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REPORT ON SPACECRAFT ANOMALIES FROM SOLAR EVENTS

In response to CGMS action PA 02

This paper reports about all anomalies attributed to solar events that have been detected on the EUMETSAT in-orbit satellites (i.e. Meteosat-6, 7, 8 and 9 and Metop-A) from October 09 till June 10.

The anomalies on EUMETSAT spacecraft due to solar events before October 2009 were reported in CGMS-35 EUM-WP-05, CGMS-36 EUM-WP-05 and CGMS-37 EUM-WP-06.

Report on Spacecraft Anomalies from Solar Events

1 INTRODUCTION

This paper reports about all anomalies attributed to solar events that have been detected on the EUMETSAT in-orbit satellites (i.e. Meteosat-6, 7, 8 and 9 and Metop-A) from October 09 till June 10.

All similar events occurred before October 09 can be found in CGMS-35 EUM-WP-05, CGMS-36 EUM-WP-05 and CGMS-37 EUM-WP-06.

2 SOLAR EVENTS

This working paper is the EUMETSAT response to the Permanent Action No. 02: "CGMS Members to report on spacecraft anomalies from solar events at CGMS meetings".

Solar events are here defined as any in-orbit event that has a sudden impact on the satellite status or performances (e.g. unexpected outages, re-configurations, triggering of on-board protections, loss of performances) and are due to in-orbit radiation effects, meteorites or debris impacts and other similar sudden events (as opposed to ageing) that can be attributed to the space environment.

The paper is divided in two main sections, the first one is dedicated to the geostationary satellites (Meteosat) and the second one to the polar satellite (Metop-A)

2.1 Meteosat Satellites

There are currently 4 Meteosat satellites in operations, two of the first generation (i.e. Meteosat-6 at 67.5 deg East, and Meteosat-7 at 57.5 deg East) and two of the second generation (i.e. Meteosat-8 at 9.5 deg East, and Meteosat-9 at 0.0 deg).

The sections below list and describe briefly all solar events on board the Meteosat satellites from October 09 till June 10.

2.1.1 Meteosat-9 Latch Current Limiter spurious switch on

On 8-12-09 the status of the Latch Current Limiter number 36 (LCL36) on board Met-9 unexpectedly changed from Off to On. LCL36 is used to supply power to the redundant Raw Data Modulator (RDM) which is not in use being the satellite operated with the nominal RDM.

A pre-agreed reaction is currently in place in case of unexpected LCL switch on and therefore the LCL36 was rapidly and successfully switched OFF.

Industrial investigation indicates that a possible cause is a Single Event Upset on the LCL hybrid component.

2.1.2 Meteosat-8 Fixed Beam

On 9 Oct 09 at 14.21 UTC the Meteosat-8 Mission Communication Payload (MCP) electronics unexpectedly changed mode from Normal to Fixed Beam with the effect that the Met-8 SEVIRI raw image, although acquired, was no longer down-linked to the receiving antenna on ground. This is a re-occurrence of an anomaly which occurred on Met-8 on 14-6-03 which has been analysed and attributed to an SEU on the on board antenna power supply which causes a reset of the electronics and send the antenna in fixed beam mode. The satellite was commanded back to its nominal configuration in less than 1 hour and therefore the RSS outage caused by this occurrence was limited from 14:20 till 15:10 UTC.

2.1.3 Meteosat-7 Uncommanded Gain change

On 8 Feb 10 at 22.20 UTC the Meteosat-7 radiometer detection electronics unexpectedly changed gain for both infrared and water vapour channels. This caused about 7 hours of degraded images in these two channels. This is a re-occurrence of an anomaly which is caused by a SEU on the radiometer detection electronics. As this anomaly is not visible via the standard telemetry of the satellite, a detection algorithm based on the image brightness is currently under test to provide alarms in case of re-occurrence so that the duration of the outage can be reduced.

2.2 Metop-A Satellite

The table here after gives an overview of anomalies attributed to a Single Event Upset during the reporting period. In most of the cases, the mission data availability was impacted. The geographical location of Metop A is also given as additional information when known.

EVT.UTC	Inst.	Mission Impact	Comment	Geo location
30/10/2009 04:50:00	IASI	none	EDAC Counter Incrementing	Northern Polar Band
30/10/2009 04:50:22	IASI	Science Data Production Interrupted	Autonomous transition to Heater Refuse mode due to OOL detected by IMS on parameter ENC0013 (CCM Status & Mode Acquisition).	Northern Polar Band
07/11/2009 03:14:46	MHS	None	MHS anomaly counter incremented. FMU IF PARITY ERROR No effect on scientific data production	
18/02/2010 09:50:36	ASCAT	Science Data Production Interrupted	The PMC detected a FORMAT_CCA_ERROR with the ASCAT ICU, which triggered ASCAT switch-off (EQ-SOL with ICU suspend).	Northern Polar Band
13/04/2010 14:30:00	GRAS	Science Data Production Interrupted	GRAS stand by refuse mode Mission outage 04:49:37	
08/05/2010 22:25:58	IASI	Science Data Production Interrupted	EDAC Counter Incrementing	South Atlantic Anomaly

3 CONCLUSIONS

As a EUMETSAT response to Permanent Action No. 02, this paper reports about all anomalies attributed to solar events that have been detected on the EUMETSAT in-orbit satellites (i.e. Metosat-6, 7, 8 and 9 and Metop-A) from October 09 till June 10.

All similar events occurred before October 09 can be found in CGMS-35 EUM-WP-05, CGMS-36 EUM-WP-05 and CGMS-37 EUM-WP-06.