Factory FATP Test Plan for J307

Module: Scorpius
Stations: QT0a + Scorpius Test (QT4)
Build: P1B
Release Date: 3 April 2020

This Document Covers the Following Products: J307
Revision: P1B_V2.5
<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	Initial Draft	25 June 2019	Initial release for J307 P1 Build.	Bhushan Koli, Bernard dela Cruz
	1.1	22 August 2019	Updates the changes for HWID Check, LPP Free Air Calibration at QT0A station,No more SWD fuse related testing and replaced critical error Check with MTP Sector Check	Bhushan Koli
	1.2	28 August 2019	Updates the changes for Loading fw & LPP Free Air Calibration at QT0A station to include checksum calculation and Updated Load Tx Fw Section & Read Rx FW version Section.	Bhushan Koli
	1.3	29 August 2019	Updated HWID & CTx word location in MTP Section. And Commands in LPP Section	Bhushan Koli
	1.4	30 August 2019	Add Radar for Scorpius Factory FW releases and smokey Commnads updates and Checksum Calculation update.	Bhushan Koli, Lou Cendana
	1.5	5 September 2019	Updated Power, Efficiency and Pingpong test procedure to include changing Bridge phase to achieve desired loading conditions and response format of Pingpong test data.	Bhushan Koli, Lou Cendana
	1.6	9 September 2019	Updated MTP Sector Read section to include CTx value into Sector 127:Word2	Bhushan Koli, Samira Bakhtiari
	1.7	17 September 2019	Updated Power Efficiency section to swap the sequence of Enable Boost and Full Bridge Enable.	Bhushan Koli
	1.8	20 September 2019	Updated the test limits for all parameters.	Bhushan Koli
	1.9	26 September 2019	Corrected Limits for Power Transfer Test	Bhushan Koli
P1	2.0	12 November 2019	Corrected Limits for Power Transfer Test updated MTP Word locations and added delta Calculation for LPP	Bhushan Koli/Frank/Samira/ Bernard/mikhal/Jin
	2.1	18 November 2019	Updated Some command for SOC GPIOs and MTP Section and added Coupling values	Bhushan Koli/Frank/Samira/ Bernard/Mikhal/Jin
	2.2	4 December 2019	Updated MTP Write and Read Section	Bhushan Koli/Selestino
	2.3	16 December 2019	Updated MTP Read Section and limits. Station changed from **CT1 to QT0A**	Bhushan Koli/Selestino
P1B	2.4	21 February 2020	Updated Minimum Vboost requirement from 6V to 6.1V	Bhushan/Mikhal
P1B	2.5	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 Updated Vsense during calibration and power flow test to Disable LFOD.	Bhushan/Aijun/Jin

2. Purpose

This document describes the FATP test plan for J307 Scorpius Inductive Power 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 FATP Station
LPP Free Air Calibration	✓
MTP Sector Check	✓
LPP Test	✓
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
VBoost	-	Voltage across Boost output

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.

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

Resets into the quiesce mode with the bridge disabled.

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.***

6.2. Nominal Mode

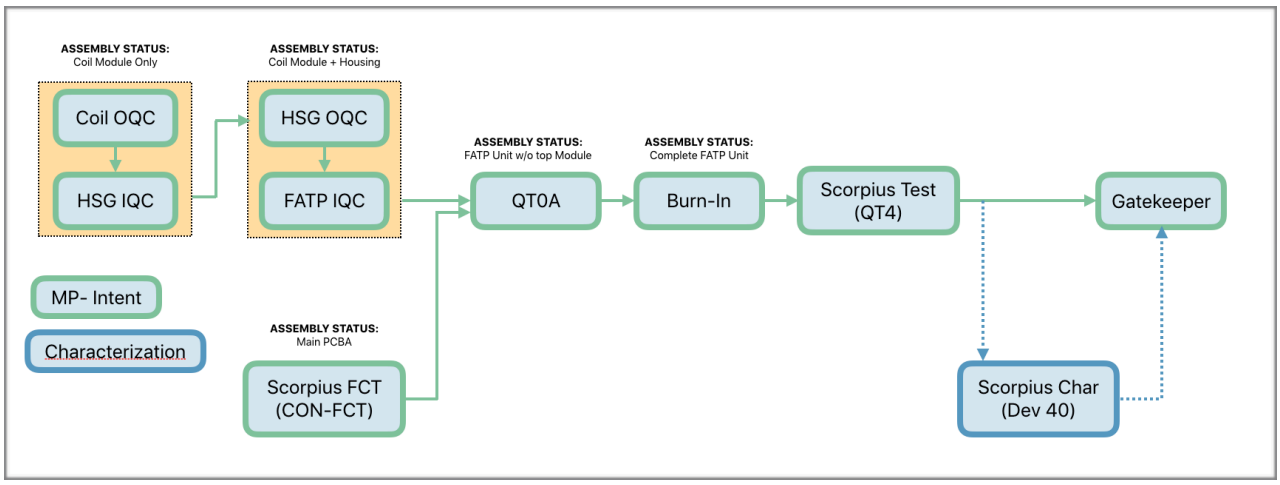
This is the normal runtime mode. Here, a subset of commands used for test/validation are deactivated.

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.

7. Overview

The block diagram below shows the overall end-end test coverage for the inductive Scorpius module.



7.1. 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 limits.

Physical parameter / InSight Keys Recorded	K Spec	Comments
KMax	0.656 - 0.672 (0.664±0.008)	Coupling for Scorpius Test Station should be between Kmax and Kmin. Ideally should be close to Knom
KNom	0.644	
KMin	0.490 - 0.531 (0.516±0.015)	

8. Test Coverage @ Scorpius FATP Stations

8.1. Load Tx FW & Read Version @ QT0A & QT4

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 (i.e.,* ***Section 8.3.6. Writing Calibration Values into MTP****) 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	pmugpio --pin 3 --pushpull --output 1 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 @ QT4

Ginger SN: diags get mlbsn

Eload SN: diags get eloadsn

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

8.3. Initial MTP Sector Check @ QT0A & QT4 Before Test.

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

Note:

1. The MTP data should be written in one go using the MTP Sector Write Command. This means the data needs to be prepared in advance in an array of thirty-two (Word0-31) 32bit words with the checksum occupying the last word (word31). Then the sector write command can be executed. Figure 3 below outlines the MTP data that needs to be written for sections 126 and 127.
2. Please use the "READ, MODIFY, WRITE" process when updating MTP. This is to ensure that data is Un-intentionally overwritten with wrong values.

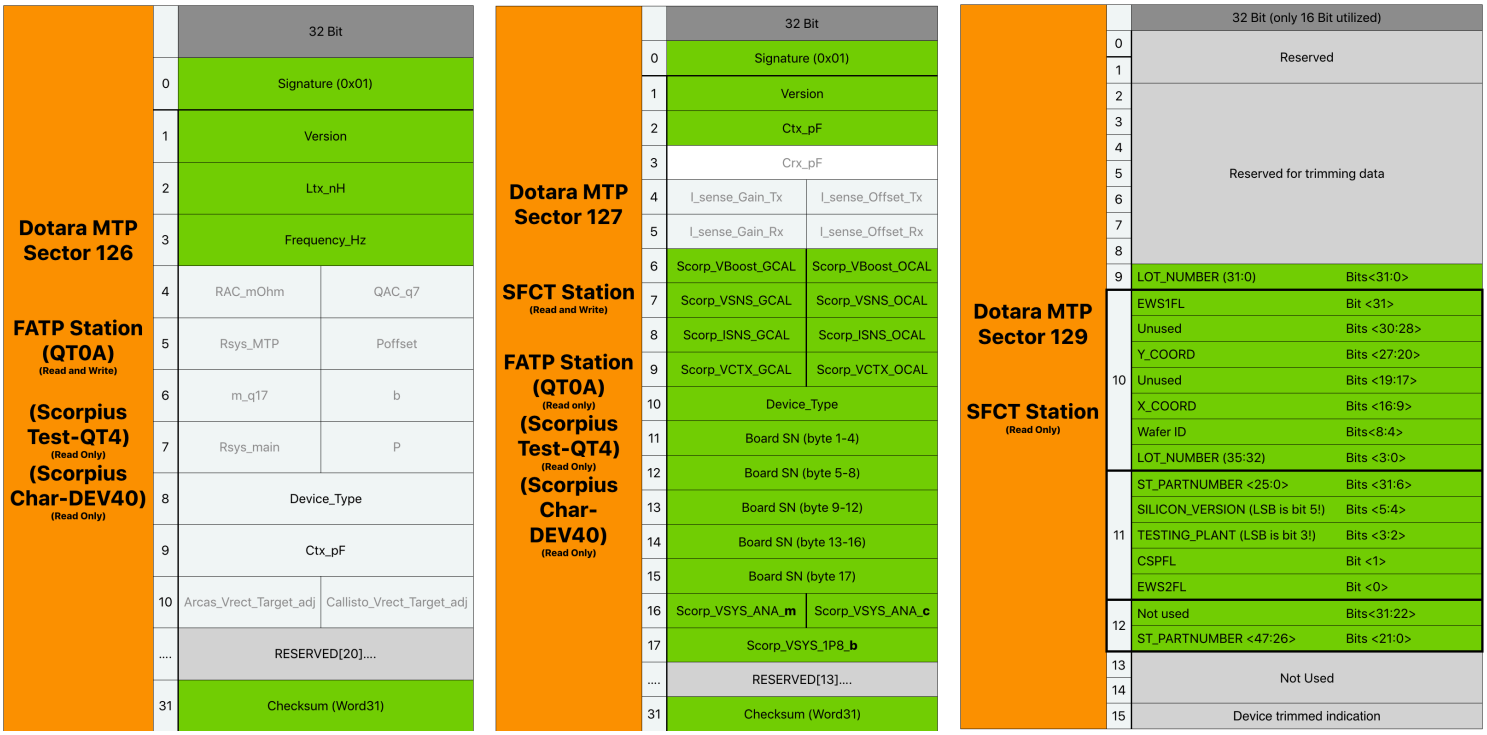


Figure 1 : MTP Word Locations

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 *(written at SFCT station)*	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 : 0x00000000 Word 4 : 0x00000000 Word 5 : 0x00000000 **Word 6 : 0x0A0A0A0A** **Word 7 : 0x0B0B0B0B** **Word 8 : 0x0C0C0C0C** **Word 9 : 0x0D0D0D0D** **Word 10 : 0x03070001** **Word 11 : 0x33323130** **Word 12 : 0x37363534** **Word 13 : 0x42413938** **Word 14 : 0x46454443** **Word 15 : 0x00000041** 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 : 0xDBDBE83E**

Step	Description	Interface	Command / Notes
4	Read MTP Sector 126 *(written at FATP station-QT0A)*	Tx Diags	smokey ScorpiusHid --run --test "Print_Sector" --args "MTP_sector=126" **Example:-Overlay will read Words that are printed:-** **Word 0 : 0x000000000** Word 4 : 0x00000000 Word 8 : 0x00000000 Word 12 : 0x00000000 Word 16 : 0x00000000 Word 20 : 0x00000000 Word 24 : 0x00000000 Word 28 : 0x00000000 **Word 1 : 0x000000000** Word 5 : 0x00000000 Word 9 : 0x00000000 Word 13 : 0x00000000 Word 17 : 0x00000000 Word 21 : 0x00000000 Word 25 : 0x00000000 Word 29 : 0x00000000 **Word 2 : 0x00000000** Word 6 : 0x00000000 Word 10 : 0x00000000 Word 14 : 0x00000000 Word 18 : 0x00000000 Word 22 : 0x00000000 Word 26 : 0x00000000 Word 30 : 0x00000000 **Word 3 : 0x00000000** Word 7 : 0x00000000 Word 11 : 0x00000000 Word 15 : 0x00000000 Word 19 : 0x00000000 Word 23 : 0x00000000 Word 27 : 0x00000000 **Word 31 : 0x00000000**
5	Location to store Signature, LTx, frequency_Hz, Checksum into MTP	Test Overlay	Sector 126 :-Word 0(Signature = 0x01); Word 1(Version = 0x02): Word 2(LTx); Word 3(Frequency_Hz), Word 31 (Checksum).
6	Check if is units are calibrated at SFCT	Test Overlay	Check if Signature @ MTP Sector 127 Word 0 = 0x00000001 **@ QT0A**
	Check if is units are calibrated at SFCT & QT0A	Test Overlay	Check if Signature @ MTP Sector 127 Word 0 = 0x00000001 **@ QT0A & QT4** Check if Signature @ MTP Sector 126 Word 0 = 0x00000001 **@ QT0A & QT4**
7	Check if Checksum is correct	Test Overlay	Pass if **Word 31 = 2's compliment of** $\left[Sum(Word\ 0 + Word\ 2\ + \ldots . + Word\ 30)\right]$

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**	Ignore this value for QT0A until the LPP Free Air Calibration is done.
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. LPP Free Air Calibration @ QT0A

Description: Write free air (without Rx coil) LPP Inductance and Frequency values in NVRAM

Failure Mode(s) Captured:

Test Setup and Procedure:

Step	Description	Interface	Command / Notes
1	No Rx Coil Connect/Present	Fixture	
2	Send 1.4uS LPP pulse	Tx Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x05, ReportPayload={0x0; 0x46}" Note: 0x46 gives 70 * 20ns = 1.4uS is the duration of the pulse.
3	Delay 15mS before proceeding	Fixture	
4	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)
5	Collect raw ADC samples and upload to Insight	Tx Diags & Fixture	Collect Pointer to raw LPP data by sending the following command from bytes15-18 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
6	Delay for Write to take effect		Delay 60ms
7	Record parameters as per the table below		Apply limits accordingly
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)
10	Calculating Check Sum for writing into MTP. Value of Word 0 is 2's compliment of Sum of all values are to be written into MTP i.e. cal values of Sector 126—> Word31 = Sum(Word0 to Word30)	Test Overlay	**Sector 126: Word 31:** 2's compliment of $\left[Sum(Word\ 0 + Word\ 2\ + ... + Word\ 30)\right]$ **Example: —> Word 31:** 2's Compliment of $(22261F1F) = DDD9E0E1$
11	Set Boost Voltage to 6.1V	TX Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x03, ReportPayload={0xD4; 0x17; 0x88; 0x13}" **Payload: ——>** Byte0-1: Boost voltage (eg. 0x17D4 = 6100mV)
12	Pulling High the Dotara_OTP_WREN pin for writing calibration into MTP.	Tx Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x41, ReportPayload={0x08; 0x0c; 0x00; 0x40; 0x08; 0x00; 0x00; 0x00}"
13	Update MTP Sector 126 with Custom/Calibration Data ***Note: The default values of unused words need to remain unchanged (Refer to note2 in section 8.3 above about using the read/modify/write process).***	Tx Diags	**Command Format to use for Sector Write** smokey ScorpiusHid --run --test "Write_Sector" --args "MTP_sector=127, MTP_Words={word0 [Signature]; word1 [Version]; word2 [Ltx_nH]; word3 [frequency_Hz]; word4; word5; word6; word7; word8; word9; word10; word11 [MLB SN: bytes0-3; word12; word13; word14; word15; word16; word17; word18; word19; word20; word21; word22; word23; word24; word25; word26; word27; word28; word29; word30; word31 [Checksum]}" **Example:** Word0: Signature = **0x00000001** Word1: Version = **0x00000002** Word2: Ltx_nH = **0xABCDEFGH** Word3: frequency_Hz = **0x0E0E0E0E** Word31: Checksum = **0xDBD8E83E** Note : Refer to instructions in step 10 above on how to calculate this. **Example Command to Write Sector:** smokey ScorpiusHid --run --test "Write_Sector" --args "MTP_sector=126, MTP_Words={**0x00000001**; **0x00000002**; **0xABCDEFGH**; **0x0E0E0E0E**; 0x00000000; 0x00000000; **0x00000000**; **0x00000000**; **0x00000000**; **0x00000000**; **0x00000000**; **0x00000000**; **0x00000000**; **0x00000000**; **0x00000000**; **0x00000000**; 0x00000000; 0x00000000; 0x00000000; 0x00000000; 0x00000000; 0x00000000; 0x00000000; 0x00000000; 0x00000000; 0x00000000; 0x00000000; 0x00000000; 0x00000000; 0x00000000; 0x00000000; 0xDDD9E0E1}" **———> Wait 1 sec <———** smokey ScorpiusHid --run --test "Print_Sector" --args "MTP_sector=126" **Example:-After Writing MTP Sector Values are:** **Word 0 : 0x0000001** **Word 1 : 0x00000002** **Word 2 : 0x0E0E0E0E** **Word 3 : 0x0F0F0F0F** Word 4 : 0x0000000 Word 5 : 0x0000000 Word 6 : 0x0000000 Word 7 : 0x0000000 Word 8 : 0x0000000 Word 9 : 0x0000000 Word 10 : 0x0000000 Word 11 : 0x0000000 Word 12 : 0x0000000 Word 13 : 0x0000000 Word 14 : 0x0000000 Word 15 : 0x0000000 Word 16 : 0x0000000 Word 17 : 0x0000000 Word 18 : 0x0000000 Word 19 : 0x0000000 Word 20 : 0x0000000 Word 21 : 0x0000000 Word 22 : 0x0000000 Word 23 : 0x0000000 Word 24 : 0x0000000 Word 25 : 0x0000000 Word 26 : 0x0000000 Word 27 : 0x0000000 Word 28 : 0x0000000 Word 29 : 0x0000000 Word 30 : 0x0000000 **Word 31 : 0xDDD9E0E1**
14	Pulling Low the Dotara_OTP_WREN pin after writing calibration into MTP.	Tx Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x41, ReportPayload={0x0c; 0x0c; 0x00; 0x40; 0x08; 0x00; 0x00; 0x00}"
15	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	

Step	Description	Interface	Command / Notes
	Pull High test pin **TP93EF** i.e. **"AOP_TO_DOTARA_RESET_L "**	Tx Diags	socgpio --port 1 --pin 46 --output 1
16	Wait 1s	Fixture	
17	Preparation	Tx Diags	pmugpio --pin 3 --pushpull --output 1 socgpio --port 1 --pin 46 --output 1
18	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.
19	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'"
20	Wait 1s	Fixture	Scorpius FW will take less than 1 second to boot
21	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 : 0x0000001** / Word 1 : 0x00000002 / Word 2 : 0x0E0E0E0E / Word 3 : 0x0F0F0F0F Word 4 : 0x0000000 / Word 5 : 0x0000000 / Word 6 : 0x0000000 / Word 7 : 0x0000000 Word 8 : 0x0000000 / Word 9 : 0x0000000 / Word 10 : 0x0000000 / Word 11 : 0x0000000 Word 12 : 0x0000000 / Word 13 : 0x0000000 / Word 14 : 0x0000000 / Word 15 : 0x0000000 Word 16 : 0x0000000 / Word 17 : 0x0000000 / Word 18 : 0x0000000 / Word 19 : 0x0000000 Word 20 : 0x0000000 / Word 21 : 0x0000000 / Word 22 : 0x0000000 / Word 23 : 0x0000000 Word 24 : 0x0000000 / Word 25 : 0x0000000 / Word 26 : 0x0000000 / Word 27 : 0x0000000 Word 28 : 0x0000000 / Word 29 : 0x0000000 / Word 30 : 0x0000000 / **Word 31 : 0xDDD9E0E1**

Test Parameter	Insight Keys Recorded	LL	UL	Unit	Offset Positions	Notes
LPP Inductance	**SCRP_LPP_Inductance_Free_Air_Cal**	12.8	15.4	µH	Air	
LPP Frequency	**SCRP_LPP_FREQ_Free_Air_Cal**	68.6	72.4	kHz	Air	
Check Sum - Sector 126 (Word 31)	**SCRP_Check Sum_126_MTP_BEFORE**	-	-	Hex	Air	Need to be in Hex.Will need this Values to be compared against MTP Check after test **Section 8.7.**
Version (Word 1)	**SCRP_Version_126_MTP_BEFORE**	-	-	Hex	Air	
Signature (Word 0)	**SCRP_Signature_126_MTP_BEFORE**	-	-	Hex	Air	
LPP Inductance_MTP (Word 2)	**SCRP_LPP_L_126_MTP_BEFORE**	-	-	Hex	Air	
LPP Frequency_MTP (Word 3)	**SCRP_LPP_FREQ_126_MTP_BEFORE**	-	-	Hex	Air	

8.5. Low Power Ping (LPP) @ QT4

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	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.
3	Delay 15mS before proceeding	Fixture	
4	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)
5	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
6	Record parameters as per the table below	Fixture	Apply limits accordingly
7	Calculate Δ Tx Frequency & Δ Tx Inductance	Tx Diags & Fixture	Δ Tx Frequency = SCRP_LPP_FREQ_MTP_BEFORE (From Section 8.3) - SCRP_LPP_FREQ (from Step 4) Δ Tx Inductance = SCRP_LPP_Inductance (from Step 4) - SCRP_LPP_L_MTP_BEFORE (From Section 8.3)

Test Parameter	Insight Keys Recorded	LL	UL	Unit	Notes
LPP Frequency	**SCRP_LPP_FREQ**	52.8	63.8	kHz	
LPP Inductance	**SCRP_LPP_Inductance**	17.5	24.5	µH	
Δ Tx Frequency	**SCRP_LPP_FREQ_delta**			kHz	This is to make sure that the delta is similar to fw calculation and within the range
Δ Tx Inductance	**SCRP_LPP_Inductance_delta**			µH	

8.6. Power, Efficiency & Ping Pong Tests @ QT4

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).

Failure Mode(s) Captured:

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

Test Setup and Procedure:

Order of load ramping as follows:

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

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

Description		Interface	Command
Set load and coupling position		Fixture	Repeat all below tests for the following Load conditions **0.1C; 3C; 10C**
Step	**Description**	**Interface**	**Command**
			Power & Efficiency Testing
			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; 0x88; 0x13}" **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; 0x88; 0x13}" **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 2 sec <———** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x40" **Response —>** bits 7 & bit 8 = 0 if Disabled, 1 if enabled Note: Here, a "set" report command is first sent followed by a "get" report to return the requested data. **VSense:** smokey ScorpiusHid --run --test "Set" --args "ReportID=0x31, ReportPayload={0x00; 0x00; 0x0F}" **———> Fixture wait 2 sec <———** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x31" **Response —>** bytes1-4 = Floating point value from ADC **—> VSense_kmxx_MCU** **Isense:** smokey ScorpiusHid --run --test "Set" --args "ReportID=0x31, ReportPayload={0x12; 0x00; 0x0F}" **———> Fixture wait 2 sec <———** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x31" **Response —>** bytes1-4 = Floating point value from ADC **—> Isense_kmxx_MCU** **Enabled LFOD after Isense reading:** **smokey ScorpiusHid --run --test "Set" --args "ReportID=0x41, ReportPayload={0x98; 0x35; 0x00; 0x40; 0x80; 0x01; 0x00; 0x00}"** **Wait 1 sec after setting back LFOD before doing next test.** **LFOD(VCTx)**: smokey ScorpiusHid --run --test "Set" --args "ReportID=0x0B, ReportPayload={0x18; 0x03}" **———> Fixture wait 2 sec <———** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x0B" **Response—>** byte0 = report **byte16-17 = [u16] Read averaged ictx peak value in mA (based on factory calibrated** **byte18-19 = [u16] Accumulated ADC raw averaged sampling value** Note: Upload this raw data into Insight.

	Description	Interface	Command
4	Measure Dotara (U6200) Temp	Tx HID	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x31, ReportPayload={0x08; 0x00; 0x8C}" **<-- Trigger reading of Temp1 (channel 8)** smokey ScorpiusHid --run --test "Set" --args "ReportID=0x31, ReportPayload={0x09; 0x00; 0x8C}" **<--Trigger reading of Temp2 (channel 9)** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x31"
	Ping Pong Testing		
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
6	Choose Comm1	Rx I2C	Write I2C packet: (39) c0 ae 80 80 1e 01 00 05 AD Ginger command: ikt write 0x0xF0000B80 0xAD050001
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: Last error(e.g. 0x00 = no errors) byte3-4: Pings Sent(eg. 0x000A = 10 pings sent) byte5-6: Pongs Received(eg. 0x000A = 10 pongs received) ***Note:- If byte1:Status is in process then repeat the step***
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	**SCRP_Vsense@0.1C**	5800	6200	mV	
Isense @ 0.1C	**SCRP_Isense@0.1C**	65	90	mA	
Vctx_IPeak @ 0.1C	**SCRP Vctx_Ipk@0.1C**	375	715	mA	
Vrect_FXST @ 0.1C	**SCRP_Vrect@0.1C**	6370	6630	mV	Fixture Cmd: Vrect Target = 6.5V ±2%
Irect_FXST @ 0.1C	**SCRP_Irect@0.1C**	35	45	mA	Iktara ballast load = 40mA. **No fixture load required.**
Rx_Loading_Power @ 0.1C	**SCRP_Rx_Loading_Power@0.1C**	222.95	298.35	mW	Vrect * Irect
Efficiency @ 0.1C	**SCRP_Efficiency@0.1C**	50	65	%	Rx_Power / (Vsense * Isense)
Number of Pings Sent @ 0.1C	**SCRP_Pings_Sent@0.1C**	10	10	-	
Number of Pongs Received @ 0.1C	**SCRP_Pongs_Recieved@0.1C**	10	10	-	
Dotara Surface Temperature @ 0.1C	SCRP_Temp1_MCU@0.1C SCRP_Temp2_MCU@0.1C	20	61	℃	Based on J307 P1 data
Load 3C					
Vsense @ 3C	**SCRP_Vsense@3C**	5800	6200	mV	
Isense @ 3C	**SCRP_Isense@3C**	210	250	mA	
Vctx_IPeak_ @ 3C	**SCRP Vctx_Ipk@3C**	401	1058	mA	
Vrect_FXST @ 3C	**SCRP_Vrect@3C**	7840	8160	mV	Fixture Cmd: Vrect Target = 8V ±2%
Irect_FXST @ 3C	**SCRP_Irect@3C**	113	128	mA	Fixture Cmd: Irect Target = 113mA +iktara load(~0 to 15mA)
Rx_Loading_Power @ 3C	**SCRP_Rx_Loading_Power@3C**	885.92	1044.48	mW	Vrect * Irect
Efficiency @ 3C	**SCRP_Efficiency@3C**	62	74	%	Rx_Power / (Vsense * Isense)
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	SCRP_Temp1_MCU@3C SCRP_Temp2_MCU@3C	20	61	℃	Based on J307 P1 data

Test Parameter	Insight Keys Recorded	LL	UL	Units	Comments/Notes
Load 10C					
Vsense @ 10C	**SCRP_Vsense@10C**	9500	11000	mV	
Isense @ 10C	**SCRP_Isense@10C**	425	470	mA	
Vctx_IPeak_ @ 10C	**SCRP Vctx_Ipk@10C**	688	1650	mA	
Vrect_FXST @ 10C	**SCRP_Vrect@10C**	13720	14280	mV	Fixture Cmd: Vrect Target = 14v
Irect_FXST @ 10C	**SCRP_Irect@10C**	214	229	mA	Fixture Cmd: Irect Target = 214mA
Rx_Loading_Power @ 10C	**SCRP_Rx_Loading_Power@10C**	2936.08	3270.12	mW	Vrect * Irect
Efficiency @ 10C	**SCRP_Efficiency@10C**	63	72	%	Rx_Power / (Vsense * Isense)
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	SCRP_Temp1_MCU@10C SCRP_Temp2_MCU@10C	20	61	℃	Based on J307 P1 data

8.7. Final MTP Sector Check @ QT0A & QT4 After Tests.

Description: Make sure FW is in a good state at the end of the test. [TBD]

Failure Mode(s) Captured: TBD

Test Setup and Procedure: Refer below

Step	Description	Interface	Command / Notes
1	Pull Low test pin **TP93EF** i.e. **"AOP_TO_DOTARA_RESET_L"** to reset Scorpius	Tx Diags	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	pmugpio --pin 3 --pushpull --output 1 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 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 : 0x000000002** / **Word 2 : 0x00030570** / Word 3 : 0x00000000 Word 4 : 0x00000000 / Word 5 : 0x00000000 / **Word 6 : 0x0A0A0A0A** / **Word 7 : 0x0B0B0B0B** **Word 8 : 0x0C0C0C0C** / **Word 9 : 0x0D0D0D0D** / **Word 10 : 0x03070001** / **Word 11 : 0x33323130** **Word 12 : 0x37363534** / **Word 13 : 0x42413938** / **Word 14 : 0x46454443** / **Word 15 : 0x00000041** 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 : 0xDBD8E83E**
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 : 0x0000001** / **Word 1 : 0x00000002** / **Word 2 : 0x0E0E0E0E** / **Word 3 : 0x0F0F0F0F** Word 4 : 0x0000000 / Word 5 : 0x0000000 / Word 6 : 0x0000000 / Word 7 : 0x0000000 Word 8 : 0x0000000 / Word 9 : 0x0000000 / Word 10 : 0x0000000 / Word 11 : 0x0000000 Word 12 : 0x0000000 / Word 13 : 0x0000000 / Word 14 : 0x0000000 / Word 15 : 0x0000000 Word 16 : 0x0000000 / Word 17 : 0x0000000 / Word 18 : 0x0000000 / Word 19 : 0x0000000 Word 20 : 0x0000000 / Word 21 : 0x0000000 / Word 22 : 0x0000000 / Word 23 : 0x0000000 Word 24 : 0x0000000 / Word 25 : 0x0000000 / Word 26 : 0x0000000 / Word 27 : 0x0000000 Word 28 : 0x0000000 / Word 29 : 0x0000000 / Word 30 : 0x0000000 / **Word 31 : 0xDDD9E0E1**
10	Location to store 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)

Step	Description	Interface	Command / Notes
11	Location of Signature, Version, LTx, frequency_Hz, Checksum into MTP	Test Overlay	Sector 126 :-Word 0(Signature = 0x01); Word 1(Version = 0x02); Word 2(LTx); Word 3(Frequency_Hz).
12	Check if Checksum is correct	Test Overlay	Pass if **Word 31 = 2's compliment of** $\left[Sum(Word\ 0 + Word\ 2\ + ... + Word\ 30)\right]$
13	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**	**@ QT0A & QT4:** 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**	**@ QT0A:** Pass if this values match with LPP Free Air Calibration test i.e. **Section 8.4 @ QT0A** **@ QT4:**Pass if this values match with MTP check before test i.e. **Section 8.3@ QT4**
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**	

A. Feature DRI Comments for Changes to this Document

Feature	DRI	Description/Comments/Reason for Change	Date	Approved and released in Version:
Comms	Bhushan	Replaced Open Loop ASK/FSK with Pingpong test	9 August 2019	
HWID Check	Bhushan	Took out the HWID check as it wont be same as J3xx /J4xx. This will be included in MTP sector Check.	22 August 2019	
SWD Fuse	Bhushan	Taken out this entire Section as there is no SWD fuse for J307, so no test coverage t Gatekeeper.	22 August 2019	
Critical error Check	Bhushan	Replaced Critical error check with MTP sector check.	22 August 2019	
LPP Free Air Calibration	Bhushan	Moved this test to Station QT0A as there is No QT0a for P0 and for future builds this test can stay at QT0A	22 August 2019	
Load FW & MTP Write	Bhushan	Updated the load fw section and MTP write section for LPP free air calibration to include Checksum calculation. And updated Load Tx Fw Section.	28 August 2019	
MTP	Bhushan	Update HWID & CTx word location in MTP.	29 August 2019	
Fw Radar	Lou	Updated fw radar for factory.	30 August 2019	
Power Efficiency	Bhushan	Added Bridge phase changing to get desired Vrect to meet the loading conditions.	5 September 2019	
PingPong	Lou	Updated the PingPong response format	5 September 2019	
MTP	Bhushan/Samira	Updated MTP Sector Read section to include CTx value into Sector 127:Word2	9 September 2019	
Power Transfer	Bhushan	Swaped the Sequence of Boost enable & Full Bridge to avoid loading from LPP Boost.	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	
Power Transfer	Bhushan	Corrected Limits for Power Transfer test	25 September 2019	
LPP test	Frank	Need to ensure that raw LPP data is captured and also that delta f and delta Ltx from knom to free air is reported by overlay (Added Delta F and Delta Ltx Calculations)	25 October 2019	Frank
11/5 KBha: Ensure all limits Vctx, Vboost, IBoost, 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.	11 November 2019	Samira
Power Transfer	Bhushan	Corrected Limits for Power Transfer test	11 November 2019	All DRIs
MTP	Stino	Updated ERS to use MTP “Write_Sector” instead of “Write_Word” command	26 November 2019	Samira/Bhushan
General	Bhushan	Updated limits	16 December 2019	Bhushan
MTP Check	Bhushan	Updated procedure to see if checksum value is correct	16 December 2019	Bhushan/Selestino
Power Transfer	Mikhal	Minimum boost requirement has changed from 6000mV to 6100mV.	21 February 2020	Mikhal/Bhushan/P1B_V2.4
LPP & VCTx	Bhushan	Updated command and response format for LPP and VCTx respectively for update from FW V520 onwards	1 April 2020	Bhushan/Aijun/Jin/ P1B_V2.5
MTP	Bhushan	Updated ERS form insight key parameters.		
Power Transfer	Bhushan	Added Temperature measurements during power flow	3 April 2020	
Power Transfer	Bhushan/Jin	Updated procedure to Disable LFOD during Vsense & Isense reading.		