



# FCC RF Test Report

**APPLICANT** : Motorola Mobility LLC  
**EQUIPMENT** : Mobile Cellular Phone  
**BRAND NAME** : Motorola  
**FCC ID** : IHDT56XJ1  
**STANDARD** : FCC Part 15 Subpart C §15.247  
**CLASSIFICATION** : (DTS) Digital Transmission System

The product was received on May 15, 2018 and testing was completed on May 26, 2018. 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.

This report contains data that were produced under subcontract by Laboratory SPORTON INTERNATIONAL INC.

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.



Approved by: James Huang / Manager

**Sporton International (Kunshan) Inc.**

**No.3-2 Ping-Xiang Rd, Kunshan Development Zone Kunshan City Jiangsu Province 215335  
China**



# TABLE OF CONTENTS

**REVISION HISTORY.....3**

**SUMMARY OF TEST RESULT .....4**

**1 GENERAL DESCRIPTION.....5**

1.1 Applicant .....5

1.2 Manufacturer .....5

1.3 Product Feature of Equipment Under Test.....5

1.4 Product Specification of Equipment Under Test.....6

1.5 Modification of EUT .....6

1.6 Specification of Accessory.....6

1.7 Testing Location .....7

1.8 Applicable Standards.....8

**2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST.....9**

2.1 Carrier Frequency Channel .....9

2.2 Test Mode.....10

2.3 Connection Diagram of Test System.....11

2.4 Support Unit used in test configuration and system .....11

2.5 EUT Operation Test Setup .....12

2.6 Measurement Results Explanation Example.....12

**3 TEST RESULT .....13**

3.1 6dB Bandwidth Measurement .....13

3.2 Output Power Measurement.....18

3.3 Power Spectral Density Measurement .....19

3.4 Conducted Band Edges and Spurious Emission Measurement .....28

3.5 Radiated Band Edges and Spurious Emission Measurement .....37

3.6 AC Conducted Emission Measurement.....41

3.7 Antenna Requirements .....43

**4 LIST OF MEASURING EQUIPMENT.....44**

**5 UNCERTAINTY OF EVALUATION.....45**

**APPENDIX A. CONDUCTED TEST RESULTS**

**APPENDIX B. AC CONDUCTED EMISSION TEST RESULT**

**APPENDIX C. RADIATED SPURIOUS EMISSION**

**APPENDIX D. DUTY CYCLE PLOTS**

**APPENDIX E. SETUP PHOTOGRAPHS**





### SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	$\geq 0.5\text{MHz}$	Pass	-
3.2	15.247(b)(3)	Peak Output Power	$\leq 30\text{dBm}$	Pass	-
3.3	15.247(e)	Power Spectral Density	$\leq 8\text{dBm}/3\text{kHz}$	Pass	-
3.4	15.247(d)	Conducted Band Edges and Spurious Emission	$\leq 20\text{dBc}$	Pass	-
3.5	15.247(d)	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 3.02 dB at 2493.400 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 7.83 dB at 0.240 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-



# 1 General Description

## 1.1 Applicant

Motorola Mobility LLC  
222 W, Merchandise Mart Plaza, Chicago IL 60654 USA

## 1.2 Manufacturer

Motorola Mobility LLC  
222 W, Merchandise Mart Plaza, Chicago IL 60654 USA

## 1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Mobile Cellular Phone
Brand Name	Motorola
FCC ID	IHDT56XJ1
EUT supports Radios application	CDMA/EVDO/GSM/GPRS/EGPRS/WCDMA/HSPA/ DC-HSDPA/HSPA+(16QAM uplink is not supported)/LTE/NFC WLAN 2.4GHz 802.11b/g/n HT20 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth v3.0 + EDR/Bluetooth v4.2 LE/Bluetooth v5.0 LE
IMEI Code	Conducted: 355550090015731 Conduction: 355550090016408 Radiation: 355550090017364
HW Version	DVT2
SW Version	fastboot_messi_verizon_oem_vzw_userdebug_8.1.0_ODX28. 56_50ee_intcfg-test-keys_vzw
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 v4.2 LE :5.56 dBm (0.0036 W) Bluetooth v5.0 LE :5.79 dBm (0.0038 W)
Antenna Type / Gain	Fixed Internal Antenna with gain 0.5 dBi
Type of Modulation	Bluetooth LE : GFSK

### 1.5 Modification of EUT

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

### 1.6 Specification of Accessory

Specification of Accessory			
AC Adapter 1	Brand Name	Motorola (Salom)	Model Name SC-22
	Power Rating	I/P: 100-240 Vac, 500mA, O/P: 5Vdc,3000mA or 9Vdc,1600mA or 12Vdc,1200mA	
AC Adapter 2	Brand Name	Motorola (Chenyang)	Model Name SC-22
	Power Rating	I/P: 100-240 Vac, 500mA, O/P: 5Vdc,3000mA or 9Vdc,1600mA or 12Vdc,1200mA	
AC Adapter 3	Brand Name	Motorola (Salom)	Model Name SC-51
	Power Rating	I/P: 100-240 Vac, 600mA, O/P: 5Vdc,3000mA or 9Vdc,2000mA or 12Vdc,1500mA	
AC Adapter 4	Brand Name	Motorola (Chenyang)	Model Name SC-51
	Power Rating	I/P: 100-240 Vac, 600mA, O/P: 5Vdc,3000mA or 9Vdc,2000mA or 12Vdc,1500mA	
Battery	Brand Name	Motorola (Sunwoda)	Model Name JS40
	Power Rating	3.8Vdc,3000mAh	Type Li-ion
USB Cable 1	Brand Name	Motorola (Cabletech)	Model Name SKN6473A
	Signal Line Type	1.0 meter, shielded cable, without ferrite core	
USB Cable 2	Brand Name	Motorola (Luxshare)	Model Name SKN6473A
	Signal Line Type	1.0 meter, shielded cable, without ferrite core	
Audio Cable	Brand Name	Motorola (Luxshare)	Model Name SC18C27844
	Signal Line Type	0.08 meter, shielded cable, without ferrite core	



### 1.7 Testing Location

Sporton International (Kunshan) Inc. is accredited to ISO 17025 by National Voluntary Laboratory Accreditation Program (NVLAP code: 600155-0) and the FCC designation No. is CN5013.

<b>Test Site</b>	Sporton International (Kunshan) Inc.		
<b>Test Site Location</b>	No.3-2 Ping-Xiang Rd, Kunshan Development Zone Kunshan City Jiangsu Province 215335 China TEL : +86-512-57900158 FAX : +86-512-57900958		
<b>Test Site No.</b>	<b>Sporton Site No.</b>		<b>FCC Test Firm Registration No.</b>
	TH01-KS	CO01-KS	630927

SPORTON INTERNATIONAL INC. is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and under the FCC-recognized accredited testing laboratories by Mutual Recognition Agreement (MRA) in FCC Test.

<b>Test Site</b>	SPORTON INTERNATIONAL INC.		
<b>Test Site Location</b>	No.58, Aly. 75, Ln. 564 Wenhua 3rd Rd. Guishan Dist. Taoyuan City Taiwan TEL: 86-3-327-3456 FAX: +886-3-328-4978		
<b>Test Site No.</b>	<b>Sporton Site No.</b>	<b>FCC designation No.</b>	<b>FCC Test Firm Registration No.</b>
	03CH11-HY	TW0007	214511

**Note:**

1. The test site complies with ANSI C63.4 2014 requirement.
2. Test data subcontracted: radiated spurious emissions only in section 3.5 of this report.



## **1.8 Applicable Standards**

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

- ♦ FCC Part 15 Subpart C §15.247
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04
- ♦ ANSI C63.10-2013

### **Remark:**

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



## 2 Test Configuration of Equipment Under Test

### 2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 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
	10	2422	31	2464
	11	2424	32	2466
	12	2426	33	2468
	13	2428	34	2470
	14	2430	35	2472
	15	2432	36	2474
	16	2434	37	2476
	17	2436	38	2478
	18	2438	39	2480
	19	2440	-	-
20	2442	-	-	



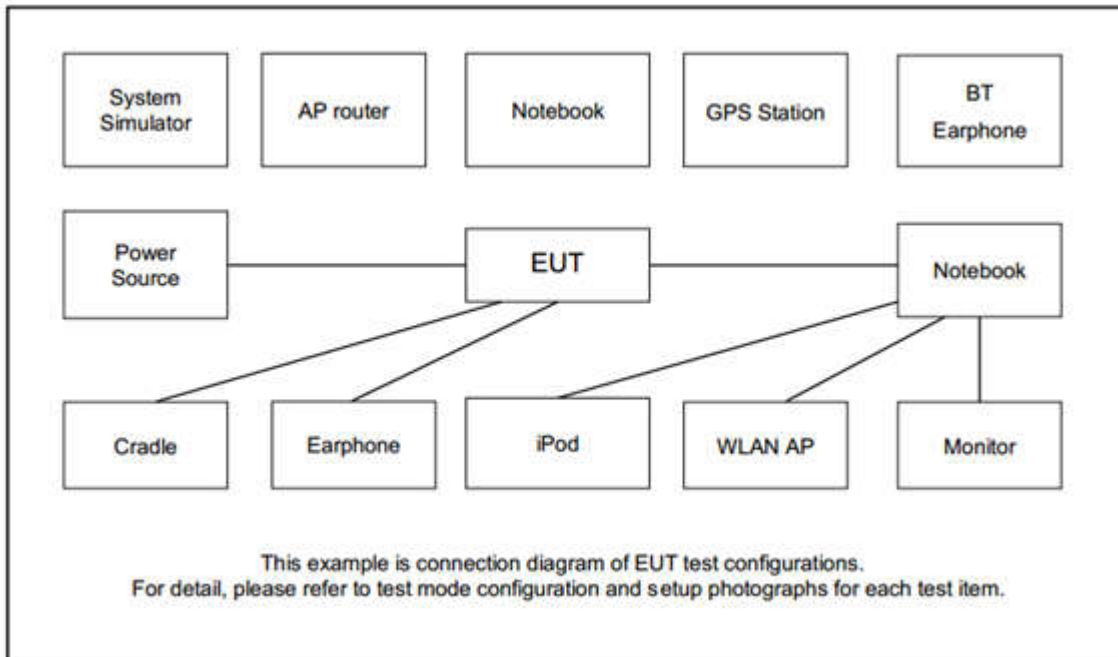
## 2.2 Test Mode

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X /Z 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
	Bluetooth LE / GFSK
Conducted TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
Radiated TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
AC Conducted Emission	Mode 1: GSM850 Idle + Bluetooth Link + WLAN Link(2.4G) + USB Cable 2(Charging from Adapter 2)
<b>Remark:</b> For Radiated Test Cases, The tests were performed with Adapter 2, Battery and USB Cable 2.	

### 2.3 Connection Diagram of Test System



### 2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	System Simulator	R&S	CMU 200	N/A	N/A	Unshielded, 1.8 m
2.	WLAN AP	D-Link	DIR-855	KA2DIR855A2	N/A	Unshielded, 1.8 m
3.	Notebook	Lenovo	G480	FCC DoC	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
4.	Bluetooth Earphone	Lenovo	LBH308	N/A	N/A	N/A



## 2.5 EUT Operation Test Setup

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

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

## 2.6 Measurement Results Explanation Example

**For all conducted test items:**

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

Example :

The spectrum analyzer offset is derived from RF cable loss.

*Offset = RF cable loss.*

Following shows an offset computation example with cable loss 5.4 dB.

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)}. \\ &= 5.4 \text{ (dB)} \end{aligned}$$

### 3 Test Result

#### 3.1 6dB Bandwidth Measurement

##### 3.1.1 Limit of 6dB Bandwidth

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

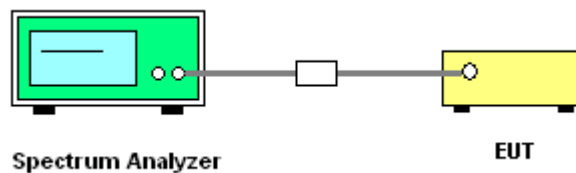
##### 3.1.2 Measuring Instruments

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 FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
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) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. Measure and record the results in the test report.

##### 3.1.4 Test Setup



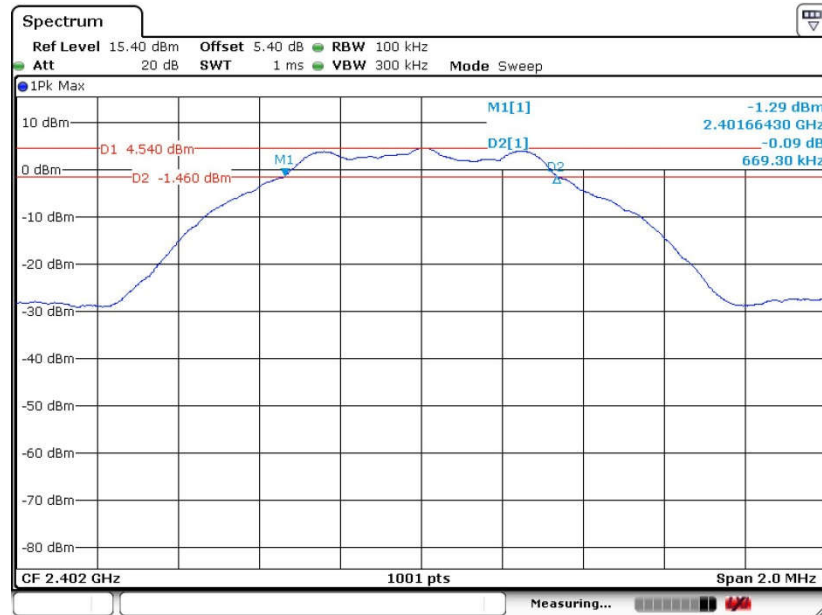


### 3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.

#### Bluetooth v4.2 LE

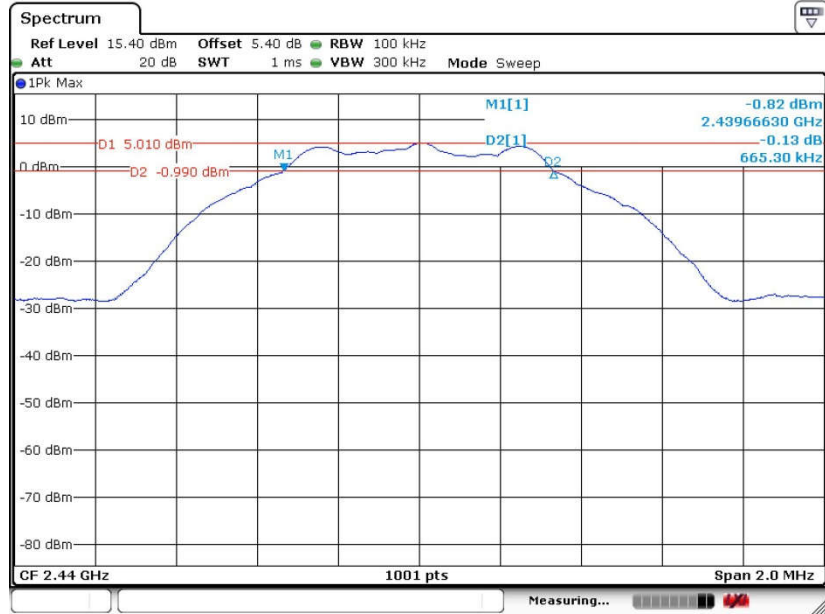
##### 6 dB Bandwidth Plot on Channel 00



Date: 26 MAY 2018 17:14:33

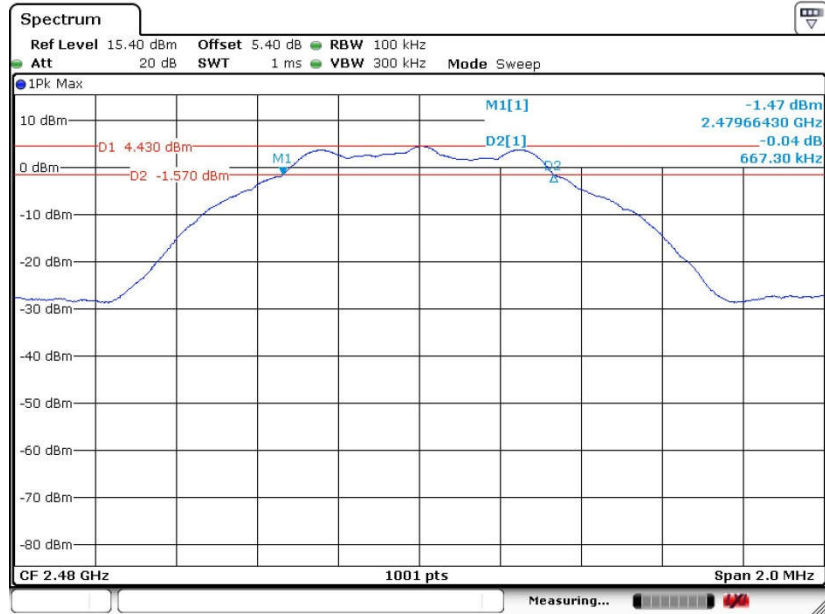


6 dB Bandwidth Plot on Channel 19



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6 dB Bandwidth Plot on Channel 39

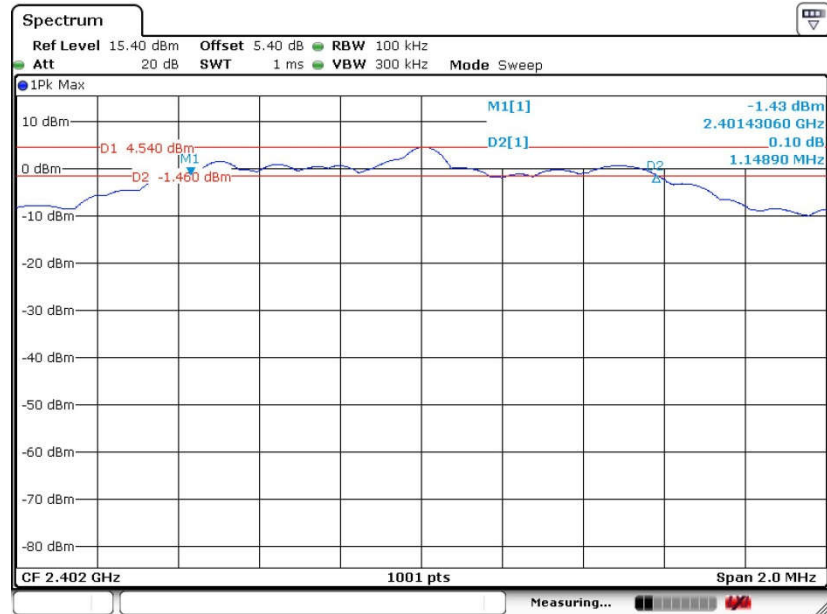


Date: 26.MAY.2018 17:07:25



Bluetooth v5.0 LE

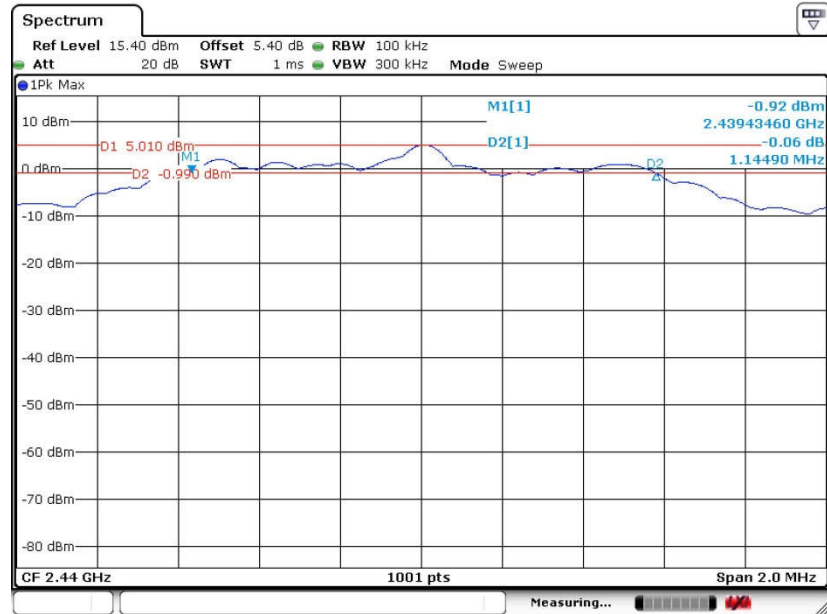
6 dB Bandwidth Plot on Channel 00



Date: 26.MAY.2018 17:30:38

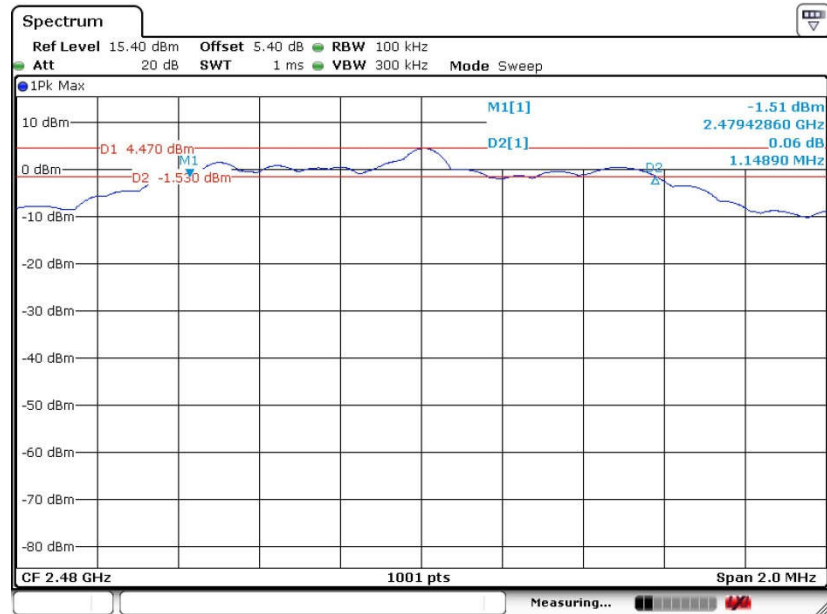


6 dB Bandwidth Plot on Channel 19



Date: 26.MAY.2018 17:26:18

6 dB Bandwidth Plot on Channel 39



Date: 26.MAY.2018 17:21:19

## 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.

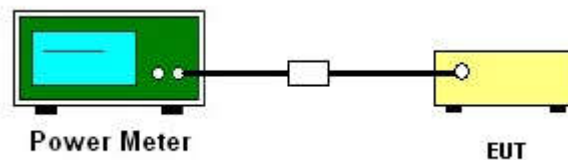
### 3.2.2 Measuring Instruments

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

### 3.2.3 Test Procedures

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v04 section 9.1.3 PKPM1 Peak power meter 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.

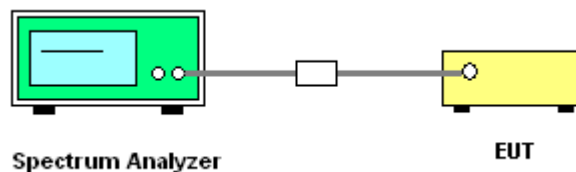
#### 3.3.2 Measuring Instruments

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 10.2 Method PKPSD of FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04
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

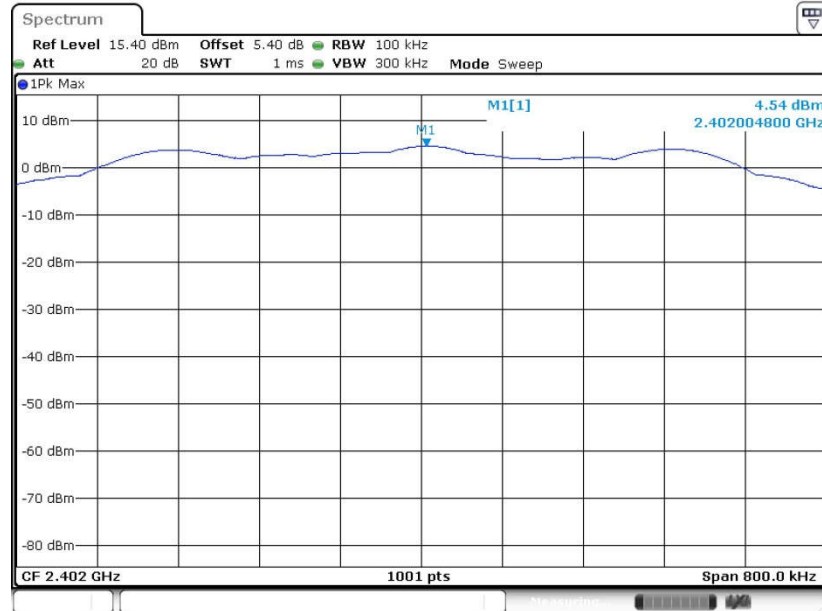
Please refer to Appendix A.



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

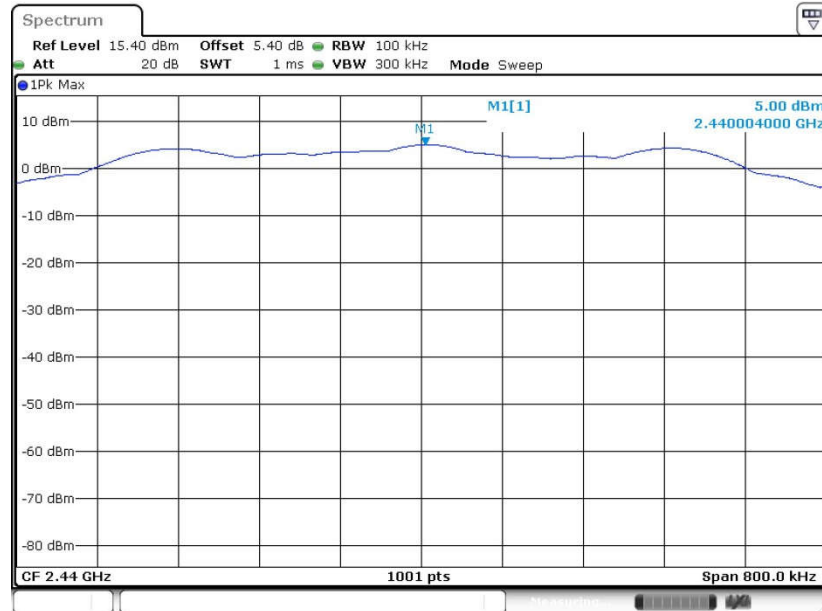
#### Bluetooth v4.2 LE

PSD 100kHz Plot on Channel 00



Date: 26.MAY.2018 17:14:57

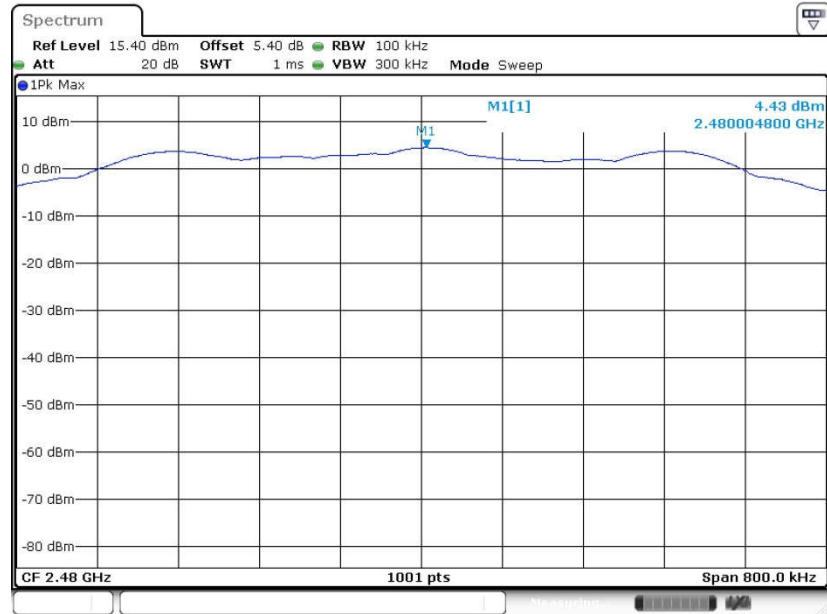
PSD 100kHz Plot on Channel 19



Date: 26.MAY.2018 17:12:11



PSD 100kHz Plot on Channel 39

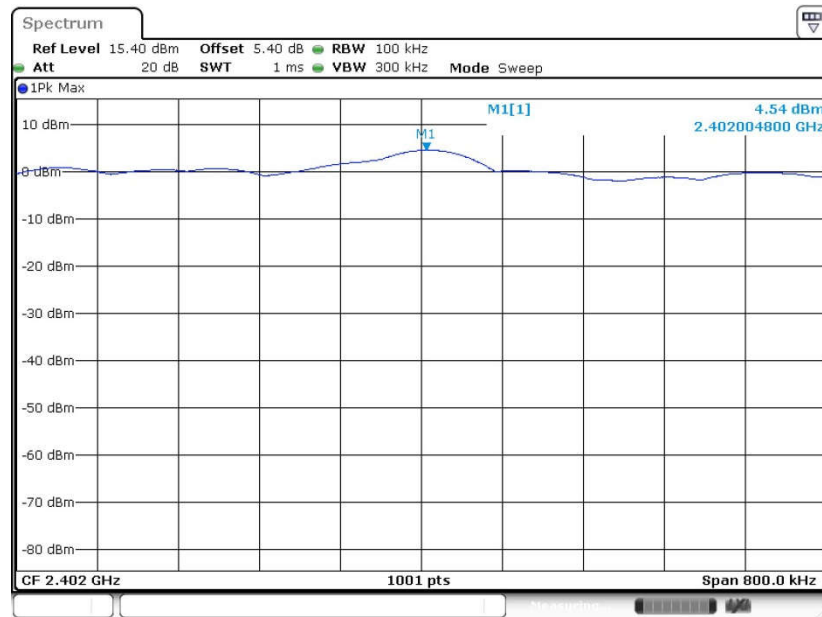


Date: 26.MAY.2018 17:08:10



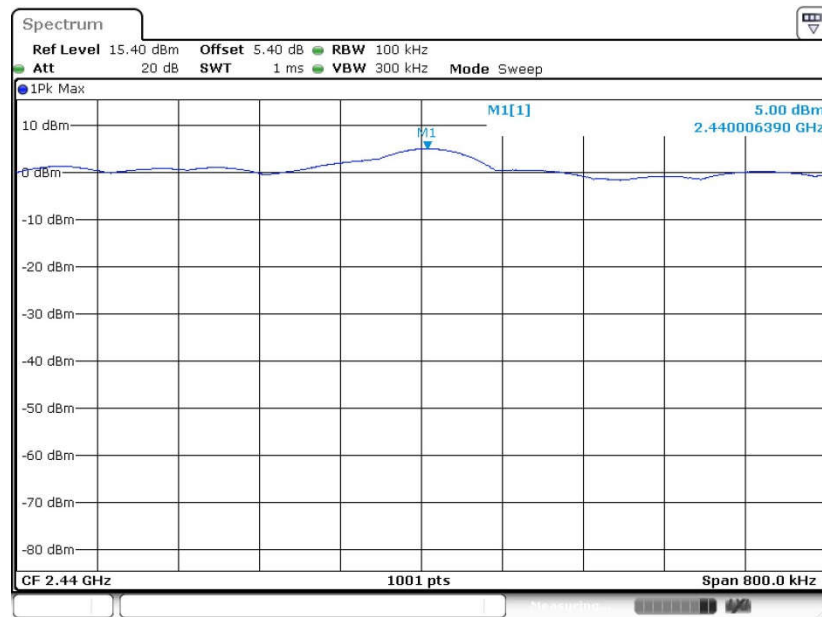
Bluetooth v5.0 LE

PSD 100kHz Plot on Channel 00



Date: 26.MAY.2018 17:31:16

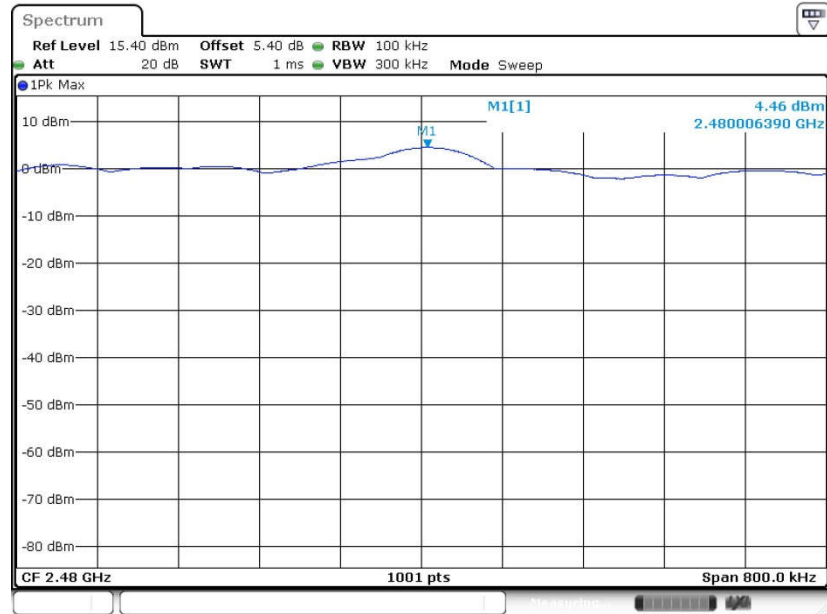
PSD 100kHz Plot on Channel 19



Date: 26.MAY.2018 17:26:53



PSD 100kHz Plot on Channel 39



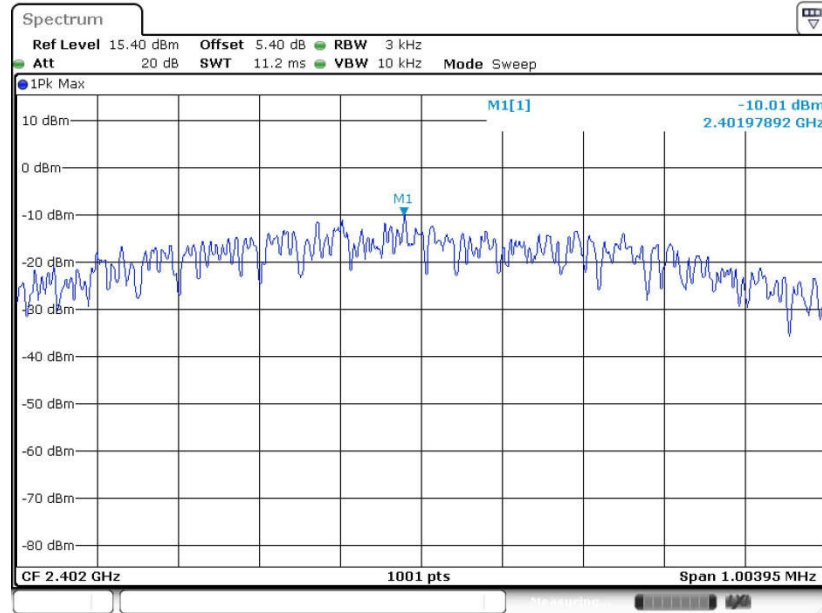
Date: 26.MAY.2018 17:22:15



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

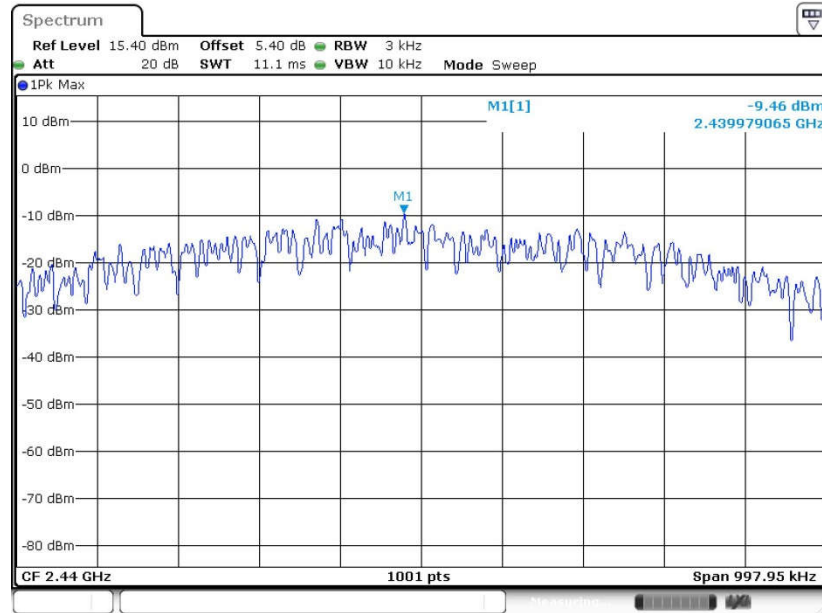
#### Bluetooth v4.2 LE

PSD 3kHz Plot on Channel 00



Date: 26 MAY 2018 17:14:44

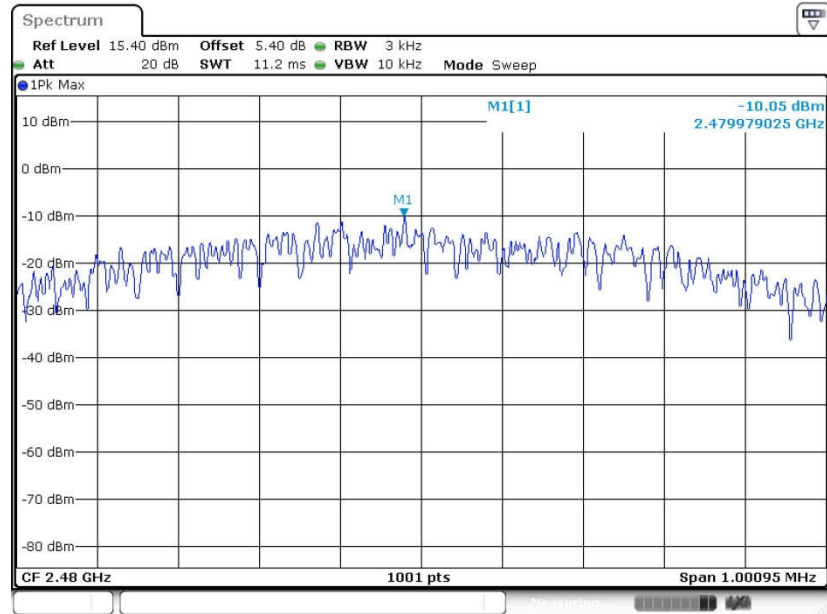
PSD 3kHz Plot on Channel 19



Date: 26 MAY 2018 17:11:49



PSD 3kHz Plot on Channel 39

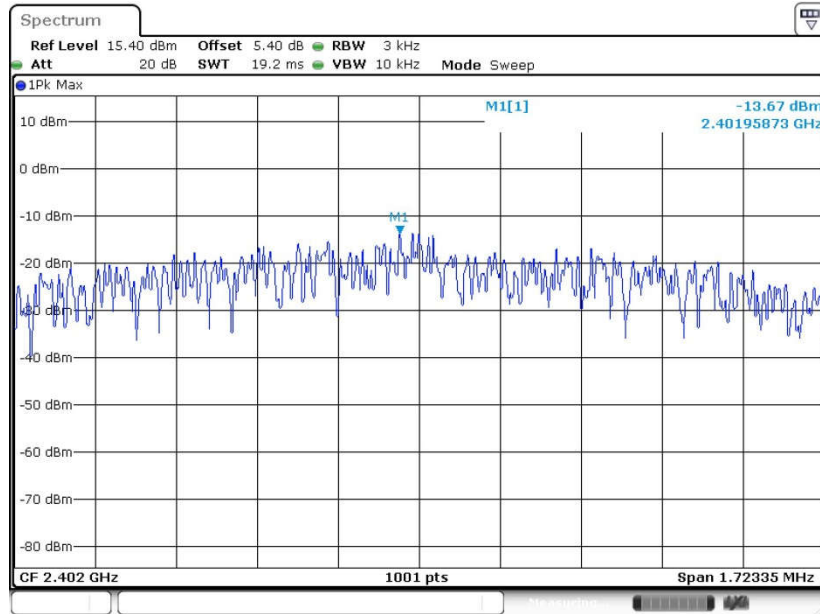


Date: 26.MAY.2018 17:07:51



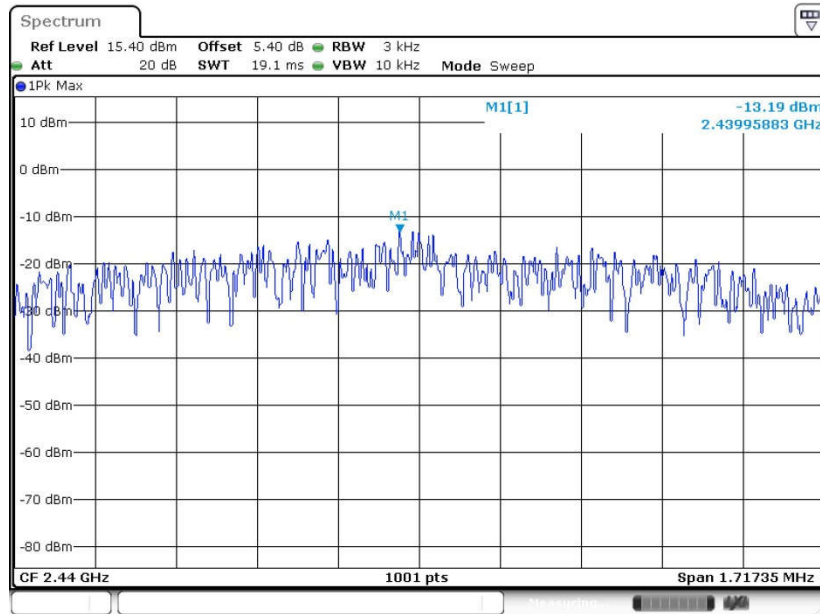
Bluetooth v5.0 LE

PSD 3kHz Plot on Channel 00



Date: 26.MAY.2018 17:30:56

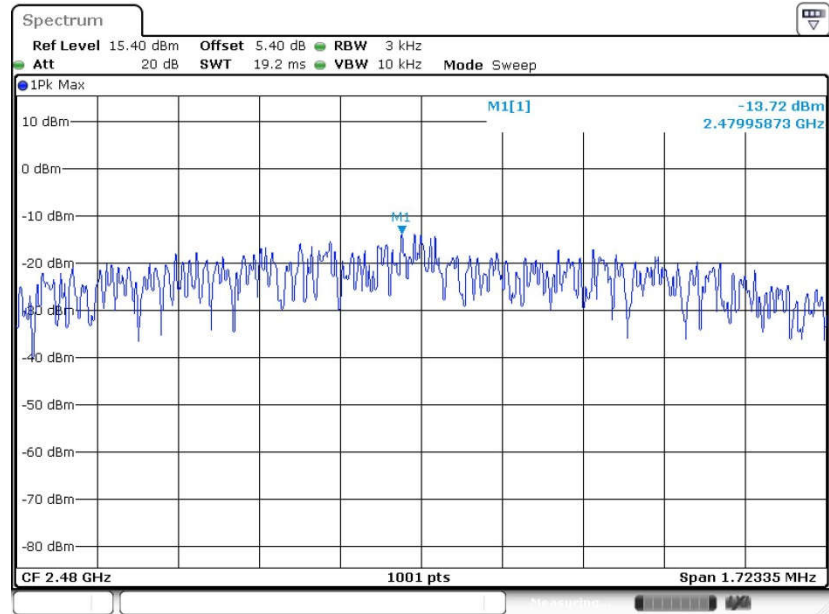
PSD 3kHz Plot on Channel 19



Date: 26.MAY.2018 17:26:38



PSD 3kHz Plot on Channel 39



Date: 26.MAY.2018 17:21:54

## 3.4 Conducted Band Edges and Spurious Emission Measurement

### 3.4.1 Limit of Conducted Band Edges and Spurious Emission

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

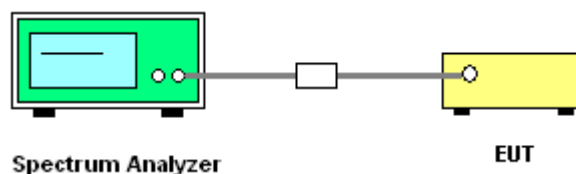
### 3.4.2 Measuring Instruments

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

### 3.4.3 Test Procedure

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
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

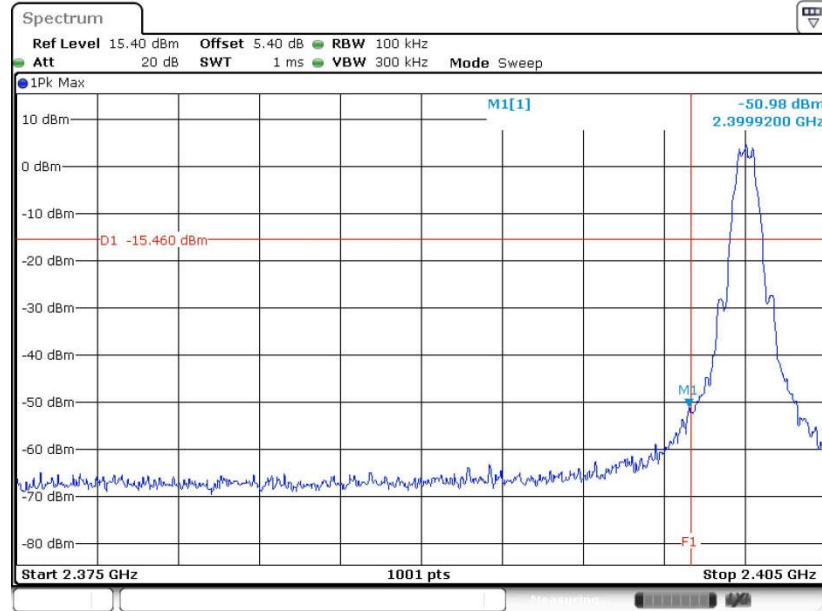




### 3.4.5 Test Result of Conducted Band Edges Plots

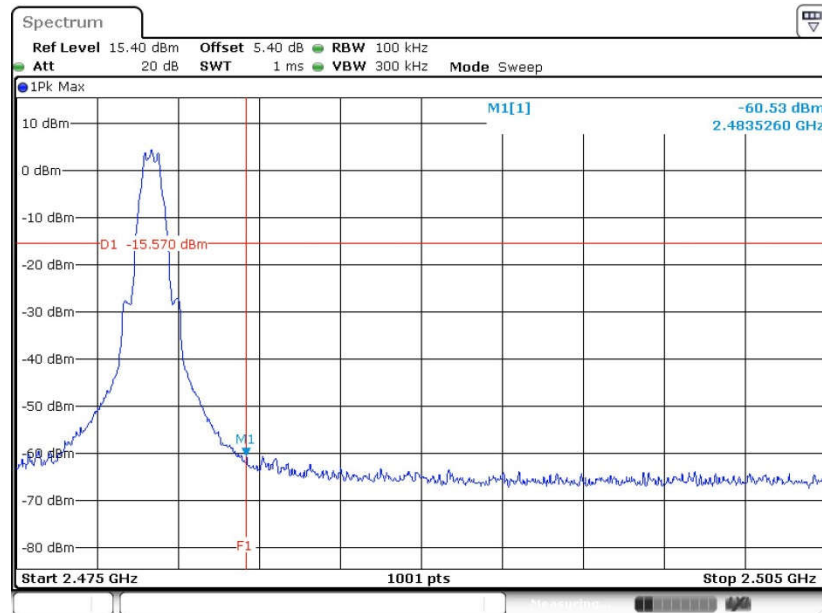
#### Bluetooth v4.2 LE

##### Low Band Edge Plot on Channel 00



Date: 26.MAY.2018 17:16:30

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

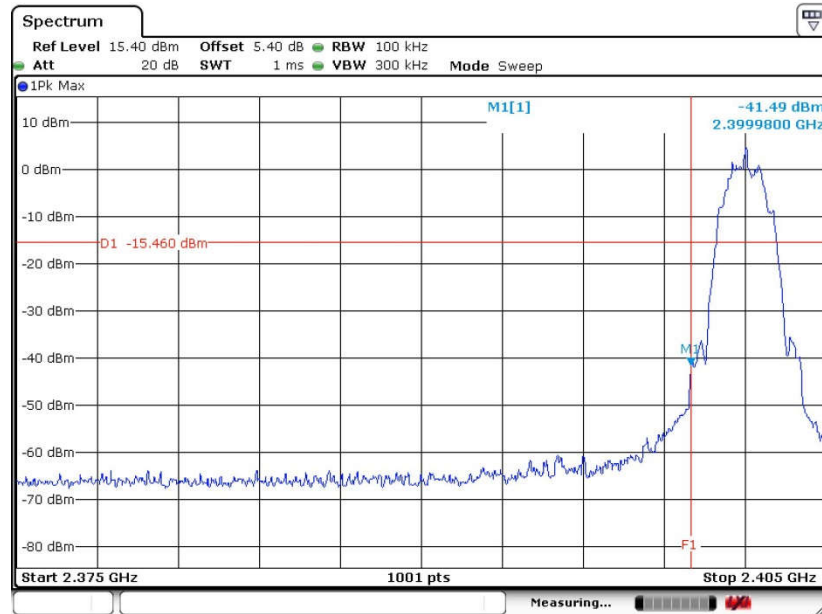


Date: 26.MAY.2018 17:08:31



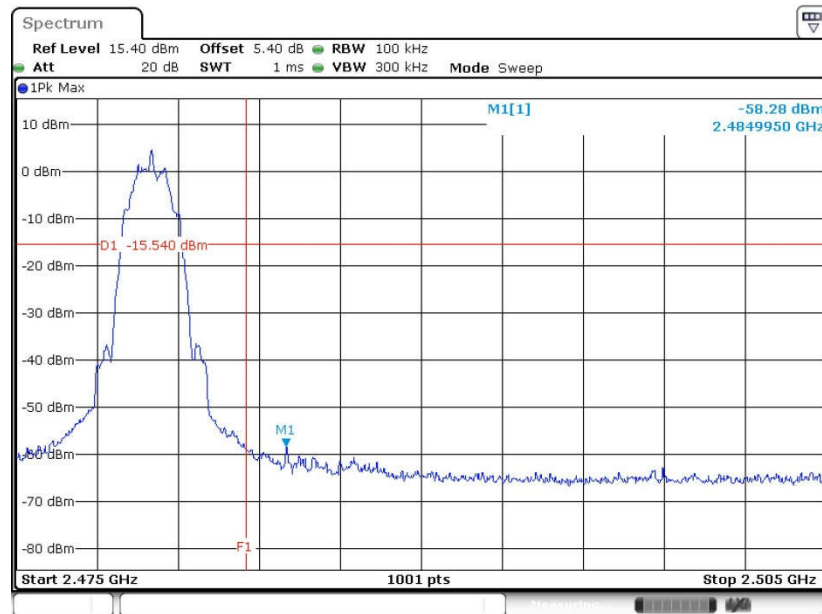
Bluetooth v5.0 LE

Low Band Edge Plot on Channel 00



Date: 26.MAY.2018 17:32:20

High Band Edge Plot on Channel 39



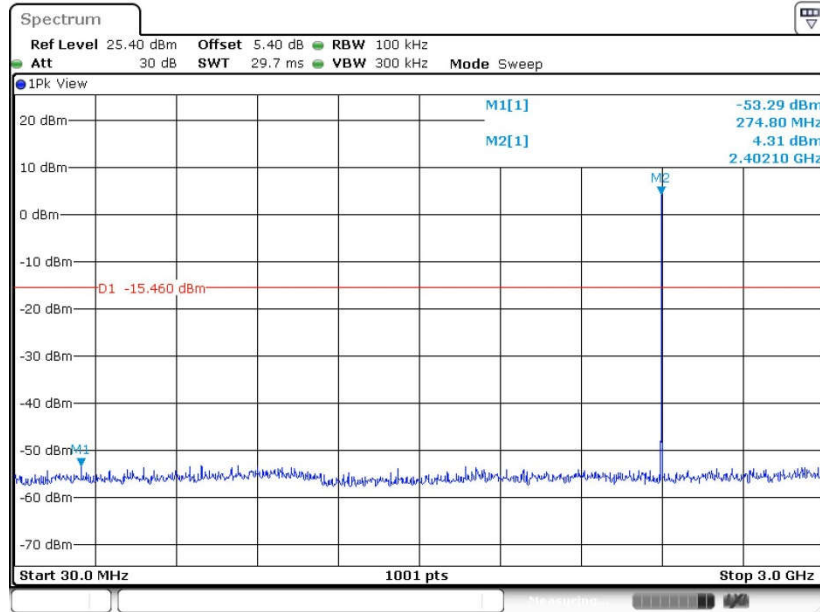
Date: 26.MAY.2018 17:22:54



### 3.4.6 Test Result of Conducted Spurious Emission Plots

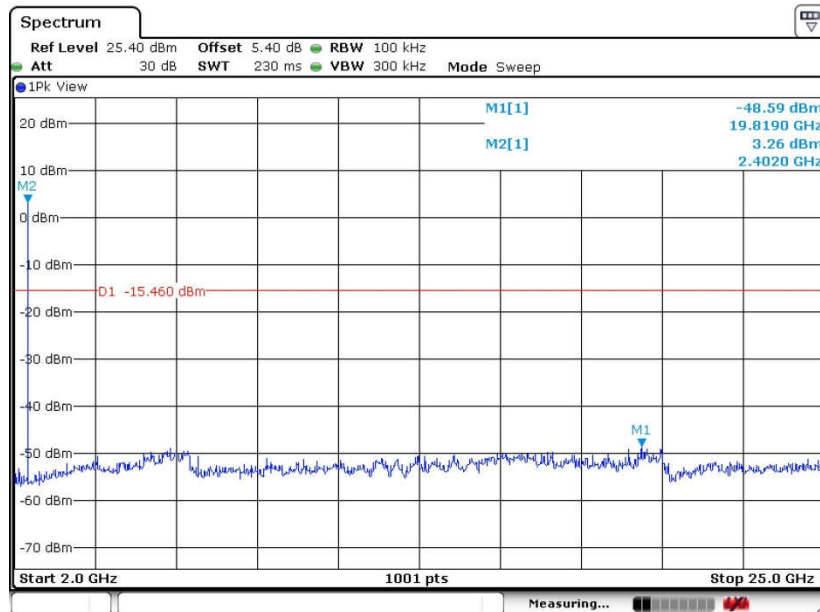
Bluetooth v4.2 LE

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



Date: 26.MAY.2018 17:15:23

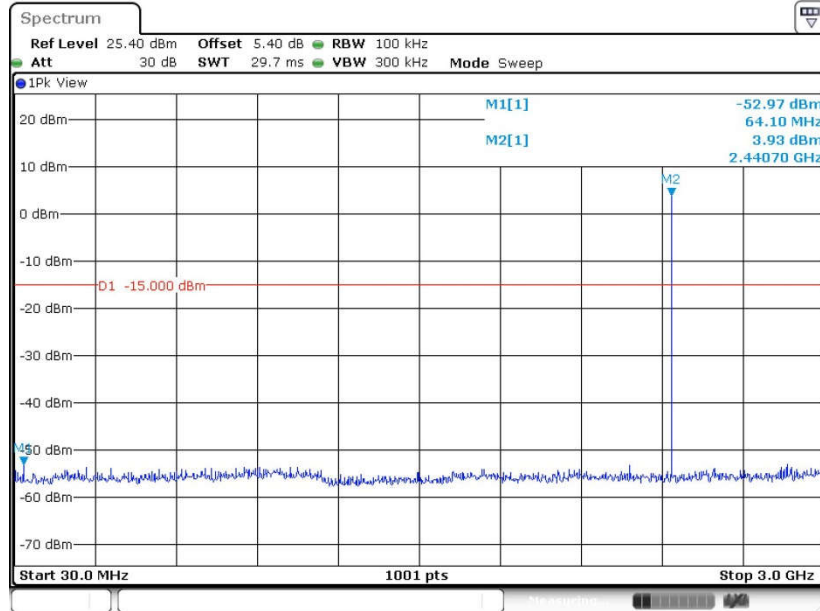
#### Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 00



Date: 26.MAY.2018 17:15:40

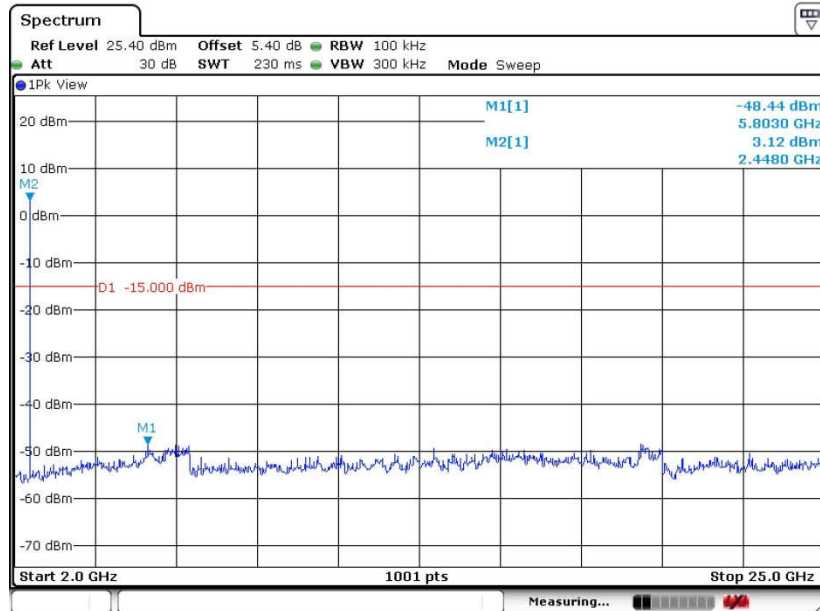


Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 19



Date: 26.MAY.2018 17:12:22

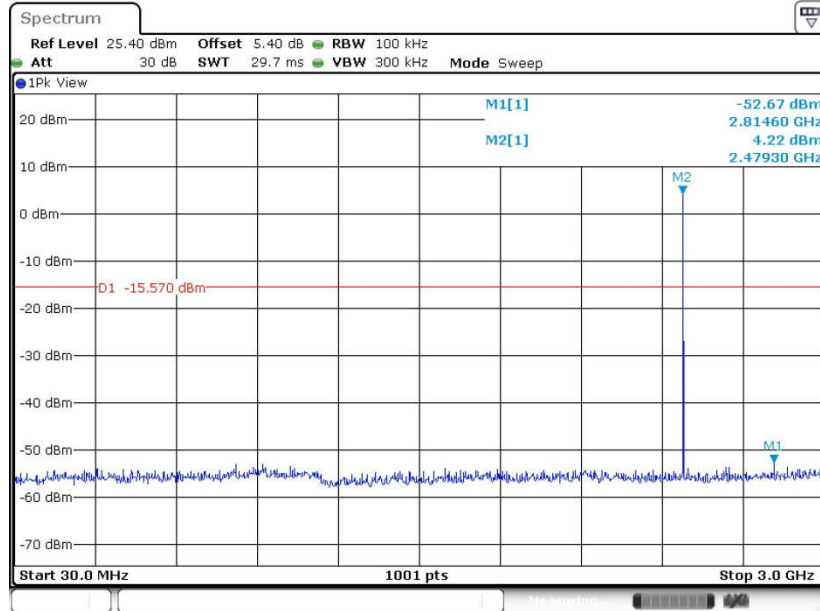
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 19



Date: 26.MAY.2018 17:12:36

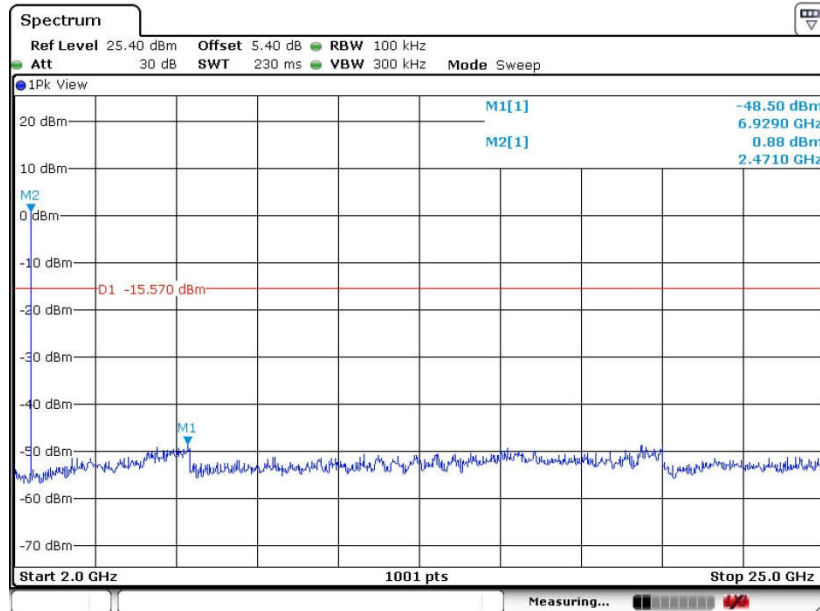


### Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39



Date: 26.MAY.2018 17:08:45

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

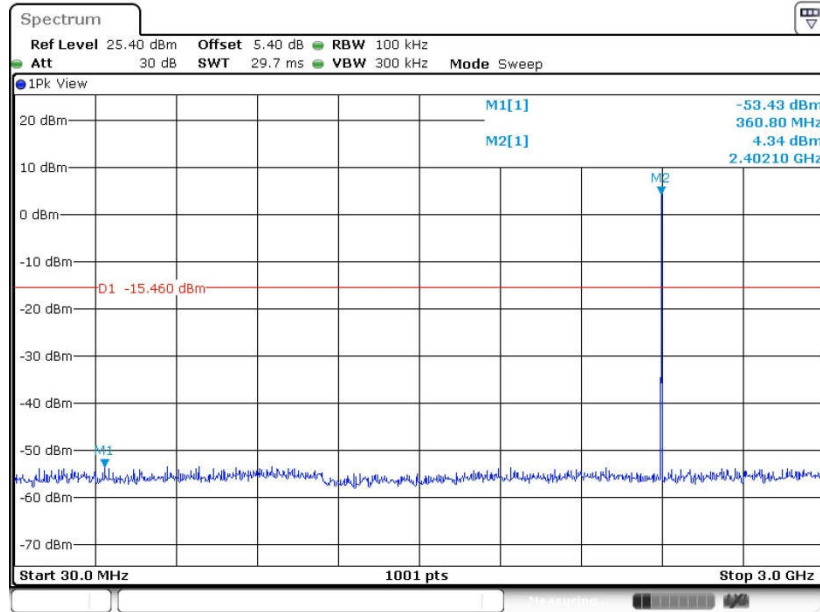


Date: 26.MAY.2018 17:08:59



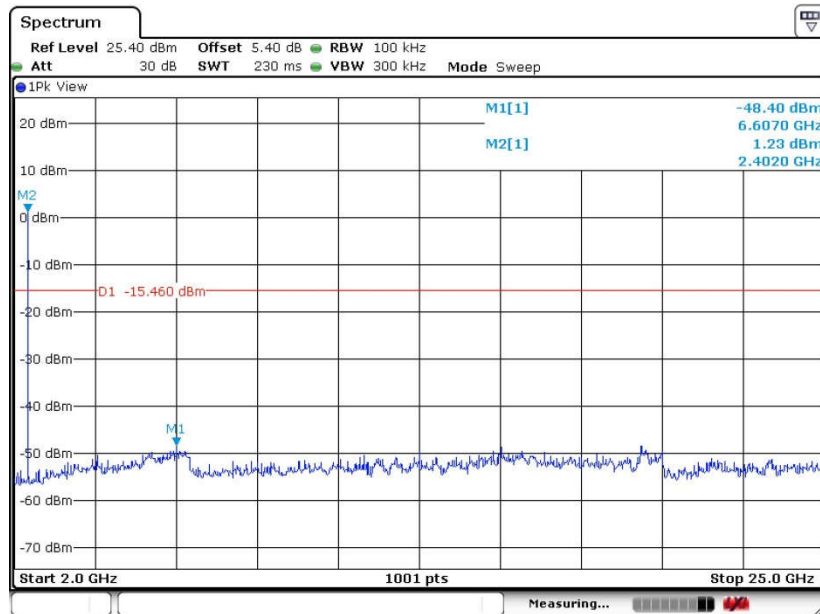
Bluetooth v5.0 LE

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



Date: 26.MAY.2018 17:32:36

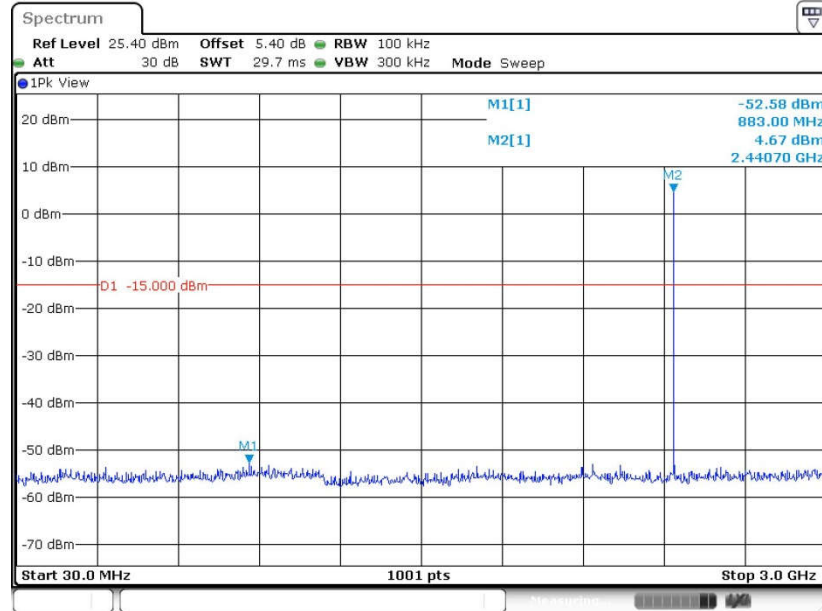
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps  
GFSK Channel 00



Date: 26.MAY.2018 17:33:18

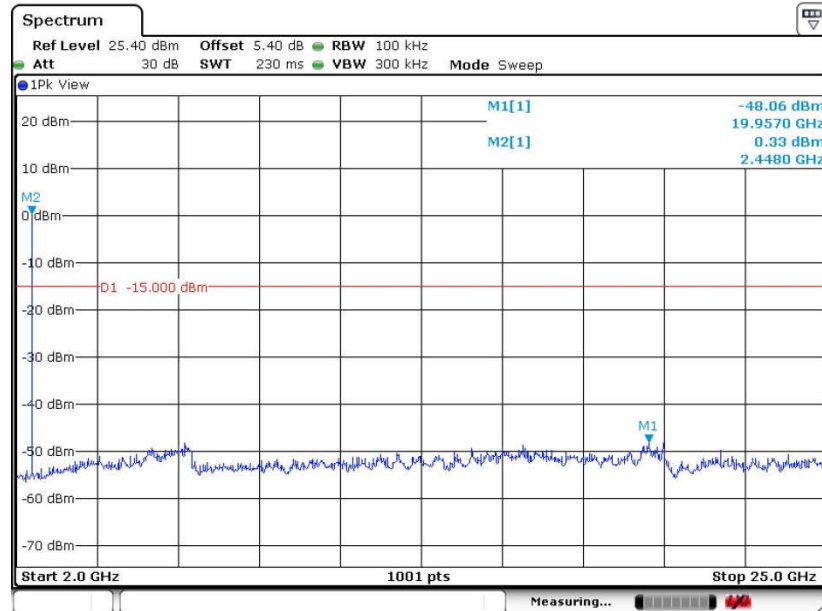


Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 19



Date: 26.MAY.2018 17:27:03

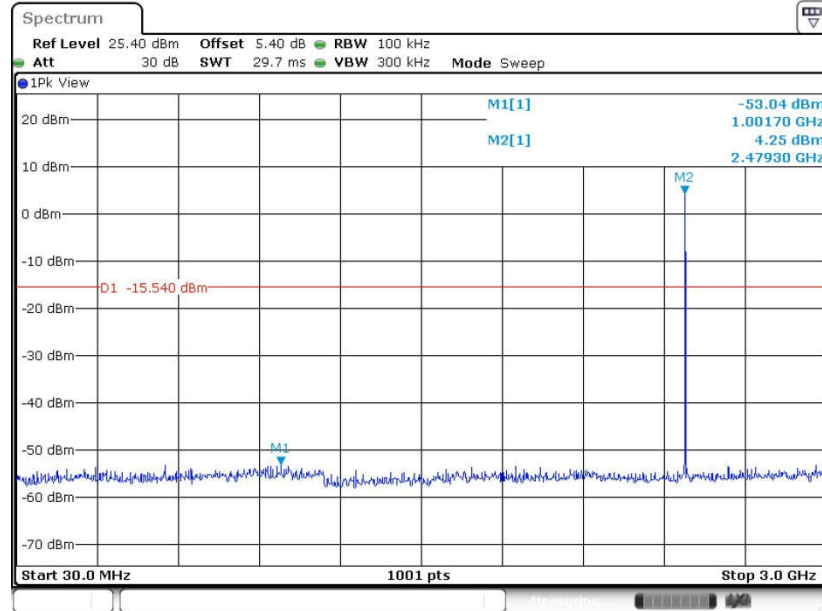
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 19



Date: 26.MAY.2018 17:27:49

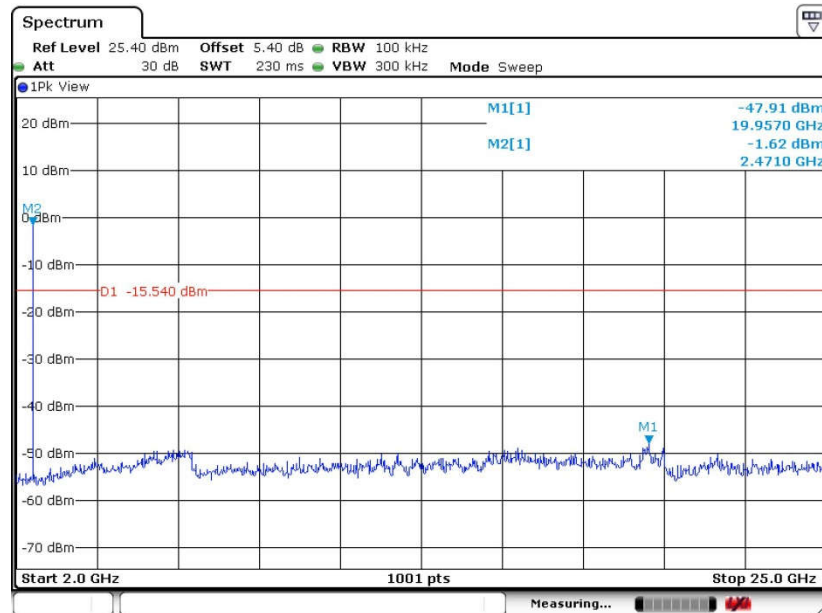


Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39



Date: 26.MAY.2018 17:23:04

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



Date: 26.MAY.2018 17:23:21



### 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 (MHz)	Field Strength (microvolts/meter)	Measurement Distance (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.

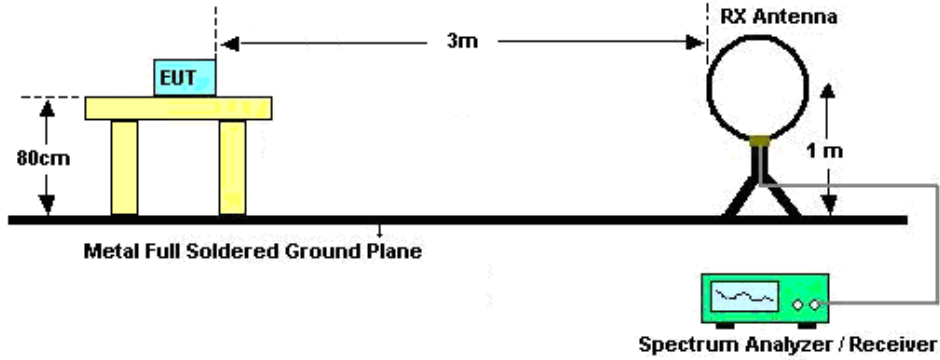


### 3.5.3 Test Procedures

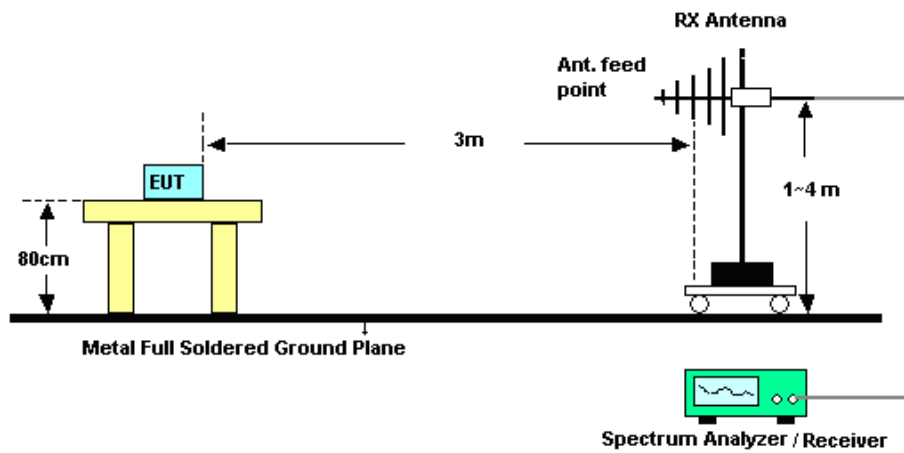
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test 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 average 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;  $VBW \geq RBW$ ; Sweep = auto; Detector function = peak; Trace = max hold;
  - (3) Set RBW = 1 MHz, VBW= 3MHz for  $f \geq 1$  GHz for peak measurement.  
For average measurement:
    - $VBW = 10$  Hz, when duty cycle is no less than 98 percent.
    - $VBW \geq 1/T$ , 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

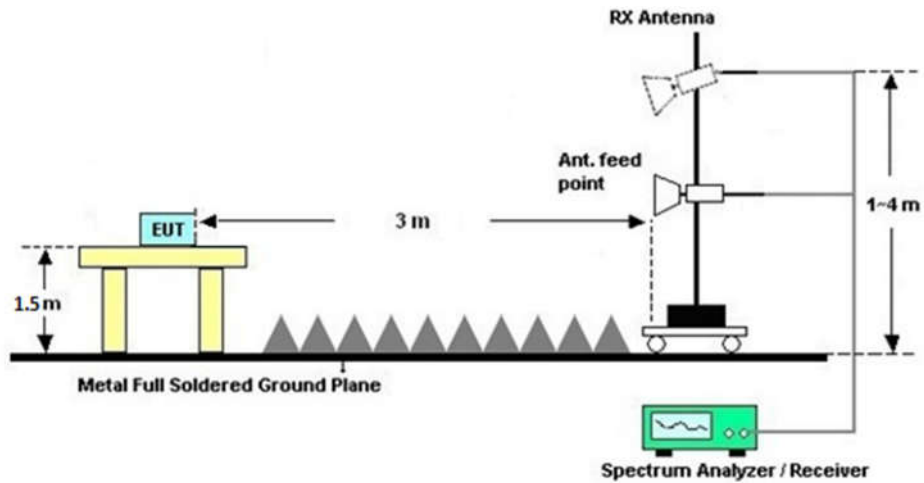
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz





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

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

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

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

Please refer to Appendix C.

### **3.5.7 Duty Cycle**

Please refer to Appendix D.

### **3.5.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)**

Please refer to Appendix C.



### 3.6 AC Conducted Emission Measurement

#### 3.6.1 Limit of AC Conducted Emission

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

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

\*Decreases with the logarithm of the frequency.

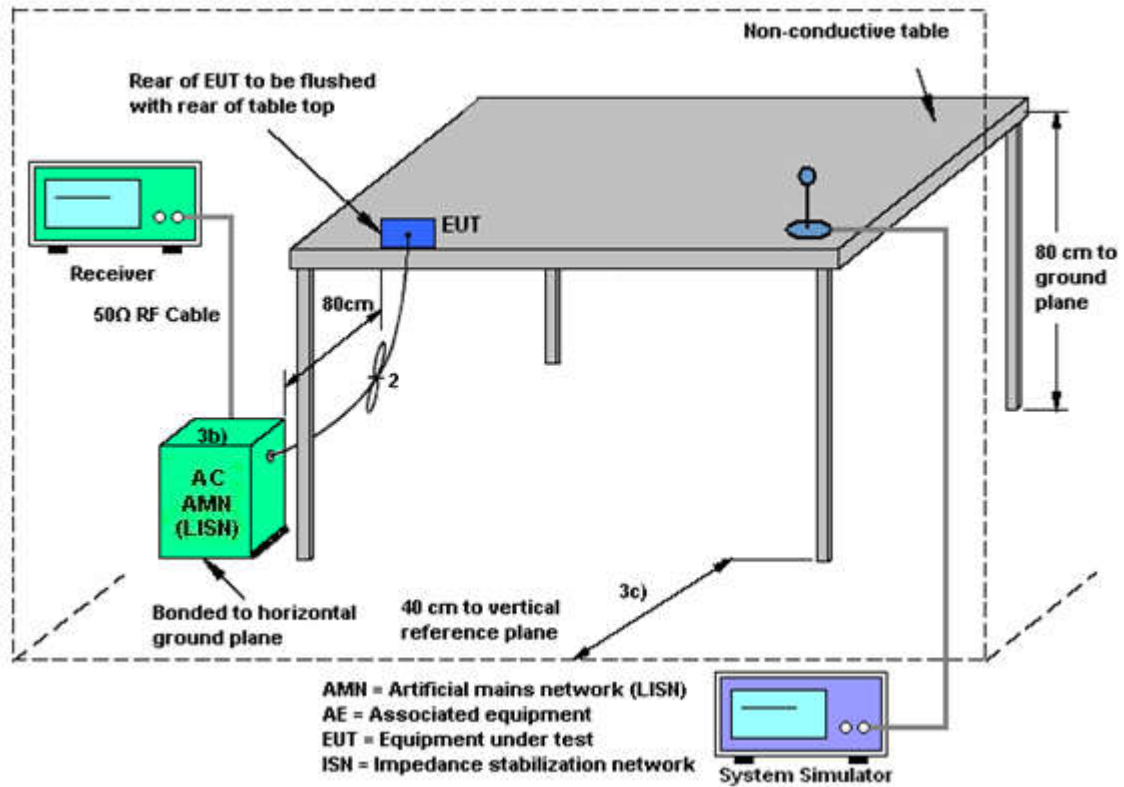
#### 3.6.2 Measuring Instruments

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

#### 3.6.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
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.

### 3.6.4 Test Setup



### 3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



## **3.7 Antenna Requirements**

### **3.7.1 Standard Applicable**

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

### **3.7.2 Antenna Anti-Replacement Construction**

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.



## 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	Aug. 08, 2017	May 26, 2018	Aug. 07, 2018	Conducted (TH01-KS)
Pulse Power Sensor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 18, 2018	May 26, 2018	Jan. 17, 2019	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 18, 2018	May 26, 2018	Jan. 17, 2019	Conducted (TH01-KS)
Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz, VSWR : 2.5:1 max	Jul. 18, 2017	May 24, 2018 ~ May 25, 2018	Jul. 17, 2018	Radiation (03CH11-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Jan. 16, 2018	May 24, 2018 ~ May 25, 2018	Jan. 15, 2019	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D&N-6-06	35414&AT-N0602	30MHz~1GHz	Oct. 14, 2017	May 24, 2018 ~ May 25, 2018	Oct. 13, 2018	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1326	1GHz ~ 18GHz	Oct. 16, 2017	May 24, 2018 ~ May 25, 2018	Oct. 15, 2018	Radiation (03CH11-HY)
Hygrometer	TECEPEL	DTN-303B	TP140325	N/A	Oct. 12, 2017	May 24, 2018 ~ May 25, 2018	Oct. 11, 2018	Radiation (03CH11-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Nov. 23, 2017	May 24, 2018 ~ May 25, 2018	Nov. 22, 2018	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY53270080	1GHz~26.5GHz	Jan. 16, 2018	May 24, 2018 ~ May 25, 2018	Jan. 15, 2019	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz ~ 44GHz	Oct. 19, 2017	May 24, 2018 ~ May 25, 2018	Oct. 18, 2018	Radiation (03CH11-HY)
Controller	EMEC	EM 1000	N/A	Control Turn table & Ant Mast	NCR	May 24, 2018 ~ May 25, 2018	NCR	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	NCR	May 24, 2018 ~ May 25, 2018	NCR	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	NCR	May 24, 2018 ~ May 25, 2018	NCR	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Nov. 27, 2017	May 24, 2018 ~ May 25, 2018	Nov. 26, 2018	Radiation (03CH11-HY)
Preamplifier	Jet-Power	JPA0118-55-303K	1710001800054002	1GHz~18GHz	Apr. 17, 2018	May 24, 2018 ~ May 25, 2018	Apr. 16, 2019	Radiation (03CH11-HY)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	Apr. 19, 2018	May 25, 2018	Apr. 18, 2019	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060103	9kHz~30MHz	Oct. 13, 2017	May 25, 2018	Oct. 12, 2018	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060105	9kHz~30MHz	Oct. 13, 2017	May 25, 2018	Oct. 12, 2018	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP00000811	AC 0V~300V, 45Hz~1000Hz	Oct. 12, 2017	May 25, 2018	Oct. 11, 2018	Conduction (CO01-KS)

NCR: No Calibration Required



## 5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	2.3dB
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### Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	5.2dB
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### Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	5.5dB
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### Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	5.2dB
---	-------



## **Appendix A. conducted test results**

**Bluetooth v4.2 Low Energy**

Test Engineer:	Silent Hai	Temperature:	21~25	°C
Test Date:	2018/5/26	Relative Humidity:	51~55	%

**TEST RESULTS DATA**  
**6dB Occupied Bandwidth**

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE	1Mbps	1	0	2402	0.67	0.50	Pass
BLE	1Mbps	1	19	2440	0.67	0.50	Pass
BLE	1Mbps	1	39	2480	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	5.11	30.00	0.50	5.61	36.00	Pass
BLE	1Mbps	1	19	2440	5.56	30.00	0.50	6.06	36.00	Pass
BLE	1Mbps	1	39	2480	4.99	30.00	0.50	5.49	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	1Mbps	1	0	2402	2.04	5.01
BLE	1Mbps	1	19	2440	2.04	5.31
BLE	1Mbps	1	39	2480	2.04	4.80

**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	4.54	-10.01	0.50	8.00	Pass
BLE	1Mbps	1	19	2440	5.00	-9.46	0.50	8.00	Pass
BLE	1Mbps	1	39	2480	4.43	-10.05	0.50	8.00	Pass

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

**Bluetooth v5.0 Low Energy**

Test Engineer:	Silent Hai	Temperature:	21~25	°C
Test Date:	2018/5/26	Relative Humidity:	51~55	%

**TEST RESULTS DATA**  
**6dB Occupied Bandwidth**

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE	1Mbps	1	0	2402	1.15	0.50	Pass
BLE	1Mbps	1	19	2440	1.14	0.50	Pass
BLE	1Mbps	1	39	2480	1.15	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	5.44	30.00	0.50	5.94	36.00	Pass
BLE	1Mbps	1	19	2440	5.79	30.00	0.50	6.29	36.00	Pass
BLE	1Mbps	1	39	2480	5.26	30.00	0.50	5.76	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	1Mbps	1	0	2402	4.83	4.88
BLE	1Mbps	1	19	2440	4.83	5.14
BLE	1Mbps	1	39	2480	4.83	4.77

**TEST RESULTS DATA**  
**Peak Power Density**

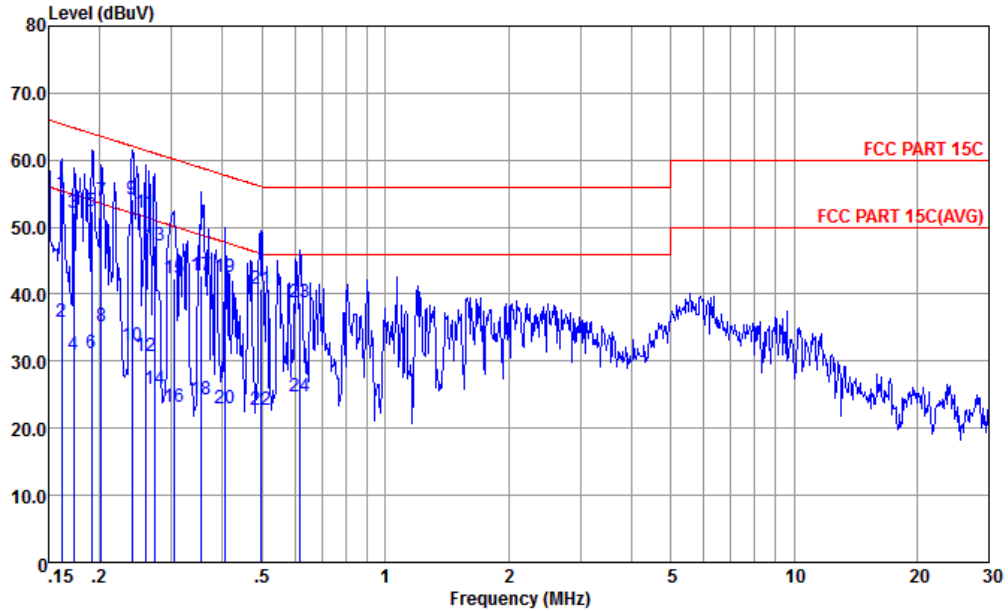
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak PSD (dBm /100kHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
BLE	1Mbps	1	0	2402	4.54	-13.67	0.50	8.00	Pass
BLE	1Mbps	1	19	2440	5.00	-13.19	0.50	8.00	Pass
BLE	1Mbps	1	39	2480	4.46	-13.72	0.50	8.00	Pass

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

Test Engineer :	Amos Zhang	Temperature :	25.1~25.3°C
		Relative Humidity :	55~58%
Test Voltage :	120Vac / 60Hz	Phase :	Line



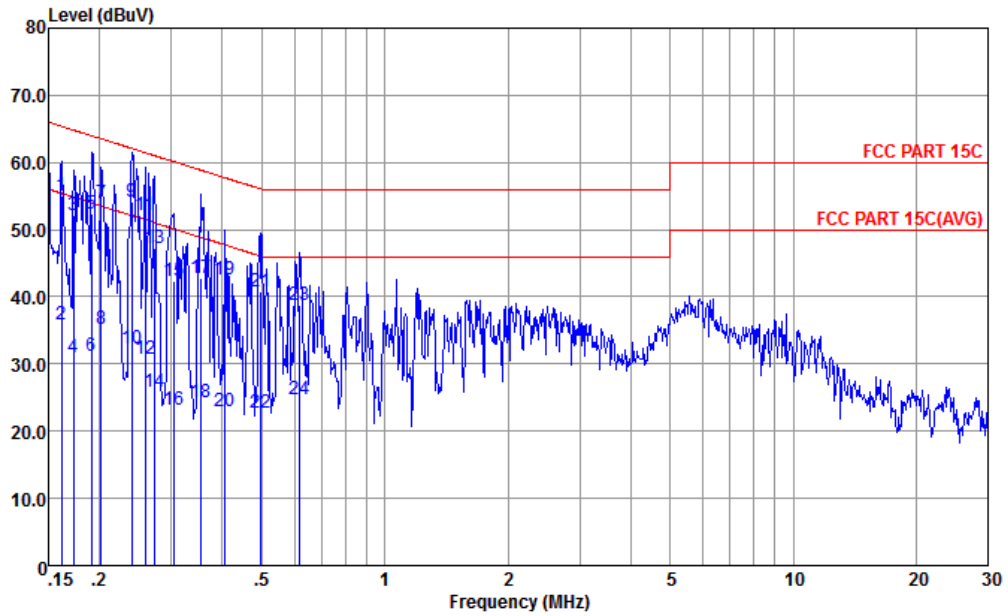
Site : CO01-KS  
Condition : FCC PART 15C LISN-L-171013-060103 LINE

mode : Mode 1  
: 355550090016408 #18

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.162	54.95	-10.43	65.38	44.20	0.17	10.58	QP
2	0.162	35.85	-19.53	55.38	25.10	0.17	10.58	Average
3	0.173	52.22	-12.59	64.81	41.50	0.18	10.54	QP
4	0.173	30.92	-23.89	54.81	20.20	0.18	10.54	Average
5	0.191	52.28	-11.70	63.98	41.61	0.19	10.48	QP
6	0.191	31.28	-22.70	53.98	20.61	0.19	10.48	Average
7	0.202	53.96	-9.58	63.54	43.31	0.20	10.45	QP
8	0.202	35.26	-18.28	53.54	24.61	0.20	10.45	Average
9 *	0.240	54.25	-7.83	62.08	43.60	0.21	10.44	QP
10	0.240	32.25	-19.83	52.08	21.60	0.21	10.44	Average
11	0.259	52.15	-9.32	61.47	41.49	0.22	10.44	QP
12	0.259	30.85	-20.62	51.47	20.19	0.22	10.44	Average
13	0.273	47.25	-13.78	61.03	36.60	0.22	10.43	QP
14	0.273	25.85	-25.18	51.03	15.20	0.22	10.43	Average
15	0.303	42.25	-17.90	60.15	31.59	0.23	10.43	QP
16	0.303	23.25	-26.90	50.15	12.59	0.23	10.43	Average
17	0.354	42.85	-16.02	58.87	32.19	0.24	10.42	QP



Test Engineer :	Amos Zhang	Temperature :	25.1~25.3°C
		Relative Humidity :	55~58%
Test Voltage :	120Vac / 60Hz	Phase :	Line

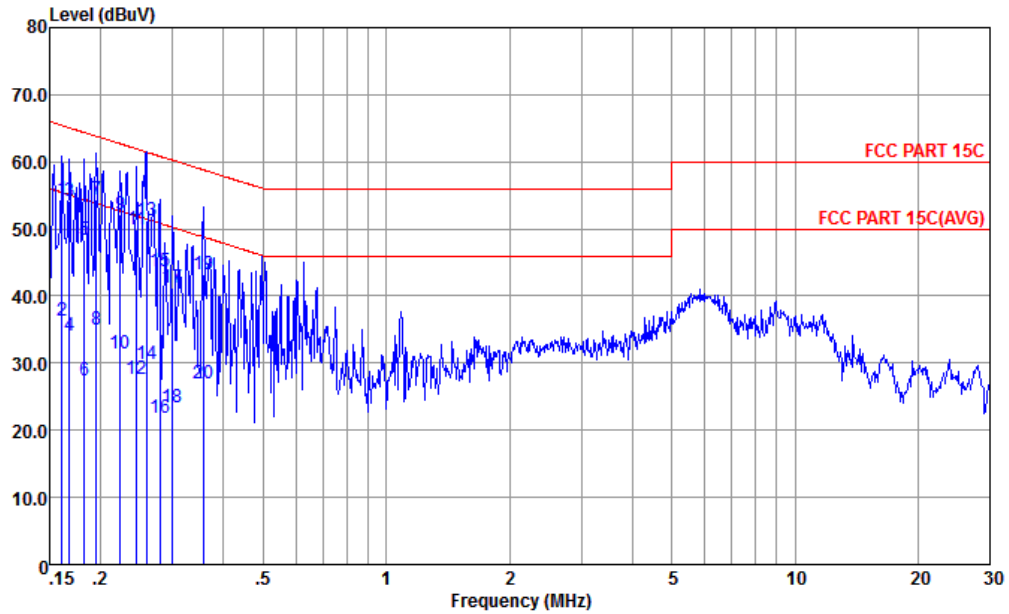


Site : CO01-KS  
 Condition : FCC PART 15C LISN-L-171013-060103 LINE  
 mode : Mode 1  
 : 355550090016408 #18

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
18	0.354	24.25	-24.62	48.87	13.59	0.24	10.42	Average
19	0.406	42.55	-15.18	57.73	31.90	0.25	10.40	QP
20	0.406	22.85	-24.88	47.73	12.20	0.25	10.40	Average
21	0.494	40.77	-15.33	56.10	30.20	0.26	10.31	QP
22	0.494	22.77	-23.33	46.10	12.20	0.26	10.31	Average
23	0.617	38.68	-17.32	56.00	28.20	0.26	10.22	QP
24	0.617	24.68	-21.32	46.00	14.20	0.26	10.22	Average



Test Engineer :	Amos Zhang	Temperature :	25.1~25.3°C
		Relative Humidity :	55~58%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral



Site : CO01-KS  
 Condition : FCC PART 15C LISN-N-171013-060103 NEUTRAL  
 mode : Mode 1  
 : 355550090016408 #18

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.161	54.46	-10.97	65.43	43.60	0.28	10.58	QP
2	0.161	36.36	-19.07	55.43	25.50	0.28	10.58	Average
3	0.168	54.13	-10.95	65.08	43.30	0.28	10.55	QP
4	0.168	34.13	-20.95	55.08	23.30	0.28	10.55	Average
5	0.182	48.29	-16.08	64.37	37.50	0.28	10.51	QP
6	0.182	27.39	-26.98	54.37	16.60	0.28	10.51	Average
7 *	0.195	54.35	-9.45	63.80	43.60	0.28	10.47	QP
8	0.195	34.95	-18.85	53.80	24.20	0.28	10.47	Average
9	0.223	52.23	-10.47	62.70	41.50	0.28	10.45	QP
10	0.223	31.33	-21.37	52.70	20.60	0.28	10.45	Average
11	0.246	49.92	-11.99	61.91	39.20	0.28	10.44	QP
12	0.246	27.62	-24.29	51.91	16.90	0.28	10.44	Average
13	0.259	51.32	-10.15	61.47	40.60	0.28	10.44	QP
14	0.259	29.92	-21.55	51.47	19.20	0.28	10.44	Average
15	0.279	43.62	-17.23	60.85	32.91	0.28	10.43	QP
16	0.279	21.92	-28.93	50.85	11.21	0.28	10.43	Average
17	0.299	41.31	-18.97	60.28	30.60	0.28	10.43	QP
18	0.299	23.31	-26.97	50.28	12.60	0.28	10.43	Average
19	0.358	43.20	-15.58	58.78	32.50	0.29	10.41	QP
20	0.358	26.90	-21.88	48.78	16.20	0.29	10.41	Average



## Appendix C. Radiated Spurious Emission

Bluetooth v4.2 LE

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	( P/A )	( H/V )
BLE CH 00 2402MHz		2388.12	52.21	-21.79	74	42.39	27.13	16.29	33.6	314	79	P	H
		2385.81	41.46	-12.54	54	31.64	27.13	16.29	33.6	314	79	A	H
	*	2402	107.19	-	-	97.36	27.13	16.29	33.59	314	79	P	H
	*	2402	106.22	-	-	96.39	27.13	16.29	33.59	314	79	A	H
		2357.985	52.75	-21.25	74	43.09	27.04	16.22	33.6	354	135	P	V
		2376.255	41.42	-12.58	54	31.71	27.09	16.22	33.6	354	135	A	V
	*	2402	104.47	-	-	94.64	27.13	16.29	33.59	354	135	P	V
	*	2402	103.65	-	-	93.82	27.13	16.29	33.59	354	135	A	V
BLE CH 19 2440MHz		2316.86	52.84	-21.16	74	43.46	26.91	16.08	33.61	301	79	P	H
		2380.56	41.42	-12.58	54	31.64	27.09	16.29	33.6	301	79	A	H
	*	2440	107.46	-	-	97.47	27.27	16.31	33.59	301	79	P	H
	*	2440	106.59	-	-	96.6	27.27	16.31	33.59	301	79	A	H
		2483.84	52.37	-21.63	74	42.28	27.36	16.31	33.58	301	79	P	H
		2484.16	41.72	-12.28	54	31.63	27.36	16.31	33.58	301	79	A	H
		2379.72	52.09	-21.91	74	42.38	27.09	16.22	33.6	341	125	P	V
		2375.8	41.34	-12.66	54	31.63	27.09	16.22	33.6	341	125	A	V
	*	2440	103.5	-	-	93.51	27.27	16.31	33.59	341	125	P	V
	*	2440	102.53	-	-	92.54	27.27	16.31	33.59	341	125	A	V
		2492.08	51.85	-22.15	74	41.7	27.4	16.32	33.57	341	125	P	V
	2498.48	41.75	-12.25	54	31.6	27.4	16.32	33.57	341	125	A	V	



BLE CH 39 2480MHz	*	2480	107.08	-	-	96.99	27.36	16.31	33.58	296	74	P	H
	*	2480	106.01	-	-	95.92	27.36	16.31	33.58	296	74	A	H
		2483.52	56.55	-17.45	74	46.46	27.36	16.31	33.58	296	74	P	H
		2493.6	50.81	-3.19	54	40.66	27.4	16.32	33.57	296	74	A	H
	*	2480	102.66	-	-	92.57	27.36	16.31	33.58	332	106	P	V
	*	2480	101.85	-	-	91.76	27.36	16.31	33.58	332	106	A	V
		2483.56	54.37	-19.63	74	44.28	27.36	16.31	33.58	332	106	P	V
		2483.6	41.9	-12.1	54	31.81	27.36	16.31	33.58	332	106	A	V
Remark	<ol style="list-style-type: none"> <li>No other spurious found.</li> <li>All results are PASS against Peak and Average limit line.</li> </ol>												



2.4GHz 2400~2483.5MHz
BLE (Harmonic @ 3m)

Table with 14 columns: BLE, Note, Frequency (MHz), Level (dBµV/m), Over Limit (dB), Limit Line (dBµV/m), Read Level (dBµV), Antenna Factor (dB/m), Path Loss (dB), Preamp Factor (dB), Ant Pos (cm), Table Pos (deg), Peak Avg. (P/A), Pol. (H/V). Rows include data for BLE CH 00 (2402MHz) and BLE CH 19 (2440MHz) and BLE CH 39 (2480MHz).



Emission below 1GHz

2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	( P/A )	( H/V )
2.4GHz BLE LF		31.62	23.21	-16.79	40	31.62	23.24	0.84	32.49	-	-	P	H
		170.67	21.26	-22.24	43.5	36.67	15.31	1.7	32.42	-	-	P	H
		271.11	27.62	-18.38	46	38.7	19.13	2.17	32.38	-	-	P	H
		353.9	21.42	-24.58	46	31	20.34	2.43	32.35	-	-	P	H
		558.3	27.27	-18.73	46	30.66	25.97	3.07	32.43	-	-	P	H
		913.2	32.35	-13.65	46	30.72	29.22	3.95	31.54	100	0	P	H
		45.66	34.6	-5.4	40	49.93	16.14	1.02	32.49	100	0	P	V
		148.26	29.09	-14.41	43.5	42.96	16.88	1.69	32.44	-	-	P	V
		177.15	21.11	-22.39	43.5	36.82	14.92	1.78	32.41	-	-	P	V
		411.3	22.98	-23.02	46	30.48	22.15	2.69	32.34	-	-	P	V
		657	27.74	-18.26	46	30.65	26.25	3.31	32.47	-	-	P	V
		915.3	32.18	-13.82	46	30.5	29.25	3.95	31.52	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



Bluetooth v5.0 LE

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 )
BLE CH 00 2402MHz		2341.71	52.82	-21.18	74	43.27	27	16.15	33.6	289	37	P	H
		2386.65	42.05	-11.95	54	32.23	27.13	16.29	33.6	289	37	A	H
	*	2402	104.63	-	-	94.8	27.13	16.29	33.59	289	37	P	H
	*	2402	101.79	-	-	91.96	27.13	16.29	33.59	289	37	A	H
		2374.575	52.46	-21.54	74	42.75	27.09	16.22	33.6	155	73	P	V
		2374.365	46.46	-7.54	54	36.75	27.09	16.22	33.6	155	73	A	V
	*	2402	107.04	-	-	97.21	27.13	16.29	33.59	155	73	P	V
	*	2402	104.26	-	-	94.43	27.13	16.29	33.59	155	73	A	V
BLE CH 19 2440MHz		2352.4	52.56	-21.44	74	42.97	27.04	16.15	33.6	280	60	P	H
		2388.88	42.06	-11.94	54	32.24	27.13	16.29	33.6	280	60	A	H
	*	2440	105.06	-	-	95.07	27.27	16.31	33.59	280	60	P	H
	*	2440	102.23	-	-	92.24	27.27	16.31	33.59	280	60	A	H
		2496.56	51.84	-22.16	74	41.69	27.4	16.32	33.57	280	60	P	H
		2484.96	42.66	-11.34	54	32.56	27.36	16.32	33.58	280	60	A	H
		2333.68	51.95	-22.05	74	42.46	26.95	16.15	33.61	163	112	P	V
		2388.56	41.95	-12.05	54	32.13	27.13	16.29	33.6	163	112	A	V
	*	2440	106.46	-	-	96.47	27.27	16.31	33.59	163	112	P	V
	*	2440	103.57	-	-	93.58	27.27	16.31	33.59	163	112	A	V
		2490.64	53.49	-20.51	74	43.35	27.4	16.32	33.58	163	112	P	V
	2488.72	42.36	-11.64	54	32.22	27.4	16.32	33.58	163	112	A	V	



BLE CH 39 2480MHz	*	2480	105.64	-	-	95.55	27.36	16.31	33.58	268	58	P	H
	*	2480	102.7	-	-	92.61	27.36	16.31	33.58	268	58	A	H
		2483.52	58.32	-15.68	74	48.23	27.36	16.31	33.58	268	58	P	H
		2493.6	48.89	-5.11	54	38.74	27.4	16.32	33.57	268	58	A	H
	*	2480	105.96	-	-	95.87	27.36	16.31	33.58	153	95	P	V
	*	2480	103.07	-	-	92.98	27.36	16.31	33.58	153	95	A	V
		2483.56	58.09	-15.91	74	48	27.36	16.31	33.58	153	95	P	V
		2493.4	50.98	-3.02	54	40.83	27.4	16.32	33.57	153	95	A	V
Remark	<ol style="list-style-type: none"> <li>No other spurious found.</li> <li>All results are PASS against Peak and Average limit line.</li> </ol>												



2.4GHz 2400~2483.5MHz
BLE (Harmonic @ 3m)

Table with 14 columns: BLE, Note, Frequency (MHz), Level (dBµV/m), Over Limit (dB), Limit Line (dBµV/m), Read Level (dBµV), Antenna Factor (dB/m), Path Loss (dB), Preamp Factor (dB), Ant Pos (cm), Table Pos (deg), Peak Avg. (P/A), Pol. (H/V). Rows include data for CH 00 (2402MHz), CH 19 (2440MHz), and CH 39 (2480MHz).



Emission below 1GHz

2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	( P/A )	( H/V )
2.4GHz BLE LF		31.89	22.74	-17.26	40	31.15	23.24	0.84	32.49	-	-	P	H
		163.65	21.36	-22.14	43.5	36.19	15.88	1.71	32.42	-	-	P	H
		268.68	24.51	-21.49	46	35.42	19.3	2.17	32.38	-	-	P	H
		436.5	24.39	-21.61	46	31.25	22.74	2.75	32.35	-	-	P	H
		681.5	28.71	-17.29	46	31.49	26.3	3.39	32.47	-	-	P	H
		934.9	33.34	-12.66	46	30.82	29.87	3.99	31.34	100	0	P	H
		45.93	34.7	-5.3	40	50.03	16.14	1.02	32.49	100	0	P	V
		116.94	28.42	-15.08	43.5	42.31	17.14	1.43	32.46	-	-	P	V
		168.51	28.81	-14.69	43.5	44.07	15.45	1.71	32.42	-	-	P	V
		442.1	23.76	-22.24	46	30.54	22.83	2.74	32.35	-	-	P	V
		563.2	27.48	-18.52	46	30.84	25.95	3.12	32.43	-	-	P	V
		749.4	29.92	-16.08	46	30.87	27.81	3.57	32.33	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



Note symbol

*	<b>Fundamental Frequency</b> 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	<b>Peak</b> or <b>Average</b>
H/V	<b>Horizontal</b> or <b>Vertical</b>



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.
		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	( P/A )	( H/V )
BLE CH 00 2402MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) =  
Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/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(dBμV/m) – 74(dBμV/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(dBμV) – 35.86 (dB)  
= 43.54 (dBμV/m)
2. Over Limit(dB)  
= Level(dBμV/m) – Limit Line(dBμV/m)  
= 43.54(dBμV/m) – 54(dBμV/m)  
= -10.46(dB)

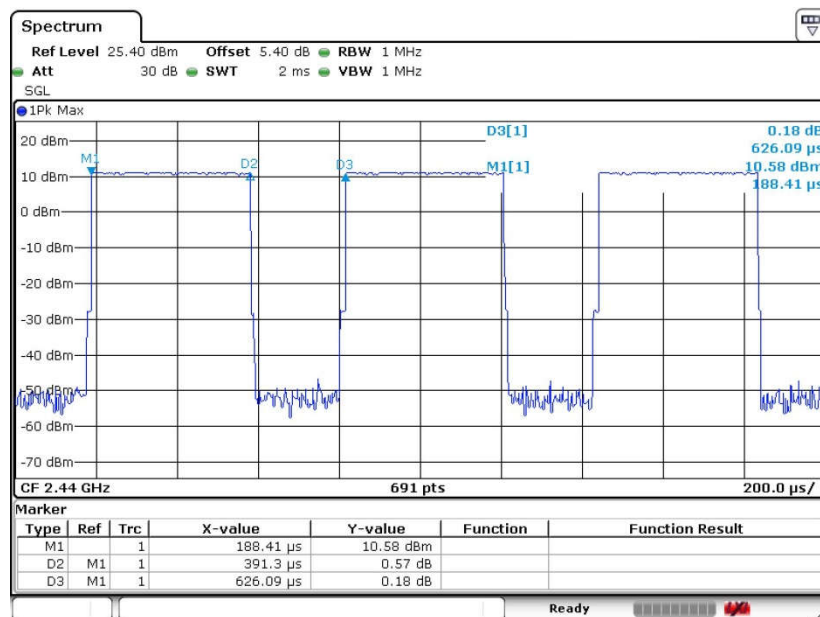
**Both peak and average measured complies with the limit line, so test result is “PASS”.**



## Appendix D. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
Bluetooth v4.2 LE	62.50	0.391	2.558	3KHz
Bluetooth v5.0 LE	32.87	0.206	4.854	10KHz

### Bluetooth v4.2 LE





Bluetooth v5.0 LE

