

Test Report No.: 24012105-RF-US-02

## FCC Part 15, Subpart C Test Report

FCC ID: 2AR2STAB5309

Applicant: MMD Hong Kong Holding Limited

Address: Units 1208-11, 12th Floor, C-Bons International Center, 108 Wai Yip Street, Kwun Tong, Kowloon, Hong Kong

Manufacturer: MMD Hong Kong Holding Limited

Address: Units 1208-11, 12th Floor, C-Bons International Center, 108 Wai Yip Street, Kwun Tong, Kowloon, Hong Kong

Product: Soundbar speaker

Brand: PHILIPS or 

Test Model(s): TAB5309/37

Series Model(s): See Section 2.1

Test Date: Jan. 16, 2024 ~ Mar. 08, 2024

Issued Date: Mar. 25, 2024

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

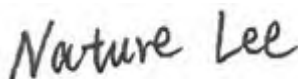
Address: No.101, Building N1, Yuyuan 2 Road, Yuyuan Industrial Park, HuangJiang Town, Dongguan City, People's Republic of China

Test Firm Registration No.: 915896

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)  
ANSI C63.10:2013

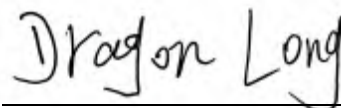
The above equipment has been tested by **Hwa-Hsing (Dongguan) Testing Co., Ltd.**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the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

Prepared by :



Nature Lee

Reviewed by :



Dragon Long

Approved by :



Scott He

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Release

Ver. 1.5

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**Release Control Record**

Issue No.	Description	Date Issued
24012105-RF-US-02	Original Release	Mar. 25, 2024

**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) (±)
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	Soundbar speaker
Test Model(s)	TAB5309/37
Sample No.	HS2401190002
Series Model(s)	TAB5309, TAB5309/61, TAB5309/98, TAB5309/10, TAB5309/yy (yy=00-99 or blank, for country code)
Status of EUT	Engineering Prototype
Power Supply Rating	AC 100-240V 50/60Hz 25W
Modulation Type	GFSK for DTS
Transfer Rate	1 Mbps, 2Mbps
Operating Frequency	2402 ~ 2480MHz
Number of Channel	40
Maximum Output Power	-0.75dBm (Peak)
Antenna Type and Antenna Gain	FPC Antenna; 4.02 dBi Gain
Antenna Connector	N/A
Accessory Device	Remote Control
Cable Supplied	AC Line: 150cm Non-shielded, Detachable

**Note:**

1. Please refer to the EUT photo document (Reference No.: 24012105-01-01&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. For the test results, the EUT had been tested with all conditions, and only the worst case was shown in the test report.
4. Model differences: These models are only different for model name and trademark 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)
<b>0</b>	<b>2402</b>	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	<b>19</b>	<b>2440</b>	29	2460	<b>39</b>	<b>2480</b>

## 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	AC 120V
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	

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

### Test Condition:

Applicable test items	Environmental Conditions	Test Date	Tested by
Radiated Emissions	24.1deg. C, 56%RH	Mar. 05, 2024	Hua
Antenna Port Conducted Measurement	25.2deg. C, 50.3%RH	Jan. 25, 2024	Dragon

- 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.

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**Radiated Emission Test (Above 1GHz):**

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

**Radiated Emission Test (Below 1GHz):**

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

**Power Line Conducted Emission Test:**

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

**Antenna Port Conducted Measurement:**

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

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

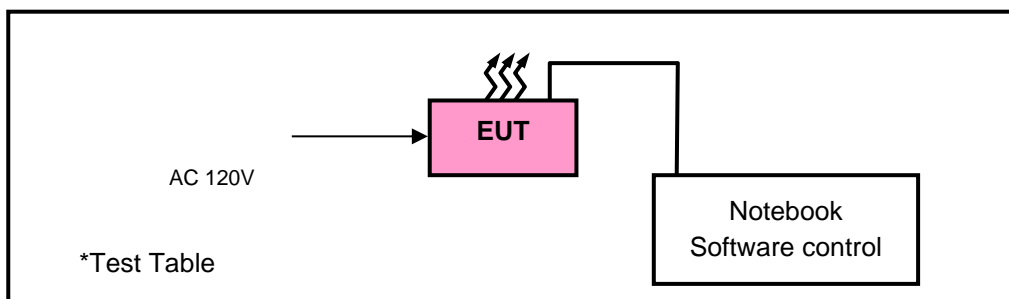
## 2.4 Description of Support Units

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

No.	Product	Brand	Model No.	Serial No.	FCC ID
1	Notebook	HUAWEI	NbD-WFH9	EUEPM21725002655	N/A
2	Notebook	DELL	Inspiron 14R Aluminum Edition	6WPG9-63PV4-RBPF2- T6RHW-W9GBP	N/A

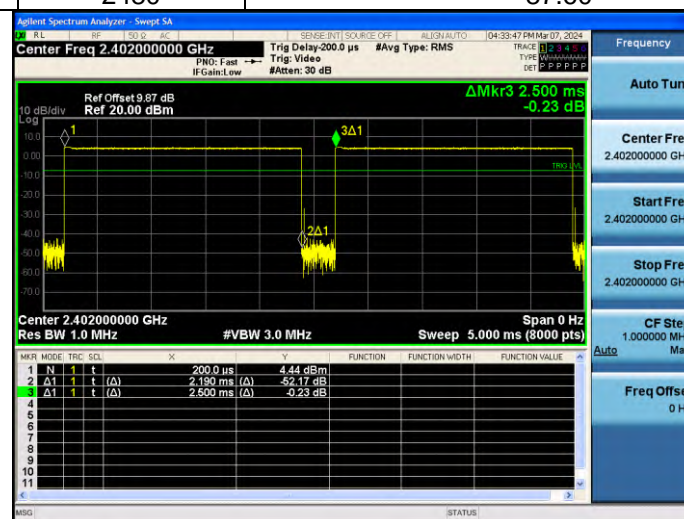
No.	Signal Cable Description of The Above Support Units
1.	USB extension cord: Unshielded, Detachable 1.2m;

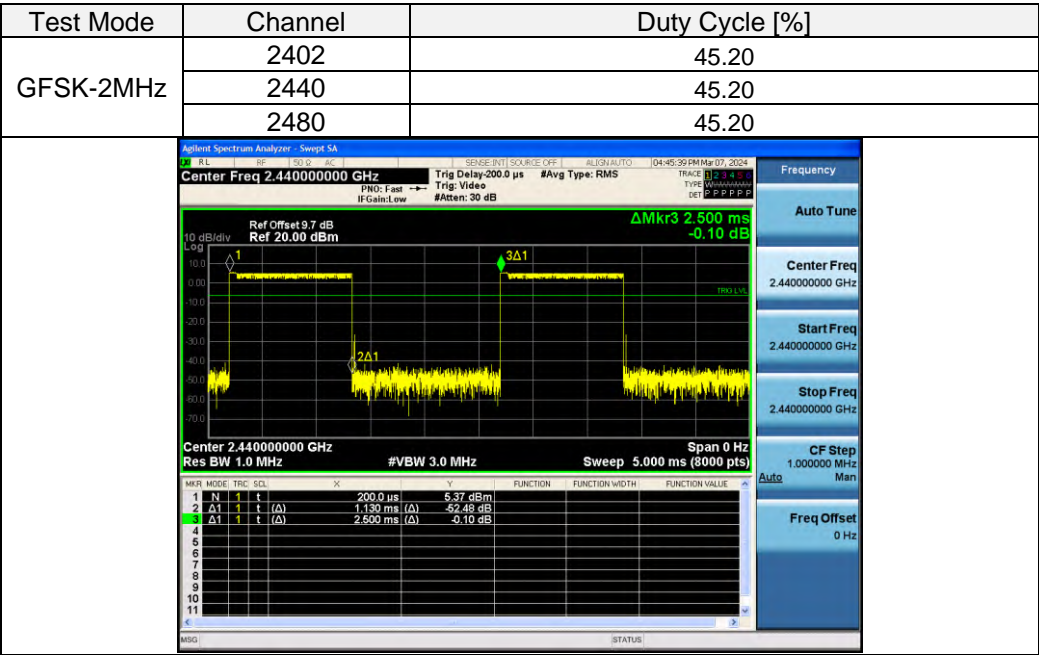
## 2.5 Configuration of System under Test



## 2.6 Duty Cycle of Test Signal

Test Mode	Channel	Duty Cycle [%]
GFSK-1MHz	2402	87.60
	2440	87.60
	2480	87.60





### 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	2024-12-17
3m Semi-anechoic Chamber	MAORUI	9m*6m*6m	NSEMC003	2026-03-12**
Test software	FARAD	FARAD	EZ_EMCV1.1.4.2	N/A
Loop Antenna	EMCI	HLA 6121	56735	2024-05-04*
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	2026-03-12**
EMI Test Receiver	Rohde&Schwarz	ESPI 7	101978	2024-12-17
Broadband antenna	Schwarzbeck	VULB 9168	00937	2024-08-18
Signal Amplifier	Com-power	PAM-103	18020051	2024-08-06
Attenuator	Rohde&Schwarz	TS2GA-6dB	18101101	N/A
Test software	FARAD	FARAD	EZ_EMCV1.1.4.2	N/A

Frequency Range above 1GHz:

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
3m Semi-anechoic Chamber	MAORUI	9m*6m*6m	NSEMC003	2026-03-12**
Horn Antenna	Schwarzbeck	BBHA 9120D	02202	2024-08-27*
Broadband Coaxial Preamplifier	Schwarzbeck	BBV 9718	25	2024-08-06
Spectrum	Keysight	N9020A	MY51240612	2024-08-06
Pre-Amplifier	EMCI	EMC 184045SE	9870709	2024-12-17
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 (\*) or 36 months (\*\*).
2. The test was performed in 966.

## 3.1.3 Test Procedures

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

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

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

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

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

**b. Average emission levels are measured by setting the instrument as follow:****● Trace averaging with continuous EUT transmission at full power**

If the EUT can be configured or modified to transmit continuously ( $D \geq 98\%$ ), 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 (Above 1GHz) 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 1GHz), which was mounted on the top of a variable-height antenna tower.
- 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:**

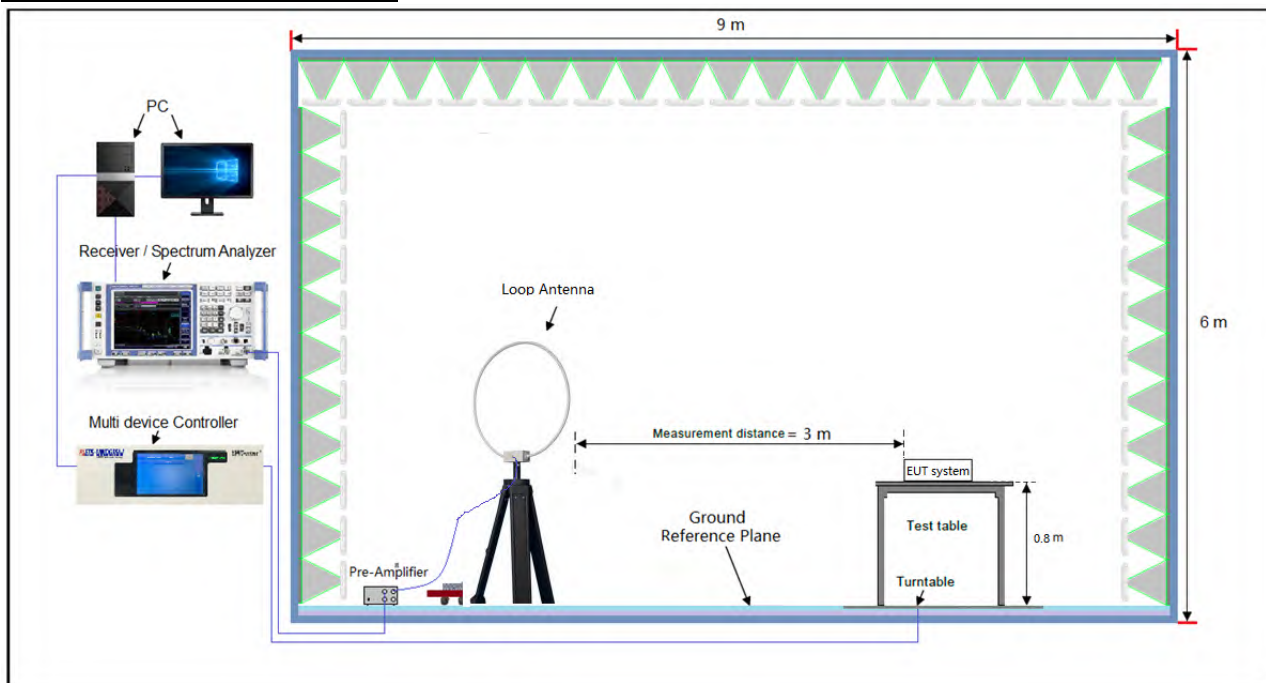
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz & 360kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth = 3 MHz for Peak detection (PK) at frequency above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

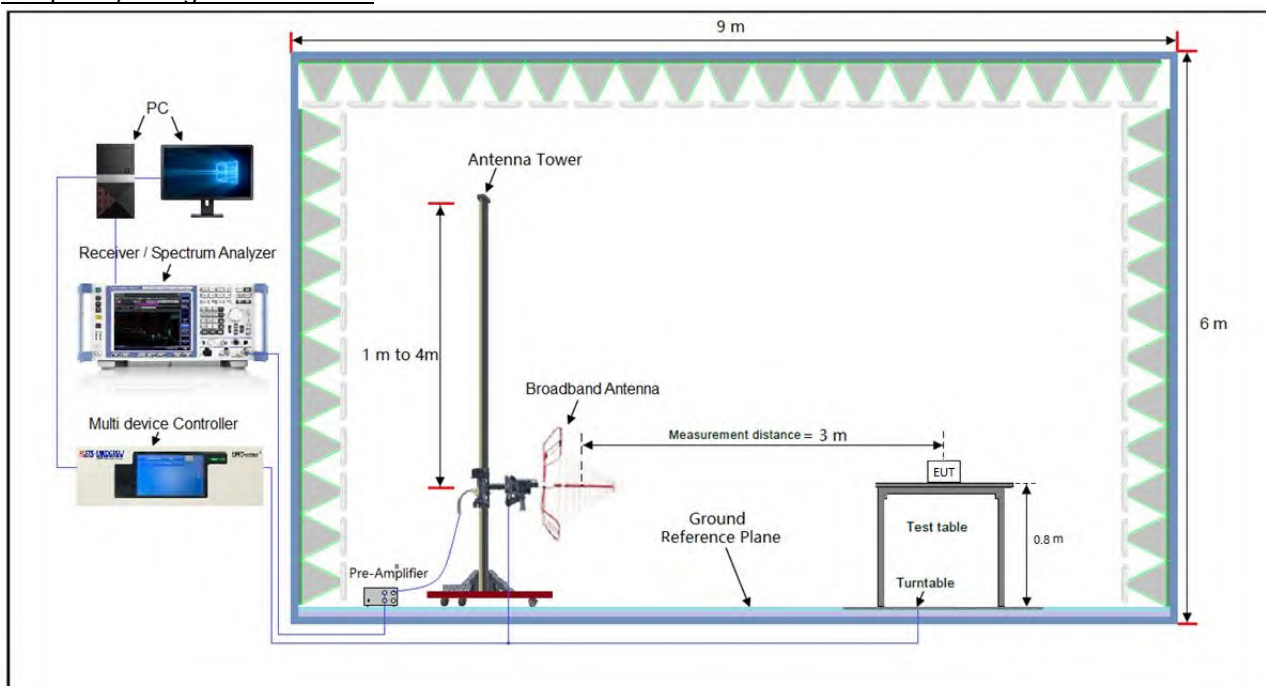
No deviation.

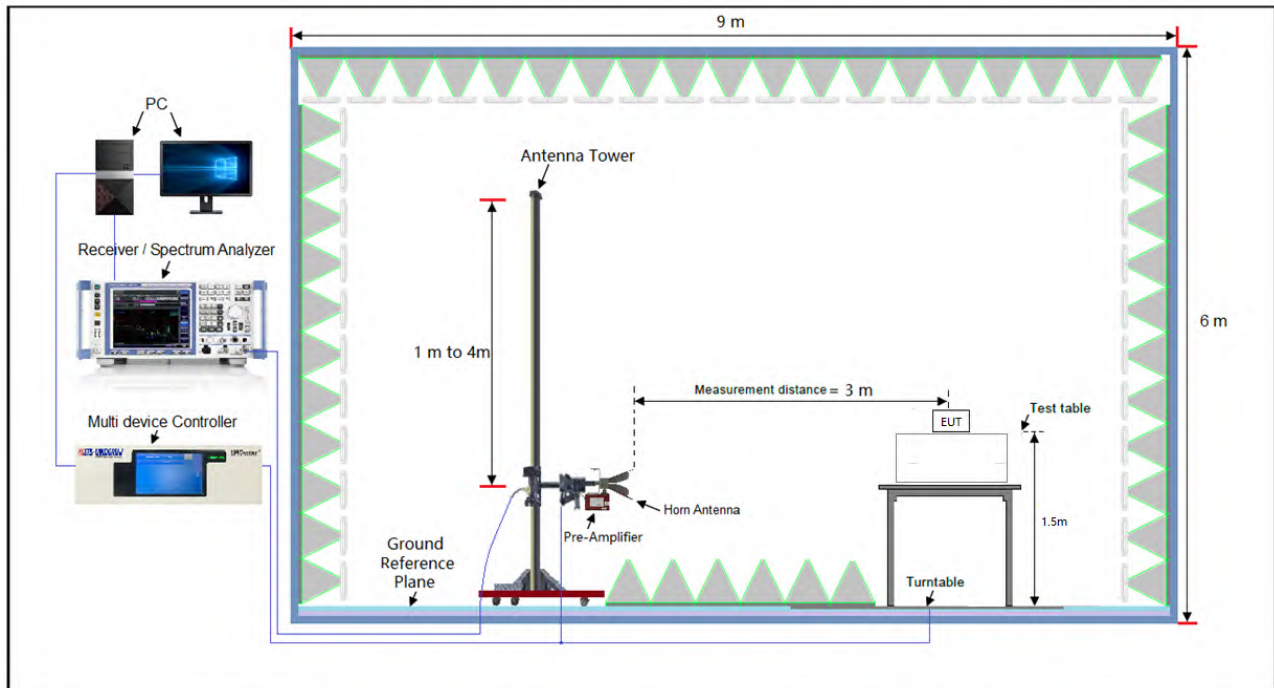
## 3.1.5 Test Setup

### Radiated emission below 30MHz:



### Frequency Range below 1GHz:



Frequency Range above 1GHz:

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.

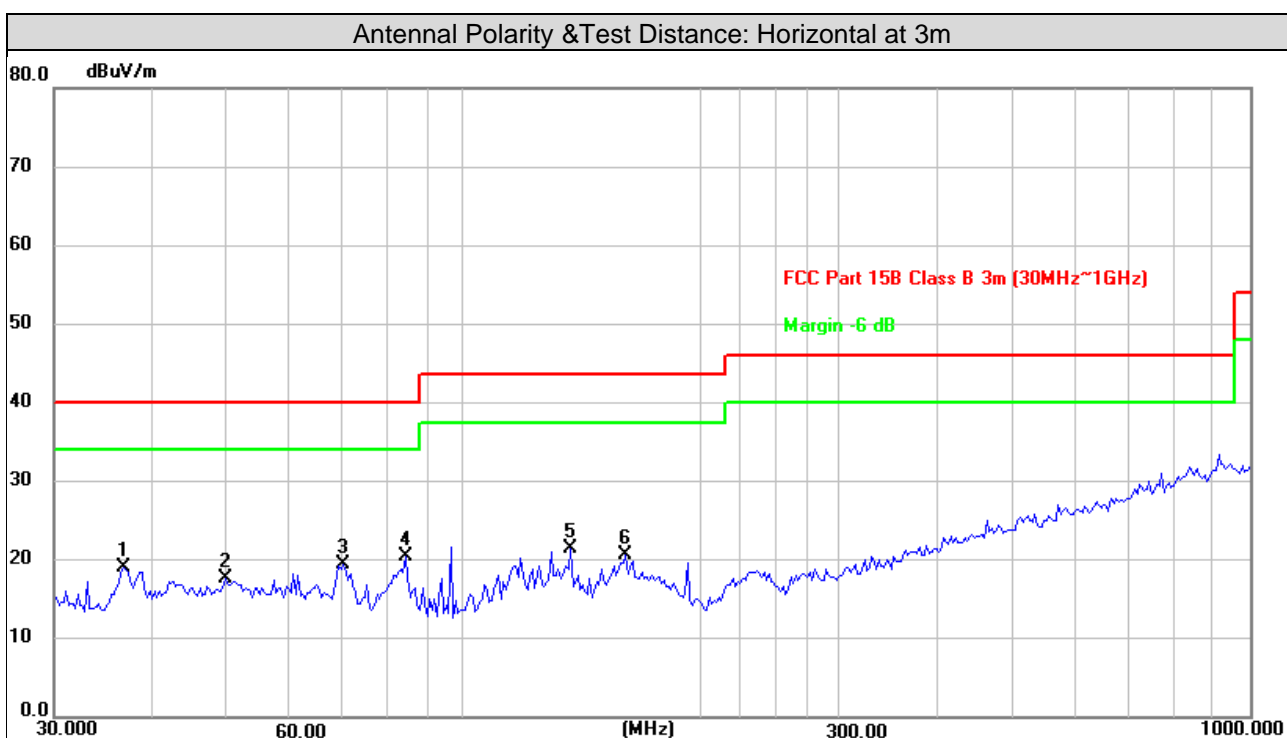
## 3.1.7 Test Results

### 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	Hua

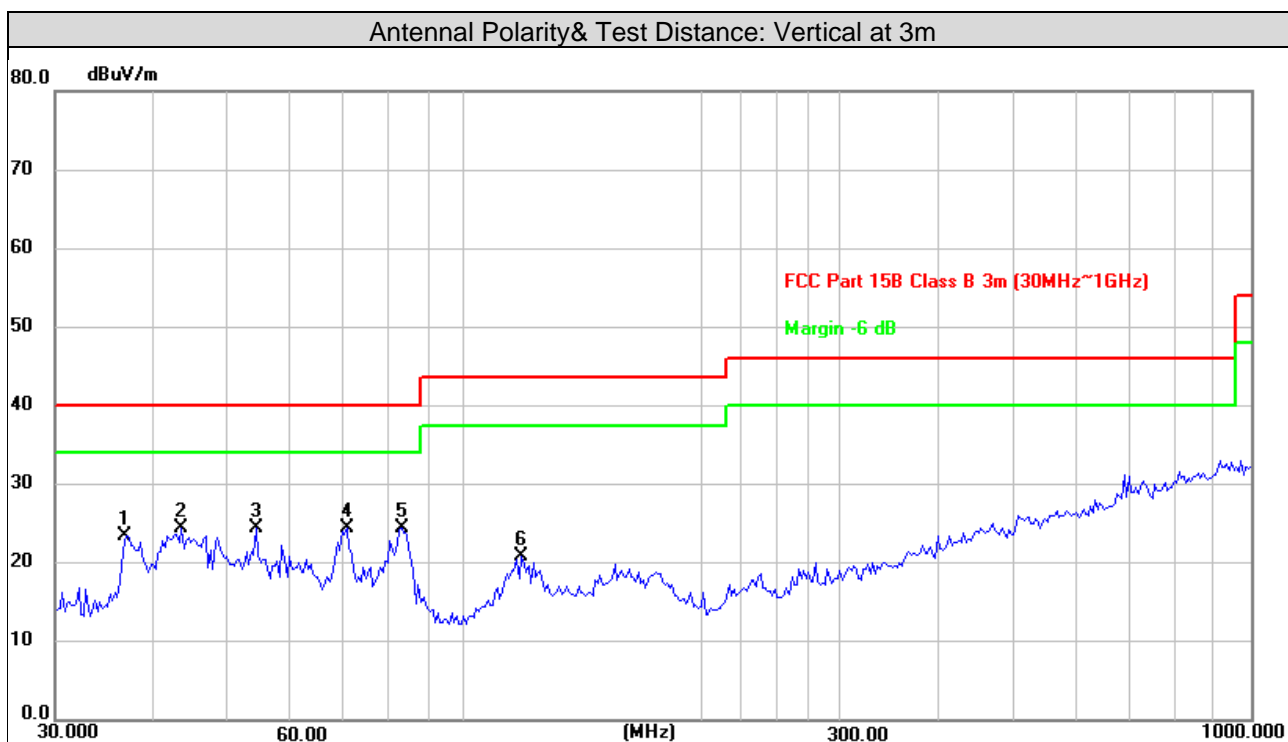


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1	36.7662	35.93	-16.84	19.09	40.00	-20.91	peak	263	189
2	49.7068	32.63	-14.92	17.71	40.00	-22.29	peak	150	246
3	70.0903	35.91	-16.54	19.37	40.00	-20.63	peak	208	326
4	84.1100	39.83	-19.40	20.43	40.00	-19.57	peak	173	114
5	136.4598	36.55	-15.19	21.36	43.50	-22.14	peak	226	203
6	160.3456	33.65	-13.09	20.56	43.50	-22.94	peak	243	173

### 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	Hua



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	37.0248	40.30	-16.78	23.52	40.00	-16.48	peak	136	169
2	43.5057	39.71	-15.19	24.52	40.00	-15.48	peak	100	240
3	54.0711	39.61	-15.27	24.34	40.00	-15.66	peak	127	273
4	70.5836	41.15	-16.67	24.48	40.00	-15.52	peak	115	225
5	82.9385	43.54	-19.10	24.44	40.00	-15.56	peak	102	183
6	117.7725	36.37	-15.62	20.75	43.50	-22.75	peak	142	10

Remarks:

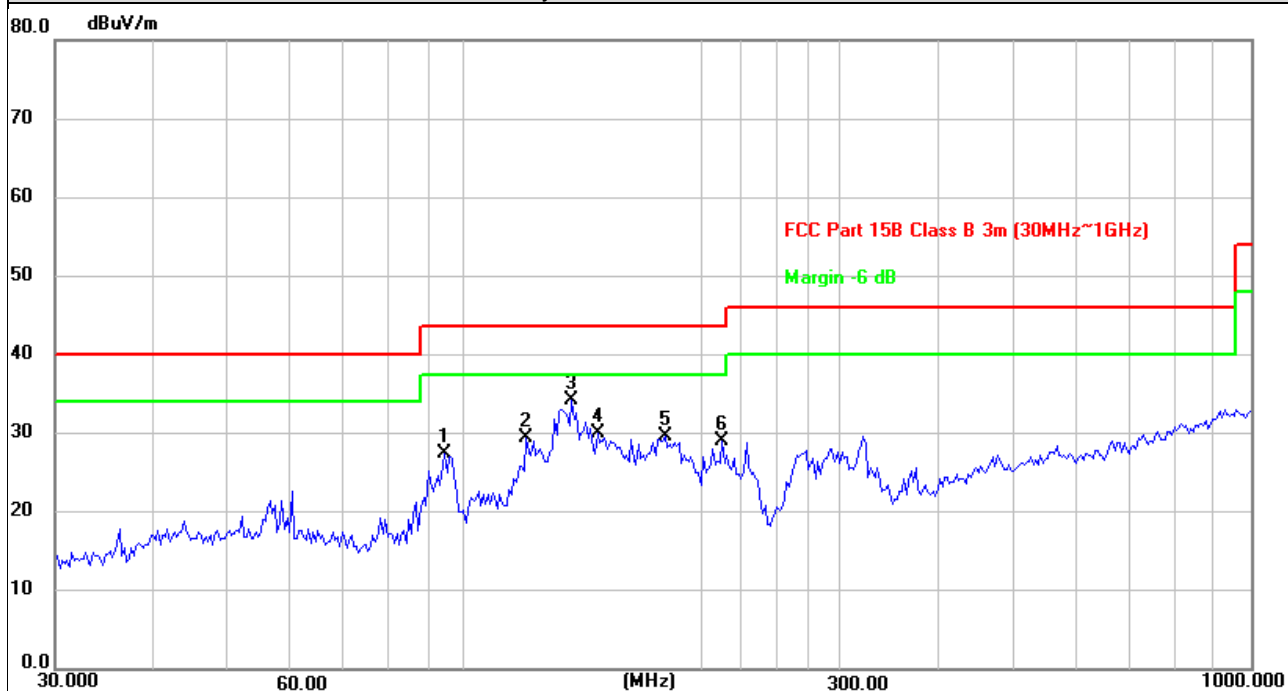
1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value



Test Report No.: 24012105-RF-US-02

Test Channel	JL7012 2480+JL7016 8DPSK 2441	Frequency Range	30MHz ~ 1GHz
Detector Function	Peak (PK) Quasi-peak (QP)	Tested By	Hua

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	94.0979	47.33	-19.89	27.44	43.50	-16.06	peak	252	252
2	119.4361	44.92	-15.40	29.52	43.50	-13.98	peak	185	227
3	136.4598	49.48	-15.19	34.29	43.50	-9.21	peak	166	183
4	147.4036	44.77	-14.83	29.94	43.50	-13.56	peak	204	194
5	179.3863	44.11	-14.54	29.57	43.50	-13.93	peak	173	165
6	212.2695	46.00	-16.90	29.10	43.50	-14.40	peak	200	140

Remarks:

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

Lab: [Hwa-Hsing \(Dongguan\) Testing Co., Ltd.](#)

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Tel: [0769-83078199](#)

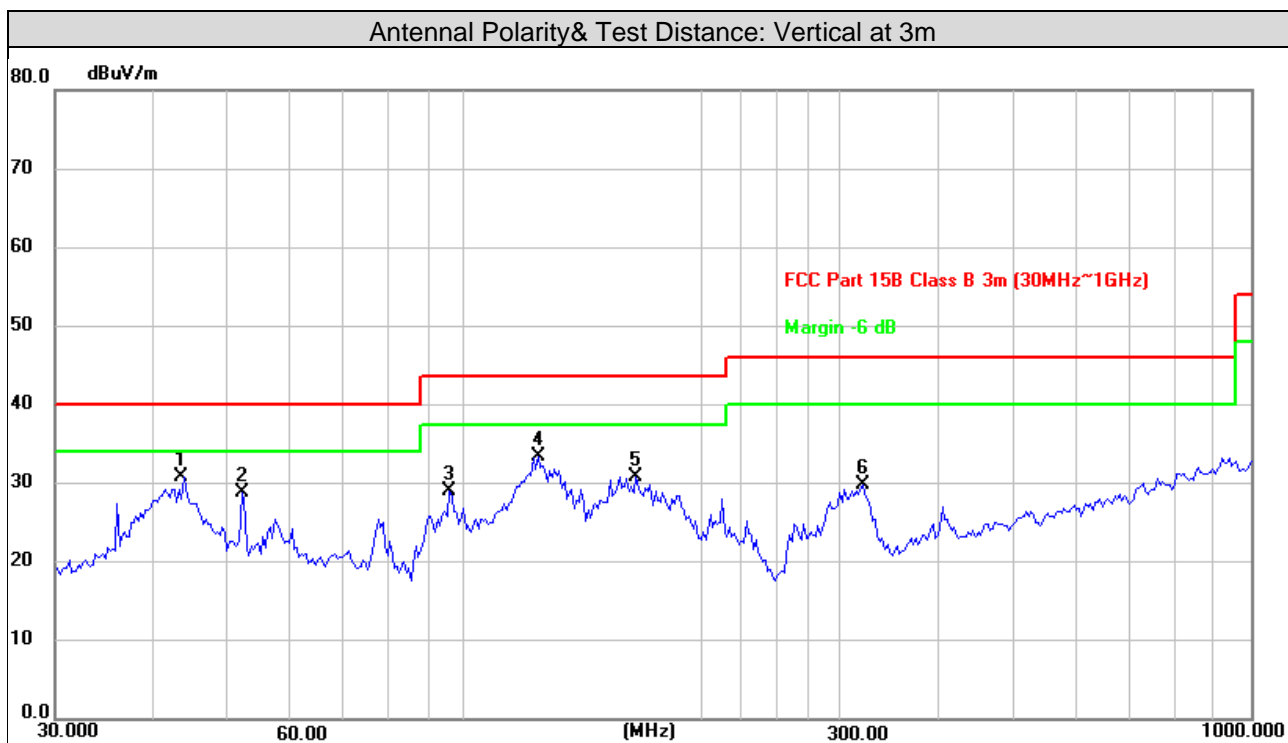
Web.: [www.hwa-hsing.com](#)

E-Mail: [customerservice.dg@hwa-hsing.com](#)

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[Ver. 1.5](#)

Test Channel	JL7012 2480+JL7016 8DPSK 2441	Frequency Range	30MHz ~ 1GHz
Detector Function	Peak (PK) Quasi-peak (QP)	Tested By	Hua



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	43.8119	45.91	-15.13	30.78	40.00	-9.22	peak	102	111
2	51.8430	43.84	-15.02	28.82	40.00	-11.18	peak	115	213
3	95.4270	48.75	-19.63	29.12	43.50	-14.38	peak	134	296
4	123.6985	48.67	-15.35	33.32	43.50	-10.18	peak	107	263
5	164.9075	44.53	-13.69	30.84	43.50	-12.66	peak	142	75
6	321.0608	42.55	-12.70	29.85	46.00	-16.15	peak	153	144

Remarks:

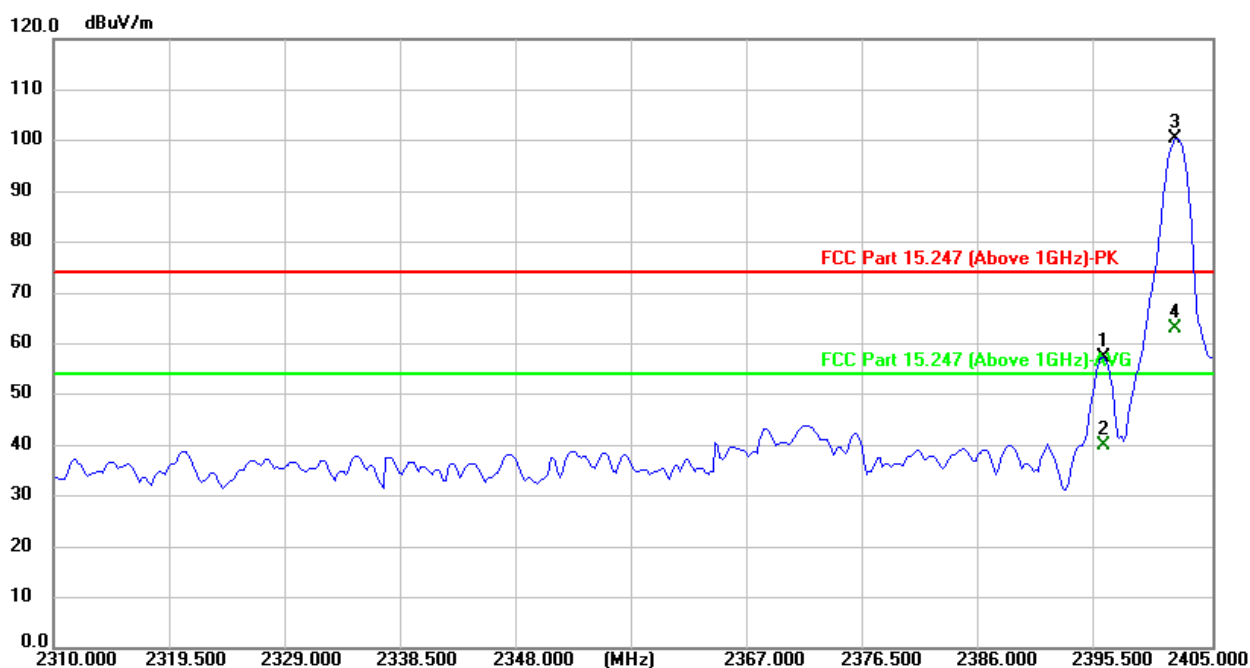
1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value

## Above 1GHz Data:

### BLE-1Mbps

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

#### 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	2396.052	57.80	-0.40	57.40	74.00	-16.60	peak	335	189
2	2396.052	40.30	-0.40	39.90	54.00	-14.10	AVG	335	189
3 #	2402.144	100.85	-0.39	100.46			peak	335	189
4 #	2402.144	63.25	-0.39	62.86			AVG	335	189
5	4804.000	41.72	5.30	47.02	74.00	-26.98	peak	237	200
6	4804.000	37.61	5.30	42.91	54.00	-11.09	AVG	237	200
7	7206.000	41.76	12.40	54.16	74.00	-19.84	peak	166	166
8	7206.000	30.67	12.40	43.07	54.00	-10.93	AVG	166	166
9	9608.000	40.27	15.83	56.10	74.00	-17.90	peak	215	185
10	9608.000	30.47	15.83	46.30	54.00	-7.70	AVG	215	185

#### Remarks:

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

Lab: [Hwa-Hsing \(Dongguan\) Testing Co., Ltd.](#)

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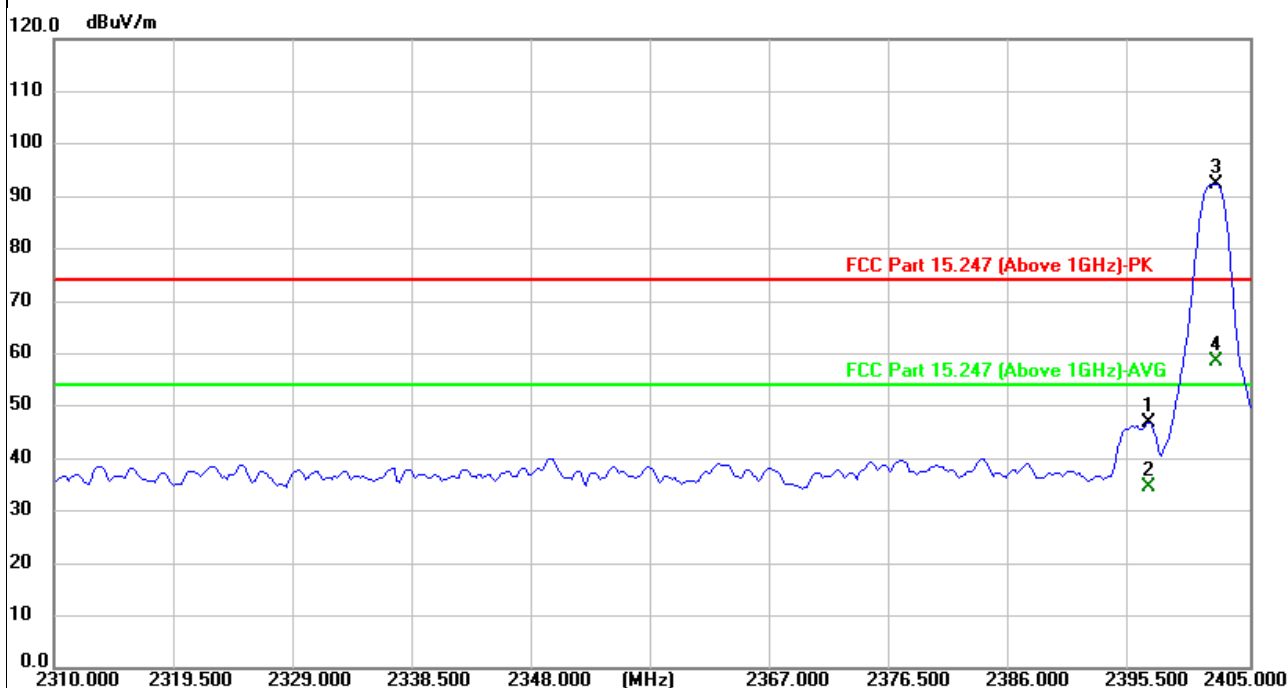
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[Ver. 1.5](#)



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

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	2397.004	47.20	-0.39	46.81	74.00	-27.19	peak	341	227
2	2397.004	34.82	-0.39	34.43	54.00	-19.57	AVG	341	227
3 #	2402.335	92.62	-0.39	92.23			peak	341	227
4 #	2402.335	58.92	-0.39	58.53			AVG	341	227
5	4804.000	43.81	5.30	49.11	74.00	-24.89	peak	112	225
6	4804.000	38.58	5.30	43.88	54.00	-10.12	AVG	112	225
7	7206.000	41.77	12.40	54.17	74.00	-19.83	peak	105	317
8	7206.000	30.98	12.40	43.38	54.00	-10.62	AVG	105	317
9	9608.000	41.08	15.83	56.91	74.00	-17.09	peak	137	104
10	9608.000	30.46	15.83	46.29	54.00	-7.71	AVG	137	104

Remarks:

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

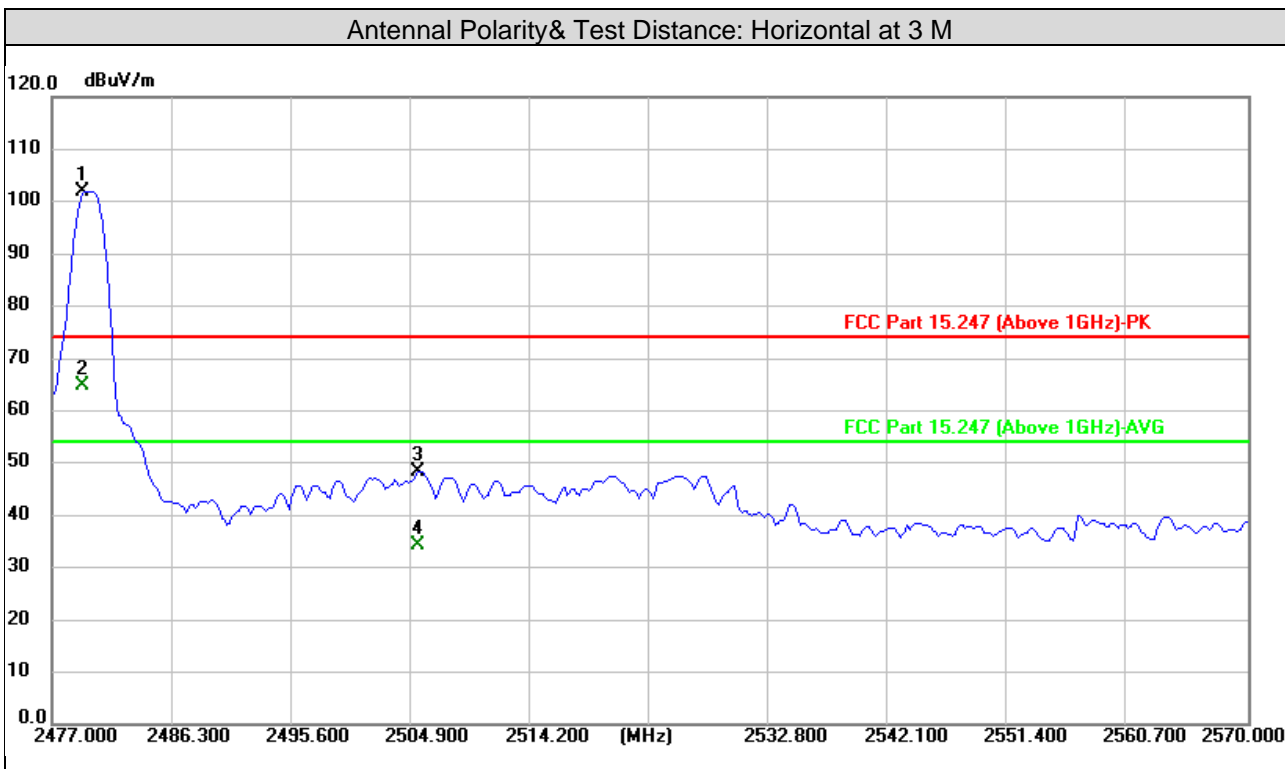
Test channel	Channel 19	Frequency Range	1GHz ~ 25GHz
Detector Function	Peak (PK) Average (AVG)	Tested By	Hua

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	101.65	-0.31			27.34	peak	359	178
2#	2440.000	65.18	-0.31			10.87	AVG	359	178
3	4880.000	41.44	6.25	47.69	74.00	-26.31	peak	225	66
4	4880.000	34.82	6.25	41.07	54.00	-12.93	AVG	225	66
5	7320.000	39.93	12.65	52.58	74.00	-21.42	peak	186	207
6	7320.000	30.55	12.65	43.20	54.00	-10.80	AVG	186	207
7	9760.000	40.32	16.24	56.56	74.00	-17.44	peak	237	327
8	9760.000	30.27	16.24	46.51	54.00	-7.49	AVG	237	327
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	102.77	-0.31			28.46	peak	286	167
2#	2440.000	65.25	-0.31			10.94	AVG	286	167
3	4880.000	41.95	6.25	48.20	74.00	-25.80	peak	227	187
4	4880.000	36.75	6.25	43.00	54.00	-11.00	AVG	227	187
5	7320.000	41.00	12.65	53.65	74.00	-20.35	peak	128	250
6	7320.000	30.85	12.65	43.50	54.00	-10.50	AVG	128	250
7	9760.000	42.09	16.24	58.33	74.00	-15.67	peak	116	316
8	9760.000	30.47	16.24	46.71	54.00	-7.29	AVG	116	316

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	Hua

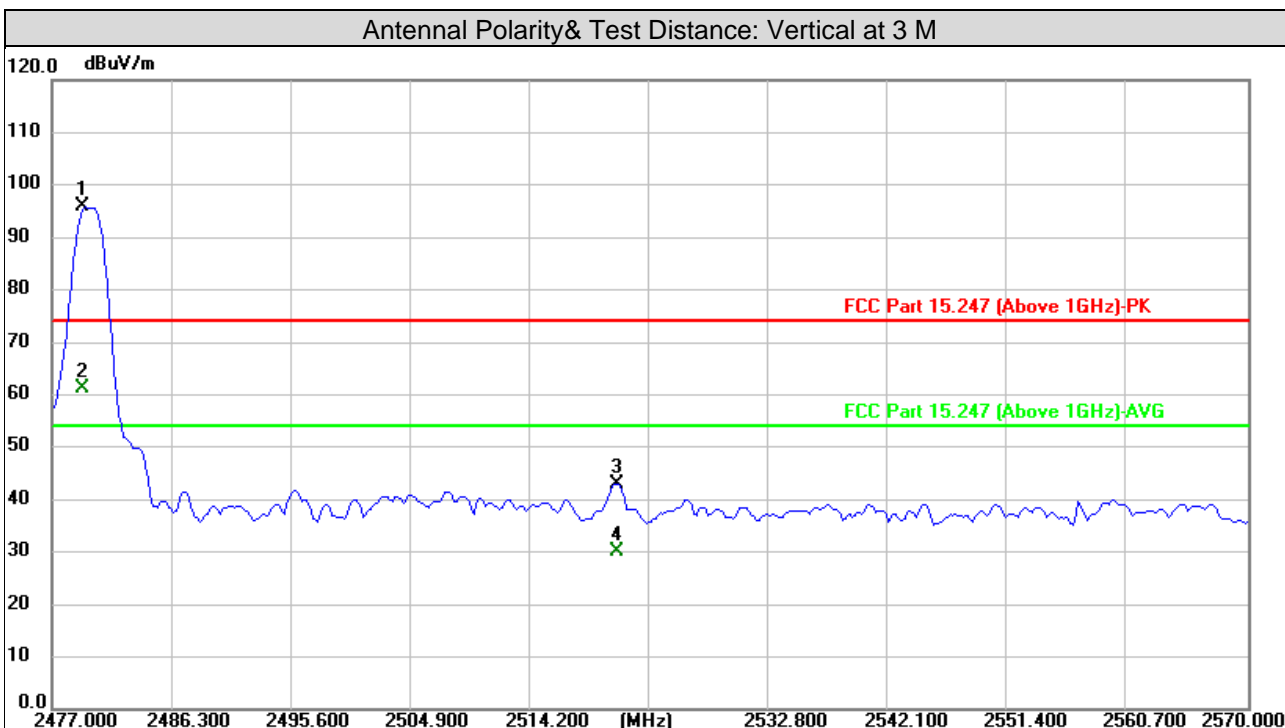


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1#	2479.609	102.19	-0.21			27.98	peak	345	182
2#	2479.609	65.00	-0.21			10.79	AVG	345	182
3	2505.701	48.47	-0.15	48.32	74.00	-25.68	peak	345	182
4	2523.220	30.94	-0.11	30.83	54.00	-23.17	AVG	100	43
5	4960.000	41.36	6.16	47.52	74.00	-26.48	peak	215	51
6	4960.000	34.38	6.16	40.54	54.00	-13.46	AVG	215	51
7	7440.000	40.30	12.91	53.21	74.00	-20.79	peak	186	163
8	7440.000	29.97	12.91	42.88	54.00	-11.12	AVG	186	163
9	9920.000	40.60	16.68	57.28	74.00	-16.72	peak	237	204
10	9920.000	31.52	16.68	48.20	54.00	-5.80	AVG	237	204

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	Hua



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#	2479.609	95.99	-0.21			21.78	peak	388	113
2#	2479.609	61.50	-0.21			7.29	AVG	388	113
3	2520.984	43.17	-0.12	43.05	74.00	-30.95	peak	388	113
4	2520.984	30.19	-0.12	30.07	54.00	-23.93	AVG	388	113
5	4960.000	41.30	6.16	47.46	74.00	-26.54	peak	107	209
6	4960.000	35.16	6.16	41.32	54.00	-12.68	AVG	107	209
7	7440.000	40.92	12.91	53.83	74.00	-20.17	peak	126	176
8	7440.000	30.16	12.91	43.07	54.00	-10.93	AVG	126	176
9	9920.000	40.82	16.68	57.50	74.00	-16.50	peak	115	238
10	9920.000	30.98	16.68	47.66	54.00	-6.34	AVG	115	238

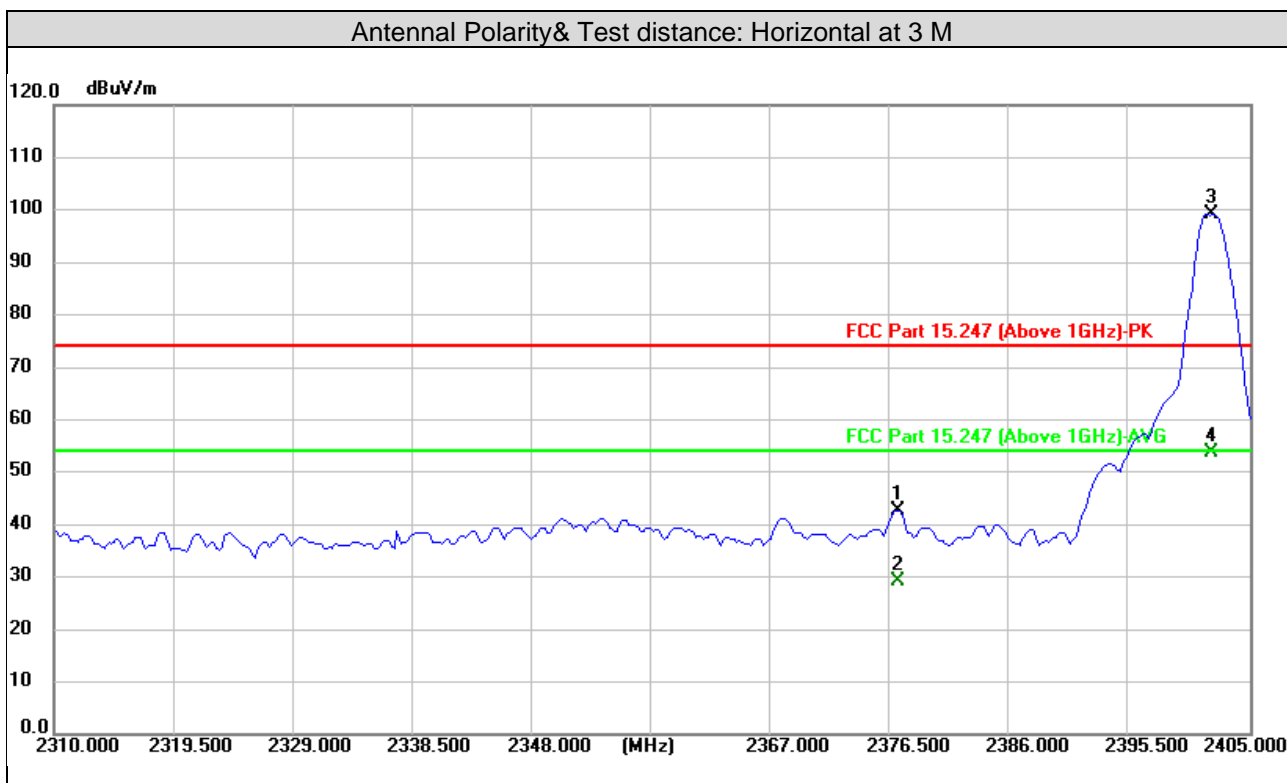
Remarks:

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

## Above 1GHz Data:

### BLE-2Mbps

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



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	2377.014	43.23	-0.44	42.79	74.00	-31.21	peak	328	187
2	2377.014	29.64	-0.44	29.20	54.00	-24.80	AVG	328	187
3 #	2402.144	99.63	-0.39	99.24	74.00	25.24	peak	328	187
4 #	2402.144	54.16	-0.39	53.77	54.00	-0.23	AVG	328	187
5	4804.000	42.00	5.30	47.30	74.00	-26.70	peak	221	316
6	4804.000	34.79	5.30	40.09	54.00	-13.91	AVG	221	316
7	7206.000	40.46	12.40	52.86	74.00	-21.14	peak	186	244
8	7206.000	30.60	12.40	43.00	54.00	-11.00	AVG	186	244
9	9608.000	41.44	15.83	57.27	74.00	-16.73	peak	204	119
10	9608.000	30.32	15.83	46.15	54.00	-7.85	AVG	204	119

#### Remarks:

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

Lab: [Hwa-Hsing \(Dongguan\) Testing Co., Ltd.](#)

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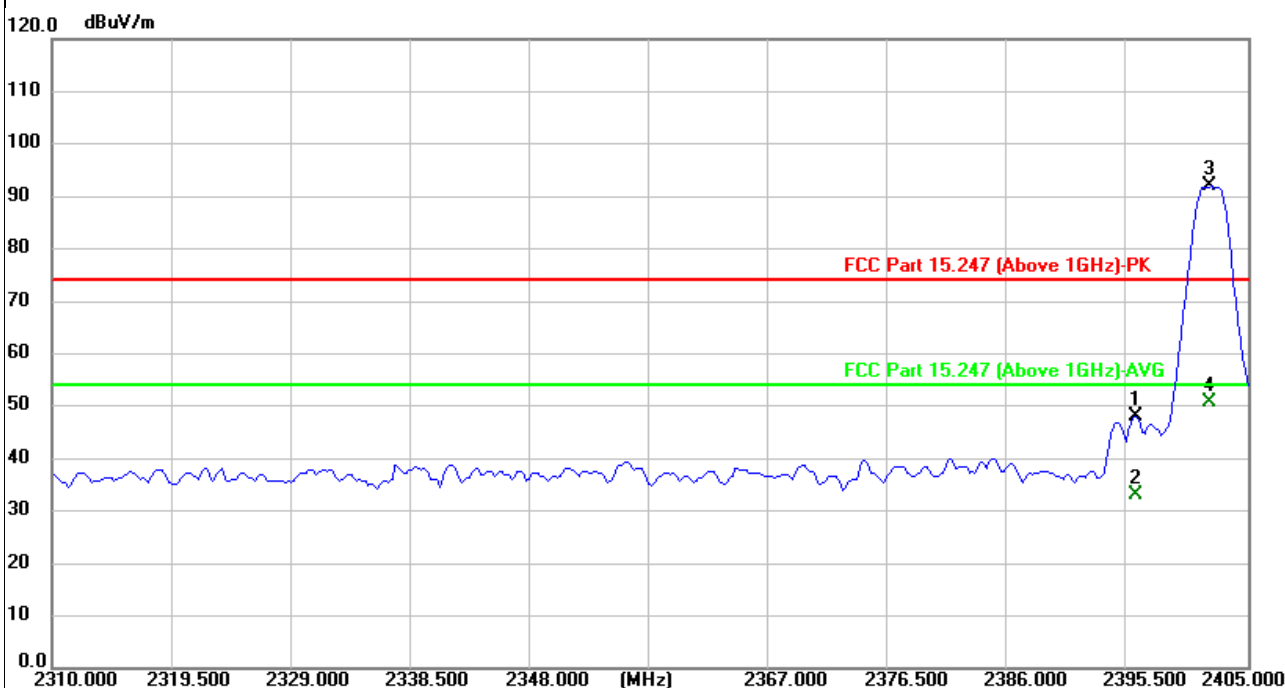
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Test channel	Channel 0	Frequency Range	1GHz ~ 25GHz
Detector Function	Peak (PK) Average (AVG)	Tested By	Hua

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	2396.052	48.39	-0.40	47.99	74.00	-26.01	peak	400	36
2	2396.052	33.41	-0.40	33.01	54.00	-20.99	AVG	400	36
3 #	2402.144	92.29	-0.39			17.90	peak	400	36
4 #	2402.144	51.20	-0.39			-3.19	AVG	400	36
5	4804.000	42.59	5.30	47.89	74.00	-26.11	peak	105	206
6	4804.000	35.80	5.30	41.10	54.00	-12.90	AVG	105	206
7	7206.000	41.67	12.40	54.07	74.00	-19.93	peak	127	115
8	7206.000	30.50	12.40	42.90	54.00	-11.10	AVG	127	115
9	9608.000	43.02	15.83	58.85	74.00	-15.15	peak	116	237
10	9608.000	30.12	15.83	45.95	54.00	-8.05	AVG	116	237

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 Report No.: 24012105-RF-US-02

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

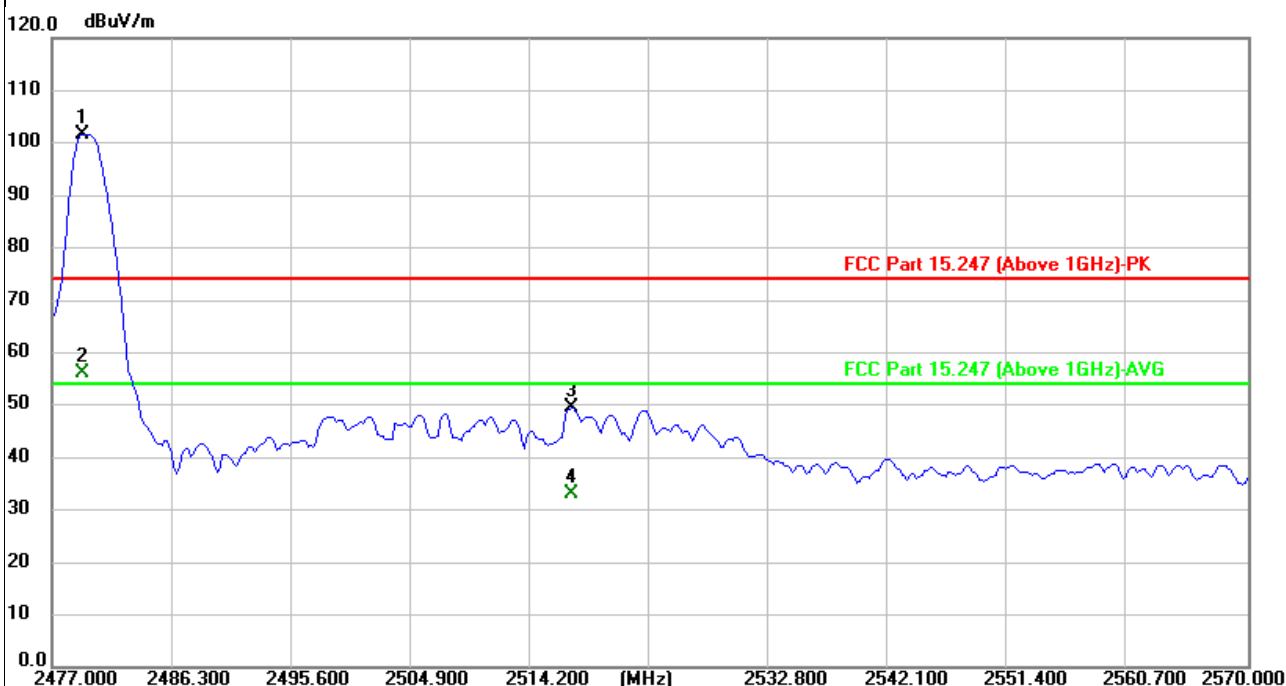
Antennal Polarity& Test Distance: Horizontal at 3m									
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1#	2440.000	102.30	-0.31			27.99	peak	364	175
2#	2440.000	56.85	-0.31			2.54	AVG	364	175
3	4880.000	40.92	6.25	47.17	74.00	-26.83	peak	163	169
4	4880.000	34.14	6.25	40.39	54.00	-13.61	AVG	163	169
5	7320.000	41.29	12.65	53.94	74.00	-20.06	peak	175	118
6	7320.000	30.06	12.65	42.71	54.00	-11.29	AVG	175	118
7	9760.000	39.19	16.24	55.43	74.00	-18.57	peak	220	202
8	9760.000	30.09	16.24	46.33	54.00	-7.67	AVG	220	202
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	54.89	-0.31			0.58	AVG	400	288
2#	2440.000	97.77	-0.31			43.46	AVG	400	288
3	4880.000	41.53	6.25	47.78	74.00	-26.22	peak	115	226
4	4880.000	34.88	6.25	41.13	54.00	-12.87	AVG	115	226
5	7320.000	40.06	12.65	52.71	74.00	-21.29	peak	128	273
6	7320.000	30.97	12.65	43.62	54.00	-10.38	AVG	128	273
7	9760.000	40.98	16.24	57.22	74.00	-16.78	peak	103	115
8	9760.000	30.31	16.24	46.55	54.00	-7.45	AVG	103	115

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	Hua

Antennal Polarity& Test Distance: Horizontal at 3 M

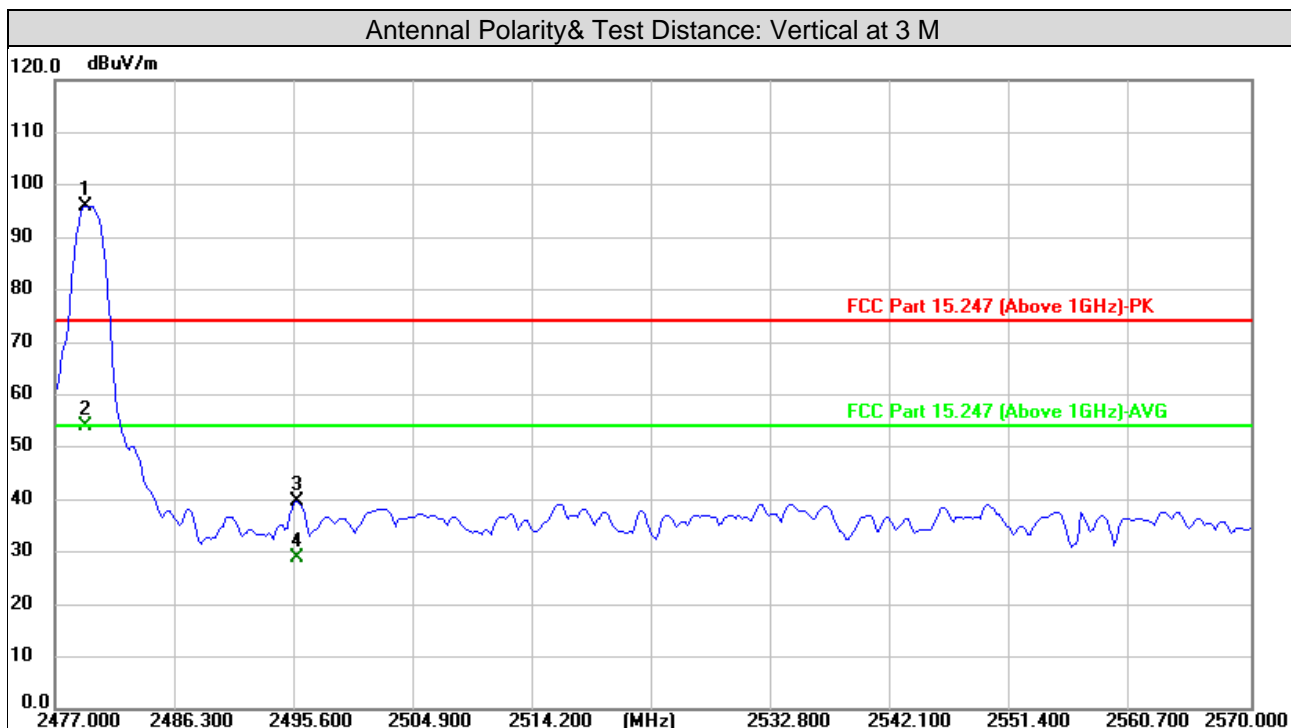


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)
1#	2479.423	101.94	-0.21	101.73	74.00	27.73	peak	343	182
2#	2479.423	56.31	-0.21	56.10	54.00	2.10	AVG	343	182
3	2517.443	49.54	-0.13	49.41	74.00	-24.59	peak	343	182
4	2517.443	33.17	-0.13	33.04	54.00	-20.96	AVG	343	182
5	4960.000	47.06	6.16	53.22	74.00	-20.78	peak	115	336
6	4960.000	36.46	6.16	42.62	54.00	-11.38	AVG	115	336
7	7440.000	42.34	12.91	55.25	74.00	-18.75	peak	163	276
8	7440.000	30.01	12.91	42.92	54.00	-11.08	AVG	163	276
9	9920.000	40.38	16.68	57.06	74.00	-16.94	peak	207	142
10	9920.000	31.17	16.68	47.85	54.00	-6.15	AVG	207	142

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	Hua



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#	2479.423	96.17	-0.21			21.96	peak	400	114
2#	2479.423	54.32	-0.21			0.11	AVG	400	114
3	2495.824	39.79	-0.18	39.61	74.00	-34.39	peak	400	114
4	2495.824	29.17	-0.18	28.99	54.00	-25.01	AVG	400	114
5	4960.000	40.63	6.16	46.79	74.00	-27.21	peak	138	169
6	4960.000	34.20	6.16	40.36	54.00	-13.64	AVG	138	169
7	7440.000	42.24	12.91	55.15	74.00	-18.85	peak	104	238
8	7440.000	29.70	12.91	42.61	54.00	-11.39	AVG	104	238
9	9920.000	41.66	16.68	58.34	74.00	-15.66	peak	115	66
10	9920.000	30.84	16.68	47.52	54.00	-6.48	AVG	115	66

Remarks:

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



## JL7012+JL7016

Test channel	JL7012 2480+JL7016 8DPSK 2441	Frequency Range	1GHz ~ 25GHz
Detector Function	Peak (PK) Average (AVG)	Tested By	Hua

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#	2441.000	100.56	-0.30	100.26			peak	295	277
2#	2441.000	55.59	-0.30	55.29			AVG	295	277
3#	2480.000	100.47	-0.21	100.26			peak	339	292
4#	2480.000	63.48	-0.21	63.27			AVG	339	292
5	4882.000	41.02	6.27	47.29	74.00	-26.71	peak	281	281
6	4882.000	35.00	6.27	41.27	54.00	-12.73	AVG	281	281
7	4960.000	41.36	6.16	47.52	74.00	-26.48	peak	374	108
8	4960.000	34.38	6.16	40.54	54.00	-13.46	AVG	374	108
9	7323.000	39.53	12.65	52.18	74.00	-21.82	peak	105	175
10	7323.000	28.64	12.65	41.29	54.00	-12.71	AVG	105	175
11	7440.000	40.30	12.91	53.21	74.00	-20.79	peak	192	59
12	7440.000	29.97	12.91	42.88	54.00	-11.12	AVG	192	59
13	9764.000	36.95	16.24	53.19	74.00	-20.81	peak	107	176
14	9764.000	28.62	16.24	44.86	54.00	-9.14	AVG	107	176
15	9920.000	40.60	16.68	57.28	74.00	-16.72	peak	202	18
16	9920.000	31.52	16.68	48.20	54.00	-5.80	AVG	202	18

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#	2441.000	52.51	-0.30	52.21	74.00	-21.79	peak	136	68
2#	2441.000	95.61	-0.30	95.31	54.00	41.31	AVG	136	68
3#	2480.000	94.28	-0.21	94.07	74.00	20.07	peak	150	129
4#	2480.000	60.55	-0.21	60.34	54.00	6.34	AVG	150	129
5	4882.000	41.25	6.27	47.52	74.00	-26.48	peak	104	346
6	4882.000	33.95	6.27	40.22	54.00	-13.78	AVG	104	346
7	4960.000	40.10	6.16	46.26	74.00	-27.74	peak	115	251
8	4960.000	36.17	6.16	42.33	54.00	-11.67	AVG	115	251
9	7323.000	40.01	12.65	52.66	74.00	-21.34	peak	168	202
10	7323.000	30.62	12.65	43.27	54.00	-10.73	AVG	168	202
11	7440.000	41.27	12.91	54.18	74.00	-19.82	peak	146	166
12	7440.000	29.35	12.91	42.26	54.00	-11.74	AVG	146	166
13	9764.000	39.95	16.24	56.19	74.00	-17.81	peak	107	91
14	9764.000	29.11	16.24	45.35	54.00	-8.65	AVG	107	91
15	9920.000	38.55	16.68	55.23	74.00	-18.77	peak	127	82
16	9920.000	28.49	16.68	45.17	54.00	-8.83	AVG	127	82

Lab: [Hwa-Hsing \(Dongguan\) Testing Co., Ltd.](#)

Address: [No.101, Building N1, Yuyuan 2 Road, Yuyuan Industrial Park, HuangJiang Town, Dongguan City, People's Republic of China](#)

Tel: [0769-83078199](#)

Web.: [www.hwa-hsing.com](#)

E-Mail: [customerservice.dg@hwa-hsing.com](#)

Release  
Ver. 1.5

Test Report No.: 24012105-RF-US-02

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value
3. #2480MHz&#2441MHz: Fundamental frequency.
4. This data is tested under JL7012 and JL7016 emission state.

**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**

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR 7	101962	2024-12-17
Artificial Mains Network	Rohde&Schwarz	ENV216	3560.6550.15	2024-12-17
Test software	FARAD	EZ_EMV V1.1.4.2	N/A	N/A
Broadcast test system	R&S	SFU	100410	2024-08-06

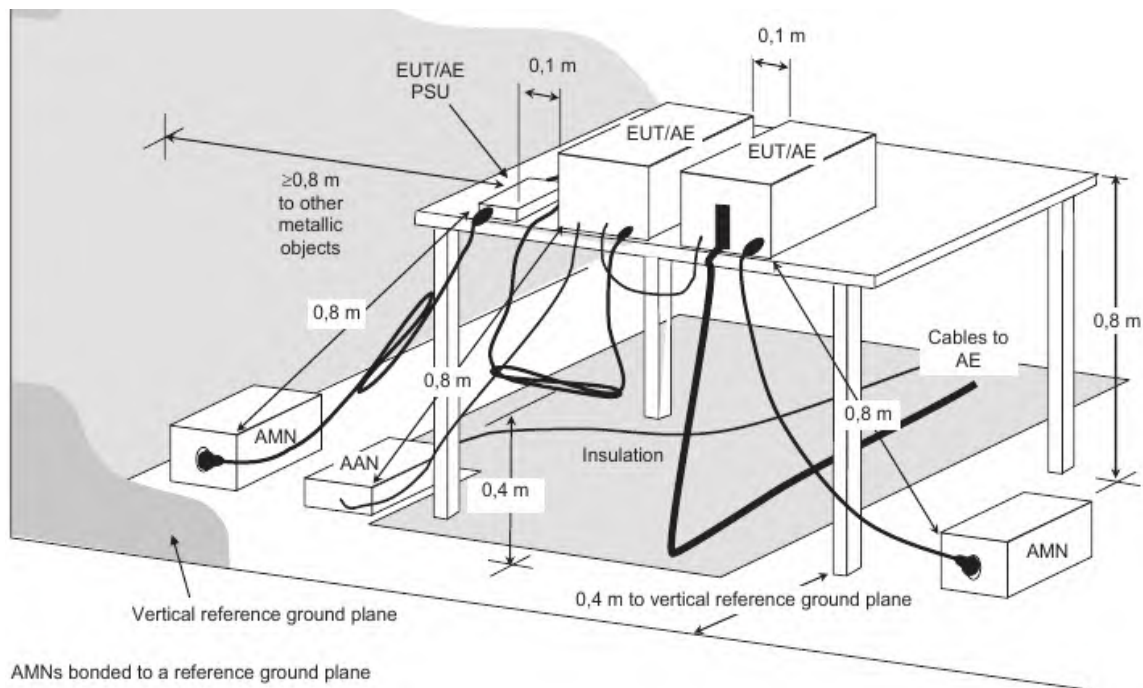
Note: 1. The calibration interval of the above test instruments is 12 months.  
2. The test was performed in Shielded Room.

### 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 Test Setup



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

### 3.2.5 EUT Operating Condition

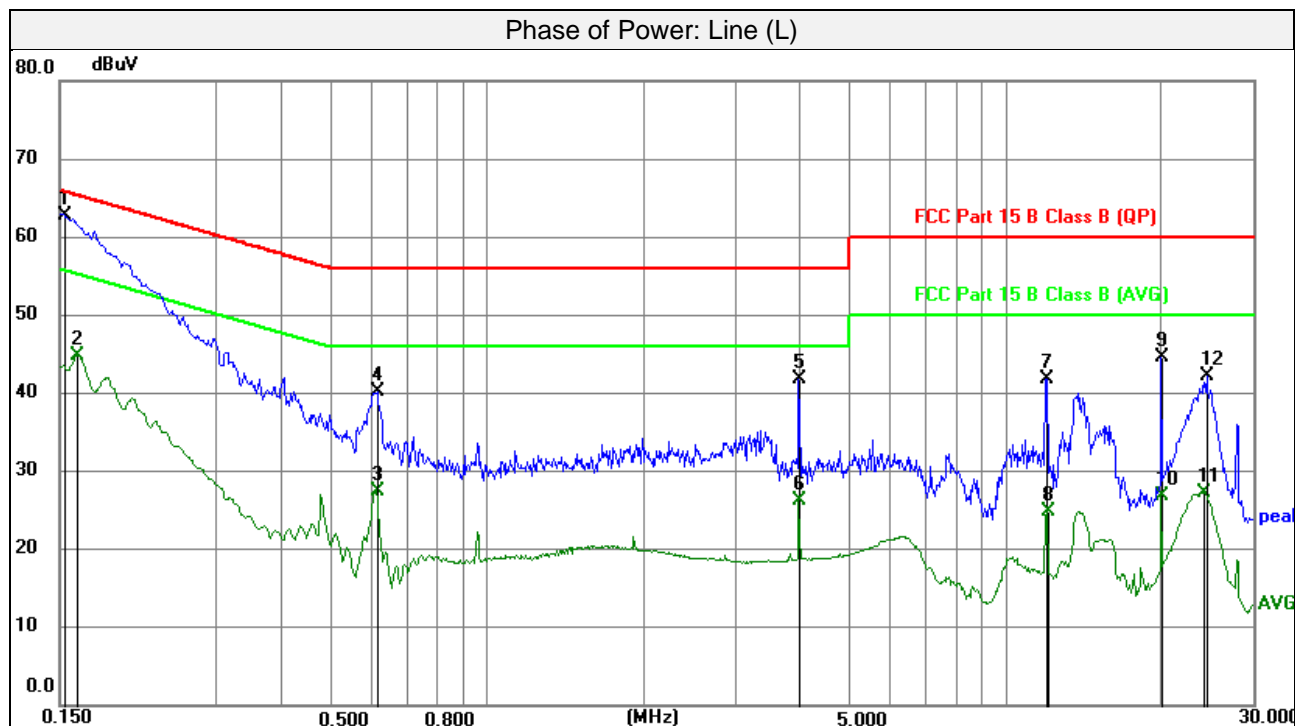
Set the EUT under transmission condition continuously at specific channel frequency.

### 3.2.6 Deviation from Test Standard

No deviation.

3.2.7 Test Results

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

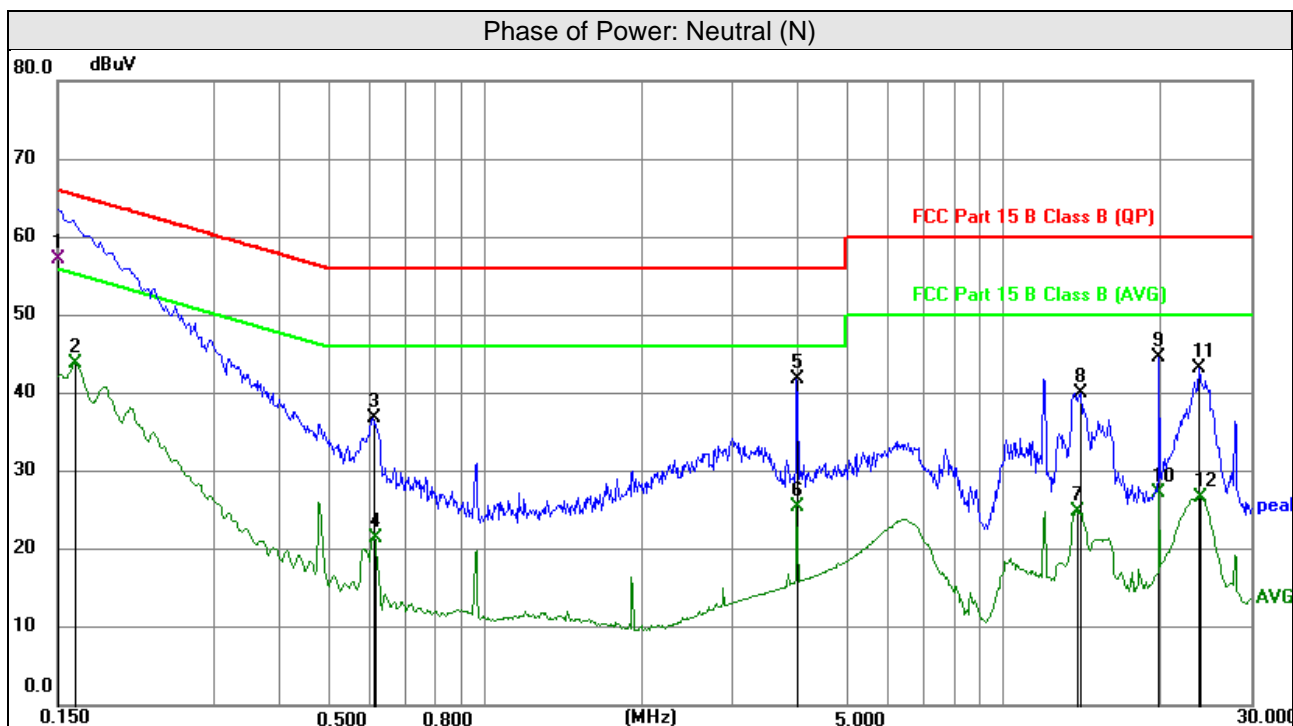


No.	Frequency (MHz)	Reading (dBuV)	Correction Factor dB	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)	Remark Detector
1	0.1532	52.61	10.18	62.79	65.82	-3.03	peak
2	0.1613	34.63	10.17	44.80	55.40	-10.60	AVG
3	0.6112	17.39	10.10	27.49	46.00	-18.51	AVG
4	0.6157	30.06	10.10	40.16	56.00	-15.84	peak
5	3.9998	31.70	10.10	41.80	56.00	-14.20	peak
6	3.9998	16.13	10.10	26.23	46.00	-19.77	AVG
7	11.9940	31.63	10.17	41.80	60.00	-18.20	peak
8	12.0008	14.68	10.17	24.85	50.00	-25.15	AVG
9	20.0018	34.15	10.40	44.55	60.00	-15.45	peak
10	20.0018	16.50	10.40	26.90	50.00	-23.10	AVG
11	24.0855	16.96	10.37	27.33	50.00	-22.67	AVG
12	24.4028	31.83	10.37	42.20	60.00	-17.80	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.

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



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor dB	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)	Remark Detector
1	0.1500	46.95	10.19	57.14	66.00	-8.86	QP
2	0.1613	33.65	10.17	43.82	55.40	-11.58	AVG
3	0.6090	26.66	10.10	36.76	56.00	-19.24	peak
4	0.6112	11.41	10.10	21.51	46.00	-24.49	AVG
5	3.9998	31.67	10.10	41.77	56.00	-14.23	peak
6	3.9998	15.39	10.10	25.49	46.00	-20.51	AVG
7	13.8165	14.56	10.25	24.81	50.00	-25.19	AVG
8	14.0730	29.76	10.25	40.01	60.00	-19.99	peak
9	19.9995	34.15	10.40	44.55	60.00	-15.45	peak
10	19.9995	16.80	10.40	27.20	50.00	-22.80	AVG
11	23.8245	32.82	10.41	43.23	60.00	-16.77	peak
12	23.9370	16.25	10.41	26.66	50.00	-23.34	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.

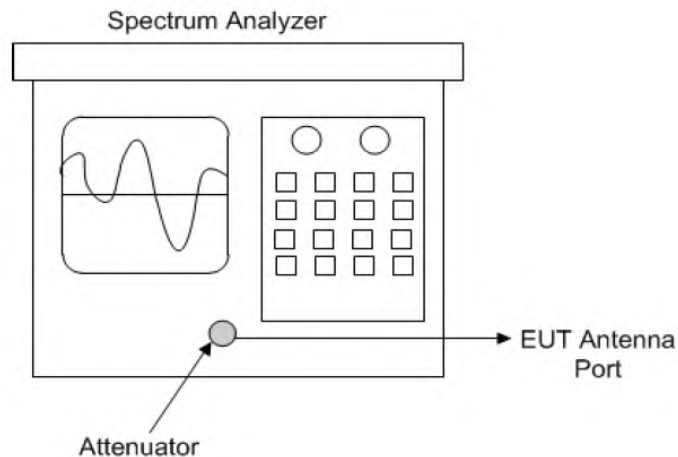
### 3.3 6dB Bandwidth Measurement

#### 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:

- a. Set resolution bandwidth (RBW) = 30kHz
- b. Set the video bandwidth (VBW)  $\geq 3 \times$  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  $\geq 3 \times$  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  $\geq 6$  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

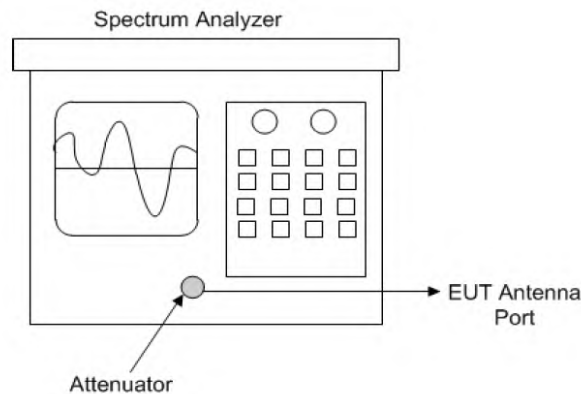
BLE-1Mbps			
Operation Channel	Frequency	Occupied Bandwidth (MHz)	
		Result	Limit
0	2402MHz	0.660	>0.5
19	2440MHz	0.656	>0.5
39	2480MHz	0.660	>0.5

BLE-2Mbps			
Operation Channel	Frequency	Occupied Bandwidth (MHz)	
		Result	Limit
0	2402MHz	1.104	>0.5
19	2440MHz	1.108	>0.5
39	2480MHz	1.112	>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

BLE-1Mbps			
Operation Channel	Frequency	Occupied Bandwidth (MHz)	
		Result	Limit
0	2402MHz	1.017	2400~2483.5
19	2440MHz	1.011	2400~2483.5
39	2480MHz	1.022	2400~2483.5

BLE-2Mbps			
Operation Channel	Frequency	Occupied Bandwidth (MHz)	
		Result	Limit
0	2402MHz	2.080	2400~2483.5
19	2440MHz	2.007	2400~2483.5
39	2480MHz	2.076	2400~2483.5



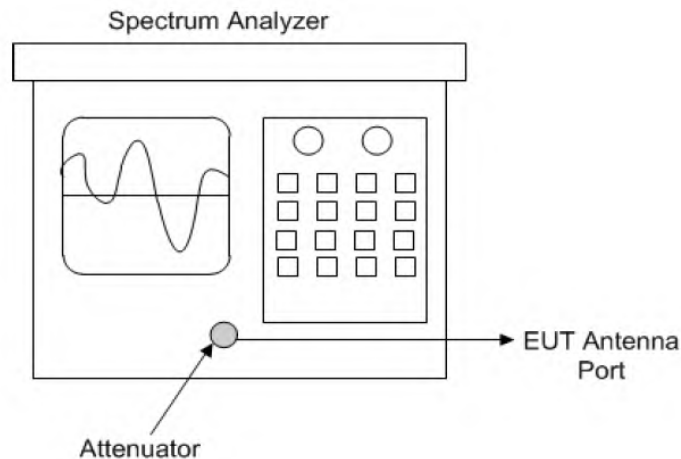
### 3.5 Conducted Output Power Measurement

#### 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.

Test Report No.: 24012105-RF-US-02

☒ 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 (Method AVGSA-2):

- 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  $\leq$  (number of points in sweep)  $\times$  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

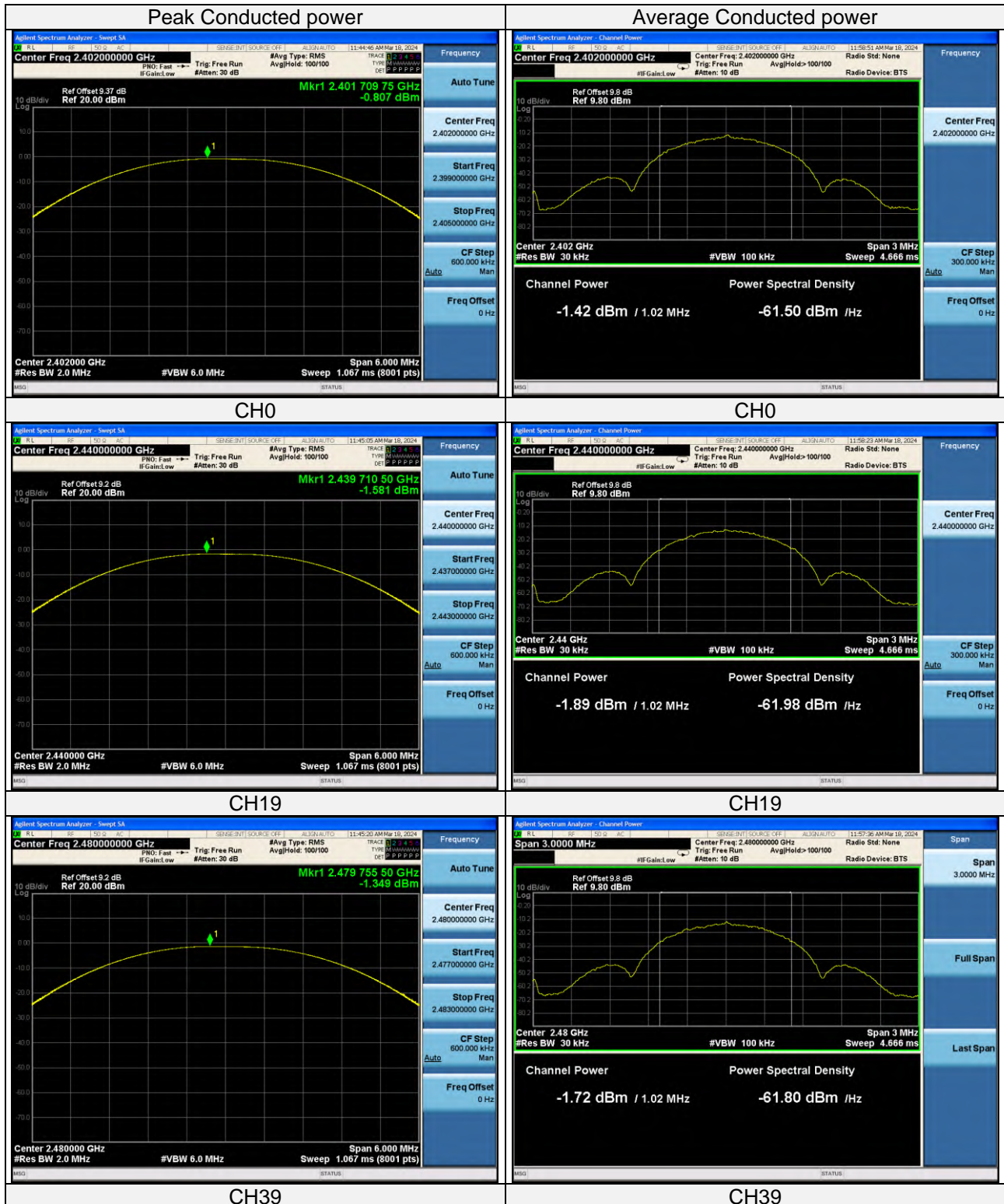
BLE-1Mbps						
Peak Power						
Channel	Freq.	RF Output Power		Limit (mW)		Verdict
No.	(MHz)	(dBm)	(mW)	Rss-247	FCC	
0	2402	-0.81	0.830	<125	<1000	Pass
19	2440	-1.58	0.695	<125	<1000	Pass
39	2480	-1.34	0.735	<125	<1000	Pass

BLE-1Mbps						
Average Power						
Channel	Freq.	RF Output Power		Limit (mW)		Verdict
No.	(MHz)	(dBm)	(mW)	Rss-247	FCC	
0	2402	-1.42	0.721	<125	<1000	Pass
19	2440	-1.89	0.647	<125	<1000	Pass
39	2480	-1.72	0.673	<125	<1000	Pass

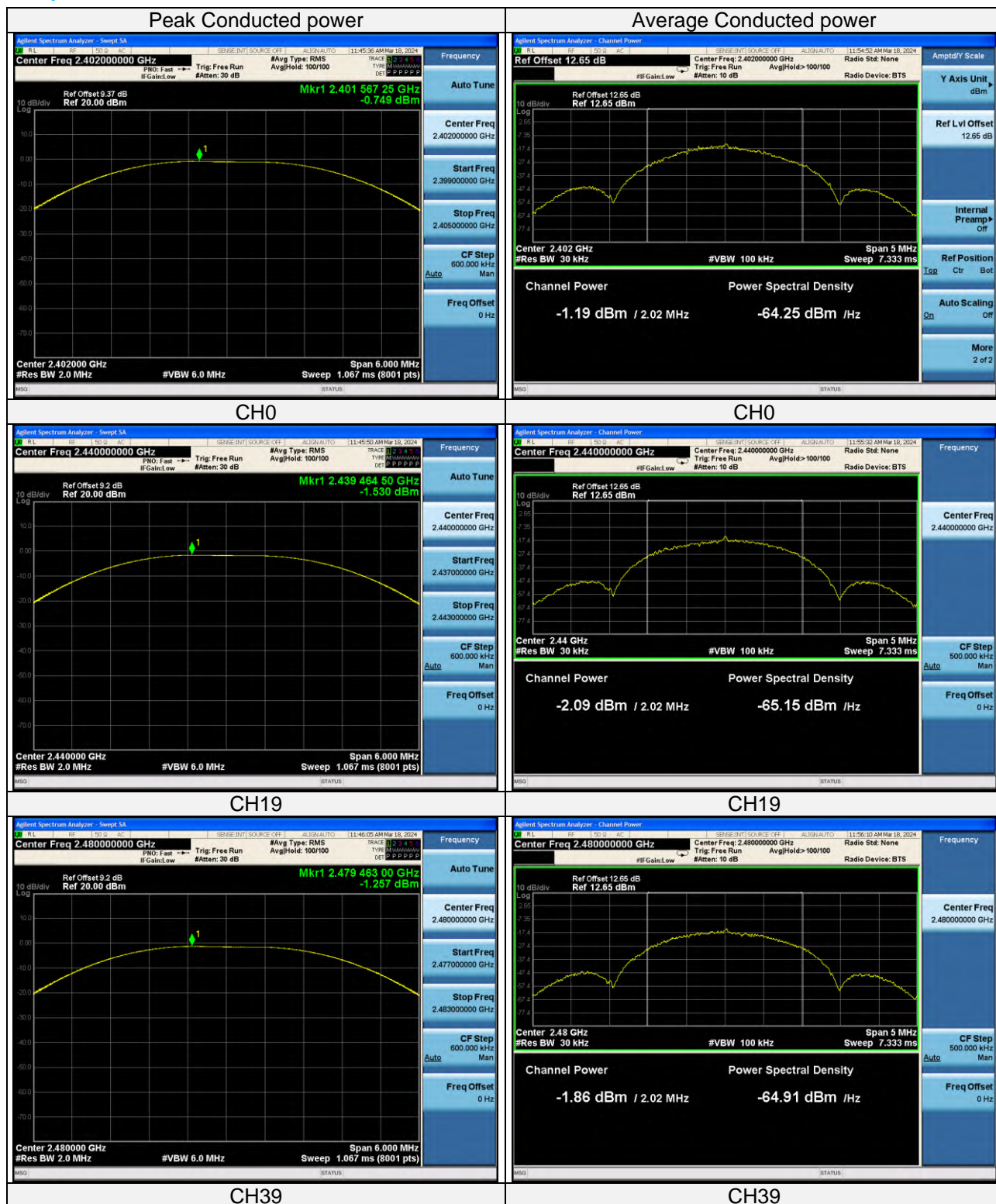
BLE-2Mbps						
Peak Power						
Channel	Freq.	RF Output Power		Limit (mW)		Verdict
No.	(MHz)	(dBm)	(mW)	Rss-247	FCC	
0	2402	-0.75	0.841	<125	<1000	Pass
19	2440	-1.53	0.703	<125	<1000	Pass
39	2480	-1.25	0.750	<125	<1000	Pass

BLE-2Mbps						
Average Power						
Channel	Freq.	RF Output Power		Limit (mW)		Verdict
No.	(MHz)	(dBm)	(mW)	Rss-247	FCC	
0	2402	-1.19	0.760	<125	<1000	Pass
19	2440	-2.09	0.618	<125	<1000	Pass
39	2480	-1.86	0.652	<125	<1000	Pass

1Mbps



## 2Mbps



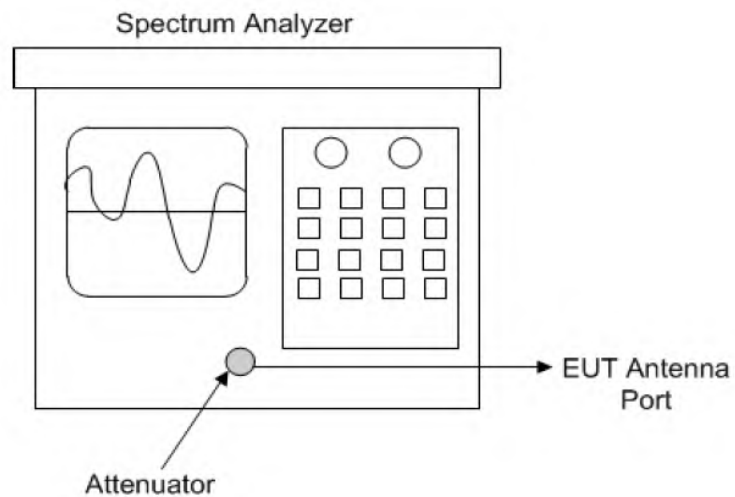
### 3.6 Power Spectral Density Measurement

#### 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 AVGPSD-1 or method AVGPSD-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 AVGPSD-2 or method AVGPSD-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 AVGPSD-3 or method AVGPSD-3A (alternative)** shall be applied if the conditions of the preceding paragraphs a) and b) cannot be achieved.

#### 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  $\pm 2\%$ ),

#### 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.

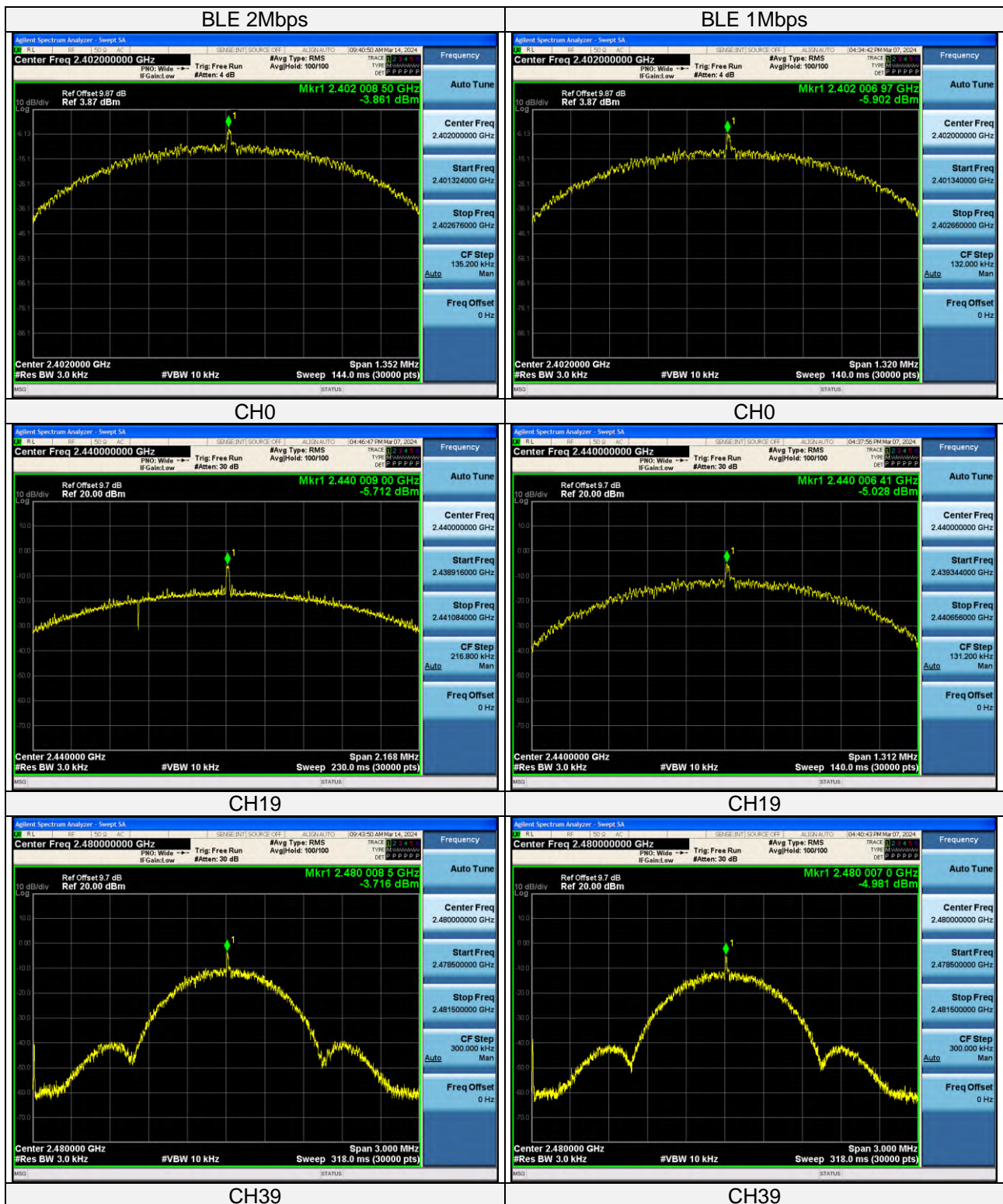
### 3.6.6 EUT Operating Condition

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/10kHz)	Limit (dBm/3kHz)
0	2402MHz	-5.90	<8
19	2440MHz	-5.02	<8
39	2480MHz	-4.98	<8

BLE-2Mbps	Power Density		
Test Channel	Channel Frequency	Test Result (dBm/10kHz)	Limit (dBm/3kHz)
0	2402MHz	-3.86	<8
19	2440MHz	-5.71	<8
39	2480MHz	-3.71	<8



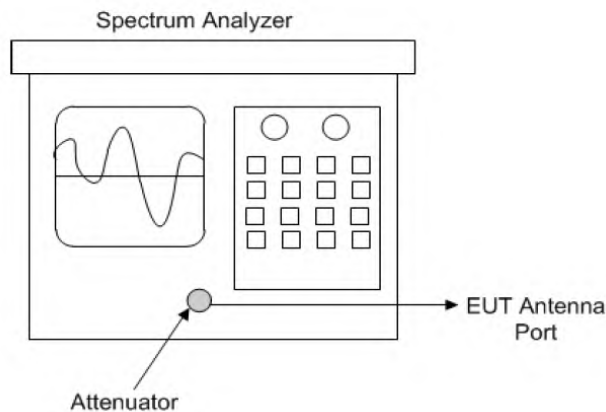
### 3.7 Conducted Out of Band Emission Measurement

#### 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  $\geq 300$  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.

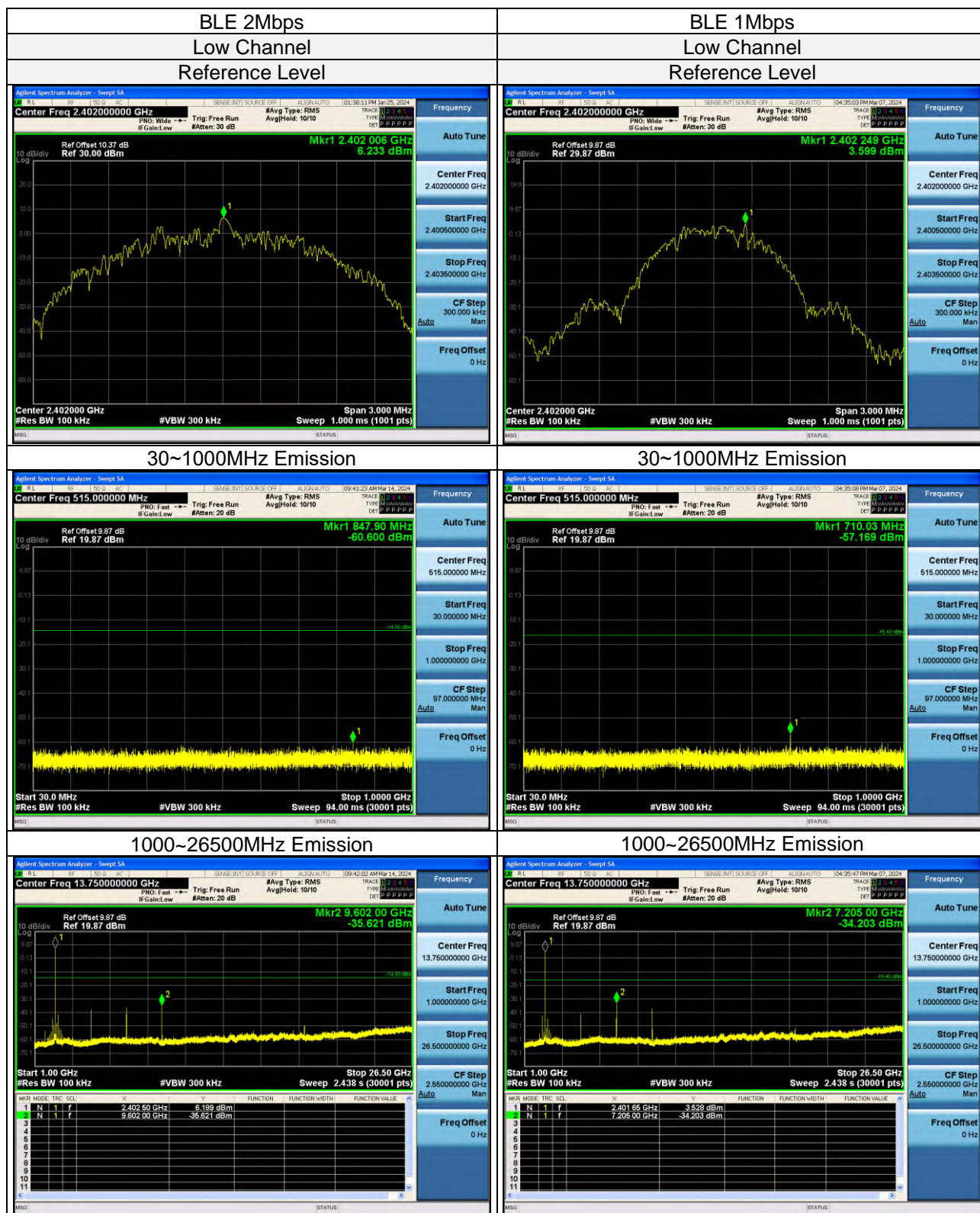
**3.7.5 Deviation from Test Standard**

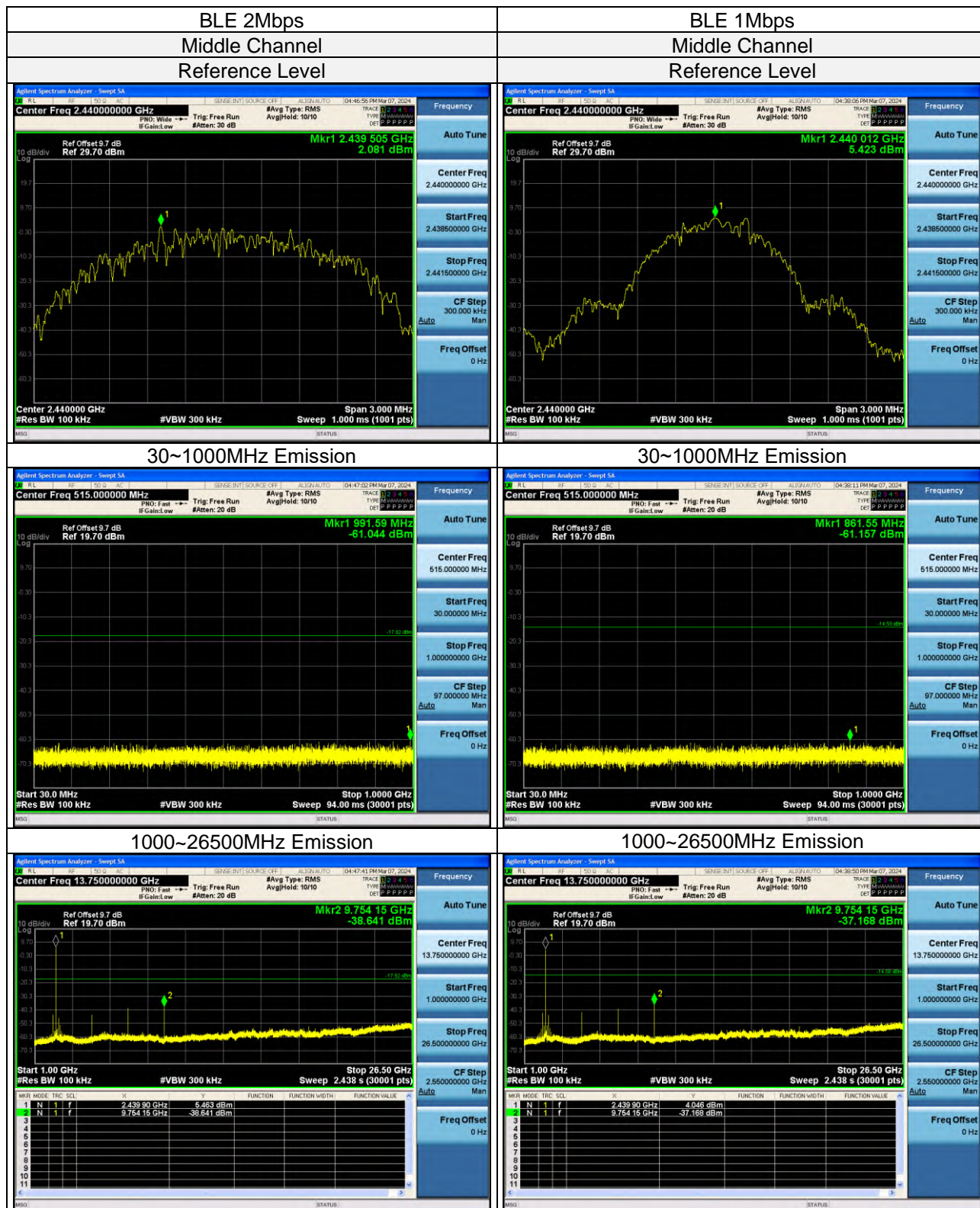
No deviation.

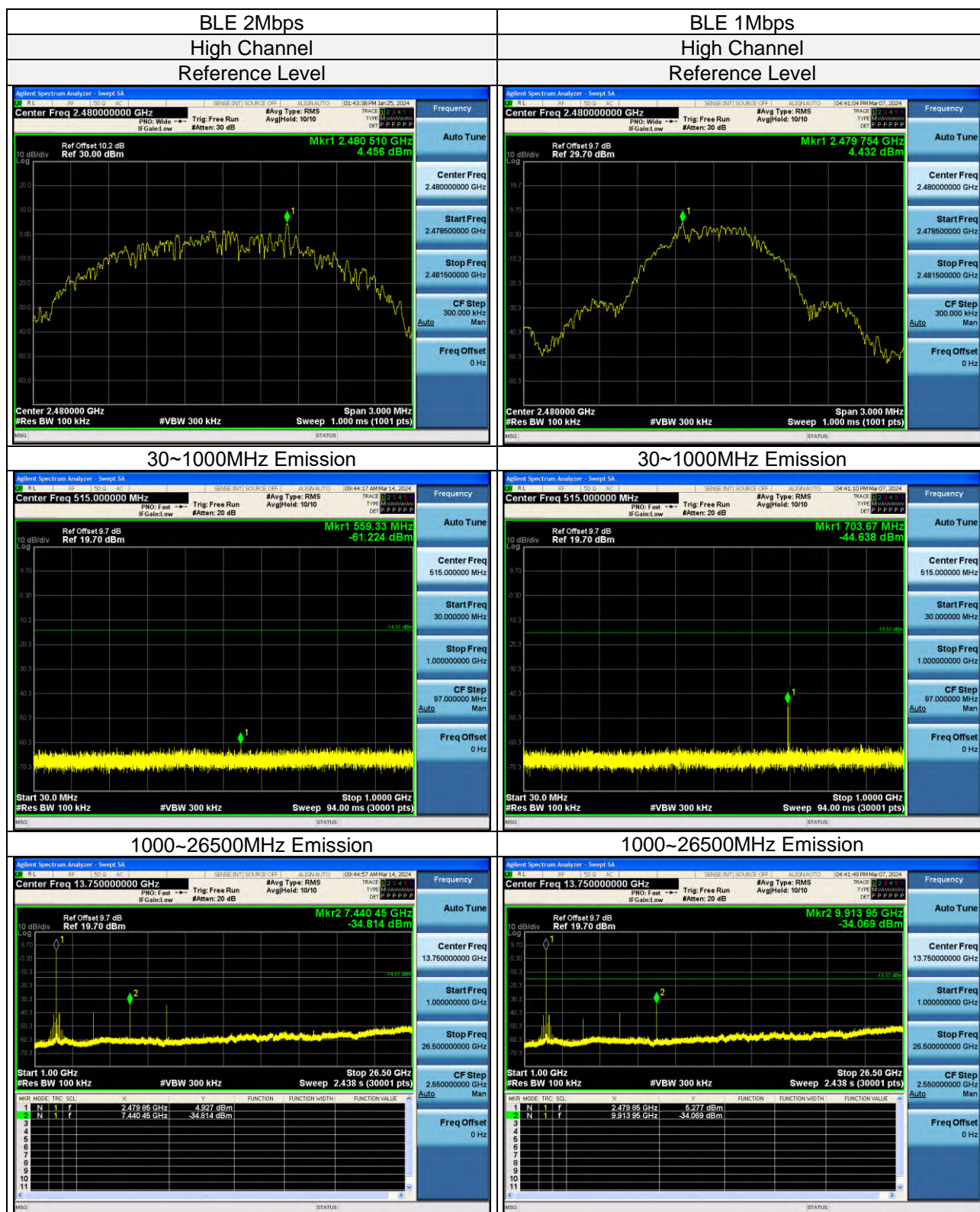
**3.7.6 EUT Operating Condition**

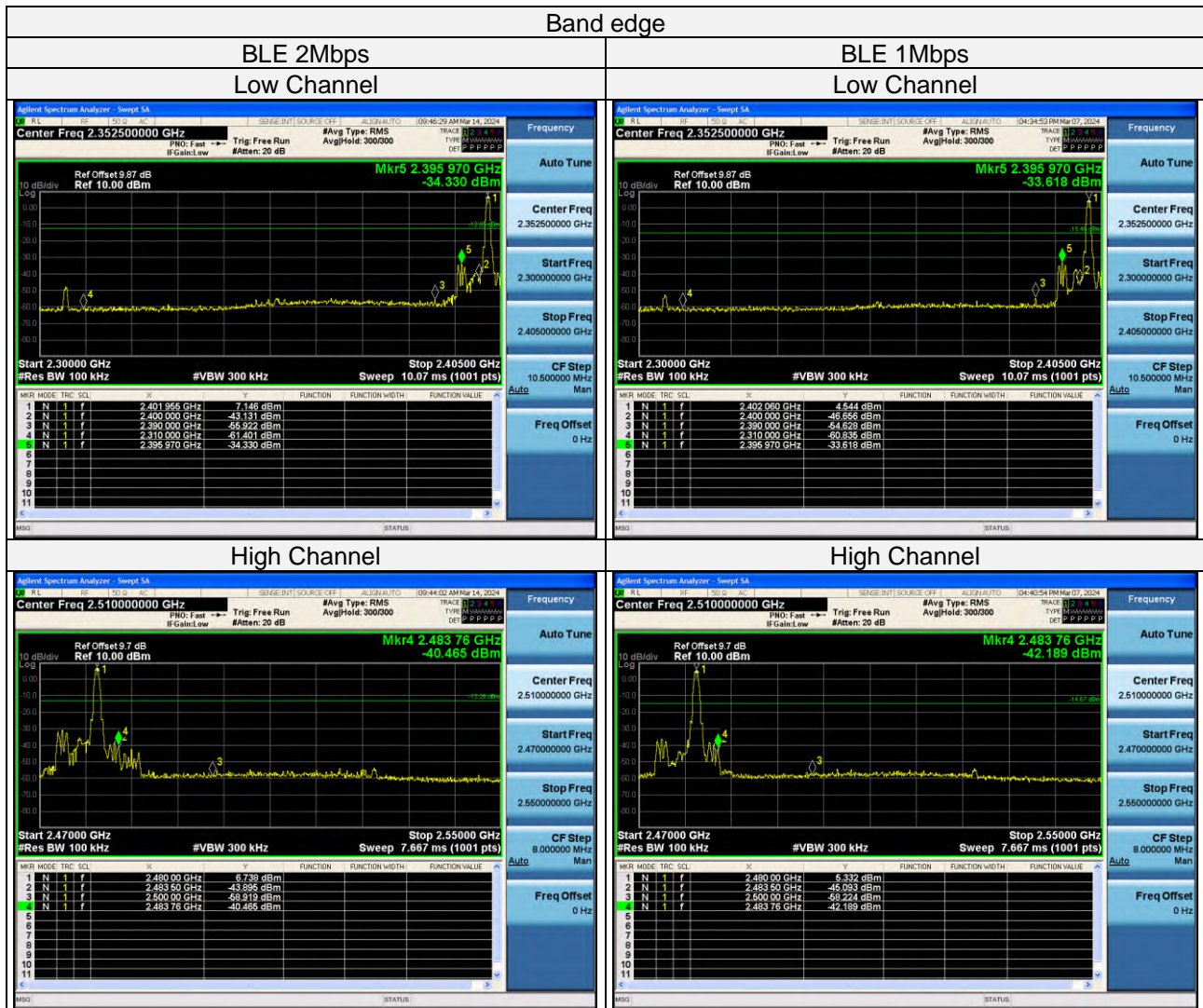
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

### 3.7.7 Test results









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Release

Ver. 1.5

**4. Pictures of Test Arrangements**

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

**5. Test Instruments**

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.Date
Spectrum	Keysight	N9020A	MY51240612	2024-08-06
Spectrum Analyzer	Rohde&Schwarz	FSV-40N	101783	2024-12-17
Power Meter 10Hz~18GHz	Tonscend	JS0806-2	188060126	2024-08-06
Signal generator	Keysight	E4421B	GB40051020	2024-03-15
Universal Switch Control Unit	Rohde&Schwarz	CMW500	12010002k50	2024-12-17
Test Software	Tonscend	JS0806-2	NA	NA
Humidity tester	Jingchuang	GSP-8A	CMA22B000592	2024-12-24

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

**Appendix – Information on The Testing Laboratories**

We, [Hwa-Hsing \(Dongguan\) Testing 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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