



FCC PART 15.247

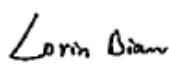

TEST REPORT

For

INMOTION TECHNOLOGIES CO., LTD.

18F, B1, Nanshan i Park, No.1001 Xueyuan Ave., Nanshan District, Shenzhen, China

FCC ID: 2ADUSP1

| | |
|--|--|
| Report Type: Original Report | Product Name: INMOTION E-BIKE |
| Test Engineer: | <u>Lorin Bian</u>  |
| Report Number: | <u>RDG161026004B</u> |
| Report Date: | <u>2016-11-30</u> |
| Reviewed By: | Henry Ding  EMC Leader |
| Test Laboratory: | Bay Area Compliance Laboratories Corp. (Chengdu) 5040, HuiLongWan Plaza, No. 1, ShaWan Road, JinNiu District, ChengDu, China Tel: 028-65523123, Fax: 028-65525125 www.baclcorp.com |

Note: This test report was prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Chengdu). Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. This report was valid only with a valid digital signature.

TABLE OF CONTENTS

| | |
|---|-----------|
| GENERAL INFORMATION | 4 |
| PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) | 4 |
| OBJECTIVE | 4 |
| RELATED SUBMITTAL(S)/GRANT(S) | 4 |
| TEST METHODOLOGY | 4 |
| TEST FACILITY | 5 |
| SYSTEM TEST CONFIGURATION | 6 |
| DESCRIPTION OF TEST CONFIGURATION | 6 |
| EQUIPMENT MODIFICATIONS | 6 |
| EUT EXERCISE SOFTWARE | 6 |
| SUPPORT EQUIPMENT LIST AND DETAILS | 7 |
| EXTERNAL CABLE | 7 |
| BLOCK DIAGRAM OF TEST SETUP | 8 |
| SUMMARY OF TEST RESULTS | 9 |
| FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE | 10 |
| APPLICABLE STANDARD | 10 |
| FCC §15.203 - ANTENNA REQUIREMENT | 11 |
| APPLICABLE STANDARD | 11 |
| ANTENNA CONNECTOR CONSTRUCTION | 11 |
| FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS | 12 |
| APPLICABLE STANDARD | 12 |
| MEASUREMENT UNCERTAINTY | 12 |
| EUT SETUP | 12 |
| EMI TEST RECEIVER SETUP | 13 |
| TEST PROCEDURE | 13 |
| CORRECTED AMPLITUDE & MARGIN CALCULATION | 13 |
| TEST EQUIPMENT LIST AND DETAILS | 14 |
| TEST RESULTS SUMMARY | 14 |
| TEST DATA | 14 |
| FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS | 17 |
| APPLICABLE STANDARD | 17 |
| MEASUREMENT UNCERTAINTY | 17 |
| EUT SETUP | 18 |
| EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP | 19 |
| TEST PROCEDURE | 19 |
| CORRECTED AMPLITUDE & MARGIN CALCULATION | 19 |
| TEST EQUIPMENT LIST AND DETAILS | 20 |
| TEST RESULTS SUMMARY | 20 |
| TEST DATA | 20 |
| FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH | 22 |
| APPLICABLE STANDARD | 22 |
| TEST PROCEDURE | 22 |
| TEST EQUIPMENT LIST AND DETAILS | 22 |
| TEST DATA | 22 |
| FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER | 25 |

| | |
|--|-----------|
| APPLICABLE STANDARD..... | 25 |
| TEST PROCEDURE | 25 |
| TEST EQUIPMENT LIST AND DETAILS | 25 |
| TEST DATA | 25 |
| FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE | 28 |
| APPLICABLE STANDARD..... | 28 |
| TEST PROCEDURE | 28 |
| TEST EQUIPMENT LIST AND DETAILS | 28 |
| TEST DATA | 29 |
| FCC §15.247(e) - POWER SPECTRAL DENSITY | 31 |
| APPLICABLE STANDARD..... | 31 |
| TEST PROCEDURE | 31 |
| TEST EQUIPMENT LIST AND DETAILS | 31 |
| TEST DATA | 31 |

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The **INMOTION TECHNOLOGIES CO., LTD.**'s product, model number: **P1 (FCC ID: 2ADUSP1)** (the "EUT") in this report was a **INMOTION E-BIKE**, which was measured approximately: 89.0 cm (L) x 48.0 cm (W) x 99.1 cm (H), rated input voltage: DC36V from rechargeable Lithium-ion battery or DC42V charging from adapter.

Adapter Information :

MODEL : FY-4202000

INPUT : 100-240V~ 50/60Hz 2.5A

OUTPUT: DC42.0V, 2.0A

Note: The series product, model P1, P1+, P1S, P1C, P1D, P1F are electrically identical, the difference between them is the different name, we selected P1 for fully testing, the details was explained in the declaration letter.

**All measurement and test data in this report was gathered from final production sample, serial number: 161026004 (assigned by the BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2016-10-26, and EUT conformed to test requirement.*

Objective

This report is prepared on behalf of **INMOTION TECHNOLOGIES CO., LTD.** in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communications Commission's rules

The tests were performed in order to determine the compliance of the EUT with FCC Part 15-Subpart C, section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

N/A

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Chengdu). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

The uncertainty of any RF tests which use conducted method measurement is ± 3.17 dB, the uncertainty of any radiation on emissions measurement is:

30M~200MHz: ± 4.7 dB;

200M~1GHz: ± 6.0 dB;

1G~6GHz: ± 5.13 dB;

6G~25GHz: ± 5.47 dB;

And the uncertainty will not be taken into consideration for all test data recorded in the report.

Report No.: RDG161026004B

Page 4 of 33

Test Facility

The test site used by BACL to collect test data is located in the 5040, HuiLongWan Plaza, No. 1, ShaWan Road, JinNiu District, ChengDu, China.

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on April 24, 2015. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 560332. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in testing mode, which was provided by manufacturer. For Bluetooth LE mode, 40 channels are provided for testing:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|
| 0 | 2402 | 20 | 2442 |
| 1 | 2404 | ... | ... |
| ... | ... | ... | ... |
| ... | ... | ... | ... |
| .. | ... | 38 | 2478 |
| 19 | 2440 | 39 | 2480 |

EUT was tested with channel 0, 19 and 39.

Equipment Modifications

No modification was made to the EUT tested.

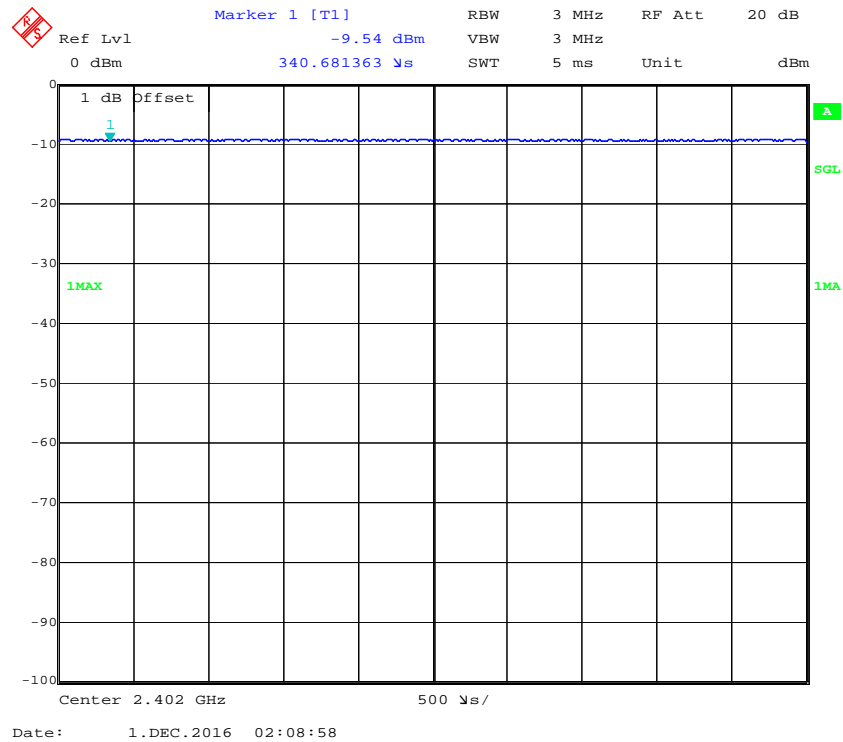
EUT Exercise Software

“SmartRF Studio 7” was used in test. The worst condition (maximum power) was setting by the Engineer Mode as default value.

The maximum duty cycle as following table:

| Test mode | T _{on} (ms) | T _{on+off} (ms) | Duty Cycle (%) |
|-----------|----------------------|--------------------------|----------------|
| BLE | 5 | 5 | 100% |

The minimum transmission duration(T) is 5ms for BLE mode.



Support Equipment List and Details

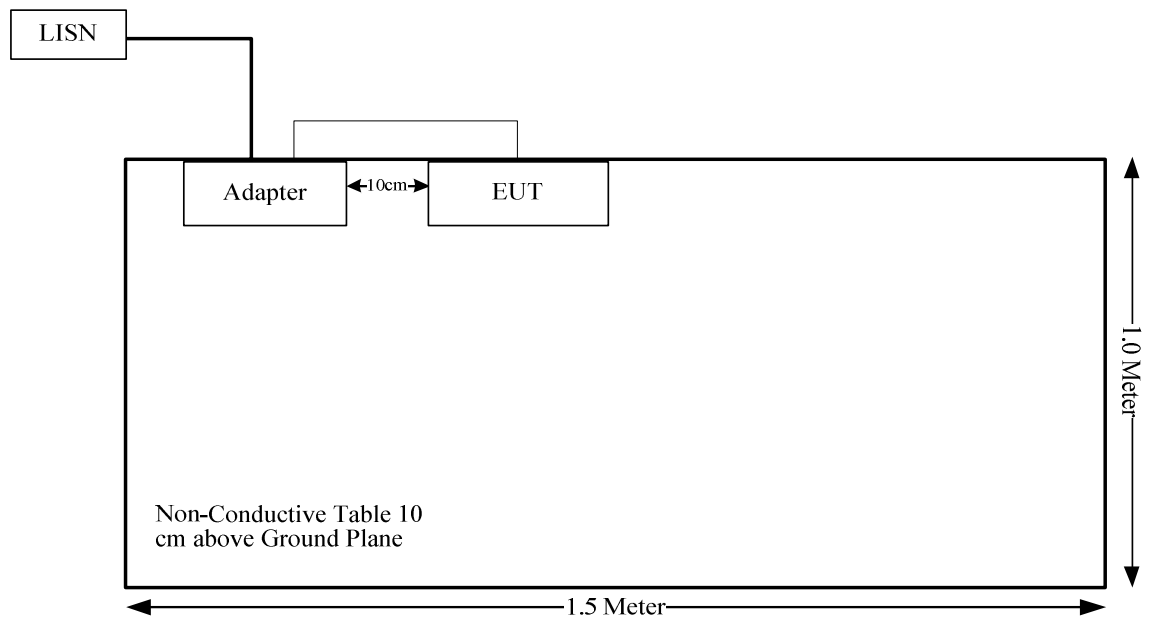
| Manufacturer | Description | Model | Serial Number |
|--------------|-------------|------------|---------------|
| Fuyuandan | Adapter | FY-4202000 | / |

External Cable

| Cable Description | Shielding Type | Ferrite Core | Length (m) | From Port | To |
|-------------------|----------------|--------------|------------|-----------|-----|
| Adapter Cable | NO | NO | 1.55 | Adapter | EUT |

Block Diagram of Test Setup

AC power line conducted Emissions test:



SUMMARY OF TEST RESULTS

| FCC Rules | Description of Test | Result |
|-------------------------------------|--|-----------|
| FCC §15.247 (i) & §1.1310 & §2.1093 | RF Exposure | Compliant |
| §15.203 | Antenna Requirement | Compliant |
| §15.207 (a) | AC Line Conducted Emissions | Compliant |
| §15.205, §15.209, §15.247(d) | Spurious Emissions | Compliant |
| §15.247 (a)(2) | 6 dB Emission Bandwidth | Compliant |
| §15.247(b)(3) | Maximum conducted output power | Compliant |
| §15.247(d) | 100 kHz Bandwidth of Frequency Band Edge | Compliant |
| §15.247(e) | Power Spectral Density | Compliant |

FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE

Applicable Standard

According to §15.247(i) and §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB447498 D01 General RF Exposure Guidance v06

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

Measurement Result

The tune-up power is -10 dBm (0.1 mW).

$[(\text{max. power of channel, mW})/(\text{min. test separation distance, mm})][\sqrt{f(\text{GHz})}]$
 $= 0.1/5 \cdot (\sqrt{2.480}) = 0.03 < 7.5$

So the SAR evaluation is not necessary.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

Antenna Connector Construction

The EUT has one PCB antenna arrangement and the antenna gain is 0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

Measurement Uncertainty

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If U_{lab} is less than or equal to U_{cispr} of Table 1, then:

–compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
 –non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{lab} is greater than U_{cispr} of Table 1, then:

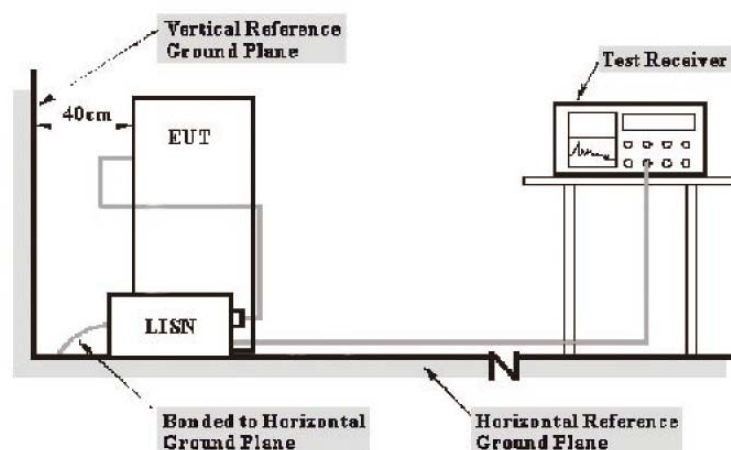
–compliance is deemed to occur if no measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit;
 –non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit.

Based on CISPR 16-4-2:2011, measurement uncertainty of conducted disturbance at mains port using AMN at Bay Area Compliance Laboratories Corp. (Chengdu) is ± 3.17 dB (150 kHz to 30 MHz).

Table 1 – Values of U_{cispr}

| Measurement | U_{cispr} |
|---|-------------|
| Conducted disturbance at mains port using AMN (150 kHz to 30 MHz) | 3.4 dB |

EUT Setup



Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 30 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

The adapter was connected to a 120 V/60 Hz AC power source

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

| Frequency Range | IF B/W |
|------------------|--------|
| 150 kHz – 30 MHz | 9 kHz |

Test Procedure

During the conducted emission test, the adapter was connected to the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$V_C = V_R + A_C + VDF$$

$$C_f = A_C + VDF$$

Herein,

V_C (cord. Reading): corrected voltage amplitude

V_R : reading voltage amplitude

A_C : attenuation caused by cable loss

VDF: voltage division factor of AMN

C_f : Correction Factor

The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|-------------------|---------|---------------|------------------|----------------------|
| Rohde & Schwarz | EMI Test Receiver | ESCS 30 | 836858/0016 | 2015-12-02 | 2016-12-01 |
| Rohde & Schwarz | L.I.S.N. | ENV216 | 3560.6550.06 | 2015-12-02 | 2016-12-01 |
| Rohde & Schwarz | PULSE LIMITER | ESH3Z2 | 357.8810.52 | 2016-10-31 | 2017-10-30 |
| N/A | Conducted Cable | NO.5 | N/A | 2015-11-10 | 2016-11-09 |
| R&S | Test Software | EMC32 | Version8.53.0 | N/A | N/A |

* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

Test Data

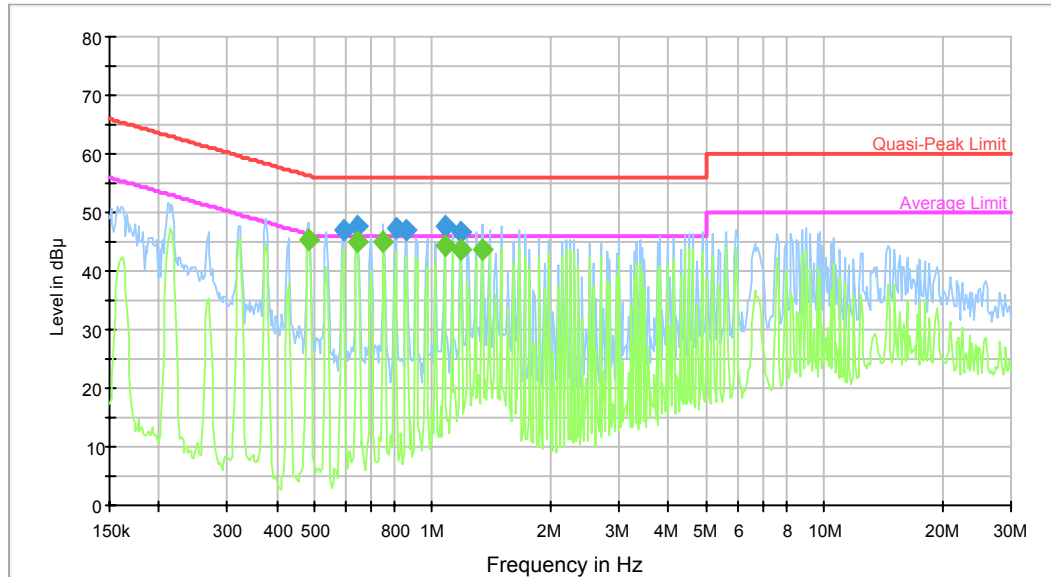
Environmental Conditions

| | |
|--------------------|-----------|
| Temperature: | 26.7 °C |
| Relative Humidity: | 45 % |
| ATM Pressure: | 101.5 kPa |

The testing was performed by Lorin Bian on 2016-11-02.

Test Mode: Transmitting

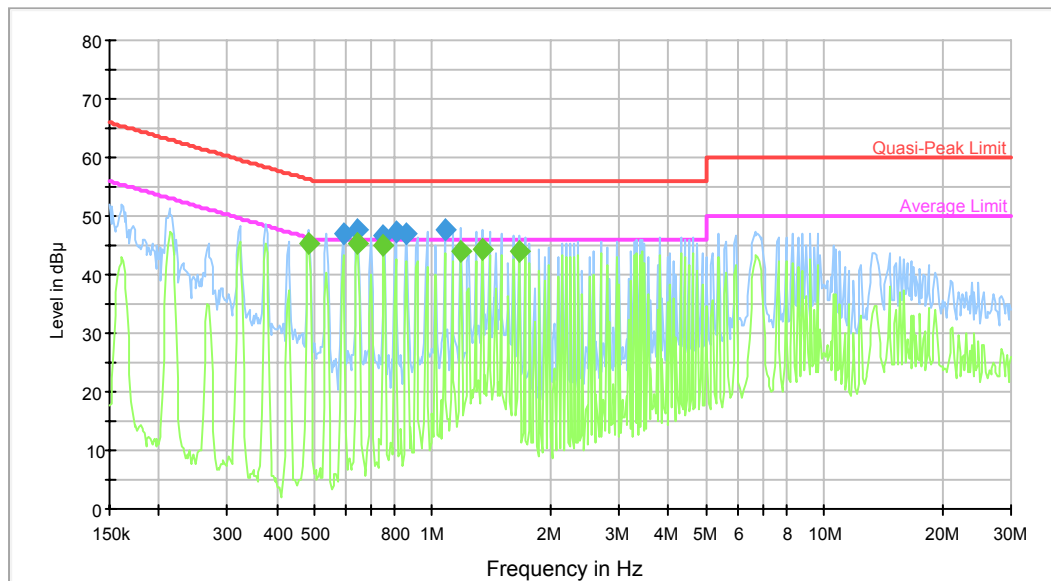
AC120 V, 60 Hz, Line:



| Frequency (MHz) | QuasiPeak (dB μ V) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dB μ V) | Comment |
|-----------------|------------------------|-----------------|------|------------|-------------|--------------------|------------|
| 0.590613 | 47.0 | 9.000 | L1 | 19.75 | 9.0 | 56.0 | Compliance |
| 0.644717 | 47.6 | 9.000 | L1 | 19.73 | 8.4 | 56.0 | Compliance |
| 0.805868 | 47.2 | 9.000 | L1 | 19.7 | 8.8 | 56.0 | Compliance |
| 0.858911 | 47.0 | 9.000 | L1 | 19.69 | 9.0 | 56.0 | Compliance |
| 1.073601 | 47.5 | 9.000 | L1 | 19.7 | 8.5 | 56.0 | Compliance |
| 1.181325 | 46.6 | 9.000 | L1 | 19.71 | 9.4 | 56.0 | Compliance |

| Frequency (MHz) | Average (dB μ V) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dB μ V) | Comment |
|-----------------|----------------------|-----------------|------|------------|-------------|--------------------|------------|
| 0.483938 | 45.5 | 9.000 | L1 | 19.73 | 0.8 | 46.3 | Compliance |
| 0.644717 | 45.1 | 9.000 | L1 | 19.73 | 0.9 | 46.0 | Compliance |
| 0.750100 | 45.0 | 9.000 | L1 | 19.7 | 1.0 | 46.0 | Compliance |
| 1.073601 | 44.2 | 9.000 | L1 | 19.7 | 1.8 | 46.0 | Compliance |
| 1.181325 | 43.7 | 9.000 | L1 | 19.71 | 2.3 | 46.0 | Compliance |
| 1.341955 | 43.7 | 9.000 | L1 | 19.7 | 2.3 | 46.0 | Compliance |

AC120 V, 60 Hz, Neutral:



| Frequency (MHz) | QuasiPeak (dBμV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) | Comment |
|-----------------|------------------|-----------------|------|------------|-------------|--------------|------------|
| 0.590613 | 46.8 | 9.000 | N | 19.58 | 9.2 | 56.0 | Compliance |
| 0.644717 | 47.6 | 9.000 | N | 19.58 | 8.4 | 56.0 | Compliance |
| 0.750100 | 46.8 | 9.000 | N | 19.61 | 9.2 | 56.0 | Compliance |
| 0.805868 | 47.5 | 9.000 | N | 19.62 | 8.5 | 56.0 | Compliance |
| 0.858911 | 47.1 | 9.000 | N | 19.64 | 8.9 | 56.0 | Compliance |
| 1.073601 | 47.5 | 9.000 | N | 19.65 | 8.5 | 56.0 | Compliance |

| Frequency (MHz) | Average (dBμV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) | Comment |
|-----------------|----------------|-----------------|------|------------|-------------|--------------|------------|
| 0.483938 | 45.3 | 9.000 | N | 19.63 | 1.0 | 46.3 | Compliance |
| 0.644717 | 45.2 | 9.000 | N | 19.58 | 0.8 | 46.0 | Compliance |
| 0.750100 | 45.1 | 9.000 | N | 19.61 | 0.9 | 46.0 | Compliance |
| 1.181325 | 43.9 | 9.000 | N | 19.64 | 2.1 | 46.0 | Compliance |
| 1.341955 | 44.2 | 9.000 | N | 19.64 | 1.8 | 46.0 | Compliance |
| 1.664073 | 44.1 | 9.000 | N | 19.65 | 1.9 | 46.0 | Compliance |

FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

Measurement Uncertainty

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If U_{lab} is less than or equal to U_{cispr} of Table 2, then:

–compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
–non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{lab} is greater than U_{cispr} of Table 2, then:

–compliance is deemed to occur if no measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit;
–non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit.

Based on CISPR 16-4-2-2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Chengdu) is:

30M~200MHz: ± 4.7 dB;

200M~1GHz: ± 6.0 dB;

1G~6GHz: ± 5.13 dB;

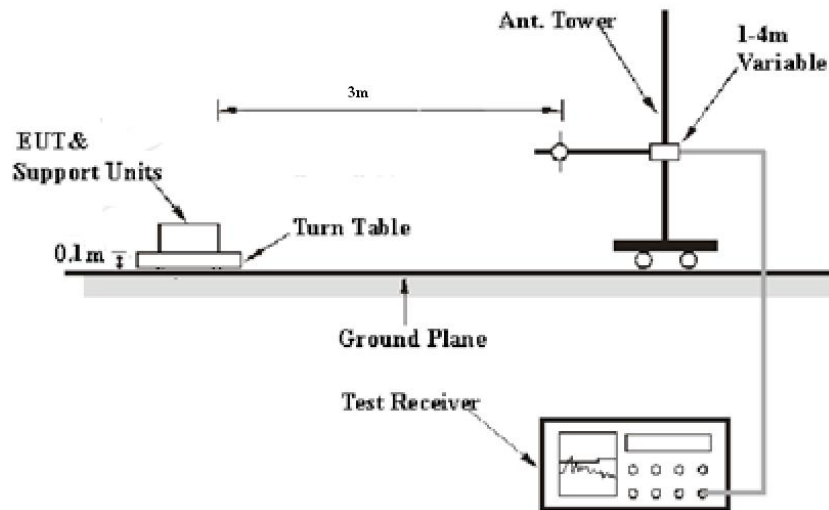
6G~25GHz: ± 5.47 dB;

Table 2 – Values of U_{cispr}

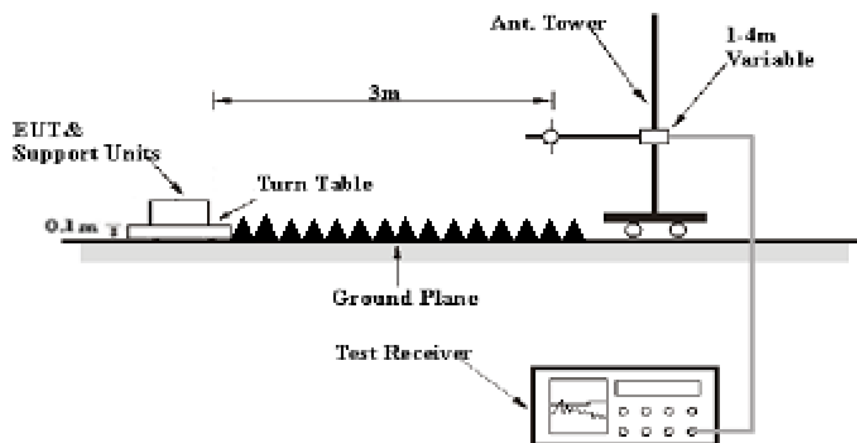
| Measurement | U_{cispr} |
|--|-------------|
| Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz) | 6.3 dB |
| Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz) | 5.2 dB |
| Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz) | 5.5 dB |

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

30MHz-1000MHz:

| Detector | RBW | Video B/W | IF B/W |
|----------|---------|-----------|--------|
| QP | 120 kHz | 300 kHz | 120kHz |

1GHz- 25GHz:

| Detector | Duty cycle | RBW | Video B/W |
|----------|------------|------|-----------|
| PK | Any | 1MHz | 3 MHz |
| Ave. | >98% | 1MHz | 10 Hz |
| | <98% | 1MHz | 1/T |

Note: T is minimum transmission duration

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Loss and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Loss} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|-----------------------|-----------------------|-------------|-----------------|------------------|----------------------|
| Agilent | Amplifier | 8447D | 2944A10442 | 2015-12-02 | 2016-12-01 |
| Rohde & Schwarz | EMI Test Receiver | ESCI | 100028 | 2015-12-02 | 2016-12-01 |
| Sunol Sciences | Broadband Antenna | JB3 | A101808 | 2016-04-10 | 2019-04-09 |
| Rohde & Schwarz | Spectrum Analyzer | FSEM30 | 100018 | 2015-12-02 | 2016-12-01 |
| ETS | Horn Antenna | 3115 | 003-6076 | 2015-12-02 | 2016-12-01 |
| Ducommun Technologies | Horn Antenna | ARH-4223-02 | 1007726-0113024 | 2014-06-16 | 2017-06-15 |
| Mini-circuits | Amplifier | ZVA-183-S+ | 771001215 | 2016-05-20 | 2017-05-19 |
| HP | Amplifier | 8449B | 3008A00277 | 2015-12-02 | 2016-12-01 |
| EMCT | Semi-Anechoic Chamber | 966 | N/A | 2015-04-24 | 2018-04-23 |
| N/A | RF Cable (below 1GHz) | NO.1 | N/A | 2016-11-10 | 2017-11-09 |
| N/A | RF Cable (below 1GHz) | NO.4 | N/A | 2016-11-10 | 2017-11-09 |
| N/A | RF Cable (above 1GHz) | NO.2 | N/A | 2016-11-10 | 2017-11-09 |

* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Section 15.205, 15.209 and 15.247.

Test Data

Environmental Conditions

| | |
|--------------------|----------|
| Temperature: | 24.3 °C |
| Relative Humidity: | 34 % |
| ATM Pressure: | 101.3kPa |

* The testing was performed by Lorin Bian on 2016-11-12.

30MHz-25GHz:

| Frequency (MHz) | Receiver | | Rx Antenna | | Cable loss (dB) | Amplifier Gain (dB) | Corrected Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|--------------------------|-------------------|----------|----------------|----------------|-----------------------|---------------------------|------------------------------------|-------------------|----------------|
| | Reading (dBμV) | Detector | Polar (H/V) | Factor (dB) | | | | | |
| Low Channel: 2402 MHz | | | | | | | | | |
| 2402 | 56.64 | PK | H | 23.53 | 3.00 | 0.00 | 83.17 | N/A | N/A |
| 2402 | 54.78 | AV | H | 23.53 | 3.00 | 0.00 | 81.31 | N/A | N/A |
| 2402 | 55.63 | PK | V | 23.53 | 3.00 | 0.00 | 82.16 | N/A | N/A |
| 2402 | 53.28 | AV | V | 23.53 | 3.00 | 0.00 | 79.81 | N/A | N/A |
| 2390 | 25.33 | PK | H | 23.57 | 3.00 | 0.00 | 51.90 | 74.00 | 22.10 |
| 2390 | 16.54 | AV | H | 23.57 | 3.00 | 0.00 | 43.11 | 54.00 | 10.89 |
| 4804 | 41.74 | PK | H | 30.77 | 5.12 | 26.87 | 50.76 | 74.00 | 23.24 |
| 4804 | 35.22 | AV | H | 30.77 | 5.12 | 26.87 | 44.24 | 54.00 | 9.76 |
| 7206 | 32.52 | PK | H | 34.71 | 6.16 | 26.35 | 47.04 | 74.00 | 26.96 |
| 7206 | 26.15 | AV | H | 34.71 | 6.16 | 26.35 | 40.67 | 54.00 | 13.33 |
| 1256 | 31.05 | PK | H | 23.47 | 2.33 | 26.56 | 30.29 | 74.00 | 43.71 |
| 1256 | 24.34 | AV | H | 23.47 | 2.33 | 26.56 | 23.58 | 54.00 | 30.42 |
| 40.67 | 48.32 | QP | V | 14.70 | 0.34 | 28.52 | 34.84 | 40.00 | 5.16 |
| 80.44 | 50.48 | QP | V | 8.14 | 0.46 | 28.39 | 30.69 | 40.00 | 9.31 |
| Middle Channel: 2440 MHz | | | | | | | | | |
| 2440 | 57.05 | PK | H | 23.40 | 3.00 | 0.00 | 83.45 | N/A | N/A |
| 2440 | 55.84 | AV | H | 23.40 | 3.00 | 0.00 | 82.24 | N/A | N/A |
| 2440 | 53.29 | PK | V | 23.40 | 3.00 | 0.00 | 79.69 | N/A | N/A |
| 2440 | 52.06 | AV | V | 23.40 | 3.00 | 0.00 | 78.46 | N/A | N/A |
| 4880 | 42.06 | PK | H | 31.02 | 5.09 | 26.87 | 51.30 | 74.00 | 22.70 |
| 4880 | 35.63 | AV | H | 31.02 | 5.09 | 26.87 | 44.87 | 54.00 | 9.13 |
| 7320 | 33.25 | PK | H | 34.94 | 6.22 | 26.40 | 48.01 | 74.00 | 25.99 |
| 7320 | 27.16 | AV | H | 34.94 | 6.22 | 26.40 | 41.92 | 54.00 | 12.08 |
| 1305 | 32.27 | PK | H | 23.59 | 2.40 | 26.52 | 31.74 | 74.00 | 42.26 |
| 1305 | 26.38 | AV | H | 23.59 | 2.40 | 26.52 | 25.85 | 54.00 | 28.15 |
| 2252 | 31.64 | PK | H | 24.04 | 3.02 | 26.86 | 31.84 | 74.00 | 42.16 |
| 2252 | 25.73 | AV | H | 24.04 | 3.02 | 26.86 | 25.93 | 54.00 | 28.07 |
| 40.67 | 48.77 | QP | V | 14.70 | 0.34 | 28.52 | 35.29 | 40.00 | 4.71 |
| 80.44 | 50.29 | QP | V | 8.14 | 0.46 | 28.39 | 30.50 | 40.00 | 9.50 |
| High Channel: 2480 MHz | | | | | | | | | |
| 2480 | 56.06 | PK | H | 23.27 | 2.99 | 0.00 | 82.32 | N/A | N/A |
| 2480 | 54.97 | AV | H | 23.27 | 2.99 | 0.00 | 81.23 | N/A | N/A |
| 2480 | 55.31 | PK | V | 23.27 | 2.99 | 0.00 | 81.57 | N/A | N/A |
| 2480 | 54.09 | AV | V | 23.27 | 2.99 | 0.00 | 80.35 | N/A | N/A |
| 2483.5 | 27.53 | PK | H | 23.26 | 2.99 | 0.00 | 53.78 | 74.00 | 20.22 |
| 2483.5 | 17.13 | AV | H | 23.26 | 2.99 | 0.00 | 43.38 | 54.00 | 10.62 |
| 4960 | 37.84 | PK | H | 31.27 | 5.05 | 26.88 | 47.28 | 74.00 | 26.72 |
| 4960 | 31.05 | AV | H | 31.27 | 5.05 | 26.88 | 40.49 | 54.00 | 13.51 |
| 7440 | 31.25 | PK | H | 35.18 | 6.27 | 26.45 | 46.25 | 74.00 | 27.75 |
| 7440 | 25.22 | AV | H | 35.18 | 6.27 | 26.45 | 40.22 | 54.00 | 13.78 |
| 1437 | 31.46 | PK | H | 23.94 | 2.58 | 26.39 | 31.59 | 74.00 | 42.41 |
| 1437 | 25.33 | AV | H | 23.94 | 2.58 | 26.39 | 25.46 | 54.00 | 28.54 |
| 40.67 | 49.28 | QP | V | 14.70 | 0.34 | 28.52 | 35.80 | 40.00 | 4.20 |
| 80.44 | 51.27 | QP | V | 8.14 | 0.46 | 28.39 | 31.48 | 40.00 | 8.52 |

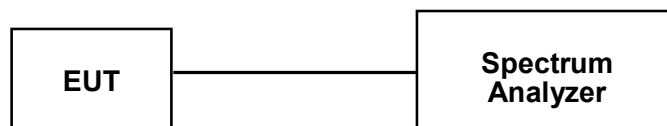
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

Applicable Standard

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Procedure

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW) $\geq 3 \times$ RBW
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|-----------------|--------|---------------|------------------|----------------------|
| Rohde & Schwarz | Signal Analyzer | FSIQ26 | 831929/005 | 2016-09-21 | 2017-09-20 |
| N/A | RF Cable | N/A | N/A | Each Time | / |

* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

| | |
|--------------------|---------|
| Temperature: | 25.6 °C |
| Relative Humidity: | 31 % |
| ATM Pressure: | 101 kPa |

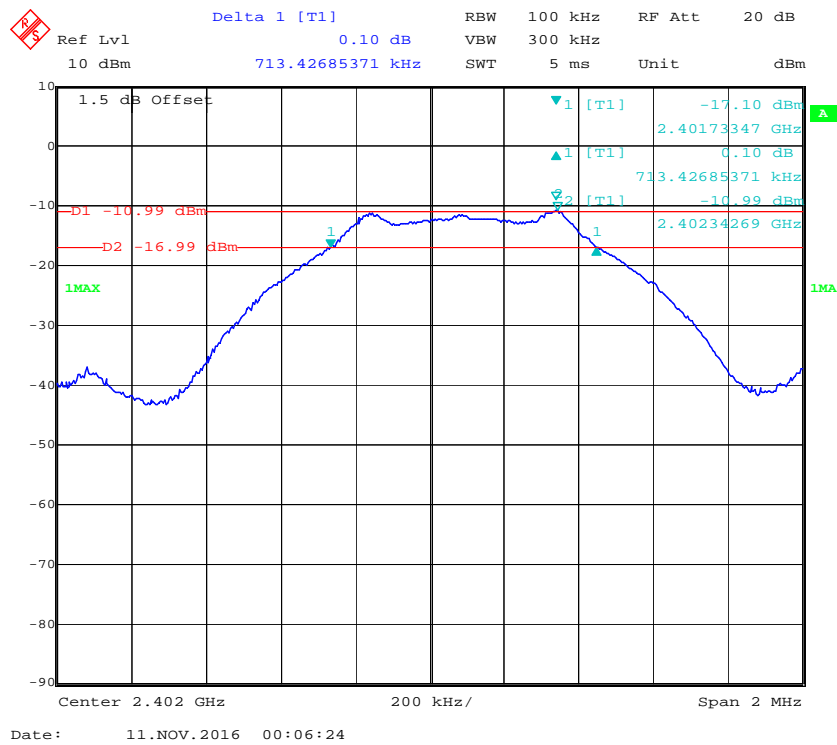
* The testing was performed by Lorin Bian on 2016-11-11.

Test Mode: Transmitting

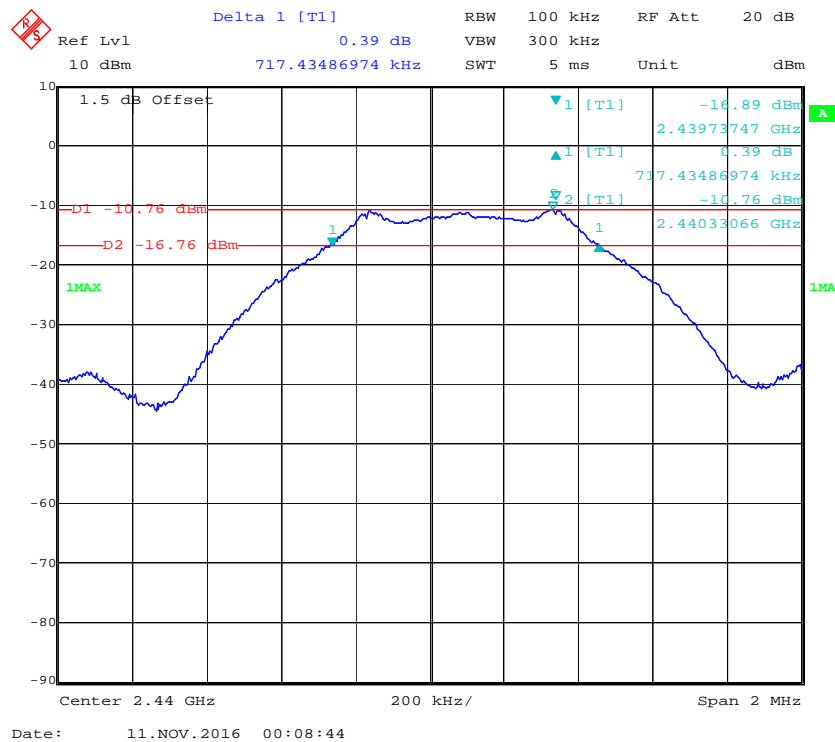
Test Result: Compliant. Please refer to the following table and plots.

| Channel | Frequency (MHz) | 6 dB Bandwidth (MHz) | Limit (MHz) |
|---------|-----------------|----------------------|-------------|
| Low | 2402 | 0.71 | ≥0.5 |
| Middle | 2440 | 0.72 | ≥0.5 |
| High | 2480 | 0.72 | ≥0.5 |

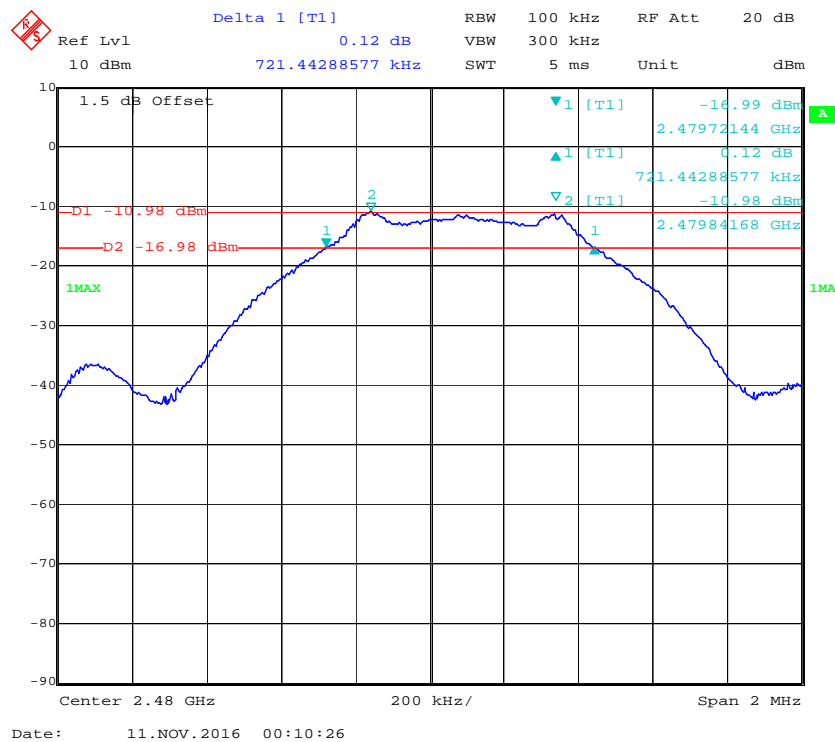
BLE Low Channel



BLE Middle Channel



BLE High Channel



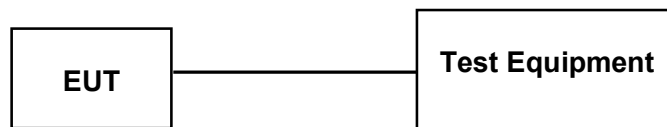
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to test equipment.
3. Add a correction factor to the display.



Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|-----------------|--------|---------------|------------------|----------------------|
| Rohde & Schwarz | Signal Analyzer | FSIQ26 | 831929/005 | 2016-09-21 | 2017-09-20 |
| N/A | RF Cable | N/A | N/A | Each Time | / |

* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

| | |
|--------------------|---------|
| Temperature: | 25.6 °C |
| Relative Humidity: | 31 % |
| ATM Pressure: | 101 kPa |

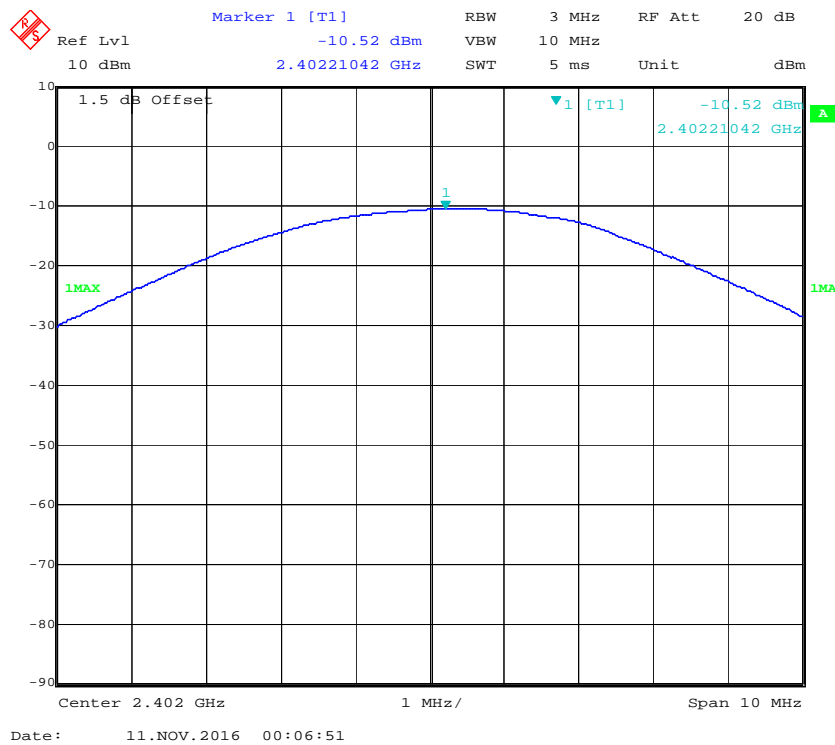
* The testing was performed by Lorin Bian on 2016-11-11.

Test Mode: Transmitting

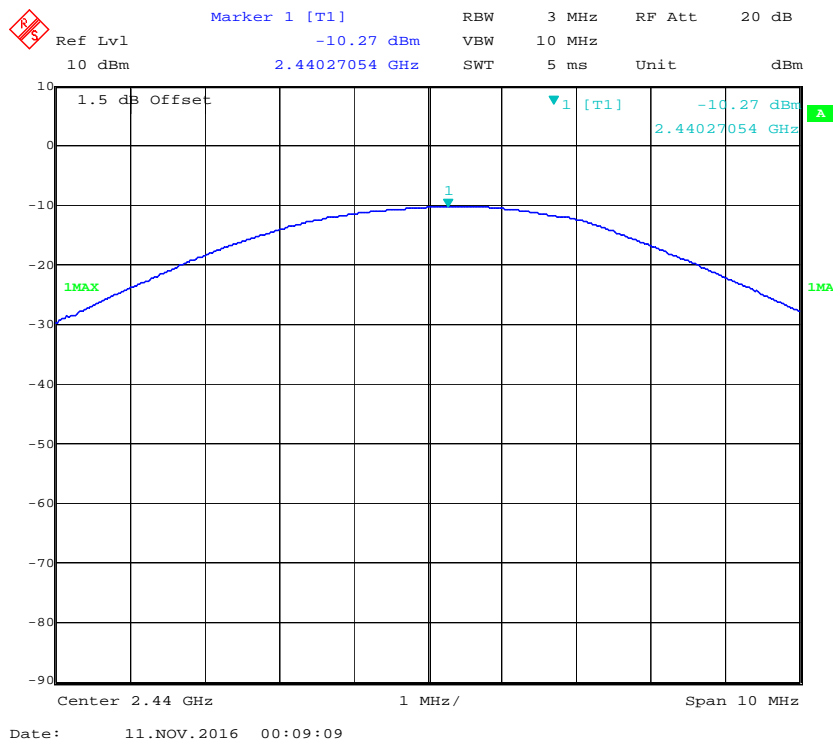
Test Result: Compliant. Please refer to the following table.

| Channel | Frequency (MHz) | Max Peak Conducted Output Power (dBm) | Limit (dBm) |
|---------|-----------------|---------------------------------------|-------------|
| Low | 2402 | -10.52 | 30 |
| Middle | 2440 | -10.27 | 30 |
| High | 2480 | -10.27 | 30 |

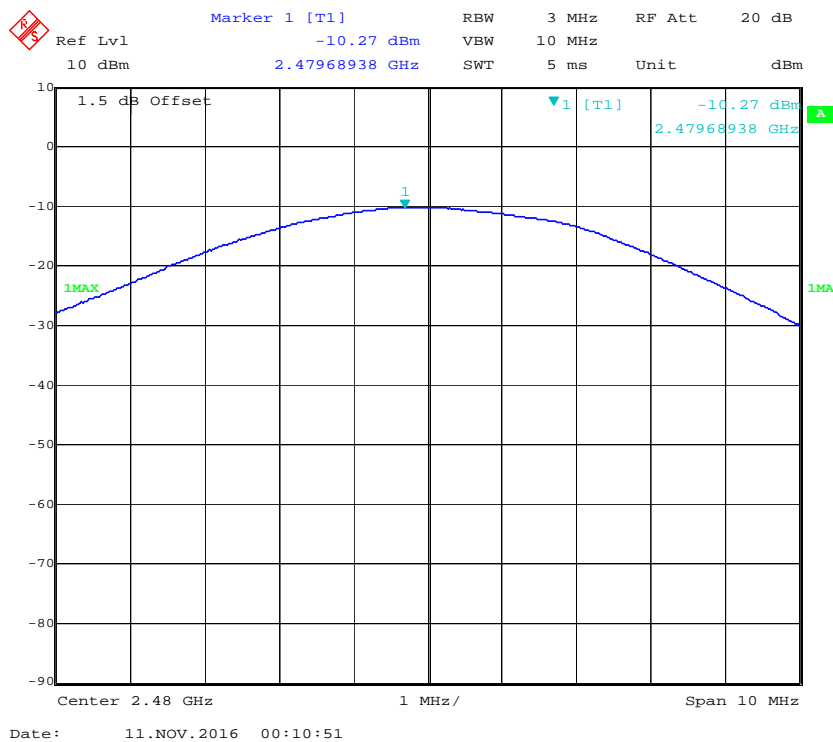
Low Channel



Middle Channel



High Channel



FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---------------------|--------------------|--------------|----------------------|-------------------------|-----------------------------|
| Rohde & Schwarz | Signal Analyzer | FSIQ26 | 831929/005 | 2016-09-21 | 2017-09-20 |
| N/A | RF Cable | N/A | N/A | Each Time | / |

* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

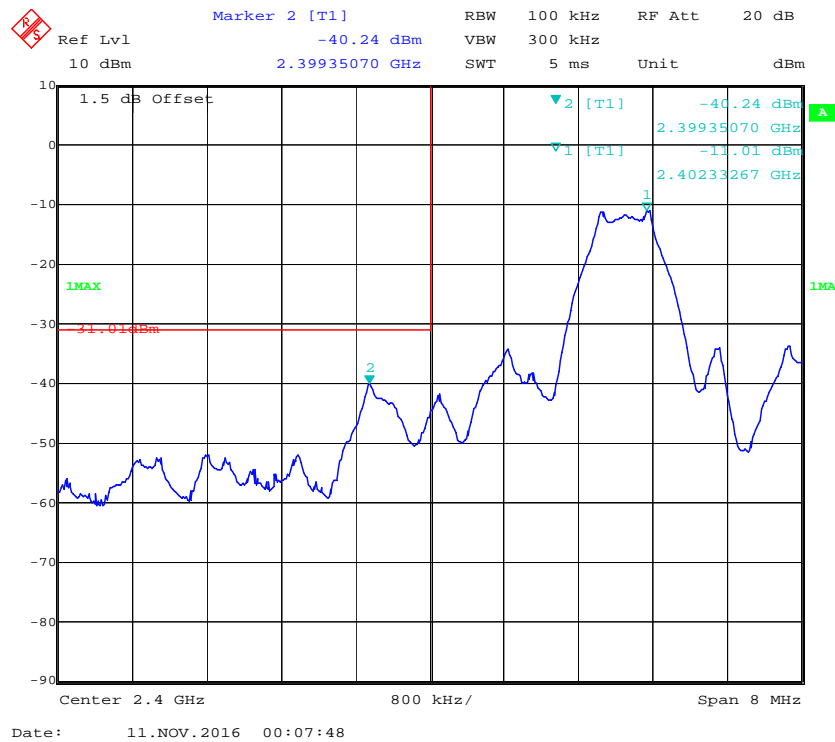
| | |
|--------------------|---------|
| Temperature: | 25.6 °C |
| Relative Humidity: | 31 % |
| ATM Pressure: | 101 kPa |

* The testing was performed by Lorin Bian on 2016-11-11.

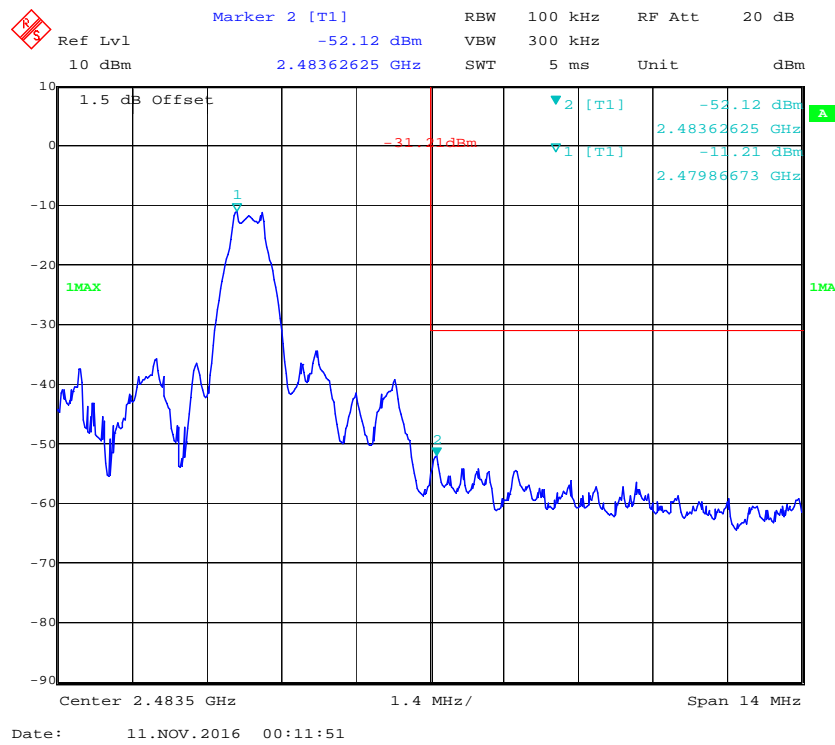
Test mode: Transmitting

Test Result: Compliant. Please refer to following plots.

BLE Band Edge, Left Side



BLE Band Edge, Right Side



FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

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.
- j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|-----------------|--------|---------------|------------------|----------------------|
| Rohde & Schwarz | Signal Analyzer | FSIQ26 | 831929/005 | 2016-09-21 | 2017-09-20 |
| N/A | RF Cable | N/A | N/A | Each Time | / |

* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

| | |
|--------------------|---------|
| Temperature: | 25.6 °C |
| Relative Humidity: | 31 % |
| ATM Pressure: | 101 kPa |

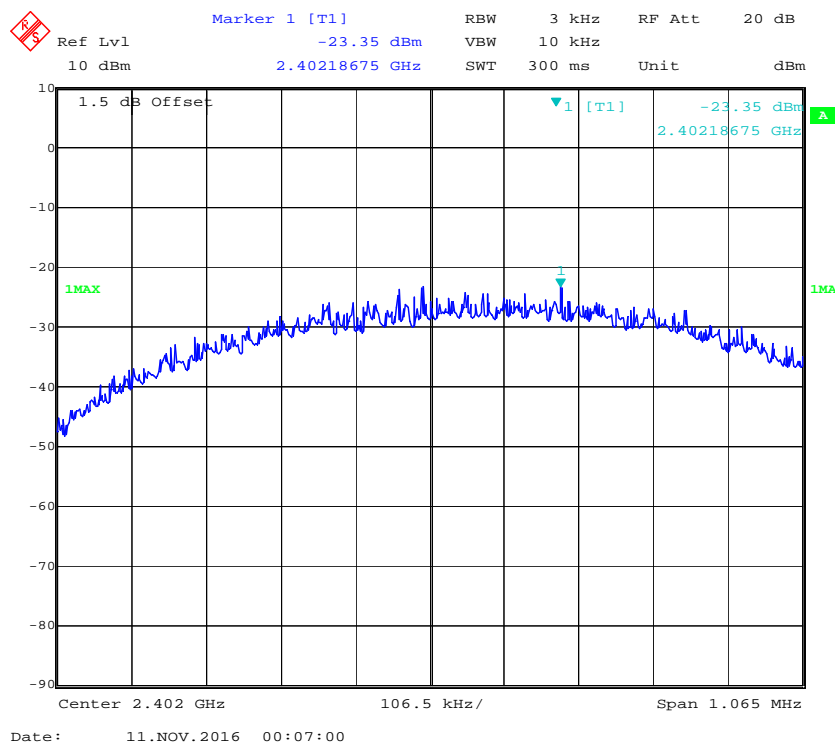
* The testing was performed by Lorin Bian on 2016-11-11.

Test Mode: Transmitting

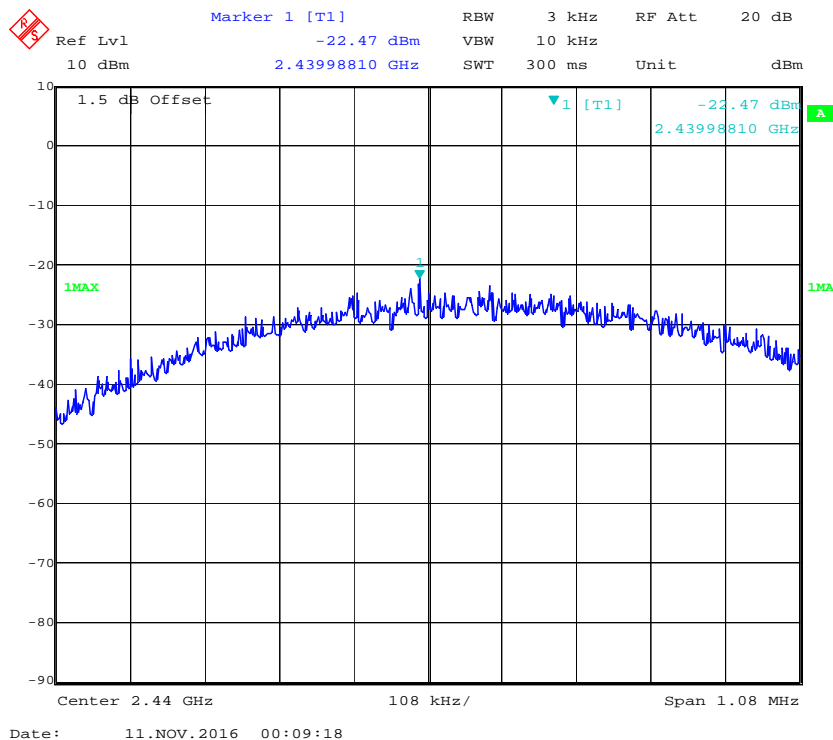
Test Result: Compliant. Please refer to the following table and plots

| Channel | Frequency (MHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) |
|---------|-----------------|----------------|------------------|
| Low | 2402 | -23.35 | ≤8 |
| Middle | 2440 | -22.47 | ≤8 |
| High | 2480 | -23.07 | ≤8 |

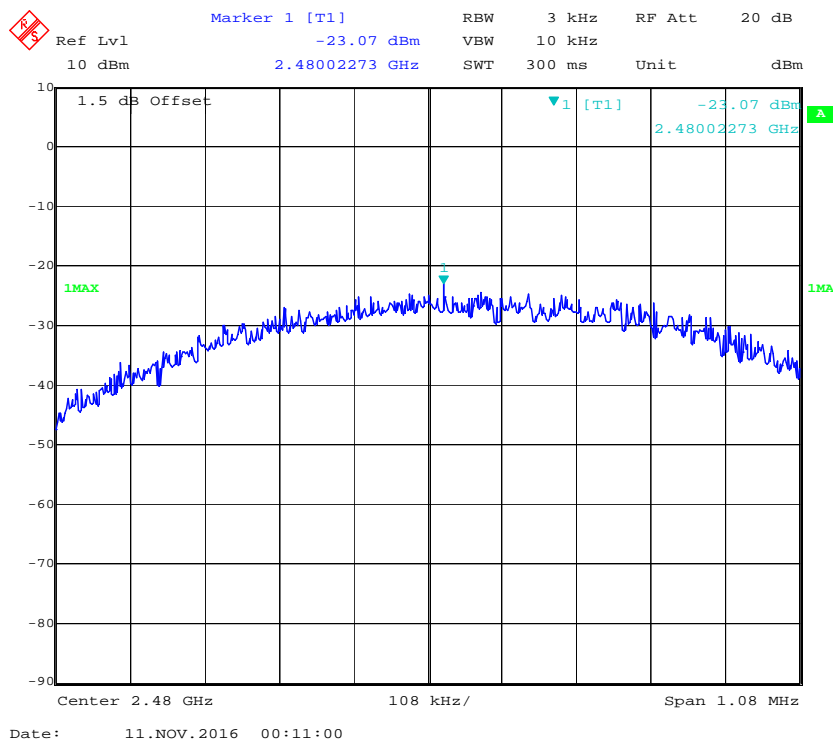
Low Channel



Middle Channel



High Channel



***** END OF REPORT *****