

FCC Test Report

Report No.: RF180115E03

FCC ID: JNZYR0067

Test Model: Y-R0067

Received Date: Jan. 15, 2018

Test Date: Jan. 16 to 18, 2018

Issued Date: Jan. 26, 2018

Applicant: LOGITECH FAR EAST LTD.

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



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Release Control Record

| Issue No. | Description | Date Issued |
|-------------|-------------------|---------------|
| RF180115E03 | Original release. | Jan. 26, 2018 |

1 Certificate of Conformity

Product: Wireless Keyboard

Brand: Logitech

Test Model: Y-R0067

Sample Status: ENGINEERING SAMPLE

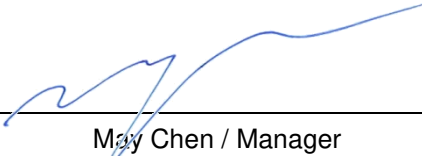
Applicant: LOGITECH FAR EAST LTD.

Test Date: Jan. 16 to 18, 2018

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 :  , **Date:** Jan. 26, 2018
Claire Kuan / Specialist

Approved by :  , **Date:** Jan. 26, 2018
May Chen / 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 & 209 & 15.247(d) | Radiated Emissions & Band Edge Measurement | PASS | Meet the requirement of limit. Minimum passing margin is -7.1dB at 2483.50MHz. |
| 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 | No antenna connector is used. |

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) |
|--------------------------------|---------------|--------------------------------------|
| Radiated Emissions up to 1 GHz | 30MHz ~ 1GHz | 5.33 dB |
| Radiated Emissions above 1 GHz | 1GHz ~ 6GHz | 5.10 dB |
| | 6GHz ~ 18GHz | 4.85 dB |
| | 18GHz ~ 40GHz | 5.24 dB |

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT (GFSK)

| | |
|---------------------|--------------------|
| Product | Wireless Keyboard |
| PMN | MK320, MK330 |
| Brand | Logitech |
| Test Model | Y-R0067 |
| Status of EUT | ENGINEERING SAMPLE |
| Power Supply Rating | DC 3V from battery |
| Modulation Type | GFSK |
| Transfer Rate | 2Mbps |
| Operating Frequency | 2405MHz ~ 2474MHz |
| Number of Channel | 12 |
| Output Power | 1.33mW |
| Antenna Type | Refer to Note |
| Antenna Connector | NA |
| Accessory Device | NA |
| Data Cable Supplied | NA |

Note:

1. The EUT may have a lot of colors for marketing requirement.
2. The antenna provided to the EUT, please refer to the following table:

| Antenna Gain (dBi) | Frequency range(GHz) | Antenna Type | Connector Type | Cable Length |
|--------------------|----------------------|-----------------|----------------|--------------|
| 1.40 | 2.4-2.4835 | Printed Antenna | None | NA |

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

3.2 Description of Test Modes

12 channels are provided to this EUT:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|
| 1 | 2405 | 7 | 2441 |
| 2 | 2408 | 8 | 2444 |
| 3 | 2414 | 9 | 2462 |
| 4 | 2417 | 10 | 2465 |
| 5 | 2432 | 11 | 2471 |
| 6 | 2435 | 12 | 2474 |

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 1GHz **RE<1G**: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission **APCM**: Antenna Port Conducted Measurement

NOTE: 1. 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 |
|-------------------|----------------|-----------------|
| 1 to 12 | 1, 8, 12 | GFSK |

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 |
|-------------------|----------------|-----------------|
| 1 to 12 | 1 | GFSK |

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 |
|-------------------|----------------|-----------------|
| 1 to 12 | 1, 8, 12 | GFSK |

Test Condition:

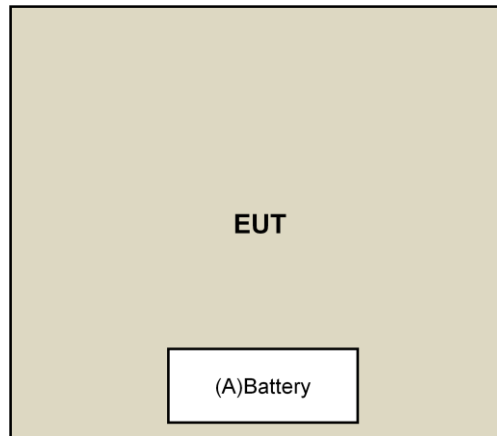
| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | INPUT POWER | TESTED BY |
|---------------|--------------------------|-------------|---------------|
| RE \geq 1G | 23deg. C, 64%RH | DC 3V | Steven Chiang |
| RE<1G | 24deg. C, 70%RH | DC 3V | Steven Chiang |
| APCM | 25deg. C, 60%RH | DC 3V | Robert Cheng |

3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

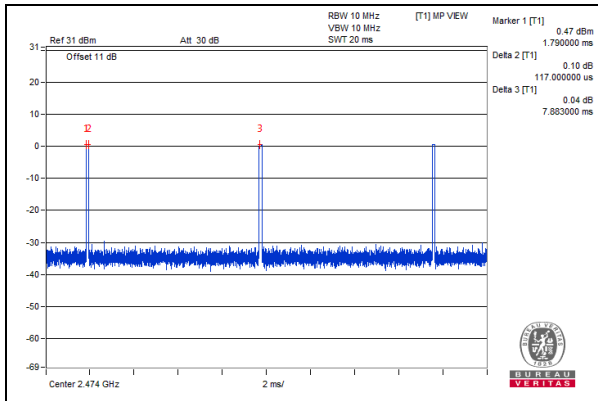
| ID | Product | Brand | Model No. | Serial No. | FCC ID | Remarks |
|----|-----------|----------|-----------|------------|--------|-----------------|
| A. | Battery*2 | Duracell | AAA | NA | NA | Provided by Lab |

3.3.1 Configuration of System under Test



3.4 Duty Cycle of Test Signal

Duty cycle = $0.117 \text{ ms} / 7.883 \text{ ms} = 0.015 * 100 \% = 1.5 \%$



3.5 General Description of Applied Standards

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

FCC Part 15, Subpart C (15.247)
KDB 558074 D01 DTS Meas Guidance v04
ANSI C63.10-2013

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

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

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|-------------------------------|---|---|
| Test Receiver Keysight | N9038A | MY54450088 | July 08, 2017 | July 07, 2018 |
| Loop Antenna ^(*) TESEQ | HLA 6121 | 45745 | May 19, 2017 | May 18, 2018 |
| Pre-Amplifier Mini-Circuits | ZFL-1000VH2B | AMP-ZFL-01 | Nov. 09, 2017 | Nov. 08, 2018 |
| Trilog Broadband Antenna SCHWARZBECK | VULB 9168 | 9168-406 | Nov. 29, 2017 | Nov. 28, 2018 |
| RF Cable | 8D | 966-4-1 966-4-2 966-4-3 | Apr. 01, 2017 | Mar. 31, 2018 |
| Fixed attenuator Mini-Circuits | UNAT-5+ | PAD-3m-4-01 | Oct. 03, 2017 | Oct. 02, 2018 |
| Horn_Antenna SCHWARZBECK | BBHA 9120D | 9120D-783 | Dec. 12, 2017 | Dec. 11, 2018 |
| Pre-Amplifier EMCI | EMC12630SE | 980385 | Feb. 02, 2017 | Feb. 01, 2018 |
| RF Cable | EMC104-SM-SM-1200 EMC104-SM-SM-2000 EMC104-SM-SM-5000 | 160923 150318 150321 | Feb. 02, 2017 Mar. 29, 2017 Mar. 29, 2017 | Feb. 01, 2018 Mar. 28, 2018 Mar. 28, 2018 |
| Pre-Amplifier EMCI | EMC184045SE | 980387 | Feb. 02, 2017 | Feb. 01, 2018 |
| Horn_Antenna SCHWARZBECK | BBHA 9170 | BBHA9170608 | Dec. 14, 2017 | Dec. 13, 2018 |
| RF Cable | SUCOFLEX 102 | 36432/2 36433/2 | Jan. 11, 2018 | Jan. 10, 2019 |
| Software | ADT_Radiated_V8.7.08 | NA | NA | NA |
| Antenna Tower & Turn Table Max-Full | MF-7802 | MF780208410 | NA | NA |
| Boresight Antenna Fixture | FBA-01 | FBA-SIP02 | NA | NA |
| Spectrum Analyzer R&S | FSV40 | 100964 | July 1, 2017 | June 30, 2018 |
| Power meter Anritsu | ML2495A | 1014008 | May 11, 2017 | May 10, 2018 |
| Power sensor Anritsu | MA2411B | 0917122 | May 11, 2017 | May 10, 2018 |

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 calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. The test was performed in 966 Chamber No. 4.
4. The CANADA Site Registration No. is 20331-2
5. Loop antenna was used for all emissions below 30 MHz.
6. Tested Date: Jan. 16 to 18, 2018

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. Both X and Y axes 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 detect 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:

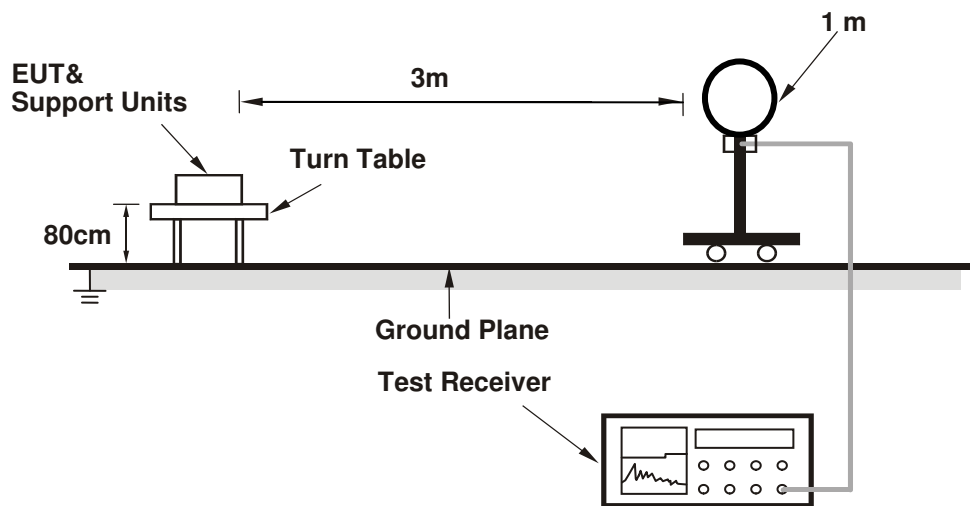
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz 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

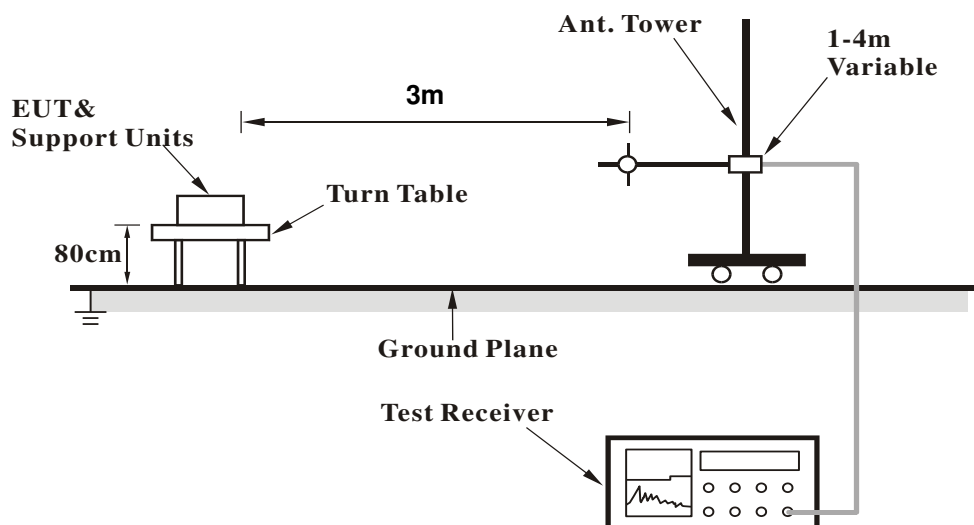
No deviation.

4.1.5 Test Setup

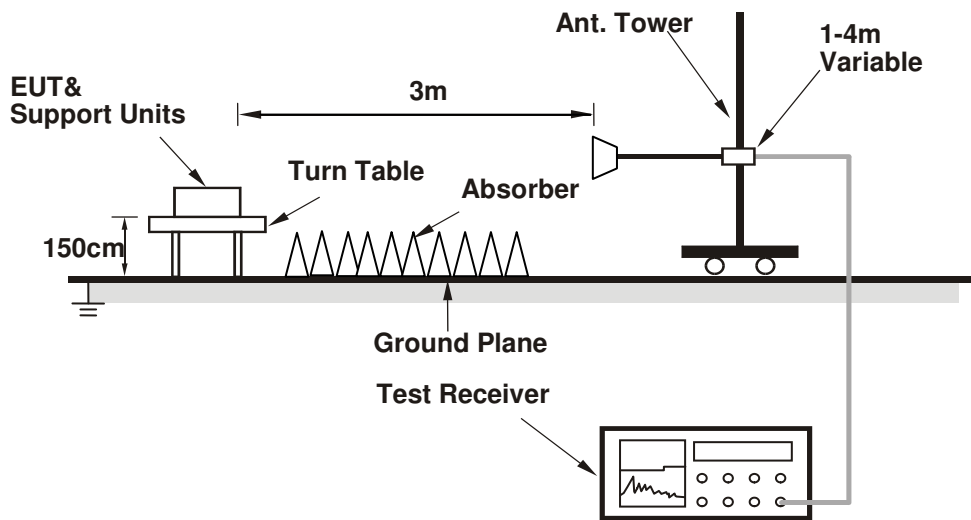
For Radiated emission below 30MHz



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 (RF Sample with Receiver C-U0010 [Number Lock]) has been activated to set the EUT under transmission/receiving condition continuously.

4.1.7 Test Results

Above 1GHz Data:

| | | | |
|------------------------|--------------|------------------------------|--------------|
| CHANNEL | TX Channel 1 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 1GHz ~ 25GHz | | Average (AV) |

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

| NO. | FREQ. (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 | 60.1 PK | 74.0 | -13.9 | 1.45 H | 144 | 61.1 | -1.0 |
| 2 | 2390.00 | 43.1 AV | 54.0 | -10.9 | 1.45 H | 144 | 44.1 | -1.0 |
| 3 | *2405.00 | 100.3 PK | | | 1.45 H | 144 | 101.3 | -1.0 |
| 4 | *2405.00 | 63.7 AV | | | 1.45 H | 144 | 64.7 | -1.0 |
| 5 | 4810.00 | 47.7 PK | 74.0 | -26.3 | 1.00 H | 260 | 44.6 | 3.1 |
| 6 | 4810.00 | 11.1 AV | 54.0 | -42.9 | 1.00 H | 260 | 8.0 | 3.1 |
| 7 | #7215.00 | 58.6 PK | 74.0 | -15.4 | 1.56 H | 187 | 48.9 | 9.7 |
| 8 | #7215.00 | 22.0 AV | 54.0 | -32.0 | 1.56 H | 187 | 12.3 | 9.7 |

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

| NO. | FREQ. (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 | 54.7 PK | 74.0 | -19.3 | 3.60 V | 290 | 55.7 | -1.0 |
| 2 | 2390.00 | 42.1 AV | 54.0 | -11.9 | 3.60 V | 290 | 43.1 | -1.0 |
| 3 | *2405.00 | 91.8 PK | | | 3.60 V | 290 | 92.8 | -1.0 |
| 4 | *2405.00 | 55.2 AV | | | 3.60 V | 290 | 56.2 | -1.0 |
| 5 | 4810.00 | 48.8 PK | 74.0 | -25.2 | 1.56 V | 63 | 45.7 | 3.1 |
| 6 | 4810.00 | 12.2 AV | 54.0 | -41.8 | 1.56 V | 63 | 9.1 | 3.1 |
| 7 | #7215.00 | 55.7 PK | 74.0 | -18.3 | 2.40 V | 68 | 46.0 | 9.7 |
| 8 | #7215.00 | 19.1 AV | 54.0 | -34.9 | 2.40 V | 68 | 9.4 | 9.7 |

REMARKS:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
- The other emission levels were very low against the limit.
- Margin value = Emission Level – Limit value
- " * ": Fundamental frequency.
- " # ": The radiated frequency is out of the restricted band.
- The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty factor is calculated from following formula:

$$20 \log(\text{Duty cycle}) = 20 \log(0.117 \text{ ms} / 7.883 \text{ ms}) = -36.6 \text{ dB}$$

| | | | |
|------------------------|--------------|--------------------------|--------------|
| CHANNEL | TX Channel 8 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 1GHz ~ 25GHz | | Average (AV) |

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

| NO. | FREQ. (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 | 55.2 PK | 74.0 | -18.8 | 1.44 H | 141 | 56.2 | -1.0 |
| 2 | 2390.00 | 18.6 AV | 54.0 | -35.4 | 1.44 H | 141 | 19.6 | -1.0 |
| 3 | *2444.00 | 100.4 PK | | | 1.44 H | 141 | 101.8 | -1.4 |
| 4 | *2444.00 | 63.8 AV | | | 1.44 H | 141 | 65.2 | -1.4 |
| 5 | 2483.50 | 57.2 PK | 74.0 | -16.8 | 1.44 H | 141 | 58.4 | -1.2 |
| 6 | 2483.50 | 20.6 AV | 54.0 | -33.4 | 1.44 H | 141 | 21.8 | -1.2 |
| 7 | 4888.00 | 47.6 PK | 74.0 | -26.4 | 1.07 H | 270 | 44.2 | 3.4 |
| 8 | 4888.00 | 11.0 AV | 54.0 | -43.0 | 1.07 H | 270 | 7.6 | 3.4 |
| 9 | 7332.00 | 59.2 PK | 74.0 | -14.8 | 1.49 H | 190 | 49.1 | 10.1 |
| 10 | 7332.00 | 22.6 AV | 54.0 | -31.4 | 1.49 H | 190 | 12.5 | 10.1 |

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

| NO. | FREQ. (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 | 48.9 PK | 74.0 | -25.1 | 3.83 V | 305 | 49.9 | -1.0 |
| 2 | 2390.00 | 12.3 AV | 54.0 | -41.7 | 3.83 V | 305 | 13.3 | -1.0 |
| 3 | *2444.00 | 92.1 PK | | | 3.83 V | 305 | 93.5 | -1.4 |
| 4 | *2444.00 | 55.5 AV | | | 3.83 V | 305 | 56.9 | -1.4 |
| 5 | 2483.50 | 52.3 PK | 74.0 | -21.7 | 3.83 V | 305 | 53.5 | -1.2 |
| 6 | 2483.50 | 15.7 AV | 54.0 | -38.3 | 3.83 V | 305 | 16.9 | -1.2 |
| 7 | 4888.00 | 48.6 PK | 74.0 | -25.4 | 1.44 V | 69 | 45.2 | 3.4 |
| 8 | 4888.00 | 12.0 AV | 54.0 | -42.0 | 1.44 V | 69 | 8.6 | 3.4 |
| 9 | 7332.00 | 55.8 PK | 74.0 | -18.2 | 2.48 V | 80 | 45.7 | 10.1 |
| 10 | 7332.00 | 19.2 AV | 54.0 | -34.8 | 2.48 V | 80 | 9.1 | 10.1 |

REMARKS:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
- The other emission levels were very low against the limit.
- Margin value = Emission Level – Limit value
- " * ": Fundamental frequency.
- The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty factor is calculated from following formula:
 $20 \log(\text{Duty cycle}) = 20 \log(0.117 \text{ ms} / 7.883 \text{ ms}) = -36.6 \text{ dB}$

| | | | |
|------------------------|---------------|------------------------------|--------------|
| CHANNEL | TX Channel 12 | DETECTOR FUNCTION | Peak (PK) |
| FREQUENCY RANGE | 1GHz ~ 25GHz | | Average (AV) |

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
|-----|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| 1 | *2474.00 | 100.0 PK | | | 1.45 H | 115 | 101.3 | -1.3 |
| 2 | *2474.00 | 63.4 AV | | | 1.45 H | 115 | 64.7 | -1.3 |
| 3 | 2483.50 | 63.9 PK | 74.0 | -10.1 | 1.45 H | 115 | 65.1 | -1.2 |
| 4 | 2483.50 | 46.9 AV | 54.0 | -7.1 | 1.45 H | 115 | 48.1 | -1.2 |
| 5 | 4948.00 | 48.1 PK | 74.0 | -25.9 | 1.04 H | 273 | 44.6 | 3.5 |
| 6 | 4948.00 | 11.5 AV | 54.0 | -42.5 | 1.04 H | 273 | 8.0 | 3.5 |
| 7 | 7422.00 | 59.0 PK | 74.0 | -15.0 | 1.50 H | 200 | 49.0 | 10.0 |
| 8 | 7422.00 | 22.4 AV | 54.0 | -31.6 | 1.50 H | 200 | 12.4 | 10.0 |

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
|-----|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| 1 | *2474.00 | 92.2 PK | | | 4.00 V | 312 | 93.5 | -1.3 |
| 2 | *2474.00 | 55.6 AV | | | 4.00 V | 312 | 56.9 | -1.3 |
| 3 | 2483.50 | 57.0 PK | 74.0 | -17.0 | 4.00 V | 312 | 58.2 | -1.2 |
| 4 | 2483.50 | 44.4 AV | 54.0 | -9.6 | 4.00 V | 312 | 45.6 | -1.2 |
| 5 | 4948.00 | 48.0 PK | 74.0 | -26.0 | 1.50 V | 67 | 44.5 | 3.5 |
| 6 | 4948.00 | 11.4 AV | 54.0 | -42.6 | 1.50 V | 67 | 7.9 | 3.5 |
| 7 | 7422.00 | 55.9 PK | 74.0 | -18.1 | 2.45 V | 68 | 45.9 | 10.0 |
| 8 | 7422.00 | 19.3 AV | 54.0 | -34.7 | 2.45 V | 68 | 9.3 | 10.0 |

REMARKS:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
- The other emission levels were very low against the limit.
- Margin value = Emission Level – Limit value
- " * ": Fundamental frequency.
- The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty factor is calculated from following formula:
 $20 \log(\text{Duty cycle}) = 20 \log(0.117 \text{ ms} / 7.883 \text{ ms}) = -36.6 \text{ dB}$

Below 1GHz Data:

| | | | |
|------------------------|--------------|------------------------------|-----------------|
| CHANNEL | TX Channel 1 | DETECTOR FUNCTION | Quasi-Peak (QP) |
| FREQUENCY RANGE | 9kHz ~ 1GHz | | |

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
|-----|-------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| 1 | 54.93 | 19.5 QP | 40.0 | -20.5 | 2.00 H | 52 | 27.5 | -8.0 |
| 2 | 155.64 | 20.1 QP | 43.5 | -23.4 | 1.50 H | 125 | 27.7 | -7.6 |
| 3 | 432.02 | 29.8 QP | 46.0 | -16.2 | 2.00 H | 207 | 33.2 | -3.4 |
| 4 | 602.08 | 27.8 QP | 46.0 | -18.2 | 1.50 H | 224 | 27.5 | 0.3 |
| 5 | 732.28 | 29.2 QP | 46.0 | -16.8 | 1.50 H | 1 | 27.3 | 1.9 |
| 6 | 891.94 | 32.5 QP | 46.0 | -13.5 | 1.50 H | 295 | 28.2 | 4.3 |

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

| NO. | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
|-----|-------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| 1 | 159.52 | 19.6 QP | 43.5 | -23.9 | 2.00 V | 0 | 27.3 | -7.7 |
| 2 | 298.59 | 19.9 QP | 46.0 | -26.1 | 2.00 V | 360 | 27.2 | -7.3 |
| 3 | 367.51 | 22.2 QP | 46.0 | -23.8 | 2.00 V | 255 | 27.5 | -5.3 |
| 4 | 594.93 | 27.9 QP | 46.0 | -18.1 | 1.50 V | 216 | 27.8 | 0.1 |
| 5 | 763.34 | 31.1 QP | 46.0 | -14.9 | 1.00 V | 195 | 28.4 | 2.7 |
| 6 | 995.08 | 34.0 QP | 54.0 | -20.0 | 1.50 V | 263 | 28.3 | 5.7 |

REMARKS:

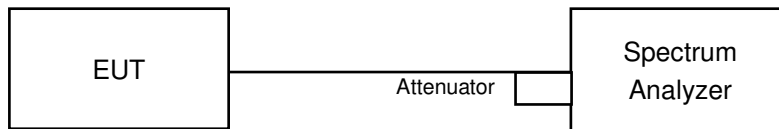
1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

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) $\geq 3 \times$ 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

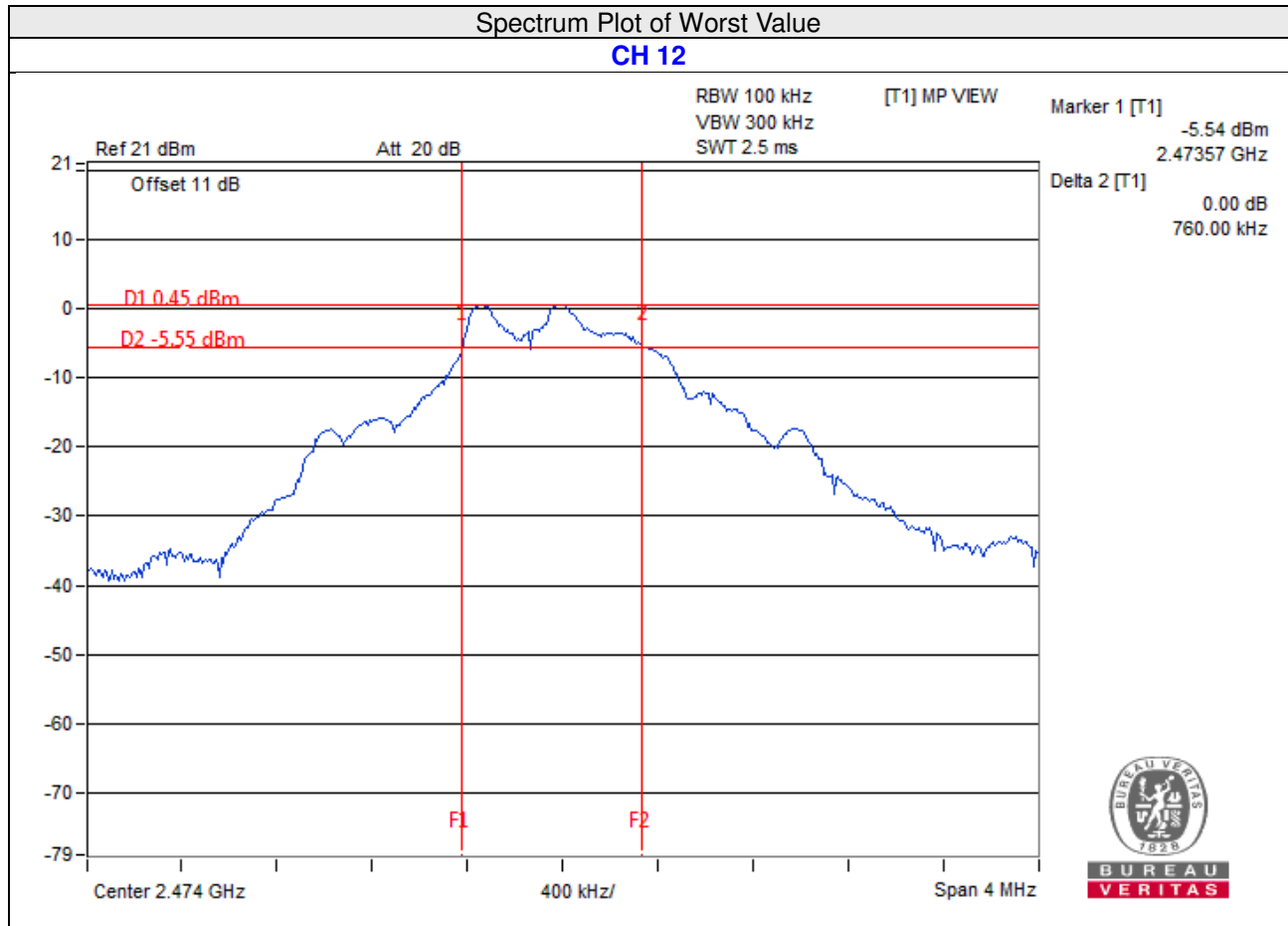
No deviation.

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 Result

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Minimum Limit (MHz) | Pass / Fail |
|---------|-----------------|---------------------|---------------------|-------------|
| 1 | 2405 | 0.77 | 0.5 | PASS |
| 8 | 2444 | 0.78 | 0.5 | PASS |
| 12 | 2474 | 0.76 | 0.5 | PASS |

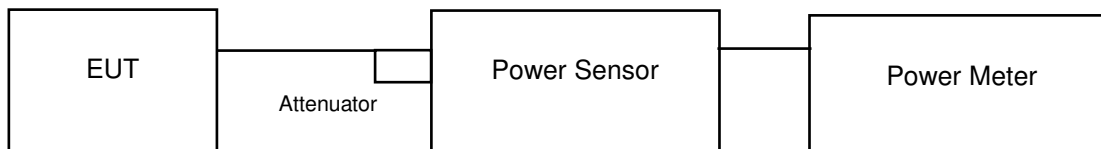


4.3 Conducted Output Power Measurement

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

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

Same as Item 4.2.6.

4.3.7 Test Results

FOR PEAK POWER

| Channel | Frequency (MHz) | Peak Power (mW) | Peak Power (dBm) | Limit (dBm) | Pass/Fail |
|---------|-----------------|-----------------|------------------|-------------|-----------|
| 1 | 2405 | 1.33 | 1.24 | 30 | Pass |
| 8 | 2444 | 1.297 | 1.13 | 30 | Pass |
| 12 | 2474 | 1.197 | 0.78 | 30 | Pass |

FOR AVERAGE POWER

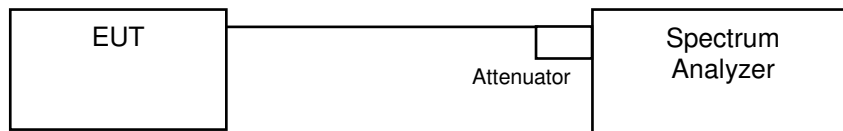
| Channel | Frequency (MHz) | Average Power (mW) | Average Power (dBm) |
|---------|-----------------|--------------------|---------------------|
| 1 | 2405 | 1.315 | 1.19 |
| 8 | 2444 | 1.279 | 1.07 |
| 12 | 2474 | 1.18 | 0.72 |

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 3kHz.

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: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- d. Set the VBW $\geq 3 \times \text{RBW}$.
- 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

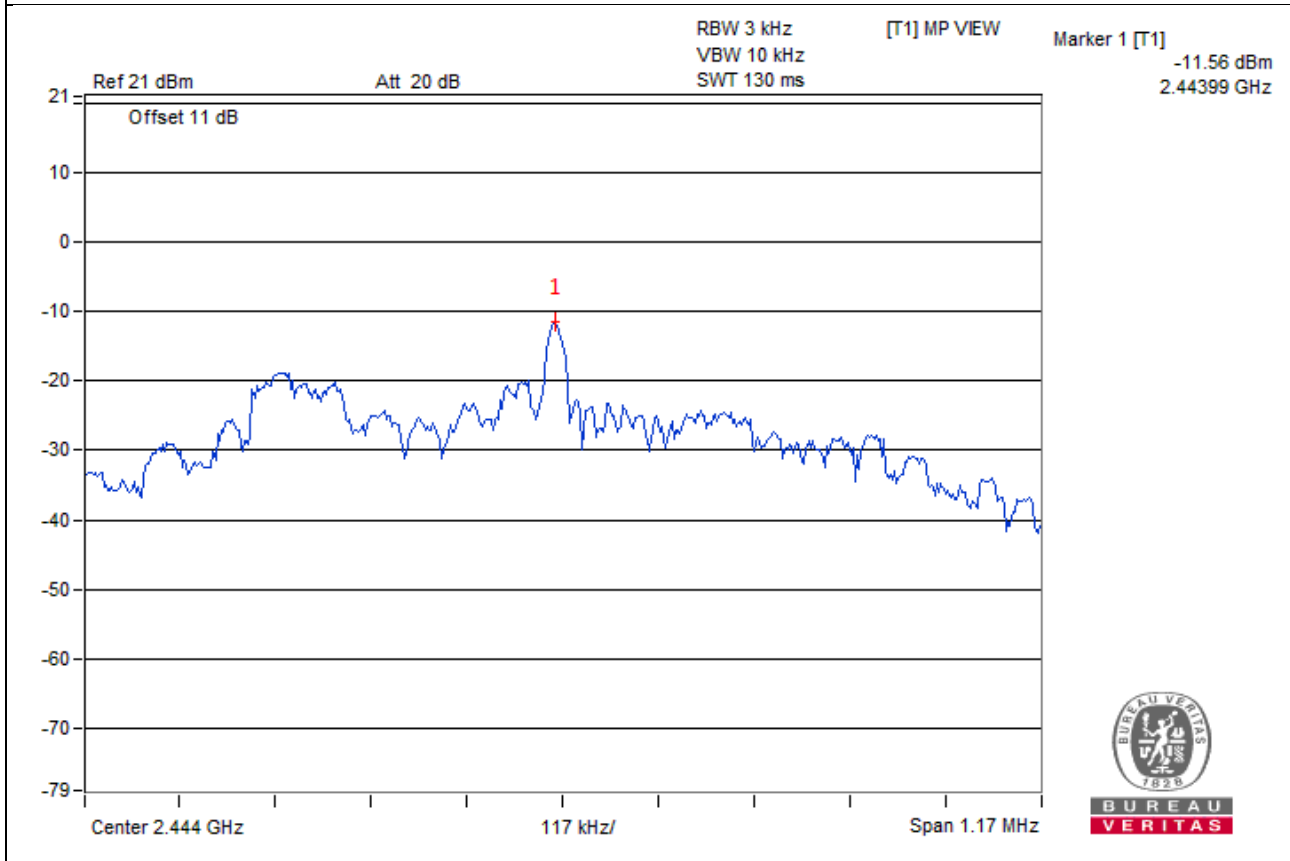
Same as Item 4.2.6

4.4.7 Test Results

| Channel | Freq. (MHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Pass /Fail |
|---------|-------------|----------------|------------------|------------|
| 1 | 2405 | -11.75 | 8 | Pass |
| 8 | 2444 | -11.56 | 8 | Pass |
| 12 | 2474 | -11.87 | 8 | Pass |

Spectrum Plot of Worst Value

CH8

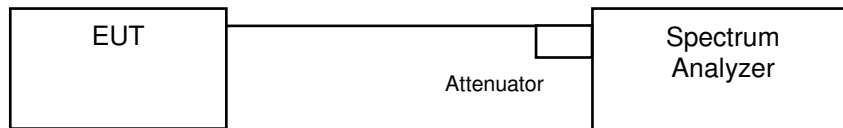


4.5 Conducted Out of Band Emission Measurement

4.5.1 Limits of Conducted Out of Band Emission Measurement

Below 20dBc 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 \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.

4.5.5 Deviation from Test Standard

No deviation.

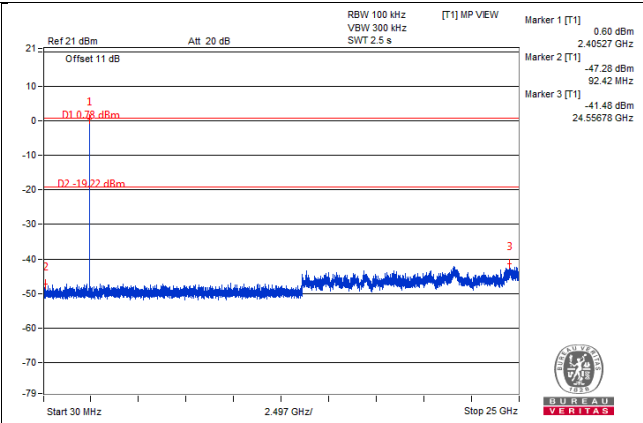
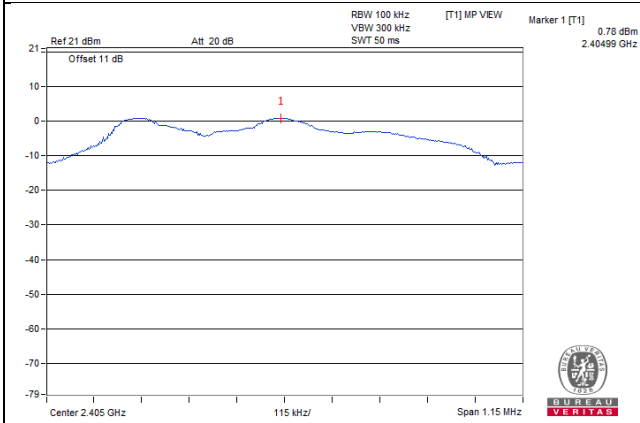
4.5.6 EUT Operating Condition

Same as Item 4.2.6

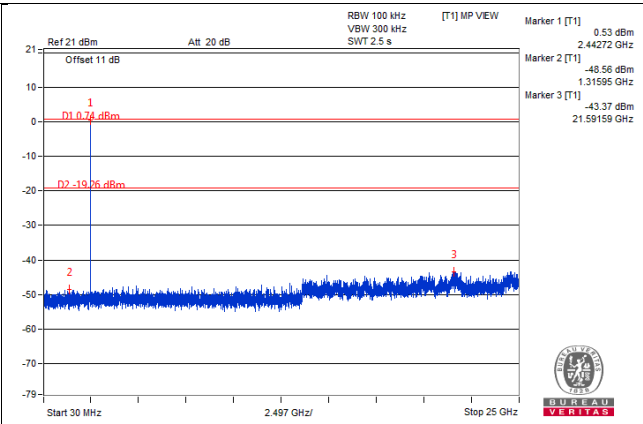
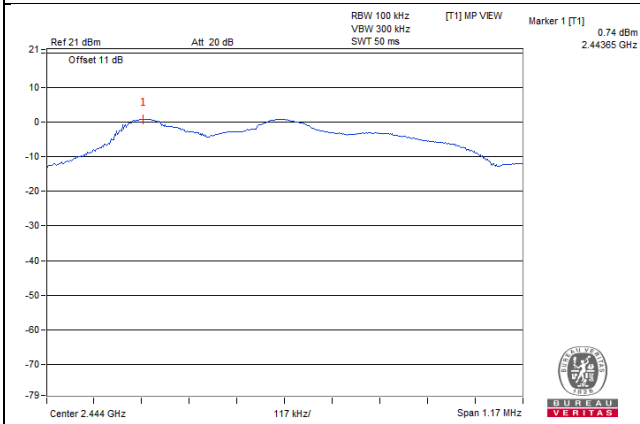
4.5.7 Test Results

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.

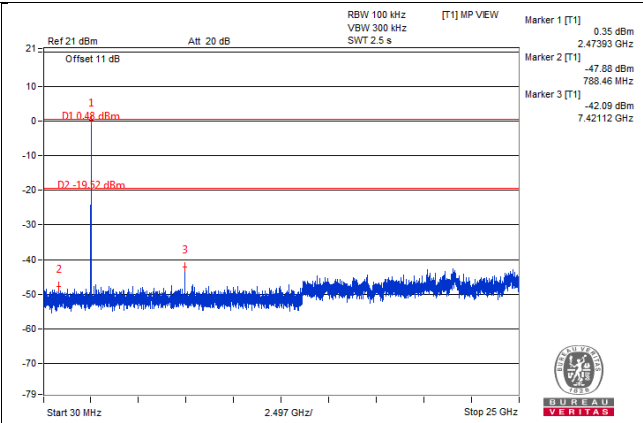
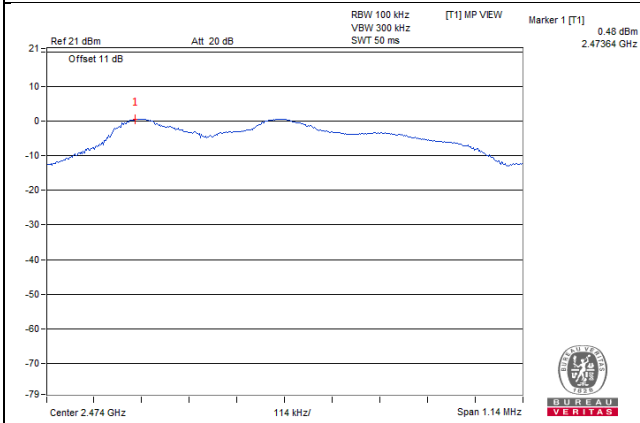
CH 1



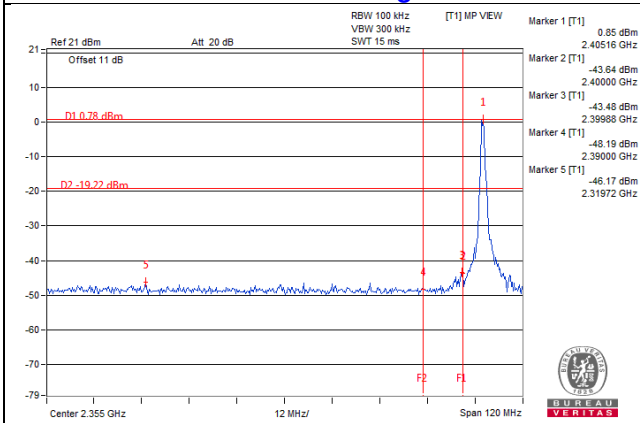
CH 8



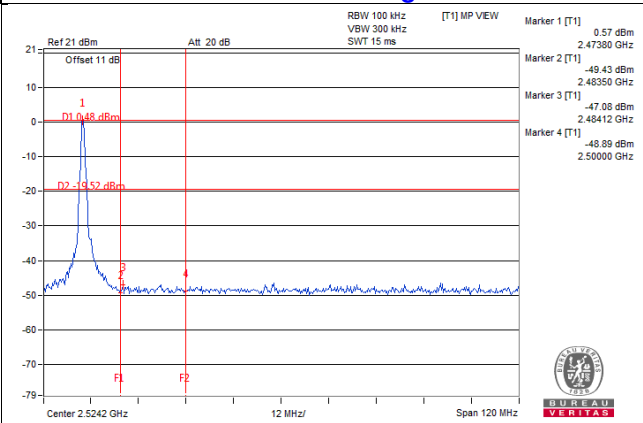
CH 12



CH 1 Band edge



CH 12 Band edge



5 Pictures of Test Arrangements

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

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:

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Web Site: 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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