Factory Scorpius Char Test Plan for J307

Module: Scorpius
Station: Scorpius Char (DEV40)
Build:EVT
Release Date: 22 July 2020

This Document Covers the Following Products:J307
Revision: EVT_V2.4
<rdar://problem/51782237> J307 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	2 September 2019	Initial release for J307 P0 Build.	Bhushan Koli
	1.1	14 September 2019	Updated coil fixture specifications and Power flow Efficiency test for setup and Rx commands	Bhushan Koli
	1.2	17 September 2019	Updated Power Efficiency section to swap the sequence of Enable sense and Full Bridge Enable.	Bhushan Koli
	1.3	20 September 2019	Updated the test limits for all parameters.	Bhushan Koli
	1.4	26 September 2019	Correted LPP & Power efficiency Limits	Bhushan Koli
P1	1.5	26 November 2019	Updated Location of words in MTP and few commands	Bhushan Koli
	1.6	5 December 2019	Added Digital Ping test at 0.1C loading condition	Bhushan Koli/Mikhal
	1.7	16 December 2019	Updated MTP Read Section and limits	Bhushan Koli/Selestino
	1.8	18 December 2019	Updated Calculation in LLP section	Bhushan Koli
	1.9	14 January 2020	Updated limits based on Factory data	Bhushan Koli
P1B	2.0	21 February 2020	Updated Minimum Vboost requirement from 6V to 6.1V	Bhushan Koli/Mikhal
	2.1	3 April 2020	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/Jin
Pre-EVT	2.2	11 May 2020	Updated limits for Digital Ping Vrect	Bhushan Koli/Mikhal
EVT	2.3	19 June 2020	Switch entire Scorpius testing from EFI Diags to iOS Non UI mode. • Switched to CloseLoop from Open loop EFI Diags mode • Added ASK_CR register disable before Vsense/Isense • Added Vsense measurement before LPP	Bhushan Koli/ Rex/Scorpius FW team
EVT	2.4	22 July 2020	Updated the ERS to start using data streaming tool. Updated limits based on iOS test procedures.	Bhushan Koli/FW Team/Rex

2. Purpose

This document describes the FATP Scorpius Char test plan for the J307 inductive charging Tx module for P0.

3. Scope

The scope of this document is the Scorpius only module of the J307 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> J307 FW specifications
<rdar://problem/54853341> Radar for Scorpius Factory FW releases
J307 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(J307 MLB)
VCTX	-	Voltage across Tx coil
Vsense	-	Voltage across sense output
VRect	-	Voltage across Rx Rectifier

6. Critical and Frequently Used Commands

6.1. 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.*

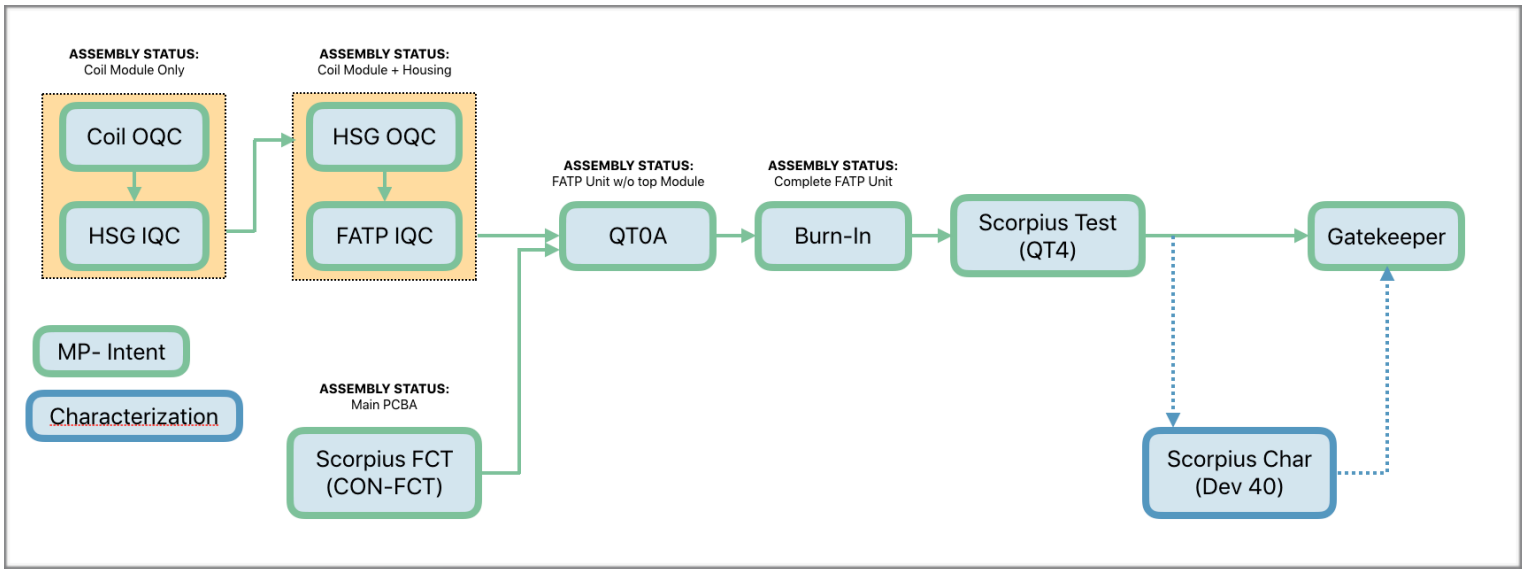
This is the normal runtime mode. Here, a subset of commands used for test/validation are deactivated.

```
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. Overview

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



7.1. Summary of Test Coverage

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

7.2. 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.

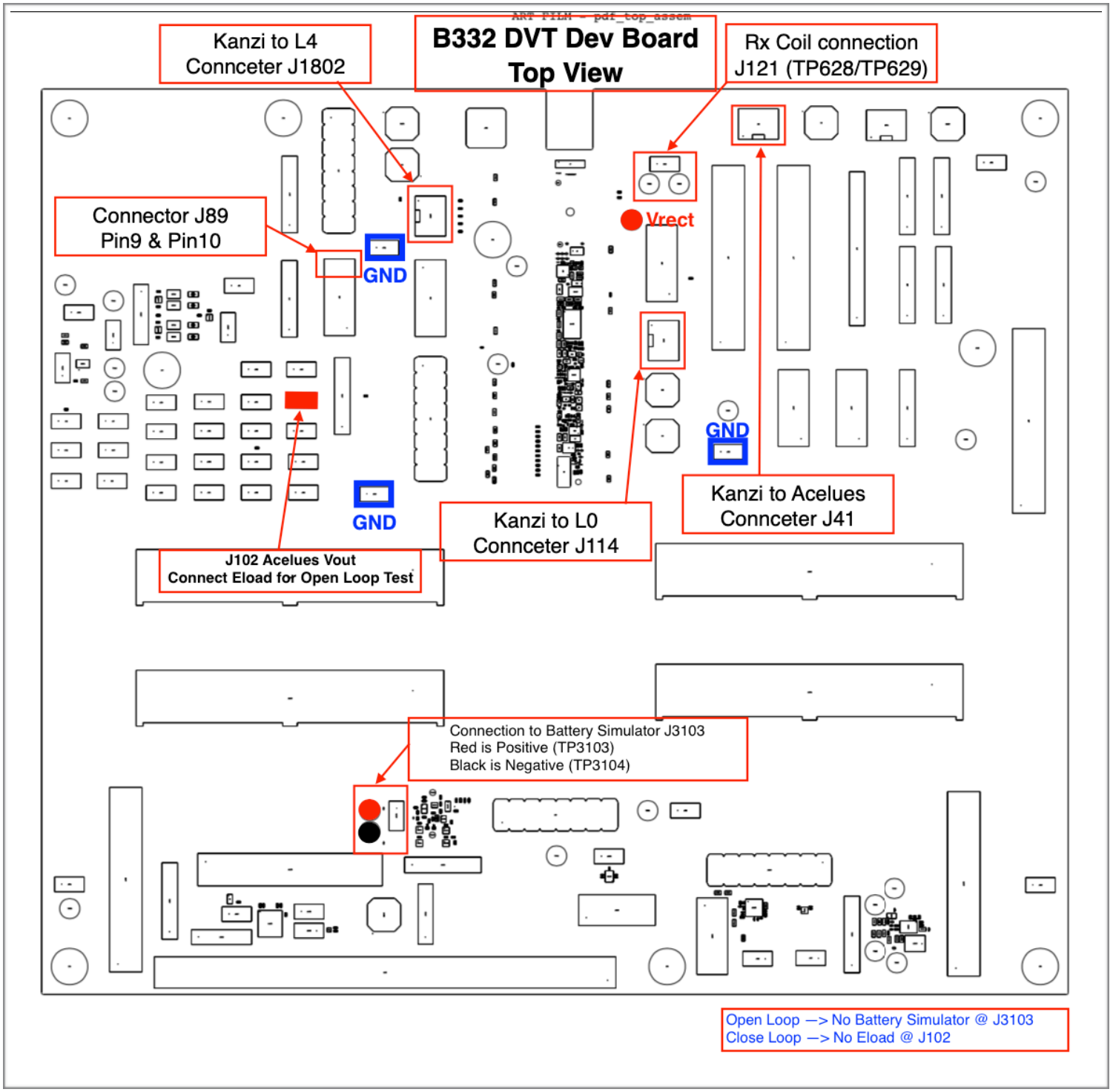
All = all possible positions (MaxK, NomK,MinK)

InSight Keys Recorded	Position (mm)	K Spec	Measured Results (averaged after 5 readings)
KMax	0, 0.83, 0	0.656 - 0.672 (0.664±0.008)	Limits investigation on going, limits to be used need to be same as IQC_coupling station. FYI only. To be updated.
KNom	D1.1, 0.88, L1.1	0.644	
KMin	D1.5, 0.93, L1.5	0.490 - 0.531 (0.516±0.015)	

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:

Step	Description	Interface	Command / Notes
1	Tell Tx to enter Quiesce Mode	TX HID	hidreport --noplugin -u 0xFF00,0x0036 set 0x09 09 01
2	Read Status (Version)	Tx HID	hidreport --noplugin -u 0xFF00,0x0036 get 0xbb

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:
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

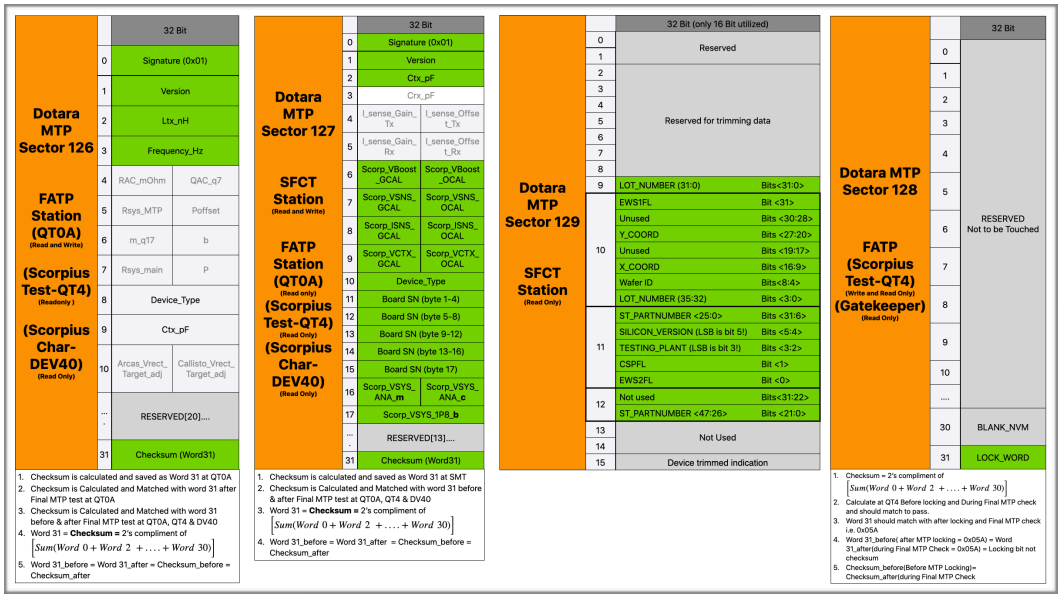


Figure 1 : MTP Word Locations

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 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
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
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 - Tx HWID_MTP (Word 10)	SCRP_TX_HWID_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 - 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 Data streaming in Normal 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 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.**
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 1s	Fixture	
5	Measure Vsense		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
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		

Step	Description	Interface	Command / Notes
9	Send 1.4uS LPP pulse	Tx HID	hidreport --noplugin -u 0xFF00,0x0036 set 0x05 0x05 0x00 0x46
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 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	Fixture & Tx HID	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	53.89	57.97	kHz	Kmax
	KNom_OL_LPP_Frequency	55.95	60.19		Knom
	KMin_OL_LPP_Frequency	57.5	61.88		Kmin
LPP Inductance	KMax_OL_LPP_Inductance	21.17	23.66	µH	Kmax
	KNom_OL_LPP_Inductance	19.64	21.94		Knom
	KMin_OL_LPP_Inductance	18.56	20.80		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 =3.45V	Overlay	VoC=3.45V —> 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 15sec		
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
15	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
16	Let the unit run at 0.1C for 15sec		
17	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
18	Move the Rx to Free Air Position from KMax coupling position		
19	Set Battery VOC =3.45V	Overlay	VoC=3.45V —> 10C

Step	Description	Interface	Command / Notes
20	Move the Rx from Free Air Position to KNom coupling position		KNom = D1.1, 0.88, L1.1
21	Repeat Step 8 to 17		
22	Move the Rx to Free Air Position from KNom coupling position		
23	Set Battery VOC =3.45V	Overlay	VoC=3.45V —> 10C
24	Move the Rx from Free Air Position to KMin coupling position		KMin = D1.5, 0.93, L1.5
25	Repeat Step 8 to 17		

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	68.6	72.4	kHz	
	Free_Air_LPP_Frequency_STD-DEV	-	0.4	-	
LPP Inductance Free Air	Free_Air_LPP_Inductance_avg	12.8	15.4	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	7500	9000	mV	
	CL_KNom_Vrect@DP0.1C	6500	8500	mV	
	CL_KMin_Vrect@DP0.1C	6000	7500	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	9400	mV	Tx Observable command for IBC data
	CL_KNom_Vsense@10C	9400	10500		
	CL_KMin_Vsense@10C	10100	10600		
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		
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	69.25	72.53	%	
	CL_KNom_Efficiency_Tx_IBC@10C	65.13	69.72		
	CL_KMin_Efficiency_Tx_IBC@10C	60.69	66.76		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	5900	6200	mV	Tx Observable command for IBC data
	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		
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	69.06	75.07	%	Tx Observable command for IBC data
	CL_KNom_Efficiency_Tx_IBC@3C	65.10	72.00		
	CL_KMin_Efficiency_Tx_IBC@3C	59.70	68.20		
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	5897	6200	mV	Tx Observable command for IBC data
	CL_KNom_Vsense@0.1C	5889	6200		
	CL_KMin_Vsense@0.1C	5889	6200		
CL_Isense @ 0.1C	CL_KMax_Isense@0.1C	48	58	mA	
	CL_KNom_Isense@0.1C	59	69		
	CL_KMin_Isense@0.1C	66	76		
CL_Ictx @ 0.1C	CL_KMax_Ictx@0.1C	181	728	mA	
	CL_KNom_Ictx@0.1C	194	785		
	CL_KMin_Ictx@0.1C	224	839		
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	52.65	70.75	%	Tx Observable command for IBC data
	CL_KNom_Efficiency_Tx_IBC@0.1C	50.11	66.35		
	CL_KMin_Efficiency_Tx_IBC@0.1C	45.75	61.60		
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	
Sector 127 - Version (Word 1)	SCRP_Version_127_MTP_BEFORE	
Sector 127 - Signature (Word 0)	SCRP_Signature_127_MTP_BEFORE	
Sector 127 - Tx HWID_MTP (Word 10)	SCRP_TX_HWID_127_MTP_BEFORE	

Test Parameter	Insight Keys Recorded	Comments/Notes
Sector 127 - CTx MTP (Word 2)	SCRP_CTx_127_MTP_BEFORE	Pass if this values match with MTP check before test i.e. **Section 8.3**
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 - 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 0x31 31 00 00 8c **———> Fixture wait 5mS <———** hidreport --noplugin -u 0xFF00,0x0036 get 0x31 **Response —>** bytes1-4 = Floating point value from ADC **—> Vsense_kmxx_MCU**
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	53.89	57.97	kHz	Kmax
	KNom_LPP_Frequency	55.95	60.19		Knom
	KMin_LPP_Frequency	57.5	61.88		Kmin
	KMax_LPP_Frequency_avg	53.89	57.97		Kmax
	KNom_LPP_Frequency_avg	55.95	60.19		Knom
	KMin_LPP_Frequency_avg	57.5	61.88		Kmin

Physical Parameter	InSight Keys Recorded	LL	UL	Unit	Offset Positions
LPP Inductance	KMax_LPP_Inductance	21.17	23.66	µH	Kmax
	KNom_LPP_Inductance	19.64	21.94		Knom
	KMin_LPP_Inductance	18.56	20.80		Kmin
	KMax_LPP_Inductance_avg	21.17	23.66		Kmax
	KNom_LPP_Inductance_avg	19.64	21.94		Knom
	KMin_LPP_Inductance_avg	18.56	20.80		Kmin
Δ Tx Frequency	KMax_LPP_Frequency_FA_delta	13.26	15.34	kHz	All
	KNom_LPP_Frequency_FA_delta	10.81	13.23		
	KMin_LPP_Frequency_FA_delta	9.13	11.55		
Δ Tx Inductance	KMax_LPP_Inductance_FA_delta	7.07	9.12	µH	
	KNom_LPP_Inductance_FA_delta	5.46	7.32		
	KMin_LPP_Inductance_FA_delta	4.44	6.09		
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

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
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

	Description	Interface	Command
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	9000	mV	
	Kmin_SCRP_Vrect@DP0.1C	6000	7500	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	
8	Check if TX is in CloseLoop		hidreport --noplugin -u 0xFF00,0x0036 get 0x0a rsp: 0x0A xx 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

Steps	Description	Interface	Command	Insight Key Recorder
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		
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				

Steps	Description	Interface	Command	Insight Key Recorder
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	5897	6200	mV	Tx Observable command
	CL_KNom_Vsense@0.1C	5889	6200		
	CL_KMin_Vsense@0.1C	5889	6200		
CL_Isense @ 0.1C	CL_KMax_Isense@0.1C	48	58	mA	
	CL_KNom_Isense@0.1C	59	69		
	CL_KMin_Isense@0.1C	66	76		
CL_Vctx_IPeak @ 0.1C	CL_KMax_Ictx@0.1C	181	728	mA	
	CL_KNom_Ictx@0.1C	194	785		
	CL_KMin_Ictx@0.1C	224	839		
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				
	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				

Test Parameter	Insight Keys Recorded	LL	UL	Units	Comments/Notes
CL_Efficiency_Tx_IBC @ 0.1C CL_Efficiency_Calculated @ 0.1C	CL_KMax_Efficiency_Tx_IBC@0.1C CL_KMax_Efficiency_Calculated@0.1C	52.65	70.75	%	Tx Observable command for IBC data Rx_Power / (Vsense * Isense)
	CL_KNom_Efficiency_Tx_IBC@0.1C CL_KNom_Efficiency_Calculated@0.1C	50.11	66.35		
	CL_KMin_Efficiency_Tx_IBC@0.1C CL_KMin_Efficiency_Calculated@0.1C	45.75	61.60		
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		
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				

Test Parameter	Insight Keys Recorded	LL	UL	Units	Comments/Notes
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 Diags**	**i2c -w 5 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 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}"**
1	Set Vin 3.6V. Or Preparation to pull high: PMU_TO_DOTARA_EN_EXT	Fixture	socgpio --port 1 --pin 46 --output 1 **Note: 3.6V ±1% must be met.**
2	Tell Tx to get out of standalone mode.	TX Diags	i2c -w 5 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 Diags	**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\\J307\\ScorpiusTx-dotara.bin'"
4	Tell Tx to get out of standalone mode.	TX Diags	i2c -w 5 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 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}"
6	Read Status (Version)	TX Diags	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 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:

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 all tests.

Description: Make sure FW is in a good state at the Before of the test.

Failure Mode(s) Captured: TBD

Test Setup and Procedure: Refer below

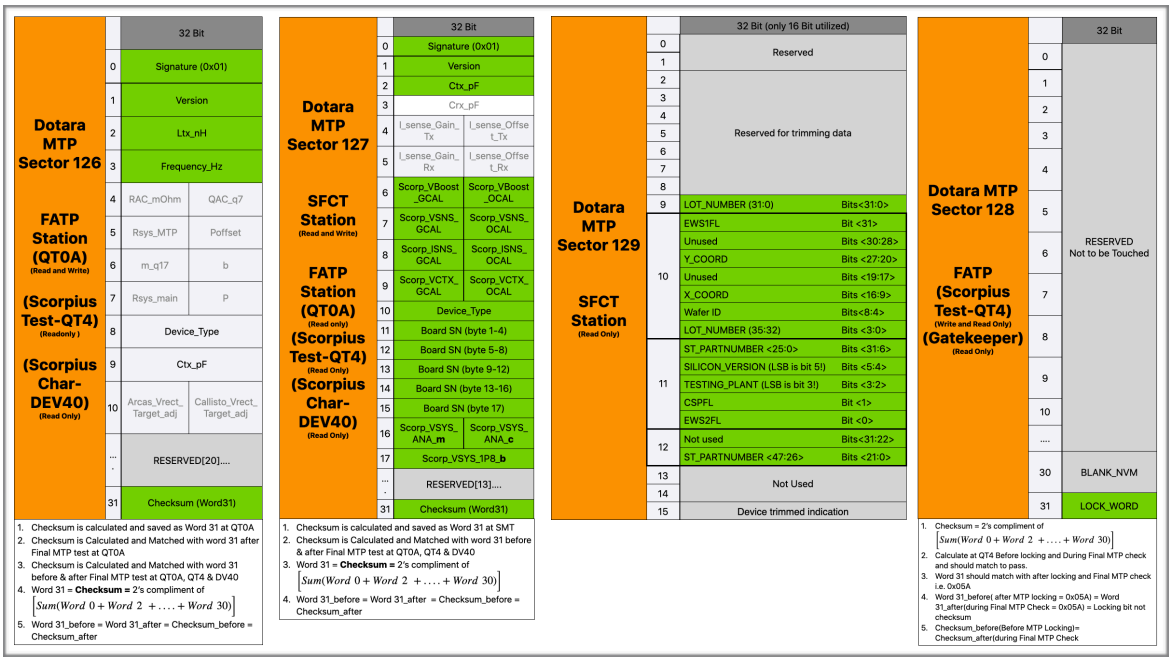

Figure 1 : MTP Word Locations

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 Diags	i2c -w 5 0x39 6 **Note:-Send this command 2x times.**There may be I2C error reported with this command, but can be ignored.
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}"
Skip the above 2 steps if the unit is already in Quiesce Mode			
3	Read MTP Sector 127	TX Diags	smokey ScorpiusHid --run --test "Print_Sector" --args "MTP_sector=127" **Example:-Overlay will read Words that are printed:-** **Word 0 : 0x00000001** **Word 1 : 0x000000002** **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 : 0x03070001** **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 Diags	smokey ScorpiusHid --run --test "Print_Sector" --args "MTP_sector=126" **Example:-Overlay will read Words that are printed:-** **Word 0 : 0x00000001** **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)	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	
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.**
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	

Step	Description	Interface	Command / Notes
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 Criteria:

Physical Parameter	InSight Keys Recorded	LL	UL	Unit	Offset Positions
LPP Frequency	SCRP_KMax_LPP_Frequency	53.89	57.97	kHz	Kmax
	KNom_LPP_Frequency	55.95	60.19		Knom
	SCRP_KMin_LPP_Frequency	57.5	61.88		Kmin
	KMax_LPP_Frequency_avg	53.89	57.97		Kmax
	KNom_LPP_Frequency_avg	55.95	60.19		Knom
	SCRP_SCRP_KMin_LPP_Frequency_avg	57.5	61.88		Kmin
LPP Inductance	KMax_LPP_Inductance	21.17	23.66	µH	Kmax
	KNom_LPP_Inductance	19.64	21.94		Knom
	SCRP_KMin_LPP_Inductance	18.56	20.80		Kmin
	KMax_LPP_Inductance_avg	21.17	23.66		Kmax
	SCRP_KNom_LPP_Inductance_avg	19.64	21.94		Knom
	SCRP_KMin_LPP_Inductance_avg	18.56	20.80		Kmin
Δ Tx Frequency	KMax_LPP_Frequency_FA_delta	13.26	15.34	kHz	All
	SCRP_KNom_LPP_Frequency_FA_delta	10.81	13.23		
	SCRP_KMin_LPP_Frequency_FA_delta	9.13	11.55		
Δ Tx Inductance	KMax_LPP_Inductance_FA_delta	7.07	9.12	µH	
	KNom_LPP_Inductance_FA_delta	5.46	7.32		
	SCRP_SCRP_KMin_LPP_Inductance_FA_delta	4.44	6.09		
LPP Frequency STD	Kxxx_LPP_Frequency_STDEV	-	0.4	-	All
LPP Inductance STD	Kxxx_LPP_Inductance_STDEV	-	0.4	-	All
LPP_repeatability		100	100	-	All

8.5. Digital Ping Level Tests

Description: This test required ginger/B332 dev board, both Tx and Rx coil. Test digital ping level (6V1boost 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)

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	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x03, ReportPayload={0xD4; 0x17; 0xF4; 0x01}" **Payload: ——>** Byte0-1: Boost voltage (eg. 0x17D4 = 6100mV)
2	Set the Bridge phase **100deg**	TX Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x04, ReportPayload={0x1C; 0xF3; 0x01; 0x00; 0x10; 0x27; 0x50; 0x46}" **Eg 0x2710:** 10000cdeg = 100deg phase
3	Command for following variables: Rx:- Vrect	Rx I2C	Vrect:- scorpius get vrect
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 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
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 Diags	smokey ScorpiusHid --run --test "Get" --args "ReportID=0x02" Response: byte0: ID *(PingPongID = 0x02)* byte1: Status *(eg. 0x00 = complete)* [0 = Complete; 1 = In-Progress] byte2-3: 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_FXST @ DP0.1C	**Kmax_SCRP_Vrect@DP0.1C**	7500	8500	mV	
	Kmin_SCRP_Vrect@DP0.1C	6500	7400	mV	
Number of Pings Sent @ DP	**SCRP_Pings_Sent@DP**	10	10	-	
Number of Pongs Received @ DP	**SCRP_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.**(ramp speed <=500mV/mS)**

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

Step	Description	Interface	Command
Set load and coupling position		Fixture	Repeat all below tests for the following conditions Loads @ all Couplings: **0.1C; 3C & 10C**
			Power & Efficiency Testing
			For 0.1C & 3C
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; 0xF4; 0x01}" **Payload: ——>** Byte0-1: Boost voltage (eg. 0x17D4 = 6100mV)
2	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
			For 10C
1	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
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; 0xF4; 0x01}" **Payload: ——>** Byte0-1: Boost voltage (eg. 0x17D4 = 6100mV)
3	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 msec <——** 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 msec <——** 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 msec <——** 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 msec <——** 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.

Step	Description	Interface	Command
4	Measure Dotara (U6200) Temp at all Load conditions	Tx Diags	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		
5	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**
6	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**
7	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
8	Wait 1 second for RX to send packets before reading buffer	Fixture	Wait 1 second
9	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] byte2-3: 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*
10	Repeat step 1 to 9 with All loading and coupling positions		

Acceptance criteria:

Test Parameter	Insight Keys Recorded	LL	UL	Units	Comments/Notes
Load 0.1C					
Vsense @ 0.1C	**KMax_Vsense@0.1C**	5897	6200	mV	
	KNom_Vsense@0.1C	5889	6200		
	KMin_Vsense@0.1C	5889	6200		
Isense @ 0.1C	**KMax_Isense@0.1C**	70.46	80.56	mA	
	KNom_Isense@0.1C	75.38	85.98		
	KMin_Isense@0.1C	80.66	93.19		
Vctx_IPeak @ 0.1C	**KMax_VCtx_IctxPeakFactory@0.1C**	181	728	mA	
	KNom_VCtx_IctxPeakFactory@0.1C	194	785		
	KMin_VCtx_IctxPeakFactory@0.1C	224	839		
Vrect_FXST @ 0.1C	**KMax_Vrect_FXST@0.1C**	6346	6670	mV	Fixture Cmd: Vrect Target = 6.5V ±2% Use Filtered Vrect Value from 'Ikt Adc' command
	KNom_Vrect_FXST@0.1C	6367	6661		
	KMin_Vrect_FXST@0.1C	6391	6638		
Irect_FXST @ 0.1C	**KMax_Irect_FXST@0.1C**	40	46	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**	241.00	318.20	mW	Vrect * Irect
	KNom_Rx_Loading_Power@0.1C	247.20	317.20		
	KMin_Rx_Loading_Power@0.1C	240.00	320.50		
Efficiency @ 0.1C	**KMax_Efficiency@0.1C**	52.65	70.75	%	Rx_Power / (Vsense * Isense)
	KNom_Efficiency@0.1C	50.11	66.35		
	KMin_Efficiency@0.1C	45.75	61.60		
Number of Pings Sent @ 0.1C	**SCRP_Pings_Sent@0.1C**	10	10	-	

Test Parameter	Insight Keys Recorded	LL	UL	Units	Comments/Notes
Number of Pongs Received @ 0.1C	**SCRP_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					
Vsense @ 3C	**KMax_Vsense@3C**	5900	6200	mV	
	KNom_Vsense@3C	5900	6200		
	KMin_Vsense@3C	5900	6411		
Isense @ 3C	**KMax_Isense@3C**	212	225.4	mA	
	KNom_Isense@3C	212	241.42		
	KMin_Isense@3C	212	250.28		
Vctx_IPeak_ @ 3C	**KMax_VCtx_IctxPeakFactory@3C**	417	618	mA	
	KNom_VCtx_IctxPeakFactory@3C	427	710		
	KMin_VCtx_IctxPeakFactory@3C	528	877		
Vrect_FXST @ 3C	**KMax_Vrect_FXST@3C**	7957	8105	mV	Fixture Cmd: Vrect Target = 8V ±2%
	KNom_Vrect_FXST@3C	7879	8200		
	KMin_Vrect_FXST@3C	7770	8232		
Irect_FXST @ 3C	**KMax_Irect_FXST@3C**	114	122.25	mA	Fixture Cmd: Irect Target = 113mA +iktara load(~0 to 15mA)
	KNom_Irect_FXST@3C	114.8	121.2		
	KMin_Irect_FXST@3C	114.8	121.2		
Rx_Loading_Power @ 3C	**KMax_Rx_Loading_Power@3C**	914.00	984.50	mW	Vrect * Irect
	KNom_Rx_Loading_Power@3C	919.65	976.40		
	KMin_Rx_Loading_Power@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	-	
Dotara Surface Temperature @ 3C	Kxxx_Temp1_MCU@3C Kxxx_Temp2_MCU@3C	20	61	℃	Based on J307 P1 data
Load 10C					
Vsense @ 10C	**KMax_Vsense@10C**	9217	9903	mV	
	KNom_Vsense@10C	9685	10542		
	KMin_Vsense@10C	10165	11295		
Isense @ 10C	**KMax_Isense@10C**	447.29	462.45	mA	
	KNom_Isense@10C	443.2	460.02		
	KMin_Isense@10C	439.9	461.55		
Vctx_IPeak_ @ 10C	**KMax_VCtx_IctxPeakFactory@10C**	657	1041	mA	
	KNom_VCtx_IctxPeakFactory@10C	732	1345		
	KMin_VCtx_IctxPeakFactory@10C	887	1575		
Vrect_FXST @ 10C	**KMax_Vrect_FXST@10C**	13436	14587	mV	Fixture Cmd: Vrect Target = 14v
	KNom_Vrect_FXST@10C	13503	14471		
	KMin_Vrect_FXST@10C	13619	14380		
Irect_FXST @ 10C	**KMax_Irect_FXST@10C**	218.48	221.62	mA	Fixture Cmd: Irect Target = 214mA
	KNom_Irect_FXST@10C	217.56	222.72		
	KMin_Irect_FXST@10C	217.28	223.08		
	KMax_Rx_Loading_Power@10C	2935.50	3232.77		Vrect * Irect

Test Parameter	Insight Keys Recorded	LL	UL	Units	Comments/Notes
Rx_Loading_Power @ 10C	**KNom_Rx_Loading_Power@10C**	2969.00	3190.00	mW	
	KMin_Rx_Loading_Power@10C	2986.00	3178.00		
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	-	
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 all 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	Pull Low test pin **TP93EF** i.e. **"AOP_TO_DOTARA_RESET_L"** to reset Scorpius	Tx Diags	socgpio --port 1 --pin 46 --output 0
	Wait 500ms	Fixture	
	Pull High test pin **TP93EF** i.e. **"AOP_TO_DOTARA_RESET_L "**	Tx Diags	socgpio --port 1 --pin 46 --output 1
2	Wait 1s	Fixture	
3	Preparation	Tx Diags	socgpio --port 1 --pin 46 --output 1
4	Tell Tx to get out of standalone mode.	Tx Diags	i2c -w 5 0x39 6 **Note:-Send this command 2x times.**There may be I2C error reported with this command, but can be ignored.
5	Load Tx FW	Tx Diags	**Note**: Need to send this command every time within **3sec** of above command. You cannot enter Load FW without exiting the standalone mode. smokey ScorpiusHid --run --test "FwLoad" --args "PathToFwLoad='nandfs:\\AppleInternal\\Diags\\Scorpius\\J307\\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 Diags	i2c -w 5 0x39 6 Note:-Send this command 2x times.There may be I2C error reported with this command, but can be ignored.
8	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}"
8	Read MTP Sector 127	Tx Diags	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 : 0x03070001** **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**
9	Read MTP Sector 126	Tx Diags	smokey ScorpiusHid --run --test "Print_Sector" --args "MTP_sector=126" **Example:-Overlay will read Words that are printed:-** **Word 0 : 0x00000001** **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**
10	Pull Low test pin **TP93EF** i.e. **"AOP_TO_DOTARA_RESET_L"** to reset Scorpius	Tx Diags	socgpio --port 1 --pin 46 --output 0
	Wait 500ms	Fixture	
	Pull High test pin **TP93EF** i.e. **"AOP_TO_DOTARA_RESET_L "**	Tx Diags	socgpio --port 1 --pin 46 --output 1

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)	**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**	
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:
Power, Efficiency & Comms	Bhushan	Replaced Close Loop with Open Loop and Comms with Pingpong as P0 does not support Close Loop.	2 September 2019	
Magnetic - Coil fixture specs	Bhushan/Jin	Updated Coil fixture specification for coupling measurements value to include nominal values + Tolerance limits	14 September 2019	
Power Transfer	Bhushan	Swaped the Sequence of sense enable & Full Bridge to avoid loading from LPP sense.	17 September 2019	
General	Bhushan/Mikhal/Jin/ Bernard/Frank	Updated the test limits for all the test parameters based on GBD and Factory data distribution.	20 September 2019	
LPP/Power Transfer	Bhushan	Corrected the LPP and Power Transfer Limits	25 September 2019	
		11/5 KBha: Ensure all limits Vctx, Vboost, Isense, Vrect and Irect are tailored based on ***actual*** Rx QLC for station. Current limits are based on many Rx QLC corners which will result in missed learnings and CPx >> 2.		
MTP	Bhushan/Samira	Update locations of all the word calibrated/Used from MTP.	26 November 2019	Samira/P1_V1.5
Comms	Bhushan/Mikhal	Added Digital ping test at 0.1C	5 December 2019	Mikhal/P1_V1.6
LPP	Bhushan	Corrected calculation for LLP delta values	18 December 2019	Bhushan/P1_V1.8
Power Transfer	Mikhal	Minimum boost requirement has changed from 6000mV to 6100mV.	21 February 2020	Mikhal/Bhushan/ P1_V2.0
Dotara	Bhushan	Added Dotara Temperature measurement	3 April 2020	Bhushan/Rex/Nan/ P1_V2.1
LPP & VCTX	Bhushan	Updated command and response format of LPP and VCTx respectively		
Power Transfer	Bhushan/Jin	Updated procedure to disable LFOD during Vsense & Isense measurement		
Digital Ping	Bhushan/Mikhal	Updated Vrect Limit for digital ping	11 May 2020	Bhushan/Mikhal/ EVT_V2.2
Power Transfer	Bhushan	Limits update for Vsense/Isense @ 01.C &3C and Lowerd temp LL to 17℃	3 June 2020	Bhushan/Daniel/ Samira/EVT_V2.3
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.		
iOS	Bhushan/Fw Team/ Rex	Updated procedure to use data streaming tool. And some data limits.	22 July 2020	Bhushan/Fw team/ Mikhal/EVT_V2.4