Factory FATP Test Plan for J5xx

Module: Scorpius
Stations: QT0a + Scorpius Test (QT4) + Gatekeeper
Build: EVT
Release Date: 30 September 2020

This Document Covers the Following Products: J5xx

Revision: EVT_V2.0

<rdar://problem/56766302> J5xx Scorpius Factory ERS

<rdar://problem/60027625> J3xx&J5xx Scorpius ERS - Foxconn

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

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1. Revision

Build Type	Version	Date	Notes	Author
Please refer to last section of this document for Details/Comments on change to this document				
P1	1.0	19 February 2020	Initial release for J5xx P1 Build based on J307 P1 build.	Bhushan Koli, Rex Haung, Nan Liu
	1.1	21 February 2020	Updated Minimum Vboost requirement from 6V to 6.1V	Bhushan/Mikhal
	1.2	18 March 2020	Updated Limits for LPP at QT0a & QT4. Updated Power flow test procedure to include Flex drop. Added Flex connectivity test at QT0a Added VSYS_1P8 test at both QT0a and Scorpius Test	Bhushan Koli, Rex Haung, Nan Liu, Daniel Randall
	1.3	3 April 2020	Updated Flex Connectivity test at QT0A Updated command and response format of LPP and VCTx respectively Added Dotara Temperature measurement At QT4 Updated Vsense during calibration and power flow test to Disable LFOD.	Bhushan Koli, Rex Haung, Nan Liu
	1.4	17 April 2020	Updated LPP limits for Frequency and Inductance Updated Efficiency limits Updated Isns @ 0.1C and Vsns @ 3C limits. Updated formulas to calculate VSYS_ANA & VSYS_1P8	Bhushan Koli, Frank B, Nan Liu
P2	1.5	8 July 2020	Updated procedure to Disable ASK_CR register during Vsense & Isense reading. Added 2C charging test from Power Flow. Added Vsense measurement before LPP at QT4 Added MTP locking test procedure at QT4[TBD]	Bhushan Koli, Nan Liu, Samira
	1.6	31 July 2020	Updated limits on Vsense measurement before LPP at QT4	Bhushan Koli, Nan Liu
EVT	2.0	30 September 2020	Updated some limits based on new data. Replaced Scorpius Hard reset procedure with reset command Took out 2C charging test from Power Flow. Replaced Potomac command with gasgauge cmd due to Ibatt read back issue	Bhushan Koli, Nan Liu

2. Purpose

This document describes the FATP test plan for J5xx Scorpius Inductive Power Tx module for P0.

3. Scope

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

Test	Scorpius 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> J5xx FW specifications
<rdar://problem/54853341> Radar for Scorpius Factory FW releases
J5xx Schematic

5. Glossary & Definitions

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

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

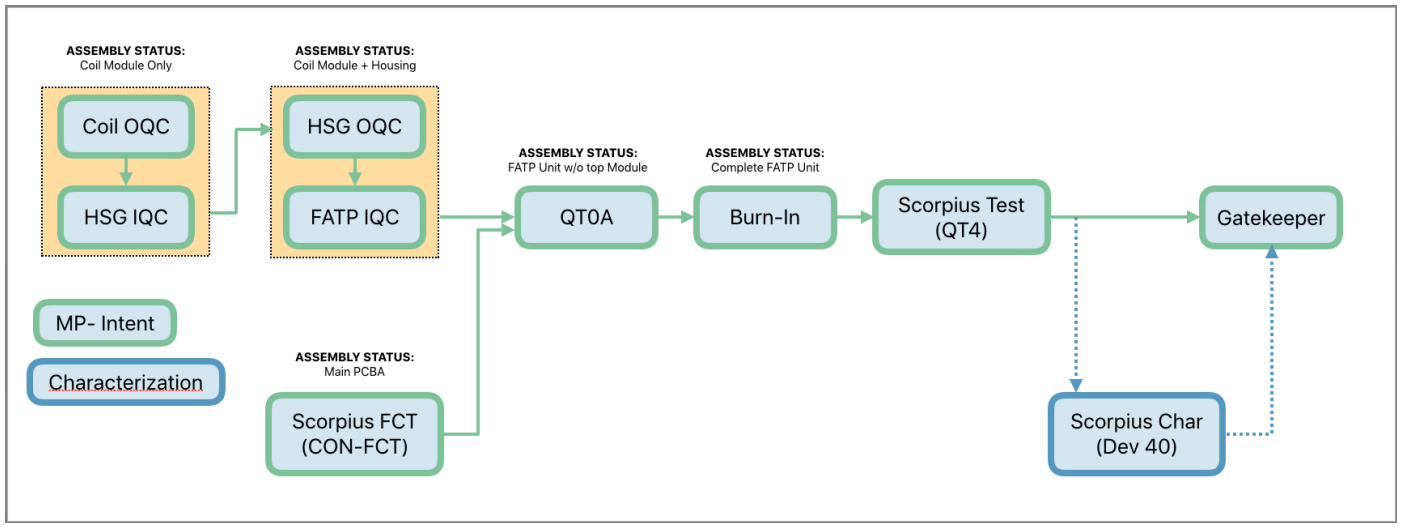
This is the normal runtime mode. Here, a subset of commands used for test/validation are deactivated.

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.

InSight Keys Recorded	Position (mm)	K Spec	Comments
KMax	0, 0.83, 0	0.535 - 0.610	Coupling for Scorpius Test Station should be between Kmax and Kmin. Ideally should be close to Knom
KNom	D1.1, 0.88, L1.1	TBD	
KMin	D1.5, 0.93, L1.5	0.440 - 0.530	

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

Command to read Tx FW version:

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

Example:-This reads back 4 bytes: 0x01 0x00 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.

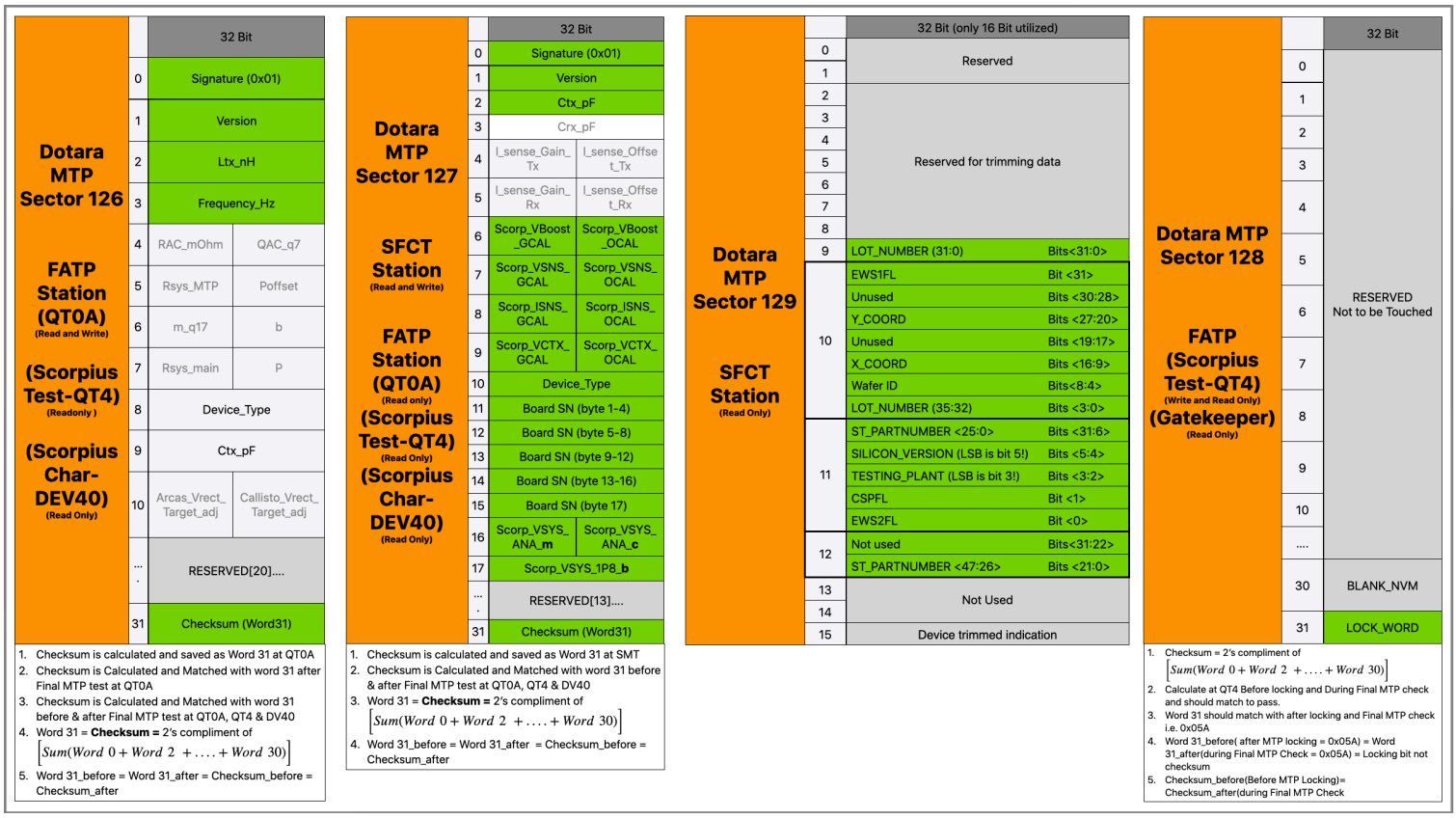


Figure 1 : MTP Word Locations

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 6 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 : 0xDBD8E83E**

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** $\left[Sum(Word\ 0 + Word\ 2\ + \ldots . + Word\ 30)\right]$

Acceptance criteria:

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.**
Signature (Word 0)	SCRP_Signature_127_MTP_BEFORE	
Version (Word 1)	SCRP_Version_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	
Tx HWID_MTP (Word 10):- J51x - 0x05170000 J52x - 0x05200000	SCRP_TX_HWID_127_MTP_BEFORE	
VSYS_ANA (Word 16)	SCRP_VSYS_ANA_127_MTP_BEFORE	
VSYS_1P8 (Word 17)	SCRP_VSYS_1P8_127_MTP_BEFORE	
MLB Serial No. (Word 11 to Word 15 - Bits<1:17>)	SCRP_MLB_SN_127_MTP_BEFORE	
Sector 126		
Check Sum - Sector 126 (Word 31)	SCRP_Check Sum_126_MTP_BEFORE	Ignore this value for QT0A until the LPP Free Air Calibration is done.
Signature (Word 0)	SCRP_Signature_126_MTP_BEFORE	
Version (Word 1)	SCRP_Version_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. QT0A

8.4.1.Flex Connectivity test

Description: To check if any other the connection on flex connecting Scorpius to Main Board are broken.

Failure Mode(s) Captured:

Test Setup and Procedure:

Step	Description	Interface	Command / Notes
1	No Rx Coil Connect/Present	Fixture	
2	PPVCC_MAIN(VSYS_ANA) Record this as x**1**	Tx HID	**PPVCC_MAIN(VSYS_ANA)**: smokey ScorpiusHid --run --test "Set" --args "ReportID=0x31, ReportPayload={0x06; 0x00; 0x8C}" note: the last part "0x8C" donates the number of samples with a multiplier of 32x. i.e 0x8C = 140 x 32 = 4480 samples **------> Fixture wait 5mS <------** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x31" **Response-->** byte0: [u8] ID (GetAdcID = 0x31) byte1-4: [u32] Floating point value read from ADC (eg 0xYYYYYYYY)(Convert this value to mV from V) byte5: [u8] Error Code (eg. 0x00 - no error) byte6: [u8] Reserved (eg. 0x00) byte7-8: [u16] ADC raw value (eg. 0xXXXX) byte9-12: [u32] Channel_Id that was read (eg. 0x00000007 = VSYS_1P8)
	Calculate PPVCC_MAIN(VSYS_ANA) actual	Overlay	$y_1 = (m\ x_1 / 10000) + (c\ / 1000)$ —> Where m = slope & c = offset —>from Word16 = VSYS_ANA_Offset_MTP <<16 || VSYS_ANA_Slope_MTP **Note : Convert m & c values into decimal before calculating y1**
3	Record value of VSYS_1P8 Record this as **x1**	Tx HID	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x31, ReportPayload={0x07; 0x00; 0x8C}" note: the last part "0x8C" donates the number of samples with a multiplier of 32x. i.e 0x8C = 140 x 32 = 4480 samples **------> Fixture wait 5mS <------** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x31" **Response-->** byte0: [u8] ID (GetAdcID = 0x31) byte1-4: [u32] Floating point value read from ADC (eg 0xYYYYYYYY)(Convert this value to mV from V) byte5: [u8] Error Code (eg. 0x00 - no error) byte6: [u8] Reserved (eg. 0x00) byte7-8: [u16] ADC raw value (eg. 0xXXXX) byte9-12: [u32] Channel_Id that was read (eg. 0x00000007 = VSYS_1P8)
	Calculate VSYS_1P8 actual	Overlay	$y_1 = x_1 + (b\ / 1000)$ Where b = offset —>from Word17 = value from step 14 above in Hex Note : Convert b value into decimal before calculating X1
4	Command for following variables: Tx:- Vbatt, Ibatt	Tx Diags	Ibatt :- device -k gasgauge -g current Vbatt :- device -k gasgauge -g voltage
5	Difference between VSYS-ANA & Vbatt	Fixture	$V_{Flex_Drop} = V_{batt} - V_{SYS_ANA_actual}$
6	Set Boost Voltage to 6.1V **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)
7	Command for following variables: Vsense	Tx Diags	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 5mS <———** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x31, ReportPayload={}" **Response —>** bytes1-4 = Floating point value from ADC **—> VSense_MCU**
Dotara Heart Beat Connection Test			
8	Pull Test Pin TP064O High (i.e. "DOTAR_WAKE_HEART_BEAT")	Tx Diags	socgpio --port 5 --pin 20 --output 1
9	Read the this signal from MCU	Tx HID	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x40, ReportPayload={0x9C; 0x3C; 0x00, 0x40}" **——> Fixture wait 5mS <——** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x40" **Response—>** byte 0 = report ID byte 1 = error code (0 = no error) byte 6, second bit = (0 : low, 1: high)
10	Pull Test Pin TP064O Low (i.e. "DOTAR_WAKE_HEART_BEAT")	Tx Diags	socgpio --port 5 --pin 20 --output 0
11	Read the this signal from MCU	Tx HID	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x40, ReportPayload={0x9C; 0x3C; 0x00, 0x40}" **——> Fixture wait 5mS <——** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x40" **Response—>** byte 0 = report ID byte 1 = error code (0 = no error) byte 6, second bit = (0 : low, 1: high)
Grape to Dotara Sync Connection Test			
12	Enable Touch Display	Tx Diags	--touch --on

Step	Description	Interface	Command / Notes
13	Pull Test Pin TP934H High (i.e. "GPIO_GRAPE_TO_DOTARA_TIME_SYNC_1V8")	Tx Diags	egpio --pick touch:1 --pin 10 --mode output --write 1
14	Read the this signal from MCU	TX Diags	The following command reads directly from the address specified: smokey ScorpiusHid --run --test "Mem32" --args "Address=0x40000C00, Length=4" **Check bit1 is set of the response data (ie GPIO2 pin state is high)**
15	Pull Test Pin TP934H Low (i.e. "GPIO_GRAPE_TO_DOTARA_TIME_SYNC_1V8")	Tx Diags	egpio --pick touch:1 --pin 10 --mode output --write 0
16	Read the this signal from MCU	TX Diags	The following command reads directly from the address specified: smokey ScorpiusHid --run --test "Mem32" --args "Address=0x40000C00, Length=4" **Check bit1 is set of the response data (ie GPIO2 pin state is high)** Example:- When it is high , 40000C00 : 0xxxxxx6, when it is low, 40000C00:0xxxxxx4 6 (Hex) —-> 0110 (Binary) ===> Bit 1 = 1; 4 (Hex) —-> 0100 (Binary) ===> Bit 1 = 0
17	Disable Touch Display	Tx Diags	--touch --off
	Dotara to AOP IRQ Connection Test		
18	Pull Test Pin TP9349 High (i.e. "SCORPIUS_TO_AOP_INT")	Tx Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x41, ReportPayload={0x6c; 0x35; 0x00; 0x40; 0x01; 0x00; 0x00; 0x00}"
19	Read AOP_FUN18 on AOP side	TX Diags	socgpio --port5 --pin22 --get
20	Pull Test Pin TP9349 low (i.e. "SCORPIUS_TO_AOP_INT")	Tx Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x41, ReportPayload={0x6c; 0x36; 0x00; 0x40; 0x01; 0x00; 0x00; 0x00}"
21	Read AOP_FUN18 on AOP side	TX Diags	socgpio --port5 --pin22 --get
	AOP to Dotara Connection Test		
22	Disable SWD for GPIO reading	Tx Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x41, ReportPayload={0x08; 0x36; 0x00; 0x40; 0x01; 0x00; 0x00; 0x00}"
23	Pull Test Pin TP0649 High (i.e. "DOTARA_SWDIO")	Tx Diags	socgpio --port 0 --pin 140 --output 1
24	Pull Test Pin TP0648 High (i.e. "DOTARA_SWDCLK")	Tx Diags	socgpio --port 0 --pin 107 --output 1
25	Read status of this pin on Dotara	Tx Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x40, ReportPayload={0x00; 0x0C; 0x00: 0x40}" ——> Fixture wait 5mS <—— smokey ScorpiusHid --run --test "Get" --args "ReportID=0x40" **Response—>** byte 0 = report ID byte 1 = error code (0 = no error) byte 6, bit0-SWDIO = (0 : low, 1: high), bit4-SWDCLK = (0 : low, 1: high)
26	Pull Test Pin TP0649 Low (i.e. "DOTARA_SWDIO")	Tx Diags	socgpio --port 0 --pin 140 --output 0
27	Pull Test Pin TP0648 Low (i.e. "DOTARA_SWDCLK")	Tx Diags	socgpio --port 0 --pin 107 --output 0
28	Read status of this pin on Dotara	Tx Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x40, ReportPayload={0x00; 0x0C; 0x00: 0x40}" ——> Fixture wait 5mS <—— smokey ScorpiusHid --run --test "Get" --args "ReportID=0x40" **Response—>** byte 0 = report ID byte 1 = error code (0 = no error) byte 6, bit0-SWDIO = (0 : low, 1: high), bit4-SWDCLK = (0 : low, 1: high)
29	Enable SWD	Tx Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x41, ReportPayload={0x08; 0x35; 0x00; 0x40; 0x01; 0x00; 0x00; 0x00}"

Acceptance criteria:

Net Name	Insight Keys Recorded	Nominal	Units	Comments
"DOTARA_WAKE_HEART_BEAT"	SCRP_DOTARA_WAKE_HEART_BEAT_HIGH	1	N/A	Note: Convert Hex response to Bin and check the Bit1 . For High —>Bit 1 = 1, For Low —> Bit 1 = 0
	SCRP_DOTARA_WAKE_HEART_BEAT_LOW	0	N/A	
"KONA_TO_DOTARA_TIME_SYNC_1V8"	SCRP_GPIO_GRAPE_TO_DOTARA_TIME_SYNC_High	1	N/A	Example:- When it is high , 40000C00 : 0xxxxxx6, when it is low, 40000C00:0xxxxxx4 6 (Hex) —-> 0110 (Binary) ===> Bit 1 = 1; 4 (Hex) —-> 0100 (Binary) ===> Bit 1 = 0 Note: Convert Hex response to Bin
	SCRP_GPIO_GRAPE_TO_DOTARA_TIME_SYNC_Low	0	N/A	
"DOTARA_SWDIO"	SCRP_DOTARA_SWDIO_1V8_High	1	N/A	Note: Convert Hex response to Bin and check the Bit0 & Bit4 of byte6 For High —>Bit 1 & Bit4 = 1, For Low —> Bit 1 & Bit4 = 0
	SCRP_DOTARA_SWDIO_1V8_Low	0	N/A	
"DOTARA_SWDCLK"	SCRP_DOTARA_SWDIO_1V8_High	1	N/A	
	SCRP_DOTARA_SWDIO_1V8_Low	0	N/A	
"DOTARA_TO_AOP_IRQ"	SCRP_DOTARA_TO_AOP_IRQ_High	1	N/A	
	SCRP_DOTARA_TO_AOP_IRQ_Low	0	N/A	

Net Name	Insight Keys Recorded	LL	UL	Units	Comments

Net Name	Insight Keys Recorded	Nominal		Units	Comments
PPVCC_MAIN(VSYS_ANA) Actual	SCRP_VSYS_ANA_Actual	TBD	TBD	mV	
VSYS_1P8 actual	SCRP_VSYS_1P8_Actual	1650	1950	mV	
Vbatt	SCRP_Vbatt	TBD	TBD	mV	
Ibatt	SCRP_Ibatt	TBD	TBD	mA	
VFlex_drop	SCRP_VFlex-Drop	TBD	TBD	mV	
VSense @6.1V	SCRP_VSENSE_6V1	6000	7000	mV	

8.4.2.LPP Free Air Calibration

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	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 $\left[Sum(Word\ 0 + Word\ 2\ + \ldots . + Word\ 30)\right]$ **Example: —> Word 31:** 2's Compliment of $\left(22261F1F\right) = DDD9E0E1$
11	Set Boost Voltage to 6.1V	TX Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x03, ReportPayload={0xD4; 0x17; 0xF4; 0x01}" **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; 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**

Step	Description	Interface	Command / Notes
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~~	~~pmugpio --pin 18 --output 0 —pushpull~~
	~~Wait 500ms~~	~~Fixture~~	
	~~Pull High test pin **TP93EF** i.e. **"AOP_TO_DOTARA_RESET_L "**~~	~~Tx Diags~~	~~pmugpio --pin 18 --output 1 —pushpull~~
~~16~~	~~Wait 1s~~	~~Fixture~~	
~~17~~	~~Preparation~~	~~Tx Diags~~	~~pmugpio --pin 14 --output 1 --pushpull~~
~~18~~	~~Tell Tx to get out of standalone mode.~~	~~Tx Diags~~	~~i2c -w 6 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\\J517J522\\ScorpiusTx-dotara.bin'"~~
15	Reset Scorpius Module	Tx Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x91, ReportPayload={}"
16	Wait 1s	Fixture	Scorpius FW will take less than 1 second to boot
17	Tell Tx to get out of standalone mode.	Tx Diags	i2c -w 6 0x39 6 **Note:-Send this command 2x times.** There may be I2C error reported with this command, but can be ignored.
18	Tell Tx to enter Quiesce Mode	TX Diags	**Note**: Need to send this command every time within **3sec** of above command. You cannot enter Quiesce mode without exiting the standalone mode. smokey ScorpiusHid --run --test "Set" --args "ReportID=0x09, ReportPayload={0x01}"
19	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

Acceptance criteria:

Test Parameter	Insight Keys Recorded	LL	UL	Unit	Offset Positions	Notes
LPP Inductance	SCRP_LPP_Inductance_Free_Air_Cal	15.49	18.72	µH	Air	
LPP Frequency	SCRP_LPP_FREQ_Free_Air_Cal	75.75	85.81	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. QT4 - Scorpius Test

8.5.1.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 5mS <———** 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 5mS <———** 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	
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	Record parameters as per the table below	Fixture	Apply limits accordingly
14	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)

Acceptance criteria:

Test Parameter	Insight Keys Recorded	LL	UL	Unit	Notes
VSNS	SCRP_LPP_Vsense_Disabled	-100	100	mV	
	SCRP_LPP_Vsense_Enabled	4950	5260	mV	
LPP Frequency	SCRP_LPP_FREQ	63	72.8	kHz	
LPP Inductance	SCRP_LPP_Inductance	21.5	27	µH	
Δ Tx Frequency	SCRP_LPP_FREQ_delta	5000	21193	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	3.3	10.5	µH	

8.5.2.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).

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	~~2C @ 6.8V Vrect~~	3C @ 8V Vrect	10C @ 14V Vrect
Loading	40mA ballast —> No Eload i.e. turn Eload off/Set Eload to 0A	~~~0.6W —> Set Eload to~110mA~~	~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 Load conditions —> **0.1C;** **~~2C;~~** **3C;** **10C**
			Power & Efficiency Testing
A	PPVCC_MAIN(VSYS_ANA) Record this as x**1**	Tx HID	**PPVCC_MAIN(VSYS_ANA)**: smokey ScorpiusHid --run --test "Set" --args "ReportID=0x31, ReportPayload={0x06; 0x00; 0x8C}" note: the last part "0x8C" donates the number of samples with a multiplier of 32x. i.e 0x8C = 140 x 32 = 4480 samples **------> Fixture wait 5mS <------** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x31" **Response-->** byte0: [u8] ID (GetAdcID = 0x31) byte1-4: [u32] Floating point value read from ADC (eg 0xYYYYYYYY)(Convert this value to mV from V) byte5: [u8] Error Code (eg. 0x00 - no error) byte6: [u8] Reserved (eg. 0x00) byte7-8: [u16] ADC raw value (eg. 0xXXXX) byte9-12: [u32] Channel_Id that was read (eg. 0x00000007 = VSYS_1P8)
B	Calculate PPVCC_MAIN(VSYS_ANA) actual **VSYS_ANA_Actual = y1**	Overlay	$y_1 = (m\,x_1/10000) + (c/1000)$ —> Where m = slope & c = offset (Word16 = VSYS_ANA_Offset_MTP <<16 || VSYS_ANA_Slope_MTP) **Note : Convert m & c values into decimal before calculating y1**
C	Record value of VSYS_1P8 Record this as **x1**	Tx HID	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x31, ReportPayload={0x07; 0x00; 0x8C}" note: the last part "0x8C" donates the number of samples with a multiplier of 32x. i.e 0x8C = 140 x 32 = 4480 samples **------> Fixture wait 5mS <------** smokey ScorpiusHid --run --test "Get" --args "ReportID=0x31" **Response-->** byte0: [u8] ID (GetAdcID = 0x31) byte1-4: [u32] Floating point value read from ADC (eg 0xYYYYYYYY)(Convert this value to mV from V) byte5: [u8] Error Code (eg. 0x00 - no error) byte6: [u8] Reserved (eg. 0x00) byte7-8: [u16] ADC raw value (eg. 0xXXXX) byte9-12: [u32] Channel_Id that was read (eg. 0x00000007 = VSYS_1P8)
D	Calculate VSYS_1P8 actual **VSYS_1P8_Actual = y1**	Overlay	$y_1 = x_1 + (b/1000)$ ——> Where b = offset —>from Word17 = value from step 14 above in Hex Note : Convert b value into decimal before calculating y1
E	Command for following variables: Tx:- Vbatt, Ibatt	Tx Diags	Ibatt :- device -k gasgauge -g current Vbatt :- device -k gasgauge -g voltage
F	Difference between VSYS-ANA & Vbatt	Fixture	$V_{Flex_Drop} = V_{batt} - V_{SYS_ANA_actual}$
			For 0.1C; ~~2C~~ & 3C
1	Repeat Step A, B, C & D	Tx Diags & Fixture	**@Standby i.e. before 0.1C testing**

Step	Description	Interface	Command
2	Set boost to meet the load conditions. **Note:** Minimum Vboost is 6100mV, Don't set Vboost < 6100mV.	TX Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x03, ReportPayload={0xD4; 0x17; 0xF4; 0x01}" **Payload: ——>** Byte0-1: Boost voltage (eg. 0x17D4 = 6100mV)
3	Set the Bridge phase to meet the load condition (Set Bridge phase to 0-180)	Tx Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x04, ReportPayload={0x1C; 0xF3; 0x01; 0x00; 0x50; 0x46; 0x50; 0x46}" **Eg 0x4650:** 18000cdeg = 180deg phase
4	Repeat Step A, B, C & D	Tx Diags & Fixture	**During 0.1C & 3C loading**
			For 10C
2	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
3	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)
4	Repeat Step A, B, C & D	Tx Diags & Fixture	**During 10C loading**
5	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 5mS <———** 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 5mS <———** 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 5mS <———** 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 5mS <———** 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.
6	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		
7	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
8	Choose Comm1	Rx I2C	Write I2C packet: (39) c0 ae 80 80 1e 01 00 05 AD Ginger command: ikt write 0x0xF0000B80 0xAD050001
9	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
10	Wait 1 second for RX to send packets before reading buffer	Fixture	Wait 1 second
11	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***

Step	Description	Interface	Command
12	Repeat step 1 to 11 with All loading and coupling positions		

Acceptance criteria:

Test Parameter	Insight Keys Recorded	LL	UL	Units	Comments/Notes
PPVCC_MAIN(VSYS_ANA)Actual @ Standby	SCRP_PPVCC_MAIN@Standby	TBD	TBD	mV	
VSYS_1P8 @ Standby	SCRP_VSYS_1P8@Standby	1650	1950	mV	
Vbatt @ Standby	SCRP_Vbatt@Standby	TBD	TBD	mV	
Ibatt @ Standby	SCRP_Ibatt@Standby	TBD	TBD	mA	
VFlex_Drop @ Standby	SCRP_VFlex_Drop@Standby	TBD	TBD	mA	
Load 0.1C					
PPVCC_MAIN @ 0.1C	SCRP_PPVCC_MAIN@0.1C	TBD	TBD	mV	
VSYS_1P8 @ 0.1C	SCRP_VSYS_1P8@0.1C	1650	1950	mV	
Vbatt@0.1C	SCRP_Vbatt@0.1C	TBD	TBD	mV	
Ibatt@0.1C	SCRP_Ibatt@0.1C	TBD	TBD	mA	
VFlex_Drop@0.1C	SCRP_VFlex_Drop@0.1C	TBD	TBD	mA	
Vsense @ 0.1C	SCRP_Vsense@0.1C	5980	6500	mV	min = 6100mV * 0.98
Isense @ 0.1C	SCRP_Isense@0.1C	70	160	mA	
Vctx_IPeak @ 0.1C	SCRP Vctx_Ipk@0.1C	300	630	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	223	298	mW	Vrect * Irect
Efficiency @ 0.1C	SCRP_Efficiency@0.1C	35	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 2C**~~					
~~PPVCC_MAIN @ 2C~~	~~SCRP_PPVCC_MAIN@2C~~	~~TBD~~	~~TBD~~	~~mV~~	
~~VSYS_1P8 @ 2C~~	~~SCRP_VSYS_1P8@2C~~	~~1650~~	~~1950~~	~~mV~~	
~~Vbatt@2C~~	~~SCRP_Vbatt@2C~~	~~TBD~~	~~TBD~~	~~mV~~	
~~Ibatt@2C~~	~~SCRP_Ibatt@2C~~	~~TBD~~	~~TBD~~	~~mA~~	
~~VFlex_Drop@2C~~	~~SCRP_VFlex_Drop@2C~~	~~TBD~~	~~TBD~~	~~mA~~	
~~Vsense @ 2C~~	~~SCRP_Vsense@2C~~	~~TBD~~	~~TBD~~	~~mV~~	~~min = 6100mV * 0.98~~
~~Isense @ 2C~~	~~SCRP_Isense@2C~~	~~TBD~~	~~TBD~~	~~mA~~	
~~Vctx_IPeak @ 2C~~	~~SCRP Vctx_Ipk@2C~~	~~TBD~~	~~TBD~~	~~mA~~	
~~Vrect_FXST @ 2C~~	~~SCRP_Vrect@2C~~	~~6664~~	~~6936~~	~~mV~~	~~Fixture Cmd: Vrect Target = 6.8V ±2%~~
~~Irect_FXST @ 2C~~	~~SCRP_Irect@2C~~	~~100~~	~~120~~	~~mA~~	~~Fixture Cmd: Irect Target = 110mA + iktara load(~0 to 15mA)~~
~~Rx_Loading_Power @ 2C~~	~~SCRP_Rx_Loading_Power@2C~~	~~666~~	~~832~~	~~mW~~	~~Vrect * Irect~~
~~Efficiency @ 2C~~	~~SCRP_Efficiency@2C~~	~~TBD~~	~~TBD~~	~~%~~	~~Rx_Power / (Vsense * Isense)~~
~~Number of Pings Sent @ 2C~~	~~SCRP_Pings_Sent@2C~~	~~10~~	~~10~~	-	
~~Number of Pongs Received @ 2C~~	~~SCRP_Pongs_Recieved@2C~~	~~10~~	~~10~~	-	
~~Dotara Surface Temperature @ 2C~~	~~SCRP_Temp1_MCU@2C~~ ~~SCRP_Temp2_MCU@2C~~	~~20~~	~~61~~	~~℃~~	~~Based on J307 P1 data~~
Load 3C					
PPVCC_MAIN @ 3C	SCRP_PPVCC_MAIN@3C	TBD	TBD	mV	
VSYS_1P8 @ 3C	SCRP_VSYS_1P8@3C	1650	1950	mV	

Test Parameter	Insight Keys Recorded	LL	UL	Units	Comments/Notes
Vbatt@3C	SCRP_Vbatt@3C	TBD	TBD	mV	
Ibatt@3C	SCRP_Ibatt@3C	TBD	TBD	mA	
VFlex_Drop@3C	SCRP_VFlex_Drop@3C	TBD	TBD	mA	
Vsense @ 3C	SCRP_Vsense@3C	5980	7000	mV	
Isense @ 3C	SCRP_Isense@3C	210	300	mA	
Vctx_IPeak_ @ 3C	SCRP Vctx_Ipk@3C	400	850	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	886	1044	mW	Vrect * Irect
Efficiency @ 3C	SCRP_Efficiency@3C	46	66	%	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
Load 10C					
PPVCC_MAIN @ 10C	SCRP_PPVCC_MAIN@10C	TBD	TBD	mV	
VSYS_1P8 @ 10C	SCRP_VSYS_1P8@10C	1650	1950	mV	
Vbatt@10C	SCRP_Vbatt@10C	TBD	TBD	mV	
Ibatt@10C	SCRP_Ibatt@10C	TBD	TBD	mA	
VFlex_Drop@10C	SCRP_VFlex_Drop@10C	TBD	TBD	mA	
Vsense @ 10C	SCRP_Vsense@10C	9000	13000	mV	
Isense @ 10C	SCRP_Isense@10C	380	550	mA	
Vctx_IPeak_ @ 10C	SCRP Vctx_Ipk@10C	730	1380	mA	
Vrect_FXST @ 10C	SCRP_Vrect@10C	13720	14280	mV	Fixture Cmd: Vrect Target = 14v ±2%
Irect_FXST @ 10C	SCRP_Irect@10C	214	225	mA	Fixture Cmd: Irect Target = 214mA
Rx_Loading_Power @ 10C	SCRP_Rx_Loading_Power@10C	2936	3213	mW	Vrect * Irect
Efficiency @ 10C	SCRP_Efficiency@10C	47	65	%	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

8.6. MTP Locking @ QT4 [TBD - For MP Intend]

Description: To Lock all the calibration data stored into MTP.

Note: This step is ***irreversible*** so need to make sure if the Pre Lock Condition is met. Do not proceed if this condition does not meet.

Failure Mode(s) Captured: If Pre Lock Check Fails.

Test Setup and Procedure:

Step	Description	Interface	Command / Notes
~~1~~	~~Pull Low test pin **TP93EF** i.e. **"AOP_TO_DOTARA_RESET_L" to reset Scorpius~~	~~Tx Diags~~	~~pmugpio --pin 18 --output 0~~
	~~Wait 500ms~~	~~Fixture~~	
	~~Pull High test pin **TP93EF** i.e. **"AOP_TO_DOTARA_RESET_L "~~	~~Tx Diags~~	~~pmugpio --pin 18 --output 1~~
~~2~~	~~Wait 1s~~	~~Fixture~~	
~~3~~	~~Preparation~~	~~Tx Diags~~	~~pmugpio --pin 14 --output 1~~
~~4~~	~~Tell Tx to get out of standalone mode.~~	~~Tx Diags~~	~~i2c -w **6** 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. ***Path for FW might change.***~~ ~~smokey ScorpiusHid --run --test "FwLoad" --args "PathToFwLoad='handfs:\\AppleInternal\\Diags\\Scorpius\\J517J522\\ScorpiusTx-dotara.bin'"~~
1	Reset Scorpius Module	Tx Diags	smokey ScorpiusHid --run --test "Set" --args "ReportID=0x91, ReportPayload={}"
2	Wait 1s	Fixture	Scorpius FW will take less than 1 second to boot
3	Tell Tx to get out of standalone mode.	Tx Diags	i2c -w **6** 0x39 6 **Note:-Send this command 2x times.**There may be I2C error reported with this command, but can be ignored.
4	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}"
5	Read MTP Sector 127 Note: No need to record or save all the word from this read command into Insight if condition in step 11 is TRUE	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**
6	Read MTP Sector 126 Note: No need to record or save all the word from this read command into Insight if condition in step 11 is TRUE	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**
7	Read MTP Sector 128	Tx Diags	smokey ScorpiusHid --run --test "Print_Sector" --args "MTP_sector=128" **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 : 0x0000005A**
8	Calculate CheckSum of sector 128. **Note: there is no word for checksum in Sector 128**	Test Overlay	**Checksum =** 2's compliment of $\left[Sum(Word\ 0 + Word\ 2\ + \ldots . + Word\ 30)\right]$ **Example: —> Checksum =** 2's Compliment of $\left(22261F1F\right) = DDD9E0E1$ **SCRP_CheckSum_128_MTP_BEFORE**
9	Pre Locking Check	Overlay	Lock **if and only if** Sector 127 :- Word 31(Checksum from Step 8 Above) = SCRP_Check Sum_127_MTP_BEFORE (From Section 8.3) & Sector 126 :- Word 31(Checksum from Step 9 Above) = SCRP_Check Sum_126_MTP_BEFORE (From Section 8.3)

Step	Description	Interface	Command / Notes
10	Update MTP Sector 128 to lock 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=128, 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:** Word31: LOCK_WORD = **0x000005A** 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=128, MTP_Words={0x00000001; 0x00000002; 0xABCDEFGH; 0x0E0E0E0E; 0x00000000; 0x00000000; 0x00000000

Step	Description	Interface	Command / Notes
6	Read MTP Sector 126 Only @ QT0A & QT4	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**
7	Read MTP Sector 128 Only @ QT4 & Gatekeeper	Tx Diags	smokey ScorpiusHid --run --test "Print_Sector"--args "MTP_sector=128" **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 : 0x000005A**
8	Location of stored Calibrated values of VBoost, Vsense, Isense, LFOD & CTx into MTP and other values into MTP :- Signature, Version,HWID, MLB SN, Checksum Follow Figure 1 Above 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)
9	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).
10	Check if Checksum of Sector 127 & Sector 126 are correct	Test Overlay	Pass if **Word 31 = 2's compliment of** $\left[Sum(Word\ 0 + Word\ 2\ + \ldots + Word\ 30)\right]$
	Check if Checksum of Sector 128 are correct Only @ QT4 & Gatekeeper **Note: there is no word for checksum in Sector 128**		Pass if **Checksum = 2's compliment of** $\left[Sum(Word\ 0 + Word\ 2\ + \ldots + Word\ 30)\right]$
11	Check if MTP is locked Only @ QT4 & Gatekeeper	Test Overlay	Sector 128 :-Word 31(LOCK_WORD = 0x000005A)

Acceptance:

Test Parameter	Insight Keys Recorded	Comments/Notes
Sector 128 - [TBD]		
LOCK_WORD - Sector 128 (Word 31)	SCRP_LOCK_WORD_128_MTP_AFTER	**@QT4:** Pass if this values match with MTP check before test i.e. **Section 8.6**
Check Sum - Sector 128	SCRP_Check Sum_128_MTP_AFTER	
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**
Signature (Word 0)	SCRP_Signature_127_MTP_AFTER	
Version (Word 1)	SCRP_Version_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	
Tx HWID_MTP (Word 10):- J51x - 0x05170000 J52x - 0x05200000	SCRP_TX_HWID_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_AFTER	**@ 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**
Signature (Word 0)	SCRP_Signature_126_MTP_AFTER	
Version (Word 1)	SCRP_Version_126_MTP_AFTER	
LPP Inductance_MTP (Word 2)	SCRP_LPP_L_126_MTP_AFTER	
LPP Frequency_MTP (Word 3)	SCRP_LPP_FREQ_126_MTP_AFTER	

A. Feature DRI Comments for Changes to this Document

Feature	DRI	Description/Comments/Reason for Change	Date	Approved and released in Version:
Power Transfer	Mikhal	Minimum boost requirement has changed from 6000mV to 6100mV.	21 February 2020	Mikhal/Bhushan/ P1_V1.1
Power Transfer	Nan	Updated observable limits in 8.5.2, based on J4xx FATP Scorpius and J5xx Char data	10 March 2020	P1_V1.2
LPP	Rex	Updated LPP limits for QT0a & QT4	11 March 2020	
Power Transfer	Bhushan/Rex	Updated Power flow test procedure to include flex drop measurement	12 March 2020	
QT0a	Bhushan/Rex	Added flex connectivity test.	12 March 2020	
Power	Daniel R	Added VSYS_1P8 to both QT0a and Scorpius Test	18 March 2020	
QT0A	Bhushan/Rex	Updated Flex Connectivity test at QT0A	3 April 2020	Bhushan/Rex/Nan/ P1_V1.3
LPP & VCTX	Bhushan	Updated command and response format of LPP and VCTx respectively		
Dotara	Bhushan	Added Dotara Temperature measurement At QT4		
Power Transfer	Bhushan/Jin	Updated procedure to Disable LFOD during Vsense & Isense reading.		
Power Transfer	Bhushan/Nan	Updated Limits for Vsense/Isense/VSYS_1P8 Updated formulas to calculate VSYS_ANA & VSYS_1P8	17 April 2020	Bhushan/Frank/Nan/ P1_V1.4
LPP	Frank	Updated LL for Frequency and UL for Inductance		
Flex Drop	Bhushan	Updated procedure and commands for Dotara Time Sync test		
Power Transfer	Bhushan/Jin	Updated procedure to Disable ASK_CR register during Vsense & Isense reading. Added 2C charging test from Power Flow.	8 July 2020	Bhushan/Rex/Nan/ Samira/P2_V1.5
LPP test	Bhushan/Rex	Added Vsense measurement before LPP at QT4		
MTP locking	Bhushan/ Samira	Added MTP locking test procedure at QT4, but will not do this until we know which units will be for production fusing.		
Boost	Bhushan	Updated Boost ramp speed as per FW POR to 500mV/mS		
General	Bhushan/Nan	Updated some limits based on new data.	8 July 2020	Bhushan/Nan/ EVT_V2.0
MTP	Bhushan	Replaced Scorpius Hard reset procedure with command		
Power Transfer	Bhushan/Nan	Took out 2C charging test from Power Flow.		
Flex drop	Bhushan	Replaced Potomac command with gasgauge cmd due to Ibatt read back issue		