

FCC PART 15.247
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TEST REPORT

For

SZ DJI Osmo Technology Co.,Ltd.

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Nanshan District, Shenzhen, China

FCC ID: 2ANDR-R2TX11708
IC: 23060-R2TX11708

| | |
|--|---|
| Report Type: Original Report | Product Name: RONIN 2 TX1 |
| Report Number: RDG170730008-00B | |
| Report Date: 2017-08-24 | |
| Jerry Zhang | |
| Reviewed By: | EMC Manager |
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Note: This test report is 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. (Dongguan).

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *SZ DJI Osmo Technology Co.,Ltd.*'s product, model number: *R2-TX1* (**FCC ID:2ANDR-R2TX11708, IC: 23060-R2TX11708**) (the "EUT") in this report was a *RONIN 2 TX1*, which was measured approximately: 170 mm (L) x 35 mm (W) x 115 mm (H), rated input voltage: DC 3.7V from battery DC 5V from USB port.

All measurement and test data in this report was gathered from production sample serial number: 170730008 (Assigned by BACL, Dongguan). The EUT was received on 2017-07-30.

Objective

This report is prepared on behalf of ***SZ DJI Osmo Technology Co.,Ltd.*** in accordance with Part 2, Subpart J, Part 15, Subparts A, and C of the Federal Communications Commission's rules and RSS-247, Issue 2, February 2017 of the Innovation, Science and Economic Development Canada, RSS-Gen Issue 4, November 2014 of the Innovation, Science and Economic Development Canada.

The tests were performed in order to determine the compliance of the EUT with FCC Rules Part 15-Subpart C, section 15.203, 15.205, 15.207, 15.209, 15.247 rules and RSS-247, Issue 2, February 2017, RSS-Gen Issue 4, November 2014 of the Innovation, Science and Economic Development Canada.

Related Submittal(s)/Grant(s)

FCC submissions with Part 15E NII, FCC ID: 2ANDR-R2TX11708.

ISED submissions with RSS-247 LE-LAN, IC: 23060-R2TX11708.

Part of system submissions with FCC: 2ANDR-R21708, IC: 23060-R21708.

Test Methodology

All measurements detailed in this Test Report were performed in accordance with ANSI C63.10-2013 "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices". And RSS-247, Issue 2, February 2017 of the Innovation, Science and Economic Development Canada, RSS-Gen Issue 4, November 2014 of the Innovation, Science and Economic Development Canada.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

Measurement Uncertainty

| Parameter | Measurement Uncertainty |
|-----------------------------------|--|
| Occupied Channel Bandwidth | ±5 % |
| RF output power, conducted | ±0.61dB |
| Power Spectral Density, conducted | ±0.61 dB |
| Unwanted Emissions, radiated | 30M~200MHz: 4.58 dB for Horizontal, 4.59 dB for Vertical 200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical 1G~6GHz: 4.45 dB, 6G~26.5GHz: 5.23 dB |
| Unwanted Emissions | ±1.5 dB |
| Temperature | ±1 °C |
| Humidity | ±5% |
| DC and low frequency voltages | ±0.4% |
| Duty Cycle | 1% |
| AC Power Lines Conducted Emission | 3.12 dB (150 kHz to 30 MHz) |

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China

Bay Area Compliance Laboratories Corp. (Dongguan) has been accredited to ISO 17025 by CNAS(Lab code: L5662). And accredited to ISO 17025 by NVLAP(Test Laboratory Accreditation Certificate Number 500069-0), the FCC Designation No. CN5002 under the KDB 974614 D01.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Bay Area Compliance Laboratories Corp. (Dongguan) was registered with ISED Canada under ISED Canada Registration Number 3062D.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in engineering mode, which was provided by manufacturer.

The system employed FHSS technology, total 46 channels was used:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|
| 1 | 2408 | 24 | 2442.5 |
| 2 | 2409.5 | ... | ... |
| ... | ... | ... | ... |
| ... | ... | ... | ... |
| ... | ... | 45 | 2474 |
| 23 | 2441 | 46 | 2475.5 |

3 channels were tested: 2408MHz, 2442.5MHz and 2475.5MHz

EUT Exercise Software

The software “HG910-wireless_authority-v3.2.10.10-beta3 - special- baudrate256000” was used for testing, which was provided by manufacturer. The maximum power level was configured as below table:

| | | | |
|-----------------------|---|-----------|-----------|
| Test Software Version | HG910-wireless_authority-v3.2.10.10-beta3 - special- baudrate256000 | | |
| Test Frequency | 2408MHz | 2442.5MHz | 2475.5MHz |
| GFSK | 30 | 35 | 35 |

Equipment Modifications

No modification was made to the EUT.

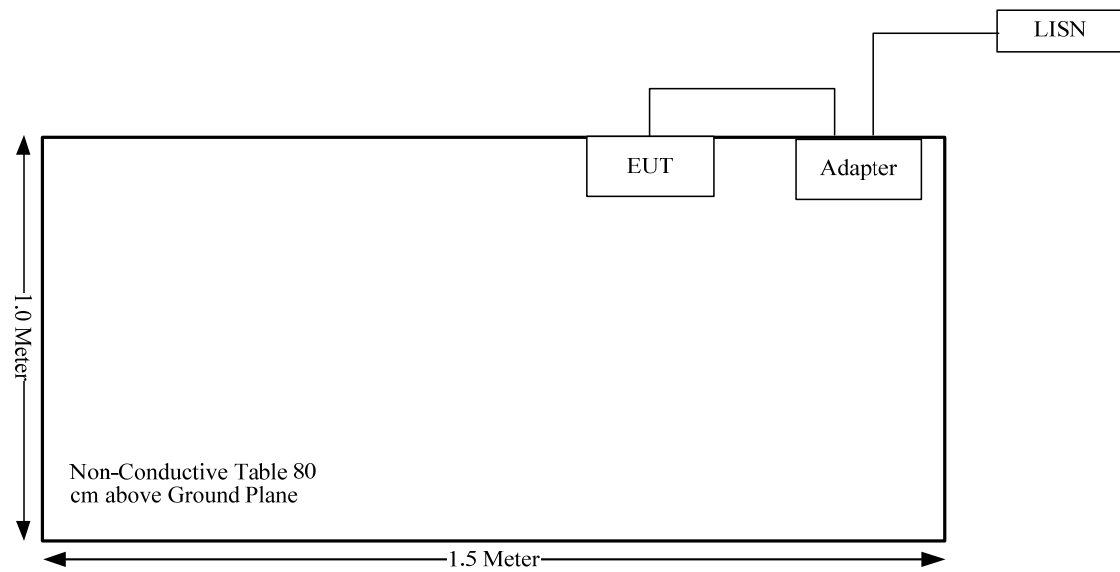
Support Equipment List and Details

| Manufacturer | Description | Model | Serial Number |
|--------------|-------------|-------|---------------|
| RAMNIU | AC ADAPTER | FN45 | UNBC0501G0UF |

Support Cable List and Details

| Cable Description | Shielding Type | Ferrite Core | Length (m) | From Port | To |
|-------------------|----------------|--------------|------------|-----------|-----|
| Type C Cable | yes | yes | 1.00 | Adapter | EUT |

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

| Rules | Description of Test | Result |
|--|----------------------------------|------------|
| FCC §15.247 (i) & §1.1310 & §2.1093 RSS-102 §4 | RF Exposure | Compliance |
| FCC§15.203 RSS-Gen Clause 8.3 | Antenna Requirement | Compliance |
| FCC§15.207 (a) RSS-Gen Clause 8.8 | Conducted Emissions | Compliance |
| FCC§15.205, §15.209, FCC §15.247(d) RSS-247 Clause 5.5, RSS-Gen Clause 8.10 | Spurious Emissions | Compliance |
| FCC§15.247 (a)(1) RSS-247 Clause 5.1 b) RSS-Gen Clause 6.6 | Emission Bandwidth | Compliance |
| FCC§15.247(a)(1) RSS-247 Clause 5.1 b) | Channel Separation Test | Compliance |
| FCC§15.247(a)(1)(iii) RSS-247 Clause 5.1 d) | Time of Occupancy (Dwell Time) | Compliance |
| FCC§15.247(a)(1)(iii) RSS-247 Clause 5.1 d) | Quantity of hopping channel Test | Compliance |
| FCC§15.247(b)(1) RSS-247 Clause 5.4 b) | Peak Output Power Measurement | Compliance |
| FCC§15.247(d) RSS-247 Clause 5.5 | Band Edges | Compliance |

FCC §15.247 (i) & §1.1310 & §2.1093, RSS-102 §4- RF EXPOSURE**Applicable Standard**

According to §15.247(i), §1.1310 and §2.1093.

According to RSS-102 §4 Table 3, SAR limits for device used by the general public

| Body Region | Average SAR (W/Kg) | Averaging Time (minutes) | Mass Average (g) |
|--------------------------------|-----------------------|-----------------------------|---------------------|
| Whole Body | 0.08 | 6 | Whole Body |
| Localized Head, Neck and Trunk | 1.6 | 6 | 1 |
| Localized Limbs | 4 | 6 | 10 |

Test Result

Compliant, please refer to the SAR report: RDG170703008-20A for FCC and RDG170703008-20B for Canada ISED.

FCC §15.203& RSS-GEN CLAUSE 8.3 - ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 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 use of a standard antenna jack or electrical connector is prohibited.

According to RSS-Gen §8.3, The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

Antenna Connector Construction

The EUT has one internal antenna arrangement, and the antenna gain is 1.5 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

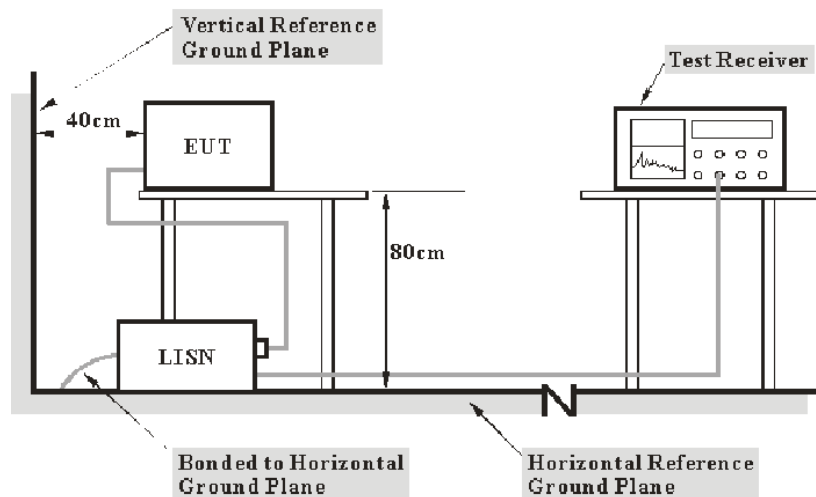
Result: Compliance.

FCC §15.207 (a)& RSS-GEN CLAUSE 8.8 – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207(a) and RSS-GEN CLAUSE 8.8

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 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 and RSS-Gen clause 8.8 limits.

The spacing between the peripherals was 10 cm.

The adapter was connected to the main lisn with 120 V/60 Hz AC power.

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 outlet of 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:

$$V_C = V_R + A_C + VDF$$

Herein,

V_C : corrected voltage amplitude

V_R : reading voltage amplitude

A_C : attenuation caused by cable loss

VDF: voltage division factor of AMN or ISN

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 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 |
|--------------|--------------------|---------|---------------|------------------|----------------------|
| R&S | EMI Test Receiver | ESCS 30 | 830245/006 | 2016-12-08 | 2017-12-08 |
| R&S | L.I.S.N | ESH2-Z5 | 892107/021 | 2016-09-01 | 2017-09-01 |
| R&S | Two-line V-network | ENV 216 | 3560.6550.12 | 2016-12-08 | 2017-12-08 |
| R&S | Test Software | EMC32 | Version8.53.0 | N/A | N/A |
| Unknown | Coaxial Cable | 2m | Con-1 | 2016-09-01 | 2017-09-01 |

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

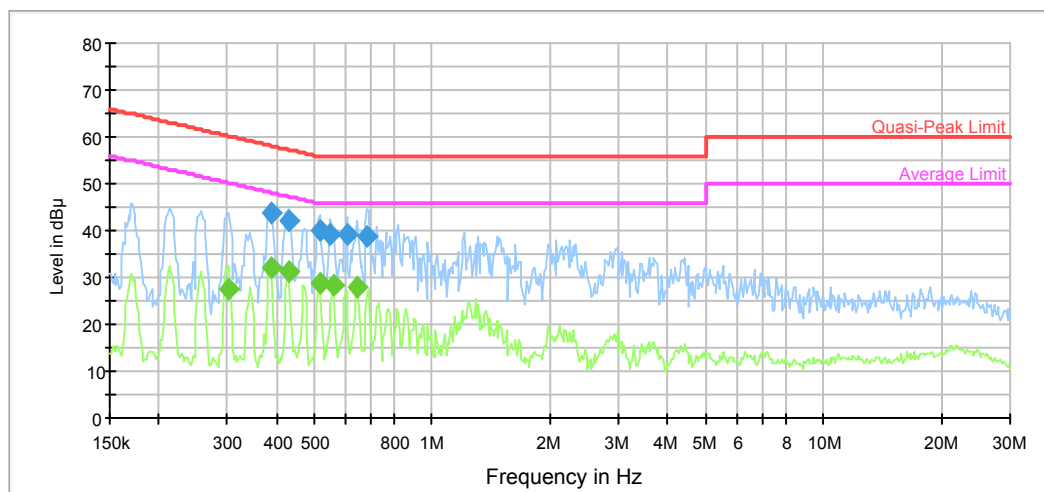
Environmental Conditions

| | |
|--------------------|-----------|
| Temperature: | 26.8 °C |
| Relative Humidity: | 48 % |
| ATM Pressure: | 100.2 kPa |

The testing was performed by Gaochao Gong on 2017-08-12.

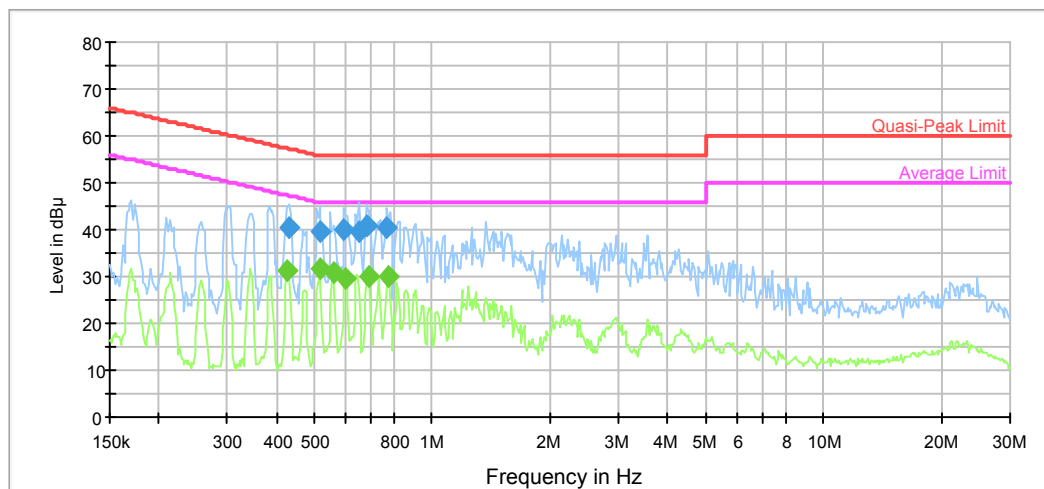
Test Mode: Transmitting

AC120 V, 60 Hz, Line:



| Frequency (MHz) | QuasiPeak (dBμV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) | Comment |
|-----------------|------------------|-----------------|------|------------|-------------|--------------|------------|
| 0.387164 | 43.6 | 9.000 | L1 | 10.0 | 14.5 | 58.1 | Compliance |
| 0.429420 | 41.9 | 9.000 | L1 | 9.9 | 15.4 | 57.3 | Compliance |
| 0.515791 | 39.9 | 9.000 | L1 | 9.9 | 16.1 | 56.0 | Compliance |
| 0.549741 | 39.1 | 9.000 | L1 | 9.9 | 16.9 | 56.0 | Compliance |
| 0.604902 | 39.2 | 9.000 | L1 | 9.8 | 16.8 | 56.0 | Compliance |
| 0.681699 | 39.0 | 9.000 | L1 | 9.8 | 17.0 | 56.0 | Compliance |

| Frequency (MHz) | Average (dBμV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) | Comment |
|-----------------|----------------|-----------------|------|------------|-------------|--------------|------------|
| 0.302425 | 27.4 | 9.000 | L1 | 10.1 | 22.8 | 50.2 | Compliance |
| 0.387164 | 32.2 | 9.000 | L1 | 10.0 | 15.9 | 48.1 | Compliance |
| 0.429420 | 31.3 | 9.000 | L1 | 9.9 | 16.0 | 47.3 | Compliance |
| 0.515791 | 28.6 | 9.000 | L1 | 9.9 | 17.4 | 46.0 | Compliance |
| 0.558572 | 28.4 | 9.000 | L1 | 9.8 | 17.6 | 46.0 | Compliance |
| 0.644717 | 28.0 | 9.000 | L1 | 9.8 | 18.0 | 46.0 | Compliance |

AC120 V, 60 Hz, Neutral:

| Frequency (MHz) | QuasiPeak (dBμV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) | Comment |
|-----------------|------------------|-----------------|------|------------|-------------|--------------|------------|
| 0.432855 | 40.3 | 9.000 | N | 9.9 | 16.9 | 57.2 | Compliance |
| 0.515791 | 39.5 | 9.000 | N | 9.9 | 16.5 | 56.0 | Compliance |
| 0.595338 | 40.0 | 9.000 | N | 9.8 | 16.0 | 56.0 | Compliance |
| 0.649874 | 39.7 | 9.000 | N | 9.8 | 16.3 | 56.0 | Compliance |
| 0.681699 | 40.9 | 9.000 | N | 9.8 | 15.1 | 56.0 | Compliance |
| 0.768247 | 40.4 | 9.000 | N | 9.8 | 15.6 | 56.0 | Compliance |

| Frequency (MHz) | Average (dBμV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) | Comment |
|-----------------|----------------|-----------------|------|------------|-------------|--------------|------------|
| 0.426011 | 31.4 | 9.000 | N | 9.9 | 15.9 | 47.3 | Compliance |
| 0.515791 | 31.8 | 9.000 | N | 9.9 | 14.2 | 46.0 | Compliance |
| 0.558572 | 30.9 | 9.000 | N | 9.8 | 15.1 | 46.0 | Compliance |
| 0.600101 | 29.5 | 9.000 | N | 9.8 | 16.5 | 46.0 | Compliance |
| 0.687153 | 30.1 | 9.000 | N | 9.8 | 15.9 | 46.0 | Compliance |
| 0.774393 | 30.0 | 9.000 | N | 9.8 | 16.0 | 46.0 | Compliance |

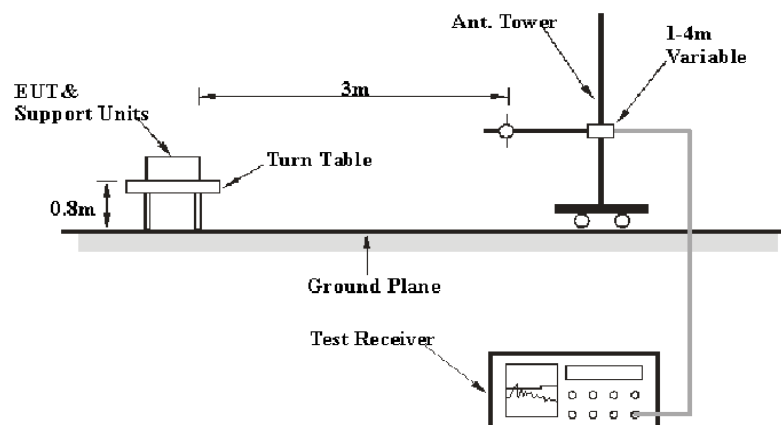
FCC §15.209, §15.205 & §15.247(d) & RSS-247 CLAUSE 5.5, RSS-GEN CLAUSE 8.10- SPURIOUS EMISSIONS

Applicable Standard

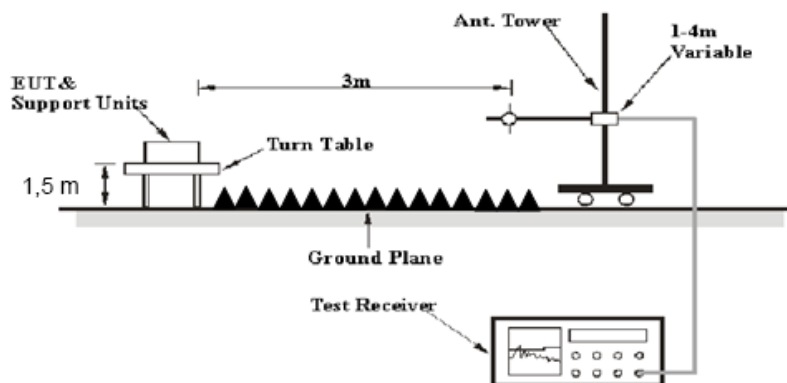
FCC §15.247 (d); §15.209; §15.205; RSS-247 Clause 5.5, RSS-GEN Clause 8.10

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters distance, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, 15.247 and RSS-247 Clause 5.5, RSS-GEN Clause 8.10 limits.

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

The spacing between the peripherals was 10 cm.

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:

| Frequency Range | RBW | Video B/W | IF B/W | Detector |
|-------------------|---------|-----------|---------|----------|
| 30 MHz – 1000 MHz | 120 kHz | 300 kHz | 120 kHz | QP |
| Above 1 GHz | 1MHz | 3 MHz | / | PK |
| | 1MHz | 10 Hz | / | AV |

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.

Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|-----------------------|-------------------|-----------------|--------------------|------------------|----------------------|
| R&S | EMI Test Receiver | ESCI | 100224 | 2016-09-01 | 2017-08-31 |
| Sunol Sciences | Antenna | JB3 | A060611-1 | 2014-11-06 | 2017-11-05 |
| HP | Amplifier | 8447E | 2434A02181 | 2016-09-01 | 2017-09-01 |
| R&S | Spectrum Analyzer | FSU 26 | 200256 | 2016-12-08 | 2017-12-08 |
| ETS-Lindgren | Horn Antenna | 3115 | 000 527 35 | 2016-01-05 | 2019-01-04 |
| Ducommun Technologies | Horn Antenna | ARH-4223-02 | 1007726-02 1304 | 2017-06-16 | 2020-06-15 |
| Mini-Circuit | Amplifier | ZVA-213-S+ | SN054201245 | 2017-02-19 | 2018-02-19 |
| Quinstar | Amplifier | QLW-18405536-JO | 15964001001 | 2016-09-06 | 2017-09-06 |
| Unknown | Coaxial Cable | Chamber A-1 | 4m | 2016-09-01 | 2017-09-01 |
| Unknown | Coaxial Cable | Chamber B-1 | 0.75m | 2016-09-01 | 2017-09-01 |
| Unknown | Coaxial Cable | Chamber A-2 | 10m | 2016-09-01 | 2017-09-01 |
| Unknown | Coaxial Cable | Chamber B-2 | 8m | 2016-09-01 | 2017-09-01 |
| Farad | Test Software | EZ-EMC | V1.1.4.2 | N/A | N/A |

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Corrected Amplitude & Margin Calculation

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

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

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:

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

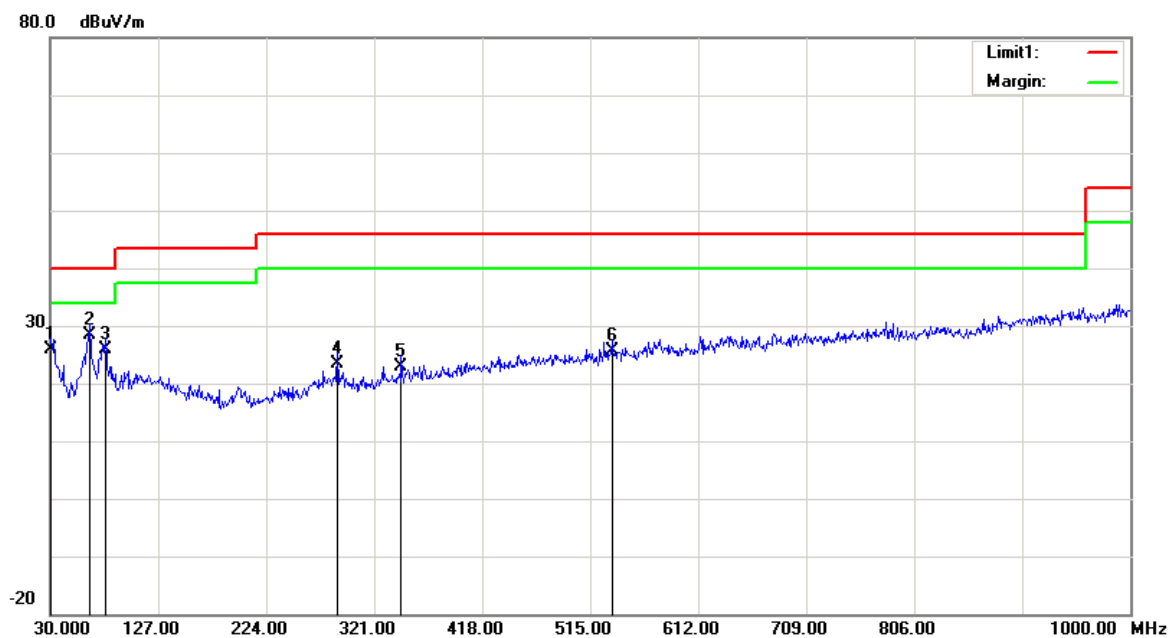
Test Data

Environmental Conditions

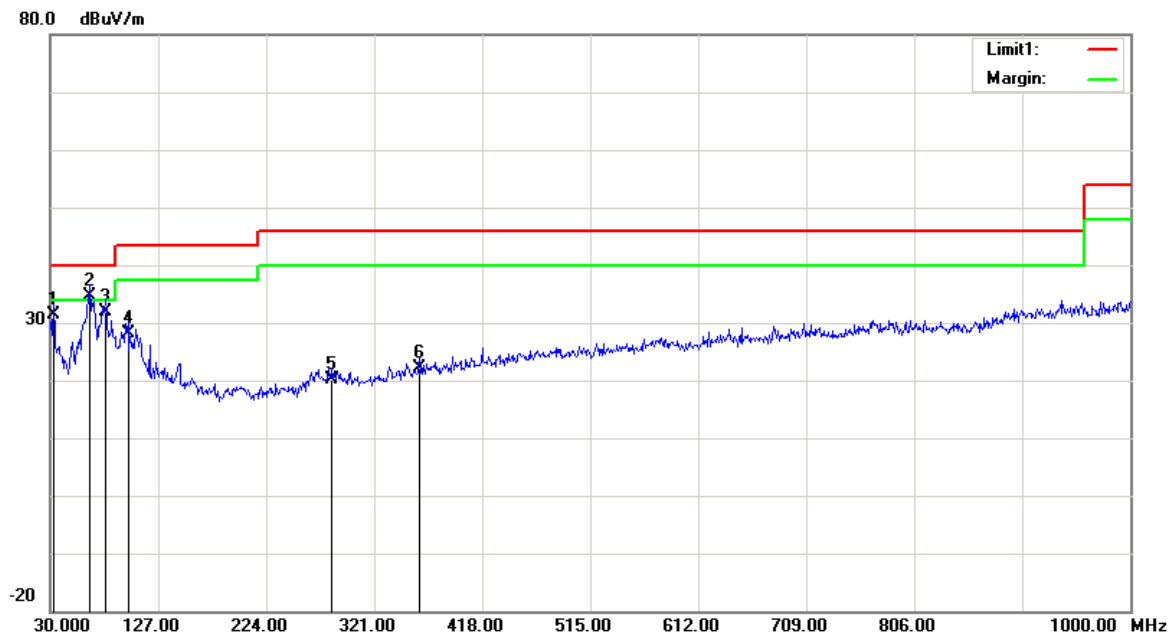
| | |
|---------------------------|-----------|
| Temperature: | 27.3 °C |
| Relative Humidity: | 50.7 % |
| ATM Pressure: | 100.1 kPa |

** The testing was performed by Tony Zeng on 2017-08-10.*

Test Mode: Transmitting

1) 30MHz-1GHz:**Horizontal:**

| Frequency (MHz) | Receiver Reading (dBuV) | Detector | Correction Factor (dB/m) | Cord. Amp. (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-------------------------|----------|--------------------------|---------------------|----------------|-------------|
| 30.9700 | 25.45 | QP | 0.35 | 25.80 | 40.00 | 14.20 |
| 65.8900 | 40.17 | QP | -11.87 | 28.30 | 40.00 | 11.70 |
| 79.4700 | 37.12 | QP | -11.22 | 25.90 | 40.00 | 14.10 |
| 288.0200 | 27.40 | QP | -4.10 | 23.30 | 46.00 | 22.70 |
| 345.2500 | 26.38 | QP | -3.48 | 22.90 | 46.00 | 23.10 |
| 534.4000 | 26.02 | QP | -0.32 | 25.70 | 46.00 | 20.30 |

Vertical:

| Frequency (MHz) | Receiver Reading (dBuV) | Detector | Correction Factor (dB/m) | Cord. Amp. (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-------------------------|----------|--------------------------|---------------------|----------------|-------------|
| 32.9100 | 32.60 | QP | -1.10 | 31.50 | 40.00 | 8.50 |
| 65.8900 | 46.47 | QP | -11.87 | 34.60 | 40.00 | 5.40 |
| 79.4700 | 43.22 | QP | -11.22 | 32.00 | 40.00 | 8.00 |
| 99.8400 | 36.53 | QP | -8.43 | 28.10 | 43.50 | 15.40 |
| 283.1700 | 24.10 | QP | -3.90 | 20.20 | 46.00 | 25.80 |
| 361.7400 | 25.16 | QP | -3.06 | 22.10 | 46.00 | 23.90 |

2) 1-25GHz:

| 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: 2408 MHz | | | | | | | | | |
| 2408 | 76.09 | PK | H | 28.12 | 3.11 | 0.00 | 107.32 | N/A | N/A |
| 2408 | 71.74 | AV | H | 28.12 | 3.11 | 0.00 | 102.97 | N/A | N/A |
| 2408 | 81.22 | PK | V | 28.12 | 3.11 | 0.00 | 112.45 | N/A | N/A |
| 2408 | 74.53 | AV | V | 28.12 | 3.11 | 0.00 | 105.76 | N/A | N/A |
| 2390 | 30.69 | PK | V | 28.08 | 3.10 | 0.00 | 61.87 | 74.00 | 12.13 |
| 2390 | 19.27 | AV | V | 28.08 | 3.10 | 0.00 | 50.45 | 54.00 | 3.55 |
| 4816 | 51.66 | PK | V | 32.93 | 4.32 | 35.49 | 53.42 | 74.00 | 20.58 |
| 4816 | 43.23 | AV | V | 32.93 | 4.32 | 35.49 | 44.99 | 54.00 | 9.01 |
| 7224 | 47.79 | PK | V | 35.78 | 5.46 | 35.97 | 53.06 | 74.00 | 20.94 |
| 7224 | 34.59 | AV | V | 35.78 | 5.46 | 35.97 | 39.86 | 54.00 | 14.14 |
| 4688 | 47.22 | PK | V | 32.68 | 4.26 | 35.39 | 48.77 | 74.00 | 25.23 |
| 4688 | 34.11 | AV | V | 32.68 | 4.26 | 35.39 | 35.66 | 54.00 | 18.34 |
| Middle Channel: 2442.5 MHz | | | | | | | | | |
| 2442.5 | 75.15 | PK | H | 28.19 | 3.11 | 0.00 | 106.45 | N/A | N/A |
| 2442.5 | 70.28 | AV | H | 28.19 | 3.11 | 0.00 | 101.58 | N/A | N/A |
| 2442.5 | 80.01 | PK | V | 28.19 | 3.11 | 0.00 | 111.31 | N/A | N/A |
| 2442.5 | 74.47 | AV | V | 28.19 | 3.11 | 0.00 | 105.77 | N/A | N/A |
| 4885 | 50.54 | PK | V | 33.07 | 4.40 | 35.54 | 52.47 | 74.00 | 21.53 |
| 4885 | 39.83 | AV | V | 33.07 | 4.40 | 35.54 | 41.76 | 54.00 | 12.24 |
| 7327.5 | 48.23 | PK | V | 36.05 | 5.53 | 35.98 | 53.83 | 74.00 | 20.17 |
| 7327.5 | 34.46 | AV | V | 36.05 | 5.53 | 35.98 | 40.06 | 54.00 | 13.94 |
| 5523 | 47.09 | PK | V | 34.11 | 4.49 | 35.85 | 49.84 | 74.00 | 24.16 |
| 5523 | 34.13 | AV | V | 34.11 | 4.49 | 35.85 | 36.88 | 54.00 | 17.12 |
| 6124 | 46.69 | PK | V | 34.28 | 4.82 | 35.82 | 49.97 | 74.00 | 24.03 |
| 6124 | 34.71 | AV | V | 34.28 | 4.82 | 35.82 | 37.99 | 54.00 | 16.01 |
| High Channel: 2475.5 MHz | | | | | | | | | |
| 2475.5 | 75.29 | PK | H | 28.25 | 3.10 | 0.00 | 106.64 | N/A | N/A |
| 2475.5 | 70.67 | AV | H | 28.25 | 3.10 | 0.00 | 102.02 | N/A | N/A |
| 2475.5 | 80.03 | PK | V | 28.25 | 3.10 | 0.00 | 111.38 | N/A | N/A |
| 2475.5 | 75.42 | AV | V | 28.25 | 3.10 | 0.00 | 106.77 | N/A | N/A |
| 2483.5 | 30.91 | PK | V | 28.27 | 3.10 | 0.00 | 62.28 | 74.00 | 11.72 |
| 2483.5 | 19.59 | AV | V | 28.27 | 3.10 | 0.00 | 50.96 | 54.00 | 3.04 |
| 4951 | 49.09 | PK | V | 33.20 | 4.42 | 35.59 | 51.12 | 74.00 | 22.88 |
| 4951 | 36.23 | AV | V | 33.20 | 4.42 | 35.59 | 38.26 | 54.00 | 15.74 |
| 7426.5 | 47.82 | PK | V | 36.31 | 5.59 | 35.98 | 53.74 | 74.00 | 20.26 |
| 7426.5 | 35.12 | AV | V | 36.31 | 5.59 | 35.98 | 41.04 | 54.00 | 12.96 |
| 5625 | 47.25 | PK | V | 34.15 | 4.57 | 35.85 | 50.12 | 74.00 | 23.88 |
| 5625 | 34.11 | AV | V | 34.15 | 4.57 | 35.85 | 36.98 | 54.00 | 17.02 |

FCC §15.247(a) (1)& RSS-247 CLAUSE 5.1 b) - CHANNEL SEPARATION**Applicable Standard**

According to FCC §15.247(a) (1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.50 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater provided the systems operate with an output power no greater than 125 mW.

According to RSS-247 Clause 5.1 b)

- b) FHSs shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, FHSs operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.

Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|--------------|-------------------|--------|---------------|------------------|----------------------|
| R&S | Spectrum Analyzer | FSU 26 | 200256 | 2016-12-08 | 2017-12-08 |
| Unknown | Coaxial Cable | 0.1m | C-1 | Each Time | / |

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Procedure

1. Set the EUT in transmitting mode, spectrum Bandwidth was set at 30 kHz, maxhold the channel.
2. Set the adjacent channel of the EUT maxhold another trace.
3. Measure the channel separation.

Test Data**Environmental Conditions**

| | |
|---------------------------|-----------|
| Temperature: | 27.5°C |
| Relative Humidity: | 47.6 % |
| ATM Pressure: | 100.2 kPa |

** The testing was performed by Calvin Chen on 2017-08-15.*

Test Result: Compliance.

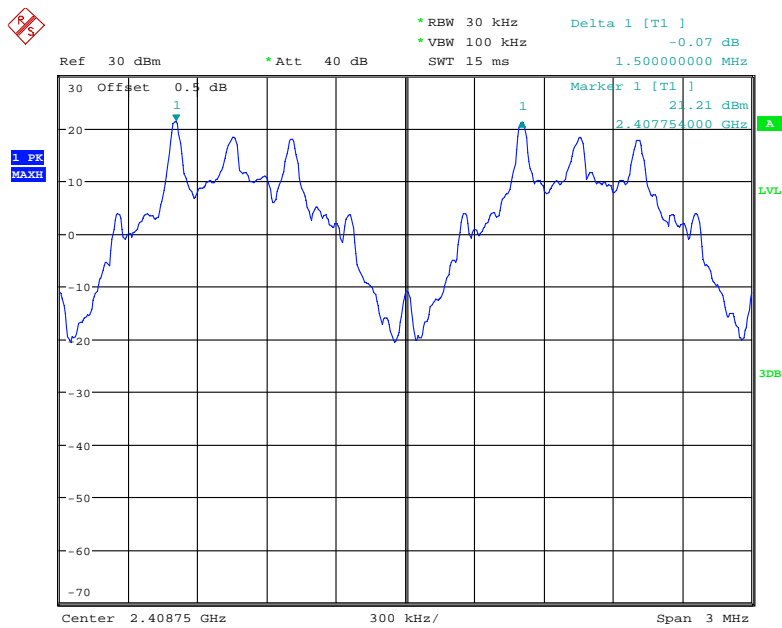
Please refer to following tables and plots

Test Mode: Transmitting

| Channel | Frequency | Channel Separation | Limit |
|---------|-----------|--------------------|-------|
| | MHz | MHz | MHz |
| Low | 2408 | 1.5 | 0.68 |
| Middle | 2442.5 | 1.5 | 0.68 |
| High | 2475.5 | 1.5 | 0.69 |

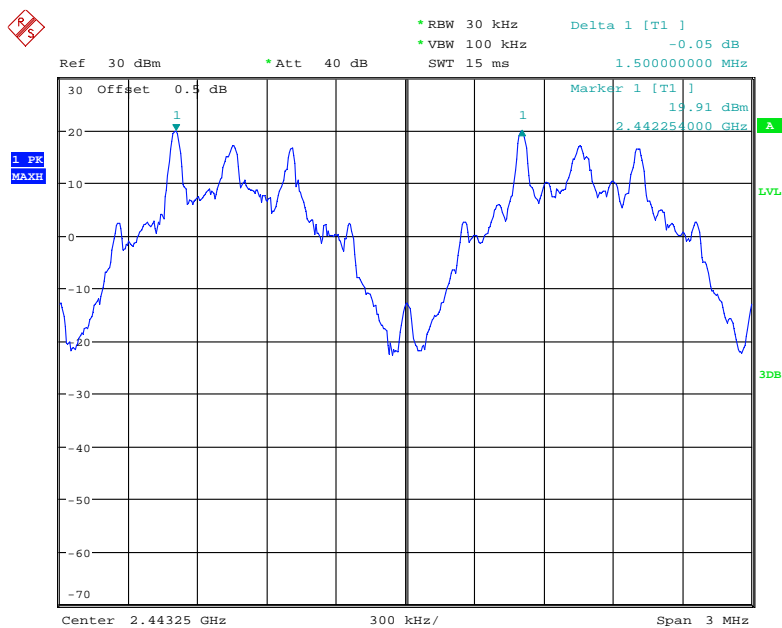
Note: Limit= (2/3)× 20dB bandwidth

Low Channel



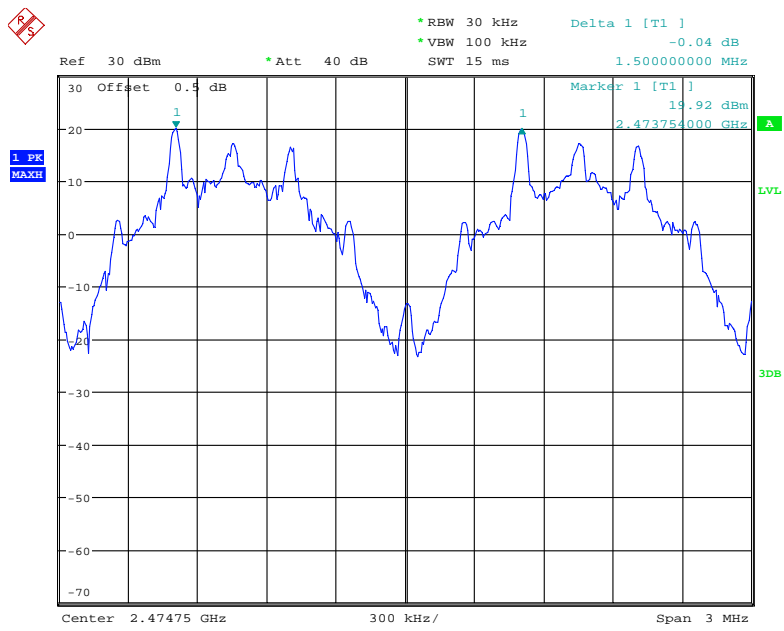
Date: 15.AUG.2017 15:06:02

Middle Channel



Date: 15.AUG.2017 15:07:15

High Channel



Date: 15.AUG.2017 15:08:11

**FCC §15.247(a) (1)& RSS-247 CLAUSE 5.1 b) ,RSS-GEN CLAUSE 6.6 –
EMISSION BANDWIDTH****Applicable Standard**

According to FCC §15.247(a) (1)

Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

According to RSS-247 Clause 5.1 b)

- b) FHSs shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, FHSs operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.

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 on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Use Occupied bandwidth test function, measure the 99% Occupied bandwidth.
5. Repeat above procedures until all frequencies measured were complete.

Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|--------------|-------------------|--------|---------------|------------------|----------------------|
| R&S | Spectrum Analyzer | FSU 26 | 200256 | 2016-12-08 | 2017-12-08 |
| Unknown | Coaxial Cable | 0.1m | C-1 | Each Time | / |

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

| | |
|---------------------------|-----------|
| Temperature: | 27.5°C |
| Relative Humidity: | 47.6 % |
| ATM Pressure: | 100.2 kPa |

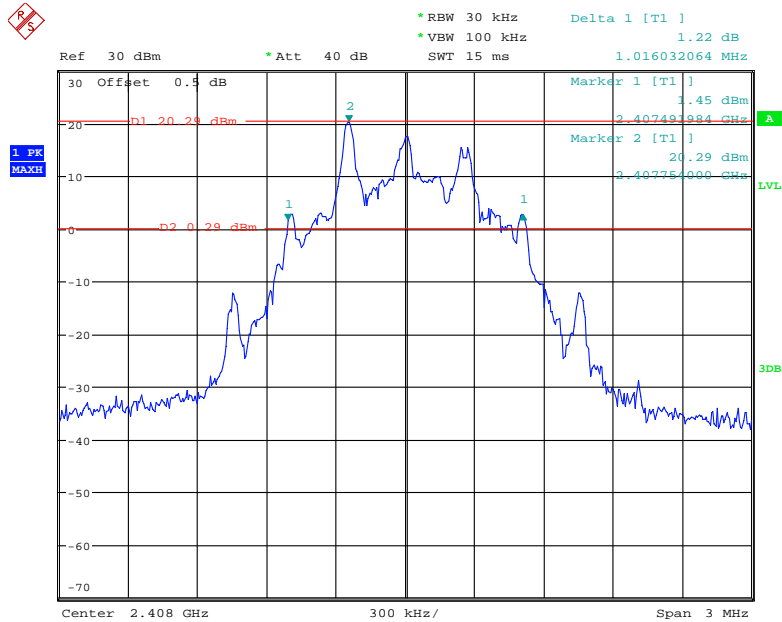
** The testing was performed by Calvin Chen on 2017-08-15.*

Test Result: Compliance.

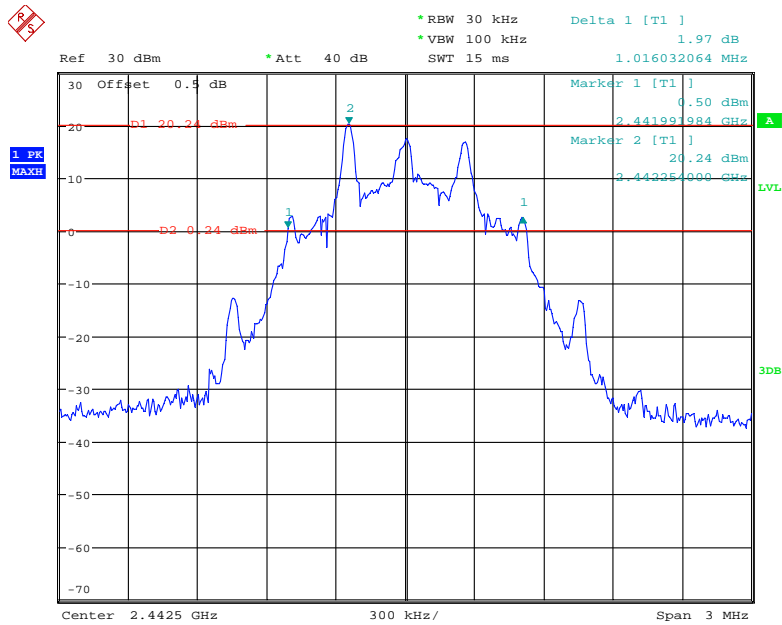
Please refer to following tables and plots

Test Mode: Transmitting

| Channel | Frequency (MHz) | 20 dB Bandwidth (MHz) | 99% occupied Bandwidth (MHz) |
|----------------|----------------------------|--------------------------------------|---|
| Low | 2408 | 1.02 | 0.90 |
| Middle | 2442.5 | 1.02 | 0.99 |
| High | 2475.5 | 1.03 | 0.98 |

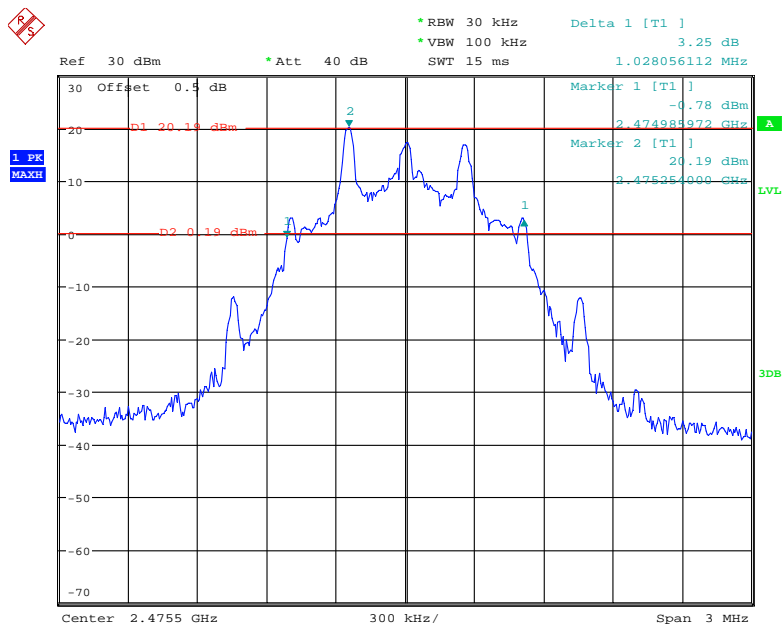
20dB Bandwidth:**Low Channel**

Date: 15.AUG.2017 14:39:42

Middle Channel

Date: 15.AUG.2017 14:42:20

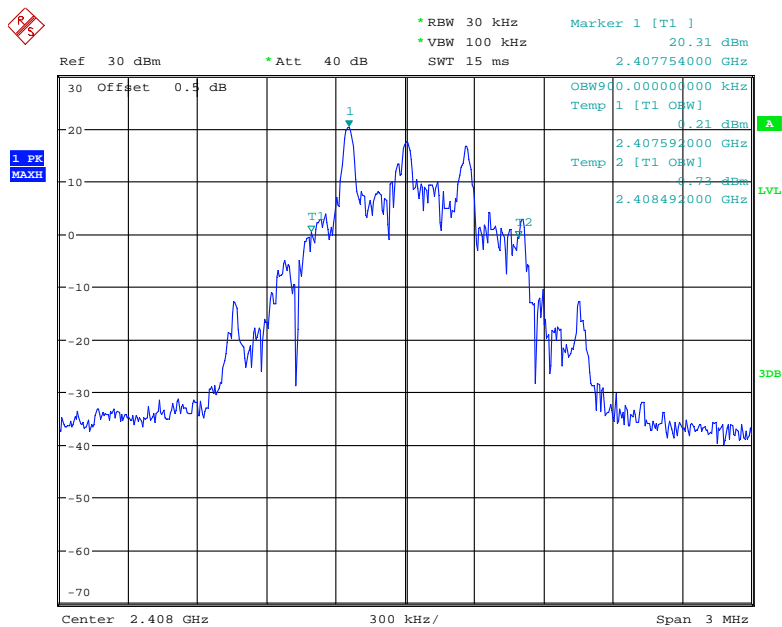
High Channel



Date: 15.AUG.2017 14:43:38

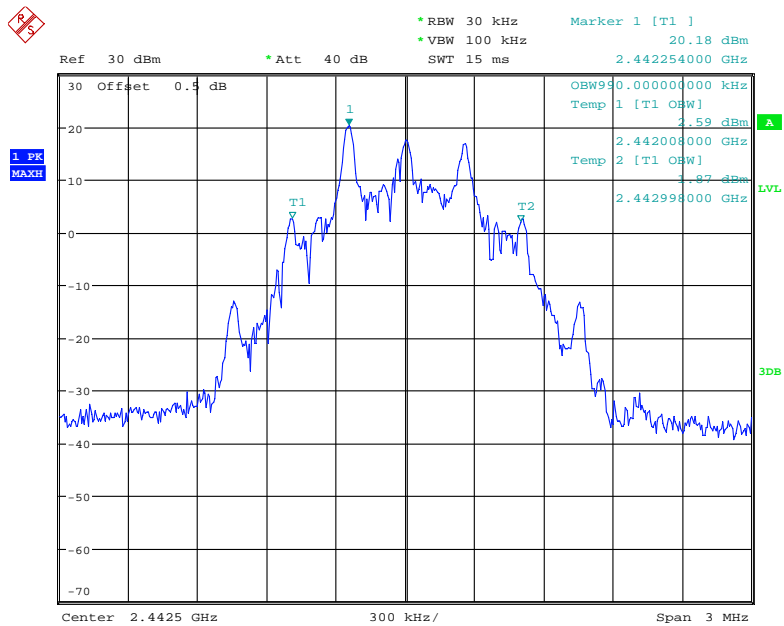
99% Occupied Bandwidth:

Low Channel



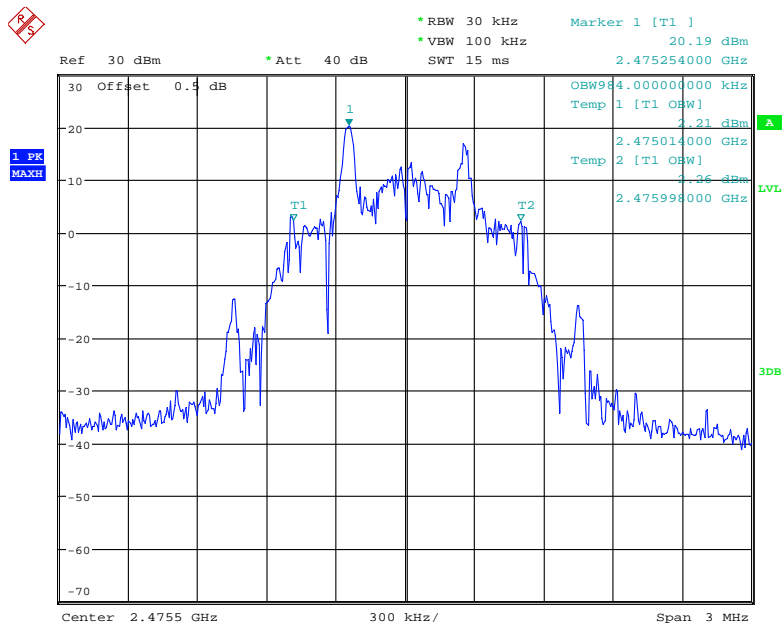
Date: 15.AUG.2017 14:39:56

Middle Channel



Date: 15.AUG.2017 14:42:34

High Channel



Date: 15.AUG.2017 14:43:51

FCC §15.247(a) (1) (iii)& RSS-247 CLAUSE 5.1 d) - QUANTITY OF HOPPING CHANNEL**Applicable Standard**

According to FCC §15.247(a) (1) (iii)

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

According to RSS-247 Clause 5.1 d)

- d) FHSs operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

Test Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Set the EUT in hopping mode from first channel to last.
3. By using the Max-Hold function record the Quantity of the channel.

Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|--------------|-------------------|--------|---------------|------------------|----------------------|
| R&S | Spectrum Analyzer | FSU 26 | 200256 | 2016-12-08 | 2017-12-08 |
| Unknown | Coaxial Cable | 0.1m | C-1 | Each Time | / |

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

| | |
|---------------------------|-----------|
| Temperature: | 27.5°C |
| Relative Humidity: | 47.6 % |
| ATM Pressure: | 100.2 kPa |

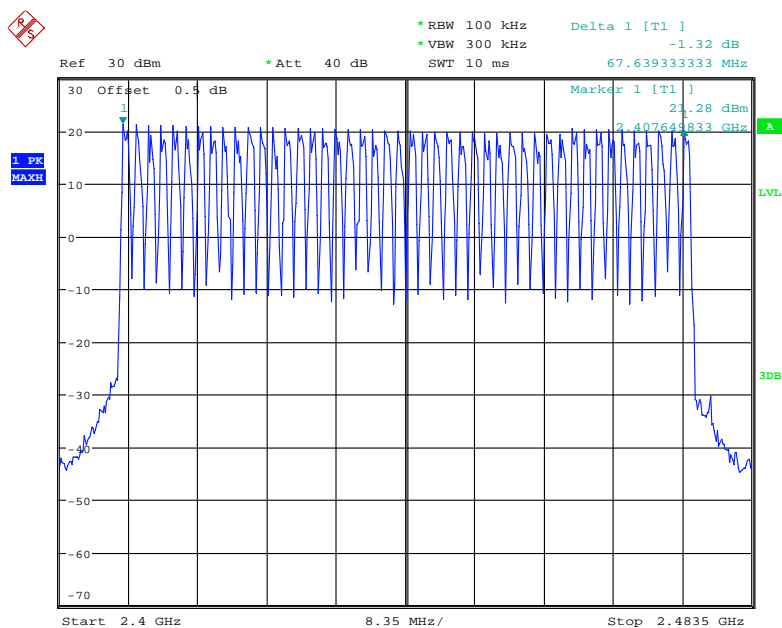
* The testing was performed by Calvin Chen on 2017-08-15.

Test Result: Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

| Frequency Range (MHz) | Number of Hopping Channel | Limit |
|-----------------------|---------------------------|-------|
| 2400-2483.5 | 46 | ≥15 |

Number of Hopping Channels

Date: 15.AUG.2017 15:14:36

FCC §15.247(a) (1) (iii)&RSS-247 CLAUSE 5.1 d) - TIME OF OCCUPANCY (DWELL TIME)

Applicable Standard

According to FCC §15.247(a) (1) (iii)

Frequency hopping systems in the 2400-2483.5 MHz shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

According to RSS-247 Clause 5.1 d)

- d) FHSs operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

Test Procedure

The EUT was worked in channel hopping; Spectrum SPAN was set as 0. The time of single pulses was tested.

Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|--------------|-------------------|--------|---------------|------------------|----------------------|
| R&S | Spectrum Analyzer | FSU 26 | 200256 | 2016-12-08 | 2017-12-08 |
| Unknown | Coaxial Cable | 0.1m | C-1 | Each Time | / |

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

| | |
|--------------------|-----------|
| Temperature: | 27.5°C |
| Relative Humidity: | 47.6 % |
| ATM Pressure: | 100.2 kPa |

* The testing was performed by Calvin Chen on 2017-08-15

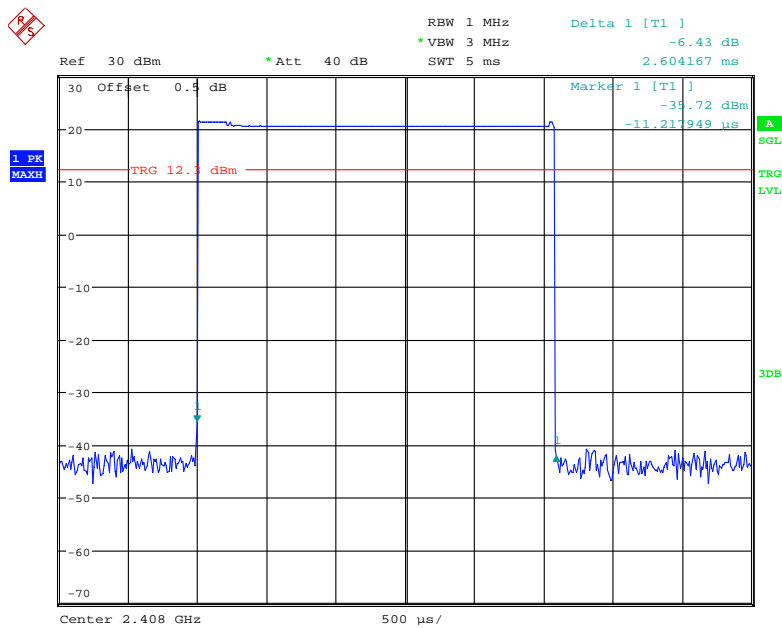
Test Result: Compliance.

Please refer to following tables and plots

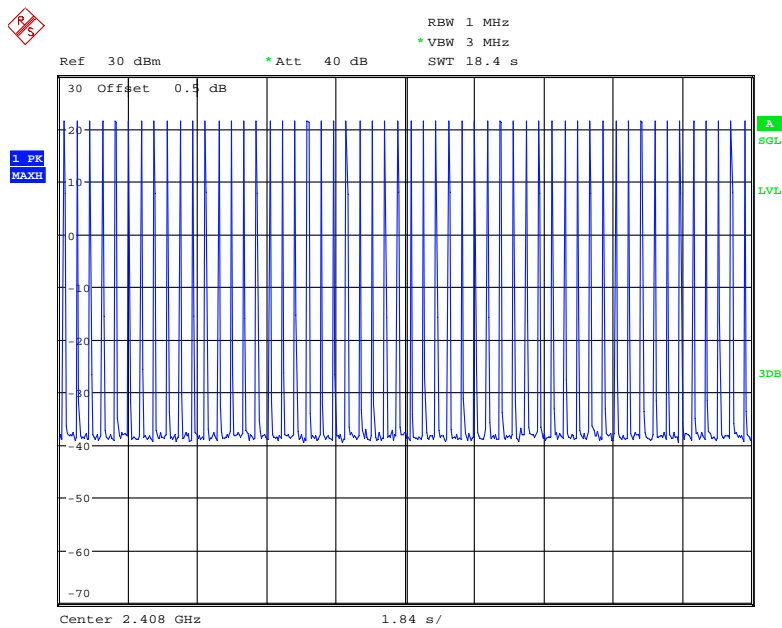
Test Mode: Transmitting

| Channel | Pulse Width (ms) | Hopping numbers in during (Hopping channel number*0.4) | Dwell Time (s) | Limit (s) | Result |
|---------|------------------|--|----------------|-----------|------------|
| Low | 2.604 | 54 | 0.14 | 0.4 | Compliance |
| Middle | 2.596 | 54 | 0.14 | 0.4 | Compliance |
| High | 2.596 | 54 | 0.14 | 0.4 | Compliance |

Note: Dwell time=Pulse time (ms) × hopping numbers in during

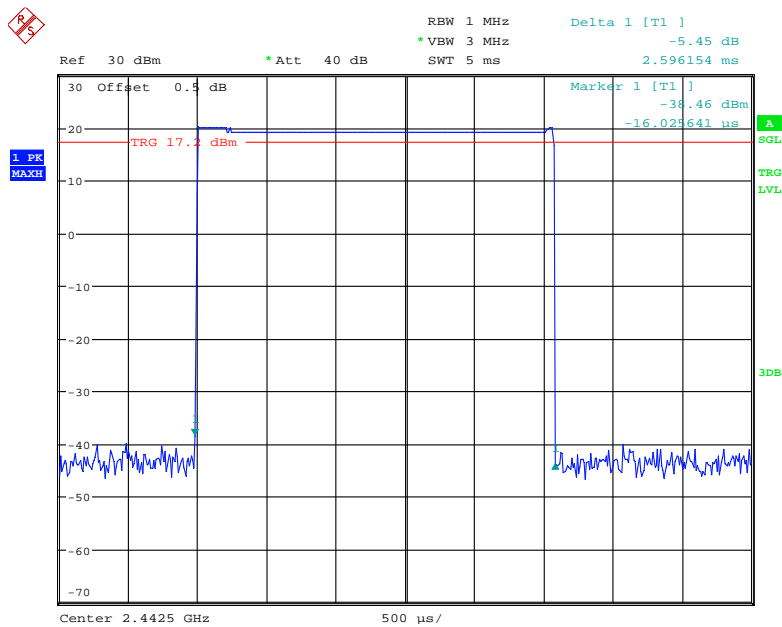
Low Channel

Date: 15.AUG.2017 15:18:58

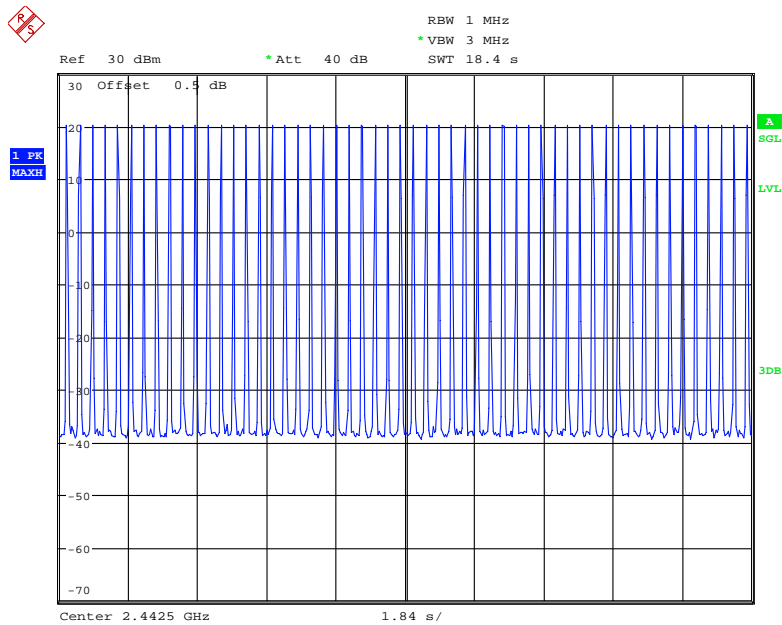


Date: 15.AUG.2017 15:21:01

Middle Channel

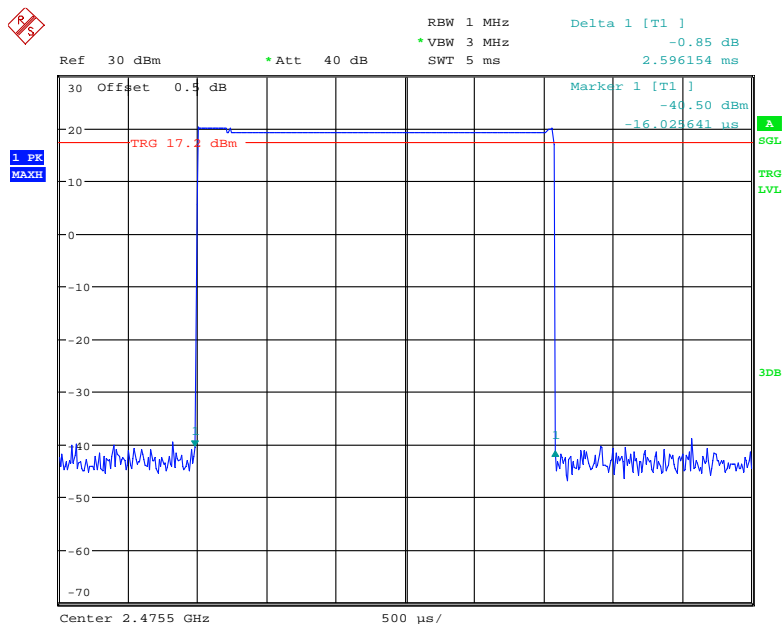


Date: 15.AUG.2017 15:22:30

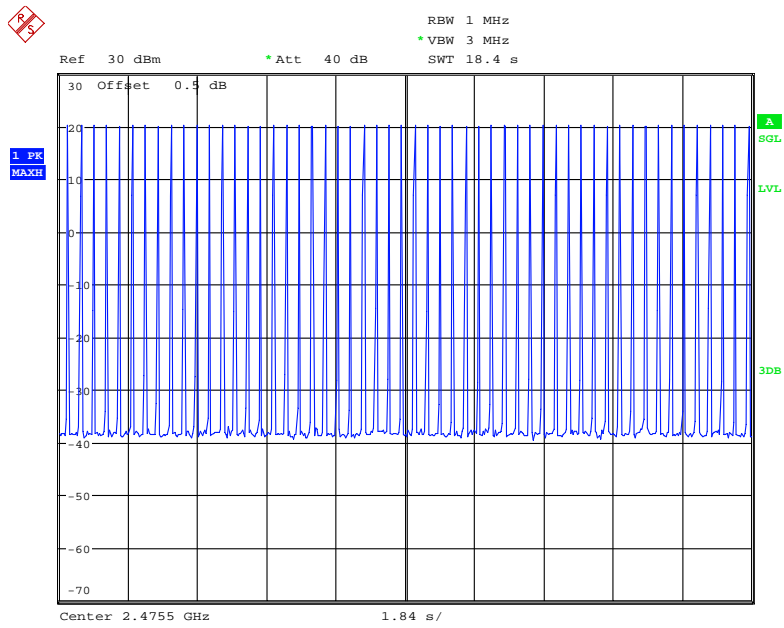


Date: 15.AUG.2017 15:24:45

High Channel



Date: 15.AUG.2017 15:25:17



Date: 15.AUG.2017 15:24:14

FCC §15.247(b) (1)& RSS-247 CLAUSE 5.4 b) - PEAK OUTPUT POWER MEASUREMENT

Applicable Standard

According to §15.247(b) (1)

For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts

According to RSS-247 Clause 5.4 b)

- b) For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

Test Procedure

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one 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 |
|--------------|-------------------|--------|---------------|------------------|----------------------|
| R&S | Spectrum Analyzer | FSU 26 | 200256 | 2016-12-08 | 2017-12-08 |
| Unknown | Coaxial Cable | 0.1m | C-1 | Each Time | / |

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

| | |
|--------------------|-----------|
| Temperature: | 27.5°C |
| Relative Humidity: | 47.6 % |
| ATM Pressure: | 100.2 kPa |

* The testing was performed by Calvin Chen on 2017-08-15.

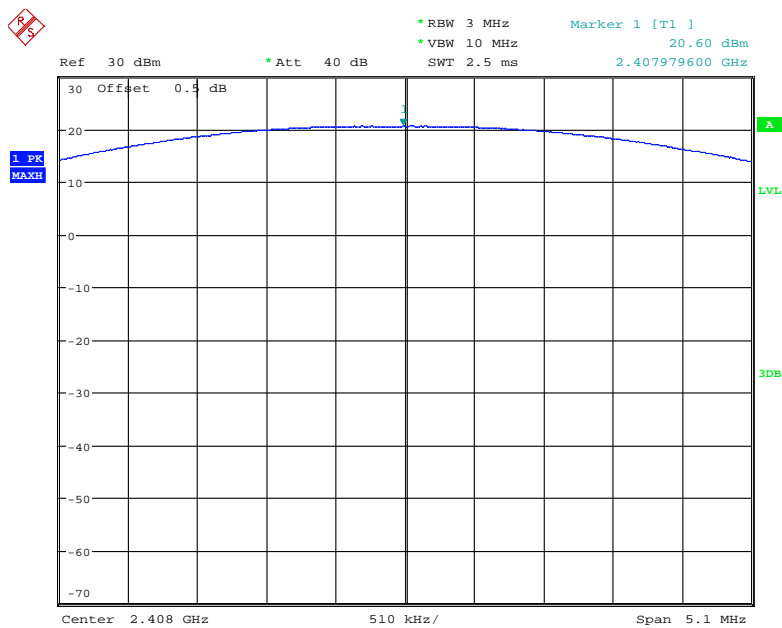
Test Result: Compliance.

Test Mode: Transmitting

| Frequency (MHz) | Conducted Peak Output power (dBm) | Limit (dBm) |
|-----------------|-----------------------------------|-------------|
| 2408 | 20.60 | 21 |
| 2442.5 | 20.46 | 21 |
| 2475.5 | 20.48 | 21 |

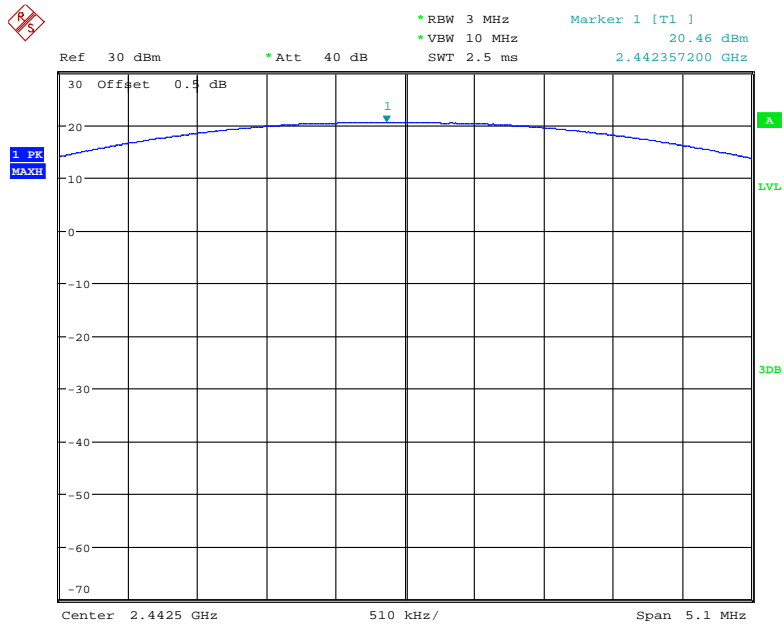
Note: The data above was tested in conducted mode, the antenann gain is 1.5dBi in 2.4GHz band.

Low Channel



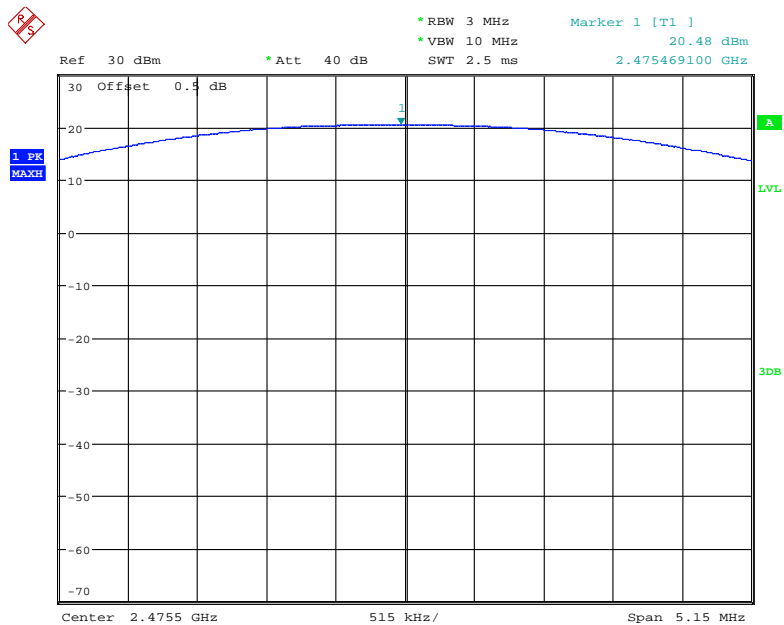
Date: 15.AUG.2017 14:40:09

Middle Channel



Date: 15.AUG.2017 14:42:47

High Channel



Date: 15.AUG.2017 14:44:05

FCC §15.247(d)& RSS-247 CLAUSE 5.5 - BAND EDGES TESTING

Applicable Standard

According to FCC §15.247(d)

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)).

According to RSS-247 Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW/VBW=100/300kHz of spectrum analyze 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 |
|--------------|-------------------|--------|---------------|------------------|----------------------|
| R&S | Spectrum Analyzer | FSU 26 | 200256 | 2016-12-08 | 2017-12-08 |
| Unknown | Coaxial Cable | 0.1m | C-1 | Each Time | / |

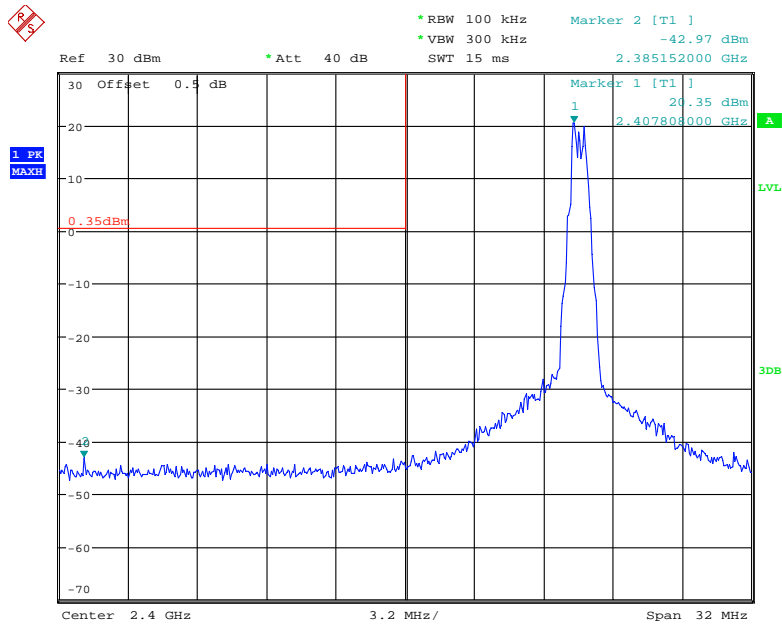
* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

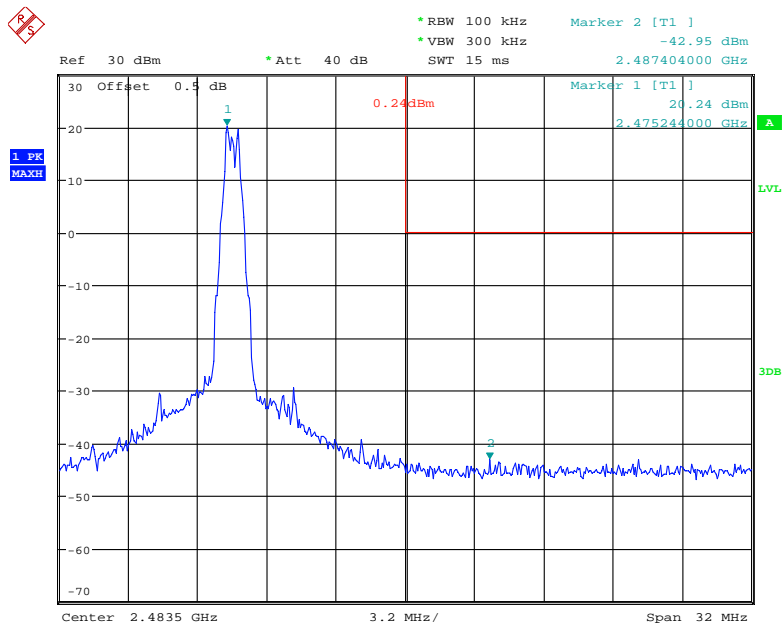
| | |
|---------------------------|-----------|
| Temperature: | 27.5°C |
| Relative Humidity: | 47.6 % |
| ATM Pressure: | 100.2 kPa |

* The testing was performed by Calvin Chen on 2017-08-15.

Test Result: Compliance

Band Edge, Left Side

Date: 15.AUG.2017 14:40:26

Band Edge, Right Side

Date: 15.AUG.2017 14:44:23

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