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HERSCHEL / PLANCK

Herschel-Planck Instruments Warm Units AVM I&T and UFT Test Specification

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CHANGE RECORDS

ISSUE	DATE	§ CHANGE RECORDS	AUTHOR
1	14-JUL-06		
2	24-JUL-06	Updating of the Test Spec. as MoM H-P-MI-AI-1265: ➢ **In-Rush Current:** Replace $T_{trip\ max}$ with $T_{overshoot}$ and add that the nominal current value have to be measured after 5 ms. ➢ **Power Line Verification:** The LCL's redundant have to be switch ON after the switch OFF of the nominal ones (after the cross strap installation to close the connection on the BoB). Then only one chain at the time will be used. ➢ **In-Rush Current (SCE):** The inrush current for SCE has to be performed as reported here below: ➢ SCE Switch On ➢ Reach Stand By Mode ➢ Switch on the SCC by dedicated TC. ➢ **1553B mil bus:** For the 1553B mil bus electrical verification is required to measure the rise time and fall time for BC signal and RT signal: Time rise and Time fall = 100nsec ÷ 300nsec ➢ **OBT verification:** The OBT verification has to be performed Unloaded (Verification polarity) and Loaded (Timing verification).	

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1. SCOPE AND APPLICABILITY

1.1 Scope

This test specification represents an input for the preparation of step in the test procedure for Herschel & Planck instruments warm units on AVM test.

Purpose of this document is to provide a clear identification and description of the AVM I&T and abbreviate integrated tests needed to verify the efficiency of the SVM-I/F between each Herschel & Planck instruments warm unit interface to/from PCDU and CDMU.

Within this document the test objectives, test configuration, detailed requirements and methodologies for the test execution are clearly identified. Major goal of this document is derived from specific detailed system requirements.

1.2 Test objective

The purpose of the test is to verify the interface design checking the electrical interfaces (signal/grounding) among the instruments warm units with PCDU and CDMU with respect to the applicable requirements.
The database provided and the relevant check will be limited only to the HK parameters and telecommand dedicate to execute of the integration and test procedure

1.3 Applicable Document

The present document is intended to be applicable for Herschel & Planck Instruments to define the I&T activities whose aim is the verification of the electrical I/F functions and compatibility at SVM level.

AD 1 SCI-PT-IIDB/HIFI-02125 (HIFI IID-B)
AD 2 SCI-PT-IIDB/PACS-02126 (PACS IID-B)
AD 3 SCI-PT-IIDB/SPIRE-02124 (SPIRE IID-B)
AD 4 SCI-PT-IIDB-HFI-04141 (HFI IID-B)
AD 5 SCI-PT-IIDB-LFI-04142 (LFI IIDB)
AD 6 H-P-1-ASPI-SP-0027 (GDIR)
AD 7 SCI-PT-ICD-7527 (PSICD)

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2. AVM-SVM TEST DEFINITION

2.1 I&T and UFT

The aim of AVM I&T is to verify all the SMV I/F's, from mechanical and electrical point of view, for each instrument warm unit installed onto its dedicated lateral panel of the AVM-SVM.

The goal of the Integration and test procedure is to verify the following items:

> ➢ Bonding verification
> ➢ Grounding S.P.G. verification
> ➢ Harness pin functions
> ➢ Voltage and current verification
> ➢ 1553B verification (timing and amplitude)

To perform the above listed verifications the tools, which will be used, are:

> ➢ Break Out Box
> ➢ a dedicate "T" adapter connector (Mil 1553 Bus verification)

The consequent UFT will be performed by the direct connection of the harness to the Units and it will be done just like switch on with the verification of the relevant correct communication standard behaviour.

2.2 Electrical Interface Requirements

In the following paragraphs will be reported the electrical requirements which will be checked during the AVM I&T.

2.2.1 Bonding Verification

• To provide electrical continuity throughout the Satellites structure, electrical frames and other conductive parts, adequate bonding (electrical conductivity) shall be realized.

• The bonding resistance between any adjacent metallic structure parts shall be lower than 5mΩ.

• The bonding of equipment shall provide a low and stable impedance path between two metallic parts by the use of a bond strap, in addition to the direct contact.

2.2.2 Grounding S.P.G. Verification

The insulation value, which will be measured, is reported the following table:

BONDING RESISTANCE	INSULATION VALUES
Between return power line and structure	R≥1 MOhm

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2.2.3 Electrical Power System Interface

2.2.3.1 Power supply voltage

The DC main bus is regulated to 28 V with a maximum tolerance at the source (regulation point) of +1%/-2%. This tolerance includes effects of load regulation, temperature and ageing.

Each Distribution Unit output is protected by a Latch Current Limiter (LCL) or Fold-back Current Limiter (FCL).

➢ In case of a redundant user, a non-redundant protection is provided for each redundancy.

➢ In case of a non-redundant user, a redundant protection is provided for the user.

➢ Each satellite user Subsystem/Equipment shall be able to operate nominally within the following steady state voltage limits (applicable to S/C harness-Subsystems interface i.e. the voltage drop inside the Subsystem harness is not covered by these limits) :

➢ 26 V as minimum voltage (mean voltage excluding any noise, ripple and spikes). If the bus voltage falls below 26 V, then all units connected to the bus shall operate in a predictable way that shall not interfere with functioning redundant units

➢ 29 V as maximum voltage (mean voltage excluding any noise, ripple and spikes).
This range shall be used to establish Subsystem or Unit power budgets as reported in the IDS

2.2.3.2 Voltage transients and ripple

Transients and over voltages are:

The ripple and spikes shall be less than:

➢ 140 mV peak to peak for ripple
➢ 300 mV peak to peak for ripple + spikes on 28 V lines.

2.2.3.3 Current limiter characteristics

For what concern the H-P instruments warm units just only the LCL is taken in consideration as current limiter as PCDU I/F:

➢ ON/OFF switch able Latching Current Limiters (LCL) for "non-essential" loads, i.e. for those items which do not jeopardise the spacecraft if they are switched OFF. Two levels of OFF command shall be provided within the LCL for those LCL's whose users cannot tolerate a failed permanent ON condition.

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The LCLs used in the power subsystem (equipments and instruments power supply lines) shall have the following characteristics:

➢ Except during the first 50 µs of operation (i.e. switch on or entry into protection mode), the current limitation shall be set at a value I_{limit} in the range $I_{limit\ min} \leq I_{limit} \leq I_{limit\ max}$. Class of the LCL, corresponding I_{class} , $I_{limit\ min}$ and $I_{limit\ max}$ are defined in Table 2.2.3.3-1.

➢ If the current exceeds I_{limit} for a time greater than T_{trip} , then the LCL will automatically switch-off .

➢ During the first 50 µs of operation (i.e. switch on or entry into protection mode), the overshoot current $I_{overshoot}$ shall not exceed I_{limit} by more than 50% (see Fig. 2.2.3.3-1).

➢ The LCL shall have a power bus under-voltage detector.

➢ The LCL under-voltage threshold shall be settable during manufacture between 21 and 26 V with an accuracy better than ± 0.25 V.

➢ If the power bus voltage falls below the under-voltage threshold for more than 50 µs, then the LCL shall be latched off.

➢ It shall be possible to determine the status of each LCL via the 1553 data bus, including ON/OFF condition, latch status and output current (accuracy ± 5%).

LCL Type	I_{class}	$I_{limit\ min}=1.2\ I_{class}$	$I_{limit\ max}=1.5\ I_{class}$	$I_{overshoot}$	$T_{trip\ min}$	$T_{trip\ max}$
Class I	1 A	1.2 A	1.5 A	2.25 A	10 ms	12 ms
Class II	2.5 A	3.0 A	3.75 A	5.63 A	10 ms	12 ms
Class III	5 A	6.0 A	7.5 A	11.25 A	10 ms	12 ms

Table 2.2.3.3-1: Definition of LCL classes and corresponding I_{class}, $I_{limit\ min}$ and $I_{limit\ max}$
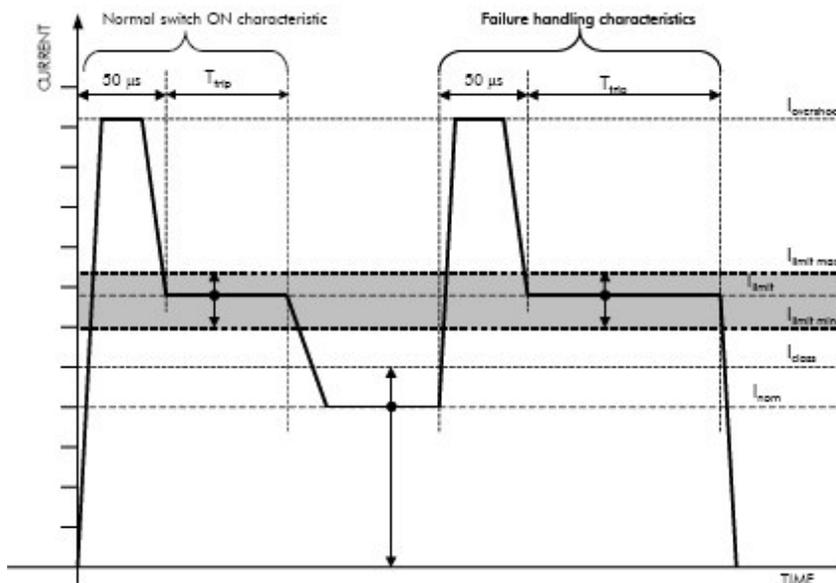
Fig. 2.2.3.3-1: LCL characteristics

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2.2.3.4 In-Rush Current

When connected to a non limiting current source (in test configuration) the inrush current at switch-on of the equipment shall be within the envelop defined as follows:

The recorded inrush current (measured with an oscilloscope in single shot mode) shall show the following two distinct aspects:

> ➢ A plug-in current transient corresponding to the charge of the primary filter capacitors
> ➢ A DC/DC converter start current transient

When connected to a LCL the inrush current at switch-on will be constrained to the envelope shown in Fig.2.2.3.3-1 by the Power Distribution Unit.
In this condition the user shall operate nominally (nominal current I_{nom} under nominal voltage) before T_{trip}.
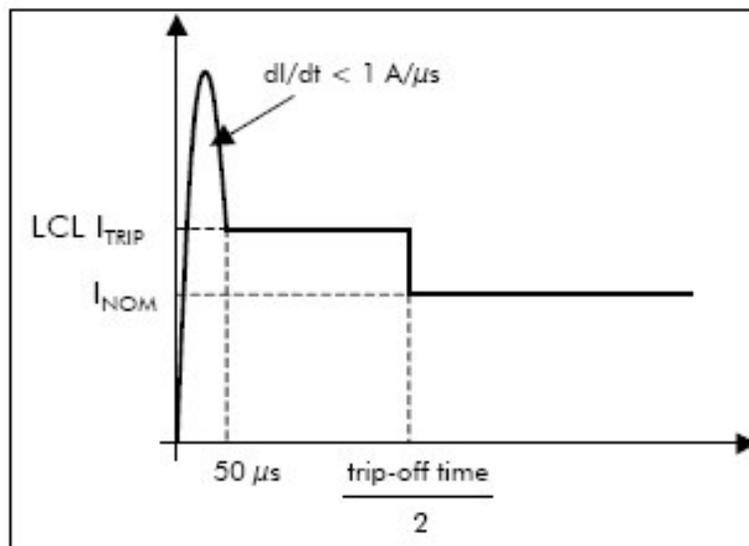
Fig. 2.2.3.3-1: Nominal Current envelope

2.2.3.5 MIL-STD-1553B bus

MIL-STD-1553B users shall conform to the bus protocol specified in Packet Structure – Interface Control Document SCI-PT-ICD-7527 Appendix 9.

2.2.3.6 OBT

The OBT characteristics to verity are:

➢ **Differential Output Voltage** $2.0V ≤ |V| ≤ 5.5V$
➢ **Frequency**   131.072 KHz
➢ **Rise Time** $0.1µS ≤ |T_{rise}| ≤ 0.8µS$
➢ **Fall Time** $0.1µS ≤ |T_{fall}| ≤ 0.3µS$
➢ **Jitter**   ± 150 nsec

2.2.3.7 H-P Instruments Remote Terminal Address for 1553 S/C bus

The dedicated H&P Instruments RT address for the 1553 S/C bus are the following Table:

RT Address	Unit	
	Herschel	Planck
16	HIFI A	HFI A
17	-	HFI B
18	-	LFI A
19	HIFI B	LFI B
20	-	SCE A
21	SPIRE A	SCE B
22	SPIRE B	-
25	PACS A	-
26	PACS B	-

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3. HERSCHEL INSTRUMENTS WARM UNITS SVM I/F'S

The Instruments for Herschel SVM are the following:

- **HIFI** (**H**eterodyne **I**nstrument for the **F**ar **I**nfrared)
- **SPIRE** (**S**pectral **P**hotometer **I**maging **RE**ceiver)
- **PACS** (**P**hotoconductor **A**rray **C**amera and **S**pectrometer)
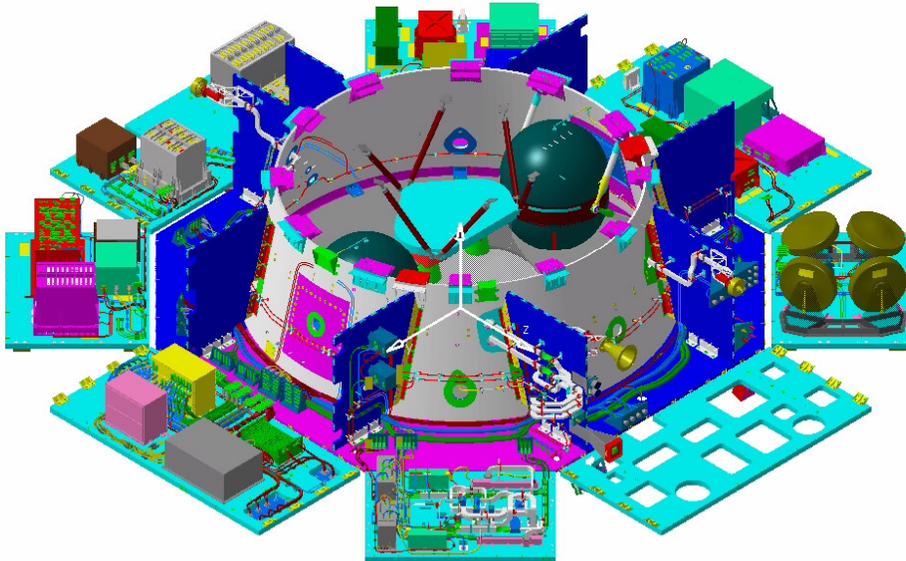

Fig. 3-1 Herschel SVM layout.

3.1 HIFI

The HIFI warm units will be installed onto two dedicated Herschel-SVM lateral panels:

On the –Y Herschel HIFI lateral panel are located the following units:

- FHLSU
- FHLCU
- FHWOH
- FHWEH
- FHHRH
- FHIFH

On the –Y-Z Herschel HIFI lateral panel are located the following units:

- FHICU
- FHFCU
- FHWOV
- FHWEV
- FHHRV
- FHIFV

In the following table there are the project codes allocated to HIFI warm units:

Project Code	Instrument Unit
FHLCU	HIFI Local Oscillator Control Unit
FHLSU	HIFI Local Oscillator Source Unit
FHHRH	HIFI High-Resolution Spectrometer, Horizontal Polarisation
FHHRV	HIFI High-Resolution Spectrometer, Vertical Polarisation
FHFCU	HIFI Focal Plane Control Unit
FHWEV	HIFI Wide-Band Spectrometer Electronics Vertical Polarisation
FHWEH	HIFI Wide-Band Spectrometer Electronics Horizontal Polarisation
FHICU	HIFI Instrument Control Unit
FHWOV	HIFI Wide-Band Spectrometer Optics Vertical Polarisation
FHWOH	HIFI Wide-Band Spectrometer Optics Horizontal Polarisation
FHIFH	HIFI IF up-converter Horizontal Polarisation
FHIFV	HIFI IF up-converter Vertical Polarisation

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3.1.1 HIFI SVM I/F's

The Power I/F's to be checked, for what concern the HIFI warm unit, are reported in the Table 3.1.1-1:

LCL#	Type	Class	PCDU Conn	Pin+	Pin-		Herschel HIFI Allocation	Conn	Pin+	Pin-	Avg Power [W]
43	LCL	II	J32	3, 4	22, 23		FHWEH	J03	2	4	30,0
44	LCL	II	J06	3, 4	22, 23		FHWEV	J03	2	4	30,0
53	LCL	III	J30	9, 10	28, 29		FHLCU nom.	J01	2	4	100,2
54	LCL	III	J08	9, 10	28, 29		FHLCU red.	J121	2	4	0,0
63	Par-LCL	III	J10	7, 8	26, 27		FHHRH	J01	2	4	70,0
67	Par-LCL	III	J28	7, 8	26, 27		FHHRV	J01	2	4	70,0
64	Par-LCL	III	J10	9, 10	28, 29		FHICU nom.	J01	2	4	49,6
68	Par-LCL	III	J28	9, 10	28, 29		FHICU red.	J02	2	4	0,0

Table 3.1.1-1: PCDU HIFI I/F's

All the others HIFI units don't have interface with the PCDU and the power supply will be provide them as described in the following diagram of Fig.3.1.1-1:
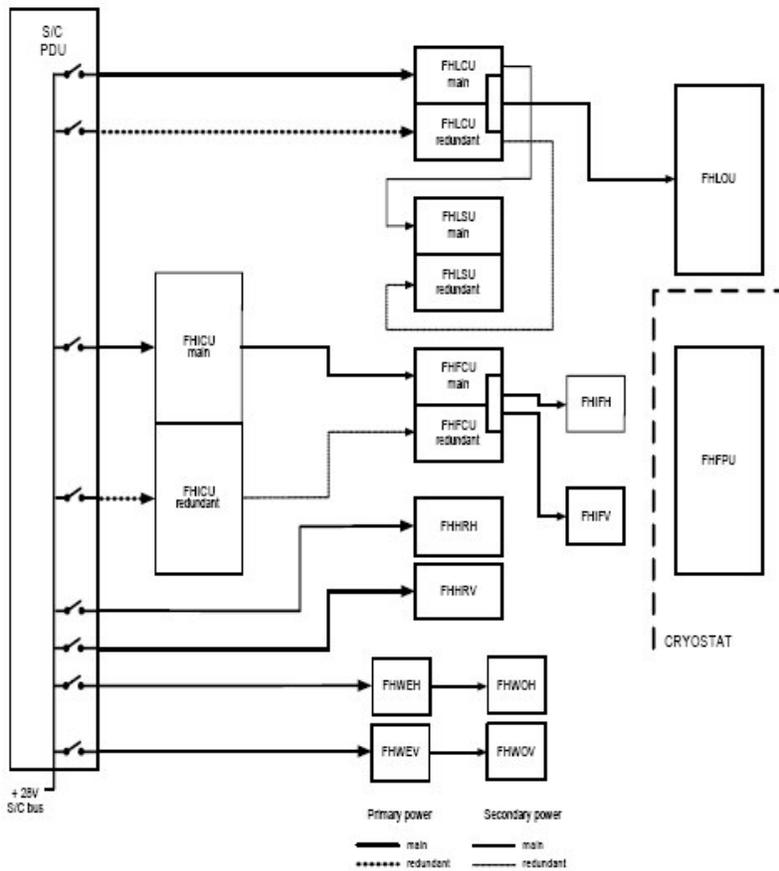
Fig.3.1.1-1: HIFI Power Distribution Diagram

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The Mil 1553 Bus I/F's to be checked, for what concern the HIFI warm unit, are reported in the Table 3.1.1-2:

Herschel HIFI	CDMU I/F 1553 Bus	Conn	Pin(true)	Pin(comp)
FHWEH	N/A	-	-	-
FHWEV	N/A	-	-	-
FHLCU nom.	N/A	-	-	-
FHLCU red.	N/A	-	-	-
FHHRH	N/A	-	-	-
FHHRV	N/A	-	-	-
FHICU nom.	1	J03(Bus A)	2	6
		J04(Bus B)	2	6
FHICU red.	1	J05(Bus A)	2	6
		J06(Bus B)	2	6

Table 3.1.1-2: CDMU HIFI I/F's

Then only the FHICU (nom.+red.) has interface with the CDMU by Mil 1553 bus as described in the following diagram of Fig.3.1.1-2:

Fig.3.1.1-2: HIFI CDMS interface

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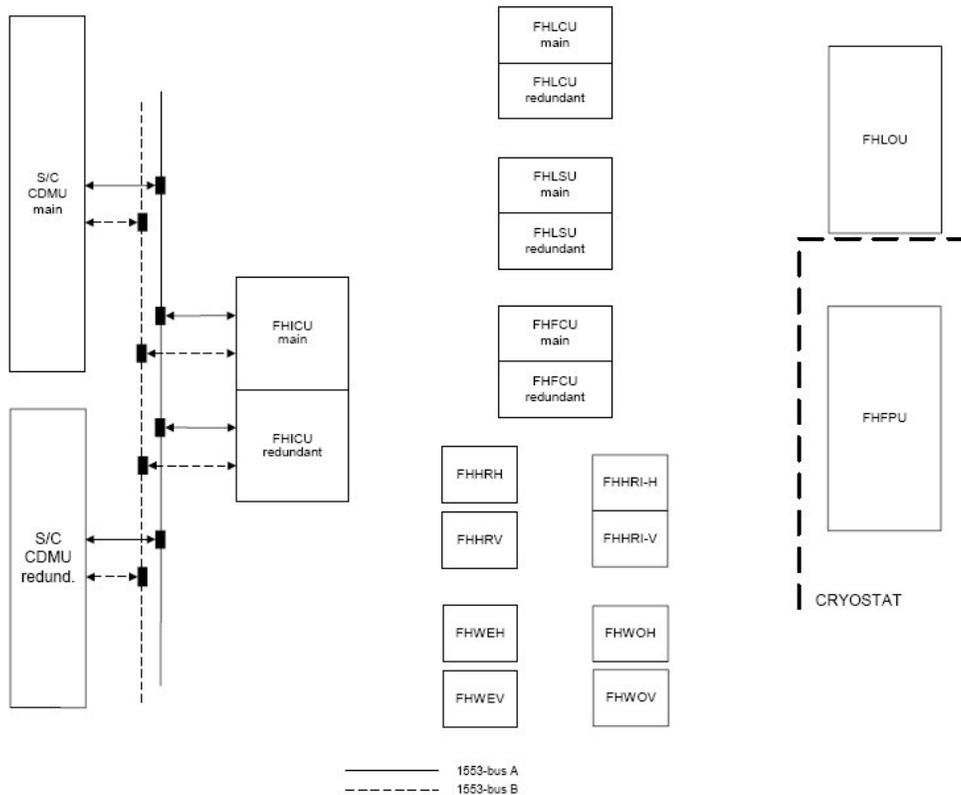
3.1.2 HIFI I&T Verification

The I&T verification, for each HIFI warm unit, will be performed as described here below:

FHWEH:

➢ Install BOB between the connector FHWEH-P03 to FHWEH-J03 (without cross strap)

➢ On BOB, using the digital ohmmeter, check the Unit insulation (Unit Side):
Value Required > 1Mohm (between RTN line (pin 4) and GND)

➢ Execute satellite "POWER-ON"

➢ Install Digital Voltmeter on Pin 2(+) & 4(-) of the BOB

➢ Send the command Switch ON to the power dedicated line for HIFI WEH: **DC43D170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify the following TLM parameters:
   ➢ **STS (LCL43) = ON**
   ➢ **ITLM_(LCL43) = 0 Amp**

➢ Send the command Switch OFF to the power dedicated line for HIFI WEH: **DC43B170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **0 Volts**

➢ Verify the following TLM parameters:
   ➢ **STS (LCL43) = OFF**
   ➢ **ITLM_(LCL43) = 0 Amp**

➢ On BOB connect cross strap on pin: 2(+) and 4(-)

➢ Connect current probe on pin 2(+) of the BOB in order to perform the In-Rush current verification

➢ Send the command Switch ON to the power dedicated line for HIFI WEH: **DC43D170**

➢ Verify/record the WEH inrush current (no LCL intervention has to be verified):
I $_{overshoot}$ = 5.50 A max
T $_{overshoot}$ ≤ 50 μsec
I $_{nom}$ = 1.9 A (after 5msec)

➢ Send the command Switch OFF to the power dedicated line for HIFI WEH: **DC43B170**

➢ Remove BOB and connect the power connector to the relevant harness receptacle one

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FHWEV:

➢ Install BOB between the connector FHWEV-P03 to FHWEV-J03 (without cross strap)

➢ On BOB, using the digital ohmmeter, check the Unit insulation (Unit Side):
Value Required > 1Mohm (between RTN line (pin 4) and GND)

➢ Execute satellite "POWER-ON"

➢ Install Digital Voltmeter on Pin 2(+) & 4(-) of the BOB

➢ Send the command Switch ON to the power dedicated line for HIFI WEV: **DC44D170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL44) = ON**
  ➢ **ITLM_(LCL44) = 0 Amp**

➢ Send the command Switch OFF to the power dedicated line for HIFI WEV: **DC44B170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL44) = OFF**
  ➢ **ITLM_(LCL44) = 0 Amp**

➢ On BOB connect cross strap on pin: 2(+) and 4(-)

➢ Connect current probe on pin 2(+) of the BOB in order to perform the In-Rush current verification

➢ Send the command Switch ON to the power dedicated line for HIFI WEV: **DC44D170**

➢ Verify/record the WEV inrush current (no LCL intervention has to be verified):
$I_{overshoot}$ = 5.50 A max
$T_{overshoot}$ ≤ 50 µsec
I_{nom} = 1.9 A (after 5msec)

➢ Send the command Switch OFF to the power dedicated line for HIFI WEV: **DC44B170**

➢ Remove BOB and connect the power connector to the relevant harness receptacle one

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FHHRH:

- ➢ Install BOB between the connector FHHRH-P01 to FHHRH-J01 (without cross strap)

- ➢ On BOB, using the digital ohmmeter, check the Unit insulation (Unit Side):
  Value Required > 1Mohm (between RTN line (pin 4) and GND)

- ➢ Execute satellite "POWER-ON"

- ➢ Install Digital Voltmeter on Pin 2(+) & 4(-) of the BOB

- ➢ Send the command Switch ON to the power dedicated line for HIFI HRH: **DC63D170**

- ➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

- ➢ Verify the following TLM parameters:
  - ➢ **STS (LCL63) = ON**
  - ➢ **ITLM_(LCL63) = 0 Amp**

- ➢ Send the command Switch OFF to the power dedicated line for HIFI HRH: **DC63B170**

- ➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **0 Volts**

- ➢ Verify the following TLM parameters:
  - ➢ **STS (LCL63) = OFF**
  - ➢ **ITLM_(LCL63) = 0 Amp**

- ➢ On BOB connect cross strap on pin: 2(+) and 4(-)

- ➢ Connect current probe on pin 2(+) of the BOB in order to perform the In-Rush current verification

- ➢ Send the command Switch ON to the power dedicated line for HIFI HRH: **DC63D170**

- ➢ Verify/record the HRH inrush current (no LCL intervention has to be verified):
  $I_{overshoot}$ **= 11.0 A max**
  $T_{overshoot}$ **≤ 50 µsec**
  I_{nom} **= 2.54 A (after 5msec)**

- ➢ Send the command Switch OFF to the power dedicated line for HIFI HRH: **DC63B170**

- ➢ Remove BOB and connect the power connector to the relevant harness receptacle one

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FHHRV:

- Install BOB between the connector FHHRV-P01 to FHHRV-J01 (without cross strap)

- On BOB, using the digital ohmmeter, check the Unit insulation (Unit Side):
  Value Required > 1Mohm (between RTN line (pin 4) and GND)

- Execute satellite "POWER-ON"

- Install Digital Voltmeter on Pin 2(+) & 4(-) of the BOB

- Send the command Switch ON to the power dedicated line for HIFI HRV: **DC67D170**

- Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

- Verify the following TLM parameters:
  - **STS (LCL67) = ON**
  - **ITLM_(LCL67) = 0 Amp**

- Send the command Switch OFF to the power dedicated line for HIFI HRV: **DC67B170**

- Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **0 Volts**

- Verify the following TLM parameters:
  - **STS (LCL67) = OFF**
  - **ITLM_(LCL67) = 0 Amp**

- On BOB connect cross strap on pin: 2(+) and 4(-)

- Connect current probe on pin 2(+) of the BOB in order to perform the In-Rush current verification

- Send the command Switch ON to the power dedicated line for HIFI HRV: **DC67D170**

- Verify/record the HRV inrush current (no LCL intervention has to be verified):
  I $_{overshoot}$ = 11.0 A max
  T $_{overshoot}$ ≤ 50 μsec
  I $_{nom}$ = 2.54 A (after 5msec)

- Send the command Switch OFF to the power dedicated line for HIFI HRV: **DC67B170**

- Remove BOB and connect the power connector to the relevant harness receptacle one

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FHLCU (nom. & red.):

➤ Install BOB#1 (main) between the connector FHLCU-P01 to FHLCU-J01 (without cross strap)

➤ Install BOB#2 (red.) between the connector FHLCU-P121 to FHLCU-J121 (without cross strap)

➤ On BOB#1 and BOB#2, using the digital ohmmeter, check the Unit insulation (Unit Side):
  Value Required > 1Mohm (between RTN line (pin 4) and GND)

➤ Execute satellite "POWER-ON"

➤ Install Digital Voltmeter on both BOB's on Pin 2(+) & 4(-)

➤ Send the command Switch ON to the power line (main) for HIFI LCU: **DC53D170**

➤ Verify with digital Voltmeter on BOB#1 between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➤ Verify with digital Voltmeter on BOB#2 between Pin 2(+) & 4(-): **0 Volts**

➤ Verify the following TLM parameters:
  ➤ **STS (LCL53) = ON**
  ➤ **STS (LCL54) = OFF**
  ➤ **ITLM_(LCL53) = 0 Amp**
  ➤ **ITLM (LCL54) = 0 Amp**

➤ Send the command Switch ON to the power line (red.) for HIFI LCU: **DC54D170**

➤ Verify with digital Voltmeter on BOB#1 between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➤ Verify with digital Voltmeter on BOB#2 between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➤ Verify the following TLM parameters:
  ➤ **STS (LCL53) = ON**
  ➤ **STS (LCL54) = ON**
  ➤ **ITLM_(LCL53) = 0 Amp**
  ➤ **ITLM (LCL54) = 0 Amp**

➤ Send the command Switch OFF to the power line (main) for HIFI LCU: **DC53B170**

➤ Send the command Switch OFF to the power line (red.) for HIFI LCU: **DC54B170**

➤ Verify with digital Voltmeter on both BOB's between Pin 2(+) & 4(-): **0 Volts**

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- ➢ Verify the following TLM parameters:
    - ➢ **STS (LCL53) = OFF**
    - ➢ **STS (LCL54) = OFF**
    - ➢ **ITLM_(LCL53) = 0 Amp**
    - ➢ **ITLM (LCL54) = 0 Amp**

- ➢ On both BOB's connect cross strap on pin: 2(+) and 4(-)

- ➢ Connect current probe on pin 2(+) of both BOB's in order to perform the In-Rush current verification

- ➢ Send the command Switch ON to the power line (main) for HIFI LCU: **DC53D170**

- ➢ Verify/record for both LCU (main and red.) inrush current (no LCL's intervention has to be verified):
    I $_{overshoot}$ = 11.0 A max
    T $_{overshoot}$≤ 50 µsec
    I $_{nom}$ = 3.70 A (after 5msec)

- ➢ Send the command Switch OFF to the power line (main) for HIFI LCU: **DC53B170**

- ➢ Repeat the same verification also on the power line (red.) for HIFI LCU

- ➢ Remove BOB's and connect the power connectors to the relevant harness receptacle ones

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FHICU (nom. & red.):

➢ Verify that the **RT Add** = **16 (nom.), 19 (red.)**

➢ Install BOB#1 (main) between the connector FHICU-P01 to FHICU-J01 (without cross strap)

➢ Install BOB#2 (red.) between the connector FHICU-P02 to FHICU-J02 (without cross strap)

➢ On BOB#1 and BOB#2, using the digital ohmmeter, check the Unit insulation (Unit Side):
Value Required > 1Mohm (between RTN line (pin 4) and GND)

➢ Execute satellite "POWER-ON"

➢ Install Digital Voltmeter on both BOB's on Pin 2(+) & 4(-)

➢ Send the command Switch ON to the power line (main) for HIFI ICU: **DC64D170**

➢ Verify with digital Voltmeter on BOB#1 between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB#2 between Pin 2(+) & 4(-): **0 Volts**

➢ Verify the following TLM parameters:
    ➢ **STS (LCL64) = ON**
    ➢ **STS (LCL64) = ON**
    ➢ **STS (LCL68) = OFF**
    ➢ **STS (LCL68) = OFF**
    ➢ **ITLM_(LCL64) = 0 Amp**
    ➢ **ITLM (LCL68) = 0 Amp**

➢ Send the command Switch ON to the power line (red.) for HIFI ICU: **DC68D170**

➢ Verify with digital Voltmeter on BOB#1 between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB#2 between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify the following TLM parameters:
    ➢ **STS (LCL64) = ON**
    ➢ **STS (LCL64) = ON**
    ➢ **STS (LCL68) = ON**
    ➢ **STS (LCL68) = ON**
    ➢ **ITLM_(LCL64) = 0 Amp**
    ➢ **ITLM (LCL68) = 0 Amp**

➢ Send the command Switch OFF to the power line (main) for HIFI ICU: **DC64B170**

➢ Send the command Switch OFF to the power line (red.) for HIFI ICU: **DC68B170**

➢ Verify with digital Voltmeter on both BOB's between Pin 2(+) & 4(-): **0 Volts**

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➢ Verify the following TLM parameters:
  - ➢ **STS (LCL64) = OFF**
  - ➢ **STS (LCL64) = OFF**
  - ➢ **STS (LCL68) = OFF**
  - ➢ **STS (LCL68) = OFF**
  - ➢ **ITLM_(LCL64) = 0 Amp**
  - ➢ **ITLM (LCL68) = 0 Amp**

➢ On both BOB's connect cross strap on pin: 2(+) and 4(-)

➢ Connect current probe on pin 2(+) of both BOB's in order to perform the In-Rush current verification

➢ Send the command Switch ON to the power line (main) for HIFI ICU: **DC64D170**

➢ Verify/record for both ICU (main) inrush current (no LCL intervention has to be verified):
  $I_{overshoot}$ = 11.0 A max
  $T_{overshoot}$ ≤ 50 μsec
  I_{nom} = 1.80 A (after 5msec)

➢ Send the command Switch OFF to the power line (main) for HIFI ICU: **DC64B170**

➢ Remove BOB#1 and connect FHICU-P01 to the relevant harness receptacle (FHICU-J01)

➢ Send the command Switch ON to the power line (red.) for HIFI ICU: **DC68D170**

➢ Verify/record for both ICU (red.) inrush current (no LCL intervention has to be verified):
  $I_{overshoot}$ = 11.0 A max
  $T_{overshoot}$ ≤ 50 μsec
  I_{nom} = 1.80 A (after 5msec)

➢ Send the command Switch OFF to the power line (red.) for HIFI ICU: **DC68B170**

➢ Remove BOB#2 and connect FHICU-P02 to the relevant harness receptacle (FHICU-J02)

➢ Send the command Switch ON to the power line (main) for HIFI ICU: **DC64D170**

➢ Send the command Switch ON to the power line (red.) for HIFI ICU: **DC68D170**

➢ Install **"T"** adapters on connector FHICU-P03 to FHICU-J03 (and FHICU-P05 to FHICU-J05) and install the Oscilloscope with differential probe to the "T" adapter in order to verify the correct 1553B signal amplitude pin:
  2(True) and 6(comp)

➢ With differential probe, verify the peak to peak voltage levels:
  Between 1V ÷ 14 V BC in Transmission
  Between 18V ÷ 27V RT in Transmission
  T_{rise} and T_{fall} = 100 nsec ÷ 300 nsec

➢ Send the command Switch Over from bus A to bus B dedicate to HIFI ICU (main): **TC(8,4,10,1)**

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➢ Install **"T"** adapter on connector FHICU-P04 to FHICU-J04 (and FHICU-P06 to FHICU-J06) and install the Oscilloscope with differential probe to the "T" adapter in order to verify the correct 1553B signal amplitude pin: **2(True) and 6(comp)**

➢ With differential probe, verify the peak to peak voltage levels:
Between 1V ÷ 14 V BC in Transmission
Between 18V ÷ 27V RT in Transmission
T_{rise} and T_{fall} = 100 nsec ÷ 300 nsec

➢ Send the command Switch OFF to the power line (main) for HIFI ICU: **DC64B170**

➢ Send the command Switch OFF to the power line (red.) for HIFI ICU: **DC68B170**

➢ Remove the **"T"** adapter connectors and connect all the 1553B connectors to the relevant harness receptacle ones.

3.1.3 HIFI UFT Verification

The HIFI UFT verification will be performed as described here below:

➢ Send the command Switch ON to the power line (main) for HIFI ICU: **DC64D170**

➢ Verify that an **"Event Report" TM (5, 2)** (APID 1024) has been issued by ICU.

➢ To start the ASW send the following command "HIFI_Force_Boot": **HC000289**

➢ After the execution of boot, verify/record on ICU Housekeeping Parameter Report **TM (3,25) APID 1026 (0X402)** contains the following information:
  ➢ **SID**   **TBD**
  ➢ **Length**   **TBD**
  ➢ **OBSID**   **TBD**
  ➢ **BBID**   **TBD**
  ➢ **Software Version** **TBD**

➢ Verify that the **TM (3,25) APID 1026 (0X402)** is generated at rate of 0.33Hz (one Pkt/3sec)

➢ After the execution of boot, verify on ICU Housekeeping Parameter Report **TM (3,25) APID 1024 (0X400)** contains the following information:
  ➢ **SID**   **TBD**
  ➢ **Length**   **TBD**
  ➢ **OBSID**   **TBD**
  ➢ **BBID**   **TBD**
  ➢ **Software Version** **TBD**

➢ Verify that the **TM (3,25) APID 1024 (0X400)** is generated at rate of 0.33Hz (one Pkt/3sec)

➢ Send the command Switch OFF to the power line (main) for HIFI ICU: **DC64B170**

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3.2 SPIRE

The SPIRE warm units will be installed onto the dedicated –Z lateral panel of Herschel-SVM (in the same panel of CCU):

In the following table there are the project codes allocated to SPIRE warm units:

Project Code	Instrument Unit
HSDCU	SPIRE Detector Control Unit
HSFCU	SPIRE FPU Control Unit
HSDPU	SPIRE Digital Processing Unit

3.2.1 SPIRE SVM I/F's

The Power I/F's to be checked, for what concern the SPIRE warm unit, are reported in the Table 3.2.1-1:

LCL#	Type	Class	PCDU Conn	Pin+	Pin-		Herschel SPIRE Allocation	Conn	Pin+	Pin-	Avg Power [W]
11	LCL	I	J06	7,8	26,27		**HSDPU nom.**	J01	2	4	15,3
12	LCL	I	J32	7,8	26,27		**HSDPU red.**	J02	2	4	0,0
51	LCL	III	J08	7,8	26,27		**HSFCU nom.**	J05	2	4	80,0
52	LCL	III	J30	7,8	26,27		**HSFCU red.**	J06	2	4	0,0

Table 3.2.1-1: PCDU SPIRE I/F's

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The HSDCU unit doesn't have interface with the PCDU and the power supply will be provide it as described in the following diagram of Fig.3.2.1-1:
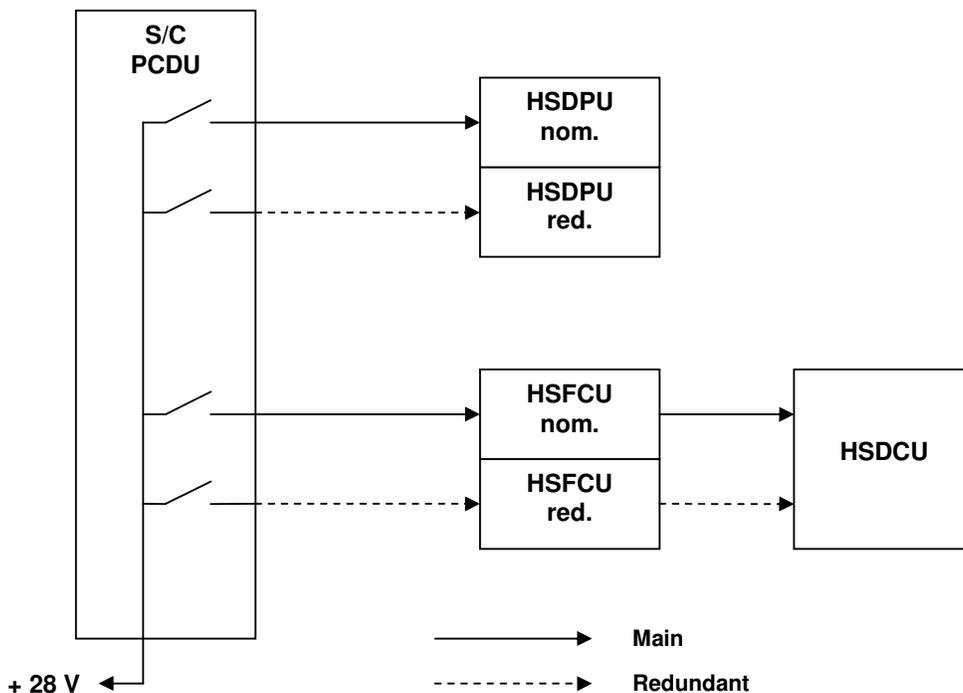
Fig.3.2.1-1: SPIRE Power Distribution Diagram

The Mil 1553 Bus I/F's to be checked, for what concern the SPIRE warm unit, are reported in the Table 3.2.1-2:

Herschel HIFI	CDMU I/F 1553 Bus	Conn	Pin(true)	Pin(comp)
HSDCU	N/A	-	-	-
HSFCU nom.	N/A	-	-	-
HSFCU red.	N/A	-	-	-
HSDPU nom.	1	J03(Bus A) J04(Bus B)	2 2	6 6
HSDPU red.	1	J05(Bus A) J06(Bus B)	2 2	6 6

Table 3.2.1-2: CDMU SPIRE I/F's

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Then only the HSDPU (nom.+red.) has interface with the CDMU by Mil 1553 bus as described in the following diagram of Fig.3.2.1-2:
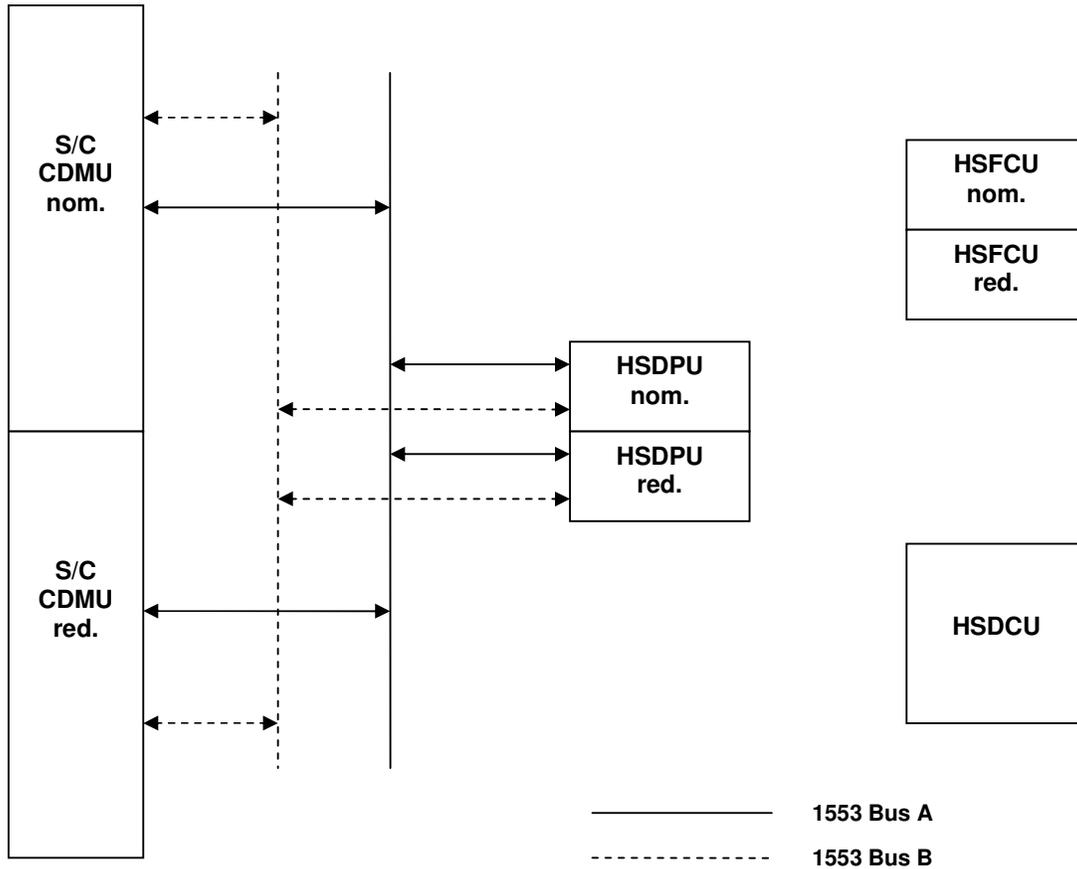
Fig.3.2.1-2: SPIRE CDMS interface

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3.2.2 SPIRE I&T Verification

The I&T verification, for each SPIRE warm unit, will be performed as described here below:

HSFCU (nom. & red.):

➢ Install BOB#1 (main) between the connector HSFCU-P05 to HSFCU-J05 (without cross strap)

➢ Install BOB#2 (red.) between the connector HSFCU-P06 to HSFCU-J06 (without cross strap)

➢ On BOB#1 and BOB#2, using the digital ohmmeter, check the Unit insulation (Unit Side):
Value Required > 1Mohm (between RTN line (pin 4) and GND)

➢ Execute satellite "POWER-ON"

➢ Install Digital Voltmeter on both BOB's on Pin 2(+) & 4(-)

➢ Send the command Switch ON to the power line (main) for SPIRE FCU: **DC51D170**

➢ Verify with digital Voltmeter on BOB#1 between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB#2 between Pin 2(+) & 4(-): **0 Volts**

➢ Verify the following TLM parameters:
 ➢ **STS (LCL51) = ON**
 ➢ **STS (LCL52) = OFF**
 ➢ **ITLM_(LCL51) = 0 Amp**
 ➢ **ITLM (LCL52) = 0 Amp**

➢ Send the command Switch ON to the power line (red.) for SPIRE FCU: **DC52D170**

➢ Verify with digital Voltmeter on BOB#1 between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB#2 between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify the following TLM parameters:
 ➢ **STS (LCL51) = ON**
 ➢ **STS (LCL52) = ON**
 ➢ **ITLM_(LCL51) = 0 Amp**
 ➢ **ITLM (LCL52) = 0 Amp**

➢ Send the command Switch OFF to the power line (main) for SPIRE FCU: **DC51B170**

➢ Send the command Switch OFF to the power line (red.) for SPIRE FCU: **DC52B170**

➢ Verify with digital Voltmeter on both BOB's between Pin 2(+) & 4(-): **0 Volts**

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➢ Verify the following TLM parameters:
  - ➢ **STS (LCL51) = OFF**
  - ➢ **STS (LCL52) = OFF**
  - ➢ **ITLM_(LCL51) = 0 Amp**
  - ➢ **ITLM (LCL52) = 0 Amp**

➢ On both BOB's connect cross strap on pin: 2(+) and 4(-)

➢ Connect current probe on pin 2(+) of both BOB's in order to perform the In-Rush current verification

➢ Send the command Switch ON to the power line (main) for SPIRE FCU: **DC51D170**

➢ Verify/record for both FCU (main and red.) inrush current (no LCL's intervention has to be verified):
  $I_{overshoot}$ = **11.0 A max**
  $T_{overshoot}$ **≤ 50 μsec**
  I_{nom} = **2.90 A (after 5msec)**

➢ Send the command Switch OFF to the power line (main) for SPIRE FCU: **DC51B170**

➢ Repeat the same verification on the power line (red.) for SPIRE FCU

➢ Remove BOB and connect the power connector to the relevant harness receptacle one

HSDPU (nom. & red.):

➢ Verify that the **RT Add** = **21(nom.)**, **22(red.)**

➢ Install BOB#1 (main) between the connector HSDPU-P01 to HSDPU-J01 (without cross strap)

➢ Install BOB#2 (red.) between the connector HSDPU-P02 to HSDPU-J02 (without cross strap)

➢ On BOB#1 and BOB#2, using the digital ohmmeter, check the Unit insulation (Unit Side):
  Value Required > 1Mohm (between RTN line (pin 4) and GND)

➢ Execute satellite "POWER-ON"

➢ Install Digital Voltmeter on both BOB's on Pin 2(+) & 4(-)

➢ Send the command Switch ON to the power line (main) for SPIRE DPU: **DC11D170**

➢ Verify with digital Voltmeter on BOB#1 between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB#2 between Pin 2(+) & 4(-): **0 Volts**

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➢ Verify the following TLM parameters:
  ➢ **STS (LCL11) = ON**
  ➢ **STS (LCL11) = ON**
  ➢ **STS (LCL12) = OFF**
  ➢ **STS (LCL12) = OFF**
  ➢ **ITLM (LCL11) = 0 Amp**
  ➢ **ITLM (LCL12) = 0 Amp**

➢ Send the command Switch ON to the power line (red.) for SPIRE DPU: **DC12D170**

➢ Verify with digital Voltmeter on BOB#1 between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB#2 between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL11) = ON**
  ➢ **STS (LCL11) = ON**
  ➢ **STS (LCL12) = ON**
  ➢ **STS (LCL12) = ON**
  ➢ **ITLM (LCL11) = 0 Amp**
  ➢ **ITLM (LCL12) = 0 Amp**

➢ Send the command Switch OFF to the power line (main) for SPIRE DPU: **DC11B170**

➢ Send the command Switch OFF to the power line (red.) for SPIRE DPU: **DC12B170**

➢ Verify with digital Voltmeter on both BOB's between Pin 2(+) & 4(-): **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL11) = OFF**
  ➢ **STS (LCL11) = OFF**
  ➢ **STS (LCL12) = OFF**
  ➢ **STS (LCL12) = OFF**
  ➢ **ITLM (LCL11) = 0 Amp**
  ➢ **ITLM (LCL12) = 0 Amp**

➢ On both BOB's connect cross strap on pin: 2(+) and 4(-)

➢ Connect current probe on pin 2(+) of both BOB's in order to perform the In-Rush current verification

➢ Send the command Switch ON to the power line (main) for SPIRE DPU: **DC11D170**

➢ Verify/record for both DPU (main) inrush current (no LCL intervention has to be verified):
  I $_{overshoot}$ = 2.10 A max
  T $_{overshoot}$ ≤ 50 μsec
  I $_{nom}$ = 556 mA (after 5msec)

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➢ Send the command Switch OFF to the power line (main) for SPIRE DPU: **DC11B170**

➢ Remove BOB#1 and connect HSDPU-P01 to the relevant harness receptacle (HSDPU-J01)

➢ Send the command Switch ON to the power line (red.) for SPIRE DPU: **DC12D170**

➢ Verify/record for both DPU (main) inrush current (no LCL intervention has to be verified):
 I $_{overshoot}$ = 2.10 A max
 T $_{overshoot}$ ≤ 50 µsec
 I $_{nom}$ = 556 mA (after 5msec)

➢ Send the command Switch OFF to the power line (red.) for SPIRE DPU: **DC12B170**

➢ Remove BOB#2 and connect HSDPU-P02 to the relevant harness receptacle (HSDPU-J02)

➢ Send the command Switch ON to the power line (main) for SPIRE DPU: **DC11D170**

➢ Send the command Switch ON to the power line (red.) for SPIRE DPU: **DC12D170**

➢ Install **"T"** adapters on connector HSDPU-P03 to HSDPU-J03 (and HSDPU-P05 to HSDPU-J05) and install the Oscilloscope with differential probe to the "T" adapter in order to verify the correct 1553B signal amplitude pin:
 2(True) and 6(comp)

➢ With differential probe, verify the peak to peak voltage levels:
 Between 1V ÷ 14 V BC in Transmission
 Between 18V ÷ 27V RT in Transmission
 T $_{rise}$ and T $_{fall}$ = 100 nsec ÷ 300 nsec

➢ Send the command Switch Over from bus A to bus B dedicate to SPIRE DPU (main): **TC(8,4,10,1)**

➢ Install **"T"** adapter on connector HSDPU-P04 to HSDPU-J04 (and HSDPU-P06 to HSDPU-J06) and install the Oscilloscope with differential probe to the "T" adapter in order to verify the correct 1553B signal amplitude pin:
 2(True) and 6(comp)

➢ With differential probe, verify the peak to peak voltage levels:
 Between 1V ÷ 14 V BC in Transmission
 Between 18V ÷ 27V RT in Transmission
 T $_{rise}$ and T $_{fall}$ = 100 nsec ÷ 300 nsec

➢ Send the command Switch OFF to the power line (main) for SPIRE DPU: **DC11B170**

➢ Send the command Switch OFF to the power line (red.) for SPIRE DPU: **DC12B170**

➢ Remove the **"T"** adapter connectors and connect all the 1553B connectors to the relevant harness receptacle ones.

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3.2.3 SPIRE UFT Verification

The SPIRE UFT verification will be performed as described here below:

➢ Send the command Switch ON to the power line (main) for SPIRE DPU: **DC11D170**

➢ Verify that an **"Event Report" TM(5, 1)** (APID 1280) has been issued by DPU.

➢ To start the ASW send the following command DPULLSW_Force_Boot: **SCD09505**

➢ After the execution of boot, verify/record on DPU Housekeeping Parameter Report **TM(3,25) APID 1280 (0X500)** contains the following information:
  ➢ **SID**   **TBD**
  ➢ **Length**   **TBD**
  ➢ **OBSID**   **TBD**
  ➢ **BBID**   **TBD**
  ➢ **Software Version** **TBD**

➢ Verify that the **TM(3,25) APID 1280 (0X500)** is generated at rate of 0.5Hz (one Pkt/2sec)

➢ After the execution of boot, verify/record on DPU Housekeeping Parameter Report **TM(3,25) APID 1282 (0X502)** contains the following information:
  ➢ **SID**   **TBD**
  ➢ **Length**   **TBD**
  ➢ **OBSID**   **TBD**
  ➢ **BBID**   **TBD**
  ➢ **Software Version** **TBD**

➢ Verify that the **TM(3,25) APID 1282 (0X502)** is generated at rate of 1Hz (one Pkt/sec)

➢ Send the command Switch OFF to the power line (main) for SPIRE DPU: **DC11B170**

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3.3 PACS

The PACS warm units will be installed onto the dedicated +Y–Z lateral panel of Herschel-SVM:

In the following table there are the project codes allocated to PACS warm units:

Project Code	Instrument Unit
FPDECMEC	PACS Detector Control Mechanism Control
FPBOLC	PACS Bolometer/Cooler Control
FPDPU	PACS Digital Processing Unit
FPSPU	PACS Signal Processing Unit

3.3.1 PACS SVM I/F's

The interconnection between the nominal S/C power subsystem and the nominal PACS warm electronic boxes shall comprise four power lines, one for each of the DPU, SPU, DECMEC (connector corresponding to MEC1) and BOLC units. Similarly, identical interconnection harnesses shall ensure interconnection between the redundant S/C power subsystem and the redundant warm electronic boxes, i.e. redundant DPU and SPU, DECMEC (connector corresponding to MEC2), and BOLC.

Then the Power I/F's to be checked, for what concern the PACS warm unit, are reported in the Table 3.3.1-1:

LCL#	Type	Class	PCDU Conn	Pin+	Pin-		Herschel PACS Allocation	Conn	Pin+	Pin-	Avg Power [W]
27	LCL	II	J32	9, 10	28, 29		FPBOLC nom.	J25	2, 7	4, 9	37.5
28	LCL	II	J06	9, 10	28, 29		FPBOLC red.	J26	2, 7	4, 9	0,0
35	LCL	II	J10	3, 4	22, 23		FPSPU1	J11	2, 1	4, 5	33,2
36	LCL	II	J28	3, 4	22, 23		FPSPU2	J11	2, 1	4, 5	0,0
41	LCL	II	J30	5, 6	24, 25		FPDPU nom.	J01	2, 7	4, 9	14,7
42	LCL	II	J08	5, 6	24, 25		FPDPU red.	J02	2, 7	4, 9	0,0
65	Par-LCL	III	J10	11, 12	30, 31		FPMEC1	J30	2, 7	4, 9	50.3
69	Par-LCL	III	J28	11, 12	30, 31		FPMEC2	J130	2, 7	4, 9	0,0

Table 3.2.1-1: PCDU PACS I/F's

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The power supply will be provide as described in the following diagram of Fig.3.3.1-1:
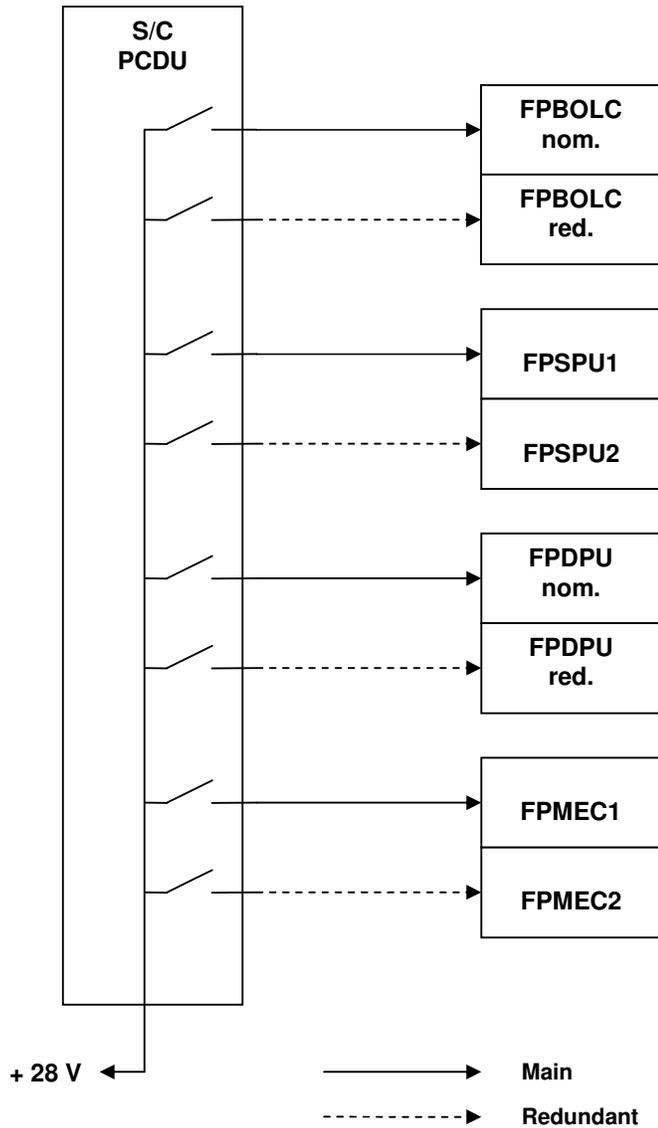
Fig.3.3.1-1: PACS Power Distribution Diagram

The S/C data handling subsystem shall provide two Mil 1553 Bus links to the nominal DPU and two Mil 1553 Bus links to the redundant DPU.

Then the interfaces to be checked are reported in the Table 3.3.1-2:

Herschel HIFI	CDMU I/F 1553 Bus	Conn	Pin(true)	Pin(comp)
FPBOLC	N/A	-	-	-
FPSPU	N/A	-	-	-
FPMEC1	1 OBT (Synch)	J31	5 (OBT+)	9 (OBT-)
FPMEC2	1 OBT (Synch)	J131	5 (OBT+)	9 (OBT-)
FPDPU nom.	1	J03(Bus A)	2	6
		J04(Bus B)	2	6
FPDPU red.	1	J05(Bus A)	2	6
		J06(Bus B)	2	6

Table 3.3.1-2: CDMU PACS I/F's

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In the diagram below the interface with the CDMU by Mil 1553 bus is described (see Fig.3.3.1-2):
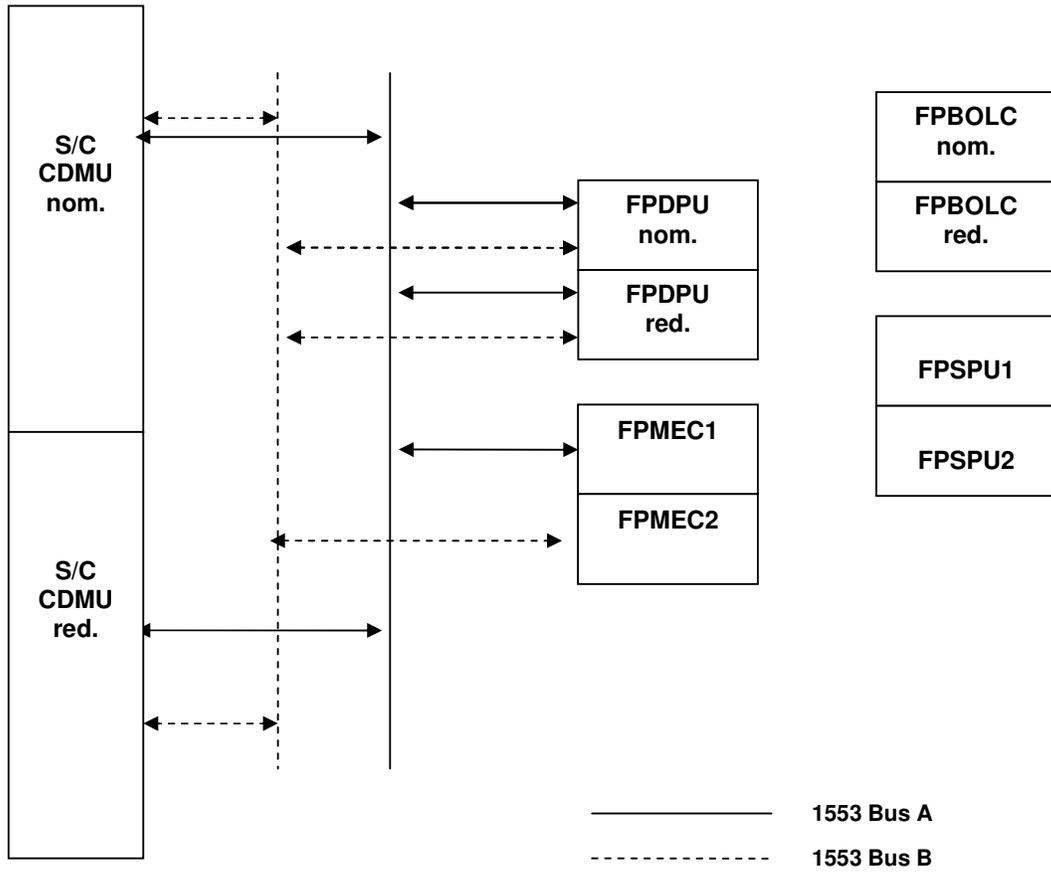

Fig.3.3.1-2: PACS CDMS interface

3.3.2   PACS I&T Verification

The I&T verification, for each PACS warm unit, will be performed as described here below:

FPBOLC (nom. & red.):

➢ Install BOB#1 (main) between the connector FPBOLC-P25 to FPBOLC-J25 (without cross strap)

➢ Install BOB#2 (red.) between the connector FPBOLC-P26 to FPBOLC-J26 (without cross strap)

➢ On BOB#1 and BOB#2, using the digital ohmmeter, check the Unit insulation (Unit Side):
   Value Required > 1Mohm (between RTN line (pin 4 & pin 9) and GND)

➢ Execute satellite "POWER-ON"

➢ Install Digital Voltmeter on both BOB's on Pin 2(+) & 4(-)

➢ Send the command Switch ON to the power line (main) for PACS BOLC: **DC27D170**

➢ Verify with digital Voltmeter on BOB#1 between Pin 2(+), [7(+)] & 4(-), [9(-)]: **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB#2 between Pin 2(+), [7(+)] & 4(-), [9(-)]: **0 Volts**

➢ Verify the following TLM parameters:
   ➢ **STS (LCL27) = ON**
   ➢ **STS (LCL28) = OFF**
   ➢ **ITLM_(LCL27) = 0 Amp**
   ➢ **ITLM (LCL28) = 0 Amp**

➢ Send the command Switch ON to the power line (red.) for PACS BOLC: **DC28D170**

➢ Verify with digital Voltmeter on BOB#1 between Pin 2(+), [7(+)] & 4(-), [9(-)]: **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB#2 between Pin 2(+), [7(+)] & 4(-), [9(-)]: **28 Volts +1% and - 4%**

➢ Verify the following TLM parameters:
   ➢ **STS (LCL27) = ON**
   ➢ **STS (LCL28) = ON**
   ➢ **ITLM_(LCL27) = 0 Amp**
   ➢ **ITLM (LCL28) = 0 Amp**

➢ Send the command Switch OFF to the power line (main) for PACS BOLC: **DC27B170**

➢ Send the command Switch OFF to the power line (red.) for PACS BOLC: **DC28B170**

➢ Verify with digital Voltmeter on both BOB's between Pin 2(+), [7(+)] & 4(-), [9(-)]: **0 Volts**

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➢ Verify the following TLM parameters:
  ➢ **STS (LCL27) = OFF**
  ➢ **STS (LCL28) = OFF**
  ➢ **ITLM_(LCL27) = 0 Amp**
  ➢ **ITLM (LCL28) = 0 Amp**

➢ On both BOB's connect cross strap on pin: 2(+), [7(+)] & 4(-), [9(-)]

➢ Connect current probe on pin 2(+) [7(+)] of both BOB's in order to perform the In-Rush current verification

➢ Send the command Switch ON to the power line (main) for PACS BOLC: **DC27D170**

➢ Verify/record for both BOLC (main and red.) inrush current (no LCL's intervention has to be verified):
  $I_{overshoot}$ = **5.50 A max**
  $T_{overshoot}$ ≤ **50 µsec**
  I_{nom} = **1.36 A (after 5msec)**

➢ Send the command Switch OFF to the power line (main) for PACS BOLC: **DC27B170**

➢ Repeat the same verification on the power line (red.) for PACS BOLC

➢ Remove BOB's and connect the power connectors to the relevant harness receptacle ones

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FPSPU (1 & 2):

➢ Install BOB#1 (main) between the connector FPSPU1-P11 to FPSPU1-J11 (without cross strap)

➢ Install BOB#2 (red.) between the connector FPSPU2-P11 to FPSPU2-J11 (without cross strap)

➢ On BOB#1 and BOB#2, using the digital ohmmeter, check the Unit insulation (Unit Side):
Value Required > 1Mohm (between RTN line (pin 4 & pin 5) and GND)

➢ Execute satellite "POWER-ON"

➢ Install Digital Voltmeter on both BOB's on Pin 2(+) & 4(-)

➢ Send the command Switch ON to the power line (main) for PACS SPU1: **DC35D170**

➢ Verify with digital Voltmeter on BOB#1 between Pin 2(+), [1(+)] & 4(-), [5(-)]: **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB#2 between Pin 2(+), [1(+)] & 4(-), [5(-)]: **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL35) = ON**
  ➢ **STS (LCL36) = OFF**
  ➢ **ITLM_(LCL35) = 0 Amp**
  ➢ **ITLM (LCL36) = 0 Amp**

➢ Send the command Switch ON to the power line (red.) for PACS SPU2: **DC36D170**

➢ Verify with digital Voltmeter on BOB#1 between Pin 2(+), [1(+)] & 4(-), [5(-)]: **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB#2 between Pin 2(+), [1(+)] & 4(-), [5(-)]: **28 Volts +1% and - 4%**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL35) = ON**
  ➢ **STS (LCL36) = ON**
  ➢ **ITLM_(LCL35) = 0 Amp**
  ➢ **ITLM (LCL36) = 0 Amp**

➢ Send the command Switch OFF to the power line (main) for PACS SPU1: **DC35B170**

➢ Send the command Switch OFF to the power line (red.) for PACS SPU2: **DC36B170**

➢ Verify with digital Voltmeter on both BOB's between Pin 2(+), [1(+)] & 4(-), [5(-)]: **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL35) = OFF**
  ➢ **STS (LCL36) = OFF**
  ➢ **ITLM_(LCL35) = 0 Amp**
  ➢ **ITLM (LCL36) = 0 Amp**

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➢ On both BOB's connect cross strap on pin: 2(+), [1(+)] & 4(-), [5(-)]

➢ Connect current probe on pin 2(+) [1(+)] of both BOB's in order to perform the In-Rush current verification

➢ Send the command Switch ON to the power line (main) for PACS SPU1: **DC35D170**

➢ Verify/record for both SPU (1 and 2) inrush current (no LCL's intervention has to be verified):
  I $_{overshoot}$ = 5.50 A max
  T $_{overshoot}$ ≤ 50 µsec
  I $_{nom}$ = 1.20 A (after 5msec)

➢ Send the command Switch OFF to the power line (main) for PACS SPU1: **DC35B170**

➢ Repeat the same verification on the power line (red.) for PACS SPU2

➢ Remove BOB's and connect the power connectors to the relevant harness receptacle ones

FPMEC (1 & 2):

➢ Install BOB#1 (main) between the connector FPMEC1-P30 to FPMEC1-J30 (without cross strap)

➢ Install BOB#2 (red.) between the connector FPMEC2-P130 to FPMEC2-J130 (without cross strap)

➢ On BOB#1 and BOB#2, using the digital ohmmeter, check the Unit insulation (Unit Side):
  Value Required > 1Mohm (between RTN line (pin 4 & pin 9) and GND)

➢ Execute satellite "POWER-ON"

➢ Install Digital Voltmeter on both BOB's on Pin 2(+) & 4(-)

➢ Send the command Switch ON to the power line (main) for PACS MEC1: **DC65D170**

➢ Verify with digital Voltmeter on BOB#1 between Pin 2(+), [7(+)] & 4(-), [9(-)]: **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB#2 between Pin 2(+), [7(+)] & 4(-), [9(-)]: **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL65) = ON**
  ➢ **STS (LCL69) = OFF**
  ➢ **ITLM_(LCL65) = 0 Amp**
  ➢ **ITLM (LCL69) = 0 Amp**

➢ Send the command Switch ON to the power line (red.) for PACS MEC2: **DC69D170**

➢ Verify with digital Voltmeter on BOB#1 between Pin 2(+), [7(+)] & 4(-), [9(-)]: **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB#2 between Pin 2(+), [7(+)] & 4(-), [9(-)]: **28 Volts +1% and - 4%**

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- ➢ Verify the following TLM parameters:
  - ➢ **STS (LCL65) = ON**
  - ➢ **STS (LCL69) = ON**
  - ➢ **ITLM_(LCL65) = 0 Amp**
  - ➢ **ITLM (LCL69) = 0 Amp**

- ➢ Send the command Switch OFF to the power line (main) for PACS MEC1: **DC65B170**

- ➢ Send the command Switch OFF to the power line (red.) for PACS MEC2: **DC69B170**

- ➢ Verify with digital Voltmeter on both BOB's between Pin 2(+), [7(+)] & 4(-), [9(-)]: **0 Volts**

- ➢ Verify the following TLM parameters:
  - ➢ **STS (LCL65) = OFF**
  - ➢ **STS (LCL69) = OFF**
  - ➢ **ITLM_(LCL65) = 0 Amp**
  - ➢ **ITLM (LCL69) = 0 Amp**

- ➢ On both BOB's connect cross strap on pin: 2(+), [7(+)] & 4(-), [9(-)]

- ➢ Connect current probe on pin 2(+), [7(+)] of both BOB's in order to perform the In-Rush current verification

- ➢ Send the command Switch ON to the power line (main) for PACS MEC1: **DC65D170**

- ➢ Verify/record for both MEC (1 and 2) inrush current (no LCL's intervention has to be verified):
  I overshoot = 11.0 A max
  T overshoot ≤ 50 µsec
  I nom = 1.83 A (after 5msec)

- ➢ Send the command Switch OFF to the power line (main) for PACS MEC1: **DC65B170**

- ➢ Repeat the same verification on the power line (red.) for PACS MEC2

- ➢ Send the command Switch ON to the power line (main) for PACS MEC1: **DC65D170**

- ➢ Verify by digital probe on connector J31 and J131 ["T" adapter pin 5 (OBT+) and 9 (OBT-)], the OBT characteristics:

  - ➢ **Differential Output Voltage**   2.0V ≤ |V| ≤ 5.5V
  - ➢ **Frequency**   131.072 KHz
  - ➢ **Rise Time**   0.1µS ≤ |T_{rise}| ≤ 0.8µS
  - ➢ **Fall Time**   0.1µS ≤ |T_{fall}| ≤ 0.3µS
  - ➢ **Jitter**   ± 150 nsec

  Note: The OBT verification has to be performed Unloaded (Verification polarity) and Loaded (Timing verification).

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➢ Send the command Switch OFF to the power line (main) for PACS MEC1: **DC65B170**

➢ Repeat the same verification on the power line (red.) for PACS MEC2

➢ Remove BOB and connect the power connector to the relevant harness receptacle one

FPDPU (nom. & red.):

➢ Verify that the **RT Add** = **25(nom.)**, **26(red.)**

➢ Install BOB#1 (main) between the connector FPDPU-P01 to FPDPU-J01 (without cross strap)

➢ Install BOB#2 (red.) between the connector FPDPU-P02 to FPDPU-J02 (without cross strap)

➢ On BOB#1 and BOB#2, using the digital ohmmeter, check the Unit insulation (Unit Side): **Value Required > 1Mohm** (between RTN line (pin 4 & pin 9) and GND)

➢ Execute satellite "POWER-ON"

➢ Install Digital Voltmeter on both BOB's on Pin 2(+) & 4(-)

➢ Send the command Switch ON to the power line (main) for PACS DPU: **DC41D170**

➢ Verify with digital Voltmeter on BOB#1 between Pin 2(+), [7(+)] & 4(-), [9(-)]: **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB#2 between Pin 2(+), [7(+)] & 4(-), [9(-)]: **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL41) = ON**
  ➢ **STS (LCL42) = OFF**
  ➢ **ITLM (LCL41) = 0 Amp**
  ➢ **ITLM (LCL42) = 0 Amp**

➢ Send the command Switch ON to the power line (red.) for PACS DPU: **DC42D170**

➢ Verify with digital Voltmeter on BOB#1 between Pin 2(+), [7(+)] & 4(-), [9(-)]: **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB#2 between Pin 2(+), [7(+)] & 4(-), [9(-)]: **28 Volts +1% and - 4%**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL41) = ON**
  ➢ **STS (LCL42) = ON**
  ➢ **ITLM (LCL41) = 0 Amp**
  ➢ **ITLM (LCL42) = 0 Amp**

➢ Send the command Switch OFF to the power line (main) for PACS DPU: **DC41B170**

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➢ Send the command Switch OFF to the power line (red.) for PACS DPU: **DC42B170**

➢ Verify with digital Voltmeter on both BOB's between Pin 2(+), [7(+)] & 4(-), [9(-)]: **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL41) = OFF**
  ➢ **STS (LCL42) = OFF**
  ➢ **ITLM (LCL41) = 0 Amp**
  ➢ **ITLM (LCL42) = 0 Amp**

➢ On both BOB's connect cross strap on pin: 2(+) and 4(-)

➢ Connect current probe on pin 2(+),[7(+)] of both BOB's in order to perform the In-Rush current verification

➢ Send the command Switch ON to the power line (main) for PACS DPU: **DC41D170**

➢ Verify/record for both DPU (main) inrush current (no LCL intervention has to be verified):
  $I_{overshoot}$ **= 5.50 A max**
  $T_{overshoot}$ **≤ 50 µsec**
  I_{nom} **= 534 mA (after 5msec)**

➢ Send the command Switch OFF to the power line (main) for PACS DPU: **DC41B170**

➢ Remove BOB#1 and connect FPDPU-P01 to the relevant harness receptacle (FPDPU-J01)

➢ Send the command Switch ON to the power line (red.) for PACS DPU: **DC42D170**

➢ Verify/record for both DPU (main) inrush current (no LCL intervention has to be verified):
  $I_{overshoot}$ **= 5.50 A max**
  $T_{overshoot}$ **≤ 50 µsec**
  I_{nom} **= 534 mA (after 5msec)**

➢ Send the command Switch OFF to the power line (red.) for PACS DPU: **DC42B170**

➢ Remove BOB#2 and connect FPDPU-P02 to the relevant harness receptacle (FPDPU-J02)

➢ Send the command Switch ON to the power line (main) for PACS DPU: **DC41D170**

➢ Send the command Switch ON to the power line (red.) for PACS DPU: **DC42D170**

➢ Install **"T"** adapters on connector FPDPU-P03 to FPDPU-J03 (and FPDPU-P05 to FPDPU-J05) and install the Oscilloscope with differential probe to the "T" adapter in order to verify the correct 1553B signal amplitude pin:
  2(True) and 6(comp)

➢ With differential probe, verify the peak to peak voltage levels:
  Between 1V ÷ 14 V BC in Transmission
  Between 18V ÷ 27V RT in Transmission
  T_{rise} **and** T_{fall} **= 100 nsec ÷ 300 nsec**

➢ Send the command Switch Over from bus A to bus B dedicate to PACS DPU (main): **TC(8,4,10,1)**

➢ Install **"T"** adapter on connector FPDPU-P04 to FPDPU-J04 (and FPDPU-P06 to FPDPU-J06) and install the Oscilloscope with differential probe to the "T" adapter in order to verify the correct 1553B signal amplitude pin:
  2(True) and 6(comp)

➢ With differential probe, verify the peak to peak voltage levels:
  Between 1V ÷ 14 V BC in Transmission
  Between 18V ÷ 27V RT in Transmission
  T_{rise} **and** T_{fall} **= 100 nsec ÷ 300 nsec**

➢ Send the command Switch OFF to the power line (main) for PACS DPU: **DC41B170**

➢ Send the command Switch OFF to the power line (red.) for PACS DPU: **DC42B170**

➢ Remove the **"T"** adapter connectors and connect all the 1553B connectors to the relevant harness receptacle ones.

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3.3.3 PACS UFT Verification

The PACS UFT verification will be performed as described here below:

➢ Send the command Switch ON to the power line (main) for PACS DPU: **DC41D170**

➢ Verify that an **"Event Report" TM(5, 2)** has been issued by DPU.

➢ To start the ASW send the following command "DPULLSW_Force_Boot": **PC032380**

➢ After the execution of boot, verify/record on DPU Housekeeping Parameter Report **TM(3,25) APID 1154 (0X482)** contains the following information:
  - ➢ **SID**   **TBD**
  - ➢ **Length**   **TBD**
  - ➢ **OBSID**   **TBD**
  - ➢ **BBID**   **TBD**
  - ➢ **Software Version** **TBD**

➢ Verify that the **TM(3,25) APID 1154 (0X482)** is generated at rate of one Pkt/2sec

➢ After the execution of boot, verify/record on DPU Housekeeping Parameter Report **TM(3,25) APID 1152 (0X480)** contains the following information:
  - ➢ **SID**   **TBD**
  - ➢ **Length**   **TBD**
  - ➢ **OBSID**   **TBD**
  - ➢ **BBID**   **TBD**
  - ➢ **Software Version** **TBD**

➢ Verify that the **TM(3,25) APID 1152 (0X480)** is generated at rate of one Pkt/10sec

➢ Send the command Switch OFF to the power line (main) for PACS DPU: **DC41B170**

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4. PLANCK INSTRUMENTS WARM UNITS SVM I/F's

The Instruments for Planck SVM are the following:

- **HFI** (**H**igh-**F**requency **I**nstrument)
- **LFI** (**L**ow-**F**requency **I**nstrument)
- **SCS** (**S**orption **C**ooler **S**ubsystem)
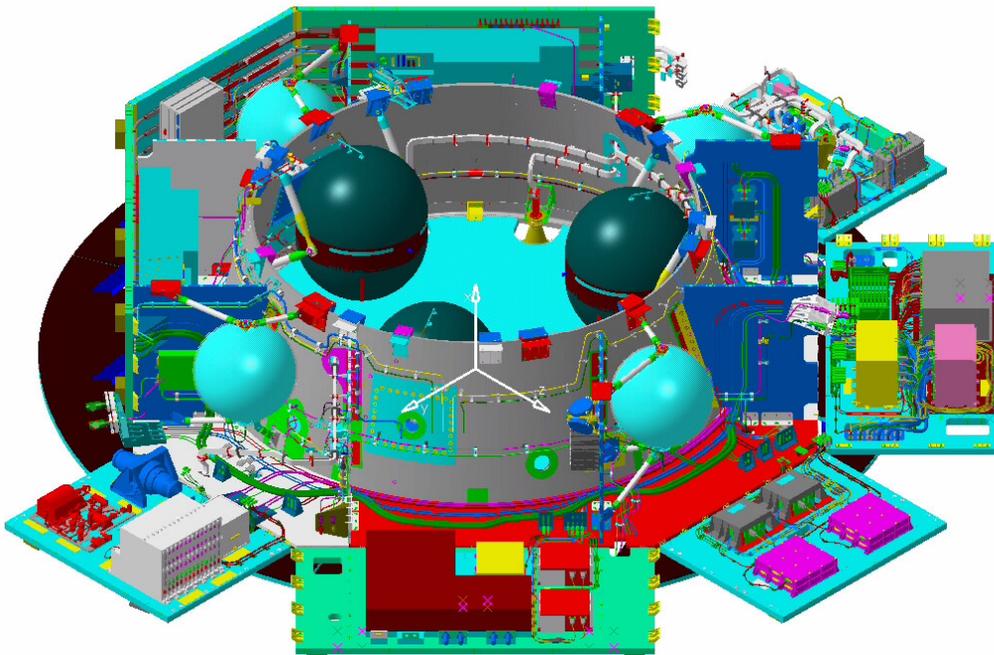
Fig. 4-1 Planck SVM layout.

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4.1 HFI

The HFI warm units are mainly grouped on three dedicated SVM panels, while the Pre-Amplifier Unit (PAU) is located on the P/L sub-platform and the 4K Current Pre-Regulator is located on a shear panel.

- ➢ <u>+Y Panel</u>: 4KCCU, 4KCAU, 4KCDE and REU
- ➢ <u>+Y+Z(+Z) Shear panel</u>: 4K Current Pre-Regulator
- ➢ <u>+Z Panel</u>: DPU (nom.+ red.)
- ➢ <u>+Y+Z Panel</u>: DCCU
- ➢ <u>P\L Sub. PLT +X</u>: PAU

In the following table there are the project codes allocated to HFI warm units:

Project Code	Instrument Unit
4KCCU (PHDA)	HFI 4K Cooler Compressor Unit
4KCAU (PHDB)	HFI 4K Cooler Ancillary Unit
4KCDE (PHDC)	HFI 4K Cooler Electronics Unit
DPU nom.& red. (PHBA-N&R)	HFI Data Processing Unit
REU (PHCBC)	HFI Readout Electronics Unit
DCCU (PHEB)	HFI Dilution Cooler Control Unit
4KCCR (PHDJ)	HFI 4K Cooler Current Regulator
PAU (PHCBA)	HFI Pre-Amplifier Unit

4.1.1 HFI SVM I/F's

The Power I/F's to be checked, for what concern the HFI warm unit, are reported in the Table 4.1.1-1:

LCL#	Type	Class	PCDU Conn	Pin+	Pin-		Planck HFI Allocation	Code	Conn	Pin+	Pin-	Avg Power [W]
11	LCL	I	J06	7, 8	26, 27		REU Proc Nom	PHCBC	12J07	2	4	24,0
12	LCL	I	J32	7, 8	26, 27		REU Proc Red	PHCBC	13J07	2	4	0,0
29	LCL	II	J06	11, 12	30, 31		DPU Nom	PHBAN	J05	2	4	25,0
30	LCL	II	J32	11, 12	30, 31		DPU Red	PHBAR	J05	2	4	0,0
36	LCL	II	J28	3, 4	22, 23		DCE (DCCU)	PHEB	J01	2	6	16,0
37	LCL	II	J02	3, 4	22, 23		4KCDE Nom	PHDC	J01A	2	9	17.2
38	LCL	II	J36	3, 4	22, 23		4KCDE Red	PHDC	J01B	2	9	0,0
39	LCL	II	J08	3, 4	22, 23		REU belts 0&1	PHBAR	J142	5	13	13,8
40	LCL	II	J30	3, 4	22, 23		REU belts 2&3	PHBAR	J142	3	11	13,8
41	LCL	II	J30	5, 6	24, 25		REU belts 4&5	PHBAR	J142	1	9	13,8
42	LCL	II	J08	5, 6	24, 25		REU belts 6&7	PHBAN	J141	5	13	13,8
43	LCL	II	J32	3, 4	22, 23		REU belts 8&9	PHBAN	J141	3	11	13,8
44	LCL	II	J06	3, 4	22, 23		REU belts 10&11	PHBAN	J141	1	9	13,8
59	Par-LCL	III	J08	13, 14	32, 33		4KC Drive bus Nom	PHDJ	J01	1,2	14,15	62,0
60	Par-LCL	III	J08	11, 12	30, 31		4KC Drive bus Nom	PHDJ	J01	3,4	16,17	62,0
61	Par-LCL	III	J30	13, 14	32, 33		4KC Drive bus Red	PHDJ	J01	5,6	18,19	0,0
62	Par-LCL	III	J30	11, 12	30, 31		4KC Drive bus Red	PHDJ	J01	7,8	20,21	0,0

Table 4.1.1-1: PCDU HFI I/F's

All the others HFI units don't have directly interface with PCDU and the power supply will be provide them as described in the diagram of Fig.4.1.1-1.

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The S/C data handling subsystem (CDMU) shall provide two Mil 1553 Bus links to the nominal DPU, and two Mil 1553 Bus links to the redundant DPU.

Then the interfaces to be checked are reported in the Table 4.1.1-2:

Planck HFI	CDMU I/F 1553 Bus & OBT (Synch)	Conn	Pin(true)	Pin(comp)
4KCCU (PHDA)	N/A	-	-	-
4KCAU (PHDB)	N/A	-	-	-
4KCDE (PHDC)	N/A	-	-	-
4KCCR (PHDJ)	N/A	-	-	-
PAU (PHCBA)	N/A	-	-	-
REU (PHCBC)	N/A	-	-	-
DCCU (PHEB)	N/A	-	-	-
DPU nom. (PHBAN)	1 + 1 OBT (Synch)	J01 (Bus A) J02 (Bus B) + J15	2 2 + 2 (OBT+)	6 6 + 6 (OBT-)
DPU red. (PHBAR)	1 + 1 OBT (Synch)	J01 (Bus A) J02 (Bus B) + J15	2 2 + 2 (OBT+)	6 6 + 6 (OBT-)

Table 4.1.1-2: CDMU HFI I/F's

All the SVM I/F's with PCDU and CDMU are described in the following diagram of Fig.4.1.1-1:

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Fig. 4.1.1-1: HFI SVM I/F's

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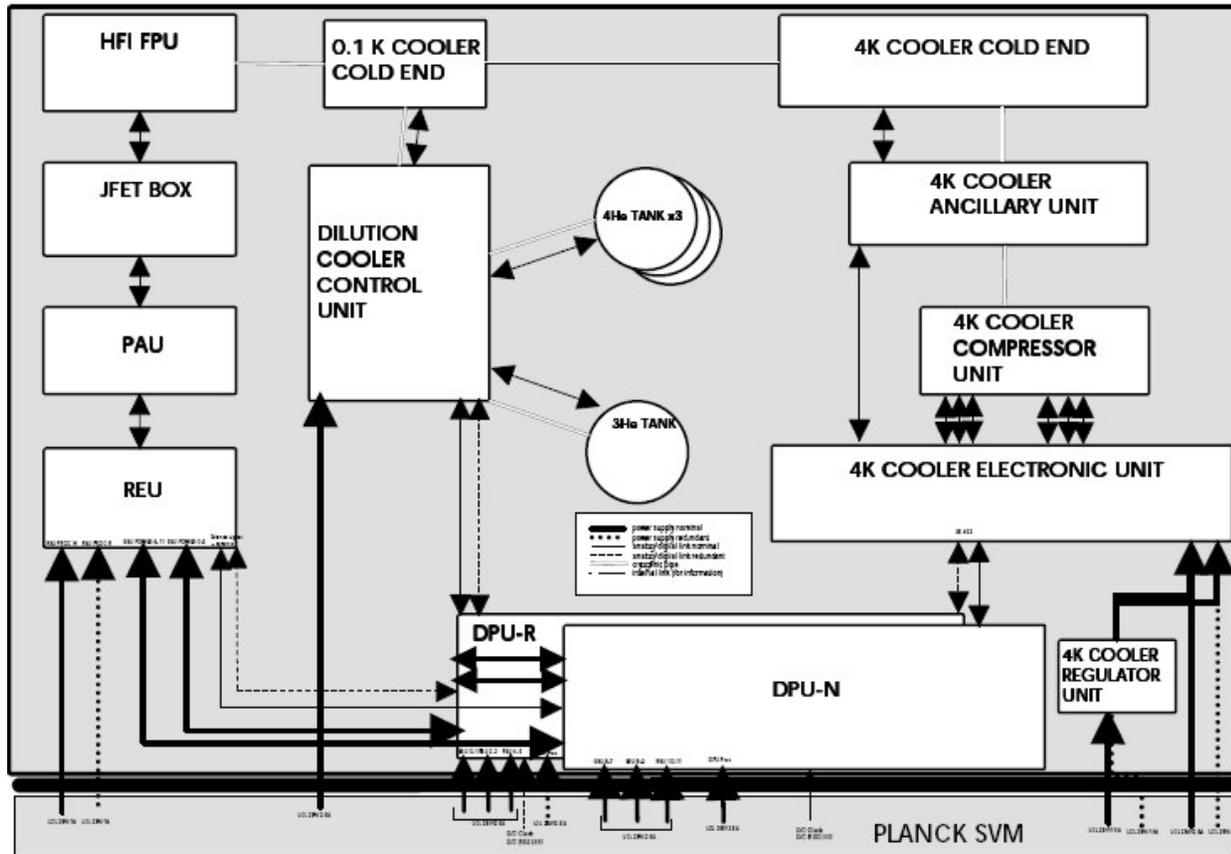
### 4.1.2 HFI I&T Verification

The I&T verification, for each HFI warm unit, will be performed as described here below:

REU (PHCBC):

➢ Install BOB#1 (main) between the connector PHCBC-12P07 to PHCBC-12J07 (without cross strap)

➢ Install BOB#2 (red.) between the connector PHCBC-13P07 to PHCBC-13J07 (without cross strap)

➢ On BOB#1 and BOB#2, using the digital ohmmeter, check the Unit insulation (Unit Side):
Value Required > 1Mohm (between RTN line (pin 4) and GND)

➢ Execute satellite "POWER-ON"

➢ Install Digital Voltmeter on both BOB's on Pin 2(+) & 4(-)

➢ Send the command Switch ON to the power line (main) for HFI REU: **DC11D170**

➢ Verify with digital Voltmeter on BOB#1 between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB#2 between Pin 2(+) & 4(-): **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL11) = ON**
  ➢ **STS (LCL12) = OFF**
  ➢ **ITLM_(LCL11) = 0 Amp**
  ➢ **ITLM (LCL12) = 0 Amp**

➢ Send the command Switch ON to the power line (red.) for HFI REU: **DC12D170**

➢ Verify with digital Voltmeter on BOB#1 between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB#2 between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL11) = ON**
  ➢ **STS (LCL12) = ON**
  ➢ **ITLM_(LCL11) = 0 Amp**
  ➢ **ITLM (LCL12) = 0 Amp**

➢ Send the command Switch OFF to the power line (main) for HFI REU: **DC11B170**

➢ Send the command Switch OFF to the power line (red.) for HFI REU: **DC12B170**

➢ Verify with digital Voltmeter on both BOB's between Pin 2(+) & 4(-): **0 Volts**

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➢ Verify the following TLM parameters:
  ➢ **STS (LCL11) = OFF**
  ➢ **STS (LCL12) = OFF**
  ➢ **ITLM_(LCL11) = 0 Amp**
  ➢ **ITLM (LCL12) = 0 Amp**

➢ On both BOB's connect cross strap on pin: 2(+) & 4(-)

➢ Connect current probe on pin 2(+) of both BOB's in order to perform the In-Rush current verification

➢ Send the command Switch ON to the power line (main) for HFI REU: **DC11D170**

➢ Verify/record for both REU (main and red.) inrush current (no LCL's intervention has to be verified):
  I $_{overshoot}$ = 2.10 A max
  T $_{overshoot}$ ≤ 50 µsec
  I $_{nom}$ = 872 mA (after 5msec)

➢ Send the command Switch OFF to the power line (main) for HFI REU: **DC11B170**

➢ Repeat the same verification on the power line (red.) for HFI REU

➢ Remove BOB's and connect the power connectors to the relevant harness receptacle ones

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4KCDE (PHDC):

- Install BOB#1 (main) between the connector PHDC-P01A to PHDC-J01A (without cross strap)

- Install BOB#2 (red.) between the connector PHDC-P01B to PHDC-J01B (without cross strap)

- On BOB#1 and BOB#2, using the digital ohmmeter, check the Unit insulation (Unit Side): **Value Required > 1Mohm** (between RTN line (pin 9) and GND)

- Execute satellite "POWER-ON"

- Install Digital Voltmeter on both BOB's on Pin 2(+) & 9(-)

- Send the command Switch ON to the power line (main) for HFI 4KCDE: **DC37D170**

- Verify with digital Voltmeter on BOB#1 between Pin 2(+) & 9(-): **28 Volts +1% and - 4%**

- Verify with digital Voltmeter on BOB#2 between Pin 2(+) & 9(-): **0 Volts**

- Verify the following TLM parameters:
  - **STS (LCL37) = ON**
  - **STS (LCL38) = OFF**
  - **ITLM_(LCL37) = 0 Amp**
  - **ITLM (LCL38) = 0 Amp**

- Send the command Switch ON to the power line (red.) for HFI 4KCDE: **DC38D170**

- Verify with digital Voltmeter on BOB#1 between Pin 2(+) & 9(-): **28 Volts +1% and - 4%**

- Verify with digital Voltmeter on BOB#2 between Pin 2(+) & 9(-): **28 Volts +1% and - 4%**

- Verify the following TLM parameters:
  - **STS (LCL37) = ON**
  - **STS (LCL38) = ON**
  - **ITLM_(LCL37) = 0 Amp**
  - **ITLM (LCL38) = 0 Amp**

- Send the command Switch OFF to the power line (main) for HFI 4KCDE: **DC37B170**

- Send the command Switch OFF to the power line (red.) for HFI 4KCDE: **DC38B170**

- Verify with digital Voltmeter on both BOB's between Pin 2(+) & 9(-): **0 Volts**

- Verify the following TLM parameters:
  - **STS (LCL37) = OFF**
  - **STS (LCL38) = OFF**
  - **ITLM_(LCL37) = 0 Amp**
  - **ITLM (LCL38) = 0 Amp**

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➢ On both BOB's connect cross strap on pin: 2(+) & 9(-)

➢ Connect current probe on pin 2(+) of both BOB's in order to perform the In-Rush current verification

➢ Send the command Switch ON to the power line (main) for HFI 4KCDE: **DC37D170**

➢ Verify/record for both 4KCDE (main and red.) inrush current (no LCL's intervention has to be verified):
$I_{overshoot}$ = 5.50 A max
$T_{overshoot}$ ≤ 50 µsec
I_{nom} = 625 mA (after 5msec)

➢ Send the command Switch OFF to the power line (main) for HFI 4KCDE: **DC37B170**

➢ Repeat the same verification on the power line (red.) for HFI 4KCDE

➢ Remove BOB's and connect the power connectors to the relevant harness receptacle ones

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DCCU (DCE) (PHEB):

➢ Install BOB between the connector PHEB-P01 to PHEB-J01 (without cross strap)

➢ On BOB, using the digital ohmmeter, check the Unit insulation (Unit Side):
  Value Required > 1Mohm (between RTN line (pin 6) and GND)

➢ Execute satellite "POWER-ON"

➢ Install Digital Voltmeter on both BOB's on Pin 2(+) & 6(-)

➢ Send the command Switch ON to the power line for HFI DCCU (DCE): **DC36D170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 6(-): **28 Volts +1% and - 4%**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL36) = ON**
  ➢ **ITLM_(LCL36) = 0 Amp**

➢ Send the command Switch OFF to the power line (main) for HFI DCCU (DCE): **DC36B170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 6(-): **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL36) = OFF**
  ➢ **ITLM_(LCL36) = 0 Amp**

➢ On both BOB connect cross strap on pin: 2(+) & 6(-)

➢ Connect current probe on pin 2(+) of BOB in order to perform the In-Rush current verification

➢ Send the command Switch ON to the power line for HFI DCCU (DCE): **DC36D170**

➢ Verify/record for both DCCU (DCE) inrush current (no LCL's intervention has to be verified):
  $I_{overshoot}$ **= 5.50 A max**
  $T_{overshoot}$ **≤ 50 µsec**
  I_{nom} **= 581 mA (after 5msec)**

➢ Send the command Switch OFF to the power line (main) for HFI DCCU (DCE): **DC36B170**

➢ Remove BOB and connect the power connectors to the relevant harness receptacle one.

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4KCCR (PHDJ):

➢ Install BOB between the connector PHDJ-P01 to PHDJ-J01 (without cross strap)

➢ On BOB, using the digital ohmmeter, check the Unit insulation (Unit Side):
Value Required > 1Mohm (between RTN line (pin 14, pin 15, pin 16, pin 17, pin 18, pin 19, pin 20, pin 21) and GND)

➢ Execute satellite "POWER-ON"

➢ Install Digital Voltmeter on BOB on:
Pin 1(+) & 14(-)
Pin 2(+) & 15(-)
Pin 3(+) & 16(-)
Pin 4(+) & 17(-)
Pin 5(+) & 18(-)
Pin 6(+) & 19(-)
Pin 7(+) & 20(-)
Pin 8(+) & 21(-)

➢ Send the command Switch ON to the power line (main) for HFI 4KCCR: **DC59D170**

➢ Verify with digital Voltmeter on BOB between Pin 1(+) & 14(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 15(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 3(+) & 16(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin 4(+) & 17(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin 5(+) & 18(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin 6(+) & 19(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin 7(+) & 20(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin 8(+) & 21(-): **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL59) = ON**
  ➢ **STS (LCL60) = OFF**
  ➢ **STS (LCL61) = OFF**
  ➢ **STS (LCL62) = OFF**
  ➢ **ITLM_(LCL59) = 0 Amp**
  ➢ **ITLM (LCL60) = 0 Amp**
  ➢ **ITLM_(LCL61) = 0 Amp**
  ➢ **ITLM (LCL62) = 0 Amp**

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➢ Send the command Switch ON to the power line (main) for HFI 4KCCR: **DC60D170**

➢ Verify with digital Voltmeter on BOB between Pin 1(+) & 14(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 15(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 3(+) & 16(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 4(+) & 17(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 5(+) & 18(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin 6(+) & 19(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin 7(+) & 20(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin 8(+) & 21(-): **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL59) = ON**
  ➢ **STS (LCL60) = ON**
  ➢ **STS (LCL61) = OFF**
  ➢ **STS (LCL62) = OFF**
  ➢ **ITLM_(LCL59) = 0 Amp**
  ➢ **ITLM (LCL60) = 0 Amp**
  ➢ **ITLM_(LCL61) = 0 Amp**
  ➢ **ITLM (LCL62) = 0 Amp**

➢ Send the command Switch ON to the power line (red.) for HFI 4KCCR: **DC61D170**

➢ Verify with digital Voltmeter on BOB between Pin 1(+) & 14(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 15(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 3(+) & 16(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 4(+) & 17(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 5(+) & 18(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 6(+) & 19(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 7(+) & 20(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin 8(+) & 21(-): **0 Volts**

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- ➢ Verify the following TLM parameters:
    - ➢ **STS (LCL59) = ON**
    - ➢ **STS (LCL60) = ON**
    - ➢ **STS (LCL61) = ON**
    - ➢ **STS (LCL62) = OFF**
    - ➢ **ITLM_(LCL59) = 0 Amp**
    - ➢ **ITLM (LCL60) = 0 Amp**
    - ➢ **ITLM_(LCL61) = 0 Amp**
    - ➢ **ITLM (LCL62) = 0 Amp**

- ➢ Send the command Switch ON to the power line (red.) for HFI 4KCCR: **DC62D170**

- ➢ Verify with digital Voltmeter on BOB between Pin 1(+) & 14(-): **28 Volts +1% and - 4%**

- ➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 15(-): **28 Volts +1% and - 4%**

- ➢ Verify with digital Voltmeter on BOB between Pin 3(+) & 16(-): **28 Volts +1% and - 4%**

- ➢ Verify with digital Voltmeter on BOB between Pin 4(+) & 17(-): **28 Volts +1% and - 4%**

- ➢ Verify with digital Voltmeter on BOB between Pin 5(+) & 18(-): **28 Volts +1% and - 4%**

- ➢ Verify with digital Voltmeter on BOB between Pin 6(+) & 19(-): **28 Volts +1% and - 4%**

- ➢ Verify with digital Voltmeter on BOB between Pin 7(+) & 20(-): **28 Volts +1% and - 4%**

- ➢ Verify with digital Voltmeter on BOB between Pin 8(+) & 21(-): **28 Volts +1% and - 4%**

- ➢ Verify the following TLM parameters:
    - ➢ **STS (LCL59) = ON**
    - ➢ **STS (LCL60) = ON**
    - ➢ **STS (LCL61) = ON**
    - ➢ **STS (LCL62) = ON**
    - ➢ **ITLM_(LCL59) = 0 Amp**
    - ➢ **ITLM (LCL60) = 0 Amp**
    - ➢ **ITLM_(LCL61) = 0 Amp**
    - ➢ **ITLM (LCL62) = 0 Amp**

- ➢ Send the command Switch OFF to the power line (main) for HFI 4KCCR: **DC59B170**

- ➢ Send the command Switch OFF to the power line (main) for HFI 4KCCR: **DC60B170**

- ➢ Send the command Switch OFF to the power line (red.) for HFI 4KCCR: **DC61B170**

- ➢ Send the command Switch OFF to the power line (red.) for HFI 4KCCR: **DC62B170**

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- ➢ Verify with digital Voltmeter on BOB between Pin 1(+) & 14(-): **0 Volts**

- ➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 15(-): **0 Volts**

- ➢ Verify with digital Voltmeter on BOB between Pin 3(+) & 16(-): **0 Volts**

- ➢ Verify with digital Voltmeter on BOB between Pin 4(+) & 17(-): **0 Volts**

- ➢ Verify with digital Voltmeter on BOB between Pin 5(+) & 18(-): **0 Volts**

- ➢ Verify with digital Voltmeter on BOB between Pin 6(+) & 19(-): **0 Volts**

- ➢ Verify with digital Voltmeter on BOB between Pin 7(+) & 20(-): **0 Volts**

- ➢ Verify with digital Voltmeter on BOB between Pin 8(+) & 21(-): **0 Volts**

- ➢ Verify the following TLM parameters:
  - ➢ **STS (LCL59) = OFF**
  - ➢ **STS (LCL60) = OFF**
  - ➢ **STS (LCL61) = OFF**
  - ➢ **STS (LCL62) = OFF**
  - ➢ **ITLM_(LCL59) = 0 Amp**
  - ➢ **ITLM (LCL60) = 0 Amp**
  - ➢ **ITLM_(LCL61) = 0 Amp**
  - ➢ **ITLM (LCL62) = 0 Amp**

- ➢ On both BOB's connect cross strap on:
  Pin 1(+) & 14(-)
  Pin 2(+) & 15(-)
  Pin 3(+) & 16(-)
  Pin 4(+) & 17(-)
  Pin 5(+) & 18(-)
  Pin 6(+) & 19(-)
  Pin 7(+) & 20(-)
  Pin 8(+) & 21(-)

- ➢ Connect current probe on pin (+) of BOB in order to perform the In-Rush current verification

- ➢ Send the command Switch ON to the power line (main) for HFI 4KCCR: **DC59D170**

- ➢ Send the command Switch ON to the power line (main) for HFI 4KCCR: **DC60D170**

- ➢ Verify/record for both 4KCCR (main and red.) inrush current (no LCL's intervention has to be verified):
  I $_{overshoot}$ = 11.0 A max
  T $_{overshoot}$ ≤ 50 µsec
  I $_{nom}$ = 2.25 A (after 5msec)

➢ Send the command Switch OFF to the power line (main) for HFI 4KCCR: **DC59B170**

➢ Send the command Switch OFF to the power line (main) for HFI 4KCCR: **DC60B170**

➢ Repeat the same verification on the power lines (red.) for HFI 4KCCR

➢ Remove BOB and connect the power connectors to the relevant harness receptacle one

DPU nom. (PHBAN):

➢ Verify that the **RT Add** = **16**

➢ Install BOB#1 between the connector PHBAN-P05 to PHBAN-J05 (without cross strap)

➢ Install BOB#2 between the connector PHBAN-P141 to PHBAN-J141 (without cross strap)

➢ On BOB's, using the digital ohmmeter, check the Unit insulation (Unit Side):
Value Required > 1Mohm (between RTN line (pin 4, pin 13, pin 11, pin 9) and GND)

➢ Execute satellite "POWER-ON"

➢ Install Digital Voltmeter on both BOB's on:
Pin 2(+) & 4(-)
Pin 5(+) & 13(-)
Pin 3(+) & 11(-)
Pin 1(+) & 9(-)

➢ Send the command Switch ON to the power line for HFI DPU nom.: **DC29D170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 5(+) & 13(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin 3(+) & 11(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin 1(+) & 9(-): **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL29) = ON**
  ➢ **STS (LCL42) = OFF**
  ➢ **STS (LCL43) = OFF**
  ➢ **STS (LCL44) = OFF**
  ➢ **ITLM_(LCL29) = 0 Amp**
  ➢ **ITLM (LCL42) = 0 Amp**
  ➢ **ITLM_(LCL43) = 0 Amp**
  ➢ **ITLM (LCL44) = 0 Amp**

➢ Send the command Switch ON to the power line for HFI DPU (REU belts 6&7): **DC42D170**

➤ Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➤ Verify with digital Voltmeter on BOB between Pin 5(+) & 13(-): **28 Volts +1% and - 4%**

➤ Verify with digital Voltmeter on BOB between Pin 3(+) & 11(-): **0 Volts**

➤ Verify with digital Voltmeter on BOB between Pin 1(+) & 9(-): **0 Volts**

➤ Verify the following TLM parameters:
  ➤ **STS (LCL29) = ON**
  ➤ **STS (LCL42) = ON**
  ➤ **STS (LCL43) = OFF**
  ➤ **STS (LCL44) = OFF**
  ➤ **ITLM_(LCL29) = 0 Amp**
  ➤ **ITLM (LCL42) = 0 Amp**
  ➤ **ITLM_(LCL43) = 0 Amp**
  ➤ **ITLM (LCL44) = 0 Amp**

➤ Send the command Switch ON to the power line for HFI DPU (REU belts 8&9): **DC43D170**

➤ Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➤ Verify with digital Voltmeter on BOB between Pin 5(+) & 13(-): **28 Volts +1% and - 4%**

➤ Verify with digital Voltmeter on BOB between Pin 3(+) & 11(-): **28 Volts +1% and - 4%**

➤ Verify with digital Voltmeter on BOB between Pin 1(+) & 9(-): **0 Volts**

➤ Verify the following TLM parameters:
  ➤ **STS (LCL29) = ON**
  ➤ **STS (LCL42) = ON**
  ➤ **STS (LCL43) = ON**
  ➤ **STS (LCL44) = OFF**
  ➤ **ITLM_(LCL29) = 0 Amp**
  ➤ **ITLM (LCL42) = 0 Amp**
  ➤ **ITLM_(LCL43) = 0 Amp**
  ➤ **ITLM (LCL44) = 0 Amp**

➤ Send the command Switch ON to the power line for HFI DPU (REU belts 10&11): **DC44D170**

➤ Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➤ Verify with digital Voltmeter on BOB between Pin 5(+) & 13(-): **28 Volts +1% and - 4%**

➤ Verify with digital Voltmeter on BOB between Pin 3(+) & 11(-): **28 Volts +1% and - 4%**

➤ Verify with digital Voltmeter on BOB between Pin 1(+) & 9(-): **28 Volts +1% and - 4%**

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➢ Verify the following TLM parameters:
  ➢ **STS (LCL29) = ON**
  ➢ **STS (LCL42) = ON**
  ➢ **STS (LCL43) = ON**
  ➢ **STS (LCL44) = ON**
  ➢ **ITLM_(LCL29) = 0 Amp**
  ➢ **ITLM (LCL42) = 0 Amp**
  ➢ **ITLM_(LCL43) = 0 Amp**
  ➢ **ITLM (LCL44) = 0 Amp**

➢ Send the command Switch OFF to the power line for HFI DPU nom.: **DC29B170**

➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 6&7): **DC42B170**

➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 8&9): **DC43B170**

➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 10&11): **DC44B170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin 5(+) & 13(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin 3(+) & 11(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin 1(+) & 9(-): **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL29) = OFF**
  ➢ **STS (LCL42) = OFF**
  ➢ **STS (LCL43) = OFF**
  ➢ **STS (LCL44) = OFF**
  ➢ **ITLM_(LCL29) = 0 Amp**
  ➢ **ITLM (LCL42) = 0 Amp**
  ➢ **ITLM_(LCL43) = 0 Amp**
  ➢ **ITLM (LCL44) = 0 Amp**

➢ On both BOB's connect cross strap on:
  Pin 2(+) & 4(-)
  Pin 5(+) & 13(-)
  Pin 3(+) & 11(-)
  Pin 1(+) & 9(-)

➢ Connect current probe on pin (+) of both BOB's in order to perform the In-Rush current verification

➢ Send the command Switch ON to the power line for HFI DPU nom.: **DC29D170**

➢ Send the command Switch ON to the power line for HFI DPU (REU belts 6&7): **DC42D170**

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➢ Send the command Switch ON to the power line for HFI DPU (REU belts 8&9): **DC43D170**

➢ Send the command Switch ON to the power line for HFI DPU (REU belts 10&11): **DC44D170**

➢ Verify/record for DPU nom. inrush current (no LCL's intervention has to be verified):
I $_{overshoot}$ = 5.50 A max
T$_{overshoot}$ ≤ 50 μsec
I $_{nom}$ = 909 mA (after 5msec)

➢ Send the command Switch OFF to the power line for HFI DPU nom.: **DC29B170**

➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 6&7): **DC42B170**

➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 8&9): **DC43B170**

➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 10&11): **DC44B170**

➢ Send the command Switch ON to the power line for HFI DPU nom.: **DC29D170**

➢ Verify by digital probe on connector J15 ["T" adapter pin 2 (OBT+) and 6 (OBT-)], the OBT characteristics:

  ➢ **Differential Output Voltage** $2.0V ≤ |V| ≤ 5.5V$
  ➢ **Frequency**   131.072 KHz
  ➢ **Rise Time** $0.1μS ≤ |T_{rise}| ≤ 0.8μS$
  ➢ **Fall Time** $0.1μS ≤ |T_{fall}| ≤ 0.3μS$
  ➢ **Jitter**   ± 150 nsec

  Note: The OBT verification has to be performed Unloaded (Verification polarity) and Loaded (Timing verification).

➢ Send the command Switch OFF to the power line for HFI DPU nom.: **DC29B170**

➢ Remove BOB's and connect the power connectors to the relevant harness receptacle ones.

➢ Send the command Switch ON to the power line for HFI DPU nom.: **DC29D170**

➢ Send the command Switch ON to the power line for HFI DPU (REU belts 6&7): **DC42D170**

➢ Send the command Switch ON to the power line for HFI DPU (REU belts 8&9): **DC43D170**

➢ Send the command Switch ON to the power line for HFI DPU (REU belts 10&11): **DC44D170**

➢ Install **"T"** adapters on connector PHBAN-P01 to PHBAN-J01 and install the Oscilloscope with differential probe to the "T" adapter in order to verify the correct 1553B signal amplitude pin:
2(True) and 6(comp)

➢ With differential probe, verify the peak to peak voltage levels:
   Between 1V ÷ 14 V BC in Transmission
   Between 18V ÷ 27V RT in Transmission
   T_{rise} **and** T_{fall} **= 100 nsec ÷ 300 nsec**

➢ Send the command Switch Over from bus A to bus B dedicate to HFI DPU nom.: **TC(8,4,10,1)**

➢ Install **"T"** adapter on connector PHBAN-P02 to PHBAN-J02 and install the Oscilloscope with differential probe to the "T" adapter in order to verify the correct 1553B signal amplitude pin:
   2(True) and 6(comp)

➢ With differential probe, verify the peak to peak voltage levels:
   Between 1V ÷ 14 V BC in Transmission
   Between 18V ÷ 27V RT in Transmission
   T_{rise} **and** T_{fall} **= 100 nsec ÷ 300 nsec**

➢ Send the command Switch OFF to the power line for HFI DPU nom.: **DC29B170**

➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 6&7): **DC42B170**

➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 8&9): **DC43B170**

➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 10&11): **DC44B170**

➢ Remove the **"T"** adapter connectors and connect all the 1553B connectors to the relevant harness receptacle ones.

➢ Re-install a BOB on connector J141 and put a cross strap on:
   Pin 5(+) & 13(-)
   Pin 3(+) & 11(-)
   Pin 1(+) & 9(-)

➢ Connect current probe on pin (+) of both BOB's in order to perform the In-Rush current verification

➢ Send the command Switch ON to the power line for HFI DPU nom.: **DC29D170**

➢ Send the command Switch ON to the power line for HFI DPU (REU belts 6&7): **DC42D170**

➢ Send the command Switch ON to the power line for HFI DPU (REU belts 8&9): **DC43D170**

➢ Send the command Switch ON to the power line for HFI DPU (REU belts 10&11): **DC44D170**

➢ Switching ON each dedicated line (REU belts 6&7, 8&9, 10&11), verify/record inrush current (no LCL's intervention has to be verified):
   I $_{overshoot}$ **= 5.50 A max**
   T $_{overshoot}$ **≤ 50 µsec**
   I $_{nom}$ **= 500 mA (after 5msec)**

➢ Send the command Switch OFF to the power line for HFI DPU nom.: **DC29B170**

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➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 6&7): **DC42B170**

➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 8&9): **DC43B170**

➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 10&11): **DC44B170**

DPU red. (PHBAR):

➢ Verify that the **RT Add** = **17**

➢ Install BOB#1 between the connector PHBAR-P05 to PHBAR-J05 (without cross strap)

➢ Install BOB#2 between the connector PHBAR-P142 to PHBAR-J142 (without cross strap)

➢ On BOB's, using the digital ohmmeter, check the Unit insulation (Unit Side):
Value Required > 1Mohm (between RTN line (pin 4, pin 13, pin 11, pin 9) and GND)

➢ Execute satellite "POWER-ON"

➢ Install Digital Voltmeter on both BOB's on:
Pin 2(+) & 4(-)
Pin 5(+) & 13(-)
Pin 3(+) & 11(-)
Pin 1(+) & 9(-)

➢ Send the command Switch ON to the power line for HFI DPU red.: **DC30D170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 5(+) & 13(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin 3(+) & 11(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin 1(+) & 9(-): **0 Volts**
➢ Verify the following TLM parameters:
  ➢ **STS (LCL30) = ON**
  ➢ **STS (LCL39) = OFF**
  ➢ **STS (LCL40) = OFF**
  ➢ **STS (LCL41) = OFF**
  ➢ **ITLM_(LCL30) = 0 Amp**
  ➢ **ITLM (LCL39) = 0 Amp**
  ➢ **ITLM_(LCL40) = 0 Amp**
  ➢ **ITLM (LCL41) = 0 Amp**

➢ Send the command Switch ON to the power line for HFI DPU (REU belts 0&1): **DC39D170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

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➢ Verify with digital Voltmeter on BOB between Pin 5(+) & 13(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 3(+) & 11(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin 1(+) & 9(-): **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL30) = ON**
  ➢ **STS (LCL39) = ON**
  ➢ **STS (LCL40) = OFF**
  ➢ **STS (LCL41) = OFF**
  ➢ **ITLM_(LCL30) = 0 Amp**
  ➢ **ITLM (LCL39) = 0 Amp**
  ➢ **ITLM_(LCL40) = 0 Amp**
  ➢ **ITLM (LCL41) = 0 Amp**

➢ Send the command Switch ON to the power line for HFI DPU (REU belts 2&3): **DC40D170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 5(+) & 13(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 3(+) & 11(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 1(+) & 9(-): **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL30) = ON**
  ➢ **STS (LCL39) = ON**
  ➢ **STS (LCL40) = ON**
  ➢ **STS (LCL41) = OFF**
  ➢ **ITLM_(LCL30) = 0 Amp**
  ➢ **ITLM (LCL39) = 0 Amp**
  ➢ **ITLM_(LCL40) = 0 Amp**
  ➢ **ITLM (LCL41) = 0 Amp**

➢ Send the command Switch ON to the power line for HFI DPU (REU belts 4&5): **DC41D170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 5(+) & 13(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 3(+) & 11(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin 1(+) & 9(-): **28 Volts +1% and - 4%**

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- Verify the following TLM parameters:
  - **STS (LCL30) = ON**
  - **STS (LCL39) = ON**
  - **STS (LCL40) = ON**
  - **STS (LCL41) = ON**
  - **ITLM_(LCL30) = 0 Amp**
  - **ITLM (LCL39) = 0 Amp**
  - **ITLM_(LCL40) = 0 Amp**
  - **ITLM (LCL41) = 0 Amp**

- Send the command Switch OFF to the power line for HFI DPU red.: **DC30B170**

- Send the command Switch OFF to the power line for HFI DPU (REU belts 0&1): **DC39B170**

- Send the command Switch OFF to the power line for HFI DPU (REU belts 2&3): **DC40B170**

- Send the command Switch OFF to the power line for HFI DPU (REU belts 4&5): **DC41B170**

- Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **0 Volts**

- Verify with digital Voltmeter on BOB between Pin 5(+) & 13(-): **0 Volts**

- Verify with digital Voltmeter on BOB between Pin 3(+) & 11(-): **0 Volts**

- Verify with digital Voltmeter on BOB between Pin 1(+) & 9(-): **0 Volts**

- Verify the following TLM parameters:
  - **STS (LCL30) = OFF**
  - **STS (LCL39) = OFF**
  - **STS (LCL40) = OFF**
  - **STS (LCL41) = OFF**
  - **ITLM_(LCL30) = 0 Amp**
  - **ITLM (LCL39) = 0 Amp**
  - **ITLM_(LCL40) = 0 Amp**
  - **ITLM (LCL41) = 0 Amp**

- On both BOB's connect cross strap on:
  Pin 2(+) & 4(-)
  Pin 5(+) & 13(-)
  Pin 3(+) & 11(-)
  Pin 1(+) & 9(-)

- Connect current probe on pin (+) of both BOB's in order to perform the In-Rush current verification

- Send the command Switch ON to the power line for HFI DPU red.: **DC30D170**

- Send the command Switch ON to the power line for HFI DPU (REU belts 0&1): **DC39D170**

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➢ Send the command Switch ON to the power line for HFI DPU (REU belts 2&3): **DC40D170**

➢ Send the command Switch ON to the power line for HFI DPU (REU belts 4&5): **DC41D170**

➢ Verify/record for DPU red. inrush current (no LCL's intervention has to be verified):
   I $_{overshoot}$ = 5.50 A max
   T $_{overshoot}$ ≤ 50 μsec
   I $_{nom}$ = 909 mA (after 5msec)

➢ Send the command Switch OFF to the power line for HFI DPU red.: **DC30B170**

➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 0&1): **DC39B170**

➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 2&3): **DC40B170**

➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 4&5): **DC41B170**

➢ Send the command Switch ON to the power line for HFI DPU red.: **DC30D170**

➢ Verify by digital probe on connector J15 ["T" adapter pin 2 (OBT+) and 6 (OBT-)], the OBT characteristics:

   ➢ **Differential Output Voltage**   2.0V ≤ |V| ≤ 5.5V
   ➢ **Frequency**   131.072 KHz
   ➢ **Rise Time** $0.1\mu S ≤ |T_{rise}| ≤ 0.8\mu S$
   ➢ **Fall Time** $0.1\mu S ≤ |T_{fall}| ≤ 0.3\mu S$
   ➢ **Jitter**   ± 150 nsec

   Note: The OBT verification has to be performed Unloaded (Verification polarity) and Loaded (Timing verification).

➢ Send the command Switch OFF to the power line for HFI DPU red.: **DC30B170**

➢ Remove BOB's and connect the power connectors to the relevant harness receptacle ones.

➢ Send the command Switch ON to the power line for HFI DPU red.: **DC30D170**

➢ Send the command Switch ON to the power line for HFI DPU (REU belts 0&1): **DC39D170**

➢ Send the command Switch ON to the power line for HFI DPU (REU belts 2&3): **DC40D170**

➢ Send the command Switch ON to the power line for HFI DPU (REU belts 4&5): **DC41D170**

➢ Install **"T"** adapters on connector PHBAN-P01 to PHBAN-J01 and install the Oscilloscope with differential probe to the "T" adapter in order to verify the correct 1553B signal amplitude pin:
   2(True) and 6(comp)

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➢ With differential probe, verify the peak to peak voltage levels:
   Between 1V ÷ 14 V BC in Transmission
   Between 18V ÷ 27V RT in Transmission
   T_{rise} and T_{fall} = 100 nsec ÷ 300 nsec

➢ Send the command Switch Over from bus A to bus B dedicate to HFI DPU red.: **TC(8,4,10,1)**

➢ Install **"T"** adapter on connector PHBAN-P02 to PHBAN-J02 and install the Oscilloscope with differential probe to the "T" adapter in order to verify the correct 1553B signal amplitude pin:
   2(True) and 6(comp)

➢ With differential probe, verify the peak to peak voltage levels:
   Between 1V ÷ 14 V BC in Transmission
   Between 18V ÷ 27V RT in Transmission
   T_{rise} and T_{fall} = 100 nsec ÷ 300 nsec

➢ Send the command Switch OFF to the power line for HFI DPU red.: **DC30B170**

➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 0&1): **DC39B170**

➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 2&3): **DC40B170**

➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 4&5): **DC41B170**

➢ Remove the **"T"** adapter connectors and connect all the 1553B connectors to the relevant harness receptacle ones.

➢ Re-install a BOB on connector J142 and put a cross strap on:
   Pin 5(+) & 13(-)
   Pin 3(+) & 11(-)
   Pin 1(+) & 9(-)

➢ Connect current probe on pin (+) of both BOB's in order to perform the In-Rush current verification

➢ Send the command Switch ON to the power line for HFI DPU red.: **DC30D170**

➢ Send the command Switch ON to the power line for HFI DPU (REU belts 0&1): **DC39D170**

➢ Send the command Switch ON to the power line for HFI DPU (REU belts 2&3): **DC40D170**

➢ Send the command Switch ON to the power line for HFI DPU (REU belts 4&5): **DC41D170**

➢ Switching ON each dedicated line (REU belts 0&1, 2&3, 4&5), verify/record inrush current (no LCL's intervention has to be verified):
   I $_{overshoot}$ = 5.50 A max
   T $_{overshoot}$ ≤ 50 μsec
   I $_{nom}$ = 500 mA (after 5msec)

➢ Send the command Switch OFF to the power line for HFI DPU red.: **DC30B170**

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➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 0&1): **DC39B170**

➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 2&3): **DC40B170**

➢ Send the command Switch OFF to the power line for HFI DPU (REU belts 4&5): **DC41B170**

4.1.3 HFI UFT Verification

The HFI UFT verification will be performed as described here below:

<u>**DPU nom.**</u>

➢ Send the command Switch ON to the power line for HFI DPU nom.: **DC29D170**

➢ After the execution of boot, verify/record on DPU Housekeeping Parameter Report **TM(3,25) APID TBD** contains the following information:
   - ➢ **SID**   **TBD**
   - ➢ **Length**   **TBD**
   - ➢ **OBSID**   **TBD**
   - ➢ **BBID**   **TBD**
   - ➢ **Software Version**   **TBD**

➢ Verify that the **TM(3,25) APID TBD** is generated at rate of one Pkt/sec (TBC)

➢ Send the command Switch OFF to the power line for HFI DPU nom.: **DC29B170**

<u>**DPU red.**</u>

➢ Send the command Switch ON to the power line for HFI DPU red.: **DC30D170**

➢ After the execution of boot, verify/record on DPU Housekeeping Parameter Report **TM(3,25) APID TBD** contains the following information:
   - ➢ **SID**   **TBD**
   - ➢ **Length**   **TBD**
   - ➢ **OBSID**   **TBD**
   - ➢ **BBID**   **TBD**
   - ➢ **Software Version**   **TBD**

➢ Verify that the **TM(3,25) APID TBD1** is generated at rate of one Pkt/sec (TBC)

➢ Send the command Switch OFF to the power line for HFI DPU red.: **DC30B170**

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4.2 LFI

The LFI Warm Units will be installed on a dedicated lateral panel and on the Planck Sub platform:

- ➢ <u>P\L Sub PLT +X</u>: BEU
- ➢ <u>P\L Sub PLT –X</u>: DAE Power Box.
- ➢ <u>+Y+Z panel</u>: REBA (nom. + red.)

In the following table there are the project codes allocated to LFI warm units:

Project Code	Instrument Unit
PLBEU	Back End Unit (BEU)
PLAEF	DAE (Data Acquisition Electronic) Power Box
PLREN	REBA (nominal)
PLRER	REBA (redundant)

4.2.1 LFI SVM I/F's

The Power I/F's to be checked, for what concern the LFI warm unit, are reported in the Table 4.2.1-1:

LCL#	Type	Class	PCDU Conn	Pin+	Pin–		Planck LFI Allocation	Code	Conn	Pin+	Pin–	Avg Power [W]
27	LCL	II	J32	9, 10	28, 29		LFI REBA Nom	PLREN	J11	2	4	41,5
28	LCL	II	J06	9, 10	28, 29		LFI REBA Red	PLRER	J11	2	4	0,0
51	LCL	III	J08	7, 8	26, 27		LFI DAE Power Box Nom	PLAEF	J01	2	6	78,7
52	LCL	III	J30	7, 8	26, 27		LFI DAE Power Box Red	PLAEF	J02	2	6	0,0

Table 4.2.1-1: PCDU LFI I/F's

the other HFI unit doesn't have directly interface with PCDU and the power supply will be provide it as described in the diagram of Fig.4.2.1-1.

The Mil 1553 Bus I/F's to be checked, for what concern the LFI warm unit, are reported in the Table 4.2.1-2:

Planck LFI	Synch	CDMU I/F 1553 Bus	Conn	Pin(true)	Pin(comp)
PLAEF	N/A	N/A	-	-	-
PLBEU	1 OBT (Synch) 1 OBT (Synch)	N/A	J03 J04	1(OBT+) 1(OBT+)	6(OBT-) 6(OBT-)
PLREN	1 OBT (Synch)	1	J12 (OBT) J41(Bus A) J42(Bus B)	4(OBT+) 2 2	5(OBT-) 6 6
PLRER	1 OBT (Synch)	1	J12 (OBT) J41(Bus A) J42(Bus B)	4(OBT+) 2 2	5(OBT-) 6 6

Table 4.2.1-2: CDMU LFI I/F's

All the SVM I/F's with PCDU and CDMU are described in the following diagram of Fig.4.2.1-1:

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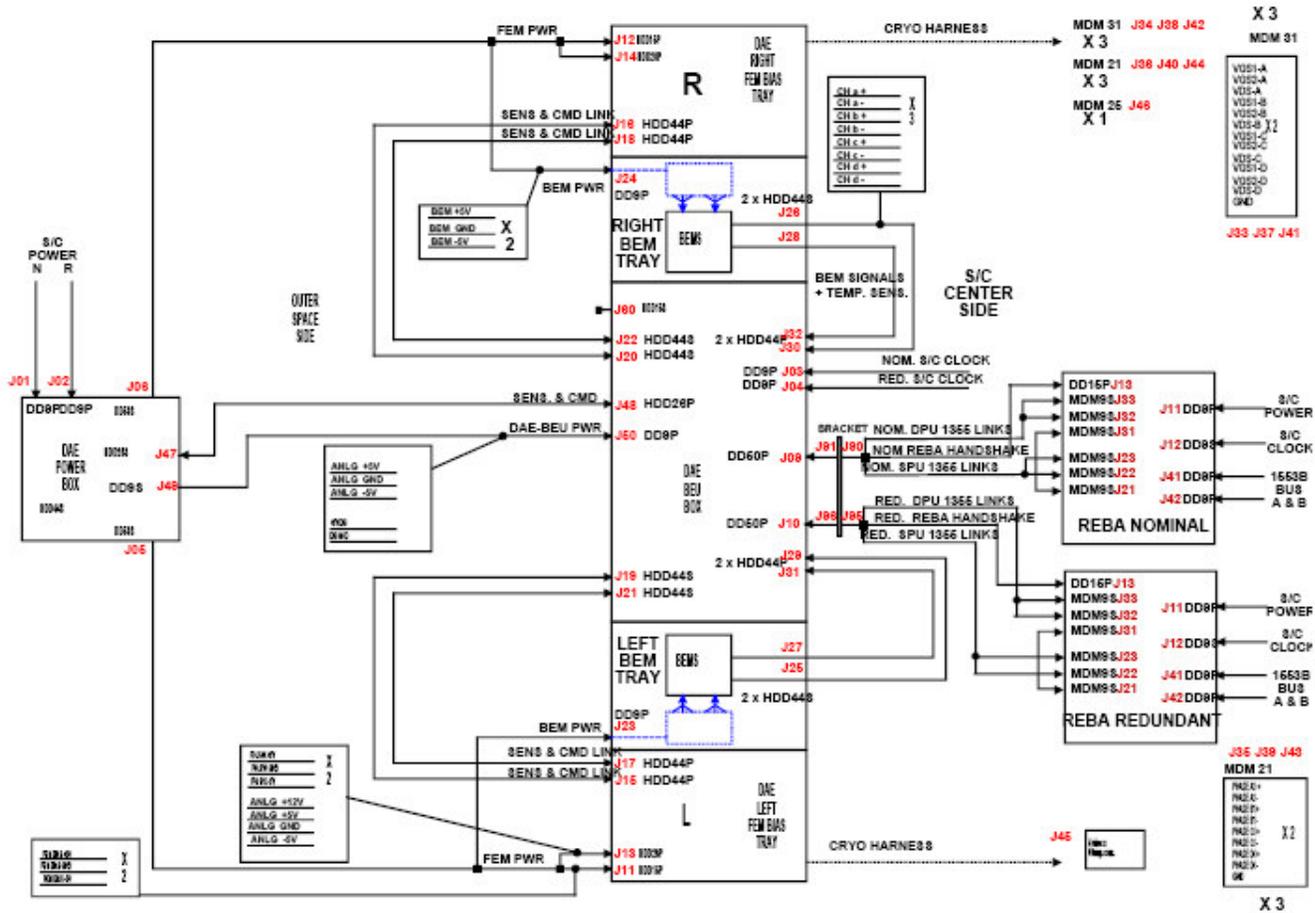
Fig. 4.2.1-1: LFI SVM I/F's

4.2.2 LFI I&T Verification

The I&T verification, for each LFI warm unit, will be performed as described here below:

DAE Power Box (PLAEF):

➢ Install BOB#1 (main) between the connector PLAEF-P01 to PLAEF-J01 (without cross strap)

➢ Install BOB#2 (red.) between the connector PLAEF-P02 to PLAEF-J02 (without cross strap)

➢ On BOB#1 and BOB#2, using the digital ohmmeter, check the Unit insulation (Unit Side):
   Value Required > 1Mohm (between RTN line (pin 6) and GND)

➢ Execute satellite "POWER-ON"

➢ Install Digital Voltmeter on both BOB's on Pin 2(+) & 6(-)

➢ Send the command Switch ON to the power line (main) for LFI DAE Power Box: **DC51D170**

➢ Verify with digital Voltmeter on BOB#1 between Pin 2(+) & 6(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB#2 between Pin 2(+) & 6(-): **0 Volts**

➢ Verify the following TLM parameters:
   ➢ **STS (LCL51) = ON**
   ➢ **STS (LCL52) = OFF**
   ➢ **ITLM_(LCL51) = 0 Amp**
   ➢ **ITLM (LCL52) = 0 Amp**

➢ Send the command Switch ON to the power line (red.) for LFI DAE Power Box: **DC52D170**

➢ Verify with digital Voltmeter on BOB#1 between Pin 2(+) & 6(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB#2 between Pin 2(+) & 6(-): **28 Volts +1% and - 4%**

➢ Verify the following TLM parameters:
   ➢ **STS (LCL51) = ON**
   ➢ **STS (LCL52) = ON**
   ➢ **ITLM_(LCL51) = 0 Amp**
   ➢ **ITLM (LCL52) = 0 Amp**

➢ Send the command Switch OFF to the power line (main) for LFI DAE Power Box: **DC51B170**

➢ Send the command Switch OFF to the power line (red.) for LFI DAE Power Box: **DC52B170**

➢ Verify with digital Voltmeter on both BOB's between Pin 2(+) & 6(-): **0 Volts**

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> Verify the following TLM parameters:
>> **STS (LCL51) = OFF**
>> **STS (LCL52) = OFF**
>> **ITLM_(LCL51) = 0 Amp**
>> **ITLM (LCL52) = 0 Amp**

> On both BOB's connect cross strap on pin: 2(+) & 6(-)

> Connect current probe on pin 2(+) of both BOB's in order to perform the In-Rush current verification

> Send the command Switch ON to the power line (main) for LFI DAE Power Box: **DC51D170**

> Verify/record for both DAE Power Box (main and red.) inrush current (no LCL's intervention has to be verified):
> $I_{overshoot}$ = 11.0 A max
> $T_{overshoot}$ ≤ 50 μsec
> I_{nom} = 2.86 A (after 5msec)

> Send the command Switch OFF to the power line (main) for LFI DAE Power Box: **DC51B170**

> Repeat the same verification on the power line (red.) for LFI DAE Power Box

> Remove BOB's and connect the power connectors to the relevant harness receptacle ones

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REBA nom. (PLREN):

➢ Verify that the **RT Add** = **18**

➢ Install BOB between the connector PLREN-P11 to PLREN-J11 (without cross strap)

➢ On BOB, using the digital ohmmeter, check the Unit insulation (Unit Side):
   Value Required > 1Mohm (between RTN line (pin 4) and GND)

➢ Execute satellite "POWER-ON"

➢ Install Digital Voltmeter on BOB on: Pin 2(+) & 4(-)

➢ Send the command Switch ON to the power line for LFI REBA nom.: **DC27D170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify the following TLM parameters:
   ➢ **STS (LCL27) = ON**
   ➢ **ITLM_(LCL27) = 0 Amp**

➢ Send the command Switch OFF to the power line for LFI REBA nom.: **DC27B170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **0 Volts**

➢ Verify the following TLM parameters:
   ➢ **STS (LCL27) = OFF**
   ➢ **ITLM_(LCL27) = 0 Amp**

➢ On BOB connect cross strap on: Pin 2(+) & 4(-)

➢ Connect current probe on pin 2(+) of BOB in order to perform the In-Rush current verification

➢ Send the command Switch ON to the power line for LFI REBA nom.: **DC27D170**

➢ Verify/record for REBA nom. inrush current (no LCL's intervention has to be verified):
   I $_{overshoot}$ = 5.50 A max
   T $_{overshoot}$ ≤ 50 µsec
   I $_{nom}$ = 1.50 A (after 5msec)

➢ Send the command Switch OFF to the power line for LFI REBA nom.: **DC27B170**

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➢ Send the command Switch ON to the power line for LFI REBA nom.: **DC27D170**

➢ Verify by digital probe on connector J12 ["T" adapter pin 4 (OBT+) and 5 (OBT-)], the OBT characteristics:

   ➢ **Differential Output Voltage**   2.0V ≤ |V| ≤ 5.5V
   ➢ **Frequency**   131.072 KHz
   ➢ **Rise Time** $0.1\mu S ≤ |T_{rise}| ≤ 0.8\mu S$
   ➢ **Fall Time** $0.1\mu S ≤ |T_{fall}| ≤ 0.3\mu S$
   ➢ **Jitter**   ± 150 nsec

   Note: The OBT verification has to be performed Unloaded (Verification polarity) and Loaded (Timing verification).

➢ Send the command Switch OFF to the power line for LFI REBA nom.: **DC27B170**

➢ Remove BOB and connect the power connectors to the relevant harness receptacle one.

➢ Send the command Switch ON to the power line for LFI REBA nom.: **DC27D170**

➢ Install **"T"** adapters on connector PLREN-P41 to PLREN-J41 and install the Oscilloscope with differential probe to the "T" adapter in order to verify the correct 1553B signal amplitude pin: **2(True) and 6(comp)**

➢ With differential probe, verify the peak to peak voltage levels:
   Between 1V ÷ 14 V BC in Transmission
   Between 18V ÷ 27V RT in Transmission
   T_{rise} **and** T_{fall} **= 100 nsec ÷ 300 nsec**

➢ Send the command Switch Over from bus A to bus B dedicate to LFI REBA nom.: **TC(8,4,10,1)**

➢ Install **"T"** adapter on connector PLREN-P42 to PLREN-J42 and install the Oscilloscope with differential probe to the "T" adapter in order to verify the correct 1553B signal amplitude pin: **2(True) and 6(comp)**

➢ With differential probe, verify the peak to peak voltage levels:
   Between 1V ÷ 14 V BC in Transmission
   Between 18V ÷ 27V RT in Transmission
   T_{rise} **and** T_{fall} **= 100 nsec ÷ 300 nsec**

➢ Send the command Switch OFF to the power line for LFI REBA nom.: **DC27B170**

➢ Remove the **"T"** adapter connectors and connect all the 1553B connectors to the relevant harness receptacle ones.

REBA red. (PLRER):

➢ Verify that the **RT Add** = **19**

➢ Install BOB between the connector PLRER-P11 to PLRER-J11 (without cross strap)

➢ On BOB, using the digital ohmmeter, check the Unit insulation (Unit Side):
Value Required > 1Mohm (between RTN line (pin 4) and GND)

➢ Execute satellite "POWER-ON"

➢ Install Digital Voltmeter on BOB on: Pin 2(+) & 4(-)

➢ Send the command Switch ON to the power line for LFI REBA red.: **DC28D170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **28 Volts +1% and - 4%**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL28) = ON**
  ➢ **ITLM_(LCL28) = 0 Amp**

➢ Send the command Switch OFF to the power line for LFI REBA red.: **DC28B170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 4(-): **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL28) = OFF**
  ➢ **ITLM_(LCL28) = 0 Amp**

➢ On BOB connect cross strap on: Pin 2(+) & 4(-)

➢ Connect current probe on pin 2(+) of BOB in order to perform the In-Rush current verification

➢ Send the command Switch ON to the power line for LFI REBA red.: **DC28D170**

➢ Verify/record for REBA red. inrush current (no LCL's intervention has to be verified):
I $_{overshoot}$ = 5.50 A max
T $_{overshoot}$ ≤ 50 μsec
I $_{nom}$ = 1.50 A (after 5msec)

➢ Send the command Switch OFF to the power line for LFI REBA red.: **DC28B170**

➢ Send the command Switch ON to the power line for LFI REBA red.: **DC28D170**

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➢ Verify by digital probe on connector J12 ["T" adapter pin 4 (OBT+) and 5 (OBT-)], the OBT characteristics:

    ➢ **Differential Output Voltage** $2.0V \leq |V| \leq 5.5V$
    ➢ **Frequency**   131.072 KHz
    ➢ **Rise Time** $0.1\mu S \leq |T_{rise}| \leq 0.8\mu S$
    ➢ **Fall Time** $0.1\mu S \leq |T_{fall}| \leq 0.3\mu S$
    ➢ **Jitter** ± 150 nsec

Note: The OBT verification has to be performed Unloaded (Verification polarity) and Loaded (Timing verification).

➢ Send the command Switch OFF to the power line for LFI REBA red.: **DC28B170**

➢ Remove BOB and connect the power connectors to the relevant harness receptacle one.

➢ Send the command Switch ON to the power line for LFI REBA red.: **DC28D170**

➢ Install **"T"** adapters on connector PLRER-P41 to PLRER-J41 and install the Oscilloscope with differential probe to the "T" adapter in order to verify the correct 1553B signal amplitude pin: **2(True) and 6(comp)**

➢ With differential probe, verify the peak to peak voltage levels:
Between 1V ÷ 14 V BC in Transmission
Between 18V ÷ 27V RT in Transmission
T_{rise} and T_{fall} = 100 nsec ÷ 300 nsec

➢ Send the command Switch Over from bus A to bus B dedicate to LFI REBA red.: **TC(8,4,10,1)**

➢ Install **"T"** adapter on connector PLRER-P42 to PLRER-J42 and install the Oscilloscope with differential probe to the "T" adapter in order to verify the correct 1553B signal amplitude pin: **2(True) and 6(comp)**

➢ With differential probe, verify the peak to peak voltage levels:
Between 1V ÷ 14 V BC in Transmission
Between 18V ÷ 27V RT in Transmission
T_{rise} and T_{fall} = 100 nsec ÷ 300 nsec

➢ Send the command Switch OFF to the power line for LFI REBA red.: **DC28B170**

➢ Remove the **"T"** adapter connectors and connect all the 1553B connectors to the relevant harness receptacle ones.

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BEU (PLBEU):

➢ Verify by digital probe on connector J03 and J04 ["T" adapter pin 1 (OBT+) and 6 (OBT-)], the OBT characteristics:

> ➢ **Differential Output Voltage**   2.0V ≤ |V| ≤ 5.5V
> ➢ **Frequency**   131.072 KHz
> ➢ **Rise Time** $0.1\mu S ≤ |T_{rise}| ≤ 0.8\mu S$
> ➢ **Fall Time** $0.1\mu S ≤ |T_{fall}| ≤ 0.3\mu S$
> ➢ **Jitter**   ± 150 nsec

Note: The OBT verification has to be performed Unloaded (Verification polarity) and Loaded (Timing verification).

4.2.3 LFI UFT Verification

The LFI UFT verification will be performed as described here below:

REBA nom. (PLREN):

➢ Send the command Switch ON to the power line for LFI REBA nom.: **DC27D170**

➢ After the execution of boot, verify/record on REBA Housekeeping Parameter Report **TM(3,25) APID 1538** contains the following information:
> ➢ **SID**   **TBD**
> ➢ **Length**   **TBD**
> ➢ **LFI Status**   **TBD**
> ➢ **Software Version** **TBD**

➢ Verify that the **TM(3,25) APID 1538** is generated at rate of one Pkt/sec

➢ Send the command Switch OFF to the power line for LFI REBA nom.: **DC27B170**

REBA red. (PLRER):

➢ Send the command Switch ON to the power line for LFI REBA red.: **DC28D170**

➢ After the execution of boot, verify/record on REBA Housekeeping Parameter Report **TM(3,25) APID** (TBD) contains the following information:
> ➢ **SID**   **TBD**
> ➢ **Length**   **TBD**
> ➢ **LFI Status**   **TBD**
> ➢ **Software Version** **TBD**

➢ Verify that the **TM(3,25) APID** (TBD) is generated at rate of one Pkt/sec

➢ Send the command Switch OFF to the power line for LFI REBA red.: **DC28B170**

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4.3 SCS

The Sorption Cooler Subsystem is mainly grouped on three dedicated SVM lateral panels and they are mounted over the Heat Pipes network.

➢ -Z panel: SCE (nom.+red.) units
➢ +Y-Z panel: SCC unit
➢ –Y-Z panel: SCC unit

In the following table there are the project codes allocated to SCS warm units:

Project Code	Instrument Unit
PSM3	SCS Sorption Cooler Compressor (SCC) nom.
PSR3	SCS Sorption Cooler Compressor (SCC) red.
PSM4	SCS Sorption Cooler Electronic (SCE) nom.
PSR4	SCS Sorption Cooler Electronic (SCE) red.

4.3.1 SCS SVM I/F's

The Power I/F's to be checked, for what concern the SCS warm unit, are reported in the Table 4.3.1-1:

LCL#	Type	Class	PCDU Conn	Pin+	Pin-		Planck SCS Allocation	Code	Conn	Pin+	Pin-	Avg Power [W]
53	LCL	III	J30	9,10	28,29		SCE red.	**PSR4**	J23	2	6	0
54	LCL	III	J08	9,10	28,29		SCE nom.	**PSM4**	J23	2	6	110,0
63	Par-LCL	III	J10	7,8	26,27		SCC B1	**PSR4**	J24	A	D	0
64	Par-LCL	III	J10	9,10	28,29		SCC B2	**PSR4**	J24	B	F	0
65	Par-LCL	III	J10	11,12	30,31		SCC B3	**PSR4**	J24	C	G	0
66	Par-LCL	III	J10	13,14	32,33		SCC B4	**PSR4**	J24	E	H	0
67	Par-LCL	III	J28	7,8	26,27		SCC A1	**PSM4**	J24	A	D	117,5
68	Par-LCL	III	J28	9,10	28,29		SCC A2	**PSM4**	J24	B	F	117,5
69	Par-LCL	III	J28	11,12	30,31		SCC A3	**PSM4**	J24	C	G	117,5
70	Par-LCL	III	J28	13,14	32,33		SCC A4	**PSM4**	J24	E	H	117,5

Table 4.3.1-1: PCDU SCS I/F's

the other SCS unit doesn't have directly interface with PCDU and the power supply will be provide it as described in the diagram of Fig.4.3.1-1.

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The Mil 1553 Bus I/F's to be checked, for what concern the SCS warm unit, are reported in the Table 4.3.1-2:

Planck SCS	Synch	CDMU I/F 1553 Bus	Conn	Pin(true)	Pin(comp)
PSM3	N/A	N/A	-	-	-
PSR3	N/A	N/A	-	-	-
PSM4	1 OBT (Synch)	1	J21 (OBT)	5(OBT+)	9(OBT-)
			J21(Bus A)	2	6
			J22(Bus B)	2	6
PSR4	1 OBT (Synch)	1	J21 (OBT)	5(OBT+)	9(OBT-)
			J21(Bus A)	2	6
			J22(Bus B)	2	6

Table 4.3.1-2: CDMU SCS I/F's

All the SVM I/F's with PCDU and CDMU are described in the following diagram of Fig.4.3.1-1:

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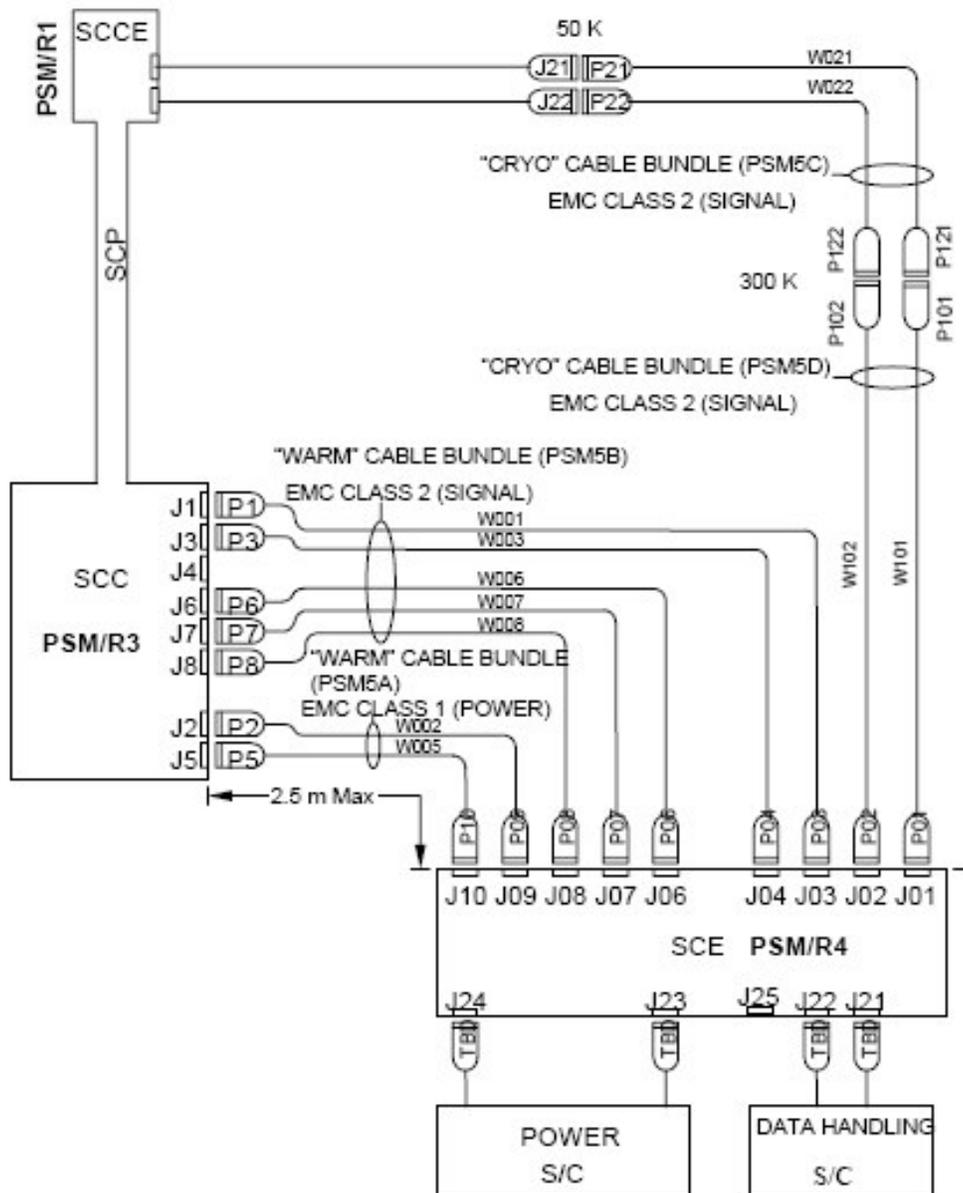
Fig. 4.3.1-1: SCS SVM I/F's

4.3.2 SCS I&T Verification

The I&T verification, for each SCS warm unit, will be performed as described here below:

<u>**SCE nom. (PSM4):**</u>

➢ Verify that the **RT Add** = **20**

➢ Install BOB#1 between the connector PSM4-P23 to PSM4-J23 (without cross strap)

➢ Install BOB#2 between the connector PSM4-P24 to PSM4-J24 (without cross strap)

➢ On BOB's, using the digital ohmmeter, check the Unit insulation (Unit Side):
   Value Required > 1Mohm (between RTN line (pin 6, pin D, pin F, pin G, pin H) and GND)

➢ Execute satellite "POWER-ON"

➢ Install Digital Voltmeter on both BOB's on:
   Pin 2(+) & 6(-)
   Pin A(+) & D(-)
   Pin B(+) & F(-)
   Pin C(+) & G(-)
   Pin E(+) & H(-)

➢ Send the command Switch ON to the power line for SCS SCE nom.: **DC54D170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 6(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin A(+) & D(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin B(+) & F(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin C(+) & G(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin E(+) & H(-): **0 Volts**

➢ Verify the following TLM parameters:
   ➢ **STS (LCL54) = ON**
   ➢ **STS (LCL67) = OFF**
   ➢ **STS (LCL68) = OFF**
   ➢ **STS (LCL69) = OFF**
   ➢ **STS (LCL70) = OFF**
   ➢ **ITLM_(LCL54) = 0 Amp**
   ➢ **ITLM (LCL67) = 0 Amp**
   ➢ **ITLM_(LCL68) = 0 Amp**
   ➢ **ITLM (LCL69) = 0 Amp**
   ➢ **ITLM (LCL70) = 0 Amp**

- ➢ Send the command Switch ON to the power line for SCS SCC A1: **DC67D170**

- ➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 6(-): **28 Volts +1% and - 4%**

- ➢ Verify with digital Voltmeter on BOB between Pin A(+) & D(-): **28 Volts +1% and - 4%**

- ➢ Verify with digital Voltmeter on BOB between Pin B(+) & F(-): **0 Volts**

- ➢ Verify with digital Voltmeter on BOB between Pin C(+) & G(-): **0 Volts**

- ➢ Verify with digital Voltmeter on BOB between Pin E(+) & H(-): **0 Volts**

- ➢ Verify the following TLM parameters:
    - ➢ **STS (LCL54) = ON**
    - ➢ **STS (LCL67) = ON**
    - ➢ **STS (LCL68) = OFF**
    - ➢ **STS (LCL69) = OFF**
    - ➢ **STS (LCL70) = OFF**
    - ➢ **ITLM_(LCL54) = 0 Amp**
    - ➢ **ITLM (LCL67) = 0 Amp**
    - ➢ **ITLM_(LCL68) = 0 Amp**
    - ➢ **ITLM (LCL69) = 0 Amp**
    - ➢ **ITLM (LCL70) = 0 Amp**

- ➢ Send the command Switch ON to the power line for SCS SCC A2: **DC68D170**

- ➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 6(-): **28 Volts +1% and - 4%**

- ➢ Verify with digital Voltmeter on BOB between Pin A(+) & D(-): **28 Volts +1% and - 4%**

- ➢ Verify with digital Voltmeter on BOB between Pin B(+) & F(-): **28 Volts +1% and - 4%**

- ➢ Verify with digital Voltmeter on BOB between Pin C(+) & G(-): **0 Volts**

- ➢ Verify with digital Voltmeter on BOB between Pin E(+) & H(-): **0 Volts**

- ➢ Verify the following TLM parameters:
    - ➢ **STS (LCL54) = ON**
    - ➢ **STS (LCL67) = ON**
    - ➢ **STS (LCL68) = ON**
    - ➢ **STS (LCL69) = OFF**
    - ➢ **STS (LCL70) = OFF**
    - ➢ **ITLM_(LCL54) = 0 Amp**
    - ➢ **ITLM (LCL67) = 0 Amp**
    - ➢ **ITLM_(LCL68) = 0 Amp**
    - ➢ **ITLM (LCL69) = 0 Amp**
    - ➢ **ITLM (LCL70) = 0 Amp**

➢ Send the command Switch ON to the power line for SCS SCC A3: **DC69D170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 6(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin A(+) & D(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin B(+) & F(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin C(+) & G(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin E(+) & H(-): **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL54) = ON**
  ➢ **STS (LCL67) = ON**
  ➢ **STS (LCL68) = ON**
  ➢ **STS (LCL69) = ON**
  ➢ **STS (LCL70) = OFF**
  ➢ **ITLM_(LCL54) = 0 Amp**
  ➢ **ITLM (LCL67) = 0 Amp**
  ➢ **ITLM_(LCL68) = 0 Amp**
  ➢ **ITLM (LCL69) = 0 Amp**
  ➢ **ITLM (LCL70) = 0 Amp**

➢ Send the command Switch ON to the power line for SCS SCC A4: **DC70D170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 6(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin A(+) & D(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin B(+) & F(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin C(+) & G(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin E(+) & H(-): **28 Volts +1% and - 4%**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL54) = ON**
  ➢ **STS (LCL67) = ON**
  ➢ **STS (LCL68) = ON**
  ➢ **STS (LCL69) = ON**
  ➢ **STS (LCL70) = ON**
  ➢ **ITLM_(LCL54) = 0 Amp**
  ➢ **ITLM (LCL67) = 0 Amp**
  ➢ **ITLM_(LCL68) = 0 Amp**
  ➢ **ITLM (LCL69) = 0 Amp**
  ➢ **ITLM (LCL70) = 0 Amp**

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- ➢ Send the command Switch OFF to the power line for SCS SCE nom.: **DC54B170**

- ➢ Send the command Switch OFF to the power line for SCS SCC A1: **DC67B170**

- ➢ Send the command Switch OFF to the power line for SCS SCC A2: **DC68B170**

- ➢ Send the command Switch OFF to the power line for SCS SCC A3: **DC69B170**

- ➢ Send the command Switch OFF to the power line for SCS SCC A4: **DC70B170**

- ➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 6(-): **0 Volts**

- ➢ Verify with digital Voltmeter on BOB between Pin A(+) & D(-): **0 Volts**

- ➢ Verify with digital Voltmeter on BOB between Pin B(+) & F(-): **0 Volts**

- ➢ Verify with digital Voltmeter on BOB between Pin C(+) & G(-): **0 Volts**

- ➢ Verify with digital Voltmeter on BOB between Pin E(+) & H(-): **0 Volts**

- ➢ Verify the following TLM parameters:
  - ➢ **STS (LCL54) = OFF**
  - ➢ **STS (LCL67) = OFF**
  - ➢ **STS (LCL68) = OFF**
  - ➢ **STS (LCL69) = OFF**
  - ➢ **STS (LCL70) = OFF**
  - ➢ **ITLM_(LCL54) = 0 Amp**
  - ➢ **ITLM (LCL67) = 0 Amp**
  - ➢ **ITLM_(LCL68) = 0 Amp**
  - ➢ **ITLM (LCL69) = 0 Amp**
  - ➢ **ITLM (LCL70) = 0 Amp**

- ➢ On both BOB's connect cross strap on:
  Pin 2(+) & 6(-)
  Pin A(+) & D(-)
  Pin B(+) & F(-)
  Pin C(+) & G(-)
  Pin E(+) & H(-)

- ➢ Connect current probe on pin (+) of both BOB's in order to perform the In-Rush current verification

- ➢ Send the command Switch ON to the power line for SCS SCE nom.: **DC54D170**

- ➢ Send the command Switch ON to the power line for SCS SCC A1: **DC67D170**

- ➢ Send the command Switch ON to the power line for SCS SCC A2: **DC68D170**

- ➢ Send the command Switch ON to the power line for SCS SCC A3: **DC69D170**

➢ Send the command Switch ON to the power line for SCS SCC A4: **DC70D170**

➢ Reach the stand-by mode, before to verify the in-rush current, switching ON the SCC by a dedicated **TC (TBD)**

➢ Verify/record for SCE nom. inrush current (no LCL's intervention has to be verified):
I overshoot = 11.0 A max
T overshoot ≤ 50 μsec
I nom = 4 A (after 5msec)

➢ Send the command Switch OFF to the power line for SCS SCE nom.: **DC54B170**

➢ Send the command Switch OFF to the power line for SCS SCC A1: **DC67B170**

➢ Send the command Switch OFF to the power line for SCS SCC A2: **DC68B170**

➢ Send the command Switch OFF to the power line for SCS SCC A3: **DC69B170**

➢ Send the command Switch OFF to the power line for SCS SCC A4: **DC70B170**

➢ Send the command Switch ON to the power line for SCS SCE nom.: **DC54D170**

➢ Verify by digital probe on connector J21 ["T" adapter pin 5 (OBT+) and 9 (OBT-)], the OBT characteristics:

➢ **Differential Output Voltage** $2.0V ≤ |V| ≤ 5.5V$
➢ **Frequency**   131.072 KHz
➢ **Rise Time** $0.1μS ≤ |T_{rise}| ≤ 0.8μS$
➢ **Fall Time** $0.1μS ≤ |T_{fall}| ≤ 0.3μS$
➢ **Jitter**   ± 150 nsec

Note: The OBT verification has to be performed Unloaded (Verification polarity) and Loaded (Timing verification).

➢ Send the command Switch OFF to the power line for SCS SCE nom.: **DC54B170**

➢ Remove BOB's and connect the power connectors to the relevant harness receptacle ones.

➢ Send the command Switch ON to the power line for SCS SCE nom.: **DC54D170**

➢ Send the command Switch ON to the power line for SCS SCC A1: **DC67D170**

➢ Send the command Switch ON to the power line for SCS SCC A2: **DC68D170**

➢ Send the command Switch ON to the power line for SCS SCC A3: **DC69D170**

➢ Send the command Switch ON to the power line for SCS SCC A4: **DC70D170**

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➢ Install **"T"** adapters on connector PSM4-P21 to PSM4-J21 and install the Oscilloscope with differential probe to the "T" adapter in order to verify the correct 1553B signal amplitude pin:
2(True) and 6(comp)

➢ With differential probe, verify the peak to peak voltage levels:
Between 1V ÷ 14 V BC in Transmission
Between 18V ÷ 27V RT in Transmission
T_{rise} **and** T_{fall} **= 100 nsec ÷ 300 nsec**

➢ Send the command Switch Over from bus A to bus B dedicate to SCS SCE nom.: **TC(8,4,10,1)**

➢ Install **"T"** adapter on connector PSM4-P22 to PSM4-J22 and install the Oscilloscope with differential probe to the "T" adapter in order to verify the correct 1553B signal amplitude pin:
2(True) and 6(comp)

➢ With differential probe, verify the peak to peak voltage levels:
Between 1V ÷ 14 V BC in Transmission
Between 18V ÷ 27V RT in Transmission
T_{rise} **and** T_{fall} **= 100 nsec ÷ 300 nsec**

➢ Send the command Switch OFF to the power line for SCS SCE nom.: **DC54B170**

➢ Send the command Switch OFF to the power line for SCS SCC A1: **DC67B170**

➢ Send the command Switch OFF to the power line for SCS SCC A2: **DC68B170**

➢ Send the command Switch OFF to the power line for SCS SCC A3: **DC69B170**

➢ Send the command Switch OFF to the power line for SCS SCC A4: **DC70B170**

➢ Remove the **"T"** adapter connectors and connect all the 1553B connectors to the relevant harness receptacle ones.

➢ Re-install a BOB on connector J24 and put a cross strap on:
Pin A(+) & D(-)
Pin B(+) & F(-)
Pin C(+) & G(-)
Pin E(+) & H(-)

➢ Connect current probe on pin (+) of both BOB's in order to perform the In-Rush current verification

➢ Send the command Switch ON to the power line for SCS SCE nom.: **DC54D170**

➢ Send the command Switch ON to the power line for SCS SCC A1: **DC67D170**

➢ Send the command Switch ON to the power line for SCS SCC A2: **DC68D170**

➢ Send the command Switch ON to the power line for SCS SCC A3: **DC69D170**

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➢ Send the command Switch ON to the power line for SCS SCC A4: **DC70D170**

➢ Reach the stand-by mode, before to verify the in-rush current, switching ON the SCC by a dedicated **TC (TBD)**

➢ Switching ON each dedicated line (SCC A1, A2, A3, A4), verify/record inrush current (no LCL's intervention has to be verified):
  $I_{overshoot}$ = **11.0 A max**
  $T_{overshoot}$ ≤ **50 µsec**
  I_{nom} = **4.27 A (after 5msec)**

➢ Send the command Switch OFF to the power line for SCS SCE nom.: **DC54B170**

➢ Send the command Switch OFF to the power line for SCS SCC A1: **DC67B170**

➢ Send the command Switch OFF to the power line for SCS SCC A2: **DC68B170**

➢ Send the command Switch OFF to the power line for SCS SCC A3: **DC69B170**

➢ Send the command Switch OFF to the power line for SCS SCC A4: **DC70B170**

SCE red. (PSR4):

➢ Verify that the **RT Add** = **21**

➢ Install BOB#1 between the connector PSR4-P23 to PSR4-J23 (without cross strap)

➢ Install BOB#2 between the connector PSR4-P24 to PSR4-J24 (without cross strap)

➢ On BOB's, using the digital ohmmeter, check the Unit insulation (Unit Side):
  Value Required > 1Mohm (between RTN line (pin 6, pin D, pin F, pin G, pin H) and GND)

➢ Execute satellite "POWER-ON"

➢ Install Digital Voltmeter on both BOB's on:
  Pin 2(+) & 6(-)
  Pin A(+) & D(-)
  Pin B(+) & F(-)
  Pin C(+) & G(-)
  Pin E(+) & H(-)

➢ Send the command Switch ON to the power line for SCS SCE red.: **DC53D170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 6(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin A(+) & D(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin B(+) & F(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin C(+) & G(-): **0 Volts**

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➢ Verify with digital Voltmeter on BOB between Pin E(+) & H(-): **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL53) = ON**
  ➢ **STS (LCL63) = OFF**
  ➢ **STS (LCL64) = OFF**
  ➢ **STS (LCL65) = OFF**
  ➢ **STS (LCL66) = OFF**
  ➢ **ITLM_(LCL53) = 0 Amp**
  ➢ **ITLM (LCL63) = 0 Amp**
  ➢ **ITLM_(LCL64) = 0 Amp**
  ➢ **ITLM (LCL65) = 0 Amp**
  ➢ **ITLM (LCL66) = 0 Amp**

➢ Send the command Switch ON to the power line for SCS SCC B1: **DC63D170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 6(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin A(+) & D(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin B(+) & F(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin C(+) & G(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin E(+) & H(-): **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL53) = ON**
  ➢ **STS (LCL63) = ON**
  ➢ **STS (LCL64) = OFF**
  ➢ **STS (LCL65) = OFF**
  ➢ **STS (LCL66) = OFF**
  ➢ **ITLM_(LCL53) = 0 Amp**
  ➢ **ITLM (LCL63) = 0 Amp**
  ➢ **ITLM_(LCL64) = 0 Amp**
  ➢ **ITLM (LCL65) = 0 Amp**
  ➢ **ITLM (LCL66) = 0 Amp**

➢ Send the command Switch ON to the power line for SCS SCC B2: **DC64D170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 6(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin A(+) & D(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin B(+) & F(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin C(+) & G(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin E(+) & H(-): **0 Volts**

➢ Verify the following TLM parameters:
  - ➢ **STS (LCL53) = ON**
  - ➢ **STS (LCL63) = ON**
  - ➢ **STS (LCL64) = ON**
  - ➢ **STS (LCL65) = OFF**
  - ➢ **STS (LCL66) = OFF**
  - ➢ **ITLM_(LCL53) = 0 Amp**
  - ➢ **ITLM (LCL63) = 0 Amp**
  - ➢ **ITLM_(LCL64) = 0 Amp**
  - ➢ **ITLM (LCL65) = 0 Amp**
  - ➢ **ITLM (LCL66) = 0 Amp**

➢ Send the command Switch ON to the power line for SCS SCC B3: **DC65D170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 6(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin A(+) & D(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin B(+) & F(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin C(+) & G(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin E(+) & H(-): **0 Volts**

➢ Verify the following TLM parameters:
  - ➢ **STS (LCL53) = ON**
  - ➢ **STS (LCL63) = ON**
  - ➢ **STS (LCL64) = ON**
  - ➢ **STS (LCL65) = ON**
  - ➢ **STS (LCL66) = OFF**
  - ➢ **ITLM_(LCL53) = 0 Amp**
  - ➢ **ITLM (LCL63) = 0 Amp**
  - ➢ **ITLM_(LCL64) = 0 Amp**
  - ➢ **ITLM (LCL65) = 0 Amp**
  - ➢ **ITLM (LCL66) = 0 Amp**

➢ Send the command Switch ON to the power line for SCS SCC B4: **DC66D170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 6(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin A(+) & D(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin B(+) & F(-): **28 Volts +1% and - 4%**

➢ Verify with digital Voltmeter on BOB between Pin C(+) & G(-): **28 Volts +1% and - 4%**

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➢ Verify with digital Voltmeter on BOB between Pin E(+) & H(-): **28 Volts +1% and - 4%**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL53) = ON**
  ➢ **STS (LCL63) = ON**
  ➢ **STS (LCL64) = ON**
  ➢ **STS (LCL65) = ON**
  ➢ **STS (LCL66) = ON**
  ➢ **ITLM_(LCL53) = 0 Amp**
  ➢ **ITLM (LCL63) = 0 Amp**
  ➢ **ITLM_(LCL64) = 0 Amp**
  ➢ **ITLM (LCL65) = 0 Amp**
  ➢ **ITLM (LCL66) = 0 Amp**

➢ Send the command Switch OFF to the power line for SCS SCE red.: **DC53B170**

➢ Send the command Switch OFF to the power line for SCS SCC B1: **DC63B170**

➢ Send the command Switch OFF to the power line for SCS SCC B2: **DC64B170**

➢ Send the command Switch OFF to the power line for SCS SCC B3: **DC65B170**

➢ Send the command Switch OFF to the power line for SCS SCC B4: **DC66B170**

➢ Verify with digital Voltmeter on BOB between Pin 2(+) & 6(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin A(+) & D(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin B(+) & F(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin C(+) & G(-): **0 Volts**

➢ Verify with digital Voltmeter on BOB between Pin E(+) & H(-): **0 Volts**

➢ Verify the following TLM parameters:
  ➢ **STS (LCL53) = OFF**
  ➢ **STS (LCL63) = OFF**
  ➢ **STS (LCL64) = OFF**
  ➢ **STS (LCL65) = OFF**
  ➢ **STS (LCL66) = OFF**
  ➢ **ITLM_(LCL53) = 0 Amp**
  ➢ **ITLM (LCL63) = 0 Amp**
  ➢ **ITLM_(LCL64) = 0 Amp**
  ➢ **ITLM (LCL65) = 0 Amp**
  ➢ **ITLM (LCL66) = 0 Amp**

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➢ On both BOB's connect cross strap on:
   Pin 2(+) & 6(-)
   Pin A(+) & D(-)
   Pin B(+) & F(-)
   Pin C(+) & G(-)
   Pin E(+) & H(-)

➢ Connect current probe on pin (+) of both BOB's in order to perform the In-Rush current verification

➢ Send the command Switch ON to the power line for SCS SCE red.: **DC53D170**

➢ Send the command Switch ON to the power line for SCS SCC B1: **DC63D170**

➢ Send the command Switch ON to the power line for SCS SCC B2: **DC64D170**

➢ Send the command Switch ON to the power line for SCS SCC B3: **DC65D170**

➢ Send the command Switch ON to the power line for SCS SCC B4: **DC66D170**

➢ Reach the stand-by mode, before to verify the in-rush current, switching ON the SCC by a dedicated **TC (TBD)**

➢ Verify/record for SCE red. inrush current (no LCL's intervention has to be verified):
   $I_{overshoot}$ **= 11.0 A max**
   $T_{overshoot}$ **≤ 50 µsec**
   I_{nom} **= 4 A (after 5msec)**

➢ Send the command Switch OFF to the power line for SCS SCE red.: **DC53B170**

➢ Send the command Switch OFF to the power line for SCS SCC B1: **DC63B170**

➢ Send the command Switch OFF to the power line for SCS SCC B2: **DC64B170**

➢ Send the command Switch OFF to the power line for SCS SCC B3: **DC65B170**

➢ Send the command Switch OFF to the power line for SCS SCC B4: **DC66B170**

➢ Send the command Switch ON to the power line for SCS SCE red.: **DC53D170**

➢ Verify by digital probe on connector J21 ["T" adapter pin 5 (OBT+) and 9 (OBT-)], the OBT characteristics:

   ➢ **Differential Output Voltage**   2.0V ≤ |V| ≤ 5.5V
   ➢ **Frequency**   131.072 KHz
   ➢ **Rise Time** $0.1\mu S ≤ |T_{rise}| ≤ 0.8\mu S$
   ➢ **Fall Time** $0.1\mu S ≤ |T_{fall}| ≤ 0.3\mu S$
   ➢ **Jitter**   ± 150 nsec

Note: The OBT verification has to be performed Unloaded (Verification polarity) and Loaded (Timing verification).

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➢ Send the command Switch OFF to the power line for SCS SCE red.: **DC53B170**

➢ Remove BOB's and connect the power connectors to the relevant harness receptacle ones.

➢ Send the command Switch ON to the power line for SCS SCE red.: **DC53D170**

➢ Send the command Switch ON to the power line for SCS SCC B1: **DC63D170**

➢ Send the command Switch ON to the power line for SCS SCC B2: **DC64D170**

➢ Send the command Switch ON to the power line for SCS SCC B3: **DC65D170**

➢ Send the command Switch ON to the power line for SCS SCC B4: **DC66D170**

➢ Install **"T"** adapters on connector PSR4-P21 to PSR4-J21 and install the Oscilloscope with differential probe to the "T" adapter in order to verify the correct 1553B signal amplitude pin:
2(True) and 6(comp)

➢ With differential probe, verify the peak to peak voltage levels:
Between 1V ÷ 14 V BC in Transmission
Between 18V ÷ 27V RT in Transmission
T_{rise} and T_{fall} = 100 nsec ÷ 300 nsec

➢ Send the command Switch Over from bus A to bus B dedicate to SCS SCE red.: **TC(8,4,10,1)**

➢ Install **"T"** adapter on connector PSR4-P22 to PSR4-J22 and install the Oscilloscope with differential probe to the "T" adapter in order to verify the correct 1553B signal amplitude pin:
2(True) and 6(comp)

➢ With differential probe, verify the peak to peak voltage levels:
Between 1V ÷ 14 V BC in Transmission
Between 18V ÷ 27V RT in Transmission
T_{rise} and T_{fall} = 100 nsec ÷ 300 nsec

➢ Send the command Switch OFF to the power line for SCS SCE red.: **DC53B170**

➢ Send the command Switch OFF to the power line for SCS SCC B1: **DC63B170**

➢ Send the command Switch OFF to the power line for SCS SCC B2: **DC64B170**

➢ Send the command Switch OFF to the power line for SCS SCC B3: **DC65B170**

➢ Send the command Switch OFF to the power line for SCS SCC B4: **DC66B170**

➢ Remove the **"T"** adapter connectors and connect all the 1553B connectors to the relevant harness receptacle ones.

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➢ Re-install a BOB on connector J24 and put a cross strap on:
 Pin A(+) & D(-)
 Pin B(+) & F(-)
 Pin C(+) & G(-)
 Pin E(+) & H(-)

➢ Connect current probe on pin (+) of both BOB's in order to perform the In-Rush current verification

➢ Send the command Switch ON to the power line for SCS SCE red.: **DC53D170**

➢ Send the command Switch ON to the power line for SCS SCC B1: **DC63D170**

➢ Send the command Switch ON to the power line for SCS SCC B2: **DC64D170**

➢ Send the command Switch ON to the power line for SCS SCC B3: **DC65D170**

➢ Send the command Switch ON to the power line for SCS SCC B4: **DC66D170**

➢ Reach the stand-by mode, before to verify the in-rush current, switching ON the SCC by a dedicated **TC (TBD)**

➢ Switching ON each dedicated line (SCC B1, B2, B3, B4), verify/record inrush current (no LCL's intervention has to be verified):
 $I_{overshoot}$ **= 11.0 A max**
 $T_{overshoot}$ **≤ 50 µsec**
 I_{nom} **= 4.27 A (after 5msec)**

➢ Send the command Switch OFF to the power line for SCS SCE red.: **DC53B170**

➢ Send the command Switch OFF to the power line for SCS SCC B1: **DC63B170**

➢ Send the command Switch OFF to the power line for SCS SCC B2: **DC64B170**

➢ Send the command Switch OFF to the power line for SCS SCC B3: **DC65B170**

➢ Send the command Switch OFF to the power line for SCS SCC B4: **DC66B170**

4.3.3 SCS UFT Verification

The SCS UFT verification will be performed as described here below:

SCE nom. (PSM4):

➢ Send the command Switch ON to the power line for SCS SCE nom.: **DC54D170**

➢ After the execution of boot, verify/record on SCE Housekeeping Parameter Report **TM(3,25) APID 1664** contains the following information:
  - ➢ **SID** **TBD**
  - ➢ **Length** **TBD**
  - ➢ **OBSID** **TBD**
  - ➢ **BBID** **TBD**
  - ➢ **Software Version** **TBD**

➢ Verify that the **TM(3,25) APID 1664** is generated at rate of one Pkt/sec

➢ Send the command Switch OFF to the power line for SCS SCE nom.: **DC54D170**

SCE red. (PSR4):

➢ Send the command Switch ON to the power line for SCS SCE red.: **DC53D170**

➢ After the execution of boot, verify/record on SCE Housekeeping Parameter Report **TM(3,25) APID** (TBD) contains the following information:
  - ➢ **SID** **TBD**
  - ➢ **Length** **TBD**
  - ➢ **OBSID** **TBD**
  - ➢ **BBID** **TBD**
  - ➢ **Software Version** **TBD**

➢ Verify that the **TM(3,25) APID** (TBD) is generated at rate of one Pkt/sec

➢ Send the command Switch OFF to the power line for SCS SCE red.: **DC53D170**

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