiliary packet length, the Image packet length and the number of calibration images issued during the calibration phase.	
2) The maximum value of the auxiliary packet is equal to 1024 octets (c.f. [METOP])	

16. Appendix A: temperature calibration curves

The transfer Functions, which are model dependant, have been removed from IMVD and transferred in the “Calibration Report” [CALIB].

17. Appendix B: Error identification

In the tables the following abbreviations are used:

EID = Error Id,

Severity	**Meaning**
3	Major
2A	Medium A
2B	Medium B
1	Minor

It shall be noted that the coding defined here is not the same as in the ELT entry report for the severity field.

β(k) shall be decoded as follows (nota: A means 'CD=0' or 'CD=backward', B means 'CD=1' or 'CD=forward'):

β(1) ='pixel 1A' β(2) = 'pixel 1B'
β(3) = 'pixel 2A' β(4) = 'pixel 2B'
β(5) = 'pixel 3A' β(6) = 'pixel 3B'
β(7) = 'pixel 4A' β(8) = 'pixel 4B'

EID	Sev.	Name	Cause
1	3	Err_DMC	Checksum error in the DMC program Detected by health check.
4	3	Err_SendBeforeRdy	FMU LBR signal 'Enable' high while ASE rising edge occurring. FMU data not completely transmitted.
5	3	Err_MissingASE	ASE missing while in OPERATIONAL mode
5+k	2A	Pixel β(k): DPC checksum error or Memory Test Error	Checksum error detected in a DPC.
13+k	2A	Pixel β(k): DPC arithmetic error	Floating point or Fixed point error in a DPC.
29+k	2A	Pixel β(k): DPC / DMC communication error	Error in the ICB or DOB communication.
495	3	Err_SW	Software error in DMC. Shall not occur in flight, used for SW debug.
499	2A	Err_ICBAck	Error in the DPC communication on the ICB.
502	3	Err_SavePrgm	The Save Program command failed, or SEU in RAM.
503	3	Err_ConfigDPS	The DPS did not succeed to configure according to command.
504	3	Err_DMCReg	Software copy and hardware content of DMC register differ. Detected by health check.
505	3	Err_TOP	Checksum error in the TOP in DMC Detected by health check.

Table 1: **Major and Medium A errors**

EID	Sev.	Name	Cause
System errors			
1	2B	Err_NofWords	Flag BDcoFlagMASErrorNbWords raised, i.e the received number of samples is not the same as given in OD data.
2	2B	Err_ODNV SN	SN in OD not valid
3	2B	Err_ODNV CD	CD in OD not valid
4	2B	Err_ODNV SP	SP in OD not valid
5	2B	Err_ODNV NS	NS in OD not valid
6	1	Err_ODNV CSQ	CSQ in OD not valid
7	1	Err_ODNV SQ1	SQ1 in OD not valid
8	1	Err_ODNV SQ2	SQ2 in OD not valid
9	1	OTM_NV bit ‘bbt’ raised	Black Body Temperature (BBT) in OTM not valid.
494	1	DMC arithmetic error	Fixed Point Overflow has occurred in the DMC.
496	2B	Err_StepNum	Internal Subcycle Counter or Internal Cube Direction value differs from SN value in OD.
501	2B	Err_MissingOD	OD not received.
IIS errors			
10	1	Err_ImgLength<4100	IIS samples in default, i.e number of counted samples < 4100
11	1	Err_ImgLength>4100	IIS samples in excess, i.e number of counted samples > 4100
12	1	ADC Overflow flag raised	ADC Overflow flag raised in one or more of the received samples
497	1	Err_NoImgData	No image data was received in the current subcycle
MAS errors			
13	2B	Err_MASVLNFlag	LNR-Rx 'VLN' flag raised
13+k	2B	BdcoFlagMasError Path	Pixel β(k) DPC ADC Amplification Path set to 0 for Band 1
21+k	2B	BdcoFlagMasError Path	Pixel β(k) DPC ADC Amplification Path set to 0 for Band 2
29+k	2B	BdcoFlagMasError Path	Pixel β(k) DPC ADC Amplification Path set to 0 for Band 3
37+k	1	BdcoFlagMas Overflow	Pixel β(k) D PC ADC Overflow flag raised for Band 1
45+k	1	BdcoFlagMas Overflow	Pixel β(k) DPC ADC Overflow flag raised for Band 2
53+k	1	BdcoFlagMas Overflow	Pixel β(k) DPC ADC Overflow flag raised for Band 3
61+k	1	BDcoFlagMasEcret	Pixel β(k) DPC ADC Spike flag raised for Band 1
69+k	1	BDcoFlagMasEcret	Pixel β(k) DPC ADC Spike flag raised for Band 2
77+k	1	BDcoFlagMasEcret	Pixel β(k) DPC ADC Spike flag raised for Band 3
86	1	MAS Frames in excess	Too many MAS frames received
498	2B	Err_MASDataMissing	No MAS data received
500	2B	Err_MASDVLflag	LNR-Rx 'DVL' flag raised

EID	Sev.	Name	Cause
Algorithm errors			
86+k	2B	BNlcFlagIntegrity Pixel β(k) DPC flag raised for band 1	NLC algorithm has been aborted for band 1
94+k	2B	BNlcFlagIntegrity Pixel β(k) DPC flag raised for band 2	NLC algorithm has been aborted for band 2
102+k	2B	BNlcFlagIntegrity Pixel β(k) DPC flag raised for band 3	NLC algorithm has been aborted for band 3
110+k	2B	BZpdFlagNzpdNonQual Pixel β(k) DPC flag raised	Quality index equals –1 or exceeds IDefZpdQualIndexCutOffXX
118+k	2B	BIsiFlagErrorFft Pixel β(k) DPC flag raised for band 1	There are not enough interferogram points available on both sides of the NZPD
126+k	2B	BIsiFlagErrorFft Pixel β(k) DPC flag raised for band 2	There are not enough interferogram points available on both sides of the NZPD
134+k	2B	BIsiFlagErrorFft Pixel β(k) DPC flag raised for band 3	There are not enough interferogram points available on both sides of the NZPD
142+k	1	BSpkFlagSpik Pixel β(k) DPC flag raised for band 1	A spike in the non linearity corrected MAS Interferogram has been detected in band 1
150+k	1	BSpkFlagSpik Pixel β(k) DPC flag raised for band 2	A spike in the non linearity corrected MAS Interferogram has been detected in band 2
158+k	1	BSpkFlagSpik Pixel β(k) DPC flag raised for band 3	A spike in the non linearity corrected MAS Interferogram has been detected in band 2
166+k	1	BIrsFlagSrdNonIntegrity Pixel β(k) DPC flag raised	Distance in IRS algorithm exceeds IDefSrdDistCutOffXX
174+k	1	BRcifFlagNon $\text{IntegritySlope}_{px,b,cd}$	BRciFlagNonIntegritySlope Pixel β(k) DPC flag raised for band 1, i.e. Dslope lower or equal to IDefRciCutOffSlope
182+k	1	BRciFlagNon $\text{IntegritySlope}_{px,b,cd}$	BRciFlagNonIntegritySlope Pixel β(k) DPC flag raised for band 2, i.e. Dslope lower or equal to IDefRciCutOffSlope
190+k	1	BRciFlagNon $\text{IntegritySlope}_{px,b,cd}$	BRciFlagNonIntegritySlope Pixel β(k) DPC flag raised for band 3, i.e. Dslope lower or equal to IDefRciCutOffSlope
198+k	1	BRciFlagNon $\text{IntegrityOffset}_{px,b,cd}$	BRciFlagNonIntegrityOffset Pixel β(k) DPC flag raised for band 1, i.e. DOffset lower or equal to IDefRciCutOffOffset
206+k	1	BRciFlagNon $\text{IntegrityOffset}_{px,b,cd}$	BRciFlagNonIntegrityOffset Pixel β(k) DPC flag raised for band 2, i.e. DOffset lower or equal to IDefRciCutOffOffset
214+k	1	BRciFlagNon $\text{IntegrityOffset}_{px,b,cd}$	BRciFlagNonIntegrityOffset Pixel β(k) DPC flag raised for band 3, i.e. DOffset lower or equal to IDefRciCutOffOffset
222+k	1	BarcFlagCalSpect NonQual Pixel β(k) DPC flag raised for band 1	In ARC algorithm, BArcImagMeanRMS is lower or equal to IDefArcImagMeanRMSCutoff for band 1
230+k	1	BArcFlagCalSpectNonQual Pixel β(k) DPC flag raised for band 2	In ARC algorithm, BArcImagMeanRMS is lower or equal to IDefArcImagMeanRMSCutoff for band 2
238+k	1	BArcFlagCalSpectNonQual Pixel β(k) DPC flag raised for band 3	In ARC algorithm, BArcImagMeanRMS is lower or equal to IDefArcImagMeanRMSCutoff for band 3
246+k	1	BCodFlagFlood Pixel β(k) DPC flag raised	COD algorithm has been aborted.

EID	Sev.	Name	Cause
Semantic protocol errors			
511	1	Err_CmdAPID	APID not correct.
510	1	Err_CmdCode	No such command defined.
509	1	Err_CmdLength	Wrong numer of words in command.
508	1	Err_CmdOverrun	Previous command not ready.
507	1	Err_CmdMode	Command not allowed in current mode.
506	1	Err_CmdField	One or more of the command fields contain now allowed values.

Table 2 **Medium B and Minor errors**

18. Appendix C: Length of packets

Spectrum		
Spectral coverage (cm-1)	645	2760
Laser Frequency (mm)		1,5377
Size of the on-board MFFT		51200
Maximum Average coding (average = on the whole spectral coverage) for spectra samples.		8,3
Number of spectra per 8 seconds		4*30

Images	
Image Pixels	4096+4
Pixel Coding	12
Number of images per 8 seconds	34

Verification	
IZsbNsLastSrd - IZsbNsFirstSrd	45
IUsbNslast - IUsbNsfirst + 1 in B3	3600

	Spectrum		Image		Verification data (Max length)		Auxiliary data	
	Bits	**Octets**	**Bits**	**Octets**	**Bits**	**Octets**	**Bits**	**Octets**
Packet Primary Header	**48**	**6**	**48**	**6**	**48**	**6**	**48**	**6**
Secondary Header	**64**	**8**	**64**	**8**	**64**	**8**	**64**	**8**
Ancillary info	**2448**	**306**	**288**	**36**	**528**	**66**	**1008**	**126**
Application Data	**69104**	**8638**	**49200**	**6150**	**466560**	**58320**	**5120**	**640**
PEC	**16**	**2**	**16**	**2**	**16**	**2**	**16**	**2**
TOTAL	**71680**	**8960**	**41142**	**6202**	**467216**	**57682**	**6256**	**782**

19. Appendix D: Packets formats summary

19.1. PX packet structure

The PX packet is structured as follows:

words #	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**
1	*00001b*					*Application Process Identifier (APID)*										
2	*11b*		*Source Sequence Count (SSC)*													
3	*Length*															
4-7	*IMS UTC, size = 4 words*															
8-10	*IMS OBT, size = 3 words*															
11-13	IMS OD data without the UTC & OBT, size = 3 words															
14	IASI Configuration Word 1															
15	IASI Configuration Word 2															
16	PTSI (MSW)															
17	PTSI (LSW)															
18	IMS OTM Line Number															
19	IMS OTM Instrument Mode															
20	IMS OTM SQIS															
21	Pixel Identifier (0001h: pixel 1, 0002h: pixel 2, 0003h: pixel 3, 0004h: pixel 4)															
22	Number of MAS Frames counted by the DPS : BDcoNbReceivedWords															
23-24	Value $BNlcAnaMV_{b=B1}$, size = 2 words															
25-26	Value $BNlcAnaMV_{b=B2}$, size = 2 words															
27-28	Value $BNlcAnaMV_{b=B3}$, size = 2 words															
29	Value BZpdNzpd															
30-31	Value BZpdNzpdQualIndexEW, size = 2 words															
32-47	Array $BArcImagMean_{b=B1}$(0 .. $IDefArcNbSeg_{b=B1}$ - 1), size = 16 words															
48-67	Array $BArcImagMean_{b=B2}$(0 .. $IDefArcNbSeg_{b=B2}$ - 1) , size = 20 words															
68-87	Array $BArcImagMean_{b=B3}$(0 .. $IDefArcNbSeg_{b=B3}$ - 1)) , size = 20 words															
88-103	Array $BArcImagRMS_{b=B1}$(0 .. $IDefArcNbSeg_{b=B1}$ - 1) , size = 16 words															
104-123	Array $BArcImagRMS_{b=B2}$(0 .. $IDefArcNbSeg_{b=B2}$ - 1) , size = 20 words															
124-143	Array $BArcImagRMS_{b=B3}$(0 .. $IDefArcNbSeg_{b=B3}$ - 1) , size = 20 words															
144-145	Value $BArcImagMeanRMS_{b=B1}$, size = 2 words															
146-147	Value $BArcImagMeanRMS_{b=B2}$, size = 2 words															
148-149	Value $BArcImagMeanRMS_{b=B3}$, size = 2 words															
150-154	Status Area, size = 5 words															
155-156	Value IDefCodNbBitMax, size = 2 words															
157-160	spare (set to 0), size = 4 words															
	Array BCodSpect(0 .. IDefCodNbBitMax -1)															
	CRC															

IMS OD data without the UTC & OBT is structured as follows:

00	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**
Number of sample NS															
Step number SN								Scan position SP							
CD	CSQ	SQ1	SQ2	IEQ	"0"	"0"	"0"	SN_NV	CD_NV	CSQ_NV	SP_NV	SQ1_NV	SQ2_NV	NS_NV	IEQ_NV

The 'Status Area' is structured as follows:

Position	Flag (related to the Pixel Identifier)
word 1, bit 00	Set to ERROR if there is a LNR-Rx command symbol received between the LNR SC1 & SC2 events
word 1, bit 01	Set to ERROR if there is a LNR-Rx code rule violation in a IASI subcycle
word 1, bit 02	flag BbofFlagSpectNonQual
word 1, bit 03 (resp. 04,05)	flag BDcoFlagMasErrorPath for band B1 (resp. B2,B3)
word 1, bit 06 (resp. 07,08)	flag BDcoFlagMasOverflow for band B1 (resp. B2,B3)
word 1, bit 09 (resp. 10,11)	flag BDcoFlagMasEcret for band B1 (resp. B2,B3)
word 1, bit 12	flag BdcoFlagMasErrorNbWords
word 1, bit 13,14,15	spare (set to 0)
word 2, bit 00 (resp. 01,02)	flag BSpkFlagSpik for band B1 (resp. B2,B3)
word 2, bit 03	flag BzpdFlagNzpdNonQualXX with XX = EW
word 2, bit 04 (resp. 05,06)	flag BIsiFlagErrorFft for band B1 (resp. B2,B3)
word 2, bit 07 (resp. 08,09)	flag BArcFlagCalSpectNonQual for band B1 (resp. B2,B3)
word 2, bit 10	flag BcodFlagFlood
word 2, bit 11 (resp. 12,13)	flag BDcoFlagErrorInterf for band B1 (resp. B2,B3)
word 2, bit 14 to 15	spare (set to 0)
words 3 to 5	spare (set to 0)

19.2. IP packet structure

The IP packet is structured as follows:

words #	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**
1	*00001b*					*Application Process Identifier (APID)*										
2	*11b*		*Source Sequence Count (SSC)*													
3	*Length*															
4-7	*IMS UTC, size = 4 words*															
8-10	*IMS OBT, size = 3 words*															
11-13	IMS OD data without the UTC & OBT, size = 3 words															
14	IASI Configuration Word 1															
15	IASI Configuration Word 2															
16	PTSI (MSW)															
17	PTSI (LSW)															
18	IMS OTM Line Number															
19	IMS OTM Instrument Mode															
20	IMS OTM SQII															
21	Value IIS_SIZE								Status Area							
22	Number of IIS Samples counted by the DPS, say IIS_COUNT															
23-25	spare (set to 0), size = 3 words															
26	*array BIISImagSlice(0 .. IIS_COUNT-1), size = see chapter 15*															
	CRC															

IMS OD data without the UTC & OBT is structured as follows:

00	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**
Number of sample NS															
Step number SN								Scan position SP							
CD	CSQ	SQ1	SQ2	IEQ	"0"	"0"	"0"	SN_NV	CD_NV	CSQ_NV	SP_NV	SQ1_NV	SQ2_NV	NS_NV	IEQ_NV

The 'Status Area' is structured as follows:

Position	**Flag**
bit 08	set to ERROR in case one (at least) IIS ADC Overflow flag is raised in an image
bit 09	set to ERROR in case IIS_COUNT <> 4100
bit 10 to 15	spare (set to 0)

19.3. VPA packet structure

The VPA packet is structured as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
00001b					*Application Process Identifier (APID)*										
11b		*Source Sequence Count (SSC)*													
Length															
IMS UTC, size = 4 words															
IMS OBT, size = 3 words															
IMS OD data without the UTC & OBT related to the VDS-selected SN, size = 3 words															
IASI Configuration Word 1															
IASI Configuration Word 2															
PTSI (MSW)															
PTSI (LSW)															
IMS OTM Line Number															
IMS OTM Instrument Mode															
VDS															
Verification Packet Identifier								Dummy "0" data							
Dummy "0" data															
Dummy "0" data , size = 2 words															
Number of counted MAS Framesof the VDS-selected pixel & SN BDcoNbReceivedWords															
Value IzsbNsfirstSrd for the VDS-selected pixel															
Value IzsbNslastSrd for the VDS-selected pixel															
Value IusbNsfirst for the VDS-selected pixel & band															
Value IusbNslast for the VDS-selected pixel & band															
Value IosbNsFirstMb1b2 of the VDS-selected pixel & SN															
Value IosbNsLastMb1b2 of the VDS-selected pixel & SN															
Value IosbNsFirstMb2b3 of the VDS-selected pixel & SN															
Value IosbNsLastMb2b3 of the VDS-selected pixel & SN															
Spare (set to 0), size = 7 words															
*Values V(**1**) to V(**(M + M mod 2) / 2**) of the VDS-selected SN*															
CRC															

IMS OD data without the UTC & OBT is structured as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Number of sample NS															
Step number SN								Scan position SP							
CD	CSQ	SQ1	SQ2	IEQ	"0"	"0"	"0"	SN_NV	CD_NV	CSQ_NV	SP_NV	SQ1_NV	SQ2_NV	NS_NV	IEQ_NV

19.4. VPB packet structure

The VPB packet is structured as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
00001b					*Application Process Identifier (APID)*										
11b		*Source Sequence Count (SSC)*													
Length															
IMS UTC, size = 4 words															
IMS OBT, size = 3 words															
IMS OD data without the UTC & OBT related to the VDS-selected SN, size = 3 words															
IASI Configuration Word 1															
IASI Configuration Word 2															
PTSI (MSW)															
PTSI (LSW)															
IMS OTM Line Number															
IMS OTM Instrument Mode															
VDS															
Verification Packet Identifier								Dummy "0" data							
Dummy "0" data															
Dummy "0" data , size = 2 words															
Number of counted MAS Frames of the VDS-selected pixel & SN BDcoNbReceivedWords															
Value IZsbNsfirstSrd for the VDS-selected pixel															
Value IZsbNslastSrd for the VDS-selected pixel															
Value IUsbNsfirst for the VDS-selected pixel & band															
Value IUsbNslast for the VDS-selected pixel & band															
Value IOsbNsFirstMb1b2 of the VDS-selected pixel & SN															
Value IOsbNsLastMb1b2 of the VDS-selected pixel & SN															
Value IOsbNsFirstMb2b3 of the VDS-selected pixel & SN															
Value IOsbNsLastMb2b3 of the VDS-selected pixel & SN															
spare (set to 0), size = 7 words															
*Values V(**1 + (M + M mod 2) / 2**) to V(**M**) of the VDS-selected SN*															
CRC															

IMS OD data without the UTC & OBT is structured as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Number of sample NS															
Step number SN								Scan position SP							
CD	CSQ	SQ1	SQ2	IEQ	"0"	"0"	"0"	SN_NV	CD_NV	CSQ_NV	SP_NV	SQ1_NV	SQ2_NV	NS_NV	IEQ_NV

19.5. VPC packet structure

The VPC packet is structured as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
00001b					*Application Process Identifier (APID)*										
11b		*Source Sequence Count (SSC)*													
Length															
IMS UTC, size = 4 words															
IMS OBT, size = 3 words															
IMS OD data without the UTC & OBT related to the VDS-selected SN, size = 3 words															
IASI Configuration Word 1															
IASI Configuration Word 2															
PTSI (MSW)															
PTSI (LSW)															
IMS OTM Line Number															
IMS OTM Instrument Mode															
VDS															
Verification Packet Identifier								Dummy "0" data							
Dummy "0" data															
Dummy "0" data , size = 2 words															
Dummy "0" data															
Value IZsbNsfirstSrd for the VDS-selected pixel															
Value IZsbNslastSrd for the VDS-selected pixel															
Value IUsbNsfirst for the VDS-selected pixel & band															
Value IUsbNslast for the VDS-selected pixel & band															
Value IOsbNsFirstMb1b2 of the VDS-selected pixel & SN															
Value IOsbNsLastMb1b2 of the VDS-selected pixel & SN															
Value IOsbNsFirstMb2b3 of the VDS-selected pixel & SN															
Value IOsbNsLastMb2b3 of the VDS-selected pixel & SN															
spare (set to 0), size = 7 words															
array BFrsSrdCS(IZsbNsfirstSrd .. IZsbNslastSrd) of the VDS-selected pixel															
array BFrsSrdBB(IZsbNsfirstSrd .. IZsbNslastSrd) of the VDS-selected pixel															
array BFrcOffset(IUsbNsfirst .. IUsbNslast) of the VDS-selected pixel & band															
array BFrcSlope(IUsbNsfirst .. IUsbNslast) of the VDS-selected pixel & band															
CRC															

IMS OD data without the UTC & OBT is structured as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Number of sample NS															
Step number SN								Scan position SP							
CD	CSQ	SQ1	SQ2	IEQ	"0"	"0"	"0"	SN_NV	CD_NV	CSQ_NV	SP_NV	SQ1_NV	SQ2_NV	NS_NV	IEQ_NV

NOTA: the *IMS UTC, IMS OBT and IMS OD data (SN, SP, CD,CSQ, SQ1, SQ2, IEQ, SN_NV, CD_NV, CSQ_NV, SP_NV, SQ1_NV, SQ2_NV, NS_NV, IEQ_NV)* are set to 0 in case the Verification Data Selector target is relative to SN=35 or SN=36

19.6. VPD packet structure

The VPD packet is structured as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
00001b					*Application Process Identifier (APID)*										
11b		*Source Sequence Count (SSC)*													
Length															
IMS UTC, size = 4 words															
IMS OBT, size = 3 words															
IMS OD data without the UTC & OBT related to the VDS-selected SN, size = 3 words															
IASI Configuration Word 1															
IASI Configuration Word 2															
PTSI (MSW)															
PTSI (LSW)															
IMS OTM Line Number															
IMS OTM Instrument Mode															
VDS															
Verification Packet Identifier								Dummy "0" data							
Dummy "0" data															
Dummy "0" data , size = 2 words															
Number of counted MAS Frames of the VDS-selected pixel & SN BDcoNbReceivedWords															
Value IZsbNsfirstSrd for the VDS-selected pixel															
Value IZsbNslastSrd for the VDS-selected pixel															
Value IUsbNsfirst for the VDS-selected pixel & band															
Value IUsbNslast for the VDS-selected pixel & band															
Value IOsbNsFirstMb1b2 of the VDS-selected pixel & SN															
Value IOsbNsLastMb1b2 of the VDS-selected pixel & SN															
Value IOsbNsFirstMb2b3 of the VDS-selected pixel & SN															
Value IOsbNsLastMb2b3 of the VDS-selected pixel & SN															
spare (set to 0), size = 7 words															
array BCrcOffset(IUsbNsFirst .. IUsbNsLast) of the VDS-selected pixel & band															
array BCrcSlope(IUsbNsFirst .. IUsbNsLast) of the VDS-selected pixel & band															
CRC															

IMS OD data without the UTC & OBT is structured as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Number of sample NS															
Step number SN								Scan position SP							
CD	CSQ	SQ1	SQ2	IEQ	"0"	"0"	"0"	SN_NV	CD_NV	CSQ_NV	SP_NV	SQ1_NV	SQ2_NV	NS_NV	IEQ_NV

19.7. VPE packet structure

The VPE packet is structured as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
00001b					*Application Process Identifier (APID)*										
11b		*Source Sequence Count (SSC)*													
Length															
IMS UTC, size = 4 words															
IMS OBT, size = 3 words															
IMS OD data without the UTC & OBT related to the VDS-selected SN, size = 3 words															
IASI Configuration Word 1															
IASI Configuration Word 2															
PTSI (MSW)															
PTSI (LSW)															
IMS OTM Line Number															
IMS OTM Instrument Mode															
VDS															
Verification Packet Identifier								Status area							
Value BZpdNzpd related to VDS selection (invalid value for data SN 32, 33, 35, 36)															
Value BZpdNzpdQualIndexXX related to the VDS-selected SN & pixel (XX = EW if SN in 1..30, BB if SN in 32..33, CS if SN in 35..36), size = 2 words, (invalid value for data SN 32, 33, 35, 36)															
Number of counted MAS Frames of the VDS-selected pixel & SN BDcoNbReceivedWords															
Value IZsbNsfirstSrd for the VDS-selected pixel															
Value IZsbNslastSrd for the VDS-selected pixel															
Value IUsbNsfirst for the VDS-selected pixel & band															
Value IUsbNslast for the VDS-selected pixel & band															
Value IOsbNsFirstMb1b2 of the VDS-selected pixel & SN															
Value IOsbNsLastMb1b2 of the VDS-selected pixel & SN															
Value IOsbNsFirstMb2b3 of the VDS-selected pixel & SN															
Value IOsbNsLastMb2b3 of the VDS-selected pixel & SN															
spare (set to 0), size = 7 words															
array $BArcSpect_{b=1}$(IOsbNsFirstMb1b2 .. IOsbNsLastMb1b2) of the VDS-selected pixel & SN															
array $BArcSpect_{b=2}$(IOsbNsFirstMb1b2 .. IOsbNsLastMb1b2) of the VDS-selected pixel & SN															
array $BArcSpect_{b=2}$(IOsbNsFirstMb2b3 .. IOsbNsLastMb2b3) of the VDS-selected pixel & SN															
array $BArcSpect_{b=3}$(IOsbNsFirstMb2b3 .. IOsbNsLastMb2b3) of the VDS-selected pixel & SN															
CRC															

IMS OD data without the UTC & OBT is structured as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Number of sample NS															
Step number SN								Scan position SP							
CD	CSQ	SQ1	SQ2	IEQ	"0"	"0"	"0"	SN_NV	CD_NV	CSQ_NV	SP_NV	SQ1_NV	SQ2_NV	NS_NV	IEQ_NV

The 'Status Area' is structured as follows:

Position	Flag
bit 08	flag BZpdFlagNzpdNonQualXX related to the VDS-selected SN & pixel (XX = EW if SN in 1..30, BB if SN in 32..33, CS if SN in 35..36)
bit 09	flag BDcoFlagMASErrorNbWords for the VDS-selected SN
bit 10 to 15	spare (set to 0)

19.8. AP packet structure

The AP packet is structured as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
00001b					*Application Process Identifier (APID)*										
11b	*Source Sequence Count (SSC)*														
Length															
IMS UTC, size = 4 words															
IMS OBT, size = 3 words															
IASI Configuration Word 1															
IASI Configuration Word 2															
PTSI (MSW)															
PTSI (LSW)															
IMS OTM data without the UTC & OBT, size = 18 words															
DPS OTM data, size = 30 words															
spare (set to 0), size = 8 words															
Main Data Area for pixel 1, size = 60 words															
Main Data Area for pixel 2, size = 60 words															
Main Data Area for pixel 3, size = 60 words															
Main Data Area for pixel 4, size = 60 words															
Main Status Area for pixel 1, size = 20 words															
Main Status Area for pixel 2, size = 20 words															
Main Status Area for pixel 3, size = 20 words															
Main Status Area for pixel 4, size = 20 words															
CRC															

The ‘IMS OTM data’ area is structured as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Black Body Temperature (BBT), size = 2 words, LSB = 0.001 Kelvin															
Instrument Mode															
Line Number															
SQIS															
SQII															
RTS (not used by the DPS)															
RTL (not used by the DPS)															
IFPT (not used by the DPS)															
FPT (not used by the DPS)															
HAUT (not used by the DPS)															
OPBT (not used by the DPS)															
CCAT (not used by the DPS)															
OTM_NV (bit 0, only, used by the DPS)															
SPTSI (not used by the DPS), size = 2 words															
spare, size = 2 words															

The OTM_NV field (0b: not valid) shall be decoded as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
bbt	fpt	haut	ifpt	opbt	ccat	0	0	0	0	0	0	0	0	0	0

The ‘DPS OTM data’ area is structured as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
DPS_POWER_STATUS								DPS_INIT_STATUS							
P1_MODE			P2_MODE			P3_MODE			P4_MODE			OP_MODE			
VDS															
NO_OD_INFO, size = 2 words															
NO_IIS_INFO, size = 2 words															
NO_MAS_INFO, size = 2 words															
ELT_INFO, size = 4x3 words															
spare (set to 0), size = 9 words															

The DPS_POWER_STATUS field is coded as follows:

- bit 00: DPC1 ON/OFF status (0b: OFF)
- bit 01: DPC2 ON/OFF status (0b: OFF)
- bit 02: DPC3 ON/OFF status (0b: OFF)
- bit 03: DPC4 ON/OFF status (0b: OFF)
- bit 04: DPC5 ON/OFF status (0b: OFF)
- bit 05: FMU I/F N status (0b: OFF)
- bit 06: FMU I/F R status (0b: OFF)
- bit 07: LNR input status (1b: MAS input in use; 0b: Test input in use)

The DPS_INIT_STATUS field is coded as follows:

- bit 08: Pixel 1A/1B DPC SWs initialisation status (1b: initialisation OK for both SWs)
- bit 09: Pixel 2A/2B DPC SWs initialisation status (1b: initialisation OK for both SWs)
- bit 10: Pixel 3A/3B DPC SWs initialisation status (1b: initialisation OK for both SWs)
- bit 11: Pixel 4A/4B DPC SWs initialisation status (1b: initialisation OK for both SWs)
- bit 12: spare (set to 0b)
- bit 13: DMC SW initialisation status (1b: initialisation OK)
- bit 14: EEPROM to RAM transfer status (1b: transfer OK)
- bit 15: DMC RAM check status (1b: check OK)

The Pk_MODE (k = 1,2,3,4) field is coded as follows:

- 000b: Pixel k DPC in mode OFF or SUSPEND
- 111b: Pixel k DPC in mode OPERATIONAL

The OP_MODE field does indicate the current DPS operational mode with the following coding:

- 1111b: OPERATIONAL/OPER
- 0000b: OPERATIONAL/CALIB

The NO_OD_INFO field does indicate that the OD CMD was not received in a given subcycle with the following coding:

- bit k = 1, k = 0 to 29 => OD CMD not received in subcycle k+1
- bit 30 = 1 => OD CMD not received in subcycle 32 or 33
- bit 31 = 1 => OD CMD not received in subcycle 35 or 36

The NO_IIS_INFO field does indicate that no IIS data were received in a given subcycle (same coding as hereabove)

The NO_MAS_INFO field does indicate that no MAS data were received in a given subcycle (same coding as hereabove)

Nota: NO_MAS_INFO is set to 0 for step number 1,2,30 if selected by VDS in EXTERNAL CALIBRATION mode.

The ELT_INFO field is structured as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
E1 (first occured)															
E2															
E3															
E4 (last occured)															

The Ek field (k=1 to 4) is structured as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
CD	Error									Step Number					
Line Number															
Pixel			Band		Severity			00h							
Anomaly Detail, size = - 4 words for Major & Medium A errors - 0 words for Medium B & Minor Errors															

The 'Main Data Area' for any pixel is structured as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Data Area for SN = 32, size = 15 words															
Data Area for SN = 33, size = 15 words															
Data Area for SN = 35, size = 15 words															
Data Area for SN = 36, size = 15 words															

The 'Main Status Area' for any pixel is structured as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Status Area for SN = 32, size = 4 words															
Status Area for SN = 33, size = 4 words															
Status Area for SN = 35, size = 4 words															
Status Area for SN = 36, size = 4 words															
Extra Status Area, size = 4 words															

The 'Data Area' for any calibration SN is structured as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
IMS OD data without the UTC & OBT, size = 3 words															
Number of MAS Frames counted by the DPS : BDcoNbReceivedWords															
Value BNlcAnaMV for band B1, size = 2 words															
Value BNlcAnaMV for band B2, size = 2 words															
Value BNlcAnaMV for band B3, size = 2 words															
Value BZpdNzpd															
Value BZpdNzpdQualIndex XX (XX = BB if SN in 32..33, CS if SN in 35..36), size = 2 words															
spare (set to 0), size = 2 words															

IMS OD data without the UTC & OBT is structured as follows:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Number of sample NS															
Step number SN								Scan position SP							
CD	CSQ	SQ1	SQ2	IEQ	"0"	"0"	"0"	SN_NV	CD_NV	CSQ_NV	SP_NV	SQ1_NV	SQ2_NV	NS_NV	IEQ_NV

The 'Status Area' for any calibration SN is structured as follows:

Position	Flag
word 1, bit 00	Set to ERROR if there is a LNR-Rx command symbol received between the LNR SC1 & SC2 events
word 1, bit 01	Set to ERROR if there is a LNR-Rx code rule violation in a IASI subcycle
word 1, bit 02	flag BBofFlagSpectNonQual (up to FFT algorithm)
word 1, bit 03 (resp. 04,05)	flag BDcoFlagMasErrorPath for band B1 (resp. B2,B3)
word 1, bit 06 (resp. 07,08)	flag BDcoFlagMasOverflow for band B1 (resp. B2,B3)
word 1, bit 09 (resp. 10,11)	flag BDcoFlagMasEcret for band B1 (resp. B2,B3)
word 1, bit 12	flag BDcoFlagMasErrorNbWords
word 1, bit 13,14,15	flag BDcoFlagErrorInterf for band B1 (resp. B2,B3)
word 2, bit 00 (resp. 01,02)	flag BNlcFlagIntegrity for band B1 (resp. B2, B3)
word 2, bit 03 (resp. 04,05)	flag BSpkFlagSpik for band B1 (resp. B2,B3)
word 2, bit 06	flag BZpdFlagNzpdNonQualXX (XX = BB if SN in 32..33, CS if SN in 35..36)
word 2, bit 07	flag BIrsFlagSrdNonIntegrity
word 2, bit 08 (resp. 09,10)	flag BIsiFlagErrorFft for band B1 (resp. B2,B3)
word 2, bit 11 to 15	spare (set to 0)
words 3 to 4	spare (set to 0)

The 'Extra-Status Area' is structured as follows:

Position	Flag
word 1, bit 00 (resp. 01)	flag BBofFlagSrdInit for CD = 0 (resp. CD = 1)
word 1, bit 02 (resp. 03)	flag BBofFlagSrdNonUpdate for CD = 0 (resp. CD = 1)
word 1, bit 04 (resp. 05,06)	flag BBofFlagCoefCalInit for band B1 (resp. B2,B3) & CD = 0
word 1, bit 07 to 15	spare (set to 0)
word 2, bit 00 (resp. 01,02)	flag BBofFlagCoefCalInit for band B1 (resp. B2,B3) & CD = 1
word 2, bit 03 (resp. 04,05)	flag BBofFlagCoefCalNonUpdate for band B1(resp.B2,B3)&CD=0
word 2, bit 06 (resp. 07,08)	flag BBofFlagCoefCalNonUpdate for band B1(resp.B2,B3)&CD=1
word 2, bit 09 (resp. 10,11)	flag BRciFlagNonIntegritySlope for band B1 (resp. B2,B3)&CD=0
word 2, bit 12 (resp. 13,14)	flag BRciFlagNonIntegritySlope for band B1 (resp. B2,B3)&CD=1
word 2, bit 15	spare (set to 0)
word 3, bit 00 to 02	flag BRciFlagNonIntegrityOffset for band B1 (resp. B2,B3)&CD=0
word 3, bit 03 to 05	flag BRciFlagNonIntegrityOffset for band B1 (resp. B2,B3)&CD=1
word 3, bit 06 to 15	spare (set to 0)
word 4, bit 00 to 15	spare (set to 0)

20. Appendix E: Impacts of errors & DPS configuration on packets transmission

The table herebelow describes the management of errors by the DPS and the effects on transmitted packets, the following cases are described:

- major errors
- medium A errors
- medium B errors
- minor errors
- pixel OFF or not configured
- branch inhibition (IDefBranchStatus)

Errors are classified according to their error ID (see appendix B).

NOTA: the IMS reaction to the errors defined in this annex is the following one:

- transition to HEATER_REFUSE in case of major or medium A errors
- transition to HEATER_REFUSE in case of persistent medium B errors (cf. § 8)

The minor errors are not handled by the IMS therefore persistent minor errors will have no effect at IMS level.

Major errors / severity 3

Error ID		Error management				
1, 2, 4, 5, 495, 502, 503, 504, 505		DPS goes to WAIT (instrument transition to HEATER_REFUSE)				
PX packets	Ip packets	VPA & VPB packets	VPC packets	VPD packets	VPE packets	AP packets
No packets issued	No packets issued	No packets issued	No packets issued	No packets issued	No packets issued	No packets issued

Medium A errors / severity 2A

Error ID		Error management				
6-13, 14-29, 30-37, 499		Faulty DPC goes to SUSPEND then DPS goes to WAIT (instrument transition to HEATER_REFUSE)				
PX packets	Ip packets	VPA & VPB packets	VPC packets	VPD packets	VPE packets	AP packets
No packets issued for faulty DPC. Other pixel not affected.	No impact	No impact excepted VDS corresponding to faulty DPC then no ADF issued (*zero ADF length*).	No impact excepted VDS corresponding to faulty DPC then no ADF issued (*zero ADF length*).	No impact excepted VDS corresponding to faulty DPC then no ADF issued (*zero ADF length*).	No impact excepted VDS corresponding to faulty DPC then no ADF issued (*zero ADF length*).	Packets filled with zero value for the related pixel.

Medium B Errors / severity 2B *

System & MAS errors

Error ID	Error management in observational phase	Error management in calibration phase
1-5, 13, 500	Global abortion	A/ Global abortion B/ Non up-date of the filtered reduced spectrum C/ Non up-date of the B1, B2, B3 filtered calibration coefficients

PX packets	Ip packets	VPA & VPB packets	VPC packets	VPD packets	VPE packets	AP packets
No packet issued	*No impact*, packet issued, data not affected by errors.	*No impact*, data transmitted even if VDS corresponding to a global abortion in observational phase.	*No impact*, data transmitted even if VDS corresponding to a non up-date of the filtered reduced spectrum or filtered calibration coefficients	No impact, excepted if VDS corresponding to a non up-date of the filtered calibration coefficients then *packet contains rubbish values*	No impact, excepted if VDS corresponding to a processing abortion in observational phase then *packet contains old values*.	*Packet might contain rubbish value*.
	Flag error in VPx AIF: 2-5; Flag error in VPE AIF: 1					ELT entry for error in SN 1-30 and resp. 35-36 Flag error in ADF: 1-5, 13, 500 & BbofFlagSrdNonUpdate & BBofFlagCoefCalNonUpdate

System and MAS error (OD and MAS data missimg)

Error ID	Error management in observational phase	Error management in calibration phase
498, 501	Global abortion	A/ Global abortion B/ Non up-date of the filtered reduced spectrum C/ Non up-date of the B1, B2, B3 filtered calibration coefficients

PX packets	Ip packets	VPA & VPB packets	VPC packets	VPD packets	VPE packets	AP packets
No packet issued	*No impact*, packet issued, data not affected by errors (498). *No packet issued*. (501)	No impact, excepted if VDS corresponding to a global abortion in observational phase then no ADF issued (*zero ADF length*).	*No impact*, data transmitted even if VDS corresponding to a non up-date of the filtered reduced spectrum or filtered calibration coefficients	No impact, excepted if VDS corresponding to a non up-date of the filtered calibration coefficients then *packet contains rubbish values*	No impact, excepted if VDS corresponding to a processing abortion in observational phase then *packet contains old values*.	*Packet might contain rubbish value.*
						ELT entry for error in SN 1-30 and resp. 35-36 Flag error in AIF: 498, 501 Flag error in ADF: BbofFlagSrdNonUpdate & BbofFlagCoefCalNonUpdate

System error (Step number discrepency)

Error ID						
496	If SN (resp. CD) not valid in OD then the internal subcycle counter SN (resp. CD) is used. If SN is valid in OD and if SN value is within range (1..37) then (Internal Subcycle Counter = SN) otherwise the Internal Subcycle Counter is not updated and keeps its value.					
PX packets	Ip packets	VPA & VPB packets	VPC packets	VPD packets	VPE packets	AP packets
No impact	No impact	No impact	No impact	No impact	No impact	No impact

Algorithm error in band 1 & 2

Error ID	Error management in observational phase			Error management in calibration phase		
14-29, 87-102, 119-134	Abortion limited to the faulty band			A/ Abortion limited to the faulty band B/ Non up-date of the filtered calibration coefficients for the faulty band		
PX packets	Ip packets	VPA & VPB packets	VPC packets	VPD packets	VPE packets	AP packets
Null values inserted in ADF of faulty band	*No impact*, packet issued, data not affected by errors.	*No impact*, data transmitted even if VDS corresponding to a global abortion in observational phase.	*No impact*, data transmitted even if VDS corresponding to a non up-date of the filtered calibration coefficients	No impact, excepted if VDS corresponding to a non up-date of the filtered calibration coefficients then *packet contains rubbish values*	No impact, excepted if VDS corresponding to a processing abortion in observational phase then *packet contains old values*.	*Packet might contain rubbish value.*
Flag error in AIF: 14-29, 119-134 & BdcoFlagErrorInterf						ELT entry for error in SN 1-30 and resp. 35-36 Flag error in ADF : 14-29, 87-102, 119-134 & BBofFlagCoefCalNonUpdate

Algorithm error in band 3

Error ID	Error management in observational phase		Error management in calibration phase			
30-37, 103-110, 111-118, 135-142	Global abortion		A/ Global abortion B/ Non up-date of the filtered reduced spectrum C/ Non up-date of the B1, B2, B3 filtered calibration coefficients			
PX packets	Ip packets	VPA & VPB packets	VPC packets	VPD packets	VPE packets	AP packets
Rubbish values inserted in ADF of faulty band	*No impact*, packet issued, data not affected by errors.	*No impact*, data transmitted even if VDS corresponding to a global abortion in observational phase.	*No impact*, data transmitted even if VDS corresponding to a non up-date of the filtered reduced spectrum or filtered calibration coefficients	No impact, excepted if VDS corresponding to a non up-date of the filtered calibration coefficients then *packet contains rubbish values*	No impact, excepted if VDS corresponding to a processing abortion in observational phase then *packet contains old values*.	*Packet might contain rubbish value*.
Flag error in AIF: 30-37, 111-118, 135-142 & BdcoFlagErrorInterf *BbofFlagSpectNonQual*					*Flag error in AIF: 111-118*	ELT entry for error in SN 1-30 and resp. 35-36 Flag error in ADF : 30-37, 103-110, 111-118, 135-142 & *BbofFlagSpectNonQual* & BbofFlagSrdNonUpdate & BbofFlagCoefCalNonUpdate

Minor errors / severity 1 *

System & MAS error in band 3

Error ID	Error management in observational phase			Error management in calibration phase		
6-9, 86, 54-61, 78-85, 159-166	No action			A/ Non up-date of the filtered reduced spectrum B/ Non up-date of the B1, B2, B3 filtered calibration coefficients		
PX packets	Ip packets	VPA & VPB packets	VPC packets	VPD packets	VPE packets	AP packets
No impact	*No impact*, packet issued, data not affected by errors.	*No impact*	*No impact*, data transmitted even if VDS corresponding to a non up-date of the filtered reduced spectrum or filtered calibration coefficients	No impact, excepted if VDS corresponding to a non up-date of the filtered calibration coefficients then *packet contains rubbish values*	*No impact.*	*No Impact.*
Flag error in AIF: 6-8, 54-85, 159-166 & BdcoFlagErrorInter (for error 54-85 only) BbofFlagSpectNonQual		Flag error in VPx AIF: 6-8				ELT entry for error in SN 1-30 and resp. 35-36 Flag error in ADF : 6-8, 54-85, 159-166 & BbofFlagCoefCalNonUpdate & *BbofFlagSpectNonQual*

MAS error in band 1, 2 & Algorithm error (RCI)

Error ID	Error management in observational phase			Error management in calibration phase		
38-53, 62-77, 143-158, 175-222	No action			B/ Non up-date of the filtered calibration coefficients for the faulty band		
PX packets	Ip packets	VPA & VPB packets	VPC packets	VPD packets	VPE packets	AP packets
No impact	*No impact*, packet issued, data not affected by errors.	*No impact*	*No impact*, data transmitted even if VDS corresponding to a non up-date of the filtered calibration coefficients	No impact, excepted if VDS corresponding to a non up-date of the filtered calibration coefficients then *packet contains rubbish values*	*No impact.*	*No Impact.*
Flag error in AIF: 143-158 only for SN 1,30 & BdcoFlagErrorInterf *BbofFlagSpectNonQual*						ELT entry for error in SN 1-30 and resp. 35-36 Flag error in ADF : 38-53, 143-158,175-222 & BbofFlagCoefCalNonUpdate & *BbofFlagSpectNonQual*

Algorithm error (IRS)

Error ID	Error management in observational phase			Error management in calibration phase		
167-174	No action			A/ Non up-date of the filtered reduced spectrum		
PX packets	Ip packets	VPA & VPB packets	VPC packets	VPD packets	VPE packets	AP packets
No impact	*No impact*, packet issued, data not affected by errors.	*No impact*	*No impact*, data transmitted even if VDS corresponding to a non up-date of the filtered reduced spectrum.	No impact	*No impact.*	*No Impact.*
						ELT entry for error in SN 1-30 and resp. 35-36 *Flag error in ADF : 167-174 & BBofFlagSrdNonUpdate*

Algorithm error (ARC)

Error ID	Error management					
223-254	No action **					
PX packets	Ip packets	VPA & VPB packets	VPC packets	VPD packets	VPE packets	AP packets
No impact	*No impact*	*No impact*	*No impact*	No impact	*No impact*	*No Impact*
Flag error in AIF : 223-254						ELT entry for error in SN 1-30 and resp. 35-36

IIs error (image length and overflow)

Error ID	Error management					
10-12	No action (Ignore IIS sample > 4100 in case of ID 11) **					
PX packets	Ip packets	VPA & VPB packets	VPC packets	VPD packets	VPE packets	AP packets
No impact	*No impact*	*No impact*	*No impact*	No impact	*No impact*	*No Impact*
	Flag error in AIF : 10-12					ELT entry for error in SN 1-30 and resp. 35-36

IIS error (no image)

Error ID	Error management					
497	The Image packet corresponding to the subcycle when the error was detected shall not be sent to the FMU **					
PX packets	Ip packets	VPA & VPB packets	VPC packets	VPD packets	VPE packets	AP packets
No impact	*No packet issued corresponding to the faulty subcycle*	*No impact*	*No impact*	No impact	*No impact*	*No Impact*
						ELT entry for error in SN 1-30 and resp. 35-36 Flag error in AIF: 497

Semantic error

Error ID	Error management					
506-511	Reject CMD					
PX packets	Ip packets	VPA & VPB packets	VPC packets	VPD packets	VPE packets	AP packets
No impact	*No impact*	*No impact*	*No impact*	No impact	*No impact*	*No Impact*

Branch inhibition

PX packets	Ip packets	VPA & VPB packets	VPC packets	VPD packets	VPE packets	AP packets
Packets filled with zeros for related pixels and bands	No impact	No impact	No impact	No impact	No impact	Packets filled with zeros for related pixels and bands

Pixel OFF

PX packets	Ip packets	VPA & VPB packets	VPC packets	VPD packets	VPE packets	AP packets
No packets issued for faulty DPC. Other pixel not affected.	No impact	No impact excepted VDS corresponding to faulty DPC then no ADF issued (*zero ADF length*).	No impact excepted VDS corresponding to faulty DPC then no ADF issued (*zero ADF length*).	No impact excepted VDS corresponding to faulty DPC then no ADF issued (*zero ADF length*).	No impact excepted VDS corresponding to faulty DPC then no ADF issued (*zero ADF length*).	Packets filled with zero value for the related pixel.

* The first four error medium B and minor entry are reported in ELT table in Auxiliary packets.

** In case of IIS errors CD value in ELT table is inverted.

21.Appendix F: Packets structure when the DPS is in TEST mode

When the DPS is in TEST mode all the issued packets have the following structure:

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
00001b					*Application Process Identifier (APID)*										
11b		*Source Sequence Count (SSC)*													
Length = 2(N+1) - 1															
Pattern(0..N-1)															
CRC															

With:

- N = 4480-4, Pattern(k) = 1111h for PX1 packets
- N = 4480-4, Pattern(k) = 2222h for PX2 packets
- N = 4480-4, Pattern(k) = 3333h for PX3 packets
- N = 4480-4, Pattern(k) = 4444h for PX4 packets
- N = 2076-4, Pattern(k) = 5555h for IP packets
- N = 27541-4, Pattern(k) = 6666h for VPA packets
- N = 27541-4, Pattern(k) = 7777h for VPB packets
- N = 29201-4, Pattern(k) = 8888h for VPC packets
- N = 28841-4, Pattern(k) = 9999h for VPD packets
- N = 2601-4, Pattern(k) = AAAAh for VPE packets
- N = 391-4, Pattern(k) = BBBBh for AP packets

Nota: APID values for OPER/CALIB mode and TEST mode are identical

****** END OF DOCUMENT ******