FCC RF Test Report

APPLICANT	:	**Motorola Mobility LLC**
EQUIPMENT	:	**Mobile Cellular Phone**
BRAND NAME	:	**Motorola**
MODEL NAME	:	**XT1970-1, XT1970-2**
FCC ID	:	**IHDT56XT1**
STANDARD	:	**FCC Part 15 Subpart C §15.247**
CLASSIFICATION	:	**(DTS) Digital Transmission System**

The product was received on Dec. 20, 2018 and testing was completed on Feb. 01, 2019. 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.

James Huang

Approved by: James Huang / Manager

TESTING
NVLAP LAB CODE 600155-0

Sporton International (Kunshan) Inc.
No. 1098, Pengxi North Road, Kunshan Economic Development Zone, Jiangsu Province 215335, China

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR8D2002B	Rev. 01	Initial issue of report	Mar. 01, 2019

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	≥ 0.5MHz	Pass	-
3.2	15.247(b)(3)	Peak Output Power	≤ 30dBm	Pass	-
3.3	15.247(e)	Power Spectral Density	≤ 8dBm/3kHz	Pass	-
3.4	15.247(d)	Conducted Band Edges and Spurious Emission	≤ 20dBc	Pass	-
3.5	15.247(d)	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 7.84 dB at 2483.510 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 7.64 dB at 0.159 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
Model Name	XT1970-1, XT1970-2
FCC ID	IHDT56XT1
EUT supports Radios application	GSM/GPRS/EGPRS/WCDMA/HSPA/DC-HSDPA/HSPA +(16QAM uplink is not supported)/LTE WLAN 2.4GHz 802.11b/g/n HT20 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth BR / EDR / LE NFC/GNSS/FM Receiver
IMEI Code	Conducted: 352170100016414/352170100016422 Conduction: 352170100023196/352170100023204 Radiation: 352170100023279/352170100023287
HW Version	DVT2
SW Version	PSA29.76
EUT Stage	Identical Prototype

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. There are two types of EUT sample 1 and sample 2, the differences between two samples are only for SIM slot, sample 1(model name XT1970-1) is dual SIM slot, sample 2(model name XT1970-2) is single SIM slot. According to the difference, we evaluate is not affect RF performance, so only choose sample 1 to perform RF test.

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: 10.28 dBm (0.0107 W) Bluetooth v5.0 LE: 9.66 dBm (0.0092 W)
Antenna Type / Gain	PIFA Antenna with gain -0.50 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(US)	**Brand Name**	Motorola (Salom)	**Model Name**	SC-51
	Power Rating	I/P: 100-240 Vac, 600mA O/P: 5Vdc,3000mA; 9Vdc,2000mA; 12Vdc,1500mA		
AC Adapter 1(EU)	**Brand Name**	Motorola (Salom)	**Model Name**	SC-52
	Power Rating	I/P: 100-240 Vac, 600mA O/P: 5Vdc,3000mA; 9Vdc,2000mA; 12Vdc,1500mA		
AC Adapter 1(UK)	**Brand Name**	Motorola (Salom)	**Model Name**	SC-53
	Power Rating	I/P: 100-240 Vac, 600mA O/P: 5Vdc,3000mA; 9Vdc,2000mA; 12Vdc,1500mA		
AC Adapter 1(IN)	**Brand Name**	Motorola (Salom)	**Model Name**	SC-54
	Power Rating	I/P: 100-240 Vac, 600mA O/P: 5Vdc,3000mA; 9Vdc,2000mA; 12Vdc,1500mA		
AC Adapter 1(AU)	**Brand Name**	Motorola (Salom)	**Model Name**	SC-55
	Power Rating	I/P: 100-240 Vac, 600mA O/P: 5Vdc,3000mA; 9Vdc,2000mA; 12Vdc,1500mA		
AC Adapter 1(AR)	**Brand Name**	Motorola (Salom)	**Model Name**	SC-56
	Power Rating	I/P: 100-240 Vac, 600mA O/P: 5Vdc,3000mA; 9Vdc,2000mA; 12Vdc,1500mA		
AC Adapter 1(BR)	**Brand Name**	Motorola (Salom)	**Model Name**	SC-57
	Power Rating	I/P: 100-240 Vac, 600mA O/P: 5Vdc,3000mA; 9Vdc,2000mA; 12Vdc,1500mA		
AC Adapter 1(PRC)	**Brand Name**	Motorola (Salom)	**Model Name**	SC-58
	Power Rating	I/P: 100-240 Vac, 600mA O/P: 5Vdc,3000mA; 9Vdc,2000mA; 12Vdc,1500mA		
AC Adapter 1(Chile)	**Brand Name**	Motorola (Salom)	**Model Name**	SC-52
	Power Rating	I/P: 100-240 Vac, 600mA O/P: 5Vdc,3000mA; 9Vdc,2000mA; 12Vdc,1500mA		

AC Adapter 2(US)	Brand Name	Motorola (Chenyang)	Model Name	SC-51
	Power Rating	I/P: 100-240 Vac, 600mA O/P: 5Vdc,3000mA; 9Vdc,2000mA; 12Vdc,1500mA		
AC Adapter 2(EU)	Brand Name	Motorola (Chenyang)	Model Name	SC-52
	Power Rating	I/P: 100-240 Vac, 600mA O/P: 5Vdc,3000mA; 9Vdc,2000mA; 12Vdc,1500mA		
AC Adapter 2(UK)	Brand Name	Motorola (Chenyang)	Model Name	SC-53
	Power Rating	I/P: 100-240 Vac, 600mA O/P: 5Vdc,3000mA; 9Vdc,2000mA; 12Vdc,1500mA		
AC Adapter 2(AU)	Brand Name	Motorola (Chenyang)	Model Name	SC-55
	Power Rating	I/P: 100-240 Vac, 600mA O/P: 5Vdc,3000mA; 9Vdc,2000mA; 12Vdc,1500mA		
AC Adapter 2(AR)	Brand Name	Motorola (Chenyang)	Model Name	SC-56
	Power Rating	I/P: 100-240 Vac, 600mA O/P: 5Vdc,3000mA; 9Vdc,2000mA; 12Vdc,1500mA		
AC Adapter 2(PRC)	Brand Name	Motorola (Chenyang)	Model Name	SC-58
	Power Rating	I/P: 100-240 Vac, 600mA O/P: 5Vdc,3000mA; 9Vdc,2000mA; 12Vdc,1500mA		
AC Adapter 3(BR)	Brand Name	Motorola (Salom/Flex)	Model Name	SC-57
	Power Rating	I/P: 100-240 Vac, 600mA O/P: 5Vdc,3000mA; 9Vdc,2000mA; 12Vdc,1500mA		
AC Adapter 4(BR)	Brand Name	Motorola (Tenpao/Cliptech)	Model Name	SC-57
	Power Rating	I/P: 100-240 Vac, 600mA O/P: 5Vdc,3000mA; 9Vdc,2000mA; 12Vdc,1500mA		
Battery	Brand Name	Motorola (ATL)	Model Name	KR40
	Power Rating	3.8Vdc,3500mAh	Type	Li-ion, Polymer
Earphone 1	Brand Name	Motorola (Lyand)	Model Name	SH38C37773
	Signal Line	1.1 meter, non-shielded cable, without ferrite core		
Earphone 2	Brand Name	Motorola (jiahe)	Model Name	SH38C44959
	Signal Line	1.1 meter, non-shielded cable, without ferrite core		
USB Cable 1	Brand Name	Motorola (LiQi)	Model Name	L32B-053000100/L32B-053000100L
	Signal Line	1.0 meter, shielded cable, without ferrite core		
USB Cable 2	Brand Name	Motorola (Saibao)	Model Name	S32B-053000100/S32B-053000100L
	Signal Line	1.0 meter, shielded cable, without ferrite core		
USB Cable 3	Brand Name	Motorola (I SHENG)	Model Name	SC18C28955
	Signal Line	1.0 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).

Test Site	Sporton International (Kunshan) Inc.		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone, Jiangsu Province 215335, China TEL : 86-512-57900158 FAX : 86-512-57900958		
Test Site No.	**Sporton Site No.**	**FCC designation No.**	**FCC Test Firm Registration No.**
	TH01-KS CO01-KS 03CH05-KS	CN5013	630927

1.8 Applicable Standards

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

- 47 CFR Part 15 Subpart C §15.247
- FCC KDB 558074 D01 15.247 Meas Guidance v05r01
- 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

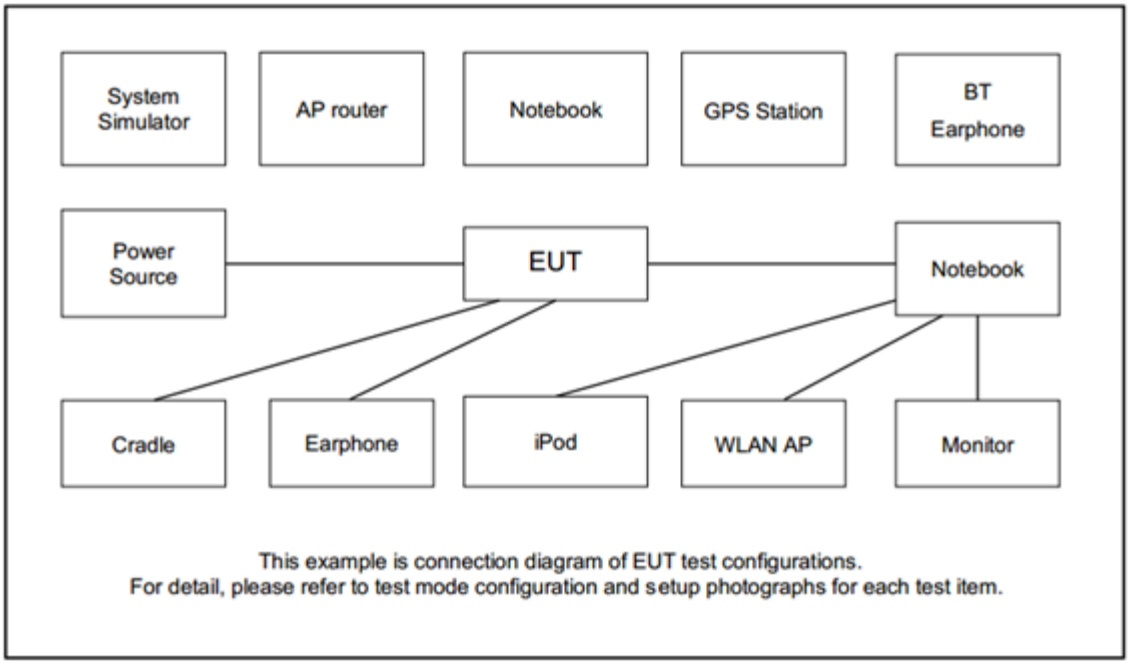
a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (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 4) + Earphone 2
Remark: The accessories are from Part 15B worst case for conducted emission.	

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	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,1.8m
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 BLE 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 and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss

Offset = RF cable loss

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

Offset(dB) = RF cable loss(dB) .

= 5.8 (dB)

3 Test Result

3.1 6dB Bandwidth Measurement

3.1.1 Limit of 6dB Bandwidth

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

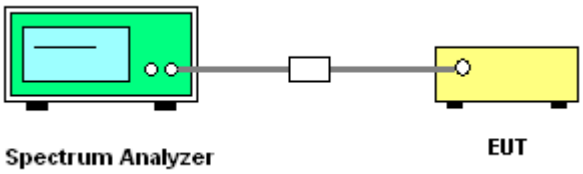
3.1.2 Measuring Instruments

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 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.
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

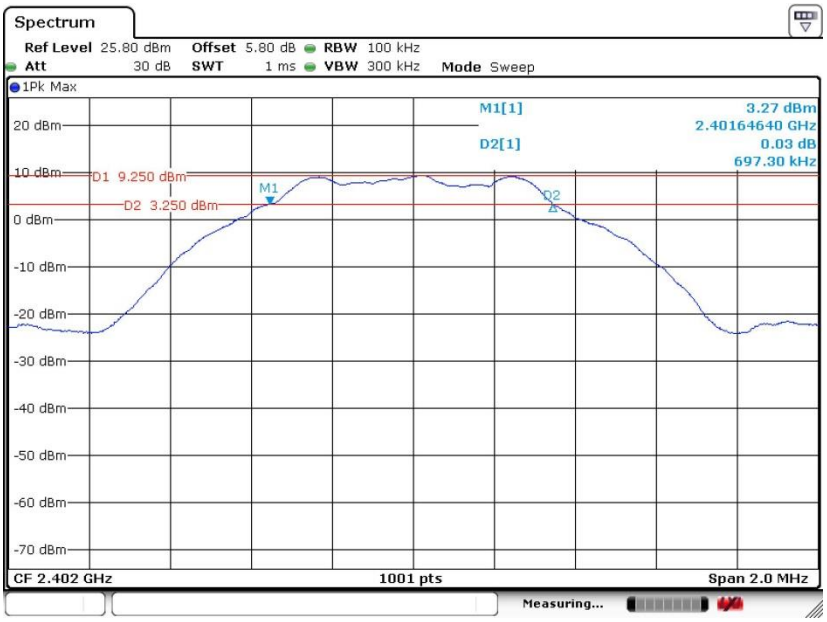


3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.

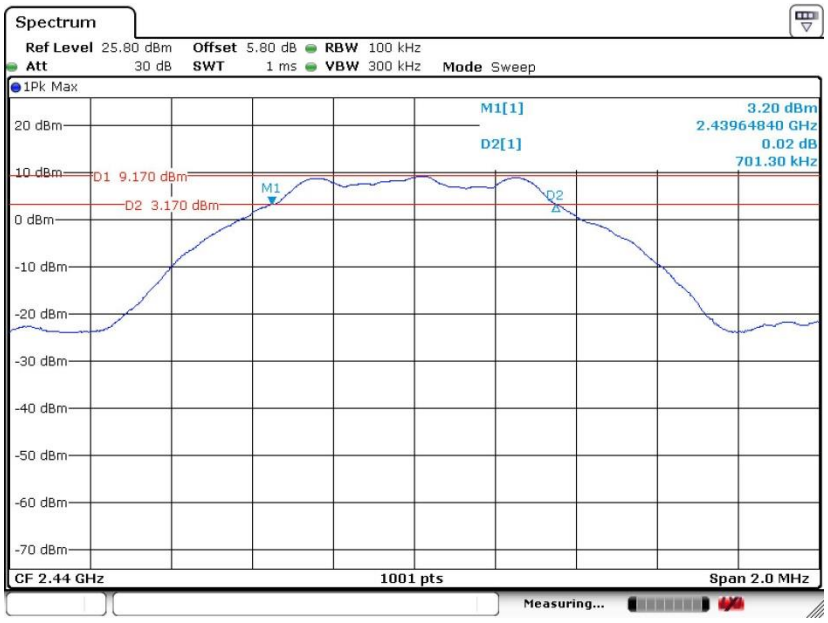
Bluetooth v4.2 LE

6 dB Bandwidth Plot on Channel 00



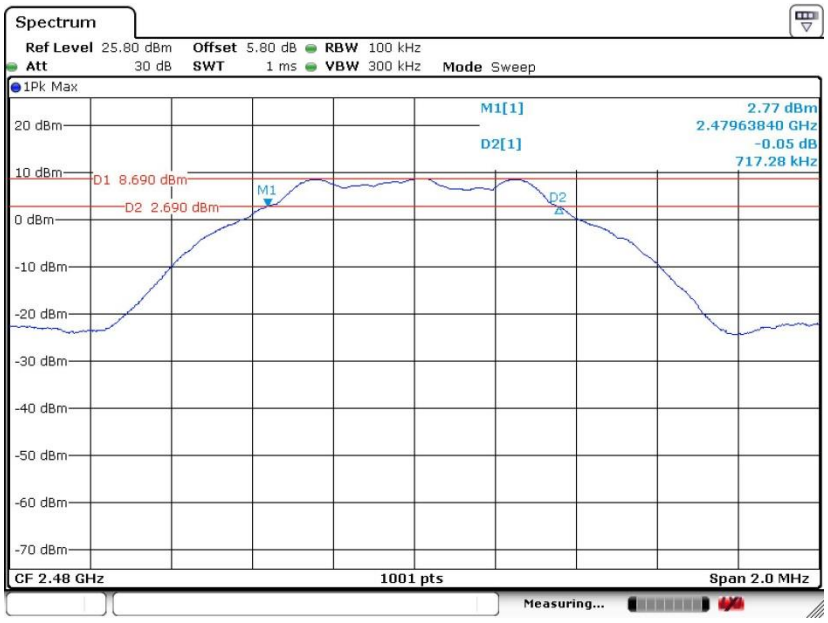
Date: 1.FEB.2019 13:57:30

6 dB Bandwidth Plot on Channel 19



Date: 1.FEB.2019 13:54:37

6 dB Bandwidth Plot on Channel 39



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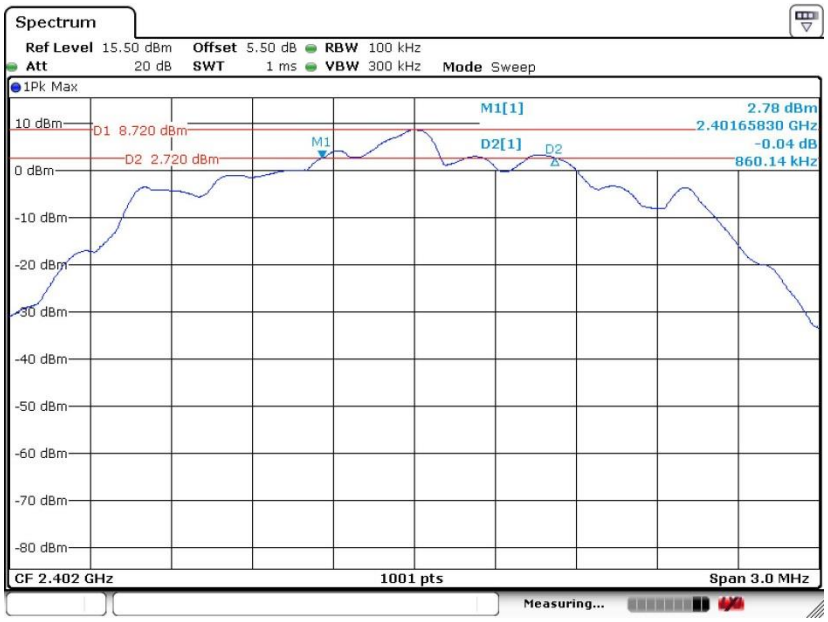
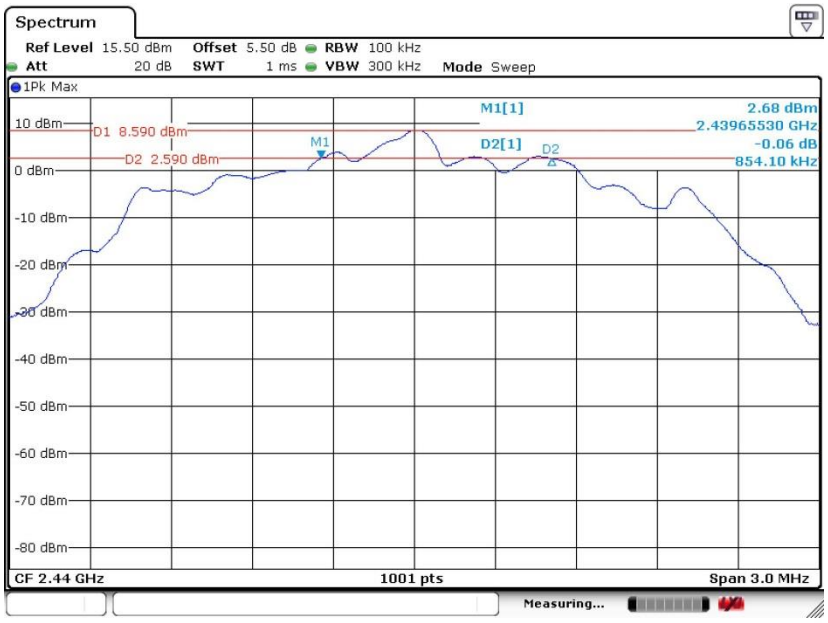
Bluetooth v5.0 LE

6 dB Bandwidth Plot on Channel 00



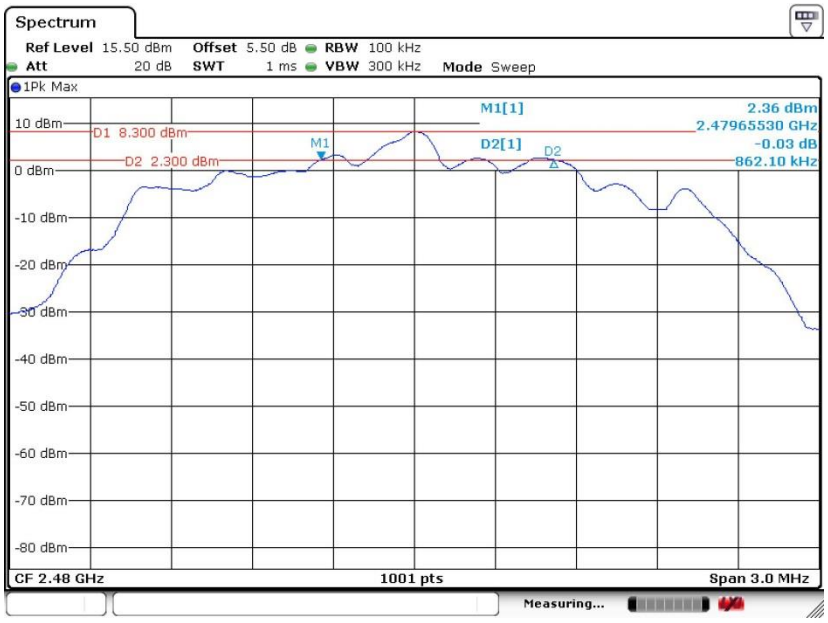
Date: 28.JAN.2019 13:00:42

6 dB Bandwidth Plot on Channel 19



Date: 28.JAN.2019 13:35:09

6 dB Bandwidth Plot on Channel 39



Date: 28.JAN.2019 13:29:05

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.

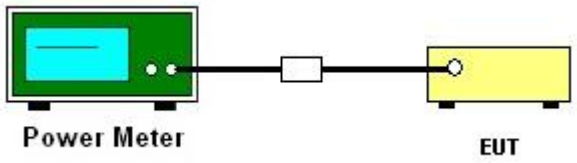
3.2.2 Measuring Instruments

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 ANSI C63.10-2013 clause 11.9.1.3 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.

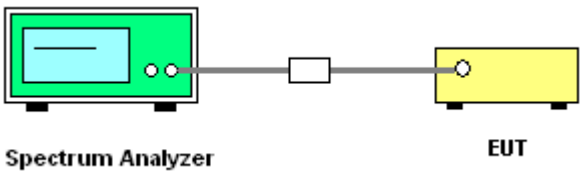
3.3.2 Measuring Instruments

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

3.3.4 Test Setup



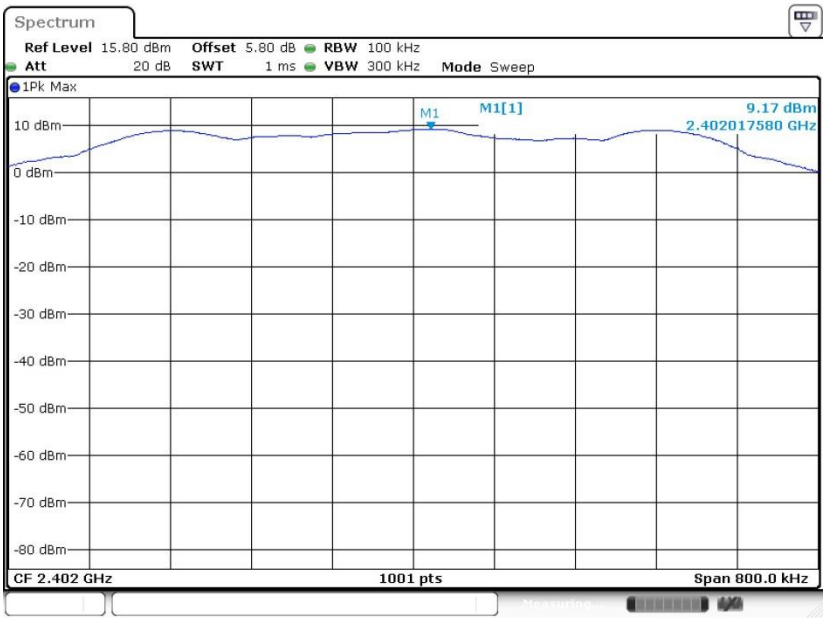
3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

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

Bluetooth v4.2 LE

PSD 100kHz Plot on Channel 00



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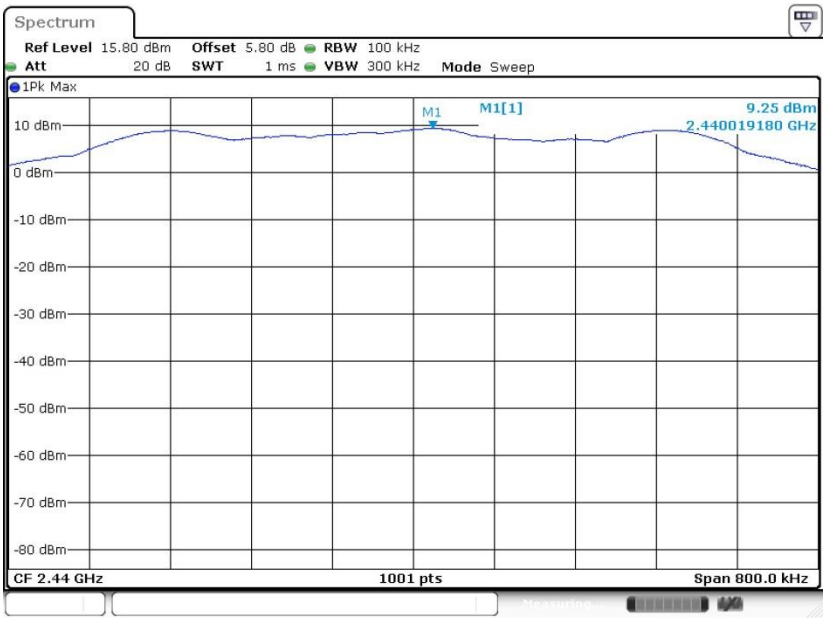
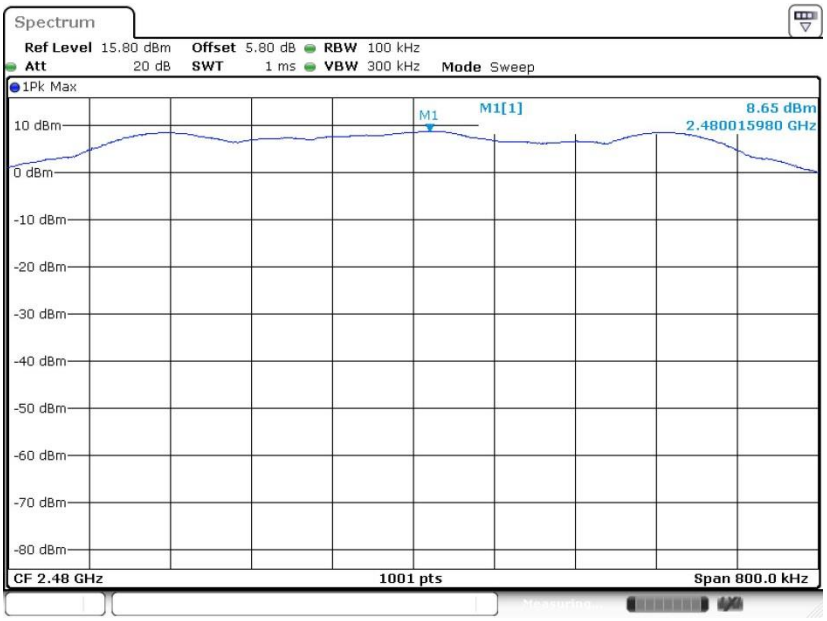
PSD 100kHz Plot on Channel 19



Date: 1.FEB.2019 13:59:05

PSD 100kHz Plot on Channel 39



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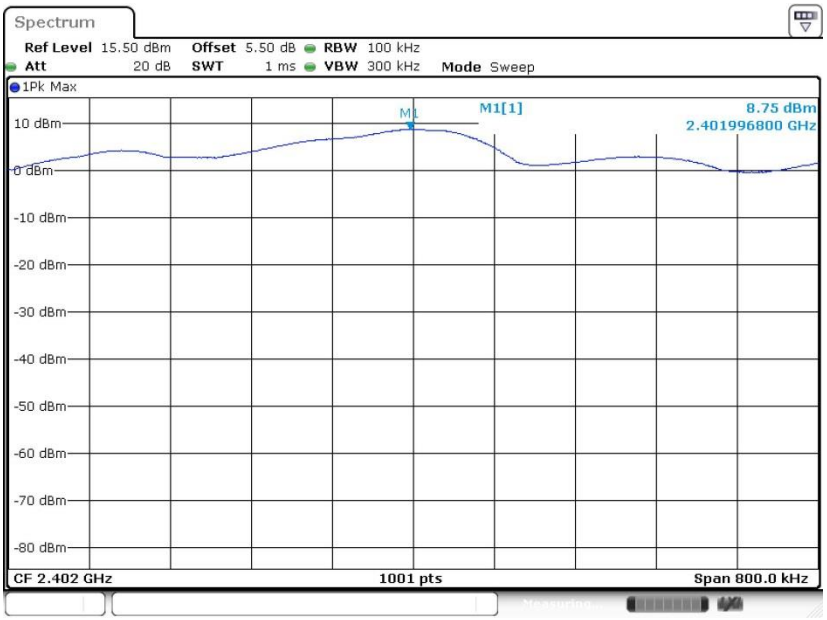
Bluetooth v5.0 LE

PSD 100kHz Plot on Channel 00



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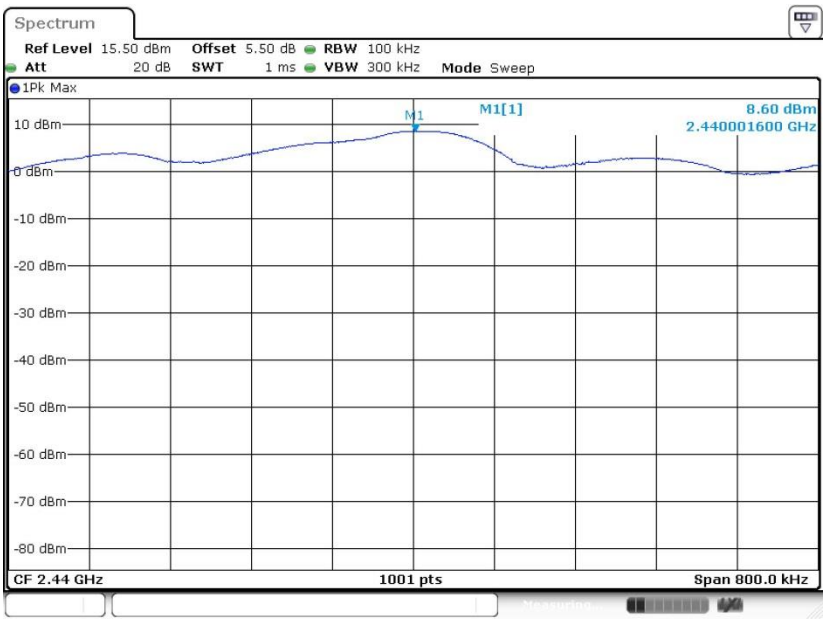
PSD 100kHz Plot on Channel 19



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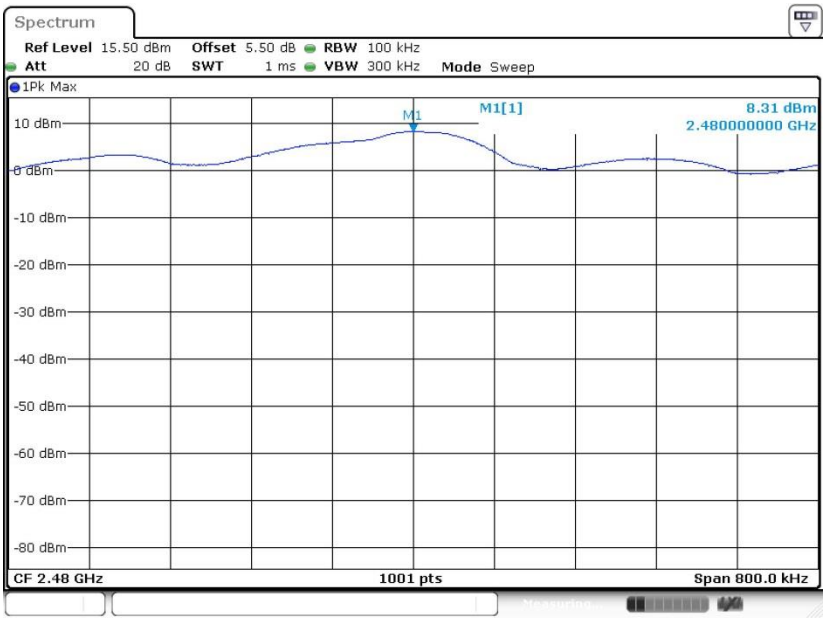
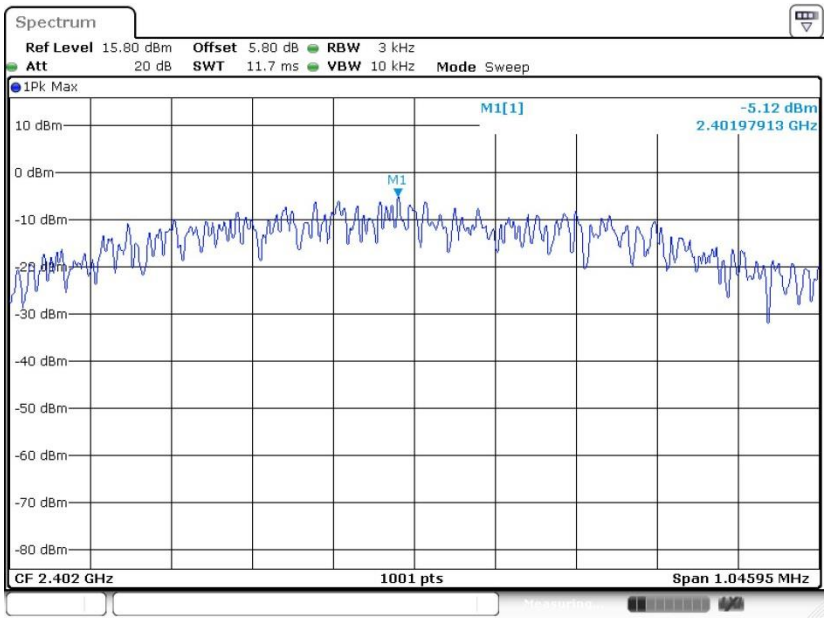
PSD 100kHz Plot on Channel 39



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

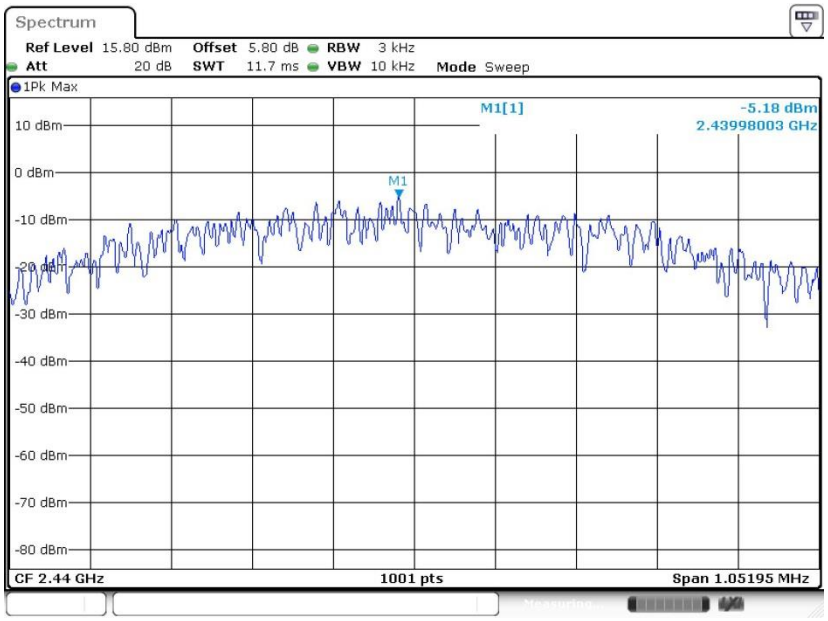
Bluetooth v4.2 LE

PSD 3kHz Plot on Channel 00



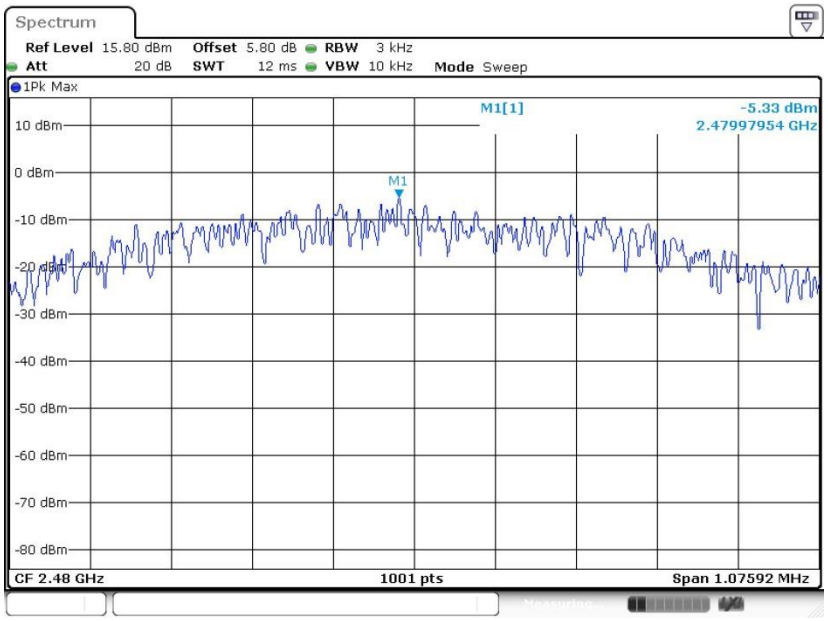
Date: 1.FEB.2019 13:49:14

PSD 3kHz Plot on Channel 19



Date: 1.FEB.2019 13:58:51

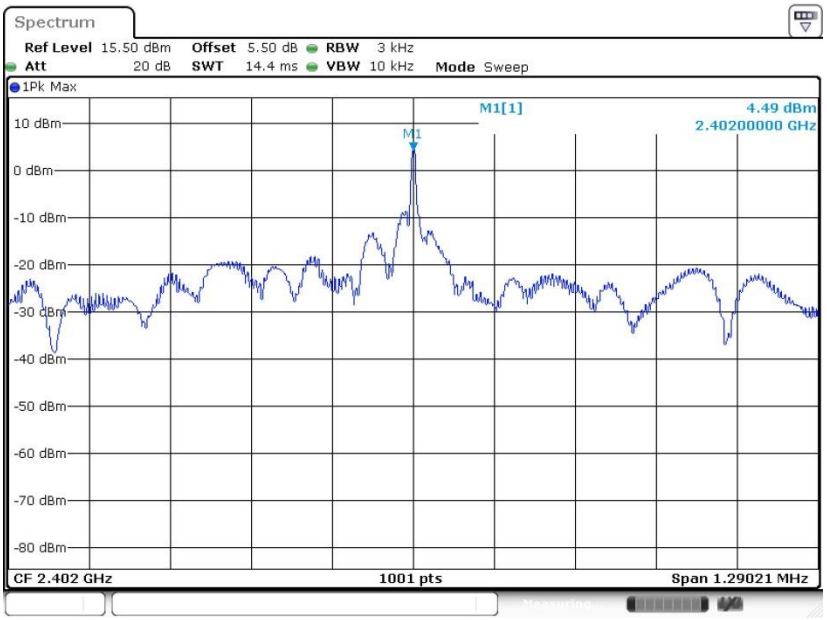
PSD 3kHz Plot on Channel 39



Date: 1.FEB.2019 14:03:14

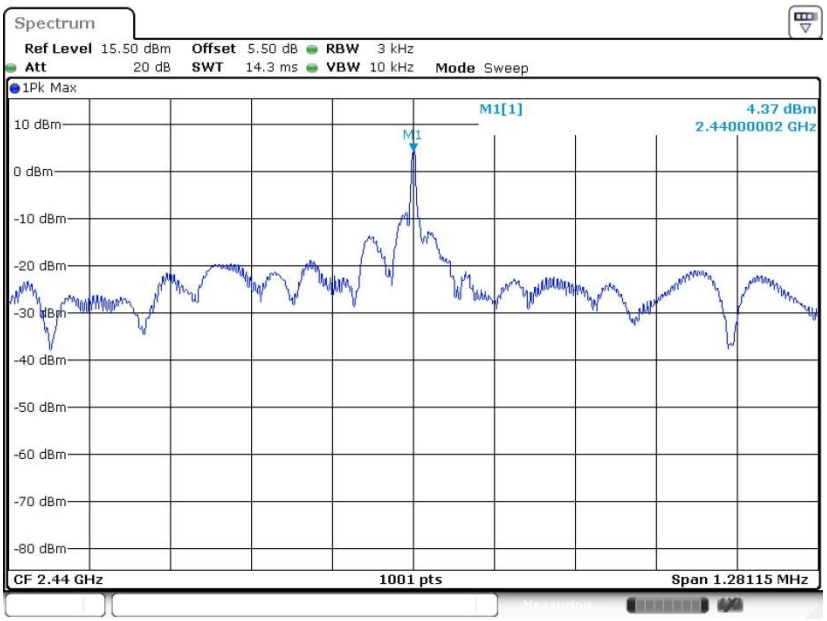
Bluetooth v5.0 LE

PSD 3kHz Plot on Channel 00



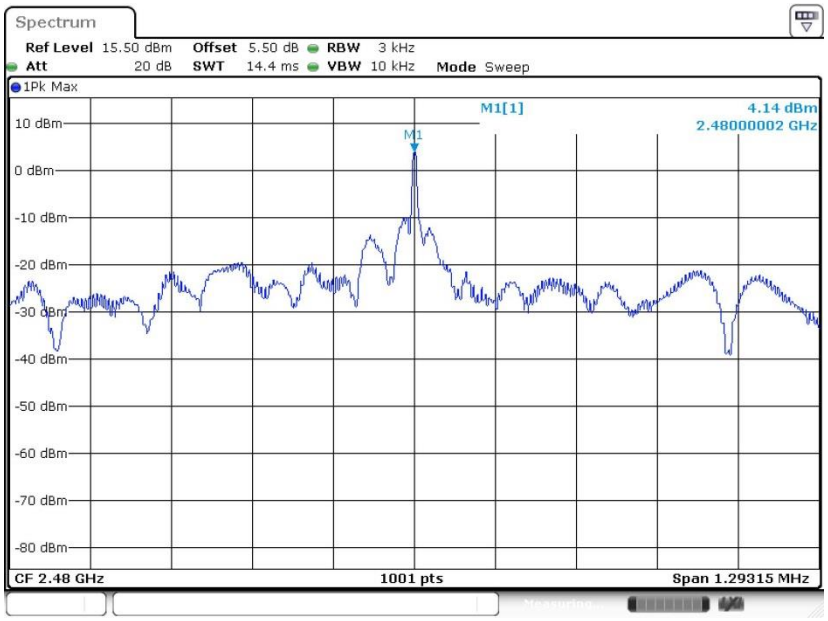
Date: 28.JAN.2019 13:02:10

PSD 3kHz Plot on Channel 19



Date: 28.JAN.2019 13:36:02

PSD 3kHz Plot on Channel 39



Date: 28.JAN.2019 13:29:38

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.

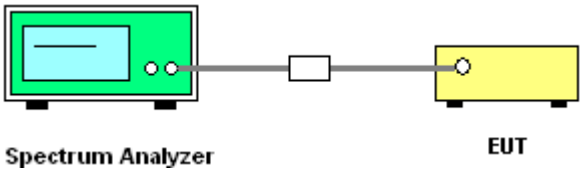
3.4.2 Measuring Instruments

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.

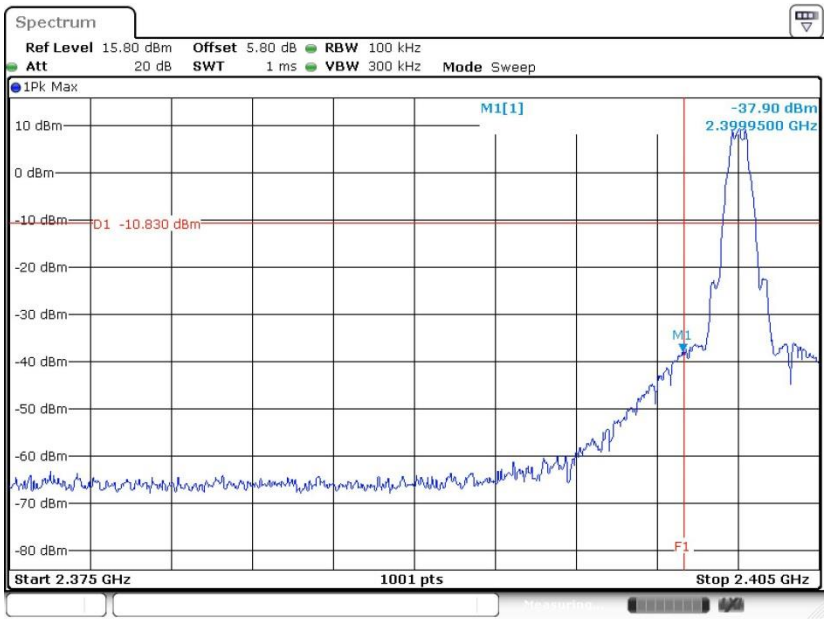
3.4.4 Test Setup



3.4.5 Test Result of Conducted Band Edges Plots

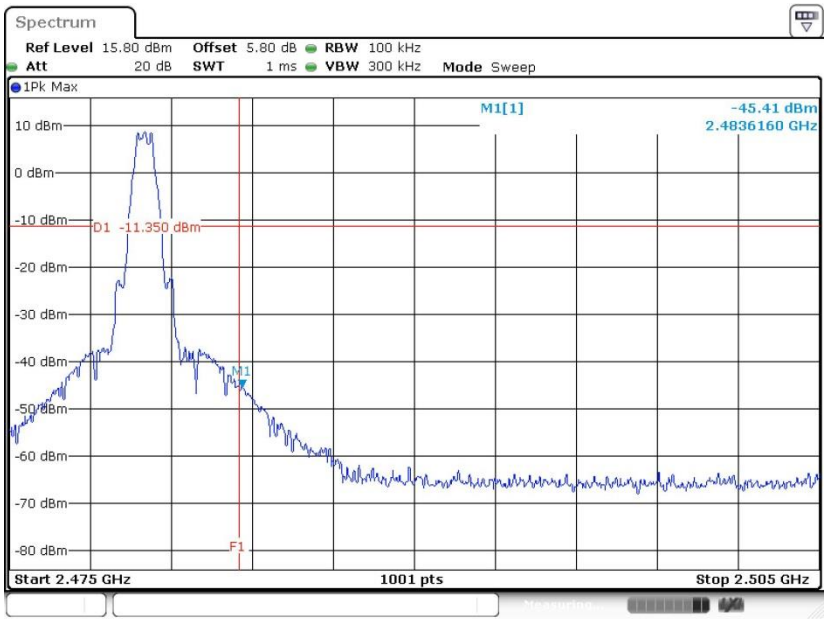
Bluetooth v4.2 LE

Low Band Edge Plot on Channel 00



Date: 1.FEB.2019 13:49:52

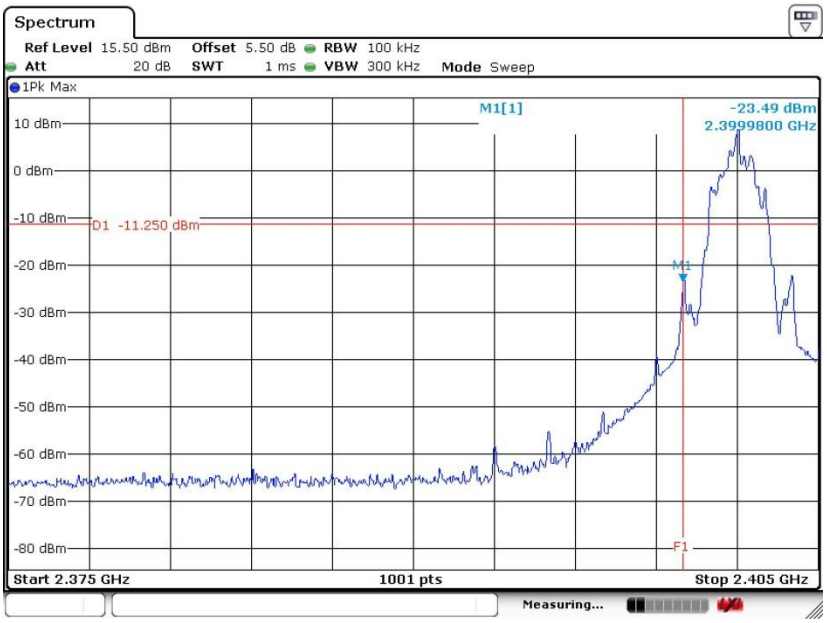
High Band Edge Plot on Channel 39



Date: 1.FEB.2019 14:03:43

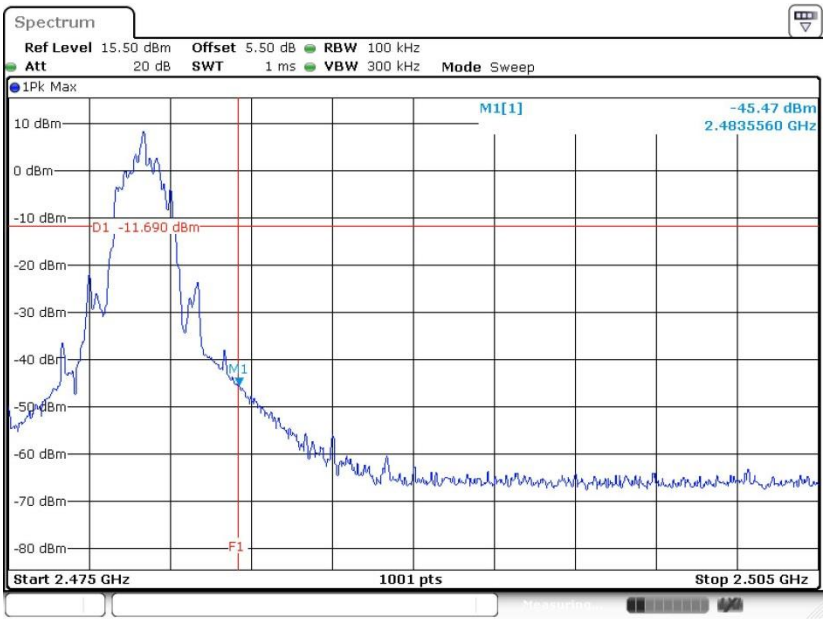
Bluetooth v5.0 LE

Low Band Edge Plot on Channel 00



Date: 28.JAN.2019 13:05:25

High Band Edge Plot on Channel 39

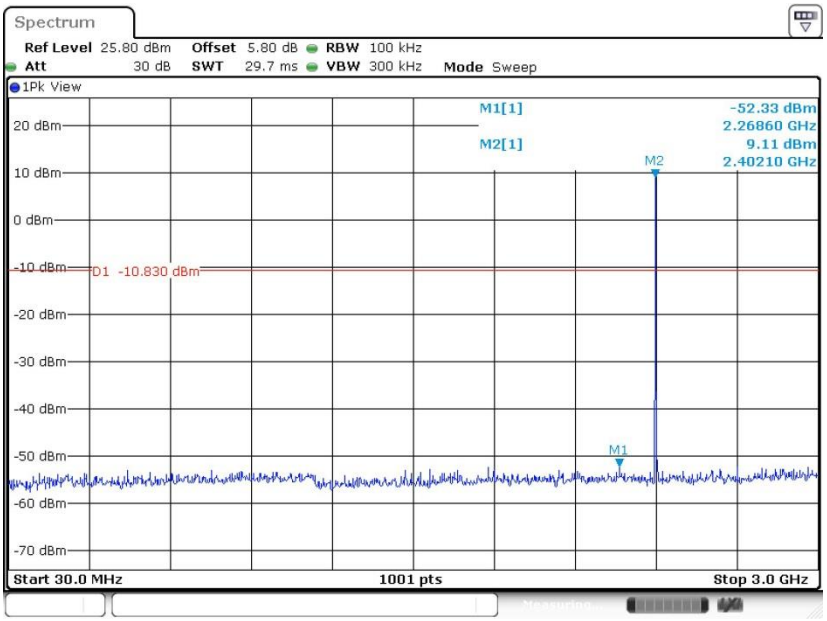


Date: 28.JAN.2019 13:30:10

3.4.6 Test Result of Conducted Spurious Emission Plots

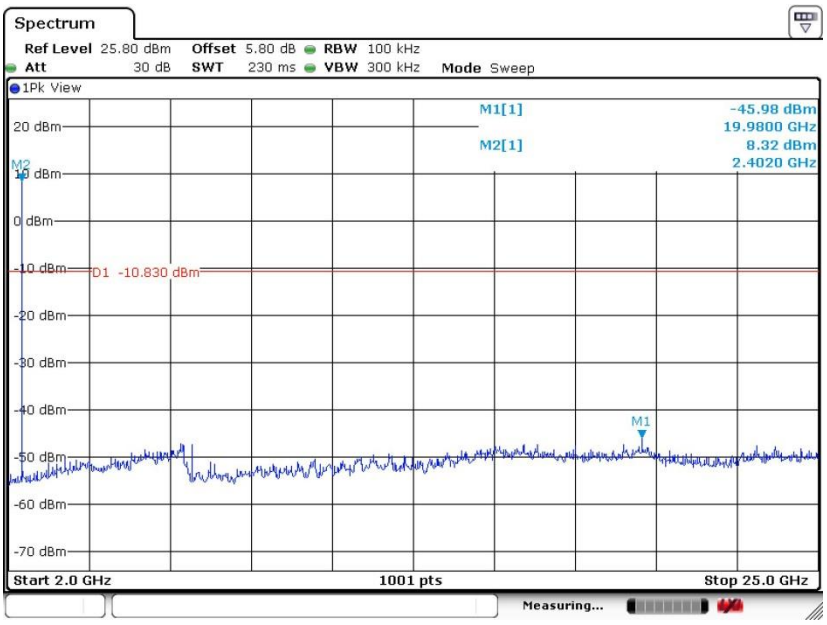
Bluetooth v4.2 LE

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



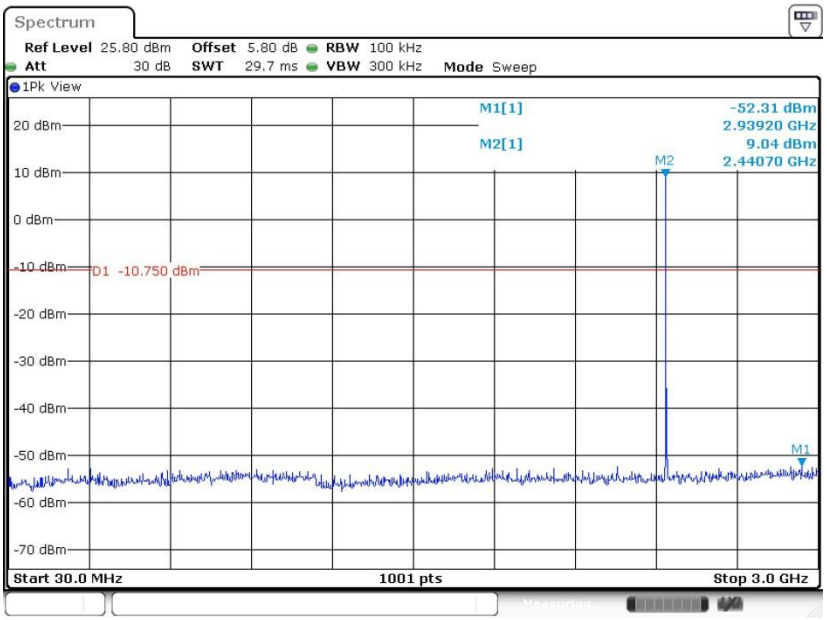
Date: 1.FEB.2019 13:50:07

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



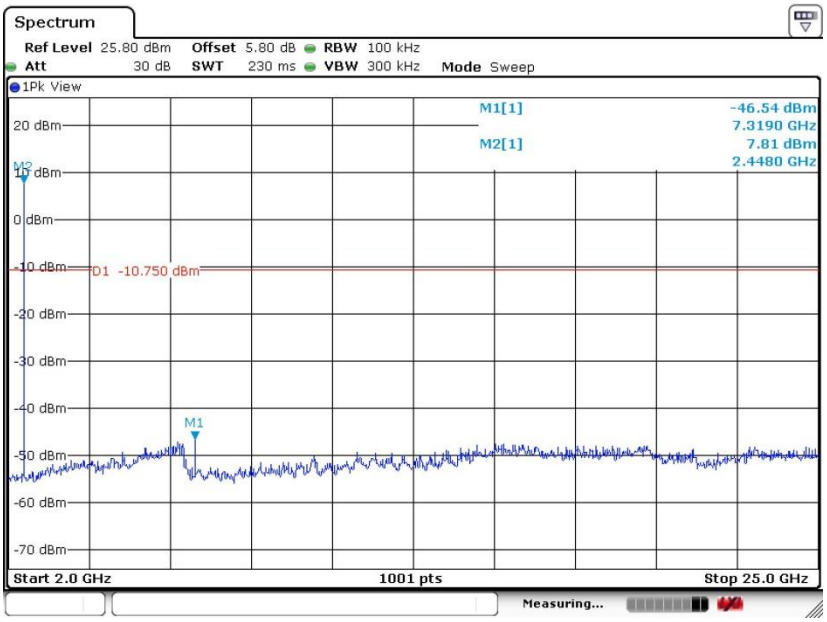
Date: 1.FEB.2019 13:51:04

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



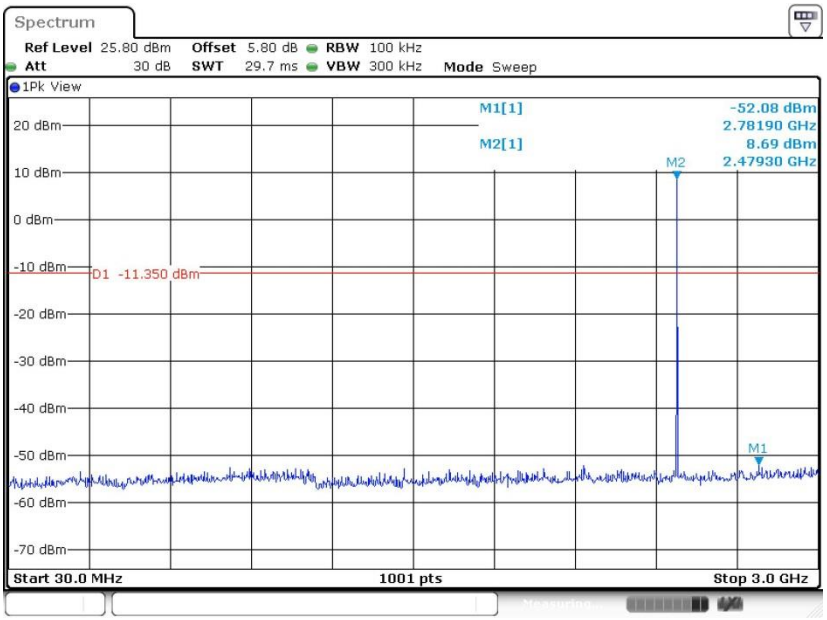
Date: 1.FEB.2019 13:59:24

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



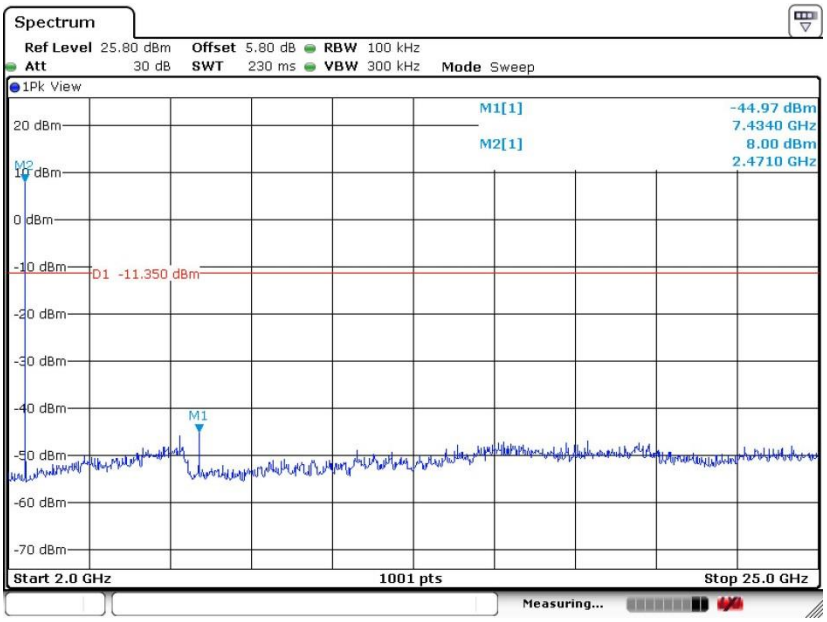
Date: 1.FEB.2019 14:00:09

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



Date: 1.FEB.2019 14:03:57

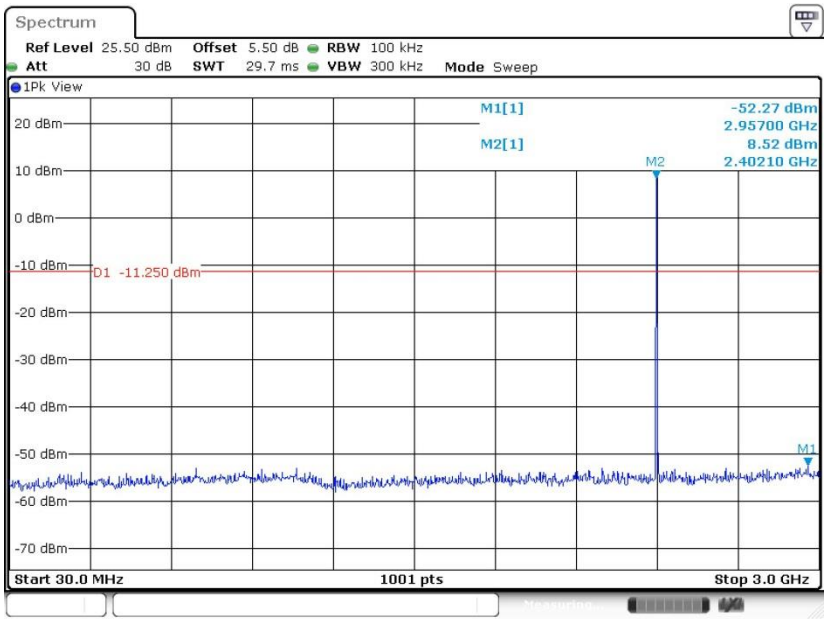
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39



Date: 1.FEB.2019 14:04:19

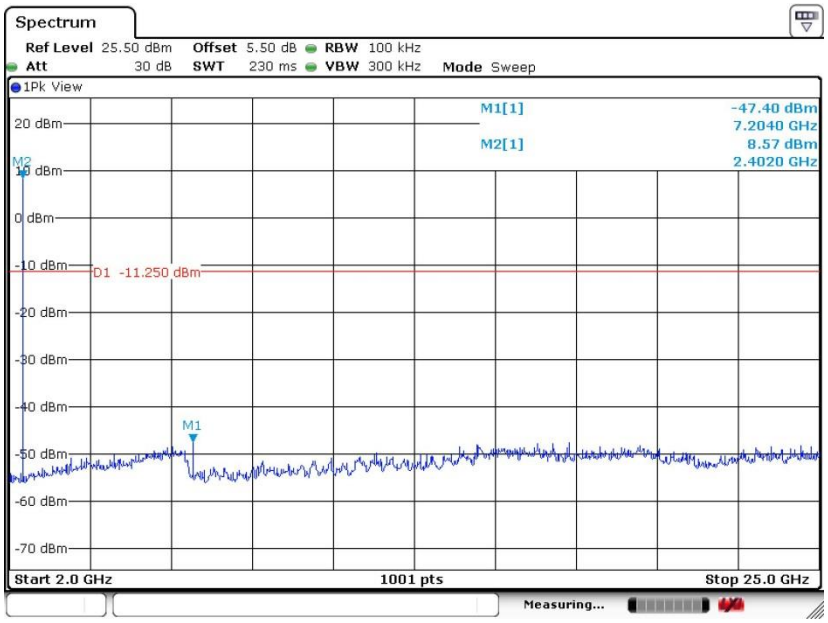
Bluetooth v5.0 LE

Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 00



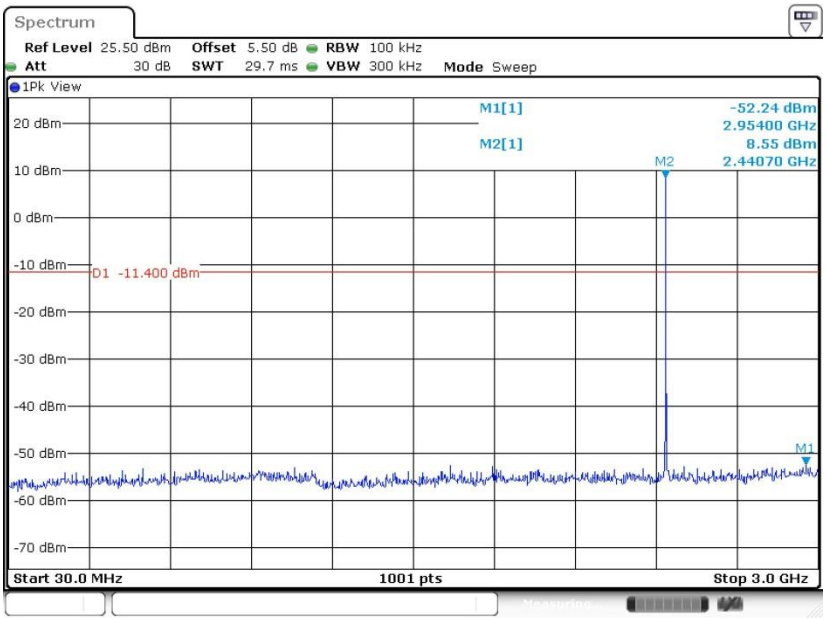
Date: 28.JAN.2019 13:05:48

Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 00



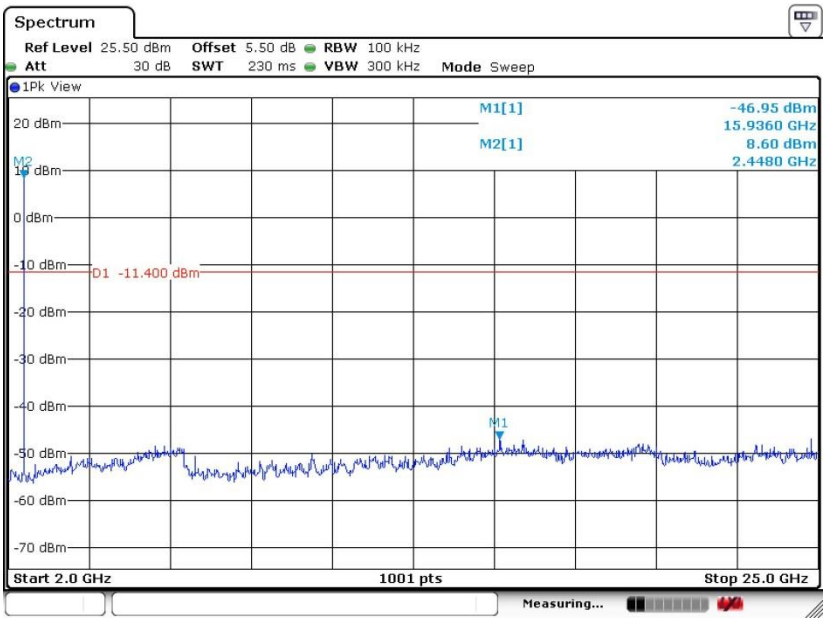
Date: 28.JAN.2019 13:06:04

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



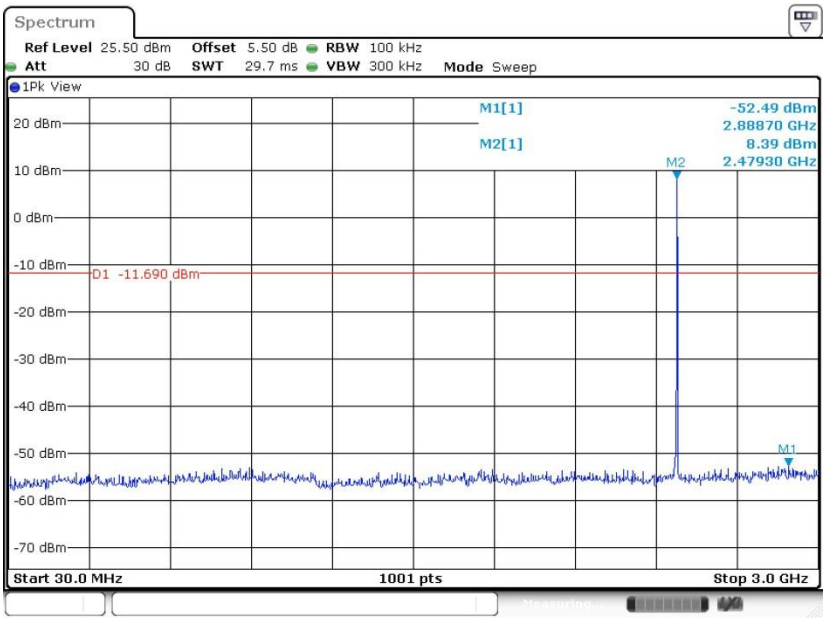
Date: 28.JAN.2019 13:36:36

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



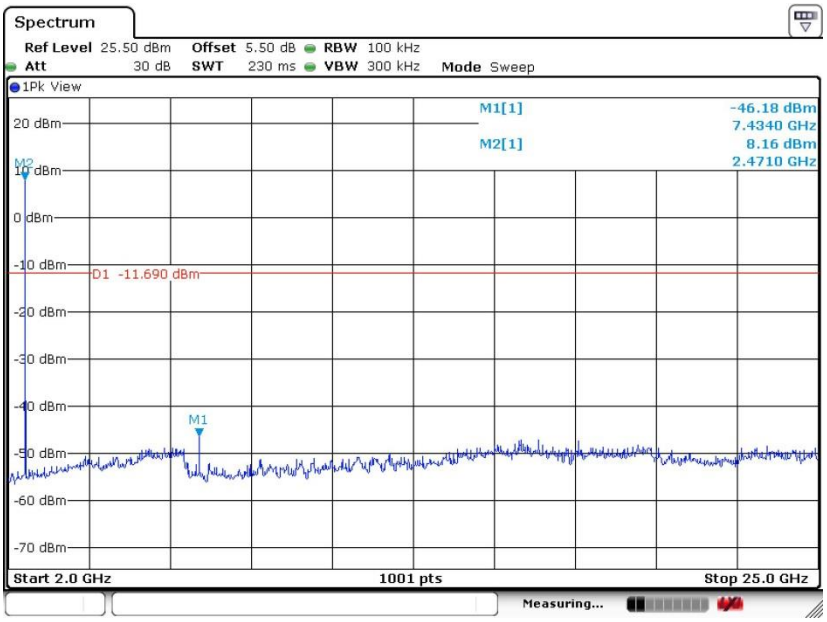
Date: 28.JAN.2019 13:37:04

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



Date: 28.JAN.2019 13:30:25

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



Date: 28.JAN.2019 13:30:42

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

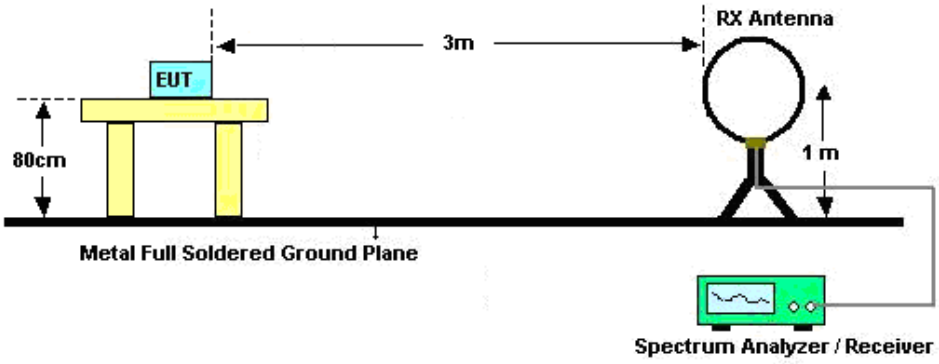
The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.5.3 Test Procedures

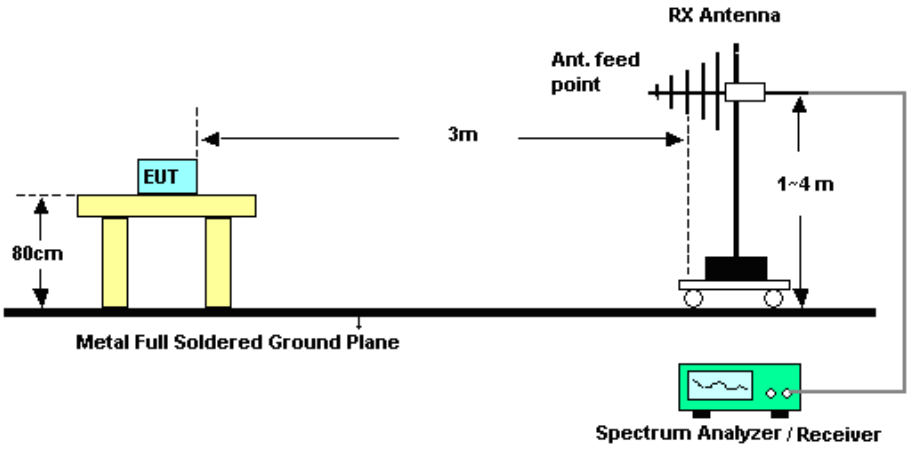
1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better 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 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 ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 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

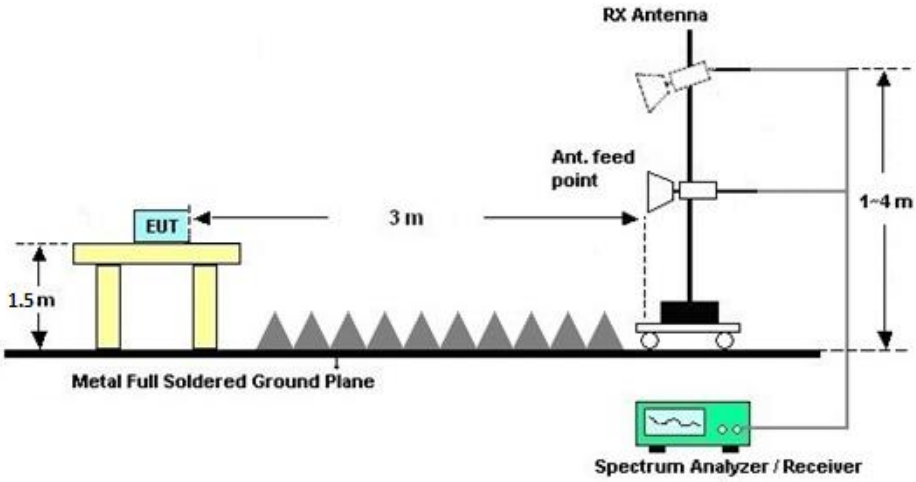
For radiated emissions below 30MHz



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.

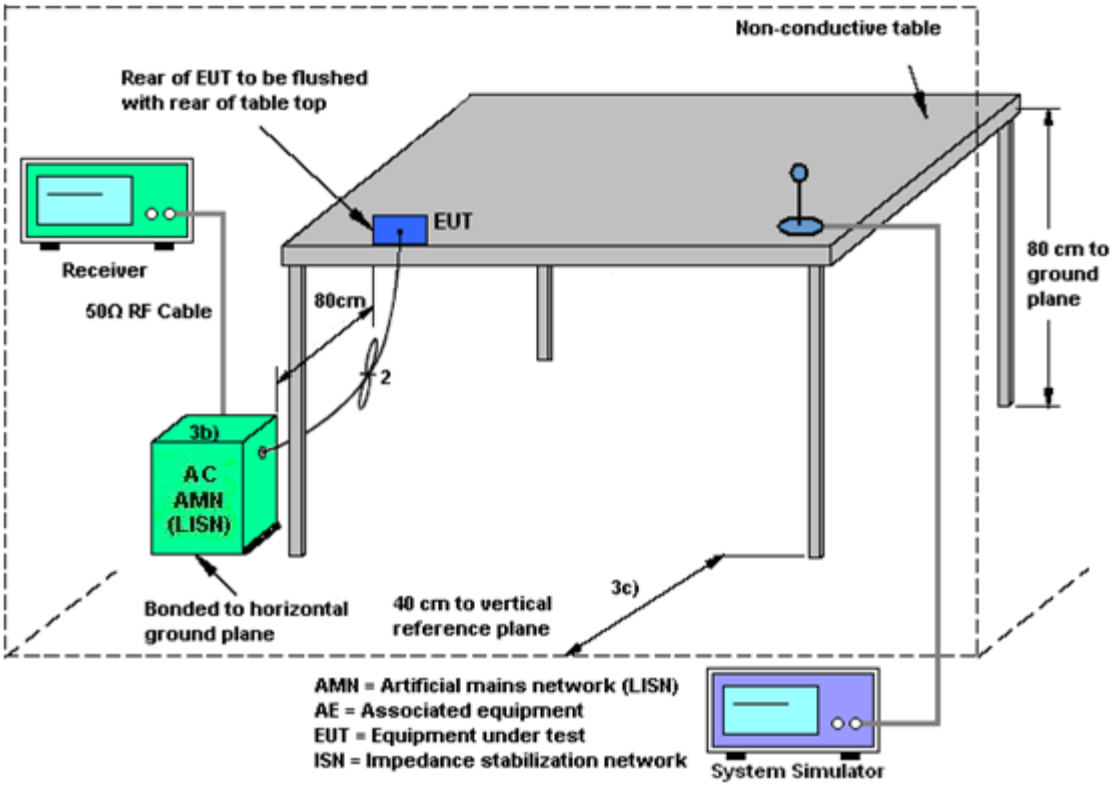
3.6.2 Measuring Instruments

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. 07, 2018	Jan. 28, 2019~ Feb. 01, 2019	Aug. 06, 2019	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 14, 2019	Jan. 28, 2019~ Feb. 01, 2019	Jan. 13, 2020	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 14, 2019	Jan. 28, 2019~ Feb. 01, 2019	Jan. 13, 2020	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY57290151	3Hz~8.5GHz;Max 30dBm	Jun. 25, 2018	Jan. 23, 2019~ Jan. 24, 2019	Jun. 24, 2019	Radiation (03CH05-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150244	10Hz-44GHz	Apr. 17, 2018	Jan. 23, 2019~ Jan. 24, 2019	Apr. 16, 2019	Radiation (03CH05-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 19, 2018	Jan. 23, 2019~ Jan. 24, 2019	Oct. 18, 2019	Radiation (03CH05-KS)
Bilog Antenna	TeseQ	CBL6111D	49922	30MHz-1GHz	Jun. 12, 2018	Jan. 23, 2019~ Jan. 24, 2019	Jun. 11, 2019	Radiation (03CH05-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	218642	1GHz~18GHz	Mar. 18, 2018	Jan. 23, 2019~ Jan. 24, 2019	Mar. 17, 2019	Radiation (03CH05-KS)
SHF-EHF Horn	Schwarzbeck	BBHA 9170	BBHA170249	15GHz~40GHz	Feb. 07, 2018	Jan. 23, 2019~ Jan. 24, 2019	Feb. 06, 2019	Radiation (03CH05-KS)
Amplifier	com-power	PA-103A	161069	1MHz ~1000MHz / 32 dB	Apr. 17, 2018	Jan. 23, 2019~ Jan. 24, 2019	Apr. 16, 2019	Radiation (03CH05-KS)
Amplifier	MITEQ	TTA1840-35-HG	1887435	18~40GHz	Feb. 08, 2018	Jan. 23, 2019~ Jan. 24, 2019	Feb. 07, 2019	Radiation (03CH05-KS)
high gain Amplifier	MITEQ	AMF-7D-00101800-30-10P	2025788	1Ghz-18Ghz	Apr. 17, 2018	Jan. 23, 2019~ Jan. 24, 2019	Apr. 16, 2019	Radiation (03CH05-KS)
Amplifier	Keysight	83017A	MY57280106	500MHz~26.5GHz	Apr. 18, 2018	Jan. 23, 2019~ Jan. 24, 2019	Apr. 17, 2019	Radiation (03CH05-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Jan. 23, 2019~ Jan. 24, 2019	NCR	Radiation (03CH05-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Jan. 23, 2019~ Jan. 24, 2019	NCR	Radiation (03CH05-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Jan. 23, 2019~ Jan. 24, 2019	NCR	Radiation (03CH05-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	Apr. 19, 2018	Jan. 18, 2019	Apr. 18, 2019	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060103	9kHz~30MHz	Oct. 12, 2018	Jan. 18, 2019	Oct. 11, 2019	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060105	9kHz~30MHz	Nov. 19, 2018	Jan. 18, 2019	Nov. 18, 2019	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	AC 0V~300V, 45Hz~1000Hz	Oct. 12, 2018	Jan. 18, 2019	Oct. 11, 2019	Conduction (CO01-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 Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.9dB**

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

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

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

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

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

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

Appendix A. Conducted Test Results

Report Number : FR8D2002B

Bluetooth v4.2 Low Energy

Test Engineer:	Silent Hai	Temperature:	24~25	°C
Test Date:	2019/1/28~2019/2/01	Relative Humidity:	49~51	%

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

Mod.	Data Rate	NTx	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE	1Mbps	1	0	2402	1.02	0.70	0.50	Pass
BLE	1Mbps	1	19	2440	1.02	0.70	0.50	Pass
BLE	1Mbps	1	39	2480	1.03	0.72	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	10.28	30.00	-0.50	9.78	36.00	Pass
BLE	1Mbps	1	19	2440	10.04	30.00	-0.50	9.54	36.00	Pass
BLE	1Mbps	1	39	2480	9.95	30.00	-0.50	9.45	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	2.11	9.85
BLE	1Mbps	1	19	2440	2.11	9.82
BLE	1Mbps	1	39	2480	2.11	9.83

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	9.17	-5.12	-0.50	8.00	Pass
BLE	1Mbps	1	19	2440	9.25	-5.18	-0.50	8.00	Pass
BLE	1Mbps	1	39	2480	8.65	-5.33	-0.50	8.00	Pass

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

Report Number : FR8D2002B

Bluetooth v5.0 Low Energy

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

Mod.	Data Rate	NTx	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE	2Mbps	1	0	2402	2.05	0.86	0.50	Pass
BLE	2Mbps	1	19	2440	2.06	0.85	0.50	Pass
BLE	2Mbps	1	39	2480	2.06	0.86	0.50	Pass

TEST RESULTS DATA
Peak Power Table

Mod.	Data Rate	NTx	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	2Mbps	1	0	2402	9.66	30.00	-0.50	9.16	36.00	Pass
BLE	2Mbps	1	19	2440	9.64	30.00	-0.50	9.14	36.00	Pass
BLE	2Mbps	1	39	2480	9.19	30.00	-0.50	8.69	36.00	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

Mod.	Data Rate	NTx	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
BLE	2Mbps	1	0	2402	5.02	9.47
BLE	2Mbps	1	19	2440	5.02	9.41
BLE	2Mbps	1	39	2480	5.02	8.99

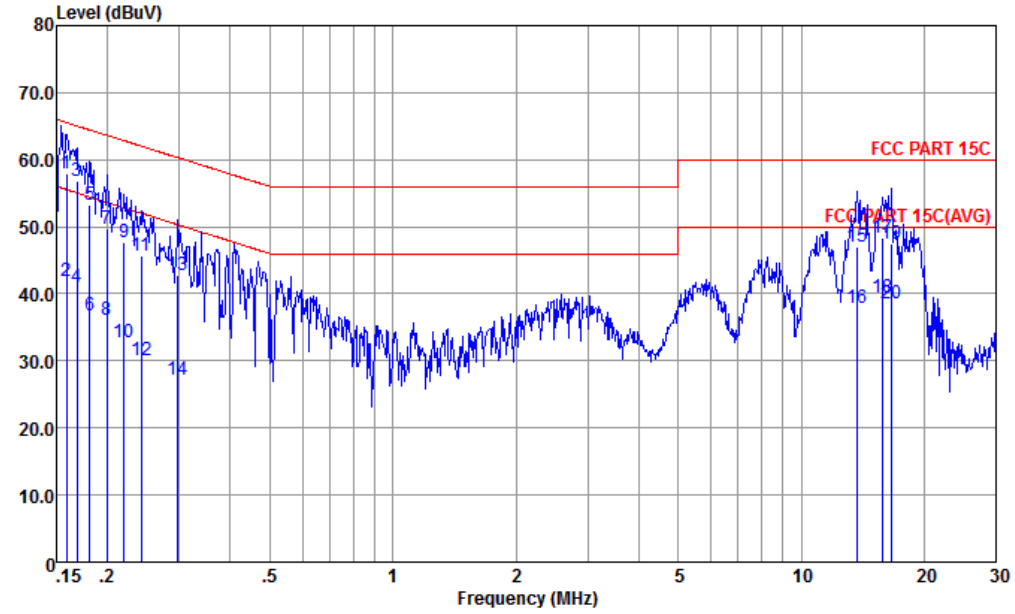
TEST RESULTS DATA
Peak Power Density

Mod.	Data Rate	NTx	CH.	Freq. (MHz)	Peak PSD (dBm /100kHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
BLE	2Mbps	1	0	2402	8.75	4.49	-0.50	8.00	Pass
BLE	2Mbps	1	19	2440	8.60	4.37	-0.50	8.00	Pass
BLE	2Mbps	1	39	2480	8.31	4.14	-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 :**	23.3~24.2℃
		Relative Humidity :	38~40%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line

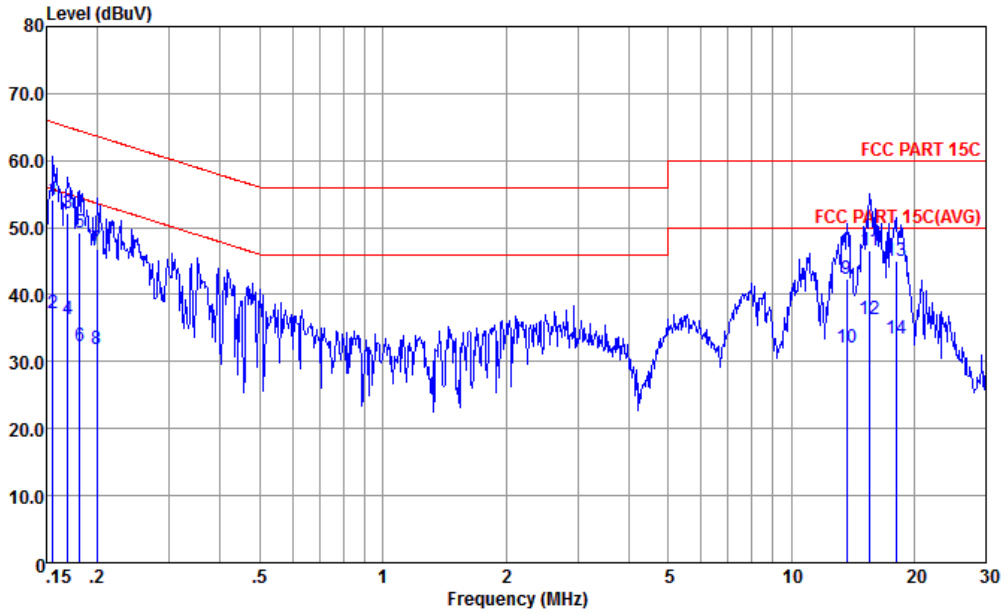


Site : CO01-KS
Condition : FCC PART 15C LISN-L-181013-060103 LINE

: 352170100023196/352170100023204 #12

		Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	*	0.159	57.88	-7.64	65.52	47.19	0.23	10.46	QP
2		0.159	41.88	-13.64	55.52	31.19	0.23	10.46	Average
3		0.169	56.86	-8.17	65.03	46.20	0.23	10.43	QP
4		0.169	40.96	-14.07	55.03	30.30	0.23	10.43	Average
5		0.181	53.23	-11.23	64.46	42.61	0.22	10.40	QP
6		0.181	36.83	-17.63	54.46	26.21	0.22	10.40	Average
7		0.200	49.78	-13.84	63.62	39.20	0.22	10.36	QP
8		0.200	36.08	-17.54	53.62	25.50	0.22	10.36	Average
9		0.220	47.77	-15.06	62.83	37.20	0.22	10.35	QP
10		0.220	32.77	-20.06	52.83	22.20	0.22	10.35	Average
11		0.242	45.76	-16.28	62.04	35.20	0.22	10.34	QP
12		0.242	30.16	-21.88	52.04	19.60	0.22	10.34	Average
13		0.297	42.73	-17.59	60.32	32.20	0.22	10.31	QP
14		0.297	27.13	-23.19	50.32	16.60	0.22	10.31	Average
15		13.695	46.91	-13.09	60.00	36.20	0.33	10.38	QP
16		13.695	37.91	-12.09	50.00	27.20	0.33	10.38	Average
17		15.801	48.30	-11.70	60.00	37.51	0.38	10.41	QP
18		15.801	39.40	-10.60	50.00	28.61	0.38	10.41	Average
19		16.661	47.44	-12.56	60.00	36.60	0.41	10.43	QP
20		16.661	38.64	-11.36	50.00	27.80	0.41	10.43	Average

Test Engineer :	Amos Zhang	**Temperature :**	23.3~24.2℃
		Relative Humidity :	38~40%
Test Voltage :	120Vac / 60Hz	**Phase :**	Neutral



Site : CO01-KS
Condition : FCC PART 15C LISN-N-181013-060103 NEUTRAL

: 352170100023196/352170100023204 #12

		Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	*	0.156	54.17	-11.52	65.69	43.49	0.21	10.47	QP
2		0.156	37.27	-18.42	55.69	26.59	0.21	10.47	Average
3		0.169	52.24	-12.75	64.99	41.60	0.21	10.43	QP
4		0.169	36.24	-18.75	54.99	25.60	0.21	10.43	Average
5		0.181	49.21	-15.25	64.46	38.61	0.20	10.40	QP
6		0.181	32.21	-22.25	54.46	21.61	0.20	10.40	Average
7		0.200	46.76	-16.86	63.62	36.20	0.20	10.36	QP
8		0.200	31.76	-21.86	53.62	21.20	0.20	10.36	Average
9		13.695	42.24	-17.76	60.00	31.60	0.26	10.38	QP
10		13.695	32.14	-17.86	50.00	21.50	0.26	10.38	Average
11		15.552	46.49	-13.51	60.00	35.79	0.29	10.41	QP
12		15.552	36.29	-13.71	50.00	25.59	0.29	10.41	Average
13		18.039	44.97	-15.03	60.00	34.20	0.31	10.46	QP
14		18.039	33.37	-16.63	50.00	22.60	0.31	10.46	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	Read	Antenna	Cable	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		2380.72	53.02	-20.98	74	47.41	31.27	6.14	31.8	358	48	P	H
		2351.47	43.37	-10.63	54	37.88	31.22	6.07	31.8	358	48	A	H
	*	2402	97.93	-	-	92.29	31.3	6.14	31.8	358	48	P	H
	*	2402	97.52	-	-	91.88	31.3	6.14	31.8	358	48	A	H
		2353.16	53.57	-20.43	74	48.05	31.25	6.07	31.8	348	222	P	V
		2310.13	43.31	-10.69	54	37.92	31.16	6.03	31.8	348	222	A	V
	*	2402	101.18	-	-	95.54	31.3	6.14	31.8	348	222	P	V
	*	2402	100.75	-	-	95.11	31.3	6.14	31.8	348	222	A	V
BLE CH 39 2480MHz		2483.56	57.62	-16.38	74	51.82	31.44	6.16	31.8	368	46	P	H
		2483.5	44.1	-9.9	54	38.3	31.44	6.16	31.8	368	46	A	H
	*	2480	95.72	-	-	89.92	31.44	6.16	31.8	368	46	P	H
	*	2480	95.25	-	-	89.45	31.44	6.16	31.8	368	46	A	H
		2483.5	60	-14	74	54.2	31.44	6.16	31.8	338	247	P	V
		2483.5	44.8	-9.2	54	39	31.44	6.16	31.8	338	247	A	V
	*	2480	98.49	-	-	92.69	31.44	6.16	31.8	338	247	P	V
	*	2480	97.99	-	-	92.19	31.44	6.16	31.8	338	247	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable 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		4806	40.36	-33.64	74	56.25	35.66	8.41	59.96	100	360	P	H
		4806	40.12	-33.88	74	56.01	35.66	8.41	59.96	100	360	P	V
BLE CH 19 2440MHz		4878	40.57	-33.43	74	56.31	35.61	8.59	59.94	100	360	P	H
		7320	41.74	-32.26	74	56.33	35.9	10.4	60.89	100	360	P	H
		4878	40.8	-33.2	74	56.54	35.61	8.59	59.94	100	360	P	V
		7320	42.05	-31.95	74	56.64	35.9	10.4	60.89	100	360	P	V
BLE CH 39 2480MHz		4962	42.16	-31.84	74	57.78	35.54	8.77	59.93	100	360	P	H
		7440	40.49	-33.51	74	55.1	35.97	10.44	61.02	100	360	P	H
		4962	41.22	-32.78	74	56.84	35.54	8.77	59.93	100	360	P	V
		7440	40.19	-33.81	74	54.8	35.97	10.44	61.02	100	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	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)
2.4GHz BLE LF		30	22.38	-17.62	40	28.34	25.2	0.66	31.82			P	H
		138.64	16.59	-26.91	43.5	29.24	17.48	1.41	31.54			P	H
		338.46	20.24	-25.76	46	29.24	20.13	2.33	31.46			P	H
		482.99	23.84	-22.16	46	29.2	23.42	2.59	31.37			P	H
		714.82	26.85	-19.15	46	28.19	26.68	3.48	31.5			P	H
		853.53	29.65	-16.35	46	29.07	28.67	3.53	31.62	100	0	P	H
		30	24.39	-15.61	40	30.35	25.2	0.66	31.82	100	0	P	V
		359.8	25.52	-20.48	46	33.9	20.64	2.43	31.45			P	V
		651.77	27.85	-18.15	46	30.33	26.01	3	31.49			P	V
		796.3	29.56	-16.44	46	29.61	28.23	3.26	31.54			P	V
		845.77	30.26	-15.74	46	29.74	28.62	3.51	31.61			P	V
		940.83	31.22	-22.78	54	29.81	29.45	3.6	31.64			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	Limit Line	Read Level	Antenna Factor	Cable 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		2353.81	53.04	-20.96	74	47.52	31.25	6.07	31.8	300	225	P	H
		2358.1	42.54	-11.46	54	36.99	31.25	6.1	31.8	300	225	A	H
	*	2402	98.06	-	-	92.42	31.3	6.14	31.8	300	225	P	H
	*	2402	94.08	-	-	88.44	31.3	6.14	31.8	300	225	A	H
		2337.17	53.54	-20.46	74	48.05	31.22	6.07	31.8	100	307	P	V
		2348.35	42.71	-11.29	54	37.22	31.22	6.07	31.8	100	307	A	V
	*	2402	100.71	-	-	95.07	31.3	6.14	31.8	100	307	P	V
	*	2402	96.74	-	-	91.1	31.3	6.14	31.8	100	307	A	V
BLE CH 39 2480MHz		2480	93.85	-	-	88.05	31.44	6.16	31.8	303	1	P	H
		2480	89.71	-	-	83.91	31.44	6.16	31.8	303	1	A	H
	*	2483.68	56.98	-17.02	74	51.18	31.44	6.16	31.8	303	1	P	H
	*	2483.51	44.53	-9.47	54	38.73	31.44	6.16	31.8	303	1	A	H
		2480	97.28	-	-	91.48	31.44	6.16	31.8	128	124	P	V
		2480	93.19	-	-	87.39	31.44	6.16	31.8	128	124	A	V
	*	2483.51	59.11	-14.89	74	53.31	31.44	6.16	31.8	128	124	P	V
	*	2483.51	46.16	-7.84	54	40.36	31.44	6.16	31.8	128	124	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable 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		4806	40.26	-33.74	74	56.15	35.66	8.41	59.96	100	360	P	H
		4806	40.45	-33.55	74	56.34	35.66	8.41	59.96	100	360	P	V
BLE CH 19 2440MHz		4878	40.66	-33.34	74	56.4	35.61	8.59	59.94	100	360	P	H
		7320	40.98	-33.02	74	55.57	35.9	10.4	60.89	100	360	P	H
		4878	40.97	-33.03	74	56.71	35.61	8.59	59.94	100	360	P	V
		7320	42.13	-31.87	74	56.72	35.9	10.4	60.89	100	360	P	V
BLE CH 39 2480MHz		4962	40.38	-33.62	74	56	35.54	8.77	59.93	100	360	P	H
		7440	41.42	-32.58	74	56.03	35.97	10.44	61.02	100	360	P	H
		4962	41.39	-32.61	74	57.01	35.54	8.77	59.93	100	360	P	V
		7440	40.57	-33.43	74	55.18	35.97	10.44	61.02	100	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable 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)
2.4GHz BLE LF		30.97	22.44	-17.56	40	28.95	24.65	0.66	31.82			P	H
		142.52	16.38	-27.12	43.5	29.13	17.33	1.44	31.52			P	H
		260.86	18.87	-27.13	46	28.46	19.94	1.91	31.44			P	H
		390.84	22.17	-23.83	46	29.84	21.39	2.38	31.44			P	H
		581.93	25.73	-20.27	46	29	25.27	2.93	31.47			P	H
		786.6	28.75	-17.25	46	28.99	28.04	3.27	31.55	100	0	P	H
		30	23.35	-16.65	40	29.31	25.2	0.66	31.82			P	V
		350.1	20.41	-25.59	46	29.01	20.41	2.45	31.46			P	V
		359.8	22.68	-23.32	46	31.06	20.64	2.43	31.45			P	V
		646.92	26.7	-19.3	46	29.24	25.97	2.98	31.49			P	V
		702.21	28.65	-17.35	46	30.15	26.44	3.54	31.48			P	V
		858.38	29.8	-16.2	46	29.17	28.71	3.53	31.61	100	0	P	V
Remark	3. No other spurious found. 4. All results are PASS against limit line.												

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 **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

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

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 01 2412MHz		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. Level(dBμV/m) =

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

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable 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) + Cable 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)

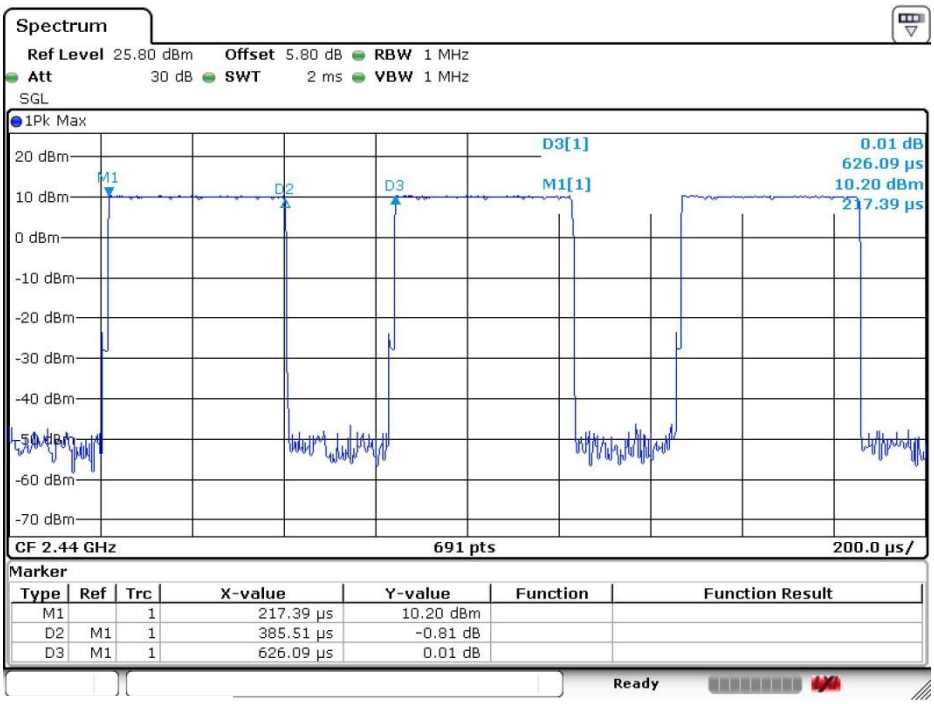
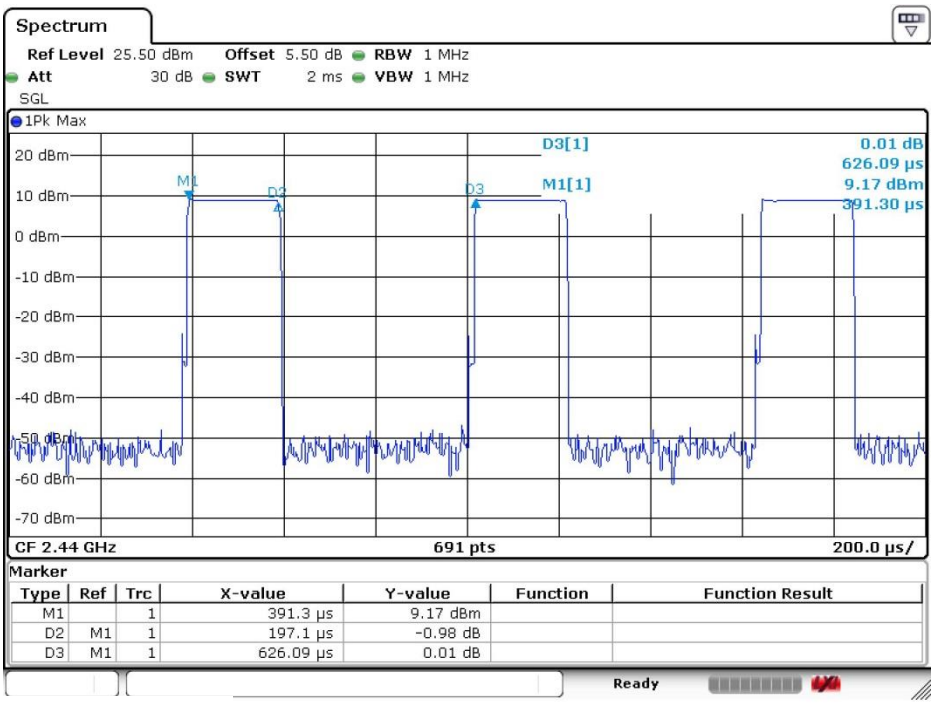
= -10.46(dB)

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	61.57	0.386	2.591	2.7KHz
Bluetooth v5.0 LE	31.48	0.197	5.076	5.1KHz

Bluetooth v4.2 LE



Bluetooth v5.0 LE