# **FCC RF Test Report**

APPLICANT : Quectel Wireless Solutions Co., Ltd.

**EQUIPMENT**: Smart Module

BRAND NAME : QUECTEL MODEL NAME : SC686A-NA

FCC ID : XMR2022SC686ANA

STANDARD : FCC Part 15 Subpart C §15.247

CLASSIFICATION : (DTS) Digital Transmission System

TEST DATE(S) : Jan. 13, 2023 ~ Jan. 31, 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





Report No.: FR310409B

# Sporton International Inc. (Kunshan)

No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China

Sporton International Inc. (Kunshan)

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Report Issued Date : Mar. 09, 2023

: Rev. 01

Report Template No.: BU5-FR15CBT4.0 Version 2.0

Report Version

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# **REVISION HISTORY**

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR310409B	Rev. 01	Initial issue of report	Mar. 09, 2023

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# 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	-
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 10.85 dB at 47.46 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 5.94 dB at 0.589 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	15.203 & 15.247(b)	Pass	-

**Note:** This is the change FCC ID report. Since no changes have been made to this device, all test cases were leveraged from original report (FCC ID: XMR2022SC680ANA, report number FR2D2302B).

## Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

## Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

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# 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

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# 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	Smart Module		
Brand Name	QUECTEL		
Model Name	SC686A-NA		
FCC ID	XMR2022SC686ANA		
IMEI Code	Conducted: 862160060004446/862160060004453 Conduction: 862160060006342/862160060006359 Radiation: 862160060007969/862160060007977		
HW Version R1.0			
SW Version SC686ANAPAR60A02			
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 Output Power to Antenna	Bluetooth LE (1Mbps) : 1.53 dBm (0.0014 W)		
Maximum Output Power to Antenna	Bluetooth LE (2Mbps) : 1.54 dBm (0.0014 W)		
99% Occupied Bandwidth	Bluetooth LE (1Mbps): 1.02MHz		
39 % Occupied Baildwidth	Bluetooth LE (2Mbps) : 2.03MHz		
Antenna Type / Gain	Folded Dipole Antenna with gain 0.47 dBi		
Type of Modulation Bluetooth LE : GFSK			

# 1.5 Modification of EUT

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

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# 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.

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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				
rest Site Location	TEL: +86-512-57900158				
	FAX: +86-512-57900958				
	Sporton Site No.	FCC Designation No.	FCC Test Firm		
Test Site No.	Sporton Site No.	rec besignation No.	Registration No.		
Test Site 140.	CO01-KS 03CH05-KS TH01-KS	CN1257	314309		

# 1.7 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH05-KS	AUDIX	E3	6.2009-8-24
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:

- 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.

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# 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 16	2432	36	2474
		2434	37	2476
	17	2436	38	2478
	18	2438	39	2480
	19	2440	-	-
	20	2442	-	-

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## 2.2 Test Mode

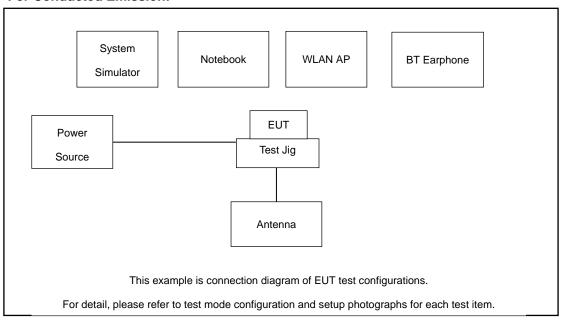
- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental 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 table is showing all test modes to demonstrate in compliance with the standard.

	Summary table of Test Cases				
Test Item	Data Rate / Modulation				
rest item	Bluetooth – LE / GFSK				
	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps				
Conducted TCs	Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps				
	Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps				
Radiated TCs	Refer to Appendix C				
AC Conducted	Made 4.1 TE Dond 5 Idle . Divisional link . W/ ANI link /2 4C) . Deviced by Test lin				
Emission	Mode 1: LTE Band 5 Idle + Bluetooth Link + WLAN Link (2.4G) + Powered by Test Jig				

# 2.3 Connection Diagram of Test System

#### For Conducted Emission:

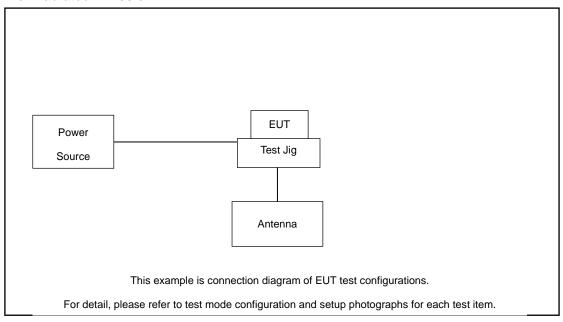


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#### For Radiated Emission:



# 2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	LTE Base Station	Anritus	MT8821C	N/A	N/A	Unshielded, 1.8m
2.	Bluetooth Earphone	Lenovo	LBH308	N/A	N/A	N/A
3.	WLAN AP	D-link	DIR-655	KA21R655B1	N/A	Unshielded, 1.8m
4.	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
5.	Test Jig	N/A	N/A	N/A	N/A	N/A
6.	Adapter	N/A	N/A	N/A	N/A	N/A
7.	Antenna	N/A	N/A	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.

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# 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 5.6 dB.

 $Offset(dB) = RF \ cable \ loss(dB).$ = 5.6 (dB)

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#### 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.

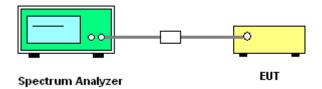
# 3.1.2 Measuring Instruments

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

## 3.1.3 Test Procedures

- 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.
- Set to the maximum power setting and enable the EUT transmit continuously. 3.
- 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.
- 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.
- Measure and record the results in the test report.

# 3.1.4 Test Setup



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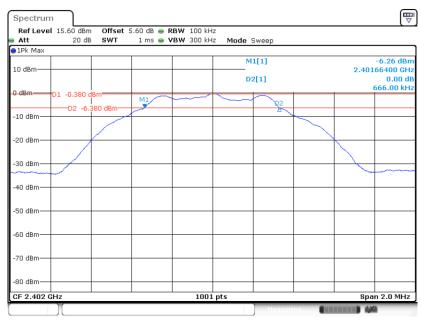
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## 3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.

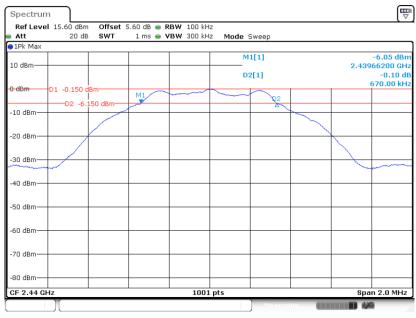
## For Bluetooth LE (1Mbps):

#### 6 dB Bandwidth Plot on Channel 00



Date: 16.JAN.2023 02:49:35

## 6 dB Bandwidth Plot on Channel 19



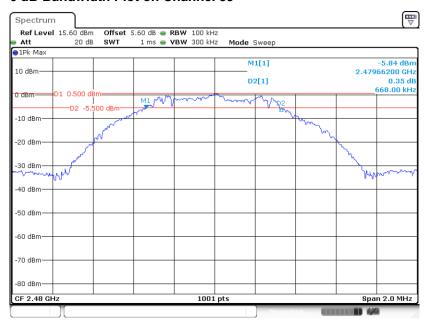
Date: 16.JAN.2023 02:52:11

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#### 6 dB Bandwidth Plot on Channel 39



Date: 16.JAN.2023 02:55:19

## For Bluetooth LE (2Mbps):

## 6 dB Bandwidth Plot on Channel 00



Date: 16.JAN.2023 02:59:18

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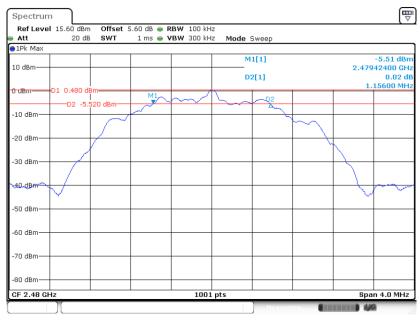
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### 6 dB Bandwidth Plot on Channel 19



Date: 16.JAN.2023 03:03:05

#### 6 dB Bandwidth Plot on Channel 39



Date: 16.JAN.2023 03:05:45

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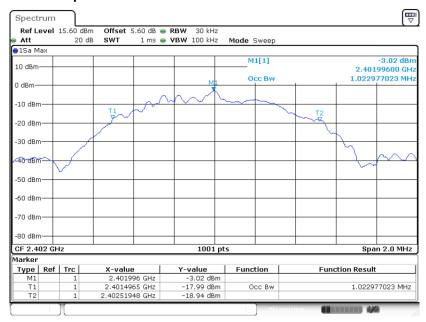
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# 3.1.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

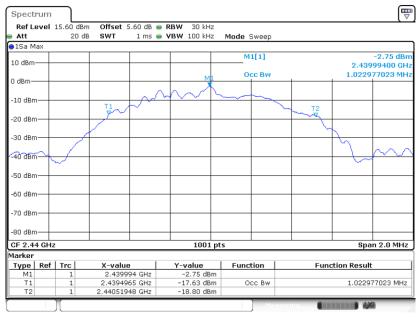
## For Bluetooth LE (1Mbps):

## 99% Occupied Bandwidth Plot on Channel 00



Date: 16.JAN.2023 02:51:22

## 99% Occupied Bandwidth Plot on Channel 19



Date: 16.JAN.2023 02:53:39

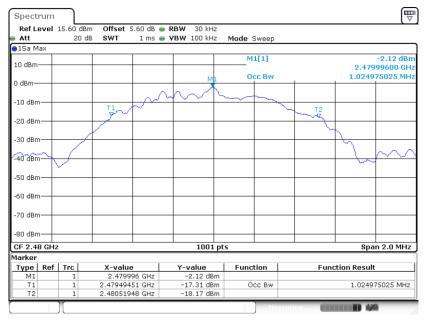
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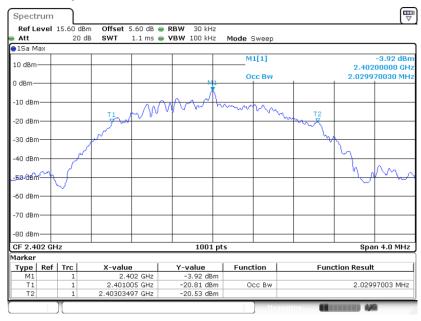
# 99% Occupied Bandwidth Plot on Channel 39



Date: 16.JAN.2023 02:57:06

### For Bluetooth LE (2Mbps):

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



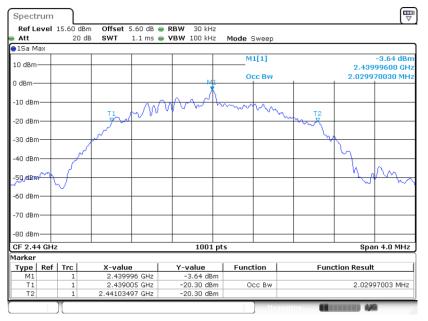
Date: 16.JAN.2023 03:01:05

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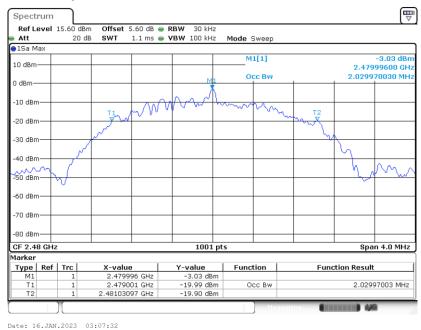
## 99% Occupied Bandwidth Plot on Channel 19



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Date: 16.JAN.2023 03:04:33

### 99% Occupied Bandwidth Plot on Channel 39



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

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# 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 6dBi.

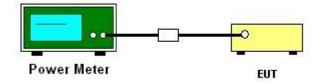
# 3.2.2 Measuring Instruments

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.

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# 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

- 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.
- 4. 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.

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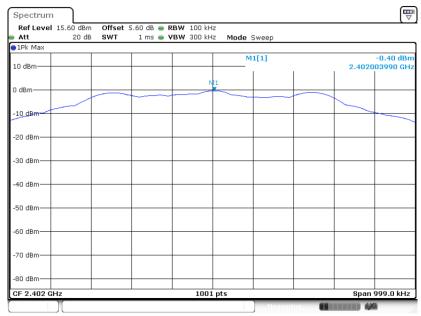
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# 3.3.6 Test Result of Power Spectral Density Plots (100kHz)

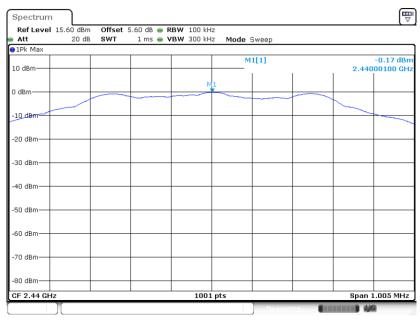
## For Bluetooth LE (1Mbps):

## PSD 100kHz Plot on Channel 00



Date: 16.JAN.2023 02:50:13

#### PSD 100kHz Plot on Channel 19



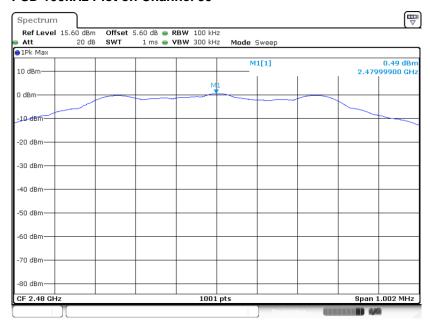
Date: 16.JAN.2023 02:52:49

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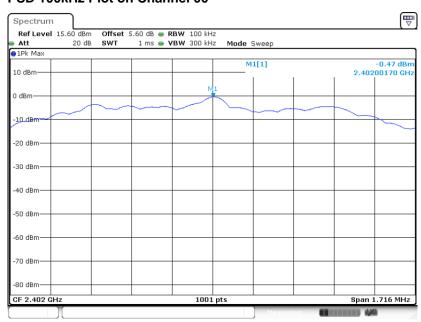
#### PSD 100kHz Plot on Channel 39



Date: 16.JAN.2023 02:55:57

## For Bluetooth LE (2Mbps):

## PSD 100kHz Plot on Channel 00



Date: 16.JAN.2023 02:59:56

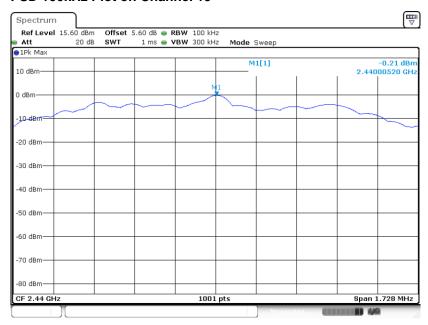
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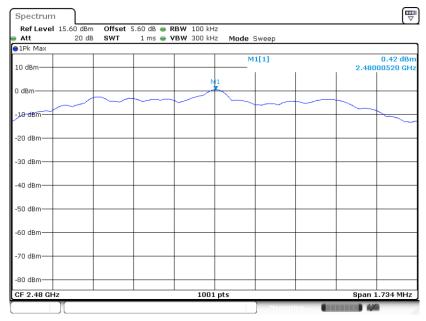
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#### PSD 100kHz Plot on Channel 19



Date: 16.JAN.2023 03:03:43

#### PSD 100kHz Plot on Channel 39



Date: 16.JAN.2023 03:06:23

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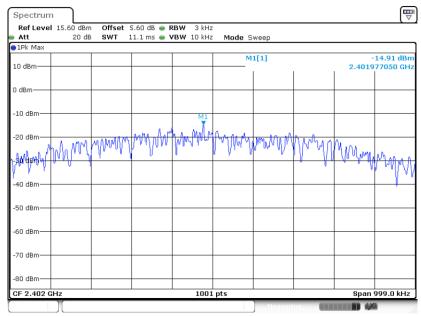
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# 3.3.7 Test Result of Power Spectral Density Plots (3kHz)

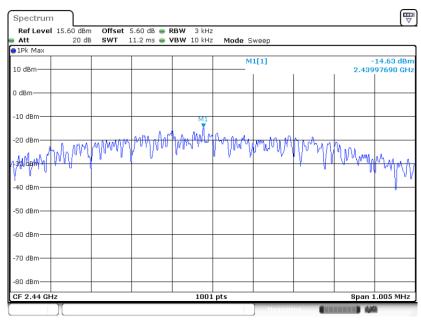
## For Bluetooth LE (1Mbps):

#### PSD 3kHz Plot on Channel 00



#### Date: 16.JAN.2023 02:49:54

#### **PSD 3kHz Plot on Channel 19**



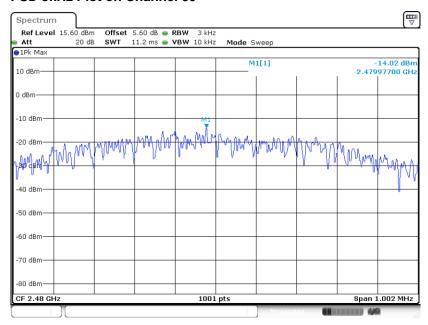
Date: 16.JAN.2023 02:52:30

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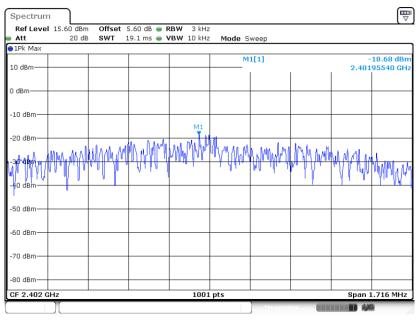
#### PSD 3kHz Plot on Channel 39



Date: 16.JAN.2023 02:55:38

## For Bluetooth LE (2Mbps):

## **PSD 3kHz Plot on Channel 00**



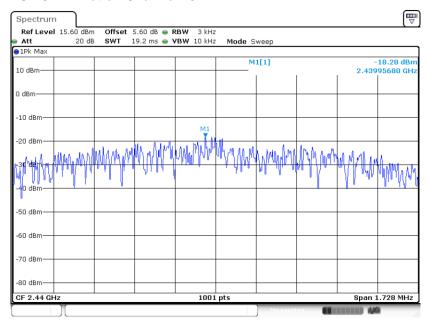
Date: 16.JAN.2023 02:59:37

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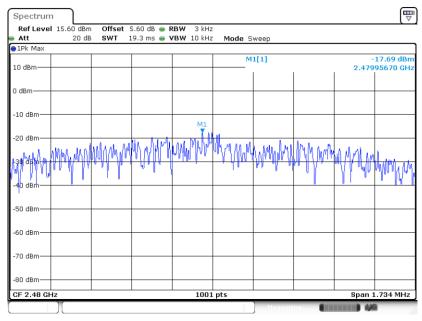
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#### **PSD 3kHz Plot on Channel 19**



Date: 16.JAN.2023 03:03:24

#### **PSD 3kHz Plot on Channel 39**



Date: 16.JAN.2023 03:06:04

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# 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.

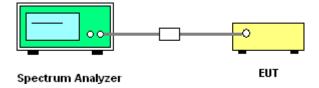
# 3.4.2 Measuring Instruments

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



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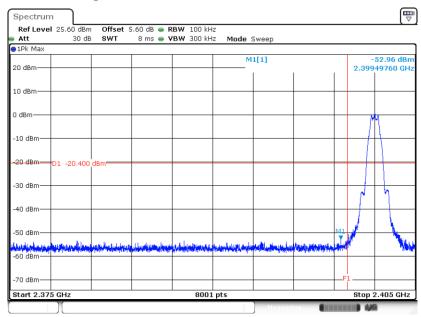
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# 3.4.5 Test Result of Conducted Band Edges Plots

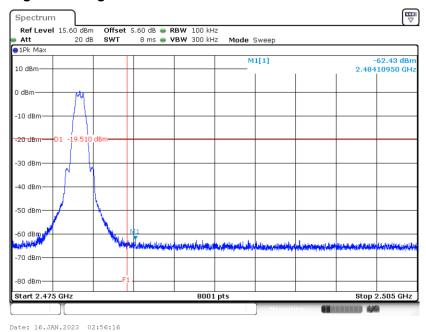
## For Bluetooth LE (1Mbps):

# Low Band Edge Plot on Channel 00



#### Date: 31.JAN.2023 20:10:49

## **High Band Edge Plot on Channel 39**



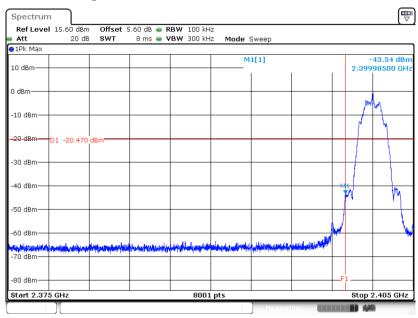
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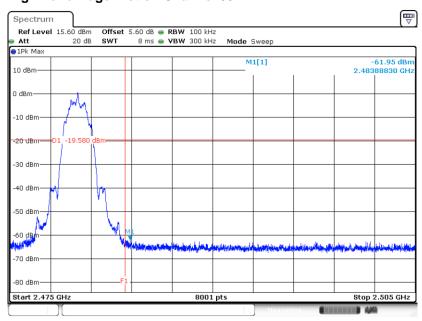
# For Bluetooth LE (2Mbps):

## Low Band Edge Plot on Channel 00



Date: 16.JAN.2023 03:00:15

# **High Band Edge Plot on Channel 39**



Date: 16.JAN.2023 03:06:42

Sporton International Inc. (Kunshan)

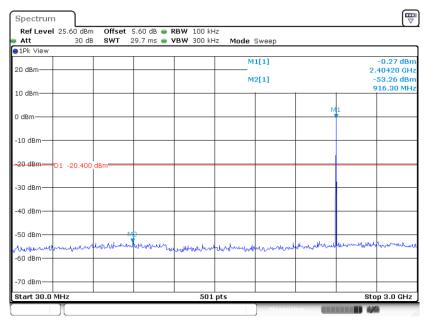
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# 3.4.6 Test Result of Conducted Spurious Emission Plots

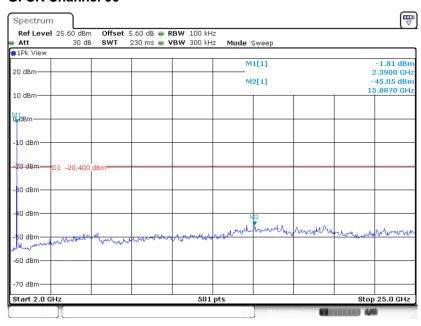
## For Bluetooth LE (1Mbps):

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



Date: 31.JAN.2023 20:11:32

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



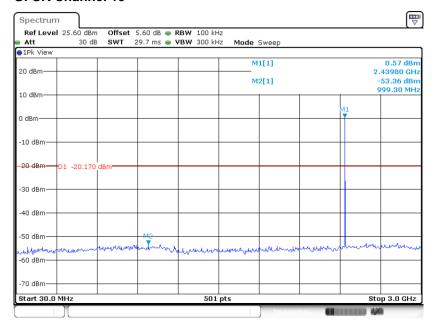
Date: 31.JAN.2023 20:11:48

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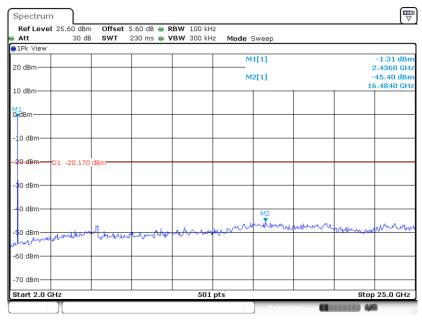
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# Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 19



Date: 31.JAN.2023 20:15:14

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



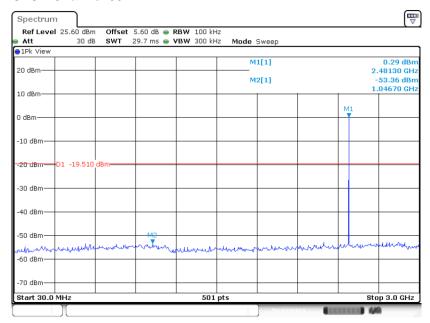
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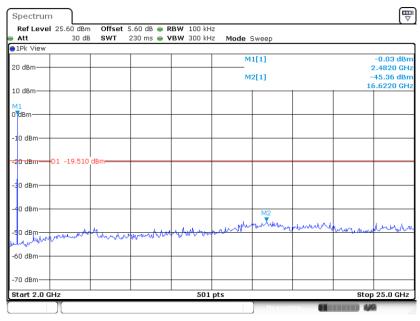
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# Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39



Date: 16.JAN.2023 02:56:37

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



Date: 16.JAN.2023 02:56:57

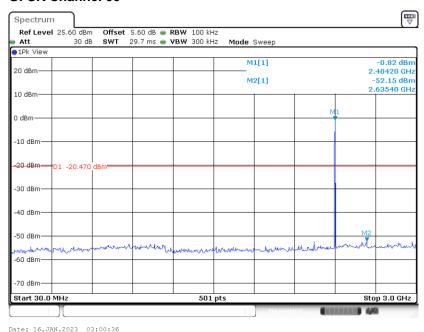
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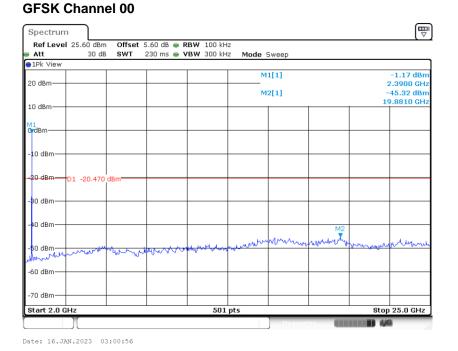
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## For Bluetooth LE (2Mbps):

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



# Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

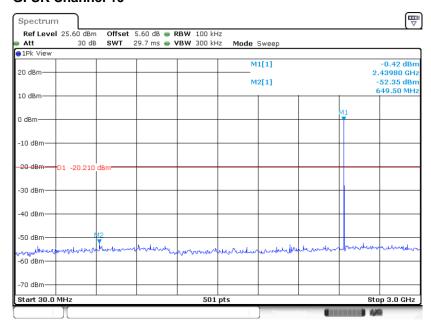


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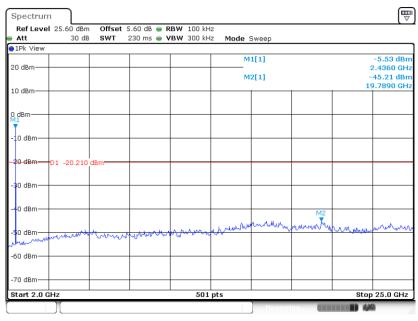
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# Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 19



Date: 16.JAN.2023 03:04:04

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



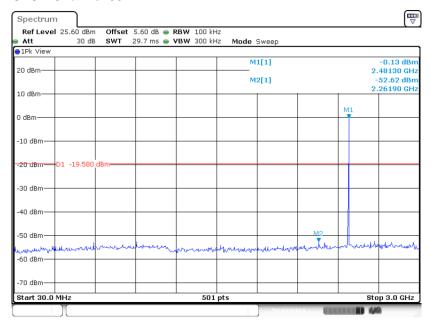
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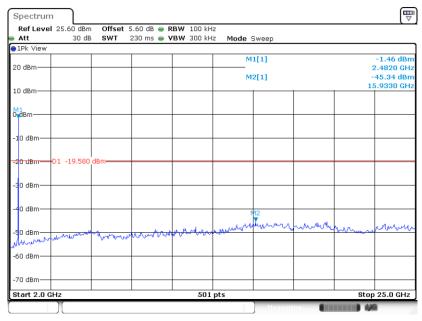
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# Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39



Date: 16.JAN.2023 03:07:03

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



Date: 16.JAN.2023 03:07:23

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# 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.

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#### 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.

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- 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.

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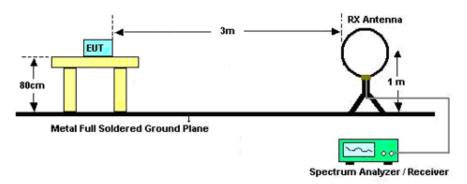
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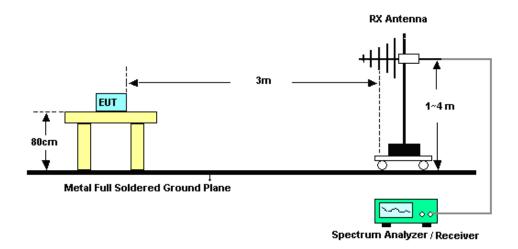
FCC ID: XMR2022SC686ANA Report Template No.: BU5-FR15CBT4.0 Version 2.0

#### 3.5.4 Test Setup

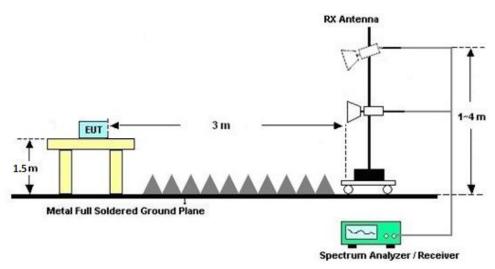
#### For radiated emissions below 30MHz



#### For radiated emissions from 30MHz to 1GHz



#### For radiated emissions above 1GHz



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#### 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.

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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.

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#### 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.

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Fraguency of emission (MUz)	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			

<sup>\*</sup>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.
- 8. 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.

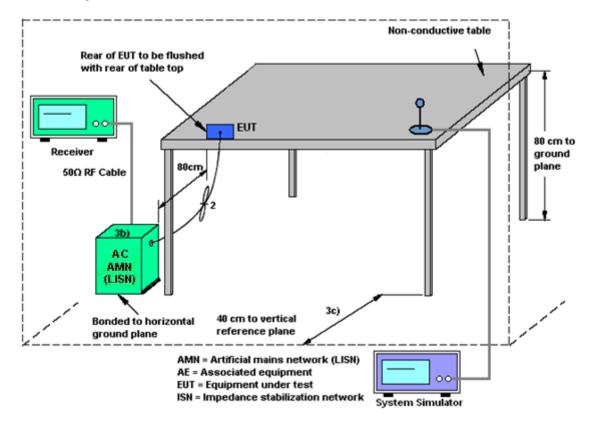
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#### 3.6.4 Test Setup



#### 3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

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#### 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

An embedded-in antenna design 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.

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## 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	Jan. 16, 2023~ Jan. 31, 2023	Oct. 11, 2023	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GH z	Jan. 05, 2023	Jan. 16, 2023~ Jan. 31, 2023	Jan. 04, 2024	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 05, 2023	Jan. 16, 2023~ Jan. 31, 2023	Jan. 04, 2024	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY564000 04	3Hz~8.5GHz;M ax 30dBm	Oct. 13, 2022	Jan. 17, 2023	Oct. 12, 2023	Radiation (03CH05-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY551502 44	10Hz-44G,MAX 30dB	Mar. 24, 2022	Jan. 17, 2023	Mar. 23, 2023	Radiation (03CH05-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 16, 2022	Jan. 17, 2023	Oct. 15, 2023	Radiation (03CH05-KS)
Bilog Antenna	TeseQ	CBL6111D	49922	30MHz-1GHz	May 24 ,2022	Jan. 17, 2023	May 23, 2023	Radiation (03CH05-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00218642	1GHz~18GHz	Apr. 18, 2022	Jan. 17, 2023	Apr. 17, 2023	Radiation (03CH05-KS)
SHF-EHF Horn	Com-power	AH-840	101070	18GHz~40GHz	Jan. 04, 2023	Jan. 17, 2023	Jan. 03, 2024	Radiation (03CH05-KS)
Amplifier	SONOMA	310N	380826	9KHz-1GHz	Jul. 11, 2022	Jan. 17, 2023	Jul. 10, 2023	Radiation (03CH05-KS)
Amplifier	MITEQ	EM18G40GG A	060728	18~40GHz	Jan. 04, 2023	Jan. 17, 2023	Jan. 03, 2024	Radiation (03CH05-KS)
high gain Amplifier	EM	EM01G18GA	060839	1Ghz-18Ghz	Oct. 12, 2022	Jan. 17, 2023	Oct. 11, 2023	Radiation (03CH05-KS)
Amplifier	EM	EM01G18GA	060833	1Ghz-18Ghz	Jan. 04, 2023	Jan. 17, 2023	Jan. 03, 2024	Radiation (03CH05-KS)
AC Power Source	Chroma	61601	F1040900 04	N/A	NCR	Jan. 17, 2023	NCR	Radiation (03CH05-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Jan. 17, 2023	NCR	Radiation (03CH05-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Jan. 17, 2023	NCR	Radiation (03CH05-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	May 24, 2022	Jan. 13, 2023	May 23, 2023	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 13, 2022	Jan. 13, 2023	Oct. 12, 2023	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	May 24, 2022	Jan. 13, 2023	May 23, 2023	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP00000 0811	AC 0V~300V, 45Hz~1000Hz	Oct. 12, 2022	Jan. 13, 2023	Oct. 11, 2023	Conduction (CO01-KS)

NCR: No Calibration Required

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### 5 Uncertainty of Evaluation

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.

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#### **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			

#### <u>Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)</u>

Measuring Uncertainty for a Level of Confidence	2.78dB	
of 95% (U = 2Uc(y))	2.76015	

#### <u>Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)</u>

Measuring Uncertainty for a Level of Confidence	
of 95% (U = 2Uc(y))	5.0dB

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

Measuring Uncertainty for a Level of Confidence	5.0dB
of 95% (U = 2Uc(y))	5.0dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.0dB
---	-------

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

 Sporton International Inc. (Kunshan)
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 TEL: +86-512-57900158
 Report Issued Date
 : Mar. 09, 2023

 FAX: +86-512-57900958
 Report Version
 : Rev. 01

FCC ID: XMR2022SC686ANA Report Template No.: BU5-FR15CBT4.0 Version 2.0

## **Appendix A. Conducted Test Results**

Sporton International Inc. (Kunshan)

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Report Number : FR310409B

#### **Bluetooth Low Energy(1Mbps)**

Test Engineer:	Wei Xu	Temperature:	20~26	°C
Test Date:	2023/1/16~2023/1/31	Relative Humidity:	40~51	%

#### TEST RESULTS DATA 6dB and 99% Occupied Bandwidth

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE	1Mbps	1	0	2402	1.02	0.67	0.50	Pass
BLE	1Mbps	1	19	2440	1.02	0.67	0.50	Pass
BLE	1Mbps	1	39	2480	1.02	0.67	0.50	Pass

### TEST RESULTS DATA

#### Peak Power Table

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	1Mbps	1	0	2402	0.29	30.00	0.47	0.76	36.00	Pass
BLE	1Mbps	1	19	2440	0.55	30.00	0.47	1.02	36.00	Pass
BLE	1Mbps	1	39	2480	1.53	30.00	0.47	2.00	36.00	Pass

# TEST RESULTS DATA Average Power Table (Reporting Only)

Mod.	Data Rate	INITYI (CH		Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
BLE	1Mbps	1	0	2402	2.04	0.03
BLE	1Mbps	1	19	2440	2.04	0.26
BLE	1Mbps	1	39	2480	2.04	0.97

## 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	1Mbps	1	0	2402	-0.40	-14.91	0.47	8.00	Pass
BLE	1Mbps	1	19	2440	-0.17	-14.63	0.47	8.00	Pass
BLE	1Mbps	1	39	2480	0.49	-14.02	0.47	8.00	Pass

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

Report Number : FR310409B

#### **Bluetooth Low Energy(2Mbps)**

Test Engineer:	Wei Xu	Temperature:	20~26	°C
Test Date:	2023/1/16~2023/1/31	Relative Humidity:	40~51	%

#### TEST RESULTS DATA 6dB and 99% Occupied Bandwidth

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	1.16	0.50	Pass

## TEST RESULTS DATA Peak Power Table

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	0.63	30.00	0.47	1.10	36.00	Pass
BLE	2Mbps	1	19	2440	0.77	30.00	0.47	1.24	36.00	Pass
BLE	2Mbps	1	39	2480	1.54	30.00	0.47	2.01	36.00	Pass

#### TEST RESULTS DATA Average Power Table (Reporting Only)

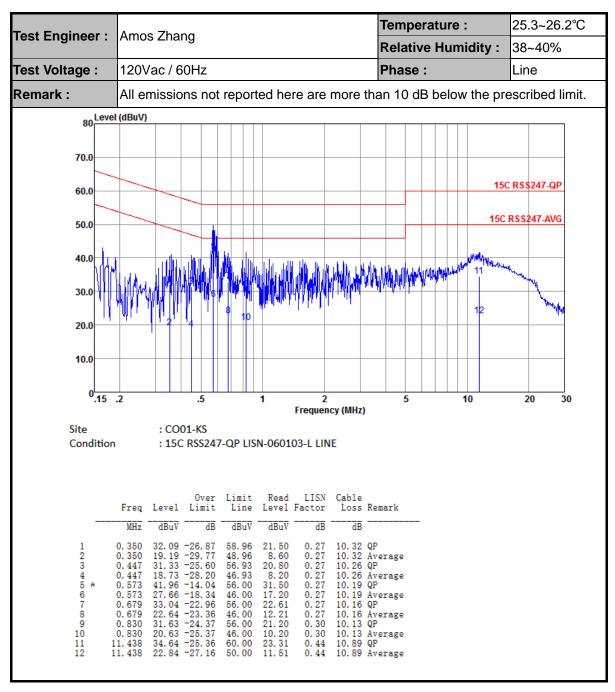
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
BLE	2Mbps	1	0	2402	4.83	0.12
BLE	2Mbps	1	19	2440	4.83	0.16
BLE	2Mbps	1	39	2480	4.83	1.08

## 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	-0.47	-18.68	0.47	8.00	Pass
BLE	2Mbps	1	19	2440	-0.21	-18.28	0.47	8.00	Pass
BLE	2Mbps	1	39	2480	0.42	-17.69	0.47	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**



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Toot Engineer	Amac 7h -	~~				Tem	peratu	re:	25.3~26.2°C	
Test Engineer :	Amos Zha	ng		Rela	tive H	umidity:	38~40%			
Test Voltage :	120Vac / 60Hz						se :		Neutral	
Remark :	All emission	All emissions not reported here are more the					dB be	low the pr	escribed limit	
80 Leve	I (dBuV)									
80										
70.0										
60.0								150	C RS\$247-QP	
00.0										
50.0								15C	RSS247-AVG	
40.0		4								
Ma	M. My	الألأم المتاهر	MAN MAN M	N. MANALIA	north develop	Yan Villey	and the second section.	mallered where we great	Mary III	
30.0	MAN NO.	<b>,</b>	10	AHA	1	2			The state of the s	
20.0										
10.0										
0.15	.2	.5	1	2			<u> </u> i	10	20 30	
Site	. 60	01-KS		Frequen	cy (MHz)					
Condition		C RSS247-QP	LISN-0601	LO3-N NE	UTRAL					
	Freq Level	Over Lim		LISN Factor	Cable Loss R	emark				
	MHz dBuV	dBdB	uV dBuV	<u>dB</u>						
1 2 3 4 * 5 6 7	0. 150 38. 05 0. 589 47. 06 0. 589 40. 06 0. 658 36. 05	-24.65 66. -17.95 56. -8.94 56. -5.94 46. -19.95 56. -16.25 46.	00 27.30 00 36.60 00 29.60 00 25.60	0. 32 0. 27 0. 27 0. 28	10. 43 Q 10. 43 A 10. 19 Q 10. 19 A 10. 17 Q 10. 17 A	verage P verage P				
7	0.796 32.64	-23.36 56. -20.36 46.	00 22.20	0.30 0.30	10. 14 Q 10. 14 A 10. 12 Q	P verage				

#### 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)

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## **Appendix C. Radiated Spurious Emission**

Took Engineer	Henzy Li	Relative Humidity :	41 ~ 42 %
Test Engineer :	nerizy Li	Temperature :	22 ~ 23 ℃

## **Radiated Spurious Emission Test Modes**

Mode	Band (MHz)	Antenna	Modulation	Channel	Frequency	Data Rate	RU	Remark
Mode 1	2400-2483.5	1	Bluetooth-LE	00	2402	1Mbps	-	-
Mode 2	2400-2483.5	1	Bluetooth-LE	19	2440	1Mbps	-	1
Mode 3	2400-2483.5	1	Bluetooth-LE	39	2480	1Mbps	-	-
Mode 4	2400-2483.5	1	Bluetooth-LE	00	2402	2Mbps	-	-
Mode 5	2400-2483.5	1	Bluetooth-LE	19	2440	2Mbps	-	-
Mode 6	2400-2483.5	1	Bluetooth-LE	39	2480	2Mbps	-	-
Mode 7	2400-2483.5	1	Bluetooth-LE_GSFK	39	2480	2Mbps	-	LF

Sporton International Inc. (Kunshan)

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Summary of each worse mode

Mode	Modulation	Ch.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol.	Peak Avg.	Result	Remark
	Bluetooth-LE	00	2389.56	38.99	54.00	-15.01	Н	AVERAGE	Pass	Band Edge
1	Bluetooth-LE	00	4804.00	39.45	74.00	-34.55	Н	PEAK	Pass	Harmonic
	Bluetooth-LE	19	-	-	-	-	-	-	-	Band Edge
2	Bluetooth-LE	19	7320.00	41.24	74.00	-32.76	Н	PEAK	Pass	Harmonic
2	Bluetooth-LE	39	2483.86	38.64	54.00	-15.36	Н	AVERAGE	Pass	Band Edge
3	Bluetooth-LE	39	7440.00	41.47	74.00	-32.53	V	PEAK	Pass	Harmonic
4	Bluetooth-LE	00	2384.88	39.54	54.00	-14.46	Н	AVERAGE	Pass	Band Edge
4	Bluetooth-LE	00	4804.00	39.46	74.00	-34.54	Н	PEAK	Pass	Harmonic
5	Bluetooth-LE	19	-	-	-	-	-	-	-	Band Edge
5	Bluetooth-LE	19	7320.00	42.00	74.00	-32.00	V	PEAK	Pass	Harmonic
6	Bluetooth-LE	39	2483.50	39.92	54.00	-14.08	Н	AVERAGE	Pass	Band Edge
0	Bluetooth-LE	39	7440.00	41.71	74.00	-32.29	V	PEAK	Pass	Harmonic
7	Bluetooth-LE	39	47.46	29.15	40.00	-10.85	V	PEAK	Pass	LF

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1 Mode **Band Edge** 2400-2483.5\_Bluetooth-LE \_CH00\_2402MHz **ANT** Pol. Horizontal **Fundamental** 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 FCC PART 150 65.0 65.0 48.8 48.8 **Peak** 32.5 32.5 16.3 16.3 1000 2310 2336. 2. 2388. Frequency (MHz) 2440 1400. 3000 2362. Frequency (MHz) Limit Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Remark Freq Level Line Margin Level Factor Loss Factor Factor Remark Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg cm deg 1 2368.24 49.27 74.00 -24.73 40.50 32.26 7.07 36.56 6.00 379 360 PEAK 1 2402.00 97.72 ----- 88.77 32.39 7.13 36.57 6.00 379 360 PEAK 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 65.0 65.0 FCC PART 15C (AVG FCC PART 15C (AVG Avg 32.5 32.5 16.3 16.3 0 2310 2388. Frequency (MHz) 1000 2336. 2362. 2414. 2440 1400. 2600. 3000 Frequency (MHz) Limit Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Remark Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB deg cm deg cm 1 2402.00 96.86 ----- 87.91 32.39 7.12 36.56 6.00 360 AVERAGE 1 2389.56 38.99 54.00 -15.01 30.03 32.38 7.10 36.52 6.00 379 360 AVERAGE

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1 Mode **Band Edge** 2400-2483.5\_Bluetooth-LE \_CH00\_2402MHz **ANT** Pol. Vertical **Fundamental** 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 FCC PART 150 65.0 65.0 48.8 48.8 **Peak** 32.5 32.5 16.3 16.3 1000 2310 2336. 2362. 2. 2388. Frequency (MHz) 2440 1400. 3000 Frequency (MHz) Limit Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Remark Freq Level Line Margin Level Factor Loss Factor Factor Remark Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg cm deg 1 2370.97 49.12 74.00 -24.88 40.32 32.28 7.08 36.56 6.00 367 273 PEAK 1 2402.00 94.35 ----- 85.40 32.39 7.13 36.57 6.00 367 273 PEAK 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 65.0 65.0 FCC PART 15C (AVG FCC PART 15C (AVG Avg 32.5 16.3 16.3 0 2310 2. 2388. Frequency (MHz) 1000 2336. 2362. 2414. 2440 1400. 2600. 3000 Frequency (MHz) Limit Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Remark Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB deg CM deg cm

1 2387.61 38.96 54.00 -15.04 30.01 32.37 7.10 36.52 6.00 367 273 AVERAGE

TEL: +86-512-57900158 FAX: +86-512-57900958 FCC ID: XMR2022SC686ANA 1 2402.00 93.49 ----- 84.54 32.39 7.12 36.56 6.00

367 273 AVERAGE

1 Mode Harmonic 2400-2483.5\_Bluetooth-LE \_CH00\_2402MHz **ANT** Pol. Horizontal Vertical 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 FCC PART 15C 65.0 65.0 FCC PART 15C (AVG FCC PART 15C (AVG Peak Avg 16.3 16.3 3000 0 3000 9000, Frequency (MHz) 9000, 12000. Frequency (MHz) 6000. 15000. 18000 6000. 12000. 15000. 18000 Limit Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Remark Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 4804.00 39.45 74.00 -34.55 60.50 34.00 10.20 65.25 0.00 --- PEAK 1 4804.00 39.09 74.00 -34.91 60.14 34.00 10.20 65.25 0.00 --- PEAK

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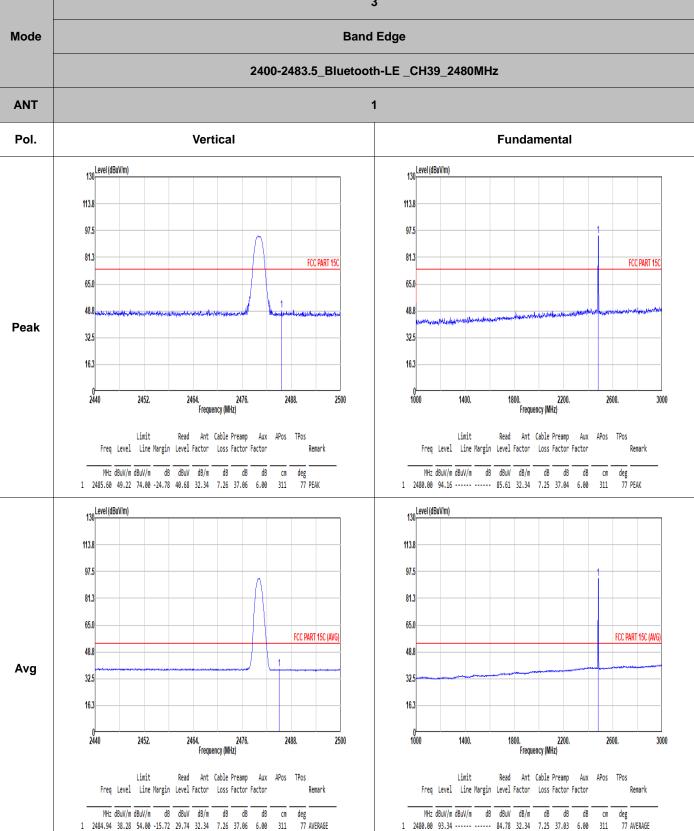
2 Mode Harmonic 2400-2483.5\_Bluetooth-LE \_CH19\_2440MHz **ANT** 1 Pol. Horizontal Vertical 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 65.0 65.0 **Peak** 32.5 32.5 Avg 16.3 16.3 3000 0<u></u> 3000 15000. 18000 15000. 18000 Frequency (MHz) Frequency (MHz) Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Limit Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor Remark Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB MHz dBuV/m dBuV/m dB dBuV dB/m dB dB 1 4880.00 40.82 74.00 -33.18 61.80 34.00 10.30 65.28 0.00 --- --- PEAK 1 4880.00 40.48 74.00 -33.52 61.46 34.00 10.30 65.28 0.00 --- PEAK 2 7320.00 41.24 74.00 -32.76 59.48 35.76 12.72 66.72 0.00 2 7320.00 41.17 74.00 -32.83 59.41 35.76 12.72 66.72 0.00

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FCC RF Test Report Report No.: FR310409B 3 **Band Edge** Mode 2400-2483.5\_Bluetooth-LE \_CH39\_2480MHz **ANT** 1 Pol. Horizontal **Fundamental** 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 FCC PART 150 FCC PART 150 65.0 65.0 48.8 48.8 Peak 32.5 325 16.3 16.3 2452. 2488. 2500 1400. 2600. 3000 2476. 2200. Frequency (MHz) Frequency (MHz) Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB 1 2498.44 48.81 74.00 -25.19 40.34 32.33 7.28 37.14 6.00 1 2480.00 97.55 ----- 89.00 32.34 7.25 37.04 6.00 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 81.3 81.3 65.0 65.0 FCC PART 15C (AVG 48.8 48.8 Avg 32.5 32.5

16.3 16.3 2440 1000 3000 2452. 2476. 1800. 2200. Frequency (MHz) Frequency (MHz) Limit Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB 1 2483.86 38.64 54.00 -15.36 30.09 32.34 7.26 37.05 6.00 312 0 AVERAGE 1 2480.00 96.77 ----- 88.21 32.34 7.25 37.03 6.00 312 0 AVERAGE Sporton International Inc. (Kunshan) Page Number : C7 of C18 TEL: +86-512-57900158

Report No.: FR310409B



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3 Mode Harmonic 2400-2483.5\_Bluetooth-LE \_CH39\_2480MHz **ANT** 1 Pol. Horizontal Vertical 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 65.0 65.0 FCC PART 15C (AVG **Peak** 32.5 Avg 16.3 16.3 3000 0<u></u> 3000 15000. 18000 15000. 18000 Frequency (MHz) Frequency (MHz) Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Limit Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor Remark Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB MHz dBuV/m dBuV/m dB dBuV dB/m dB dB 1 4960.00 39.84 74.00 -34.16 60.76 34.00 10.40 65.32 0.00 --- --- PEAK 1 4960.00 40.42 74.00 -33.58 61.34 34.00 10.40 65.32 0.00 --- PEAK

2 7440.00 41.35 74.00 -32.65 59.91 35.79 12.78 67.13 0.00

TEL: +86-512-57900158 FAX: +86-512-57900958 FCC ID: XMR2022SC686ANA 2 7440.00 41.47 74.00 -32.53 60.03 35.79 12.78 67.13 0.00

**Band Edge** Mode 2400-2483.5\_Bluetooth-LE \_CH00\_2402MHz **ANT** 1 Pol. Horizontal **Fundamental** 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 FCC PART 150 FCC PART 150 65.0 65.0 48.8 48.8 Peak 32.5 325 16.3 16.3 2336. 2414. 1400. 2600. 3000 2388. 1800. 2200. Frequency (MHz) Frequency (MHz) Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB MHz dBuV/m dBuV/m dB dBuV dB/m dB dB cm deg 1 2387.74 49.29 74.00 -24.71 40.34 32.37 7.10 36.52 6.00 1 2402.00 98.10 ----- 89.15 32.39 7.13 36.57 6.00 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 81.3 81.3 65.0 65.0 FCC PART 15C (AVG 48.8 48.8 Avg 32.5 32.5 16.3 16.3 1000 3000 2336. 2388. 2440 1800. 2200. Frequency (MHz) Frequency (MHz) Limit Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor

MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB

1 2384.88 39.54 54.00 -14.46 30.62 32.35 7.10 36.53 6.00 152 181 AVERAGE

MHz dBuV/m dBuV/m dB dBuV dB/m dB dB

1 2402.00 95.85 ----- 86.90 32.39 7.12 36.56 6.00 152 181 AVERAGE

dB

Report No.: FR310409B **Band Edge** Mode 2400-2483.5\_Bluetooth-LE \_CH00\_2402MHz **ANT** 1 Pol. Vertical **Fundamental** 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 FCC PART 150 FCC PART 150 65.0 65.0 48.8 48.8 Peak 32.5 32.5 16.3 16.3 2336. 2414. 1400. 2600. 3000 2388. 1800. 2200. Frequency (MHz) Frequency (MHz) Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB 1 2389.17 49.85 74.00 -24.15 40.90 32.37 7.10 36.52 6.00 1 2402.00 92.01 ----- 83.06 32.39 7.12 36.56 6.00 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 81.3 81.3 65.0 65.0 FCC PART 15C (AVG 48.8 48.8 Avg 32.5 32.5 16.3 16.3 1000 3000 2336. 2388. 2440 1800. 2200. Frequency (MHz) Frequency (MHz)

Limit

Freq Level Line Margin Level Factor Loss Factor Factor

MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB

1 2388.91 39.41 54.00 -14.59 30.46 32.37 7.10 36.52 6.00 300 76 AVERAGE

Read Ant Cable Preamp Aux APos TPos

TEL: +86-512-57900158 FAX: +86-512-57900958 FCC ID: XMR2022SC686ANA Freq Level Line Margin Level Factor Loss Factor Factor

1 2402.00 89.83 ----- 80.88 32.39 7.12 36.56 6.00 300 76 AVERAGE

MHz dBuV/m dBuV/m dB dBuV dB/m dB dB

Limit

Read Ant Cable Preamp Aux APos TPos

dB



Mode **Harmonic** 2400-2483.5\_Bluetooth-LE \_CH00\_2402MHz ANT 1 Pol. Horizontal Vertical 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 FCC PART 15C FCC PART 150 65.0 65.0 FCC PART 15C (AVG FCC PART 15C (AVG 48.8 48.8 **Peak** 32.5 32.5 Avg 16.3 16.3 6000. 12000. 15000. 6000. 12000. 15000. Frequency (MHz) Frequency (MHz) Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg

1 4804.00 39.46 74.00 -34.54 60.51 34.00 10.20 65.25 0.00 ---

TEL: +86-512-57900158 FAX: +86-512-57900958 FCC ID: XMR2022SC686ANA 1 4804.00 38.93 74.00 -35.07 59.98 34.00 10.20 65.25 0.00



5 Mode Harmonic 2400-2483.5\_Bluetooth-LE \_CH19\_2440MHz **ANT** 1 Pol. Horizontal Vertical 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 65.0 **Peak** 32.5 32.5 Avg 16.3 16.3 3000 0<u></u> 3000 15000. 18000 15000. 18000 Frequency (MHz) Frequency (MHz) Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Limit Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor Remark Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB MHz dBuV/m dBuV/m dB dBuV dB/m dB dB 1 4880.00 40.31 74.00 -33.69 61.29 34.00 10.30 65.28 0.00 --- --- PEAK 1 4880.00 40.86 74.00 -33.14 61.84 34.00 10.30 65.28 0.00 --- PEAK 2 7320.00 41.97 74.00 -32.03 60.21 35.76 12.72 66.72 0.00 2 7320.00 42.00 74.00 -32.00 60.24 35.76 12.72 66.72 0.00

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FCC RF Test Report Report No.: FR310409B **Band Edge** Mode 2400-2483.5\_Bluetooth-LE \_CH39\_2480MHz **ANT** 1 Pol. Horizontal **Fundamental** 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 FCC PART 150 FCC PART 150 65.0 65.0 48.8 Peak 32.5 325 16.3 16.3 2452. 2488. 1400. 2600. 3000 2476. 1800. 2200. Frequency (MHz) Frequency (MHz) Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB 1 2483.62 52.39 74.00 -21.61 43.84 32.34 7.26 37.05 6.00 1 2480.00 97.56 ----- 89.00 32.34 7.25 37.03 6.00 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 81.3 81.3 65.0 65.0 FCC PART 15C (AVG 48.8 48.8 Avg 32.5 32.5

Sporton International Inc. (Kunshan) Page Number : C14 of C18
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16.3

1000

Limit

1800.

Freq Level Line Margin Level Factor Loss Factor Factor

1 2480.00 95.39 ----- 86.83 32.34 7.25 37.03 6.00 315 360 AVERAGE

MHz dBuV/m dBuV/m dB dBuV dB/m dB dB

0, 2200. Frequency (MHz)

Read Ant Cable Preamp Aux APos TPos

dB

3000

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16.3

2440

2452.

Limit

Freq Level Line Margin Level Factor Loss Factor Factor

MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB

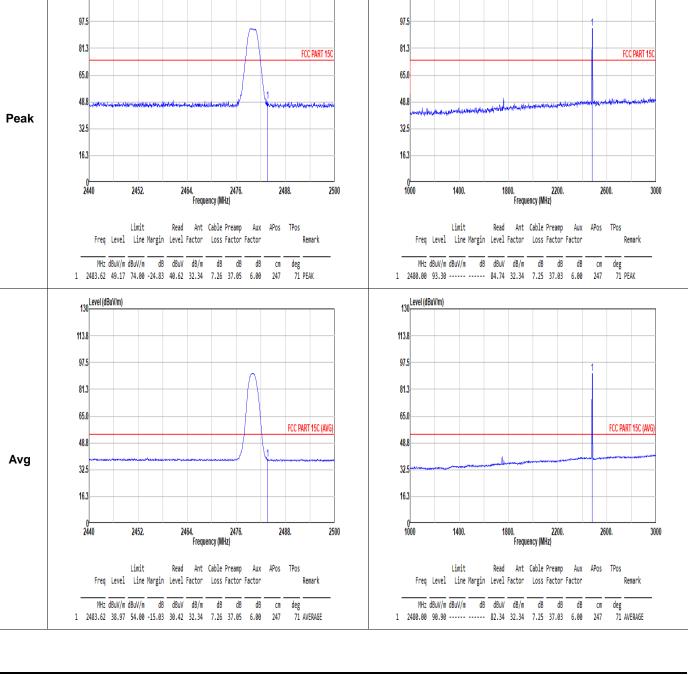
1 2483.50 39.92 54.00 -14.08 31.37 32.34 7.26 37.05 6.00 315 360 AVERAGE

2476.

Read Ant Cable Preamp Aux APos TPos

Frequency (MHz)

FCC RF Test Report Report No.: FR310409B **Band Edge** Mode 2400-2483.5\_Bluetooth-LE \_CH39\_2480MHz **ANT** 1 Pol. Vertical **Fundamental** 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 FCC PART 150 FCC PART 150 65.0 65.0 48.8 Peak 32.5 32.5 16.3 16.3 2452. 2488. 1400. 2600. 3000 2476. 1800. 2200. Frequency (MHz) Frequency (MHz) Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB 1 2483.62 49.17 74.00 -24.83 40.62 32.34 7.26 37.05 6.00 1 2480.00 93.30 ----- 84.74 32.34 7.25 37.03 6.00 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 81.3 81.3 65.0 65.0 FCC PART 15C (AVG 48.8 48.8



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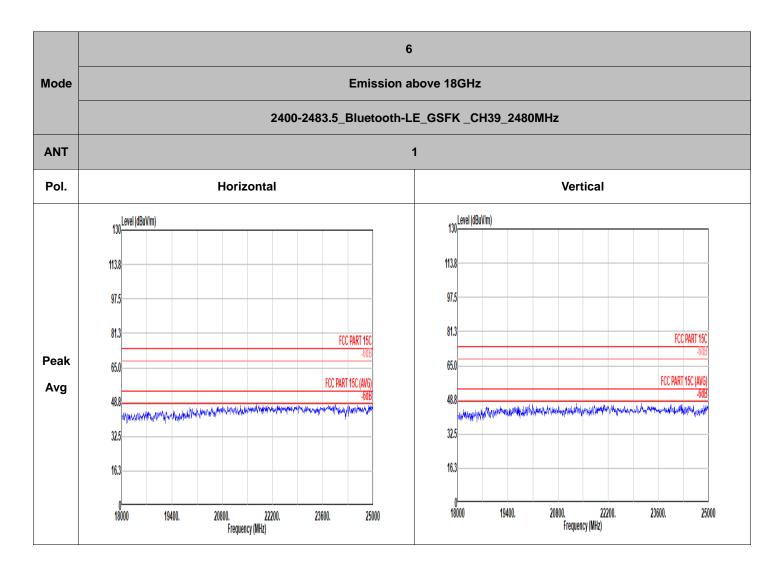


6 Mode Harmonic 2400-2483.5\_Bluetooth-LE \_CH39\_2480MHz **ANT** 1 Pol. Horizontal Vertical 130 Level (dBuV/m) 130 Level (dBuV/m) 113.8 113.8 97.5 97.5 81.3 81.3 65.0 65.0 **Peak** 32.5 Avg 16.3 16.3 3000 0<u></u> 3000 15000. 18000 15000. 18000 Frequency (MHz) Frequency (MHz) Read Ant Cable Preamp Aux APos TPos Limit Read Ant Cable Preamp Aux APos TPos Limit Freq Level Line Margin Level Factor Loss Factor Factor Freq Level Line Margin Level Factor Loss Factor Factor Remark Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB MHz dBuV/m dBuV/m dB dBuV dB/m dB dB 1 4960.00 40.20 74.00 -33.80 61.12 34.00 10.40 65.32 0.00 --- --- PEAK 1 4960.00 39.71 74.00 -34.29 60.63 34.00 10.40 65.32 0.00 --- PEAK

2 7440.00 40.50 74.00 -33.50 59.06 35.79 12.78 67.13 0.00

TEL: +86-512-57900158 FAX: +86-512-57900958 FCC ID: XMR2022SC686ANA 2 7440.00 41.71 74.00 -32.29 60.27 35.79 12.78 67.13 0.00





TEL: +86-512-57900158 FAX: +86-512-57900958 FCC ID: XMR2022SC686ANA



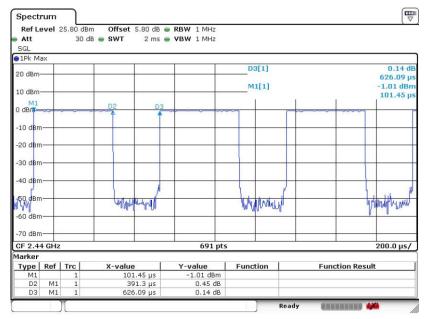
7 LF Mode 2400-2483.5\_Bluetooth-LE\_GSFK \_CH39\_2480MHz **ANT** Pol. Horizontal Vertical http://www.sporton.com.cn Data: 3 60.0 60.0 50.0 QP/ **Peak** 03CH05-KS FCC PART 15C 3m CBL6111D SN23188 HORIZONTAL RBW:100.000KHz VBW:300.000KHz SWT:Auto 2D2302 03CH05-KS FCC PART 15C 3m CBL6111D SN23188 VERTICAL RBW: 100,000KHz VBW: 300,000KHz SWT: Auto 2D2302 Site Condition Over Limit ReadAntenna Cable Preamp A/Pos T/Pos
Freq Level Limit Line Level Factor Loss Factor Remark Over Limit ReadAntenna Cable Preamp A/Pos T/Pos
Freq Level Limit Line Level Factor Loss Factor Remark Pol/Phas MHz dBuV/m dB dBuV/m dBuV dB/m MHz dBuV/m dB dBuV/m dBuV dB/m dB 47.46 29.15 -10.85 40.00 45.65 15.40 146.40 24.29 -19.21 43.50 38.81 16.47 192.96 21.18 -22.32 43.50 36.36 15.55 259.89 26.36 -25.64 46.00 32.08 18.60 459.71 23.35 -22.65 46.00 30.37 22.74 60.715 26.85 19.15 46.00 31.17 24.98 1.04 32.94 1.83 32.82 2.11 32.84 2.46 32.78 3.27 33.03 3.76 33.06 145.43 22.69 -21.41 43.50 36.60 16.48 199.65 22.32 -21.18 43.50 37.45 15.61 256.98 23.24 -22.76 46.00 35.03 18.25 26.43 359.10 21.60 -24.40 46.00 31.25 20.43 470.38 26.60 -19.40 46.00 31.01 25.00 56.00 19.40 46.00 31.01 25.00 1.83 32.82 2.10 32.84 2.45 32.78 2.85 32.93 3.31 33.00 3.68 33.09

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## Appendix D. Duty Cycle Plots

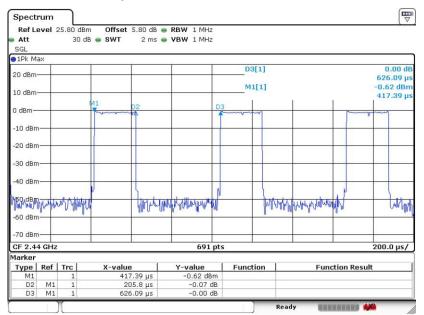
Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting	
Bluetooth LE 1Mbps	62.50	0.391	2.556	2.7kHz	
Bluetooth LE 2Mbps	32.87	0.206	4.859	5.1kHz	

#### **Bluetooth LE 1Mbps**



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



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