FCC Part 15, Subpart C
Test Report

FCC ID:	24589-TAT3508
Applicant:	MMD Hong Kong Holding Limited
Address:	Unit 1006, 10th Floor, C-Bons International Center, 108 Wai Yip Street, Kwun Tong, Kowloon, Hong Kong
Manufacturer:	MMD Hong Kong Holding Limited
Address:	Unit 1006, 10th Floor, C-Bons International Center, 108 Wai Yip Street, Kwun Tong, Kowloon, Hong Kong
Product:	Active Noise Canceling True wireless headphones
Brand:	PHILIPS or
Test Model(s):	TAT3508
Series Model(s):	TAT3508Ⅱ, TAT3508xx/yy, TAT3508Ⅱxx/yy (xx=AA-ZZ or blank denoted different color; yy=00-99 denoted different country destination)
Test Date:	Nov. 18, 2022~ Dec. 14, 2022
Issued Date:	Jan. 13, 2023
Issued By:	Hwa-Hsing (Dongguan) Testing Co., Ltd.
Address:	No.101, Bld. N1, Yuyuan 2Rd, Yuyuan Industrial Park, HuangJiang Town, Dongguan, China
Test Firm Registration No.:	915896
Designation No.:	CN1255
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) ANSI C63.10:2013

The above equipment has been tested by **Hwa-Hsing (Dongguan) Testing Co., Ltd.**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Niny Zhang — *Niny Zhang*

Reviewed by : Tank Tan — *Tank Tan*

Approved by : Scott He — *Scott He*

HWA-HSING (DONGGUAN) TESTING CO.,LTD. "TESTREPORT"

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
221027KH16-RF-US-02	Original Release	Jan. 13, 2023

1. Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247) KDB 558074 D01 15.247 Meas Guidance v05r02 ANSI C63.10:2013			
Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit.
15.205 & 209	Radiated Emissions	Pass	Meet the requirement of limit.
15.247(d)	Band Edge Measurement	Pass	Meet the requirement of limit.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.247(a)(2)	6dB Bandwidth	Pass	Meet the requirement of limit.
---	Occupied Bandwidth Measurement	Pass	Reference only
15.247(b)	Conducted power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	No antenna connector is used. The device is professionally installed

Note: The EUT has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

1.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:
The listed uncertainties are the worst cases uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

Measurement	Frequency	Expended Uncertainty (k=2) (±)
Radiated Emissions up to 1 GHz	9KHz ~ 30MHz	2.16 dB
	30MHz ~ 1000MHz	3.47 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	4.84 dB
	18GHz ~ 40GHz	4.67 dB

1.2 Modification Record

There were no modifications required for compliance.

2. General Information

2.1 General Description of EUT

Product	Active Noise Canceling True wireless headphones
Test Model(s)	TAT3508
Sample No.	HS221109-01-09
Series Model(s)	TAT3508Ⅱ, TAT3508xx/yy, TAT3508Ⅱxx/yy (xx=AA-ZZ or blank denoted different color; yy=00-99 denoted different country destination)
Status of EUT	Engineering Prototype
Power Supply Rating	Charge case: Input: DC 5V, 500mA from USB or DC 3.7V from battery; Each Headphone: Input: DC 5V 55mA from Charge case
Modulation Type	GFSK for DTS
Transfer Rate	1 Mbps, 2Mbps
Operating Frequency	2402 ~ 2480MHz
Number of Channel	40
Maximum Output Power	6.623dBm (Peak)
Antenna Type	FPC Antenna
Antenna Gain	L: -0.83dBi R: -0.85dBi
Antenna Connector	N/A
Accessory Device	N/A

Note:

1. Please refer to the EUT photo document (Reference No.: 221027KH16-01&-02) for detailed product photo.
2. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.
3. All models are identical except model name, color and country destination for marketing purpose.
4. The left and right earphone circuit motherboards are basically symmetrical. Only the test items evaluate the Radiated emission (30MHz-1000MHz) of the two in-ear headphones, and the other test items only evaluate the left in-ear headphones.

2.2 Description of Test Channels

40 channels are provided to this EUT:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

2.3 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable test items	X-Axis	Y-Axis	Z-Axis	Voltage Supply
Radiated	AC Power Conducted Emission	N/A	N/A	N/A	DC 3.7V from battery
Radiated	Radiated Emissions	√	√	√	
Antenna Port Conducted Measurement	Band Edge Measurement	N/A	N/A	N/A	
	Antenna Port Emission	N/A	N/A	N/A	
	6dB Bandwidth	N/A	N/A	N/A	
	Occupied Bandwidth Measurement	N/A	N/A	N/A	
	Conducted power	N/A	N/A	N/A	
	Power Spectral Density	N/A	N/A	N/A	

1. *: The EUT had been pre-tested on the positioned of each 3 Axis. The worst case was found when positioned on **Z-plane**.
2. "N/A" means no effect.

Test Condition:

Applicable test items	Environmental Conditions	Test Date	Tested by
Radiated Emissions	25.6deg. C, 59%RH	2022-11-25	Jim Xu
Antenna Port Conducted Measurement	25.1deg. C, 50%RH	2022-12-05	Dragon Long

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

Radiated Emission Test (Above 1GHz):

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	0 to 39	0, 19, 39	GFSK	2
-	0 to 39	0, 19, 39	GFSK	1

Radiated Emission Test (Below 1GHz):

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	0 to 39	39	GFSK	2
-	0 to 39	39	GFSK	1

Power Line Conducted Emission Test:

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	0 to 39	39	GFSK	2
-	0 to 39	39	GFSK	1

Antenna Port Conducted Measurement:

*This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	0 to 39	0, 19, 39	GFSK	2
-	0 to 39	0, 19, 39	GFSK	1

2.4 Description of Support Units

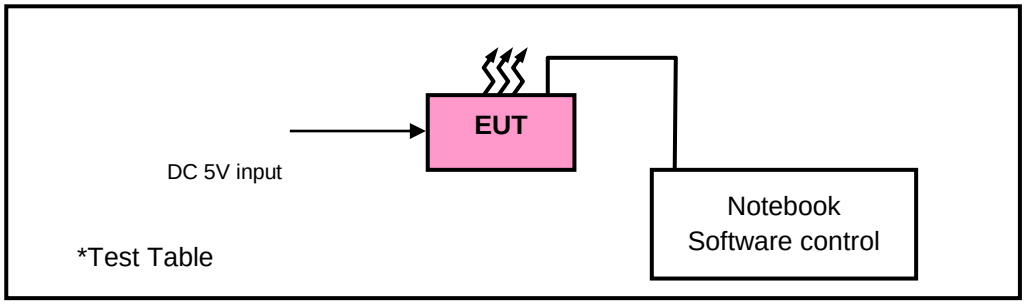
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	Notebook	DELL	Latitude 5300	N/A	N/A

Insert Cable Connections to/from EUT provided by test team.

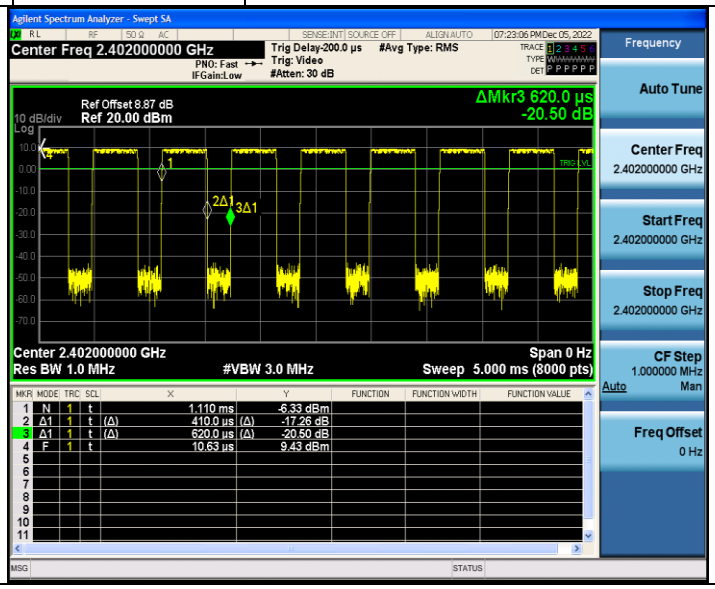
No.	Signal Cable Description of The Above Support Units
1.	USB serial cable Un-shielding 1.2m

2.5 Configuration of System under Test

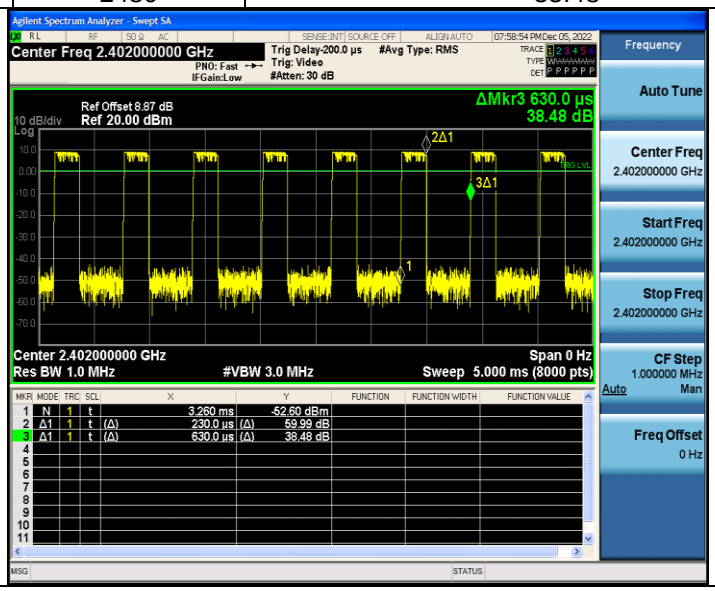


2.6 Duty Cycle of Test Signal

Test Mode	Channel	Duty Cycle [%]
GFSK-1MHz	2402	66.13
	2440	66.13
	2480	66.13



Test Mode	Channel	Duty Cycle [%]
GFSK-2MHz	2402	36.51
	2440	35.48
	2480	35.48



3. Test Types and Results

3.1 Radiated Emission and Band-edge Measurement

3.1.1 Limits of radiated emission and band-edge measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

Frequencies (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
* DTS emissions in non-restricted frequency bands Subclause 11.11 of ANSI C63.10 is applicable. * DTS emissions in restricted frequency bands Subclause 11.12 of ANSI C63.10 is applicable		

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

3.1.2 Test Instruments

Radiated emission below 30MHz:

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR7	100962	2023-01-13
3m Semi-anechoic Chamber	MAORUI	9m*6m*6m	NSEMC003	2023-04-15*
Test software	FARAD	FARAD	EZ_EMCV1.1.4.2	N/A
Loop Antenna	EMCI	HLA 6121	45745	2023-04-15*
Pre-Amplifier	EMCI	EMC 184045SE	980201	2023-01-12
Antenna Tower	MF	MFA-440H	NA	NA
Turn Table	MF	MFT-201SS	NA	NA
Antenna Tower&Turn Table Controller	MF	MF-7802	NA	NA

Frequency Range below 1GHz:

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR7	100962	2023-01-13
Broadband antenna	Schwarzbeck	VULB 9168	00937	2023-09-12*
3m Semi-anechoic Chamber	MAORUI	9m*6m*6m	NSEMC003	2023-04-15*
Signal Amplifier	Com-power	PAM-103	18020051	2023-08-25
Attenuator	Rohde&Schwarz	TS2GA-6dB	18101101	N/A
Test software	FARAD	FARAD	EZ_EMCV1.1.4.2	N/A

Frequency Range 1-18GHz:

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
3m Semi-anechoic Chamber	MAORUI	9m*6m*6m	NSEMC003	2023-04-15*
Horn Antenna	Schwarzbeck	BBHA 9170	974	2024-05-04*
Broadband Coaxial Preamplifier	Schwarzbeck	PAM-118A	1804003	2023-08-25
Spectrum	Keysight	N9020A	MY51240612	2023-08-25
Antenna Tower	MF	MFA-440H	NA	NA
Turn Table	MF	MFT-201SS	NA	NA
Antenna Tower&Turn Table Controller	MF	MF-7802	NA	NA

Frequency Range 18-40GHz:

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
3m Semi-anechoic Chamber	MAORUI	9m*6m*6m	NSEMC003	2023-04-15*
Spectrum Analyzer	Rohde&Schwarz	FSV-40N	101783	2023-01-13
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170242	2023-04-10*
Pre-Amplifier	EMCI	EMC 184045	980102	2023-01-12
Antenna Tower	MF	MFA-440H	NA	NA
Turn Table	MF	MFT-201SS	NA	NA
Antenna Tower&Turn Table Controller	MF	MF-7802	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months or 24 months (*).

2. The test was performed in 966.

3.1.3 Test Procedures

a. Peak emission levels are measured by setting the instrument as follow:

1) RBW & VBW setting as a function of frequency:

Frequency	RBW	VBW
9kHz~150kHz	200Hz	600Hz
0.15MHz~30MHz	9kHz	30kHz
30MHz~1000MHz	120kHz	300kHz
>1000MHz	1MHz	3MHz

2) Detector = peak.
3) Sweep time = auto.
4) Trace mode = max hold.
5) Allow sweeps to continue until the trace stabilizes. (Note that the required measurement time may be lengthened for low-duty-cycle applications.)

Note: If the peak-detected amplitude can be shown to comply with the average limit, then it is not necessary to perform a separate average measurement

b. Average emission levels are measured by setting the instrument as follow:

- **Trace averaging with continuous EUT transmission at full power**

If the EUT can be configured or modified to transmit continuously (D ≥ 98%). then the average emission levels shall be measured using the following method (with EUT transmitting continuously):

1) RBW=1 MHz (unless otherwise specified).
2) VBW ≥ 3 *RBW.
3) Detector =RMS
4) Sweep time = auto.
5) Perform a trace average of at least 100 traces.

- **Trace averaging across ON and OFF times of the EUT transmissions followed by duty cycle correction**

If continuous transmission of the EUT (D ≥ 98%) cannot be achieved and the duty cycle is constant (duty cycle variations are less than ±2%). then the following procedure shall be used

1) The EUT shall be configured to operate at the maximum achievable duty cycle.
2) Measure the duty cycle D of the transmitter output signal as described in 11.6.
3) RBW=1 MHz (unless otherwise specified).
4) VBW ≥ 3 *RBW.
5) Detector =RMS
6) Sweep time = auto.
7) Perform a trace average of at least 100 traces.

A correction factor shall be added to the measurement results prior to comparing with the emission limit to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

*If power averaging (rms) mode was used in step 5). then the applicable correction factor is [10 10g (1/ D)], where D is the duty cycle.

**If linear voltage averaging mode was used in step f). then the applicable correction factor is [20 10g (1/D)], where D is the duty cycle.

***If a specific emission is demonstrated to be continuous (D > 98%) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that

- **Reduced VBW Averaqing across ON and OFF times of the EUT transmissions with max hold**

If continuous transmission of the EUT (D > 98%) cannot be achieved and the duty cycle is not constant (duty cycle variations exceed ±2%), then the following procedure shall be used:

1) RBW = 1 MHz.
2) VBW ≥ 1/T.
3) Detector =peak
4) Sweep time = auto.
5) Trace mode = max hold.
6) Allow max hold to run for at least [50 x (1/ D)] traces

c. The EUT was placed on the top of a rotating table 0.8 meters (below 1GHz) / 1.5 meters (1-18GHz) / 1.5 meters (18-40GHz) above the reference ground. The table was rotated 360 degrees to determine the position of the highest radiation.
d. The EUT was set 3 meters away from the interference-receiving antenna (Below 1GHz) & (Above 1-18GHz), which was mounted on the top of a variable-height antenna tower. The EUT was set 1meters away from the interference-receiving antenna (18-40GHz).
e. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
f. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
g. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
h. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

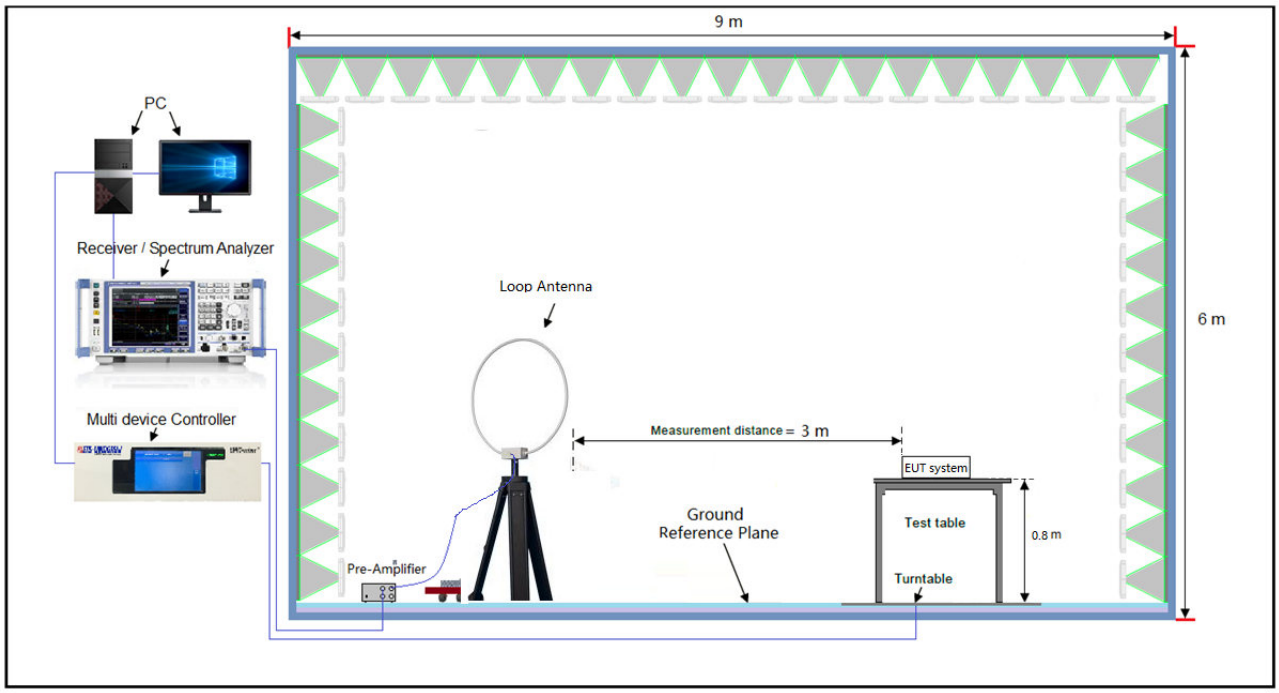
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz & 360kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth =3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth =1/T for Average (Duty cycle < 98 %) detection at frequency above 1 GHz.
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is =10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

3.1.4 Deviation from Test Standard

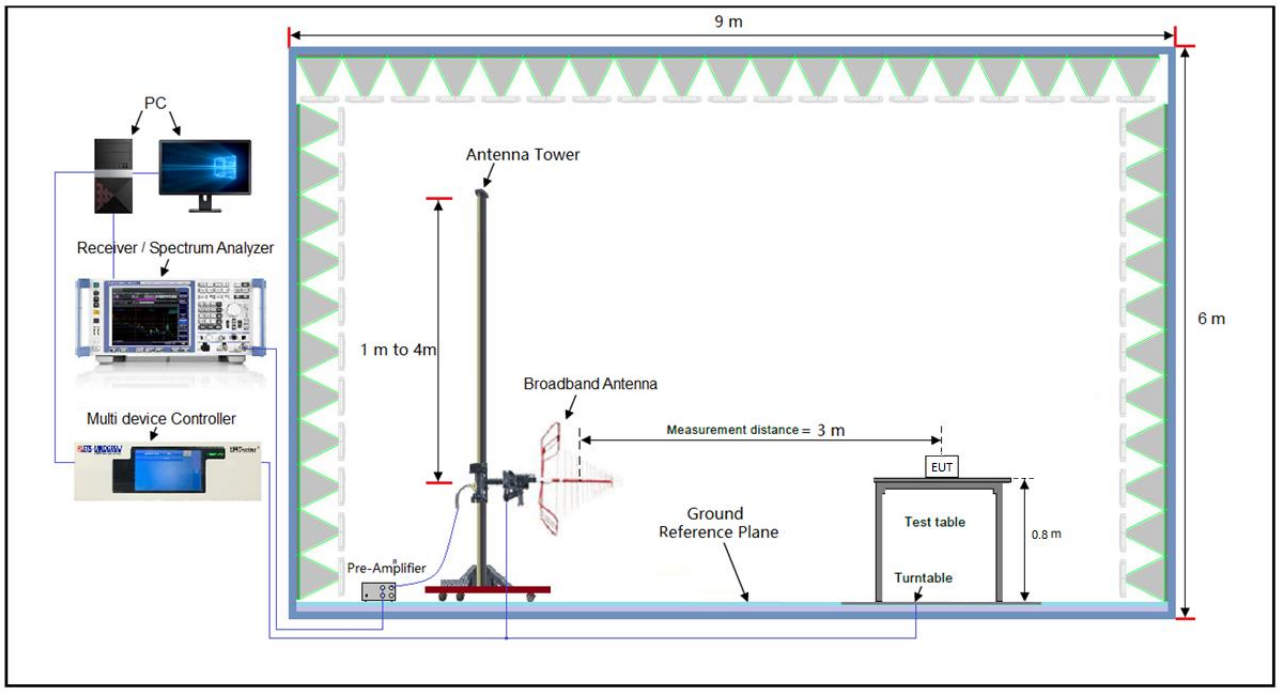
No deviation.

3.1.5 Test Setup

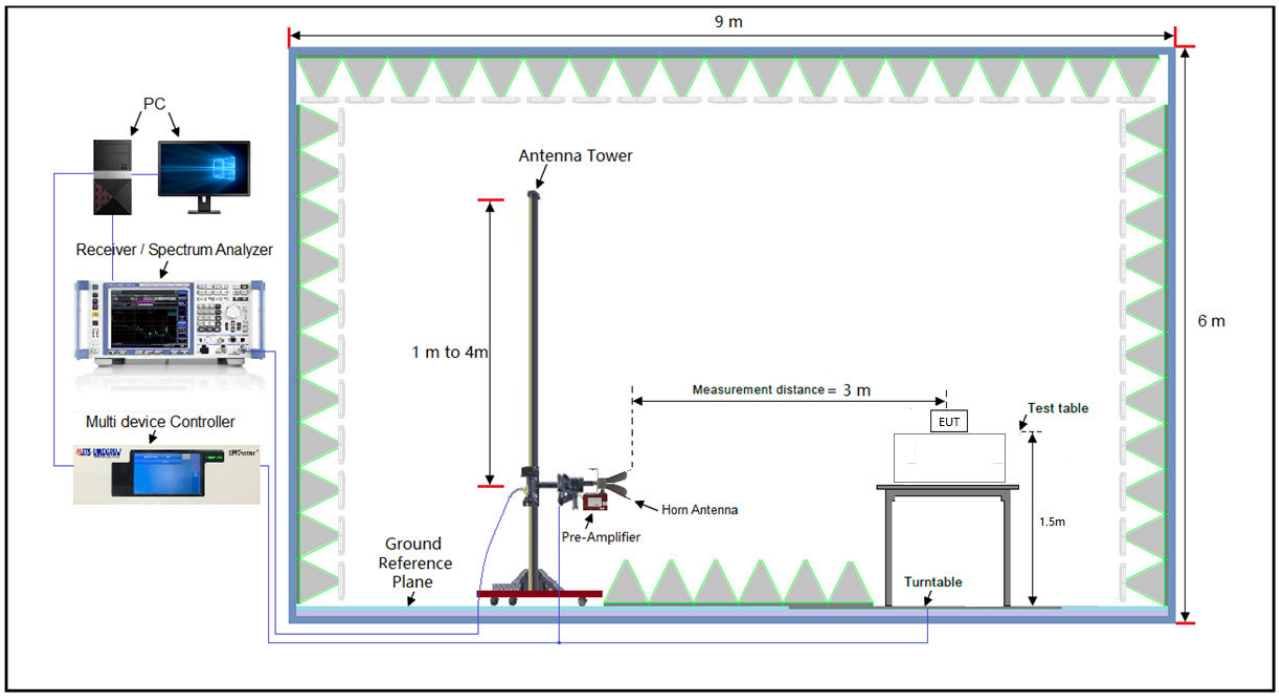
Radiated emission below 30MHz:



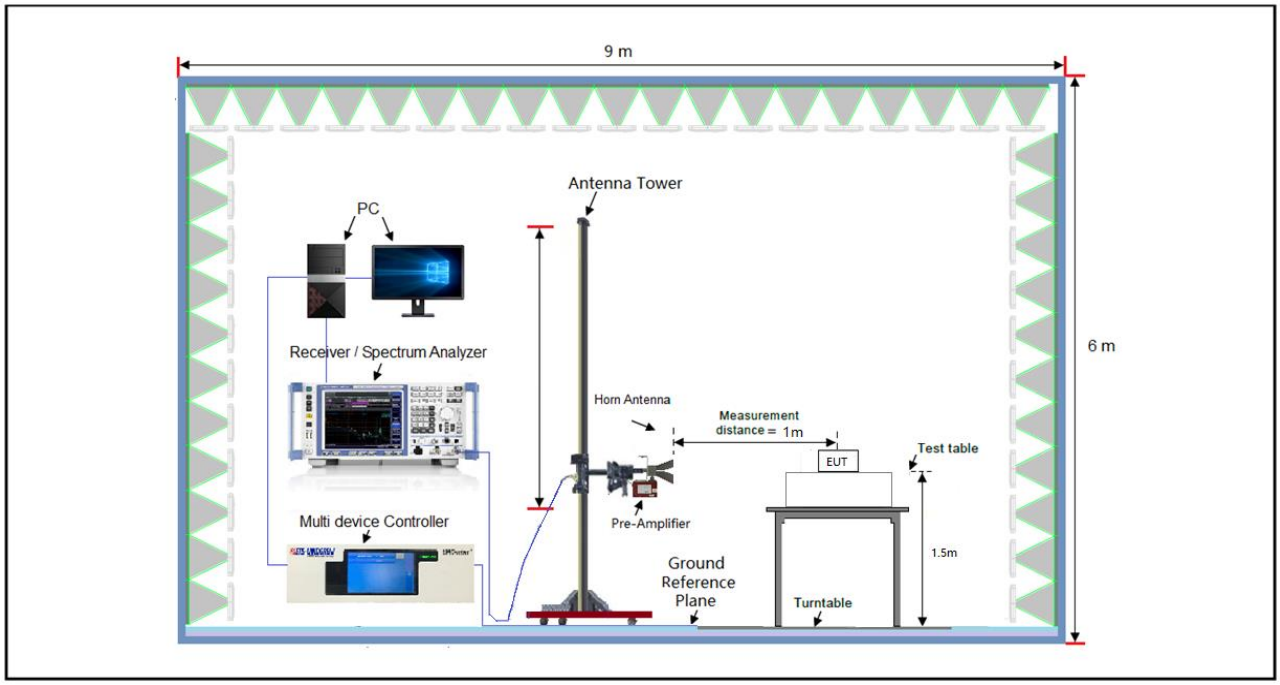
Frequency Range below 1GHz:



Frequency Range 1-18GHz:



Frequency Range 18-40GHz:



For the actual test configuration, please refer to the attached file (Test Setup Photo).

3.1.6 EUT Operating Conditions

a. Placed the EUT on the testing table.

b. Set the EUT under transmission condition continuously at specific channel frequency.

3.1.7 Test Results

9kHz ~ 30MHz Data:

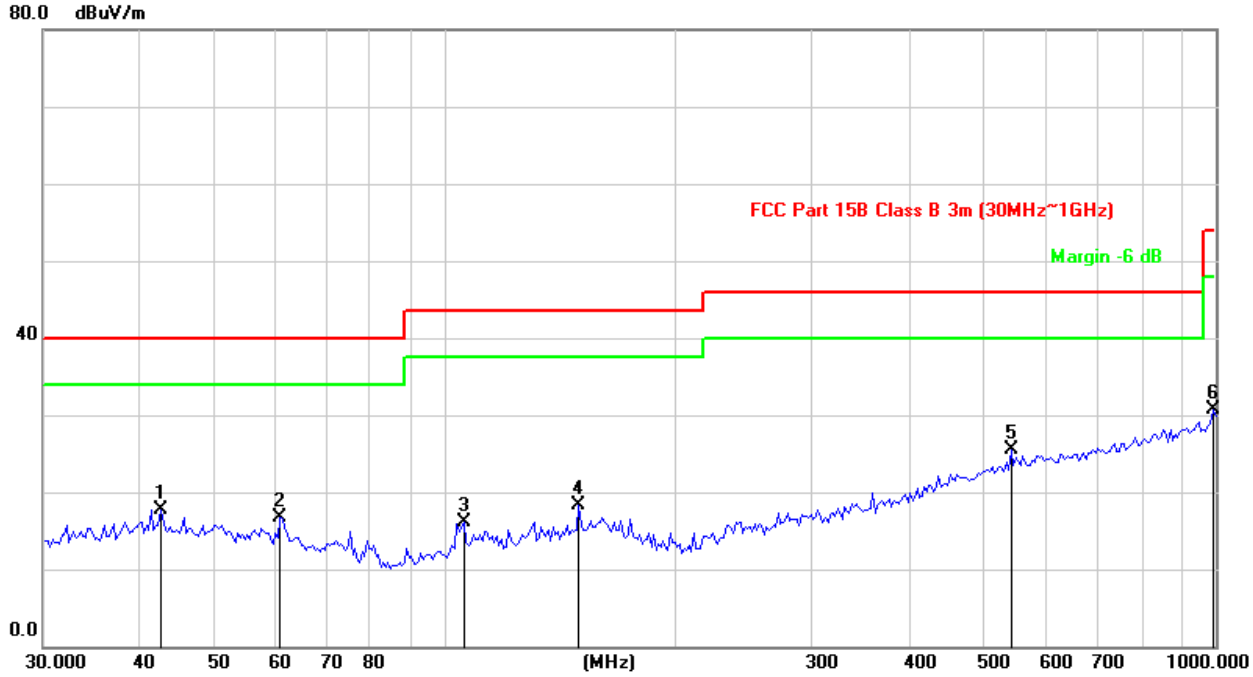
The amplitude of spurious emissions attenuated more than 20dB below the permissible value is not required to be report.

Left

30MHz ~ 1GHz Worst-Case Data:

Test Channel	Channel 39	Frequency Range	30MHz ~ 1GHz
Detector Function	Peak (PK) Quasi-peak (QP)	Tested By	Jim Xu

Antennal Polarity &Test Distance: Horizontal at 3m



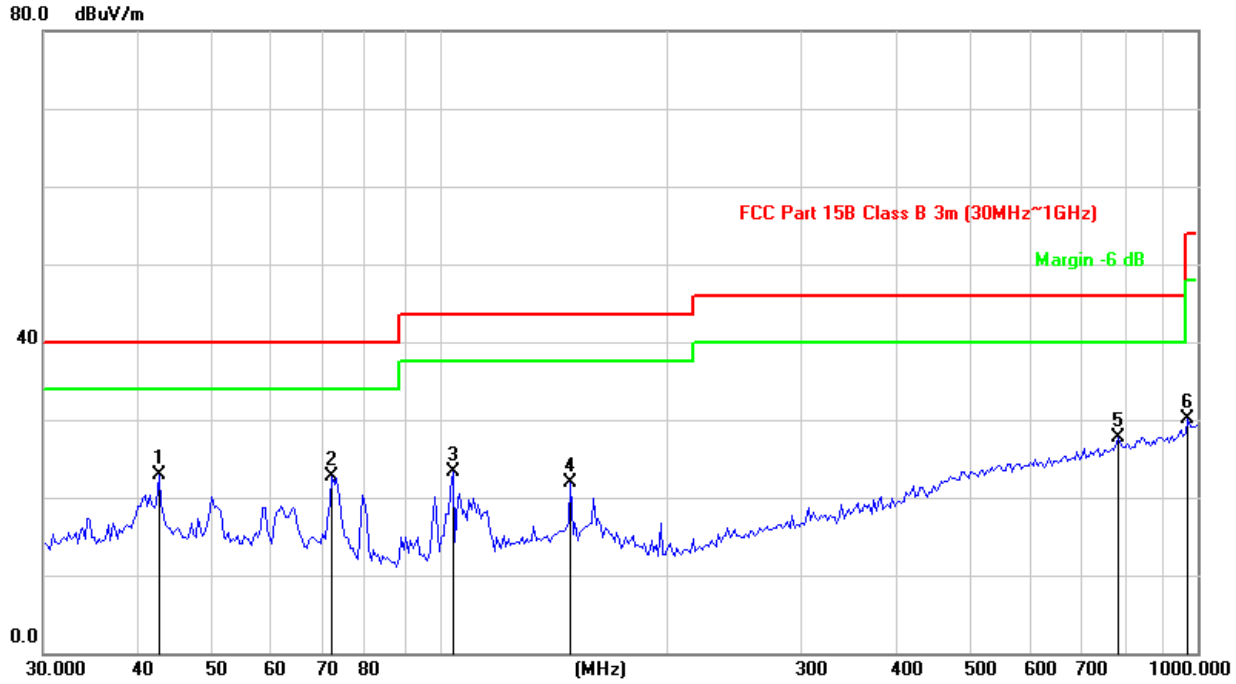
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1	42.6299	32.63	-14.92	17.71	40.00	-22.29	peak	300	288
2	61.0041	32.90	-16.26	16.64	40.00	-23.36	peak	200	265
3	105.5369	33.50	-17.48	16.02	43.50	-27.48	peak	200	233
4	148.9175	32.74	-14.48	18.26	43.50	-25.24	peak	200	177
5	542.6104	31.46	-5.95	25.51	46.00	-20.49	peak	100	198
6	992.9975	29.64	1.09	30.73	54.00	-23.27	peak	100	125

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value

Test Channel	Channel 39	Frequency Range	30MHz ~ 1GHz
Detector Function	Peak (PK) Quasi-peak (QP)	Tested By	Jim Xu

Antennal Polarity& Test Distance: Vertical at 3m



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1	42.6299	37.91	-14.92	22.99	40.00	-17.01	peak	200	54
2	72.2111	40.39	-17.68	22.71	40.00	-17.29	peak	100	298
3	104.0640	40.95	-17.61	23.34	43.50	-20.16	peak	100	168
4	148.9175	36.45	-14.48	21.97	43.50	-21.53	peak	200	255
5	787.4749	30.03	-2.31	27.72	46.00	-18.28	peak	200	125
6	972.2827	29.45	0.66	30.11	54.00	-23.89	peak	300	133

Remarks:

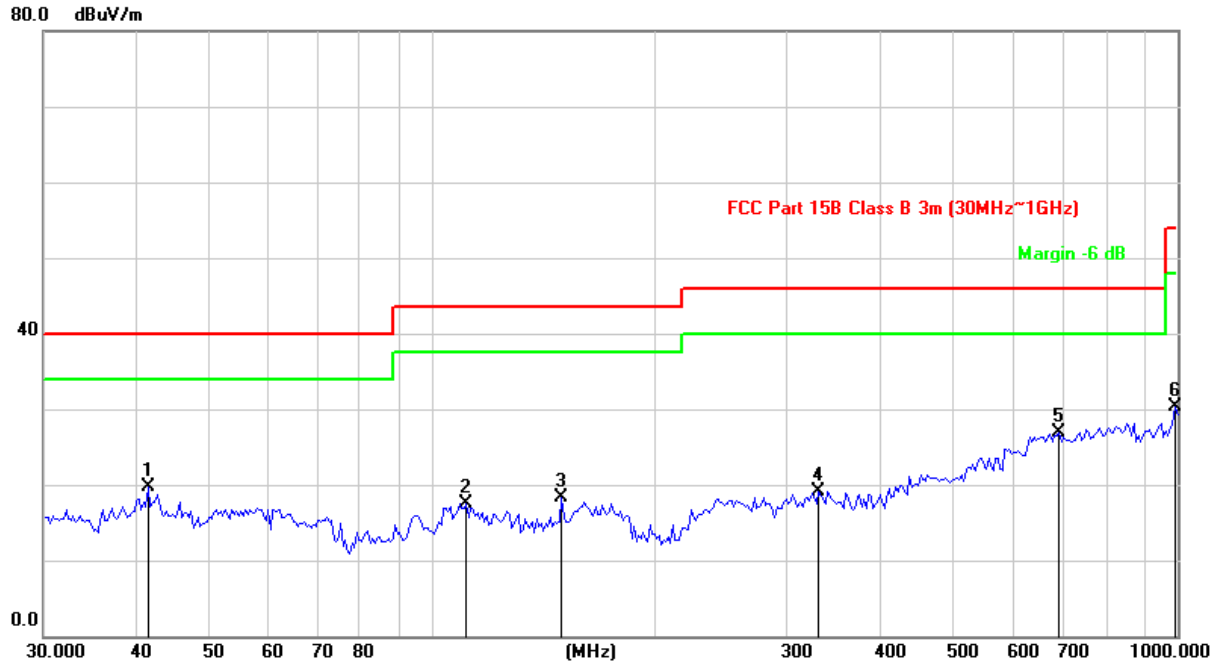
1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value

Right

30MHz ~ 1GHz Worst-Case Data:

Test Channel	Channel 39	Frequency Range	30MHz ~ 1GHz
Detector Function	Peak (PK) Quasi-peak (QP)	Tested By	Jim Xu

Antennal Polarity &Test Distance: Horizontal at 3m



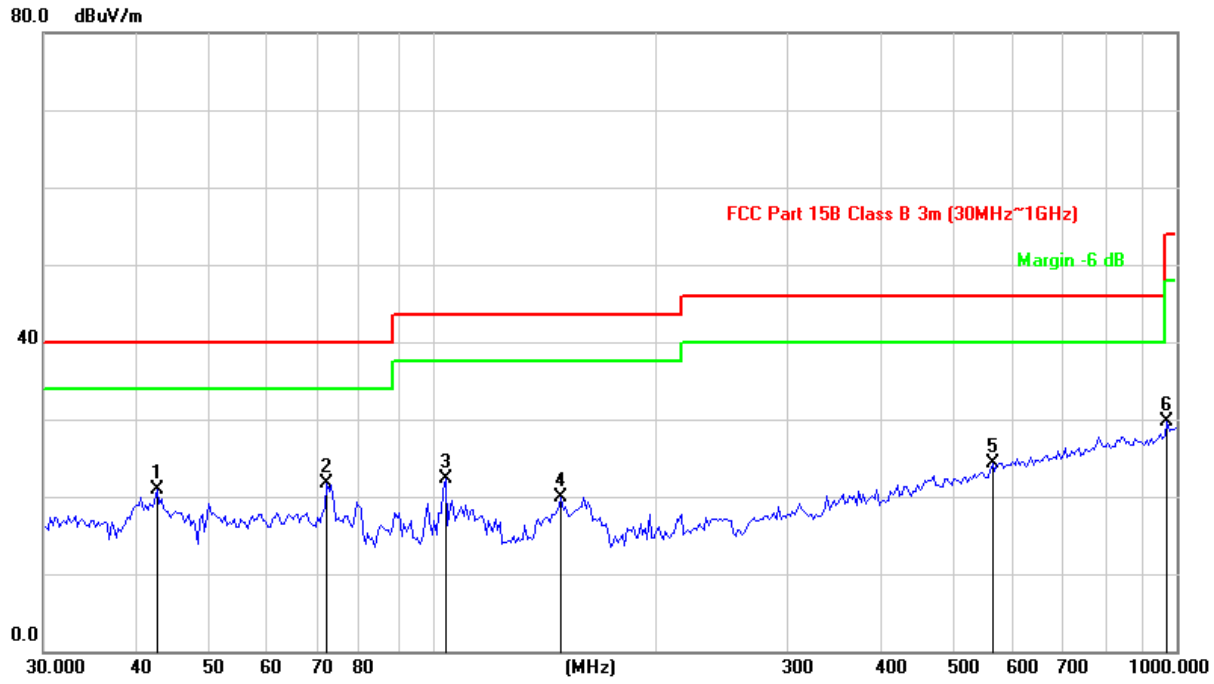
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1	41.4483	34.52	-14.88	19.64	40.00	-20.36	peak	100	153
2	110.8580	34.56	-16.98	17.58	43.50	-25.92	peak	200	210
3	148.9173	32.74	-14.48	18.26	43.50	-25.24	peak	100	168
4	329.4624	31.34	-12.14	19.20	46.00	-26.80	peak	200	55
5	693.9101	30.80	-3.80	27.00	46.00	-19.00	peak	300	66
6	992.9973	29.14	1.09	30.23	54.00	-23.77	peak	200	123

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value

Test Channel	Channel 39	Frequency Range	30MHz ~ 1GHz
Detector Function	Peak (PK) Quasi-peak (QP)	Tested By	Jim Xu

Antennal Polarity& Test Distance: Vertical at 3m



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1	42.6298	35.91	-14.92	20.99	40.00	-19.01	peak	300	288
2	72.2111	39.39	-17.68	21.71	40.00	-18.29	peak	200	168
3	104.0639	39.95	-17.61	22.34	43.50	-21.16	peak	100	88
4	148.9173	34.45	-14.48	19.97	43.50	-23.53	peak	200	265
5	565.9776	29.83	-5.59	24.24	46.00	-21.76	peak	100	233
6	972.2826	28.96	0.65	29.61	54.00	-24.39	peak	200	125

Remarks:

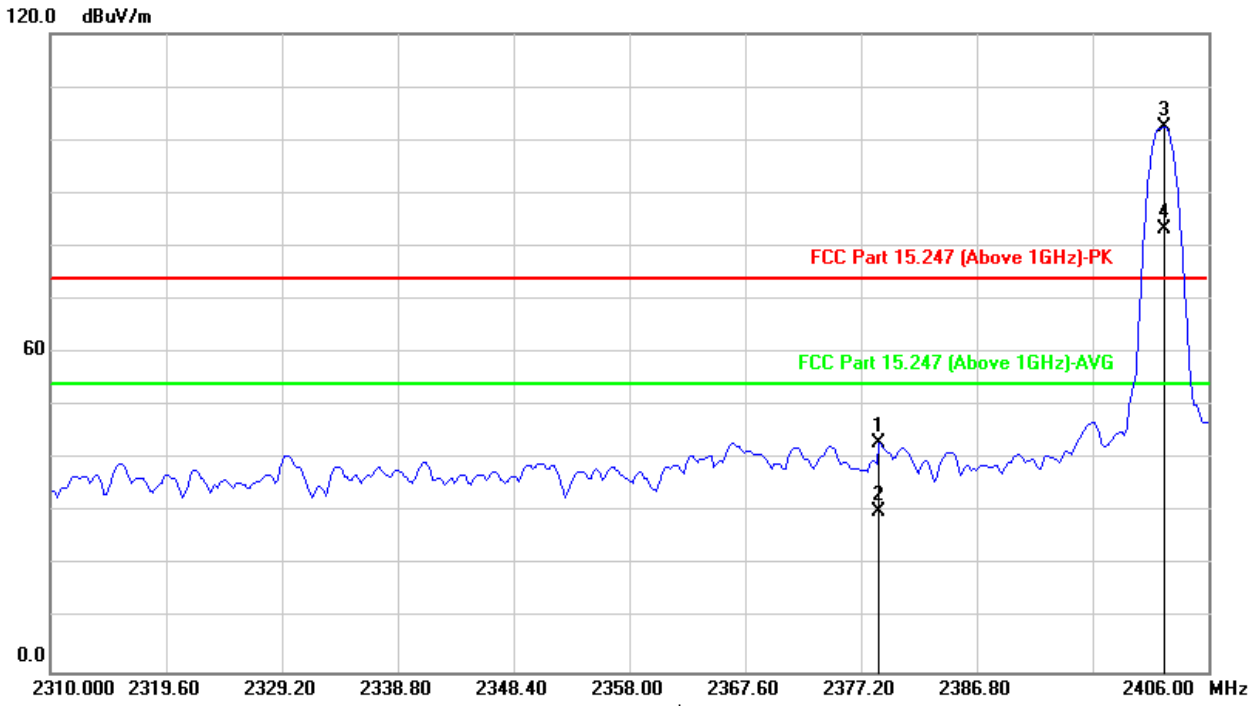
1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value

Above 1GHz Data:

BLE-1Mbps

Test channel	Channel 0	Frequency Range	1GHz ~ 25GHz
Detector Function	Peak (PK) Average (AVG)	Tested By	Jim Xu

Antennal Polarity& Test distance: Horizontal at 3 M



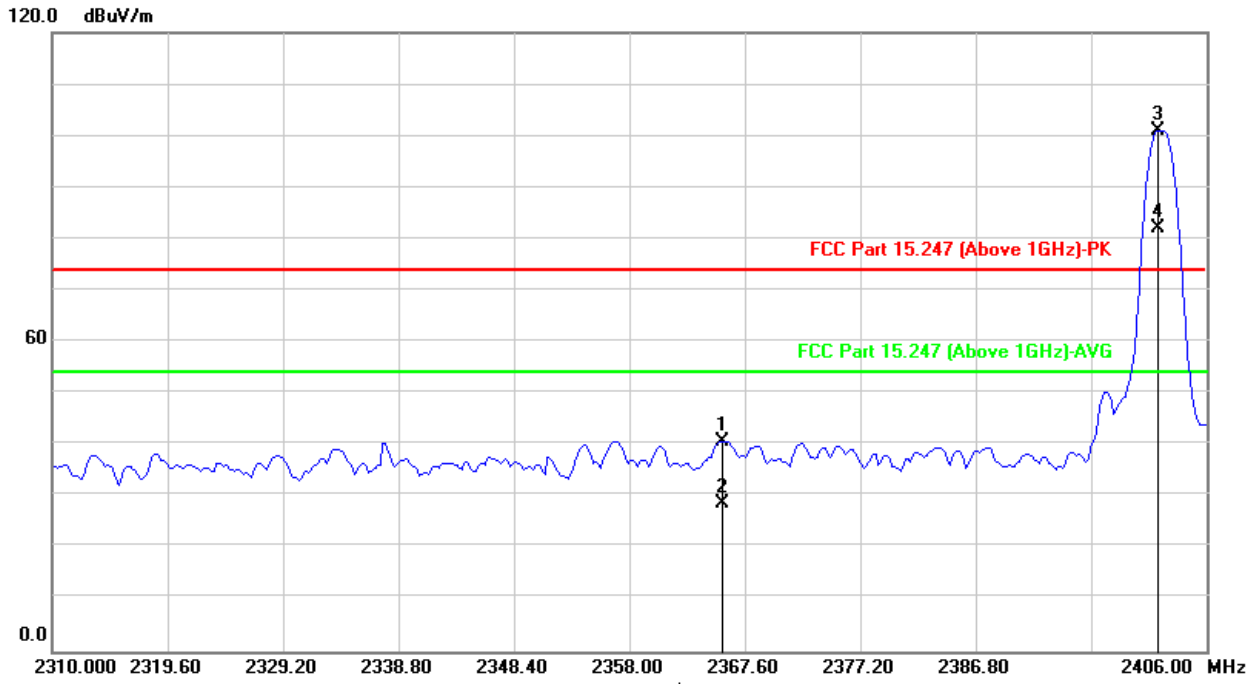
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1	2378.681	42.28	0.77	43.05	74.00	-30.95	peak	100	307
2	2378.681	29.49	0.77	30.26	54.00	-23.74	AVG	100	307
3 #	2402.345	101.57	0.74	102.31			peak	100	307
4 #	2402.345	82.54	0.74	83.28			AVG	100	307
5	4804.000	59.13	7.27	66.40	74.00	-7.60	peak	220	100
6	4804.000	38.03	7.27	45.30	54.00	-8.70	AVG	220	100
7	7206.000	54.75	10.75	65.50	74.00	-8.50	peak	260	100
8	7206.000	32.81	10.75	43.56	54.00	-10.44	AVG	260	100

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value
3. #2402MHz: Fundamental frequency.

Test channel	Channel 0	Frequency Range	1GHz ~ 25GHz
Detector Function	Peak (PK) Average (AVG)	Tested By	Jim Xu

Antennal Polarity& Test Distance: Vertical at 3m



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1	2365.792	39.93	0.80	40.73	74.00	-33.27	peak	100	267
2	2365.792	27.84	0.80	28.64	54.00	-25.36	AVG	100	267
3 #	2401.960	100.17	0.75	100.92			peak	100	267
4 #	2401.960	81.18	0.75	81.93			AVG	100	267
5	4804.000	57.03	7.27	64.30	74.00	-9.70	peak	100	250
6	4804.000	35.23	7.27	42.50	54.00	-11.50	AVG	100	250
7	7206.000	52.45	10.75	63.20	74.00	-10.80	peak	160	49
8	7206.000	30.50	10.75	41.25	54.00	-12.75	AVG	160	49

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value
3. #2402MHz: Fundamental frequency.

Test channel	Channel 19	Frequency Range	1GHz ~ 25GHz
Detector Function	Peak (PK) Average (AVG)	Tested By	Jim Xu

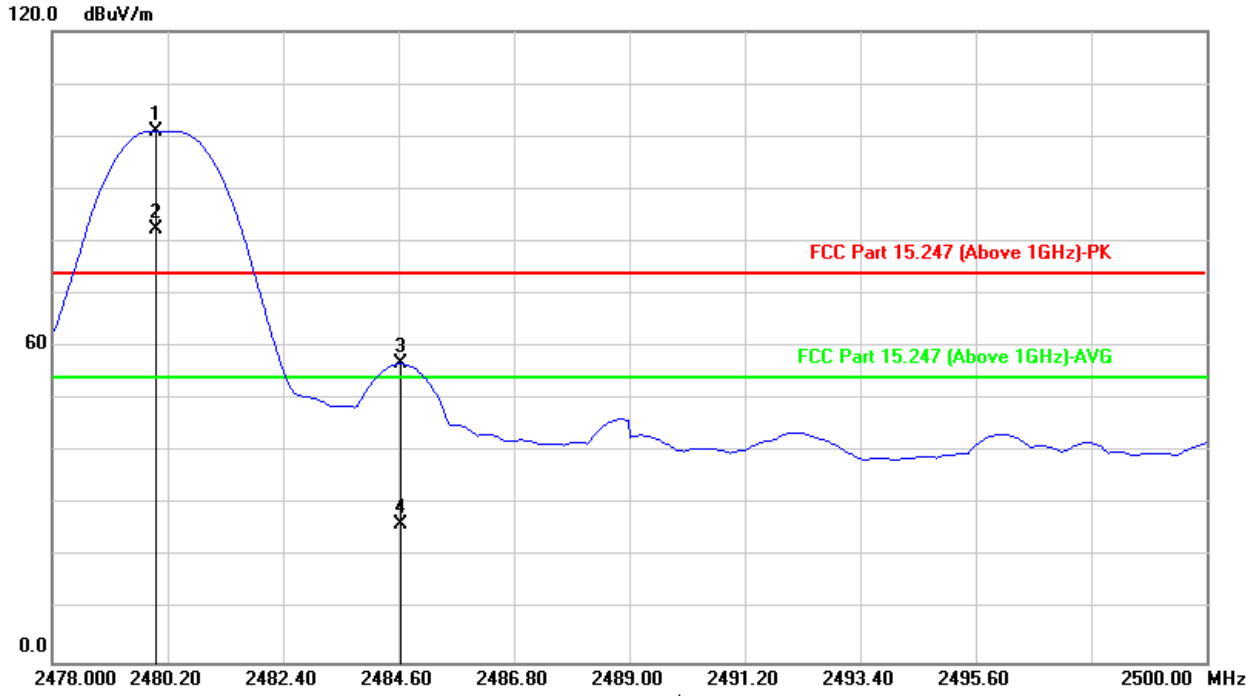
Antennal Polarity& Test Distance: Horizontal at 3m									
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1#	2440.000	100.81	0.69	101.50			peak	100	260
2#	2440.000	76.99	0.69	77.68			AVG	100	260
3	4880.000	52.06	7.60	59.66	74.00	-14.34	peak	120	242
4	4880.000	30.05	7.60	37.65	54.00	-16.35	AVG	120	242
5	7320.000	53.63	10.92	64.55	74.00	-9.45	peak	118	258
6	7320.000	26.64	10.92	37.56	54.00	-16.44	AVG	118	258
Antennal Polarity& Test Distance: Vertical at 3 M									
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1#	2440.000	101.61	0.69	102.30			peak	100	268
2#	2440.000	77.33	0.69	78.02			AVG	100	268
3	4880.000	52.04	7.60	59.64	74.00	-14.36	peak	100	269
4	4880.000	30.20	7.60	37.80	54.00	-16.20	AVG	100	269
5	7320.000	52.63	10.92	63.55	74.00	-10.45	peak	250	340
6	7320.000	27.77	10.92	38.69	54.00	-15.31	AVG	250	340

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value
3. #2440MHz: Fundamental frequency.

Test channel	Channel 39	Frequency Range	1GHz ~ 25GHz
Detector Function	Peak (PK) Average (AVG)	Tested By	Jim Xu

Antennal Polarity& Test Distance: Horizontal at 3 M



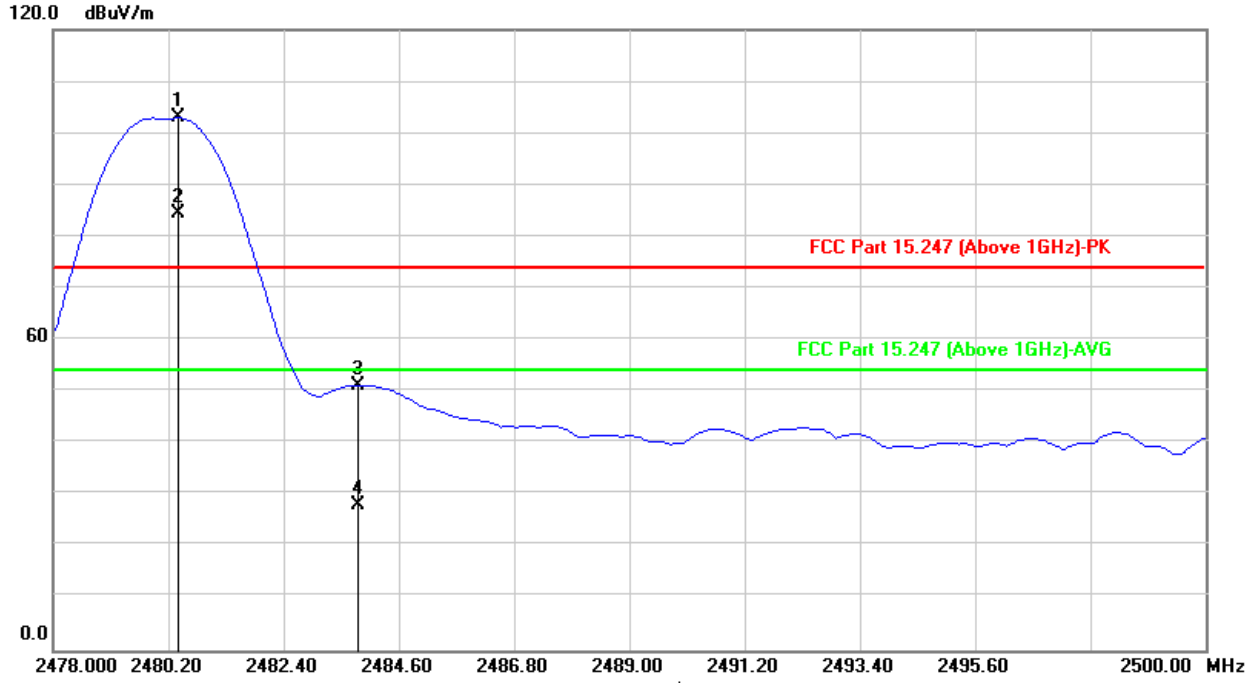
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1#	2479.984	100.35	0.64	100.99			peak	100	217
2#	2479.984	81.70	0.64	82.34			AVG	100	217
3	2484.657	56.11	0.63	56.74	74.00	-17.26	peak	100	217
4	2484.657	25.47	0.63	26.10	54.00	-27.90	AVG	100	217
5	4960.000	59.58	7.94	67.52	74.00	-6.48	peak	250	200
6	4960.000	38.56	7.94	46.50	54.00	-7.50	AVG	250	200
7	**7440.000**	**56.81**	**11.09**	**67.90**	**74.00**	**-6.10**	**peak**	**136**	**270**
8	7440.000	34.68	11.09	45.77	54.00	-8.23	AVG	136	270

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value
3. #2480MHz: Fundamental frequency.

Test channel	Channel 39	Frequency Range	1GHz ~ 25GHz
Detector Function	Peak (PK) Average (AVG)	Tested By	Jim Xu

Antennal Polarity& Test Distance: Vertical at 3 M



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1#	2480.381	102.29	0.64	102.93			peak	100	267
2#	2480.381	83.76	0.64	84.40			AVG	100	267
3	2483.820	50.61	0.63	51.24	74.00	-22.76	peak	100	267
4	2483.820	27.51	0.63	28.14	54.00	-25.86	AVG	100	267
5	4960.000	57.37	7.94	65.31	74.00	-8.69	peak	160	278
6	4960.000	35.66	7.94	43.60	54.00	-10.40	AVG	160	278
7	7440.000	54.73	11.09	65.82	74.00	-8.18	peak	289	220
8	7440.000	33.49	11.09	44.58	54.00	-9.42	AVG	289	220

Remarks:

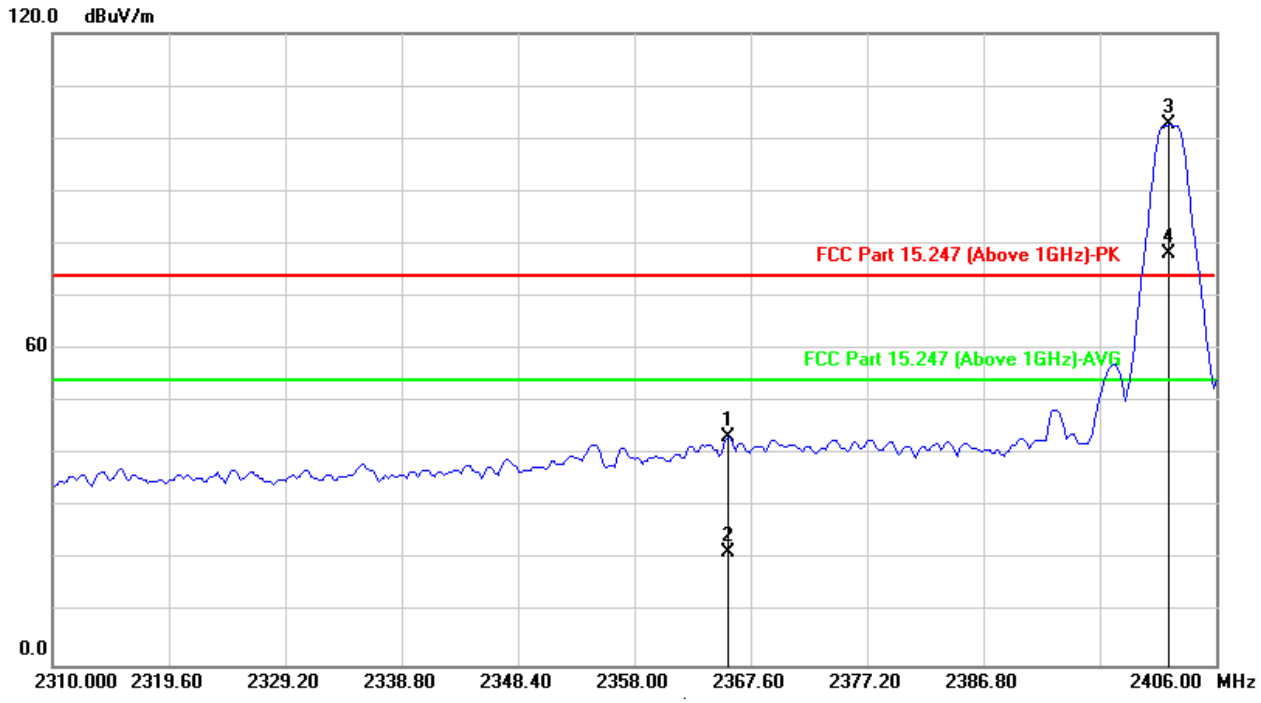
4. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
5. Margin value = Emission level – Limit value
6. #2480MHz: Fundamental frequency.

Above 1GHz Data:

BLE-2Mbps

Test channel	Channel 0	Frequency Range	1GHz ~ 25GHz
Detector Function	Peak (PK) Average (AVG)	Tested By	Jim Xu

Antennal Polarity& Test distance: Horizontal at 3 M



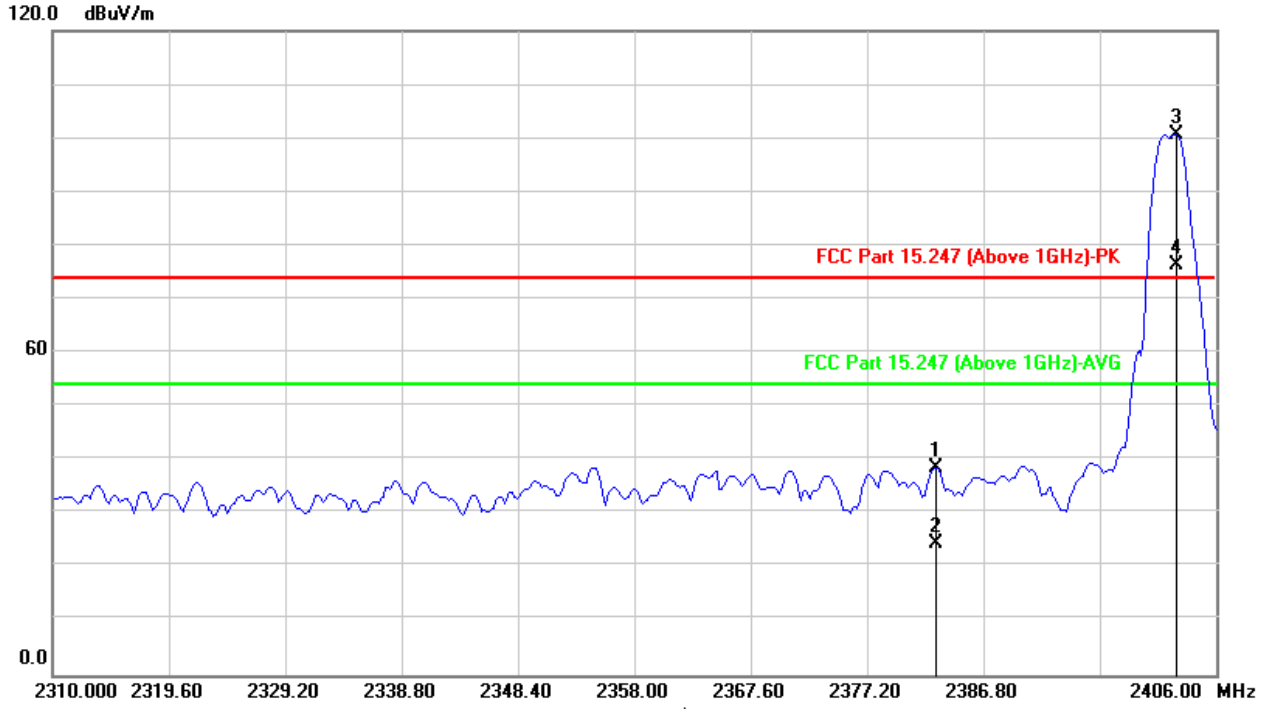
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1	2365.792	42.53	0.80	43.33	74.00	-30.67	peak	100	310
2	2365.792	20.56	0.80	21.36	54.00	-32.64	AVG	100	310
3 #	2402.152	101.87	0.74	102.61			peak	100	310
4 #	2402.152	77.28	0.74	78.02			AVG	100	310
5	4804.000	50.37	7.27	57.64	74.00	-16.36	peak	125	150
6	4804.000	33.98	7.27	41.25	54.00	-12.75	AVG	125	150
7	7206.000	42.45	10.75	53.20	74.00	-20.80	peak	230	211
8	7206.000	24.46	10.75	35.21	54.00	-18.79	AVG	230	211

Remarks:

4. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
5. Margin value = Emission level – Limit value
6. #2402MHz: Fundamental frequency.

Test channel	Channel 0	Frequency Range	1GHz ~ 25GHz
Detector Function	Peak (PK) Average (AVG)	Tested By	Jim Xu

Antennal Polarity& Test Distance: Vertical at 3m



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1	2382.914	37.87	0.77	38.64	74.00	-35.36	peak	100	268
2	2382.914	23.59	0.77	24.36	54.00	-29.64	AVG	100	268
3 #	2402.729	99.96	0.74	100.70			peak	100	268
4 #	2402.729	75.66	0.74	76.40			AVG	100	268
5	4804.000	51.38	7.27	58.65	74.00	-15.35	peak	100	100
6	4804.000	33.06	7.27	40.33	54.00	-13.67	AVG	100	100
7	7206.000	41.61	10.75	52.36	74.00	-21.64	peak	100	350
8	7206.000	23.46	10.75	34.21	54.00	-19.79	AVG	100	350

Remarks:

4. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
5. Margin value = Emission level – Limit value
6. #2402MHz: Fundamental frequency.

Test channel	Channel 19	Frequency Range	1GHz ~ 25GHz
Detector Function	Peak (PK) Average (AVG)	Tested By	Jim Xu

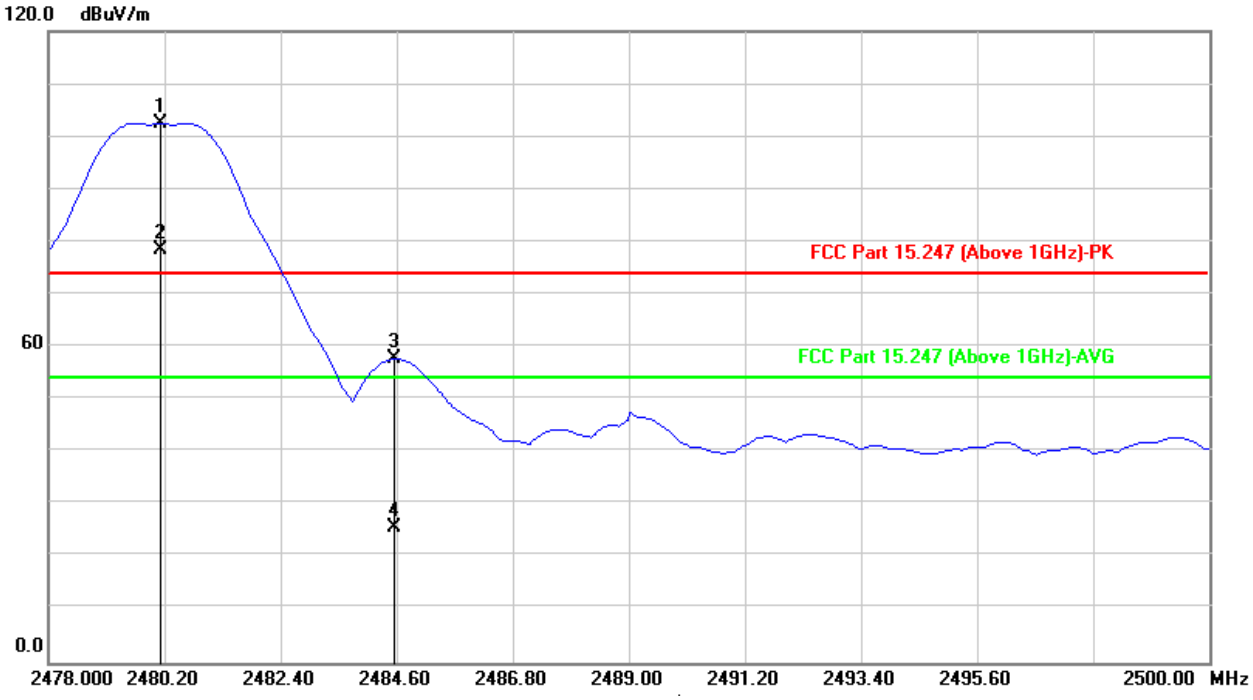
Antennal Polarity& Test Distance: Horizontal at 3m									
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1#	2440.000	100.61	0.69	101.30			peak	100	260
2#	2440.000	76.96	0.69	77.65			AVG	100	260
3	4880.000	48.94	7.60	56.54	74.00	-17.46	peak	160	230
4	4880.000	26.90	7.60	34.50	54.00	-19.50	AVG	160	230
5	7320.000	50.40	10.92	61.32	74.00	-12.68	peak	140	210
6	7320.000	25.86	10.92	36.78	54.00	-17.22	AVG	140	210
Antennal Polarity& Test Distance: Vertical at 3 M									
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1#	2440.000	100.91	0.69	101.60			peak	100	246
2#	2440.000	77.51	0.69	78.20			AVG	100	246
3	4880.000	49.73	7.60	57.33	74.00	-16.67	peak	150	236
4	4880.000	28.94	7.60	36.54	54.00	-17.46	AVG	150	236
5	7320.000	51.66	10.92	62.58	74.00	-11.42	peak	110	280
6	7320.000	26.94	10.92	37.86	54.00	-16.14	AVG	110	280

Remarks:

4. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
5. Margin value = Emission level – Limit value
6. #2440MHz: Fundamental frequency.

Test channel	Channel 39	Frequency Range	1GHz ~ 25GHz
Detector Function	Peak (PK) Average (AVG)	Tested By	Jim Xu

Antennal Polarity& Test Distance: Horizontal at 3 M



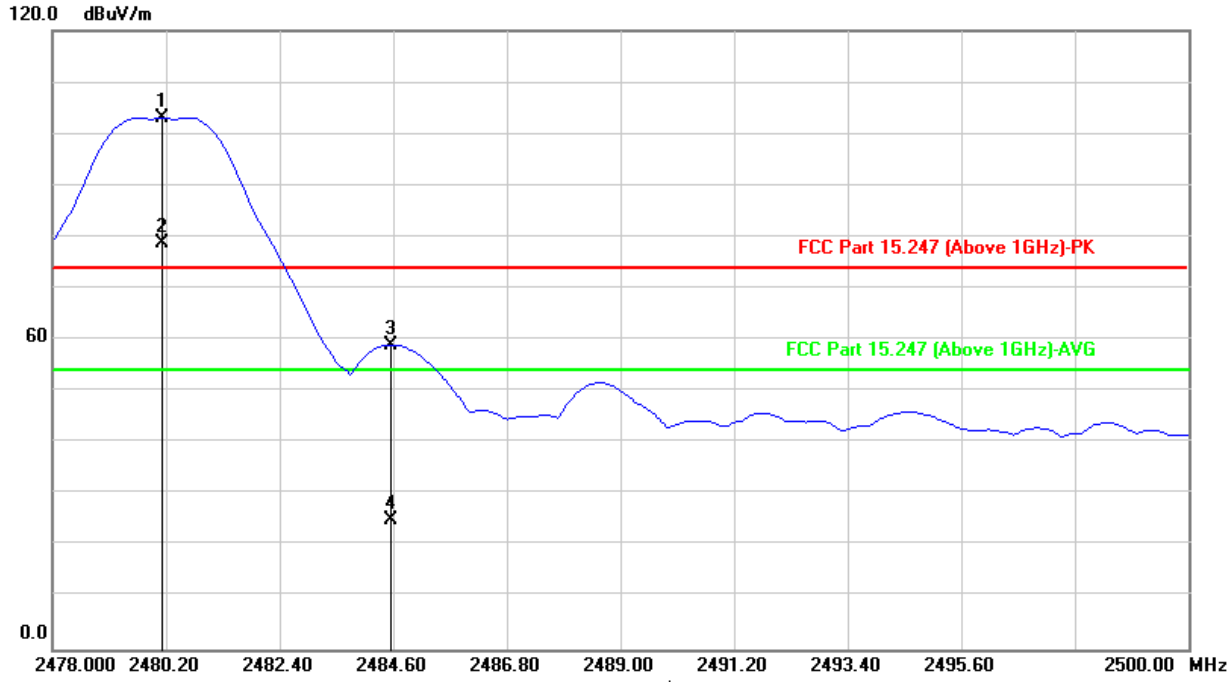
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1#	2480.116	101.91	0.64	102.55			peak	100	54
2#	2480.116	77.76	0.64	78.40			AVG	100	54
3	2484.569	57.07	0.63	57.70	74.00	-16.30	peak	100	54
4	2484.569	24.97	0.63	25.60	54.00	-28.40	AVG	100	54
5	4960.000	52.38	7.94	60.32	74.00	-13.68	peak	100	60
6	4960.000	35.27	7.94	43.21	54.00	-10.79	AVG	100	60
7	7440.000	46.51	11.09	57.60	74.00	-16.40	peak	100	120
8	7440.000	27.24	11.09	38.33	54.00	-15.67	AVG	100	120

Remarks:

7. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
8. Margin value = Emission level – Limit value
9. #2480MHz: Fundamental frequency.

Test channel	Channel 39	Frequency Range	1GHz ~ 25GHz
Detector Function	Peak (PK) Average (AVG)	Tested By	Jim Xu

Antennal Polarity& Test Distance: Vertical at 3 M



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1#	2480.116	102.50	0.64	103.14			peak	100	265
2#	2480.116	78.23	0.64	78.87			AVG	100	265
3	2484.569	58.45	0.63	59.08	74.00	-14.92	peak	100	265
4	2484.569	24.37	0.63	25.00	54.00	-29.00	AVG	100	265
5	4960.000	49.71	7.94	57.65	74.00	-16.35	peak	100	250
6	4960.000	33.39	7.94	41.33	54.00	-12.67	AVG	100	250
7	7440.000	42.13	11.09	53.22	74.00	-20.78	peak	100	300
8	7440.000	24.55	11.09	35.64	54.00	-18.36	AVG	100	300

Remarks:

10.Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)

11.Margin value = Emission level – Limit value

12.#2480MHz: Fundamental frequency.

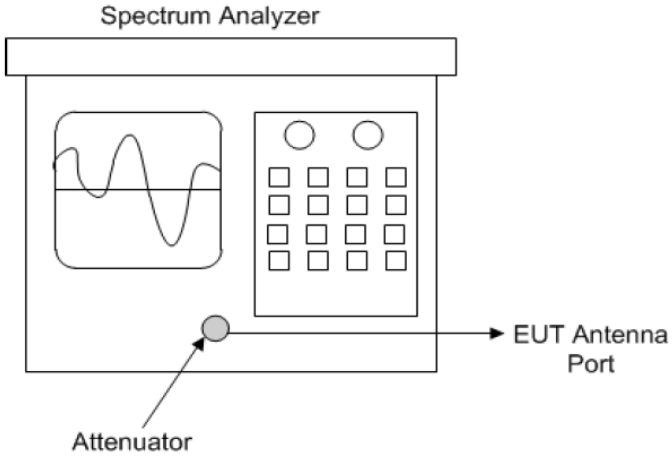
3.2 6dB Bandwidth Measurement

3.2.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5MHz.

3.2.2 Test Setup

Subclause 11.8 of ANSI C63.10 is applicable.



Spectrum analyzer test configuration

3.2.3 Test Instruments

Refer to section 5 to get information of above instrument.

3.2.4 Test Procedure

Option 1:

a. Set resolution bandwidth (RBW) = 30kHz
b. Set the video bandwidth (VBW) ≥ 3 x RBW
c. Detector = Peak.
d. Trace mode = max hold.
e. Sweep = auto couple.
f. Allow the trace to stabilize.
g. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

Option 2:

The automatic bandwidth measurement capability of an instrument may be employed using the dB bandwidth mode with *X* set to 6 dB. if the functionality described in 11.8.1 (i.e. RBW= 100 kHz. VBW ≥ 3*RBW. and peak detector with maximum hold) is implemented by the instrumentation function. When using this capability. care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥6 dB

3.2.5 Deviation from Test Standard

No deviation.

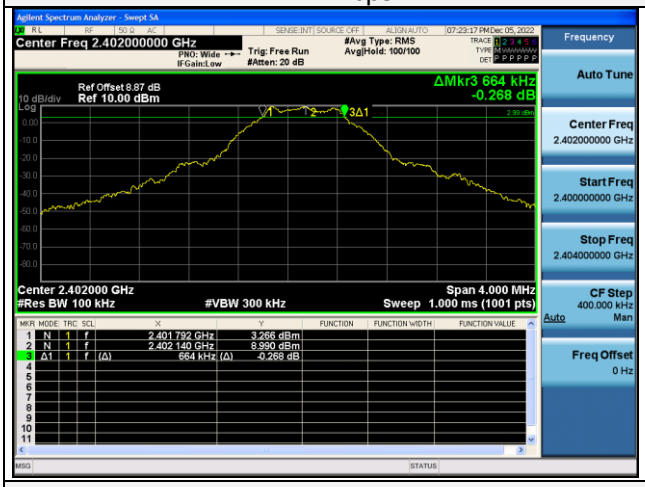
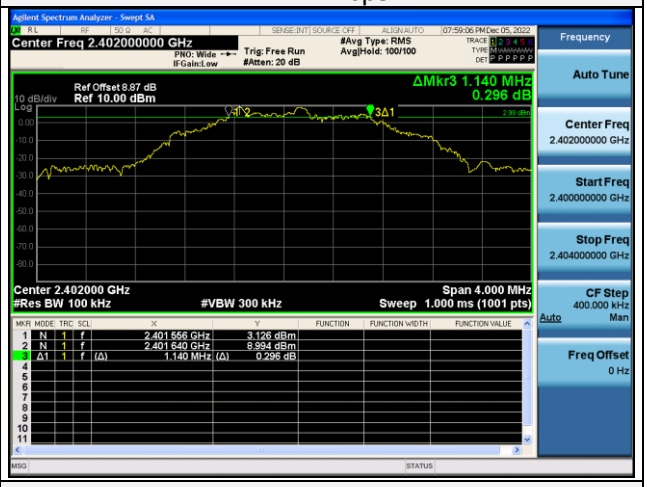
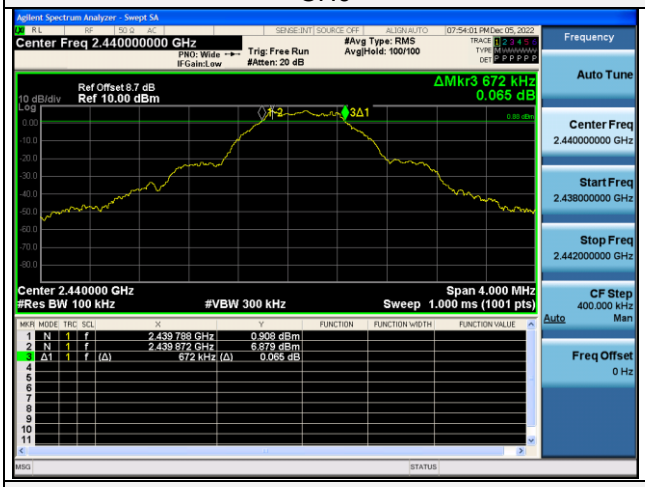
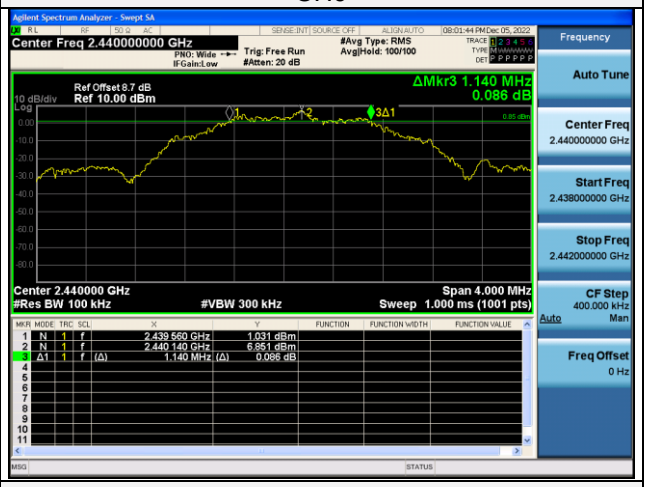
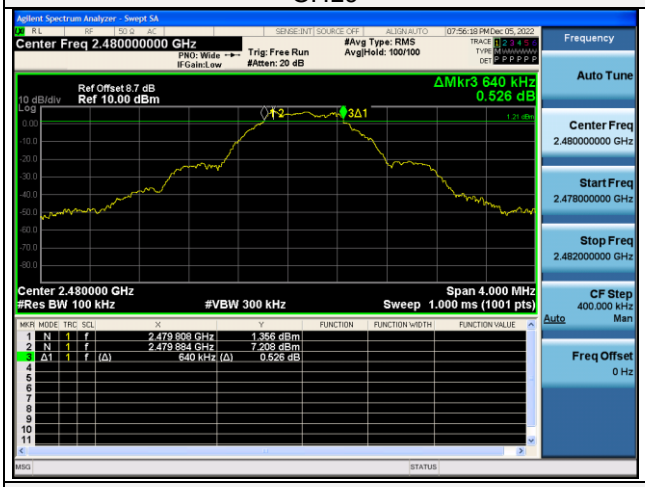
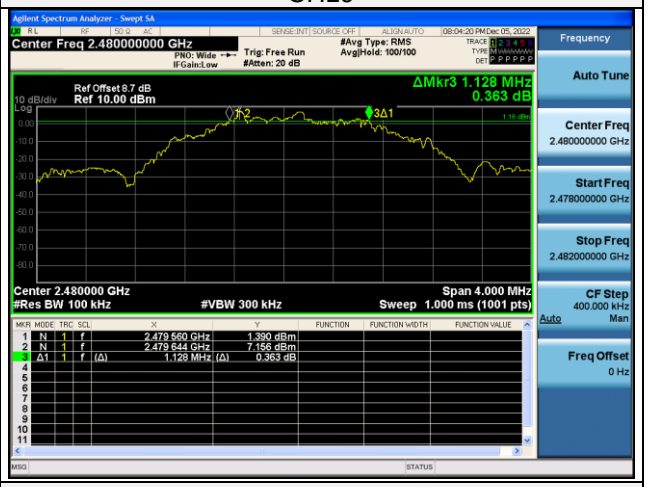
3.2.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

3.2.7 Test Result

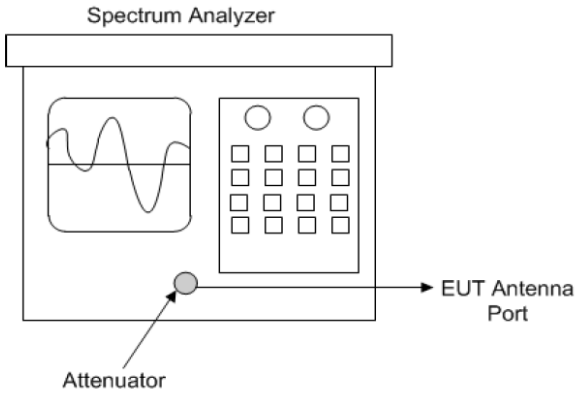
BLE-1Mbps			
Operation Channel	Frequency	6dB Bandwidth (MHz)	
		Result	Limit
0	2402MHz	0.664	>0.5
19	2440MHz	0.672	>0.5
39	2480MHz	0.640	>0.5

BLE-2Mbps			
Operation Channel	Frequency	6dB Bandwidth (MHz)	
		Result	Limit
0	2402MHz	1.140	>0.5
19	2440MHz	1.140	>0.5
39	2480MHz	1.128	>0.5

BLE 1Mbps	BLE 2Mbps
	
CH0	CH0
	
CH19	CH19
	
CH39	CH39

3.3 Occupied Bandwidth Measurement

3.3.1 Test Setup



3.3.2 Test Instruments

Refer to section 5 to get information of above instrument.

3.3.3 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to peak. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 %of the total mean power of a given emission.

3.3.4 Deviation from Test Standard

No deviation.

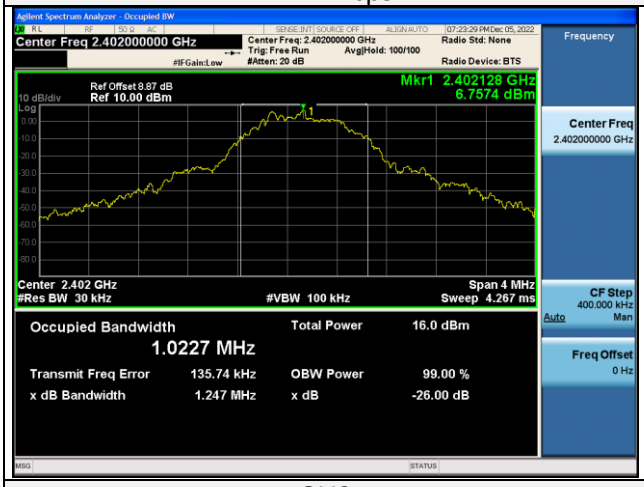
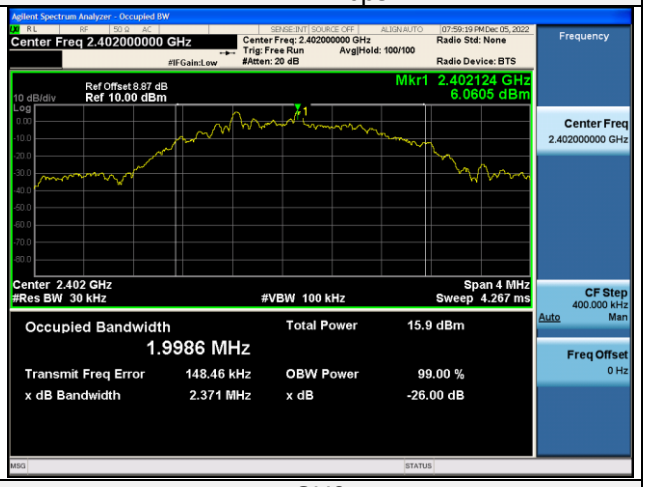
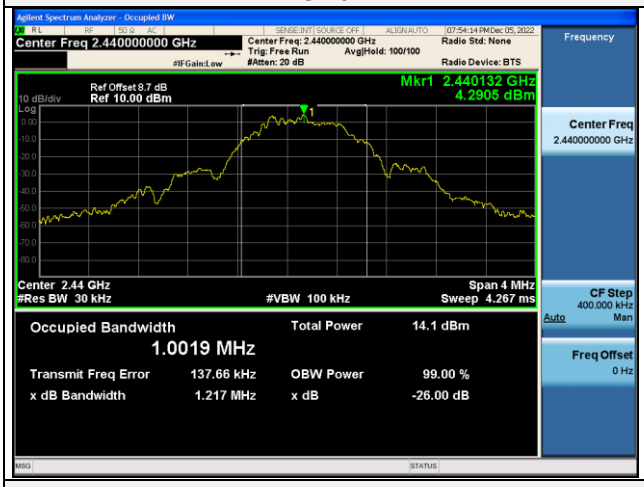
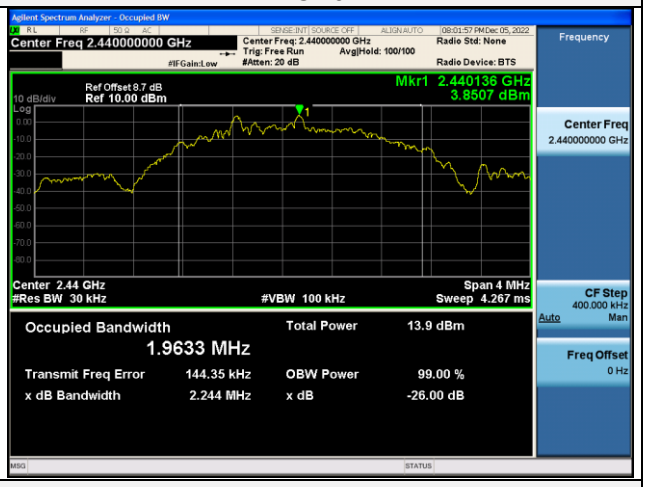
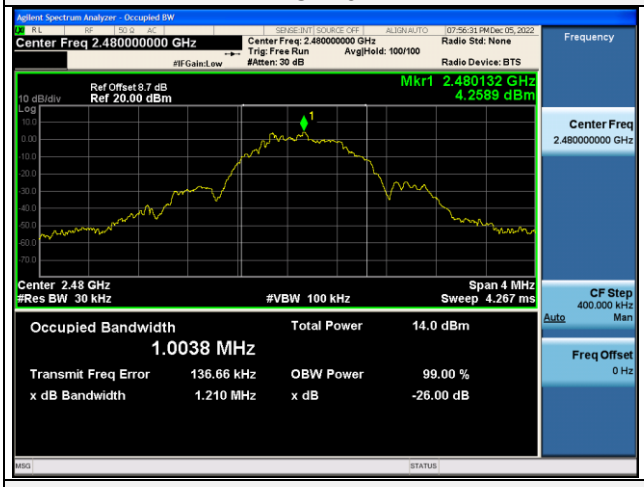
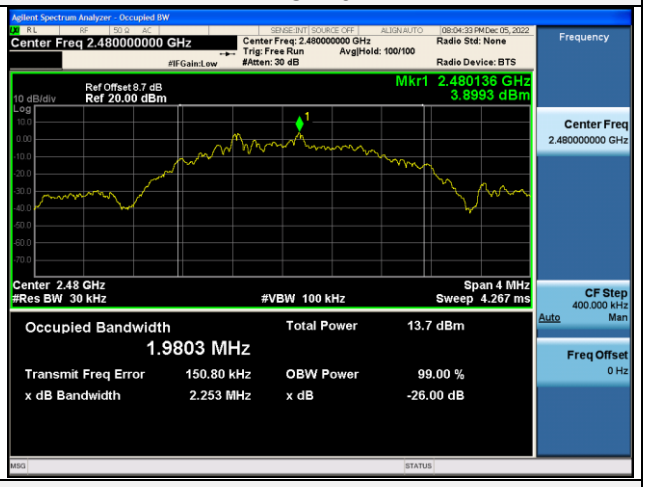
3.3.5 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

3.3.6 Test Results

BLE-1Mbps			
Operation Channel	Frequency	Occupied Bandwidth (MHz)	
		Result	Limit
0	2402MHz	1.023	2400~2483.5
19	2440MHz	1.002	2400~2483.5
39	2480MHz	1.004	2400~2483.6

BLE-2Mbps			
Operation Channel	Frequency	Occupied Bandwidth (MHz)	
		Result	Limit
0	2402MHz	1.999	2400~2483.5
19	2440MHz	1.963	2400~2483.5
39	2480MHz	1.980	2400~2483.6

BLE 1Mbps	BLE 2Mbps
	
CH0	CH0
	
CH19	CH19
	
CH39	CH39

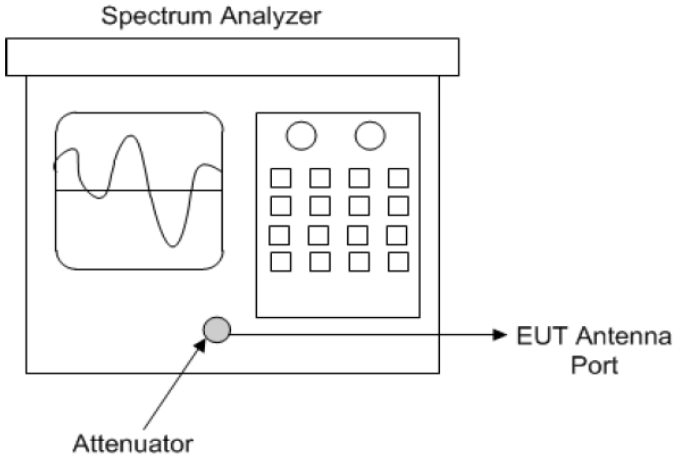
3.4 Conducted Output Power Measurement

3.4.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

3.4.2 Test Setup

- Measurement using a spectrum analyzer (SA) Subclause 11.9.2.2 of ANSI C63.10 is applicable



Spectrum analyzer output power test configuration

3.4.3 Test Instruments

Refer to section 5 to get information of above instrument.

3.4.4 Test Procedures

Measurement using a spectrum analyzer (SA)，Selection of test method：

The proper test method is selected based on the following criteria:

a) **Method AVGSA-1 or method AVGSA-1A (alternative)** shall be applied if either of the following conditions can be satisfied:
1) The EUT transmits continuously (or with a D> 98%).
2) Sweep triggering can be implemented in such a way that the device transmits at the maximum power control level throughout the duration of each of the instrument sweeps to be averaged. This condition can generally be achieved by triggering the instrument's sweep if the duration of the sweep (with the instrument configured as in method AVGSA-1) is equal to or shorter than the duration T of each transmission from the EUT, and if those transmissions exhibit full power throughout their durations.

b) **Method AVGSA-2 or method AVGSA-2A (alternative)** shall be applied if the conditions of the preceding item a) cannot be achieved and the transmissions exhibit a constant duty cycle during the measurement duration. Duty cycle will be considered to be constant if variations are less than +2%.

c) **Method AVGSA-3 or method AVGSA-3A** (alternative) shall be applied if the conditions of the preceding item a) and item b) cannot be achieved.

Method AVGSA-3 or method AVGSA-3A:

a) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b) Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
c) SA Setting:
1* Set span to at least 1.5 times the OBW
2* Set sweep trigger to "free run."
3* Set RBW= 1% to 5% of the OBW. not to exceed 1MHz.
4* Set VBW ≥ 3 x RBW
5* Number of points in sweep≥ 2 x span /RBW. (This gives bin-to-bin spacing ≤ RBW / 2. so that narrowband signals are not lost between frequency bins).
6* Sweep time ≤ (number of points in sweep) x T. where T is defined in 11.6. If this gives a sweep time less than the auto sweep time of the instrument. then method AVGSA-3 shall not be used (use AVGSA-3A). The purpose of this step is so that the averaging time in each bin is less than or equal to the minimum time of a transmission.
7* Detector =RMS (power averaging).
8* Trace mode =max hold.
9* Allow max hold to run for at least 60 s or longer as needed to allow the trace to stabilize.
10* Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges. If the instrument does not have a band power function. then sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW
d. Measure the captured power within the band and recording the plot.
e. Repeat above procedures until all frequencies required were complete.

3.4.5 Deviation from Test Standard

No deviation.

3.4.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

3.4.7 Test Results

Left ear earphone

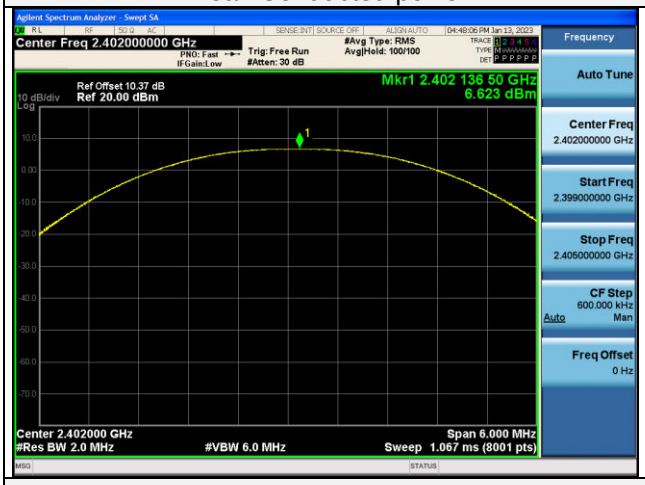
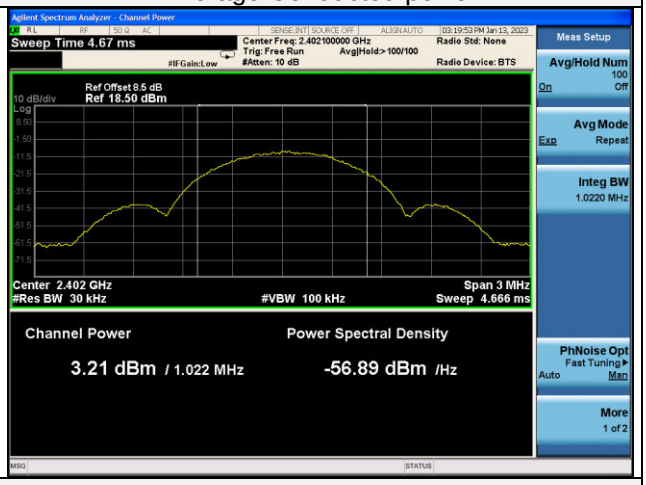
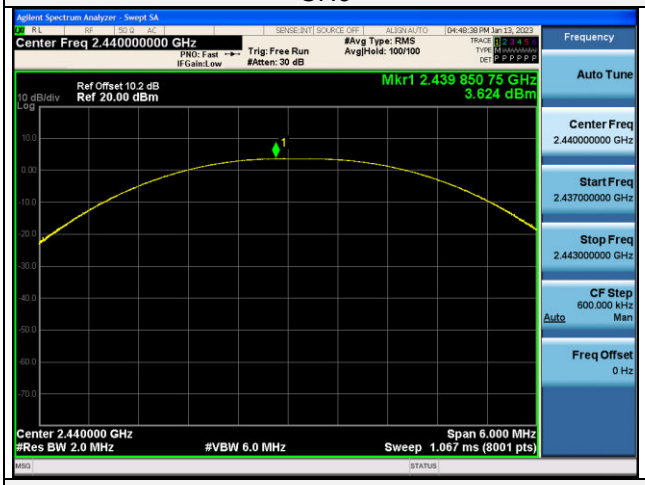
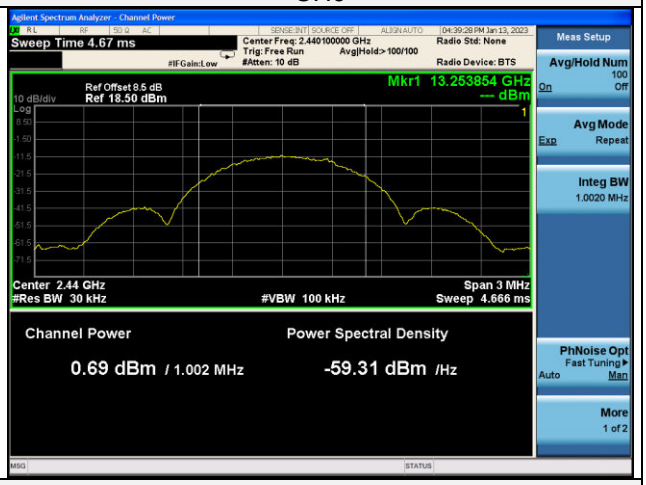
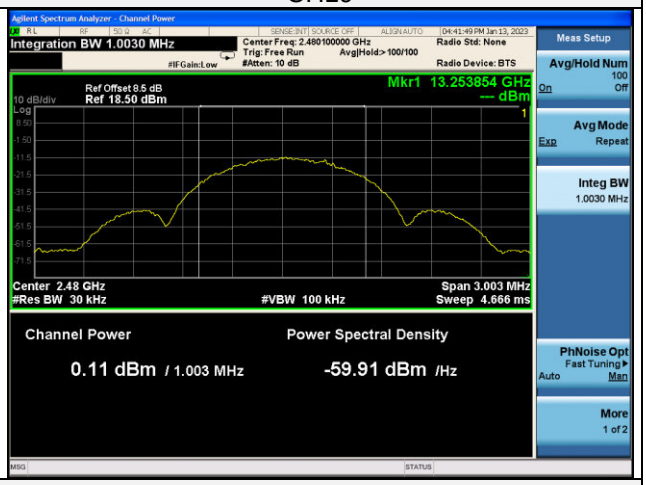
BLE-1Mbps						
Peak Power						
Channel	Freq.	RF Output Power		Limit (mW)		Verdict
No.	(MHz)	(dBm)	(mW)	Rss-247	FCC	
0	2402	6.623	4.595	<125	<1000	Pass
19	2440	3.624	2.304	<125	<1000	Pass
39	2480	3.241	2.109	<125	<1000	Pass

BLE-1Mbps						
Average Power						
Channel	Freq.	RF Output Power		Limit (mW)		Verdict
No.	(MHz)	(dBm)	(mW)	Rss-247	FCC	
0	2402	3.21	2.094	<125	<1000	Pass
19	2440	0.69	1.172	<125	<1000	Pass
39	2480	0.11	1.026	<125	<1000	Pass

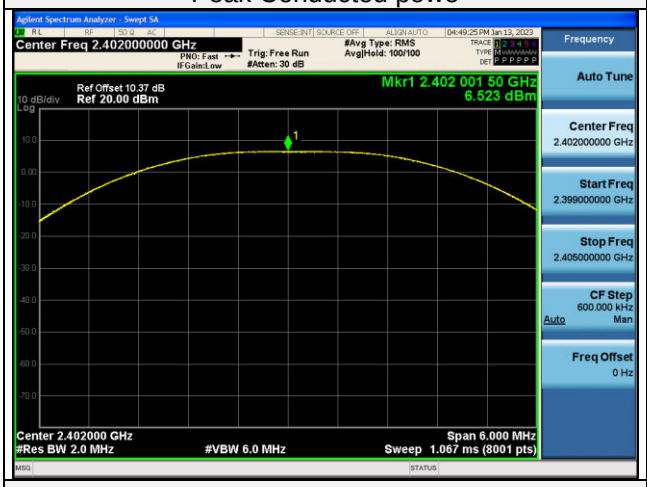
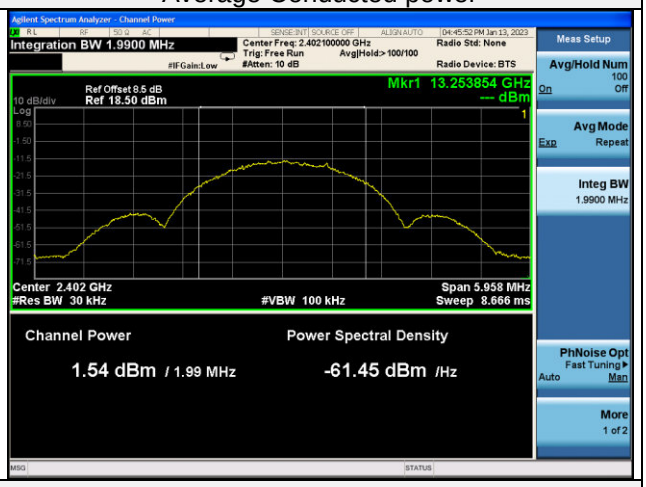
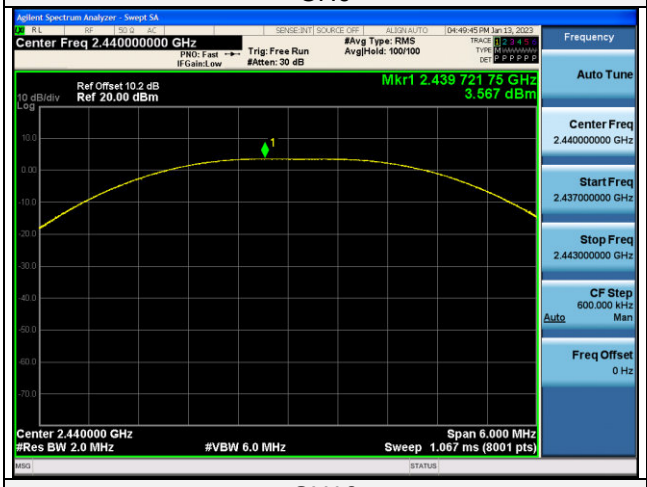
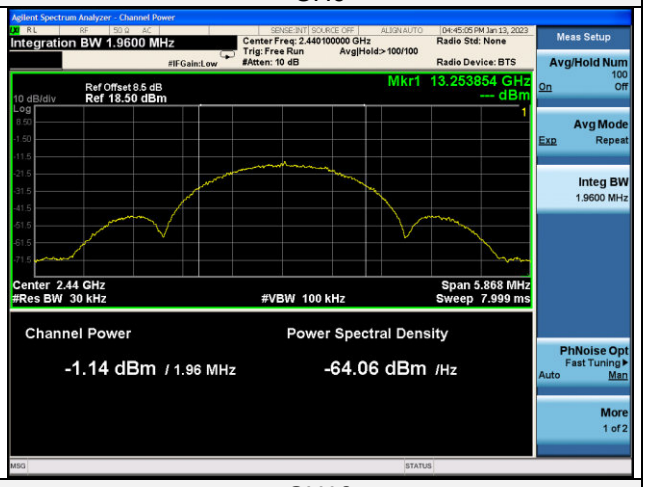
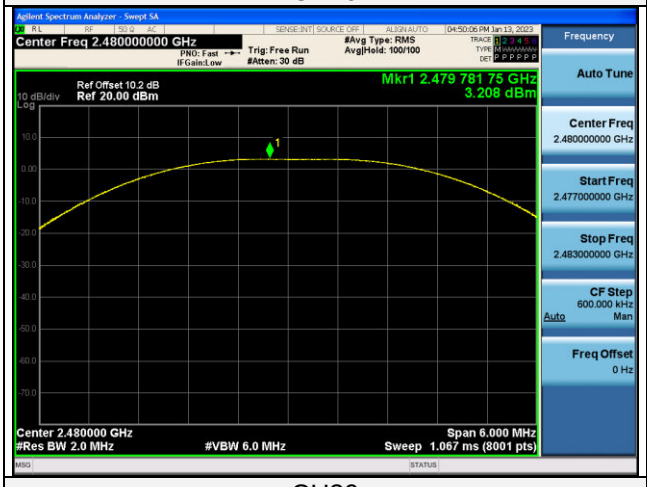
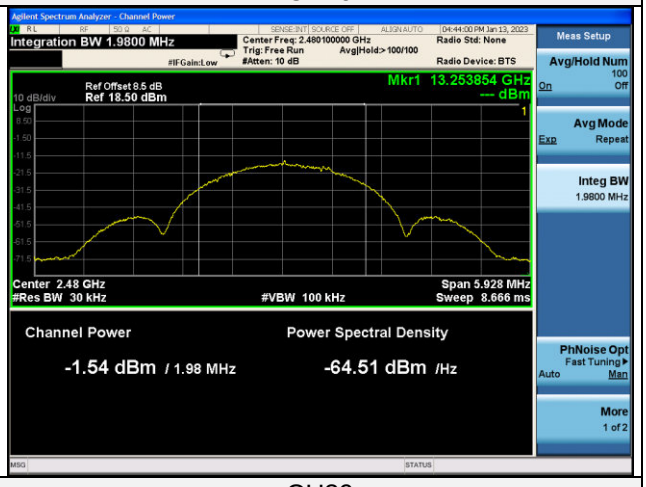
BLE-2Mbps						
Peak Power						
Channel	Freq.	RF Output Power		Limit (mW)		Verdict
No.	(MHz)	(dBm)	(mW)	Rss-247	FCC	
0	2402	6.523	4.491	<125	<1000	Pass
19	2440	3.567	2.274	<125	<1000	Pass
39	2480	3.208	2.093	<125	<1000	Pass

BLE-2Mbps						
Average Power						
Channel	Freq.	RF Output Power		Limit (mW)		Verdict
No.	(MHz)	(dBm)	(mW)	Rss-247	FCC	
0	2402	1.54	1.426	<125	<1000	Pass
19	2440	-1.14	0.769	<125	<1000	Pass
39	2480	-1.54	0.701	<125	<1000	Pass

1Mbps

Peak Conducted powe	Average Conducted power
	
CH0	CH0
	
CH19	CH19
	
CH39	CH39

2Mbps

Peak Conducted powe	Average Conducted power
	
CH0	CH0
	
CH19	CH19
	
CH39	CH39

Right ear earphone

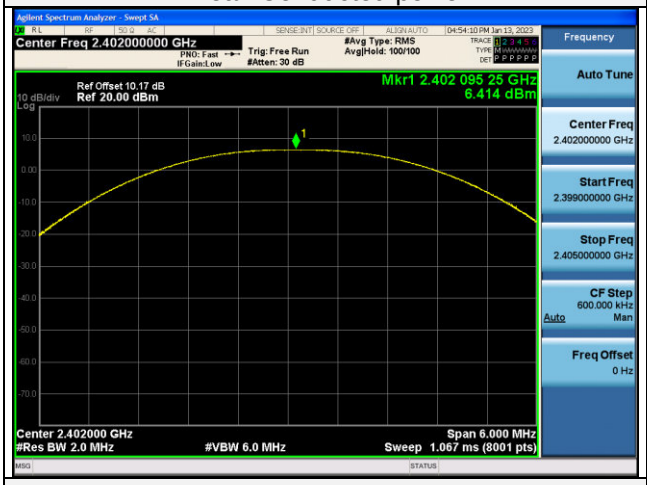
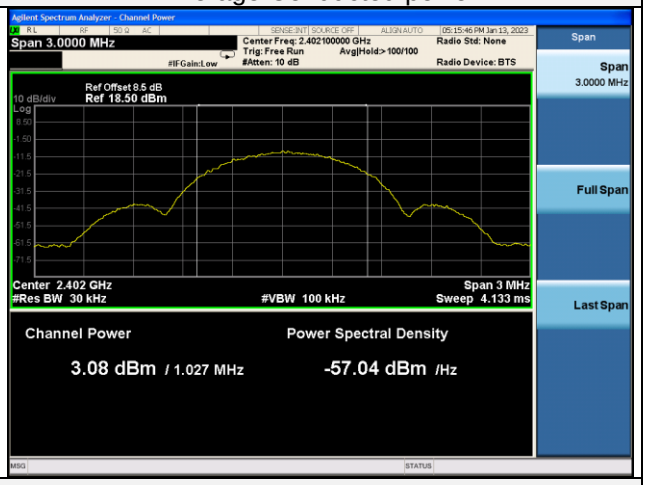
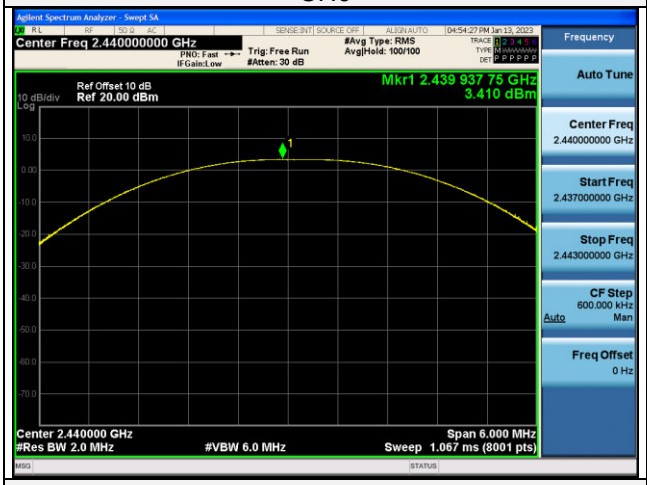
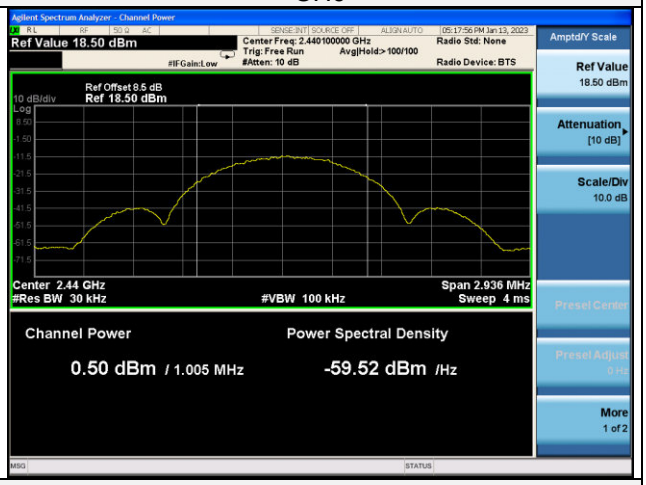
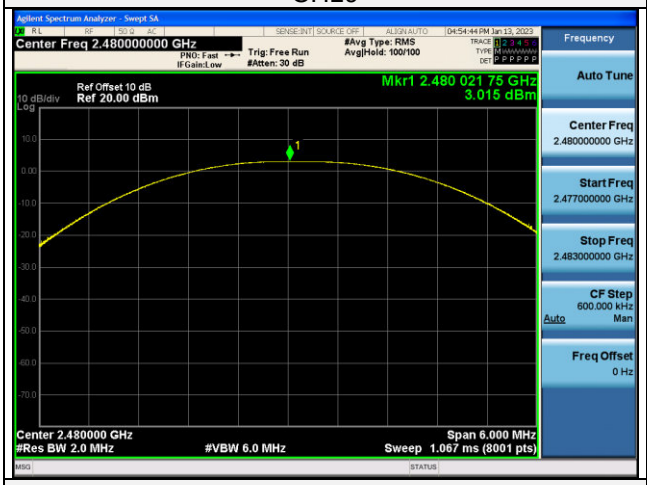
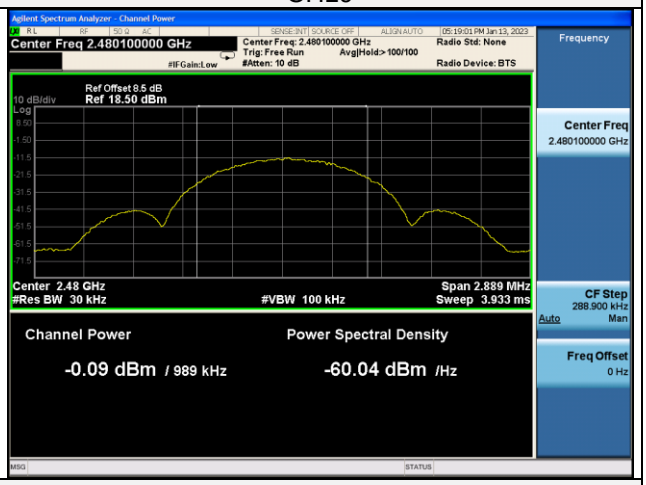
BLE-1Mbps						
Peak Power						
Channel	Freq.	RF Output Power		Limit (mW)		Verdict
No.	(MHz)	(dBm)	(mW)	Rss-247	FCC	
0	2402	6.414	4.379	<125	<1000	Pass
19	2440	3.410	2.193	<125	<1000	Pass
39	2480	3.015	2.002	<125	<1000	Pass

BLE-1Mbps						
Average Power						
Channel	Freq.	RF Output Power		Limit (mW)		Verdict
No.	(MHz)	(dBm)	(mW)	Rss-247	FCC	
0	2402	3.08	2.032	<125	<1000	Pass
19	2440	0.5	1.122	<125	<1000	Pass
39	2480	-0.09	0.979	<125	<1000	Pass

BLE-2Mbps						
Peak Power						
Channel	Freq.	RF Output Power		Limit (mW)		Verdict
No.	(MHz)	(dBm)	(mW)	Rss-247	FCC	
0	2402	6.291	4.257	<125	<1000	Pass
19	2440	3.317	2.146	<125	<1000	Pass
39	2480	2.984	1.988	<125	<1000	Pass

BLE-2Mbps						
Average Power						
Channel	Freq.	RF Output Power		Limit (mW)		Verdict
No.	(MHz)	(dBm)	(mW)	Rss-247	FCC	
0	2402	1.4	1.380	<125	<1000	Pass
19	2440	-1.23	0.753	<125	<1000	Pass
39	2480	-1.63	0.687	<125	<1000	Pass

1Mbps

Peak Conducted powe	Average Conducted power
	
CH0	CH0
	
CH19	CH19
	
CH39	CH39