

# TEST REPORT

## CERTIFICATE OF CONFORMITY

**Standard:** 47 CFR FCC Part 15, Subpart C (Section 15.247)

**Report No.:** RFBDKG-WTW-P24040541

**FCC ID:** JNZMR0114

**Product:** Wireless Mouse

**Brand:** Logitech, logi, logitech

**Model No.:** MR0114

**Received Date:** 2024/4/23

**Test Date:** 2024/4/25 ~ 2024/4/28

**Issued Date:** 2024/5/20

**Applicant:** Logitech Far East Ltd.

**Address:** #2 Creation Rd. 4, Science-Based Ind. Park Hsinchu Taiwan, R.O.C.


**Issued By:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch  
Hsin Chu Laboratory

**Lab Address:** E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan

**Test Location:** E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan

**FCC Registration /** 723255 / TW2022

**Designation Number:**

**Approved by:**  \_\_\_\_\_, **Date:** 2024/5/20  
May Chen / Manager

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Prepared by : Vito Lung / Specialist

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## Release Control Record

Issue No.	Description	Date Issued
RFBDKG-WTW-P24040541	Original release.	2024/5/20

## 1 Certificate

**Product:** Wireless Mouse

**Brand:** Logitech, logi, logitech

**Test Model:** MR0114

**Sample Status:** Engineering sample

**Applicant:** Logitech Far East Ltd.

**Test Date:** 2024/4/25 ~ 2024/4/28

**Standard:** 47 CFR FCC Part 15, Subpart C (Section 15.247)

**Measurement** ANSI C63.10-2013

**procedure:** KDB 558074 D01 15.247 Meas Guidance v05r02

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, 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 RF characteristics under the conditions specified in this report.

## 2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
Standard / Clause	Test Item	Result	Remark
15.247(b)	RF Output Power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	Pass	Meet the requirement of limit.
15.247(a)(2)	6 dB Bandwidth	Pass	Meet the requirement of limit.
15.247(d)	Conducted Out of Band Emissions	Pass	Meet the requirement of limit.
15.207	AC Power Conducted Emissions	N/A	Power supply is from battery.
15.205 / 15.209 / 15.247(d)	Unwanted Emissions below 1 GHz	Pass	Minimum passing margin is -8.3 dB at 914.30 MHz
15.205 / 15.209 / 15.247(d)	Unwanted Emissions above 1 GHz	Pass	Minimum passing margin is -5.4 dB at 2483.50 MHz
15.203	Antenna Requirement	Pass	No antenna connector is used.

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

### 2.1 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:

Measurement	Specification	Expanded Uncertainty (k=2) (±)
RF Output Power	-	1.1 dB
Power Spectral Density	-	1.3 dB
6 dB Bandwidth	-	1050.00 Hz
Conducted Out of Band Emissions	9 kHz ~ 40 GHz	2.6 dB
Unwanted Emissions below 1 GHz	9 kHz ~ 30 MHz	3.1 dB
	30 MHz ~ 1 GHz	5.4 dB
Unwanted Emissions above 1 GHz	1 GHz ~ 18 GHz	5.0 dB
	18 GHz ~ 40 GHz	5.3 dB

The other instruments specified are routine verified to remain within the calibrated levels, no measurement uncertainty is required to be calculated.

### 2.2 Supplementary Information

There is not any deviation from the test standards for the test method, and no modifications required for compliance.

### 3 General Information

#### 3.1 General Description

Product	Wireless Mouse
Brand	Logitech, logi, logitech
Test Model	MR0114
Status of EUT	Engineering sample
Power Supply Rating	1.5 Vdc from battery
Modulation Type	GFSK
Modulation Technology	DTS
Transfer Rate	1 Mbps
Operating Frequency	2.402 GHz ~ 2.48 GHz
Number of Channel	40
Output Power	0.8551 mW (-0.68 dBm)

Note:

1. The EUT may have a lot of colors for marketing requirement.
2. The product is powered by an alkaline battery.
3. 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.

#### 3.2 Antenna Description of EUT

1. The antenna information is listed as below.

Antenna Gain (dBi)	Frequency Range (GHz)	Antenna Type	Connector Type
5.15	2.4~2.4835	Monopole	None

\* Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.

### 3.3 Channel List

40 channels are provided for BT-LE:

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



### 3.4 Test Mode Applicability and Tested Channel Detail

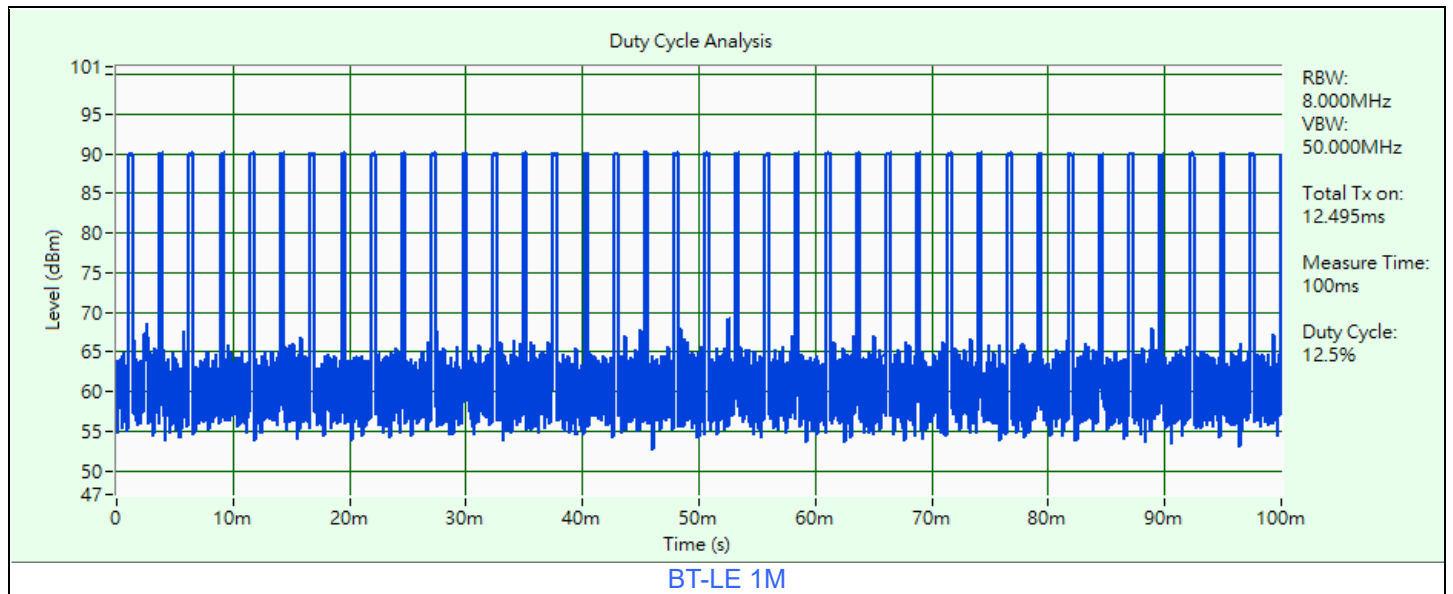
Pre-Scan:	1. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
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Following channel(s) was (were) selected for the final test as listed below:

Test Item	Mode	Tested Channel	Modulation	Data Rate Parameter
RF Output Power	BT-LE 1M	0, 19, 39	GFSK	1Mb/s
Power Spectral Density	BT-LE 1M	0, 19, 39	GFSK	1Mb/s
6 dB Bandwidth / Conducted Out of Band Emissions	BT-LE 1M	0, 19, 39	GFSK	1Mb/s
Unwanted Emissions below 1 GHz	BT-LE 1M	0	GFSK	1Mb/s
Unwanted Emissions above 1 GHz	BT-LE 1M	0, 19, 39	GFSK	1Mb/s

### 3.5 Duty Cycle of Test Signal

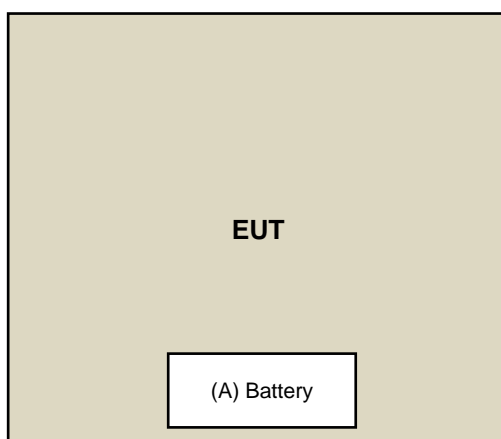
**BT-LE 1M:** Duty cycle = 12.495 ms / 100 ms x 100% = 12.495%



### 3.6 Test Program Used and Operation Descriptions

Controlling software (Press the key into specific mode) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

### 3.7 Connection Diagram of EUT and Peripheral Devices



### 3.8 Configuration of Peripheral Devices and Cable Connections

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	Battery	TOSHIBA	AA	N/A	N/A	Provided by Lab

## 4 Test Instruments

The calibration interval of the all test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

### 4.1 RF Output Power

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Pulse Power Sensor Anritsu	MA2411B	1726434	2023/6/19	2024/6/18
RF Power Meter Anritsu	ML2495A	1529002	2023/6/17	2024/6/16

Notes:

1. The test was performed in Oven room 2.
2. Tested Date: 2024/4/28

### 4.2 Power Spectral Density

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
MXA Signal Analyzer Keysight	N9020B	MY60112409	2024/2/20	2025/2/19
Software	ADT_RF Test Software V7.6.5.4	N/A	N/A	N/A

Notes:

1. The test was performed in Oven room 2.
2. Tested Date: 2024/4/28

### 4.3 6 dB Bandwidth

Refer to section 4.2 to get information of the instruments.

### 4.4 Conducted Out of Band Emissions

Refer to section 4.2 to get information of the instruments.

#### 4.5 Unwanted Emissions below 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	N/A	N/A
Bi_Log Antenna Schwarzbeck	VULB 9168	9168-361	2023/10/13	2024/10/12
Fix tool for Boresight antenna tower BV	FBA-01	FBA_SIP01	N/A	N/A
Fixed Attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	2024/2/17	2025/2/16
Loop Antenna Electro-Metrics	EM-6879	264	2024/2/23	2025/2/22
MXE EMI Receiver Agilent	N9038A	MY50010156	2023/6/13	2024/6/12
Preamplifier EMCI	EMC330N	980852	2024/2/17	2025/2/16
	EMC001340	980142	2024/2/19	2025/2/18
RF Coaxial Cable JYEBAO	5D-FB	LOOPCAB-001	2024/2/19	2025/2/18
		LOOPCAB-002	2024/2/19	2025/2/18
RF Coaxial Cable PEWC	8D	001	2024/2/16	2025/2/15
		966-3-2	2024/2/16	2025/2/15
		966-3-3	2024/2/16	2025/2/15
Software	ADT_Radiated_V8.7.08	N/A	N/A	N/A

Notes:

1. The test was performed in 966 Chamber No. 3.
2. Tested Date: 2024/4/25

#### 4.6 Unwanted Emissions above 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	N/A	N/A
Fix tool for Boresight antenna tower BV	FBA-01	FBA_SIP01	N/A	N/A
Horn Antenna Schwarzbeck	BBHA 9120D	9120D-406	2023/11/12	2024/11/11
	BBHA 9170	9170-739	2023/11/12	2024/11/11
MXE EMI Receiver Agilent	N9038A	MY50010156	2023/6/13	2024/6/12
Preamplifier EMCI	EMC12630SE	980384	2024/1/29	2025/1/28
	EMC184045SE	980387	2023/8/9	2024/8/8
PXA Signal Analyzer Keysight	N9030B	MY57142938	2024/3/20	2025/3/19
RF Coaxial Cable EMCI	EMC102-KM-KM-1200	160924	2024/1/29	2025/1/28
	EMC102-KM-KM-4000	200214	2024/1/29	2025/1/28
	EMC104-SM-SM-1500	180504	2024/1/29	2025/1/28
	EMC104-SM-SM-2000	180601	2024/1/29	2025/1/28
	EMC104-SM-SM-6000	210201	2024/1/29	2025/1/28
Software	ADT_Radiated_V8.7.08	N/A	N/A	N/A

Notes:

1. The test was performed in 966 Chamber No. 3.
2. Tested Date: 2024/4/25 ~ 2024/4/26

## 5 Limits of Test Items

### 5.1 RF Output Power

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

### 5.2 Power Spectral Density

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

### 5.3 6 dB Bandwidth

The minimum of 6 dB Bandwidth Measurement is 0.5 MHz.

### 5.4 Conducted Out of Band Emissions

Below 20 dB of the highest emission level of operating band (in 100 kHz Resolution Bandwidth).

### 5.5 Unwanted Emissions below 1 GHz

Radiated emissions up to 1 GHz which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20 dB 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

Notes:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).

### 5.6 Unwanted Emissions above 1 GHz

Radiated emissions above 1 GHz which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20 dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
Above 960	500	3

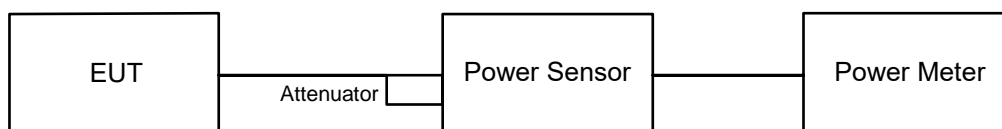
Notes:

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 1000 MHz, 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 20 dB under any condition of modulation.

## 6 Test Arrangements

### 6.1 RF Output Power

#### 6.1.1 Test Setup



#### 6.1.2 Test Procedure

##### Peak Power:

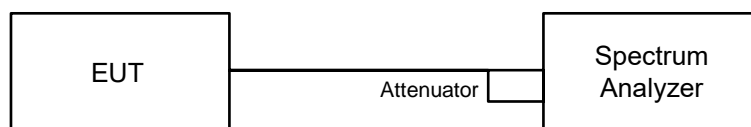
A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

##### Average Power:

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

### 6.2 Power Spectral Density

#### 6.2.1 Test Setup



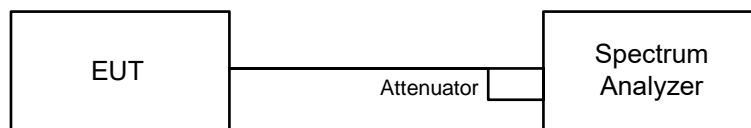
#### 6.2.2 Test Procedure

- a. Set analyzer center frequency to DTS channel center frequency.
- b. Set the span to 1.5 times the DTS bandwidth.
- c. Set the RBW to: 3 kHz.
- d. Set the VBW  $\geq 3 \times$  RBW.
- e. Detector = peak.
- f. Sweep time = auto couple.
- g. Trace mode = max hold.
- h. Allow trace to fully stabilize.
- i. Use the peak marker function to determine the maximum amplitude level within the RBW.



### 6.3 6 dB Bandwidth

#### 6.3.1 Test Setup

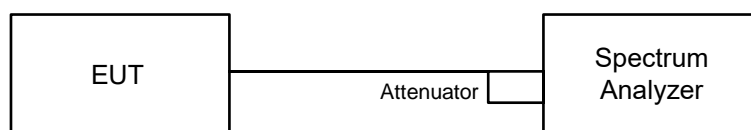


#### 6.3.2 Test Procedure

- Set resolution bandwidth (RBW) = 100 kHz.
- Set the video bandwidth (VBW)  $\geq 3 \times$  RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- 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.

### 6.4 Conducted Out of Band Emissions

#### 6.4.1 Test Setup



#### 6.4.2 Test Procedure

##### MEASUREMENT PROCEDURE REF

- Set the RBW = 100 kHz.
- Set the VBW  $\geq 300$  kHz.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

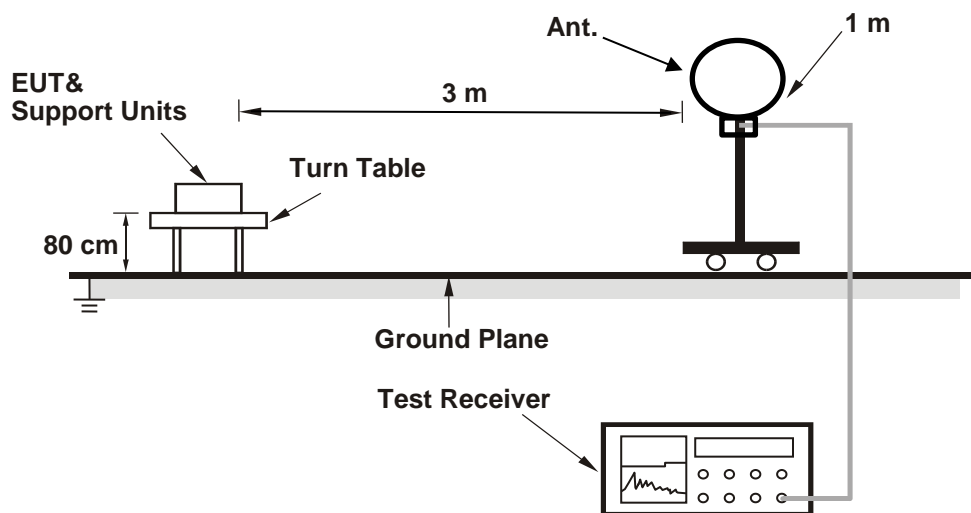
##### MEASUREMENT PROCEDURE OOB

- Set RBW = 100 kHz.
- Set VBW  $\geq 300$  kHz.
- Detector = peak.
- Sweep = auto couple.
- Trace Mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

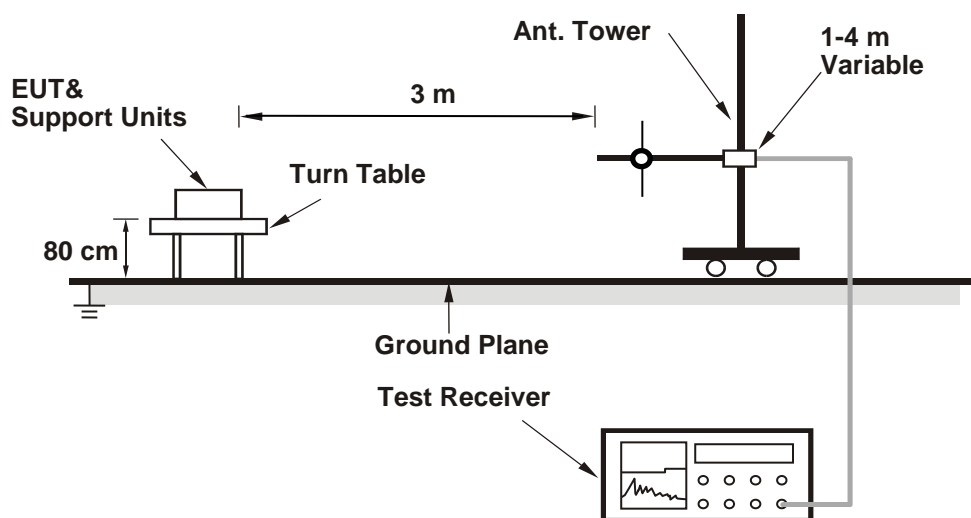
## 6.5 Unwanted Emissions below 1 GHz

### 6.5.1 Test Setup

#### For Radiated emission below 30 MHz



#### For Radiated emission above 30 MHz



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

## 6.5.2 Test Procedure

### For Radiated emission below 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode, except for the frequency band (9 kHz to 90 kHz and 110 kHz to 490 kHz) set to average detect function and peak detect function.

#### Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 200 Hz at frequency below 150 kHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz or 10 kHz at frequency (150 kHz to 30 MHz).
3. All modes of operation were investigated and the worst-case emissions are reported.

### For Radiated emission above 30 MHz

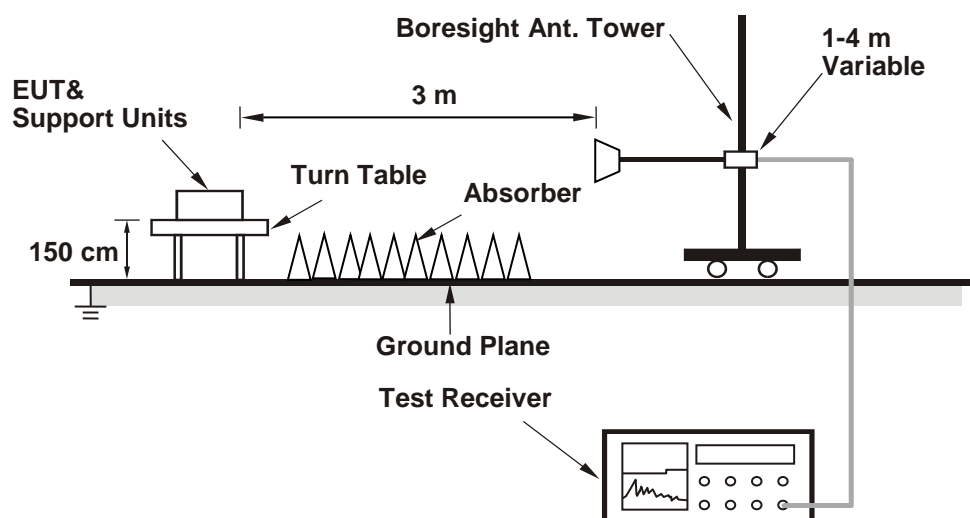
- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. 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.
- d. 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.
- e. 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.

#### Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

## 6.6 Unwanted Emissions above 1 GHz

### 6.6.1 Test Setup



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

### 6.6.2 Test Procedure

- The EUT was placed on the top of a rotating table 1.5 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 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.
- 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.
- The test-receiver/spectrum analyzer was set to peak and average detects 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.

#### Notes:

- The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) and Average detection (AV) at frequency above 1 GHz.
- For fundamental and harmonic signal measurement, according to KDB 558074 D01 15.247 Meas Guidance v05r02 section 8.1(c)(3). The spectrum analyzer settings meet the requirements of 11.12.2.4 in ANSI C63.10 for making a Peak measurement, the average value = Peak value + duty cycle correction factor. The duty cycle measurement refers to FCC 47 CFR Part 15C section 15.35 (c). For duty cycle correction factor values, see the Test Signal Duty Cycle section in this report.
- All modes of operation were investigated and the worst-case emissions are reported.

## 7 Test Results of Test Item

### 7.1 RF Output Power

Input Power:	1.5 Vdc	Environmental Conditions:	23°C, 62% RH	Tested By:	Katina Lu
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#### For Peak Power

Chan.	Chan. Freq. (MHz)	Peak Power (mW)	Peak Power (dBm)	Power Limit (dBm)	Test Result
0	2402	0.8551	-0.68	30	Pass
19	2440	0.826	-0.83	30	Pass
39	2480	0.8072	-0.93	30	Pass

Note: The antenna gain is 5.15 dBi < 6 dBi, so the output power limit shall not be reduced.

#### For Average Power

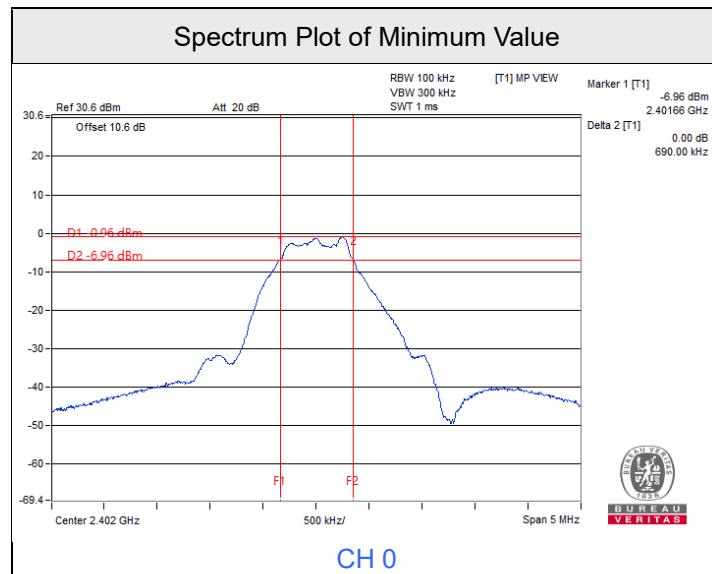
Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
0	2402	0.8147	-0.89
19	2440	0.7925	-1.01
39	2480	0.7709	-1.13



### 7.3 6 dB Bandwidth

Input Power:	1.5 Vdc	Environmental Conditions:	23°C, 62% RH	Tested By:	Katina Lu
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Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Test Result
0	2402	0.69	0.5	Pass
19	2440	0.7	0.5	Pass
39	2480	0.7	0.5	Pass

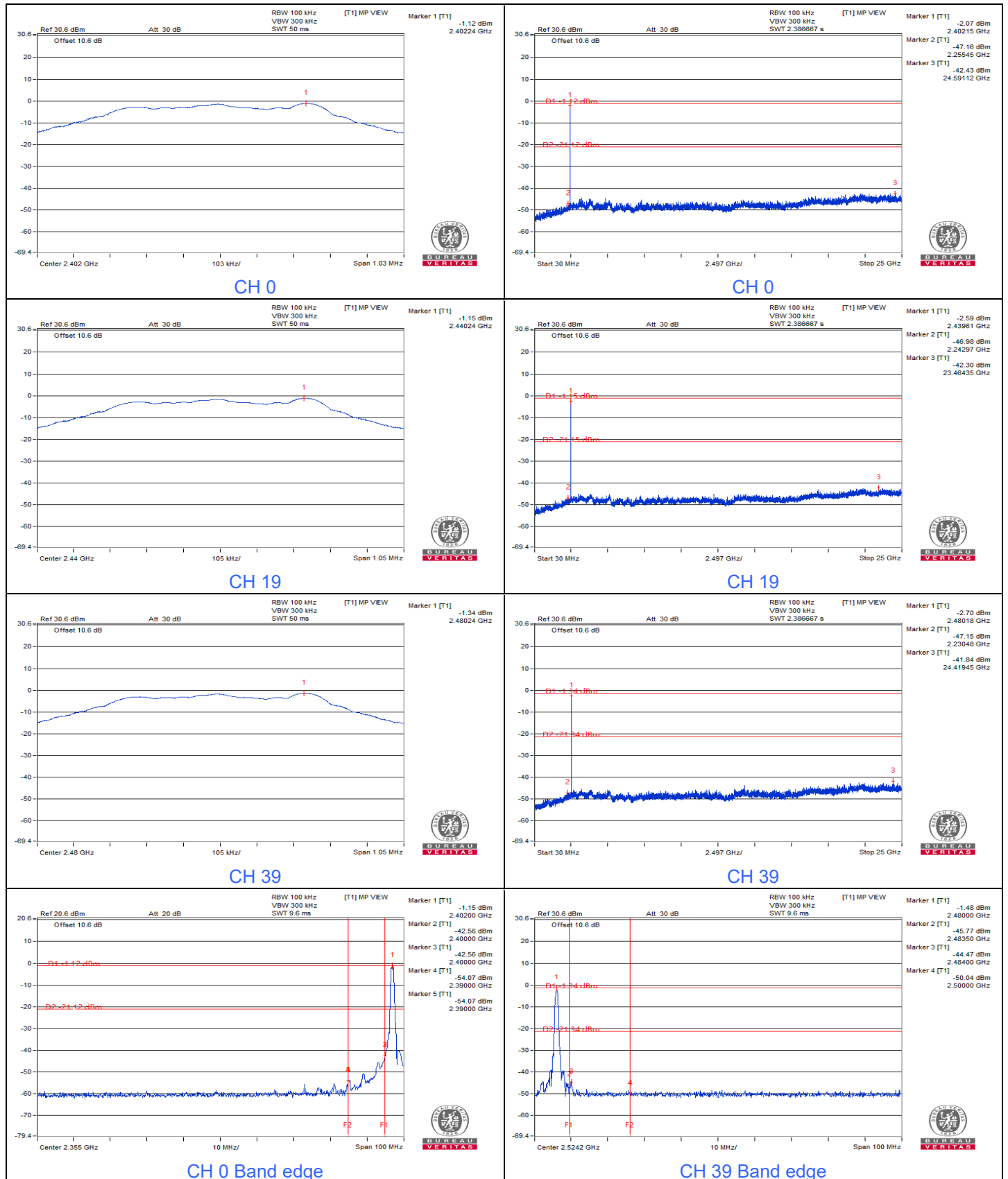




BUREAU VERITAS

### 7.4 Conducted Out of Band Emissions

Input Power:	1.5 Vdc	Environmental Conditions:	23°C, 62% RH	Tested By:	Katina Lu
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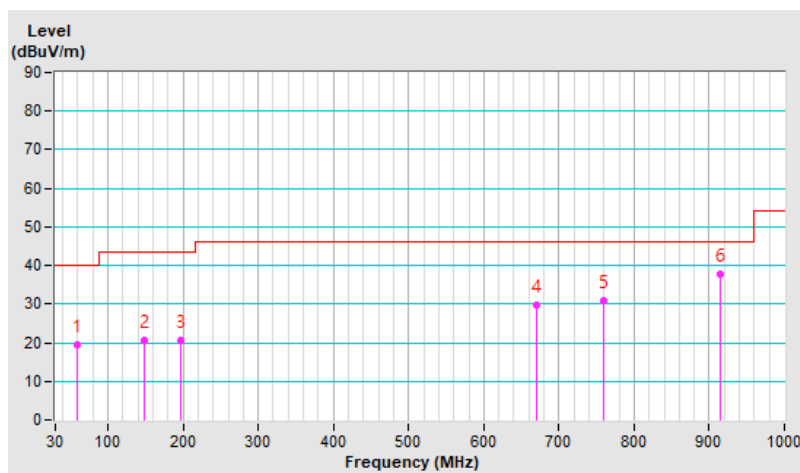
## 7.5 Unwanted Emissions below 1 GHz

RF Mode	BT-LE 1M	Channel	CH 0 : 2402 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	QP: RB=120kHz, DET=Quasi-Peak
Input Power	1.5 Vdc	Environmental Conditions	21°C, 65% RH
Tested By	Willy Lin	Test Date	2024/4/25

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	58.15	19.3 QP	40.0	-20.7	1.00 H	331	32.4	-13.1
2	147.83	20.6 QP	43.5	-22.9	2.00 H	246	33.1	-12.5
3	197.06	20.6 QP	43.5	-22.9	2.00 H	169	36.2	-15.6
4	670.76	29.7 QP	46.0	-16.3	3.00 H	328	32.9	-3.2
5	759.56	31.0 QP	46.0	-15.0	1.00 H	183	32.1	-1.1
6	914.30	37.7 QP	46.0	-8.3	3.00 H	0	37.0	0.7

### Remarks:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
- Margin value = Emission Level – Limit value
- The other emission levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
- The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.

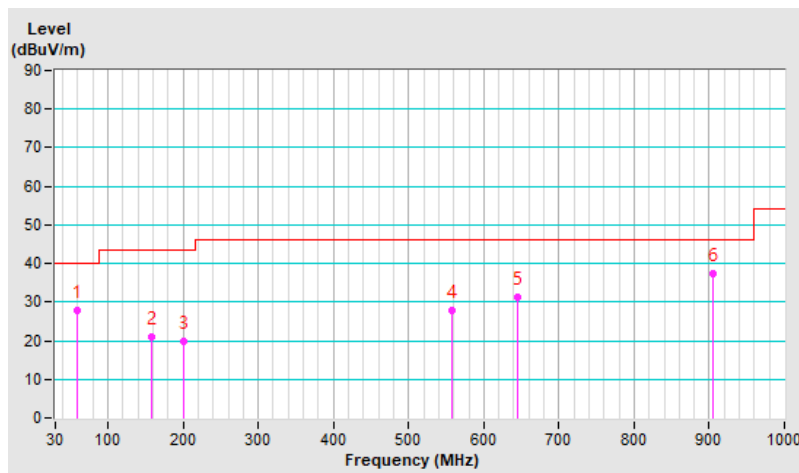


<b>RF Mode</b>	BT-LE 1M	<b>Channel</b>	CH 0 : 2402 MHz
<b>Frequency Range</b>	30 MHz ~ 1 GHz	<b>Detector Function &amp; Bandwidth</b>	QP: RB=120kHz, DET=Quasi-Peak
<b>Input Power</b>	1.5 Vdc	<b>Environmental Conditions</b>	21°C, 65% RH
<b>Tested By</b>	Willy Lin	<b>Test Date</b>	2024/4/25

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	59.49	27.7 QP	40.0	-12.3	2.00 V	0	40.9	-13.2
2	157.56	21.0 QP	43.5	-22.5	1.00 V	353	33.6	-12.6
3	200.55	19.8 QP	43.5	-23.7	2.00 V	178	35.5	-15.7
4	558.43	27.8 QP	46.0	-18.2	3.00 V	119	33.5	-5.7
5	644.35	31.2 QP	46.0	-14.8	3.00 V	269	34.6	-3.4
6	904.16	37.3 QP	46.0	-8.7	2.00 V	330	36.9	0.4

**Remarks:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.



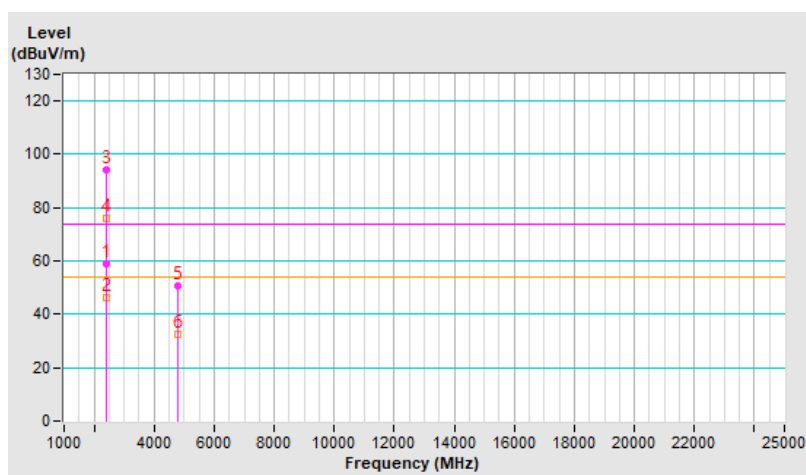
## 7.6 Unwanted Emissions above 1 GHz

<b>RF Mode</b>	BT-LE 1M	<b>Channel</b>	CH 0 : 2402 MHz
<b>Frequency Range</b>	1 GHz ~ 25 GHz	<b>Detector Function &amp; Bandwidth</b>	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
<b>Input Power</b>	1.5 Vdc	<b>Environmental Conditions</b>	22°C, 64% RH
<b>Tested By</b>	Willy Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	59.1 PK	74.0	-14.9	1.50 H	9	61.4	-2.3
2	2390.00	46.5 AV	54.0	-7.5	1.50 H	9	48.8	-2.3
3	*2402.00	94.1 PK			1.50 H	9	96.4	-2.3
4	*2402.00	76.0 AV			1.50 H	9	78.3	-2.3
5	4804.00	50.6 PK	74.0	-23.4	1.07 H	297	48.7	1.9
6	4804.00	32.5 AV	54.0	-21.5	1.07 H	297	30.6	1.9

### Remarks:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
- Margin value = Emission Level – Limit value
- The other emission levels were very low against the limit.
- " \* " : Fundamental frequency, the limit was restricted at the RF Output Power.
- The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty cycle correction factor is calculated from following formula:  
 $20 \log(\text{Duty cycle}) = 20 \log(12.495 \text{ ms} / 100 \text{ ms}) = -18.1 \text{ dB}$

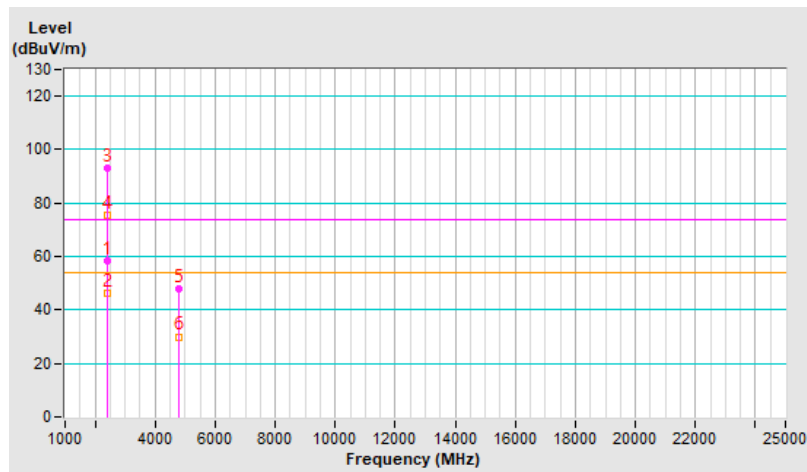


<b>RF Mode</b>	BT-LE 1M	<b>Channel</b>	CH 0 : 2402 MHz
<b>Frequency Range</b>	1 GHz ~ 25 GHz	<b>Detector Function &amp; Bandwidth</b>	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
<b>Input Power</b>	1.5 Vdc	<b>Environmental Conditions</b>	22°C, 64% RH
<b>Tested By</b>	Willy Lin		

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	58.4 PK	74.0	-15.6	3.78 V	136	60.7	-2.3
2	2390.00	46.1 AV	54.0	-7.9	3.78 V	136	48.4	-2.3
3	*2402.00	93.3 PK			3.78 V	136	95.6	-2.3
4	*2402.00	75.2 AV			3.78 V	136	77.5	-2.3
5	4804.00	48.1 PK	74.0	-25.9	3.14 V	271	46.2	1.9
6	4804.00	30.0 AV	54.0	-24.0	3.14 V	271	28.1	1.9

**Remarks:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " \* " : Fundamental frequency, the limit was restricted at the RF Output Power.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty cycle correction factor is calculated from following formula:  
 $20 \log(\text{Duty cycle}) = 20 \log(12.495 \text{ ms} / 100 \text{ ms}) = -18.1 \text{ dB}$

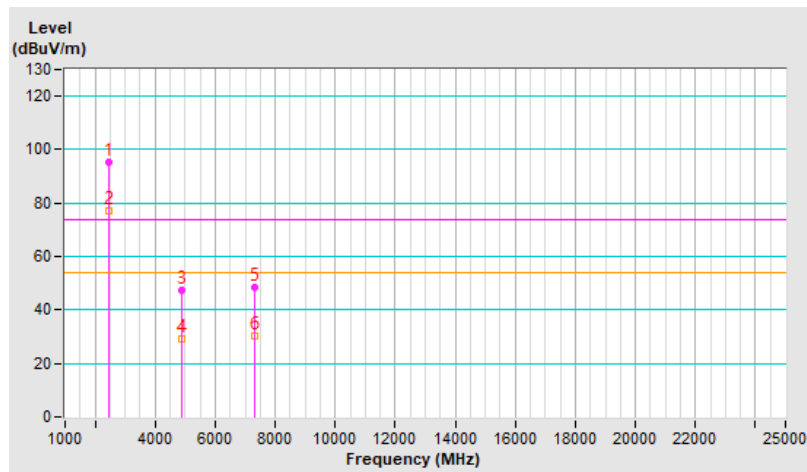


<b>RF Mode</b>	BT-LE 1M	<b>Channel</b>	CH 19 : 2440 MHz
<b>Frequency Range</b>	1 GHz ~ 25 GHz	<b>Detector Function &amp; Bandwidth</b>	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
<b>Input Power</b>	1.5 Vdc	<b>Environmental Conditions</b>	22°C, 64% RH
<b>Tested By</b>	Willy Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2440.00	95.2 PK			1.52 H	15	97.4	-2.2
2	*2440.00	77.1 AV			1.52 H	15	79.3	-2.2
3	4880.00	47.1 PK	74.0	-26.9	1.00 H	296	45.2	1.9
4	4880.00	29.0 AV	54.0	-25.0	1.00 H	296	27.1	1.9
5	7320.00	48.6 PK	74.0	-25.4	1.16 H	135	40.9	7.7
6	7320.00	30.5 AV	54.0	-23.5	1.16 H	135	22.8	7.7

**Remarks:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " \* " : Fundamental frequency, the limit was restricted at the RF Output Power.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty cycle correction factor is calculated from following formula:  
 $20 \log(\text{Duty cycle}) = 20 \log(12.495 \text{ ms} / 100 \text{ ms}) = -18.1 \text{ dB}$

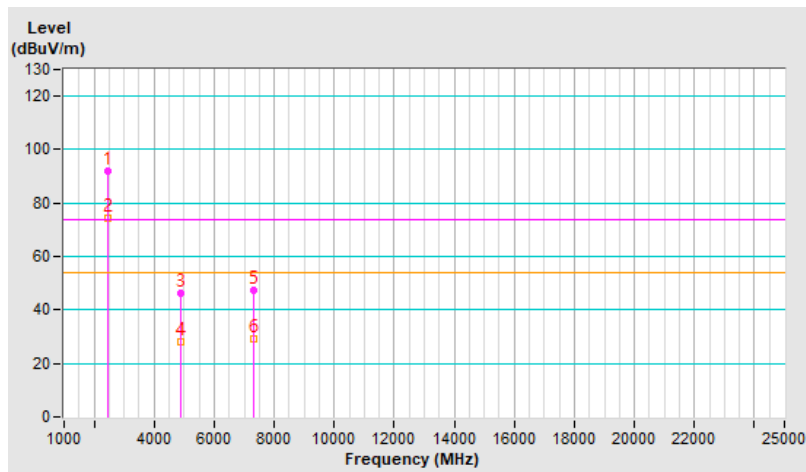


<b>RF Mode</b>	BT-LE 1M	<b>Channel</b>	CH 19 : 2440 MHz
<b>Frequency Range</b>	1 GHz ~ 25 GHz	<b>Detector Function &amp; Bandwidth</b>	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
<b>Input Power</b>	1.5 Vdc	<b>Environmental Conditions</b>	22°C, 64% RH
<b>Tested By</b>	Willy Lin		

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2440.00	92.2 PK			3.74 V	131	94.4	-2.2
2	*2440.00	74.1 AV			3.74 V	131	76.3	-2.2
3	4880.00	46.2 PK	74.0	-27.8	3.09 V	283	44.3	1.9
4	4880.00	28.1 AV	54.0	-25.9	3.09 V	283	26.2	1.9
5	7320.00	47.3 PK	74.0	-26.7	2.54 V	156	39.6	7.7
6	7320.00	29.2 AV	54.0	-24.8	2.54 V	156	21.5	7.7

**Remarks:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " \* " : Fundamental frequency, the limit was restricted at the RF Output Power.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty cycle correction factor is calculated from following formula:  
 $20 \log(\text{Duty cycle}) = 20 \log(12.495 \text{ ms} / 100 \text{ ms}) = -18.1 \text{ dB}$



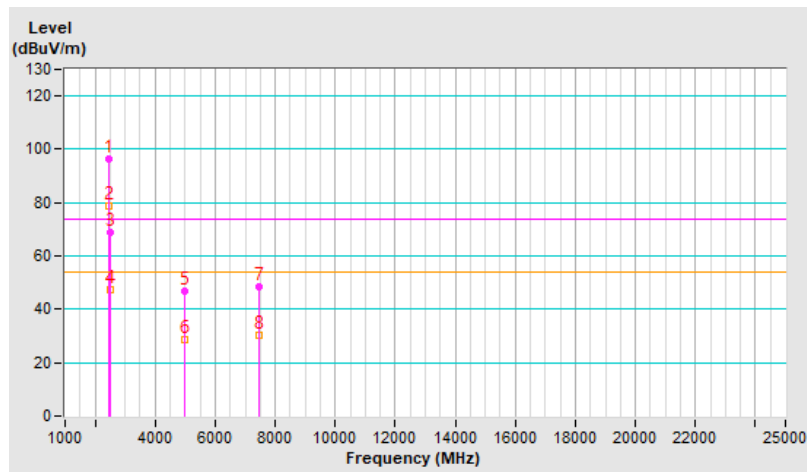
<b>RF Mode</b>	BT-LE 1M	<b>Channel</b>	CH 39 : 2480 MHz
<b>Frequency Range</b>	1 GHz ~ 25 GHz	<b>Detector Function &amp; Bandwidth</b>	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
<b>Input Power</b>	1.5 Vdc	<b>Environmental Conditions</b>	22°C, 64% RH
<b>Tested By</b>	Willy Lin		

**Antenna Polarity & Test Distance : Horizontal at 3 m**

No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2480.00	96.6 PK			2.85 H	20	98.8	-2.2
2	*2480.00	78.5 AV			2.85 H	20	80.7	-2.2
<b>3</b>	<b>2483.50</b>	<b>68.6 PK</b>	<b>74.0</b>	<b>-5.4</b>	<b>2.85 H</b>	<b>20</b>	<b>70.8</b>	<b>-2.2</b>
4	2483.50	47.5 AV	54.0	-6.5	2.85 H	20	49.7	-2.2
5	4960.00	46.8 PK	74.0	-27.2	1.00 H	305	44.6	2.2
6	4960.00	28.7 AV	54.0	-25.3	1.00 H	305	26.5	2.2
7	7440.00	48.3 PK	74.0	-25.7	1.19 H	145	40.5	7.8
8	7440.00	30.2 AV	54.0	-23.8	1.19 H	145	22.4	7.8

**Remarks:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " \* " : Fundamental frequency, the limit was restricted at the RF Output Power.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty cycle correction factor is calculated from following formula:  
 $20 \log(\text{Duty cycle}) = 20 \log(12.495 \text{ ms} / 100 \text{ ms}) = -18.1 \text{ dB}$

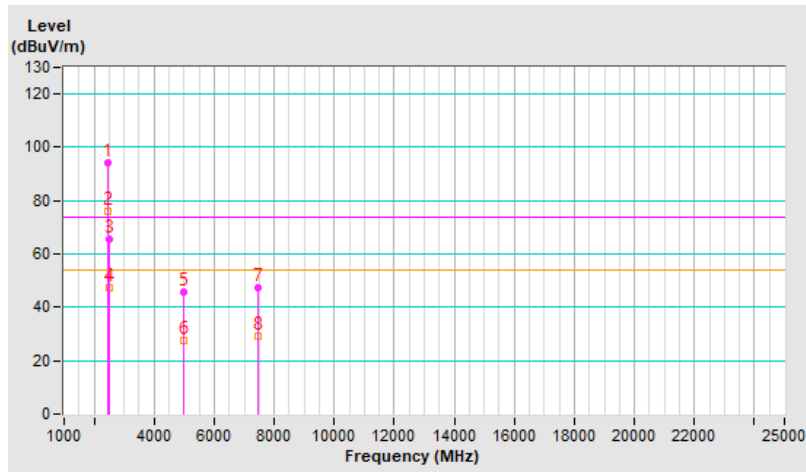


<b>RF Mode</b>	BT-LE 1M	<b>Channel</b>	CH 39 : 2480 MHz
<b>Frequency Range</b>	1 GHz ~ 25 GHz	<b>Detector Function &amp; Bandwidth</b>	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
<b>Input Power</b>	1.5 Vdc	<b>Environmental Conditions</b>	22°C, 64% RH
<b>Tested By</b>	Willy Lin		

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2480.00	94.1 PK			3.58 V	269	96.3	-2.2
2	*2480.00	76.0 AV			3.58 V	269	78.2	-2.2
3	2483.50	65.4 PK	74.0	-8.6	3.58 V	269	67.6	-2.2
4	2483.50	47.1 AV	54.0	-6.9	3.58 V	269	49.3	-2.2
5	4960.00	45.7 PK	74.0	-28.3	3.10 V	282	43.5	2.2
6	4960.00	27.6 AV	54.0	-26.4	3.10 V	282	25.4	2.2
7	7440.00	47.2 PK	74.0	-26.8	2.54 V	159	39.4	7.8
8	7440.00	29.1 AV	54.0	-24.9	2.54 V	159	21.3	7.8

**Remarks:**

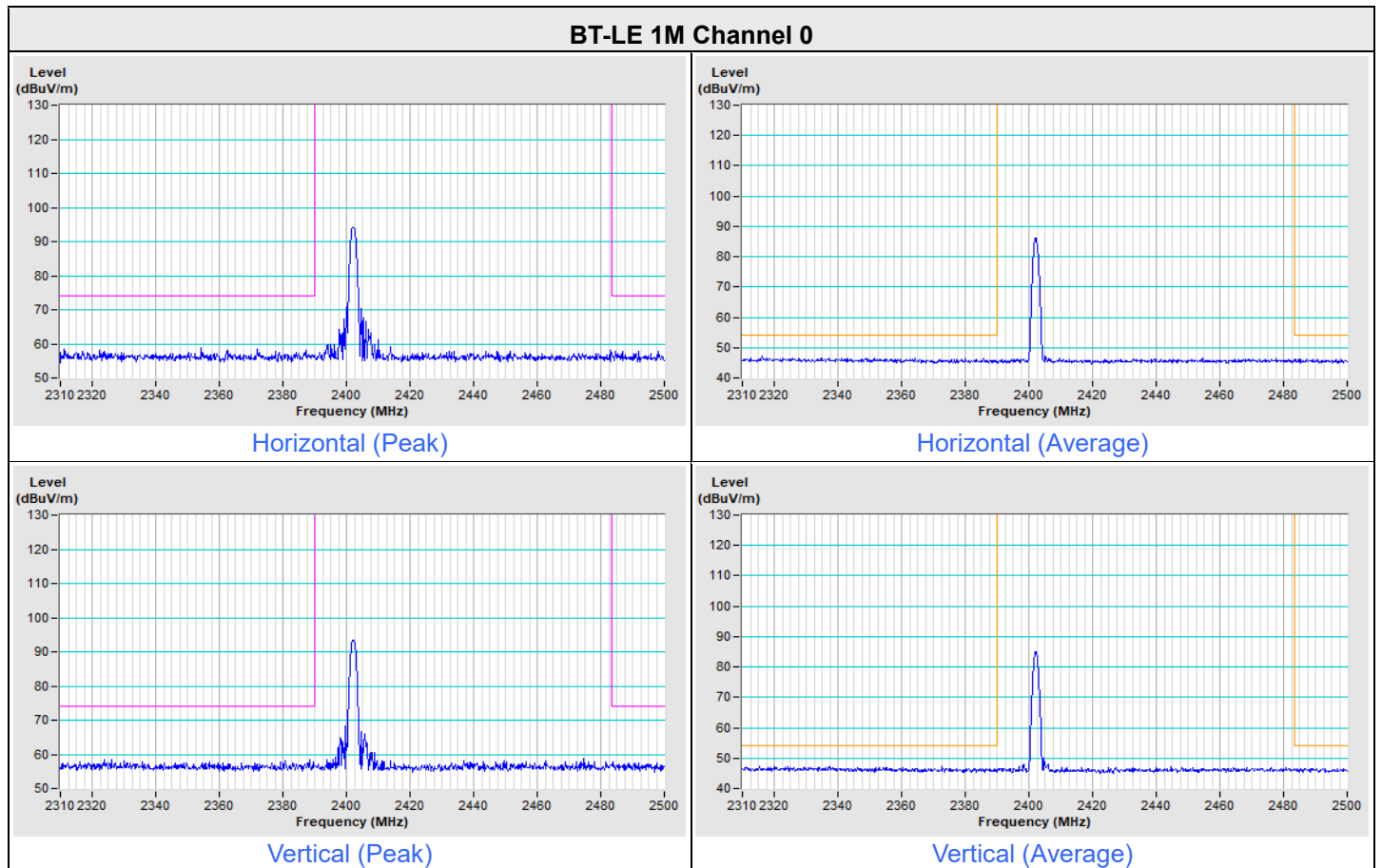
1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " \* ": Fundamental frequency, the limit was restricted at the RF Output Power.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty cycle correction factor is calculated from following formula:  
 $20 \log(\text{Duty cycle}) = 20 \log(12.495 \text{ ms} / 100 \text{ ms}) = -18.1 \text{ dB}$



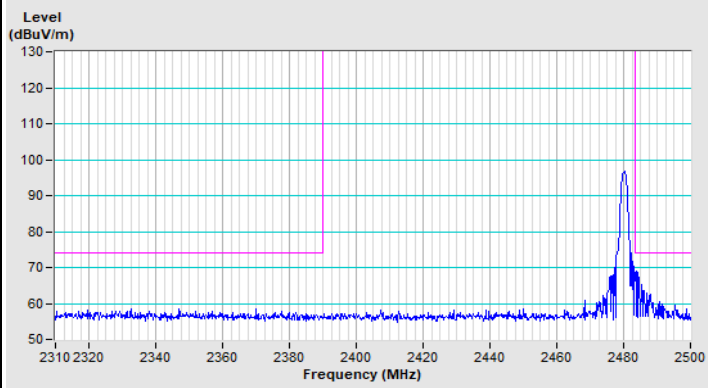


### Plot of Band Edge

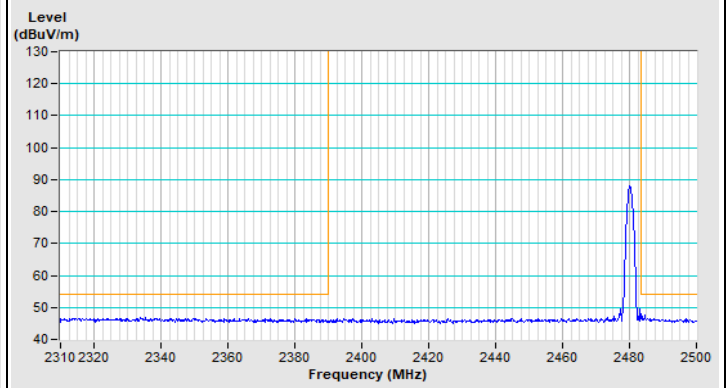
Frequency Range	2.31 GHz ~ 2.5 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
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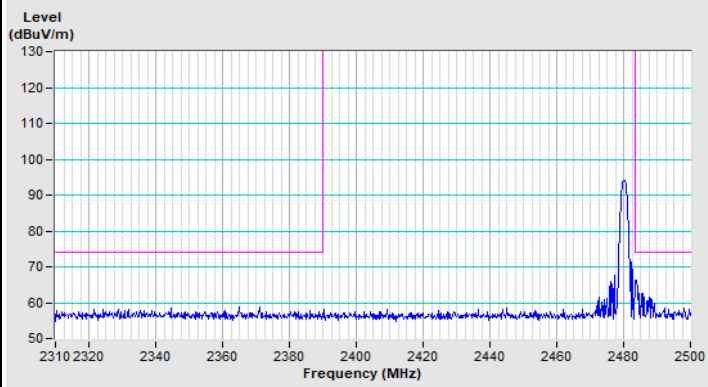
### BT-LE 1M Channel 39



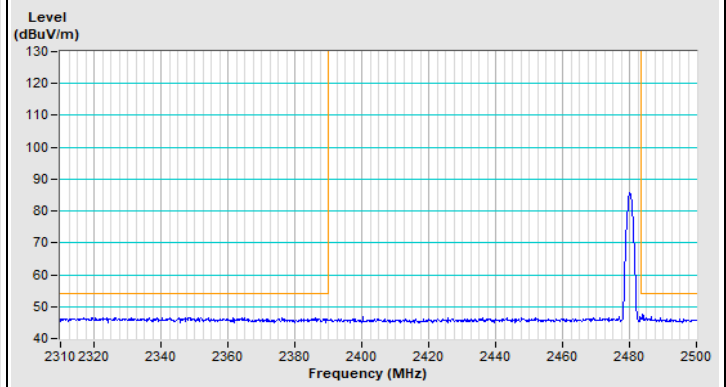
Horizontal (Peak)



Horizontal (Average)



Vertical (Peak)



Vertical (Average)

## 8 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo)

## 9 Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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

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Fax: 886-2-26051924

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**Email:** [service.adt@bureauveritas.com](mailto:service.adt@bureauveritas.com)

**Web Site:** <http://ee.bureauveritas.com.tw>

The address and road map of all our labs can be found in our web site also.

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