ACCREDITED Certificate # 5200.01

FCC Part 15, Subpart C

Test Report

FCC ID:	2AR2STAN7506
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(s):	Active Noise Canceling wireless headphones
Brand(s):	PHILIPS or
Test Model(s):	TAN7506
Series Model(s):	TAN7506xx/yy (xx=AA-ZZ or blank denoted different color; yy=00-99 denoted different country destination)
Test Date:	Apr. 26, 2022~ May 10, 2022
Issued Date:	May 21, 2022
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 : Tank Tan — *Tank Tan*

Reviewed by : Scott He — *Scott He*

Approved by : *Harry Li*

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Release Control Record

Issue No.	Description	Date Issued
220425KH01-01-RF-US-01	Original Release	May 21, 2022

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	Meet the requirement of limit.

Note: The EUT has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (sDoC). 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) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.66 dB
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(s)	Active Noise Canceling wireless headphones
Test Model(s)	TAN7506
Sample No.	HS220425-02-04&HS220425-02-02
Series Model(s)	TAN7506xx/yy (xx=AA-ZZ or blank denoted different color; yy=00-99 denoted different country destination)
Status of EUT	Engineering Prototype
Power Supply Rating	DC 5V from USB or DC 3.7V from battery
Modulation Type	BT-LE(GFSK)
Transfer Rate	1 Mbps
Operating Frequency	2402 ~ 2480MHz
Number of Channel	40
Maximum Output Power	3.340dBm (Peak), -7.772dBm (AVG)
Antenna Type	Chip Antenna
Antenna Gain	1.06dBi Maximum peak Gain
Antenna Connector	N/A
Accessory Device	N/A
Data Cable Supplied	Type-C to USB-A Cable:0.5m

Note:

1. Please refer to the EUT photo document (Reference No.: 220425KH01-01-01&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. Model difference: These models are only different for model name for trade purpose.

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 **X-plane**.
2. "N/A" means no effect.

Test Condition:

Applicable test items	Environmental Conditions	Test Date	Tested by
AC Power Conducted Emission	23deg. C, 53%RH	Apr. 30, 2022	Jim Xu
Radiated Emissions	24deg. C, 45%RH	Apr. 29, 2022	Jim Xu
Antenna Port Conducted Measurement	25deg. C, 56%RH	May 07, 2022	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	1

Radiated Emission Test (Below 1GHz):

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
-	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	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	1

2.4 Description of Support Units

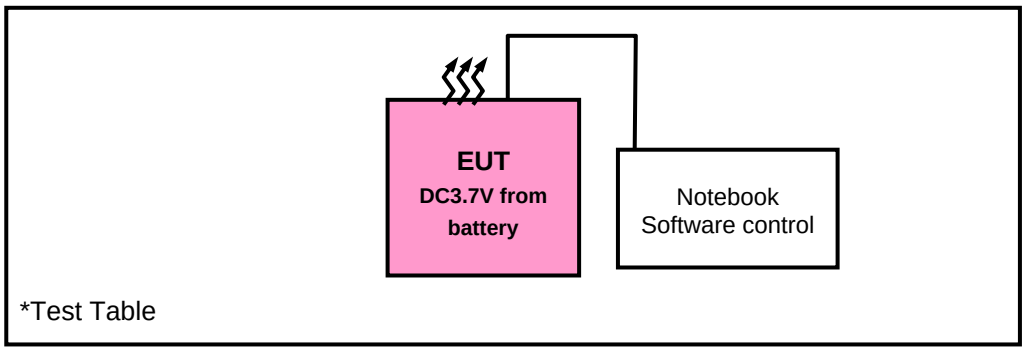
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	Notebook	HUAWEI	NbD-WFH9	EUEPM21725002655	N/A

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

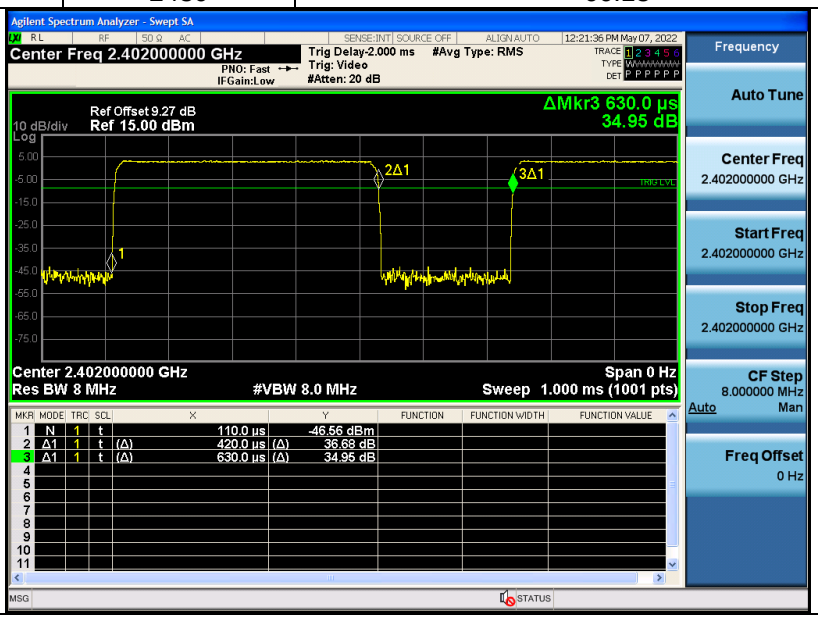
No.	Signal Cable Description of The Above Support Units
1.	USB serial cable Un-shielding 1.2m

2.5 Configuration of System under Test



2.6 Duty Cycle of Test Signal

Test Mode	Channel	Duty Cycle [%]
GFSK-1MHz	2402	66.67
	2440	66.67
	2480	66.13



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	56735	2023-04-15*
Preamplifier	EMCI	EMC001340	980201	2022-09-08
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.
3m Semi-anechoic Chamber	MAORUI	9m*6m*6m	NSEMC003	2023-04-15*
EMI Test Receiver	Rohde&Schwarz	ESR7	100962	2023-01-13
Broadband antenna	Schwarzbeck	VULB 9168	00937	2023-09-12*
Signal Amplifier	Com-power	PAM-103	18020051	2022-09-08
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 9120D	01959	2022-09-12*
Broadband Coaxial Preamplifier	Com-power	PAM-118A	1804003	2022-09-07
Spectrum	Keysight	N9020A	MY51240612	2022-09-08
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. <u>Peak emission levels are measured by setting the instrument as follow:</u>

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. <u>Average emission levels are measured by setting the instrument as follow:</u>

- **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:

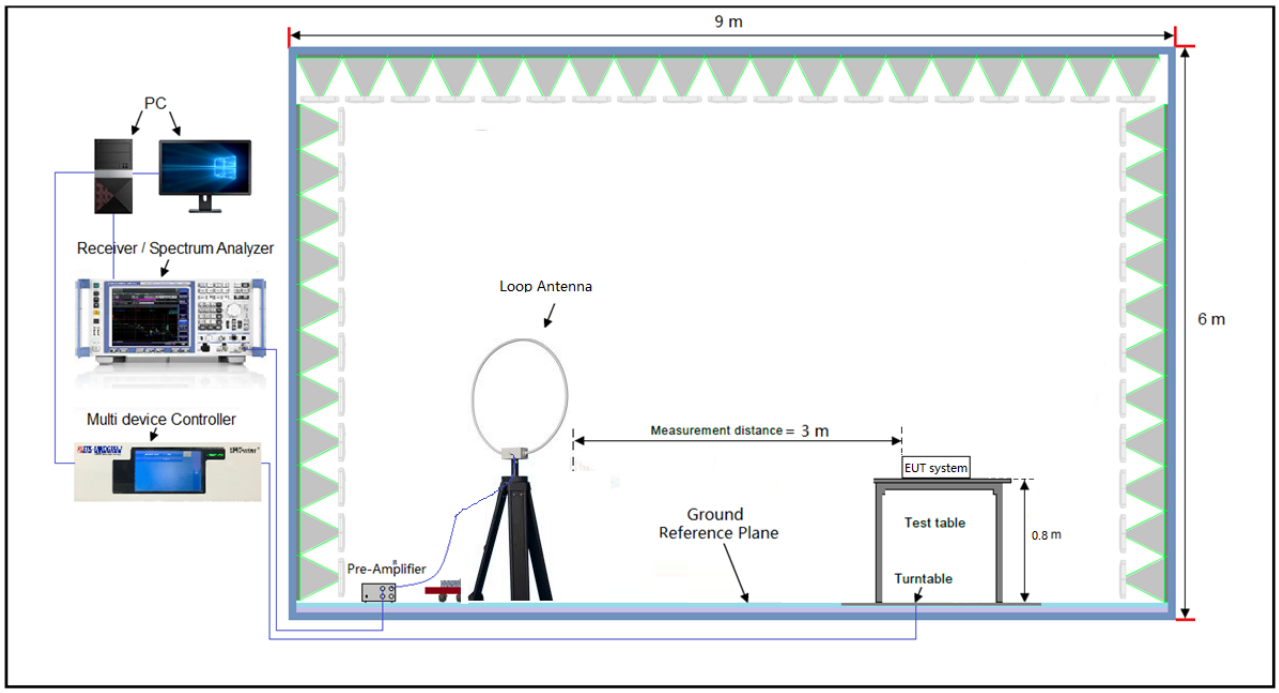
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz & 360kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth =3 MHz for Peak detection (PK) at frequency above 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

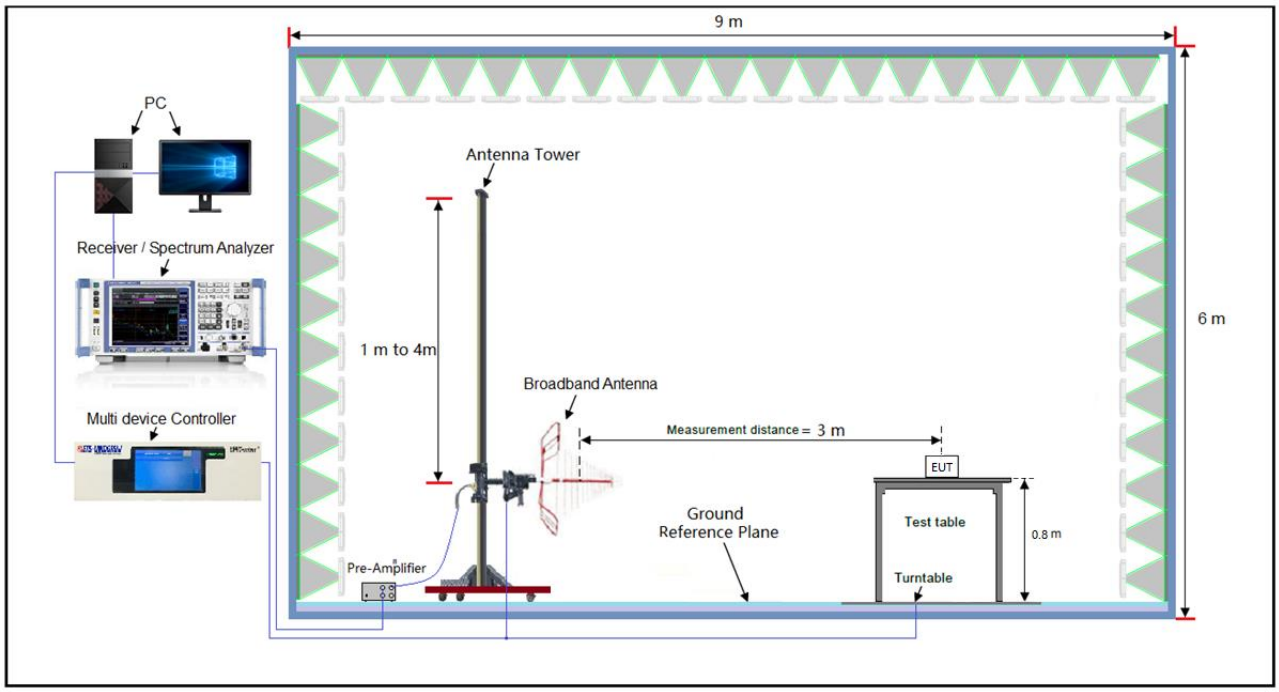
No deviation.

3.1.5 Test Setup

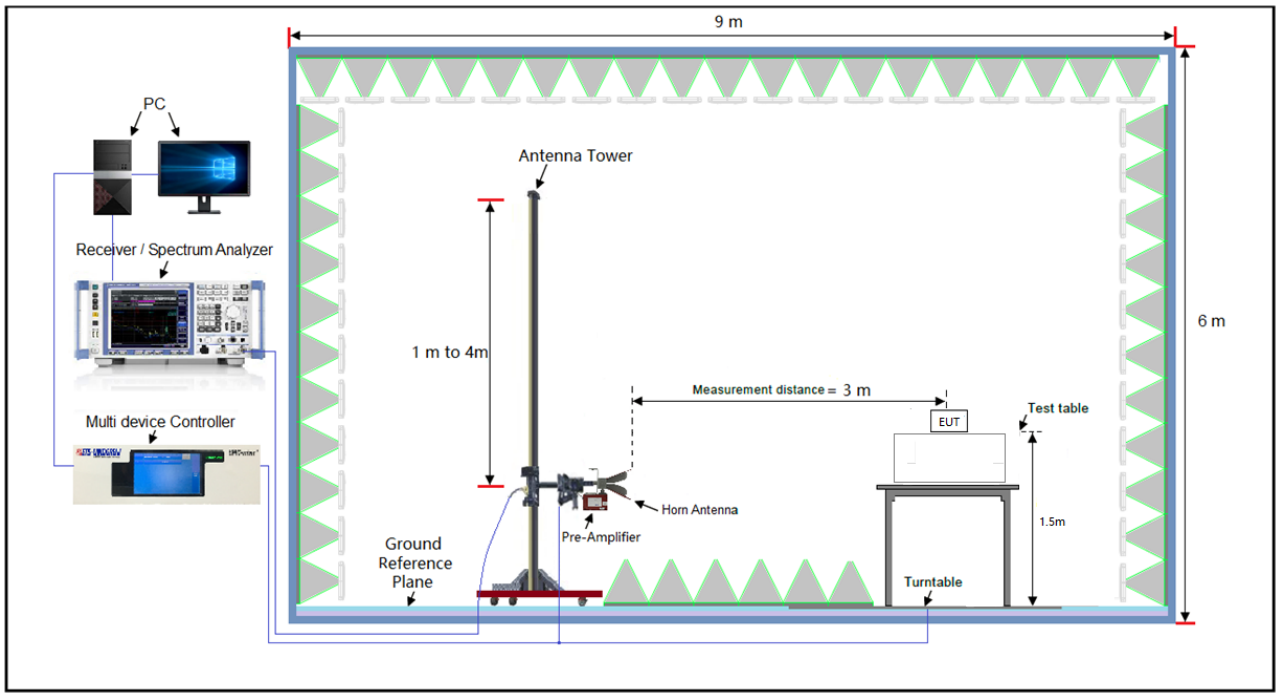
Radiated emission below 30MHz:



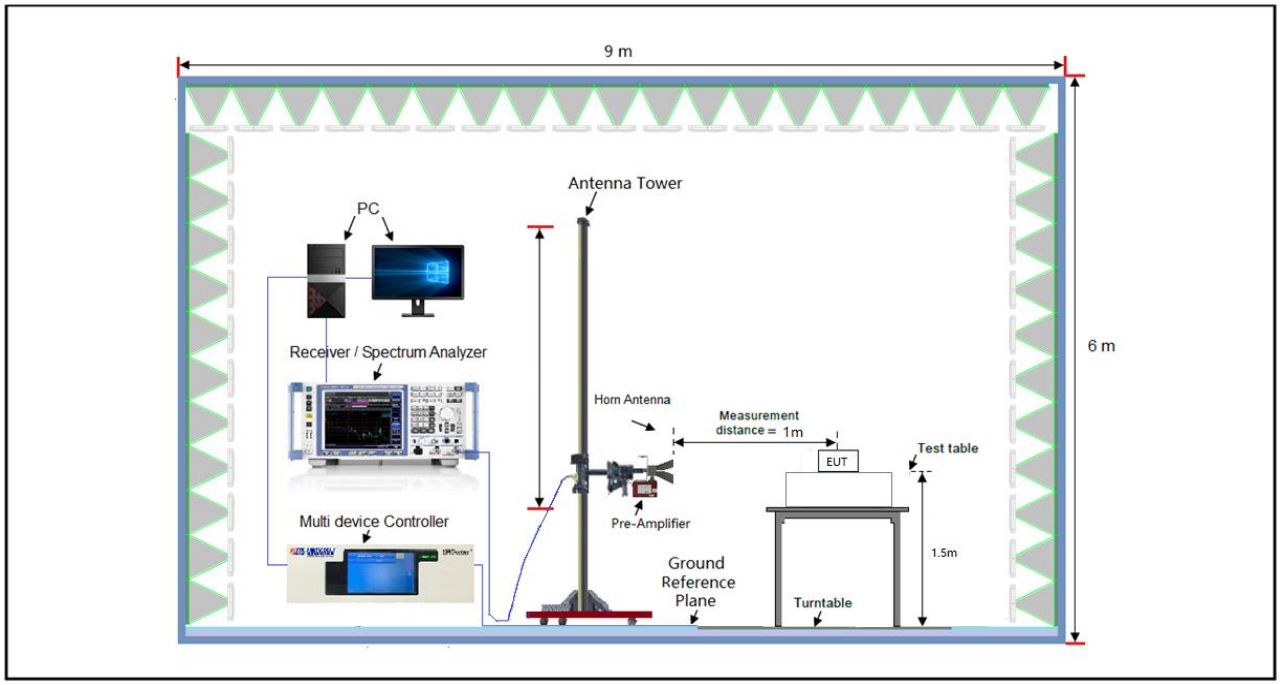
Frequency Range below 1GHz:



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

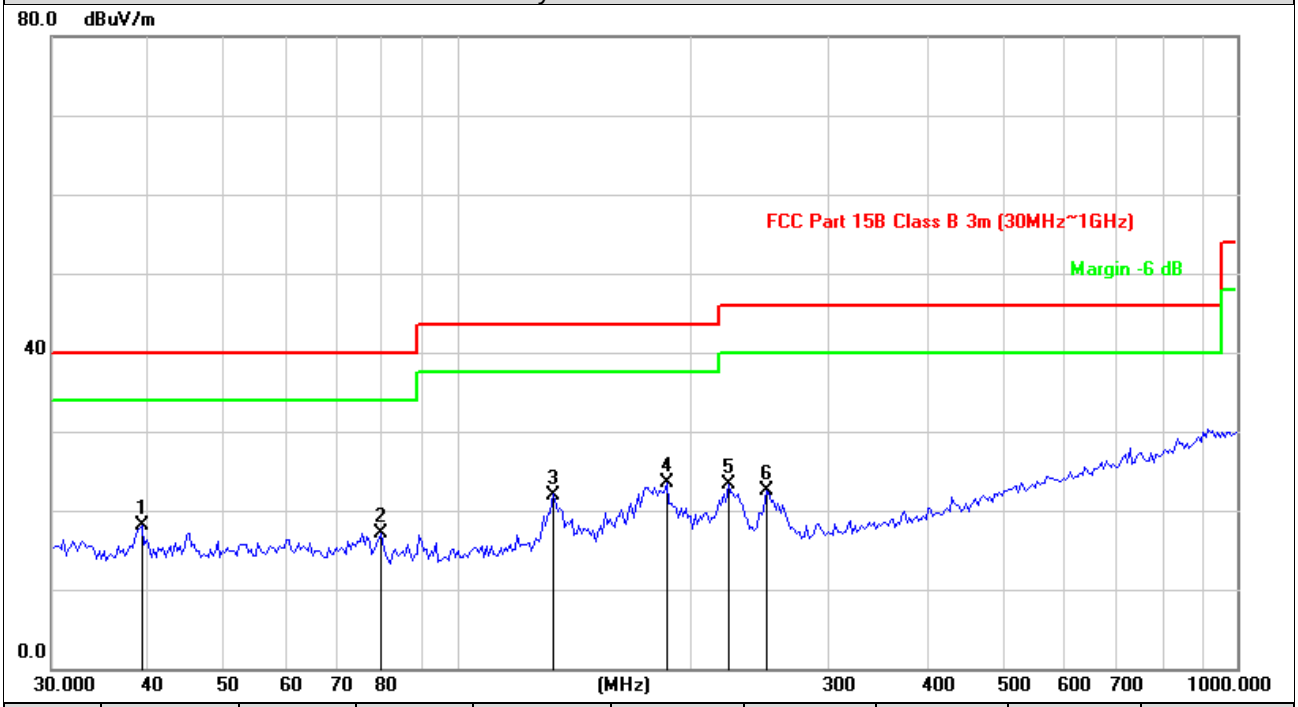
9kHz ~ 30MHz Data:

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

30MHz ~ 1GHz Worst-Case Data:

Test Channel	Channel 0	Frequency Range	30MHz ~ 1GHz
Detector Function	Peak (PK) Quasi-peak (QP)	Tested By	Jim Xu

Antennal Polarity &Test Distance: Horizontal at 3m



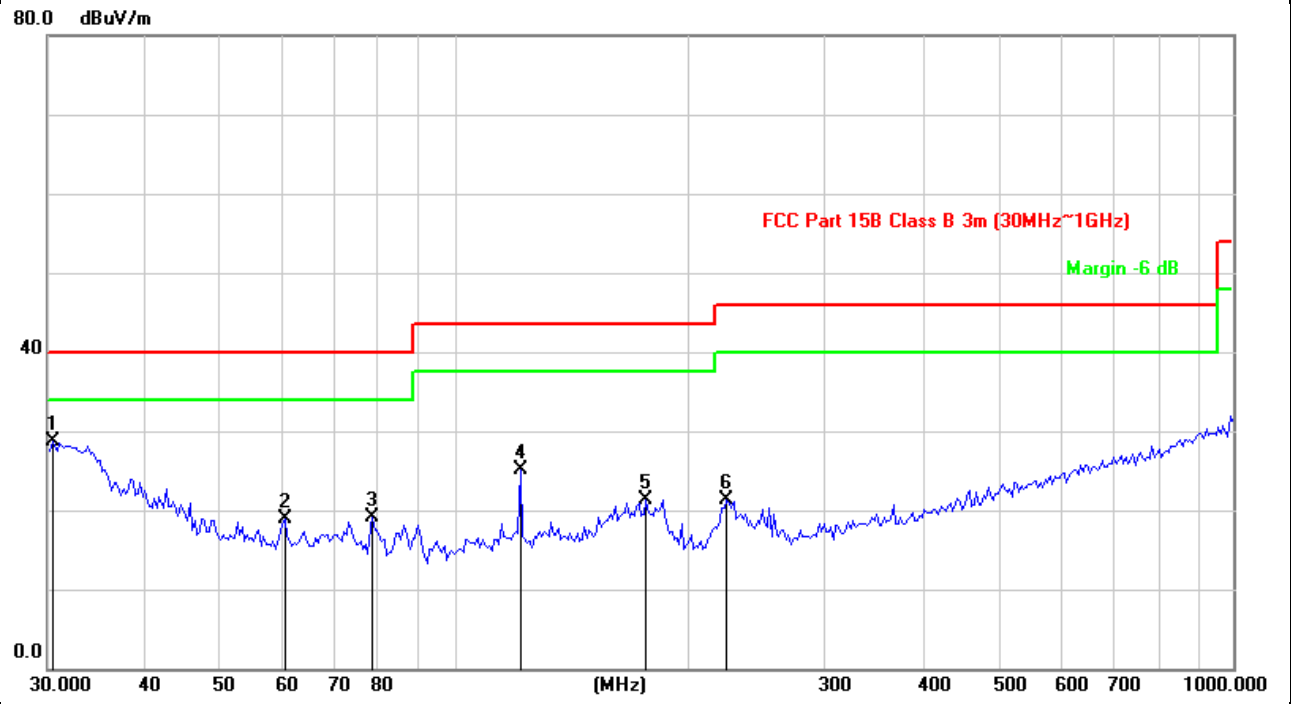
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1	39.1825	34.79	-16.73	18.06	40.00	-21.94	peak	200	125
2	79.6764	34.84	-17.65	17.19	40.00	-22.81	peak	200	178
3	132.1489	37.54	-15.54	22.00	43.50	-21.50	peak	300	264
4	185.1626	38.37	-14.88	23.49	43.50	-20.01	peak	200	217
5	222.2807	39.36	-16.08	23.28	46.00	-22.72	peak	200	318
6	248.7319	37.71	-15.28	22.43	46.00	-23.57	peak	200	95

Remarks:

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

Test Channel	Channel 0	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	30.4246	45.43	-16.80	28.63	40.00	-11.37	peak	100	174
2	60.5769	35.72	-16.87	18.85	40.00	-21.15	peak	100	144
3	78.5645	36.61	-17.58	19.03	40.00	-20.97	peak	200	122
4	121.4623	41.05	-16.02	25.03	43.50	-18.47	peak	200	264
5	176.2748	34.84	-13.51	21.33	43.50	-22.17	peak	100	294
6	223.8482	37.39	-16.03	21.36	46.00	-24.64	peak	200	315

Remarks:

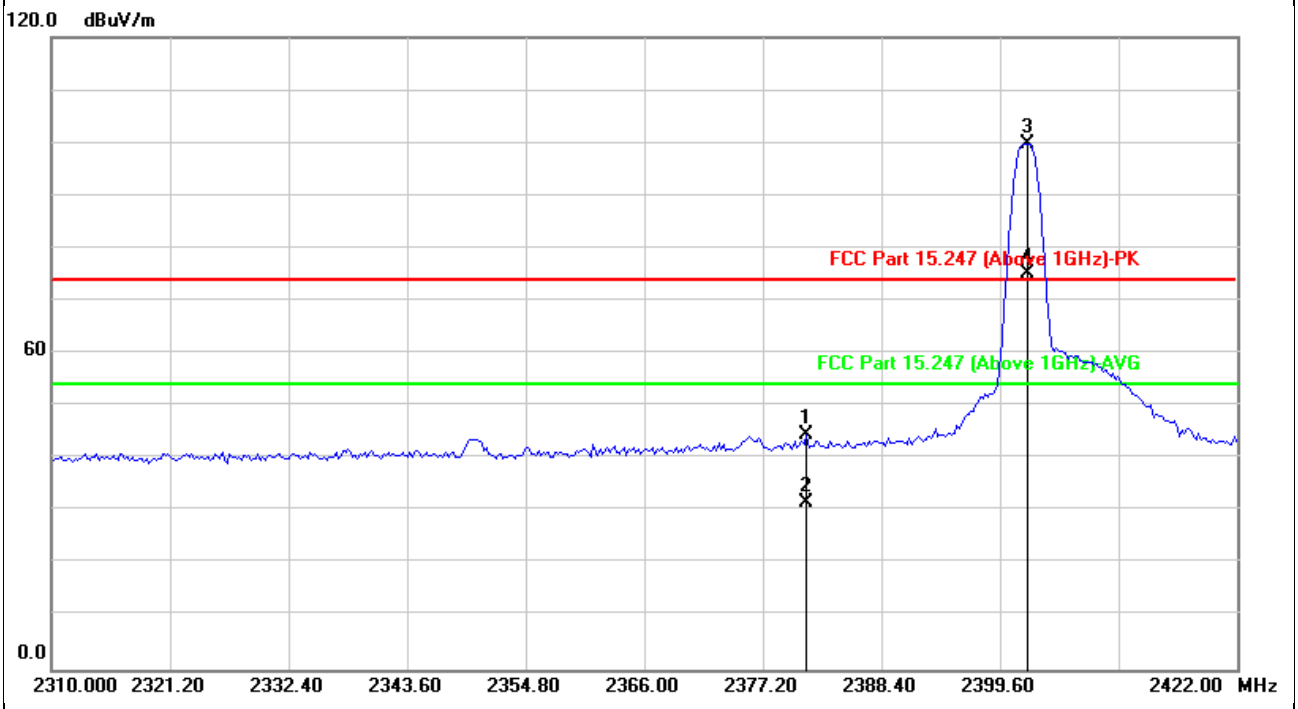
1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value

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



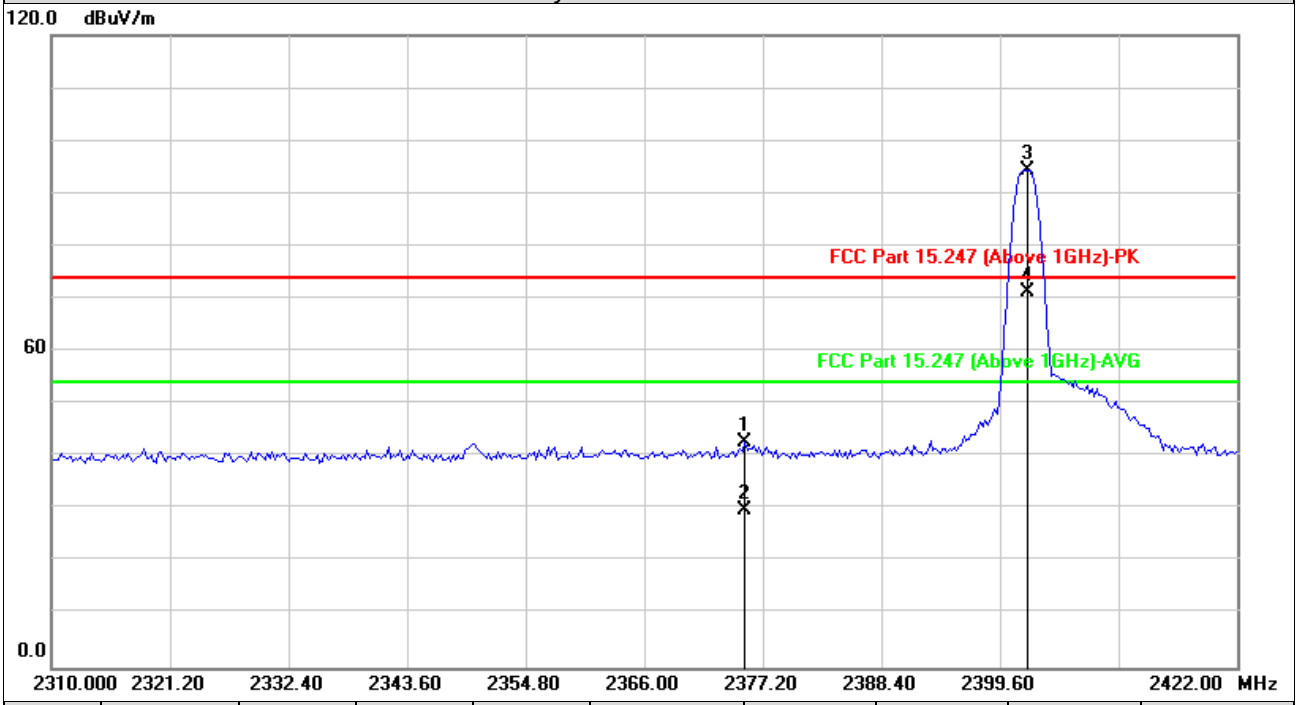
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1	2381.375	43.77	0.68	44.45	74.00	-29.55	peak	100	300
2	2381.375	30.93	0.68	31.61	54.00	-22.39	AVG	100	300
3 #	2402.249	99.14	0.70	99.84			peak	100	300
4 #	2402.249	74.43	0.70	75.13			AVG	100	300
5	4804.000	32.95	7.10	40.05	74.00	-33.95	peak	100	151
6	4804.000	22.17	7.10	29.27	54.00	-24.73	AVG	100	151
7	7206.000	33.55	12.08	45.63	74.00	-28.37	peak	100	184
8	7206.000	22.25	12.08	34.33	54.00	-19.67	AVG	100	184

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value
3. #2402MHz: Fundamental frequency.
4. The other spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

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	2375.539	41.95	0.67	42.62	74.00	-31.38	peak	100	169
2	2375.539	29.06	0.67	29.73	54.00	-24.27	AVG	100	169
3 #	2402.249	93.64	0.70	94.34			peak	100	169
4 #	2402.249	70.65	0.70	71.35			AVG	100	169
5	4804.000	33.83	7.10	40.93	74.00	-33.07	peak	100	215
6	4804.000	22.26	7.10	29.36	54.00	-24.64	AVG	100	215
7	7206.000	33.68	12.08	45.76	74.00	-28.24	peak	100	310
8	7206.000	22.17	12.08	34.25	54.00	-19.75	AVG	100	310

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value
3. #2402MHz: Fundamental frequency.
4. The other spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

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

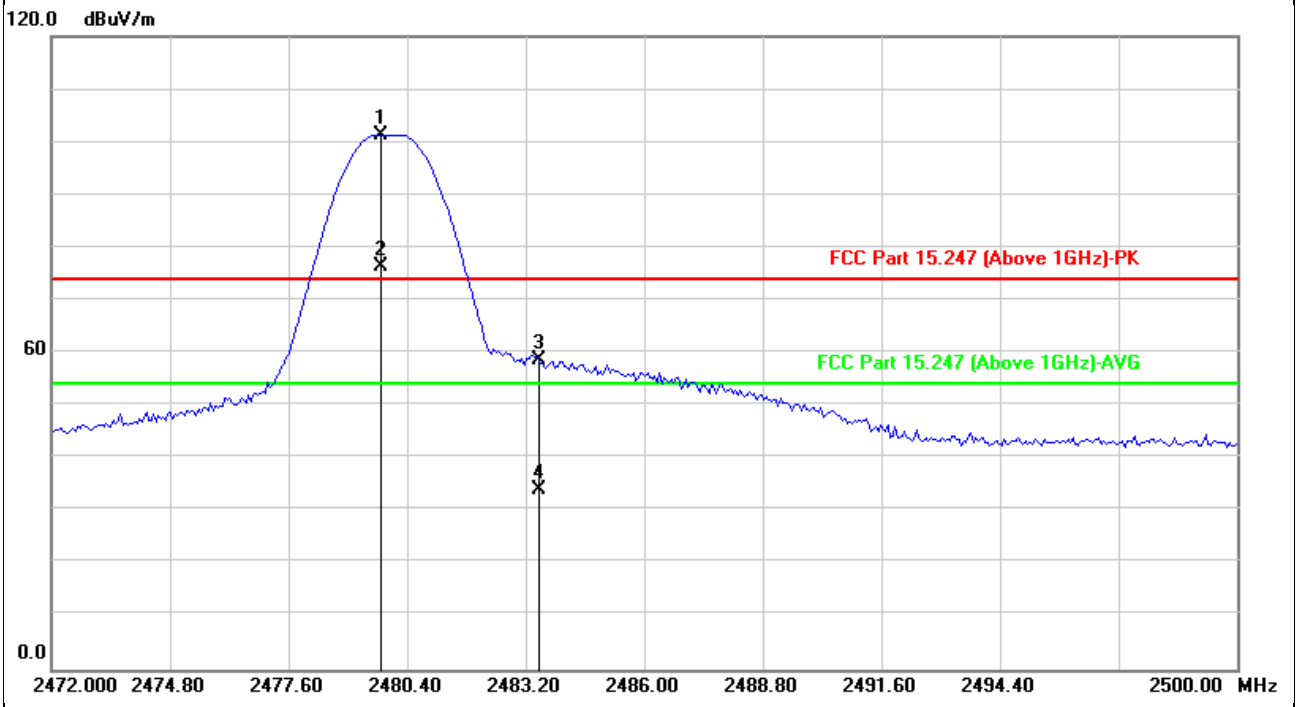
Antennal Polarity& Test Distance: Horizontal at 3m									
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1#	2440.000	105.88	0.76	106.64			peak	100	294
2#	2440.000	73.58	0.76	74.34			AVG	100	294
3	4880.000	44.65	7.33	51.98	74.00	-22.02	peak	100	84
4	4880.000	32.31	7.33	39.64	54.00	-14.36	AVG	100	84
5	7320.000	45.88	12.26	58.14	74.00	-15.86	peak	100	215
6	7320.000	33.55	12.26	45.81	54.00	-8.19	AVG	100	215
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	106.18	0.76	106.94			peak	100	144
2#	2440.000	74.93	0.76	75.69			AVG	100	144
3	4880.000	42.88	7.33	50.21	74.00	-23.79	peak	100	282
4	4880.000	30.92	7.33	38.25	54.00	-15.75	AVG	100	282
5	7320.000	44.76	12.26	57.02	74.00	-16.98	peak	100	125
6	7320.000	32.66	12.26	44.92	54.00	-9.08	AVG	100	125

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value
3. #2440MHz: Fundamental frequency.
4. The other spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

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



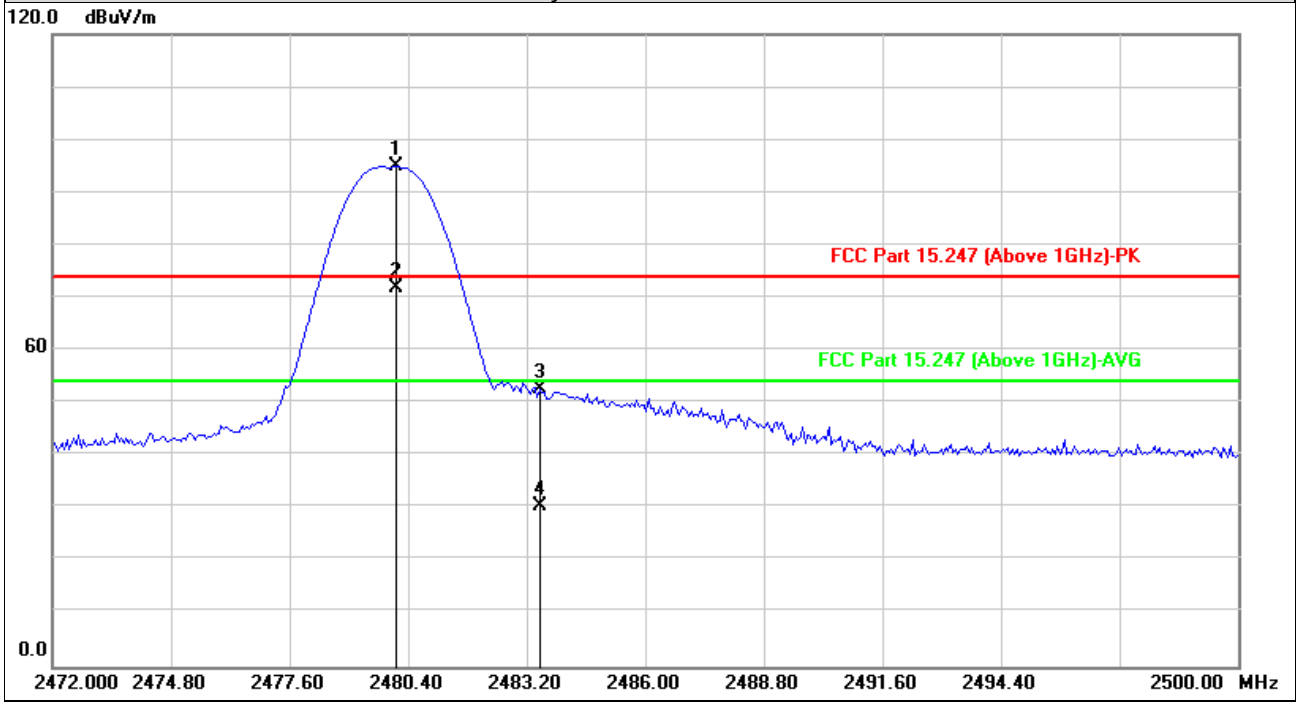
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1#	2479.800	100.53	0.84	101.37			peak	100	302
2#	2479.800	75.47	0.84	76.31			AVG	100	302
3	2483.500	57.69	0.84	58.53	74.00	-15.47	peak	100	302
4	2483.500	33.25	0.84	34.09	54.00	-19.91	AVG	100	302
5	4960.000	33.56	7.56	41.12	74.00	-32.88	peak	100	244
6	4960.000	21.33	7.56	28.89	54.00	-25.11	AVG	100	244
7	7440.000	32.69	12.43	45.12	74.00	-28.88	peak	100	162
8	7440.000	19.88	12.43	32.31	54.00	-21.69	AVG	100	162

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value
3. #2480MHz: Fundamental frequency.
4. The other spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

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#	2480.136	94.01	0.84	94.85			peak	100	231
2#	2480.136	71.11	0.84	71.95			AVG	100	231
3	2483.500	51.95	0.84	52.79	74.00	-21.21	peak	100	231
4	2483.500	29.70	0.84	30.54	54.00	-23.46	AVG	100	231
5	4960.000	33.40	7.56	40.96	74.00	-33.04	peak	100	74
6	4960.000	22.45	7.56	30.01	54.00	-23.99	AVG	100	74
7	7440.000	32.31	12.43	44.74	74.00	-29.26	peak	100	205
8	7440.000	21.89	12.43	34.32	54.00	-19.68	AVG	100	205

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value
3. #2480MHz: Fundamental frequency.
4. The other spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

3.2 Conducted Emission Measurement

3.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to0.50MHz.

3.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Due Date of Calibration
EMI Test Receiver Rohde&Schwarz	ESCI3	101418	2022/09/12
Artificial Mains Network Rohde&Schwarz	ENV216	3560.6550.15	2022/09/12
Test software FARAD	EZ_EMC V1.1.4.2	N/A	N/A

Note: 1. The calibration interval of the above test instruments is 12 months.
2. The test was performed in Shielded Room 1.

3.2.3 Test Procedures

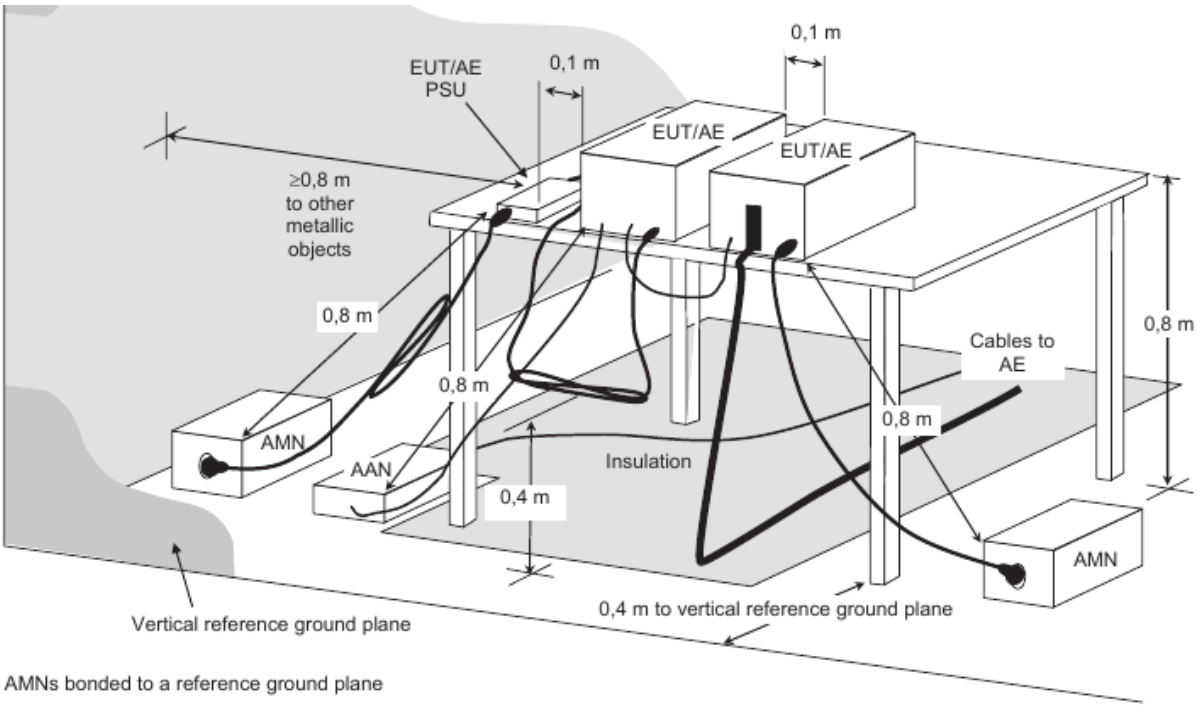
a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50uH of coupling impedance for the measuring instrument.
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit –20dB) was not recorded.

Note: All modes of operation were investigated and the worst-case emissions are reported.

3.2.4 Deviation from Test Standard

No deviation.

3.2.5 Test setup



AMNs bonded to a reference ground plane

3.2.6 EUT Operating Conditions

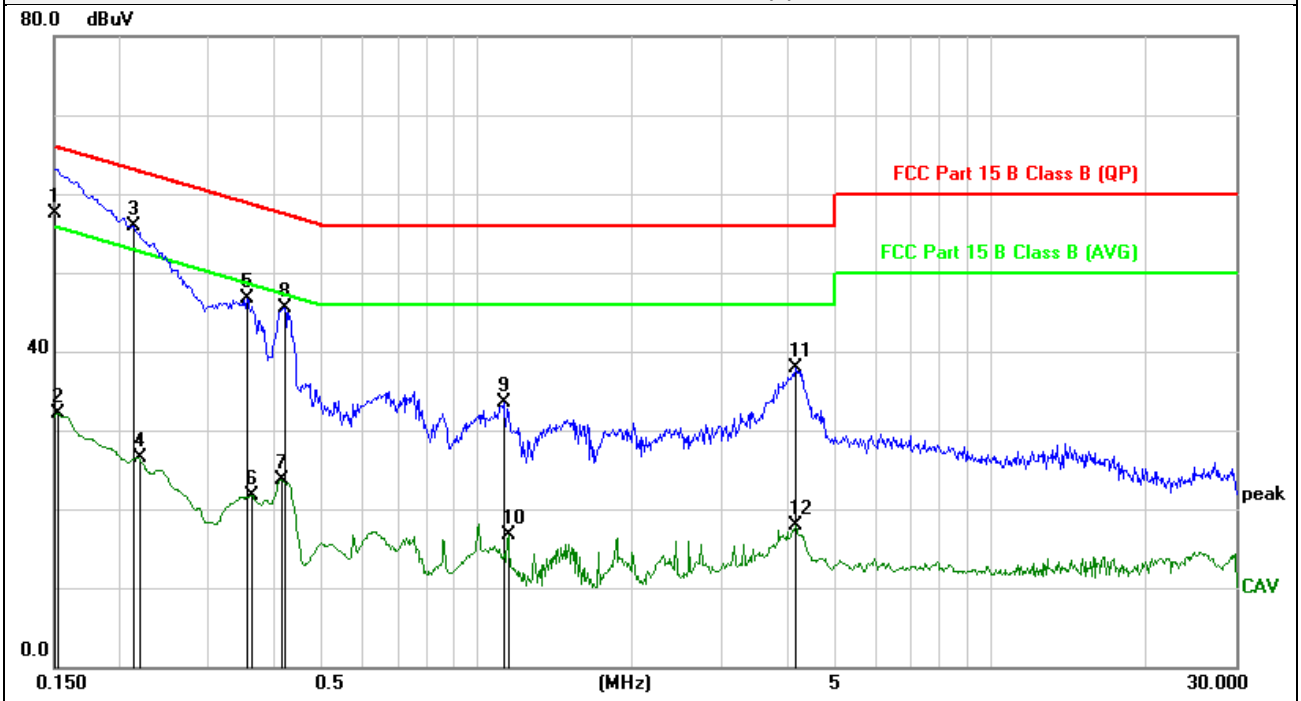
a. Placed the EUT on the testing table.

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

3.2.7 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

Phase of Power: Line (L)



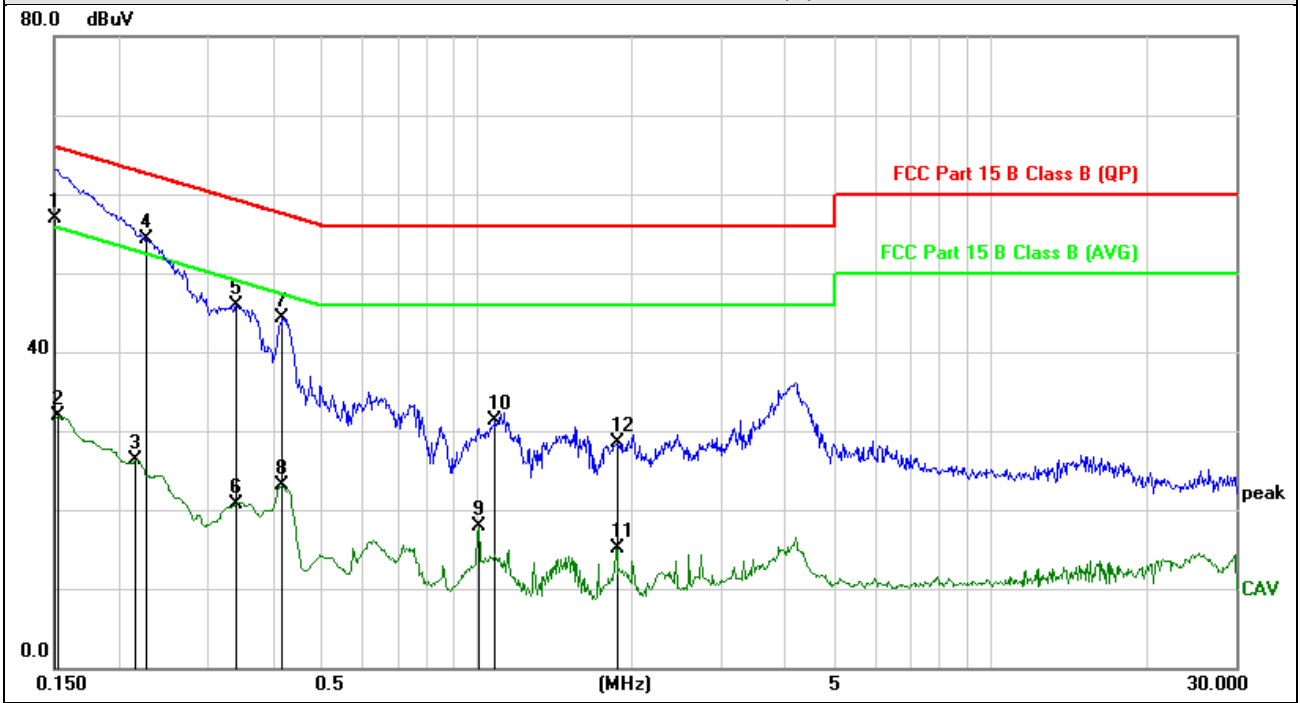
No.	Frequency	Reading	Correcttion Factor	Emission Level	Limit	Margin	Remark
	(MHz)	(dBuV)	dB	(dBuV)	(dBuV)	(dB)	Detector
1	0.1500	47.41	10.19	57.60	66.00	-8.40	QP
2	0.1522	22.02	10.18	32.20	65.88	-33.68	AVG
3	0.2130	45.69	10.15	55.84	63.09	-7.25	peak
4	0.2175	16.37	10.15	26.52	62.91	-36.39	AVG
5	0.3570	36.51	10.15	46.66	58.80	-12.14	peak
6	0.3636	11.61	10.15	21.76	58.65	-36.89	AVG
7	0.4155	13.67	10.11	23.78	57.54	-33.76	AVG
8	0.4222	35.40	10.11	45.51	57.40	-11.89	peak
9	1.1286	23.49	10.04	33.53	56.00	-22.47	peak
10	1.1490	6.73	10.05	16.78	56.00	-39.22	AVG
11	4.1640	27.73	10.10	37.83	56.00	-18.17	peak
12	4.1640	7.80	10.10	17.90	56.00	-38.10	AVG

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

Phase of Power: Neutral (N)



No.	Frequency	Reading	Correct Factor	Emission Level	Limit	Margin	Remark
	(MHz)	(dBuV)	dB	(dBuV)	(dBuV)	(dB)	Detector
1	0.1500	46.70	10.19	56.89	66.00	-9.11	QP
2	0.1522	21.79	10.18	31.97	55.88	-23.91	AVG
3	0.2153	16.14	10.15	26.29	53.00	-26.71	AVG
4	0.2265	44.21	10.15	54.36	62.58	-8.22	peak
5	0.3390	35.75	10.14	45.89	59.23	-13.34	peak
6	0.3390	10.58	10.14	20.72	49.23	-28.51	AVG
7	0.4177	34.31	10.09	44.40	57.49	-13.09	peak
8	0.4177	12.98	10.09	23.07	47.49	-24.42	AVG
9	1.0050	7.80	10.05	17.85	46.00	-28.15	AVG
10	1.0837	21.18	10.05	31.23	56.00	-24.77	peak
11	1.8668	4.99	10.09	15.08	46.00	-30.92	AVG
12	1.8690	18.49	10.09	28.58	56.00	-27.42	peak

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

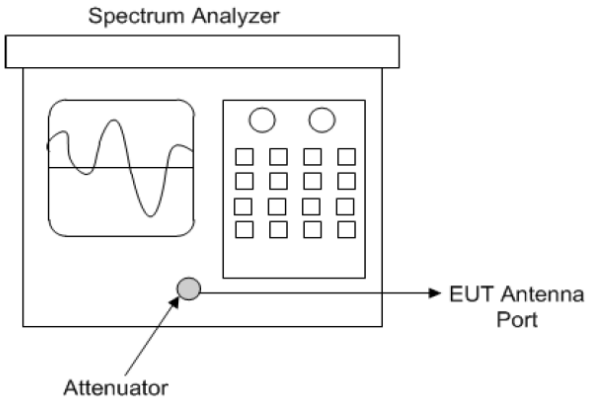
3.3 6dB Bandwidth Measurement

3.3.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5MHz.

3.3.2 Test Setup

Subclause 11.8 of ANSI C63.10 is applicable.



3.3.3 Test Instruments

Refer to section 5 to get information of above instrument.

3.3.4 Test Procedure

Option 1:

a. Set resolution bandwidth (RBW) = 100kHz
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

3.3.5 Deviation from Test Standard

No deviation.

3.3.6 EUT Operating Conditions

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

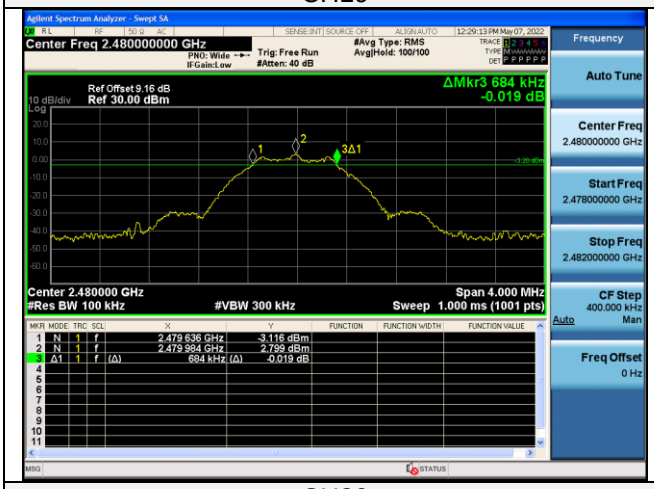
3.3.7 Test Result

BLE-1Mbps			
Operation Channel	Frequency	Occupied Bandwidth (MHz)	
		Result	Limit
0	2402MHz	0.684	>0.5
19	2440MHz	0.680	>0.5
39	2480MHz	0.684	>0.5

BLE 1Mbps

CH0

CH19



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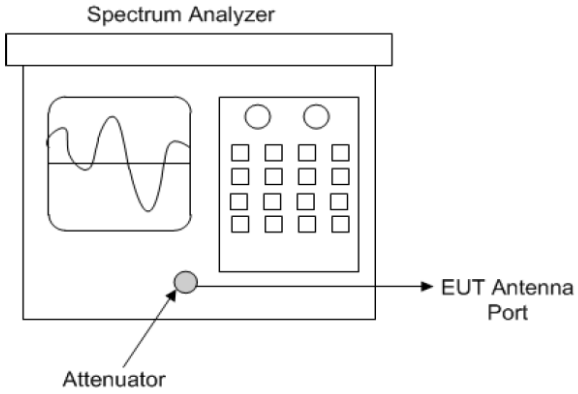
3.4 Occupied Bandwidth Measurement

3.4.1 Test Setup



3.4.2 Test Instruments

Refer to section 5 to get information of above instrument.

3.4.3 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.

3.4.4 Deviation from Test Standard

No deviation.

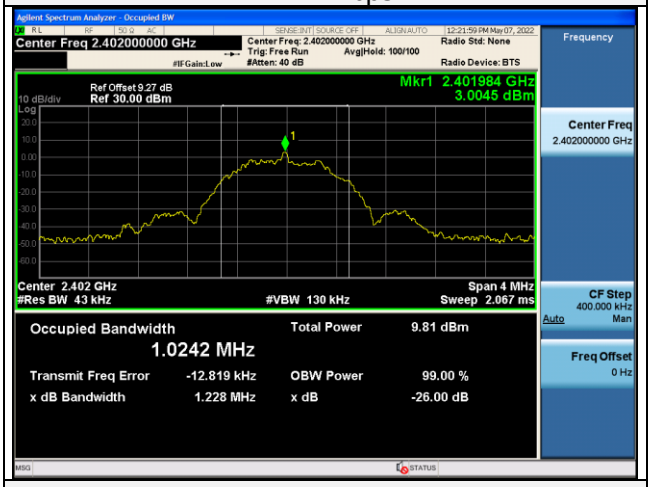
3.4.5 EUT Operating Conditions

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

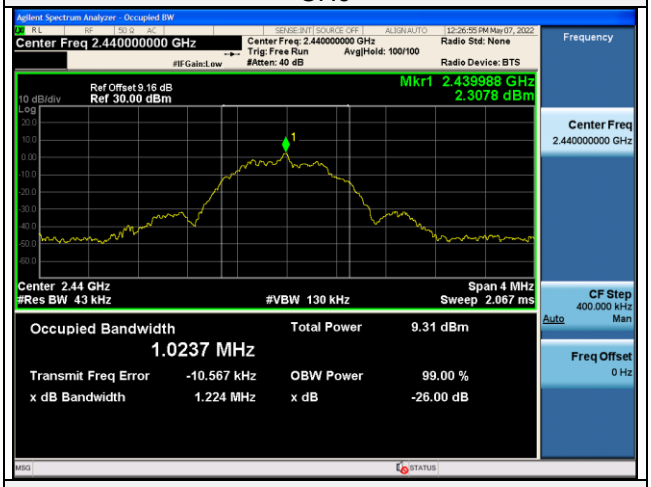
3.4.6 Test Results

BLE-1Mbps			
Operation Channel	Frequency	Occupied Bandwidth (MHz)	
		Result	Limit
0	2402MHz	1.0242	2400~2483.5
19	2440MHz	1.0237	2400~2483.5
39	2480MHz	1.0213	2400~2483.6

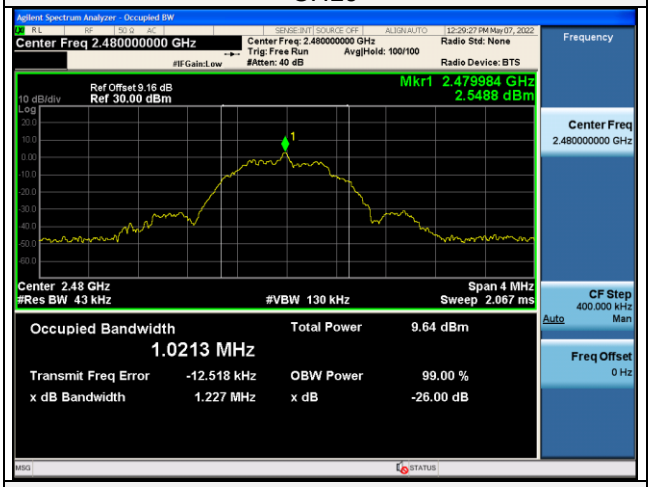
BLE 1Mbps



CH0



CH19



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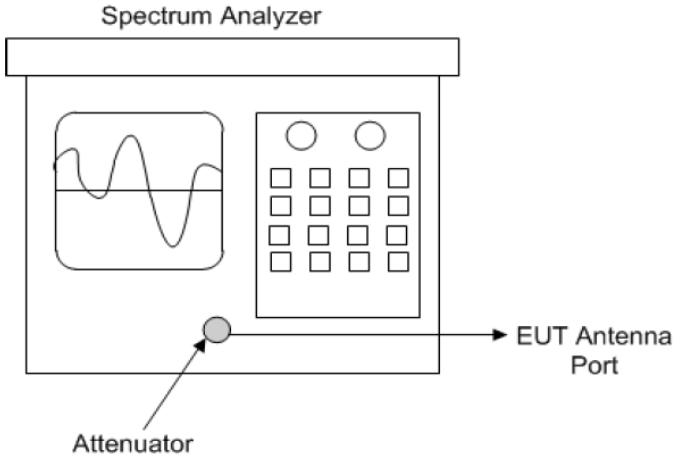
3.5 Conducted Output Power Measurement

3.5.1 Limits of Conducted Output Power Measurement

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

3.5.2 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

3.5.3 Test Instruments

Refer to section 5 to get information of above instrument.

3.5.4 Test Procedures

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

☒ Maximum peak conducted output power

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:

a) Set the RBW > DTS bandwidth.

b) Set VBW> [3 x RBW]

c) Set span > [3 x RBW]

d) Sweep time = auto couple.

e) Detector = peak

f) Trace mode = max hold.

g) Allow trace to fully stabilize.

h) Use peak marker function to determine the peak amplitude level.

☒ Maximum conducted (average) output power

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.

3.5.5 Deviation from Test Standard

No deviation.

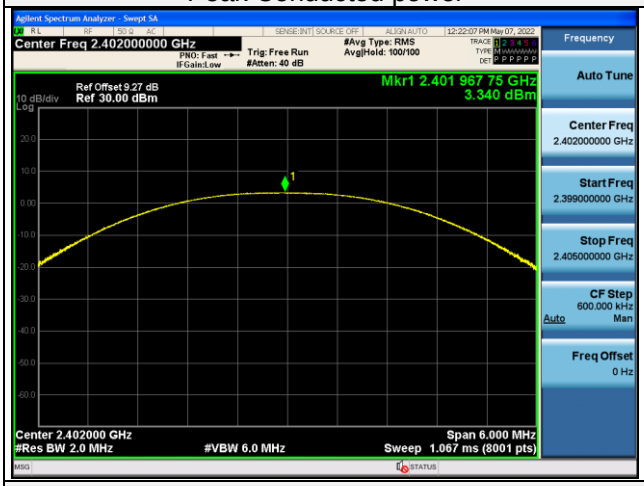
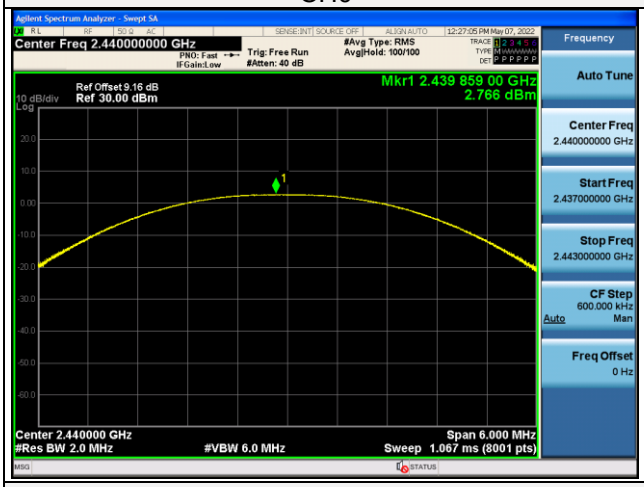
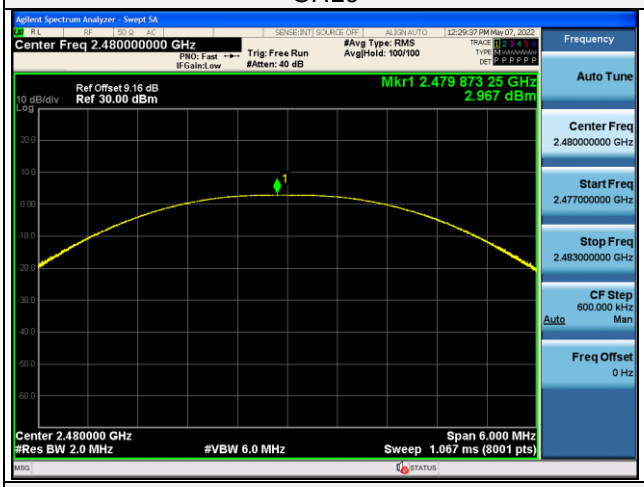
3.5.6 EUT Operating Conditions

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

3.5.7 Test Results

BLE-1Mbps						
Peak Power						
Channel	Freq.	RF Output Power		Limit (mW)		Verdict
No.	(MHz)	(dBm)	(mW)	Rss-247	FCC	
0	2402	3.340	2.158	<125	<1000	Pass
19	2440	2.766	1.891	<125	<1000	Pass
39	2480	2.967	1.980	<125	<1000	Pass

BLE-1Mbps						
Average Power						
Channel	Freq.	RF Output Power		Limit (mW)		Verdict
No.	(MHz)	(dBm)	(mW)	Rss-247	FCC	
0	2402	-7.772	0.167	<125	<1000	Pass
19	2440	-8.464	0.142	<125	<1000	Pass
39	2480	-8.299	0.148	<125	<1000	Pass

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

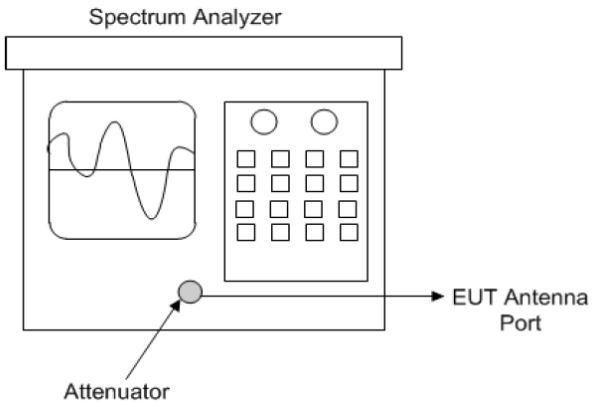
3.6 Power Spectral Density Measurement

3.6.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm/3kHz.

3.6.2 Test Setup

- DTS maximum power spectral density level in the fundamental emission Subclause 11.10 of ANSI C63.10 is applicable



3.6.3 Test Instruments

Refer to section 5 to get information of above instrument.

3.6.4 Test Procedure

☒ Maximum peak Power Spectral Density

The following procedure shall be used if maximum peak conducted output power was used to determine compliance:

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to 3 kHz < RBW < 100 kHz.
d) Set the VBW > [3 x RBW].
e) Detector = peak.
f) Sweep time = auto couple
g) Trace mode = max hold
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW
j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

☒ Maximum Average Power Spectral Density

The maximum conducted (average) output power was used to determine compliance

Method AVGPSD-3:

Method AVGPSD-3 uses mms detection across ON and OFE times of the EUT with max hold. The following procedure is applicable when the EUT cannot be configured to transmit continuously (i.e. D<98%), when sweep triggering/signal gating cannot be used to measure only when the EUT is transmitting at its maximum power control level. and when the transmission duty cycle is not constant (i.e., duty cycle variations exceed ±2%),

SA Setting:

a. Set the instrument span to a minimum of 1.5 times the OBW.
b. Set sweep trigger to "free run."
c. Set the RBW = 3 kHz, VBW =10 kHz,
d. Detector = RMS (power averaging).
e. Sweep time = Auto couple,
f. Allow max hold to run for at least 60 s or longer as needed to allow the trace to stabilize.
g. Use the peak marker function to determine the maximum PSD level

- If the measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced).

3.6.5 Deviation from Test Standard

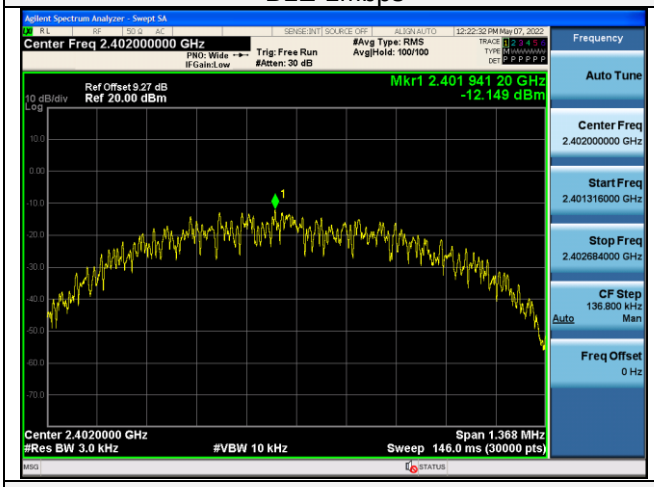
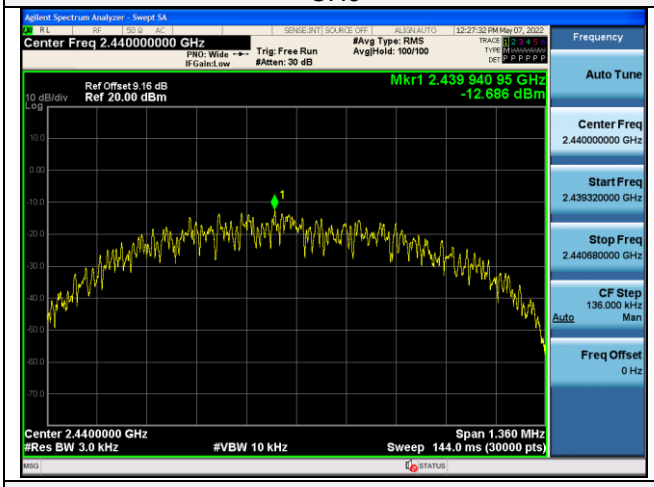
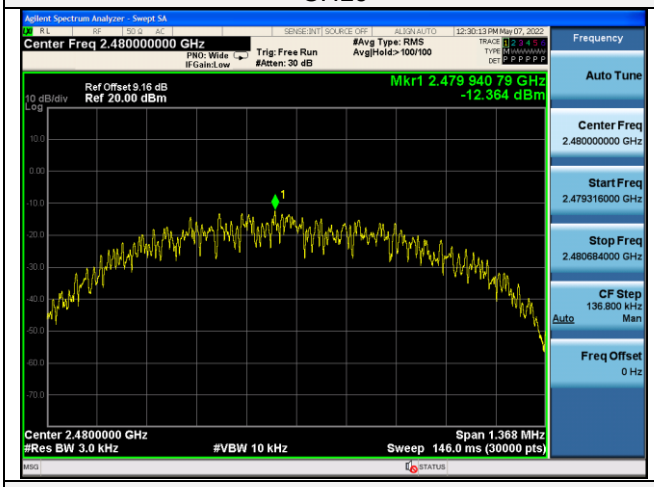
No deviation.

3.6.6 EUT Operating Condition

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

3.6.7 Test Results

BLE-1Mbps	Power Density		
Test Channel	Channel Frequency	Test Result (dBm/3kHz)	Limit (dBm/3kHz)
0	2402MHz	-12.149	<8
19	2440MHz	-12.686	<8
39	2480MHz	-12.364	<8

BLE-1Mbps

CH0

CH19

CH39

3.7 Conducted Out of Band Emission Measurement

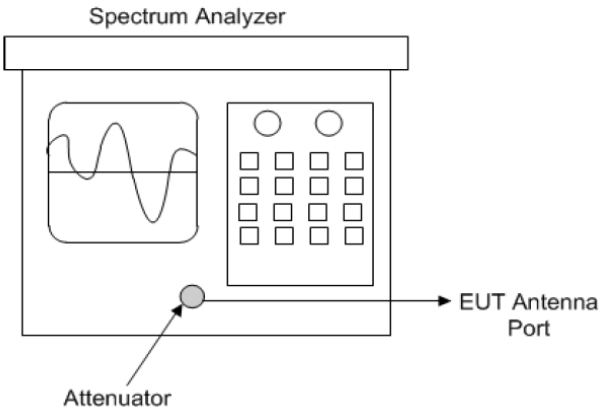
3.7.1 Limits of Conducted Out of Band Emission Measurement

a. **If the maximum peak conducted output power procedure was used to determine compliance as described in 11.9.1**, then the peak output power 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 (i.e., 20 dBc).

b. **If maximum conducted (average) output power was used to determine compliance as described in 11.9.2**. then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc).

3.7.2 Test Setup

- 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



Spectrum analyzer test configuration

3.7.3 Test Instruments

Refer to section 5 to get information of above instrument.

3.7.4 Test Procedure

a. Establish a reference level by using the following procedure:

1) Set instrument center frequency to DTS channel center frequency.
2) Set the span to 21.5 times the DTS bandwidth)
3) Set the RBW= 100 kHz)
4) Set the VBW ≥3 x RBW
5) Detector = peak
6) Sweep time = auto coupling
7) Trace mode =max hold
8) Allow trace to fully stabilize
9) Use the peak marker function to determine the maximum PSD level.

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

b. Establish an emission level by using the following procedure:

1) Set the center frequency and span to encompass frequency range to be measured.
2) Set the RBW = 100 kHz
3) Set the VBW ≥ 300 kHz.
4) Detector = peak.
5) Sweep time = auto couple.
6) Trace mode = max hold.
7) Allow trace to fully stabilize.
8) Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

3.7.5 Deviation from Test Standard

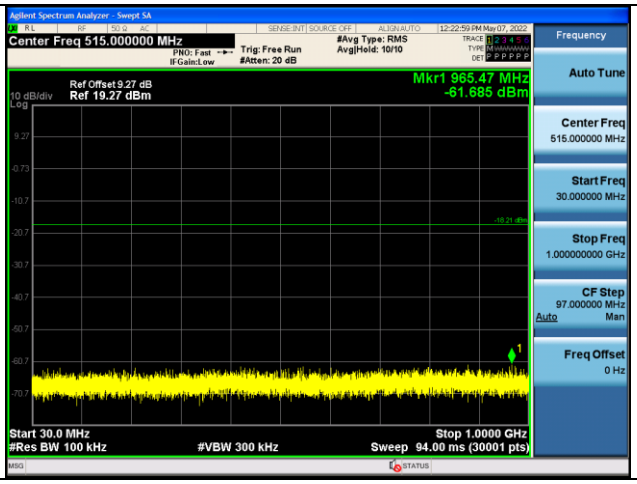
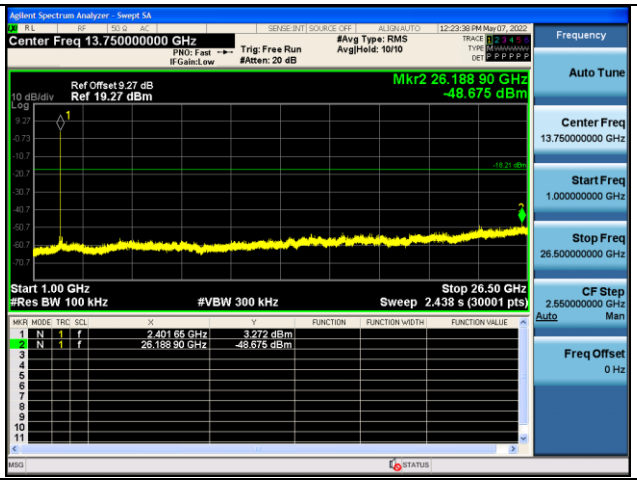
No deviation.

3.7.6 EUT Operating Condition

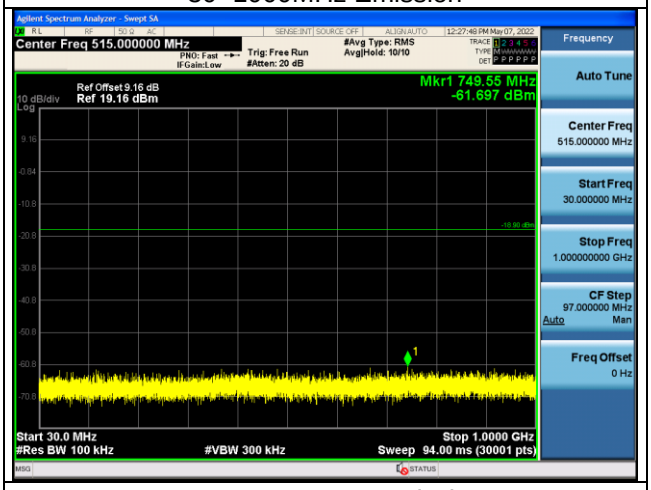
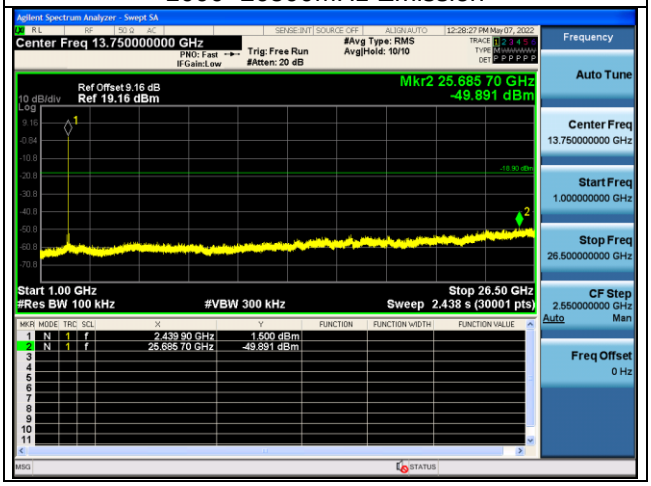
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

3.7.7 Test results

BLE 1Mbps
Low Channel
Reference Level

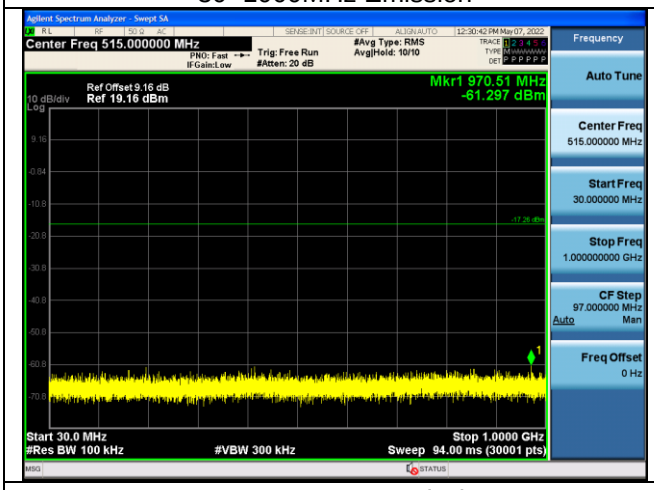
30~1000MHz Emission

1000~26500MHz Emission


BLE 1Mbps
Middle Channel
Reference Level

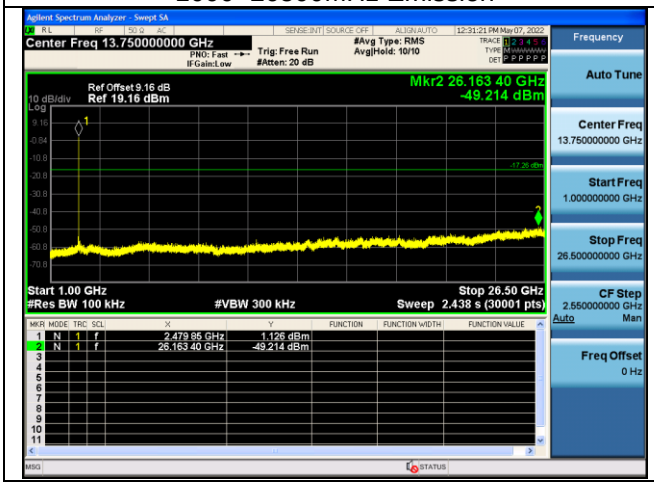
30~1000MHz Emission

1000~26500MHz Emission


BLE 1Mbps
High Channel
Reference Level

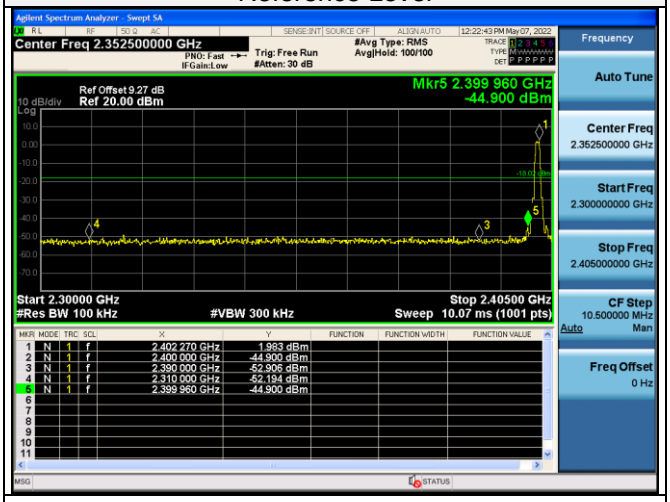
30~1000MHz Emission



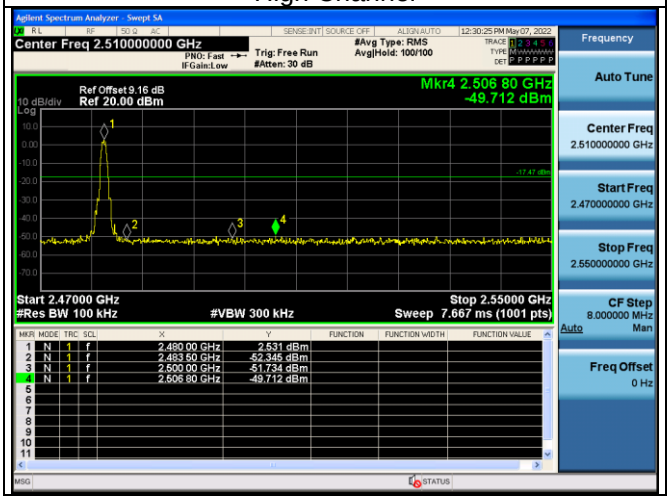
1000~26500MHz Emission



Band edge measurements
BLE 1Mbps
Lowest Channel
Reference Level



High Channel



4. Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

5. Test Instruments

Description & Manufacturer	Model No.	Serial No.	Due Date of Calibration
Spectrum Keysight	N9020A	MY51240612	2022/09/12
Spectrum Analyzer Rohde&Schwarz	FSV-40N	101783	2022/09/12
Power Meter 10Hz~18GHz Tonscend	JS0806-2	188060126	2022/09/12
Signal generator Keysight	E4421B	GB40051020	2022/09/12
Signal generator Keysight	N5182A	MY47420944	2022/09/12
Test Software Tonscend	JS0806-2	NA	NA
Hygrothermograph Yuhuaze	HTC-1	NA	2022/09/12

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA.
2. The test was performed in Chamber 1.

Appendix – Information on The Testing Laboratories

We, Hwa-Hsing (Dongguan) Co., Ltd., A global provider of TESTING and CERTIFICATION services for consumer products, electronic products and wireless information technology products. Adhering to the core values “HONEST and TRUSTWORTHY, OBJECTIVE and IMPARTIALITY, RIGOROUS and AFFICIENT”, commitment to provide professional, perfect and efficient comprehensive ONE-STOP solution of TESTING and CERTIFICATION services for Manufacturers, Buyers, Traders, Brands, Retailers. Assist client to better manage risk, protect their brands, reduce costs and cut time to over 150 markets in global. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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