CM# FAST-TEV-067

SMEX FAST
EMI/EMC AND MAGNETIC TEST PLAN

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1.0 SCOPE

This document describes the electromagnetic interference (EMI), electromagnetic compatibility (EMC), and DC magnetic cleanliness testing planned for the Fast Auroral Snapshot Explorer (FAST).

2.0 TEST OBJECTIVES

These tests will verify spacecraft compliance with the SMEX FAST "Magnetic Contamination and EMI/EMC Control and Implementation Plan" (FAST-SPEC-012). Specifically, this test will measure the spacecraft's radiated electric and magnetic fields, its susceptibility to radiated electric fields, and its DC magnetic properties when it is powered and unpowered.

3.0 FACILITIES

The EMI and EMC tests will take place in the smaller EMI chamber in the basement of building 7. This room was chosen because its walls are non-reflecting and magnetically shielded.

The DC magnetic compatibility testing will take place at the Goddard Magnetic Test Facility on Goodluck Road.

4.0 TEST CONDITIONS

4.1 Radiated Electric Field Emissions

This test is the standard RE02 test with levels tailored to the FAST mission. Two different antenna positions will be used--one on the IDPU side of the spacecraft and the other on the MUE side. These positions target the primary emitters while covering all the way around the spacecraft. The test will be performed with all components powered, with the spacecraft umbilical connected and providing power. The test will then be repeated with the umbilical disconnected and the spacecraft powered via the battery.

4.2 Susceptibility to Radiated Electric Fields

This test is the standard RS03 test with levels tailored to the FAST mission. The spacecraft will be considered susceptible if any change in telemetry occurs due to the applied field. The field instruments are excluded since they will be susceptible by this definition; they measure much smaller electric fields. Levels should be reduced in the vicinity of the transponder receive frequency (2039.65 ± 50 MHz) to prevent damage to the command

receiver. This test will be performed twice, using a different antenna location for each test (similar position as radiated emissions test).

4.3 Radiated Magnetic Field Emissions

Radiated AC magnetic fields from the spacecraft will be measured with the search-coil magnetometer on the spacecraft. The specification was derived from data on the noise floor of the instrument; the requirement is that the spacecraft emissions measured at the search-coil magnetometer are below its noise floor. The search-coil magnetometer boom will be placed in its deployed configuration and the spacecraft will be powered in its nominal science-taking configuration. Spacecraft data from the instrument will be compared to a background measurement made with the spacecraft off. Naturally, the spacecraft's flight magnetometer cannot be used for this background measurement. An engineering test unit search-coil will be connected to a spectrum analyzer for the background measurement.

4.4 DC Magnetic Cleanliness

The following conditions will be measured in a zeroed field using the magnetometers at the Magnetic Test Facility:

--initial perm; the initial magnetization of the spacecraft.
--post deperm; degauss the spacecraft with a 5 gauss field then remeasure.
--powered in normal mode with instruments on. Power via solar array connectors.
--powered in normal mode with instruments and transmitter on. Power via solar array connectors.
--powered in normal mode with instruments on. Power via battery.
--powered in normal mode with instruments on and battery charging. Power via solar array connectors.
--powered in normal mode with instruments and ACS sensors off. Power via battery. This is a background test for the following.
--powered in normal mode with instruments and ACS sensors off. Power via battery and solar arrays. The solar arrays will be illuminated with a bank of sun guns provided by the Magnetic Test Facility.

Magnetometers should be placed 1, 1.5, and 2 m away from the spacecraft.

Trimming and calibration of the ACS magnetometer and alignment of the science fluxgate magnetometer will also occur at the Magnetic Test Facility, but these tests are not described here.

5.0 TEST LEVELS

5.1 Radiated Electric Field Emissions

This test should be sensitive enough to measure compliance with the specification for radiated electric fields. This specification is described in paragraph 5.2.3.1 of FAST-SPEC-012.

5.2 Susceptibility to Radiated Electric Fields

Test levels for radiated susceptibility to electric fields are described in paragraph 5.2.4 of FAST-SPEC-012.

5.3 Radiated Magnetic Field Emissions

This test should be sensitive enough to measure compliance with the specification for radiated magnetic fields. This specification is described in paragraph 5.2.3.2 of FAST-SPEC-012.

5.4 DC Magnetic Cleanliness

This test should be sensitive enough to measure compliance with the specification for DC magnetic cleanliness. This specification is described in paragraph 5.2.5 of FAST-SPEC-012.

6.0 SUCCESS/ABORT CRITERIA

Several excursions beyond the specified limits are expected. The spacecraft engineers and especially the instrument scientists must decide if the excursions are acceptable. Any extreme deviations should be investigated during the test. The spacecraft should meet the radiated susceptibility requirements.

7.0 TEST FIXTURES AND SUPPORT EQUIPMENT

For the radiated magnetic field testing, a special fixture is required to support one magnetometer boom. This fixture should contain as little metal as possible.

For all powered testing, a complete set of GSE is required. The radiated susceptibility test requires enough workstations so that each subsystem lead can watch telemetry displays. The AC and DC magnetic field tests require instrument GSE monitoring telemetry.

The DC magnetic test requires the sun simulator at the Magnetic Test Facility.