

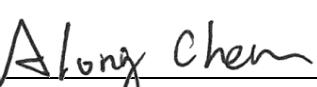


# FCC Test Report

**FCC ID** : QVHDBWIFIABLE04  
**Equipment** : 802.11 abgn + BLE 5.0 module  
**Model No.** : DBWIFIABLE04  
**Brand Name** : Dyson  
**Applicant** : Dyson Technology Ltd  
**Address** : Tetbury Hill Malmesbury Wiltshire SN16 0RP  
United Kingdom  
**Standard** : 47 CFR FCC Part 15.247  
**Received Date** : Feb. 12, 2022  
**Tested Date** : Feb. 15 ~ Mar. 01, 2022

We, International Certification Corporation, would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by:

  
Along Chen / Assistant Manager

Approved by:

  
Gary Chang / Manager

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## Release Record

Report No.	Version	Description	Issued Date
FR212701AE	Rev. 01	Initial issue	May 06, 2022

## Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	AC Power Line Conducted Emissions	[dBuV]: 0.159MHz 49.45 (Margin -16.07dB) - QP	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 264.85MHz 40.42 (Margin -5.58dB) - PK	Pass
15.247(b)(3)	Maximum Output Power	Power [dBm]: 7.25	Pass
15.247(a)(2)	6dB Bandwidth	Meet the requirement of limit	Pass
15.247(e)	Power Spectral Density	Meet the requirement of limit	Pass
15.203	Antenna Requirement	Meet the requirement of limit	Pass

### Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

### Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

## 1 General Description

### 1.1 Information

#### 1.1.1 Specification of the Equipment under Test (EUT)

RF General Information				
Frequency Range (MHz)	Bluetooth Mode	Ch. Freq. (MHz)	Channel Number	Data Rate
2400-2483.5	V5.0 LE	2402-2480	0-39 [40]	1 Mbps
2400-2483.5	V5.0 LE	2402-2480	0-39 [40]	2 Mbps
Note: Bluetooth LE (Low energy) uses GFSK modulation.				

#### 1.1.2 Antenna Details

Ant. No.	Brand	Model	Type	Connector	Gain (dBi)
1	Dyson	ANT2_1370X950	PIFA	No	2.12

#### 1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	3.3Vdc from host
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#### 1.1.4 Accessories

N/A

### 1.1.5 Channel List

Frequency band (MHz)				2400~2483.5			
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
37	2402	9	2422	18	2442	28	2462
0	2404	10	2424	19	2444	29	2464
1	2406	38	2426	20	2446	30	2466
2	2408	11	2428	21	2448	31	2468
3	2410	12	2430	22	2450	32	2470
4	2412	13	2432	23	2452	33	2472
5	2414	14	2434	24	2454	34	2474
6	2416	15	2436	25	2456	35	2476
7	2418	16	2438	26	2458	36	2478
8	2420	17	2440	27	2460	39	2480

### 1.1.6 Test Tool and Duty Cycle

<b>Test Tool</b>	Realtek Bluetooth MP Kit Setup Package, Version: 32601	
<b>Modulation Mode</b>	<b>Duty Cycle Of Test Signal (%)</b>	<b>Duty Factor (dB)</b>
BT-LE(1Mbps)	65.74%	1.82
BT-LE(2Mbps)	35.02%	4.56

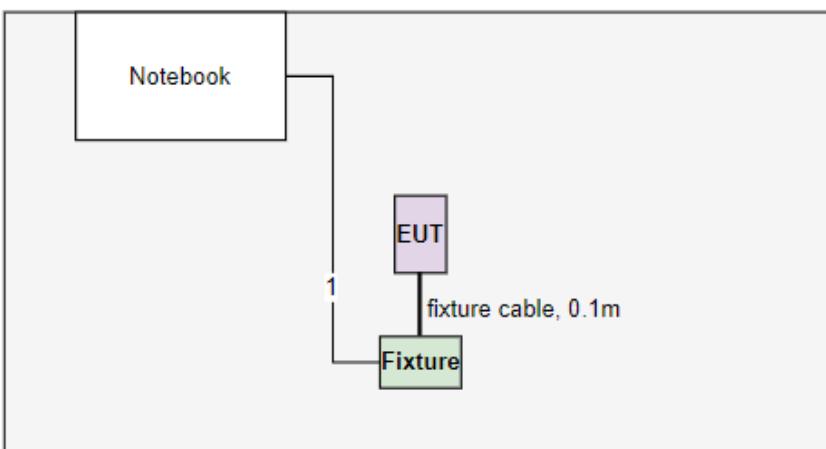
### 1.1.7 Power Index of Test Tool

<b>Modulation Mode</b>	<b>Test Frequency (MHz)</b>		
	<b>2402</b>	<b>2440</b>	<b>2480</b>
BT-LE(1Mbps)	05	05	05
BT-LE(2Mbps)	05	05	05

## 1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Remarks
1	Notebook	DELL	Latitude E5470	DoC	---
2	Fixture	WNC	48DHSK07.SGA	---	Provided by applicant.

## 1.3 Test Setup Chart

Test Setup Diagram	
No.	Signal cable / Length (m)
1	 <p>fixture cable, 0.1m</p>

## 1.4 Test Equipment List and Calibration Data

<b>Test Item</b>	Conducted Emission				
<b>Test Site</b>	Conduction room 1 / (CO01-WS)				
<b>Tested Date</b>	Feb. 28, 2022				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101658	Feb. 16, 2022	Feb. 15, 2023
LISN	R&S	ENV216	101579	Mar. 17, 2021	Mar. 16, 2022
LISN (Support Unit)	SCHWARZBECK MESS-ELEKTRONIK	NSLK 8127	8127667	Jan. 07, 2022	Jan. 06, 2023
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 19, 2021	Oct. 18, 2022
50 ohm terminal (Support Unit)	NA	50	04	May 25, 2021	May 24, 2022
Measurement Software	AUDIX	e3	6.120210k	NA	NA

Note: Calibration Interval of instruments listed above is one year.

<b>Test Item</b>	Radiated Emission				
<b>Test Site</b>	966 chamber3 / (03CH03-WS)				
<b>Tested Date</b>	Feb. 15 ~ Feb. 23, 2022				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101657	Mar. 12, 2021	Mar. 11, 2022
Spectrum Analyzer	R&S	FSV40	101499	Mar. 02, 2021	Mar. 01, 2022
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 08, 2021	Nov. 07, 2022
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-685	May 06, 2021	May 05, 2022
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1206	Dec. 20, 2021	Dec. 19, 2022
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170508	Jan. 11, 2022	Jan. 10, 2023
Preamplifier	EMC	EMC02325	980187	Jul. 26, 2021	Jul. 25, 2022
Preamplifier	Agilent	83017A	MY39501309	Sep. 06, 2021	Sep. 05, 2022
Preamplifier	EMC	EMC184045B	980192	Jul. 14, 2021	Jul. 13, 2022
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 05, 2021	Oct. 04, 2022
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800-001	Sep. 24, 2021	Sep. 23, 2022
LF cable-3M	EMC	EMC8D-NM-NM-3000	131103	Sep. 24, 2021	Sep. 23, 2022
LF cable-13M	EMC	EMC8D-NM-NM-1300	131104	Sep. 24, 2021	Sep. 23, 2022
RF cable-3M	HUBER+SUHNER	SUCOFLEX104	MY22620/4	Sep. 24, 2021	Sep. 23, 2022
RF cable-8M	EMC	EMC104-SM-SM-800	181107	Sep. 24, 2021	Sep. 23, 2022
Measurement Software	AUDIX	e3	6.120210g	NA	NA

Note: Calibration Interval of instruments listed above is one year.

<b>Test Item</b>	RF Conducted				
<b>Test Site</b>	(TH01-WS)				
<b>Tested Date</b>	Mar. 01, 2022				
<b>Instrument</b>	<b>Brand</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Calibration Date</b>	<b>Calibration Until</b>
Spectrum Analyzer	R&S	FSV40	101498	Nov. 29, 2021	Nov. 28, 2022
Power Meter	Anritsu	ML2495A	1241002	Nov. 07, 2021	Nov. 06, 2022
Power Sensor	Anritsu	MA2411B	1207366	Nov. 07, 2021	Nov. 06, 2022
Measurement Software	Sporton	SENSE-15247_DTS	V5.10	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

## 1.5 Test Standards

47 CFR FCC Part 15.247

ANSI C63.10-2013

## 1.6 Reference Guidance

FCC KDB 558074 D01 15.247 Meas Guidance v05r02

## 1.7 Deviation from Test Standard and Measurement Procedure

None

## 1.8 Measurement Uncertainty

The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)).

Measurement Uncertainty	
Parameters	Uncertainty
Bandwidth	±34.130 Hz
Conducted power	±0.808 dB
Power density	±0.583 dB
Conducted emission	±2.715 dB
AC conducted emission	±2.92 dB
Radiated emission ≤ 1GHz	±3.96 dB
Radiated emission > 1GHz	±4.51 dB

## 2 Test Configuration

### 2.1 Testing Facility

Test Laboratory	International Certification Corporation
Test Site	CO01-WS, TH01-WS
Address of Test Site	No.3-1, Lane 6, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 33381, Taiwan (R.O.C.)
Test Site	03CH03-WS
Address of Test Site	No.14-1, Lane 19, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 333, Taiwan (R.O.C.)

- FCC Designation No.: TW0009
- FCC site registration No.: 207696
- ISED#: 10807A
- CAB identifier: TW2732

### 2.2 The Worst Test Modes and Channel Details

Test item	Mode	Test Frequency (MHz)	Test Configuration
AC Power Line Conducted Emissions Radiated Emissions ≤ 1GHz	BT-LE(2Mbps)	2440	---
Maximum Output Power 6dB bandwidth Power spectral density Radiated Emissions > 1GHz	BT-LE(1Mbps) BT-LE(2Mbps)	2402, 2440, 2480 2402, 2440, 2480	---
<b>NOTE:</b>			
1. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The <b>Z-plane</b> results were found as the worst case and were shown in this report.			

## 3 Transmitter Test Results

### 3.1 Conducted Emissions

#### 3.1.1 Limit of Conducted Emissions

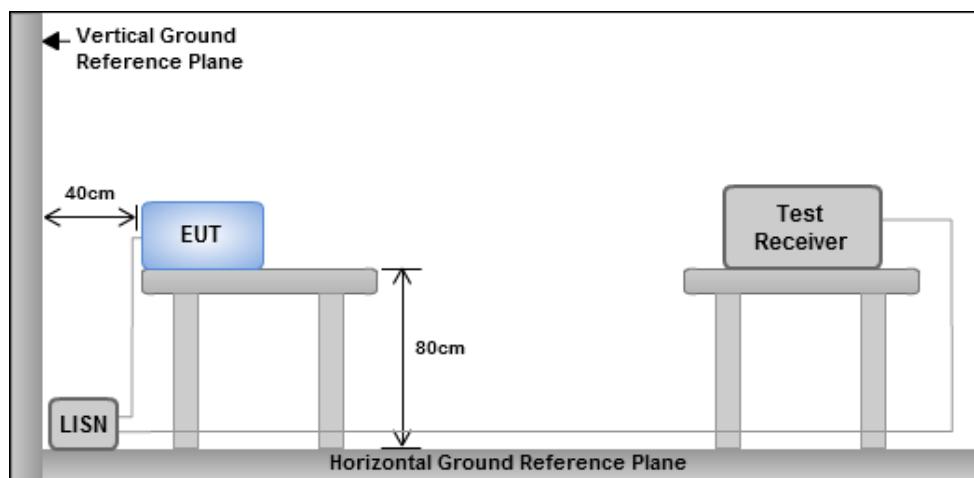
Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

Note 1: \* Decreases with the logarithm of the frequency.

#### 3.1.2 Test Procedures

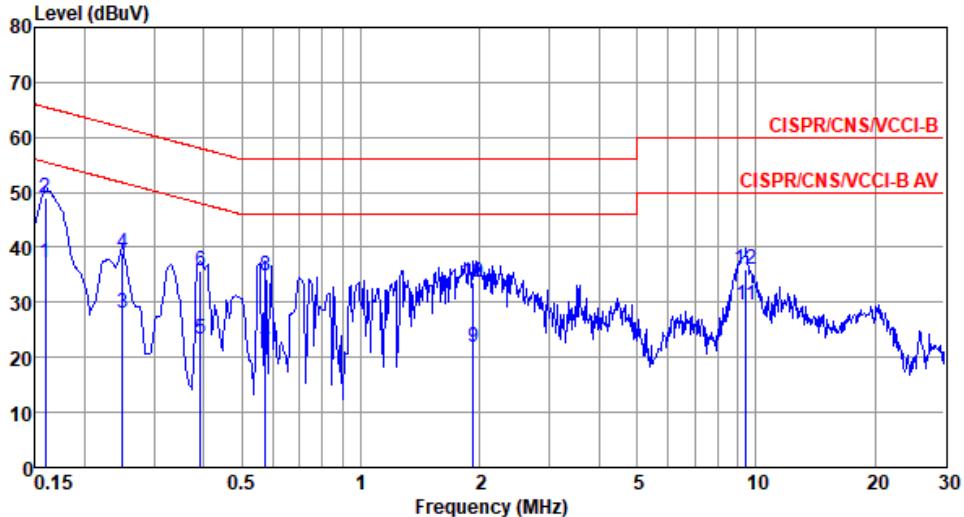
1. The device is placed on a test table, raised 80 cm above the reference ground plane. The vertical conducting plane is located 40 cm to the rear of the device.
2. The device is connected to line impedance stabilization network (LISN) and other accessories are connected to other LISN. Measured levels of AC power line conducted emission are across the 50 Ω LISN port.
3. AC conducted emission measurements is made over frequency range from 150 kHz to 30 MHz.
4. This measurement was performed with AC 120V/60Hz

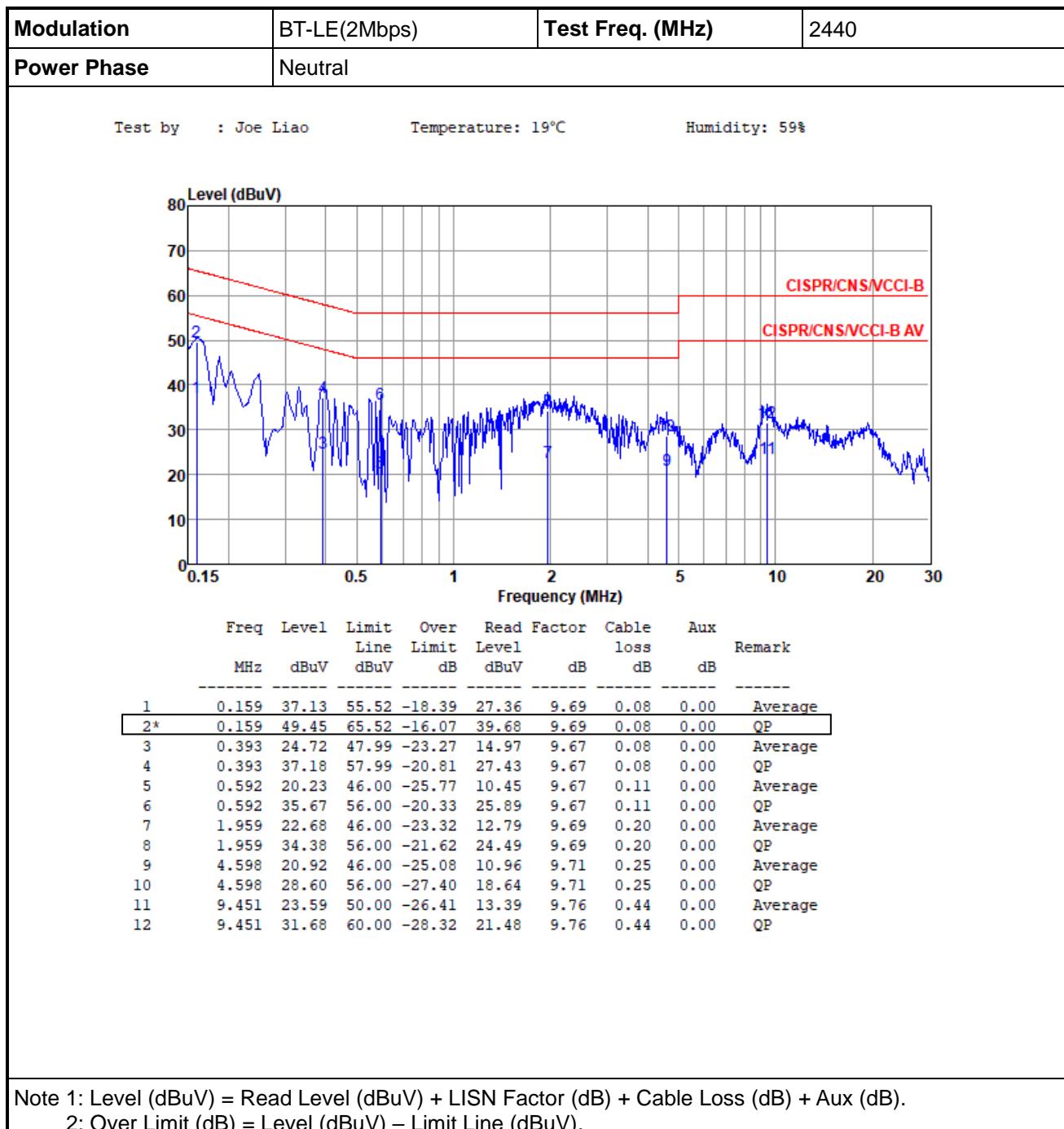
#### 3.1.3 Test Setup



Note: 1. Support units were connected to second LISN.  
 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

### 3.1.4 Test Result of Conducted Emissions

<b>Modulation</b>	BT-LE(2Mbps)	<b>Test Freq. (MHz)</b>	2440																																																																																																																																		
<b>Power Phase</b>	Line																																																																																																																																				
Test by	: Joe Liao	Temperature: 19°C	Humidity: 59%																																																																																																																																		
																																																																																																																																					
<table border="1"> <thead> <tr> <th></th> <th>Freq MHz</th> <th>Level dBuV</th> <th>Limit Line dBuV</th> <th>Over Limit dB</th> <th>Read Level dBuV</th> <th>Factor dB</th> <th>Cable loss dB</th> <th>Aux dB</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>0.159</td> <td>37.28</td> <td>55.52</td> <td>-18.24</td> <td>27.54</td> <td>9.66</td> <td>0.08</td> <td>0.00</td> <td>Average</td> </tr> <tr> <td>2*</td> <td>0.159</td> <td>49.07</td> <td>65.52</td> <td>-16.45</td> <td>39.33</td> <td>9.66</td> <td>0.08</td> <td>0.00</td> <td>QP</td> </tr> <tr> <td>3</td> <td>0.249</td> <td>28.15</td> <td>51.78</td> <td>-23.63</td> <td>18.42</td> <td>9.65</td> <td>0.08</td> <td>0.00</td> <td>Average</td> </tr> <tr> <td>4</td> <td>0.249</td> <td>39.04</td> <td>61.78</td> <td>-22.74</td> <td>29.31</td> <td>9.65</td> <td>0.08</td> <td>0.00</td> <td>QP</td> </tr> <tr> <td>5</td> <td>0.393</td> <td>23.38</td> <td>47.99</td> <td>-24.61</td> <td>13.66</td> <td>9.64</td> <td>0.08</td> <td>0.00</td> <td>Average</td> </tr> <tr> <td>6</td> <td>0.393</td> <td>35.77</td> <td>57.99</td> <td>-22.22</td> <td>26.05</td> <td>9.64</td> <td>0.08</td> <td>0.00</td> <td>QP</td> </tr> <tr> <td>7</td> <td>0.573</td> <td>21.01</td> <td>46.00</td> <td>-24.99</td> <td>11.26</td> <td>9.64</td> <td>0.11</td> <td>0.00</td> <td>Average</td> </tr> <tr> <td>8</td> <td>0.573</td> <td>34.97</td> <td>56.00</td> <td>-21.03</td> <td>25.22</td> <td>9.64</td> <td>0.11</td> <td>0.00</td> <td>QP</td> </tr> <tr> <td>9</td> <td>1.928</td> <td>21.72</td> <td>46.00</td> <td>-24.28</td> <td>11.86</td> <td>9.66</td> <td>0.20</td> <td>0.00</td> <td>Average</td> </tr> <tr> <td>10</td> <td>1.928</td> <td>33.58</td> <td>56.00</td> <td>-22.42</td> <td>23.72</td> <td>9.66</td> <td>0.20</td> <td>0.00</td> <td>QP</td> </tr> <tr> <td>11</td> <td>9.451</td> <td>29.61</td> <td>50.00</td> <td>-20.39</td> <td>19.46</td> <td>9.71</td> <td>0.44</td> <td>0.00</td> <td>Average</td> </tr> <tr> <td>12</td> <td>9.451</td> <td>35.97</td> <td>60.00</td> <td>-24.03</td> <td>25.82</td> <td>9.71</td> <td>0.44</td> <td>0.00</td> <td>QP</td> </tr> </tbody> </table>					Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	Factor dB	Cable loss dB	Aux dB	Remark	1	0.159	37.28	55.52	-18.24	27.54	9.66	0.08	0.00	Average	2*	0.159	49.07	65.52	-16.45	39.33	9.66	0.08	0.00	QP	3	0.249	28.15	51.78	-23.63	18.42	9.65	0.08	0.00	Average	4	0.249	39.04	61.78	-22.74	29.31	9.65	0.08	0.00	QP	5	0.393	23.38	47.99	-24.61	13.66	9.64	0.08	0.00	Average	6	0.393	35.77	57.99	-22.22	26.05	9.64	0.08	0.00	QP	7	0.573	21.01	46.00	-24.99	11.26	9.64	0.11	0.00	Average	8	0.573	34.97	56.00	-21.03	25.22	9.64	0.11	0.00	QP	9	1.928	21.72	46.00	-24.28	11.86	9.66	0.20	0.00	Average	10	1.928	33.58	56.00	-22.42	23.72	9.66	0.20	0.00	QP	11	9.451	29.61	50.00	-20.39	19.46	9.71	0.44	0.00	Average	12	9.451	35.97	60.00	-24.03	25.82	9.71	0.44	0.00	QP
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Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB) + Aux (dB). 2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).																																																																																																																																					



## 3.2 6dB and Occupied Bandwidth

### 3.2.1 Limit of 6dB Bandwidth

The minimum 6dB bandwidth shall be at least 500 kHz.

### 3.2.2 Test Procedures

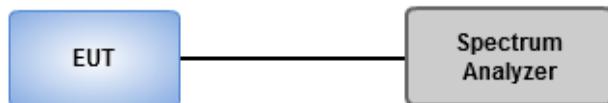
#### 6dB Bandwidth

1. Set resolution bandwidth (RBW) = 100 kHz, Video bandwidth = 300 kHz.
2. Detector = Peak, Trace mode = max hold.
3. Sweep = auto couple, Allow the trace to stabilize.
4. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6dB relative to the maximum level measured in the fundamental emission.

#### Occupied Bandwidth

1. Set resolution bandwidth (RBW) = 1% ~ 5 % of OBW, Video bandwidth = 3 x RBW.
2. Detector = Sample, Trace mode = max hold.
3. Sweep = auto couple, Allow the trace to stabilize.
4. Use the OBW measurement function of spectrum analyzer to measure the occupied bandwidth.

### 3.2.3 Test Setup



### 3.2.4 Test Result of 6dB and Occupied Bandwidth

Ambient Condition	24°C / 67%	Tested By	Aska Huang
-------------------	------------	-----------	------------

#### Summary

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
2.4-2.4835GHz	-	-	-	-	-
BT-LE(1Mbps)	666.667k	1.035M	1M04F1D	652.174k	1.02M
BT-LE(2Mbps)	1.138M	2.055M	2M06F1D	949.275k	2.041M

Max-N dB = Maximum 6dB down bandwidth; Max-OBW = Maximum 99% occupied bandwidth;

Min-N dB = Minimum 6dB down bandwidth; Min-OBW = Minimum 99% occupied bandwidth

#### Result

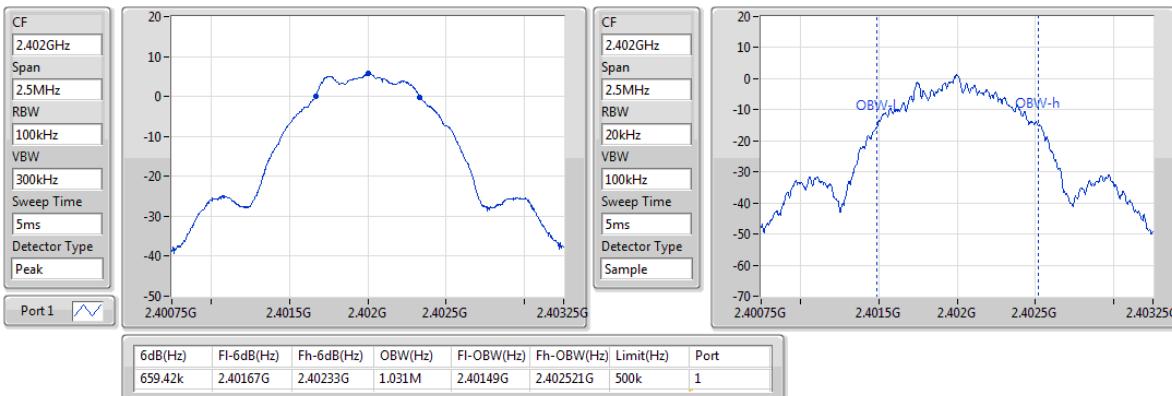
Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	500k	659.42k	1.031M
2440MHz	Pass	500k	666.667k	1.02M
2480MHz	Pass	500k	652.174k	1.035M
BT-LE(2Mbps)	-	-	-	-
2402MHz	Pass	500k	1.116M	2.041M
2440MHz	Pass	500k	1.138M	2.041M
2480MHz	Pass	500k	949.275k	2.055M

Port X-N dB = Port X 6dB down bandwidth;

Port X-OBW = Port X 99% occupied bandwidth

**BT-LE(1Mbps)**

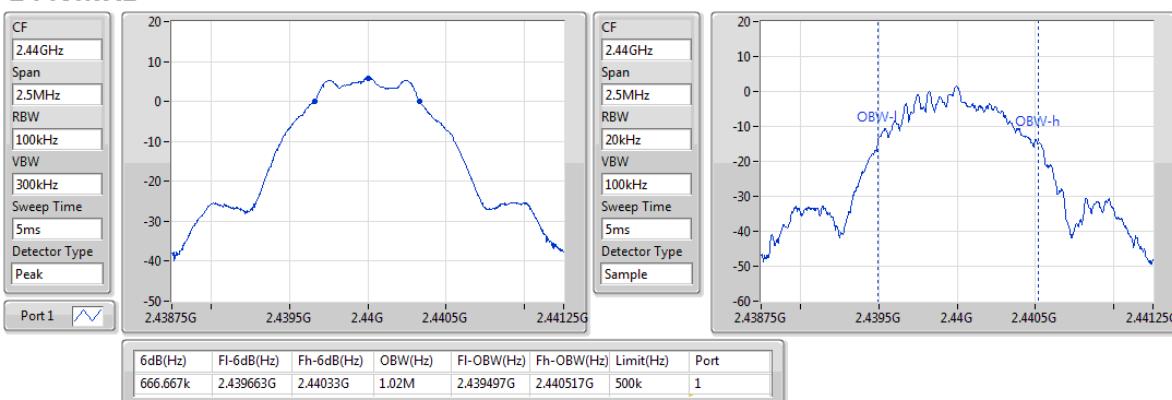
**2402MHz**



**EBW-DTS**

**BT-LE(1Mbps)**

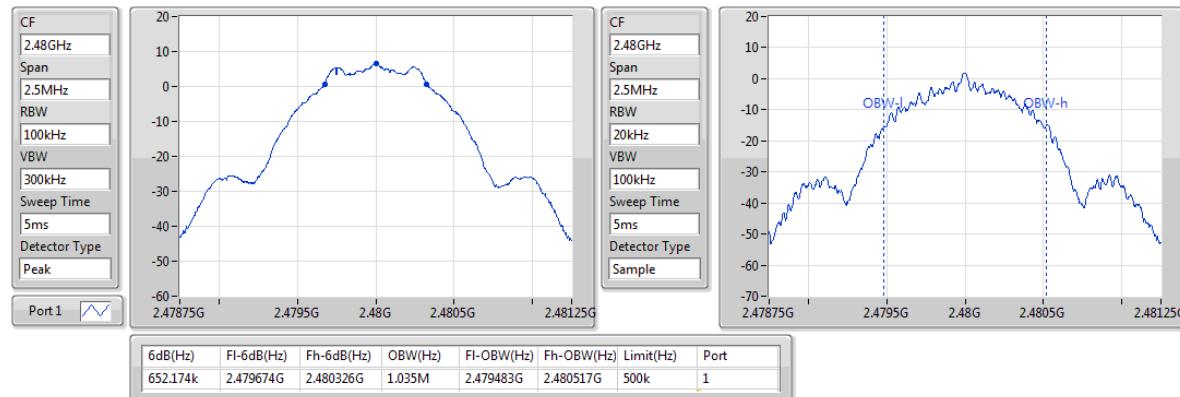
**2440MHz**



**EBW-DTS**

**BT-LE(1Mbps)**

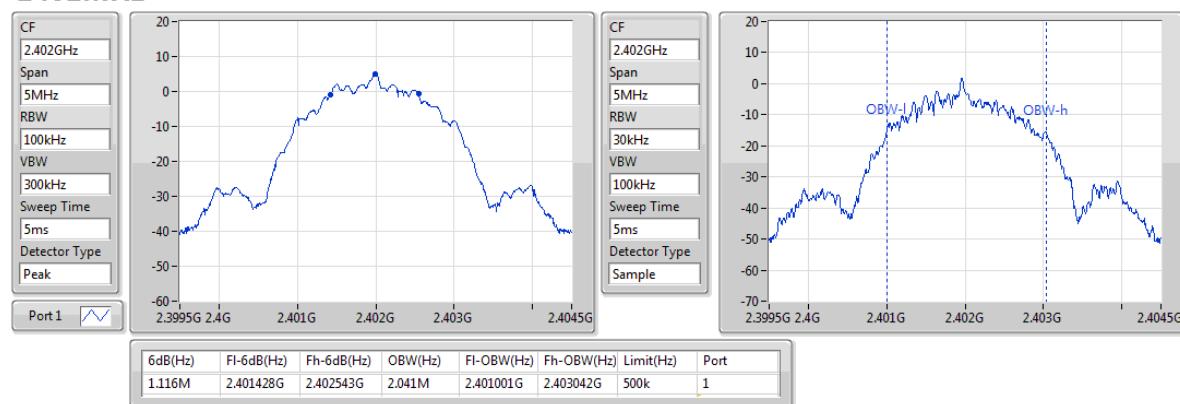
**2480MHz**



**EBW-DTS**

**BT-LE(2Mbps)**

**2402MHz**



**EBW-DTS**

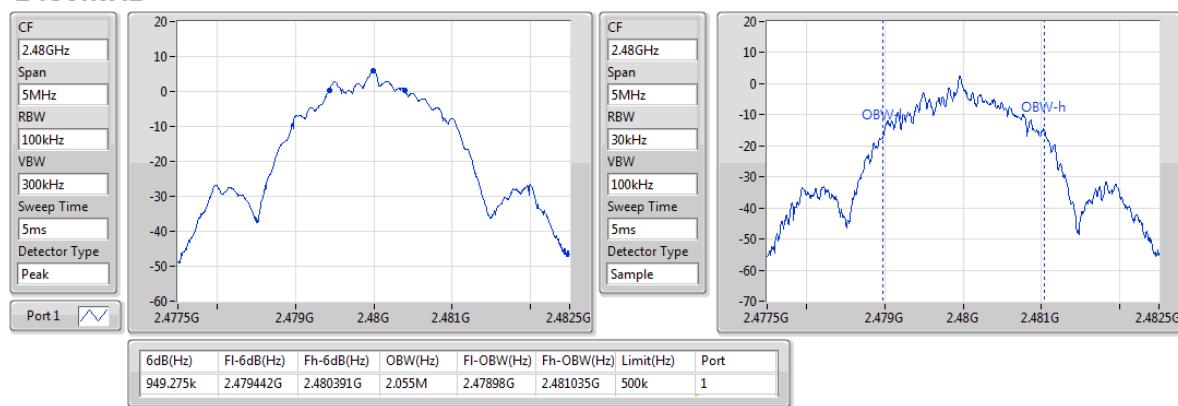
**BT-LE(2Mbps)**

**2440MHz**



**BT-LE(2Mbps)**

**2480MHz**



### 3.3 RF Output Power

#### 3.3.1 Limit of RF Output Power

Conducted power shall not exceed 1 Watt.

Antenna gain  $\leq$  6dBi, no any corresponding reduction is in output power limit.

#### 3.3.2 Test Procedures

A broadband RF power meter is used for output power measurement. The video bandwidth of power meter is greater than DTS bandwidth of EUT. If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power.

#### 3.3.3 Test Setup



### 3.3.4 Test Result of Maximum Output Power

Ambient Condition	24°C / 67%	Tested By	Aska Huang
-------------------	------------	-----------	------------

#### Summary of Peak Conducted Output Power

Mode	Power (dBm)	Power (W)
2.4-2.4835GHz	-	-
BT-LE(1Mbps)	7.12	0.00515
BT-LE(2Mbps)	7.25	0.00531

#### Result

Mode	Result	Antenna Gain (dBi)	Power (dBm)	Power Limit (dBm)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	2.12	6.92	30.00
2440MHz	Pass	2.12	7.12	30.00
2480MHz	Pass	2.12	7.05	30.00
BT-LE(2Mbps)	-	-	-	-
2402MHz	Pass	2.12	7.07	30.00
2440MHz	Pass	2.12	<b>7.25</b>	30.00
2480MHz	Pass	2.12	7.12	30.00

**Summary of Conducted (Average) Output Power**

Mode	Power (dBm)	Power (W)
2.4-2.4835GHz	-	-
BT-LE(1Mbps)	6.86	0.00485
BT-LE(2Mbps)	<b>6.99</b>	0.00500

**Result**

Mode	Result	Antenna Gain (dBi)	Power (dBm)	Power Limit (dBm)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	2.12	6.62	-
2440MHz	Pass	2.12	6.81	-
2480MHz	Pass	2.12	6.86	-
BT-LE(2Mbps)	-	-	-	-
2402MHz	Pass	2.12	6.82	-
2440MHz	Pass	2.12	6.99	-
2480MHz	Pass	2.12	6.85	-

Note: Average power is for reference only.

## 3.4 Power Spectral Density

### 3.4.1 Limit of Power Spectral Density

Power spectral density shall not be greater than 8 dBm in any 3 kHz band.

### 3.4.2 Test Procedures

#### Peak PSD

1. Set the RBW = 3 kHz, VBW = 10 kHz.
2. Detector = Peak, Sweep time = auto couple.
3. Trace mode = max hold, allow trace to fully stabilize.
4. Use the peak marker function to determine the maximum amplitude level.

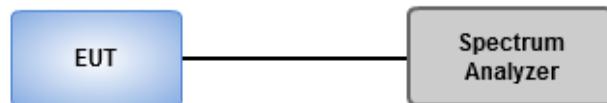
#### Average PSD, duty cycle $\geq 98\%$

1. Set the RBW = 30 kHz, VBW = 100 kHz.
2. Detector = RMS, Sweep time = auto couple.
3. Sweep time = auto couple.
4. Employ trace averaging (RMS) mode over a minimum of 100 traces.
5. Use the peak marker function to determine the maximum amplitude level.

#### Average PSD, duty cycle $< 98\%$

1. Set the RBW = 30 kHz, VBW = 100 kHz. Detector = RMS.
2. Set the sweep time to:  $\geq 10 \times (\text{number of measurement points in sweep}) \times (\text{total on/off period of the transmitted signal})$ .
3. Perform the measurement over a single sweep.
4. Use the peak marker function to determine the maximum amplitude level.
5. Add  $10 \log (1/x)$ , where x is the duty cycle.

### 3.4.3 Test Setup



### 3.4.4 Test Result of Power Spectral Density

Ambient Condition	24°C / 67%	Tested By	Aska Huang
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#### Summary

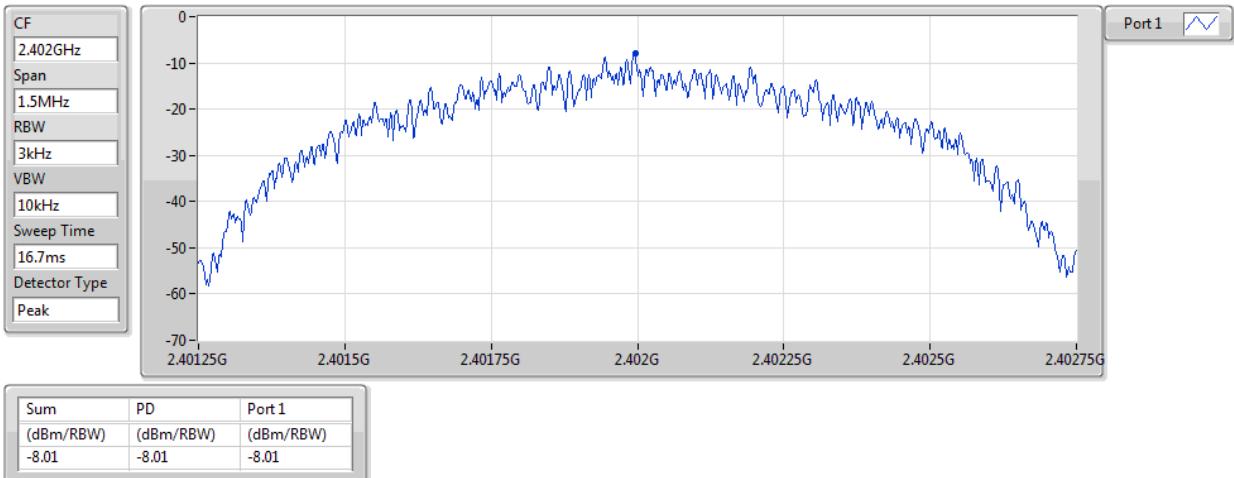
Mode	PD (dBm/3kHz)
2.4-2.4835GHz	-
BT-LE(1Mbps)	-8.01
BT-LE(2Mbps)	-11.35

#### Result

Mode	Result	Antenna Gain (dBi)	Power Density (dBm/3kHz)	Power Density Limit (dBm/3kHz)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	2.12	-8.01	8.00
2440MHz	Pass	2.12	-9.17	8.00
2480MHz	Pass	2.12	-9.00	8.00
BT-LE(2Mbps)	-	-	-	-
2402MHz	Pass	2.12	-12.41	8.00
2440MHz	Pass	2.12	-12.21	8.00
2480MHz	Pass	2.12	-11.35	8.00

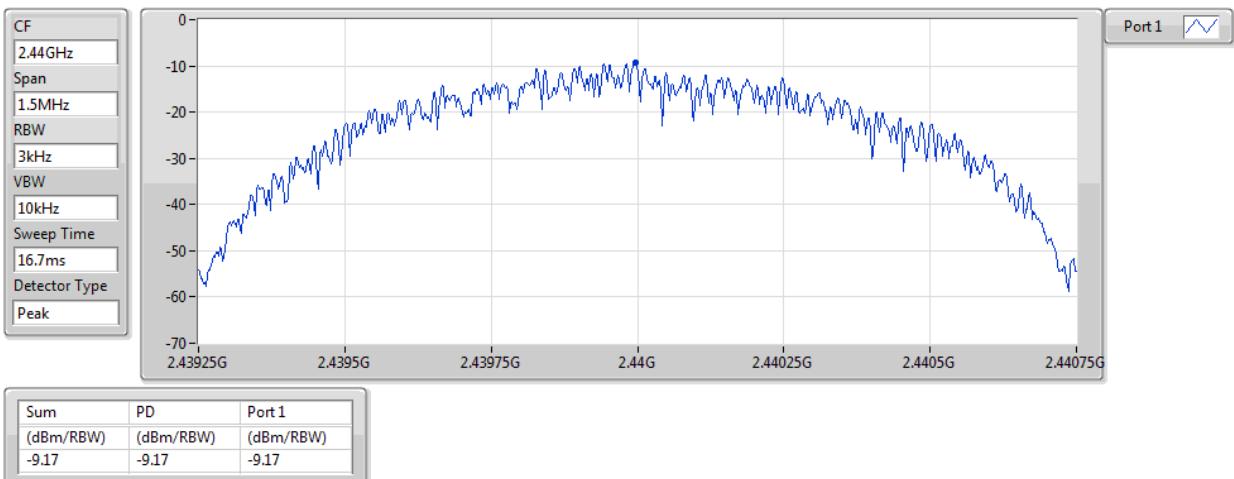
### BT-LE(1Mbps)

2402MHz



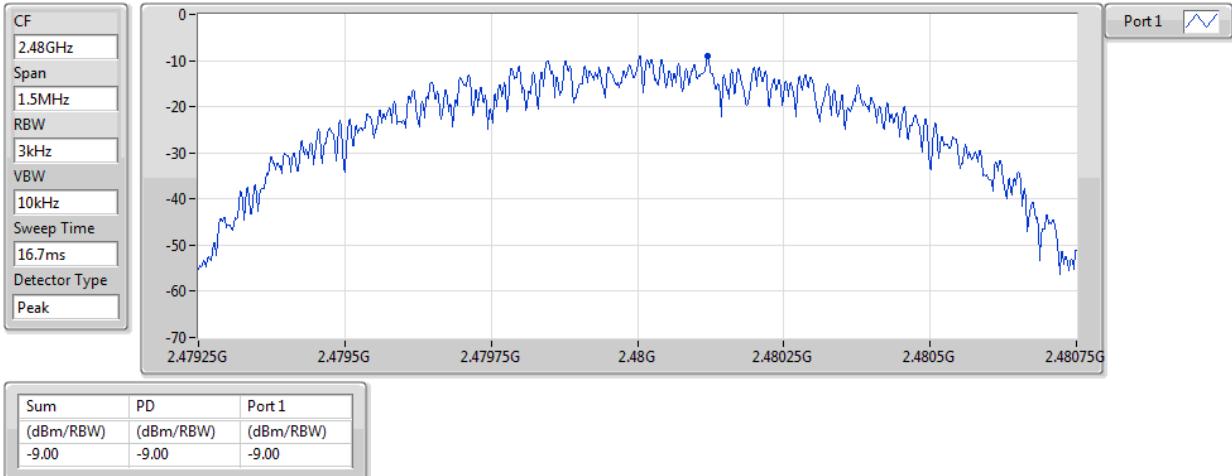
### BT-LE(1Mbps)

2440MHz



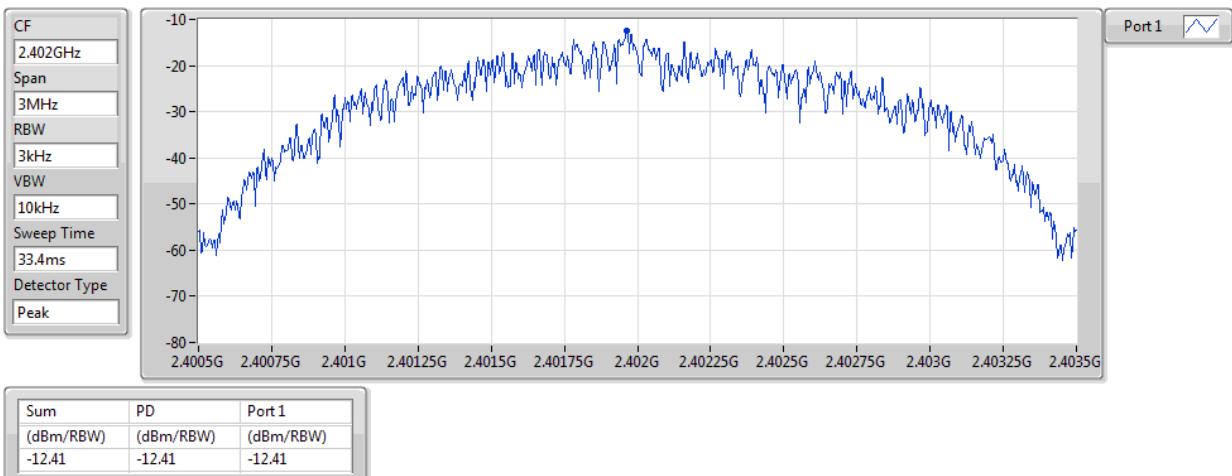
### BT-LE(1Mbps)

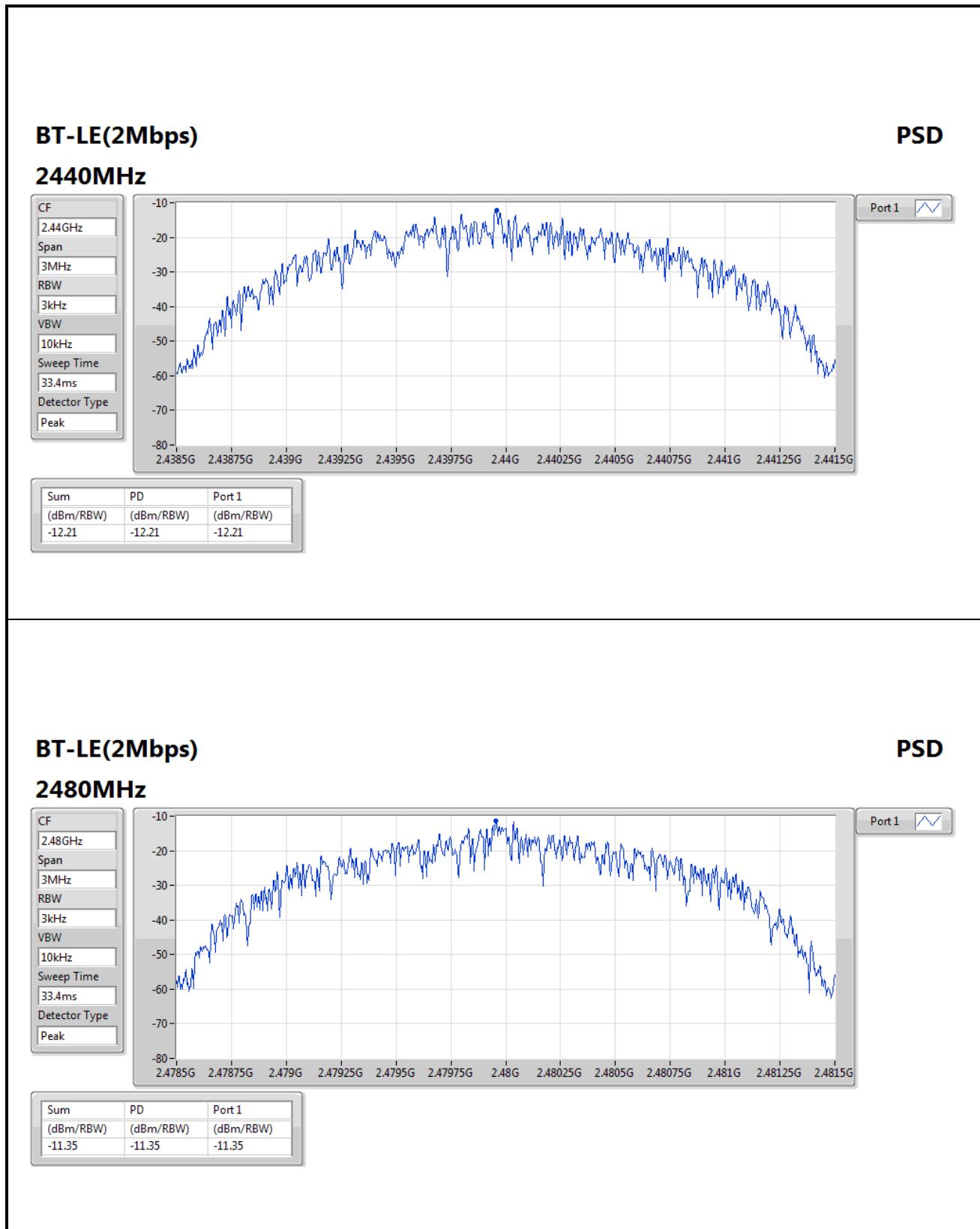
2480MHz



### BT-LE(2Mbps)

2402MHz





## 3.5 Emissions in Restricted Frequency Bands

### 3.5.1 Limit of Emissions in Restricted Frequency Bands

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

**Note 1:**  
Quasi-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit

**Note 2:**  
Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

### 3.5.2 Test Procedures

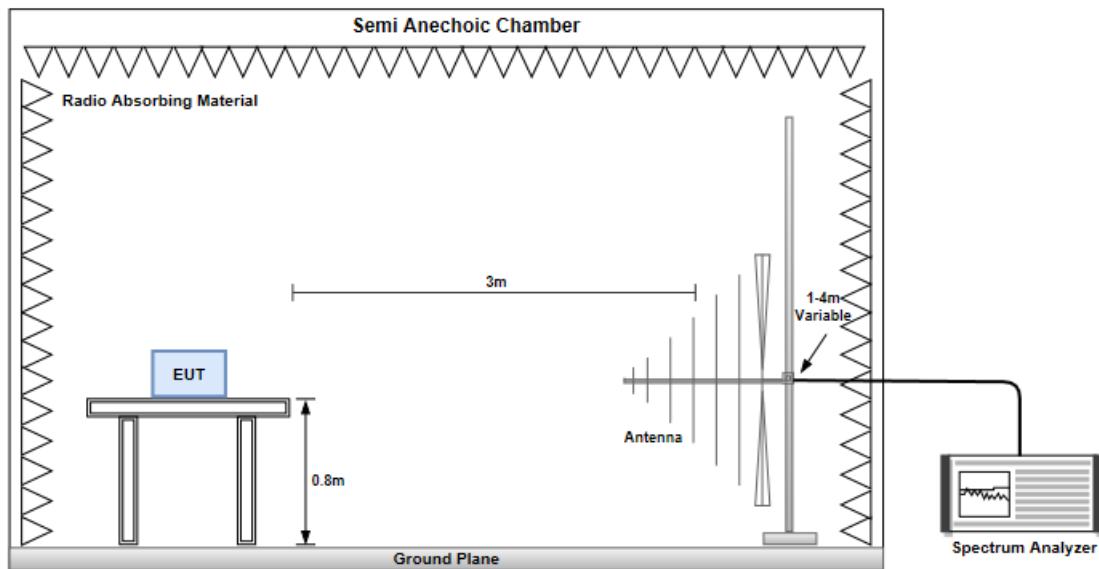
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m
2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

Note:

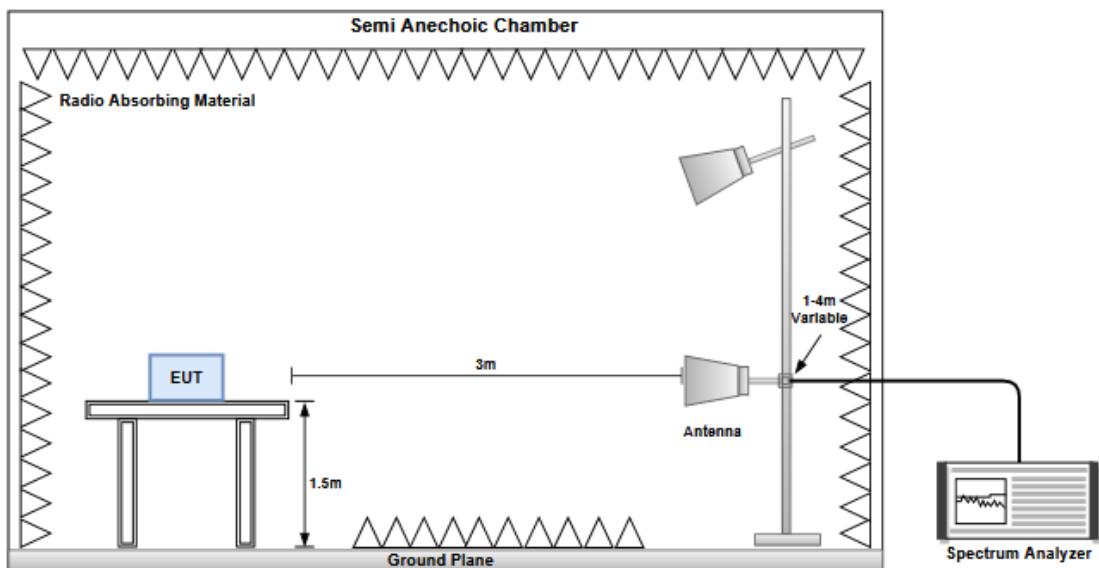
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above 1GHz.

### 3.5.3 Test Setup

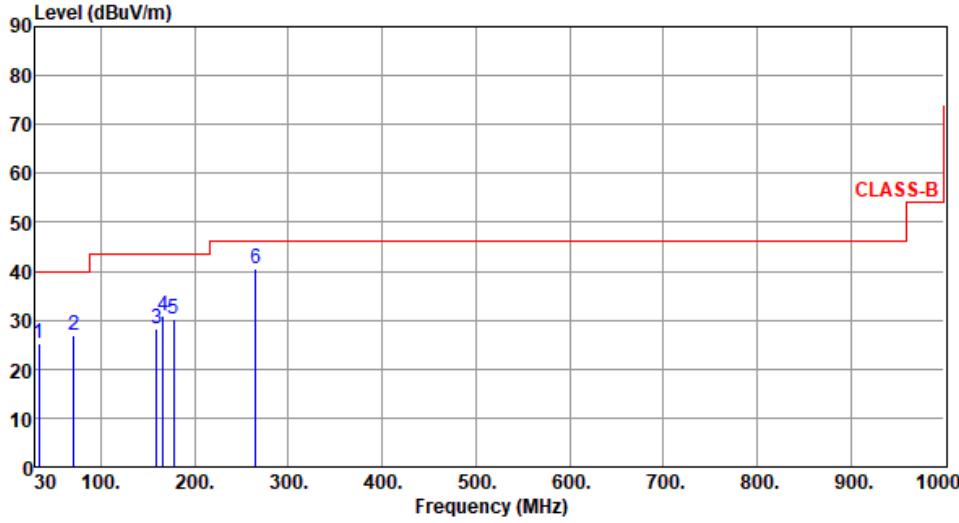
#### Radiated Emissions below 1 GHz

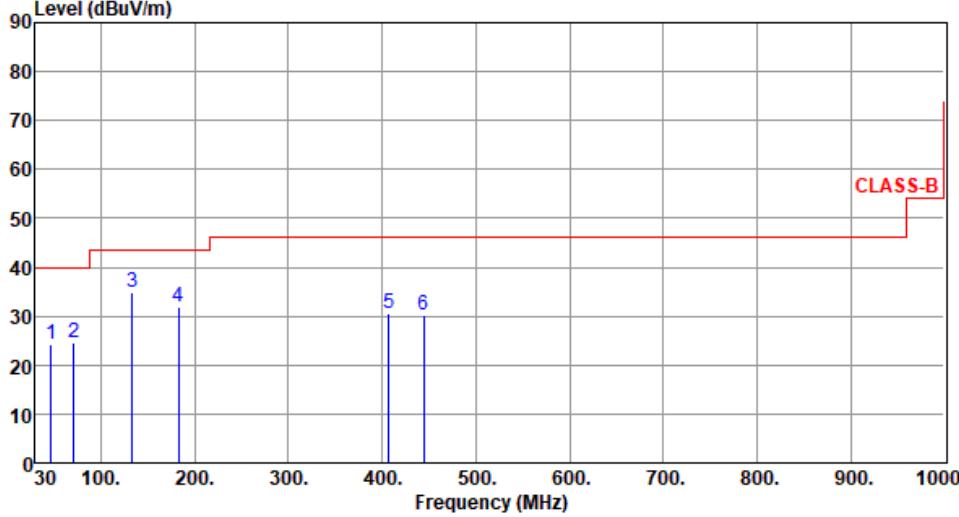


#### Radiated Emissions above 1 GHz



### 3.5.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	BT-LE (2Mbps)	Test Freq. (MHz)	2440																																																																				
Polarization	Horizontal																																																																						
Test By	:Akun Chung	Temperature(°C):22	Humidity(%):66																																																																				
																																																																							
<table border="1"> <thead> <tr> <th>Freq. (MHz)</th> <th>Emission level (dBuV/m)</th> <th>Margin (dB)</th> <th>SA reading (dBuV)</th> <th>Factor (dB/m)</th> <th>Remark</th> <th>ANT High (cm)</th> <th>Turn Table deg</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>33.55</td> <td>25.15</td> <td>40.00</td> <td>-14.85</td> <td>35.43</td> <td>-10.28</td> <td>Peak</td> <td>---</td> <td>---</td> </tr> <tr> <td>2</td> <td>70.63</td> <td>26.95</td> <td>40.00</td> <td>-13.05</td> <td>37.98</td> <td>-11.03</td> <td>Peak</td> <td>---</td> <td>---</td> </tr> <tr> <td>3</td> <td>159.25</td> <td>28.25</td> <td>43.50</td> <td>-15.25</td> <td>36.64</td> <td>-8.39</td> <td>Peak</td> <td>---</td> <td>---</td> </tr> <tr> <td>4</td> <td>166.55</td> <td>30.95</td> <td>43.50</td> <td>-12.55</td> <td>39.72</td> <td>-8.77</td> <td>Peak</td> <td>---</td> <td>---</td> </tr> <tr> <td>5</td> <td>177.51</td> <td>30.23</td> <td>43.50</td> <td>-13.27</td> <td>39.96</td> <td>-9.73</td> <td>Peak</td> <td>---</td> <td>---</td> </tr> <tr> <td>6</td> <td>264.85</td> <td>40.42</td> <td>46.00</td> <td>-5.58</td> <td>49.86</td> <td>-9.44</td> <td>Peak</td> <td>---</td> <td>---</td> </tr> </tbody> </table>				Freq. (MHz)	Emission level (dBuV/m)	Margin (dB)	SA reading (dBuV)	Factor (dB/m)	Remark	ANT High (cm)	Turn Table deg	1	33.55	25.15	40.00	-14.85	35.43	-10.28	Peak	---	---	2	70.63	26.95	40.00	-13.05	37.98	-11.03	Peak	---	---	3	159.25	28.25	43.50	-15.25	36.64	-8.39	Peak	---	---	4	166.55	30.95	43.50	-12.55	39.72	-8.77	Peak	---	---	5	177.51	30.23	43.50	-13.27	39.96	-9.73	Peak	---	---	6	264.85	40.42	46.00	-5.58	49.86	-9.44	Peak	---	---
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<b>Modulation</b>	BT-LE (2Mbps)	<b>Test Freq. (MHz)</b>	2440																																																															
<b>Polarization</b>	Vertical																																																																	
Test By	:Akun Chung	Temperature(°C):22	Humidity(%):66																																																															
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	Freq. (MHz)	Emission level (dBuV/m)	Margin (dB)	SA reading (dBuV)	Factor (dB/m)	Remark	ANT High (cm)	Turn Table deg																																																										
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3	133.55	34.88	43.50	-8.62	44.41	-9.53	Peak	---																																																										
4	182.54	31.75	43.50	-11.75	42.10	-10.35	Peak	---																																																										
5	407.55	30.66	46.00	-15.34	35.90	-5.24	Peak	---																																																										
6	444.11	30.33	46.00	-15.67	34.23	-3.90	Peak	---																																																										

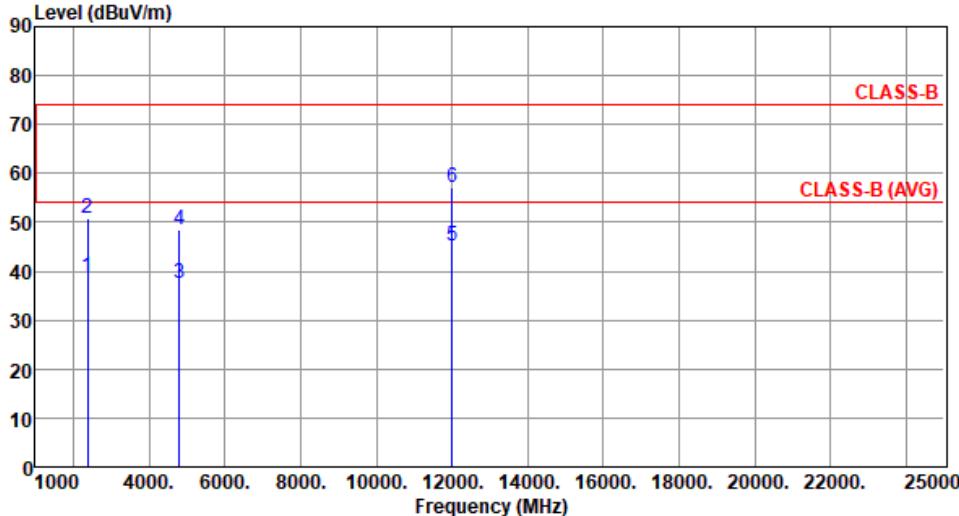
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

### 3.5.5 Transmitter Radiated Unwanted Emissions (Above 1GHz)

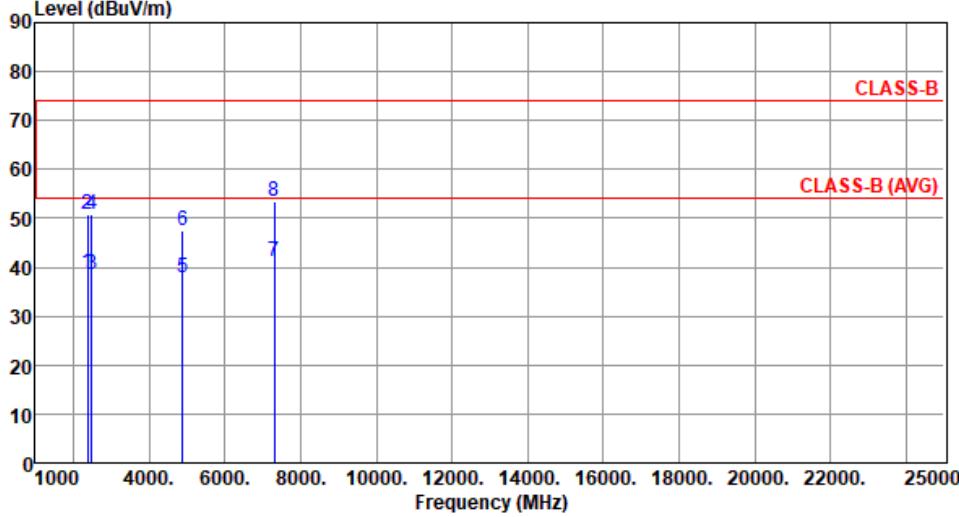
Modulation	BT-LE (1Mbps)	Test Freq. (MHz)	2402																																																																					
Polarization	Horizontal																																																																							
Test By	:Akun Chung	Temperature(°C):22	Humidity(%):69																																																																					
 <p>The graph plots Emission Level (dBuV/m) on the y-axis (0 to 90) against Frequency (MHz) on the x-axis (1000 to 25000). Two horizontal red lines represent the 'CLASS-B' limit at approximately 74 dBuV/m. Six vertical blue lines connect the measured levels to the corresponding frequency values in the table below. The measured levels are: 1 (2390.00 MHz, 38.83 dBuV/m), 2 (2390.00 MHz, 50.88 dBuV/m), 3 (4804.00 MHz, 37.45 dBuV/m), 4 (4804.00 MHz, 48.45 dBuV/m), 5 (12010.00 MHz, 45.09 dBuV/m), and 6 (12010.00 MHz, 57.09 dBuV/m).</p>																																																																								
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	Freq. (MHz)	Emission level (dBuV/m)	Margin (dB)	SA reading (dBuV)	Factor (dB/m)	Remark	ANT High (cm)	Turn Table deg																																																																
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3	4804.00	37.45	54.00	-16.55	32.25	5.20	Average	101	60																																																															
4	4804.00	48.45	74.00	-25.55	43.25	5.20	Peak	101	60																																																															
5	12010.00	45.09	54.00	-8.91	30.35	14.74	Average	100	54																																																															
6	12010.00	57.09	74.00	-16.91	42.35	14.74	Peak	100	54																																																															
<p>Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor* (dB/m)            *Factor includes antenna factor, cable loss and amplifier gain            Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).</p>																																																																								

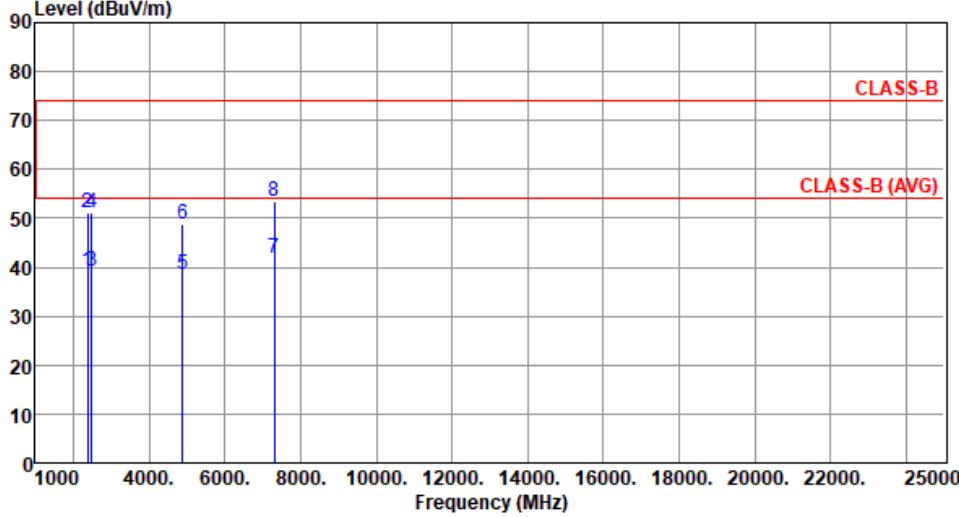
<b>Modulation</b>	BT-LE (1Mbps)	<b>Test Freq. (MHz)</b>	2402																																																																						
<b>Polarization</b>	Vertical																																																																								
Test By	:Akun Chung	Temperature(°C):22	Humidity(%):69																																																																						
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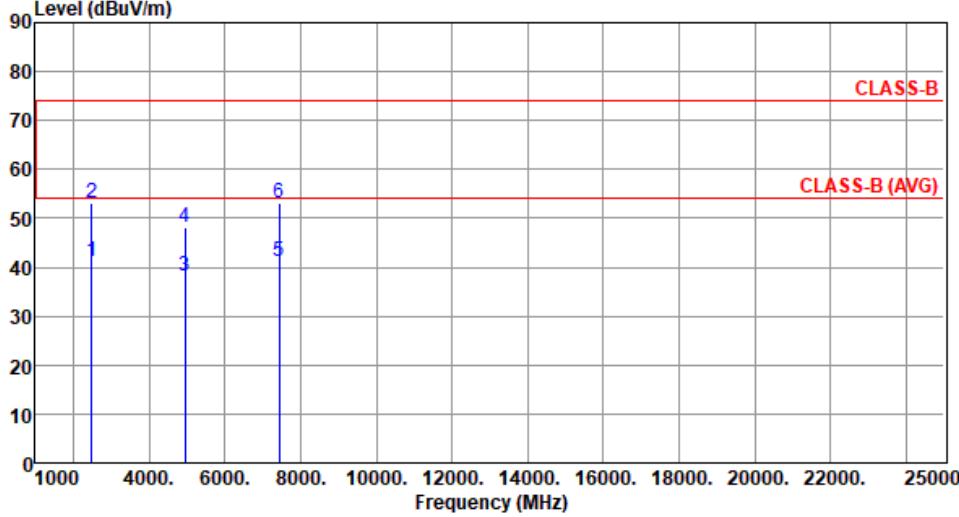
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

<b>Modulation</b>	BT-LE (1Mbps)	<b>Test Freq. (MHz)</b>	2440																																																																																														
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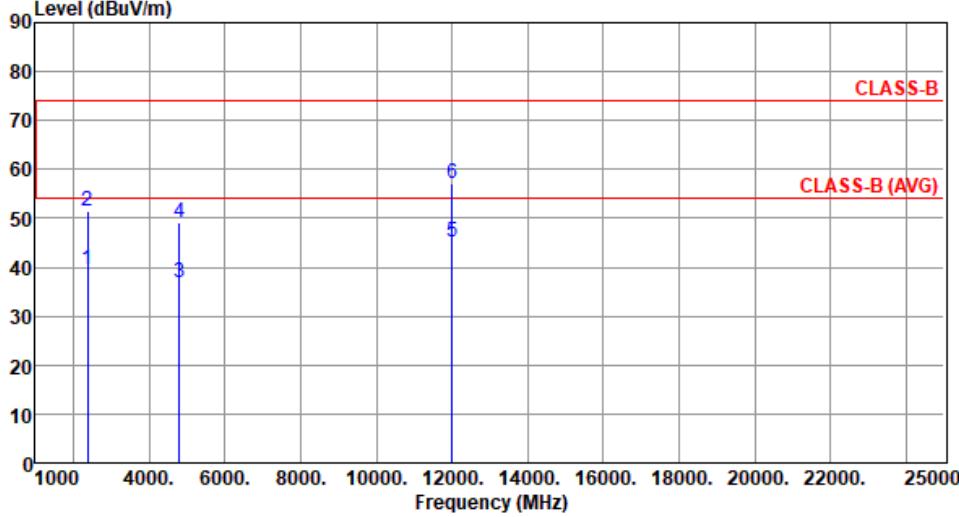
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\*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

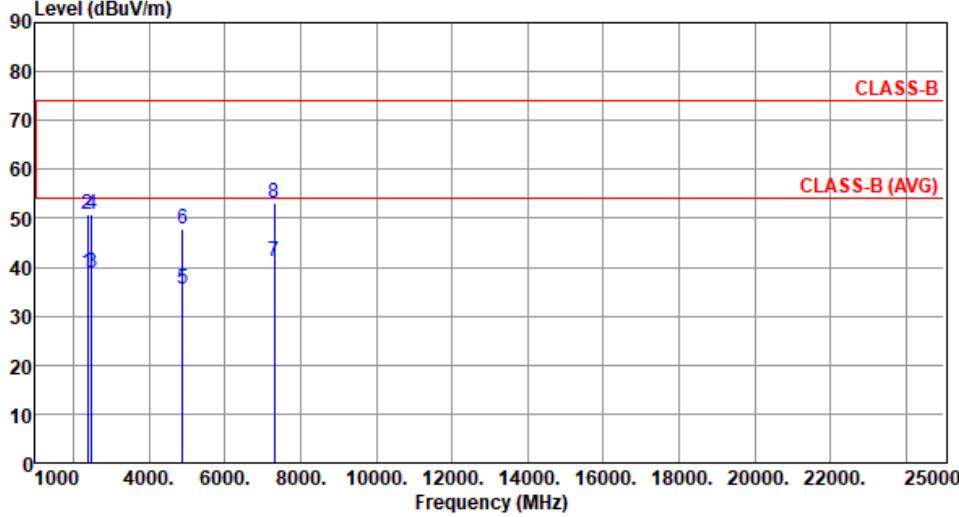
<b>Modulation</b>	BT-LE (2Mbps)	<b>Test Freq. (MHz)</b>	2402																																																																						
<b>Polarization</b>	Horizontal																																																																								
Test By	:Akun Chung	Temperature(°C):22	Humidity(%):69																																																																						
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<b>Modulation</b>	BT-LE (2Mbps)	<b>Test Freq. (MHz)</b>	2402						
<b>Polarization</b>	Vertical								
Test By	:Akun Chung	Temperature(°C):22	Humidity(%):69						
Test By :Akun Chung      Temperature(°C):22      Humidity(%):69									
									
Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg	
1	2390.00	39.45	54.00	-14.55	40.94	-1.49	Average	211	315
2	2390.00	51.46	74.00	-22.54	52.95	-1.49	Peak	211	315
3	4804.00	36.97	54.00	-17.03	31.77	5.20	Average	335	292
4	4804.00	49.00	74.00	-25.00	43.80	5.20	Peak	335	292
5	12010.00	45.29	54.00	-8.71	30.55	14.74	Average	100	296
6	12010.00	57.26	74.00	-16.74	42.52	14.74	Peak	100	296

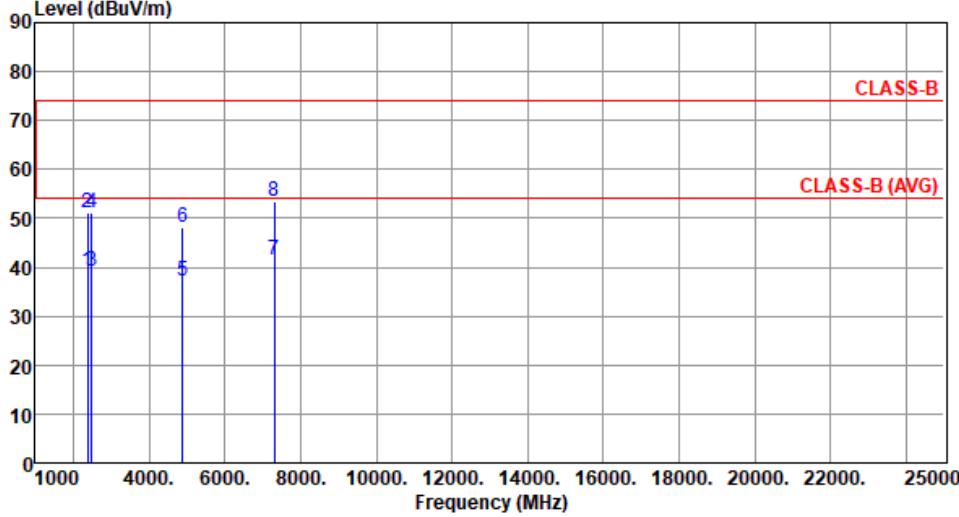
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

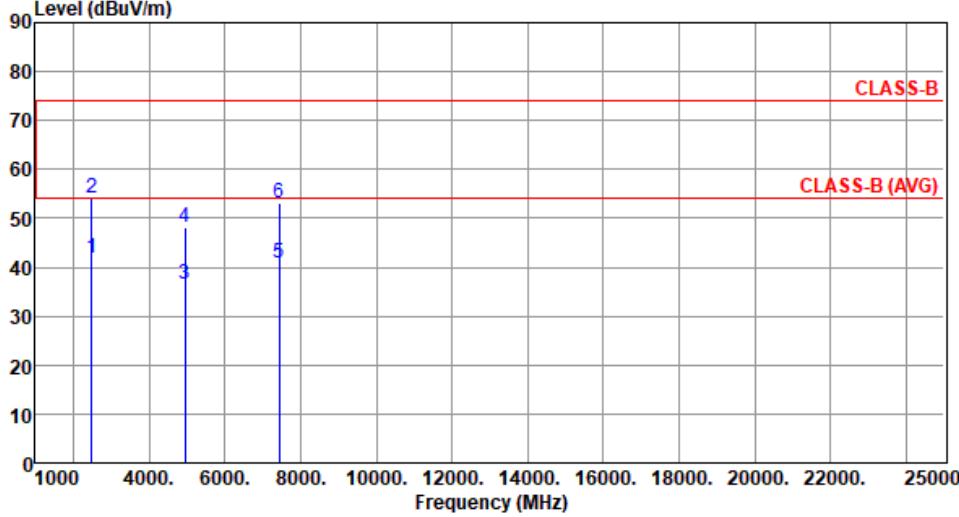
\*Factor includes antenna factor , cable loss and amplifier gain

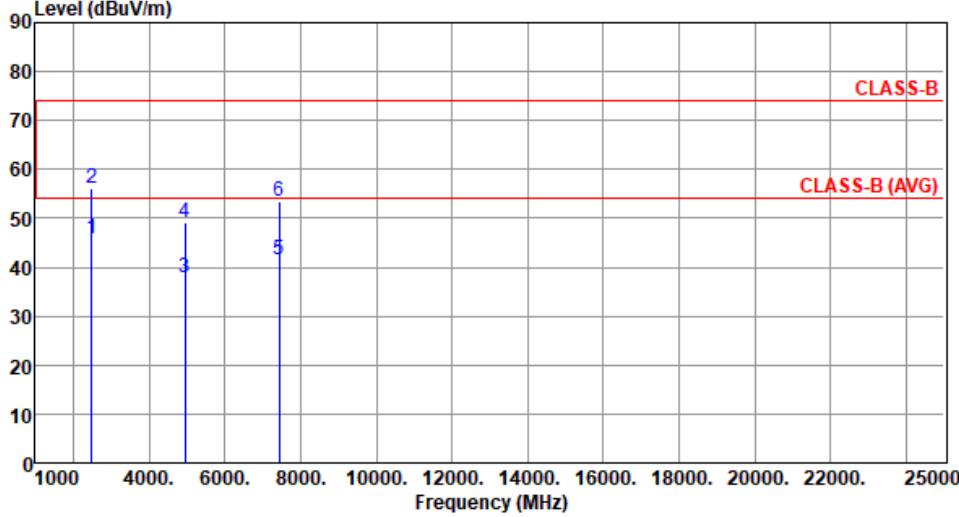
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

<b>Modulation</b>	BT-LE (2Mbps)	<b>Test Freq. (MHz)</b>	2440						
<b>Polarization</b>	Horizontal								
Test By	:Akun Chung	Temperature(°C):22	Humidity(%):69						
Test By :Akun Chung      Temperature(°C):22      Humidity(%):69									
									
Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg	
1	2390.00	38.91	54.00	-15.09	40.40	-1.49	Average	235	14
2	2390.00	50.95	74.00	-23.05	52.44	-1.49	Peak	235	14
3	2483.50	38.81	54.00	-15.19	40.39	-1.58	Average	235	14
4	2483.50	50.91	74.00	-23.09	52.49	-1.58	Peak	235	14
5	4880.00	35.63	54.00	-18.37	30.31	5.32	Average	100	39
6	4880.00	47.70	74.00	-26.30	42.38	5.32	Peak	100	39
7	7320.00	41.13	54.00	-12.87	30.30	10.83	Average	100	47
8	7320.00	53.12	74.00	-20.88	42.29	10.83	Peak	100	47

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)  
 \*Factor includes antenna factor , cable loss and amplifier gain  
 Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

<b>Modulation</b>	BT-LE (2Mbps)	<b>Test Freq. (MHz)</b>	2440																																																																																																
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Test By	:Akun Chung	Temperature(°C):22	Humidity(%):69																																																																																																
																																																																																																			
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## 3.6 Emissions in non-restricted Frequency Bands

### 3.6.1 Emissions in non-restricted frequency bands limit

Peak power 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

### 3.6.2 Test Procedures

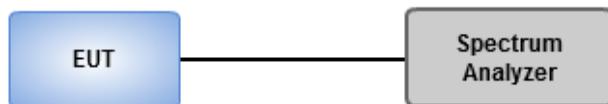
#### Reference level measurement

1. Set RBW=100kHz, VBW = 300kHz , Detector = Peak, Sweep time = Auto
2. Trace = max hold , Allow Trace to fully stabilize
3. Use the peak marker function to determine the maximum PSD level

#### Emission level measurement

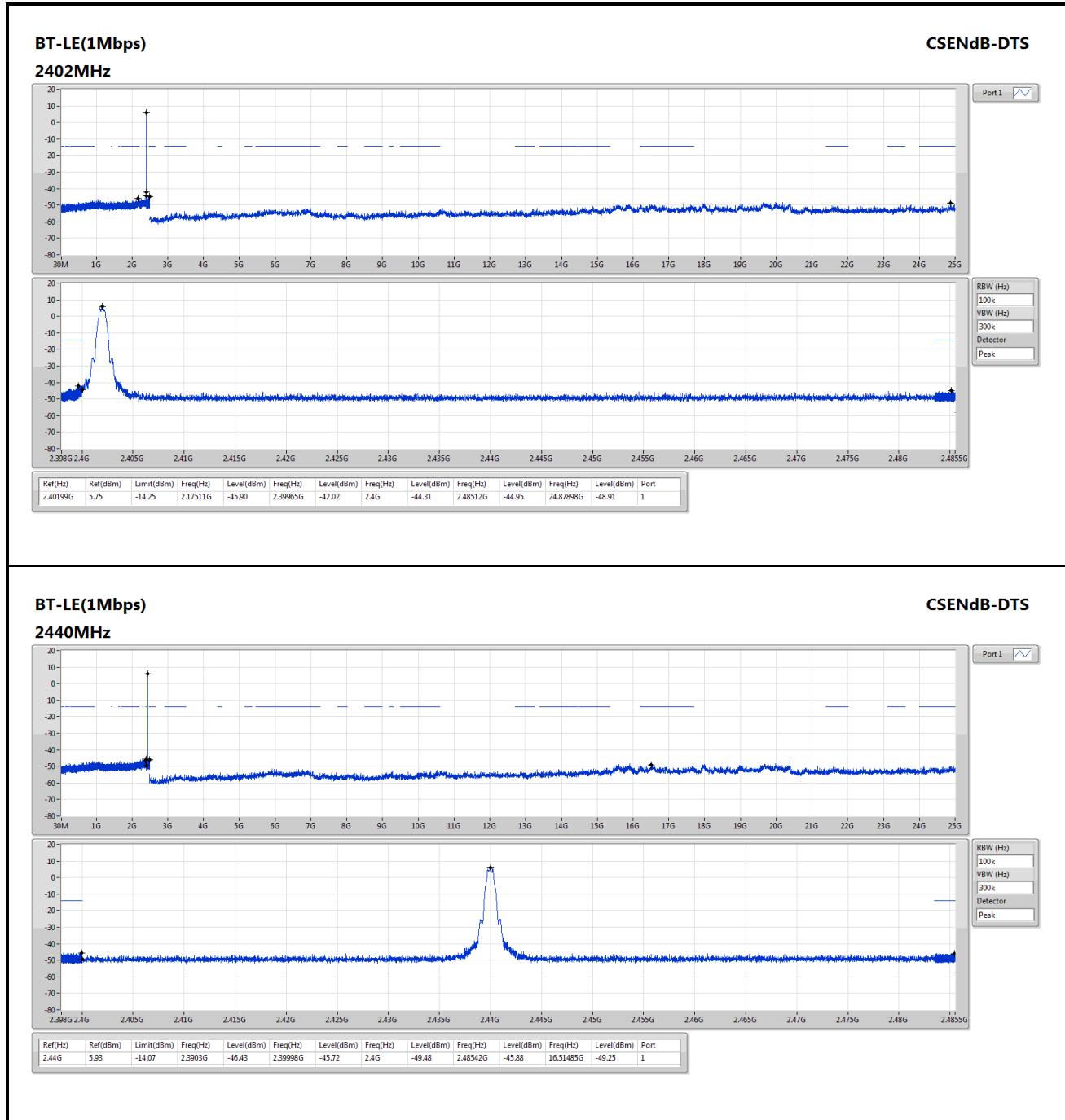
1. Set RBW=100kHz, VBW = 300kHz , Detector = Peak, Sweep time = Auto
2. Trace = max hold , Allow Trace to fully stabilize
3. Scan Frequency range is up to 25GHz
4. Use the peak marker function to determine the maximum amplitude level

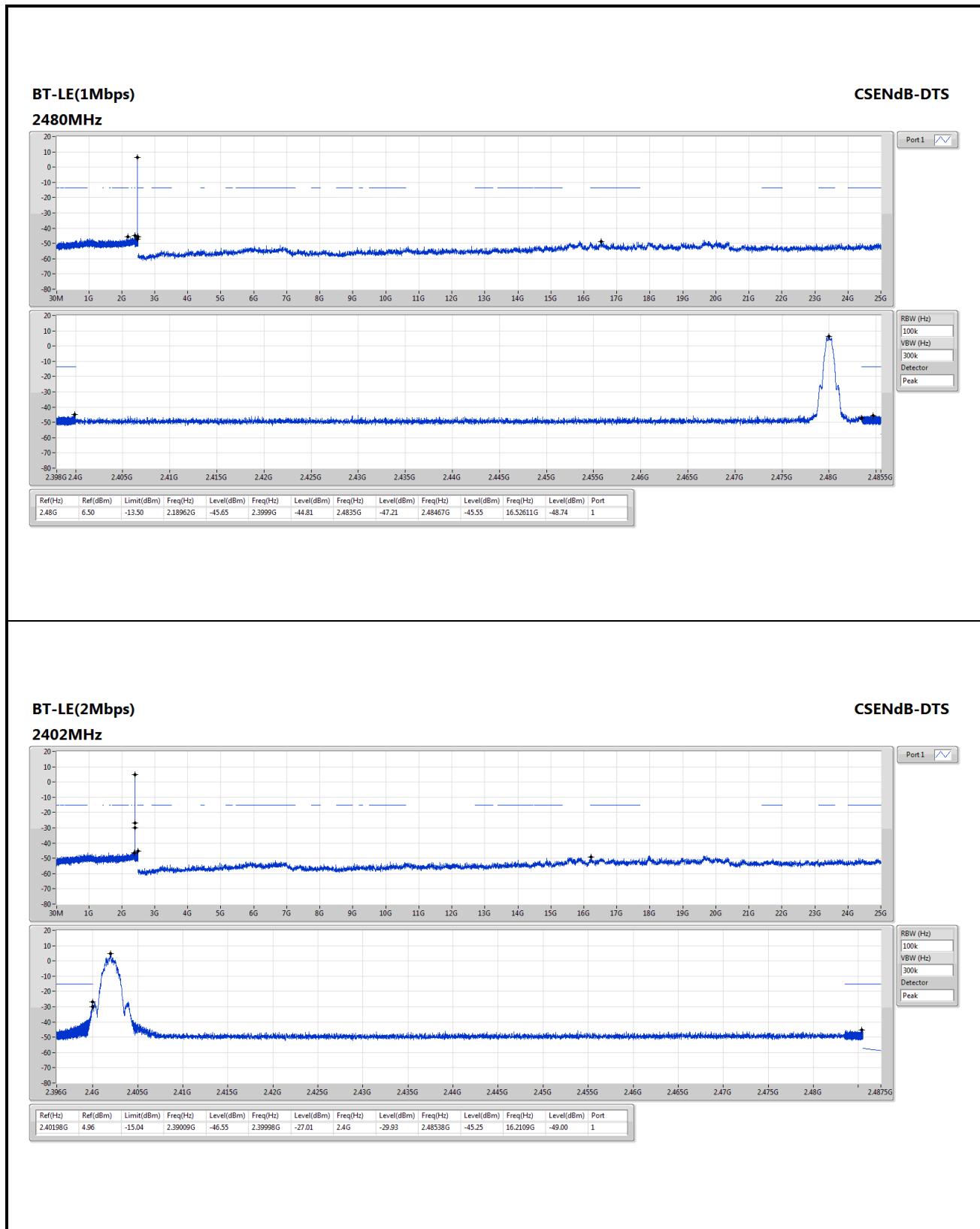
### 3.6.3 Test Setup

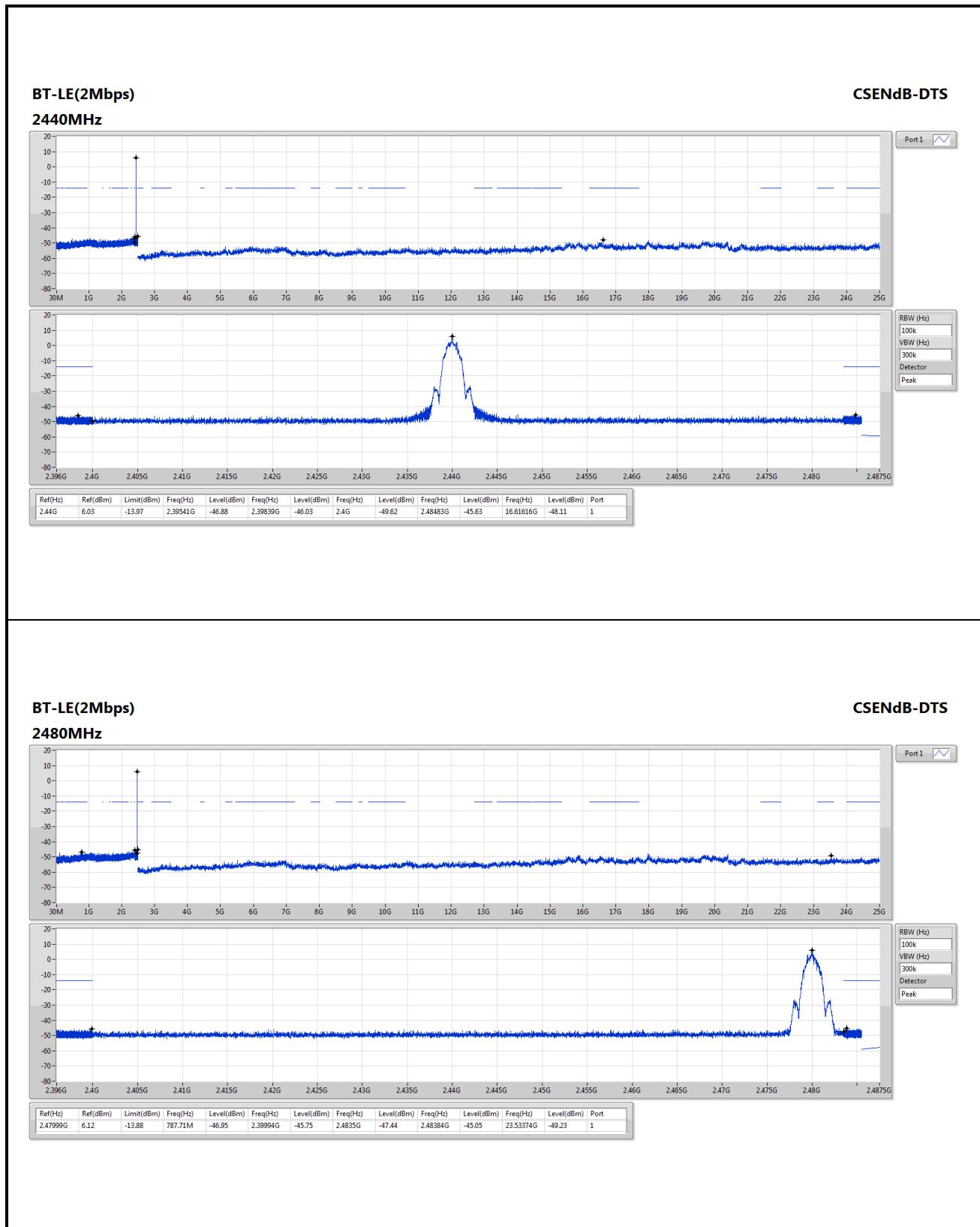


### 3.6.4 Test Result of Emissions in non-restricted Frequency Bands

Ambient Condition	24°C / 67%	Tested By	Aska Huang
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## 4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corporation (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website <http://www.icertifi.com.tw>.

### Linkou

Tel: 886-2-2601-1640  
No.30-2, Ding Fwu Tsuen, Lin Kou  
District, New Taipei City, Taiwan  
(R.O.C.)

### Kwei Shan

Tel: 886-3-271-8666  
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St., Kwei Shan Dist., Tao Yuan  
City 33381, Taiwan (R.O.C.)  
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### Kwei Shan Site II

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If you have any suggestion, please feel free to contact us as below information.

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