

# FCC RF Test Report

:	Lava Sources LLC
:	Wireless Remote
:	E4GE9R
:	2AYUC-3443
:	FCC Part 15 Subpart C §15.247
:	(DTS) Digital Transmission System
:	May 21, 2021 ~ May 27, 2021
	::

We, Sporton International (Kunshan) Inc., 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 (Kunshan) Inc., the test report shall not be reproduced except in full.

JasonJia

Reviewed by: Jason Jia / Supervisor

Alexano

Approved by: Alex Wang / Manager



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



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# **REVISION HISTORY**

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR150608-01	Rev. 01	Initial issue of report	Jun. 09, 2021
FR150608-01	Rev. 02	Update test mode	Jun. 23, 2021
FR150608-01	Rev. 03	Updated "Bluetooth v5.0 LE" to "Bluetooth LE 2Mbps" on page 27	Aug. 30, 2021



Report Section	FCC Rule	FCC Rule Description Limit		FCC Rule Description Limit Res		Result
3.1	15.247(a)(2)	6dB Bandwidth	≥ 0.5MHz	Pass		
3.1	-	99% Bandwidth	-	N/A		
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		
-	15.207	AC Conducted Emission	15.207(a)	Not Required		
3.6	15.203 & 15.247(b)	Antenna Requirement	N/A	N/A		

Remark: Not required means after assessing, test items are not necessary to carry out.

#### 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.



# **1** General Description

# 1.1 Applicant

# Lava Sources LLC

12 Penns Trail Newtown, PA 18940

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

Product Feature			
Equipment	Wireless Remote		
Model Name E4GE9R			
FCC ID 2AYUC-3443			
EUT supports Radios application Bluetooth LE			

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

Standards-related Product Specification			
Tx/Rx Frequency Range2402 MHz ~ 2480 MHz			
Number of Channels	40		
<b>Carrier Frequency of Each Channel</b> 40 Channel(37 hopping + 3 advertising channel)			
Meximum Output Dewerte Antenne	Bluetooth LE 1M: 3.89 dBm (0.0024 W)		
Maximum Output Power to Antenna	Bluetooth LE 2M: 3.69 dBm (0.0023 W)		
99% Occupied Bandwidth	Bluetooth LE 1M: 1.143MHz		
99% Occupied Bandwidth	Bluetooth LE 2M: 2.098MHz		
Antenna Type / Gain	PCB Inv F Antenna with gain 3.60 dBi		
Type of Modulation         Bluetooth LE : GFSK			

# **1.4 Modification of EUT**

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



# 1.5 Testing Location

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

Test Firm	Sporton International (Kunshan) Inc.				
<b>T</b> ( <b>0</b> ) ( <b>1</b> ()	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China				
Test Site Location	TEL:+86-512-57900158				
	FAX : +86-512-57900958				
Test Offe Ne	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.		
Test Site No.	03CH06-KS TH01-KS CN1257		314309		

# 1.6 Test Software

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

# **1.7 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 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	-	-

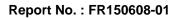


# 2.2 Test Mode

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: 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.

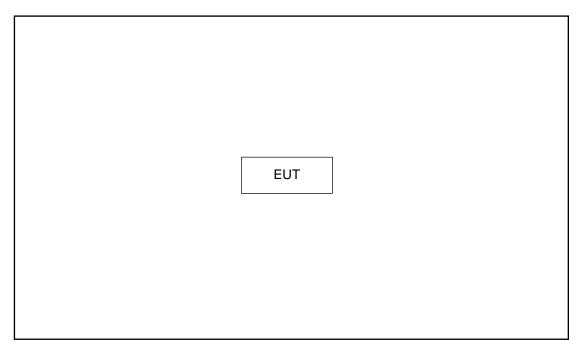
The following summary table is showing all test modes to demonstrate in compliance with the standard.

	Summary table of Test Cases			
Test Item	Data Rate / Modulation			
Test item	Bluetooth LE / GFSK			
Conducted	Mode 1: Bluetooth Tx CH00_2402 MHz			
TCs	Mode 2: Bluetooth Tx CH19_2440 MHz			
105	Mode 3: Bluetooth Tx CH39_2480 MHz			
Radiated	Mode 1: Bluetooth Tx CH00_2402 MHz			
TCs	Mode 2: Bluetooth Tx CH19_2440 MHz			
105	Mode 3: Bluetooth Tx CH39_2480 MHz			





# 2.3 Connection Diagram of Test System



# 2.4 EUT Operation Test Setup

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

# 2.5 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 6.20 dB.

 $Offset(dB) = RF \ cable \ loss(dB).$ = 6.20 (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.

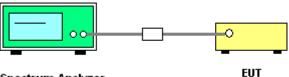
# 3.1.2 Measuring Instruments

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.
- 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



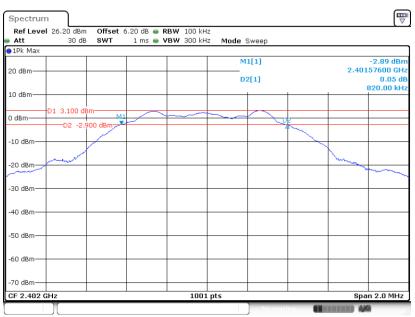
Spectrum Analyzer



### 3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.

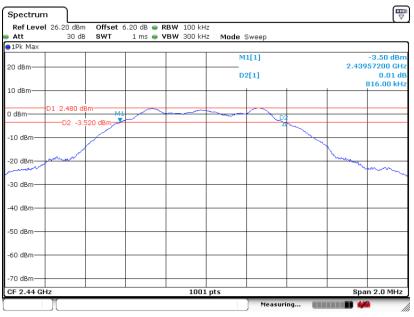
### Bluetooth LE 1Mbps



#### 6 dB Bandwidth Plot on Channel 00

Date: 21.MAY.2021 15:13:15

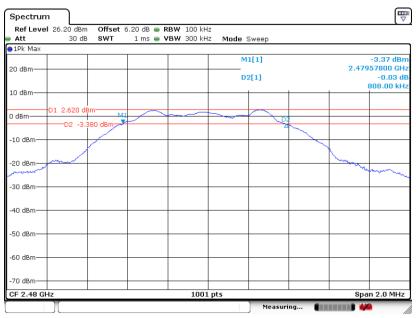




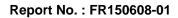
#### 6 dB Bandwidth Plot on Channel 19

Date: 21.MAY.2021 15:17:27

#### 6 dB Bandwidth Plot on Channel 39

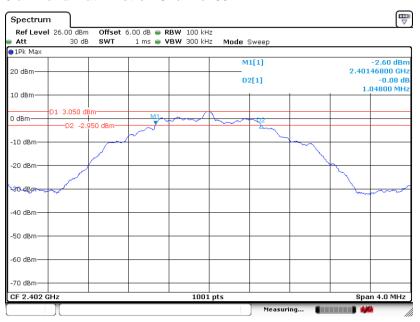


Date: 21.MAY.2021 15:20:50





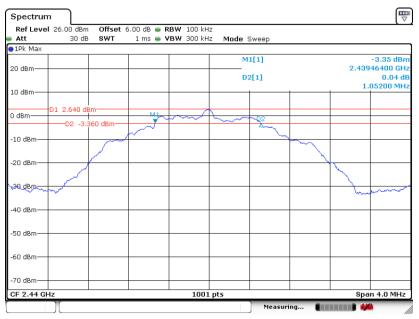
#### Bluetooth LE 2Mbps



#### 6 dB Bandwidth Plot on Channel 00

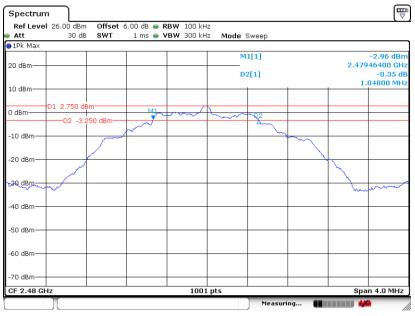
Date: 21.MAY.2021 15:29:42

#### 6 dB Bandwidth Plot on Channel 19



Date: 21.MAY.2021 08:55:43





### 6 dB Bandwidth Plot on Channel 39

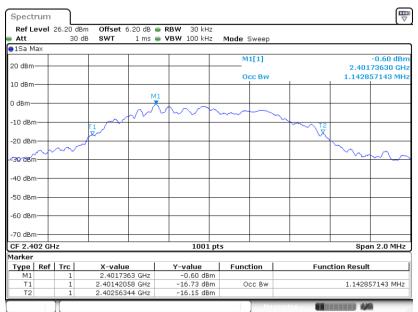
Date: 21.MAY.2021 09:00:06



# 3.1.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

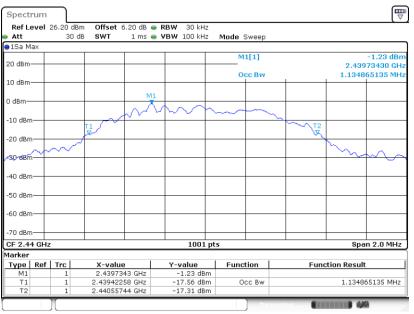
#### Bluetooth LE 1Mbps



99% Occupied Bandwidth Plot on Channel 00

Date: 21.MAY.2021 15:14:21

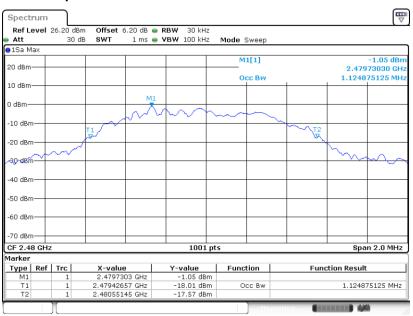




### 99% Occupied Bandwidth Plot on Channel 19

Date: 21.MAY.2021 15:20:14

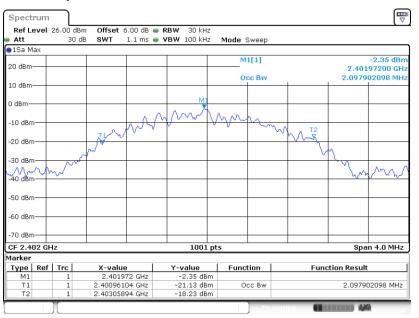
#### 99% Occupied Bandwidth Plot on Channel 39



Date: 21.MAY.2021 15:23:34



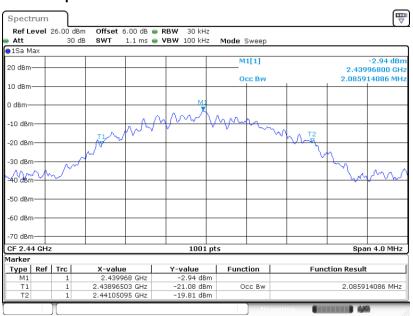
#### Bluetooth LE 2Mbps



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

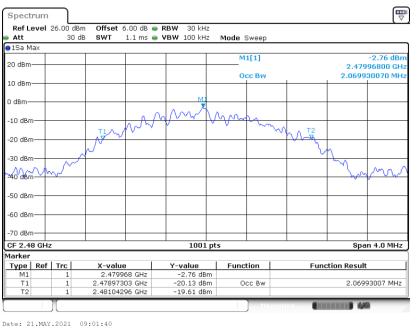
Date: 21.MAY.2021 08:53:06

#### 99% Occupied Bandwidth Plot on Channel 19



Date: 21.MAY.2021 08:59:00





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

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.

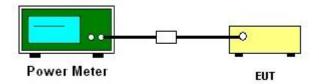
# 3.2.2 Measuring Instruments

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 11.9.2.3.2 Method AVGPM-G 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.

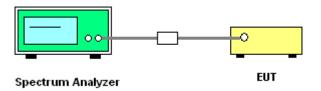
# 3.3.2 Measuring Instruments

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

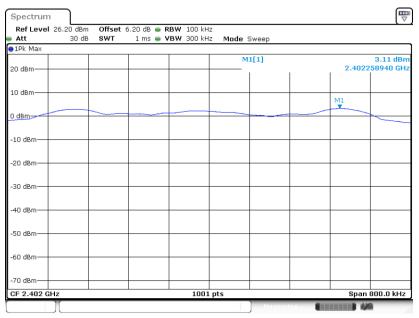
Please refer to Appendix A.



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

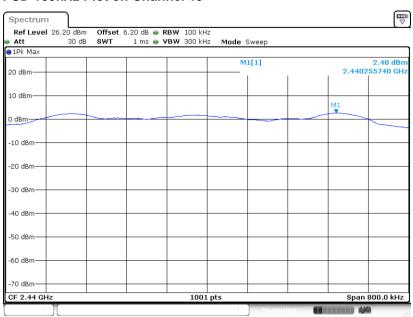
#### Bluetooth LE 1Mbps

PSD 100kHz Plot on Channel 00



Date: 21.MAY.2021 15:14:46

#### PSD 100kHz Plot on Channel 19



Date: 21.MAY.2021 15:18:43



#### PSD 100kHz Plot on Channel 39

Spectrum Ref Level 26.20 dBm	Offset 6.20 dB 👄 RBN	<b>W</b> 100 kHz		
Att 30 dB	SWT 1 ms 🖶 VB	W 300 kHz Mode Swi	еер	
1Pk Max				
10 dBm		M1[:		2.64 dBm 2.480255740 GHz
.0 dBm			M1	
l dBm				
10 dBm				
20 dBm				
30 dBm				
40 dBm				
50 dBm				
60 dBm				
70 dBm				
CF 2.48 GHz		1001 pts		Span 800.0 kHz

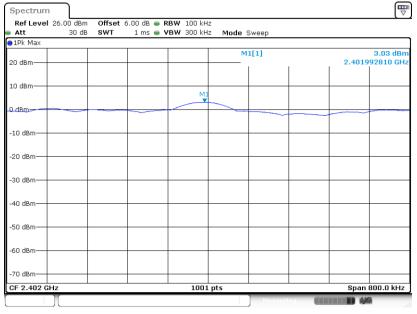
Date: 21.MAY.2021 15:21:33





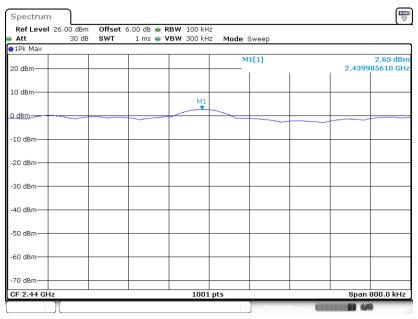
#### Bluetooth LE 2Mbps

#### PSD 100kHz Plot on Channel 00



Date: 21.MAY.2021 15:30:46

#### PSD 100kHz Plot on Channel 19



Date: 21.MAY.2021 08:56:36



#### PSD 100kHz Plot on Channel 39

Ref Level 26.00		.00 dB 😑 RBW 100		, , , , , , , , , , , , , , , , , , ,
	db SWT	1 ms 👄 <b>VBW</b> 300	kHz <b>Mode</b> Sweep	
1Pk Max				
20 dBm			M1[1]	2.74 dBn 2.479983220 GH
10 dBm		м		
0 dBm				
-10 dBm				
-20 dBm				
-30 dBm				
-40 dBm				
-50 dBm				
-60 dBm				
-70 dBm				
CF 2.48 GHz		10	01 pts	Span 800.0 kHz

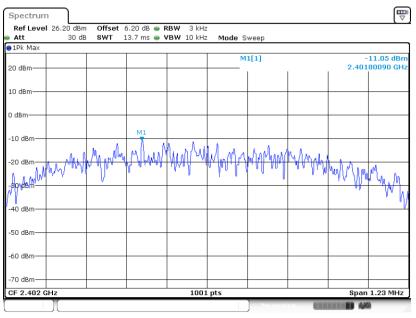
Date: 21.MAY.2021 09:00:46



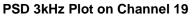
# 3.3.7 Test Result of Power Spectral Density Plots (3kHz)

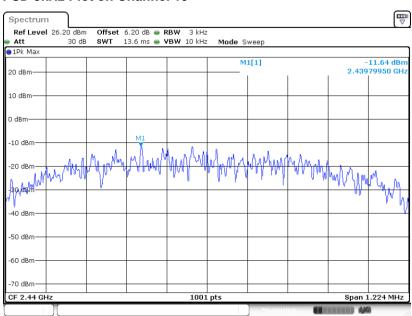
#### Bluetooth LE 1Mbps

PSD 3kHz Plot on Channel 00



Date: 21.MAY.2021 15:13:34

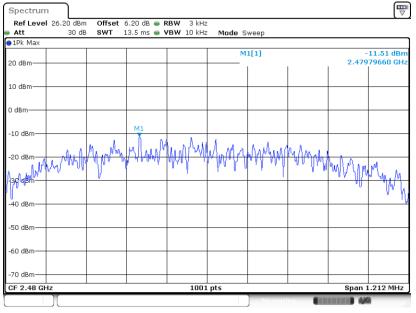




Date: 21.MAY.2021 15:18:12



#### PSD 3kHz Plot on Channel 39

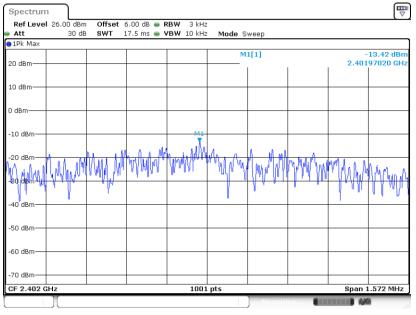


Date: 21.MAY.2021 15:21:05



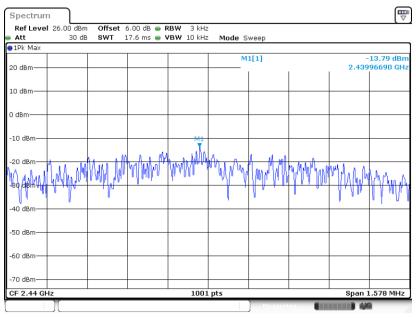
#### **Bluetooth LE 2Mbps**





Date: 21.MAY.2021 15:30:18

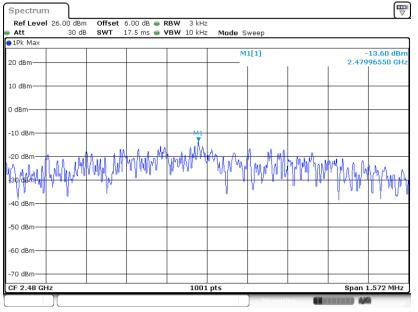
#### PSD 3kHz Plot on Channel 19



Date: 21.MAY.2021 08:56:05



#### PSD 3kHz Plot on Channel 39



Date: 21.MAY.2021 09:00:21



# 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.

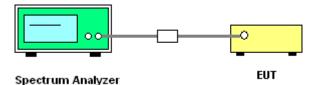
### 3.4.2 Measuring Instruments

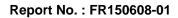
The section 4.0 of List of Measuring Equipment of this test report is used for test.

# 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



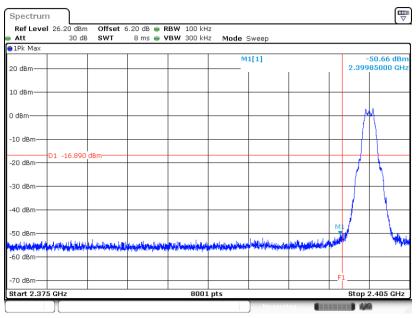




# 3.4.5 Test Result of Conducted Band Edges Plots

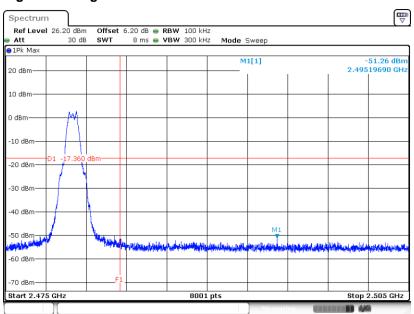
#### Bluetooth LE 1Mbps

#### Low Band Edge Plot on Channel 00



Date: 21.MAY.2021 15:15:09

#### High Band Edge Plot on Channel 39

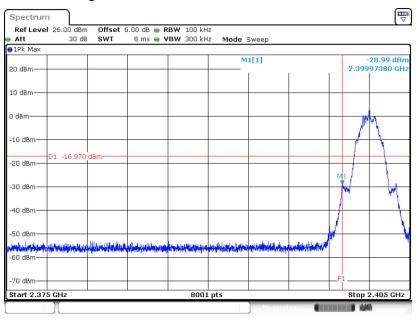


Date: 21.MAY.2021 15:21:45





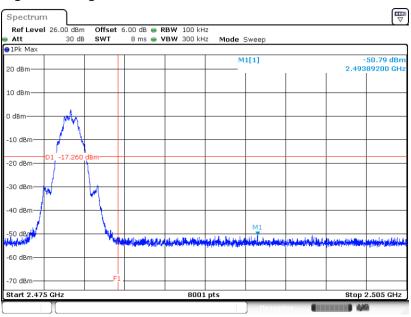
#### Bluetooth LE 2Mbps



#### Low Band Edge Plot on Channel 00

Date: 21.MAY.2021 15:30:57

#### High Band Edge Plot on Channel 39



Date: 21.MAY.2021 09:00:58

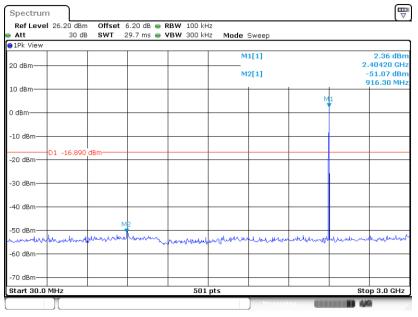


# 3.4.6 Test Result of Conducted Spurious Emission Plots

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

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

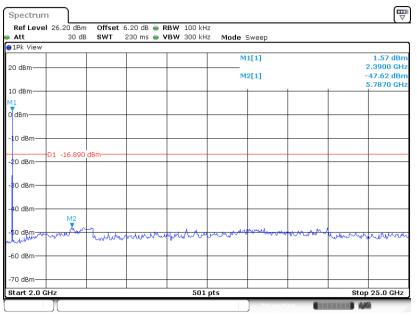
#### GFSK Channel 00



Date: 21.MAY.2021 15:16:12

# Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

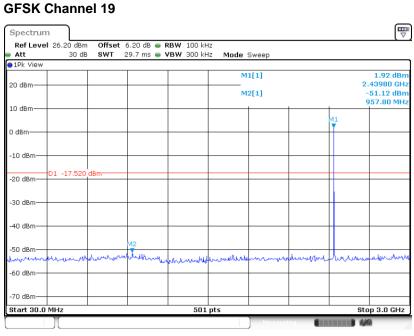
#### GFSK Channel 00



Date: 21.MAY.2021 15:16:24

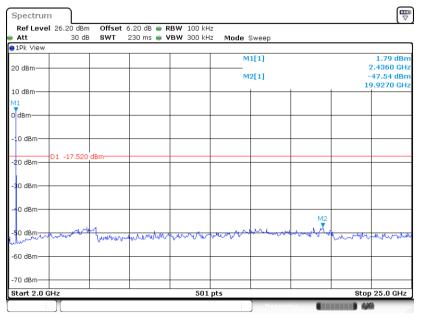


### Conducted Spurious Emission Plot on Bluetooth LE 1Mbps



Date: 21.MAY.2021 15:19:52

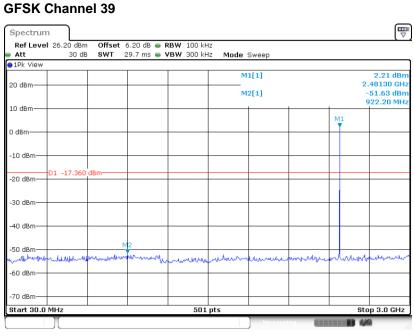
# Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 19



Date: 21.MAY.2021 15:20:03

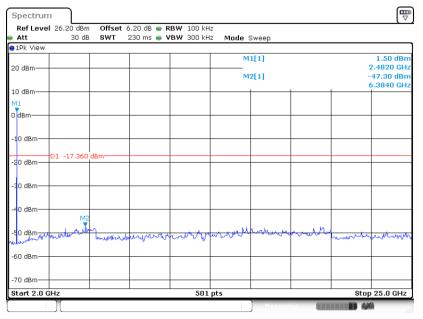


### Conducted Spurious Emission Plot on Bluetooth LE 1Mbps



Date: 21.MAY.2021 15:23:14

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

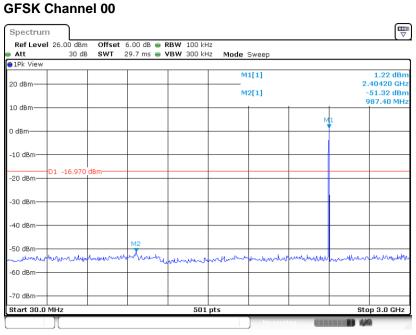


Date: 21.MAY.2021 15:23:24



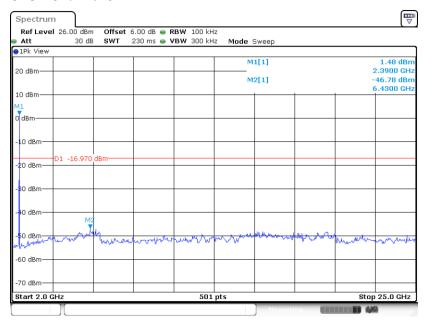
#### Bluetooth LE 2Mbps

#### **Conducted Spurious Emission Plot on Bluetooth LE 2Mbps**



Date: 21.MAY.2021 15:34:13

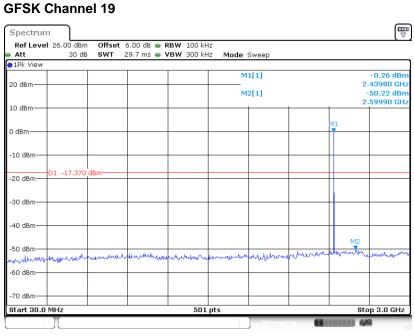
# Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 01



Date: 21.MAY.2021 15:34:24

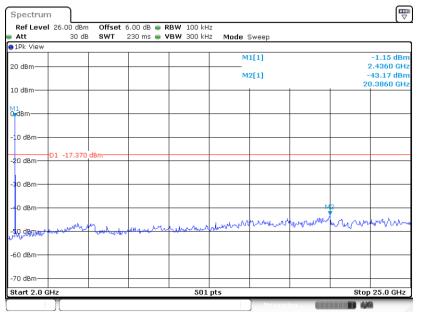


### Conducted Spurious Emission Plot on Bluetooth LE 2Mbps



Date: 21.MAY.2021 08:57:52

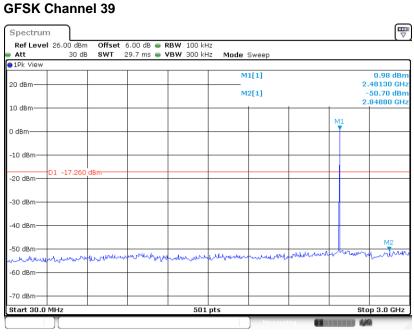
# Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 19



Date: 21.MAY.2021 08:58:04

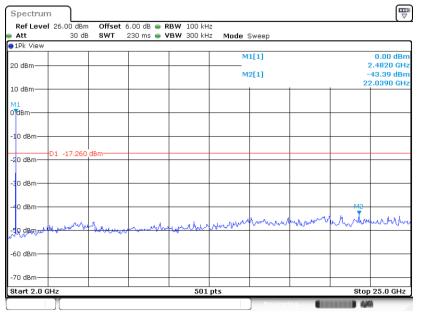


#### Conducted Spurious Emission Plot on Bluetooth LE 2Mbps



Date: 21.MAY.2021 09:01:18

## Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 39



Date: 21.MAY.2021 09:01:29



## 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.



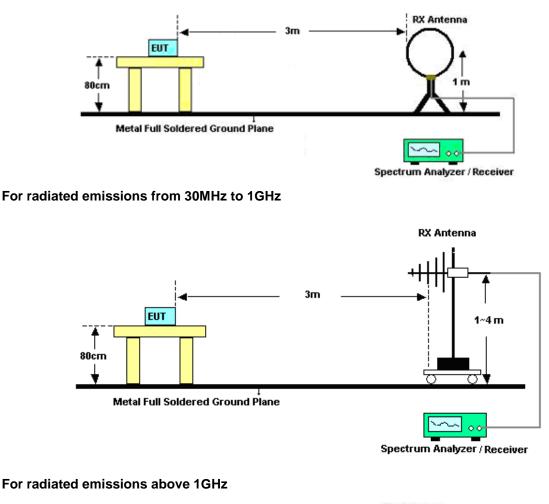
#### 3.5.3 Test Procedures

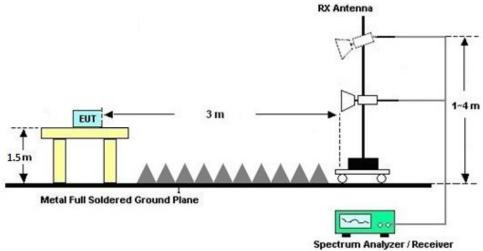
- 1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
- 2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get 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





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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.

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 B & 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 B & C.



## 3.6 Antenna Requirements

## 3.6.1 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.

## 3.6.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

## 3.6.3 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	Nov. 01, 2020	May 21, 2021	Oct. 31, 2021	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GH z	Jan. 07, 2021	May 21, 2021	Jan. 06, 2022	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 07, 2021	May 21, 2021	Jan. 06, 2022	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY564000 04	3Hz~8.5GHz;M ax 30dBm	Oct. 17, 2020	May 27, 2021	Oct. 16, 2021	Radiation (03CH06-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY551502 08	10Hz-44GHz	Apr. 12, 2021	May 27, 2021	Apr. 11, 2022	Radiation (03CH06-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Nov. 01, 2020	May 27, 2021	Oct. 31, 2021	Radiation (03CH06-KS)
Bilog Antenna	TeseQ	CBL6111D	49921	30MHz-1GHz	May 29, 2020	May 27, 2021	May 28, 2021	Radiation (03CH06-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00218652	1GHz~18GHz	Apr. 25, 2021	May 27, 2021	Apr. 24, 2022	Radiation (03CH06-KS)
SHF-EHF Horn	Com-power	AH-840	101115	18GHz~40GHz	Nov. 10, 2020	May 27, 2021	Nov. 09, 2021	Radiation (03CH06-KS)
Amplifier	SONOMA	310N	187289	9KHz ~1GHZ	Apr. 12, 2021	May 27, 2021	Apr. 11, 2022	Radiation (03CH06-KS)
Amplifier	MITEQ	EM18G40GG A	060728	18~40GHz	Jan. 06, 2021	May 27, 2021	Jan. 05, 2022	Radiation (03CH06-KS)
high gain Amplifier	MITEQ	AMF-7D-0010 1800-30-10P	2025788	1Ghz-18Ghz	Jan. 06, 2021	May 27, 2021	Jan. 05, 2022	Radiation (03CH06-KS)
Amplifier	Keysight	83017A	MY532702 03	500MHz~26.5G Hz	Apr. 13, 2021	May 27, 2021	Apr. 12, 2022	Radiation (03CH06-KS)
AC Power Source	Chroma	61601	F1040900 04	N/A	NCR	May 27, 2021	NCR	Radiation (03CH06-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	May 27, 2021	NCR	Radiation (03CH06-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	May 27, 2021	NCR	Radiation (03CH06-KS)

NCR: No Calibration Required



## 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.

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

Measuring Uncertainty for a Level of Confidence	5.0dB
of 95% (U = 2Uc(y))	3.00B

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

Measuring Uncertainty for a Level of Confidence	5.0dB
of 95% (U = 2Uc(y))	3.00B

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

Measuring Uncertainty for a Level of Confidence	5.0dB
of 95% (U = 2Uc(y))	3.00B



## Appendix A. Conducted Test Results

Report Number : FR150608-01

#### Bluetooth Low Energy 1Mbps

Test Engineer:	Jiang Jun	Temperature:	20~26	°C
Test Date:	2021/5/21	Relative Humidity:	40~51	%

					<u>6d</u>		RESULTS 6 Occupie	<u>DATA</u> d Bandwid
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	1.143	0.820	0.50	Pass
BLE	1Mbps	1	19	2440	1.135	0.816	0.50	Pass
BLE	1Mbps	1	39	2480	1.125	0.808	0.50	Pass

							-	<u>RESULTS</u> k Power Ta				
M	lod.	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	
В	BLE	1Mbps	1	0	2402	3.89	30.00	3.60	7.49	36.00	Pass	
В	BLE	1Mbps	1	19	2440	3.22	30.00	3.60	6.82	36.00	Pass	
В	BLE	1Mbps	1	39	2480	3.43	30.00	3.60	7.03	36.00	Pass	

						<u>(Re</u>
Mod.	Data Rate	Nтх	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
BLE	1Mbps	1	0	2402	2.04	3.52
BLE	1Mbps	1	19	2440	2.04	2.93
BLE	1Mbps	1	39	2480	2.04	3.16

						-	RESULTS Power De		
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	3.11	-11.05	3.60	8.00	Pass
BLE	1Mbps	1	19	2440	2.48	-11.64	3.60	8.00	Pass
BLE	1Mbps	1	39	2480	2.64	-11.51	3.60	8.00	Pass

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

Report Number : FR150608-01

#### Bluetooth Low Energy 2Mbps

Test Engineer:	Jiang Jun	Temperature:	20~26	°C
Test Date:	2021/5/21	Relative Humidity:	40~51	%

					<u>6d</u>		RESULTS 6 Occupie	<u>DATA</u> d Bandwid
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE	2Mbps	1	0	2402	2.098	1.048	0.50	Pass
BLE	2Mbps	1	19	2440	2.086	1.052	0.50	Pass
BLE	2Mbps	1	39	2480	2.070	1.048	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	3.69	30.00	3.60	7.29	36.00	Pass	
BLE	2Mbps	1	19	2440	3.03	30.00	3.60	6.63	36.00	Pass	
BLE	2Mbps	1	39	2480	3.23	30.00	3.60	6.83	36.00	Pass	

						Avera	RESULTS DATA ge Power Table porting Only)
Mod.	Data Rate	Ntx	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)	
BLE	2Mbps	1	0	2402	4.83	3.25	
BLE	2Mbps	1	19	2440	4.83	2.97	
BLE	2Mbps	1	39	2480	4.83	3.08	
	· · ·		-			-	

	<u>TEST RESULTS DATA</u> <u>Peak Power Density</u>										
Mod.	Rate (MHZ) /100kHz) /3kHz) (dBi) (dBm /3kHz)										
BLE	2Mbps	1	0	2402	3.03	-13.42	3.60	8.00	Pass		
BLE	2Mbps	1	19	2440	2.63	-13.79	3.60	8.00	Pass		
BLE	2Mbps	1	39	2480	2.74	-13.60	3.60	8.00	Pass		

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



## Appendix B. Radiated Spurious Emission

### Bluetooth LE 1Mbps

#### 2.4GHz 2400~2483.5MHz

#### BLE (Band Edge @ 3m)

515		_							_			<b>_</b> .	<b>.</b> .
BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant		Peak	Pol.
		(MHz)	(dBµV/m)	Limit (dB)	Line (dBµV/m)	Level (dBµV)	Factor (dB/m)	Loss (dB)	Factor (dB)	Pos (cm)	Pos (deg)	Avg. (P/A)	(H/V)
		2358.1	54.65	-19.35	74	48.03	32.05	8.02	33.45	146	68	P	Η
		2384.36	44.41	-9.59	54	37.65	32.15	8.06	33.45	146	68	А	Н
515	*	2402	100.83	-	-	93.98	32.2	8.09	33.44	146	68	Ρ	Н
BLE CH 00	*	2402	100.06	-	-	93.21	32.2	8.09	33.44	146	68	А	Н
2402MHz		2383.45	55.74	-18.26	74	47.84	33.29	8.06	33.45	380	111	Р	V
2402101112		2388.13	45.64	-8.36	54	37.5	33.5	8.09	33.45	380	111	А	V
	*	2402	98.6	-	-	90.45	33.5	8.09	33.44	380	111	Ρ	V
	*	2402	97.88	-	-	89.73	33.5	8.09	33.44	380	111	А	V
		2349.52	54.34	-19.66	74	47.75	32.05	7.99	33.45	168	64	Ρ	Н
		2372.66	44.42	-9.58	54	37.71	32.1	8.06	33.45	168	64	А	Н
		2488.6	54.26	-19.74	74	47.74	31.7	8.24	33.42	168	64	Ρ	Н
		2484.88	44.39	-9.61	54	37.8	31.8	8.22	33.43	168	64	А	Н
	*	2440	101.31	-	-	94.58	32	8.16	33.43	168	64	Ρ	Н
BLE	*	2440	100.6	-	-	93.87	32	8.16	33.43	168	64	А	Н
CH 19 2440MHz		2375.78	55.37	-18.63	74	47.47	33.29	8.06	33.45	367	105	Ρ	V
2440101112		2389.56	45.55	-8.45	54	37.41	33.5	8.09	33.45	367	105	А	V
		2494.36	55.3	-18.7	74	47.75	32.73	8.24	33.42	367	105	Ρ	V
		2490.88	45.34	-8.66	54	37.79	32.73	8.24	33.42	367	105	А	V
	*	2440	98.37	-	-	90.53	33.11	8.16	33.43	367	105	Ρ	V
	*	2440	97.53	-	-	89.69	33.11	8.16	33.43	367	105	А	V



		2483.74	54.42	-19.58	74	47.83	31.8	8.22	33.43	107	62	Р	Н
		2403.74	J4.4Z	-19.50	74	47.03	31.0	0.22	33.43	107	02	Г	
		2483.5	47.05	-6.95	54	40.46	31.8	8.22	33.43	107	62	Α	Н
51.5	*	2480	100.66	-	-	94.07	31.8	8.22	33.43	107	62	Р	Н
BLE CH 39	*	2480	99.95	-	-	93.36	31.8	8.22	33.43	107	62	А	Н
2480MHz		2491.54	55.6	-18.4	74	48.05	32.73	8.24	33.42	353	100	Р	V
240011112		2483.5	47.17	-6.83	54	39.52	32.86	8.22	33.43	353	100	А	V
	*	2480	98.7	-	-	91.05	32.86	8.22	33.43	353	100	Р	V
	*	2480	97.94	-	-	90.29	32.86	8.22	33.43	353	100	А	V
Remark		o other spurio I results are P		st Peak a	and Avera	ge limit line	э.						



_	BLE (Harmonic @ 3m)												
BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
		(MHz)	(dBµV/m)	Limit (dB)	Line ( dBµV/m )	Level ( dBµV )	Factor ( dB/m )	Loss (dB)	Factor (dB)	Pos ( cm )	Pos ( deg )	Avg. (P/A)	(H/V)
BLE		4806	44.38	-29.62	74	59.08	34.96	11.51	61.17	300	0	Р	н
CH 00 2402MHz		4806	44.43	-29.57	74	59.25	34.84	11.51	61.17	300	360	Р	V
		4878	43.86	-30.14	74	58.33	35.04	11.6	61.11	300	0	Р	Н
BLE		7320	43.13	-30.87	74	52.65	36.86	14.69	61.07	300	0	Ρ	Н
CH 19 2440MHz		4878	44.1	-29.9	74	58.78	34.83	11.6	61.11	300	360	Ρ	V
2440101712		7320	42.62	-31.38	74	52.6	36.4	14.69	61.07	300	360	Ρ	V
		4962	47.44	-26.56	74	61.63	35.14	11.71	61.04	300	0	Ρ	Н
BLE		7440	43.22	-30.78	74	52.5	36.89	14.88	61.05	300	0	Ρ	Н
CH 39 2480MHz		4962	44.3	-29.7	74	58.82	34.81	11.71	61.04	300	360	Ρ	V
240010172		7440	42.85	-31.15	74	52.55	36.47	14.88	61.05	300	360	Ρ	V
Remark		o other spurio I results are F		st Peak	and Averag	e limit lin	e.						

#### 2.4GHz 2400~2483.5MHz

#### **Sporton International (Kunshan) Inc.** TEL : +86-512-57900158 FAX : +86-512-57900958 FCC ID: 2AYUC-3443



### Emission below 1GHz

## 2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	( dBµV/m )	(dB)	( dBµV/m )	(dBµV)	( dB/m )	( dB )	(dB)	( cm )	(deg)	(P/A)	(H/V)
		30	20.97	-19.03	40	27.79	25.3	0.58	32.7	-	-	Р	Н
		96.93	18.88	-24.62	43.5	34.39	15.68	1.59	32.78	-	-	Р	Н
		460.68	22.78	-23.22	46	28.7	23.31	3.49	32.72	-	-	Р	н
		690.57	26.2	-19.8	46	28.01	26.7	4.27	32.78	-	-	Р	н
		831.22	28.73	-17.27	46	27.75	28.84	4.7	32.56	203	35	Р	Н
2.4GHz BLE		979.63	27.67	-26.33	54	24.47	30.28	5.1	32.18	-	-	Р	Н
LF		30.97	21.59	-18.41	40	29.66	24.04	0.59	32.7	108	98	Р	V
		96.93	19.02	-24.48	43.5	33.74	16.47	1.59	32.78	-	-	Р	V
		442.25	22.73	-23.27	46	29.57	22.46	3.42	32.72	-	-	Р	V
		557.68	25.07	-20.93	46	28.86	24.95	3.84	32.58	-	-	Р	V
		855.47	27.56	-18.44	46	28.95	26.43	4.77	32.59	-	-	Р	V
		965.08	27.22	-26.78	54	27.35	27.05	5.06	32.24	-	-	Р	V
	1. No	o other spurio	us found.										
Remark		l results are P		st limit li	ne.								



### **Bluetooth LE 2Mbps**

#### 2.4GHz 2400~2483.5MHz

## BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	( dBµV/m )	( dB )	( dBµV/m )	(dBµV)	( dB/m )	( dB )	(dB)	( cm )	(deg)	(P/A)	(H/V)
		2366.03	54.14	-19.86	74	47.47	32.1	8.02	33.45	146	67	Р	Н
		2389.3	43.88	-10.12	54	37.09	32.15	8.09	33.45	146	67	А	Н
BLE	*	2402	101.37	-	-	94.52	32.2	8.09	33.44	146	67	Р	Н
CH 00	*	2402	99.78	-	-	92.93	32.2	8.09	33.44	146	67	А	Н
2402MHz		2386.83	55.72	-18.28	74	47.58	33.5	8.09	33.45	382	111	Р	V
240211112		2388.26	45.14	-8.86	54	37	33.5	8.09	33.45	382	111	А	V
	*	2402	99.34	-	-	91.19	33.5	8.09	33.44	382	111	Р	V
	*	2402	97.72	-	-	89.57	33.5	8.09	33.44	382	111	А	V
		2381.76	55.1	-18.9	74	48.39	32.1	8.06	33.45	169	64	Р	Н
		2382.93	44.07	-9.93	54	37.31	32.15	8.06	33.45	169	64	А	Н
		2489.74	53.94	-20.06	74	47.42	31.7	8.24	33.42	169	64	Ρ	Н
		2483.98	43.92	-10.08	54	37.33	31.8	8.22	33.43	169	64	А	Н
	*	2440	101.8	-	-	95.07	32	8.16	33.43	169	64	Р	Н
BLE	*	2440	100.4	-	-	93.67	32	8.16	33.43	169	64	А	Н
CH 19 2440MHz		2381.89	55.48	-18.52	74	47.58	33.29	8.06	33.45	369	103	Р	V
2440141112		2389.69	45.45	-8.55	54	37.31	33.5	8.09	33.45	369	103	А	V
-		2499.58	55.12	-18.88	74	47.57	32.73	8.24	33.42	369	103	Ρ	V
		2486.02	44.96	-9.04	54	37.3	32.86	8.22	33.42	369	103	А	V
	*	2440	98.66	-	-	90.82	33.11	8.16	33.43	369	103	Р	V
	*	2440	97.23	-	-	89.39	33.11	8.16	33.43	369	103	А	V



		2483.5	56.2	-17.8	74	49.61	31.8	8.22	33.43	157	236	Р	Н
		2483.5	50.29	-3.71	54	43.7	31.8	8.22	33.43	157	236	А	Н
	*	2480	100.83	-	-	94.24	31.8	8.22	33.43	157	236	Р	Н
BLE	*	2480	99.59	-	-	93	31.8	8.22	33.43	157	236	А	Н
CH 39 2480MHz		2483.56	56.4	-17.6	74	48.75	32.86	8.22	33.43	353	103	Ρ	V
2400141112		2483.5	48.49	-5.51	54	40.84	32.86	8.22	33.43	353	103	А	V
	*	2480	98.26	-	-	90.61	32.86	8.22	33.43	353	103	Р	V
	*	2480	96.8	-	-	89.15	32.86	8.22	33.43	353	103	А	V
Remark		o other spurio I results are P		st Peak a	and Avera	ge limit lin	э.						



_	BLE (Harmonic @ 3m)												
BLE	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	( dB )	(dB)	( cm )	(deg)	(P/A)	(H/V)
BLE		4806	44.67	-29.33	74	59.37	34.96	11.51	61.17	300	0	Р	н
CH 00 2402MHz		4806	45.03	-28.97	74	59.85	34.84	11.51	61.17	300	360	Р	V
		4878	44.61	-29.39	74	59.08	35.04	11.6	61.11	300	0	Р	Н
BLE		7320	43.21	-30.79	74	52.73	36.86	14.69	61.07	300	0	Р	н
CH 19 2440MHz		4878	44.02	-29.98	74	58.7	34.83	11.6	61.11	300	360	Р	V
244010172		7320	42.44	-31.56	74	52.42	36.4	14.69	61.07	300	360	Р	V
515		4962	46.14	-27.86	74	60.33	35.14	11.71	61.04	300	0	Р	Н
BLE		7440	42.48	-31.52	74	51.76	36.89	14.88	61.05	300	0	Р	Н
CH 39 2480MHz		4962	44.01	-29.99	74	58.53	34.81	11.71	61.04	300	360	Р	V
2400141112		7440	42.2	-31.8	74	51.9	36.47	14.88	61.05	300	360	Р	V
Remark		o other spurio I results are P		st Peak	and Averag	e limit lin	е.						

#### 2.4GHz 2400~2483.5MHz



### Emission below 1GHz

## 2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	( dBµV/m )	( dB )	(dBµV/m)	(dBµV)	( dB/m )	( dB )	( dB )	( cm )	(deg)	(P/A)	(H/V)
		30	19.97	-20.03	40	26.79	25.3	0.58	32.7	-	-	Р	н
		96.93	17.88	-25.62	43.5	33.39	15.68	1.59	32.78	-	-	Р	н
		565.44	24.71	-21.29	46	28.06	25.35	3.87	32.57	-	-	Р	Н
		690.57	25.2	-20.8	46	27.01	26.7	4.27	32.78	-	-	Р	н
0.4011-		831.22	27.73	-18.27	46	26.75	28.84	4.7	32.56	185	65	Р	н
2.4GHz BLE		979.63	26.67	-27.33	54	23.47	30.28	5.1	32.18	-	-	Р	н
LF		30.97	20.59	-19.41	40	28.66	24.04	0.59	32.7	120	36	Р	V
		96.93	22.02	-21.48	43.5	36.74	16.47	1.59	32.78	-	-	Р	V
		557.68	24.07	-21.93	46	27.86	24.95	3.84	32.58	-	-	Р	V
		694.45	25.4	-20.6	46	29.08	24.83	4.28	32.79	-	-	Р	V
		855.47	26.56	-19.44	46	27.95	26.43	4.77	32.59	-	-	Р	V
		982.54	26.33	-27.67	54	26.17	27.23	5.1	32.17	-	-	Р	V
Remark		o other spurio I results are P		st limit li	ne.								



## Note symbol

*	Fundamental Frequency which can be ignored. However, the level of any
	unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is <b>over limit</b> line.
P/A	Peak or Average
H/V	Horizontal or Vertical



## A calculation example for radiated spurious emission is shown as below:

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBµV/m)	( dB )	(dBµV/m)	(dBµV)	( dB/m )	( dB )	(dB)	( cm )	(deg)	(P/A)	(H/V)
BLE		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	Р	н
CH 00													
2402MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	А	Н

- 1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
- 2. Level(dB $\mu$ V/m) =

Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBµV) - Preamp Factor(dB)

3. Over Limit(dB) = Level(dB $\mu$ V/m) – Limit Line(dB $\mu$ V/m)

#### For Peak Limit @ 2390MHz:

- 1. Level(dBµV/m)
- = Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBµV) Preamp Factor(dB)
- = 32.22(dB/m) + 4.58(dB) + 54.51(dBµV) 35.86 (dB)
- = 55.45 (dBµV/m)
- 2. Over Limit(dB)
- = Level(dBµV/m) Limit Line(dBµV/m)
- $= 55.45(dB\mu V/m) 74(dB\mu V/m)$
- = -18.55(dB)

#### For Average Limit @ 2390MHz:

- 1. Level(dBµV/m)
- = Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBµV) Preamp Factor(dB)
- $= 32.22(dB/m) + 4.58(dB) + 42.6(dB\mu V) 35.86 (dB)$
- = 43.54 (dBµV/m)
- 2. Over Limit(dB)
- = Level(dBµV/m) Limit Line(dBµV/m)
- $= 43.54(dB\mu V/m) 54(dB\mu V/m)$
- = -10.46(dB)

Both peak and average measured complies with the limit line, so test result is "PASS".



## Appendix C. Radiated Spurious Emission Plots

## Note symbol

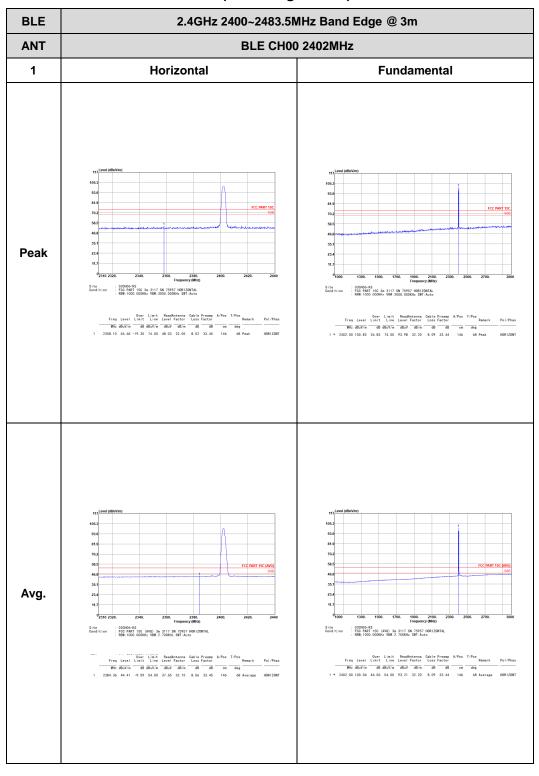
-L	Low channel location
-R	High channel location



#### Bluetooth LE 1Mbps

#### 2.4GHz 2400~2483.5MHz

#### BLE (Band Edge @ 3m)

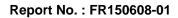




BLE	2.4GHz 2400~2483.5M	/Hz Band Edge @ 3m
ANT	BLE CHO	) 2402MHz
1	Vertical	Fundamental
Peak	$11 \frac{1}{10000000000000000000000000000000000$	$ \begin{array}{c} 1 \\ 1 \\ 1 \\ 1 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\$
Avg	11         Sever distribution           12         2000 - 2000         2000 <th><math display="block">\frac{11}{1000} + \frac{11}{1000} + \frac{11}{1000} + \frac{11}{1000000000000000000000000000000000</math></th>	$\frac{11}{1000} + \frac{11}{1000} + \frac{11}{1000} + \frac{11}{1000000000000000000000000000000000$



BLE	2.4GHz 2400~2483.5M	1Hz Band Edge @ 3m
ANT	BLE CH19 2	2440MHz - L
1	Horizontal	Fundamental
Peak	$1 \\ \frac{1}{1} \\ $	Image: second
Avg.	$\frac{10^{4} \text{ever(600Vm)}}{10^{4} \text{ever(600Vm)}}$ $\frac{10^{4} \text{ever(600Vm)}}{10^{4} \text{ever(600Vm)}}}$	1         2         2         0





BLE	2.4GHz 2400~2483.5MHz	Band Edge @ 3m
ANT	BLE CH19 2440	MHz - R
1	Horizontal	Fundamental
Peak	$1 + \frac{1}{1} + $	-
Avg.	$m_{1}^{\text{perfection}} = \frac{1}{1} + $	-



BLE	2.4GHz 2400~2483.5N	1Hz Band Edge @ 3m
ANT	BLE CH19 2	2440MHz - L
1	Vertical	Fundamental
Peak		111       1111       111       111
Avg.	$\begin{split} & 111 \underbrace{\text{teref (HBVPH)}}{101} \\ & 101 \\ &$	Image: selection of the se



BLE	2.4GHz 2400~2483.5M	/Hz Band Edge @ 3m
ANT	BLE CH19 2	2440MHz - R
1	Vertical	Fundamental
Peak	$\frac{1}{1} \frac{1}{2464.36} \frac{1}{56.39} - \frac{1}{16.79} \frac{1}{76.09} \frac{1}{67.79} \frac{1}{76.79} \frac{1}{76.99} \frac{1}$	_
Avg.	100       1	



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m				
ANT	BLE CH39	) 2480MHz			
1	Horizontal	Fundamental			
Peak		$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			
Avg.	$\frac{110^{400} (600^{100})}{100^{40} (100^{10})}$	101         102			

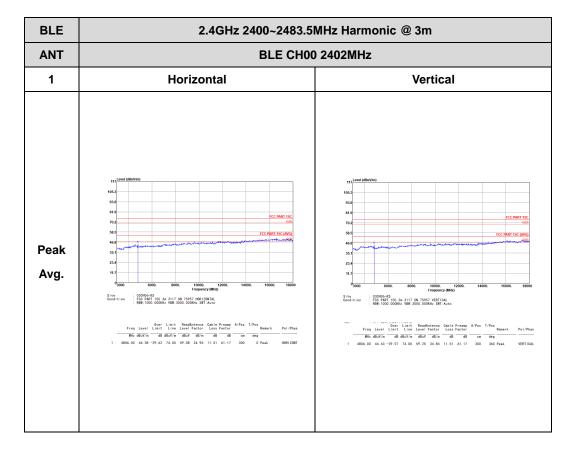


BLE	2.4GHz 2400~2483.5	MHz Band Edge @ 3m
ANT	BLE CH3	9 2480MHz
1	Vertical	Fundamental
Peak	1       2400       1000-15       1000-15       1000-15       1000-15         1       2400       2400       2400       2400       2400       2600       2500         1       2600-15       2600	$\frac{11}{1000000000000000000000000000000000$
Avg.	$I_{1} = \frac{1}{1000} + \frac{1}{10000} + \frac{1}{10000} + \frac{1}{100000} + \frac{1}{10000000000000000000000000000000000$	$\frac{1}{10000000000000000000000000000000000$

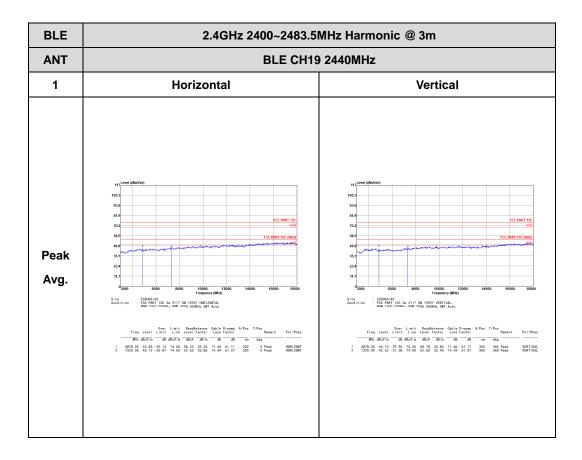


#### 2.4GHz 2400~2483.5MHz

#### BLE (Harmonic @ 3m)









BLE	2.4GHz 2400~2483.5	MHz Harmonic @ 3m
ANT	BLE CH39	2480MHz
1	Horizontal	Vertical
Peak		$\frac{1}{2} \int_{1}^{1} \frac{1}{1} $



#### Emission below 1GHz

2.4GHz BLE (	LF)
--------------	-----

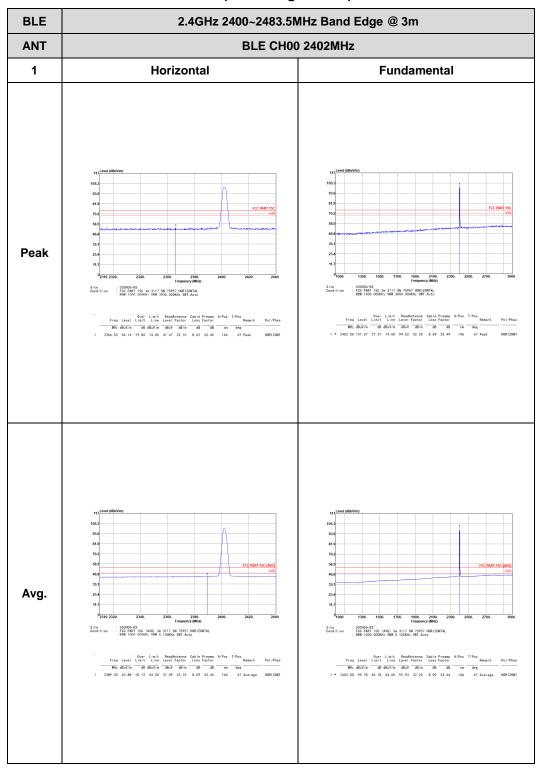
BLE	2.4GHz 2400	~2483.5MHz		
ANT	BLE	LF		
1	Horizontal	Vertical		
QP / Peak	<figure></figure>	<figure><figure><text></text></figure></figure>		



#### Bluetooth LE 2Mbps

#### 2.4GHz 2400~2483.5MHz

#### BLE (Band Edge @ 3m)

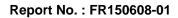




BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH00 2402MHz	
1	Vertical	Fundamental
Peak	$\frac{1}{1} \underbrace{\frac{1}{1}}_{220} \underbrace{\frac{1}{1}}_{2$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
Avg	$\frac{111}{100000000000000000000000000000000$	$\frac{11}{100} + \frac{1}{100} + 1$



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m			
ANT	BLE CH19 2	2440MHz - L		
1	Horizontal			
Peak	$M_{1}^{(n)} = M_{1}^{(n)} = $			
Avg.		$\begin{array}{c} 11 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 $		





BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m		
ANT	BLE CH19 2440MHz - R		
1	Horizontal	Fundamental	
Peak	$M_{1}^{\text{ever}(\text{eff}(W)\text{ever})} = \frac{1}{12} \frac$	-	
Avg.	$\frac{1}{1} \frac{1}{1} \frac{1}$	-	



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m			
ANT	BLE CH19 2440MHz - L			
1	Vertical	Fundamental		
Peak	Image: second	10		
Avg.	1       1	$\frac{1}{10000000000000000000000000000000000$		



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m			
ANT	BLE CH19 2440MHz - R			
1	Vertical	Fundamental		
Peak	$\frac{1}{1} \frac{ever (BibVin)}{ever (BibVin)} + \frac{1}{1} $			
Avg.	$\frac{1}{1} \frac{1}{100} \frac{1}{1$			



BLE	E 2.4GHz 2400~2483.5MHz Band Edge @ 3m			
ANT	BLE CH39 2480MHz			
1	Horizontal	Fundamental		
Peak	<figure></figure>	1       2		
Avg.	$w_{1}^{torst (BWVM)} = 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1$	1         20000-05           1         20000-05 </th		

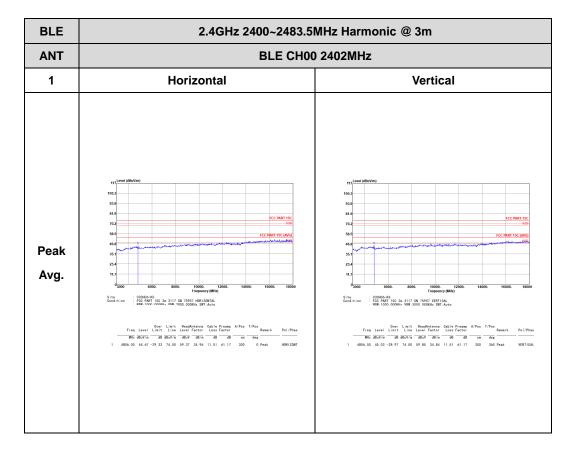


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m			
ANT	BLE CH39 2480MHz			
1	Vertical	Fundamental		
Peak	$111 \frac{1}{1000} \frac{1}{10000} \frac{1}{10000} \frac{1}{10000} \frac{1}{10000} \frac{1}{10000} \frac{1}{10000} \frac{1}{10000} \frac{1}{10000} \frac{1}{100000} \frac{1}{100000} \frac{1}{100000} \frac{1}{1000000} \frac{1}{10000000} \frac{1}{10000000000000000000000000000000000$			
Avg.	$I_{1} \underbrace{free (ddvm)}{free (ddvm)} \underbrace{free (ddvm)}{free (d$	Image: selection of the se		

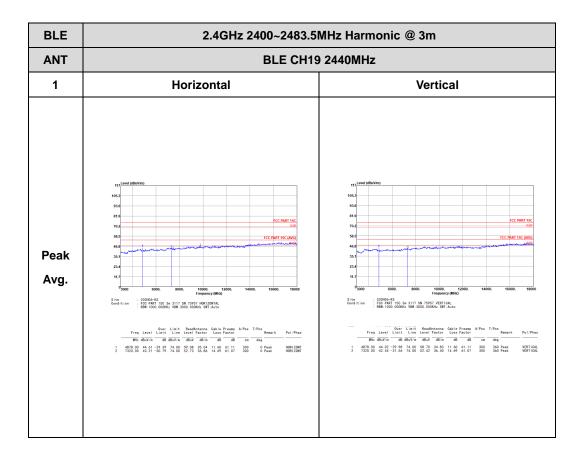


### 2.4GHz 2400~2483.5MHz

### BLE (Harmonic @ 3m)









BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m		
ANT	BLE CH39 2480MHz		
1	Horizontal	Vertical	
Peak			



## Emission below 1GHz

2.4GHz BLE (	LF)
--------------	-----

BLE	2.4GHz 2400~2483.5MHz				
ANT	BLE LF				
1	Horizontal	Vertical			
QP / Peak	<figure></figure>	<figure><figure><text></text></figure></figure>			

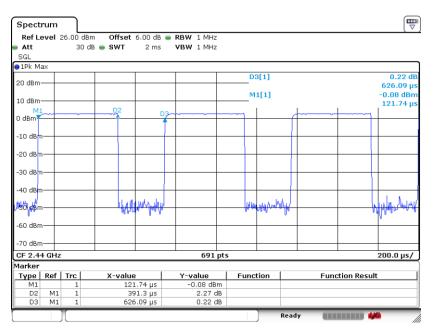




# Appendix D. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
Bluetooth LE 1Mbps	62.50	0.391	2.578	2.7KHz
Bluetooth LE 2Mbps	32.87	0.206	4.854	5.1KHz

### **Bluetooth LE 1Mbps**





#### Bluetooth LE 2Mbps

