# FCC Test Report (BT-LE)

| | |
|---|---|
| **Report No.:** | RFBDKG-WTW-P20120012 |
| **FCC ID:** | JNZRR0017 |
| **Test Model:** | RR0017 |
| **Received Date:** | Feb. 27, 2021 |
| **Test Date:** | Feb. 27 to Mar. 23, 2021 |
| **Issued Date:** | Mar. 30, 2021 |
| **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 / Designation Number:** | 723255 / TW2022 |

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## Table of Contents


**Release Control Record** ..... **4**

**1 Certificate of Conformity** ..... **5**

**2 Summary of Test Results** ..... **6**

2.1 Measurement Uncertainty ..... 6
2.2 Modification Record ..... 6

**3 General Information** ..... **7**

3.1 General Description of EUT (BT-LE) ..... 7
3.2 Description of Test Modes ..... 8
3.2.1 Test Mode Applicability and Tested Channel Detail ..... 9
3.3 Duty Cycle of Test Signal ..... 10
3.4 Description of Support Units ..... 11
3.4.1 Configuration of System under Test ..... 11
3.5 General Description of Applied Standards and References ..... 12

**4 Test Types and Results** ..... **13**

4.1 Radiated Emission and Bandedge Measurement ..... 13
4.1.1 Limits of Radiated Emission and Bandedge Measurement ..... 13
4.1.2 Test Instruments ..... 14
4.1.3 Test Procedures ..... 18
4.1.4 Deviation from Test Standard ..... 18
4.1.5 Test Setup ..... 19
4.1.6 EUT Operating Conditions ..... 20
4.1.7 Test Results ..... 21
4.2 6dB Bandwidth Measurement ..... 26
4.2.1 Limits of 6dB Bandwidth Measurement ..... 26
4.2.2 Test Setup ..... 26
4.2.3 Test Instruments ..... 26
4.2.4 Test Procedure ..... 26
4.2.5 Deviation from Test Standard ..... 26
4.2.6 EUT Operating Conditions ..... 26
4.2.7 Test Results ..... 27
4.3 Conducted Output Power Measurement ..... 28
4.3.1 Limits of Conducted Output Power Measurement ..... 28
4.3.2 Test Setup ..... 28
4.3.3 Test Instruments ..... 28
4.3.4 Test Procedures ..... 28
4.3.5 Deviation from Test Standard ..... 28
4.3.6 EUT Operating Conditions ..... 28
4.3.7 Test Results ..... 29
4.4 Power Spectral Density Measurement ..... 30
4.4.1 Limits of Power Spectral Density Measurement ..... 30
4.4.2 Test Setup ..... 30
4.4.3 Test Instruments ..... 30
4.4.4 Test Procedure ..... 30
4.4.5 Deviation from Test Standard ..... 30
4.4.6 EUT Operating Condition ..... 30
4.4.7 Test Results ..... 31
4.5 Conducted Out of Band Emission Measurement ..... 32
4.5.1 Limits of Conducted Out of Band Emission Measurement ..... 32
4.5.2 Test Setup ..... 32
4.5.3 Test Instruments ..... 32
4.5.4 Test Procedure ..... 32
4.5.5 Deviation from Test Standard ..... 32
4.5.6 EUT Operating Condition ..... 32

4.5.7 Test Results ..... 32
**5 Pictures of Test Arrangements ..... 34**
**Annex A - Band-Edge Measurement ..... 35**
**Appendix – Information of the Testing Laboratories ..... 36**

## Release Control Record

| Issue No. | Description | Date Issued |
|---|---|---|
| RFBDKG-WTW-P20120012 | Original release. | Mar. 30, 2021 |

## 1 Certificate of Conformity

**Product:** REMOTE

**Brand:** Logitech

**Test Model:** RR0017

**Sample Status:** Engineering sample

**Applicant:** Logitech Far East Ltd

**Test Date:** Feb. 27 to Mar. 23, 2021

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

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 EMC characteristics under the conditions specified in this report.

**Prepared by :** Vivian Huang , **Date:** Mar. 30, 2021

Vivian Huang / Specialist

**Approved by :** , **Date:** Mar. 30, 2021

Clark Lin / Technical Manager

## 2 Summary of Test Results

| 47 CFR FCC Part 15, Subpart C (Section 15.247) | | | |
|---|---|---|---|
| FCC Clause | Test Item | Result | Remarks |
| 15.207 | AC Power Conducted Emission | NA | Without AC power port of the EUT. |
| 15.205 / 15.209 / 15.247(d) | Radiated Emissions and Band Edge Measurement | PASS | Meet the requirement of limit. Minimum passing margin is -4.5 dB at 34.70 MHz. |
| 15.247(d) | Antenna Port Emission | PASS | Meet the requirement of limit. |
| 15.247(a)(2) | 6dB bandwidth | PASS | Meet the requirement of limit. |
| 15.247(b) | Conducted power | PASS | Meet the requirement of limit. |
| 15.247(e) | Power Spectral Density | PASS | Meet the requirement of limit. |
| 15.203 | Antenna Requirement | PASS | Antenna connector is Pogo pin not a standard connector. |

Note:
1. For 2.4 GHz band compliance with rule 15.247(d) of the band-edge items, the test plots were recorded in Annex A.
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 | Frequency | Expanded Uncertainty (k=2) (±) |
|---|---|---|
| Conducted emissions | - | 2.5 dB |
| Radiated Emissions up to 1 GHz | 9kHz ~ 30MHz | 3.1 dB |
| | 30MHz ~ 1GHz | 5.5 dB |
| Radiated Emissions above 1 GHz | 1GHz ~ 18GHz | 5.1 dB |
| | 18GHz ~ 40GHz | 5.3 dB |

### 2.2 Modification Record

There were no modifications required for compliance.

# 3 General Information

## 3.1 General Description of EUT (BT-LE)

| | |
|---|---|
| Product | REMOTE |
| Brand | Logitech |
| Test Model | RR0017 |
| Status of EUT | Engineering sample |
| Power Supply Rating | DC 3V from battery |
| Modulation Type | GFSK |
| Modulation Technology | DTS |
| Transfer Rate | Up to 1 Mbps |
| Operating Frequency | 2.402 ~ 2.480 GHz |
| Number of Channel | 40 |
| Output Power | 1.419 mW |
| Antenna Type | Refer to Note |
| Antenna Connector | Refer to Note |
| Accessory Device | Battery x2 |
| Cable Supplied | NA |

Note:

1. The EUT may have a lot of colors for marketing requirement.
2. The EUT could be supplied with battery as the following table:

| Brand Name | Model No. | Spec. |
|---|---|---|
| Panasonic | CR2032 | DC 3V |

3. The antenna provided to the EUT, please refer to the following table:

| Antenna Gain (dBi) | Frequency Range (GHz) | Antenna Type | Connector Type |
|---|---|---|---|
| 4.34 | 2.4-2.4835 | Dipole | Pogo pin |

4. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.
5. 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.

## 3.2 Description of Test Modes

40 channels are provided to this EUT:

| 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 |

### 3.2.1 Test Mode Applicability and Tested Channel Detail

| EUT CONFIGURE MODE | APPLICABLE TO | | | | DESCRIPTION |
|---|---|---|---|---|---|
| | RE≥1G | RE<1G | PLC | APCM | |
| - | √ | √ | - | √ | - |

Where **RE≥1G:** Radiated Emission above 1GHz & Bandedge Measurement **RE<1G:** Radiated Emission below 1GHz

**PLC:** Power Line Conducted Emission **APCM:** Antenna Port Conducted Measurement

**Note:** 1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane.**
2. No need to concern of Conducted Emission due to the EUT is powered by battery.

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

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

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

| AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE | DATA RATE (Mbps) |
|---|---|---|---|
| 0 to 39 | 0, 19, 39 | GFSK | 1 |

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

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

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

| AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE | DATA RATE (Mbps) |
|---|---|---|---|
| 0 to 39 | 39 | GFSK | 1 |

**Antenna Port Conducted Measurement:**

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

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

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

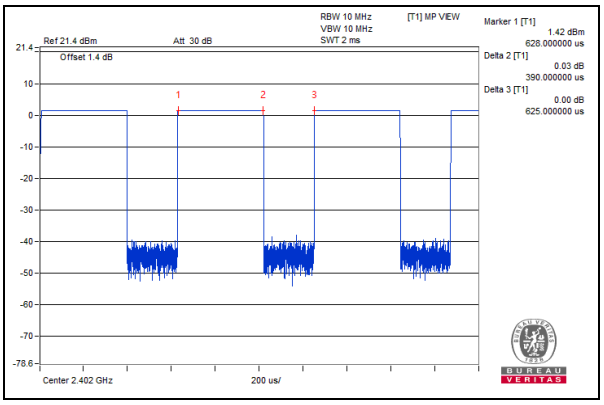
| AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE | DATA RATE (Mbps) |
|---|---|---|---|
| 0 to 39 | 0, 19, 39 | GFSK | 1 |

**Test Condition:**

| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | INPUT POWER | TESTED BY |
|---|---|---|---|
| RE≥1G | 25deg. C, 71%RH | 3Vdc | Sampon Chen |
| RE<1G | 24deg. C, 66%RH | 3Vdc | Sampon Chen |
| APCM | 25deg. C, 60%RH | 3Vdc | Jyunchun Lin |

## 3.3 Duty Cycle of Test Signal

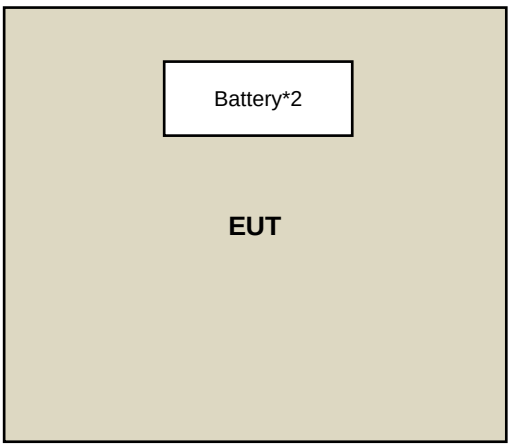
Duty cycle of test signal is < 98 %, duty factor shall be considered.
Duty cycle = 0.39 ms/0.625 ms = 0.624, Duty factor = 10 * log( 1/Duty cycle) = 2.05 dB



## 3.4 Description of Support Units

The EUT has been tested as an independent unit.

### 3.4.1 Configuration of System under Test



## 3.5 General Description of Applied Standards and References

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards and references:

**Test Standard:**

**FCC Part 15, Subpart C (15.247)**

**ANSI C63.10-2013**

All test items have been performed and recorded as per the above standards.

**References Test Guidance:**

**KDB 558074 D01 15.247 Meas Guidance v05r02**

All test items have been performed as a reference to the above KDB test guidance.

# 4 Test Types and Results

## 4.1 Radiated Emission and Bandedge Measurement

### 4.1.1 Limits of Radiated Emission and Bandedge Measurement

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

| Frequencies (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009 ~ 0.490 | 2400/F(kHz) | 300 |
| 0.490 ~ 1.705 | 24000/F(kHz) | 30 |
| 1.705 ~ 30.0 | 30 | 30 |
| 30 ~ 88 | 100 | 3 |
| 88 ~ 216 | 150 | 3 |
| 216 ~ 960 | 200 | 3 |
| Above 960 | 500 | 3 |

**Note:**

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.1.2 Test Instruments

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

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|---|---|---|
| Test Receiver Agilent | N9038A | MY51210202 | Dec. 01, 2020 | Nov. 30, 2021 |
| Horn_Antenna SCHWARZBECK | BBHA 9120D | 9120D-783 | Nov. 22, 2020 | Nov. 21, 2021 |
| Pre-Amplifier EMCI | EMC 12630 SE | 980638 | Apr. 08, 2020 | Apr. 07, 2021 |
| RF Cable | EMC104-SM-SM-1200 | 160922 | Dec. 25, 2020 | Dec. 24, 2021 |
| RF Cable | EMC104-SM-SM-2000 | 180502 | Apr. 29, 2020 | Apr. 28, 2021 |
| RF Cable | EMC104-SM-SM-6000 | 180418 | Apr. 29, 2020 | Apr. 28, 2021 |
| Pre-Amplifier EMCI | EMC184045SE | 980387 | Jan. 11, 2021 | Jan. 10, 2022 |
| Horn_Antenna SCHWARZBECK | BBHA 9170 | BBHA9170519 | Nov. 22, 2020 | Nov. 21, 2021 |
| RF Cable | EMC102-KM-KM-1200 | 160924 | Jan. 11, 2021 | Jan. 10, 2022 |
| RF Cable | EMC-KM-KM-4000 | 200214 | Mar. 10, 2021 | Mar. 09, 2022 |
| Software | ADT_Radiated_V8.7.08 | NA | NA | NA |
| Boresight Antenna Tower & Turn Table Max-Full | MF-7802BS | MF780208530 | NA | NA |

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in 966 Chamber No. 4.
3. Tested Date: Mar. 23, 2021

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

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|---|---|---|
| Test Receiver Agilent | N9038A | MY51210202 | Dec. 01, 2020 | Nov. 30, 2021 |
| Pre-Amplifier EMCI | EMC001340 | 980142 | May 25, 2020 | May 24, 2021 |
| Loop Antenna Electro-Metrics | EM-6879 | 264 | Mar. 05, 2021 | Mar. 04, 2022 |
| RF Cable | 5D-FB | LOOPCAB-001 | Jan. 07, 2021 | Jan. 06, 2022 |
| RF Cable | 5D-FB | LOOPCAB-002 | Jan. 07, 2021 | Jan. 06, 2022 |
| Pre-Amplifier EMCI | EMC330N | 980701 | Mar. 10, 2021 | Mar. 09, 2022 |
| Trilog Broadband Antenna SCHWARZBECK | VULB 9168 | 9168-406 | Nov. 06, 2020 | Nov. 05, 2021 |
| RF Cable | 8D | 966-6-1 | Apr. 04, 2020 | Apr. 03, 2021 |
| RF Cable | 8D | 966-4-2 | Mar. 18, 2020 | Mar. 17, 2021 |
| RF Cable | 8D | 966-4-3 | Mar. 18, 2020 | Mar. 17, 2021 |
| Fixed attenuator Mini-Circuits | UNAT-5+ | PAD-ATT5-03 | Jan. 11, 2021 | Jan. 10, 2022 |
| Software | ADT_Radiated_V8.7.08 | NA | NA | NA |
| Boresight Antenna Tower & Turn Table Max-Full | MF-7802BS | MF780208530 | NA | NA |

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in 966 Chamber No. 4.
3. Tested Date: Mar. 11, 2021

**For Band-Edge Test:**

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|---|---|---|
| Test Receiver Agilent | N9038A | MY51210202 | Dec. 01, 2020 | Nov. 30, 2021 |
| Horn_Antenna SCHWARZBECK | BBHA 9120D | 9120D-783 | Nov. 22, 2020 | Nov. 21, 2021 |
| Pre-Amplifier EMCI | EMC 12630 SE | 980638 | Apr. 08, 2020 | Apr. 07, 2021 |
| RF Cable | EMC104-SM-SM-1200 | 160922 | Dec. 25, 2020 | Dec. 24, 2021 |
| RF Cable | EMC104-SM-SM-2000 | 180502 | Apr. 29, 2020 | Apr. 28, 2021 |
| RF Cable | EMC104-SM-SM-6000 | 180418 | Apr. 29, 2020 | Apr. 28, 2021 |
| Pre-Amplifier EMCI | EMC184045SE | 980387 | Jan. 11, 2021 | Jan. 10, 2022 |
| Horn_Antenna SCHWARZBECK | BBHA 9170 | BBHA9170519 | Nov. 22, 2020 | Nov. 21, 2021 |
| RF Cable | EMC102-KM-KM-1200 | 160924 | Jan. 11, 2021 | Jan. 10, 2022 |
| RF Cable | EMC-KM-KM-4000 | 200214 | Mar. 11, 2020 | Mar. 10, 2021 |
| Software | ADT_Radiated_V8.7.08 | NA | NA | NA |
| Boresight Antenna Tower & Turn Table Max-Full | MF-7802BS | MF780208530 | NA | NA |

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in 966 Chamber No. 4.
3. Tested Date: Feb. 27, 2021

**For other test items:**

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|---|---|---|
| Spectrum Analyzer R&S | FSV40 | 100964 | May 29, 2020 | May 28, 2021 |
| Power meter Anritsu | ML2495A | 1529002 | July 22, 2020 | July 21, 2021 |
| Power sensor Anritsu | MA2411B | 1339443 | July 22, 2020 | July 21, 2021 |
| Fixed Attenuator Mini-Circuits | MDCS18N-10 | MDCS18N-10-01 | Apr. 14, 2020 | Apr. 13, 2021 |
| Software | ADT_RF Test Software V6.6.5.4 | NA | NA | NA |

**NOTE:**
1. The test was performed in Oven room 2.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Tested Date: Mar. 12, 2021

### 4.1.3 Test Procedures

**For Radiated emission below 30MHz**

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. 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.

**Note:**

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

**For Radiated emission above 30MHz**

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) 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.

f. 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.

**Note:**

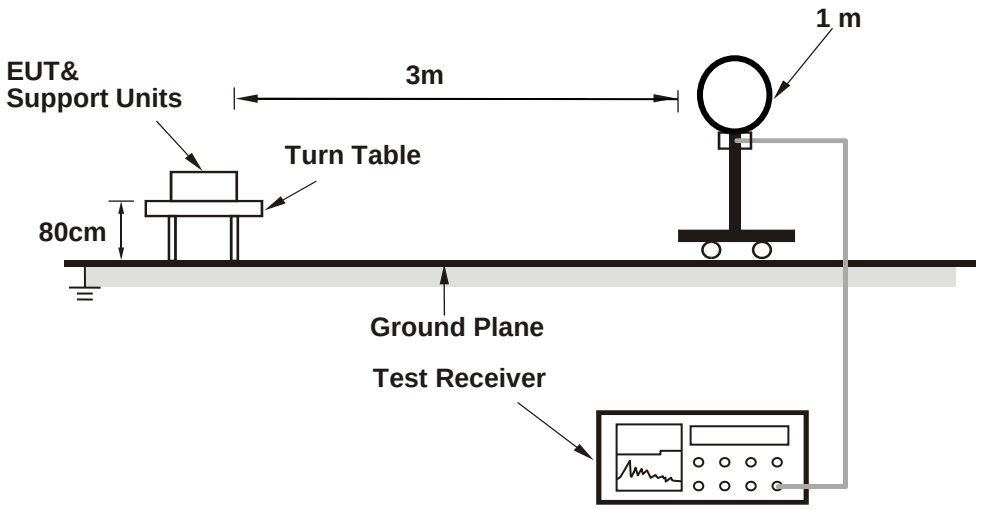
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

### 4.1.4 Deviation from Test Standard

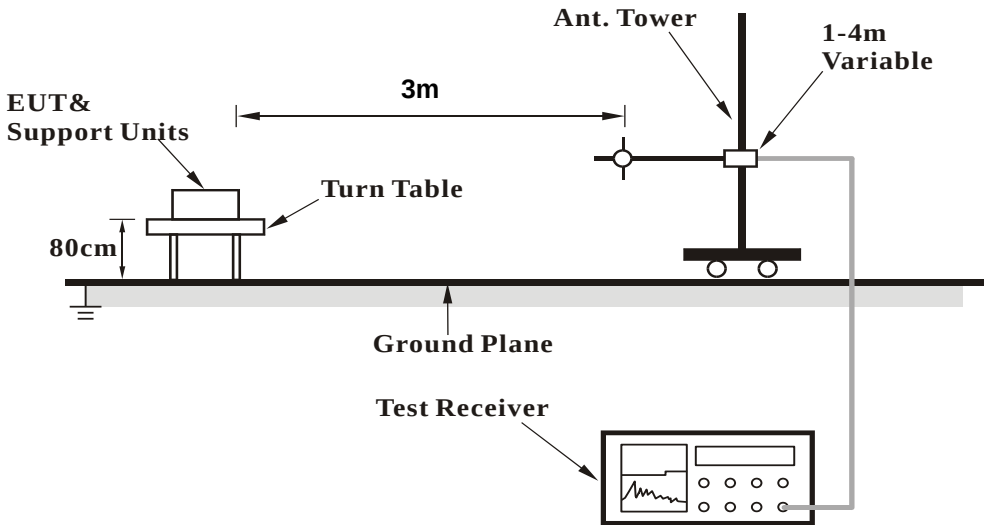
No deviation.

4.1.5 Test Setup

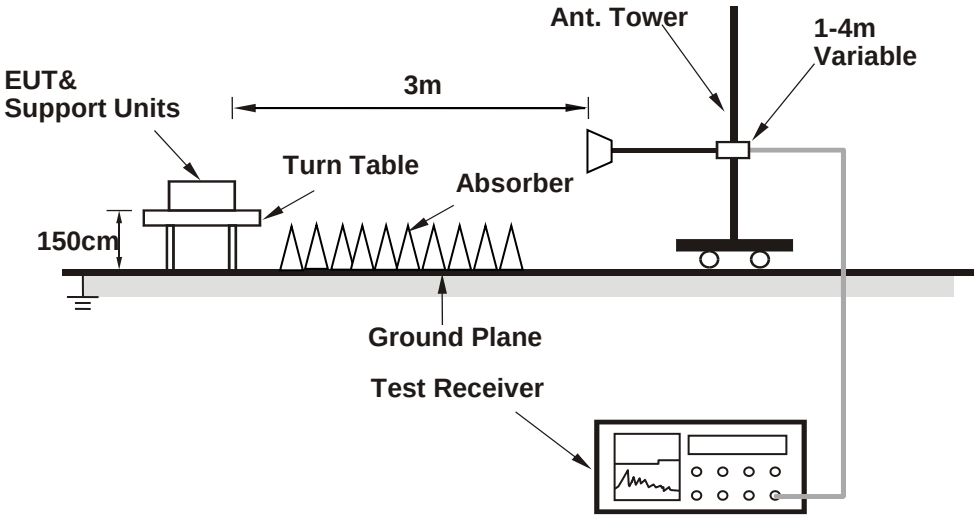
**For Radiated emission below 30MHz**




**For Radiated emission 30MHz to 1GHz**



**For Radiated emission above 1GHz**




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

4.1.6 EUT Operating Conditions

a. Placed the EUT on the testing table.
b. Controlling software (nRFgo Studio [v1.21.2.10]) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

**Above 1GHz Data:**

| **RF Mode** | TX BT_LE-1M | **Channel** | CH 0：2402 MHz |
|---|---|---|---|
| **Frequency Range** | 1GHz ~ 25GHz | **Detector Function** | Peak (PK)<br>Average (AV) |

| **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 | 2377.00 | 53.5 PK | 74.0 | -20.5 | 1.88 H | 102 | 57.9 | -4.4 |
| 2 | 2377.00 | 42.6 AV | 54.0 | -11.4 | 1.88 H | 102 | 47.0 | -4.4 |
| 3 | *2402.00 | 97.0 PK | | | 1.88 H | 102 | 101.4 | -4.4 |
| 4 | *2402.00 | 96.0 AV | | | 1.88 H | 102 | 100.4 | -4.4 |
| 5 | 4804.00 | 55.7 PK | 74.0 | -18.3 | 1.04 H | 69 | 55.7 | 0.0 |
| 6 | 4804.00 | 47.8 AV | 54.0 | -6.2 | 1.04 H | 69 | 47.8 | 0.0 |
| **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 | 2381.00 | 53.1 PK | 74.0 | -20.9 | 3.44 V | 360 | 57.5 | -4.4 |
| 2 | 2381.00 | 42.4 AV | 54.0 | -11.6 | 3.44 V | 360 | 46.8 | -4.4 |
| 3 | *2402.00 | 92.1 PK | | | 3.44 V | 360 | 96.5 | -4.4 |
| 4 | *2402.00 | 91.0 AV | | | 3.44 V | 360 | 95.4 | -4.4 |
| 5 | 4804.00 | 44.7 PK | 74.0 | -29.3 | 1.56 V | 212 | 44.7 | 0.0 |
| 6 | 4804.00 | 38.7 AV | 54.0 | -15.3 | 1.56 V | 212 | 38.7 | 0.0 |

**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.

| RF Mode | TX BT_LE-1M | Channel | CH 19：2440 MHz |
|---|---|---|---|
| Frequency Range | 1GHz ~ 25GHz | Detector Function | Peak (PK)<br>Average (AV) |

| 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 | 97.5 PK | | | 1.59 H | 103 | 101.9 | -4.4 |
| 2 | *2440.00 | 96.5 AV | | | 1.59 H | 103 | 100.9 | -4.4 |
| 3 | 4880.00 | 56.5 PK | 74.0 | -17.5 | 1.04 H | 64 | 56.4 | 0.1 |
| 4 | 4880.00 | 48.1 AV | 54.0 | -5.9 | 1.04 H | 64 | 48.0 | 0.1 |
| 5 | 7320.00 | 44.4 PK | 74.0 | -29.6 | 1.21 H | 181 | 38.1 | 6.3 |
| 6 | 7320.00 | 34.9 AV | 54.0 | -19.1 | 1.21 H | 181 | 28.6 | 6.3 |
| **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 | 92.9 PK | | | 3.78 V | 353 | 97.3 | -4.4 |
| 2 | *2440.00 | 91.9 AV | | | 3.78 V | 353 | 96.3 | -4.4 |
| 3 | 4880.00 | 44.8 PK | 74.0 | -29.2 | 1.52 V | 219 | 44.7 | 0.1 |
| 4 | 4880.00 | 38.8 AV | 54.0 | -15.2 | 1.52 V | 219 | 38.7 | 0.1 |
| 5 | 7320.00 | 42.8 PK | 74.0 | -31.2 | 1.35 V | 178 | 36.5 | 6.3 |
| 6 | 7320.00 | 32.7 AV | 54.0 | -21.3 | 1.35 V | 178 | 26.4 | 6.3 |

**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.

| RF Mode | TX BT_LE-1M | Channel | CH 39：2480 MHz |
|---|---|---|---|
| Frequency Range | 1GHz ~ 25GHz | Detector Function | Peak (PK)<br>Average (AV) |

| 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 | 97.6 PK | | | 1.79 H | 104 | 102.1 | -4.5 |
| 2 | *2480.00 | 96.7 AV | | | 1.79 H | 104 | 101.2 | -4.5 |
| 3 | 2483.50 | 60.2 PK | 74.0 | -13.8 | 1.79 H | 104 | 64.7 | -4.5 |
| 4 | 2483.50 | 42.8 AV | 54.0 | -11.2 | 1.79 H | 104 | 47.3 | -4.5 |
| 5 | 4960.00 | 57.7 PK | 74.0 | -16.3 | 1.09 H | 58 | 57.1 | 0.6 |
| 6 | 4960.00 | 48.8 AV | 54.0 | -5.2 | 1.09 H | 58 | 48.2 | 0.6 |
| 7 | 7440.00 | 44.1 PK | 74.0 | -29.9 | 1.15 H | 174 | 37.4 | 6.7 |
| 8 | 7440.00 | 34.6 AV | 54.0 | -19.4 | 1.15 H | 174 | 27.9 | 6.7 |
| **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 | 92.3 PK | | | 3.99 V | 352 | 96.8 | -4.5 |
| 2 | *2480.00 | 91.2 AV | | | 3.99 V | 352 | 95.7 | -4.5 |
| 3 | 2499.00 | 53.0 PK | 74.0 | -21.0 | 3.99 V | 352 | 57.5 | -4.5 |
| 4 | 2499.00 | 42.7 AV | 54.0 | -11.3 | 3.99 V | 352 | 47.2 | -4.5 |
| 5 | 4960.00 | 44.9 PK | 74.0 | -29.1 | 1.52 V | 226 | 44.3 | 0.6 |
| 6 | 4960.00 | 38.9 AV | 54.0 | -15.1 | 1.52 V | 226 | 38.3 | 0.6 |
| 7 | 7440.00 | 42.7 PK | 74.0 | -31.3 | 1.34 V | 174 | 36.0 | 6.7 |
| 8 | 7440.00 | 32.5 AV | 54.0 | -21.5 | 1.34 V | 174 | 25.8 | 6.7 |

**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.

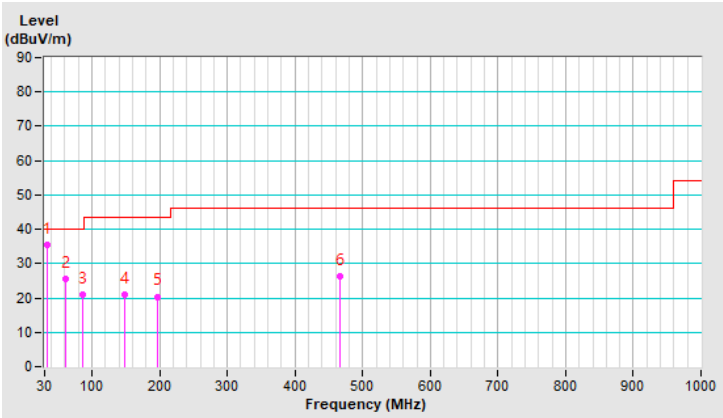
## Below 1GHz Data:

| RF Mode | TX BT_LE-1M | Channel | CH 39：2480 MHz |
|---|---|---|---|
| Frequency Range | 9kHz ~ 1GHz | Detector Function | Quasi-Peak (QP) |

| 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** | **34.70** | **35.5 QP** | **40.0** | **-4.5** | **2.00 H** | **72** | **49.1** | **-13.6** |
| 2 | 60.53 | 25.4 QP | 40.0 | -14.6 | 2.00 H | 340 | 38.9 | -13.5 |
| 3 | 85.41 | 21.0 QP | 40.0 | -19.0 | 2.00 H | 140 | 39.6 | -18.6 |
| 4 | 147.54 | 20.9 QP | 43.5 | -22.6 | 1.00 H | 352 | 33.5 | -12.6 |
| 5 | 196.11 | 20.4 QP | 43.5 | -23.1 | 2.00 H | 347 | 36.2 | -15.8 |
| 6 | 467.23 | 26.3 QP | 46.0 | -19.7 | 2.00 H | 132 | 34.0 | -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 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.

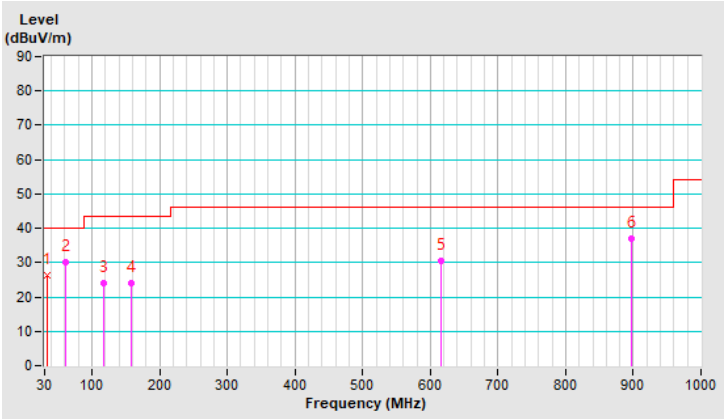


| RF Mode | TX BT_LE-1M | Channel | CH 39：2480 MHz |
|---|---|---|---|
| Frequency Range | 9kHz ~ 1GHz | Detector Function | Quasi-Peak (QP) |

| 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 | 34.51 | 26.2 QP | 40.0 | -13.8 | 1.50 V | 0 | 39.8 | -13.6 |
| 2 | 60.51 | 30.0 QP | 40.0 | -10.0 | 1.50 V | 360 | 43.5 | -13.5 |
| 3 | 117.52 | 24.0 QP | 43.5 | -19.5 | 1.00 V | 30 | 38.9 | -14.9 |
| 4 | 157.51 | 23.9 QP | 43.5 | -19.6 | 1.00 V | 78 | 36.4 | -12.5 |
| 5 | 615.71 | 30.6 QP | 46.0 | -15.4 | 2.00 V | 190 | 35.1 | -4.5 |
| 6 | 896.28 | 37.0 QP | 46.0 | -9.0 | 2.00 V | 259 | 36.9 | 0.1 |

**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 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.

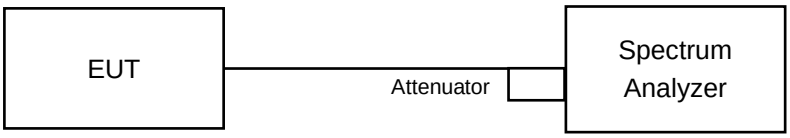


## 4.2 6dB Bandwidth Measurement

### 4.2.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

### 4.2.2 Test Setup




### 4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.2.4 Test Procedure

a. Set resolution bandwidth (RBW) = 100kHz
b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = Peak.
c. Trace mode = max hold.
d. Sweep = auto couple.
e. 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

### 4.2.5 Deviation from Test Standard

No deviation.

### 4.2.6 EUT Operating Conditions

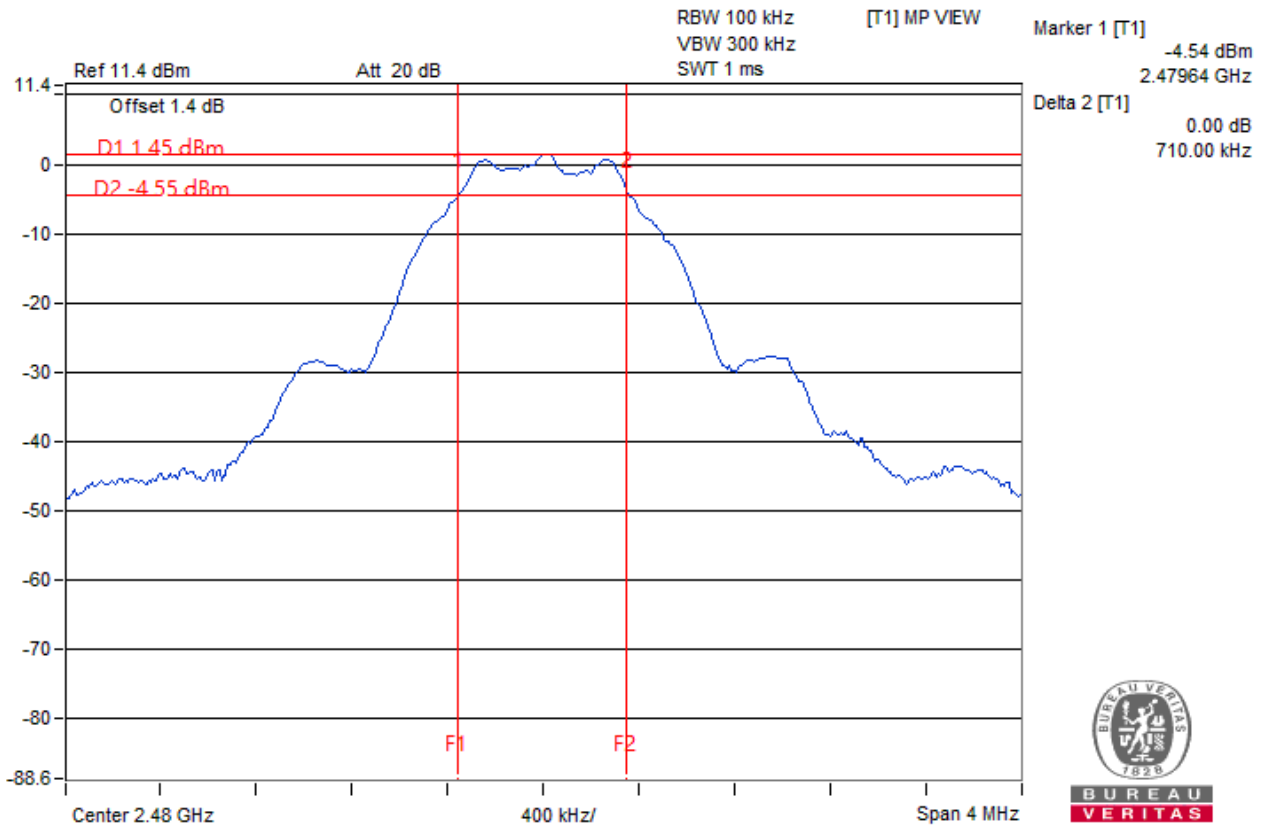
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.2.7 Test Results

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Minimum Limit (MHz) | Pass / Fail |
|---|---|---|---|---|
| 0 | 2402 | 0.72 | 0.5 | Pass |
| 19 | 2440 | 0.72 | 0.5 | Pass |
| 39 | 2480 | 0.71 | 0.5 | Pass |

Spectrum Plot of Worst Value

**CH 39**

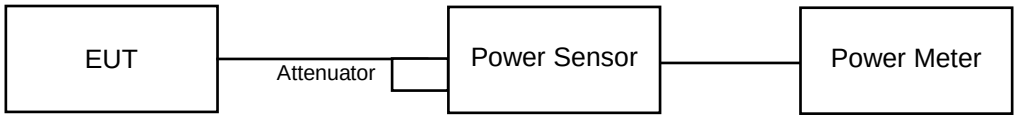


## 4.3 Conducted Output Power Measurement

### 4.3.1 Limits of Conducted Output Power Measurement

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

### 4.3.2 Test Setup




### 4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.3.4 Test Procedures

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 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.

### 4.3.5 Deviation from Test Standard

No deviation.

### 4.3.6 EUT Operating Conditions

Same as Item 4.3.6.

### 4.3.7 Test Results

**FOR PEAK POWER**

| Channel | Frequency (MHz) | Peak Power (mW) | Peak Power (dBm) | Limit (dBm) | Pass/Fail |
|---|---|---|---|---|---|
| 0 | 2402 | 1.327 | 1.23 | 30 | Pass |
| 19 | 2440 | 1.387 | 1.42 | 30 | Pass |
| 39 | 2480 | 1.419 | 1.52 | 30 | Pass |

**FOR AVERAGE POWER**

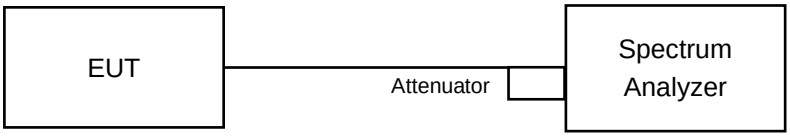
| Channel | Frequency (MHz) | Average Power (mW) | Average Power (dBm) |
|---|---|---|---|
| 0 | 2402 | 1.312 | 1.18 |
| 19 | 2440 | 1.377 | 1.39 |
| 39 | 2480 | 1.406 | 1.48 |

## 4.4 Power Spectral Density Measurement

### 4.4.1 Limits of Power Spectral Density Measurement

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

### 4.4.2 Test Setup




### 4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.4.4 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 ≤ RBW ≤ 100 kHz.
d. Set the VBW ≥ 3 × 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.

### 4.4.5 Deviation from Test Standard

No deviation.

### 4.4.6 EUT Operating Condition

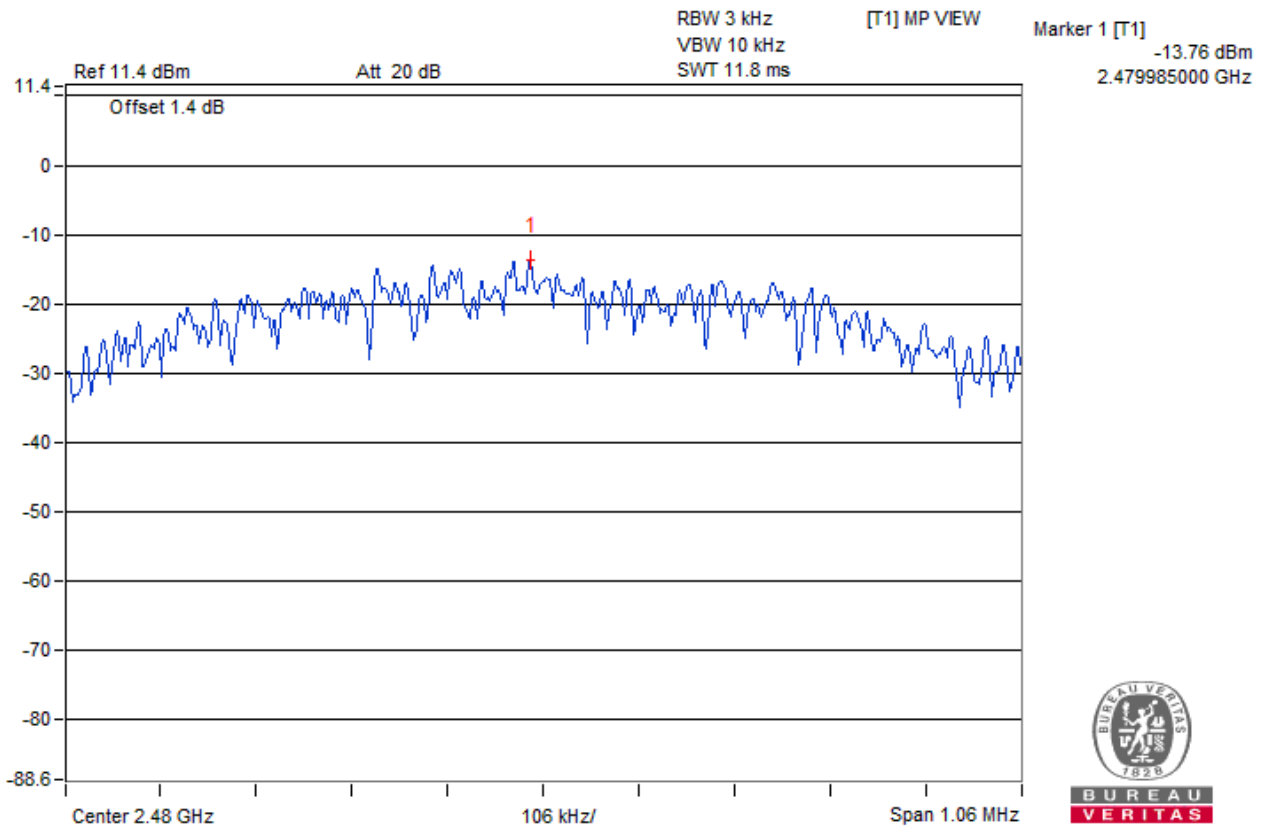
Same as Item 4.3.6.

4.4.7 Test Results

| Channel | Freq. (MHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Pass /Fail |
|---|---|---|---|---|
| 0 | 2402 | -13.85 | 8 | Pass |
| 19 | 2440 | -13.85 | 8 | Pass |
| 39 | 2480 | -13.76 | 8 | Pass |

Spectrum Plot of Worst Value

**CH 39**

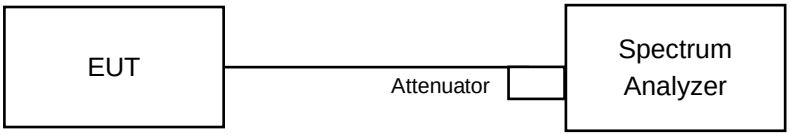


## 4.5 Conducted Out of Band Emission Measurement

### 4.5.1 Limits of Conducted Out of Band Emission Measurement

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

### 4.5.2 Test Setup




### 4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.5.4 Test Procedure

**MEASUREMENT PROCEDURE REF**

1. Set the RBW = 100 kHz.
2. Set the VBW ≥ 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

**MEASUREMENT PROCEDURE OOBE**

1. Set RBW = 100 kHz.
2. Set VBW ≥ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

### 4.5.5 Deviation from Test Standard

No deviation.

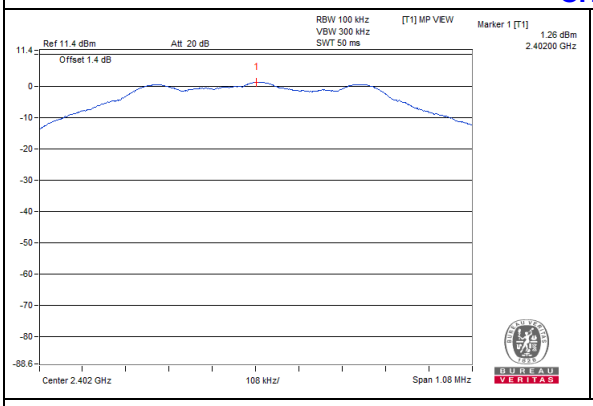
### 4.5.6 EUT Operating Condition

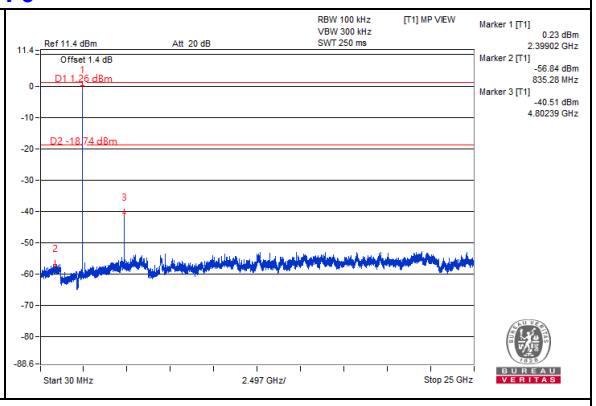
The software provided by client enabled the EUT to transmit and receive data at lowest and highest channel frequencies individually.

### 4.5.7 Test Results

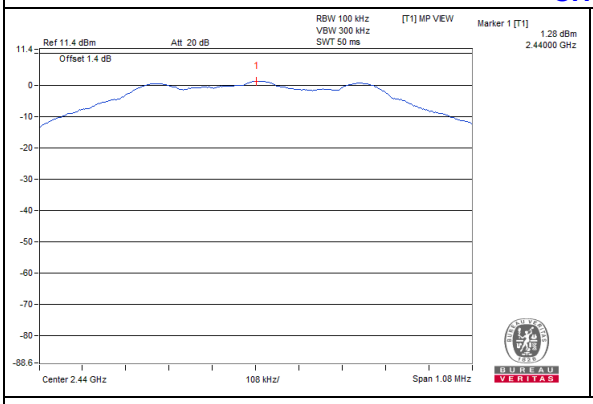
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

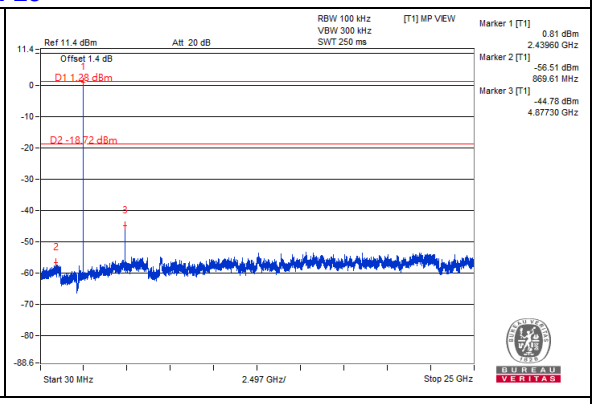
## CH 0



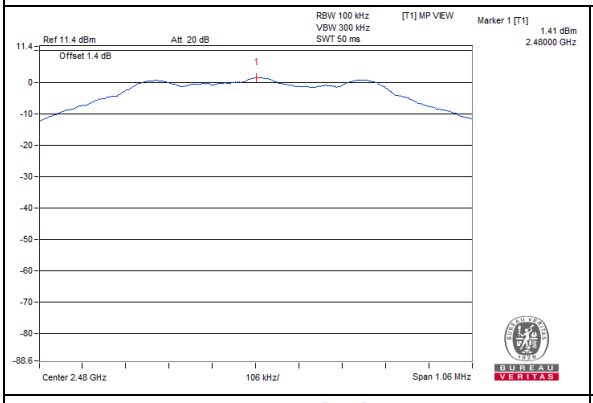



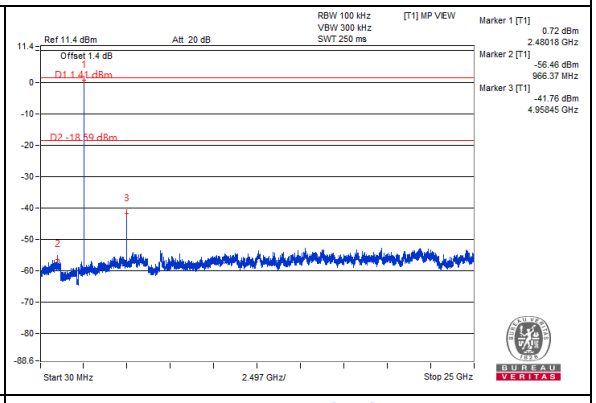

## CH 19



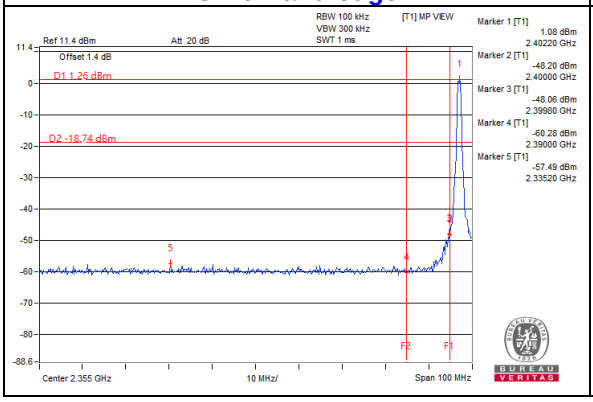




## CH 39

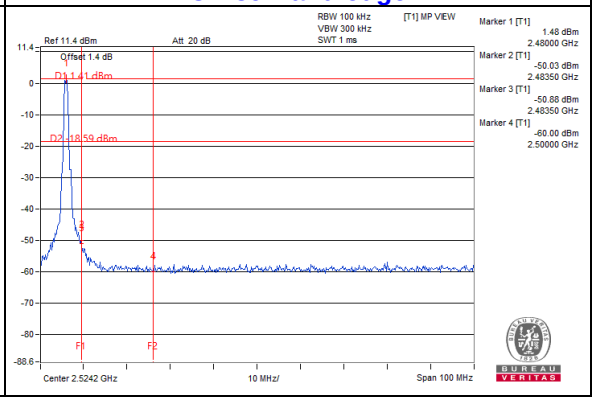



## CH 0 Band edge




## CH 39 Band edge



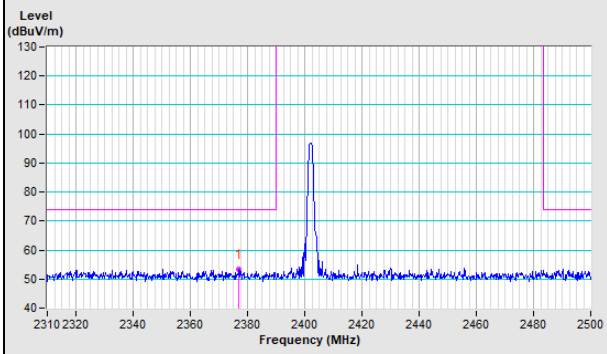
## 5 Pictures of Test Arrangements

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

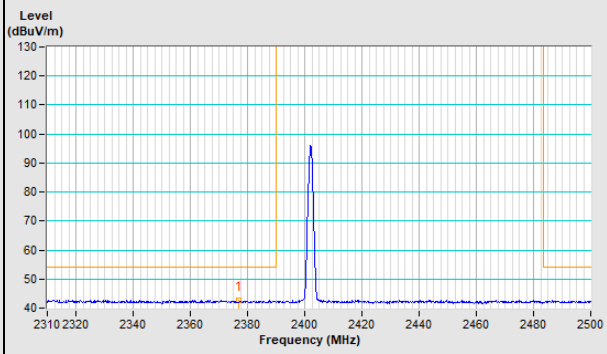
## Annex A - Band-Edge Measurement

### BT_LE-1M Channel 0

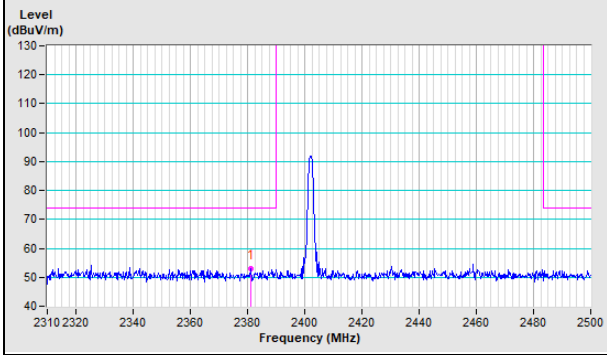
#### Horizontal (Peak)



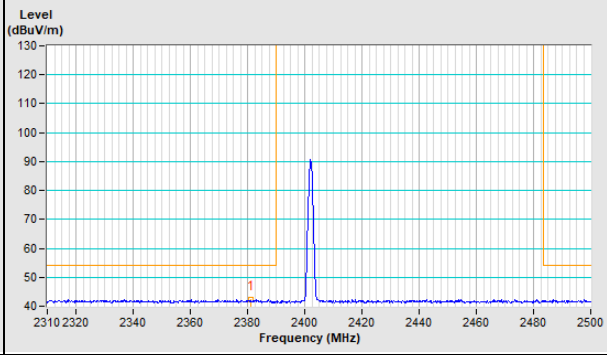

#### Horizontal (Average)




#### Vertical (Peak)

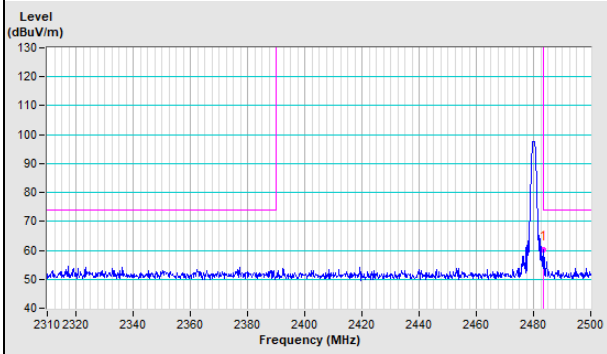



#### Vertical (Average)

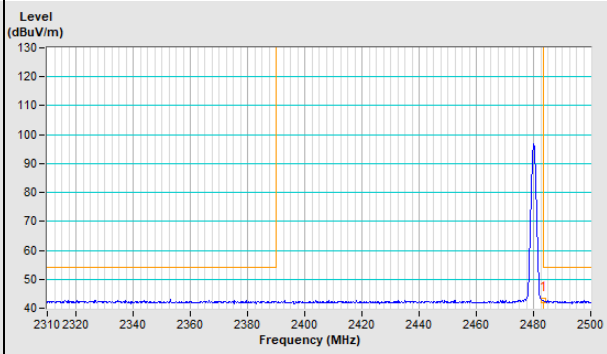



### BT_LE-1M Channel 39

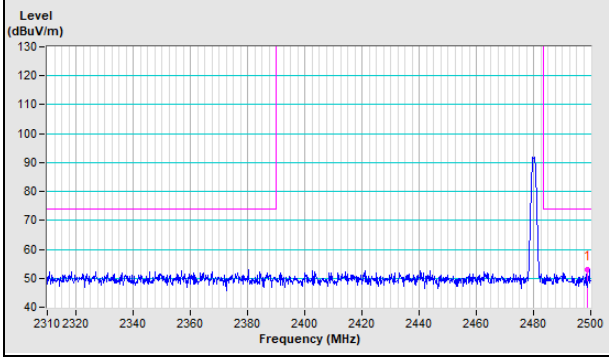
#### Horizontal (Peak)



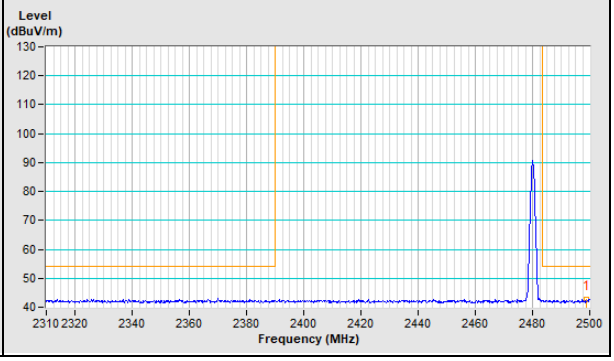

#### Horizontal (Average)




#### Vertical (Peak)




#### Vertical (Average)



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

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