TEST REPORT

APPLICANT	:	Shenzhen Hope Microelectronics Co., Ltd
PRODUCT NAME	:	HopeRF CMT453X
MODEL NUMBER	:	CMT453X
BRAND NAME	:	HOPERF
BLUETOOTH VERSION	:	5.2
STANDARD(S)	:	Bluetooth Low Energy RFPHY Test Specification RFPHY.TS.p20
RECEIPT DATE	:	2023-08-23
TEST DATE	:	2023-08-23 to 2023-08-31
ISSUE DATE	:	2023-10-18

Edited by: Hu Qiuyue (Rapporteur)

Approved by: Shen Junsheng (Supervisor)

DIRECTORY

Change History		
Version	Date	Reason for change
1.0	2023-10-09	First edition
2.0	2023-10-18	Replace Version 1.0. Update Description of IUT.

1. IDENTIFICATION SUMMARY

1.1 Test Laboratory

Name:	Shenzhen Morlab Communications Technology Co., Ltd.
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Competences and guarantees:

Morlab is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, Morlab has a calibration and maintenance programme for its measuring equipment.

Morlab guarantees the reliability of the data presented in this report, which is the result of measurements and tests performed to the item under test on the date and under the conditions stated on the report and is based on the knowledge and technical facilities available at Morlab at the time of execution of the test.

Morlab is liable to the client for the maintenance by its personnel of the confidentiality of all information related to the item under test and the results of the test.

1.2 Client

Name:	Shenzhen Hope Microelectronics Co., Ltd
Address:	30th floor of 8th Building, C Zone, Vanke Cloud City, Xili Sub-district, Nanshan, Shenzhen, GD, P.R. China

1.3 Manufacturer

Name:	Shenzhen Hope Microelectronics Co., Ltd
Address:	30th floor of 8th Building, C Zone, Vanke Cloud City, Xili Sub-district, Nanshan, Shenzhen, GD, P.R. China

1.4 Implementation Under Test (IUT)

Hw version:	1.0
Sw version:	1.0
Android version:	N/A
Description of IUT:	Ultra power-efficient Bluetooth LE 5.2 chip with 256KB-2048KB Flash, 48KB RAM, and industry leading 2.4GHz RF transceivers. It is built around an ARM Cortex-M0 running up to 64MHz, and a wide selection of peripherals. The chip features an ultra-low transmit and receive power (4.2mA TX at 0dBm, 3.8mA RX) and sleep power consumption is 1.4uA with all RAM retention. CMT453X supports Bluetooth Low Energy 5.2 including 2Mbps PHY, LE Coded PHYs, direction finding using Angle-of-Arrival (AoA) and Angle-of-Departure (AoD), etc. It also supports Bluetooth Mesh, multi-connections, operating as both peripheral and central devices simultaneously. The device is well suited for high performance, low energy consumption IoT connected applications. The HM-BT4531, HM-BT4531B, HM-BT4531C, HM-BT4531D, HM-BT4531E are BLE data transmission module with AT commands support, based on CMT453X BLE 5.2 SoC chip with 256KB-2048KB Flash and 48KB RAM, features a high-performance 2.4GHz transceiver, equipped with an on-board PCB antenna and the external

	antenna is optional with connector. The modules are a full solution that comes with upgradeable firmware, robust software stacks, worldwide regulatory certifications, and makes it easy for the developer to solve complex wireless communication challenges in their end-products and accelerate time to market.
Sampling method:	Samples undergoing test have been selected by: the client

Internal Control No.:	**Element:**	**BT_ADD:**
3#	1PCS	2F6300173931

1.5 Testing Environment

PICS:	See annex A
Test Results reference:	See item 5
Retention date for log reference:	2 years
Test Requested	Bluetooth RFPHY conformance testing

1.6 Test conditions:

NOMINAL

TEMPERATURE IN THE RANGE 15ºC TO 35 ºC	YES
RELATIVE HUMIDITY IN THE RANGE 20% TO 75 %	YES
AIR PRESSURE IN THE RANGE 86 kPa TO 106 kPa	YES

2. IUT CONFORMANCE STATUS

This IUT has the following conformance status according to the referenced ATS specification(s).

Static Conformance errors?	NO
Dynamic Conformance errors?	NO

Number of test cases run.

Passed:	28
Failed:	0

Total:	28

3. STATIC CONFORMANCE SUMMARY

The PICS(s) for this IUT is consistent with the static conformance requirements in the referenced base specification(s).

The qualified PICS/PIXIT menu of the test system was defined in accordance with the client.

4. DYNAMIC CONFORMANCE SUMMARY

The test campaign did NOT reveal errors in the IUT.

5. TEST RESULT LIST

Transmitter Tests (TRM-LE)					
Test Case ID	Temperate	Voltage	Verdict	Test Execution Date	Test Equipment Platform
RFPHY/TRM/BV-01-C Output power, 1 Ms/s	Nominal	Nominal	Pass	2023.08.31	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/TRM/BV-03-C In-band emissions, uncoded data at 1 Ms/s	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/TRM/BV-05-C Modulation Characteristics, uncoded data at 1 Ms/s	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/TRM/BV-06-C Carrier frequency offset and drift, uncoded data at 1 Ms/s	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/TRM/BV-08-C In-band emissions at 2 Ms/s	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/TRM/BV-09-C Stable Modulation Characteristics, uncoded data at 1 Ms/s	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/TRM/BV-10-C Modulation Characteristics at 2 Ms/s	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/TRM/BV-11-C Stable Modulation Characteristics at 2 Ms/s	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/TRM/BV-12-C Carrier frequency offset and drift at 2 Ms/s	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS -RTSB-A Test System

RFPHY/TRM/BV-13-C Modulation Characteristics, LE Coded (S=8)	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/TRM/BV-14-C Carrier frequency offset and drift, LE Coded (S=8)	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/TRM/BV-15-C Output power, With Constant Tone Extension, 1 Ms/s	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/TRM/BV-16-C Carrier frequency offset and drift, uncoded data at 1 Ms/s, Constant Tone Extension	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/TRM/BV-17-C Carrier frequency offset and drift at 2 Ms/s, Constant Tone Extension	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/TRM/BV-18-C Output power, Class 1, 1 Ms/s	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/TRM/BV-19-C Output power, 2 Ms/s	Nominal	Nominal	Pass	2023.08.31	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/TRM/BV-20-C Output power, Class 1, 2 Ms/s	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/TRM/BV-21-C Output power, With Constant Tone Extension, Class1, 1 Ms/s	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/TRM/BV-22-C Output power, With Constant Tone Extension, 2 Ms/s	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/TRM/BV-23-C Output power, With	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS-RTSB-A Test

Constant Tone Extension, Class1, 2 Ms/s					System
RFPHY/TRM/PS/BV-01-C Tx Power Stability, AoD Transmitter at 1 Ms/s with 2 µs Switching Slot	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/TRM/PS/BV-02-C Tx Power Stability, AoD Transmitter at 1 Ms/s with 1 µs Switching Slot	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/TRM/PS/BV-03-C Tx Power Stability, AoD Transmitter at 2 Ms/s with 2 µs Switching Slot	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/TRM/PS/BV-04-C Tx Power Stability, AoD Transmitter at 2 Ms/s with 1 µs Switching Slot	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/TRM/ASI/BV-05-C Antenna switching integrity, AoD Transmitter at 1 Ms/s with 2 µs Switching Slot	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/TRM/ASI/BV-06-C Antenna switching integrity, AoD Transmitter at 1 Ms/s with 1 µs Switching Slot	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/TRM/ASI/BV-07-C Antenna switching integrity, AoD Transmitter at 2 Ms/s with 2 µs Switching Slot	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/TRM/ASI/BV-08-C Antenna switching integrity, AoD Transmitter at 2 Ms/s with 1 µs Switching Slot	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
Receiver Tests (RCV-LE)					

Test Case ID	Temperate	Voltage	Verdict	Test Execution Date	Test Equipment Platform
RFPHY/RCV/BV-01-C Receiver sensitivity, uncoded data at 1 Ms/s	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/RCV/BV-03-C C/I and Receiver Selectivity Performance, uncoded data at 1 Ms/s	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/RCV/BV-04-C Blocking Performance, uncoded data at 1 Ms/s	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/RCV/BV-05-C Intermodulation Performance, uncoded data at 1 Ms/s	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/RCV/BV-06-C Maximum input signal level, uncoded data at 1 Ms/s	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/RCV/BV-07-C PER Report Integrity, uncoded data at 1 Ms/s	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/RCV/BV-08-C Receiver sensitivity at 2 Ms/s	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/RCV/BV-09-C C/I and Receiver Selectivity Performance at 2 Ms/s	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/RCV/BV-10-C Blocking performance at 2 Ms/s	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/RCV/BV-11-C Intermodulation performance at 2 Ms/s	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/RCV/BV-12-C Maximum input signal level at 2 Ms/s	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS-RTSB-A Test System

RFPHY/RCV/BV-13-C PER Report Integrity at 2 Ms/s	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/RCV/BV-14-C Receiver Sensitivity, uncoded data at 1 Ms/s, Stable Modulation Index	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/RCV/BV-15-C C/I and Receiver Selectivity Performance, uncoded data at 1 Ms/s, Stable Modulation Index	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/RCV/BV-16-C Blocking Performance, uncoded data at 1 Ms/s, Stable Modulation Index	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/RCV/BV-17-C Intermodulation Performance, uncoded data at 1 Ms/s, Stable Modulation Index	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/RCV/BV-18-C Maximum input signal level, uncoded data at 1 Ms/s, Stable Modulation Index	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/RCV/BV-19-C PER Report Integrity, uncoded data at 1 Ms/s, Stable Modulation Index	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/RCV/BV-20-C Receiver sensitivity at 2 Ms/s, Stable Modulation Index	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/RCV/BV-21-C C/I and Receiver Selectivity Performance at 2 Ms/s, Stable Modulation Index	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS-RTSB-A Test System
RFPHY/RCV/BV-22-C	Nominal	Nominal	N/A	Not	CTTL-SYSTEMS

Blocking performance at 2 Ms/s, Stable Modulation Index				Required	-RTSB-A Test System
RFPHY/RCV/BV-23-C Intermodulation performance at 2 Ms/s, Stable Modulation Index	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/BV-24-C Maximum input signal level at 2 Ms/s, Stable Modulation Index	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/BV-25-C PER Report Integrity at 2 Ms/s, Stable Modulation Index	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/BV-26-C Receiver sensitivity, LE Coded (S=2)	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/BV-27-C Receiver sensitivity, LE Coded (S=8)	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/BV-28-C C/I and Receiver Selectivity Performance, LE Coded (S=2)	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/BV-29-C C/I and Receiver Selectivity Performance, LE Coded (S=8)	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/BV-30-C PER Report Integrity, LE Coded (S=2)	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/BV-31-C PER Report Integrity, LE Coded (S=8)	Nominal	Nominal	Pass	2021.08.06-2021.08.18	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/BV-32-C Receiver sensitivity, LE Coded (S=2), Stable	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System

Modulation Index					
RFPHY/RCV/BV-33-C Receiver sensitivity, LE Coded (S=8), Stable Modulation Index	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/BV-34-C C/I and Receiver Selectivity Performance, LE Coded (S=2), Stable Modulation Index	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/BV-35-C C/I and Receiver Selectivity Performance, LE Coded (S=8), Stable Modulation Index	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/BV-36-C PER Report Integrity, LE Coded (S=2), Stable Modulation Index	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/BV-37-C PER Report Integrity, LE Coded (S=8), Stable Modulation Index	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/IQC/BV-01-C IQ Samples Coherency, AoD Receiver at 1 Ms/s with 2 µs Slot	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/IQC/BV-02-C IQ Samples Coherency, AoD Receiver at 1 Ms/s with 1 µs Slot	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/IQC/BV-03-C IQ Samples Coherency, AoD Receiver at 2 Ms/s with 2 µs Slot	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/IQC/BV-04-C IQ Samples Coherency, AoD Receiver at 2 Ms/s with	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System

1 µs Slot					
RFPHY/RCV/IQC/BV-05-C IQ Samples Coherency, AoA Receiver at 1 Ms/s with 2 µs Slot	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/IQC/BV-06-C IQ Samples Coherency, AoA Receiver at 2 Ms/s with 2 µs Slot	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/IQDR/BV-07-C IQ Samples Dynamic Range, AoD Receiver at 1 Ms/s with 2 µs Slot	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/IQDR/BV-08-C IQ Samples Dynamic Range, AoD Receiver at 1 Ms/s with 1 µs Slot	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/IQDR/BV-09-C IQ Samples Dynamic Range, AoD Receiver at 2 Ms/s with 2 µs Slot	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/IQDR/BV-10-C IQ Samples Dynamic Range, AoD Receiver at 2 Ms/s with 1 µs Slot	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/IQDR/BV-11-C IQ Samples Dynamic Range, AoA Receiver at 1 Ms/s with 2 µs Slot	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System
RFPHY/RCV/IQDR/BV-12-C IQ Samples Dynamic Range, AoA Receiver at 2 Ms/s with 2 µs Slot	Nominal	Nominal	N/A	Not Required	CTTL-SYSTEMS -RTSB-A Test System

Note 1: When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% confidence intervals.

Note 2: Some of the test results in this report are based on the original report (Report No.: SZ21080072B01). CMT453X can reuse the same test evidence due to the similarity in electrical circuit design, layout, materials.

Annex A. PICS & PIXIT

Table 1:Bluetooth LE RF Capabilities

Item	Capability	Reference	Status	Support: YES or NO
1/1	LE Transmitter	[1] 3	C.1	YES
1/2	LE Receiver	[1] 4	C.1	YES
1/3	LE Transceiver	[1] 3,4	C.1	YES
1/4	LE 2M PHY	[3] 3,4	C.2	YES
1/5	Stable Modulation Index-Transmitter	[3] 3.1.1	C.3	NO
1/6	Stable Modulation Index-Receiver	[3] 3.1.1	C.4	NO
1/7	LE Coded PHY	[3] 3,4	C.2	YES
1/8	Transmitting Constant Tone Extensions	[4] 5	C.10	NO
1/9	2 μs Antenna Switching During Constant Tone Extension Transmission (AoD)	[4] 5	C.5	NO
1/10	1 μs Antenna Switching During Constant Tone Extension Transmission (AoD)	[4] 5	C.6	NO
1/11	2 μs Antenna Sampling During Constant Tone Extension Reception (AoD)	[4] 5	C.11	NO
1/12	2 μs Antenna Switching and Sampling During Constant Tone Extension Reception (AoA)	[4] 5	C.7	NO
1/13	1 μs Antenna Sampling During Constant Tone Extension Reception (AoD)	[4] 5	C.7	NO
1/14	1 μs Antenna Switching and Sampling During Constant Tone Extension Reception (AoA)	4] 5	C.8	NO
1/15	Power Class 1	[5] 4.6	C.9	NO

2/1	HCI Test Interface	[2] 2	C.1	YES
2/2	UART Test Interface	[2] 3	C.1	YES

C.1: Mandatory to support at least one of RFPHY 1/1 "LE Transmitter" OR RFPHY 1/2 "LE Receiver" OR RFPHY 1/3 "LE Transceiver". Note: Selecting both RFPHY 1/1 "LE Transmitter" and RFPHY 1/2 "LE Receiver" is equivalent to selecting RFPHY 1/3 "LE Transceiver" and vice versa.

C.2: Excluded IF SUM ICS 21/14 "Core v4.2", otherwise Optional.

C.3: Excluded IF SUM ICS 21/14 "Core v4.2", otherwise Optional IF RFPHY 1/1 "LE Transmitter" OR RFPHY 1/3 "LE Transceiver", otherwise Excluded.

C.4: Excluded IF SUM ICS 21/14 "Core v4.2", otherwise Optional IF RFPHY 1/2 "LE Receiver" OR RFPHY 1/3 "LE Transceiver", otherwise Excluded.

C.5: Optional IF RFPHY 1/8 "Transmitting Constant Tone Extensions", otherwise Excluded.

C.6: Optional IF RFPHY 1/9 "2 µs Antenna Switching During Constant Tone Extension Transmission (AoD)", otherwise Excluded.

C.7: Optional IF RFPHY 1/11 "2 µs Antenna Sampling During Constant Tone Extension Reception (AoD)", otherwise Excluded.

C.8: Mandatory IF RFPHY 1/12 "2 µs Antenna Switching and Sampling During Constant Tone Extension Reception (AoA)" AND RFPHY 1/13 "1 µs Antenna Sampling During Constant Tone Extension Reception (AoD)", otherwise Excluded.

C.9: Excluded IF SUM ICS 21/14 "Core v4.2" AND NOT SUM ICS 21/15 "CSA 5", otherwise Optional IF RFPHY 1/1 "LE Transmitter" OR RFPHY 1/3 "LE Transceiver", otherwise Excluded.

C.10: Excluded IF SUM ICS 21/14 "Core v4.2" OR SUM ICS 21/16 "Core v5.0", otherwise Optional IF RFPHY 1/1 "LE Transmitter" OR RFPHY 1/3 "LE Transceiver", otherwise Excluded.

C.11: Excluded IF SUM ICS 21/14 "Core v4.2" OR SUM ICS 21/16 "Core v5.0", otherwise Optional IF RFPHY 1/2 "LE Receiver" OR RFPHY 1/3 "LE Transceiver", otherwise Excluded.

C.1: Mandatory to support at least one of RFPHY 2/1 "HCI Test Interface" OR RFPHY 2/2 "UART Test Interface".

Table 2:PIXIT for Conformance Test : Implementation eXtra Information for Test

Identifier	Description	Value	Units	Comments
TSPX_ OUT_RX_Image_Freq_Low	Inband Image Frequency (1Ms/s uncoded or coded), Low	3	MHz	Chapter 4.5.2, 4.5.8, 4.5.14, 4.5.20, 4.5.27, 4.5.28, 4.5.33 and 4.5.34, Bluetooth Low Energy RF-PHY Test Suite Chapter 4.2, Vol 6, Part A, Core Specification
TSPX_OUT_RX_Image_ Freq_Mid	Inband Image Frequency (1Ms/s uncoded or coded), Middle	3	MHz	
TSPX_OUT_RX_Image_ Freq_High	Inband Image Frequency (1Ms/s uncoded or coded), High	3	MHz	
TSPX_Intermod_Test_Number_Low	Test frequency for Intermodulation test, Low	5	Integer	Chapter 4.5.4, 4.5.10, 4.5.16 and 4.5.22, Bluetooth Low Energy RF-PHY Test Suite Chapter 4.4, Vol 6, Part A, Core Specification 3 or 4 or 5 is the allowed value here.
TSPX_Intermod_Test_Number_Medium	Test frequency for Intermodulation test, Middle	5	Integer	
TSPX_Intermod_Test_Number_High	Test frequency for Intermodulation test, High	5	Integer	
TSPX_Voltage_Nominal_ Value	Power source voltage	3.6	V	Vol. 6, Part A, Appendix A, Section A.1.2, Nominal Supply Voltage Chapter A.1.2, Vol 6, Part A, Core Specification.

TSPX_Temperature_Normal_Value	Normal operating temperature	25	°C	Vol. 6, Part A, Appendix A, Section A.1.1, Normal Temperature and Air Humidity. The NOC test temperature shall be within ±10° C of this value. Chapter A.1.1, Vol 2, Part A, Core Specification.
TSPX_Air_Humidity	Air humidity level for NOC tests	60	%	The level shall be within declared range Chapter A.1.1, Vol 2, Part A, Core Specification.
TSPX_Test_Interface	Test interface implementation	HCI	text	HCI or 2-wire UART Chapter 1, Vol 6, Part F, Core Specification
TSPX_MAX_TX_LENGTH	Maximum TX packet length (MAX_TX_LENGTH)	37	Bytes	Chapter 6.7, Bluetooth Low Energy RF-PHY Test Suite Chapter 4, Vol 6, Part F, Core Specification. A Integer Value in the range of 37 to 255 Bytes is reasonable here.
TSPX_MAX_RX_LENGTH	Maximum RX packet length (MAX_RX_LENGTH)	37	Bytes	
TSPX_MAX_TX_LENGTH_2M	Maximum TX packet length (MAX_TX_LENGTH_2M)	37	Bytes	
TSPX_MAX_TX_LENGTH_CODED_S2	Maximum TX packet length (MAX_TX_LENGTH_CODED_S2)	37	Bytes	
TSPX_MAX_TX_LENGTH_CODED_S8	Maximum TX packet length (MAX_TX_LENGTH_CODED_S8)	37	Bytes	

TSPX_MAX_RX_LENGTH_2M	Maximum RX packet length (MAX_RX_LENGTH_2M)	37	Bytes	Chapter 6.7, Bluetooth Low Energy RF-PHY Test Suite Chapter 4, Vol 6, Part F, Core Specification. A Integer Value in the range of 37 to 255 Bytes is reasonable here.
TSPX_MAX_RX_LENGTH_CODED_S2	Maximum RX packet length (MAX_RX_LENGTH_CODED_S2)	37	Bytes	
TSPX_MAX_RX_LENGTH_CODED_S8	Maximum RX packet length (MAX_RX_LENGTH_CODED_S8)	37	Bytes	
TSPX_MAX_TX_Power	Maximum TX mode output power	6.516	dBm	Part A, Chapter 3, Bluetooth Low Energy Controller Specification Chapter 3, Vol 6, Part A, Core Specification. A value in the range of -20 to 20 dBm is the allowed one.
TSPX_OUT_RX_Image_Freq_2M_Low	Inband Image Frequency (2Ms/s), Low	3	MHz	Chapter 4.5.2, 4.5.8, 4.5.14, 4.5.20, 4.5.27, 4.5.28, 4.5.33 and 4.5.34, Bluetooth Low Energy RF-PHY Test Suite Chapter 4.2, Vol 6, Part A, Core Specification
TSPX_OUT_RX_Image_Freq_2M_Mid	Inband Image Frequency (2Ms/s), Middle	3	MHz	
TSPX_OUT_RX_Image_Freq_2M_High	Inband Image Frequency (2Ms/s), High	3	MHz	
TSPX_Intermod_Test_Number_2M_Low	Value n for Intermodulation test (2Ms/s), Low	5	Integer	Chapter 4.5.4, 4.5.10, 4.5.16 and 4.5.22, Bluetooth Low Energy RF-PHY Test Suite Chapter 4.4, Vol 6, Part A, Core Specification 3 or 4 or 5 is the allowed value here.

TSPX_Intermod_Test_Number_2M_Mid	Value n for Intermodulation test (2Ms/s), Middle	5	Integer	
TSPX_Intermod_Test_Number_2M_High	Value n for Intermodulation test (2Ms/s), high	5	Integer	
TSPX_OUT_RX_Image_Freq_SMI_Low	Inband Image Frequency (Stable Modulation Receiver, 1Ms/s uncoded or coded), Low	N/A	MHz	Chapter 4.5.2, 4.5.8, 4.5.14, 4.5.20, 4.5.27, 4.5.28, 4.5.33 and 4.5.34, Bluetooth Low Energy RF-PHY Test Suite Chapter 4.2, Vol 6, Part A, Core Specification
TSPX_OUT_RX_Image_Freq_SMI_Mid	Inband Image Frequency (Stable Modulation Receiver, 1Ms/s uncoded or coded), Middle	N/A	MHz	
TSPX_OUT_RX_Image_Freq_SMI_High	Inband Image Frequency (Stable Modulation Receiver, 1Ms/s uncoded or coded), High	N/A	MHz	
TSPX_Intermod_Test_Number_SMI_Low	Value n for Intermodulation test (Stable Modulation Receiver), Low	N/A	Integer	Chapter 4.5.4, 4.5.10, 4.5.16 and 4.5.22, Bluetooth Low Energy RF-PHY Test Suite Chapter 4.4, Vol 6, Part A, Core Specification 3 or 4 or 5 is the allowed value here.

TSPX_Intermod_Test_Number_SMI_Mid	Value n for Intermodulation test (Stable Modulation Receiver), Middle	N/A	Integer	
TSPX_Intermod_Test_Number_SMI_High	Value n for Intermodulation test (Stable Modulation Receiver), Hgh	N/A	Integer	
TSPX_OUT_RX_Image_Freq_2M_SMI_Low	Inband Image Frequency (Stable Modulation Receiver, 2Ms/s), Low	N/A	MHz	Chapter 4.5.2, 4.5.8, 4.5.14, 4.5.20, 4.5.27, 4.5.28, 4.5.33 and 4.5.34, Bluetooth Low Energy RF-PHY Test Suite Chapter 4.2, Vol 6, Part A, Core Specification
TSPX_OUT_RX_Image_Freq_2M_SMI_Mid	Inband Image Frequency (Stable Modulation Receiver, 2Ms/s), Middle	N/A	MHz	
TSPX_OUT_RX_Image_Freq_2M_SMI_High	Inband Image Frequency (Stable Modulation Receiver, 2Ms/s), High	N/A	MHz	
TSPX_Intermod_Test_Number_2M_SMI_Low	Value n for Intermodulation test (Stable Modulation Receiver, 2Ms/s), Low	N/A	Integer	Chapter 4.5.4, 4.5.10, 4.5.16 and 4.5.22, Bluetooth Low Energy RF-PHY Test Suite Chapter 4.4, Vol 6, Part A, Core Specification 3 or 4 or 5 is the allowed value here.

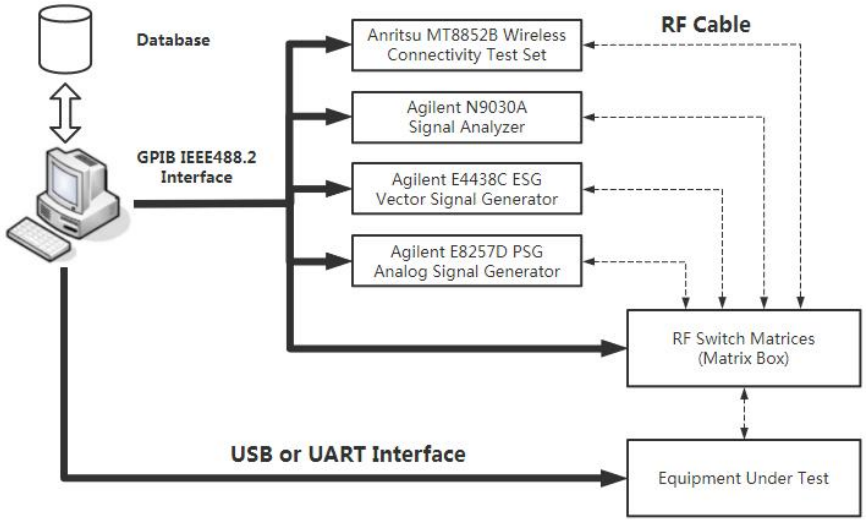
TSPX_Intermod_Test_Number_2M_SMI_Mid	Value n for Intermodulation test (Stable Modulation Receiver, 2Ms/s), Middle	N/A	Integer	
TSPX_Intermod_Test_Number_2M_SMI_High	Value n for Intermodulation test (Stable Modulation Receiver, 2Ms/s), High	N/A	Integer	
TSPX_IQ_Report_Rate	IQ Report Rate	0x0006 to 0xFFFF	Hex	Indicates the rate of the IQ report generation. Advertising interval for periodic advertising = N * 1.25ms, N = 0x0006-0xFFFF. Time Range: 7.5 ms - 81.91875 seconds. Vol 4, Part E, Section 7.7.65.22, Core Specification. 0x0006 to 0xFFFF is the allowed range here.
TSPX_CTE_len_max	The length of the Constant Tone Extension(1Ms/s)	16 to 160	bits	Vol. 6, Part F, 4, Section 4.1.7, Constant Tone Extension, RF Test Suite Vol 4, Part E, Section 7.7.87, Core Specification.
TSPX_CTE_len_max	The length of the Constant Tone Extension(2Ms/s)	32 to 320	bits	Vol. 6, Part F, 4, Section 4.1.7, Constant Tone Extension, RF Test Suite Vol 4, Part E, Section 7.7.87, Core Specification.

TSPX_number_of_antennae	The number of antennae	N/A	Integer	Vol 4, Part E, Section 7.7.87, Core Specification. 2 or 3 or 4 is the allowed value here.
TSPX_Antenna_Gain	Antenna gain	0	dBi	Vol 6, Part A, Section 3, RFPHY Test Suite
TSPX_Antenna_IDs	An array specifying the antenna ID numbers for the IUT, corresponding to the A0, A1, A2, A3 antenna designations in the test setup.	N/A	N/A	Vol 6, Part A, Section 5.2.3, Core Specification. Chapter 4.6.2, Bluetooth Low Energy RFPHY Test Suite. For AoA and AoD testing, this array may be used to describe a vendor-specific antenna switching pattern. The size of the array is equal to TSPX_number_of_antennae. The values in the array represent the antenna IDs used in the switching pattern. If not specified, the default is ascending numerical order.

Annex B. TEST SYSTEM

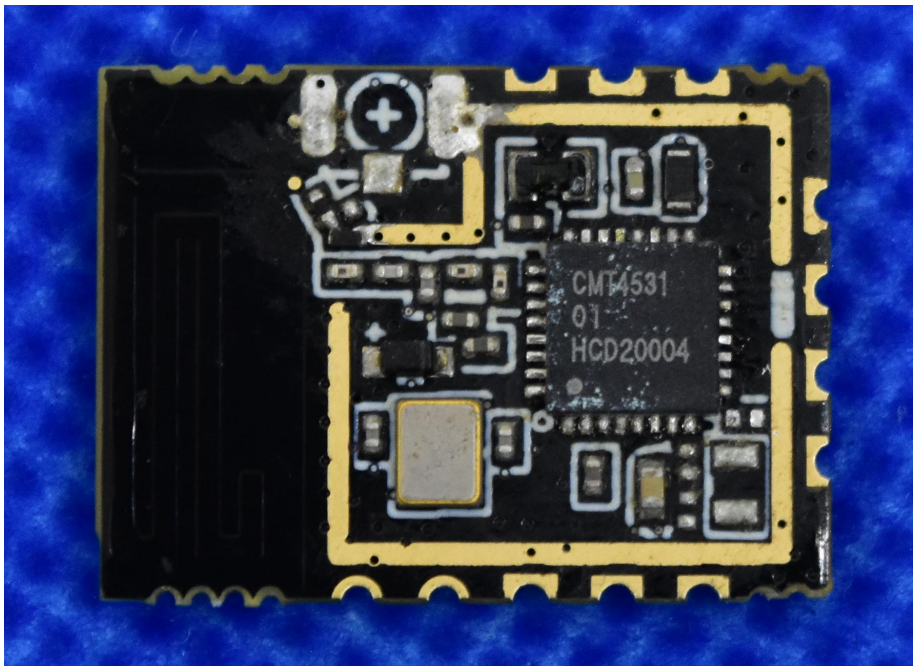
Equipment Name	Serial No.	Type	Manufacturer	Cal Date	Due Date
CTTL-SYSTEMS-RTSB-A Test System					
Spectrum Analyser	MY53120346	N9030A	Keysight	2023.06.21	2024.06.20
RF Signal Generator	MY45095851	E4438C	Agilent	2023.02.09	2024.02.08
Wideband Generator	MY47461226	E8257D	Agilent	2023.02.09	2024.02.08
Signalling Unit	6K00005351	MT8852B	Anritsu	2022.10.11	2023.10.10
Industrial PC	--	TEMPEL	Advantech	--	--
RTSB-A Switch Unit	A010208AZ07	RTSB-A	CTTL	--	--
RF Tester Software	--	SW ver. 3.23.1	CTTL	--	--

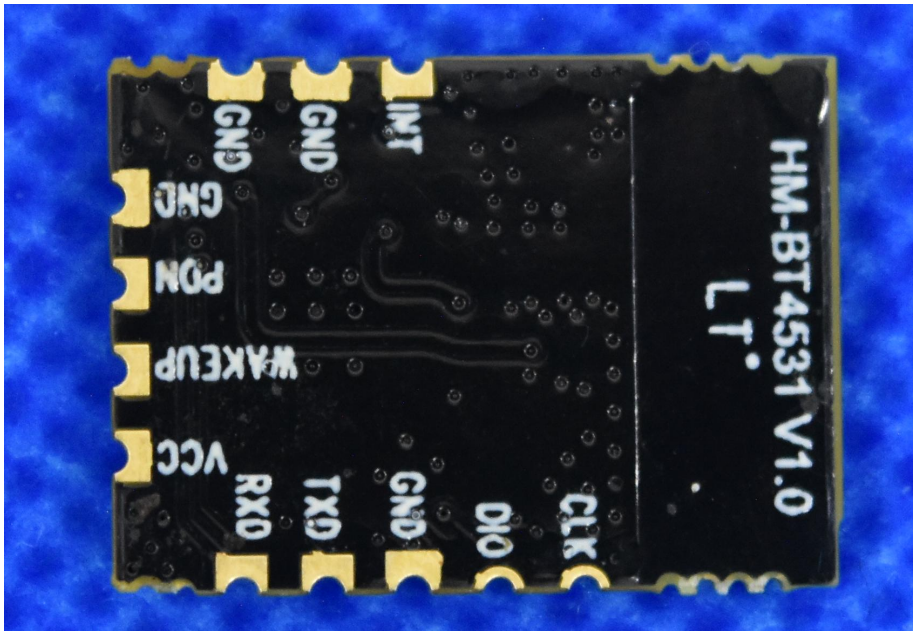
Annex C. TEST SETUP



CTTL-SYSTEMS-RTSB-A Test System

Annex D. EUT PHOTO





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