

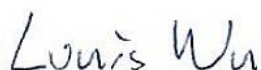


# FCC RADIO TEST REPORT

**FCC ID** : HD5-CT30PL0N  
**Equipment** : Mobile computer  
**Brand Name** : Honeywell  
**Model Name** : CT30PL0N  
**Applicant** : Honeywell International Inc.  
9680 Old Bailes Road, Fort Mill, SC 29707 USA  
**Manufacturer** : Honeywell International Inc.  
9680 Old Bailes Road, Fort Mill, SC 29707 USA  
**Standard** : FCC Part 15 Subpart C §15.247

The product was received on Nov. 11, 2021 and testing was performed from Nov. 15, 2021 to Dec. 27, 2021. We, Sporton International Inc. Wensan 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 from Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.



Approved by: Louis Wu

**Sporton International Inc. Wensan Laboratory**

No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)



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## History of this test report

Report No.	Version	Description	Issue Date
FR1N0506B	01	Initial issue of report	Jan. 04, 2022
FR1N0506B	02	1. Revise typo 2. Revise description in section 3.5.3 3. Revise List of Measuring Equipment 4. Revise antenna information	Jan. 10, 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	6.00 dB under the limit at 2483.680 MHz
3.6	15.207	AC Conducted Emission	Pass	13.60 dB under the limit at 0.708 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 product specifications of the EUT presented in the report are declared by the manufacturer who shall take full responsibility for the authenticity.

**Reviewed by: Wei Chen**

**Report Producer: Celery Wei**

# 1 General Description

## 1.1 Product Feature of Equipment Under Test

Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n/ac, Wi-Fi 5GHz 802.11a/n/ac and NFC.

Product Feature	
Sample 1	with Scanner (S0703)
Sample 2	Non Scanner
HW Version	EVT1.5
SW Version	311.C0.00.0630-N-DEBUG
Antenna Type	WLAN <Ant. 1> WLAN5G: PIFA Antenna <Ant. 2> WLAN2.4G: PIFA Antenna Bluetooth: PIFA Antenna NFC: Loop Antenna

Antenna information		
2400 MHz ~ 2483.5 MHz	Peak Gain (dBi)	2.5

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

## 1.2 Modification of EUT

No modifications made to the EUT during the testing.

### 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> CO05-HY (TAF Code: 1190)
<b>Remark</b>	The Conducted Emission test item subcontracted to Sporton International Inc. EMC & Wireless Communications Laboratory.

<b>Test Site</b>	Sporton International Inc. Wensan Laboratory
<b>Test Site Location</b>	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
<b>Test Site No.</b>	<b>Sporton Site No.</b> TH05-HY, 03CH13-HY

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

FCC designation No.: TW1190 and TW3786

### 1.4 Applicable Standards

According to the specifications declared by 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 the test items were validated and recorded in accordance with the standards without any modification during the testing.
2. The TAF code is not including all the FCC KDB listed without accreditation.



## 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, 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 X plane as worst plane.
- 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
Conducted Test Cases	Bluetooth – LE / GFSK
	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
Radiated Test Cases	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
AC Conducted Emission	Mode 1: Bluetooth Link + WLAN Link + USB Cable (Charging from AC Adapter) for Sample 1
<b>Remark:</b> For Radiated Test Cases, the tests were performed with Sample 1.	



## 2.3 Connection Diagram of Test System



## 2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Earphone	Sony Ericsson	MW600	PY700A2029	N/A	N/A
2.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8m
3.	Notebook	Dell	Latitude 3400	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
4.	Notebook	Acer	N18Q13	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m



## 2.5 EUT Operation Test Setup

The RF test items, utility “QRCT 4.0.00195.0” 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 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

Please refer to the measuring equipment list in 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 is connected to the spectrum analyzer by RF cable and attenuator. The path loss is 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.

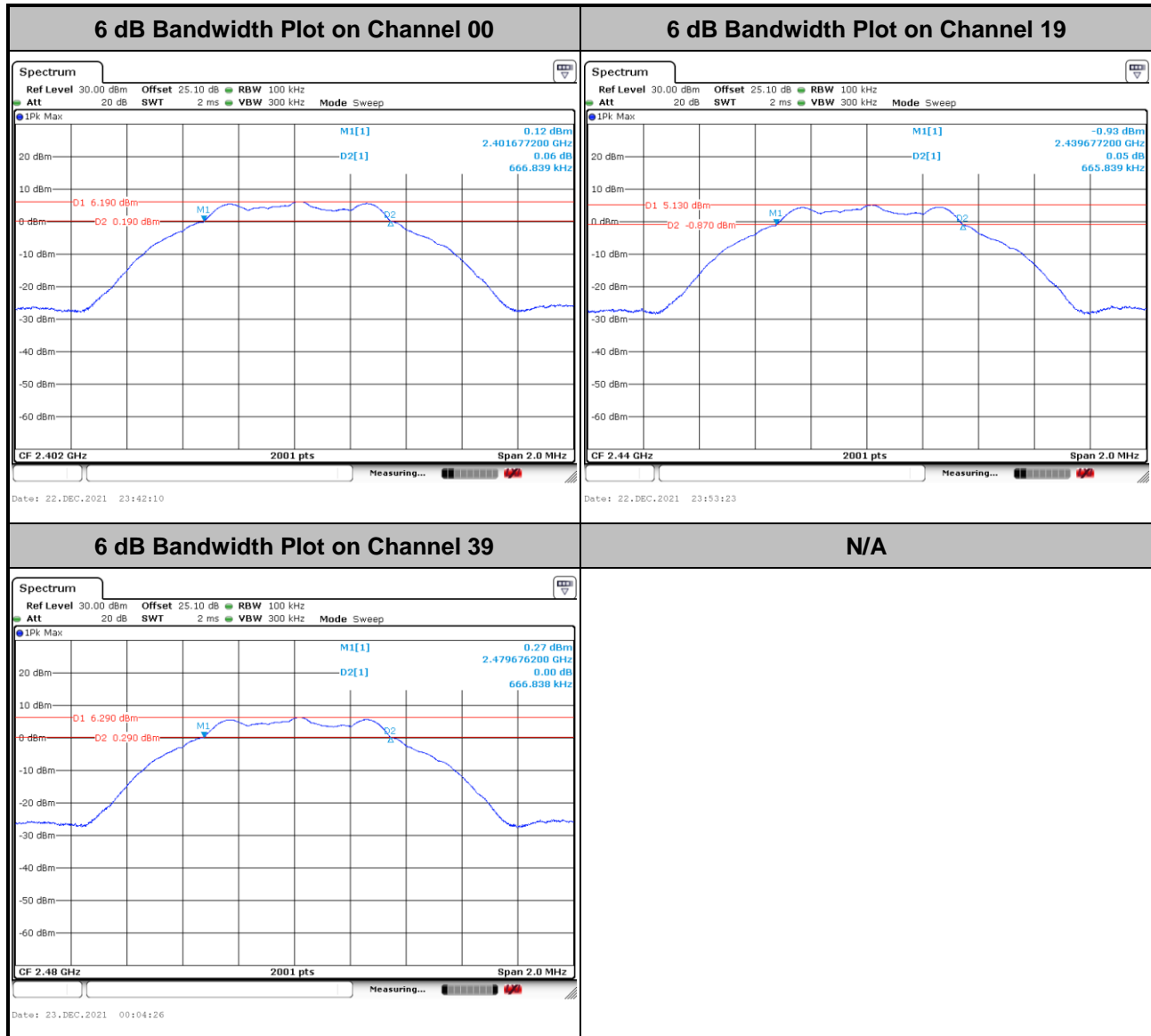
##### 3.1.4 Test Setup



### 3.1.5 Test Result of 6dB Bandwidth

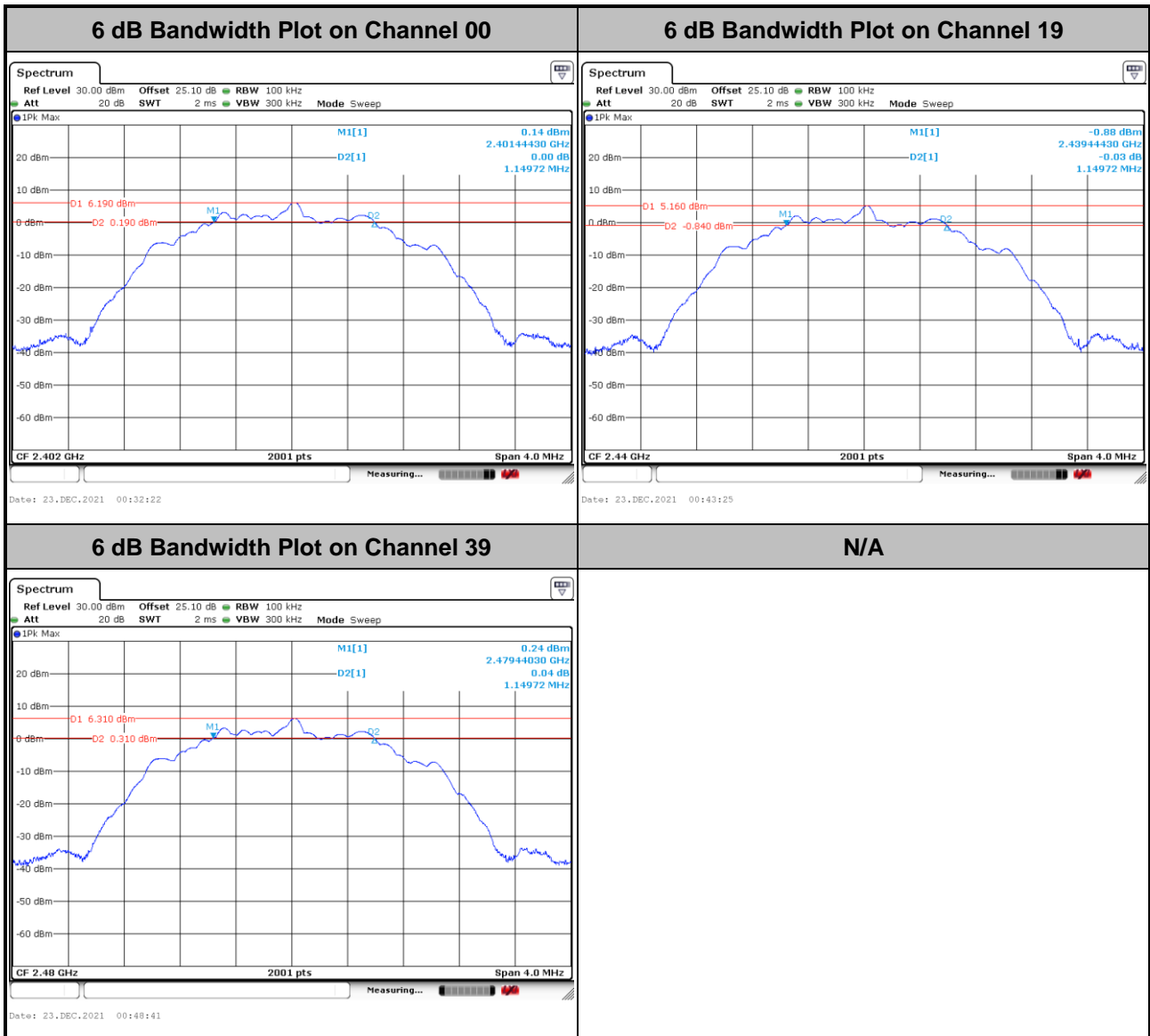
Please refer to Appendix A.

**<1 Mbps>**





<2Mbps>

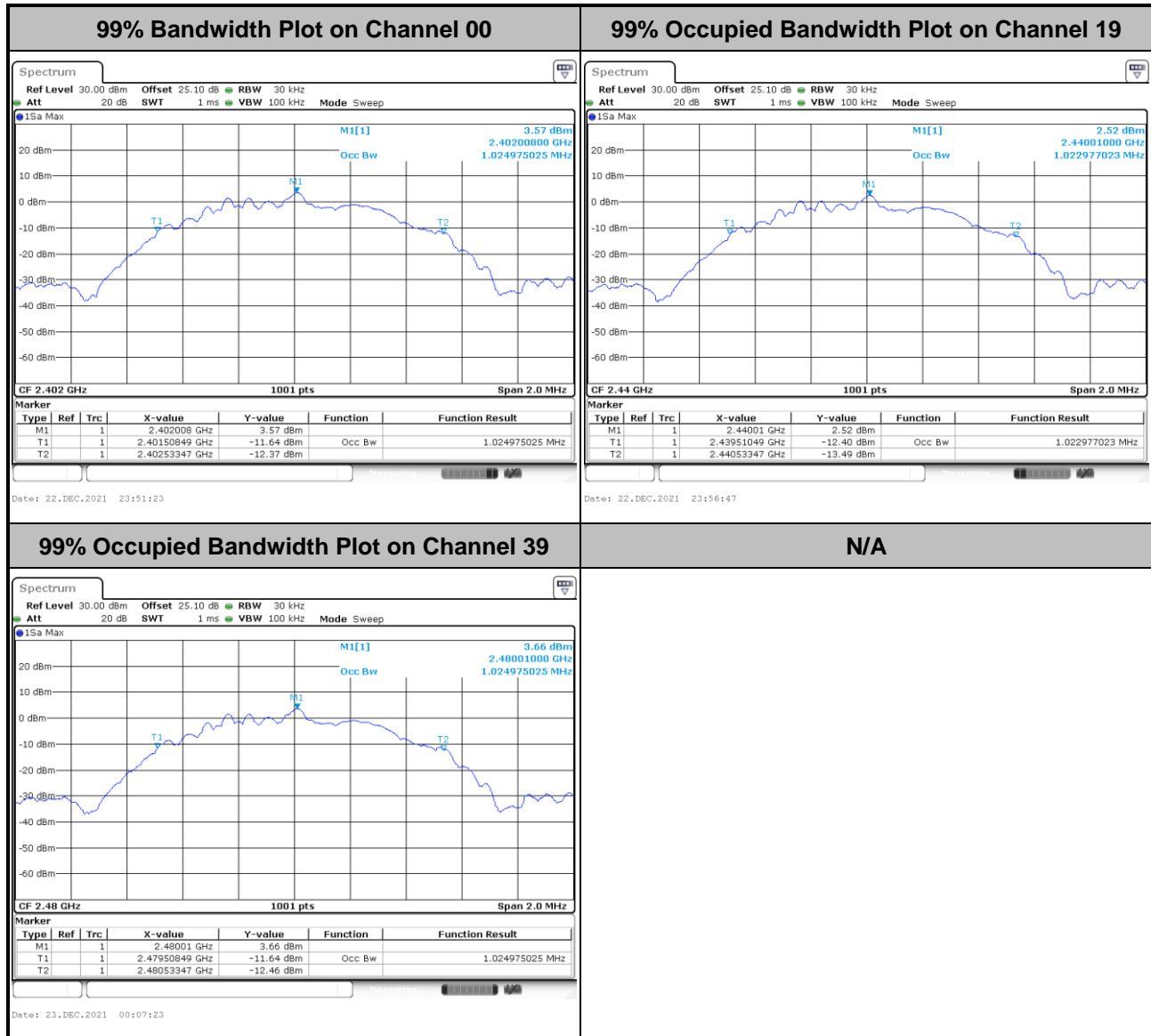




### 3.1.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

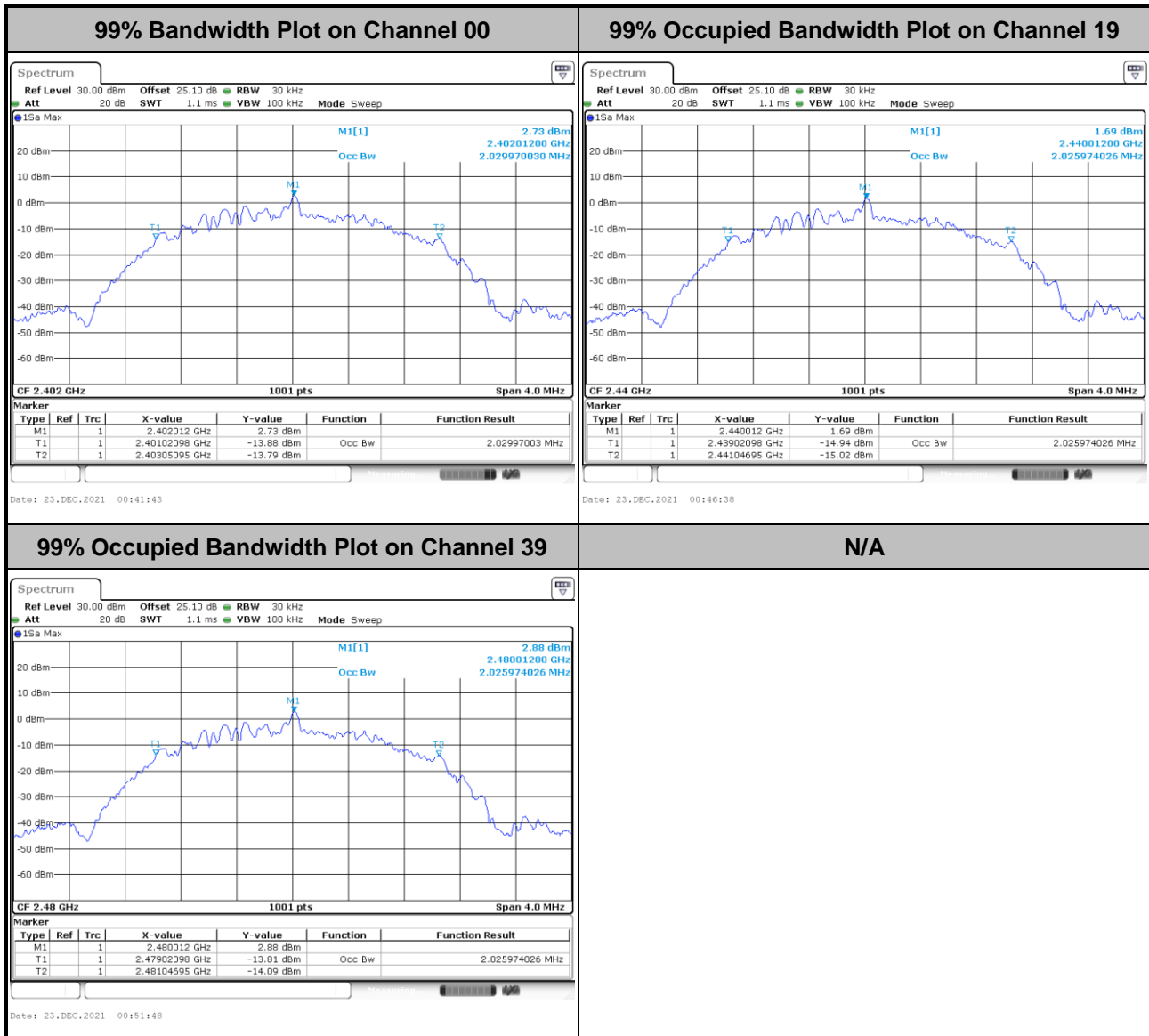
<1Mbps>



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



&lt;2Mbps&gt;



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

Please refer to the measuring equipment list in this test report.

### 3.2.3 Test Procedures

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

### 3.2.4 Test Setup



### 3.2.5 Test Result of Average Output Power

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.

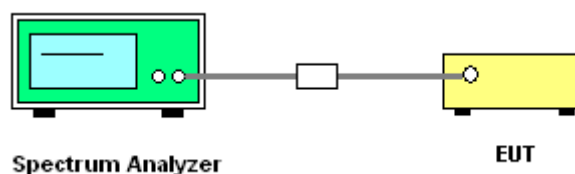
#### 3.3.2 Measuring Instruments

Please refer to the measuring equipment list in 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 is connected to the spectrum analyzer by RF cable and attenuator. The path loss is 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. (6 dB 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



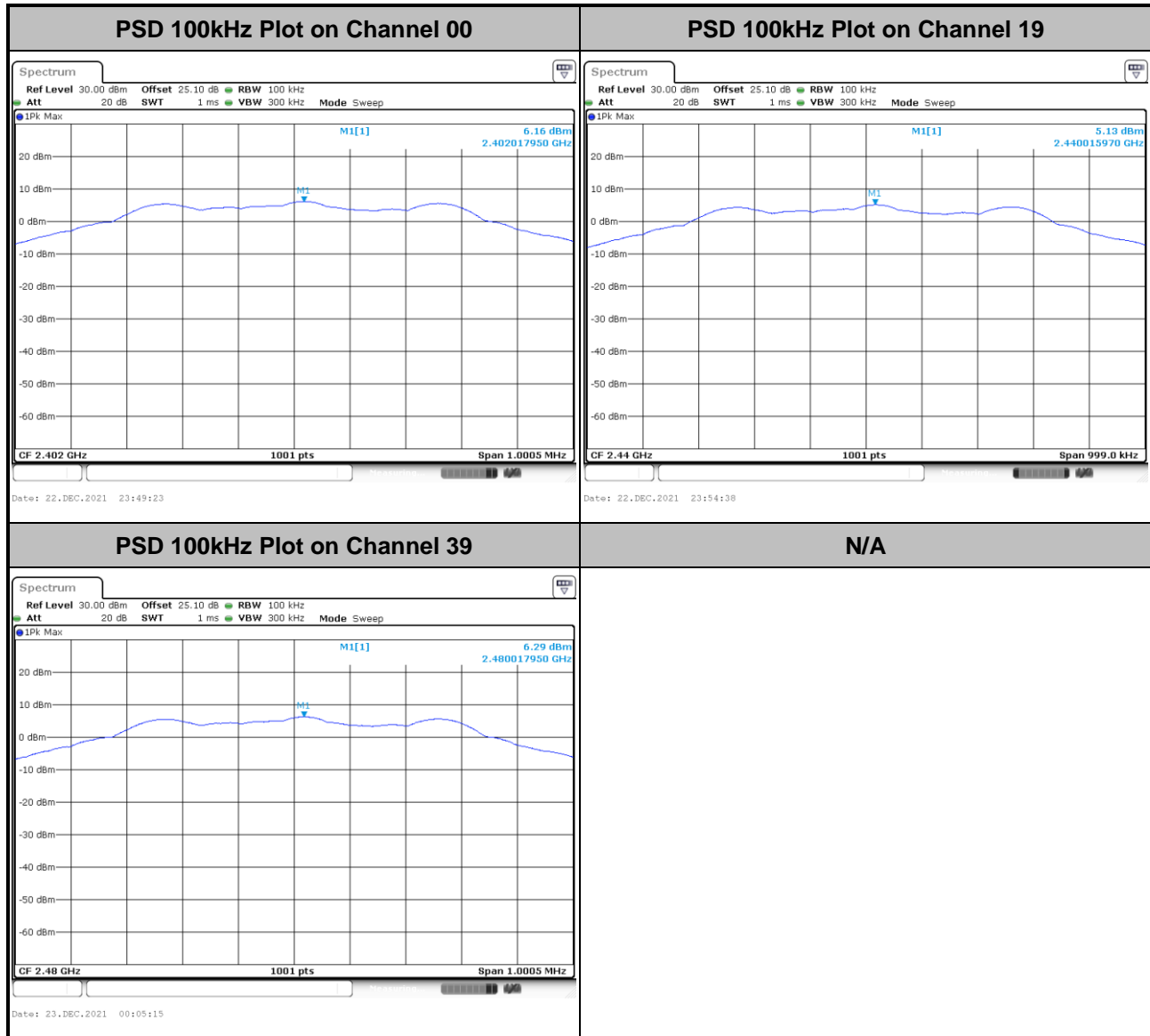
#### 3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.



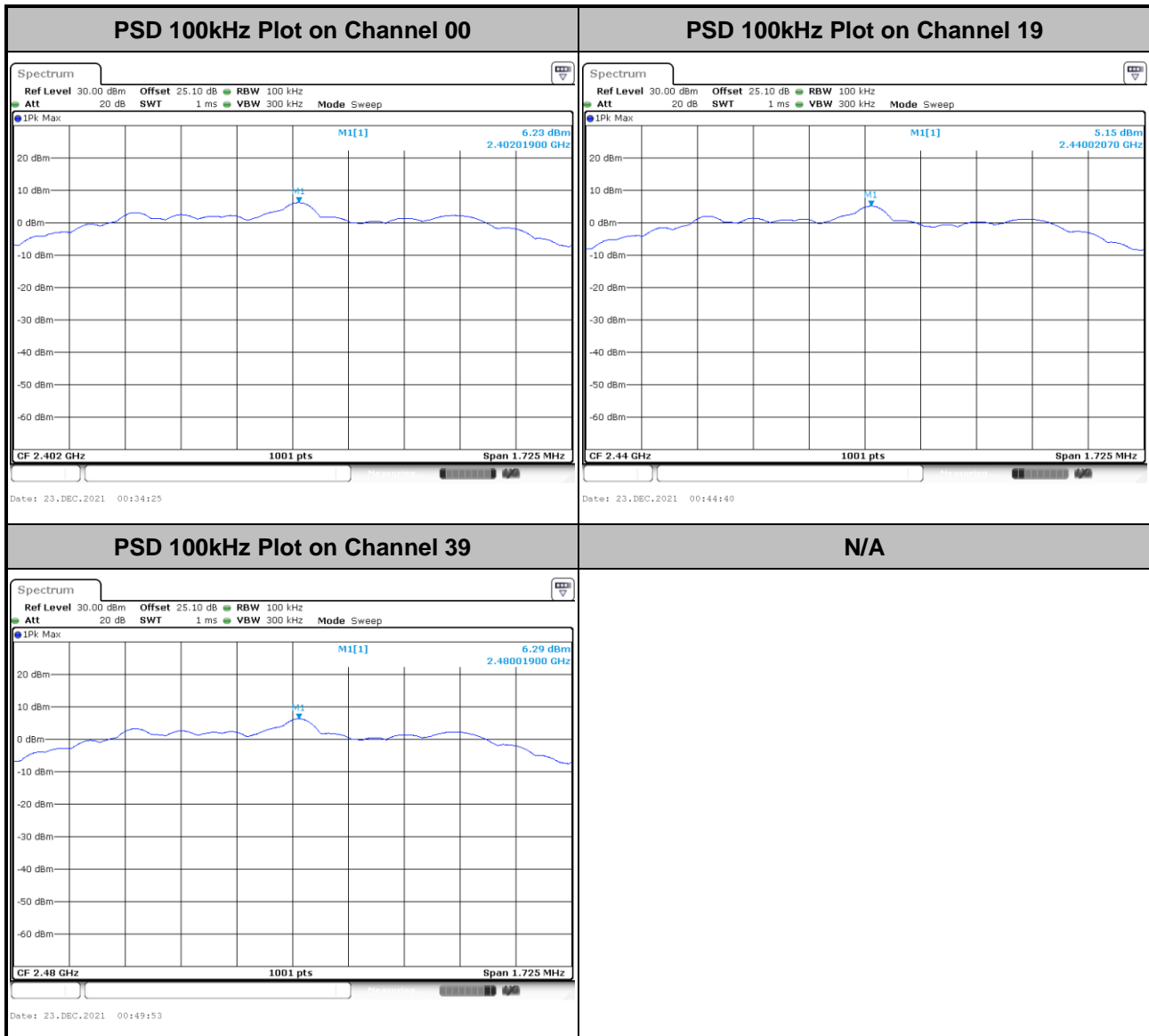
## 3.3.6 Test Result of Power Spectral Density Plots (100kHz)

&lt;1Mbps&gt;





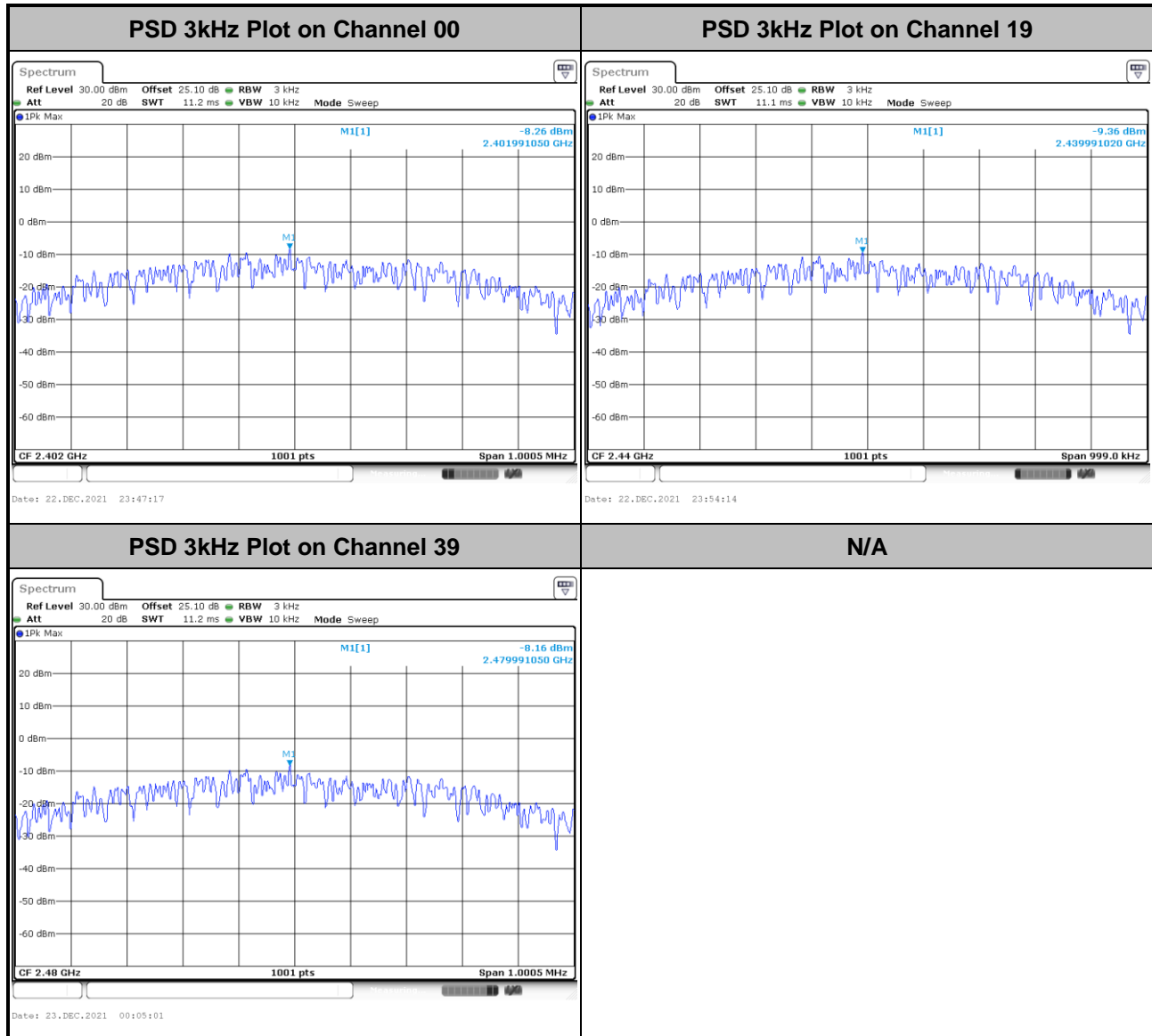
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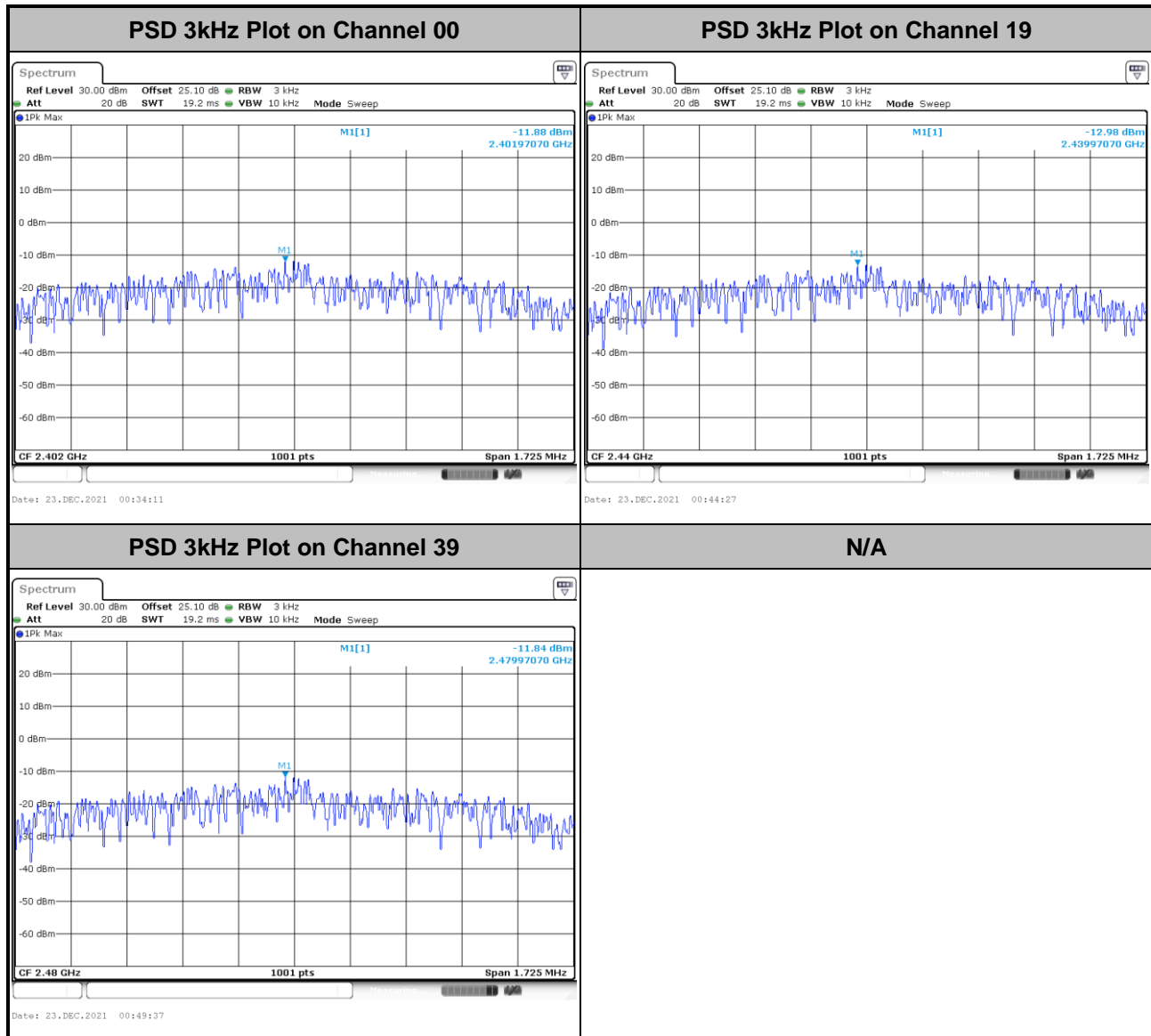
## 3.3.7 Test Result of Power Spectral Density Plots (3kHz)

&lt;1Mbps&gt;





<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.

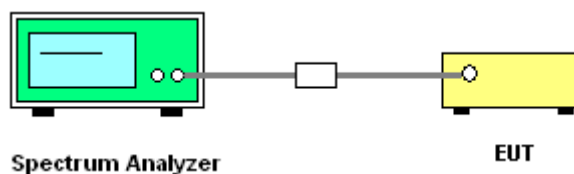
#### 3.4.2 Measuring Instruments

Please refer to the measuring equipment list in 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 is connected to the spectrum analyzer by RF cable and attenuator. The path loss is 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.

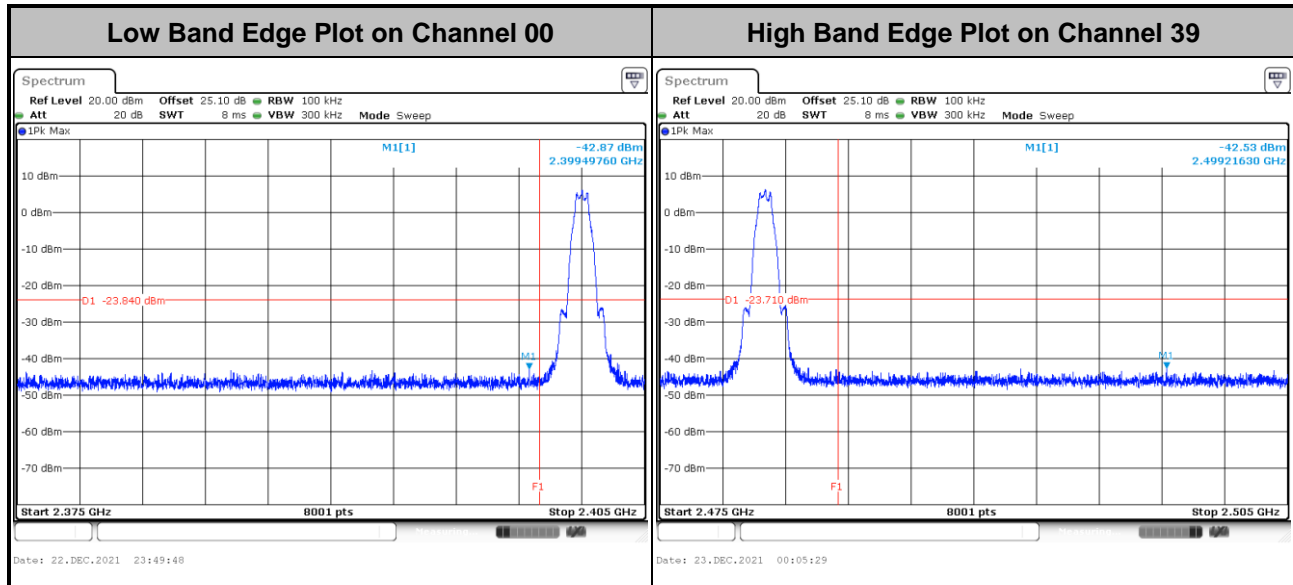
#### 3.4.4 Test Setup



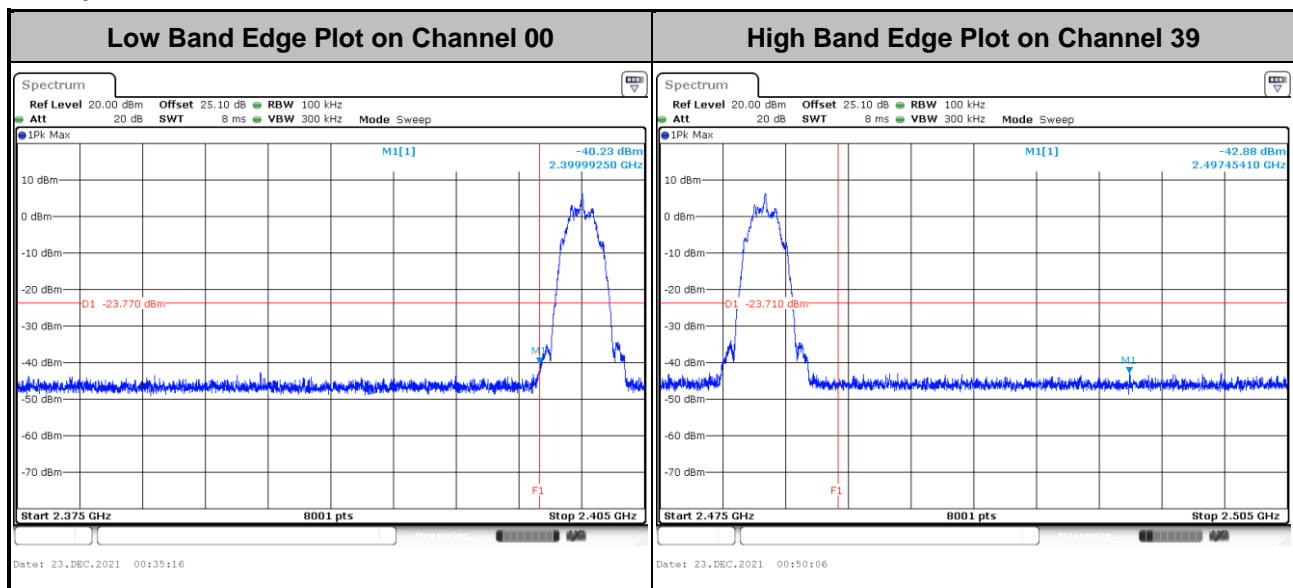


## 3.4.5 Test Result of Conducted Band Edges Plots

&lt;1Mbps&gt;



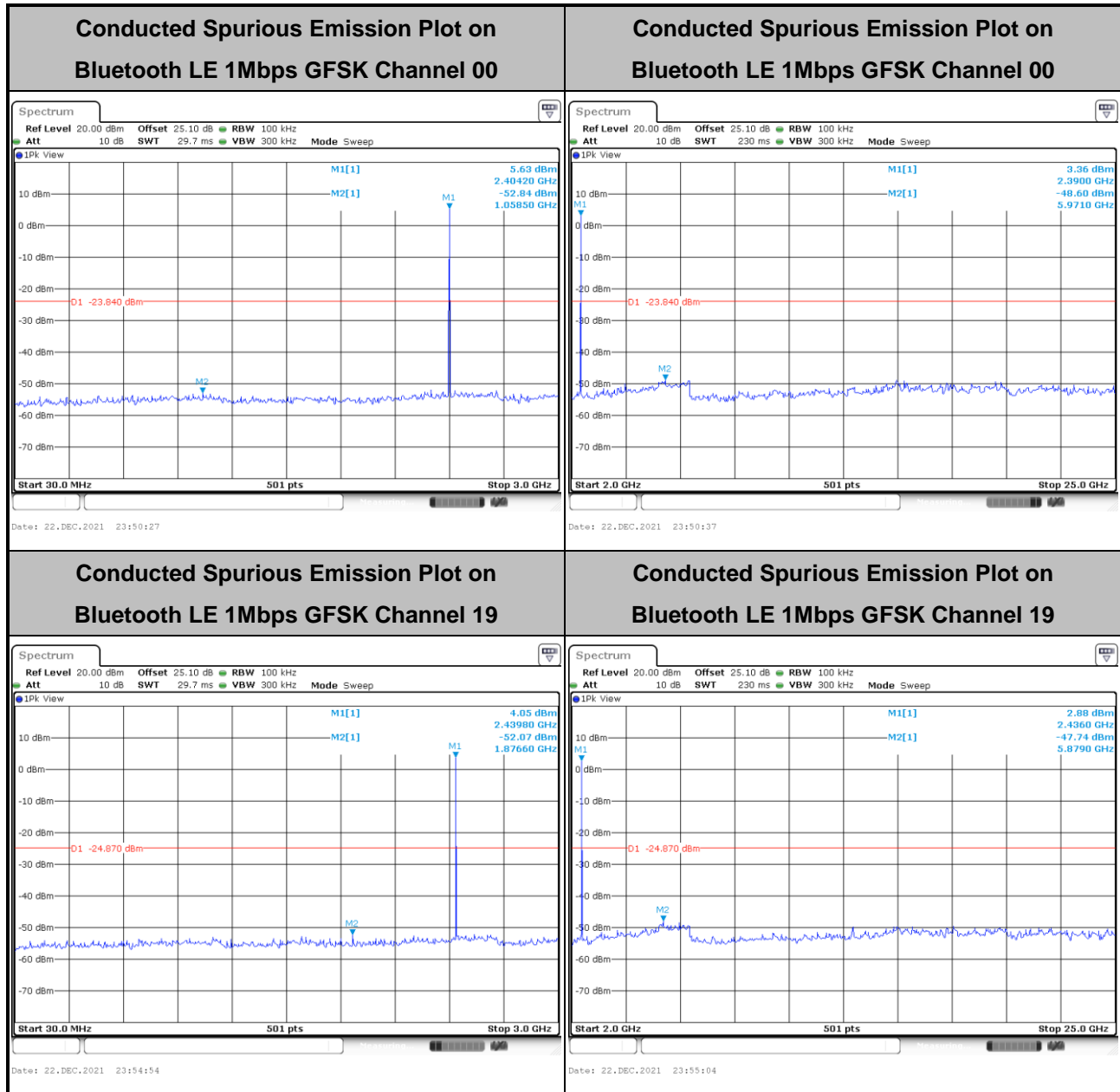
&lt;2Mbps&gt;



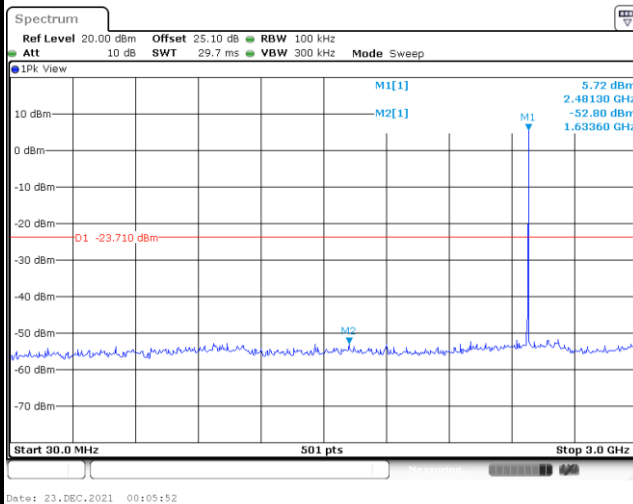
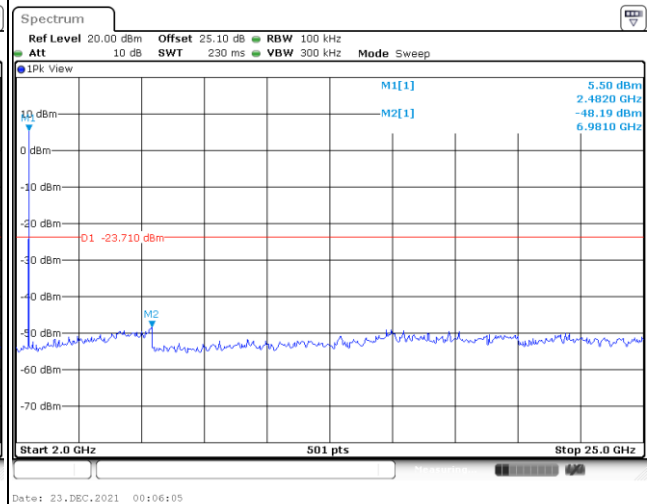


## 3.4.6 Test Result of Conducted Spurious Emission Plots

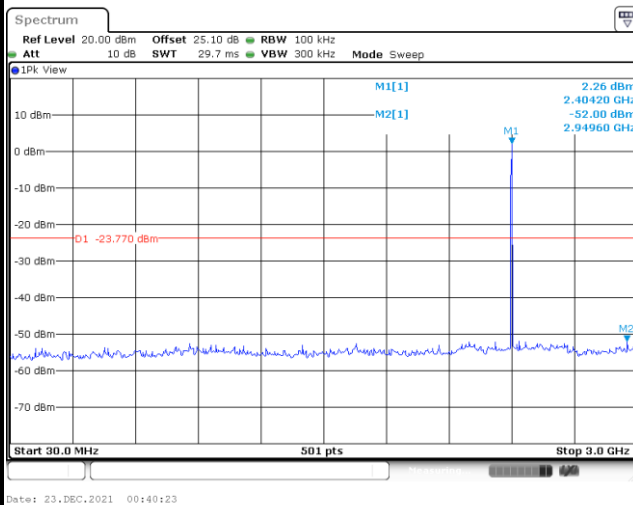
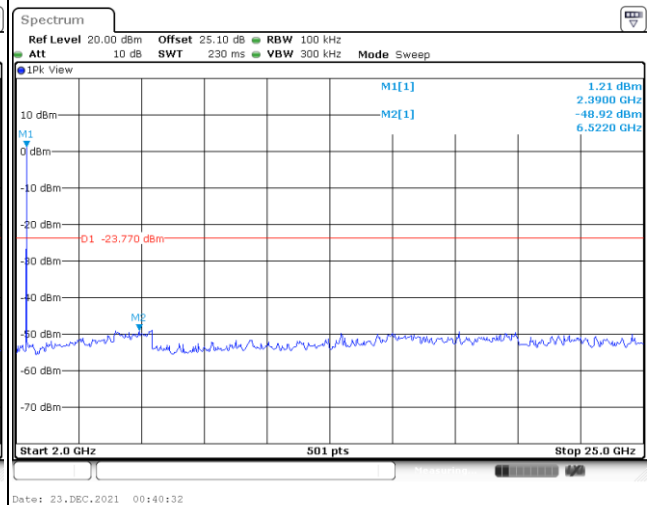
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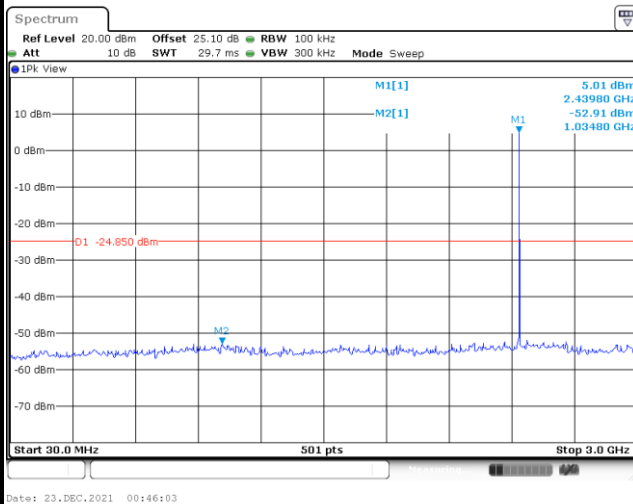
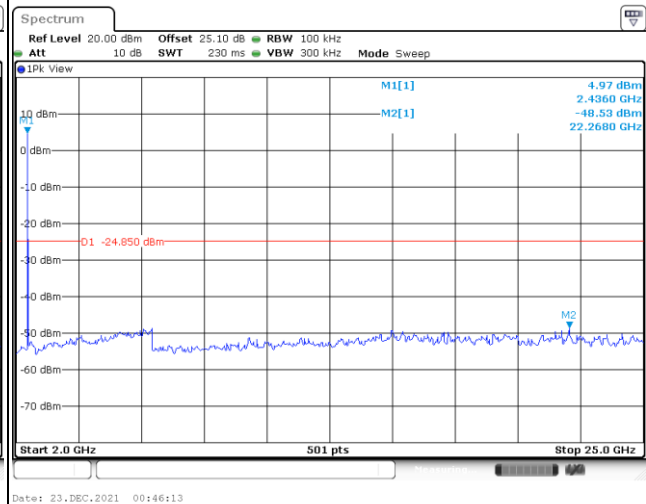
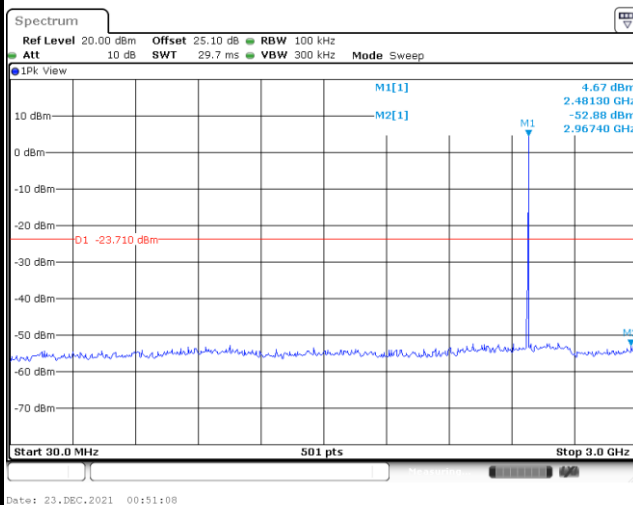
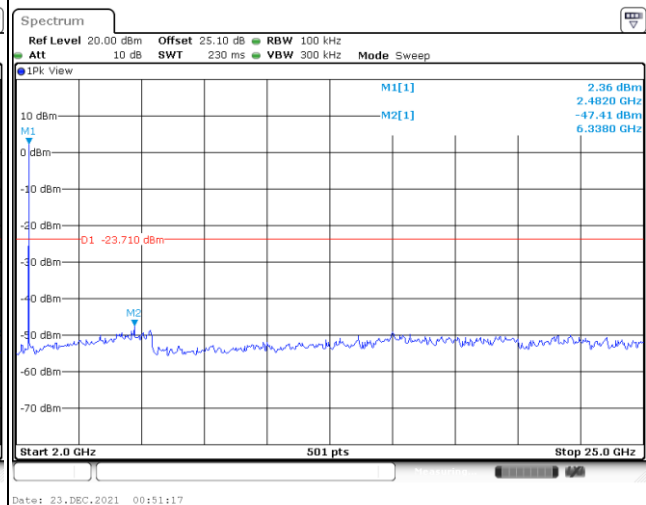




**Conducted Spurious Emission Plot on  
Bluetooth LE 1Mbps GFSK Channel 39****Conducted Spurious Emission Plot on  
Bluetooth LE 1Mbps GFSK Channel 39**

## &lt;2Mbps&gt;

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

**Conducted Spurious Emission Plot on  
Bluetooth LE 2Mbps GFSK Channel 19****Conducted Spurious Emission Plot on  
Bluetooth LE 2Mbps GFSK Channel 19****Conducted Spurious Emission Plot on  
Bluetooth LE 2Mbps GFSK Channel 39****Conducted Spurious Emission Plot on  
Bluetooth LE 2Mbps GFSK Channel 39**



### **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 is 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.

<b>Frequency (MHz)</b>	<b>Field Strength (microvolts/meter)</b>	<b>Measurement Distance (meters)</b>
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**

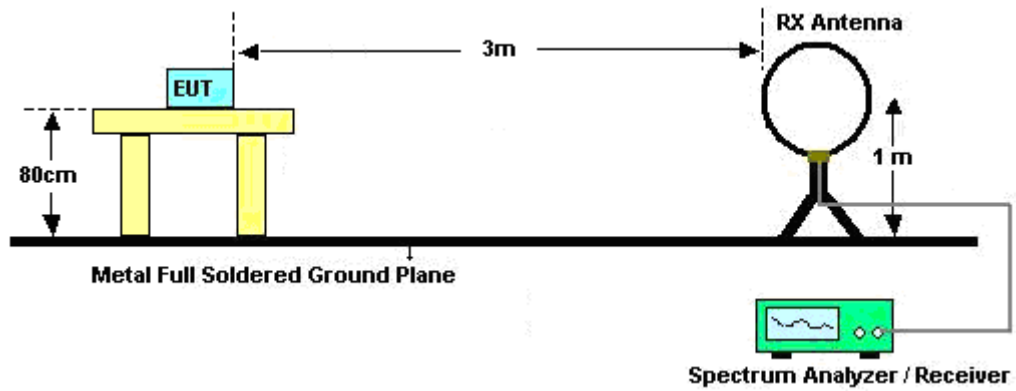
Please refer to the measuring equipment list in this test report.

### 3.5.3 Test Procedures

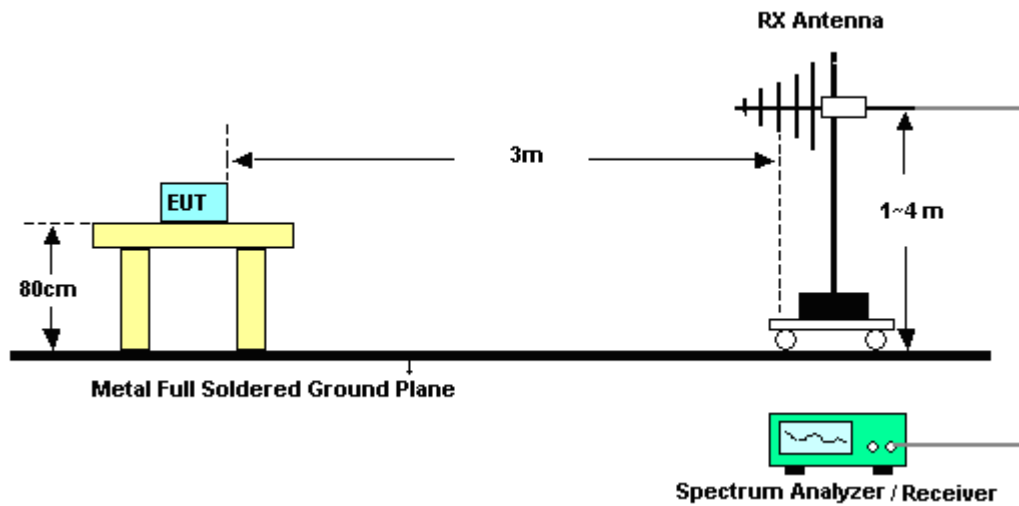
1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT is arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT is 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 is set 3 meters away from the receiving antenna, which is mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamplifier 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

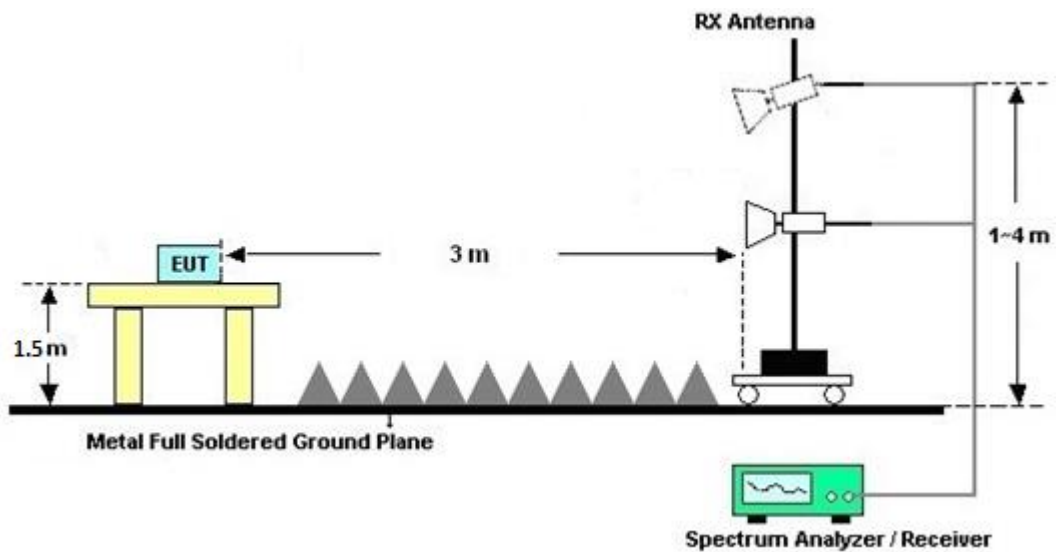
For radiated test below 30MHz



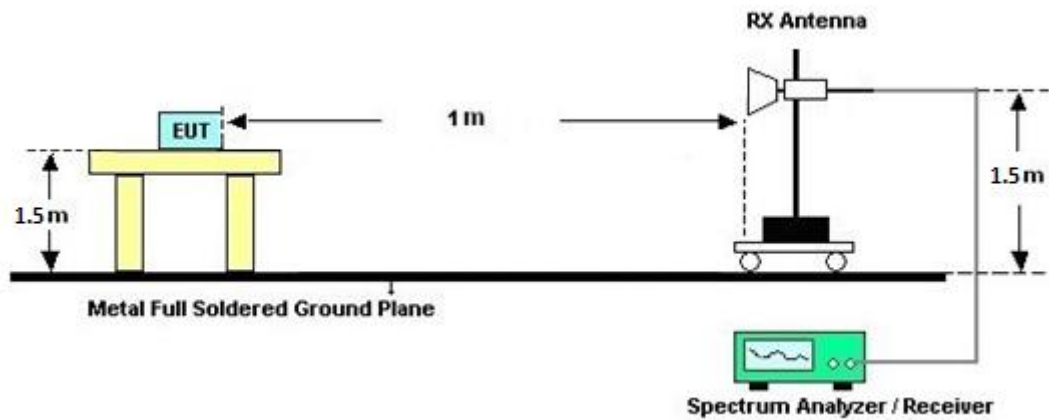
For radiated test from 30MHz to 1GHz



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 starts from 9 kHz to 30 MHz, is pre-scanned and the result which is 20 dB lower than the limit line is 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 comes 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 (30 MHz ~ 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.

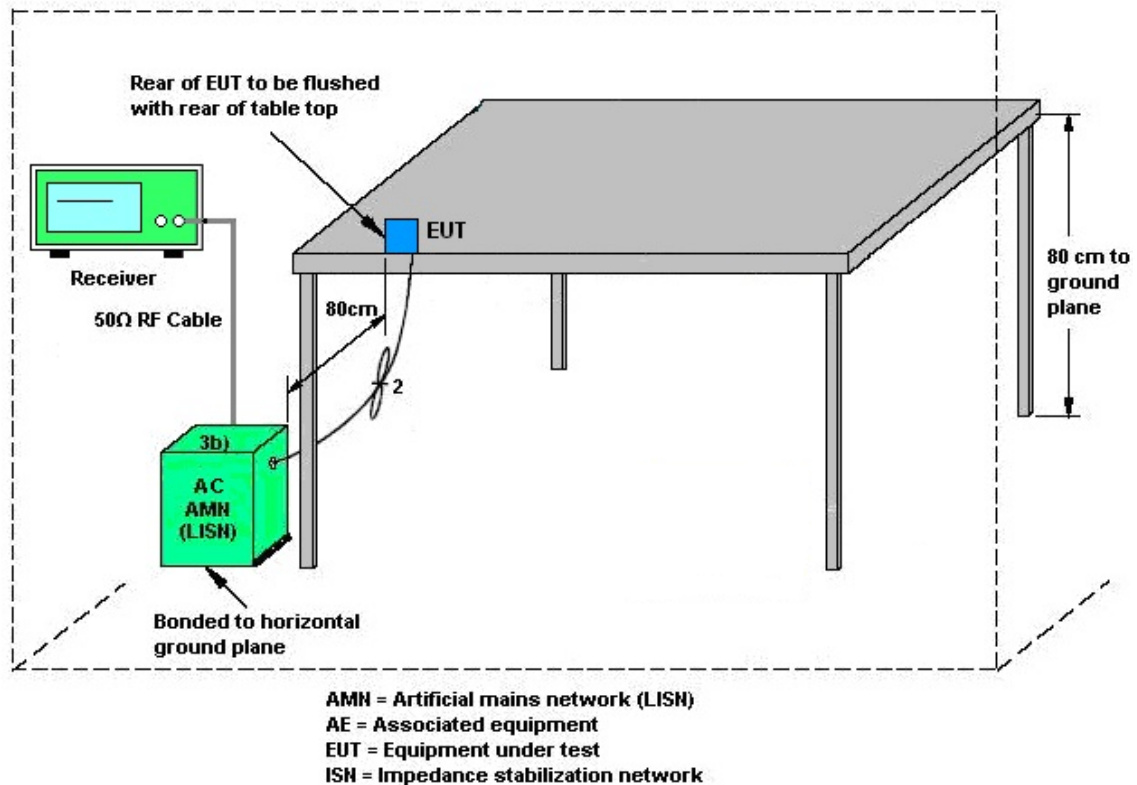
#### 3.6.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

#### 3.6.3 Test Procedures

1. The EUT is placed 0.4 meter away from the conducting wall of the shielding room, and is 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 shall be used.
6. Both Line and Neutral shall be tested in order to find out the maximum conducted emission.
7. The frequency range from 150 kHz to 30 MHz is scanned.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9 kHz) 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 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.

### **3.7.2 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	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jan. 04, 2021	Nov. 19, 2021~ Dec. 27, 2021	Jan. 03, 2022	Radiation (03CH13-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1241	1GHz ~ 18GHz	Jul. 13, 2021	Nov. 19, 2021~ Dec. 27, 2021	Jul. 12, 2022	Radiation (03CH13-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170576	18GHz- 40GHz	May 21, 2021	Nov. 19, 2021~ Dec. 27, 2021	May 20, 2022	Radiation (03CH13-HY)
Amplifier	Sonoma-Instrument	310 N	187282	9KHz~1GHz	Dec. 16, 2020	Nov. 19, 2021~ Dec. 14, 2021	Dec. 15, 2021	Radiation (03CH13-HY)
Amplifier	Sonoma-Instrument	310 N	187282	9KHz~1GHz	Dec. 15, 2021	Dec. 15, 2021~ Dec. 27, 2021	Dec. 14, 2022	Radiation (03CH13-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	1590074	1GHz~18GHz	May 18, 2021	Nov. 19, 2021~ Dec. 27, 2021	May 17, 2022	Radiation (03CH13-HY)
Preamplifier	Keysight	83017A	MY53270147	1GHz~26.5GHz	Oct. 26, 2021	Nov. 19, 2021~ Dec. 27, 2021	Oct. 25, 2022	Radiation (03CH13-HY)
Preamplifier	EMEC	EM18G40G	060801	18GHz ~ 40GHz	Jun. 22, 2021	Nov. 19, 2021~ Dec. 27, 2021	Jun. 21, 2022	Radiation (03CH13-HY)
Spectrum Analyzer	Keysight	N9010A	MY55370526	10Hz~44GHz	Mar. 18, 2021	Nov. 19, 2021~ Dec. 27, 2021	Mar. 17, 2022	Radiation (03CH13-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Nov. 19, 2021~ Dec. 27, 2021	N/A	Radiation (03CH13-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Nov. 19, 2021~ Dec. 27, 2021	N/A	Radiation (03CH13-HY)
Software	Audix	E3 6.2009-8-24	RK-000992	N/A	N/A	Nov. 19, 2021~ Dec. 27, 2021	N/A	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0030/126E	30M-18G	Feb. 10, 2021	Nov. 19, 2021~ Dec. 27, 2021	Feb. 09, 2022	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	804793/4	30M-18G	Feb. 10, 2021	Nov. 19, 2021~ Dec. 27, 2021	Feb. 09, 2022	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30M~40GHz	Feb. 22, 2021	Nov. 19, 2021~ Dec. 27, 2021	Feb. 21, 2022	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY4274/2	30MHz~40GHz	Mar. 11, 2021	Nov. 19, 2021~ Dec. 27, 2021	Mar. 10, 2022	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24961/4	30M-18G	Feb. 10, 2021	Nov. 19, 2021~ Dec. 27, 2021	Feb. 09, 2022	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	9kHz~30MHz	Mar. 11, 2021	Nov. 19, 2021~ Dec. 27, 2021	Mar. 10, 2022	Radiation (03CH13-HY)
Filter	Wainwright	WLK4-1000-15 30-8000-40SS	SN12	1.53GHz Low Pass Filter	Sep. 14, 2021	Nov. 19, 2021~ Dec. 27, 2021	Sep. 13, 2022	Radiation (03CH13-HY)
Filter	Wainwright	WHKX8-5872. 5-6750-18000- 40ST	SN5	6.75GHz High Pass Filter	Mar. 11, 2021	Nov. 19, 2021~ Dec. 27, 2021	Mar. 10, 2022	Radiation (03CH13-HY)
Filter	Wainwright	WHKX12-2700 -3000-18000-6 OSS	SN2	3GHz High Pass Filter	Jul. 12, 2021	Nov. 19, 2021~ Dec. 27, 2021	Jul. 11, 2022	Radiation (03CH13-HY)



Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Hygrometer	TECEPIL	DTM-303A	TP201996	N/A	Nov. 16, 2021	Dec. 21, 2021~ Dec. 23, 2021	Nov. 15, 2022	Conducted (TH05-HY)
Power Meter	DARE	RPR3006W	13I00030SNO 31(NO:182)	10MHz~6GHz	Dec. 30, 2020	Dec. 21, 2021~ Dec. 23, 2021	Dec. 29, 2021	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101566	10Hz~40GHz	Aug. 30, 2021	Dec. 21, 2021~ Dec. 23, 2021	Aug. 29, 2022	Conducted (TH05-HY)
Switch Box & RF Cable	EM Electronics	EMSW18SE	SW191204(B OX8)	N/A	Jan. 07, 2021	Dec. 21, 2021~ Dec. 23, 2021	Jan. 06, 2022	Conducted (TH05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Nov. 15, 2021	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9kHz~3.6GHz	Nov. 30, 2020	Nov. 15, 2021	Nov. 29, 2021	Conduction (CO05-HY)
Hygrometer	Testo	608-H1	34913912	N/A	Nov. 18, 2020	Nov. 15, 2021	Nov. 17, 2021	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Dec. 01, 2020	Nov. 15, 2021	Nov. 30, 2021	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Nov. 15, 2021	N/A	Conduction (CO05-HY)
Pulse Limiter	SCHWARZBECK	VTSD 9561-F N	00691	N/A	Jul. 28, 2021	Nov. 15, 2021	Jul. 27, 2022	Conduction (CO05-HY)
LISN Cable	MVE	RG-400	260260	N/A	Dec. 31, 2020	Nov. 15, 2021	Dec. 30, 2021	Conduction (CO05-HY)

## 5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	3.1 dB
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### Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	6.0 dB
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### Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	5.2 dB
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### Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	5.9 dB
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**Appendix A. Test Result of Conducted Test Items**

Test Engineer:	Mina Liu/Shiming Liu	Temperature:	20.9~24.2	°C
Test Date:	2021/12/21~2021/12/23	Relative Humidity:	52.9~57.1	%

**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	1.025	0.667	0.50	Pass
BLE	1Mbps	1	19	2440	1.023	0.666	0.50	Pass
BLE	1Mbps	1	39	2480	1.025	0.667	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	6.10	30.00	2.50	8.60	36.00	Pass
BLE	1Mbps	1	19	2440	4.90	30.00	2.50	7.40	36.00	Pass
BLE	1Mbps	1	39	2480	6.10	30.00	2.50	8.60	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	6.16	-8.26	2.50	8.00	Pass
BLE	1Mbps	1	19	2440	5.13	-9.36	2.50	8.00	Pass
BLE	1Mbps	1	39	2480	6.29	-8.16	2.50	8.00	Pass

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 30dBc 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	2.030	1.150	0.50	Pass
BLE	2Mbps	1	19	2440	2.026	1.150	0.50	Pass
BLE	2Mbps	1	39	2480	2.026	1.150	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	2Mbps	1	0	2402	6.00	30.00	2.50	8.50	36.00	Pass
BLE	2Mbps	1	19	2440	4.80	30.00	2.50	7.30	36.00	Pass
BLE	2Mbps	1	39	2480	6.00	30.00	2.50	8.50	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	6.23	-11.88	2.50	8.00	Pass
BLE	2Mbps	1	19	2440	5.15	-12.98	2.50	8.00	Pass
BLE	2Mbps	1	39	2480	6.29	-11.84	2.50	8.00	Pass

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



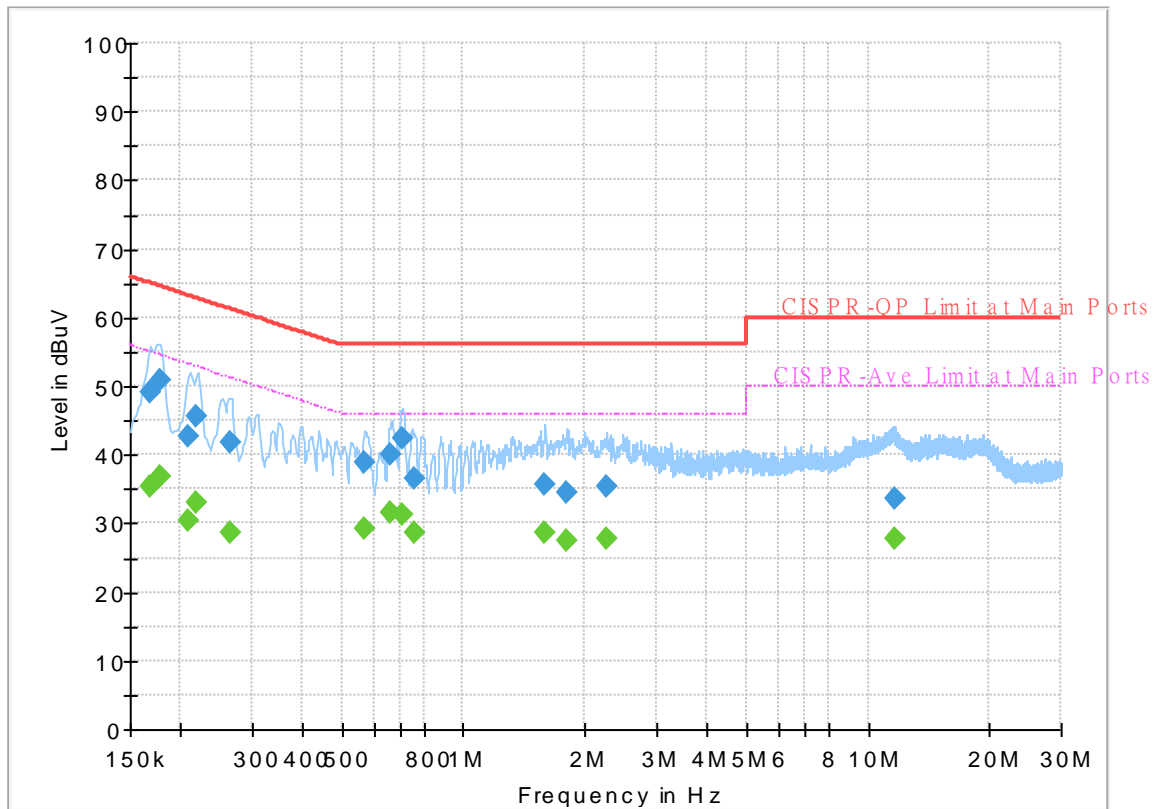
## Appendix B. AC Conducted Emission Test Results

Test Engineer :	Calvin Wang	Temperature :	23~26°C
		Relative Humidity :	45~55%

## EUT Information

Report NO : 1N0506  
Test Mode : Mode 1  
Test Voltage : 120Vac/60Hz  
Phase : Line

Full Spectrum



## Final\_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.168000	---	35.28	55.06	19.78	L1	OFF	19.7
0.168000	49.02	---	65.06	16.04	L1	OFF	19.7
0.177000	---	36.93	54.63	17.70	L1	OFF	19.7
0.177000	50.78	---	64.63	13.85	L1	OFF	19.7
0.208500	---	30.27	53.27	23.00	L1	OFF	19.7
0.208500	42.83	---	63.27	20.44	L1	OFF	19.7
0.217500	---	33.05	52.91	19.86	L1	OFF	19.7
0.217500	45.52	---	62.91	17.39	L1	OFF	19.7
0.264750	---	28.79	51.28	22.49	L1	OFF	19.7
0.264750	41.93	---	61.28	19.35	L1	OFF	19.7
0.568500	---	29.19	46.00	16.81	L1	OFF	19.9
0.568500	38.77	---	56.00	17.23	L1	OFF	19.9
0.658500	---	31.66	46.00	14.34	L1	OFF	20.0
0.658500	39.94	---	56.00	16.06	L1	OFF	20.0
0.708000	---	31.31	46.00	14.69	L1	OFF	20.0
0.708000	42.40	---	56.00	13.60	L1	OFF	20.0
0.759750	---	28.63	46.00	17.37	L1	OFF	20.0
0.759750	36.47	---	56.00	19.53	L1	OFF	20.0
1.592250	---	28.68	46.00	17.32	L1	OFF	20.2
1.592250	35.57	---	56.00	20.43	L1	OFF	20.2
1.794750	---	27.38	46.00	18.62	L1	OFF	20.2

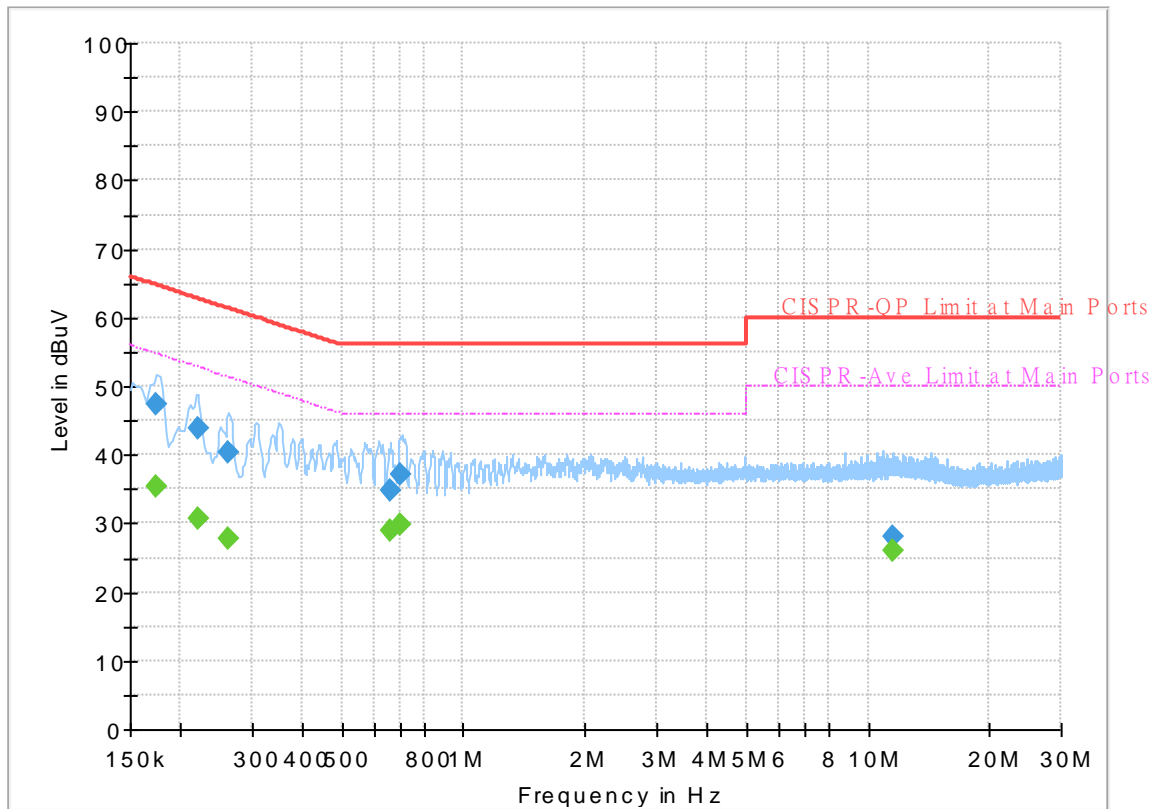


1.794750	34.45	---	56.00	21.55	L1	OFF	20.2
2.253750	---	27.91	46.00	18.09	L1	OFF	20.1
2.253750	35.38	---	56.00	20.62	L1	OFF	20.1
11.638500	---	27.68	50.00	22.32	L1	OFF	20.2
11.638500	33.54	---	60.00	26.46	L1	OFF	20.2

## EUT Information

Report NO : 1N0506  
Test Mode : Mode 1  
Test Voltage : 120Vac/60Hz  
Phase : Neutral

Full Spectrum



## Final\_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.174750	---	35.27	54.73	19.46	N	OFF	19.7
0.174750	47.48	---	64.73	17.25	N	OFF	19.7
0.219750	---	30.75	52.83	22.08	N	OFF	19.7
0.219750	43.84	---	62.83	18.99	N	OFF	19.7
0.262500	---	27.84	51.35	23.51	N	OFF	19.7
0.262500	40.34	---	61.35	21.01	N	OFF	19.7
0.660750	---	28.97	46.00	17.03	N	OFF	20.0
0.660750	34.94	---	56.00	21.06	N	OFF	20.0
0.699000	---	29.70	46.00	16.30	N	OFF	20.0
0.699000	37.18	---	56.00	18.82	N	OFF	20.0
11.492250	---	25.94	50.00	24.06	N	OFF	20.2
11.492250	27.95	---	60.00	32.05	N	OFF	20.2



## Appendix C. Radiated Spurious Emission

Test Engineer :	Yuan Lee, Jacky Hong, Wilson Wu and Peter Liao	Temperature :	20~25°C
		Relative Humidity :	50~60%

&lt;1Mbps&gt;

## 2.4GHz 2400~2483.5MHz

## BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preampl 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		2379.405	55.24	-18.76	74	40.46	27.74	14.11	27.07	107	97	P	H
		2310.63	46.13	-7.87	54	31.07	28.11	14.04	27.09	107	97	A	H
	*	2402	102.24	-	-	87.47	27.7	14.13	27.06	107	97	P	H
	*	2402	101.73	-	-	86.96	27.7	14.13	27.06	107	97	A	H
													H
													H
		2362.08	55.34	-18.66	74	40.54	27.78	14.09	27.07	100	78	P	V
		2322.285	46.51	-7.49	54	31.53	28.02	14.05	27.09	100	78	A	V
	*	2402	95.91	-	-	81.14	27.7	14.13	27.06	100	78	P	V
	*	2402	95.37	-	-	80.6	27.7	14.13	27.06	100	78	A	V
													V
													V
BLE CH 19 2440MHz		2380.14	55.47	-18.53	74	40.69	27.74	14.11	27.07	100	96	P	H
		2376.5	46.32	-7.68	54	31.53	27.75	14.11	27.07	100	96	A	H
	*	2440	100.32	-	-	85.59	27.62	14.16	27.05	100	96	P	H
	*	2440	99.76	-	-	85.03	27.62	14.16	27.05	100	96	A	H
		2496.22	56.34	-17.66	74	41.47	27.69	14.21	27.03	100	96	P	H
		2497.06	46.13	-7.87	54	31.26	27.69	14.21	27.03	100	96	A	H
		2389.66	55.81	-18.19	74	41.04	27.72	14.12	27.07	103	77	P	V
		2314.76	46.36	-7.64	54	31.33	28.08	14.04	27.09	103	77	A	V
	*	2440	94.88	-	-	80.15	27.62	14.16	27.05	103	77	P	V
	*	2440	94.24	-	-	79.51	27.62	14.16	27.05	103	77	A	V
		2484.32	55.88	-18.12	74	41.05	27.67	14.2	27.04	103	77	P	V
		2486.98	46.37	-7.63	54	31.53	27.67	14.2	27.03	103	77	A	V



<b>BLE CH 39 2480MHz</b>	*	2480	101.83	-	-	87.02	27.66	14.19	27.04	100	93	P	H
	*	2480	101.32	-	-	86.51	27.66	14.19	27.04	100	93	A	H
		2485.16	55.43	-18.57	74	40.59	27.67	14.2	27.03	100	93	P	H
		2493.32	46.18	-7.82	54	31.32	27.69	14.2	27.03	100	93	A	H
													H
													H
	*	2480	96.36	-	-	81.55	27.66	14.19	27.04	100	77	P	V
	*	2480	95.82	-	-	81.01	27.66	14.19	27.04	100	77	A	V
		2499.64	55.49	-18.51	74	40.61	27.7	14.21	27.03	100	77	P	V
		2499.2	46.19	-7.81	54	31.31	27.7	14.21	27.03	100	77	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	39.66	-34.34	74	58.86	31.41	6.48	57.09	-	-	P	H
													H
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													H
		4804	39.93	-34.07	74	59.13	31.41	6.48	57.09	-	-	P	V
													V
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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 )
<b>BLE CH 19 2440MHz</b>		4880	39.63	-34.37	74	58.35	31.44	6.8	56.96	-	-	P	H
		7320	44.54	-29.46	74	55.75	37.06	8.65	56.92	-	-	P	H
													H
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		4880	39.24	-34.76	74	57.96	31.44	6.8	56.96	-	-	P	V
		7320	44.54	-29.46	74	55.75	37.06	8.65	56.92	-	-	P	V
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&lt;2Mbps&gt;

## 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		2346.645	55.61	-18.39	74	40.78	27.83	14.08	27.08	273	89	P	H
		2320.71	47.67	-6.33	54	32.68	28.03	14.05	27.09	273	89	A	H
	*	2402	102.97	-	-	88.2	27.7	14.13	27.06	273	89	P	H
	*	2402	101.62	-	-	86.85	27.7	14.13	27.06	273	89	A	H
													H
													H
		2314.095	55.5	-18.5	74	40.46	28.09	14.04	27.09	318	40	P	V
		2317.035	47.63	-6.37	54	32.61	28.06	14.05	27.09	318	40	A	V
	*	2402	96.84	-	-	82.07	27.7	14.13	27.06	318	40	P	V
	*	2402	95.39	-	-	80.62	27.7	14.13	27.06	318	40	A	V
													V
													V
BLE CH 19 2440MHz		2316.44	55.62	-18.38	74	40.59	28.07	14.05	27.09	267	93	P	H
		2379.44	47.53	-6.47	54	32.75	27.74	14.11	27.07	267	93	A	H
	*	2440	100.85	-	-	86.12	27.62	14.16	27.05	267	93	P	H
	*	2440	99.58	-	-	84.85	27.62	14.16	27.05	267	93	A	H
		2488.87	55.8	-18.2	74	40.95	27.68	14.2	27.03	267	93	P	H
		2484.53	47.5	-6.5	54	32.66	27.67	14.2	27.03	267	93	P	H
		2318.68	55.45	-18.55	74	40.44	28.05	14.05	27.09	315	41	P	V
		2317.98	47.61	-6.39	54	32.59	28.06	14.05	27.09	315	41	A	V
	*	2440	95.55	-	-	80.82	27.62	14.16	27.05	315	41	P	V
	*	2440	94.3	-	-	79.57	27.62	14.16	27.05	315	41	A	V
		2495.87	55	-19	74	40.13	27.69	14.21	27.03	315	41	P	V
		2487.89	47.77	-6.23	54	32.92	27.68	14.2	27.03	315	41	A	V





<b>BLE CH 39 2480MHz</b>	*	2480	102.07	-	-	87.26	27.66	14.19	27.04	253	91	P	H
	*	2480	100.86	-	-	86.05	27.66	14.19	27.04	253	91	A	H
		2493.52	55.26	-18.74	74	40.4	27.69	14.2	27.03	253	91	P	H
		2483.68	48	-6	54	33.17	27.67	14.2	27.04	253	91	A	H
													H
													H
	*	2480	96.58	-	-	81.77	27.66	14.19	27.04	303	42	P	V
	*	2480	95.3	-	-	80.49	27.66	14.19	27.04	303	42	A	V
		2497.36	55.79	-18.21	74	40.92	27.69	14.21	27.03	303	42	P	V
		2491.12	47.8	-6.2	54	32.95	27.68	14.2	27.03	303	42	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	39.28	-34.72	74	58.48	31.41	6.48	57.09	-	-	P	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
		4804	39.39	-34.61	74	58.59	31.41	6.48	57.09	-	-	P	V
													V
													V
													V
													V
													V
													V
													V
													V
													V



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 )
<b>BLE CH 19 2440MHz</b>		4880	39.13	-34.87	74	57.85	31.44	6.8	56.96	-	-	P	H
		7320	44.62	-29.38	74	55.83	37.06	8.65	56.92	-	-	P	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
		4880	39.46	-34.54	74	58.18	31.44	6.8	56.96	-	-	P	V
		7320	45.04	-28.96	74	56.25	37.06	8.65	56.92	-	-	P	V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V

[illegible]

## Emission below 1GHz

## 2.4GHz BLE (LF)

[illegible]



**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>P</b> eak or <b>A</b> verage
H/V	<b>H</b> orizontal or <b>V</b> ertical

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

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	( P/A )	( H/V )
<b>BLE CH 00 2402MHz</b>		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”.**

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## Appendix D. Radiated Spurious Emission Plots

<b>Test Engineer :</b>	Yuan Lee, Jacky Hong, Wilson Wu and Peter Liao	<b>Temperature :</b>	20~25°C
		<b>Relative Humidity :</b>	50~60%

### Note symbol

-L	Low channel location
-R	High channel location



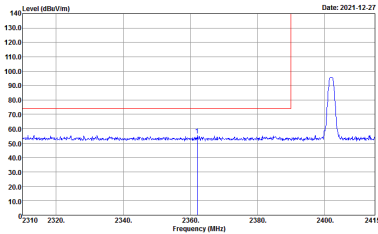
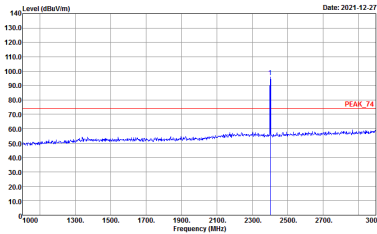
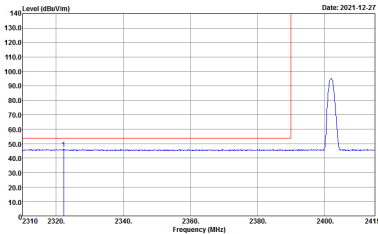
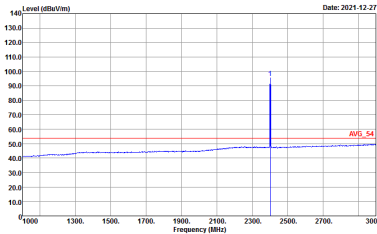


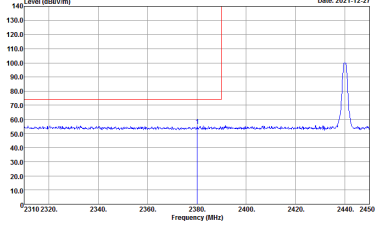
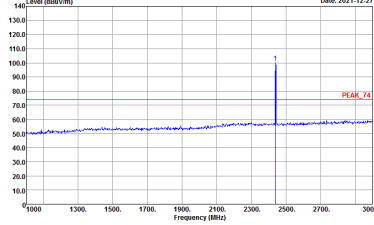
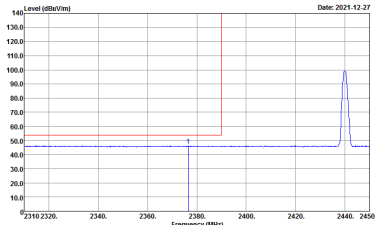
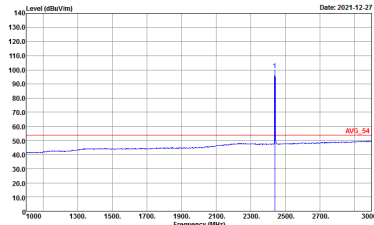
&lt;1Mbps&gt;

2.4GHz 2400~2483.5MHz

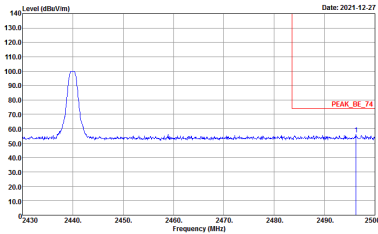
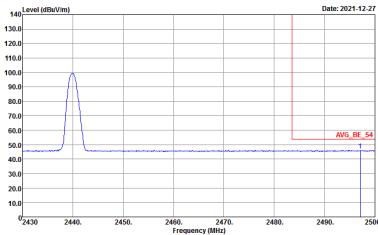
BLE (Band Edge @ 3m)

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH00 2402MHz	
	Horizontal	Fundamental
Peak	<p>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	<p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>
Avg.	<p>Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_91200_1241 HORIZONTAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto</p>	<p>Site : 03CH13-HY Condition : AVG_54 3m HORN_91200_1241 HORIZONTAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto</p>

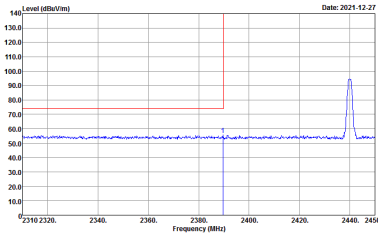
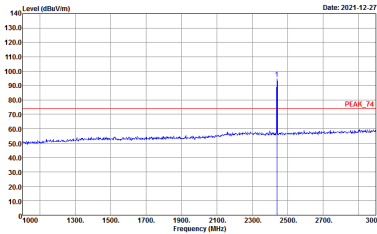
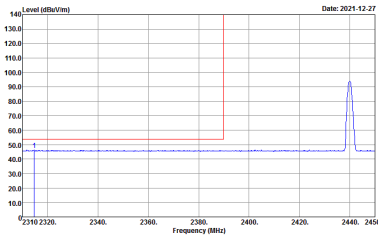
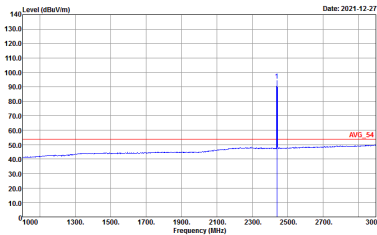
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH00 2402MHz	
	Vertical	Fundamental
Peak	 <p>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	 <p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>
Avg	 <p>Site : 03CH13-HY Condition : AV6_BE_54 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	 <p>Site : 03CH13-HY Condition : AV6_54 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>

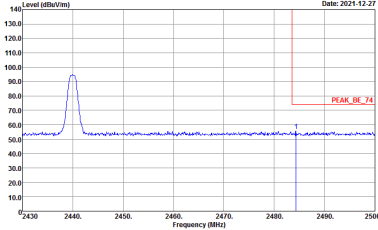
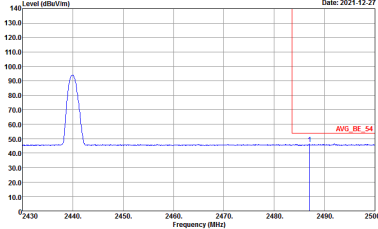
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - L	
	Horizontal	Fundamental
Peak	 <p>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	 <p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>
Avg.	 <p>Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_91200_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	 <p>Site : 03CH13-HY Condition : AVG_54 3m HORN_91200_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>

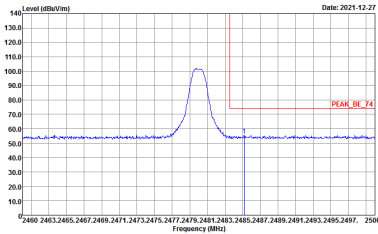
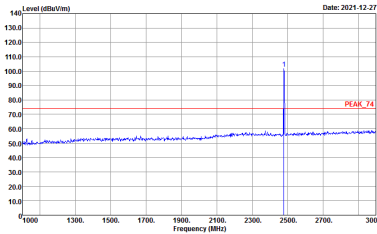
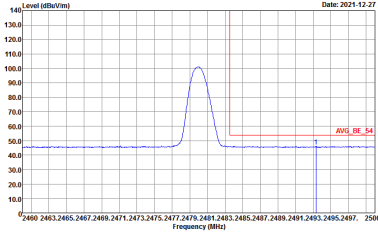
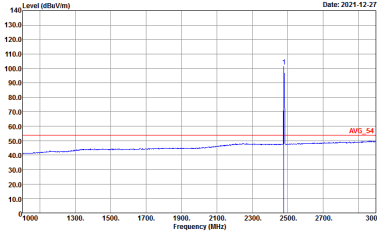


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - R	
	Horizontal	Fundamental
Peak	<div><p>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1241 HORIZONTAL RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p></div>	Left blank
Avg.	<div><p>Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_91200_1241 HORIZONTAL RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p></div>	Left blank



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - L	
	Vertical	Fundamental
Peak	 <p>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	 <p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>
Avg.	 <p>Site : 03CH13-HY Condition : AV6_BE_54 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:3.000KHz SWT:Auto</p>	 <p>Site : 03CH13-HY Condition : AV6_54 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:3.000KHz SWT:Auto</p>

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - R	
	Vertical	Fundamental
<b>Peak</b>	 <p>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1241 VERTICAL RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p>	Left blank
<b>Avg.</b>	 <p>Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_91200_1241 VERTICAL RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p>	Left blank

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH39 2480MHz	
	Horizontal	Fundamental
Peak	 <p>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1241 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	 <p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>
Avg.	 <p>Site : 03CH13-HY Condition : AV6_BE_54 3m HORN_91200_1241 HORIZONTAL RBW:1000.000KHz VBW:3.000KHz SWT:Auto</p>	 <p>Site : 03CH13-HY Condition : AV6_54 3m HORN_91200_1241 HORIZONTAL RBW:1000.000KHz VBW:3.000KHz SWT:Auto</p>



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH39 2480MHz	
	Vertical	Fundamental
Peak	<p>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	<p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>
Avg.	<p>Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	<p>Site : 03CH13-HY Condition : AVG_54 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT: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.	<div><p>Level (dBu/1m)</p><p>Date: 2021-12-27</p><p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 HORIZONTAL</p></div>	<div><p>Level (dBu/1m)</p><p>Date: 2021-12-27</p><p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 VERTICAL</p></div>



BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH19 2440MHz	
	Horizontal	Vertical
Peak Avg.	<div><p>Level (dBuV/m)</p><p>Date: 2021-12-27</p><p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 HORIZONTAL</p></div>	<div><p>Level (dBuV/m)</p><p>Date: 2021-12-27</p><p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 VERTICAL</p></div>



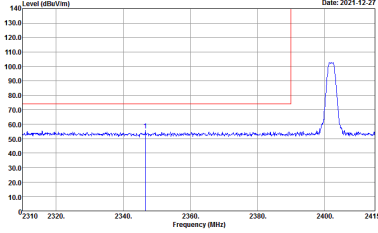
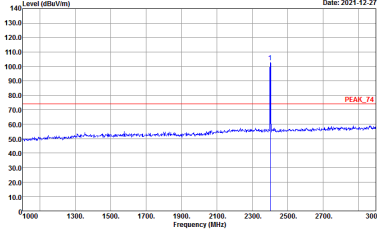
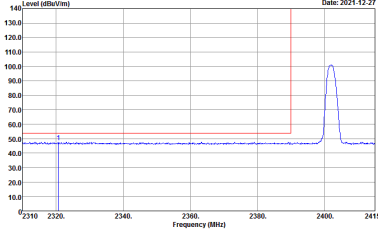
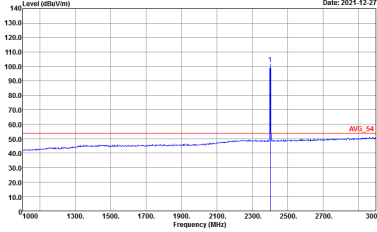
BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH39 2480MHz	
	Horizontal	Vertical
Peak Avg.	<div><p>Level (dBuV/m)</p><p>Date: 2021-12-27</p><p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 HORIZONTAL</p></div>	<div><p>Level (dBuV/m)</p><p>Date: 2021-12-27</p><p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 VERTICAL</p></div>

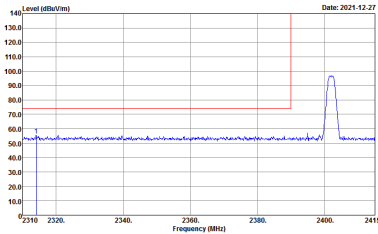
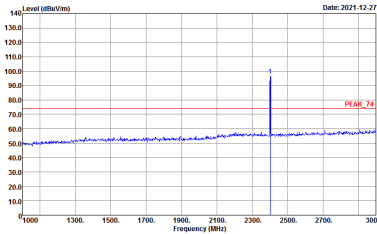
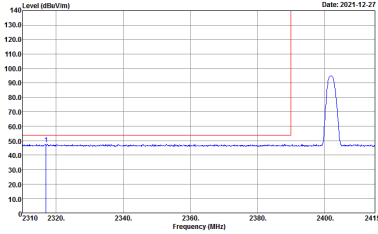
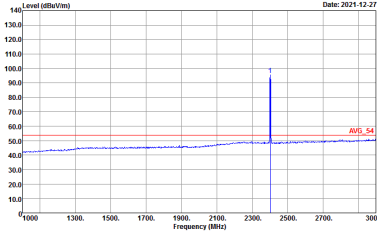


&lt;2Mbps&gt;

2.4GHz 2400~2483.5MHz

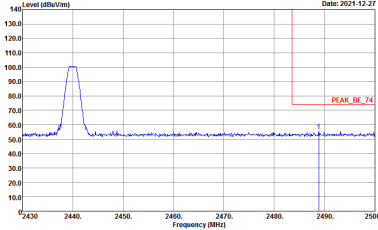
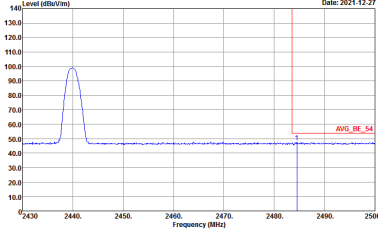
BLE (Band Edge @ 3m)

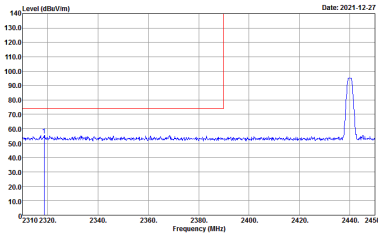
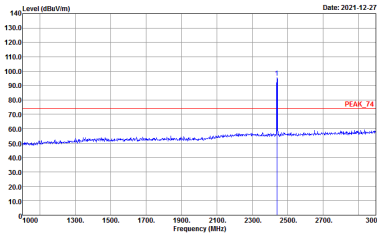
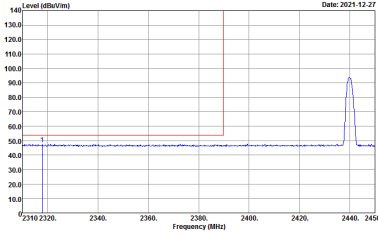
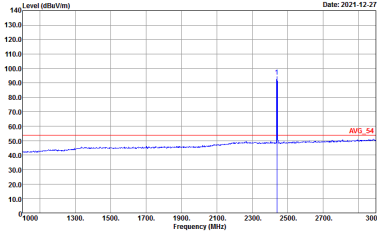
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH00 2402MHz	
	Horizontal	Fundamental
Peak	 <p>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1241 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	 <p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>
Avg.	 <p>Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_91200_1241 HORIZONTAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto</p>	 <p>Site : 03CH13-HY Condition : AVG_54 3m HORN_91200_1241 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>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	 <p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>
Avg	 <p>Site : 03CH13-HY Condition : AV6_BE_54 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto</p>	 <p>Site : 03CH13-HY Condition : AV6_54 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto</p>



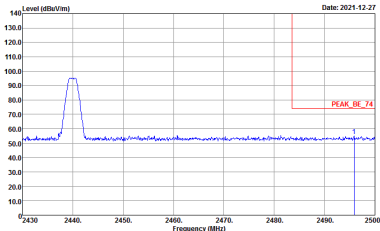
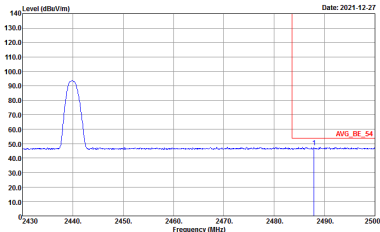
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - L	
	Horizontal	Fundamental
Peak	<p>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	<p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>
Avg.	<p>Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_91200_1241 HORIZONTAL : RBW:1000.000KHz VBW:10.000KHz SWT:Auto</p>	<p>Site : 03CH13-HY Condition : AVG_54 3m HORN_91200_1241 HORIZONTAL : RBW:1000.000KHz VBW:10.000KHz SWT:Auto</p>

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - R	
	Horizontal	Fundamental
<b>Peak</b>	 <p>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1241 HORIZONTAL RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p>	Left blank
<b>Avg.</b>	 <p>Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_91200_1241 HORIZONTAL RBW:1000.000kHz VBW:10.000kHz SWT:Auto</p>	Left blank

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - L	
	Vertical	Fundamental
Peak	 <p>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	 <p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>
Avg.	 <p>Site : 03CH13-HY Condition : AV6_BE_54 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto</p>	 <p>Site : 03CH13-HY Condition : AV6_54 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto</p>

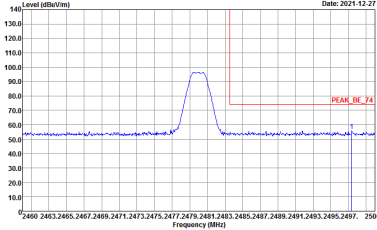
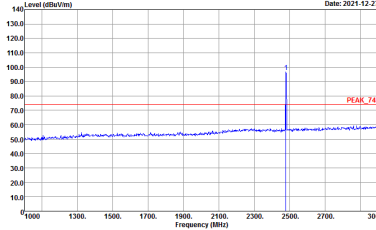
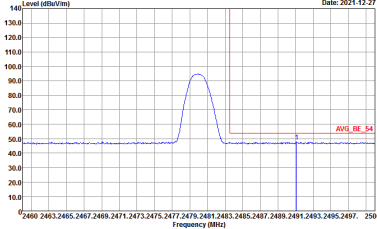
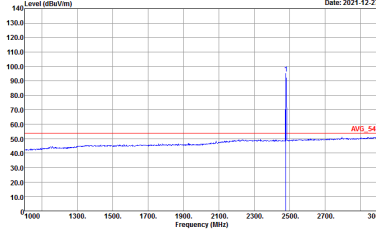




BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - R	
	Vertical	Fundamental
Peak	<div><p>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1241 VERTICAL RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p></div>	Left blank
Avg.	<div><p>Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_91200_1241 VERTICAL RBW:1000.000kHz VBW:10.000kHz SWT:Auto</p></div>	Left blank



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH39 2480MHz	
	Horizontal	Fundamental
Peak	<p>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1241 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	<p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>
Avg.	<p>Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_91200_1241 HORIZONTAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto</p>	<p>Site : 03CH13-HY Condition : AVG_54 3m HORN_91200_1241 HORIZONTAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto</p>

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH39 2480MHz	
	Vertical	Fundamental
Peak	 <p>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	 <p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>
Avg.	 <p>Site : 03CH13-HY Condition : AV6_BE_54 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:10.000KHz SWT:Auto</p>	 <p>Site : 03CH13-HY Condition : AV6_54 3m HORN_91200_1241 VERTICAL RBW:1000.000KHz VBW:10.000KHz SWT: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.	<div><p>Level (dBu/1m)</p><p>Date: 2021-12-27</p><p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 HORIZONTAL</p></div>	<div><p>Level (dBu/1m)</p><p>Date: 2021-12-27</p><p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 VERTICAL</p></div>

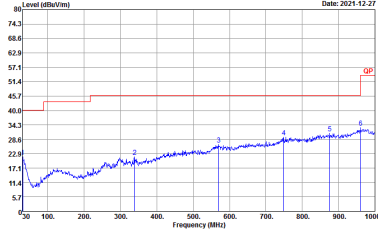
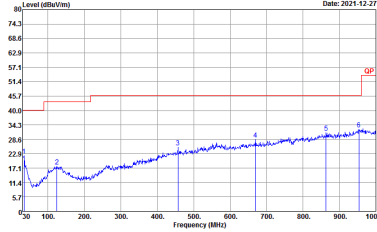


BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH19 2440MHz	
	Horizontal	Vertical
Peak Avg.	<div><p>Level (dBuV/m)</p><p>Date: 2021-12-27</p><p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 HORIZONTAL</p></div>	<div><p>Level (dBuV/m)</p><p>Date: 2021-12-27</p><p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 VERTICAL</p></div>



BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH39 2480MHz	
	Horizontal	Vertical
Peak Avg.	<div><p>Level (dBuV/m)</p><p>Date: 2021-12-27</p><p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 HORIZONTAL</p></div>	<div><p>Level (dBuV/m)</p><p>Date: 2021-12-27</p><p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_91200_1241 VERTICAL</p></div>

**Emission below 1GHz**
**2.4GHz BLE (LF)**

BLE	2.4GHz 2400~2483.5MHz	
	BLE LF	
	Horizontal	Vertical
QP / Peak	 <p>Site : 03CH13-HY Condition : QP 3m B1LOG_40103 HORIZONTAL</p>	 <p>Site : 03CH13-HY Condition : QP 3m B1LOG_40103 VERTICAL</p>



## Appendix E. Duty Cycle Plots

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
Bluetooth - LE for 1Mbps	62.45	390	2.56	3kHz
Bluetooth - LE for 2Mbps	32.26	200	5.00	10kHz

