



SPIRE Technical Report

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Issue: 1.0

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SPIRE IST EMC Test Plan Overview
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Change Log

Date	Change	Issue
Friday, 26 October 2007	Initial release	1.0

Reference Documents

RD	Document	Comments
RD1	SPIRE EMC DRB Status Summary, Issue 1.0 SPIRE-RAL-REP-002853	This document summarises the EMC qualification status of SPIRE at the time of the flight model instrument delivery

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RD1 summarises the EMC qualification status of SPIRE at the time of the flight model instrument delivery to ESA/Industry (March 2007). The purpose of this document is to give an update on this document at the time of the SPIRE SVR-3 review. Specifically;

1. RS qualification of SPIRE

Current Status: During the EQM tests, two NCRs were raised against SPIRE for susceptibilities of the instrument to radiated E and B fields. An attempt to improve the susceptibility threshold of the instrument through the use of ferrite beads on the cryoharness and/or capacitive feedthrough filters on the DRCU was investigated during the STM2 test campaign. Both of these countermeasures showed to have little or no beneficial effect on the instrument susceptibilities. An EMC review meeting held on 12-01-07 between SPIRE/ESA/Industry concluded that the testing approached used during CS and RS testing of SPIRE of square wave modulating the disturbance at 1 Hz was an over test as the amplitude modulation of in-flight disturbances are likely to be small and unlikely to be within the detection bandwidth of SPIRE. In the light of the detailed analysis of the magnetic field emitted by the solar array and shunt regulator, that the predicted field strength at the location of SPIRE will be below the thresholds identified during the EQM and STM2 tests and therefore the H-Field NCR could be closed.

Spacecraft Tests: It is currently planned that the final RS E-Field qualification of SPIRE (and closeout of the E-Field NCR raised during the EQM campaign) will be achieved during the test. The sequence of the testing is as follows:

1. The overall envelope of the magnitude of the RE E-Field emissions from the spacecraft will be measured in the Maxwell EMC anechoic test chamber in various spacecraft modes across the spectrum.
2. SPIRE will then be irradiated while it is in its most sensitive mode using a field strength mask mirroring the levels obtained during the RE test including a margin. The disturbance signal will not be amplitude modulated within the detection bandwidth of SPIRE. Removing this low frequency modulation of the disturbance should improve the inferred susceptibility threshold of the instrument derived from the tests.



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If SPIRE does not pass this system level auto-compatibility RS test, then two countermeasures are available to mitigate the susceptibility. Firstly, extra EMI shielding can be fixed over the SPIRE cryoharness to reduce the pickup on the harnesses and secondly, the apertures in the SVM which represent a leakage path can be closed by sealing them with conductive foil.

Extra H-Field RS tests are planned to be carried out on the PACS instrument due to an NCR raised during the EQM test campaign. SPIRE have requested to be switch on during these H-Field tests to gather serendipitous detector data as a performance test under this disturbance.

The system level RS tests are currently planned to be carried prior to the mechanical and thermal environmental testing at ESTEC.

2. CS qualification of SPIRE

Current status: CS testing on the instrument prior to ILT5 indicated that SPIRE had susceptibilities to conducted emissions on the primary power lines. All of these test were carried out with low frequency modulation of the disturbance. During the SPIRE EMC review of 12-01-07, it was concluded that the CS testing of the instrument using a low frequency modulation of the disturbance within the pass band of the instrument is an over test. During the ILT-5 test campaign, further CS tests were carried out on the photometer without any modulation of the disturbance. As expected, the EMI on the PSW and PLW detectors was seen to disappear when the in-band modulation of the disturbance was removed. Unexpectedly, the steady state disturbances caused EMI at ~ 1.5 Hz on the PMW detector array. The ILT test campaign finished before these results could be analysed and processed and therefore there was no further opportunity to carry out detailed investigations into this phenomena. It has been agreed that limited CS testing will be carried out on SPIRE in the system configuration during the SPT testing. The purpose of this test will be to establish if there is any EMI pickup on the detectors in the flight configuration. If it is detected, then the tests will attempt to characterise and operationally ameliorate them.

To properly calibrate the level of the disturbance to be injected for this test, a pre-test will be carried out at RAL prior to the commencement of the FS ILT test campaign.

This system level CS test will be carried out at ASED FN prior to spacecraft delivery to ESTEC.

3. System level CE qualification

Current status: The conducted emissions from various instrument and spacecraft subsystems towards the spacecraft PCDU. Although this test will involve the powering on of SPIRE, it is considered that passing the test will be a formality for SPIRE as the SPIRE DPU and PSU have been qualified at subsystem level (albeit with RFWs on the emission levels which have been accepted).

4. RE qualification of the DRCU

Current Status: In 2006, it was decided to delay the DRCU RE qualification tests until after the full instrument cryogenic end-to-end pre-delivery ILT tests were completed. It subsequently transpired that the sub-system provider would not be able to carry out the test as their EMC test facility was put out of service by storm damage. It was decided to submit an RFW against carrying out this test on the units. The main justifications for the RFW are: the schedule drivers and priorities for the overall SPIRE



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programme, the routine nature of the test, the difficulties in adequately reproducing a representative flight-like environment during such a test and the demonstrated self-compatibility of the SPIRE detectors to radiated emissions in the ILT and STM2 environments. The disposition to the RFW is pending.