

## FCC Test Report

**Report No.:** RF200715C05-5

**FCC ID:** L6AITF100-1

**Test Model:** ITF100-1

**Received Date:** Jul. 15, 2020

**Test Date:** Aug. 25 ~ Nov. 03, 2020

**Issued Date:** Nov. 04, 2020

**Applicant:** BlackBerry Limited

**Address:** 2200 University Avenue East, Waterloo, Ontario, Canada N2K 0A7

**Issued By:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch  
Lin Kou Laboratories

**Lab Address:** No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan

**Test Location:** No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City  
33383, Taiwan

**FCC Registration /**  
**Designation Number:** 788550 / TW0003



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## Table of Contents

|                                                                   |           |
|-------------------------------------------------------------------|-----------|
| <b>Release Control Record .....</b>                               | <b>4</b>  |
| <b>1 Certificate of Conformity .....</b>                          | <b>5</b>  |
| <b>2 Summary of Test Results.....</b>                             | <b>6</b>  |
| 2.1 Measurement Uncertainty.....                                  | 6         |
| 2.2 Modification Record .....                                     | 6         |
| <b>3 General Information .....</b>                                | <b>7</b>  |
| 3.1 General Description of EUT .....                              | 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 .....                            | 10        |
| 3.4.1 Configuration of System under Test .....                    | 10        |
| 3.5 General Description of Applied Standards and References ..... | 10        |
| <b>4 Test Types and Results .....</b>                             | <b>11</b> |
| 4.1 Radiated Emission and Bandedge Measurement .....              | 11        |
| 4.1.1 Limits of Radiated Emission and Bandedge Measurement .....  | 11        |
| 4.1.2 Test Instruments .....                                      | 12        |
| 4.1.3 Test Procedures.....                                        | 13        |
| 4.1.4 Deviation from Test Standard .....                          | 13        |
| 4.1.5 Test Set Up .....                                           | 14        |
| 4.1.6 EUT Operating Conditions.....                               | 15        |
| 4.1.7 Test Results .....                                          | 16        |
| 4.2 6 dB Bandwidth Measurement.....                               | 21        |
| 4.2.1 Limits of 6 dB Bandwidth Measurement.....                   | 21        |
| 4.2.2 Test Setup.....                                             | 21        |
| 4.2.3 Test Instruments .....                                      | 21        |
| 4.2.4 Test Procedure .....                                        | 21        |
| 4.2.5 Deviation from Test Standard .....                          | 21        |
| 4.2.6 EUT Operating Conditions.....                               | 21        |
| 4.2.7 Test Results .....                                          | 22        |
| 4.3 Occupied Bandwidth Measurement.....                           | 23        |
| 4.3.1 Test Setup.....                                             | 23        |
| 4.3.2 Test Instruments .....                                      | 23        |
| 4.3.3 Test Procedure .....                                        | 23        |
| 4.3.4 Deviation from Test Standard .....                          | 23        |
| 4.3.5 EUT Operating Conditions.....                               | 23        |
| 4.3.6 Test Results .....                                          | 24        |
| 4.4 Conducted Output Power Measurement .....                      | 25        |
| 4.4.1 Limits of Conducted Output Power Measurement.....           | 25        |
| 4.4.2 Test Setup.....                                             | 25        |
| 4.4.3 Test Instruments .....                                      | 25        |
| 4.4.4 Test Procedures.....                                        | 25        |
| 4.4.5 Deviation from Test Standard .....                          | 25        |
| 4.4.6 EUT Operating Conditions.....                               | 25        |
| 4.4.7 Test Results .....                                          | 25        |
| 4.5 Power Spectral Density Measurement .....                      | 26        |
| 4.5.1 Limits of Power Spectral Density Measurement.....           | 26        |
| 4.5.2 Test Setup.....                                             | 26        |
| 4.5.3 Test Instruments .....                                      | 26        |
| 4.5.4 Test Procedure .....                                        | 26        |
| 4.5.5 Deviation from Test Standard .....                          | 26        |
| 4.5.6 EUT Operating Condition .....                               | 26        |
| 4.5.7 Test Results .....                                          | 27        |

|                                                                 |           |
|-----------------------------------------------------------------|-----------|
| 4.6 Conducted Out of Band Emission Measurement .....            | 28        |
| 4.6.1 Limits of Conducted Out of Band Emission Measurement..... | 28        |
| 4.6.2 Test Setup.....                                           | 28        |
| 4.6.3 Test Instruments .....                                    | 28        |
| 4.6.4 Test Procedure .....                                      | 28        |
| 4.6.5 Deviation from Test Standard .....                        | 28        |
| 4.6.6 EUT Operating Condition .....                             | 28        |
| 4.6.7 Test Results .....                                        | 29        |
| <b>5 Pictures of Test Arrangements.....</b>                     | <b>31</b> |
| <b>Annex A- Band Edge Measurement .....</b>                     | <b>32</b> |
| <b>Appendix – Information on the Testing Laboratories .....</b> | <b>33</b> |

### Release Control Record

| Issue No.     | Description      | Date Issued   |
|---------------|------------------|---------------|
| RF200715C05-5 | Original Release | Nov. 04, 2020 |

## 1 Certificate of Conformity

**Product:** Radar H2

**Brand:** BlackBerry

**Test Model:** ITF100-1

**Sample Status:** Identical Prototype

**Applicant:** BlackBerry Limited

**Test Date:** Aug. 25 ~ Nov. 03, 2020

**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 RF characteristics under the conditions specified in this report.

**Prepared by :**

*Lena Wang*

, **Date:** Nov. 04, 2020

Lena Wang / Specialist

**Approved by :**

*Dylan Chiou*

, **Date:** Nov. 04, 2020

Dylan Chiou / Senior Project Engineer

## 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    | N/A    | Without AC port of EUT                                                                           |
| 15.205 & 209                                   | Radiated Emissions             | Pass   | Meet the requirement of limit.<br>Minimum passing margin is -3.6 dB at 2483.50 MHz and 32.91 MHz |
| 15.247(d)                                      | Band Edge Measurement          | Pass   | Meet the requirement of limit.                                                                   |
| 15.247(d)                                      | Antenna Port Emission          | Pass   | Meet the requirement of limit.                                                                   |
| 15.247(a)(2)                                   | 6 dB Bandwidth                 | Pass   | Meet the requirement of limit.                                                                   |
| ---                                            | Occupied Bandwidth Measurement | Pass   | Reference only                                                                                   |
| 15.247(b)                                      | Conducted Power                | Pass   | Meet the requirement of limit.                                                                   |
| 15.247(e)                                      | Power Spectral Density         | Pass   | Meet the requirement of limit.                                                                   |
| 15.203                                         | Antenna Requirement            | Pass   | No antenna connector is used.                                                                    |

N/A: Not Applicable

Note:

- For 2.4G band compliance with rule 15.247(d) of the band-edge items, the test plots were recorded in Annex A. Test Procedures refer to report 4.1.3.
- 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) ( $\pm$ ) |
|------------------------------------|--------------------|--------------------------------------|
| Conducted Emissions at mains ports | 150 kHz ~ 30 MHz   | 2.79 dB                              |
| Radiated Emissions up to 1 GHz     | 9 kHz ~ 30 MHz     | 3.04 dB                              |
|                                    | 30 MHz ~ 200 MHz   | 3.59 dB                              |
|                                    | 200 MHz ~ 1000 MHz | 3.60 dB                              |
| Radiated Emissions above 1 GHz     | 1 GHz ~ 18 GHz     | 2.29 dB                              |
|                                    | 18 GHz ~ 40 GHz    | 2.29 dB                              |

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

|                            |                                                                                                                   |
|----------------------------|-------------------------------------------------------------------------------------------------------------------|
| <b>Product</b>             | Radar H2                                                                                                          |
| <b>Brand</b>               | BlackBerry                                                                                                        |
| <b>Test Model</b>          | ITF100-1                                                                                                          |
| <b>Status of EUT</b>       | Identical Prototype                                                                                               |
| <b>Power Supply Rating</b> | 7.2 Vdc (Battery)                                                                                                 |
| <b>Modulation Type</b>     | 2GFSK, OQPSK                                                                                                      |
| <b>Transfer Rate</b>       | 32 kbps, 40 kbps, 64 kbps, 75 kbps, 76 kbps, 80 kbps, 100 kbps, 200 kbps, 250 kbps, 608 kbps, 800 kbps, 2000 kbps |
| <b>Operating Frequency</b> | 2405 ~ 2475 MHz                                                                                                   |
| <b>Number of Channel</b>   | 15                                                                                                                |
| <b>Output Power</b>        | 45.082 mW                                                                                                         |
| <b>Antenna Type</b>        | Inverted F Antenna with 3.42 dBi gain                                                                             |
| <b>Antenna Connector</b>   | N/A                                                                                                               |
| <b>Accessory Device</b>    | Refer to Note as below                                                                                            |
| <b>Data Cable Supplied</b> | N/A                                                                                                               |

Note:

1. The EUT contains following accessory devices.

| Product | Brand      | Model         | Description   |
|---------|------------|---------------|---------------|
| Battery | BlackBerry | BAT-63320-001 | 7.2 Vdc, 38 A |

2. 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. 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.
4. SRD & WWAN technology cannot transmit same time.

### 3.2 Description of Test Modes

15 channels are provided to this EUT:

| Channel | Freq. (MHz) | Channel | Freq. (MHz) |
|---------|-------------|---------|-------------|
| 1       | 2405        | 10      | 2450        |
| 2       | 2410        | 11      | 2455        |
| 3       | 2415        | 12      | 2460        |
| 4       | 2420        | 13      | 2465        |
| 5       | 2425        | 14      | 2470        |
| 6       | 2430        | 15      | 2475        |
| 7       | 2435        |         |             |
| 8       | 2440        |         |             |
| 9       | 2445        |         |             |

### 3.2.1 Test Mode Applicability and Tested Channel Detail

| EUT Configure Mode | Applicable To |       |     |      | Description |
|--------------------|---------------|-------|-----|------|-------------|
|                    | RE $\geq$ 1G  | RE<1G | PLC | APCM |             |
| -                  | √             | √     | -   | √    | -           |

Where **RE $\geq$ 1G**: Radiated Emission above 1 GHz **RE<1G**: Radiated Emission below 1 GHz  
**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. "-" means no effect.  
3. For radiated emission test, pre-tested 2GFSK, OQPSK modulation type and found 2GFSK was the worse, therefore chosen for the final test and presented in the test report.

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

- ☒ 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.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Type | Data Rate (kbps) |
|--------------------|-------------------|----------------|-----------------|------------------|
| -                  | 1 to 15           | 1, 8, 15       | 2GFSK           | 100              |

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

- ☒ 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.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Type | Data Rate (kbps) |
|--------------------|-------------------|----------------|-----------------|------------------|
| -                  | 1 to 15           | 1              | 2GFSK           | 100              |

#### **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.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Type | Data Rate (kbps) |
|--------------------|-------------------|----------------|-----------------|------------------|
| -                  | 1 to 15           | 1, 8, 15       | 2GFSK           | 100              |

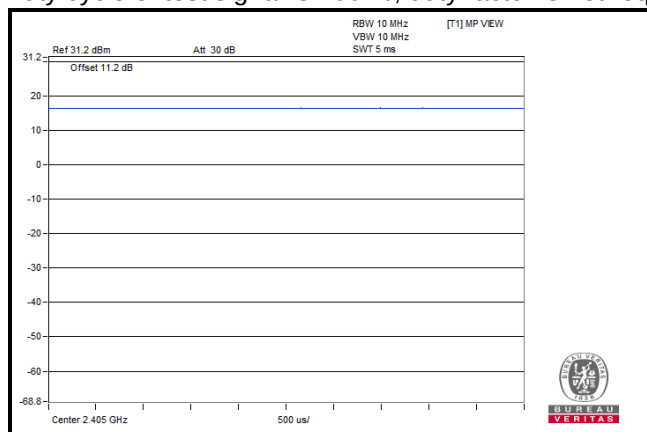
#### **Test Condition:**

| Applicable To | Environmental Conditions | Input Power | Tested by |
|---------------|--------------------------|-------------|-----------|
| RE $\geq$ 1G  | 25 deg. C, 65 % RH       | 7.2 Vdc     | Greg Lin  |
| RE<1G         | 25 deg. C, 65 % RH       | 7.2 Vdc     | Greg Lin  |

|      |                    |         |           |
|------|--------------------|---------|-----------|
| APCM | 25 deg. C, 65 % RH | 7.2 Vdc | Wayne Lin |
|------|--------------------|---------|-----------|

### 3.3 Duty Cycle of Test Signal

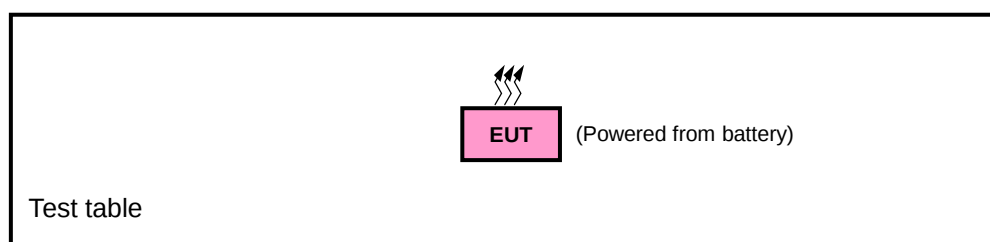
Duty cycle of test signal is 100 %, duty factor is not required.



### 3.4 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units.

#### 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 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 30 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                             |

**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 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.

#### 4.1.2 Test Instruments

| Description & Manufacturer               | Model No.                              | Serial No.                                              | Date of Calibration | Due Date of Calibration |
|------------------------------------------|----------------------------------------|---------------------------------------------------------|---------------------|-------------------------|
| Test Receiver<br>KEYSIGHT                | N9038A                                 | MY55420137                                              | Apr. 16, 2020       | Apr. 15, 2021           |
| Spectrum Analyzer<br>ROHDE & SCHWARZ     | FSV40                                  | 100979                                                  | Mar. 18, 2020       | Mar. 17, 2021           |
| Spectrum Analyzer<br>ROHDE & SCHWARZ     | FSP40                                  | 100039                                                  | Jun. 12, 2020       | Jun. 11, 2021           |
| BILOG Antenna<br>SCHWARZBECK             | VULB9168                               | 9168-160                                                | Nov. 07, 2019       | Nov. 06, 2020           |
| HORN Antenna<br>SCHWARZBECK              | BBHA 9120 D                            | 9120D-1169                                              | Nov. 24, 2019       | Nov. 23, 2020           |
| HORN Antenna<br>SCHWARZBECK              | BBHA 9170                              | BBHA9170241                                             | Nov. 24, 2019       | Nov. 23, 2020           |
| Loop Antenna<br>TESEQ                    | HLA 6121                               | 45745                                                   | Jul. 06, 2020       | Jul. 05, 2021           |
| Preamplifier<br>Agilent<br>(Below 1GHz)  | 8447D                                  | 2944A10638                                              | Jun. 08, 2020       | Jun. 07, 2021           |
| Preamplifier<br>Agilent<br>(Above 1GHz)  | 8449B                                  | 3008A02367                                              | Feb. 18, 2020       | Feb. 17, 2021           |
| RF signal cable<br>HUBER+SUHNER&EMCI     | SUCOFLEX 104 &<br>EMC104-SM-<br>SM8000 | CABLE-CH9-02<br>(248780+171006)                         | Jan. 18, 2020       | Jan. 17, 2021           |
| RF signal cable<br>HUBER+SUHNER          | SUCOFLEX 104                           | CABLE-CH9-<br>(250795/4)                                | Jan. 18, 2020       | Jan. 17, 2021           |
| RF signal cable<br>Woken                 | 8D-FB                                  | Cable-CH9-01                                            | Jun. 08, 2020       | Jun. 07, 2021           |
| Software<br>BV ADT                       | ADT_Radiated_<br>V7.6.15.9.5           | NA                                                      | NA                  | NA                      |
| Antenna Tower<br>EMCO                    | 2070/2080                              | 512.835.4684                                            | NA                  | NA                      |
| Turn Table<br>EMCO                       | 2087-2.03                              | NA                                                      | NA                  | NA                      |
| Antenna Tower & Turn<br>BV ADT           | AT100                                  | AT93021705                                              | NA                  | NA                      |
| Turn Table<br>BV ADT                     | TT100                                  | TT93021705                                              | NA                  | NA                      |
| Turn Table Controller<br>BV ADT          | SC100                                  | SC93021705                                              | NA                  | NA                      |
| Boresight Antenna Fixture                | FBA-01                                 | FBA-SIP01                                               | NA                  | NA                      |
| USB Wideband Power<br>Sensor<br>KEYSIGHT | U2021XA                                | MY55050005/MY<br>55190004/MY551<br>90007/MY552100<br>05 | Jul. 13, 2020       | Jul. 12, 2021           |

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 HwaYa Chamber 9.

#### 4.1.3 Test Procedures

##### **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 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 9 kHz at frequency below 30 MHz.

##### **For Radiated Emission above 30 MHz**

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) 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 detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

##### **Note:**

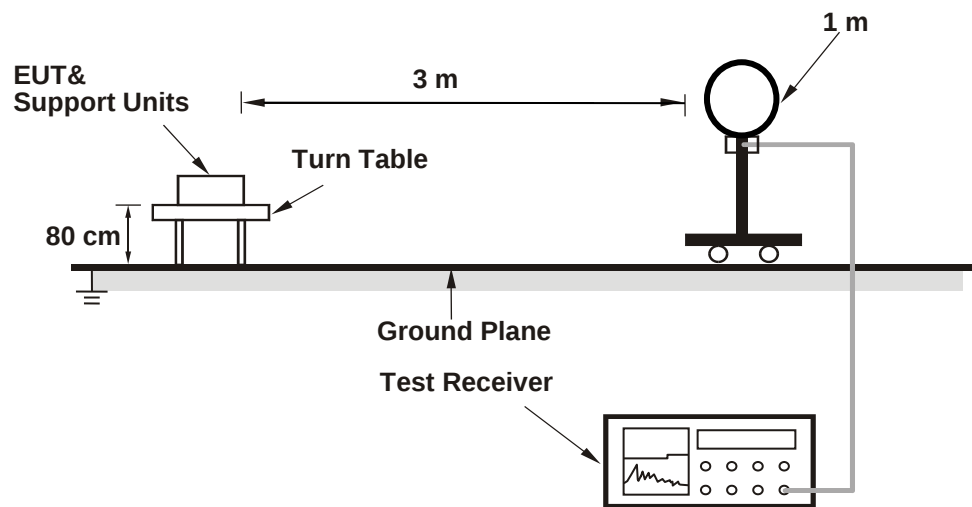
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK)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

#### 4.1.4 Deviation from Test Standard

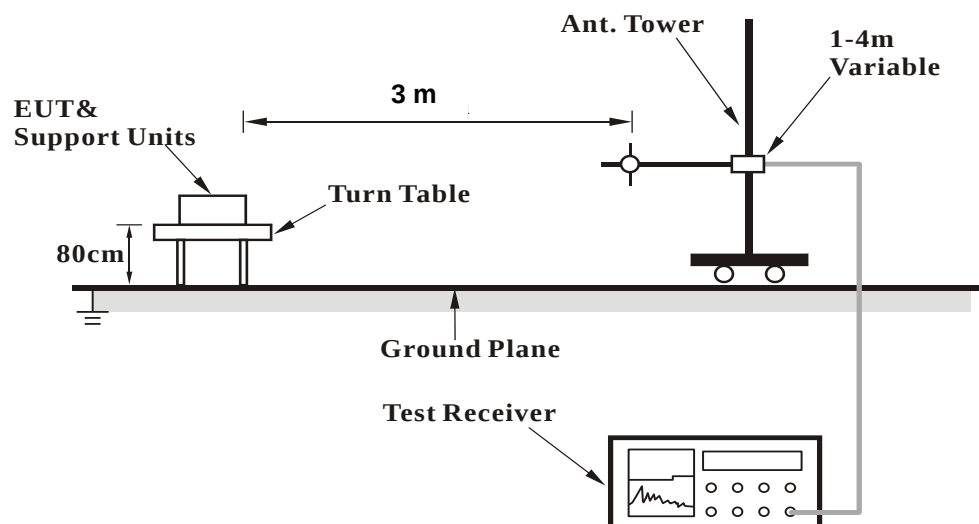
No deviation.

#### 4.1.5 Test Set Up

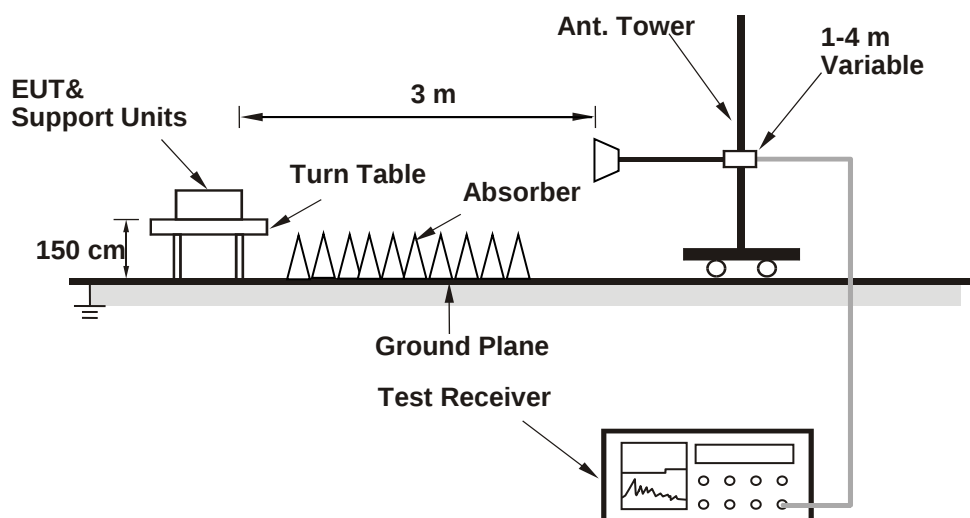
##### <Radiated Emission below 30 MHz>



##### <Radiated Emission 30 MHz to 1 GHz>



### <Radiated Emission above 1 GHz>



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

#### 4.1.6 EUT Operating Conditions

- Placed the EUT on the testing table.
- Set the EUT under transmission condition continuously at specific channel frequency.

#### 4.1.7 Test Results

##### Above 1 GHz Data:

| EUT Test Condition       |                    | Measurement Detail |                           |
|--------------------------|--------------------|--------------------|---------------------------|
| Channel                  | Channel 1          | Frequency Range    | 1 GHz ~ 10 GHz            |
| Input Power              | 7.2 Vdc            | Detector Function  | Peak (PK)<br>Average (AV) |
| Environmental Conditions | 22 deg. C, 66 % RH | Tested By          | Greg 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         | 56.0 PK                 | 74.0           | -18.0       | 1.30 H             | 318                  | 24.8             | 31.2                     |
| 2                                                    | 2390.00         | 45.3 AV                 | 54.0           | -8.7        | 1.30 H             | 318                  | 14.1             | 31.2                     |
| 3                                                    | 2405.00         | 109.6 PK                |                |             | 1.30 H             | 318                  | 78.5             | 31.1                     |
| 4                                                    | 2405.00         | 106.2 AV                |                |             | 1.30 H             | 318                  | 75.1             | 31.1                     |
| 5                                                    | 4810.00         | 47.2 PK                 | 74.0           | -26.8       | 1.24 H             | 310                  | 45.3             | 1.9                      |
| 6                                                    | 4810.00         | 37.6 AV                 | 54.0           | -16.4       | 1.24 H             | 310                  | 35.7             | 1.9                      |
| 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         | 55.3 PK                 | 74.0           | -18.7       | 3.45 V             | 182                  | 24.1             | 31.2                     |
| 2                                                    | 2390.00         | 43.8 AV                 | 54.0           | -10.2       | 3.45 V             | 182                  | 12.6             | 31.2                     |
| 3                                                    | 2405.00         | 104.0 PK                |                |             | 3.45 V             | 182                  | 72.9             | 31.1                     |
| 4                                                    | 2405.00         | 100.6 AV                |                |             | 3.45 V             | 182                  | 69.5             | 31.1                     |
| 5                                                    | 4810.00         | 46.3 PK                 | 74.0           | -27.7       | 3.85 V             | 241                  | 44.4             | 1.9                      |
| 6                                                    | 4810.00         | 35.4 AV                 | 54.0           | -18.6       | 3.85 V             | 241                  | 33.5             | 1.9                      |

##### Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamplifier Factor  
Margin value = Emission level – Limit value
- 2405 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

| EUT Test Condition       |                    | Measurement Detail |                           |
|--------------------------|--------------------|--------------------|---------------------------|
| Channel                  | Channel 8          | Frequency Range    | 1 GHz ~ 10 GHz            |
| Input Power              | 7.2 Vdc            | Detector Function  | Peak (PK)<br>Average (AV) |
| Environmental Conditions | 22 deg. C, 66 % RH | Tested By          | Greg 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         | 110.0 PK                |                |             | 1.02 H             | 314                  | 78.9             | 31.1                     |
| 2                                                    | 2440.00         | 106.6 AV                |                |             | 1.02 H             | 314                  | 75.5             | 31.1                     |
| 3                                                    | 4880.00         | 49.8 PK                 | 74.0           | -24.2       | 1.26 H             | 299                  | 47.8             | 2.0                      |
| 4                                                    | 4880.00         | 39.5 AV                 | 54.0           | -14.5       | 1.26 H             | 299                  | 37.5             | 2.0                      |
| 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                                                    | 2440.00         | 105.3 PK                |                |             | 1.29 V             | 314                  | 74.2             | 31.1                     |
| 2                                                    | 2440.00         | 101.9 AV                |                |             | 1.29 V             | 314                  | 70.8             | 31.1                     |
| 3                                                    | 4880.00         | 48.7 PK                 | 74.0           | -25.3       | 3.81 V             | 234                  | 46.7             | 2.0                      |
| 4                                                    | 4880.00         | 37.4 AV                 | 54.0           | -16.6       | 3.81 V             | 234                  | 35.4             | 2.0                      |

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2440 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

| EUT Test Condition       |                    | Measurement Detail |                           |
|--------------------------|--------------------|--------------------|---------------------------|
| Channel                  | Channel 15         | Frequency Range    | 1 GHz ~ 10 GHz            |
| Input Power              | 7.2 Vdc            | Detector Function  | Peak (PK)<br>Average (AV) |
| Environmental Conditions | 22 deg. C, 66 % RH | Tested By          | Greg 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                                                    | 2475.00         | 111.5 PK                |                |             | 1.06 H             | 312                  | 80.4             | 31.1                     |
| 2                                                    | 2475.00         | 108.1 AV                |                |             | 1.06 H             | 312                  | 77.0             | 31.1                     |
| 3                                                    | 2483.50         | 62.5 PK                 | 74.0           | -11.5       | 1.06 H             | 312                  | 31.3             | 31.2                     |
| 4                                                    | 2483.50         | 50.4 AV                 | 54.0           | -3.6        | 1.06 H             | 312                  | 19.2             | 31.2                     |
| 5                                                    | 4950.00         | 50.6 PK                 | 74.0           | -23.4       | 1.19 H             | 307                  | 48.4             | 2.2                      |
| 6                                                    | 4950.00         | 40.9 AV                 | 54.0           | -13.1       | 1.19 H             | 307                  | 38.7             | 2.2                      |
| 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                                                    | 2475.00         | 106.9 PK                |                |             | 1.24 V             | 309                  | 75.8             | 31.1                     |
| 2                                                    | 2475.00         | 103.5 AV                |                |             | 1.24 V             | 309                  | 72.4             | 31.1                     |
| 3                                                    | 2483.50         | 59.7 PK                 | 74.0           | -14.3       | 1.24 V             | 309                  | 28.5             | 31.2                     |
| 4                                                    | 2483.50         | 47.6 AV                 | 54.0           | -6.4        | 1.24 V             | 309                  | 16.4             | 31.2                     |
| 5                                                    | 4950.00         | 49.5 PK                 | 74.0           | -24.5       | 3.76 V             | 246                  | 47.3             | 2.2                      |
| 6                                                    | 4950.00         | 38.7 AV                 | 54.0           | -15.3       | 3.76 V             | 246                  | 36.5             | 2.2                      |

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2475 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

### 9 kHz ~ 30 MHz Data:

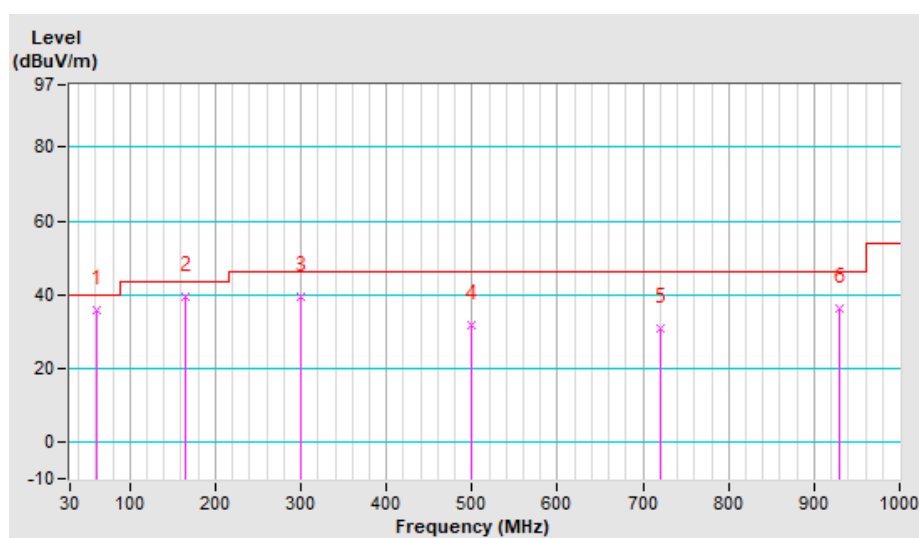
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

### 30 MHz ~ 1 GHz Data:

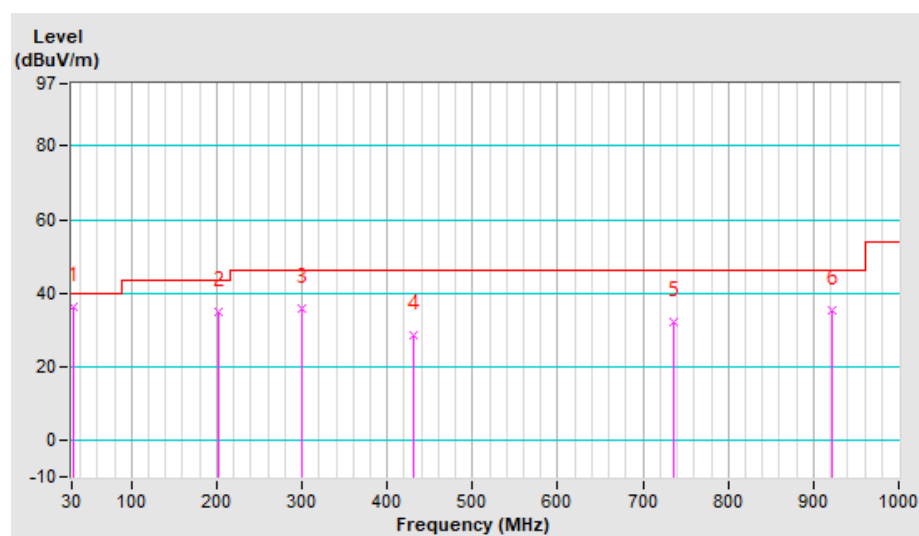
#### <Spurious Emissions Measurement>

| EUT Test Condition       |                    | Measurement Detail |                              |
|--------------------------|--------------------|--------------------|------------------------------|
| Channel                  | Channel 1          | Frequency Range    | 30 MHz ~ 1 GHz               |
| Input Power              | 7.2 Vdc            | Detector Function  | Peak (PK)<br>Quasi-peak (QP) |
| Environmental Conditions | 22 deg. C, 66 % RH | Tested By          | Greg Lin                     |

#### Horizontal



#### Vertical



| 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                                                    | 61.04           | 35.7 QP                 | 40.0           | -4.3        | 1.00 H             | 285                  | 45.4             | -9.7                     |
| 2                                                    | 165.80          | 39.5 QP                 | 43.5           | -4.0        | 1.00 H             | 129                  | 48.2             | -8.7                     |
| 3                                                    | 299.66          | 39.3 QP                 | 46.0           | -6.7        | 1.25 H             | 75                   | 46.4             | -7.1                     |
| 4                                                    | 498.51          | 31.8 QP                 | 46.0           | -14.2       | 1.25 H             | 212                  | 34.8             | -3.0                     |
| 5                                                    | 720.64          | 31.0 QP                 | 46.0           | -15.0       | 1.00 H             | 125                  | 29.9             | 1.1                      |
| 6                                                    | 930.16          | 36.4 QP                 | 46.0           | -9.6        | 1.00 H             | 177                  | 31.2             | 5.2                      |
| 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                                                    | 32.91           | 36.4 QP                 | 40.0           | -3.6        | 1.00 V             | 270                  | 47.1             | -10.7                    |
| 2                                                    | 201.69          | 35.0 QP                 | 43.5           | -8.5        | 1.25 V             | 239                  | 46.5             | -11.5                    |
| 3                                                    | 299.66          | 36.0 QP                 | 46.0           | -10.0       | 1.50 V             | 16                   | 43.1             | -7.1                     |
| 4                                                    | 431.58          | 28.7 QP                 | 46.0           | -17.3       | 1.25 V             | 317                  | 32.9             | -4.2                     |
| 5                                                    | 735.19          | 32.2 QP                 | 46.0           | -13.8       | 1.00 V             | 2                    | 30.7             | 1.5                      |
| 6                                                    | 921.43          | 35.4 QP                 | 46.0           | -10.6       | 1.00 V             | 236                  | 30.3             | 5.1                      |

Remarks:

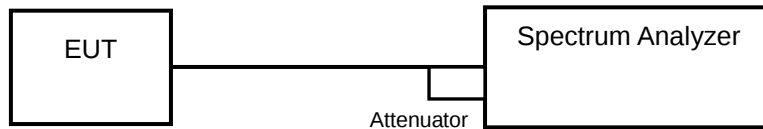
- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- The emission levels of other frequencies were very low against the limit.

## 4.2 6 dB Bandwidth Measurement

### 4.2.1 Limits of 6 dB Bandwidth Measurement

The minimum of 6 dB 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

- 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

### 4.2.5 Deviation from Test Standard

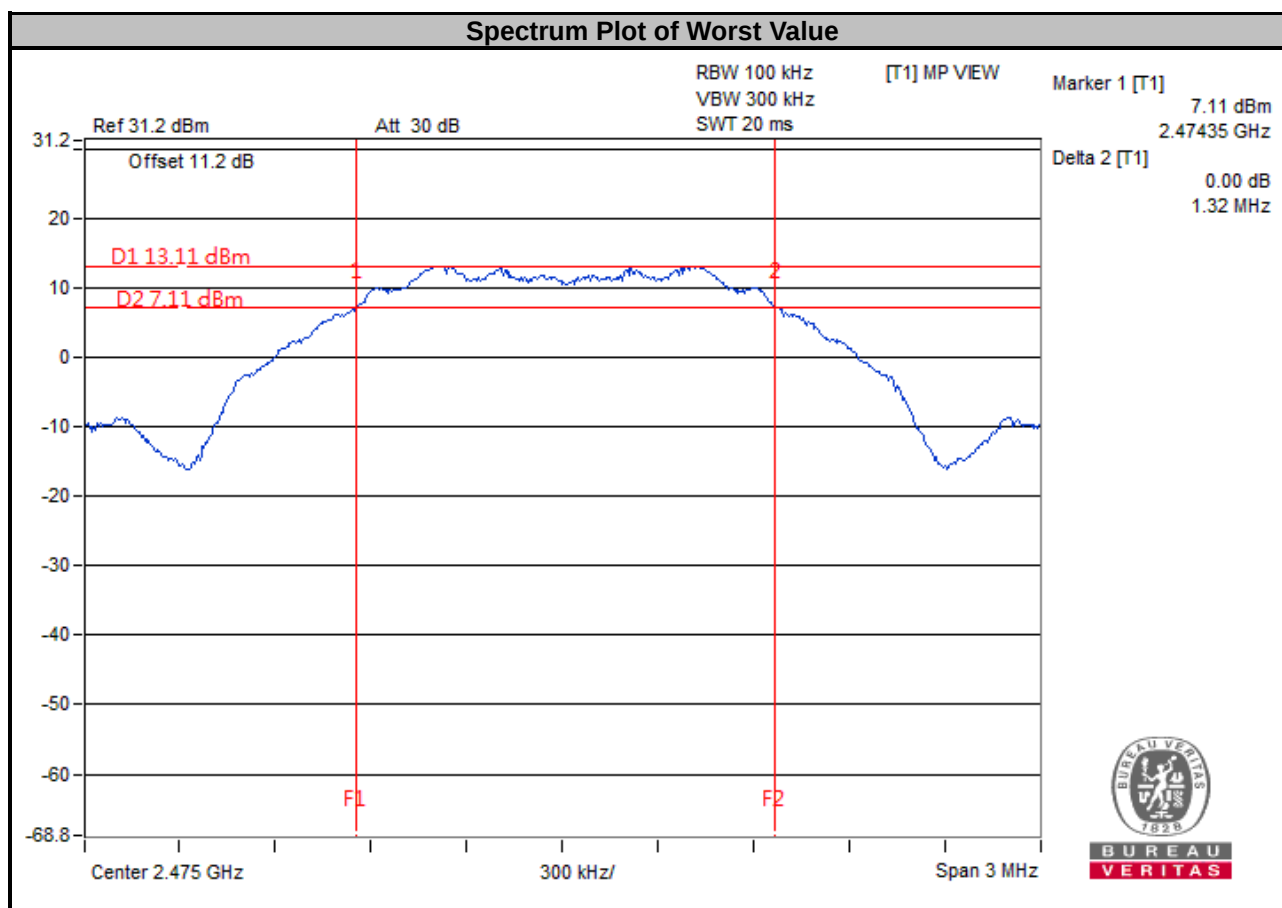
No deviation.

### 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.

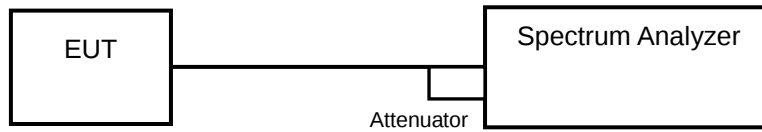
#### 4.2.7 Test Results

| Channel | Frequency (MHz) | 6 dB Bandwidth (MHz) | Minimum Limit (MHz) | Pass / Fail |
|---------|-----------------|----------------------|---------------------|-------------|
| 1       | 2405            | 1.34                 | 0.5                 | Pass        |
| 8       | 2440            | 1.33                 | 0.5                 | Pass        |
| 15      | 2475            | 1.32                 | 0.5                 | Pass        |



### 4.3 Occupied Bandwidth Measurement

#### 4.3.1 Test Setup



#### 4.3.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

#### 4.3.3 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1 % to 5 % of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to SAMPLE. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

#### 4.3.4 Deviation from Test Standard

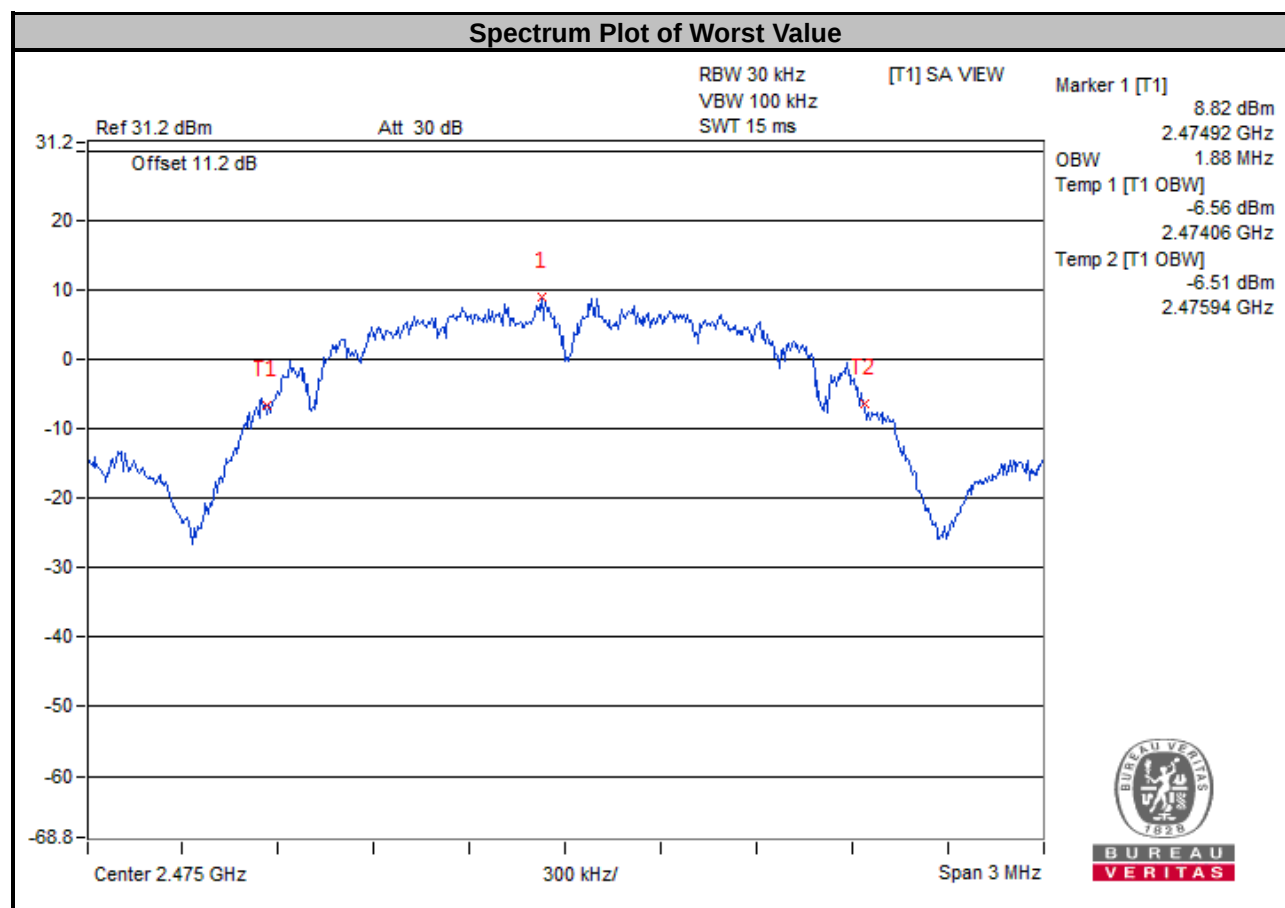
No deviation.

#### 4.3.5 EUT Operating Conditions

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

#### 4.3.6 Test Results

| Channel | Frequency (MHz) | Occupied Bandwidth (MHz) | Pass / Fail |
|---------|-----------------|--------------------------|-------------|
| 1       | 2405            | 1.87                     | Pass        |
| 8       | 2440            | 1.87                     | Pass        |
| 15      | 2475            | 1.88                     | Pass        |

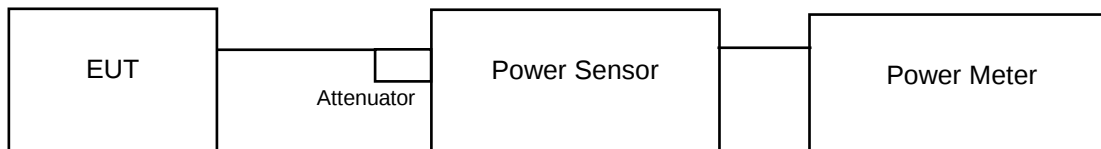


#### 4.4 Conducted Output Power Measurement

##### 4.4.1 Limits of Conducted Output Power Measurement

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

##### 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 Procedures

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.

##### 4.4.5 Deviation from Test Standard

No deviation.

##### 4.4.6 EUT Operating Conditions

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

##### 4.4.7 Test Results

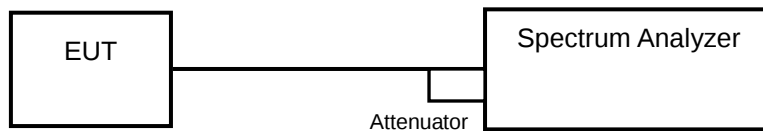
| Channel | Frequency (MHz) | Average Power (mW) | Average Power (dBm) | Limit (dBm) | Pass / Fail |
|---------|-----------------|--------------------|---------------------|-------------|-------------|
| 1       | 2405            | 45.082             | 16.54               | 30          | Pass        |
| 8       | 2440            | 42.56              | 16.29               | 30          | Pass        |
| 15      | 2475            | 40.087             | 16.03               | 30          | Pass        |

## 4.5 Power Spectral Density Measurement

### 4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### 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

- Set instrument center frequency to DTS channel center frequency.
- Set span to at least 1.5 times the OBW.
- Set RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- Set VBW  $\geq 3 \times \text{RBW}$ .
- Detector = power averaging (RMS) or sample detector (when RMS not available).
- Ensure that the number of measurement points in the sweep  $\geq 2 \times \text{span/RBW}$ .
- Sweep time = auto couple.
- Employ trace averaging (RMS) mode over a minimum of 100 traces.
- Use the peak marker function to determine the maximum amplitude level.

### 4.5.5 Deviation from Test Standard

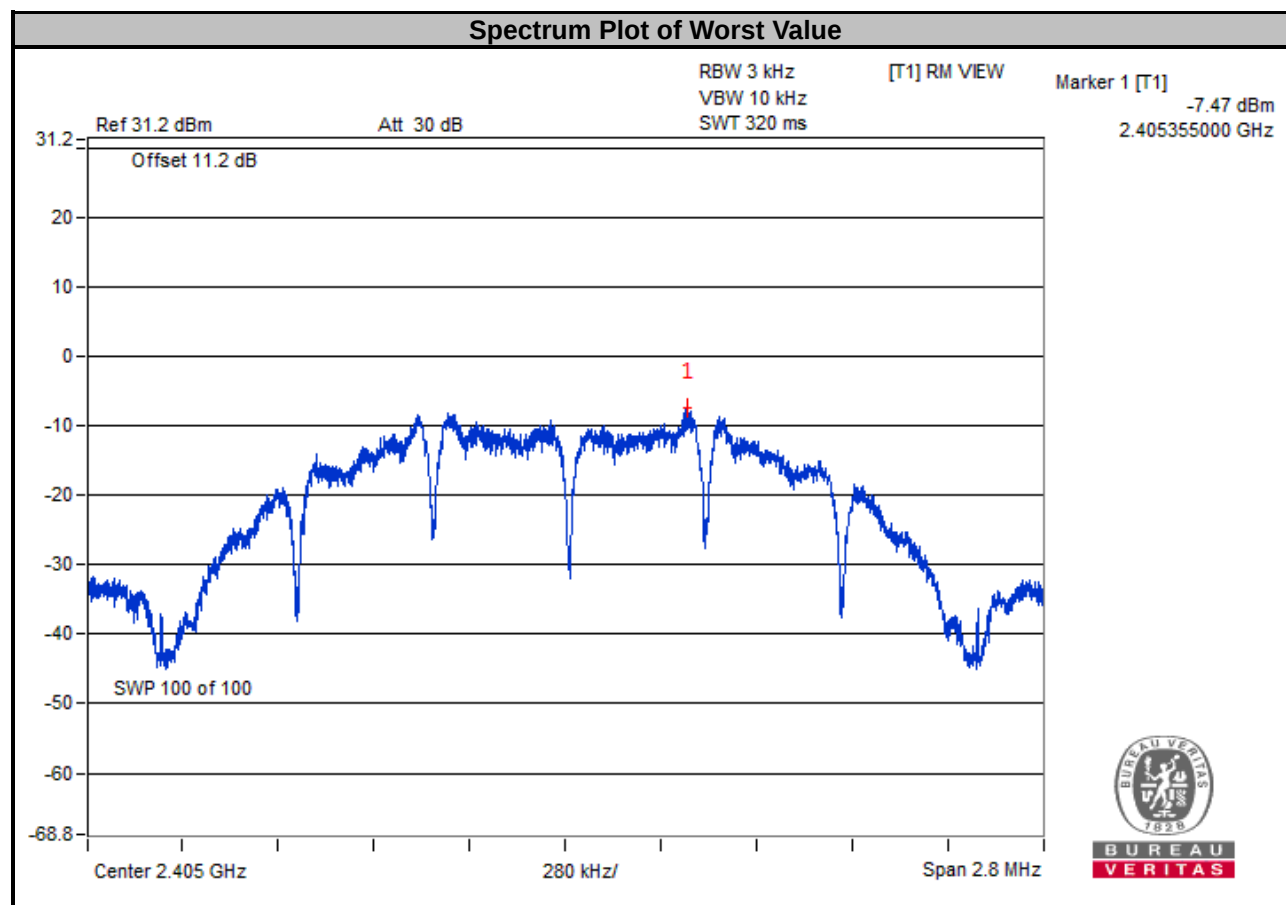
No deviation.

### 4.5.6 EUT Operating Condition

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

#### 4.5.7 Test Results

| Channel | Frequency (MHz) | PSD (dBm/3 kHz) | Limit (dBm/3 kHz) | Pass / Fail |
|---------|-----------------|-----------------|-------------------|-------------|
| 1       | 2405            | -7.47           | 8                 | Pass        |
| 8       | 2440            | -7.89           | 8                 | Pass        |
| 15      | 2475            | -7.85           | 8                 | Pass        |

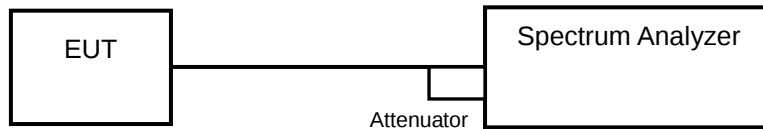


#### 4.6 Conducted Out of Band Emission Measurement

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

Below -30 dB of the highest emission level of operating band (in 100 kHz Resolution Bandwidth).

##### 4.6.2 Test Setup



##### 4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

##### 4.6.4 Test Procedure

###### MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW  $\geq$  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 OOB

1. Set RBW = 100 kHz.
2. Set VBW  $\geq$  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.

##### 4.6.5 Deviation from Test Standard

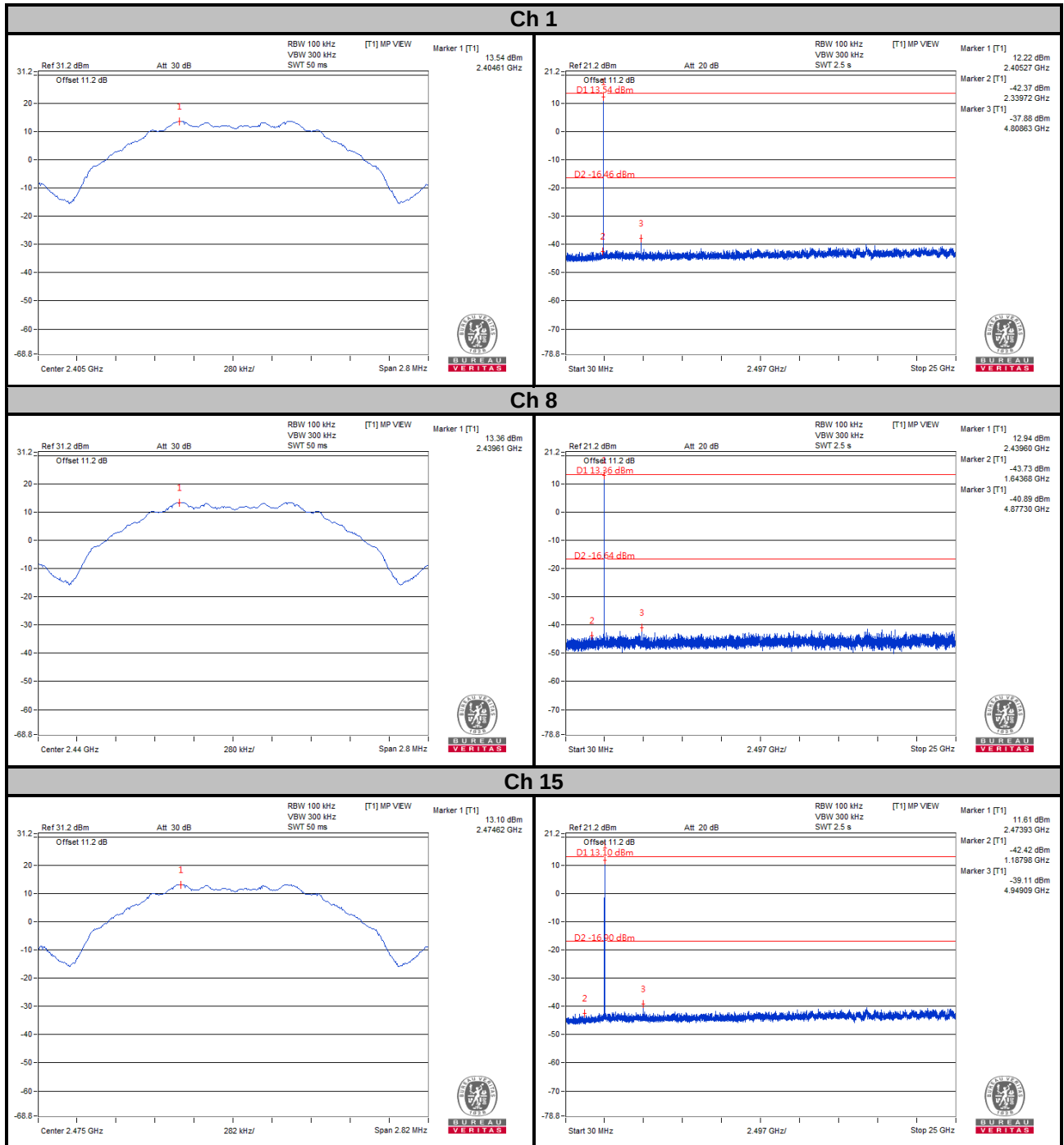
No deviation.

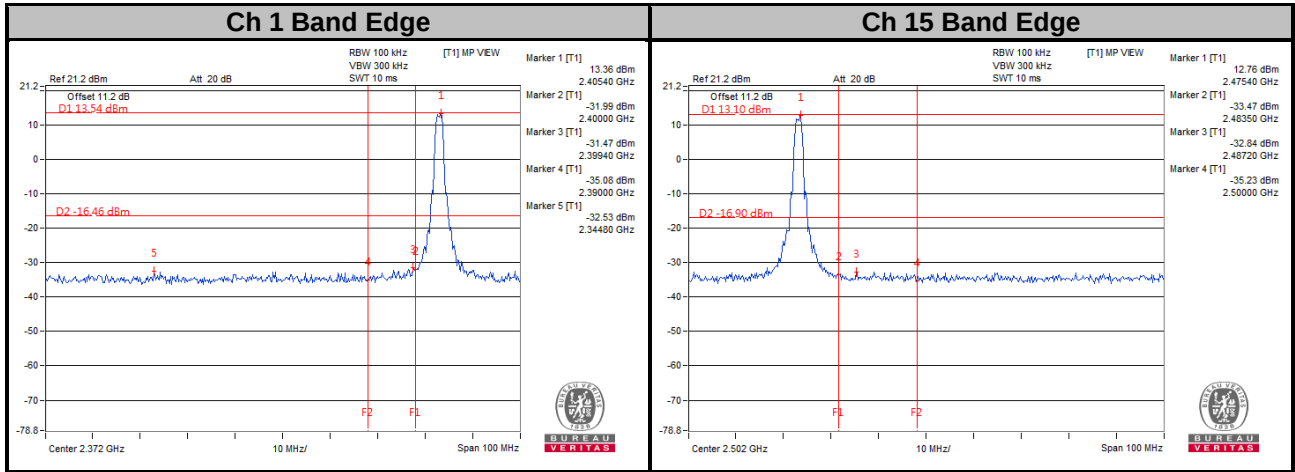
##### 4.6.6 EUT Operating Condition

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

#### 4.6.7 Test Results

The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 30dB offset below D1. It shows compliance with the requirement.

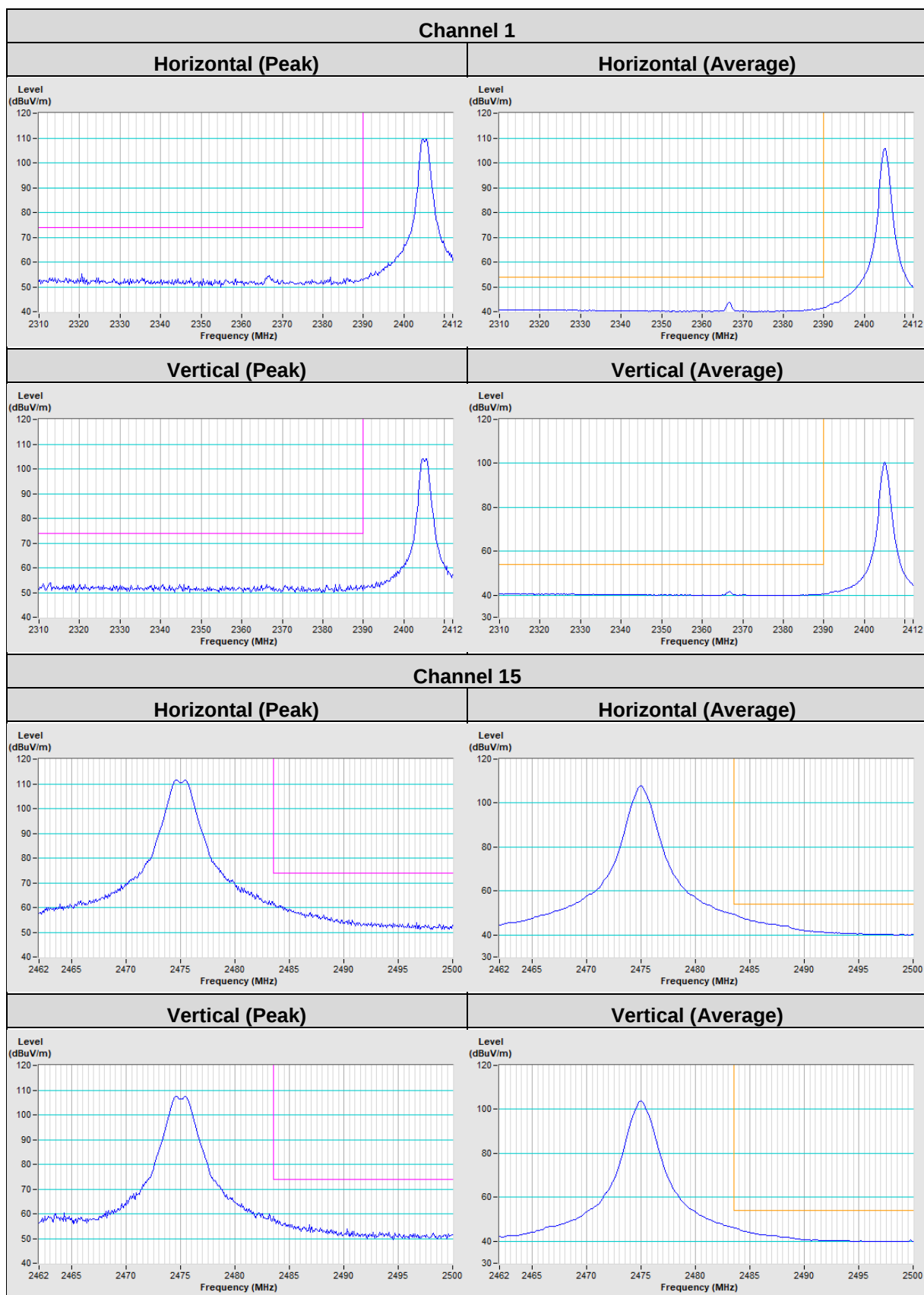




## 5 Pictures of Test Arrangements

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

## Annex A- Band Edge Measurement



## Appendix – Information on 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:

**Linko EMC/RF Lab**

Tel: 886-2-26052180

Fax: 886-2-26051924

**Hsin Chu EMC/RF/Telecom Lab**

Tel: 886-3-6668565

Fax: 886-3-6668323

**Hwa Ya EMC/RF/Safety**

Tel: 886-3-3183232

Fax: 886-3-3270892

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

**Web Site:** [www.bureauveritas-adt.com](http://www.bureauveritas-adt.com)

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

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