DIRECTION DES SYSTÈMES ORBITAUX Toulouse
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RPW Commissioning Activity Report

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SUMMARY

This document reports the results of the activities carried out during the Near Earth Commissioning Phase (NECP) allowing to assess the functioning and the performances of the RPW instrument.

It includes also the activities performed in the early life of the instrument corresponding to the deployments of the spacecraft I-boom and the RPW antennas done during the Launch and Early Orbit Phase (LEOP).

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1 PRESENTATION OF THE DOCUMENT

1.1 PURPOSE OF THE DOCUMENT

This document reports the results of the activities carried out during the Near Earth Commissioning Phase (NECP) allowing to assess the functioning and the performances of the RPW instrument.

It includes also the activities performed in the early life of the instrument corresponding to the deployments of the spacecraft I-boom and the RPW antennas done during the Launch and Early Orbit Phase (LEOP).

1.2 APPLICATION

The spacecraft was launched by the US Atlas V 411 rocket from NASA's Kennedy Space Centre in Cape Canaveral, Florida, on 9th February 2020 at 11:03 p.m. EST (or on 10th February 2020 at 05:03 a.m CET).

This document covers all the activities where RPW was involved, over the LEOP and NECP phases, respectively performed between:
- 11/02/2020 to 13/02/2020 (LEOP)
- 24/02/2020 to 15/06/2020 (NECP)

2 REFERENCES

2.1 REFERENCE DOCUMENTS

Title		Reference
[RD-1]	The Solar Orbiter Radio and Plasma Waves (RPW) instrument, M. Maksimovic et al.	A&A, 2020 - DOI: https://doi.org/10.1051/0004-6361/201936214
[RD-2]	RPW Instrument User Manual	SOLO-RPWSY-TN-1160-CNES v2.5
[RD-3]	EMC impact on the RPW science performance in space	RPW-SCI-TSR-001894-LES
[RD-4]	CALIBRATION AND ARA MEASUREMENT DURING RPW SELF COMPATIBILITY TEST - TEST REPORT	SOLO-RPW-RP-2483-CNES
[RD-5]	RPW Operations Centre Commissioning Report	ROC-GEN-OTH-RPT-00120-LES
[RD-6]	NECP_timeline_v5_10	
[RD-7]	SEE Rate Predictions on UT8ER1Mxx from Aeroflex	SOLO-SY-AN-1316-CNES issue 1

2.2 APPLICABLE DOCUMENTS

Title of the Document	Reference

2.3 GLOSSARY & ACRONYMS

Abbr.	Signification
AIT	Assembly Integration and Test
ANT	ANTenna
COM	Commissioning
CP	Cruise Phase
CRP	Contingency Recovery Procedure
DAS	DPU Application Software
DBS	DPU Boot Software
DPU	Data Processing Unit
FCP	Flight Control Procedure
HF	High Frequency
HK	House Keeping
LCL	Latching Current Line
LEOP	Launch and Early Orbit Phase
LF	Low Frequency
LFR	Low Frequency Receiver
LVPS	Low-Voltages Power Supply
MA-SGSE	Monitoring and Analysis – Software Ground Support Equipment
MEB	Main Electronics Box
MOC	Mission Operations Centre
NECP	Near Earth Commissioning Phase
PA	PreAmplifier
PCB	Printed Circuit Board
PCDU	Power Conditioning and Distribution Unit
PDU	Power Distribution Unit
PSU	Power Supply Unit
RIU	Remote Interface Unit
ROC	RPW Operations Centre
RPW	Radio and Plasma Waves
RW	Reaction Wheels
S/C	SpaceCraft
SBM	Selected Burst Mode
SBM1	Selected Burst Mode1 (interplanetary shock measurement)
SBM2	Selected Burst Mode2 (in-situ Type III measurements)
SCM	Search Coil Magnetometer
SOC	Science Operations Centre
SpW	SpaceWire
TBC	To Be Confirmed
TBD	To Be Defined
TBW	To Be Written
TC	TeleCommand
TDS	Time Domain Sampler
TM	TeleMetry
TNR-HFR	Thermal Noise Receiver – High Frequency Receiver
TSWF	Triggered Snapshot Wave Forms

3 OVERVIEW

3.1 MISSION OVERVIEW

Solar Orbiter is a mission dedicated to solar and heliospheric physics. It was selected as the first medium-class mission of ESA's Cosmic Vision 2015-2025 Programme.

Solar Orbiter will be used to examine how the Sun creates and controls the heliosphere, the vast bubble of charged particles blown by the solar wind into the interstellar medium. The spacecraft will combine in situ and remote sensing observations to gain new information about the solar wind, the heliospheric magnetic field, solar energetic particles, transient interplanetary disturbances and the Sun's magnetic field.

The mission will provide close-up, high-latitude observations of the Sun. Solar Orbiter will have a highly elliptic orbit – between 1.2AU at aphelion and 0.28AU at perihelion. It will reach its operational orbit just under two years after launch by using gravity assist maneuvers (GAMs) at Earth and Venus. Subsequent GAMs at Venus will increase its inclination to the solar equator over time, reaching up to 24° at the end of the nominal mission (approximately 7 years after launch) and up to 33° in the extended mission phase.

The scientific payload elements of Solar Orbiter are being provided by ESA Member States, NASA and ESA. They have been selected and funded through a competitive selection process. The Solar Orbiter payload accommodates a set of ten instruments, with a total payload mass of 209 kg.

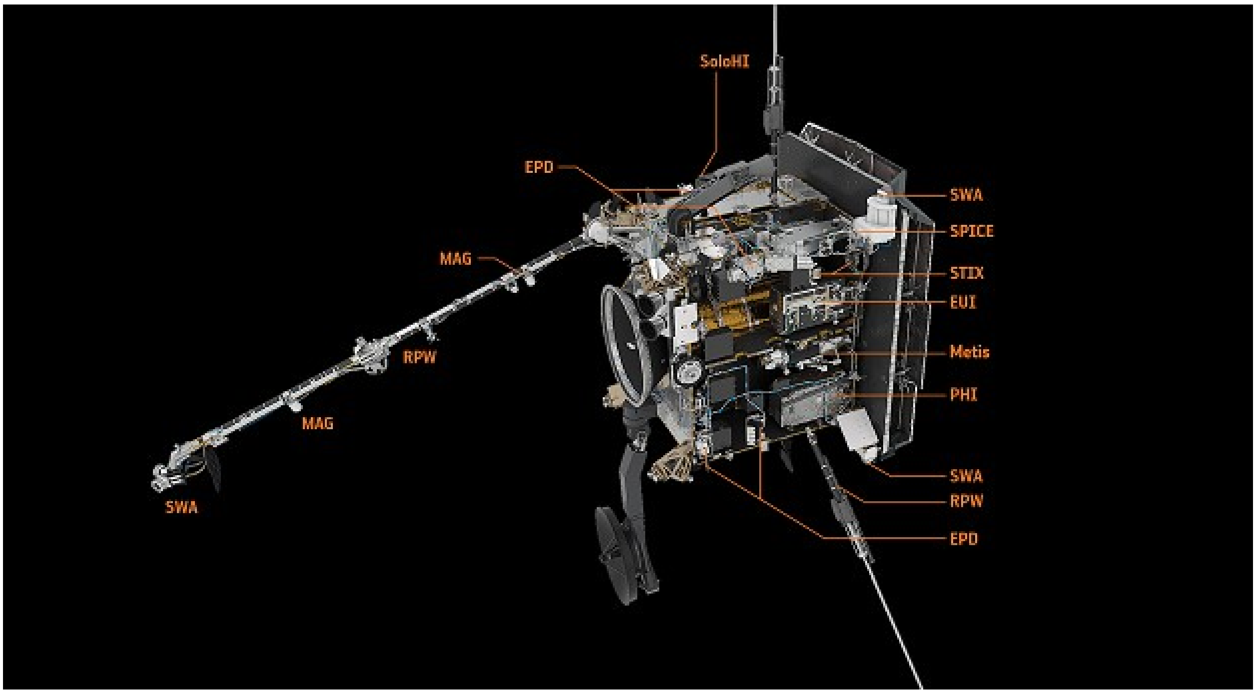

Figure 1 : Payload accommodation onboard Solar Orbiter (credit: ESA/ATG medialab).

3.2 RPW INSTRUMENT OVERVIEW

3.2.1 GENERAL DESCRIPTION OF THE INSTRUMENT

To meet the science objectives, the RPW consortium proposes a sophisticated plasma/radio wave receiver system, including high sensitivity electric and magnetic sensors. Since the receiver system covers a very wide frequency range (near-DC to 16 MHz for electric, and 0.1 Hz to 500 kHz for magnetic), different kinds of sensors are used for the measurements [RD-1].

The electric antenna (ANT), consisting on a set of three monopoles and the magnetic search coil unit (SCM) are designed to perform correctly for near-DC as well as for high frequency measurements. In particular, ANT design is optimized to satisfy the goal of measuring both: the DC/low frequency electric fields and higher frequency radio and thermal noise emissions.

A biasing unit (BIAS) will allow DC electric measurements. The three TDS, LFR and TNR-HFR sub-systems will have a common Data Processing Unit (DPU) that will handle commands, data and communication with S/C.

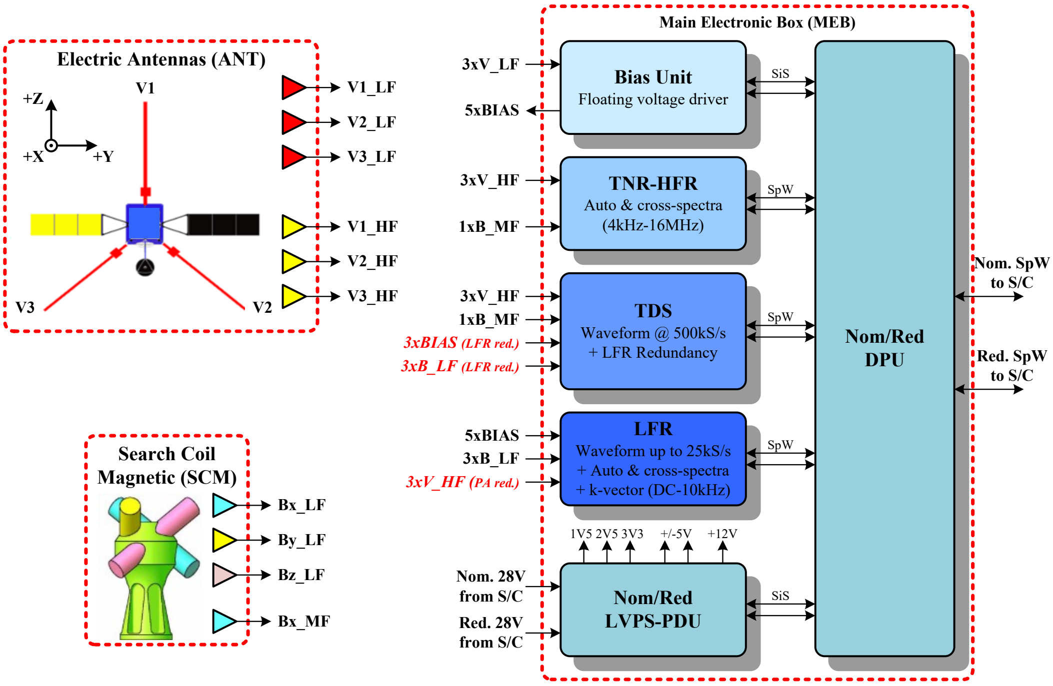

Figure 2 : Overall RPW Bloc Diagram.

3.2.2 MEASUREMENT PRINCIPLE

The RPW instrument includes:

- A Thermal Noise and High Frequency receiver (TNR-HFR) for electron measurements at the local plasma frequency and remote detection of radio emissions. TNR-HFR will provide electric power spectral densities from 4 kHz up to 16 MHz and magnetic power spectral densities from 10 kHz up to 500 kHz
- A Time Domain Sampler (TDS) for waveform capture up to 500 kSPS.
- A Low Frequency Receiver (LFR), covering both in-situ electric and magnetic measurements from DC to about 10 kHz. LFR will provide both waveform and power spectral densities in this frequency range.

These three sub-systems are connected to two different sensor units: an electric antenna unit (**ANT**) and a magnetic search coil unit (**SCM**), both of which are optimized to perform correctly for near-DC as well as high frequency measurements. In particular, the antenna sensor design will be optimized to satisfy the goal of measuring both DC/low frequency electric fields and higher frequency radio and thermal noise emissions. A biasing unit (**BIAS**) allows DC electric measurements. The three TDS, LFR and TNR-HFR sub-systems have a common Data Processing Unit (**DPU)** that handles commands, data and communication with S/C.

ANT: Each ANT monopole serves as a simple voltage sensor. At low frequencies, an antenna is coupled to the local plasma potential through a photoelectron sheath. Successful measurement of DC/low frequency plasma electric fields requires that the antenna be biased (as described below). At sufficiently high (radio) frequencies, an antenna behaves as if in a vacuum. The antenna naming convention is summed up in the following table

Serial #	Antenna	Panel	Measurement
FM01	ANT 1	PZ	V1
FM02	ANT 2	PY	V2
FM03	ANT 3	MY	V3

Table 1 : Identification of the different antennas with measurement channels.

Preamplifiers: Each monopole is connected to the inputs of both: low frequency and high frequency preamplifiers.

The LF preamplifiers will measure voltage and provide bias current, using a high input impedance follower with a bootstrapped bias resistor and voltage source. The input stage needs to handle a high source impedance of R ≈ 50 Mohms, and C ≈ 40 pF. Thus, it must have a low leakage current, < 10pA, for the whole mission, and a low input capacitance, < 4pF, to minimize attenuation of the input signal. This can only be achieved by proper bootstrapping of the current generator, and by using FET operational amplifiers.

The HF preamplifiers will provide a low noise and flat frequency response from 100Hz to more than 16 MHz. As well as the LF preamplifier, theirs input impedance will be as high as possible.

BIAS Unit: The BIAS drives a constant current to the electrical antennas allowing reliable DC/LF electric field and satellite potential measurements. The floating potential V of a conductive surface in plasma (either an individual probe or the entire spacecraft) is determined by current balance between the out-flowing photoelectron current and the inflowing plasma electron current. In the expected solar wind plasma, a conductive surface will charge up positively and the value of the floating potential will depend on the density and (to a lesser extent) the temperature of the surrounding plasma. In contrast to the spacecraft potential, the antenna potential should be anchored tightly to the local plasma potential, and should not depend on the plasma parameters and also should be affected as little as possible by the nearby satellite. To achieve this, we draw a constant bias current from the antennas to the spacecraft. If the bias current is suitably chosen, then the antennas float close to the local plasma potential and their potential is not a function of the plasma parameters. Then measurements of the potential difference between two opposite antennas which are anchored to the local plasma potential gives reliable measurement of DC/LF electric field component along that direction. In addition, the potential difference between antennas and spacecraft give an estimate of the spacecraft potential that can be used to determine the plasma density.

SCM: The Search Coil Magnetometer SCM is an inductive magnetic sensor. It is made of a core in a high permeability material (ferrite or perm-alloy) on which are wound a main coil with several thousand turns and a secondary coil with a few turns.

The induced voltage in the main coil is: $e = \mu_{eff} \cdot N \cdot S \cdot \frac{d}{dt} < B >$ (Lenz law)

Where *µeff* is the relative effective permeability, N the number of wire turns, S the cross section of the core, B the magnetic induction outside the core, aligned with the core. *µeff* depends strongly on the ratio L/d (length / diameter) of the core, and on the permeability of the core.

The secondary coil is used to create a flux feedback in order to have a flat frequency response on a bandwidth centered on the resonance frequency of the main coil. The induced voltage is raised to a proper level by a preamplifier to allow its transportation to the analyze system.

TNR-HFR: The proposed TNR-HFR instrument is a contribution to the RPW experiment consisting of a double channel radio and plasma wave spectrometer. The TNR (Thermal Noise Receiver) is a direct conversion receiver, providing quasi-instantaneous spectra, for the electrostatic thermal noise and/or magnetic field, while the HFR (High Frequency Receiver) is a sweeping receiver, for the survey of high frequency radio emissions. Its analogue front end is interfaced with three sensors, two E-field inputs (4 kHz - 16MHz.) and one B-field component (10kHz to 500kHz)

TDS: The Time Domain Sampler module (TDS) will provide in-situ waveform measurements of plasma waves around local electron plasma frequency, notably Langmuir waves found in the source region of type II and type III solar bursts and the associated electromagnetic waves. The TDS will perform digitization of the electric and magnetic field waveforms in the frequency range from 100 Hz to 250 kHz, their pre-processing and selection of potentially interesting events to be stored in internal memory and later transmitted to the ground. It is known from previous observations, which impacts of dust particles on the spacecraft body show up in the electric field data as short large amplitude spikes of a characteristic shape. An algorithm for detection of these spikes will be implemented in the on-board software in order to collect statistics of dust impacts as a function of time.

LFR: The Low Frequency Receiver (LFR) performs onboard digital processing of the electric and magnetic field data (2*E*, 3*B*, 3*V*) and covers a frequency range from a fraction of a Hertz to 10 kHz. It is designed to analyze the in situ measurements of the low frequency ($f < f_{ce}$) electro-magnetic waves in the solar wind and in the extended corona. Given the limitations in the telemetry, it is necessary to implement specific techniques to take the maximum advantage of the data. The LFR is tailored to optimize the scientific return of the data.

The LFR design gives the possibility of mixing different types of output data, from low-level processed data (waveform data) to high-level processed data (averaged Hermitian spectral matrices and their derived parameters), with various data rate possibilities (continuous or cyclic transmission, adaptable frequency bandwidth as well as adaptable frequency and time resolutions). The scientific added value stems from the choice of the most relevant combination of the different data to be transmitted.

3.2.3 POWER SUPPLY AND REDUNDANCY CONCEPT

The two LPVS units receive independent raw +28V input voltages from the prime and redundant power interfaces of the S/C. The swapping from one to the other unit is performed by switching the primary power from the main to the redundant bus. In addition, a dedicated command controls a relay located into each LVPS unit.

In order to keep the management of the DPU redundancy under the S/C control, the LVPS modules provide dedicated outputs for each DPU. These voltages are routed through the PDU by independent power buses, so that the Nom/Red DPU are respectively associated to the Nom/Red LVPS.

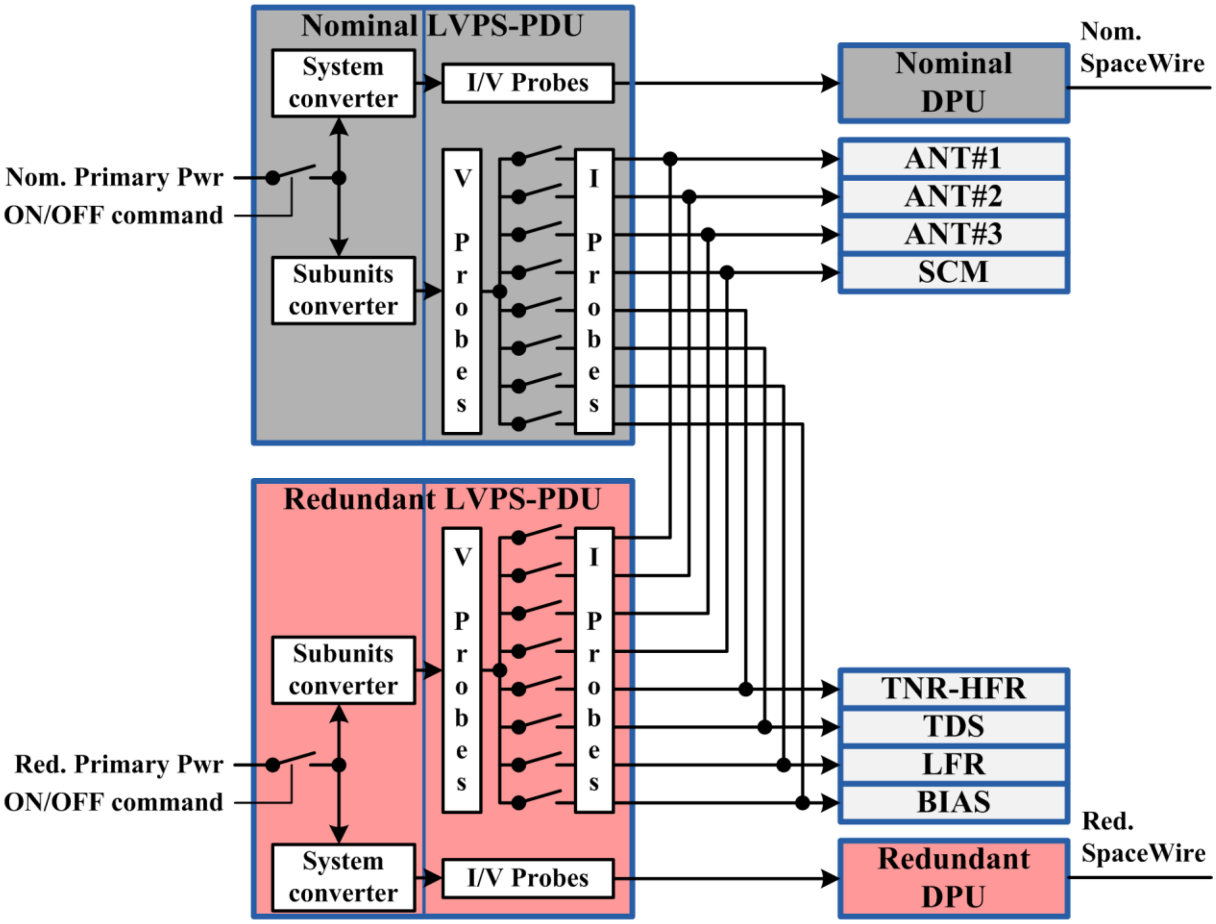

Figure 3 : Concept of redundancy and power distribution

3.3 EXPECTED TIMELINE AND ACTIVITIES

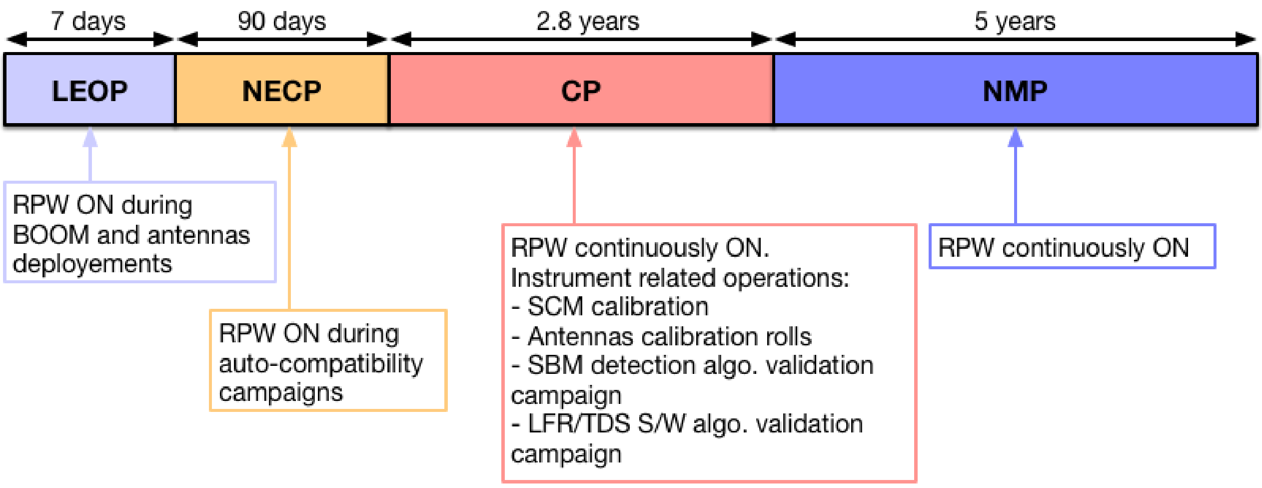

Figure 4 : General timeline of Solar Orbiter mission.

The SOLAR Orbiter spacecraft was launched from NASA's Kennedy Space Centre in Cape Canaveral, Florida, on 9th February 2020 at 11:03 p.m. EST (or on 10th February 2020 at 05:03 a.m CET) instead of the originally planned 5th February 2020 at 11:27 p.m. launch (or on 6th February 2020 at 05:27 a.m CET).

The following table describes the activities as originally planned before launch (from NECP Timeline v3.5). Blue and yellow parts describe activities respectively planned in LEOP and NECP. One activity (in orange) has been postponed to Cruise Phase (CP).

Payload	Activities Originally planned in UM	Expected Duration (hrs)	Order/Timing	OBSM Planned	Pointing Requirements	Interactivity Real Time ops	Parallel Operations	Power (W)	MOC comments	Comments
RPW-2	**I-Boom Deployment Observation** **1)** Nominal switch-on **2)** Boot DAS in Stand-by **3)** Enter Service Mode and SWON all units in right order **4)** Put RPW in I-Boom deployment configuration **5)** Abandon science mode and SWOFF RPW	10min + I-Boom deployement duration + 10min		No	Pointing needed for Boom deployment	No	Only boom deployment MAG	19.1		RPW: In the latest scenario the RPW-2 and RPW-3 activities will be planned as a single operation during LEOP: the RPW antenna +Z will be deployed first, then the i-boom, then the two other +Y/-Y RPW antennas. No interaction with the MOC team. RPW should be switched ON/OFF 10 min. before/after the whole deployement operation.
RPW-3	**RPW Antennae Deployment** **1)** RPW SWON in antennae deployment configuration and S/C TM verification (current in SMA heater, PA temperature of each antenna, micro-switches status, S/C AOCS TM) For each antenna **2)** Stub boom deployment & check correct deployment **3)** Stacer monopole deployment & check deployment **4)** Switch OFF RPW.	3 x (10 min + 1 antenna deployement duration + 10 min)		No	S/C 3-axis stabilised & Sun pointing (TBC, depending on the deployment scenario)	No	No	19.1		
RPW-1	**In-flight Short Functional Test** **1)** RPW SWON and run RPW in-flight SFT **2)** Switch OFF RPW.	1.5		No	No	No	No	19.1		RPW: SFT shall now be planned before the RPW-4 activity. RPW-1 activity (In-flight Short Functional Test) does not require real-time interactivity with MOC.
RPW-4	**RPW Antenna calibration rolls** **1)** RPW SWON in antennae calibration rolls configuration **2)** SWOFF RPW	4 x 8h		No	S/C rolls around X-axis	No	No	19.1	Downlink data rate is low in this phase of the mission. It will not be possible to download all the data between rolls, and it might take several days	RPW: Shall be planned during the first week of the NECP, when S/C is close enough from Earth to observe AKR. 8hrs of rolls in 4 days are

Payload	**Activities Originally planned in UM**	**Expected Duration (hrs)**	**Order/Timing**	**OBSM Planned**	**Pointing Requirements**	**Interactivity Real Time ops**	**Parallel Operations**	**Power (W)**	**MOC comments**	**Comments**
									until we get all the data on ground. Data between rolls could only be possible if the activity is scheduled after 10th of March, but then it might be too late for the obsevrations.	requested. EMC quiet.
RPW-7	**RPW-PAS filtering tune campaign** **1)** Determine configuration of the RPW filtering parameters	? (9h allocated)		No	No	No	SWA shall be ON	19.1		Activity to be better defined
RPW-8	**RPW electrical/magnetic characterization** 1) RPW measurements during NECP when other instruments turn-on and perform commissioning (RPW in normal mode)	~ 90 days		No	No	No	Yes	19,1		RPW: This activity should start asap after the end of RPW-4 (antenna rolls). RPW should be continuously ON in normal mode, except during RPW-6 and RPW-7 activities.
IW-6	Inter-instruments Interference Campaign (EMC campaign) 1) Successive swith ON of instruments 2) All in-situ instruments ON (remote sensing OFF) 3) All remote sensing ON (in-situ OFF) 4) All instruments ON 5) Interference campaign with the platform	> 20 (14h allocated to step 1/ 1.5h allocated to step 2/ 1.5h allocated to step 3/ 2h allocated to step 4/ 9h allocated to step 5.)		No	No	No	No	19,1		Towards the end of NECP when all instruments have been commissioned. SPICE: The EMC campaign is scheduled at a point in the timeline where the SPICE detectors are cold, and the doors are open. We cannot power off SPICE in this configuration for the interference campaign (implied in IW-61 and IW-63), but we can transition up to an operational state and back down again. Powering off would only be

Payload	Activities Originally planned in UM	Expected Duration (hrs)	Order/Timing	OBSM Planned	Pointing Requirements	Interactivity Real Time ops	Parallel Operations	Power (W)	MOC comments	Comments
										possible if the IW-6x activities were scheduled after both IC-RSC-00 and IC-SOU-80_1-8.
IM-IIC	MAG Inter-Instrument Communication test Test MAG reaction to (MAG should go to Burst Mode) after RPW issues shock flag). Ideally all In-situ instruments should participate to test reaction to S20 messages. Activity to be coordinated between MAG, RPW, EPD, SWA	3 hrs	6	No	No	Yes	Yes			
RPW-5	~~**RPW SCM calibration**~~ ~~1) RPW SWON in SCM calibration configuration~~ ~~2) SWOFF RPW~~ **Activity removed from NECP timeline. To be replanned during the first Earth GAM (depending on the operational constraints)**	~~9 (TBC)~~	-	~~No~~	~~No~~	~~No~~	~~No~~	~~19.1~~	-	~~RPW: Shall be planned during the first week of the NECP, when S/C passes through the Earth magnetic lobes. EMC quiet.~~

Table 2 : Activities originally planned before launch (LEOP part in blue, NECP part in yellow, postponed to CP in orange)

In order to manage these activities and the associated operations, a ROB (RPW Operation Board) telecons have been held Friday on every week. An activity report was generated and distributed to ESA at the end of each one of these meeting when it was needed.

3.4 COVID-19 PANDEMIC IMPACT

In response to the escalating coronavirus pandemic in March 2020, ESA has decided to reduce on-site personnel at its mission control center in Darmstadt, Germany.

This adjustment required temporarily stopping instruments operations and data gathering on Solar Orbiter mission between the 21st and the 28th of March. After a restart of the NECP timeline, most of the interactive operation have been reprogrammed in a non-interactive way when possible. RPW instrument has been switched on again on the 30th of March.

4 MAIN ACTIVITIES PERFORMED DURING LEOP AND NECP PHASES

4.1 EFFECTIVE TIMELINE

The table below gives the effective timeline of the main events concerning RPW over the LEOP and NECP Phases.

Activity	Date/Hour (UTC) Start	Duration	Date/Hour (UTC) End
First RPW Switch ON	11/02/2020 08:00:37		
PZ Antenna Deployment	11/02/2020 09:21:11	0:12:06	11/02/2020 09:33:17
Hinge Frangibolt activation	*11/02/2020 09:21:11*	*0:00:49*	*11/02/2020 09:22:00*
Boom deployment	*11/02/2020 09:22:00*	*0:00:02*	*11/02/2020 09:22:02*
Hinge Frangibolt activation	*11/02/2020 09:31:41*	*0:01:24*	*11/02/2020 09:33:05*
Stacer Deployment	*11/02/2020 09:33:05*	*0:00:12*	*11/02/2020 09:33:17*
RPW Switch OFF	11/02/2020 ~15:00:00		
RPW Switch ON	12/02/2020 13:01:00		
IBoom Deployment - Part 1	12/02/2020 19:03:00		
IBoom Deployment - Part 2	12/02/2020 19:04:00		
PY Antenna Deployment	13/02/2020 00:12:11	0:12:10	13/02/2020 00:24:21
Hinge Frangibolt activation	*13/02/2020 00:12:11*	*0:00:52*	*13/02/2020 00:13:03*
Boom deployment	*13/02/2020 00:13:03*	*0:00:03*	*13/02/2020 00:13:06*
Hinge Frangibolt activation	*13/02/2020 00:22:49*	*0:01:20*	*13/02/2020 00:24:09*
Stacer Deployment	*13/02/2020 00:24:09*	*0:00:12*	*13/02/2020 00:24:21*
MY Antenna Deployment	13/02/2020 00:36:41	0:12:05	13/02/2020 00:48:46
Hinge Frangibolt activation	*13/02/2020 00:36:41*	*0:00:53*	*13/02/2020 00:37:34*
Boom deployment	*13/02/2020 00:37:34*	*0:00:03*	*13/02/2020 00:37:37*
Hinge Frangibolt activation	*13/02/2020 00:47:19*	*0:01:15*	*13/02/2020 00:48:34*
Stacer Deployment	13/02/2020 00:48:34	*0:00:12*	13/02/2020 00:48:46
RPW Switch OFF	13/02/2020 01:45:42		
RPW SFT	24/02/2020 23:35:00	3:32:00	25/02/2020 03:07:00
Calibration rolls #1 - IW4	25/02/2020 03:27:00	8:00:00	25/02/2020 11:27:00
Calibration rolls #2 - IW4	26/02/2020 03:24:00	8:00:00	26/02/2020 11:24:00
Calibration rolls #3 - IW4	27/02/2020 03:18:00	8:00:00	27/02/2020 11:18:00
Calibration rolls #4 - IW4	28/02/2020 03:16:00	8:00:00	28/02/2020 11:16:00
IW8 - Continuous activity	28/02/2020 11:16:00	528:35:00	21/03/2020 11:51:00
IW8 - Continuous activity	30/03/2020 00:00:00	178:09:23	06/04/2020 10:09:23
IW8 - Continuous activity	07/04/2020 14:14:21	725:45:39	07/05/2020 20:00:00
PAS Filtering - IW7	07/05/2020 20:00:00	9:00:00	08/05/2020 05:00:00
IW8 - Continuous activity	08/05/2020 05:00:00	327:03:00	21/05/2020 20:03:00
IW8 - Continuous activity	30/05/2020 00:00:00	78:47:00	02/06/2020 06:47:00
Interference campaign - IW-6 - PL	02/06/2020 06:47:00	27:30:00	03/06/2020 10:17:00
Interference campaign - IW-6 - PF	03/06/2020 10:17:00	3:00:00	03/06/2020 13:17:00

Activity	Date/Hour (UTC) Start	Duration	Date/Hour (UTC) End
IW8 - Continuous activity	03/06/2020 13:17:00	63:43:00	06/06/2020 05:00:00
IIC - IM-IIC_MAG_RPW_EPD_SWA	06/06/2020 05:00:00	3:00:00	06/06/2020 08:00:00

Table 3 : Effective timeline of the events concerning RPW (LEOP part in blue, NECP part in yellow)

The latest NECP planning can be found in [RD-6].

To add Solar Orbiter safe mode transitions list

4.2 RPW HOUSE-KEEPING AND PLATFORM PARAMETERS

For instrument monitoring, housekeeping parameters have been classified in two different categories: high and low priority parameters. The first one has been used on nominal basis to monitor the in-flight instrument behavior during the Solar Orbiter commissioning phase. The complete list of these parameters is given in annex.

In addition, some S/C HK parameters have been data processed in order to help for instrument data analysis. The list of the useful S/C HK parameters is given in annex.

4.3 ANTENNAS DEPLOYMENTS (IW-3)

Figures and tables below show the deployment timeline respectively for PZ antenna and Y antennas as given by micro switch status parameters and the frangibolt line currents.

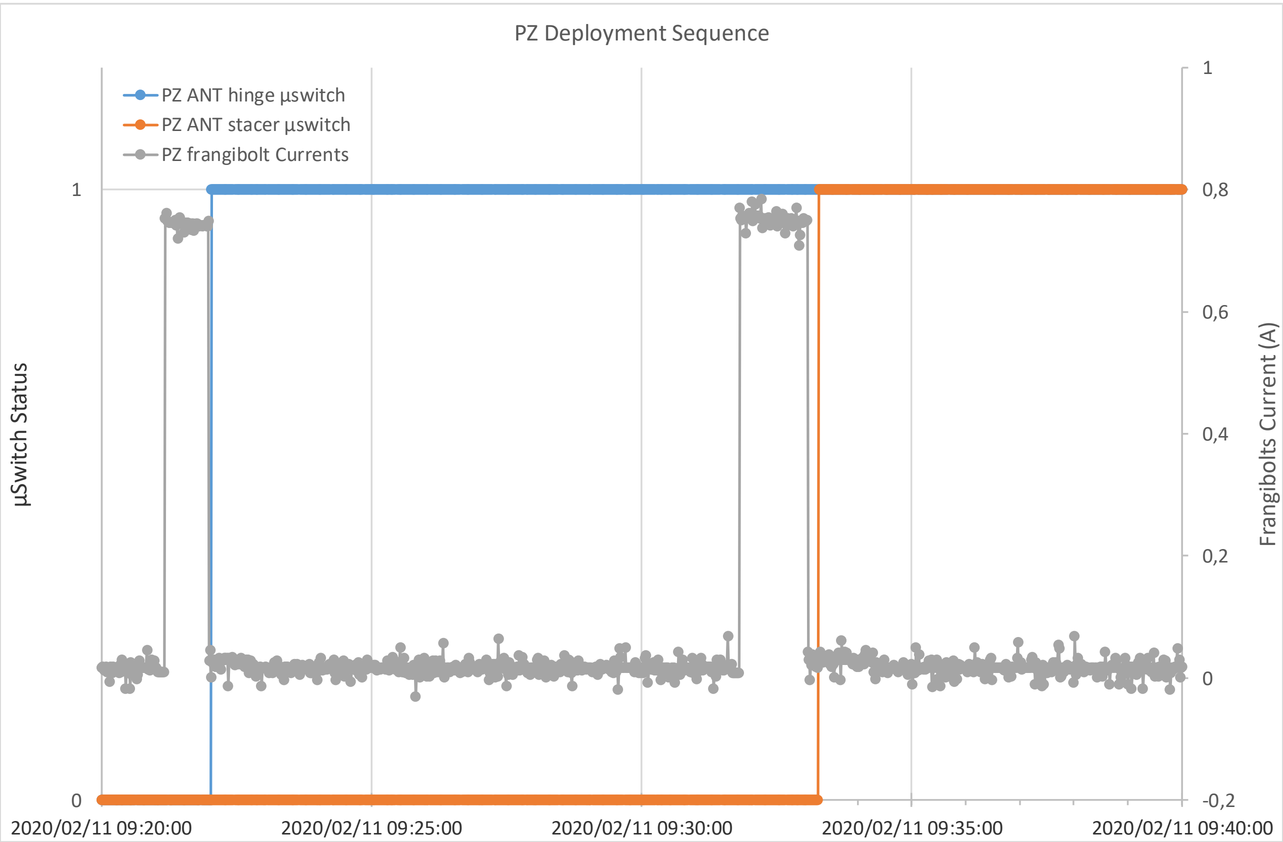

Figure 5 : PZ antenna deployment sequence.

Note that only one of the hinge micro switches (on both) gave the right status of the antenna boom deployment.

PZ Deployment	Start	End	Duration
Hinge Frangibolt activation	2020/02/11 09:21:11	2020/02/11 09:22:00	0:00:49
Boom deployment	2020/02/11 09:22:00	**2020/02/11 09:22:02**	0:00:02
Hinge Frangibolt activation	2020/02/11 09:31:41	2020/02/11 09:33:05	0:01:24
Stacer Deployment	2020/02/11 09:33:05	**2020/02/11 09:33:17**	0:00:12

Table 4 : Detailed timeline of events related to PZ deployment

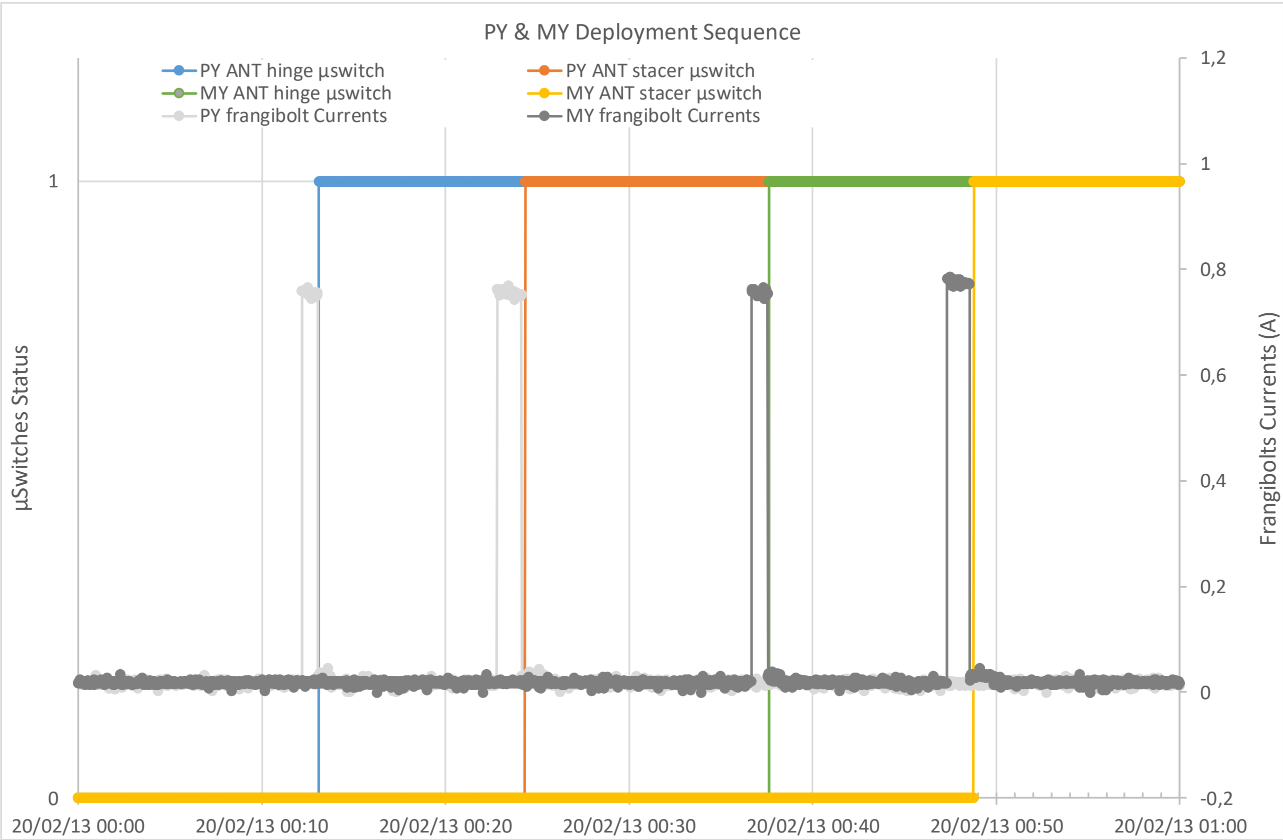

Figure 6 : PY & MY antennas deployment sequence.

PY Deployment	Start	End	Duration
Hinge Frangibolt activation	2020/02/13 00:12:11	2020/02/13 00:13:03	0:00:52
Boom deployment	2020/02/13 00:13:03	**2020/02/13 00:13:06**	0:00:03
Hinge Frangibolt activation	2020/02/13 00:22:49	2020/02/13 00:24:09	0:01:20
Stacer Deployment	2020/02/13 00:24:09	**2020/02/13 00:24:21**	0:00:12

Table 5 : Detailed timeline of events related to PY deployment

MY Deployment	Start	End	Duration
Hinge Frangibolt activation	2020/02/13 00:36:41	2020/02/13 00:37:34	0:00:53
Boom deployment	2020/02/13 00:37:34	**2020/02/13 00:37:37**	0:00:03

Hinge Frangibolt activation	2020/02/13 00:47:19	2020/02/13 00:48:34	0:01:15
Stacer Deployment	2020/02/13 00:48:34	**2020/02/13 00:48:46**	0:00:12

Table 6 : Detailed timeline of events related to MY deployment

Concerning PY & MY antenna deployments, all the micro switches worked as expected.

Due to Solar Orbiter safe mode transition on the 11th of February, RPW telemetry from the PZ antenna deployment has been lost.

More details on the RPW measurements during the PY/MY deployments will be given in the final version of the document.

4.4 I-BOOM DEPLOYMENTS (IW-2)

More details on the RPW measurements during the I-boom deployment will be given in the final version of the document.

4.5 SFT STATUS (IW-1)

RPW SFT has been performed in-flight on the 24th of February. A summary of this SFT analysis is given in this paragraph. The corresponding report is given in Annex (TBW)

The following table sums up the main steps of the SFT as they are described in SFT procedure.

Activity	Step		Description	RPW Mode
Instrument initialisation	A	_	Switch ON MEB (nominal chain)	SAFE
SFT on redundant chain	B	B1	Load DBS	SAFE
		B2	Load DAS and enter Standby	STANDBY
		B3	Enter Service Mode and configure RPW equipments	SERVICE
		B4	Science Mode without compression	SURVEY_NORMAL, SBM_DETECTION, SBM1_DUMP, SBM_DETECTION, SURVEY_BURST, SBM_DETECTION, SBM2_ACQ, SERVICE, SURVEY_BACKUP
		B5	Science Mode with compression	SURVEY_NORMAL, SBM_DETECTION, SBM1_DUMP, SBM_DETECTION, SURVEY_BURST, SBM_DETECTION, SBM2_ACQ, SERVICE, SURVEY_BACKUP
		B6	Perform Calibration	SERVICE, SURVEY_NORMAL
		B7	Test end: back to Safe Mode	STANDBY, SAFE
Instrument initialisation	C	_	Switch to nominal chain	_
SFT on nominal chain	D	D1	Load DBS	SAFE
		D2	Load DAS and enter Standby	STANDBY
		D3	Enter Service Mode and configure RPW equipments	SERVICE
		D4	Science Mode without compression	SURVEY_NORMAL, SBM_DETECTION, SBM1_DUMP, SBM_DETECTION, SURVEY_BURST, SBM_DETECTION, SBM2_ACQ, SERVICE, SURVEY_BACKUP

Activity	Step	Description	RPW Mode
	D5	Science Mode with compression	SURVEY_NORMAL, SBM_DETECTION, SBM1_DUMP, SBM_DETECTION, SURVEY_BURST, SBM_DETECTION, SBM2_ACQ, SERVICE, SURVEY_BACKUP
	D6	Perform Calibration	SERVICE, SURVEY_NORMAL
	D7	Test end: stay in SERVICE untill the next planned activities	SERVICE

Table 7 : Steps of the in-flight RPW SFT.

The following graph shows that the DPU mode follows what is expected from the procedure. It also clearly shows the two parts of the tests, the first one on the redundant chain and the second one on the nominal chain. This graph also allows to check that the analyzers mode are coherent with the DPU mode.

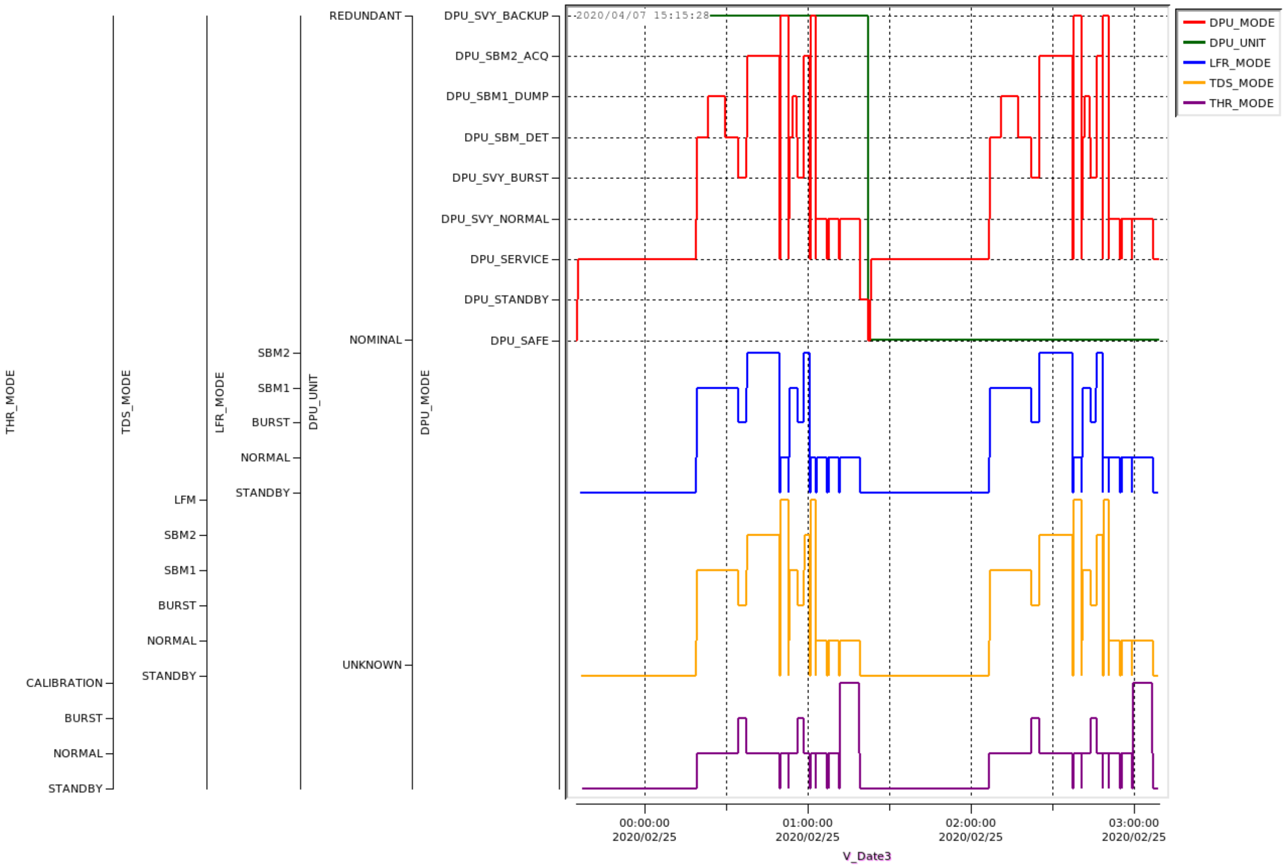

Figure 7 : RPW modes during SFT.

The following graph shows that the primary voltage is quite stable 27.8 +/-0.2V, thus RPW consumption is approximately equal to 27.8xPDU_PRIMARY_CURRENT. RPW consumption is coherent with RPW mode and the power budget.

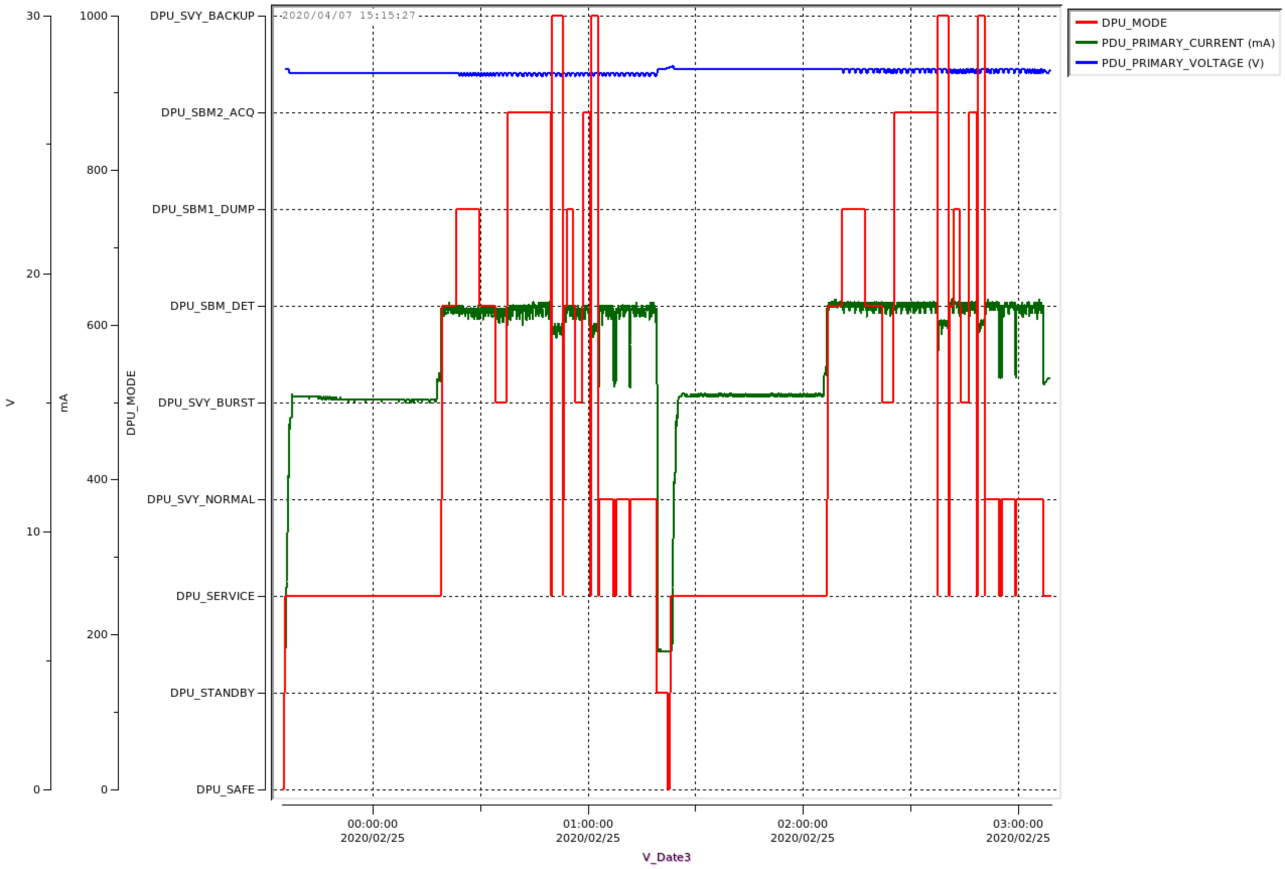

Figure 8 : RPW consumption during SFT.

During the in-flight SFT no errors are generated on purpose. However, the DPU_LE_CNT does not stay equal to zero here are the error that have been detected during the test:

- LE_DPU_AHB : 10 errors during the test all are correctable errors (see §5.2.4 for more information)
- LE_DPU_COMP: 181 errors while the compression is activated on the redundant side and 186 errors when the compression is activated on nominal side. All those errors are CPKT_TOO_BIG errors (see §5.2.6 for more information)
- LE_RPW_CURRENT : 1 error @00:19:25 on the W_BIA_M5V it happens while the bias current are set to the maximum allowed value on the redundant side (see §5.2.7 for more information).

Concerning PDU alimentation, the following tensions and currents are monitored by the S/C FDIR. The associated thresholds are sum up in the table below. No S/C FDIR triggering has been observed.

Telemetry	Parameter	Thresholds	
		Low Thr	High Thr
DPU_OBC_HK	PDU_DPU_3V3_VOLTAGE	3.6 V	4.46 V
DPU_OBC_HK	PDU_DPU_3V3_CURRENT	0 mA	519 mA
DPU_OBC_HK	PDU_DPU_2V5_VOLTAGE	2.8 V	3.43 V
DPU_OBC_HK	PDU_DPU_2V5_CURRENT	0 mA	800 mA

Table 8 : Tension and current parameters monitored by S/C FDIR.

The values of PDU secondary voltages were coherent with those were seen on the instrument SFT performed in CNES. The following table gives the average values on nominal and redundant sides.

Parameters	Average values	
	Nominal	Redundant
PDU_P12V_VOLTAGE	11.7 V	11.9 V
PDU_P5V_VOLTAGE	5.04 V	5.08 V
PDU_3V3_VOLTAGE	4.08 V	4.13 V
PDU_1V5_VOLTAGE	2.25 V	2.28 V
PDU_M5V_VOLTAGE	-4.94 V	-5.02 V

Table 9 : Average values on nominal and redundant sides for PDU secondary voltages.

Note that contrary to what the name suggest it is normal that PDU_1V5_VOLTAGE is around 2.25 V and not 1.5 V.

The DPU supply voltages show coherent values with those were seen during the instrument SFT performed in CNES. The following table gives the average values on nominal and redundant sides.

Parameter	Average values	
	Nominal	Redundant
DPU_P1V9_SUPPLY	1.87 V	1.87 V
DPU_P2V5_SUPPLY	2.46 V	2.47 V
DPU_P3V3_SUPPLY	3.30 V	3.30 V

Table 10 : Average values on nominal and redundant sides for DPU supply voltages.

Concerning the consumption of the sub-systems consumption, they vary with their associated mode as expected. The consumptions are in accordance with RPW power budget.

Concerning the temperatures, all monitored values are in the range of the expected values. Only SCM temperature (LFR_TEMP_SCM) show an unexpected behavior. Indeed, the measurements cannot go under -53.8 °C. This anomaly is detailed in paragraph 5.2.2.

During SFT, some internal flags have been rise. The DPU_TIME_SYNC_FLAG is set to 1 twice. This is due to the time between RPW switch ON and the start of the synchronization with the S/C. This will happen each time RPW is powered ON

Two low events (LE) have been detected by TDS. Both happen during SBM2_ACQ and are SW_PROCANOMALY errors (see §5.2.10)

Two low events (LE) have been detected by THR. One error happened at the end of each of THR calibration and correspond to TIMECODE_CTR errors (see §5.2.11).

4.6 CALIBRATION ROLLS STATUS (IW-4)

More details on the RPW measurements during the calibration rolls will be given in the final version of the document.

4.7 CONTINUOUS ACTIVITY (IW-8)

Activities and Operations

4.8 IIC CAMPAIGN (IM-IIC)

Data processing and analysis on going.

Two issues have been highlighted:

- IIT housekeeping packets seem to be produced but not routed or received without any event generated.

- SBM2 events do not confirmed by TDS after EPD detection (internal problem to RPW: wrong configuration of TDS ?)

Investigations in progress.

See summary tables below

IIC-1					
UTC	**PDOR ID (<subsystem>_<freetest>)**	**PDOR summary / Step description**	**Successful ? Yes/No**	**Comments**	Old UTC
RPW Issues SBM1 Trigger; EPD, MAG and SWA-EAS React					
2020-06-06T05:00:00	**IW_IS-IIC-1-01-En-dump**	RPW to enable TM(3,25) HK "TM_DPU_IIT_HK" at 1 Hz to dump contents of TC(20,128) from EPD, MAG, RPW and SWA. To be kept enabled during the duration of the entire IS-IIC campaing (IIC-1, IIC-2, IIC-3, IIC-4 and IIC5). RPW Activate also SBM1 HK (1 per sec)	YES	First S1 HK produced on 00:00:03.69 (then every 1s). IIT not produced even so TC has been accepted and weel executed (no failure/event). Is it an issue of retrieving data ? or operation ?	2020-05-24T15:00:00
2020-06-06T05:00:04	**IW_IS-IIC-1-02-Dis_shock**	RPW to feed IIC TM(3,25) with test pattern: SMB1_FLAG and SMB2_FLAG1 are set to 0; SBM1_ENABLED to 1; SBM2_ENABLED to 0	YES		2020-05-24T15:00:04
2020-06-06T05:00:05	**ID_IS-IIC-1-01-En-trigger-mode-2**	EPD to enable trigger mode 2, set trigger mode 2 threshold to 0xB0FF, set internal instrument particle flux threshold to 0x00, set idle time of all modes to 0 mins (to guarantee consecutive transitions during the IS-IIC).			2020-05-24T15:00:05
2020-06-06T05:01:20	**IM_IS-IIC-1-01-En-trigger**	MAG to enable BM trigger, threshold set to 0xB0FF, duration set to 5 minutes (AIMF406A)			2020-05-24T15:01:20
2020-06-06T05:02:10	**IA_IS-IIC-1-01-En-trigger**	SWA to enable trigger mode for SWA-EAS, keep SWA-PAS reaction disabled, set threshold to 0xB0FF EAS 1&2 Compression ON			2020-05-24T15:02:10
2020-06-06T05:08:11	**IW_IS-IIC-1-03-En-shock-01**	RPW to feed IIC TM(3,25) with test pattern SMB1_FLAG to 1; SMB2_FLAG1 to 0; SBM1_ENABLED to 1; SBM2_ENABLED to 0	YES		2020-05-24T15:08:11
Autonomous Reactions		EPD Burst Mode 2 Triggered			
		Mag mode transition from NM to BM			
		SWA-EAS Trigger mode Enabled			
2020-06-06T05:13:11		MAG transition back from Bust to Normal mode after 5 minutes			2020-05-24T15:13:11
2020-06-06T05:13:12	**IW_IS-IIC-1-02-Dis_shock-02**	RPW to feed IIC TM(3,25) with test pattern SMB1_FLAG and SMB2_FLAG1 are set to 0; SBM1_ENABLED to 1; SBM2_ENABLED to 0	YES		2020-05-24T15:13:12
Autonomous Reactions		EPD disables burst mode 2			
RPW Issues SBM1 Trigger; No reaction because quality too low					
2020-06-06T05:13:13	**ID_IS-IIC-1-02-En-trigger-no-reac**	EPD to enable trigger mode 2, set trigger mode 2 threshold to 0xB200, set internal instrument particle flux threshold to 0x00, set idle time of all modes to 0 mins (to guarantee consecutive transitions during the IS-IIC).			2020-05-24T15:13:13
2020-06-06T05:13:18	**IM_IS-IIC-1-02-En-trigger-no-reac**	MAG to enable BM trigger, threshold set to 0xB200, duration set to 5 minutes (AIMF406A)			2020-05-24T15:13:18
2020-06-06T05:44:08	**IA_IS-IIC-1-02-En-trigger-no-reac**	SWA to enable trigger mode for SWA-EAS, keep SWA-PAS reaction disabled, set threshold to 0xB200			2020-05-24T15:44:08
2020-06-06T05:44:09	**IW_IS-IIC-1-03-En-shock**	RPW to feed IIC TM(3,25) with test pattern SMB1_FLAG to 1; SMB2_FLAG1 to 0; SBM1_ENABLED to 1; SBM2_ENABLED to 0	YES		2020-05-24T15:44:09
Autonomous Reactions		EPD Does not enter burst mode			
		MAG Does not enter burst mode			
		SWA does not enter trigger mode			
RPW issues SB1 Trigger; EPD enters trigger mode 3					

2020-06-06T05:49:10	**IW_IS-IIC-1-02-Dis_shock**	RPW to feed IIC TM(3,25) with test pattern SMB1_FLAG and SMB2_FLAG1 are set to 0; SBM1_ENABLED to 1; SBM2_ENABLED to 0	YES		2020-05-24T15:49:10
2020-06-06T05:49:11	**ID_IS-IIC-1-03-En-trigger-mode-3**	EPD to enable trigger mode 3, set trigger mode 3 threshold to 0xB1FF, set internal instrument particle flux threshold to 0x00, set idle time of all modes to 0 mins (to guarantee consecutive transitions during the IS-IIC).			2020-05-24T15:49:11
2020-06-06T05:49:56	**IW_IS-IIC-1-03-En-shock**	RPW to feed IIC TM(3,25) with test pattern SMB1_FLAG to 1; SMB2_FLAG1 to 0; SBM1_ENABLED to 1; SBM2_ENABLED to 0	YES		2020-05-24T15:49:56
Autonomous Reactions		EPD burst mode 3 triggered			
2020-06-06T05:54:57	**IW_IS-IIC-1-02-Dis_shock**	RPW to feed IIC TM(3,25) with test pattern SMB1_FLAG and SMB2_FLAG1 are set to 0; SBM1_ENABLED to 1; SBM2_ENABLED to 0	YES		2020-05-24T15:54:57
Autonomous Reactions		EPD disables burst mode 3			

Table 11 : Summary tables of IIC test results (IIC-1 part)

IIC-2					
UTC	**PDOR ID (<subsystem>_<freetest>)**	**PDOR summary / Step description**	**Successful? Yes/No**	**Comments**	Old UTC
		IIC-2-A: RPW Issues SBM2 Trigger, EPD reacts			
2020-06-06T06:00:00	**IW_IS-IIC-2-01-Dis_shock**	RPW to feed IIC TM(3,25) with test pattern SMB1_FLAG and SMB2_FLAG1 are set to 0; SBM1_ENABLED to 0; SBM2_ENABLED to 1	YES		2020-05-24T16:00:00
2020-06-06T06:00:06	ID_IS-IIC-2-01-En-trigger-mode-5	EPD to enable trigger mode 5, set trigger mode 5 threshold to 0xC0FF, set idle time of all modes to 0 mins (to guarantee consecutive transitions during the IS-IIC).			2020-05-24T16:00:06
2020-06-06T06:00:46	**IW_IS-IIC-2-01-En_shock-01**	RPW to feed IIC TM(3,25) with test pattern SMB1_FLAG to 0; SMB2_FLAG1 to 1; SBM1_ENABLED to 0; SBM2_ENABLED to 1	YES		2020-05-24T16:00:46
Autonomous Reactions		EPD burst mode 5 triggered			
2020-06-06T06:15:47	**IW_IS-IIC-2-01-Dis_shock-02**	RPW to feed IIC TM(3,25) with test pattern SMB1_FLAG and SMB2_FLAG1 are set to 0; SBM1_ENABLED to 0; SBM2_ENABLED to 1	YES		2020-05-24T16:15:47
Autonomous Reactions		EPD burst mode 5 disabled			
		IIC-2-B: RPW Issues SBM2 Trigger, no reaction, quality factor smaller than EPD's threshold			
2020-06-06T06:15:48	**ID_IS-IIC-2-02-En-trigger-mode-5-no-react**	EPD to enable trigger mode 5, set trigger mode 5 threshold to 0xC200, set idle time of all modes to 0 mins (to guarantee consecutive transitions during the IS-IIC).			2020-05-24T16:15:48
2020-06-06T06:16:33	**IW_IS-IIC-2-01-En_shock**	RPW to feed IIC TM(3,25) with test pattern SMB1_FLAG to 0; SMB2_FLAG1 to 1; SBM1_ENABLED to 0; SBM2_ENABLED to 1	YES		2020-05-24T16:16:33
Autonomous Reactions		No reaction expected from EPD			
2020-06-06T06:21:34	**IW_IS-IIC-2-03-Dis_shock**	RPW to feed IIC TM(3,25) with test pattern SMB1_FLAG and SMB2_FLAG1 are set to 0; SBM1_ENABLED to 0; SBM2_ENABLED to 0	YES		2020-05-24T16:21:34
Autonomous Reactions		No reaction expected from EPD			

Table 12 : Summary tables of IIC test results (IIC-2 part)

IIC-4					
UTC	**PDOR ID (<subsystem>_<freetest>)**	**PDOR summary / Step description**	**Successful? Yes/No**	**Comments**	Old UTC
		IIC-4 RPW Issues SBM1 Trigger Based on Changes in MAG data. Other instruments react			

2020-06-06T06:50:00	ID_IS-IIC-4-01-En-trigger-mode-3	EPD to enable trigger mode 3, set trigger mode 3 threshold to 0x0000, set internal instrument particle flux threshold to 0x00, set idle time of all modes to 0 mins (to guarantee consecutive transitions during the IS-IIC).			2020-05-24T16:50:00
2020-06-06T06:50:15	IM_IS-IIC-4-02-En-trigger	MAG to enable BM trigger, threshold set to 0x0000, duration set to 5 minutes (AIMF406A)			2020-05-24T16:50:15
2020-06-06T06:51:05	IW_IS-IIC-4-01-En_SBM1	RPW to enable SBM1 detection algorithm, with coefficient values of alpha=1, beta=0, gamma=0	YES		2020-05-24T16:51:05
2020-06-06T06:51:10	IA_IS-IIC-4-01-En-trigger	SWA to enable trigger mode for SWA-EAS, keep SWA-PAS reaction disabled, set threshold to 0x0000			2020-05-24T16:51:10
2020-06-06T06:57:20	IM_IS-IIC-4-03-Load-matrices-2	IM-FCP-404: MAG send Matrix 2: contents such that there is a step change in X of 100nT e.g. X=-1000nT, Y=-600nT, Z=-100nT			2020-05-24T16:57:20
Autonomous Reactions		RPW Issues SBM1 Trigger & sends SBM1 data	YES	RPW detects SBM1 event at : - 06:51:09 - 06:58:57 - 07:06:45 - 07:14:33 - 07:22:22 - 07:30:10 RPW enters SBM1_DUMP mode (sending SBM1 data) : - from 06:54:09 to 06:58:59 - from 07:01:57 to 07:06:45 - from 07:09:45 to 07:14:33 - from 07:17:33 to 07:22:22 - from 07:25:22 to 07:30:10 (in between those times, RPW returns in SBM_DETECTION mode)	
Autonomous Reactions		EPD enters Burst Mode 3			
		MAG transitions from Normal to Burst mode			
		SWA-EAS Enters Trigger mode			
Autonomous Reactions		EPD disables Burst Mode 3			
		MAG transitions from Burst to Normal mode			
		RPW returns to Normal Mode	YES	See E12 cell	
2020-06-06T07:32:17	IW_IS-IIC-4-02-Dis_SBM1	RPW to disable SBM1 detection algorithm	YES		2020-05-24T17:32:17
2020-06-06T07:32:21	IM_IS-IIC-4-04-Load-default-matrices	MAG to load default calibration matrices			2020-05-24T17:32:21

Table 13 : Summary tables of IIC test results (IIC-4 part)

IIC-5					
UTC	**PDOR ID (<subsystem>_<freetext>)**	**PDOR summary / Step description**	**Successful ? Yes/No**	**Comments**	Old UTC
IIC-4 RPW Issues SBM2 Trigger Based on Changes in EPD data. EPD reacts					
2020-06-06T07:35:05	ID_IS-IIC-5-01-En-trigger-mode-5	EPD to enable trigger mode 5, set trigger mode 5 threshold to 0x0000, set idle time of all modes to 0 mins (to guarantee consecutive transitions during the IS-IIC).			2020-05-24T17:35:05
2020-06-06T07:35:15	IW_IS-IIC-5-01-En_SBM2	RPW to enable SBM2 detectino algorithm, set ΔTEPD to 5mins (TBD), set NEPD-tresh to 1	YES		2020-05-24T17:35:15

		(TBD), set ΔTSBM2 to 15mins (TBD), set NLW-thresh to 0, set ΔTLW to 5mins (TBD).			
2020-06-06T07:35:16	ID_IS-IIC-5-02-Set-test-pattern	EPD Command test pattern. Contents of the test pattern should contain the following values: Electrons Sun 40/60 = 0; Electrons ASun 40/60 = 8.			2020-05-24T17:35:16
Autonomous Reaction		RPW SBM2 mode automatic transition	YES	RPW enters SBM2_ACQUISITION mode at 07:35:32	
Autonomous Reaction		RPW stays in SBM2 and notifies SBM2 detection	YES (from an IIC point of view, as link with EPD worked)	RPW notifies detection at 07:35:30 via TM_DPU_EVENT_PR_DPU_SBM2 with PA_DPU_SBM2_PR_CODE = 1 (SBM2_DETECTED and not CONFIRMED) --> RPW has been alerted by EPD but TDS did not confirmed the SBM2 event so no data acquired -> wrong configuration of TDS ?	
Autonomous Reaction		EPD burst mode 5 triggered			
Autonomous Reaction		RPW exits SBM2 and set SBM2 flag to 0	YES	RPW exits SBM2_ACQUISITION mode at 07:50:33	
Autonomous Reaction		EPD burst mode 5 disabled			
2020-06-06T07:55:21	ID_IS-IIC-5-03-Set-default-config	EPD: comand to default configuration	YES (from an IIC point of view, as link with EPD worked)	RPW enters SBM2_ACQUISITION mode at 07:55:54 and notify detection at 07:55:52 via TM_DPU_EVENT_PR_DPU_SBM2 with PA_DPU_SBM2_PR_CODE = 1 (SBM2_DETECTED and not CONFIRMED) --> RPW has been alerted by EPD but TDS did not confirmed the SBM2 event so no data acquired -> wrong configuration of TDS ?	2020-05-24T17:55:21
2020-06-06T07:56:51	IM_IS-IIC-5-01-Set-default-configuration	MAG: Normal Mode, BM trigger reaction disabled, default calibration matrices			2020-05-24T17:56:51
2020-06-06T07:59:51	IW_IS-IIC-5-02-Set_default_config	RPW: Command to default configuration (including disabling of TM(3,25) HK "TM_DPU_IIT_HK"generation)	YES	RPW exits SBM2_ACQUISITION mode at 07:59:52 (as required by PDOR)	2020-05-24T17:59:51
2020-06-06T07:59:56	IA_IS-IIC-5-01-Set-default-config	SWA: command to default configuration (i.e. switch off)			2020-05-24T17:59:56

Table 14 : Summary tables of IIC test results (IIC-5 part)

4.9 SWA PAS FILTERING (IW-7)

First analysis show that no significate perturbation has been measured during this activity.

More details on the RPW measurements during SWA PAS filtering activity will be given in the final version of the document.

4.10 EMC INTERFERENCE CAMPAIGN (IW-6)

A summary of main results obtained during the EMC interference campaign will be given in the final version of the document

4.11 ATLAS COMET CROSSING

A summary of main results obtained during ATLAS comet crossing will be given in the final version of the document

5 COMMAND CONTROL STATUS

During the Solar Orbiter commissioning phase, the monitoring of the instrument has been performed mainly by the RPW team at CNES.

5.1 UNEXPECTED EVENTS AND ANOMALIES

The table below summarizes the events occurred during LEOP and NECP phases and returned in RPW event telemetry.

Date	Events	Comments
2020/02/11 08:27:41,053	DPU_EVENT_HE_RPW_TEMPERATURE	SCM temperature FDIR triggering leading to a SCM switch-off (see § 5.2.1)
2020/02/11 08:14:31,250	DPU_EVENT_LE_DPU_AHB	Regular since this date (see § 5.2.4)
2020/02/11 14:16:09,003 2020/02/11 14:16:10,001 2020/02/11 14:16:10,002	DPU_EVENT_LE_DPU_TIMECODE DPU_EVENT_LE_DPU_TIME DPU_EVENT_LE_DPU_TIME	LE_DPU_TIMEC/ DPU_EVENT_LE_DPU_TIMECODE LE_DPU_TIME/ TIMECODE_IT LE_DPU_TIME/ NOT_SYNCHRO (see § 5.2.5)
2020/02/25 00:55:04,530 - 2020/02/25 00:56:38,893 2020/02/25 02:42:47,535 - 2020/02/25 02:44:21,876	DPU_EVENT_LE_DPU_COMP	LE_DPU_COMP/ CPKT_TOO_BIG: 181 + 186 events (see § 5.2.6)
2020/02/25 00:19:25,037	DPU_EVENT_LE_RPW_CURRENT	LE_RPW_CURRENT/ W_BIA_M5V warning occurred during RPW SFT (see § 5.2.7)
2020/02/25 07:28:15,618 - 2020/02/25 08:53:30,507 2020/02/26 07:28:59,298 - 2020/02/26 08:49:13,468 2020/02/27 07:29:59,333 - 2020/02/27 08:50:00,859 2020/02/28 07:31:00,379 - 2020/02/28 08:50:51,030	DPU_EVENT_ME_DAS_BUFFER	ME_DAS_BUFFER/ SBM_TM_FIFO: 16 + 13 + 13 + 10 events (see § 5.2.8)
2020/04/06 10:09:28.480 2020/04/06 10:09:54.479	DPU_EVENT_LE_DPU_SC_LINK DPU_EVENT_ME_DPU_SC_LINK DPU_EVENT_HE_DPU_RESET	LE_DPU_SC_LK/ S20_TIMEOUT ME_DPU_SC_LINK/ S20_MISSING HE_DPU_RESET UNEXP_RESET Linked to unexpected switch OFF on the 6th of April.
2020/04/06 10:09:29.198 2020/04/18 02:58:20,001 2020/04/20 05:48:28,001	DPU_EVENT_LE_DPU_TIMECODE	LE_DPU_TIMEC/ MISSING LE_DPU_TIMEC/ ERRONEOUS LE_DPU_TIMEC/ ERRONEOUS (see § 5.2.5)
2020/04/25 00:04:56.297 - 2020/04/25 23:29:16,300 2020/04/26 01:14:16.286 - 2020/04/26 23:19:16,315	DPU_EVENT_LE_DPU_COMP	LE_DPU_COMP/ CPKT_TOO_BIG: 94 events (see § 5.2.6)
2020/04/30 23:59:53.009	DPU_EVENT_ME_BIA_SWEEP	ME_BIA_SWEEP/ ABORTED Root cause is wrong TC sequence
2020/05/03 20:08:30.001 2020/05/30 22:09:27.003	DPU_EVENT_LE_DPU_TIMECODE	LE_DPU_TIMEC/ ERRONEOUS LE_DPU_TIMEC/ ERRONEOUS (see § 5.2.5)
2020/05/19 16:00:00,530 2020/05/19 16:00:05,663 2020/05/19 20:00:00,503 2020/05/19 20:00:05,644	DPU_EVENT_ME_DAS_BUFFER	ME_DAS_BUFFER/ SBM_TM_FIFO: 4 events (see § 5.2.8)
2020/05/30 23:59:20.649	DPU_EVENT_ME_DPU_WAIT_SYNC	ME_DPU_WAITSYN/ TRANS_ABORTED (see § 5.2.9)
2020/06/01-07	DPU_EVENT_LE_DPU_COMP	LE_DPU_COMP/ CPKT_TOO_BIG: 30986 events (see 5.2.6)
2020/06/02 06:47:05.272	DPU_EVENT_ME_DPU_WAIT_SYNC	ME_DPU_WAITSYN/ TRANS_ABORTED (see § 5.2.9)
2020/06/02 07:55:22.001 2020/06/02 07:55:23.001 2020/06/02 07:55:23.002	DPU_EVENT_LE_DPU_TIMECODE DPU_EVENT_LE_DPU_TIME DPU_EVENT_LE_DPU_TIME	LE_DPU_TIMEC/ ERRONEOUS LE_DPU_TIME/ TIMECODE_IT LE_DPU_TIME/ NOT_SYNCHRO (see § 5.2.5)

Table 15 : List of RPW unexpected events

5.2 ERRORS AND ANOMALIES OBSERVED DURING LEOP AND NECP PHASES

5.2.1 TEMPERATURE FDIR TRIGGERING AT SCM SWITCH-ON - YIW00117

During the first switch-on of RPW (before deploying PZ antenna on 2020-02-110 at 8:27:41.216), SCM FDIR triggering (YIW00117 - TM_DPU_EVENT_HE_RPW_TEMPERATURE: RPW temperature critical alarm) occurred leading to a SCM switch-off. The SCM temperature FDIR threshold was to -50°C (FTHR_LOW corresponding to the lower threshold was defined in the IDB to -50°C / FTHR_UP corresponding to the upper threshold was defined in the IDB to +80°C).

For other reasons, a spacecraft safe mode had to be commanded during I boom deployment.

Deployment timeline was resumed on the day after, this time not resetting the SCM heater thermal control range (managed via procedure IW-FCP-100) and SCM remained ON. This means that SCM remained all the time in the Warm-up control range (between -44°C and -42°C, see table below).

As a reminder, the SCM switch-on sequence is as follows (see [RD-2]):

1. Initial state: SCM is regulated by the survival line on its survival set-points (NOP set-points)
2. Temporarily the survival heater line set points are changed to upper values in order to warm-up SCM (Warm-up set-points)
3. After an amount of time (Warm-up dwell), SCM is switched-on. So, the operational heater line is then available (OP set-points)
4. Survival heater line set-points revert to original set-points survival values (NOP set-points).
5. SCM is regulated by the operation line

This sequence is summarized by the diagram below.

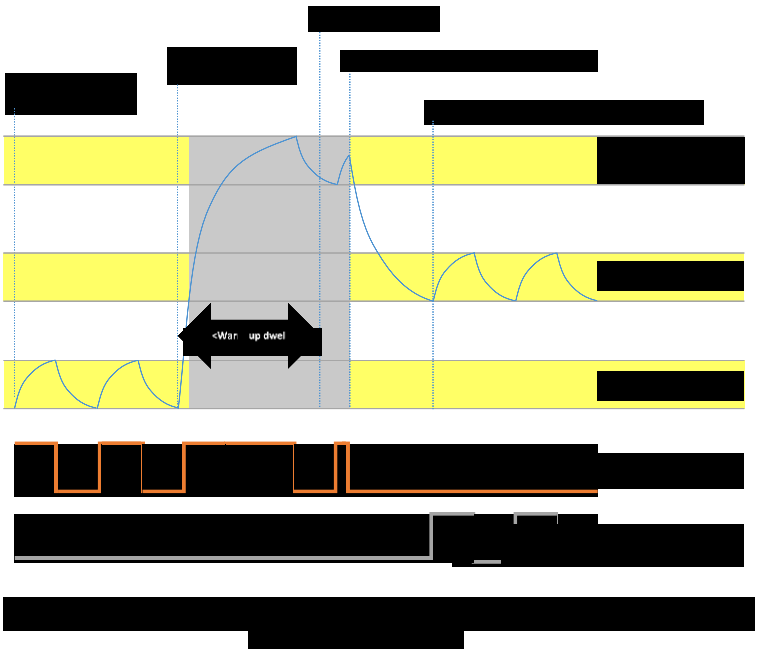

Figure 9 : RPW SCM switch-on sequence concept.

The table hereafter gives the thermal parameters of the SCM Switch-on sequence described above.

	Set-points	
	Min	Max
NOP	-56	-54
OP	-48	-46
Warm-up	-44	-42
Warm-up dwell	20 minutes	

Table 16 : SCM switch-on sequence thermal parameters values.

As shown by analysis, the FDIR threshold was too high compared to the in-flight temperature measured by SCM internal housekeeping sensor. Indeed, the temperature gradient is more important than expected between the regulation and HK sensors (the respective location are described on figure below).

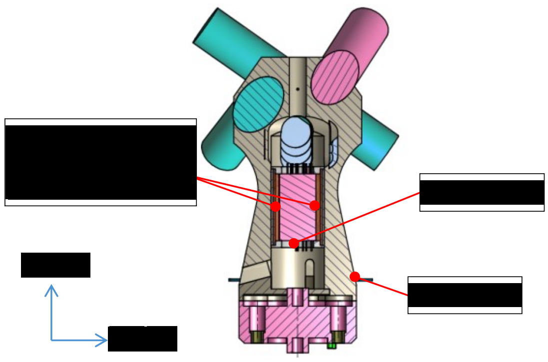

Figure 10 : SCM active thermal control hardware.

Due to spacecraft safe mode, the RPW HK data hasn't been retrieved. But the solar orbiter temperature parameter values confirm this assumption (see figure below). The FDIR triggering occurred when regulation sensor still measured ~-48°C (instead of -50°C which is the threshold limit for the FDIR).

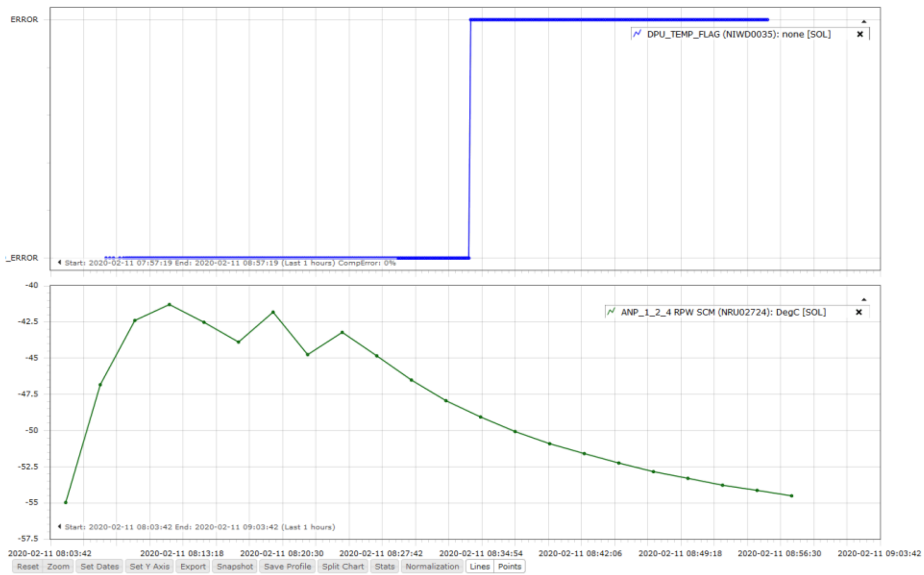

Figure 11 : SCM FDIR triggering (in blue) and regulation sensor temperature (in green).

For the following SCM switch-on (on the 24th of February), the FDIR threshold has been decreased to -58°C and the warm-up dwell duration set to 40 minutes. No FDIR triggering occurred anymore.

For information, the TC_DPU_LOAD_TEMP_PAR is used to modify the SY_DPU_LFR_TEMP_SCM_LOW parameter specifying the FDIR threshold.

In the following operations, the warm-up dwell duration has been adjusted to xx minutes without any consequence.

5.2.2 SCM TEMPERATURE TELEMETRY VALUE NOT BELOW -53,8°C

During SFT, the value of SCM temperature HK_LFR_TEMP_SCM (NIW00832) does not drop below -53.8°C (see figure below, the value of SCM temperature (blue curve) never goes under this value). This parameter is included in the LFR part of the telemetry and is used to trigger the SCM temperature FDIR. The measured temperature curve is in accordance with raw telemetry values. This has not been observed before because the low FDIR threshold was previously set to -50°C.

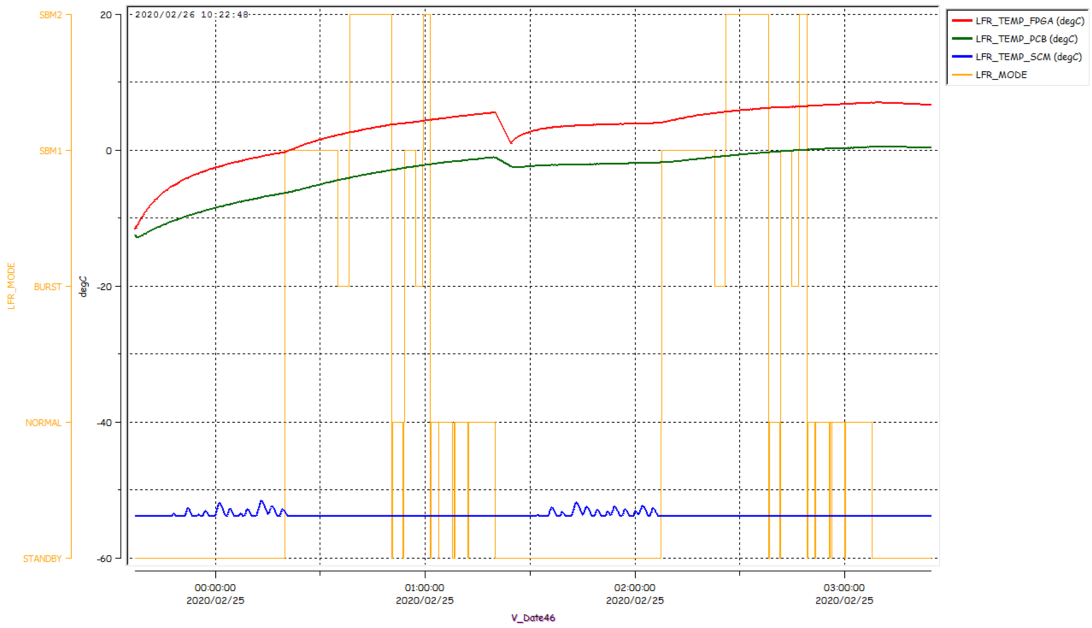

Figure 12 : SCM temperatures at SCM switch ON during in-flight SFT in February 2020.

The root cause of this anomaly is a wrong definition of the acquisition range for the SCM temperatures. It seems that the requirements to measure this value until -80°C were not implemented because they were never transmitted or took into account.

As we can see on figure below, the ADC is only able to acquire the SCM temperature until -53.8°C (blue curve). The acquisition range is hard coded by passive components on LFR board and cannot be modified.

The main consequence is that the *low FDIR threshold is only usable for values higher than -53.8°C. Unfortunately, the adequate in-flight value is lower. The thermal control range in non-op could be increased a little bit in order to avoid to reach temperatures too close to the limits but this does not change in fact the issue.*

Finally, we analyzed the in-flight operational heater duty cycle. We are able to deduce at ground the in-flight SCM temperature even when the temperature acquisition is wrong. This is an important point because SCM temperature has to be monitored by one way or another for data calibration purpose.

5.2.3 HEATER SPURIOUS ON SCM MEASUREMENTS

To be written. Spurious are induced by SCM heater switch-on and switch-off transitions on SCM measurements. These spurious disturb only small part of the measurements.

5.2.4 DPU AHB CORRECTABLE ERRORS (MEMORY CORRUPTION DETECTED BY EDAC) -YIW00033

Since the first instrument switch-on, correctable EDAC error events (YIW00033 DPU AHB) have been regularly generated by the DPU SRAM. These errors are regularly transmitted in DPU_EVENT_LE_DPU_AHB packet and correspond to expected SEUs observed and corrected on the memory. These single errors are all correctable. No un-correctable error (multiple errors) has been observed (DPU_EVENT_ME_DPU_AHB) over the Solar Orbiter commissioning period.

Due to the important number of observed error, the related action has been set to "to be ignored, always no action" in the actions table in case of detected events (see CRP_000_RPW). So the SolO MOC engineer don't call the RPW list anymore in case of this event.

The figure below gives the cumulated EDAC error count versus time (in orange) and the duration in minutes between two consecutive events (in blue) for March-April period. We observe that the error occurrence is well distributed. The periods without error correspond to periods where RPW was switched off.

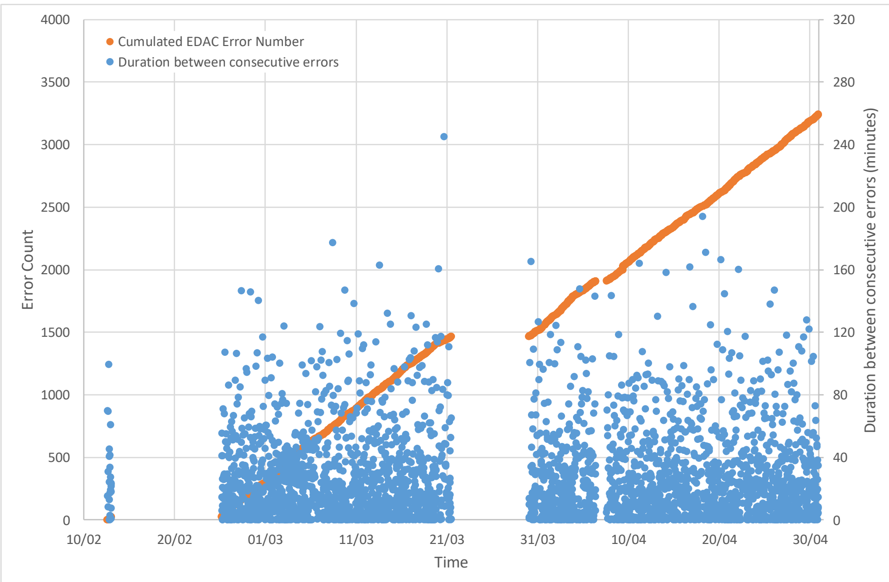

Figure 13 : Cumulated EDAC error count and duration between consecutive events.

Moreover, on the following figure giving also the corresponding memory addresses for each error (in numerical value), we observe that there is no area more sensitive on the memory.

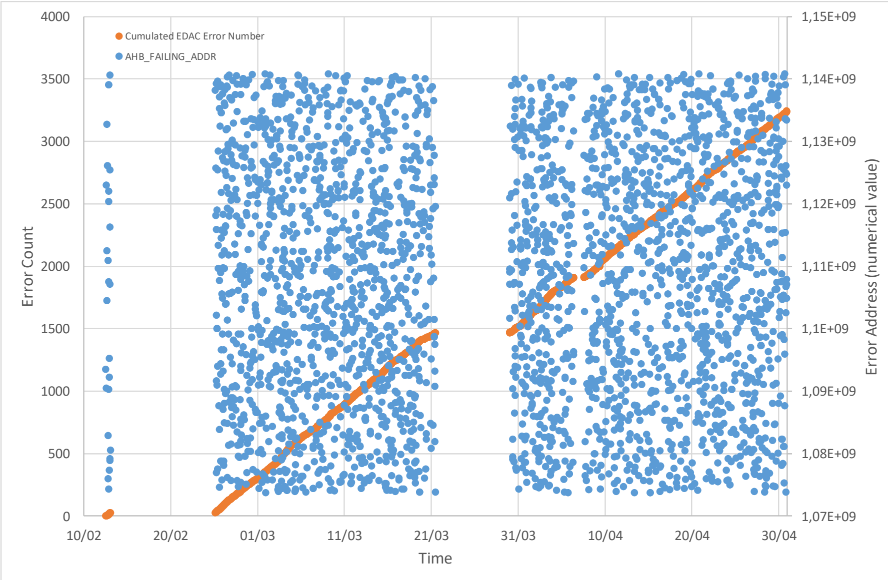

Figure 14 : Cumulated EDAC error count and corresponding memory addresses.

The observed error rate has been compared to the SEE rate predictions in flight for the SRAM. At the time of the analysis, several launch scenarios had been studied but not the one for February 2020. However, in the different studied cases, the rates are quite the same and the observed error rate is consistent with the predictions. Indeed, the worst estimation for the beginning of the mission gives a cumulative rate of 6.74E-7 (behind standard shielding of 3.7mm Al), whether about 4.7 errors per hour. This corresponds to the same order of magnitude that we observed.

In the case of a solar particle event, this rate could be increased by a factor 1000 to 10,000 (corresponding to more than 10,000 errors / hour in the "worst day" case). Moreover, the number of multiple errors (MBU type, multiple bit upset), not corrected by the EDAC system, is then no longer negligible.

The figures for the May-June period will be added.

5.2.5 TIME CODE ANOMALY - I YIW00038 & YIW00039

Each time that a timestamp sending by the platform is delayed or missing on the SpW, RPW sends a DPU time or timecode anomaly event. This has been seen sometimes at ground (during TVAC but also after, see SOL.SC.ASTR.NCR.01306 – "PFM - Payload provides unexpected PPS reports with timestamp not synchronized").

When error occurs, the impact on RPW is minimal. DPU resynchronizes correctly upon receipt of a time code after the wrong/missing time code. No definitive desynchronization of the RPW clock is observed as can be seen on other instruments. The impact on science is minimal also because RPW analyzers use time for packets dating but not for acquisition synchronization.

If DPU sends a slightly wrong time to the analyzers, it can perhaps occur on a moment where one of the analyzers have to date a packet: then there will be science packets with a slightly incorrect acquisition date.

RPW provides also SBM event detection information with time information that can be used by other instruments. If there is a time divergence between the instruments in situ, because some, as it seems to be the case, do not manage to re-synchronize, then it is indeed problematic (for the on board management of the SBM events by these instruments and for the synchronization at ground of the in-situ instruments data). But this could be occurred rarely.

Concerning a possible mitigation for RPW, it is obviously a huge work for making RPW even more robust than it is to the time-code troubles. That is not justified, because RPW shows a good ability to resynchronize.

5.2.6 ERROR DURING COMPRESSION PROCESS - YIW00089

Many errors while the compression is enabled (LE_DPU_COMP - CPKT_TOO_BIG). This is a warning from the FSW indicating that the size of the compressed packet is larger than the size of the uncompressed packet. In this case, the compression algorithm of TDS SBM1 RSWF packets is ineffective with respect to this data (i.e. there is not enough signal and too much noise induced mostly by the platform perturbations at 80 and 120 kHz).

Note that no non-compressed packet is not lost, it is retransmitted uncompressed, as it is.

Regarding compression (see Table 17), we observe very good compression rates for LFR waveforms. Compression rates are poor for TDS except for the LFM_CWF and the Normal MAMP.

DAS_STATISTICS_HK gives compression efficiency per packet.

	Eng values				Selected compression rate for ISM calculations
Packet type	Apr-21	May-30	Jun-01	Apr-26	
LFR Normal CWF F3	4,2	0,0	0,0	4,1	4
LFR Normal CWF Long F3	4,1	5,1	5,2	3,5	
LFR Burst CWF F2	3,4	0,0	0,0	3,5	3.5
LFR Normal CWF F0	2,9	2,9	2,9	3,0	2,9
LFR Normal CWF F1	3,0	3,1	3,0	3,0	3
LFR Normal CWF F2	3,4	3,4	3,5	3,5	3,4
LFR SBM1 CWF F1	0,0	0,0	0,0	0,0	2
LFR SBM2 CWF F2	0,0	0,0	0,0	0,0	2
TDS Normal RSWF	1,7	1,4	1,4	1,6	1,5
TDS Normal TSWF	1,7	1,5	1,4	1,6	1,5
TDS SBM1 RSWF	0,0	0,0	0,0	0,0	2
TDS SBM2 TSWF	0,0	0,0	0,0	0,0	2
TDS BACKUP RSWF	0,0	0,0	0,0	0,0	2
TDS BACKUP CWF	0,0	0,0	0,0	0,0	2
TDS MAMP	4,0	0,0	0,0	3,9	4
Global average	2,8	3,1	3,1	2,9	

Table 17 : Compression efficiency recorder per packet for different dates.

5.2.7 WARNING ON PDU_BIAS_M5V_CURRENT PARAMETER - YIW00086

On the 2020-056 at 00:19:27.030 during SFT (IW-1 activity), RPW current consumption warning occurred (see figure below).

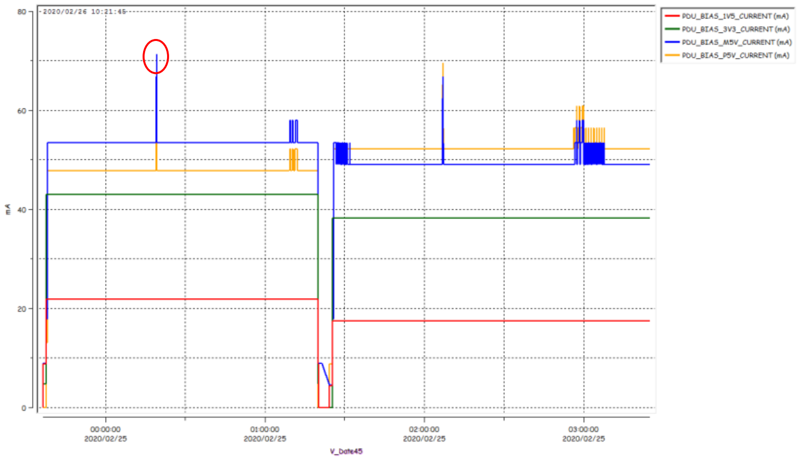

Figure 15 : BIAS current acquisition at the time of the anomaly.

Indeed, the warning value of PDU_BIAS_M5V_CURRENT parameter has been exceeded when RPW was on redundant side. For information, those current were monitored by RPW internal FDIR the thresholds are sum up in the table below. If the value is out of [LNOM-WDEV HNOM+WDEV] range then a warning is sent. If the value is out of [LNOM-PDEV HNOM+PDEV] range then BIAS is restarted using a power OFF/power ON procedure.

Telemetry	Parameter	LNOM	HNOM		WDEV	PDEV
DPU_PDU_HK	PDU_BIAS_P5V_CURRENT	8.68 mA	86.82 mA		5 %	20 %
DPU_PDU_HK	PDU_BIAS_M5V_CURRENT	13.35 mA	66.76 mA		5 %	20 %
DPU_PDU_HK	PDU_BIAS_3V3_CURRENT	9.54 mA	52.5 mA		5 %	20 %
DPU_PDU_HK	PDU_BIAS_1V5_CURRENT	13.06 mA	30.53 mA		5 %	20 %

Table 18 : FDIR thresholds for BIAS Currents.

The raw value was 1 LSB above the warning threshold. This was only a warning and did not lead to any reconfiguration of the instrument. Nonetheless the thresholds might have to be re-tuned and it has been proposed to set limits (HNOM) for PDU_BIAS_M5V_CURRENT at the same value than PDU_BIAS_P5V_CURRENT (86,82mA instead of 66,76 mA).

5.2.8 DAS BUFFER OVERFLOW - YIW00105

This TM buffer is used to store SBM1 type TMs before sending to S/C. When there is an overflow, TM are lost. This buffer has lower priority than the TM buffer dedicated to SURVEY type TM. the RPW configuration used in the case of the anomaly is very specific: the bit rate in SURVEY mode is huge relative to the nominal case (around 350 kbps). In this case, the SURVEY TM flow is occasionally blocked by the transmission of the SBM flow. The SBM circular buffer was emptied at 300 kbps: this speed was chosen for the nominal case. This speed should be reduced when the SURVEY flow is so large in order to avoid a TM SBM buffer overflow.

This error is not a malfunction but corresponds to an inappropriate RPW setting. A higher frequency of DAS_STATISTICS_HK packets would allow a fine tracking of the different bit rates and to fully investigate the problem.

As soon as the RPW test bench will be available, correct setting of SY_DPU_MAX_RATE_DM_SBM_CB1 and CB2 parameters will be checked on MEB EM1. Afterward, these parameters shall be modified consequently in case of running the same configuration.

5.2.9 DPU_EVENT_ME_DPU_WAIT_SYNC

On May 30 and June 2, two mode transition failure errors have been observed. The failure report for May 30 was the following:

Mnemonic	Description	APID	PID	EID	Severity	Generation Time	SSC
YIW00293	A delayed mode transition has been aborted.	1207	RPW_0	42356	ERROR	30/05/2020 23:59:36.597	132

After data analysis, the following transitions were observed (the time corresponds to the time of the packet header):
- 23:53:46: transition from SBM_DET to SERVICE
- 23:53:57: transition from SERVICE to SVY_NORMAL
- 23:58:33: transition from SVY_NORMAL to SERVICE
- 23:59:15: TC passing in SERVICE rejected (RPW was already in SERVICE according to the DAS so this behavior is expected)
- 23:59:20: DPU_EVENT_ME_WAIT_SYNC transition anomaly
- 23:59:22: transition from SERVICE to SBM_DET

The status of the analyzers is consistent with this sequence.

But, the PDOR sequence was the following:
- 23:54:00: transition from SBM to SERVICE
- 23:54:11: transition from SERVICE to NORMAL
- 23:58:47: transition from NORMAL to SERVICE
- 23:58:57: transition from SERVICE to SBM (missing transition)
- 23:59:31: transition from SBM to SERVICE
- 23:59:34: config TNR-HFR NORMAL
- 23:59:35: LFR NORMAL config
- 23:59:36: transition from SERVICE to SBM

It seems that there was a missing transition but that the TC was accepted and executed since we did not have an error. In fact, this comes from the synchronization of snapshots with SWA.

Indeed, when this synchronization is activated, the transition to SBM can be effective only each 5 minutes. The request to switch to SBM which does not seem to have taken place is too close to the request to switch to the next SERVICE transition.

Taking into account the synchronization, the entry into SBM should have seen at 00:00:00, but the entry into SERVICE takes place just before (at 11:59:31 p.m.) and induced the cancelation of the entry into SBM.

5.2.10 SW_PROCANOMALY ERRORS DURING SFT

2 low events (LE) have been detected by TDS during SFT on the 24th of February. Both happened during SBM2 data acquisition (SBM2_ACQ) and correspond to a processing error of the SW (SW_PROCANOMALY error).

The root cause of this anomaly has been understood (to add more details) and should be fixed by TDS SW upgrade.

5.2.11 TIMECODE_CTR ERRORS DURING SFT

Two low events (LE) have been detected by THR. One error happened at the end of each of THR calibration and correspond to TIMECODE_CTR errors. This error indicates that the data used in the processing were saturated. THR team concluded that it is not the best way of doing that and expect to modify the THR SW consequently.

5.2.12 TNR EPOCH TIME ISSUE

The issue does not come directly from the Epoch time, but from the TICKS_NR values, which are used to calculate the time for all the samples of each TNR band.

This occurs only for few samples when values are very high and mostly for the A TNR band. The root cause of this issue seems to be on board (TBC).

Investigation in progress

5.3 INSTRUMENT MODES

All instrument functional modes have been tested in-flight during the NECP.
- NORMAL mode: DEFAULT configuration, LOW rate/ HIGH rate, Galaxy mode measurements, as well as many other configurations for each analyzer
- BURST mode: DEFAULT configuration
- "Degraded" SBM mode: DEFAULT configuration
- BACK UP mode (but only during an half day)
- Internal Calibration for LFR, TNR-HFR and BIAS
- BIAS sweep
- Triggering snapshot (TS) Dump in NORMAL mode
- Non nominal HK generation

All these configurations have been checked in flight with and without data compression and also with and without SWA synchronization.

For more details about the analyzers configurations used during NECP, please refer to chapter 6.3 and Annex 1.

Some capabilities have still to be checked in flight more or less extensively:

- Other SBM modes (carried out only during IIC test) with TS Dump in SBM2
- BACK UP mode more extensively
- LFR k-coefficients Modification in flight
- HFR list mode (selected frequency acquisition)

5.4 MISSING TELEMETRIES

No significant missing telemetry has been observed during LEOP and NECP excepted telemetry lost during spacecraft safe mode transition, SSMM shutdown issues or induced by on ground data distribution and processing.

The percentage of missing telemetries are summarized in table in Annex 4.

6 INSTRUMENT BEHAVIOR

6.1 THERMAL BEHAVIOR

RPW thermal behavior seems to be in accordance with the expected one. A detailed analysis will be provided in the final version of this document.

6.1.1 THERMAL IMPACT OF SOLAR ARRAY ROTATIONS

During the NECP, 4 steering of the solar panels have been performed. They took place on the following dates.

DoY	Date	Solar Array Rotations
91	31/03/2020	SA steering from 0 to 30 degrees @11h17
120	29/04/2020	SA steering from 30 to 56 degrees @00h47
127	06/05/2020	SA steering from 56 to 60 degrees @19h52
152	31/05/2020	SA steering from 60 to 70 degrees @20h30

Table 19 : Dates of solar array rotations

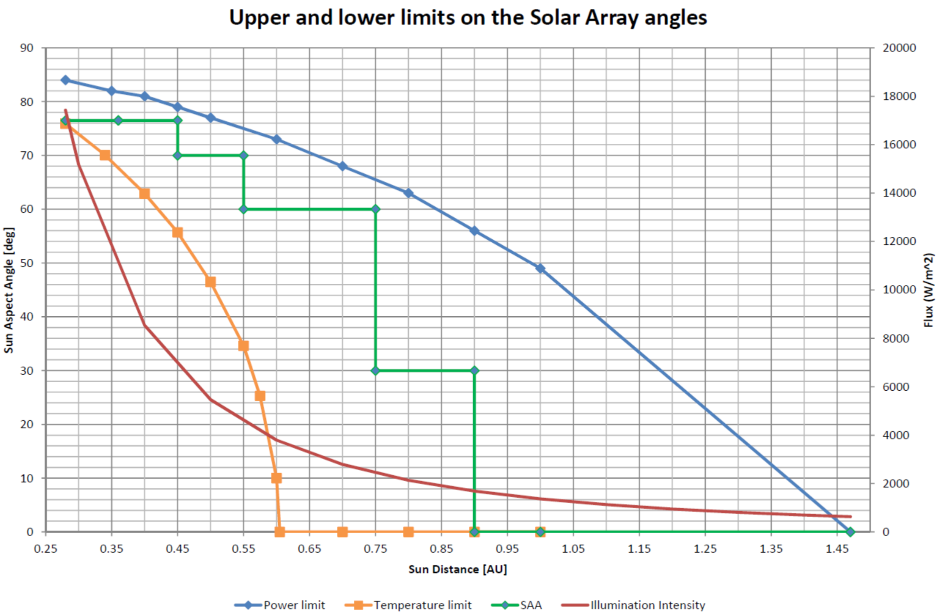

Figure 16 : expected solar array angle versus sun distance in AU.

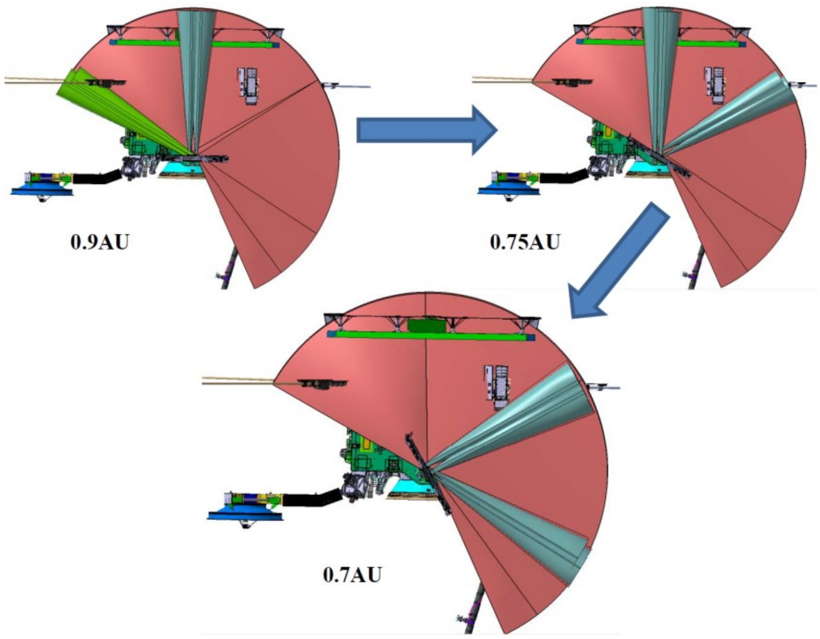

Figure 17 : Main solar array rotation cases including unexpected additional yoke reflections.

Preliminary analysis of temperature during SA rotation on March 31st (~11:17/11:22)

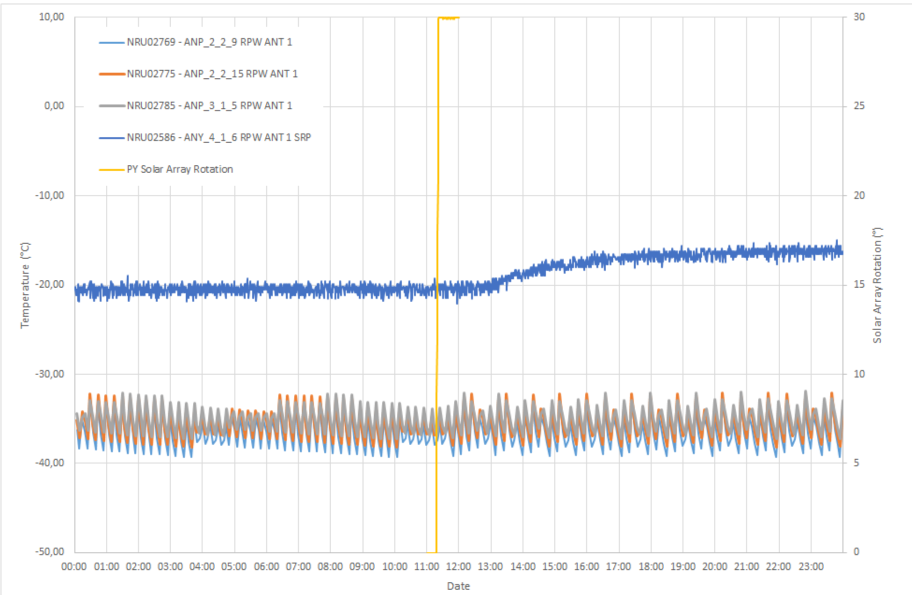

Figure 18 : PZ antenna temperature during solar array rotation on March 31st.

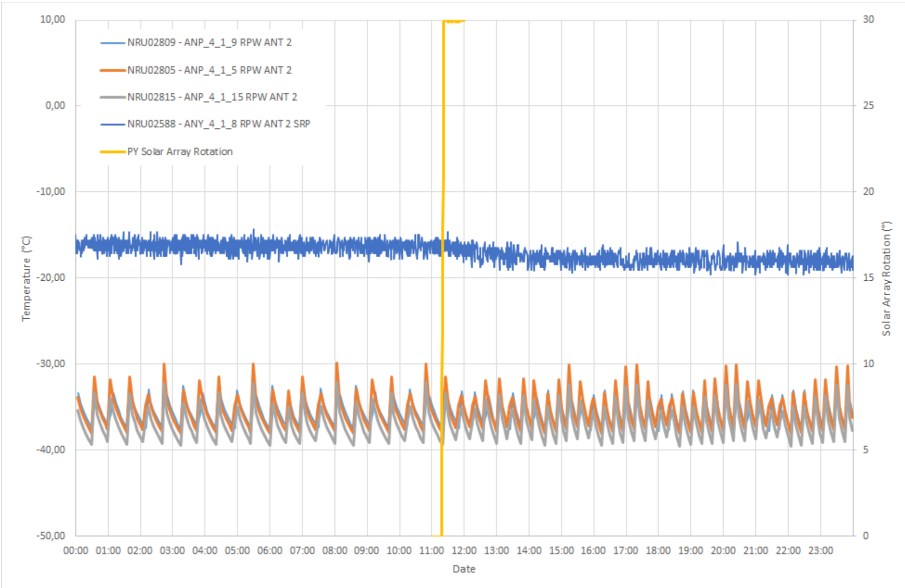

Figure 19 : PY antenna temperature during solar array rotation on March 31st.

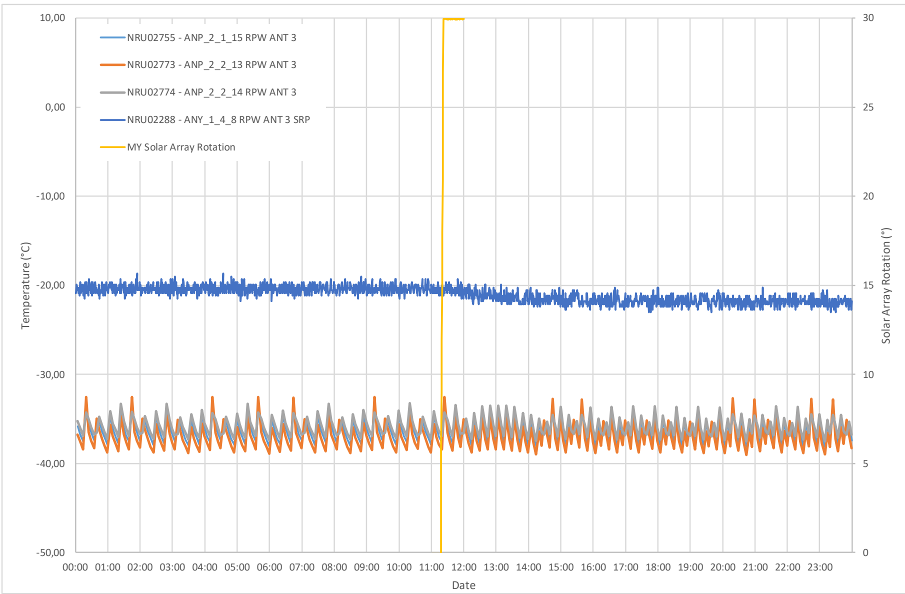

Figure 20 : MY antenna temperature during solar array rotation on March 31st.

Slight increase of PZ antenna temperature / decrease of thermal control regulation duty cycle. Slight decrease of PY/MY antenna temperatures / increase of thermal control regulation duty cycle.

Related to yoke OSR reflections? Analysis in progress

6.2 POWER CONSUMPTION

RPW power consumption and electrical behavior seem to be in accordance with the expected ones. A detailed analysis will be provided in the final version of this document.

6.3 FUNCTIONAL BEHAVIOR AND MEASUREMENT MODES

In the final version of this document, this chapter will focus on the description of some specific nominal behavior or modes checked in flight during the NECP.

7 ELECTROMAGNETIC COMPATIBILITY SYNTHESIS

7.1 EMC INTERFERENCE CAMPAIGN STATUS

7.1.1 MAIN PLATFORM PERTURBATIONS

TBW

7.1.2 INSTRUMENT PERTURBATIONS

TBW

7.2 WHEEL OFF LOADS

Only some of the most significant Wheel Off Loads (WOL) over the March to April period have been analyzed. From the figures below, the chosen WOL periods have been the following:

- On March 18th around 19:00,
- On March 9th around 23:30,
- On April 13th around 21:00,
- On April 27th around 21:00.

Analysis in progress.

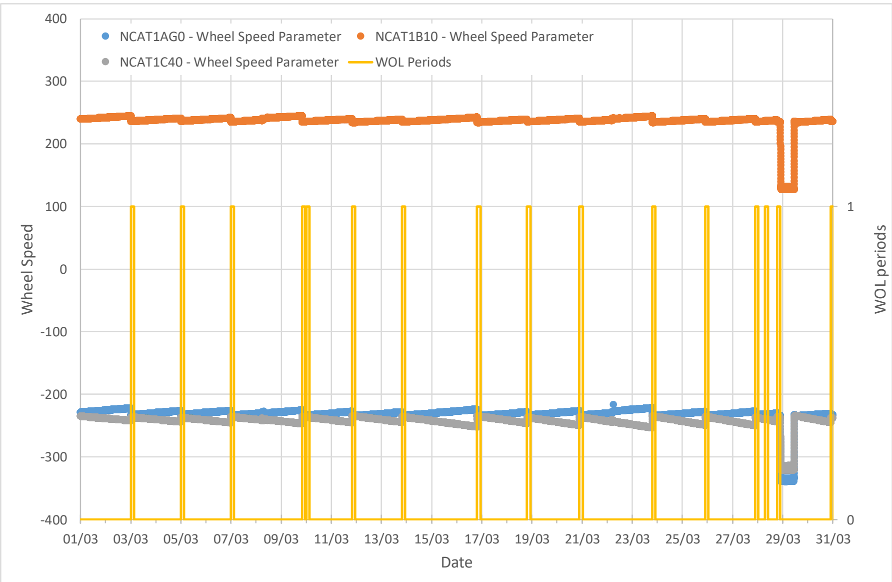

Figure 21 : Wheel speed parameters and WOL periods on March 2020

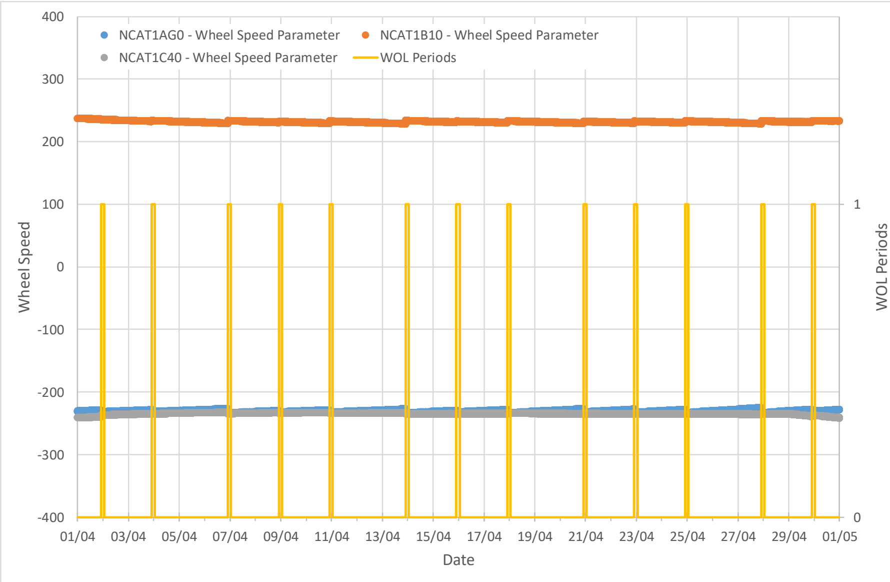

Figure 22 : Wheel speed parameters and WOL periods on April 2020.

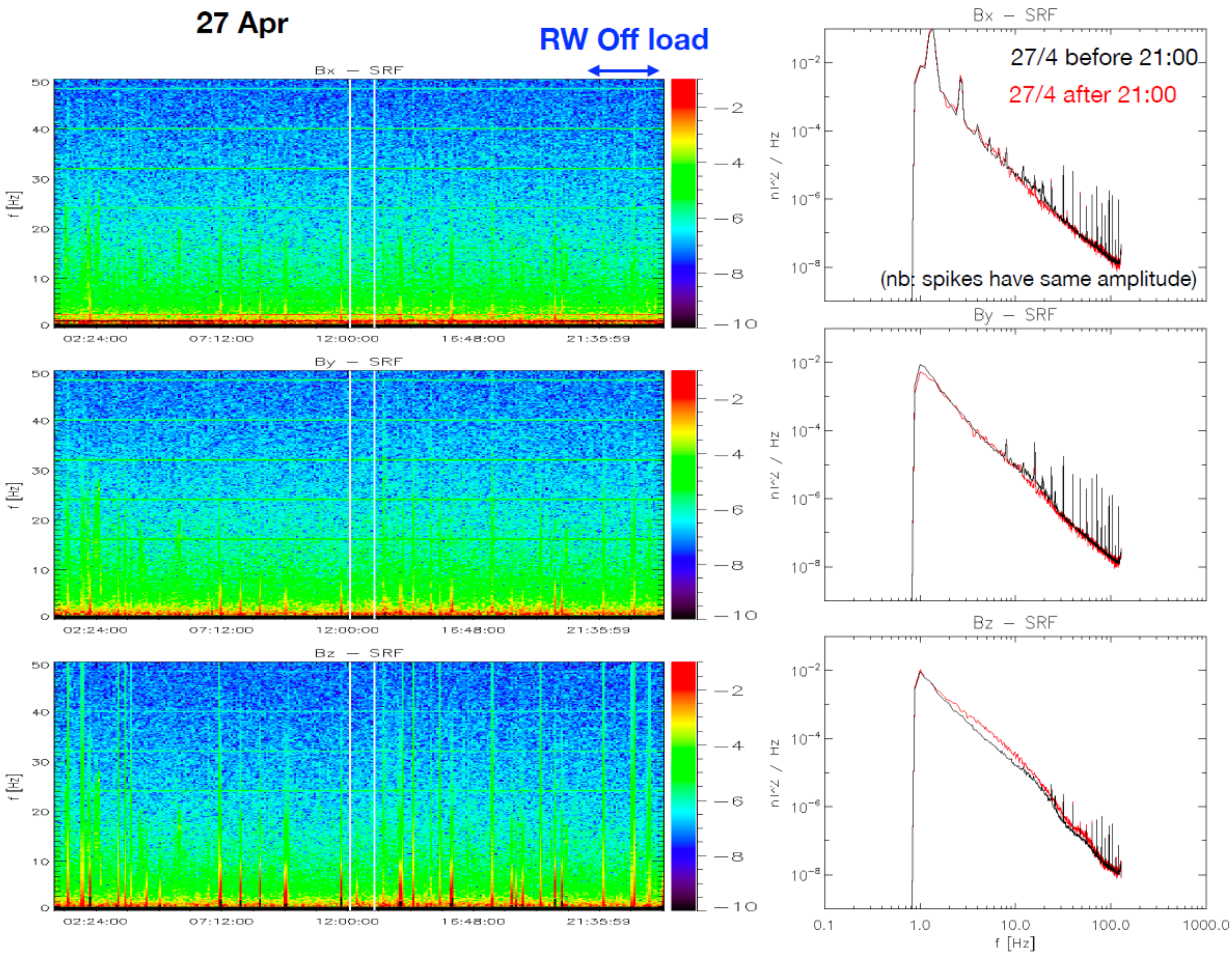

Figure 23 : WOL perturbation analysis done by SCM team (WOL on April 27th).

7.3 SPICE CMS OPERATION

The SPICE CMS (Contamination Monitoring System; QCMs) has been operated several times since February 24th.

The time slots of the first two measurements, the second one included bake outs on both sensors, are:

- 24 Feb: 21:55:49 - 22:10:40 UTC
- 26 Feb: 16:15:16 - 21:24:07 UTC (16:42:58 - 18:34:53 approximate time CMS1 heater activation / 19:00:53 - 21:08:05 approximate time CMS2 heater activation).

These activities on Feb. 26 included the only bake out so far and should be the worst case in terms of EMC interference.

There have also been hourly CMS measurements since the 28th of February. Unfortunately, RPW was off during these time slots and we are not able to report if any interference with RPW measurements due to the CMS operations can be occurred. To our knowledge, no other heater activation has been done since.

7.4 ELECTROSTATIC IMPACT OF SOLAR ARRAY ROTATIONS

During the NECP, 4 steering of the solar panels have been performed. They took place on the following dates.

DoY	Date	Solar Array Rotations
91	31/03/2020	SA steering from 0 to 30 degrees @11h17
120	29/04/2020	SA steering from 30 to 56 degrees @00h47
127	06/05/2020	SA steering from 56 to 60 degrees @19h52
152	31/05/2020	SA steering from 60 to 70 degrees @20h30

Table 20 : Dates of solar array rotations

Analysis in progress. To be written

8 RPW OPERATIONS CENTRE ACTIVITY STATUS DURING LEOP AND NECP PHASES

This chapter gives a summary status on the activities performed on-ground by the RPW Operations Centre (ROC) during the Solar Orbiter commissioning phase. A complete report of these activities can be found in [RD-5]. Particularly, this document gives the list of main anomalies related to the ROC activities still open at the end of the commissioning.

8.1 INSTRUMENT COMMANDING

The operation requesting and the command tracking have been performed nominally.

More details will be provided in the final version of this document.

8.2 INSTRUMENT DATA PROCESSING

The data retrieval process for RPW is nominal:
- New RPW TmRaw data are queried from MOC EDDS by “STORAGE TIME” every 6 hours;
- New RPW TcReport data are queried from MOC EDDS by “EXECUTION TIME” every 24 hours;
- New Solar Orbiter HK parameters relevant to RPW are queried from MOC EDDS by “STORAGE TIME” every 24 hours;
- New SOC-provided SPICE kernels ZIP files are processed every 24 hours.

Resulting products of the data retrieval process are distributed to the RPW teams via the ROC Web site at LESIA. Table below gives the location of the products.

The production of RPW L0 and L1 data files are nominal. They are triggered in an automous way every 24 hours. Resulting files are distributed to the RPW teams via the ROC Web site at LESIA.

Concerning the RPW L2 data files, the production is close to be nominal. L2 data file production is triggered in an automous way every 24 hours. Resulting files are distributed to the RPW teams via the ROC Web site at LESIA

More details will be provided in the final version of this document.

8.3 ROC STATUS BEFORE CP

The ROC is up-and-running and has ensured the critical functions to support the RPW activities during the commissioning phase.

Nevertheless, weaknesses highlighted during the ROC “Acceptance” review on January 2020, still remain and shall be mitigated during cruise phase:
- A particular attention must be also paid to the monitoring of the instrument.
- Monitoring of the data processing shall be improved
- Mechanism and procedures to asset science data quality must be re-enforced
- Selective downlink life-cycle shall be fully operational before NMP. It includes: the full understanding of the on-board SBM algorithms behavior, the mapping of the SBM PS, the procedures and tools to select and retrieve SBM event data stored on-board SSMM.

9 ACTIVITIES POSTPONED TO CRUISE PHASE

9.1 FSW UPGRADES

As a consequence of platform induced perturbation impacts (see compression errors §5.2.6 and main platform perturbations §7.1.1), TDS software has to be upgrade. But this upgrade will not be implemented before the end of June. Realistically, with the testing and software validation, we are targeting not earlier than August or September.

Concerning TNR-HFR, software upgrade is also needed. We may try to evaluate whether a software update could be possible in order to mitigate the EMC contamination from the S/C (see § 7.1.1) and to correct some different anomalies (see §5.2.11 and §5.2.12).

This requires however a thorough evaluation which will probably take several months. So no target date for now but in any case not before the end of this year.

9.2 SCM CALIBRATION

The SCM calibration measurements have to be done when the S/C passes through the Earth magnetic lobes (i.e. close to the Earth) during the first weeks of the NECP and/or during the Earth GAM (EGAM) at the end of the CP.

But, due to LEOP operation constraints It was not possible to plan this activity in the first times of operation after launch when Solar Orbiter was still in earth magnetosphere lobes.

This activity has been postponed to the first E-GAM. Indeed, during EGAM, all payload instruments will not be switched-off and some instruments should be authorized to perform sciences measurements with instrument commands only between maneuvers. Moreover, as most of the payload should be at least switched-off, the spacecraft should be in EMC quiet mode at this time.

9.3 SELECTED BURST MODES

The assessment of the different RPW Selected Burst Modes (SBM) were not possible during the commissioning phase. Indeed, the activity needed that several others instruments were switched on at the same time (MAG, SWA, EPD) for long time period which was not able to planned.

the "degraded" SBM, which can be used with own RPW data only, has been performed during NECP phase. But, it was not a priority to assess this mode because it was need to check and tune on-board algorithm parameters and this was a too huge work at this time.

This activity is postponed to the CP.

9.4 HGA INDUCED PERTURBATION ANALYSIS

Taking into account Solar Orbiter trajectory and relative direction to the earth for telemetry emissions, the High Gain Antenna (HGA) is not expected to be in a position where emissions are in direction of RPW PY or MY antennas. So, possible perturbations could not be observed or measured during commissioning phase.

Indeed, no perturbations is expected when HGA azimuth angle is between -90° and +90°. Higher and lower values for this angle are only expected after the NECP phase.

The flight dynamic attitude engineers calibrated in-flight the HGA. A 3dB half cone angle of 0.64 degrees was estimated. The HGA pattern calibration was repeated the last time on 01/06. Data is being analyzed. ADS reports a slight bias of 0.1 to 0.2 degrees. Flight dynamic analysis is on-going.

The platform telemetry parameters corresponding to HGA position are given in Annex 3.

9.5 SPICE HEATSHIELD DOOR OPEN

TBW

9.6 HFR LIST MODE

TBW

9.7 LFR K-COEFFICIENT SETTING

TBW

9.8 SBM MODES

TBW

9.9 BACK UP MODE VERIFICATIONS

TBW

9.10 AOB

RPW EM Swap

RPW hardware return from ADS

CRP document to update by MOC

10 CONCLUSION

RPW instrument and its sub-systems show a nominal functional behavior in-flight.

RPW antennas have been fully deployed during LEOP phase.

The SFT performed at the beginning of the NECP phase allowed to assess the good health of the instrument suffering the launch environmental constraints. The behavior of the instrument and its sub-systems is nominal and all functional parameters are in the range of the expected values.

Despite the COVID context, all the activities, originally planned for the NECP, have been carried out. However, most of the data provided during these activities are still under analysis.

Particularly, the 30 hours of data acquired during EMC interference test remain to be extensively analyzed. It has been however possible to demonstrate that two main perturbations coming from the Solar Orbiter platform do not allow to obtain expected RPW performance in entire frequency range. RPW science is affected. From our point of view, the platform is not compliant with EIDA-5145 / EIDA R-707 therefore a NCR shall be raised by ESA/AIRBUS.

All unexpected errors and anomalies observed during LEOP and NECP phases are described in the document (see chapter 5.2). All of them are understood, fixed or minor.

Despite this last point and the remaining data to analyzed, the commissioning of the RPW instrument is successful.

We take the opportunity to thank all the people involved in this success at RPW level, of course, but also at MOC/SOC and at Solar Orbiter project level.

ANNEX 1. RPW VERSUS SOLAR ORBITER TIMELINES

The table above only reports interactive activities. Many non-interactive activities have been run throughout the NECP for all instruments but no summary table has been provided by MOC.

DoY	Date	STP	Activity	Software mode	Configurations TDS	TNR-HFR	LFR	BIAS Gain	BIAS Sweep table	BIAS Current	Compression	HK
41	10/02/2020		Launch and transition to NM	RPW OFF								
42	11/02/2020		RPW PZ deployment	SBM_DETECTION (degraded mode)	ANEF601B	ANEF601G and 601D	ANEF601A	5	Default (AIWF033F)	0	OFF	every second
			Commanded safe mode (SM) to preserve pin pullers	RPW OFF								
43	12/02/2020		SM2									
			SC SM recovery									
			Pin puller removal									
			Bridge back into boom deployment timeline									
			I boom and PY/MY boom deployment	SBM_DETECTION (degraded mode)	ANEF600B (I-Boom) and ANEF600A (ANT)	ANEF600D and E (Iboom), then ANEF601G and 601E (PY ANT) and 601F (MY ANT)	ANEF600A (I-Boom) and ANEF601A (ANT)	5	Default (AIWF033F)	0	OFF	every second
44	13/02/2020		HGA deployment, swap to HGA up and downlink	RPW OFF								
			End of LEOP (delayed by one day due to DoY 42 issues)									
45	14/02/2020		Test OCM type 1; No LIC needed due to perfect injection									
46	15/02/2020		SM3 while trying to regain OMM redundancy									
47	16/02/2020		SM3 recovery completion, on time for PF NECP start									
48	17/02/2020		MGA deployment									
			Alternative IMU-A config									

DoY	Date	STP	Activity	Software mode	Configurations TDS	TNR-HFR	LFR	BIAS Gain	BIAS Sweep table	BIAS Current	Compression	HK
			RIU-B ON and OFF									
			IMU B Gyro Bias calibration									
			STR EEPROM dump									
			DOR tones commissioning									
49	18/02/2020		MGA up and downlink testing									
			MGA/HGA pattern characterization									
			SSMM SW upload									
50	19/02/2020		STR B acquisitions (out of pass)									
			IMU B switch ON									
			STR B foto dump (out of pass)									
			Transponder delay characterization and redundant DST checkout									
51	20/02/2020		de-icing slew (out of pass)									
			SADE-B testing									
			Solar arrays to end stop + characterization									
52	21/02/2020		SSMM SW update									
			PHI SW upload									
53	22/02/2020		OMM redundancy regaining									
			OMM mirroring restart									
54	23/02/2020		PHI SW upload continuation. 6 files missing; this will be completed on DoY 055									
55	24/02/2020	1	***STP 1 start***	SERVICE between rolls and SBM DETECTION during rolls (detection algorith disabled)	ANEF602C	ANEF602F	ANEF602B	BIAS OFF			OFF	Every Second during rolls and every minute btween rolls
			MAG interactive and non-interactive									
			RPW non interactive									
			SPICE interactive and non interactive									
			SPICE CMS interactive									
56	25/02/2020		EUI interactive and non interactive									
			PHI interactive									

DoY	Date	STP	Activity	Software mode	Configurations TDS	TNR-HFR	LFR	BIAS Gain	BIAS Sweep table	BIAS Current	Compression	HK
			RPW Rolls									
			SSMM PS5 fixing									
57	26/02/2020		SPICE interactive									
			SPICE CMS interactive non interactive									
			RPW Rolls									
58	27/02/2020		METIS ineractive									
			RPW Rolls									
			MGA selected as safe mode antenna									
			New TC init file in place									
59	28/02/2020		EPD interactive and non interactive									
			PHI interactive and non interactive									
			SOLOHI interactive and non interactive									
			RPW Rolls									
60	29/02/2020			NORMAL	AIWF038E	AIWF037A with monopole	AIWF039D without long CWF	5	Test 1, 2, 3 (AIWF033F, J, K, N)	- 1 uA		Every 2s
61	01/03/2020											
62	02/03/2020	2	***STP 2 start***	NORMAL	AIWF038E	AIWF037A with monopole	AIWF039D without long CWF	5	Test 1, 2, 3 (AIWF033F, J, K, N)	- 1 uA	OFF	Every 2s
			EPD interactive									
			EUI interactive									
			PHI interactive									
			OMM file clean up									
63	03/03/2020		EUI interactive									
			PHI interactive									
			SoloHI interactive									
			WOL 00:00 to 03:00									
64	04/03/2020		SWA interactive									
65	05/03/2020		SoloHI interactive									
			SPICE interactive									
			WOL 04/03 23:53 to 02:52									
66	06/03/2020		Metis interactive									
			SA relubrication 14:06 to 14:13									
67	07/03/2020		WOL 06/03 23:43 to 02:43									
68	08/03/2020		CPS purging 00:30 to 09:19									

DoY	Date	STP	Activity	Software mode	Configurations: TDS	TNR-HFR	LFR	BIAS: Gain	BIAS: Sweep table	BIAS: Current	Compression	HK
69	09/03/2020	3	***STP 3 start*** SPICE interactive SWA interactive SPICE D-heater OP WOL 20:06 to 23:06	NORMAL	AIWF038L	AIWF037A with monopole	AIWF039D without long CWF	5	Test 4 every 2h (AIWF033K)	- 4 uA	OFF	Every 2s
70	10/03/2020		SWA interactive EUI interactive Open HS door WOL 00:00 to 03:00		AIWF038K							
71	11/03/2020		SWA interactive WOL from 19:55 to 22:55		AIWF038L with TDS_N_SAMP_RATE = SR_256							
72	12/03/2020		SWA interactive METIS D-heater OFF		AIWF038L with TDS_N_SAMP_RATE=SR_256 TDS_N_FILTERS=FILTER_SET2							
73	13/03/2020		METIS interactive METIS Open door and CAP release METIS D-heater ON Addition of a SWA interactive slot WOL from 19:49 to 22:49		AIWF038L with TDS_ALGO_CHANNEL=ADC2 TDS_ALGO_MIN_AMP=200							
74	14/03/2020				AIWF038K with TDS_ALGO_MIN_AMP=600							
75	15/03/2020		In-orbit thermal correlation		AIWF038L with CP_TDS_ALGO_SELECTION ="PEAK_AMP"			100				
76	16/03/2020	4	***STP 4 start*** Sun distance < 0.95 AU WOL 19:35 to 22:35	NORMAL	AIWF038K with: TDS_N_SAMP_RATE = SR_256 CP_TDS_ALGO_SELECTION="BEST_WAVES_ALT" TDS_N_FILTERS = FILTER_SET2 SY_ALGO_THRESH_DUST = 160000000 SY_TDS_ALGO_DUST_NUM = 4;	AIWF037A with monopole	AIWF039D without long CWF	5	Test 4 every 2h (AIWF033K)	- 4 uA	OFF	Every 2s
77	17/03/2020		SWA interactive -> HIS switch off due to internal FDIR -> interactive activities did not take place									
78	18/03/2020		SPICE Interactive SWA interactive WOL 19:27 to 22:27		AIWF038K with: TDS_N_SAMP_RATE = SR_512 CP_TDS_ALGO_SELECTION="BEST_WAVES_ALT" SY_ALGO_THRESH_DUST = 160000000 SY_TDS_ALGO_DUST_NUM = 4;							
79	19/03/2020		PHI Interactive Flow decay OCM									
80	20/03/2020		SPICE interactive -> postponed WOL 21:32 to 00:32		AIWF038L with: TDS_N_SAMP_RATE = SR_256 CP_TDS_ALGO_SELECTION="BEST_WAVES_ALT" TDS_N_FILTERS = FILTER_SET2							

DoY	Date	STP	Activity	Software mode	Configurations TDS	TNR-HFR	LFR	BIAS Gain	BIAS Sweep table	BIAS Current	Compression	HK
					SY_ALGO_THRESH_DUST = 160000000 SY_TDS_ALGO_DUST_NUM = 4;							
81	21/03/2020		RPW OFF	RPW OFF								
82	22/03/2020		CPS Purging									
83	23/03/2020		***STP 5 start*** WOL from 19:21 to 22:21	RPW OFF								
84	24/03/2020		Unmanned GS pass, no dumps									
85	25/03/2020		Unmanned GS pass, no dumps WOL from 21:55 till 00:55									
86	26/03/2020	5	Uplink of 8 weeks of planning products									
87	27/03/2020		Unmanned GS pass, no dumps MAG ON for weekend rolls WOL from 21:59 till 00:58									
88	28/03/2020		GS pass released WOL from 07:13 to 09:58 WOL from 18:53 to 21:53 Rolls from 21:53 to 11:09									
89	29/03/2020		GS pass released									
90	30/03/2020	6	***STP 6 start*** WOL from 22:00 to 31/03/202001:00 RPW ON as of 00:00	NORMAL	AIWF038L with: TDS_N_SAMP_RATE = SR_256 TDS_N_FILTERS = FILTER_SET2	Default (AIWF037A)	Default (AIWF039D)	5	No BIAS sweep	- 4 uA	OFF	Default / 2 (every 30s)
91	31/03/2020		SA steering 11:17 to 11:32 (going to 30 deg) TC link monitor update Close EUI HS Doors IU-6_4-7 Interactive SPICE SWON Interactive MAG power cycle									
92	01/04/2020		WOL from 22:00 to 02/04/202001:00 EPD SWON Interactive IC-SOU-42_46 Interactive. SPICE Decont. Heater threshold to OP values									

DoY	Date	STP	Activity	Software mode	Configurations TDS	TNR-HFR	LFR	BIAS Gain	BIAS Sweep table	BIAS Current	Compression	HK
93	02/04/2020		ID-51 interactive EPD									
			IA-5 Interactive SWA									
94	03/04/2020		WOL from 22:00 to 04/04/202001:00									
			IC-SOU-50 Interactive SPICE									
			ID-52 Interactive EPD									
95	04/04/2020											
96	05/04/2020											
97	06/04/2020	7	***STP 7 start (PL NECP week 6)***	NORMAL	EMC1 ANEF604E	EMC1 ANEF604N	EMC ANEF600A	5	No BIAS sweep	- 4 uA	OFF	Default / 2 (every 30s)
			WOL from 22:00 to 07/04/202001:00	RPW OFF								
			IT-4_1 Interactive METIS									
			METIS SW crash, with cascade effect on RPW and SPICE (switch off)									
			IA-5 Interactive SWA									
98	07/04/2020		IP-4 Interactive PHI									
			IA-5 Interactive SWA									
			RPW back on									
99	08/04/2020		WOL from 22:00 to 09/04/202001:00	NORMAL	HIGH1 : AIWF038K: - CP_TDS_N_SAMP_RATE = SR_256 - SY_TDS_N_RS_DELAY_COARSE = 30 - SY_TDS_N_RS_LEN = NSAMP_8K - SY_TDS_N_FILTERS = FILTER_SET2 - SY_TDS_N_MAMP_ENAB = 1 - SY_TDS_N_MAMP_DEC_RATE = 2x	HIGH1 : AIWF037G	HIGH1 : AIWF039H	5	default (AIWF033F)	- 4 uA	OFF	Default / 2 (every 30s)
			IC-SOU-50 Interactive SPICE -> postponed, replaced by SPICE on									
			IT-4_2-11 Interactive METIS -> redefined activity		High 2 - AIWF038L: - CP_TDS_N_SAMP_RATE = SR_256 - SY_TDS_N_RS_DELAY_COARSE = 30 - SY_TDS_N_RS_LEN = NSAMP_8K - SY_TDS_N_FILTERS = FILTER_SET2 - SY_TDS_N_MAMP_ENAB = 1 - SY_TDS_N_MAMP_DEC_RATE = 1x		HIGH2 : AIWF039I					
			IP-4 Interactive PHI									
100	09/04/2020		No pass	BACKUP	LFM : AIWF038D		LFR OFF					
				NORMAL + 1h of BURST (14h-15h)	AIWF038L : - CP_TDS_N_SAMP_RATE = SR_256 - CP_TDS_N_2D_HIST2_TYPE = DISABLED - SY_TDS_N_FILTERS = FILTER_SET2	AIWF037A	Default (AIWF039D)					

DoY	Date	STP	Activity	Software mode	Configurations TDS	TNR-HFR	LFR	BIAS Gain	BIAS Sweep table	BIAS Current	Compression	HK
101	10/04/2020		WOL from 22:00 to 11/04/202001:00	NORMAL								
102	11/04/2020											
103	12/04/2020											
104	13/04/2020	8	***STP 8 start (PL NECP week 7)***	NORMAL	EMC1 ANEF604E	EMC1 ANEF604N	EMC ANEF600A	5	No BIAS sweep	- 4 uA	OFF	default
			WOL from 22:00 to 14/04/202001:00		EMC2 ANEF604F	EMC2 ANEF604O						
105	14/04/2020		STIX IX-1		Low 1 - AIWF038K: - SY_TDS_N_RS_DELAY_COARSE = 1800	LOW1 (AIWF037E)	LOW1 : AIWF039F					
			SWA IA-5		LOW 2 : AIWF038L: - SY_TDS_N_RS_DELAY_COARSE = 3600		LOW2 : AIWF039G					
106	15/04/2020		WOL from 22:00 to 16/04/202001:00		AIWF038L with: TDS_N_SAMP_RATE = SR_256 TDS_N_FILTERS = FILTER_SET2	Default (AIWF037A)	Default (AIWF039D)		default (AIWF033F)			
			STIX IX-1									
			SWA IA-5									
107	16/04/2020		STIX IX-1									
			SWA IA-5									
108	17/04/2020		WOL from 22:00 to 18/04/202001:00		AIWF038L with: TDS_N_SAMP_RATE = SR_256 TDS_N_FILTERS = FILTER_SET2 SY_ALGO_THRESH_DUST = 160000000							
			Pressure relief function period update									
			EPD ID-53									
			PHI IP-5									
			SPICE -> replan of activities from previous week									
109	18/04/2020											
110	19/04/2020											
111	20/04/2020	9	***STP 9 start (PL NECP week 8)***	NORMAL	AIWF038L with: TDS_N_SAMP_RATE = SR_256 TDS_N_FILTERS = FILTER_SET2 SY_ALGO_THRESH_DUST = 250000000 SY_TDS_ALGO_MIN_AMP = 55; SY_TDS_ALGO_DUST_NUM = 4			5	default (AIWF033F)	- 4 uA	ON	Default + DAS_STAT every 5s
			WOL @ 22:00									
			IP-5									
			ID-54									
112	21/04/2020		IC-SOU-60_1-7 IH-11 IM-5									
113	22/04/2020		WOL @ 22:00									
			IA-6 ID-54									
114	23/04/2020		ID-54 IT-4_12		AIWF038L with: TDS_N_SAMP_RATE = SR_256 TDS_N_FILTERS = FILTER_SET2							
115	24/04/2020		WOL @ 22:00									

DoY	Date	STP	Activity	Software mode	Configurations TDS	TNR-HFR	LFR	BIAS Gain	BIAS Sweep table	BIAS Current	Compression	HK
			ID-54 IA-6		SY_ALGO_THRESH_DUST = 250000000 SY_TDS_ALGO_DUST_NUM = 4 SY_TDS_ALGO_MIN_AMP = 1; CP_TDS_N_1D_HIST4_TYPE = PEAK_S_AMP;							
116	25/04/2020				AIWF038L with: TDS_N_SAMP_RATE = SR_512							
117	26/04/2020				CP_TDS_ALGO_SELECTION = PEAK_AMP							
118	27/04/2020	10	**STP 10 start (PL NECP week 9)**	Switch ON on redundant side								
			WOL @ 22:00 IX-2	NORMAL	AIWF038L with TDS_N_SAMP_RATE = SR_256 TDS_N_FILTERS = FILTER_SET2 CP_TDS_ALGO_SELECTION = PEAK_AMP SY_TDS_ALGO_MIN_AMP = 55; SY_TDS_ALGO_CHANNEL = ADC4; CP_TDS_N_1D_HIST2_TYPE = PEAK_S_AMP; CP_TDS_N_1D_HIST2_AXIS = LOG_HIST_128; CP_TDS_N_1D_HIST4_TYPE = MAXAMP_CH4;	Default (AIWF037A)	Default (AIWF039D)	5	Default (AIWF033F)	- 4 uA	OFF	Default / 2 (every 30s)
119	28/04/2020		IX-2 SWA									
120	29/04/2020		WOL @ 22:00	Switch ON on prime side								
			SA steering 00:47 to 00:52 (going to 56 deg) ID-T IU-5 SWA MAG power cycle	SBM DETECTION - disabled algorithm with one SBM1 dump at 6h and one SBM2 dump at 7h + 1h of BURST mode between 12h and 13h	AIWF038L with: TDS_N_SAMP_RATE = SR_256 TDS_N_FILTERS = FILTER_SET2 SY_ALGO_THRESH_DUST = 200000000 SY_TDS_ALGO_DUST_NUM = 2	Default (AIWF037A)	Default (AIWF039D)	5	Default (AIWF033F)	- 4 uA	OFF	Default / 2 (every 30s)
121	30/04/2020		IU-8 2-7 SWA		AIWF038K with TDS_N_SAMP_RATE = SR_256 TDS_N_FILTERS = FILTER_SET2 SY_ALGO_THRESH_DUST = 250000000 SY_TDS_ALGO_DUST_NUM = 4 SY_TDS_ALGO_MIN_AMP = 60; CP_TDS_N_1D_HIST4_TYPE = DUST_AMP;							
122	01/05/2020		WOL @ 22:00 MAG switch off upon PI request									
123	02/05/2020				AIWF038L with: TDS_N_SAMP_RATE = SR_256 TDS_N_FILTERS = FILTER_SET2 SY_ALGO_THRESH_DUST = 250000000 SY_TDS_ALGO_DUST_NUM = 4 SY_TDS_ALGO_MIN_AMP = 60; CP_TDS_N_1D_HIST1_AXIS = LOG_HIST_256; CP_TDS_N_1D_HIST3_AXIS = LOG_HIST_256; CP_TDS_N_1D_HIST2_TYPE = RMS_W_AMP; CP_TDS_N_1D_HIST2_AXIS = LOG_HIST_256; CP_TDS_N_1D_HIST4_TYPE = PEAK_S_AMP;							
124	03/05/2020											
125	04/05/2020	11	**STP 11 start (PL NECP week 10)**	SBM DETECTION	AIWF038L with TDS_N_SAMP_RATE = SR_256 TDS_N_FILTERS = FILTER_SET2	Default (AIWF037A)	Default (AIWF039D)	5	default (AIWF033F)	- 4 uA	OFF	Default / 2

DoY	Date	STP	Activity	Software mode	Configurations TDS	TNR-HFR	LFR	BIAS Gain	BIAS Sweep table	BIAS Current	Compression	HK
			WOL @ 22:00	except for Iw-7 (PAS filtering campaign) : BURST mode	SY_ALGO_THRESH_DUST = 250000000 SY_TDS_ALGO_DUST_NUM = 2 SY_TDS_ALGO_MIN_AMP = 63; ---------- Burst config : full BURST config: SY_TDS_B_RS_ENAB = 1 CP_TDS_B_RS_ADC_CH_NR = N_4_CH SY_TDS_B_RS_ADC_CH4 = 1 SY_TDS_B_RS_ADC_CH3 = 1 SY_TDS_B_RS_ADC_CH2 = 1 SY_TDS_B_RS_ADC_CH1 = 1 SY_TDS_B_RS_DELAY_COARSE = 300 SY_TDS_B_RS_DELAY_FINE = 0 SY_TDS_B_RS_LEN = NSAMP_4K SY_TDS_B_MAMP_ENAB = 1 SY_TDS_B_MAMP_DEC_RATE = MAMP_DEC_2X SY_TDS_B_MAMP_ADC_CH4 = 1 SY_TDS_B_MAMP_ADC_CH3 = 1 SY_TDS_B_MAMP_ADC_CH2 = 1 SY_TDS_B_MAMP_ADC_CH1 = 1							(every 30s)
126	05/05/2020		IH-11 SWA ID-T IH-31_20-29									
127	06/05/2020		WOL @ 22:00 SA Steering 19:47 to 19:52 (going to 60 deg) SWA									
128	07/05/2020		IX-3 IW-7 SWA									
129	08/05/2020		WOL @ 22:00 SWA IX-3									
130	09/05/2020											
131	10/05/2020											
132	11/05/2020	12	**STP 12 start (PL NECP week 11)**	NORMAL	EMC1 between 00h and 2h -AIWF038K with : - PIW00298 (CP_TDS_N_SAMP_RATE) = SR_512 - PIW00309 (SY_TDS_N_HF_CH4_LOW_GAIN) = 0 - PIW00311 (SY_TDS_N_HF_CH3_LOW_GAIN) = 0 - PIW00313 (SY_TDS_N_HF_CH2_LOW_GAIN) = 0 - PIW00315 (SY_TDS_N_HF_CH1_LOW_GAIN) = 0 SY_TDS_N_RS_DELAY_COARSE = 11 SY_TDS_N_RS_LEN = NSAMP_32K CP_TDS_ALGO_SELECTION = PEAK_AMP SY_TDS_N_MAMP_ENAB = 1 SY_TDS_N_MAMP_DEC_RATE = MAMP_DEC_1X CP_TDS_N_1D_HIST1_TYPE = DISABLED CP_TDS_N_1D_HIST2_TYPE = DISABLED CP_TDS_N_1D_HIST3_TYPE = DISABLED CP_TDS_N_1D_HIST4_TYPE = DISABLED CP_TDS_N_2D_HIST1_TYPE = DISABLED SY_TDS_ALGO_MIN_AMP = 16	EMC1 between 00h and 2h -ANEF601G	EMC1 between 00h and 4h - ANEF604A	5	Default (AIWF033F)	0 uA	OFF	Default / 2 (every 30s)
			IU-9_1-3		EMC2 between 2h and 4h -AIWF038L with - PIW00298 (CP_TDS_N_SAMP_RATE) = SR_512 - PIW00309 (SY_TDS_N_HF_CH4_LOW_GAIN) = 0 - PIW00311 (SY_TDS_N_HF_CH3_LOW_GAIN) = 0 - PIW00313	EMC2 between 2h and 4h -ANEF604O						

DoY	Date	STP	Activity	Software mode	Configurations TDS	TNR-HFR	LFR	BIAS Gain	BIAS Sweep table	BIAS Current	Compression	HK
					(SY_TDS_N_HF_CH2_LOW_GAIN) = 0 - PIW00315 (SY_TDS_N_HF_CH1_LOW_GAIN) = 0 SY_TDS_N_RS_DELAY_COARSE = 11 SY_TDS_N_RS_LEN = NSAMP_32K CP_TDS_ALGO_SELECTION = PEAK_AMP SY_TDS_N_MAMP_ENAB = 1 SY_TDS_N_MAMP_DEC_RATE = MAMP_DEC_1X CP_TDS_N_1D_HIST1_TYPE = DISABLED CP_TDS_N_1D_HIST2_TYPE = DISABLED CP_TDS_N_1D_HIST3_TYPE = DISABLED CP_TDS_N_1D_HIST4_TYPE = DISABLED CP_TDS_N_2D_HIST1_TYPE = DISABLED SY_TDS_ALGO_MIN_AMP = 16							
			IU_9_4	SBM DETECTION degraded mode	AIWF038L with TDS_N_SAMP_RATE = SR_256 TDS_N_FILTERS = FILTER_SET2 SY_TDS_N_HF_CH4_LOW_GAIN = 0; SY_TDS_N_HF_CH3_LOW_GAIN = 0; SY_TDS_N_HF_CH2_LOW_GAIN = 0; SY_TDS_N_HF_CH1_LOW_GAIN = 0; SY_TDS_ALGO_MIN_AMP = 200; SY_ALGO_THRESH_DUST = 200000000 SY_TDS_ALGO_DUST_NUM = 2 CP_TDS_N_2D_HIST1_TYPE = WA_RMS_VS_FQ CP_TDS_N_2D_HIST1_X_AXIS = LOG_HIST_128 CP_TDS_N_2D_HIST1_Y_AXIS = LOG_HIST_128	Default (AIWF037A)	Default (AIWF039D			-4 uA		
			SWA									
			PHI (installation of new compression module)									
			IT-6A									
			WOL @ 15:07									
133	12/05/2020		ID-T									
			IU_9-5-14 + EUI Heat Shield doors 2 & 3 (EUI FSI and EUI HRI) were opened. First light images were acquired.									
			IC-SOU-60_8									
			IP-6									
134	13/05/2020		IU_9-5-14									
			IP-7									
			WOL @ 15:00									
135	14/05/2020		gyro calibration update in SGM		AIWF038K with TDS_N_SAMP_RATE = SR_256 TDS_N_FILTERS = FILTER_SET2 CP_TDS_ALGO_SELECTION = PEAK_AMP SY_TDS_ALGO_MIN_AMP = 64; CP_TDS_N_1D_HIST2_TYPE = PEAK_S_AMP; CP_TDS_N_2D_HIST1_TYPE = WA_RMS_VS_FQ CP_TDS_N_2D_HIST1_X_AXIS = LOG_HIST_128 CP_TDS_N_2D_HIST1_Y_AXIS = LOG_HIST_128							
			IP-8									
			IC-SOU-70									
136	15/05/2020		IT-6B1									
			IC-SOU-70									
			Close SPICE Door									
			WOL @ 15:22									
137	16/05/2020		IU-10_1-2									

DoY	Date	STP	Activity	Software mode	Configurations TDS	TNR-HFR	LFR	BIAS Gain	BIAS Sweep table	BIAS Current	Compression	HK
138	17/05/2020		Linear CEL buffer full with EUI events		AIWF038L with TDS_N_SAMP_RATE = SR_256 TDS_N_FILTERS = FILTER_SET2 SY_TDS_ALGO_MIN_AMP = 62; CP_TDS_N_1D_HIST2_TYPE = WAVE_PAR_BLK CP_TDS_N_1D_HIST2_AXIS = HISTA_256 SY_ALGO_THRESH_DUST = 250000000 SY_TDS_ALGO_DUST_NUM = 4 CP_TDS_N_2D_HIST1_TYPE = WA_RMS_VS_FQ CP_TDS_N_2D_HIST1_X_AXIS = LOG_HIST_128 CP_TDS_N_2D_HIST1_Y_AXIS = LOG_HIST_128							
139	18/05/2020	13	**STP 13 start (PL NECP week 12)**	SBM DETECTION degraded mode. Start of snapshots synchronization with SWA	EMC1 between 00h and 2h -AIWF038K with - PIW00298 (CP_TDS_N_SAMP_RATE) = SR_512 - PIW00309 (SY_TDS_N_HF_CH4_LOW_GAIN) = 0 - PIW00311 (SY_TDS_N_HF_CH3_LOW_GAIN) = 0 - PIW00313 (SY_TDS_N_HF_CH2_LOW_GAIN) = 0 - PIW00315 (SY_TDS_N_HF_CH1_LOW_GAIN) = 0 SY_TDS_N_RS_DELAY_COARSE = 11 SY_TDS_N_RS_LEN = NSAMP_32K CP_TDS_ALGO_SELECTION = PEAK_AMP SY_TDS_N_MAMP_ENAB = 1 SY_TDS_N_MAMP_DEC_RATE = MAMP_DEC_1X CP_TDS_N_1D_HIST1_TYPE = DISABLED CP_TDS_N_1D_HIST2_TYPE = DISABLED CP_TDS_N_1D_HIST3_TYPE = DISABLED CP_TDS_N_1D_HIST4_TYPE = DISABLED CP_TDS_N_2D_HIST1_TYPE = DISABLED SY_TDS_ALGO_MIN_AMP = 16	EMC1 between 00h and 2h -ANEF601G, then default (AIWF037A)	Default (AIWF039D)	5	Default/2 - AIWF033J	-10 uA	OFF	Default / 2 (every 30s)
			IX-4		AIWF038M with: - CP_TDS_N_SAMP_RATE = SR_256 - SY_TDS_N_FILTERS = FILTER_SET2 - SY_TDS_ALGO_THRESH_DUST = 240000000 - SY_TDS_N_RS_DELAY_COARSE = 600 - SY_TDS_ALGO_DUST_NUM = 2							
			STR-B alignment update in RAM									
			STR-B defective pixel detection									
			WOL									
140	19/05/2020		IX-4									
			IP-FDT (pointing SOL-SGS-TN-0019 0.4)									
141	20/05/2020		IU-10_4 IU-10_5-10		AIWF038M with: - CP_TDS_N_SAMP_RATE = SR_512 - SY_TDS_ALGO_THRESH_DUST = 200000000 - SY_TDS_N_RS_DELAY_COARSE =							
			STR B Foto Dump									
			WOL									

DoY	Date	STP	Activity	Software mode	Configurations TDS	TNR-HFR	LFR	BIAS Gain	BIAS Sweep table	BIAS Current	Compression	HK
142	21/05/2020		IU-10_5-10		600 - SY_TDS_ALGO_MIN_AMP = 100 - CP_TDS_ALGO_SELECTION = PEAK_AMP - SY_TDS_ALGO_DUST_NUM = 2							
			IP-HRT									
			Activities interrupted by SpW overload									
143	22/05/2020		IU-10_5-10, activity interrupted by SpW overload	RPW OFF								
			CPS Purging									
			WOL									
144	23/05/2020		IX-Crab Nebula (preserved)									
145	24/05/2020		Did not take place:									
			IU-10_5-10									
			IM-IIC_MAG_RPW_EPD_SWA									
146	25/05/2020	14	**STP 14 start (PL NECP week 13)**	RPW OFF								
			SSMM router configuration dump and analysis									
			EUI switch off									
			STR-B alignment update in SGM									
			WOL									
147	26/05/2020		SSMM cold restart									
			"Instrument Cascade switch-off" patch installation									
			EUI switch ON									
			STIX switch ON									
			SPICE recovery									
			MAG switch ON									
148	27/05/2020		**STP 14 continuation (PL NECP week 13)**									
			PHI Switch On, PHI SW upload									
			open SPICE Door									
			IU-11									
			WOL									
149	28/05/2020		Alignment campaign									
150	29/05/2020		EPD Switch On									

DoY	Date	STP	Activity	Software mode	Configurations TDS	TNR-HFR	LFR	BIAS Gain	BIAS Sweep table	BIAS Current	Compression	HK
			IT-5 IU-12 (EXTRA SLOT FOR EUI) IC-IIC campaign WOL									
151	30/05/2020		IC-IIC campaign completion	SBM DETECTION degraded mode	Comet Ion tail config: AIWF038K with: - CP_TDS_N_SAMP_RATE = SR_256 - SY_TDS_N_FILTERS = FILTER_SET2 - SY_TDS_ALGO_THRESH_DUST = 250000000 (7 zeros) - SY_TDS_N_RS_DELAY_COARSE = 600 - SY_TDS_ALGO_DUST_NUM = 4 - SY_TDS_ALGO_MIN_AMP = 110; - CP_TDS_N_1D_HIST2_TYPE = PEAK_S_AMP - CP_TDS_N_1D_HIST2_AXIS = LOG_HIST_128	Comet Ion tail config	Comet config	5	Cold Electrons	-12 uA	ON	Default + SBM1 HK every 5s
152	31/05/2020		SA Steering xx:xx to xx:xx (going to 70 deg)									
153	01/06/2020	15	**STP 15 start (PL NECP week 14)** HGA pattern repetition	SBM DETECTION degraded mode	Comet Ion tail config : AIWF038K with: - CP_TDS_N_SAMP_RATE = SR_256 - SY_TDS_N_FILTERS = FILTER_SET2 - SY_TDS_ALGO_THRESH_DUST = 250000000 (7 zeros) - SY_TDS_N_RS_DELAY_COARSE = 600 - SY_TDS_ALGO_DUST_NUM = 4 - SY_TDS_ALGO_MIN_AMP = 110; - CP_TDS_N_1D_HIST2_TYPE = PEAK_S_AMP - CP_TDS_N_1D_HIST2_AXIS = LOG_HIST_128	Comet Ion tail config	Comet config	5	Cold Electrons	-13 uA	ON	Default + SBM1 HK every 5s
154	02/06/2020		IW6 NECP campaign	NORMAL	EMC config : AIWF038K and L with - PIW00298 (CP_TDS_N_SAMP_RATE) = SR_512 - PIW00309 (SY_TDS_N_HF_CH4_LOW_GAIN) = 0 - PIW00311 (SY_TDS_N_HF_CH3_LOW_GAIN) = 0 - PIW00313 (SY_TDS_N_HF_CH2_LOW_GAIN) = 0 - PIW00315 (SY_TDS_N_HF_CH1_LOW_GAIN) = 0 SY_TDS_N_RS_DELAY_COARSE = 11 SY_TDS_N_RS_LEN = NSAMP_32K CP_TDS_ALGO_SELECTION = PEAK_AMP SY_TDS_N_MAMP_ENAB = 1 SY_TDS_N_MAMP_DEC_RATE = MAMP_DEC_1X CP_TDS_N_1D_HIST1_TYPE = DISABLED CP_TDS_N_1D_HIST2_TYPE = DISABLED CP_TDS_N_1D_HIST3_TYPE = DISABLED CP_TDS_N_1D_HIST4_TYPE = DISABLED CP_TDS_N_2D_HIST1_TYPE = DISABLED SY_TDS_ALGO_MIN_AMP = 16	EMC config : ANEF601G and ANEF604O	EMC config : ANEF604A	5	Default/2 (AIWF033J)		OFF	every second

DoY	Date	STP	Activity	Software mode	Configurations TDS	TNR-HFR	LFR	BIAS Gain	BIAS Sweep table	BIAS Current	Compression	HK
			IC-SOU-80_2-8	SBM DETECTION degraded mode	Comet dust tail config : AIWF038K with: - CP_TDS_N_SAMP_RATE = SR_256 - SY_TDS_N_FILTERS = FILTER_SET2 - SY_TDS_ALGO_THRESH_DUST = 250000000 (7 zeros) - SY_TDS_N_RS_DELAY_COARSE = 600 - SY_TDS_ALGO_DUST_NUM = 12 - SY_TDS_ALGO_MIN_AMP = 114; - CP_TDS_N_1D_HIST1_TYPE = DUST_AMP - CP_TDS_N_1D_HIST2_TYPE = PEAK_S_AMP - CP_TDS_N_1D_HIST2_AXIS = LOG_HIST_128	Comet dust tail config	Comet config				ON	Default + SBM1 HK every 5s
155	03/06/2020		SPICE IC-SOU-80_9									
156	04/06/2020		TC link monitor update METIS IT6									
157	05/06/2020		STR A EEPROM dump STR A defective pixels Swap to STR B PCDU EEPROM patch IMU200 set point update to solve the STIX Aspect System disturbances WOL SoloHI door deployment									
158	06/06/2020		IM-IIC campaign	NORMAL and SBM DETECTION	Default (AIWF038K)						OFF	Default + SBM1 and IIT HK every second
			No ground contact	SBM DETECTION degraded mode	Comet Dust tail config : AIWF038K with: - CP_TDS_N_SAMP_RATE = SR_256 - SY_TDS_N_FILTERS = FILTER_SET2 - SY_TDS_ALGO_THRESH_DUST = 250000000 (7 zeros) - SY_TDS_N_RS_DELAY_COARSE = 600 - SY_TDS_ALGO_DUST_NUM = 12 - SY_TDS_ALGO_MIN_AMP = 114; - CP_TDS_N_1D_HIST1_TYPE = DUST_AMP - CP_TDS_N_1D_HIST2_TYPE = PEAK_S_AMP - CP_TDS_N_1D_HIST2_AXIS = LOG_HIST_128						ON	Default + SBM1 HK every 5s
159	07/06/2020		No ground contact									
160	08/06/2020	16		SBM DETECTION degraded mode	HIGH1 (AIWF038I) until 12:00 and HIGH2 (AIWF038J) after	Default (AIWF037A)	Default (AIWF039D)	5	Default/2 (AIWF033J)	-13 uA	ON	Default + SBM1 HK every 5s
161	09/06/2020				AIWF038M : - CP_TDS_N_SAMP_RATE = SR_512 - SY_TDS_ALGO_THRESH_DUST = 240000000 - CP_TDS_ALGO_SELECTION = PEAK_AMP - SY_TDS_ALGO_CHANNEL = ADC3 - SY_TDS_N_RS_DELAY_COARSE = 600 - SY_TDS_ALGO_MIN_AMP = 100 - SY_TDS_ALGO_DUST_NUM = 2 - CP_TDS_N_1D_HIST1_TYPE = PEAK_S_AMP -						ON	
162	10/06/2020										ON until 18:00:00	
163	11/06/2020										OFF	

DoY	Date	STP	Activity	Software mode	Configurations TDS	TNR-HFR	LFR	BIAS Gain	BIAS Sweep table	BIAS Current	Compression	HK
					CP_TDS_N_1D_HIST2_TYPE = DUST_AMP - CP_TDS_N_1D_HIST2_AXIS = LOG_HIST_128 - CP_TDS_N_2D_HIST2_TYPE = WA_RMS_VS_FQ - CP_TDS_N_2D_HIST2_X_AXIS = LOG_HIST_128 - CP_TDS_N_2D_HIST2_Y_AXIS = LOG_HIST_128							
164	12/06/2020				AIWF038L : - CP_TDS_N_SAMP_RATE = SR_256 - SY_TDS_N_FILTERS = FILTER_SET2 - SY_TDS_N_HF_CH4_LOW_GAIN = 0 - SY_TDS_ALGO_THRESH_DUST = 250000000 (there are 7 zeros) - SY_TDS_N_RS_DELAY_COARSE = 600 - SY_TDS_ALGO_DUST_NUM = 3 - SY_TDS_ALGO_MIN_AMP = 66; - CP_TDS_N_1D_HIST2_TYPE = PEAK_S_AMP - CP_TDS_N_1D_HIST2_AXIS = LOG_HIST_128 - CP_TDS_N_2D_HIST1_TYPE = WA_RMS_VS_FQ - CP_TDS_N_2D_HIST1_X_AXIS = LOG_HIST_128 - CP_TDS_N_2D_HIST1_Y_AXIS = LOG_HIST_128							
165	13/06/2020											
166	14/06/2020											

FSW version
DAS 3.6.1.0
DBS 1.3.0.0
LFR 3.2.0.24
TDS 3.2.2.0
THR 3.6.0.0
IDB version
IDB 4.3.5

Ressources
https://www.cosmos.esa.int/web/solar-orbiter/where-is-solar-orbiter

ANNEX 2. RPW INSTRUMENT HK PARAMETER LIST FOR MONITORING

TM_DPU_DBS_HK		TM_DPU_PDU_HK		TM_DPU_OBC_HK		TM_DPU_DAS_HK		TM_DPU_BIA_HK		TM_LFR_HK		TM_TDS_HK		TM_THR_HK	
NIW00033	DPU_LE_CNT	NIW00103	PDU_PRIMARY_VOLTAGE	NIWD0000	DPU_MODE	NIW00033	DPU_LE_CNT	NIW00664	BIA_BIAS1	NIWD0162	LFR_MODE	NIWD0200	TDS_MODE	NIWD0436	THR_MODE
NIW00034	DPU_ME_CNT	NIW00104	PDU_PRIMARY_CURRENT	NIWD0008	DPU_UNIT	NIW00034	DPU_ME_CNT	NIW00665	BIA_BIAS2	NIW00821	LFR_LE_CNT	NIW01121	TDS_LE_CNT	NIW01369	THR_LE_CNT
NIW00035	DPU_HE_CNT	NIW00106	PDU_HEATER_CURRENT	NIWD0766	DPU_TIME_SYNC_FLAG	NIW00035	DPU_HE_CNT	NIW00666	BIA_BIAS3	NIW00822	LFR_ME_CNT	NIW01122	TDS_ME_CNT	NIW01370	THR_ME_CNT
		NIW00113	PDU_P12V_VOLTAGE	NIWD0738	DPU_OVV_FLAG			NIWD0115	BIA_REF_VOLTAGE_H	NIW00823	LFR_HE_CNT	NIW01123	TDS_HE_CNT	NIW01371	THR_HE_CNT
		NIW00114	PDU_P5V_VOLTAGE	NIWD0695	DPU_SCM_ERR_FLAG			NIWD0116	BIA_REF_VOLTAGE_L	NIW00832	LFR_TEMP_SCM	NIW01137	TDS_TEMP_PCB	NIW01380	THR_TEMP_ANT1_HF_PA
		NIW00115	PDU_M5V_VOLTAGE	NIWD0696	DPU_ANT1_ERR_FLAG			NIW00670	BIA_TEMP_ANT1_LF_PA	NIW00833	LFR_TEMP_PCB	NIW01138	TDS_TEMP_FPGA	NIW01381	THR_TEMP_ANT2_HF_PA
		NIW00116	PDU_3V3_VOLTAGE	NIWD0697	DPU_ANT2_ERR_FLAG			NIW00671	BIA_TEMP_ANT2_LF_PA	NIW00834	LFR_TEMP_FPGA	NIW01139	TDS_TEMP_SRAM	NIW01382	THR_TEMP_ANT3_HF_PA
		NIW00117	PDU_1V5_VOLTAGE	NIWD0698	DPU_ANT3_ERR_FLAG			NIW00672	BIA_TEMP_ANT3_LF_PA					NIW01383	THR_TEMP_PCB
		NIW00118	PDU_BIAS_P5V_CURRENT	NIWD0029	BIA_LINK_ERR_FLAG			NIW00673	BIA_TEMP_PCB					NIW01384	THR_TEMP_FPGA
		NIW00119	PDU_BIAS_M5V_CURRENT	NIWD0030	PDU_LINK_ERR_FLAG			NIW00675	BIA_NHV					NIW01385	THR_POWER_SUPPLY_VOLT1
		NIW00120	PDU_BIAS_3V3_CURRENT	NIWD0031	LFR_LINK_ERR_FLAG			NIW00674	BIA_PHV					NIW01386	THR_POWER_SUPPLY_VOLT2
		NIW00121	PDU_BIAS_1V5_CURRENT	NIWD0032	TDS_LINK_ERR_FLAG			NIW00676	BIA_REF2_VOLT					NIW01387	THR_POWER_SUPPLY_VOLT3
		NIW00122	PDU_LFR_P5V_CURRENT	NIWD0033	THR_LINK_ERR_FLAG			NIWD0121	BIA_MODE_HV_ENABLED						
		NIW00123	PDU_LFR_M5V_CURRENT	NIWD0034	DPU_CUR_CONS_FLAG			NIWD0122	BIA_MODE_BIAS3_ENABLED						
		NIW00124	PDU_LFR_3V3_CURRENT	NIWD0035	DPU_TEMP_FLAG			NIWD0123	BIA_MODE_BIAS2_ENABLED						
		NIW00125	PDU_LFR_1V5_CURRENT	NIWD0036	DPU_UNEXP_RESET_FLAG			NIWD0124	BIA_MODE_BIAS1_ENABLED						
		NIW00126	PDU_TDS_P5V_CURRENT	NIWD0037	DPU_SHORT_CIRCUIT_FLAG										
		NIW00127	PDU_TDS_M5V_CURRENT	NIWD0038	DPU_ADC_ERR_FLAG										
		NIW00128	PDU_TDS_3V3_CURRENT	NIW00109	PDU_DPU_3V3_VOLTAGE										
		NIW00129	PDU_TDS_1V5_CURRENT	NIW00110	PDU_DPU_3V3_CURRENT										
		NIW00130	PDU_THR_P12V_CURRENT	NIW00111	PDU_DPU_2V5_VOLTAGE										
		NIW00131	PDU_THR_P5V_CURRENT	NIW00112	PDU_DPU_2V5_CURRENT										
		NIW00132	PDU_THR_M5V_CURRENT	NIWD0051	PDU_CONV_ON_OFF										
		NIW00133	PDU_THR_3V3_CURRENT	NIWD0052	PDU_SCM_ON_OFF										
		NIW00134	PDU_THR_1V5_CURRENT	NIWD0053	PDU_ANT3_ON_OFF										
		NIW00135	PDU_ANT1_P5V_CURRENT	NIWD0054	PDU_ANT2_ON_OFF										
		NIW00136	PDU_ANT1_M5V_CURRENT	NIWD0055	PDU_ANT1_ON_OFF										
		NIW00137	PDU_ANT2_P5V_CURRENT	NIWD0056	PDU_THR_ON_OFF										
		NIW00138	PDU_ANT2_M5V_CURRENT	NIWD0057	PDU_TDS_ON_OFF										
		NIW00139	PDU_ANT3_P5V_CURRENT	NIWD0058	PDU_LFR_ON_OFF										
		NIW00140	PDU_ANT3_M5V_CURRENT	NIWD0059	PDU_BIAS_ON_OFF										
		NIW00141	PDU_SCM_P12V_CURRENT	NIWD0043	DPU_TEMP1										
		NIW00142	PDU_SCM_M5V_CURRENT	NIWD0044	DPU_TEMP2										
				NIWD0045	DPU_TEMP3										
				NIWD0046	DPU_TEMP4										
				NIW00107	PDU_TEMP1										
				NIW00108	PDU_TEMP2										
				NIWD0047	DPU_P3V3_SUPPLY										
				NIWD0048	DPU_P2V5_SUPPLY										
				NIWD0049	DPU_P1V9_SUPPLY										
				NIWD0050	DPU_2V5_REF										

ANNEX 3. S/C HK PARAMETERS USED FOR INSTRUMENT DATA ANALYSIS

Temperature Parameters

Hinge temperature	Mnemonic RIU A	Mnemonic RIU B	Description
PZ ANT	NRU02586	NRU12586	ANY_4_1_6 RPW ANT SRP
PY ANT	NRU02588	NRU12588	ANY_4_1_8 RPW 2 SRP
MY ANT	NRU02288	NRU12288	ANY_1_4_8 RPW 3 SRP

Table 1: TM parameters for hinge temperatures.

Temperature	Mnemonic RIU A	Mnemonic RIU B	Description
PZ ANT PA	NRU02769 NRU02775 NRU02785	NRU12769 NRU12775 NRU12785	ANP_2_2_9 RPW ANT 1 ANP_2_2_15 RPW ANT 1 ANP_3_1_5 RPW ANT 1
PY ANT PA	NRU02809 NRU02805 NRU02815	NRU12809 NRU12805 NRU12815	ANP_4_1_9 RPW 2 ANP_4_1_5 RPW 2 ANP_4_1_15 RPW 2
MY ANT PA	NRU02755 NRU02773 NRU02774	NRU12755 NRU12773 NRU12774	ANP_2_1_15 RPW 3 ANP_2_2_13 RPW 3 ANP_2_2_14 RPW 3
RPW EB URP	NRU02582 NRU02369 NRU02564	NRU12582 NRU12369 NRU12564	ANY_4_1_2 RPW EB URP ANY_2_2_9 RPW EB URP ANY_3_6_4 RPW EB URP
RPW SCM	NRU02724 NRU02753 NRU02787	NRU12724 NRU12753 NRU12787	ANP_1_2_4 RPW SCM ANP_2_1_13 RPW SCM ANP_3_1_7 RPW SCM
I-BOOM (TH2311)	NRU02707	NRU12707	ANP_1_1_7 RPW SCM SRP

Table 2: TM parameters for preamplifier temperatures, MEB URP temperatures, SCM thermal control and SCM "URP" temperature (I-boom temperature).

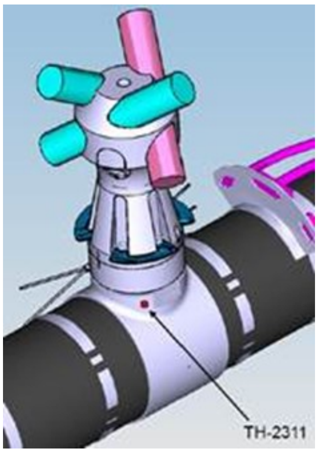

Figure 1: Location of "RPW SCM SRP" (I-Boom temperature reference)

Antenna Deployment Status

Microswitch status	Mnemonic RIU A	Mnemonic RIU B	Description
PZ ANT hinge nom	NRUD2026	NRUT2026	RSA_1_2_10 RPW 1_MLI A
PZ ANT hinge red	NRUD2086	NRUT2086	RSA_2_2_10 RPW 1_MLI B
PZ ANT stacer nom	NRUD2033	NRUT2033	RSA_1_2_3 RPW 1 STACER A
PZ ANT stacer red	NRUD2087	NRUT2087	RSA_2_2_9 RPW 1 STACER B
PY ANT hinge nom	NRUD2032	NRUT2032	RSA_1_2_4 RPW 2_MLI A
PY ANT hinge red	NRUD2169	NRUT2169	RSA_3_3_7 RPW 2_MLI B
PY ANT stacer nom	NRUD2093	NRUT2093	RSA_2_2_3 RPW 2 STACER A
PY ANT stacer red	NRUD2194	NRUT2194	RSA_4_1_2 RPW 2 STACER B
MY ANT hinge nom	NRUD2027	NRUT2027	RSA_1_2_9 RPW 3_MLI A
MY ANT hinge red	NRUD2167	NRUT2167	RSA_3_3_9 RPW 3_MLI B
MY ANT stacer nom	NRUD2193	NRUT2193	RSA_4_1_3 RPW 3 STACER A
MY ANT stacer red	NRUD2235	NRUT2235	RSA_4_3_1 RPW 3 STACER B

Table 21 : TM parameters for microswitch status.

Frangibolt current	Mnemonic PCDU DHS A	Mnemonic PCDU DHS B	Description
PZ ANT boom nom	NPWD4002	NPWT4002	IFA_DPL1_CH1_IOUT_TM
PZ ANT boom red	NPWD4008	NPWT4008	IFA_DPL2_CH1_IOUT_TM
PZ ANT stacer nom	NPWD4002	NPWT4002	IFA_DPL1_CH1_IOUT_TM
PZ ANT stacer red	NPWD4008	NPWT4008	IFA_DPL2_CH1_IOUT_TM
PY ANT boom nom	NPWD4002	NPWT4002	IFA_DPL1_CH1_IOUT_TM
PY ANT boom red	NPWD4008	NPWT4008	IFA_DPL2_CH1_IOUT_TM
PY ANT stacer nom	NPWD4002	NPWT4002	IFA_DPL1_CH1_IOUT_TM
PY ANT stacer red	NPWD4008	NPWT4008	IFA_DPL2_CH1_IOUT_TM
MY ANT boom nom	NPWD4004	NPWT4004	IFA_DPL1_CH2_IOUT_TM
MY ANT boom red	NPWD4010	NPWT4010	IFA_DPL2_CH2_IOUT_TM
MY ANT stacer nom	NPWD4004	NPWT4004	IFA_DPL1_CH2_IOUT_TM
MY ANT stacer red	NPWD4010	NPWT4010	IFA_DPL2_CH2_IOUT_TM

Table 22 : TM parameters for frangibolt currents.

The PCDU contains 2 deployment modules (DPL1, DPL2), each module has 2 deployment chains (CH1, CH2), each chain commands 33 deployment outputs. The TM corresponds to the output current of a specific deployment chain.

I-Boom deployment Parameters

To be completed

Reaction wheel speeds

NCAT1AG0 RW1_RATE
NCAT1B10 RW2_RATE
NCAT1AK0 RW3_RATE
NCAT1C40 RW4_RATE

WDE power and status

LCL currents:
NPWD2521 A_LCL1_20 WDE-1 PWR TM
NPWD2771 A_LCL2_20 WDE-2 PWR TM
NPWD3021 A_LCL3_20 WDE-3 TM
NPWD3521 A_LCL5_20 WDE-4 PWR TM

These are all for PCDU-A, for equivalent PCDU-B parameters substitute NPWTxxxx.

There are LCL status parameters as well, but frankly for simplicity the current values can be used (if the engineering value is within a few bits of zero then the LCL is off).

Solar Array Position

NCFT55P0 SADE-A calibrated PY array position (deg)
NCFT55U0 SADE-A calibrated MY array position (deg)
And equivalently NCFT56U0 and NCFT56Y0 if we are ever using the SADE-B

APR temperature and Power

The external URP is at least at the correct end of the PCDU, but it's external. The internal ones are (as far as I can see now) not close to the APR end.

You can look at power coming in to the APR (from the arrays), or power going out. The former is probably more interesting
NPWD4255 IFA_ISA1_NOM_TM
NPWD4256 IFA_VSA1_NOM_TM
NPWD4257 IFA_ISA1_RED_TM
NPWD4258 IFA_VSA1_RED_TM
NPWD4267 IFA_ISA2_NOM_TM
NPWD4268 IFA_VSA2_NOM_TM
NPWD4269 IFA_ISA2_RED_TM
NPWD4270 IFA_VSA2_RED_TM

There are pairs of measurements being current and voltage (nominal and redundant measurements on array 1 and on array 2). It can also get a sense of how hard the APR is working from the Main Error Amplifier voltage, NPWD5002. These are all for PCDU-A, for equivalent PCDU-B parameters substitute NPWTxxxx. Note that the APR is adapting its behavior very fast. You only have a subsampling in TM.

Star Tracker Status

NPWD2516	A_LCL1_15 STR-1 TM	Prime Star Tracker LCL current
NPWD3015	A_LCL3_14 STR-2 TM	Backup Star Tracker LCL current

These are for PCDU-A, for equivalent PCDU-B parameters substitute NPWTxxxx.

STR currents typically have a lot of jitter because photon integration is less power-intensive than detector readout. How you see this may be a bit weird, in that the PCDU sampling may happen to mostly miss the readout peak, or mostly sample it, and these sampling sync effects can potentially change based on artificial things like switchovers. There may also be some additional variation due to the thermo-electric cooler, when active. There are LCL status parameters as well, but frankly for simplicity I would probably just take the current, if the engineering value is within a few bits of zero then the LCL is off.

HGA Status

Mnemonic	HGA Status
NCSG3JC0	APME HGA A SCV Status
NCSG3JD0	APME HGA B SCV Status
NCFB0015	HGA A APME TM State
NCFB0016	HGA B APME TM State
NCFB0006	HGA A APME Op State
NCFB0007	HGA B APME Op State
NAHD0000	APMHA_Mode
NAHT0000	APMHB_Mode
NCFT29S0	HGA Acquired Azimuth
NCFT29T0	HGA Acquired Elevation
NAHD0042	APMHA_Az coarse_Pos
NAHD0032	APMHA_El_Coarse_Pos
NAHT0042	APMHB_Az coarse_Pos
NAHT0032	APMHB_El_Coarse_Pos
NCFT2P10	HGA Steer Executing

Table 23 : TM parameters for HGA status.

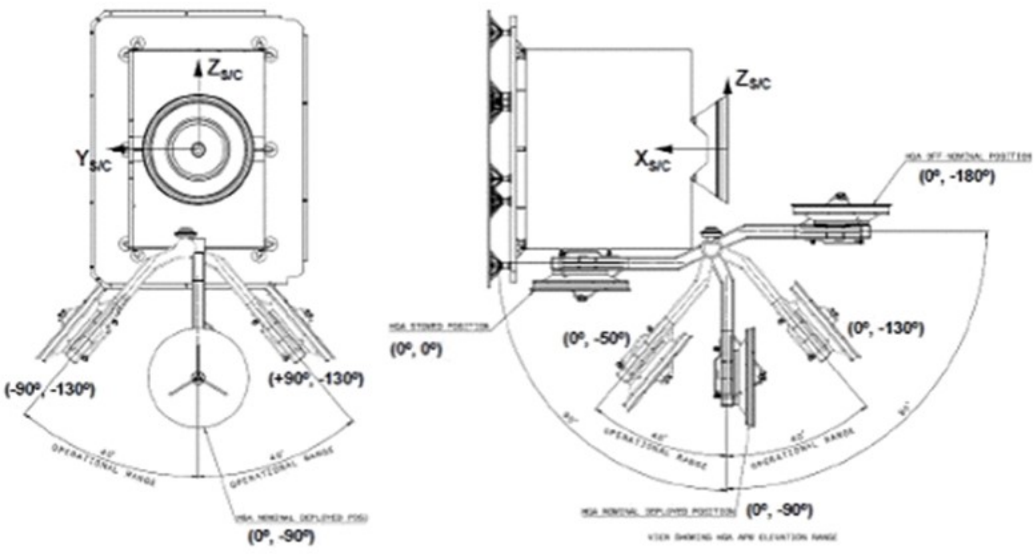

Figure 24 : Definition of Azimuth and Elevation in HGA coordinate system (Stowed position: Az = 0, El = 0 / Canonical position: Az = 0, El = -90)).

ANNEX 4. MISSING TELEMETRY SUMMARY

Date	DPU_EVENT	DPU_HK	DPU_OBC_HK	DPU_OBC_TC	DPU_PARAMETER_DUMP	DPU_PID5_TC	DPU_PID6_TC	DPU_SCIENCE	DPU_TC	LFR_HK	LFR_PARAMETER_DUMP	LFR_SCIENCE	LFR_SCIENCE_SBM	LFR_TC	TDS_HK	TDS_PARAMETER_DUMP	TDS_SCIENCE	TDS_SCIENCE_SBM	TDS_TC	THR_HK	THR_PARAMETER_DUMP	THR_SCIENCE	THR_TC
20/05/2020	100%	98%	100%	-	-	-	-	-	100%	100%	-	-	-	100%	100%	-	-	-	100%	100%	-	-	-
19/05/2020	100%	98%	100%	-	-	-	-	-	100%	100%	-	-	-	100%	100%	-	-	-	100%	100%	-	-	100%
18/05/2020	100%	98%	100%	100%	100%	100%	-	-	96%	100%	-	-	-	100%	100%	-	-	-	100%	100%	-	-	100%
17/05/2020	100%	98%	100%	-	100%	-	-	100%	98%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	100%
16/05/2020	100%	98%	100%	-	100%	-	-	100%	98%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
15/05/2020	100%	98%	100%	-	100%	-	-	100%	100%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
14/05/2020	100%	98%	100%	-	100%	-	-	100%	98%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
13/05/2020	100%	98%	100%	-	100%	-	-	100%	99%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
12/05/2020	100%	98%	100%	-	100%	-	-	100%	99%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
11/05/2020	100%	98%	100%	-	100%	-	-	100%	99%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	100%
10/05/2020	100%	98%	100%	-	100%	-	-	100%	97%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
09/05/2020	100%	98%	100%	-	100%	-	-	100%	98%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
08/05/2020	100%	98%	100%	-	100%	-	-	100%	98%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
07/05/2020	100%	98%	100%	-	100%	-	-	100%	100%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
06/05/2020	100%	98%	100%	-	100%	-	-	100%	99%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
05/05/2020	100%	98%	100%	-	100%	-	-	100%	100%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
04/05/2020	100%	98%	100%	-	100%	-	-	100%	99%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	100%
03/05/2020	100%	98%	100%	-	-	-	-	100%	98%	100%	-	100%	100%	100%	100%	-	100%	100%	100%	100%	-	100%	-
02/05/2020	100%	98%	100%	-	-	-	-	100%	98%	100%	-	100%	100%	100%	100%	-	100%	100%	100%	100%	-	100%	-
01/05/2020	100%	98%	100%	-	-	-	-	100%	96%	100%	-	100%	100%	100%	100%	-	100%	100%	100%	100%	-	100%	-
30/04/2020	100%	98%	100%	-	-	-	-	100%	99%	100%	-	100%	100%	100%	100%	-	100%	100%	100%	100%	-	100%	-
29/04/2020	100%	98%	100%	100%	100%	100%	-	96%	97%	100%	-	92%	100%	100%	100%	-	94%	90%	100%	100%	-	93%	100%
28/04/2020	100%	98%	100%	-	-	-	-	100%	100%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
27/04/2020	100%	98%	100%	100%	100%	100%	-	100%	97%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	100%
26/04/2020	100%	98%	100%	-	-	-	-	100%	98%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
25/04/2020	100%	98%	100%	-	-	-	-	100%	96%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-

Date	DPU_EVENT	DPU_HK	DPU_OBC_HK	DPU_OBC_TC	DPU_PARAMETER_DUMP	DPU_PID5_TC	DPU_PID6_TC	DPU_SCIENCE	DPU_TC	LFR_HK	LFR_PARAMETER_DUMP	LFR_SCIENCE	LFR_SCIENCE_SBM	LFR_TC	TDS_HK	TDS_PARAMETER_DUMP	TDS_SCIENCE	TDS_SCIENCE_SBM	TDS_TC	THR_HK	THR_PARAMETER_DUMP	THR_SCIENCE	THR_TC
24/04/2020	100%	98%	100%	-	-	-	-	100%	96%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
23/04/2020	100%	98%	100%	-	-	-	-	100%	98%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
22/04/2020	100%	98%	100%	-	-	-	-	100%	100%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
21/04/2020	100%	98%	100%	-	-	-	-	100%	100%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
20/04/2020	100%	98%	100%	-	-	-	-	100%	100%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	100%
19/04/2020	100%	98%	100%	-	100%	-	-	100%	99%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
18/04/2020	100%	98%	100%	-	100%	-	-	100%	100%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
17/04/2020	100%	98%	100%	-	100%	-	-	100%	100%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
16/04/2020	100%	98%	100%	-	100%	-	-	100%	98%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	100%
15/04/2020	100%	98%	100%	-	100%	-	-	100%	100%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
14/04/2020	100%	98%	100%	-	-	-	-	100%	100%	100%	100%	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	100%
13/04/2020	100%	98%	100%	-	-	-	-	100%	100%	100%	100%	100%	-	100%	100%	100%	100%	-	100%	100%	100%	100%	100%
12/04/2020	100%	98%	100%	-	-	-	-	100%	100%	100%	-	100%	-	100%	100%	100%	100%	-	100%	100%	100%	100%	100%
11/04/2020	100%	98%	100%	-	-	-	-	100%	97%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
10/04/2020	100%	98%	100%	-	-	-	-	100%	98%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
09/04/2020	100%	98%	100%	-	100%	-	-	100%	96%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	100%
08/04/2020	100%	98%	100%	-	-	-	-	100%	100%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
07/04/2020	100%	98%	100%	100%	100%	100%	-	100%	98%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	100%	100%	100%
06/04/2020	100%	100%	100%	-	-	-	-	100%	-	100%	-	100%	-	-	100%	-	100%	-	-	100%	-	100%	-
05/04/2020	100%	100%	100%	-	-	-	-	100%	100%	100%	-	100%	-	100%	100%	100%	100%	-	100%	100%	100%	100%	100%
04/04/2020	100%	100%	100%	-	-	-	-	100%	-	100%	-	100%	-	-	100%	-	100%	-	100%	100%	-	100%	-
03/04/2020	100%	100%	100%	-	-	-	-	100%	-	100%	-	100%	-	-	100%	-	100%	-	100%	100%	-	100%	-
02/04/2020	100%	100%	100%	-	-	-	-	100%	-	100%	-	100%	-	-	100%	-	100%	-	100%	100%	-	100%	-
01/04/2020	100%	100%	100%	-	-	-	-	100%	-	100%	-	100%	-	-	100%	-	100%	-	100%	100%	-	100%	-
31/03/2020	100%	100%	100%	-	-	-	-	100%	100%	100%	-	100%	-	-	100%	-	100%	-	100%	100%	-	100%	-
30/03/2020	100%	100%	100%	100%	100%	100%	-	100%	100%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	100%
29/03/2020	100%	-	100%	-	-	-	-	-	100%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21/03/2020	100%	100%	100%	-	100%	-	-	100%	98%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	100%	-
20/03/2020	100%	100%	100%	-	100%	-	-	100%	98%	100%	-	1%	-	100%	100%	-	0%	-	100%	100%	-	100%	-
19/03/2020	100%	100%	100%	-	100%	-	-	-	99%	100%	-	100%	-	100%	100%	-	-	-	100%	100%	-	-	-

Date	DPU_EVENT	DPU_HK	DPU_OBC_HK	DPU_OBC_TC	DPU_PARAMETER_DUMP	DPU_PID5_TC	DPU_PID6_TC	DPU_SCIENCE	DPU_TC	LFR_HK	LFR_PARAMETER_DUMP	LFR_SCIENCE	LFR_SCIENCE_SBM	LFR_TC	TDS_HK	TDS_PARAMETER_DUMP	TDS_SCIENCE	TDS_SCIENCE_SBM	TDS_TC	THR_HK	THR_PARAMETER_DUMP	THR_SCIENCE	THR_TC
18/03/2020	100%	100%	100%	-	100%	-	-	-	98%	100%	-	0%	-	100%	100%	-	100%	-	100%	100%	-	-	-
17/03/2020	100%	100%	100%	-	100%	-	-	100%	98%	100%	-	0%	-	100%	100%	-	-	-	100%	100%	-	100%	-
16/03/2020	100%	100%	100%	-	100%	-	-	-	97%	100%	-	0%	-	100%	100%	-	100%	-	100%	100%	-	-	-
15/03/2020	100%	100%	100%	-	100%	-	-	-	98%	100%	-	0%	-	100%	100%	-	-	-	100%	100%	-	-	-
14/03/2020	100%	100%	100%	-	100%	-	-	-	98%	100%	-	100%	-	100%	100%	-	100%	-	100%	100%	-	-	-
13/03/2020	100%	100%	100%	-	100%	-	-	-	97%	100%	-	0%	-	100%	100%	-	-	-	100%	100%	-	-	-
12/03/2020	100%	100%	100%	-	100%	-	-	-	99%	100%	-	100%	-	100%	100%	-	-	-	100%	100%	-	-	-
11/03/2020	100%	100%	100%	-	100%	-	-	-	99%	100%	-	100%	-	100%	100%	-	-	-	100%	100%	-	-	-
10/03/2020	100%	100%	100%	-	100%	-	-	-	98%	100%	-	100%	-	100%	100%	-	-	-	100%	100%	-	-	100%
09/03/2020	100%	100%	100%	-	100%	-	-	-	98%	100%	-	0%	-	100%	100%	-	-	-	100%	100%	-	-	-
08/03/2020	100%	75%	100%	100%	100%	100%	-	-	98%	100%	-	0%	-	97%	100%	-	-	-	92%	100%	-	-	100%
07/03/2020	100%	75%	100%	-	100%	-	-	-	96%	100%	-	0%	-	100%	100%	-	-	-	100%	100%	-	-	-
06/03/2020	100%	76%	100%	-	100%	-	-	-	98%	100%	-	0%	-	100%	100%	-	100%	-	100%	100%	-	-	-
05/03/2020	100%	75%	100%	-	100%	-	-	-	100%	100%	-	100%	-	100%	100%	-	-	-	100%	100%	-	-	-
04/03/2020	100%	75%	100%	-	100%	-	-	-	100%	100%	-	-	-	100%	100%	-	100%	-	100%	100%	-	-	-
03/03/2020	100%	75%	100%	-	100%	-	-	-	96%	100%	-	0%	-	100%	100%	-	100%	-	100%	100%	-	-	100%
02/03/2020	100%	75%	100%	-	100%	-	-	-	97%	100%	-	-	-	100%	100%	-	0%	-	100%	100%	-	-	-
01/03/2020	100%	75%	100%	-	100%	-	-	-	97%	100%	-	0%	-	100%	100%	-	-	-	100%	100%	-	-	-
29/02/2020	100%	75%	100%	-	100%	-	-	-	97%	100%	-	0%	-	100%	100%	-	-	-	100%	100%	-	-	-
28/02/2020	100%	87%	100%	100%	100%	75%	-	-	98%	100%	-	0%	-	100%	100%	-	0%	-	100%	100%	-	-	100%
27/02/2020	100%	100%	100%	75%	100%	67%	-	100%	79%	100%	-	100%	100%	75%	100%	-	100%	100%	99%	100%	-	100%	67%
26/02/2020	100%	100%	100%	100%	100%	67%	-	-	97%	100%	-	100%	100%	100%	100%	-	100%	100%	100%	100%	-	100%	100%
25/02/2020	100%	92%	100%	71%	100%	86%	-	-	95%	100%	100%	100%	100%	98%	100%	100%	100%	100%	99%	100%	100%	100%	96%
24/02/2020	95%	82%	100%	100%	100%	100%	-	-	89%	100%	-	-	-	100%	100%	-	-	-	100%	100%	-	-	100%
13/02/2020	100%	76%	100%	-	-	-	-	100%	100%	100%	-	100%	-	-	100%	-	100%	-	-	100%	100%	100%	100%
12/02/2020	100%	76%	100%	100%	100%	100%	-	100%	100%	100%	83%	100%	-	100%	100%	100%	100%	-	100%	100%	100%	100%	100%
11/02/2020	100%	-	100%	100%	-	100%	-	-	97%	-	-	-	-	100%	-	-	-	-	100%	-	-	-	100%

Table 24 : Received telemetry percentage per day for each APID.

ANNEX 5. DISTRIBUTION LIST

PROJECT TEAM		TEL	BPI	HIERARCHY		TEL	BPI
DSO/SC/SOL	FRATTER I.	74427	2220	DSO	CLAIR Marie-Anne	74629	2521
				DSO/DA	MARCHAL Philippe	74456	2911
DSO/TB/SM	HOT A.	82594	1717				
DSO/TB/SM	PUILLET C.	82305	1717	DSO/BL	DUBOURG Vincent	73523	2222
DSO/TB/MS	TREMOLIERE S.	73520	1715	DSO/BL	VARGAS Andre	73493	2222
DSO/SC/SOL	BELLOUARD E.	82615	2220	DSO/AVI	LANDIECH Philippe	81958	1416
DSO/SC/SOL	LORFEVRE Eric	82353	2220	DSO/AVI	LADIETTE Nadine	74972	1416
DSO/TB/TH	LIQUIERES N. (EPSILON)	75612		DSO/DV	VAN-TROOSTENBERGHE Paola	81820	1421
DSO/AVI/RI	SANISIDRO J.	73782	2212	DSO/DV	DESMAZEAUX Pascal	83345	1421
DSO/AVI/RI	GASC P.	83049	2212	DSO/NT	BOLOH Loic	81401	212
				DSO/NT	GUAY Philippe	82620	212
DSO/AVI/RI	MERCIER M (SOGETI)	75227	2212				
DSO/AVI/RI	SEGUR Jérôme (SOGETI HT)	75524	2212				
DSO/SC/SOL	DANTO P.	82921	2220	DSO/OT	GLEYZES Alain	73187	2524
DSO/AVI/SI	JARLAUD J-L.	74950	2212	DSO/OT	BRICOUT Jean-Noel	81320	2524
DSO/AQ/LE	FAYE D.	81812	1414	DSO/RF	PRADINES Dominique	74747	2512
DSO/AQ/BA	JULIEN S. (LOGIQUAL)	73110	1415	DSO/RF	LAPORTE Christophe	81324	2512
DSO/AQ/BA	BENEZETH J-M. (LOGIQUAL)	75879	1415	DSO/SC	LIER Philippe	82155	2532
DSO/AQ/BA	WORGAGUE M.	74768	1415				
DSO/AQ/IM	RIBAIMONT A. (MI-GSO)	81914	1415				
DSO/AQ/MP	COMBES H.	73073	1414	DSO/SI	BOUSSARIE Eric	74354	1711
DSO/DA/CP	LE GALLUDEC J.	81745	2502	DSO/SI	CUGNY Bruno	73139	1711
DSO/TB/EL	LE HUEDE Y (ADS)	73446	1713				
DIA/DA	CASOLI F.	67862	Paris	DSO/TB	SERENE Fabienne	83180	1716
DIA/SME	AMSIF .K	73704	213	DSO/TB	REMAURY Stéphanie	73133	1716
DAJ/AR/SB	SOLIVERES M.	75153	1511				
DSO/TB/ET	SABA B.	82876	1713	DSO/AQ	CADIOU Anne.	82632	1411
				DSO/AQ/IM	MAZEAU Sophie.	82918	1415
DSO/AVI/CC	TRAVERT J-M (ALTRAN)	82169	2213	DSO/AQ/BA	GEAY-KAMINSKI N.	82047	1415
DSO/AVI/MT	IMBERT Christian	74700	1714				

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