

FCC Part 15, Subpart C Test Report

FCC ID: 2AGA7MH40W2

Applicant: New Audio LLC

Address: 132 W. 31st 7th Floor New York, 10001 United States

Manufacturer: New Audio LLC

Address: 132 W. 31st 7th Floor New York, 10001 United States

Product: Wireless headphone

Brand: MASTER & DYNAMIC

Test Model(s): MH40-W2

Series Model(s): N/A

Test Date: Aug. 23 2022~ Oct. 19, 2022

Issued Date: Oct. 19, 2022

Issued By: Hwa-Hsing (Dongguan) Testing Co., Ltd.

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Test Firm Registration No.: 915896

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.

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Table of Contents

Release Control Record	4
1. Summary of Test Results	5
1.1 Measurement Uncertainty	5
1.2 Modification Record	5
2. General Information	6
2.1 General Description of EUT	6
2.2 Description of Test Channels	7
2.3 Test Mode Applicability and Tested Channel Detail	7
2.4 Description of Support Units	9
2.5 Configuration of System under Test	9
2.6 Duty Cycle of Test Signal	9
3. Test Types and Results	10
3.1 Radiated Emission and Band-edge Measurement	10
3.1.1 Limits of radiated emission and band-edge measurement	10
3.1.2 Test Instruments	11
3.1.3 Test Procedures	12
3.1.4 Deviation from Test Standard	13
3.1.5 Test Setup	14
3.1.6 EUT Operating Conditions	15
3.1.7 Test Results	16
3.2 Conducted Emission Measurement	28
3.2.1 Limits of Conducted Emission Measurement	28
3.2.2 Test Instruments	28
3.2.3 Test Procedures	28
3.2.4 Deviation from Test Standard	28
3.2.5 Test setup	29
3.2.6 EUT Operating Conditions	29
3.2.7 Test Results	30
3.3 6dB Bandwidth Measurement	32
3.3.1 Limits of 6dB Bandwidth Measurement	32
3.3.2 Test Setup	32
3.3.3 Test Instruments	32
3.3.4 Test Procedure	33
3.3.5 Deviation from Test Standard	33
3.3.6 EUT Operating Conditions	33
3.3.7 Test Result	33
3.4 Occupied Bandwidth Measurement	35
3.4.1 Test Setup	35
3.4.2 Test Instruments	35
3.4.3 Test Procedure	35
3.4.4 Deviation from Test Standard	35
3.4.5 EUT Operating Conditions	35
3.4.6 Test Results	35
3.5 Conducted Output Power Measurement	37
3.5.1 Limits of Conducted Output Power Measurement	37
3.5.2 Test Setup	37
3.5.3 Test Instruments	37
3.5.4 Test Procedures	37
3.5.5 Deviation from Test Standard	38
3.5.6 EUT Operating Conditions	38
3.5.7 Test Results	39
3.6 Power Spectral Density Measurement	42



3.6.1	Limits of Power Spectral Density Measurement.....	42
3.6.2	Test Setup	42
3.6.3	Test Instruments	42
3.6.4	Test Procedure	43
3.6.5	Deviation from Test Standard	43
3.6.6	EUT Operating Condition	43
3.6.7	Test Results	44
3.7	Conducted Out of Band Emission Measurement	46
3.7.1	Limits of Conducted Out of Band Emission Measurement.....	46
3.7.2	Test Setup	46
3.7.3	Test Instruments	46
3.7.4	Test Procedure	47
3.7.5	Deviation from Test Standard	47
3.7.6	EUT Operating Condition	47
3.7.7	Test results	48
4.	Pictures of Test Arrangements	52
5.	Test Instruments.....	53
	Appendix – Information on The Testing Laboratories	54



HWA-HSING

Test Report No.: 220823EL10-RF-US-02

Release Control Record

Issue No.	Description	Date Issued
220823EL10-RF-US-02	Original Release	Oct. 19, 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	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	Expanded 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	Wireless headphone
Test Model(s)	MH40-W2
Sample No.	HS220824-03-08/05
Series Model(s)	N/A
Status of EUT	Engineering Prototype
Power Supply Rating	DC3.7V from battery
Modulation Type	GFSK for DTS
Transfer Rate	1Mbps, 2Mbps
Operating Frequency	2402 ~ 2480MHz
Number of Channel	40
Maximum Output Power	4.972dBm
Antenna Type	FPC Antenna
Antenna Gain	-0.68dBi
Antenna Connector	I-PEX
Accessory Device	3.5mm audio adapter; Type-C-USB-A adapter
Data Cable Supplied	Type-C Line: Unshielded, Detachable 1.0m; Aux In Line: Unshielded, Detachable 1.0m;

Note:

1. Please refer to the EUT photo document (Reference No.: 220823EL10-1&-2) 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.



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	AC120/60Hz
Radiated	Radiated Emissions	√	√	√	DC3.7V from battery
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
AC Power Conducted Emission	24deg. C, 60%RH	Aug. 30, 2022	Jim Xu
Radiated Emissions	28.2deg. C, 37%RH	Aug. 31, 2022	Jim Xu
Antenna Port Conducted Measurement	25deg. C, 63%RH	Sep. 02, 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
-	0 to 39	0, 19, 39	GFSK	2

● **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	2

● **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
-	0 to 39	0, 19, 39	GFSK	2



2.4 Description of Support Units

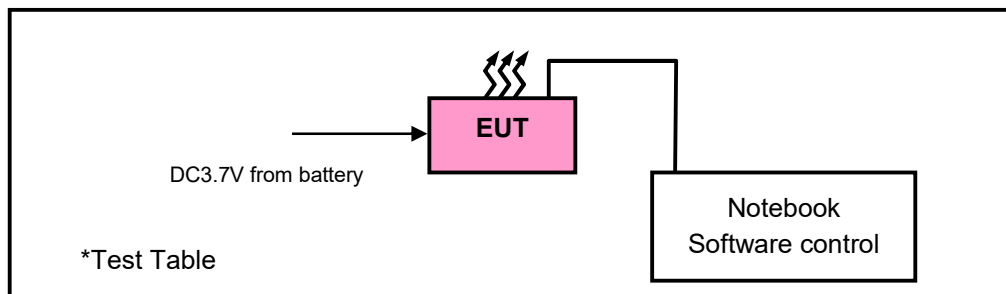
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

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

3. Test Mode	Channel	Duty Cycle [%]
GFSK-1MHz	2402	85.60
	2440	85.60
	2480	85.60

Test Mode	Channel	Duty Cycle [%]
GFSK-2MHz	2402	57.75
	2440	57.75
	2480	57.75



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	2023-04-10
Preamplifier	EMCI	EMC001340	980201	2023-04-15
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	FSV-40N	101783	2023-01-13
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 12/24months and the calibrations are traceable to CEPREI/CHINA.

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 ($D \geq 98\%$), 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 $\geq 3 \times$ 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 ($D \geq 98\%$) cannot be achieved and the duty cycle is constant (duty cycle variations are less than $\pm 2\%$), 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 $\geq 3 \times$ 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 $[10 \log (1/D)]$, where D is the duty cycle.

**If linear voltage averaging mode was used in step f), then the applicable correction factor is $[20 \log (1/D)]$, 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 Averaging 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 $\pm 2\%$), then the following procedure shall be used:

- 1) RBW = 1 MHz.
 - 2) VBW $\geq 1/T$.
 - 3) Detector = peak
 - 4) Sweep time = auto.
 - 5) Trace mode = max hold.
 - 6) Allow max hold to run for at least $[50 \times (1/D)]$ 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 1 meter 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 $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

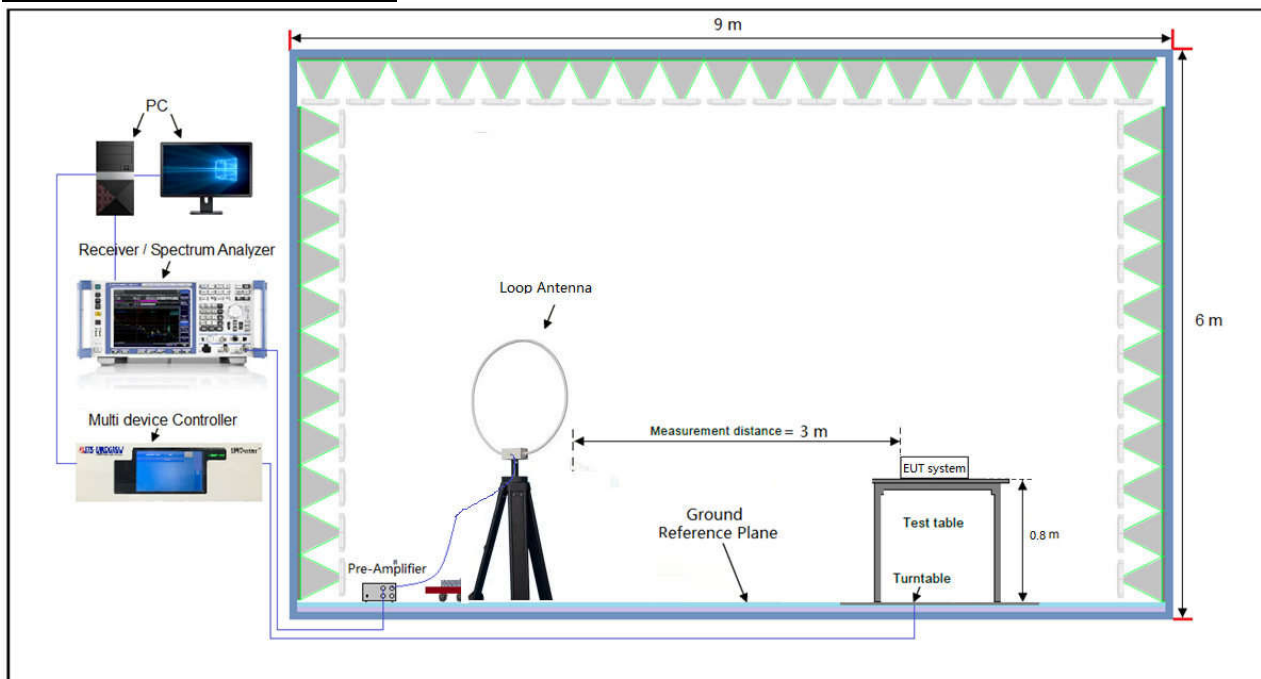
3.1.4 Deviation from Test Standard

No deviation.

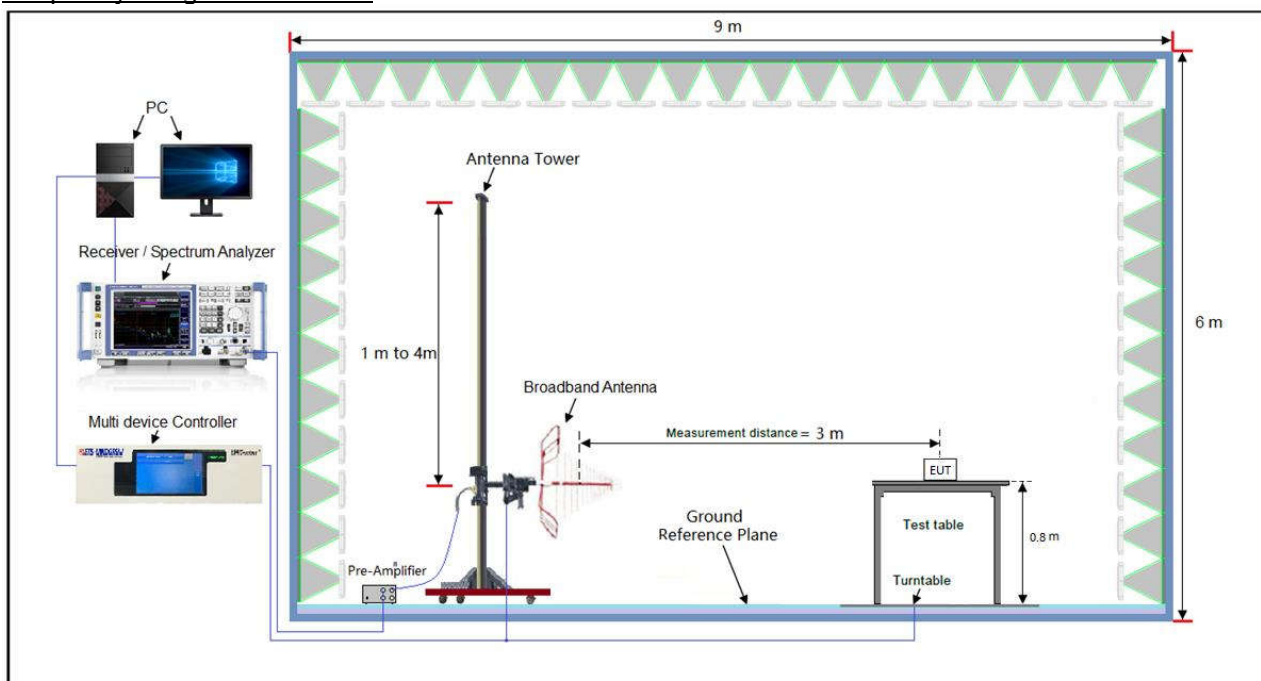


3.1.5 Test Setup

Radiated emission below 30MHz:

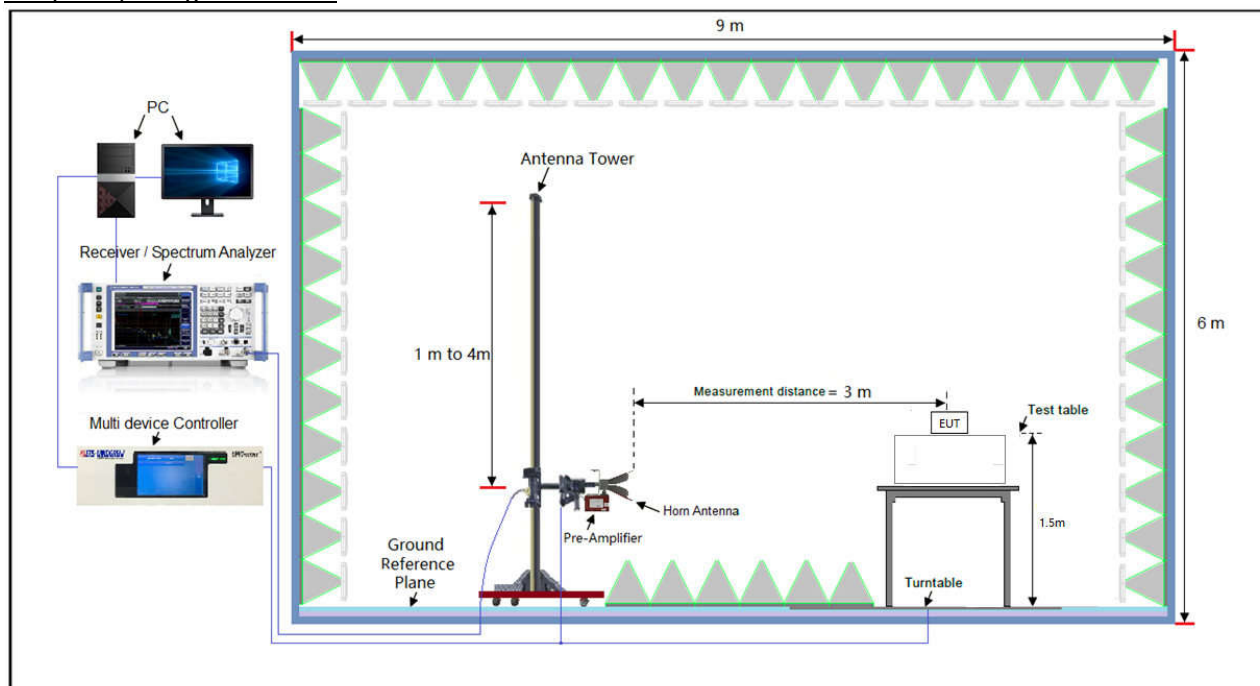


Frequency Range below 1GHz:

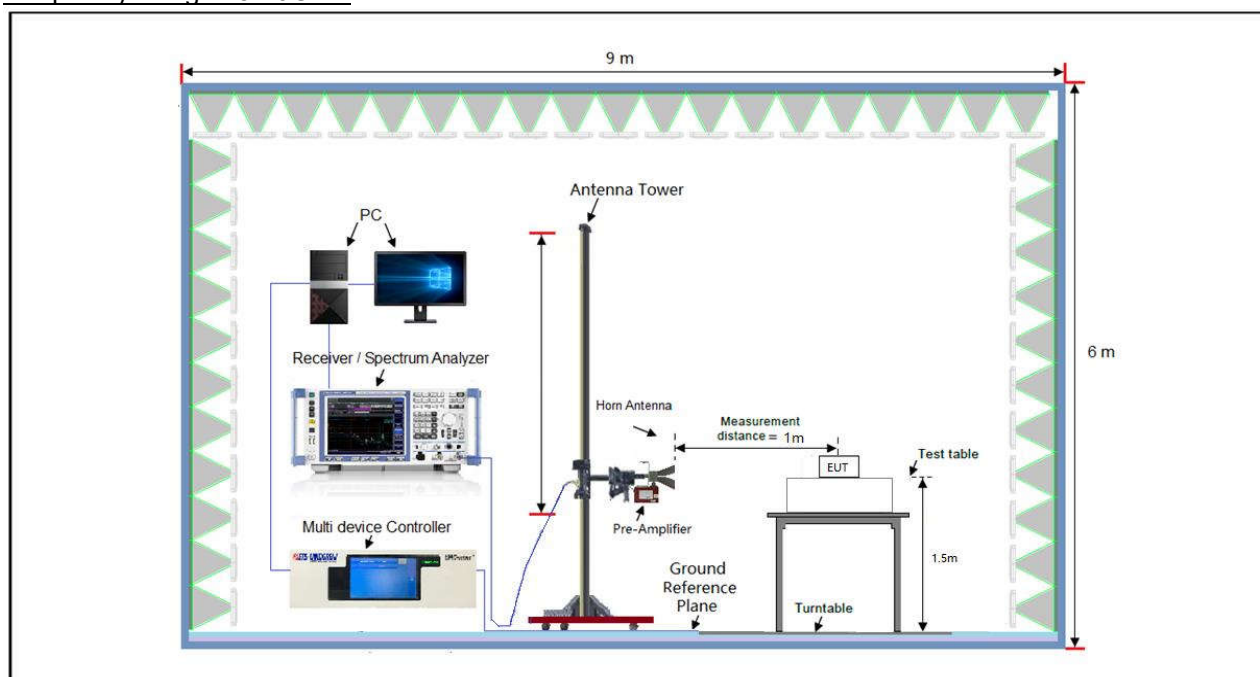




Frequency Range 1-18GHz:



Frequency Range 18-40GHz:



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

3.1.6 EUT Operating Conditions

- Placed the EUT on the testing table.
- Set the EUT under transmission condition continuously at specific channel frequency.



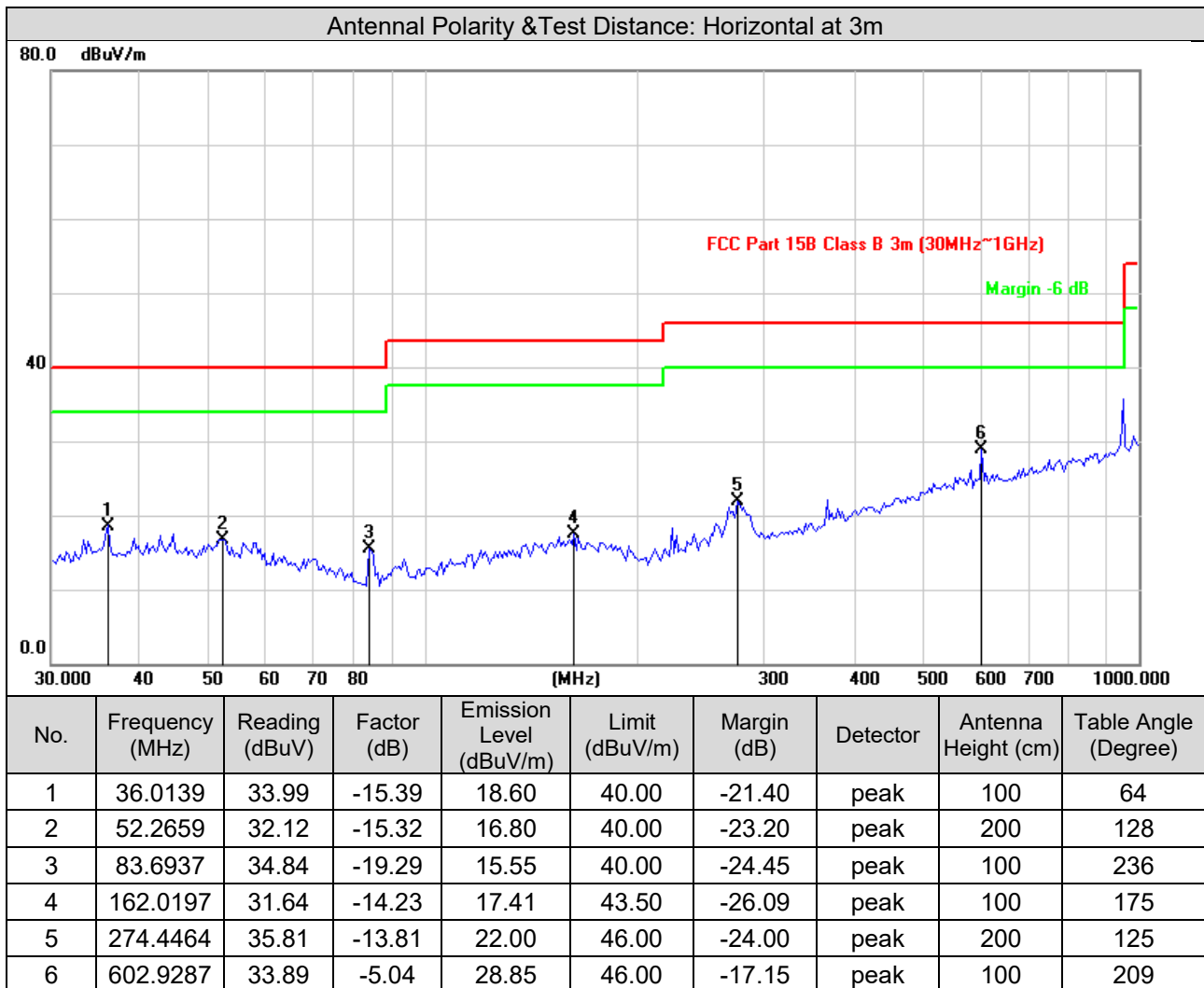
3.1.7 Test Results

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:

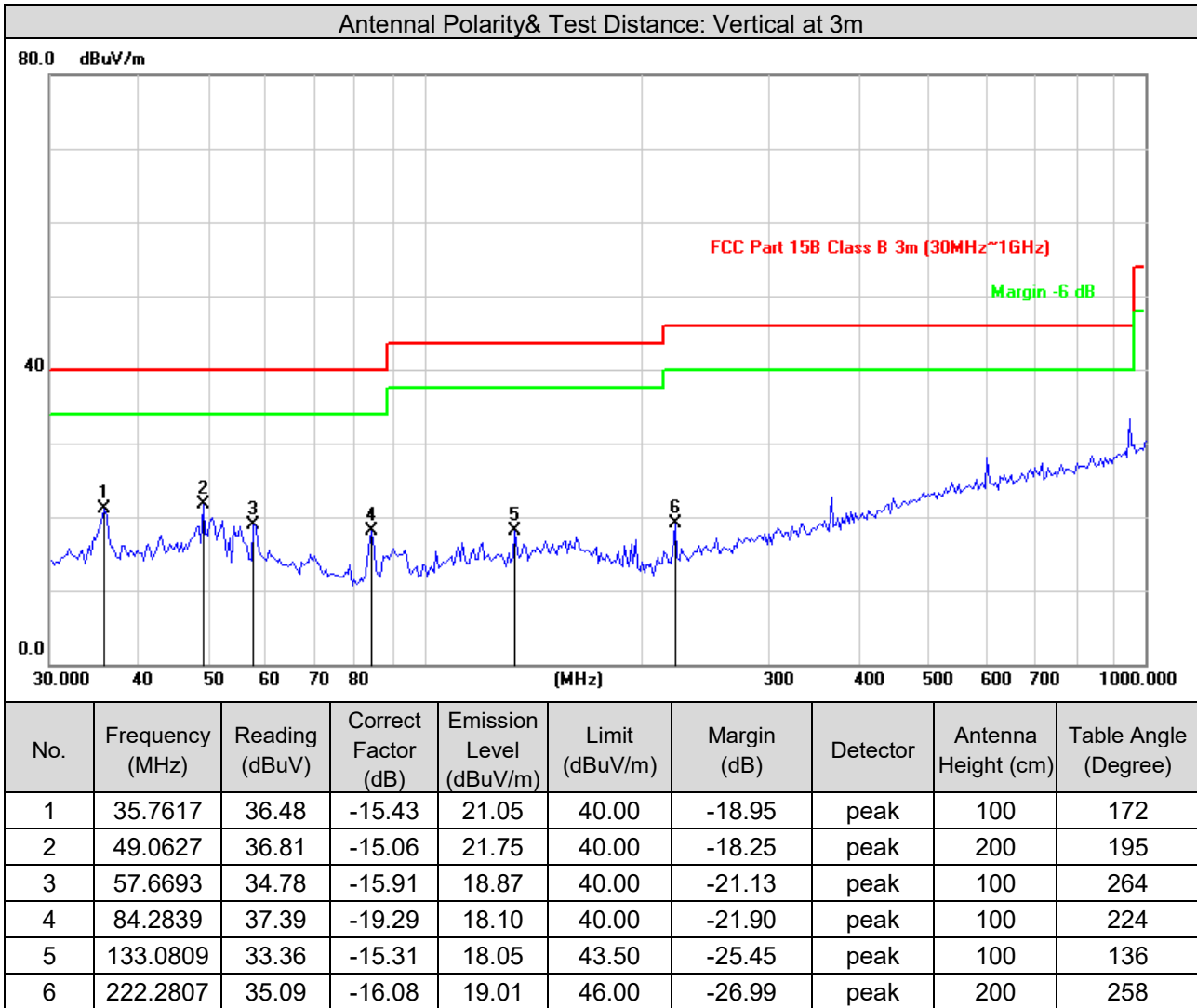
Test Channel	Channel 0	Frequency Range	30MHz ~ 1GHz
Detector Function	Peak (PK) Quasi-peak (QP)	Tested By	Jim Xu



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



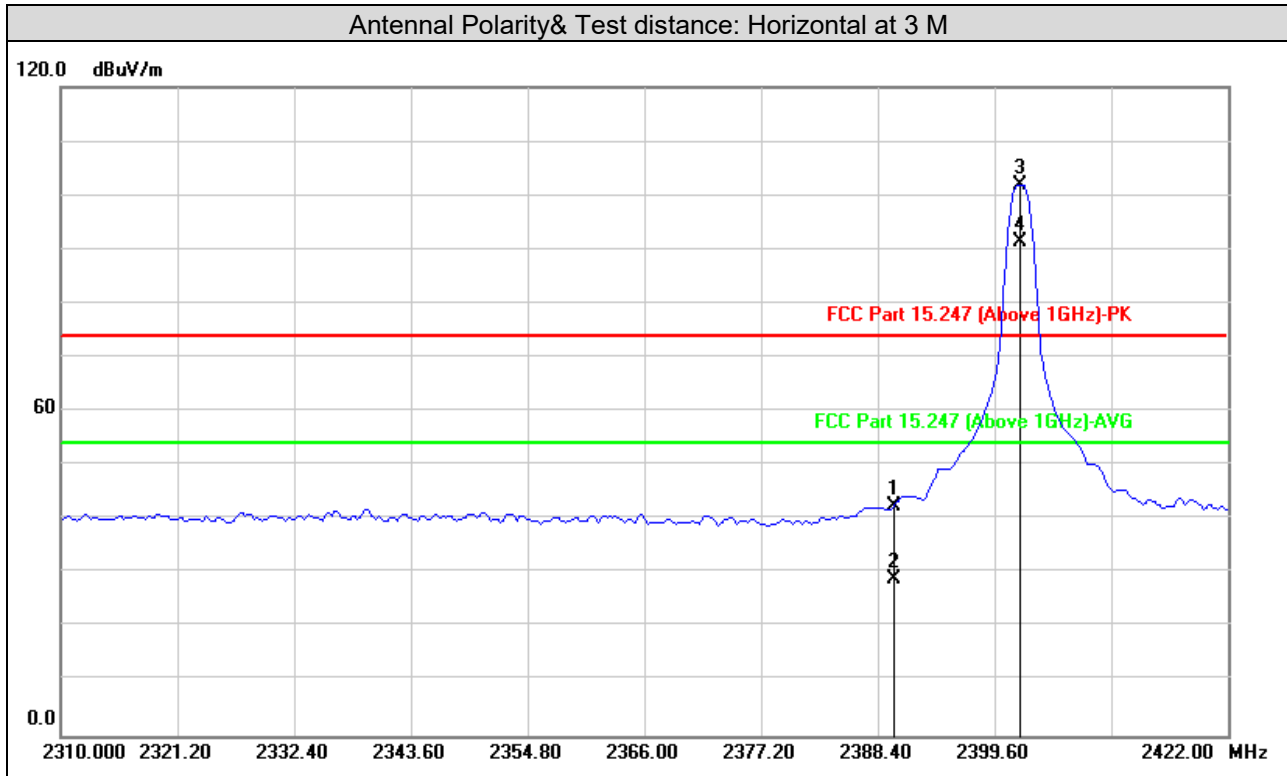
Remarks:

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	King Ye



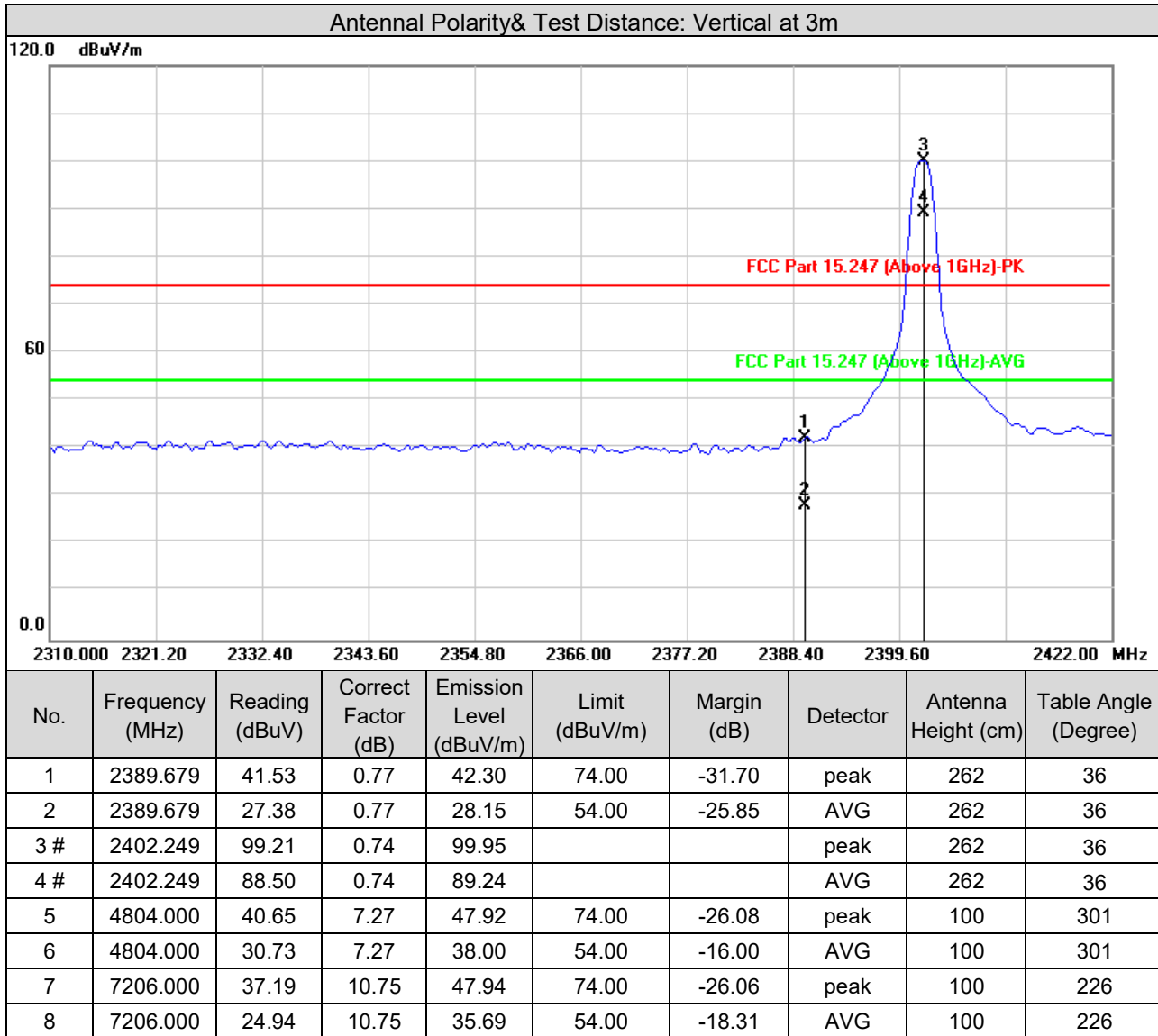
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1	2389.904	41.83	0.77	42.60	74.00	-31.40	peak	317	71
2	2389.904	28.20	0.77	28.97	54.00	-25.03	AVG	317	71
3 #	2402.024	101.13	0.74	101.87			peak	317	71
4 #	2402.024	90.50	0.74	91.24			AVG	317	71
5	4804.000	42.87	7.27	50.14	74.00	-23.86	peak	100	311
6	4804.000	34.38	7.27	41.65	54.00	-12.35	AVG	100	311
7	7206.000	37.00	10.75	47.75	74.00	-26.25	peak	100	205
8	7206.000	24.67	10.75	35.42	54.00	-18.58	AVG	100	205

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



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	100.78	0.69	101.47			peak	117	97
2#	2440.000	89.60	0.69	90.29			AVG	117	97
3	4880.000	39.76	7.60	47.36	74.00	-26.64	peak	100	148
4	4880.000	28.54	7.60	36.14	54.00	-17.86	AVG	100	148
5	7320.000	35.29	10.92	46.21	74.00	-27.79	peak	100	111
6	7320.000	25.80	10.92	36.72	54.00	-17.28	AVG	100	111
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	101.95	0.69	102.64			peak	264	175
2#	2440.000	90.55	0.69	91.24			AVG	264	175
3	4880.000	40.71	7.60	48.31	74.00	-25.69	peak	100	217
4	4880.000	28.51	7.60	36.11	54.00	-17.89	AVG	100	217
5	7320.000	35.30	10.92	46.22	74.00	-27.78	peak	100	199
6	7320.000	25.89	10.92	36.81	54.00	-17.19	AVG	100	199

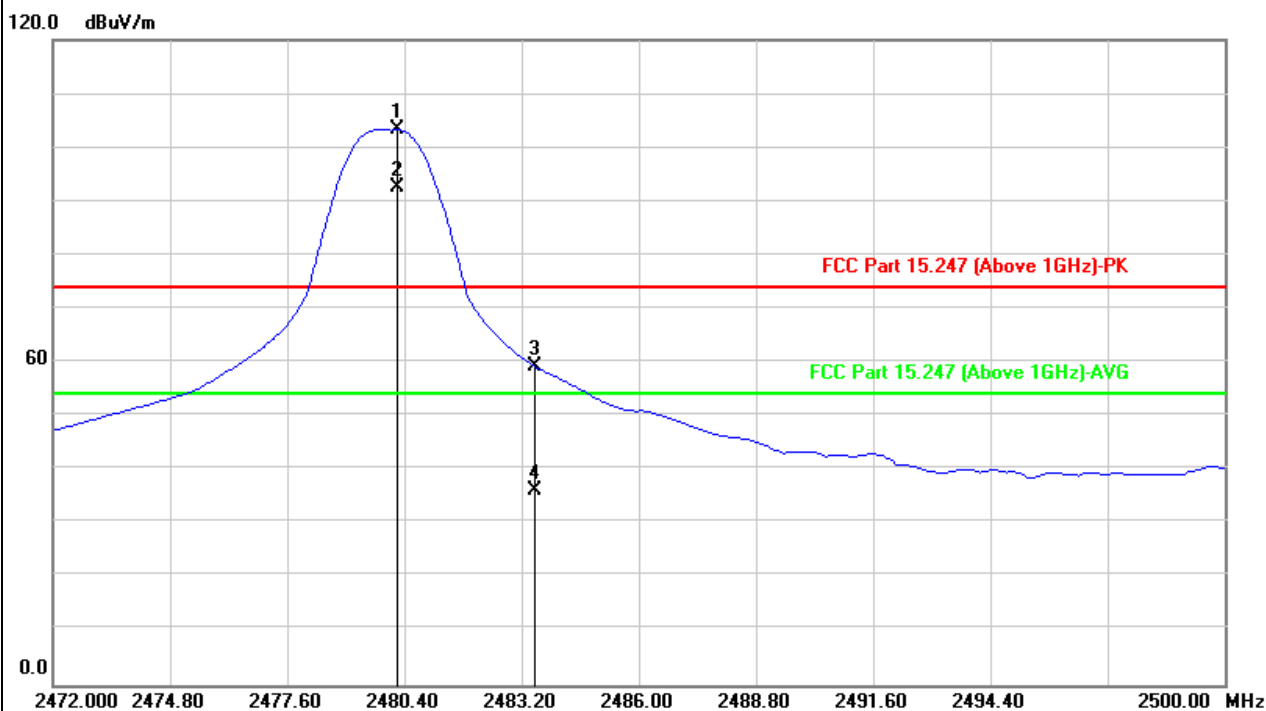
Remarks:

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



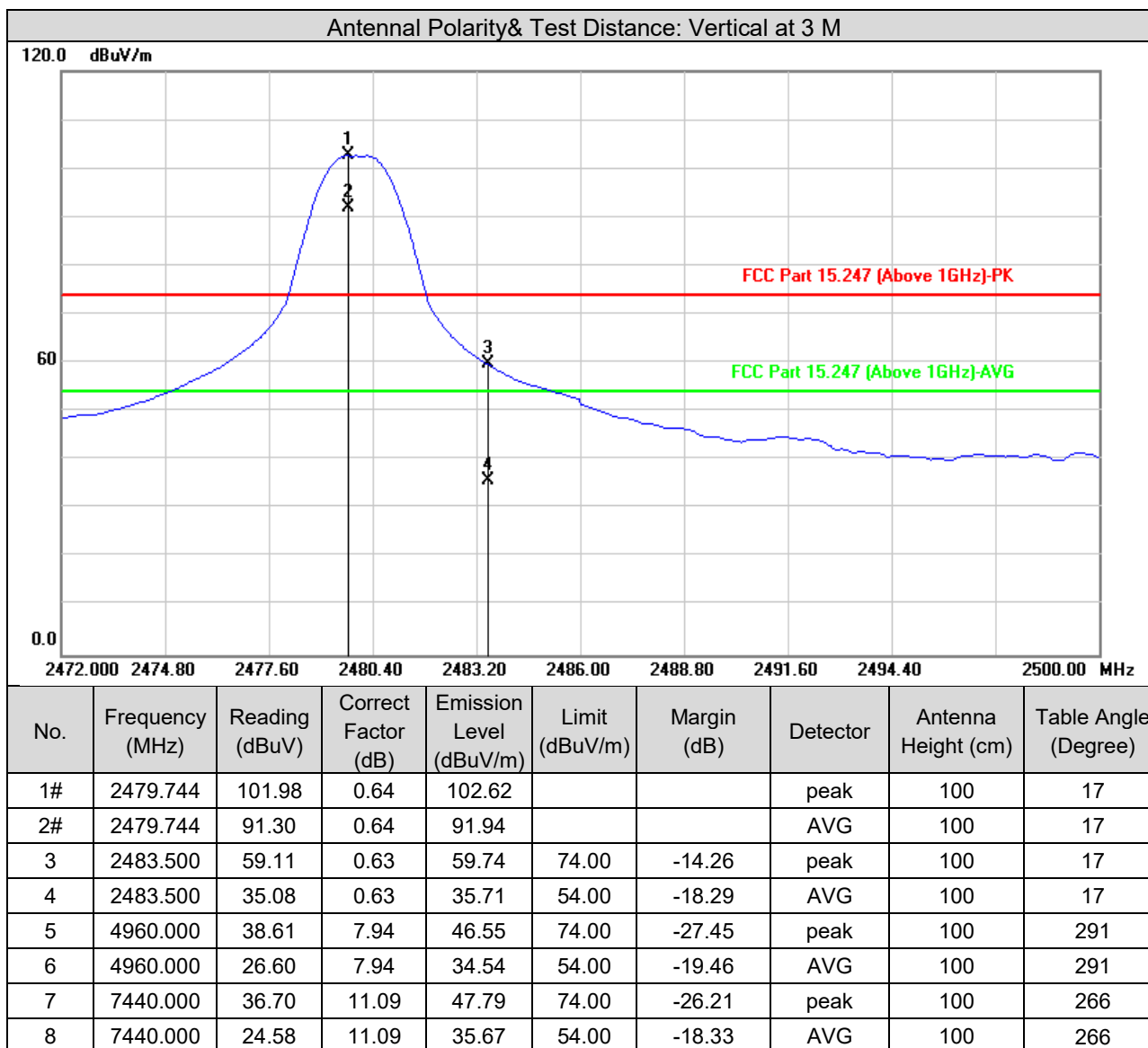
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1#	2480.249	102.62	0.64	103.26			peak	141	66
2#	2480.249	91.85	0.64	92.49			AVG	141	66
3	2483.500	58.66	0.63	59.29	74.00	-14.71	peak	141	66
4	2483.500	35.56	0.63	36.19	54.00	-17.81	AVG	141	66
5	4960.000	38.39	7.94	46.33	74.00	-27.67	peak	100	117
6	4960.000	25.49	7.94	33.43	54.00	-20.57	AVG	100	117
7	7440.000	36.98	11.09	48.07	74.00	-25.93	peak	100	305
8	7440.000	24.42	11.09	35.51	54.00	-18.49	AVG	100	305

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



Remarks:

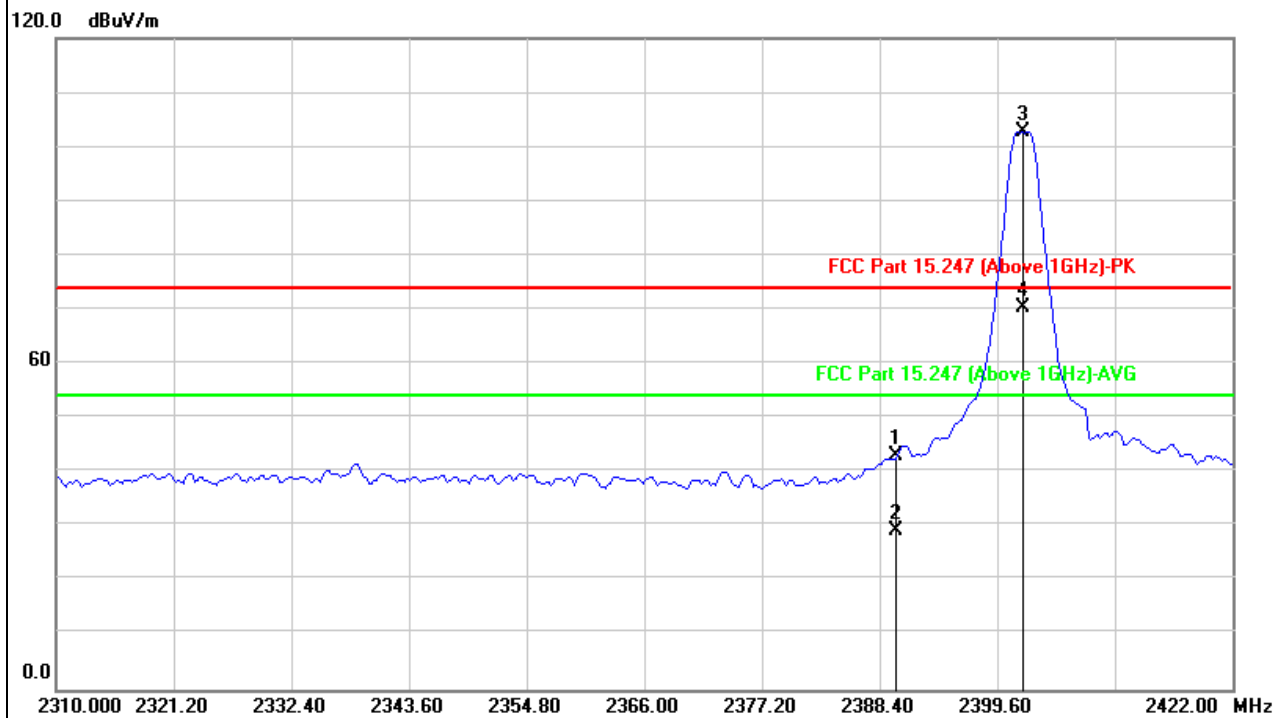
1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value
3. #2480MHz: Fundamental frequency.



BLE-2Mbps

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

Antennal Polarity& Test distance: Horizontal at 3 M

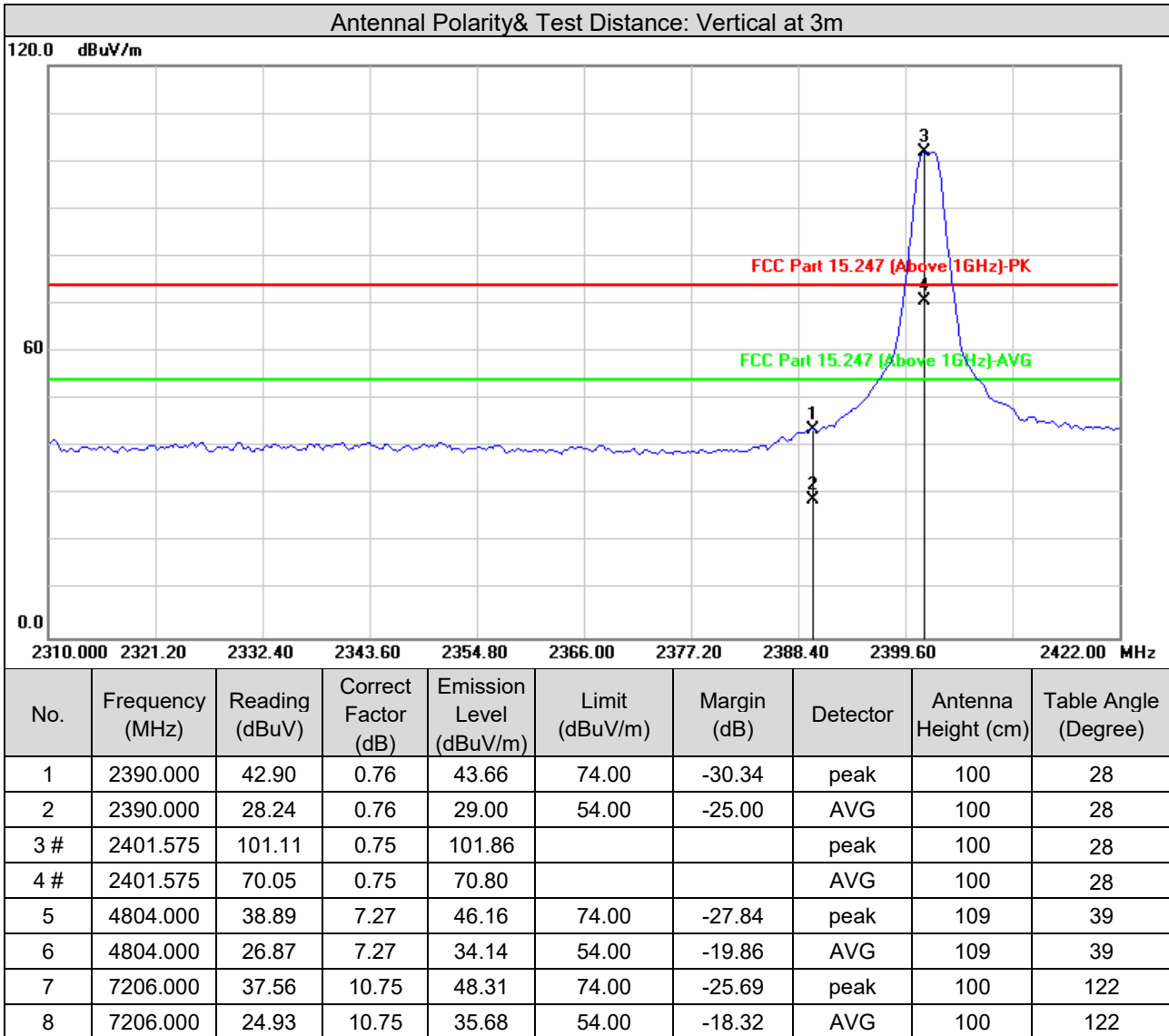


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1	2390.000	42.37	0.76	43.13	74.00	-30.87	peak	100	69
2	2390.000	28.40	0.76	29.16	54.00	-24.84	AVG	100	69
3 #	2402.024	101.92	0.74	102.66			peak	100	69
4 #	2402.024	69.49	0.74	70.23			AVG	100	69
5	4804.000	42.43	7.27	49.70	74.00	-24.30	peak	100	315
6	4804.000	29.36	7.27	36.63	54.00	-17.37	AVG	100	315
7	7206.000	36.72	10.75	47.47	74.00	-26.53	peak	100	141
8	7206.000	24.76	10.75	35.51	54.00	-18.49	AVG	100	141

Remarks:

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

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



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	102.03	0.69	102.72			peak	179	311
2#	2440.000	69.92	0.69	70.61			AVG	179	311
3	4880.000	40.77	7.60	48.37	74.00	-25.63	peak	100	269
4	4880.000	29.88	7.60	37.48	54.00	-16.52	AVG	100	269
5	7320.000	36.64	10.92	47.56	74.00	-26.44	peak	100	174
6	7320.000	26.02	10.92	36.94	54.00	-17.06	AVG	100	174
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	101.15	0.69	101.84			peak	182	187
2#	2440.000	70.79	0.69	71.48			AVG	182	187
3	4880.000	41.12	7.60	48.72	74.00	-25.28	peak	100	294
4	4880.000	30.09	7.60	37.69	54.00	-16.31	AVG	100	294
5	7320.000	37.38	10.92	48.30	74.00	-25.70	peak	100	145
6	7320.000	25.95	10.92	36.87	54.00	-17.13	AVG	100	145

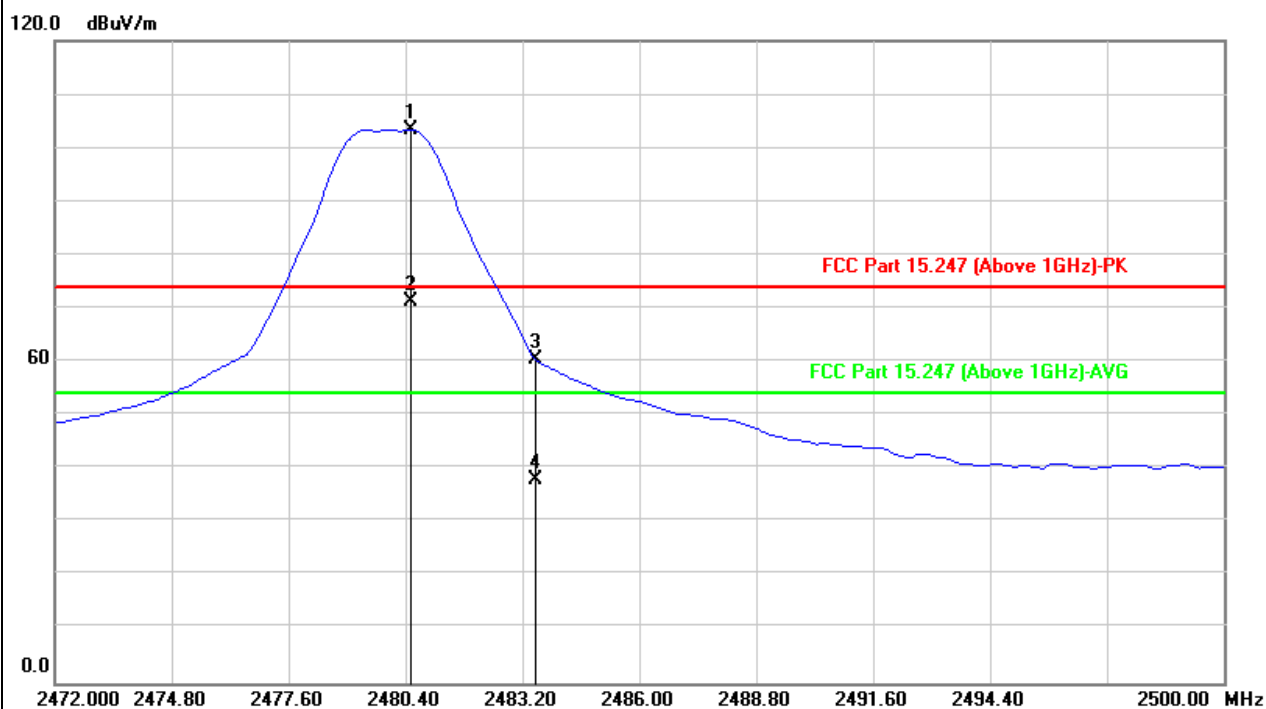
Remarks:

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

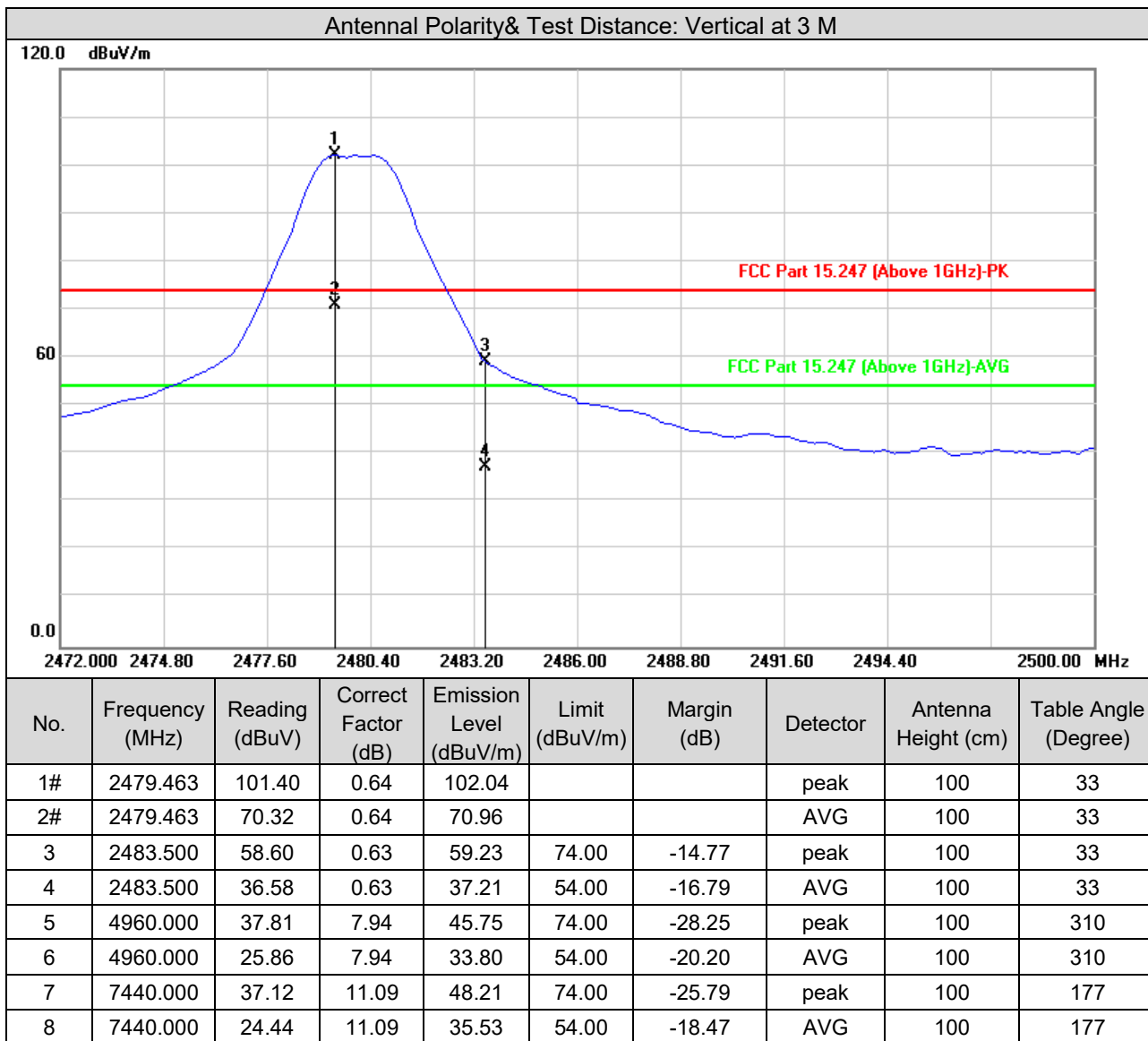


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1#	2480.529	102.76	0.64	103.40			peak	139	67
2#	2480.529	70.54	0.64	71.18			AVG	139	67
3	2483.500	59.75	0.63	60.38	74.00	-13.62	peak	139	67
4	2483.500	37.42	0.63	38.05	54.00	-15.95	AVG	139	67
5	4960.000	37.50	7.94	45.44	74.00	-28.56	peak	100	328
6	4960.000	25.48	7.94	33.42	54.00	-20.58	AVG	100	328
7	7440.000	37.77	11.09	48.86	74.00	-25.14	peak	100	201
8	7440.000	24.40	11.09	35.49	54.00	-18.51	AVG	100	201

Remarks:

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

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



Remarks:

7. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamplifier Factor)

8. Margin value = Emission level – Limit value

9. #2480MHz: Fundamental frequency.



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 to 0.50MHz.

3.2.2 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Due Date of Calibration
EMI Test Receiver	Rohde&Schwarz	ESR 7	101961	2023-01-13
Artificial Mains Network	Rohde&Schwarz	ENV216	3560.6550.15	2023-01-12
Test software	FARAD	EZ EMC V1.1.4.2	N/A	N/A
Hygrothermograph	Yuhuaze	HTC-1	NA	2022-09-09
Digital Multimeter	FLUKE	15B+	43512617WS	2022-09-11

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 Shielded Room 1.

3.2.3 Test Procedures

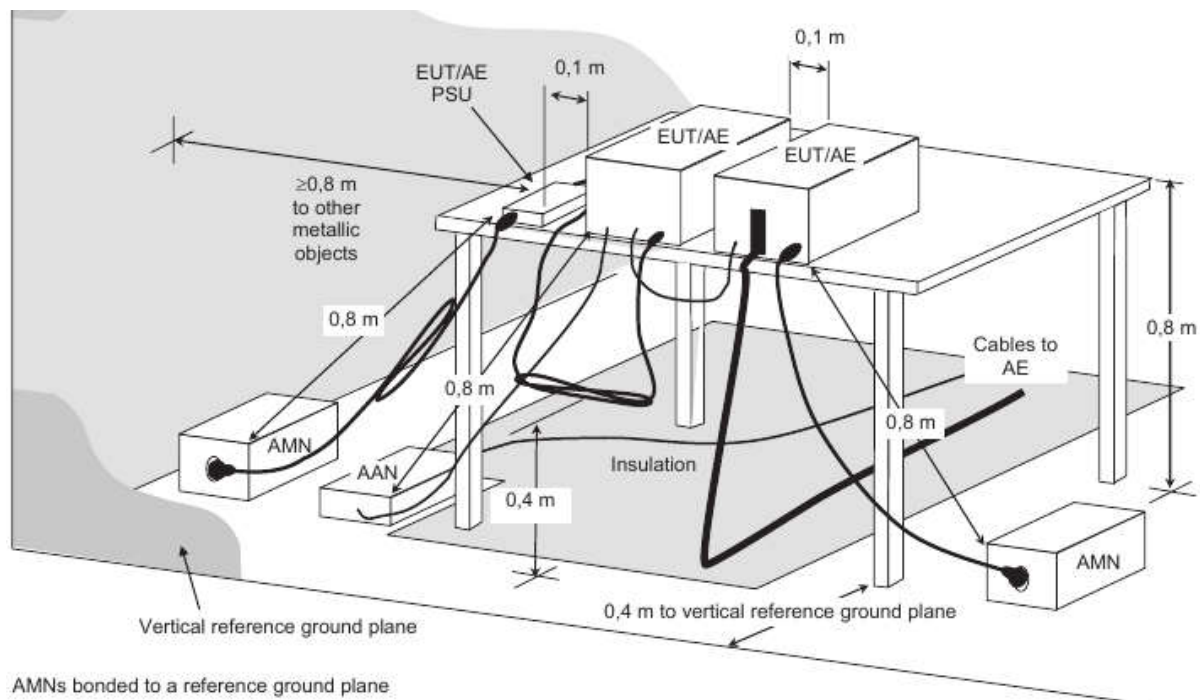
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- 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



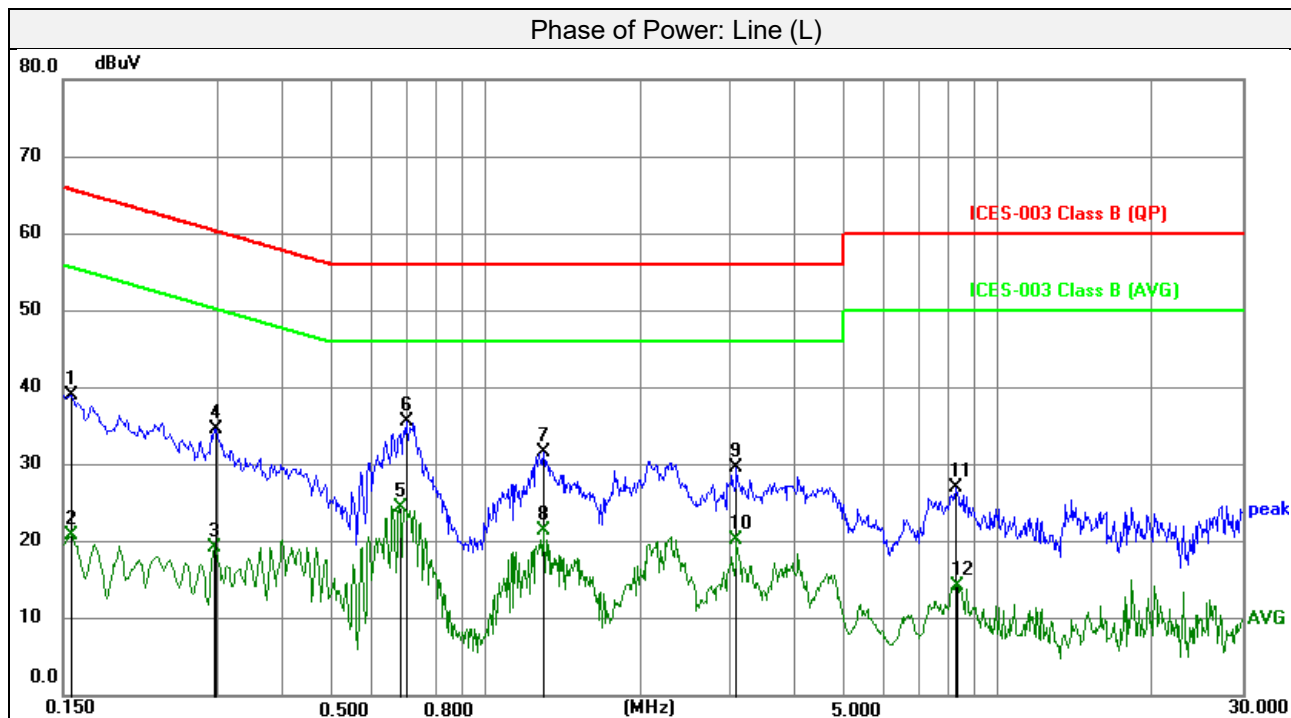
3.2.6 EUT Operating Conditions

- 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
Power supply	AC 120V/60Hz	Environmental Conditions	26°C, 60%RH



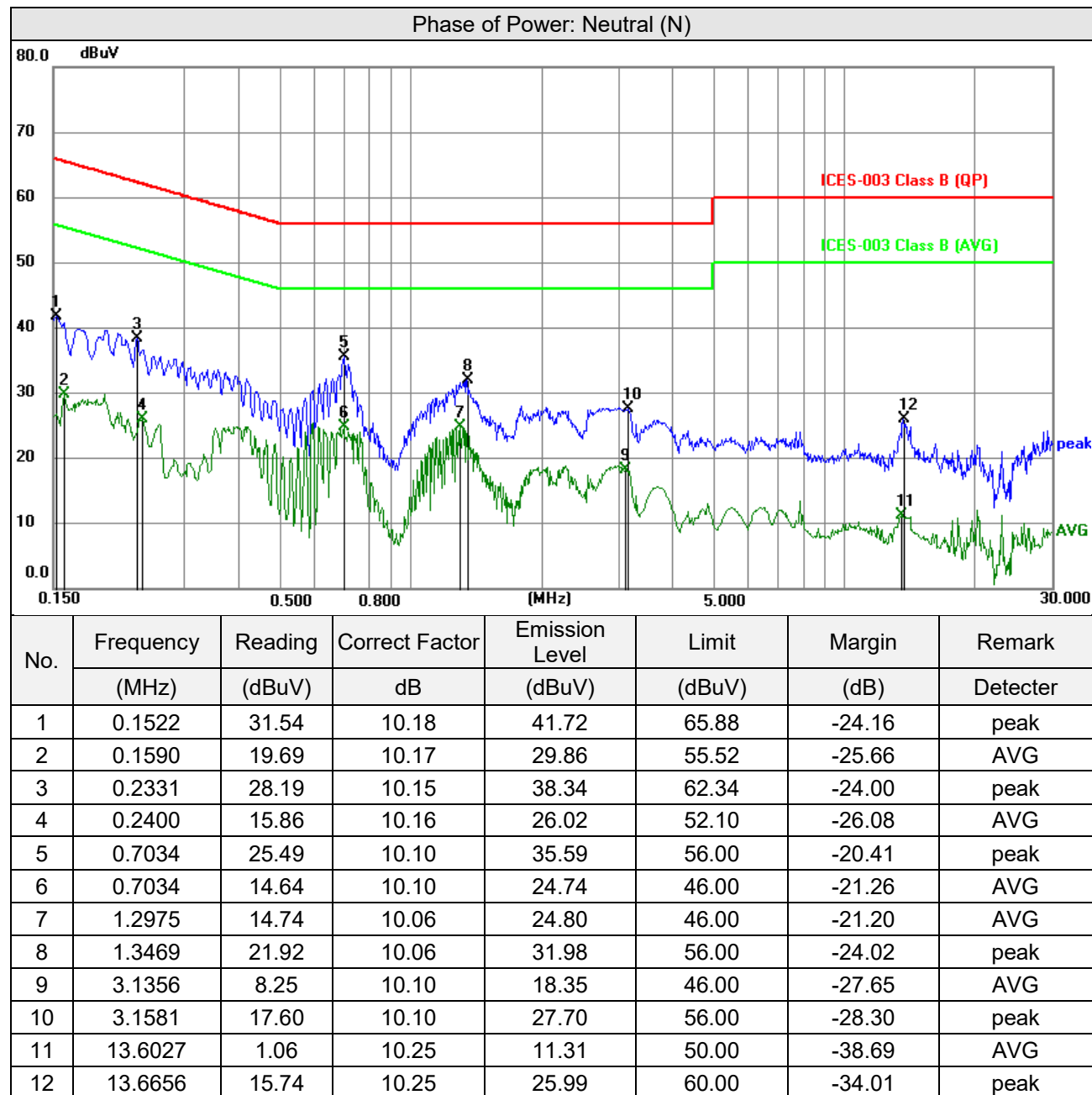
No.	Frequency (MHz)	Reading (dBuV)	Correction Factor dB	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)	Remark Detector
1	0.1554	28.78	10.18	38.96	65.71	-26.75	peak
2	0.1554	10.67	10.18	20.85	55.71	-34.86	AVG
3	0.2962	9.04	10.18	19.22	50.35	-31.13	AVG
4	0.2983	24.50	10.18	34.68	60.29	-25.61	peak
5	0.6807	14.35	10.10	24.45	46.00	-21.55	AVG
6	0.7012	25.47	10.10	35.57	56.00	-20.43	peak
7	1.3020	21.47	10.06	31.53	56.00	-24.47	peak
8	1.3042	11.44	10.06	21.50	46.00	-24.50	AVG
9	3.0951	19.60	10.09	29.69	56.00	-26.31	peak
10	3.0951	10.23	10.09	20.32	46.00	-25.68	AVG
11	8.3175	17.06	10.06	27.12	60.00	-32.88	peak
12	8.3353	4.28	10.06	14.34	50.00	-35.66	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 andwidth	Quasi-Peak (QP) / Average (AV), 9kHz
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**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.



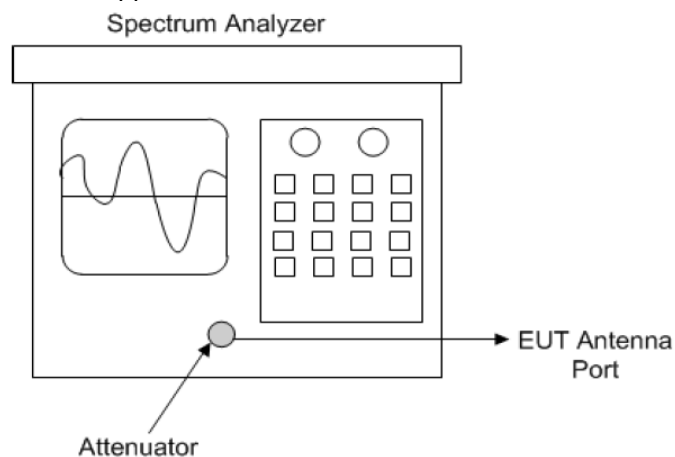
3.3 6dB Bandwidth Measurement

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.



Spectrum analyzer test configuration

3.3.3 Test Instruments

Refer to section 5 to get information of above instrument.



3.3.4 Test Procedure

Option 1:

- Set resolution bandwidth (RBW) = 30kHz
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- 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 $\geq 3 \times$ 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-2Mbps			
Operation Channel	Frequency	Occupied Bandwidth (MHz)	
		Result	Limit
0	2402MHz	1.240	>0.5
19	2440MHz	1.280	>0.5
39	2480MHz	1.244	>0.5

BLE-1Mbps			
Operation Channel	Frequency	Occupied Bandwidth (MHz)	
		Result	Limit
0	2402MHz	0.756	>0.5



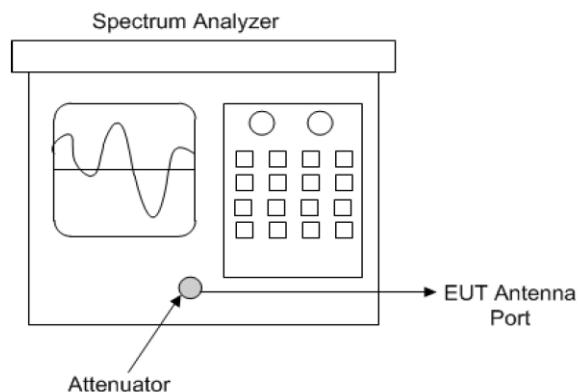
19	2440MHz	0.700	>0.5
39	2480MHz	0.716	>0.5





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

Operation Channel	Frequency	Occupied Bandwidth (MHz)		
		BLE1Mbps	BLE2Mbps	Limit
0	2402MHz	1.0480	2.0807	2400~2483.5
19	2440MHz	1.0515	2.0781	2400~2483.5
39	2480MHz	1.0483	2.0753	2400~2483.6





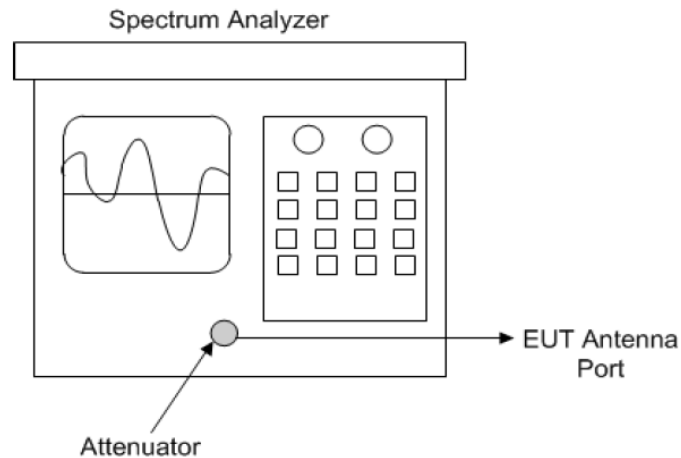
3.5 Conducted Output Power Measurement

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:

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

- 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.
- 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 $+2\%$.
- 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 $\geq 3 \times$ RBW
 - 5* Number of points in sweep $\geq 2 \times$ span /RBW. (This gives bin-to-bin spacing $\leq$ RBW / 2. so that narrowband signals are not lost between frequency bins).
 - 6* Sweep time: Auto
 - 7* Detector =RMS (power averaging).
 - 8* Trace average at least 100 traces in power averaging(rms) mode.
 - 9* 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	4.961	3.134	<125	<1000	Pass
19	2440	4.317	2.702	<125	<1000	Pass
39	2480	4.792	3.014	<125	<1000	Pass

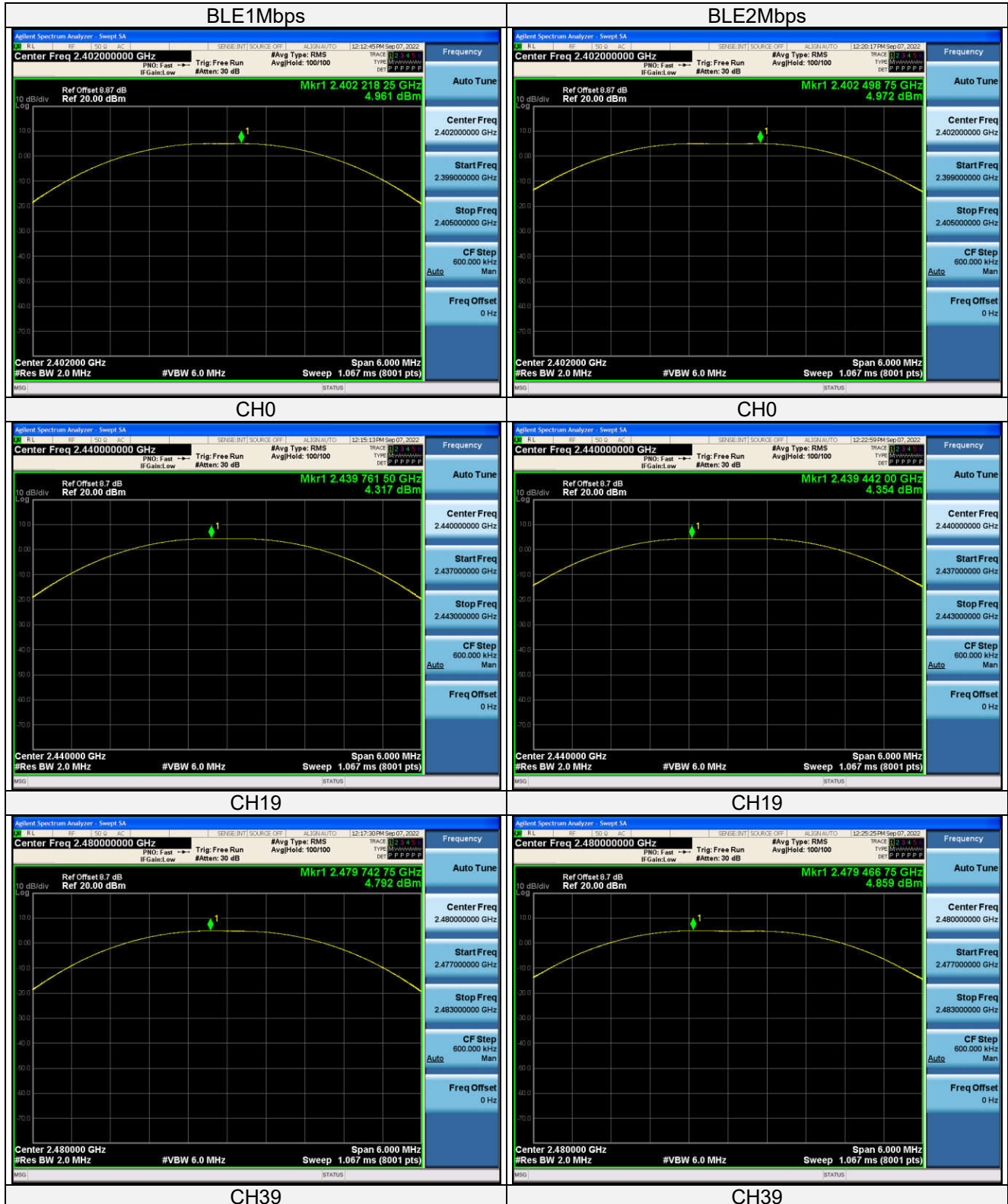
BLE-1Mbps						
Average Power						
Channel	Freq.	RF Output Power		Limit (mW)		Verdict
No.	(MHz)	(dBm)	(mW)	Rss-247	FCC	
0	2402	1.640	1.459	<125	<1000	Pass
19	2440	1.300	1.349	<125	<1000	Pass
39	2480	1.620	1.452	<125	<1000	Pass

BLE-2Mbps						
Peak Power						
Channel	Freq.	RF Output Power		Limit (mW)		Verdict
No.	(MHz)	(dBm)	(mW)	Rss-247	FCC	
0	2402	4.972	3.142	<125	<1000	Pass
19	2440	4.354	2.725	<125	<1000	Pass
39	2480	4.859	3.061	<125	<1000	Pass

BLE-2Mbps						
Average Power						
Channel	Freq.	RF Output Power		Limit (mW)		Verdict
No.	(MHz)	(dBm)	(mW)	Rss-247	FCC	
0	2402	-0.090	0.979	<125	<1000	Pass
19	2440	-0.420	0.908	<125	<1000	Pass
39	2480	-0.100	0.977	<125	<1000	Pass



PEAK POWER





AVERAGE POWER





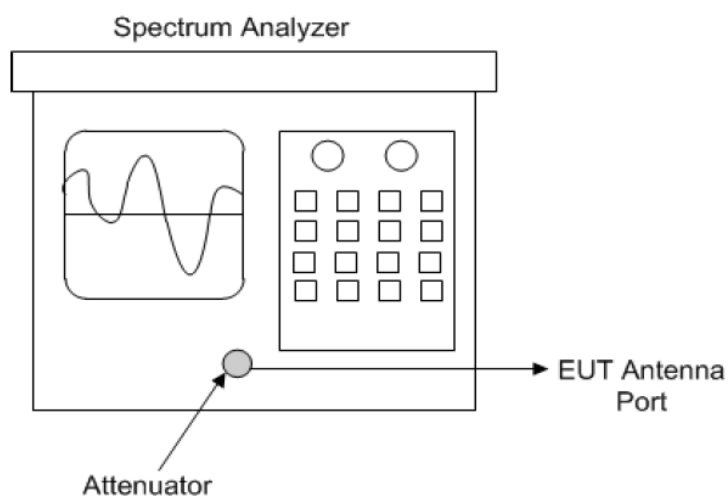
3.6 Power Spectral Density Measurement

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



Spectrum analyzer test configuration

3.6.3 Test Instruments

Refer to section 5 to get information of above instrument.

3.6.4 Test Procedure

- a. **Method AVGPDS-1 or method AVGPDS-1A (alternative)** shall be applied if either of the following conditions can be satisfied:
 - 1) The EUT transmits continuously (or with a $D \geq 98\%$).
 - 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 is equal to or shorter than the duration I of each transmission from the EUT, and if those transmissions exhibit full power throughout these durations.
- b. **Method AVGPDS-2 or method AVGPDS-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 $\pm 2\%$.
- c. **Method AVGPDS-3 or method AVGPDS-3A (alternative)** shall be applied if the conditions of the preceding paragraphs a) and b) cannot be achieved.

Method AVGPDS-3:

Method AVGPDS-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 $\pm 2\%$),

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

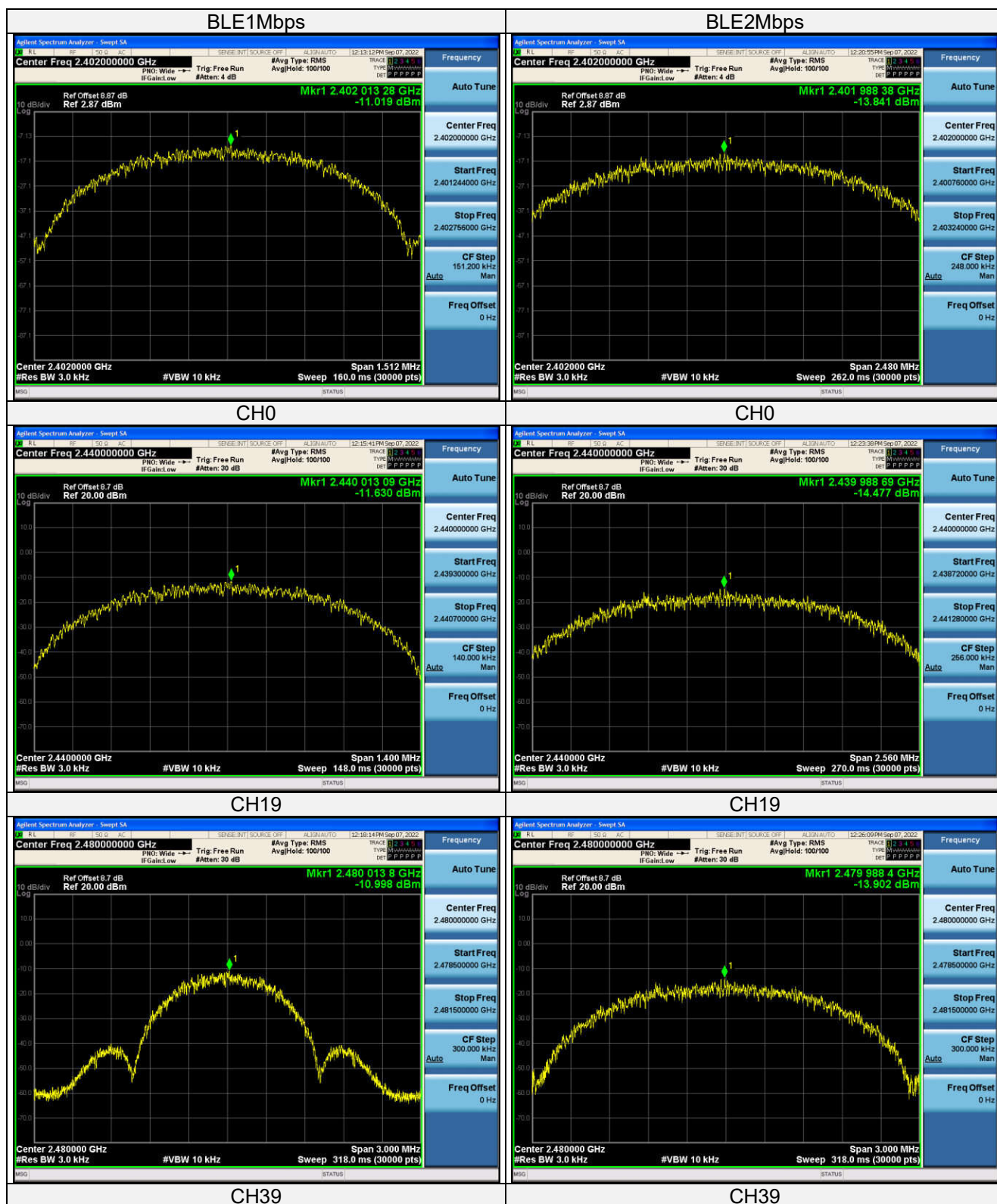
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



3.6.7 Test Results

BLE-1Mbps	Power Density		
Test Channel	Channel Frequency	Test Result (dBm/3kHz)	Limit (dBm/3kHz)
0	2402MHz	-11.02	<8
19	2440MHz	-11.63	<8
39	2480MHz	-11.00	<8

BLE-2Mbps	Power Density		
Test Channel	Channel Frequency	Test Result (dBm/3kHz)	Limit (dBm/3kHz)
0	2402MHz	-13.84	<8
19	2440MHz	-14.48	<8
39	2480MHz	-13.90	<8





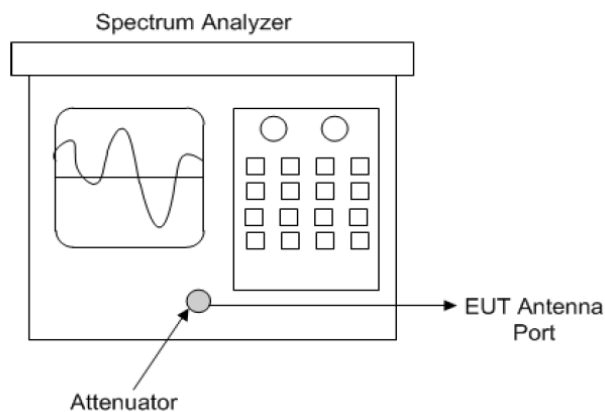
3.7 Conducted Out of Band Emission Measurement

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 $\geq 3 \times$ 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

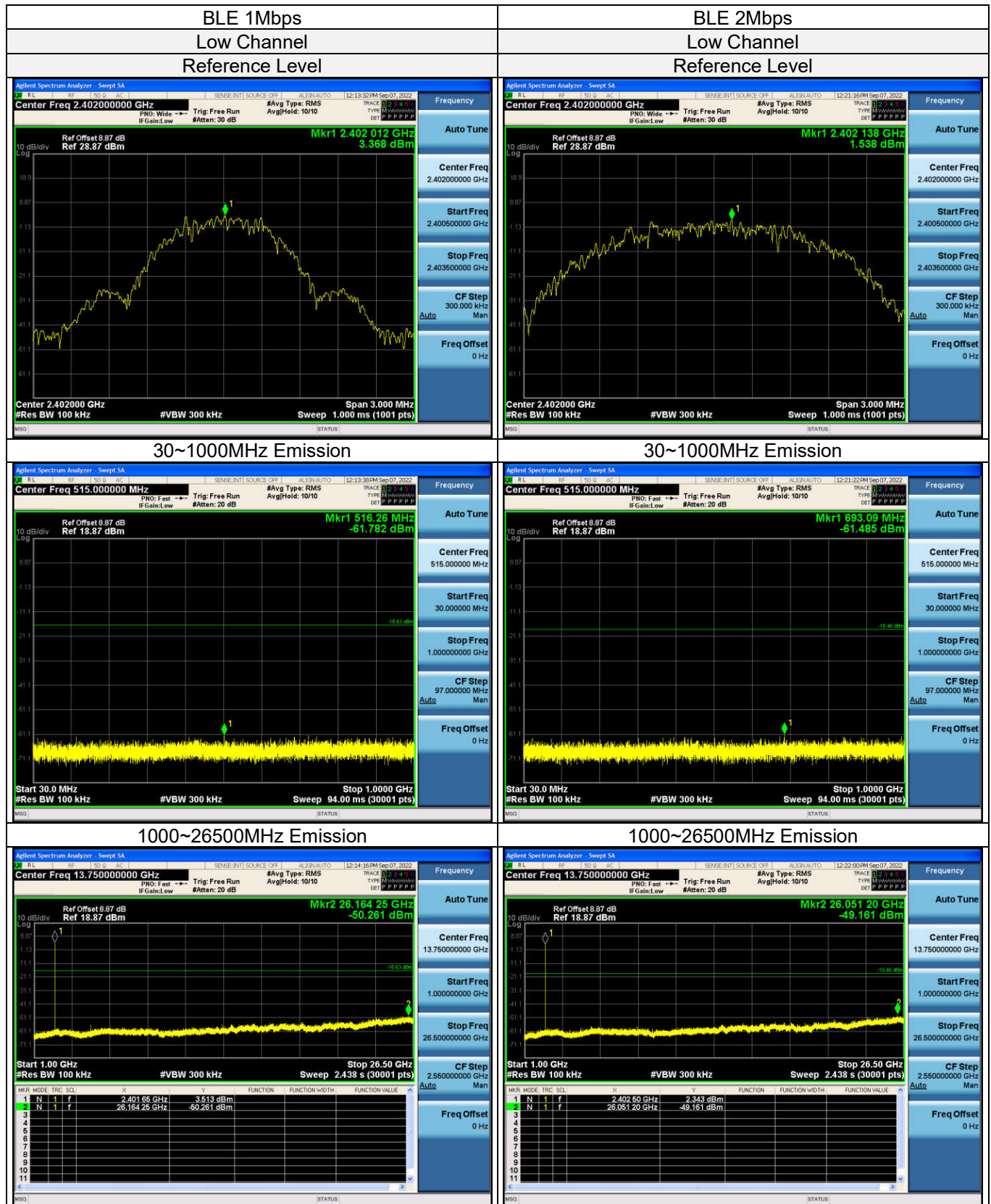
No deviation.

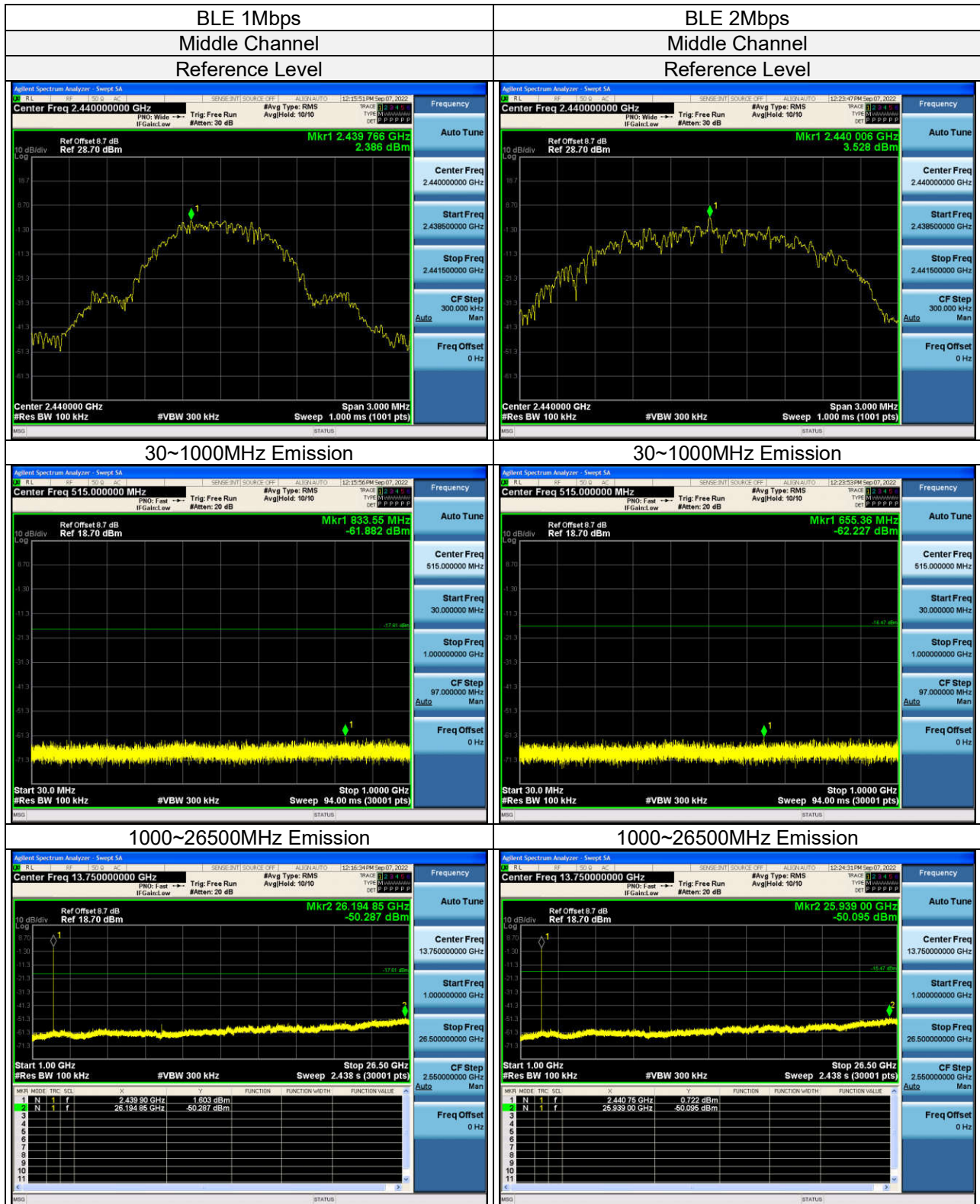
3.7.6 EUT Operating Condition

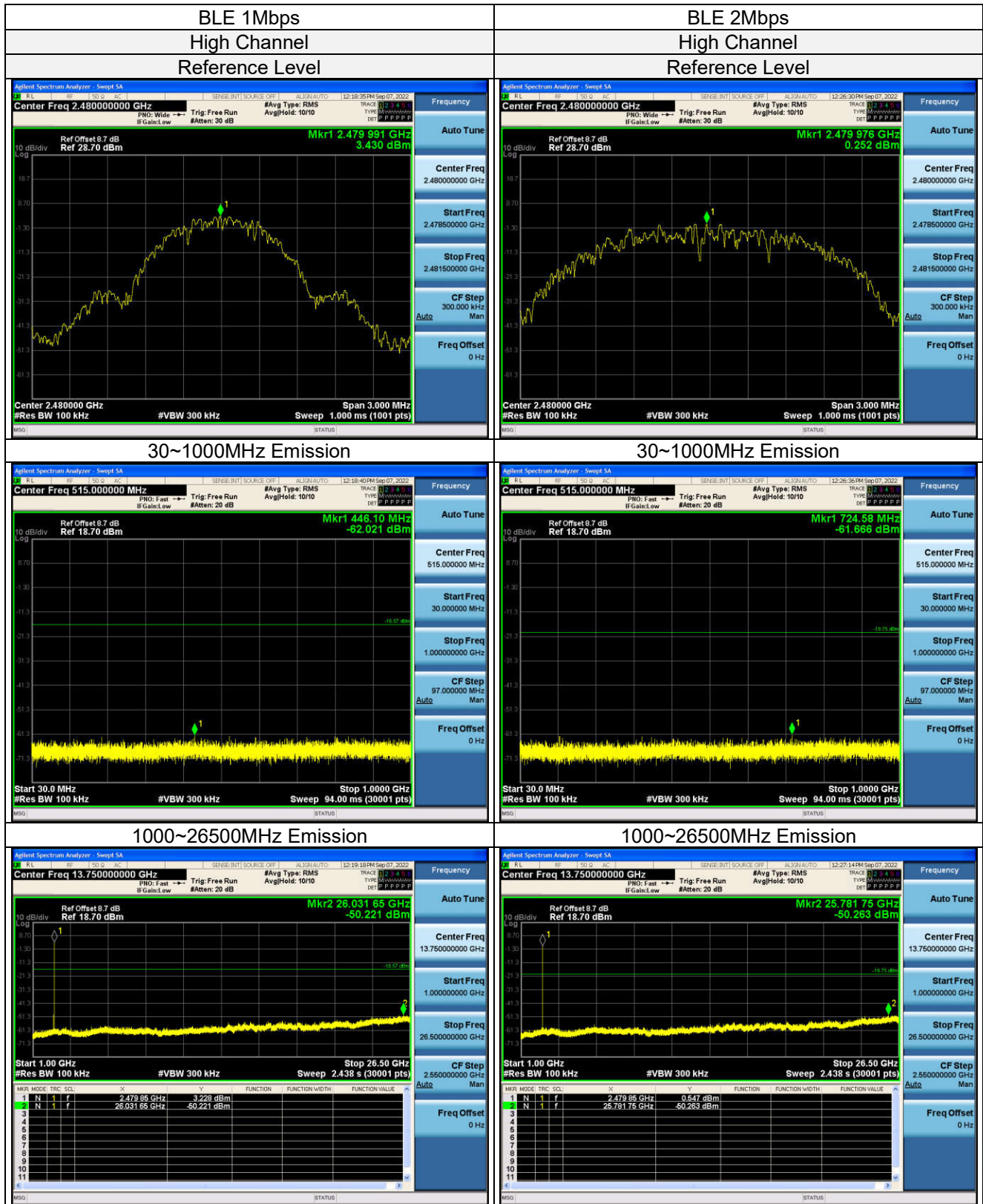
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

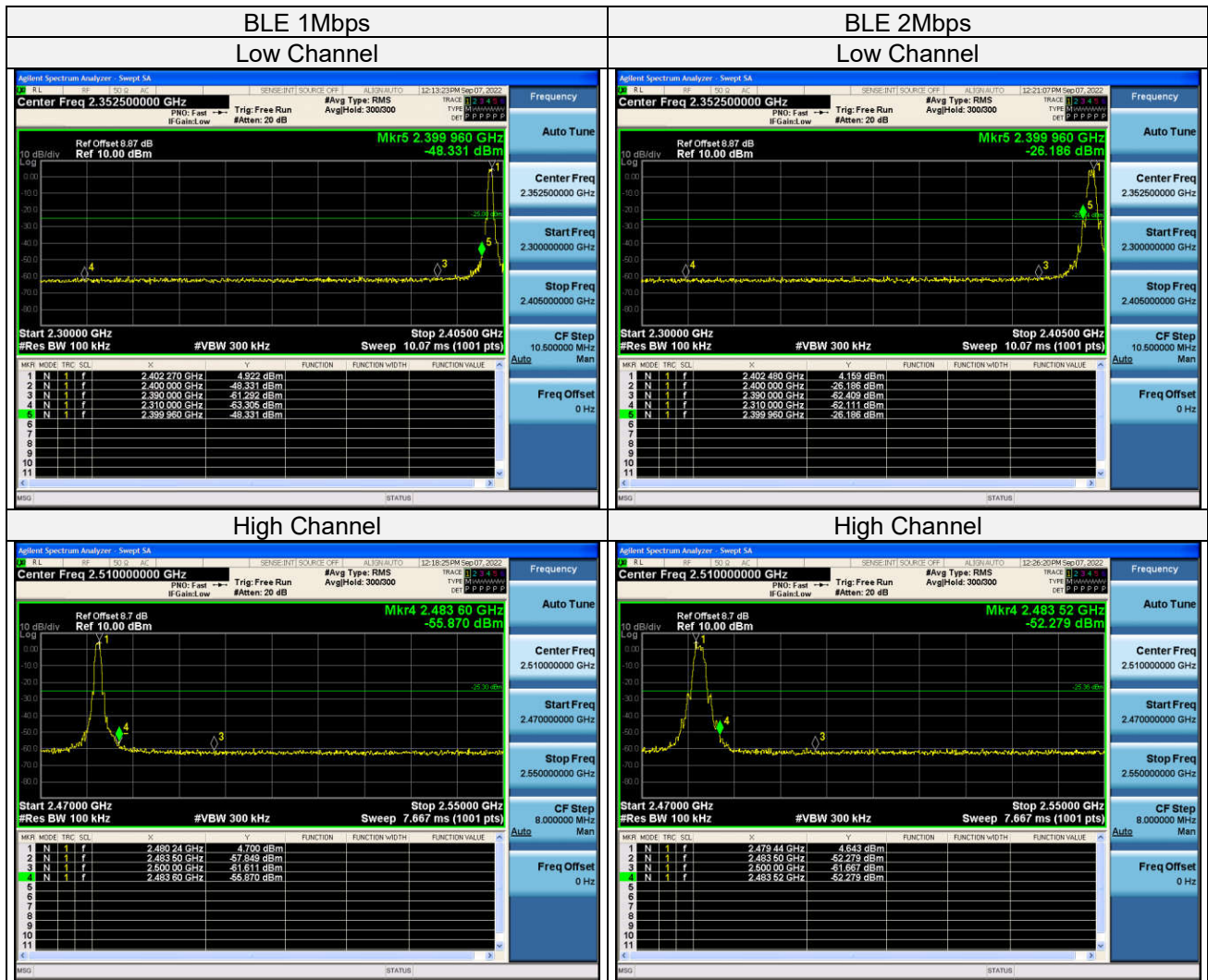


3.7.7 Test results











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	2022-09-08
Spectrum Analyzer	Rohde&Schwarz	FSV-40N	101783	2023-01-13
Power Meter 10Hz~18GHz	Tonscend	JS0806-2	188060126	2022-09-08
Signal generator	Keysight	E4421B	GB40051020	2022-09-12
Signal generator	Keysight	N5182A	MY47420944	2022-09-08
Test Software	Tonscend	JS0806-2	NA	NA
Hygrothermograph	Yuhuaze	HTC-1	NA	2022-09-09

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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Email: Customerservice.dg@hwa-hsing.com

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