



CENTRE NATIONAL D'ÉTUDES SPATIALES

## RPW General Status

RPW consortium meeting  
June 19<sup>th</sup> 2017



- ♦ **CNES RPW team**
- ♦ **RPW activities since December 2016**
- ♦ **RPW residual risks at MEB and SCM PFM delivery**
- ♦ **Open tasks linked to MEB/SCM delivery**
- ♦ **Coming activities at spacecraft level**
- ♦ **Antenna status (see dedicated slides, prepared by Pascale Danto)**

**Desi Raulin**  
(Ground  
segment  
expert)

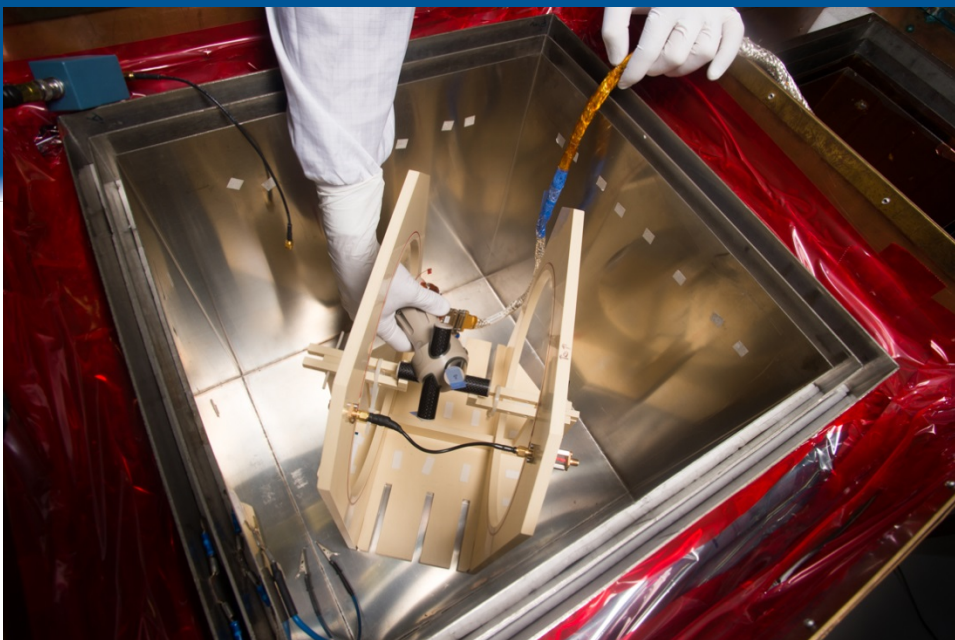


**Eric Lorfèvre**  
(Instrument  
technical  
manager)

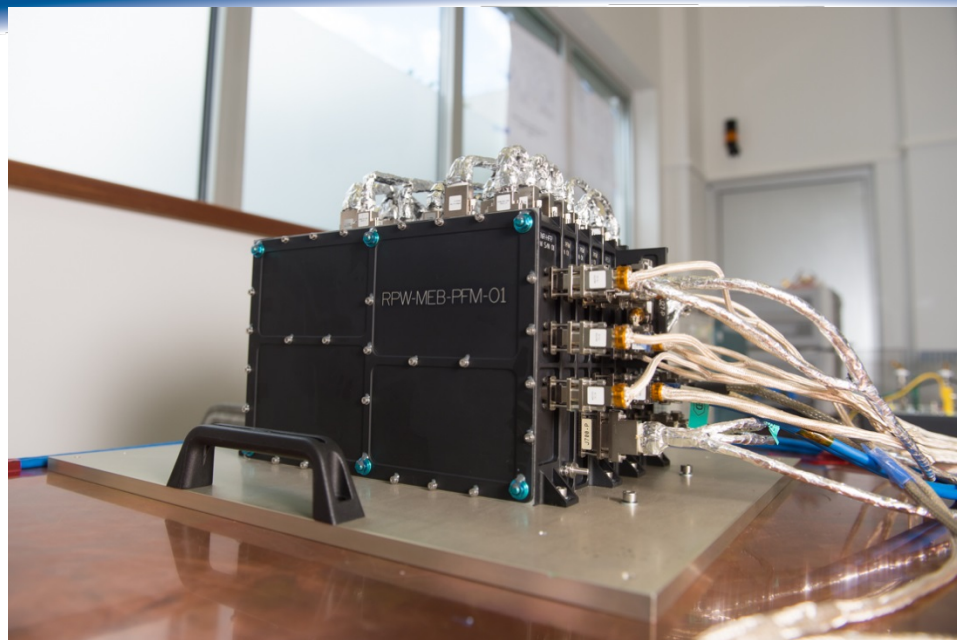




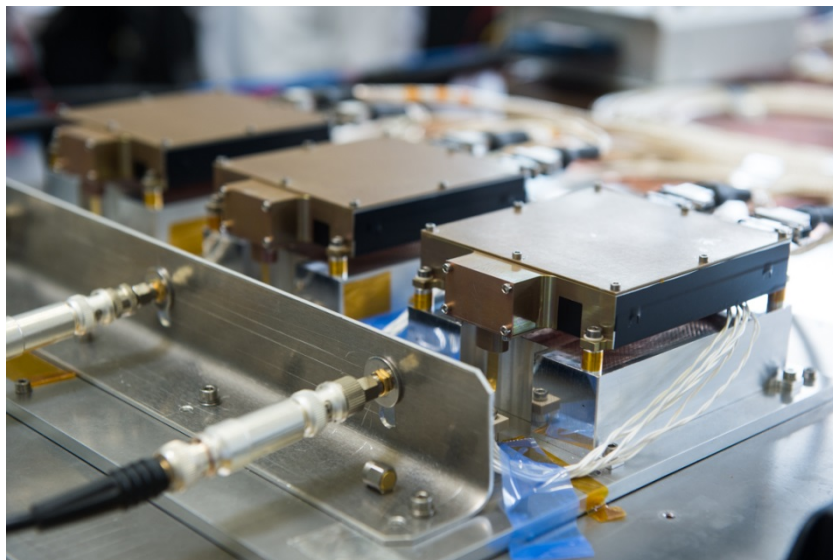
- **Calibration** (with LVPS-PDU PFM1- LFR PFM2 with off-set bug in FPGA) completed, in December, at LESIA
- **Delta-calibration** performed in June, at CNES (with LVPS-PDU PFM2 and FS, and LFR PFM2 with retrofitted FPGA)
- **Delivery of LVPS PDU boards** : April 3<sup>rd</sup> (after new manufacturing of transformers...)
- **MEB and SCM integration and tests** → May 3<sup>rd</sup> (see dedicated presentations)
- **MEB and SCM PFM delivery to CNES** : May 4<sup>th</sup>
- **RPW FM test campaign at CNES** : May 5<sup>th</sup> → June 12<sup>th</sup>
- **MEB and SCM PFM Delivery Review Board (DRB)** : June 8<sup>th</sup> at CNES
  - **declared successful** pending closure of actions (open NCRs & RFDs/RFWs considered acceptable for flight)
  - CTS given on the 14<sup>th</sup> of June"
- **MEB and SCM PFM shipment to Airbus DS UK** : June 14-15<sup>th</sup>
- **MEB and SCM PFM pre-handover tests/handover** at Airbus DS UK : June 19-20<sup>th</sup>



**SCM PFM**



**MEB PFM**



**PA FMs**

## ■ Electrical measurements

➔ *see dedicated slides prepared by Emmanuel Guilhem (RPW system manager)*

## ■ R3++ new functionalities tested

➔ *see dedicated slides prepared by Emmanuel Guilhem (RPW system manager)*

## ■ EMC performances

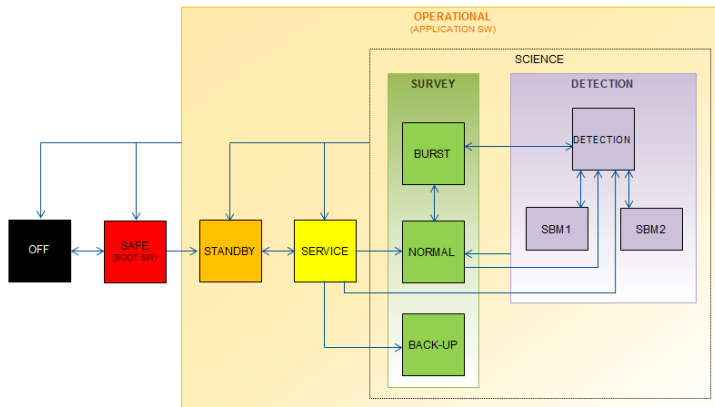
➔ *see dedicated slides prepared by Cecile Fiachetti (EMC CNES expert)*

## ■ FDIR validated

➔ *see dedicated slides prepared by Emmanuel Guilhem (RPW system manager)*

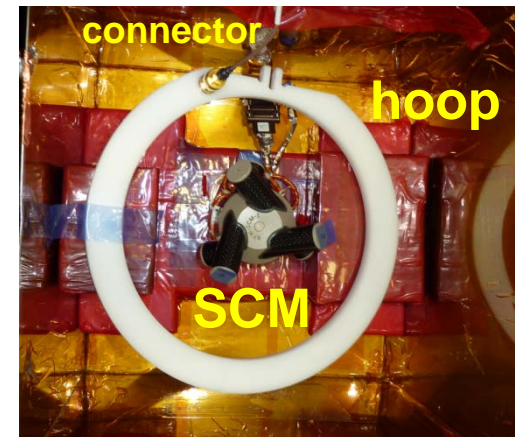
## ■ SFT

- ◆ Verification of **ALL RPW operational modes, including** :
  - In depth verification of **boot SW** (DBS)
  - **Configuration** of BIAS, PA, SCM and analyzers
  - Scientific **TM reception** (including compression)
  - >600 checks on received **HK TM parameters**
  - Execution of **100% of RPW commands**
- ◆ Verification of **main and redundant chains**
- ◆ Compatibility to last **flight SW** and **IDB** versions



## ■ FFT

- The FFT has been done successfully on RPW PFM.
- The FFT has been slightly modified since EM2, in order to be adapted to the S/C configuration. The injection on SCM is now done with a hoop. This test method is valid, whatever the position of the S/C boom, the presence of the MLI or not, on SCM.
- The FFT verifies by a noise floor measurement and a CW injection the behavior of every channels of RPW multiplexer



- Procedure v3.3: *SOLO-RPWAI-TN-1084-CNES*
- As-Run on PFM: *SOLO-RPW-RP-2109-CNES* (24/05/17 ✓)

Stockholm,  
June 19<sup>th</sup> 2017

E.Bellouard





## ■ Mass

Unit	Weighed Mass (g)	Best estimated Mass (g)	Uncertainties (if applicable)	Total Mass (g)		
SCM	663			663		
ANT +Z		5234	5%	5496		
ANT +Y		5427	5%	5698		
ANT -Y		5407	5%	5677		
MEB	6461			6461	Required by EIDA (g)	
Harness	3157			3157		
<b>Total RPW mass</b>	<b>10281</b>			<b>27153</b>	<b>24300</b>	<b>+ 11.7%</b>

5% margin on weighed ANT QM mass taken into account to estimate final ANT FM ones.

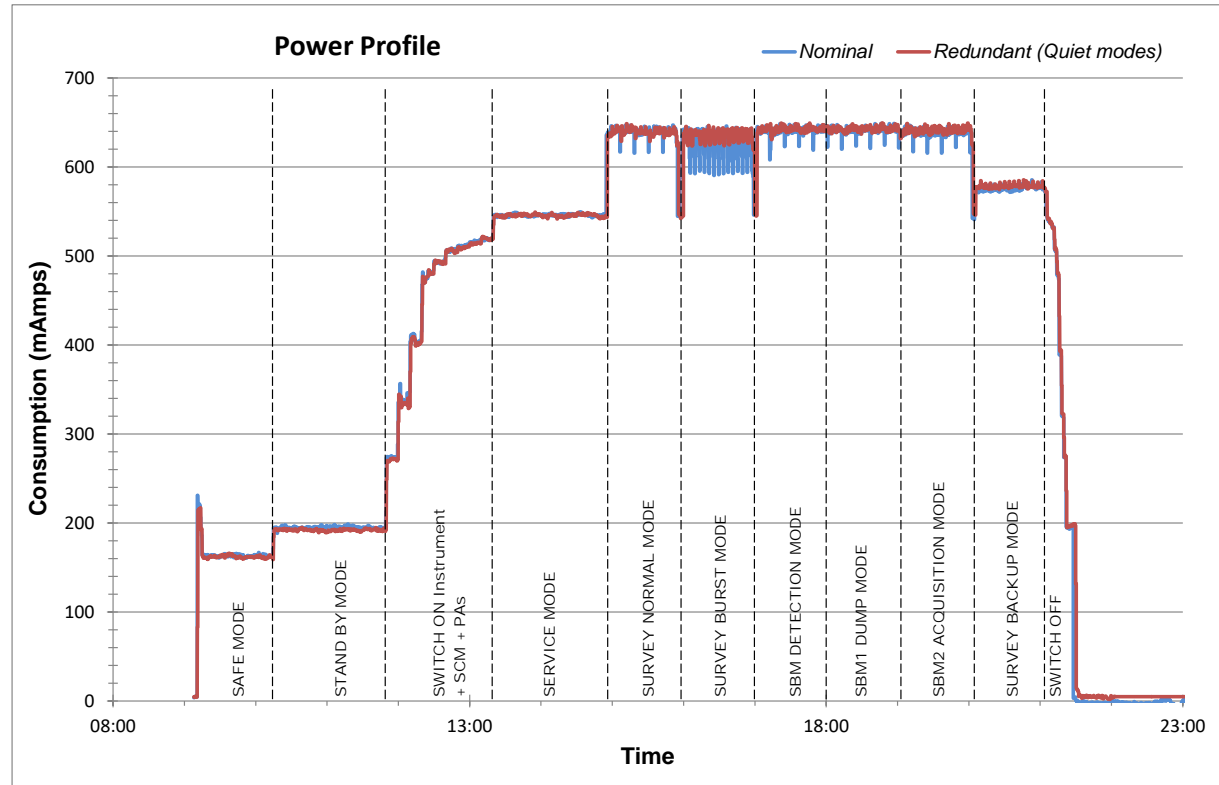
**RPW mass budget is above specification by 2.853 kg (RFW SOLO-RPW-DD-102)**

## ■ Power consumption

	MEB Mode	MEB + PreAmp Consumption (mW)	Heater consumption	Total RPW consumption	Margin wrt allocation for 23 W (EIDA-R-145)	
<b>Average</b>	Science modes @28V	17640	100	<b>17740</b>	22,9%	Hot Case (0.28 UA)
Long peak			3940	21580		
<b>Average</b>			4700	<b>22340</b>	2,9%	Cold Case (1.2 UA)
Long peak			16450	34090		



## ■ Power consumption



## ■ Thermal dissipation

The maximum mean value measured on MEB PFM is 17.6 W @28 V. The maximum MEB thermal dissipation is **~16.8 W** (subtracting PA and SCM consumption).

## LVPS-PDU FS :

- Risk of failure of C161 capacitor (cf. NCR RPW-NCR-720-039-ASI )

## LVPS-PDU PFM2 considered not reliable :

- High number of repairs, reworks, modifications, exceeding ECSS standards,
- Risk of losing electrical contact between PSU and PDU board due to bad degolding before soldering of Hypertac connector.
- Risk of crack on SMD0.5 components on ground (soldering qualification at CSRC failed)
- Risk of failure of C161 capacitor (cf. NCR RPW-NCR-720-039-ASI)

Risk mitigation : PFM2 to be replaced by FS2 after MEB delivery should the opportunity arise

## LFR PFM2:

Several anomalies implying LFR are still under investigations, and not understood so far:

- noise on measurements (BIAS4&5 channels) at low temperature (temperature at board level below -20°C) (cf. NCR SOLO-RPW-FT-310)
- booting at high temperatures (above 55°C for nominal channel, and at 70°C for redundant channel) failed during TVAC MEB (cf. NCR RPWMEB-671)
- Improper design in the VHDL code leading to read the data when the bus is no more driven
- 96Hz and harmonics emitted from LFR board

Risk mitigation: PFM2 to be replaced by PFM1 after MEB delivery should the opportunity arise (and if issues are understood and fixed on PFM1)

**NC 287: LFR rare unsynchronouse snapshots seen during calibration.**

## **No spares available for LVPS-PDU and LFR:**

- LVPS-PDU FS2 components are under procurement: FS2 board will not be available before 1<sup>st</sup> quarter 2018 (TBC PRODEX/ASU).
- LFR PFM1 has to be retrofitted with a new FPGA, waiting for programming, after LFR anomalies investigations.

Risk mitigation: complete the spare boards as soon as possible

## **SCM PFM:**

- Risk of losing one (or more) measurement channel after thermal cycling during TVAC at spacecraft level or in-orbit (thermal fatigue), due to a manufacturing defect.

Risk mitigation: PFM to be replaced by FS once available

## **NC 272: SCM LF calibration fails.**

- During RPW FM calibration, SCM response in frequency has presented strange shape. The expected result is a flat response curve in frequency, the obtained result presents a non-negligible variation for  $F > 100\text{Hz}$ .

## ■ MEB

- Investigation of open NCRs (LFR noise at low temperature, LFR boot failure at high temperature, ...)
- Formal close-out of LFR DRB : **pending on final documentation**
- Software delta-qualification review for formal close-out :
  - **Scheduled June 29<sup>th</sup> for LFR R3++**
- LFR spare board procurement (after NCR investigations)
- LVPS-PDU spare (FS2) board procurement and PFM1 retrofit.

## ■ SCM

- MLI spare manufacturing and bake-out (scheduled between May and August) → **on-going**
- Thermal flight predictions update (taking into account modification of specified (in EIDA-v6) temperature at -135° C at SRP) → **on-going**
- SCM FS assembly, tests (and calibration ?) → **due date September 2017**

## ■ RPW

- Update of final EIDP (for delivery of MEB and SCM PFM) → **v3 due date for June 23<sup>th</sup> , including RPW FM EMC test report (first version), final SFT/FFT as-run reports**
- Delta-calibration of RPW instrument : **report to write**
- Update of “Science performance justification” (SOLO-SY-TN-271-CNES) → **scheduled for Nov. 2017**



## ■ Activities planned on S/C:

- ◆ Mechanical integration of MEB on S/C panel : June 24<sup>th</sup>
- ◆ Electrical integration of MEB on S/C panel : July 20-21<sup>st</sup>
- ◆ SFT with MEB and SCM : July 22<sup>nd</sup>
- ◆ FFT dry-run with MEB and SCM only : September 1<sup>st</sup>
- ◆ Antennas and SCM FS DRB : September  
followed by antennas mechanical/electrical integration on S/C, and SCM FS integration on a thermal plate for S/C TVAC test
- ◆ TVAC, vibrations, EMC, SVT...

## ■ Activities on AIRBUS test bench, tests required with EM2

- ◆ FDIR including OBC I/F
- ◆ Intercommunication tests (service 20)
  - IIC-3: Validation of service 20 exchanges (accepted by ADS)
  - IIC-4: Instrument reaction on instrument parameters is verified (not accepted by ADS, to negotiate with ESA)
  - MAG/RPW synchro (accepted by ADS)