MTG End-User Requirements Document [EURD]
Document Change Record

<table>
<thead>
<tr>
<th>Issue</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>v3C of 30 March 2010</td>
<td>First version approved by Council in the context of the Programme Proposal approval</td>
</tr>
<tr>
<td>v4 Draft 15th Aug 2018</td>
<td>Reflects the changes presented to the Delegate Bodies in the first half of 2018. As clarified at that time, the changes related to the instrument performances will be introduced in the issue 5 of the [EURD], after the system CDR has been held.</td>
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</table>

a) The details of the changes to the requirement is provided in the new Annex F with a comparison of the old text vs new text accompanied by an explanation of the change and its rationale. A summary is provided in the change record herebelow.

1) The [EURD] is now accompanied by a unique self-standing document [MTGDIS] defining the data distribution baseline. This allows to update the requirements and the dissemination baseline independently. This is further explained in §1.1. It led to the update of the requirements: MET-08020, MET-08060, DIS-14040, DIS-14250, the deletion of MET-08040, MET-08080, DIS-14045, DIS-14047, DIS-14260, and the addition of DIS-14048.

2) The internet interface being a re-use of the corporate functionalities, it is now merged into the chapter 6 Data retrieval services. It led to the deletion of DIS-14380, DIS-14390, DIS-14400, DIS-14420, DIS-14440.

3) Reworded but scope unchanged: the wording of some requirements had to be modified for various reasons (e.g. consistency with terminology recalled in Annex C, update of obsolete text, removal of TBC) but the scope is unchanged. It led to the update of the requirements: FCI-02340, IRS-04075, IRS-04140, LI-06120, ARC-12060, DIS-14050, DIS-14220, DIS-14240, USR-18020 and the addition of MET-08090 and Note modification for: DCP-10020, RET-16040

4) Handled by Multi-Mission Element (MME): It led to the update of the requirements: DIS-14020 and the deletion of: DIS-14100, DIS-14140

5) Mission performance clarification: it led to the addition of the requirements: FCI-02230 (MTF performance), IRS-04122 (spectral sampling interval); IRS-04124 (spectral FWHM.), IRS-04230 (integrated energy); IRS-04250 (ASPKE (LAC)), IRS-04255 (ASPKE (dwell)), DIS-14190 (for IRS L2 timeliness). The update of the following requirements: FCI-02320 (removal of TBC), IRS-04020 (spectral channel interval clarification), IRS-04040 (coverage clarification and see below §4.2.1 for new scanning pattern.), IRS-04080 (clarification of missing sounding), IRS-04135 (method for spectral sample spectral response function difference calculation), LI-06020 (coverage clarification), LI-06040 (spectral radiance), LI-06100 (spectral radiance). For IRS-04140, IRS-04160, IRS-04180 and IRS-04200, the associated table 9 has been updated with refined radiometric performance.
b) Latest version of the Conventions definition and Glossary have been provided in Annex C/D (without tracking).

c) Various changes in the descriptive text have been made to bring it in line with the latest terminology used at corporate level or MTG convention & terms as defined in Annex C. For example:

- GMES replaced by Copernicus (changes not tracked).
- High rate dissemination service replaced by EUMETCast terrestrial.
- Operational scenario replaced by operational practice.

d) New section 1.5 for open issues and assumptions.

e) IRS Level 1 timeliness: the goal is to have a timeliness better than 15mn but this remains to be confirmed after system CDR and test by EUM on the operational configuration. See Table 17 in §5.

f) IRS Level 2 timeliness: the goal is to have a timeliness better than 30mn but this remains to be confirmed after system CDR and test by EUM on the operational configuration. See Table 17 in §5.

g) On top of the above, the following changes have been made:

- §1.2.1 Instructions, Plans and Arrangements updated (C/S was TBD, [DATAPO-S4] added, preliminary programme proposal [PPP] replaced by [PP], removed Current SAF Strategy EUM/C/52/02/DOC/51 (not used), [TD-15] replacing obsolete TD-04 and EUM, deleted [CGMS_GS] reference replaced by annex C (CONV), [KOP_S4-5] version update for UVN.
- §2: Text improvement to make it up to date.
- §4.1: Text clarification for the operational practice between FDSS and RSS in line with requirement SYS-00020.
- §4.2.1 Deletion of the TBC in table 5 & 6, any deviation to this requirement will be handled as a non-conformance.
- §4.2.1 The scanning pattern for the IRS instrument has been modified as per IRS-MAG of October 2017.
- §4.3.3 Text improvement (albedo -> reflectance at TOA).
- §4.4: Text updated with latest available Sentinel 4 / UVN information.
- §4.5 Text improvement to make it up to date.
- §4.5.2: Update with SAF products timeliness at system level (originating from [L2SAF]).
- §4.6: delete the ARGOS part (as being abandoned).
- §5 & 5.1 text reworded in line with requirements update (in particular EUMETCast).
- §5.1 Table 14 updated. In line with [MTGDIS] introduction, new column “timeliness applies to”, FCI & IRS L2 split in 2 separate rows. Suppression of FSD & MDD not related to MTG, LI is at level 2 only.
- §5.4 Deleted, the retrieval of data via internet is now merged into §6 Data Retrieval Services.
- §6 Text improvement.
<table>
<thead>
<tr>
<th>Version</th>
<th>Changes</th>
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</table>
| v4.A Draft 10th Sept 2018 | Updated to reflect the comments of the STG-SWG and STG-OPSWG of Sept 2018 before submission to STG:  
•§1.2.2 Deletion of the old (2008) GMES document [KOP_S4] which is not cross referenced in the text. Addition of the date to [KOP_S4-5]  
•§1.5 open issues: the way forward for the FCI level 2 products for RSS has been clarified. Added "applicability of timeliness for FCI/IRS level 2 products". NOAA is not a Global NWP Centres.  
•FCI-02055 updated to clarify the wording for the southern boundaries of the LAC 4 in RSS mode (in §4.1.1).  
•§7.2 "Level 3 products" added in the descriptive text  
•New appendix F2 to capture the requirement change between the version 4 and 4A.  
Miscellaneous editorials.                                                                                                                                                                                                 |
| V4B Draft 9th October 2018 | §4.1.1 Correction of an editorial related to FCI-02055 (issue 4.1 replaced by version 4.A). Otherwise no change since version 4A.  
Submitted for approval by Council after review and endorsement by STG #73 on 09th October 2018.                                                                                                                                                                                                 |
| V4C 6th December 2018 | Version approved by 90th council in December 2018.  
Addition of an open issue related to an old definition of "scheduled outage" spotted during FCI-MAG #1.                                                                                                                                                                                                 |
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1 INTRODUCTION

1.1 Purpose and Scope

The purpose of this document [EURD] is to define the End-User Requirements applicable to the Meteosat Third Generation (MTG) Programme.

Service requirements expressed in this [EURD] apply at the interface between EUMETSAT and the End Users (excluding networks and service components that are outside the EUMETSAT control).

Requirements in the [EURD] are used for the end-to-end verification and validation of system functionalities, services, interfaces and operational performance till commissioning. Actual performances of the services of the system will be described in the Operational Services Specification after the system has been commissioned.

The essential and In-orbit verifiable End-Users requirements on content, operational availability, timeliness, etc. are presented for each services provided by the EUMETSAT facilities at its Headquarters as well as in general terms for the EUMETSAT Satellite Application Facilities (SAF) network. The detailed requirements addressing the SAF services are covered separately in SAF-dedicated user and product requirements documentation to be established for each SAF project.

Service delivered by the MTG System will be provided through a cost-effective combination of dedicated and specific new developments and acquisitions and generic, enterprise-like multi-mission infrastructure maintained, sustained, and upgraded by EUMETSAT. Provisions, functions and capabilities made available by the latter will not be detailed in this document.

The "MTG Products Distribution Baseline [MTGDIS]" (EUM/MTG/DOC/17/946090) is an appendix of the [EURD] aiming to define the Level 1 and Level 2 datasets that will be disseminated and archived at EUMETSAT Headquarters as part of the Meteosat Third Generation (MTG) Programme. These are the datasets that will be available to End Users and to SAF for processing. The [L2SAF] document is considered as an annex of [MTGDIS] of relevance for SAF developers.

The requirements affected by the instruments performance will be updated in the issue 5 of the [EURD] foreseen after the CDRs and before the launch. As announced at STG in May 2018.
1.2 Applicable and Reference Documents

1.2.1 Instructions, Plans and Arrangements

The following documents have been used to establish this document.

<table>
<thead>
<tr>
<th>Doc ID</th>
<th>Title</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>[CONVENTION]</td>
<td>EUMETSAT Convention</td>
<td>EUM/C/59/06/DOC/28</td>
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<td>[STRATEGY]</td>
<td>EUMETSAT Strategy: 2030</td>
<td></td>
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<tr>
<td>[DATAPO]</td>
<td>EUMETSAT principles on Data Policy</td>
<td>EUM/C/98/rec IV</td>
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<tr>
<td></td>
<td>Date: 3 July 1998</td>
<td></td>
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<tr>
<td>[PP]</td>
<td>MTG Programme Proposal</td>
<td>EUM/C/69/10/DOC/02</td>
</tr>
<tr>
<td>[EUM_CS]</td>
<td>EUMETSAT - COSPAS-SARSAT Cooperation Arrangement</td>
<td>EUM/LAD/CA/09/0664</td>
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</tbody>
</table>

1.2.2 Reference Documents

The following documents provide useful information but are not cross-referenced in a requirement.

<table>
<thead>
<tr>
<th>Doc ID</th>
<th>Title</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>[RSE]</td>
<td>Response of Remote Sensing Experts (RSE) to User Requirements Formulated by Post-MSG Application Expert Groups</td>
<td>EUM/C/01/DOC/16 - Annex III</td>
</tr>
<tr>
<td>[SYSCON]</td>
<td>MTG System Concept</td>
<td>EUM/MTG/TEN/07/0042</td>
</tr>
<tr>
<td>[L2SAF]</td>
<td>SAF Level 2 Products Generation and Dissemination Baseline for MTG</td>
<td>EUM/PPS/DOC/09/0032</td>
</tr>
<tr>
<td>[CGMS02]</td>
<td>CGMS IDCS Users' Guide</td>
<td>CGMS02</td>
</tr>
<tr>
<td>[TD15]</td>
<td>EUMETCast - EUMETSAT's Broadcast System for Environmental Data</td>
<td>EUM/OPS/DOC/06/0118</td>
</tr>
<tr>
<td>[CGMS_35]</td>
<td>CGMS position Report of the 35th Meeting of the Coordination Group for Meteorological Satellites</td>
<td>CGM 35</td>
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<tr>
<td>[KOP_S4-5]</td>
<td>GMES Sentinel 4 and 5 Mission Requirements</td>
<td>EOP-SMA/1507/JL-dr Issue 3 Rev. 1.4 of 31 Jan 2011</td>
</tr>
<tr>
<td>[UG04]</td>
<td>EUMETSAT Archive User Guide</td>
<td>UG04</td>
</tr>
<tr>
<td>[TD10]</td>
<td>MSG - Meteorological Data Dissemination Service</td>
<td>EUM TD-10</td>
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</table>
1.3 Identification of Requirements

The requirements are written in the form:

\[ \text{[EURD] XXX-nnnnn iss: IR} \]

This is the body of the requirement.

Note: may be attached to provide clarification, interpretation, verification method.....

All requirements are uniquely identified according to the following convention:
- ‘XXX’ represents for information the requirements group identifier (i.e. the service type),
- ‘nnnnn’ represents the requirement number. This number is unique within this document.
- ‘I.R’ represents the Issue and Revision of the document when the body of the requirement was last modified, e.g. '3.C' means the requirement has not been modified since the release 3.C of the [EURD]. It is not necessarily updated if only the note is updated or if only a table shared by several requirements is updated. However those changes are also tracked in the Appendix F.

The following requirement groups (i.e. service type) are defined:

SYS = System Level
FCI = FCI data acquisition and generation
IRS = IRS data acquisition and generation
LI = LI data acquisition and generation
UVN = UVN data acquisition and generation
MET = Meteorological/Level 2 product(s) generation
DCP = DCP data acquisition and generation
ARC = Archiving and cataloguing
DIS = Near real time dissemination services
RET = Archive retrieval services
USR = User support services

Additionally, notes may be attached to requirements providing clarification, interpretation to the requirement body. Even if this information is a component of the requirement; as such, this information is not to be verified.

1.4 Acronyms and Definitions

A complete list of acronyms is provided in Appendix G.

Words appearing in *italics* have special meaning defined in Appendix F.
1.5 Open Issues and Assumptions

The open issues and assumptions below are those affecting the scope or general content of the document. The open issues and assumptions specific to a given product or recipient are listed in [MTGDIS].

Specific assumptions are written as notes to the relevant requirements.

Specific open issues are identified with a TBD or a TBC and a summary list of TBC/TBDs is provided at the back of this document.

Assumptions and Open Issues related to Services

<table>
<thead>
<tr>
<th>Service</th>
<th>Open issues / Assumptions</th>
</tr>
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</table>
| FCI-RSS  (L1) | • Assumption: Baseline is the dissemination of the 16 channels at normal resolution (FDHIS) for both FDSS and RSS via EUMETCast satellite. The 4 channels at high resolution (HRFI) for RSS are disseminated via EUMETCast terrestrial. Should all channels be disseminated at both resolutions (16 NR + 4 HR), this would imply doubling the bandwidth for FCI-L1. Increase by 18% if a single normal resolution channel is replaced by the corresponding high resolution channel. Increase by 25% if a single high resolution channel is on top of the corresponding normal resolution channel.  
  • Associated requirements: [MTGDIS] §2.1 and §2.2 |
| FCI-RSS  (L2) | • Open issue: "RSS Level 2 products” are not defined.  
  • Assumption: No level 2 products for the RSS service.  
  • Associated requirements: [MTGDIS] §3.2  
  • Way forward: To select a subset of the FCI-FDSS Level 2 Products (including SAF), after having gained experience in orbit with MTG-I1, and to adapt them for RSS before the launch of MTG-I2. |
| LI        | • Open issue “LI timeliness”: The requirement is for 120s but the goal of the users (recalled in LI-MAG of spring 2018) is for 30s.  
  • Assumption: the current design, considered as challenging, is for 60s.  
  • Associated requirements: DIS-14220 and Table 17 of §5.1, [MTGDIS] §3.3  
  • Way forward: During development phase, the design will be scrutinized. Should there be a risk that one minute is not achievable, the situation will be reported and reconsidered in particular at the CDR. During AIV and Commissioning, reasonable attempts will be made to tune the configuration parameters to try to improve the timeliness to achieve the 30s target (in particular over Europe). If not sufficient, bottleneck will be identified and a further design improvement will be considered taking benefit of technology evolution. |
| LI        | • Assumption "LI accumulation window for accumulated product is 30 seconds".  
  • Associated requirements: [MTGDIS] §3.3  
  • Way forward: The duration of the accumulation window may vary between 10s and 30s. The situation will be re-assessed after gaining experience with MTG-I1 in orbit and in consultation of LI-MAG. |
| IRS  (L1) | • Open Issue: "IRS Level 1 timeliness". The request of the users through IRS-MAG is to have a timeliness better than 15 min. EUMETSAT analysis showed that it should be feasible and the [EURD] requirement has been modified accordingly. However industry commitment remains at 30mn.  
  • Assumption: Timeliness of 15mn.  
  • Associated requirements: DIS-14180 and Table 17 of §5.1, [MTGDIS] §2.4  
  • Way forward: The design will be scrutinised through the facility and system CDR and tested by EUM on the operational configuration to confirm feasibility. |
| IRS  (L2) | • Assumption "all LAC to be disseminated", not only LAC 4. The availability of LAC 1, LAC 2, and LAC 3 is not a condition for declaring the readiness to enter routine operations.  
  • Associated requirements: [MTGDIS] §3.4 |
<table>
<thead>
<tr>
<th>Service</th>
<th>Open issues / Assumptions</th>
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| IRS (L2) | • Open Issue: "IRS Level 2 timeliness". The request of the users through IRS-MAG is to have a timeliness better than 30 min. EUMETSAT analysis showed that it should be feasible and the [EURD] requirement has been modified accordingly. However industry commitment remains at 60mn.  
  • Assumption: Timeliness of 30mn.  
  • Associated requirements: DIS-14190 and Table 17 of §5.1, [MTGDIS] §3.4  
  • Way forward: The design will be scrutinised through the facility and system CDR and tested by EUM on the operational configuration to confirm feasibility |
| UVN / S4 | • Open Issue "Copernicus/UVN data distribution baseline remains to be formally endorsed by the EU commission.  
  • Associated requirements: [MTGDIS] §2.5 and §3.5 |

**Assumptions and Open Issues related to Distribution Mechanisms**

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Open issues / Assumptions</th>
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| EUMETCast Europe | • Open Issue “applicability of timeliness for FCI/IRS level 2 product” need to be clarified as it uses a term “chunk” which is not defined  
  • Assumption: As per table 17 in §5.1  
  • Way forward: Define the term chunk or replace it by a term already defined while checking potential impact on timeliness value, update the table 17 §5.1 accordingly. |
| EUMETCast Africa | • Open Issue "Dissemination to Africa": The dissemination baseline over Africa will not be finalised before 2020 earliest.  
  • Assumption: An aggregate bitrate of 3.5Mbps is currently assumed which will be revisited depending on the capacities, affordability and priorities. Current baseline considers to disseminate MSG-like L1 spectral channels every 10 minutes with a spatial resolution similar to MSG, plus a Lightning accumulated product (pseudo radar) complemented with some Level 2 products.  
  • Associated requirements: [MTGDIS] §4.  
  • Way forward: Review during the African User Forum at end of September 2020 before being submitted to council decision.  
  • Risk: Additional dissemination cost. |
| EUMETCast Terrestrial | • Open issue: “EUMETCast terrestrial”: This MME functionality may not be fully operational/available for End Users and private companies at the time of MTG-I1 launch.  
  • Assumption: EUMETCast terrestrial is not planned to be used before MTG-S1 commissioning in 2023.  
  • Associated requirements: DIS-14020, USR-18020, Table 17 of §5, [MTGDIS]  
  • Way forward: The situation will be re-assessed at each milestone. Next one is CDR. |
| Global NWP Centres | • Open Issue "Global NWP Centres, dissemination mechanism". "Global NWP Centres" is not exactly a dissemination mechanism, but a recipient. And there are over 20 global NWP centres designated by WMO. The list of datasets and products to Global NWP Centres is tentative as it has not been discussed/agreed with them. Dedicated communication lines to the global NWP Centres may be needed.  
  • Assumption: For Copernicus/S4, (ECMWF) as defined with ESA. Otherwise, EUMETSAT educated guess.  
  • Associated requirements: [MTGDIS] §2.X.1 & 3.X.1  
  • Way forward:  
    a) For initial IOC version (after MTG-I1 launch), EUM will use whatever corporate data distribution mechanisms which exist now or will exist before the launch. This includes with current knowledge the mechanism like EUMETCast satellite, EUMETCast terrestrial, internet, GTS/RMDCN complemented by a few point to point links (e.g. ECMWF) regrouped in the document under "Global NWP Centre".  
    b) For MTG-S1 and MTG-I2, any evolution of the corporate data distribution mechanism would benefit to MTG. For example, once the "high-capacity WIS core network" will have |
performance compatible with the MTG needs, it will become part of the MTG baseline.

| RMDCN/GTS | • Open issue "GTS/RMDCN". The list of MTG products to be disseminated by GTS/RMDCN is tentative and subject to change.  
• Associated requirements: DIS-14250, [MTGDIS] §2.X.1 & 3.X.1  
• Way forward: To be discussed in the context of GODEX_NWP (global body representing the NWP data consumption community and the satellite data providers). |
| Extract of conventions | • TBC and old text (once the satellite supplier / design is known) to be corrected in the extract of the convention document related to “scheduled outage” (annex C page 71). |
2 METEOSAT THIRD GENERATION MISSION NEED

The mission of the Meteosat Third Generation (MTG) System is to provide continuous high spatial, spectral and temporal resolution observations and geophysical parameters of the Earth / Atmosphere System derived from direct measurements of its emitted and reflected radiation using satellite based sensors from the geo-stationary orbit. To fulfil its mission it is required to deploy sustained capabilities to acquire, process and distribute to downstream application users and second tier processing centres environmental data on a broad spectral range (from UV to LWIR), covering extensive areas (global and regional), and within a variety of different time scales to continue and enhance the services offered by the Second Generation of the Meteosat System (MSG).

The MTG mission encompasses the following observation missions:

- **Flexible Combined Imager (FCI) mission**, providing 16 channels with a spatial sampling distance in the range 1-2km (also called Full Disc High Spectral resolution Imagery (FDHSI)); and/or 4 channels with a spatial sampling distance in the range 0.5-1km (also called High spatial Resolution Fast Imagery (HRFI)). It is possible to configure the FCI to scan the earth disc in 10 minutes in support of the Full Disc Scanning Service (FDSS) or a quarter of the disc in 2.5mn in support of the Rapid Scanning Service (RSS). The combination of channels and coverage areas are defined in the list of products. - Implemented by MTG-I

- **InfraRed Sounding mission** is achieved through the Infrared Sounder (IRS) instrument, providing hyperspectral sounding information in two bands, a Long Wave InfraRed (LWIR: 700-1210 cm-1) and Mid Wave InfraRed (MWIR: 1600-2175 cm-1) band with a spatial sampling distance around 4km at nadir. The earth disc is split in 4 zones of equal size (called LAC for Local Area Coverage), and numbered LAC 1 to LAC 4, from south to north. The scan pattern repeat sequence is arranged to revisit each LAC zone in a manner adapted to the need of the End Users (Europe is revisited more often). - Implemented by MTG-S.

- **Lightning Imagery mission** is achieved through the Lightning Imager (LI) instrument, detecting continuously over almost the full disc, the lightning discharges taking place in clouds or between cloud and ground with a spatial sampling distance less than 10km at 45 degrees north for the sub-satellite longitude. - Implemented by MTG-I

Moreover, the MTG missions comprise the accommodation of the Copernicus Sentinel-4 (S4) sounding mission, achieved through the Ultraviolet, Visible and Near-infrared (UVN) Instrument, covering Europe every hour taking measurements in three spectral bands (UV: 305 - 400 nm; VIS: 400 - 500 nm, NIR: 750 - 775 nm) with spatial sampling distance around 8km. - Implemented by MTG-S

In addition, the MTG mission makes a major contribution to climate monitoring activities providing high quality radiances, reprocessed level 1 dataset as Fundamental Climate Data Records (FCDRs) supporting generation of Thematic Climate Data Records (TCDRs), providing also stewardship of decadal geostationary data records of the First and Second Generation of Meteosat. - Implemented by reprocessing

The Space Segment of the MTG System consists of a satellites constellation. Three in-orbit satellites are needed to support the complete and total set of missions and functions listed above, the full operational capability (FOC). To span the operational life time of the programme over at least 20 years for the imagery mission and 15.5 years for the sounding
mission, there will be in total 4 satellites dedicated to support the Imagery missions (MTG-I), and 2 satellites to support the sounding missions (MTG-S).

Each satellite is specified for a nominal lifetime (including commissioning) of ca. 8.5 years, carrying the payload complements or meteorological sensors according to the following split which have been confirmed in the definition and feasibility phase -Phase A- for its detailed design and implementation:

- MTG-I: FCI, LI, DCS and SAR
- MTG-S: IRS + UVN (Copernicus S-4)

This distribution of the payload complement and redundancies gives regard to the novelty nature of the sounding missions (IRS and UVN) and their respective downstream applications using data from geo-stationary systems, balancing the payload mass distribution, power, consumables such as propellant, and data rates making effective use of the same platform.

Complementary to the direct observation missions summarised above and yet essential to satisfy key user needs, the following objectives have also to be fulfilled by the MTG System:

- **Level 1 dataset** generation in the context of above direct observation mission;
- **Level 2 product** extraction;
- **Data Collection System** (DCS), for collecting and transmitting observations and data from surface, buoy, ship, balloon or airborne Data Collection Platforms (DCP);
- **Long term archiving** in the **EUMETSAT Data Centre** including reprocessing of **instrument data** (level 0) and **level 1 datasets**;
- **Near Real Time Data Dissemination and Relay services** to users
  - **EUMETCast** services (by satellite and terrestrial);
  - **RMDCN dissemination service**;
  - **Search And Rescue (SAR) relay service**. Similarly to MSG, the MTG System has the capability to accommodate a GEOSAR transponder, enabling the operations of the mission under the aegis of the COSPAS-SARSAT System.
  - **Internet dissemination services**;
- **Archived dataset** retrieval services continue to be provided as part of the multi-mission **EUMETSAT Data Centre services**.
- **User support services** are enhanced to address MTG as well.

The full nominal operational configuration includes a prime **MTG-I satellite** (supporting the FDSS services), a second **MTG-I satellite** (acting as in-orbit hot backup for the prime **MTG-I satellite** and supporting the RSS services) and an **MTG-S satellite**. These three in-orbit satellites are needed to support the complete and total set of missions and functions listed above, also called the full operational capability (FOC).
3 SYSTEM-WIDE REQUIREMENTS

Using the data received from the satellites, the following data services are provided within the MTG system:

- FCI data acquisition and generation,
- IR Sounding data acquisition and generation,
- Lightning data acquisition and generation,
- UVN data acquisition and generation,
- Level 2 product(s) generation,
- DCP message acquisition, bulletin generation and statistics generation,
- Data Archival in EUMETSAT Data Centre.

The following set of services shall be nominally provided during the operational lifetime of the MTG Programme (at least 20 years), once these services become operational for the first time (i.e. after commissioning of MTG-I1):

1) FCI Full disc data acquisition and generation (in support of the FDSS)
2) Lightning data acquisition and generation
3) Level 2 Products generation
4) DCP messages acquisition, DCP Bulletins generation and statistics generation
5) Data Archival in the EUMETSAT Data Centre
6) Near Real Time data dissemination and Relay;
7) archived dataset retrieval services (from the EUMETSAT Data Centre)
8) User support

The following set of services shall be nominally provided during at least 15.5 years once these services become operational for the first time (i.e. after commissioning of MTG-S1):

1) IR Sounding data acquisition and generation
2) UVN data acquisition and generation
3) Related Level 2 product(s) generation

Note: These services are on top of the ones specified to be available after the commissioning of MTG-I1.

The following set of services shall be nominally provided during at least 12.5 years once these services become operational for the first time (after commissioning of the MTG-I2):

1) FCI Local Area Coverage data acquisition and generation (in support of the RSS)
2) Related Level 2 product(s) generation
Note 1: MTG Rapid Scanning nominally starts after commissioning of MTG-I2. Until that time, the Rapid Scanning Service (RSS) is provided by MSG-4.

Note 2: These services are on top of the ones specified to be available after the commissioning of MTG-I1.

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**[EURD] SYS-00080 iss: 3A**

The satellite specified lifetime shall be 8.5 years.

Note 1: This applies to the MTG-I and MTG-S and includes commissioning duration.

Note 2: The system commissioning of MTG-I1 and MTG-S1 is expected to last 12 months. Any follow-on MTG satellite is expected to be commissioned within 6 months.

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**[EURD] SYS-00100 iss: 3A**

The MTG System shall include 4 satellites (MTG-I) embarking the Flexible Combined Imager (FCI), the Lightning Imager (LI), the Data Collection Platform (DCP) receiver and the Search And Rescue (SAR) repeater.

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**[EURD] SYS-00120 iss: 3A**

The MTG System shall include 2 satellites (MTG-S) embarking the Infra-Red Sounder (IRS) and the UVN-Copernicus sounder.

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**[EURD] SYS-00130 iss: 3B**

The system shall provide the operational MTG missions (and the related services) when the supporting satellites are located within the nominal longitude range between 10°W and 10°E.
4 DATA ACQUISITION, GENERATION AND ARCHIVING SERVICES

4.1 FCI Data Acquisition and Generation Services

The MTG Flexible Combined Imager (FCI) generates simultaneously images at various spatial resolutions for 16 spectral channels, including 4 at high spatial resolution (extension of SEVIRI HRV to 4 channels). A local area scanning is possible with a higher repetition rate (further called rapid scan for consistency with Meteosat first and second Generation). Normal (full disc) and local area scanning can be interleaved on a single satellite (e.g. when only one imaging satellite is operational in orbit) or conducted in parallel when 2 satellites are available in-orbit. These two scanning modes correspond respectively to the Full Disc Scanning Service (FDSS) and Rapid Scanning Service (RSS).

The operational practices for the Full Disc Scanning Service (FDSS), after the launch of MTG-I1, and the Rapid Scanning Service (RSS), after the launch of MTG-I2, are both defined. The capability to perform RSS and interleaved scanning is verified during MTG-I1 commissioning. The potential use of interleaved scanning during routine operations depends on experience in orbit and recommendation of the OPS-WG.

The FCI acquires the spectral channels simultaneously by scanning a detector array per spectral channel in an east/west direction to form a swath. The swaths are collected moving from south to north to form an image per spectral channel covering either the full disc coverage or the local area coverage within the respective repeat cycle duration. Radiance samples are created from the detector elements at specific spatial sample locations and are then rectified to a reference grid, before dissemination to the End Users as level 1 datasets. Spectral channels may be sampled at more than one spatial sampling distance or radiometric resolution, where the spectral channel has to fulfil FDHSI and HRFI missions or present data over an extended radiometric measurement range for fire detection applications.

4.1.1 FCI Image Acquisition Requirements

The Flexible Combined Imager (FCI) shall generate simultaneously images for the spectral channels given in Table 1:

Table 1: Channel specification for the Flexible Combined Imager (FCI)

<table>
<thead>
<tr>
<th>Spectral Channel</th>
<th>Central Wavelength, $\lambda_0$</th>
<th>Spectral Width, $\Delta\lambda$</th>
<th>Spatial Sampling Distance (SSD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIS 0.4</td>
<td>0.444 $\mu$m</td>
<td>0.060 $\mu$m</td>
<td>1.0 km</td>
</tr>
<tr>
<td>VIS 0.5</td>
<td>0.510 $\mu$m</td>
<td>0.040 $\mu$m</td>
<td>1.0 km</td>
</tr>
<tr>
<td>VIS 0.6</td>
<td>0.640 $\mu$m</td>
<td>0.050 $\mu$m</td>
<td>1.0 km (0.5 km #1)</td>
</tr>
<tr>
<td>VIS 0.8</td>
<td>0.865 $\mu$m</td>
<td>0.050 $\mu$m</td>
<td>1.0 km</td>
</tr>
<tr>
<td>VIS 0.9</td>
<td>0.914 $\mu$m</td>
<td>0.020 $\mu$m</td>
<td>1.0 km</td>
</tr>
<tr>
<td>NIR 1.3</td>
<td>1.380 $\mu$m</td>
<td>0.030 $\mu$m</td>
<td>1.0 km</td>
</tr>
</tbody>
</table>
### Table 2: Flexible Combined Imager (FCI) coverage versus repeat cycle duration

<table>
<thead>
<tr>
<th>Coverage</th>
<th>Repeat cycle duration</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDC = 17.70° diameter circle centred at SSP</td>
<td>10 minutes</td>
<td>Corresponds to Full Disc Scanning Service (FCI-FDSS)</td>
</tr>
<tr>
<td>LAC = FDC / 4</td>
<td>2.5 minutes</td>
<td>Corresponds to the Rapid Scanning Service (FCI-RSS)</td>
</tr>
</tbody>
</table>

Note 1: The operational practice for the FDSS (based on the FDC alone) is that the acquisition start times are around HH:00, HH:10, HH:20 etc. where HH represents the hours in UTC, as shown in [Figure 1](#).
Figure 1: Operational practice for Full Disc Scanning Service (FDSS)

Note 2: The operational practice for the RSS (based on the LAC alone) is to scan Europe, as shown in Figure 2.
Operational practice for Rapid Scanning Service (RSS) with LAC = FDC/4

Elapsed time (repeated every hour)

LAC zone 4
LAC zone 3
LAC zone 2
LAC zone 1

Figure 2: Operational practice for Rapid Scanning Service (RSS)

Note 3: The capability to support simultaneously the FDSS and RSS service using a single satellite is verified during MTG-I1 commissioning. The reference scenario (based on FDC interleaved with LAC) is that the acquisition start times for FDC are around HH:00, HH:15, HH:30, HH:45 and the acquisition start times for LAC are around HH:10, HH:12.5, HH:25, HH:27.5, HH:40, HH:42.5, HH:55, HH:57.5, etc. where HH represents the hours in UTC, as shown in Figure 3.
The start of the FCI LAC shall be configurable, by ground telecommand, to any position within the FDC, provided that the LAC is fully contained in the FDC.

Note 1: The LAC zones are labelled consecutively 1 to 4 starting at the southernmost and ending at northernmost (European) LAC zone.

The FCI image shall be such that:

When delivering FDSS:

- The complete FDC area of coverage is available in the acquired image;

When delivering RSS:

- At least the complete Earth surface visible from geostationary altitude at 0° inclination and at the north of the boundary described in Figure 4 is available.
Note: The diagram indicates the minimum LAC zone 4 coverage in terms of latitude and longitude on the earth.

**Figure 4: Minimum LAC zone 4 coverage for FCI**

### 4.1.2 FCI Image Quality Threshold

As defined in [CONV], the quality threshold is met when the requirements on completeness, accuracy and timeliness are fulfilled. The percentages of the images that meet the quality threshold requirements (within timeliness) are addressed in the dissemination sections.

<table>
<thead>
<tr>
<th>ABCD</th>
<th>30°N</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC</td>
<td>22°W</td>
</tr>
<tr>
<td>CD</td>
<td>25°N</td>
</tr>
<tr>
<td>DE</td>
<td>10°W</td>
</tr>
<tr>
<td>EF</td>
<td>30°N</td>
</tr>
<tr>
<td>FG</td>
<td>50°E</td>
</tr>
<tr>
<td>GH</td>
<td>35°N</td>
</tr>
</tbody>
</table>

An FCI image shall be considered complete if all of the conditions below are met:

a) FCI image acquisition requirements are met,
b) Less than 5% of the radiance samples in the image are declared missing samples

An FCI image shall be considered accurate if all of the conditions below are met:

a) FCI image level 1 spectral requirements are met,
b) FCI image level 1 radiometric requirements are met,
c) FCI image level 1 spatial & temporal requirements are met,
d) FCI image level 1 geometric requirements are met.

4.1.3 FCI Image Level 1 Spectral Requirements

Unless otherwise stated the requirements in this section apply:
• to all spectral channels
• to all spatial samples in a repeat cycle
• to all repeat cycles over each MTG-I satellite specified lifetime.

EURD FCI-02100 iss: 3A

The FCI spectral response function difference between any two spatial samples of the same image shall be less than 0.05 for VIS and NIR spectral channels and less than 0.10 for IR spectral channels when integrated over three times the spectral width and centred on the central wavelength.

EURD FCI-02120 iss: 3A

The FCI spectral response function difference between the actual spectral response function and that characterised on-ground shall be less than 0.10 for VIS and NIR spectral channels and 0.20 for IR spectral channels when integrated over three times the spectral width and centred on the central wavelength.

4.1.4 FCI Image Level 1 Radiometric Requirements

Unless otherwise stated the requirements in this section apply:
• to all spectral channels
• to all signal levels between the minimum and maximum signal
• to all repeat cycles over each MTG-I satellite specified lifetime.

Table 3: Radiometric requirements of the FCI Images

<table>
<thead>
<tr>
<th>Spectral Channel</th>
<th>Min. Signal, $a_{\text{min}}$</th>
<th>Max. Signal, $a_{\text{max}}$</th>
<th>Ref. Signal, $a_{\text{ref}}$</th>
<th>Radiometric Noise (SNR)</th>
<th>Medium Term Radiometric Stability</th>
<th>Long Term Radiometric Stability</th>
<th>Radiometric Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIS 0.4</td>
<td>0.01</td>
<td>1.20</td>
<td>0.01</td>
<td>&gt;25</td>
<td>&lt;0.1%</td>
<td>&lt;2%</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>VIS 0.5</td>
<td>0.01</td>
<td>1.20</td>
<td>0.01</td>
<td>&gt;25</td>
<td>&lt;0.1%</td>
<td>&lt;2%</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>VIS 0.6</td>
<td>0.01</td>
<td>1.20</td>
<td>0.01</td>
<td>&gt;30 &gt;12#1</td>
<td>&lt;0.1%</td>
<td>&lt;2%</td>
<td>&lt;5% &lt;10%#1</td>
</tr>
<tr>
<td>VIS 0.8</td>
<td>0.01</td>
<td>1.20</td>
<td>0.01</td>
<td>&gt;21</td>
<td>&lt;0.1%</td>
<td>&lt;2%</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>VIS 0.9</td>
<td>0.01</td>
<td>0.80</td>
<td>0.01</td>
<td>&gt;12</td>
<td>&lt;0.1%</td>
<td>&lt;2%</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>NIR 1.3</td>
<td>0.01</td>
<td>0.80</td>
<td>0.01</td>
<td>&gt;40</td>
<td>&lt;0.1%</td>
<td>&lt;2%</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>NIR 1.6</td>
<td>0.01</td>
<td>1.00</td>
<td>0.01</td>
<td>&gt;30</td>
<td>&lt;0.1%</td>
<td>&lt;2%</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>NIR 2.2</td>
<td>0.01</td>
<td>1.00</td>
<td>0.01</td>
<td>&gt;25 &gt;12#1</td>
<td>&lt;0.1%</td>
<td>&lt;2%</td>
<td>&lt;5% &lt;10%#1</td>
</tr>
<tr>
<td>Spectral Channel</td>
<td>Min. Signal, Tmin</td>
<td>Max. Signal, Tmax</td>
<td>Ref. Signal, Tref</td>
<td>Radiometric Noise (NEdT)</td>
<td>Medium Term Radiometric Stability</td>
<td>Long Term Radiometric Stability</td>
<td>Radiometric Accuracy</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------------</td>
<td>------------------</td>
<td>-------------------</td>
<td>--------------------------</td>
<td>-------------------------------</td>
<td>-------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>IR (TIR) 3.8</td>
<td>200K 350K</td>
<td>350K 450K</td>
<td>300K</td>
<td>&lt;0.1K, &lt;0.2K&lt;sup&gt;①&lt;/sup&gt;</td>
<td>&lt;0.1K&lt;sup&gt;①&lt;/sup&gt;</td>
<td>&lt;0.3K&lt;sup&gt;①&lt;/sup&gt;</td>
<td>&lt;0.7K&lt;sup&gt;①&lt;/sup&gt;</td>
</tr>
<tr>
<td>WV 6.3</td>
<td>165K 270K</td>
<td>250K</td>
<td>&lt;0.3K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.1K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.3K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.7K&lt;sup&gt;②&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>WV 7.3</td>
<td>165K 285K</td>
<td>250K</td>
<td>&lt;0.3K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.1K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.3K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.7K&lt;sup&gt;②&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>IR (TIR) 8.7</td>
<td>165K 330K</td>
<td>300K</td>
<td>&lt;0.1K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.1K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.3K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.7K&lt;sup&gt;②&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>IR (O&lt;sub&gt;3&lt;/sub&gt;) 9.7</td>
<td>165K 310K</td>
<td>250K</td>
<td>&lt;0.3K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.1K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.3K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.7K&lt;sup&gt;②&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>IR (TIR) 10.5</td>
<td>165K 340K</td>
<td>300K</td>
<td>&lt;0.1K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.1K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.3K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.7K&lt;sup&gt;②&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>IR (TIR) 12.3</td>
<td>165K 340K</td>
<td>300K</td>
<td>&lt;0.2K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.1K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.3K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.7K&lt;sup&gt;②&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>IR (CO&lt;sub&gt;2&lt;/sub&gt;) 13.3</td>
<td>165K 300K</td>
<td>270K</td>
<td>&lt;0.2K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.1K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.3K&lt;sup&gt;②&lt;/sup&gt;</td>
<td>&lt;0.7K&lt;sup&gt;②&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: The channels VIS 0.6, NIR 2.2, IR 3.8 and IR 10.5 are delivered in FDHSI sampling and HRFI sampling configurations. The radiometric requirements for the HRFI sampling configuration are indicated by <sup>①</sup> in the table.

Note 2: For the IR 3.8 channel the dynamic range has been extended with a reduced radiometric noise specification for active fire monitoring and are indicated by <sup>②</sup> in the table.

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**[EURD] FCI-02140 iss: 3A**

The FCI radiometric noise shall be as given in Table 3 with the SNR (or NEdT) requirement scaled, at signal levels $\alpha$ (or $T$) between the minimum and maximum signal, different from $\alpha_{ref}$ (or $T_{ref}$), according to the radiometric scaling function.

**[EURD] FCI-02160 iss: 3C**

The FCI medium term radiometric stability in the image data shall be as per Table 3.

**[EURD] FCI-02180 iss: 3C**

The FCI long term radiometric stability in the image data shall be as per Table 3.

**[EURD] FCI-02200 iss: 3C**

The FCI calibration system shall ensure that the radiometric accuracy over satellite specified lifetime does not exceed the values provided in Table 3.

### 4.1.5 FCI Image Level 1 Spatial & Temporal Requirements

Unless otherwise stated the requirements in this section apply:

- to all spectral channels
- to all areas in the coverage of the repeat cycle,
to all repeat cycles over each MTG-I satellite specified lifetime, 
separately in N/S and E/W directions.

[EURD] FCI-02220 iss: 3A
The FCI spatial sampling distance (SSD) shall be as per Table 1.

[EURD] FCI-02230 iss: 4
The FCI modulation transfer function (MTF) for each spatial sample shall:

a) For the spectral channels VIS 0.6, NIR 2.2, IR 3.8 and IR 10.5 when delivered in the HRFI sampling configuration comply with the values defined in Figure 6.

b) For the spectral channels when delivered in the FDHSI sampling configuration comply with the values defined in Figure 5.

Note 1: The aim of the MTF inner template at the point at which the analogue signal is converted to a digital signal is to maximise the sub-Nyquist MTF.

Note 2: On-board and/or on-ground digital processing can be applied to achieve the MTF outer template, in order to minimise the super Nyquist MTF, i.e. minimise alias noise, at the specified SSD.

Note 3: Digital OTF manipulation applied to meet the inter channel co-registration accuracy and N/S to E/W MTF similarity requirements is allowed provided that the resulting MTF complies with the MTF templates and radiometric requirements are met.

<table>
<thead>
<tr>
<th>Normalised Spatial Frequency, κ</th>
<th>Inner MTF Template</th>
<th>Outer MTF Template</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.95</td>
<td>1.05</td>
</tr>
<tr>
<td>0.42</td>
<td>0.3</td>
<td>-</td>
</tr>
<tr>
<td>&gt;0.42</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>0.54</td>
<td>-</td>
<td>1.05</td>
</tr>
<tr>
<td>$0.54&lt;\kappa&lt;=0.85$</td>
<td>-</td>
<td>$0.15/\left(\kappa/0.54\right)^4$</td>
</tr>
<tr>
<td>-----------------</td>
<td>---</td>
<td>------------------</td>
</tr>
<tr>
<td>$0.85&lt;\kappa&lt;=4$ (for SSD= 1km)</td>
<td>-</td>
<td>0.05</td>
</tr>
<tr>
<td>$0.85&lt;\kappa&lt;=8$ (for SSD=2km)</td>
<td>-</td>
<td>$0.15/\left(\kappa/0.54\right)^4$</td>
</tr>
</tbody>
</table>

**Figure 5: MTF Template for FDHSI sampling configuration**

<table>
<thead>
<tr>
<th>Normalised Spatial Frequency, $\kappa$</th>
<th>Inner MTF Template</th>
<th>Outer MTF Template</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.95</td>
<td>1.05</td>
</tr>
<tr>
<td>0.42</td>
<td>0.3</td>
<td>-</td>
</tr>
<tr>
<td>$&gt;0.42$</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>0.54</td>
<td>-</td>
<td>1.05</td>
</tr>
<tr>
<td>$0.54&lt;\kappa&lt;=0.85$</td>
<td>-</td>
<td>$0.3/\left(\kappa/0.54\right)^4$</td>
</tr>
<tr>
<td>$0.85&lt;\kappa&lt;=2$ (SSD=0.5km)</td>
<td>-</td>
<td>0.05</td>
</tr>
<tr>
<td>$0.85&lt;\kappa&lt;=4$ (SSD=1km)</td>
<td>-</td>
<td>$0.3/\left(\kappa/0.54\right)^4$</td>
</tr>
<tr>
<td>(goal)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>$0.85&lt;\kappa&lt;=2$ (SSD=0.5km)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>$0.85&lt;\kappa&lt;=4$ (SSD=1km)</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 6: MTF Template for VIS 0.6, NIR 2.2, IR 3.8 and IR 10.5 in HRFI sampling configuration**

**4.1.6 FCI Image Level 1 Geometric Requirements**

Unless otherwise stated the requirements in this section apply:

- to all spectral channels
- to all areas in the coverage of the repeat cycle,
- to all repeat cycles over each MTG-I satellite specified lifetime,
• separately in N/S and E/W directions.

Table 4: Geometric Quality Criterion

<table>
<thead>
<tr>
<th></th>
<th>Confidence Level</th>
<th>SSD=0.5 km</th>
<th>SSD=1.0 km</th>
<th>SSD=2.0 km</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPKE (500x500 pixels)</td>
<td>99.73%</td>
<td>&lt;0.90 km</td>
<td>&lt;1.80 km</td>
<td>&lt;3.60 km</td>
</tr>
<tr>
<td>APPKE (image)</td>
<td>99.73%</td>
<td>&lt;0.75 km</td>
<td>&lt;1.50 km</td>
<td>&lt;3.00 km</td>
</tr>
<tr>
<td>RPPKE (between consecutive images)</td>
<td>99.73%</td>
<td>&lt;1.05 km</td>
<td>&lt;1.05 km</td>
<td>&lt;1.05 km</td>
</tr>
</tbody>
</table>

[EURD] FCI-02240 iss: 3A
The absolute value of the FCI absolute pixel position knowledge error (APPKE) within a 500 by 500 pixel imagette shall be as given in Table 4.

[EURD] FCI-02280 iss: 3A
The absolute value of the FCI absolute pixel position knowledge error (APPKE) evaluated over the complete FDC or LAC image shall be as given in Table 4.

[EURD] FCI-02300 iss: 3A
The absolute value of the FCI relative pixel position knowledge error (RPPKE) shall be as given in Table 4, when evaluated over all pixels common between two consecutive FDC or LAC images of the same spectral channel.

[EURD] FCI-02320 iss: 4
The absolute value of the FCI relative pixel position knowledge error (RPPKE) between two spectral channels when evaluated over all pixels between two FDC or LAC images taken in the same repeat cycle shall be:

a) For the spectral channels as specified in Table 5 at a 68.26% confidence level, when delivered in the HRFI sampling configuration.

b) For the spectral channels as specified in Table 6 at a 68.26% confidence level, when delivered in the FDHSI sampling configuration.

Table 5: FCI HRFI Relative Pixel Position Knowledge Error between Spectral channels (at SSP)

<table>
<thead>
<tr>
<th></th>
<th>VIS</th>
<th>NIR</th>
<th>TIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIS</td>
<td>&lt;0.30 km</td>
<td>&lt;1.00 km</td>
<td></td>
</tr>
<tr>
<td>NIR</td>
<td>&lt;1.00 km</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIR</td>
<td></td>
<td>&lt;0.68 km</td>
<td></td>
</tr>
</tbody>
</table>
Table 6: FCI FDHSI Relative Pixel Position Knowledge Error between Spectral channels (at SSP)

<table>
<thead>
<tr>
<th></th>
<th>VIS</th>
<th>NIR</th>
<th>TIR</th>
<th>WV</th>
<th>O₃</th>
<th>CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIS</td>
<td>&lt;0.32 km</td>
<td>&lt;0.40 km</td>
<td>&lt;1.00 km</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NIR</td>
<td>&lt;0.32 km</td>
<td></td>
<td>&lt;1.00 km</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIR</td>
<td></td>
<td>&lt;0.48 km</td>
<td>&lt;1.60 km</td>
<td>&lt;0.64 km</td>
<td>&lt;0.64 km</td>
<td></td>
</tr>
<tr>
<td>WV</td>
<td></td>
<td></td>
<td>&lt;1.92 km</td>
<td></td>
<td></td>
<td>&lt;0.84 km</td>
</tr>
<tr>
<td>O₃</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO₂</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It shall be possible to rectify FCI images from a satellite to any longitude within +/- 10° from the sub-satellite point of that satellite according to a reference grid and projection defined according to [CONV]

Note: The operational practice is to rectify at 0° if the satellite is located close to 0°.

4.2 IRS Data Acquisition and Generation Services

The IRS has no operational predecessors in the geostationary orbit (GEO); pioneering experiments of an imaging infrared spectrometer in GEO are just being made with the first GIIRS instruments on the FY4 Chinese platforms. However, long relevant experience in retrieving geophysical parameters from hyperspectral satellite data has been made for soon two decades from Low Earth Orbits (LEO), starting with AIRS and continued with IASI and CrIS. The development of the IRS Level 2 (L2) product processing chain will capitalise on this very valuable heritage and in particular on IASI operational experience within EUMETSAT.

The IRS acquires a number of spectral soundings simultaneously over a dwell using a two dimensional detector array. The dwell coverage is stepped in an east/west direction to form a line of dwell spectral soundings, before moving northward to form the next line, covering the local area coverage (LAC) within the repeat cycle duration. Up to 4 separate LAC zones can be defined and the LAC zones scanned in any order with maximum sequence length of 96 LACs before repetition of the sequence. The spectral soundings are transmitted to the ground as interferograms and transformed to spectral channels as part of the ground processing, before dissemination to the End Users as level 1 datasets.

4.2.1 IRS Dataset Acquisition Requirements

The IRS shall cover the spectral domain from 680 - 2250 cm⁻¹ in two spectral bands; a long wave infrared (LWIR) and a medium wave infrared (MWIR) spectral band with the characteristics provided in Table 7.
Table 7: Infra-Red Sounder (IRS) Spectral Bands

<table>
<thead>
<tr>
<th>Spectral Band</th>
<th>Status</th>
<th>Wavenumber range</th>
<th>Spectral Channel Interval</th>
<th>Spatial Sampling Distance (SSD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LWIR</td>
<td>Extended</td>
<td>680-700 cm⁻¹</td>
<td>Better than 0.625 cm⁻¹</td>
<td>4.0 km</td>
</tr>
<tr>
<td></td>
<td>Specified</td>
<td>700-1210 cm⁻¹</td>
<td>Better than 0.625 cm⁻¹</td>
<td></td>
</tr>
<tr>
<td>MWIR</td>
<td>Specified</td>
<td>1600-2175 cm⁻¹</td>
<td>Better than 0.625 cm⁻¹</td>
<td>4.0 km</td>
</tr>
<tr>
<td></td>
<td>Extended</td>
<td>2175-2250 cm⁻¹</td>
<td>Better than 0.625 cm⁻¹</td>
<td></td>
</tr>
</tbody>
</table>

Note: The LWIR and MWIR spectral bands contain specified and extended wavenumber ranges. For spectral channels lying inside the specified portion of the spectral band full compliance is required. No requirements apply to the extended range, except data delivery.

[EURD] IRS-04040 iss: 4

The IRS shall generate a dataset covering a subset of the full earth disc (called local area coverage (LAC)) with the repeat cycle duration and coverage as specified in Table 8.

Table 8: IRS coverage versus repeat cycle duration

<table>
<thead>
<tr>
<th>Coverage</th>
<th>Repeat cycle duration</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDC = 17.70° diameter circle centred at SSP</td>
<td>N/A</td>
<td>The FDC coverage is the result of the combination of LAC 1, 2, 3, and 4. Restriction of coverage to 16.80° diameter circle centred at SSP for LAC 1, 2, and 3 is acceptable.</td>
</tr>
<tr>
<td>LAC = FDC/4</td>
<td>15 minutes</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: The reference pattern for satellite commissioning consists in sequences of quarter of disc scanning, with the complete sequence repeated every 6 hours according to the following patterns: 5 times (LAC3 + LAC4) followed by 4 times (LAC2 + LAC4) followed by 3 times (LAC1 + LAC4).

Note 2: The operational practice is to have only sequences of quarter of disc scanning, with the complete sequence repeated every 6 hours according to the following patterns: 3 times (LAC3 + LAC4) followed by 3 times (LAC2 + LAC4) followed by 3 times again (LAC3 + LAC4) and ultimately 3 times (LAC1 + LAC4) as shown in Figure 7.
The IRS LAC shall be scanned using a regular *dwell* sequence with respect to the *target grid*, with a slow step from geographic south to geographic north and a fast step in the geographic east/west direction.

*Note: A *dwell* sequence moving from east to west then from west to east for alternate lines of *dwells* is permitted.*

The IRS shall allow the configuration of 4 *LAC zones*, by ground telecommand, each LAC starting at any position within the FDC, provided that the LAC is fully contained in the FDC.
Figure 8: Example of LAC zone definition for a FDC divided by 45 dwells

The IRS image shall be such that:

- For the LAC zone 4 in the IRS operational practice the complete Earth surface visible from geostationary altitude at 0° inclination and North of the LAC boundary described in Figure 9 is available.

Note: The diagram indicates the mandatory LAC zone 4 coverage in terms of latitude and longitude on the earth.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>30°N</td>
</tr>
<tr>
<td>BC</td>
<td>40°W</td>
</tr>
</tbody>
</table>
4.2.2 IRS Dataset Quality Threshold

As defined in [CONV], the quality threshold is met when the requirements on completeness, accuracy and timeliness are fulfilled. The percentages of the datasets that meet the quality threshold requirements (within timeliness) are addressed in the dissemination sections.

The IRS shall provide complete datasets. An IRS LAC dataset is considered incomplete if any of the conditions below occur:

a) The IRS dataset acquisition requirements are not met,

b) More than 5% of the MWIR spectral soundings in the LAC are declared missing soundings,

c) More than 15% of the LWIR spectral soundings in the LAC are declared missing soundings,

d) Three or more contiguous spectral soundings (in either direction) are declared missing soundings and have been declared missing soundings for the previous 20 LAC images.

where

N=3 and M=0.01 in the definition of missing sounding

Note 1: For contiguous missing sounding assessment the spectral soundings are referenced by dwell, column and row (s,i,j) between LAC images.

Note 2: The bullet d) intends to cover satellite detector ("permanent") failure. Thus for assessing the satellite performance, the whole requirement applies. For the assessment of the completeness of the data delivered to the End-Users, the last bullet d) has to be ignored, if it is due to a transient loss of dataset during the transmission.

An IRS LAC dataset shall be considered accurate if all of the conditions below are met:

a) IRS dataset level 1 spectral requirements are met,

b) IRS dataset level 1 radiometric requirements are met,

c) IRS dataset level 1 spatial and temporal requirements are met,

d) IRS dataset level 1 geometric requirements are met.
4.2.3 IRS Dataset Level 1 Spectral Requirements

Unless otherwise stated the requirements in this section apply:

- to all spectral channels
- to all spatial samples in a repeat cycle
- to all repeat cycles over each MTG-S satellite specified lifetime.

---

**[EURD] IRS-04120 iss: 3A**

The IRS instrument shall be based on an interferometer concept (Fourier Transform Spectrometer or FTS type) that converts input spectral radiances into interferograms.

---

**[EURD] IRS-04122 iss: 4**

The spectral channel interval (Δν) for both IRS spectral bands LWIR and MWIR shall not exceed the value given in Table 7.

Note: The spectral channel interval is given for the resampled spectral channel spacing. The actual spectral sampling of the interferogram will be variable across a dwell coverage dependent on the maximum optical path difference for a spatial sample.

---

**[EURD] IRS-04124 iss: 4**

The full width half maximum (FWHM) of the IRS spectral sample spectral response function (SRF) shall be less than or equal to 0.754 cm⁻¹.

---

**[EURD] IRS-04130 iss: 3A**

The IRS spectral sample SRF centroid wavenumber shall be determined by the spectral calibration algorithm such that the radiometric error associated to the shift determination does not exceed 50 mK (NEdT@280K) when considering a spatially homogeneous scene and the spectra given by Figure 10.

Note: The requirement applies at a 68.26% confidence level calculated over all spectral samples within a spectral band, considering the LWIR and MWIR spectral bands separately.

---

**[EURD] IRS-04135 iss: 4**

The IRS spectral sample spectral response function difference between the actual spectral response function averaged over one day, and that given by the SRF Estimation model shall not exceed a value corresponding to a radiometric error of 50 mK (NEdT@280K) when considering a spatially homogeneous scene and the spectra given by Figure 10.

Note: The requirement applies at a 68.26% confidence level calculated over all spectral samples within a spectral band, considering the LWIR and MWIR spectral bands separately. This means that, for every spectral band, at least 68.26% of the spectral channels of every spatial sample) meet the requirement.
Figure 10: Spectral radiances for a hot desert and cold thick cirrus scene

4.2.4 IRS Dataset Level 1 Radiometric Requirements

Unless otherwise stated the requirements in this section apply:
to all spectral channels in the specified wavenumber range given in Table 7. The portion of the spectral bands lying in the extended wavenumber range will be delivered, but no radiometric performance is specified.

• to all signal levels between the minimum and maximum signal levels scaled according to "IRS NEdT scaling rule" defined at signal levels between black body temperatures 200K and 280K according to the radiometric scaling function and between black body temperatures 280K to 313K with a scaling factor of 1.

• to all repeat cycles over each MTG-S satellite nominal operational lifetime.

• to effective radiances calculated using a single reference spectral response function per spectral channel across the complete area of coverage, where performance is evaluated after spectral resampling, i.e. including spectral calibration.

Table 9: Radiometric requirements of the IRS Spectra

<table>
<thead>
<tr>
<th>LWIR Wavenumber (cm⁻¹)</th>
<th>Ref. Signal, Tref</th>
<th>Radiometric Noise (NEdT)</th>
<th>Medium Term Radiometric Stability</th>
<th>Long Term Radiometric Stability</th>
<th>Radiometric Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>700</td>
<td>280K</td>
<td>&lt;0.5K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>714</td>
<td>280K</td>
<td>&lt;0.5K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>715</td>
<td>280K</td>
<td>&lt;0.4K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>729</td>
<td>280K</td>
<td>&lt;0.4K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>730</td>
<td>280K</td>
<td>&lt;0.3K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>769</td>
<td>280K</td>
<td>&lt;0.3K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>770</td>
<td>280K</td>
<td>&lt;0.2K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>1040</td>
<td>280K</td>
<td>&lt;0.2K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>1118</td>
<td>280K</td>
<td>&lt;0.224K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>1210</td>
<td>280K</td>
<td>&lt;0.35K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MWIR Wavenumber (cm⁻¹)</th>
<th>Ref. Signal, Tref</th>
<th>Radiometric Noise(NEdT)</th>
<th>Medium Term Radiometric Stability</th>
<th>Long Term Radiometric Stability</th>
<th>Radiometric Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1600</td>
<td>280K</td>
<td>&lt;0.224K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>1630</td>
<td>280K</td>
<td>&lt;0.2K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>1750</td>
<td>280K</td>
<td>&lt;0.2K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>1871</td>
<td>280K</td>
<td>&lt;0.269K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>1980</td>
<td>280K</td>
<td>&lt;0.4K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>2134</td>
<td>280K</td>
<td>&lt;0.757K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>2175</td>
<td>280K</td>
<td>&lt;0.906K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
</tbody>
</table>

The IRS radiometric noise shall be as given in Table 9 with the NEdT scaled at signal levels between black body temperatures 200K and 280K according to the radiometric scaling function and between black body temperatures 280K to 313K with a scaling factor of 1.

The IRS medium term radiometric stability for a spectral channel shall be as per Table 9.
The IRS long term radiometric stability for a spectral channel shall be as per Table 9.

The IRS calibration system shall ensure that the radiometric accuracy is as per Table 9.

4.2.5 IRS Dataset Level 1 Spatial and Temporal Requirements

Unless otherwise stated the requirements in this section apply:

- to all spectral samples and spectral channels
- to all areas in the coverage of the repeat cycle,
- to all repeat cycles over each MTG-S satellite nominal operational lifetime,
- separately in N/S and E/W directions.

The IRS spatial sampling distance (SSD) shall be as per Table 7.

For all IRS spatial samples of the spectral channels in the wavenumber range from 900 cm\(^{-1}\) to 2175 cm\(^{-1}\) the integrated energy (IE) shall be: over a square 4x4 km\(^2\) shall be equal to or larger than 67%.

a) over a square 4x4 km\(^2\) equal to or larger than 67%,

b) over a square 12x12 km\(^2\) equal to or larger than 92%.

The absolute value of the IRS relative sample position error (RSPE) between any two spectral channels shall meet the requirements in Table 10 when evaluated over a LAC.

Note: In the definition of RSPE r1=r2 for this requirement

### Table 10: IRS Spectral Channel Relative Sample Position Error

<table>
<thead>
<tr>
<th>Channel Group</th>
<th>Confidence Level</th>
<th>RSPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel to channel (within a spectral band)</td>
<td>68.26%</td>
<td>&lt; 0.4 km</td>
</tr>
<tr>
<td>Channel to channel (between spectral bands)</td>
<td>68.26%</td>
<td>&lt; 0.8 km</td>
</tr>
</tbody>
</table>

4.2.6 IRS Dataset Level 1 Geometric Requirements

Unless otherwise stated the requirements in this section apply:

- to all spectral channels
- to all areas in the coverage of the repeat cycle,
- to all repeat cycles over each MTG-S satellite nominal operational lifetime,
• separately in N/S and E/W directions.

[EURD] IRS-04250 iss: 4
The absolute value of the IRS absolute sample position knowledge error (ASPKE) shall be as given in Table 11 when evaluated over any LAC zone.

[EURD] IRS-04255 iss: 4
The absolute value of the IRS absolute sample position knowledge error (ASPKE) when evaluated over a single dwell shall be as given in Table 11.

[EURD] IRS-04260 iss: 3A
The absolute value of the IRS relative sample position knowledge error (RSPKE) shall be as given in Table 11, when evaluated over all spatial samples common between two images of the same LAC zone separated in time by twice the repeat cycle.

Note: In the definition of RSPKE k1=k2 for this requirement

Table 11: Geometric Quality Criteria

<table>
<thead>
<tr>
<th></th>
<th>Confidence Level</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASPKE (dwell)</td>
<td>99.73%</td>
<td>&lt;3.32 km</td>
</tr>
<tr>
<td>ASPKE (LAC)</td>
<td>99.73%</td>
<td>&lt;2.37 km</td>
</tr>
<tr>
<td>RSPKE (between two LAC images)</td>
<td>99.73 %</td>
<td>&lt;3.15 km</td>
</tr>
</tbody>
</table>

4.3 Lightning Data Acquisition and Generation Services

The Lightning Imager acquisition and generation has no MSG heritage. It provides a real time lightning location and detection (cloud-to-cloud and cloud-to-ground strokes, with no discrimination between the two types).

The LI is using detector elements arranged in a detector array covering the earth (no scanning mechanism). The power received by each detector element is integrated over the integration period and then compared with the LI Trigger Threshold. If the energy exceeds this threshold, it is identified as an LI Triggered Event.

The integration period is optimised to meet the Detection Efficiency (DE) and the False Alarm Rate (FAR) requirements, taking into consideration a typical stroke of 0.6 ms duration when observed from above.

During the ground Level 0 to Level 1 processing, the LI triggered events are filtered to minimise false alarms. In parallel the LI background radiance images are processed to improve the geolocation of the flashes.
4.3.1 LI Dataset Acquisition Requirements

The Lightning Imager (LI) coverage shall contain at least the European territories of all the EUMETSAT member states and at least 84% of the visible earth disc (taken as a circle of 17.54° in diameter centred at SSP) when the satellite is within the nominal longitude range.

Note: The whole of Turkey is to be taken to lie within Europe for this definition. The coverage is to be achieved when the satellite is positioned at 0° longitude, with the requirement SYS-00130 not being applicable for the calculation of the coverage.

The LI triggered events shall be obtained by measuring the LI lightning spectral radiance from the strongest lightning emission features within the cloud top optical spectra produced by the neutral oxygen atom lines in the near infrared.

Note: The OI(1) line at 777.4 nm made of three lines of nearly equal intensity with a total separation of 0.34 nm.

4.3.2 LI Dataset Quality Threshold

As defined in [CONV], the quality threshold is met when the requirements on completeness, accuracy and timeliness are fulfilled. The percentages of the datasets that meet the criteria threshold requirements (within timeliness) are addressed in the dissemination sections.

The LI datasets collected over 10 minutes shall be considered complete if all of the following requirements are fulfilled:

a) LI dataset acquisition requirements,

b) LI detection efficiency requirements.

Note: Deleted.

An LI dataset shall be considered accurate if all of the following requirements are fulfilled:

a) LI dataset Level 1 radiometric requirements,

b) LI dataset Level 1 spatial & temporal requirements,

c) LI dataset Level 1 geometric requirements.

Note: Radiometric requirements are identified in LI-06100

4.3.3 LI Dataset Level 1 Radiometric Requirements

Unless otherwise stated the requirements in this section apply:

• for all illumination conditions,
• over each MTG-I satellite specified lifetime,
- for a 50% cloud cover of the earth,
- for an average cloud reflectance at TOA of 80%.

For any lightning pulse characterised by:
- a duration longer than 0.6ms, and
- a size larger than a circle of 10km diameter, and
- an energy density higher than 16.7 mWm$^{-2}$sr$^{-1}$ (day) or 6.7 mWm$^{-2}$sr$^{-1}$ (night),

the LI shall transmit to the ground:
all the LI triggered events with a Detection Efficiency (DE) better than

a) 90% at 45°N latitude, SSP longitude
b) 70% in average over the whole instrument coverage area

The LI shall provide the lightning event radiance measured from the LI lightning spectral radiance specified in LI-06040, over the full range from 6.7 to 670 mWm$^{-2}$sr$^{-1}$, with an error (at 1σ) less than:

a) 10% relative accuracy for radiances higher than 70 mWm$^{-2}$sr$^{-1}$
b) 7 mWm$^{-2}$sr$^{-1}$ absolute accuracy for radiances lower than 70 mWm$^{-2}$sr$^{-1}$

4.3.4 LI Dataset Level 1 Spatial and Temporal Requirements

The LI shall provide a spatial sampling less than or equal to 10km at 45°N for the sub-satellite longitude.

4.3.5 LI Dataset Level 1 Geometric Requirements

The absolute value of the LI absolute sample position knowledge error (ASPKE) evaluated over the complete Full Disc Coverage (FDC) shall be less than 4 km (112 µrad) at SSP, at a 99.73% confidence level.

4.4 UVN-Copernicus Data Acquisition and Generation Services

Observation of ultraviolet and visible and near-infrared radiation will be provided by MTG through measurements made with a dedicated instrument (UVN payload), that will be the GEO part of the Sentinel 4/5 System provided by EC and ESA. The UVN observations are used to measure several trace gas species (O3, NO2, SO2, HCHO, CHOCHO), and gain information on aerosols, clouds and the Earth surface.
The UVN is specified and developed in context of an ESA programme. This section can therefore not contain EUMETSAT requirements on the instrument, but rather reflects the current understanding of expected UVN performance as well as requirements on the ground segment to support its operations. Details on UVN instrument requirements can be found in [KOP_S4-5].

4.4.1 UVN Sounding performances

In its nominal mode, the UVN data acquisition service will provide data over the Geographical Coverage Area (GCA) specified in Figure 11. The nominal GCA will comprise the longitude range from 30°W to 45°E at latitude 40°N. The nominal repeat cycle of 1 h will correspond to a longitude range of 55° at 40°N indicated as the Reference Area (RA). The RA is positioned at the easternmost point in the GCA during the morning and is moved westward to follow the solar illumination of the GCA during the day. The scan will be performed from East to West.

![Figure 11: Geographical Coverage Area (blue curve); Reference Area (green curve); OZA=75° (red curve)](image)

4.4.2 UVN Spatial resolution and geometric quality performances

The spatial sampling distance at 45N latitude, 0E longitude of UVN measurements, in both N-S and E-W directions, will be smaller than or equal to 8 km.

4.4.3 UVN Spectral measurements and quality performances

*Table 12: Spectral bands and performances for GEO-UVN.*

<table>
<thead>
<tr>
<th>Band ID</th>
<th>Spectral range [nm]</th>
<th>Spectral resolution [nm]</th>
<th>Spectral sampling ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV</td>
<td>305-400</td>
<td>0.5</td>
<td>3</td>
</tr>
<tr>
<td>VIS</td>
<td>400-500</td>
<td>0.5</td>
<td>3</td>
</tr>
<tr>
<td>NIR</td>
<td>750-775</td>
<td>0.5 (Threshold)</td>
<td>3</td>
</tr>
</tbody>
</table>
The UVN sounder will cover the spectral bands according to the ranges as specified in Table 12.

The spectral resolution will be smaller than or equal to the values specified in Table 12.

The spectral sampling ratio will be larger than or equal to the values specified in Table 12.

The position of the spectral channels centres in Earth spectral radiance mode for all samples acquired between two consecutive solar measurements will not vary by more than 0.01 (UV-VIS) and 0.05 (NIR) of the spectral sampling interval (SSI).

### 4.4.4 UVN Radiometric performances

The SNR of the spectral channels for (Earth) radiance and reflectance measurements will be larger than or equal to the values specified in Table 13.

Note: this performance estimate applies per spectral resolution element.

**Table 13: Radiometric performances (per spectral resolution element) for GEO-UVN.**

<table>
<thead>
<tr>
<th>Wavelength [nm]</th>
<th>SNR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Threshold</td>
</tr>
<tr>
<td>305</td>
<td>160</td>
</tr>
<tr>
<td>310</td>
<td>320</td>
</tr>
<tr>
<td>315</td>
<td>630</td>
</tr>
<tr>
<td>320</td>
<td>900</td>
</tr>
<tr>
<td>350</td>
<td>1040</td>
</tr>
<tr>
<td>400</td>
<td>1240</td>
</tr>
<tr>
<td>450</td>
<td>1440</td>
</tr>
<tr>
<td>500</td>
<td>1440</td>
</tr>
<tr>
<td>750</td>
<td>250 at 0.5nm</td>
</tr>
<tr>
<td></td>
<td>130 at 0.2nm</td>
</tr>
<tr>
<td></td>
<td>85 at 0.12nm</td>
</tr>
</tbody>
</table>

The absolute radiometric accuracy of the Earth spectral radiance (resp. reflectance) in any spectral channel of centre λi is smaller than:

- UV-VIS: MAX [2% $S_{ref}(\lambda_o)$, 5% $S(\lambda_i)$] (threshold), MAX [0.5% $S_{ref}(\lambda_o)$, 2% $S(\lambda_i)$] (goal).
- NIR: MAX [1% $S_{ref}(\lambda_o)$, 5% $S(\lambda_i)$] (threshold), MAX [1% $S_{ref}(\lambda_o)$, 2% $S(\lambda_i)$] (goal).

The relative spatial radiometric accuracy of the (Earth) radiance and reflectance measurements will be smaller than 0.25% (1σ).
4.4.5 Data navigation and registration performances

The knowledge of the navigation information is better than

- Over land: 0.1 (Goal) / 0.2 (Threshold) SSD (1-sigma).
- Over ocean: 0.5 SSD (1-sigma).

Interband spatial co-registration knowledge between bands will be better than 0.2 SSD between NIR and the UV and VIS bands; and 0.1 SSD between the UV and VIS band.

The inter-channel (intra-band) spatial co-registration within each band will be better than 10% of SSD.

4.5 Level 2 Product Generation Services

In order to provide continuity to the present Meteosat Second Generation (MSG) programme and its set of derived products, the extraction of Level 2 product(s) is also foreseen as a key service for MTG.

The list of products to be generated from the MTG missions, the respective generation philosophies, and the decision where each product is generated (at the EUMETSAT Headquarter or within the SAF network) are decisions taken by Council following the established process as described below.

For the Level 2 products generated at the Headquarter, the process for preparing these decisions include the consultation of the STG-SWG and OPS-WG before being presented to STG and approved by Council. For the SAF network, the decisions are taken in the context of the CDOP approval by Council of the SAF proposals and also by subsequent decisions of SAF SGs, as SAF plans evolve in response to user requirements.

4.5.1 Level 2 Product Generation at EUMETSAT HQ

The Level 2 Products generation service at EUMETSAT Headquarters shall provide a continuity of service between MSG and MTG concerning the Level 2 Products generated, albeit with improved quality, resolution, timeliness and new Level 2 Products, as defined in [MTGDIS].

Note: [MTGDIS] is reviewed and approved by delegate bodies.

4.5.2 Level 2 Product(s) Product Generation by the SAFs

The Satellite Application Facilities (SAFs) use specialised expertise in Member States, to complement the production of Level 2 product(s) at EUMETSAT’s HQ.
The SAFs also supply software packages for generating products at the end-users’ own sites or generate additional products which may be fed or not into EUMETSAT’s dissemination infrastructure.

As is the case for the centrally generated Level 2 product(s), the SAFs ensure a continuity of service between MSG and MTG while new MTG specific products are developed.

The operational availability requirements that apply to product generation at the SAF are to be agreed between EUMETSAT and the SAFs.

The timeliness apportionment for SAF products is calculated such that for the end-users, the timeliness is comparable to centrally generated products.

The following diagram is showing the apportionment of the activities required for providing SAF products to the final users.

The timeliness depends on the characteristics of the product, in particular its periodicity.

The following tables are showing the allocation of the end-to-end timeliness to the various contributors according to SAF categories. Like for any other L1 and L2 products, details per product are recorded in [MTGDIS] §5.1.3

**Table 14: FCI based SAF products**

<table>
<thead>
<tr>
<th>Product Generation Frequency</th>
<th>T0 to T5 timeliness (end to end)</th>
<th>T0 to T1 Processing level 1 at EUMETSAT</th>
<th>T1 to T3 Timeliness SAF acquisition, processing and SAF to EUM HQ transmission</th>
<th>T3 to T4 Timeliness for SAF retransmission to End Users (applicable at product level)</th>
<th>T4 to T5 System Margin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than hourly</td>
<td>45 mn</td>
<td>15 mn</td>
<td>15 mn</td>
<td>10 mn</td>
<td>5 mn</td>
</tr>
<tr>
<td>Hourly products</td>
<td>90 mn</td>
<td>15 mn</td>
<td>35 mn</td>
<td>20 mn</td>
<td>20 mn</td>
</tr>
<tr>
<td>3 hourly or more</td>
<td>180 mn</td>
<td>15 mn</td>
<td>65 mn</td>
<td>60 mn</td>
<td>40 mn</td>
</tr>
</tbody>
</table>

**Table 15: LI based SAF products**

<table>
<thead>
<tr>
<th>L1 based SAF products</th>
<th>T0 to T5 timeliness (end to end)</th>
<th>T0 to T1 Processing level 1 at EUMETSAT</th>
<th>T1 to T3 Timeliness SAF acquisition, processing and SAF to EUM HQ</th>
<th>T3 to T4 Timeliness for SAF retransmission to End Users</th>
<th>T4 to T5 System Margin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T0 to T5 timeliness (end to end)</td>
<td>T0 to T1 Processing level 1 at EUMETSAT</td>
<td>T1 to T3 Timeliness SAF acquisition, processing and SAF to EUM HQ transmission</td>
<td>T3 to T4 Timeliness for SAF retransmission to End Users (applicable at product level)</td>
<td>T4 to T5 System Margin</td>
<td></td>
</tr>
<tr>
<td>---------------------------------</td>
<td>------------------------------------------</td>
<td>------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>------------------------</td>
<td></td>
</tr>
<tr>
<td>120 mn</td>
<td>60 mn</td>
<td>35 mn</td>
<td>20 mn</td>
<td>5 mn</td>
<td></td>
</tr>
</tbody>
</table>

Table 16: UVN based SAF products

Note 1: The T1 to T3 Timeliness include a tentative allocation of 5 min for SAF to EUM HQ transmission

Note 2: Timeliness for FCI based products is calculated on a repeat cycle basis

Note 3: Timeliness for LI is calculated per chunk of ca 10s.

Note 4: Timeliness for UVN based products is calculated on a chunk / granule.

Note 5: Timeliness for LI initial processing is 2mn specified with a 30s goal as per DIS-14220. See also note 2 of this requirement. For T0 to T5, the product timeliness is documented in [MTGDIS] and is the reference for the end to end operational validation of SAF MTG products

Note 6: The SAF system provides the catalogue update to MME-DAC (for archiving) within a day of the products generation.

The Level 2 Products generation service by the SAF shall provide a continuity of service between MSG and MTG concerning the Level 2 Products generated, albeit with improved quality, resolution, timeliness and new Level 2 Products as defined in [MTGDIS].

Note: [MTGDIS] is reviewed and approved by delegate bodies.

The operational availability for the SAF acquisition, processing and SAF to EUM HQ transmission shall be 98% within the timeliness defined in Table 14, Table 15 and Table 16 in the column T1 to T3.

Note 1: This is verified by each SAF individually. Operational availability, timeliness and the calculation method are defined in [EURD] annex F.

Note 2: The operational validation of the end to end performance (T0 – T5) is performed jointly by EUM and SAF against the thresholds values defined in the [MTGDIS], see also §5.
4.6 DCP Message Acquisition, Bulletin and Statistics Generation Services

The MTG Data Collection Platform (DCP) services involves, as a continuity of MSG service, the relay of DCP messages by the satellite, on-ground processing of the digitised DCP spectrum and dissemination of the resulting DCP messages, statistics and DCP Bulletins to end-users. The DCP platforms can be fixed on land or embarked on a buoy, ship, balloon or airborne.

Two types of DCP messages exist:
- self-timed messages: messages transmitted periodically within the allocated time-slots,
- alert messages: special messages transmitted when the values of one or more measured parameters exceed predefined thresholds.

The performance monitoring of the DCP mission includes monitoring of the reception of DCP reference platforms and the quality and timeliness of DCP messages.

In continuity of MSG, the system shall provide the following functionality for handling Data Collection Platform (DCP) messages:

a) Acquire data, via MTG-I satellite relay from registered DCPs for further distribution.
b) Monitor and derive statistics for each individual DCP (e.g. deviations from the nominal time slot and frequency channel allocation) and provide notification to the relevant DCP operator within 2 working days of any anomaly detected.
c) Provide real time indication on the quality of the signal.
d) Process DCP alert messages without waiting, for further distribution via EUMETCast and internet.
e) Create DCP bulletins from acquired DCP messages for further distribution.

Note: Deleted

4.7 Archiving Services

The EUMETSAT Data Centre (previously UMARF) provides long-term archiving and catalogue functions for all EUMETSAT programmes and projects. This section provides the requirements for the archiving. The retrieval requirements are provided in §6.

It is expected that the EUMETSAT existing multi-mission EUMETSAT Data Centre evolves to cope with the MTG needs.

The SAFs are each expected to have their own local archive for the SAF-generated products. However, some SAF-generated products may be transferred for archiving in the EUMETSAT Data Centre. In any case, each SAF makes available the catalogue of its own archive on the EUMETSAT Earth Observation Portal. In this way, it is possible for end-users to browse the catalogue of SAF-generated products, as well as all of the centrally stored mission data.
The following datasets shall be archived and catalogued in the EUMETSAT Data Centre to allow later retrieval:

a) The Level 0 datasets received from EUMETSAT satellites including all auxiliary data necessary for reprocessing.

b) The Level 1b and Level 1c disseminated dataset which have been centrally generated.

c) The Level 2 disseminated dataset which have been centrally generated.

d) Selected SAF Level 2 product(s).

e) Reprocessed datasets from Level 1, Level 2 and selected SAF Level 2 product(s).

f) Verification / validation data and products, including external data used for verification and validation purposes;

Note 1: Appendix B lists the archived Level 1 datasets at the time of publication of this document. They are identified in the column "EUMETSAT Data Centre".

The MTG System shall include, for each SAF either:

a) the catalogue of products generated and archived by that SAF;

b) an interoperability mechanism which allows the access to the SAF product catalogue.

Note: Assuming that the catalogue is maintained by the SAF archiving centre and provided to EUMETSAT.

The MTG System shall ensure that mission related datasets shall be available in the EUMETSAT Data Centre, for later retrieval, with a completeness of 99%.

The EUMETSAT Data Centre archive and catalogue of all archived dataset elaborated from Meteosat First Generation (MOP/MTP), Meteosat Second Generation (MSG) satellites, and MTG shall be maintained over the lifetime of the MTG programme.

Note: The continuity of EPS archive has to be addressed by Post-EPS programme and the continuity of Jason archive has to be addressed by Jason follow-on programme.

The MTG System shall allow reprocessing of any archived dataset to derive and archive new datasets or new versions of any dataset without impact on the nominal operational missions.
5 NEAR REAL TIME DATA DISSEMINATION AND RELAY SERVICES

The following near-real time dissemination and relay services are covered in the following sections:

- EUMETCast Services,
- RMDCN Dissemination Service (GTS),
- EUMETSAT Earth Observation Portal,
- Search & Rescue (SAR) Relay Service.

5.1 EUMETCast Dissemination Services

The EUMETCast Dissemination Services might in future consist out of a combination of different telecommunication means such as satellite and terrestrial links.

The assignment of a service to a delivery mechanism is flexible and depends on the geographical distribution and size of the user communities.

The split between them depends mostly on the amount of datasets to be delivered to users, with associated timeliness requirements taking into account their affordability to the users/member states.

Note: The need of different dissemination systems: EUMETCast over Europe and Africa and other distribution mechanism (Terrestrial, OLDA, GTS, MME-DAC, MME-MON) and the split between them depends mostly on the amount of datasets to be delivered to users, with associated timeliness requirements taking into account their affordability to the users/member states (main reason why there were two different dissemination methods in MTP and MSG).

With the information at hand today, delivery of the full set of MTG datasets to all potential users at all potential locations might not be possible within the financial envelope of MTG (at least at the beginning of the programme).

The following main MTG disseminated datasets are expected to be delivered by EUMETCast (satellite or terrestrial):

- The radiometrically calibrated and geometrically rectified FCI images at reduced, normal or high spatial resolution and reduced or normal temporal resolution
- A compressed representation (e.g. Principal Components) of calibrated and geolocated IR sounder spectra
- Calibrated and geolocated UVN sounder datasets.
- Level 2 Products generated at EUMETSAT Head Quarters
- Data Collection Platforms DCP Messages and DCP Bulletins
- Selected SAF Products
- Service messages
Encryption Control Information

The dissemination coverage is split in several zones (e.g. Europe, Africa, terrestrial…) and the exact content depends on the zone.

EUMETCast is also transmitting data from other internal programmes and is relaying as well data from third parties e.g. Foreign Satellite Data (FSD) and Meteorological Data Dissemination (MDD). Those are no more addressed in this document.

Table 17: Operational Availability within timeliness for EUMETCast dissemination

<table>
<thead>
<tr>
<th>disseminated dataset</th>
<th>operational availability (1)</th>
<th>End to end timeliness per product are defined in [MTGDIS] within the following constraints (3)</th>
<th>Timeliness applies to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCI Rectified images</td>
<td>95% with a goal of 98%</td>
<td></td>
<td>Repeat Cycle</td>
</tr>
<tr>
<td>Full Disc Scanning Service (FCI-FDSS)</td>
<td></td>
<td>15 mn with a goal of 10 mn</td>
<td></td>
</tr>
<tr>
<td>Rapid Scanning Service (FCI-RSS)</td>
<td></td>
<td>5mn with a goal of 2.5mn</td>
<td></td>
</tr>
<tr>
<td><strong>FCI Level 2 Products</strong></td>
<td>95% with a goal of 98%</td>
<td></td>
<td>Chunk level when existing otherwise to Level 2 Product</td>
</tr>
<tr>
<td>&gt;=Daily products (e.g. CRM)</td>
<td></td>
<td></td>
<td>Half a day</td>
</tr>
<tr>
<td>&gt;=3-hourly products</td>
<td></td>
<td></td>
<td>60mn</td>
</tr>
<tr>
<td>&gt;=Hourly products</td>
<td></td>
<td></td>
<td>30mn</td>
</tr>
<tr>
<td>&lt; hourly</td>
<td></td>
<td></td>
<td>20mn</td>
</tr>
<tr>
<td>DCP messages and DCP bulletins</td>
<td>95% with a goal of 98%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alert messages</td>
<td>3mn with a goal of 2mn</td>
<td></td>
<td>Message</td>
</tr>
<tr>
<td>Bulletins</td>
<td></td>
<td>10mn with a goal of 5mn</td>
<td>Last contributing message</td>
</tr>
<tr>
<td><strong>IR Sounder Level 1 dataset (principal components)</strong></td>
<td>95% with a goal of 98%</td>
<td>15 mn (see open issue in Section 1.5)</td>
<td>Dwell</td>
</tr>
<tr>
<td><strong>IRS Level 2 Products</strong></td>
<td>95% with a goal of 98%</td>
<td>30mn (see open issue in Section 1.5)</td>
<td>Chunk level when existing otherwise to Level 2 Product</td>
</tr>
<tr>
<td>S4/UVN sounder Level 1 dataset</td>
<td>95% with a goal of 98%</td>
<td>60mn</td>
<td>5 mn data chunk</td>
</tr>
<tr>
<td>S4/UVN sounder Level 2 Product</td>
<td>95% with a goal of 98%</td>
<td>60mn (120mn for day 2 Level 2 Products)</td>
<td>5 mn data chunk</td>
</tr>
<tr>
<td>Lightning Group and</td>
<td>95% with a goal of</td>
<td>2mn with a goal of 30s</td>
<td>Flash</td>
</tr>
</tbody>
</table>
### Flash product (5)

<table>
<thead>
<tr>
<th>Product</th>
<th>Percentage</th>
<th>Timeliness</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAF Products</td>
<td>95% with a goal of 98%</td>
<td>See Section 4.5.2</td>
<td></td>
</tr>
<tr>
<td>Service Messages</td>
<td>95% with a goal of 98%</td>
<td>60mn</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: Operational availability, timeliness and the calculation method are defined in [CONV]. A dataset arriving after the mentioned timeliness is not considered as available for the end-user. These figures apply as is to EUMETCast by Satellite. In the case of EUMETCast terrestrial, the network used has no formal Service Level Agreement (SLA), offering a best effort service. Thus its outages are classified as external outages and are not taken into account in the figures. When including the availability of the network, the achieved value of the EUMETCast terrestrial service is expected to be above 95%.

Note 2: Deleted

Note 3: The objective is to achieve the goal during routine operations. This implies that the initial MTG System and its operation are designed to achieve the goal. The difference between the spec and the goal being a margin allowing some design optimisation and shared between system, ground segment and facilities. At system level the formal verification will consist in the assessment of the margin against the specified values. The operational system validation will be against the goal.

Note 4: Deleted

Note 5: The LI flash product is generated following level 2 processing and consists of LI triggered events clustered into LI groups associated with a particular lightning flash.

#### 5.1.1 Data Delivered and Coverage

The *EUMETCast* Dissemination Services shall provide data to the following geographic regions with the following characteristics:

- a) *EUMETCast* terrestrial services for pre-defined users.
- b) *EUMETCast* Satellite service over Europe.
- c) *EUMETCast* Satellite service over Africa.
- d) Deleted

Note: The dissemination of IRS level 2 products for the LAC 1, 2 or 3 is not a condition for the entry into operational services of the other IRS based services.

Note 2: Deleted
The list, timeliness and periodicity of the datasets disseminated via the various dissemination mechanisms shall be configurable.

The IRS disseminated dataset shall consist of a number of principal component (PC) scores derived from the full set of spectral channels.

Note: To be based on the experience derived from IASI data distribution.

5.1.2 Dataset Operational Availability

The operational availability of rectified images of the Full disc scanning service (FCI-FDSS) shall be as per Table 17.

The operational availability of FCI Level 2 product(s) shall be as per Table 17.

The operational availability of DCP messages & bulletins shall be as per Table 17.

The operational availability of rectified images of the Rapid scanning service (FCI-RSS) shall be as per Table 17.

The operational availability of IR sounder dataset shall be as per Table 17.

The operational availability of IRS level 2 products shall be as per Table 17.
The operational availability of UVN sounder dataset shall be as per Table 17.

The operational availability of Lightning group and flash product shall be as per Table 17.  
Note: During development phase, the design will be scrutinized. Should there be a risk that one minute is not achievable, the situation will be reported and reconsidered in particular at the CDR. During AIV and Commissioning, reasonable attempts will be made to tune the configuration parameters to try to improve the timeliness to achieve the 30s target (in particular over Europe). If not sufficient, bottleneck will be identified and a further design improvement will be considered taking benefit of technology evolution.

The operational availability of SAF Products shall be as per Table 17.

Note 1: The timeliness allocation for SAF Products dissemination is defined in §4.5.2.

5.2 RMDCN Dissemination Service

The Regional Meteorological Data Communication Network (RMDCN) is used by WMO Region VI to carry the following GTS traffic (within Europe):

- A subset of Level 1 datasets,
- A subset of Level 2 product(s),
- Data Collection Platforms (DCP) Bulletins,
- Service messages.

The Global Telecommunication System (GTS) of the WMO (World Meteorological Organisation) may further distribute these data to users which are not connected to the RMDCN.

An evolution of the GTS into the WMO Information System (WIS) is foreseen.

Table 18: Characteristics and operational availability within timeliness for RMDCN Dissemination

<table>
<thead>
<tr>
<th>disseminated dataset</th>
<th>Operational Availability</th>
<th>Timeliness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 dataset</td>
<td>95% with a goal of 98%</td>
<td>1 hour</td>
</tr>
<tr>
<td>Level 2 product(s)</td>
<td>95% with a goal of 98%</td>
<td>1 hour</td>
</tr>
<tr>
<td>DCPs bulletins</td>
<td>95% with a goal of 98%</td>
<td>1 hour</td>
</tr>
<tr>
<td>Service Messages</td>
<td>95% with a goal of 98%</td>
<td>1 hour</td>
</tr>
</tbody>
</table>

Note: Operational availability, timeliness and the calculation method are defined in Annex C. A dataset arriving after the mentioned timeliness is not considered as available for the end-user.
5.2.1 Data Delivered (RMDCN)

[EURD] DIS-14250 iss: 4

The list, characteristics and periodicity of disseminated datasets transmitted via RMDCN shall be as defined in [MTGDIS].

Note 1: Deleted

Note 2: Deleted

[EURD] DIS-14260 iss: 4

Deleted

5.2.2 Dataset Operational Availability (RMDCN)

[EURD] DIS-14270 iss: 3B

The operational availability of Level 1 datasets shall be as per Table 18.

[EURD] DIS-14280 iss: 3A

The operational availability of Level 2 product(s) shall be as per Table 18.

[EURD] DIS-14300 iss: 3A

The operational availability of DCP bulletins shall be as per Table 18.

5.3 Search and Rescue (SAR) Relay Service

Since MSG-1, every METEOSAT satellite carries a Search and Rescue (SAR) transponder for relay of 406 MHz beacons activated anywhere in its field of view. This secondary mission means that the satellite is part of the constellation of satellites that constitutes the space segment of the Cospas-Sarsat international system, whose aim is to provide distress alert and location information to appropriate rescue authorities for maritime, aviation and land users in distress.

A detailed description of the SAR system can be found at [www.cospas-sarsat.org]

[EURD] DIS-14340 iss: 3A

The MTG System shall support the SAR mission by accommodating a satellite repeater, on each MTG-I, between the SAR distress beacons and the SAR receive ground stations, as long as this is not to the detriment of the other missions.

[EURD] DIS-14360 iss: 3A

The operational availability of the satellite SAR repeater shall be better than 99%.

Note: Achieved when considering two MTG-I satellites in orbit. Otherwise redundancy is ensured via Cospas-Sarsat satellites overlapping.
5.4 Section deleted

The retrieval of data via internet is now merged into §6 Data Retrieval Services.

<table>
<thead>
<tr>
<th>[EURD] DIS-14380</th>
<th>iss: 4</th>
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</table>

<table>
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<th>[EURD] DIS-14390</th>
<th>iss: 4</th>
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</table>

<table>
<thead>
<tr>
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<th>iss: 4</th>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>[EURD] DIS-14420</th>
<th>iss: 4</th>
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</thead>
<tbody>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[EURD] DIS-14440</th>
<th>iss: 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deleted</td>
<td></td>
</tr>
</tbody>
</table>
6 DATA RETRIEVAL SERVICES

EUMETSAT provides Data Retrieval services as part of the multi-mission EUMETSAT Data Centre and internet downloading services which allow:

• for authorised users to retrieve recent centrally disseminated datasets;
• for the DCP operators to retrieve their own DCP messages and information about the operational status of their DCP platforms including statistics on the performance of the DCP system;
• for authorised users, to retrieve the archived datasets;
• for the general public, via the EUMETSAT website, to retrieve some dataset (e.g. Satellite Images or animation).

The service allow the users to register, navigate through the catalogue of MTG data, retrieve historical scientific mission data, browse low to moderate resolution data/products, and request data. The dataset retrieval for off-line users is addressed in §7.4 Helpdesk service.

Registration is done via the EO Portal service described in §7.2. The Corporate web interface is addressed in §7.3.

[EURD] RET-16020 iss: 3A

The EUMETSAT Data Centre archived dataset and catalogue of all Meteosat programmes shall be available for retrieval by users over the lifetime of the MTG programme.

Note: For MTG, the archived dataset are defined in §4.7.

[EURD] RET-16040 iss: 3B

The EUMETSAT Data Centre archive user guide (EUMETSAT Archive User Guide (see [UG04]) shall be maintained, to describe the ordering mechanism and options including the available media, the delivery formats and other characteristics of the MTG archived datasets which can be retrieved.

Note 1: For EUMETSAT Data Centre supported service and performances, refer to publication in http://www.eumetsat.int.

Note 2: One of the supported format for archived datasets retrieval is the one currently used for dissemination.

Note 3: Minor differences are acceptable between what is disseminated and what is retrieved, as long as it is documented for End Users. Differences may relate to time ranges of data, subsetting, compression, etc.

[EURD] RET-16080 iss: 3A

The operational availability, with a timeliness of 1 hour, of disseminated dataset for retrieval by End-Users shall be better than 99%.
7 USER SUPPORT SERVICES

The User Support Services are indispensable for enhancing the usage and reach of EUMETSAT Datasets and Services both within the EUMETSAT Member States as well as within the WMO Member States by:

- The distribution of information about the operational status of the systems and services.
- The provision of a centralised data access point (the Earth Observation Portal).
- The provision of Operational Programmes data content on EUMETSAT corporate web pages.
- The provision of a helpdesk function.
- The provision of training.

The User support services are capable of providing general, descriptive and expert information about the MTG and its mission data, products and services, both routinely and in response to requests.

7.1 Operational information dissemination service

Depending on the context and urgency, the following Service Messages concerning the operational services are provided to the users:

- Administrative - Summarising the service interruptions during the whole of the previous calendar day.
- News - Announcement of an interruption to services in real-time
- Weekly schedule - Announcement of scheduled service interruptions in the forthcoming week

Service messages shall provide information on the status and planning of the MTG operational services, including regular administrative messages (historical information), news messages (on event occurrence) and scheduled service outages (one week in advance), via:

- EUMETCast satellite Europe
- EUMETCast satellite Africa
- EUMETCast terrestrial
- RMDCN/GTS dissemination.
- User Notification e-mails.

Note: The service messages and their release conditions are described in Appendix A.

7.2 EUMETSAT EO Portal service

The EUMETSAT Earth Observation Portal is a component of the multi-mission element Data Centre which provides to the users a single online access point to all data and
dissemination services including the supporting user administration functions. It allows users, taking into account [DATAPO], to:

- Discover the collection of *datasets* (e.g. *image, Level 2 Products, Level 3 Products, SAF*) and related services for EUMETSAT data and partners;
- Search for and order of specific instances of EUMETSAT *archived datasets* (see §6) and of external partners (WMO, NOAA, ESA, CNES...);
- Subscribe to EUMETSAT or external partners dissemination services;
- Subscribe to User Notification Services (UNS).
- Access to service-related documentation, and appropriate links to information available on EUMETSAT internet.

It also allows partner agencies to discover, search, order and subscribe to EUMETSAT data and dissemination services through their own portal.

It federates with a common interface the following operational services:

- Subscription to the real-time dissemination services:
  - Satellite Direct Dissemination services (for MSG only);
  - Satellite broadcast services (e.g. EUMETCast);
  - Network dissemination services: via RMDCN, GTS and WIS,
  - Internet retrieval services (e.g. *images, DCP downloading*);
  - *EUMETSAT Data Centre* Retrieval services including catalogue searching and ordering services;
  - Archive Direct services (for MTP only);
  - User Notification Services (UNS).

---

**[EURD] USR-18040** iss: 3A

MTG Mission *archived dataset* and services shall be discoverable by users through the EUMETSAT Earth Observation Portal.

**[EURD] USR-18060** iss: 3A

Users shall be able to search, order, and retrieve MTG *archived datasets* through the EUMETSAT Earth Observation Portal.

**[EURD] USR-18080** iss: 3A

Users shall be able to register to MTG services through the EUMETSAT Earth Observation Portal.

*Note: For description of EO portal functions and performances refer to [http://www.eumetsat.int](http://www.eumetsat.int).*
Users shall be able to retrieve all the information necessary to read and display archived datasets and disseminated datasets.

Note: This includes pseudo code where appropriate, documentation, user guides...

### 7.3 Web Information

Through EUMETSAT Corporative web interface, using a browser, any anonymous user shall be able to retrieve:

a) Information about the MTG programme, data, documentation, services and status;

b) A subset of MTG sub sampled images.

### 7.4 Helpdesk Services

A significant part of these services are available on-line (through the EO portal (see §7.2) and the internet web pages (§7.3)). However some users may not have a proper internet access and thus an alternative way is provided here.

A helpdesk service is provided to:

- respond to user requests for the provision of user documentation to assist in the full exploitation of the operational services (as an alternative to the on-line access);
- respond to general queries or complaints about the operational services;
- respond to off-line user requests for archived dataset retrieval or dissemination subscription (as an alternative to the on-line access);
- respond to user requests for licenses and decryption units for nonessential services (as an alternative to the on-line access);
- respond to requests for admission to the Data Collection Service (as an alternative to the on-line access);
- respond to requests for the certification of Data Collection Platforms;
- maintain a register of users of the operational services (as an alternative to the on-line access);

The response time of the Helpdesk Function depends on whether the user request involves a bespoke response or an off-the-shelf response (e.g. one which can be found on the EO portal).

### 7.5 User Training

The scope of user training provided covers the following:
provision of classroom workshops to National Meteorological Services (NMS’), to assist them in the optimisation of satellite-data usage for current operational services and transition to future ones

provision of information to NMS’ and other user groups, to assist in the development of EPS, MSG and MTG applications

facilitation in the generation of further Computer Aided Learning modules (CAL - e.g. ASMET, EUMeTRAIN etc.)

coop-eration in international training activities on satellite meteorology and remote sensing for the GEO societal benefit areas, in the framework of EUMETCAL and the WMO Virtual Laboratory for education and training

support of training courses in Africa and other WMO regions, with the aim of establishing discussions/cooperation (between users of EUMETSAT data), using the WMO Virtual Laboratory focus group mechanism.

organisation of Graduate Trainee Fellowships
organisation of Training Placements (in accordance with Council decision)

EUMETSAT commitments concerning training will be extended to cover MTG data use and will be defined for agreement with Council.
8 DATA POLICY

When delivering the services, the EUMETSAT [DATAPO] and the Sentinel-4 [DATAPO-S4] data policies are taken into account.
Annex A Service Message Baseline

Service message types and their schedule of dissemination are as follows:

<table>
<thead>
<tr>
<th>Type</th>
<th>Schedule</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUMETCast</td>
<td>RMDCN</td>
<td>MTG specific service message</td>
</tr>
<tr>
<td>ADMIN</td>
<td>- Updated every day in the morning.</td>
<td>- Sections for open and closed related information.</td>
</tr>
<tr>
<td></td>
<td>- Closed, every 15 minutes</td>
<td>- Non available repeat cycles</td>
</tr>
<tr>
<td></td>
<td>- Open, every 30 minutes</td>
<td></td>
</tr>
<tr>
<td>NEWS</td>
<td>Once, at the time of problem detection</td>
<td>The news message is used to inform users in real time of problems that have occurred, issuing further messages when problems are resolved.</td>
</tr>
<tr>
<td>REG-RPT</td>
<td>Updated weekly every Thursday, disseminated once per day</td>
<td>This report contains scheduled announcements for the following week.</td>
</tr>
</tbody>
</table>
Annex BMTG Level 1 datasets generation and dissemination baseline

The MTG Level 1 Datasets generation and dissemination baseline is provided in [MTGDIS].
Annex C CONVENTIONS and TERMS
The following text lists definitions for all reserved terms used in this document. It is a subset of the "MTG Conventions and Terms" document. The section numbers below are the original section numbers from this document.

C.1 [EURD] specific conventions and terms

LI lightning spectral radiance
The LI lightning spectral radiance is the lightning optical pulse radiance as measured by the LI instrument in orbit.

The LI lightning spectral radiance is defined as the spectral radiance from the triplet of emission lines from the 3p 5P1,2,3 → 3s 5S2 transitions of neutral atomic oxygen, with the following spectral characteristics:

1. Wavelengths of the emission peaks at 777.408 nm, 777.631 nm and 777.753 nm vacuum wavelengths (see Table 1).

2. Peak intensities of the three spectral lines according to the oscillator strengths specified in Table 1, where it shall be assumed that the relative emission strength of the lines depends linearly on the oscillator strength f (dimensionless number).

3. Line widths (full width at half maximum) of each of the three spectral lines is 0.1 nm.

4. Each of the three spectral lines is a Gaussian.

More details about these emission lines are provided in Table 1.

<table>
<thead>
<tr>
<th>Wavelength in vacuum [nm]</th>
<th>Oscillator strength f</th>
</tr>
</thead>
<tbody>
<tr>
<td>[dimensionless] E_i</td>
<td>[cm^{-1}] E_k</td>
</tr>
<tr>
<td>[cm^{-1}] Lower Level</td>
<td>Upper Level</td>
</tr>
<tr>
<td>Conf., Term, J</td>
<td>Conf., Term, J</td>
</tr>
</tbody>
</table>

777.408 0.45 73 768.200 86 631.454 2s^2 2p^3(4S^o)3s,5S^o, J=2 2s^2 2p^3(4S^o)3p,5P, J=3

777.631 0.32 73 768.200 86 627.778 2s^2 2p^3(4S^o)3s,5S^o, J=2 2s^2 2p^3(4S^o)3p,5P, J=2

777.753 0.19 73 768.200 86 625.757 2s^2 2p^3(4S^o)3s,5S^o, J=2 2s^2 2p^3(4S^o)3p,5P, J=1
Notes:

1. $E_i$ and $E_k$ are the atomic oxygen energy levels from which the transition wavelengths are derived.
2. The two rightmost columns provide background information on the oxygen energy levels and spin states.

_Table 1: Spectral characteristics of the $3p \ 5P_{1,2,3} \rightarrow \ 3s \ 5S_2$ transitions in neutral atomic oxygen._

### C.2 Programme wide conventions and terms

**Annex F.2 MTG Naming Conventions**

The MTG space segment elements (MTG satellites) are named according to their type and launch sequence as:

- **[Conventions and Terms] MTG-I1 iss: 3B**
  - The first MTG-I satellite launched.

- **[Conventions and Terms] MTG-I2 iss: 3B**
  - The second MTG-I satellite launched.

- **[Conventions and Terms] MTG-I3 iss: 3B**
  - The third MTG-I satellite launched.

- **[Conventions and Terms] MTG-I4 iss: 3B**
  - The fourth MTG-I satellite launched.

- **[Conventions and Terms] MTG-S1 iss: 3B**
  - The first MTG-S satellite launched.

- **[Conventions and Terms] MTG-S2 iss: 3B**
  - The second MTG-S satellite launched.

- **[Conventions and Terms] MTG-I iss: 3B**
  - Any imaging satellite of the series (MTG-I1, MTG-I2, MTG-I3 or MTG-I4).

- **[Conventions and Terms] MTG-S iss: 3B**
  - Any sounding satellite of the series (MTG-S1, MTG-S2).
Annex F.3 System Wide Conventions

Annex F.3.1 Data Definition

[Conventions and Terms] reserved terms iss: 3B

It designates the terms defined in the Conventions and Terms document.

[Conventions and Terms] Dataset iss: 3D

A dataset is a logical grouping of data e.g. it can be a packet, a subset of image or interferogram (group of related spatial samples or lines, swath, segment, spectral sounding information), LI triggered events, LI group, meteorological products, DCP messages or DCP bulletins... or a collection of the above over time (e.g. for climate related dataset).

[Conventions and Terms] Housekeeping Telemetry iss: 3D

Housekeeping telemetry (HKTM) is all the telemetry necessary to monitor the health and status of the satellite and transmitted through the S-band telemetry link. 

Note: Data going exclusively via the Payload telemetry link does not qualify as housekeeping telemetry, but may be classed as instrument auxiliary data or platform auxiliary data or more generally as satellite auxiliary data.

[Conventions and Terms] Payload Data iss: 4D

All the data transmitted via the payload telemetry link. After decryption and extraction of the packets from the frames the payload data is presented as:

• instrument data, 
• digitised DCP spectrum, 
• Platform auxiliary data, 
• a copy of the housekeeping telemetry.

Note: Extraction of the packets from the transfer frames includes any necessary re-ordering and consolidation.

[Conventions and Terms] Instrument data iss: 3B

For each instrument, the instrument data is composed of:

• science data at Level 0, 
• Instrument auxiliary data. 

Note: Compression may apply according to the instrument design.

[Conventions and Terms] Digitised DCP Spectrum iss: 4G

See Digitised DCP Signal
[Conventions and Terms] Platform Auxiliary Data iss: 3D
Platform auxiliary data is any auxiliary data derived from platform equipments that is not transmitted as part of the housekeeping telemetry.

Note: Raw data coming from the AOCS is classed as platform auxiliary data, since it cannot be transmitted as part of the HKTM on the S-band telemetry link due to its volume or any other appropriate reason.

[Conventions and Terms] Science Data iss: 3B
The science data is the observation data originating from the instrument(s)/sensors, it applies at any data level.

Note: Earth location information is part of associated auxiliary data.

[Conventions and Terms] Instrument Auxiliary Data  iss: 3B
Instrument auxiliary data is auxiliary data recording the internal parameters of an instrument as necessary for instrument data processing.

[Conventions and Terms] Auxiliary Data  iss: 3B
Auxiliary data is any data that is neither science data, Digitised DCP spectrum nor housekeeping telemetry, used in or generated by Instrument Data Processing or Application Ground Processing. See also instrument auxiliary data, platform auxiliary data, IDP auxiliary data, IQT auxiliary data, AGP auxiliary data...

[Conventions and Terms] IDP Auxiliary Data  iss: 3B
IDP auxiliary data is auxiliary data resulting from the instrument data processing.

Note: for example: radiometric and spectral calibration information, Earth location information, data derived from external sources and data quality metrics.

[Conventions and Terms] AGP Auxiliary Data  iss: 3B
AGP Auxiliary Data is auxiliary data resulting from the application ground processing.

Note: for example: radiometric and spectral calibration information, earth location information, data derived from external sources and data quality metrics.

[Conventions and Terms] Disseminated Dataset  iss: 3D
The Disseminated Dataset includes all the data disseminated in Near Real Time via the various dissemination mechanisms (e.g. EUMETCast, internet, GTS/RMDCN...).

Note: For Level 1 dataset and Level 2 Product, it contains all the information necessary for the user to:
- interpret the science data temporally, spatially, spectrally and radiometrically;
- be informed of the quality of the science data;
- be informed of the configuration of the processing chain (satellite, IDP, AGP).

[Conventions and Terms] Archived Dataset  iss: 3D
The Archived Datasets includes all the data stored in the Data Centre and retrievable by internal or external users.

[Conventions and Terms] Level 1 Dataset  iss: 4I
The Level 1 dataset consists of the science data at level 1 and the IDP auxiliary data nominally collected during one repeat cycle or accumulation interval.
Note: It is composed of one or more data chunks (for processing) or data segments (for dissemination)

[Conventions and Terms] Level 2 Product  iss: 4I
The Level 2 Products consists of the science data at level 2 and the AGP auxiliary data nominally collected during the product time span (e.g. one or several repeat cycles).

[Conventions and Terms] DCP Messages  iss: 3D
Messages sent by DCP platforms containing measured meteorological information. Two types of DCP messages exist, the self-timed messages: messages transmitted periodically within the allocated time-slots and the alert messages which are special messages transmitted when the values of one or more measured parameters exceed predefined thresholds.

[Conventions and Terms] DCP Bulletins  iss: 3D
DCP Bulletins are generated from one or more DCP Messages conforming to the WMO Manual on Codes depending on their contents and dissemination formats.

[Conventions and Terms] External Data  iss: 3D
The External Data are those necessary for the Level 1 and Level 2 (re-)processing (include forecast data, observation data, calibration data) or for relaying by EUMETCast (e.g. MDD).

[Conventions and Terms] IQT Auxiliary Data  iss: 3B
The IQT auxiliary data is the additional data produced by the IQT at the same time as the level 1 science data allowing the interpretation of the science data and providing the satellite and IQT model status.
Note: This excludes the off-line IQT performance assessment data.

Annex F.3.3  Operational availability
[Conventions and Terms] Operational availability iss: 4D

The ratio of the datasets “received” and that meet the Quality threshold, with that scheduled to have been “sent” or "made available", for a given period (removing the part of the period corresponding to the scheduled outages and the external outages).

Note 1: Implicitly it is a measurement of unscheduled outages due to either space or ground segment problems.

Note 2: By removing the "seasonal effect" (the scheduled outage), the obtained performance can be compared over time to detect any degradation of the service.

Note 3: For the End-users, it is calculated across a complete chain, for example for images, from data acquisition by the Meteosat satellite until reception by the User.

Note 4: A dataset is deemed "received" if at least one representative user stations / receiver terminals has received it.

Note 5: Unless otherwise specified, the operational availability is calculated over a calendar month.

Note 6: The Scheduled outages have to be announced to the end-user through the weekly schedule message.

Note 7: It is also used to derive the contributions of the off-line functions to service to end-users.

[Conventions and Terms] Outage iss: 3B

Outages are defined as "the state of an item of being unable to perform its required function or performances". Outages can be scheduled outage, unscheduled outage or external outage.

[Conventions and Terms] Satellite Availability iss: 3D

Satellite availability is defined as the percentage of the time during which the Satellite provides all the required payload data, with Quality threshold being met. All sources of outages have to be considered. It has to include the allowance for response from the ground as defined in [SRD]/[OBRD].

Note: The sources of outage to be considered are those at satellite level.

Annex F.3.3.1 Quality Threshold (Completeness, Accuracy, Timeliness)

[Conventions and Terms] Quality threshold iss: 3B

The Quality threshold is met when the requirements on Completeness, Accuracy and Timeliness are fulfilled.

Note: This implies that a short outage preventing a repeat cycle to be completed on time has to be considered as an outage of the whole repeat cycle.
[Conventions and Terms] Completeness \ iss: 3D

A dataset is complete if no data has been lost since its generation, unless a requirement in the product specification or service specification allows some losses (e.g. missing samples).

Note 1: service specification only applies at system and ground segment level, not at satellite level. Product is used in the sense of the ECSS.

Note 2: For example for Level 1 dissemination this means that no data is missing during satellite sampling and any subsequent handling (downlink, payload data processing, dissemination) beyond what is specified in the [SRD].

[Conventions and Terms] Accuracy \ iss: 3D

The requirements on accuracy are dataset specific and provided in the product specification or service specification.

Note: service specification only applies at system and ground segment level, not at satellite level. Product is used in the sense of the ECSS.

[Conventions and Terms] Timeliness \ iss: 4F

The timeliness is the time difference between the foreseen end of acquisition of the last contributing data (e.g. from a sample, a dwell, a swath, granule, a segment, an image, a file) by EUMETSAT (at satellite level for Meteosat, Metop or at Ground Segment level for external data like FSD and SAF), and the end of reception of the corresponding data (possibly processed) by the users (i.e. before decryption and decompression).

Note 1: It excludes delay introduced by transmission lines and networks outside EUMETSAT control (e.g. internet, RMDCN, GTS, WIS). It excludes also the processing time outside EUMETSAT control (e.g. SAF processing time).

Note 2: It can also be applied at any level (satellite, ground segment, facility...) as long as the start point and end point are defined.

Annex F.3.3.2 Scheduled Outages

[Conventions and Terms] Scheduled Outage \ iss: 4D

The scheduled outages are due to planned operations or predictable events. At satellite level the specification limits these outages to 3% per year. Other scheduled outages are mainly due to planned ground segment maintenance and should be less than 0.5%.

Also, the quality of around 5% of the acquired datasets per year may be degraded for some channels during eclipse seasons.

The tentative list hereafter identifies the events leading to the outage or quality degradation and attempts to estimate their individual duration.

Planned operations or predictable events:
Satellite orbit manoeuvres (e.g. Station Keeping) leading to a disturbance of the satellite attitude. The frequency of the outages depends on several parameters such as orbital position, satellite collocation strategy, satellite design and manoeuvre strategy. There can be up to a few tens of manoeuvres per year with the outage lasting up to three hours each time.

Satellite yaw-flip leading to re-orientation of the satellite attitude and consequently to an interruption of the mission. This occurs twice a year and with the outage lasting up to half a day [TBC 1] each time.

Instrument decontamination requires that the Infrared sensors are switched off, thus interrupting the imaging in these channels. The decontamination may also require interrupting/degrading the other channels (due to distortions introduced by the IR decontamination). Outage is typically one day once or twice per year, influence on other channels will be re-assessed once the satellite supplier / design is known.

Outage due to wheel off-loading manoeuvres. Frequency and duration will be refined once the platform supplier / design is known.

Sun, satellite, ground station co-linearity effect. When the Sun enters the main lobe of the ground station antenna, this may prevent the proper reception of the Ka-Band link. The co-linearity occurs twice a year around the Equinox seasons for around 10 days, impacting a few repeat cycles per day. The extend of the co-linearity effect will be re-assessed once the MDA sites and characteristics are known.

The swap of a mission from one satellite to another (e.g. after the completion of satellite commissioning when the operational missions are transferred to a new satellite) will result in an outage of a few hours.

The temporary swap of the full disc scanning service (FDSS) from the prime to the secondary imaging satellite and vice versa would result in an outage of a few hours on the FCI-FDSS at each swap and an outage of the Rapid Scanning Service (FCI-RSS) for the whole duration of the swap (e.g. during prime satellite decontamination, yaw flip manoeuvre).

Some ground segment maintenance may not be achievable without service interruption (e.g. to swap between a prime and redundant service). These interruptions are sporadic over the year and their exact duration depends on the disseminated dataset and maintenance activity performed.

Calibration / sun measurements

Morning / evening sun illumination

Other images quality degradation:

During the eclipse season the dataset quality will be degraded for some channels and/or a part of the coverage, however no interruption of the dataset acquisition and dissemination is foreseen. The quality degradation around the eclipse is primarily due to stray light and thermal effects. The degradation occurs typically for a few hours around midnight. There are 2 eclipse seasons per year, each lasting 42 days. The exact influence of the stray light on the dataset will be characterised in orbit, although the period of affected data will be predicted from on-ground analysis.

Annex F.3.3.3 Unscheduled Outages
[Conventions and Terms] Unscheduled Outage  iss: 3B

This denotes all the unscheduled outages, thus a precise list cannot be made. The most common causes for the unscheduled outages are:

- Ground segment reconfiguration may cause outages, however such maintenance activities are normally scheduled in advance.
- Loss of communication links (e.g. between ground stations and headquarters).
- Satellite single event upset (SEU)
- Satellite safe mode
- Random failures
- Any disasters or major events outside EUMETSAT’s control.

Annex F.3.3.4 Outages outside EUMETSAT control

[Conventions and Terms] External outage  iss: 5

This term groups all the outages outside EUMETSAT control, thus a precise list cannot be made. The most common causes for the outages outside the control of EUMETSAT are:

- Networks outside EUMETSAT responsibility, which in this context are networks that are not managed by EUMETSAT or for which no Service Level Agreement (SLA) exists (for instance RMDCN, GTS, Internet, GEANT.)
- External data unavailability (e.g. Meteorological Data Dissemination (MDD), Foreign Satellite Data (FSD), incoming forecast data...).
- Effect of lack of redundancy of the space segment (i.e. only one satellite in orbit).
- Unavailability of DCP beacons and SAR beacons, or those working outside specification.
- Interface with ESA S4 Mission Management.

Annex F.3.7 Lifetime
MTG Satellite Lifetime

Notes:

(1) Flight Acceptance Review (FAR) – S/C acceptance prior to shipment to launch pad or prior to S/C storage (Pre-Storage Review)
Duration of S/C Storage – to be defined on the basis of the MTG deployment sequence
(2) Begin of Life (BOL) = BOL Satellite Specified Lifetime, starting from Launch
(3) End Of Life (EOL) of Satellite Specified In-Orbit Lifetime
(4) End Of Extended Life (EOEL) at the end of Satellite Lifetime extension
(5) First Satellite Commissioning for both MTG-I and MTG-S is expected to last 4 months.
Recursent satellites are expected to last 2 months.
(6) System Commissioning for both MTG-I and MTG-S is expected to last one year.
Recursent satellites are expected to last 6 months.

[Conventions and Terms] Satellite Specified Lifetime iss: 3G
The Satellite Specified Lifetime is defined as the time in orbit from separation from the launch vehicle to satellite re-orbiting as depicted in Figure 1.

[Conventions and Terms] Satellite Nominal Operational Lifetime iss: 3D
The satellite nominal operational lifetime is defined as the time in orbit over which the performances have to be met with a given satellite availability and excluding the time necessary for the execution of LEOP and satellite commissioning (see Figure 1).

Annex F.3.9 Space Segment related

[Conventions and Terms] Satellite iss: 3B
The word Satellite is used within MTG system to define a complete self standing subset of the MTG space segment, including Platform and Payload (observational instruments), all Platform and Payload supporting functionalities, and the interfaces to the external environment. Two types of ‘Satellite’ are foreseen in the MTG system, the MTG-I and the MTG-S.
[Conventions and Terms] Platform iss: 3B

The part of the satellite excluding the payload. The ‘platform’ provides all the resources, functionalities and performances necessary to support the nominal and contingency operation of the payload.

[Conventions and Terms] Payload iss: 3B

The parts of the satellite used to acquire the data that will generate the mission products.

Note: For MTG the payload comprises FCI, IRS, LI, UVN, DCP and SAR when embarked on their respective satellites.

[Conventions and Terms] Consumable iss: 3B

A satellite item that can be physically depleted after a given period of time. Applies e.g. to propellant.

[Conventions and Terms] Ranging iss: 5A

Orbit determination of a spacecraft requires as input measurements that are related to the satellite’s position and velocity.

The classical two-way radar ranging employs a ranging signal that is radiated from the ground station to the satellite. A satellite transponder is required to receive the signal and to transmit it back to the ground station. The ground station receives the transponder ranging signal from the satellite and determines the signal travel time T. This is expressed as an equivalent range value $R = cT$, which is equal to the sum of the uplink and downlink distance.

There are basically two different techniques, see Figure 2, to generate ranging signals:

![Figure 13: Principle of distance measurements using tone ranging (left) and code ranging (right)](image)

[Conventions and Terms] Nominal longitude range iss: 3B

On the geostationary arc, with a longitude anywhere between $10^\circ$W and $10^\circ$E.

Note: This value is defined in the SRD requirement SYS-00630 Annex F.3.10 Ground Segment related
[Conventions and Terms] **Ground Segment iss: 3D**

The part of the MTG System that is on ground and encompasses all software and hardware resources (including communication) to enable operations of all in-orbit MTG satellites, interfacing with external entities (e.g. Launch provider, satellite manufacturer, ECMWF) and provision of the services to the end-users with high operational availability. It also encompasses additional resources enabling development, testing, verification and operational validation of software, hardware and configuration data, as well as operations preparation, training and performance analysis, in parallel to operations.

[Conventions and Terms] **Instrument Data Processing iss: 3D**

Instrument data processing (IDP) is the function that converts instrument data coming from the satellites into level 1 datasets.

[Conventions and Terms] **Application Ground Processing iss: 3D**

Application Ground Processing is the combination of the central Level 2 Processing located at the EUMETSAT Headquarter and the decentralised Satellite Application Facilities (SAF).

[Conventions and Terms] **Level 2 Processing iss: 3D**

Level 2 Processing (L2P) is the function that converts Level 1 Datasets into Level 2 Products.

[Conventions and Terms] **Data Centre iss: 3D**

The Data Centre is a Multi-Mission Element (MME) composed of UMARF, Earth Observation Portal and GSICS server.

[Conventions and Terms] **EUMETSAT Data Centre iss: 3B**

see Data Centre

[Conventions and Terms] **UMARF iss: 3D**

Data Centre component that receives and archives datasets at level 0, level 1 and level 2 together with auxiliary data and other associated data for all EUMETSAT satellites in view of deferred retrievals. The archiving process is automated, and is carried out 24 hours a day, every day of the year.

[Conventions and Terms] **Earth Observation Portal iss: 3D**

Data Centre component that provides a comprehensive data retrieval service including On-line access (via internet) to the archived dataset catalogues and other information on the archive. The EUMETSAT EO Portal provides means to discover the archived dataset collections, navigate and query the MTG catalogue. The retrieved archived datasets can be tailored (e.g. spectral and spatial sub-setting) prior to media / online dataset delivery.
The service includes administration functions with end-user interface (User Management and licensing, Help-desk, information Service, ordering, subscription, etc.).

[Conventions and Terms] GSICS server iss: 3D

Data Centre component. The GSICS data and products server is a platform for the inter-calibration of operational satellite sensors. The Global Space-based Inter-Calibration System (GSICS) is an international collaborative effort to examine and harmonize calibration data from operational weather satellites sensors to improve climate monitoring and weather forecasting.

[Conventions and Terms] EUMETCast iss: 3D

EUMETSAT’s Broadcast System for Environmental Data is a Multi-Mission Element dissemination system based on standard Digital Video Broadcast (DVB) technology. It uses commercial telecommunication geostationary satellites to multicast files (e.g. Level 1 dataset, Level 2 products) to the user community.

Annex F.3.12 Process relevant

[Conventions and Terms] Commissioning iss: 4B

Verification and validation activities conducted after the launch and before the entry in operational service either on the space elements only or on the overall system (including the ground elements).

Note: As per ECSS-E-ST-10-02C

[Conventions and Terms] System commissioning iss: 3B

Commissioning of the overall system terminating with the closure of the System Commissioning Results Review (SCRR).

[Conventions and Terms] Satellite commissioning iss: 4B

A subset of the overall system commissioning focusing on the satellite aspects and terminating with the closure of the satellite Commissioning Result Review (CRR)

[Conventions and Terms] Verification iss: 4C

Confirmation through the provision of objective evidence that specified requirements have been fulfilled.

Note: As per ECSS-S-ST-00-01C.

[Conventions and Terms] Validation iss: 4B

Confirmation, through the provision of objective evidence that the requirements for a specific intended use or application have been fulfilled.
Note: As per ECSS-S-ST-00-01C.

Annex F.4 Observation Missions Conventions

Annex F.4.1 General

[Conventions and Terms] Centroid iss: 3B

The centroid is the generalized mathematical expression for quantities used in science and engineering such as centre of gravity, centre of mass and barycentre. The centroid of a function of $N$ independent variables is the intersection of all hyperplanes that divide the function into two parts of equal moment. The co-ordinates of the centroid in terms of the independent variables is given by the equation:

$$
\bar{x}_i = \frac{\int \cdots \int x_i f(x_1, \ldots, x_N) \, dx_1 \cdots dx_N}{\int \cdots \int f(x_1, \ldots, x_N) \, dx_1 \cdots dx_N}
$$

where

$\bar{x}_i$ is the centroid co-coordinate for independent variable $x_i$

$x_i$ is the independent variable, with $1 \leq i \leq N$

$f(x_1, \ldots, x_N)$ is the dependent function

For example the centroid of a function with two independent variables is given by the equation:

$$
\bar{x} = \frac{\int \int x \cdot f(x, y) \, dx \, dy}{\int \int f(x, y) \, dx \, dy}
$$

$$
\bar{y} = \frac{\int \int y \cdot f(x, y) \, dx \, dy}{\int \int f(x, y) \, dx \, dy}
$$

where

$\bar{x}, \bar{y}$ are the centroid co-ordinates

$x, y$ are the independent variables

$f(x, y)$ is the dependent function

[Conventions and Terms] Data Level iss: 3B

Data levels are used to describe the condition of the science data at various points in the ground processing cycle. The WMO lists the following data levels on their web site:

*Level 0 - Raw data.*
Level 1 - Data extracted by instrument, at full instrument pixel resolution, with Earth-location and calibration information.

Level 2 - Geophysical value (temperature, humidity, radiative flux...) at instrument pixel resolution.

Level 3 - Remapped (gridded) product based on geophysical value derived at instrument pixel resolution.

Level 4 - Composite product (multisource) or result of model analysis of lower level data.

For MTG the basic sense of WMO data levels is maintained, without the concept that the science data has to be at instrument pixel resolution. However, the WMO data sub-levels are not used. Enhancements of the data level definitions are given in the definitions of level 0, level 1 data.

[Conventions and Terms] Level 0 iss: 3B

Level 0 data is the science data at packet level, after restoration of the packet-wise chronological data sequence for a given instrument.

[Conventions and Terms] Level 1 iss: 3D

Level 1 describes, for a given instrument, a variety of different data sub-levels that are related to Instrument Data Processing (IDP). Refer also to level 1a, level 1b and level 1c.

Note 1: Not all of the sub-levels will appear as an externally available dataset for each instrument and may remain internal to the instrument data processing process or not be generated.

Note 2: Earth-location and calibration information are treated as part of the IDP auxiliary data that will be disseminated and archived with the level 1 data.

Note 3: A radiance sample appearing at level 1b can represent a measurement taken from an individual detector element or a combination of measurements derived from a group of detector elements. At level 1b radiance samples are associated with a particular spatial sample. The spatial samples may then be rectified to form pixels located at fixed positions in the reference grid giving the level 1c data.

[Conventions and Terms] Level 1a iss: 3B

Level 1a data is level 0 science data in counts after removal from the packets, whilst maintaining the spatio-temporal sequencing of the data.

[Conventions and Terms] Level 1b iss: 3B

Level 1b data is level 1a science data radiometrically and spectrally calibrated.

[Conventions and Terms] Level 1c iss: 3B

Level 1c data is level 1b science data rectified to a reference grid.
[Conventions and Terms] Level 2 iss: 3B

Level 2 relates to level 1b or level 1c science data converted to geophysical values (temperature, humidity, radiative flux…) during application ground processing.

[Conventions and Terms] Spatial Sampling Distance iss: 3B

The spatial sampling distance is the required spatial sample spacing and is used as a base unit against which geometric requirements are assessed. All requirements expressed in spatial sampling distance are taken to apply at the sub-satellite point and can be translated to a spatial sampling angle used to evaluate the requirement at all other positions in the area of coverage.

[Conventions and Terms] Spatial Sampling Angle iss: 3B

The angle subtended by the spatial sampling distance at the Sub-Satellite Point as seen from the satellite.

[Conventions and Terms] Sub-Satellite Point iss: 3B

The sub-satellite point (SSP) is the intersection by the line drawn from the satellite to the centre of the Earth with the surface of the <Earth’s Reference Ellipsoid>.

[Conventions and Terms] Reference Grid iss: 3B

The reference grid defines the geo-referenced position of the image pixel centroids at level 1c.

The grid angles are defined, in terms of the Normalized Geostationary Projection, as follows:

- Rotation about the axis S3 (λS);
- Rotation about the axis S2’ (φS), where S2’ lies in the S1/S2 plane at an angle λS from S2 about the S3 axis.

The grid steps are equiangular both in λS and φS and equal to the spatial sampling angle of the considered channel, Figure 3. The corresponding projected distance at the sub-satellite point is the spatial sampling distance.

For reference grids of differing resolutions the grids are aligned as given in Figure 4 i.e. the fine grid pixel centres are offset by half the smaller spatial sampling angle from the coarse grid pixel centres in both λS and φS.

See Figure 5.
Figure 14: Angular Definition of the Reference Grid
Figure 15: Alignment of Reference Grids of Differing Resolutions

[Conventions and Terms] Target Grid \ iss: 3B
The Target Grid is the set of spatial samples defined by the scan strategy for an unperturbed spacecraft at a fixed geostationary position. The points are defined using the same projection as the reference grid.
Note: See Figure 5.

Figure 16: Relationship between data grids

[Conventions and Terms] Estimated Grid \ iss: 3B
The estimated grid is the set of spatial samples defined as an outcome of the image navigation process, i.e. each spatial sample's location in space as a result of the image navigation process. The points are defined using the same projection as the reference grid.
See Figure 5.

[Conventions and Terms] Verification Grid \ iss: 3B
The verification grid is the set of spatial samples used for image navigation verification in conjunction with the estimated grid. The points are defined using the same projection as the reference grid.
See Figure 5.
Annex F.4.2 Dataset Acquisition and Generation

[Conventions and Terms] Image  iss: 3B
An image is defined as the set of radiance samples acquired in a repeat cycle, associated with a single spectral channel and
• at level 1c: with all the points (pixels) of the reference grid that are included in the area of coverage;
• at level 1a and 1b: with all the points (spatial samples) of the actual grid that are included in the area of coverage.

[Conventions and Terms] Imagette  iss: 3B
An imagette is defined as a fraction of an image.

[Conventions and Terms] Coverage  iss: 3B
Coverage is defined as the region over which science data is collected.

[Conventions and Terms] Full Disc Coverage  iss: 3B
Full Disc Coverage (FDC) is defined as the maximum area of coverage required from an instrument, particularly if this involves the complete coverage of the Earth disc.

[Conventions and Terms] Local Area Coverage  iss: 3B
Local Area Coverage (LAC) is defined as a sub-area of full disc coverage.

[Conventions and Terms] LAC Zone  iss: 3B
A LAC zone is defined as an area of coverage meeting the LAC requirements. In cases where more than one LAC zone are in use the LAC zones should be numbered from south to north starting from 1; see Figure 6 and Figure 7.
Figure 17: Illustration of LAC zone numbering for the IRS
Figure 18: Illustration of LAC zone numbering for the FCI
**Figure 19:** Illustration of the derivation of the image solid angle for LAC Clipping calculation

**Figure 20:** Illustration of areas of LAC missing due to pointing and inclination variation

**[Conventions and Terms]** **Dwell**  iss: 3B

A dwell is the time period and area over which the sounder gathers simultaneously a group of spectral soundings and has properties of dwell time and dwell coverage. The dwells within a LAC zone are numbered in the order of acquisition starting from 1; see **Figure 10**. Synonyms: Stare
Figure 21: Illustration of dwell numbering within a LAC zone

[Conventions and Terms] Dwell Coverage  iss: 3B
Dwell coverage is the area covered by all spatial samples of the spectral soundings collected during the same acquisition time.

[Conventions and Terms] Dwell Time  iss: 3D
The dwell time is the time period required to collect an interferogram (from which are deduced all spectral samples).

[Conventions and Terms] Swath  iss: 3B
A swath is defined as the area covered by the spatial samples collected during a single east to west or west to east scan of a scanning instrument. The swaths are numbered from south to north staring from 1; see Figure 11.
Figure 22: Illustration of swath numbering

*Conventions and Terms* Row iss: 3B

A row is defined as a line of *spatial samples* or *pixels* running in a (nominal) East to West and West to East direction. The rows are numbered from the south to north starting from 1. The term row can be applied to *dwells, swaths* or rectified *images*; see Figure 12, Figure 13 and Figure 14.
Figure 23: Illustration of row numbering within a dwell

Figure 24: Illustration of row numbering within a swath
Figure 25: Illustration of row numbering within a rectified image

[Conventions and Terms] Column  iss: 3B

A column is defined a line of spatial samples or pixels running in a (nominal) South to North direction. The columns are numbered from the west to east starting from 1. The term column can be applied to dwells, swaths or rectified images; see Figure 15, Figure 16 and Figure 17.
**Figure 26: Illustration of column numbering within a dwell**

**Figure 27: Illustration of column numbering within a swath**
Figure 28: Illustration of column numbering within a rectified image

[Conventions and Terms] Repeat Cycle iss: 5

For the FCI: The repeat cycle is defined as the time elapsed between the start of two consecutive sets of images taken in all spectral channels covering the same defined coverage.

For the IRS: The repeat cycle is defined as the time elapsed between the start of the data acquisition for two consecutive LAC zones.

For the LI: The repeat cycle is defined as the time elapsed between the start of the data acquisition for two consecutive LI background radiance images.

For the UVN: The repeat cycle is defined as the time elapsed between the start of two consecutive east-west scans.

Note: In above definition, consecutive should be interpreted as temporally consecutive.

Note: For data from other sources (e.g. LI triggered event or from satellite platform), an accumulation interval may be defined.

[Conventions and Terms] Detector Element iss: 3B

A detector element is a single measurement device that, together with others with similar characteristics, makes up a detector array. The detector element responds to incoming radiation to produce a signal that can be converted from an analogue to a digital format.

[Conventions and Terms] Detector Array iss: 3B

A detector array is a collection of detector elements. It may be linear or two dimensional.

[Conventions and Terms] Lightning Optical Pulse iss: 3B

A lightning optical pulse is produced by an electric discharge within or below a cloud, where the optical radiation is emitted from the hot lightning channel. The lightning pulse duration is on the order of 50 µs and the released photons are transported to the cloud surfaces by scattering. The resulting lightning optical signal to be observed at the cloud top has a pulse duration delayed and widened in time to about 600 µs, distributed over an enlarged area of a minimum of about 100 km² up to a maximum area of about 10.000 km² depending on the number of scattering processes involved. The spectral and temporal characteristics are illustrated in Figure 18.
Figure 29: Optical emission from lightning and lightning pulse duration

**[Conventions and Terms] Lightning Pulse**  
iss: 3B  
Synonym for Lightning Optical Pulse

**Annex F.4.3 Dataset Quality Threshold**

**[Conventions and Terms] Missing Sample**  
iss: 4  
For the FCI: A radiance sample is deemed a missing sample if either no measurement has been returned or the difference between its radiometric error and the radiometric accuracy is more than N times the specified radiometric noise for a specific repeat cycle.

For a missing sample:

\[ |\Delta L^{\text{eff}}_{ijksr} - \Delta L^{\text{eff}}_{kr} | > N \times NEdL^{\text{eff}}_{[k]} \]

Where

- \( \Delta L^{\text{eff}}_{ijksr} \) is the radiometric error
- \( \Delta L^{\text{eff}}_{kr} \) is the radiometric accuracy
- NEdL^{\text{eff}}_{[k]} is the noise equivalent delta radiance requirement
- i and j identify the spatial sample within a swath in terms of column and row
- k is the spectral channel
- s is the swath of a repeat cycle
- r is the repeat cycle
- N is the noise equivalent delta radiance multiplication factor as given in the requirement for missing samples.
For the IRS: A spectral sounding is deemed a missing sounding if either no measurement has been returned or a fraction of the spectral channels greater than M, within the considered spectral band, have associated radiance samples where the difference between the radiometric error and the radiometric accuracy is more than N times the specified radiometric noise, for a specific repeat cycle.

For a missing sounding:

$$\left| \Delta L_{\text{eff}}^{[ijklr]} - \Delta L_{\text{eff}}^{[\nu]} \right| > N \cdot N E d L_{\text{eff}}^{[k]}$$

Where

- $\Delta L_{\text{eff}}^{[ijklr]}$ is the radiometric error
- $\Delta L_{\text{eff}}^{[\nu]}$ is the radiometric accuracy
- $N E d L_{\text{eff}}^{[k]}$ is the noise equivalent delta radiance requirement
- $i$ and $j$ identify the spatial sample within a dwell in terms of column and row
- $k$ is the spectral channel
- $s$ is the dwell of a repeat cycle
- $r$ is the repeat cycle
- $N$ is the noise equivalent delta radiance multiplication factor

Note: The parameters $M$ and $N$ are given in the requirement for missing sounding.

**Annex F.4.4 Spectral**

**[Conventions and Terms] Wavenumber iss: 3B**

Wavenumber, $\nu$, is defined as the reciprocal of the spectral wavelength.

$$\nu = \frac{1}{\lambda}$$

Note: In this definition the symbol $\nu$ is used in place of the symbol $\sigma$ used in ISO 31-6-4:1992(E)

**[Conventions and Terms] Spectral Variable iss: 3B**

The spectral variable, $\xi$, is any quantity used to represent the frequency behaviour of a monochromatic wave. The spectral variable can be a spectral frequency, wavelength or wavenumber. The term spectral variable will be used in all the statements that are applicable to any one of the above mentioned quantities.
[Conventions and Terms] Spectral Range  iss: 3B
The spectral range is defined as the complete spectral domain over which the instrument is able to produce calibrated measurements. The spectral domain may or may not be contiguous (continuous, with its parts in uninterrupted contact).

[Conventions and Terms] Spectral Band  iss: 3B
A spectral band is a subset of the spectral range of an instrument that has associated common properties and is contiguous. For example the IRS has two spectral bands MWIR and LWIR.

[Conventions and Terms] Spectral Channel  iss: 3B
A spectral channel is the smallest spectral interval measured by an instrument. A spectral band is formed by a set of contiguous spectral channels.

For the FCI: A spectral channel is characterised by a set of spectral response functions per spatial sample that comply with the spectral response template for that spectral channel.

For the IRS: A spectral channel is defined after spectral resampling of the measured spectral samples to a discrete spectral positions separated according to the spectral channel interval within the spectral band.

The spectral channel, identified by the index \( k \), has an associated spectral variable, \( \xi_k \), where this location corresponds to the position of its spectral response function centroid.

See also radiance sample.

[Conventions and Terms] Radiance Sample  iss: 3B
A radiance sample is an effective radiance measured by the instrument at a specific spatial and spectral location, see Figure 19. The radiance sample has spatial properties of spatial location \((x_i, y_j)\) and shape (point spread function). Together the spatial properties are referred to as the spatial sample or pixel depending on whether the radiance sample has been located on the estimated grid or the reference grid respectively. Likewise the radiance sample has spectral properties of spectral location \((\xi_k)\) and shape (spectral response function). Together the spectral properties are referred to as the spectral sample or spectral channel depending on whether the radiance sample is located according to a reference spectral location and spectral response function. The point spread function and spectral response function are related to the instrument response function.

For the FCI: The spectral channel is fixed by the optical and detector element spectral filtering characteristics. Thus for each spatial sample of a spectral channel a single radiance sample is measured. The spatial samples are rectified to the reference grid to form pixels, again each with their associated radiance sample.

For the IRS: A spectral sounding is taken at a location given by the spatial sample. Once the spectral sounding interferogram has been Fourier transformed to the spectral domain a series of spectral samples are obtained, each with its own radiance sample. The spectral samples are then subject to spectral resampling to fixed spectral locations and spectral
response functions to form spectral channels, again each with their associated radiance sample.

For the LI: A single spectral channel is defined, thus each spatial sample has an associated radiance sample.

Note: In the case of the IRS the PSF of the spatial sample will vary with the spectral sample or spectral channel, although the nominal location will be the same across the spectral variable range.

![Figure 30: Radiance Sampling](image)

**[Conventions and Terms] Spectral Sample**  
iss: 3B

For the IRS: Spectral samples are obtained by performing a discrete Fourier Transform of the sampled spectral sounding interferogram for a spatial sample.

The spectral sample, identified by the index \( k \), has an associated spectral variable, \( \xi_k \), where this location corresponds to the position of its spectral response function centroid.

See also radiance sample.

Note: As the IRS will perform a number of spectral soundings simultaneously there will be a scale change between the spectral spacing of the spectral samples for each spatial sample. This is due to the change in maximum optical path difference caused by the position of a spatial sample in relation to the optical axis. Thus each spatial sample will have spectral samples taken at a set of wavenumbers specific to that spatial sample.

**[Conventions and Terms] Spectral Sample Surface**  
iss: 3D

For the IRS: The spectral sample surface is defined as the group of spectral samples with the same index number following the discrete Fourier transform of all the spectral sounding interferograms in an area of coverage. The spectral sample surface has an associated wavenumber that is taken as the wavenumber corresponding to a spectral
sample located on the optical axis. The wavenumbers of the individual spectral samples making up a spectral sample surface is illustrated in Figure 20.

Note: In this definition it is assumed that each spectral sounding consists of the same number of interferogram samples. On performing a Fourier transform of the interferogram each spectral sounding has the same number of spectral samples.
Notes:

1. The plots of the spectral sampling surfaces are generated assuming a 4km spatial sampling distance, a 0.625 cm$^{-1}$ spectral channel interval, a magnification ratio of one and are plotted for a dwell coverage of 640km x 640km.

2. The plots assume that the optical axis lies in the centre of the dwell coverage and that the Zero Optical Path Difference (ZOPD) for each interferogram within the dwell is in the same interferogram sample position.

**Figure 31: Illustration of Spectral Sample Surface**

[Conventions and Terms] Spectral Channel Interval iss: 3B

For the IRS: The spectral channel interval is the spectral distance between adjacent spectral channels within a spectral band.

Note: The spectral channel interval defines the standard grid to which the spectral samples collected for each spatial sample are spectrally resampled to form spectral channels.
For the FCI: The spectral width is used to specify the spectral extent of a spectral channel in terms of the normalised spectral response envelope.

Note: The specified spectral width, $\Delta \lambda_0$, will be different from the actual spectral width, $\Delta \lambda_s$, of a spectral channel, where the actual spectral width has traditionally been defined as the Full Width Half Maximum value of the spectral response function, ignoring local oscillations in the passband. However, with the usage of effective radiance there is strictly speaking no longer a need to provide the actual spectral width, although in practice the spectral width will still be quoted for historical comparison and conceptual understanding reasons.

For the FCI: The central wavelength is used to specify the spectral location of a spectral channel in terms of the normalised spectral response envelope.

Note: The specified central wavelength, $\lambda_0$, will be different from the actual central wavelength, $\lambda_s$, of a spectral channel, where the actual central wavelength has traditionally been defined as the centroid of the spectral response function. However, with the usage of Effective Radiance there is strictly speaking no longer a need to provide the actual central wavelength, although in practice the central wavelength will still be quoted for historical comparison and conceptual understanding reasons.

For the IRS: Spectral calibration is the process of determining the position and shape of the spectral response function (SRF) of a spectral sample or group of spectral samples by the observation of a known, stable spectral scene.

See ECSS-P-001B 3.28 Calibration.

For the IRS: Spectral resampling is the process by which the spectral samples derived from a sampled interferogram are relocated to pre-determined wavenumber locations, thus forming spectral channels. The positions of the spectral channels are those given by the spectral channel interval starting at the first wavenumber in the spectral band.

The normalised spectral response is equal to the spectral response function normalised by the maximum spectral response function over the spectral variable range of interest at the time of measurement.

$$S_{[ijkr]}(\xi) = \frac{SRF_{[ijkr]}(\xi)}{\max(SRF_{[ijkr]}(\xi))}$$

where
$S_{[i j k r]}(\xi)$ is the normalised spectral response

$SRF_{[i j k r]}(\xi)$ is the spectral response function

$i$ and $j$ identify the spatial sample within a swath/dwell or the pixel within a repeat cycle in terms of column and row

$k$ is the spectral sample or spectral channel

$s$ is the swath or dwell of a repeat cycle when considering spatial samples

$r$ is the repeat cycle

$\xi$ is the spectral variable

[Conventions and Terms] Instrument Response Function iss: 4

The Instrument Response Function (IRF) is defined as the output signal to input radiant intensity ratio, with the output signal being the effective radiance measured by the instrument when observing a monochromatic point source. The IRF is specific to the selected spatial sample or pixel and spectral sample or spectral channel and is a function of the spatial position and the spectral variable of the source. The IRF units are $m^{-2} \cdot \mu m^{-1}$.

As a consequence of the above definition

$$L^{\text{eff}}_{[i j k r]} = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} \text{IRF}_{[i j k r]}(x, y, \xi, \xi) \cdot L_{\xi}(x, y, \xi) \cdot dx \cdot dy \cdot d\xi$$

where

$L^{\text{eff}}_{[i j k r]}$ is the effective radiance, including all the spectral and spatial filtering actions produced by the combined effect of the optical system, the detector and processing up to point of interest.

$\text{IRF}_{[i j k r]}(x, y, \xi)$ is the instrument response function

$L_{\xi}(x, y, \xi)$ is the spectral radiance of the scene

$i$ and $j$ identify the spatial sample within a swath/dwell or the pixel within a repeat cycle in terms of column and row

$k$ is the spectral sample or spectral channel

$s$ is the swath or dwell of a repeat cycle when considering spatial samples

$r$ is the repeat cycle

$x$ and $y$ are the spatial variables

$\xi$ is the spectral variable
Another consequence of the definition is the fact that the integral of IRF along the spatial variables and spectral variable is unity.

\[
\int_{-\infty}^{\infty} \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} IRF_{ijksr}(x, y, \xi) \, dx \, dy \, d\xi = 1
\]

Note: In the definition of IRF the instruments are assumed to be linear.

**[Conventions and Terms]** Spectral Response Function \( iss: 4 \)

The Spectral Response Function (SRF) is defined as the output signal to input radiance ratio, with the output signal being the effective radiance measured by the instrument when observing a spatially uniform, monochromatic source. The SRF is specific to the selected spatial sample or pixel and spectral sample or spectral channel and is a function of the spectral variable of the source. The SRF units are \( \mu m^{-1} \).

The SRF can be equivalently defined as integral of IRF

\[
SRF_{ijksr}(\xi) = \int_{-\infty}^{+\infty} \int_{-\infty}^{+\infty} IRF_{ijksr}(x, y, \xi) \, dx \, dy
\]

where

\( IRF_{ijksr}(x, y, \xi) \) is the instrument response function

\( SRF_{ijksr}(\xi) \) is the spectral response function

\( i \) and \( j \) identify the spatial sample within a swath/dwell or the pixel within a repeat cycle in terms of column and row

\( k \) is the spectral sample or spectral channel

\( s \) is the swath or dwell of a repeat cycle when considering spatial samples

\( r \) is the repeat cycle

\( x \) and \( y \) are the spatial variables

\( \xi \) is the spectral variable

As a consequence of the above definition, in the special case where the scene is spatially uniform, the SRF can be used (in place of the IRF) to evaluate the instrument output by the equation:

\[
L_{eff}^{ijksr} = \int_{0}^{+\infty} SRF_{ijksr}(\xi) L_\xi(\xi) d\xi
\]

where
$L_{\text{eff}}_{ijksr}$ is the effective radiance including all the spectral and spatial filtering actions produced by the combined effect of the optical system, the detector and processing, up to the point of interest.

$L_\zeta (\zeta)$ is the spectral radiance of the scene.

Another consequence of the definition is the fact that the integral of SRF along the spectral variable is unity.

$$\int_{0}^{+\infty} SRF_{ijksr} (\zeta) d\zeta = 1$$

Synonyms: instrument spectral response function, instrument line shape

Note: In the definition of SRF the instruments are assumed to be linear.

[Conventions and Terms] Instrument Spectral Response Function  iss: 3B

Synonym for Spectral Response Function (SRF)

[Conventions and Terms] Instrument Line Shape  iss: 3B

Synonym for Spectral Response Function (SRF).

[Conventions and Terms] Spectral Response Function Difference  iss: 3B

The spectral response function difference is given for two different conditions.

For the difference between the actual SRF and a characterised SRF

$$\Delta SRF_{ijksr} = \int_{\zeta_i}^{\zeta_2} SRF^a_{ijksr} (\zeta) - SRF^m_{ijksr} (\zeta) d\zeta$$

where

$\Delta SRF_{ijksr}$ is the spectral response function difference

$SRF^m_{ijksr}$ is the characterised spectral response function

$SRF^a_{ijksr}$ is the actual spectral response function

$i$ and $j$ identify the spatial sample within a swath/dwell or the pixel within a repeat cycle in terms of column and row

$k$ is the spectral sample or spectral channel

$s$ is the swath or dwell of a repeat cycle when considering spatial samples

$r$ is the repeat cycle

$\zeta$ is the spectral variable.
\( \xi_1 \) and \( \xi_2 \) are the integration limits

For the difference between two actual SRF separated either in space or in time

\[
\Delta SRF_{[(i_1-j_2) (j_1-j_2) k(r_1-r_2)]} = \int_{\xi_1}^{\xi_2} [SRF_{[i_1,j_1,r_1]}(\xi) - SRF_{[i_2,j_2,r_2]}(\xi)] d\xi
\]

where

\( \Delta SRF_{[(i_1-i_2) (j_1-j_2) k(r_1-r_2)]} \) is the spectral response function difference

\( SRF_{[i_1,j_1,r_1]}(\xi) \) and \( SRF_{[i_2,j_2,r_2]}(\xi) \) are the spectral response functions for either two different spatial samples within the same repeat cycle \((r_1=r_2)\) or the same spatial sample belonging to two different repeat cycles \((i_1=i_2, j_1=j_2)\) for spectral channel \( k \)

Synonym: SRF shape error index

[Conventions and Terms] SRF Shape Error Index iss: 3B

Synonym for spectral response function difference

[Conventions and Terms] Fourier Transform Spectrometer iss: 3B

A Fourier Transform Spectrometer (FTS) is an interferometer concept that converts input spectral radiances into interferograms that contain spectral information within the bandpass of the interferometer.

[Conventions and Terms] Spectral Sounding iss: 3B

A spectral sounding is defined as the complete set of spectral samples for any fixed spatial sample captured during a dwell of a sounder.

See also radiance sample.

Annex F.4.5 Radiometric

[Conventions and Terms] Radiant Energy iss: 3B

Radiant energy is the energy emitted, transferred or received in the form of electromagnetic radiation.

[Conventions and Terms] Radiant Power iss: 3B

Radiant power is the radiant energy per unit time.

[Conventions and Terms] Irradiance iss: 3B

Irradiance is defined as the radiant power incident on a surface element, divided by the area of the element:
\[ E = \frac{d\Phi}{ds} \]

where

\( ds \) is an infinitesimal element of surface

\( d\Phi \) is the radiant power incident over \( ds \)

\( E \) is the irradiance evaluated on \( ds \)

As all the radiometric quantities, irradiance can be integral or spectral. The above definition is applicable to the integral irradiance (with \( \Phi \) the radiant power over a generic spectral interval). The spectral irradiance is irradiance per unit spectral interval and is represented by the equation:

\[ E_\xi = \frac{dE}{d\xi} \]

where

\( \xi \) is the spectral variable

\( E_\xi \) is the spectral irradiance per unit spectral variable

[Conventions and Terms] Radiance iss: 3B

Radiance is defined as the radiant power per unit projected area and unit solid angle, leaving a surface in a given direction.

\[ L = \frac{d^2\Phi}{ds.d\Omega \cos \theta} \] where

\( ds \) is an infinitesimal element of surface

\( \theta \) is the angle between the direction of observation and the normal to \( ds \)

\( d\Omega \) is an infinitesimal solid angle around the observation direction

\( d^2\Phi \) is the radiant power emitted by \( ds \) within the solid angle \( d\Omega \)

\( L \) is the radiance from the surface, in the direction given by \( \theta \)

The spectral radiance is radiance per unit spectral interval and is represented by the equation:

\[ L_\xi = \frac{dL}{d\xi} \] where

\( \xi \) is the spectral variable

\( L_\xi \) is the spectral radiance per unit spectral variable
[Conventions and Terms] Radiant Intensity    iss: 3B
Radiant intensity is defined as the radiant power per unit solid angle leaving a surface or point source

\[ I = \frac{d\Phi}{d\Omega} \]

where

\[ d\Omega \] is an infinitesimal solid angle around the observation direction

\[ d\Phi \] is the radiant power emitted in the solid angle \( d\Omega \)

\( I \) is the radiant intensity from the surface or point source

[Conventions and Terms] Effective Radiance iss: 3B
The effective radiance is the calibrated output of an instrument with finite spatial and spectral resolution, in units of spectral radiance. It equates to spectral radiance of a spatially and spectrally flat scene that would produce the same output as that produced by the actual scene.

[Conventions and Terms] LI Effective Radiance    iss: 3E
The LI effective radiance is the calibrated output of the LI instrument with finite spatial and temporal resolution, in units of radiance. It is equal to the radiance of a spatially homogeneous scene with a constant output in time that would produce the same output as that produced by the actual scene.

[Conventions and Terms] Radiometric Measurement Range    iss: 3B
The radiometric measurement range is defined as the complete radiometric domain over which the instrument is able to produce calibrated measurements.

[Conventions and Terms] Planck Function Derivative in Temperature    iss: 3B
The Planck function derivative in temperature is given by:

In terms of wavelength (\( \lambda \)) in m

\[
\frac{\partial B(\lambda, T)}{\partial T} \cdot d\lambda = \frac{2 \cdot h^2 \cdot c^3}{k \cdot T^2 \cdot \lambda^5} \cdot \frac{h \cdot c}{e^{\frac{h \cdot c}{k \cdot T \cdot \lambda}} - 1} \cdot d\lambda
\]

In terms of wavelength (\( \lambda' \)) in \( \mu m \)
\[
\frac{\partial B}{\partial T}(\lambda', T), d\lambda' = 2 \cdot h^2 \cdot c^3 \frac{e^{10^6 \cdot h \cdot c}}{e^{\frac{k \cdot h \cdot c}{T} \cdot \lambda^16}} \cdot 10^{-30} \cdot d\lambda'
\]

In terms of wavenumber (ν) in m⁻¹
\[
\frac{\partial B}{\partial T}(\nu, T), d\nu = 2 \cdot h^2 \cdot c^3 \cdot \nu^4 \frac{e^{10^6 \cdot h \cdot c}}{e^{\frac{k \cdot h \cdot c}{T} \cdot \nu^16}} \cdot 10^{-30} \cdot d\nu
\]

In terms of wavenumber (ν') in cm⁻¹
\[
\frac{\partial B}{\partial T}(\nu', T), d\nu' = 2 \cdot h^2 \cdot c^3 \cdot \nu'^4 \frac{e^{10^6 \cdot h \cdot c \cdot \nu'}}{e^{\frac{k \cdot h \cdot c \cdot \nu'}{T} \cdot \nu'^16}} \cdot 10^{-30} \cdot d\nu'
\]

**[Conventions and Terms] Reflectance** iss: 3B

For a given spectral value, reflectance is the ratio between the power per unit surface area emitted by a surface and the power per unit surface area (irradiance) incident on the surface.

**[Conventions and Terms] Albedo** iss: 3B

For a given spectral interval, albedo is the ratio between the power per unit surface area emitted by a surface and the power per unit surface area incident on the surface.

**[Conventions and Terms] Spectral Radiance at the Top Of Atmosphere** iss: 4

For the VIS/NIR spectral channels the spectral radiance at the Top Of Atmosphere (TOA) is estimated according to the following formula:

\[
L_{\lambda}^{\text{sun}} = \frac{\rho(\lambda) \cdot E_{\lambda}^{\text{sun}} \cdot \cos(\theta_{\text{sun}})}{\pi}
\]

Where

- \( L_{\lambda}^{\text{sun}} \) is the spectral radiance at TOA
- \( \rho(\lambda) \) is the reflectance at TOA
- \( E_{\lambda}^{\text{sun}} \) is the sun extraterrestrial spectral irradiance perpendicular to the direction of propagation. Unless otherwise indicated this is given in Figure 21.
\( \lambda \) is wavelength

\( \theta_{sun} \) is the solar zenith angle

Note: The data needed to generate these plots can be found on the EUMETSAT website (<http://www.eumetsat.int/Home/Main/Satellites/MeteosatThirdGeneration/Resources/index.htm>)

**Figure 32: FCI Reference Solar Spectral Irradiance**

**Conventions and Terms** Radiometric Error iss: 3B

The radiometric error is defined as the difference between the measured effective radiance for a particular radiance sample and the reference effective radiance

\[
\Delta L^\text{eff}[ijkr] = L^\text{eff,m}[ijkr] - L^\text{eff,r}[ijkr]
\]

where

\( \Delta L^\text{eff}[ijkr] \) is the radiometric error

\( L^\text{eff,m}[ijkr] \) is the measured effective radiance

\( L^\text{eff,r}[ijkr] \) is the reference effective radiance

\( i \) and \( j \) identify the spatial sample within a swath/dwell or the pixel within a repeat cycle in terms of column and row

\( k \) is the spectral sample or spectral channel

\( s \) is the swath or dwell of a repeat cycle when considering spatial samples

\( r \) is the repeat cycle
Note: In this definition the measured *effective radiance* is assumed to contain calibration related errors and *radiometric noise* contributions, whereas the reference *effective radiance* is derived using a perfectly characterised reference *spectral response function* viewing a scene, traceable to a radiometric standards (e.g. National Physical Laboratory (UK)), with zero *radiometric noise* contribution.

**[Conventions and Terms] Radiometric Noise iss: 3G**

The *radiometric noise* is the standard deviation of the *radiometric error* associated with a spectral sample surface or a spectral channel respectively, collected during one *repeat cycle*. When expressed in this form the *radiometric noise* is given as *noise equivalent delta radiance* (*NEdL*).

$$\text{NEdL}_{[kr]}^{\text{eff}} = \left( \frac{\sum_{s} \sum_{i} \sum_{j} (\Delta L_{[iks]}^{\text{eff}})^2}{n} - \Delta L_{[kr]}^{\text{eff}} \right)^2$$

$$n = \sum_{s} \sum_{i} \sum_{j} 1$$

where

- $\Delta L_{[iks]}^{\text{eff}}$ is the *radiometric error*
- $\Delta L_{[kr]}^{\text{eff}}$ is the *radiometric accuracy*
- $\text{NEdL}_{[kr]}^{\text{eff}}$ is the *noise equivalent delta radiance*
- $i$ and $j$ identify the *spatial sample* within a *swath/dwell* or the *pixel* within a *repeat cycle* in terms of *column* and *row*
- $k$ is the *spectral sample* or *spectral channel*
- $s$ is the *swath* or *dwell* of a *repeat cycle* when considering *spatial samples*
- $r$ is the *repeat cycle*
- $n$ is the number of *spatial samples* or *pixels* in the *repeat cycle*

For the infrared (IR) *spectral channels*, the *radiometric noise* can be given in terms of *noise equivalent delta temperature* (*NEdT*) associated with a blackbody temperature at which the *NEdT* is computed.

$$\text{NEdT}_{[kr]} = \frac{\text{NEdL}_{[kr]}^{\text{eff}} \cdot n}{\sum_{s} \sum_{i} \sum_{j} \int_{0}^{+\infty} \text{SRF}_{[iks]}^{\text{eff}}(\xi) \frac{\partial B(\xi, T)}{\partial T} d\xi} \approx \frac{\text{NEdL}_{[kr]}^{\text{eff}}}{\partial B(\xi_0, T) / \partial T}$$

where

- $\text{NEdT}_{[kr]}$ is the *noise equivalent delta temperature*
- $\frac{\partial B(\xi, T)}{\partial T}$ is the Planck function derivative in temperature
$SRF_{[ijkr]}(\xi)$ is the reference spectral response function

$\xi_0$ is the spectral channel reference position; central wavelength for the FCI and wavenumber of the spectral channel for the IRS.

For the VIS/NIR spectral channels, the radiometric noise can be given in terms of signal to noise ratio (SNR) associated with a signal at which the SNR is computed.

$$SNR_{[kr]} = \frac{L_{[kr]}^{eff}}{NEdL_{[kr]}^{eff}}$$

$$L_{[kr]}^{eff} = \frac{\sum_{i} \sum_{j} \sum_{l} L_{[ijksr]}^{eff}}{n}$$

where

SNR$_{[kr]}$ is the signal to noise ratio

$L_{[ijkr]}^{eff}$ is the measured effective radiance

Note: Radiometric noise applies to radiometrically calibrated spectra, meaning that the noise induced by radiometric calibration is included.

[Conventions and Terms] 1/f Noise iss: 3B

1/f noise is a non-stationary noise associated with each pixel; when present, this noise causes each pixel to drift with respect to the other pixels on the array in a spatially uncorrelated manner.

1/f noise is the component of the noise power spectral density that falls of according to the formula.

$$NPSD_{[pqkr]}^{1/f} = a \cdot \kappa_p^{m_p} \cdot \kappa_q^{m_q}$$

$m_p \approx -1$

$m_q \approx -1$

where

$NPSD_{[pqkr]}^{1/f}$ is the noise power spectral density 1/f noise component

$a$ is a constant of proportionality for the 1/f noise component

$m_p$ and $m_q$ are constants defining the slope of the 1/f noise in a logarithmic plot in the column and row directions

$\kappa_p$ and $\kappa_q$ are the normalised spatial frequencies in the column and row directions

$p$ and $q$ identify the sample in the spatial frequency domain in the ‘directions’ of column and row respectively
k is the spectral sample or spectral channel
s is the swath or dwell of a repeat cycle {when considering spatial samples}
r is the repeat cycle
See white noise for the derivation of the constants from the noise power spectral density.
Synonyms: Pink noise

Figure 33: Example of 1/f noise and white noise characterisation

[Conventions and Terms] Radiometric Scaling Function iss: 4C
The radiometric scaling function is used to derive radiometric requirements for measurement conditions different from the reference case.

For the IR spectral channels, the radiometric scaling function, applied to radiometric requirements given in equivalent temperature, is given by the equation

\[ R(T^m) = R(T^r) \frac{\partial B(\xi_0, T^r)}{\partial T} \frac{\partial T}{\partial T^m} \]

Where
\( R(T^m) \) and \( R(T^r) \) are the radiometric requirements for the measured and reference temperatures respectively.

\[ \frac{\partial B(\xi_0, T^m)}{\partial T} \quad \text{and} \quad \frac{\partial B(\xi_0, T^r)}{\partial T} \]

are the Planck function derivative in temperature for the measured and reference temperatures respectively.

\( \xi_0 \) is the spectral channel reference position, being central wavelength for the FCI and position given by the wavenumber for the IRS.

\( T^m \) and \( T^r \) are the measured and reference temperatures respectively.

For the FCI IR3.8 spectral channel, the radiometric scaling function, applied to radiometric requirements given in equivalent temperature, is given by the equation:

\[
R(T^m) = R(T^r) \frac{\partial B(\xi_0, T^r)}{\partial T} \left( \frac{\partial B(\xi_0, T^m)}{\partial T} \right) ; \text{ for } T^m \leq T^r
\]

\[
R(T^m) = R(T^r) \left( \frac{\partial B(\xi_0, T^r)}{\partial T} \right) \left( \frac{\partial B(\xi_0, T^m)}{\partial T} \right) ; \text{ for } T^m > T^r
\]

For the VIS/NIR spectral channels, the radiometric scaling function, applied to radiometric requirements given as signal to noise ratio, is given by the equation:

\[
\text{SNR}^m = \text{SNR}^r \left( \frac{\rho^m(\lambda_0) \cos(\theta_{\text{sun}, m})}{\rho^r(\lambda_0) \cos(\theta_{\text{sun}, r})} \right)
\]

Where \( \text{SNR}^m \) and \( \text{SNR}^r \) are the signal to noise ratios for the measured and reference conditions respectively.

\( \rho^m(\lambda_0) \) and \( \rho^r(\lambda_0) \) are the reflectance at the TOA for the measured and reference conditions respectively.

\( \theta_{\text{sun}, m} \) and \( \theta_{\text{sun}, r} \) are the solar zenith angles for the measured and reference conditions respectively.

\( \lambda_0 \) is the central wavelength of the spectral channel.

The radiometric scaling function, applied to radiometric requirements given as a percentage, is given by the equation:

\[
R(L^m) = R(L^r) \frac{\rho^r(\lambda_0) \cos(\theta_{\text{sun}, r})}{\rho^m(\lambda_0) \cos(\theta_{\text{sun}, m})}
\]

Where
\( R(L_m^r) \) and \( R(L_r^m) \) are the radiometric requirement in percent for the measured and reference radiances respectively.

**[Conventions and Terms] Radiometric Resolution iss: 3B**

The radiometric resolution is the minimum radiometric quantization step of an instrument.

**[Conventions and Terms] Noise Equivalent delta Temperature iss: 3B**

See radiometric noise.

Synonyms: noise equivalent differential temperature, noise equivalent temperature

**[Conventions and Terms] Noise Equivalent differential Temperature iss: 3B**

Synonym for noise equivalent delta temperature.

**[Conventions and Terms] Noise Equivalent Temperature iss: 3B**

Synonym for noise equivalent delta temperature.

**[Conventions and Terms] Noise Equivalent delta Radiance iss: 3B**

See radiometric noise.

Synonyms: noise equivalent differential radiance.

**[Conventions and Terms] Noise Equivalent differential Radiance iss: 3B**

Synonym for noise equivalent delta radiance.

**[Conventions and Terms] Signal to Noise Ratio iss: 3B**

See radiometric noise.

**[Conventions and Terms] Radiometric Accuracy iss: 3B**

The radiometric accuracy is the mean radiometric error associated with a spectral sample surface or a spectral channel, collected during a repeat cycle. In terms of effective radiance this is expressed by the equation

\[
\Delta L_{\text{eff}}^{\nu_r} = \frac{\sum_s \sum_i \sum_j \Delta L_{\text{eff}}^{\nu \text{ijk}}}{n}
\]

\( n = \sum_s \sum_i \sum_j 1 \)

Where

\( \Delta L_{\text{eff}}^{\nu_r} \) is the radiometric accuracy expressed as an effective radiance

\( \Delta L_{\text{eff}}^{\nu \text{ijk}} \) is the radiometric error
i and j identify the spatial sample within a swath/dwell or the pixel within a repeat cycle in terms of column and row

k is the spectral sample or spectral channel

s is the swath or dwell of a repeat cycle {when considering spatial samples}

r is the repeat cycle

n is the number of spatial samples or pixels in the image

For the IR spectral channels the radiometric accuracy is measured in terms of a brightness temperature; this can be related to the effective radiance expression by the equation

\[
\Delta T_{[kr]} = \frac{\Delta L_{[kr]}^{\text{eff}}, n}{\sum_{s} \sum_{i} \sum_{j} \int_{0}^{\infty} SRF_{[iksr]}(\xi) \frac{\partial B(\xi, T)}{\partial T} \ d\xi} \approx \frac{\Delta L_{[kr]}^{\text{eff}}}{\partial B(\xi_{0}, T)/\partial T}
\]

where

\(\Delta T_{[kr]}\) is the radiometric accuracy expressed as a brightness temperature

\(\frac{\partial B(\xi, T)}{\partial T}\) is the Planck function derivative in temperature

\(SRF_{[iksr]}(\xi)\) is the reference spectral response function

\(\xi_{0}\) is the spectral channel reference position; central wavelength for the FCI and wavenumber of the spectral channel for the IRS.

For the VIS/NIR spectral channels the radiometric accuracy is expressed as a percentage of the effective radiance when viewing the solar irradiance reflected with a reflectance of \(\rho(\lambda)\) and a solar zenith angle of \(\theta_{s}\); this can be related to the effective radiance expression by the equation

\[
\Delta L_{[kr]}^{\text{sun}} = \frac{\Delta L_{[kr]}^{\text{eff}}, n}{\sum_{s} \sum_{i} \sum_{j} \int_{0}^{\infty} SRF_{[iksr]}(\lambda) \rho(\lambda) E_{\text{sun}}(\lambda) \cos(\theta_{\text{sun}}) d\lambda} \times 100
\]

\(\Delta L_{[kr]}^{\text{sun}}\) is the radiometric accuracy expressed as a percentage of the effective radiance when viewing the solar irradiance reflected with a reflectance of \(\rho(\lambda)\) and a solar zenith angle of \(\theta_{\text{sun}}\).

\(\rho(\lambda)\) is the reflectance at TOA.
\(E_{\text{sun}}(\lambda)\) is the sun extraterrestrial spectral irradiance perpendicular to the direction of propagation given in Figure 21.

\(\lambda\) is wavelength

\(\theta_{\text{sun}}\) is the solar zenith angle

Note: The above definition deviates from the ISO 5725:1998 usage of the term accuracy.

**Conventions and Terms** Radiometric Stability \(\text{iss}: 3G\)

The radiometric stability is the absolute value of the difference between the radiometric accuracy of two different images.

\[
\Delta L_{\text{eff}}^{[k(r_1-r_2)]} = \Delta L_{\text{eff}}^{[kr]} - \Delta L_{\text{eff}}^{[kr_2]}
\]

where

\(\Delta L_{\text{eff}}^{[k(r_1-r_2)]}\) is the radiometric stability

\(\Delta L_{\text{eff}}^{[kr]}\) is the radiometric accuracy

\(k\) is the spectral sample or spectral channel

\(r\) is the repeat cycle

\(r_1\) and \(r_2\) are two different repeat cycles

For the IR spectral channels the radiometric stability is measured in terms of a brightness temperature; this can be related to the effective radiance expression by the equation

\[
\Delta T_{[k(r_1-r_2)]} = \frac{\Delta L_{\text{eff}}^{[k(r_1-r_2)]},2,n}{\sum \sum \sum \int_{-\infty}^{\infty} \left(SRF_{[ij],[rk]},SFR_{[ij],[rk2]}\right) \frac{\partial B(\xi,T)}{\partial T} \, d\xi} \approx \frac{\Delta L_{\text{eff}}^{[k(r_1-r_2)]}}{\partial B(\xi_0,T) / \partial T}
\]

\(n = \sum \sum \sum 1\)

where

\(\Delta T_{[k(r_1-r_2)]}\) is the radiometric stability

\(\frac{\partial B(\xi,T)}{\partial T}\) is the Planck function derivative in temperature

\(SRF_{[ij],[rk]}(\xi)\) is the reference spectral response function

\(i\) and \(j\) identify the spatial sample within a swath/dwell or the pixel within a repeat cycle in terms of column and row

\(s\) is the swath or dwell of a repeat cycle when considering spatial samples
\( \xi \) is the spectral variable

\( \xi \) is the spectral channel reference position; central wavelength for the FCI and wavenumber of the spectral channel for the IRS.

\( n \) is the number of spatial samples or pixels in the image

For the VIS/NIR spectral channels the radiometric stability is expressed as a percentage of the effective radiance when viewing the solar irradiance reflected with a reflectance \( \rho(\lambda) \) and a solar zenith angle of \( \theta_{\text{sun}} \); this can be related to the effective radiance expression by the equation

\[
\frac{\Delta L_{\text{vis/nir}}[\{t_1\rightarrow t_2\}]}{\Delta L_{\text{eff}}[\{t_1\rightarrow t_2\}].\pi.2.n} \cdot 100
\]

where

\( \Delta L_{\text{vis/nir}}[\{t_1\rightarrow t_2\}] \) is the radiometric stability expressed as a percentage of the effective radiance when viewing the solar irradiance reflected with a reflectance \( \rho(\lambda) \) and a solar zenith angle of \( \theta_{\text{sun}} \).

\( \rho(\lambda) \) is the reflectance at TOA

\( E_{\text{sun}}^\lambda(\lambda) \) is the sun extraterrestrial spectral irradiance perpendicular to the direction of propagation given in Figure 21

\( \lambda \) is wavelength

\( \theta_{\text{sun}} \) is the solar zenith angle

[Conventions and Terms] Medium Term Radiometric Stability iss: 4I

For the FCI IR spectral channels the medium term radiometric stability is the radiometric stability between any two images lying in the interval between two calibration cycles. For the FCI VIS/NIR spectral channels the medium term radiometric stability is the radiometric stability evaluated between any two images separated by less than or equal to 24 hours. For the IRS spectral channels the medium term radiometric stability is the radiometric stability evaluated between any two sounding LAC’s or FDC’s separated by less than or equal to 24 hours.

[Conventions and Terms] Long Term Radiometric Stability iss: 3G

The long term radiometric stability is the radiometric stability evaluated between any two images separated by less than or equal to the satellite nominal operational lifetime.
[Conventions and Terms] LI Triggered Event  iss: 3B
A triggered event occurs when the energy registered by a detector element exceeds the LI trigger threshold.

[Conventions and Terms] LI Trigger Threshold  iss: 3B
The trigger threshold is used, at detector element level to discriminate a lightning optical pulse from the background radiance.

[Conventions and Terms] LI background radiance images  iss: 3B
The Background Radiance for each LI detector element in the LI detector array averaged over a given time interval.

[Conventions and Terms] Lightning Event  iss: 3B
A lightning event is defined as a LI triggered event caused by a lightning optical pulse.

Annex F.4.6 Spatial and Temporal

[Conventions and Terms] Field of View  iss: 3B
The field of view (FOV) is the solid angle subtended by some portion of an instrument. The term can be applied to a detector element, a detector array, a focal plane containing multiple detector arrays or the complete instrument.
Note: Usage of the term field of view without a specific reference to the item under consideration is often confusing. Care should be exercised when using this term.

[Conventions and Terms] Spatial Sample  iss: 3B
A spatial sample is a spatial location in the area of coverage at which an instrument returns a measurement.
For the FCI: The spatial sample is associated with a single radiance sample per spectral channel.
For the IRS: The spatial sample is associated with a single radiance sample per spectral sample in the case of a non-resampled spectra, a single radiance sample per spectral channel in the case of a resampled spectra and the mean radiance sample for all spectral samples in the case of an spectral sounding interferogram.
For the LI: The spatial sample is associated with a single radiance sample for the single defined spectral channel.
The spatial sample, identified by the indices (i,j), is spatially located at (x_i,y_j), where this location corresponds to the position of its point spread function centroid.
See also radiance sample.
The Point Spread Function (PSF) is defined as the output signal to input spectral radiant intensity ratio, with the output signal being the effective radiance measured by the instrument when observing a spectrally uniform point source. The PSF is specific to the selected spatial sample or pixel and spectral sample or spectral channel and is a function of the spatial position. The PSF units are m\(^2\).

The PSF can be equivalently defined as integral of IRF

\[
PSF_{ijksr}(x, y) = \int_{0}^{+\infty} IRF_{ijksr}(x, y, \xi) d\xi
\]

where

- \(PSF_{ijksr}(x, y)\) is the point spread function
- \(IRF_{ijksr}(x, y, \xi)\) is the instrument response function
- \(i\) and \(j\) identify the spatial sample within a swath/dwell or the pixel within a repeat cycle in terms of column and row
- \(k\) is the spectral sample or spectral channel
- \(s\) is the swath or dwell of a repeat cycle when considering spatial samples
- \(r\) is the repeat cycle
- \(x\) and \(y\) are the spatial variables
- \(\xi\) is the spectral variable

As a consequence of the above definition, in the special case where the scene is spectrally uniform, the PSF can be used (in place of the IRF) to evaluate the instrument output by the equation:

\[
L_{\text{eff}}^{ijksr} = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} PSF_{ijksr}(x, y).L_{\xi}(x, y) dx dy
\]

where

- \(L_{\text{eff}}^{ijksr}\) is the effective radiance including all the spectral and spatial filtering actions produced by the combined effect of the optical system, the detector and processing up to point of interest.
- \(L_{\xi}(x, y)\) is the spectral radiance of the scene

Another consequence of the definition is the fact that the integral of PSF along the spatial variables is unity.
\[ \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} PSF_{[ik,s]}(x, y) \, dx \, dy = 1 \]

Note: In the definition of PSF the instruments are assumed to be linear.

Annex F.4.7 Geometric

[Conventions and Terms] Image Rectification iss: 3B

Image rectification is the process creating a level 1c image from a level 1b image. The level 1c image has the property that there is a well-defined and invariant relationship between image coordinates (rows and columns) and the Earth location (geodetic latitude and longitude). In order to achieve this transformation the radiance samples associated with the level 1b spatial samples are interpolated from the estimated grid to the reference grid to give radiance samples for each level 1c pixel.

[Conventions and Terms] Image Navigation iss: 3B

Image navigation specifically refers to the knowledge of the relationship between a spatial sample in instrument coordinates and the corresponding point on the earth, given by latitude and longitude coordinates. In general, image navigation refers to the methods employed to obtain that knowledge, whereas image navigation accuracy is a measure of how well that relationship is known. Image navigation is used to derive the verification grid of past spatial sample positions, where means to derive this knowledge are available. When used to derive the position of future spatial samples based on past information the estimated grid is generated.

[Conventions and Terms] Image Registration iss: 3B

Image registration is an indication as to how well image navigation knowledge is maintained and controlled between images separated over time or between different spectral channels or instruments.

[Conventions and Terms] Pixel iss: 3B

A pixel is a precise location on the reference grid at which an instrument returns a measurement. The pixel is constructed from a number of spatial samples that have been interpolated to the given reference grid location during the image rectification process.

The pixel, identified by the indices (i,j), is spatially located at \((x_i, y_j)\).

See also radiance sample.

Note: Like the spatial sample the pixel also possess a point spread function that may extend over a number of SSDs in all directions, i.e. it will not be same as a square of sides SSD in length.
[Conventions and Terms] Actual Site iss: 3B

The actual site (AS) of a spatial sample corresponds to the centroid of the true projection of the spatial sample point spread function on the Earth’s surface at the time of measurement.

Note: The combined actual sites of an image give the actual grid.

[Conventions and Terms] Measured Site iss: 3B

The measured site (MS) of a spatial sample corresponds to the estimate of the spatial sample actual site as derived from the image navigation process and used in the image rectification process or delivered as IDP auxiliary data with the level 1b data.

Note: The combined measured sites of an image give the estimated grid.

[Conventions and Terms] Reference Site iss: 3B

The reference site (RS) is the geographical location of a pixel and corresponds to one of the grid points of the reference grid.

[Conventions and Terms] Corrected Site iss: 3B

The corrected site (CS) is the true geographical location of the centroid of the PSF associated with a pixel. Ideally a corrected site corresponding to each pixel is measureable, but in practice only geographic features such as coast lines, mountains and lakes will be available.

Note: In practice the location of the geographic features will be to sub-SSD accuracy.

[Conventions and Terms] Absolute Sample Position Knowledge Error iss: 3B

The absolute sample position knowledge error (ASPKE) is defined by the equation

\[ ASPKE_{ijklrd} = AS_{ijklrd} - MS_{ijklrd} \]

where

- ASPKE is the absolute sample position knowledge error
- AS is the actual site
- MS is the measured site
- i and j identify the spatial sample in terms of column and row within a swath or dwell
- k is the spectral channel
- s is the swath or dwell of a repeat cycle
- r is the repeat cycle
- d is the direction of evaluation (north/south or east/west)

[Conventions and Terms] Absolute Pixel Position Knowledge Error iss: 3B

The absolute pixel position knowledge error (APPKE) is defined by the equation...
\[ APPKE_{[i,j,k]} = CS_{[i,j,k]} - RS_{[i,j,k]} \]

where

\( APPKE \) is the absolute pixel position knowledge error

\( CS \) is the corrected site

\( RS \) is the reference site

\( i \) and \( j \) identify the pixel in terms of column and row within an repeat cycle

\( k \) is the spectral channel

\( r \) is the repeat cycle

\( d \) is the direction of evaluation (north/south or east/west)

[Conventions and Terms] Coregistration \( iss: 3B \)

Coregistration is used to describe the relative position of the spatial samples or pixels between different spectral channels of an instrument or between instruments. The term can be applied to the spatial or the temporal position of spatial samples or pixels.

[Conventions and Terms] Relative Sample Position Error \( iss: 3B \)

The relative sample position error (RSPE) is defined by the equation

\[ RSPE_{[(k1\rightarrow k2)s(r1\rightarrow r2)d]} = AS_{[i,j,k1s]} - AS_{[i,j,k2s]} \]

where

\( RSPE \) is the relative sample position error

\( AS \) is the actual site

\( i,j \) identify the spatial sample in terms of column and row within a swath or dwell

\( s \) is the swath or dwell

\( k1 \) and \( k2 \) are two spectral channels

\( r1 \) and \( r2 \) are two repeat cycles

\( d \) is the direction of evaluation (north/south or east/west)

The RSPE is assessed between spectral channels for \( r1=r2 \) or repeat cycles for \( k1=k2 \)

[Conventions and Terms] Relative Sample Position Knowledge Error \( iss: 3B \)

The relative sample position knowledge error (RSPKE) is defined by the equation

\[ RSPKE_{[(i,j)\rightarrow (i,j)s(r1\rightarrow r2)d]} = (AS_{[i,j,k1s]} - MS_{[i,j,k1s]}) - (AS_{[i,j,k2s]} - MS_{[i,j,k2s]}) \]

where

\( RSPKE \) is the relative sample position knowledge error
AS is the actual site
MS is the measured site

\(i, j, s\) identify the spatial sample in terms of column, row and swath or dwell for spectral channel \(k1\) and repeat cycle \(r1\)

\(s\) is the swath or dwell of spectral channel \(k1\) and repeat cycle \(r1\)

\(i', j', s'\) identify the spatial sample in terms of column, row and swath or dwell for spectral channel \(k2\) and repeat cycle \(r2\) that lies closest in terms of the measured site position to spatial sample \((i,j,s)\) of spectral channel \(k1\) and repeat cycle \(r1\)

\(k1\) and \(k2\) are two spectral channels

\(r1\) and \(r2\) are two repeat cycles

\(d\) is the direction of evaluation (north/south or east/west)

The RSPKE is assessed by the process of image registration between spectral channels for \(r1=r2\) or repeat cycles for \(k1=k2\)

Synonyms: misregistration, coregistration

Note: RSPKE is only given for spectral channels of identical spatial sampling distance.

[Conventions and Terms] Relative Pixel Position Knowledge Error iss: 3G

The relative pixel position knowledge error (RPPKE) is defined by the equation

\[
RPPKE_{\left[ \left( \left( i, j, k \right) \left( r, t \right) \left( d \right) \right) \right]} = \left( CS_{\left[ \left( i, j, k \right) \left( r, t \right) \left( d \right) \right]} - RS_{\left[ \left( i', j', k \right) \left( r, t \right) \left( d \right) \right]} \right) - \left( CS_{\left[ \left( i, j, k \right) \left( r', t \right) \left( d \right) \right]} - RS_{\left[ \left( i', j', k \right) \left( r', t \right) \left( d \right) \right]} \right)
\]

where

- \(RPPKE\) is the relative pixel position knowledge error
- \(CS\) is the corrected site
- \(i\) and \(j\) identify the pixel or pixel group in terms of column and row within a repeat cycle
- \(k1\) and \(k1\) are two spectral channels
- \(r1\) and \(r2\) are two repeat cycles
- \(d\) is the direction of evaluation (north/south or east/west)

The RPPKE is assessed by the process of image registration between spectral channels for \(r1=r2\) or repeat cycles for \(k1=k2\)

When the RPPKE between spectral channels with differing spatial sampling distance is required:

A group of \(p^2\) of the finer resolution spectral channel pixels centred on a coarse resolution pixel is taken as a pixel group. Each fine resolution pixel group is identified by the indices \((i,j)\) of the coarse resolution pixel.
\[ p = \frac{SSD_{\text{coarse}}}{SSD_{\text{fine}}} \]

where

- \( SSD_{\text{coarse}} \) is the coarse resolution spatial sampling distance
- \( SSD_{\text{fine}} \) is the fine resolution spatial sampling distance

The reference site for the fine resolution pixel group is the mean reference site of the fine resolution pixels. Due to the properties of the reference grid this means that the fine resolution pixel group and coarse resolution pixel are located at the same position. Likewise the corrected site for the fine resolution pixel group is the mean corrected site of the fine resolution pixels.

Synonyms: misregistration, coregistration
Annex F.4.8 Restricted Operations

[Econventions and Terms] Eclipse iss: 3B

Eclipse is defined as when the solar disk is occulted by the Earth or Moon, as viewed from the MTG satellite. An eclipse can be total or partial.

The eclipse start is the time at which the sun starts to be occulted by the Earth or moon.

The maximum depth of an eclipse occurs at the time when the sun centre crosses the plane containing the satellite and Earth (or moon) centre lying perpendicular to the sun’s direction of relative motion in satellite centred reference frame with the x axis pointing to the Earth (or moon) centre.

The solar restricted zones are applicable for the uneclipsed and partially eclipsed sun. It is defined to allow graded relaxation of requirements for spatial samples and pixels located close to the sun.
Figure 36: Illustration of Solar Restricted Zones including orbit inclination

Annex F.5 Coordinates Frame Conventions

Annex F.5.4 Body Frame Specifications

Annex F.5.4.1 MTG Satellite Coordinate Frames
Annex F.5.4.2 Local Orbital Frame

[Conventions and Terms] Local Orbital Frame (LVLH) iss: 3B
‘LVLH’ stands for ‘Local Vertical Local Horizontal’.

\[
\hat{z} = -\frac{\vec{z}}{||\vec{z}||}
\]

Figure 38: Local Orbital LVLH frame

[Conventions and Terms] Local Orbital Frame (T,N,W) iss: 3B
In ‘TNW’, T stands for tangential, N for normal, and W for the Greek omega (\(\omega\)) denoting the axis of angular momentum.

\[
\vec{n} = \vec{W} \times \vec{I}
\]

\[
\hat{i} = \frac{\vec{F}}{||\vec{F}||}
\]

Figure 39: Local Orbital TNW frame

[Conventions and Terms] Local Orbital Frame (Q,S,W) iss: 3B
Also named RTN (Radial, Transverse, Normal).
Annex F.5.6 Coordinate System Transformations

[Conventions and Terms] Normalized Geostationary Projection iss: 5A

The normalized geostationary projection describes the view from a virtual satellite to an idealized Earth. Herein, the virtual satellite is in a geostationary orbit, perfectly located in the Equator plane at the given longitude, $\lambda_D$. The distance between spacecraft and centre of Earth is given by the geostationary radius and the idealized Earth by the Earth’s reference ellipsoid.

In the following a short description of the theoretical background is provided:

Two cartesian coordinate frames are introduced. $(e_1,e_2,e_3)$ has its origin in the centre of the earth. $(e_3)$ points in the northern direction, $(e_1)$ points towards the Greenwich meridian. $(s_1,s_2,s_3)$ has its origin at the satellite position. Again $(s_3)$ points northwards, and $(s_1)$ directs to the centre of the earth. Figure 30 visualizes this situation and identifies several angles and lengths used in the following.

The vector $r_e$ points from the centre of the earth to a point P on the earth’s surface. Thus, $\lambda_e$ is the longitude and $\phi_e$ is the geocentric latitude describing the point P.

The transformation from geographical coordinates $(\text{lon}, \text{lat})$ to geocentric latitude and geocentric longitude is as follows:

$$\lambda_e = \text{lon}$$
$$\phi_e = \arctan\left(\frac{r_{pol}^2}{r_{eq}} \cdot \frac{\tan(\text{lat})}{1}\right)$$

Where

$r_{pol}$ is the earth’s polar radius
\( r_{eq} \) is the earth’s equatorial radius

**Forwards Projection:**

The cartesian components of the vector \( r_s \) (in the satellite coordinate frame) result as follows:

\[
\begin{bmatrix}
    r_1 \\
    r_2 \\
    r_3
\end{bmatrix} =
\begin{bmatrix}
    h - r_e \cdot \cos(\phi_e) \cdot \cos(\lambda_e - \lambda_0) \\
    -r_e \cdot \cos(\phi_e) \cdot \sin(\lambda_e - \lambda_0) \\
    r_e \cdot \sin(\phi_e)
\end{bmatrix}
\]

Where

\( h \) is the geostationary radius

\( r_s \) is distance from the centre of the Earth to the point P on the earth's surface

\[
\begin{align*}
    r_s &= \frac{r_{pol}}{\sqrt{1 + \frac{r_{eq}^2 - r_{pol}^2}{r_{eq}^2} \cos^2(\phi_e)}} \\
    &\text{From the above equations the satellite scanning angles can be derived:}
\end{align*}
\]

\[
\begin{align*}
    \lambda_s &= \arctan\left(\frac{r_2}{r_1}\right) \\
    \phi_s &= \arcsin\left(\frac{r_3}{\sqrt{r_1^2 + r_2^2 + r_3^2}}\right)
\end{align*}
\]

---

Where

\( \lambda_s \) is the E-W scanning angle, but does not correspond to the standard definition of azimuth, for an observation from the instrument perspective, that runs from negative to positive in a clockwise sense. Instead \( \lambda_s \) but runs from negative to positive in an anti-clockwise sense. Thus pixels at the western side of the Earth have a lower index and a higher value of \( \lambda_s \) than those on the eastern side of the Earth.

\( \phi_s \) is the N-S scanning angle and corresponds to the standard definition of elevation, for an observation from the instrument perspective.

**Inverse Projection:**

The inverse transformation can be used to convert from scanning angles \((\lambda_s, \phi_s)\) to geographical coordinates. This can be performed as follows:
\[
\begin{pmatrix}
\text{lon} \\
\text{lat}
\end{pmatrix} = \begin{pmatrix}
\arctan \left( \frac{s_2}{s_1} + \lambda_D \right) \\
\arctan \left( \frac{s_4}{s_3} \right)
\end{pmatrix}
\]

Where:

\[
s_1 = h \cdot s_n \cdot \cos(\lambda_s) \cdot \cos(\phi_s)
\]
\[
s_2 = -s_n \cdot \sin(\lambda_s) \cdot \cos(\phi_s)
\]
\[
s_3 = s_n \cdot \sin(\phi_s)
\]
\[
s_4 = \frac{r_{eq}^2}{r_{pol}^2}
\]
\[
s_5 = \sqrt{h^2 - r_{eq}^2}
\]
\[
s_{xy} = \sqrt{s_1^2 + s_2^2}
\]
\[
s_n = \frac{h \cdot \cos(\lambda_s) \cdot \cos(\phi_s) - s_d}{\cos^2(\phi_s) + s_4 \cdot \sin^2(\phi_s)}
\]
\[
s_d = \sqrt{(h \cdot \cos(\lambda_s) \cdot \cos(\phi_s))^2 - (\cos^2(\phi_s) + s_4 \cdot \sin^2(\phi_s)) \cdot s_5}
\]

**Scaling Function**

The scaling function provides a linear relation between the intermediate coordinates or scanning angles \((\lambda_s, \phi_s)\), now written \((x, y)\), and the image coordinates \((c, r)\).

The definition is as follows:

\[
c = (x_0 - x) / x\_scale + 1
\]
\[
r = (y - y_0) / y\_scale + 1
\]

Where:

\- **r** and **c** are the row and column respectively in the reference grid. Note that the first row, column of the reference grid is indexed 1,1.

\- **x_0** and **y_0** gives the angle from the origin of the projection (the direction \(s_1\)) to the centre of the pixel in the first row and column of the reference grid.

\- \(x\_scale\) and \(y\_scale\) are the reference grid spatial sampling angles, representing scan angle increments between pixels in the W-E and S-N directions respectively.

Note: All trigonometric functions assume angles in degree.
Annex F.6 System Parameter and Model Conventions

Annex F.6.1 Orbit and Attitude Parameters and Models
Figure 42: Classical Keplerian Orbit orientation angles

[Conventions and Terms] Geostationary Radius iss: 3B

The geostationary radius is the distance from the Earth’s centre to the satellite in geostationary orbit and can be calculated from the sum of the geostationary altitude and the equatorial Earth radius, in turn derived from the Earth’s reference ellipsoid.

[Conventions and Terms] Geostationary Altitude iss: 3B

The geostationary altitude (35786.4 km) is the distance from the satellite in geostationary orbit to the sub-satellite point.

Annex F.6.2 Earth related Parameters and Models

[Conventions and Terms] Geographical Coordinates iss: 3B

Geographical co-ordinates give a location on earth as determined by geographical longitude (lon) and geographical latitude (lat). Both co-ordinates are specified in degree.

The geographical longitude is counted eastwards positive, beginning at the Greenwich meridian. The permitted range is -180.0 ... +180.0. The geographical latitude is counted from -90.0 (south pole) through 0.0 (equator) until +90.0 (north pole).

Figure 32 shows the situation for a spherical model of the earth.
Figure 43: Geographical Coordinates

[Conventions and Terms] Geodetic position iss: 4G

The geodetic coordinates of a point are defined with respect to a given reference surface of the Earth (Earth’s Reference Ellipsoid). The normal projection of a point onto the local horizontal plane defines the geodetic longitude $\lambda$, latitude $\phi$ and the height $h$ (see figure below).

![Geographical Coordinates Diagram](image)

Figure 44: Geocentric and geodetic latitude

[Conventions and Terms] Geodetic latitude iss: 5A

The geodetic latitude $\phi$ differs from the geocentric latitude $\phi'$ (see figure above) and are related by the expression:

$$\tan \phi = \frac{1}{(1-f)^2} \tan \phi'$$

[Conventions and Terms] Geocentric latitude iss: 5A

The geocentric latitude is defined, with reference to Figure 33, as the angle, $\phi'$, between the equatorial plane and the radius from the centre or the earth to a point on the surface. See also geographical coordinates, geodetic latitude.

Annex F.8 Date and Time Conventions

Annex F.8.1 Time Reference Systems
The following figure provides an overview of the differences between the most relevant time scales described in references [RD2] and [RD5]:

![Figure 45: Differences between Relevant Time Scales between 1950 and 2020](image)
## Annex DGlossary

The following table lists definitions for all acronyms used in this document. It is a subset of the "MTG Glossary" document.

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full name</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD</td>
<td>Applicable Document</td>
</tr>
<tr>
<td>AEG</td>
<td>Application Expert Group</td>
</tr>
<tr>
<td>AND</td>
<td>Alphanumeric Display</td>
</tr>
<tr>
<td>APPKE</td>
<td>Absolute Pixel Position Knowledge Error</td>
</tr>
<tr>
<td>ARGOS</td>
<td>Advanced Research and Global Observation Satellite</td>
</tr>
<tr>
<td>ASMET</td>
<td>African Satellite Meteorology Education and Training</td>
</tr>
<tr>
<td>ASPKE</td>
<td>Absolute Sample Position Knowledge Error</td>
</tr>
<tr>
<td>CAL</td>
<td>Calibration</td>
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<tr>
<td>CDOP</td>
<td>Continuous Development and Operational Phase</td>
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<tr>
<td>CGMS</td>
<td>Coordination Group for Meteorological Satellites</td>
</tr>
<tr>
<td>CNES</td>
<td>Centre National d'Etudes Spatiales (French Space Agency)</td>
</tr>
<tr>
<td>COSPAS</td>
<td>Cosmicheska Sisteyma Polska Avaritich Sudov (Space System for the Search of Vessels in Distress)</td>
</tr>
<tr>
<td>DCP</td>
<td>Data Collection Platforms</td>
</tr>
<tr>
<td>DCS</td>
<td>Data Collection System</td>
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<tr>
<td>DE</td>
<td>Detection Efficiency</td>
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<tr>
<td>DWD</td>
<td>Deutscher WetterDienst</td>
</tr>
<tr>
<td>E/W</td>
<td>East/West</td>
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<tr>
<td>EC</td>
<td>European Commission</td>
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<tr>
<td>ECMWF</td>
<td>European Centre for Medium Range Weather Forecasting</td>
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<tr>
<td>EO</td>
<td>Earth Observation</td>
</tr>
<tr>
<td>EOP</td>
<td>Earth Observation Portal</td>
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<tr>
<td>EPS</td>
<td>EUMETSAT Polar System</td>
</tr>
<tr>
<td>ESA</td>
<td>European Space Agency</td>
</tr>
<tr>
<td>EUMETCAL</td>
<td>The European Virtual Organisation for Meteorological Training</td>
</tr>
<tr>
<td>EUMETSAT</td>
<td>European Organisation for the Exploitation of Meteorological Satellites</td>
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<tr>
<td>FAR</td>
<td>False Alarm Rate</td>
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<td>FRA</td>
<td>Final Acceptance Review</td>
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<tr>
<td>FRA</td>
<td>Flight Acceptance Review</td>
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<tr>
<td>FCI</td>
<td>Flexible Combined Imagery Mission</td>
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<tr>
<td>FDC</td>
<td>Full Disc Coverage</td>
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<tr>
<td>FDHSI</td>
<td>Full Disc High Resolution Imagery Mission</td>
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<tr>
<td>FDSS</td>
<td>Full Disc Scanning Service</td>
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<tr>
<td>FG</td>
<td>Fixed Gain</td>
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<tr>
<td>FCC</td>
<td>Full Operational Capability</td>
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<td>FSD</td>
<td>Foreign Satellite Data</td>
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<td>FTS</td>
<td>Fourier Transform Spectrometer</td>
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<td>GEO</td>
<td>Geostationary Orbit</td>
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<td>GEO</td>
<td>Group on Earth Observations</td>
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<td>GEONETCast</td>
<td>global network of satellite based data dissemination systems</td>
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<tr>
<td>GEOCMET</td>
<td>Geostationary Search and Rescue mission</td>
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<td>GIFTS</td>
<td>Geosynchronous Imaging Fourier Transform Spectrometer</td>
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<td>GMES</td>
<td>Global Monitoring for Environment and Security</td>
</tr>
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<td>GTS</td>
<td>Global Telecommunication System</td>
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<tr>
<td>HQ</td>
<td>Headquarter</td>
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<tr>
<td>HRFI</td>
<td>High Resolution Fast Imagery mission</td>
</tr>
<tr>
<td>HRV</td>
<td>High Resolution Visible</td>
</tr>
<tr>
<td>IASI</td>
<td>Infrared Atmospheric Sounding Interferometer</td>
</tr>
<tr>
<td>IDS</td>
<td>International Data Collection System</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full name</td>
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<td>---------</td>
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<tr>
<td>IODC</td>
<td>Indian Ocean Data Coverage</td>
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<td>IR</td>
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<td>IRS</td>
<td>Infrared Sounding Mission</td>
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<td>LI</td>
<td>Lightning Imagery Mission</td>
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<td>Long Wave Infra Red</td>
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<td>MOD</td>
<td>Meteorological Data Distribution</td>
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<td>MHz</td>
<td>MegaHertz</td>
</tr>
<tr>
<td>MiST</td>
<td>MTG IRS Science Team</td>
</tr>
<tr>
<td>MOSS</td>
<td>Meteosat Operation Service Specification</td>
</tr>
<tr>
<td>MSG</td>
<td>Meteosat Second Generation</td>
</tr>
<tr>
<td>MTG</td>
<td>Meteosat Third Generation</td>
</tr>
<tr>
<td>MTP</td>
<td>Meteosat Transition Program</td>
</tr>
<tr>
<td>MWIR</td>
<td>Medium Wave Infra Red</td>
</tr>
<tr>
<td>N/A</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>N/S</td>
<td>North/South</td>
</tr>
<tr>
<td>NEdT</td>
<td>Noise Equivalent Differential Temperature</td>
</tr>
<tr>
<td>NGA</td>
<td>National Geospatial Agency</td>
</tr>
<tr>
<td>NIR</td>
<td>Near-Infrared</td>
</tr>
<tr>
<td>NMS</td>
<td>National Meteorological Services</td>
</tr>
<tr>
<td>NWS</td>
<td>National Weather Service</td>
</tr>
<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
</tr>
<tr>
<td>NWP</td>
<td>Numerical Weather Prediction</td>
</tr>
<tr>
<td>OZA</td>
<td>Observation Zenith Angle</td>
</tr>
<tr>
<td>PC</td>
<td>Principal Components</td>
</tr>
<tr>
<td>PPP</td>
<td>Preparatory Programme Proposal</td>
</tr>
<tr>
<td>PRR</td>
<td>Preliminary Requirements Review</td>
</tr>
<tr>
<td>RMDCN</td>
<td>Regional Meteorological Data Communication Network</td>
</tr>
<tr>
<td>RPPKE</td>
<td>Relative Pixel Position Knowledge Error</td>
</tr>
<tr>
<td>RSE</td>
<td>Remote Sensing Expert</td>
</tr>
<tr>
<td>RSPPE</td>
<td>Relative Sample Position Error</td>
</tr>
<tr>
<td>RSPPKPE</td>
<td>Relative Sample Position Knowledge Error</td>
</tr>
<tr>
<td>RSS</td>
<td>Rapid Scanning Service</td>
</tr>
<tr>
<td>SAF</td>
<td>Satellite Application Facilities</td>
</tr>
<tr>
<td>SAR (or S&amp;R)</td>
<td>Search and Rescue</td>
</tr>
<tr>
<td>SARSAT</td>
<td>Search and Rescue Satellite - Aided Tracking</td>
</tr>
<tr>
<td>SEVIRI</td>
<td>Spinning Enhanced Visible and Infrared Imager</td>
</tr>
<tr>
<td>SNR</td>
<td>Signal to Noise Ratio</td>
</tr>
<tr>
<td>SRF</td>
<td>Spectral Response Function</td>
</tr>
<tr>
<td>SRR</td>
<td>System Requirement Review</td>
</tr>
<tr>
<td>SSD</td>
<td>Spatial Sampling Distance</td>
</tr>
<tr>
<td>SSI</td>
<td>Spectral Sampling Interval</td>
</tr>
<tr>
<td>SSP</td>
<td>Sub-Satellite Point (Nadir)</td>
</tr>
<tr>
<td>STG</td>
<td>Scientific and Technical Group</td>
</tr>
<tr>
<td>TBC</td>
<td>To Be Confirmed</td>
</tr>
<tr>
<td>TBD</td>
<td>To Be Defined/Determined</td>
</tr>
<tr>
<td>TBW</td>
<td>To Be Written</td>
</tr>
<tr>
<td>TIR</td>
<td>Thermal Infrared</td>
</tr>
<tr>
<td>TOA</td>
<td>Top of the Atmosphere</td>
</tr>
<tr>
<td>UMARF</td>
<td>Unified Meteorological Archive and Retrieval Facility</td>
</tr>
<tr>
<td>UNS</td>
<td>User Notification Service</td>
</tr>
<tr>
<td>UTC</td>
<td>Universal Time Coordinated</td>
</tr>
<tr>
<td>UV</td>
<td>Ultra-violet</td>
</tr>
<tr>
<td>UVN</td>
<td>Ultraviolet, Visible and Near-infrared</td>
</tr>
<tr>
<td>UVN</td>
<td>UV-VIS and NIR spectrometer/instrument</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full name</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>VIS</td>
<td>Visible</td>
</tr>
<tr>
<td>WIS</td>
<td>WMO Information System</td>
</tr>
<tr>
<td>WMO</td>
<td>World Meteorological Organisation</td>
</tr>
</tbody>
</table>
Annex E List of TBCs / TBDs

List of TBC:

- Satellite yaw-flip leading to re-orientation of the satellite attitude and consequently to an interruption of the mission. This occurs twice a year and with the outage lasting up to half a day [TBC 1] each time.

List of TBD:

No table of figures entries found.

[This document was created from DOORS Module: /ProgPrep/MTG/Users/EURD; Module version: 3.0 (D Draft)]
# Annex F Requirement modifications

## F.1 Evolution between version 3C (programme proposal) and 4 (for STG-SWG/OPSWG sept 2018)

### Comparison between successive versions and change justification

<table>
<thead>
<tr>
<th>ID</th>
<th>[EURD v3C requirement]</th>
<th>[EURD v4 requirement]</th>
<th>Category/Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCI-02040</td>
<td>Note 3: The operational practice for FDSS and RSS supported by a single satellite (based on FDC interleaved with LAC) is that the acquisition start times for FDC are around HH:00, HH:15, HH:30, HH:45 and the acquisition start times for LAC are around HH:10, HH:12.5, HH:25, HH:27.5, HH:40, HH:42.5, HH:55, HH:57.5, etc where HH represents the hours in UTC, as shown in Figure 3.</td>
<td>Note 3: The capability to support simultaneously the FDSS and RSS service using a single satellite is verified during MTG-I1 commissioning and data samples collected during this test. The potential use during routine operations depends on experience in orbit and recommendation of the OPS-WG. The reference scenario (based on FDC interleaved with LAC) is that the acquisition start times for FDC are around HH:00, HH:15, HH:30, HH:45 and the acquisition start times for LAC are around HH:10, HH:12.5, HH:25, HH:27.5, HH:40, HH:42.5, HH:55, HH:57.5, etc. where HH represents the hours in UTC, as shown in Figure 3.</td>
<td>Note Update: Clarification of note to remove ambiguity between baseline and potential evolution tested during commissioning.</td>
</tr>
<tr>
<td>FCI-02055</td>
<td>Note: The implementation of the goal LAC zone 4 coverage might have technical implications making it impossible to scan the LAC zone 4 area in 2.5 minutes. With a reduction to 3.3 minutes, the LAC area could be enlarged to cover 1/3 of the FDC, i.e. north of 20°N</td>
<td>Note deleted</td>
<td>Note Update: Removal of note, as FDC/4 scan pattern covered the required area</td>
</tr>
<tr>
<td>FCI-02230</td>
<td>None</td>
<td>The <strong>FCI modulation transfer function (MTF)</strong> for each spatial sample shall:</td>
<td>Mission performance clarification related to the Modulation Transfer Function (MTF)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• For the <strong>spectral channels VIS 0.6</strong>, <strong>NIR 2.2</strong>, <strong>IR 3.8</strong> and <strong>IR 10.5</strong> when delivered in the <strong>HRFI</strong> sampling configuration comply with the values defined in Figure 6.</td>
<td></td>
</tr>
</tbody>
</table>

---

Note: The implementation of the goal LAC zone 4 coverage might have technical implications making it impossible to scan the LAC zone 4 area in 2.5 minutes. With a reduction to 3.3 minutes, the LAC area could be enlarged to cover 1/3 of the FDC, i.e. north of 20°N.
<table>
<thead>
<tr>
<th>ID</th>
<th>[EURD v3C requirement]</th>
<th>[EURD] v4 requirement</th>
<th>Category/Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• For the spectral channels when delivered in the FDHSI sampling configuration comply with the values defined in Figure 5.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Note 1: The aim of the MTF inner template at the point at which the analogue signal is converted to a digital signal is to maximise the sub-Nyquist MTF.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Note 2: On-board and/or on-ground digital processing can be applied to achieve the MTF outer template, in order to minimise the super Nyquist MTF, i.e. minimise alias noise, at the specified SSD.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
|    | Note 3: Digital OTF manipulation applied to meet the inter channel co-registration accuracy and N/S to E/W MTF similarity requirements is allowed provided that the resulting MTF complies with the MTF templates and radiometric requirements are met."
<table>
<thead>
<tr>
<th>ID</th>
<th>[EURD v3C requirement]</th>
<th>[EURD v4 requirement]</th>
<th>Category/Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normalised Spatial Frequency, $\kappa$</td>
<td>Inner MTF Template</td>
<td>Outer MTF Template</td>
</tr>
<tr>
<td>0</td>
<td>0.95</td>
<td>1.05</td>
<td></td>
</tr>
<tr>
<td>0.42</td>
<td>0.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;0.42</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.54</td>
<td></td>
<td>1.05</td>
<td></td>
</tr>
<tr>
<td>0.54 $&lt; \kappa \leq 0.85$</td>
<td></td>
<td>0.15/($\kappa/0.54)^4$</td>
<td></td>
</tr>
<tr>
<td>0.85 $&lt; \kappa \leq 4$</td>
<td>(for SSD=1km)</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>0.85 $&lt; \kappa \leq 8$</td>
<td>(for SSD=2km)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(goal)</td>
<td>0.85 $&lt; \kappa \leq 4$</td>
<td>(for SSD=1km)</td>
<td>0.15/($\kappa/0.54)^4$</td>
</tr>
<tr>
<td></td>
<td>0.85 $&lt; \kappa \leq 8$</td>
<td>(for SSD=2km)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 5: MTF Template for FDHSI sampling configuration
<table>
<thead>
<tr>
<th>ID</th>
<th>[EURD v3C requirement]</th>
<th>[EURD] v4 requirement</th>
<th>Category/Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normalised Spatial Frequency, $\kappa$</td>
<td>Inner Template MTF</td>
<td>Outer Template MTF</td>
</tr>
<tr>
<td>0</td>
<td>0.95</td>
<td>1.05</td>
<td></td>
</tr>
<tr>
<td>0.42</td>
<td>0.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;0.42</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.54</td>
<td></td>
<td>1.05</td>
<td></td>
</tr>
<tr>
<td>0.54&lt;\kappa&lt;0.85</td>
<td></td>
<td>0.3/(\kappa/0.54)^4</td>
<td></td>
</tr>
<tr>
<td>0.85&lt;\kappa&lt;2 (SSD=0.5km)</td>
<td></td>
<td></td>
<td>0.05</td>
</tr>
<tr>
<td>0.85&lt;\kappa&lt;4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The absolute value of the FCI relative pixel position knowledge error (RPPKE) between two spectral channels when evaluated over all pixels between two FDC or LAC images taken in the same repeat cycle shall be:

a) For the spectral channels as specified in Table 5 at a 68.26% confidence level, when delivered in the HRFI sampling configuration.

b) For the spectral channels as specified in Table 6 at a 68.26% confidence level, when delivered in the FDHSI sampling configuration.

<table>
<thead>
<tr>
<th>VIS</th>
<th>NIR</th>
<th>TIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIS</td>
<td>&lt;0.25 km (TBC)</td>
<td>&lt;1.00 km</td>
</tr>
<tr>
<td>NIR</td>
<td>&lt;1.00 km</td>
<td></td>
</tr>
<tr>
<td>TIR</td>
<td>&lt;0.5 km (TBC)</td>
<td></td>
</tr>
</tbody>
</table>

Table 5: FCI HRFI Relative Pixel Position Knowledge Error between Spectral channels (at SSP)

The absolute value of the FCI relative pixel position knowledge error (RPPKE) between two spectral channels when evaluated over all pixels between two FDC or LAC images taken in the same repeat cycle shall be:

a) For the spectral channels as specified in Table 5 at a 68.26% confidence level, when delivered in the HRFI sampling configuration.

b) For the spectral channels as specified in Table 6 at a 68.26% confidence level, when delivered in the FDHSI sampling configuration.

<table>
<thead>
<tr>
<th>VIS</th>
<th>NIR</th>
<th>TIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIS</td>
<td>&lt;0.30 km</td>
<td>&lt;1.00 km</td>
</tr>
<tr>
<td>NIR</td>
<td>&lt;1.00 km</td>
<td></td>
</tr>
<tr>
<td>TIR</td>
<td>&lt;0.68 km</td>
<td></td>
</tr>
</tbody>
</table>

Table 6: FCI FDHSI Relative Pixel Position Knowledge Error between Spectral channels (at SSP)

Mission performance clarification:
Removal of TBCs following alignment of the [EURD] requirement with the space segment specification.
### Error between Spectral channels (at SSP)

<table>
<thead>
<tr>
<th>ID</th>
<th>[EURD v3C requirement]</th>
<th>[EURD] v4 requirement</th>
<th>Category/Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Error</td>
<td>Error</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>VIS</th>
<th>NIR</th>
<th>TIR</th>
<th>WV</th>
<th>O3</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIS</td>
<td>&lt;0.20 km (TBC)</td>
<td>&lt;0.20 km (TBC)</td>
<td>&lt;1.00 km</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NIR</td>
<td>&lt;0.20 km (TBC)</td>
<td>&lt;1.00 km</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIR</td>
<td>&lt;0.15 km (TBC)</td>
<td>&lt;0.60 km (TBC)</td>
<td>&lt;0.30 km (TBC)</td>
<td>&lt;0.30 km (TBC)</td>
<td>&lt;0.40 km (TBC)</td>
<td>&lt;0.32 km (TBC)</td>
</tr>
<tr>
<td>WV</td>
<td>&lt;0.75 km (TBC)</td>
<td>&lt;0.40 km (TBC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O3</td>
<td>&lt;0.75 km (TBC)</td>
<td>&lt;0.40 km (TBC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>&lt;0.75 km (TBC)</td>
<td>&lt;0.40 km (TBC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**FCI-02340**  
It shall be possible to rectify FCI images from a satellite to any longitude within +/- 10° (TBC) from the sub-satellite point of that satellite according to a reference grid and projection defined according to [CGMS_GS]  
Note: The operational practice is to rectify at 0° if the satellite is located close to 0°.

**IRS-04020**  
The IRS shall cover the spectral domain from 680 - 2250 cm⁻¹ in two spectral bands; a long wave infrared (LWIR) and a medium wave infrared (MWIR) spectral band with the characteristics provided in Table 7.

**Mission performance clarification related to spectral channel interval**

**Scope unchanged.**  
Removal of TBC and replacement of [CGMS_GS] with [CONV]

**Table 7: Infra-Red Sounder (IRS) Spectral Bands**

<table>
<thead>
<tr>
<th>Spectral</th>
<th>Status</th>
<th>Wavenum</th>
<th>Spectral Channel</th>
<th>Spatial Sampling</th>
</tr>
</thead>
</table>

---

*Note: The operational practice is to rectify at 0° if the satellite is located close to 0°.*
## Table 8: IRS coverage versus repeat cycle duration

<table>
<thead>
<tr>
<th>Coverage</th>
<th>Repeat cycle duration</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDC = 17.70° diameter circle centred at SSP</td>
<td>N/A</td>
<td>Indicates the maximum coverage achievable by combining 4 LACs</td>
</tr>
<tr>
<td>LAC = FDC/4</td>
<td>15 minutes</td>
<td></td>
</tr>
</tbody>
</table>

### IRS-04040

The IRS shall generate a dataset covering a subset of the full earth disc (called local area coverage (LAC)) with the repeat cycle duration and coverage as specified in Table 8.

The IRS shall generate a dataset covering a subset of the full earth disc (called local area coverage (LAC)) with the repeat cycle duration and coverage as specified in Table 8.

**Mission performance clarification related to the full disk coverage and scanning pattern**

<table>
<thead>
<tr>
<th>Coverage</th>
<th>Repeat cycle duration</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDC = 17.70° diameter circle centred at SSP</td>
<td>N/A</td>
<td>The FDC coverage is the result of the combination of LAC 1, 2, 3, and 4. Restriction of coverage to 16.80° diameter circle centred at SSP for LAC 1, 2, and 3 is acceptable.</td>
</tr>
<tr>
<td>LAC = FDC/4</td>
<td>15 minutes</td>
<td></td>
</tr>
</tbody>
</table>
Note 1: The operational practice is to have only sequences of quarter of disc scanning, with the complete sequence repeated every 6 hours according to the following patterns: 5 times (zone3 + zone4) followed by 4 times (zone2 + zone4) followed by 3 times (zone1 + zone4) as shown in Figure 5.

Note 2: The operational practice is to have only sequences of quarter of disc scanning, with the complete sequence repeated every 6 hours according to the following patterns: 3 times (LAC3 + LAC4) followed by 3 times (LAC2 + LAC4) followed by 3 times again (LAC3 + LAC4) and ultimately 3 times (LAC1 + LAC4) as shown in Figure 5.

<table>
<thead>
<tr>
<th>ID</th>
<th><strong>[EURD v3C requirement]</strong></th>
<th><strong>[EURD] v4 requirement</strong></th>
<th>Category/Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Note 1: The reference pattern for satellite commissioning consists in sequences of quarter of disc scanning, with the complete sequence repeated every 6 hours according to the following patterns: 5 times (zone3 + zone4) followed by 4 times (zone2 + zone4) followed by 3 times (zone1 + zone4)</td>
<td>Note 1: The reference pattern for satellite commissioning consists in sequences of quarter of disc scanning, with the complete sequence repeated every 6 hours according to the following patterns: 5 times (zone3 + zone4) followed by 4 times (zone2 + zone4) followed by 3 times (zone1 + zone4)</td>
<td></td>
</tr>
</tbody>
</table>

*Figure 5: Operational practice for IRS scanning pattern*
<table>
<thead>
<tr>
<th>ID</th>
<th>[EURD v3C requirement]</th>
<th>[EURD] v4 requirement</th>
<th>Category/Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRS-04075</td>
<td>The IRS image shall be such that: For the LAC zone 4 in the IRS operational scenario the complete Earth surface visible from geostationary altitude at 0° inclination and North of the LAC boundary described in Figure 7 is available.</td>
<td>The IRS image shall be such that: For the LAC zone 4 in the IRS operational practice the complete Earth surface visible from geostationary altitude at 0° inclination and North of the LAC boundary described in Figure 9 is available.</td>
<td>Scope unchanged. General replacement of Operational scenario by operational practice</td>
</tr>
<tr>
<td>IRS-04080</td>
<td>An IRS LAC dataset shall be considered complete if all of the conditions below are met: a) The IRS dataset acquisition requirements are met, b) Less than 5% of the MWIR spectral soundings in the LAC are declared missing soundings, c) Less than 15% of the LWIR spectral soundings in the LAC are declared missing soundings.</td>
<td>The IRS shall provide complete datasets. An IRS LAC dataset is considered incomplete if any of the conditions below occur: a) The IRS dataset acquisition requirements are not met, b) More than 5% of the MWIR spectral soundings in the LAC are declared missing soundings,</td>
<td>Mission performance clarification With a clearer wording and adding the case of contiguous missing soundings.</td>
</tr>
</tbody>
</table>

Figure 7: Operational practice for IRS scanning pattern
<table>
<thead>
<tr>
<th>ID</th>
<th>[EURD v3C requirement]</th>
<th>[EURD] v4 requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRS-04122</td>
<td>none</td>
<td>c) <strong>More than</strong> 15% of the LWIR spectral soundings in the LAC are declared <strong>missing soundings</strong>.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d) <strong>Three or more contiguous spectral soundings (in either direction) are declared missing soundings and have been declared missing soundings for the previous 20 LAC images.</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>where <strong>N=3 and M=0.01 in the definition of missing sounding</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note 1: For contiguous missing sounding assessment the spectral soundings are referenced by dwell, column and row (s,i,j) between LAC images.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note 2: The bullet d) intends to cover satellite detector (&quot;permanent&quot;) failure. Thus for assessing the satellite performance, the whole requirement applies. For the assessment of the completeness of the data delivered to the End-Users, the last bullet d) has to be ignored, if it is due to a transient loss of dataset during the transmission.</td>
</tr>
</tbody>
</table>

| IRS-04124 | none                  | The spectral channel interval (Δν) for both IRS spectral bands LWIR and MWIR shall not exceed the value given in Table 7. |
|           |                       | Note: The spectral channel interval is given for the resampled spectral channel spacing. The actual spectral sampling of the interferogram will be variable across a dwell coverage dependent on the maximum optical path difference for a spatial sample. |
| IRS-04135 | The IRS spectral sample spectral response function difference between the actual spectral response function and The IRS spectral sample spectral response function difference between the actual spectral response function | Mission performance clarification related to spectral channel interval |

<p>| IRS-04124 | none                  | The full width half maximum (FWHM) of the IRS spectral sample spectral response function (SRF) shall be less than or equal to 0.754 cm⁻¹. |
| IRS-04135 | The IRS spectral sample spectral response function difference between the actual spectral response function and The IRS spectral sample spectral response function difference between the actual spectral response function | Mission performance clarification Related to spectral FWHM. |
| IRS-04135 | The IRS spectral sample spectral response function difference between the actual spectral response function and The IRS spectral sample spectral response function difference between the actual spectral response function | Mission performance clarification To provide further information on |
| ID     | [EURD v3C requirement]                                                                                                                                                                                                 | [EURD] v4 requirement                                                                                                                                                                                                                                                                                                                                 | Category/Justification                                                                                                                                                                                                                           |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IRS-04140 | that characterised during spectral calibration averaged over the spectral calibration period shall not exceed a value corresponding to a radiometric error of 50 mK (NEdT@280K) when considering a spatially homogeneous scene and the spectra given by Figure 8. Note: The requirement applies at a 68.26% confidence level calculated over all spectral samples within a spectral band, considering the LWIR and MWIR spectral bands separately. | averaged over one day, and that given by the SRF Estimation model shall not exceed a value corresponding to a radiometric error of 50 mK (NEdT@280K) when considering a spatially homogeneous scene and the spectra given by Figure 10. Note: The requirement applies at a 68.26% confidence level calculated over all spectral samples within a spectral band, considering the LWIR and MWIR spectral bands separately. This means that, for every spectral band, at least 68.26% of the spectral channels of every spatial sample) meet the requirement. | the parameter calculation method.                                                                                                                                                                                                                                                   |
|        | The IRS radiometric noise shall be as given in Table 9 with the NEdT scaled at signal levels between black body temperatures 200K and 280K according to the radiometric scaling function and between black body temperatures 280K to 313K with a scaling factor of 1. | The IRS radiometric noise shall be as given in Table 9. New table 9 refinement in next row.                                                                                                           | Scope unchanged. Removal of a redundancy with the text at beginning of §4.2.4. Those radiometric requirements were defined during Phase A by the User Consultation process and led to the old table 9 here below. Since this time the following modifications have taken place: a. The requirement was split to before and after spectral calibration the former being applicable at spacecraft level and the latter at system level. The system level requirement includes an additional 100 mK error allowance for the spectral calibration process. b. At satellite level the NEdT template has been further rounded to take into account possible apodisation to meet IRS-04135. The old table 9, summarising the radiometric performances, is cross referenced by IRS-04140, IRS-04160, IRS-04180, IRS-04200. Those requirements are unchanged but the table 9 cross referenced by them is updated. See table 9 refinement below. Mission performance clarification Related to the refinement of the radiometric requirements |</p>
<table>
<thead>
<tr>
<th>ID</th>
<th>[EURD v3C requirement]</th>
<th>[EURD] v4 requirement</th>
<th>Category/Justification</th>
</tr>
</thead>
</table>
| IRS- 04230 | such requirements will not be considered in the statistics reported in this section. | For all IRS spatial samples of the spectral channels in the wavenumber range from 900 cm\(^{-1}\) to 2175 cm\(^{-1}\) the integrated energy (IE) shall be: over a square 4x4 km\(^2\) shall be equal to or larger than 67%.  
• over a square 4x4 km\(^2\) equal to or larger than 67%,  
• over a square 12x12 km\(^2\) equal to or larger than 92%. | Mission performance clarification related to integrated energy |
| IRS- 04250 | none                                                                                   | The absolute value of the IRS absolute sample position knowledge error (ASPKE) shall be as given in Table 11 when evaluated over any LAC zone.                                                                 | Mission performance clarification related to ASPKE (LAC) |
| IRS- 04255 | none                                                                                   | The absolute value of the IRS absolute sample position knowledge error (ASPKE) when evaluated over a single dwell shall be as given in Table 11.                                                                   | Mission performance clarification related to ASPKE (dwell) |
| LI- 06020 | The Lightning Imager (LI) full disc coverage shall include the Earth within a circle of 16\(^\circ\) in diameter, shifted northward to cover high latitude regions.  
Note: If for design optimisation the coverage is not circular then it must cover at least 84\% of the visible earth disc (a circle of 17.54\(^\circ\) in diameter centred at SSP) and the European territories of all the EUMETSAT member states when the satellite is within the nominal longitude range. | The Lightning Imager (LI) coverage shall contain at least the European territories of all the EUMETSAT member states and at least 84\% of the visible earth disc (taken as a circle of 17.54\(^\circ\) in diameter centred at SSP) when the satellite is within the nominal longitude range.  
Note: The whole of Turkey is to be taken to lie within Europe for this definition. The coverage is to be achieved when the satellite is positioned at 0\(^\circ\) longitude, with the requirement SYS-00130 not being applicable for the calculation of the coverage. | Mission performance clarification related to LI coverage |
| LI- 06040 | The LI triggered events shall consist in the measurements of the strongest lightning emission features within the cloud top optical spectra produced by the neutral oxygen lines in the near infrared.  
Note: The OI(1) line at 777.4 nm made of three lines | The LI triggered events shall be obtained by measuring the LI lightning spectral radiance from the strongest lightning emission features within the cloud top optical spectra produced by the neutral oxygen atom lines in the near infrared. | Mission performance clarification related to LI coverage  
Definition of LI lightning spectral radiance added including the wavelength shift when leaving the Earth’s atmosphere |
<table>
<thead>
<tr>
<th>ID</th>
<th>[EURD v3C requirement]</th>
<th>[EURD] v4 requirement</th>
<th>Category/Justification</th>
</tr>
</thead>
</table>
| LI-   | of nearly equal intensity with a total separation of 0.34 nm.                           | The LI shall provide the *lightning event radiance measured in the* spectral interval centred at 777.4 nm and having a width of 0.34 nm, over the full range from 6.7 to 670 mWm^-2sr^-1, with an error (at 1σ) less than: | Mission performance clarification
Definition of LI lightning spectral radiance added including the wavelength shift when leaving the Earth’s atmosphere |
| 06100 | The LI shall provide the *lightning event radiance measured in* the spectral interval centred at 777.4 nm and having a width of 0.34 nm, over the full range from 6.7 to 670 mWm^-2sr^-1, with an error (at 1σ) less than: | a) 10% relative accuracy for *radiances* higher than 70 mWm^-2sr^-1  
b) 7 mWm-2sr-1 absolute accuracy for *radiances* lower than 70 mWm-2sr-1 | |
| LI-   | The LI shall provide a *spatial sampling distance* less than or equal to 10km at 45oN for the sub-satellite longitude. | The LI shall provide a spatial sampling less than or equal to 10km at 45oN for the sub-satellite longitude. | Scope unchanged.
The previous wording was contradicting the definition of spatial sampling distance. |
| 06120 |                                                                                         |                                                                                                                                                    | |
| MET-  | The *Level 2* products generation service at EUMETSAT Headquarters shall provide a continuity of service between MSG and MTG concerning the *Level 2 Products* generated, albeit with improved quality, resolution, timeliness. | The *Level 2 Products* generation service at EUMETSAT Headquarters shall provide a continuity of service between MSG and MTG concerning the *Level 2 Products* generated, albeit with improved quality, resolution, timeliness and new *Level 2 Products*, as defined in [MTGDIS]. | Introduction of [MTGDIS]
Combine 2 requirements (MET-08020, MET-08040). |
| 08020 |                                                                                         |                                                                                                                                                      | |
| MET-  | The *Level 2 Products* generation service by the SAF shall provide a continuity of service between MSG and MTG concerning the *Level 2 Products* generated, albeit with improved quality, resolution, timeliness. | Deleted                                                                                                                                  | Introduction of [MTGDIS]
Combined with MET-08020 above. [L2HQ] is now part of [MTGDIS] |
| 08040 |                                                                                         |                                                                                                                                                      | |
| MET-  | The *Level 2 Products* generation service by the SAF shall provide a continuity of service between MSG and MTG concerning the *Level 2 Products* generated, albeit with improved quality, resolution, timeliness. | The *Level 2 Products* generation service by the SAF shall provide a continuity of service between MSG and MTG concerning the *Level 2 Products* generated, albeit with improved quality, resolution, timeliness and new *Level 2 Products* as defined in [MTGDIS]. | Introduction of [MTGDIS]
Combine 2 requirements (MET-08060, MET-08080). |
<p>| 08060 |                                                                                         |                                                                                                                                                      | |
| MET-  | The <em>Level 2 Products</em> generation service by the SAF shall                              | Deleted                                                                                                                                  | Introduction of [MTGDIS]                                                                 |
|       |                                                                                         |                                                                                                                                                      |</p>
<table>
<thead>
<tr>
<th>ID</th>
<th>[EURD v3C requirement]</th>
<th>[EURD] v4 requirement</th>
<th>Category/Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>08080</td>
<td>provide new SAF Level 2 Products specific to MTG as agreed by Delegate Bodies.</td>
<td>The operational availability for the SAF acquisition, processing and SAF to EUM HQ transmission shall be 98% within the timeliness defined in Table 14, Table 15 and Table 16 in the column T1 to T3. Note 1: This is verified by each SAF individually. Operational availability, timeliness and the calculation method are defined in [EURD] annex C. Note 2: The operational validation of the end to end performance (T0 – T5) is performed jointly by EUM and SAF against the thresholds values defined in the [MTGDIS], see also §5</td>
<td>Combined with MET-08060. [L2SAF] is now included in [MTGDIS]</td>
</tr>
<tr>
<td>MET-08090</td>
<td>none</td>
<td></td>
<td>Scope unchanged. Performances copied from [L2SAF] such that End Users have a clear reference without digging into [L2SAF].</td>
</tr>
<tr>
<td>DCP-10020</td>
<td>Note: ARGOS/GEO signals are relayed as any DCP uplink/downlink. ARGOS data are also extracted from DCP downlink, but further on-ground processing for the ARGOS data is currently (TBD).</td>
<td>Note deleted</td>
<td>Note update Removal of Note, containing obsolete text: the contemplated relay of ARGOS signal by GEO satellites in cooperation with CNES didn’t materialise in an agreement (abandoned by CNES).</td>
</tr>
<tr>
<td>ARC-12060</td>
<td>The MTG System shall ensure that mission related datasets shall be available in the EUMETSAT Data Centre, for later retrieval, with a completeness of 99% (TBC).</td>
<td>The MTG System shall ensure that mission related datasets shall be available in the EUMETSAT Data Centre, for later retrieval, with a completeness of 99%</td>
<td>Scope unchanged Removal of the TBC</td>
</tr>
<tr>
<td>DIS-14020</td>
<td>The EUMETCast &amp; High Rate Dissemination services shall provide data to the following geographic regions with the following characteristics: a) High rate service over Europe; b) EUMETCast service over Europe. c) EUMETCast service over Africa. d) EUMETCast service over South America (TBC).</td>
<td>The EUMETCast Dissemination Services shall provide data to the following geographic regions with the following characteristics: a) EUMETCast terrestrial services for pre-defined users b) EUMETCast service via Satellite over Europe. c) EUMETCast service via Satellite over Africa.</td>
<td>Handled by Multi-Mission Element (MME) Reflect the abandon of south America dissemination already decided at corporate level. The rest is a change of terminology.</td>
</tr>
<tr>
<td>ID</td>
<td>[EURD v3C requirement](Note 1: Coverage details regarding current implementation for MSG are provided in [TD15].)</td>
<td>[EURD] v4 requirement</td>
<td>Category/Justification</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>DIS-14040</td>
<td>The list and periodicity of disseminated Level 1 datasets transmitted by EUMETCast &amp; High Rate dissemination, for each of the geographic regions, shall be as defined in Appendix B. Note 1: Appendix B lists the contents of the dissemination service for each of the geographic regions at the time of publication of this document. Note 2: This implies that the services are configurable, during operations.</td>
<td>The list and periodicity of disseminated dataset transmitted by EUMETCast, for each of the geographic regions, shall be as defined in [MTGDIS]. Note 1: The dissemination of IRS level 2 products for the LAC 1, 2 or 3 is not a condition for the entry into operational services of the other IRS based services.</td>
<td>Introduction of [MTGDIS] Combine 3 requirements (DIS-14040, DIS-14045, DIS-14047). Dissemination of LAC 1-3 has been added in [MTGDIS]. Note 2 is now DIS-14048.</td>
</tr>
<tr>
<td>DIS-14045</td>
<td>EUMETCast shall support the dissemination of centrally generated Level 2 datasets. Note: The list and characteristics of centrally generated Level 2 datasets and the dissemination periodicity are continuously reviewed through STG-SWG and STG OPS-WG before approval by Council.</td>
<td>Deleted</td>
<td>Introduction of [MTGDIS] Now part of DIS-14040</td>
</tr>
<tr>
<td>DIS-14047</td>
<td>EUMETCast shall support the dissemination of a subset of SAF datasets. Note 1: The list and characteristics of SAF datasets is subject to the approval of Council and is documented and specified in the Product Requirement Documents (PRD)s of each individual SAF. Note 2: The list of SAF datasets disseminated by EUMETCast and the associated periodicity are continuously reviewed through STG OPS-WG before approval by Council.</td>
<td>Deleted</td>
<td>Introduction of [MTGDIS] Now part of DIS-14040</td>
</tr>
<tr>
<td>DIS-14048</td>
<td>none</td>
<td>The list, timeliness and periodicity of the datasets disseminated via the various dissemination mechanisms shall be configurable.</td>
<td>Introduction of [MTGDIS] Former note 2 of DIS-14040 is now an explicit requirement.</td>
</tr>
<tr>
<td>DIS-14047</td>
<td>The IRS disseminated dataset shall consist of either 300</td>
<td>The IRS disseminated dataset shall consist of a number of</td>
<td>Scope unchanged</td>
</tr>
<tr>
<td>ID</td>
<td>[EURD v3C requirement]</td>
<td>[EURD] v4 requirement</td>
<td>Category/Justification</td>
</tr>
<tr>
<td>------</td>
<td>---------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| 14050| (TBC) selected spectral channels or 300 (TBC) principal component (PC) scores derived from the full set of spectral channels.  
                 Note: To be based on the experience derived from IASI data distribution. | principal component (PC) scores derived from the full set of spectral channels.  
                 Note: To be based on the experience derived from IASI data distribution. | Removal of the TBC as per recommendation 7 of the 3rd MIST meeting 31 August 2010 with positive response from the 29th SWG meeting 06/07 September 2010. |
| DIS-14100 | The contribution of the EUM ground segment to the operational availability of Foreign Satellite Data shall be as per Table 14. | DELETED | Handled by Multi-Mission Element (MME)  
This is an operational corporate functionality for which MTG GS is not involved.                                 |
| DIS-14140 | The contribution of the EUM ground segment to the operational availability of MDD shall be as per Table 14. | DELETED | Handled by Multi-Mission Element (MME)  
This is an operational corporate functionality for which MTG GS is not involved.                                 |
| DIS-14190 | None                                                                                     | The operational availability of IRS level 2 products shall be as per Table 17.      | Mission performance clarification  
Related to missing requirement on IRS L2 timeliness.                                                                                  |
| DIS-14220 | The operational availability of Lightning dataset shall be as per Table 14.              | The operational availability of Lightning group and flash product shall be as per Table 17.  
Note: During development phase, the design will be scrutinized. Should there be a risk that one minute is not achievable, the situation will be reported and reconsidered in particular at the CDR. During AIV and Commissioning, reasonable attempts will be made to finalize timing. | Scope unchanged  
Clarification note added to stress the importance of the timeliness goal recalled by LI-MAG. Update of terminology. |
<table>
<thead>
<tr>
<th>ID</th>
<th>[EURD v3C requirement]</th>
<th>[EURD] v4 requirement</th>
<th>Category/Justification</th>
</tr>
</thead>
</table>
| DIS-14240 | The contribution of the EUM ground segment to the operational availability of SAF Products shall be as per Table 14.  
Note: The operational availability of the SAF product generation for SAF Products that are not disseminated by EUMETSAT is not specified in this document but is specified in each SAF specification | The operational availability of SAF Products shall be as per Table 17.  
Note 1: The timeliness allocation for SAF Products dissemination is defined in §4.5.2. | Scope unchanged  
Requirement is now end to end.  
Allocation to EUM GS is now MET-08090. |
| DIS-14250 | The list, characteristics and periodicity of disseminated Level 1 datasets transmitted by RMDCN shall be as defined in Appendix B.  
Note 1: Appendix B lists the contents of the dissemination service at the time of publication of this document.  
Note 2: This implies that the services are configurable, during operations. | The list, characteristics and periodicity of disseminated datasets transmitted via RMDCN shall be as defined in [MTGDIS]. | Introduction of [MTGDIS]  
Configurability is addressed in DIS-14048 |
| DIS-14260 | The RMDCN Dissemination service shall support the dissemination of Level 2 datasets. | DELETEDE | Introduction of [MTGDIS]  
Included in DIS-14250 |
| DIS-14360 | None | DIS-14360.  
Note: Achieved when considering two MTG-I satellites in orbit. Otherwise redundancy is ensured via Cospas-Sarsat satellites overlapping. | Note update  
Redundancy for Search And Rescue is ensured via satellite overlapping and is done on a best effort basis. |
| DIS-14380 | The list, characteristics and periodicity of disseminated Level 1 datasets transmitted by Internet shall be as defined in Appendix B.  
Note 1: Appendix B lists the contents of the dissemination service at the time of publication of this document. | DELETEDE | Internet  
The retrieval of data via internet is now merged in §6 Data Retrieval Services |
<table>
<thead>
<tr>
<th>ID</th>
<th>[EURD v3C requirement]</th>
<th>[EURD] v4 requirement</th>
<th>Category/Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIS-14390</td>
<td>The Internet Dissemination Service shall support the dissemination of Level 2 datasets.</td>
<td>DELETED</td>
<td>Internet</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The retrieval of data via internet is now merged in §6 Data Retrieval Services</td>
</tr>
<tr>
<td>DIS-14400</td>
<td>The internet dissemination service user guide shall be made available, and kept up to date, to describe the formats and other characteristics of the disseminated dataset.</td>
<td>DELETED</td>
<td>Internet</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The retrieval of data via internet is now merged in §6 Data Retrieval Services</td>
</tr>
<tr>
<td>DIS-14420</td>
<td>The Internet Dissemination Service shall only deliver to the registered DCP Operator its own dataset.</td>
<td>DELETED</td>
<td>Internet</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Already included in DCP-10020. The retrieval of data via internet is now merged in §6 Data Retrieval Services</td>
</tr>
<tr>
<td>DIS-14440</td>
<td>The operational availability of the datasets via the Internet Dissemination Service shall be as defined in Table 14 for EUMETCast.</td>
<td>DELETED</td>
<td>Internet</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The retrieval of data via internet is now merged in §6 Data Retrieval Services</td>
</tr>
<tr>
<td>RET-16040</td>
<td>Note 3: Minor differences are acceptable between what is disseminated and what is retrieved, as long as it is documented for end users. Differences may relate to time ranges of data, subsetting, compression, etc.</td>
<td>Note update</td>
<td>Requirement text unchanged but clarification added with note 3.</td>
</tr>
<tr>
<td>USR-18020</td>
<td>Service messages shall provide information on the status and planning of the MTG operational services, including regular administrative messages (historical information), news messages (on event occurrence) and scheduled service outages (one week in advance), via: a) EUMETCast dissemination. b) High-Rate dissemination.</td>
<td>Service messages shall provide information on the status and planning of the MTG operational services, including regular administrative messages (historical information), news messages (on event occurrence) and scheduled service outages (one week in advance), via: a) EUMETCast satellite Europe b) EUMETCast satellite Africa</td>
<td>Scope unchanged</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Harmonisation of terminology</td>
</tr>
</tbody>
</table>
TABLE Radiometric requirements of the IRS Spectra
Old Table 9 used by requirements IRS-04140 IRS-04160, IRS-04180 and IRS-04200. The parts modified are in bold.

<table>
<thead>
<tr>
<th>LWIR Wavenumber (cm(^{-1}))</th>
<th>Ref. Signal, Tref</th>
<th>Radiometric Noise (NEdT)</th>
<th>Medium Term Radiometric Stability</th>
<th>Long Term Radiometric Stability</th>
<th>Radiometric Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>700</td>
<td>280K</td>
<td>&lt;0.5K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>714</td>
<td>280K</td>
<td>&lt;0.5K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>715</td>
<td>280K</td>
<td>&lt;0.4K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>729</td>
<td>280K</td>
<td>&lt;0.4K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>730</td>
<td>280K</td>
<td>&lt;0.3K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>769</td>
<td>280K</td>
<td>&lt;0.3K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>770</td>
<td>280K</td>
<td>&lt;0.2K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>1100</td>
<td>280K</td>
<td>&lt;0.2K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>1210</td>
<td>280K</td>
<td>&lt;0.35K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>MWIR Wavenumber (cm(^{-1}))</td>
<td>Ref. Signal, Tref</td>
<td>Radiometric Noise (NEdT)</td>
<td>Medium Term Radiometric Stability</td>
<td>Long Term Radiometric Stability</td>
<td>Radiometric Accuracy</td>
</tr>
<tr>
<td>1600</td>
<td>280K</td>
<td>&lt;0.2K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>1810</td>
<td>280K</td>
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<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
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<tr>
<td>1980</td>
<td>280K</td>
<td>&lt;0.4K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
</tbody>
</table>
New Table 9 used by requirements IRS-04140 IRS-04160, IRS-04180 and IRS-04200. The parts modified are in bold.

<table>
<thead>
<tr>
<th>LWIR Wavenumber (cm⁻¹)</th>
<th>Ref. Signal, Tref</th>
<th>Radiometric Noise (NEdT)</th>
<th>Medium Term Radiometric Stability</th>
<th>Long Term Radiometric Stability</th>
<th>Radiometric Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>700</td>
<td>280K</td>
<td>&lt;0.5K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
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<tr>
<td>714</td>
<td>280K</td>
<td>&lt;0.5K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
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<td>715</td>
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<td>&lt;0.4K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>729</td>
<td>280K</td>
<td>&lt;0.4K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
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<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>1040</td>
<td>280K</td>
<td>&lt;0.2K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>1118</td>
<td>280K</td>
<td>&lt;0.224K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>1210</td>
<td>280K</td>
<td>&lt;0.35K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>MWIR Wavenumber (cm⁻¹)</td>
<td>Ref. Signal, Tref</td>
<td>Radiometric Noise (NEdT)</td>
<td>Medium Term Radiometric Stability</td>
<td>Long Term Radiometric Stability</td>
<td>Radiometric Accuracy</td>
</tr>
<tr>
<td>1600</td>
<td>280K</td>
<td>&lt;0.224K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>1630</td>
<td>280K</td>
<td>&lt;0.2K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>1750</td>
<td>280K</td>
<td>&lt;0.2K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>1871</td>
<td>280K</td>
<td>&lt;0.269K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>1980</td>
<td>280K</td>
<td>&lt;0.4K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>2134</td>
<td>280K</td>
<td>&lt;0.757K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
<tr>
<td>2175</td>
<td>280K</td>
<td>&lt;0.906K</td>
<td>&lt;0.1K</td>
<td>&lt;0.3K</td>
<td>&lt;0.5K</td>
</tr>
</tbody>
</table>
### TABLE: Operational Availability within timeliness for EUMETCast dissemination

Old Table 14 (now Table 17) used by requirements DIS-14060, DIS-14080, DIS-14100, DIS-14120, DIS-14140, DIS-14160, DIS-14180, DIS-14200, DIS-14220, DIS-14240, DIS-14400. The parts modified are in bold.

<table>
<thead>
<tr>
<th>disseminated dataset</th>
<th>operational availability</th>
<th>End to end timeliness via EUMETCast (see Note 1)</th>
<th>End to end Timeliness via high rate dissemination (see note 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCI Rectified images</td>
<td>95% with a goal of 98%</td>
<td>15mn</td>
<td>10mn with a goal of 5mn</td>
</tr>
<tr>
<td>Full Disc Scanning Service (FCI-FDSS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rapid Scanning Service (FCI-RSS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 2 Products</td>
<td>95% with a goal of 98%</td>
<td>60mn</td>
<td>N/A</td>
</tr>
<tr>
<td>&gt;=Daily products</td>
<td></td>
<td>60mn</td>
<td></td>
</tr>
<tr>
<td>&gt;=3-hourly products</td>
<td></td>
<td>60mn</td>
<td></td>
</tr>
<tr>
<td>&gt;=Hourly products</td>
<td></td>
<td>30mn</td>
<td></td>
</tr>
<tr>
<td>&lt;= hourly</td>
<td></td>
<td>20mn</td>
<td></td>
</tr>
<tr>
<td>Retransmission of Foreign Satellite Data (FSD)</td>
<td>95% with a goal of 98%</td>
<td>60mn</td>
<td>N/A</td>
</tr>
<tr>
<td>DCPs messages and bulletins</td>
<td>95% with a goal of 98%</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Alert messages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulletins</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retransmission of MDD data received from RMDCN</td>
<td>95% with a goal of 98%</td>
<td>60mn</td>
<td>N/A</td>
</tr>
</tbody>
</table>
### End-to-end timeliness via EUMETCast (see Note 1)

<table>
<thead>
<tr>
<th>Disseminated Dataset</th>
<th>Operational Availability</th>
<th>End to end Timeliness via EUMETCast</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR Sounder dataset</td>
<td>95% with a goal of 98%</td>
<td>N/A</td>
</tr>
<tr>
<td>UVN sounding dataset</td>
<td>95% with a goal of 98%</td>
<td>N/A</td>
</tr>
<tr>
<td>Lightning dataset</td>
<td>95% with a goal of 98%</td>
<td>2mn with a goal of 30s</td>
</tr>
<tr>
<td>Retransmission of SAF Products</td>
<td>95% with a goal of 98%</td>
<td>60mn</td>
</tr>
<tr>
<td>Service Messages</td>
<td>95% with a goal of 98%</td>
<td>60mn</td>
</tr>
</tbody>
</table>

Note 1: Operational availability, timeliness and the calculation method are defined in [CONV]. A dataset arriving after the mentioned timeliness is not considered as available for the end-user. Delays outside EUMETSAT control have to be added (e.g. for FSD, MDD, SAF).

Note 2: TBD if required & financed in context of GMES.

Note 3: The objective is to achieve the goal during routine operations. This implies that the initial MTG System and its operation are designed to achieve the goal. The difference between the spec and the goal being a margin allowing some design optimisation and shared
between system, ground segment and facilities. At system level the formal verification will consist in the assessment of the margin against the specified values. The operational system validation will be against the goal.

Note 4: The specified timeliness only refers to the EUMETCast contribution, i.e. the dissemination of SAF products and does not include the time required to generate the products at the SAFs. The latter is specified in the respective SAF Product Requirements Documents.

New Table 17 (was Table 14) used by requirements DIS-14060, DIS-14080, DIS-14120, DIS-14160, DIS-14180, DIS-14190, DIS-14200, DIS-14220, DIS-14240. The parts modified are in bold.

<table>
<thead>
<tr>
<th>disseminated dataset</th>
<th>operational availability (1)</th>
<th>End to end timeliness per product are defined in [MTGDIS] within the following constraints (3)</th>
<th>Timeliness applies to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCI Rectified images</td>
<td>95% with a goal of 98%</td>
<td></td>
<td>Repeat Cycle</td>
</tr>
<tr>
<td>Full Disc Scanning Service (FCI-FDSS)</td>
<td></td>
<td>15 mn with a goal of 10 mn</td>
<td></td>
</tr>
<tr>
<td>Rapid Scanning Service (FCI-RSS)</td>
<td></td>
<td>5 mn with a goal of 2.5 mn</td>
<td></td>
</tr>
<tr>
<td>FCI Level 2 Products</td>
<td>95% with a goal of 98%</td>
<td></td>
<td>Chunk level when existing otherwise to Level 2 Product</td>
</tr>
<tr>
<td>&gt;=Daily products (e.g. CRM)</td>
<td></td>
<td>Half a day</td>
<td></td>
</tr>
<tr>
<td>&gt;=3-hourly products</td>
<td></td>
<td>60 mn</td>
<td></td>
</tr>
<tr>
<td>&gt;=Hourly products</td>
<td></td>
<td>30 mn</td>
<td></td>
</tr>
<tr>
<td>&lt; hourly</td>
<td></td>
<td>20 mn</td>
<td></td>
</tr>
<tr>
<td>DCP messages and DCP bulletins</td>
<td>95% with a goal of 98%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Note 1: Operational availability, timeliness and the calculation method are defined in [CONV]. A dataset arriving after the mentioned timeliness is not considered as available for the end-user. These figures apply as is to EUMETCast by Satellite. In the case of EUMETCast terrestrial, the network used has no formal Service Level Agreement (SLA), offering a best effort service. Thus its outages are classified as external outages and are not taken into account in the figures. When including the availability of the network, the achieved value of the EUMETCast terrestrial service is expected to be above 95%.

Note 2: Deleted

Note 3: The objective is to achieve the goal during routine operations. This implies that the initial MTG System and its operation are designed to achieve the goal. The difference between the spec and the goal being a margin allowing some design optimisation and shared
between system, ground segment and facilities. At system level the formal verification will consist in the assessment of the margin against the specified values. The operational system validation will be against the goal.

Note 4: Deleted

Note 5: The LI flash product is generated following level 2 processing and consists of LI triggered events clustered into LI groups associated with a particular lightning flash.

Statistics

<table>
<thead>
<tr>
<th>Category of the change</th>
<th>Requirements modified</th>
<th>Requirements added</th>
<th>Requirements deleted</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Related to [MTGDIS] introduction (minor)</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Related to internet dissemination merged into Data retrieval (minor)</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Scope Unchanged but wording had to be modified (minor)</td>
<td>9</td>
<td>1</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Handled by Multi-Mission Element - MME (minor)</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Mission performance clarification (major)</td>
<td>8</td>
<td>7</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>22</strong></td>
<td><strong>9</strong></td>
<td><strong>12</strong></td>
<td><strong>43</strong></td>
</tr>
</tbody>
</table>

Modification affecting only notes are not tracked in the statistics but still listed above for completeness.

F.2 Evolution between version 4 (for STG-SWG/OPSWG sept 2018) and 4A (for STG before CDR)

Comparison between successive versions and change justification
### ID | EURD v4 requirement | EURD v4A requirement | Category/Justification
--- | --- | --- | ---
FCI-02055 | The FCI image shall be such that:  
When delivering FDSS:  
The complete FDC area of coverage is available in the acquired image;  
When delivering RSS:  
the complete Earth surface visible from geostationary altitude at 0° inclination and North of latitude 30°N (OR with a goal of the LAC zone 4 boundary described in Figure 4) is available. | The FCI image shall be such that:  
When delivering FDSS:  
The complete FDC area of coverage is available in the acquired image;  
When delivering RSS:  
At least the complete Earth surface visible from geostationary altitude at 0° inclination and at the north of the boundary described in Figure 4 is available. | Mission performance clarification. Former goal is now baseline (OPSWG sept 2018)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>30°N</td>
<td></td>
</tr>
<tr>
<td>BC</td>
<td>22°W</td>
<td></td>
</tr>
<tr>
<td>CD</td>
<td>25°N</td>
<td></td>
</tr>
<tr>
<td>DE</td>
<td>10°W</td>
<td></td>
</tr>
<tr>
<td>EF</td>
<td>30°N</td>
<td></td>
</tr>
<tr>
<td>FG</td>
<td>50°E</td>
<td></td>
</tr>
<tr>
<td>GH</td>
<td>35°N</td>
<td></td>
</tr>
<tr>
<td>ID</td>
<td>[EURD v4 requirement]</td>
<td>[EURD] v4A requirement</td>
</tr>
<tr>
<td>----</td>
<td>----------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td></td>
<td>Note: The diagram indicates the goal LAC zone 4 coverage in terms of latitude and longitude on the earth.</td>
<td>Note: The diagram indicates the minimum LAC zone 4 coverage in terms of latitude and longitude on the earth.</td>
</tr>
<tr>
<td></td>
<td><strong>Figure 46: Goal LAC zone 4 coverage for FCI</strong></td>
<td><strong>Figure 47: Minimum LAC zone 4 coverage for FCI</strong></td>
</tr>
</tbody>
</table>

### Statistics

<table>
<thead>
<tr>
<th>Category of the change</th>
<th>Requirements modified</th>
<th>Requirements added</th>
<th>Requirements deleted</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mission performance clarification (major)</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Modification affecting only notes are not tracked in the statistics but still listed above for completeness.

**F.3 Evolution between version 4A (for STG before CDR) and 4B (for Council approval before CDR)**

None

**F.4 Evolution between version 4B (for Council approval before CDR) and 4C (approved by Council before CDR)**

None