

# FCC RF Test Report

APPLICANT	: Quectel Wireless Solutions Co., Ltd.
EQUIPMENT	: Wi-Fi & Bluetooth Module
BRAND NAME	: Quectel
MODEL NAME	: FCS850R-B
FCC ID	: XMR2023FCS850RB
STANDARD	: FCC Part 15 Subpart C §15.247
CLASSIFICATION	: (DTS) Digital Transmission System
TEST DATE(S)	: Apr. 04, 2023 ~ May 16, 2023

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

JasonJia

Approved by: Jason Jia



**Sporton International Inc. (Kunshan)** No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China



# TABLE OF CONTENTS

		N HISTORY	
SUI	MMAR	RY OF TEST RESULT	4
1	GENE	ERAL DESCRIPTION	5
	1.1	Applicant	5
	1.2	Manufacturer	5
	1.3	Product Feature of Equipment Under Test	5
	1.4	Product Specification of Equipment Under Test	5
	1.5	Modification of EUT	5
	1.6	Testing Location	6
	1.7	Test Software	6
	1.8	Applicable Standards	6
2	TEST	CONFIGURATION OF EQUIPMENT UNDER TEST	7
	2.1	Carrier Frequency Channel	7
	2.2	Test Mode	-
	2.3	Connection Diagram of Test System	9
	2.4	Support Unit used in test configuration and system	
	2.5	EUT Operation Test Setup	10
	2.6	Measurement Results Explanation Example	
3	TEST	RESULT	
	3.1	6dB and 99% Bandwidth Measurement	11
	3.2	Output Power Measurement	18
	3.3	Power Spectral Density Measurement	19
	3.4	Conducted Band Edges and Spurious Emission Measurement	26
	3.5	Radiated Band Edges and Spurious Emission Measurement	35
	3.6	AC Conducted Emission Measurement	39
	3.7	Antenna Requirements	
4	LIST	OF MEASURING EQUIPMENT	42
5	MEAS	SUREMENT UNCERTAINTY	43
AP	PEND	IX A. CONDUCTED TEST RESULTS	
API	PEND	IX B. AC CONDUCTED EMISSION TEST RESULT	
AP	PEND	IX C. RADIATED SPURIOUS EMISSION	
AP	PEND	IX D. DUTY CYCLE PLOTS	

**APPENDIX E. SETUP PHOTOGRAPHS** 



# **REVISION HISTORY**

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR2D2912B	Rev. 01	Initial issue of report	May 31, 2023



# SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	≥ 0.5MHz	Pass	-
3.1	-	99% Bandwidth	-	Report only	-
3.2	15.247(b)(3)	Peak Output Power	≤ 30dBm	Pass	-
3.3	15.247(e)	Power Spectral Density ≤ 8dBm/3kHz Pass		Pass	-
3.4	15.247(d) Conducted Band Edges and Spurious Emission		≤ 20dBc	Pass	-
3.5	15.247(d)	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 3.12 dB at 4804.00 MHz
3.6	15.207	AC Conducted Emission	onducted Emission 15.207(a) Pass		Under limit 12.15 dB at 0.155 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	15.203 & 15.247(b)	Pass	-

### **Conformity Assessment Condition:**

 The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.

2. The measurement uncertainty please refer to each test result in the section "Measurement Uncertainty"

#### **Disclaimer:**

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.



# **1** General Description

# 1.1 Applicant

### Quectel Wireless Solutions Co., Ltd.

Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China

# 1.2 Manufacturer

### **Quectel Wireless Solutions Co., Ltd.**

Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China

# **1.3 Product Feature of Equipment Under Test**

Product Feature			
Equipment	Wi-Fi & Bluetooth Module		
Brand Name	Quectel		
Model Name	FCS850R-B		
FCC ID	XMR2023FCS850RB		
SN	Conducted: YY230217000024 Conduction: YY230217000010 Radiation: YY230217000033		
HW Version	R1.0		
EUT Stage	Identical Prototype		

**Remark:** The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

# **1.4 Product Specification of Equipment Under Test**

Standards-related Product Specification			
Tx/Rx Frequency Range 2402 MHz ~ 2480 MHz			
Number of Channels	40		
Carrier Frequency of Each Channel    40 Channel(37 hopping + 3 advertising channel)			
Maximum Qutnut Bawar to Antonno	Bluetooth LE 1Mbps: 10.68 dBm (0.0117 W)		
Maximum Output Power to Antenna	Bluetooth LE 2Mbps: 10.70 dBm (0.0117 W)		
99% Occupied Bandwidth	Bluetooth LE 1Mbps: 1.02 MHz		
	Bluetooth LE 2Mbps: 2.03 MHz		
Antenna Type / Gain	Dipole Antenna with gain 0.73 dBi		
Type of Modulation      Bluetooth LE : GFSK			

# **1.5 Modification of EUT**

No modifications are made to the EUT during all test items.



# **1.6 Testing Location**

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International Inc. (Kunshan)			
	No. 1098, Pengxi North Road, Kunshan Economic Development Zone			
Test Site Location	Jiangsu Province 215300 People's Republic of China			
	TEL : +86-512-57900158			
	Sporton Sito No	FCC Designation No.	FCC Test Firm	
Test Site No.	Sporton Site No.	FCC Designation No.	Registration No.	
Test one NU.	CO01-KS 03CH06-KS TH01-KS	CN1257	314309	

# 1.7 Test Software

ltem	Site	Manufacturer	Name	Version
1.	03CH06-KS	AUDIX	E3	6.2009-8-24al
2.	CO01-KS	AUDIX	E3	6.2009-8-24

# 1.8 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 15 Subpart C §15.247
- FCC KDB 558074 D01 15.247 Meas Guidance v05r02
- ANSI C63.10-2013

### Remark:

- 1. All test items were verified and recorded according to the standards and without any deviation during the test.
- 2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.



# 2 Test Configuration of Equipment Under Test

# 2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
	0	2402	21	2444
	1	2404	22	2446
	2	2406	23	2448
	3	2408	24	2450
	4	2410	25	2452
	5	2412	26	2454
	6	2414	27	2456
	7	2416	28	2458
	8	2418	29	2460
	9	2420	30	2462
2400-2483.5 MHz	10	2422	31	2464
	11	2424	32	2466
	12	2426	33	2468
	13	2428	34	2470
	14	2430	35	2472
	15	2432	36	2474
	16	2434	37	2476
	17	2436	38	2478
	18	2438	39	2480
	19	2440	-	-
	20	2442	-	-



# 2.2 Test Mode

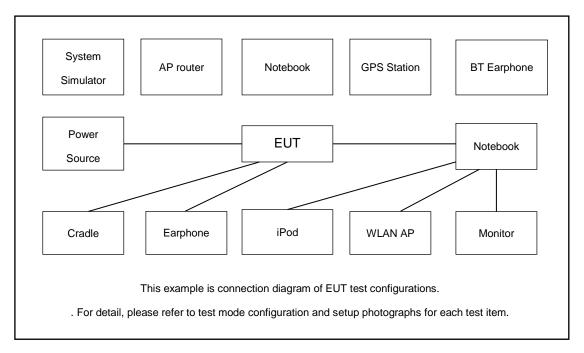
- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

The following summary fal	ble is showing all test modes	to demonstrate in compliance	e with the standard
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	Summary table of Test Cases
Test Item	Data Rate / Modulation
Test item	Bluetooth – LE / GFSK
Conducted	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps & 2Mbps
TCs	Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps & 2Mbps
105	Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps & 2Mbps
Radiated	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps & 2Mbps
TCs	Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps & 2Mbps
TCS	Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps & 2Mbps
AC	
Conducted	Mode 1: BT Link+ EUT(Powered from Test Jig)
Emission	



# 2.3 Connection Diagram of Test System



# 2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	D-link	DIR-655	KA21R655B1	N/A	Unshielded,1.8m
2.	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
3.	Test Jig	Quectel	N/A	N/A	N/A	N/A
4.	Hard DISK	WD	C6B	N/A	N/A	N/A



# 2.5 EUT Operation Test Setup

For BLE function, the engineering test program was provided and enabled to make EUT continuous transmit.

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.

# 2.6 Measurement Results Explanation Example

### For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss.

Offset = RF cable loss.

Following shows an offset computation example with cable loss 5.8 dB.

 $Offset(dB) = RF \ cable \ loss(dB).$ = 5.8 (dB)



# 3 Test Result

# 3.1 6dB and 99% Bandwidth Measurement

# 3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

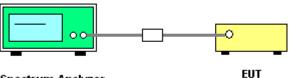
### 3.1.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

### 3.1.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 11.8
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
- 5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1% to 5% of the 99% OBW and the VBW is set to 3 times of the RBW.
- 6. Measure and record the results in the test report.

# 3.1.4 Test Setup



Spectrum Analyzer



### 3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.

### Bluetooth LE 1Mbps:

### 6 dB Bandwidth Plot on Channel 00



Date: 4.APR.2023 23:39:15

### 6 dB Bandwidth Plot on Channel 19



Date: 4.APR.2023 23:42:14

Span 2.0 MHz

B 446



#### Spectrum Offset 5.80 dB ● RBW 100 kHz SWT 1 ms ● VBW 300 kHz RefLevel 15.80 dBm Att 20 dB Mode Sweep ●1Pk Ma: 3.87 dBn 2.47967400 GH M1[1] 10 dBr D1 9.810 di M1 D2[1] Q2 0.14 dl -D2 3.810 dBm 666.00 kH 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm -80 dBm

1001 pts

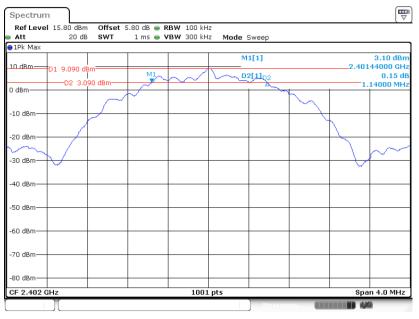
#### 6 dB Bandwidth Plot on Channel 39

Date: 4.APR.2023 23:45:04

CF 2.48 GHz

### **Bluetooth LE 2Mbps:**

#### 6 dB Bandwidth Plot on Channel 00



Date: 4.APR.2023 23:48:12





#### 6 dB Bandwidth Plot on Channel 19

Date: 4.APR.2023 23:51:18

#### 6 dB Bandwidth Plot on Channel 39



Date: 4.APR.2023 23:53:35

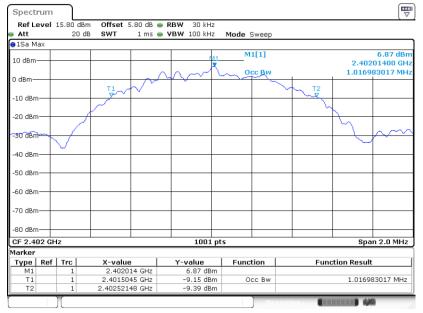


### 3.1.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

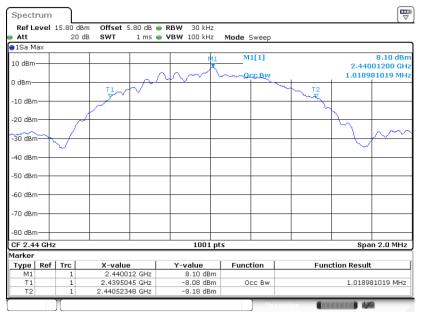
### Bluetooth LE 1Mbps:

### 99% Occupied Bandwidth Plot on Channel 00



Date: 4.APR.2023 23:41:02

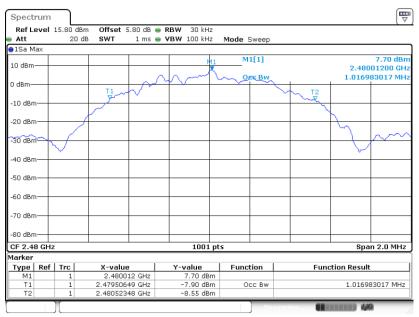
### 99% Occupied Bandwidth Plot on Channel 19



Date: 4.APR.2023 23:44:01

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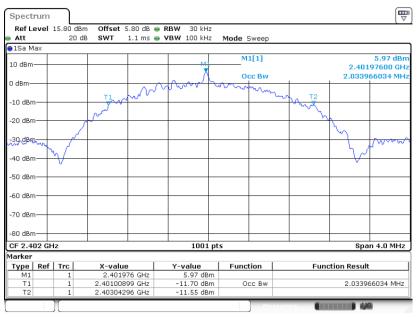


#### 99% Occupied Bandwidth Plot on Channel 39

Date: 4.APR.2023 23:46:51

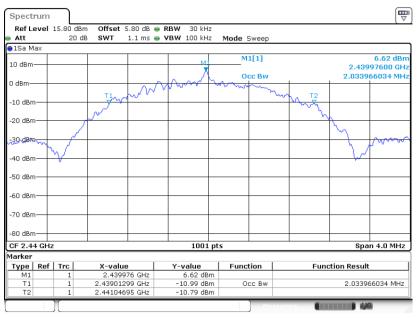
### Bluetooth LE 2Mbps:

#### 99% Occupied Bandwidth Plot on Channel 00



Date: 4.APR.2023 23:50:00

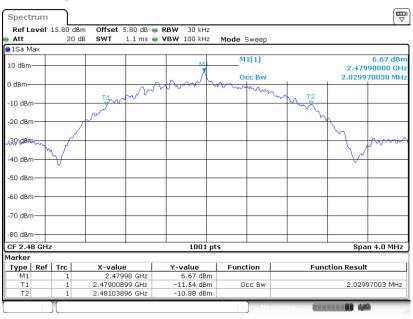




### 99% Occupied Bandwidth Plot on Channel 19

Date: 4.APR.2023 23:53:05

### 99% Occupied Bandwidth Plot on Channel 39



Date: 4.APR.2023 23:55:22

Note : The occupied channel bandwidth is maintained within the band of operation for all of the modulations.



# 3.2 Output Power Measurement

# 3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna of directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6 dBi.

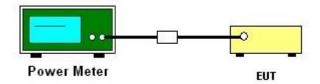
# **3.2.2 Measuring Instruments**

The section 4.0 of List of Measuring Equipment of this test report is used for test.

### 3.2.3 Test Procedures

- The testing follows the Measurement Procedure of ANSI C63.10-2013 clause 11.9.1.3 PKPM1 Peak power meter or ANSI C63.10-2013 clause 11.9.2.3.1 Method AVGPM method.
- 2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Measure the conducted output power and record the results in the test report.

### 3.2.4 Test Setup



# 3.2.5 Test Result of Peak Output Power

Please refer to Appendix A.

# 3.2.6 Test Result of Average Output Power (Reporting Only)

Please refer to Appendix A.



# 3.3 Power Spectral Density Measurement

# 3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

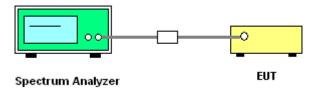
# 3.3.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

# 3.3.3 Test Procedures

- 1. The testing follows Measurement Procedure of ANSI C63.10-2013 clause 11.10.2 Method PKPSD.
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz.
  Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
- 5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
- 6. Measure and record the results in the test report.
- 7. The Measured power density (dBm)/ 100kHz is a reference level and used as 20dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

# 3.3.4 Test Setup



# 3.3.5 Test Result of Power Spectral Density

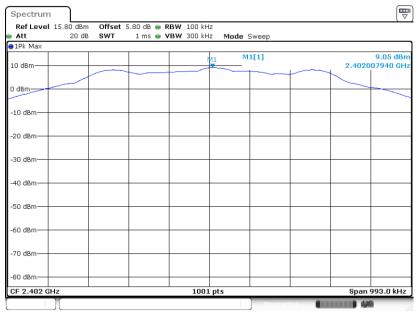
Please refer to Appendix A.



## 3.3.6 Test Result of Power Spectral Density Plots (100kHz)



### PSD 100kHz Plot on Channel 00



Date: 4.APR.2023 23:39:53

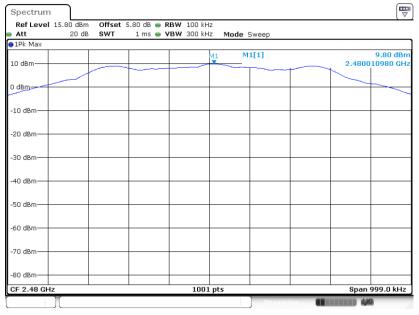
### PSD 100kHz Plot on Channel 19



Date: 4.APR.2023 23:42:52



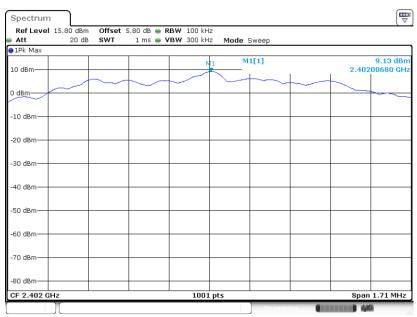
### PSD 100kHz Plot on Channel 39



Date: 4.APR.2023 23:45:42

### Bluetooth LE 2Mbps:

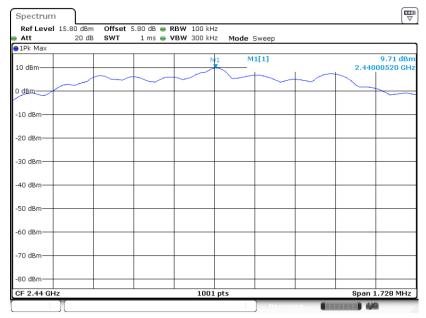
### PSD 100kHz Plot on Channel 00



Date: 4.APR.2023 23:48:51

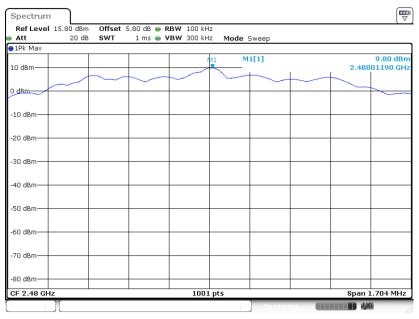


### PSD 100kHz Plot on Channel 19



Date: 4.APR.2023 23:51:56

#### PSD 100kHz Plot on Channel 39



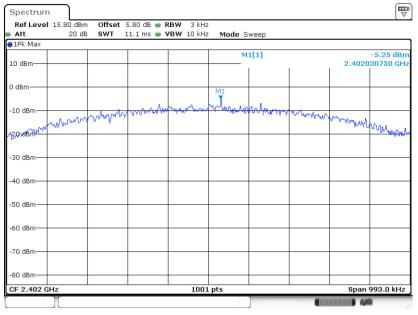
Date: 4.APR.2023 23:54:13



# 3.3.7 Test Result of Power Spectral Density Plots (3kHz)

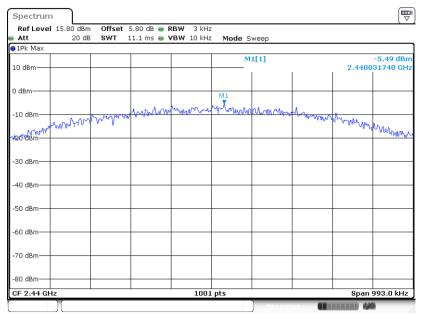


### PSD 3kHz Plot on Channel 00



Date: 4.APR.2023 23:39:34

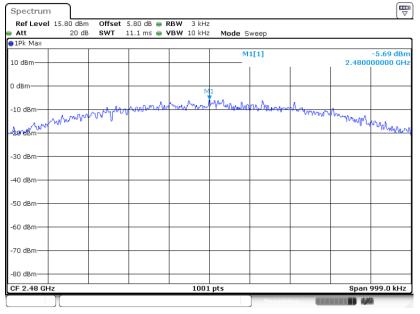
### PSD 3kHz Plot on Channel 19



Date: 4.APR.2023 23:42:33



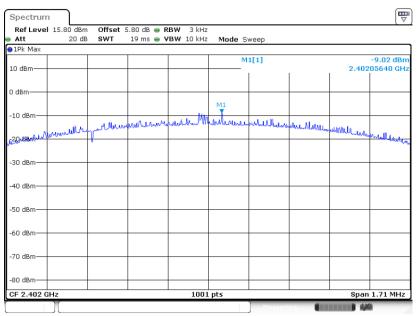
### PSD 3kHz Plot on Channel 39



Date: 4.APR.2023 23:45:24

### Bluetooth LE 2Mbps:

### PSD 3kHz Plot on Channel 00



Date: 4.APR.2023 23:48:32

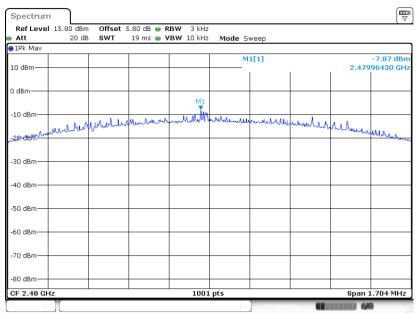


### PSD 3kHz Plot on Channel 19

Att	15.80 dBm 20 dB		5.80 dB 👄 I 19.2 ms 👄 '	RBW 3 kHz VBW 10 kHz	Mode Sv	veep			
●1Pk Max									
10 dBm					M1	[1]	I	2.440	-7.08 dBi 05350 GH
0 dBm					M1				
-10 dBm				LINE MAR	T				
Raden	monalited	-p-rutur	Martin and	umr		and all whether an	and a particular	Muruhanders	-ullagen
-30 dBm									
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									
-80 dBm									
CF 2.44 GH	lz			1001	pts			Span 1	L.728 MHz

Date: 4.APR.2023 23:51:37

#### PSD 3kHz Plot on Channel 39



Date: 4.APR.2023 23:53:54



# 3.4 Conducted Band Edges and Spurious Emission Measurement

# 3.4.1 Limit of Conducted Band Edges and Spurious Emission

All harmonics/spurious must be at least 20 dB down from the highest emission level within the authorized band.

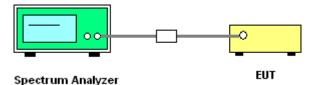
# 3.4.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

### 3.4.3 Test Procedure

- 1. The testing follows ANSI C63.10-2013 clause 11.13
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
- 5. Measure and record the results in the test report.
- 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

# 3.4.4 Test Setup

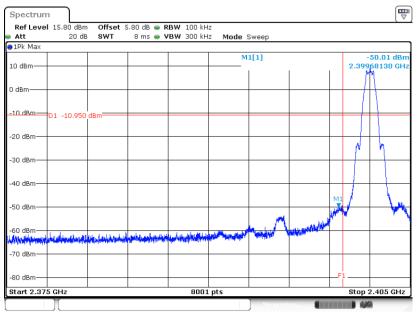




# 3.4.5 Test Result of Conducted Band Edges Plots

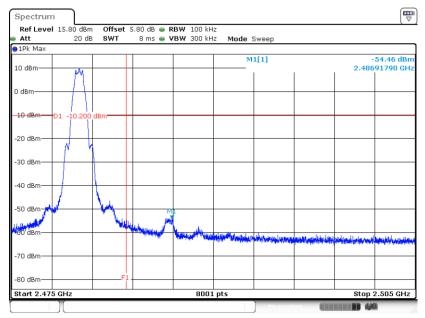
### Bluetooth LE 1Mbps:

### Low Band Edge Plot on Channel 00



Date: 4.APR.2023 23:40:12

### High Band Edge Plot on Channel 39

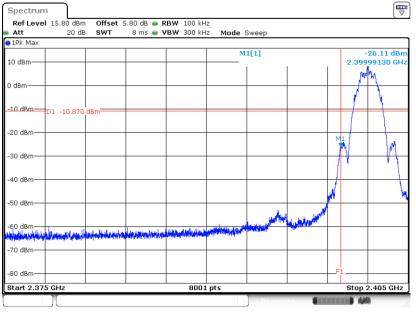


Date: 4.APR.2023 23:46:01



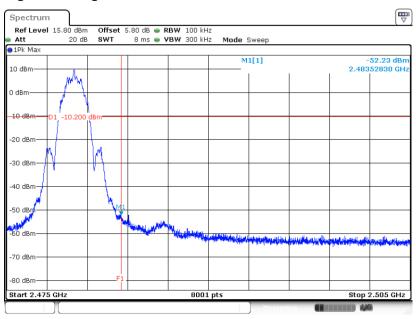
### Bluetooth LE 2Mbps:

### Low Band Edge Plot on Channel 00



Date: 4.APR.2023 23:49:10

### High Band Edge Plot on Channel 39



Date: 4.APR.2023 23:54:32

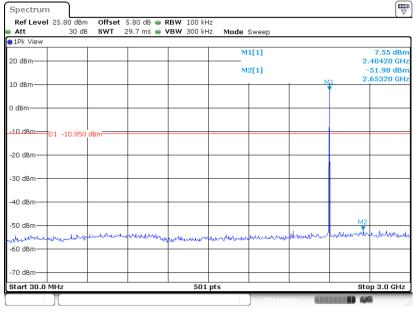


# 3.4.6 Test Result of Conducted Spurious Emission Plots

### Bluetooth LE 1Mbps:

### **Conducted Spurious Emission Plot on Bluetooth LE 1Mbps**

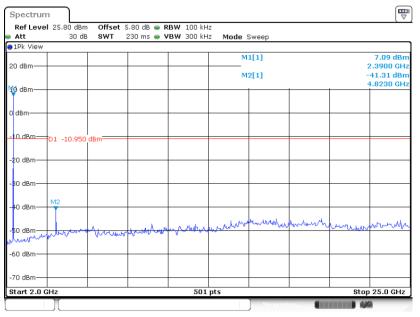
### GFSK Channel 00



Date: 4.APR.2023 23:40:33

# Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

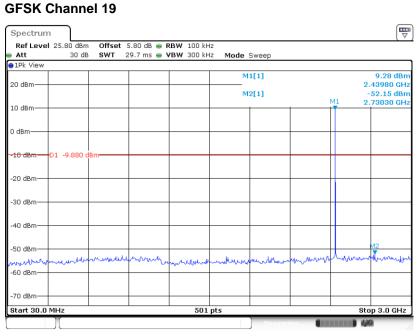
### GFSK Channel 00



Date: 4.APR.2023 23:40:54

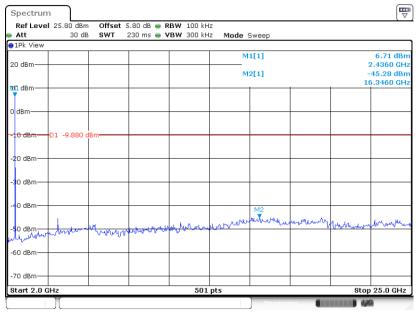


## Conducted Spurious Emission Plot on Bluetooth LE 1Mbps



Date: 4.APR.2023 23:43:32

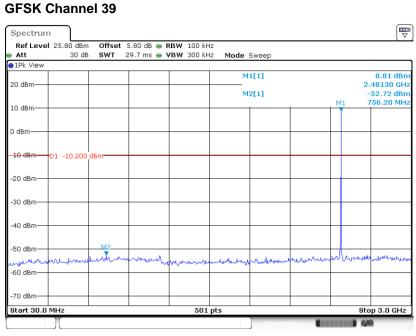
# Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 19



Date: 4.APR.2023 23:43:52

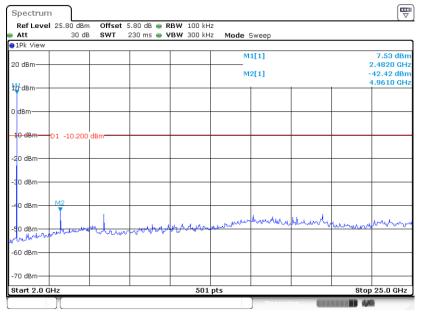


### Conducted Spurious Emission Plot on Bluetooth LE 1Mbps



#### Date: 4.APR.2023 23:46:22

# Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39

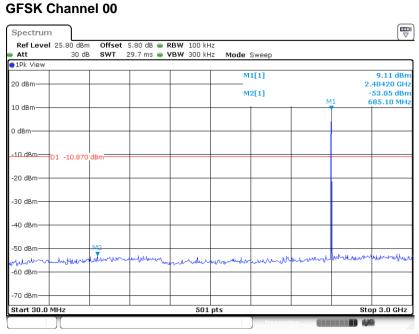


Date: 4.APR.2023 23:46:43



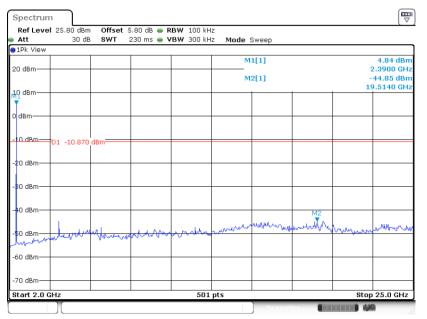
### Bluetooth LE 2Mbps:

### **Conducted Spurious Emission Plot on Bluetooth LE 1Mbps**



Date: 4.APR.2023 23:49:31

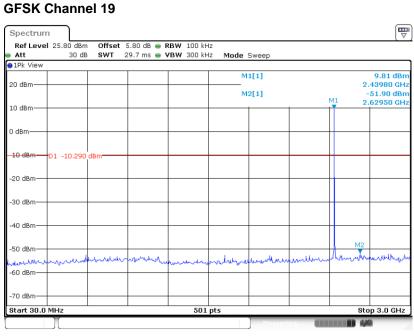
# Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 00



Date: 4.APR.2023 23:49:51

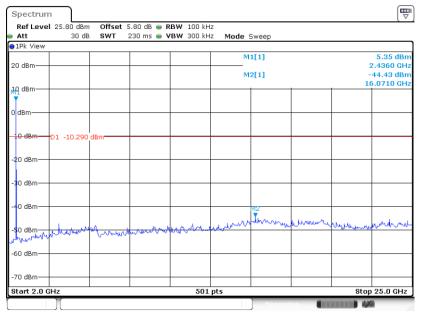


## Conducted Spurious Emission Plot on Bluetooth LE 1Mbps



#### Date: 4.APR.2023 23:52:36

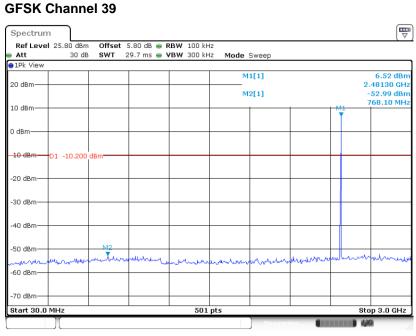
# Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 19



Date: 4.APR.2023 23:52:56

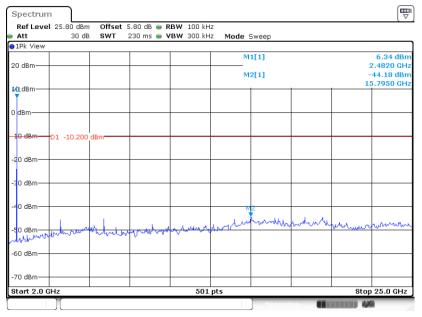


### Conducted Spurious Emission Plot on Bluetooth LE 1Mbps



Date: 4.APR.2023 23:54:53

# Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39



Date: 4.APR.2023 23:55:13



# 3.5 Radiated Band Edges and Spurious Emission Measurement

# 3.5.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

Frequency	Field Strength	Measurement Distance		
(MHz)	(microvolts/meter)	(meters)		
0.009 - 0.490	2400/F(kHz)	300		
0.490 – 1.705	24000/F(kHz)	30		
1.705 – 30.0	30	30		
30 – 88	100	3		
88 – 216	150	3		
216 - 960	200	3		
Above 960	500	3		

### 3.5.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.



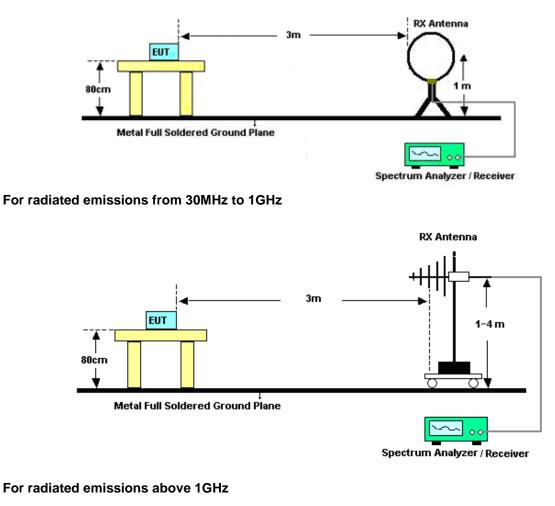
### 3.5.3 Test Procedures

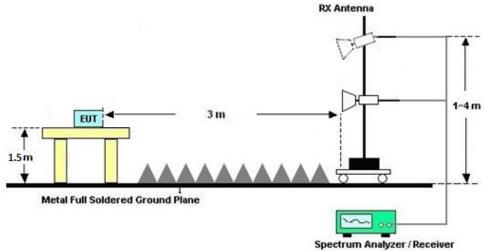
- 1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
- 2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
- 3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
- 4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- 5. Corrected Reading: Antenna Factor + Cable Loss + Read Level Preamp Factor = Level
- 6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
- 7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than peak limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- 8. Use the following spectrum analyzer settings:
  - (1) Span shall wide enough to fully capture the emission being measured;
  - (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
  - (3) Set RBW = 1 MHz, VBW= 3MHz for  $f \ge 1$  GHz for peak measurement. For average measurement:
    - VBW = 10 Hz, when duty cycle is no less than 98 percent.
    - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.



### 3.5.4 Test Setup

For radiated emissions below 30MHz





Sporton International Inc. (Kunshan) TEL : +86-512-57900158 FCC ID: XMR2023FCS850RB



### 3.5.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

### 3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

#### 3.5.7 Duty Cycle

Please refer to Appendix D.

# 3.5.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic or 40GHz, whichever is lower)

Please refer to Appendix C.



# 3.6 AC Conducted Emission Measurement

### 3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBµV)					
Frequency of emission (MHZ)	Quasi-peak	Average				
0.15-0.5	66 to 56*	56 to 46*				
0.5-5	56	46				
5-30	60	50				

\*Decreases with the logarithm of the frequency.

### 3.6.2 Measuring Instruments

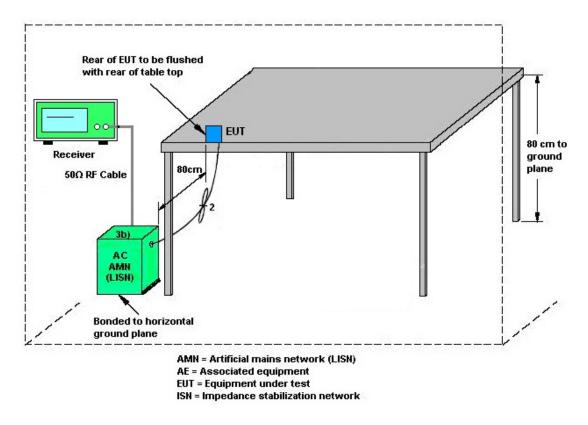
The section 4.0 of List of Measuring Equipment of this test report is used for test.

#### 3.6.3 Test Procedures

- 1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- 2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- 3. All the support units are connecting to the other LISN.
- 4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- 5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
- 6. Both sides of AC line were checked for maximum conducted interference.
- 7. The frequency range from 150 kHz to 30 MHz was searched.
- Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.



# 3.6.4 Test Setup



### 3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



# 3.7 Antenna Requirements

### 3.7.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

## 3.7.2 Antenna Anti-Replacement Construction

Non-standard antenna connector is used.

## 3.7.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



# 4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Oct. 12, 2022	Apr. 04, 2023	Oct. 11, 2023	Conducted (TH01-KS)
Pulse Power Senor	Δητίτει		0917070	300MHz~40GHz	Jan. 04, 2023	Apr. 04, 2023	Jan. 03, 2024	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 04, 2023	Apr. 04, 2023	Jan. 03, 2024	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY564000 04	3Hz~8.5GHz;Ma x 30dBm	Oct. 13, 2022	May 16, 2023	Oct. 12, 2023	Radiation (03CH06-KS)
EXA Spectrum Analyzer	Keysight	N9010B	MY602421 26	10Hz-44GHz	Oct. 13, 2022	May 16, 2023	Oct. 12, 2023	Radiation (03CH06-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 16, 2022	May 16, 2023	Oct. 15, 2023	Radiation (03CH06-KS)
Bilog Antenna	TeseQ	CBL6111D	49921	30MHz-1GHz	May 24, 2022	May 16, 2023	May 23, 2023	Radiation (03CH06-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00218652	1GHz~18GHz	Apr. 06, 2023	May 16, 2023	Apr. 05, 2024	Radiation (03CH06-KS)
SHF-EHF Horn	Com-power	AH-840	101093	18GHz~40GHz	Jan. 08, 2023	May 16, 2023	Jan. 07, 2024	Radiation (03CH06-KS)
Amplifier	SONOMA	310N	380827	9KHz ~1GHZ	Jul. 11, 2022	May 16, 2023	Jul. 10, 2023	Radiation (03CH06-KS)
Amplifier	MITEQ	EM18G40GG A	060728	18~40GHz	Jan. 05, 2023	May 16, 2023	Jan. 04, 2024	Radiation (03CH06-KS)
high gain Amplifier	MITEQ	AMF-7D-001 01800-30-10 P	2082395	1Ghz-18Ghz	Jan. 05, 2023	May 16, 2023	Jan. 04, 2024	Radiation (03CH06-KS)
Amplifier	Keysight	83017A	19	500MHz~26.5GH z	Oct. 12, 2022	May 16, 2023	Oct. 12, 2023	Radiation (03CH06-KS)
AC Power Source	Chroma	61601	F10409000 4	N/A	NCR	May 16, 2023	NCR	Radiation (03CH06-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	May 16, 2023	NCR	Radiation (03CH06-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	May 16, 2023	NCR	Radiation (03CH06-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	May 24, 2022	May 09, 2023	May 23, 2023	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 13, 2022	May 09, 2023	Oct. 12, 2023	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	May 24, 2022	May 09, 2023	May 23, 2023	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP00000 0811	AC 0V~300V, 45Hz~1000Hz	Oct. 12, 2022	May 09, 2023	Oct. 11, 2023	Conduction (CO01-KS)

NCR: No Calibration Required



# **5** Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

#### **Uncertainty of Conducted Measurement**

Test Item	Uncertainty			
Conducted Power	±0.46 dB			
Conducted Emissions	±0.48 dB			
Occupied Channel Bandwidth	±0.1 %			
Conducted Power Spectral Density	±0.40 dB			

#### Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence	2.94dB	
of 95% (U = 2Uc(y))	2.940B	

#### Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence	6.26dB	
of 95% (U = 2Uc(y))	0.20UB	

#### Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence	5.02dB	
of 95% (U = 2Uc(y))	5.020B	

#### Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence	5.26dB	
of 95% (U = 2Uc(y))	5.200B	

----- THE END ------



# **Appendix A. Conducted Test Results**

Report Number : FR2D2912B

#### Bluetooth Low Energy

Test Engineer:	Jiang Jun	Temperature:	20~26	°C
Test Date:	2023.04.04	Relative Humidity:	40~51	%

					<u>6d</u>	TEST	E1M RESULTS 6 Occupie	<u>DATA</u> d Bandwidi
Mod.	Data Rate	Ντx	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE	1Mbps	1	0	2402	1.02	0.66	0.50	Pass
BLE	1Mbps	1	19	2440	1.02	0.66	0.50	Pass
BLE	1Mbps	1	39	2480	1.02	0.67	0.50	Pass

<u>TEST RESULTS DATA</u> <u>Peak Power Table</u>												
Мос	d. Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail		
BLE	E 1Mbps	1	0	2402	10.06	30.00	0.73	10.79	36.00	Pass		
BLE	E 1Mbps	1	19	2440	10.68	30.00	0.73	11.41	36.00	Pass		
BLE	E 1Mbps	1	39	2480	10.55	30.00	0.73	11.28	36.00	Pass		

#### <u>TEST RESULTS DATA</u> <u>Average Power Table</u> (Reporting Only)

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
BLE	1Mbps	1	0	2402	0.68	9.76
BLE	1Mbps	1	19	2440	0.68	10.40
BLE	1Mbps	1	39	2480	0.68	10.27

#### TEST RESULTS DATA Peak Power Density

Mod.	Data Rate	Ντx	CH.	Freq. (MHz)	Peak PSD (dBm /100kHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
BLE	1Mbps	1	0	2402	9.05	-5.25	0.73	8.00	Pass
BLE	1Mbps	1	19	2440	10.12	-5.49	0.73	8.00	Pass
BLE	1Mbps	1	39	2480	9.80	-5.69	0.73	8.00	Pass

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 20dBc limit.

Report Number : FR2D2912B

#### Bluetooth Low Energy

Test Engineer:	Jiang Jun	Temperature:	20~26	°C
Test Date:	2023.04.04	Relative Humidity:	40~51	%

BLE2M <u>TEST RESULTS DATA</u> <u>6dB and 99% Occupied Bandwidth</u>								
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE	2Mbps	1	0	1000	2.03	1.14	0.50	Pass
BLE	2Mbps	1	19	2440	2.03	1.15	0.50	Pass
BLE	2Mbps	1	39	2480	2.03	1.14	0.50	Pass

	<u>TEST RESULTS DATA</u> <u>Peak Power Table</u>												
Mod.	Data Rate	Ntx	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail			
BLE	2Mbps	1	0	2402	10.19	30.00	0.73	10.92	36.00	Pass			
BLE	2Mbps	1	19	2440	10.70	30.00	0.73	11.43	36.00	Pass			
BLE	2Mbps	1	39	2480	10.62	30.00	0.73	11.35	36.00	Pass			

#### <u>TEST RESULTS DATA</u> <u>Average Power Table</u> <u>(Reporting Only)</u>

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
BLE	2Mbps	1	0	2402	2.42	9.90
BLE	2Mbps	1	19	2440	2.42	10.63
BLE	2Mbps	1	39	2480	2.42	10.55

#### TEST RESULTS DATA Peak Power Density

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak PSD (dBm /100kHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
BLE	2Mbps	1	0	2402	9.13	-9.02	0.73	8.00	Pass
BLE	2Mbps	1	19	2440	9.71	-7.08	0.73	8.00	Pass
BLE	2Mbps	1	39	2480	9.80	-7.87	0.73	8.00	Pass

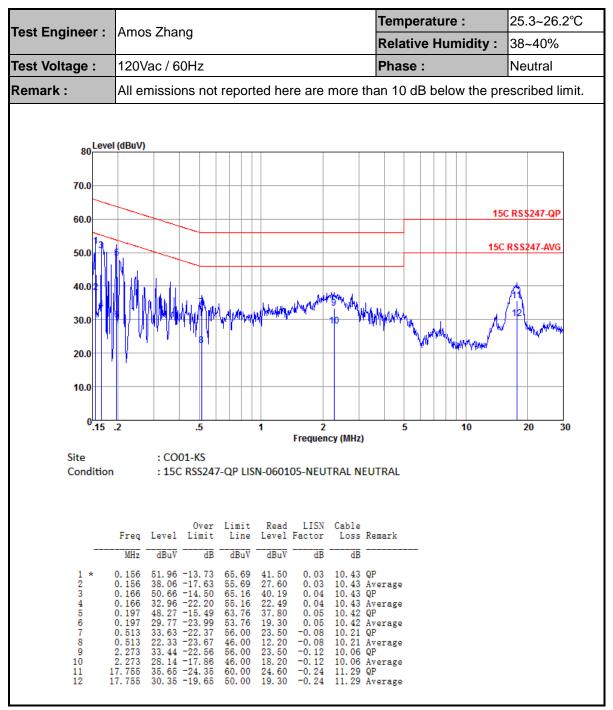
Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 20dBc limit.



# **Appendix B. AC Conducted Emission Test Results**

Fost Engineer .	Amos Zhang		Temperature :	25.3~26.2°C
Test Engineer :	Amos Zhang		Relative Humidity :	38~40%
Fest Voltage :	120Vac / 60Hz		Phase :	Line
Remark :	All emissions not repo	orted here are more th	an 10 dB below the pr	escribed limit.
80	(dBuV)			
00				
70.0				
60.0			15	C RSS247-QP
12				DECAT NC
50.0			150	RSS247-AVG
40.0				<u>A</u>
	A A A A A A A A A A A A A A A A A A A	Mar Mar Mar Marker Marker	mourse A	mt .
30.0		MMM LIMMA	hopen and b	12Mun MM
20.0				
10.0				
10.0				
0.15	2.5	1 2	5 10	20 30
Site	: CO01-KS	Frequency (MHz)		
Condition		ISN-060105-LINE LINE		
	Over Limi			
	Freq Level Limit Lin 		emark 	
1 *	0. 155 53. 59 -12. 15 65. 7	4 43.10 0.06 10.43 0	P	
2 3	0.155 37.09 -18.65 55.7 0.165 51.38 -13.83 65.2	4 26.60 0.06 10.43 Å 1 40.90 0.05 10.43 QI	verage P	
5	0.165 36.08 -19.13 55.2 0.198 46.64 -17.07 63.7 0.198 32.34 -21.37 53.7	1 36.20 0.02 10.42 QI	P	
7 8	0.237 40.93 -21.29 62.2 0.237 27.33 -24.89 52.2	2 30.50 0.04 10.39 QI 2 16.90 0.04 10.39 A	Pverage	
10	0.505 34.28 -21.72 56.0 0.505 25.38 -20.62 46.0 8.328 32.51 -27.49 60.0	0 15.20 -0.03 10.21 At	verage	
	8.328 32.51 -27.49 60.0 8.328 25.61 -24.39 50.0			





Note:

1. Level(dB $\mu$ V) = Read Level(dB $\mu$ V) + LISN Factor(dB) + Cable Loss(dB)

2. Over Limit(dB) = Level(dB $\mu$ V) – Limit Line(dB $\mu$ V)



# **Appendix C. Radiated Spurious Emission**

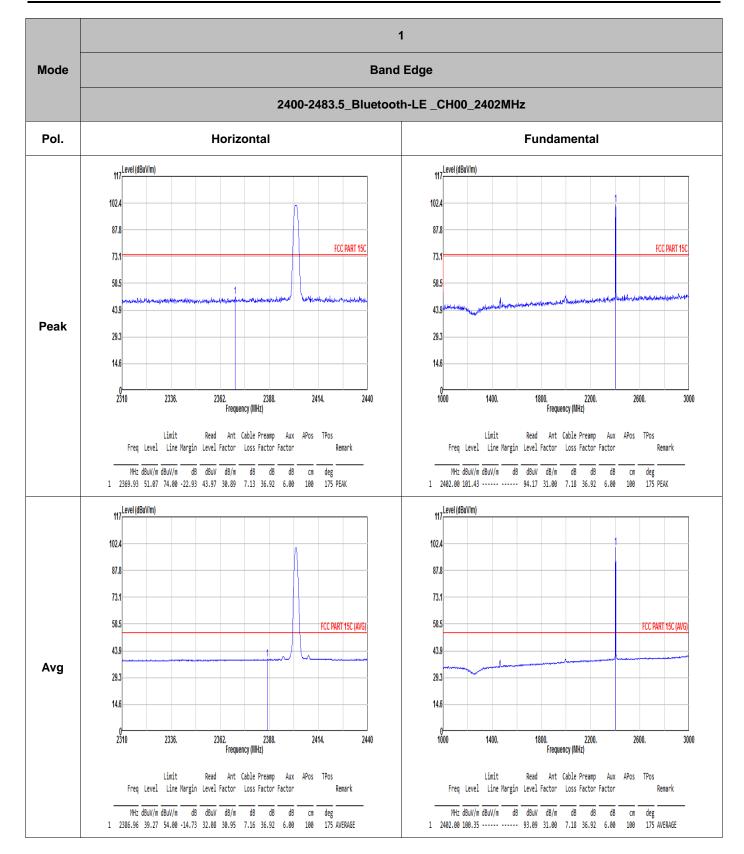
# **Radiated Spurious Emission Test Modes**

Mode	Band (MHz)	Modulation	Channel	Frequency	Data Rate	Remark
Mode 1	2400-2483.5	Bluetooth-LE	00	2402	1Mbps	-
Mode 2	2400-2483.5	Bluetooth-LE	19	2440	1Mbps	-
Mode 3	2400-2483.5	Bluetooth-LE	39	2480	1Mbps	-
Mode 4	2400-2483.5	Bluetooth-LE	00	2402	2Mbps	-
Mode 5	2400-2483.5	Bluetooth-LE	19	2440	2Mbps	-
Mode 6	2400-2483.5	Bluetooth-LE	39	2480	2Mbps	-
Mode 1	2400-2483.5	Bluetooth-LE	00	2402	1Mbps	LF

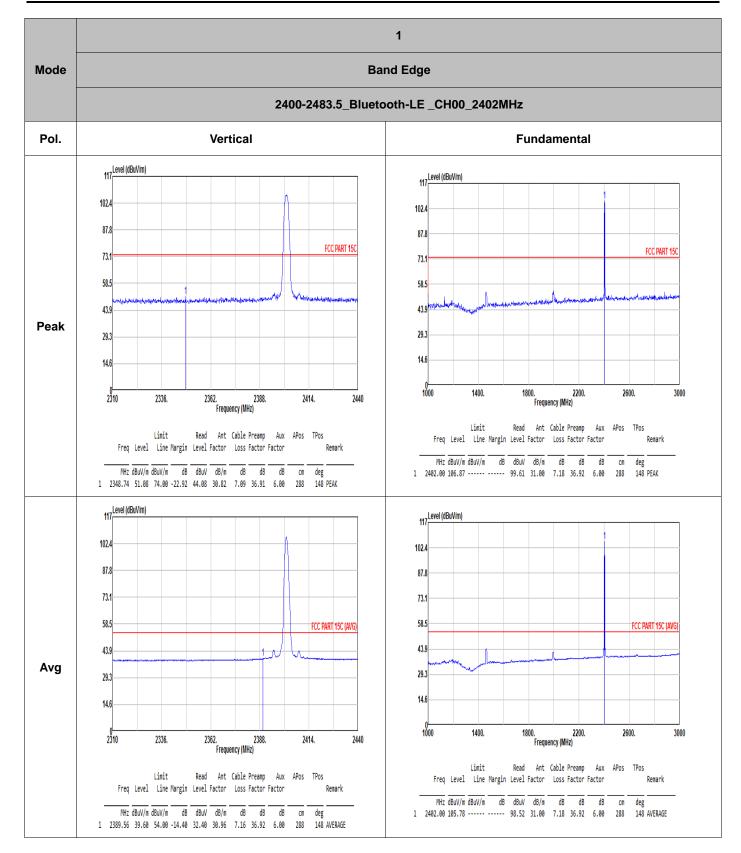
# Summary of each worse mode

Mode	Modulation	Ch.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol.	Peak Avg.	Result	Remark
1	Bluetooth-LE	00	2389.56	39.60	54.00	-14.40	V	AVERAGE	Pass	Band Edge
1	Bluetooth-LE	00	4804.00	50.88	54.00	-3.12	V	AVERAGE	Pass	Harmonic
2	Bluetooth-LE	19	-	-	-	-	-	-	-	Band Edge
2	Bluetooth-LE	19	4880.00	47.26	54.00	-6.74	V	AVERAGE	Pass	Harmonic
3	Bluetooth-LE	39	2486.74	44.88	54.00	-9.12	V	AVERAGE	Pass	Band Edge
3	Bluetooth-LE	39	4960.00	47.14	54.00	-6.86	V	AVERAGE	Pass	Harmonic
4	Bluetooth-LE	00	2388.39	39.93	54.00	-14.07	V	AVERAGE	Pass	Band Edge
4	Bluetooth-LE	00	4804.00	47.66	54.00	-6.34	V	AVERAGE	Pass	Harmonic
5	Bluetooth-LE	19	-	-	-	-	-	-	-	Band Edge
5	Bluetooth-LE	19	4880.00	47.81	54.00	-6.19	V	AVERAGE	Pass	Harmonic
6	Bluetooth-LE	39	2483.50	49.69	54.00	-4.31	V	AVERAGE	Pass	Band Edge
6	Bluetooth-LE	39	4960.00	50.63	54.00	-3.37	V	AVERAGE	Pass	Harmonic
1	Bluetooth-LE	00	40.67	26.68	40.00	-13.32	V	Peak	Pass	LF

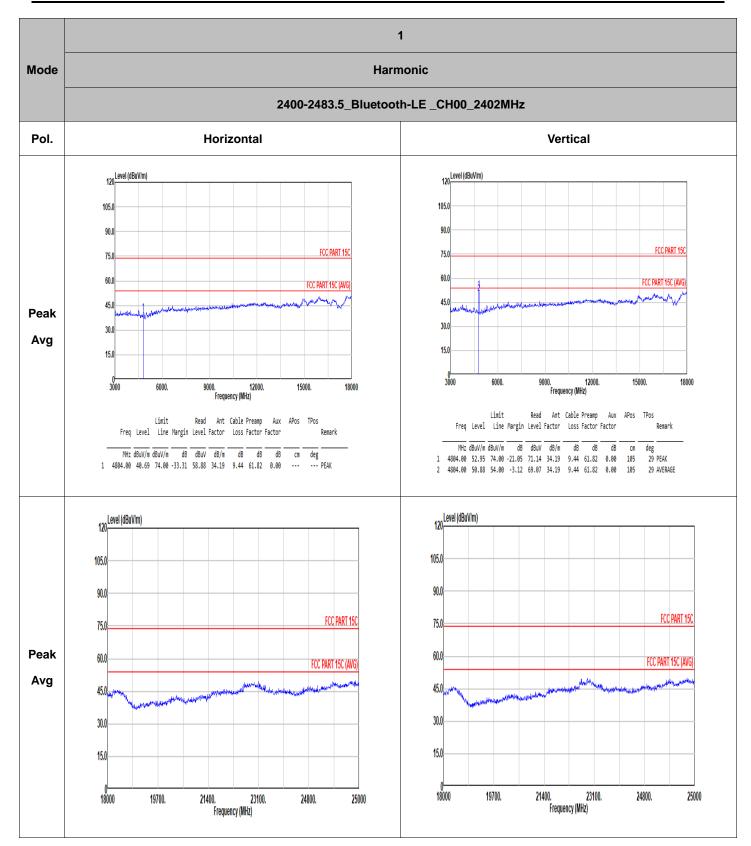




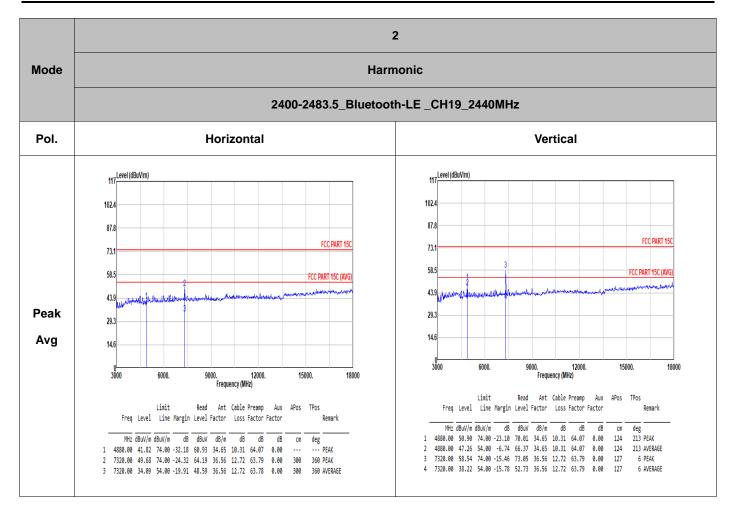




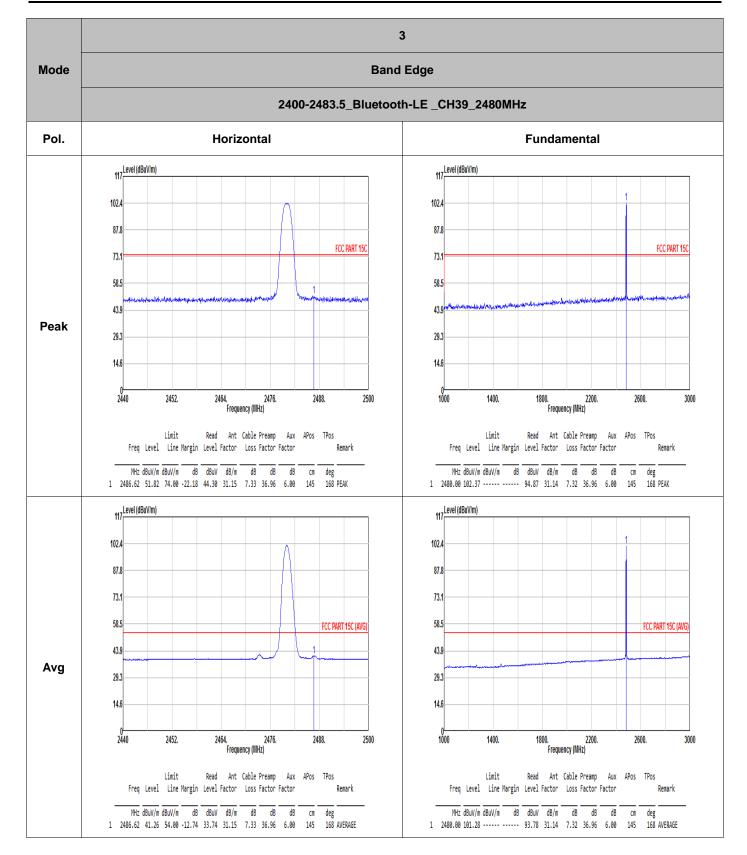




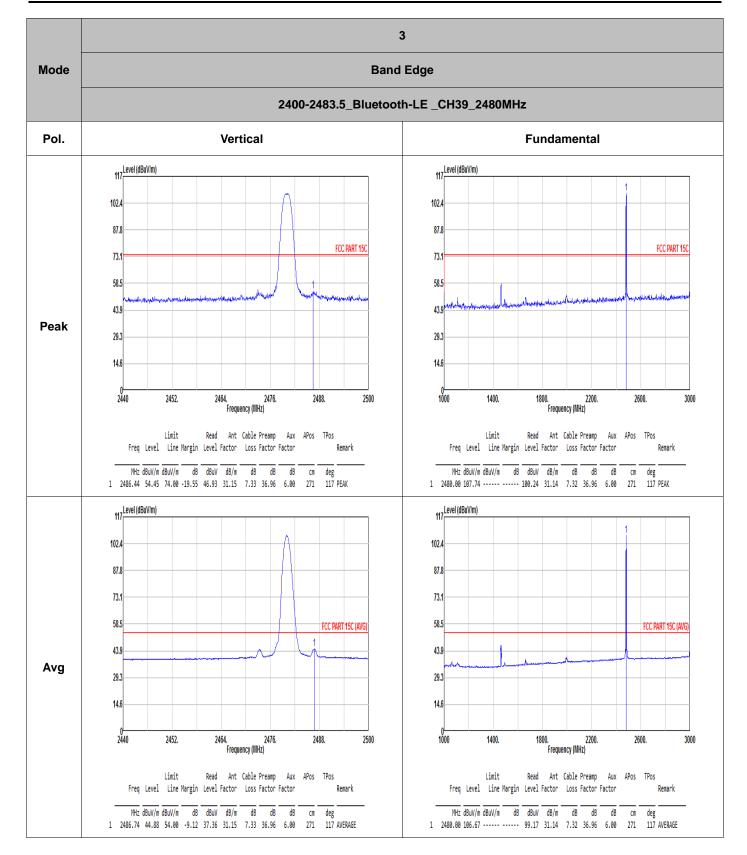




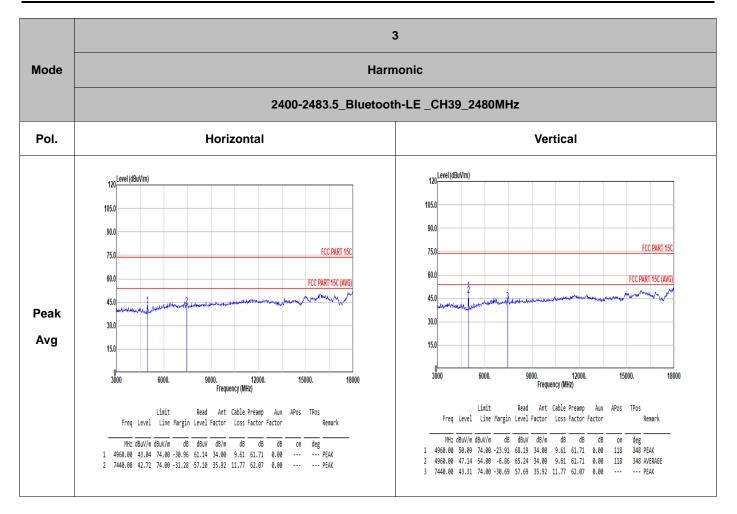




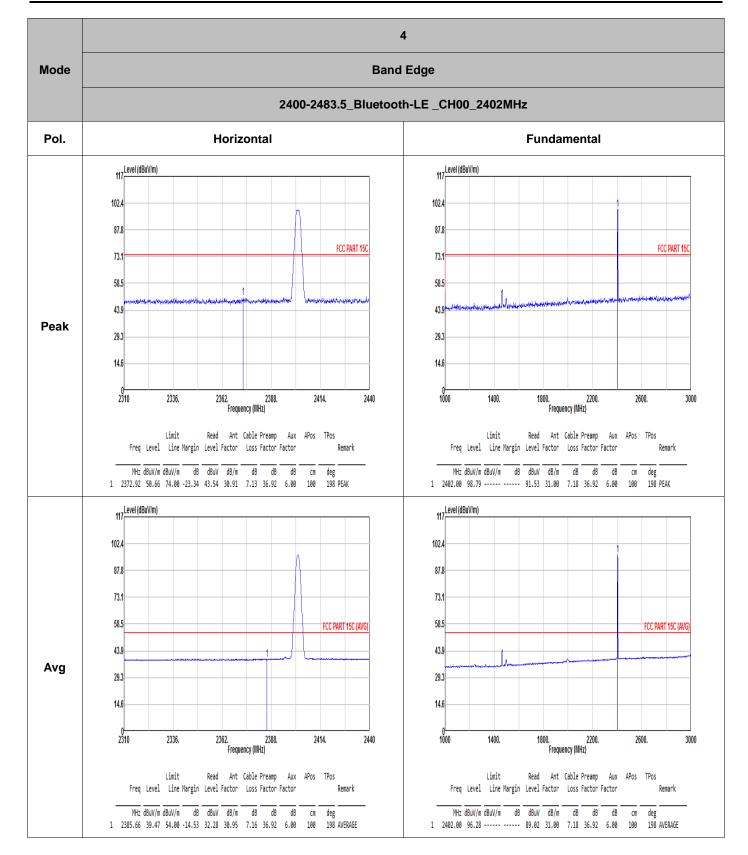




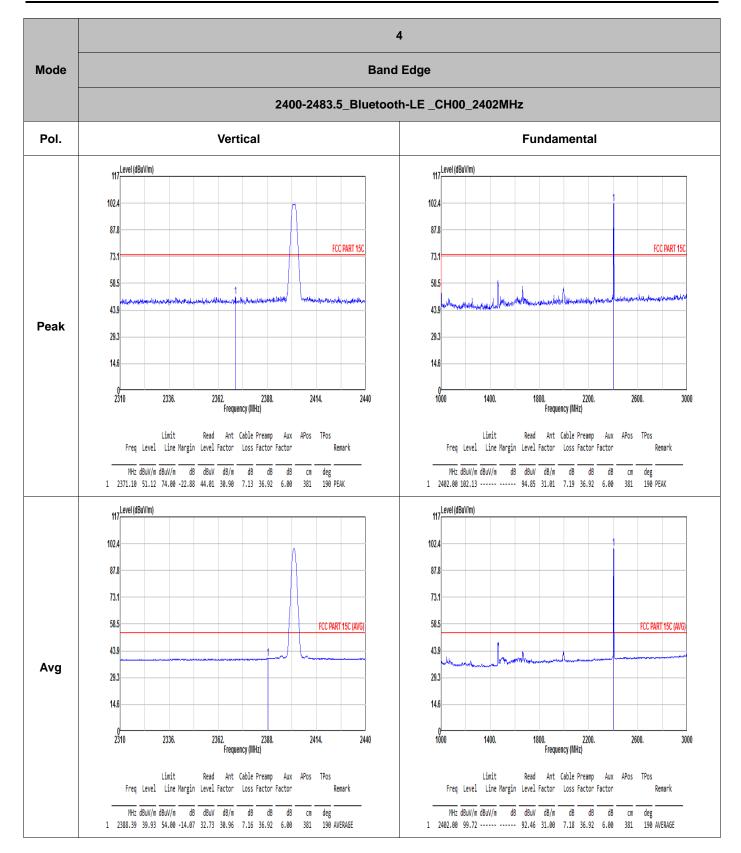




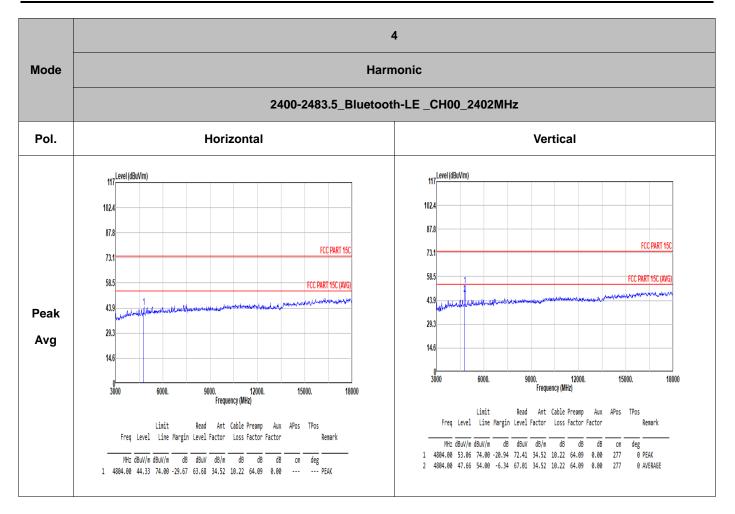




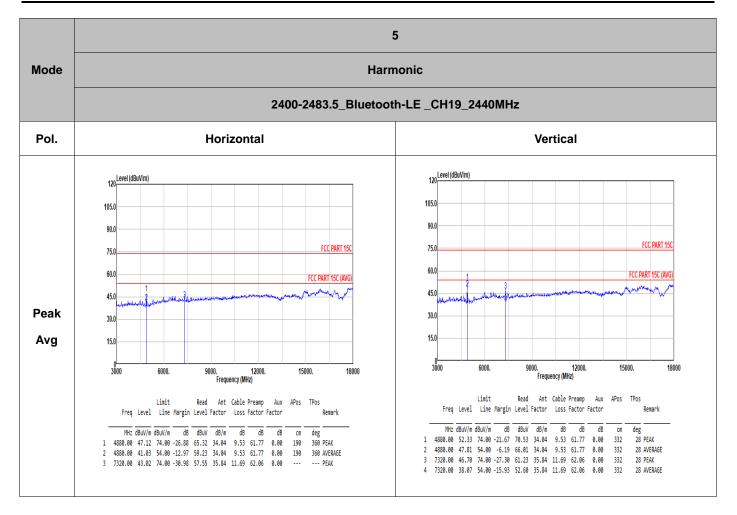




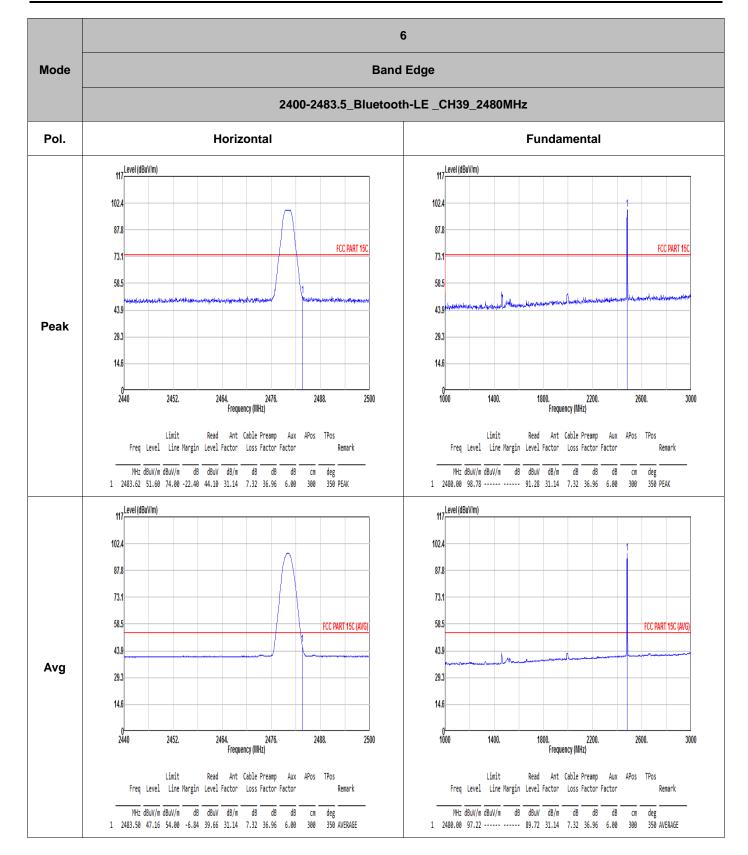




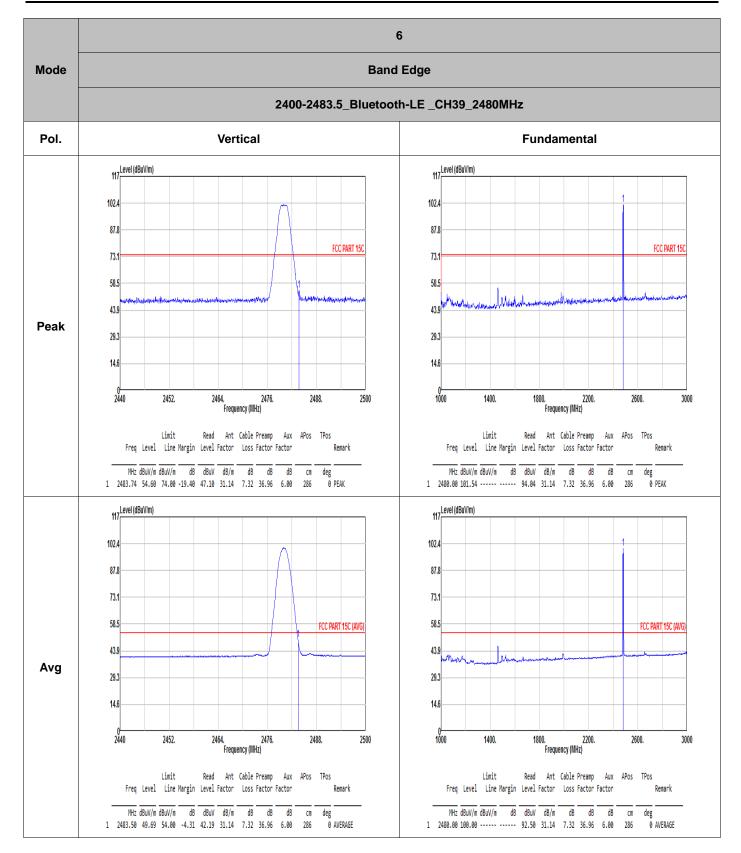




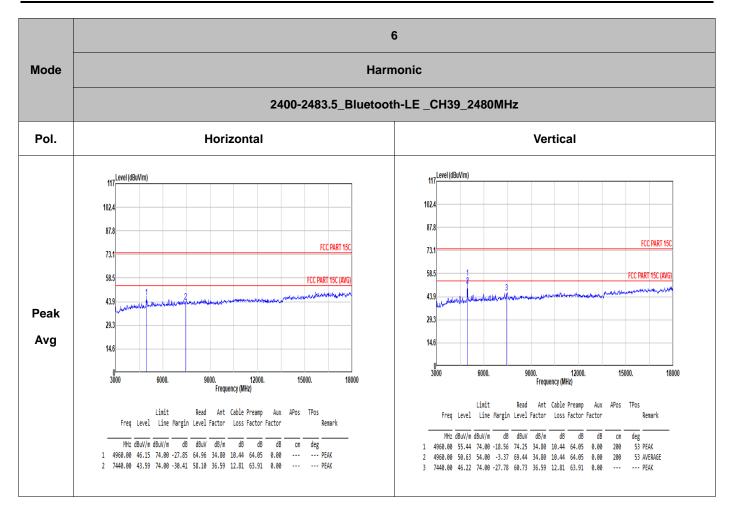




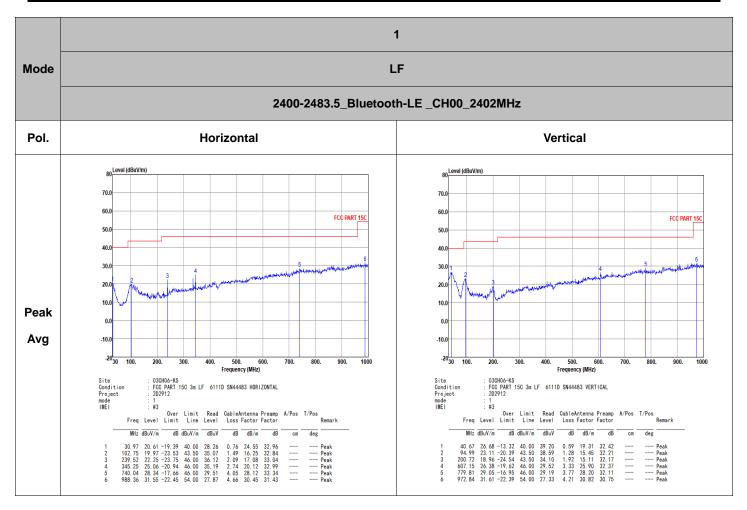










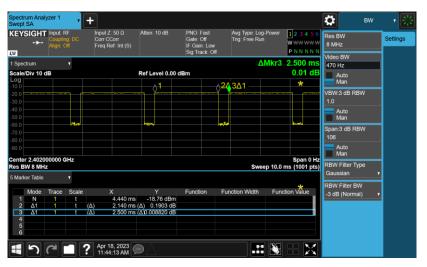




# Appendix D. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
Bluetooth LE 1Mbps	85.60	2.140	0.467	0.51KHz
Bluetooth LE 2Mbps	57.45	1.080	0.926	1KHz

#### Bluetooth LE 1Mbps



#### **Bluetooth LE 2Mbps**

