ATOVS Level 1b Product Guide

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V1	08/09/2004		First issue of the document.
v2	31/08/2007		Update to reflect start of Metop/ ATOVS Level 1b.
v2A	10/07/2008		Section 3 revised to reflect configuration history. Appendices G, H, I: Table added to each appendix summarising record contents for each product format version. Other general layout improvements, and text and typo corrections.
v3	11/01/2010		Sec. 2: Added references RD25 & RD26 and replaced RD20. Sec. 3: Configuration history tables updated. Sec. 6.3.5: Added description of how to derive radiances from MDR data using factors. Improved equation and its description. Sec. 11: In AMSU-A bitfield description tables, updates for FOV_Data_Quality (totally wrong before), Instrument_Status_A1, Instrument_Status_A2, Scan_Line_Quality. Sec. 12: In MDR-1B table: Improved descriptions of compound data entries. In HIRS bitfield description tables, Digital_A_Data_Element_Flag deleted (because not a bitfield), Flag_Data updated to give better description. Sec. 13: In MHS bitfield description tables, updates for Gain_Code, OB_ICU_Time_Int, Scan_Line_Quality, Telemetry_Update. Document restructured - App. F, G, H & I renamed as Sec. 10, 11, 12 & 13, and common appendices removed to keep as separate document. Other general typo corrections, and minor text and hyperlink amendments.
v3A	13/12/2011		New version 4 of MDR-1B for product format version 11.0. New version 3 of MDR-1B for PFV 11.0. New version 4 of MDR-1B for PFV 11.0.
v3B	31/03/2016		Added table of values for EPS ATOVs calibration pairs.

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1 INTRODUCTION

This user guide is intended for users of EPS ATOVS Level 1b products. It provides information about the products available, how to access them, how to extract and interpret the data, and it also aims to help the user in choosing a product for a particular application.

A supplement of appendices applicable to all the Product Guides is also available. This contains a product summary and details of generic data, as well as information on the Metop operational orbit, and a list of acronyms and abbreviations. The supplement is accessible under Document Reference: EUM/OPS-EPS/MAN/08/0034

In Appendix A, a full list of EPS products generated at EUMETSAT is given. These ATOVS Level 1b products are addressed in this guide:

- AMSU-A Level 1b
- HIRS/4 Level 1b
- MHS Level 1b

The above products will be generated by the EPS CGS from instruments on board the Metop and the NOAA-18 and NOAA -19 satellites.

Note that the Numerical Weather Prediction Satellite Application Facility (NWP SAF) is responsible for the development, distribution and maintenance of the ATOVS and AVHRR Pre-processing Package (AAPP), which allows users to generate equivalent products from ATOVS locally-received data corresponding to both NOAA and Metop platforms.

The NWP SAF develops additionally different software packages for the assimilation of ATOVS Level 1 data in Numerical Weather Prediction models, as well as providing different monitoring tools for operational assimilation of the data.

Higher-level products of direct application in meteorology and climatology can be derived from ATOVS Level 1b, such as temperature and humidity profiles, cloud top temperature and pressure, effective cloud amount and cloud precipitable water content. EUMETSAT generates and distributes those ATOVS Level 2 products as well in near-real time, and their description and retrieval are addressed in a different guide, the "ATOVS Level 2 Product Guide".

For further questions not addressed in this guide, on these or other EPS products, users are welcome to access the EUMETSAT Polar System pages on our website www.eumetsat.int, or to contact directly the EUMETSAT User Services helpdesk. These pages should be the main interface for information on access to all EPS products.

Comprehensive information on the NWP SAF and their products and activities can also be found on the EUMETSAT website, and the help desk of the relevant SAF can be accessed directly on www.nwpsaf.org/.

2 REFERENCE DOCUMENTS

The following documents have been used to compile the information in this guide. Some of them are referenced within the text, others are provided here for further reading.

2.1 EPS Programme Documents

Number	*Author, title, reference*	*DM Reference*
RD 1	EPS Generic Product Format Specification	EPS.GGS.SPE.96167
RD 2	AMSU-A Level 1 Product Format Specification	EPS.MIS.SPE.97228
RD 3	AMSU-A Level 1 Product Generation Specification	EUM.EPS.SYS.SPE.990005
RD 4	MHS Level 1 Product Format Specification	EPS.MIS.SPE.97229
RD 5	MHS Level 1 Product Generation Specification	EUM.EPS.SYS.SPE.990006
RD 6	HIRS/4 Level 1 Product Format Specification	EPS/MIS/SPE/97230
RD 7	HIRS/4 Level 1 Product Generation Specification	EPS.SYS.SPE.990007
RD 8	ATOVS Calibration and Validation Plan	EUM.EPS.SYS.PLN.01.012
RD 9	EPS Programme Calibration and Validation Overall Plan	EUM.EPS.SYS.PLN.02.004
RD 10	AVHRR L1 Product Generation Specification	EUM.EPS.SYS.SPE.990004
RD 11	U-MARF LEO Format Descriptions	EUM/OPS/USR/06/1855
RD 12	EUMETCast Technical Description	EUM TD 15
RD 13	EPS Product file naming for EUMETCast	EUM/OPS-EPS-TEN/07/0012
RD 14	Minutes of 9th ATOVS Meeting	EUM.EPS.SYS.MOM.03.063
RD 15	Metop Space to Ground Interface Specification	MO-IF-MMT-SY0001
RD 16	HIRS/4 Instrument Interface Control Document	MO-IC-MMT-HI-0001

See the EUMETSAT web page www.eumetsat.int for more information on the project.

2.2 Papers, reports and other technical documentation

Number	*Author, title, reference*	*Reference*
RD 17	NOAA KLM User's Guide	www2.ncdc.noaa.gov/docs/klm
RD 18	Assimilation of satellite data for Numerical Weather Prediction	Simmons, A. In *ECMWF Seminar Proceedings: Exploitation of the New Generation of Satellite Instruments for Numerical Weather Prediction*, 4 -8 September 2000, pp. 21 - 46.
RD 19	Manual on the Global Telecommunication System	WMO - No. 386
RD 20	World Meteorological Organization Manual on Codes	WMO - No. 306

3 ATOVS LEVEL 1B PRODUCTS CONFIGURATION HISTORY

In the following tables the current versions on the operational Ground Segment are shown on a white background.

3.1 ATOVS Level 1b processing software

ATOVS L1 PPF software version	*Date introduced*	*Comments*
4.0	17/07/2007	
4.3	11/09/2007	
4.4	05/12/2007	
4.5	17/03/2008	
5.1	08/12/2008	
5.4.3	16/06/2009	
5.5	03/09/2009	

Table 3-1: ATOVS Level 1 PPF software versions

Note: the ATOVS Level 1 Product Processing Facility (PPF) applies to AMSU-A, HIRS and MHS.

3.2 AMSU-A Level 1b products

Date introduced	*Product format version*		*PFS version*	*PGS version*	*Comments*
	Major number	*Minor number*			
19/10/2006	10	0	6.4	5.3	
22/05/2007	10	0	v7C	5.3/v5C	Antenna correction

Table 3-2: AMSU-A Level 1 document versions

AMSU-A L1 auxiliary files set version	*AMSU-A L1 auxiliary files*	*Date introduced*	*Comments*
Metop files			
1.6	AMSA_CAL_xx_M02_20070509070000Z_xxxxxxxxxxxxxxx_20070508000106Z_xxxx_xxxxxxxxxx	22/05/2007	
1.7	AMSA_CAL_xx_M02_20070730100000Z_xxxxxxxxxxxxxxx_20070726000107Z_xxxx_xxxxxxxxxx	11/09/2007	
1.8	AMSA_CAL_xx_M02 tagged: PPF_ATOVS1_AUX_DU-2_0-BMR1363, U_AAT_20091209	09/12/2009	
NOAA files			
1.5	AMSA_CAL_xx_N18_20070730100000Z_xxxxxxxxxxxxxxx_20070726000105Z_xxxx_xxxxxxxxxx	11/09/2007	
1.6	AMSA_CAL_xx_N10_20070926040000Z_xxxxxxxxxxxxxxx_20070918000106Z_xxxx_xxxxxxxxxx	04/10/2007	
1.7	AMSA_CAL_xx_N18_20080207060000Z_xxxxxxxxxxxxxxx_20080208000107Z_xxxx_xxxxxxxxxx	02/02/2008	

Table 3-3: AMSU-A Level 1 PPF auxiliary parameter file versions

Note: The auxiliary parameter files are available from the EUMETSAT Data Centre.

3.3 HIRS Level 1b products

Date introduced	*Product format version*		*PFS version*	*PGS version*	*Comments*
	Major number	*Minor number*			
19/10/2006	10	0	6.5/v7C	5.2/v5B	

Table 3-4: HIRS Level 1 document versions

HIRS L1 auxiliary files set version	*HIRS L1 auxiliary files*	*Date introduced*	*Comments*
Metop files			
1.3	HIRS_CAL_xx_M02_20070509070000Z_xxxxxxxxxxxxxxx_20070508000103Z_xxxx_xxxxxxxxxx	22/05/2007	
1.4	HIRS_CAL_xx_M02_20070730100000Z_xxxxxxxxxxxxxxx_20070726000104Z_xxxx_xxxxxxxxxx	11/09/2007	
NOAA files			
1.2	HIRS_CAL_xx_N18_20070730100000Z_xxxxxxxxxxxxxxx_20070726000102Z_xxxx_xxxxxxxxxx	11/09/2007	
1.3	HIRS_CAL_xx_N18_20080508130000Z_xxxxxxxxxxxxxxx_20080508000103Z_xxxx_xxxxxxxxxx	21/05/2008	

Table 3-5: HIRS Level 1 PPF auxiliary parameter file versions

3.4 MHS Level 1b products

Date introduced	*Product format version*		*PFS version*	*PGS version*	*Comments*
	Major number	*Minor number*			
19/10/2006	10	0	6.5	5.3	
22/05/2007	10	0	6.5/v7C	5.3/v5C	Limb correction

Table 3-6: MHS Level 1 document versions

MHS L1 auxiliary files set version	*MHS L1 auxiliary files*	*Date introduced*	*Comments*
Metop files			
1.3	MHSx_CAL_xx_M02_20070509070000Z_xxxxxxxxxxxxxxx_20070508000103Z_xxxx_xxxxxxxxxx	22/05/2007	
1.4	MHSx_CAL_xx_M02_20070730100000Z_xxxxxxxxxxxxxxx_20070726000104Z_xxxx_xxxxxxxxxx	11/09/2007	
NOAA files			
1.2	MHSx_CAL_xx_N18_20070730100000Z_xxxxxxxxxxxxxxx_20070726000102Z_xxxx_xxxxxxxxxx	11/09/2007	

Table 3-7: MHS Level 1 PPF auxiliary parameter file versions

4 ATOVS LEVEL 1B PRODUCTS OVERVIEW

4.1 The ATOVS instrument suite

The ATOVS (Advanced TIROS (Television and Infrared Observational Satellite) Operational Vertical Sounder) is a sounding instrument package first flown on the NOAA-KLM (-15, -16, -17) satellite series. It is composed of the Advanced Microwave Sounding Units A and B (AMSU-A, AMSU-B) and is complemented by the High Resolution InfraRed Sounder (HIRS/3).

For Metop and the NOAA-18 and -19 satellite series, the AMSU-B sounder has been replaced by the Microwave Humidity Sounder (MHS), and the infrared sounder has been upgraded to HIRS/4.

Although not considered formally part of the ATOVS package, the Advanced Very High Resolution Radiometer (AVHRR/3) is an imager also flying on Metop and on NOAA-18 and NOAA-19, which supports the ATOVS Level 1b processing. A separate AVHRR Level 1b Product Guide is provided and AVHRR/3 will be discussed here only in the context of its support to the ATOVS products processing.

A detailed account of the ATOVS instruments technical characteristics is given in RD 8, but we will give in the next sections the basic information necessary for product understanding and usage.

4.1.1 AMSU-A

4.1.1.1 Technical description and spectral characteristics

The AMSU-A is a fifteen-channel microwave radiometer that is used for measuring global atmospheric temperature profiles and providing information on atmospheric water in all of its forms.

AMSU-A measures in 15 spectral bands, summarised in the table below, where the temperature sounding mainly exploits the oxygen band at 50 GHz.

Hardware for the two lowest frequencies is located in one module (AMSU-A2) and that for the remaining thirteen frequencies in the second module (AMSU-A1). This arrangement puts the two lower atmospheric moisture viewing channels into one module and the oxygen absorption channels into a second common module, in order to ensure commonality of viewing angle independent of any module and/or spacecraft misalignment due to structural or thermal distortions. The AMSU-A2 module has a single antenna assembly, providing data for channels 1 and 2. AMSU-A1 has two separate antenna assemblies: AMSU-A11 provides data for channels 6, 7 and 9-15, and AMSU-A12 provides data for channels 3, 4, 5 and 8.

Table 4-1summarises the spectral characteristics of AMSU-A.

Channel	*Channel frequency (GHz)*	*No. of pass bands*	*Nominal bandwidth (MHz)*	*Temperature sensitivity (K)*	*Calibration accuracy (K)*	*Polarisation angles*
AMSU-A2						
1	23.8	1	270	0.30	< 2.0	90–θ
2	31.4	1	180	0.30	< 2.0	90–θ
AMSU-A1						
3	50.3	1	180	0.40	< 1.5	90–θ
4	52.8	1	400	0.25	< 1.5	90–θ
5	53.59 ± 0.115	2	170	0.25	< 1.5	θ
6	54.40	1	400	0.25	< 1.5	θ
7	54.94	1	400	0.25	< 1.5	90–θ
8	55.50	1	330	0.25	< 1.5	θ
9	F_{LO} = 57.290344	1	330	0.25	< 1.5	θ
10	F_{LO} ± 0 .217	2	78	0.40	< 1.5	θ
11	F_{LO} ± 0 .3222 ± 0 .048	4	36	0.40	< 1.5	θ
12	F_{LO} ± 0 .3222 ± 0 .022	4	16	0.60	< 1.5	θ
13	F_{LO} ± 0 .3222 ± 0 .010	4	8	0.80	< 1.5	θ
14	F_{LO} ± 0 .3222 ± 0 .0045	4	3	1.20	< 1.5	θ
15	89.0	1	< 6000	0.50	< 2.0	90–θ
The polarisation angle is defined as the angle from horizontal polarisation (electric field vector parallel to the satellite track) where θ is the scan angle from nadir. θ indicates horizontal polarisation and 90-θ indicates vertical polarisation.						

Table 4-1: Spectral characteristics of AMSU-A

Each antenna assembly contains a warm calibration target with a different number of Platinum Resistance Thermometers (PRTs), five for the AMSU-A1 modules and seven for the AMSU-2 module.

4.1.1.2 Scanning geometry

AMSU-A is an across-track scanning system with a scan range of ±48.33° with respect to the nadir direction. The instantaneous field of view (IFOV) of each channel is approximately 57.6 milliradians (3.3°) leading to a circular instantaneous field of view size close to 47.63 km at nadir and a swath width of ±1026.31 km (sampling time of 200.0 ms) for a nominal altitude of 833 km. The sampling angular interval is close to 58.18 milliradians (3.3333°). The distance between two consecutive scans is approximately equal to 52.69 km.

There are 30 Earth views, two views of the internal warm target, and two views of cold space per scan line for each channel. Each scan takes 8.0 seconds to complete.

Table 4-2 summarises the scanning characteristics.

Characteristics	*Value*	*Unit*
Scan direction	west to east (northbound)	-
Scan type	step	-
Scan rate	8	s
Sampling interval (duration)	200	ms
Sampling interval	3.3333	degree
Pixels/scan	30	-
Swath	±48.33	degree
Swath width	±1026.31	km
IFOV	3.3	degree
IFOV type	circular	-
IFOV size (nadir)	47.63	km
IFOV size (edge) - across track	146.89	km
IFOV size (edge) - along track	78.79	km
Scan separation (adjacent scan lines)	52.69	km

Table 4-2: Scanning characteristics of AMSU-A

4.1.1.3 Instrument calibration

During each in-orbit scan line, the AMSU-A views three different types of targets:

- 30 Earth views (pixels)
- 2 views of the internal warm target (~300 K)
- 2 views of cold space (~2.73 K)

The accuracy of the warm calibration load brightness temperature is better than ±0.2 K.

The cold space views, together with the internal warm target views and PRT measurements, are used during the ground processing to calibrate the AMSU-A radiances.

4.1.2 HIRS/4

4.1.2.1 Technical description and spectral characteristics

The HIRS/4 instrument measures the incident radiation primarily in the infrared region of the spectrum in 19 channels, including both longwave (6.5 – 15 μm) and shortwave (3.7 μm – 4.6 μm) regions, and it also has one channel in the visible (0.69 μm).

The instrument is composed of a single telescope and a rotating wheel with 20 filters. The energy received by the telescope is separated by a dichroic beam splitter into longwave (> 6.4 μm) and shortwave (< 6.4 μm) energy, controlled by filter stops. The shortwave energy is passed through a second dichroic beam splitter to separate the visible channel. At each of the scan mirror positions, all

20 filter segments are sampled. There are separate sensors for the visible, shortwave, and longwave IR energy. The shortwave and visible optical paths have a common field stop, the longwave path has an identical but separate field stop.

If the IR channels data appear to be affected by contamination of the sensors, the IR channel cooler can be heated up to 300 K. During such a decontamination campaign, HIRS/4 IR scans are not produced.

Table 4-3summarises the spectral characteristics of HIRS/4.

Channel	*Centre wavenumber (cm^{-1})*	*Centre frequency (μm)*	*Half bandwidth (cm^{-1})*	*Maximum anticipated scene temp (K)*	*Specified NEΔN ($mW/m^2/sr/cm^{-1}$)*
1	668.5 ± 1.3	14.959	3.0 +1/-5	280	3.00
2	680.0 ± 1.8	14.706	10.0 +4/-1	265	0.67
3	690.0 ± 1.8	14.493	12.0 +6/-0	240	0.50
4	703.0 ± 1.8	14.225	16.0 +4/-2	250	0.31
5	716.0 ± 1.8	13.966	16.0 +4/-2	265	0.21
6	733.0 ± 1.8	13.643	16.0 +4/-2	280	0.24
7	749.0 ± 1.8	13.351	16.0 +4/-2	290	0.20
8	900.0 ± 2.7	11.111	35.0 ± 5.0	330	0.10
9	1030.0 ± 4.0	9.709	25.0 ± 3.0	270	0.15
10	802.0 ± 2.0	12.469	16.0 +4/-2	300	0.15
11	1365.0 ± 5.0	7.326	40.0 ± 5.0	275	0.20
12	1533.0 +2/-6	6.523	55.0 ± 5.0	255	0.20
13	2188.0 ± 4.4	4.570	23.0 ± 3.0	300	0.006
14	2210.0 ± 4.4	4.525	23.0 ± 3.0	290	0.003
15	2235.0 ± 4.4	4.474	23.0 ± 3.0	280	0.004
16	2245.0 ± 4.4	4.454	23.0 ± 3.0	270	0.004
17	2420.0 ± 4.0	4.132	28.0 ± 3.0	330	0.002
18	2515.0 ± 5.0	3.976	35.0 ± 5.0	340	0.002
19	2660.0 ± 9.5	3.759	100.0 ± 15.0	340	0.001
20	14500.0 ± 220	0.690	1000.00 ± 150.0	100 % Albedo	0.10 % Albedo

Table 4-3: Spectral characteristics of HIRS/4

4.1.2.2 Scanning geometry

HIRS/4 is an across-track scanning system with a rotating mirror and a scan range of ±49.5° with respect to the nadir direction. The instantaneous field of view (IFOV) of each channel is approximately 0.69°, leading to a circular IFOV size close to 10.0 km at nadir for a nominal altitude of 833 ± 19 km. The major difference between HIRS/3 and HIRS/4 is that HIRS/3 has an IFOV size close to 20 km. Each scan line takes 6.4 s to complete. At the end of the scan line, the mirror rapidly returns to its home position (8 retrace steps of 100 ms each) and the scanning pattern is repeated.

There are 56 Earth view samples per scan for a swath width of ±1080.35 km (sampling time of 100.0 ms). The sampling angular interval is close to 31.42 milliradians (1.8°). The distance between two consecutive scans is approximately equal to 42.15 km.

The HIRS/4 instrument can be commanded by a Calibration Enable command to automatically enter a calibration mode every 256 seconds (i.e., every 40 scan cycles). This is the nominal instrument mode. If the instrument is commanded by the Calibration Disable command not to perform calibration scans, normal Earth view scans are produced instead of calibration scans.
When the instrument is in the calibration mode, the mirror rapidly slews to a space view position and performs measurements in all channels for the equivalent time of one complete scan line. Due to the time required to bring the mirror into its space view position, the first 8 scan steps are not usable, reducing the number of usable space scan steps to 48. Next, the mirror is moved to a position where it views the warm internal calibration target and data are taken for the equivalent time of 56 scan steps. Upon completion of the calibration mode, the mirror continues its motion to home position, where it begins a normal Earth scan. The total calibration is equivalent to two scan lines (no Earth data are acquired during this period). Therefore, there will be two lines of calibration data followed by 38 lines of Earth view data, forming a so-called calibration cycle.

Table 4-4 Summarises the scanning characteristics.

Characteristics	*Value*	*Unit*
Scan direction	West to East (northbound)	-
Scan type	continuous	-
Scan rate	6.4	s
Sampling interval (duration)	100	ms
Sampling interval	1.8	degree
Pixels/scan	56	-
Swath	±49.5	degree
Swath width	±1080.35	km
IFOV	0.69	degree
IFOV type	circular	-
IFOV size (nadir)	10.0	km

Characteristics	Value	Unit
IFOV size (edge) - across track	33.27	km
IFOV size (edge) - along track	17.03	km
Scan separation	42.15	km

Table 4-4: Scanning characteristics of HIRS/4

4.1.2.3 Instrument calibration

IR calibration of the HIRS/4 is provided by programmed views of two radiometric targets: the warm target mounted on the instrument baseplate, and a view of space. Data from these views provide sensitivity calibrations for each channel at 256-second intervals if commanded. Internally generated electronic signals provide calibration and stability monitoring of the detector amplifier and signal processing electronics.

During each calibration cycle, the HIRS/4 views three different types of targets:

- 38 scans of 56 Earth views (pixels) each
- 1 scan of 48 views of the internal warm target
- 1 scan of 56 views of cold space

The calibration repeatability is specified to be better than 0.3 K and the inter-channel accuracy better than 0.2 K.

The cold space views, together with the internal warm target views and PRT measurements, are used during the ground processing to calibrate the HIRS/4 radiances.

Note that two on-board targets at different temperatures are available on HIRS instruments and that temperature measurements are carried out for both targets. However, it was found on HIRS/2 that the cold on-board target did not improve the calibration and was largely not used in the ground processing. Therefore, only the warm target is used in the operational HIRS/4 calibration sequence. The view of the second cold on-board target is only selectable by command, and it is not planned to use this command for HIRS/4 operations.

Finally, it is important to mention that additional radiation coming from different parts of the instrument is also measured by the HIRS/4 detector. For that reason, the instrument temperature is carefully controlled. The exception is the baffle (secondary mirror/telescope), which due to its composition materials is subject to relatively high short-term temperature variations. The baffle temperature is measured every scan line and an additional correction for this effect can be applied in the ground calibration processing.

4.1.3 MHS

4.1.3.1 Technical description and spectral characteristics

The MHS is the follow-on instrument to the Advanced Microwave Sounding Unit-B (AMSU-B) which flew as a part of ATOVS on the NOAA-KLM satellite series. It is procured by EUMETSAT for the Metop and NOAA satellites.

MHS is a five-channel microwave radiometer, which complements the Advanced Microwave Sounding Unit-A (AMSU-A) channels. In some MHS descriptions documents, MHS channels may be numbered as a continuation of the AMSU-A channels: 16, 17, 18, 19 and 20.

- (H1) channel 16: 89 GHz
- (H2) channel 17: 157 GHz
- (H3 and H4) channels 18 & 19: 183.311 +/- 1 and +/- 3 GHz
- (H5) channel 20: 190.311 GHz

It is planned to derive from these frequencies humidity profiles and cloud liquid water content. Additionally, the instrument's sensitivity to large water droplets in precipitating clouds can provide a qualitative estimate of precipitation rates.

It is technically similar to the AMSU-B instrument, except for channel 20, where the AMSU-B side-band at 176.31 GHz is missing. Table 4-5 summarises the spectral characteristics of MHS.

Channel	*Central frequency (GHz)*	*Bandwidth (MHz)*	*Temperature sensitivity (K)*	*Calibration accuracy (K)*	*Polarisation*
H1	89.0	±1400	1.0	1.0	V
H2	157.0	±1400	1.0	1.0	V
H3	183.311±1.00	±250	1.0	1.0	H
H4	183.311±1.00	±500	1.0	1.0	H
H5	190.311	±1100	1.0	1.0	V

Table 4-5: Spectral characteristics of MHS

4.1.3.2 Scanning geometry

MHS is an across-track scanning system with a scan range of ±49.44° with respect to the nadir direction. The IFOV of each channel is approximately 19.2 milliradians (1.1°) leading to a circular instantaneous field of view size close to 15.88 km at nadir for a nominal altitude of 833 km. Each scan takes 2.667 seconds to complete.

The scan of the MHS instrument is synchronised with the AMSU-A scan, i.e. there are three scans of MHS for each scan of AMSU-A.

There are 90 Earth samples per scan and per channel for a swath width of ±1077.68 km (sampling time of 19.0 ms). The sampling angular interval is close to 19.39 milliradians (1.1111°), which is slightly larger than that of AMSU-B (1.1000°). The distance between two consecutive scans is approximately equal to 17.56 km.

The following table summarises the scanning characteristics.

Characteristics	*Value*	*Unit*
Scan direction	West to East (northbound)	-
Scan type	continuous	-
Scan rate	2.667	s
Sampling interval (duration)	18.52	ms
Sampling interval	1.1111	degree
Pixels/scan	90	-
Swath	±49.44	degree
Swath width	±1077.68	km
IFOV	1.1	degree
IFOV type	circular	-
IFOV size (nadir)	15.88	km
IFOV size (edge) - across track	52.83	km
IFOV size (edge) - along track	27.10	km
Scan separation	17.56	km

Table 4-6: Scanning characteristics of MHS

4.1.3.3 Instrument calibration

The MHS instrument calibration is based upon the measurement of cold space and of an on-board black body target. This calibration sequence is performed once every 2.667 seconds for each scan line. During one scan, MHS observes

- 90 Earth views (pixels)
- 4 views of the internal warm target (~300 K)
- 4 views of cold space (2.73 K)

The warm target contains five platinum resistance thermometers (PRTs), as opposed to the seven PRTs for the older AMSU-B instrument.

The cold space views, together with the internal warm target views and PRT measurements, are used during the ground processing to calibrate the MHS radiances.

4.2 Overview of the ground processing and calibration

The Level 1 ground processing chains for the AMSU-A, MHS and HIRS/4 are illustrated in Figure 4-1 below.

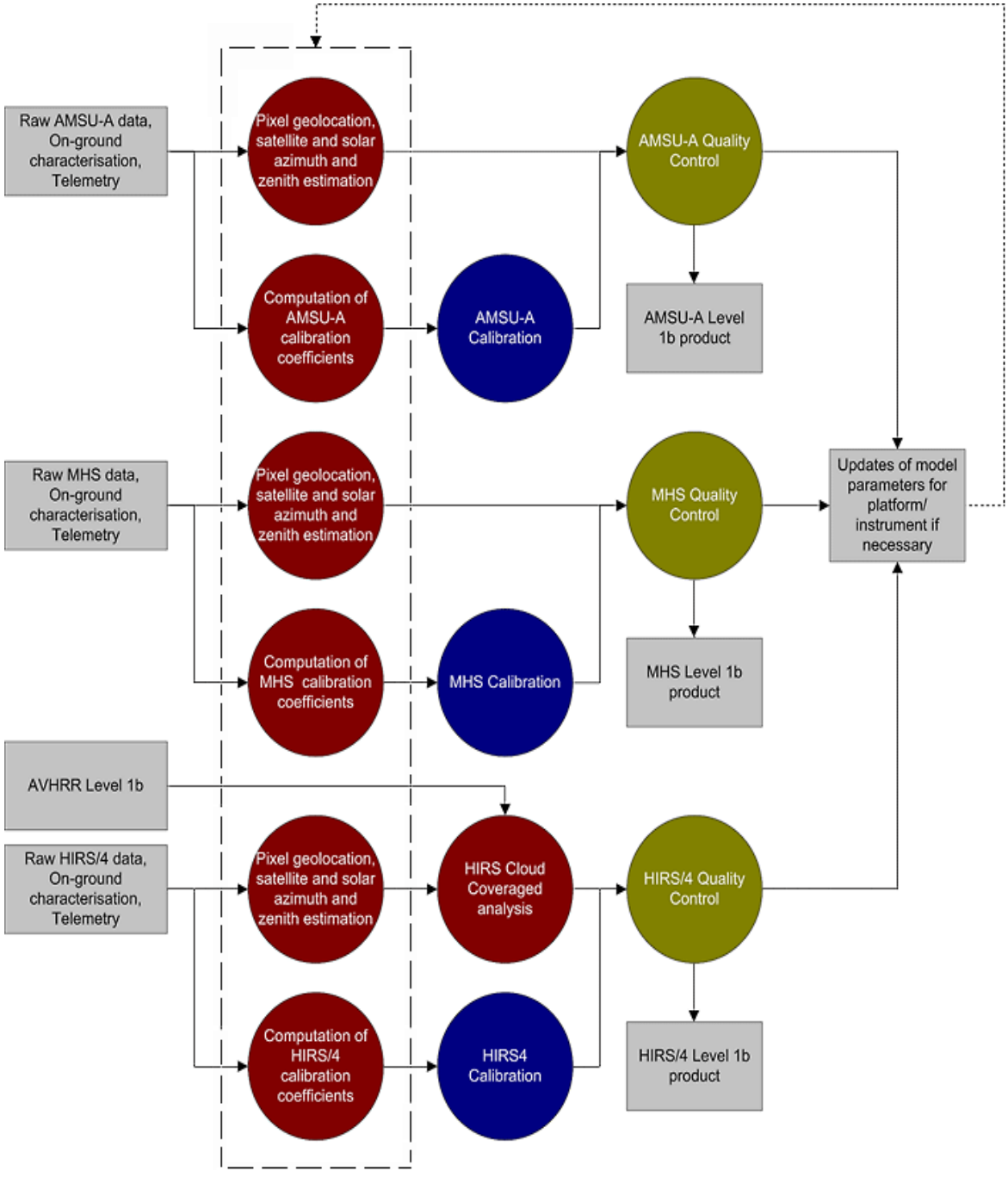


Figure 4-1: Functional overview of the ATOVS Level 1 ground processing chain

The first objective of Level 1 ground processing for the ATOVS instruments data is the generation of the AMSU-A, MHS and HIRS/4 Level 1b products, containing radiances as the main geophysical parameter. This processing is data driven and is applied to every science source packet.

Additionally, ATOVS Level 1b products are considered an input to the EUMETSAT ATOVS and IASI Level 2 processors. Furthermore, AVHRR/3 Level 1b generated at EUMETSAT is used as an input for HIRS Level 1b processing. In Section 10, the context of the ATOVS, IASI and AVHRR processing chain interactions is provided for information.

The ATOVS ground processing at EUMETSAT is applied to data from the ATOVS instruments on both Metop and NOAA satellites.

4.2.1 Pre-processing

Pre-processing of ATOVS data has similar objectives for data coming from AMSU-A, MHS and HIRS/4, namely validation of input data, geolocation of each pixel, estimation of solar and satellite azimuth and zenith angles and finally, computation of calibration coefficients, which will be later applied in the Level 1b processing to calculate radiances.

Basic raw data validation checks are applied and the instruments' telemetry and other auxiliary data are also validated and related to the input raw data flow.

4.2.1.1 Geolocation

Geolocation for individual pixels along the scan line is performed, as well as their satellite and solar zenith and azimuth angles. The navigation of individual pixels is carried out by means of a satellite ephemeris model and an instrument scanning model. This first step in the navigation is based on default attitude values, directly after data acquisition. Please refer to Appendix B for further information on satellite orbit and attitude models.

The calculation of the satellite zenith and azimuth is done by applying a transformation matrix to the Earth fixed satellite position coordinates previously obtained during the pixel navigation. The solar azimuth and zenith are obtained taking into account the actual solar declination, for which an accurate time stamp for the scan line is necessary.

Using a high resolution coastline data set and the geolocation information estimated above, a surface type is assigned to each pixel.

Full details on geolocation processing are provided in RD 10.

4.2.1.2 Computation of calibration coefficients for AMSU-A and MHS

In the case of AMSU-A and MHS, each Earth scene radiance is related to the Earth view counts for that scene through a non-linear relationship involving a linear gain, to which a non-linearity correction is applied in terms of an additional quadratic term. Several steps are involved in the calibration processing:

- Computation of the mean internal warm target temperature from the PRT measurements
- Computation of the effective internal warm target and cold space temperatures, after applying corrections to the mean internal warm target temperature and the known fixed temperature of cold space, by using on-ground instrument characterisation data

- Conversion of effective internal warm target and cold space temperatures into radiances using Planck's law
- Computation of the mean instrument counts for the warm target and cold space instrument measurements
- For each Earth view measured count in a scene, estimation of the linear gain using reference count/radiance values of the warm target and cold space, via linear interpolation
- Computation of the non-linear correction term, using coefficients determined on ground at three different instrument temperatures
- Compute calibration coefficients

The corrections of the internal warm target temperature are intended to compensate for expected instrument temperature effects. The instrument temperature is measured on board and reflected in the instrument telemetry.

The corrections of known fixed temperature of cold space are necessary to compensate for the effect of contamination by radiation coming from the spacecraft and the Earth limb. Additionally, a moon glint correction is applied.

4.2.1.3 Computation of calibration coefficients for HIRS/4

Concerning HIRS/4, computation of the calibration coefficients of all thermal channels and the visible channel is also performed during the pre-processing.

The HIRS/4 IR channels calibration processing is also based on a two-point calibration scheme, using a warm on-board target of known temperature and deep space view. In this case however, calibration counts are only available every 40 scan lines. Instantaneous calibration coefficients are calculated every time a scan of calibration data is available, and those corresponding to the Earth view scans of that cycle are estimated by interpolation between the instantaneous calibration coefficients of the present and previous cycle.

In general, the relationship between Earth view counts and radiances is assumed to be quadratic. The coefficient of the quadratic term is assumed to be invariant and determined prior to launch as part of the instrument on-ground characterisation. It is usually set to 0 for all channels. The following steps are involved in obtaining the coefficients of the linear part of the equation.

- Computation of the mean internal warm target temperature from the PRT measurements.
- Conversion of effective internal warm target and cold space temperatures into radiances using Planck's law. For the warm target radiance calculation, an on-ground defined, channel-dependent, linear correction s applied to the estimated temperature, before applying Planck's law at the central wave number of the corresponding channel. The linear correction is applied to reflect the filtering effect of the channel's spectral response functions.
- Computation of the mean instrument counts for the warm target and cold space instrument measurements.
- Derivation of instantaneous calibration coefficients for a calibration cycle, and interpolation between these and those of the previous cycle to every Earth view scan line in between. A simple linear interpolation is carried out, and additional correction can be applied for the effects of variation of the baffle temperature, estimated using the measured baffle temperature at every scan line.

The HIRS/4 visible channel calibration consists of a linear equation, whose coefficients are determined prior to launch as part of the instrument on-ground characterisation and rarely change.

4.2.1.4 Determination of cloud coverage for a HIRS/4 scene

The determination of the cloud coverage consists in determining which AVHRR/3 pixels fall into the HIRS/4 IFOV and calculating from the cloudy/clear information in the AVHRR/3 Level 1b pixel data set, the percentage of the clear AVHRR/3 pixels. This method involves therefore two steps: AVHRR/3-HIRS/4 measurement collocation and AVHRR/3 clear pixel counting.

4.2.2 Level 1b processing

Calibration coefficients are applied to both visible (linear equation) and IR channels (quadratic equation, but with the quadratic term set to zero), in order to convert channel count values into reflectivity and radiances, respectively. These are the geophysical parameters which constitute the HIRS/4 Level 1b products. For AMSU-A and MHS, the quadratic calibration equation is applied to all channels, converting counts to radiances. Then, an antenna correction is applied.

4.2.3 Quality control

This function covers both the radiometric and the geometric quality assessment. The radiometric quality assessment consists of the production of a detailed set of radiometric characteristics of the data for each detector/channels, this for different imaged scenes during the dump (day/night sides, calibration viewing, etc.).

For AMSU-A and MHS, the geometric quality control consists of a check for every scan line on the Earth's view antenna position against a set of pre-defined thresholds. Geometric quality control is not performed operationally for the HIRS/4 instrument.

Finally, statistics produced by the quality control function are used to perform trend analysis and to derive information on the misalignments between instruments and mis-registration between channels. Updates of the model parameters for the platform/instrument being processed are then estimated and this information allows compensating for slow drifts and changes in these parameters.

4.3 ATOVS Level 1b product characteristics and use

4.3.1 General characteristics

Table 4-7 summarises the main characteristics of ATOVS Level 1b products available to users. All products contain quality control and other information about the retrieval and their use, which are important to know when you choose the product needed for your application. Two different types of Level 1b products are generated, from Metop and from NOAA data.

Instrument	*Product*	*Main geophysical parameter*	*Accuracy*	*Resolution /grid spacing (nadir)*	*Swath width*	*Coverage*	*Generated*
AMSU-A	Level 1b from Metop Level 1b from NOAA	Geolocated radiances	< 1 K	47.3 km/ 30 pixels per scan, 52.69 km scan separation along track	2053 km	Global and continuous	EPS CGS
HIRS/4	Level 1b from Metop Level 1b from NOAA	Geolocated IR radiances and reflectivity for channel 20	< 1 K for IR channels	10.0 km/ 56 pixels per scan, 42.15 km scan separation along track	2161 km		
MHS	Level 1b from NOAA	Geolocated radiances	< 1 K	15.88 km / 90 pixels per scan, 17.56 km scan separation along track	2155 km		

Table 4-7: Summary of the main characteristics of ATOVS Level 1b products

Apart from the main geophysical parameters given for each pixel, navigation information per scan line and geolocation information for every pixel is given, as well as angular relations for every navigation point. Calibration data are also appended to the product for all channels.

In the case of the HIRS/4 Level 1b product, the percentage of clear sky as derived from the analysis of geolocated AVHRR/3 data is also included.

4.3.2 Quality information in the products

A number of quality flags are generated during the Level 1b processing, associated with individual scan lines. The following are the most relevant with respect to data use. A full list and detailed explanation of all flags is given in the record contents and format descriptions for the AMSU-A, HIRS/4 and MHS Level 1b products in Section 11, Section 12 and Section 13 respectively.

- Instrument degradation and/or processing degradation - Boolean flags reporting any possible degradation anywhere in the chain, from the instrument to the end of the processing.
- General quality indicator for a given scan, detecting cases such as gaps, instrument status changes, insufficient data for calibration, Earth location data not available, time sequence anomalies. This flag includes a recommendation to either use or not use the scan for further product generation, which is later used in the ATOVS and IASI Level 2 processors.
- The general quality indicator is complemented by a more detailed flag qualifying the reasons for the anomalies detected in the general quality indicator.
- Additionally, instrument telemetry is included in the product, so that in the event of instrument anomalies, they can be traced down to the instrument status detailed report.

- Calibration quality summary flag, summarising the IR channels calibration results. This is a bit flag, and all bits = 0 indicate a good calibration of the IR channels.
- For AMSU-A and MHS Level 1b, PRT measurements, as well as instrument temperatures used for the non-linear calibration correction, are also appended to every scan line. Lunar angles (angle between individual space views and the moon) used for the moon glint calibration correction are also included.
- A surface type flag (water, land or mixed) is also appended to every pixel for all instrument products.

4.4 Summary of ATOVS Level 1b product current and potential applications

The main internal use of the ATOVS Level 1b product is for further processing in the ATOVS and IASI Level 2 processors in the EPS CGS.

In particular, higher level products of direct application in meteorology and climatology are derived from ATOVS Level 1b, such as temperature and humidity profiles, cloud top temperature and pressure, effective cloud amount, total ozone column, cloud cover. Applications of those geophysical parameters are discussed in the *ATOVS Level 2 Product Guide*.

Direct applications of ATOVS Level 1b products consist of direct assimilation of radiances in NWP. In most major NWP centres, satellite data are introduced into the assimilation process, which is the first step in a forecast cycle. The satellite observations are used as radiances, i.e. directly after calibration, and not as derived parameters as temperature profiles or similar. In an assimilation system, a variable measured within a certain time window (cut-off window) is processed to correct a so-called background state (also called first guess), which is in most cases the result of a short-term forecast from the previous analysis step. The assimilation process provides a series of corrections of this background state closer to the observations, hence correcting the previous forecast trajectory in the phase space. See [RD 18] for more information).

The assimilation of satellite data is particularly different from the assimilation of “conventional” data. Measured quantities (radiances) are not related directly to model quantities. Hence model variables have to be adjusted within the processing to simulate the measurements as well as possible, i.e., there is the need for a radiative transfer model, or better, an observation operator to simulate the radiances from the model variables. Furthermore, the incoming data are difficult to use and may require the clearing from cloud effects and similar. Bias corrections need to be introduced before the assimilation process can start. A good knowledge of the error characteristics of the measurements is needed as well. Strict monitoring and quality control is required.

This advance in data assimilation techniques, alongside other improvements in the quality and range of satellite observations and our understanding of how to model them, has led to a situation where satellite measurements are a vital and integral part of the global observing system in all regions, not just those where other observations are sparse. ECMWF, the Met Office and Météo-France assimilate ATOVS radiances operationally in their models.

Assimilation of raw (cloud cleared) radiances, rather than higher level products, allows more accurate representation of the scanning geometry and of the impact of cloudiness, better quality control and faster usage of data.

5 DATA VIEWING AND READING

Readers for the native EPS format AMSU-A, HIRS and MHS Level 1b products are available online at the EUMETSAT website. Go to the **Data** menu item.

The products in HDF5 format can be read using standard HDF libraries. For more information on HDF5 formats in general, see the HDF5 webpages.

Software capable of reading the WMO formats is available from a variety of sources, including ECMWF.

6 ATOVS LEVEL 1B PRODUCT FORMATS AND DISSEMINATION

A description of the dissemination means for EPS products and formats is provided in the following paragraphs, focusing down on ATOVS Level 1b products and their formats.

6.1 EPS products available dissemination means

6.1.1 Satellite Direct Broadcast Service

Instrument and ancillary data acquired by the Metop satellites will be broadcast and received by authorised users in real time via:

- High Resolution Picture Transmission (HRPT) - transmission of data from all Metop instruments in full resolution;

The data will be received by local reception stations. It is the responsibility of the user to procure and install a local reception station.

The output format of the EUMETSAT HRPT Reference User Station is Level 0 products in the EPS Native format [RD 1], [RD 15].

The broadcast data are encrypted. To get authorisation to access the data, users need to register with the EUMETSAT User Services and will receive the data decryption information.

Data from the NOAA payload are also broadcast and received by local users via the HRPT mechanism. For details on the NOAA HRPT system, see the NOAA KLM User's Guide [RD 17].

6.1.2 EUMETCast

Global EPS products at different levels will be distributed in near-real time via EUMETSAT's Data Distribution System (EUMETCast). EUMETCast utilises the services of a satellite operator and telecommunications provider to distribute data files using Digital Video Broadcast (DVB) to a wide audience located within the geographical coverage zone which includes most of Europe and certain areas in Africa.

Within the current EUMETCast configuration, the multicast system is based upon a client/server system with the server side implemented at the EUMETCast uplink site (Usingen, Germany) and the client side installed on the individual EUMETCast reception stations. The telecommunications suppliers provide the DVB multicast distribution mechanism. Data/product files are transferred via a dedicated communications line from EUMETSAT to the uplink facility. These files are encoded and transmitted to a geostationary communications satellite for broadcast to user receiving stations. Each receiving station decodes the signal and recreates the data/products according to a defined directory and file name structure. A single reception station can receive any combination of the provided services.

A typical EUMETCast reception station comprises a standard PC with DVB card inserted and a satellite off-set antenna fitted with a digital universal V/H LNB. In addition, users require the multicast client software, which can be obtained via the EUMETSAT User Services.

More detailed information on this service can be found in the EUMETSAT webpage. See **Data/Meteosat Services**.

Products distributed on EUMETCast can be formatted in a variety of formats, including EPS native format and the WMO formats (BUFR and GRIB).

6.1.3 GTS/RMDCN

A subset of EPS products will be disseminated additionally in near-real time via the Global Telecommunication System (GTS). GTS is the World Meteorological Organization integrated network of point-to-point circuits, and multi-point circuits which interconnect meteorological telecommunication centres. Its purpose is to enable an efficient exchange of meteorological data and products in a timely and reliable way to meet the needs of World, Regional and National Meteorological Centres. The circuits of the GTS are composed of a combination of terrestrial and satellite telecommunication links. Meteorological Telecommunication Centres are responsible for receiving data and relaying them selectively on GTS circuits. The GTS is organised on a three-level basis, namely:

- The Main Telecommunication Network, linking together 3 World meteorological centres and 15 regional telecommunication hubs.
- The Regional Meteorological Telecommunication Networks, consisting of an integrated network of circuits interconnecting meteorological centres in a region, which are complemented by radio broadcasts where necessary. In Europe, the GTS network is supported by the Regional Meteorological Data Communication Network (RMDCN).
- The National Meteorological Telecommunication Networks, which extend the GTS network down to national level.

More detailed information on this service can be found on the WMO website www.wmo.int.

Products distributed on the GTS are in official WMO formats, namely BUFR or GRIB.

6.1.4 EUMETSAT Data Centre

All EPS products and auxiliary data are normally archived and made available to users from the EUMETSAT Data Centre (formerly known as the UMARF or Archive Services) upon request.

The Data Centre can be accessed through the EUMETSAT Data Centre. Access is through a Web interface, the Online Ordering Application, through which the users are able to browse and order products, manage their user profile, retrieve products, documentation and software libraries, get help, etc.

The Data Centre features include geographical and time sub-setting and image preview. EPS products archived in the Data Centre can be accessed in a variety of formats, including EPS native format and HDF5.

6.2 ATOVS products dissemination

Table 6-1 summarises the different dissemination means and formats for all ATOVS products available to users. ***Note:*** *Timeliness* refers to the elapsed time between sensing and dissemination.

Format	*Real-Time Direct Broadcast*	*Near-Real-Time dissemination on EUMETCast (timeliness)*	*Near-Real-Time dissemination on GTS (timeliness)*	*EUMETSAT Data Centre retrieval (timeliness)*
Metop-ATOVS raw data format	ATOVS HRPT data streams and Metop Admin message	--	--	--
NOAA-ATOVS raw data format	ATOVS HRPT data streams	--	--	--
EPS native format	--	--	--	ATOVS Level 0 and Level 1b from Metop and NOAA (8-9 h)
HDF5	--	--	--	ATOVS Level 0 and Level 1b from Metop and NOAA (8-9 h)
WMO (BUFR)	--	ATOVS Level 1b from Metop and NOAA (2 h 15 min)	ATOVS Level 1b product from Metop and NOAA (2 h 15 min)	

Table 6-1: Summary of dissemination means and formats for ATOVS Level 0 and Level 1 products

Real-time broadcast of ATOVS raw data is not covered in this guide. It is noted though for information that the raw data streams mentioned in the table above indicate what is broadcast by the platform. Depending on the reception system used (i.e., the HRPT local reception system), different formats of this raw data stream are produced. This depends on the local reception station provider. For Metop HRPT stations, the Reference User Station has been developed to produce EPS Native Level 0 format products.

Although available through the EUMETSAT Data Centre, ATOVS Level 0 products are not considered an end-user product, hence they are not addressed in this guide either.

6.2.1 Near-real-time dissemination

The ATOVS Level 1b products disseminated to users in near-real time are:

- AMSU-A, HIRS/4 and MHS Level 1b BUFR products from Metop with a timeliness of 2 hours 15 minutes from sensing on GTS and EUMETCast
- AMSU-A, HIRS/4 and MHS Level 1b BUFR products from NOAA with a timeliness of 2 hours 15 minutes from sensing on GTS and EUMETCast

The dissemination granularity of the data is three minutes.

6.2.2 Archive retrieval

The ATOVS Level 1b products available from the EUMETSAT Data Centre via the Online Ordering Application are:

- AMSU-A, HIRS/4 and MHS Level 1b products from Metop in EPS native format or HDF5
- AMSU-A, HIRS/4 and MHS Level 1b products from NOAA in EPS native format or HDF5

The products are archived as full-dump products, but sub-setting capabilities are provided to the user in the retrieval step. The products are available for the users in the EUMETSAT Data Centre 8 to 9 hours after sensing.

6.3 ATOVS EPS native product formats

6.3.1 The EPS native formats

6.3.1.1 General overview of the EPS generic product format

All products in EPS native format are structured and defined according to an EPS Generic Product Format. This format is not ATOVS specific. The general product section breakdown is given, and the following sections will focus on how this generic format is further applied to ATOVS products.

This description is not aimed at supporting the writing of reader software for the ATOVS or other EPS products, because readers and product extraction tools are already available. See Section 5. The intention of this and the following sections is to provide enough information to be able to use such available tools and to interpret the retrieved information.

For users interested in writing their own product readers for one or several ATOVS products in EPS native format, we refer them to the detailed format specifications provided in [RD 1] and [RD 2].

The general structure of the products is broken down in sections, which contain one or more records of different classes. Every single record is accompanied by a Generic Record Header (GRH), which contains the metadata necessary to uniquely identify the record type and occurrence within the product. The following general structure is followed by all EPS products, where all the sections occur always in the given order.

Header Section, containing metadata applicable to the entire product. The header section may contain two records, the Main Product Header Record (MPHR) and the Secondary Product Header Record (SPHR). This is the only section that contains ASCII records; the rest of the product is in binary.

Pointer Section, containing pointer information to navigate within the product. It consists of a series of Internal Pointer Records (IPR), which include pointers to records within the Global Auxiliary Data, Variable Auxiliary Data and Body Sections that follow.

Global Auxiliary Data Section, containing information on the auxiliary data that have been used or produced during the process of the product and applies to the whole length of the product. There can be zero or more records in this section, and they can be of two classes: Global External Auxiliary Data Record (GEADR), containing an ASCII pointer to the source of the auxiliary data used, and Global Internal Auxiliary Data Record (GIADR), containing the auxiliary data used itself.

Variable Auxiliary Data Section, containing information on the auxiliary data that have been used or produced during the process of the product and may vary within a product, but with a frequency in

any case less than the measurement data itself. There can be zero or more records in this section, and they can be of two classes: Variable External Auxiliary Data Record (VEADR), containing an ASCII pointer to the source of the auxiliary data used, and Variable Internal Auxiliary Data Record (VIADR), containing the auxiliary data used itself.

Body Section, which is usually the main bulk of the product and contains the raw or processed instrument data and associated information. This section contains time-ordered Measurement Data Records (MDR). A particular type of MDR can occur to indicate the location of an unexpected data gap within any product, the Dummy Measurement Data Record (DMDR).

The format of the MPHR, IPRs, GEADR, VEADR and DMDRs is common to all products, while the other records can be of different formats and contents, and identified as of different sub-classes for different products. Every record consists of a series of fields, which can have different data types. See Appendix C for all possible data types.

It is important to note that GEADR and VEADR records are included in the products to support processing configuration control for EUMETSAT at product level. They point to the name of auxiliary data files used in the processing, but they are not of any interest or use to the end-user for the utilisation of the products.

Two types of records deserve special description, because they are key to navigating within the products, namely the GRH and the IPR. Their format and the meaning of their fields are detailed in Appendix D. In particular, IPRs can be used to skip through VEADRs and GEADRs and get to the measurement data of interest to the user.

Table 6-2 gives an example of the general structure of the Generic Product Format.

Section	*RECORD CLASS*	*RECORD SUBCLASS*	*START TIME*	*STOP TIME*
HEADER SECTION	MAIN PRODUCT HEADER RECORD		T1	T6
	SECONDARY PRODUCT HEADER RECORD		T1	T6
INTERNAL POINTER SECTION	INTERNAL POINTER RECORD (GEADR Subclass A)		T1	T6
	INTERNAL POINTER RECORD (GEADR Subclass B)		T1	T6
	INTERNAL POINTER RECORD (GIADR Subclass A)		T1	T6
	INTERNAL POINTER RECORD (GIADR Subclass B)		T1	T6
	INTERNAL POINTER RECORD (GIADR Subclass C)		T1	T6
	INTERNAL POINTER RECORD (VEADR Subclass A)		T1	T6
	INTERNAL POINTER RECORD (VEADR Subclass B)		T1	T6
	INTERNAL POINTER RECORD (VEADR Subclass C)		T1	T6
	INTERNAL POINTER RECORD (VIADR Subclass A)		T1	T6
	INTERNAL POINTER RECORD (VIADR Subclass B)		T1	T6
	INTERNAL POINTER RECORD (VIADR Subclass C)		T1	T6
	INTERNAL POINTER RECORD (MDR Subclass A)		T1	T6
	INTERNAL POINTER RECORD (MDR Subclass B)		T1	T6
	INTERNAL POINTER RECORD (MDR DUMMY)		T1	T6
	INTERNAL POINTER RECORD (MDR Subclass A)		T1	T6
	INTERNAL POINTER RECORD (MDR Subclass B)		T1	T6
GLOBAL	GLOBAL INTERNAL AUXILIARY DATA RECORD	SUBCLASS A	T1	T6

Section	*RECORD CLASS*	*RECORD SUBCLASS*	*START TIME*	*STOP TIME*
AUXILIARY DATA SECTION	GLOBAL INTERNAL AUXILIARY DATA RECORD	SUBCLASS B	T1	T6
	GLOBAL INTERNAL AUXILIARY DATA RECORD	SUBCLASS A	T1	T6
	GLOBAL INTERNAL AUXILIARY DATA RECORD	SUBCLASS B	T1	T6
	GLOBAL INTERNAL AUXILIARY DATA RECORD	SUBCLASS C	T1	T6
VARIABLE AUXILIARY DATA SECTION	VARIABLE INTERNAL AUXILIARY DATA RECORD	SUBCLASS A	T1	T6
	VARIABLE INTERNAL AUXILIARY DATA RECORD	SUBCLASS B	T1	T3
	VARIABLE INTERNAL AUXILIARY DATA RECORD	SUBCLASS B	T3	T6
	VARIABLE INTERNAL AUXILIARY DATA RECORD	SUBCLASS C	T1	T5
	VARIABLE INTERNAL AUXILIARY DATA RECORD	SUBCLASS C	T5	T6
	VARIABLE INTERNAL AUXILIARY DATA RECORD	SUBCLASS A	T1	T2
	VARIABLE INTERNAL AUXILIARY DATA RECORD	SUBCLASS A	T2	T4
	VARIABLE INTERNAL AUXILIARY DATA RECORD	SUBCLASS A	T4	T6
	VARIABLE INTERNAL AUXILIARY DATA RECORD	SUBCLASS B	T1	T6
	VARIABLE INTERNAL AUXILIARY DATA RECORD	SUBCLASS C	T1	T6
BODY SECTION	MEASUREMENT DATA RECORD	SUBCLASS A	T1	T2
	MEASUREMENT DATA RECORD	SUBCLASS B	T2	T3
	MEASUREMENT DATA RECORD	DUMMY	T3	T4
	MEASUREMENT DATA RECORD	SUBCLASS A	T4	T5
	MEASUREMENT DATA RECORD	SUBCLASS B	T5	T6

Table 6-2: Generalised schematic of the generic product format

6.3.1.2 Granularity of the EPS products

The Full EPS product is produced by processing a dump of data. This is the product size used to archive in the EUMETSAT Data Centre.

In addition, the Regional EPS product is a full product that has been passed through a geographical filter. This may happen, for example, during the retrieval of the product from the Data Centre.

Finally, a Product Dissemination Unit (PDU) is the near-real-time dissemination of the full product, and it is typically of 3 minutes. A PDU is often referred to as product 'granule'.

The EPS Generic Product Format has been defined to apply to any length of sensing. That means that the same generic format described above applies to a 3-minute duration granule, half an orbit or a full dump of data. The length in time of the product is contained in the MPHR.

6.3.1.3 Product format version control

Every record class and sub-class has an associated record version number contained in its corresponding GRH. In addition, each product has a format version number, which is stored in the MPHR.

6.3.1.4 Product naming convention

File naming convention for EPS products in EPS native format provides a product name that uniquely identifies any product and provides a summary of its contents. The field contents in a product name correspond to those in the MPHR.

<INSTRUMENT_ID>_
<PRODUCT_TYPE>_
<PROCESSING_LEVEL>_
<SPACECRAFT_ID>_
<SENSING_START>_
<SENSING_END>_
<PROCESSING_MODE>_
<DISPOSITION_MODE>_
<PROCESSING_ TIME>

Product Name Field / MPHR Field	*Description*	*Size in Characters*
INSTRUMENT_ID	Instrument identification	4
PRODUCT_TYPE	Product Type	3
PROCESSING_LEVEL	Processing Level Identification	2
SPACECRAFT_IUD	Spacecraft identification	3
SENSING_START	UTC Time of start of Sensing Data	15
SENSING_END	UTC Time of end of Sensing Data	15
PROCESSING_MODE	Identification of the mode of processing	1
DISPOSITION_MODE	Identification of the type of processing	1
PROCESSING_TIME	UTC time at start of processing for the product	15

Table 6-3: EPS product name fields and their correspondence with MPHR fields

For the ATOVS Level 1b products, the resulting product file names are as follows:

Product	*Product name*
AMSU-A Level L1b from Metop	AMSA_xxx_1B_Mnn_< ...>
AMSU-A Level L1b from NOAA	AMSA_xx_1B_Nnn_< ...>
HIRS/4 Level L1b from Metop	HIRS_xxx_1B_Mnn_< ...>
HIRS/4 Level L1b from NOAA	HIRS_xxx_1B_Nnn_< ...>
MHS Level L1b from Metop	MHSx_xxx_1B_Mnn_< ...>
MHS Level L1b from NOAA	MHSx_xxx_1B_Nnn_< ...>

Table 6-4: Generic ATOVS Level 1b product names

6.3.2 The AMSU-A Level 1b product format

Records to be found in the AMSU-A Level 1b product are as follows:

Record Name	*Description*	*Usage*	*Subclass ID*
MPHR	Main Product Header Record	Main product identification details	0
Necessary IPRs	Internal Product Record Pointers	Necessary to access directly different records in the product	1, 2, ...
GEADRs	Pointers to global auxiliary data file names used in the processing	Not relevant for end-user	not available
GIADR-ADCONV	Analogue to digital conversion coefficients	Not relevant for end-user	2
MDR-1B	Same record format for products from Metop and NOAA	Level 1b main product contents (see below for more details)	2

Table 6-5: Record types in AMSU-A Level 1b product

These products are organised as successive lines of pixels along track, referenced by the orbit time that corresponds to that line of pixels. The START/STOP times indicated in the MPHR and the corresponding VIADRs are also referenced with respect to that time.

Each MDR contains data corresponding to one scan line of pixels. Pixels in one scan line are given in the direction of scanning: left to right (e.g., West to East for Northbound satellite direction). Data included in each MDR are of several types:

- Measurement data, including 15 calibrated radiances, for all 30 pixels in that line, together with a quality flag associated with that line of calculated radiances.
- Navigation data corresponding to that line and geolocation of every pixel. For every pixel, surface type based on a high-resolution land mask and terrain elevation is also given.
- Calibration coefficients (slope, intercept and quadratic term coefficient) used for all pixels in that scan line, for each one of the 15 channels. Two sets of coefficients are given, corresponding to a Primary and a Secondary calibration. Those used operationally are the Primary calibration coefficients. The Secondary calibration coefficients are only used if no in-flight calibration can be carried out, in which case the product is flagged by setting up the corresponding flag in the field QUALITY_INDICATOR.
- Moon glint calibration data used.
- Generic and specific quality information associated with each MDR. In particular, the flag QUALITY_INDICATOR includes a recommendation to use or not use the corresponding measurements line for further processing. A full list of quality flags and their meaning can be found in Section 11: Record Description of the AMSU-A Level 1b Product.

The number of pixels in an AMSU-A Level 1b product MDR is 30. The swath is continuous and no interruptions are expected in nominal operation.

To summarise, the occurrence of the different records in the AMSU-A Level 1b products is as follows:

Record	*Occurrence*
MPHR	Once per product
IPRs	Once each per product
GEADRs	Once each per product
GIADR-ADCONV	Once per product
MDR-1B	Once every instrument scan line

Table 6-6: Occurrence of records in AMSU-A Level 1b product

See Section 11 for more details on the contents and format of the AMSU-A Level 1b products.

6.3.3 The HIRS/4 Level 1b product format

Records to be found in the HIRS/4 Level 1b product are as listed in Table 6-7:

Record Name	*Description*	*Usage*	*Subclass ID*
MPHR	Main Product Header Record	Main product identification details	0
Necessary IPRs	Internal Product Record Pointers	Necessary to access directly different records in the product	1, 2, ...
GEADRs	Pointers to global auxiliary data file names used in the processing	Not relevant for end-user	not available
GIADR-TEMP	Temperature-radiance conversion factors	Not relevant for end-user	1
GIADR-ANALOG	Analogue telemetry conversion coefficients	Not relevant for end-user	2
MDR-1B	Same record format for products from Metop and NOAA	Level 1b main product contents (see below for more details)	2

Table 6-7: Record types in HIRS/4 Level 1b product

These products are organised as successive scan lines of pixels along track, referenced by the orbit time that corresponds to that line of pixels. The START/STOP times indicated in the MPHR and the corresponding VIADRs are also referenced with respect to that time.

Each MDR contains data corresponding to one scan line of pixels. Pixels in one scan line are given in the direction of scanning: left to right (e.g., West to East for Northbound satellite direction). The number of pixels in an HIRS/4 Level 1b product is 56 and there is one line of pixels for every scan line.

All scans are included in the product, and they may be of different types: Earth view, space view, warm black body view and cold black body view (the latter not likely to appear in the nominal operations scan sequence).

Data included in each MDR are of several types:

- Scan line information, including type of scan, counter of a measurement scan within a cycle.
- Measurement data, including 19 calibrated radiances and 1 reflectance factor for all 56 pixels in that line, together with a quality flag associated with that line of calculated radiances.
- Navigation data corresponding to that line and geolocation of every pixel. For every pixel, surface type based on a high-resolution land mask and terrain elevation is also given.
- Calibration coefficients (slope, intercept and quadratic term coefficient) to be used for all pixels in that scan line, for each one of the 20 channels. Two sets of coefficients are given, corresponding to a Primary and a Secondary calibration. Those used operationally are the Primary calibration coefficients. The Secondary calibration coefficients are only used if no in-flight calibration can be carried out, in which case the product is flagged by setting up the corresponding flag in the field QUALITY_INDICATOR.
- Cloud coverage information for every pixel, containing the percentage of clear sky based on the analysis of collocated AVHRR/3 data.
- Generic and specific quality information associated with each MDR. In particular, the flag QUALITY_INDICATOR includes a recommendation to use or not use the corresponding measurements line for further processing. A full list of quality flags and their meaning can be found in Section 12.

The number of pixels in an HIRS/4 Level 1b product MDR is 56.

To summarise, the occurrence of the different records in the HIRS/4 Level 1b products is as follows:

Record	*Occurrence*
MPHR	Once per product
IPRs	Once each per product
GEADRs	Once each per product
GIADR-TEMP	Once per product
GIADR-ANALOG	Once per product
MDR-1B	Once every instrument scan line

Table 6-8: Occurrence of records in HIRS/4 Level 1b product

See Section 12 for more details on the contents and format of the HIRS/4 Level 1b products.

6.3.4 The MHS Level 1b product format

Records to be found in the MHS Level 1b product are as listed in Table 6-9:

Record Name	*Description*	*Usage*	*Subclass ID*
MPHR	Main Product Header Record	Main product identification details	0
Necessary IPRs	Internal Product Record Pointers	Necessary to access directly different records in the product	1, 2, ...
GEADRs	Pointers to global auxiliary data file names used in the processing.	Not relevant for end-user	not available

Record Name	*Description*	*Usage*	*Subclass ID*
GIADR-NAVIGATION	Earth view telemetry	Not relevant for end-user	1
GIADR-RADIANCES	Radiance conversion telemetry	Not relevant for end-user	2
GIADR-ADCONV	Conversion coefficients for the digital telemetry	Not relevant for end-user	3
MDR-1B	Same record format for products from Metop and NOAA	Level 1b main product contents (see below for more details)	2

Table 6-9: Record types in MHS Level 1b product

Note: A full list of GEADRs for MHS Level 1b product is not available. IPRs as found in the products can be used to skip over GEADRs, as those records do not contain any information relevant for the end-user.

These products are organised as successive scan lines of pixels along track, referenced by the orbit time that corresponds to that line of pixels. The START/STOP times indicated in the MPHR and the corresponding VIADRs are also referenced with respect to that time.

Each MDR contains data corresponding to one scan line of pixels. Pixels in one scan line are given in the direction of scanning: left to right (e.g., West to East for Northbound satellite direction). Data included in each MDR are of several types:

- Measurement data, including five calibrated radiances, for all 90 pixels in that line, together with a quality flag associated with that line of calculated radiances.
- Navigation data corresponding to that line and geolocation of every pixel. For every pixel, surface type based on a high-resolution land mask and terrain elevation is also given.
- Calibration coefficients (slope, intercept and quadratic term coefficient) to be used for all pixels in that scan line, for each one of the five channels. Two sets of coefficients are given, corresponding to a Primary and a Secondary calibration. Those used operationally are the Primary calibration coefficients. The Secondary calibration coefficients are only used if no in-flight calibration can be carried out, in which case the product is flagged by setting up the corresponding flag in the field QUALITY_INDICATOR.
- Moon glint calibration data used.
- Generic and specific quality information associated with each MDR. In particular, the flag QUALITY_INDICATOR includes a recommendation to use or not use the corresponding measurements line for further processing. A full list of quality flags and their meaning can be found in Section 13.
- Specific position validity flags (pointing).

The number of pixels in an MHS Level 1b product MDR is 90. The swath is continuous and no interruptions are expected in nominal operation.

To summarise, the occurrence of the different records in the MHS Level 1b products is listed in Table 6-10:

Record	*Occurrence*
MPHR	Once per product
IPRs	Once each per product
GEADRs	Once each per product
GIADR-NAVIGATION	Once each per product
GIADR-RADIANCES	Once each per product
GIADR-ADCONV	Once per product
MDR-1B	Once every instrument scan line

Table 6-10: Occurrence of records in MHS Level 1b product

See Section 13 for more details on the contents and format of the MHS Level 1b products.

6.3.5 Deriving brightness temperatures

To get the radiances in m W m^{-2} sr^{-1} cm from the array 'SCENE_RADIANCE' (for AMSU-A and MHS) or RAD_DATA (for HIRS) in the MDR, the values have to be divided by 10^7.

Brightness temperatures can be computed from radiances according to the following equations:

$$T^* = \frac{C_2 \cdot \gamma}{\ln\left(1 + \frac{C_1 \cdot \gamma^3}{R}\right)}$$

$$T = A + B \cdot T^*$$

Equation 1

where:

R	= radiance as decoded from the product ($mW/(m^2.sr.cm^{-1})$)
T*	= the brightness temperature (K)
T	= corrected brightness temperatures (K)
C1 (constant)	= $1.191062.10^{-5}$ ($mW/(m^2.sr.cm^{-4})$)
C2 (constant)	= 1.4387863 (K/cm^{-1})
γ	= the channel central wave number (cm^{-1})
A and B	are linear correction coefficients
ln	is the natural logarithm function

For the instruments, these coefficients can be found in Appendix A. Linear coefficients for the MHS instruments are in Appendix B. For other instruments (AVHRR, HIRS) contact the EUMETSAT help desk.

They may also be available in the product as listed in the table below.

Parameter	*Location in product*
HIRS : GIADR_RADIANCE	
γ	TEMPERATURE_RADIANCE_CENTRAL_WAVENUMBER
A	TEMPERATURE_RADIANCE_CONSTANTB
B	TEMPERATURE_RADIANCE_CONSTANTC
MHS : GIADR_RADIANCE	
γ	CENTRAL_WAVENUMBER_H{1,2,3,4,5}
A	TEMPERATURE_H{1,2,3,4,5}_INTERCEPT
B	TEMPERATURE_H{1,2,3,4,5}_SLOPE

Table 6-11: Location of coefficients for radiance-temperature conversion

6.4 The HDF format

The contents and formats of the individual fields of the ATOVS Level 1b HDF5 products are the same as for the EPS native format. The organisation of the data is different. Typically, the EPS native format presents each scan and corresponding parameters as one complete sequence, stored in a Measurement Data Record (MDR), which is successively repeated until the whole swath is completed. In conversion to HDF5 the measurement values and associated parameters are grouped into separate arrays.

Detailed format descriptions are provided in [RD 11]. The products retrieved from the EUMETSAT Data Centre have the same name as the original EPS formatted ones, with the extension appended: *h5* for HDF5 formatted products, and *.nat* for products in the native EPS format. The products can be read using standard HDF libraries. See the HDF5 webpages for more information on HDF5 formats.

6.5 The WMO formats

The ATOVS Level 1b products available in WMO (BUFR) format are summarised in Table 6-12.

Product	*Bulletin header*	*Originating station*	*Descriptor sequence*
AMSU-A Level 1b	IEAXii (ii from 01 to 89)	EUMP	3-10-009
HIRS Level 1b	IEHXii (ii from 01 to 89)	EUMP	3-10-008
MHS Level 1	IEMXii (ii from 01 to 89)	EUMP	3-10-010

Table 6-12: ATOVS Level 1b products available in WMO (BUFR) format

The full format description of these products is available in the WMO Manual on Codes. The names of the ATOVS Level 1b products distributed on EUMETCast are specified in [*RD 13*]. They follow the pattern:

<instrument>_yyyymmdd_hhmmss_metopa_nnnnn_eps_o.l1_bufr

where:

nnnnn	is the orbit number
instrument	is *amsua*, *hirs* or *mhs*
yyyymmdd	stands for the UTC year, month, day of the data start sensing time
hhmmss	stands for the UTC hour, minute, second of the data start sensing time

7 ATOVS LEVEL 1 PRODUCT PROCESSING ALGORITHMS

The data calibration and retrieval algorithms are documented in the Product Generation Specification (PGS) documents [RD 3], [RD 5], [RD 7]. The operational processing algorithms for Level 1a are summarised below.

7.1 AMSU-A Level 1a processing details

7.1.1 Radiance computation

1) Like the AVHRR IR channels, AMSU-A is calibrated by viewing on-board calibration targets and cold space to determine **gains** and **offsets** for each channel.

2) Then, a number of corrections are applied:

- A **detector non-linearity** correction is applied to the measured signals based upon pre-flight measurements of the instrument response, and the actual instrument temperature.
- A **warm bias** correction is also added to the measured calibration target temperature for all 15 AMSU-A channels. This is based upon pre-flight measurements of the difference between its effective radiating temperature and its measured temperature. It is a function of instrument temperature and the phase-locked loop oscillator (PLLO). It corrects for contamination by radiation originating from the enclosure of the black body target, which is influenced by the spacecraft temperature and the Earth limb radiance.
  - In the case of channels 9 – 14, there is a primary and a secondary phase-locked loop oscillator (PLLO # 1 and PLLO # 2, respectively). Therefore there are two different values of the warm bias correction for these channels.
- The **cold bias** correction linearly shifts temperature to produce a space-view value consistent with the known radiative background. It corrects for contamination of the measured background radiation by radiation originating from the spacecraft and the Earth limb when viewing space.
- A **limb adjustment** is applied to the brightness temperatures provided to AVHRR. Reported Level 1 radiances and ATOVS Level 2 products are based upon non-limb-corrected data.
  - It is applied to the AMSU-A data used for the total column water vapour content determination over sea, that is then analysed in the cloud detection routine. The correction is based partially upon the cosine of the satellite viewing angle. More details can be found in Section 5.2.2 of the AMSU-A PGS [RD 3].
  - The AMSU-A stand-alone retrieval uses the same limb correction as for AVHRR cloud detection.
- An **antenna efficiency** correction is also applied to the radiances.
- A **lunar intrusion** correction is applied. A model is implemented of the relative position of the moon with respect to the field of view. Cold space counts are ignored when the moon lies within a certain angular range; temporally interpolated cold space counts from non-contaminated scenes are employed in their stead. See Section 5.1.2.32 of [RD 3] for details.

7.1.2 Geolocation

Geolocation is calculated separately for each pixel, on the assumption of nominal scanning properties and knowledge of the satellite's position.

7.2 MHS Level 1a processing details

7.2.1 Radiance computation

- Radiance calibration involves corrections for detector non-linearity, warm bias, cold bias and lunar intrusion, as for AMSU-A.
- An antenna efficiency correction is applied since the deployment of PPF v4.0.
- Provision has also been made for possible scan-dependent limb corrections, but currently these will not be applied.
- The PRT count-to-resistance conversion is carried out based upon three constant (reference) resistors that are measured as well as the PRTs.

7.2.2 Geolocation

Geolocation is calculated separately for each pixel.

7.3 HIRS Level 1a processing details

7.3.1 Radiance calibration

Radiance calibration is channel dependent:

1) For the **IR channels** (1-19):

- For **gain** and **offset** determination:
  - The **cold space** signal is averaged over 48 of the 56 samples comprising one scan line. The first eight samples are unusable since the measured radiance is still contaminated.
  - All 56 samples from viewing the **warm target** are used.
  - Samples falling out of the "**3σ**" interval of the set of measurements are not used.
- A **non-linearity** correction is applied when converting counts into radiances. This correction is based upon pre-launch measurements.
  - In practice, NOAA does not apply any non-linearity correction to their HIRS data, and EUMETSAT may not exercise this option either. However, provision has been made in the operational processor to implement such a correction if eventually deemed necessary.
- **Calibration coefficients** are interpolated between calibration events to the specific Earth scan line.

2) **Visible channel** radiance calibration (channel 20) is based upon pre-launch measurements, is linear as a function of counts, and will be updated in-orbit based upon opportunistic measurements (e.g. using desert scenes).

7.3.2 Cloud coverage

Cloud coverage for HIRS (and for the Level 2 product) is determined based upon AVHRR scenes analysis within the HIRS field of view (FOV) ellipses. AVHRR data is mapped onto the HIRS FOV to determine the fraction of cloudy scenes.

7.3.3 Geolocation

Geolocation is calculated separately for each pixel.

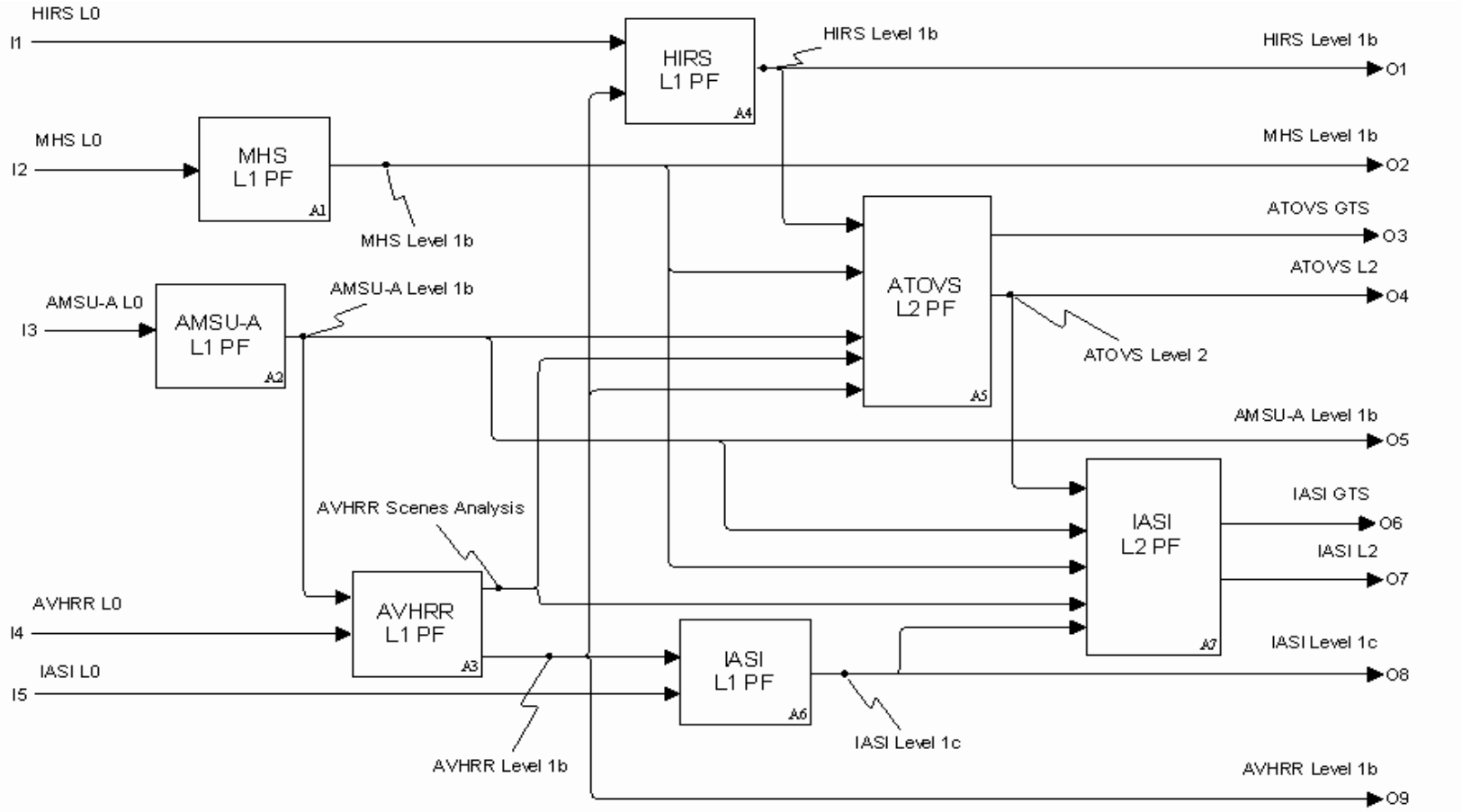
8 ATOVS LEVEL 1B PRODUCTS VALIDATION

Please refer to [RD 8] for a detailed description of planned Calibration and Validation activities and methods.

9 ATOVS LEVEL 1B PRODUCTS ROUTINE MONITORING

Please refer to [RD 9] for a detailed description of relevant periodical product quality reports during operations, their contents and explanation as well as planned routine monitoring activities and methods.

10 ATOVS, IASI AND AVHRR PROCESSING CHAIN INTER-DEPENDENCIES



11 RECORD DESCRIPTION OF THE AMSU-A LEVEL 1B PRODUCT

This AMSU-A 1b description corresponds to the AMSU-A PFS [RD 2] Issue v7E and the Generic PFS [RD 1] Issue v8E**.**

In the tables below, coloured items have the following meanings:

Compound data type, which consists of at least two basic or other compound data types. The name of the compound data type is shown first, followed by a list of the items contained within it.

Dimension parameter for variable product fields.

Summary of Product Format Version record contents history:

	PFV = 10.0	**PFV = 11.0**
Record name	***Record version***	***Record version***
mphr	2	2
giadr-adconv	3	3
mdr-1b	3	4

If more than one version of a record exists, all versions are described below.

Contents:

Certain record types with formats common to all products (IPR, DMDR, GEADR, VEADR) are not included below, since they are not relevant to the average user. If required, details of these records can be found in the Generic PFS [RD 1].

11.1 MPHR (name 'mphr', class 1, subclass 0, version 2)

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
RECORD_HEADER	Generic Record Header			1	1	1	1	REC_HEAD	20	20	0
Product Details											
PRODUCT_NAME	Complete name of the product			1	1	1	1	string	67	100	20
PARENT_PRODUCT_NAME_1	Name of the parent product from which this product has been produced. For Level 0 products, this field is filled with lower case x's.			1	1	1	1	string	67	100	120
PARENT_PRODUCT_NAME_2	Name of the parent product from which this product has been produced. For Level 0 products or products for which this is not appropriate, this field is filled with lower case x's.			1	1	1	1	string	67	100	220
PARENT_PRODUCT_NAME_3	Name of the parent product from which this product has been produced. For Level 0 products or products for which this is not appropriate, this field is filled with lower case x's.			1	1	1	1	string	67	100	320
PARENT_PRODUCT_NAME_4	Name of the parent product from which this product has been produced. For Level 0 products or products for which this is not appropriate, this field is filled with lower case x's.			1	1	1	1	string	67	100	420
INSTRUMENT_ID	Instrument identification			1	1	1	1	enumerated	4	37	520
INSTRUMENT_MODEL	Instrument Model identification			1	1	1	1	enumerated	3	36	557
PRODUCT_TYPE	Product Type			1	1	1	1	enumerated	3	36	593
PROCESSING_LEVEL	Processing Level Identification			1	1	1	1	enumerated	2	35	629
SPACECRAFT_ID	Spacecraft identification			1	1	1	1	enumerated	3	36	664
SENSING_START	UTC Time of start of sensing data in this object (PDU, ROI or Full Product)			1	1	1	1	time	15	48	700
SENSING_END	UTC Time of end of sensing data in this object (PDU, ROI or Full Product)			1	1	1	1	time	15	48	748

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
SENSING_START_THEORETICAL	Theoretical UTC Time of start of sensing data in the dump from which this object is derived. This data is the predicted start time at the MPF level.			1	1	1	1	time	15	48	796
SENSING_END_THEORETICAL	Theoretical UTC Time of end of sensing data in the dump from which this object is derived. This data is the predicted end time at the MPF level.			1	1	1	1	time	15	48	844
PROCESSING_CENTRE	Processing Centre Identification			1	1	1	1	enumerated	4	37	892
PROCESSOR_MAJOR_VERSION	Processing chain major version number			1	1	1	1	uinteger	5	38	929
PROCESSOR_MINOR_VERSION	Processing chain minor version number			1	1	1	1	uinteger	5	38	967
FORMAT_MAJOR_VERSION	Dataset Format Major Version number			1	1	1	1	uinteger	5	38	1005
FORMAT_MINOR_VERSION	Dataset Format Minor Version number			1	1	1	1	uinteger	5	38	1043
PROCESSING_TIME_START	UTC time of the processing at start of processing for the product			1	1	1	1	time	15	48	1081
PROCESSING_TIME_END	UTC time of the processing at end of processing for the product			1	1	1	1	time	15	48	1129
PROCESSING_MODE	Identification of the mode of processing			1	1	1	1	enumerated	1	34	1177
DISPOSITION_MODE	Identification of the disposition mode			1	1	1	1	enumerated	1	34	1211
RECEIVING_GROUND_STATION	Acquisition Station Identification			1	1	1	1	enumerated	3	36	1245
RECEIVE_TIME_START	UTC time of the reception at CDA for first Data Item			1	1	1	1	time	15	48	1281
RECEIVE_TIME_END	UTC time of the reception at CDA for last Data Item			1	1	1	1	time	15	48	1329
ORBIT_START	Start Orbit Number, counted incrementally since launch			1	1	1	1	uinteger	5	38	1377
ORBIT_END	Stop Orbit Number			1	1	1	1	uinteger	5	38	1415
ACTUAL_PRODUCT_SIZE	Size of the complete product		bytes	1	1	1	1	uinteger	11	44	1453
ASCENDING NODE ORBIT PARAMETERS											
STATE_VECTOR_TIME	Epoch time (in UTC) of the orbital elements and the orbit state vector. this corresponds to the time of crossing the ascending node for ORBIT_START		UTC	1	1	1	1	longtime	18	51	1497

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
SEMI_MAJOR_AXIS	Semi major axis of orbit at time of the ascending node crossing.		mm	1	1	1	1	integer	11	44	1548
ECCENTRICITY	Orbit eccentricity at time of the ascending node crossing	10^6		1	1	1	1	integer	11	44	1592
INCLINATION	Orbit inclination at time of the ascending node crossing	10^3	degree	1	1	1	1	integer	11	44	1636
PERIGEE_ARGUMENT	Argument of perigee at time of the ascending node crossing	10^3	degree	1	1	1	1	integer	11	44	1680
RIGHT_ASCENSION	Right ascension at time of the ascending node crossing	10^3	degree	1	1	1	1	integer	11	44	1724
MEAN_ANOMALY	Mean anomaly at time of the ascending node crossing	10^3	degree	1	1	1	1	integer	11	44	1768
X_POSITION	X position of the orbit state vector in the orbit frame at ascending node	10^3	m	1	1	1	1	integer	11	44	1812
Y_POSITION	Y position of the orbit state vector in the orbit frame at ascending node	10^3	m	1	1	1	1	integer	11	44	1856
Z_POSITION	Z position of the orbit state vector in the orbit frame at ascending node	10^3	m	1	1	1	1	integer	11	44	1900
X_VELOCITY	X velocity of the orbit state vector in the orbit frame at ascending node	10^3	m/s	1	1	1	1	integer	11	44	1944
Y_VELOCITY	Y velocity of the orbit state vector in the orbit frame at ascending node	10^3	m/s	1	1	1	1	integer	11	44	1988
Z_VELOCITY	Z velocity of the orbit state vector in the orbit frame at ascending node	10^3	m/s	1	1	1	1	integer	11	44	2032
EARTH_SUN_DISTANCE_RATIO	Earth-Sun distance ratio - ratio of current Earth-Sun distance to Mean Earth-Sun distance			1	1	1	1	integer	11	44	2076
LOCATION_TOLERANCE_RADIAL	Nadir Earth location tolerance radial		m	1	1	1	1	integer	11	44	2120
LOCATION_TOLERANCE_CROSSTRACK	Nadir Earth location tolerance cross-track		m	1	1	1	1	integer	11	44	2164
LOCATION_TOLERANCE_ALONGTRACK	Nadir Earth location tolerance along-track		m	1	1	1	1	integer	11	44	2208
YAW_ERROR	Constant Yaw attitude error	10^3	degree	1	1	1	1	integer	11	44	2252
ROLL_ERROR	Constant Roll attitude error	10^3	degree	1	1	1	1	integer	11	44	2296
PITCH_ERROR	Constant Pitch attitude error	10^3	degree	1	1	1	1	integer	11	44	2340

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
LOCATION SUMMARY											
SUBSAT_LATITUDE_START	Latitude of sub-satellite point at start of the data set	10^3	Degree	1	1	1	1	integer	11	44	2384
SUBSAT_LONGITUDE_START	Longitude of sub-satellite point at start of the data set	10^3	Degree	1	1	1	1	integer	11	44	2428
SUBSAT_LATITUDE_END	Latitude of sub-satellite point at end of the data set	10^3	Degree	1	1	1	1	integer	11	44	2472
SUBSAT_LONGITUDE_END	Longitude of sub-satellite point at end of the data set	10^3	Degree	1	1	1	1	integer	11	44	2516
Leap Second Information											
LEAP_SECOND	Occurrence of Leap second within the product. Field is set to -1, 0 or +1 dependent upon occurrence of leap second and direction.			1	1	1	1	integer	2	35	2560
LEAP_SECOND_UTC	UTC time of occurrence of the Leap Second (If no leap second in the product, value is null)			1	1	1	1	time	15	48	2595
Record counts											
TOTAL_RECORDS	Total count of all records in the product			1	1	1	1	uinteger	6	39	2643
TOTAL_MPHR	Total count of all MPHRs in product (should always be 1!)			1	1	1	1	uinteger	6	39	2682
TOTAL_SPHR	Total count of all SPHRs in product (should be 0 or 1 only)			1	1	1	1	uinteger	6	39	2721
TOTAL_IPR	Total count of all IPRs in the product			1	1	1	1	uinteger	6	39	2760
TOTAL_GEADR	Total count of all GEADRs in the product			1	1	1	1	uinteger	6	39	2799
TOTAL_GIADR	Total count of all GIADRs in the product			1	1	1	1	uinteger	6	39	2838
TOTAL_VEADR	Total count of all VEADRs in the product			1	1	1	1	uinteger	6	39	2877
TOTAL_VIADR	Total count of all VIADRs in the product			1	1	1	1	uinteger	6	39	2916
TOTAL_MDR	Total count of all MDRs in the product			1	1	1	1	uinteger	6	39	2955
Record Based Generic Quality Flags											
COUNT_DEGRADED_INST_MDR	Count of MDRs with degradation due to instrument problems			1	1	1	1	uinteger	6	39	2994
COUNT_DEGRADED_PROC_MDR	Count of MDRs with degradation due to processing problems			1	1	1	1	uinteger	6	39	3033

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
COUNT_DEGRADED_INST_MDR_BLOCKS	Count of the number of blocks of MDRs degraded due to degraded instrument			1	1	1	1	uinteger	6	39	3072
COUNT_DEGRADED_PROC_MDR_BLOCKS	Count of the number of blocks of MDRs degraded due to degraded processing			1	1	1	1	uinteger	6	39	3111
Time Based Generic Quality Flags											
DURATION_OF_PRODUCT	The duration of the product in milliseconds		ms	1	1	1	1	uinteger	8	41	3150
MILLISECONDS_OF_DATA_PRESENT	The total amount of data present in the product		ms	1	1	1	1	uinteger	8	41	3191
MILLISECONDS_OF_DATA_MISSING	The total amount of data missing from the product		ms	1	1	1	1	uinteger	8	41	3232
Regional Product Information											
SUBSETTED_PRODUCT	Set when product has been subset (e.g. geographically subset using a region of interest filter). Implies the presence of one or more EUMETSAT Data Centre GIADRs in GAD section for product retrieved from Data Centre.			1	1	1	1	boolean	1	34	3273
											Total: 3307

11.2 GIADR (name 'giadr-adconv', class 5, subclass 2, version 3)

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
RECORD_HEADER	Generic Record Header			1	1	1	1	REC_HEAD	20	20	0
AMSU-A1_A/D_CONVERSION											
SCAN_MOTOR_A11_TEMPERATURE_ COEFFICIENT	Scan Motor A1-1 Temperature Coefficients	10^4,10^9,10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	20
SCAN_MOTOR_A12_TEMPERATURE_ COEFFICIENT	Scan Motor A1-2 Temperature Coefficients	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	36
FEED_HORN_A11_TEMPERATURE_ COEFFICIENT	Feed Horn A1-1 Temperature Coefficients	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	52
FEED_HORN_A12_TEMPERATURE_ COEFFICIENT	Feed Horn A1-2 Temperature Coefficients	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	68
RF_MUX_A11_TEMPERATURE_COEFFICIENT	RF Mux A1-1 Temperature Coefficients	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	84
RF_MUX_A12_TEMPERATURE_COEFFICIENT	RF Mux A1-2 Temperature Coefficients	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	100

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
OSCILLATOR_TEMPERATURE_CH3TO8_ COEFFICIENT	Local Oscillator Temperature Coefficients - channels 3-8 - ch. 3: f0, f1, f2, f3 TO ch. 8: f0, f1, f2, f3	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	6	1	1	integer4	4	96	116
OSCILLATOR_TEMPERATURE_CH15_ COEFFICIENT	Local Oscillator Temperature Coefficients - Channel 15	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	212
PLLO2_TEMPERATURE_COEFFICIENT	PLLO#2 Temperature Coefficients, (one set for ch. 9-14)	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	228
PLLO1_TEMPERATURE_COEFFICIENT	PLLO#1 Temperature Coefficients, (one set for ch. 9-14)	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	244
PLLO_REFERENCE_TEMPERATURE_ COEFFICIENT	PLLO (Reference Oscillator) Temperature Coefficients	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	260
MIXER_TEMPERATURE_CH3TO8_ COEFFICIENT	Mixer/IF Amplifier Temp. Coefficients, channel 3-8	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	6	1	1	integer4	4	96	276
MIXER_TEMPERATURE_CH9TO14_ COEFFICIENT	Mixer/IF Amplifier Temperature Coefficients - (one set for channel. 9-14)	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	372

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
MIXER_TEMPERATURE_CH15_COEFFICIENT	Mixer/IF Amplifier Temperature Coefficients - CHANNEL 15	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	388
AMPLIFIER_TEMPERATURE_CH11TO14_ COEFFICIENT	IF Amplifier Temperature Coefficients - channels 11/14 (TBC)	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	404
AMPLIFIER_TEMPERATURE_CH9TO11_ COEFFICIENT	IF Amplifier Temperature Coefficients - channels 9 to 11 (ch.9 f0, f1, f2, f3 to ch. 11 f0, f1, f2, f3)	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	3	1	1	integer4	4	48	420
DC_CONVERTER_TEMPERATURE_ COEFFICIENT	DC/DC Converter Temperature Coefficients	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	468
RF_SHELF_A11_TEMPERATURE_COEFFICIENT	RF Shelf A1-1 Temperature Coefficients	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	484
RF_SHELF_A12_TEMPERATURE_COEFFICIENT	RF Shelf A1-2 Temperature Coefficients	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	500
DETECTOR_PREAMPLIFIER_TEMPERATURE_ COEFFICIENT	Detector/preamp Assembly Temp. Coefficients,	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	516

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
A11_WARM_TEMPERATURE_PRT1TO5_ COEFFICIENT	A1-1 Warm Load Temperature Coefficients for PRT 1,2,3,4, and centre PRT 5 (PRT 1 f10, f11, f12, f13 to PRT 5 f50, f51, f52, f53)	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	5	1	1	integer4	4	80	532
A12_WARM_TEMPERATURE_PRT1TO5_ COEFFICIENT	A1-2 Warm Load Temperature Coefficients for PRT 1,2,3,4, and centre PRT 5 (PRT 1 f10, f11, f12, f13 to PRT 5 f50, f51, f52, f53)	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	5	1	1	integer4	4	80	612
AMSU-A1_ANALOG_TELEMETRY_CONVERSION											
A11_SCAN_MOTOR_TEMPERATURE_ INTERCEPT_SLOPE	A1-1 Scan Motor Temperature Intercept and Slope	10^3	Intercept=C, Slope=C/V	2	1	1	1	integer4	4	8	692
A12_SCAN_MOTOR_TEMPERATURE_ INTERCEPT_SLOPE	A1-2 Scan Motor Temperature Intercept and Slope	10^3	Intercept=C, Slope=C/V	2	1	1	1	integer4	4	8	700
A11_RF_SHELF_TEMPERATURE_INTERCEPT_ SLOPE	A1-1 RF Shelf Temp. Intercept and Slope	10^3	Intercept=C, Slope=C/V	2	1	1	1	integer4	4	8	708
A12_RF_SHELF_TEMPERATURE_INTERCEPT_ SLOPE	A1-2 RF Shelf Temperature Intercept and Slope	10^3	Intercept=C, Slope=C/V	2	1	1	1	integer4	4	8	716

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
A11_WARM_TEMPERATURE_INTERCEPT_ SLOPE	A1-1 Warm Load Temperature Intercept and Slope	10^3	Intercept=C, Slope=C/V	2	1	1	1	integer4	4	8	724
A12_WARM_TEMPERATURE_INTERCEPT_ SLOPE	A1-2 Warm Load Temperature Intercept and Slope	10^3	Intercept=C, Slope=C/V	2	1	1	1	integer4	4	8	732
A11_ANTENNA_MOTOR_CURRENT_ INTERCEPT_SLOPE	A1-1 Antenna Motor Current Intercept and Slope	10^3	Intercept=A, Slope=A/V	2	1	1	1	integer4	4	8	740
A12_ANTENNA_MOTOR_CURRENT_ INTERCEPT_SLOPE	A1-2 Antenna Motor Current Intercept and Slope	10^3	Intercept=A, Slope=A/V	2	1	1	1	integer4	4	8	748
PLUS15_SIGNAL_PROCESSING_INTERCEPT_ SLOPE	+15V Signal Processing Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	756
PLUS15_ANTENNA_DRIVE_INTERCEPT_SLOPE	+15V Antenna Drive Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	764
MINUS15_SIGNAL_PROCESSING_INTERCEPT_ SLOPE	-15V Signal Processing Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	772
MINUS15_ANTENNA_DRIVE_INTERCEPT_ SLOPE	-15V Antenna Drive Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	780

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
PLUS8_RECEIVER_AMPLIFIER_INTERCEPT_ SLOPE	+8V Receiver Amps Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	788
PLUS5_SIGNAL_PROCESSING_INTERCEPT_ SLOPE	+5V Signal Processing Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	796
PLUS5_ANTENNA_DRIVE_INTERCEPT_SLOPE	+5V Antenna Drive Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	804
PLUS85_PHASE_LOOP_INTERCEPT_SLOPE	+8.5V Phase Lock Loop Ch 9/14 Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	812
PLUS15_PHASE_LOOP_INTERCEPT_SLOPE	+15V Phase Lock Loop Ch 9/14 Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	820
MINUS15_PHASE_LOOP_INTERCEPT_SLOPE	-15V Phase Lock Loop Ch 9/14 Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	828
GDO_VOLTAGE_CH3_INTERCEPT_SLOPE	GDO Voltage 50.3 GHz Ch 3 Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	836
GDO_VOLTAGE_CH4_INTERCEPT_SLOPE	GDO Voltage 52.8 GHz Ch 4 Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	844

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
GDO_VOLTAGE_CH5_INTERCEPT_SLOPE	GDO Voltage 53.596 GHz Ch 5 Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	852
GDO_VOLTAGE_CH6_INTERCEPT_SLOPE	GDO Voltage 54.4 GHz Ch 6 Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	860
GDO_VOLTAGE_CH7_INTERCEPT_SLOPE	GDO Voltage 54.94 GHz Ch 7 Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	868
GDO_VOLTAGE_CH8_INTERCEPT_SLOPE	GDO Voltage 55.5 GHz Ch 8 Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	876
PLLO_PRIMAY_LOCK_INTERCEPT_SLOPE	PLLO Primary Lock Detect Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	884
PLLO_REDUNDANT_LOCK_INTERCEPT_SLOPE	PLLO Redundant Lock Detect Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	892
GDO_VOLTAGE_CH15_INTERCEPT_SLOPE	GDO Voltage 89.0 GHz Ch 15 Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	900

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
AMSU-A2_A/D_CONVERSION											
A2_SCAN_MOTOR_TEMPERATURE_ COEFFICIENT	A2 Scan Motor Temperature Coefficients	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	908
A2_FEED_HORN_TEMPERATURE_ COEFFICIENT	A2 Feed Horn Temperature Coefficients	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	924
A2_RF_MUX_TEMPERATURE_COEFFICIENT	A2 RF Mux Temperature Coefficients	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	940
A2_MIXER_AMPLIFIER_TEMPERATURE_CH1_ COEFFICIENT	A2 Mixer/IF Amplifier Temp Coefficients, ch. 1	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	956
A2_MIXER_AMPLIFIER_TEMPERATURE_CH2_ COEFFICIENT	A2 Mixer/IF Amplifier Temp Coefficients, ch. 2	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	972
A2_OSCILLATOR_TEMPERATURE_CH1_ COEFFICIENT	A2 Local Oscillator Temp Coefficients, ch. 1	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	988
A2_OSCILLATOR_TEMPERATURE_CH2	A2 Local Oscillator Temp Coefficients, ch. 2	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	1004

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
A2_COMPENSATION_MOTOR_TEMPERATURE_ COEFFICIENT	A2 Compensation Motor Temp Coefficients	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	1020
A2_SUBREFLECTOR_TEMPERATURE_ COEFFICIENT	A2 Subreflector Temperature Coefficients	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	1036
A2_DC_CONVERTER_TEMPERATURE_ COEFFICIENT	A2 DC/DC Converter Temperature Coefficients	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	1052
A2_RF_SHELF_TEMPERATURE_COEFFICIENT	A2 RF Shelf Temperature Coefficients	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	1068
A2_DETECTOR_PREAMPLIFIER_TEMPERATURE_ COEFFICIENT	A2Detector/preamp Assembly Temperature Coefficients	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	1	1	1	integer4	4	16	1084
A2_WARM_TEMPERATURE_PRT1TO7_ COEFFICIENT	A2 Warm Load Temperature Coefficients for PRT 1,2,3,4,5, 6, and centre 7: PRT 1 f10, f11, f12, f13 TO PRT 7 f70, f71, f72, f73	10^4,10^9, 10^16,10^20	f0= K, f1=K/cnt, f2=K/cnt^2, f3=K/cnt^3	4	7	1	1	integer4	4	112	1100
AMSU-A2_ANALOG_TELEMETRY_CONVERSION											
A2_SCAN_MOTOR_TEMPERATURE_ INTERCEPT_SLOPE	A2 Scan Motor Temperature Intercept and Slope	10^3	Intercept=C, Slope=C/Vt	2	1	1	1	integer4	4	8	1212

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
A2_COMPENSATOR_MOTOR_TEMPERATURE_ INTERCEPT_SLOPE	A2 Compensator Motor Temperature Intercept and Slope	10^3	Intercept=C, Slope=C/Vt	2	1	1	1	integer4	4	8	1220
A2_RF_SHELF_TEMPERATURE_INTERCEPT_ SLOPE	A2 RF Shelf Temperature Intercept and Slope	10^3	Intercept=C, Slope=C/Vt	2	1	1	1	integer4	4	8	1228
A2_WARM_TEMPERATURE_INTERCEPT_ SLOPE	A2 Warm Load Temperature Intercept and Slope	10^3	Intercept=C, Slope=C/Vt	2	1	1	1	integer4	4	8	1236
A2_COMPENSATOR_MOTOR_CURRENT_ INTERCEPT_SLOPE	A2 Compensator Motor Current Intercept and Slope	10^3	Intercept=A, Slope=A/V	2	1	1	1	integer4	4	8	1244
A2_ANTENNA_MOTOR_CURRENT_ INTERCEPT_SLOPE	A2 Antenna Motor Current Intercept and Slope	10^3	Intercept=A, Slope=A/V	2	1	1	1	integer4	4	8	1252
A2_PLUS15_SIGNAL_PROCESSING_ INTERCEPT_SLOPE	+15V A2 Signal Processing Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	1260
A2_PLUS15_ANTENNA_DRIVE_INTERCEPT_ SLOPE	+15V A2 Antenna Drive Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	1268
A2_MINUS15_SIGNAL_PROCESSING_ INTERCEPT_SLOPE	-15V A2 Signal Processing Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	1276

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
A2_MINUS15_ANTENNA_DRIVE_INTERCEPT_ SLOPE	-15V A2 Antenna Drive Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	1284
A2_PLUS8_RECEIVER_AMPLIFIER_ INTERCEPT_SLOPE	+8V A2 Receiver Amps Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	1292
A2_PLUS5_SIGNAL_PROCESSING_INTERCEPT_ SLOPE	+5V A2 Signal Processing Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	1300
A2_PLUS5_ANTENNA_DRIVE_INTERCEPT_ SLOPE	+5V A2 Antenna Drive Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	1308
A2_GDO_VOLTAGE_CH1_INTERCEPT_SLOPE	GDO Voltage 23.8 GHz Ch 1 Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	1316
A2_GDO_VOLTAGE_CH2_INTERCEPT_SLOPE	GDO Voltage 31.4 GHz Ch 2 Intercept and Slope	10^3	Intercept=V, Slope=V/V	2	1	1	1	integer4	4	8	1324
MOON_DATA											
LUNAR_ANGLE_THRESHOLD	Threshold value for lunar angle	10^2	degrees	1	1	1	1	integer2	2	2	1332
											Total: 1334

11.3 MDR (name 'mdr-1b', class 8, subclass 2, version 3)

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
RECORD_HEADER	Generic Record Header			1	1	1	1	REC_HEAD	20	20	0
GENERIC_QUALITY_INDICATORS											
DEGRADED_INST_MDR	Quality of MDR has been degraded from nominal due to an instrument degradation			1	1	1	1	boolean	1	1	20
DEGRADED_PROC_MDR	Quality of MDR has been degraded from nominal due to a processing degradation			1	1	1	1	boolean	1	1	21
MEASUREMENT_DATA											
SCENE_RADIANCE	Scene radiance (channels 1-15) (View 1 - 30)	10^7	mW/m2/sr/cm-1	15	30	1	1	integer4	4	1800	22
FOV_DATA_QUALITY	FOV data quality flags. (all bits off implies acceptable data) - bit 15-1: bit n set to 1 if scene radiance for channel n is physically unreasonable or has not been calculated due to calibration problems. -bit 0 not used			1	1	1	1	bitfield (2)	2	2	1822
NAVIGATION_DATA_AT_SCAN_LINE											
TIME_ATTITUDE	Time Associated with Attitude Angles		s	1	1	1	1	uinteger4	4	4	1824
EULER_ANGLE	Euler Angles: Roll, Pitch, Yaw	10^3	degree	3	1	1	1	integer2	2	6	1828
NAVIGATION_STATUS	Navigation Status Bit Field			1	1	1	1	bitfield (4)	4	4	1834
SPACECRAFT_ALTITUDE	Spacecraft Altitude Above Reference Geoid (MSL)	10^1	km	1	1	1	1	uinteger4	4	4	1838
ANGULAR_RELATION	Angular relationships: solar zenith angle, satellite zenith angle, solar	10^2	degree	4	30	1	1	integer2	2	240	1842

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
	azimuth angle, satellite azimuth angle - (points 1 to 30)										
EARTH_LOCATION	Earth Location: latitude, longitude (point 1 to 30)	10^4	degree	2	30	1	1	integer4	4	240	2082
SURFACE_PROPERTIES	Surface property(0 = water, 1 = mixed/coast, 2 = land) (point 1 to 30)			30	1	1	1	integer2	2	60	2322
TERRAIN_ELEVATION	Average terrain elevation (point 1 to 30)		m	30	1	1	1	integer2	2	60	2382
Quality_Indicators											
QUALITY_INDICATOR	Quality Indicator Bit Field			1	1	1	1	bitfield (4)	4	4	2442
SCAN_LINE_QUALITY	Scan Line Quality Flags			1	1	1	1	bitfield (4)	4	4	2446
CALIBRATION_QUALITY	Calibration Quality Flags			16	1	1	1	bitfield (2)	2	32	2450
Calibration_Coefficients											
PRIMARY_CALIBRATION	Primary Calibration a2 - a0, ch 1 - 15	10^19,10^13, 10^9	a2 = mW/m2/sr/ cm-1/cnt^2 a1 = mW/m2/sr/ cm-1/cnt a0=mW/m2/sr/ cm-1	3	15	1	1	integer4	4	180	2482
SPARE_CALIBRATION	Spare Calibration a2 - a0, ch 1 - 15	10^19,10^13, 10^9	a2 = mW/m2/sr/ cm-1/cnt^2 a1 = mW/m2/sr/ cm-1/cnt a0=mW/m2/sr/ cm-1	3	15	1	1	integer4	4	180	2662
INSTRUMENT_STATE											
INSTRUMENT_STATUS_A1	Instrument status: AMSU-A1			1	1	1	1	bitfield (2)	2	2	2842
INSTRUMENT_STATUS_A2	Instrument status: AMSU-A2			1	1	1	1	bitfield (2)	2	2	2844

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
Raw_Reflector_Position_Data											
REFLECTOR_A11_POSITION	Reflector A1-1 measurement position, reading 1 and 2 (Earth view 1-30)		counts	2	30	1	1	uinteger2	2	120	2846
REFLECTOR_A12_POSITION	Reflector A1-2 measurement position, reading 1 and 2 (Earth view 1-30)		counts	2	30	1	1	uinteger2	2	120	2966
REFLECTOR_A2_POSITION	Reflector A2 measurement position, reading 1 and 2 (Earth view 1-30)		counts	2	30	1	1	uinteger2	2	120	3086
REFLECTOR_A11_COLD_POSITION	Reflector A1-1 cold calibration position, reading 1 and 2		counts	2	1	1	1	uinteger2	2	4	3206
REFLECTOR_A12_COLD_POSITION	Reflector A1-2 cold calibration position, reading 1 and 2		counts	2	1	1	1	uinteger2	2	4	3210
REFLECTOR_A2_COLD_POSITION	Reflector A2 cold calibration position, reading 1 and 2		counts	2	1	1	1	uinteger2	2	4	3214
REFLECTOR_A11_WARM_POSITION	Reflector A1-1 warm calibration position, reading 1 and 2		counts	2	1	1	1	uinteger2	2	4	3218
REFLECTOR_A12_WARM_POSITION	Reflector A1-2 warm calibration position, reading 1 and 2		counts	2	1	1	1	uinteger2	2	4	3222
REFLECTOR_A2_WARM_POSITION	Reflector A2 warm calibration position, reading 1 and 2		counts	2	1	1	1	uinteger2	2	4	3226
AMSU-A1_Temperature_Sensor_Data											
A11_SCAN_MOTOR_TEMPERATURE_DATA	A1-1 scan motor temperature		counts	1	1	1	1	uinteger2	2	2	3230
A12_SCAN_MOTOR_TEMPERATURE_DATA	A1-2 scan motor temperature		counts	1	1	1	1	uinteger2	2	2	3232
A11_FEED_HORN_TEMPERATURE_DATA	A1-1 feed horn temperature		counts	1	1	1	1	uinteger2	2	2	3234
A12_FEED_HORN_TEMPERATURE_DATA	A1-2 feed horn temperature		counts	1	1	1	1	uinteger2	2	2	3236
A11_RF_MUX_TEMPERATURE_DATA	A1-1 RF mux temperature		counts	1	1	1	1	uinteger2	2	2	3238
A12_RF_MUX_TEMPERATURE_DATA	A1-2 RF mux temperature		counts	1	1	1	1	uinteger2	2	2	3240

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
OSCILLATOR_TEMPERATURE_CH3TO8_DATA	Local oscillator temperature (channel 3-8)		counts	6	1	1	1	uinteger2	2	12	3242
OSCILLATOR_TEMPERATURE_CH15_DATA	Local oscillator temperature (ch 15)		counts	1	1	1	1	uinteger2	2	2	3254
PLLO2_TEMPERATURE_CH9TO14_DATA	PLLO#2 temperature (one value for channel 9-14)		counts	1	1	1	1	uinteger2	2	2	3256
PLLO1_TEMPERATURE_CH9TO14_DATA	PLLO#1 temperature (one value for channel 9-14)		counts	1	1	1	1	uinteger2	2	2	3258
PLLO_REFERENCE_TEMPERATURE_DATA	PLLO (reference oscillator) temperature		counts	1	1	1	1	uinteger2	2	2	3260
MIXER_AMPLIFIER_TEMPERATURE_CH3TO8_ DATA	Mixer/IF amplifier temperature (channel 3-8)		counts	6	1	1	1	uinteger2	2	12	3262
MIXER_AMPLIFIER_TEMPERATURE_CH9TO14_ DATA	Mixer/IF amplifier temperature (channel 9/14)		counts	1	1	1	1	uinteger2	2	2	3274
MIXER_AMPLIFIER_TEMPERATURE_CH15_ DATA	Mixer/IF amplifier temperature (channel 15)		counts	1	1	1	1	uinteger2	2	2	3276
IF_AMPLIFIER_TEMPERATURE_CH11TO14_ DATA	IF amplifier temperature (channel 11/14)		counts	1	1	1	1	uinteger2	2	2	3278
IF_AMPLIFIER_TEMPERATURE_CH9TO11_ DATA	IF amplifier temperature (ch 9-11)		counts	3	1	1	1	uinteger2	2	6	3280
DC_CONVERTER_TEMPERATURE_DATA	DC/DC converter temperature		counts	1	1	1	1	uinteger2	2	2	3286
IF_AMPLIFIER_TEMPERATURE_CH13TO14_ DATA	IF amplifier temperature (channel 13-14)		counts	2	1	1	1	uinteger2	2	4	3288
IF_AMPLIFIER_TEMPERATURE_CH12_DATA	IF amplifier temperature (channel 12)		counts	1	1	1	1	uinteger2	2	2	3292
A11_RF_SHELF_TEMPERATURE_DATA	A1-1 RF shelf temperature		counts	1	1	1	1	uinteger2	2	2	3294
A12_RF_SHELF_TEMPERATURE_DATA	A1-2 RF shelf temperature		counts	1	1	1	1	uinteger2	2	2	3296
DETECTOR_PREAMPLIFIER_TEMPERATURE_ DATA	Detector/preamp assembly temperature		counts	1	1	1	1	uinteger2	2	2	3298
A11_WARM_TEMPERATURE_PRT1TO5_DATA	A1-1 warm target temp (PRT 1-4 and centre 5)		counts	5	1	1	1	uinteger2	2	10	3300

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
A12_WARM_TEMPERATURE_PRT1TO5_DATA	A1-2 warm target temp (PRT 1-4 and centre 5)		counts	5	1	1	1	uinteger2	2	10	3310
REFERENCE_VOLTAGE_DATA	Reference voltage		counts	1	1	1	1	uinteger2	2	2	3320
AMSU-A1_Digital_B_Telemetry_Flags											
AMSU_A1_INVALID_DIGITALB_WORD_FLAG	Invalid word bit flags: (if bit=0, associated AMSU-A1 digital B telemetry data in following field is valid)			1	1	1	1	bitfield (2)	2	2	3322
AMSU_A1_DIGITALB_DATA	AMSU-A1 digital B telemetry data flags			1	1	1	1	bitfield (2)	2	2	3324
AMSU-A1_Analog_Housekeeping_Data											
AMSU_A1_INVALID_ANALOG_WORD_FLAG	Invalid word bit flags:(if bit=0, associated AMSU-A1 analogue housekeeping telemetry word in following fields is valid)			1	1	1	1	bitfield (4)	4	4	3326
A11_SCANNER_MOTOR_TEMPERATURE	A1-1 scanner motor temperature		counts	1	1	1	1	uinteger2	2	2	3330
A12_SCANNER_MOTOR_TEMPERATURE	A1-2 scanner motor temperature		counts	1	1	1	1	uinteger2	2	2	3332
A11_RF_SHELF_TEMPERATURE	A1-1 RF shelf temperature		counts	1	1	1	1	uinteger2	2	2	3334
A12_RF_SHELF_TEMPERATURE	A1-2 RF shelf temperature		counts	1	1	1	1	uinteger2	2	2	3336
A11_WARM_TEMPERATURE	A1-1 warm load temperature		counts	1	1	1	1	uinteger2	2	2	3338
A12_WARM_TEMPERATURE	A1-2 warm load temperature		counts	1	1	1	1	uinteger2	2	2	3340
A11_ANTENNA_DRIVE_MOTOR_ TEMPERATURE	A1-1 antenna drive motor current (Avg)		counts	1	1	1	1	uinteger2	2	2	3342
A12_ANTENNA_DRIVE_MOTOR_ TEMPERATURE	A1-2 antenna drive motor current (Avg)		counts	1	1	1	1	uinteger2	2	2	3344
PLUS15_SIGNAL_PROCESSING	+15V signal processing		counts	1	1	1	1	uinteger2	2	2	3346
PLUS15_ANTENNA_DRIVE	+15V antenna drive		counts	1	1	1	1	uinteger2	2	2	3348
MINUS15_SIGNAL_PROCESSING	-15V signal processing		counts	1	1	1	1	uinteger2	2	2	3350

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
MINUS15_ANTENNA_DRIVE	–15V antenna drive		counts	1	1	1	1	uinteger2	2	2	3352
PLUS8_RECEIVER_AMPLIFIER	+8V receiver amplifier		counts	1	1	1	1	uinteger2	2	2	3354
PLUS5_SIGNAL_PROCESSING	+5V signal processing		counts	1	1	1	1	uinteger2	2	2	3356
PLUS5_ANTENNA_DRIVE	+5V antenna drive		counts	1	1	1	1	uinteger2	2	2	3358
PLUS15_PHASE_LOCK_CH9TO14	+15V phase lock loop (ch 9/14)		counts	1	1	1	1	uinteger2	2	2	3360
MINUS15_PHASE_LOCK_CH9TO14	–15V phase lock loop (ch 9/14)		counts	1	1	1	1	uinteger2	2	2	3362
GDO_VOLTAGE_CH3	GDO Voltage 50.3 GHz (ch 3)		counts	1	1	1	1	uinteger2	2	2	3364
GDO_VOLTAGE_CH4	GDO Voltage 52.8 GHz (ch 4)		counts	1	1	1	1	uinteger2	2	2	3366
GDO_VOLTAGE_CH5	GDO Voltage 53.596 GHz (ch 5)		counts	1	1	1	1	uinteger2	2	2	3368
GDO_VOLTAGE_CH6	GDO Voltage 54.4 GHz (ch 6)		counts	1	1	1	1	uinteger2	2	2	3370
GDO_VOLTAGE_CH7	GDO Voltage 54.94 GHz (ch 7)		counts	1	1	1	1	uinteger2	2	2	3372
GDO_VOLTAGE_CH8	GDO Voltage 55.5 GHz (ch 8)		counts	1	1	1	1	uinteger2	2	2	3374
PLLO_PRIMAY_LOCK	PLLO primary lock detect		counts	1	1	1	1	uinteger2	2	2	3376
PLLO_REDUNDANT_LOCK	PLLO redundant lock detect		counts	1	1	1	1	uinteger2	2	2	3378
GDO_VOLTAGE_CH15	GDO Voltage 89.0 GHz (ch 15)		counts	1	1	1	1	uinteger2	2	2	3380
AMSU-A2_Temperature_Sensor_Data											
A2_SCAN_MOTOR_TEMPERATURE	A2 scan motor temperature		counts	1	1	1	1	uinteger2	2	2	3382
A2_FEED_HORN_TEMPERATURE	A2 feed horn temperature		counts	1	1	1	1	uinteger2	2	2	3384
A2_RF_MUX_TEMPERATURE	A2 RF mux temperature		counts	1	1	1	1	uinteger2	2	2	3386
A2_MIXER_AMPLIFIER_TEMPERATURE	A2 Mixer/IF amplifier temperature (ch 1-2)		counts	2	1	1	1	uinteger2	2	4	3388
A2_OSCILLATOR_TEMPERATURE_CH1TO2	A2 Local oscillator temperature (channels 1-2)		counts	2	1	1	1	uinteger2	2	4	3392
A2_COMPENSATION_MOTOR_TEMPERATURE	A2 Compensation motor temperature		counts	1	1	1	1	uinteger2	2	2	3396
A2_SUBREFLECTOR_TEMPERATURE	A2 subreflector temperature		counts	1	1	1	1	uinteger2	2	2	3398
A2_DC_CONVERTER_TEMPERATURE	A2 DC/DC converter temperature		counts	1	1	1	1	uinteger2	2	2	3400

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
A2_RF_SHELF_TEMPERATURE	A2 RF shelf temperature		counts	1	1	1	1	uinteger2	2	2	3402
A2_DETECTOR_PREAMPLIFIER_ TEMPERATURE	Detector/preamp assembly temperature		counts	1	1	1	1	uinteger2	2	2	3404
A2_WARM_TEMPERATURE_PRT1TO7	A2 warm target temp (PRT 1-6 and centre 7)		counts	7	1	1	1	uinteger2	2	14	3406
A2_REFERENCE_VOLTAGE	Reference voltage		counts	1	1	1	1	uinteger2	2	2	3420
AMSU-A2_Digital_B_Telemetry_Flags											
AMSU_A2_INVALID_WORD_FLAG	Invalid word bit flags:(if bit=0, associated AMSU-A2 digital B telemetry data in following field is valid)			1	1	1	1	bitfield (2)	2	2	3422
AMSU_A2_DIGITALB_FLAG	AMSU-A2 digital B telemetry data flags			1	1	1	1	bitfield (2)	2	2	3424
AMSU-A2_Analog_Housekeeping_Data											
AMSU_A2_INVALID_ANALOG_WORD_FLAG	Invalid word bit flags: (if bit=0, associated AMSU-A2 analogue housekeeping telemetry word in following fields is valid)			1	1	1	1	bitfield (4)	4	4	3426
A2_ANALOG_SCANNER_MOTOR_ TEMPERATURE	A2 scanner motor temperature		counts	1	1	1	1	uinteger2	2	2	3430
A2_ANALOG_COMPENSATOR_MOTOR_ TEMPERATURE	A2 Compensator motor temperature		counts	1	1	1	1	uinteger2	2	2	3432
A2_ANALOG_RF_SHELF_TEMPERATURE	A2 RF shelf temperature		counts	1	1	1	1	uinteger2	2	2	3434
A2_ANALOG_WARM_TEMPERATURE	A2 warm load temperature		counts	1	1	1	1	uinteger2	2	2	3436
A2_ANALOG_COMENSATOR_MOTOR_ CURRENT	Compensator motor current (Avg)		counts	1	1	1	1	uinteger2	2	2	3438
A2_ANALOG_ANTENNA-DRIVE_MOTOR_CURRENT	A2 antenna drive motor current (Avg)		counts	1	1	1	1	uinteger2	2	2	3440
A2_ANALOG_PLUS15_SIGNAL_PROCESSING	+15V signal processing		counts	1	1	1	1	uinteger2	2	2	3442

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
A2_ANALOG_PLUS15_ANTENNA-DRIVE	+15V antenna drive		counts	1	1	1	1	uinteger2	2	2	3444
A2_ANALOG_MINUS15_SIGNAL_PROCESSING	-15V signal processing		counts	1	1	1	1	uinteger2	2	2	3446
A2_ANALOG_MINUS15_ANTENNA-DRIVE	-15V antenna drive		counts	1	1	1	1	uinteger2	2	2	3448
A2_ANALOG_PLU10_RECEIVER	+10V receiver		counts	1	1	1	1	uinteger2	2	2	3450
A2_ANALOG_PLUS5_SIGNAL_PROCESSING	+5V signal processing		counts	1	1	1	1	uinteger2	2	2	3452
A2_ANALOG_PLUS5_ANTENNA-DRIVE	+5V antenna drive		counts	1	1	1	1	uinteger2	2	2	3454
A2_ANALOG_GDO_VOLTAGE_CH1	GDO Voltage 23.8 GHz (ch 1)		counts	1	1	1	1	uinteger2	2	2	3456
A2_ANALOG_GDO_VOLTAGE_CH2	GDO Voltage 31.4 GHz (ch 2)		counts	1	1	1	1	uinteger2	2	2	3458
MOON_DATA											
AMSU_A1_LUNAR_ANGLE	Angle between moon and space view for AMSU-A1	10^2	degrees	1	1	1	1	integer2	2	2	3460
AMSU_A2_LUNAR_ANGLE	Angle between moon and space view for AMSU-A2	10^2	degrees	1	1	1	1	integer2	2	2	3462
											Total: 3464

11.4 MDR (name 'mdr-1b', class 8, subclass 2, version 4)

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
RECORD_HEADER	Generic Record Header			1	1	1	1	REC_HEAD	20	20	0
GENERIC_QUALITY_INDICATORS											
DEGRADED_INST_MDR	Quality of MDR has been degraded from nominal due to an instrument degradation			1	1	1	1	boolean	1	1	20
DEGRADED_PROC_MDR	Quality of MDR has been degraded from nominal due to a processing degradation			1	1	1	1	boolean	1	1	21
MEASUREMENT_DATA											
SCENE_RADIANCE	Scene radiance (channels 1-15) (View 1 - 30)	10^7	mW/m2/sr/cm-1	15	30	1	1	integer4	4	1800	22
FOV_DATA_QUALITY	FOV data quality flags. (all bits off implies acceptable data) - bit 15-1: bit n set to 1 if scene radiance for channel n is physically unreasonable or has not been calculated due to calibration problems. - bit 0 not used			1	1	1	1	bitfield (2)	2	2	1822
NAVIGATION_DATA_AT_SCAN_LINE											
TIME_ATTITUDE	Time Associated with Attitude Angles		s	1	1	1	1	uinteger4	4	4	1824
EULER_ANGLE	Euler Angles: Roll, Pitch, Yaw	10^3	degree	3	1	1	1	integer2	2	6	1828
NAVIGATION_STATUS	Navigation Status Bit Field			1	1	1	1	bitfield (4)	4	4	1834

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
SPACECRAFT_ALTITUDE	Spacecraft Altitude Above Reference Geoid (MSL)	10^1	km	1	1	1	1	uinteger4	4	4	1838
ANGULAR_RELATION	Angular relationships: solar zenith angle, satellite zenith angle, solar azimuth angle, satellite azimuth angle (points 1 to 30). ***Note:*** azimuth angle range is –180 to +180, where minus is west and plus is east.	10^2	degree	4	30	1	1	integer2	2	240	1842
EARTH_LOCATION	Earth Location: latitude, longitude (point 1 to 30)	10^4	degree	2	30	1	1	integer4	4	240	2082
SURFACE_PROPERTIES	Surface property 0 = water, 1 = mixed/coast, 2 = land) (point 1 to 30)			30	1	1	1	integer2	2	60	2322
TERRAIN_ELEVATION	Average terrain elevation (point 1 to 30)		m	30	1	1	1	integer2	2	60	2382
Quality_Indicators											
QUALITY_INDICATOR	Quality Indicator Bit Field			1	1	1	1	bitfield (4)	4	4	2442
SCAN_LINE_QUALITY	Scan Line Quality Flags			1	1	1	1	bitfield (4)	4	4	2446
DATA_CALIBRATION	Noise-Equivalent Delta T and Channel Quality Flags			16	1	1	1	DATA_CALQUAL	2	32	2450
NEDT_VALUE	Value of the noise equivalent temperature	10^2	K	1	1	1	1	ubyte	1	1	
CALIBRATNION _QUALITY	Channel Quality Flags			1	1	1	1	bitfield (1)	1	1	
Calibration_Coefficients											
PRIMARY_CALIBRATION	Primary Calibration a2 - a0, channels 1 - 15	10^19,10^13, 10^9	a2 = mW/m2/sr/ cm-1/cnt^2	3	15	1	1	integer4	4	180	2482

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
			a1 = mW/m2/sr/cm-1/cnt a0=mW/m2/sr/cm-1								
SPARE_CALIBRATION	Spare Calibration a2 - a0, channels 1 - 15	10^19,10^13, 10^9	a2 = mW/m2/sr/cm-1/cnt^2 a1 = mW/m2/sr/cm-1/cnt a0=mW/m2/sr/cm-1	3	15	1	1	integer4	4	180	2662
INSTRUMENT_STATE											
INSTRUMENT_STATUS_A1	Instrument status: AMSU-A1			1	1	1	1	bitfield (2)	2	2	2842
INSTRUMENT_STATUS_A2	Instrument status: AMSU-A2			1	1	1	1	bitfield (2)	2	2	2844
Raw_Reflector_Position_Data											
REFLECTOR_A11_POSITION	Reflector A1-1 measurement position, reading 1 and 2 (Earth view 1-30)		counts	2	30	1	1	uinteger2	2	120	2846
REFLECTOR_A12_POSITION	Reflector A1-2 measurement position, reading 1 and 2 (Earth view 1-30)		counts	2	30	1	1	uinteger2	2	120	2966
REFLECTOR_A2_POSITION	Reflector A2 measurement position, reading 1 and 2 (Earth view 1-30)		counts	2	30	1	1	uinteger2	2	120	3086
REFLECTOR_A11_COLD_POSITION	Reflector A1-1 cold calibration position, reading 1 and 2		counts	2	1	1	1	uinteger2	2	4	3206
REFLECTOR_A12_COLD_POSITION	Reflector A1-2 cold calibration position, reading 1 and 2		counts	2	1	1	1	uinteger2	2	4	3210
REFLECTOR_A2_COLD_POSITION	Reflector A2 cold calibration position, reading 1 and 2		counts	2	1	1	1	uinteger2	2	4	3214

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
REFLECTOR_A11_WARM_POSITION	Reflector A1-1 warm calibration position, reading 1 and 2		counts	2	1	1	1	uinteger2	2	4	3218
REFLECTOR_A12_WARM_POSITION	Reflector A1-2 warm calibration position, reading 1 and 2		counts	2	1	1	1	uinteger2	2	4	3222
REFLECTOR_A2_WARM_POSITION	Reflector A2 warm calibration position, reading 1 and 2		counts	2	1	1	1	uinteger2	2	4	3226
AMSU-A1_Temperature_Sensor_Data											
A11_SCAN_MOTOR_TEMPERATURE_DATA	A1-1 scan motor temperature		counts	1	1	1	1	uinteger2	2	2	3230
A12_SCAN_MOTOR_TEMPERATURE_DATA	A1-2 scan motor temperature		counts	1	1	1	1	uinteger2	2	2	3232
A11_FEED_HORN_TEMPERATURE_DATA	A1-1 feed horn temperature		counts	1	1	1	1	uinteger2	2	2	3234
A12_FEED_HORN_TEMPERATURE_DATA	A1-2 feed horn temperature		counts	1	1	1	1	uinteger2	2	2	3236
A11_RF_MUX_TEMPERATURE_DATA	A1-1 RF mux temperature		counts	1	1	1	1	uinteger2	2	2	3238
A12_RF_MUX_TEMPERATURE_DATA	A1-2 RF mux temperature		counts	1	1	1	1	uinteger2	2	2	3240
OSCILLATOR_TEMPERATURE_CH3TO8_DATA	Local oscillator temperature (channels 3-8)		counts	6	1	1	1	uinteger2	2	12	3242
OSCILLATOR_TEMPERATURE_CH15_DATA	Local oscillator temperature (ch 15)		counts	1	1	1	1	uinteger2	2	2	3254
PLLO2_TEMPERATURE_CH9TO14_DATA	PLLO#2 temperature (one value for channels 9-14)		counts	1	1	1	1	uinteger2	2	2	3256
PLLO1_TEMPERATURE_CH9TO14_DATA	PLLO#1 temperature (one value for channels 9-14)		counts	1	1	1	1	uinteger2	2	2	3258
PLLO_REFERENCE_TEMPERATURE_DATA	PLLO (reference oscillator) temperature		counts	1	1	1	1	uinteger2	2	2	3260
MIXER_AMPLIFIER_TEMPERATURE_CH3TO8_DATA	Mixer/IF amplifier temperature (channels 3-8)		counts	6	1	1	1	uinteger2	2	12	3262

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
MIXER_AMPLIFIER_TEMPERATURE_CH9TO14_ DATA	Mixer/IF amplifier temperature (channels 9/14)		counts	1	1	1	1	uinteger2	2	2	3274
MIXER_AMPLIFIER_TEMPERATURE_CH15_ DATA	Mixer/IF amplifier temperature (channel 15)		counts	1	1	1	1	uinteger2	2	2	3276
IF_AMPLIFIER_TEMPERATURE_CH11TO14_ DATA	IF amplifier temperature (channels 11/14)		counts	1	1	1	1	uinteger2	2	2	3278
IF_AMPLIFIER_TEMPERATURE_CH9TO11_ DATA	IF amplifier temperature (channels 9-11)		counts	3	1	1	1	uinteger2	2	6	3280
DC_CONVERTER_TEMPERATURE_DATA	DC/DC converter temperature		counts	1	1	1	1	uinteger2	2	2	3286
IF_AMPLIFIER_TEMPERATURE_CH13TO14_ DATA	IF amplifier temperature (channels 13-14)		counts	2	1	1	1	uinteger2	2	4	3288
IF_AMPLIFIER_TEMPERATURE_CH12_DATA	IF amplifier temperature (channels 12)		counts	1	1	1	1	uinteger2	2	2	3292
A11_RF_SHELF_TEMPERATURE_DATA	A1-1 RF shelf temperature		counts	1	1	1	1	uinteger2	2	2	3294
A12_RF_SHELF_TEMPERATURE_DATA	A1-2 RF shelf temperature		counts	1	1	1	1	uinteger2	2	2	3296
DETECTOR_PREAMPLIFIER_TEMPERATURE_ DATA	Detector/preamp assembly temperature		counts	1	1	1	1	uinteger2	2	2	3298
A11_WARM_TEMPERATURE_PRT1TO5_DATA	A1-1 warm target temp (PRT 1-4 and centre 5)		counts	5	1	1	1	uinteger2	2	10	3300
A12_WARM_TEMPERATURE_PRT1TO5_DATA	A1-2 warm target temp (PRT 1-4 and centre 5)		counts	5	1	1	1	uinteger2	2	10	3310
REFERENCE_VOLTAGE_DATA	Reference voltage		counts	1	1	1	1	uinteger2	2	2	3320
AMSU-A1_Digital_B_Telemetry_Flags											
AMSU_A1_INVALID_DIGITALB_WORD_FLAG	Invalid word bit flags: (if bit=0, associated AMSU-A1 digital B telemetry data in following field is valid)			1	1	1	1	bitfield (2)	2	2	3322

Name	Description	Scaling factor	Units	Dim1	Dim2	Dim3	Dim4	Type	Type size	Field size	Offset
AMSU_A1_DIGITALB_DATA	AMSU-A1 digital B telemetry data flags			1	1	1	1	bitfield (2)	2	2	3324
AMSU-A1_Analog_Housekeeping_Data											
AMSU_A1_INVALID_ANALOG_WORD_FLAG	Invalid word bit flags:(if bit=0, associated AMSU-A1 analogue housekeeping telemetry word in following fields is valid)			1	1	1	1	bitfield (4)	4	4	3326
A11_SCANNER_MOTOR_TEMPERATURE	A1-1 scanner motor temperature		counts	1	1	1	1	uinteger2	2	2	3330
A12_SCANNER_MOTOR_TEMPERATURE	A1-2 scanner motor temperature		counts	1	1	1	1	uinteger2	2	2	3332
A11_RF_SHELF_TEMPERATURE	A1-1 RF shelf temperature		counts	1	1	1	1	uinteger2	2	2	3334
A12_RF_SHELF_TEMPERATURE	A1-2 RF shelf temperature		counts	1	1	1	1	uinteger2	2	2	3336
A11_WARM_TEMPERATURE	A1-1 warm load temperature		counts	1	1	1	1	uinteger2	2	2	3338
A12_WARM_TEMPERATURE	A1-2 warm load temperature		counts	1	1	1	1	uinteger2	2	2	3340
A11_ANTENNA_DRIVE_MOTOR_ TEMPERATURE	A1-1 antenna drive motor current (Avg)		counts	1	1	1	1	uinteger2	2	2	3342
A12_ANTENNA_DRIVE_MOTOR_ TEMPERATURE	A1-2 antenna drive motor current (Avg)		counts	1	1	1	1	uinteger2	2	2	3344
PLUS15_SIGNAL_PROCESSING	+15V signal processing		counts	1	1	1	1	uinteger2	2	2	3346
PLUS15_ANTENNA_DRIVE	+15V antenna drive		counts	1	1	1	1	uinteger2	2	2	3348
MINUS15_SIGNAL_PROCESSING	-15V signal processing		counts	1	1	1	1	uinteger2	2	2	3350
MINUS15_ANTENNA_DRIVE	-15V antenna drive		counts	1	1	1	1	uinteger2	2	2	3352
PLUS8_RECEIVER_AMPLIFIER	+8V receiver amplifier		counts	1	1	1	1	uinteger2	2	2	3354
PLUS5_SIGNAL_PROCESSING	+5V signal processing		counts	1	1	1	1	uinteger2	2	2	3356
PLUS5_ANTENNA_DRIVE	+5V antenna drive		counts	1	1	1	1	uinteger2	2	2	3358

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
PLUS15_PHASE_LOCK_CH9TO14	+15V phase lock loop (channels 9/14)		counts	1	1	1	1	uinteger2	2	2	3360
MINUS15_PHASE_LOCK_CH9TO14	-15V phase lock loop (channels 9/14)		counts	1	1	1	1	uinteger2	2	2	3362
GDO_VOLTAGE_CH3	GDO Voltage 50.3 GHz (channel 3)		counts	1	1	1	1	uinteger2	2	2	3364
GDO_VOLTAGE_CH4	GDO Voltage 52.8 GHz (channel 4)		counts	1	1	1	1	uinteger2	2	2	3366
GDO_VOLTAGE_CH5	GDO Voltage 53.596 GHz (channel 5)		counts	1	1	1	1	uinteger2	2	2	3368
GDO_VOLTAGE_CH6	GDO Voltage 54.4 GHz (channel 6)		counts	1	1	1	1	uinteger2	2	2	3370
GDO_VOLTAGE_CH7	GDO Voltage 54.94 GHz (channel 7)		counts	1	1	1	1	uinteger2	2	2	3372
GDO_VOLTAGE_CH8	GDO Voltage 55.5 GHz (channel 8)		counts	1	1	1	1	uinteger2	2	2	3374
PLLO_PRIMAY_LOCK	PLLO primary lock detect		counts	1	1	1	1	uinteger2	2	2	3376
PLLO_REDUNDANT_LOCK	PLLO redundant lock detect		counts	1	1	1	1	uinteger2	2	2	3378
GDO_VOLTAGE_CH15	GDO Voltage 89.0 GHz (channel 15)		counts	1	1	1	1	uinteger2	2	2	3380
AMSU-A2_Temperature_Sensor_Data											
A2_SCAN_MOTOR_TEMPERATURE	A2 scan motor temperature		counts	1	1	1	1	uinteger2	2	2	3382
A2_FEED_HORN_TEMPERATURE	A2 feed horn temperature		counts	1	1	1	1	uinteger2	2	2	3384
A2_RF_MUX_TEMPERATURE	A2 RF mux temperature		counts	1	1	1	1	uinteger2	2	2	3386
A2_MIXER_AMPLIFIER_TEMPERATURE	A2 Mixer/IF amplifier temperature (channels 1-2)		counts	2	1	1	1	uinteger2	2	4	3388
A2_OSCILLATOR_TEMPERATURE_CH1TO2	A2 Local oscillator temperature (channels 1-2)		counts	2	1	1	1	uinteger2	2	4	3392

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
A2_COMPENSATION_MOTOR_TEMPERATURE	A2 Compensation motor temperature		counts	1	1	1	1	uinteger2	2	2	3396
A2_SUBREFLECTOR_TEMPERATURE	A2 subreflector temperature		counts	1	1	1	1	uinteger2	2	2	3398
A2_DC_CONVERTER_TEMPERATURE	A2 DC/DC converter temperature		counts	1	1	1	1	uinteger2	2	2	3400
A2_RF_SHELF_TEMPERATURE	A2 RF shelf temperature		counts	1	1	1	1	uinteger2	2	2	3402
A2_DETECTOR_PREAMPLIFIER_ TEMPERATURE	Detector/preamp assembly temperature		counts	1	1	1	1	uinteger2	2	2	3404
A2_WARM_TEMPERATURE_PRT1TO7	A2 warm target temp (PRT 1-6 and centre 7)		counts	7	1	1	1	uinteger2	2	14	3406
A2_REFERENCE_VOLTAGE	Reference voltage		counts	1	1	1	1	uinteger2	2	2	3420
AMSU-A2_Digital_B_Telemetry_Flags											
AMSU_A2_INVALID_WORD_FLAG	Invalid word bit flags:(if bit=0, associated AMSU-A2 digital B telemetry data in following field is valid)			1	1	1	1	bitfield (2)	2	2	3422
AMSU_A2_DIGITALB_FLAG	AMSU-A2 digital B telemetry data flags			1	1	1	1	bitfield (2)	2	2	3424
AMSU-A2_Analog_Housekeeping_Data											
AMSU_A2_INVALID_ANALOG_WORD_FLAG	Invalid word bit flags: (if bit=0, associated AMSU-A2 analogue housekeeping telemetry word in following fields is valid)			1	1	1	1	bitfield (4)	4	4	3426
A2_ANALOG_SCANNER_MOTOR_ TEMPERATURE	A2 scanner motor temperature		counts	1	1	1	1	uinteger2	2	2	3430
A2_ANALOG_COMPENSATOR_MOTOR_ TEMPERATURE	A2 Compensator motor temperature		counts	1	1	1	1	uinteger2	2	2	3432
A2_ANALOG_RF_SHELF_TEMPERATURE	A2 RF shelf temperature		counts	1	1	1	1	uinteger2	2	2	3434

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
A2_ANALOG_WARM_TEMPERATURE	A2 warm load temperature		counts	1	1	1	1	uinteger2	2	2	3436
A2_ANALOG_COMENSATOR_MOTOR_ CURRENT	Compensator motor current (Avg)		counts	1	1	1	1	uinteger2	2	2	3438
A2_ANALOG_ANTENNA-DRIVE_MOTOR_CURRENT	A2 antenna drive motor current (Avg)		counts	1	1	1	1	uinteger2	2	2	3440
A2_ANALOG_PLUS15_SIGNAL_PROCESSING	+15V signal processing		counts	1	1	1	1	uinteger2	2	2	3442
A2_ANALOG_PLUS15_ANTENNA-DRIVE	+15V antenna drive		counts	1	1	1	1	uinteger2	2	2	3444
A2_ANALOG_MINUS15_SIGNAL_PROCESSING	–15V signal processing		counts	1	1	1	1	uinteger2	2	2	3446
A2_ANALOG_MINUS15_ANTENNA-DRIVE	–15V antenna drive		counts	1	1	1	1	uinteger2	2	2	3448
A2_ANALOG_PLU10_RECEIVER	+10V receiver		counts	1	1	1	1	uinteger2	2	2	3450
A2_ANALOG_PLUS5_SIGNAL_PROCESSING	+5V signal processing		counts	1	1	1	1	uinteger2	2	2	3452
A2_ANALOG_PLUS5_ANTENNA-DRIVE	+5V antenna drive		counts	1	1	1	1	uinteger2	2	2	3454
A2_ANALOG_GDO_VOLTAGE_CH1	GDO Voltage 23.8 GHz (channel 1)		counts	1	1	1	1	uinteger2	2	2	3456
A2_ANALOG_GDO_VOLTAGE_CH2	GDO Voltage 31.4 GHz (channel 2)		counts	1	1	1	1	uinteger2	2	2	3458
MOON_DATA											
AMSU_A1_LUNAR_ANGLE	Angle between moon and space view for AMSU-A1	10^2	degrees	1	1	1	1	integer2	2	2	3460
AMSU_A2_LUNAR_ANGLE	Angle between moon and space view for AMSU-A2	10^2	degrees	1	1	1	1	integer2	2	2	3462
											Total: 3464

11.4.1 Enumeration DISPOSITION_MODE

Value	*Name*	*Description*
T	Testing	
O	Operational	
C	Commissioning	

11.4.2 Enumeration INSTRUMENT_ID

Value	*Name*	*Description*
AMSA	AMSU-A	
ASCA	ASCAT	
ATOV	ATOVS	instruments: AVHRR/3, HIRS/4, AMSU-A, MHS
AVHR	AVHRR/3	
GOME	GOME	
GRAS	GRAS	
HIRS	HIRS/4	
IASI	IASI	
MHSx	MHS	
NOAA	All NOAA	instruments specific to Level 0 NOAA product
SEMx	SEM	
ADCS	ADCS	
SBUV	SBUV	
xxxx	No specific instrument	
HKTM	VCDU34	data specific to Level 0

11.4.3 Enumeration INSTRUMENT_MODEL

Value	*Name*	*Description*
0	Reserved	
1	Flight Model 1	
2	Flight Model 2	
3	Engineering Model	
4	Protoflight Model	

11.4.4 Enumeration PROCESSING_CENTRE

Value	*Name*	*Description*
CGS1		First EUMETSAT EPS Core Ground Segment
CGS2		Second EUMETSAT EPS Core Ground Segment
NSSx		NOAA/NESDIS
RUSx		Reference User Station
DMIx		DMI, Copenhagen (GRAS SAF)
DWDx		DWD, Offenbach (Climate SAF)
FMIx		FMI , Helsinki (Ozone SAF)
IMPx		IMP, Lisbon (Land SAF)
INMx		INM, Madrid (NCW SAF)
MFxx		MF, Lannion (OSI SAF)
UKMO		UKMO, Bracknell (NWP SAF)

11.4.5 Enumeration PROCESSING_LEVEL

Value	*Name*	*Description*
00	Level 0	
01	Level 1	
1A	Level 1a	
1B	Level 1b	
1C	Level 1c	
02	Level 2	
03	Level 3	
xx	No Specific Level	

11.4.6 Enumeration PROCESSING_MODE

Value	*Name*	*Description*
N	Nominal	NRT processing
B	Backlog Processing	
R	Reprocessing	
V	Validation	

11.4.7 Enumeration PRODUCT_TYPE

Value	*Name*	*Description*
ENG		IASI engineering data
GAC		NOAC Global Area Coverage AVHRR data
SND		Sounding Data
SZF		ASCAT calibrated s0 data at full resolution

Value	*Name*	*Description*
SZO		ASCAT-calibrated s0 data at operational resolution (50 km)
SZR		ASCAT-calibrated s0 data at research resolution (25 km)
VER		IASI verification data
xxx		No specific product type specified
AIP		NOAA AIP/SAIP data
TIP		NOAA TIP/STIP data
HRP		HRPT data
LRP		LRPT data

11.4.8 Enumeration RECEIVING_GROUND_STATION

Value	*Name*	*Description*
SVL		Svalbard
WAL		Wallops Island, Virginia
FBK		Fairbanks, Alaska
SOC		SOCC (NESDIS Satellite Operations Control Centre), Suitland, Maryland
RUS		Reference User Station

11.4.9 Enumeration SPACECRAFT_ID

Value	*Name*	*Description*
xxx		No specific spacecraft
M01		METOP 01
M02		METOP 02
M02		METOP 03
N15		NOAA-K

Value	*Name*	*Description*
N16		NOAA-L
N17		NOAA-M
N18		NOAA-N
N19		NOAA-N'

11.4.10 Bitfield AMSU_A1_DIGITALB_DATA

Length: 2 bytes

Name	*Description*	*Length*
Not used		1
cold space cal position	bit 14 = msb, bit 13 = lsb (0=6.667, 1=8.333, 2=9.999, 3=13.332 degrees)	2
nadir mode	0 = not in nadir	1
cold space cal mode	0 = not in cold cal	1
warm target cal mode	0 = not in warm cal	1
full scan mode	0 =not in full scan	1
Not used		4
survival heater power	0 = off	1
PLLO power	0 = secondary, 1 = primary	1
scanner A1-2 power	0 = off	1
scanner A1-1 power	0 = off	1
Not used		1
Total		**16**

11.4.11 Bitfield AMSU_A1_INVALID_ANALOG_WORD_FLAG

Length: 4 bytes

Name	*Description*	*Length*
Not used		4
Data	Word 27 (0 = valid) - Word 1 (0 = valid)	27
Not used		1
Total		**32**

11.4.12 Bitfield AMSU_A1_INVALID_DIGITALB_WORD_FLAG

Length: 2 bytes

Name	*Description*	*Length*
Not used		1
cold space cal position msb		1
cold space cal position lsb		1
nadir mode		1
cold space cal mode		1
warm target cal mode		1
full scan mode		1
Not used		4
survival heater power		1
PLLO power		1
scanner A1-2 power		1
scanner A1-1 power		1
Not used		1
Total		**16**

11.4.13 Bitfield AMSU_A2_DIGITALB_FLAG

Length: 2 bytes

Name	*Description*	*Length*
Not used		1
cold space cal position	bit 14 = msb, bit 13 = lsb (0=6.667, 1=8.333, 2=9.999, 3=13.332 degrees)	2
nadir mode	0 = not in nadir	1
cold space cal mode	0 = not in cold cal	1
warm target cal mode	0 = not in warm cal	1
full scan mode	0 =not in full scan	1
Not used		4
survival heater power	0 = off	1
Not used		1
scanner compensator power	0 = off	1
scanner A2 power	0 = off	1
Not used		1
Total		**16**

11.4.14 Bitfield AMSU_A2_INVALID_ANALOG_WORD_FLAG

Length: 4 bytes

Name	*Description*	*Length*
Not used		16
Data	Word 15 (0 = valid) - Word 1 (0 = valid)	15
Not used		1
Total		**32**

11.4.15 Bitfield AMSU_A2_INVALID_WORD_FLAG

Length: 2 bytes

Name	*Description*	*Length*
Not used		1
cold space cal position msb		1
cold space cal position lsb		1
nadir mode	0 = not in nadir	1
cold space cal mode	0 = not in cold cal	1
warm target cal mode	0 = not in warm cal	1
full scan mode	0 =not in full scan	1
Not used		4
survival heater power-	0 = off	1
Not used		1
scanner compensator power	0 = off	1
scanner A2 power	0 = off	1
Not used		1
Total		**16**

11.4.16 Bitfield FOV_DATA_QUALITY

Length: 2 bytes

Name	*Description*	*Length*
Scene radiance problems	If bit *n* set to 1, then scene radiance in channel *n* is physically unreasonable or has not been calculated due to calibration problems	15
Not used	Not used	1
Total		**16**

11.4.17 Bitfield INSTRUMENT_STATUS_A1

Length: 2 bytes

Name	*Description*	*Length*
Not used		1
Cold space cal position	MSB and LSB respectively (0 = 6.667, 1 = 8.333, 2 = 9.999, 3 = 13.332 degrees)	2
Nadir mode	0 = not in nadir	1
Cold space cal mode	0 = not in cold cal	1
Warm target cal mode	0 = not in warm cal	1
Full scan mode	0 = not in full scan	1
Not used		4
survival heater power	0 = off	1
PLLO power	0 = secondary, 1 = primary	1
scanner A1-2 power	0 = off	1
scanner A1-1 power	0 = off	1
Not used		1
Total		**16**

11.4.18 Bitfield INSTRUMENT_STATUS_A2

Length: 2 bytes

Name	*Description*	*Length*
Not used		1
Cold space cal position	MSB and LSB respectively (0 = 6.667, 1 = 8.333, 2 = 9.999, 3 = 13.332 degrees)	2
Nadir mode	0 = not in nadir	1
Cold space cal mode	0 = not in cold cal	1
Warm target cal mode	0 = not in warm cal	1
Full scan mode	0 = not in full scan	1

Name	*Description*	*Length*
Not used		4
survival heater power	0 = off	1
Not used		1
scanner compensator power	0 = off	1
scanner A2 power	0 = off	1
Not used		1
Total		**16**

11.4.19 Bitfield NAVIGATION_STATUS

Length: 4 bytes

Name	*Description*	*Length*
Not used		15
Earth location corrected for Euler angles		1
Earth location indicator	0 = earth location available, 1 = user ephemeris files older than 24 hours, 2 = no earth location available	4
Spacecraft attitude control	0 = operating in YGC or NOMINAL mode, 1 = operating in another mode, 2 = attitude exceeds nominal tolerance	4
Attitude SMODE	0 = NOMINAL mode, 1 = rate nulling mode, 2 = YGC mode, 3 = search mode, 4 = coast mode	4
Attitude mode	0 = NOMINAL mode/no test, 1 = yaw axis test in progress, 2 = roll axis test in progress, 3 = pitch axis test in progress	4
Total		**32**

11.4.20 Bitfield QUALITY_INDICATOR

Length: 4 bytes

Name	*Description*	*Length*
do not use scan for dataset generation	If a bit is on (=1) then the statement is true	1
time sequence error detected with this scan	If a bit is on (=1) then the statement is true	1

Name	*Description*	*Length*
data gap precedes this scan	If a bit is on (=1) then the statement is true	1
no calibration	If a bit is on (=1) then the statement is true	1
no earth location	If a bit is on (=1) then the statement is true	1
first good time following a clock update	If a bit is on (=1) then the statement is true	1
instrument status changed with this scan	If a bit is on (=1) then the statement is true	1
Not used		25
Total		**32**

11.4.21 Bitfield SCAN_LINE_QUALITY

Length: 4 bytes

Name	*Description*	*Length*
	Not used	6
	Lunar flag, scan line contaminated	1
	Lunar flag, scan line corrected for contamination	1
	Time field is bad but can probably be inferred from the previous good time	1
	Time field is bad and can’t be inferred from the previous good time	1
	This record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity). This may or may not be associated with a spacecraft clock update (See bit 26 in QUALITY_INDICATOR Field)	1
	Start of a sequence that apparently repeats scan times that have been previously accepted	1
	Not used	4
	Scan line was not calibrated because of bad time	1
	Scan line was calibrated using fewer than the preferred number of scan lines because of proximity to start or end of data set or to a data gap	1
	Scan line was not calibrated because of bad or insufficient PRT data	1
	Scan line was calibrated but with marginal PRT data	1
	Some uncalibrated channels on this scan. (See channel indicators.)	1
	Uncalibrated due to instrument mode.	1

Name	*Description*	*Length*
	Questionable calibration because of antenna position error of space view	1
	Questionable calibration because of antenna position error of black body	1
	Not earth located because of bad time; earth location fields zero filled	1
	Earth location questionable because of questionable time code. (See time problem flags above.)	1
	Earth location questionable - only marginal agreement with reasonableness check.	1
	Earth location questionable - fails reasonableness check	1
	Earth location questionable because of antenna position check	1
	Not used	3
Total		**32**

Bitfield CALIBRATION_QUALITY

As used in **MDR-1B Version 3**

Length: 2 bytes

Name	*Description*	*Length*
	Not used	10
	No good blackbody counts for scan line	1
	No good space view counts for scan line	1
	No good PRTs for this line	1
	Some bad blackbody counts for this line	1
	Some bad space view counts for this line	1
	Some bad PRTs temps for this line	1
Total		**16**

Bitfield CALIBRATION_QUALITY

As used in **MDR-1B Version 4+**

Length: 1 byte

Name	*Description*	*Length*
	Actual NEdT value exceeds specification	1
	Not used	1
	No good blackbody counts for scan line	1
	No good space view counts for scan line	1
	No good PRTs for this line	1
	Some bad blackbody view counts for this scan line	1
	Some bad space view counts for this scan line	1
	Some bad PRTs temps for this scan line	1
Total		**8**

Boolean values

Field	*value = 0*	*value = 1*
SUBSETTED_PRODUCT	Always set for near-real-time granule products. For EUMETSAT Data Centre products, set when the product contains a full dump	For EUMETSAT Data Centre products, set when the product contains subset information
DEGRADED_INST_MDR	TBC	TBC
DEGRADED_PROC_MDR	TBC	TBC

12 RECORD DESCRIPTION OF THE HIRS/4 LEVEL 1B PRODUCT

This HIRS/4 1b description corresponds to the HIRS/4 PFS [RD 6] Issue v7F and the Generic PFS [RD 1] Issue v8B.

In the tables below, coloured items have the following meanings:

Compound data type, which consists of at least two basic or other compound data types. The name of the compound data type is shown first, followed by a list of the items contained within it.

Dimension parameter for variable product fields.

Summary of Product Format Version record contents history:

	PFV = 10.0	**PFV = 11.0**
Record name	***Record version***	***Record version***
mphr	2	2
giadr-temp	2	2
giadr-analog	2	2
mdr-1b	2	3

If more than one version of a record exists, all versions are described below.

Contents:

Certain record types with formats common to all products (IPR, DMDR, GEADR, VEADR) are not included below, since they are not relevant to the average user. If required, details of these records can be found in the Generic PFS [RD 1].

12.1 MPHR (name 'mphr', class 1, subclass 0, version 2)

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
RECORD_HEADER	Generic Record Header			1	1	1	1	REC_HEAD	20	20	0
Product Details											
PRODUCT_NAME	Complete name of the product			1	1	1	1	string	67	100	20
PARENT_PRODUCT_NAME_1	Name of the parent product from which this product has been produced. For Level 0 products, this field is filled with lower case x's.			1	1	1	1	string	67	100	120
PARENT_PRODUCT_NAME_2	Name of the parent product from which this product has been produced. For Level 0 products or products for which this is not appropriate, this field is filled with lower case x's.			1	1	1	1	string	67	100	220
PARENT_PRODUCT_NAME_3	Name of the parent product from which this product has been produced. For Level 0 products or products for which this is not appropriate, this field is filled with lower case x's.			1	1	1	1	string	67	100	320
PARENT_PRODUCT_NAME_4	Name of the parent product from which this product has been produced. For Level 0 products or products for which this is not appropriate, this field is filled with lower case x's.			1	1	1	1	string	67	100	420
INSTRUMENT_ID	Instrument identification			1	1	1	1	enumerated	4	37	520
INSTRUMENT_MODEL	Instrument Model identification			1	1	1	1	enumerated	3	36	557
PRODUCT_TYPE	Product Type			1	1	1	1	enumerated	3	36	593
PROCESSING_LEVEL	Processing Level Identification			1	1	1	1	enumerated	2	35	629
SPACECRAFT_ID	Spacecraft identification			1	1	1	1	enumerated	3	36	664
SENSING_START	UTC Time of start of sensing data in this object (PDU, ROI or Full Product)			1	1	1	1	time	15	48	700
SENSING_END	UTC Time of end of sensing data in this object (PDU, ROI or Full Product)			1	1	1	1	time	15	48	748

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
SENSING_START_THEORETICAL	Theoretical UTC Time of start of sensing data in the dump from which this object is derived. This data is the predicted start time at the MPF level.			1	1	1	1	time	15	48	796
SENSING_END_THEORETICAL	Theoretical UTC Time of end of sensing data in the dump from which this object is derived. This data is the predicted end time at the MPF level.			1	1	1	1	time	15	48	844
PROCESSING_CENTRE	Processing Centre Identification			1	1	1	1	enumerated	4	37	892
PROCESSOR_MAJOR_VERSION	Processing chain major version number			1	1	1	1	uinteger	5	38	929
PROCESSOR_MINOR_VERSION	Processing chain minor version number			1	1	1	1	uinteger	5	38	967
FORMAT_MAJOR_VERSION	Dataset Format Major Version number			1	1	1	1	uinteger	5	38	1005
FORMAT_MINOR_VERSION	Dataset Format Minor Version number			1	1	1	1	uinteger	5	38	1043
PROCESSING_TIME_START	UTC time of the processing at start of processing for the product			1	1	1	1	time	15	48	1081
PROCESSING_TIME_END	UTC time of the processing at end of processing for the product			1	1	1	1	time	15	48	1129
PROCESSING_MODE	Identification of the mode of processing			1	1	1	1	enumerated	1	34	1177
DISPOSITION_MODE	Identification of the disposition mode			1	1	1	1	enumerated	1	34	1211
RECEIVING_GROUND_STATION	Acquisition Station Identification			1	1	1	1	enumerated	3	36	1245
RECEIVE_TIME_START	UTC time of the reception at CDA for first Data Item			1	1	1	1	time	15	48	1281
RECEIVE_TIME_END	UTC time of the reception at CDA for last Data Item			1	1	1	1	time	15	48	1329
ORBIT_START	Start Orbit Number, counted incrementally since launch			1	1	1	1	uinteger	5	38	1377
ORBIT_END	Stop Orbit Number			1	1	1	1	uinteger	5	38	1415
ACTUAL_PRODUCT_SIZE	Size of the complete product		bytes	1	1	1	1	uinteger	11	44	1453
ASCENDING NODE ORBIT PARAMETERS											
STATE_VECTOR_TIME	Epoch time (in UTC) of the orbital elements and the orbit state vector. this corresponds to the time of crossing the ascending node for ORBIT_START		UTC	1	1	1	1	longtime	18	51	1497

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
SEMI_MAJOR_AXIS	Semi major axis of orbit at time of the ascending node crossing.		mm	1	1	1	1	integer	11	44	1548
ECCENTRICITY	Orbit eccentricity at time of the ascending node crossing	10^6		1	1	1	1	integer	11	44	1592
INCLINATION	Orbit inclination at time of the ascending node crossing	10^3	degree	1	1	1	1	integer	11	44	1636
PERIGEE_ARGUMENT	Argument of perigee at time of the ascending node crossing	10^3	degree	1	1	1	1	integer	11	44	1680
RIGHT_ASCENSION	Right ascension at time of the ascending node crossing	10^3	degree	1	1	1	1	integer	11	44	1724
MEAN_ANOMALY	Mean anomaly at time of the ascending node crossing	10^3	degree	1	1	1	1	integer	11	44	1768
X_POSITION	X position of the orbit state vector in the orbit frame at ascending node	10^3	m	1	1	1	1	integer	11	44	1812
Y_POSITION	Y position of the orbit state vector in the orbit frame at ascending node	10^3	m	1	1	1	1	integer	11	44	1856
Z_POSITION	Z position of the orbit state vector in the orbit frame at ascending node	10^3	m	1	1	1	1	integer	11	44	1900
X_VELOCITY	X velocity of the orbit state vector in the orbit frame at ascending node	10^3	m/s	1	1	1	1	integer	11	44	1944
Y_VELOCITY	Y velocity of the orbit state vector in the orbit frame at ascending node	10^3	m/s	1	1	1	1	integer	11	44	1988
Z_VELOCITY	Z velocity of the orbit state vector in the orbit frame at ascending node	10^3	m/s	1	1	1	1	integer	11	44	2032
EARTH_SUN_DISTANCE_RATIO	Earth-Sun distance ratio - ratio of current Earth-Sun distance to Mean Earth-Sun distance			1	1	1	1	integer	11	44	2076
LOCATION_TOLERANCE_RADIAL	Nadir Earth location tolerance radial		m	1	1	1	1	integer	11	44	2120
LOCATION_TOLERANCE_CROSSTRACK	Nadir Earth location tolerance cross-track		m	1	1	1	1	integer	11	44	2164
LOCATION_TOLERANCE_ALONGTRACK	Nadir Earth location tolerance along-track		m	1	1	1	1	integer	11	44	2208
YAW_ERROR	Constant Yaw attitude error	10^3	degree	1	1	1	1	integer	11	44	2252
ROLL_ERROR	Constant Roll attitude error	10^3	degree	1	1	1	1	integer	11	44	2296
PITCH_ERROR	Constant Pitch attitude error	10^3	degree	1	1	1	1	integer	11	44	2340

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
LOCATION SUMMARY											
SUBSAT_LATITUDE_START	Latitude of sub-satellite point at start of the data set	10^3	Degree	1	1	1	1	integer	11	44	2384
SUBSAT_LONGITUDE_START	Longitude of sub-satellite point at start of the data set	10^3	Degree	1	1	1	1	integer	11	44	2428
SUBSAT_LATITUDE_END	Latitude of sub-satellite point at end of the data set	10^3	Degree	1	1	1	1	integer	11	44	2472
SUBSAT_LONGITUDE_END	Longitude of sub-satellite point at end of the data set	10^3	Degree	1	1	1	1	integer	11	44	2516
Leap Second Information											
LEAP_SECOND	Occurrence of Leap second within the product. Field is set to -1, 0 or +1 dependent upon occurrence of leap second and direction.			1	1	1	1	integer	2	35	2560
LEAP_SECOND_UTC	UTC time of occurrence of the Leap Second (If no leap second in the product, value is null)			1	1	1	1	time	15	48	2595
Record counts											
TOTAL_RECORDS	Total count of all records in the product			1	1	1	1	uinteger	6	39	2643
TOTAL_MPHR	Total count of all MPHRs in product (should always be 1!)			1	1	1	1	uinteger	6	39	2682
TOTAL_SPHR	Total count of all SPHRs in product (should be 0 or 1 only)			1	1	1	1	uinteger	6	39	2721
TOTAL_IPR	Total count of all IPRs in the product			1	1	1	1	uinteger	6	39	2760
TOTAL_GEADR	Total count of all GEADRs in the product			1	1	1	1	uinteger	6	39	2799
TOTAL_GIADR	Total count of all GIADRs in the product			1	1	1	1	uinteger	6	39	2838
TOTAL_VEADR	Total count of all VEADRs in the product			1	1	1	1	uinteger	6	39	2877
TOTAL_VIADR	Total count of all VIADRs in the product			1	1	1	1	uinteger	6	39	2916
TOTAL_MDR	Total count of all MDRs in the product			1	1	1	1	uinteger	6	39	2955
Record Based Generic Quality Flags											
COUNT_DEGRADED_INST_MDR	Count of MDRs with degradation due to instrument problems			1	1	1	1	uinteger	6	39	2994
COUNT_DEGRADED_PROC_MDR	Count of MDRs with degradation due to processing problems			1	1	1	1	uinteger	6	39	3033

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
COUNT_DEGRADED_INST_MDR_BLOCKS	Count of the number of blocks of MDRs degraded due to degraded instrument			1	1	1	1	uinteger	6	39	3072
COUNT_DEGRADED_PROC_MDR_BLOCKS	Count of the number of blocks of MDRs degraded due to degraded processing			1	1	1	1	uinteger	6	39	3111
Time Based Generic Quality Flags											
DURATION_OF_PRODUCT	The duration of the product in milliseconds		ms	1	1	1	1	uinteger	8	41	3150
MILLISECONDS_OF_DATA_PRESENT	The total amount of data present in the product		ms	1	1	1	1	uinteger	8	41	3191
MILLISECONDS_OF_DATA_MISSING	The total amount of data missing from the product		ms	1	1	1	1	uinteger	8	41	3232
Regional Product Information											
SUBSETTED_PRODUCT	Set when product has been subset (e.g. geographically subset using a region of interest filter). Implies the presence of one or more EUMETSAT Data Centre GIADRs in GAD section for product retrieved from Data Centre.			1	1	1	1	boolean	1	34	3273
											Total: 3307

12.2 GIADR (name 'giadr-temp', class 5, subclass 1, version 2)

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
RECORD_HEADER	Generic Record Header			1	1	1	1	REC_HEAD	20	20	0
TEMPERATURE-SENSOR_CONVERSION											
TEMPERATURE_RADIANCE_CENTRAL_WAVENUMBER	Temperature-Radiance Central Wavenumber nc - (ch. 1-19). Scale Factor is: 6 for ch 1 - 12 5 for ch 13 - 19 (ch 1 - 19 in order)		cm-1	19	1	1	1	integer4	4	76	20
TEMPERATURE_RADIANCE_CONSTANTB	Temperature-Radiance Constant Intercept b (ch 1 - 19 in order)	10^6	K	19	1	1	1	integer4	4	76	96

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
TEMPERATURE_RADIANCE_CONSTANTC	Temperature-Radiance Constant Slope c - (ch 1 - 19 in order)	10^6	K/K	19	1	1	1	integer4	4	76	172
ALBEDO_RADIANCE_SOLAR_IRRADIANCE	Albedo-Radiance Ch 20 Solar Filtered Irradiance	10^6	W/m^2	1	1	1	1	integer2	2	2	248
ALBEDO_RADIANCE_EQUIVALENT_WIDTH	Albedo-Radiance Ch 20 Equivalent Filter Width	10^6	cm^-1	1	1	1	1	integer2	2	2	250
											Total: 252

12.3 GIADR (name 'giadr-analog', class 5, subclass 2, version 2)

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
RECORD_HEADER	Generic Record Header			1	1	1	1	REC_HEAD	20	20	0
AD_CONVERSION											
Analog_telemetry_conversion											
RADIATOR_TEMPERATURE_COEFFICIENT	Radiator Temperature Coefficients (c0-c5)	10^2,10^2,10^3, 10^3,10^3,10^5	c0=K c1=K/cnt c2=K/cnt^2 c3=K/cnt^3 c4=K/cnt^4 c5=K/cnt^5	6	1	1	1	integer2	2	12	20
BASEPLATE_TEMPERATURE_COEFFICIENT	Base Plate Temperature Coefficients (c0-c5)	10^2,10^2,10^3, 10^3,10^3,10^5	c0=K c1=K/cnt c2=K/cnt^2 c3=K/cnt^3 c4=K/cnt^4 c5=K/cnt^5	6	1	1	1	integer2	2	12	32
ELECTRONIC_TEMPERATURE_COEFFICIENT	Electronics Temperature Coefficients (c0-c5)	10^2,10^2,10^3, 10^3,10^3,10^5	c0=K c1=K/cnt c2=K/cnt^2 c3=K/cnt^3 c4=K/cnt^4 c5=K/cnt^5	6	1	1	1	integer2	2	12	44
PATCH_TEMPERATURE_COEFFICIENT	Patch Temperature Coefficients (c0-c5)	10^2,10^2,10^3, 10^3,10^3,10^5	c0=K c1=K/cnt c2=K/cnt^2 c3=K/cnt^3 c4=K/cnt^4 c5=K/cnt^5	6	1	1	1	integer2	2	12	56
FILTER_HOUSING_CONTROLLER_CURRENT_	Filter Housing	10^2,10^2,10^3,	c0=K c1=K/cnt	6	1	1	1	integer2	2	12	68

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
COEFFICIENT	Controller Current Coefficients (c0-c5)	10^3,10^3,10^5	c2=K/cnt^2 c3=K/cnt^3 c4=K/cnt^4 c5=K/cnt^5								
SCAN_MOTOR_TEMPERATURE_COEFFICIENT	Scan Motor Temperature Coefficients (c0-c5)	10^2,10^2,10^3, 10^3,10^3,10^5	c0=K c1=K/cnt c2=K/cnt^2 c3=K/cnt^3 c4=K/cnt^4 c5=K/cnt^5	6	1	1	1	integer2	2	12	80
FILTER_WHEEL_MOTOR_TEMPERATURE_ COEFFICIENT	Filter Wheel Motor Temperature Coefficients (c0-c5)	10^2,10^2,10^3, 10^3,10^3,10^5	c0=K c1=K/cnt c2=K/cnt^2 c3=K/cnt^3 c4=K/cnt^4 c5=K/cnt^5	6	1	1	1	integer2	2	12	92
PLUS5_VDC_MONITOR_COEFFICIENT	+5 VDC Monitor Coefficients (c0-c5)	10^2,10^2,10^3, 10^3,10^3,10^5	c0=V c1=V/cnt c2=V/cnt^2 c3=V/cnt^3 c4=V/cnt^4 c5=V/cnt^5	6	1	1	1	integer2	2	12	104
PLUS10_VDC_TMLDC_COEFFICIENT	+10 VDC TLM/DC/DC Coefficients (c0-c5)	10^2,10^2,10^3, 10^3,10^3,10^5	c0=V c1=V/cnt c2=V/cnt^2 c3=V/cnt^3 c4=V/cnt^4 c5=V/cnt^5	6	1	1	1	integer2	2	12	116
PLUS75_VDC_TMLDC_COEFFICIENT	+7.5 VDC TLM/DC/DC Coefficients (c0-c5)	10^2,10^2,10^3, 10^3,10^3,10^5	c0=V c1=V/cnt c2=V/cnt^2 c3=V/cnt^3 c4=V/cnt^4 c5=V/cnt^5	6	1	1	1	integer2	2	12	128
MINUS75_VDC_TMLDC_COEFFICIENT	-7.5 VDC TLM/DC/DC Coefficients (c0-c5)	10^2,10^2,10^3, 10^3,10^3,10^5	c0=V c1=V/cnt c2=V/cnt^2 c3=V/cnt^3 c4=V/cnt^4 c5=V/cnt^5	6	1	1	1	integer2	2	12	140
PLUS15_VDC_MONITOR_COEFFICIENT	+15 VDC Monitor Coefficients (c0-c5)	10^2,10^2,10^3, 10^3,10^3,10^5	c0=V c1=V/cnt c2=V/cnt^2 c3=V/cnt^3 c4=V/cnt^4 c5=V/cnt^5	6	1	1	1	integer2	2	12	152
MINUS15_VDC_MONITOR_COEFFICIENT	–15 VDC Monitor Coefficients (c0-c5)	10^2,10^2,10^3, 10^3,10^3,10^5	c0=V c1=V/cnt c2=V/cnt^2 c3=V/cnt^3 c4=V/cnt^4 c5=V/cnt^5	6	1	1	1	integer2	2	12	164
FILTER_WHEEL_MOTOR_CURRENT_COEFFICIENT	Filter Wheel Motor Current Coefficients (c0-c5)	10^2,10^2,10^3, 10^3,10^3,10^5	c0=A c1=A/cnt c2=A/cnt^2 c3=A/cnt^3 c4=A/cnt^4 c5=A/cnt^5	6	1	1	1	integer2	2	12	176

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
SCAN_MOTOR_CURRENT_COEFFICIENT	Scan Motor Current Coefficients (c0-c5)	10^2,10^2,10^3, 10^3,10^3,10^5	c0=A c1=A/cnt c2=A/cnt^2 c3=A/cnt^3 c4=A/cnt^4 c5=A/cnt^5	6	1	1	1	integer2	2	12	188
PATCH_CONTROLLER_POWER_COEFFICIENT	Patch Controller Power Coefficients (c0-c5)	10^2,10^2,10^3, 10^3,10^3,10^5	c0=W c1=W/cnt c2=W/cnt^2 c3=W/cnt^3 c4=W/cnt^4 c5=W/cnt^5	6	1	1	1	integer2	2	12	200
											Total: 212

12.4 MDR (name 'mdr-1b', class 8, subclass 2, version 2)

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
RECORD_HEADER	Generic Record Header			1	1	1	1	REC_HEAD	20	20	0
GENERIC_QUALITY_INDICATORS											
DEGRADED_INST_MDR	Quality of MDR has been degraded from nominal due to an instrument degradation			1	1	1	1	boolean	1	1	20
DEGRADED_PROC_MDR	Quality of MDR has been degraded from nominal due to a processing degradation			1	1	1	1	boolean	1	1	21
Scan_Line_Information											
LINE_COUNTER	Line counter since last auto-calibration sequence. If calibration enabled then it runs from 0 to 39 else from 0 to 8191 followed by 0 to 8191 and so on			1	1	1	1	uinteger2	2	2	22
SCAN_TYPE_CODE	Scan type code (0 = Earth view, 1 = space view, 2 = cold BB view, 3 = warm BB view, 4 = else.			1	1	1	1	uinteger2	2	2	24
QUALITY_INDICATOR	Quality Indicator Bit Field			1	1	1	1	bitfield (4)	4	4	26

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
SCAN_LINE_QUALITY	Scan Line Quality Flags			1	1	1	1	bitfield (4)	4	4	30
CALIBRATION_QUALITY	Calibration Quality Flags			20	1	1	1	bitfield (2)	2	40	34
MEASUREMENT_DATA											
DIGITAL_A_DATA_ELEMENT_RAD	Radiances for 56 pixel values of a scan line in the 20 channels. Earth scan pixel values are calibrated to radiances (channel 1 - 19) and reflectance factors (channel 20).			56	1	1	1	DATA_ELEM_RAD	84	4704	74
DATA_ELEM_HEAD	Header			1	1	1	1	bitfield (4)	4	4	
RAD_DATA	Array elements (= channels) 1-19: Instrument radiance; 20: Reflectance	10^7	Ch 1 - 19: mW/(m^2.sr.cm) Ch 20: Percentage Reflectance	20	1	1	1	integer4	4	80	
DIGITAL_A_DATA_ELEMENT_FLAG	Information on the instrument status.			8	1	1	1	DATA_ELEM_FLAG	44	352	4778
DATA_ELEM_HEAD	Header			1	1	1	1	bitfield (4)	4	4	
FLAG_DATA	20 array elements containing data flags			20	1	1	1	bitfield (2)	2	40	
Digital_B_telemetry											
INSTRUMENT_INVALID_DIGITAL_WORD_FLAG	Invalid Word Bit Flags			1	1	1	1	bitfield (2)	2	2	5130
DIGITAL_B_DATA	Digital B Data			1	1	1	1	bitfield (2)	2	2	5132
Analog_telemetry											
INSTRUMENT_INVALID_ANALOG_WORD_FLAG	Invalid Word Bit Flags			1	1	1	1	bitfield (4)	4	4	5134
ANALOG_DATA	Analogue Data			16	1	1	1	u-byte	1	16	5138
NAVIGATION_DATA_AT_SCAN_LINE											
TIME_ATTITUDE	Time Associated with Attitude Angles		s	1	1	1	1	uinteger4	4	4	5154
EULER_ANGLE	Euler Angles: Roll, Pitch, Yaw	10^3	degree	3	1	1	1	integer2	2	6	5158
NAVIGATION_STATUS	Navigation Status Bit Field			1	1	1	1	bitfield (4)	4	4	5164

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
SPACECRAFT_ALTITUDE	Spacecraft Altitude Above Reference Geoid (MSL)	10^1	km	1	1	1	1	uinteger4	4	4	5168
ANGULAR_RELATION	Angular relationships: solar zenith angle, satellite zenith angle, solar azimuth angle, satellite azimuth angle (FOV 1 to 56)	10^2	degree	4	56	1	1	integer2	2	448	5172
EARTH_LOCATION	Earth Location: latitude, longitude (FOV 1 to 56)	10^4	degree	2	56	1	1	integer4	4	448	5620
SURFACE_PROPERTY	Surface property (0 = water, 1 = mixed/coast, 2 = land)			56	1	1	1	integer2	2	112	6068
TERRAIN_ELEVATION	Average terrain elevation (FOV 1 to 56)		m	56	1	1	1	integer2	2	112	6180
Calibration_Coefficient See Section 3.5.1.12 of HIRS/4 PFS [RD 6)											
PRIMARY_CALIBRATION_SECOND_ TERM	Primary Calibration Second Order Term a2 (ch. 1-20)	10^12	mW/m2/sr/ cm-1/cnt2 or % alb/cnt2 (ch 20)	20	1	1	1	integer4	4	80	6292
PRIMARY_CALIBRATION_FIRST_TERM	Primary Calibration First Order Term a1 (ch. 1-20)	10^9	mW/m2/sr/ cm-1/cnt or % alb/cnt (ch 20)	20	1	1	1	integer4	4	80	6372
PRIMARY_CALIBRATION_ZEROTH_ TERM	Primary Calibration Zero Order Term a0 (ch. 1-20)	10^6	mW/m2/sr/cm-1 or % alb (ch 20)	20	1	1	1	integer4	4	80	6452
SPARE_CALIBRATION_SECOND_TERM	Spare Calibration Second Order Term (ch. 1-20)	10^12	mW/m2/sr/ cm-1/cnt2 or % alb/cnt2 (ch 20)	20	1	1	1	integer4	4	80	6532
SPARE_CALIBRATION_FIRST_TERM	Spare Calibration First Order Term (ch. 1-20)	10^9	mW/m2/sr/ cm-1/cnt or % alb/cnt (ch 20)	20	1	1	1	integer4	4	80	6612
SPARE_CALIBRATION_ZEROTH_TERM	Spare Calibration Zero Order Term(ch. 1-20)	10^6	mW/m2/sr/cm-1 or % alb (ch 20)	20	1	1	1	integer4	4	80	6692
CLOUD_COVERAGE_INFORMATION											
PERCENTAGE_CLEAR_SKY	Percentage of sky that is clear of clouds	10^2	%	56	1	1	1	uinteger2	2	112	6772
											Total: 6884

12.5 MDR (name 'mdr-1b', class 8, subclass 2, version 3)

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
RECORD_HEADER	Generic Record Header			1	1	1	1	REC_HEAD	20	20	0
GENERIC_QUALITY_INDICATORS											
DEGRADED_INST_MDR	Quality of MDR has been degraded from nominal due to an instrument degradation			1	1	1	1	boolean	1	1	20
DEGRADED_PROC_MDR	Quality of MDR has been degraded from nominal due to a processing degradation			1	1	1	1	boolean	1	1	21
Scan_Line_Information											
LINE_COUNTER	Line counter since last auto-calibration sequence. If calibration enabled then it runs from 0 to 39 else from 0 to 8191 followed by 0 to 8191 and so on			1	1	1	1	uinteger2	2	2	22
SCAN_TYPE_CODE	Scan type code (0 = Earth view, 1 = space view, 2 = cold BB view, 3 = warm BB view, 4 = else.			1	1	1	1	uinteger2	2	2	24
QUALITY_INDICATOR	Quality Indicator Bit Field			1	1	1	1	bitfield (4)	4	4	26
SCAN_LINE_QUALITY	Scan Line Quality Flags			1	1	1	1	bitfield (4)	4	4	30
DATA_CALIBRATION	Noise-Equivalent Delta N and Channel Quality Flags			20	1	1	1	DATA_CALQUAL	2	40	34
NEDN_VALUE	Value of the noise equivalent channel radiance	**1** for Ch.1; **2** for Ch. 2 to 12; **4** for Ch. 13 to 19	$mW/(m^2\ sr\ cm^{-1})$	1	1	1	1	ubyte	1	1	
CALIBRATION_QUALITY	Channel Quality Flags			1	1	1	1	bitfield (1)	1	1	
MEASUREMENT_DATA											
DIGITAL_A_DATA_ELEMENT_RAD	Radiances for 56 pixel values of a scan			56	1	1	1	DATA_ELEM_	84	4704	74

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
	line in the 20 channels. Earth scan pixel values are calibrated to radiances (channel 1 - 19) and reflectance factors (channel 20).							RAD			
DATA_ELEM_HEAD	Header			1	1	1	1	bitfield (4)	4	4	
RAD_DATA	Array elements (= channels) 1-19: Instrument radiance; 20: Reflectance	10^7	Ch 1 - 19: mW/(m^2.sr.cm) Ch 20: Percentage Reflectance	20	1	1	1	integer4	4	80	
DIGITAL_A_DATA_ELEMENT_FLAG	Information on the instrument status.			8	1	1	1	DATA_ELEM_ FLAG	44	352	4778
DATA_ELEM_HEAD	Header			1	1	1	1	bitfield (4)	4	4	
FLAG_DATA	20 array elements containing data flags			20	1	1	1	bitfield (2)	2	40	
Digital_B_telemetry											
INSTRUMENT_INVALID_DIGITAL_ WORD_FLAG	Invalid Word Bit Flags			1	1	1	1	bitfield (2)	2	2	5130
DIGITAL_B_DATA	Digital B Data			1	1	1	1	bitfield (2)	2	2	5132
Analog_telemetry											
INSTRUMENT_INVALID_ANALOG_ WORD_FLAG	Invalid Word Bit Flags			1	1	1	1	bitfield (4)	4	4	5134
ANALOG_DATA	Analogue Data			16	1	1	1	u-byte	1	16	5138
NAVIGATION_DATA_AT_SCAN_LINE											
TIME_ATTITUDE	Time Associated with Attitude Angles		s	1	1	1	1	uinteger4	4	4	5154
EULER_ANGLE	Euler Angles: Roll, Pitch, Yaw	10^3	degree	3	1	1	1	integer2	2	6	5158
NAVIGATION_STATUS	Navigation Status Bit Field			1	1	1	1	bitfield (4)	4	4	5164
SPACECRAFT_ALTITUDE	Spacecraft Altitude Above Reference Geoid (MSL)	10^1	km	1	1	1	1	uinteger4	4	4	5168

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
ANGULAR_RELATION	Angular relationships: solar zenith angle, satellite zenith angle, solar azimuth angle, satellite azimuth angle (FOV 1 to 56)	10^2	degree	4	56	1	1	integer2	2	448	5172
EARTH_LOCATION	Earth Location: latitude, longitude (FOV 1 to 56)	10^4	degree	2	56	1	1	integer4	4	448	5620
SURFACE_PROPERTY	Surface property (0 = water, 1 = mixed/coast, 2 = land)			56	1	1	1	integer2	2	112	6068
TERRAIN_ELEVATION	Average terrain elevation (FOV 1 to 56)		m	56	1	1	1	integer2	2	112	6180
Calibration_Coefficient See Section 3.5.1.12 of HIRS/4 PFS [RD 6]											
PRIMARY_CALIBRATION_SECOND_ TERM	Primary Calibration Second Order Term a2 (channels 1-20)	10^12	mW/m2/sr/ cm-1/cnt2 or % alb/cnt2 (ch 20)	20	1	1	1	integer4	4	80	6292
PRIMARY_CALIBRATION_FIRST_TERM	Primary Calibration First Order Term a1 (channels 1-20)	10^9	mW/m2/sr/ cm-1/cnt or % alb/cnt (ch 20)	20	1	1	1	integer4	4	80	6372
PRIMARY_CALIBRATION_ZEROTH_ TERM	Primary Calibration Zero Order Term a0 (channels 1-20)	10^6	mW/m2/sr/cm-1 or % alb (ch 20)	20	1	1	1	integer4	4	80	6452
SPARE_CALIBRATION_SECOND_TERM	Spare Calibration Second Order Term (channels 1-20)	10^12	mW/m2/sr/ cm-1/cnt2 or % alb/cnt2 (ch 20)	20	1	1	1	integer4	4	80	6532
SPARE_CALIBRATION_FIRST_TERM	Spare Calibration First Order Term (channels 1-20)	10^9	mW/m2/sr/ cm-1/cnt or % alb/cnt (ch 20)	20	1	1	1	integer4	4	80	6612
SPARE_CALIBRATION_ZEROTH_TERM	Spare Calibration Zero Order Term (channels 1-20)	10^6	mW/m2/sr/cm-1 or % alb (ch 20)	20	1	1	1	integer4	4	80	6692
CLOUD_COVERAGE_INFORMATION											
PERCENTAGE_CLEAR_SKY	Percentage of sky that is clear of clouds	10^2	%	56	1	1	1	uinteger2	2	112	6772
											Total: 6884

12.5.1 Enumeration DISPOSITION_MODE

Value	*Name*	*Description*
T	Testing	
O	Operational	
C	Commissioning	

12.5.2 Enumeration INSTRUMENT_ID

Value	*Name*	*Description*
AMSA	AMSU-A	
ASCA	ASCAT	
ATOV	ATOVS	instruments: AVHRR/3, HIRS/4, AMSU-A, MHS
AVHR	AVHRR/3	
GOME	GOME	
GRAS	GRAS	
HIRS	HIRS/4	
IASI	IASI	
MHSx	MHS	
NOAA	All NOAA	instruments specific to Level 0 NOAA product
SEMx	SEM	
ADCS	ADCS	
SBUV	SBUV	
xxxx	No specific instrument	
HKTM	VCDU34	data specific to Level 0

12.5.3 Enumeration INSTRUMENT_MODEL

Value	*Name*	*Description*
0	Reserved	
1	Flight Model 1	
2	Flight Model 2	
3	Engineering Model	
4	Protoflight Model	

12.5.4 Enumeration PROCESSING_CENTRE

Value	*Name*	*Description*
CGS1		First EUMETSAT EPS Core Ground Segment
CGS2		Second EUMETSAT EPS Core Ground Segment
NSSx		NOAA/NESDIS
RUSx		Reference User Station
DMIx		DMI, Copenhagen (GRAS SAF)
DWDx		DWD, Offenbach (Climate SAF)
FMIx		FMI , Helsinki (Ozone SAF)
IMPx		IMP, Lisbon (Land SAF)
INMx		INM, Madrid (NCW SAF)
MFxx		MF, Lannion (OSI SAF)
UKMO		UKMO, Bracknell (NWP SAF)

12.5.5 Enumeration PROCESSING_LEVEL

Value	*Name*	*Description*
00	Level 0	
01	Level 1	
1A	Level 1a	
1B	Level 1b	
1C	Level 1c	
02	Level 2	
03	Level 3	
xx	No Specific Level	

12.5.6 Enumeration PROCESSING_MODE

Value	*Name*	*Description*
N	Nominal	NRT processing
B	Backlog Processing	
R	Reprocessing	
V	Validation	

12.5.7 Enumeration PRODUCT_TYPE

Value	*Name*	*Description*
ENG		IASI engineering data
GAC		NOAC Global Area Coverage AVHRR data
SND		Sounding Data
SZF		ASCAT calibrated s0 data at full resolution
SZO		ASCAT calibrated s0 data at operational resolution (50 km)

Value	*Name*	*Description*
SZR		ASCAT calibrated s0 data at research resolution (25 km)
VER		IASI verification data
xxx		No specific product type specified
AIP		NOAA AIP/SAIP data
TIP		NOAA TIP/STIP data
HRP		HRPT data
LRP		LRPT data

12.5.8 Enumeration RECEIVING_GROUND_STATION

Value	*Name*	*Description*
SVL		Svalbard
WAL		Wallops Island, Virginia
FBK		Fairbanks, Alaska
SOC		SOCC (NESDIS Satellite Operations Control Centre), Suitland, Maryland
RUS		Reference User Station

12.5.9 Enumeration SPACECRAFT_ID

Value	*Name*	*Description*
xxx		No specific spacecraft
M01		METOP 01
M02		METOP 02
M02		METOP 03
N15		NOAA-K
N16		NOAA-L

Value	*Name*	*Description*
N17		NOAA-M
N18		NOAA-N
N19		NOAA-N'

12.5.10 Bitfield DATA_ELEM_HEAD

Length: 4 bytes

Name	*Description*	*Length*
	Scan Encoder Position (0 to 199)	8
	Electronic Cal Level Indicator (0 to 31)	5
	Not used	2
	1 = Valid data, 0 = Ignore radiometric data	1
	Odd Bit Parity	1
	Not used	2
	Channel 1 Period Monitor (0 - 63)	6
	Element Number (0 - 63)	6
	Filter Sync Designator (= 1 if the filter wheel is in sync with timing system)	1
Total		**32**

12.5.11 Bitfield DIGITAL_B_DATA

Length: 2 bytes

Name	*Description*	*Length*
instrument power	0=off; 1=on	1
electronics power	0=off; 1=on	1

Name	*Description*	*Length*
filter motor power	0=off; 1=on	1
scan motor power	0=off; 1=on	1
cooler heater	0=off; 1=on	1
filter housing heater	0=off; 1=on	1
cooler door release	0=disabled; 1=enabled	1
cooler window heater	0=on; 1=off	1
go to nadir position	0=no; 1=yes/initiated	1
calibration sequence	0=disabled; 1=enabled	1
cooler door closed	0=yes; 1=no	1
cooler door fully open	0=yes; 1=no	1
filter motor power level	0=normal; 1=high	1
patch temperature controller	0=off; 1=on	1
spare	not used	2
Total		**16**

12.5.12 Bitfield INSTRUMENT_INVALID_ANALOG_WORD_FLAG

Length: 4 bytes

Name	*Description*	*Length*
Spare1	not used	15
pcp	patch controller power (following word 16)	1
words	following words 15 through 2 (in order)	14
rtemp	radiator temperature (following word 1)	1
Spare2	not used	1
Total		**32**

12.5.13 Bitfield INSTRUMENT_INVALID_DIGITAL_WORD_FLAG

Length: 2 bytes

Name	*Description*	*Length*
instrument power		1
electronics power		1
filter motor power		1
scan motor power		1
cooler heater		1
filter housing heater		1
cooler door release		1
cooler window heater		1
go to nadir position		1
calibration sequence		1
cooler door closed		1
cooler door fully open		1
filter motor power level		1
patch temperature controller		1
not used		2
Total		**16**

12.5.14 Bitfield NAVIGATION_STATUS

Length: 4 bytes

Name	*Description*	*Length*
Spare	Not used	15
EL_Corrected	Earth location corrected for Euler angles	1
EL_Indicator	Earth location indicator (0 = earth location available, 1 = user ephemeris files older than 24 hours, 2 = no earth location available)	4
SA_Control	Spacecraft attitude control (0 = operating in YGC or NOMINAL mode, 1 = operating in another mode, 2 = attitude exceeds nominal tolerance)	4
A_SMODE	Attitude SMODE (0 = NOMINAL mode, 1 = rate nulling mode, 2 = YGC mode, 3 = search mode, 4 = coast mode)	4
A_MODE	Attitude mode (0 = NOMINAL mode/no test, 1 = yaw axis test in progress, 2 = roll axis test in progress, 3 = pitch axis test in progress)	4
Total		**32**

12.5.15 Bitfield QUALITY_INDICATOR

Length: 4 bytes

Name	*Description*	*Length*
	do not use scan for dataset generation	1
	time sequence error detected with this scan (see below)	1
	data gap precedes this scan	1
	no calibration (see below)	1
	no earth location (see below)	1
	first good time following a clock update	1
	instrument status changed with this scan	1
	line incomplete, pixels missing	1
Not used	Not used	24
Total		**32**

12.5.16 Bitfield SCAN_LINE_QUALITY

Length: 4 bytes

Name	*Description*	*Length*
	Not used	8
	Time field is bad but can probably be inferred from the previous good time	1
	Time field is bad and can't be inferred from the previous good time	1
	This record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity). This may or may not be associated with a spacecraft clock update (See bit 26 in QUALITY_INDICATOR Field)	1
	Start of a sequence that apparently repeats scan times that have been previously accepted	1
	Not used	4
	Scan line was not calibrated because of bad time	1
	Scan line was calibrated using fewer than the preferred number of scan lines because of proximity to start or end of data set or to a data gap	1
	Scan line was not calibrated because of bad or insufficient PRT data	1
	Scan line was calibrated but with marginal PRT data	1
	Some uncalibrated channels on this scan. (See channel indicators.)	1
	Uncalibrated due to instrument mode.	1
	Questionable calibration because of antenna position error of space view	1
	Questionable calibration because of antenna position error of black body	1
	Not earth located because of bad time; earth location fields zero filled	1
	Earth location questionable because of questionable time code. (See time problem flags above.)	1
	Earth location questionable - only marginal agreement with reasonableness check.	1
	Earth location questionable - fails reasonableness check	1
	Earth location questionable because of antenna position check	1
	Not used	3
Total		**32**

12.5.17 Bitfield CALIBRATION_QUALITY

As used in **MDR-1B Version 2**

Length: 2 bytes

Name	*Description*	*Length*
	Not used	10
	No good blackbody counts for scan line	1
	No good space view counts for scan line	1
	No good PRTs for this line	1
	Marginal blackbody counts for this line	1
	Marginal space view counts for this line	1
	Marginal PRTs temps for this line	1
Total		**16**

12.5.18 Bitfield CALIBRATION_QUALITY

As used in **MDR-1B Version 3+**

Length: 1 byte

Name	*Description*	*Length*
	Actual NEdN value exceeds specification	1
	Actual NEdN value exceeds 95% of specification	1
	No good blackbody counts for scan line	1
	No good space view counts for scan line	1
	No good PRTs for this line	1
	Marginal blackbody view counts for this scan line	1
	Marginal space view counts for this scan line	1
	Marginal PRT temperatures for this scan line	1
Total		**8**

Bitfield FLAG_DATA

Length: 2 bytes

Name	*Description*	*Length*
	Instrument status information. See [RD 16], Figure 3.3.3.2/1.	16
Total		**16**

Boolean values

Field	*value = 0*	*value = 1*
SUBSETTED_PRODUCT	Always set for near-real-time granule products. For EUMETSAT Data Centre products, set when the product contains a full dump	For EUMETSAT Data Centre products, set when the product contains subset information
DEGRADED_INST_MDR	TBC	TBC
DEGRADED_PROC_MDR	TBC	TBC

13 RECORD DESCRIPTION OF THE MHS LEVEL 1B PRODUCT

This MHS 1b description corresponds to the MHS PFS [RD 4] Issue v7E and the Generic PFS [RD 1] Issue v8B.

In the tables below, coloured items have the following meanings:

Compound data type, which consists of at least two basic or other compound data types. The name of the compound data type is shown first, followed by a list of the items contained within it.

Dimension parameter for variable product fields.

Summary of Product Format Version record contents history

	PFV = 10.0	***PFV = 11.0***
Record name	***Record version***	***Record version***
mphr	2	2
giadr-navigation	3	3
giadr-radiance	3	3
giadr-adconv	1	1
mdr-1b	3	4

If more than one version of a record exists, all versions are described below.

Contents:

- MPHR (name 'mphr', class 1, subclass 0, version 2)
- GIADR (name 'giadr-navigation', class 5, subclass 1, version 3)
- GIADR (name 'giadr_radiance', class 5, subclass 2, version 3)
- GIADR (name 'giadr-adconv', class 5, subclass 3, version 1)
- MDR (name 'mdr-1b', class 8, subclass 2, version 3)
- MDR (name 'mdr-1b', class 8, subclass 2, version 4)

Certain record types with formats common to all products (IPR, DMDR, GEADR, VEADR) are not included below, since they are not relevant to the average user. If required, details of these records can be found in the Generic PFS [RD 1].

13.1 MPHR (name 'mphr', class 1, subclass 0, version 2)

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
RECORD_HEADER	Generic Record Header			1	1	1	1	REC_HEAD	20	20	0
Product Details											
PRODUCT_NAME	Complete name of the product			1	1	1	1	string	67	100	20
PARENT_PRODUCT_NAME_1	Name of the parent product from which this product has been produced. For Level 0 products, this field is filled with lower case x's.			1	1	1	1	string	67	100	120
PARENT_PRODUCT_NAME_2	Name of the parent product from which this product has been produced. For Level 0 products or products for which this is not appropriate, this field is filled with lower case x's.			1	1	1	1	string	67	100	220
PARENT_PRODUCT_NAME_3	Name of the parent product from which this product has been produced. For Level 0 products or products for which this is not appropriate, this field is filled with lower case x's.			1	1	1	1	string	67	100	320
PARENT_PRODUCT_NAME_4	Name of the parent product from which this product has been produced. For Level 0 products or products for which this is not appropriate, this field is filled with lower case x's.			1	1	1	1	string	67	100	420
INSTRUMENT_ID	Instrument identification			1	1	1	1	enumerated	4	37	520
INSTRUMENT_MODEL	Instrument Model identification			1	1	1	1	enumerated	3	36	557
PRODUCT_TYPE	Product Type			1	1	1	1	enumerated	3	36	593
PROCESSING_LEVEL	Processing Level Identification			1	1	1	1	enumerated	2	35	629
SPACECRAFT_ID	Spacecraft identification			1	1	1	1	enumerated	3	36	664
SENSING_START	UTC Time of start of sensing data in this object (PDU, ROI or Full Product)			1	1	1	1	time	15	48	700
SENSING_END	UTC Time of end of sensing data in this object (PDU, ROI or Full Product)			1	1	1	1	time	15	48	748
SENSING_START_THEORETICAL	Theoretical UTC Time of start of sensing data in the			1	1	1	1	time	15	48	796

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
	dump from which this object is derived. This data is the predicted start time at the MPF level.										
SENSING_END_THEORETICAL	Theoretical UTC Time of end of sensing data in the dump from which this object is derived. This data is the predicted end time at the MPF level.			1	1	1	1	time	15	48	844
PROCESSING_CENTRE	Processing Centre Identification			1	1	1	1	enumerated	4	37	892
PROCESSOR_MAJOR_VERSION	Processing chain major version number			1	1	1	1	uinteger	5	38	929
PROCESSOR_MINOR_VERSION	Processing chain minor version number			1	1	1	1	uinteger	5	38	967
FORMAT_MAJOR_VERSION	Dataset Format Major Version number			1	1	1	1	uinteger	5	38	1005
FORMAT_MINOR_VERSION	Dataset Format Minor Version number			1	1	1	1	uinteger	5	38	1043
PROCESSING_TIME_START	UTC time of the processing at start of processing for the product			1	1	1	1	time	15	48	1081
PROCESSING_TIME_END	UTC time of the processing at end of processing for the product			1	1	1	1	time	15	48	1129
PROCESSING_MODE	Identification of the mode of processing			1	1	1	1	enumerated	1	34	1177
DISPOSITION_MODE	Identification of the disposition mode			1	1	1	1	enumerated	1	34	1211
RECEIVING_GROUND_STATION	Acquisition Station Identification			1	1	1	1	enumerated	3	36	1245
RECEIVE_TIME_START	UTC time of the reception at CDA for first Data Item			1	1	1	1	time	15	48	1281
RECEIVE_TIME_END	UTC time of the reception at CDA for last Data Item			1	1	1	1	time	15	48	1329
ORBIT_START	Start Orbit Number, counted incrementally since launch			1	1	1	1	uinteger	5	38	1377
ORBIT_END	Stop Orbit Number			1	1	1	1	uinteger	5	38	1415
ACTUAL_PRODUCT_SIZE	Size of the complete product		bytes	1	1	1	1	uinteger	11	44	1453
ASCENDING NODE ORBIT PARAMETERS											
STATE_VECTOR_TIME	Epoch time (in UTC) of the orbital elements and the orbit state vector. this corresponds to the time of crossing the ascending node for ORBIT_START		UTC	1	1	1	1	longtime	18	51	1497
SEMI_MAJOR_AXIS	Semi major axis of orbit at time of the ascending node crossing.		mm	1	1	1	1	integer	11	44	1548

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
ECCENTRICITY	Orbit eccentricity at time of the ascending node crossing	10^6		1	1	1	1	integer	11	44	1592
INCLINATION	Orbit inclination at time of the ascending node crossing	10^3	degree	1	1	1	1	integer	11	44	1636
PERIGEE_ARGUMENT	Argument of perigee at time of the ascending node crossing	10^3	degree	1	1	1	1	integer	11	44	1680
RIGHT_ASCENSION	Right ascension at time of the ascending node crossing	10^3	degree	1	1	1	1	integer	11	44	1724
MEAN_ANOMALY	Mean anomaly at time of the ascending node crossing	10^3	degree	1	1	1	1	integer	11	44	1768
X_POSITION	X position of the orbit state vector in the orbit frame at ascending node	10^3	m	1	1	1	1	integer	11	44	1812
Y_POSITION	Y position of the orbit state vector in the orbit frame at ascending node	10^3	m	1	1	1	1	integer	11	44	1856
Z_POSITION	Z position of the orbit state vector in the orbit frame at ascending node	10^3	m	1	1	1	1	integer	11	44	1900
X_VELOCITY	X velocity of the orbit state vector in the orbit frame at ascending node	10^3	m/s	1	1	1	1	integer	11	44	1944
Y_VELOCITY	Y velocity of the orbit state vector in the orbit frame at ascending node	10^3	m/s	1	1	1	1	integer	11	44	1988
Z_VELOCITY	Z velocity of the orbit state vector in the orbit frame at ascending node	10^3	m/s	1	1	1	1	integer	11	44	2032
EARTH_SUN_DISTANCE_RATIO	Earth-Sun distance ratio - ratio of current Earth-Sun distance to Mean Earth-Sun distance			1	1	1	1	integer	11	44	2076
LOCATION_TOLERANCE_RADIAL	Nadir Earth location tolerance radial		m	1	1	1	1	integer	11	44	2120
LOCATION_TOLERANCE_CROSSTRACK	Nadir Earth location tolerance cross-track		m	1	1	1	1	integer	11	44	2164
LOCATION_TOLERANCE_ALONGTRACK	Nadir Earth location tolerance along-track		m	1	1	1	1	integer	11	44	2208
YAW_ERROR	Constant Yaw attitude error	10^3	degree	1	1	1	1	integer	11	44	2252
ROLL_ERROR	Constant Roll attitude error	10^3	degree	1	1	1	1	integer	11	44	2296
PITCH_ERROR	Constant Pitch attitude error	10^3	degree	1	1	1	1	integer	11	44	2340
LOCATION SUMMARY											
SUBSAT_LATITUDE_START	Latitude of sub-satellite point at start of the data set	10^3	Degree	1	1	1	1	integer	11	44	2384

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
SUBSAT_LONGITUDE_START	Longitude of sub-satellite point at start of the data set	10^3	Degree	1	1	1	1	integer	11	44	2428
SUBSAT_LATITUDE_END	Latitude of sub-satellite point at end of the data set	10^3	Degree	1	1	1	1	integer	11	44	2472
SUBSAT_LONGITUDE_END	Longitude of sub-satellite point at end of the data set	10^3	Degree	1	1	1	1	integer	11	44	2516
Leap Second Information											
LEAP_SECOND	Occurrence of Leap second within the product. Field is set to -1, 0 or +1 dependent upon occurrence of leap second and direction.			1	1	1	1	integer	2	35	2560
LEAP_SECOND_UTC	UTC time of occurrence of the Leap Second (If no leap second in the product, value is null)			1	1	1	1	time	15	48	2595
Record counts											
TOTAL_RECORDS	Total count of all records in the product			1	1	1	1	uinteger	6	39	2643
TOTAL_MPHR	Total count of all MPHRs in product (should always be 1!)			1	1	1	1	uinteger	6	39	2682
TOTAL_SPHR	Total count of all SPHRs in product (should be 0 or 1 only)			1	1	1	1	uinteger	6	39	2721
TOTAL_IPR	Total count of all IPRs in the product			1	1	1	1	uinteger	6	39	2760
TOTAL_GEADR	Total count of all GEADRs in the product			1	1	1	1	uinteger	6	39	2799
TOTAL_GIADR	Total count of all GIADRs in the product			1	1	1	1	uinteger	6	39	2838
TOTAL_VEADR	Total count of all VEADRs in the product			1	1	1	1	uinteger	6	39	2877
TOTAL_VIADR	Total count of all VIADRs in the product			1	1	1	1	uinteger	6	39	2916
TOTAL_MDR	Total count of all MDRs in the product			1	1	1	1	uinteger	6	39	2955
Record Based Generic Quality Flags											
COUNT_DEGRADED_INST_MDR	Count of MDRs with degradation due to instrument problems			1	1	1	1	uinteger	6	39	2994
COUNT_DEGRADED_PROC_MDR	Count of MDRs with degradation due to processing problems			1	1	1	1	uinteger	6	39	3033
COUNT_DEGRADED_INST_MDR_BLOCKS	Count of the number of blocks of MDRs degraded due to degraded instrument			1	1	1	1	uinteger	6	39	3072

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
COUNT_DEGRADED_PROC_MDR_BLOCKS	Count of the number of blocks of MDRs degraded due to degraded processing			1	1	1	1	uinteger	6	39	3111
Time-Based Generic Quality Flags											
DURATION_OF_PRODUCT	The duration of the product in milliseconds		ms	1	1	1	1	uinteger	8	41	3150
MILLISECONDS_OF_DATA_PRESENT	The total amount of data present in the product		ms	1	1	1	1	uinteger	8	41	3191
MILLISECONDS_OF_DATA_MISSING	The total amount of data missing from the product		ms	1	1	1	1	uinteger	8	41	3232
Regional Product Information											
SUBSETTED_PRODUCT	Set when product has been subset (e.g. geographically subset using a region of interest filter). Implies the presence of one or more EUMETSAT Data Centre GIADRs in GAD section for product retrieved from Data Centre.			1	1	1	1	boolean	1	34	3273
											Total: 3307

13.2 GIADR (name 'giadr-navigation', class 5, subclass 1, version 3)

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
RECORD_HEADER	Generic Record Header			1	1	1	1	REC_HEAD	20	20	0
ANTENNA_POSITION_PARAMETRS											
MID_PIX_POSITION_INC	Mid Pixel position increment	10^3	degree	1	1	1	1	uinteger2	2	2	20
MID_PIX_POSITION_ZERO	Zero Mid Pixel Position equivalent 0 degree = centre of OBCT 180 degree = nadir	10^2	degree	1	1	1	1	uinteger2	2	2	22
OUT_OF_SCAN_PLANE_ERROR	tabulated mispointing data for each pixel - out of scan plane errors for 91 positions Earth pixel 1-90 and 118 -5 channels	10^3	degree	5	91	1	1	integer2	2	910	24
IN_SCAN_PLANE_ERROR	tabulated mispointing data for each pixel - in scan plane errors for 91 Boresight angles - 5 channels	10^3	degree	5	91	1	1	integer2	2	910	934
IDEAL_POINTING_ANGLE	Ideal pointing spacing between two pixels for MHS (nominal 1.11111 degree.)	10^4	degree	1	1	1	1	integer2	2	2	1844
MHS_POINTING_PARAMETERS											
IDEAL_NADIR_PIXEL	Ideal nadir pointing position (180 degree)	10^2	degree	1	1	1	1	uinteger2	2	2	1846
IDEAL_OBCT_POSITION	Ideal OBCT Position	10^2	degree	4	1	1	1	uinteger2	2	8	1848
IDEAL_SPACE_TGT_POSITION	Ideal Space Target Position	10^2	degree	4	1	1	1	uinteger2	2	8	1856
IDEAL_EARTH_PIXEL_POS	Ideal Earth View Position	10^2	degree	90	1	1	1	uinteger2	2	180	1864
											Total: 2044

13.3 GIADR (name 'giadr_radiance', class 5, subclass 2, version 3)

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
RECORD_HEADER	Generic Record Header			1	1	1	1	REC_HEAD	20	20	0
PRIMARY_PRT_TEMPERATURE_PARAMETERS_(PIE-A)											
PRIMARY_REF_RESISTANCES	Reference Resistances for the primary PRT Set (Three channels)	10^4	Ohms	3	1	1	1	integer4	4	12	20

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
PRIMARY_RES_POL_COEFF_PRT_1_F0	PRT 1 zero order resistance-to -temperature conversion	10^6	K	1	1	1	1	integer4	4	4	32
PRIMARY_RES_POL_COEFF_PRT_1_F1	PRT 1 first order resistance-to -temperature conversion	10^6	K/Ohms	1	1	1	1	integer4	4	4	36
PRIMARY_RES_POL_COEFF_PRT_1_F2	PRT 1 second order resistance-to -temperature conversion	10^10	K/Ohms**2	1	1	1	1	integer4	4	4	40
PRIMARY_RES_POL_COEFF_PRT_1_F3	PRT 1 third order resistance-to -temperature conversion	10^13	K/Ohms**3	1	1	1	1	integer4	4	4	44
PRIMARY_RES_POL_COEFF_PRT_2_F0	PRT 2 zero order resistance-to -temperature conversion	10^6	K	1	1	1	1	integer4	4	4	48
PRIMARY_RES_POL_COEFF_PRT_2_F1	PRT 2 first order resistance-to -temperature conversion	10^6	K/Ohms	1	1	1	1	integer4	4	4	52
PRIMARY_RES_POL_COEFF_PRT_2_F2	PRT 2 second order resistance-to -temperature conversion	10^10	K/Ohms**2	1	1	1	1	integer4	4	4	56
PRIMARY_RES_POL_COEFF_PRT_2_F3	PRT 2 third order resistance-to -temperature conversion	10^13	K/Ohms**3	1	1	1	1	integer4	4	4	60
PRIMARY_RES_POL_COEFF_PRT_3_F0	PRT 3 zero order resistance-to -temperature conversion	10^6	K	1	1	1	1	integer4	4	4	64
PRIMARY_RES_POL_COEFF_PRT_3_F1	PRT 3 first order resistance-to -temperature conversion	10^6	K/Ohms	1	1	1	1	integer4	4	4	68
PRIMARY_RES_POL_COEFF_PRT_3_F2	PRT 3 second order resistance-to -temperature conversion	10^10	K/Ohms**2	1	1	1	1	integer4	4	4	72
PRIMARY_RES_POL_COEFF_PRT_3_F3	PRT 3 third order resistance-to -temperature conversion	10^13	K/Ohms**3	1	1	1	1	integer4	4	4	76
PRIMARY_RES_POL_COEFF_PRT_4_F0	PRT 4 zero order resistance-to -temperature conversion	10^6	K	1	1	1	1	integer4	4	4	80
PRIMARY_RES_POL_COEFF_PRT_4_F1	PRT 4 first order resistance-to -temperature conversion	10^6	K/Ohms	1	1	1	1	integer4	4	4	84

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
PRIMARY_RES_POL_COEFF_PRT_4_F2	PRT 4 second order resistance-to -temperature conversion	10^10	K/Ohms**2	1	1	1	1	integer4	4	4	88
PRIMARY_RES_POL_COEFF_PRT_4_F3	PRT 4 third order resistance-to -temperature conversion	10^13	K/Ohms**3	1	1	1	1	integer4	4	4	92
PRIMARY_RES_POL_COEFF_PRT_5_F0	PRT 5 zero order resistance-to -temperature conversion	10^6	K	1	1	1	1	integer4	4	4	96
PRIMARY_RES_POL_COEFF_PRT_5_F1	PRT 5 first order resistance-to -temperature conversion	10^6	K/Ohms	1	1	1	1	integer4	4	4	100
PRIMARY_RES_POL_COEFF_PRT_5_F2	PRT 5 second order resistance-to -temperature conversion	10^10	K/Ohms**2	1	1	1	1	integer4	4	4	104
PRIMARY_RES_POL_COEFF_PRT_5_F3	PRT 5 third order resistance-to -temperature conversion	10^13	K/Ohms**3	1	1	1	1	integer4	4	4	108
PRIMARY_PRT_WEIGHTS	PRT weighting coefficients (1 = PRT ok, 0 = bad PRT, 2 = Central PRT ok)			5	1	1	1	integer2	2	10	112
SECONDARY_PRT_TEMPERATURE_PARAMETERS_(PIE-B)											
SECONDARY_REF_RESISTANCES	Reference Resistances for the secondary PRT Set	10^4	Ohms	3	1	1	1	integer4	4	12	122
SECONDARY_RES_POL_COEFF_PRT_1_F0	PRT 1 zero order resistance-to -temperature conversion	10^6	K	1	1	1	1	integer4	4	4	134
SECONDARY_RES_POL_COEFF_PRT_1_F1	PRT 1 first order resistance-to -temperature conversion	10^6	K/Ohms	1	1	1	1	integer4	4	4	138
SECONDARY_RES_POL_COEFF_PRT_1_F2	PRT 1 second order resistance-to -temperature conversion	10^10	K/Ohms**2	1	1	1	1	integer4	4	4	142
SECONDARY_RES_POL_COEFF_PRT_1_F3	PRT 1 third order resistance-to -temperature conversion	10^13	K/Ohms**3	1	1	1	1	integer4	4	4	146
SECONDARY_RES_POL_COEFF_PRT_2_F0	PRT 2 zero order resistance-to -temperature conversion	10^6	K	1	1	1	1	integer4	4	4	150

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
SECONDARY_RES_POL_COEFF_PRT_2_F1	PRT 2 first order resistance-to -temperature conversion	10^6	K/Ohms	1	1	1	1	integer4	4	4	154
SECONDARY_RES_POL_COEFF_PRT_2_F2	PRT 2 second order resistance-to -temperature conversion	10^10	K/Ohms**2	1	1	1	1	integer4	4	4	158
SECONDARY_RES_POL_COEFF_PRT_2_F3	PRT 2 third order resistance-to -temperature conversion	10^13	K/Ohms**3	1	1	1	1	integer4	4	4	162
SECONDARY_RES_POL_COEFF_PRT_3_F0	PRT 3 zero order resistance-to -temperature conversion	10^6	K	1	1	1	1	integer4	4	4	166
SECONDARY_RES_POL_COEFF_PRT_3_F1	PRT 3 first order resistance-to -temperature conversion	10^6	K/Ohms	1	1	1	1	integer4	4	4	170
SECONDARY_RES_POL_COEFF_PRT_3_F2	PRT 3 second order resistance-to -temperature conversion	10^10	K/Ohms**2	1	1	1	1	integer4	4	4	174
SECONDARY_RES_POL_COEFF_PRT_3_F3	PRT 3 third order resistance-to -temperature conversion	10^13	K/Ohms**3	1	1	1	1	integer4	4	4	178
SECONDARY_RES_POL_COEFF_PRT_4_F0	PRT 4 zero order resistance-to -temperature conversion	10^6	K	1	1	1	1	integer4	4	4	182
SECONDARY_RES_POL_COEFF_PRT_4_F1	PRT 4 first order resistance-to -temperature conversion	10^6	K/Ohms	1	1	1	1	integer4	4	4	186
SECONDARY_RES_POL_COEFF_PRT_4_F2	PRT 4 second order resistance-to -temperature conversion	10^10	K/Ohms**2	1	1	1	1	integer4	4	4	190
SECONDARY_RES_POL_COEFF_PRT_4_F3	PRT 4 third order resistance-to -temperature conversion	10^13	K/Ohms**3	1	1	1	1	integer4	4	4	194
SECONDARY_RES_POL_COEFF_PRT_5_F0	PRT 5 zero order resistance-to -temperature conversion	10^6	K	1	1	1	1	integer4	4	4	198
SECONDARY_RES_POL_COEFF_PRT_5_F1	PRT 5 first order resistance-to -temperature conversion	10^6	K/Ohms	1	1	1	1	integer4	4	4	202
SECONDARY_RES_POL_COEFF_PRT_5_F2	PRT 5 second order resistance-to -temperature conversion	10^10	K/Ohms**2	1	1	1	1	integer4	4	4	206

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
SECONDARY_RES_POL_COEFF_PRT_5_F3	PRT 5 third order resistance-to -temperature conversion	10^13	K/Ohms**3	1	1	1	1	integer4	4	4	210
SECONDARY_PRT_WEIGHTS	PRT weighting coefficients (1 = PRT ok, 0 = bad PRT, 2 = Central PRT ok)			5	1	1	1	integer2	2	10	214
INSTRUMENT_TEMPERATURE											
INST_TEMPERATURE_SENSOR_ID	Instrument sensor ID; 0=primary (H5 LO temperature [QBS5]), 1=backup (H1 LO temperature [QBS1])			1	1	1	1	integer2	2	2	224
PRIMARY_REF_TEMPERATURES	Primary reference temperatures (from QBS5, minimum, nominal, and maximum)	10^2	K	3	1	1	1	integer2	2	6	226
BACKUP_REF_TEMPERATURES	Backup reference temperatures (from QBS1, minimum, nominal, and maximum)	10^2	K	3	1	1	1	integer2	2	6	232
COLD_SPACE_BIAS_CORRECTION											
COLD_SPACE_BIAS_CORRECTION	Cold Space Bias correction term, due to spacecraft and limb contamination (5 channels, 3 profiles)	10^3	K	5	3	1	1	integer2	2	30	238
WARM_LOAD_BIAS_CORRECTION											
WARM_LOAD_BIAS_CORRECTION	Warm load correction term, (5 channels, 3 instrument temperatures [minimum, nominal, maximum])	10^3	K	5	3	1	1	integer2	2	30	268
NON_LINEARITY_CORRECTION_PARAMETERS_(LO-A)											
NON_LINEARITY_COEFF_LOA_T1	a(n), scan dependent non linearity parameter at instrument temperature T1 (minimum temperature)	10^8	m**2 sr cm**-1/mW	5	1	1	1	integer4	4	20	298
NON_LINEARITY_COEFF_LOA_T2	a(n), scan dependent non linearity parameter at instrument temperature T2 (nominal temperature)	10^8	m**2 sr cm**-1/mW	5	1	1	1	integer4	4	20	318
NON_LINEARITY_COEFF_LOA_T3	a(n), scan dependent non linearity parameter at instrument temperature T3 (maximum	10^8	m**2 sr cm**-1/mW	5	1	1	1	integer4	4	20	338

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
	temperature)										
NON_LINEARITY_CORRECTION_PARAMETERS_(LO-B)											
NON_LINEARITY_COEFF_LOB_T1	a(n), scan dependent non linearity parameter at instrument backup temperature T1 (minimum temperature)	10^8	m**2 sr cm**–1/mW	5	1	1	1	integer4	4	20	358
NON_LINEARITY_COEFF_LOB_T2	a(n), scan dependent non linearity parameter at instrument backup temperature T2 (nominal temperature)	10^8	m**2 sr cm**–1/mW	5	1	1	1	integer4	4	20	378
NON_LINEARITY_COEFF_LOB_T3	a(n), scan dependent non linearity parameter at backup instrument temperature T3 (maximum temperature)	10^8	m**2 sr cm**–1/mW	5	1	1	1	integer4	4	20	398
TEMPERATURE-RADIANCE CONVERSION											
CENTRAL_WAVENUMBER_H1	Channel H1 Central wavenumber	10^6	cm**–1	1	1	1	1	integer4	4	4	418
TEMPERATURE_H1_INTERCEPT	Intercept for band correction channel H1	10^6	K	1	1	1	1	integer4	4	4	422
TEMPERATURE_H1_SLOPE	Slope for band correction channel H1	10^6	K/K	1	1	1	1	integer4	4	4	426
CENTRAL_WAVENUMBER_H2	Channel H2 Central wavenumber	10^6	cm**–1	1	1	1	1	integer4	4	4	430
TEMPERATURE_H2_INTERCEPT	Intercept for band correction channel H2	10^6	K	1	1	1	1	integer4	4	4	434
TEMPERATURE_H2_SLOPE	Slope for band correction channel H2	10^6	K/K	1	1	1	1	integer4	4	4	438
CENTRAL_WAVENUMBER_H3	Channel H3 Central wavenumber	10^6	cm**–1	1	1	1	1	integer4	4	4	442
TEMPERATURE_H3_INTERCEPT	Intercept for band correction channel H3	10^6	K	1	1	1	1	integer4	4	4	446
TEMPERATURE_H3_SLOPE	Slope for band correction channel H3	10^6	K/K	1	1	1	1	integer4	4	4	450
CENTRAL_WAVENUMBER_H4	Channel H4 Central wavenumber	10^6	cm**–1	1	1	1	1	integer4	4	4	454
TEMPERATURE_H4_INTERCEPT	Intercept for band correction channel H4	10^6	K	1	1	1	1	integer4	4	4	458
TEMPERATURE_H4_SLOPE	Slope for band correction channel H4	10^6	K/K	1	1	1	1	integer4	4	4	462
CENTRAL_WAVENUMBER_H5	Channel H5 Central wavenumber	10^6	cm**–1	1	1	1	1	integer4	4	4	466
TEMPERATURE_H5_INTERCEPT	Intercept for band correction channel H5	10^6	K	1	1	1	1	integer4	4	4	470

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
TEMPERATURE_H5_SLOPE	Slope for band correction channel H5	10^6	K/K	1	1	1	1	integer4	4	4	474
											Total: 478

13.4 GIADR (name 'giadr-adconv', class 5, subclass 3, version 1)

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
RECORD_HEADER	Generic Record Header			1	1	1	1	REC_HEAD	20	20	0
THERMISTOR_TELEMETRY_CONVERSION											
THERM_TEMP_C0	Zero order coefficient for conversion of the 24 housekeeping thermistors	10^4	K	1	1	1	1	integer4	4	4	20
THERM_TEMP_C1	First order coefficient for conversion of the 24 housekeeping thermistors	10^7	K/count	1	1	1	1	integer4	4	4	24
THERM_TEMP_C2	Second order coefficient for conversion of the 24 housekeeping thermistors	10^10	K/count^2	1	1	1	1	integer4	4	4	28
THERM_TEMP_C3	Third order coefficient for conversion of the 24 housekeeping thermistors	10^12	K/count^3	1	1	1	1	integer4	4	4	32
THERM_TEMP_C4	Fourth order coefficient for conversion of the 24 housekeeping thermistors	10^15	K/count^4	1	1	1	1	integer4	4	4	36
RAW_CURRENT_CONSUMPTION_CONVERSION											
EEANDSM_PLUS5_CURRENT_INTERCEPT	EE and SM +5V Current Intercept	10^6	A	1	1	1	1	integer4	4	4	40
EEANDSM_PLUS5_CURRENT_SLOPE	EE and SM +5V Current Slope	10^6	A/count	1	1	1	1	integer4	4	4	44
RECEIVER_PLUS8_CURRENT_INTERCEPT	Receiver +8V Current Intercept	10^6	A	1	1	1	1	integer4	4	4	48
RECEIVER_PLUS8_CURRENT_SLOPE	Receiver +8V Current Slope	10^6	A/count	1	1	1	1	integer4	4	4	52
RECEIVER_PLUS15_CURRENT_INTERCEPT	Receiver +15V Current Intercept	10^6	A	1	1	1	1	integer4	4	4	56

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
RECEIVER_PLUS15_CURRENT_SLOPE	Receiver +15V Current Slope	10^6	A/count	1	1	1	1	integer4	4	4	60
RECEIVER_MINUS15_CURRENT_INTERCEPT	Receiver -15V Current Intercept	10^6	A	1	1	1	1	integer4	4	4	64
RECEIVER_MINUS15_CURRENT_SLOPE	Receiver -15V Current Slope	10^6	A/count	1	1	1	1	integer4	4	4	68
RDM_MOTOR_CURRENT_INTERCEPT	RDM Motor Current Intercept	10^6	A	1	1	1	1	integer4	4	4	72
RDM_MOTOR_CURRENT_SLOPE	RDM Motor Current Slope	10^6	A/count	1	1	1	1	integer4	4	4	76
FDM_MOTOR_CURRENT_INTERCEPT	FDM Motor Current Intercept	10^6	A	1	1	1	1	integer4	4	4	80
FDM_MOTOR_CURRENT_SLOPE	FDM Motor Current Slope	10^6	A/count	1	1	1	1	integer4	4	4	84
SURVIVAL_TEMPERATURE_CONVERSION_(V=002*count)											
SURVIVAL_TEMPERATURE_C0	Zero order coefficient for Volt-to-temperature conversion of the survival thermistors	10^6	K	1	1	1	1	integer4	4	4	88
SURVIVAL_TEMPERATURE_C1	First order coefficient for Volt-to-temperature conversion of the survival thermistors	10^6	K/V	1	1	1	1	integer4	4	4	92
SURVIVAL_TEMPERATURE_C2	Second order coefficient for Volt-to-temperature conversion of the survival thermistors	10^6	K/V^2	1	1	1	1	integer4	4	4	96
SURVIVAL_TEMPERATURE_C3	Third order coefficient for Volt-to-temperature conversion of the survival thermistors	10^6	K/V^3	1	1	1	1	integer4	4	4	100
SURVIVAL_TEMPERATURE_C4	Fourth order coefficient for Volt-to-temperature conversion of the survival thermistors	10^6	K/V^4	1	1	1	1	integer4	4	4	104
SURVIVAL_TEMPERATURE_C5	Fifth order coefficient for Volt-to-temperature conversion of the survival thermistors	10^6	K/V^5	1	1	1	1	integer4	4	4	108
ANTENNA_POSITION_CONVERSION											

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
ANTENNA_POSITION_CONVERSION	Conversion factor for converting antenna views in degrees (default value=7.2/1024 degrees/count)	10^8	degree/count	1	1	1	1	uinteger4	4	4	112
RFI_CORRECTION											
RFI_BIAS_CORRECTION	Bias correction values depending on channel, scan angle, and transmitter (see text)		counts	420	1	1	1	integer2	2	840	116
TRANSMITTER_POWER	Transmitter reference power (see text)		counts	4	1	1	1	integer2	2	8	956
NEW_BIAS_CORRECTION	New bias correction values for three cycles of 8 seconds each (see text)		counts	495	1	1	1	integer2	2	990	964
											Total: 1954

13.5 MDR (name 'mdr-1b', class 8, subclass 2, version 3)

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
RECORD_HEADER	Generic Record Header			1	1	1	1	REC_HEAD	20	20	0
GENERIC_QUALITY_INDICATORS											
DEGRADED_INST_MDR	Quality of MDR has been degraded from nominal due to an instrument degradation			1	1	1	1	boolean	1	1	20
DEGRADED_PROC_MDR	Quality of MDR has been degraded from nominal due to a processing degradation			1	1	1	1	boolean	1	1	21
SOURCE_PACKET_SECONDARY_HEADER											
UTC_SL_TIME_DAY	UTC SL Time (# of days w.r.t. 171/2000 (day 0))			1	1	1	1	uinteger2	2	2	22
UTC_SL_TIME_MS	Millisecond of the day		ms	1	1	1	1	uinteger4	4	4	24
UTC_SL_TIME_MICROSEC	Microseconds of the day		microsec.	1	1	1	1	uinteger2	2	2	28

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
MHS_ANCILLARY_DATA											
OB_ICU_TIME_INT	Onboard ICU Time Integer part			1	1	1	1	bitfield (3)	3	3	30
OB_ICU_TIME_FRAC	Onboard ICU Time Fractional Part			1	1	1	1	integer1	1	1	33
FULL_HK_DATA											
MODE_SUBCOMM_CODE	see MDR-1A			1	1	1	1	bitfield (1)	1	1	34
TELECOMM_ACKN_FAULT	see MDR-1A			1	1	1	1	bitfield (5)	5	5	35
SWITCH_STATUS	see MDR-1A			1	1	1	1	bitfield (3)	3	3	40
THERMISTOR_TM_CHANNELS	Thermistor TM Channels 1 to 24 (see MDR-1A)			24	1	1	1	integer1	1	24	43
5V_SEC_CURRENT	(EE and SM +5V) Secondary Current		counts	1	1	1	1	u-byte	1	1	67
8V_RECEIVER_CURRENT	(+8V) Receiver Current		counts	1	1	1	1	u-byte	1	1	68
15V_RECEIVER_CURRENT	(+15V) Receiver Current		counts	1	1	1	1	u-byte	1	1	69
M15V_RECEIVER_CURRENT	(-15V) Receiver Current		counts	1	1	1	1	u-byte	1	1	70
RDM_MOTOR_CURRENT	RDM Motor Current		counts	1	1	1	1	u-byte	1	1	71
FDM_MOTOR_CURRENT	FDM Motor Current		counts	1	1	1	1	u-byte	1	1	72
STATUS_WORD											
STATUS_WORD	see MDR-1A		counts	1	1	1	1	bitfield (1)	1	1	73
SIGNAL_PROCESSING_STATUS											
CHANNEL_H1_DC_OFFSET	Channel H1 DC offset word		counts	1	1	1	1	u-byte	1	1	74
CHANNEL_H2_DC_OFFSET	Channel H2 DC offset word		counts	1	1	1	1	u-byte	1	1	75
CHANNEL_H3_DC_OFFSET	Channel H3 DC offset word		counts	1	1	1	1	u-byte	1	1	76
CHANNEL_H4_DC_OFFSET	Channel H4 DC offset word		counts	1	1	1	1	u-byte	1	1	77
CHANNEL_H5_DC_OFFSET	Channel H5 DC offset word		counts	1	1	1	1	u-byte	1	1	78
CHANNEL_VALID	Channel Validity			1	1	1	1	bitfield (1)	1	1	79
GAIN_CODE	Gain Settings of the Receiver			1	1	1	1	bitfield (3)	3	3	80

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
MEASUREMENT_DATA											
SCENE_RADIANCES	Scene Radiances (Channels H1-H5) - (Fields of View 1 - 90)	10^7	mW/m2/sr/cm-1	5	90	1	1	integer4	4	1800	83
FOV_DATA_QUALITY	FOV data quality Flags			90	1	1	1	bitfield (4)	4	360	1883
POSITION_VALIDITY_FLAGS											
EARTH_VIEW_POSITION_FLAG	Earth view position validity flags (see MDR-1A)			12	1	1	1	u-byte	1	12	2243
SPACE_VIEW_POSITION_FLAG	Space view position validity flags (see MDR-1A)			1	1	1	1	bitfield (1)	1	1	2255
OBCT_VIEW_POSITION_FLAG	Internal calibration target view position validity flag (see MDR-1A)			1	1	1	1	bitfield (1)	1	1	2256
OBCT_TEMPERATURE_DATA											
PRT1_TEMPERATURE	bit 0-3 : 0 (unused) bit 4-15: On Board Target Temperature 1 (PRT1)		counts	1	1	1	1	uinteger2	2	2	2257
PRT2_TEMPERATURE	bit 0-3 : 0 (unused) bit 4-15: On Board Target Temperature 2 (PRT2)		counts	1	1	1	1	uinteger2	2	2	2259
PRT3_TEMPERATURE	bit 0-3 : 0 (unused) bit 4-15: On Board Target Temperature 3 (PRT3)		counts	1	1	1	1	uinteger2	2	2	2261
PRT4_TEMPERATURE	bit 0-3 : 0 (unused) bit 4-15: On Board Target Temperature 4 (PRT4)		counts	1	1	1	1	uinteger2	2	2	2263
PRT5_TEMPERATURE	bit 0-3 : 0 (unused) bit 4-15: On Board Target Temperature 5 (PRT5)		counts	1	1	1	1	uinteger2	2	2	2265
CAL_CHAN_1	bit 0-3: 0 (unused) bit 4-15: PRT Calibration 1: 118 Ohms		counts	1	1	1	1	uinteger2	2	2	2267
CAL_CHAN_2	bit 0-3: 0 (unused) bit 4-15: PRT Calibration 2: 95.3 Ohms		counts	1	1	1	1	uinteger2	2	2	2269
CAL_CHAN_3	bit 0-3: 0 (unused) bit 4-15: PRT Calibration 3: 80.6 Ohms		counts	1	1	1	1	uinteger2	2	2	2271

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
RESISTANCE_PARAMETERS											
RESISTANCE_SLOPE	Slope m of the resistance equation	10^6	Ohm/counts	1	1	1	1	uinteger4	4	4	2273
RESISTANCE_OFFSET	Offset Roff of the resistance equation	10^2	Ohm	1	1	1	1	uinteger4	4	4	2277
RESISTANCE_PRT_1	Resistance value of PRT 1	10^2	Ohm	1	1	1	1	uinteger4	4	4	2281
RESISTANCE_PRT_2	Resistance value of PRT 2	10^2	Ohm	1	1	1	1	uinteger4	4	4	2285
RESISTANCE_PRT_3	Resistance value of PRT 3	10^2	Ohm	1	1	1	1	uinteger4	4	4	2289
RESISTANCE_PRT_4	Resistance value of PRT 4	10^2	Ohm	1	1	1	1	uinteger4	4	4	2293
RESISTANCE_PRT_5	Resistance value of PRT 5	10^2	Ohm	1	1	1	1	uinteger4	4	4	2297
TEMPERATURE_PRT_1	Temperature of PRT 1	10^3	K	1	1	1	1	uinteger4	4	4	2301
TEMPERATURE_PRT_2	Temperature of PRT 2	10^3	K	1	1	1	1	uinteger4	4	4	2305
TEMPERATURE_PRT_3	Temperature of PRT 3	10^3	K	1	1	1	1	uinteger4	4	4	2309
TEMPERATURE_PRT_4	Temperature of PRT 4	10^3	K	1	1	1	1	uinteger4	4	4	2313
TEMPERATURE_PRT_5	Temperature of PRT 5	10^3	K	1	1	1	1	uinteger4	4	4	2317
DISCRETE_TELEMETRY											
MAIN_BUS	Main bus select (indicates which main bus is used by MHS); 1 (0V)=A bus (relay closed), 0 (5V)=B bus (relay opened)			1	1	1	1	u-byte	1	1	2321
MHS_SURVIVAL_HEATER	1= on, 0 = off			1	1	1	1	u-byte	1	1	2322
RF_CONVERTER_PROTECT_DISABLE	1 = no, 0 = yes			1	1	1	1	u-byte	1	1	2323
MHS_POWER_A	1= on, 0 = off			1	1	1	1	u-byte	1	1	2324
MHS_POWER_B	1= on, 0 = off			1	1	1	1	u-byte	1	1	2325
MAIN_CONVERTER_PROTECT_DISABLE	1 = no, 0 = yes			1	1	1	1	u-byte	1	1	2326
SURVIVAL_TEMPS	Survival temperatures; Word 1: Receiver temperature, Word 2: Electronics equipment temperature, Word 3: Scan mechanism temperature		counts	3	1	1	1	u-byte	1	3	2327

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
TRANSMITTER_TELEM	Transmitter telemetry (zero filled for Metop); Word 1: STX-1 status, Word 2: STX-2 status, Word 3: STX-3 status, Word 4: STX-4 status, Word 5: STX-1 power, Word 6: STX-2 power, Word 7: STX-3 power, Word 8: SARR-A power, Word 9: SARR-B power		counts	9	1	1	1	uinteger2	2	18	2330
TELEMETRY_UPDATE	Discrete telemetry update (see MDR-1A)			1	1	1	1	bitfield (4)	4	4	2348
ASSOCIATED_DATA											
QUALITY_INDICATOR	Quality Indicator Bit Field			1	1	1	1	bitfield (4)	4	4	2352
SCAN_LINE_QUALITY	Scan Line Quality Flags			1	1	1	1	bitfield (4)	4	4	2356
CALIBRATION_QUALITY	Calibration Quality Flags			5	1	1	1	bitfield (2)	2	10	2360
CALIBRATION_COEFFICIENTS											
PRIMARY_CALIBRATION_SECOND_TERM	Primary Calibration Second Order Term a2 (H1-H5)	10^16	mW/m2/sr/cm-1/cnt2	5	1	1	1	integer4	4	20	2370
PRIMARY_CALIBRATION_FIRST_TERM	Primary Calibration First Order Term a1(H1-H5)	10^10	mW/m2/sr/cm-1/cnt	5	1	1	1	integer4	4	20	2390
PRIMARY_CALIBRATION_ZEROTH_TERM	Primary Calibration Zero Order Term a0 (H1-H5)	10^6	mW/m2/sr/cm-1	5	1	1	1	integer4	4	20	2410
SECONDARY_CALIBRATION_SECOND_TERM	Secondary Calibration Second Order Term a2 (H1-H5)	10^16	mW/m2/sr/cm-1/cnt2	5	1	1	1	integer4	4	20	2430
SECONDARY_CALIBRATION_FIRST_TERM	Secondary Calibration First Order Term a1 (H1-H5)	10^10	mW/m2/sr/ cm-1/cnt	5	1	1	1	integer4	4	20	2450
SECONDARY_CALIBRATION_ZEROTH_TERM	Secondary Calibration Zero Order Term a0 (H1-H5)	10^6	mW/m2/sr/cm-1	5	1	1	1	integer4	4	20	2470
CALIBRATION_PARAMETERS											
AVERAGE_WARM_TARGET_CNT	Average warm target count		counts	5	1	1	1	uinteger2	2	10	2490
AVERAGE_COLD_TARGET_CNT	Average cold target count		counts	5	1	1	1	uinteger2	2	10	2500
ZERO_RADIANCE_CNT	Zero Radiance Count		counts	5	1	1	1	uinteger2	2	10	2510

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
MEAN_WARM_TARGET_RAD	Mean warm target radiance	10^7	mW/m2/sr/cm-1	5	1	1	1	uinteger4	4	20	2520
MEAN_COLD_TARGET_RAD	Mean cold target radiance	10^7	mW/m2/sr/cm-1	5	1	1	1	uinteger4	4	20	2540
NONLINEARITY_PARAMETER	Non linearity parameter u	10^8	(mW/m2/sr/cm-1)**-1	5	1	1	1	uinteger4	4	20	2560
NAVIGATION_DATA_AT_SCAN_LINE											
TIME_ATTITUDE	Time Associated with Attitude Angles		s	1	1	1	1	uinteger4	4	4	2580
EULER_ANGLE	Euler Angles: Roll, Pitch, Yaw	10^3	degree	3	1	1	1	integer2	2	6	2584
NAVIGATION_STATUS	Navigation Status Bit Field			1	1	1	1	bitfield (4)	4	4	2590
SPACECRAFT_ALTITUDE	Spacecraft Altitude Above Reference Geoid (MSL)	10^1	km	1	1	1	1	uinteger4	4	4	2594
ANGULAR_RELATION	Angular relationships: solar zenith angle, satellite zenith angle, solar azimuth angle, satellite azimuth angle - (points 1 to 90)	10^2	degree	4	90	1	1	integer2	2	720	2598
EARTH_LOCATION	Earth Location: latitude, longitude (point 1 to 90)	10^4	degree	2	90	1	1	integer4	4	720	3318
SURFACE_PROPERTIES	Surface property (0 = water, 1 = mixed/coast, 2 = land) (point 1 to 90)			90	1	1	1	enumerated	1	90	4038
TERRAIN_ELEVATION	Average terrain elevation (point 1 to 90)		m	90	1	1	1	integer2	2	180	4128
LUNAR_ANGLES	Angles between moon and individual space views (between 0 and 180 degrees, one word for each of the four space views)	10^2	degree	4	1	1	1	uinteger2	2	8	4308
										Total: 4316	

13.6 MDR (name 'mdr-1b', class 8, subclass 2, version 4)

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
RECORD_HEADER	Generic Record Header			1	1	1	1	REC_HEAD	20	20	0
GENERIC_QUALITY_INDICATORS											
DEGRADED_INST_MDR	Quality of MDR has been degraded from nominal due to an instrument degradation			1	1	1	1	boolean	1	1	20
DEGRADED_PROC_MDR	Quality of MDR has been degraded from nominal due to a processing degradation			1	1	1	1	boolean	1	1	21
SOURCE_PACKET_SECONDARY_HEADER											
UTC_SL_TIME_DAY	UTC SL Time (# of days with regard to 171/2000 (day 0))			1	1	1	1	uinteger2	2	2	22
UTC_SL_TIME_MS	Millisecond of the day		ms	1	1	1	1	uinteger4	4	4	24
UTC_SL_TIME_MICROSEC	Microseconds of the day		microsec.	1	1	1	1	uinteger2	2	2	28
MHS_ANCILLARY_DATA											
OB_ICU_TIME_INT	Onboard ICU Time Integer part			1	1	1	1	bitfield (3)	3	3	30
OB_ICU_TIME_FRAC	Onboard ICU Time Fractional Part			1	1	1	1	integer1	1	1	33
FULL_HK_DATA											
MODE_SUBCOMM_CODE	see MDR-1A			1	1	1	1	bitfield (1)	1	1	34
TELECOMM_ACKN_FAULT	see MDR-1A			1	1	1	1	bitfield (5)	5	5	35
SWITCH_STATUS	see MDR-1A			1	1	1	1	bitfield (3)	3	3	40
THERMISTOR_TM_CHANNELS	Thermistor TM Channels 1 to 24 (see MDR-1A)			24	1	1	1	integer1	1	24	43
5V_SEC_CURRENT	(EE and SM +5V) Secondary Current		counts	1	1	1	1	u-byte	1	1	67
8V_RECEIVER_CURRENT	(+8V) Receiver Current		counts	1	1	1	1	u-byte	1	1	68
15V_RECEIVER_CURRENT	(+15V) Receiver Current		counts	1	1	1	1	u-byte	1	1	69
M15V_RECEIVER_CURRENT	(-15V) Receiver Current		counts	1	1	1	1	u-byte	1	1	70
RDM_MOTOR_CURRENT	RDM Motor Current		counts	1	1	1	1	u-byte	1	1	71

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
FDM_MOTOR_CURRENT	FDM Motor Current		counts	1	1	1	1	u-byte	1	1	72
STATUS_WORD											
STATUS_WORD	see MDR-1A		counts	1	1	1	1	bitfield (1)	1	1	73
SIGNAL_PROCESSING_STATUS											
CHANNEL_H1_DC_OFFSET	Channel H1 DC offset word		counts	1	1	1	1	u-byte	1	1	74
CHANNEL_H2_DC_OFFSET	Channel H2 DC offset word		counts	1	1	1	1	u-byte	1	1	75
CHANNEL_H3_DC_OFFSET	Channel H3 DC offset word		counts	1	1	1	1	u-byte	1	1	76
CHANNEL_H4_DC_OFFSET	Channel H4 DC offset word		counts	1	1	1	1	u-byte	1	1	77
CHANNEL_H5_DC_OFFSET	Channel H5 DC offset word		counts	1	1	1	1	u-byte	1	1	78
CHANNEL_VALID	Channel Validity			1	1	1	1	bitfield (1)	1	1	79
GAIN_CODE	Gain Settings of the Receiver			1	1	1	1	bitfield (3)	3	3	80
MEASUREMENT_DATA											
SCENE_RADIANCES	Scene Radiances (Channels H1-H5) - (Fields of View 1 - 90)	10^7	mW/m2/sr/cm-1	5	90	1	1	integer4	4	1800	83
FOV_DATA_QUALITY	FOV data quality Flags			90	1	1	1	bitfield (4)	4	360	1883
POSITION_VALIDITY_FLAGS											
EARTH_VIEW_POSITION_FLAG	Earth view position validity flags (see MDR-1A)			12	1	1	1	u-byte	1	12	2243
SPACE_VIEW_POSITION_FLAG	Space view position validity flags (see MDR-1A)			1	1	1	1	bitfield (1)	1	1	2255
OBCT_VIEW_POSITION_FLAG	Internal calibration target view position validity flag (see MDR-1A)			1	1	1	1	bitfield (1)	1	1	2256
OBCT_TEMPERATURE_DATA											
PRT1_TEMPERATURE	bit 0-3 : 0 (unused) bit 4-15: On Board Target Temperature 1 (PRT1)		counts	1	1	1	1	uinteger2	2	2	2257
PRT2_TEMPERATURE	bit 0-3 : 0 (unused) bit 4-15: On Board Target Temperature 2 (PRT2)		counts	1	1	1	1	uinteger2	2	2	2259

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
PRT3_TEMPERATURE	bit 0-3 : 0 (unused) bit 4-15: On Board Target Temperature 3 (PRT3)		counts	1	1	1	1	uinteger2	2	2	2261
PRT4_TEMPERATURE	bit 0-3 : 0 (unused) bit 4-15: On Board Target Temperature 4 (PRT4)		counts	1	1	1	1	uinteger2	2	2	2263
PRT5_TEMPERATURE	bit 0-3 : 0 (unused) bit 4-15: On Board Target Temperature 5 (PRT5)		counts	1	1	1	1	uinteger2	2	2	2265
CAL_CHAN_1	bit 0-3: 0 (unused) bit 4-15: PRT Calibration 1: 118 Ohms		counts	1	1	1	1	uinteger2	2	2	2267
CAL_CHAN_2	bit 0-3: 0 (unused) bit 4-15: PRT Calibration 2: 95.3 Ohms		counts	1	1	1	1	uinteger2	2	2	2269
CAL_CHAN_3	bit 0-3: 0 (unused) bit 4-15: PRT Calibration 3: 80.6 Ohms		counts	1	1	1	1	uinteger2	2	2	2271
RESISTANCE_PARAMETERS											
RESISTANCE_SLOPE	Slope m of the resistance equation	10^6	Ohm/counts	1	1	1	1	uinteger4	4	4	2273
RESISTANCE_OFFSET	Offset Roff of the resistance equation	10^2	Ohm	1	1	1	1	uinteger4	4	4	2277
RESISTANCE_PRT_1	Resistance value of PRT 1	10^2	Ohm	1	1	1	1	uinteger4	4	4	2281
RESISTANCE_PRT_2	Resistance value of PRT 2	10^2	Ohm	1	1	1	1	uinteger4	4	4	2285
RESISTANCE_PRT_3	Resistance value of PRT 3	10^2	Ohm	1	1	1	1	uinteger4	4	4	2289
RESISTANCE_PRT_4	Resistance value of PRT 4	10^2	Ohm	1	1	1	1	uinteger4	4	4	2293
RESISTANCE_PRT_5	Resistance value of PRT 5	10^2	Ohm	1	1	1	1	uinteger4	4	4	2297
TEMPERATURE_PRT_1	Temperature of PRT 1	10^3	K	1	1	1	1	uinteger4	4	4	2301
TEMPERATURE_PRT_2	Temperature of PRT 2	10^3	K	1	1	1	1	uinteger4	4	4	2305
TEMPERATURE_PRT_3	Temperature of PRT 3	10^3	K	1	1	1	1	uinteger4	4	4	2309
TEMPERATURE_PRT_4	Temperature of PRT 4	10^3	K	1	1	1	1	uinteger4	4	4	2313
TEMPERATURE_PRT_5	Temperature of PRT 5	10^3	K	1	1	1	1	uinteger4	4	4	2317
DISCRETE_TELEMETRY											
MAIN_BUS	Main bus select (indicates which main			1	1	1	1	u-byte	1	1	2321

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
	bus is used by MHS); 1 (0V)=A bus (relay closed), 0 (5V)=B bus (relay opened)										
MHS_SURVIVAL_HEATER	1= on, 0 = off			1	1	1	1	u-byte	1	1	2322
RF_CONVERTER_PROTECT_DISABLE	1 = no, 0 = yes			1	1	1	1	u-byte	1	1	2323
MHS_POWER_A	1= on, 0 = off			1	1	1	1	u-byte	1	1	2324
MHS_POWER_B	1= on, 0 = off			1	1	1	1	u-byte	1	1	2325
MAIN_CONVERTER_PROTECT_DISABLE	1 = no, 0 = yes			1	1	1	1	u-byte	1	1	2326
SURVIVAL_TEMPS	Survival temperatures; Word 1: Receiver temperature, Word 2: Electronics equipment temperature, Word 3: Scan mechanism temperature		counts	3	1	1	1	u-byte	1	3	2327
TRANSMITTER_TELEM	Transmitter telemetry (zero filled for Metop); Word 1: STX-1 status, Word 2: STX-2 status, Word 3: STX-3 status, Word 4: STX-4 status, Word 5: STX-1 power, Word 6: STX-2 power, Word 7: STX-3 power, Word 8: SARR-A power, Word 9: SARR-B power		counts	9	1	1	1	uinteger2	2	18	2330
TELEMETRY_UPDATE	Discrete telemetry update (see MDR-1A)			1	1	1	1	bitfield (4)	4	4	2348
ASSOCIATED_DATA											
QUALITY_INDICATOR	Quality Indicator Bit Field			1	1	1	1	bitfield (4)	4	4	2352
SCAN_LINE_QUALITY	Scan Line Quality Flags			1	1	1	1	bitfield (4)	4	4	2356
DATA_CALIBRATION	Noise-Equivalent Delta T and Channel Quality Flags			5	1	1	1	DATA_CALQUAL	2	10	2360
NEDT_VALUE	Value of the noise equivalent temperature	10^2	K	1	1	1	1	ubyte	1	1	
CALIBRATION_QUALITY	Channel Quality Flags			1	1	1	1	bitfield (1)	1	1	

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
CALIBRATION_COEFFICIENTS											
PRIMARY_CALIBRATION_SECOND_TERM	Primary Calibration Second Order Term a2 (H1-H5)	10^16	mW/m2/sr/cm-1/cnt2	5	1	1	1	integer4	4	20	2370
PRIMARY_CALIBRATION_FIRST_TERM	Primary Calibration First Order Term a1(H1-H5)	10^10	mW/m2/sr/cm-1/cnt	5	1	1	1	integer4	4	20	2390
PRIMARY_CALIBRATION_ZEROTH_TERM	Primary Calibration Zero Order Term a0 (H1-H5)	10^6	mW/m2/sr/cm-1	5	1	1	1	integer4	4	20	2410
SECONDARY_CALIBRATION_SECOND_TERM	Secondary Calibration Second Order Term a2 (H1-H5)	10^16	mW/m2/sr/cm-1/cnt2	5	1	1	1	integer4	4	20	2430
SECONDARY_CALIBRATION_FIRST_TERM	Secondary Calibration First Order Term a1 (H1-H5)	10^10	mW/m2/sr/cm-1/cnt	5	1	1	1	integer4	4	20	2450
SECONDARY_CALIBRATION_ZEROTH_TERM	Secondary Calibration Zero Order Term a0 (H1-H5)	10^6	mW/m2/sr/cm-1	5	1	1	1	integer4	4	20	2470
CALIBRATION_PARAMETERS											
AVERAGE_WARM_TARGET_CNT	Average warm target count		counts	5	1	1	1	uinteger2	2	10	2490
AVERAGE_COLD_TARGET_CNT	Average cold target count		counts	5	1	1	1	uinteger2	2	10	2500
ZERO_RADIANCE_CNT	Zero Radiance Count		counts	5	1	1	1	uinteger2	2	10	2510
MEAN_WARM_TARGET_RAD	Mean warm target radiance	10^7	mW/m2/sr/cm–1	5	1	1	1	uinteger4	4	20	2520
MEAN_COLD_TARGET_RAD	Mean cold target radiance	10^7	mW/m2/sr/cm–1	5	1	1	1	uinteger4	4	20	2540
NONLINEARITY_PARAMETER	Non linearity parameter u	10^8	(mW/m2/sr/cm-1)**–1	5	1	1	1	uinteger4	4	20	2560
NAVIGATION_DATA_AT_SCAN_LINE											
TIME_ATTITUDE	Time Associated with Attitude Angles		s	1	1	1	1	uinteger4	4	4	2580
EULER_ANGLE	Euler Angles: Roll, Pitch, Yaw	10^3	degree	3	1	1	1	integer2	2	6	2584
NAVIGATION_STATUS	Navigation Status Bit Field			1	1	1	1	bitfield (4)	4	4	2590

Name	*Description*	*Scaling factor*	*Units*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Type*	*Type size*	*Field size*	*Offset*
SPACECRAFT_ALTITUDE	Spacecraft Altitude Above Reference Geoid (MSL)	10^1	km	1	1	1	1	uinteger4	4	4	2594
ANGULAR_RELATION	Angular relationships: solar zenith angle, satellite zenith angle, solar azimuth angle, satellite azimuth angle - (points 1 to 90). Note: azimuth angle range is -180 to +180, where minus is west and plus is east.	10^2	degree	4	90	1	1	integer2	2	720	2598
EARTH_LOCATION	Earth Location: latitude, longitude (point 1 to 90)	10^4	degree	2	90	1	1	integer4	4	720	3318
SURFACE_PROPERTIES	Surface property (0 = water, 1 = mixed/coast, 2 = land) (point 1 to 90)			90	1	1	1	enumerated	1	90	4038
TERRAIN_ELEVATION	Average terrain elevation (point 1 to 90)		m	90	1	1	1	integer2	2	180	4128
LUNAR_ANGLES	Angles between moon and individual space views (between 0 and 180 degrees, one word for each of the four space views)	10^2	degree	4	1	1	1	uinteger2	2	8	4308
											Total: 4316

13.6.1 Enumeration DISPOSITION_MODE

Value	*Name*	*Description*
T	Testing	
O	Operational	
C	Commissioning	

13.6.2 Enumeration INSTRUMENT_ID

Value	*Name*	*Description*
AMSA	AMSU-A	
ASCA	ASCAT	
ATOV	ATOVS	instruments: AVHRR/3, HIRS/4, AMSU-A, MHS
AVHR	AVHRR/3	
GOME	GOME	
GRAS	GRAS	
HIRS	HIRS/4	
IASI	IASI	
MHSx	MHS	
NOAA	All NOAA	instruments specific to Level 0 NOAA product
SEMx	SEM	
ADCS	ADCS	
SBUV	SBUV	
xxxx	No specific instrument	
HKTM	VCDU34	data specific to Level 0

13.6.3 Enumeration INSTRUMENT_MODEL

Value	*Name*	*Description*
0	Reserved	
1	Flight Model 1	
2	Flight Model 2	
3	Engineering Model	
4	Protoflight Model	

13.6.4 Enumeration PROCESSING_CENTRE

Value	*Name*	*Description*
CGS1		First EUMETSAT EPS Core Ground Segment
CGS2		Second EUMETSAT EPS Core Ground Segment
NSSx		NOAA/NESDIS
RUSx		Reference User Station
DMIx		DMI, Copenhagen (GRAS SAF)
DWDx		DWD, Offenbach (Climate SAF)
FMIx		FMI , Helsinki (Ozone SAF)
IMPx		IMP, Lisbon (Land SAF)
INMx		INM, Madrid (NCW SAF)
MFxx		MF, Lannion (OSI SAF)
UKMO		UKMO, Bracknell (NWP SAF)

13.6.5 Enumeration PROCESSING_LEVEL

Value	*Name*	*Description*
00	Level 0	
01	Level 1	
1A	Level 1a	
1B	Level 1b	
1C	Level 1c	
02	Level 2	
03	Level 3	
xx	No Specific Level	

13.6.6 Enumeration PROCESSING_MODE

Value	*Name*	*Description*
N	Nominal	NRT processing
B	Backlog Processing	
R	Reprocessing	
V	Validation	

13.6.7 Enumeration PRODUCT_TYPE

Value	*Name*	*Description*
ENG		IASI engineering data
GAC		NOAC Global Area Coverage AVHRR data
SND		Sounding Data
SZF		ASCAT calibrated s0 data at full resolution
SZO		ASCAT calibrated s0 data at operational resolution (50 km)
SZR		ASCAT calibrated s0 data at research resolution (25 km)
VER		IASI verification data
xxx		No specific product type specified
AIP		NOAA AIP/SAIP data
TIP		NOAA TIP/STIP data
HRP		HRPT data
LRP		LRPT data

13.6.8 Enumeration RECEIVING_GROUND_STATION

Value	*Name*	*Description*
SVL		Svalbard
WAL		Wallops Island, Virginia
FBK		Fairbanks, Alaska
SOC		SOCC (NESDIS Satellite Operations Control Centre), Suitland, Maryland
RUS		Reference User Station

13.6.9 Enumeration SPACECRAFT_ID

Value	*Name*	*Description*
xxx		No specific spacecraft
M01		METOP 01
M02		METOP 02
M02		METOP 03
N15		NOAA-K
N16		NOAA-L
N17		NOAA-M
N18		NOAA-N
N19		NOAA-N'

13.6.10 Enumeration SURFACE_PROPERTIES

Value	*Name*	*Description*
N/A	Undefined	Enumerated tags not defined

13.6.11 Bitfield CHANNEL_VALID

Length: 1 bytes

Name	*Description*	*Length*
Channel H1 validity		1
Channel H2 validity		1
Channel H3 validity		1
Channel H4 validity		1
Channel H5 validity	Channel H5 validity (set to 1 when all samples of the channel for this scan revolution lie within the ADC dynamic range)	1
SPE Mux Code	000 Channel H1 to SPE 6, 001 Channel H2 to SPE 6, 010 Channel H3 to SPE 6, 011 SPE 6 not used, 100 Channel H4 to SPE 6, 101 Channel H5 to SPE 6, 110 and 111: SPE 6 not used	3
Total		**8**

13.6.12 Bitfield GAIN_CODE

Length: 3 bytes

Name	*Description*	*Length*
	Gain codes are: 000 = 0 dB 001 = 1 dB 010 = 2 dB 011 = 3 dB 1xx = not used	
Channel H1 Gain		3
Channel H2 Gain		3
Unused		2
Channel H3 Gain		3
Channel H4 Gain		3

Name	*Description*	*Length*
Unused		2
Channel H5 Gain		3
Unused		5
Total		**24**

13.6.13 Bitfield MODE_SUBCOMM_CODE

Length: 1 bytes

Name	*Description*	*Length*
mode code	Power-on: 0000, Warm-up: 0001, Standby: 0010, Scan: 0011, Fixed-view: 0100, Self-test: 0101, Safeing: 0110, Fault: 0111, Unused: 1000 and 1110, Memory Data Packet ID: 1111	4
PIE ID	0: PIE A, 1: PIE B	1
sub-commutation code	Indicates which set of thermistor telemetry data is included in this scan	3
Total		**8**

13.6.14 Bitfield NAVIGATION_STATUS

Length: 4 bytes

Name	*Description*	*Length*
Not used	Not used	15
Earth location corrected for Euler angles		1
Earth location indicator	0 = earth location available, 1 = user ephemeris files older than 24 hours, 2 = no earth location available	4
Spacecraft attitude control	0 = operating in YGC or NOMINAL mode, 1 = operating in another mode, 2 = attitude exceeds nominal tolerance, 3 = both 1 and 2	4
Attitude SMODE	0 = NOMINAL mode, 1 = rate nulling mode, 2 = YGC mode, 3 = search mode, 4 = coast mode	4

Name	*Description*	*Length*
Attitude mode	0 = NOMINAL mode/no test, 1 = yaw axis test in progress, 2 = roll axis test in progress, 3 = pitch axis test in progress	4
Total		**32**

13.6.15 Bitfield OBCT_VIEW_POSITION_FLAG

Length: 1 bytes

Name	*Description*	*Length*
Zero fill		4
Position flag for OBCT view 4		1
Position flag for OBCT view 3		1
Position flag for OBCT view 2		1
Position flag for OBCT view 1		1
Total		**8**

Bitfield OB_ICU_TIME_INT

Length 3 bytes

Name	*Description*	*Length*
On-board ICU time (integer part)	On-board Instrument Control Units internal counts representing integer part of seconds of time	24
Total		**24**

13.6.16 Bitfield QUALITY_INDICATOR

Length: 4 bytes

Name	*Description*	*Length*
	Do not use scan line for product generation	1
	Time sequence error detected for this scan	1
	Data gap precedes this scan	1
	No calibration	1
	No Earth location	1
	First good time following a clock update	1
	Instrument status changed within this scan	1
Not used	Not used	25
Total		**32**

13.6.17 Bitfield SCAN_LINE_QUALITY

Length: 4 bytes

Name	*Description*	*Length*
	Not used	8
	Time field is bad but can probably be inferred from the previous good time	1
	Time field is bad and can’t be inferred from the previous good time	1
	This record starts a sequence that is inconsistent with previous times (i.e., there is a time discontinuity). This may or may not be associated with a spacecraft clock update (See bit 26 in QUALITY_INDICATOR Field)	1
	Start of a sequence that apparently repeats scan times that have been previously accepted	1
	Not used	2
	Scan line contains one or more space view that are lunar contaminated	1

Name	*Description*	*Length*
	Lunar-contaminated scan line was able to be calibrated (only applicable if the previous flag [bit 17] is 1; otherwise, zero)	1
	Scan line was not calibrated because of bad time	1
	Scan line was calibrated using fewer than the preferred number of scan lines because of proximity to start or end of data set or to a data gap	1
	Scan line was not calibrated because of bad or insufficient PRT data	1
	Scan line was calibrated but with marginal PRT data	1
	Some uncalibrated channels on this scan. (See channel indicators.)	1
	Uncalibrated due to instrument mode.	1
	Questionable calibration because of antenna position error of space view	1
	Questionable calibration because of antenna position error of black body view	1
	Not earth located because of bad time; earth location fields zero filled	1
	Earth location questionable because of questionable time code. (See time problem flags above.)	1
	Earth location questionable - only marginal agreement with reasonableness check.	1
	Earth location questionable - fails reasonableness check	1
	Earth location questionable because of antenna position check	1
	Not used	3
Total		**32**

13.6.18 Bitfield SPACE_VIEW_POSITION_FLAG

Length: 1 bytes

Name	*Description*	*Length*
Zero fill		4
Position flag for space view 4		1
Position flag for space view 3		1

Name	*Description*	*Length*
Position flag for space view 2		1
Position flag for space view 1		1
Total		**8**

13.6.19 Bitfield STATUS_WORD

Length: 1 bytes

Name	*Description*	*Length*
DC Offset Valid	One when all channels calibration targets are within acceptable limits	1
Scan Control Valid	One if all mid pixel positions of the reflector during Earth, Space OBCT views are within the limits for the Scan Mode profile	1
Profile	00: Profile 0 (nominal scan mode profile with nominal space view position), 01: Profile 1 (alternate space view position 1) , 10: Profile 2 (alternate space view position 2), 11: No Profile calculated (profile will be manually loaded and modified)	2
Unused		4
Total		**8**

13.6.20 Bitfield SWITCH_STATUS

Length: 3 bytes

Name	*Description*	*Length*
	Receiver channel H4 backend (0=off,1=on)	1
	Receiver channel H3 backend (0=off,1=on)	1
	Receiver channel H3/H4 local oscillator (0=A,1=B)	1
	Receiver channel H3/H4 front-end (0=off,1=on)	1
	Receiver channel H2 local oscillator (0=A,1=B)	1
	Receiver channel H2 (0=off,1=on)	1
	Receiver channel H1 local oscillator (0=A,1=B)	1
	Receiver channel H1 (0=off,1=on)	1
	PROM (1=a PROM segment switch has failed ON)	1
	Signal processing electronics/scan control electronics (0=off, 1=on)	1
	Auxiliary operational heaters (0=off, 1=on)	1
	Scan mechanism operational heaters(0=off, 1=on)	1
	Receiver operational heaters (0=off, 1=on)	1
	Rx CV (0=off, 1=on)	1
	Receiver channel H5 local oscillator (0=A,1=B)	1
	Receiver channel H5 (0=off,1=on)	1
	FDM motor current trip status(0=enabled,1=disabled)	1
	RDM motor current trip status(0=enabled,1=disabled)	1
	FDM motor supply (0=off, 1=on)	1
	RDM motor supply (0=off, 1=on)	1
	FDM motor sensors selected (0=A, 1=B)	1

Name	*Description*	*Length*
	RDM motor sensors selected (0=A, 1=B)	1
	FDM zero position sensors (0=A, 1=B)	1
	RDM zero position sensors (0=A, 1=B)	1
Total		**24**

13.6.21 Bitfield TELECOMM_ACKN_FAULT

Length: 5 bytes

Name	*Description*	*Length*
TC Clean	SD4:1 TC Clean (set to 1 if a parity or checksum is not found in the packet)	1
TC Conforms	SD4:2 TC Conforms (Set to 1 if the header of the received command conforms to CCSDS format)	1
TC recognised flag	SD4:3 TC recognised flag (Set to 1 if received command is recognised MHS command)	1
TC Legal flag	SD4:4 TC Legal flag (set if received command is legal for execution in the current MHS operation mode)	1
FDM Motor current Trip Status	SD5:9 FDM Motor current Trip Status	1
TC Application ID	SD4:5 TC Application ID	11
TC Packet Sequence ID count	SD4:6 TC Packet Sequence ID count	14
TC Received count	SD4:7 TC Received count	2
Current Monitor Fault	SD5:1 Current Monitor Fault	1
Thermistor Monitor Fault	SD5:2 Thermistor Monitor Fault	1
Switch fault	SD5:3 Switch fault	1
Processor Fault	SD5:4 Processor Fault	1
RDM Motor Current Trip Status	SD5:8 RDM Motor Current Trip Status	1
DC Offset Error	SD5:5 DC Offset Error	1
Scan Control Error	SD5:6 Scan Control Error	1
REF ck Error	SD5:7 REF ck Error	1
Total		**40**

13.6.22 Bitfield TELEMETRY_UPDATE

Length: 4 bytes

Name	*Description*	*Length*
Zero fill		19
SARR-B power		1
SARR-A power		1
STX-3 power		1
STX-2 power		1
STX-1 power		1
STX-4 status		1
STX-3 status		1
STX-2 status		1
STX-1 status		1
Scan mechanism temperature		1
Electronics equipment temperature		1
Receiver temperature		1
Main bus select status		1
Total		**32**

13.6.23 Bitfield CALIBRATION_QUALITY

As used in MDR-1B Version 3

Length: 2 bytes

Name	*Description*	*Length*
Not used	Not used	9
anomalous	This scan line is either the last one before or the first one after a sudden, anomalous jump (or drop) in calibration counts	1

Name	*Description*	*Length*
bad blackbody	No good blackbody counts for scanline	1
bad space view	No good space view counts for scan line	1
bad PRT	No good PRTs for this scanline	1
some bad blackbody	Some bad blackbody view counts for this scan line	1
some bad space view	Some bad space view counts for this scan line	1
some bad PRT	Some bad PRT temps on this scan line	1
Total		**16**

13.6.24 Bitfield CALIBRATION_QUALITY

As used in **MDR-1B Version 4+**

Length: 1 byte

Name	*Description*	*Length*
	Actual NEdT value exceeds specification	1
	This scan line is either the last one before or the first one after a sudden, anomalous jump (or drop) in calibration counts	1
	No good blackbody counts for scan line	1
	No good space view counts for scan line	1
	No good PRTs for this line	1
	Some bad blackbody view counts for this scan line	1
	Some bad space view counts for this scan line	1
	Some bad PRTs temps for this scan line	1
Total		**8**

13.6.25 Bitfield FOV_DATA_QUALITY

Length: 4 bytes

Name	*Description*	*Length*
Not used	Not used	1
secondary calibration	Set if secondary calibration used	1
glint correction	Moon glint correction done	1
Not used	Not used	23
calibration problems	If bit n set to 1, then counts in channel n are physically unreasonable	5
channels missing	Set if all channels are missing	1
Total		**32**

13.6.26 Boolean values

Field	*value = 0*	*value = 1*
SUBSETTED_PRODUCT	Always set for near-real-time granule products. For EUMETSAT Data Centre products, set when the product contains a full dump	For EUMETSAT Data Centre products, set when the product contains subset information
DEGRADED_INST_MDR	TBC	TBC
DEGRADED_PROC_MDR	TBC	TBC

APPENDIX A: METOP-B AMSU CALIBRATION PARAMETERS

```
#####################################################################
###                                       ###
###    AMSU Calibration Parameters for A1-108 and A2-106   ###
###           Onboard Metop-B                    ###
###                                       ###
###    version 03
###                                       ###
#####################################################################
03   ; version number (cal parameter id in 1B dataset)
2011 ; year of the version
259  ; day of year of the version.
## Values for Fundamental Constants ##
## Speed of light m/s ##
299792458
## Planck constant J s ##
6.6260755e-34
## Boltzmann constant J/K ##
1.380658e-23
## First & second radiation constants mW/(sqm.ster.cm^-4) & K/cm^-1 ##
 1.191044e-05,1.438769
## Brightness temperature of space at AMSU frequencies degK ##
2.73
## 15 Central wavenumbers ##
0.793897,1.047421,1.677830,1.761235,1.787785,1.814590,1.832608,1.851295
1.911001,1.911001,1.911001,1.911001,1.911001,1.911001,2.968887
## Band Correction Coefficients a,b for each channel --
## used to modify TW to give an effective temperature T'W for use
## in the Planck function.
0,1
0,1
0,1
0,1
0,1
0,1
0,1
0,1
0,1
0,1
0,1
0,1
0,1
0,1
0,1
## Nominal space & internal target viewing angles
-83.333,180.0
-81.667,180.0
-80.000,180.0
-76.667,180.0
# lunaflag for turning on(1)/off(0) moon
 1
# threshold angle for moon contamination in degrees * 100
 390
#############################################################################
## AMSU-A1 DATA S/N 108 (METOPB) ##
## ID of instrument
```

```
29
# Selected position of space view for calibration 0->3 (will be selected during IOV)#
0
# Slope and offset for counts to antenna posn in degree, A1-1 and A1-2 (adapted to Tab. 10.0.1 values)#
-0.021973, 51.36
-0.021973, 46.06
# Antenna Pos error allowed in degree for cal and Earth views, A1-1 and A1-2 #
1.3,0.33
1.3,0.33
# IWT PRT count to temperature in degK conversion coefficients (best fit of data in Tab. 4.1.1)#
  254.8997   1.6486870E-03   5.9915850E-09   3.0658910E-14
  254.7430   1.6523180E-03   6.0197870E-09   2.9858890E-14
  254.6643   1.6539240E-03   5.9841080E-09   2.9776300E-14
  254.8877   1.6574190E-03   5.9341200E-09   3.1709220E-14
  254.1918   1.6465040E-03   6.0760720E-09   2.8224180E-14
  255.6000   1.6162670E-03   6.1592160E-09   3.7101130E-14
  254.7424   1.6486220E-03   5.9308110E-09   3.0390770E-14
  255.5381   1.6180470E-03   6.1058810E-09   3.6427240E-14
  255.4768   1.6296350E-03   6.2061300E-09   3.8552680E-14
  254.4784   1.6470340E-03   5.9518710E-09   2.9568630E-14
# Weight coefficients for each PRT, A1-1 and A1-2 #
1,1,1,1,1
1,1,1,1,1
# Reasonable PRT temp limits in degK (min,max), A1-1 and A1-2 #
258.15,313.15
258.15,313.15
# Max PRT temp change in degK allowed before rejecting #
0.2
0.2
# Minimum number of PRT readings acceptable #
2
2
# Number of scan lines to fill in bad PRT data #
20
20
# Number of scan lines to use in consistency checks of cal views #
5
5
# Instrument temperature sensor ID, A1-1 and A1-2, 0=RF shelf, 1=RF mux
0
0
# 3 Instrument RF shelf temperatures degK, A1-1, A1-2 and A1-1 PLLO2 (from Tab. 14.1.7 Rep. 13415 [Mar 2004])#
270.05,291.95,311.42
270.73,292.12,311.43
270.68,291.53,311.25
# 3 Instrument RF mux temperatures degK, A1-1, A1-2 and A1-1 PLLO2 (adpated from Rep. 13362 [Mar 2004])#
270.66,291.94,311.05
270.49,291.54,310.83
270.13,291.00,310.38
# Instrument temp RF Shelf PRT count to temperature in degK conversion coeffs (best fit of data in Tab 4.1.1) #
263.3667, 1.753562E-03, 3.773557E-09, 1.157848E-14
263.4328, 1.746659E-03, 3.980124E-09, 7.519710E-15
# Instrument temp RF Mux PRT count to temperature in degK conversion coeffs (best fit of data in Tab 4.1.1)#
264.0316, 1.758565E-03, 3.633179E-09, 1.415604E-14
263.5459, 1.745708E-03, 4.087797E-09, 6.877655E-15
```

```
# Warm load corr factor for each ref temp, Chan 3-15 and 9-14 PLLO2 (Tab. 14.2.1.1) #
-.101,-.188,-.170,0.761,0.770,-.216,0.731,0.730,0.738,0.737,0.726,0.770,0.714,
                        0.392,0.407,0.384,0.381,0.422,0.417
0.110,0.006,0.046,0.906,0.906,-.020,0.880,0.864,0.869,0.868,0.877,0.843,0.871,
                        0.714,0.711,0.701,0.685,0.726,0.719
0.075,-.042,-.054,1.028,1.034,-.048,1.016,1.004,0.999,0.998,0.990,1.014,0.946,
                        0.283,0.282,0.291,0.302,0.285,0.278
# Cold space correction factors for each space view, Chan 3-15 and 9-14 PLLO2#
1.55, 1.21, 1.44, 1.31, 1.17, 1.75, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 0.95
                        1.00, 1.00, 1.00, 1.00, 1.00, 1.00
1.62, 1.29, 1.52, 1.36, 1.23, 1.81, 1.05, 1.05, 1.05, 1.05, 1.05, 1.05, 0.97
                        1.05, 1.05, 1.05, 1.05, 1.05, 1.05
1.69, 1.36, 1.57, 1.41, 1.29, 1.86, 1.10, 1.10, 1.10, 1.10, 1.10, 1.10, 1.01
                        1.10, 1.10, 1.10, 1.10, 1.10, 1.10
1.85, 1.52, 1.68, 1.53, 1.41, 1.97, 1.20, 1.20, 1.20, 1.20, 1.20, 1.20, 1.07
                        1.20, 1.20, 1.20, 1.20, 1.20, 1.20
# Gross count limits (minimum & maximum) for the internal target counts #
14000,14000,14000,14000,14000,14000,14000,14000,14000,14000,14000,14000,14000
                        14000,14000,14000,14000,14000,14000
32767,32767,32767,32767,32767,32767,32767,32767,32767,32767,32767,32767,32767
                        32767,32767,32767,32767,32767,32767
# Gross count limits (minimum & maximum) for the space view counts #
10000,10000,10000,10000,10000,10000,10000,10000,10000,10000,10000,10000,10000
                        10000,10000,10000,10000,10000,10000
16000,16000,16000,16000,16000,16000,17000,17000,19000,17000,17000,17000,17000
                        17000,17000,19000,17000,17000,17000
# Max change in mean counts from previous scan allowed before rejecting #
18,18,18,18,18,18,18,18,24,24,30,60,22
                18,18,24,24,30,60
# Non-lin corr coefs, 3 ref temps, chan 3-15 & 9-14 PLLO2 #
 0.385596, 0.721223, 0.563298, 1.632893, 1.632893, 0.466929
   1.776511, 1.266605, 1.823446, 1.734297, 1.793681, 1.656801, 0.424551
     1.904660, 1.458699, 2.049244, 1.888804, 1.971292, 1.789194
 0.462112, 0.638383, 0.526089, 2.463463, 2.216076, 0.534722
   2.261008, 1.788879, 2.314981, 2.217988, 2.227557, 2.101485, 0.662425
     2.029557, 1.628714, 2.031899, 1.982715, 1.956510, 1.921265
 0.188791, 0.356634, 0.623748, 2.382906, 2.291374, 0.280602
   2.248887, 1.167624, 2.195786, 2.213578, 2.081045, 2.015205, 0.729336
     2.724863, 2.269215, 2.709360, 2.566653, 2.615738, 2.433196
# Digital A conversion coefficients (4 coeffs, 45 parameters) #
  263.4500   1.7582810E-03   3.7769420E-09   1.0455180E-14
  263.6895   1.7509610E-03   3.9068450E-09   9.2147320E-15
  263.2957   1.7486100E-03   3.6202740E-09   1.9558320E-14
  263.2468   1.7546210E-03   3.7296920E-09   1.2244830E-14
  264.0316   1.7585650E-03   3.6331790E-09   1.4156040E-14
  263.5459   1.7457080E-03   4.0877970E-09   6.8776550E-15
  264.1317   1.7764280E-03   1.7439980E-09   5.6935700E-14
  263.1476   1.7566880E-03   3.4320680E-09   1.7157600E-14
  263.9358   1.7596660E-03   3.6491010E-09   1.3148280E-14
  263.5296   1.7537650E-03   3.5635560E-09   1.4427090E-14
  263.3737   1.7574640E-03   3.6806570E-09   1.3058270E-14
  263.5568   1.7545370E-03   3.7847780E-09   1.1392400E-14
  263.4084   1.7547410E-03   3.7379900E-09   1.2552870E-14
  263.6483   1.7569370E-03   3.7501670E-09   1.2411210E-14
  263.8492   1.7467990E-03   4.0989680E-09   6.7070790E-15
  263.8492   1.7467990E-03   4.0989680E-09   6.7070790E-15    ! dummy not used
  263.9014   1.7588790E-03   3.7006570E-09   1.1425270E-14
  263.5892   1.7651900E-03   3.3107420E-09   1.5555090E-14
  264.0800   1.7611660E-03   3.7602290E-09   9.1997740E-15
```

```
  263.5704   1.7584900E-03   3.5517550E-09   1.5096890E-14
  263.6794   1.7537150E-03   3.8501710E-09   1.0040740E-14
  263.7309   1.7544210E-03   3.8469020E-09   1.0159090E-14
  263.6108   1.7583850E-03   3.7352710E-09   1.2514130E-14
  263.8234   1.8160090E-03  -1.1233250E-09   1.1182210E-13
  263.6217   1.7586210E-03   3.8473050E-09   1.0777320E-14
  263.3883   1.7502340E-03   3.8226520E-09   1.0583640E-14
  263.6809   1.7505870E-03   4.1555570E-09   5.3770890E-15
  263.1202   1.7537750E-03   3.8246150E-09   1.0974060E-14
  263.2312   1.7579840E-03   3.8631160E-09   1.0348590E-14
  263.6065   1.7600690E-03   3.7434520E-09   1.1958570E-14
  263.3785   1.7578880E-03   3.5083200E-09   1.5486730E-14
  264.4315   1.7586920E-03   3.7165110E-09   1.2818290E-14
  263.3667   1.7535620E-03   3.7735570E-09   1.1578480E-14
  263.4328   1.7466590E-03   3.9801240E-09   7.5197100E-15
  263.4804   1.7477720E-03   4.0720020E-09   6.5460180E-15
  254.8997   1.6486870E-03   5.9915850E-09   3.0658910E-14
  254.7430   1.6523180E-03   6.0197870E-09   2.9858890E-14
  254.6643   1.6539240E-03   5.9841080E-09   2.9776300E-14
  254.8877   1.6574190E-03   5.9341200E-09   3.1709220E-14
  254.1918   1.6465040E-03   6.0760720E-09   2.8224180E-14
  255.6000   1.6162670E-03   6.1592160E-09   3.7101130E-14
  254.7424   1.6486220E-03   5.9308110E-09   3.0390770E-14
  255.5381   1.6180470E-03   6.1058810E-09   3.6427240E-14
  255.4768   1.6296350E-03   6.2061300E-09   3.8552680E-14
  254.4784   1.6470340E-03   5.9518710E-09   2.9568630E-14
# Analogue conversion coefficients (2 coeffs, 27 parameters) #
0,      1.36054
0,      1.36054
0,      1.36054
0,      1.36054
0,      1.36054
0,      1.36054
0,      0.466
0,      0.466
0,      0.0863
0,      0.0863
-22.562, 0.05008
-22.562, 0.05008
0,      0.05
0,      0.03334
0,      0.03334
0,      0.05778
0,      0.0863
-22.562, 0.05008
0,      0.05722
0,      0.05722
0,      0.05722
0,      0.05722
0,      0.05722
0,      0.05722
0,      0.02
0,      0.02
0,      0.0863
################################################################################
## AMSU-A2 DATA S/N 106 (METOPB) ##
## ID of instrument
22
# Selected position of space view for calibration 0->3 (will be determined during IOV)#
```

```
0
# Slope and offset for counts to antenna posn in degree #
+0.021973,  -103.80
# Antenna Pos error allowed in degree for cal and Earth views #
1.3,0.33
# IWT PRT count to temperature in degK conversion coefficients #
  254.5488   1.6522870E-03   5.8530950E-09   3.3394000E-14
  254.8630   1.6595080E-03   6.0120530E-09   3.1854660E-14
  254.4708   1.6512110E-03   5.8424830E-09   3.2493410E-14
  254.6503   1.6471490E-03   6.1711470E-09   2.6530880E-14
  254.5548   1.6532380E-03   5.9166940E-09   3.0962320E-14
  254.4847   1.6497020E-03   6.0297620E-09   2.9271450E-14
  254.7206   1.6519190E-03   6.0517960E-09   2.7588040E-14
# Weight coefficients for each PRT #
1,1,1,1,1,1,1
# Reasonable PRT temp limits in degK (min,max) #
258.15,313.15
# Max PRT temp change in degK allowed before rejecting #
0.2
# Minimum number of PRT readings acceptable #
2
# Number of scan lines to fill in bad PRT data #
20
# Number of scan lines to use in consistency checks of cal views #
5
# Instrument temperature sensor ID, 0=RF shelf, 1=RF mux
0
# 3 Instrument RF shelf temperatures degK#
265.97,284.56,303.29
# 3 Instrument RF mux temperatures degK #
266.15,285.03,303.85
# Instrument temp RF Shelf PRT count to temperature in degK conversion coeffs #
263.9771   1.6677450E-03   4.4097530E-09   2.2908140E-14
# Instrument temp RF Mux PRT count to temperature in degK conversion coeffs #
263.0303   1.7518180E-03   3.7728220E-09   1.2016230E-14
# Warm load correction factor for each reference instrument temp, chan 1-2 #
-0.062, -0.044
-0.098, -0.072
-0.155, -0.138
# Cold space correction factors for each space view, chan 1-2 #
2.70, 0.99
2.75, 1.00
2.78, 1.02
2.92, 1.06
# Gross count limits (minimum & maximum) for the internal target counts #
14000,14000
32767,32767
# Gross count limits (minimum & maximum) for the space view counts #
10000,10000
16000,16000
# Max change in mean counts from previous scan allowed before rejecting #
18,18
# Non-linearity corrn coefficients for 3 instrument ref temps & chans 1-2 #
 2.947372, 3.290203
 3.630256, 3.392226
 3.632365, 3.656533
# Digital A conversion coefficients (4 coeffs, 19 parameters) #
  263.0500   1.7687010E-03   3.0358620E-09   2.4110550E-14
  263.9791   1.7552780E-03   3.6769360E-09   1.3388680E-14
```

```
  263.0303   1.7518180E-03   3.7728220E-09   1.2016230E-14
  262.8936   1.7509500E-03   3.7418440E-09   1.1935910E-14
  263.3983   1.7478440E-03   3.9047780E-09   1.1246810E-14
  263.6706   1.7486060E-03   3.7324960E-09   1.1969410E-14
  264.0607   1.7576300E-03   3.7870520E-09   1.0742010E-14
  263.5399   1.7565350E-03   3.2934390E-09   2.3928530E-14
  263.6364   1.7625580E-03   3.1137490E-09   2.5734090E-14
  264.0059   1.7526560E-03   3.7636420E-09   1.1407930E-14
  263.9771   1.6677450E-03   4.4097530E-09   2.2908140E-14
  263.8627   1.7571800E-03   3.7195810E-09   1.2680860E-14
  254.5488   1.6522870E-03   5.8530950E-09   3.3394000E-14
  254.8630   1.6595080E-03   6.0120530E-09   3.1854660E-14
  254.4708   1.6512110E-03   5.8424830E-09   3.2493410E-14
  254.6503   1.6471490E-03   6.1711470E-09   2.6530880E-14
  254.5548   1.6532380E-03   5.9166940E-09   3.0962320E-14
  254.4847   1.6497020E-03   6.0297620E-09   2.9271450E-14
  254.7206   1.6519190E-03   6.0517960E-09   2.7588040E-14
# Analogue conversion coefficients (2 coeffs, 15 parameters) #
0,      1.36054
0,      1.36054
0,      1.36054
0,      1.36054
0,      0.932
0,      0.932
0,      0.0863
0,      0.0863
-22.562, 0.05008
-22.562, 0.05008
0,      0.05778
0,      0.03334
0,      0.03334
0,      0.05722
0,      0.05722
################################################################################
## ID of instrument or 99 terminator
99
```

APPENDIX B: MHS FM5 CALIBRATION PARAMETERS

```
############################################################
###                                      ###
###    MHS FM5 Calibration Parameters                ###
###                                      ###
############################################################
1    ; version number (cal parameter id in 1B dataset)
2011 ; year of the version
168  ; day of year of the version
## Values for Fundamental Constants ##
## It was agreed with NOAA to use the CODATA values of 1998
## Ref.: Mohr, P.J., and B.N. Taylor, 1998: CODATA Recommended Values of the
## Fundamental Physical Constants, Journal of Physical and Chemical Reference
## Data, Vol. 28, No. 6, 1999
## Speed of light m/s ##
299792458
## Planck constant J s ##
6.62606876-34
## Boltzmann constant J/K ##
1.3806503e-23
## First & second radiation constants mW/(sqm.ster.cm^-4) & K/cm^-1 ##
 1.1910427e-05,1.4387752
## Brightness temperature of space at MHS frequencies degK ##
2.73
## MHS FM_5 DATA##
## ID of instrument
105
#  5 Central wavenumbers#
2.968720
5.236956
6.114597
6.114597
6.348092
# Band Correction Coefficients a,b for each channel --
# used to modify TW to give an effective temperature T'W for use
# in the Planck function.
0.000,1.0
0.000,1.0
0.000,1.0
-0.0031,1.00027
0.000,1.0
# Selected position of space view for calibration#
0
# Conversion factor from counts in telemetry to antenna posn in degree#
7.03125E-3
# Antenna Positional error allowed in degrees for cal and Earth views#
0.8,0.25
# Resistances for the three PRT calibration channels (PIE-A)#
117.970,95.279,80.594
# Resistances for the three PRT calibration channels (PIE-B)#
117.986,95.283,80.601
# PRT resistance to temperature in degK conversion coefficients (PIE-A)#
25.22634,2.4163837,4.6494415E-04,1.6365573E-06
30.25548,2.2710961,1.8562878E-03,-2.7798189E-06
29.08906,2.3040268,1.5469377E-03,-1.8137212E-06
27.69009,2.3438489,1.1731308E-03,-6.5599665E-07
31.28914,2.2398676,2.1687929E-03,-3.8158923E-06
```

```
# PRT resistance to temperature in degK conversion coefficients (PIE-B)#
26.17037,2.3897746,7.1172484E-04,8.7799399E-07
27.87629,2.3389899,1.2133712E-03,-7.6019527E-07
24.75568,2.4306772,3.1972257E-04,2.1302343E-06
29.85037,2.2832572,1.7361599E-03,-2.3889431E-06
26.96129,2.3670665,9.2929553E-04,1.8772013E-07
# Weighting coefficients for each PRT #
 2.,1.,1.,1.,1.
# Reasonable PRT temp limits in degK (min,max) #
250,310
# Max PRT temp change in degK allowed before rejecting#
0.2
# Minimum number of PRT readings acceptable#
2
# Number of scan lines to fill in bad PRT data
50
# Instrument temperature sensor ID, 0= QBS5, 1= QBS1
0
# 3 Instrument reference temperatures (QBS5) in K#
277.98,  289.70,  301.59
# 3 Backup Instrument reference temperatures (QBS1) in K#
276.46,  287.82,  299.58
# Instrument temp (QBS5) PRT count to temperature in degK conversion coeffs #
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
# Instrument temp (QBS1) PRT count to temperature in degK conversion coeffs #
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
# Warm load correction factor for each reference instrument temp #
0, 0, 0, 0, 0
0, 0, 0, 0, 0
0, 0, 0, 0, 0
# Cold space correction factors for each space view and channel
1.64, 0.19, 0.52, 0.52, 0.23    ! Space View 0
1.94, 0.24  0.60, 0.60, 0.27    ! Space View 1
1.39, 0.17, 0.47, 0.47, 0.21    ! Space View 2
# Gross count limits (maximum & minimum) for the internal target counts#
20000,20000,20000,20000,20000
65535,65535,65535,65535,65535
# Gross count limits (maximum & minimum) for the space view counts#
1500,1500,1500,1500,1500
28000,28000,30000,28000,28000
# Max change in mean counts from previous scan allowed before rejecting#
1000, 1000, 1000, 1000, 1000
# Max number of scan lines before resetting last value
25
# Non-linearity corrn coefficients for 3 instrument ref temps & 5 chans (LO-A)#
 -2.235600E-01  -3.652610E-03   -2.948550E-02   -2.386740E-02  -1.716430E-02
 -2.068600E-01  -1.211520E-02   -3.963490E-02   -3.437370E-02  -1.841330E-02
 -1.683000E-01   8.289370E-03   -1.429980E-02   -1.735280E-02  -4.322430E-03
# Non-linearity corrn coefficients for 3 instrument ref temps & 5 chans (LO-B)#
 -1.997900E-01  -1.756920E-04   -3.827250E-02   -2.772060E-02  -2.679120E-02
 -2.062200E-01  -1.405140E-02   -2.645370E-02   -2.474630E-02  -8.775270E-03
 -1.528800E-01   2.833690E-03   -2.817620E-02   -1.674750E-02  -8.829010E-03
# Nominal space & internal target viewing angles (AAPP users have to substract 90 degree from the given value)
251.93, 253.04, 254.16, 255.27,   358.33, 359.44, 0.56, 1.67  (profile = 0)
247.49, 248.60, 249.71, 250.82,   358.33, 359.44, 0.56, 1.67  (profile = 1)
256.38, 257.49, 258.59, 259.70,   358.33, 359.44, 0.56, 1.67  (profile = 2)
# 'Digital A' conversion coefficients
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
```

```
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
3.559982E2,-2.39278E-1,-4.85712E-3,3.59838E-5,-8.02652E-8
# Analogue conversion coefficients
 0.0      ,1.681E-2
-0.0769   ,2.072E-2
-0.6280E-1 ,7.890E-3
-5.3580E-3 ,1.903E-3
 0.0      ,1.337E-2
 0.0      ,1.337E-2
# Survival thermistor coefficients
3.634522E2,-1.081E2,6.4212E1,-2.28659E1,4.11E0,-2.95E-1
3.634522E2,-1.081E2,6.4212E1,-2.28659E1,4.11E0,-2.95E-1
3.634522E2,-1.081E2,6.4212E1,-2.28659E1,4.11E0,-2.95E-1
# Conversion factor from counts to volt in the survival thermistor
# polynomials
 0.02
# Lunar angle threshold, degrees * 100
140
```