



# FCC RADIO TEST REPORT

**FCC ID** : TTUBEOPLAYEXR  
**Equipment** : Bluetooth Earphone  
**Brand Name** : Bang & Olufsen  
**Model Name** : EX Earbud R  
**Applicant** : Bang & Olufsen A/S  
Bang og Olufsen Allé 1, 7600 Struer, Denmark  
**Manufacturer** : Bang & Olufsen A/S  
Bang og Olufsen Allé 1, 7600 Struer, Denmark  
**Standard** : FCC Part 15 Subpart C §15.247

The product was received on Aug. 02, 2021 and testing was started from Aug. 11, 2021 and completed on Aug. 26, 2021. 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.

Approved by: Louis Wu

**Sporton International Inc. EMC & Wireless Communications Laboratory**

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)



# Table of Contents

**History of this test report..... 3**

**Summary of Test Result..... 4**

**1 General Description..... 5**

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

    1.2 Modification of EUT ..... 5

    1.3 Testing Location ..... 6

    1.4 Applicable Standards..... 6

**2 Test Configuration of Equipment Under Test ..... 7**

    2.1 Carrier Frequency Channel ..... 7

    2.2 Test Mode..... 8

    2.3 Connection Diagram of Test System..... 9

    2.4 EUT Operation Test Setup ..... 9

    2.5 Measurement Results Explanation Example..... 9

**3 Test Result..... 10**

    3.1 6dB and 99% Bandwidth Measurement ..... 10

    3.2 Output Power Measurement..... 15

    3.3 Power Spectral Density Measurement ..... 16

    3.4 Conducted Band Edges and Spurious Emission Measurement ..... 21

    3.5 Radiated Band Edges and Spurious Emission Measurement ..... 27

    3.6 Antenna Requirements ..... 31

**4 List of Measuring Equipment ..... 32**

**5 Uncertainty of Evaluation..... 33**

**Appendix A. Conducted Test Results**

**Appendix B. Radiated Spurious Emission**

**Appendix C. Radiated Spurious Emission Plots**

**Appendix D. Duty Cycle Plots**

**Appendix E. Setup Photographs**



### History of this test report

Report No.	Version	Description	Issued Date
FR180215-01B	01	Initial issue of report	Feb. 21, 2022
FR180215-01B	02	1. Revise description in section 3.2 2. Revise appendix A and C	Mar. 02, 2022



## 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 5.07 dB at 2483.520 MHz
-	15.207	AC Conducted Emission	Not Required	-
3.6	15.203 & 15.247(b)	Antenna Requirement	Pass	-

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

**Declaration of Conformity:**

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

**Comments and Explanations:**

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

**Reviewed by: Lewis Ho**

**Report Producer: Vivian Hsu**

# 1 General Description

## 1.1 Product Feature of Equipment Under Test

Bluetooth

Product Specification subjective to this standard	
Sample 1	TI Sensor (DRV5032AJDMRR)
Sample 2	ABLIC Sensor (S-5716ANSL3-I4T1U)
Sample 3	ABLIC Sensor (S-5716ACDL3-I4T1U)
Sample 4	Rohm Sensor (BU52095GWZ-E2)
Antenna Type	monopole Antenna

Antenna information		
2400 MHz ~ 2483.5 MHz	Peak Gain (dBi)	-2.2

**Remark:** The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.

Specification of Accessory		
Battery 1	Brand Name	Varta
	Model Name	CP1254 A4
Battery 2	Brand Name	VDL
	Model Name	ZJ1254H
USB Cable 1	Brand Name	Bang & Olufsen
	Model Name	BHC568
	Manufacturer	Mingji
USB Cable 2	Brand Name	Bang & Olufsen
	Model Name	BHC568
	Manufacturer	Perfect Cable
Bluetooth Earphone (L)	Brand Name	Bang & Olufsen
	Model Name	EX Earbud L
Charging Case	Brand Name	Bang & Olufsen
	Model Name	EX Charging case

## 1.2 Modification of EUT

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



### 1.3 Testing Location

<b>Test Site</b>	Sporton International Inc. EMC & Wireless Communications Laboratory
<b>Test Site Location</b>	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
<b>Test Site No.</b>	<b>Sporton Site No.</b>
	TH02-HY, 03CH07-HY

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

FCC designation No.: TW1190

### 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

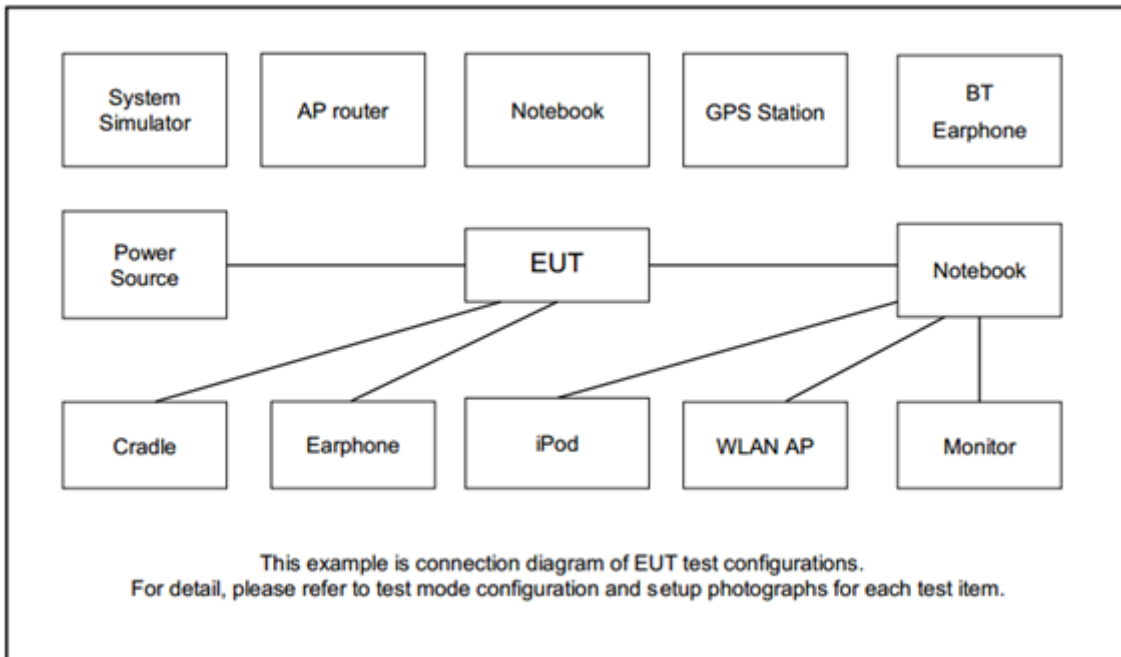
- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). The measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and find Z plane as worst plane.

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
<b>Conducted Test Cases</b>	<b>Bluetooth – LE / GFSK</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>	<b>&lt;Sample 1 with Battery 1&gt;</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>&lt;Sample 1 with Battery 2&gt;</b>	
Mode 1: Bluetooth Tx CH39_2480 MHz_2Mbps	



## 2.3 Connection Diagram of Test System



## 2.4 EUT Operation Test Setup

The RF test items, utility “Blue Test V\_3.3.2” 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.

## 2.5 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss 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 10 dB 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 the maximum power setting and enable the EUT to 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 6dB 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

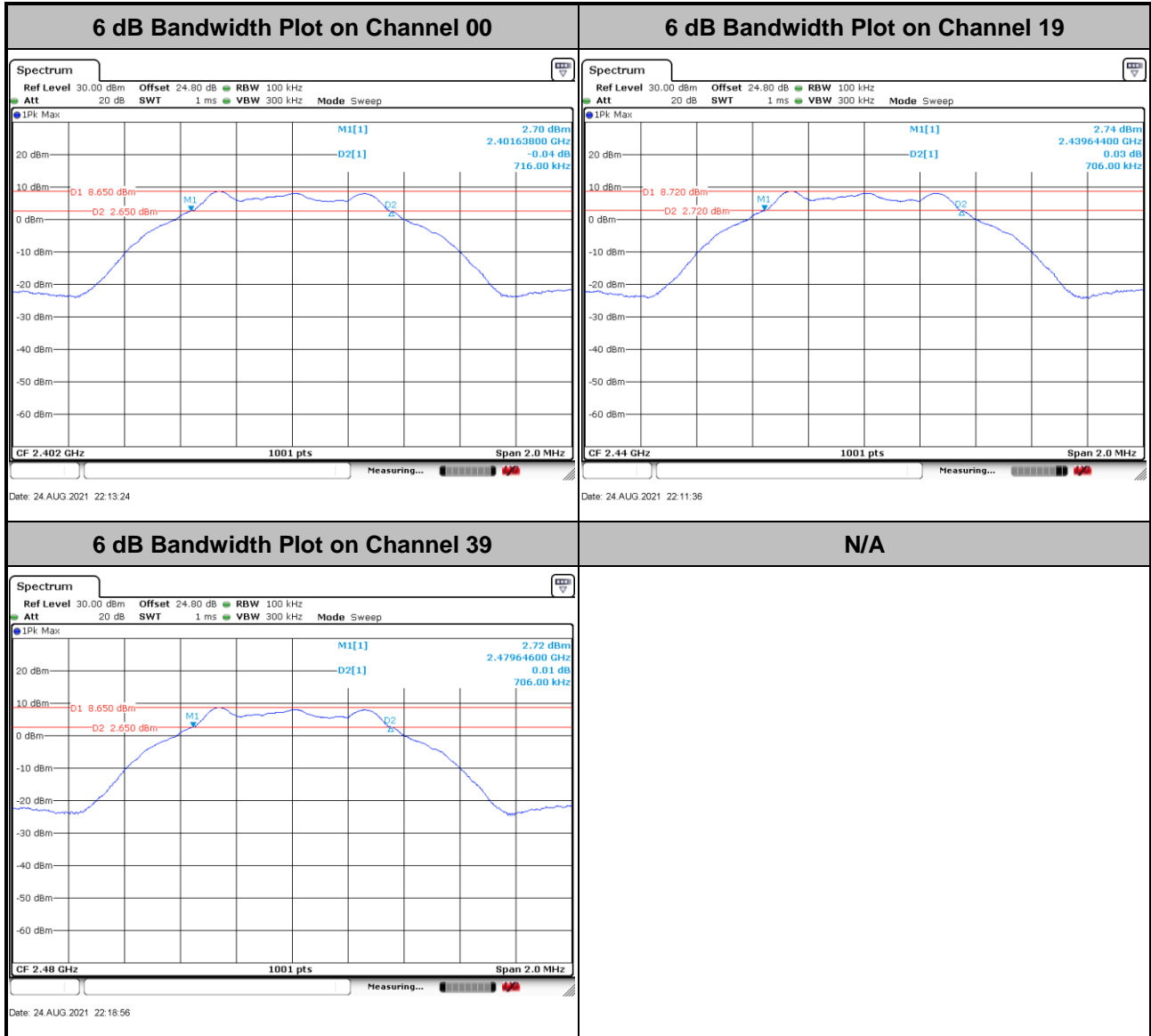




### 3.1.5 Test Result of 6dB Bandwidth

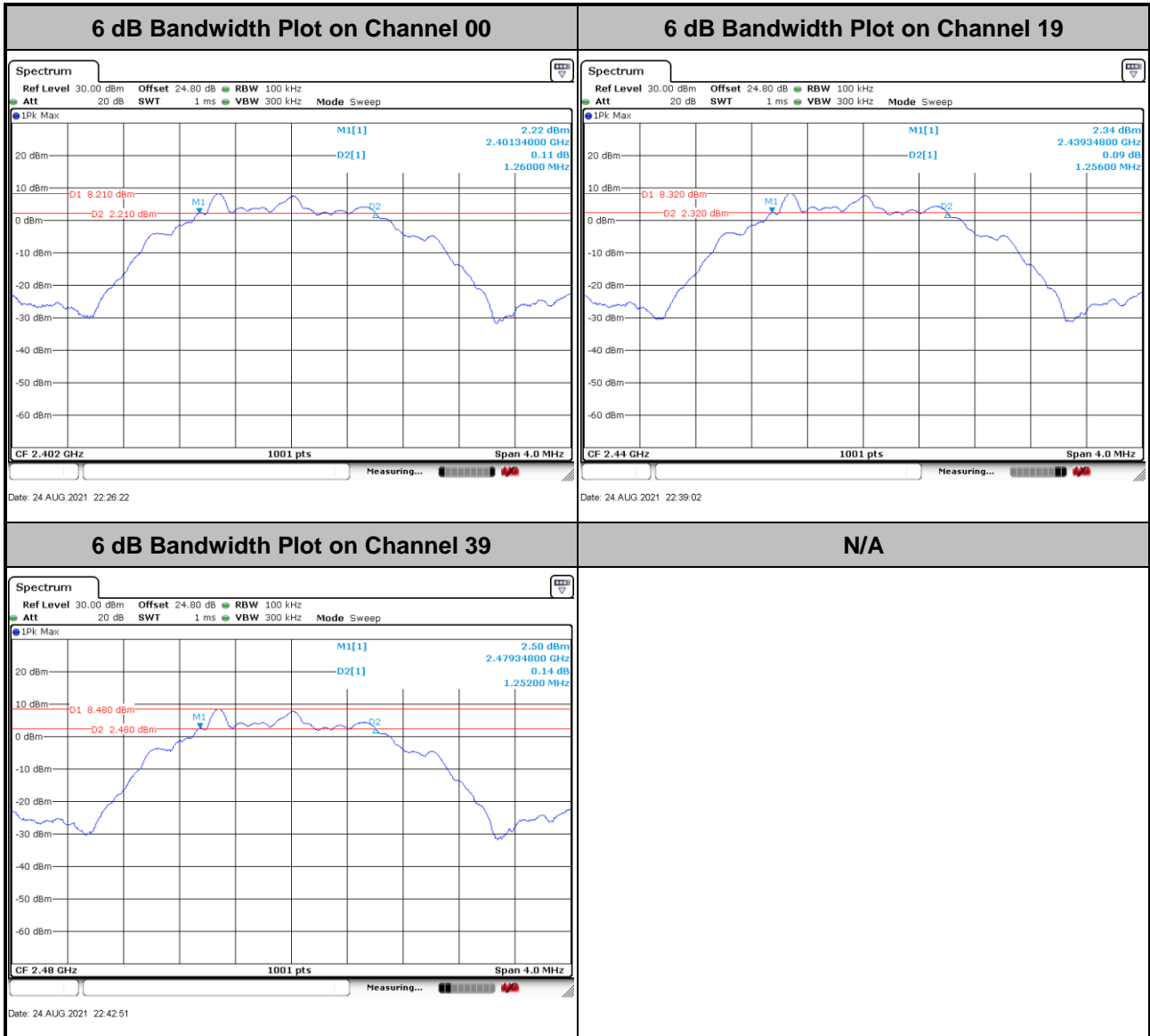
Please refer to Appendix A.

<1Mbps>





<2Mbps>

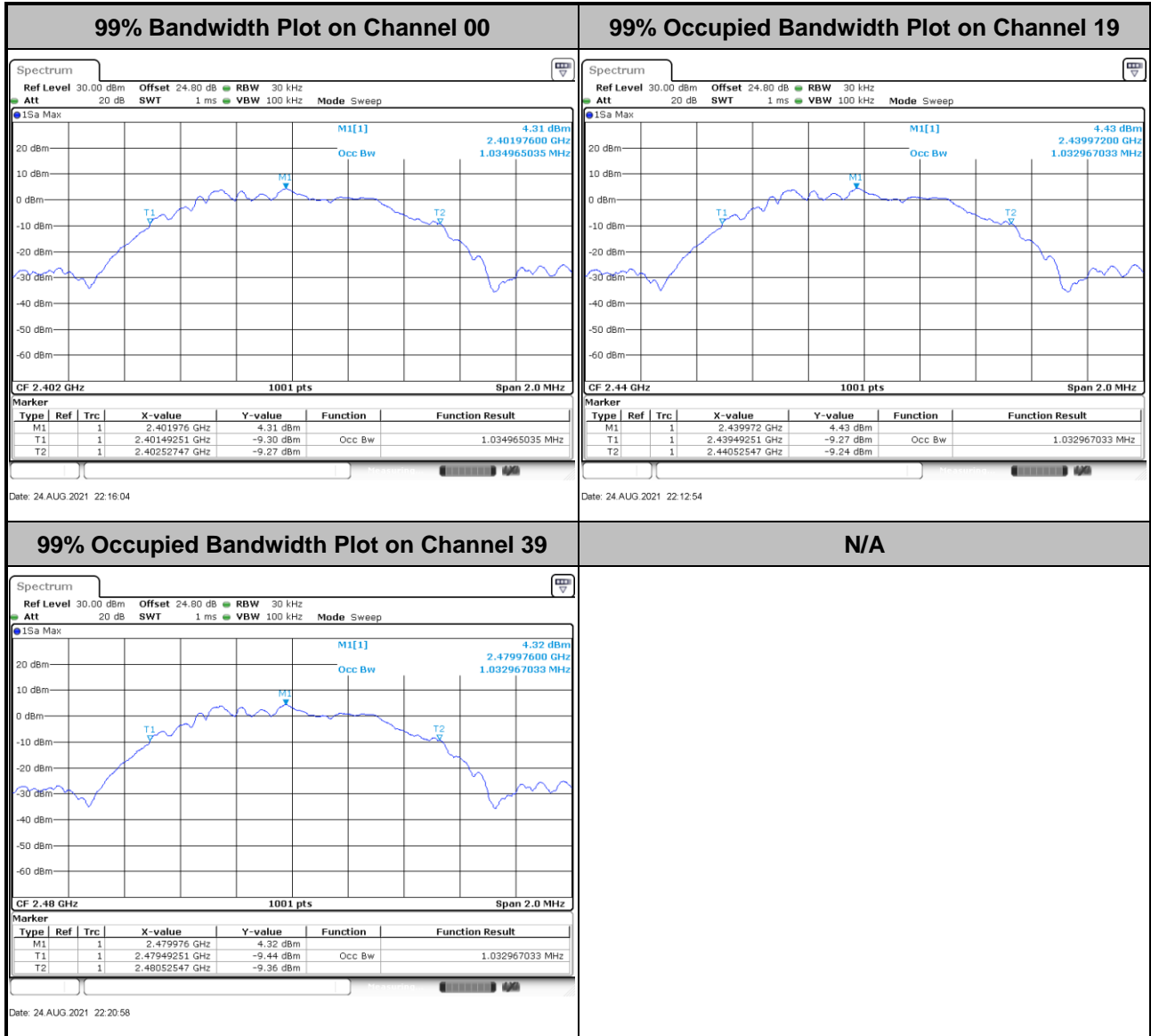




### 3.1.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

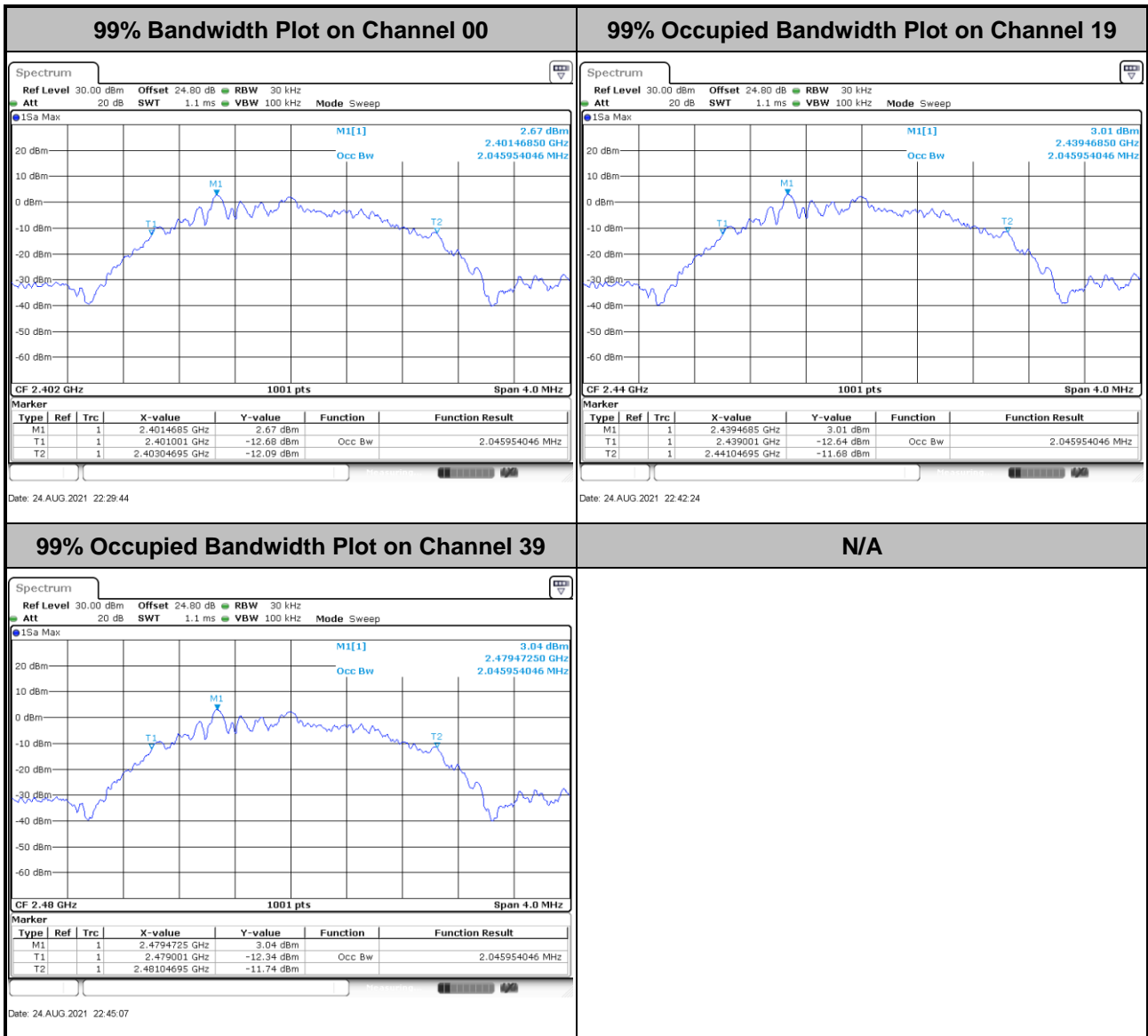
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Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.



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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 2400-2483.5 MHz, the limit for output power is 30 dBm. If transmitting antenna of directional gain greater than 6 dBi 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 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

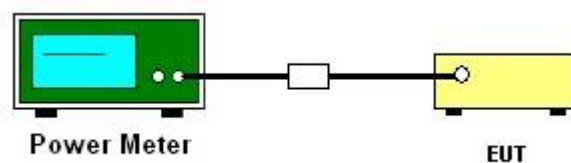
### 3.2.2 Measuring Instruments

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 the maximum power setting and enable the EUT to 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 8 dBm in any 3 kHz 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 the maximum power setting and enable the EUT to 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)/ 100 kHz is a reference level and is used as 20 dBc 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

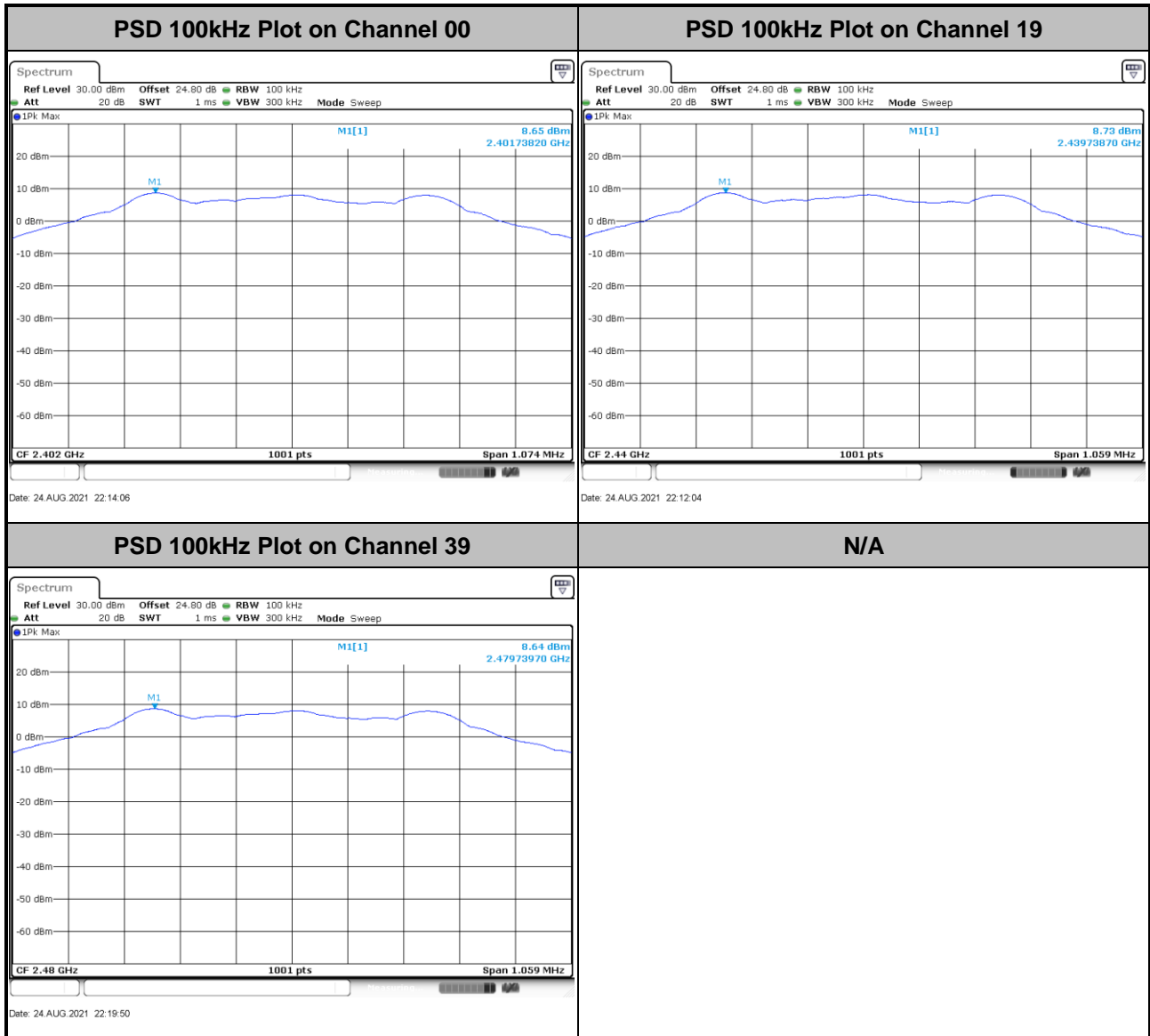
Please refer to Appendix A.





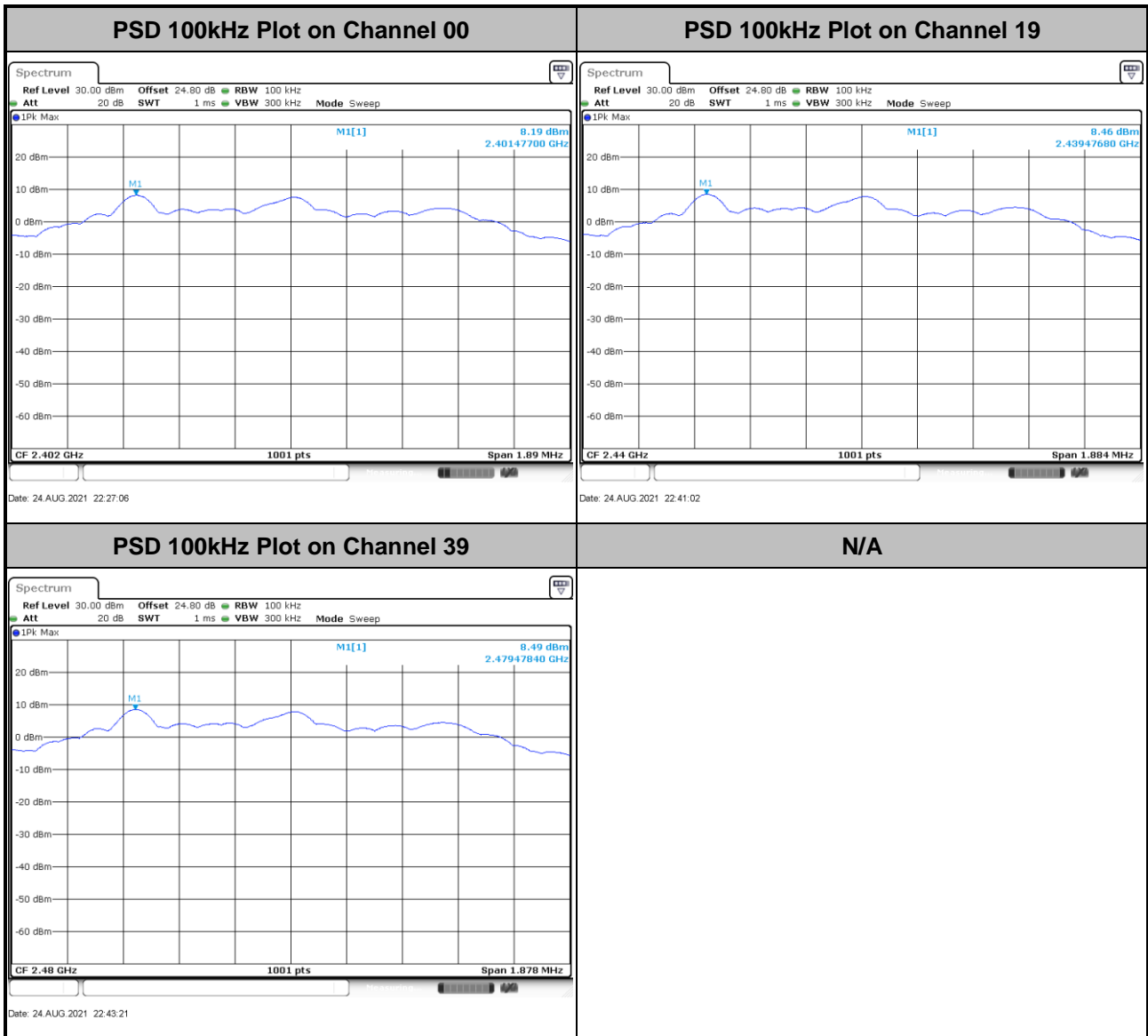
### 3.3.6 Test Result of Power Spectral Density Plots (100kHz)

<1Mbps>





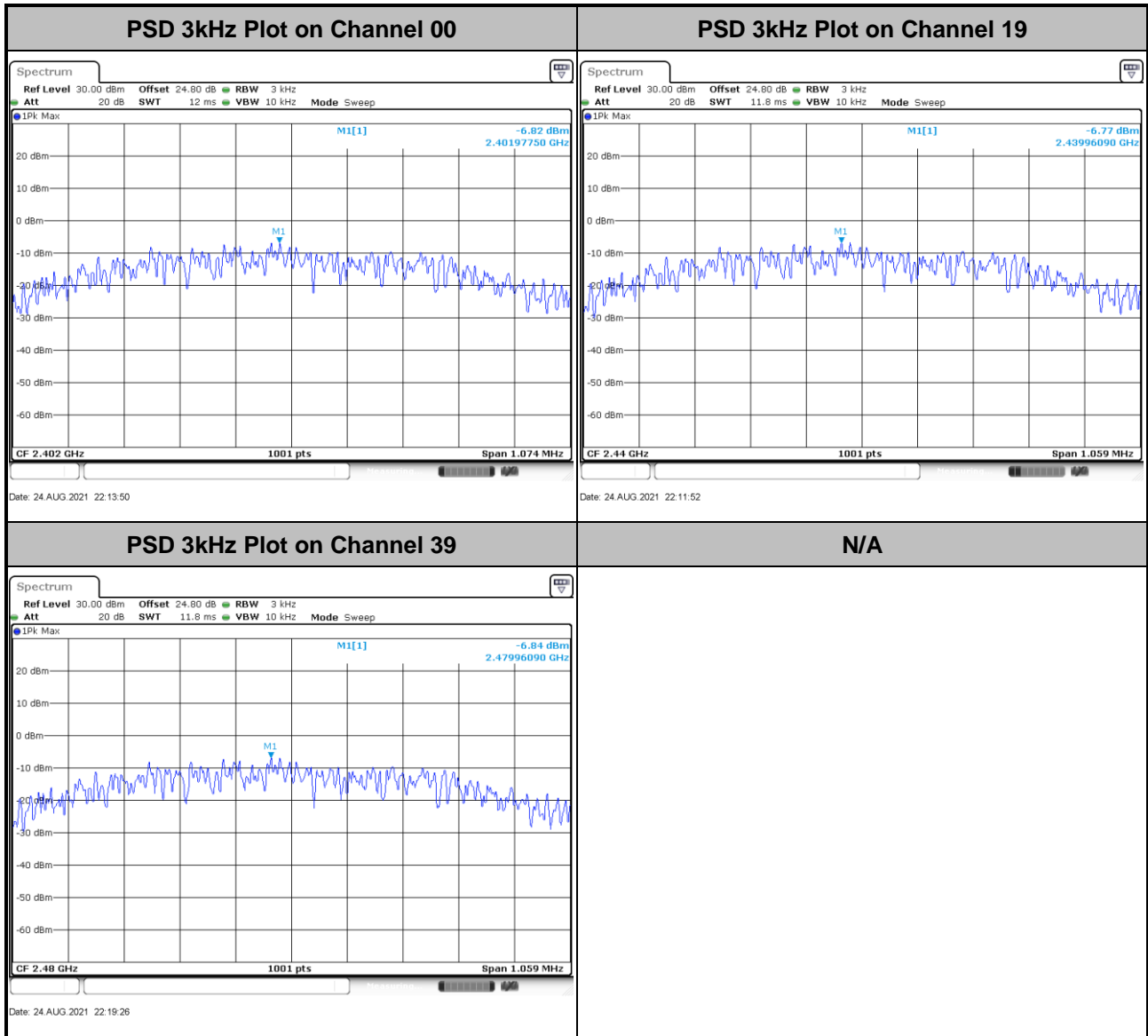
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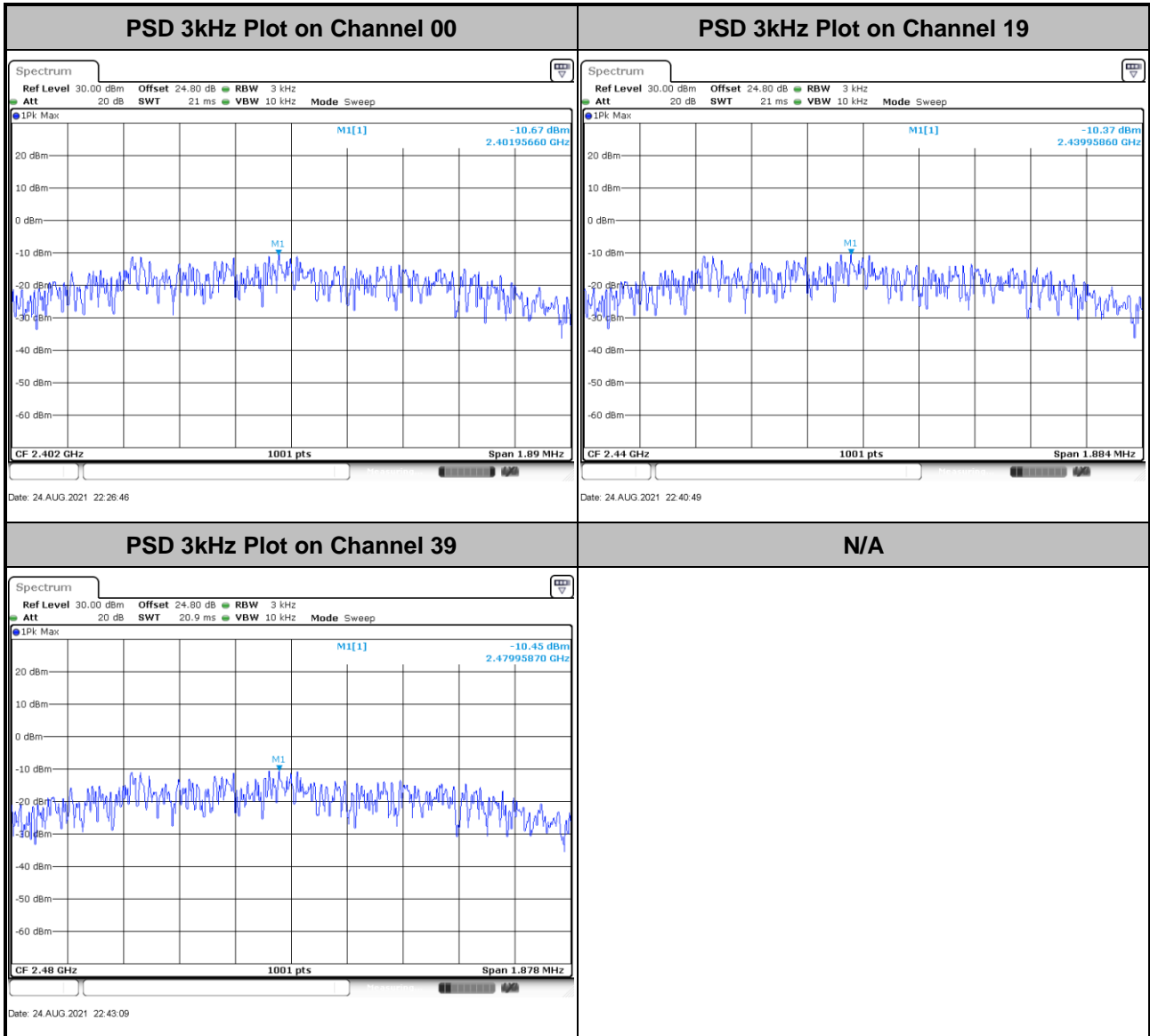
### 3.3.7 Test Result of Power Spectral Density Plots (3kHz)

<1Mbps>





<2Mbps>



## 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 the maximum power setting and enable the EUT to 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.

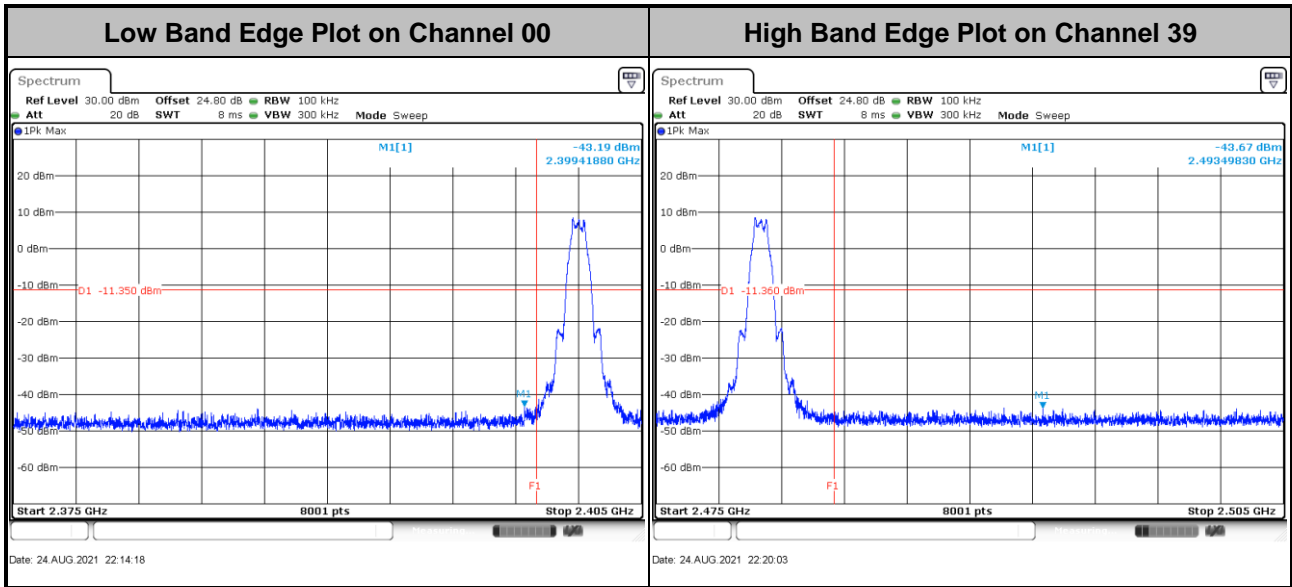
### 3.4.4 Test Setup



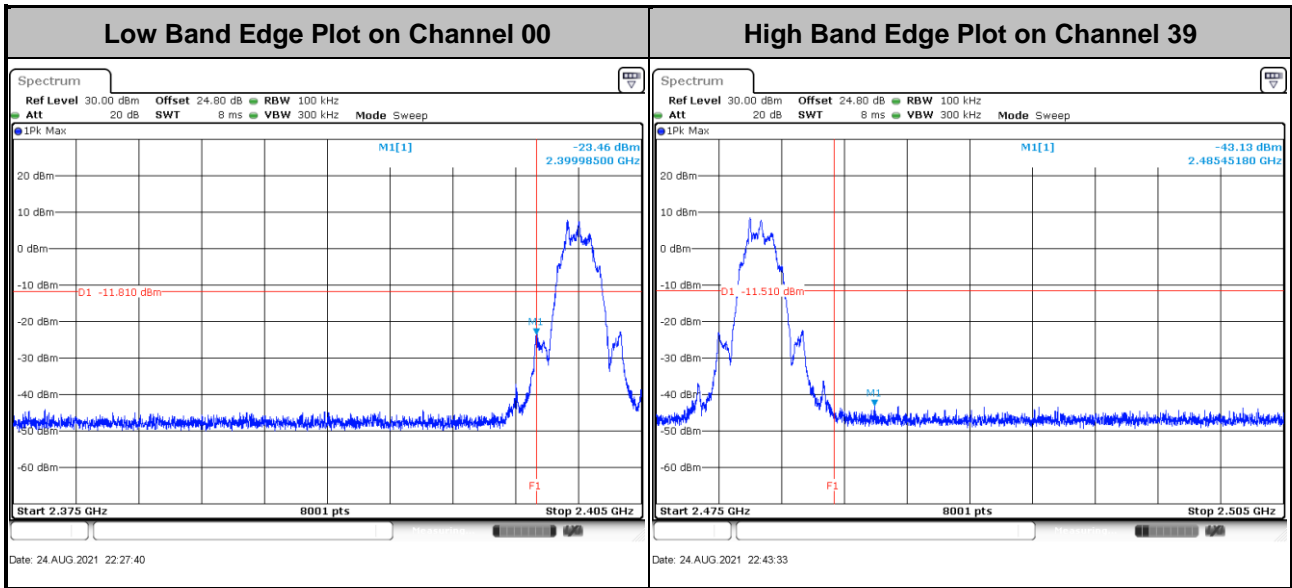


### 3.4.5 Test Result of Conducted Band Edges Plots

<1Mbps>



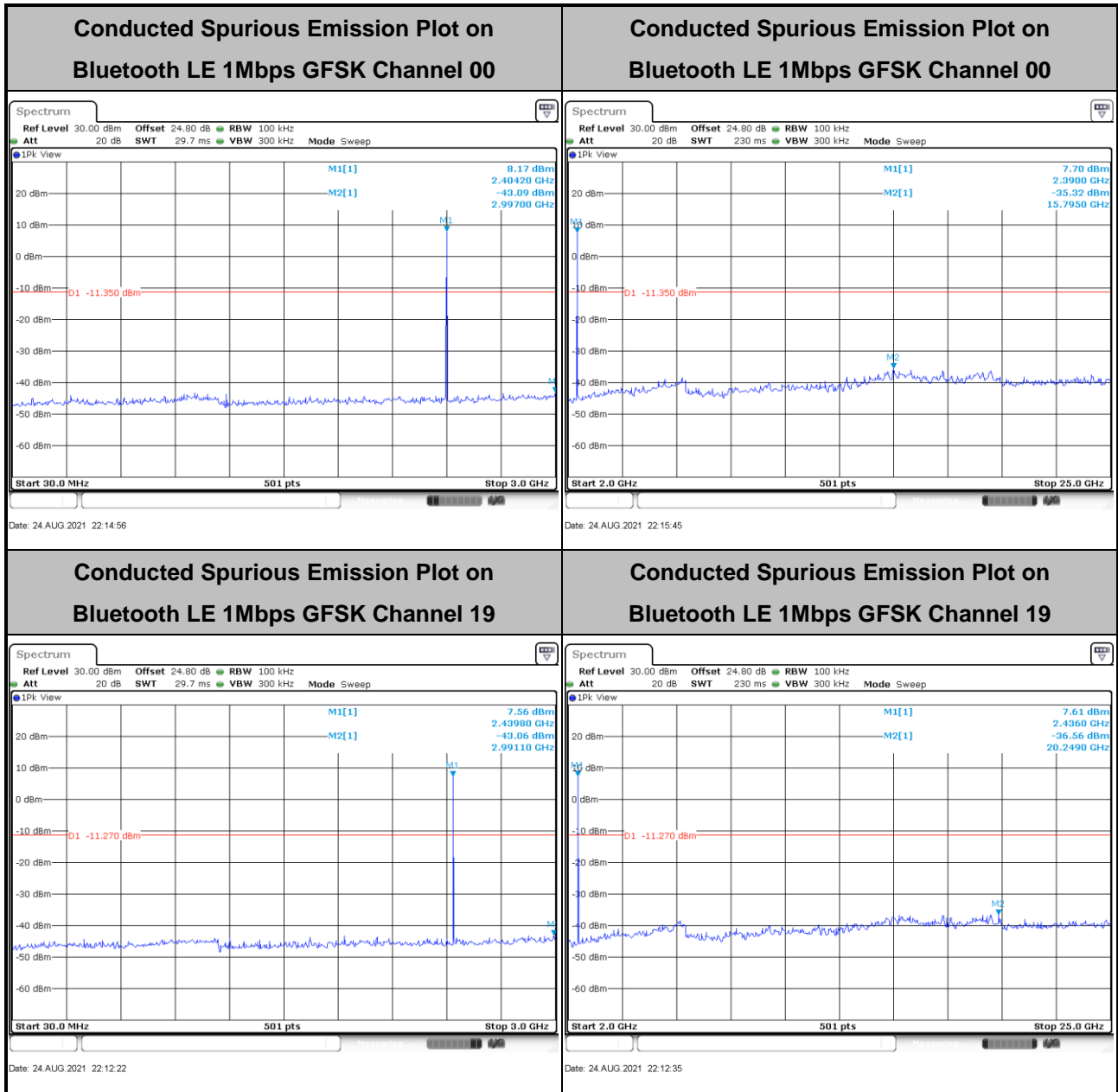
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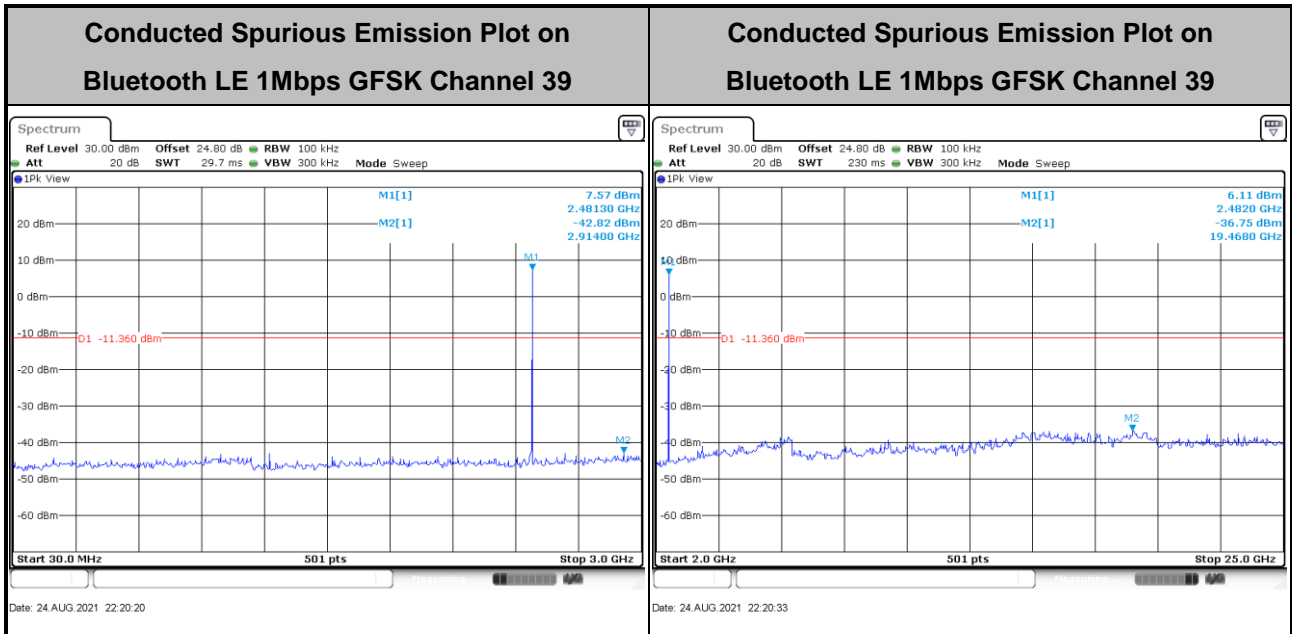




### 3.4.6 Test Result of Conducted Spurious Emission Plots

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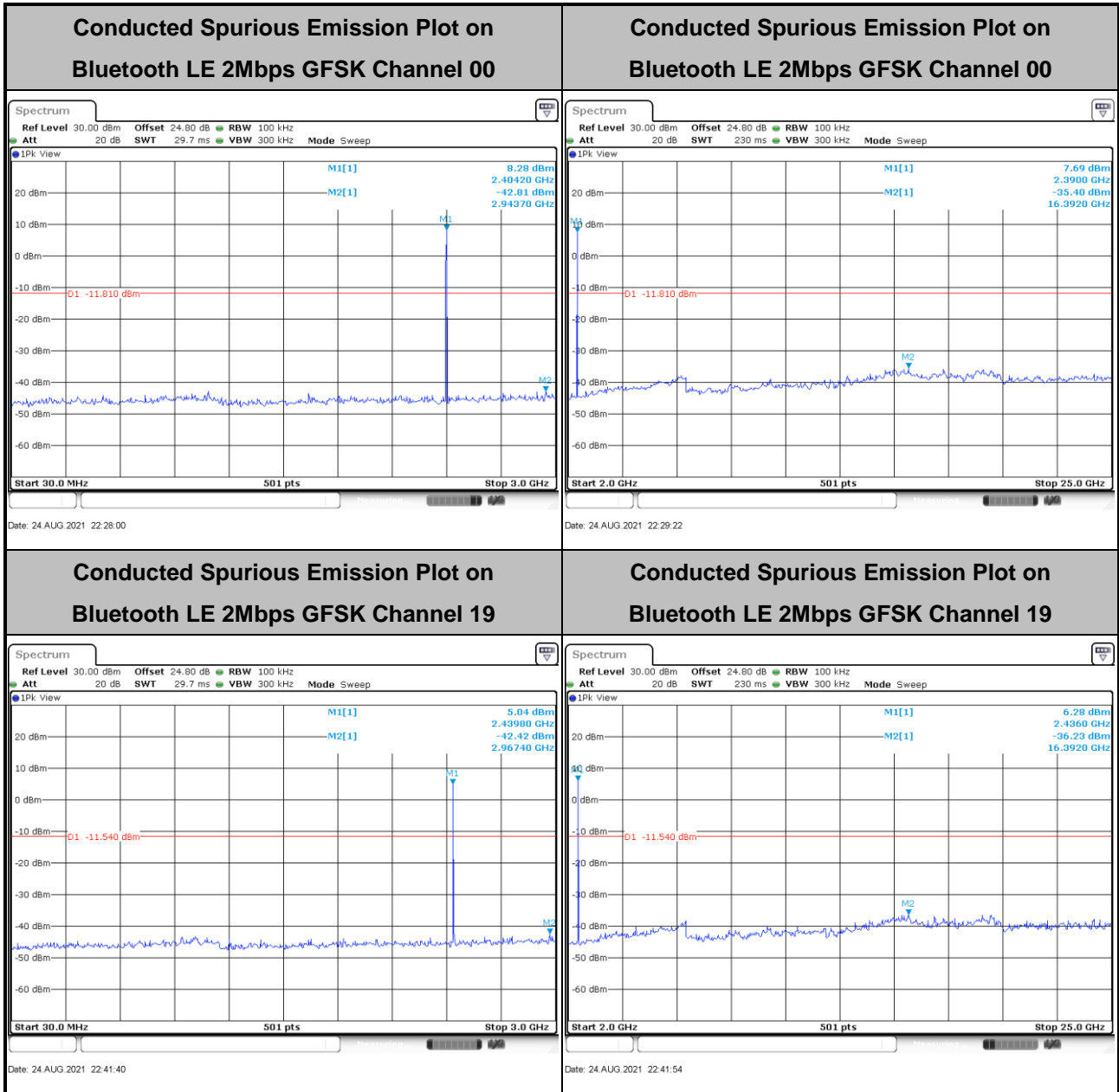


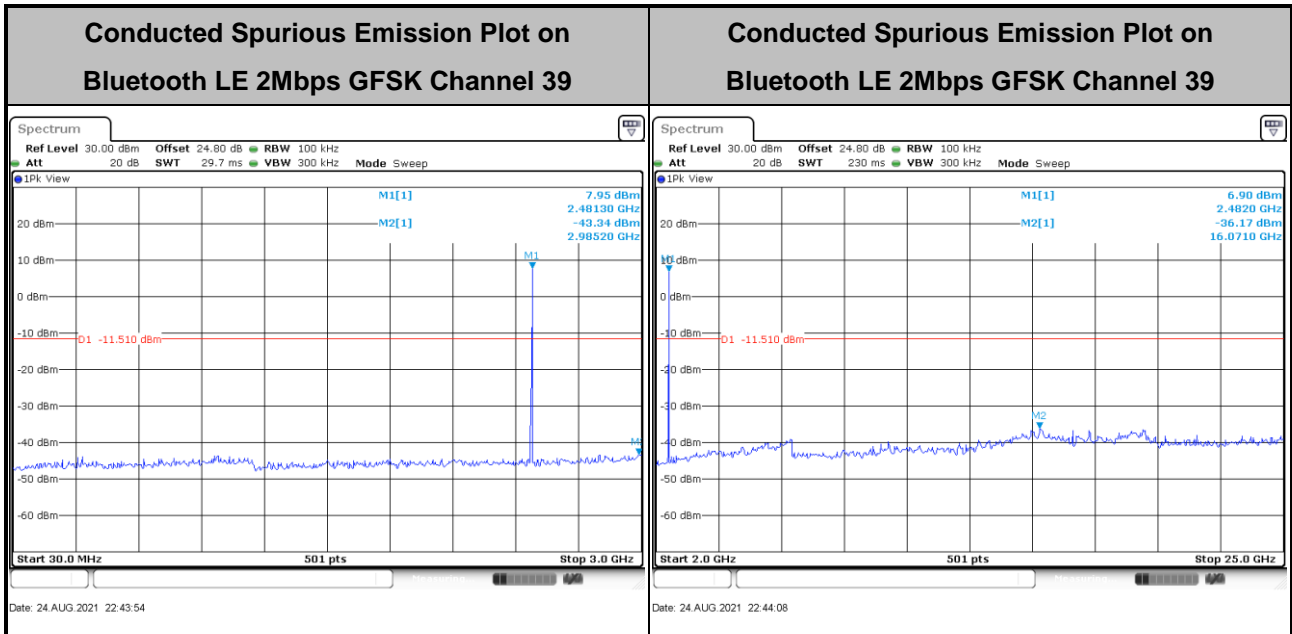






<2Mbps>







### 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.

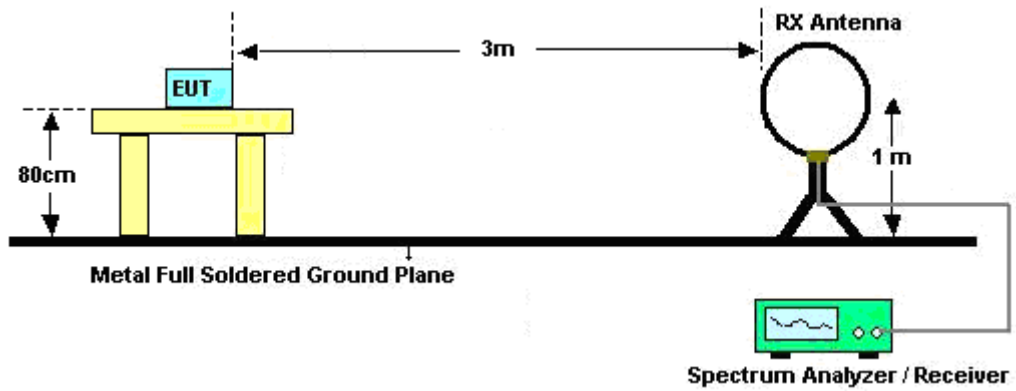


### 3.5.3 Test Procedures

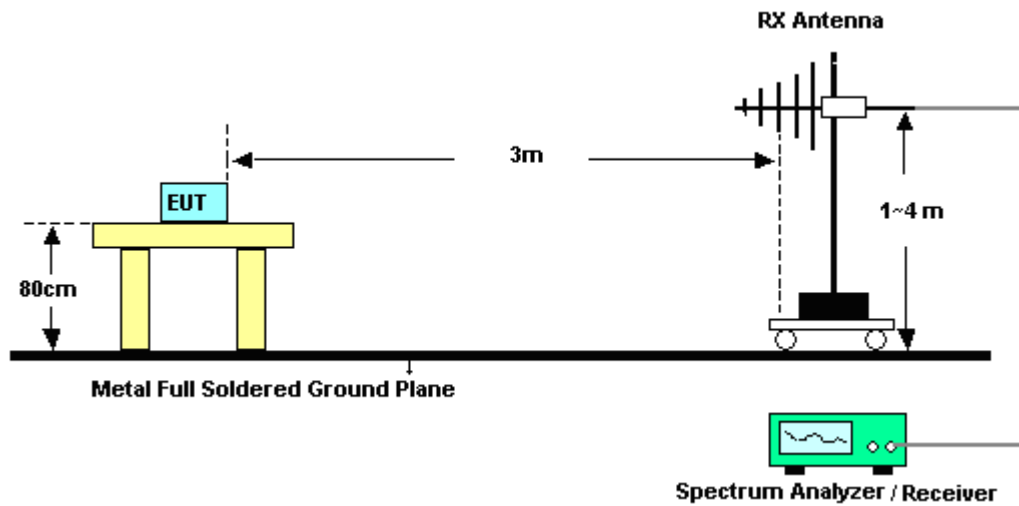
1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz 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. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as “-“.
7. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as “-“.
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,  $VBW = 3$  MHz 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

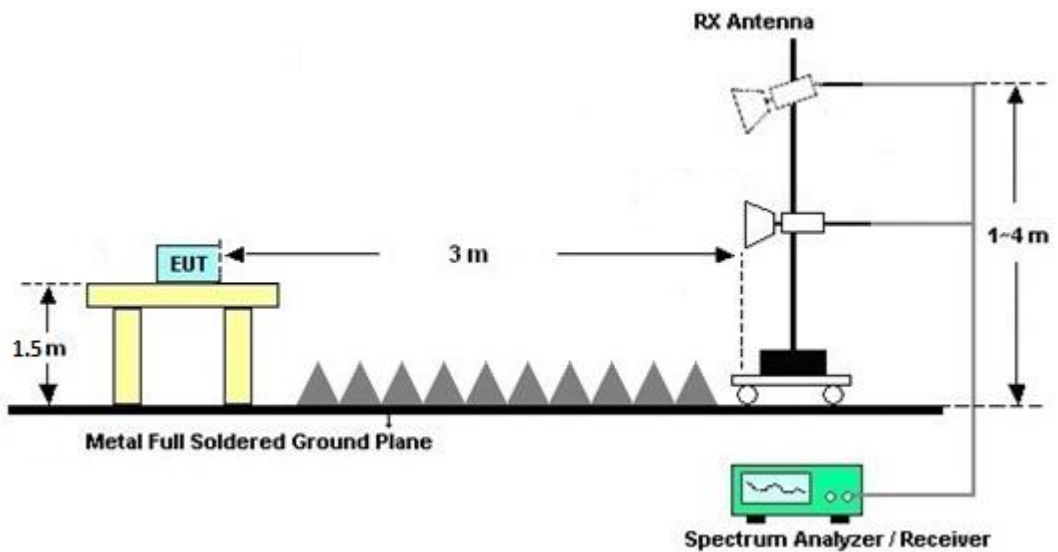
For radiated test below 30MHz



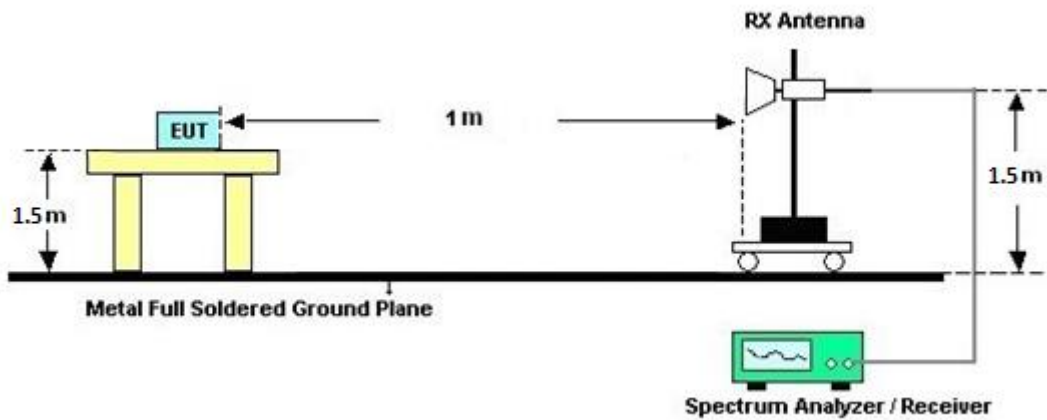
For radiated test from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test 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 adequate comparison measurement 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 B and C.

### 3.5.7 Duty Cycle

Please refer to Appendix D.

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

Please refer to Appendix B and C.



## **3.6 Antenna Requirements**

### **3.6.1 Standard Applicable**

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

### **3.6.2 Antenna Anti-Replacement Construction**

An embedded-in antenna design is used.

### **3.6.3 Antenna Gain**

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



## 4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N-06	35419 & 03	30MHz~1GHz	Apr. 28, 2021	Aug. 20, 2021~ Aug. 26, 2021	Apr. 27, 2022	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Dec. 01, 2020	Aug. 20, 2021~ Aug. 26, 2021	Nov. 30, 2021	Radiation (03CH07-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jan. 04, 2021	Aug. 20, 2021~ Aug. 26, 2021	Jan. 03, 2022	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	1590075	1GHz~18GHz	Apr. 22, 2021	Aug. 20, 2021~ Aug. 26, 2021	Apr. 21, 2022	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz~1GHz	May 18, 2021	Aug. 20, 2021~ Aug. 26, 2021	May 17, 2022	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A02362	1GHz~26.5GHz	Oct. 31, 2020	Aug. 20, 2021~ Aug. 26, 2021	Oct. 30, 2021	Radiation (03CH07-HY)
Preamplifier	EMEC	EM18G40G	0600789	18-40GHz	Jul. 23, 2021	Aug. 20, 2021~ Aug. 26, 2021	Jul. 22, 2022	Radiation (03CH07-HY)
Spectrum Analyzer	Agilent	N9030A	MY52350276	3Hz~44GHz	Jul. 22, 2021	Aug. 20, 2021~ Aug. 26, 2021	Jul. 21, 2022	Radiation (03CH07-HY)
Filter	Microwave	H1G013G1	SN477215	1GHz High Pass Filter	Oct. 31, 2020	Aug. 20, 2021~ Aug. 26, 2021	Oct. 30, 2021	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY15682-4	30MHz to 18GHz	Feb. 24, 2021	Aug. 20, 2021~ Aug. 26, 2021	Feb. 23, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24971-4	9kHz to 18GHz	Feb. 24, 2021	Aug. 20, 2021~ Aug. 26, 2021	Feb. 23, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY28655-4	9kHz to 18GHz	Feb. 24, 2021	Aug. 20, 2021~ Aug. 26, 2021	Feb. 23, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2858/2,80 1606/2	18GHz~40GHz	Feb. 24, 2021	Aug. 20, 2021~ Aug. 26, 2021	Feb. 23, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126	532078/126E	30MHz~18GHz	Sep. 18, 2020	Aug. 20, 2021~ Aug. 26, 2021	Sep. 17, 2021	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	801606/2	9KHz ~ 40GHz	Apr. 03, 2021	Aug. 20, 2021~ Aug. 26, 2021	Apr. 02, 2022	Radiation (03CH07-HY)
Controller	EMEC	EM1000	N/A	Control Ant Mast	Apr. 28, 2021	Aug. 20, 2021~ Aug. 26, 2021	Apr. 27, 2022	Radiation (03CH07-HY)
Controller	MF	MF-7802	N/A	Control Turn table	N/A	Aug. 20, 2021~ Aug. 26, 2021	N/A	Radiation (03CH07-HY)
Antenna Mast	EMEC	AM-BS-4500E	N/A	Boresight mast 1M~4M	Apr. 28, 2021	Aug. 20, 2021~ Aug. 26, 2021	Apr. 27, 2022	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	Aug. 20, 2021~ Aug. 26, 2021	N/A	Radiation (03CH07-HY)
Software	Audix	E3 6.2009-8-24	N/A	N/A	N/A	Aug. 20, 2021~ Aug. 26, 2021	N/A	Radiation (03CH07-HY)
USB Data Logger	TECPEL	TR-32	HE17XB2495	N/A	Mar. 09, 2021	Aug. 20, 2021~ Aug. 26, 2021	Mar. 08, 2022	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA917025 1	18GHz~40GHz	Dec. 02, 2020	Aug. 20, 2021~ Aug. 26, 2021	Dec. 01, 2021	Radiation (03CH07-HY)
Hygrometer	Testo	608-H1	34893241	N/A	Mar. 02, 2021	Aug. 11, 2021~ Aug. 24, 2021	Mar. 01, 2022	Conducted (TH02-HY)
Power Sensor	Agilent	E9327A	US40441548	50MHz~18GHz	Jan. 14, 2021	Aug. 11, 2021~ Aug. 24, 2021	Jan. 13, 2022	Conducted (TH02-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101397	10Hz~40GHz	Nov. 27, 2020	Aug. 11, 2021~ Aug. 24, 2021	Nov. 26, 2021	Conducted (TH02-HY)
Switch Box & RF Cable	EM Electronics	EMSW18SE	SW200302	N/A	Mar. 17, 2021	Aug. 11, 2021~ Aug. 24, 2021	Mar. 16, 2022	Conducted (TH02-HY)





## 5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	4.9 dB
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### Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	6.1 dB
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### Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	4.7 dB
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**Appendix A. Test Result of Conducted Test Items**

Test Engineer:	Hank Hsu / Tommy Lee	Temperature:	22.5~25.9	°C
Test Date:	2021/8/11~8/24	Relative Humidity:	45.1~58.7	%

**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	1.034	0.716	0.50	Pass
BLE	1Mbps	1	19	2440	1.032	0.706	0.50	Pass
BLE	1Mbps	1	39	2480	1.032	0.706	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	8.93	30.00	-2.20	6.73	36.00	Pass
BLE	1Mbps	1	19	2440	8.84	30.00	-2.20	6.64	36.00	Pass
BLE	1Mbps	1	39	2480	8.90	30.00	-2.20	6.70	36.00	Pass

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

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	8.90	30.00	-2.20	6.70	36.00	Pass
BLE	1Mbps	1	19	2440	8.80	30.00	-2.20	6.60	36.00	Pass
BLE	1Mbps	1	39	2480	8.80	30.00	-2.20	6.60	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	8.65	-6.82	-2.20	8.00	Pass
BLE	1Mbps	1	19	2440	8.73	-6.77	-2.20	8.00	Pass
BLE	1Mbps	1	39	2480	8.64	-6.84	-2.20	8.00	Pass

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

**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	2.045	1.260	0.50	Pass
BLE	2Mbps	1	19	2440	2.045	1.256	0.50	Pass
BLE	2Mbps	1	39	2480	2.045	1.252	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	8.92	30.00	-2.20	6.72	36.00	Pass
BLE	2Mbps	1	19	2440	8.84	30.00	-2.20	6.64	36.00	Pass
BLE	2Mbps	1	39	2480	8.90	30.00	-2.20	6.70	36.00	Pass

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

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	2Mbps	1	0	2402	8.80	30.00	-2.20	6.60	36.00	Pass
BLE	2Mbps	1	19	2440	8.80	30.00	-2.20	6.60	36.00	Pass
BLE	2Mbps	1	39	2480	8.80	30.00	-2.20	6.60	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	2Mbps	1	0	2402	8.19	-10.67	-2.20	8.00	Pass
BLE	2Mbps	1	19	2440	8.46	-10.37	-2.20	8.00	Pass
BLE	2Mbps	1	39	2480	8.49	-10.45	-2.20	8.00	Pass

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



## Appendix B. Radiated Spurious Emission

Test Engineer :	Jesse Wang and Stan Hsieh	Temperature :	23.5~25.1°C
		Relative Humidity :	51.3~55.5%

<Sample 1 with Battery 1>

<1Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.	
		( MHz )	( dBμV/m )	( dB )	Limit	Level	Factor	Loss	Factor	Pos	Pos	Avg.		
					Line	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	( P/A )	( H/V )	
BLE CH 00 2402MHz		2327.22	53.85	-20.15	74	39.63	31.77	17.84	35.39	243	200	P	H	
		2389.59	45.35	-8.65	54	30.75	31.9	18.11	35.41	243	200	A	H	
	*	2402	101	-	-	86.37	31.9	18.15	35.42	243	200	P	H	
	*	2402	100.52	-	-	85.89	31.9	18.15	35.42	243	200	A	H	
													H	
			2378.88	54.15	-19.85	74	39.62	31.87	18.07	35.41	356	139	P	V
			2381.925	45.37	-8.63	54	30.83	31.87	18.08	35.41	356	139	A	V
	*		2402	97.63	-	-	83	31.9	18.15	35.42	356	139	P	V
	*		2402	97.12	-	-	82.49	31.9	18.15	35.42	356	139	A	V
														V
BLE CH 19 2440MHz		2387.28	53.83	-20.17	74	39.24	31.9	18.1	35.41	209	200	P	H	
		2375.66	45.54	-8.46	54	31.03	31.87	18.05	35.41	209	200	A	H	
	*	2440	101.23	-	-	86.27	32.2	18.19	35.43	209	200	P	H	
	*	2440	100.66	-	-	85.7	32.2	18.19	35.43	209	200	A	H	
			2491.88	55.13	-18.87	74	39.75	32.6	18.24	35.46	209	200	P	H
			2498.39	46.28	-7.72	54	30.89	32.6	18.25	35.46	209	200	A	H
			2348.5	54.28	-19.72	74	39.94	31.8	17.94	35.4	305	141	P	V
			2384.34	45.8	-8.2	54	31.25	31.87	18.09	35.41	305	141	A	V
	*		2440	98.73	-	-	83.77	32.2	18.19	35.43	305	141	P	V
	*		2440	97.95	-	-	82.99	32.2	18.19	35.43	305	141	A	V
			2497.9	54.59	-19.41	74	39.2	32.6	18.25	35.46	305	141	P	V
			2496.29	46.24	-7.76	54	30.86	32.6	18.24	35.46	305	141	A	V



<b>BLE CH 39 2480MHz</b>	*	2480	99.71	-	-	84.46	32.47	18.23	35.45	100	200	P	H
	*	2480	98.94	-	-	83.69	32.47	18.23	35.45	100	200	A	H
		2484.24	56.29	-17.71	74	41.04	32.47	18.23	35.45	100	200	P	H
		2487.36	46.21	-7.79	54	30.96	32.47	18.23	35.45	100	200	A	H
													H
													H
	*	2480	96.39	-	-	81.14	32.47	18.23	35.45	300	139	P	V
	*	2480	95.8	-	-	80.55	32.47	18.23	35.45	300	139	A	V
		2488.44	54.92	-19.08	74	39.54	32.6	18.23	35.45	300	139	P	V
		2493.76	46.32	-7.68	54	30.94	32.6	18.24	35.46	300	139	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	42.53	-31.47	74	54.19	34	12.33	57.99	-	-	P	H	
													H	
													H	
													H	
			4804	42.26	-31.74	74	53.92	34	12.33	57.99	-	-	P	V
			4980	54.99	-19.01	74	66.05	34.2	12.52	57.78	100	159	P	V
			4980	43.05	-10.95	54	54.11	34.2	12.52	57.78	100	159	A	V
													V	
BLE CH 19 2440MHz		4880	42.93	-31.07	74	54.32	34.1	12.41	57.9	-	-	P	H	
		7320	44.12	-29.88	74	51.74	35.6	14.7	57.92	-	-	P	H	
													H	
													H	
			4880	43.19	-30.81	74	54.58	34.1	12.41	57.9	-	-	P	V
			4980	54.51	-19.49	74	65.57	34.2	12.52	57.78	100	159	P	V
			4980	42.79	-11.21	54	53.85	34.2	12.52	57.78	100	159	A	V
		7320	42.15	-31.85	74	49.77	35.6	14.7	57.92	-	-	P	V	
BLE CH 39 2480MHz		4960	43.34	-30.66	74	54.45	34.2	12.5	57.81	-	-	P	H	
		7440	42.62	-31.38	74	50.16	35.6	14.9	58.04	-	-	P	H	
													H	
													H	
			4960	42.47	-31.53	74	53.58	34.2	12.5	57.81	-	-	P	V
			4980	54.97	-19.03	74	66.03	34.2	12.52	57.78	100	159	P	V
			4980	42.5	-11.5	54	53.56	34.2	12.52	57.78	100	159	A	V
		7440	41.51	-32.49	74	49.05	35.6	14.9	58.04	-	-	P	V	
Remark	<ol style="list-style-type: none"> <li>No other spurious found.</li> <li>All results are PASS against Peak and Average limit line.</li> <li>The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.</li> </ol>													



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		21003	36.47	-37.53	74	52.84	38.1	5.63	60.1	-	-	P	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
			23334	35.63	-38.37	74	49.25	38.92	6.33	58.87	-	-	P
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
<b>Remark</b>	1. No other spurious found. 2. All results are PASS against limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												



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	22.76	-17.24	40	27.32	24.57	0.9	30.03	-	-	P	H	
		36.21	20.72	-19.28	40	28.34	21.3	1.1	30.02	-	-	P	H	
		106.95	18.28	-25.22	43.5	29.93	16.57	1.77	29.99	-	-	P	H	
		753.6	29.76	-16.24	46	27.49	27.68	4.26	29.67	-	-	P	H	
		850.9	31.48	-14.52	46	27.45	28.67	4.61	29.25	-	-	P	H	
		956.6	33.27	-12.73	46	26.42	30.63	4.9	28.68	-	-	P	H	
														H
														H
														H
														H
														H
														H
														H
			30	30.07	-9.93	40	34.63	24.57	0.9	30.03	-	-	P	V
			45.93	20.33	-19.67	40	32.75	16.38	1.21	30.01	-	-	P	V
			82.38	18.4	-21.6	40	33.11	13.73	1.56	30	-	-	P	V
			745.2	29.42	-16.58	46	27.35	27.52	4.24	29.69	-	-	P	V
			862.8	32.76	-13.24	46	28.42	28.89	4.62	29.17	-	-	P	V
			957.3	33.66	-12.34	46	26.77	30.67	4.9	28.68	-	-	P	V
														V
													V	
													V	
													V	
													V	
													V	
<b>Remark</b>	<ol style="list-style-type: none"> <li>No other spurious found.</li> <li>All results are PASS against limit line.</li> <li>The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.</li> </ol>													





<2Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.	
		( MHz )	( dBµV/m )	( dB )	Limit Line ( dBµV/m )	Level ( dBµV )	Factor ( dB/m )	Loss ( dB )	Factor ( dB )	Pos ( cm )	Pos ( deg )	Avg. ( P/A )	( H/V )	
BLE CH 00 2402MHz		2343.18	54.32	-19.68	74	40	31.8	17.92	35.4	130	68	P	H	
		2338.245	47.02	-6.98	54	32.72	31.8	17.89	35.39	130	68	A	H	
	*	2402	100.48	-	-	85.85	31.9	18.15	35.42	130	68	P	H	
	*	2402	99.16	-	-	84.53	31.9	18.15	35.42	130	68	A	H	
													H	
														H
			2359.56	55	-19	74	40.59	31.83	17.98	35.4	358	170	P	V
			2384.445	47.43	-6.57	54	32.88	31.87	18.09	35.41	358	170	A	V
	*		2402	97.47	-	-	82.84	31.9	18.15	35.42	358	170	P	V
	*		2402	96.29	-	-	81.66	31.9	18.15	35.42	358	170	A	V
														V
														V
BLE CH 19 2440MHz		2375.66	54.79	-19.21	74	40.28	31.87	18.05	35.41	101	70	P	H	
		2388.12	47.38	-6.62	54	32.79	31.9	18.1	35.41	101	70	A	H	
	*	2440	100.66	-	-	85.7	32.2	18.19	35.43	101	70	P	H	
	*	2440	99.15	-	-	84.19	32.2	18.19	35.43	101	70	A	H	
			2497.06	55.43	-18.57	74	40.04	32.6	18.25	35.46	101	70	P	H
			2498.6	47.59	-6.41	54	32.2	32.6	18.25	35.46	101	70	A	H
			2358.44	54.39	-19.61	74	39.98	31.83	17.98	35.4	398	172	P	V
			2363.62	46.98	-7.02	54	32.55	31.83	18	35.4	398	172	A	V
	*		2440	99.93	-	-	84.97	32.2	18.19	35.43	398	172	P	V
	*		2440	98.57	-	-	83.61	32.2	18.19	35.43	398	172	A	V
			2492.44	55.91	-18.09	74	40.53	32.6	18.24	35.46	398	172	P	V
			2499.65	47.64	-6.36	54	32.25	32.6	18.25	35.46	398	172	A	V



<b>BLE CH 39 2480MHz</b>	*	2480	99.96	-	-	84.71	32.47	18.23	35.45	118	73	P	H
	*	2480	98.56	-	-	83.31	32.47	18.23	35.45	118	73	A	H
		2483.52	57.14	-16.86	74	41.89	32.47	18.23	35.45	118	73	P	H
		2483.52	48.93	-5.07	54	33.68	32.47	18.23	35.45	118	73	A	H
													H
													H
	*	2480	97.86	-	-	82.61	32.47	18.23	35.45	384	172	P	V
	*	2480	96.55	-	-	81.3	32.47	18.23	35.45	384	172	A	V
		2483.92	54.97	-19.03	74	39.72	32.47	18.23	35.45	384	172	P	V
		2483.52	48.61	-5.39	54	33.36	32.47	18.23	35.45	384	172	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	43.31	-30.69	74	54.97	34	12.33	57.99	-	-	P	H	
													H	
													H	
													H	
			4804	43.17	-30.83	74	54.83	34	12.33	57.99	-	-	P	V
			4980	54.39	-19.61	74	65.45	34.2	12.52	57.78	100	159	P	V
			4980	44.82	-9.18	54	55.88	34.2	12.52	57.78	100	159	A	V
													V	
BLE CH 19 2440MHz		4880	43.03	-30.97	74	54.42	34.1	12.41	57.9	-	-	P	H	
		7320	42.95	-31.05	74	50.57	35.6	14.7	57.92	-	-	P	H	
													H	
													H	
			4880	43.21	-30.79	74	54.6	34.1	12.41	57.9	-	-	P	V
			4980	54.85	-19.15	74	65.91	34.2	12.52	57.78	100	159	P	V
			4980	44.29	-9.71	54	55.35	34.2	12.52	57.78	100	159	A	V
		7320	41.77	-32.23	74	49.39	35.6	14.7	57.92	-	-	P	V	
BLE CH 39 2480MHz		4960	43.18	-30.82	74	54.29	34.2	12.5	57.81	-	-	P	H	
		7440	42.13	-31.87	74	49.67	35.6	14.9	58.04	-	-	P	H	
													H	
													H	
			4960	42.36	-31.64	74	53.47	34.2	12.5	57.81	-	-	P	V
			4980	54.42	-19.58	74	65.48	34.2	12.52	57.78	100	160	P	V
			4980	44.66	-9.34	54	55.72	34.2	12.52	57.78	100	160	A	V
		7440	41.59	-32.41	74	49.13	35.6	14.9	58.04	-	-	P	V	
Remark	<ol style="list-style-type: none"> <li>No other spurious found.</li> <li>All results are PASS against Peak and Average limit line.</li> <li>The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.</li> </ol>													



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		21241	35.49	-38.51	74	51.73	38.1	5.71	60.05	-	-	P	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
			24853	36.23	-37.77	74	48.08	38.89	6.92	57.66	-	-	P
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
<b>Remark</b>	1. No other spurious found. 2. All results are PASS against limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												



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	23.32	-16.68	40	27.88	24.57	0.9	30.03	-	-	P	H	
		50.52	15.08	-24.92	40	29.72	14.08	1.29	30.01	-	-	P	H	
		106.95	18.85	-24.65	43.5	30.5	16.57	1.77	29.99	-	-	P	H	
		768.3	30.44	-15.56	46	28.05	27.74	4.3	29.65	-	-	P	H	
		853.7	32	-14	46	27.85	28.77	4.61	29.23	-	-	P	H	
		958.7	34.14	-11.86	46	27.17	30.75	4.9	28.68	-	-	P	H	
														H
														H
														H
														H
														H
														H
			30	30.5	-9.5	40	35.06	24.57	0.9	30.03	-	-	P	V
			45.93	20.24	-19.76	40	32.66	16.38	1.21	30.01	-	-	P	V
			79.95	19.09	-20.91	40	34.26	13.3	1.53	30	-	-	P	V
			745.9	30.44	-15.56	46	28.35	27.54	4.24	29.69	-	-	P	V
			847.4	32.71	-13.29	46	28.76	28.62	4.6	29.27	-	-	P	V
			952.4	33.2	-12.8	46	26.59	30.43	4.88	28.7	-	-	P	V
														V
														V
													V	
													V	
													V	
													V	
Remark	<ol style="list-style-type: none"> <li>No other spurious found.</li> <li>All results are PASS against limit line.</li> <li>The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.</li> </ol>													



<Sample 1 with Battery 2>

<2Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
		( MHz )	( dBμV/m )	( dB )	Line ( dBμV/m )	Level ( dBμV )	Factor ( dB/m )	Loss ( dB )	Factor ( dB )	Pos ( cm )	Pos ( deg )	Avg. ( P/A )	( H/V )
BLE CH 39 2480MHz	*	2480	101.05	-	-	85.8	32.47	18.23	35.45	117	88	P	H
	*	2480	98.65	-	-	83.4	32.47	18.23	35.45	117	88	A	H
		2488.92	55.83	-18.17	74	40.45	32.6	18.23	35.45	117	88	P	H
		2483.52	48.76	-5.24	54	33.51	32.47	18.23	35.45	117	88	A	H
													H
													H
	*	2480	97.09	-	-	81.84	32.47	18.23	35.45	322	10	P	V
	*	2480	94.81	-	-	79.56	32.47	18.23	35.45	322	10	A	V
		2490.96	56.36	-17.64	74	40.97	32.6	18.24	35.45	322	10	P	V
		2483.64	47.72	-6.28	54	32.47	32.47	18.23	35.45	322	10	A	V
													V
												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 ( 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 39 2480MHz		4960	41.22	-32.78	74	52.33	34.2	12.5	57.81	-	-	P	H
		4980	46.41	-27.59	74	57.47	34.2	12.52	57.78	-	-	P	H
		7440	41.06	-32.94	74	48.6	35.6	14.9	58.04	-	-	P	H
													H
		4960	41.63	-32.37	74	52.74	34.2	12.5	57.81	-	-	P	V
		4980	53.69	-20.31	74	64.75	34.2	12.52	57.78	100	159	P	V
		4980	43.67	-10.33	54	54.73	34.2	12.52	57.78	100	159	A	V
		7440	40.48	-33.52	74	48.02	35.6	14.9	58.04	-	-	P	V
Remark	<ol style="list-style-type: none"> <li>No other spurious found.</li> <li>All results are PASS against Peak and Average limit line.</li> <li>The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.</li> </ol>												



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		21682	36.54	-37.46	74	52.28	38.42	5.87	60.03	-	-	P	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
			21689	35.35	-38.65	74	51.07	38.45	5.87	60.04	-	-	P
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
<b>Remark</b>	1. No other spurious found. 2. All results are PASS against limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												





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		30.27	23.14	-16.86	40	27.89	24.37	0.91	30.03	-	-	P	H	
		41.61	16.83	-23.17	40	27.1	18.59	1.16	30.02	-	-	P	H	
		106.95	18.99	-24.51	43.5	30.64	16.57	1.77	29.99	-	-	P	H	
		764.1	30.07	-15.93	46	27.7	27.73	4.29	29.65	-	-	P	H	
		881	31.5	-14.5	46	27.2	28.7	4.64	29.04	-	-	P	H	
		958.7	33.34	-12.66	46	26.37	30.75	4.9	28.68	-	-	P	H	
														H
														H
														H
														H
														H
														H
			30	30.33	-9.67	40	34.89	24.57	0.9	30.03	-	-	P	V
			45.93	19.95	-20.05	40	32.37	16.38	1.21	30.01	-	-	P	V
			91.02	19.81	-23.69	43.5	33.46	14.73	1.61	29.99	-	-	P	V
			762	29.82	-16.18	46	27.46	27.73	4.29	29.66	-	-	P	V
			853.7	31.99	-14.01	46	27.84	28.77	4.61	29.23	-	-	P	V
			952.4	34.57	-11.43	46	27.96	30.43	4.88	28.7	-	-	P	V
														V
														V
													V	
													V	
													V	

**Remark**

- No other spurious found.
- All results are PASS against limit line.
- The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.



**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 C. Radiated Spurious Emission Plots

Test Engineer :	Jesse Wang and Stan Hsieh	Temperature :	23.5~25.1°C
		Relative Humidity :	51.3~55.5%

Note symbol

-L	Low channel location
-R	High channel location

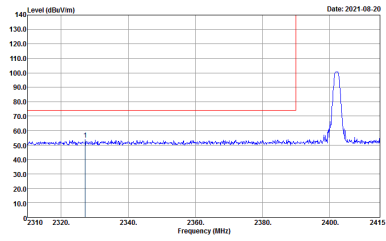
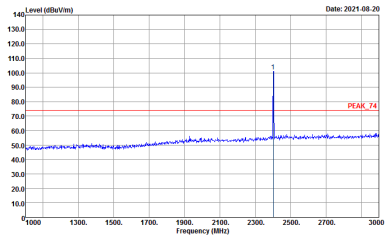
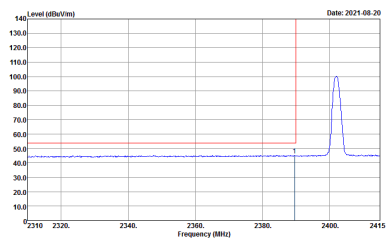
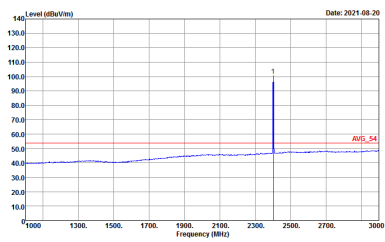


<Sample 1 with Battery 1>

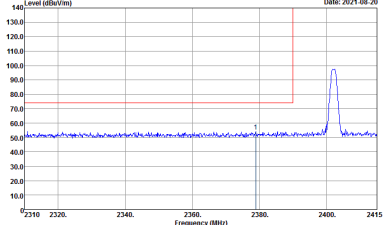
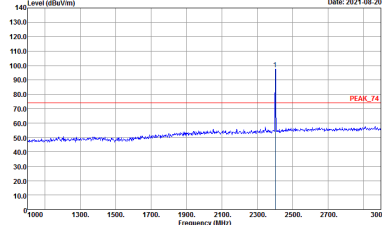
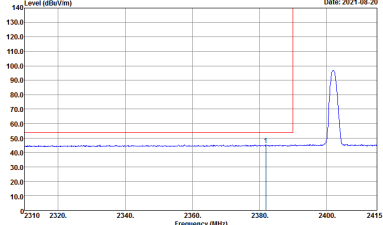
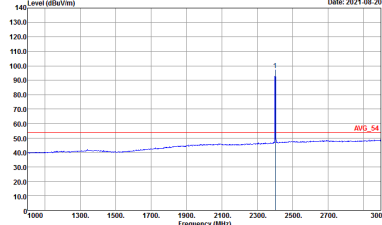
<1Mbps>

2.4GHz 2400~2483.5MHz

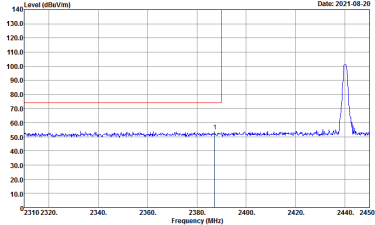
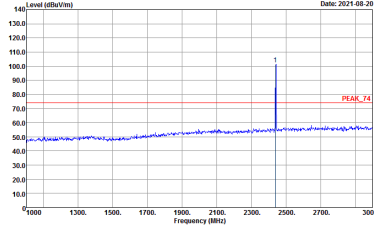
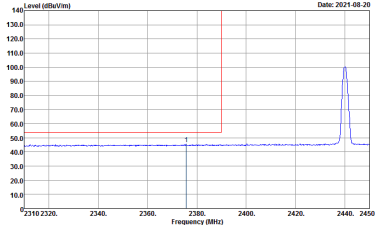
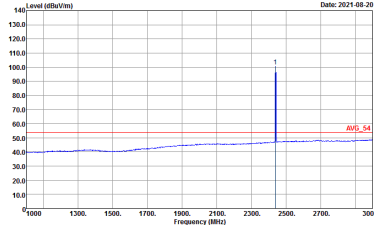
BLE (Band Edge @ 3m)

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH00 2402MHz		
Horizontal		Fundamental
Peak	 <p>Site : 03CH07-HY Condition : : PEAK_BE_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p>	 <p>Site : 03CH07-HY Condition : : PEAK_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p>
Avg.	 <p>Site : 03CH07-HY Condition : : AVG_BE_S4 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3.000kHz SWT:Auto</p>	 <p>Site : 03CH07-HY Condition : : AVG_S4 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3.000kHz SWT:Auto</p>

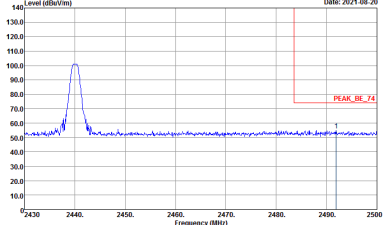
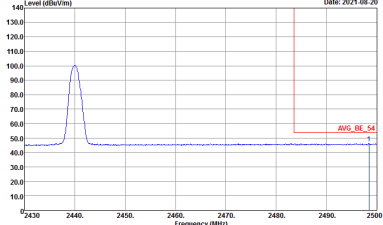


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH00 2402MHz		
Vertical		Fundamental
Peak	 <p>Level (dBu/m) vs Frequency (MHz) plot showing a peak at 2402 MHz. The y-axis ranges from 10.0 to 140.0 dBu/m, and the x-axis ranges from 2310 to 2415 MHz. A red vertical line marks the peak at 2402 MHz.</p> <p>Site : 03CH07-HY Condition : PEAK_BE_78.3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWF:Auto</p>	 <p>Level (dBu/m) vs Frequency (MHz) plot showing a peak at 2402 MHz. The y-axis ranges from 10.0 to 140.0 dBu/m, and the x-axis ranges from 1000 to 3000 MHz. A red vertical line marks the peak at 2402 MHz, labeled 'PEAK_X4'.</p> <p>Site : 03CH07-HY Condition : PEAK_78.3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWF:Auto</p>
Avg	 <p>Level (dBu/m) vs Frequency (MHz) plot showing an average level at 2402 MHz. The y-axis ranges from 10.0 to 140.0 dBu/m, and the x-axis ranges from 2310 to 2415 MHz. A red vertical line marks the average level at 2402 MHz.</p> <p>Site : 03CH07-HY Condition : AVG_BE_54.3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3.000kHz SWF:Auto</p>	 <p>Level (dBu/m) vs Frequency (MHz) plot showing an average level at 2402 MHz. The y-axis ranges from 10.0 to 140.0 dBu/m, and the x-axis ranges from 1000 to 3000 MHz. A red vertical line marks the average level at 2402 MHz, labeled 'AVG_X4'.</p> <p>Site : 03CH07-HY Condition : AVG_54.3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3.000kHz SWF:Auto</p>



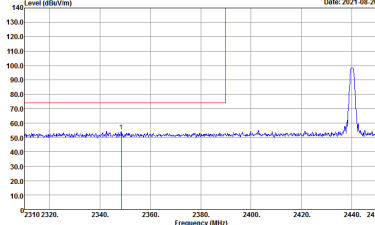
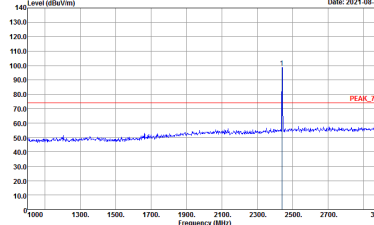
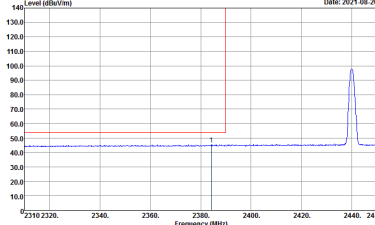
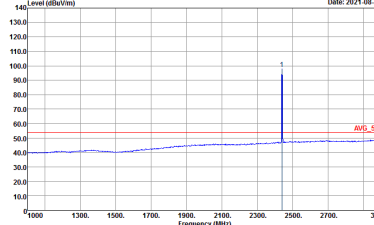
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH19 2440MHz - L		
Horizontal		Fundamental
Peak	 <p>Date: 2021-08-20</p> <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p>	 <p>Date: 2021-08-20</p> <p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p>
Avg.	 <p>Date: 2021-08-20</p> <p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3.000kHz SWT:Auto</p>	 <p>Date: 2021-08-20</p> <p>Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3.000kHz SWT:Auto</p>



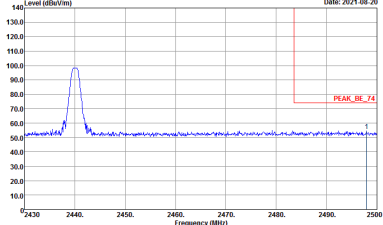
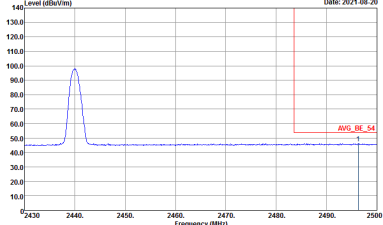
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH19 2440MHz - R		
	Horizontal	Fundamental
Peak	 <p>Site : 03CH07-HV Condition : PEAK_BE_74 3m HF_ANT_00075962 HORIZONTAL : REW:1000.000kHz VBW:3.000kHz SWFAuto</p>	Left blank
Avg.	 <p>Site : 03CH07-HV Condition : AVG_BE_54 3m HF_ANT_00075962 HORIZONTAL : REW:1000.000kHz VBW:3.000kHz SWFAuto</p>	Left blank



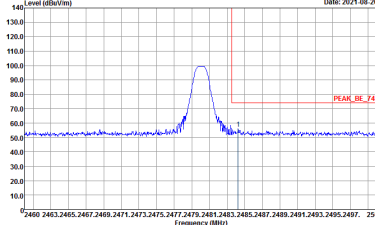
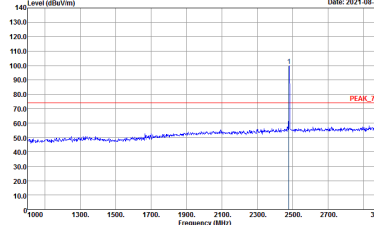
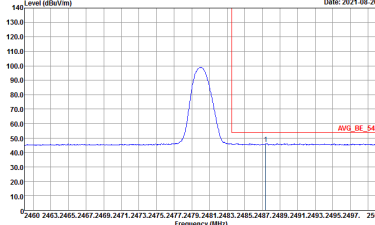
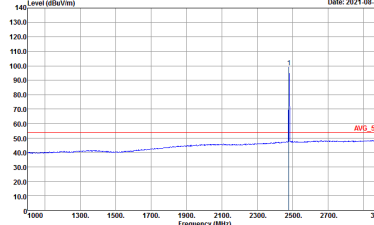


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH19 2440MHz - L		
Vertical		Fundamental
Peak	 <p>Date: 2021-08-20</p> <p>Site : 03CH07-HY Condition : :PEAK_BE_78.3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3.000kHz SWFAuto</p>	 <p>Date: 2021-08-20</p> <p>Site : 03CH07-HY Condition : :PEAK_78.3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWFAuto</p>
Avg.	 <p>Date: 2021-08-20</p> <p>Site : 03CH07-HY Condition : :AVG_BE_54.3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3.000kHz SWFAuto</p>	 <p>Date: 2021-08-20</p> <p>Site : 03CH07-HY Condition : :AVG_54.3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3.000kHz SWFAuto</p>

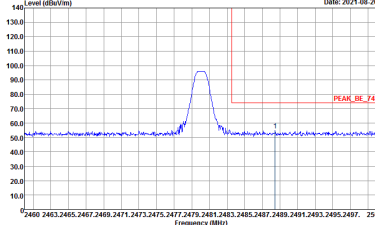
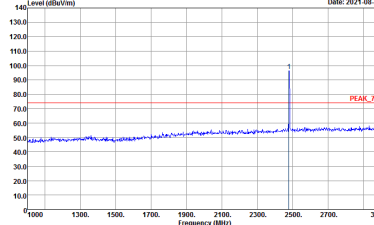
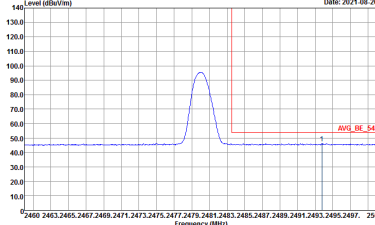
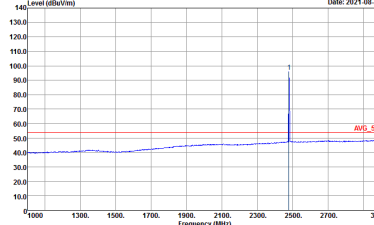


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH19 2440MHz - R		
	Vertical	Fundamental
Peak	 <p>Site : 03CH07-HV Condition : PEAK_BE_74 3m HF_ANT_00075962 VERTICAL : REW:1000.000kHz VBW:3.000kHz SWF:Auto</p>	Left blank
Avg.	 <p>Site : 03CH07-HV Condition : AVG_BE_54 3m HF_ANT_00075962 VERTICAL : REW:1000.000kHz VBW:3.000kHz SWF:Auto</p>	Left blank



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH39 2480MHz		
	Horizontal	Fundamental
Peak	 <p>Date: 2021-08-20</p> <p>Site : 03CH07-HY Condition : :PEAK_BE_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3.000kHz SWFA:Auto</p>	 <p>Date: 2021-08-20</p> <p>Site : 03CH07-HY Condition : :PEAK_F4 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWFA:Auto</p>
Avg.	 <p>Date: 2021-08-20</p> <p>Site : 03CH07-HY Condition : :AVG_BE_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3.000kHz SWFA:Auto</p>	 <p>Date: 2021-08-20</p> <p>Site : 03CH07-HY Condition : :AVG_F4 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3.000kHz SWFA:Auto</p>



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH39 2480MHz		
Vertical		Fundamental
Peak	 <p>Level (dBm/1m) vs Frequency (MHz) plot showing a peak at 2480 MHz. The peak level is approximately 100 dBm/1m. The plot includes a red line indicating the peak level and a label 'PEAK_BE_74'.</p> <p>Site Condition : 03CH07-HY : PEAK_BE_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWF:Auto</p>	 <p>Level (dBm/1m) vs Frequency (MHz) plot showing a peak at 2480 MHz. The peak level is approximately 100 dBm/1m. The plot includes a red line indicating the peak level and a label 'PEAK_F4'.</p> <p>Site Condition : 03CH07-HY : PEAK_F4 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWF:Auto</p>
Avg.	 <p>Level (dBm/1m) vs Frequency (MHz) plot showing an average level at 2480 MHz. The average level is approximately 50 dBm/1m. The plot includes a red line indicating the average level and a label 'AVG_BE_54'.</p> <p>Site Condition : 03CH07-HY : AVG_BE_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3.000kHz SWF:Auto</p>	 <p>Level (dBm/1m) vs Frequency (MHz) plot showing an average level at 2480 MHz. The average level is approximately 50 dBm/1m. The plot includes a red line indicating the average level and a label 'AVG_F4'.</p> <p>Site Condition : 03CH07-HY : AVG_F4 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3.000kHz SWF:Auto</p>



2.4GHz 2400~2483.5MHz

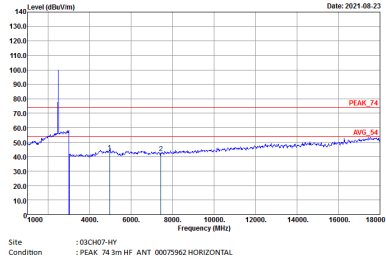
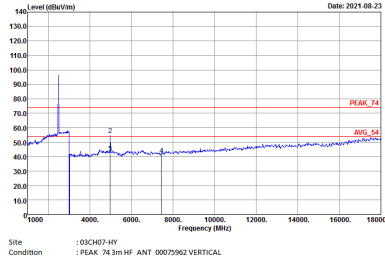
BLE (Harmonic @ 3m)

BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH00 2402MHz	
	Horizontal	Vertical
Peak Avg.	<p>Site : 03CH07-HY Condition : PEAK 74 3m HF ANT 00075962 HORIZONTAL</p>	<p>Site : 03CH07-HY Condition : PEAK 74 3m HF ANT 00075962 VERTICAL</p>



BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH19 2440MHz	
	Horizontal	Vertical
Peak Avg.	<p>Site : 03CH07-HY Condition : PEAK 74 3m HF ANT 00075962 HORIZONTAL</p>	<p>Site : 03CH07-HY Condition : PEAK 74 3m HF ANT 00075962 VERTICAL</p>



BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH39 2480MHz	
	Horizontal	Vertical
Peak Avg.	 <p>Site : 03CH07-HY Condition : PEAK 74 3m HF ANT 00075962 HORIZONTAL</p>	 <p>Site : 03CH07-HY Condition : PEAK 74 3m HF ANT 00075962 VERTICAL</p>



Emission above 18GHz

2.4GHz BLE (SHF @ 1m)

BLE	2.4GHz 2400~2483.5MHz	
	BLE SHF	
	Horizontal	Vertical
Peak Avg.	<p>Site : 03CH07-HY Condition : PEAK 74 1m SHF-EHF 9170251 HORIZONTAL</p>	<p>Site : 03CH07-HY Condition : PEAK 74 1m SHF-EHF 9170251 VERTICAL</p>





Emission below 1GHz

2.4GHz BLE (LF)

BLE	2.4GHz 2400~2483.5MHz	
	BLE LF	
	Horizontal	Vertical
QP / Peak	<p>Site : 03CH07-HY Condition : QP 3m LF-ANT-35419(6) HORIZONTAL</p>	<p>Site : 03CH07-HY Condition : QP 3m LF-ANT-35419(6) VERTICAL</p>



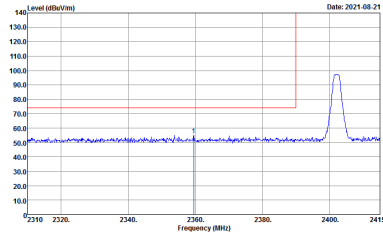
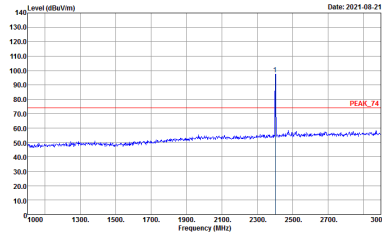
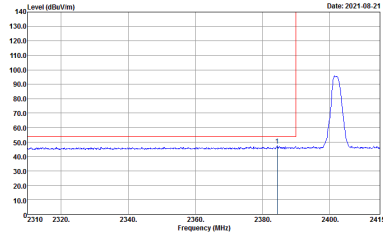
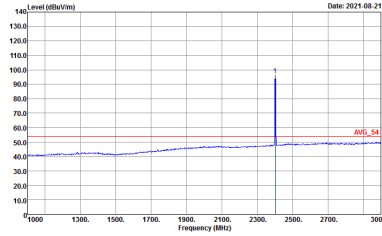
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2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH00 2402MHz		
	Horizontal	Fundamental
Peak	<p>Site Condition : 03CH07-HY : PEAK_BE_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p>	<p>Site Condition : 03CH07-HY : PEAK_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p>
Avg.	<p>Site Condition : 03CH07-HY : AVG_BE_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:10.000kHz SWT:Auto</p>	<p>Site Condition : 03CH07-HY : AVG_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:10.000kHz SWT:Auto</p>

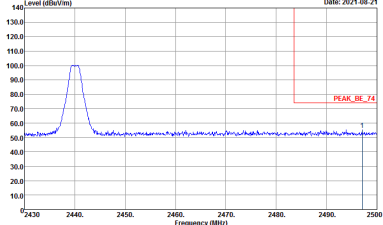
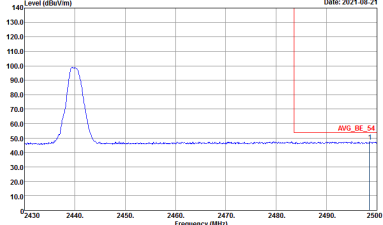


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH00 2402MHz		
Vertical		Fundamental
Peak	 <p>Level (dBuV/m) vs Frequency (MHz) plot showing a peak at 2402 MHz. The y-axis ranges from 10.0 to 140.0 dBuV/m, and the x-axis ranges from 2310 to 2415 MHz. A red vertical line marks the peak at 2402 MHz.</p> <p>Date: 2021-08-21</p> <p>Site Condition : 03CH07-HY : PEAK_BE_78.3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWF:Auto</p>	 <p>Level (dBuV/m) vs Frequency (MHz) plot showing a peak at 2402 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 vertical line marks the peak at 2402 MHz.</p> <p>Date: 2021-08-21</p> <p>Site Condition : 03CH07-HY : PEAK_78.3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWF:Auto</p>
Avg	 <p>Level (dBuV/m) vs Frequency (MHz) plot showing an average level at 2402 MHz. The y-axis ranges from 10.0 to 140.0 dBuV/m, and the x-axis ranges from 2310 to 2415 MHz. A red vertical line marks the average level at 2402 MHz.</p> <p>Date: 2021-08-21</p> <p>Site Condition : 03CH07-HY : AVG_BE_54.3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:10.000kHz SWF:Auto</p>	 <p>Level (dBuV/m) vs Frequency (MHz) plot showing an average level at 2402 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 vertical line marks the average level at 2402 MHz.</p> <p>Date: 2021-08-21</p> <p>Site Condition : 03CH07-HY : AVG_54.3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:10.000kHz SWF:Auto</p>

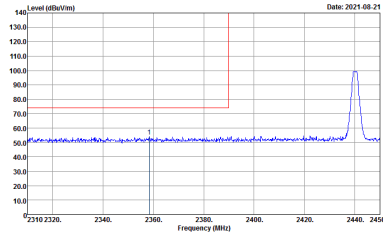
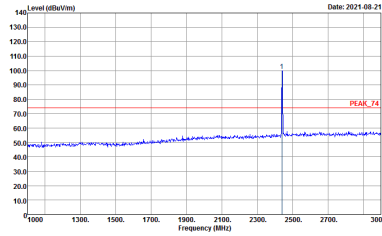
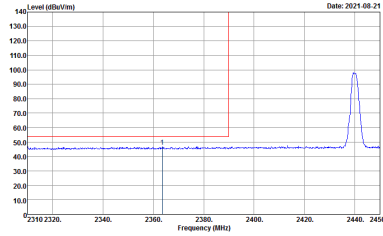
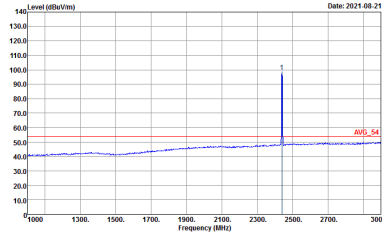


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH19 2440MHz - L		
	Horizontal	Fundamental
Peak	<p>Date: 2021-08-21</p> <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p>	<p>Date: 2021-08-21</p> <p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p>
Avg.	<p>Date: 2021-08-21</p> <p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:10.000kHz SWTA:Auto</p>	<p>Date: 2021-08-21</p> <p>Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:10.000kHz SWTA:Auto</p>

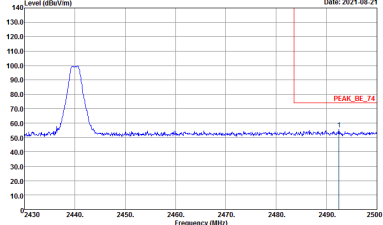
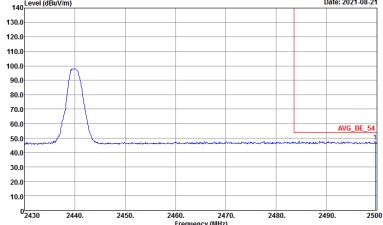


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH19 2440MHz - R		
	Horizontal	Fundamental
Peak	 <p>Site : 03CH07-HV Condition : PEAK_BE_74 3m HF_ANT_00075962 HORIZONTAL : REW:1000.000kHz VBW:3000.000kHz SWF:Auto</p>	Left blank
Avg.	 <p>Site : 03CH07-HV Condition : AVG_BE_54 3m HF_ANT_00075962 HORIZONTAL : REW:1000.000kHz VBW:10.000kHz SWF:Auto</p>	Left blank

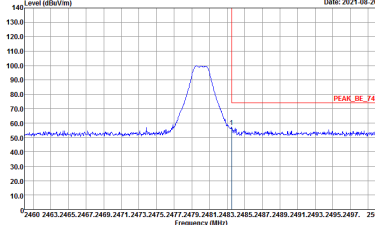
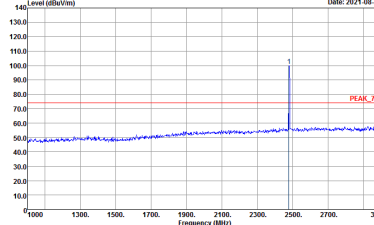
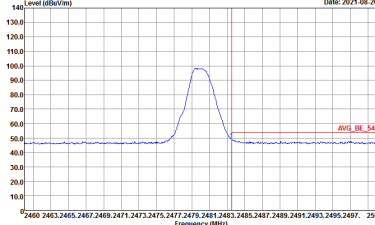
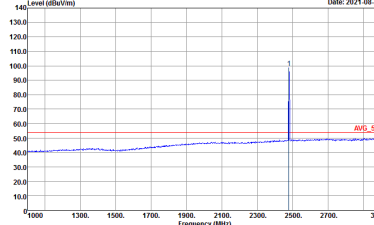


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - L	
	Vertical	Fundamental
Peak	 <p>Level (dBu/Vm) vs Frequency (MHz) plot showing a peak at 2440 MHz. The y-axis ranges from 10.0 to 140.0 dBu/Vm, and the x-axis ranges from 2310 to 2450 MHz. A red vertical line marks the peak at 2440 MHz.</p> <p>Date: 2021-08-21</p> <p>Site Condition : 03CH07-HY : PEAK_BE_78.3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWF:Auto</p>	 <p>Level (dBu/Vm) vs Frequency (MHz) plot showing a peak at 2440 MHz. The y-axis ranges from 10.0 to 140.0 dBu/Vm, and the x-axis ranges from 1000 to 3000 MHz. A red vertical line marks the peak at 2440 MHz.</p> <p>Date: 2021-08-21</p> <p>Site Condition : 03CH07-HY : PEAK_78.3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWF:Auto</p>
Avg.	 <p>Level (dBu/Vm) vs Frequency (MHz) plot showing the average spectrum. The y-axis ranges from 10.0 to 140.0 dBu/Vm, and the x-axis ranges from 2310 to 2450 MHz. A red vertical line marks the peak at 2440 MHz.</p> <p>Date: 2021-08-21</p> <p>Site Condition : 03CH07-HY : AVG_BE_54.3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:10.000kHz SWF:Auto</p>	 <p>Level (dBu/Vm) vs Frequency (MHz) plot showing the average spectrum. The y-axis ranges from 10.0 to 140.0 dBu/Vm, and the x-axis ranges from 1000 to 3000 MHz. A red vertical line marks the peak at 2440 MHz.</p> <p>Date: 2021-08-21</p> <p>Site Condition : 03CH07-HY : AVG_54.3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:10.000kHz SWF:Auto</p>



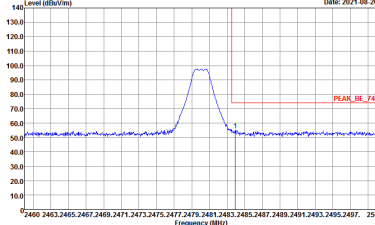
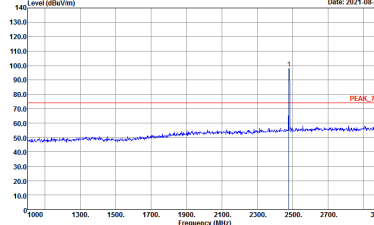
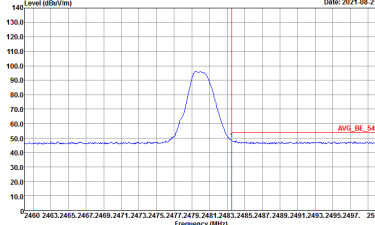
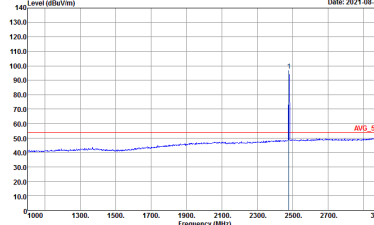
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH19 2440MHz - R		
	Vertical	Fundamental
Peak	 <p>Site : 03CH07-HV Condition : PEAK_BE_74 3m HF_ANT_00075962 VERTICAL : REW:1000.000kHz VBW:3000.000kHz SWF:Auto</p>	Left blank
Avg.	 <p>Site : 03CH07-HV Condition : AVG_BE_54 3m HF_ANT_00075962 VERTICAL : REW:1000.000kHz VBW:10.000kHz SWF:Auto</p>	Left blank



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH39 2480MHz		
Horizontal		Fundamental
Peak	 <p>Date: 2021-08-20</p> <p>Site Condition : 03CH07-HY : PEAK_BE_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWF:Auto</p>	 <p>Date: 2021-08-20</p> <p>Site Condition : 03CH07-HY : PEAK_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWF:Auto</p>
Avg.	 <p>Date: 2021-08-20</p> <p>Site Condition : 03CH07-HY : AVG_BE_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:10.000kHz SWF:Auto</p>	 <p>Date: 2021-08-20</p> <p>Site Condition : 03CH07-HY : AVG_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:10.000kHz SWF:Auto</p>





BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH39 2480MHz		
Vertical		Fundamental
Peak	 <p>Date: 2021-08-20</p> <p>Site : 03CH07-HY Condition : :PEAK_BE_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWF:Auto</p>	 <p>Date: 2021-08-21</p> <p>Site : 03CH07-HY Condition : :PEAK_F4 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWF:Auto</p>
Avg.	 <p>Date: 2021-08-21</p> <p>Site : 03CH07-HY Condition : :AVG_BE_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:10.000kHz SWF:Auto</p>	 <p>Date: 2021-08-20</p> <p>Site : 03CH07-HY Condition : :AVG_F4 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:10.000kHz SWF:Auto</p>

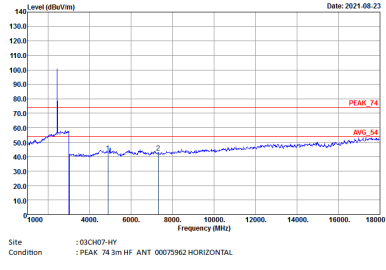
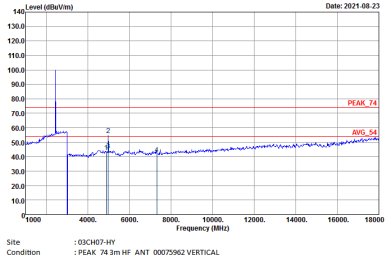


2.4GHz 2400~2483.5MHz

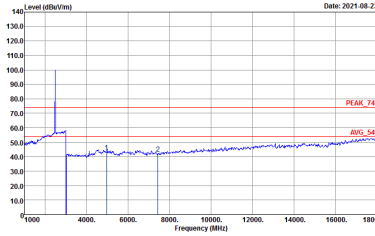
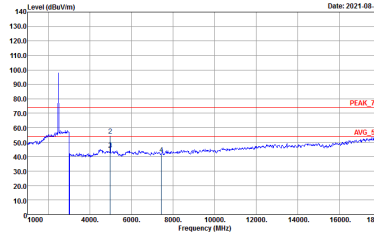
BLE (Harmonic @ 3m)

BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH00 2402MHz	
	Horizontal	Vertical
Peak Avg.	<p>Site : 03CH07-HY Condition : PEAK 74 3m HF ANT 00075962 HORIZONTAL</p>	<p>Site : 03CH07-HY Condition : PEAK 74 3m HF ANT 00075962 VERTICAL</p>



BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH19 2440MHz	
	Horizontal	Vertical
Peak Avg.	 <p>Site : 03CH07-HY Condition : PEAK 74 3m HF ANT 00075962 HORIZONTAL</p>	 <p>Site : 03CH07-HY Condition : PEAK 74 3m HF ANT 00075962 VERTICAL</p>



BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH39 2480MHz	
	Horizontal	Vertical
Peak Avg.	 <p>Site : 03CH07-HY Condition : PEAK 74 3m HF ANT 00075962 HORIZONTAL</p>	 <p>Site : 03CH07-HY Condition : PEAK 74 3m HF ANT 00075962 VERTICAL</p>



Emission above 18GHz

2.4GHz BLE (SHF @ 1m)

BLE	2.4GHz 2400~2483.5MHz	
	BLE SHF	
	Horizontal	Vertical
<b>Peak</b> <b>Avg.</b>	<p>Site : 03CH07-HY Condition : PEAK 74 1m SHF-EHF 9170251 HORIZONTAL</p>	<p>Site : 03CH07-HY Condition : PEAK 74 1m SHF-EHF 9170251 VERTICAL</p>



Emission below 1GHz

2.4GHz BLE (LF)

BLE	2.4GHz 2400~2483.5MHz	
	BLE LF	
	Horizontal	Vertical
QP / Peak	<p>Site : 03CH07-HY Condition : QP 3m LF-ANT-35419(6) HORIZONTAL</p>	<p>Site : 03CH07-HY Condition : QP 3m LF-ANT-35419(6) VERTICAL</p>



<Sample 1 with Battery 2>

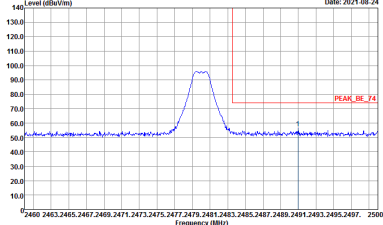
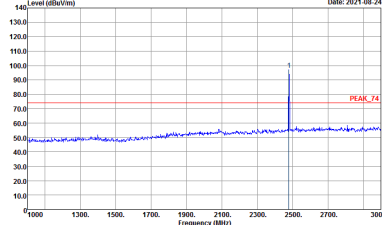
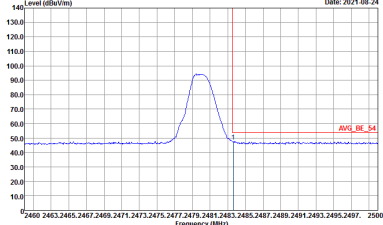
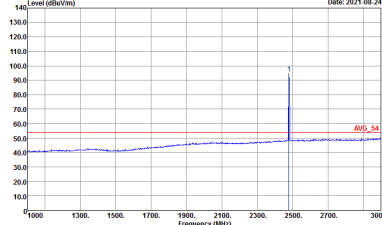
<2Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH39 2480MHz		
Horizontal		Fundamental
Peak	<p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz; VBW:3000.000kHz; SWF:Auto</p>	<p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz; VBW:3000.000kHz; SWF:Auto</p>
Avg.	<p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz; VBW:10.000kHz; SWF:Auto</p>	<p>Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz; VBW:10.000kHz; SWF:Auto</p>



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
BLE CH39 2480MHz		
Vertical		Fundamental
Peak	 <p>Level (dBuV/m) vs Frequency (MHz) plot showing a peak at 2480 MHz. The peak level is approximately 100 dBuV/m. The plot includes a red vertical line at the peak and a red horizontal line labeled 'PEAK_BE_74'.</p> <p>Site : 03CH07-HY            Condition : PEAK_BE_74 3m HF_ANT_00075962 VERTICAL            : RBW:1000.000kHz VBW:3000.000kHz SWF:Auto</p>	 <p>Level (dBuV/m) vs Frequency (MHz) plot showing a sharp peak at 2480 MHz. The peak level is approximately 100 dBuV/m. The plot includes a red vertical line at the peak and a red horizontal line labeled 'PEAK_F4'.</p> <p>Site : 03CH07-HY            Condition : PEAK_F4 3m HF_ANT_00075962 VERTICAL            : RBW:1000.000kHz VBW:3000.000kHz SWF:Auto</p>
Avg.	 <p>Level (dBuV/m) vs Frequency (MHz) plot showing an averaged peak at 2480 MHz. The peak level is approximately 100 dBuV/m. The plot includes a red vertical line at the peak and a red horizontal line labeled 'AVG_BE_54'.</p> <p>Site : 03CH07-HY            Condition : AVG_BE_54 3m HF_ANT_00075962 VERTICAL            : RBW:1000.000kHz VBW:10.000kHz SWF:Auto</p>	 <p>Level (dBuV/m) vs Frequency (MHz) plot showing an averaged sharp peak at 2480 MHz. The peak level is approximately 100 dBuV/m. The plot includes a red vertical line at the peak and a red horizontal line labeled 'AVG_F4'.</p> <p>Site : 03CH07-HY            Condition : AVG_F4 3m HF_ANT_00075962 VERTICAL            : RBW:1000.000kHz VBW:10.000kHz SWF:Auto</p>





2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH39 2480MHz	
	Horizontal	Vertical
Peak Avg.	<p>Site : 03CH07-HY Condition : PEAK 74 3m HF ANT 00075962 HORIZONTAL</p>	<p>Site : 03CH07-HY Condition : PEAK 74 3m HF ANT 00075962 VERTICAL</p>



Emission above 18GHz

2.4GHz BLE (SHF @ 1m)

BLE	2.4GHz 2400~2483.5MHz	
	BLE SHF	
	Horizontal	Vertical
Peak Avg.	<p>Site : 03CH07-HY Condition : PEAK 74 1m SHF-EHF 9170251 HORIZONTAL</p>	<p>Site : 03CH07-HY Condition : PEAK 74 1m SHF-EHF 9170251 VERTICAL</p>



Emission below 1GHz

2.4GHz BLE (LF)

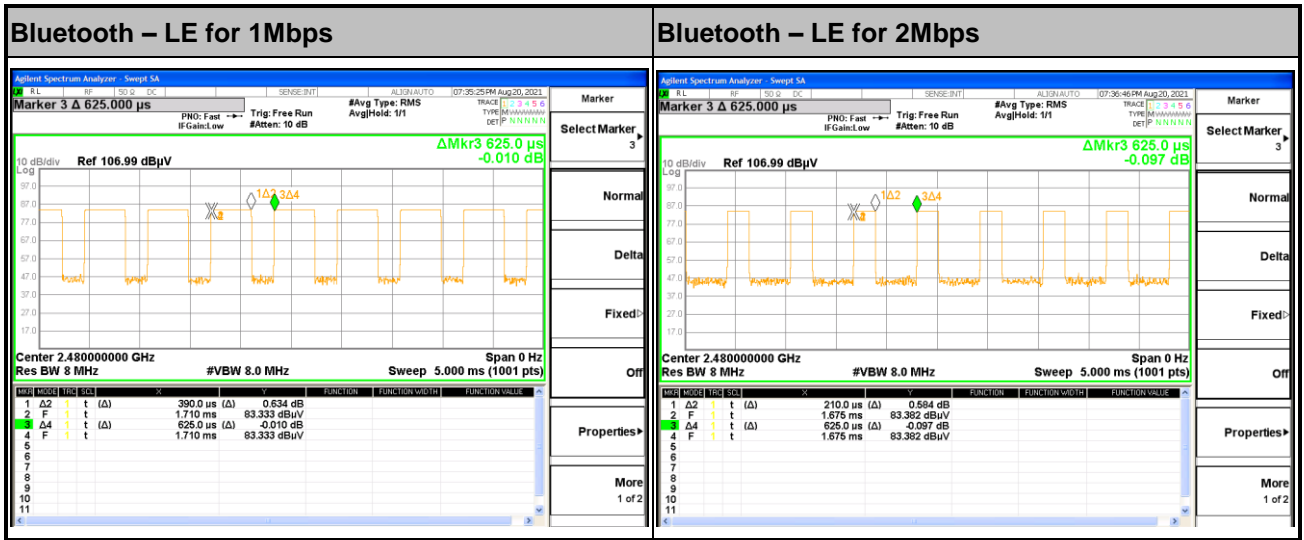
BLE	2.4GHz 2400~2483.5MHz	
	BLE LF	
	Horizontal	Vertical
QP / Peak	<p>Site : 03CH07-HY Condition : QP 3m LF-ANT-35419(6) HORIZONTAL</p>	<p>Site : 03CH07-HY Condition : QP 3m LF-ANT-35419(6) VERTICAL</p>



# Appendix D. Duty Cycle Plots

<Sample 1 with Battery 1>

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
Bluetooth - LE for 1Mbps	62.40	390	2.56	3kHz
Bluetooth - LE for 2Mbps	33.60	210	4.76	10kHz



<Sample 1 with Battery 2>

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
Bluetooth - LE for 2Mbps	33.17	207	4.83	10kHz

