

SPIRE-RAL-NOT-001192

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RE: SCI-PT/011755 – Herschel EQM (ISO Cryostat) – Radiated EMC Test of 21 February 2002

Dear Bernard and Thomas,

We have several comments we would like to make in response to your fax regarding the omission of the radiated susceptibility testing of the Herschel/SPIRE during the planned EQM testing program.

The concept of the test was originally developed in the ambit of the Herschel/Plank Power-EMC Working Group in response to the lack of representative testing of the radiated susceptibility (RS) of the cold focal plane instruments. (Attachment One contains a brief synopsis of SPIRE's understanding of these tests.) Several technical/practical difficulties have been identified in carrying out the tests; not least of which was the transmission efficiency of a small antenna inside the cryogenic test adaptor over many decades of frequency. Despite these difficulties, it was the consensus of the working group that, from a technical point of view, this was the most feasible means of testing the RS of the instruments.

However, it is also recognised by SPIRE that seeking the technically most favourable solution is not always the most efficient allocation of resources. The most important element of the proposed tests for SPIRE is to characterise the susceptibility to radiation picked up by the external cryoharness and conducted into the cryostat. Once inside, such pick-up might be either conducted directly to the FPU via the internal harness or indirectly through a combination of re-radiation and resonance inside the CVV. We regard this part of the test (which does not require the use of the antennas inside the CTA) as essential. If the RS testing of the detection system during the EQM campaign is to be abandoned, the Herschel consortium would be carrying forward a risk that would not be detectable during the PFM qualification programme. Ultimately, problems may only become evident during flight!

We would therefore find it unacceptable to abandon all RS testing of our cryogenic detection system. Before deciding on the optimum test philosophy and programme, it is necessary to

clarify certain issues in regard to the RS requirements on the cryogenic units on Herschel/Plank:

1. Is it a requirement that the instruments operate during the ground contact period when the transponder is operating?
2. Are the IID-A EMC requirements in §5.14 applicable to the cryogenic units? If not, what are the requirements and test conditions for which we need to design?
3. In the fax, it was stated that the RF environment inside the CVV was dominated by solar emissions and that the emissions from the SVM were negligible. Did this analysis include emissions from the Solar Array?

We propose that the Power-EMC Working Group address the general issue again before a final decision is made.

Best Regards

Matt Griffin

Doug Griffin

Overview of EQM EMC RS Testing of Detection Subsystem

- There is assumed to be two potential coupling paths for EMI entering the detection circuitry:
 - RFI coupling into the external cryoharness and re-radiating and/or directly coupling into low noise circuits within the CVV
 - RFI entering the CVV via the optical aperture and/or the HIFI LOU windows
- The test illustrated in Figure 1 is conducted at room temperature. It is used to determine the shielding effectiveness of the CVV in close to flight representative geometry. (but w/o the telescope)
- The test illustrated in Figure 2 is conducted at cryogenic temperature with the CTA in place. The Tx antenna inside the CVV does not radiate while the external Tx antenna radiates. The detectors are fully functional. The amplitude and frequency of the external field are swept to evaluate the susceptibility of the instruments to RFI coupling through the external cryoharness.
- The test illustrated in Figure 3 is conducted at cryogenic temperature with the CTA in place. Both the Tx antenna inside the CVV and the external Tx antenna radiate. The detectors are fully functional. The amplitude and frequency of the external and/or internal fields are swept to evaluate the susceptibility of the instruments to RFI coupling through the CVV apertures.
- The tests as presented are qualitative to demonstrate the level of RS margin (if any) that SPIRE carries.

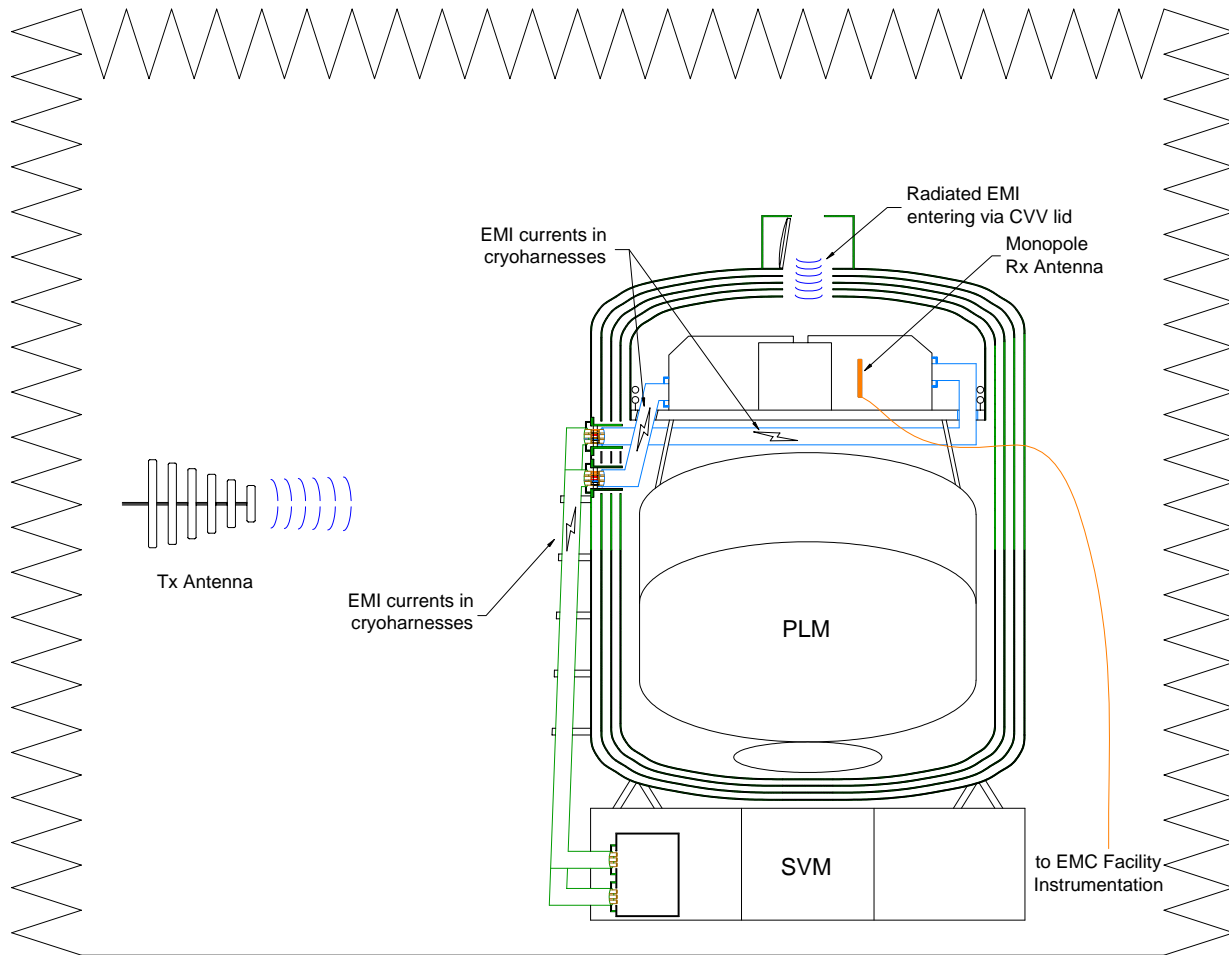


Figure 1 - Test calibration

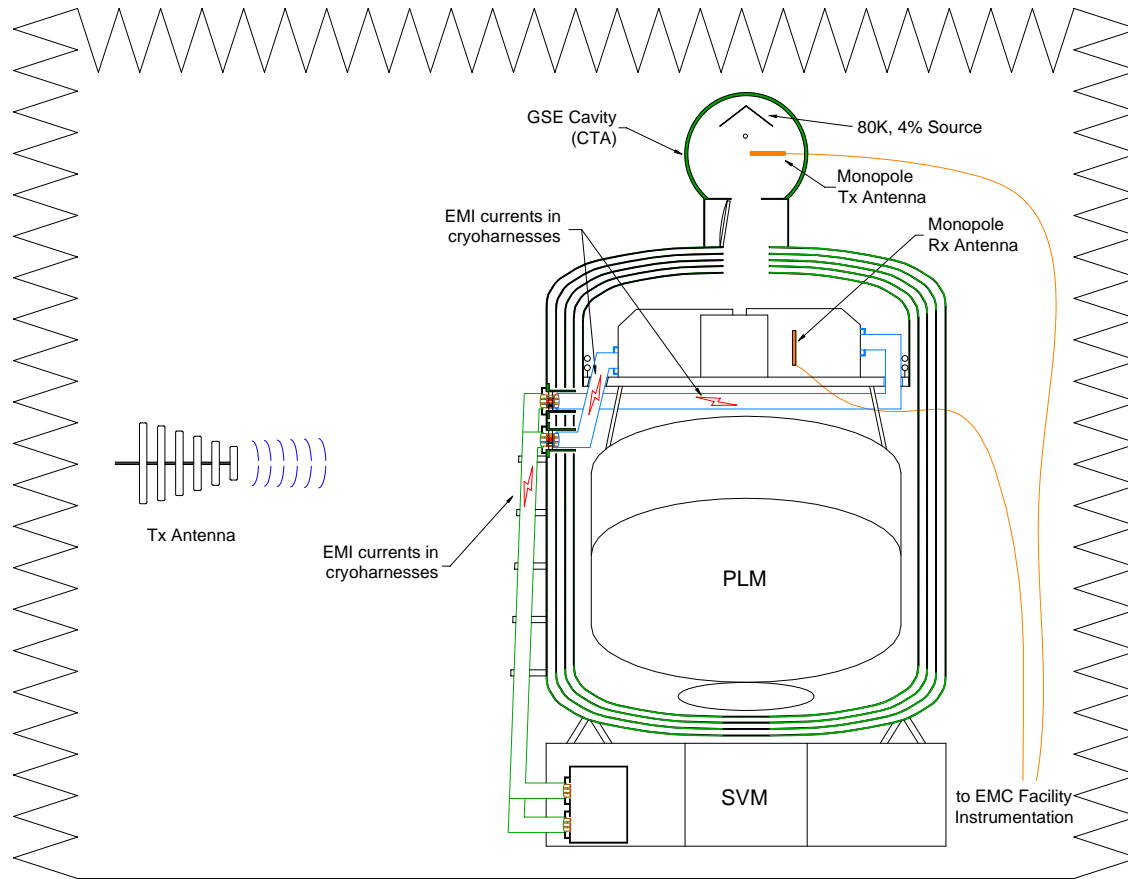


Figure 2 - Measurement of RFI penetration through cryoharnesses.

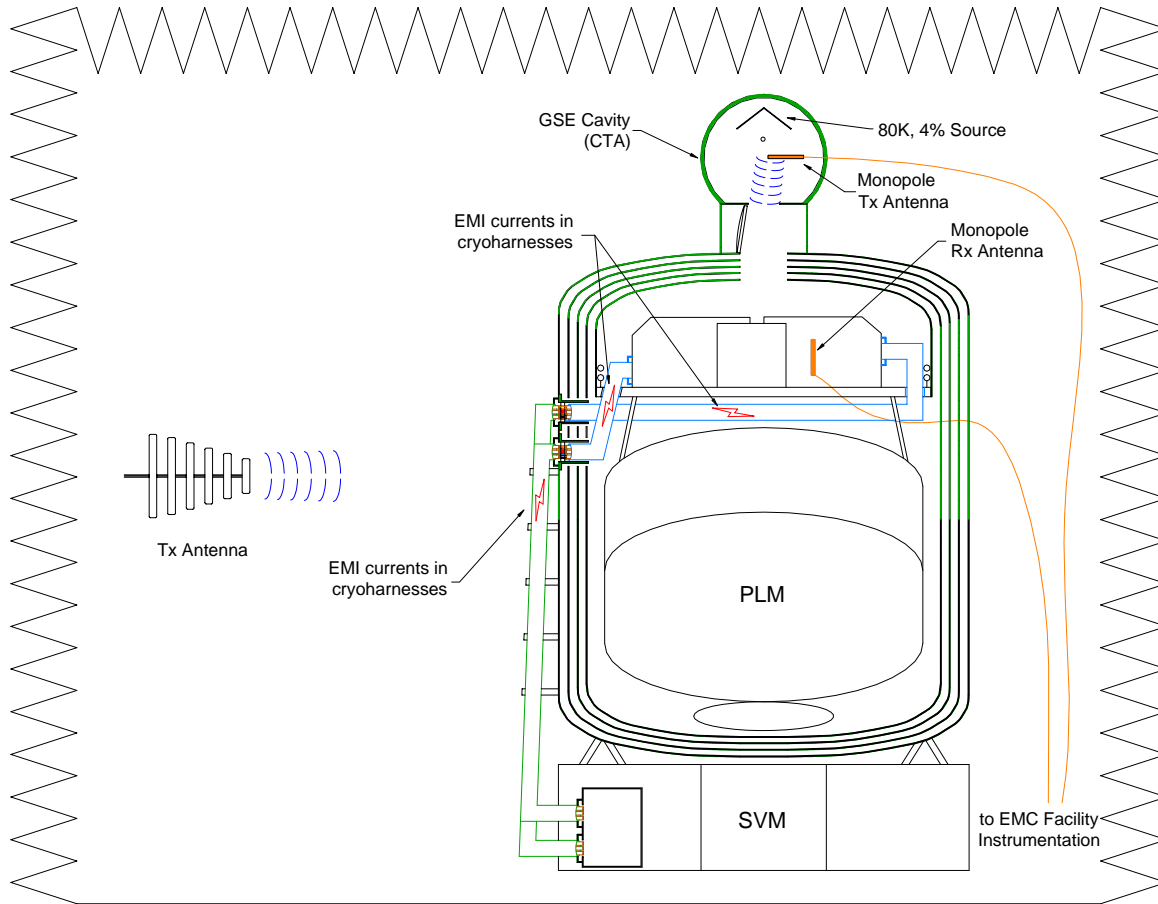


Figure 3 - Measurement of RFI penetration through apertures and cryoharness.