STEREO
IMPACT

Boom Suite EMC Acceptance Test (FM2)

IMPACT-BoomSuite-EMC-Acceptance_A.doc
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Date Run:_____

Test Conductors_____

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Document Revision Record

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Distribution List

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1. Overview

1.1. *Introduction*

STEREO is a NASA program to launch a pair of nearly identical spacecraft into heliocentric orbit to observe the Sun. STEREO is managed out of Goddard Space Flight Center (GSFC). IMPACT is a suite of instruments for STEREO to measure in-situ particles and magnetic fields. IMPACT is managed by the University of California at Berkeley (UCB) with collaborators from many institutions around the world. PLASTIC is another in-situ particles instrument for STEREO managed by the University of New Hampshire (UNH). PLASTIC shares the IMPACT central processing system, and so can be considered part of the IMPACT suite from a functional standpoint during some tests.

The STEREO IMPACT Suite FM1 (Ahead) unit went through an extensive EMC test as called out in the IMPACT_EMC test plan. The FM2 (Behind) boom suite will go through the more limited set of Acceptance testing called out in the specification, as defined by the STEREO Project EMC requirements, reference 2, sections 8.1. These Acceptance tests will be done at U. C. Berkeley. Acceptance testing for the SEP suite will be described elsewhere.

Tests shall be performed in accordance with references 2, 10, and 11. Where these documents differ this document takes precedence, followed by reference 2, followed by reference 10 and 11. Where this document differs from document 2, waivers have been submitted.

1.2. *Document Conventions*

In this document, TBD (To Be Determined) means that no data currently exists. A value followed by TBR (To Be Resolved) means that this value is preliminary. In either case, the value is typically followed by a code such as UCB indicating who is responsible for providing the data, and a unique reference number.

1.3. *Applicable Documents*

The following documents are closely interrelated with this specification. Many documents can be found on the Berkeley STEREO/IMPACT FTP site:

http://sprg.ssl.berkeley.edu/impact/dwc/

1. 7381-9012B, IMPACT_ICD (IMPACT/Spacecraft ICD, on the APL web page)
2. 7381-9030, EMC spec (EMC requirements, on the APL web page)
3. 7381-9003, Environmental Spec (STEREO Environmental Test requirements, on APL web page)
4. ICD/IMPACT_CTM (IMPACT command & telemetry database)
5. ICD/IMPACTGrounding (grounding diagram)
6. ICD/IMPACTHarnessSpec (intra-instrument harness specification)
7. Plans/STEREO-IMPACT-PAIP (Performance Assurance Plan)
8. Plans/IMPACTEnvTestPlan (IMPACT Environmental Test Plan)

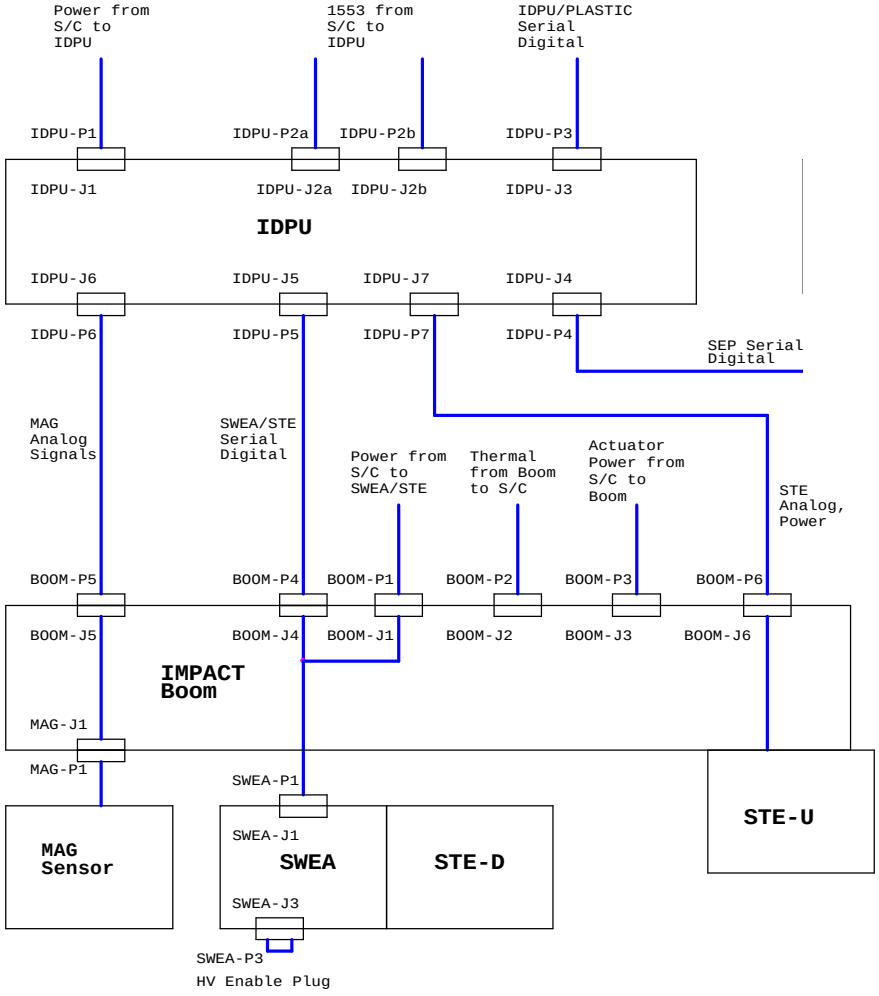
9. Plans/IMPACTContaminationControlPlan (IMPACT Contamination Control Plan)
10. Mil-Std-461A/B/C - Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference
11. Mil-Std-462 - Measurement of Electromagnetic Interference Characteristics

2. Test Setup

2.1. *Instrument Setup Issues*

a) SEP and PLASTIC will not be present. Those connections shall remain open. There is no power distributed in those interfaces.
b) The Actuator GSE is not available, so the boom actuators will not be connected. The boom actuator system is completely independent of the rest of the system.
c) SWEA shall have an enable plug installed at SWEA-J3 that enables the analyzer HV but not the MCP HV.
d) The "Noisy" operating mode for the instruments used during Emissions tests shall be that mode expected to produce the most noise (subject to high voltage restrictions described above). This shall include internal test pulsers operating and SWEA analyzer voltage sweeping.
e) The instrument suite should be setup interconnected as shown in figure 2-1, 2-2, and 2-3.
f) The instruments shall be purged during test, and shall be in a clean facility. Instrument doors and covers shall be in place.
g) A "Star ground" connected to the test area bench needs to extend into the GSE area to ground GSE equipment.
h) Instruments shall be connected to the test area bench ground, which consists of the metallic surface of the bench. Bonding resistance between the units and the bench shall be verified prior to test..
i) Reference 2 section 5.0 and 5.2 describe other configuration requirements

Figure 2-1, IMPACT Intra-instrument Harnessing



STEREO IMPACT University of California Space Science Lab		
Title: Harness Diagram		
Size: B	Document Number: IMPACT_HARNESS	Rev: E
Date: Thursday, October 31, 2002	Sheet 1 of 1	

Figure 2-2 FM1 Physical Layout for Radiated EMC tests

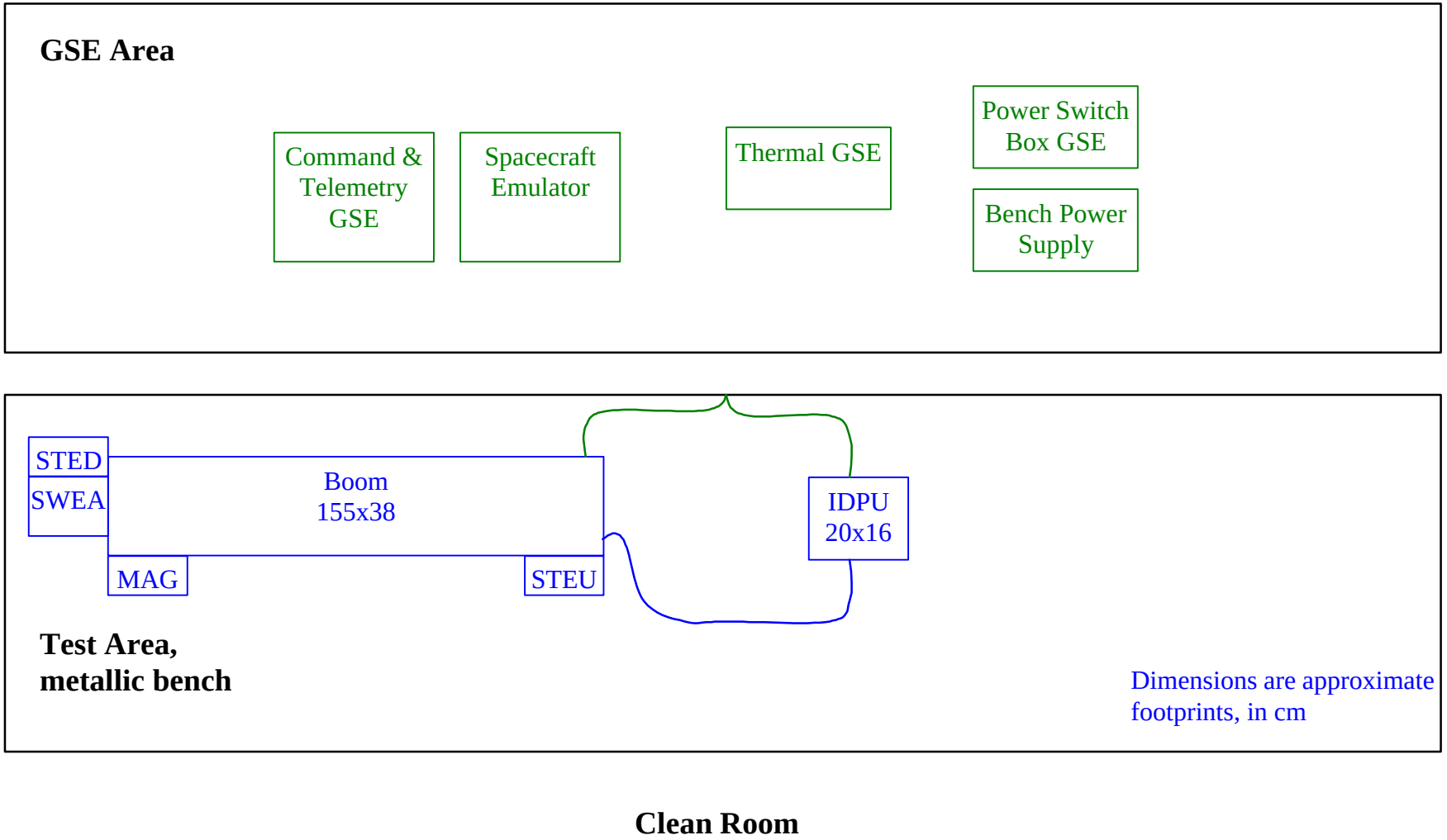
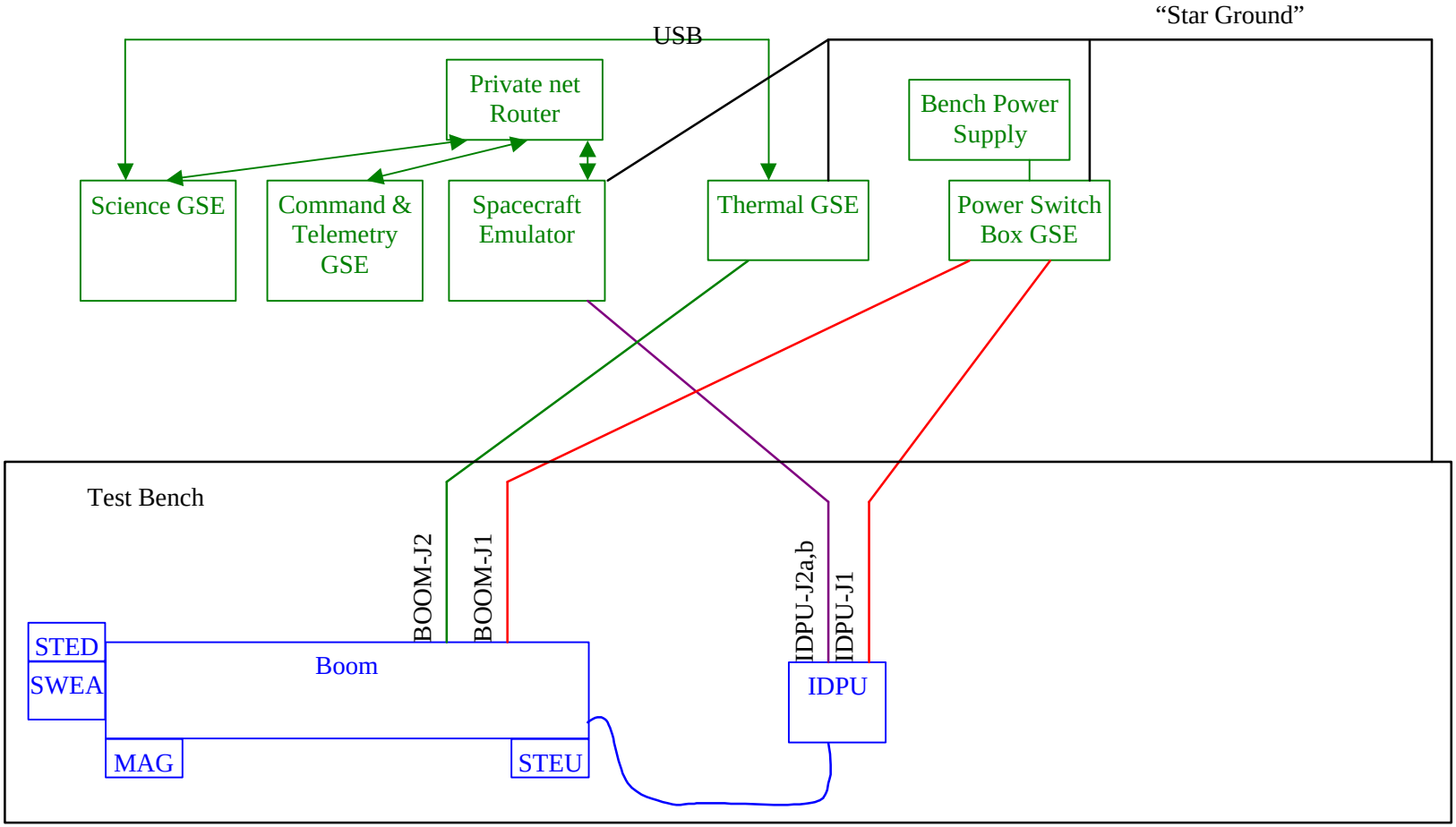


Figure 2-3, Instrument to GSE Harnessing



2.2. *Configuration*

2.2.1. Flight Unit Configuration:

1. IDPU Serial number: _____
   1.1. IDPU PROM version number:_____
   1.2. IDPU EEPROM code version number:_____
2. MAG Sensor serial number: _____
   2.1. MAG Thermal Blanket Configuration:_____
3. STE-U Preamp/Sensor serial number:_____
   3.1. STE-U Cover status: (closed)_____
4. Boom Serial Number: _____
5. SWEA/STE-D Serial Number:_____
   5.1. SWEA Enable plug status (SWEA-J2)_____
   5.2. SWEA Internal cover status: (Closed) _____
   5.3. SWEA External cover status: (In place)_____
   5.4. STE-D cover status: (closed)_____
6. Intra-instrument Harness:
   6.1. IDPU-J5 to BOOM-J4: _____
   6.2. IDPU-J6 to BOOM-J5: _____
   6.3. IDPU-J7 to BOOM-J6: _____

2.2.2. GSE Configuration:

1. Power Switch GSE:_____
   1.1. 28V Bench Power Supply_____
2. Thermal GSE:_____
3. Spacecraft Emulator connected to DCB 1553 interface
   3.1. Emulator software version_____
4. Command & Telemetry GSE connected to spacecraft emulator via TCP/IP
   4.1. C&T GSE version date_____
   4.2. C&T Database version:_____, Date:_____
5. Science GSE
   5.1. MAG GSE version: _____
   5.2. STE GSE version: _____
   5.3. SWEA GSE version: _____
6. Instrument to GSE harness:
   6.1. IDPU-J1 to Power: _____
   6.2. IDPU-J2a,b to Emulator:_____
   6.3. BOOM-J1 to Power: _____
   6.4. BOOM-J2 to Thermal: _____

2.3. *Instrument Testing*

Prior to test the instrument shall have completed a Comprehensive Performance Test (CPT) to verify the functionality of the instruments.

3. EMC Tests

3.1. *Bonding & Isolation*

These tests are described in reference 2 section 5.3.

Power isolation measurements shall be made at the level of assembly that shares a power converter (i.e. boom suite with IDPU, SEP suite, and PLASTIC). Harnesses between parts if these assemblies shall be in place except where that connector is removed to measure a pin.

3.1.1. IDPU Power Isolation

a) Primary power to chassis isolation. Measure resistance between primary power return (IDPU-J1 pin 10) to IDPU chassis ground (>1Mohm):

_____Ohms

b) Primary power to secondary isolation. Measure the resistance between primary power return (IDPU-J1 pin 10) and secondary signal ground (IDPU-J3 pin 2) (>1Mohm)

_____Ohms

c) MAG Heater power to chassis isolation. Measure resistance between MAG Heater primary power return (IDPU-J1 pin 13) to IDPU chassis ground (>1Mohm):

_____Ohms

d) MAG Heater power to secondary isolation. Measure resistance between MAG Heater primary power return (IDPU-J1 pin 13) to secondary signal ground (IDPU-J3 pin 2) (>1Mohm):

_____Ohms

TC Initials:_____

3.1.2. IDPU Chassis Bonding

Measure the bonding resistance between each adjacent pair of trays and between the top tray and the lid.

a) LVPS tray to DCB tray (<2.5milliOhm) _____mOhms
b) DCB tray to STE-U tray (<2.5milliOhm) _____mOhms
c) STE-U tray to MAG tray (<2.5milliOhm) _____mOhms
d) MAG tray to IDPU Lid (<2.5milliOhm) _____mOhms

TC Initials:_____

3.1.3. SWEA/STE-D Power Isolation

a) Primary power to chassis isolation. Measure resistance between primary power return (BOOM-J1 pin 10) to SWEA chassis ground (>1Mohm):

_____Ohms

b) Primary power to secondary isolation. Measure the resistance between primary power return (BOOM-J1 pin 10) and secondary signal ground (BOOM-J4 pin 2) (>1Mohm)

_____Ohms

c) SWEA Heater power to chassis isolation. Measure resistance between SWEA Heater primary power return (BOOM-J1 pin 13) to SWEA chassis ground (>1Mohm):

_____Ohms

d) SWEA Heater power to secondary isolation. Measure resistance between SWEA Heater primary power return (BOOM-J1 pin 13) to secondary signal ground (BOOM-J4 pin 2) (>1Mohm):

_____Ohms

e) Boom Deployment Heater power to chassis isolation. Measure resistance between Boom Deployment Heater primary power return (BOOM-J1 pin 12) to Boom chassis ground (>1Mohm):

_____Ohms

f) Boom Deployment Heater power to secondary isolation. Measure resistance between Boom Deployment Heater primary power return (BOOM-J1 pin 12) to secondary signal ground (BOOM-J4 pin 2) (>1Mohm):

_____Ohms

TC Initials:_____

3.1.4. BOOM Chassis Bonding

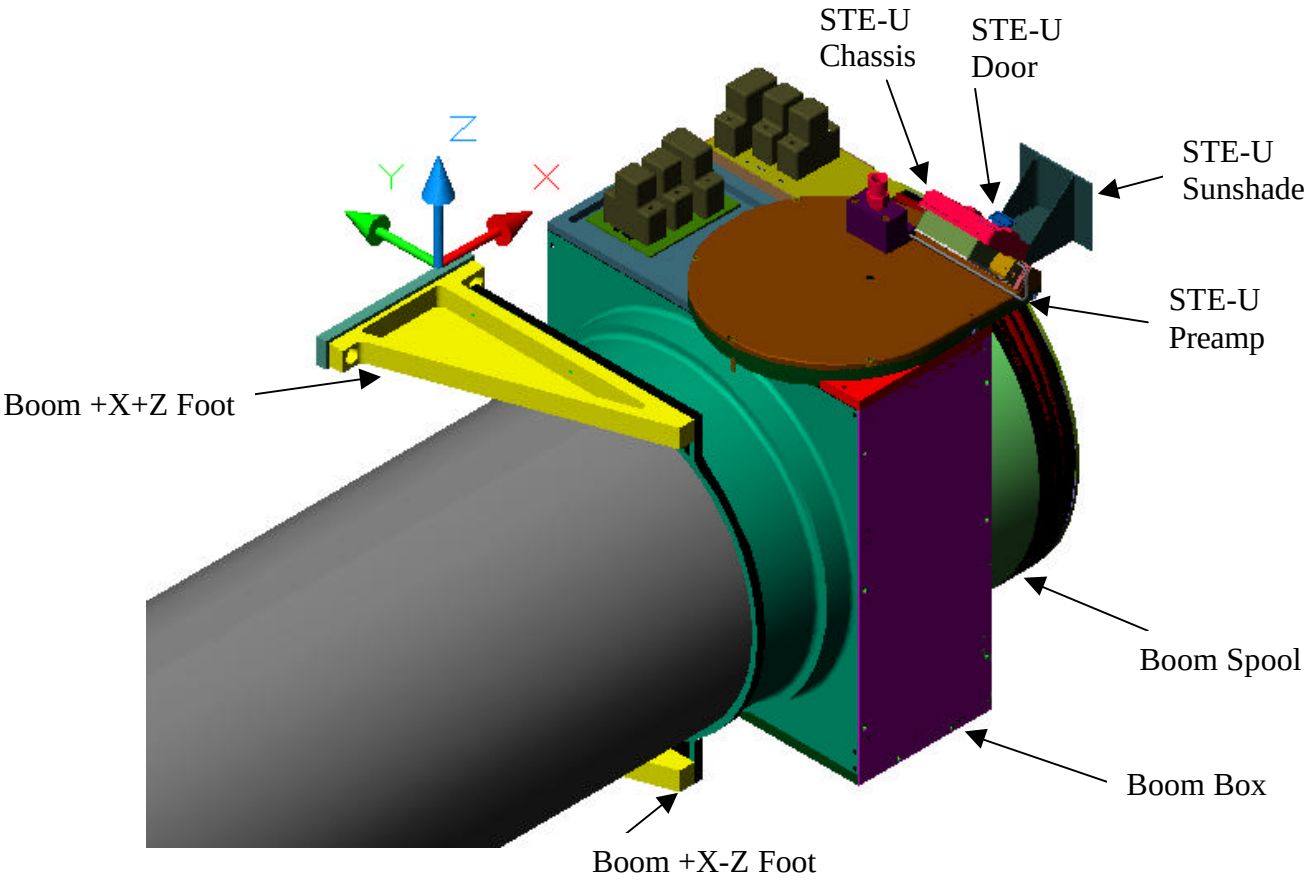


Figure 3.1.9 – Boom Assembly

a) Boom +X+Z Foot to Boom Box –X face (<2.5milliOhm) _____mOhm
b) Boom +X-Z Foot to Boom Box –X face (<2.5milliOhm) _____mOhm
c) Boom Box –X face to Boom Box +Y face (<2.5milliOhm)_____mOhm
d) Boom Box –X face to Boom Box +Z face (<2.5milliOhm)_____mOhm
e) Boom Box –X face to Boom Box -Y face (<2.5milliOhm)_____mOhm
f) Boom Box –X face to Boom Box -Z face (<2.5milliOhm)_____mOhm
g) Boom Box –Y face to Boom Box +X face (<2.5milliOhm)_____mOhm
h) Boom Box +X face to Boom Spool Side (<2.5milliOhm) _____mOhm
i) Boom Spool Side to Boom Spool End (<2.5milliOhm) _____mOhm
j) Boom Box +Z face to STE-U Preamp (<2.5milliOhm) _____mOhm
k) STE-U Preamp to STE-U Chassis (<2.5milliOhm) _____mOhm
l) STE-U Preamp to STE-U Sun Shade (<2.5milliOhm) _____mOhm
m) STE-U Chassis to STE-U Door (<2.5milliOhm) _____mOhm

TC Initials:_____

3.1.5. SWEA/STE-D Chassis Bonding

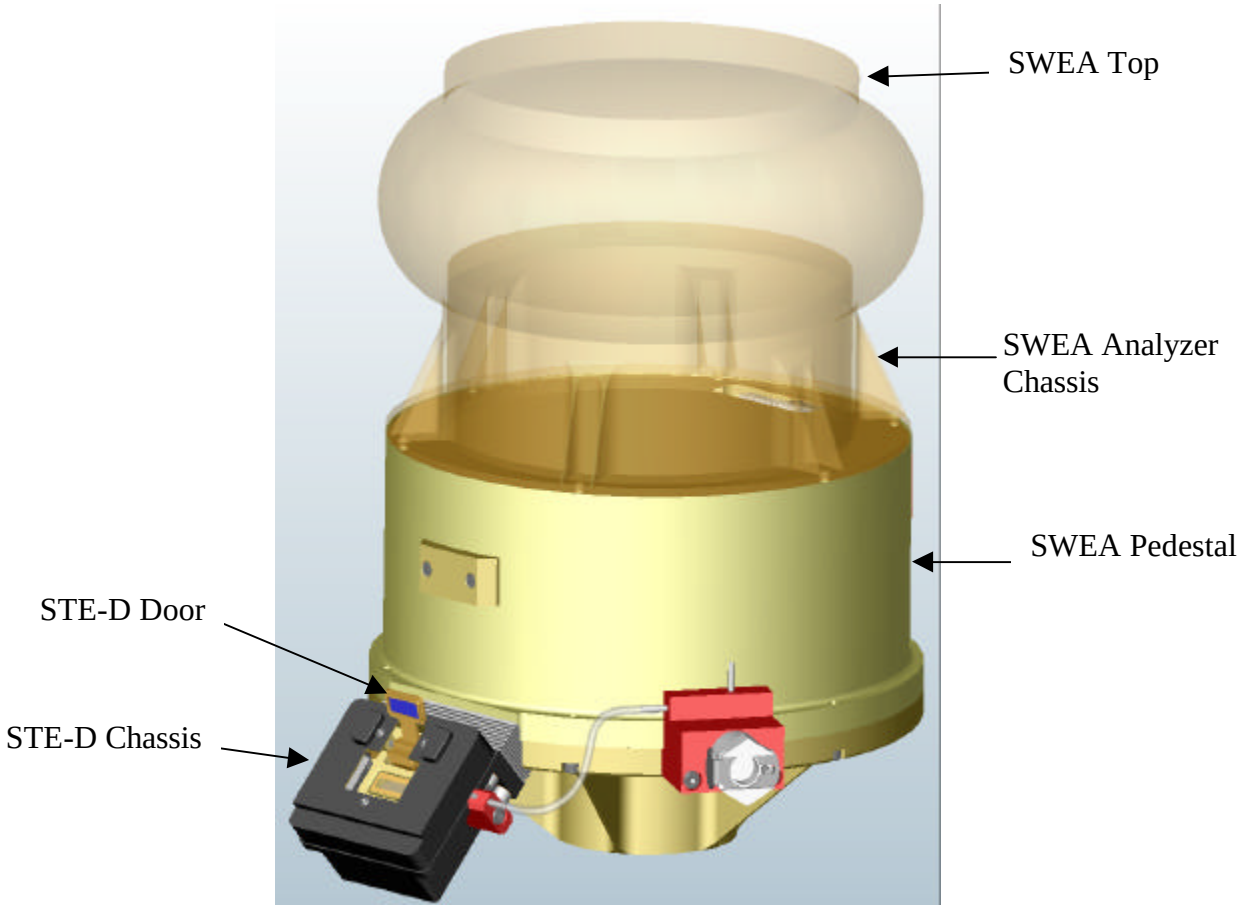


Figure 3.1.10 SWEA/STE-D

a) SWEA top to SWEA analyzer chassis (<2.5milliOhm) _____mOhm
b) SWEA analyzer chassis to SWEA pedestal (<2.5milliOhm) _____mOhm
c) SWEA pedestal to SWEA boom attachment (<2.5milliOhm) _____mOhm
d) SWEA pedestal to STE-D chassis (<2.5milliOhm) _____mOhm

TC Initials:_____

3.1.6. Bonding between Subassemblies and Table

a) IDPU to Table (<2.5milliOhm) _____mOhm
b) BOOM to Table (<2.5milliOhm) _____mOhm
c) Power Single Point Ground to Table (<2.5milliOhm) _____mOhm

TC Initials:_____

3.2. *Transients*

Turn-on and Turn-off transients shall be measured on each power service (excluding passive heater circuits) as described in reference 2, sections 4.11 and 5.13. This test will be performed at the subsystem level (where each subsystem shall consist of all equipment sharing the same power converter). This test shall be performed prior to going to the EMC facility.

The power switch GSE includes a mercury wetted-relay for bounceless switching.

Take snaps of the oscilloscope traces taken during these measurements and append to the as-run proc or test report.

3.2.1. IDPU Transients

The MAG Heater and IDPU Power service shall be tested separately. IDPU power is on connector IDPU-J1 (A 15-pin standard density D male connector), with 28V on pins 2 and 3 and return on pins 10 and 11. MAG Heater power in also on IDPU-J1, pins 5 and 6, with return on pins 13 and 14 (these points are broken out on the power switch GSE). **Be sure MAG and STE-U are connected to the IDPU for this test**. Measurements to be taken:

a) IDPU Power Turn-on current transient (nominal current = 220mA):

<10A in first 10us_____A
<2.5A for first 200ms_____A
<244mA at 200ms_____A

b) IDPU Power Turn-off voltage transient:

Between -2 and +56V_____V
<5V after 2 seconds_____V

c) MAG Heater Power Turn-on current transient (nominal current = 35mA):

<10A in first 10us_____A
<2.5A for first 200ms_____A
<39mA at 200ms_____A

d) MAG Heater Power Turn-off voltage transient:

Between -2 and +56V_____V
<5V after 2 seconds_____V

TC Initials:_____

3.2.2. SWEA/STE-D Transients

SWEA/STE-D power is on connector BOOM-J1 (A 15-pin standard density D male connector), with 28V on pins 2 and 3 and return on pins 10 and 11 (these points are broken out on the power switch GSE). Measurements to be taken:

a) SWEA/STE-D Power Turn-on current transient (nominal current = 110mA):

<10A in first 10us_____A
<2.5A for first 200ms_____A
<121mA at 200ms_____A

b) SWEA/STE-D Power Turn-off voltage transient:

Between -2 and +56V_____V
<5V after 2 seconds_____V

TC Initials:_____

3.3. ***CE03***

This test must be performed on each power service using the specification in reference 2 section 4.2 for each power service (but only to 40MHz). The test setup is shown in reference 2 figure 5.4. and 5.6.

Measurements are to be made with the boom suite harnessed together, all services powered on, and the suite functioning in its "Noisy" mode (other than high voltages as indicated in section 2.1). Spacecraft simulator GSE including thermal, and data GSE shall also be connected, and the data GSE shall be active.

Note that only narrow-band measurements are required. "True Differential Mode" tests are only needed if the differential mode tests on power or return exceed the specification in reference 2 figure 1&2.

If significant exceedances are measured relative to the requirement in reference 2 section 4.2, some diagnostic testing may be performed involving powering off some subsystems and/or demating some connectors followed by re-test.

Snaps of spectrum analyzer or scope screens are to be taken of each measurement and appended to this as-run test proc

Current Probe Used_____
Spectrum Analyzer Used_____

3.3.1. IDPU CE

IDPU power is on connector IDPU-J1 (A 15-pin standard density D male connector), with 28V on pins 2 and 3 and return on pins 10 and 11. MAG Heater power in also on IDPU-J1, pins 5 and 6, with return on pins 13 and 14. Measurements to be taken:

3.3.1.1 IDPU Power Service Current Measurements

a) Differential Mode Spectrum, Power _____
b) Differential Mode Spectrum, Return _____
c) True Differential Spectrum, if needed _____
d) Common Mode Spectrum, Power and Return _____
e) Differential Mode Spectrum, MAG Heater _____
f) Differential Mode Spectrum, MAG Heater Return _____
g) True Differential Spectrum, MAG Heater, if needed _____
h) Common Mode Spectrum, MAG Heater and Return _____
i) Common Mode Spectrum, Power harness (IDPU-J1) _____

TC Initials:_____

3.3.2. SWEA/STE-D CE

SWEA/STE-D power is on connector BOOM-J1 (A 15-pin standard density D male connector), with 28V on pins 2 and 3 and return on pins 10 and 11. SWEA heater power in on BOOM-J1 pins 5 and 6 with returns on pins 13 and 14. Boom Actuator heater on BOOM-J1 pins 4 and 7 and return on pins 12 and 15. Measurements to be taken:

3.3.2.1 SWEA/STE-D Power Service Current Measurements

a) Differential Mode Spectrum, Power _____
b) Differential Mode Spectrum, Return _____
c) True Differential Spectrum, if needed _____
d) Common Mode Spectrum, Power and Return _____
e) Common Mode Spectrum, Power harness (BOOM-J1) _____

TC Initials:_____