

Solar Probe Plus

A NASA Mission to Touch the Sun

Integrated Science Investigation of the Sun Energetic Particles

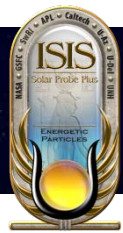
Preliminary Design Review

05 – 06 NOV 2013

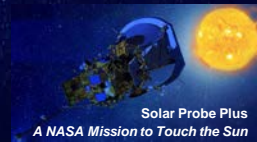
EMI / EMC

Reid Gurnee

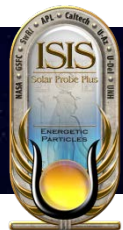




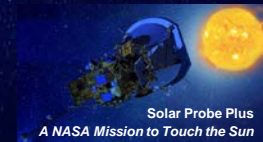
Outline



- EMI/EMC requirements and specifications as well as descriptions of design mitigations to meet these requirements
- Include the deep dielectric discharge mitigation approach
- Testing to be performed to verify compliance and when the testing will take place

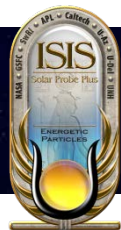


EMC Design Considerations



- Power supplies crystal controlled to a frequency window centered at $n \cdot 50$ kHz with $n \geq 3$ and 500 ppm wide over all operating conditions and time.
- Place any transformers or big inductors as far from Box walls as possible.
- Stable currents to minimize changes in Magnetic Emissions
- Control all current paths inside your box to minimize loop area. Cannot use a solid return plane if a trace is the source. Any circuit over 100 milliamps AC or 1 amp DC must be analyzed.
- All Cable outside the metal box must be twisted shielded with 360 Ohms terminated to the Box with less than 20 mOhms.
- EMI Backshells not required by EME but shield must cover connector fully
- Connector shell to Box resistance below 10 mOhms
- Any cable outside the spacecraft body attached to a device must have either 13 mils shielding or DDD first circuit protection
- All use of Magnetic Materials (Nickel, 400 Series Steels, etc) must be identified and approved by the project. High Phosphor Nickel coating is allowed because it is not magnetic.

I will add to these slides
to show how we plan to
meet these



EMC Grounding

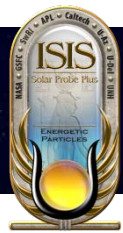


- Primary power supplies isolated by $>1\text{ M}\Omega$ from everything
- Secondary power supply returns tied to chassis with $<2.5\text{ m}\Omega$ in only the Box using the power. (RIO's excepted)
- Grounding Diagrams will show all chassis grounds, primary

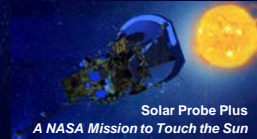
and secondary power feeds and returns, shields, and signals with returns

- ID all connector pins with first circuits
- Connectors used in flight shall have a conductive cover with less than $10\text{ m}\Omega$ from cover to Box chassis
- “Conductive” Box exterior
- Box design must be at least tongue and groove. EMI gaskets on flat joints is acceptable.

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EMC Testing



Early Testing (Breadboard, Card level, Engineering Model (EM)) can identify a problem when it can still be fixed without major schedule slip.

Doing conducted emissions (CE) can find most issues.

EM Testing can be used to reduce testing on the FM if the EM passed and is close to flight like. A list of all differences must be supplied prior to approval of FM test procedure. CE and other testing required on FM.

The conducted emissions of the EM and the FM must be the same. If not, FM testing may be required.

Required Tests:

Conducted Emissions:

Conducted Susceptibility: CS-01, CS-02, CS-06

Radiated Emissions:

Radiated Susceptibility:

Standard 3 Subpart
CE-01, CE-02, CE-07

RE-01, RE-02, Mag Sniff

RS-03, ESD

meet these