SOLAR ORBITER ENERGETIC PARTICLE DETECTOR

PQM HET Preamp Board
Mandatory Inspection Points

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CHANGES RECORD

Issue	Revision	Date	Modified by	Section / Paragraph modified	Change implemented
1	0	17/03/2015		All	Initial release

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1 INTODUCTION

1.1 Purpose

The purpose of this document is to identify the Mandatory Inspection Points (MIP) for the SIS SDD Amplifier Shaper Boards. The inspection points are defined herein is a summary of inspection identified during the visual inspection and testing.

1.2 Scope

This document applies to the current design of the electronics for EPT-HET.

1.2.1 Project Outline

The Energetic Particle Detector (EPD) suite consists of five sensors measuring electrons, protons, and ions from helium to iron, and operating at partly overlapping energy ranges from 2 keV up to 200 MeV/n. The EPD sensors are:

- SupraThermal Electrons, Ions, & Neutrals (STEIN)
- Suprathermal Ion Spectrograph (SIS)
- Electron Proton Telescope (EPT)
- Low Energy Telescope (LET)
- High Energy Telescope (HET)

The EPD sensors share the Instrument Control Unit (ICU) that is composed by the Common Data Processing Unit and the Low Voltage Power Supply (CDPU/LVPS), which is the sole power and data interface of EPD to the spacecraft.

STEIN consists of a single unit having two view cones in opposite directions. SIS consists of two sensor heads with roughly opposite (160°) view directions sharing a common electronics box. EPT-HET has multiple view cones sharing a common electronics box. There are two identical EPT-HET units. LET has multiple view cones and consists of two separate identical units.

The overall energy coverage achieved with the EPD sensors is 0.002 MeV to 20 MeV for electrons, 0.003 MeV to 100 MeV for protons, 0.008 MeV/n to 200 MeV/n for heavy ions (species-dependent). This energy and species coverage well satisfies and for a large part exceeds the requirements defined for EPD in the Solar Orbiter Payload Definition Document and in the report of the Joint Science and Technology Definition Team (JSTDT) for the Solar Orbiter/Sentinels mission.

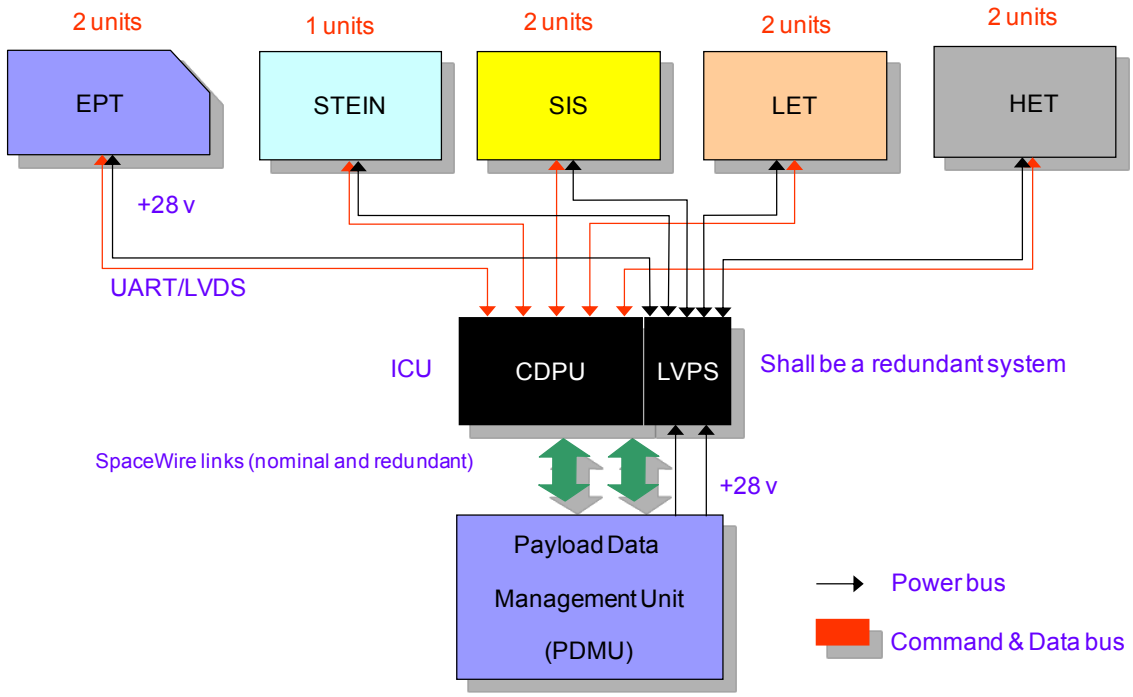

Figure 1 EPD Block Diagram

2 GLOSARY AND DEFINITIONS

2.1 Acronyms and Abbreviations

APL (Johns Hopkins University) Applied Physics Laboratory

CAU Christian-Albrechts Universität, Kiel

EEE Electronic, Electrical and Electro-mechanical

EPD Energetic Particles Detector

EPT Electron, Proton Telescope

FM Flight Model

HET High Energy Telescope

ICU Instrument Control Unit

LET Low Energy Telescope

MIP Mandatory Inspection Point

NCR Non Conformance Report

RFD Request for Deviation

RFW Request for Waiver

SSD Solid State Detector

SIS Suprathermal Ion Spectrograph

STEIN SupraThermal Electrons Ions and Neutrals

3 MANUFACTURING DATA PACKAGE FOR BOARDS

3.1 Printed Circuit Boards (PCB)

The EPT preamp Printed Circuit Board is manufactured according to the provided Gerber files by Invotec Circuits Ltd, England.

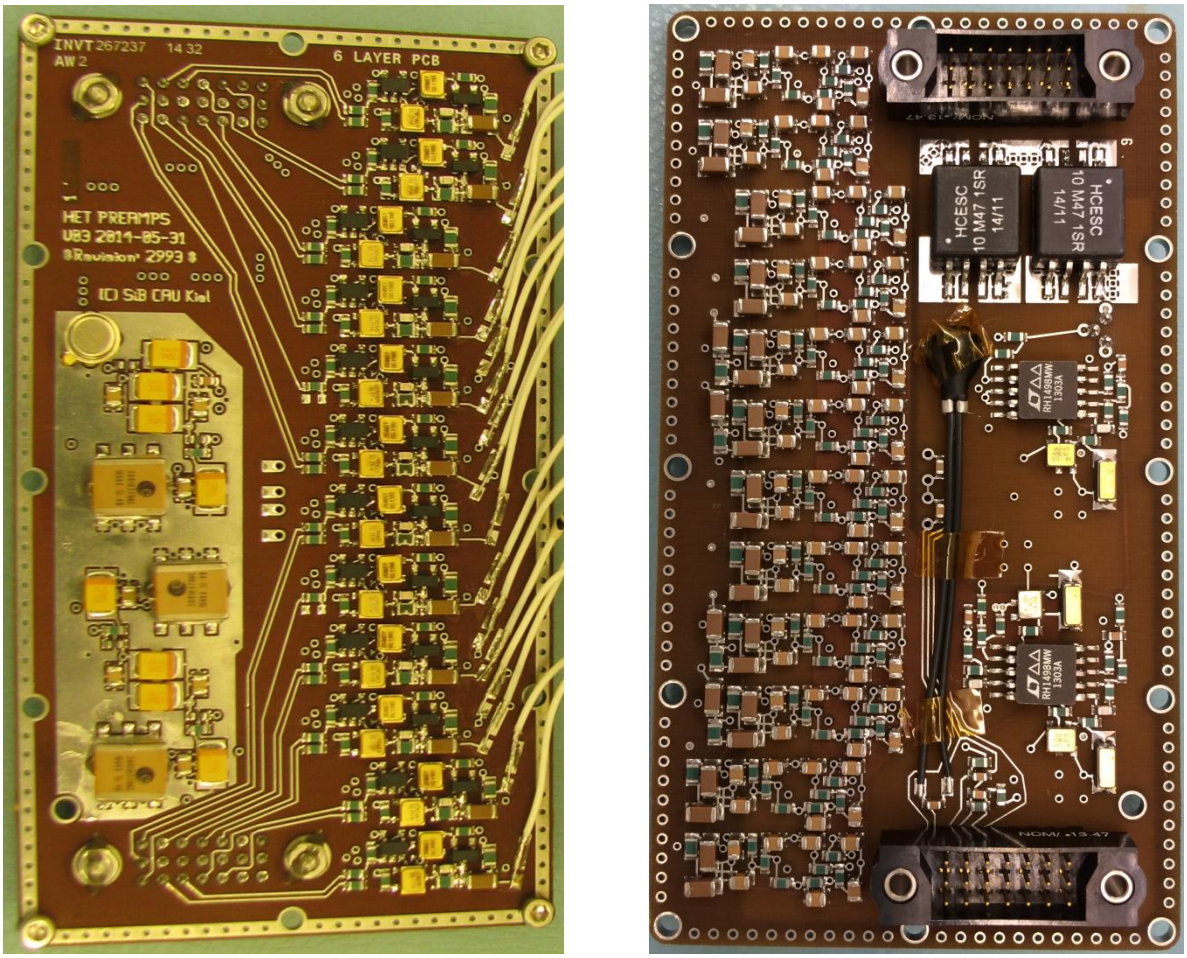

Figure 2 HET PQM Preamplifier Assembled Board

3.2 EEE Components

All the EEE components are selected and used on the EPT PQM Preamplifier board hardware are from the MIL & ESCC standards and the standards are listed below:

- Passives ESCC 4001-3001-3009-3012/EFD 558-98-390-D/MIL-PRF-55342
- Transistors/Diodes MIL-PRF19500/ESCC 5101
- Microcircuits MIL-PRF-38535
- Inductors ESCC-Q-ST-70-02C/MIL-STD-202/DSCC 03024
- Thermistors ESCC 4006
- Connectors MIL-STD-202/MIL-DTL-32139

4 PRODUCT ASSURANCE AND CONFIGURATION STATUS

4.1 NCR Status

- Diodes Soldered in the LDO circuits are soldered in wrong orientation. NCR raised **"SO-EPD-KIE-NC-0004 HET Preamps PQM Board diode population error"**→ Closed.
- Resistor population error on the HET preamp board. NCR raised **"SO-EPD-KIE-NC-0005 HET Preamps PQM Board resistor population error"** → Closed.

4.2 RFD / RFW Status

- Request to procure flight electronic printed circuit boards according to IPC 6012 Class 3 design rules instead of ECSS-Q-ST-70-11C design rules. RFD request **"SO-EPD-KIE-RD-0009_iss1_rev0_RFD_Electronics_boards.pdf"**.

5 FINDINGS

5.1 Diodes

During the smoke test of the HET Preamp PQM board, we identified that all the three diodes (X1/D1, X2/D1 and X2/D2) in the LDO circuits are soldered in the wrong orientation by OHB. The wrong orientation diodes are desoldered and soldered the same devices back on the board in the right orientation at Kiel (CAU).

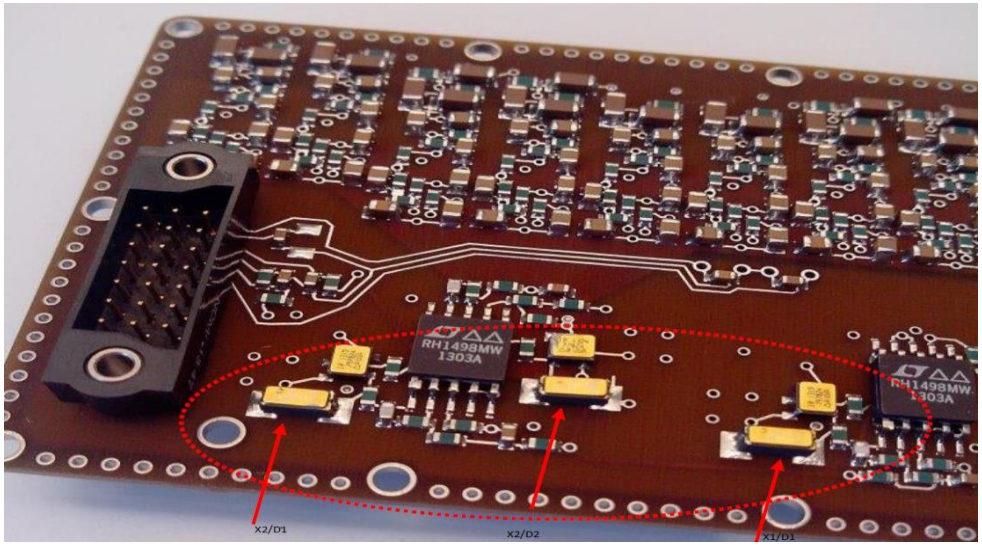

Figure 3 Diodes before rework

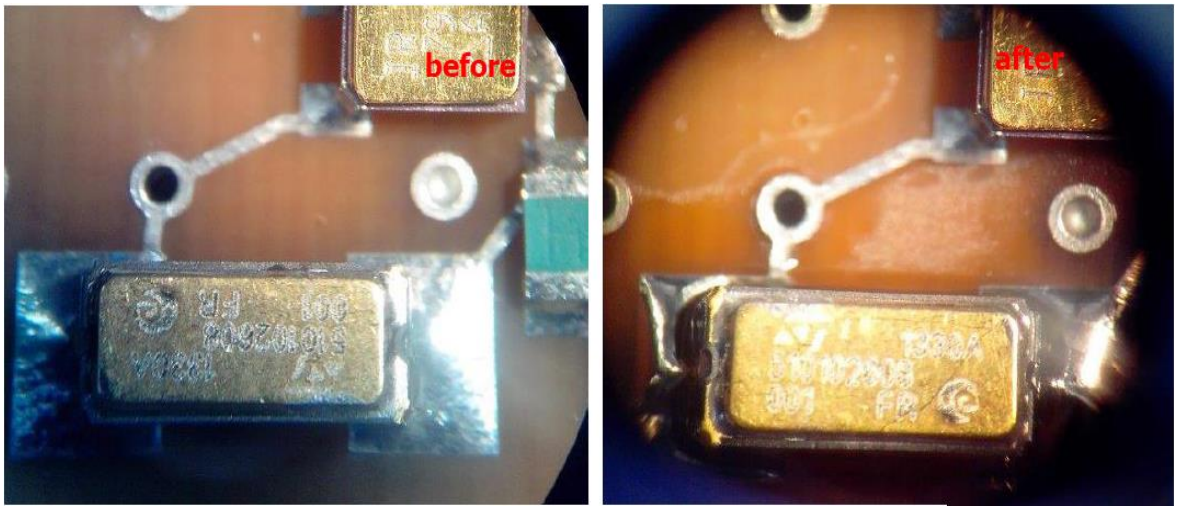

Figure 4 Diodes before and after rework

5.2 Resistors

During the smoke test of the PQM HET preamp board we found two resistors that were populated in error.

- RL8 is 1.5kOhm, should not be populated.
- RH8 is 221Ohm, should be populated.

The error was identified because the signal raise time of channel 8 did not agree with the channel 5, which should be identical.

6 COMMENTS & OPEN POINTS:

6.1 Comment

The EPT Preamp board is populated by OHB according to the Manufacturing Flow Chart “EPT-PREAMPS-OHB-X1-01.pdf”.

6.2 Thermistor (G15K4D489)

R80, R81 and R82 thermistors are installed and glued (Scotch Weld 2216) at Kiel (CAU).

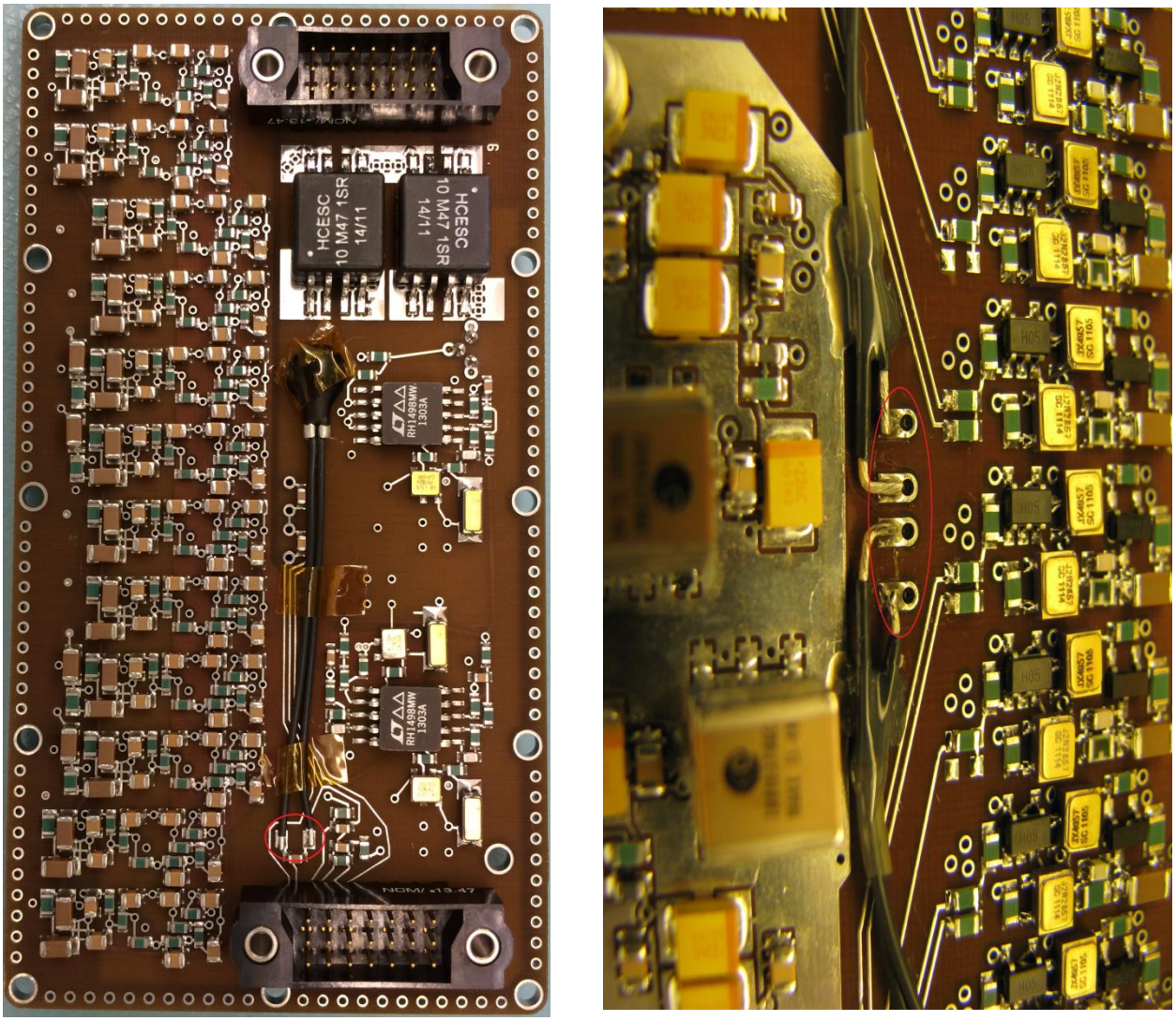

Figure 5 Thermistors on HET preamp board

Pos.	Description	Result
1	Soldering Process	ECSS-Q-ST-70-08C
2	Producer	Violetta Knierim
3	Assembly Process	Hand Soldering
4	Solder type	Wire Sn63Pb37
5	Flux	ROLO
6	Soldering Temperature	300ºC
7	Cleaning process	In acc. With 11.1 of ECSS-Q-ST-70_08C
8	Solvent	Isopropanol
9	Final Inspection	Violetta Knierim

Table 1 Soldering process of the thermistor

7 CONCLUSION

Pos.	Inspection Type	Pass/Fail/Comments
1	Connectors	Pass
2	Hardware Assembly	Pass
3	Gluing	Pass
4	Soldering	Pass
5	Cleanliness	Pass

Table 2 MIP Inspection Result