Factory Scorpius Char Test Plan for J5xx

Module: Scorpius
Station: Scorpius Char (DEV40)
Build: P1
Release Date: 31 August 2020

This Document Covers the Following Products: J5xx
Revision: P2_V1.6
<rdar://problem/56766302> J5xx Scorpius Factory ERS
<rdar://problem/60027625> J3xx&J5xx Scorpius ERS - Foxconn

[Note: Anything in brackets is expected to be updated / deleted for the official document]

Table of Contents

1. Revision

Build Type	Version	Date	Notes	Author
Please refer to last section of this document for Details/Comments on change to this document				
P0	1.0	8 January 2020	Initial release for J5xx P0 Build. Based on J307 P1. Limits need to be updated.	Bhushan Koli
	1.1	21 January 2020	General updates on limits and smokey commands	Bhushan Koli/Alberto M/Nan Liu/ Frank B
P1	1.2	19 February 2020	Reverted back to original smokey commands	Bhushan Koli
	1.3	21 February 2020	Updated Minimum Vboost requirement from 6V to 6.1V	Bhushan Koli/Mikhal
	1.3	21 February 2020	Updated Minimum Vboost requirement from 6V to 6.1V	Bhushan Koli/Rex H/Nan Liu
	1.4	3 April 2020	Updated power flow test procedure to include VCC main and Vbatt measurements Updated LPP limits Added Dotara Temperature measurement Updated command and response format of LPP and VCTx respectively Updated procedure to disable LFOD during Vsense & Isense measurement	Bhushan Koli/Rex H/Nan Liu/Frank
	1.5	17 April 2020	Updated LPP, Power Transfer & Digital ping limits Updated formulas in Power Transfer section for VSYS_ANA & VSYS_1P8	Bhushan Koli/Nan Liu/Frank
P2	1.6	31 July 2020	Switch entire Scorpius testing from EFI Diags to iOS Non UI mode similar to J307 SChar. • Switched to CloseLoop from Open loop	Bhushan Koli

2. Purpose

This document describes the FATP Scorpius Char test plan for the J5xx inductive charging Tx module for P0.

3. Scope

The scope of this document is the Scorpius only module of the J5xx products. It covers FATP tests of the following high level features:

Test	Scorpius Test
LPP ping and delta calculation	✓
Power Flow & Efficiency	✓
Comms - PingPong	✓

4. References

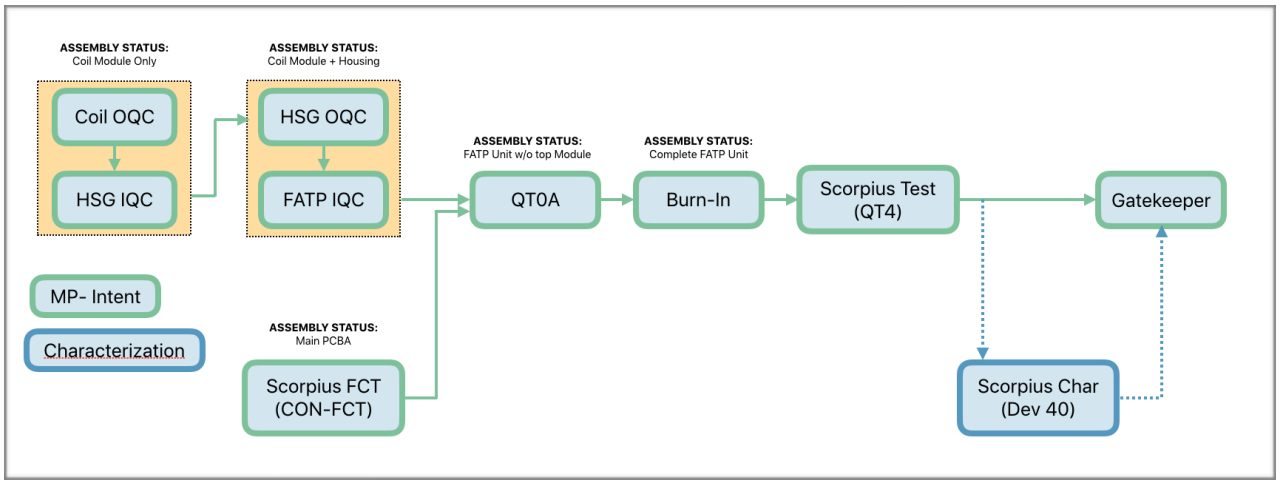
<rdar://problem/47434171> J4xx Scorpius factory ERS
<rdar://problem/48910417> Dotara Data-sheet
<rdar://problem/48964978> Dotara Block initializations
<rdar://problem/49391712> J5xx FW specifications
<rdar://problem/54853341> Radar for Scorpius Factory FW releases
J5xx Schematic

5. Glossary & Definitions

Acronym	Term	Description
AMPL	Amplitude	-
ASK	Amplitude shift keying	-
Ballast	Ballast Load	Internal load within Aculeus/Iktara that maintains a constant current load.
CAL	Calibratied	These are after calibration values.
COMM's	Communications	Referring to ASK and FSK communications
CPLG	Coupling	-
CTX	-	Series resonant capacitance.
DC	Duty Cycle	-
DSBL	Disable	-
ENBL	Enable	-
FOD	Foreign Object Detection	Detection mechanism for metallic objects near the inductive power link
FREQ	Frequency	-
FSK	Frequency shift keying	-
FXST	Fixture Setup	-
Kmax	-	Maximum Coupling Coefficient
Kmin	-	Minimum Coupling Coefficient
LPP	Low Power Ping	Object/Rx detection system
MPE	Maximum Permissible Exposure	Protection scheme to limit the maximum leakage H-field when Scorpius is charging
Rx	Receiver	Wireless Power Receiver. Also referred to as PRx
SCRP	Scorpius	Reference for searching Scorpius Module related Data in Insight.
Tx	Transmitter	Wireless Power Transmitter. Also referred to as PTx(J5xx MLB)
VCTX	-	Voltage across Tx coil
VBoost	-	Voltage across Boost output
VRect	-	Voltage across Rx Rectifier

6. Overview

The block diagram below shows the overall end-end test coverage for the inductive Scorpius module. This document covers Scorpius Char Station.



6.1. Summary of Test Coverage

	Kmax	Knom	Kmin
LPP	no load	no load	no load
Digital Ping	0.1C	n/a	0.1C
Open Loop + Ping Pong	0.1C, 3C, 10C	0.1C, 3C, 10C	0.1C, 3C, 10C

6.2. Fixture Coupling specs

Throughout this document various tests will have different limits depending on the offset position i.e. coupling. Ensure close attention is paid to the tables shown for the different coupling positions, loads and limits.

All = all possible positions (MaxK, NomK,MinK)

InSight Keys Recorded	Position (mm)	K Spec	Measured Results (averaged after 5 readings)
KMax	0, 0.83, 0	0.535 - 0.610	Limits to be used need to be same as IQC_coupling station. FYI only. To be updated.
KNom	D1.1, 0.88, L1.1	-	
KMin	D1.5, 0.93, L1.5	0.440 - 0.530	

7. Critical and Frequently Used Commands

7.1. Quiesce Test Mode

After programming the Tx defaults to NominalMode (LPP > Digital Ping > Power negotiation > Closed loop).
The following command needs to be sent to the Tx to enable QuiesceMode whereby certain test commands are then enabled.
A power cycle will mean the unit needs to be re-programmed as the firmware application is run from SRAM.
This is the test mode whereby additional commands for test/validation are active.This command will disable everything except the MCU i.e. Boost, Bridge, LPP switch will be disabled.
Resets into the quiesce mode with the bridge disabled.

```
hidreport --noplugin -u 0xFF00,0x0036 set 0x09 09 01
```

Note: *This command i.e. Quiesce Mode needs to be set once at beginning of testing or unless unit is reset or power cycled or Nominal Mode has been set for testing MTP sector, LPP & Digital Ping test.*

7.2. Nominal Mode

This is the normal runtime mode. Here, a subset of commands used for test/validation are deactivated.

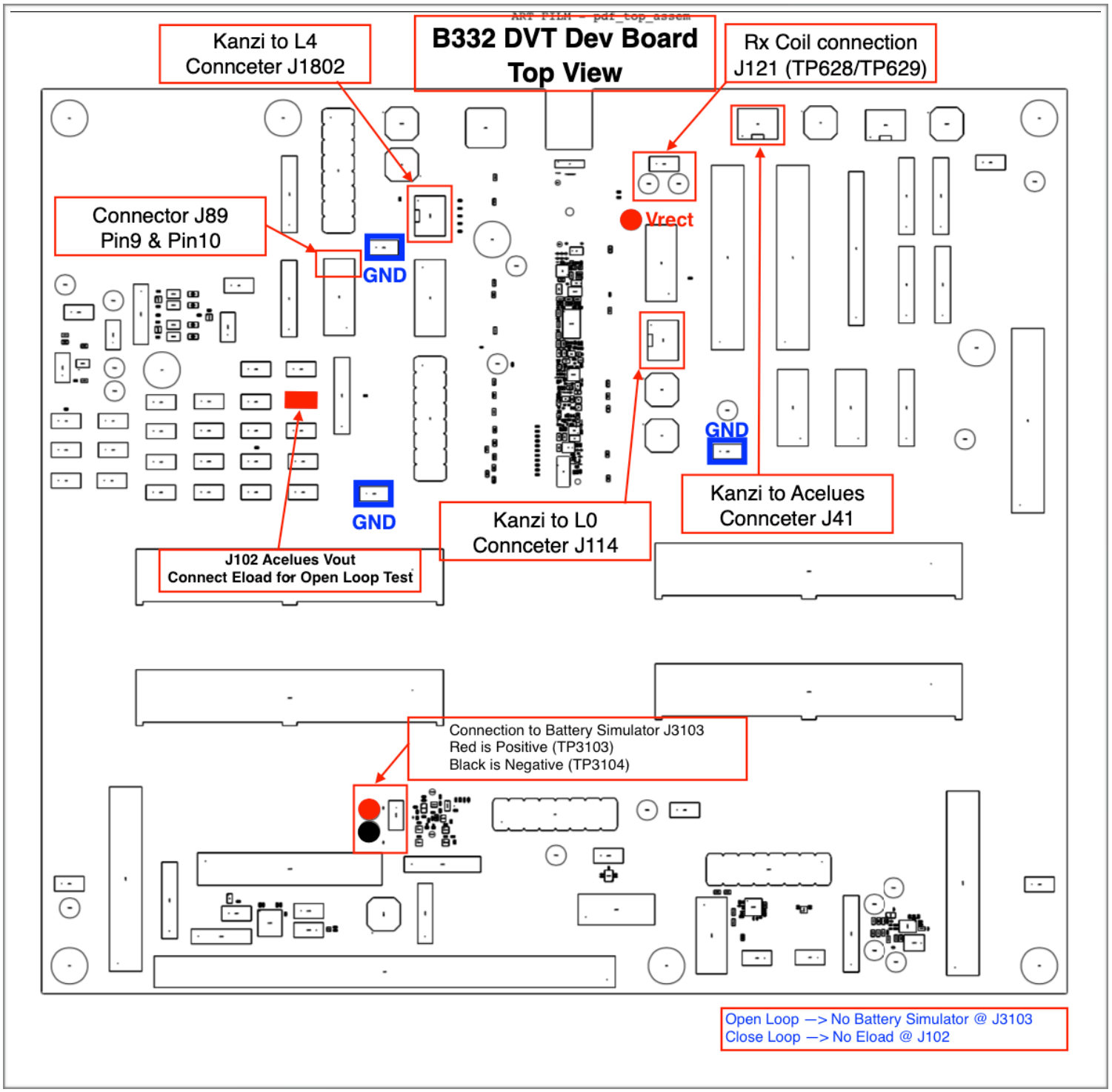
```
hidreport --noplugin -u 0xFF00,0x0036 set 0x09 09 00
```

Resets into the nominal mode where it will start the LPP-> Digital Ping-> Power Negotiation-> Closed loop sequence.

7.3. B332 Dev Board UART Baud rate

The B332 Dev Board is used to send commands to I2C of Aculeus using UART cable. Follow the steps below to open the B332 Dev Board UART.

1. Connect UART (1MBite baudrate, 1.8V) to J89 (Pin9 & Pin 10)
2. Open Terminal
3. nanocom -w 0 -c 1000000,n,8,1
4. Select your Connected UART option.



Note:-Testing with Ginger Rx board is a backup incase factory is not able to get B332 set up and running on time or has issue with B332

8. Test Coverage @ Scorpius Char Station

8.1. Read Tx FW Version

Description:- Read Tx FW. Dotara has no NVRAM and therefore will lose all the memory/setting after power cycling or load fw. Dotara will need to load the fw after each power cycling, this will be done by AOP if in iOS mode.

Failure Mode(s) Captured:TBD

Test Setup and Procedure:

Example:-This reads back 4 bytes: 0x01 0x00 0x02 0x05
Main FW Type (byte1&2): 0x0001
Main FW Version (byte3&4): 0x0502

Test Parameter	Insight Keys Recorded	Notes
Tx Fw Version	SCRP_Tx_Version	

8.2. Rx FW Version

Ginger SN: diags get mlbsn
Eload SN: diags get eloadsn
Versions: get versions ——> application: 2.6.19, this line is the Ginger FW version
B332 Dev Board Command to read Rx FW version: sys version

```
- Image Versions ------------------------------------------------------------
  Nanoboot [b0]:        v0003 - 1284 [508 free] bytes - None [0]
  Application [01]:     v0154 - 488424 [33816 free] bytes - None [0]
  BT FW [30]:           v0093 - 253632 [270656 free] bytes - None [0]
  Touch FW [20]:        v0444 -  62592 [2944 free] bytes - None [0]
  Touch Cal [c1]:       v0000 -  0 [8192 free] bytes
  Accel Algs [60]:      v0010 -   6272 [1920 free] bytes - None [0]
  Charger FW [50]:      v0060 -  51840 [46464 free] bytes - None [0]
  Power FW [58]:        v0261 -  21088 [11680 free] bytes - None [0]
  Power FW OTP [59]:    v2020 -  10240 [2048 free] bytes - None [0]
  ---------------------------------------------------------------------------
```

8.3. Initial MTP Sector Check Before Tests.

Description: Make sure FW is in a good state at the Before of the test. [TBD]
Failure Mode(s) Captured: TBD
Test Setup and Procedure: Refer below

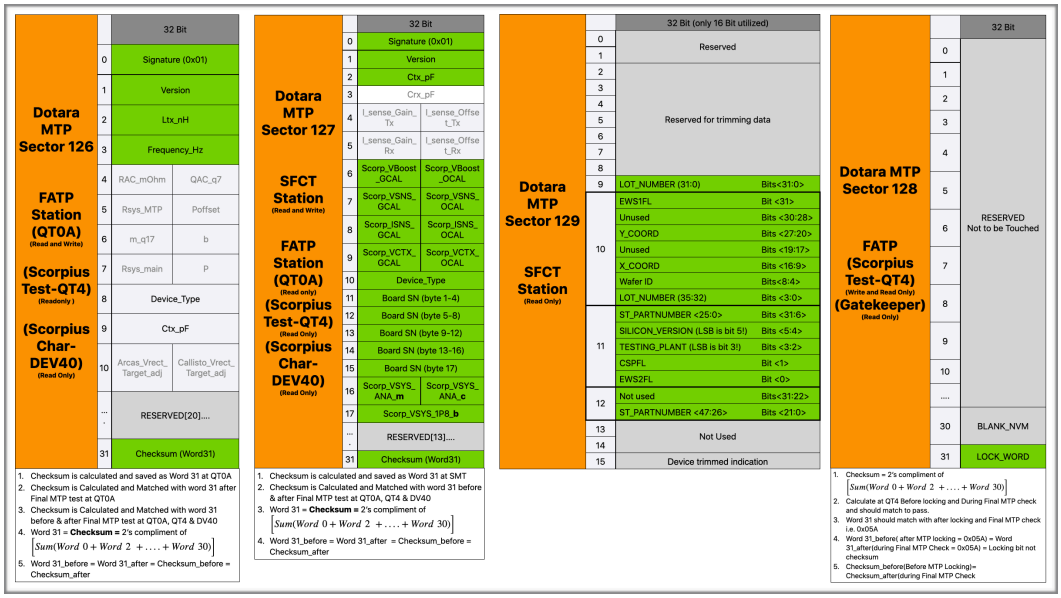


Figure 1 : MTP Word Locations

Step	Description	Interface	Command / Notes
Note: *This command i.e. Quiesce Mode needs to be set once at beginning of testing i.e. from Section 8.3 MTP Sector Check or unless unit is reset/power cycled or Nominal Mode has been set.*			
1	Tell Tx to enter Quiesce Mode	TX HID	hidreport --noplugin -u 0xFF00,0x0036 set 0x09 09 01
Skip the above steps if the unit is already in Quiesce Mode			
2	Read MTP Sector 127	Tx HID	hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 80 3F 00 50 ——> **Fixture wait 5mS** <—— hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 0 : 0x0000001 Signature hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 84 3F 00 50 ——> **Fixture wait 5mS** <—— hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 1 : 0x00000002 Version hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 88 3F 00 50 ——> **Fixture wait 5mS** <—— hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 2 : 0x0E0E0E0E CTx hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 98 3F 00 50 ——> **Fixture wait 5mS** <—— hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 6 : 0x0A0A0A0A Vboost Control hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 9C 3F 00 50 ——> **Fixture wait 5mS** <—— hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 7 : 0x0B0B0B0B Vsense Cal hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 A0 3F 00 50 ——> **Fixture wait 5mS** <—— hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 8 : 0x0C0C0C0C Isense Cal hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 A4 3F 00 50 ——> **Fixture wait 5mS** <—— hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 9 : 0x0D0D0D0D LFOD Cal hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 A8 3F 00 50 ——> **Fixture wait 5mS** <—— hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 10 : 0x03070001 Device Type hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 AC 3F 00 50 ——> **Fixture wait 5mS** <—— hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 11 : 0x00000000 SN (1-4) hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 B0 3F 00 50 ——> **Fixture wait 5mS** <—— hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 12 : 0x00000000 SN (5-8) hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 B4 3F 00 50 ——> **Fixture wait 5mS** <—— hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 13 : 0x00000000 SN (9-12) hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 B8 3F 00 50 ——> **Fixture wait 5mS** <—— hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 14 : 0x00000000 SN (13-16) hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 BC 3F 00 50 ——> **Fixture wait 5mS** <—— hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 15 : 0x00000000 SN (17) hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 E0 3F 00 50 ——> **Fixture wait 5mS** <—— hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 31 : 0xF29D9024 CheckSum
4	Read MTP Sector 126	Tx HID	hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 00 3F 00 50 ——> **Fixture wait 5mS** <—— hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 0 : 0x0000001 Signature hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 04 3F 00 50 ——> **Fixture wait 5mS** <—— hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 1 : 0x00000002 Version hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 08 3F 00 50 ——> **Fixture wait 5mS** <—— hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 2 : 0x0E0E0E0E LTx hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 0C 3F 00 50 ——> **Fixture wait 5mS** <—— hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 3 : 0x0F0F0F0F FREQ hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 60 3F 00 50 ——> **Fixture wait 5mS** <—— hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 31 : 0xDDD9E0E1 CheckSum

Step	Description	Interface	Command / Notes
5	Location of Calibrated values of Vsense, Vsense, Isense, LFOD & CTx into MTP and other values into MTP :- Signature, Version,HWID, MLB SN, Checksum Follow Figure 1 Bellow for Reference	Test Overlay	Sector 127 :-Word 0(Signature = 0x01); Word 1(Version = 0x02); Word 2(CTx); Word 6(Vsense); Word 7(Vsense); Word 8(Isense); Word 9(LFOD); Word 10(HWID); Word 11 - 15(MLB SN - 17 byte), Word 31(Checksum)
6	Location to store Calibrated values of Inductance (Ltx_nH) & frequency_Hz into MTP and also Signature and version.	Test Overlay	Sector 126 :- Word 0(Signature = 0x01); Word 1(Version = 0x02); Word 2(Ltx_nH); Word 3(frequency_Hz)

Test Parameter	Insight Keys Recorded	Comments/Notes
Sector 127 - Check Sum (Word 31)	SCRP_Check Sum_127_MTP_BEFORE	Will need this Values to be compared against MTP Check after test **Section 8.7.**
Sector 127 - Version (Word 1)	SCRP_Version_127_MTP_BEFORE	
Sector 127 - Signature (Word 0)	SCRP_Signature_127_MTP_BEFORE	
Sector 127 - CTx MTP (Word 2)	SCRP_CTx_127_MTP_BEFORE	
Sector 127 - Vsense_Control MTP (Word 6)	SCRP_Vsense_127_MTP_BEFORE	
Sector 127 - Vsense MTP (Word 7)	SCRP_Vsense_127_MTP_BEFORE	
Sector 127 - Isense MTP (Word 8)	SCRP_Isense_127_MTP_BEFORE	
Sector 127 - LFOD MTP (Word 9)	SCRP_LFOD_127_MTP_BEFORE	
Sector 127 - Tx HWID_MTP (Word 10):- J51x - 0x05170000; J52x - 0x05200000	SCRP_TX_HWID_127_MTP_BEFORE	
Sector 127 - MLB Serial No. (Word 11 to Word 15 - Bits<1:17>)	SCRP_MLB_SN_127_MTP_BEFORE	
Sector 126 - Check Sum (Word 31)	SCRP_Check Sum_126_MTP_BEFORE	Will need this Values to be compared against MTP Check after test **Section 8.7.**
Sector 126 - Version (Word 1)	SCRP_Version_126_MTP_BEFORE	
Sector 126 - Signature (Word 0)	SCRP_Signature_126_MTP_BEFORE	
Sector 126 - LPP Inductance_MTP (Word 2)	SCRP_LPP_L_126_MTP_BEFORE	
Sector 126 - LPP Frequency_MTP (Word 3)	SCRP_LPP_FREQ_126_MTP_BEFORE	

8.4. Pre Data Streaming Setup and Open Loop Tests.

Description: Set the unit for Quiesce mode and preform some test in Test mode(open Loop).
Failure Mode(s) Captured: TBD
Test Setup and Procedure:

Step	Description	Interface	Command / Notes
1	Save the co-ordinate of Kmax after doing Active referencing	Overly	Assuming active referencing is done at very beginning of the test and the current coupling position is Kmax.
2	Move Rx to Kmax position	Overlay	
3	Disable LPP Switch "LPP_5V_EN"	TX Diags	hidreport --noplugin -u 0xFF00,0x0036 set 0x01 0x01 0x00 Payload: (LSB-MSB) ——> Byte0: 0 - turn off, 1 - turn on
4	Wait 2s	Fixture	
5	Measure Vsense		hidreport --noplugin -u 0xFF00,0x0036 set 0x41 0x41 0x98 0x36 0x00 0x40 0x80 0x01 0x00 0x00 **—>Disable LFOD** hidreport --noplugin -u 0xFF00,0x0036 set 0x40 0x40 0x98 0x34 0x00 0x40 **——> Fixture wait 5mS <——** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 **Response —>** bits 7 & bit 8 = 0 if Disabled, 1 if enabled **—>Check Status of LFOD** hidreport --noplugin -u 0xFF00,0x0036 set 0x41 0x41 0x58 0x34 0x00 0x40 0x00 0x00 0x00 0x00 **—>Disable ASK_CR** hidreport --noplugin -u 0xFF00,0x0036 set 0x31 0x31 0x00 0x00 0x8C **——> Fixture wait 5mS <——** hidreport --noplugin -u 0xFF00,0x0036 get 0x31 **Response —>** bytes1-4 = Floating point value from ADC **—> Vsense_kmxx_MCU** hidreport --noplugin -u 0xFF00,0x0036 set 0x41 0x41 0x98 0x35 0x00 0x40 0x80 0x01 0x00 0x00 **—>Enable LFOD**
6	Enable LPP Switch "LPP_5V_EN"	TX Diags	hidreport --noplugin -u 0xFF00,0x0036 set 0x01 0x01 0x01 Payload: (LSB-MSB) ——> Byte0: 0 - turn off, 1 - turn on
7	Wait 1s	Fixture	
8	Repeat Step 5		
9	Send 1.4uS LPP pulse	Tx HID	hidreport --noplugin -u 0xFF00,0x0036 set 0x05 0x05 0x00 0x46
10	Delay 15mS before proceeding	Fixture	

Step	Description	Interface	Command / Notes
11	Read output parameters of F and L and raw ADC data	Tx HID	hidreport --noplugin -u 0xFF00,0x0036 get 0x05 Response —>(Received LSB First, Length should be 23bytes) Byte0: ReportId (should equal 0x05) Byte1: Error code (0x00-> no error) Byte2: Sub-cmd (should be 0x00) bytes3-6: Floating point value of frequency Bytes7-10: Floating point value of inductance Bytes19-22: Buffer address of raw ADC data Bytes23-26: Number of raw ADC data elements (of size uint16_t)
12	Collect raw ADC samples and upload to Insight	Tx HID & Fixture	Collect Pointer to raw LPP data by sending the following command from bytes19-22 in the above response.Use the above info to read the Address and use the command Below to read the raw ADC buffered data and upload to insight. hidreport --noplugin -u 0xFF00,0x0036 set 0x40 0x40 0xxx 0xxx 0xxx 0xxx (Sent LSB First) Byte1-4: [u32] Address to read **——> Fixture wait 5mS <——** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Response —> 0x40 00 f8 34 00 40 10 00 20 00 Byte0: [u8] ID (AnyAddressReadID = 0x40) Byte1: [u8] Error code (0x00 = no error for previous set report) Byte2-5: [u32] address (eg. address 0x400034f8 from previous set report) Byte6-9: [u32] data (read data 0x00200010 from the address above. Split this into 2 2-bytes data) The LPP data is 660 bytes, therefore 165 loops of above pair of set & get commands should finished reading all the LPP data
13	Repeat Steps 3 to 12 at all coupling position	Tx HID & Fixture	Coupling Position :- KMax, KNom & KMin
14	Move away to Free Air Position i.e make use Rx coil is away from Tx even further to Kmin.	Overlay	To ensure that Rx is away from the coupling position and is in Free Air the **Vrect across B332 Dev board should be 0V.**

Acceptance Criteria:

Physical Parameter	InSight Keys Recorded	LL	UL	Unit	Offset Positions
LPP Frequency	KMax_OL_LPP_Frequency	62	71.5	kHz	Kmax
	KNom_OL_LPP_Frequency	63	72.8		Knom
	KMin_OL_LPP_Frequency	64	77.2		Kmin
LPP Inductance	KMax_OL_LPP_Inductance	22.3	28	µH	Kmax
	KNom_OL_LPP_Inductance	21.5	27		Knom
	KMin_OL_LPP_Inductance	19.1	26		Kmin
LPP Vsense_Disabled	Kxxx_OL_LPP_Vsense_Disabled	0	200	mV	All
LPP Vsense_Enabled	Kxxx_OL_LPP_Vsense_Enabled	5030	5260	mV	All

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8.5. Normal Test Mode (Data Streaming) :-LLP —> DP —> Power Flow & Comms

Description: Check the actual end to end control & functionally of Scorpius module.
Failure Mode(s) Captured: If the unit does not follow the POR sequence and failing some parameters.
Test Setup and Procedure:

Step	Description	Interface	Command / Notes
1	Set Battery VOC =3.47V	Overlay	VoC=3.47V —> 10C
2	Setup Register for reading data	Tx HID	hidreport set 0x55 0x55 0x0E
3	Enable data streaming	Tx HID	hidreport inputs Note: Make sure there is no Rx present to get Free Air LPP
4	Record 100x LPP data streams @ free air		
5	Get LPP data from above count		
6	Get LPP data from above count		
7	Move the Rx from Free Air Position to Kmax coupling position		Kmax = 0, 0.83, 0 (These will be co-ordinates from Active referencing)
8	Record the data from Digital Ping Note :- In Data Streaming there will be on one Digital Ping		**Example:-** [0x21] IBC: FSK → Requester -> 0x4 [Debug Comms]; Req Num -> 0x7E0; **[Digital Ping]**; Raw: 9F 02 [0x21] IBC: ASK ← Requester -> 0x4 [Debug Comms]; Req Num -> 0x7E0; **[Rx Digital Ping Response]** RxType:0x80 **VRECT:8600mV**; Raw: 78 00 80 56 5F 9B 92 DC

Step	Description	Interface	Command / Notes
9	Start Recording Comms FSK/ASK Packets for 10C. Note:-1st **[Regular Sync]** in **[0x21] IBC:** is your 1st **FSK** for 10C and subsequent **ASK** is your 1st **ASK** for 10C **T1 --> CL_time to 10C _start** Note: Keyword **[CEP]** is always used for getting the start time. 1st **[CEP]** after [Digital Ping] in **[0x21] IBC:** is start time for Time to 10C Ramp	Overlay & Data Streaming	**Exapmle:-** **This is 1st FSK for 10C** **[0x21] IBC: FSK** → Requester -> 0x4 [Debug Comms]; Req Num -> 0x7E1; **[Regular Sync]**; Raw: 80 **This is 1st ASK for 10C** **[0x21] IBC: ASK** ← Requester -> 0x4 [Debug Comms]; Req Num -> 0x7E1; [Rx Power Req Level 3.000000W] ; Raw: 28 12 1E This 2nd FSK for 10C [0x21] IBC: FSK → Requester -> 0x4 [Debug Comms]; Req Num -> 0x7E2; [Tx Guaranteed Power] GuaranteedPower:3000mW; Raw: 2E 03 1E The is 3rd FSK for 10C [0x21] IBC: FSK → Requester -> 0x4 [Debug Comms]; Req Num -> 0x7E3; [Regular Sync]; Raw: 80 **T1 = 615766405.832418** **[0x21] IBC:** ASK ← Requester -> 0x4 [Debug Comms]; Req Num -> 0x7E3; **[CEP]** Offset: 0; Raw: 03 00 ***Ignore all FSK with [C26]*** [0x21] IBC: FSK → Requester -> 0x4 [Debug Comms]; Req Num -> 0x7E9; ***[C26 Packet]*** Raw: 8F 03 04 00 04 AA AA AA AA AA
10	Data monitoring & collection Note:-**[0x0A] PCP:** is Power count packet. Use this to get power flow data and to monitor Vrect to check charge rate status **10C Charge Rate Condition Vrect = 14V±2%, Irect = 200mA±15mA**		**Exapmle:-** **[0x0A] PCP:** itx → 521 mA, phase → 100.0°, vBoost → 6127 mV, iBoost → 87 mA, vRect → 8604 mV, iRect → 39 mA, eff → 62.3%, mpeViolation → 0, mpePowerLimit → NO, chargeRate → 1, mpeTriggerCount → 0 ..... **[0x0A] PCP:** itx → 870 mA, phase → 180.0°, vBoost → 9048 mV, iBoost → 430 mA, **vRect → 13944 mV, iRect → 190 mA**, eff → 68.0%, mpeViolation → 0, mpePowerLimit → NO, chargeRate → 1, mpeTriggerCount → 0
11	**T2**--> CL_time @ 10C start Note: When the data streams first meets **10C charge rate condition**, the **[CEP]** just before **[PCP]** is the **T2**--> CL_time @ 10C start. Keyword **[CEP]** is always used for getting the start time.		**Exapmle:-** [0x21] IBC: FSK → Requester -> 0x4 [Debug Comms]; Req Num -> 0x7FF; [Regular Sync]; Raw: 80 **T2 = 615766408.058415** **[0x21] IBC:** ASK ← Requester -> 0x4 [Debug Comms]; Req Num -> 0x7FF; **[CEP]** Offset: -5; Raw: 03 FB [0x21] IBC: FSK → Requester -> 0x4 [Debug Comms]; Req Num -> 0x800; [Power Count Sync]; Raw: C0 [0x21] IBC: ASK ← Requester -> 0x4 [Debug Comms]; Req Num -> 0x800; [Power Count Response] Offset: 2; **VRECT:13944 mV IRECT:190 mA;** Raw: 48 02 91 14 7C **[0x0A] PCP:** itx → 870 mA, phase → 180.0°, vBoost → 9048 mV, iBoost → 430 mA, **vRect → 13944 mV, iRect → 190 mA**, eff → 68.0%, mpeViolation → 0, mpePowerLimit → NO, chargeRate → 1, mpeTriggerCount → 0
12	Data monitoring & collection at **10C** and **transitioning to 3C** **T4 --> CL _time to 3C start** Note:-When **Irect** first drop below **10C condition**, then the **[CEP]** just before **[PCP]** is start time for 3C ramp down. **T3--> CL_time @10C End** Note:-You can only find T3 when you have T4. T3 will be **[CEP]** before T4. And Data for 10C will be **[PCP]** before T4.		**Exapmle:-** **T3 = 615766420.485967** **[0x21] IBC:** ASK ← Requester -> 0x4 [Debug Comms]; Req Num -> 0x8A8; **[CEP]** Offset: 1; Raw: 03 01 **This is the last FSK for 10C** **[0x21] IBC: FSK** → Requester -> 0x4 [Debug Comms]; Req Num -> 0x8A9; [Power Count Sync]; Raw: C0 **This is the last ASK for 10C** **[0x21] IBC: ASK** ← Requester -> 0x4 [Debug Comms]; Req Num -> 0x8A9; [Power Count Response] Offset: 1; VRECT:13962 mV IRECT:195 mA; Raw: 48 01 91 17 86 **10C Data ———>** **[0x0A] PCP: itx → 874 mA, phase → 180.0°, vBoost → 9099 mV, iBoost → 440 mA, vRect → 13962 mV, iRect → 195 mA, eff→ 67.9%**, mpeViolation → 0, mpePowerLimit → NO, chargeRate → 1, mpeTriggerCount → 0 **This is the first FSK for 3C** **[0x21] IBC: FSK** → Requester -> 0x4 [Debug Comms]; Req Num -> 0x8AA; [Regular Sync]; Raw: 80 **T4 = 615766420.631070** **[0x21] IBC: ASK** ← Requester -> 0x4 [Debug Comms]; Req Num -> 0x8AA; **[CEP]** Offset: -27; Raw: 03 E5 [0x21] IBC: FSK → Requester -> 0x4 [Debug Comms]; Req Num -> 0x8AB; [Power Count Sync]; Raw: C0 [0x21] IBC: ASK ← Requester -> 0x4 [Debug Comms]; Req Num -> 0x8AB; [Power Count Response] Offset: -10; VRECT:14208 mV IRECT:138 mA; Raw: 48 F6 94 10 14 **3C ramp down Condition —>** [0x0A] PCP: itx → 819 mA, phase → 180.0°, vBoost → 8672 mV, iBoost → 326 mA, vRect → 14208 mV, **iRect → 138 mA**, eff → 69.2%, mpeViolation → 0, mpePowerLimit → NO, chargeRate → 1, mpeTriggerCount → 0 ***Ignore all FSK with [C26]*** [0x21] IBC: FSK → Requester -> 0x4 [Debug Comms]; Req Num -> 0x7E9; ***[C26 Packet]*** Raw: 8F 03 04 00 04 AA AA AA AA AA
13	Data monitoring & collection **3C Charge Rate Condition Vrect = 8V±2%, Irect = 113mA±15mA** **T5 --> CL _time to 3C End** Note:-You can only find T5 if 3C condition are met.		**Exapmle:-** [0x21] IBC: FSK → Requester -> 0x4 [Debug Comms]; Req Num -> 0x8B6; [Regular Sync]; Raw: 80 **T5 = 615766421.499533** **[0x21] IBC:** ASK ← Requester -> 0x4 [Debug Comms]; Req Num -> 0x8B6; **[CEP]** Offset: -5; Raw: 03 FB [0x21] IBC: FSK → Requester -> 0x4 [Debug Comms]; Req Num -> 0x8B7; [Power Count Sync]; Raw: C0 [0x21] IBC: ASK ← Requester -> 0x4 [Debug Comms]; Req Num -> 0x8B7; [Power Count Response] Offset: -5; VRECT:8082 mV IRECT:107 mA; Raw: 48 FB 54 03 D6 [0x0A] PCP: itx → 561 mA, phase → 114.0°, vBoost → 6117 mV, iBoost → 205 mA, **vRect → 8082 mV, iRect → 107 mA,** eff → 68.7%, mpeViolation → 0, mpePowerLimit → NO, chargeRate → 1, mpeTriggerCount → 0
14	Let the unit run at 3C for 5sec		
15	Get 3C Data when stable within 15Sec wait time. Note:- Data could be stable at beginning of 15sec wait time or in between. It could possibly be lower than the limits towards the end of 15sec due to battery charing. Take the reading which are more stable. If the the stable readings are consistently below the limits then it could be a failing unit and might need to reset and resets if required.		**Exapmle:-** [0x21] IBC: FSK → Requester -> 0x4 [Debug Comms]; Req Num -> 0xD85; [Regular Sync]; Raw: 80 [0x21] IBC: ASK ← Requester -> 0x4 [Debug Comms]; Req Num -> 0xD85; [CEP] Offset: 0; Raw: 03 00 **This is the last FSK for 3C** [0x21] IBC: FSK → Requester -> 0x4 [Debug Comms]; Req Num -> 0xD86; [Power Count Sync]; Raw: C0 **This is the last ASK for 3C** [0x21] IBC: ASK ← Requester -> 0x4 [Debug Comms]; Req Num -> 0xD86; [Power Count Response] Offset: -1; VRECT:8034 mV IRECT:106 mA; Raw: 48 FF 53 0B D4 **3C Data ———>** **[0x0A] PCP: itx → 556 mA, phase → 111.50°, vBoost → 6127 mV, iBoost → 200 mA, vRect → 8034 mV, iRect → 106 mA, eff → 69.4%,** mpeViolation → 0, mpePowerLimit → NO, chargeRate → 1, mpeTriggerCount → 0 ***Ignore all FSK with [C26]*** [0x21] IBC: FSK → Requester -> 0x4 [Debug Comms]; Req Num -> 0x7E9; ***[C26 Packet]*** Raw: 8F 03 04 00 04 AA AA AA AA AA
16	Set Battery VOC =4.15V		VoC=4.15V —>0.1C
17	Data monitoring & collection **0.1C Charge Rate Condition Vrect = 6.5V±2%, Irect = ~40mA**		**Exapmle:-** **This is the first FSK for 0.1C** [0x21] IBC: FSK → Requester -> 0x4 [Debug Comms]; Req Num -> 0xD87; [Regular Sync]; Raw: 80 **This is the first ASK for 0.1C** [0x21] IBC: ASK ← Requester -> 0x4 [Debug Comms]; Req Num -> 0xD87; **[CEP]** Offset: 0; Raw: 03 00 [0x21] IBC: FSK → Requester -> 0x4 [Debug Comms]; Req Num -> 0xD88; [Power Count Sync]; Raw: C0 [0x21] IBC: ASK ← Requester -> 0x4 [Debug Comms]; Req Num -> 0xD88; [Power Count Response] Offset: -32; VRECT:9132 mV IRECT:52 mA; Raw: 48 E0 5F 02 68 **0.1C ramp down Condition->** [0x0A] PCP: itx → 539 mA, phase → 111.0°, vBoost → 6127 mV, iBoost → 108 mA, **vRect → 9132 mV, iRect → 52 mA**, eff → 71.1%, mpeViolation → 0, mpePowerLimit → NO, chargeRate → 1, mpeTriggerCount → 0 ***Ignore all FSK with [C26]*** [0x21] IBC: FSK → Requester -> 0x4 [Debug Comms]; Req Num -> 0x7E9; ***[C26 Packet]*** Raw: 8F 03 04 00 04 AA AA AA AA AA
18	Let the unit run at 0.1C for 5sec		
19	Get 0.1C Data when stable within 15Sec wait time. Note:- Data could be stable at beginning of 15sec wait time or in between. It could possibly be lower than the limits towards the end of 15sec due to battery charing. Take the reading which are more stable. If the the stable readings are consistently below the limits then it could be a failing unit and might need to reset and resets if required.		**Exapmle:-** [0x21] IBC: FSK → Requester -> 0x4 [Debug Comms]; Req Num -> 0x113E; [Regular Sync]; Raw: 80 [0x21] IBC: ASK ← Requester -> 0x4 [Debug Comms]; Req Num -> 0x113E; [CEP] Offset: 5; Raw: 03 05 **This is the Last FSK for 0.1C** [0x21] IBC: FSK → Requester -> 0x4 [Debug Comms]; Req Num -> 0x113F; [Power Count Sync]; Raw: C0 **This is the Last ASK for 0.1C** [0x21] IBC: ASK ← Requester -> 0x4 [Debug Comms]; Req Num -> 0x113F; [Power Count Response] Offset: 5; VRECT:6354 mV IRECT:39 mA; Raw: 48 05 42 03 4E **0.1C Data ———>** [0x0A] PCP: **itx → 440 mA, phase → 70.0°, vBoost → 6127 mV, iBoost → 62 mA, vRect → 6354 mV, iRect → 39 mA, eff → 64.9%,** mpeViolation → 0, mpePowerLimit → NO, chargeRate → 1, mpeTriggerCount → 0 ***Ignore all FSK with [C26]*** [0x21] IBC: FSK → Requester -> 0x4 [Debug Comms]; Req Num -> 0x7E9; ***[C26 Packet]*** Raw: 8F 03 04 00 04 AA AA AA AA AA
20	Move the Rx to Free Air Position from KMax coupling position		

Step	Description	Interface	Command / Notes
21	Set Battery VOC =3.47V	Overlay	VoC=3.47V —> 10C
22	Move the Rx from Free Air Position to KNom coupling position		KNom = D1.1, 0.88, L1.1
23	Repeat Step 8 to 18		
24	Move the Rx to Free Air Position from KNom coupling position		
25	Set Battery VOC =3.47V	Overlay	VoC=3.47V —> 10C
26	Move the Rx from Free Air Position to KMin coupling position		KMin = D1.5, 0.93, L1.5
27	Repeat Step 8 to 18		

Acceptance Criteria:

Physical Parameter	InSight Keys Recorded	LL	UL	Unit	Offset Positions
LPP counts	Free_Air_LPP_Count	98	102	-	Free Air
LPP Frequency Free Air	Free_Air_LPP_Frequency_avg	75.75	85.81	kHz	
	Free_Air_LPP_Frequency_STD-DEV	-	0.4	-	
LPP Inductance Free Air	Free_Air_LPP_Inductance_avg	15.49	18.72	µH	
	Free_Air_LPP_Inductance_STD-DEV	-	0.4	-	
LPP Q Free Air	Free_Air_LPP_Q_avg	TBD	TBD	-	
	Free_Air_LPP_Q_STD-DEV	-	0.4	-	
LPP R Free Air	Free_Air_LPP_R_avg	TBD	TBD	Ω	
	Free_Air_LPP_R_STD-DEV	-	0.4	-	
Vrect @ Digital Ping	CL_KMax_Vrect@DP0.1C	7000	8000	mV	COF if test items are not pithing limits. Will update new limits based on data collection
	CL_KNom_Vrect@DP0.1C	6500	7500	mV	
	CL_KMin_Vrect@DP0.1C	5800	6800	mV	
Time to 10C	CL_Kxxx_Time_to_10C	0.5	2.5	Sec	At all Coupling positions
Time at 10C	CL_Kxxx_Time_@_10C	11	14		
Time to 3C	CL_Kxxx_Time_to_3C	0.1	1		
Load 10C					
CL_Vsense @ 10C	CL_KMax_Vsense@10C	9000	12900	mV	Tx Observable command for IBC data
	CL_KNom_Vsense@10C	9150	10500		
	CL_KMin_Vsense@10C	9300	15000		
CL_Isense @ 10C	CL_KMax_Isense@10C	380	640	mA	
	CL_KNom_Isense@10C	370	670		
	CL_KMin_Isense@10C	360	700		
CL_Ictx @ 10C	CL_KMax_Ictx@10C	700	1100	mA	
	CL_KNom_Ictx@10C	850	1250		
	CL_KMin_Ictx@10C	1000	1400		
CL_Vrect_Tx_IBC@10C	CL_KMax_Vrect_Tx_IBC@10C	13720	14280	mV	Tx Observable command for IBC data Vrect Target = 14±2%v
	CL_KNom_Vrect_Tx_IBC@10C				
	CL_KMin_Vrect_Tx_IBC@10C				
CL_Irect_Tx_IBC@10C	CL_KMax_CL_Irect_Tx_IBC@10C	185	215	mA	Tx Observable command for IBC data Irect Target = 200mA± +iktara load(~0 to 15mA)
	CL_KNom_CL_Irect_Tx_IBC@10C				
	CL_KMin_CL_Irect_Tx_IBC@10C				
CL_Efficiency_Tx_IBC @10C	CL_KMax_Efficiency_Tx_IBC@10C	53.00	69.00	%	
	CL_KNom_Efficiency_Tx_IBC@10C	50.00	65.50		
	CL_KMin_Efficiency_Tx_IBC@10C	47.00	62.00		Tx Observable command for IBC data

Physical Parameter	InSight Keys Recorded	LL	UL	Unit	Offset Positions
CL_FSK_sent @10C	CL_Kxxx_FSK_sent @10C	-	-	-	
CL_ASK_received @10C	CL_Kxxx_ASK_received@10C	-	-	-	
CL_Overall_Packet Error @10C	CL_Kxxx_Overall_Packet Error @10C	0	2	-	CL_Overall_Packet Error = FSK-ASK
Load 3C					
CL_Vsense @ 3C	CL_KMax_Vsense@3C	6000	7600	mV	Tx Observable command for IBC data
	CL_KNom_Vsense@3C	6000	8000		
	CL_KMin_Vsense@3C	6000	8500		
CL_Isense @ 3C	CL_KMax_Isense@3C	200	570	mA	
	CL_KNom_Isense@3C	210	585		
	CL_KMin_Isense@3C	220	600		
CL_Ictx @ 3C	CL_KMax_Ictx@3C	360	600	mA	
	CL_KNom_Ictx@3C	375	710		
	CL_KMin_Ictx@3C	400	830		
CL_Vrect_Tx_IBC@3C	CL_KMax_Vrect_Tx_IBC@3C	7840	8160	mV	Tx Observable command for IBC data Vrect Target = 8V ±2%
	CL_KNom_Vrect_Tx_IBC@3C				
	CL_KMin_Vrect_Tx_IBC@3C				
CL_Irect_Tx_IBC@3C	CL_KMax_CL_Irect_Tx_IBC@3C	98	128	mA	Tx Observable command for IBC data Irect Target = 113mA +iktara load(~0 to 15mA)
	CL_KNom_CL_Irect_Tx_IBC@3C				
	CL_KMin_CL_Irect_Tx_IBC@3C				
CL_Efficiency_Tx_IBC @3C	CL_KMax_Efficiency_Tx_IBC@3C	57.00	70.00	%	Tx Observable command for IBC data
	CL_KNom_Efficiency_Tx_IBC@3C	50.00	67.00		
	CL_KMin_Efficiency_Tx_IBC@3C	46.00	63.00		
CL_FSK_sent @3C	CL_Kxxx_FSK_sent @3C	-	-	-	
CL_ASK_received@3C	CL_Kxxx_ASK_received@3C	-	-	-	
CL_Overall_Packet Error @3C	CL_Kxxx_Overall_Packet Error @3C	0	2	–	CL_Overall_Packet Error = FSK-ASK
Load 0.1C					
CL_Vsense @ 0.1C	CL_KMax_Vsense@0.1C	6000	7000	mV	Tx Observable command for IBC data
	CL_KNom_Vsense@0.1C	6000	7000		
	CL_KMin_Vsense@0.1C	6000	7000		
CL_Isense @ 0.1C	CL_KMax_Isense@0.1C	50	160	mA	
	CL_KNom_Isense@0.1C	50	160		
	CL_KMin_Isense@0.1C	50	160		
CL_Ictx @ 0.1C	CL_KMax_Ictx@0.1C	280	550	mA	
	CL_KNom_Ictx@0.1C	320	600		
	CL_KMin_Ictx@0.1C	400	650		
CL_Vrect_Tx_IBC@0.1C	CL_KMax_Vrect_Tx_IBC@0.1C	6370	6630	mV	Tx Observable command for IBC data Vrect Target = 6.5V ±2%
	CL_KNom_Vrect_Tx_IBC@0.1C				
	CL_KMin_Vrect_Tx_IBC@0.1C				
CL_Irect_Tx_IBC@0.1C	CL_KMax_CL_Irect_Tx_IBC@0.1C	35	45	mA	Tx Observable command for IBC data Iktara ballast load ~ 40mA. No fixture load required.
	CL_KNom_CL_Irect_Tx_IBC@0.1C				
	CL_KMin_CL_Irect_Tx_IBC@0.1C				
CL_Efficiency_Tx_IBC @ 0.1C	CL_KMax_Efficiency_Tx_IBC@0.1C	19.00	65.00	%	Tx Observable command for IBC data
	CL_KNom_Efficiency_Tx_IBC@0.1C	15.00	60.00		
	CL_KMin_Efficiency_Tx_IBC@0.1C	10.00	55.00		
CL_FSK_sent @0.1C	CL_Kxxx_FSK_sent @0.1C	-	-	-	

Physical Parameter	InSight Keys Recorded	LL	UL	Unit	Offset Positions
CL_ASK_received@0.1C	CL_Kxxx_ASK_received@0.1C	-	-	-	
CL_Overall_Packet Error @0.1C	CL_Kxxx_Overall_Packet Error @0.1C	0	2	-	CL_Overall_Packet Error = FSK-ASK

8.6. Final MTP Sector Check After Tests.

Description: Make sure FW is in a good state at the end of the test.
Failure Mode(s) Captured: TBD
Test Setup and Procedure: Refer below

Step	Description	Interface	Command / Notes
1	Exit Data Streaming	Overlay	ctrl+c
2	Reset Tx	Tx HID	hidreport --noplugin -u 0xFF00,0x0036 set 0x91 91
3	Wait 1s	Fixture	Scorpius FW will take less than 1 second to boot
4	Tell Tx to enter Quiesce Mode	Tx Diags	hidreport --noplugin -u 0xFF00,0x0036 set 0x09 09 01
5	Read MTP Sector 127	Tx HID	hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 80 3F 00 50 **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 0 : 0x0000001 Signature hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 84 3F 00 50 **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 1 : 0x00000002 Version hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 88 3F 00 50 **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 2 : 0x0E0E0E0E CTx hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 98 3F 00 50 **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 6 : 0x0A0A0A0A Vboost Control hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 9C 3F 00 50 **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 7 : 0x0B0B0B0B Vsense Cal hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 A0 3F 00 50 **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 8 : 0x0C0C0C0C Isense Cal hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 A4 3F 00 50 **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 9 : 0x0D0D0D0D LFOD Cal hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 A8 3F 00 50 **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 10 : 0x03070001 Device Type hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 AC 3F 00 50 **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 11 : 0x00000000 SN (1-4) hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 B0 3F 00 50 **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 12 : 0x00000000 SN (5-8) hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 B4 3F 00 50 **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 13 : 0x00000000 SN (9-12) hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 B8 3F 00 50 **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 14 : 0x00000000 SN (13-16) hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 BC 3F 00 50 **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 15 : 0x00000000 SN (17) hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 E0 3F 00 50 **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 31 : 0xF29D9024 CheckSum
6	Read MTP Sector 126	Tx HID	hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 00 3F 00 50 **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 0 : 0x0000001 Signature hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 04 3F 00 50 **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 1 : 0x00000002 Version hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 08 3F 00 50 **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 2 : 0x0E0E0E0E LTx hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 0C 3F 00 50 **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 3 : 0x0F0F0F0F FREQ hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 60 3F 00 50 **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 Word 31 : 0xDDD9E0E1 CheckSum
7	Location of Calibrated values of Vsense, Vsense, Isense, LFOD & CTx into MTP and other values into MTP :- Signature, Version,HWID, MLB SN, Checksum Follow Figure 1 Bellow for Reference	Test Overlay	Sector 127 :-Word 0(Signature = 0x01); Word 1(Version = 0x02); Word 2(CTx); Word 6(Vsense); Word 7(Vsense); Word 8(Isense); Word 9(LFOD); Word 10(HWID); Word 11 - 15(MLB SN - 17 byte), Word 31(Checksum)
8	Location to store Calibrated values of Inductance (Ltx_nH) & frequency_Hz into MTP and also Signature and version.	Test Overlay	Sector 126 :- Word 0(Signature = 0x01); Word 1(Version = 0x02); Word 2(Ltx_nH); Word 3(frequency_Hz)
9	Reset Tx	Tx HID	hidreport --noplugin -u 0xFF00,0x0036 set 0x91 91

Acceptance:

Test Parameter	Insight Keys Recorded	Comments/Notes
Sector 127 - Check Sum (Word 31)	SCRP_Check Sum_127_MTP_BEFORE	Pass if this values match with MTP check before test i.e. **Section 8.3**
Sector 127 - Version (Word 1)	SCRP_Version_127_MTP_BEFORE	
Sector 127 - Signature (Word 0)	SCRP_Signature_127_MTP_BEFORE	
Sector 127 - CTx MTP (Word 2)	SCRP_CTx_127_MTP_BEFORE	
Sector 127 - Vsense_Control MTP (Word 6)	SCRP_Vsense_127_MTP_BEFORE	
Sector 127 - Vsense MTP (Word 7)	SCRP_Vsense_127_MTP_BEFORE	
Sector 127 - Isense MTP (Word 8)	SCRP_Isense_127_MTP_BEFORE	
Sector 127 - LFOD MTP (Word 9)	SCRP_LFOD_127_MTP_BEFORE	
Sector 127 - Tx HWID_MTP (Word 10):- J51x - 0x05170000; J52x - 0x05200000	SCRP_TX_HWID_127_MTP_BEFORE	
Sector 127 - MLB Serial No. (Word 11 to Word 15 - Bits<1:17>)	SCRP_MLB_SN_127_MTP_BEFORE	
Sector 126 - Check Sum (Word 31)	SCRP_Check Sum_126_MTP_BEFORE	Pass if this values match with MTP check before test i.e. **Section 8.3**
Sector 126 - Version (Word 1)	SCRP_Version_126_MTP_BEFORE	
Sector 126 - Signature (Word 0)	SCRP_Signature_126_MTP_BEFORE	
Sector 126 - LPP Inductance_MTP (Word 2)	SCRP_LPP_L_126_MTP_BEFORE	
Sector 126 - LPP Frequency_MTP (Word 3)	SCRP_LPP_FREQ_126_MTP_BEFORE	

A. Appendix - Testing using hidreport :-LPP & Digital Ping

1. Quiesce Mode - Low Power Ping (LPP)

Description: Check the frequency and inductance for LPP at free air vs nominal position coupling.
Failure Mode(s) Captured: Poorly assembled / manufactured coils
Test Setup and Procedure:

Step	Description	Interface	Command / Notes
1	Connect coils at nominal position	Fixture	
2	Tell Tx to enter Quiesce Mode	Tx Diags	hidreport --noplugin -u 0xFF00,0x0036 set 0x09 09 01
3	Enable LPP Switch "LPP_5V_EN"	TX Diags	hidreport --noplugin -u 0xFF00,0x0036 set 0x01 01 01 **Payload: (LSB-MSB)** ——> Byte0: 0 - turn off, 1 - turn on
4	Wait 1s	Fixture	
5	Measure Vsense		hidreport --noplugin -u 0xFF00,0x0036 set 0x41 0x41 0x98 0x36 0x00 0x40 0x80 0x01 0x00 0x00 **—>Disable LFOD** hidreport --noplugin -u 0xFF00,0x0036 set 0x40 0x40 0x98 0x34 0x00 0x40 **——> Fixture wait 5mS <——** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 **Response —>** bits 7 & bit 8 = 0 if Disabled, 1 if enabled **—>Check Status of LFOD** hidreport --noplugin -u 0xFF00,0x0036 set 0x41 0x41 0x58 0x34 0x00 0x40 0x00 0x00 0x00 0x00 **—>Disable ASK_CR** hidreport --noplugin -u 0xFF00,0x0036 set 0x31 0x31 0x00 0x00 0x8C **——> Fixture wait 5mS <——** hidreport --noplugin -u 0xFF00,0x0036 get 0x31 **Response —>** bytes1-4 = Floating point value from ADC **—> Vsense_kmxx_MCU** hidreport --noplugin -u 0xFF00,0x0036 set 0x41 0x41 0x98 0x35 0x00 0x40 0x80 0x01 0x00 0x00 **—>Enable LFOD**
6	Disable LPP Switch "LPP_5V_EN"	TX Diags	hidreport --noplugin -u 0xFF00,0x0036 set 0x01 01 00 **Payload: (LSB-MSB)** ——> Byte0: 0 - turn off, 1 - turn on
7	Wait 1s	Fixture	
8	Repeat Step 5		
9	Send 1.4uS LPP pulse	Tx HID	hidreport --noplugin -u 0xFF00,0x0036 set 0x05 05 00 46
10	Delay 15mS before proceeding	Fixture	
11	Read output parameters of F and L and raw ADC data	Tx HID	hidreport --noplugin -u 0xFF00,0x0036 get 0x05 **Response: (Received LSB First, Length should be 23bytes)** Byte0: ReportId (should equal 0x05) Byte1: Error code (0x00-> no error) Byte2: Sub-cmd (should be 0x00) bytes3-6: Floating point value of frequency Bytes7-10: Floating point value of inductance Bytes19-22: Buffer address of raw ADC data Bytes23-26: Number of raw ADC data elements (of size uint16_t)
12	Collect raw ADC samples and upload to Insight	Tx HID & Fixture	Collect Pointer to raw LPP data by sending the following command from bytes19-22 in the above response.Use the above info to read the Address and use the command Below to read the raw ADC buffered data and upload to insight. hidreport --noplugin -u 0xFF00,0x0036 set 0x40 40 xx xx xx xx (Sent LSB First) byte1-4: [u32] Address to read **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x40 **Response —>** 0x40 00 f8 34 00 40 10 00 20 00 Byte0: [u8] ID (AnyAddressReadID = 0x40) Byte1: [u8] Error code (0x00 = no error for previous set report) Byte2-5: [u32] address (eg. address 0x400034f8 from previous set report) Byte6-9: [u32] data (read data 0x00200010 from the address above. Split this into 2 2-bytes data) The LPP data is 660 bytes, therefore 165 loops of above set of commands should finished reading all the LPP data
13	Repeat steps 9 - 12 x 100 times	Fixture & Tx HID	Save all of the data as a single log file for each unit and upload to InSight.
14	Calculate Free Air Δ Tx Frequency & Δ Tx Inductance Averaged over 100 repeats vs MTP sector Value	Tx HID & Fixture	Δ Tx Frequency = SCRP_LPP_FREQ_MTP_BEFORE (From Section 8.3) - **Kxx_LPP_Frequency_100_avg** Δ Tx Inductance = **Kxx_LPP_Inductance_100_avg** - SCRP_LPP_L_MTP_BEFORE (From Section 8.3)
15	Record parameters as per the table below	Fixture	Apply limits accordingly
16	Repeat steps 2 - 8 at all coupling position	Fixture & Tx HID	Coupling Position :- KMax, KNom & KMin

Acceptance Criteria:

Physical Parameter	InSight Keys Recorded	LL	UL	Unit	Offset Positions
LPP Frequency	KMax_LPP_Frequency	62	71.5	kHz	Kmax
	KNom_LPP_Frequency	63	72.8		Knom
	KMin_LPP_Frequency	64	77.2		Kmin
	KMax_LPP_Frequency_avg	62	71.5		Kmax
	KNom_LPP_Frequency_avg	63	72.8		Knom
	KMin_LPP_Frequency_avg	64	77.2		Kmin
LPP Inductance	KMax_LPP_Inductance	22.3	28	µH	Kmax
	KNom_LPP_Inductance	21.5	27		Knom
	KMin_LPP_Inductance	19.1	26		Kmin
	KMax_LPP_Inductance_avg	22.3	28		Kmax
	KNom_LPP_Inductance_avg	21.5	27		Knom
	KMin_LPP_Inductance_avg	19.1	26		Kmin
Δ Tx Frequency	KMax_LPP_Frequency_FA_delta	5.0	22.3	kHz	All
	KNom_LPP_Frequency_FA_delta	5.0	20.8		
	KMin_LPP_Frequency_FA_delta	5.0	17.3		
Δ Tx Inductance	KMax_LPP_Inductance_FA_delta	3.74	11.2	µH	
	KNom_LPP_Inductance_FA_delta	2.92	10.2		
	KMin_LPP_Inductance_FA_delta	2.13	7.4		
LPP Frequency STD	LPP_Frequency_STDEV	-	0.4	-	All
LPP Inductance STD	LPP_Inductance_STDEV	-	0.4	-	All
LPP_repeatability		100	100	-	All
LPP Vsense_Disabled	Kxxx_LPP_Vsense_Disabled	0	200	mV	All
LPP Vsense_Enabled	Kxxx_LPP_Vsense_Enabled	5030	5260	mV	All

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2. Quiesce Mode - Digital Ping Level Tests

Description: This test required ginger/B332 dev board, both Tx and Rx coil. Test digital ping level (6Vboost and 100deg bridge phase) at 0.1C charge rate at various positions and Vrect and Ping Pong Tests. Ping Pong test is performed to check In-band comms by sending a train of bits as ASK (ginger board/B332 Dev Board).

Failure Mode(s) Captured:

1. Vrect: - Ginger/B332 reach UVP or OVP at the digital ping level
2. Ping Pong :-Test Dotara's Internal ASK/FSK Communication.

Test Setup and Procedure:

Order of load ramping as follows:

- Set VBOOST to **6.1V**
- Adjust bridge phase from **100 degrees**
- Set loading to 40mA ballast (No Eload i.e. turn Eload off/Set Eload to 0A)

Description	Interface	Command
Set coupling position	Fixture	Loads @ all Couplings

Step	Description	Interface	Command
	For DP @ 0.1C		
1	Set boost to meet the load conditions. **Note:** Minimum Vboost is 6100mV, Don't set Vboost < 6100mV	TX Diags	hidreport --noplugin -u 0xFF00,0x0036 set 0x03 03 D4 17 88 13 **Payload: ——>** Byte0-1: sense voltage (eg. 0x17D4 = 6100mV)
2	Set the Bridge phase **100deg**	Tx HID	hidreport --noplugin -u 0xFF00,0x0036 set 0x04 04 1C F3 01 00 10 27 50 46 **Eg 0x2710:** 10000cdeg = 100deg phase
3	Measure Vrect on Rx	Rx I2C	Vrect:- scorpius get vrect

	Description	Interface	Command
4	Tell Rx to go into static mode	Rx I2C	Write I2C packet: (39) c0 ae 80 80 1e 09 02 01 AE Ginger command: set mode none Ginger command: set mode rx Ginger command: ikt write 0xF0000B80 0xAE010209 Read one byte: Should be 0x60 B332 DevBoard: i2c rawwrite charger 0x0f 0x00 0x2E 0x09 0x01 0x01 //set Aculeus to static closed loop mode
5	Choose Comm1	Rx I2C	Write I2C packet: (39) c0 ae 80 80 1e 01 00 05 AD Ginger command: ikt write 0x0xF0000B80 0xAD050001 B332 DevBoard : i2c rawwrite charger 0x0F 0x00 0x2d 0x01 0x00 0x05 //Select Comm cap1 - For IpadTx
6	Tell Tx to initiate ping pong with the Rx i.e. 10 packets, 100ms packet delay	Tx HID	hidreport --noplugin -u 0xFF00,0x0036 set 0x02 02 0a 00 64 00 Payload:——> byte0-1: Number of packets to send: 10 byte2-3: Delay between packets: 100ms
7	Wait 3 second for RX to send packets before reading buffer	Fixture	Wait 3 second
8	Read back data that was captured from the Tx.	Tx HID	hidreport --noplugin -u 0xFF00,0x0036 get 0x02 Response: byte0: ID *(PingPongID = 0x02)* byte1: Status *(eg. 0x00 = complete)* [0 = Complete; 1 = In-Progress] byte2-3: Pings Sent *(eg. 0x000A = 10 pings sent)* byte4-5: Pongs Received *(eg. 0x000A = 10 pongs received)* byte6: Last error *(e.g. 0x00 = no errors)* ***Note:-*** *If byte1:Status is in process then repeat the step*
9	Repeat step 2 to 8 with All coupling positions		

Acceptance criteria:

Test Parameter	Insight Keys Recorded	LL	UL	Units	Comments/Notes
Vrect_B332 @ DP0.1C	**Kmax_SCRP_Vrect@DP0.1C**	7500	8500	mV	
	Kmin_SCRP_Vrect@DP0.1C	6200	7200	mV	
Number of Pings Sent @ DP	**SCRP_Pings_Sent@DP**	10	10	-	
Number of Pongs Received @ DP	**SCRP_Pongs_Recieved@DP**	10	10	-	

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3. Normal Test Mode (hidreport) :- Power + Comms

Description: Transferring power at various loads / charge rates using full closed loop control and measuring power and efficiency. Time to reach fast charge should be minimise to maximise time spent at 10C.

Failure Mode(s) Captured : Time to 10C > then the budget. Closed loop comms not working as intended due to high ASK and FSK packet error rate.

Test Setup and Procedure: DUT needs to be taken to separate discharge station before this test can be run.

Rx battery (Simulator)SOC: 0% (3.4 V)

Steps	Description	Interface	Command	Insight Key Recorder
	Only to initiate Close loop testing			
1	Move to Kmax position, and after active reference			
2	Set battery to 4.1V	Battery Sim		
3	Reset Tx	Tx HID	hidreport --noplugin -u 0xFF00,0x0036 set 0x91 91	
4	Clear ASK and FSK counter		hidreport --noplugin -u 0xFF00,0x0036 set 0x20 20	
5	Airplane Mode/BT Enable		hidreport --noplugin -u 0xFF00,0x0036 set 0x92 92 02 00 00 00 byte0: ID (ContextStateID = 0x92) byte 1-4: [u32] Context State (32bit bimap)(ContextState = 0x00000001) Bluetooth On/Off- bit 0 (set if on) AirplaneMode On/Off- bit 1(set if on)	
6	Enable Highest Tx Power		hidreport --noplugin -u 0xFF00,0x0036 set 0x84 84 03 byte0: [u8] ID (ChargeRate = 0x84) byte1: [u8] Level 0 - Off 1 - Low 2 - Medium 3 - High	
7	Driver Ready Mode		hidreport --noplugin -u 0xFF00,0x0036 set 0x93 93 00 00 00 00	

Steps	Description	Interface	Command	Insight Key Recorder
8	Check if TX is in CloseLoop		hidreport --noplugin -u 0xFF00,0x0036 get 0x0a rsp: 0x0A xx xx xx (Received LSB First) eg. 0x0A 04 00 00 00 [u8] byte0: ID (PowerStateID = 0x0A) [32] byte1-4: State (0x00000004 = Closed Loop state) 0 - Reset 1 - LppStandby 2 - Lpp 3 - DigitalPing 4 - ClosedLoop 5 - CloakStandby 6 - Cloak 7 - ProtectionPwrOff 8 - WaitVddPwrGood 9 - TxError 10 - WaitDriverReady	Close_Loop_respond
Initialise complete, 10C test start				
9	Set battery to 3.45V	Battery Sim		
10	Repeat step 3-8	Tx HID	Reset and start	
11	Monitor “InputVoltage” until it is >5V. This is done by continuously sending pmu sensor command	Rx I2C	pmu sensor Note: pmu sensor cycle is around 50mS	
12	Record time (T1)	Overlay		CL_To_10C_start
13	Monitor “actualChargeCurrent” until it reaches >520mA. This is done by continuously sending pmu sensor command	Rx I2C	pmu sensor Note: pmu sensor cycle is around 50mS	
14	Record time (T2)	Overlay		CL_At_10C_start
15	Calculate Time_to_10C		T2-T1=Time_to_10C	CL_Time_to_10C
16	wait 1 seconds for V_{Rect} to stabilise	N/A		
17	Read back comms info from Tx side	Tx HID	hidreport --noplugin -u 0xFF00,0x0036 get 0x20 (Sent LSB First) rsp: 0x20 xx xx xx xx xx xx xx xx xx xx xx xx(Received LSB First) eg. 0x20 DD CC BB AA DD CC BB AA DD CC BB AA byte0: [u8] ID InbandStats = 0x20) byte1-4: [u32] Total FSK Packets (eg. 0xAABBCCDD) byte5-8: [u32] Total ASK Packets (eg. 0xAABBCCDD) byte9-12: [u32] Total valid ASK Packets (eg. 0xAABBCCDD)	CL_FSK_sent@10C CL_ASK_received@10C CL_Valid_ASK_received@10C
18	Clear ASK and FSK counter	Tx HID	hidreport --noplugin -u 0xFF00,0x0036 set 0x20 20	
19	Calculate the overall Packet Error Rate		Packet Error = {(Total FSK Packets) - (Total valid ASK Packets)}/Total FSK Packets	CL_Overall_Packet Error @10C
20	Tx Observable command: Ictx,Vsense, Isense,Vrect,Irect,efficiency Note:VSNS ISNS ICTX are updated every ~150ms	Tx HID	hidreport --noplugin -u 0xFF00,0x0036 get 0x30 (Sent LSB First) rsp: xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx (Received LSB First) eg. 30 39 02 10 27 f4 17 54 00 8a 18 29 00 ee 01 00 00 03 byte0: [u8] ID (0x30) byte 1-2: [u16] ICTX, mA byte 3-4: [u16] inverter phase, cdeg (1/100 deg) byte 5-6: [u16] boost(sense) voltage, mV byte 7-8: [u16] boost(sense) current, mA byte 9-10: [u16] Rx vRect, mV byte 11-12: [u16] Rx iRect, mA byte 13-14: [u16] wireless power efficiency (tenths of %, i.e. 10 = 1%) byte 15: [u8] MPE violation indicator of current PC packet bit 0 - Efficiency violation bit 1 - ICTX violation bit 2 - Rx iRect violation bit 3 - Rx iRect out of range bit 4 - Rx vRect out of range byte 16: [u8] MPE power limitation state 0 - No MPE power limitation, otherwise its in effect. byte 17: [u8] allowed charging power level 0 - Off 1 - Low 2 - Medium 3 - High	CL_Vsense@10C CL_Isense@10C CL_Ictx@10C CL_Vrect_Tx_IBC@10C CL_Irect_Tx_IBC@10C CL_Efficiency_Tx_IBC@10C
21	Rx PMU sensor command: InputVoltage (Vrect), InputCurrent (Irect), ActualChargeCurrent	Rx I2C	pmu sensor 10x average of below Command for Irect: scorpius get irect Command for Vrect: scorpius get vrect	CL_Vrect_B332@10C CL_Irect_B332@10C CL_ICharge_B332@10C
22	Calculate power and efficiency	Overlay	Rx_Output_Power_B332 =Vrect_B332 * Irect_B332 Tx_Input_Power=Vsense * Isense Efficiency =(Rx_Output_Power_B332 / Tx_Input_Power)%	CL_Rx_Output_Power_B332@10C CL_Tx_Input_Power@10C CL_Efficiency_Calculated@10C
23	Monitor charger Irect until it reaches <520mA. This is done by continuously sending pmu sensor command	Rx I2C	pmu sensor Note: pmu sensor cycle is around 50mS	
24	Record time (T3)			CL_At_10C_end
10C test finished, 3C test start				
25	Monitor “actualChargeCurrent” until it reaches <180mA. This is done by continuously sending pmu sensor command	Rx I2C	pmu sensor Note: pmu sensor cycle is around 50mS	Adding on the 20~30mA error margin during charge current change.
26	Record time (T4)	Overlay		CL_At_3C_start
27	Calculate Time_at_10C and Time_to_3C	Overlay	Time_at_10C = T3-T2 and Time_from_10C_to_3C=T4-T3	CL_Time_at_10C CL_Time_from_10C_to_3C
28	wait 5 seconds for V_{Rect} to stabilise	N/A		

Steps	Description	Interface	Command	Insight Key Recorder
29	Repeat step 17 to 19			CL_FSK_sent @3C CL_ASK_received @3C CL_Valid_ASK_received@3C CL_Overall_Packet Error@3C
30	Repeat step 20 to 22			CL_Vsense@3C CL_Isense@3C CL_Ictx@3C CL_Vrect_Tx_IBC@3C CL_Irect_Tx_IBC@3C CL_Efficiency_Tx_IBC@3C CL_Vrect_B332@3C CL_Irect_B332@3C CL_ICharge_B332@3C CL_Rx_Output_Power_B332@3C CL_Tx_Input_Power@3C CL_Efficiency_Calculated@3C
3C test finished, 0.1C test start				
31	Set battery voltage VoC to 4.2V	Battery Sim		
32	Repeat step 3-8	Tx HID	Reset and start	
33	wait 5 seconds for V_{Rect} to stabilise	N/A		
34	Repeat step 17 to 19			CL_FSK_sent @0.1C CL_ASK_received @0.1C CL_Valid_ASK_received@0.1C CL_Overall_Packet Error @0.1C
35	Repeat step 20 to 22			CL_Vsense@0.1C CL_Isense@0.1C CL_Ictx@0.1C CL_Vrect_Tx_IBC@0.1C CL_Irect_Tx_IBC@0.1C CL_Efficiency_Tx_IBC@0.1C CL_Vrect_B332@0.1C CL_Irect_B332@0.1C CL_ICharge_B332@0.1C CL_Rx_Output_Power_B332@0.1C CL_Tx_Input_Power@0.1C CL_Efficiency_Calculated@0.1C
0.1 C test finished, move to different position				
36	Move to KNom position and repeat step 2 to 35			
37	Move to KMin position and repeat step 2 to 35			

Acceptance criteria:

Test Parameter	Insight Keys Recorded	LL	UL	Units	Comments/Notes
Load 0.1C					
CL_Vsense @ 0.1C	CL_KMax_Vsense@0.1C	5990	7000	mV	Tx Observable command
	CL_KNom_Vsense@0.1C	5990	7000		
	CL_KMin_Vsense@0.1C	5990	7000		
CL_Isense @ 0.1C	CL_KMax_Isense@0.1C	50	120	mA	
	CL_KNom_Isense@0.1C				
	CL_KMin_Isense@0.1C	70	160		
CL_Vctx_IPeak @ 0.1C	CL_KMax_Ictx@0.1C	280	550	mA	
	CL_KNom_Ictx@0.1C				
	CL_KMin_Ictx@0.1C	400	650		
CL_ICharge_B332@0.1C	CL_KMax_Icharge_B332@0.1C CL_KNom_Icharge_B332@0.1C CL_KMin_Icharge_B332@0.1C	0	20	mA	Rx PMU Sensor command Advised from pencil factory
CL_Vrect_Tx_IBC@0.1C CL_Vrect_B332 @ 0.1C	CL_KMax_Vrect_Tx_IBC@0.1C CL_KMax_Vrect_B332@0.1C	6370	6630	mV	Tx Observable command for IBC data Rx PMU Sensor command Vrect target = 6.5V±2%
	CL_KNom_Vrect_Tx_IBC@0.1C CL_KNom_Vrect_B332@0.1C				

Test Parameter	Insight Keys Recorded	LL	UL	Units	Comments/Notes
	CL_KMin_Vrect_Tx_IBC@0.1C CL_KMin_Vrect_B332@0.1C				
CL_Irect_Tx_IBC@0.1C CL_Irect_B332 @ 0.1C	CL_KMax_CL_Irect_Tx_IBC@0.1C CL_KMax_Irect_B332@0.1C	35	45	mA	Tx Observable command for IBC data Rx PMU Sensor command Iktara ballast load = 40mA. **No fixture load required.**
	CL_KNom_CL_Irect_Tx_IBC@0.1C CL_KNom_Irect_B332@0.1C				
	CL_KMin_CL_Irect_Tx_IBC@0.1C CL_KMin_Irect_B332@0.1C				
CL_Rx_Output_Power_B332 @ 0.1C	CL_KMax_Rx_Output_Power_B332@0.1C	222.95	298.35	mW	Vrect_B332 * Irect_B332
	CL_KNom_Rx_Output_Power_B332@0.1C				
	CL_KMin_Rx_Output_Power_B332@0.1C				
CL_Efficiency_Tx_IBC @ 0.1C CL_Efficiency_Calculated @ 0.1C	CL_KMax_Efficiency_Tx_IBC@0.1C CL_KMax_Efficiency_Calculated@0.1C	19.00	65.00	%	Tx Observable command for IBC data Rx_Power / (Vsense * Isense)
	CL_KNom_Efficiency_Tx_IBC@0.1C CL_KNom_Efficiency_Calculated@0.1C				
	CL_KMin_Efficiency_Tx_IBC@0.1C CL_KMin_Efficiency_Calculated@0.1C	10.00	55.00		
CL_FSK_sent @0.1C	CL_Kxxx_FSK_sent @0.1C	-	-	-	
CL_ASK_received@0.1C	CL_Kxxx_ASK_received@0.1C	-	-	-	
CL_Valid_ASK_received@0.1C	CL_Kxxx_Valid_ASK_received@0.1C	-	-	-	
CL_Overall_Packet Error @0.1C	CL_Kxxx_Overall_Packet Error @0.1C	-1	0	-	
Load 3C					
CL_Vsense @ 3C	CL_KMax_Vsense@3C	5900	6200	mV	
	CL_KNom_Vsense@3C	5900	6200		
	CL_KMin_Vsense@3C	5900	6411		
CL_Isense @ 3C	CL_KMax_Isense@3C	182	192	mA	
	CL_KNom_Isense@3C	190	205		
	CL_KMin_Isense@3C	205	220		
CL_Ictx @ 3C	CL_KMax_Ictx@3C	417	618	mA	
	CL_KNom_Ictx@3C	427	710		
	CL_KMin_Ictx@3C	528	877		
Vrect_B332 @ 3C	KMax_Vrect_B332@3C	7840	8160	mV	Fixture Cmd: Vrect Target = 8V ±2%
	KNom_Vrect_B332@3C				
	KMin_Vrect_B332@3C				
Irect_B332 @ 3C	KMax_Irect_B332@3C	98	128	mA	Fixture Cmd: Irect Target = 113mA +iktara load(~0 to 15mA)
	KNom_Irect_B332@3C				
	KMin_Irect_B332@3C				
Rx_Output_Power_B332 @ 3C	KMax_Rx_Output_Power_B332@3C	914.00	984.50	mW	Vrect * Irect
	KNom_Rx_Output_Power_B332@3C	919.65	976.40		
	KMin_Rx_Output_Power_B332@3C	905.50	982.60		
Efficiency @ 3C	KMax_Efficiency@3C	69.06	75.07	%	Rx_Power / (Vsense * Isense)
	KNom_Efficiency@3C	65.10	72.00		
	KMin_Efficiency@3C	59.70	68.20		
Number of Packets Sent @ 3C	SCRP_Packets_Sent@3C	10	10	-	
Number of Packets Received @ 3C	SCRP_Packets_Recieved@3C	10	10	-	
Load 10C					
CL_Vsense @ 10C	CL_KMax_Vsense@10C	9000	9400	mV	
	CL_KNom_Vsense@10C	9400	10500		
	CL_KMin_Vsense@10C	10100	10600		

Test Parameter	Insight Keys Recorded	LL	UL	Units	Comments/Notes
CL_Isense @ 10C	CL_KMax_Isense@10C	410	450	mA	
	CL_KNom_Isense@10C	400	430		
	CL_KMin_Isense@10C	400	430		
CL_Ictx @ 10C	CL_KMax_Ictx@10C	657	1041	mA	
	CL_KNom_Ictx@10C	732	1345		
	CL_KMin_Ictx@10C	887	1575		
Vrect_B332 @ 10C	KMax_Vrect_B332@10C	13720	14280	mV	Fixture Cmd: Vrect Target = 14±2%v
	KNom_Vrect_B332@10C				
	KMin_Vrect_B332@10C				
Irect_B332 @ 10C	KMax_Irect_B332@10C	185	215	mA	Fixture Cmd: Irect Target = 200mA± +iktara load(~0 to 15mA)
	KNom_Irect_B332@10C				
	KMin_Irect_B332@10C				
Rx_Output_Power_B332 @ 10C	KMax_Rx_Output_Power_B332@10C	2538.20	3070.20	mW	Vrect * Irect
	KNom_Rx_Output_Power_B332@10C				
	KMin_Rx_Output_Power_B332@10C				
Efficiency @ 10C	KMax_Efficiency@10C	69.25	72.53	%	Rx_Power / (Vsense * Isense)
	KNom_Efficiency@10C	65.13	69.72		
	KMin_Efficiency@10C	60.69	66.76		
Number of Packets Sent @ 10C	SCRP_Packets_Sent@10C	10	10	-	
Number of Packets Received @ 10C	SCRP_Packets_Recieved@10C	10	10	-	

B. Test Procedure in EFI Diags Mode

7. Critical and Frequently Used Commands

7.1. Quiesce Test Mode

After programming the Tx defaults to NominalMode (LPP > Digital Ping > Power negotiation > Closed loop).
The following command needs to be sent to the Tx to enable QuiesceMode whereby certain test commands are then enabled.

A power cycle will mean the unit needs to be re-programmed as the firmware application is run from SRAM.

This is the test mode whereby additional commands for test/validation are active.This command will disable everything except the MCU i.e. Boost, Bridge, LPP switch will be disabled.

Resets into the quiesce mode with the bridge disabled.

```
smokey ScorpiusHid --run --test "Set" --args "ReportID=0x09, ReportPayload={0x01}"
```

Note: *This command i.e. Quiesce Mode needs to be set once at beginning of testing i.e. from* ***Section 8.1. Load FW*** *or unless unit is reset or power cycled or Nominal Mode has been set.* ***If the unit is power cycled you will need to load fw again.*** *Nominal Mode*

7.2. Nominal Mode

This is the normal runtime mode. Here, a subset of commands used for test/validation are deactivated.

```
smokey ScorpiusHid --run --test "Set" --args "ReportID=0x09, ReportPayload={0x00}"
```

Resets into the nominal mode where it will start the LPP-> Digital Ping-> Power Negotiation-> Closed loop sequence.

8. Test Coverage @ Scorpius Char Station

8.1. Load Tx FW & Read Version

Description:- Load Tx FW. Dotara has no NVRAM and therefore will lose all the memory/setting after power cycling or load fw. Dotara will need to load the fw after each power cycling.

Failure Mode(s) Captured:TBD

Test Setup and Procedure:

Step	Description	Interface	Command / Notes
Note: *This command i.e. Quiesce Mode needs to be set once at beginning of testing i.e. from* ***Section 8.1. Load FW*** *or unless unit is reset or power cycled or Nominal Mode has been set.* ***If the unit is power cycled you will need to load fw again.***			
A	Tell Tx to get out of standalone mode.	TX HID (Diags)	i2c -w 6 0x39 6 **Note:-Send this command 2x times with 1s delay. There may be I2C error reported with this command, but can be ignored.**
B	Tell Tx to enter Quiesce Mode	TX HID	**Note:** Need to send the below command after every 2nd time of the above command within 3sec or with minimum or no delay as possible of above command. You cannot enter Quiesce mode without exiting the standalone mode. smokey ScorpiusHid --run --test "Set" --args "ReportID=0x09, ReportPayload={0x01}"
1	Set Vin 3.6V. Or Preparation to pull high: PMU_TO_DOTARA_EN_EXT	Fixture	pmugpio --pin 14 --output 1 --pushpull
2	Tell Tx to get out of standalone mode.	TX HID (Diags)	i2c -w 6 0x39 6 **Note:-Send this command 2x times with 1s delay. There may be I2C error reported with this command, but can be ignored.**
3	Load Tx FW	Tx HID	**Note**: Need to send this command every time within **3sec** of above command. You cannot enter Load FW without exiting the standalone mode. ***Path for FW might change.*** smokey ScorpiusHid --run --test "FwLoad" --args "PathToFwLoad='nandfs:\\AppleInternal\\Diags\\Scorpius\\J517J522\\ScorpiusTx-dotara.bin'"
4	Tell Tx to get out of standalone mode.	TX HID (Diags)	i2c -w 6 0x39 6 **Note:-Send this command 2x times with 1s delay. There may be I2C error reported with this command, but can be ignored.**
5	Tell Tx to enter Quiesce Mode	TX HID	**Note**: Need to send the below command after every 2nd time of the above command within **3sec** or with minimum or no delay as possible of above command. You cannot enter Quiesce mode without exiting the standalone mode. smokey ScorpiusHid --run --test "Set" --args "ReportID=0x09, ReportPayload={0x01}"
6	Read Status (Version)	Tx HID	smokey ScorpiusHid --run --test "Get" --args "ReportID=0xBB"

Command to read Tx FW version:

smokey ScorpiusHid --run --test "Get" --args "ReportID=0xBB"

Example:-This reads back 4 bytes: 0x01 0x00 0x13 0x05

Main FW Type (byte1&2): 0x0001

Main FW Version (byte3&4): 0x0513

Test Parameter	Insight Keys Recorded	Notes
Tx Fw Version	**SCRP_Tx_Version**	

8.2. Rx FW Version

Ginger SN: diags get mlbsn

Eload SN: diags get eloadsn

Versions: get versions ——> application: 2.6.19, this line is the Ginger FW version

B332 Dev Board Command to read Rx FW version:

i2c lock charger

i2c rawwrite charger 0x10 0x00 0x02 0x00 0x00 0x00

i2c rawread charger 04

i2c unlock charger

Read 4 byte packet: x x x x

Last 3 bytes will determine Rx version:

8.3. Initial MTP Sector Check Before Tests.

Description: Make sure FW is in a good state at the Before of the test. [TBD]
Failure Mode(s) Captured: TBD
Test Setup and Procedure: Refer below

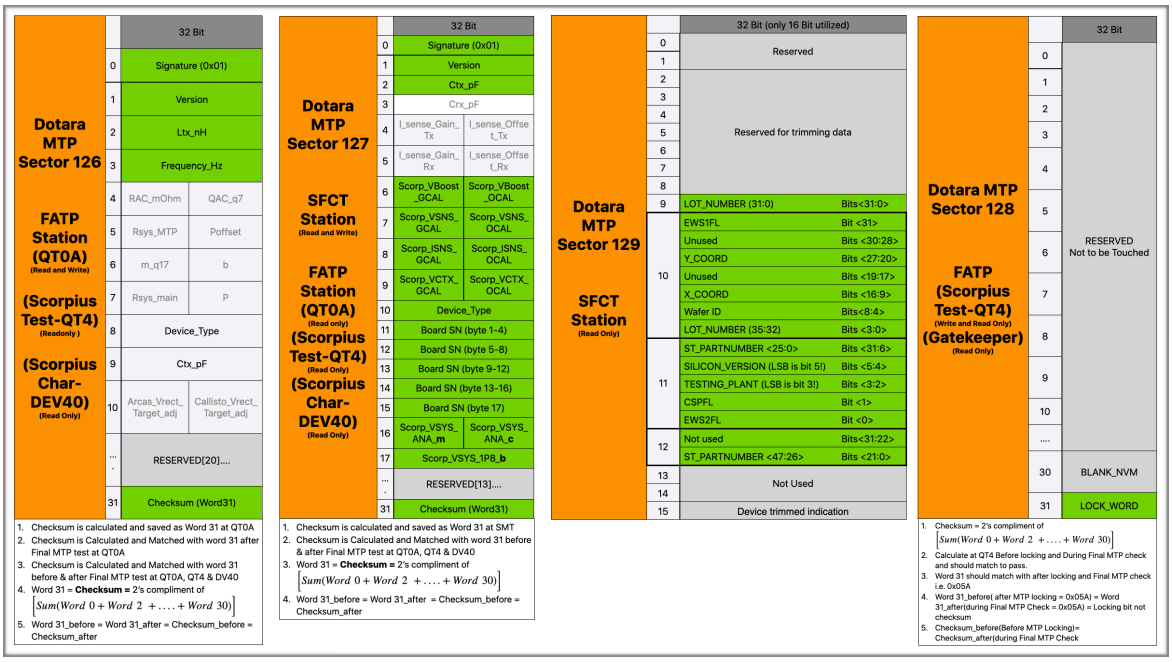

Figure 1 : MTP Word Locations

Step	Description	Interface	Command / Notes
Note: *This command i.e. Quiesce Mode needs to be set once at beginning of testing i.e. from Section 8.3 MTP Sector Check or unless unit is rest/power cycled or Nominal Mode has been set. If the unit is power cycled you will need to load fw again.*			
1	Tell Tx to get out of standalone mode.	TX HID (Diags)	i2c -w 6 0x39 6 **Note:-Send this command 2x times with 1s delay. There may be I2C error reported with this command, but can be ignored.**
2	Tell Tx to enter Quiesce Mode	TX HID	**Note**: Need to send the below command after every 2nd time of the above command within **3sec** or with minimum or no delay as possible of above command. You cannot enter Quiesce mode without exiting the standalone mode. smokey ScorpiusHid --run --test "Set" --args "ReportID=0x09, ReportPayload={0x01}"
Skip the above 2 steps if the unit is already in Quiesce Mode			
3	Read MTP Sector 127	Tx HID	smokey ScorpiusHid --run --test "Print_Sector" --args "MTP_sector=127" **Example:-Overlay will read Words that are printed:-** **Word 0 : 0x00000001** / **Word 1 : 0x00000002** / **Word 2 : 0x00030570** / Word 3 : 0x00023F00 Word 4 : 0x00000000 / Word 5 : 0x00000000 / **Word 6 : 0x0A0A0A0A** / **Word 7 : 0x0B0B0B0B** **Word 8 : 0x0C0C0C0C** / **Word 9 : 0x0D0D0D0D** / **Word 10 : 0x05170000** / **Word 11 : 0x00000000** **Word 12 : 0x00000000** / **Word 13 : 0x00000000** / **Word 14 : 0x00000000** / **Word 15 : 0x00000000** **Word 16 : 0x00000000** / **Word 17 : 0x00000000** / Word 18 : 0x00000000 / Word 19 : 0x00000000 Word 20 : 0x00000000 / Word 21 : 0x00000000 / Word 22 : 0x00000000 / Word 23 : 0x00000000 Word 24 : 0x00000000 / Word 25 : 0x00000000 / Word 26 : 0x00000000 / Word 27 : 0x00000000 Word 28 : 0x00000000 / Word 29 : 0x00000000 / Word 30 : 0x00000000 / **Word 31 : 0xF29D9024**
4	Read MTP Sector 126	Tx HID	smokey ScorpiusHid --run --test "Print_Sector" --args "MTP_sector=126" **Example:-Overlay will read Words that are printed:-** **Word 0 : 0x0000001** / **Word 1 : 0x00000002** / **Word 2 : 0x0E0E0E0E** / **Word 3 : 0x0F0F0F0F** Word 4 : 0x0000000 / Word 5 : 0x0000000 / Word 6 : 0x0000000 / Word 7 : 0x0000000 Word 8 : 0x0000000 / Word 9 : 0x0000000 / Word 10 : 0x0000000 / Word 11 : 0x0000000 Word 12 : 0x0000000 / Word 13 : 0x0000000 / Word 14 : 0x0000000 / Word 15 : 0x0000000 Word 16 : 0x0000000 / Word 17 : 0x0000000 / Word 18 : 0x0000000 / Word 19 : 0x0000000 Word 20 : 0x0000000 / Word 21 : 0x0000000 / Word 22 : 0x0000000 / Word 23 : 0x0000000 Word 24 : 0x0000000 / Word 25 : 0x0000000 / Word 26 : 0x0000000 / Word 27 : 0x0000000 Word 28 : 0x0000000 / Word 29 : 0x0000000 / Word 30 : 0x0000000 / **Word 31 : 0xDDD9E0E1**
5	Location of Calibrated values of VBoost, Vsense, Isense, LFOD & CTx into MTP and other values into MTP :- Signature, Version,HWID, MLB SN, Checksum Follow Figure 1 Bellow for Reference	Test Overlay	Sector 127 :-Word 0(Signature = 0x01); Word 1(Version = 0x02); Word 2(CTx); Word 6(VBoost); Word 7(Vsense); Word 8(Isense); Word 9(LFOD); Word 10(HWID); Word 11 - 15(MLB SN - 17 byte), Word 31(Checksum)
6	Location to store Calibrated values of Inductance (Ltx_nH) & frequency_Hz into MTP and also Signature and version.	Test Overlay	Sector 126 :- Word 0(Signature = 0x01); Word 1(Version = 0x02); Word 2(Ltx_nH); Word 3(frequency_Hz)

Test Parameter	Insight Keys Recorded	Comments/Notes
Sector 127		
Check Sum - Sector 127 (Word 31)	SCRP_Check Sum_127_MTP_BEFORE	Will need this Values to be compared against MTP Check after test **Section 8.7.**
Version (Word 1)	SCRP_Version_127_MTP_BEFORE	
Signature (Word 0)	SCRP_Signature_127_MTP_BEFORE	
Tx HWID_MTP (Word 10):- J51x - 0x05170000 J52x - 0x05200000	SCRP_TX_HWID_127_MTP_BEFORE	
CTx MTP (Word 2)	SCRP_CTx_127_MTP_BEFORE	
VBoost_Control MTP (Word 6)	SCRP_VBoost_127_MTP_BEFORE	
Vsense MTP (Word 7)	SCRP_VSense_127_MTP_BEFORE	
Isense MTP (Word 8)	SCRP_Isense_127_MTP_BEFORE	
LFOD MTP (Word 9)	SCRP_LFOD_127_MTP_BEFORE	
VSYS_ANA (Word 16)	SCRP_VSYS_ANA_127_MTP_BEFORE	
VSYS_1P8 (Word 17)	SCRP_VSYS_1P8_127_MTP_BEFORE	
MLB Serial No. (Word 11 to Word 15 - Bits<1:17>)	SCRP_MLB_SN_127_MTP_BEFORE	
Sector 126		
Check Sum - Sector 126 (Word 31)	SCRP_Check Sum_126_MTP_BEFORE	Will need this Values to be compared against MTP Check after test **Section 8.7.**
Version (Word 1)	SCRP_Version_126_MTP_BEFORE	
Signature (Word 0)	SCRP_Signature_126_MTP_BEFORE	
LPP Inductance_MTP (Word 2)	SCRP_LPP_L_126_MTP_BEFORE	
LPP Frequency_MTP (Word 3)	SCRP_LPP_FREQ_126_MTP_BEFORE	

8.4. Low Power Ping (LPP)

Description: Check the frequency and inductance for LPP at free air vs nominal position coupling.
Failure Mode(s) Captured: Poorly assembled / manufactured coils
Test Setup and Procedure:

Step	Description	Interface	Command / Notes
1	Connect coils at nominal position	Fixture	
2	Tell Tx to enter Quiesce Mode	Tx Diags	**Note:** Need to send the below command after every 2nd time of the above command within 3sec or with minimum or no delay as possible of above command. You cannot enter Quiesce mode without exiting the standalone mode. smokey ScorpiusHid --run --test "Set" --args "ReportID=0x09, ReportPayload={0x01}"
3	Disable LPP Switch "LPP_5V_EN"	TX Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x01, ReportPayload={0x00}" **Payload: (LSB-MSB) ——>** Byte0: 0 - turn off, 1 - turn on
4	Wait 2s	Fixture	
5	Measure VSNS		**Disable LFOD before reading Isense:** **smokey ScorpiusHid --run --test "Set" --args "ReportID=0x41, ReportPayload={0x98; 0x36; 0x00; 0x40; 0x80; 0x01; 0x00; 0x00}"** Check status of LFOD smokey ScorpiusHid --run --test "Set" --args "ReportID=0x40, ReportPayload={0x98; 0x34; 0x00; 0x40}" **———> Fixture wait 0.5 sec <———** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x40" **Response —>** bits 7 & bit 8 = 0 if Disabled, 1 if enabled **Disable ASK_CR before reading Isense:** smokey ScorpiusHid --run --test "Set" --args "ReportID=0x41, ReportPayload={0x58; 0x34; 0x00; 0x40; 0x00; 0x00; 0x00; 0x00}" Note: Here, a "set" report command is first sent followed by a "get" report to return the requested data. **VSense:** smokey ScorpiusHid --run --test "Set" --args "ReportID=0x31, ReportPayload={0x00; 0x00; 0x8C}" **———> Fixture wait 0.5 sec <———** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x31" **Response —>** bytes1-4 = Floating point value from ADC **—> VSense_kmxx_MCU** **Enabled LFOD after Isense reading:** **smokey ScorpiusHid --run --test "Set" --args "ReportID=0x41, ReportPayload={0x98; 0x35; 0x00; 0x40; 0x80; 0x01; 0x00; 0x00}"** **Wait 1 sec after setting back LFOD before doing next test.**

Step	Description	Interface	Command / Notes
6	Enable LPP Switch "LPP_5V_EN"	TX Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x01, ReportPayload={0x01}" **Payload: (LSB-MSB)** ——> Byte0: 0 - turn off, 1 - turn on
7	Wait 1s	Fixture	
8	Repeat Step 5		
9	Send 1.4uS LPP pulse	TX Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x05, ReportPayload={0x00; 0x46}" **Note:** 0x46 gives 70 * 20ns = 1.4uS is the duration of the pulse.
10	Delay 15mS before proceeding	Fixture	
11	Read output parameters of F and L and raw ADC data	TX Diags	To read Frequency, Inductance and Raw ADC data: smokey ScorpiusHid --run —test "Get" --args"ReportID=0x05" Response: (Received LSB First, Length should be 23bytes) Byte0: ReportId (should equal 0x05) Byte1: Error code (0x00-> no error) Byte2: Sub-cmd (should be 0x00) bytes3-6: Floating point value of frequency Bytes7-10: Floating point value of inductance Bytes19-22: Buffer address of raw ADC data Bytes23-26: Number of raw ADC data elements (of size uint16_t)
12	Collect raw ADC samples and upload to Insight	Tx Diags & Fixture	Collect Pointer to raw LPP data by sending the following command from bytes19-22 in the above response.Use the above info to read the raw data and upload to insight. Use the command Below to read the raw ADC buffered data smokey ScorpiusHid --run --test "Mem16" --args "Address=<*address*>, Length=<number of bytes to read>" smokey ScorpiusHid --run --test "Mem16" --args "Address=<buffer address>, Length=220" The LPP data is 660 bytes. Therefore 3 loops of above should finished reading all the LPP data
13	Repeat steps 2 - 5 x 100 times	Tx Diags & Fixture	Save all of the data as a single log file for each unit and upload to InSight.
14	Calculate Free Air Δ Tx Frequency & Δ Tx Inductance Averaged over 100 repeats vs MTP sector Value	Tx HID & Fixture	Δ Tx Frequency = SCRP_LPP_FREQ_MTP_BEFORE (From Section 8.3) - **Kxx_LPP_Frequency_100_avg** Δ Tx Inductance = **Kxx_LPP_Inductance_100_avg** - SCRP_LPP_L_MTP_BEFORE (From Section 8.3)
15	Record parameters as per the table below	Fixture	Apply limits accordingly
16	Repeat steps 2 - 8 at all coupling position	Tx Diags & Fixture	Coupling Position :- KMax, KNom & KMin

Acceptance:

Physical Parameter	InSight Keys Recorded	LL	UL	Unit	Comments/Notes
LPP Frequency	**KMax_LPP_Frequency**	62	71.5	kHz	Updated based on J5xx FEA MSS table
	KNom_LPP_Frequency	63	72.8		
	KMin_LPP_Frequency	64	77.2		
	KMax_LPP_Frequency_avg	62	71.5		
	KNom_LPP_Frequency_avg	63	72.8		
	KMin_LPP_Frequency_avg	64	77.2		
LPP Inductance	**KMax_LPP_Inductance**	22.3	28	µH	
	KNom_LPP_Inductance	21.5	27		
	KMin_LPP_Inductance	19.1	26		
	KMax_LPP_Inductance_avg	22.3	28		
	KNom_LPP_Inductance_avg	21.5	27		
	KMin_LPP_Inductance_avg	19.1	26		
Δ Tx Frequency	**KMax_LPP_Frequency_FA_delta**	5.0	22.3	kHz	
	KNom_LPP_Frequency_FA_delta	5.0	20.8		
	KMin_LPP_Frequency_FA_delta	5.0	17.3		
Δ Tx Inductance	**KMax_LPP_Inductance_FA_delta**	3.74	11.2	µH	
	KNom_LPP_Inductance_FA_delta	2.92	10.2		
	KMin_LPP_Inductance_FA_delta	2.13	7.4		
LPP Frequency STD	**Kxxx_LPP_Frequency_STDEV**	-	0.4	-	
LPP Inductance STD	**Kxxx_LPP_Inductance_STDEV**	-	0.4	-	
LPP_repeatability		100	100	-	

8.5. Digital Ping Level Tests

Description: This test required ginger/B332 dev board, both Tx and Rx coil. Test digital ping level (6Vboost and 110deg bridge phase) at 0.1C charge rate at various positions and Vrect and Ping Pong Tests. Ping Pong test is performed to check In-band comms by sending a train of bits as ASK (ginger board/B332 Dev Board).

Failure Mode(s) Captured:

1. Vrect: - Ginger/[B332-TBD] reach UVP or OVP at the digital ping level
2. Ping Pong :-Test Dotara's Internal ASK/FSK Communication.

Test Setup and Procedure:

Order of load ramping as follows:

- Set VBOOST to **6.1V**
- Adjust bridge phase from **110 degrees**
- Set loading to 40mA ballast (No Eload i.e. turn Eload off/Set Eload to 0A)

Description	Interface	Command
Set coupling position	Fixture	Loads @ all Couplings

Step	Description	Interface	Command
			Digital Ping Testing
			For DP @ 0.1C
1	Set boost to meet the load conditions. **Note:** Minimum Vboost is 6100mV, Don't set Vboost < 6100mV.	TX Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x03, ReportPayload={0xD4; 0x17; 0x88; 0x13}" **Payload: ——>** Byte0-1: Boost voltage (eg. 0x17D4 = 6100mV)
2	Set the Bridge phase **110deg**	Tx HID	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x04, ReportPayload={0x1C; 0xF3; 0x01; 0x00; 0xF8; 0x2A; 0x50; 0x46}" **Eg 0x2AF8:** 11000cdeg = 110deg phase
3	Command for following variables: Rx:- Vrect	Tx HID/Rx I2C	Vrect:- ~~scorpius get vrect [B332]~~ / ikt adc (Ginger)
4	Tell Rx to go into static mode	Rx I2C	**Write I2C packet:** (39) c0 ae 80 80 1e 09 02 01 AE **Ginger command:** set mode none **Ginger command:** set mode rx **Ginger command**: ikt write 0xF0000B80 0xAE010209 **Read one byte:** Should be 0x60 **B332 DevBoard:** i2c rawwrite charger 0x0f 0x00 0x2E 0x09 0x01 0x01 //set Aculeus to static closed loop mode
5	Choose Comm1	Rx I2C	**Write I2C packet**: (39) c0 ae 80 80 1e 01 00 05 AD **Ginger command:** ikt write 0x0xF0000B80 0xAD050001 **B332 DevBoard :** i2c rawwrite charger 0x0F 0x00 0x2d 0x01 0x00 0x05 //Select Comm cap1 - For IpadTx
6	Tell Tx to initiate ping pong with the Rx i.e. 10 packets, 100ms packet delay	Tx HID	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x02, ReportPayload={0x0A; 0x00; 0x64; 0x00}" Payload:----> byte0-1: Number of packets to send: 10 byte2-3: Delay between packets: 100ms
7	Wait 3 second for RX to send packets before reading buffer	Fixture	Wait 3 second
8	Read back data that was captured from the Tx.	Tx HID	smokey ScorpiusHid --run --test "Get" --args "ReportID=0x02" Response: byte0: ID *(PingPongID = 0x02)* byte1: Status *(eg. 0x00 = complete)* [0 = Complete; 1 = In-Progress] byte2-3: Pings Sent *(eg. 0x000A = 10 pings sent)* byte4-5: Pongs Received *(eg. 0x000A = 10 pongs received)* byte6: Last error *(e.g. 0x00 = no errors)* ***Note:-****If byte1:Status is in process then repeat the step*
9	Repeat step 2 to 8 At Kmax & Kmin		

Acceptance criteria:

Test Parameter	Insight Keys Recorded	LL	UL	Units	Comments/Notes
Vrect_FXST @ DP	**Kmax_SCRP_Vrect@DPxxC**	7500	8500	mV	
	Kmin_SCRP_Vrect@DPxxC	6200	7200	mV	
Number of Pings Sent @ DP	**Kxxx_Pings_Sent@DP**	10	10	-	
Number of Pongs Received @ DP	**Kxxx_Pongs_Recieved@DP**	10	10	-	

8.6. Power, Efficiency & Ping Pong Tests

Description: This test required Ginger/~~B332 dev~~ board, both Tx and Rx coil. Transferring power at various loads / charge rates (0.1C, 3C, 10C) at various positions and measuring power and efficiency and Ping Pong Tests. Ping Pong test is performed to check In-band comms by sending a train of bits as ASK (Ginger board/~~B332 Dev~~ Board).

Failure Mode(s) Captured:

1. Power & efficiency:-Unit is not able to transfer required power at different load conditions at required efficiency
2. Ping Pong :-Test Dotara's Internal ASK/FSK Communication.

Test Setup and Procedure:

Order of load ramping as follows:

- Adjust bridge phase from 0 - 180 degrees to reach target Vrect at desired load.
- If target Vrect still cannot be achieved with a phase shift of 180 degrees?
- Start increasing VBoost.
- VBoost should only be adjusted when phase = 180 degrees.
- To reach the desired Vrect start ramping the boost voltage.
- To reach the 10C load step the load with 50mA to avoid OVP.

Charge Rate	0.1C @ 6.5V Vrect	3C @ 8V Vrect	10C @ 14V Vrect
Loading	40mA ballast No Eload i.e. turn Eload off/Set Eload to 0A	~0.9W Set Eload to~112.5mA	3W Set Eload to ~214mA

Description	Interface	Command
Set load and coupling position	Fixture	Repeat all below tests for the following Load conditions **0.1C; 3C; 10C**

Step	Description	Interface	Command
			Power & Efficiency Testing
A	Enter Quiesce Mode	Tx HID	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x09, ReportPayload={0x01}"
B	PPVCC_MAIN(VSYS_ANA) Record this as x**1**	Tx HID	**PPVCC_MAIN(VSYS_ANA)**: smokey ScorpiusHid --run --test "Set" --args "ReportID=0x31, ReportPayload={0x06; 0x00; 0x8C}" note: the last part "0x8C" donates the number of samples with a multiplier of 32x. i.e 0x8C = 140 x 32 = 4480 samples **------> Fixture wait 0.5 sec <------** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x31" **Response-->** byte0: [u8] ID (GetAdcID = 0x31) byte1-4: [u32] Floating point value read from ADC (eg 0xYYYYYYYY)(Convert this value to mV from V) byte5: [u8] Error Code (eg. 0x00 - no error) byte6: [u8] Reserved (eg. 0x00) byte7-8: [u16] ADC raw value (eg. 0xXXXX) byte9-12: [u32] Channel_Id that was read (eg. 0x00000007 = VSYS_1P8)
C	Calculate PPVCC_MAIN(VSYS_ANA) actual **VSYS_ANA_Actual = y1**	Overlay	$y_1 = (m\,x_1/10000) + (c/1000)$ —> Where m = slope & c = offset —>from Word16 = VSYS_ANA_Offset_MTP <<16 || VSYS_ANA_Slope_MTP **Note : Convert m & c values into decimal before calculating y1**
D	Record value of VSYS_1P8 Record this as **x1**	Tx HID	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x31, ReportPayload={0x07; 0x00; 0x8C}" note: the last part "0x8C" donates the number of samples with a multiplier of 32x. i.e 0x8C = 140 x 32 = 4480 samples **------> Fixture wait 0.5 sec <------** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x31" **Response-->** byte0: [u8] ID (GetAdcID = 0x31) byte1-4: [u32] Floating point value read from ADC (eg 0xYYYYYYYY)(Convert this value to mV from V byte5: [u8] Error Code (eg. 0x00 - no error) byte6: [u8] Reserved (eg. 0x00) byte7-8: [u16] ADC raw value (eg. 0xXXXX) byte9-12: [u32] Channel_Id that was read (eg. 0x00000007 = VSYS_1P8)
E	Calculate VSYS_1P8 actual **VSYS_1P8_Actual = y1**	Overlay	$y_1 = x_1 + (b/1000)$ Where b = offset —>from Word17 = value from step 14 above in Hex **Note : Convert b value into decimal before calculating y1**
F	Command for following variables: Tx:- Vbatt, Ibatt	Tx (Diags & HID)	pmuadc --read all **Vbatt**:- potomac vbat : xxxx.xxxx mV; **Ibatt:-** ibat_out: xxxx.xxx mA **Example --->**00024088:2240013A] :-) pmuadc --read all vddout: 4199.9389 mV; vbat: 3036.0195 mV; brick_id: 3.6630 mV; brick_id_usb_d+: 0mV; brick_id_usb_d-: 0mV brick_id2: 3.6630 mV; .....; .....; .....; ..... ibuck9: 0.0000 mA; ibuck11: 0.0000 mA; ibuck14: 0.0000 mA; ***ibat_out: 23858.3638 mA***; BIST buck0: 775.0915 mV BIST buck1: 7.5091 mV; .....; .....; .....; ..... potomac vsys_lo : 4214.2857 mV; potomac ich_1a : 0.2442 mA; potomac tbat : -2.0451 C; **potomac vbat : 4225.2747 mV**; potomac ich_6a : 1.4652 mA
G	Difference between VSYS-ANA & Vbatt	Fixture	$V_{Flex\_Drop} = V_{batt} - V_{SYS\_ANA\_actual}$
			For 0.1C & 3C
1	Repeat Step B to G	Tx Diags & Fixture	@Standby i.e. before 0.1C testing

	Description	Interface	Command
2	Set boost to meet the load conditions. **Note:** Minimum Vboost is 6100mV, Don't set Vboost < 6100mV.	TX Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x03, ReportPayload={0xD4; 0x17; 0x88; 0x13}" **Payload: ——>** Byte0-1: Boost voltage (eg. 0x17D4 = 6100mV)
3	Set the Bridge phase to meet the load condition (Set Bridge phase to 0-180)	Tx Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x04, ReportPayload={0x1C; 0xF3; 0x01; 0x00; 0x50; 0x46; 0x50; 0x46}" **Eg 0x4650:** 18000cdeg = 180deg phase
4	Command for following variables: Vsense, Isense, LFOD (VCTx) **Note :** Disable LFOD before taking Vsense & Isense Reading and Enable LFOD back before taking LFOD(VCTx) reading.	TX Diags	**Disable LFOD before reading Isense:** **smokey ScorpiusHid --run --test "Set" --args "ReportID=0x41, ReportPayload={0x98; 0x36; 0x00; 0x40; 0x80; 0x01; 0x00; 0x00}"** Check status of LFOD smokey ScorpiusHid --run --test "Set" --args "ReportID=0x40, ReportPayload={0x98; 0x34; 0x00; 0x40}" **———> Fixture wait 0.5 sec <———** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x40" **Response —>** bits 7 & bit 8 = 0 if Disabled, 1 if enabled Note: Here, a "set" report command is first sent followed by a "get" report to return the requested data. **VSense:** smokey ScorpiusHid --run --test "Set" --args "ReportID=0x31, ReportPayload={0x00; 0x00; 0x8C}" **———> Fixture wait 0.5 sec <———** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x31" **Response —>** bytes1-4 = Floating point value from ADC **—> VSense_kmxx_MCU** **Isense:** smokey ScorpiusHid --run --test "Set" --args "ReportID=0x31, ReportPayload={0x12; 0x00; 0x8C}" **———> Fixture wait 0.5 sec <———** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x31" **Response —>** bytes1-4 = Floating point value from ADC **—> Isense_kmxx_MCU** **Enabled LFOD after Isense reading:** **smokey ScorpiusHid --run --test "Set" --args "ReportID=0x41, ReportPayload={0x98; 0x35; 0x00; 0x40; 0x80; 0x01; 0x00; 0x00}"** **Wait 1 sec after setting back LFOD before doing next test.** **LFOD(VCTx)**: smokey ScorpiusHid --run --test "Set" --args "ReportID=0x0B, ReportPayload={0x18; 0x03}" **———> Fixture wait 0.5 sec <———** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x0B" **Response—>** byte0 = report **byte16-17 = [u16] Read averaged ictx peak value in mA (based on factory calibrated** **byte18-19 = [u16] Accumulated ADC raw averaged sampling value** Note: Upload this raw data into Insight.
5	Measure Dotara (U6200) Temp at all Load conditions	Tx HID	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x31, ReportPayload={0x08; 0x00; 0x8C}" **<-- Trigger reading of Temp1 (channel 8)** smokey ScorpiusHid --run --test "Set" --args "ReportID=0x31, ReportPayload={0x09; 0x00; 0x8C}" **<--Trigger reading of Temp2 (channel 9)** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x31"
6	Repeat Step B to G	Tx Diags & Fixture	During 0.1C & 3C loading
	For 10C		
7	Set the Full phase to meet the load condition (Set Bridge phase to 180)	Tx Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x04, ReportPayload={0x1C; 0xF3; 0x01; 0x00; 0x50; 0x46; 0x50; 0x46}" **Eg 0x4650:** 18000cdeg = 180deg phase
8	Set boost to meet the load conditions. **Note:** Minimum Vboost is 6100mV, Don't set Vboost < 6100mV.	TX Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x03, ReportPayload={0xD4; 0x17; 0x88; 0x13}" **Payload: ——>** Byte0-1: Boost voltage (eg. 0x17D4 = 6100mV)
9	Repeat Step B to G	Tx Diags & Fixture	During 10C loading

	Description	Interface	Command
10	Command for following variables: Vsense, Isense, LFOD (VCTx) **Note :** Disable LFOD before taking Vsense & Isense Reading and Enable LFOD back before taking LFOD(VCTx) reading.	TX Diags	**Disable LFOD before reading Isense:** **smokey ScorpiusHid --run --test "Set" --args "ReportID=0x41, ReportPayload={0x98; 0x36; 0x00; 0x40; 0x80; 0x01; 0x00; 0x00}"** Check status of LFOD smokey ScorpiusHid --run --test "Set" --args "ReportID=0x40, ReportPayload={0x98; 0x34; 0x00; 0x40}" **———> Fixture wait 0.5 sec <———** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x40" **Response —>** bits 7 & bit 8 = 0 if Disabled, 1 if enabled Note: Here, a "set" report command is first sent followed by a "get" report to return the requested data. **VSense:** smokey ScorpiusHid --run --test "Set" --args "ReportID=0x31, ReportPayload={0x00; 0x00; 0x8C}" **———> Fixture wait 0.5 sec <———** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x31" **Response —>** bytes1-4 = Floating point value from ADC **—> VSense_kmxx_MCU** **Isense:** smokey ScorpiusHid --run --test "Set" --args "ReportID=0x31, ReportPayload={0x12; 0x00; 0x8C}" **———> Fixture wait 0.5 sec <———** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x31" **Response —>** bytes1-4 = Floating point value from ADC **—> Isense_kmxx_MCU** **Enabled LFOD after Isense reading:** **smokey ScorpiusHid --run --test "Set" --args "ReportID=0x41, ReportPayload={0x98; 0x35; 0x00; 0x40; 0x80; 0x01; 0x00; 0x00}"** **Wait 1 sec after setting back LFOD before doing next test.** **LFOD(VCTx)**: smokey ScorpiusHid --run --test "Set" --args "ReportID=0x0B, ReportPayload={0x18; 0x03}" **———> Fixture wait 0.5 sec <———** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x0B" **Response—>** byte0 = report **byte16-17 = [u16] Read averaged ictx peak value in mA (based on factory calibrated** **byte18-19 = [u16] Accumulated ADC raw averaged sampling value** Note: Upload this raw data into Insight.
11	Measure Dotara (U6200) Temp at all Load conditions	Tx HID	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x31, ReportPayload={0x08; 0x00; 0x8C}" **<-- Trigger reading of Temp1 (channel 8)** smokey ScorpiusHid --run --test "Set" --args "ReportID=0x31, ReportPayload={0x09; 0x00; 0x8C}" **<--Trigger reading of Temp2 (channel 9)** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x31"
	Ping Pong Testing		
12	Tell Rx to go into static mode	Rx I2C	Write I2C packet: (39) c0 ae 80 80 1e 09 02 01 AE Ginger command: set mode none Ginger command: set mode rx Ginger command: ikt write 0xF0000B80 0xAE010209 Read one byte: Should be 0x60
13	Choose Comm1	Rx I2C	Write I2C packet: (39) c0 ae 80 80 1e 01 00 05 AD Ginger command: ikt write 0x0xF0000B80 0xAD050001
14	Tell Tx to initiate ping pong with the Rx i.e. 10 packets, 100ms packet delay	Tx Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x02, ReportPayload={0x0A; 0x00; 0x64; 0x00}" **Payload:——>** byte0-1: Number of packets to send: 10 byte2-3: Delay between packets: 100ms
15	Wait 1 second for RX to send packets before reading buffer	Fixture	Wait 1 second
16	Read back data that was captured from the Tx.	Tx Diags	smokey ScorpiusHid --run --test "Get" --args "ReportID=0x02" **Response:** byte0: ID(PingPongID = 0x02) byte1: Status(eg. 0x00 = complete) [0 = Complete; 1 = In-Progress] byte2: Last error(e.g. 0x00 = no errors) byte3-4: Pings Sent(eg. 0x000A = 10 pings sent) byte5-6: Pongs Received(eg. 0x000A = 10 pongs received) ***Note:- If byte1:Status is in process then repeat the step***
17	Repeat step 1 to 16 with All loading and coupling positions		

Acceptance criteria:

Test Parameter	Insight Keys Recorded	LL	UL	Units	Comments/Notes
Load 0.1C					
PPVCC_MAIN@ 0.1C (VSYS_ANA_ACTUAL)	KMax_PPVCC_MAIN@0.1C	3200	4600	mV	
	KNom_PPVCC_MAIN@0.1C	3200	4600		
	KMin_PPVCC_MAIN@0.1C	3200	4600		
Vbatt@ 0.1C	KMax_Vbatt@0.1C	3200	4600	mV	
	KNom_Vbatt@0.1C	3200	4600		
	KMin_Vbatt@0.1C	3200	4600		

Test Parameter	Insight Keys Recorded	LL	UL	Units	Comments/Notes
VSYS_1P8 @ 0.1C	KMax_VSYS_1P8@0.1C	1760	1810	mV	
	KNom_VSYS_1P8@0.1C	1760	1810		
	KMin_VSYS_1P8@0.1C	1760	1810		
VFlex_Drop@0.1C	KMax_VFlex_Drop@0.1C	0	100	mA	
	KNom_VFlex_Drop@0.1C	0	100		
	KMin_VFlex_Drop@0.1C	0	100		
Ibatt @ 0.1C	KMax_Ibatt@0.1C	100	1110	mA	
	KNom_Ibatt@0.1C	100	1130		
	KMin_Ibatt@0.1C	100	1150		
Vsense @ 0.1C	KMax_Vsense@0.1C	5990	7000	mV	Refer to J4xx, but updated min Vboost = 6.1V
	KNom_Vsense@0.1C	5990	7000		
	KMin_Vsense@0.1C	5990	7000		
Isense @ 0.1C	KMax_Isense@0.1C	50	120	mA	
	KNom_Isense@0.1C				
	KMin_Isense@0.1C	70	160		
Vctx_IPeak @ 0.1C	KMax_VCtx_IctxPeakFactory@0.1C	280	550	mA	
	KNom_VCtx_IctxPeakFactory@0.1C				
	KMin_VCtx_IctxPeakFactory@0.1C	400	650		
Vrect_FXST @ 0.1C	KMax_Vrect_FXST@0.1C	6300	6700	mV	Fixture Cmd: Vrect Target = 6.5V ±2% Use Filtered Vrect Value from 'Ikt Adc' command
	KNom_Vrect_FXST@0.1C	6300	6700		
	KMin_Vrect_FXST@0.1C	6300	6700		
Irect_FXST @ 0.1C	KMax_Irect_FXST@0.1C	40	45	mA	Iktara ballast load = 40mA. **No fixture load required.**
	KNom_Irect_FXST@0.1C				
	KMin_Irect_FXST@0.1C				
Rx_Loading_Power @ 0.1C	KMax_Rx_Loading_Power@0.1C	252	301.5	mW	Vrect * Irect
	KNom_Rx_Loading_Power@0.1C	252	301.5		
	KMin_Rx_Loading_Power@0.1C	252	301.5		
Efficiency @ 0.1C	KMax_Efficiency@0.1C	19.00	65.00	%	Refer to J4xx
	KNom_Efficiency@0.1C				
	KMin_Efficiency@0.1C	10.00	55.00		
Number of Pings Sent @ 0.1C	Kxxx_Pings_Sent@0.1C	10	10	-	
Number of Pongs Received @ 0.1C	Kxxx_Pongs_Recieved@0.1C	10	10	-	
Dotara Surface Temperature @ 0.1C	Kxxx_Temp1_MCU@0.1C Kxxx_Temp2_MCU@0.1C	20	61	℃	Based on J307 P1 data
Load 3C					
PPVCC_MAIN@ 3C (VSYS_ANA_ACTUAL)	KMax_PPVCC_MAIN@3C	TBD	TBD	mV	
	KNom_PPVCC_MAIN@3C	TBD	TBD		
	KMin_PPVCC_MAIN@3C	TBD	TBD		
Vbatt@ 3C	KMax_Vbatt@3C	TBD	TBD	mV	
	KNom_Vbatt@3C	TBD	TBD		
	KMin_Vbatt@3C	TBD	TBD		
VSYS_1P8 @ 3C	KMax_VSYS_1P8@3C	1650	1950	mV	
	KNom_VSYS_1P8@3C	1650	1950		
	KMin_VSYS_1P8@3C	1650	1950		
VFlex_Drop@3C	KMax_VFlex_Drop@3C	TBD	TBD	mA	
	KNom_VFlex_Drop@3C	TBD	TBD		

Test Parameter	Insight Keys Recorded	LL	UL	Units	Comments/Notes
	KMin_VFlex_Drop@3C	TBD	TBD		
Ibatt @ 3C	KMax_Ibatt@3C	TBD	TBD	mA	
	KNom_Ibatt@3C	TBD	TBD		
	KMin_Ibatt@3C	TBD	TBD		
Vsense @ 3C	KMax_Vsense@3C	5990	7600	mV	Refer to J4xx, but updated min Vboost = 6.1V
	KNom_Vsense@3C	5990			
	KMin_Vsense@3C	5990	8500		
Isense @ 3C	KMax_Isense@3C	200	570	mA	
	KNom_Isense@3C				
	KMin_Isense@3C	220	600		
Vctx_IPeak_ @ 3C	KMax_VCtx_IctxPeakFactory@3C	360	600	mA	
	KNom_VCtx_IctxPeakFactory@3C				
	KMin_VCtx_IctxPeakFactory@3C	400	830		
Vrect_FXST @ 3C	KMax_Vrect_FXST@3C	7800	8300	mV	Fixture Cmd: Vrect Target = 8V ±2%
	KNom_Vrect_FXST@3C	7800	8300		
	KMin_Vrect_FXST@3C	7800	8300		
Irect_FXST @ 3C	KMax_Irect_FXST@3C	110	125	mA	Fixture Cmd: Irect Target = 113mA +iktara load(~0 to 15mA)
	KNom_Irect_FXST@3C	110	125		
	KMin_Irect_FXST@3C	110	125		
Rx_Loading_Power @ 3C	KMax_Rx_Loading_Power@3C	858	1037.5	mW	Vrect * Irect
	KNom_Rx_Loading_Power@3C	858	1037.5		
	KMin_Rx_Loading_Power@3C	858	1037.5		
Efficiency @ 3C	KMax_Efficiency@3C	57.00	70.00	%	Refer to J4xx
	KNom_Efficiency@3C				
	KMin_Efficiency@3C	46.00	63.00	%	
Number of Packets Sent @ 3C	Kxxx_Packets_Sent@3C	10	10	-	
Number of Packets Received @ 3C	Kxxx_Packets_Recieved@3C	10	10	-	
Dotara Surface Temperature @ 3C	Kxxx_Temp1_MCU@3C Kxxx_Temp2_MCU@3C	20	61	℃	Based on J307 P1 data
Load 10C					
PPVCC_MAIN@ 10C (VSYS_ANA_ACTUAL)	KMax_PPVCC_MAIN@ 10C	TBD	TBD	mV	
	KNom_PPVCC_MAIN@ 10C	TBD	TBD		
	KMin_PPVCC_MAIN@ 10C	TBD	TBD		
Vbatt@ 10C	KMax_Vbatt@ 10C	TBD	TBD	mV	
	KNom_Vbatt@ 10C	TBD	TBD		
	KMin_Vbatt@ 10C	TBD	TBD		
VSYS_1P8 @ 10C	KMax_VSYS_1P8@10C	1650	1950	mV	
	KNom_VSYS_1P8@10C	1650	1950		
	KMin_VSYS_1P8@10C	1650	1950		
VFlex_Drop@ 10C	KMax_VFlex_Drop@10C	TBD	TBD	mA	
	KNom_VFlex_Drop@10C	TBD	TBD		
	KMin_VFlex_Drop@10C	TBD	TBD		
Ibatt @ 10C	KMax_Ibatt@ 10C	TBD	TBD	mA	
	KNom_Ibatt@ 10C	TBD	TBD		
	KMin_Ibatt@ 10C	TBD	TBD		
	KMax_Vsense@10C	9000	12900		

Test Parameter	Insight Keys Recorded	LL	UL	Units	Comments/Notes
Vsense @ 10C	KNom_Vsense@10C			mV	
	KMin_Vsense@10C	9300	15000		
Isense @ 10C	KMax_Isense@10C	380	640	mA	
	KNom_Isense@10C				
	KMin_Isense@10C	360	700		
Vctx_IPeak_ @ 10C	KMax_VCtx_IctxPeakFactory@10C	700	1100	mA	
	KNom_VCtx_IctxPeakFactory@10C				
	KMin_VCtx_IctxPeakFactory@10C	900	1300		
Vrect_FXST @ 10C	KMax_Vrect_FXST@10C	13500	14500	mV	Fixture Cmd: Vrect Target = 14v
	KNom_Vrect_FXST@10C	13500	14500		
	KMin_Vrect_FXST@10C	13500	14500		
Irect_FXST @ 10C	KMax_Irect_FXST@10C	215	225	mA	Fixture Cmd: Irect Target = 214mA
	KNom_Irect_FXST@10C	215	225		
	KMin_Irect_FXST@10C	215	225		
Rx_Loading_Power @ 10C	KMax_Rx_Loading_Power@10C	2902.50	3262.50	mW	Vrect * Irect
	KNom_Rx_Loading_Power@10C	2902.50	3262.50		
	KMin_Rx_Loading_Power@10C	2902.50	3262.50		
Efficiency @ 10C	KMax_Efficiency@10C	53.00	69.00	%	Refer to J4xx
	KNom_Efficiency@10C				
	KMin_Efficiency@10C	47.00	62.00		
Number of Packets Sent @ 10C	Kxxx_Packets_Sent@10C	10	10	-	
Number of Packets Received @ 10C	Kxxx_Packets_Recieved@10C	10	10	-	
Dotara Surface Temperature @ 10C	Kxxx_Temp1_MCU@10C Kxxx_Temp2_MCU@10C	20	61	℃	Based on J307 P1 data

8.7. Final MTP Sector Check After Tests.

Description: Make sure FW is in a good state at the end of the test. [TBD]
Failure Mode(s) Captured: TBD
Test Setup and Procedure: Refer below

Step	Description	Interface	Command / Notes
1	Pull Low test pin **TP93EF** i.e. **"AOP_TO_DOTARA_RESET_L"** to reset Scorpius	Tx Diags	pmugpio --pin 18 --output 0 --pushpull
	Wait 500ms	Fixture	
	Pull High test pin **TP93EF** i.e. **"AOP_TO_DOTARA_RESET_L "**	Tx Diags	pmugpio --pin 18 --output 1 --pushpull
2	Wait 1s	Fixture	
3	Preparation	Tx Diags	pmugpio --pin 14 --output 1 --pushpull
4	Tell Tx to get out of standalone mode.	TX HID (Diags)	i2c -w 6 0x39 6 **Note:-Send this command 2x times with 1s delay. There may be I2C error reported with this command, but can be ignored.**
5	Load Tx FW	Tx HID	**Note**: Need to send this command every time within **3sec** of above command. You cannot enter Load FW without exiting the standalone mode. ***Path for FW might change.*** smokey ScorpiusHid --run --test "FwLoad" --args "PathToFwLoad='nandfs:\\AppleInternal\\Diags\\Scorpius\\J517J522\\ScorpiusTx-dotara.bin'"
6	Wait 1s	Fixture	Scorpius FW will take less than 1 second to boot
7	Tell Tx to get out of standalone mode.	TX HID (Diags)	i2c -w 6 0x39 6 **Note:-Send this command 2x times with 1s delay. There may be I2C error reported with this command, but can be ignored.**
8	Tell Tx to enter Quiesce Mode	TX HID	**Note**: Need to send the below command after every 2nd time of the above command within **3sec** or with minimum or no delay as possible of above command. You cannot enter Quiesce mode without exiting the standalone mode. smokey ScorpiusHid --run --test "Set" --args "ReportID=0x09, ReportPayload={0x01}"

Step	Description	Interface	Command / Notes
9	Read MTP Sector 127	Tx HID	smokey ScorpiusHid --run --test "Print_Sector" --args "MTP_sector=127" **Example:-Overlay will read Words that are printed:-** **Word 0 : 0x00000001** Word 1 : 0x00000002 Word 2 : 0x00030570 Word 3 : 0x00023F00 Word 4 : 0x00000000 Word 5 : 0x00000000 **Word 6 : 0x0A0A0A0A** **Word 7 : 0x0B0B0B0B** **Word 8 : 0x0C0C0C0C** **Word 9 : 0x0D0D0D0D** **Word 10 : 0x05170000** **Word 11 : 0x00000000** **Word 12 : 0x00000000** **Word 13 : 0x00000000** **Word 14 : 0x00000000** **Word 15 : 0x00000000** Word 16 : 0x00000000 Word 17 : 0x00000000 Word 18 : 0x00000000 Word 19 : 0x00000000 Word 20 : 0x00000000 Word 21 : 0x00000000 Word 22 : 0x00000000 Word 23 : 0x00000000 Word 24 : 0x00000000 Word 25 : 0x00000000 Word 26 : 0x00000000 Word 27 : 0x00000000 Word 28 : 0x00000000 Word 29 : 0x00000000 Word 30 : 0x00000000 **Word 31 : 0xF29D9024**
10	Read MTP Sector 126	Tx HID	smokey ScorpiusHid --run --test "Print_Sector" --args "MTP_sector=126" **Example:-Overlay will read Words that are printed:-** **Word 0 : 0x0000001** **Word 1 : 0x00000002** **Word 2 : 0x0E0E0E0E** **Word 3 : 0x0F0F0F0F** Word 4 : 0x0000000 Word 5 : 0x0000000 Word 6 : 0x0000000 Word 7 : 0x0000000 Word 8 : 0x0000000 Word 9 : 0x0000000 Word 10 : 0x0000000 Word 11 : 0x0000000 Word 12 : 0x0000000 Word 13 : 0x0000000 Word 14 : 0x0000000 Word 15 : 0x0000000 Word 16 : 0x0000000 Word 17 : 0x0000000 Word 18 : 0x0000000 Word 19 : 0x0000000 Word 20 : 0x0000000 Word 21 : 0x0000000 Word 22 : 0x0000000 Word 23 : 0x0000000 Word 24 : 0x0000000 Word 25 : 0x0000000 Word 26 : 0x0000000 Word 27 : 0x0000000 Word 28 : 0x0000000 Word 29 : 0x0000000 Word 30 : 0x0000000 **Word 31 : 0xDDD9E0E1**
11	Pull Low test pin **TP93EF** i.e. **"AOP_TO_DOTARA_RESET_L"** to reset Scorpius	Tx Diags	pmugpio --pin 18 --output 0 --pushpull
	Wait 500ms	Fixture	
	Pull High test pin **TP93EF** i.e. **"AOP_TO_DOTARA_RESET_L "**	Tx Diags	pmugpio --pin 18 --output 1 --pushpull

Acceptance:

Test Parameter	Insight Keys Recorded	Comments/Notes
Sector 127		
Check Sum - Sector 127 (Word 31)	**SCRP_Check Sum_127_MTP_AFTER**	Pass if this values match with MTP check before test i.e. **Section 8.3**
Version (Word 1)	**SCRP_Version_127_MTP_AFTER**	
Signature (Word 0)	**SCRP_Signature_127_MTP_AFTER**	
Tx HWID_MTP (Word 10):- J51x - 0x05170000 J52x - 0x05200000	**SCRP_TX_HWID_127_MTP_AFTER**	
CTx MTP (Word 2)	**SCRP_CTx_127_MTP_AFTER**	
VBoost_Control MTP (Word 6)	**SCRP_VBoost_127_MTP_AFTER**	
Vsense MTP (Word 7)	**SCRP_VSense_127_MTP_AFTER**	
Isense MTP (Word 8)	**SCRP_Isense_127_MTP_AFTER**	
LFOD MTP (Word 9)	**SCRP_LFOD_127_MTP_AFTER**	
VSYS_ANA (Word 16)	**SCRP_VSYS_ANA_127_MTP_AFTER**	
VSYS_1P8 (Word 17)	**SCRP_VSYS_1P8_127_MTP_AFTER**	
MLB Serial No. (Word 11 to Word 15 - Bits<1:17>)	**SCRP_MLB_SN_127_MTP_AFTER**	
Sector 126		
Check Sum - Sector 126 (Word 31)	**SCRP_Check Sum_126_MTP_BEFORE**	Pass if this values match with MTP check before test i.e. **Section 8.3**
Version (Word 1)	**SCRP_Version_126_MTP_BEFORE**	
Signature (Word 0)	**SCRP_Signature_126_MTP_BEFORE**	
LPP Inductance_MTP (Word 2)	**SCRP_LPP_L_126_MTP_BEFORE**	
LPP Frequency_MTP (Word 3)	**SCRP_LPP_FREQ_126_MTP_BEFORE**	

C. Feature DRI Comments for Changes to this Document

Feature	DRI	Description/Comments/Reason for Change	Date	Approved and released in Version:
General	Bhushan/Alberto/Nan/ Frank	Limits update from J307P0 to J5xx, data based on 4 units. Updated all the smokey command. Added command to measure Vbatt, Ibatt, PPVCC_MAIN	21 January 2020	P0_V1.1
General	Bhushan	Reverted back to original smokey command.	19 February 2020	Bhushan/P1_V1.2
Power Transfer	Mikhal	Minimum boost requirement has changed from 6000mV to 6100mV.	21 February 2020	Mikhal/Bhushan/ P1_V1.2
Power Transfer	Bhushan/Rex	Updated power flow test procedure to include VCC main and Vbatt measurements	11 March 2020	Rex/Nan/Bhushan/ Frank/P1_V1.3
LPP	Frank	Updated LPP limits		
Dotara	Bhushan	Added Dotara Temperature measurement	3 April 2020	Bhushan/Rex/Nan/ P1_V1.4
LPP & VCTX	Bhushan	Updated command and response format of LPP and VCTx respectively		
Power Transfer	Bhushan/Jin/Nan	Updated procedure to disable LFOD during Vsense & Isense measurement		
Power Transfer	Bhushan	Updated formula for calculating VSYS_ANA & VSYS_1P8 Updated limits	17 April 2020	Bhushan/Nan/Frank/ Mikhal/P1_V1.5
LPP	Frank	Updated limits		
Digital Ping	Mikhal/Bhushan	Updated limits		
iOS	Bhushan/ Scorpius FW team	Switch form EFI Diags to iOS Non UI mode testing using B332 dev Board. • Moving fro Open Loop to CloseLoop for Power flow only • LPP & Digital Ping are still in Open Loop Mode.	31 July 2020	Bhushan/P1_V1.6