



# FCC RADIO TEST REPORT

**FCC ID** : XRAFB511  
**Equipment** : Smartwatch  
**Brand Name** : Fitbit  
**Model Name** : FB511  
**Applicant** : Fitbit, Inc.  
199 Fremont Street, 14th Floor, San  
Francisco, CA 94105 USA  
**Manufacturer** : Fitbit, Inc.  
199 Fremont Street, 14th Floor, San  
Francisco, CA 94105 USA  
**Standard** : FCC Part 15 Subpart C §15.247

The product was received on Mar. 20, 2020 and testing was started from Apr. 07, 2020 and completed on Jul. 06, 2020. We, SPORTON INTERNATIONAL INC., EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

*Louis Wu*

Approved by: Louis Wu

**SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory**

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)



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## Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(a)(2)	6dB Bandwidth	Pass	-
3.1	2.1049	99% Occupied Bandwidth	Reporting only	-
3.2	15.247(b)(3)	Output Power	Pass	-
3.3	15.247(e)	Power Spectral Density	Pass	-
3.4	15.247(d)	Conducted Band Edges and Spurious Emission	Pass	-
3.5	15.247(d)	Radiated Band Edges and Spurious Emission	Pass	Under limit 8.49 dB at 45.520 MHz
3.6	15.207	AC Conducted Emission	Pass	Under limit 13.75 dB at 0.307 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	Pass	-

**Declaration of Conformity:**

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

**Comments and Explanations:**

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

**Reviewed by: Wii Chang**

**Report Producer: Amy Chen**



# 1 General Description

## 1.1 Product Feature of Equipment Under Test

Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n, NFC, and GNSS.

Product Specification subjective to this standard	
Sample 1	Iron strap
Sample 2	Cloth strap
Sample 3	Plastic strap
Antenna Type	WLAN: Ring slot Antenna Bluetooth: Ring slot Antenna GPS: Metal split-ring Antenna NFC: Loop Antenna

## 1.2 Modification of EUT

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

## 1.3 Testing Location

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory	
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978	
Test Site No.	<b>Sporton Site No.</b>	
	TH05-HY	CO05-HY

**Note:** The test site complies with ANSI C63.4 2014 requirement.

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory	
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855	
Test Site No.	<b>Sporton Site No.</b>	
	03CH11-HY	

**Note:** The test site complies with ANSI C63.4 2014 requirement.

FCC designation No.: TW1190 and TW0007



## 1.4 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 v05r02
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01
- ♦ 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. The TAF code is not including all the FCC KDB listed without accreditation.
3. 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 (Y 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
<b>Conducted Test Cases</b>	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps Mode 4: Bluetooth Tx CH00_2402 MHz_2Mbps Mode 5: Bluetooth Tx CH19_2440 MHz_2Mbps Mode 6: Bluetooth Tx CH39_2480 MHz_2Mbps
<b>Radiated Test Cases</b>	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps Mode 4: Bluetooth Tx CH00_2402 MHz_2Mbps Mode 5: Bluetooth Tx CH19_2440 MHz_2Mbps Mode 6: Bluetooth Tx CH39_2480 MHz_2Mbps
<b>AC Conducted Emission</b>	Mode 1: WLAN (2.4GHz) Link + GPS Rx + Vibrate + Screen flicker + Battery + USB Cable (Data Link with Notebook) for Sample 1 Mode 2: Bluetooth Link + GPS Rx + Battery + USB Cable (Power From Notebook) for Sample 1
<b>Remark:</b>	
<ol style="list-style-type: none"> <li>1. The worst case of conducted emission is mode 2; only the test data of it was reported.</li> <li>2. Data Link with Notebook means data application transferred mode between EUT and Notebook.</li> <li>3. For Radiated Test Cases, the tests were performed with Sample 1.</li> </ol>	



### 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.	GPS Station	Pendulum	GSG-54	N/A	N/A	Unshielded, 1.8 m
2.	Bluetooth Earphone	Sony Ericsson	MW600	PY7DDA-2029	N/A	N/A
3.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8 m
4.	Notebook	Apple	MacBook Pro(A1502)	QDS-BRCM 1080	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
5.	iPod	Apple	A1199	FCC DoC	Shielded, 1.2 m	N/A
6.	LCD Monitor	Dell	PB27UQ	FCC DoC	Shielded, 1.6m	Unshielded,1.8m
7.	Adapter	Samsung	RF1C632EWS	N/A	N/A	N/A

### 2.5 EUT Operation Test Setup

The RF test items, utility “Tera Term V4.95” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.



## 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 and attenuator factor.

*Offset = RF cable loss + attenuator factor.*

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)}. \\ &= 4.2 + 10 = 14.2 \text{ (dB)} \end{aligned}$$

### 3 Test Result

#### 3.1 6dB and 99% Bandwidth Measurement

##### 3.1.1 Limit of 6dB and 99% Bandwidth

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

##### 3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

##### 3.1.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 11.8.1 (6dB BW).
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. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1-5% of the emission bandwidth and set the Video bandwidth (VBW)  $\geq 3 * RBW$ .
6. Measure and record the results in the test report.

##### 3.1.4 Test Setup



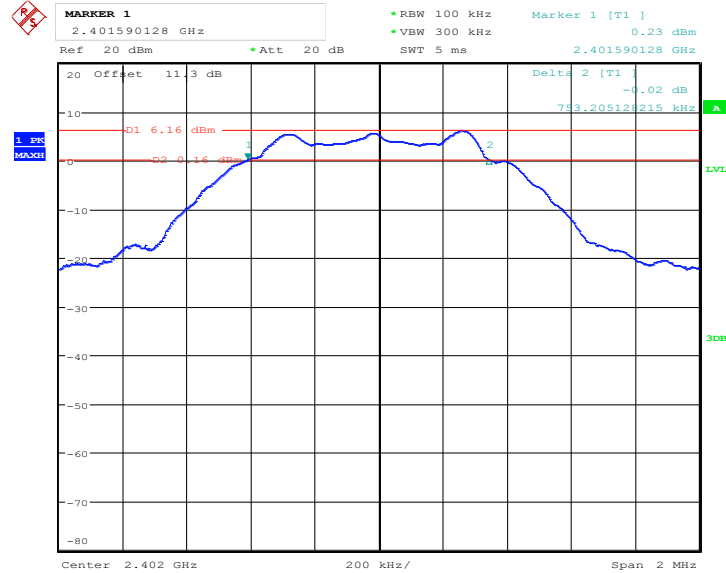


### 3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.

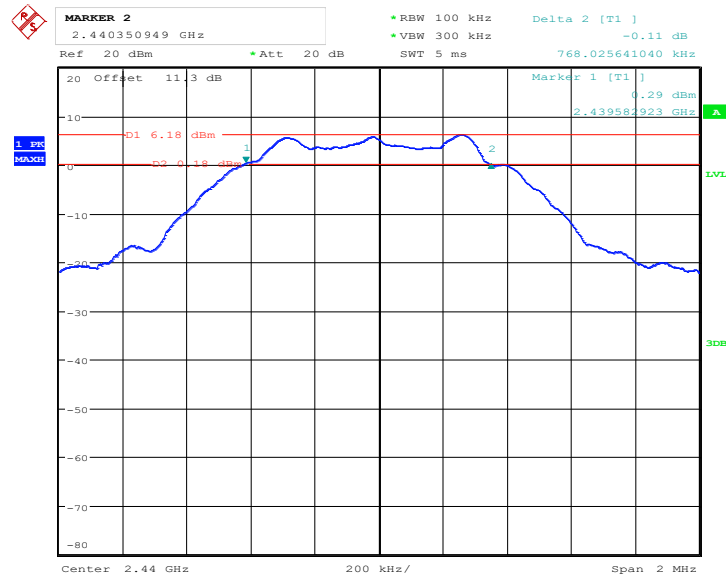
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#### 6 dB Bandwidth Plot on Channel 00



Date: 19.JUN.2020 10:06:30

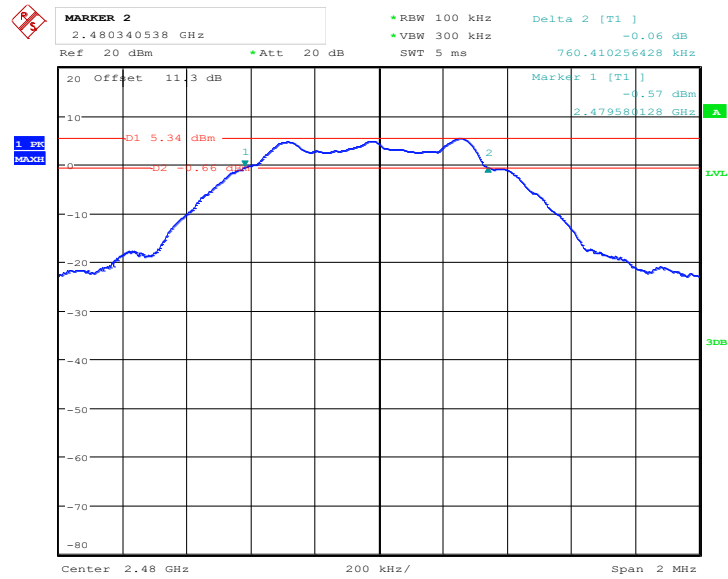
#### 6 dB Bandwidth Plot on Channel 19



Date: 19.JUN.2020 10:16:32



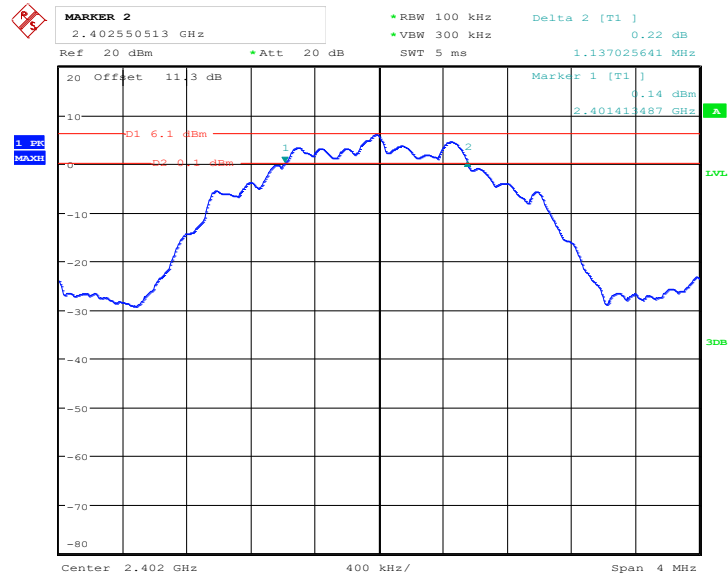
6 dB Bandwidth Plot on Channel 39



Date: 19.JUN.2020 10:22:21

<2Mbps>

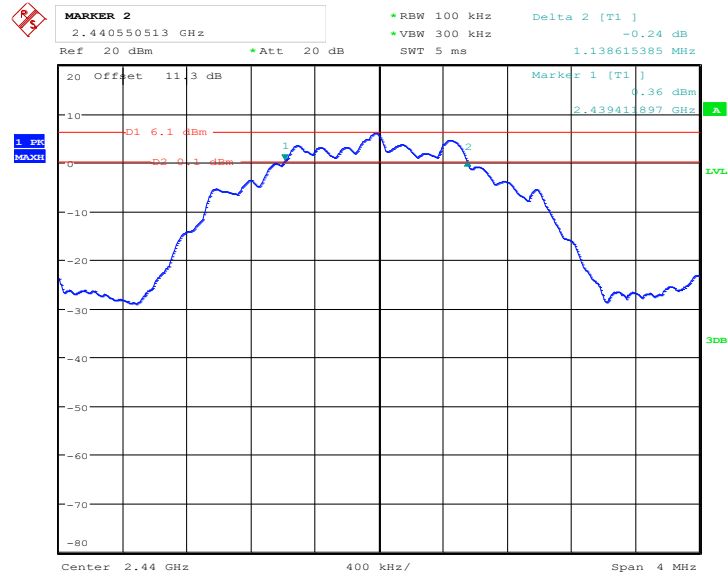
6 dB Bandwidth Plot on Channel 00



Date: 19.JUN.2020 10:31:02

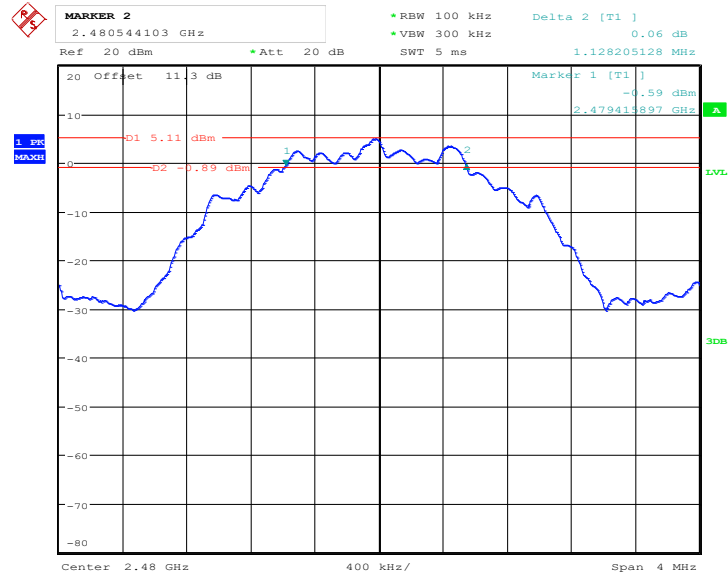


6 dB Bandwidth Plot on Channel 19



Date: 19.JUN.2020 10:38:52

6 dB Bandwidth Plot on Channel 39



Date: 19.JUN.2020 10:43:53

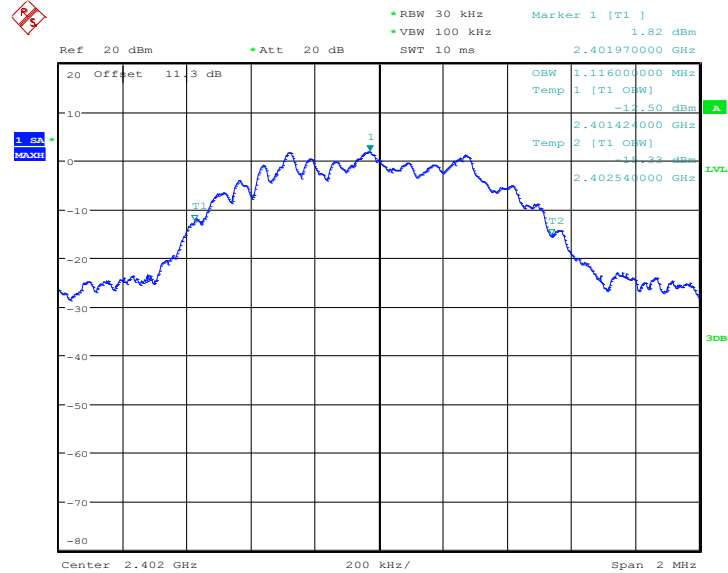


### 3.1.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

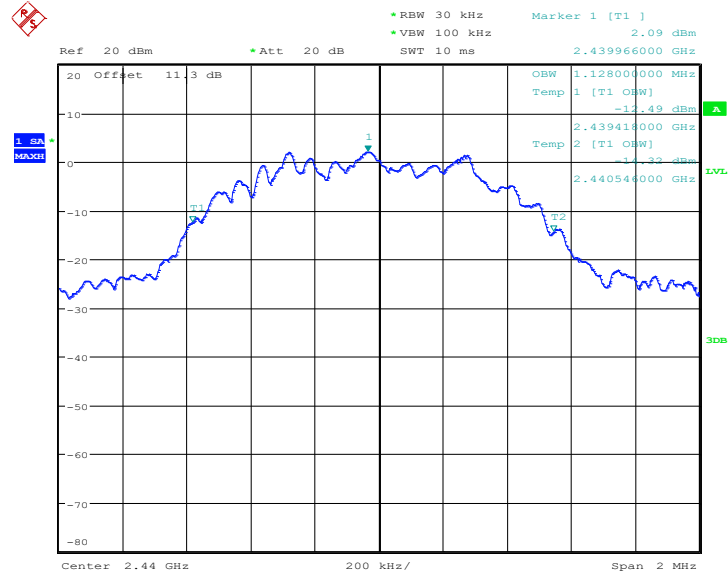
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#### 99% Bandwidth Plot on Channel 00



Date: 19.JUN.2020 10:09:39

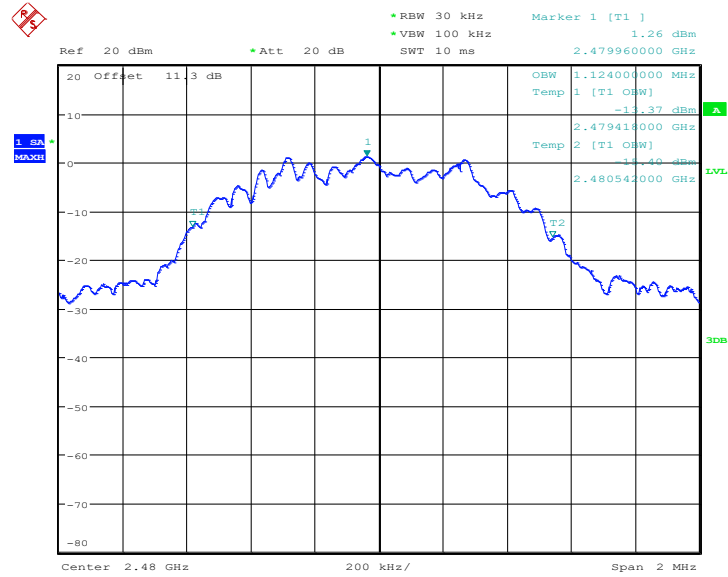
#### 99% Occupied Bandwidth Plot on Channel 19



Date: 19.JUN.2020 10:18:54



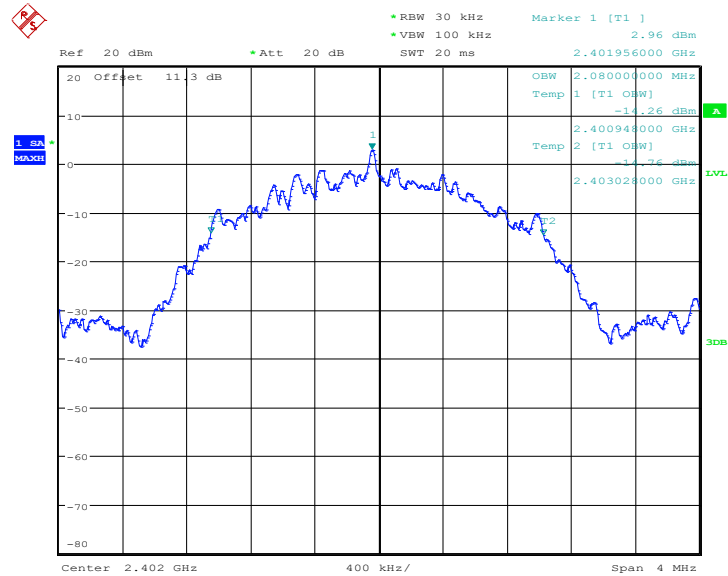
99% Occupied Bandwidth Plot on Channel 39



Date: 19.JUN.2020 10:25:53

<2Mbps>

99% Bandwidth Plot on Channel 00

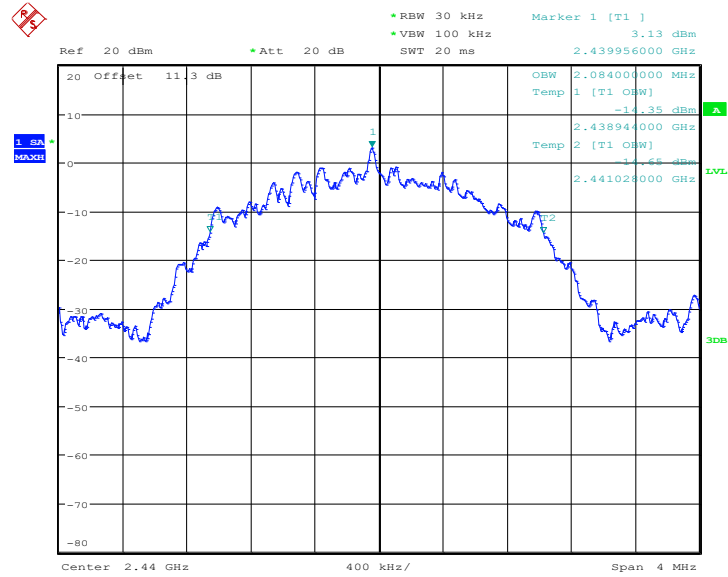


Date: 19.JUN.2020 10:36:09



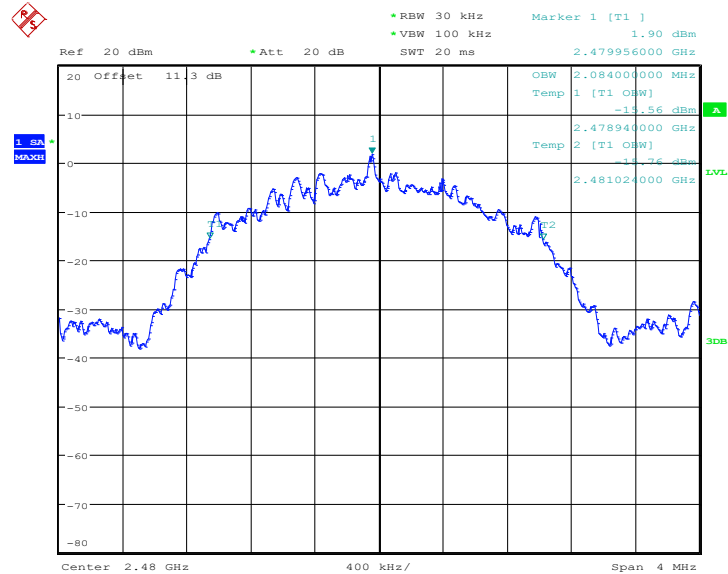


99% Occupied Bandwidth Plot on Channel 19



Date: 19.JUN.2020 10:41:50

99% Occupied Bandwidth Plot on Channel 39



Date: 19.JUN.2020 10:47:16

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

## 3.2 Output Power Measurement

### 3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for 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.

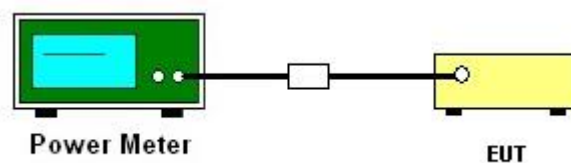
### 3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

### 3.2.3 Test Procedures

1. For Peak Power, the testing follows ANSI C63.10 Section 11.9.1.3 PKPM1.
2. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
3. The RF output of EUT was connected to the power meter by RF cable and attenuator.
4. The path loss was compensated to the results for each measurement.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. 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.

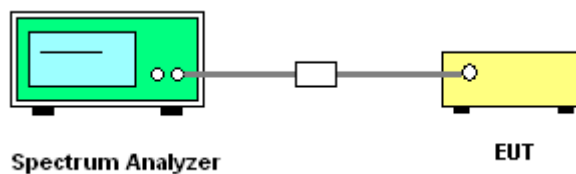
#### 3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

#### 3.3.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 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

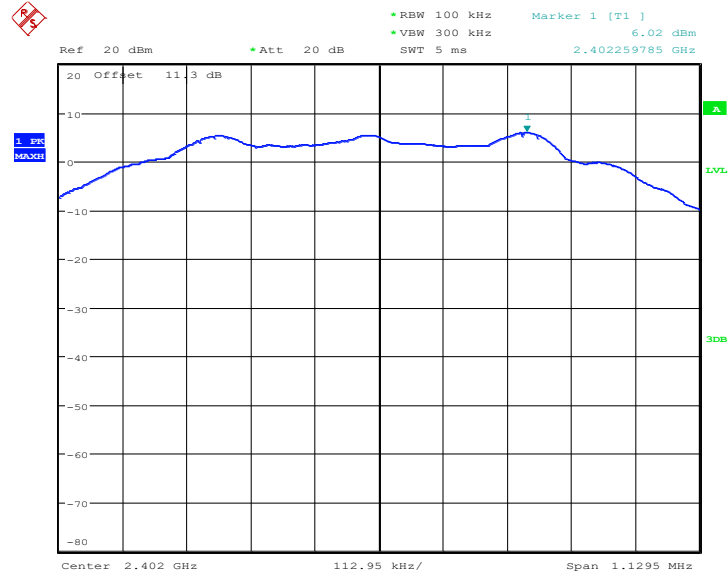
Please refer to Appendix A.



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

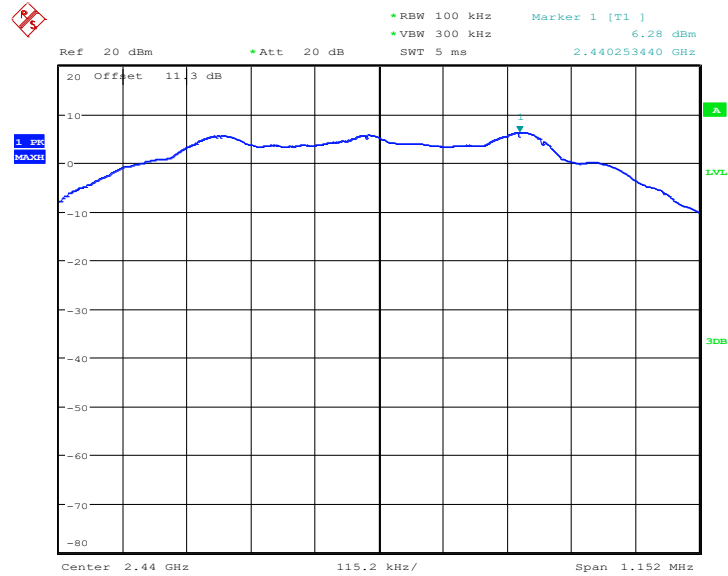
<1Mbps>

#### PSD 100kHz Plot on Channel 00



Date: 19.JUN.2020 10:07:43

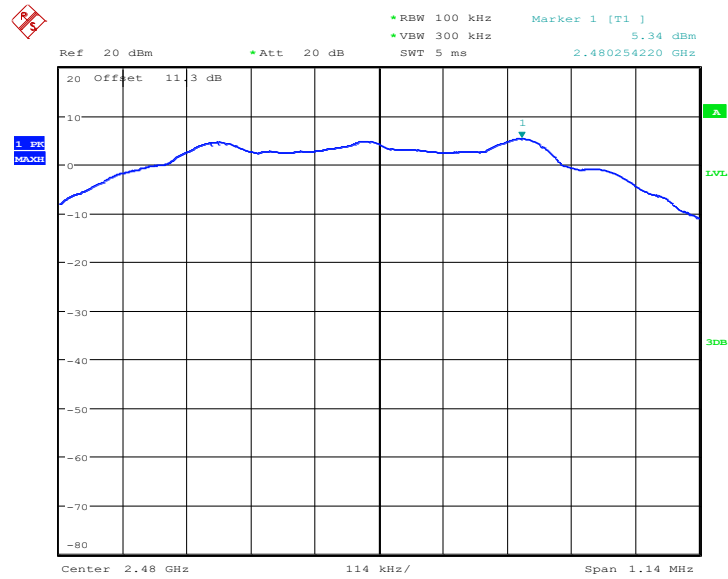
#### PSD 100kHz Plot on Channel 19



Date: 19.JUN.2020 10:17:35



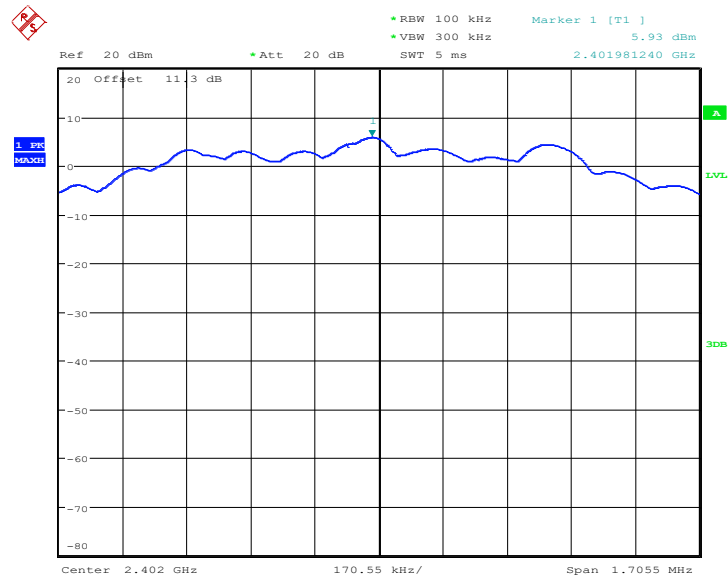
PSD 100kHz Plot on Channel 39



Date: 19.JUN.2020 10:23:32

<2Mbps>

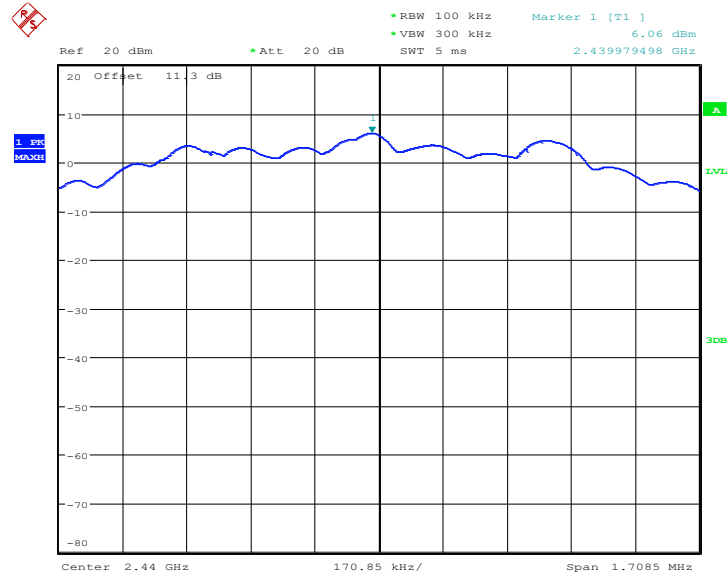
PSD 100kHz Plot on Channel 00



Date: 19.JUN.2020 10:33:16

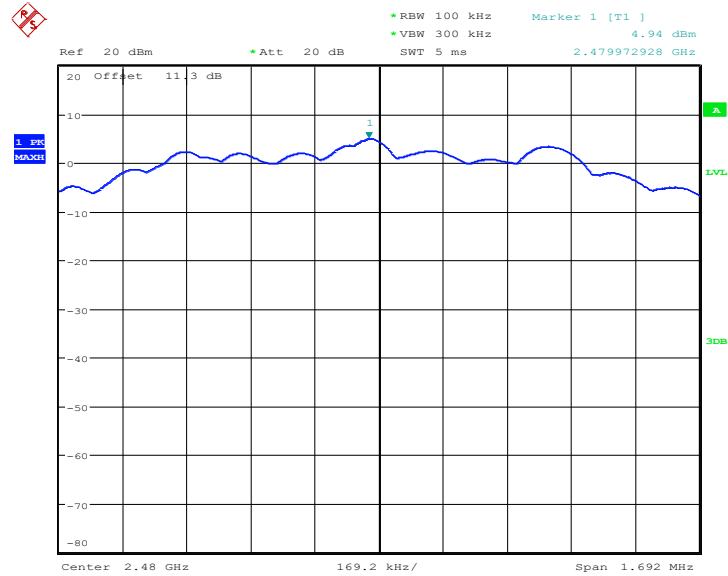


PSD 100kHz Plot on Channel 19



Date: 19.JUN.2020 10:40:02

PSD 100kHz Plot on Channel 39



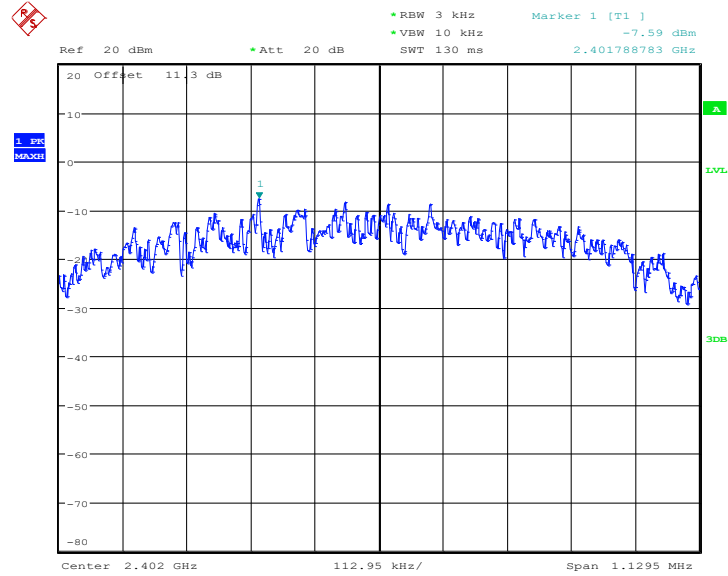
Date: 19.JUN.2020 10:45:10



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

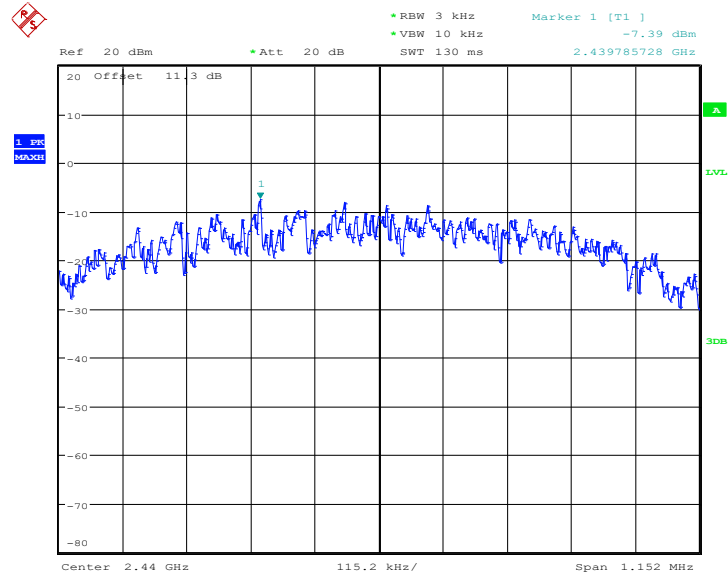
<1Mbps>

#### PSD 3kHz Plot on Channel 00



Date: 19.JUN.2020 10:07:12

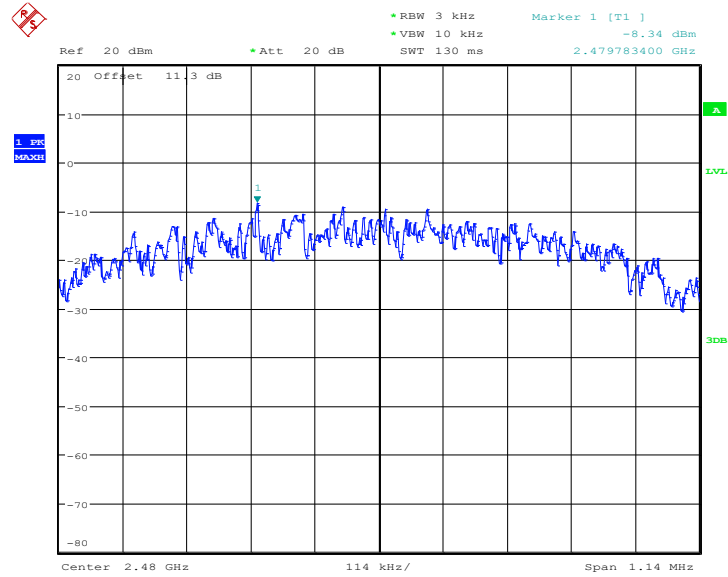
#### PSD 3kHz Plot on Channel 19



Date: 19.JUN.2020 10:17:03



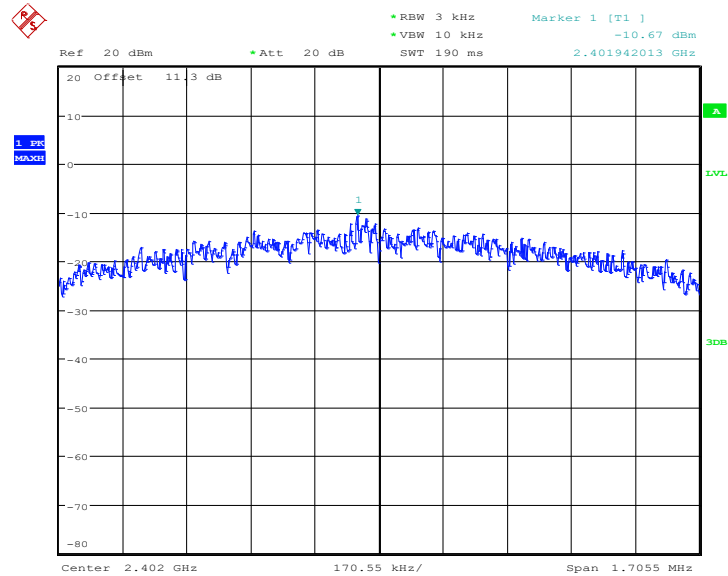
PSD 3kHz Plot on Channel 39



Date: 19.JUN.2020 10:23:00

<2Mbps>

PSD 3kHz Plot on Channel 00

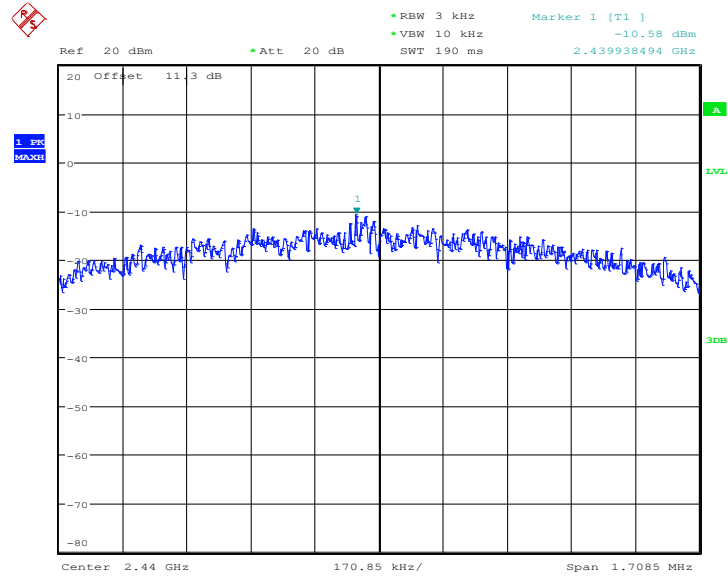


Date: 19.JUN.2020 10:32:15



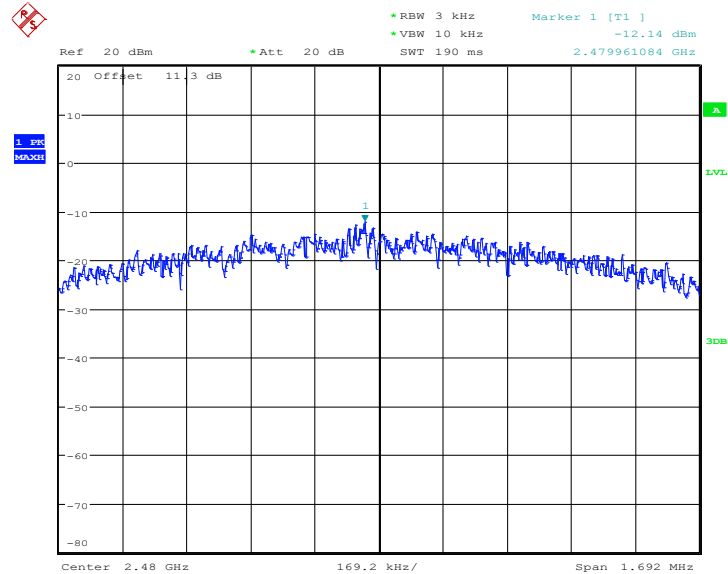


PSD 3kHz Plot on Channel 19



Date: 19.JUN.2020 10:39:22

PSD 3kHz Plot on Channel 39



Date: 19.JUN.2020 10:44:18

## 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.

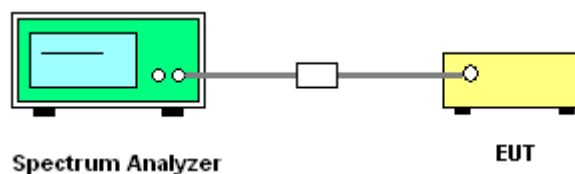
### 3.4.2 Measuring Instruments

See list of measuring equipment of this test report.

### 3.4.3 Test Procedure

1. The testing follows the ANSI C63.10 Section 11.11.3 Emission level measurement.
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

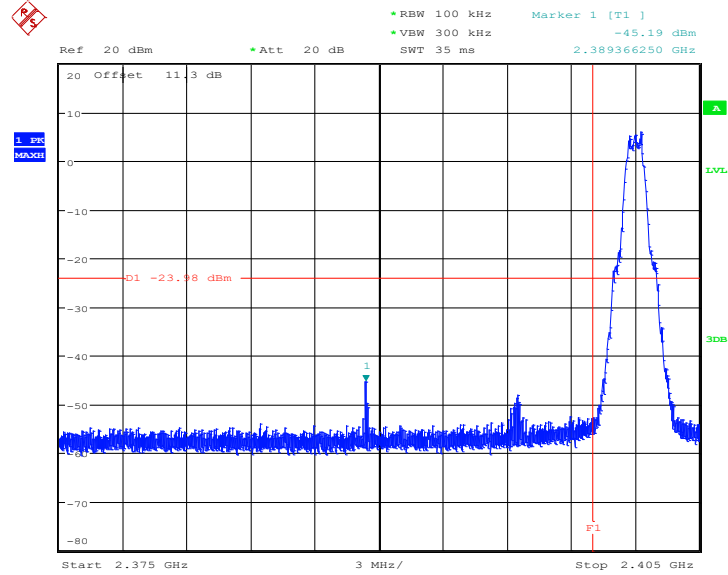




### 3.4.5 Test Result of Conducted Band Edges Plots

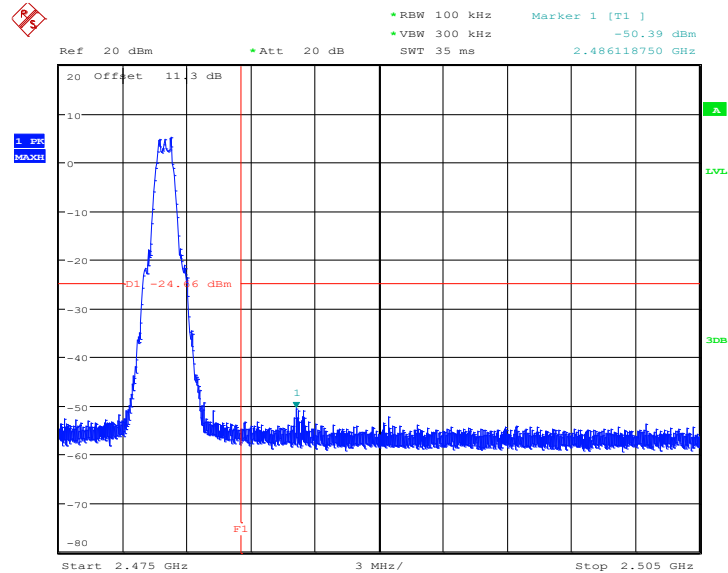
<1Mbps>

Low Band Edge Plot on Channel 00



Date: 19.JUN.2020 10:08:56

High Band Edge Plot on Channel 39

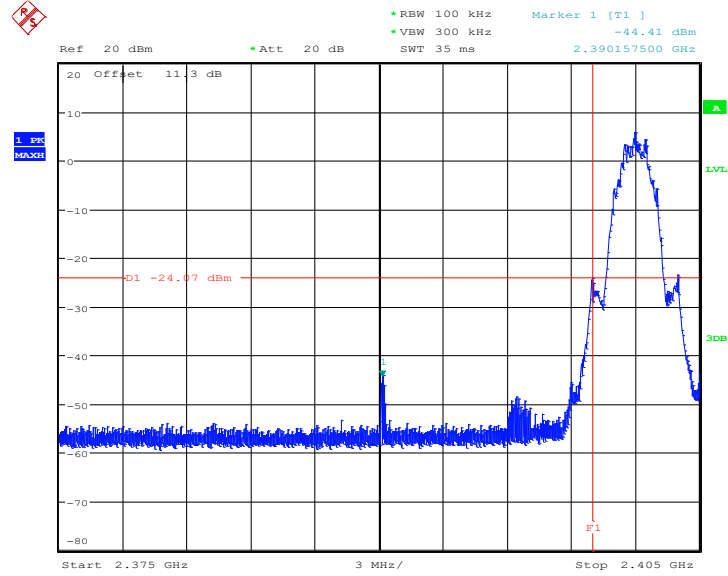


Date: 19.JUN.2020 10:24:24



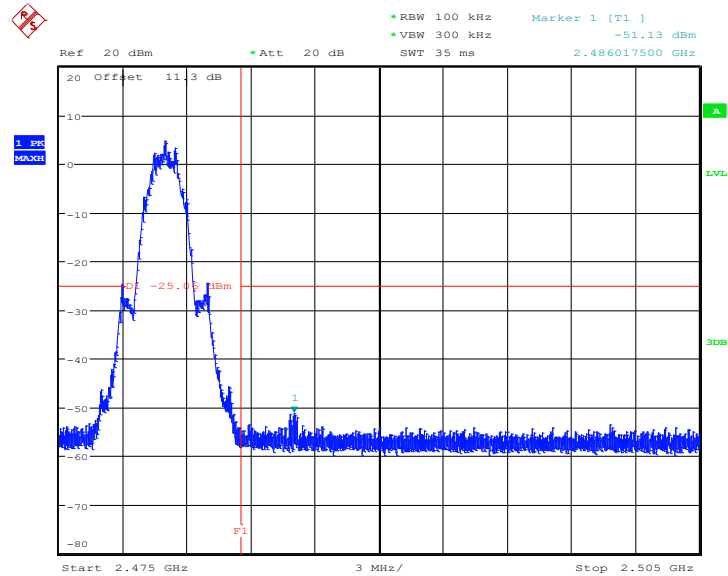
<2Mbps>

Low Band Edge Plot on Channel 00



Date: 19.JUN.2020 10:34:32

High Band Edge Plot on Channel 39

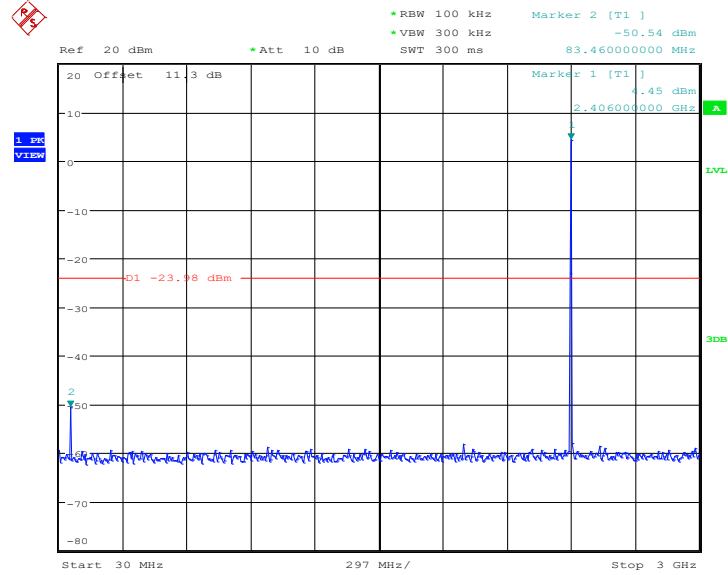


Date: 19.JUN.2020 10:45:51



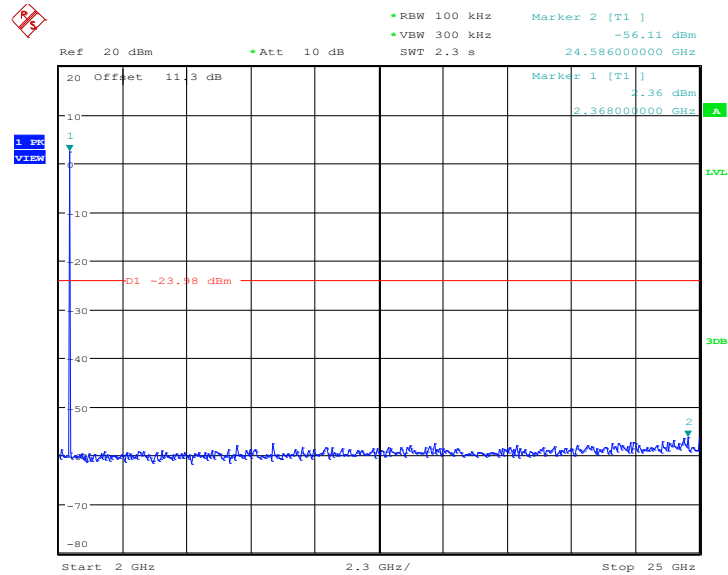
### 3.4.6 Test Result of Conducted Spurious Emission Plots

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



Date: 19.JUN.2020 10:08:06

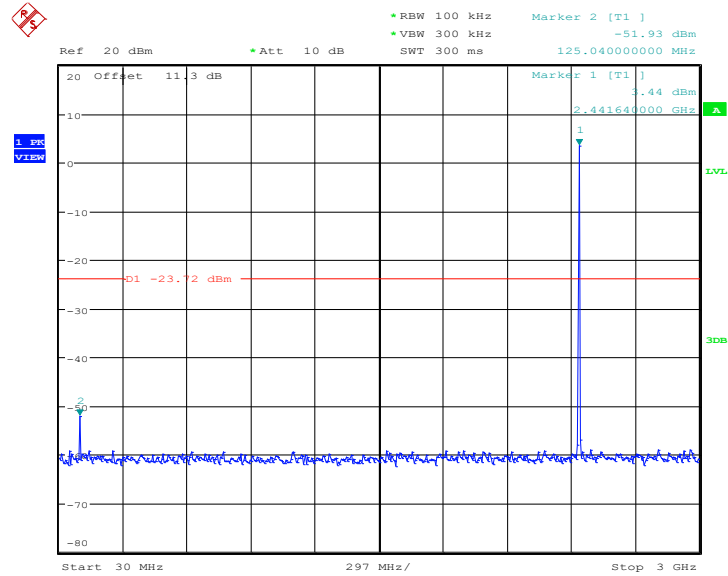
#### Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 00



Date: 19.JUN.2020 10:08:24

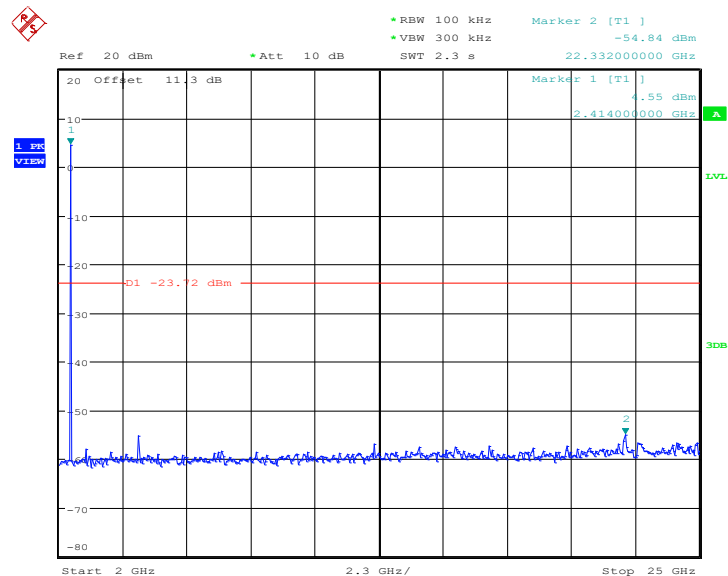


### Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 19



Date: 19.JUN.2020 10:18:01

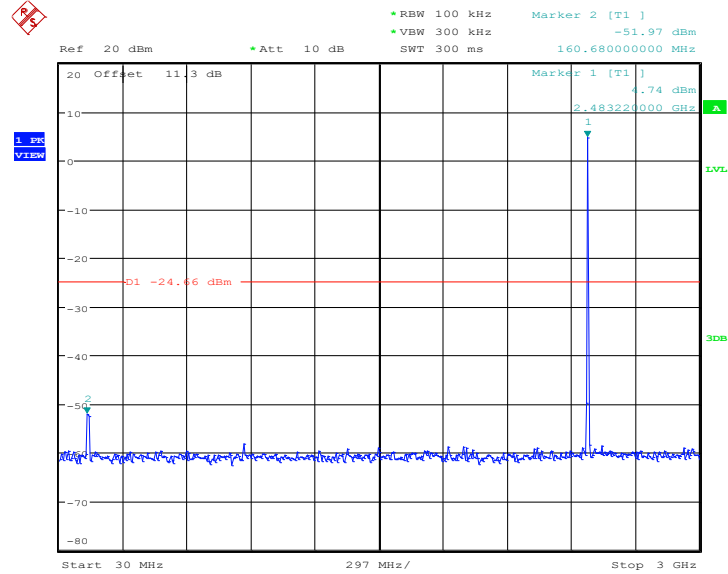
### Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 19



Date: 19.JUN.2020 10:18:18

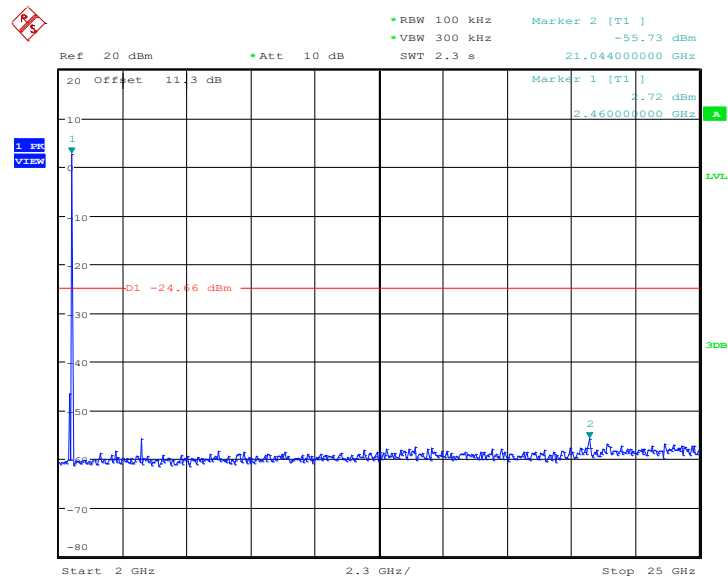


### Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39



Date: 19.JUN.2020 10:24:47

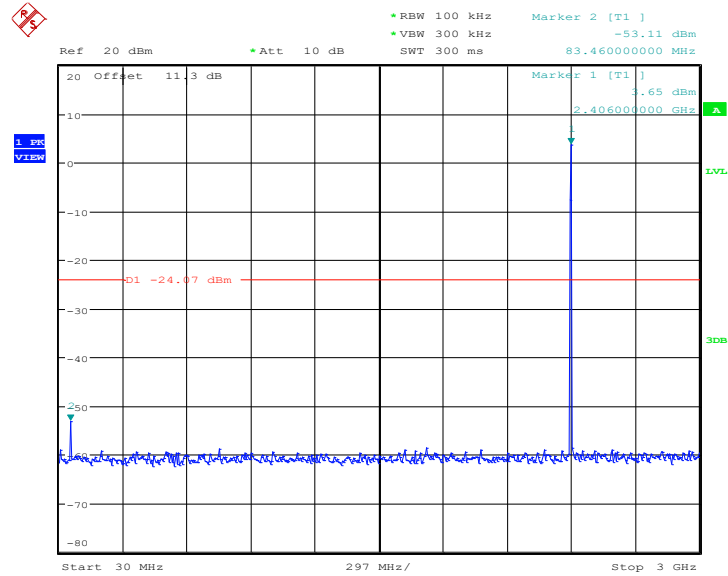
### Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39



Date: 19.JUN.2020 10:25:05

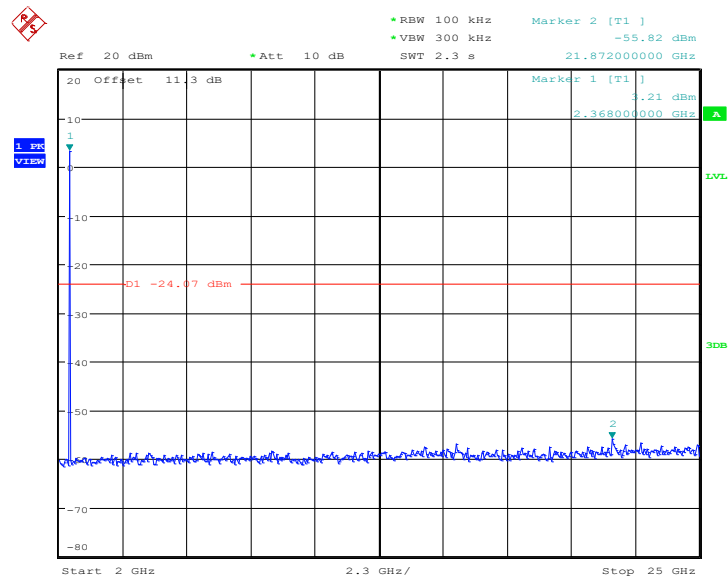


### Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 00



Date: 19.JUN.2020 10:34:56

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

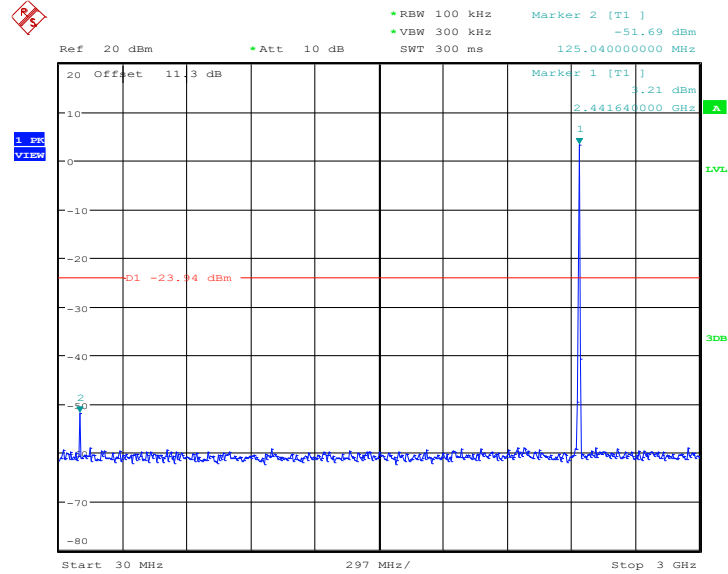


Date: 19.JUN.2020 10:35:13



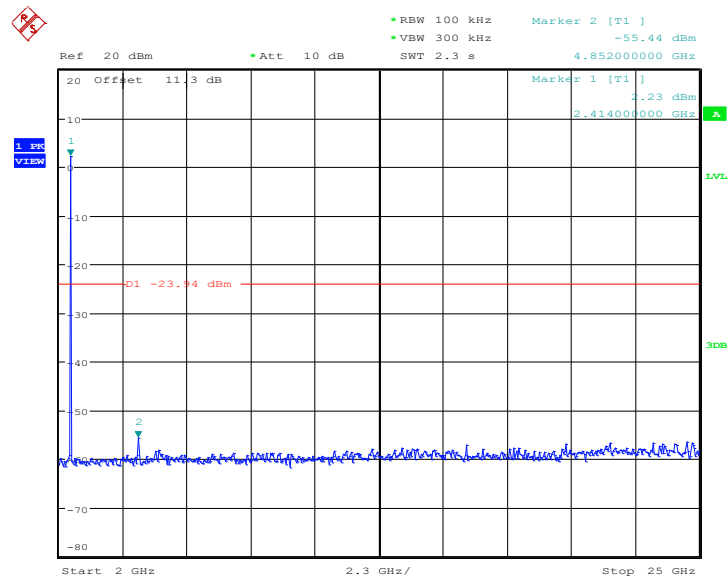


### Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 19



Date: 19.JUN.2020 10:40:31

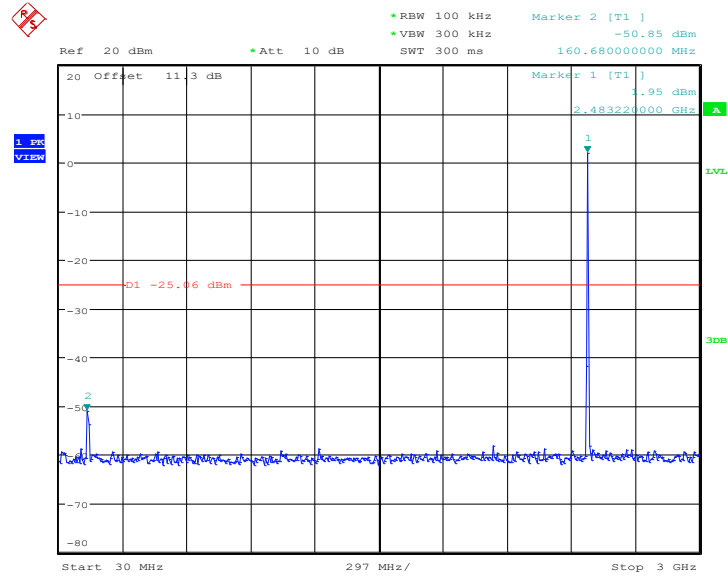
### Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 19



Date: 19.JUN.2020 10:40:50

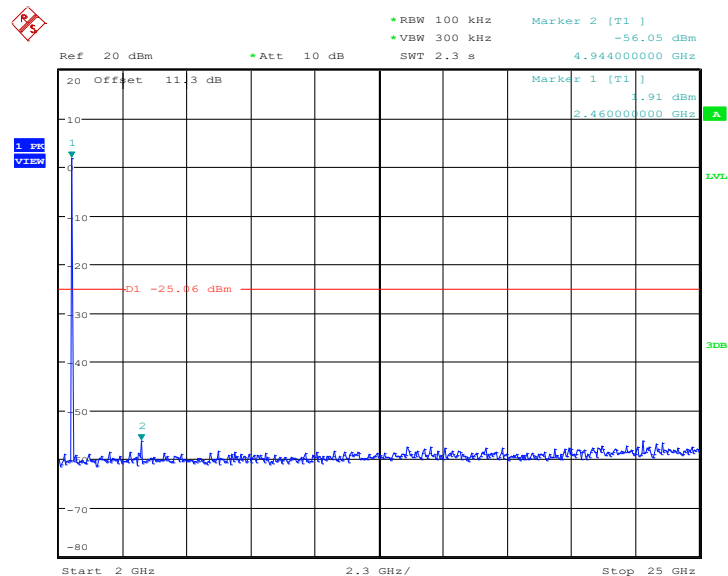


Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 39



Date: 19.JUN.2020 10:46:14

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



Date: 19.JUN.2020 10:46:36



### 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

See list of measuring equipment of this test report.

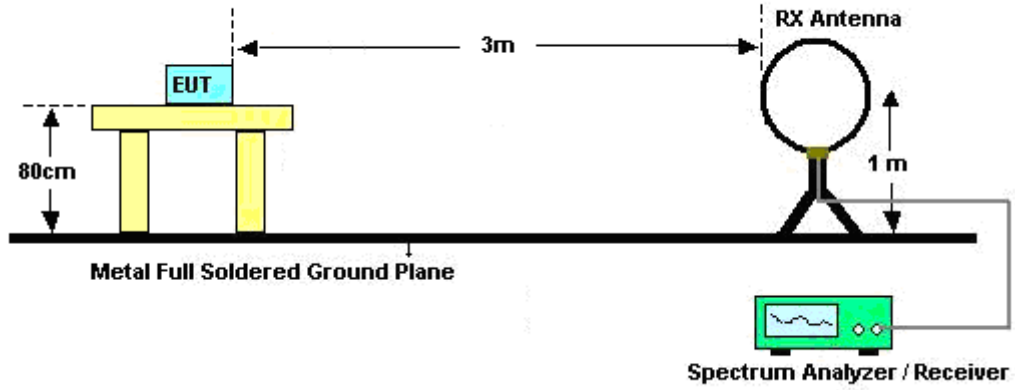


### 3.5.3 Test Procedures

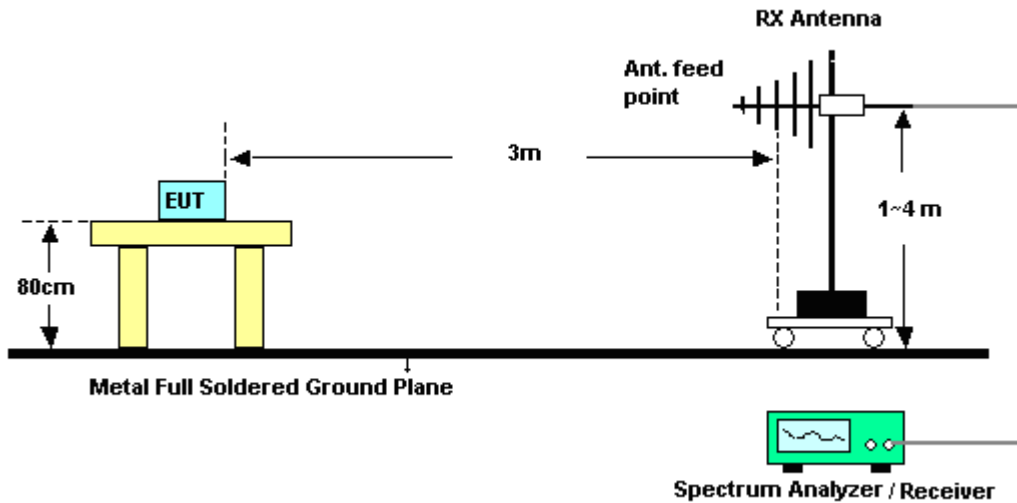
1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the 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

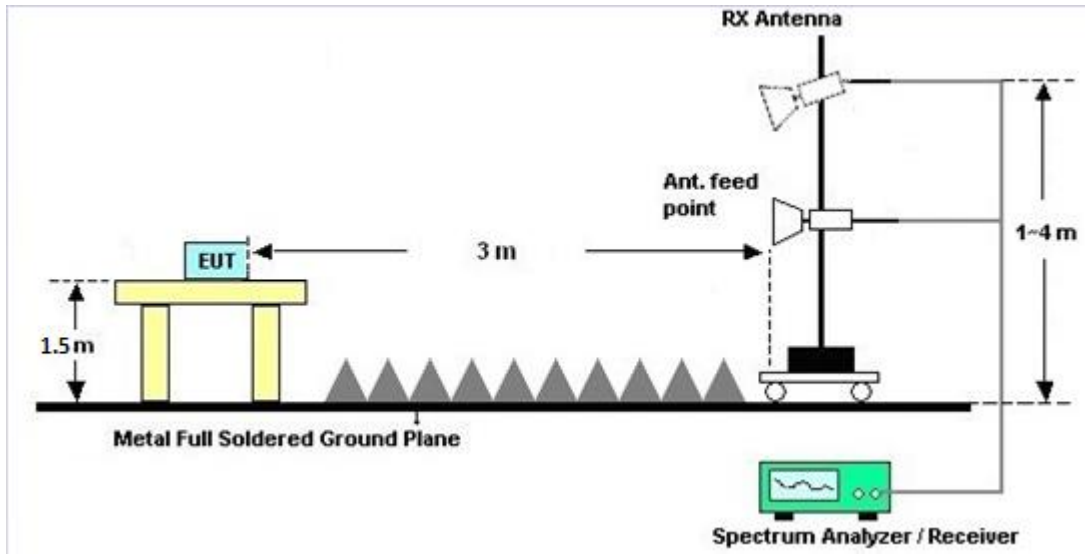
For radiated emissions below 30MHz



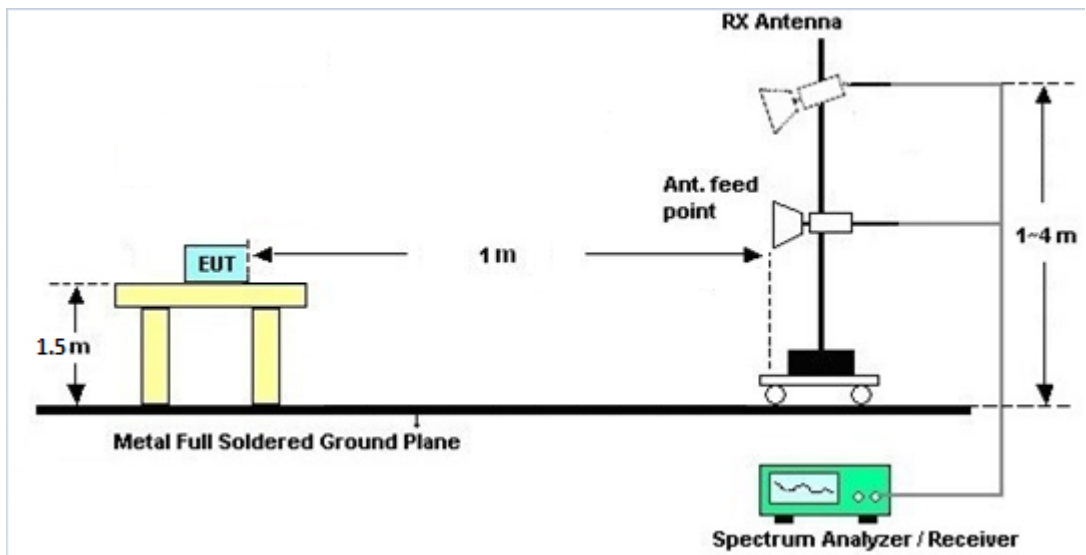
For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



For radiated emissions above 18GHz





### **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 alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

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

Please refer to Appendix C and D.

### **3.5.7 Duty Cycle**

Please refer to Appendix E.

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

Please refer to Appendix C and D.



### 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 (dB $\mu$ V)	
	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

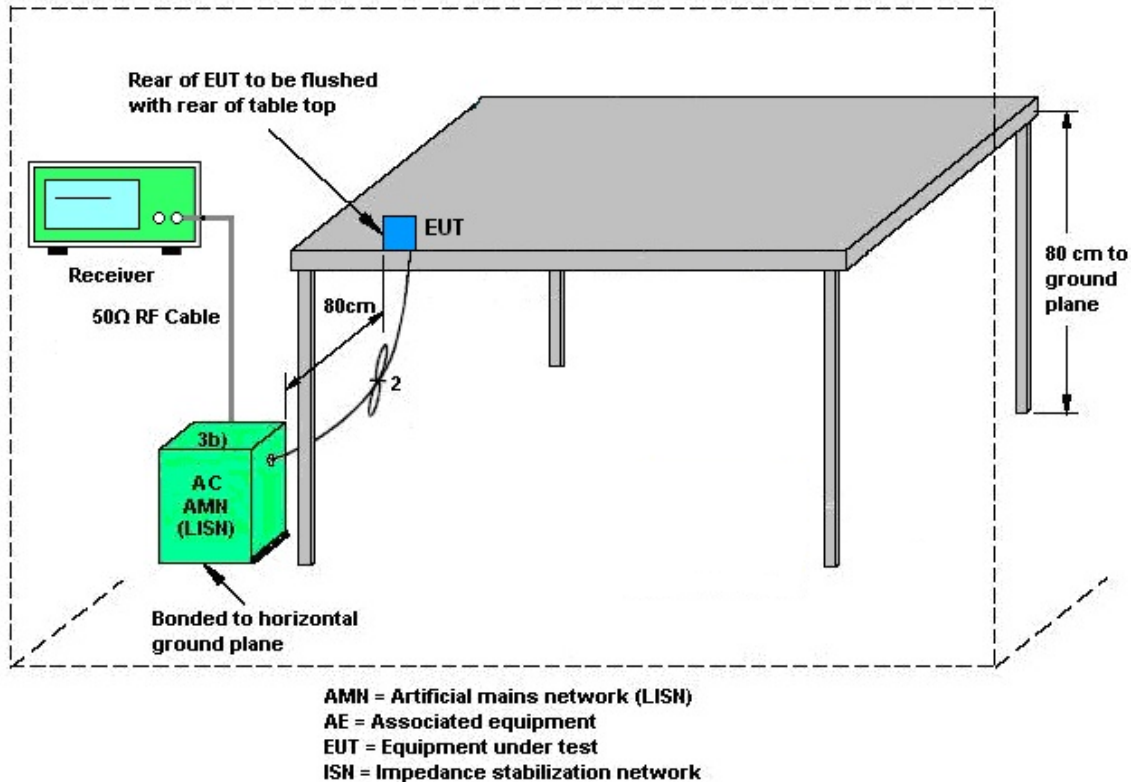
See list of measuring equipment of this test report.

#### 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
Preamplifier	EMCE	EMC184045B	980192	18GHz ~ 40GHz	Aug. 01, 2019	Apr. 07, 2020~ Jul. 06, 2020	Jul. 31, 2020	Radiation (03CH11-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Dec. 03, 2019	Apr. 07, 2020~ Jul. 06, 2020	Dec. 02, 2020	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D & N-6-06	35414 & AT-N0602	30MHz~1GHz	Oct. 12, 2019	Apr. 07, 2020~ Jul. 06, 2020	Oct. 11, 2020	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-132 6	1GHz ~ 18GHz	Nov. 04, 2019	Apr. 07, 2020~ Jul. 06, 2020	Nov. 03, 2020	Radiation (03CH11-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jan. 09, 2020	Apr. 07, 2020~ Jul. 06, 2020	Jan. 08, 2021	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY532700 80	1GHz~26.5GHz	Nov. 13, 2019	Apr. 07, 2020~ Jul. 06, 2020	Nov. 12, 2020	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY542004 86	10Hz ~ 44GHz	Oct. 28, 2019	Apr. 07, 2020~ Jul. 06, 2020	Oct. 27, 2020	Radiation (03CH11-HY)
Controller	EMEC	EM 1000	N/A	Control Turn table & Ant Mast	N/A	Apr. 07, 2020~ Jul. 06, 2020	N/A	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500- B	N/A	1~4m	N/A	Apr. 07, 2020~ Jul. 06, 2020	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Apr. 07, 2020~ Jul. 06, 2020	N/A	Radiation (03CH11-HY)
Preamplifier	Jet-Power	JPA0118-55-3 03K	171000180 0054002	1GHz~18GHz	Aug. 06, 2019	Apr. 07, 2020~ Jul. 06, 2020	Aug. 05, 2020	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA9170 576	18GHz- 40GHz	May 22, 2020	Apr. 07, 2020~ Jul. 06, 2020	May 21, 2021	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY542004 86	10Hz~44GHz	Oct. 28, 2019	Apr. 07, 2020~ Jul. 06, 2020	Oct. 27, 2020	Radiation (03CH11-HY)
Software	Audix	E3 6.2009-8-24	RK-00105 3	N/A	N/A	Apr. 07, 2020~ Jul. 06, 2020	N/A	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4 PE	9kHz-30MHz	Mar. 12, 2020	Apr. 07, 2020~ Jul. 06, 2020	Mar. 11, 2021	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2859/2	30MHz-40GHz	Mar. 12, 2020	Apr. 07, 2020~ Jul. 06, 2020	Mar. 11, 2021	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4 PE	30M-18G	Mar. 12, 2020	Apr. 07, 2020~ Jul. 06, 2020	Mar. 11, 2021	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY4274/2	30MHz-40GHz	Mar. 12, 2020	Apr. 07, 2020~ Jul. 06, 2020	Mar. 11, 2021	Radiation (03CH11-HY)
Filter	Wainwright	WLK4-1000-1 530-8000-40S S	SN11	1.53G Low Pass	Sep. 15, 2019	Apr. 07, 2020~ Jul. 06, 2020	Sep. 14, 2020	Radiation (03CH11-HY)
Filter	Wainwright	WHKX12-270 0-3000-18000 -60SS	SN3	3GHz High Pass Filter	Sep. 15, 2019	Apr. 07, 2020~ Jul. 06, 2020	Sep. 14, 2020	Radiation (03CH11-HY)
Hygrometer	TECPEL	DTN-303B	TP140325	N/A	Nov. 07, 2019	Apr. 07, 2020~ Jul. 06, 2020	Nov. 06, 2020	Radiation (03CH11-HY)
Hygrometer	TECPEL	DTN-303B	TP161237	N/A	Oct. 25, 2019	Apr. 07, 2020~ Jul. 06, 2020	Oct. 24, 2020	Radiation (03CH11-HY)



Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	May 05, 2020	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9kHz~3.6GHz	Nov. 15, 2019	May 05, 2020	Nov. 14, 2020	Conduction (CO05-HY)
Hygrometer	Testo	608-H1	34913912	N/A	Nov. 07, 2019	May 05, 2020	Nov. 06, 2020	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 20, 2019	May 05, 2020	Nov. 19, 2020	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Nov. 15, 2019	May 05, 2020	Nov. 14, 2020	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	May 05, 2020	N/A	Conduction (CO05-HY)
LF Cable	HUBER + SUHNER	RG-214/U	LF01	N/A	Jan. 02, 2020	May 05, 2020	Jan. 01, 2021	Conduction (CO05-HY)
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100851	N/A	Jan. 02, 2020	May 05, 2020	Jan. 01, 2021	Conduction (CO05-HY)
Hygrometer	Testo	HTC-1	2	N/A	Mar. 02, 2020	May 27, 2020~ Jun. 19, 2020	Mar. 01, 2021	Conducted (TH05-HY)
Power Sensor	DARE	RPR3006W	17100015S NO36	10MHz~6GHz	Jan. 22, 2020	May 27, 2020~ Jun. 19, 2020	Jan. 21, 2021	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSQ26.5	200578/02 6	20Hz-26.5GHz	Jul. 10, 2019	May 27, 2020~ Jun. 19, 2020	Jul. 09, 2020	Conducted (TH05-HY)
Switch Box & RF Cable	Burgeon	ETF-1405-0	EC190015 7	N/A	Aug. 15, 2019	May 27, 2020~ Jun. 19, 2020	Aug. 14, 2020	Conducted (TH05-HY)



## 5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	2.3
---	-----

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

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

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

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

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	5.3
---	-----

**Appendix A. Test Result of Conducted Test Items**

Test Engineer:	Jacob Yu	Temperature:	21~25	°C
Test Date:	2020/5/27-2020/6/19	Relative Humidity:	51~54	%

**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	1.116	0.753	0.50	Pass
BLE	1Mbps	1	19	2440	1.128	0.768	0.50	Pass
BLE	1Mbps	1	39	2480	1.124	0.760	0.50	Pass

**TEST RESULTS DATA**  
**Average Power Table**

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	1Mbps	1	0	2402	6.12	30.00	-5.60	0.52	36.00	Pass
BLE	1Mbps	1	19	2440	6.42	30.00	-5.60	0.82	36.00	Pass
BLE	1Mbps	1	39	2480	5.52	30.00	-5.60	-0.08	36.00	Pass

**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	6.02	-7.59	-5.60	8.00	Pass
BLE	1Mbps	1	19	2440	6.28	-7.39	-5.60	8.00	Pass
BLE	1Mbps	1	39	2480	5.34	-8.34	-5.60	8.00	Pass

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 30dBc limit.

## Appendix A. Test Result of Conducted Test Items

### 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
BLE5.0	2Mbps	1	0	2402	2.080	1.137	0.50	Pass
BLE5.0	2Mbps	1	19	2440	2.084	1.139	0.50	Pass
BLE5.0	2Mbps	1	39	2480	2.084	1.128	0.50	Pass

### TEST RESULTS DATA Average Power Table

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE5.0	2Mbps	1	0	2402	6.22	30.00	-5.60	0.62	36.00	Pass
BLE5.0	2Mbps	1	19	2440	6.52	30.00	-5.60	0.92	36.00	Pass
BLE5.0	2Mbps	1	39	2480	5.62	30.00	-5.60	0.02	36.00	Pass

### 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
BLE5.0	2Mbps	1	0	2402	5.93	-10.67	-5.60	8.00	Pass
BLE5.0	2Mbps	1	19	2440	6.06	-10.58	-5.60	8.00	Pass
BLE5.0	2Mbps	1	39	2480	4.94	-12.14	-5.60	8.00	Pass

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 30dBc limit.



## Appendix B. AC Conducted Emission Test Results

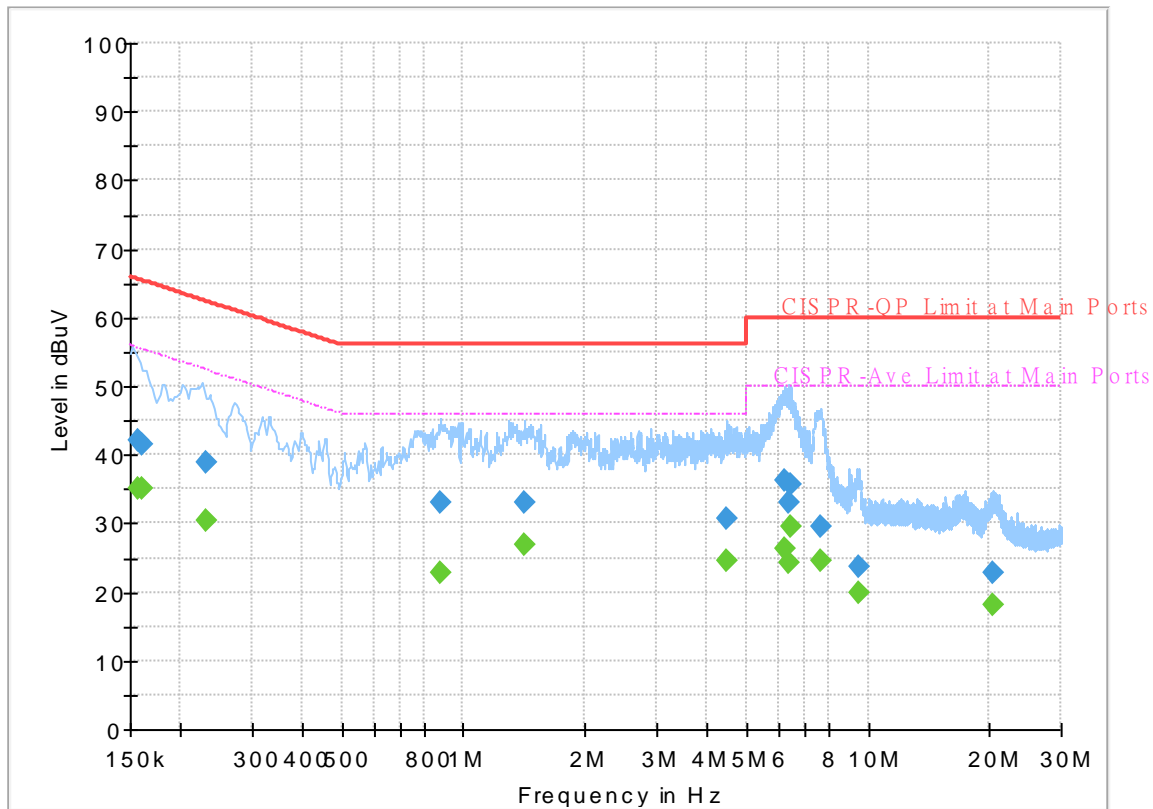
Test Engineer :	Howard Huang	Temperature :	21~25°C
		Relative Humidity :	42~45%



# EUT Information

Report NO : 032014  
 Test Mode : Mode 2  
 Test Voltage : Power From System  
 Phase : Line

Full Spectrum



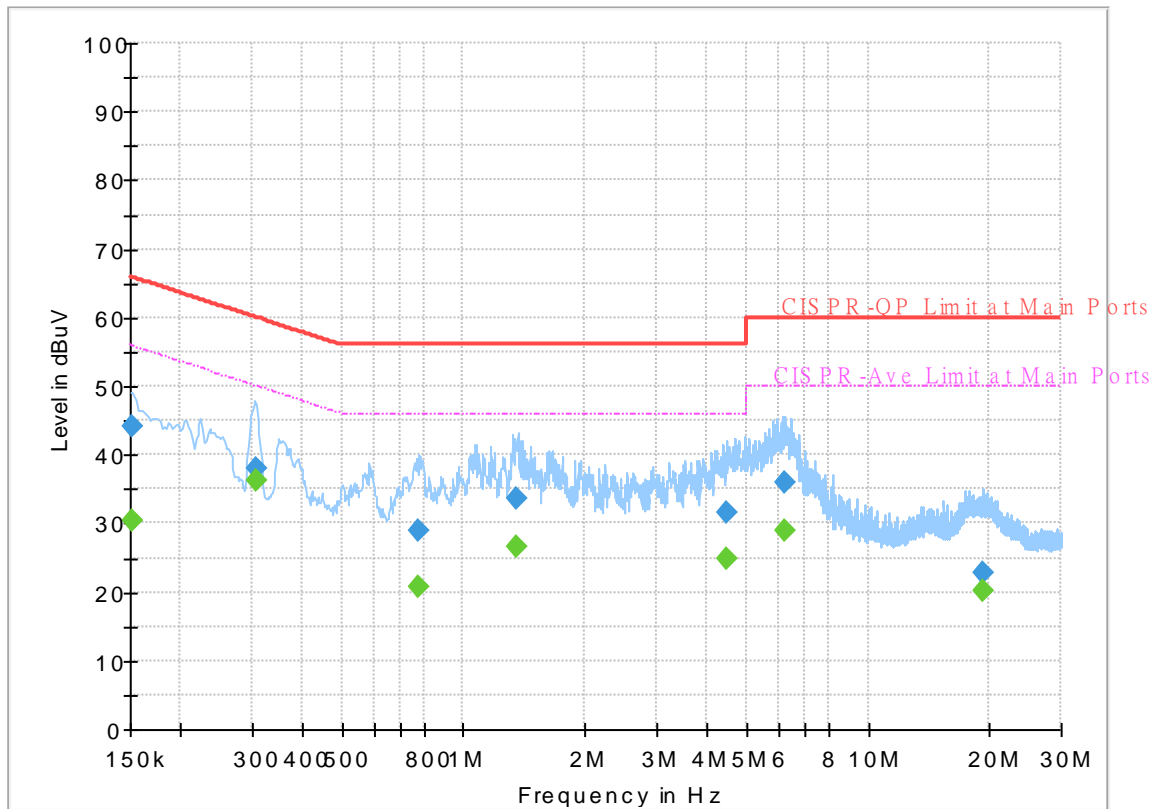
## Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.156750	---	34.95	55.63	20.68	L1	OFF	19.5
0.156750	42.01	---	65.63	23.62	L1	OFF	19.5
0.160260	---	35.01	55.45	20.44	L1	OFF	19.5
0.160260	41.56	---	65.45	23.89	L1	OFF	19.5
0.231000	---	30.45	52.41	21.96	L1	OFF	19.5
0.231000	38.88	---	62.41	23.53	L1	OFF	19.5
0.872250	---	22.95	46.00	23.05	L1	OFF	19.5
0.872250	33.05	---	56.00	22.95	L1	OFF	19.5
1.421430	---	26.91	46.00	19.09	L1	OFF	19.6
1.421430	33.10	---	56.00	22.90	L1	OFF	19.6
4.479000	---	24.48	46.00	21.52	L1	OFF	19.6
4.479000	30.79	---	56.00	25.21	L1	OFF	19.6
6.245250	---	26.37	50.00	23.63	L1	OFF	19.7
6.245250	36.34	---	60.00	23.66	L1	OFF	19.7
6.383940	---	24.32	50.00	25.68	L1	OFF	19.7
6.383940	33.10	---	60.00	26.90	L1	OFF	19.7
6.472500	---	29.53	50.00	20.47	L1	OFF	19.7
6.472500	35.76	---	60.00	24.24	L1	OFF	19.7
7.617660	---	24.43	50.00	25.57	L1	OFF	19.7
7.617660	29.48	---	60.00	30.52	L1	OFF	19.7
9.462750	---	19.83	50.00	30.17	L1	OFF	19.8
9.462750	23.76	---	60.00	36.24	L1	OFF	19.8
20.323500	---	17.99	50.00	32.01	L1	OFF	19.8
20.323500	22.70	---	60.00	37.30	L1	OFF	19.8

## EUT Information

Report NO : 032014  
 Test Mode : Mode 2  
 Test Voltage : Power From System  
 Phase : Neutral

Full Spectrum



## Final\_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152160	---	30.41	55.88	25.47	N	OFF	19.5
0.152160	44.22	---	65.88	21.66	N	OFF	19.5
0.306870	---	36.31	50.06	13.75	N	OFF	19.5
0.306870	38.11	---	60.06	21.95	N	OFF	19.5
0.776400	---	20.90	46.00	25.10	N	OFF	19.6
0.776400	28.94	---	56.00	27.06	N	OFF	19.6
1.358250	---	26.61	46.00	19.39	N	OFF	19.6
1.358250	33.64	---	56.00	22.36	N	OFF	19.6
4.484940	---	24.76	46.00	21.24	N	OFF	19.6
4.484940	31.54	---	56.00	24.46	N	OFF	19.6
6.240750	---	28.94	50.00	21.06	N	OFF	19.7
6.240750	35.97	---	60.00	24.03	N	OFF	19.7
19.140180	---	20.17	50.00	29.83	N	OFF	19.9
19.140180	22.77	---	60.00	37.23	N	OFF	19.9



### Appendix C. Radiated Spurious Emission

Test Engineer :	Cookie Ku, Fu Chen, and Troye Hsieh	Temperature :	19.1~21.6°C
		Relative Humidity :	63.1~68.9%

<1Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

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 )	
BLE CH 00 2402MHz		2316.3	52.53	-21.47	74	41.56	27.67	16.55	33.25	147	352	P	H	
		2358.825	42.68	-11.32	54	31.75	27.58	16.59	33.24	147	352	A	H	
	*	2402	95.9	-	-	85	27.5	16.63	33.23	147	352	P	H	
	*	2402	95.18	-	-	84.28	27.5	16.63	33.23	147	352	A	H	
													H	
			2311.575	52.72	-21.28	74	41.75	27.68	16.54	33.25	132	21	P	V
			2331.525	42.53	-11.47	54	31.58	27.64	16.56	33.25	132	21	A	V
	*		2402	94.36	-	-	83.46	27.5	16.63	33.23	132	21	P	V
	*		2402	93.64	-	-	82.74	27.5	16.63	33.23	132	21	A	V
														V
BLE CH 19 2440MHz		2383.92	52.11	-21.89	74	41.21	27.53	16.61	33.24	173	351	P	H	
		2338.32	42.6	-11.4	54	31.66	27.62	16.57	33.25	173	351	A	H	
	*	2440	96.58	-	-	85.71	27.42	16.67	33.22	173	351	P	H	
	*	2440	95.86	-	-	84.99	27.42	16.67	33.22	173	351	A	H	
			2497.76	51.99	-22.01	74	41.25	27.21	16.74	33.21	173	351	P	H
			2484.72	42.46	-11.54	54	31.69	27.26	16.72	33.21	173	351	A	H
			2347.44	52.32	-21.68	74	41.37	27.61	16.58	33.24	104	19	P	V
			2321.04	42.75	-11.25	54	31.79	27.66	16.55	33.25	104	19	A	V
	*		2440	93.2	-	-	82.33	27.42	16.67	33.22	104	19	P	V
	*		2440	92.46	-	-	81.59	27.42	16.67	33.22	104	19	A	V
			2497.12	52.57	-21.43	74	41.83	27.21	16.74	33.21	104	19	P	V
			2491.6	42.52	-11.48	54	31.77	27.23	16.73	33.21	104	19	A	V



<b>BLE CH 39 2480MHz</b>	*	2480	91.22	-	-	80.43	27.28	16.72	33.21	170	338	P	H
	*	2480	90.49	-	-	79.7	27.28	16.72	33.21	170	338	A	H
		2489.35	52.98	-21.02	74	42.22	27.24	16.73	33.21	170	338	P	H
		2485	42.72	-11.28	54	31.95	27.26	16.72	33.21	170	338	A	H
													H
													H
	*	2480	92.23	-	-	81.44	27.28	16.72	33.21	123	30	P	V
	*	2480	91.44	-	-	80.65	27.28	16.72	33.21	123	30	A	V
		2492.05	52.71	-21.29	74	41.96	27.23	16.73	33.21	123	30	P	V
		2485.95	42.53	-11.47	54	31.76	27.26	16.72	33.21	123	30	A	V
													V
													V
<b>Remark</b>	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 ( 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 )
BLE CH 00 2402MHz		4804	40.8	-33.2	74	59.33	31	10.93	60.46	100	0	P	H
													H
													H
													H
													H
													V
													V
BLE CH 19 2440MHz		4880	41.22	-32.78	74	59.65	31	10.97	60.4	100	0	P	H
		7320	44.15	-29.85	74	53.4	36.5	13.36	59.11	100	0	P	H
													H
													H
													V
													V
													V
BLE CH 39 2480MHz		4960	40.82	-33.18	74	59	31.14	11.01	60.33	100	0	P	H
		7440	43.12	-30.88	74	52.57	36.38	13.21	59.04	100	0	P	H
													H
													H
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



**Emission above 18GHz**

**2.4GHz BLE (SHF)**

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.	
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.		
		( MHz )	( dB $\mu$ V/m )	( dB )	( dB $\mu$ V/m )	( dB $\mu$ V )	( dB/m )	( dB )	( dB )	( cm )	( deg )	( P/A )	( H/V )	
2.4GHz BLE SHF		23670	43.1	-30.9	74	48.24	38.9	9.26	53.3	100	0	P	H	
													H	
													H	
													H	
													H	
													H	
			23502	42.21	-31.79	74	47.32	38.9	9.29	53.3	100	0	P	V
														V
														V
														V
<b>Remark</b>	1. No other spurious found. 2. All results are PASS against limit line.													



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		30	22.49	-17.51	40	30	24.15	0.76	32.42	-	-	P	H	
		79.47	19.18	-20.82	40	37.29	13.04	1.3	32.45	-	-	P	H	
		128.94	24.96	-18.54	43.5	38.32	17.46	1.62	32.44	-	-	P	H	
		425.76	27.98	-18.02	46	34.71	22.43	2.97	32.13	-	-	P	H	
		850.62	30.72	-15.28	46	29.65	28.81	4.2	31.94	-	-	P	H	
		957.32	31.24	-14.76	46	27.25	30.51	4.45	30.97	100	0	P	H	
														H
														H
														H
														H
														H
														H
			45.52	31.51	-8.49	40	46.6	16.45	0.97	32.51	100	0	P	V
			69.77	26.77	-13.23	40	45.99	12.04	1.22	32.48	-	-	P	V
			153.19	26.33	-17.17	43.5	40.4	16.6	1.82	32.49	-	-	P	V
			434.49	31.51	-14.49	46	38.18	22.55	2.99	32.21	-	-	P	V
			916.58	30.41	-15.59	46	28.65	28.92	4.35	31.51	-	-	P	V
			950.53	30.92	-15.08	46	27.45	30.09	4.44	31.06	-	-	P	V
														V
														V
													V	
													V	
													V	
													V	
Remark	1. No other spurious found. 2. All results are PASS against limit line.													



<2Mbps>

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		2365.44	53.33	-20.67	74	42.4	27.57	16.6	33.24	144	5	P	H	
		2335.2	42.83	-11.17	54	31.88	27.63	16.57	33.25	144	5	A	H	
	*	2402	98.03	-	-	87.13	27.5	16.63	33.23	144	5	P	H	
	*	2402	96.6	-	-	85.7	27.5	16.63	33.23	144	5	A	H	
													H	
													H	
			2341.395	53.14	-20.86	74	42.19	27.62	16.57	33.24	111	355	P	V
			2382.765	42.9	-11.1	54	32	27.53	16.61	33.24	111	355	A	V
	*		2402	91.68	-	-	80.78	27.5	16.63	33.23	111	355	P	V
	*		2402	90.21	-	-	79.31	27.5	16.63	33.23	111	355	A	V
													V	
												V		
BLE CH 19 2440MHz		2348.4	52.77	-21.23	74	41.83	27.6	16.58	33.24	155	7	P	H	
		2368.72	42.81	-11.19	54	31.89	27.56	16.6	33.24	155	7	A	H	
	*	2440	96.5	-	-	85.63	27.42	16.67	33.22	155	7	P	H	
	*	2440	95.04	-	-	84.17	27.42	16.67	33.22	155	7	A	H	
			2498	52.85	-21.15	74	42.11	27.21	16.74	33.21	155	7	P	H
			2489.6	42.57	-11.43	54	31.81	27.24	16.73	33.21	155	7	A	H
			2350.32	52.58	-21.42	74	41.64	27.6	16.58	33.24	104	354	P	V
			2315.6	42.89	-11.11	54	31.92	27.67	16.55	33.25	104	354	A	V
	*		2440	91.75	-	-	80.88	27.42	16.67	33.22	104	354	P	V
	*		2440	90.15	-	-	79.28	27.42	16.67	33.22	104	354	A	V
			2491.04	51.96	-22.04	74	41.2	27.24	16.73	33.21	104	354	P	V
		2497.68	42.57	-11.43	54	31.83	27.21	16.74	33.21	104	354	A	V	





<b>BLE CH 39 2480MHz</b>	*	2480	96.06	-	-	85.27	27.28	16.72	33.21	170	6	P	H
	*	2480	93.98	-	-	83.19	27.28	16.72	33.21	170	6	A	H
		2494.1	51.94	-22.06	74	41.2	27.22	16.73	33.21	170	6	P	H
		2483.5	42.74	-11.26	54	31.96	27.27	16.72	33.21	170	6	A	H
													H
													H
	*	2480	90.44	-	-	79.65	27.28	16.72	33.21	100	354	P	V
	*	2480	89	-	-	78.21	27.28	16.72	33.21	100	354	A	V
		2492.8	52.48	-21.52	74	41.73	27.23	16.73	33.21	100	354	P	V
		2497.15	42.55	-11.45	54	31.81	27.21	16.74	33.21	100	354	A	V
													V
													V
<b>Remark</b>	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 ( 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 )
BLE CH 00 2402MHz		4804	41.37	-32.63	74	59.9	31	10.93	60.46	100	0	P	H
													H
													H
													H
		4804	40.98	-33.02	74	59.51	31	10.93	60.46	100	0	P	V
													V
													V
BLE CH 19 2440MHz		4880	41.87	-32.13	74	60.3	31	10.97	60.4	100	0	P	H
		7320	43.89	-30.11	74	53.14	36.5	13.36	59.11	100	0	P	H
													H
													H
		4880	40.74	-33.26	74	59.17	31	10.97	60.4	100	0	P	V
		7320	43.17	-30.83	74	52.42	36.5	13.36	59.11	100	0	P	V
													V
BLE CH 39 2480MHz		4960	41.86	-32.14	74	60.04	31.14	11.01	60.33	100	0	P	H
		7440	43.99	-30.01	74	53.44	36.38	13.21	59.04	100	0	P	H
													H
													H
		4960	41.06	-32.94	74	59.24	31.14	11.01	60.33	100	0	P	V
		7440	43.08	-30.92	74	52.53	36.38	13.21	59.04	100	0	P	V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Emission above 18GHz

2.4GHz BLE (SHF)

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 SHF		23691	42.07	-31.93	74	47.21	38.9	9.26	53.3	100	0	P	H	
													H	
													H	
													H	
													H	
													H	
			23579	41.95	-32.05	74	47.07	38.9	9.28	53.3	100	0	P	V
														V
														V
														V
														V
														V
Remark	1. No other spurious found. 2. All results are PASS against limit line.													



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		30	22.58	-17.42	40	30.09	24.15	0.76	32.42	-	-	P	H	
		117.3	24.37	-19.13	43.5	38.11	17.15	1.53	32.42	-	-	P	H	
		127.97	24.88	-18.62	43.5	38.3	17.4	1.62	32.44	-	-	P	H	
		874.87	30.16	-15.84	46	28.69	29.06	4.25	31.84	-	-	P	H	
		941.8	30.63	-15.37	46	27.76	29.63	4.42	31.18	-	-	P	H	
		950.53	31.18	-14.82	46	27.71	30.09	4.44	31.06	100	0	P	H	
													H	
													H	
													H	
													H	
													H	
													H	
			45.52	30.25	-9.75	40	45.34	16.45	0.97	32.51	100	0	P	V
			132.82	22.07	-21.43	43.5	35.48	17.39	1.65	32.45	-	-	P	V
			170.65	21.15	-22.35	43.5	36.4	15.34	1.94	32.53	-	-	P	V
			934.04	30.48	-15.52	46	28.06	29.31	4.39	31.28	-	-	P	V
			947.62	30.65	-15.35	46	27.37	29.95	4.43	31.1	-	-	P	V
			958.29	31.17	-14.83	46	27.11	30.57	4.45	30.96	-	-	P	V
														V
														V
													V	
													V	
													V	
													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. Radiated Spurious Emission Plots

Test Engineer :	Cookie Ku, Fu Chen, and Troye Hsieh	Temperature :	19.1~21.6°C
		Relative Humidity :	63.1~68.9%

### Note symbol

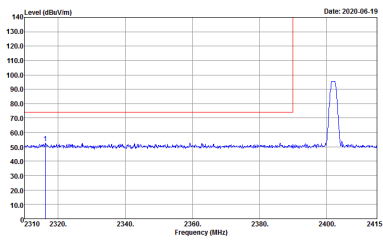
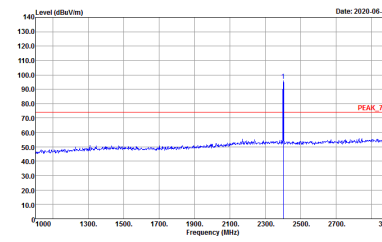
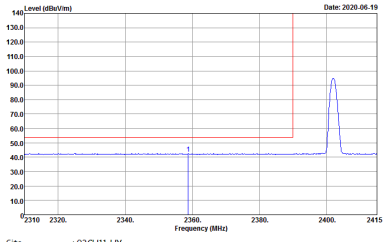
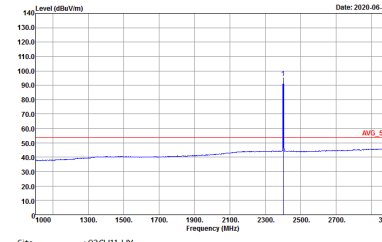
-L	Low channel location
-R	High channel location



<1Mbps>

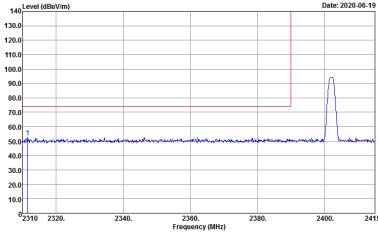
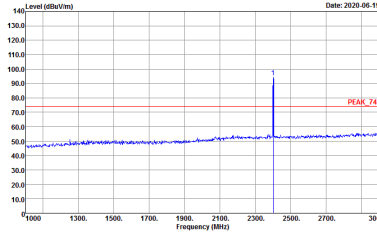
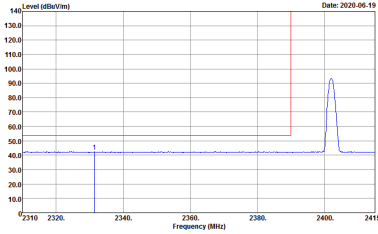
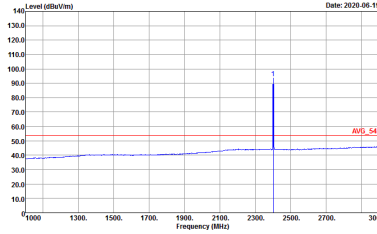
2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

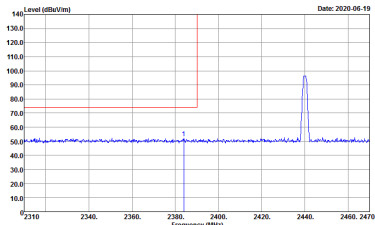
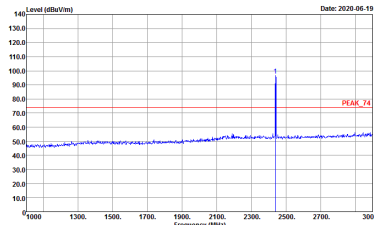
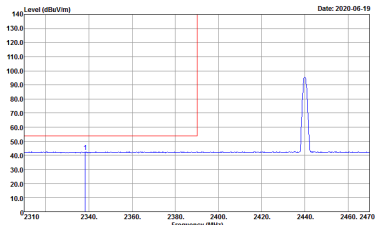
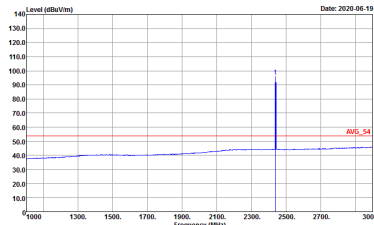
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH00 2402MHz	
	Horizontal	Fundamental
Peak	 <p>Site : 03CH11-HY            Condition : PEAK_BE_74 3m HORN 91200-HF HORIZONTAL            RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Site : 03CH11-HY            Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL            RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>
Avg.	 <p>Site : 03CH11-HY            Condition : AVG_BE_54 3m HORN 91200-HF HORIZONTAL            RBW:1000.000KHz VBW:1.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Site : 03CH11-HY            Condition : AVG_54 3m HORN 91200-HF HORIZONTAL            RBW:1000.000KHz VBW:1.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>



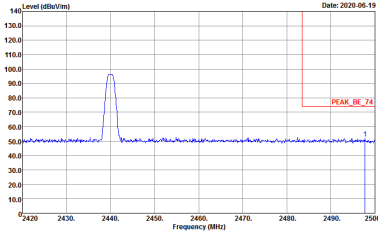
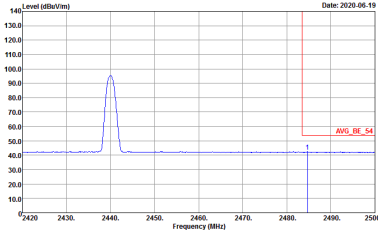


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH00 2402MHz		
	Vertical	Fundamental
Peak	 <p>Site : 03CH11-HY            Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL            RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Site : 03CH11-HY            Condition : PEAK_74 3m HORN 91200-HF VERTICAL            RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>
Avg	 <p>Site : 03CH11-HY            Condition : AVG_BE_54 3m HORN 91200-HF VERTICAL            RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Site : 03CH11-HY            Condition : AVG_54 3m HORN 91200-HF VERTICAL            RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014</p>

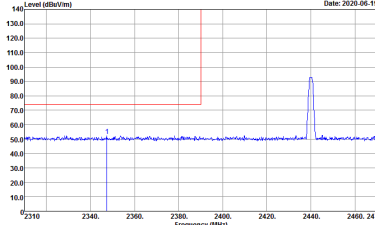
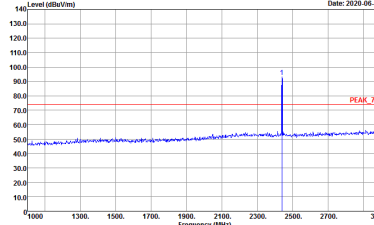
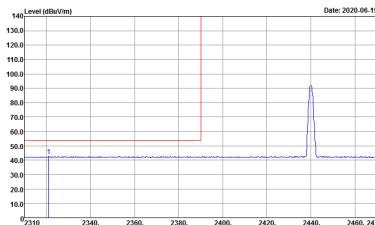
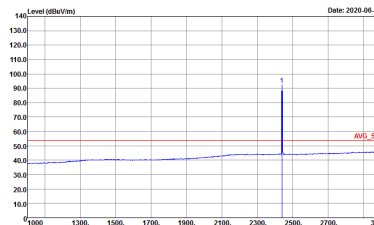


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH19 2440MHz - L		
	Horizontal	Fundamental
Peak	 <p>Level (dBm/1m) vs Frequency (MHz) plot showing a peak at 2440 MHz. The y-axis ranges from 10.0 to 140.0 dBm/1m, and the x-axis ranges from 2310 to 2470 MHz. A red line indicates the peak level at approximately 100 dBm/1m.</p> <p>Site : 03CH11-HY            Condition : PEAK_BE_74 3m HORN 9120D-HF HORIZONTAL            RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Level (dBm/1m) vs Frequency (MHz) plot showing a peak at 2440 MHz. The y-axis ranges from 10.0 to 140.0 dBm/1m, and the x-axis ranges from 0 to 3000 MHz. A red line indicates the peak level at approximately 75 dBm/1m, labeled 'PEAK_74'.</p> <p>Site : 03CH11-HY            Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL            RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>
Avg.	 <p>Level (dBm/1m) vs Frequency (MHz) plot showing an average level at 2440 MHz. The y-axis ranges from 10.0 to 140.0 dBm/1m, and the x-axis ranges from 2310 to 2470 MHz. A red line indicates the average level at approximately 50 dBm/1m.</p> <p>Site : 03CH11-HY            Condition : AVG_BE_54 3m HORN 9120D-HF HORIZONTAL            RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Level (dBm/1m) vs Frequency (MHz) plot showing an average level at 2440 MHz. The y-axis ranges from 10.0 to 140.0 dBm/1m, and the x-axis ranges from 0 to 3000 MHz. A red line indicates the average level at approximately 55 dBm/1m, labeled 'AVG_54'.</p> <p>Site : 03CH11-HY            Condition : AVG_54 3m HORN 9120D-HF HORIZONTAL            RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014</p>

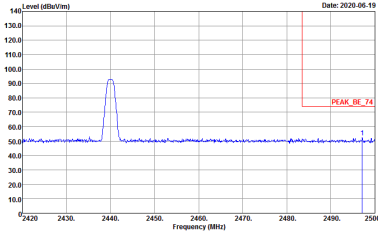
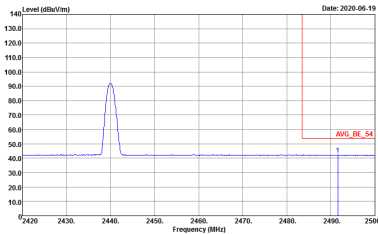


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH19 2440MHz - R		
Horizontal		Fundamental
<p><b>Peak</b></p>	 <p>Site : 03CH11-HY            Condition : PEAK_BE_74 3m HORN 91200-HF HORIZONTAL            RBW:1000.000KHz VBW:3000.000KHz SWF:Auto            Detector : Peak            Project : 032014</p>	<p>Left blank</p>
<p><b>Avg.</b></p>	 <p>Site : 03CH11-HY            Condition : AVG_BE_54 3m HORN 91200-HF HORIZONTAL            RBW:1000.000KHz VBW:1.000KHz SWF:Auto            Detector : Peak            Project : 032014</p>	<p>Left blank</p>

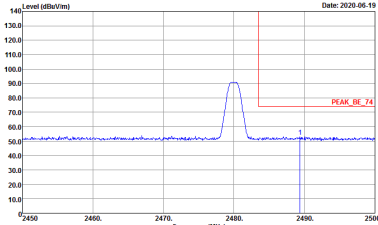
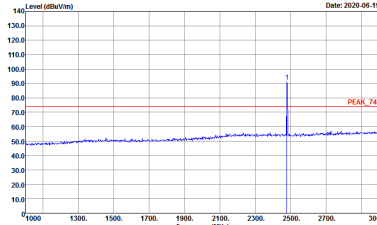
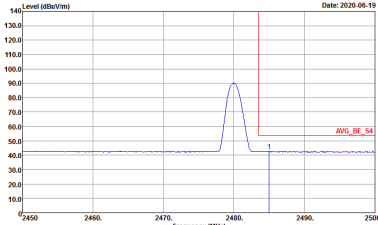
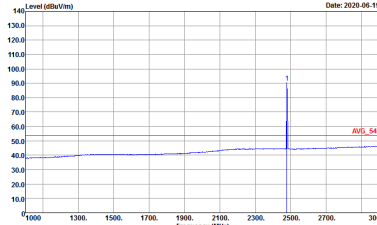


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH19 2440MHz - L		
	Vertical	Fundamental
Peak	 <p>Date: 2020-06-19</p> <p>Site : 03CH11-HY            Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL            : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Date: 2020-06-19</p> <p>Site : 03CH11-HY            Condition : PEAK_74 3m HORN 91200-HF VERTICAL            : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>
Avg.	 <p>Date: 2020-06-19</p> <p>Site : 03CH11-HY            Condition : AVG_BE_54 3m HORN 91200-HF VERTICAL            : RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Date: 2020-06-19</p> <p>Site : 03CH11-HY            Condition : AVG_54 3m HORN 91200-HF VERTICAL            : RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014</p>

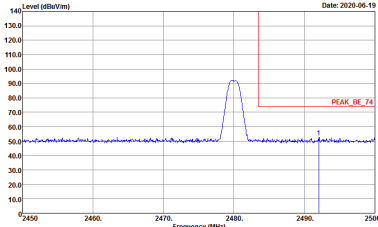
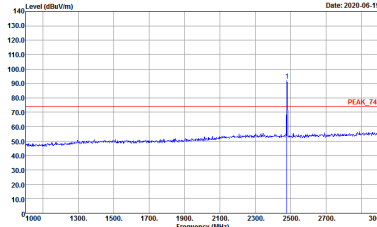
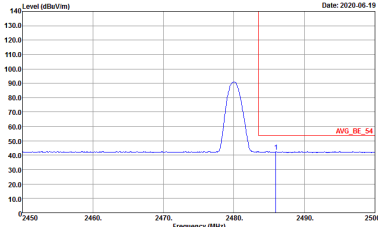
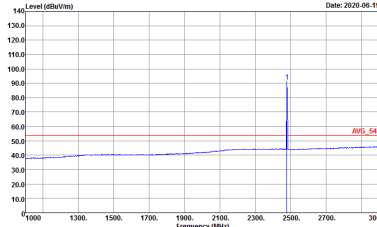


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH19 2440MHz - R		
	Vertical	Fundamental
<p><b>Peak</b></p>	 <p>Site : 03CH11-HY            Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL            RBW:1000.000KHz VBW:3000.000KHz SWF:Auto            Detector : Peak            Project : 032014</p>	<p>Left blank</p>
<p><b>Avg.</b></p>	 <p>Site : 03CH11-HY            Condition : AVG_BE_54 3m HORN 91200-HF VERTICAL            RBW:1000.000KHz VBW:1000KHz SWF:Auto            Detector : Peak            Project : 032014</p>	<p>Left blank</p>



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH39 2480MHz		
	Horizontal	Fundamental
<p><b>Peak</b></p>	 <p>Date: 2020-06-19</p> <p>Site : 03CH11-HY            Condition : PEAK_BE_74 3m HORN 91200-HF HORIZONTAL            : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Date: 2020-06-19</p> <p>Site : 03CH11-HY            Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL            : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>
<p><b>Avg.</b></p>	 <p>Date: 2020-06-19</p> <p>Site : 03CH11-HY            Condition : AVG_BE_54 3m HORN 91200-HF HORIZONTAL            : RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Date: 2020-06-19</p> <p>Site : 03CH11-HY            Condition : AVG_54 3m HORN 91200-HF HORIZONTAL            : RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014</p>



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH39 2480MHz		
	Vertical	Fundamental
Peak	 <p>Site : 03CH11-HY            Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL            RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Site : 03CH11-HY            Condition : PEAK_74 3m HORN 91200-HF VERTICAL            RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>
Avg.	 <p>Site : 03CH11-HY            Condition : AVG_BE_54 3m HORN 91200-HF VERTICAL            RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Site : 03CH11-HY            Condition : AVG_54 3m HORN 91200-HF VERTICAL            RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014</p>



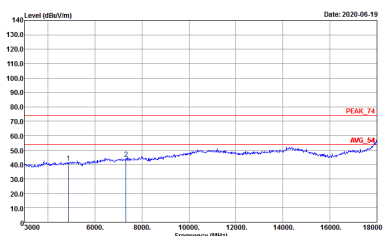
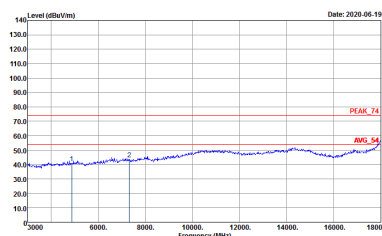
2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH00 2402MHz	
	Horizontal	Vertical
<b>Peak</b> <b>Avg.</b>	<p>Site : 03CH11-1FY Condition : PEAK_74 3m HORN 91200-1HF HORIZONTAL Detector : Peak Project : 032014</p>	<p>Site : 03CH11-1FY Condition : PEAK_74 3m HORN 91200-1HF VERTICAL Detector : Peak Project : 032014</p>





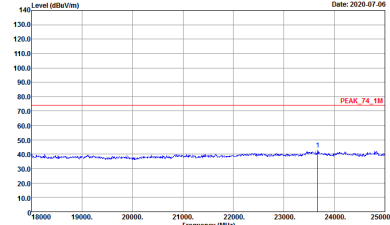
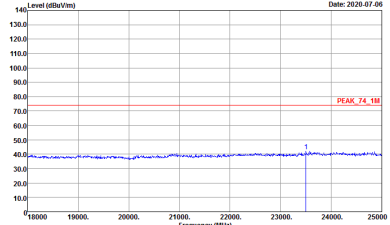
BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
BLE CH19 2440MHz		
Horizontal		Vertical
<p><b>Peak</b></p> <p><b>Avg.</b></p>	 <p>Site : 03CH11-HY            Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL            Detector : Peak            Project : 032014</p>	 <p>Site : 03CH11-HY            Condition : PEAK_74 3m HORN 91200-HF VERTICAL            Detector : Peak            Project : 032014</p>



BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH39 2480MHz	
	Horizontal	Vertical
Peak	<p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 032014</p>	<p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF VERTICAL Detector : Peak Project : 032014</p>



Emission above 18GHz  
2.4GHz BLE (SHF)

<b>BLE</b>	<b>2.4GHz 2400~2483.5MHz</b>	
	<b>BLE SHF</b>	
	<b>Horizontal</b>	<b>Vertical</b>
<b>QP / Peak</b>	 <p>Date: 2020-07-08</p> <p>Site : 03CH11-1FY Condition : PEAK_74_1M 1m SHF HORN BBHA9170576 HORIZONTAL Project : 032014</p>	 <p>Date: 2020-07-08</p> <p>Site : 03CH11-1FY Condition : PEAK_74_1M 1m SHF HORN BBHA9170576 VERTICAL Project : 032014</p>



Emission below 1GHz  
2.4GHz BLE (LF)

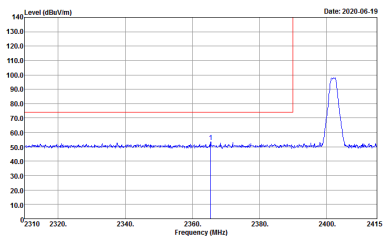
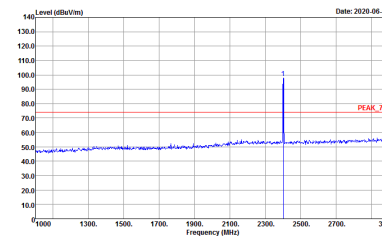
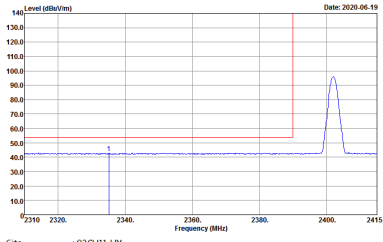
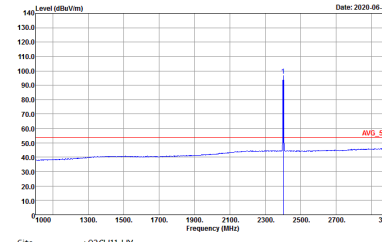
BLE	2.4GHz 2400~2483.5MHz	
	BLE LF	
	Horizontal	Vertical
QP / Peak	<p>Site : 03CH11-4FY Condition : QP 3m BT-LOG 6111D-LF_ETC HORIZONTAL Detector : Peak Project : 032014</p>	<p>Site : 03CH11-4FY Condition : QP 3m BT-LOG 6111D-LF_ETC VERTICAL Detector : Peak Project : 032014</p>



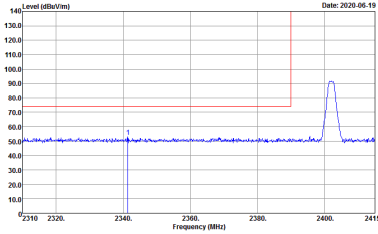
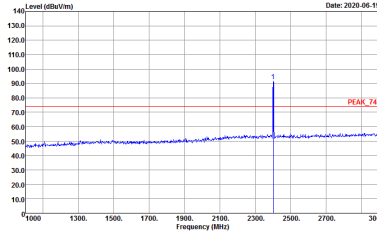
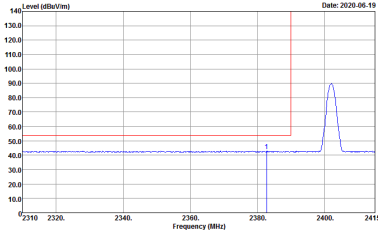
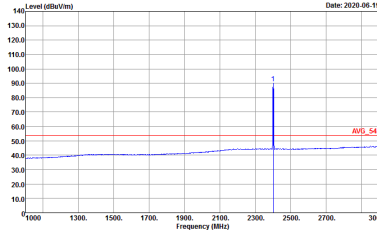
<2Mbps>

2.4GHz 2400~2483.5MHz

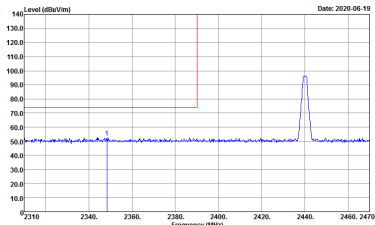
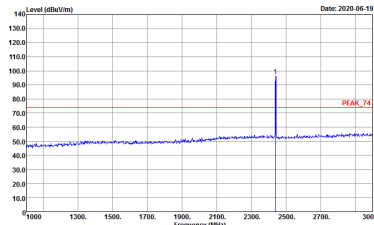
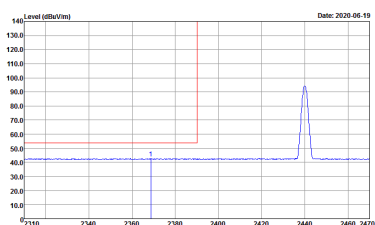
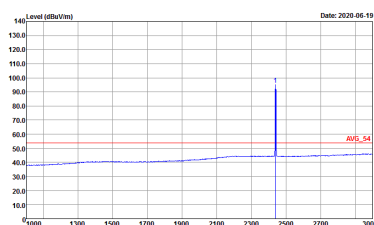
BLE (Band Edge @ 3m)

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH00 2402MHz	
	Horizontal	Fundamental
Peak	 <p>Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 032014</p>	 <p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 032014</p>
Avg.	 <p>Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 032014</p>	 <p>Site : 03CH11-HY Condition : AVG_54 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 032014</p>

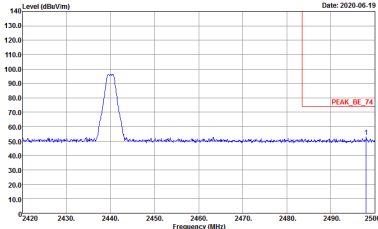
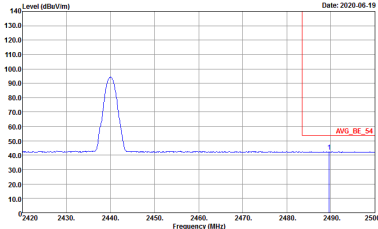


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH00 2402MHz		
	Vertical	Fundamental
Peak	 <p>Site : 03CH11-HY            Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL            RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Site : 03CH11-HY            Condition : PEAK_74 3m HORN 91200-HF VERTICAL            RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>
Avg	 <p>Site : 03CH11-HY            Condition : AVG_BE_54 3m HORN 91200-HF VERTICAL            RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Site : 03CH11-HY            Condition : AVG_54 3m HORN 91200-HF VERTICAL            RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014</p>



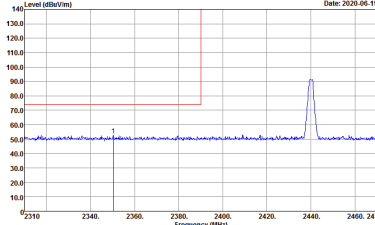
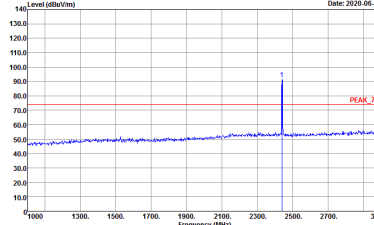
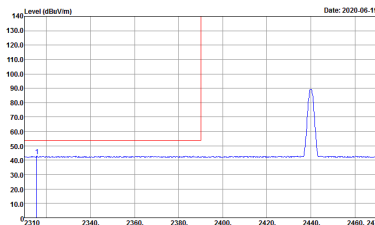
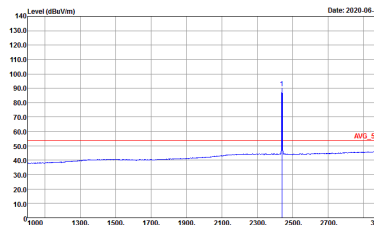
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH19 2440MHz - L		
	Horizontal	Fundamental
Peak	 <p>           Site : 03CH11-HY            Condition : PEAK_BE_74 3m HORN 9120D-HF HORIZONTAL            RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014         </p>	 <p>           Site : 03CH11-HY            Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL            RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014         </p>
Avg.	 <p>           Site : 03CH11-HY            Condition : AVG_BE_54 3m HORN 9120D-HF HORIZONTAL            RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014         </p>	 <p>           Site : 03CH11-HY            Condition : AVG_54 3m HORN 9120D-HF HORIZONTAL            RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014         </p>



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH19 2440MHz - R		
	Horizontal	Fundamental
<p><b>Peak</b></p>	 <p>Site : 03CH11-HY            Condition : PEAK_BE_74 3m HORN 91200-HF HORIZONTAL            RBW:1000.000KHz VBW:3000.000KHz SWF:Auto            Detector : Peak            Project : 032014</p>	<p>Left blank</p>
<p><b>Avg.</b></p>	 <p>Site : 03CH11-HY            Condition : AVG_BE_54 3m HORN 91200-HF HORIZONTAL            RBW:1000.000KHz VBW:1.000KHz SWF:Auto            Detector : Peak            Project : 032014</p>	<p>Left blank</p>



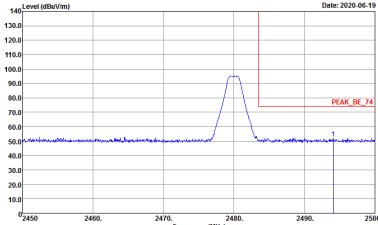
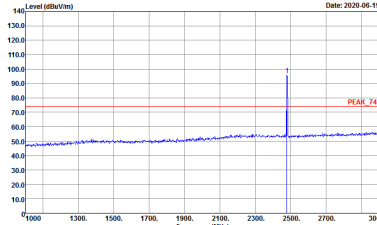
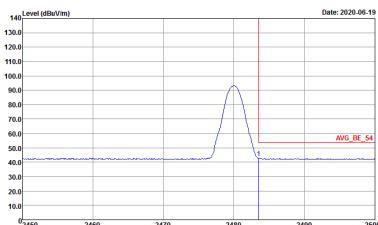
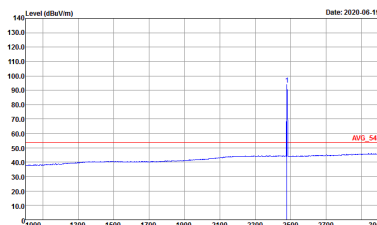


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH19 2440MHz - L		
	Vertical	Fundamental
Peak	 <p>Level (dBuV/m) vs Frequency (MHz) plot showing a peak at 2440 MHz. The y-axis ranges from 10.0 to 140.0 dBuV/m, and the x-axis ranges from 2310 to 2470 MHz. A red horizontal line is drawn at approximately 70 dBuV/m.</p> <p>Site : 03CH11-HY            Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL            : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Level (dBuV/m) vs Frequency (MHz) plot showing a peak at 2440 MHz. The y-axis ranges from 10.0 to 140.0 dBuV/m, and the x-axis ranges from 1000 to 3000 MHz. A red horizontal line is drawn at approximately 70 dBuV/m.</p> <p>Site : 03CH11-HY            Condition : PEAK_74 3m HORN 91200-HF VERTICAL            : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>
Avg.	 <p>Level (dBuV/m) vs Frequency (MHz) plot showing an average level at 2440 MHz. The y-axis ranges from 10.0 to 140.0 dBuV/m, and the x-axis ranges from 2310 to 2470 MHz. A red horizontal line is drawn at approximately 55 dBuV/m.</p> <p>Site : 03CH11-HY            Condition : AVG_BE_54 3m HORN 91200-HF VERTICAL            : RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Level (dBuV/m) vs Frequency (MHz) plot showing an average level at 2440 MHz. The y-axis ranges from 10.0 to 140.0 dBuV/m, and the x-axis ranges from 1000 to 3000 MHz. A red horizontal line is drawn at approximately 55 dBuV/m.</p> <p>Site : 03CH11-HY            Condition : AVG_54 3m HORN 91200-HF VERTICAL            : RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014</p>

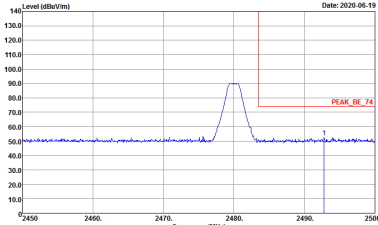
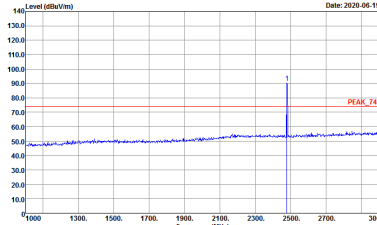
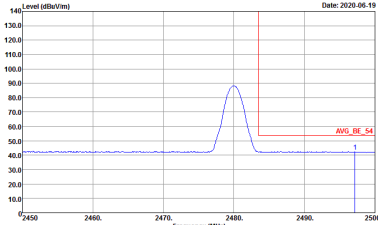
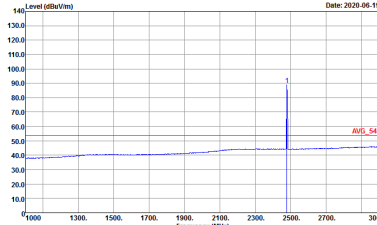


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - R	
	Vertical	Fundamental
Peak	<p>Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWF:Auto Detector : Peak Project : 032014</p>	Left blank
Avg.	<p>Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:1.000KHz SWF:Auto Detector : Peak Project : 032014</p>	Left blank



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH39 2480MHz		
	Horizontal	Fundamental
Peak	 <p>Site : 03CH11-HY            Condition : PEAK_BE_74 3m HORN 91200-HF HORIZONTAL            RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Site : 03CH11-HY            Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL            RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>
Avg.	 <p>Site : 03CH11-HY            Condition : AVG_BE_54 3m HORN 91200-HF HORIZONTAL            RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Site : 03CH11-HY            Condition : AVG_54 3m HORN 91200-HF HORIZONTAL            RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014</p>



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH39 2480MHz		
	Vertical	Fundamental
Peak	 <p>Date: 2020-06-19</p> <p>Site : 03CH11-HY            Condition : PEAK_BE_74 3m HORN 91200-HF VERTICAL            RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Date: 2020-06-19</p> <p>Site : 03CH11-HY            Condition : PEAK_74 3m HORN 91200-HF VERTICAL            RBW:1000.000KHz VBW:3000.000KHz SWT:Auto            Detector : Peak            Project : 032014</p>
Avg.	 <p>Date: 2020-06-19</p> <p>Site : 03CH11-HY            Condition : AVG_BE_54 3m HORN 91200-HF VERTICAL            RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014</p>	 <p>Date: 2020-06-19</p> <p>Site : 03CH11-HY            Condition : AVG_54 3m HORN 91200-HF VERTICAL            RBW:1000.000KHz VBW:1000KHz SWT:Auto            Detector : Peak            Project : 032014</p>



2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH00 2402MHz	
	Horizontal	Vertical
<b>Peak</b> <b>Avg.</b>	<p>Site : 03CH11-1FY Condition : PEAK_74 3m HORN 91200-1HF HORIZONTAL Detector : Peak Project : 032014</p>	<p>Site : 03CH11-1FY Condition : PEAK_74 3m HORN 91200-1HF VERTICAL Detector : Peak Project : 032014</p>



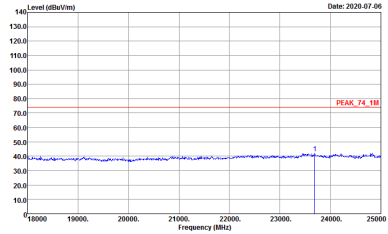
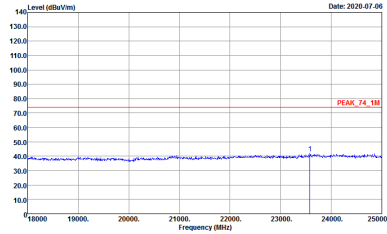
BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH19 2440MHz	
	Horizontal	Vertical
<b>Peak</b> <b>Avg.</b>	<p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 032014</p>	<p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF VERTICAL Detector : Peak Project : 032014</p>



BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH39 2480MHz	
	Horizontal	Vertical
Peak	<p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 032014</p>	<p>Site : 03CH11-HY Condition : PEAK_74 3m HORN 91200-HF VERTICAL Detector : Peak Project : 032014</p>



Emission above 18GHz  
2.4GHz BLE (SHF)

BLE	2.4GHz 2400~2483.5MHz	
	BLE SHF	
	Horizontal	Vertical
QP / Peak	 <p>Site : 03CH11-FY Condition : PEAK_74_1M 1m SHF HORN BBHA9170576 HORIZONTAL Project : 032014</p>	 <p>Site : 03CH11-FY Condition : PEAK_74_1M 1m SHF HORN BBHA9170576 VERTICAL Project : 032014</p>





Emission below 1GHz
2.4GHz BLE (LF)

Table with 2 columns: Horizontal and Vertical. Each column contains a spectral plot of Level (dBuV/m) vs Frequency (MHz) for 2.4GHz BLE LF. The plots show a blue signal line and a red stepped limit line. Metadata includes Site: 03CH11-FY, Condition: QP 3m BT-LOG 6111D-LF\_ETC, Detector: Peak, Project: 032014.

QP / Peak



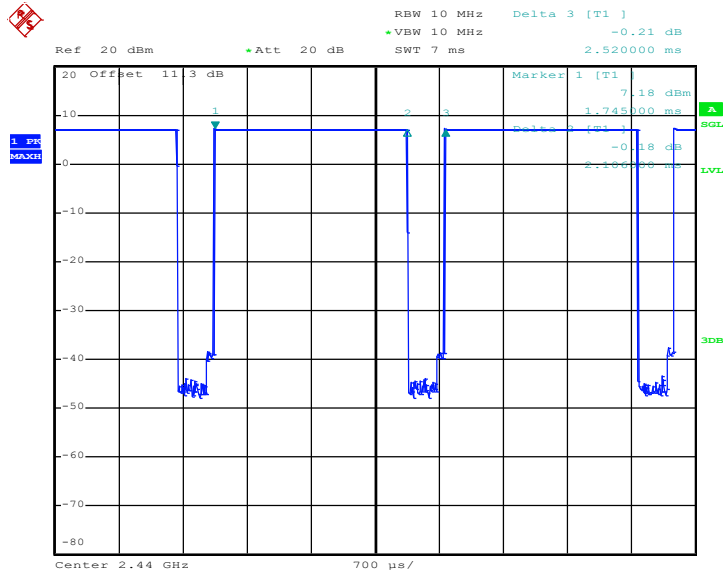
## Appendix E. Duty Cycle Plots

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
Bluetooth –LE for 1Mbps	83.57	2106	0.47	1kHz	0.78
Bluetooth –LE for 2Mbps	56.50	1065	0.94	1kHz	2.48



<For 1Mbps>

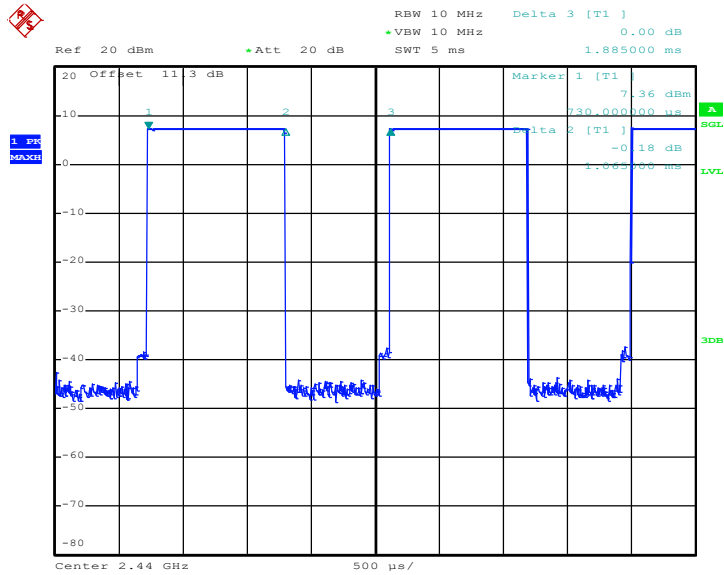
Bluetooth - LE



Date: 27.MAY.2020 11:34:59

<For 2Mbps>

Bluetooth - LE



Date: 27.MAY.2020 11:32:11

—THE END—