

TEST REPORT

CERTIFICATE OF CONFORMITY

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

Report No.: RFBDBG-WTW-P21090703A

FCC ID: JNZMR0094

Model No.: MR0094

Received Date: 2022/2/9

Test Date: 2022/2/11 ~ 2022/2/16

Issued Date: 2022/3/4

Applicant: LOGITECH FAR EAST LTD.

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
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FCC Registration / 723255 / TW2022

Designation Number:

Approved by:



Clark Lin / Technical Manager

Date:

2022/3/4

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Prepared by : Cherry Chuo / Specialist



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Release Control Record

Issue No.	Description	Date Issued
RFBDKG-WTW-P21090703A	Original release.	2022/3/4

1 Certificate

Product: Wireless Mouse

Brand: Logitech

Test Model: MR0094

Sample Status: Engineering sample

Applicant: LOGITECH FAR EAST LTD.

Test Date: 2022/2/11 ~ 2022/2/16

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

Measurement 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	NA	Refer to Note 1 below
15.247(a)(2)	6dB Bandwidth	NA	Refer to Note 1 below
15.247(d)	Conducted Out of Band Emissions	NA	Refer to Note 1 below
15.207	AC Power Conducted Emissions	NA	Refer to Note 1 below
15.205 / 15.209 / 15.247(d)	Unwanted Emissions below 1 GHz	Pass	Minimum passing margin is -9.6 dB at 38.81 MHz
15.205 / 15.209 / 15.247(d)	Unwanted Emissions above 1 GHz	Pass	Minimum passing margin is -17.6 dB at 7434.00 MHz
15.203	Antenna Requirement	Pass	No antenna connector is used.

Notes:

1. RF Output Power & Radiated Emissions were performed for this addendum. The others testing data refer to original test report.
2. 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) (±)
Unwanted Emissions below 1 GHz	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
Test Model	MR0094
Status of EUT	Engineering sample
Power Supply Rating	DC 1.5V from battery
Modulation Type	GFSK
Modulation Technology	DTS
Transfer Rate	Up to 2 Mbps (*Note 1)
Operating Frequency	2.402 ~ 2.480 GHz (*Note 1)
Number of Channel	40 (*Note 1)
Output Power	BT-LE function: BT-LE 1M: 6.839 mW BT-LE 2M: 6.871mW logi bolt function: logi bolt 1M: 6.792 mW logi bolt 2M: 6.776 mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Refer to Note
Cable Supplied	NA

Note:

1. BT-LE and logi bolt technique supports 1Mbps and 2Mbps data rates, both have been evaluated in this test report. Refer to “**section 3.3 Description of Test Modes**” for more detail specification.
2. This is a supplementary report of Report No.: RFBDKG-WTW-P21090703. The differences between them are as below information:
 - ◆ C36 change value from 2.4pF to 2.7pF.
 - ◆ Short MCU pin 10 to GND.
3. According to above conditions, only RF Output Power & Radiated Emissions need to be performed. And all data are verified to meet the requirements.
4. This device have BT-LE and logi bolt functions. logi bolt is the same technology as BT-LE and is just a different marketing name.
5. The EUT may have a lot of colors for marketing requirement.
6. For radiated emissions test, the EUT was pre-tested under the following modes:

Test Mode	Description
Mode A	Left-Hand Sample
Mode B	Right-Hand Sample

Note: In the original report, from the above modes, the worst cases were found in **Mode B**. Therefore only the test data of the mode was recorded in this report.

7. 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.

Brand	Model	Antenna Net Gain (dBi)	Frequency Range (GHz)	Antenna Type	Connector Type
Walsin	RFECA3216060A1T	-0.1	2.4~2.4835	Ceramic antenna	none

*The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

3.3 Channel List

BT-LE & logi bolt channels:

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

3.4 Test Mode Applicability and Tested Channel Detail

Following channel(s) was (were) selected for the final test as listed below:

Test Item	EUT Configure Mode	Mode	Tested Channel	Modulation	Data Rate Parameter
Unwanted Emissions below 1 GHz	A	BT-LE 2M	38	GFSK	2Mb/s
		logi bolt 1M	39	GFSK	1Mb/s
Unwanted Emissions above 1 GHz	A	BT-LE 2M	38	GFSK	2Mb/s
		logi bolt 1M	39	GFSK	1Mb/s
RF Output Power	B	BT-LE 1M	0, 19, 39	GFSK	1Mb/s
		BT-LE 2M	1, 19, 38	GFSK	2Mb/s
		logi bolt 1M	0, 19, 39	GFSK	1Mb/s
		logi bolt 2M	1, 19, 38	GFSK	2Mb/s
EUT Configure Mode:	A	Radiated measurement of right-hand sample in battery mode			
	B	Antenna Port Conducted measurement of right-hand sample			

3.5 Duty Cycle of Test Signal

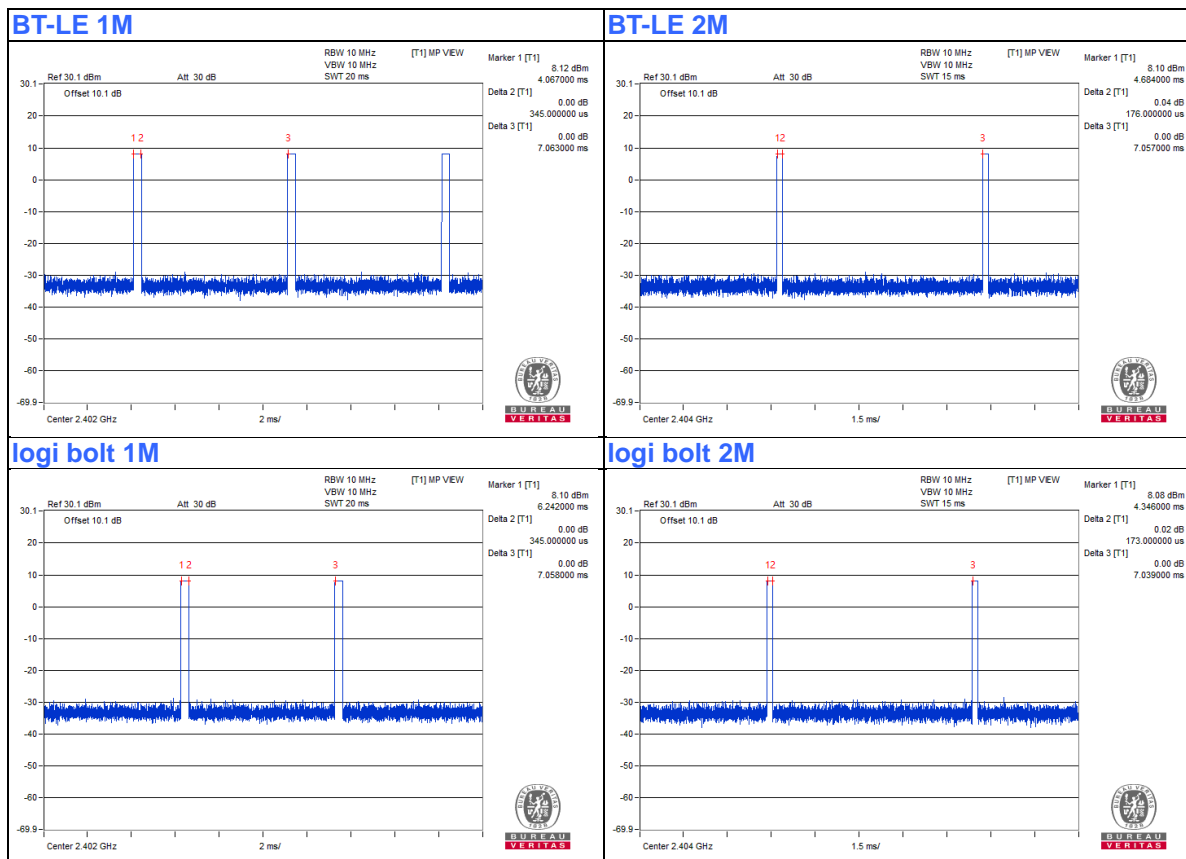
Duty cycle of test signal is < 98 %, duty factor shall be considered.

BT-LE 1M: Duty cycle = 0.345 ms/7.063 ms = 0.049, Duty factor = $10 * \log(1/\text{Duty cycle}) = 13.11 \text{ dB}$

BT-LE 2M: Duty cycle = 0.176 ms/7.057 ms = 0.025, Duty factor = $10 * \log(1/\text{Duty cycle}) = 16.03 \text{ dB}$

logi bolt 1M: Duty cycle = 0.345 ms/7.058 ms = 0.049, Duty factor = $10 * \log(1/\text{Duty cycle}) = 13.11 \text{ dB}$

logi bolt 2M: Duty cycle = 0.173 ms/7.039 ms = 0.025, Duty factor = $10 * \log(1/\text{Duty cycle}) = 16.09 \text{ dB}$

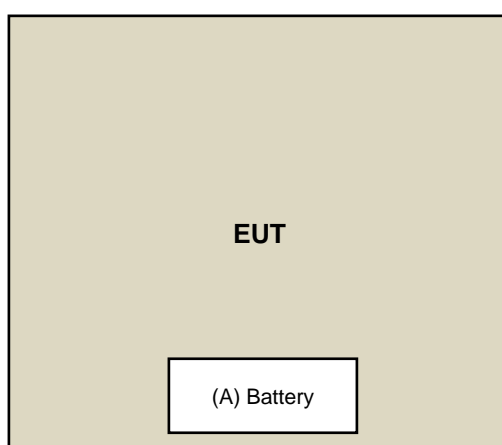


3.6 Test Program Used and Operation Descriptions

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

Test Item	Test Program Used and Operation Descriptions
RF Output Power	◆ BLE1M TX Modulated low duty 2402MHz
	◆ BLE1M TX Modulated low duty 2440MHz
	◆ BLE1M TX Modulated low duty 2480MHz
Unwanted Emissions below 1 GHz	◆ BLE2M TX Modulated low duty 2404MHz
	◆ BLE2M TX Modulated low duty 2440MHz
Unwanted Emissions above 1 GHz	◆ BLE2M TX Modulated low duty 2478MHz

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	Duracell	AA	NA	NA	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
Attenuator WOKEN	MDCS18N-10	MDCS18N-10-01	2021/4/13	2022/4/12
Power Meter Anritsu	ML2495A	1529002	2021/6/21	2022/6/20
Pulse Power Sensor Anritsu	MA2411B	1339443	2021/5/31	2022/5/30
Software	ADT_RF Test Software V6.6.5.4	NA	NA	NA
Spectrum Analyzer R&S	FSV40	101516	2021/3/8	2022/3/7

Notes:

1. The test was performed in Oven room 2.
2. Tested Date: 2022/2/11

4.2 Unwanted Emissions below 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	2021/9/23	2022/9/22
Pre_Amplifier Mini-Circuits	ZFL-1000VH2	QA0838008	2021/10/19	2022/10/18
RF Coaxial Cable COMMATE/PEWC	8D	966-3-1	2021/3/16	2022/3/15
		966-3-2	2021/3/16	2022/3/15
		966-3-3	2021/3/16	2022/3/15
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Spectrum Analyzer KEYSIGHT	N9030B	MY57142938	2021/4/26	2022/4/25
Test Receiver KEYSIGHT	N9038A	MY59050100	2021/5/3	2022/5/2
Trilog Broadband Antenna Schwarzbeck	VULB 9168	9168-361	2021/10/26	2022/10/25
Pre_Amplifier EMCI	EMC001340	980142	2021/5/24	2022/5/23
LOOP ANTENNA Electro-Metrics	EM-6879	264	2021/3/5	2022/3/4
RF Coaxial Cable JYEBO	5D-FB	LOOPCAB-001	2022/1/6	2023/1/5
RF Coaxial Cable JYEBO	5D-FB	LOOPCAB-002	2022/1/6	2023/1/5

Notes:

1. The test was performed in 966 Chamber No. 3.
2. Tested Date: 2022/2/16

4.3 Unwanted Emissions above 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Fix tool for Boresight antenna tower BV	FBA-01	FBA_SIP01	NA	NA
Horn Antenna Schwarzbeck	BBHA9120-D	9120D-406	2021/11/14	2022/11/13
	BBHA 9170	BBHA9170519	2021/11/14	2022/11/13
Pre_Amplifier EMCI	EMC12630SE	980384	2022/1/10	2023/1/9
	EMC184045SE	980387	2022/1/10	2023/1/9
RF Cable EMCI	EMC104-SM-SM-6000	210201	2021/5/13	2022/5/12
RF cable (40GHz) EMCI	EMC-KM-KM-4000	200214	2021/3/10	2022/3/9
RF Cable-Frequency range: 1- 40GHz EMCI	EMC102-KM-KM-1200	160924	2022/1/10	2023/1/9
RF Coaxial Cable EMCI	EMC104-SM-SM-1500	180504	2021/4/26	2022/4/25
	EMC104-SM-SM-2000	180601	2021/6/8	2022/6/7
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Spectrum Analyzer KEYSIGHT	N9030B	MY57142938	2021/4/26	2022/4/25
Spectrum Analyzer Keysight	N9030A	MY54490679	2021/7/9	2022/7/8
Test Receiver KEYSIGHT	N9038A	MY59050100	2021/5/3	2022/5/2

Notes:

1. The test was performed in 966 Chamber No. 3.
2. Tested Date: 2022/2/16

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 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).

5.3 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

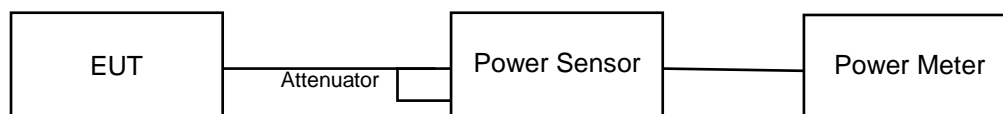
Notes:

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.

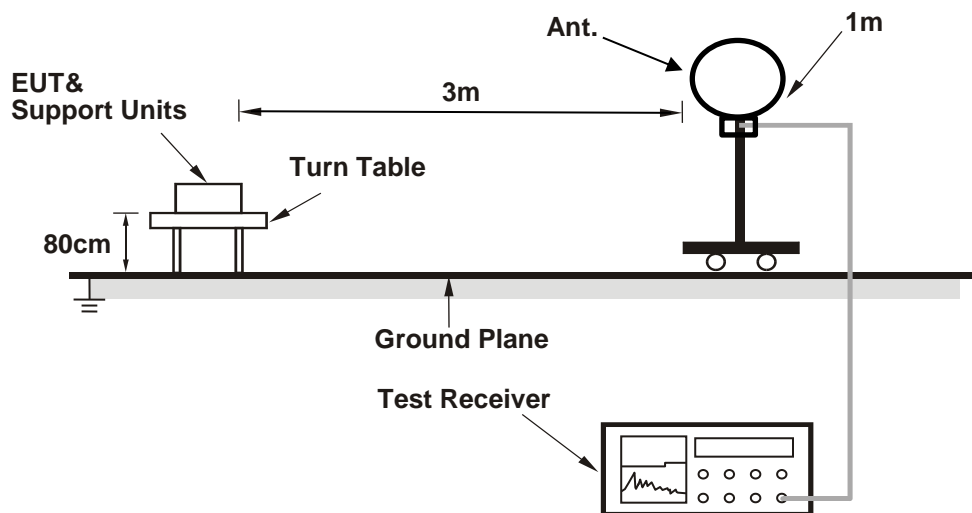
Average Power:

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.

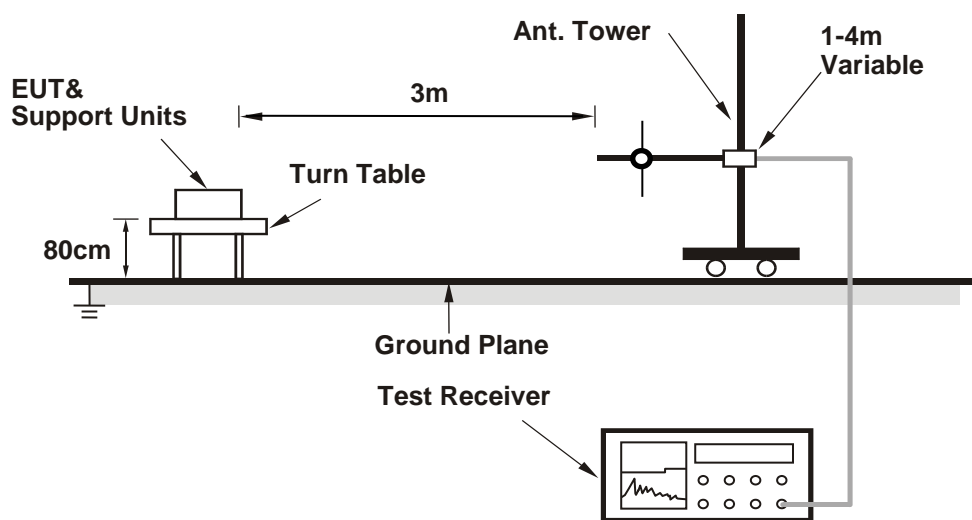
6.2 Unwanted Emissions below 1 GHz

6.2.1 Test Setup

For Radiated emission below 30 MHz



For Radiated emission above 30 MHz



6.2.2 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.

Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30 MHz.
2. 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.

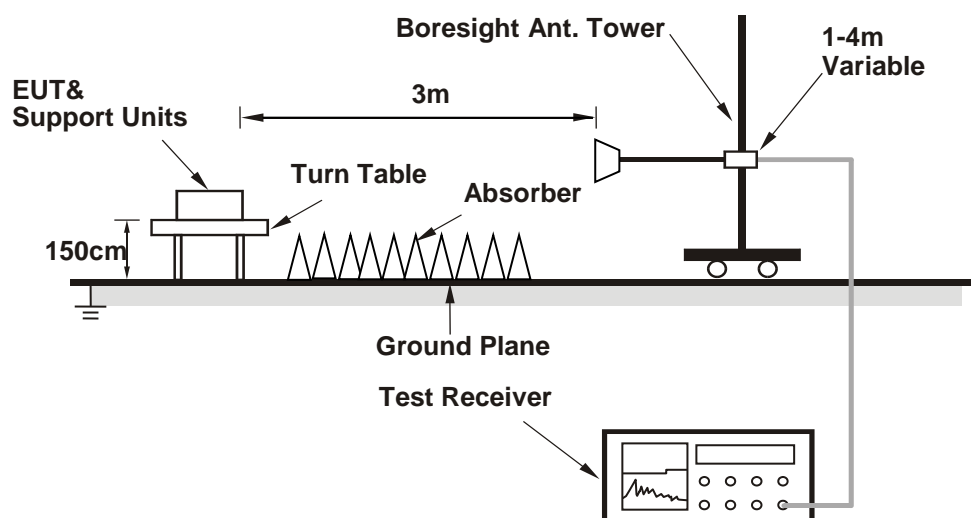
Notes:

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.

6.3 Unwanted Emissions above 1 GHz

6.3.1 Test Setup

For Radiated emission above 1 GHz



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

6.3.2 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 system 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) at frequency above 1 GHz.
- The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Average detection (AV) at frequency above 1GHz.
- 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, 60 % RH	Tested By:	Eric Peng
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For Peak Power

BT-LE 1M

Chan.	Chan. Freq. (MHz)	Peak Power (mW)	Peak Power (dBm)	Power Limit (dBm)	Test Result
0	2402	6.668	8.24	30	Pass
19	2440	6.808	8.33	30	Pass
39	2480	6.839	8.35	30	Pass

Note: The antenna gain is -0.1 dBi < 6 dBi, so the output power limit shall not be reduced.

BT-LE 2M

Chan.	Chan. Freq. (MHz)	Peak Power (mW)	Peak Power (dBm)	Power Limit (dBm)	Test Result
1	2404	6.637	8.22	30	Pass
19	2440	6.745	8.29	30	Pass
38	2478	6.871	8.37	30	Pass

Note: The antenna gain is -0.1 dBi < 6 dBi, so the output power limit shall not be reduced.

logi bolt 1M

Chan.	Chan. Freq. (MHz)	Peak Power (mW)	Peak Power (dBm)	Power Limit (dBm)	Test Result
0	2402	6.577	8.18	30	Pass
19	2440	6.714	8.27	30	Pass
39	2480	6.792	8.32	30	Pass

Note: The antenna gain is -0.1 dBi < 6 dBi, so the output power limit shall not be reduced.

logi bolt 2M

Chan.	Chan. Freq. (MHz)	Peak Power (mW)	Peak Power (dBm)	Power Limit (dBm)	Test Result
1	2404	6.561	8.17	30	Pass
19	2440	6.699	8.26	30	Pass
38	2478	6.776	8.31	30	Pass

Note: The antenna gain is -0.1 dBi < 6 dBi, so the output power limit shall not be reduced.

For Average Power

BT-LE 1M

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
0	2402	6.486	8.12
19	2440	6.653	8.23
39	2480	6.683	8.25

BT-LE 2M

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
1	2404	6.471	8.11
19	2440	6.577	8.18
38	2478	6.714	8.27

logi bolt 1M

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
0	2402	6.442	8.09
19	2440	6.546	8.16
39	2480	6.622	8.21

logi bolt 2M

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
1	2404	6.397	8.06
19	2440	6.516	8.14
38	2478	6.637	8.22

7.2 Unwanted Emissions below 1 GHz

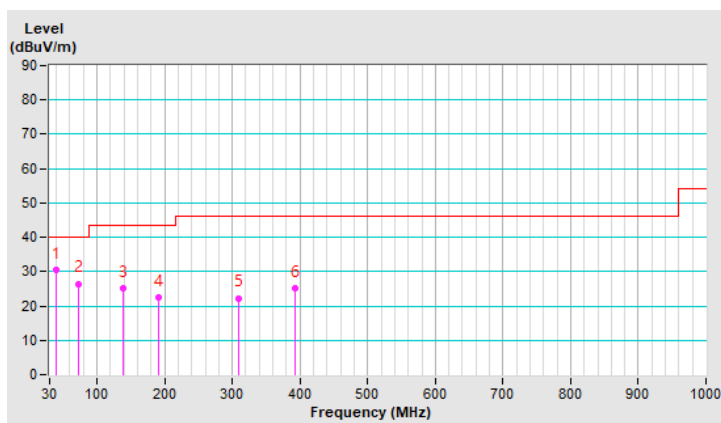
BT_LE-2M

RF Mode	TX BT-LE 2M	Channel	CH 38 : 2.478 GHz
Frequency Range	9 kHz ~ 1 GHz	Detector Function & Bandwidth	(QP) RB = 120kHz
Input Power	1.5 Vdc	Environmental Conditions	20 °C, 70 % RH
Tested By	Ryan Du		

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	38.81	30.4 QP	40.0	-9.6	1.00 H	249	39.0	-8.6
2	73.15	26.5 QP	40.0	-13.5	2.50 H	97	37.3	-10.8
3	138.20	25.3 QP	43.5	-18.2	1.50 H	267	33.3	-8.0
4	191.14	22.4 QP	43.5	-21.1	1.00 H	267	32.5	-10.1
5	309.68	22.3 QP	46.0	-23.7	2.00 H	117	28.4	-6.1
6	393.36	25.2 QP	46.0	-20.8	1.50 H	55	29.1	-3.9

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 of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

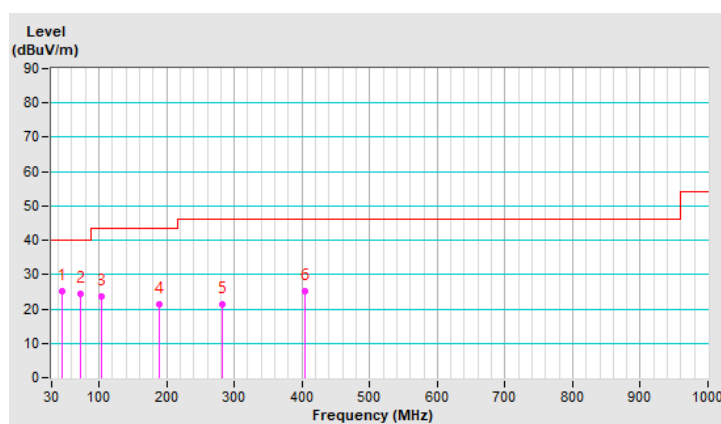


RF Mode	TX BT-LE 2M	Channel	CH 38 : 2.478 GHz
Frequency Range	9 kHz ~ 1 GHz	Detector Function & Bandwidth	(QP) RB = 120kHz
Input Power	1.5 Vdc	Environmental Conditions	20 °C, 70 % RH
Tested By	Ryan Du		

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	46.05	25.3 QP	40.0	-14.7	1.50 V	62	33.4	-8.1
2	73.37	24.3 QP	40.0	-15.7	1.00 V	237	35.2	-10.9
3	104.17	23.5 QP	43.5	-20.0	1.50 V	62	34.9	-11.4
4	189.34	21.3 QP	43.5	-22.2	1.00 V	257	31.4	-10.1
5	281.26	21.5 QP	46.0	-24.5	1.00 V	175	28.7	-7.2
6	404.83	25.3 QP	46.0	-20.7	1.00 V	96	28.9	-3.6

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 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



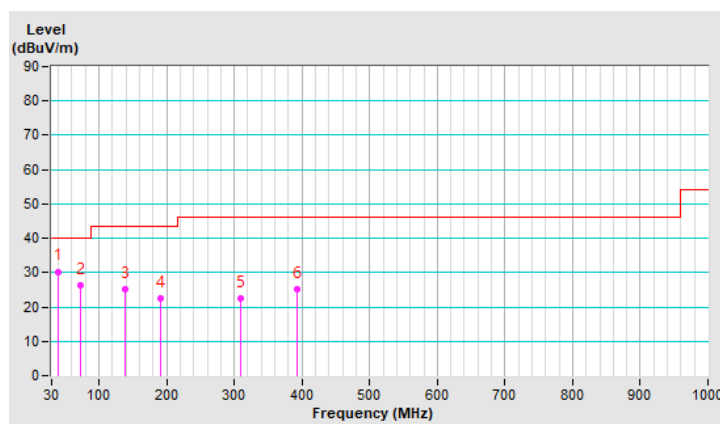
logi bolt 1M

RF Mode	TX logi bolt 1M	Channel	CH 39 : 2.48 GHz
Frequency Range	9 kHz ~ 1 GHz	Detector Function & Bandwidth	(QP) RB = 120kHz
Input Power	1.5 Vdc	Environmental Conditions	20 °C, 70 % RH
Tested By	Ryan Du		

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	38.75	30.3 QP	40.0	-9.7	1.00 H	251	38.9	-8.6
2	73.11	26.4 QP	40.0	-13.6	2.50 H	86	37.2	-10.8
3	138.15	25.2 QP	43.5	-18.3	1.50 H	244	33.2	-8.0
4	191.09	22.5 QP	43.5	-21.0	1.00 H	274	32.6	-10.1
5	309.64	22.4 QP	46.0	-23.6	2.00 H	132	28.5	-6.1
6	393.32	25.1 QP	46.0	-20.9	1.50 H	59	29.0	-3.9

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 of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

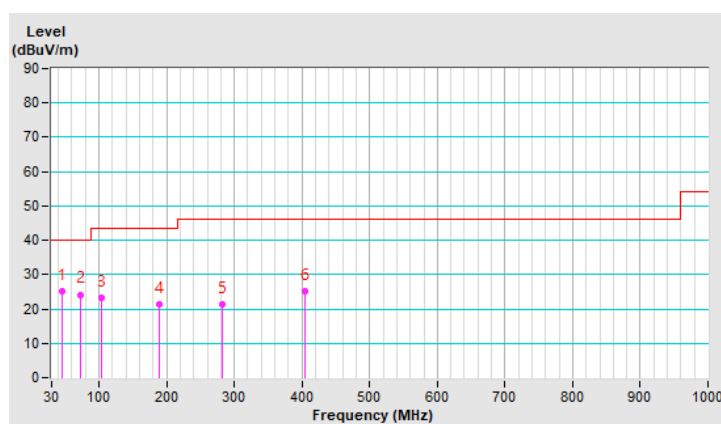


RF Mode	TX logi bolt 1M	Channel	CH 39 : 2.48 GHz
Frequency Range	9 kHz ~ 1 GHz	Detector Function & Bandwidth	(QP) RB = 120kHz
Input Power	1.5 Vdc	Environmental Conditions	20 °C, 70 % RH
Tested By	Ryan Du		

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	46.02	25.1 QP	40.0	-14.9	1.50 V	79	33.2	-8.1
2	73.30	24.2 QP	40.0	-15.8	1.00 V	248	35.1	-10.9
3	104.13	23.3 QP	43.5	-20.2	1.50 V	43	34.7	-11.4
4	189.42	21.5 QP	43.5	-22.0	1.00 V	263	31.6	-10.1
5	281.33	21.4 QP	46.0	-24.6	1.00 V	159	28.6	-7.2
6	404.76	25.2 QP	46.0	-20.8	1.00 V	83	28.8	-3.6

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 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



7.3 Unwanted Emissions above 1 GHz

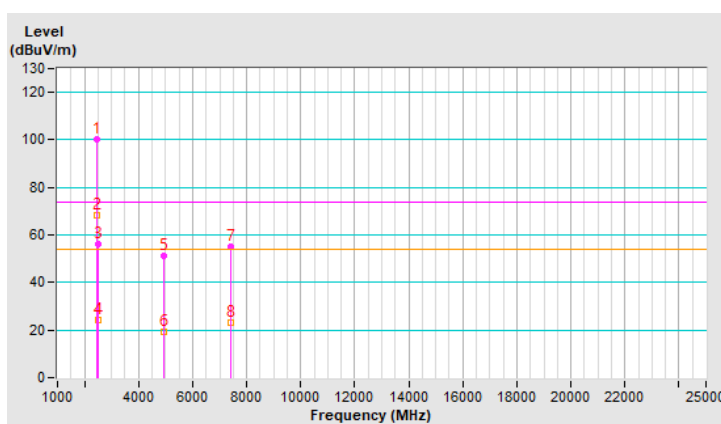
BT-LE_2M

RF Mode	TX BT-LE 2M	Channel	CH 38 : 2.478 GHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	(PK) RB = 1 MHz, VB = 3 MHz
Input Power	1.5 Vdc	Environmental Conditions	20 °C, 70 % RH
Tested By	Ryan Du		

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	*2478.00	100.3 PK			1.37 H	173	101.5	-1.2
2	*2478.00	68.2 AV			1.37 H	173	69.4	-1.2
3	2486.23	56.3 PK	74.0	-17.7	1.37 H	173	57.6	-1.3
4	2486.23	24.2 AV	54.0	-29.8	1.37 H	173	25.5	-1.3
5	4956.00	51.2 PK	74.0	-22.8	1.06 H	217	47.5	3.7
6	4956.00	19.1 AV	54.0	-34.9	1.06 H	217	15.4	3.7
7	7434.00	55.0 PK	74.0	-19.0	1.40 H	285	44.9	10.1
8	7434.00	22.9 AV	54.0	-31.1	1.40 H	285	12.8	10.1

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.
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:
 $20 \log(\text{Duty cycle}) = 20 \log(0.176 \text{ ms} / 7.057 \text{ ms}) = -32.1 \text{ dB}$ for plotted duty.

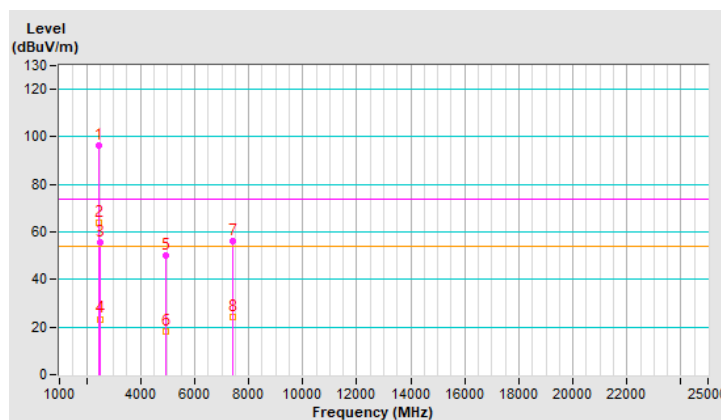


RF Mode	TX BT-LE 2M	Channel	CH 38 : 2.478 GHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	(PK) RB = 1 MHz, VB = 3 MHz
Input Power	1.5 Vdc	Environmental Conditions	20 °C, 70 % RH
Tested By	Ryan Du		

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	*2478.00	96.2 PK			3.86 V	64	97.4	-1.2
2	*2478.00	64.1 AV			3.86 V	64	65.3	-1.2
3	2486.14	55.5 PK	74.0	-18.5	3.86 V	64	56.8	-1.3
4	2486.14	23.4 AV	54.0	-30.6	3.86 V	64	24.7	-1.3
5	4956.00	50.3 PK	74.0	-23.7	1.03 V	35	46.6	3.7
6	4956.00	18.2 AV	54.0	-35.8	1.03 V	35	14.5	3.7
7	7434.00	56.4 PK	74.0	-17.6	1.54 V	289	46.3	10.1
8	7434.00	24.3 AV	54.0	-29.7	1.54 V	289	14.2	10.1

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.
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:
 $20 \log(\text{Duty cycle}) = 20 \log(0.176 \text{ ms} / 7.057 \text{ ms}) = -32.1 \text{ dB}$ for plotted duty.



logi bolt 1M

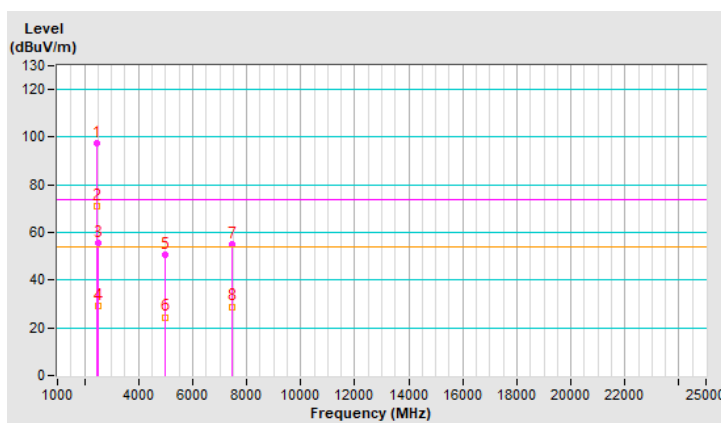
RF Mode	TX logi bolt 1M	Channel	CH 39 : 2.48 GHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	(PK) RB = 1 MHz, VB = 3 MHz
Input Power	1.5 Vdc	Environmental Conditions	20 °C, 70 % RH
Tested By	Ryan Du		

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	97.3 PK			1.06 H	170	98.7	-1.4
2	*2480.00	71.1 AV			1.06 H	170	72.5	-1.4
3	2488.13	55.5 PK	74.0	-18.5	1.06 H	170	56.9	-1.4
4	2488.13	29.3 AV	54.0	-24.7	1.06 H	170	30.7	-1.4
5	4960.00	50.7 PK	74.0	-23.3	1.06 H	200	47.2	3.5
6	4960.00	24.5 AV	54.0	-29.5	1.06 H	200	21.0	3.5
7	7440.00	55.1 PK	74.0	-18.9	1.44 H	290	45.3	9.8
8	7440.00	28.9 AV	54.0	-25.1	1.44 H	290	19.1	9.8

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.
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:

$$20 \log(\text{Duty cycle}) = 20 \log(0.345 \text{ ms} / 7.058 \text{ ms}) = -26.2 \text{ dB for plotted duty.}$$

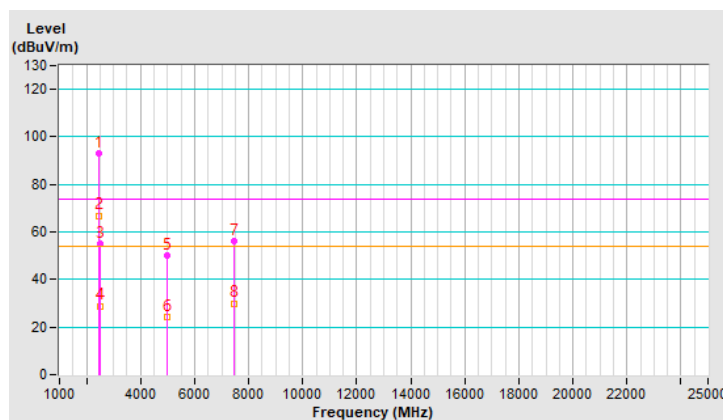


RF Mode	TX logi bolt 1M	Channel	CH 39 : 2.48 GHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	(PK) RB = 1 MHz, VB = 3 MHz
Input Power	1.5 Vdc	Environmental Conditions	20 °C, 70 % RH
Tested By	Ryan Du		

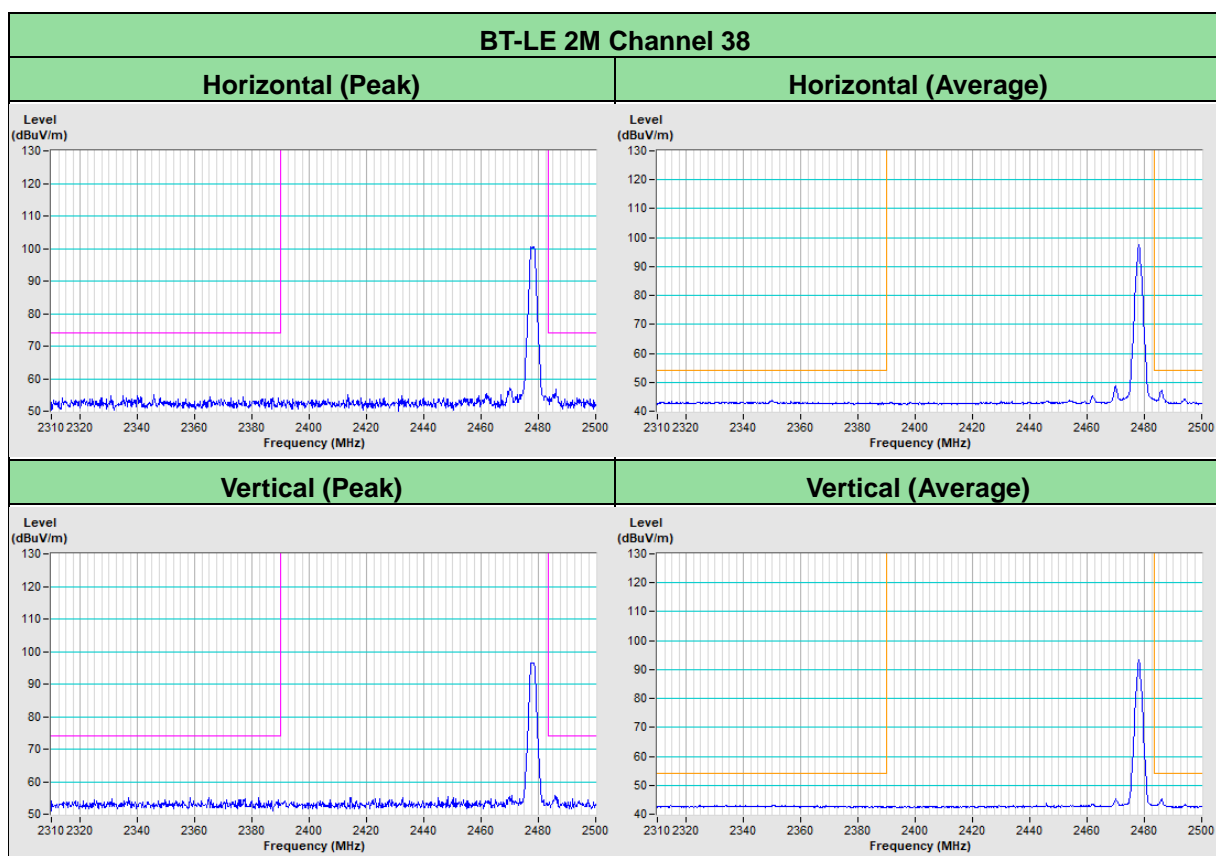
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2480.00	93.1 PK			3.94 V	34	94.5	-1.4
2	*2480.00	66.9 AV			3.94 V	34	68.3	-1.4
3	2487.84	55.1 PK	74.0	-18.9	3.94 V	34	56.5	-1.4
4	2487.84	28.9 AV	54.0	-25.1	3.94 V	34	30.3	-1.4
5	4960.00	50.3 PK	74.0	-23.7	1.05 V	25	46.8	3.5
6	4960.00	24.1 AV	54.0	-29.9	1.05 V	25	20.6	3.5
7	7440.00	56.2 PK	74.0	-17.8	1.39 V	285	46.4	9.8
8	7440.00	30.0 AV	54.0	-24.0	1.39 V	285	20.2	9.8

Remarks:

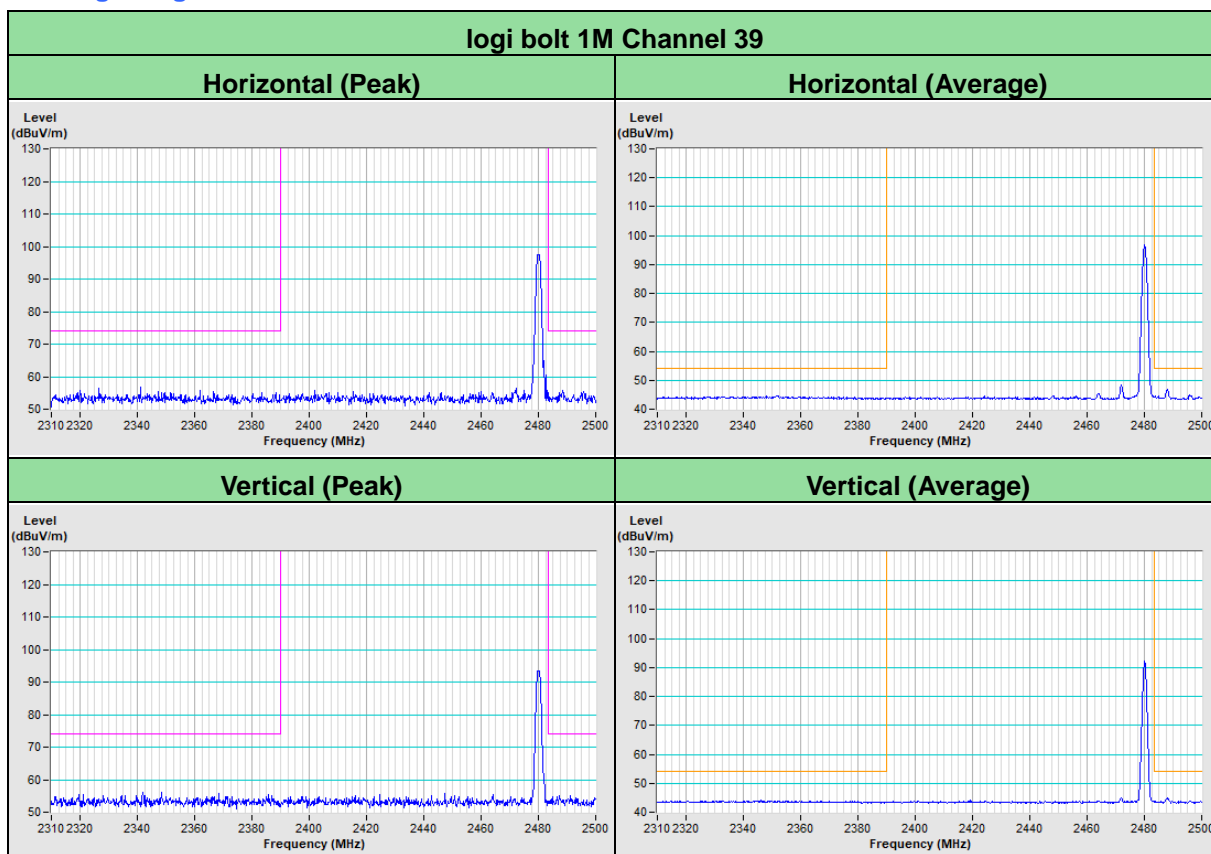
1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.
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:
 $20 \log(\text{Duty cycle}) = 20 \log(0.345 \text{ ms} / 7.058 \text{ ms}) = -26.2 \text{ dB}$ for plotted duty.



Plot of Band Edge_BT-LE_2M



Plot of Band Edge_logi bolt 1M



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.

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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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