HESSI IDPU Safe To Mate Procedure

Ref. Code: HSI-MI&T-IDPU-STM Version 2000-01-14
Point of Contact: Dave Curtis
Estimated Test Duration: 4 hours
Purpose:

Verify that the Spacecraft bus is safe to mate to the IDPU by breakout box verification of interface signals and grounding; Also verify correct signal levels on harness when mated.

Date and Time Run: _____
Test Lead: _____

Hardware Requirements:

Item	Description	OK
1.	**Spacecraft Bus**, including at least:	
1.1	SEM	_____Y/N
1.2	SSR	_____Y/N
1.3	Spacecraft Harness	_____Y/N
1.4	Power System (Battery and/or GSE supply)	_____Y/N
1.5	SEM Flight Software Version Number	_____
2.	**IDPU**, including:	
2.1	IDPU VME Chassis	_____OK
2.2	Instrument Power Converter (IPC)	_____OK
2.3	Cryo Power Converter (CPC) [May run test without if unavailable]	_____OK
2.4	Particle Detector (PD) [May run test without if unavailable]	_____OK
3.	**Instrument Harnesses**, including at least:	
3.1	IDPU/IPC/CPC Harness	_____OK
3.2	IDPU/PD Harness [Not needed if Particle Detector not available]	_____OK
3.3	IPC/PD Harness [Not needed if Particle Detector not available]	_____OK
4.	**Spacecraft GSE**, including at least:	
4.1	Spacecraft to GSE Test and Power Harness	_____OK
4.2	Power rack	_____OK
4.3	Telemetry Rack	_____OK
4.4	ITOS system, including spacecraft and instrument databases	_____OK
4.5	ITOS Software Version Number	_____
4.6	3 Breakout Boxes and cables for 2 9-pin cables and one 37 pin cable	_____OK
4.7	DVM	_____OK
4.8	Oscilliscope	_____OK

Staffing Requirements:
The following people or their delegates are required:

Item	Description	Name
1.	Instrument System Engineer (Dave Curtis)	
2.	Test Conductor	
3.	Quality Assurance	

Starting condition:

Item	Setup	OK
1	IDPU, IPC, and (perhaps) CPC and Particle Detector are mechanically integrated with spacecraft	_____OK
1.1	Is CPC Installed?	_____Y/N
1.2	Is Particle Detector Installed?	_____Y/N
2	IDPU is not yet electrically mated to the spacecraft	_____OK
3	IDPU is harnessed to the IPC and (perhaps) CPC and Particle Detector via the	

	Flight Instrument harness	_____OK
4.	Install break-out boxes on the harness to IPC-J1, CPC-J1, and IDPU-J1 (do not connect to the IDPU/IPC/CPC)	_____OK
5	Spacecraft is connected to the spacecraft GSE, and is ready for operations	_____OK
6	All instrument power services are off.	_____OK

NOTE: This test does not assume that the Spectrometer, Particle Detector, RAS, or Imager are installed.

Testing steps:

Step	Proceedure	Measurement/ Verify
1	**Verify grounding:**	
1.1	Measure impedance between spacecraft chassis and IDPU chassis (should be <0.1 ohms)	_____Ohms
1.2	Measure impedance between spacecraft chassis and IPC LVPS chassis (should be <0.1 ohms)	_____Ohms
1.3	Measure impedance between spacecraft chassis and IPC HVPS chassis (should be >10K ohms)	_____Ohms
1.4	Measure impedance between spacecraft chassis and CPC chassis (should be <0.1 ohms)	_____Ohms
1.5	Measure impedance between spacecraft chassis and Particle Detector chassis (should be >10K ohms)	_____Ohms
2.	**Power on and configure the spacecraft bus, if it is not already powered** (Processor, SSR powered up and operational) Perform Spacecraft power-on proceedure	_____OK
2.1	Verify spacecraft operating nominally via state-of-health telemetry	_____OK
2.2	**Verify Instrument, Heater, Switched, and Cryo power services are off (zero volts) by measurement at the breakout boxes on IPC-P1 and CPC-P1**	
2.2.1	Measure Heater Power on IPC-P1 pin 1 to pin 6	_____ V
2.2.2	Measure IDPU Power on IPC-P1 pin 2 to pin 7	_____ V
2.2.3	Measure Switched Power on IPC-P1 pin 3 to pin 8	_____ V
2.2.4	Measure CPC Power on CPC-P1 pin 1 to pin 6	_____ V
2.2.5	Measure CPC Power on CPC-P1 pin 2 to pin 7	_____ V
2.3	**Verify IPC, CPC, Spectrometer, IDPU, and RAS temperature sensor signals are nominal using an AD590 and monitoring the spacecraft SOH** (AD590+ pin is nearest the tab)	
2.3.1	IPC: AD590+ = IPC-P1 pin 5, AD590- = IPC-P1 pin 9	_____ °C
2.3.2	CPC: AD590+ = CPC-P1 pin 4, AD590- = CPC-P1 pin 8	_____ °C
2.3.3	Spectrometer: AD590+ = CPC-P1 pin 5, AD590- = CPC-P1 pin 9	_____ °C
2.3.4	IDPU: AD590+ = IDPU-P1 pin 19, AD590- = IDPU-P1 pin 37	_____ °C
2.3.5	RAS: AD590+ = IDPU-P1 pin 18, AD590- = IDPU-P1 pin 36	_____ °C
2.4	**Verify the following instrument signals are off (0V) on IDPU-P1** (with respect to signal ground, on IDPU-P1 pin 33)	
2.4.1	HRECDAT0+, IDPU-P1 pin 1	_____ V
2.4.2	HRECDAT1+, IDPU-P1 pin 2	_____ V
2.4.3	HRECDAT2+, IDPU-P1 pin 3	_____ V
2.4.4	HRECDAT3+, IDPU-P1 pin 4	_____ V
2.4.5	HRECDAT4+, IDPU-P1 pin 5	_____ V
2.4.6	HRECDAT5+, IDPU-P1 pin 6	_____ V
2.4.7	HRECDAT6+, IDPU-P1 pin 7	_____ V
2.4.8	HRECDAT7+, IDPU-P1 pin 8	_____ V
2.4.9	HRECCLK+, IDPU-P1 pin 9	_____ V
2.4.10	HRECVALF+, IDPU-P1 pin 10	_____ V
2.4.11	Command+, IDPU-P1 pin 12	_____ V

2.4.12	Telemetry+, IDPU-P1 pin 13	_____ V
2.4.13	CLK1HZ, IDPU-P1 pin 14	_____ V
2.4.14	CLK1MHZ, IDPU-P1 pin 15	_____ V
2.4.15	Reset, IDPU-P1 pin 16	_____ V
2.4.16	Safe, IDPU-P1 pin 17	_____ V
2.4.17	HRECDAT0-, IDPU-P1 pin 20	_____ V
2.4.18	HRECDAT1-, IDPU-P1 pin 21	_____ V
2.4.19	HRECDAT2-, IDPU-P1 pin 22	_____ V
2.4.20	HRECDAT3-, IDPU-P1 pin 23	_____ V
2.4.21	HRECDAT4-, IDPU-P1 pin 24	_____ V
2.4.22	HRECDAT5-, IDPU-P1 pin 25	_____ V
2.4.23	HRECDAT6-, IDPU-P1 pin 26	_____ V
2.4.24	HRECDAT7-, IDPU-P1 pin 27	_____ V
2.4.25	HRECCLK-, IDPU-P1 pin 28	_____ V
2.4.26	HRECVALF-, IDPU-P1 pin 29	_____ V
2.4.27	Command-, IDPU-P1 pin 31	_____ V
2.4.28	Telemetry-, IDPU-P1 pin 32	_____ V
3.	**Command on the Instrument Heater power service** Start SC_HTRON (Procedure Version Number_____)	_____OK
3.1	Measure Heater power service is on (28V): IPC-P1 pin 1 to pin 6	_____ V
3.2	Measure IDPU power service is off (0V): IPC-P1 pin 2 to pin 7	_____ V
3.3	Measure Switched power service is off (0V): IPC-P1 pin 3 to pin 8	_____ V
3.4	Measure CPC power service is off (0V): CPC-P1 pin 1 to pin 6	_____ V
3.5	Measure CPC power service is off (0V): CPC-P1 pin 2 to pin 7	_____ V
4.	**Command on the Instrument Switched Loads power service** Start SC_IDPU_SPWRON (Procedure Version Number_____)	_____OK
4.1	This is an illegal state (Instrument service off, switched service on), and should be inhibited by the ground system. Verify inhibit prevents this state with appropriate error messages.	_____OK
4.2	Measure Heater power service is on (28V): IPC-P1 pin 1 to pin 6	_____ V
4.3	Measure IDPU power service is off (0V): IPC-P1 pin 2 to pin 7	_____ V
4.4	Measure Switched power service is off (0V): IPC-P1 pin 3 to pin 8	_____ V
4.5	Measure CPC power service is off (0V): CPC-P1 pin 1 to pin 6	_____ V
4.6	Measure CPC power service is off (0V): CPC-P1 pin 2 to pin 7	_____ V
5.	**Command on the Cryocooler power service** Start SC_CPCON (Procedure Version Number_____)	_____OK
5.1	This is an illegal state (Instrument service off, switched service on), and should be inhibited by the ground system. Verify inhibit prevents this state with appropriate error messages.	_____OK
5.2	Measure Heater power service is on (28V): IPC-P1 pin 1 to pin 6	_____ V
5.3	Measure IDPU power service is off (0V): IPC-P1 pin 2 to pin 7	_____ V
5.4	Measure Switched power service is off (0V): IPC-P1 pin 3 to pin 8	_____ V
5.5	Measure CPC power service is off (0V): CPC-P1 pin 1 to pin 6	_____ V
5.6	Measure CPC power service is off (0V): CPC-P1 pin 2 to pin 7	_____ V
6.	**Command on the Instrument power service** Start SC_IDPUON (Procedure Version Number_____)	_____OK
6.1	Measure Heater power service is on (28V): IPC-P1 pin 1 to pin 6	_____ V
6.2	Measure IDPU power service is on (28V): IPC-P1 pin 2 to pin 7	_____ V
6.3	Measure Switched power service is off (0V): IPC-P1 pin 3 to pin 8	_____ V
6.4	Measure CPC power service is off (0V): CPC-P1 pin 1 to pin 6	_____ V
6.5	Measure CPC power service is off (0V): CPC-P1 pin 2 to pin 7	_____ V
6.6	**Verify nominal IDPU signal interface waveforms by measurement at the IDPU-P1:** (with respect to signal ground, on IDPU-P1 pin 33)	
6.6.1	Command+, IDPU-P1 pin 12; RS422 levels, RS232 38.4Kbaud signal, one	_____OK

	block sent each second lasting about 0.33 seconds starting within 0.1second of CLK1HZ pulse	
6.6.2	Command-, IDPU-P1 pin 31; inverse of Command+	_____OK
6.6.3	RRECRDYF+, IDPU-P1 pin 11; RS422 levels, low (if SSR ready)	_____OK
6.6.4	RRECRDYF-, IDPU-P1 pin 30, RS422 levels, high (if SSR ready)	_____OK
6.6.5	CLK1HZ, IDPU-P1 pin 14: positive going 5V pulse once a second lasting about 1us	_____OK
6.6.6	CLK1MHZ, IDPU-P1 pin 15; 5V square wave at about 1MHz	_____OK
6.6.7	Reset, IDPU-P1 pin 16; 0V	_____OK
6.6.8	Safe, IDPU-P1 pin 17; 0V	_____OK
7.	**Command on the Instrument Switched Loads power service** Start SC_IDPU_SPWRON	_____OK
7.1	Measure Heater power service is on (28V): IPC-P1 pin 1 to pin 6	_____ V
7.2	Measure IDPU power service is on (28V): IPC-P1 pin 2 to pin 7	_____ V
7.3	Measure Switched power service is on (28V): IPC-P1 pin 3 to pin 8	_____ V
7.4	Measure CPC power service is off (0V): CPC-P1 pin 1 to pin 6	_____ V
7.5	Measure CPC power service is off (0V): CPC-P1 pin 2 to pin 7	_____ V
8.	**Command off the Instrument power service** Start SC_IDPUOFF (Procedure Version Number_____)	_____OK
8.1	This is an illegal state (Instrument service off, switched service on), and should be inhibited by the ground system. Verify inhibit prevents this state with appropriate error messages.	_____OK
8.2	Measure Heater power service is on (28V): IPC-P1 pin 1 to pin 6	_____ V
8.3	Measure IDPU power service is on (28V): IPC-P1 pin 2 to pin 7	_____ V
8.4	Measure Switched power service is on (28V): IPC-P1 pin 3 to pin 8	_____ V
8.5	Measure CPC power service is off (0V): CPC-P1 pin 1 to pin 6	_____ V
8.6	Measure CPC power service is off (0V): CPC-P1 pin 2 to pin 7	_____ V
9.	**Command on the Cryocooler power service** Start SC_CPCON	_____OK
9.1	Measure Heater power service is on (28V): IPC-P1 pin 1 to pin 6	_____ V
9.2	Measure IDPU power service is on (28V): IPC-P1 pin 2 to pin 7	_____ V
9.3	Measure Switched power service is on (28V): IPC-P1 pin 3 to pin 8	_____ V
9.4	Measure CPC power service is on (28V): CPC-P1 pin 1 to pin 6	_____ V
9.5	Measure CPC power service is on (28V): CPC-P1 pin 2 to pin 7	_____ V
10.	**Command off the Instrument power service** Start SC_IDPUOFF	_____OK
10.1	This is an illegal state (Instrument service off, CPC service on), and should be inhibited by the ground system. Verify inhibit prevents this state with appropriate error messages.	_____OK
10.2	Measure Heater power service is on (28V): IPC-P1 pin 1 to pin 6	_____ V
10.3	Measure IDPU power service is on (28V): IPC-P1 pin 2 to pin 7	_____ V
10.4	Measure Switched power service is on (28V): IPC-P1 pin 3 to pin 8	_____ V
10.5	Measure CPC power service is on (28V): CPC-P1 pin 1 to pin 6	_____ V
10.6	Measure CPC power service is on (28V): CPC-P1 pin 2 to pin 7	_____ V
11.	**Command off the Instrument Heater power service** Start SC_HTROFF (Procedure Version Number_____)	_____OK
11.1	Measure Heater power service is off (0V): IPC-P1 pin 1 to pin 6	_____ V
11.2	Measure IDPU power service is on (28V): IPC-P1 pin 2 to pin 7	_____ V
11.3	Measure Switched power service is on (28V): IPC-P1 pin 3 to pin 8	_____ V
11.4	Measure CPC power service is on (28V): CPC-P1 pin 1 to pin 6	_____ V
11.5	Measure CPC power service is on (28V): CPC-P1 pin 2 to pin 7	_____ V
12	**Command off the Switched Power service** Start SC_IDPU_SPWROFF (Procedure Version Number_____)	_____OK
12.1	Measure Heater power service is off (0V): IPC-P1 pin 1 to pin 6	_____ V

12.2	Measure IDPU power service is on (28V): IPC-P1 pin 2 to pin 7	_____ V
12.3	Measure Switched power service is off (0V): IPC-P1 pin 3 to pin 8	_____ V
12.4	Measure CPC power service is on (28V): CPC-P1 pin 1 to pin 6	_____ V
12.5	Measure CPC power service is on (28V): CPC-P1 pin 2 to pin 7	_____ V
12	**Command off the Cryo Power service** Start SC_CPCOFF (Procedure Version Number_____)	_____OK
12.1	Measure Heater power service is off (0V): IPC-P1 pin 1 to pin 6	_____ V
12.2	Measure IDPU power service is on (28V): IPC-P1 pin 2 to pin 7	_____ V
12.3	Measure Switched power service is off (0V): IPC-P1 pin 3 to pin 8	_____ V
12.4	Measure CPC power service is on (0V): CPC-P1 pin 1 to pin 6	_____ V
12.5	Measure CPC power service is on (0V): CPC-P1 pin 2 to pin 7	_____ V
13.	**Command off the Instrument Power Service** Start SC_IDPUOFF	
13.1	Measure Heater power service is off (0V): IPC-P1 pin 1 to pin 6	_____ V
13.2	Measure IDPU power service is off (0V): IPC-P1 pin 2 to pin 7	_____ V
13.3	Measure Switched power service is off (0V): IPC-P1 pin 3 to pin 8	_____ V
13.4	Measure CPC power service is on (0V): CPC-P1 pin 1 to pin 6	_____ V
13.5	Measure CPC power service is on (0V): CPC-P1 pin 2 to pin 7	_____ V
14.	**Command Off the Spacecraft for harness mate** Perform spacecraft power-off procedure	_____OK
15.	**Mate the IDPU via the breakout boxes:**	
15.1	IPC-P1	_____OK
15.2	CPC-P1	_____OK
15.3	IDPU-P1	_____OK
16.	**Verify Grounding:**	
16.1	Measure impedance between spacecraft chassis and IPC HVPS chassis (should be < 0.5 ohms)	_____Ohms
16.2	Measure impedance between spacecraft chassis and Particle Detector chassis (should be < 0.5 ohms)	_____Ohms
17.	**Command On the Spacecraft** Perform spacecraft power-on procedure	_____OK
17.1	Verify spacecraft operating nominally via state-of-health telemetry	_____OK
18.	**Command on the Instrument power service** Start SC_IDPUON	_____OK
18.1	Verify expected IDPU current consumption on ITOS SOH displays (typically about 0.5A)	_____Amps
18.2	**Verify nominal IDPU temperatures on ITOS SOH telemetry** (about 20C):	
18.2.1	IDPU	_____ °C
18.2.2	IPC	_____ °C
18.2.3	CPC	_____ °C
18.3	**On IDPU-P1 breakout box, verify the following signals (IDPU Inputs);** (with respect to signal ground, on IDPU-P1 pin 33)	
18.3.1	Command+, IDPU-P1 pin 12; RS422 levels, RS232 38.4Kbaud signal, one block sent each second lasting about 0.33 seconds, starting within 0.1second of CLK1HZ pulse	_____OK
18.3.2	Command-, IDPU-P1 pin 31; inverse of Command+	_____OK
18.3.3	RRECRDYF+, IDPU-P1 pin 11; RS422 levels, low (if SSR ready)	_____OK
18.3.4	RRECRDYF-, IDPU-P1 pin 30, RS422 levels, high (if SSR ready)	_____OK
18.3.5	CLK1HZ, IDPU-P1 pin 14: positive going 5V pulse once a second lasting about 1us	_____OK
18.3.6	CLK1MHZ, IDPU-P1 pin 15; 5V square wave at about 1MHz	_____OK
18.3.7	Reset, IDPU-P1 pin 16; 0V	_____OK
18.3.8	Safe, IDPU-P1 pin 17; 0V	_____OK
18.4	**On IDPU-P1 breakout box, verify the following signals (IDPU Outputs):**	

	(with respect to signal ground, on IDPU-P1 pin 33)	
18.4.1	Telemetry+, IDPU-P1 pin 13; RS422 levels, RS232 38.4Kbaud signal, one block sent each second lasting 0.42 second, starting within 0.1second of CLK1HZ pulse	_____OK
18.4.2	Telemetry-, IDPU-P1 pin 32; inverse of Telemetry+	_____OK
18.4.3	HRECCLK+, IDPU-P1 pin 9; RS422 levels, 5.0MHz square clock	_____OK
18.4.4	HRECCLK-, IDPU-P1 pin 28; inverse of HRECCLK+	_____OK
18.4.5	HRECVALF+, IDPU-P1 pin 10; RS422 high level (inactive)	_____OK
18.4.6	HRECVALF-, IDPU-P1 pin 29; inverse on HRECVALF+	_____OK
18.4.7	HRECDAT0+, IDPU-P1 pin 1; RS422 levels, random data clocked by HRECLK+; measure setup time from data valid to HRECCLK+ falling edge (50ns minimum)	_____ ns
18.4.8	HRECDAT0-, IDPU-P1 pin 20; inverse of HRECDAT0+	_____OK
18.4.9	HRECDAT1+, IDPU-P1 pin 2; similar to HRECDAT0+	_____OK
18.4.10	HRECDAT1-, IDPU-P1 pin 21; inverse of HRECDAT1+	_____OK
18.4.11	HRECDAT2+, IDPU-P1 pin 3; similar to HRECDAT0+	_____OK
18.4.12	HRECDAT2-, IDPU-P1 pin 22; inverse of HRECDAT2+	_____OK
18.4.13	HRECDAT3+, IDPU-P1 pin 4; similar to HRECDAT0+	_____OK
18.4.14	HRECDAT3-, IDPU-P1 pin 23; inverse of HRECDAT3+	_____OK
18.4.15	HRECDAT4+, IDPU-P1 pin 5; similar to HRECDAT0+	_____OK
18.4.16	HRECDAT4-, IDPU-P1 pin 24; inverse of HRECDAT4+	_____OK
18.4.17	HRECDAT5+, IDPU-P1 pin 6; similar to HRECDAT0+	_____OK
18.4.18	HRECDAT5-, IDPU-P1 pin 25; inverse of HRECDAT5+	_____OK
18.4.19	HRECDAT6+, IDPU-P1 pin 7; similar to HRECDAT0+	_____OK
18.4.20	HRECDAT6-, IDPU-P1 pin 26; inverse of HRECDAT6+	_____OK
18.4.21	HRECDAT7+, IDPU-P1 pin 8; similar to HRECDAT0+	_____OK
18.4.22	HRECDAT7-, IDPU-P1 pin 27; inverse of HRECDAT7+	_____OK
19.	**Command Off the Spacecraft for harness mate** Perform spacecraft power-off procedure	_____OK
20.	**Remove the breakout boxes and connect the IDPU harnesses directly**	
20.1	IPC-P1	_____OK
20.2	CPC-P1	_____OK
20.3	IDPU-P1	_____OK

Proceedure Complete
Date/Time:_____