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The Meteosat Archive

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FORMAT GUIDE No. 1

Basic Imagery

OpenMTP Format

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1. INTRODUCTION

1.1. Overview

This document describes the OpenMTP format for basic imagery retrieved from the Meteosat Archive. Basic imagery consists of 8-bit image data acquired in one frequency waveband from the Meteosat radiometer. The wavebands available are:

0.5 - 0.9 μm	-	VIS	(Visible channel)
5.7 - 7.1 μm	-	WV	(Water Vapour channel)
10.5 - 12.5 μm	-	IR	(Infra-Red channel).

Full disk images acquired in the IR and WV wavebands consist of 2500 lines of 2500 picture elements or pixels. A full disk image in the VIS waveband consists of 5000 lines of 5000 pixels. In fact, this image is actually formed from two data sets acquired by two detectors. Each of these data sets (VIS North or VIS-N, and VIS South or VIS-S) consists of 2500 lines of 5000 pixels.

Imagery retrieved in OpenMTP format may consist of full disk information, or it may cover a user-specified sub-area of the image. Header information in the data format enables the content of any specific product to be easily and rapidly confirmed.

OpenMTP format Imagery may be delivered in rectified or unrectified form. Rectification is a geometric correction process which warps the image pixels to a nominal image geometry. This removes deformations in the imaging system and variations in image geometry caused by the spacecraft's location in space tending to vary around its nominal position (especially in altitude and longitude). The rectification process also corrects radiometric errors in the data whenever these are well enough understood. Unrectified data is provided with all the ancillary information needed to perform rectification if required.

1.2. Contact Point

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2. OVERVIEW

2.1. Introduction

This section provides brief details of the background to the OpenMTP format for images.

The OpenMTP format is a new format developed for the Meteosat Transition Programme (MTP). It represents a progression from the IBM-compatible 'IBMMOP' format used by ESOC during the preceding Meteosat Operational Programme (MOP) which ran until November 1995.

The main differences between the OpenMTP and IBMMOP formats are as follows:

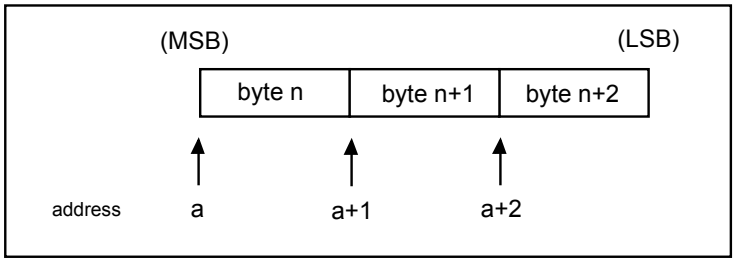
- The machine level representation of bits and bytes used in the OpenMTP format follows the standard used by UNIX / open systems architecture (SUN, HP, SGI ...) machines, whereas the IBMMOP format follows the standard used by IBM machines. The open systems representation uses the IEEE standard for real number representation, and ASCII rather than EBCDIC encoding for character data. It is anticipated that support for this open system representation will provide increased convenience for users.

  The OpenMTP data representation is discussed in section 2.2.
- The OpenMTP format includes an additional ASCII format header which can be easily examined by a user to check the content of a product file.
- The OpenMTP format has increased flexibility for handling sub-areas requested by users who do not require a full disk of data, without including excessive padding in the output image file.
- The OpenMTP format includes additional calibration data which can be used to compensate for anomalies in the Meteosat-5 and Meteosat-6 imagery.

2.2. Representation

This section describes the open system machine representation of the basic data types character, logical, short integer (two byte), integer (four byte), single-precision floating-point numbers and double-precision floating-point numbers.

The representation is 'big endian' which implies the following layout:



Where byte n is more significant than byte n+1. That is, the most significant byte is located at the lowest address, the least significant byte is located at the highest address. This is in contrast to little endian format (employed by for instance DEC VAXes and IBM PCs) where the least significant byte is located at the smallest address and the most significant bytes are located at the highest address.

In the following, bytes will be numbered from left to right starting with 0. Also bits are numbered from left to right starting with 0. Thus in a two byte integer, for example, the left-most byte will be given the number 0, the right-most byte will be given the

number 1, the left-most bit will be given the number 0 and the right-most bit will be given the number 15.

Character type

Character fields are coded in ASCII and occupy 1 byte of storage.

Logical type

Logical fields are coded in single bytes. A byte value of 0 corresponds to 'FALSE' and any other value to 'TRUE', although in line with convention a value of 1 is normally used for 'TRUE' within the OpenMTP format.

Short integer

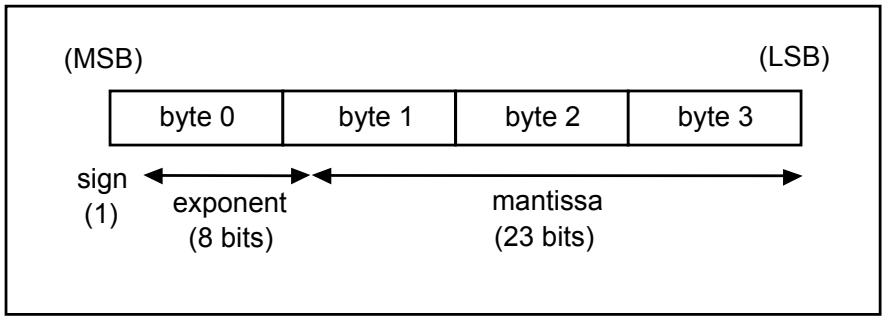
A short integer is two bytes in length. The short integer is represented in two's complement which means that bit 0 of byte 0 has negative weight (-bit0 * 2**15). Unless otherwise stated, short integer fields should therefore be interpreted as signed values with a range of -32768 ... 32767.

Integer type

A full integer is four bytes in length. It is represented in two's complement which means that bit 0 of byte 0 has negative weight (-bit0 * 2**31).

Single-precision floating point

A single-precision (four byte) floating point number has the following representation:



The following three fields describe the single-precision floating-point:

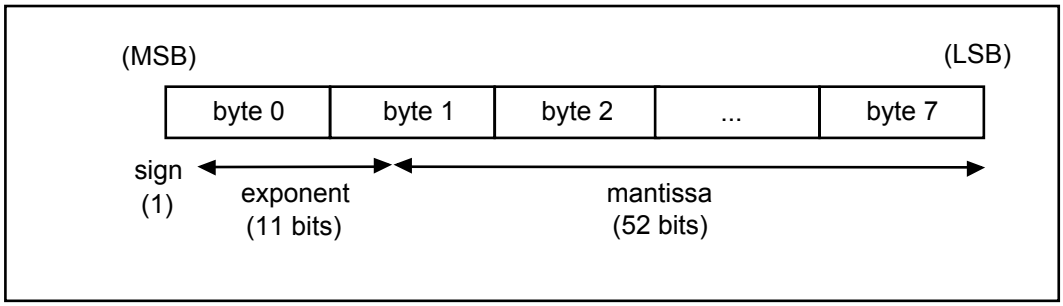
S: The sign of the number. Values 0 or 1 represent positive and negative respectively. One bit (bit 0) is devoted to this field.

E: The exponent of the number, base 2. 8 bits are devoted to this field. The exponent is biased by 127. Thus the range of the exponent is -127 to 128.

M: The fractional part of the number's mantissa, base 2. 23 bits are devoted to this field. The integer part of the mantissa is always a binary 1 for which reason it is implicit in the representation.

Double-precision floating-point

A double-precision (eight byte) floating point number has the following representation:



The following three fields describe the single-precision floating-point:

S: The sign of the number. Values 0 or 1 represent positive and negative respectively. One bit (bit 0) is devoted to this field.

E: The exponent of the number, base 2. 11 bits are devoted to this field. The exponent is biased by 1023. Thus the range of the exponent is -1023 to 1024.

M: The fractional part of the number's mantissa, base 2. 52 bits are devoted to this field. The integer part of the mantissa is always a binary 1 for which reason it is implicit in the representation.

3. PRODUCT STRUCTURE

The overall product structure is shown in figure 2. The product consists of a variable number of logical records of variable length. This structure contains three distinct components:

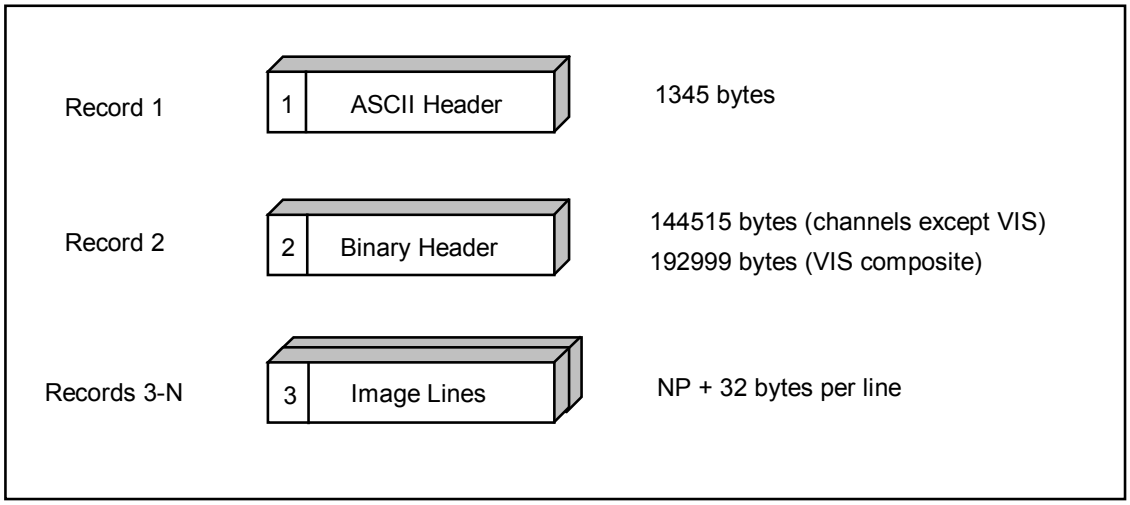
- Record 1, ASCII file header. This contains general information about the file in ASCII format. This header can be rapidly examined by a user to confirm the file's content.
- Record 2, binary file header. Contains extensive binary format information on the product and its calibration. The record has the following size:
  - 144515 bytes for data in any channel except for VIS composite.
  - 192999 bytes for VIS composite data.

  VIS composite data has to contain calibration information from two detectors, and hence requires more space than the other channels.
- Records 3-N, image line data. The number of lines of data depends on the channel (see section 1) and on whether a sub-area has been selected. One image line record is present per line of the image. Only the selected lines are included in the file.

  Each image line is (NP + 32) bytes in length, where NP is the number of pixels per line. This again depends on the channel and on whether a sub-area has been selected. Only the selected pixels are included in the file.

The three types of record have structures of type 1 to 3 respectively. Detailed descriptions of each structure are provided in section 3 of this document.

Figure 2 Basic Imagery Product Structure



For an image area with NL lines of NP pixels, the total size of the product is therefore as follows:

For all channels except VIS composite:

1345 + 144515 + NL * (NP + 32) bytes = 145860 + NL * (NP + 32) bytes.

For VIS composite:

1345 + 192999 + NL * (NP + 32) bytes = 194344 + NL * (NP + 32) bytes.

For full disk imagery (the most common format), this gives the following sizes:

Channel	NL	NP	Size (bytes)
IR	2500	2500	6475860
WV	2500	2500	6475860
VIS-N	2500	5000	12725860
VIS-S	2500	5000	12725860
VIS Composite	5000	5000	25354344

4. FORMAT AND FIELD DEFINITIONS

This section provides detailed format definitions for each of the three structures introduced in the previous section.

The following information is provided for each field:

- Offset from start of structure. (To get the overall offset from the start of the file, this number must be added to N times 6444, where N is the number of preceding physical records). The offsets are quoted in zero-relative terms.
- Name of the field. An arbitrary but convenient field identifier.
- Description. Describes the field and any special features of its population.
- Type. The data type of the field, i.e. how it is encoded. The valid types are:

  A<n> - An ASCII string of <n> characters.

  B<n> - A string of <n> values to be treated as simple bytes.

  I2 - A 2-byte integer in binary format.

  I4 - A 4-byte integer in binary format.

  L1 - A one-byte logical value (TRUE or FALSE).

  R4 - A single-precision floating-point (4-byte real) number in binary format.

  R8 - A double-precision floating-point (8-byte real) number in binary format.

  See section 2.2 for detailed descriptions of the encoding of each type in the file.
- Dimension. The number of entries in the field, e.g. 1 for a single value, 10 for an array of 10 values, (10, 10) for a two-dimensional matrix of 10 rows of 10 values, etc. The first index quoted is that which cycles fastest, i.e. the first index cycles once for each step in the second index, etc.

Footnotes to each table provide additional information where necessary.

4.1. ASCII Header

As mentioned in section 3, header record 1 is a fixed length ASCII text block of 1345 bytes. The record is divided into a series of text lines each of which has the same format, vis:

FIELD_NAME FIELD_VALUE <newline>

Every field starts with a field name, which describes the content of the field. The field name is padded out to 15 characters total width with spaces, and is left justified. The maximum length of the text is 14 characters, so that character 15 (dividing the field name from the field value) is always a blank.

The field value starts at character 16 of the field and continues until character N-1, where N is the total length of the field. If the value text does not extend to this character, the field will be padded with spaces.

A newline character is inserted at character position N of every field, so that a sensible line-by-line format is displayed when a user lists out the opening bytes of the product file using an editor or print command.

The fields of header record 1 are given in the table below. The indicated field lengths are the total lengths and therefore include the 15 characters used for the field name and the terminating newline character. The field names that appear in each field are noted as part of the description of the field.

Offset	Name	Description	Type	Dimension
000	FNAME	Field name - 'ProductType' ProductType encodes the nature of the image. For reasons of compatibility the names used are chosen to match those used in the historical ESOC formats. The field value is therefore one of the following: ' PIMA1AM' - Infra Red detector 1 data ‘IR01WDOW’ - IR detector 1 subwindow ' PIMA2AM' - Infra Red detector 2 data ‘IR02WDOW’ - IR detector 2 subwindow ' PPWV1AP' - Water Vapour detector 1 data ‘WV01WDOW’ - WV detector 1 subwindow ' PPWV2AP' - Water Vapour detector 2 data ‘WV02WDOW’ - WV detector 2 subwindow ' PVISSAN' - Visible South detector data ‘VISSWDOW’ - VIS S image subwindow ' PVISNAN’ - Visible North detector data ‘VISNWDOW’ - VIS N image subwindow ' PVISBAN' - Visible Composite (N + S detector) data. ‘VISBWDOW’ - VIS Composite image subwindow	A30	1
030	FDESC	Field name - 'Description' General description of image content, taking one of the following values: 1. 'Image subarea' 2. 'Full disk image'	A80	1
110	CHAN	Field name = 'SpectralCont' Spectral content of image data, taking one the following values: 1) 'No data available' 2) 'VISS (visible south) data' 3) 'VISN (visible north) data' 4) 'VISS + VISN (visible south + north) data' 5 'IR1 (infra red channel 1) data' 6) 'IR2 (infra red channel 2) data' 7) 'WV1 (water vapour channel 1) data' 8) 'WV2 (water vapour channel 2) data'	A80	1
190	FORMAT	Field name = 'FormatID'. Name of data format, always set to 'OpenMTP'.	A50	1
240	FVERS	Field name = 'VersionID'. Version number of format for this file, initial value is '1' (see section 5.2.2 below).	A25	1
265	REC1SIZ	Field name = 'Rec1Size'. Size of header record 1 in bytes, always set to '1345'.	A35	1
300	REC2SIZ	Field name = 'Rec2Size'. Size of header record 2 in bytes. Set to 144515 for unrectified data and 192999 for rectified data.	A35	1
335	YEAR	Field name = 'Year'. Nominal year of data in YYYY format, e.g. '1995'.	A25	1

360	JDAY	Field name = 'Day'. Nominal Julian day of year in DDD format: 1 ... 366.	A25	1
385	SLOT	Field name = 'Slot'. Slot number in day: 1 ... 48	A20	1
405	DATE	Field name = 'Date'. Nominal date of image in YYMMDD format, e.g. '890331'.	A25	1
430	TIME	Field name = 'Time'. Nominal time of image in HHMM format, e.g. '1230'.	A25	1
455	PLTFRM	Field name = 'Platform'. Satellite name in MX format, e.g. 'M5' for Meteosat-5.	A25	1
480	PROC	Field name = 'ProcessingPerf'. Processing performed on the image: 1) 'Raw Data' 2) 'Rectified Data'	A80	1
560	RTMET	Field name = 'RectMethod'.Name of rectification method used: 1) 'NONE' (if unrectified data) 2) 'Method1' 3) 'Method2', etc.	A40	1
600	DMMOD	Field name = 'DeformModel '. Deformation model used: 1) 'NONE' (if unrectified data) 2) 'BATCH' 3) 'REAL-TIME'	A30	1
630	DMSIZE	Field name = 'SizeOfDefMatrix' Number of Grid points, on which deformation matrix is based (typically 26 for MOP era data and 105 for MTP era data).	A35	1
665	DMSTRT	Field name = 'Line/PixelStart' Line / pixel coordinate where deformation grid starts. (typically 50 for MOP era data and 2 for MTP era data)	A30	1
695	DMEND	Field name = 'Line/PixelEnd' Line / pixel coordinate where deformation grid ends. (typically 2450 for MOP era data and 2498 for MTP era data).	A30	1
725	DMSTEP	Field name = 'Line/PixelStep' Line / pixel step of deformation grid. (typically 96 for MOP era data and 24 for MTP era data)	A30	1
755	RSMET	Field name = 'ResamplingMet '. Resampling method used: 1) 'NONE' (if unrectified data) 2) 'Nearest Neighbour' 3) 'Splines 4 x 4'	A40	1

795	ORIGIN	Field name = 'FirstPixelOri'. Orientation of First Pixel of data. 1) 'south east' (default) 2) 'north east' 3) 'north west' 4) 'south west'	A30	1
825	LINE1	Field name = 'StartLine' First (southernmost) line of sub-area: Y coordinate of 'south east' corner of sub-area.	A30	1
855	PIXEL1	Field name = 'StartPixel' First (easternmost) pixel of sub-area: X coordinate of 'south east' corner of sub-area.	A30	1
885	NLINES	Field name = 'NumberOfLines'. Number of lines in (height of) sub-area.	A30	1
915	NPIXELS	Field name = 'NumberOfLines'. Number of pixels in (width of) sub-area.	A30	1
945	LOFFSET	Field name = 'LineOffset'. Offset of first pixel of an image line record.	A30	1
975	ORDER	Field name = 'OrderNo'. Order Number.	A40	1
1015	ODELIV	Field name = 'Instantiation'. Delivery number for this order. (Always = 1 for normal orders, delivery sequence number of standing orders).	A40	1
1055	OITEM	Field name = 'OrderItem'. Order Item number within this delivery.	A40	1
1095	CUST	Field name = 'OrderedBy'. Identifier of customer requesting product.	A40	1
1135	PDATE	Field name = 'ProdDate'. Production date: YYMMDD format.	A25	1
1160	PTIME	Field name = 'ProdTime'. Production time: HH:MM:SS format.	A25	1
1185	SWVERS	Field name = 'SWVersion'. MARF Software Version used for production.	A80	1
1265	CRIGHT	Field name = 'CopyRight'. EUMETSAT Copyright notice.	A80	1

4.2. Binary Header

The binary header record can be broken down into three parts.

1. The first section is present and populated for all channels and for rectified and unrectified data, and has a fixed size of 5175 bytes.
2. The second section is present for all channels, but is only populated for unrectified data. For rectified data this section is fillled with zeroes. The section has a fixed size of 2636 bytes.
3. The third section is present and populated for all channels and for rectified and unrectified data. This is the section with variable size, containing 185188 bytes for VIS composite data and 136704 bytes for all other channels.

Offset	Name	Description	Type	Dimension
000	FNAME	File Name (product type). As per equivalent field in ASCII header.	A8	1
008	YEAR	Year: 1981; 1982; 1995	I4	1
012	JDAY	Day number: 1.. 366	I4	1
016	SLOT	Slot Number: 1..48	I4	1
020	DTYPE	Data Type: 0 = no data 1 = normal slot 2 = special slot	I4	1
024	DATE	Image Nominal Date: YYMMDD, e.g. 890331	I4	1
028	TIME	Image Nominal Time: HHMM (End time of Image)	I4	1
032	PLTFRM	Satellite Name. As per equivalent field in ASCII header.	A2	1
034	Spares	Spares, not used (2 bytes).	--	--
036	PROC	Processing carried out on the image. 0 = raw data (demultiplexed=split) 1 = IR processed, 2 = VIS preprocessed data, 3 = WV registered data, 4 = rectified data, 5 = rectified to next neighbour.	I4	1

040	CHAN	Spectral content of image data 0 = no data available, 1 = VISS data, 2 =VISN data, 3 = VISS + VISN data, 4 = IR1 data, 5 =IR2 data, 6 = WV1 data, 7 =WV2 data.	I4	1
044	CALCO	MPEF absolute calibration coefficient for the spectral channel requested (0.XXXXX) – only present since format version 1.1 - see section 5.2.2 below.	A5	1
049	SPACE	MPEF space count for the spectral channel requested (XX.X) – only present since format version 1.1 - see section 5.2.2 below.	A3	1
052	CALTIM	MPEF timestamp for calibration (DayDayDaySlotSlot) – only present since format version 1.1 - see section 5.2.2 below.	A5	1
057	Spares	Spares, not used (3 bytes)	--	--
060	REC2SIZ	The size of header record 2 in bytes.	I4	1
064	LRECSIZ	The size of an Image Line record in bytes, = LOFFSET + NPIXELS	I4	1
068	LOFFSET	The Offset for the first pixel in an image line record (current value =32).	I4	1
072	RTMET	Name of Rectification Method (if any) employed.	A15	1
087	DMMOD	Deformation Model used: 0 = NONE, 1 = BATCH, 2 = Real-Time	I4	1
091	RSMET	Resampling Method used: 0 = NONE, 1 = Nearest Neighbour, 2 = Splines 4x4	I4	1
095	SSP	Subsatellite point (degrees – westerly longitudes are negative)	R4	1
099	Spares	Spares, not used (12 bytes)	--	--
111	ORIGIN	**THIS FIELD IS NOT POPULATED IN FORMAT VERSIONS 2.0 AND HIGHER.** Orientation of first pixel of data: 0 = south east, 1 = north east, 2 = north west, 3 = south west.	I4	1

115	IDX	**THIS FIELD IS NOT POPULATED IN FORMAT VERSIONS 2.0 AND HIGHER.** Phenomena Index as bit mask, when FNAME = PIMA1AM (IR1 full disk).	A8	1
123	LINE1	First (southernmost) line of sub-area - Y coordinate of 'south east' corner of sub-area.	I4	1
127	PIXEL1	First (easternmost) line of sub-area - X coordinate of 'south east' corner of sub-area.	I4	1
131	NLINES	Number of lines in (height of) sub-area	I4	1
135	NPIXELS	Number of pixels in (width of) sub-area	I4	1
139	Spares	Spares, not used (16 bytes).	--	--
155	MLT1	Missing Line Table for VISS (visible south) if present; Filled with 0-bytes if 'VISN only image'. Also used for IR and WV images.	A1	2500
2655	MLT2	Missing Line Table for VISN (visible north) if present; otherwise filled with 0-bytes. Not used for IR and WV images.	A1	2500
5155	IMGQUA	Image Geometric Quality 0 = nominal, 1 = attitude unknown, 2 = orbit unknown, 3 = horizon incomplete, 4 = no deformation calculated, all set to zero, 5 = termination due to RADOPOS - LID inconsistencies, 6 = problems with HR interpretation data.	I4	1
5159	Spares	Spares, not used (16 bytes).	--	--

The following fields are only populated for **unrectified** images. For rectified images, these fields are present but empty.

Offset	Name	Description	Type	Dimension
5175	INT	Nominal Image End Time of Half-hour Slot: e.g. 1200; 2030;...	I4	1
5179	IMP	Processing carried out on image: 0 = raw data, 1 = preprocessed data.	I4	1
5183	SPR	Special output of this image: 0 = no data, 1 = VISS, 2 = VISN, 3 = VISS + VISN, 1 = IR data, 1 = WV data Note that codes are not unique.	I4	1
5187	RPR	Reference position of radiometer:	I4	1
5191	LRE	Line Number corresponding to the reference position of the radiometer RPR. Meaningful only if NSI = 1.	I4	1
5195	LB0	Scanning Law	I2	1
5197	NSI	Number of sub-images received (1-20)	I2	1
5199	FLS	Line Number of 1st line of each sub-image	I2	20
5239	NSL	Number of Lines of each sub-image	I2	20
5279	RDPSIM	Current Decoded radiometer position corresponding to 1st line of sub-image.	I2	20
5319	HIST1	Raw Image Histogram. Frequency of occurrence of each pixel value from 0 to 255, summed over the total image area. Used for IR, WV, VIS-S and VIS-composite products, filled with zeroes for VIS-N products. For VIS-composite data, the field stores the histogram for the VIS-S part of the image.	I4	256
6343	HIST2	Raw Image Histogram. Frequency of occurrence of each pixel value from 0 to 255, summed over the total image area. Used for VIS-N and VIS-composite products, filled with zeroes for IR, WV, and VIS-S products. For VIS-composite data, the field stores the histogram for the VIS-N part of the image.	I4	256
7367	TIMEF	Start of Image: secs from midnight	R8	1
7375	TIMEL	End of Image: secs from midnight	R8	1
7383	ORBF	Orbit coordinates in mean geometric frame at time TIMEF X, Y, Z, X1, Y1, Z1.	R8	6
7431	ORBL	Orbit coordinates in mean geometric frame at time TIMEL X, Y, Z, X1, Y1, Z1.	R8	6
7479	ATTF	Cartesian component of attitude (unit vector) at time TIMEF	R4	3

7491	ATTL	Cartesian component of attitude (unit vector) at time TIMEL	R4	3
7503	EARCO	Horizon Information (earth corners): (1) South horizon information: (1) = line number (2) = entrant pixel (3) = sortant pixel (2) North horizon information: (1) = line number (2) = entrant pixel (3) = sortant pixel (3) East horizon information: (1) = pixel number (2) = first line (3) = last line (4) West horizon information: (1) = pixel number (2) = first line (3) = last line	I2	(3, 4)
7527	HTIME	Time of first Pixel: secs since midnight, For southern and northern horizon line.	R8	2
7544	Spares	Spares, not used (16 bytes).	--	--
7559	STATUS	Image and Processing Status Information. Array of 16 logical flags. TRUE if successfully completed. (1) horizon analysis (2) spin speed fit (3) orbit offset vector fit (4) pixel resampling rate fit (5) attitude refinement iteration based on horizon results. (6) automatic landmark registration (7) actual image frame movement fit, based on landmark results. (8) calculation of deformation vector field. (9) completion of geometrical part of LPEF preparation. (10) completion of rectification and segmentation. (11) completion of amplitude processing Flags (12) to (16) are not currently used and can be treated as spares.	L1	16
7575	IRCHAN	IR Channel in use: 1 or 2.	I2	1
7577	LSTART	Radiometer step offset at image start	I2	1
7579	HORLIM	Horizon limit information: Southern horizon line number, first pixel, last pixel. Northern horizon line number, first pixel, last pixel. East horizon pixel number, south line, north line. West horizon pixel number, south line, north line.	I2	(3, 4)
7603	HORTIM	Times of Southern and Northern horizon scan lines. Julian day + fraction.	R8	2

7619	LS	Radiometer step at south horizon.	I2	1
7621	LN	Radiometer step at north horizon.	I2	1
7623	RMID	= 1/2(LN+LS).	R4	1
7627	TMID	Time related to RMID (Julian day).	R8	1
7635	DISTAN	Distance Satellite-Earth centre at time TMID.	R8	1
7643	BETASO	Cone angle Beta between optical axis and attitude at south horizon (observed).	R8	1
7651	BETANO	Beta at north horizon (observed).	R8	1
7659	BETASE	Beta at south horizon (expected).	R8	1
7667	BETANE	Beta at north horizon (expected).	R8	1
7675	ETAS	= 1/2(BETASO-BETASE)	R8	1
7683	ETAN	= 1/2(BETANO-BETANE)	R8	1
7691	BETASN	= 1/2(BETASO+BETASE)	R8	1
7699	BETANN	= 1/2(BETANO+BETANE)	R8	1
7707	F0OLD	Step Parameter F0 (old).	R8	1
7715	F1OLD	Step Parameter F1 (old).	R8	1
7723	F0NEW	Step Parameter F0 (new).	R8	1
7731	F1NEW	Step Parameter F1 (new).	R8	1
7739	Spares	Spares, not used (16 bytes).	--	--
7755	S0	Spin deviation fit (constant term).	R8	1
7763	S1	Spin deviation fit (linear term).	R8	1
7771	S2	Spin deviation fit (quadratic term).	R8	1
7779	SIGMAS	Standard deviation spin fit.	R8	1
7787	DEVMSP	Maximum deviation spin fit.	R8	1
7795	Spares	Spares, not used (16 bytes).	--	--

The following fields are populated for rectified and unrectified images.

Offset	Name	Description	Type	Dimension
7811	NDGRP	Number of Grid points, on which deformation matrix is based (typically 26 for MOP era data and 105 for MTP era data).	I4	1
7815	DMSTRT	Line / pixel where deformation grid starts (typically 50 for MOP era data and 2 for MTP era data)	I4	1
7819	DMEND	Line / pixel where deformation grid ends (typically 2450 for MOP era data and 2498 for MTP era data).	I4	1
7823	DMSTEP	Line / pixel step of deformation grid (typically 96 for MOP era data and 24 for MTP era data)	I4	1
7827	DEFMAX	**THIS FIELD IS NOT POPULATED IN FORMAT VERSIONS 2.0 AND HIGHER.** Deformation matrix (X-components of vectors). See note 2.	R4	(105, 105)
51927	DEFMAY	**THIS FIELD IS NOT POPULATED IN FORMAT VERSIONS 2.0 AND HIGHER.** Deformation matrix (Y-components of vectors). See note 2.	R4	(105, 105)
96027	NCOR	Number of corrected channels. 2 for VIS-Composite data, 1 otherwise.	I4	1
96031	CHID1	Channel ID for first corrected channel. Encoded as per CHAN field at offset 40.	I4	1
96035	EWGEO1	**THIS FIELD IS NOT POPULATED IN FORMAT VERSIONS 2.0 AND HIGHER.** Line Geometric Correction East-West, positive Westward (per line, from line 1 to line 3030).	R4	3030
108155	NSGEO1	**THIS FIELD IS NOT POPULATED IN FORMAT VERSIONS 2.0 AND HIGHER.** Line Geometric Correction North-South, positive Northward (per line, from line 1 to line 3030).	R4	3030
120275	ROFF1	**THIS FIELD IS NOT POPULATED IN FORMAT VERSIONS 2.0 AND HIGHER.** Line Radiometric Correction: Offset (per line, from line 1 to line 3030).	R4	3030
132395	RGAIN1	**THIS FIELD IS NOT POPULATED IN FORMAT VERSIONS 2.0 AND HIGHER.** Line Radiometric Correction: Gain (per line, from line 1 to line 3030).	R4	3030
144515 *	CHID2	Channel ID for second corrected channel. Encoded as per CHAN field at offset 40. Only used for VIS-Composite data (see note 3).	I4	1
144519 *	EWGEO2	**THIS FIELD IS NOT POPULATED IN FORMAT VERSIONS 2.0 AND HIGHER.** Line Geometric Correction East-West, positive Westward (per line, from line 1 to line 3030).	R4	3030

156639 *	NSGEO2	**THIS FIELD IS NOT POPULATED IN FORMAT VERSIONS 2.0 AND HIGHER.** Line Geometric Correction North-South, positive Northward (per line, from line 1 to line 3030).	R4	3030
168759 *	ROFF2	**THIS FIELD IS NOT POPULATED IN FORMAT VERSIONS 2.0 AND HIGHER.** Line Radiometric Correction: Offset (per line, from line 1 to line 3030).	R4	3030
180879 *	RGAIN2	**THIS FIELD IS NOT POPULATED IN FORMAT VERSIONS 2.0 AND HIGHER.** Line Radiometric Correction: Gain (per line, from line 1 to line 3030).	R4	3030

Notes.

1. The values used to populate the FNAME field at offset 000 are retained from the older ESOC version of the image format, for continuity.
2. The Deformation Matrix consists of a grid of vectors which describes the spatial deformation between the actual and nominal images. The grid is always square. The data structure has a fixed size of 11025 bytes, to store a matrix of 105 x 105 values in row major order. The pixel locations to which each deformation should be applied can be determined from the DMSTART, DMEND and DMSTEP parameters.

   When the deformation matrix contains less than 105 x 105 values (e.g. 26 x 26 values, as typically provided for MOP era data), the values are stored in the first N rows and N columns of the 105 x 105 matrix, so that the matrix retains the full size but is only partially populated.
3. The fields from NCOR onwards contain correction information needed to correct specific anomalies in the Meteosat-5 and Meteosat-6 imagery. One set of correction information is required per detector, so that one set of corrections is provided for IR, WV, VIS-N and VIS-S products and two for VIS-Composite products.

   The fields whose offsets are starred contain the second set of corrections and are only present for VIS-Composite data. The size of record 2 for unrectified data is therefore limited to 144515 bytes for single-detector data, but expands to 192999 bytes for VIS-Composite data.

4.3. Image Lines

The image line data structure is repeated for each line of data in the delivered image. Each line consists of a 32-byte header followed by an array of pixels. The number of pixels varies according to the channel and the sub-area selected, if any.

Offset	Name	Description	Type	Dimension
000	SLOT	Slot Number in the Day (1 ... 48).	I4	1
004	LNUM	Actual Image Line Number: within the earth disk 1, 2, 3, ... (referenced to whole image, i.e. this is the original number of the line before any windowing). **For mini-scans see section 5.3 below.**	I4	1
008	ERRPS	**THIS FIELD IS NOT POPULATED IN FORMAT VERSIONS 2.0 AND HIGHER.** Error in up/down counter or radiometer position.	I2	1
010	RADPOS	**THIS FIELD IS NOT POPULATED IN FORMAT VERSIONS 2.0 AND HIGHER.** Current decoded radiometer position.	I2	1
012	Spares	Spares, not used (18 bytes).	--	--
030	RPSTA	**THIS FIELD IS NOT POPULATED IN FORMAT VERSIONS 2.0 AND HIGHER.** Decoded Radiometer Position at start of image or current sub-image.	I2	1
032	PIXELS	Array of image pixels. Total of NPIXELS (section 4.2, offset 135) pixels, one byte each. Pixel values should be treated as one byte unsigned integer values from 0 to 255. Visible: NPIXELS in [1..5000] infra-red: NPIXELS in [1..2500] water vapour: NPIXELS in [1..2500]	B1	NPIXELS

5. ADDITIONAL NOTES

5.1. Applicability

The format description applies equally to products generated from the Meteosat Operational Programme (1978 - November 1995) and from the Meteosat Transition Programme (November 1995 onwards).

The correction vectors at the end of record 2 may not be populated for older data, and are not useful other than for Meteosat-5 and Meteosat-6 data.

5.2. Format History

5.2.1. Evolution from ESOC Format

The OpenMTP basic imagery format is a direct descendant of the IBMMOP basic imagery format used for many years by ESOC within the MOP programme.

The ASCII header is a new addition which has no equivalent in IBMMOP format.

The binary header incorporates data corresponding to header records 2, 3, 4 and 5 of the IBMMOP image format.

The image line records have the same structure as the image line records of the IBMMOP image format. That is, each record starts with a number of fields (currently occupying 32 bytes) that contain information about that image line. Then follow the image pixels themselves. There is however a significant difference in that the IBMMOP format pads out each image line record to a fixed size of either 2532 or 5032 bytes depending on the channel. The OpenMTP format does not use any padding. The actual size of each line is equal to (NPIXELS + 32) bytes; it may also be obtained directly from the LRECSIZ parameter at offset 64 in record 2 of the image.

5.2.2. Version numbers

- Version 1.0

  Original version – associated with MARF system versions 1.00 to 4.10 inclusive

- Version 1.1

  Space count, calibration coefficients and sub-satellite longitude added – associated with MARF system version 4.20 (January 1998)

- Version 1.2

  This version - mistake in section 1.1 corrected (wrong channel identifiers), redundant fields in format description set to "spare" (November 1998)

- Version 2.0

  The description of the field labelled “TIME” in the binary header corrected to refer to end of slot time. From this version onwards the OpenMTP format generation process no longer has access to certain information related to image rectification, hence many fields are not populated (as described in the format tables in section 4 of this document). This approach ensures that existing users’ software still ‘navigates’ successfully and it also ensures compatibility with the planned future implementation of OpenMTP format in the successor archive, the so-called “UMARF” (March 2000).

- Version 2.1

  The LNUM field of a rectified line record contains the actual line number of line within the earth disk scanned. In previous versions, this field contained a line count.

5.3 Mini-scans

On vary rare occasions, the satellite normally fulfilling the role of standby spacecraft was used to perform so-called mini-scans. These involve the scanning of a line range smaller than the full earth disc and are organised such that a small number of mini-scans are conducted during a 30-minute repeat cycle. The number of mini-scans depends on the extent of the line range chosen.

It is assumed that a MARF user would request mini-scan images explicitly and therefore be aware of what to expect but, nevertheless, there are several fields in the OpenMTP format that require cautious interpretation for mini-scan images.

Firstly, all references to the time of the image will remain associated to the nominal scanning time of the 30-minute image slot in which the mini-scan was recorded. Hence, if 5 mini-scans were recorded in one 30-minute slot they would all carry the same time information. In reality, the end-user would be provided with supporting information on how to derive a more precise time for the mini-scan image from an interpretation of the OpenMTP file name.

Secondly, and in contrast to the point above, the information about the line range of the mini-scan may be extracted from the LNUM field in the image line structure (see section 4.1) provided the image has been rectified. Hence, for rectified image mini-scans this field contains the line number of the actual part of the earth disk scanned and thus repeats for successive mini-scans. This is precisely equivalent to the contents of this field for geographical subsets of full earth disk scans. However, for unrectified mini-scans the LNUM field contains merely a line count and cannot be interpreted as the actual line number of the mini-scan lines.

Further information about mini-scan products would be made available at the time of a request.

5.4 Health Warnings

There are no known specific health warnings.