	Istituto di Astrofisica e Planetologia Spaziali **Institute For Space Astrophysics and Planetology**	

BepiColombo MPO Electro Magnetic Compatibility (EMC)

Conducted Emission (CE) Test at ESTEC 09/09/2015 – 11/09/2015

SERENA Instrument Summary Report

SERENA NPA-IS (Neutral Particle Analyzer - Ion Spectrometer)

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reference	BC-SRN-TN-04105			
Issue	1	revision	1	
date of issue	2015-09-23			

D I S T R I B U T I O N

Name	Organisation	n. of copies
SERENA Team		1
ESA BC Project Team	ESA/ESTEC	1
ASI-INAF agreement procedure responsible	ASI	1
	TAS-I	1
	ADS	1

CHANGE LOG

date	issue	revision	Section	reason for change
2015-09-23	1	0		
2015-09-23	1	1	8	Minor corrections

Contents

1. Introduction

This is the test report describing the measure collected by the SERENA PI egse, during the Electro Magnetic Compatibility (EMC) Conducted Emission (CE) Test in the test centre room ("Rosetta Clean Room") at ESTEC, Noordwijk (NL).
The objective of the Conducted EMC test is to demonstrate that BepiColombo is:

- Compliant with the BepiColombo satellite level requirements as per [RD3] w.r.t. conducted EMC performance
- Compatible with the conducted emission requirements, re-checking unit and instrument
  EMC behavior on spacecraft level
- Self-compatible w.r.t. conducted emission and susceptibility thresholds.

2. Background

This document provides a summary for the testing activities carried out during the whole period 09/09/2015 - 11/09/2015 and regarding the SERENA suite incoming data, collected by the SERENA PI egse, during the est sessions. Details on the requirements to be verified are given in [RD5], section 3. The conduct of the tests is mainly covered by the staff of ASD and TAS-I and supervised by ESA. P/L instrument teams staff is also required for verification purposes.

3. Reference Documents

N.	Reference Id	Issue	Title
RD1	BC-ASD-SP-00148	02	EMC Test Specification
RD2	BC-ASD-MO-00106	02	MPO Conducted EMC Test Definition
RD3	BC-ASD-TS-00014	02	MPO/MCS EMC Functional Verification Specification
RD4	BC-ASD-TN-00516	01	MPO PFM EMC Test Configuration
RD5	BC-ALS-TN-00229	02	MPO PFM Conducted EMC Test Procedure
RD6	BC-ALS-TN-00236	02	Skin Connector Configuration for MPO and MTM

4. List of activities

The original time-table of the test was the following

Wednesday, the 9th September 2015 till Tuesday, 15th September 2015

1. Wednesday, 9th September: Launch configuration Emission Tests --> P/L off (instr. egse setup verification)
2. Thursday, 10th September: Orbit Mode Sensitive (BELA Laser On)
3. Friday, 11th September: Orbit Mode Sensitive (SADM activation, APME activation)
4. Saturday, 12th September: Orbit Mode Injection Transient (Pyro firing)
5. Sunday, 13th September: nominal free - contingency day
6. Monday, 14th September: Orbit Mode Emissive (BELA Laser On, PHEBUS scanner rotation)
7. Tuesday, 15th September: Orbit Mode Emissive (BELA Laser On, PHEBUS scanner rotation).

Anyway was possible to compact the schedule and finishing the activities by 11/09/2015, at 19:30

The schedule has been re-shuffled due to the system optimizations in the following way:

1. **Wednesday, 9th September: Launch configuration Emission Tests + Orbit Mode Injection Transient (Pyro firing) --> P/L off (instr. egse setup verification)**
2. **Thursday, 10th September: Orbit Mode Sensitive (Laser Firing) + Orbit Mode Sensitive (APME activation)**
3. **Friday, 11th September: Orbit Mode Emissive (BELA Laser On, PHEBUS scanner rotation) + Orbit Mode Emissive (BELA Laser On, PHEBUS scanner rotation)**

Note that the SADM activation activity has been re-scheduled in a delta-test foreseen for mid October 2015 (TBC).

5. SERENA H/W & S/W Configuration

Subsystem	Model level	SW version
SRN PI-EGSE	N/A	1.8.37
SRN Data Base	FM	ASCII_SERENA_MIS_DB_V1.9_17122013r045_FM
SRN SCU App SW	FS	V36
ELENA App. SW	FS	V25
PICAM App. SW	FM	V83
MIPA	FM	Included in SCU SW
STROFIO	PFM	V9 (+ patch for Macro 8)

6. Received TM Analysis Summary

6.1 Measurements on Day 1 (2015-09-10)

The EMC "Orbit Mode sensitive" S/C configuration with SERENA running several hours in MAXSUS mode has been nominally performed, producing more than:

- 100k STROFIO Science Packets,
- 16.6k PICAM Science Packets,
- 3k ELENA Science Packets,
- 784 MIPA Science Packets.

Without any packet loss or errors recording. MIPA science packets have been continuously monitored on the dedicated spectrogram viewer. No Out Of Limits (OOL) occurred (the ELENA MCP related H/K OOLs are meaningless in this configuration) and for all SERENA the main parameters were found nominal during the whole test. Moreover the PICAM OOL for MCP temperature and voltages are not applicable during EMC test when PICAM is not set in measurement mode and MCP are off.
Here the relevant science packets statistics short summary. After a preliminary successful execution and verification at SERENA level of the science and HK TM produced by the MAXSUS procedure, the whole S/C system activity has been interrupted and restarted to solve a database inconsistency. From that time on the MIPA HK were not broadcasted by the system to the P/L egse LAN, that's why the MIPA HK counters are no longer updated from then on. This was fixed soon after as you can see in the summary of Day 2. Hereafter a snapshot of the OOLs and three big matrix samples of MIPA science spectrograms are shown. A second snapshot is reported below that shows SERENA statistics and some SERENA sensors temperature graphs.

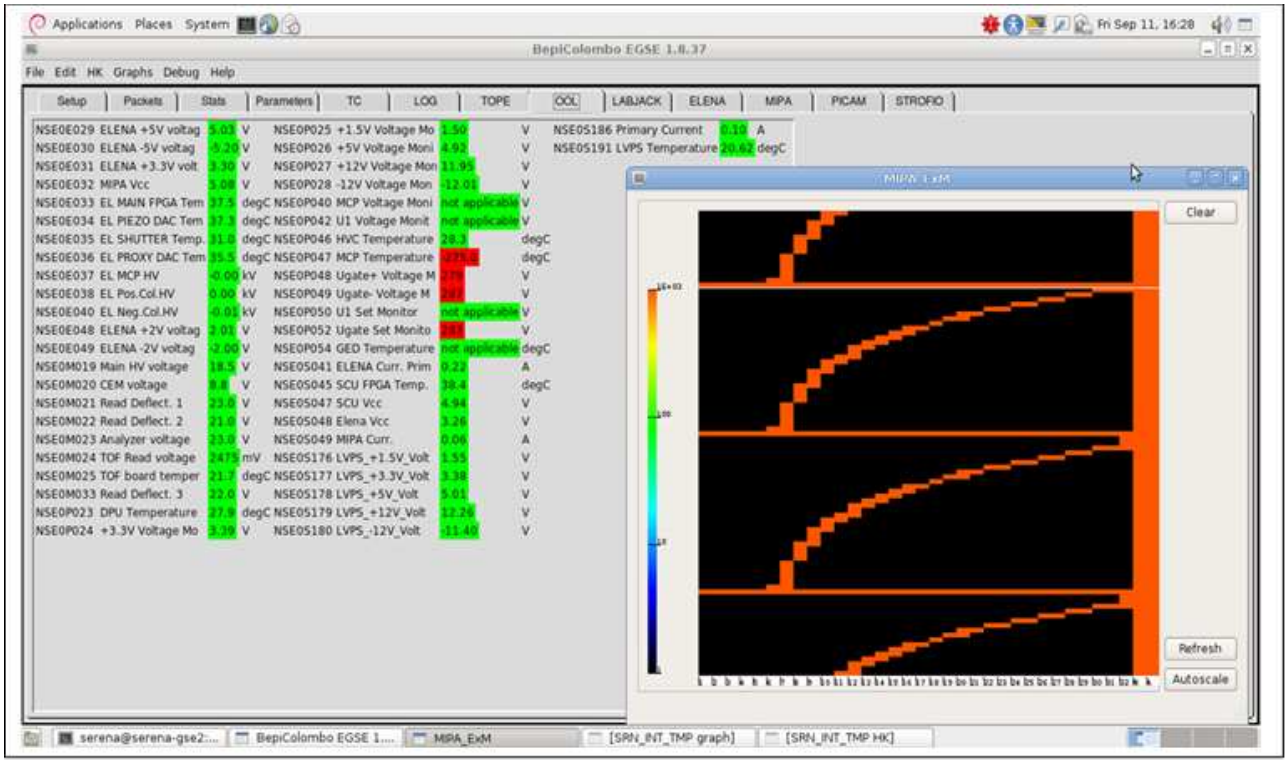

Fig. 1: Out Of Limits and MIPA Spectrograms (2015-09-10)

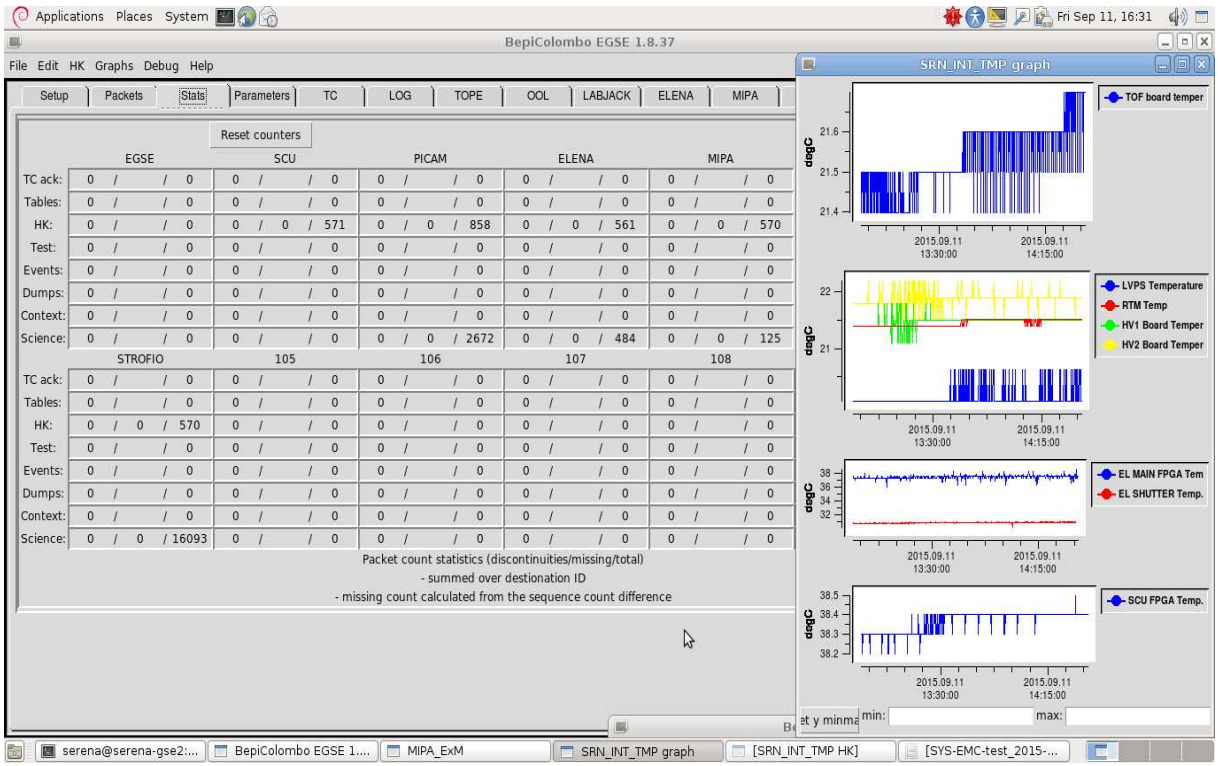

Fig. 2: Packets Statistics and Temperature Graphs (2015-09-10)

6.2 Measurements on Day 2 (2015-09-11)

The SERENA PI egse started receiving packets at ~09:31 CEST. Actually the test operations started at 13:30. All received data packets data and acks were nominal.

Laser Firing started again at 16:48.

The EMC "Orbit Mode Emissive" S/C configuration with SERENA running several hours in MAXEMI mode has been nominally performed, producing more than:

- 50k STROFIO Science Packets,
- 8k PICAM Science Packets,
- 1.3k ELENA Science Packets,
- 332 MIPA Science Packets,

without any packet loss or errors recording. MIPA science packets have been continuously monitored on the dedicated spectrogram viewer. PVS216 has been run to verify the level of the noise on the ELENA power-line on the S/C side. This action item was performed to verify the status of the Non Conformance described in BC-SRN-NC-03060. Results will be provided by S/C test report.

Hereafter the similar snapshots to day 1 are reported for the test performed in day 2.

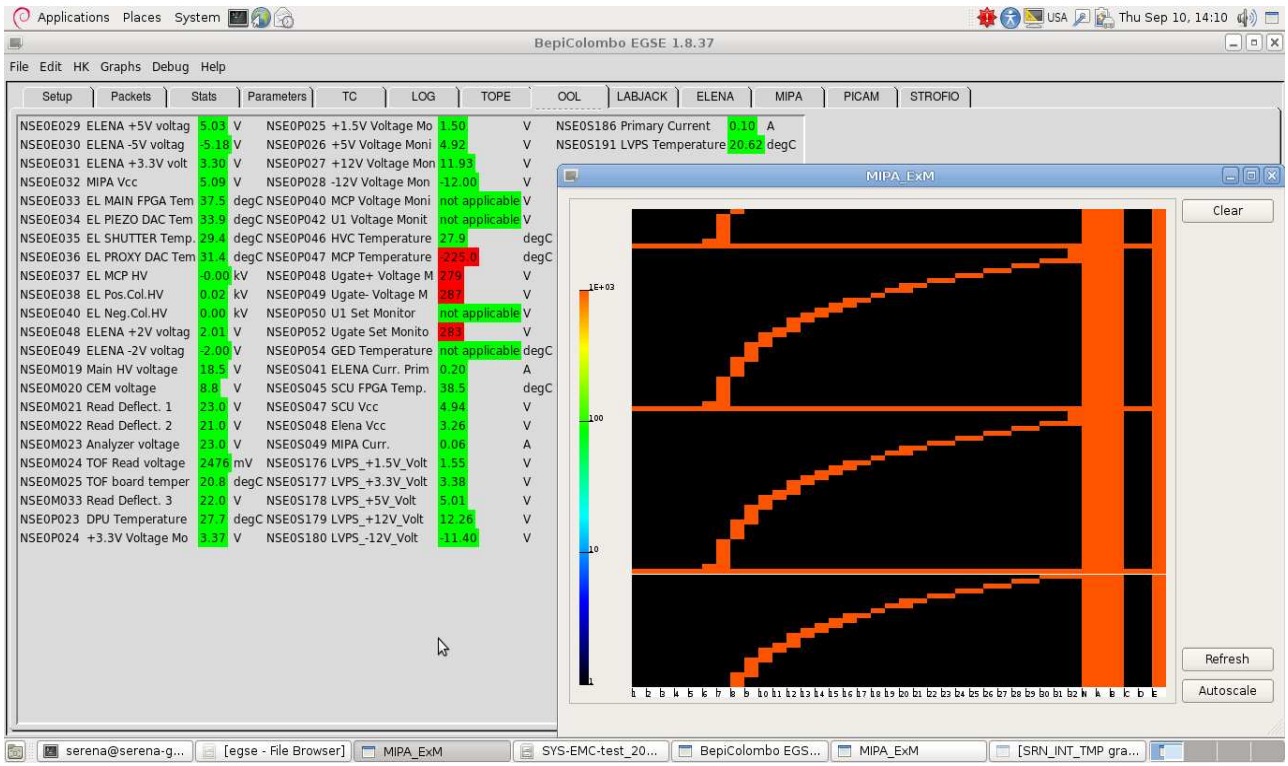

Fig. 3: Out Of Limits and MIPA Spectrograms (2015-09-11)

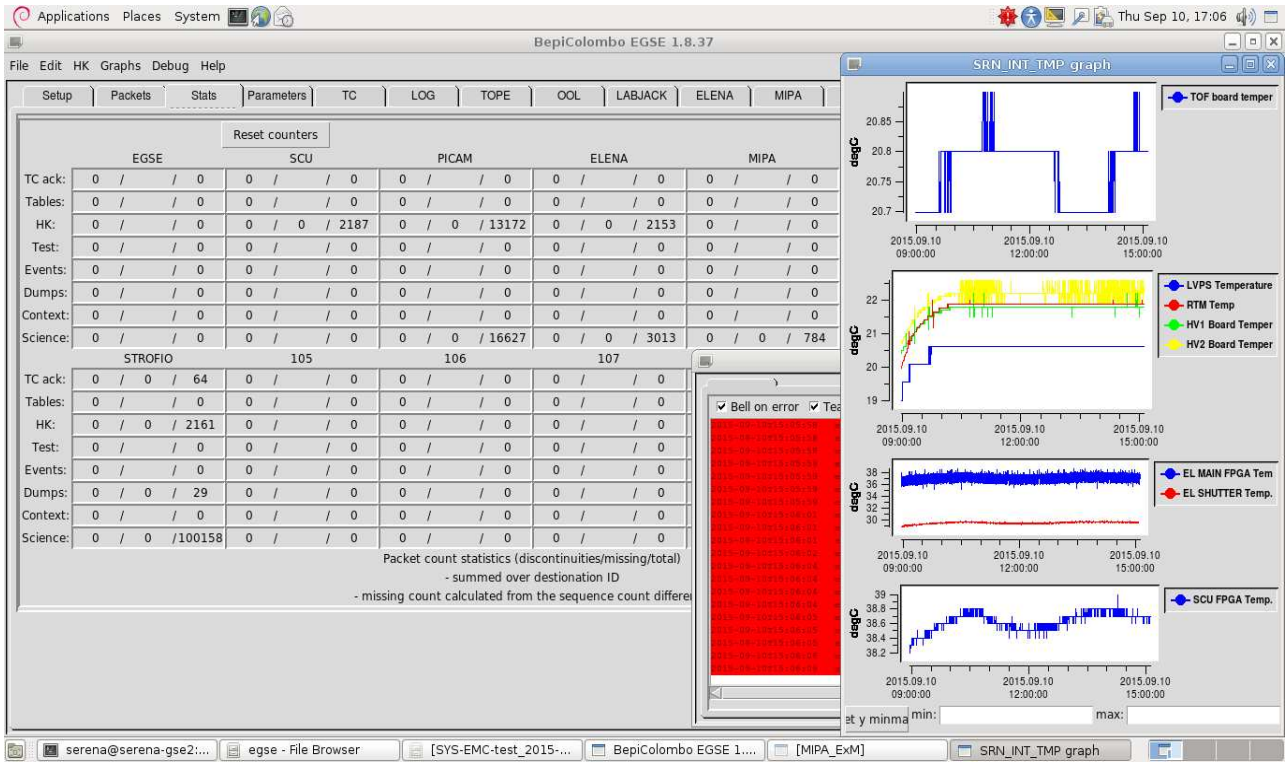

Fig. 4: Packets Statistics and Temperature Graphs (2015-09-11)

6.3 Details on Received TM Packets

6.3.1 System Packets Summary

- EPOCH time and time synchronization was correct.
- Received TM(1,1) “SERE PC Command Accepted” as expected.
- Received TM(1,7) “SERE SCU TC Exec. Ack.” as expected.
- Received TM(1,7) “SERE MIPA TC Exec. Ack.” as expected.
- Received TM(1,7) “SERE ELENA TC Exec. Ack.” as expected.
- Received TM(1,7) “SERE STROFIO TC Exec. Ack.” as expected.
- Received HK TM(3,25), all the data was as expected.

6.3.2 Science Packets Summary

All received SERENA TM(21,3) science packets for the four sensors, STROFIO, MIPA, PICAM and ELENA were without missing SSC values and look nominal.

7. Observed Susceptibilities and/or Anomalies

No appreciable susceptibility to EM emissions was observed for the whole SERENA payload instrument and its subsystems during the test sessions, in particular the anomaly observed during SERENA FS Payload EMC test for MIPA (see BC-SRN-NC-03060 "MIPA susceptibility detected during CS test") has not occurred during the S/C test. We do not confirm the occurrence of BC-ALS-NC-01489 (STROFIO-POWER-CYCLE), maybe a S/C or script procedure problem occurred. Some trends in the temperature variation were observed, but in the order of some tenths of a Celsius degree and then completely fitting the standard and absolutely not influential for correct instruments operations.

8. Other Comments

On Day 1 the EGSE remote connection was lost at ~ 10:30 after a reset of the test data generator host, the egse GUI was frozen and then the egse hanged, a restart of the application was required. As a consequence the MIPA HK TM packets were not received from then on (2015-09-10) (see sec. 6.1).
On Day 2 (2015-09-11) the same problem of egse hang occurred at ~ 14:50 until ~ 15:00 but with not lost packets.

9. Conclusions

The goal to verify the Compatibility of the SERENA Payload instrument to the EM Conducted Emissions in the context of the BC MPO system was achieved during these tests. Both at SERENA package level and for all the subsystems the operations were verified as predicted, further and deeper investigations based on offline data analysis are still on-going, but it is extremely unlikely that the global assessment on the activity will be changed.

Test Start Date: 2015-09-10 09:37:06, Test End Date: 2015-09-11 19:35:00