

FCC 47 CFR PART 15 SUBPART C

Canada RSS-247 Issue 1

Canada RSS-Gen Issue 4

TEST REPORT

For

Product Name: Laser Distance Meter

Brand Name: Stanley

Model No.: TLM99s,TLM99si

Series Model.: N/A

FCC ID:2ADA6TLM99S

IC:12409A-TLM99S

Test Report Number:

C161111R02-RPB

Issued for

Northwest Instrument Inc

330 Waterloo Valley Road,Budd Lake,New Jersey,07828,USA

Issued by

Compliance Certification Services Inc.

Kun shan Laboratory

**No.10 Weiye Rd., Innovation park, Eco&Tec,
Development Zone, Kunshan City, Jiangsu, China**

TEL: 86-512-57355888

FAX: 86-512-57370818



TESTING CERT #2541.01

Note: This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc. This document may be altered or revised by Compliance Certification Services Inc. personnel only, and shall be noted in the revision section of the document. The client should not use it to claim product endorsement by A2LA or any government agencies. The test results in the report only apply to the tested sample.

TABLE OF CONTENTS

| | | |
|----------|--|-----------|
| 1 | TEST RESULT CERTIFICATION | 4 |
| 2 | EUT DESCRIPTION | 5 |
| 3 | TEST METHODOLOGY | 6 |
| 3.1 | EUT CONFIGURATION | 6 |
| 3.2 | EXERCISE EUT | 6 |
| 3.3 | GENERAL TEST PROCEDURES | 6 |
| 3.4 | TEST MODE | 7 |
| 3.5 | FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS | 8 |
| 4 | INSTRUMENT CALIBRATION | 9 |
| 5 | FACILITIES AND ACCREDITATIONS | 9 |
| 5.1 | FACILITIES | 9 |
| 5.2 | EQUIPMENT | 9 |
| 5.3 | LABORATORY ACCREDITATIONS AND LISTING | 9 |
| 5.4 | TABLE OF ACCREDITATIONS | 10 |
| 5.5 | LIST OF MEASURING EQUIPMENT | 11 |
| 5.6 | SETUP CONFIGURATION | 12 |
| 5.7 | SUPPORT EQUIPMENT | 12 |
| 6 | FCC PART 15.247 REQUIREMENTS | 13 |
| 6.1 | PEAK POWER | 13 |
| 6.2 | PEAK POWER SPECTRAL DENSITY | 15 |
| 6.3 | 6dB BANDWIDTH MEASUREMENT | 20 |
| 6.4 | 99% BANDWIDTH MEASUREMENT | 23 |
| 6.5 | CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT | 25 |
| 6.6 | RADIATED BAND EDGE AND SPURIOUS EMISSION MEASUREMENT | 30 |
| 6.7 | POWERLINE CONDUCTED EMISSIONS | 37 |



Revision History

| Rev. | Issue Date | Report NO. | Effect Page | Contents |
|------|-------------------|----------------|-------------|------------------------------|
| 00 | December 20, 2016 | C161111R02-RPB | ALL | N/A |
| 01 | December 20, 2016 | C161111R02-RPB | P9 | Add IC registration site no. |

1 TEST RESULT CERTIFICATION

| | |
|-------------------------------|---|
| Product Name: | Laser Distance Meter |
| Trade Name: | Stanley |
| Model Name: | TLM99s,TLM99si |
| Series Model: | N/A |
| Applicant Discrepancy: | Initial |
| Device Category: | Portable unit |
| Date of Test: | December 15, 2016 ~ December 20, 2016 |
| Applicant: | Northwest Instrument Inc 330 Waterloo Valley Road,Budd Lake,New Jersey,07828,USA |
| Manufacturer: | Northwest Instrument (Shanghai) Co.,Ltd B2 No.303,Xinke Road,Qingpu Industrial Zone,Shanghai,China. |
| Application Type: | Certification |

| APPLICABLE STANDARDS | |
|------------------------------|-------------------------|
| STANDARD | TEST RESULT |
| FCC 47 CFR Part 15 Subpart C | No non-compliance noted |
| Canada RSS-247 Issue 1 | No non-compliance noted |
| Canada RSS-Gen Issue 4 | No non-compliance noted |

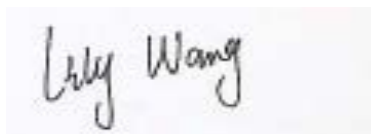
The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247.

The test results of this report relate only to the tested sample EUT identified in this report.

Approved by:



Tested by:



Jeff.Fang
RF Manager
Compliance Certification Services Inc.

Lily.Wang
Test Engineer
Compliance Certification Services Inc.

2 EUT DESCRIPTION

| | |
|-------------------------------|--|
| Product Name: | Laser Distance Meter |
| Trade Name: | Stanley |
| Model Name: | TLM99s,TLM99si |
| Series Model: | N/A |
| Model Discrepancy: | There's only minor changes on the enclosure, only the model of TLM99s was chosen to perform all the tests as representative. |
| Power Rating: | DC 3V |
| Frequency Range : | Bluetooth:2402 ~ 2480 MHz |
| Transmit Power : | Bluetooth LE4.0: 1.20dBm(1.318mW) |
| Channel Spacing | Bluetooth LE4.0: 2MHz |
| Modulation type: | Bluetooth LE4.0: GFSK |
| Transmit Data Rate : | Bluetooth LE4.0: 1 Mbps |
| Number of Channels : | Bluetooth LE4.0: 40 Channels |
| Antenna Specification: | PCB Antenna Gain: 3.3 dBi |

Remark:

- 1.The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.
- 2.This submittal(s) (test report) is intended for **FCC ID: 2ADA6TLM99S** filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.
- 3.This submittal(s) (test report) is intended for **IC: 12409A-TLM99S** filing to comply with Canada RSS-247 Issue 1 and Canada RSS-Gen Issue 4 Rules.

3 TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 and 15.247.

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2 EXERCISE EUT

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.10 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

Under 1GHz

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.10.

Above 1GHz

The EUT is placed on a turn table, which is 1.5 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.10.

3.4 TEST Mode

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

| Test Items | Mode | Data Rate | Channel | Antenna |
|--|------|-----------|---------|---------|
| 6dB Bandwidth | GFSK | 1 Mbps | 0/19/39 | 1 |
| 99% bandwidth | GFSK | 1 Mbps | 0/19/39 | 1 |
| Peak Output Power | GFSK | 1 Mbps | 0/19/39 | 1 |
| Power Spectral Density | GFSK | 1 Mbps | 0/19/39 | 1 |
| Conducted Band Edges and Spurious Emission | GFSK | 1 Mbps | 0/19/39 | 1 |
| Radiated Band Edges and Spurious Emission | GFSK | 1 Mbps | 0/19/39 | 1 |
| AC Conducted Emission | - | - | - | - |

Remark: For radiated test cases below 1 GHz, the worst mode data rate channel 39 was reported only, because this data rate has the highest RF output power at preliminary tests.

3.5 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

- (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz | MHz | MHz | GHz |
|-------------------------------|-----------------------|-----------------|-----------------------------|
| 0.0900 - 0.1100 | 16.420 - 16.423 | 399.9 - 410.0 | 4.50 - 5.15 |
| 0.4950 - 0.505 ⁽¹⁾ | 16.69475 - 16.69525 | 608 - 614 | 5.35 - 5.46 |
| 2.1735 - 2.1905 | 16.80425 - 16.80475 | 960.0 - 1240 | 7.25 - 7.75 |
| 4.1250 - 4.1280 | 25.50 - 25.67 | 1300 - 1427 | 8.025 - 8.500 |
| 4.17725 - 4.17775 | 37.50 - 38.25 | 1435.0 - 1626.5 | 9.0 - 9.2 |
| 4.20725 - 4.20775 | 73.0 - 74.6 | 1645.5 - 1646.5 | 9.3 - 9.5 |
| 6.2150 - 6.2180 | 74.8 - 75.2 | 1660 - 1710 | 10.6 - 12.7 |
| 6.26775 - 6.26825 | 108.00 - 121.94 | 1718.8 - 1722.2 | 13.25 - 13.40 |
| 6.31175 - 6.31225 | 123 - 138 | 2200 - 2300 | 14.47 - 14.50 |
| 8.2910 - 8.2940 | 149.90 - 150.05 | 2310 - 2390 | 15.35 - 16.20 |
| 8.3620 - 8.3660 | 156.52475 - 156.52525 | 2483.5 - 2500.0 | 17.7 - 21.4 |
| 8.37625 - 8.38675 | 156.7 - 156.9 | 2655 - 2900 | 22.01 - 23.12 |
| 8.41425 - 8.41475 | 162.0125 - 167.1700 | 3260 - 3267 | 23.6 - 24.0 |
| 12.2900 - 12.2930 | 167.72 - 173.20 | 3332 - 3339 | 31.2 - 31.8 |
| 12.51975 - 12.52025 | 240 - 285 | 3345 - 3358 | 36.43 - 36.5 ⁽²⁾ |
| 12.57675 - 12.57725 | 322.0 - 335.4 | 3600 - 4400 | |
| 13.3600 - 13.4100 | | | |

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

- (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

4 INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards. facilities and accreditations

5 FACILITIES AND ACCREDITATIONS

5.1 FACILTIES

All measurement facilities used to collect the measurement data are located at CCS China Kunshan Lab at 10#Weiye Rd, Innovation Park Eco. & Tec. Development Zone Kunshan city JiangSu, (215300), CHINA.

The sites are constructed in conformance with the requirements of ANSI C63.4 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

5.3 LABORATORY ACCREDITATIONS AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by American Association for Laboratory Accreditation Program for the specific scope accreditation under Lab Code: 200581-0 to perform Electromagnetic Interference tests according to FCC Part 15 or 18 requirements. In addition, the test facilities are listed with Federal Communication Commission, Laboratory Division, 424105 for 10m chamber, 238958 for 3m chamber . Also the test facilities are listed with Industry Canada, Laboratory Division, 2324E-1 for 10m chamber, 2324E-2 for 3m chamber.

5.4 TABLE OF ACCREDITATIONS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

| | |
|---------------|------|
| Taiwan | TAF |
| USA | A2LA |

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

| | |
|---------------|-----------------|
| Canada | Industry Canada |
| Japan | VCCI |
| Taiwan | BSMI |
| USA | FCC |

Copies of granted accreditation certificates are available for downloading from our web site,
<http://www.ccsrf.com>

5.5 LIST OF MEASURING EQUIPMENT

| Conducted Emissions Test Site | | | | | |
|-------------------------------|---------------|-----------|---------------|------------------|-----------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Data | Calibration Due |
| Spectrum Analyzer | Agilent | E4446A | MY44020154 | 2016-9-10 | 2017-9-9 |
| OSCILLOSCOPE | Agilent | DS06104A | MY44002585 | 2016-3-2 | 2017-3-1 |
| Power meter | Anritsu | ML2495A | 1445010 | 2016-5-16 | 2017-5-15 |
| Power sensor | Anritsu | MA2411B | 1339220 | 2016-5-16 | 2017-5-15 |
| Power SPLITTER | Mini-Circuits | ZN2PD-9G | SF078500430 | N.C.R | N.C.R |
| DC Power Supply | AGILENT | E3632A | MY50340053 | N.C.R | N.C.R |
| Temp. / Humidity Chamber | TERCHY | MHK-120AK | X30109 | 2016-5-16 | 2017-5-15 |
| Test Software | | | EZ-EMC | | |

| 977 Chamber | | | | | |
|-------------------|--------------|---------------------|---------------|------------------|-----------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Data | Calibration Due |
| Spectrum Analyzer | Agilent | E4446A | MY44020154 | 2016-9-10 | 2017-9-9 |
| EMI Test Receiver | R&S | ESCI | 101378 | 2016-1-6 | 2017-1-5 |
| Amplifier | MITEQ | AMF-6F-260400-40-8P | 1037496 | 2016-9-10 | 2017-9-9 |
| Bilog Antenna | Sunol | JB1 | A062604 | 2016-5-29 | 2017-5-28 |
| Bilog Antenna | Sunol | JB1 | A110204-1 | 2016-7-16 | 2017-7-15 |
| Loop Antenna | SCHWARZBECK | HXYZ9170 | 9170-108 | 2016-4-7 | 2017-4-6 |
| Horn-antenna | SCHWARZBECK | 9120D | 266 | 2016-3-6 | 2017-3-5 |
| Turn Table | CT | CT123 | 4165 | N.C.R | N.C.R |
| Antenna Tower | CT | CTERG23 | 3256 | N.C.R | N.C.R |
| Controller | CT | CT100 | 95637 | N.C.R | N.C.R |
| Test Software | | | EZ-EMC | | |

| Conducted Emission | | | | | |
|--------------------|--------------|-----------|---------------|------------------|-----------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Data | Calibration Due |
| EMI TEST RECEIVER | R&S | ESCI | 100781 | 2016-3-2 | 2017-3-1 |
| LISN | SCHWARZBECK | NNLK 8129 | 8129-143 | 2016-11-1 | 2017-10-31 |
| TWO-LINE V-NETWORK | R&S | ENV216 | 101604 | 2016-11-1 | 2017-10-31 |
| Pulse LIMITER | R&S | ESH3-Z2 | 100524 | 2016-1-6 | 2017-1-5 |
| Test Software | | | EZ-EMC | | |

Remark: Each piece of equipment is scheduled for calibration once a year.

5.6 SETUP CONFIGURATION

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

5.7 SUPPORT EQUIPMENT

| No. | Device Type | Brand | Model | Series No. | FCC ID |
|-----|-------------|-------|-------|------------|--------|
| 1. | N/A | N/A | N/A | N/A | N/A |

Remark:

- 1.All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
- 2.Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

6 FCC PART 15.247 REQUIREMENTS

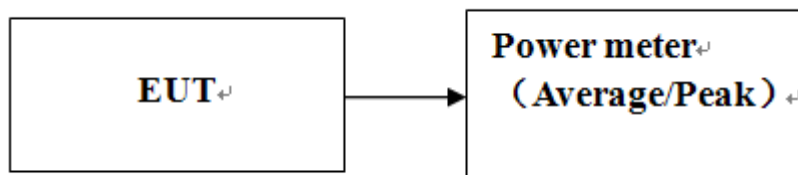
6.1 PEAK POWER

Limit of peak output power

The maximum peak output power of the intentional radiator shall not exceed the following:

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna of directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

Test Configuration



Remark: Each piece of equipment is scheduled for calibration once a year.

Test Procedure

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v03r05.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

Test Results*No non-compliance noted***Test RESULTS****BLE4.0 GFSK Modulation 1Mbps mode**

| | | | |
|-------------------|-----------------|---------------------|------------|
| Test mode: | Bluetooth LE4.0 | Temperature: | 23℃ |
| Test By: | Lily.Wang | Test Date: | 2016-12-16 |

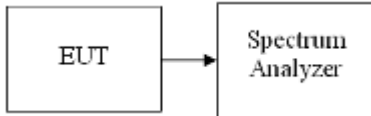
| Channel | Frequency (MHz) | Transmit Data Rate | Output Power (dBm) | Limit (dBm) | Result |
|---------|-----------------|--------------------|--------------------|-------------|--------|
| 00 | 2402 | 1Mbps | 0.45 | 30 | PASS |
| 19 | 2440 | 1Mbps | 0.87 | | PASS |
| 39 | 2480 | 1Mbps | 1.20 | | PASS |

6.2 PEAK POWER SPECTRAL DENSITY

Limit

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

Test Configuration



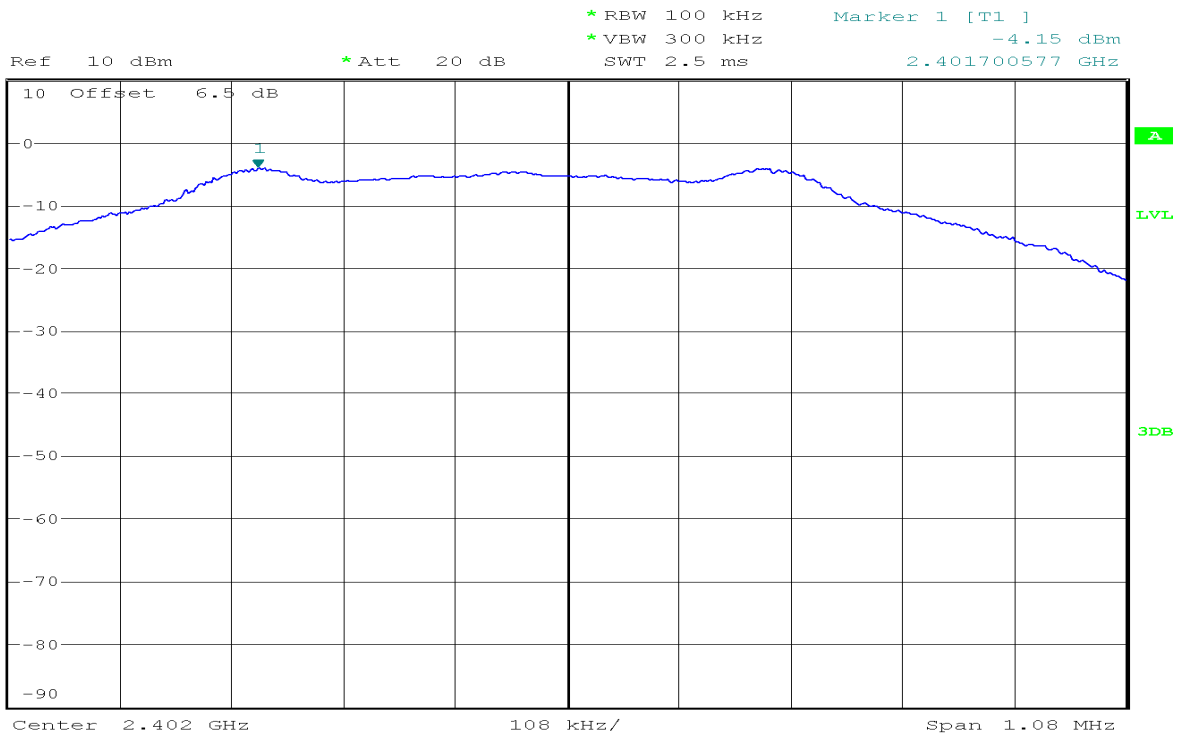
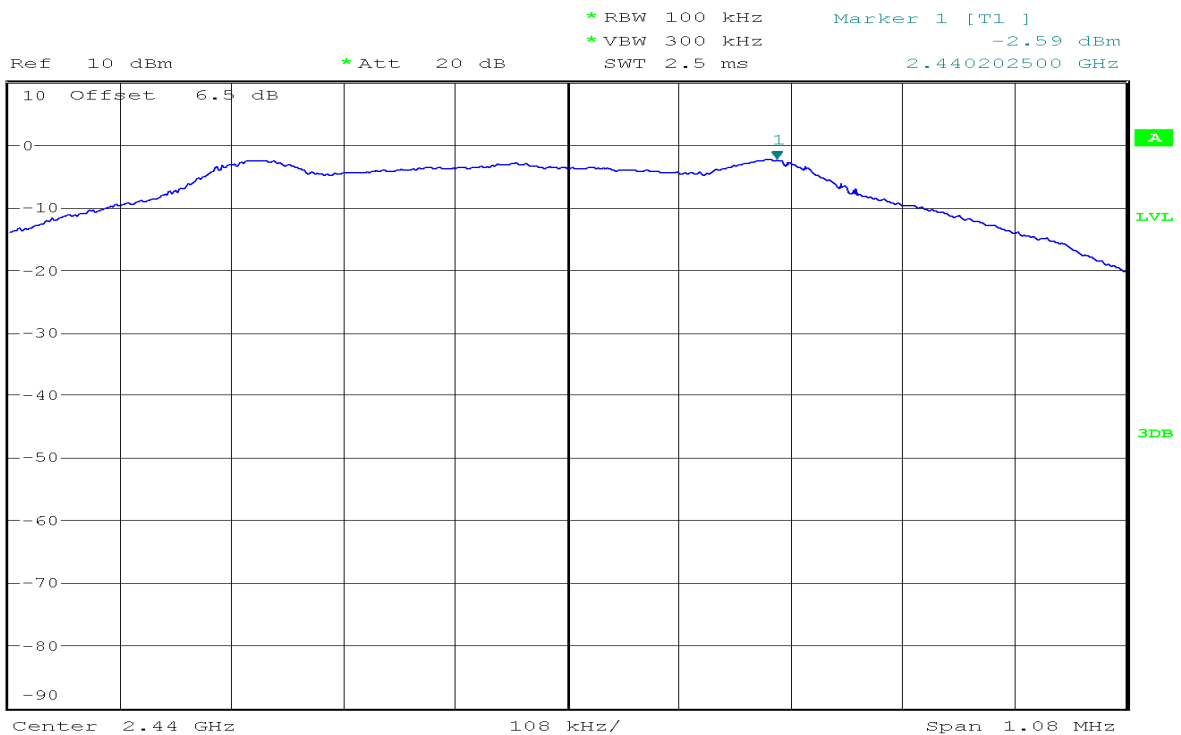
Test Procedure

1. The testing follows Measurement Procedure 10.2 Method PKPSD of FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.
7. The Measured power density (dBm)/ 100kHz is a reference level and used as 20dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

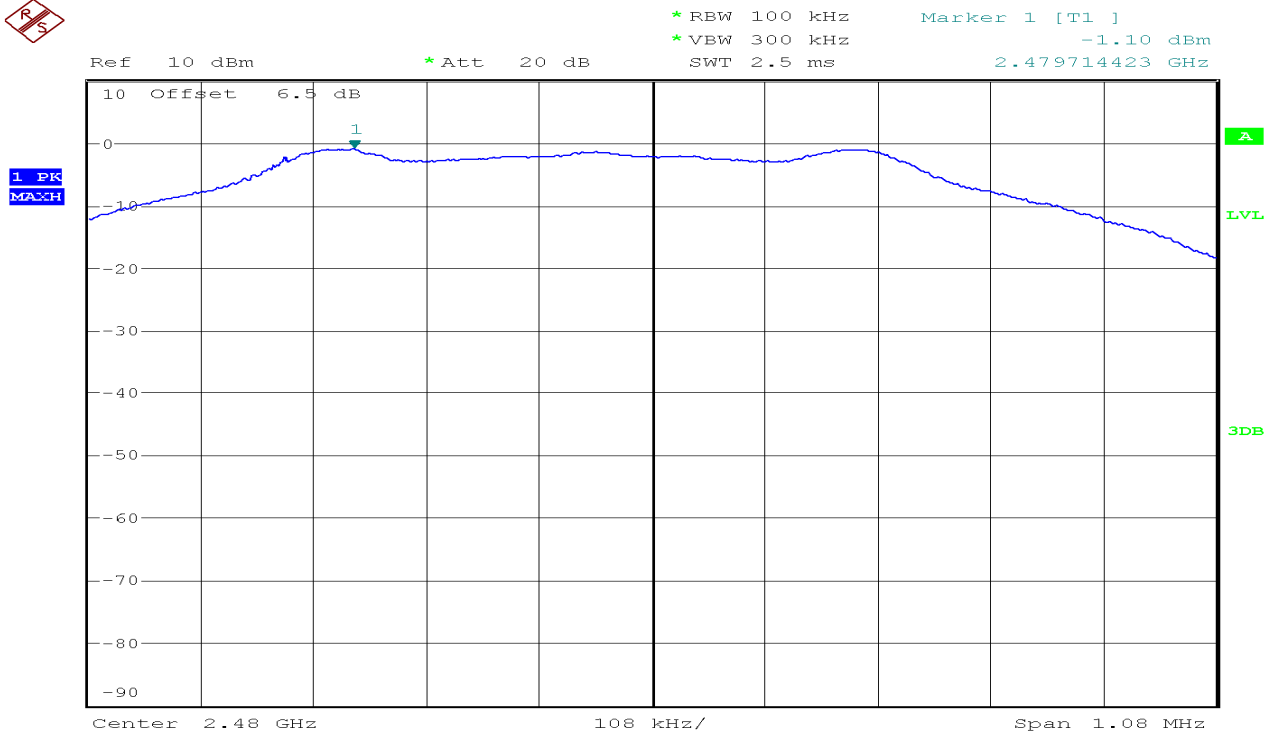
Test Results of power Spectral Density

| | | | |
|------------|-----------------|--------------|------------|
| Test mode: | Bluetooth LE4.0 | Temperature: | 23℃ |
| Test By: | Lily.Wang | Test Date: | 2016-12-16 |

| Channel | Frequency (MHz) | Power Density | | Limit (dBm) | Result |
|---------|-----------------|------------------|----------------|-------------|--------|
| | | PSD/100kHz (dBm) | PSD/3kHz (dBm) | | |
| 00 | 2402 | -4.15 | -14.89 | 8 | PASS |
| 19 | 2440 | -2.59 | -13.48 | | PASS |
| 39 | 2480 | -1.10 | -12.06 | | PASS |

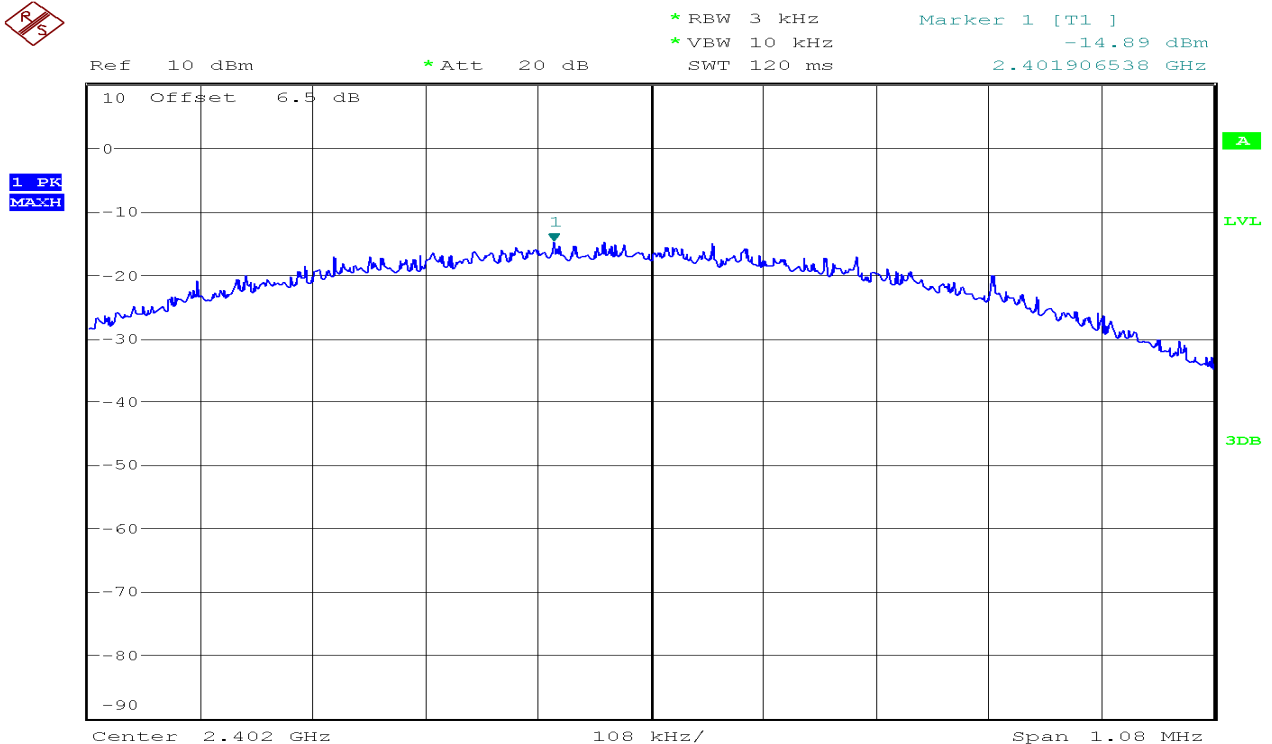
Test Plot of power Spectral Density(100kHz)**Channel 00****Channel 19**

Channel 39

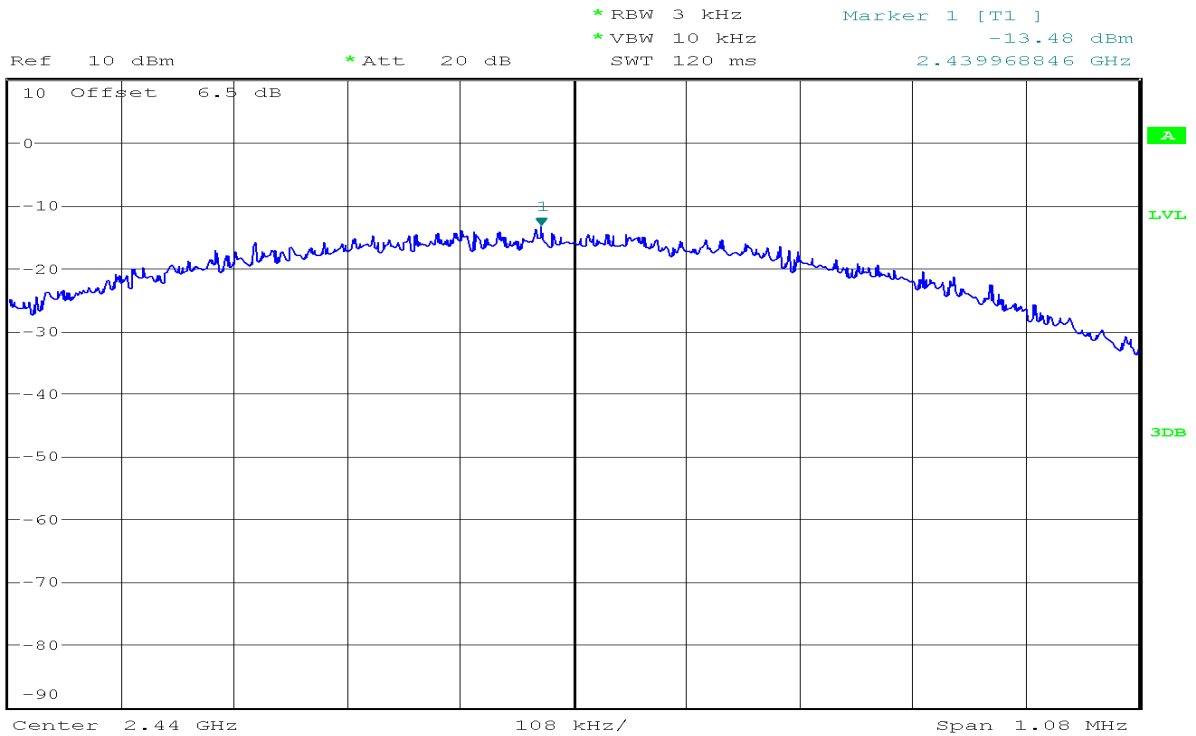


Test Plot of power Spectral Density(3kHz)

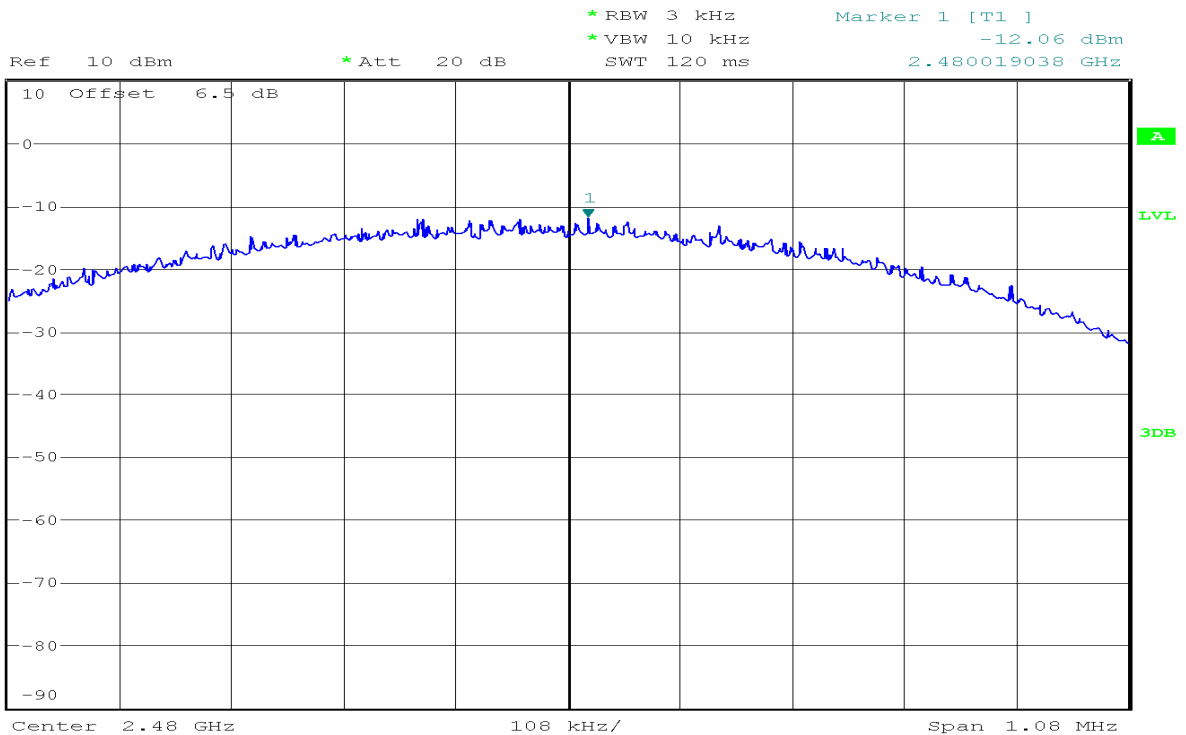
Channel 00



Channel 19



Channel 39

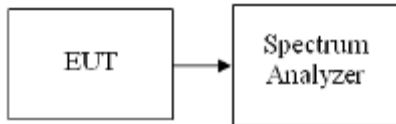


6.3 6dB Bandwidth Measurement

Limit of 6dB Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Configuration



Test Procedure

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. Measure and record the results in the test report.

Test Results of Bandwidth

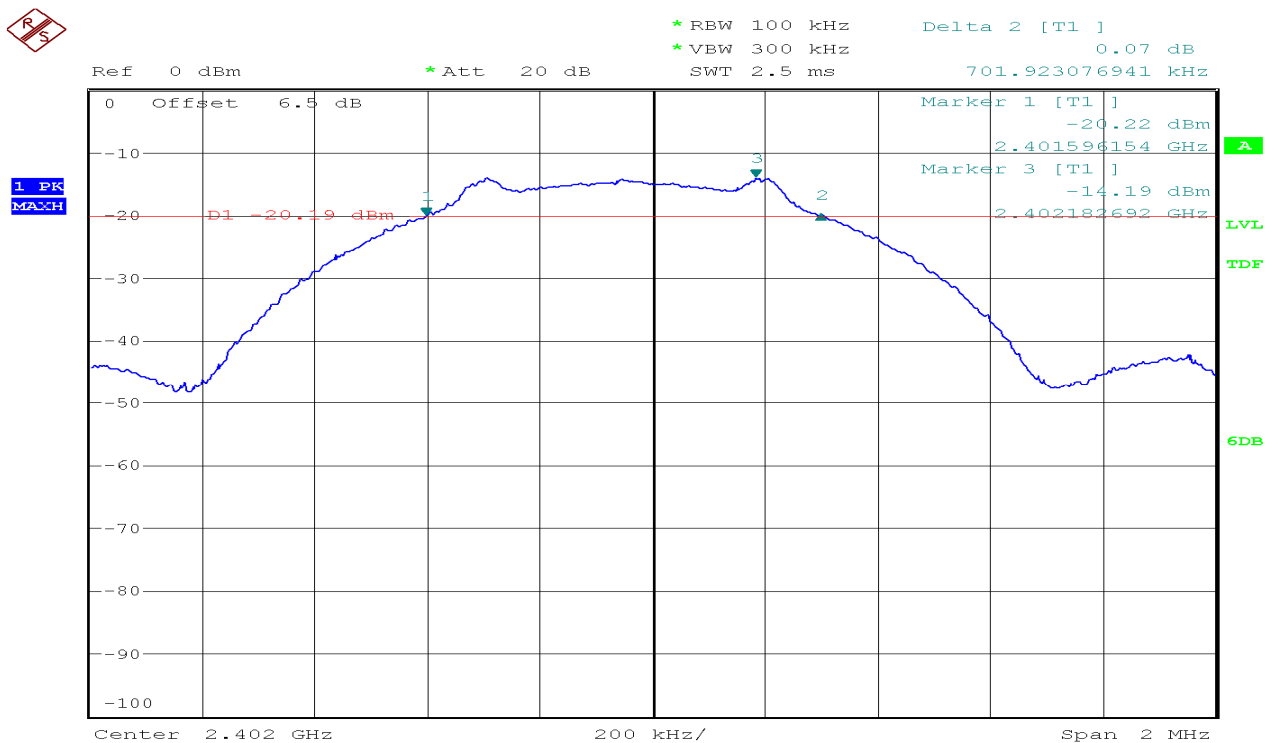
No non-compliance noted

| | | | |
|------------|-----------------|--------------|------------|
| Test mode: | Bluetooth LE4.0 | Temperature: | 23°C |
| Test By: | Lily.Wang | Test Date: | 2016-12-16 |

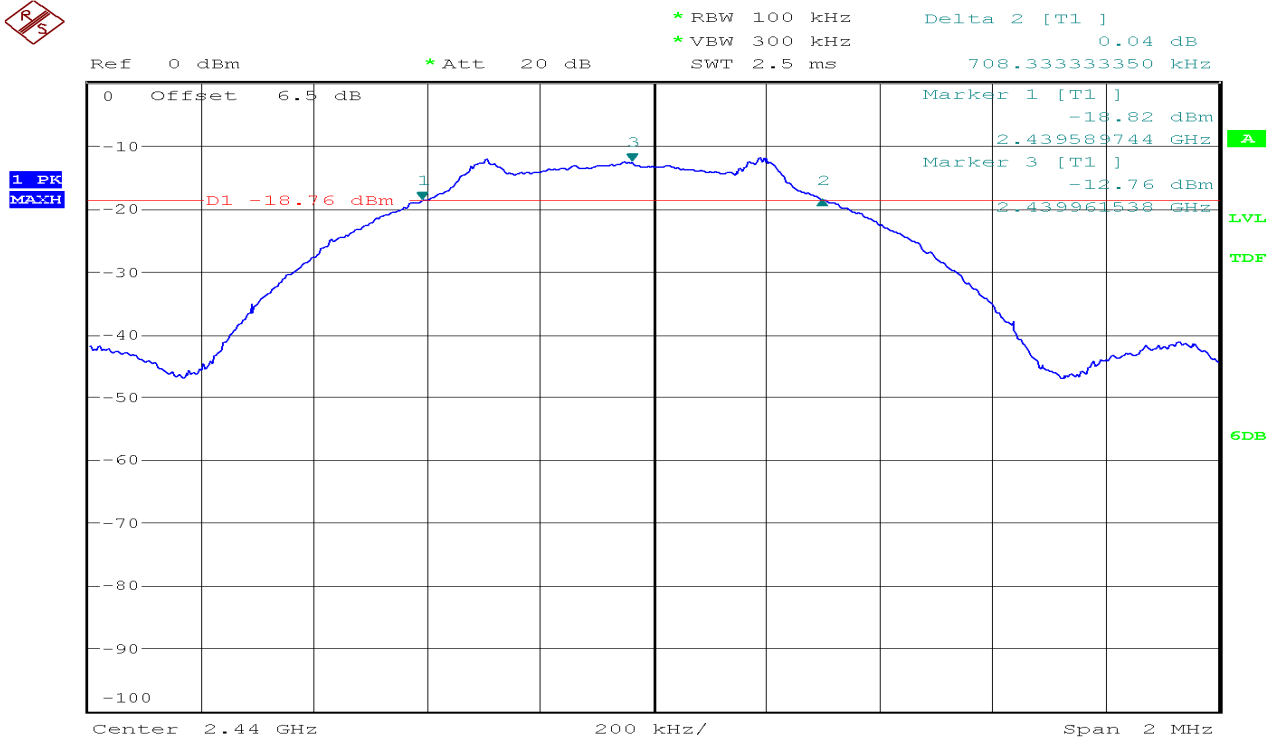
| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | 6dB Bandwidth Limit (MHz) | Result |
|---------|-----------------|---------------------|---------------------------|--------|
| 00 | 2402 | 0.702 | 0.5 | Pass |
| 19 | 2440 | 0.708 | 0.5 | Pass |
| 39 | 2480 | 0.718 | 0.5 | Pass |

Test Plot

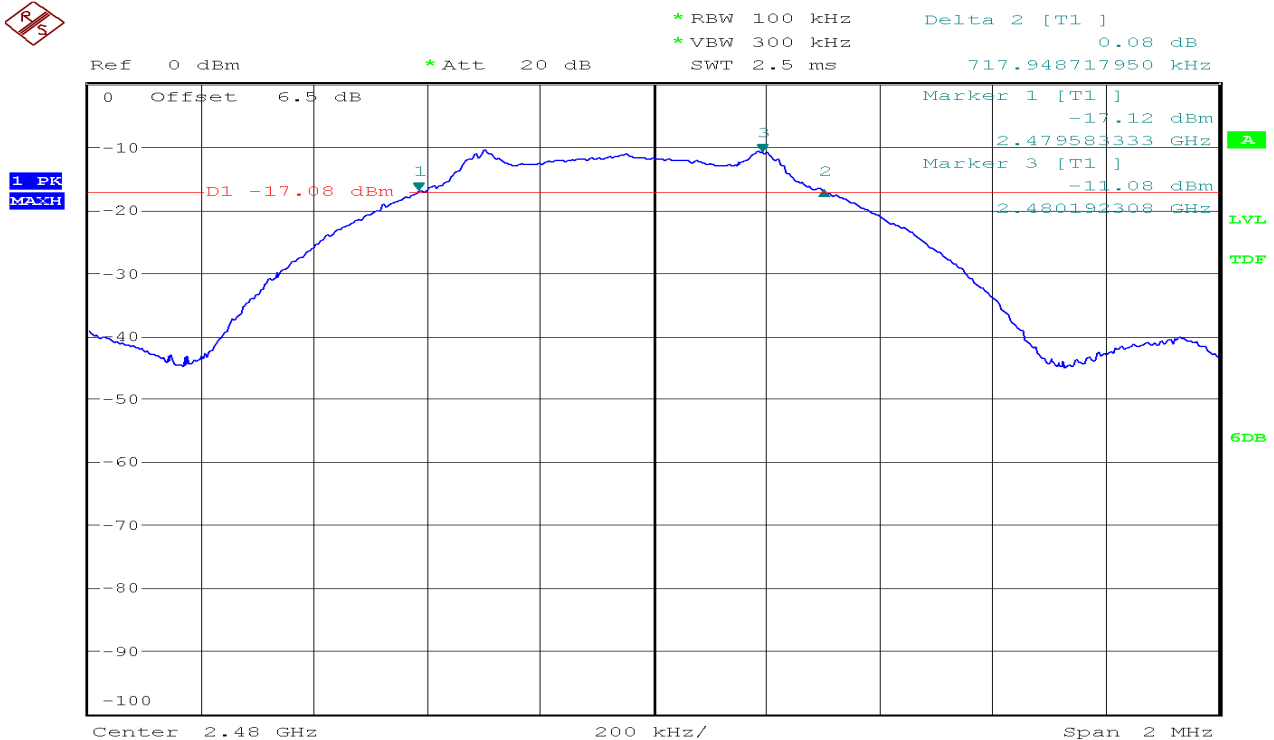
Channel 00



Channel 19



Channel 39



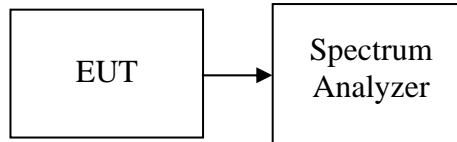
6.4 99% bandwidth measurement

LIMIT

None; for reporting purposes only

RSS-Gen 4.6.1

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to close to 1% of the selected span as is possible without being below 1%. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

TEST RESULTS

No non-compliance noted

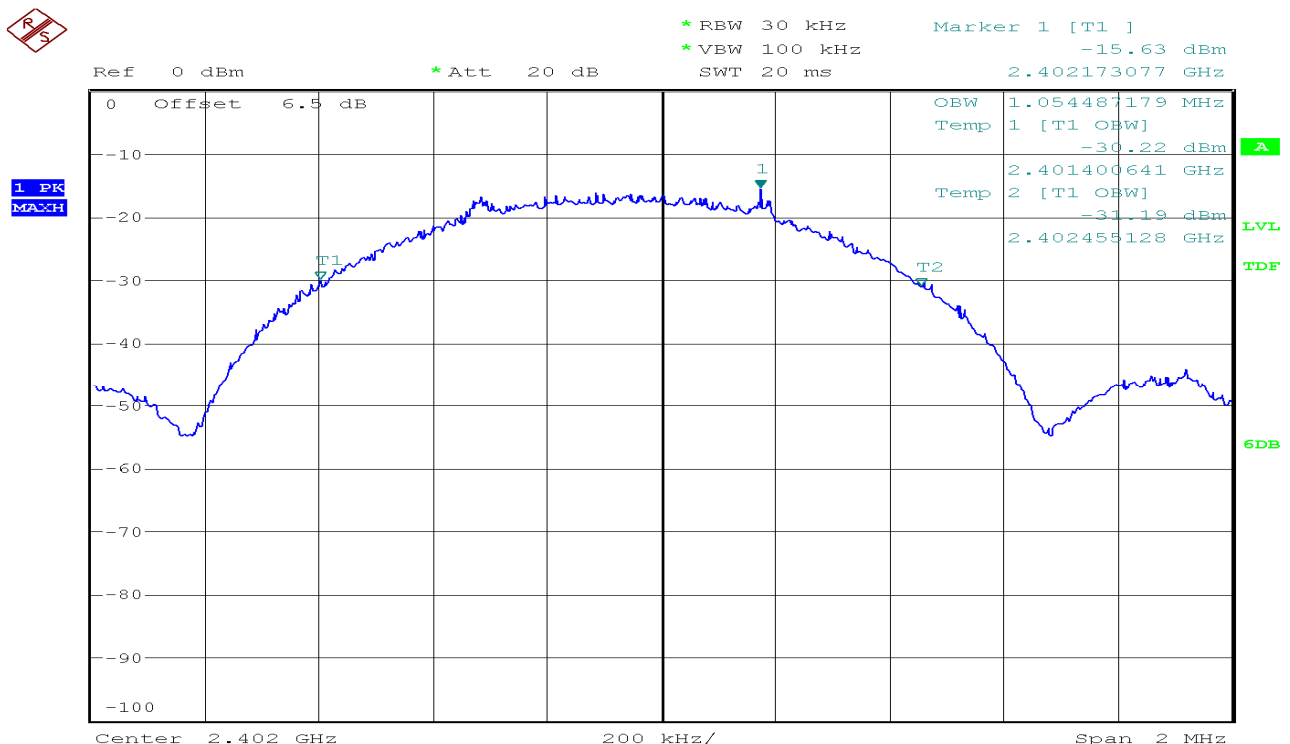
Test Data

| | | | |
|------------|-----------------|--------------|------------|
| Test mode: | Bluetooth LE4.0 | Temperature: | 23°C |
| Test By: | Lily.Wang | Test Date: | 2016-12-16 |

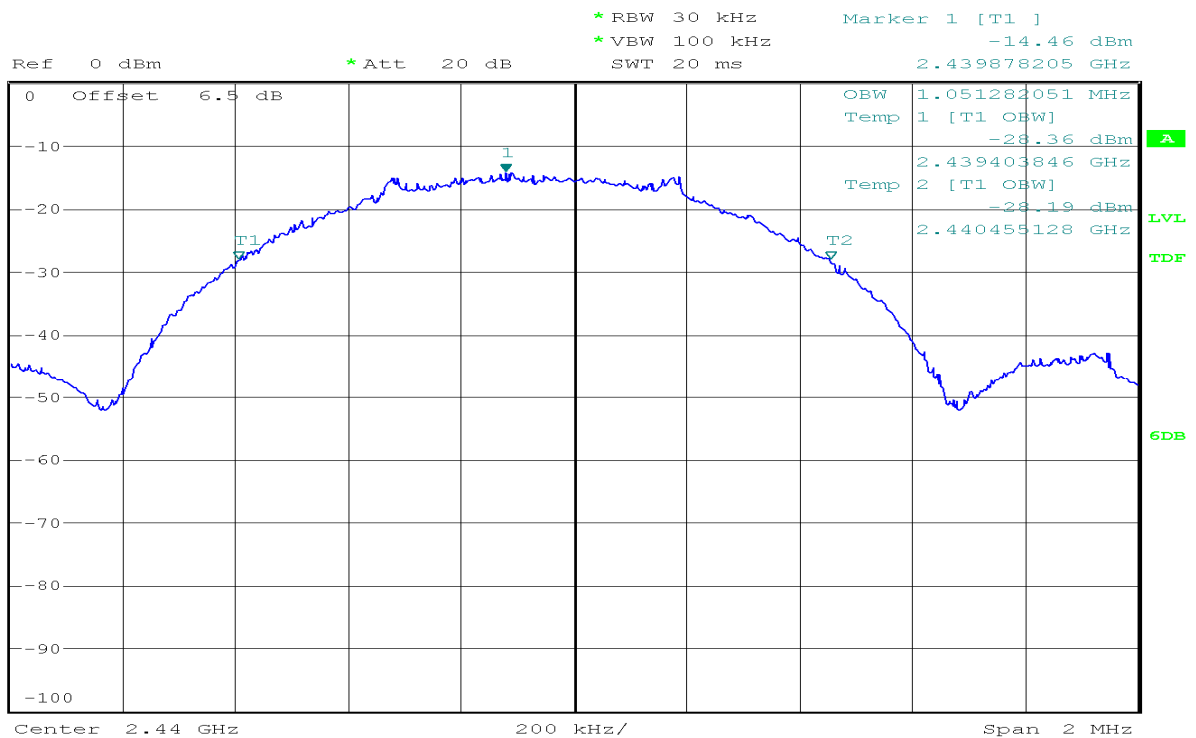
| Channel | Frequency (MHz) | 99% Bandwidth (MHz) | Result |
|---------|-----------------|---------------------|--------|
| 00 | 2402 | 1.0545 | Pass |
| 19 | 2440 | 1.0513 | Pass |
| 39 | 2480 | 1.0545 | Pass |

Test Plot

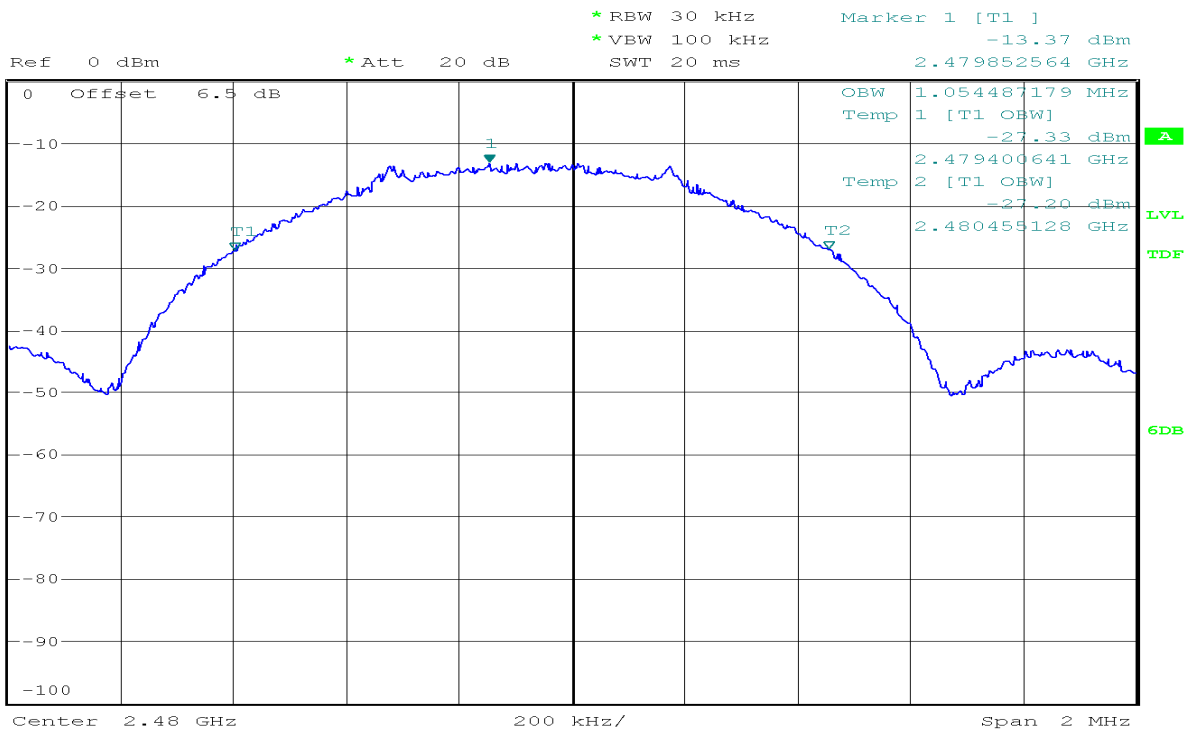
Channel 00



Channel 19

1 PK
MATCH

Channel 39

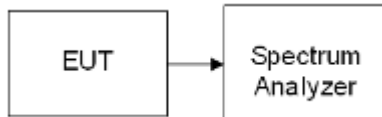
1 PK
MATCH

6.5 Conducted Band Edges and Spurious Emission Measurement

LIMIT

All harmonics/spurious must be at least 20 dB down from the highest emission level within the authorized band.

Test Configuration



TEST PROCEDURE

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

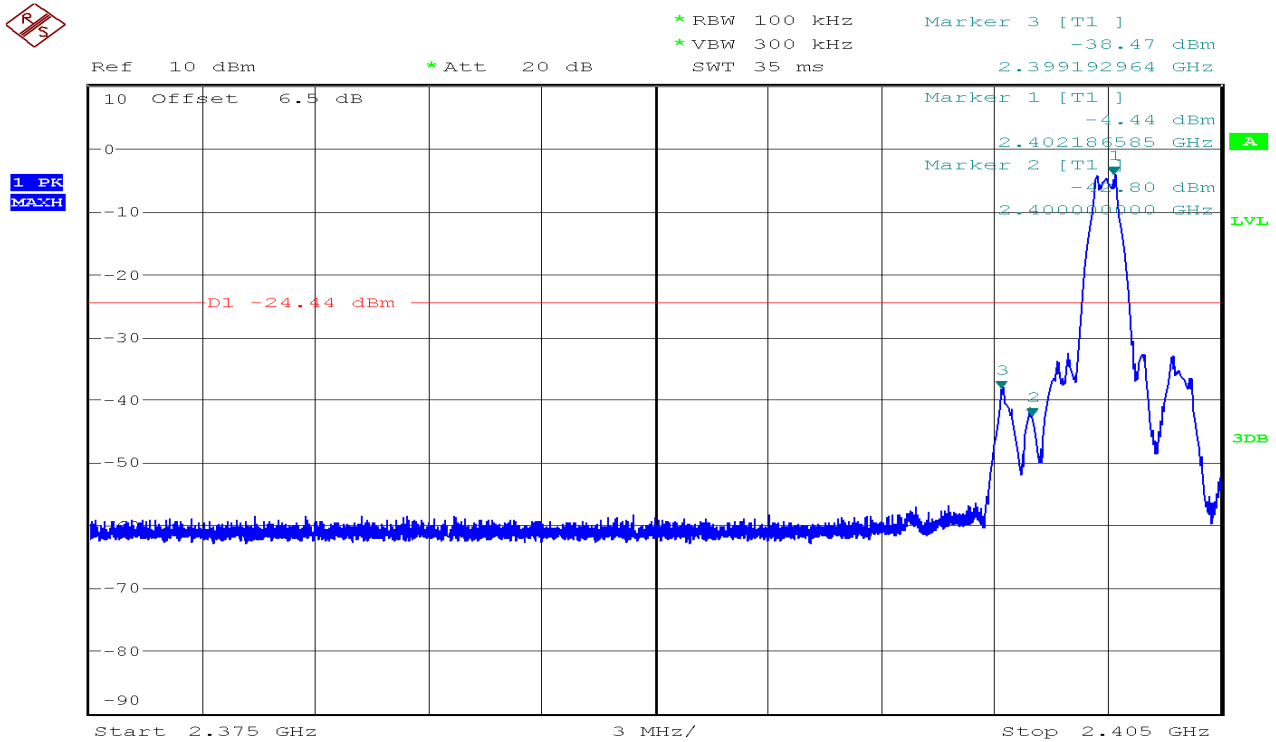
TEST RESULTS

No non-compliance noted

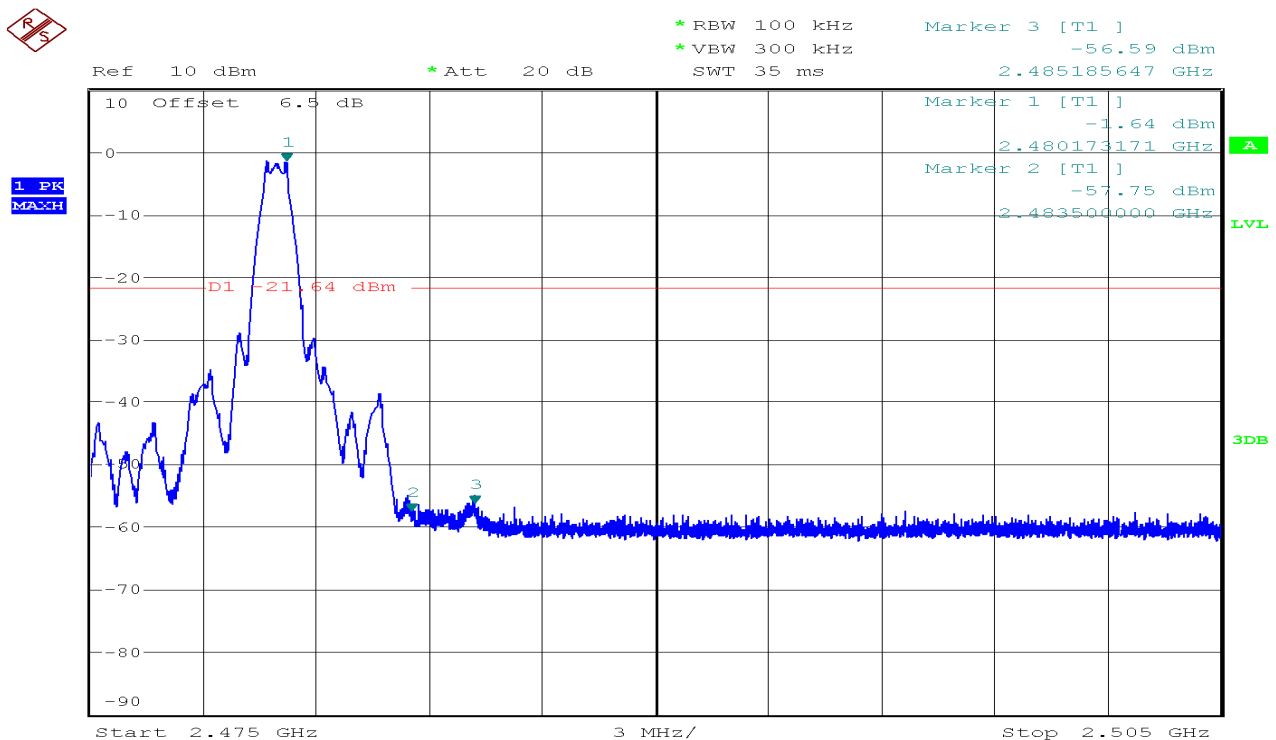
Test Result of Conducted Band Edges

| | | | |
|------------|-----------------|--------------|------------|
| Test mode: | Bluetooth LE4.0 | Temperature: | 23°C |
| Test By: | Lily.Wang | Test Date: | 2016-12-16 |

Low Band Edge Plot on Channel 00



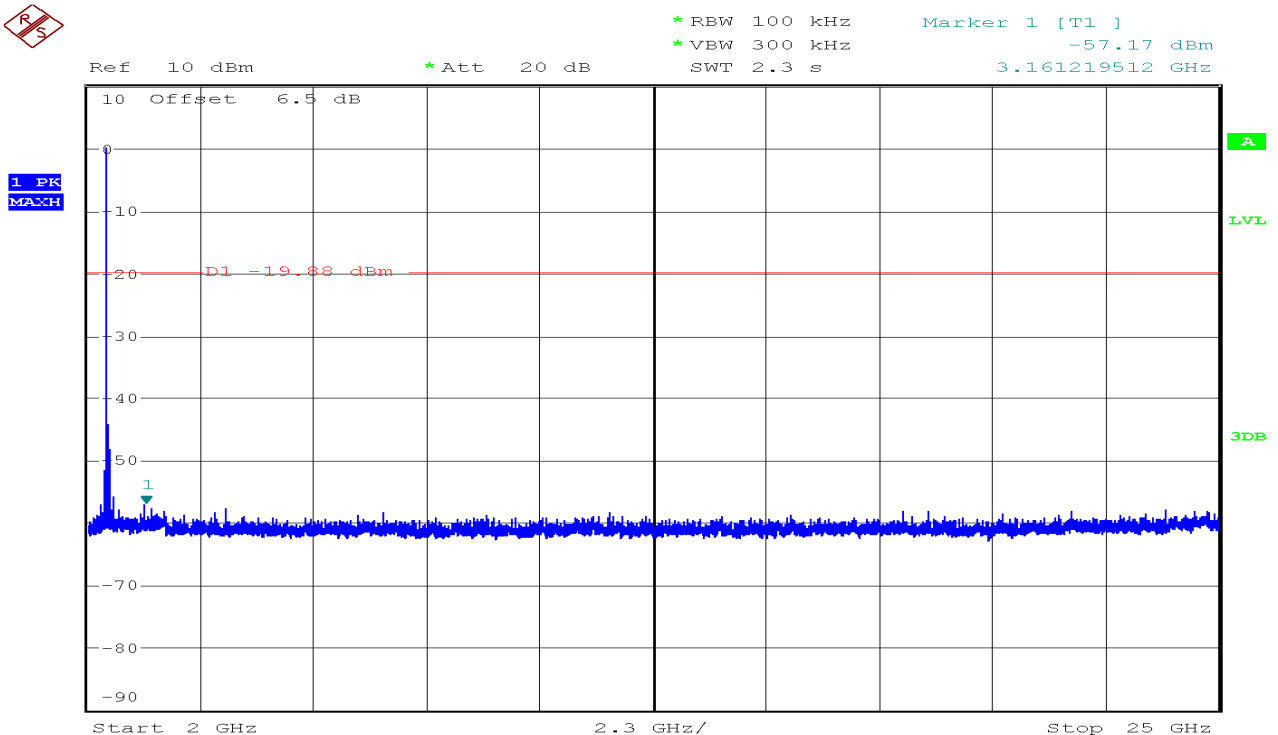
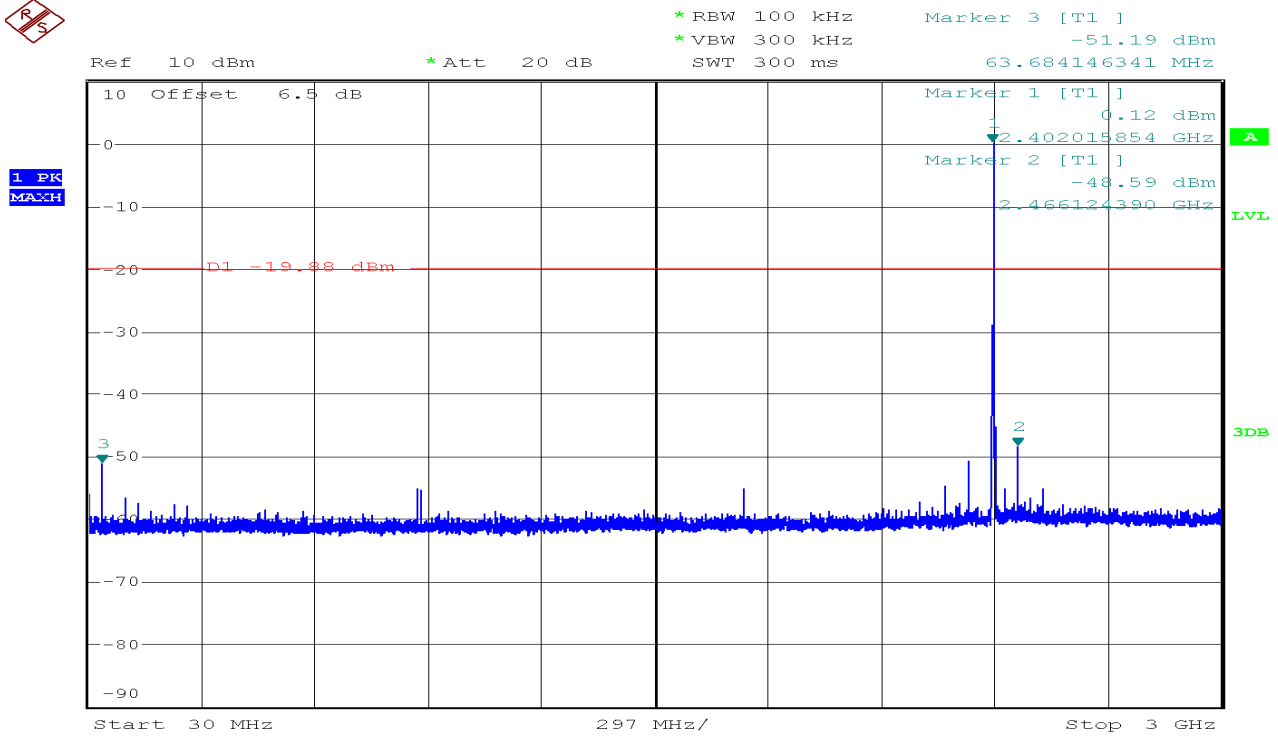
High Band Edge Plot on Channel 39



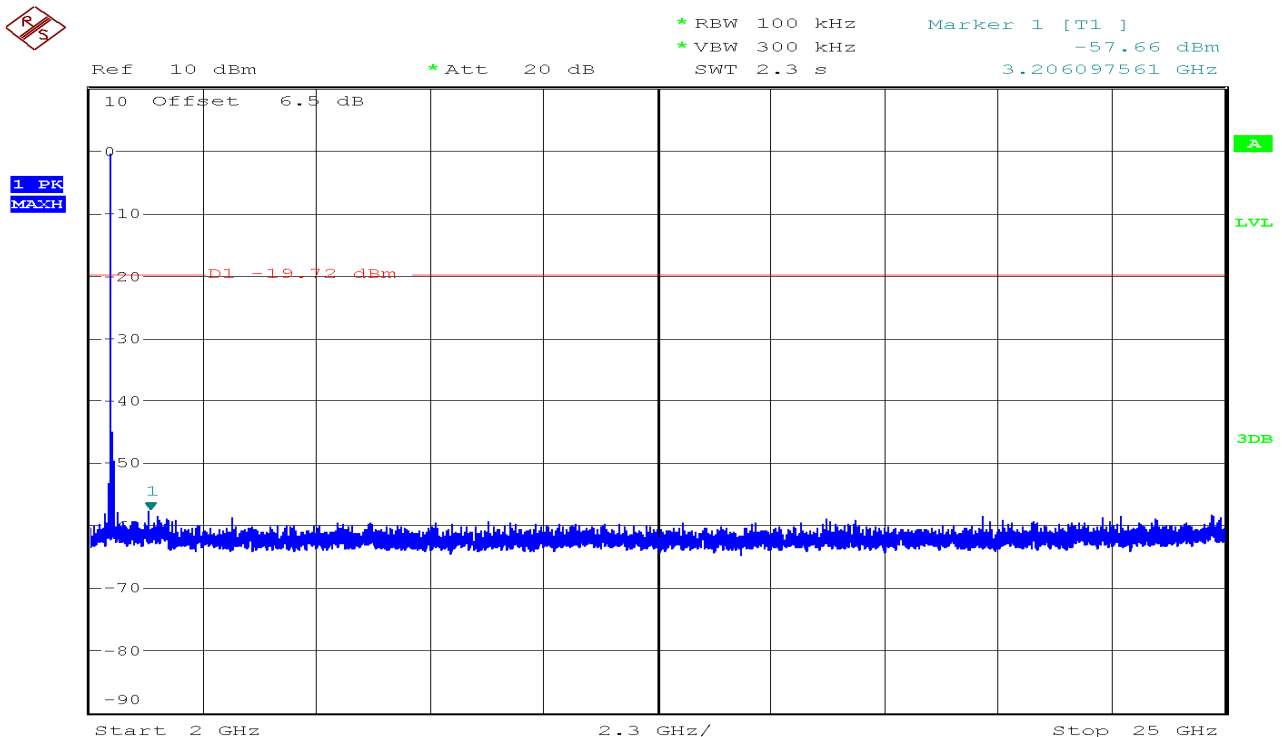
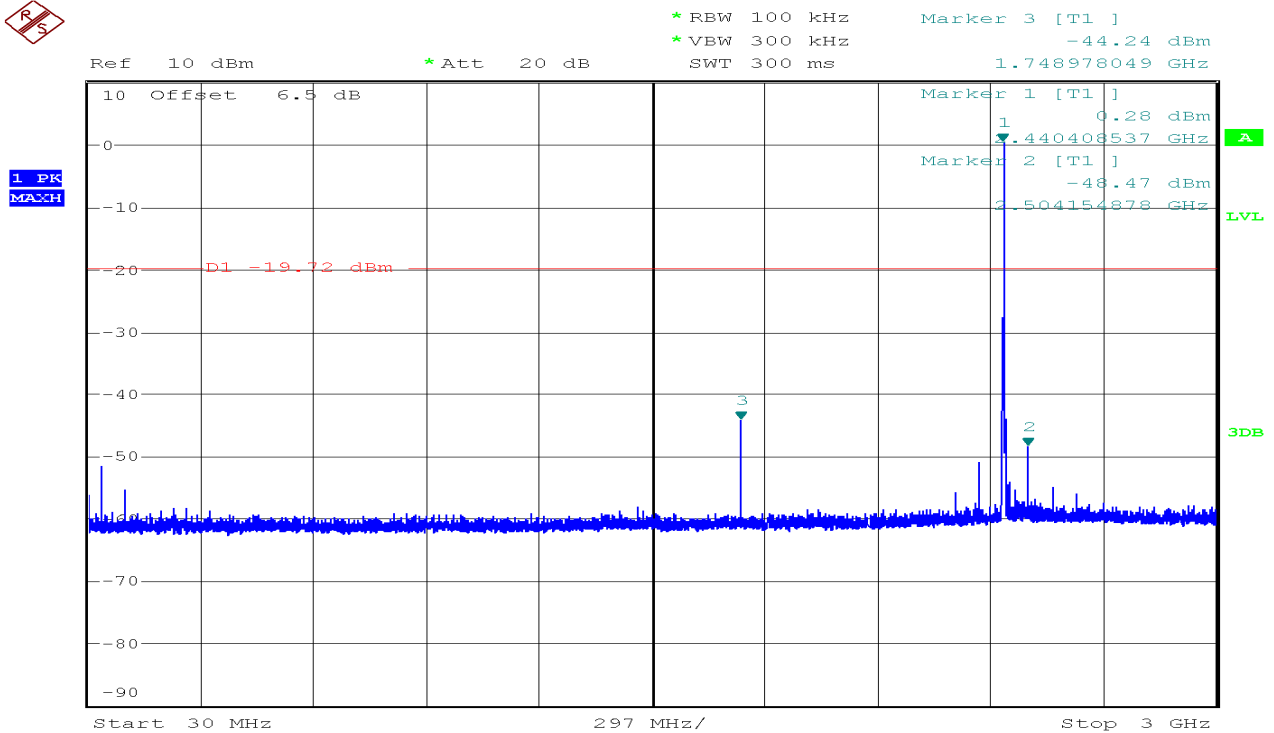
Test Result of Conducted Spurious Emission

| | | | |
|------------|-----------------|--------------|------------|
| Test mode: | Bluetooth LE4.0 | Temperature: | 23℃ |
| Test By: | Lily.Wang | Test Date: | 2016-12-16 |

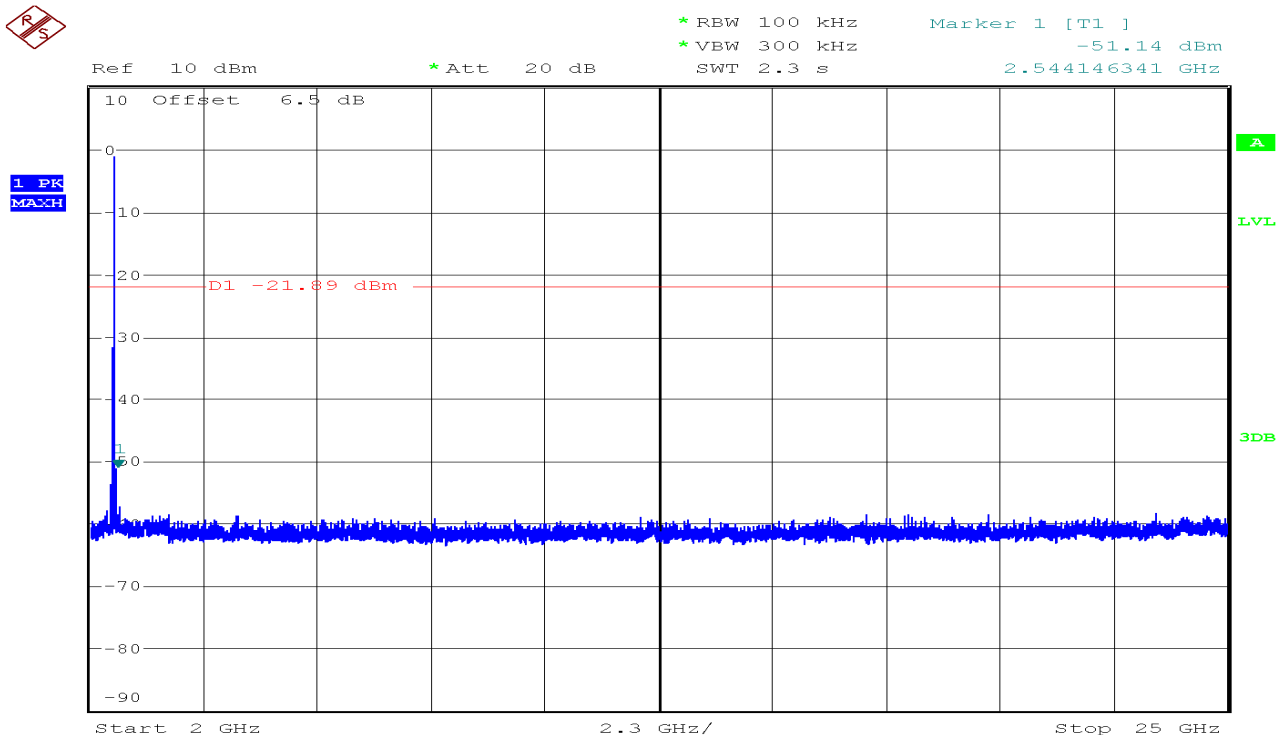
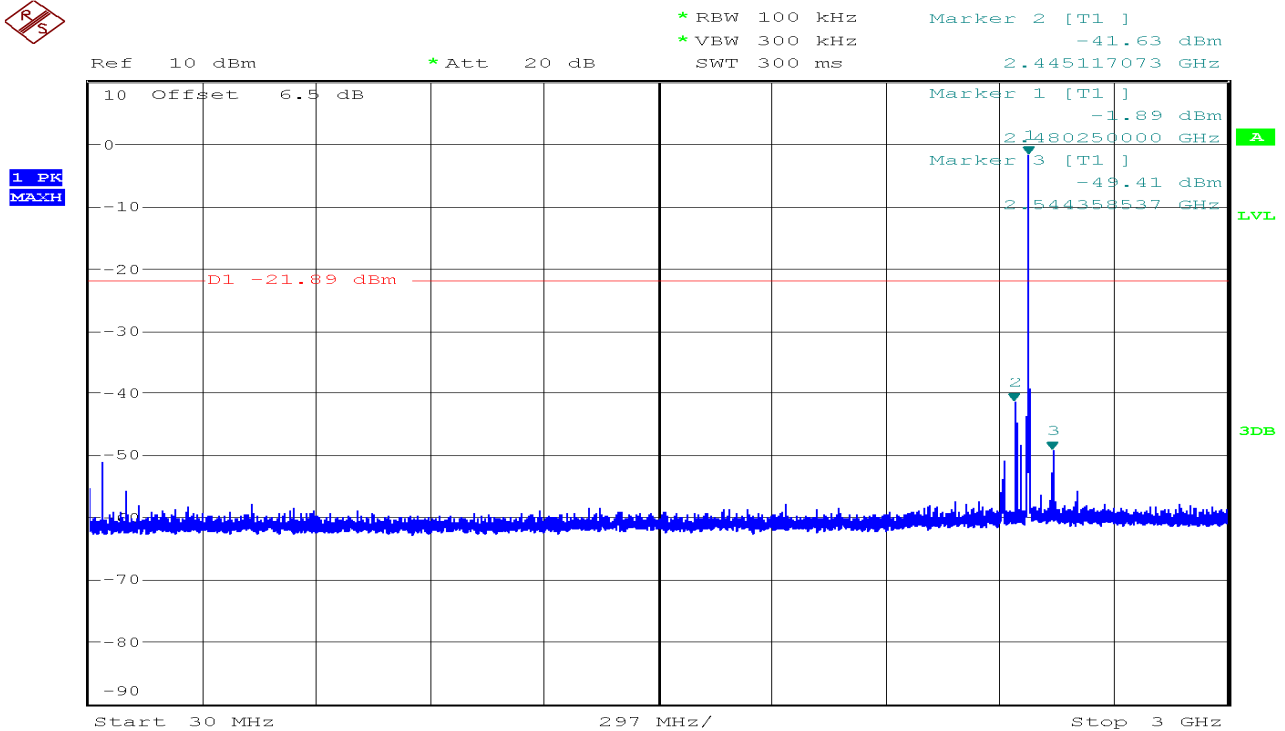
Conducted Spurious Emission Plot on Channel 00



Conducted Spurious Emission Plot on Channel 19



Conducted Spurious Emission Plot on Channel 39



6.6 Radiated Band Edge and Spurious Emission Measurement

LIMIT

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

| Frequency (MHz) | Field Strength (mV/m) | Measurement Distance (m) |
|-----------------|-----------------------|--------------------------|
| 30-88 | 100* | 3 |
| 88-216 | 150* | 3 |
| 216-960 | 200* | 3 |
| Above 960 | 500 | 3 |

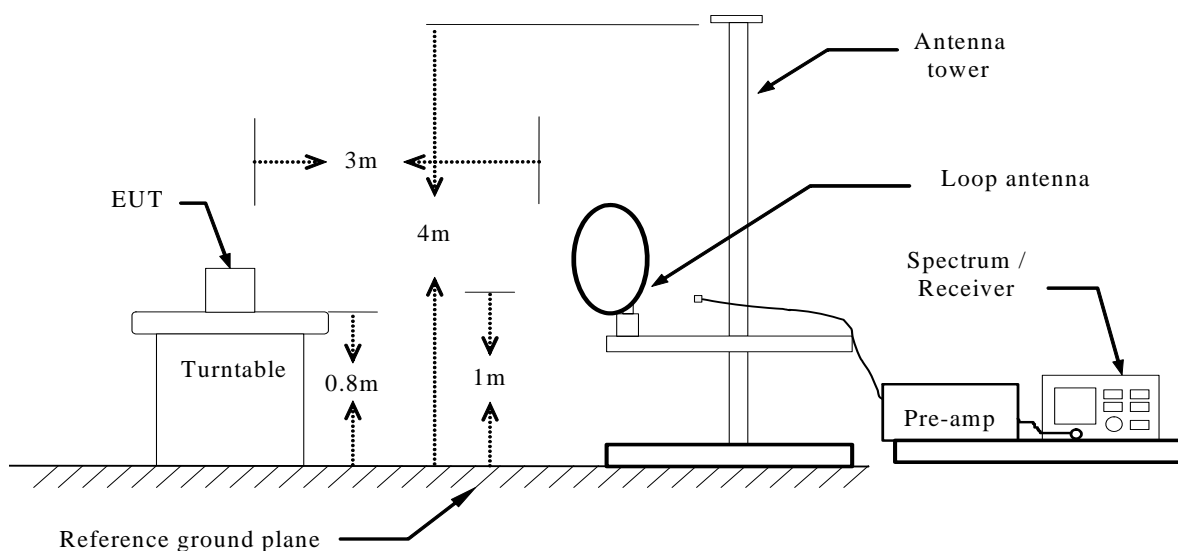
Remark: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

1. In the above emission table, the tighter limit applies at the band edges.

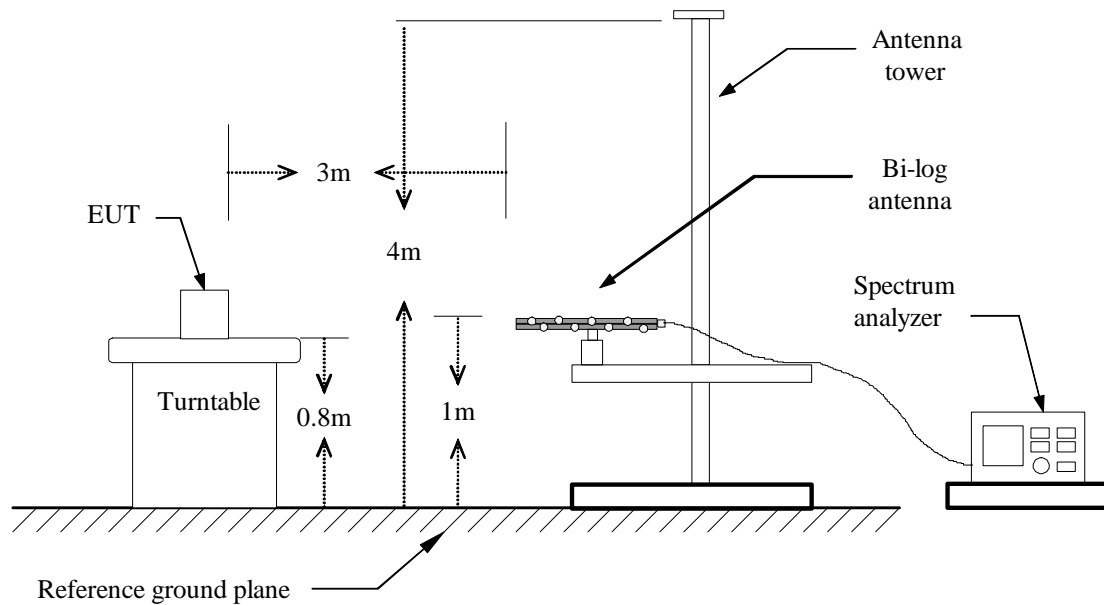
| Frequency (Hz) | Field Strength ($\mu\text{V/m}$ at 3-meter) | Field Strength (dB $\mu\text{V/m}$ at 3-meter) |
|----------------|--|--|
| 30-88 | 100 | 40 |
| 88-216 | 150 | 43.5 |
| 216-960 | 200 | 46 |
| Above 960 | 500 | 54 |

Test Configuration

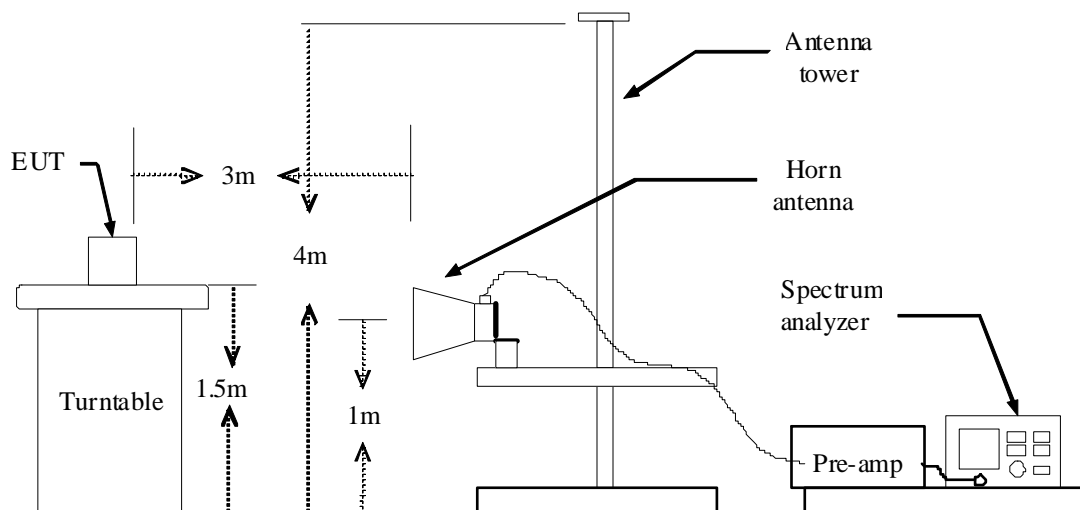
Below 30MHz



Below 1 GHz



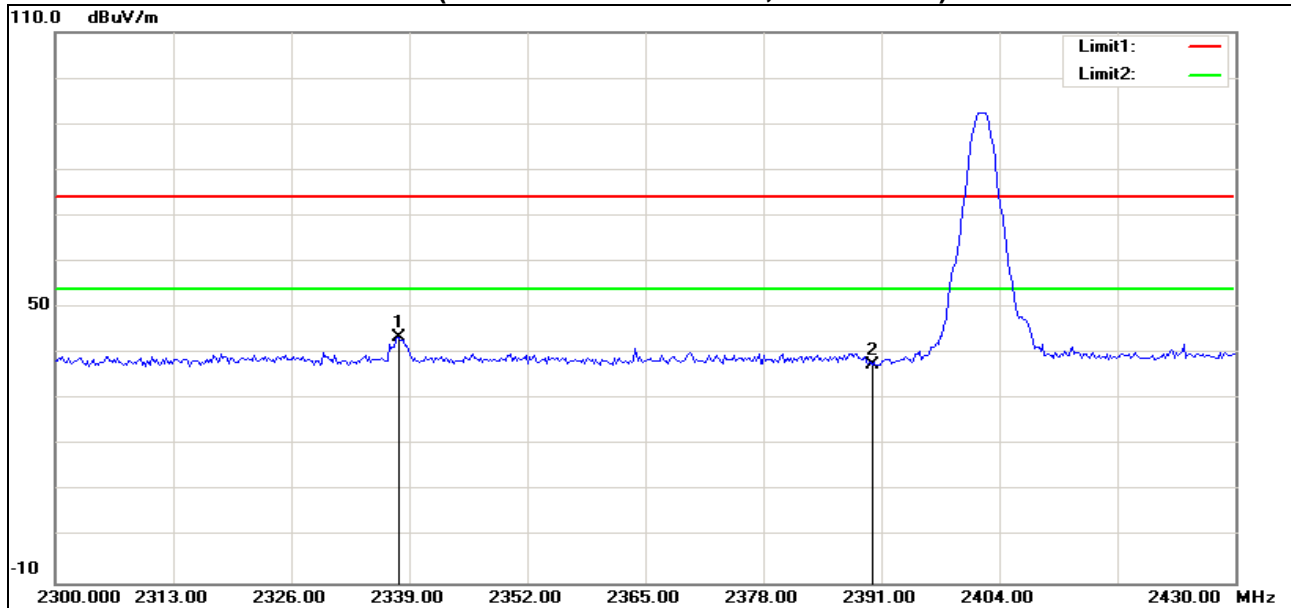
Above 1 GHz



TEST PROCEDURE

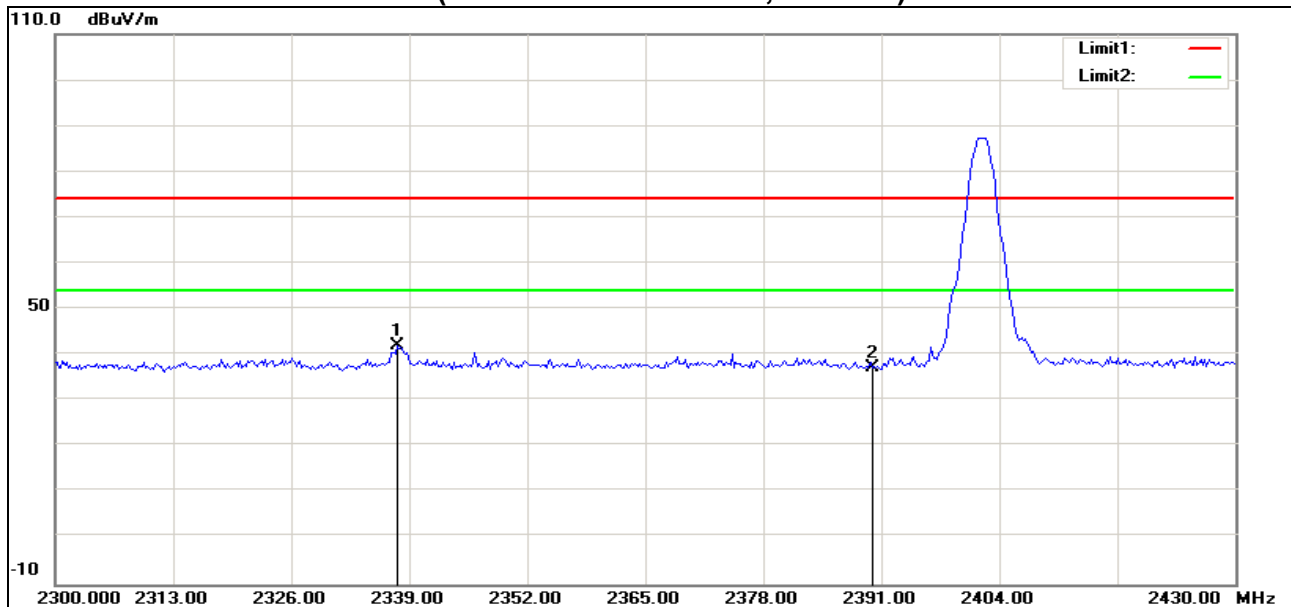
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.
 2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
 3. The EUT is placed on a turntable above ground plane, which is 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz.
 4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
 5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
 6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
 7. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for $f < 1$ GHz; VBW =3 RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3MHz for $f > 1$ GHz for peak measurement.
- For average measurement:
- VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

RESTRICTED BANDEDGE (BLE4.0 on Channel 0, Horizontal)

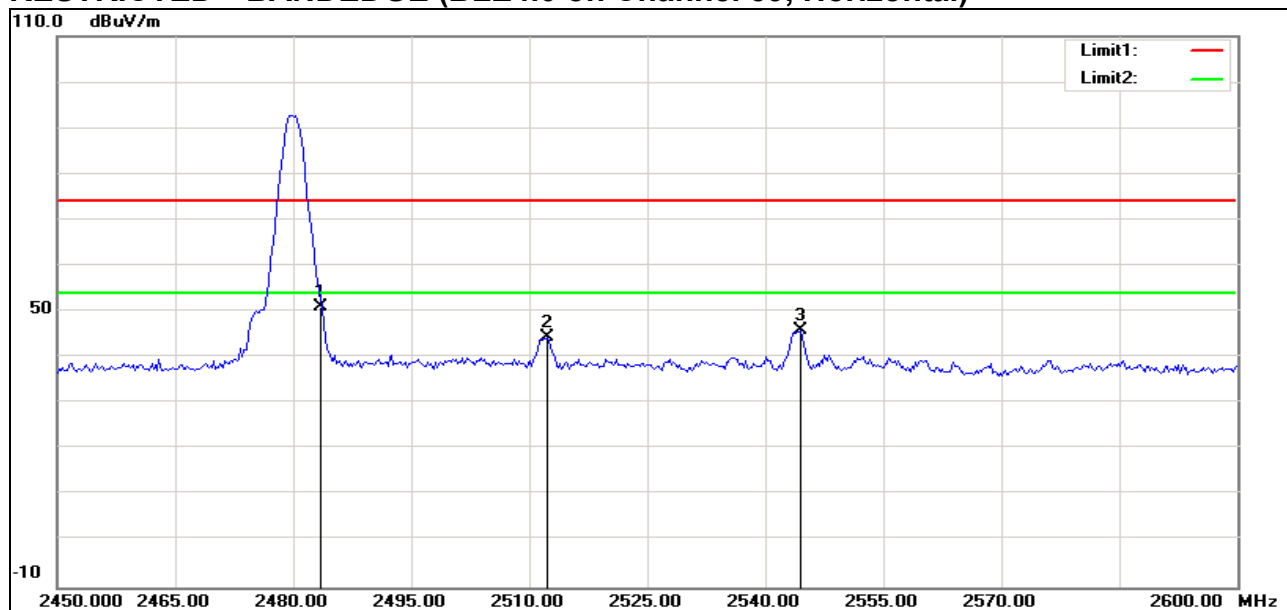


| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Height (cm) | Degree (deg.) | Remark |
|-----|-----------------|----------------|----------------------|-----------------|----------------|-------------|-------------|---------------|--------|
| 1 | 2337.917 | 52.66 | -9.00 | 43.66 | 74.00 | -30.34 | 100 | 66 | peak |
| 2 | 2390.000 | 46.31 | -8.81 | 37.50 | 74.00 | -36.50 | 100 | 141 | peak |

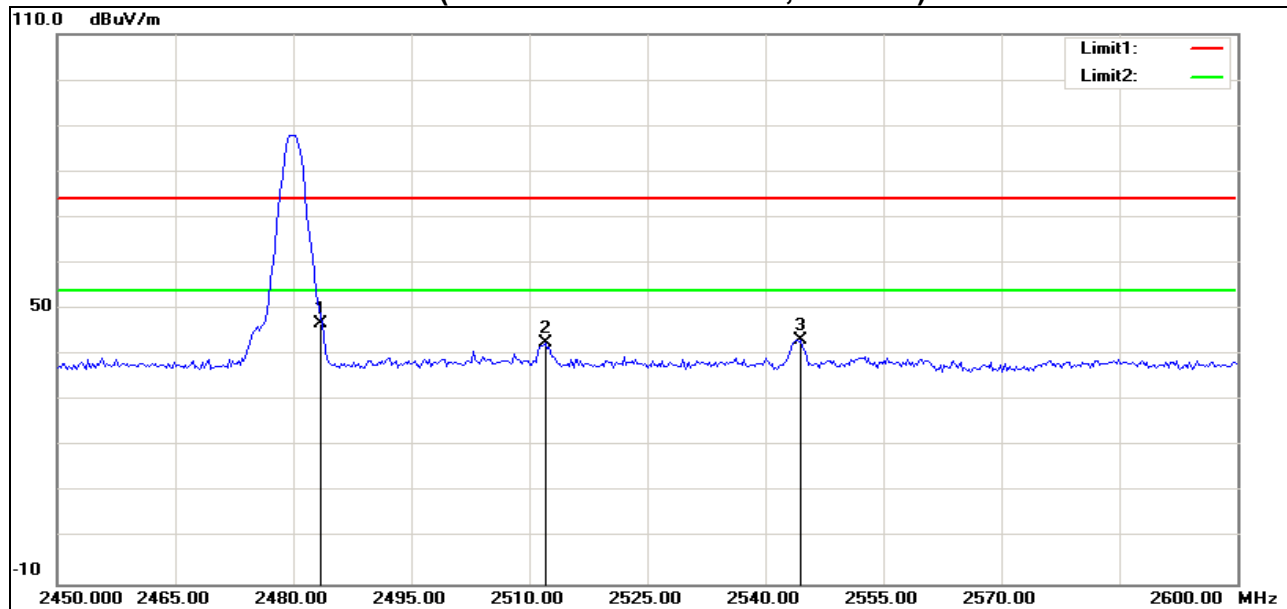
RESTRICTED BANDEDGE (BLE4.0 on Channel 0, Vertical)



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Height (cm) | Degree (deg.) | Remark |
|-----|-----------------|----------------|----------------------|-----------------|----------------|-------------|-------------|---------------|--------|
| 1 | 2337.708 | 51.18 | -9.00 | 42.18 | 74.00 | -31.82 | 100 | 250 | peak |
| 2 | 2390.000 | 45.96 | -8.81 | 37.15 | 74.00 | -36.85 | 100 | 324 | peak |

RESTRICTED BANDEDGE (BLE4.0 on Channel 39, Horizontal)

| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Height (cm) | Degree (deg.) | Remark |
|-----|-----------------|----------------|----------------------|-----------------|----------------|-------------|-------------|---------------|--------|
| 1 | 2483.500 | 59.47 | -8.47 | 51.00 | 74.00 | -23.00 | 100 | 353 | peak |
| 2 | 2512.260 | 52.80 | -8.36 | 44.44 | 74.00 | -29.56 | 100 | 337 | peak |
| 3 | 2544.471 | 54.14 | -8.23 | 45.91 | 74.00 | -28.09 | 100 | 48 | peak |

RESTRICTED BANDEDGE (BLE4.0 on Channel 39, Vertical)

| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Height (cm) | Degree (deg.) | Remark |
|-----|-----------------|----------------|----------------------|-----------------|----------------|-------------|-------------|---------------|--------|
| 1 | 2483.500 | 55.34 | -8.47 | 46.87 | 74.00 | -27.13 | 100 | 203 | peak |
| 2 | 2512.019 | 51.04 | -8.36 | 42.68 | 74.00 | -31.32 | 100 | 111 | peak |
| 3 | 2544.471 | 51.62 | -8.23 | 43.39 | 74.00 | -30.61 | 100 | 111 | peak |

Test Result of Radiated Emission**Below 30MHz**

The interference of the frequency value is lower than the limit below 20 db, measured as the background noise values and will not be recorded.

30MHz-1GHz

| | | | |
|------------------------|-------------|-------------------|-------------|
| Operation Mode: | Normal Link | Test Date: | 2016-12-20 |
| Temperature: | 25°C | Tested by: | Lily.Wang |
| Humidity: | 48% RH | Polarity: | Ver. / Hor. |

| Frequency (MHz) | Ant. Pol. (H/V) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|
| 44.5500 | V | 17.95 | 14.47 | 32.42 | 40.00 | -7.58 | peak |
| 151.2500 | V | 5.67 | 14.21 | 19.88 | 40.00 | -20.12 | peak |
| 450.9800 | V | 1.92 | 20.79 | 22.71 | 47.00 | -24.29 | peak |
| 677.9600 | V | 1.08 | 23.75 | 24.83 | 47.00 | -22.17 | peak |
| 809.8800 | V | 1.80 | 25.48 | 27.28 | 47.00 | -19.72 | peak |
| 984.4800 | V | 2.47 | 26.51 | 28.98 | 47.00 | -18.02 | peak |
| 31.9400 | H | 1.75 | 20.94 | 22.69 | 40.00 | -17.31 | peak |
| 151.2500 | H | 5.78 | 14.21 | 19.99 | 40.00 | -20.01 | peak |
| 394.7200 | H | 1.22 | 20.18 | 21.40 | 47.00 | -25.60 | peak |
| 482.9900 | H | 0.96 | 21.05 | 22.01 | 47.00 | -24.99 | peak |
| 680.8700 | H | 1.39 | 23.81 | 25.20 | 47.00 | -21.80 | peak |
| 893.3000 | H | 4.88 | 25.78 | 30.66 | 47.00 | -16.34 | peak |

Notes:

1. Measurements above show only up to maximum emissions noted, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
2. Radiated emissions measured in frequency range from 9 KHz to 1000MHz were made with an instrument using Peak detector mode.
3. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
4. The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.

Above 1 GHz**Operation Mode:** Bluetooth LE4.0**Test Date:** 2016-12-20**Test Channel:** CH00**Tested by:** Lily.Wang**Temperature:** 25°C**Polarity:** Ver. / Hor.

| Frequency (MHz) | Ant. Pol. (H/V) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|
| 4786.859 | V | 50.54 | -1.34 | 49.20 | 74.00 | -24.80 | PEAK |
| 7266.026 | V | 44.39 | 5.34 | 49.73 | 74.00 | -24.27 | PEAK |
| 4786.859 | H | 50.48 | -1.34 | 49.14 | 74.00 | -24.86 | PEAK |
| 7293.269 | H | 43.83 | 5.35 | 49.18 | 74.00 | -24.82 | PEAK |

Operation Mode: Bluetooth LE4.0**Test Date:** 2016-12-20**Test Channel:** CH19**Tested by:** Lily.Wang**Temperature:** 25°C**Polarity:** Ver. / Hor.

| Frequency (MHz) | Ant. Pol. (H/V) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|
| 4868.590 | V | 51.05 | -1.37 | 49.68 | 74.00 | -24.32 | PEAK |
| 7620.192 | V | 44.95 | 5.67 | 50.62 | 74.00 | -23.38 | PEAK |
| 4868.590 | H | 50.87 | -1.37 | 49.50 | 74.00 | -24.50 | PEAK |
| 7293.269 | H | 44.19 | 5.35 | 49.54 | 74.00 | -24.46 | PEAK |

Operation Mode: Bluetooth LE4.0**Test Date:** 2016-12-20**Test Channel:** CH39**Tested by:** Lily.Wang**Temperature:** 25°C**Polarity:** Ver. / Hor.

| Frequency (MHz) | Ant. Pol. (H/V) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|
| 4950.320 | V | 52.87 | -1.41 | 51.46 | 74.00 | -22.54 | PEAK |
| 7266.026 | V | 44.25 | 5.34 | 49.59 | 74.00 | -24.41 | PEAK |
| 4950.320 | H | 53.29 | -1.41 | 51.88 | 74.00 | -22.12 | PEAK |
| 7266.026 | H | 46.08 | 5.34 | 51.42 | 74.00 | -22.58 | PEAK |

6.7 POWERLINE CONDUCTED EMISSIONS

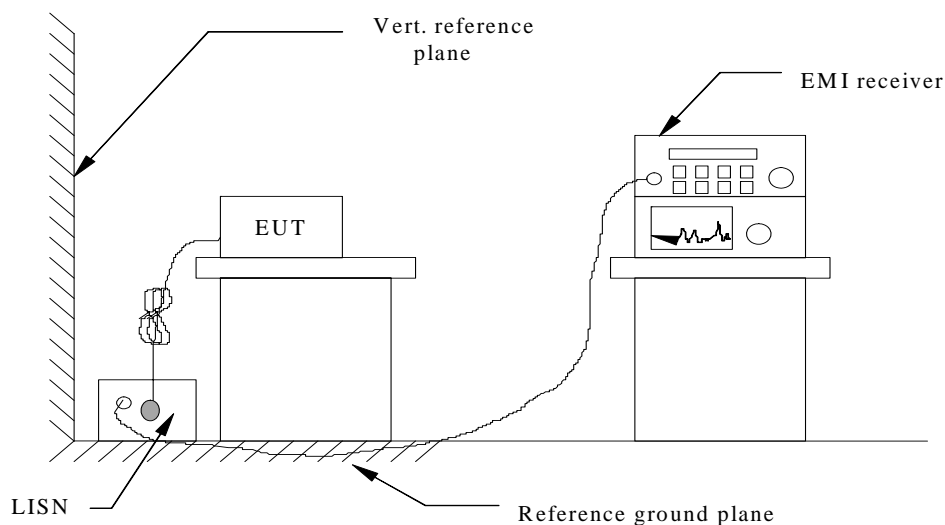
LIMIT

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

| Frequency Range (MHz) | Limits (dB μ V) | |
|-----------------------|---------------------|----------|
| | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56 | 56 to 46 |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Configuration



See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

TEST RESULTS

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.



Test Data

Note: EUT is a DC operating device, so the test item is not necessary performed.

END OF REPORT