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**RSS-GEN, ISSUE 4, NOVEMBER 2014**  
**RSS-247, ISSUE 2, FEBRUARY 2017**

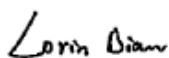

**TEST REPORT**

For

**SZ DJI TECHNOLOGY CO., LTD**

14th floor, West Wing, Skyworth Semiconductor Design Building NO.18 Gaoxin South 4th Ave,  
Nanshan, Shenzhen, Guangdong, China

**FCC ID: SS3-PM4101703**  
**IC: 11805A-PM4101703**

|   |   |
|---|---|
| <b>Report Type:</b><br>Original Report              | <b>Product Name:</b><br>MATRICE SERIES  |
| <b>Test Engineer:</b> <u>Lorin Bian</u>             |    |
| <b>Report Number:</b> <u>RDG170423002B</u>          |   |
| <b>Report Date:</b> <u>2017-06-09</u>               |   |
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## **GENERAL INFORMATION**

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### **Product Description for Equipment under Test (EUT)**

The **SZ DJI TECHNOLOGY CO., LTD**'s product, model number: **MATRICE 200 (FCC ID: SS3-PM4101703, IC: 11805A-PM4101703)** (the "EUT") in this report was a **MATRICE SERIES**, which was measured approximately: 53 cm (L) x 48 cm (W) x 29.5 cm (H), rated input voltage: DC22.8V form battery, the battery can be removed to charge.

*Note: The series product, model MATRICE 200, M210, M210RTK are electrically identical, we selected MATRICE 200 for fully testing, and all model for radiation emissions test, the details of the difference between them was explained in the attached declaration letter.*

*\*All measurement and test data in this report was gathered from final production sample, serial number: 170423002-1(M210), 170423002-2(MATRICE 200), 170423002-3(M210RTK) (assigned by the BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2017-05-03, and EUT conformed to test requirement.*

### **Objective**

This type approval report is prepared on behalf of **SZ DJI TECHNOLOGY CO., LTD** in accordance with Part 2-Subpart J, Part 15-Subparts A and E of the Federal Communications Commission's rules. And RSS-247, ISSUE 2, February 2017, RSS-Gen Issue 4, November 2014 of the Innovation, Science and Economic Development Canada.

The tests were performed in order to determine compliance with FCC Rules Part 15, Subpart E, section 15.203, 15.205, 15.207, 15.209 and 15.407 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 Part 15C DTS submissions with FCC ID: SS3-PM4101703.

RSS-247 DTSs submissions with IC: 11805A-PM4101703.

Part of system granted with FCC ID: SS3-GL6D10A1609, IC: 11805A-GL6D10A1609

## 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, RSS-Gen Issue 4, November 2014 of the Innovation, Science and Economic Development Canada.

All of the measurements detailed in this Test Report were performed by Bay Area Compliance Laboratories Corp. (Chengdu).

The Bay Area Compliance Laboratories Corp. Chengdu's measurement Uncertainties (calculated for a k=2 Coverage Factor corresponding to approximately 95% Coverage) were as follows:

-For all of the AC Line Conducted Emissions Tests reported herein:  $\pm 3.17$  dB.

-For of all of the Direct Antenna Conducted Emissions Tests reported herein:  $\pm 0.56$  dB.

-For of all of the direct Radiated Emissions Tests reported herein are:  
30 MHz to 200 MHz:  $\pm 4.7$  dB;  
200 MHz to 1 GHz:  $\pm 6.0$  dB;  
1 GHz to 6 GHz:  $\pm 5.13$ dB; and,  
6 GHz to 40 GHz:  $\pm 5.47$ dB.

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

## Test Facility

The test site used by BACL to collect test data is located in the No.5040, Huilongwan Plaza, No.1, Shawan Road, Jinniu District, Chengdu, Sichuan, 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 EUT was configured for testing in an engineering mode which was provided by the manufacturer.

The device support 2.4GHz and 5.8 GHz double band. For both bands, The EUT have 4 antennas, but only supports 2T2R MIMO mode, the system configures two of them transmitting depending on better performance by the system automatically recognizes.

For 5.8 GHz band, total 24 channels were employed by the system:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|---------|-----------------|
| 1       | 5730            | 9       | 5770            | 17      | 5810            |
| 2       | 5735            | 10      | 5775            | 18      | 5815            |
| 3       | 5740            | 11      | 5780            | 19      | 5820            |
| 4       | 5745            | 12      | 5785            | 20      | 5825            |
| 5       | 5750            | 13      | 5790            | 21      | 5830            |
| 6       | 5755            | 14      | 5795            | 22      | 5835            |
| 7       | 5760            | 15      | 5800            | 23      | 5840            |
| 8       | 5765            | 16      | 5805            | 24      | 5845            |

### EUT Exercise Software

The software “DJI-RF Certification” was used for testing, which was provided by manufacturer. The maximum power and duty cycle was configured by system default setting. The Target power level as below:

| Test Software Version | DJI-RF Certification |         |         |
|-----------------------|----------------------|---------|---------|
| Test Frequency        | 5730MHz              | 5790MHz | 5845MHz |
| Power Level Setting   | 25                   | 25      | 25      |

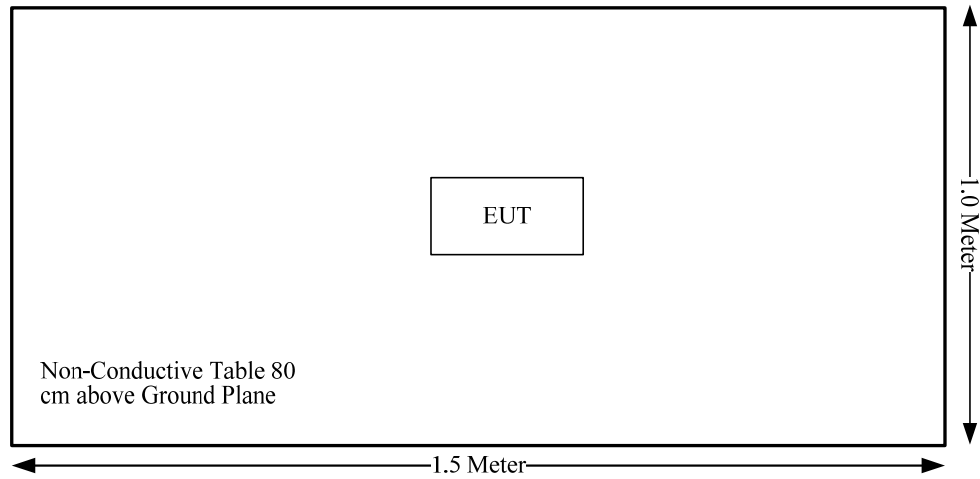
The duty cycle as below:

| T <sub>on</sub> (ms) | T <sub>on+off</sub> (ms) | Duty Cycle (%) | Minimum Transmission Duration (T) (ms) |
|----------------------|--------------------------|----------------|--|
| 10.52                | 13.93                    | 76             | 10.52                                  |

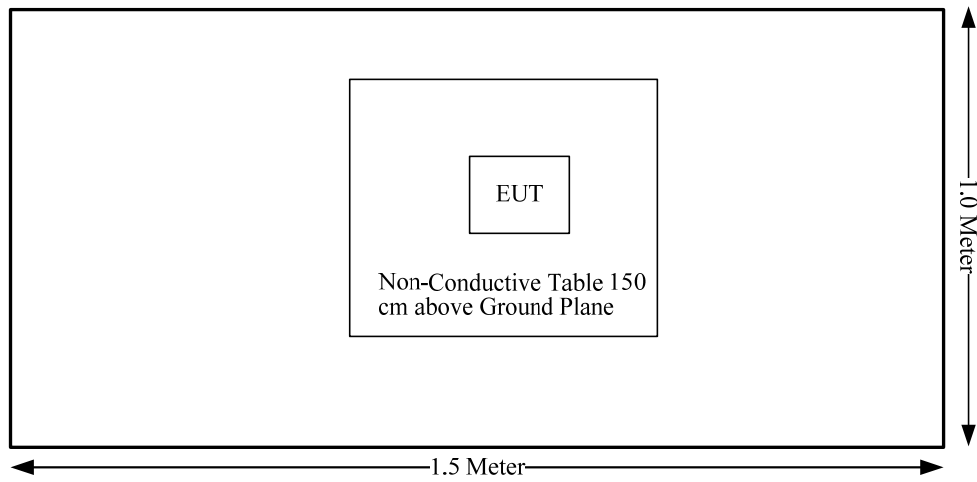


### Block Diagram of Test Setup

Radiation test below 1GHz:



Radiation test above 1GHz:





## SUMMARY OF TEST RESULTS

| FCC Rules   | Description of Test  | Result         |
|---|--|----------------|
| FCC §15.407 (f) & §1.1310<br>& §2.1091            | Maximum Permissible Exposure (MPE)                                 | Compliance     |
| RSS-102 § 2.5.2                                   | Exemption Limits For Routine Evaluation-<br>RF Exposure Evaluation | Compliance     |
| FCC§15.203<br>RSS-GEN§8.3                         | Antenna Requirement  | Compliance     |
| FCC§15.207 (a)<br>RSS-Gen §8.8                    | AC Line Conducted Emissions  | Not Applicable |
| FCC§15.205& §15.209<br>&§15.407(b)<br>RSS-247§6.2 | Undesirable Emission& Restricted Bands                             | Compliance     |
| FCC§15.407(b)<br>RSS-247§6.2                      | Out Of Band Emissions  | Compliance     |
| FCC§15.407(a)<br>RSS-247 §6.2<br>RSS-Gen§6.6      | Emission Bandwidth   | Compliance     |
| FCC§15.407(a)<br>RSS-247 §6.2                     | Conducted Transmitter Output Power                                 | Compliance     |
| FCC§15.407 (a)<br>RSS-247 §6.2                    | Power Spectral Density   | Compliance     |
| FCC§15.407(g)                                     | Frequency stability  | Compliance     |

**FCC §15.407 (f) , §1.1310 , §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

**Applicable Standard**

According to subpart 15.407(f) and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission’s guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
|--|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| Frequency Range (MHz)  | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm <sup>2</sup> ) | Averaging Time (minutes) |
| 0.3–1.34   | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34–30  | 824/f                         | 2.19/f                        | *(180/f <sup>2</sup> )              | 30                       |
| 30–300   | 27.5                          | 0.073                         | 0.2                                 | 30                       |
| 300–1500   | /                             | /                             | f/1500                              | 30                       |
| 1500–100,000   | /                             | /                             | 1.0                                 | 30                       |

f = frequency in MHz; \* = Plane-wave equivalent power density;

**Calculation Formula:**

Prediction of power density at the distance of the applicable MPE limit:

$S = PG/4\pi R^2$  = power density (in appropriate units, e.g. mW/cm<sup>2</sup>);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

**Calculated Data:**

| Frequency     | Antenna Gain |      | Maximum Conducted Power Including Tune Up Tolerance |        | Evaluation Distance | Power Density | Limit |
|---------------|--------------|------|---|--------|---------------------|---------------|-------|
|               | MHz          | dBi  | numeric   | dBm    |                     |               |       |
| 2406.5-2476.5 | 2.24         | 1.67 | 22  | 158.49 | 20.00               | 0.0528        | 1.0   |
| 5730-5845     | 1.77         | 1.50 | 25  | 316.23 | 20.00               | 0.0946        | 1.0   |

Note: The 2.4GHz and 5GHz band can’t transmit simultaneously.

**Result: Compliance,** The device meets MPE requirement for Devices Used by the General Public (Uncontrolled Environment) at distance ≥20 cm.

## **RSS-102 § 2.5.2 - EXEMPTION LIMITS FOR ROUTINE EVALUATION – RF EXPOSURE EVALUATION**

### Applicable Standard

According to RSS-102 § (2.5.2):

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz<sup>6</sup> and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than  $4.49/f^{0.5}$  W (adjusted for tune-up tolerance), where  $f$  is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than  $1.31 \times 10^{-2} f^{0.6834}$  W (adjusted for tune-up tolerance), where  $f$  is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

### Calculated Data:

#### For 2.4GHz band:

The maximum power including tune-up tolerance is 22dBm@ 2.4GHz band, the antenna gain is 2.24dBi, so the maximum e.r.i.p. is 24.24dBm (0.265W)

Exemption from Routine Evaluation Limit is:

$$1.31 \times 10^{-2} f^{0.6834} \text{ W} = 1.31 \times 10^{-2} \times 2406.5^{0.6834} \text{ W} = 2.68 \text{ W} > 0.237 \text{ W}$$

#### For 5.8GHz Band:

The maximum tune-up power including tolerance is 25dBm, and the antenna gain is 1.77 dBi, so the maximum Power(E.I.R.P or conducted) is less 26.77 dBm(0.475W).

Exemption limits for RF exposure is:

$$1.31 \times 10^{-2} f^{0.6834} = 4.85 \text{ W at } 5730 \text{ MHz} > 0.4 \text{ W}$$

So the device is compliance exemption from Routine Evaluation Limits –RF exposure Evaluation.

**Result:** Compliance

## **FCC §15.203 ,RSS-GEN§8.3- ANTENNA REQUIREMENT**

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### **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.

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.<sup>9</sup> 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 Information And Connector Construction

| Ant.    | Antenna Type | Connector | Frequency Range/Antenna Gain             |
|---------|--------------|-----------|--|
| Chain 0 | PCB          | MCX       | 2.4GHz Band/2.24dBi<br>5GHz Band/1.77dBi |
| Chain 1 | PCB          | MCX       | 2.4GHz Band/2.24dBi<br>5GHz Band/1.77dBi |
| Chain 2 | PCB          | MCX       | 2.4GHz Band/2.24dBi<br>5GHz Band/1.77dBi |
| Chain 3 | PCB          | MCX       | 2.4GHz Band/2.24dBi<br>5GHz Band/1.77dBi |

**Result:** Compliance. Please refer to the EUT photos

## **FCC §15.209, §15.205 , §15.407(b) & RSS-247 §6.2, RSS-GEN §8.10– UNWANTED EMISSION**

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### **Applicable Standard**

According to FCC §15.407; §15.209; §15.205;

(b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of -27 dBm/MHz.

(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

(7) The provisions of §15.205 apply to intentional radiators operating under this section.

According to RSS-247 §6.2

### **Frequency band 5150-5250 MHz**

#### **6.2.1.2 Unwanted emission limits**

For transmitters with operating frequencies in the band 5150-5250 MHz, all emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. Any unwanted emissions that fall into the band 5250-5350 MHz shall be attenuated below the channel power by at least 26 dB, when measured using a resolution bandwidth between 1 and 5% of the occupied bandwidth (i.e. 99% bandwidth), above 5250 MHz. The 26 dB bandwidth may fall into the 5250-5350 MHz band; however, if the occupied bandwidth also falls within the 5250-5350 MHz band, the transmission is considered as intentional and the devices shall comply with all requirements in the band 5250-5350 MHz including implementing dynamic frequency selection (DFS) and TPC, on the portion of the emission that resides in the 5250-5350 MHz band.

## **Frequency band 5250-5350 MHz**

### **6.2.2.2 Unwanted emission limits**

Devices shall comply with the following:

- a) All emissions outside the band 5250-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p.; or
- b) All emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. and its power shall comply with the spectral power density for operation within the band 5150-5250 MHz. The device, except devices installed in vehicles, shall be labelled or include in the user manual the following text “for indoor use only.”

## **Frequency bands 5470-5600 MHz and 5650-5725 MHz:**

### **6.2.3.2 Unwanted emission limits**

Emissions outside the band 5470-5600 MHz and 5650-5725 MHz shall not exceed -27 dBm/MHz e.i.r.p. However, devices with bandwidth overlapping the band edge of 5725 MHz can meet the emission limit of -27 dBm/MHz e.i.r.p. at 5850 MHz instead of 5725 MHz.

## **Frequency band 5725-5850 MHz**

### **6.2.4.2 Unwanted emission limits**

Devices operating in the band 5725-5850 MHz with antenna gain greater than 10 dBi can have unwanted emissions that comply with either the limits in this section or in section 5.5 until six (6) months after the publication date of this standard for certification. Certified devices that do not comply with emission limits in this section shall not be manufactured, imported, distributed, leased, offered for sale or sold after April 1, 2018.

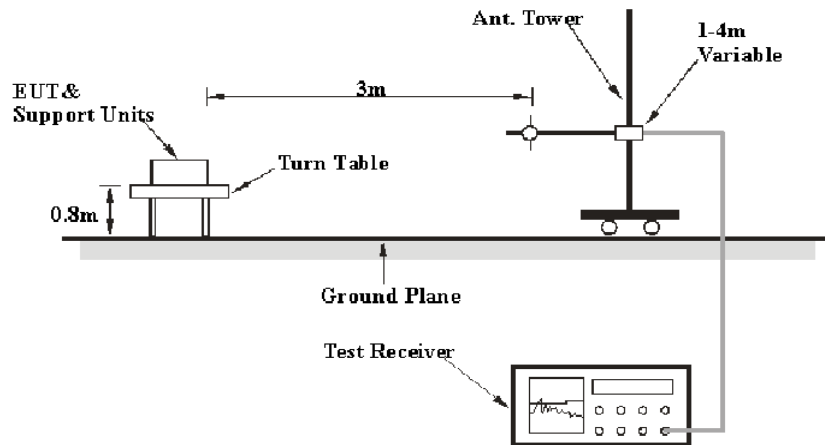
Devices operating in the band 5725-5850 MHz with antenna gain of 10 dBi or less can have unwanted emissions that comply with either the limits in this section or in section 5.5 until April 1, 2018 for certification. Certified devices that do not comply with emission limits in this section shall not be manufactured, imported, distributed, leased, offered for sale or sold after April 1, 2020.

Devices operating in the band 5725-5850 MHz shall have e.i.r.p. of unwanted emissions comply with the following:

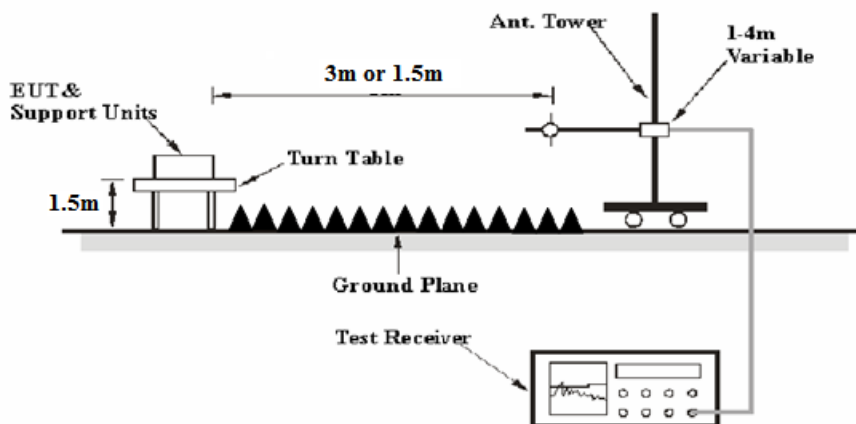
- a) 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edges;
- b) 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;
- c) 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm/MHz at 75 MHz above or below the band edges; and
- d) -27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

## EUT Setup

### Below 1 GHz:



### Above 1 GHz:



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, FCC 15.407 and RSS-247, RSS-Gen 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 40 GHz.

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



30-1000MHz:

| Frequency Range   | RBW     | Video B/W | IF B/W  | Detector |
|-------------------|---------|-----------|---------|----------|
| 30 MHz – 1000 MHz | 120 kHz | 300 kHz   | 120 kHz | QP       |

1GHz- 40GHz:

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

### 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-1GHz, peak and Average detection modes for frequencies above 1GHz.

According to KDB 789033 D02 General UNII Test Procedures New Rules v01r04, emission shall be computed as:  $E [dB\mu V/m] = EIRP[dBm] + 95.2$ , for  $d = 3$  meters.

According to C63.10, the above 1G test result shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade from 3m to 1.5m

Distance extrapolation factor =  $20 \log (\text{specific distance } [3m]/\text{test distance } [1.5m])$  dB

Extrapolation result = Corrected Amplitude (dB $\mu$ V/m) - distance extrapolation factor (6dB)

### 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:

$$\text{Margin} = \text{Extrapolation result} - \text{Limit}$$

**Test Equipment List and Details**

| Manufacturer          | Description           | Model           | Serial Number   | Calibration Date | Calibration Due Date |
|-----------------------|-----------------------|-----------------|-----------------|------------------|----------------------|
| Agilent               | Amplifier             | 8447D           | 2944A10442      | 2016-12-02       | 2017-12-01           |
| Rohde & Schwarz       | EMI Test Receiver     | ESCI            | 100028          | 2016-12-02       | 2017-12-01           |
| Sunol Sciences        | Broadband Antenna     | JB3             | A121808         | 2016-04-10       | 2019-04-09           |
| Rohde & Schwarz       | Spectrum Analyzer     | FSEM30          | 100018          | 2016-12-02       | 2017-12-01           |
| ETS                   | Horn Antenna          | 3115            | 003-6076        | 2016-12-02       | 2017-12-01           |
| Ducommun Technologies | Horn Antenna          | ARH-4223-02     | 1007726-0113024 | 2014-06-16       | 2017-06-15           |
| Mini-circuits         | Amplifier             | ZVA-183-S+      | 771001215       | 2015-05-20       | 2016-05-19           |
| Mini-circuits         | Amplifier             | ZVA-183-S+      | 771001215       | 2016-05-20       | 2017-05-19           |
| EMCT                  | Semi-Anechoic Chamber | 966             | 966-1           | 2015-04-24       | 2018-04-23           |
| Unknown               | RF Cable (below 1GHz) | Unknown         | NO.1            | 2016-11-10       | 2017-11-09           |
| Unknown               | RF Cable (below 1GHz) | Unknown         | NO.4            | 2016-11-10       | 2017-11-09           |
| Unknown               | RF Cable (above 1GHz) | Unknown         | NO.2            | 2016-11-10       | 2017-11-09           |
| Ducommun Technologies | Horn Antenna          | ARH-2823-02     | 1007726-01 1312 | 2016-08-18       | 2017-08-18           |
| Quinstar              | Amplifier             | QLW-18405536-JO | 15964001032     | 2016-08-18       | 2017-08-18           |
| Agilent               | Spectrum Analyzer     | 8564E           | 5943A01752      | 2016-08-18       | 2017-08-18           |

\* **Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B "Implementation of traceability policy in accredited laboratories".

**Test Data**

**Environmental Conditions**

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 26.3 °C   |
| <b>Relative Humidity:</b> | 56 %      |
| <b>ATM Pressure:</b>      | 100.1 kPa |

\* The testing was performed by Lorin Bian on 2017-05-10.

*Test Mode: Transmitting(M210 was the worst and recored in the report, above 1GHz test performed at distance 1.5m from EUT to Antenna)*

| Frequency (MHz)         | Receiver       |                     | Rx Antenna  |             | Cable loss (dB) | Amplifier Gain (dB) | Corrected Amplitude (dBµV/m) | Extrapolation Result dBµV/m | Limit (dBµV/m) | Margin (dB) |
|-------------------------|----------------|---------------------|-------------|-------------|-----------------|---------------------|------------------------------|-----------------------------|----------------|-------------|
|                         | Reading (dBµV) | Detector (PK/QP/AV) | Polar (H/V) | Factor (dB) |                 |                     |                              |                             |                |             |
| Low Channel:5730 MHz    |                |                     |             |             |                 |                     |                              |                             |                |             |
| 5730                    | 79.27          | PK                  | H           | 32.58       | 5.72            | 0.00                | 117.57                       | 111.57                      | N/A            | N/A         |
| 5730                    | 65.91          | AV                  | H           | 32.58       | 5.72            | 0.00                | 104.21                       | 98.21                       | N/A            | N/A         |
| 5730                    | 91.10          | PK                  | V           | 32.58       | 5.72            | 0.00                | 129.4                        | 123.4                       | N/A            | N/A         |
| 5730                    | 77.63          | AV                  | V           | 32.58       | 5.72            | 0.00                | 115.93                       | 109.93                      | N/A            | N/A         |
| 5725                    | 82.98          | PK                  | V           | 32.57       | 5.72            | 0.00                | 121.27                       | 115.27                      | 122.2          | 6.93        |
| 5720                    | 61.79          | PK                  | V           | 32.56       | 5.71            | 0.00                | 100.06                       | 94.06                       | 110.8          | 16.74       |
| 5700                    | 32.50          | PK                  | V           | 32.54       | 5.70            | 0.00                | 70.74                        | 64.74                       | 105.2          | 40.46       |
| 5650                    | 25.98          | PK                  | V           | 32.48       | 5.65            | 0.00                | 64.11                        | 58.11                       | 68.2           | 10.09       |
| 11460                   | 39.26          | PK                  | V           | 37.97       | 8.22            | 26.02               | 59.43                        | 53.43                       | 74             | 20.57       |
| 11460                   | 24.72          | AV                  | V           | 37.97       | 8.22            | 26.02               | 44.89                        | 38.89                       | 54             | 15.11       |
| 17190                   | 30.06          | PK                  | V           | 42.77       | 10.75           | 25.93               | 57.65                        | 51.65                       | 74             | 22.35       |
| 17190                   | 17.17          | AV                  | V           | 42.77       | 10.75           | 25.93               | 44.76                        | 38.76                       | 54             | 15.24       |
| 3668                    | 36.05          | PK                  | V           | 27.67       | 4.43            | 26.58               | 41.57                        | 35.57                       | 74             | 38.43       |
| 3668                    | 23.56          | AV                  | V           | 27.67       | 4.43            | 26.58               | 29.08                        | 23.08                       | 54             | 30.92       |
| 3083                    | 39.33          | PK                  | V           | 24.66       | 3.55            | 26.44               | 41.1                         | 35.1                        | 74             | 38.9        |
| 3083                    | 26.59          | AV                  | V           | 24.66       | 3.55            | 26.44               | 28.36                        | 22.36                       | 54             | 31.64       |
| 400.54                  | 45.77          | QP                  | H           | 16.12       | 1.64            | 28.23               | 35.30                        | 35.30                       | 46.00          | 10.70       |
| 442.25                  | 43.12          | QP                  | H           | 16.96       | 1.58            | 28.46               | 33.20                        | 33.20                       | 46.00          | 12.80       |
| Middle Channel:5790 MHz |                |                     |             |             |                 |                     |                              |                             |                |             |
| 5790                    | 79.16          | PK                  | H           | 32.65       | 5.78            | 0.00                | 117.59                       | 111.59                      | N/A            | N/A         |
| 5790                    | 65.38          | AV                  | H           | 32.65       | 5.78            | 0.00                | 103.81                       | 97.81                       | N/A            | N/A         |
| 5790                    | 89.77          | PK                  | V           | 32.65       | 5.78            | 0.00                | 128.2                        | 122.2                       | N/A            | N/A         |
| 5790                    | 76.63          | AV                  | V           | 32.65       | 5.78            | 0.00                | 115.06                       | 109.06                      | N/A            | N/A         |
| 11580                   | 40.62          | PK                  | V           | 38.03       | 8.21            | 26.00               | 60.86                        | 54.86                       | 74             | 19.14       |
| 11580                   | 25.34          | AV                  | V           | 38.03       | 8.21            | 26.00               | 45.58                        | 39.58                       | 54             | 14.42       |
| 17370                   | 29.23          | PK                  | V           | 43.60       | 11.05           | 26.19               | 57.69                        | 51.69                       | 74             | 22.31       |
| 17370                   | 16.72          | AV                  | V           | 43.60       | 11.05           | 26.19               | 45.18                        | 39.18                       | 54             | 14.82       |
| 4231                    | 34.83          | PK                  | V           | 29.37       | 5.08            | 26.69               | 42.59                        | 36.59                       | 74             | 37.41       |
| 4231                    | 22.10          | AV                  | V           | 29.37       | 5.08            | 26.69               | 29.86                        | 23.86                       | 54             | 30.14       |
| 3581                    | 36.31          | PK                  | V           | 27.32       | 4.30            | 26.58               | 41.35                        | 35.35                       | 74             | 38.65       |
| 3581                    | 23.68          | AV                  | V           | 27.32       | 4.30            | 26.58               | 28.72                        | 22.72                       | 54             | 31.28       |
| 400.54                  | 46.04          | QP                  | H           | 16.12       | 1.64            | 28.23               | 35.57                        | 35.57                       | 46.00          | 10.43       |
| 442.25                  | 43.26          | QP                  | H           | 16.96       | 1.58            | 28.46               | 33.34                        | 33.34                       | 46.00          | 12.66       |

| Frequency (MHz)        | Receiver       |                     | Rx Antenna  |             | Cable loss (dB) | Amplifier Gain (dB) | Corrected Amplitude (dBµV/m) | Extrapolation Result dBµV/m | Limit (dBµV/m) | Margin (dB) |
|------------------------|----------------|---------------------|-------------|-------------|-----------------|---------------------|------------------------------|-----------------------------|----------------|-------------|
|                        | Reading (dBµV) | Detector (PK/QP/AV) | Polar (H/V) | Factor (dB) |                 |                     |                              |                             |                |             |
| High Channel: 5845 MHz |                |                     |             |             |                 |                     |                              |                             |                |             |
| 5845                   | 78.65          | PK                  | H           | 32.71       | 5.82            | 0.00                | 117.18                       | 111.18                      | N/A            | N/A         |
| 5845                   | 65.12          | AV                  | H           | 32.71       | 5.82            | 0.00                | 103.65                       | 97.65                       | N/A            | N/A         |
| 5845                   | 89.39          | PK                  | V           | 32.71       | 5.82            | 0.00                | 127.92                       | 121.92                      | N/A            | N/A         |
| 5845                   | 75.80          | AV                  | V           | 32.71       | 5.82            | 0.00                | 114.33                       | 108.33                      | N/A            | N/A         |
| 5850                   | 86.54          | PK                  | V           | 32.72       | 5.83            | 0.00                | 125.09                       | 119.09                      | 122.2          | 3.11        |
| 5855                   | 60.46          | PK                  | V           | 32.73       | 5.83            | 0.00                | 99.02                        | 93.02                       | 110.8          | 17.78       |
| 5875                   | 38.70          | PK                  | V           | 32.75       | 5.85            | 0.00                | 77.3                         | 71.3                        | 105.2          | 33.9        |
| 5925                   | 25.81          | PK                  | V           | 32.81       | 5.89            | 0.00                | 64.51                        | 58.51                       | 68.2           | 9.69        |
| 11690                  | 38.76          | PK                  | V           | 38.08       | 8.19            | 25.97               | 59.06                        | 53.06                       | 74             | 20.94       |
| 11690                  | 24.83          | AV                  | V           | 38.08       | 8.19            | 25.97               | 45.13                        | 39.13                       | 54             | 14.87       |
| 17535                  | 29.06          | PK                  | V           | 44.31       | 11.22           | 26.33               | 58.26                        | 52.26                       | 74             | 21.74       |
| 17535                  | 16.81          | AV                  | V           | 44.31       | 11.22           | 26.33               | 46.01                        | 40.01                       | 54             | 13.99       |
| 3662                   | 36.10          | PK                  | V           | 27.65       | 4.42            | 26.58               | 41.59                        | 35.59                       | 74             | 38.41       |
| 3662                   | 23.77          | AV                  | V           | 27.65       | 4.42            | 26.58               | 29.26                        | 23.26                       | 54             | 30.74       |
| 4206                   | 35.21          | PK                  | V           | 29.33       | 5.06            | 26.67               | 42.93                        | 36.93                       | 74             | 37.07       |
| 4206                   | 22.63          | AV                  | V           | 29.33       | 5.06            | 26.67               | 30.35                        | 24.35                       | 54             | 29.65       |
| 400.54                 | 46.88          | QP                  | H           | 16.12       | 1.64            | 28.23               | 36.41                        | 36.41                       | 46.00          | 9.59        |
| 442.25                 | 43.68          | QP                  | H           | 16.96       | 1.58            | 28.46               | 33.76                        | 33.76                       | 46.00          | 12.24       |

## FCC §15.407(a)& RSS-247 §6.2,RSS-Gen §6.6– EMISSION BANDWIDTH

### Applicable Standard

15.407(a), RSS-247 §6.2 and RSS-Gen §6.6

### 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           |
| Unknown         | RF Cable        | Unknown | C-2           | Each Time        | /                    |

\* **Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B “Implementation of traceability policy in accredited laboratories”.

### Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v01r04

### Test Data

#### Environmental Conditions

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 26.3°C    |
| <b>Relative Humidity:</b> | 50 %      |
| <b>ATM Pressure:</b>      | 100.1 kPa |

*The testing was performed by Lorin Bian from 2017-05-10.*

**Test Result:** Pass.

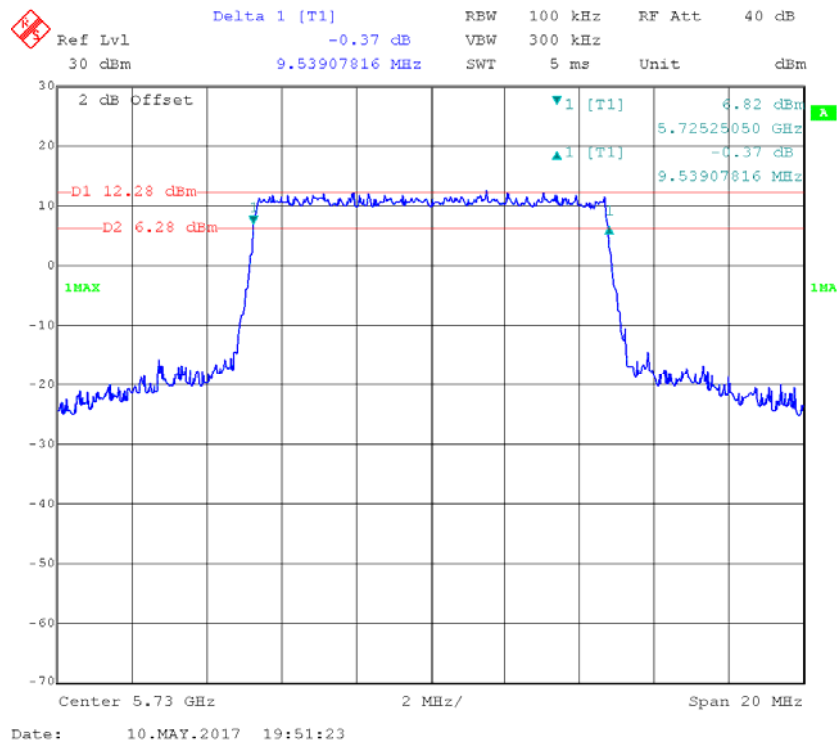
Please refer to the following tables and plots.

Test mode: Transmitting (Test performed at Chain 0)

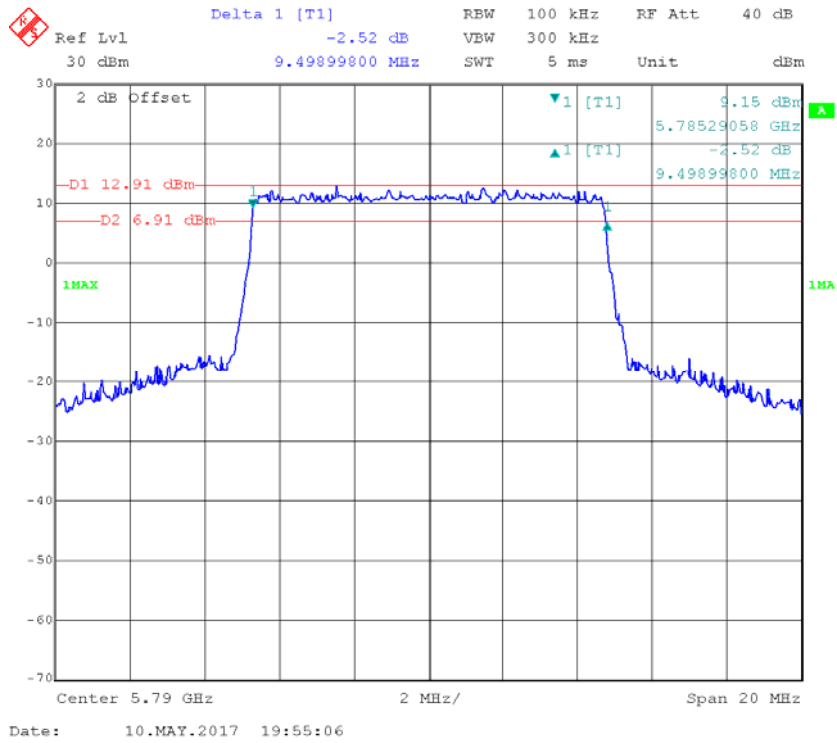
| Channel | Frequency (MHz) | 6 dB Emission Bandwidth (MHz) | 99% Occupied Bandwidth (MHz) |
|---------|-----------------|-------------------------------|------------------------------|
| Low     | 5730            | 9.54                          | 9.46                         |
| Middle  | 5790            | 9.50                          | 9.46                         |
| High    | 5845            | 9.50                          | 9.46                         |

Please refer to the test plots.

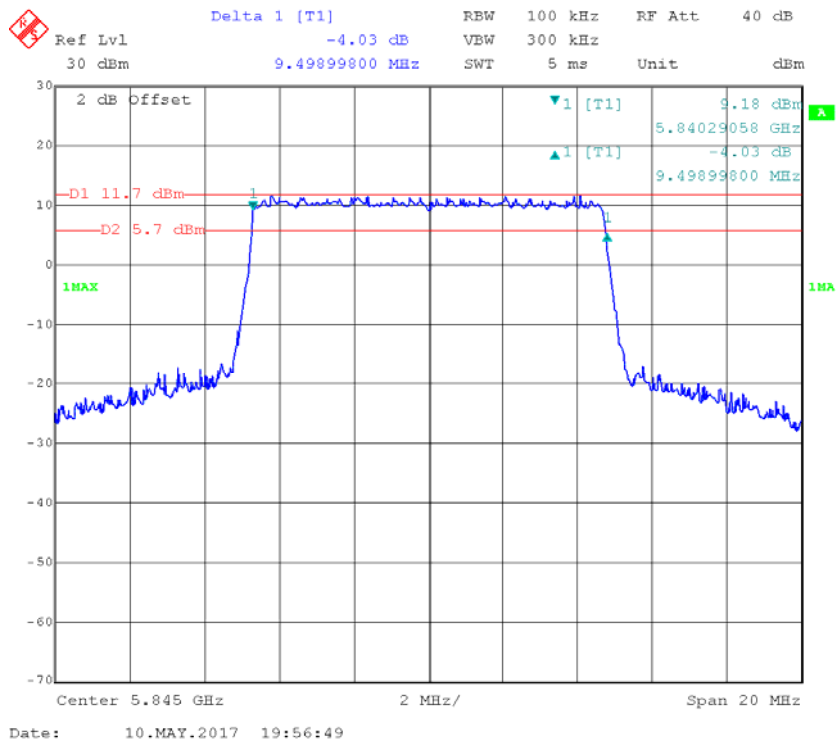
### Low Channel



### Middle Channel

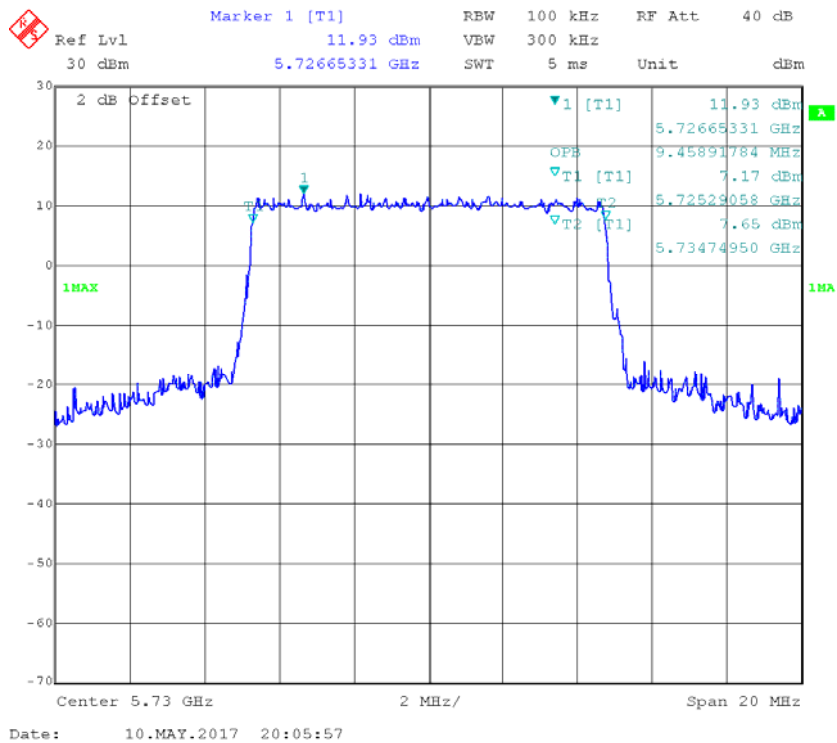


### High Channel

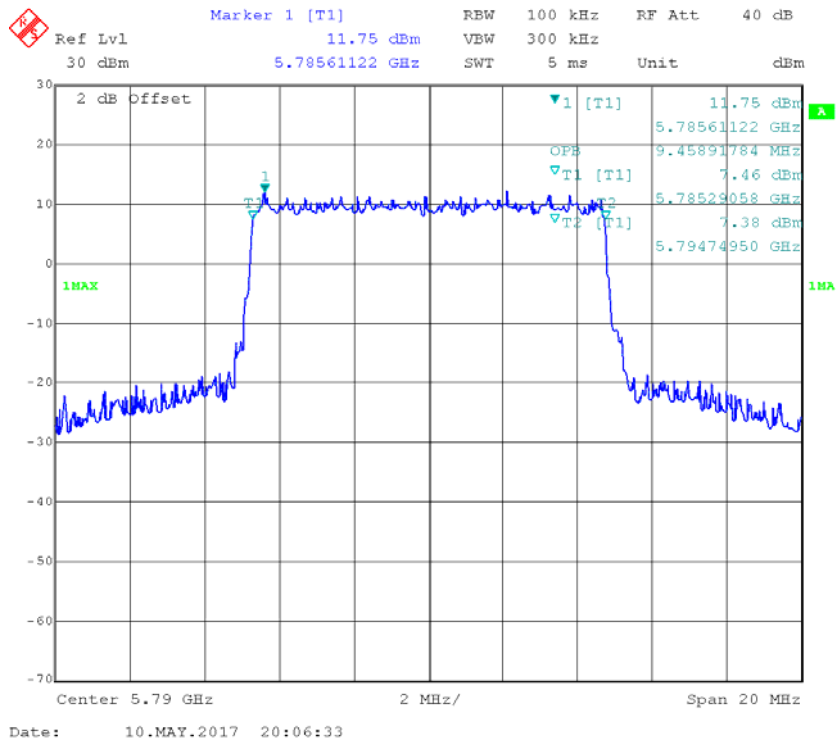


99% Occupied Bandwidth:

Low Channel

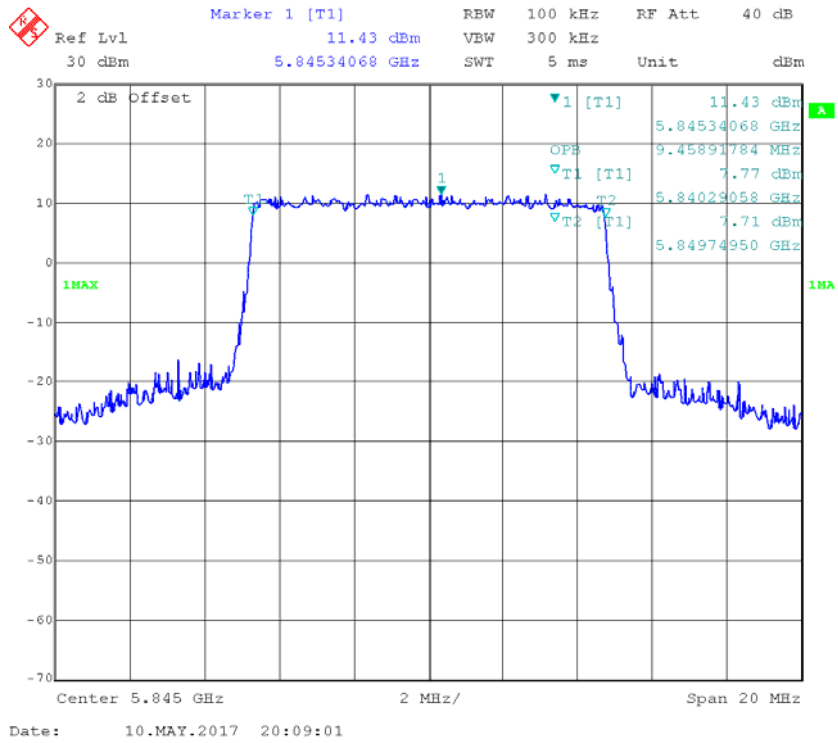


Middle Channel





### High Channel



## **FCC §15.407(a) & RSS-247 §6.2– MAXIMUM CONDUCTED OUTPUT POWER**

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### **Applicable Standard**

According to FCC §15.407(a)

(a) Power limits:

(1) For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm  $10 \log B$ , where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum

power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(4) The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.

According to RSS-247 §6.2:

### **Frequency band 5150-5250 MHz**

#### **6.2.1.1 Power limits**

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or  $1.76 + 10 \log_{10}B$ , dBm, whichever is less stringent. Devices shall implement transmitter power control (TPC) in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

For other devices, the maximum e.i.r.p. shall not exceed 200 mW or  $10 + 10 \log_{10}B$ , dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

### **Frequency band 5250-5350 MHz**

#### **6.2.2.1 Power limits**

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or  $1.76 + 10 \log_{10}B$ , dBm, whichever is less. Devices shall implement TPC in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

Devices, other than devices installed in vehicles, shall comply with the following:

- a) The maximum conducted output power shall not exceed 250 mW or  $11 + 10 \log_{10}B$ , dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band;
- b) The maximum e.i.r.p. shall not exceed 1.0 W or  $17 + 10 \log_{10}B$ , dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

## Frequency bands 5470-5600 MHz and 5650-5725 MHz

### 6.2.3.1 Power limits

The maximum conducted output power shall not exceed 250 mW or  $11 + 10 \log_{10}B$ , dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or  $17 + 10 \log_{10}B$ , dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

## Frequency band 5725-5850 MHz

### 6.2.4.1 Power limits

For equipment operating in the band 5725-5850 MHz, the minimum 6 dB bandwidth shall be at least 500 kHz.

The maximum conducted output power shall not exceed 1 W. The output power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint<sup>3</sup> systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

## Test Equipment List and Details

| Manufacturer | Description           | Model   | Serial Number | Calibration Date | Calibration Due Date |
|--------------|-----------------------|---------|---------------|------------------|----------------------|
| Agilent      | Wideband Power Sensor | N1921A  | MY54170074    | 2017-01-03       | 2018-01-03           |
| Agilent      | P-Series Power Meter  | N1912A  | MY5000798     | 2017-01-03       | 2018-01-03           |
| Unknown      | RF Cable              | Unknown | C-2           | Each Time        | /                    |

\* **Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B "Implementation of traceability policy in accredited laboratories".

## Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v01r04.

## Test Data

### Environmental Conditions

|                           |        |
|---------------------------|--------|
| <b>Temperature:</b>       | 18 °C  |
| <b>Relative Humidity:</b> | 55 %   |
| <b>ATM Pressure:</b>      | 97 kPa |

*The testing was performed by Lorin Bian on 2017-02-10.*

*Test Mode: Transmitting*

*Note: duty cycle factor was added in the result*

| Channel | Frequency (MHz) | RMS Conducted output Power (dBm) |         |         |         |       | FCC/RSS-247 Conducted Limit (dBm) | Result |
|---------|-----------------|----------------------------------|---------|---------|---------|-------|-----------------------------------|--------|
|         |                 | Chain 0                          | Chain 1 | Chain 2 | Chain 3 | Total |                                   |        |
| Low     | 5730            | 20.86                            | 20.62   | 20.54   | 20.47   | 23.75 | 30                                | PASS   |
| Middle  | 5790            | 21.42                            | 21.19   | 21.03   | 21.08   | 24.32 | 30                                | PASS   |
| High    | 5845            | 21.38                            | 20.77   | 20.47   | 20.14   | 24.1  | 30                                | PASS   |

Note:

The device supports 2T2R mode, the Total power was calculated by adding two maximum output power of them.

The antenna gains are 1.77 dBi in 5.8GHz band, the device employed Cyclic Delay Diversity (CDD) for 2TX transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01, for power measurements on IEEE 802.11 devices:

Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4;

So:

Directional gain = GANT + Array Gain = 4.77 dBi < 6dBi

## **FCC §15.407(a)& RSS-247 §6.2 - POWER SPECTRAL DENSITY**

### **Applicable Standard**

According to FCC §15.407(a)

(a) Power limits:

(1) For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm  $10 \log B$ , where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output

power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

According to RSS-247 §6.2:

### **Frequency band 5150-5250 MHz**

#### **6.2.1.1 Power limits**

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or  $1.76 + 10 \log_{10}B$ , dBm, whichever is less stringent. Devices shall implement transmitter power control (TPC) in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

For other devices, the maximum e.i.r.p. shall not exceed 200 mW or  $10 + 10 \log_{10}B$ , dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

### **Frequency band 5250-5350 MHz**

#### **6.2.2.1 Power limits**

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or  $1.76 + 10 \log_{10}B$ , dBm, whichever is less. Devices shall implement TPC in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

Devices, other than devices installed in vehicles, shall comply with the following:

- a) The maximum conducted output power shall not exceed 250 mW or  $11 + 10 \log_{10}B$ , dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band;
- b) The maximum e.i.r.p. shall not exceed 1.0 W or  $17 + 10 \log_{10}B$ , dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

## Frequency bands 5470-5600 MHz and 5650-5725 MHz

### 6.2.3.1 Power limits

The maximum conducted output power shall not exceed 250 mW or  $11 + 10 \log_{10}B$ , dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or  $17 + 10 \log_{10}B$ , dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

## Frequency band 5725-5850 MHz

### 6.2.4.1 Power limits

For equipment operating in the band 5725-5850 MHz, the minimum 6 dB bandwidth shall be at least 500 kHz.

The maximum conducted output power shall not exceed 1 W. The output power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint<sup>3</sup> systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

## Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v01r04

## 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           |
| Unknown         | RF Cable        | Unknown | C-2           | Each Time        | /                    |

\* **Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B "Implementation of traceability policy in accredited laboratories".



**Test Data**

**Environmental Conditions**

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 26.3°C    |
| <b>Relative Humidity:</b> | 50 %      |
| <b>ATM Pressure:</b>      | 100.1 kPa |

The testing was performed by Lorin Bian from 2017-05-10.

Test Mode: Transmitting(the PSD test performed at chain 0 and 1, Since per output power test, Chain 0 and 1 was the maximum output)

Test Result:Compliance.Please refer to the following table and plot.

| Frequency (MHz) | Conducted PSD (dBm/300kHz) |         | Duty Cycle Corrected Factor (dB) | Total (dBm/500kHz) | FCC/RSS-247 Limit (dBm/500kHz) | Result |
|-----------------|----------------------------|---------|----------------------------------|--------------------|--------------------------------|--------|
|                 | Chain 0                    | Chain 1 |                                  |                    |                                |        |
| 5730            | 11.67                      | 10.66   | 1.19                             | 17.59              | 30                             | Pass   |
| 5790            | 11.82                      | 10.61   | 1.19                             | 17.66              | 30                             | Pass   |
| 5845            | 11.37                      | 9.78    | 1.19                             | 17.05              | 30                             | Pass   |

**Note:**

If measurement bandwidth of Maximum PSD is specified in 500 kHz, add  $10\log(500\text{kHz}/\text{RBW})$  to the measured result, whereas RBW (< 500 KHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

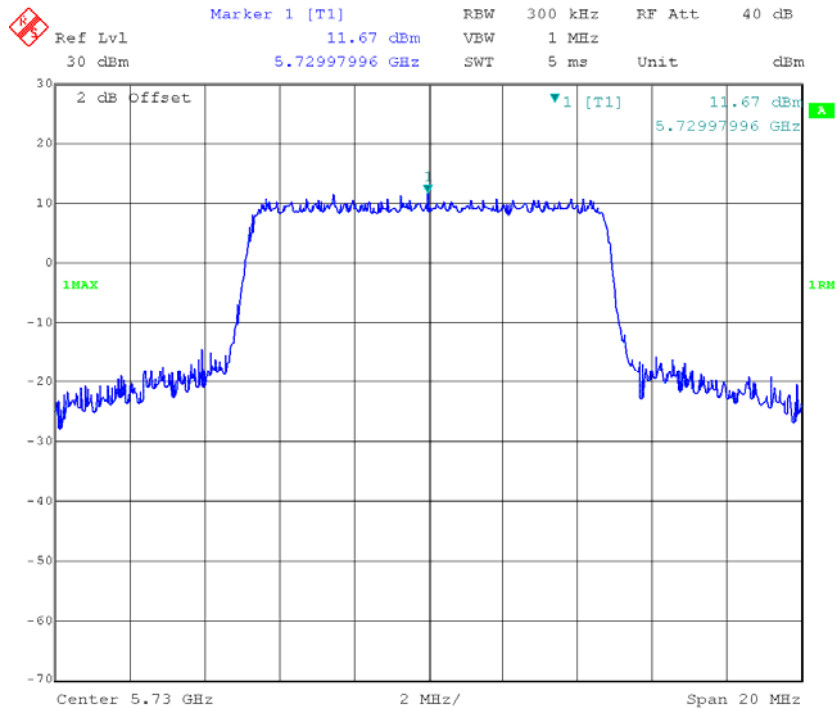
the antenna maximum gain are 1.77dBi in 5.8 GHz band, and employed Cyclic Delay Diversity (CDD) for 802.11 MIMO transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01, for power spectral density (PSD) measurements on the devices:

$$\text{Array Gain} = 10 \log(\text{NANT}/\text{NSS}) \text{ dB.}$$

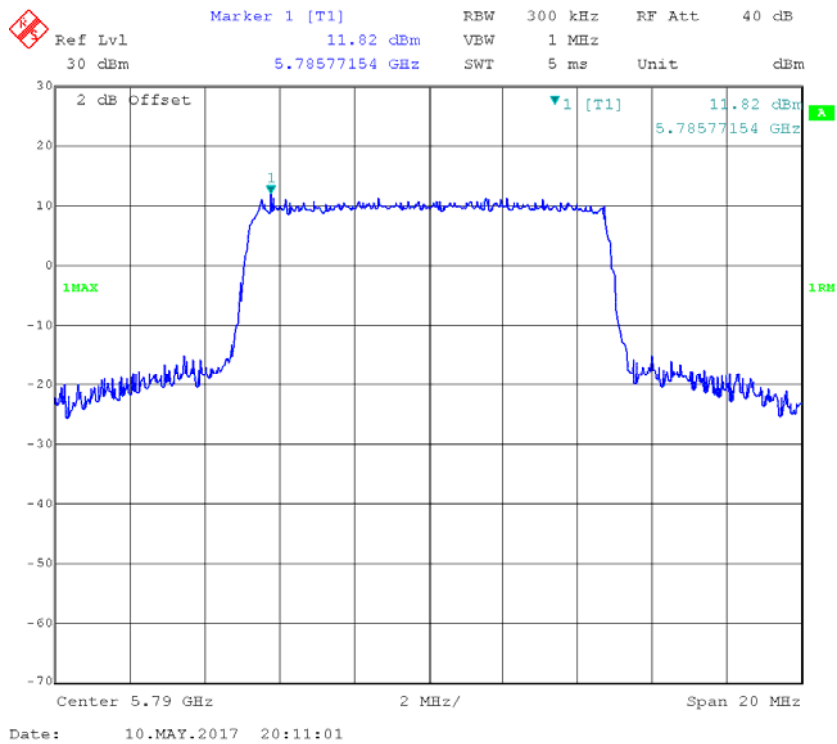
So:

$$\text{Directional gain} = \text{GANT} + \text{Array Gain} = 1.77 + 10 * \log(2) = 4.77 \text{ dBi} < 6\text{dBi}$$

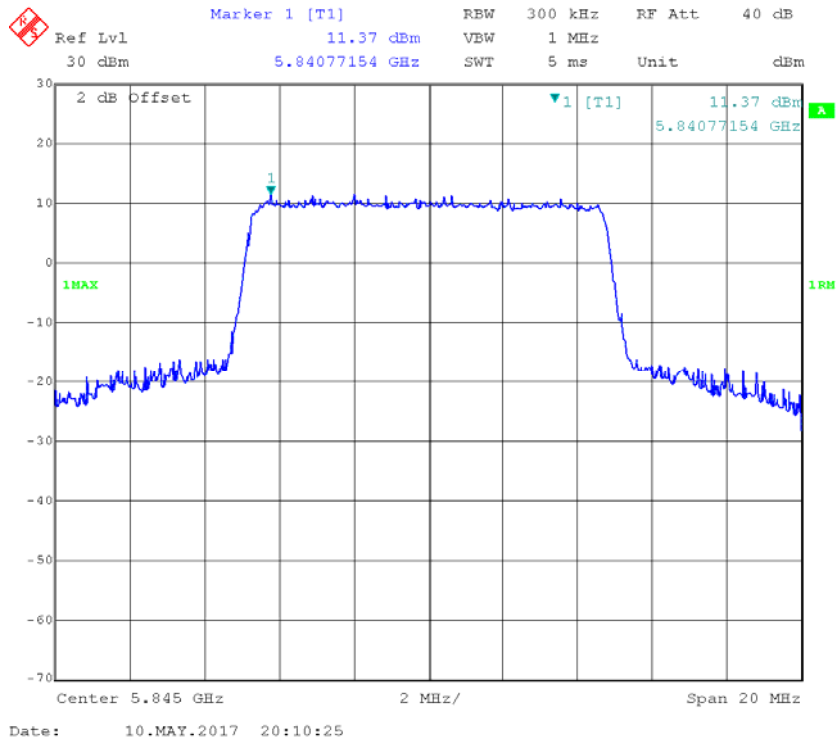
### Low Channel – Chain0



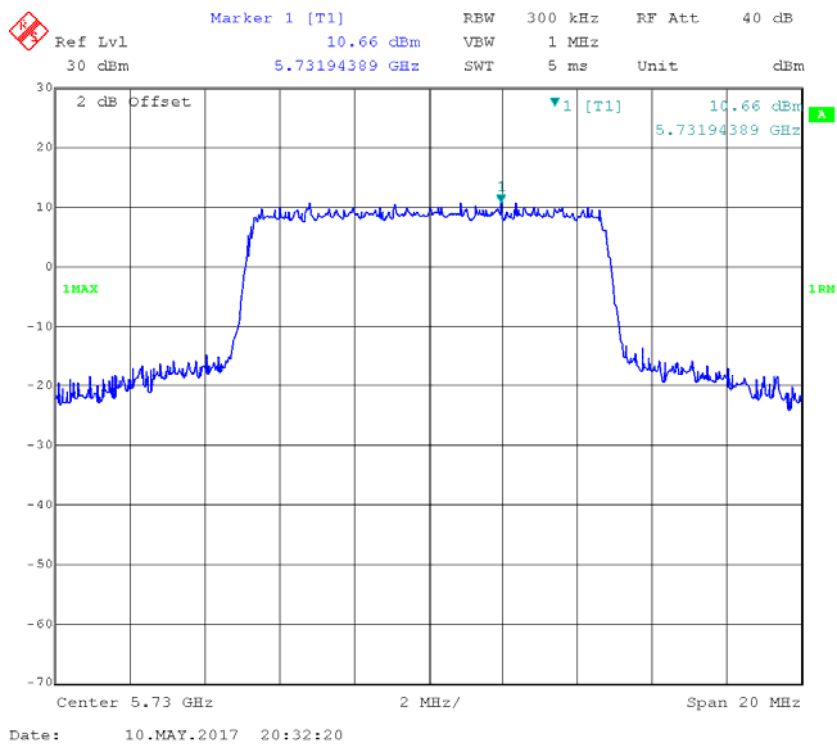
### Middle Channel – Chain0



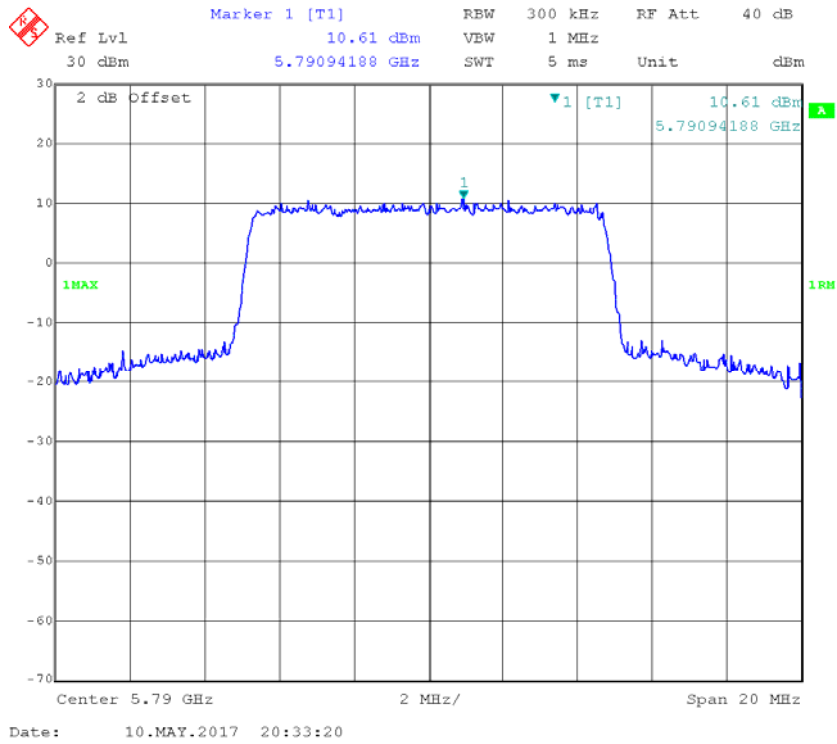
### High Channel – Chain0



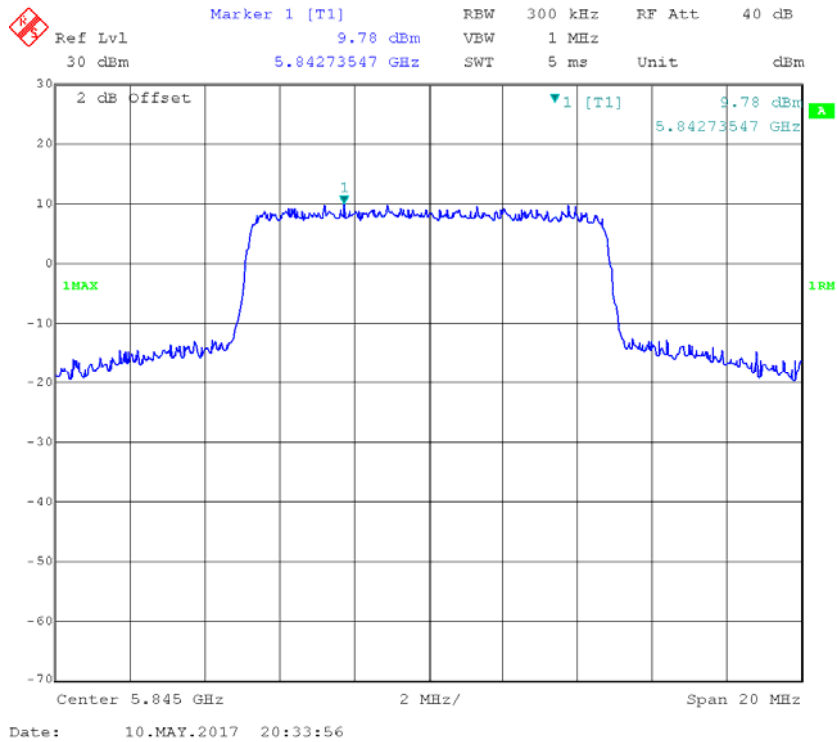
### Low Channel – Chain1



### Middle Channel – Chain1



### High Channel – Chain1



## **FCC §15.407(b)& RSS-247 §6.2 – OUT- OF-BAND EMISSIONS**

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### **Applicable Standard**

FCC §15.407

(b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band:

(i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(ii) Devices certified before March 2, 2017 with antenna gain greater than 10 dBi may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease by March 2, 2018. Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.

(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

According to RSS-247§6.2

### **Frequency band 5150-5250 MHz**

#### **6.2.1.2 Unwanted emission limits**

For transmitters with operating frequencies in the band 5150-5250 MHz, all emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. Any unwanted emissions that fall into the band 5250-5350 MHz shall be attenuated below the channel power by at least 26 dB, when measured using a resolution bandwidth between 1 and 5% of the occupied bandwidth (i.e. 99% bandwidth), above 5250 MHz. The 26 dB bandwidth may fall into the 5250-5350 MHz band; however, if the occupied bandwidth also falls within the 5250-5350 MHz band, the transmission is considered as intentional and the devices shall comply with all requirements in the band 5250-5350 MHz including implementing dynamic frequency selection (DFS) and TPC, on the portion of the emission that resides in the 5250-5350 MHz band.

## **Frequency band 5250-5350 MHz**

### **6.2.2.2 Unwanted emission limits**

Devices shall comply with the following:

- a) All emissions outside the band 5250-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p.; or
- b) All emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. and its power shall comply with the spectral power density for operation within the band 5150-5250 MHz. The device, except devices installed in vehicles, shall be labelled or include in the user manual the following text “for indoor use only.”

## **Frequency bands 5470-5600 MHz and 5650-5725 MHz:**

### **6.2.3.2 Unwanted emission limits**

Emissions outside the band 5470-5600 MHz and 5650-5725 MHz shall not exceed -27 dBm/MHz e.i.r.p. However, devices with bandwidth overlapping the band edge of 5725 MHz can meet the emission limit of -27 dBm/MHz e.i.r.p. at 5850 MHz instead of 5725 MHz.

## **Frequency band 5725-5850 MHz**

### **6.2.4.2 Unwanted emission limits**

Devices operating in the band 5725-5850 MHz with antenna gain greater than 10 dBi can have unwanted emissions that comply with either the limits in this section or in section 5.5 until six (6) months after the publication date of this standard for certification. Certified devices that do not comply with emission limits in this section shall not be manufactured, imported, distributed, leased, offered for sale or sold after April 1, 2018.

Devices operating in the band 5725-5850 MHz with antenna gain of 10 dBi or less can have unwanted emissions that comply with either the limits in this section or in section 5.5 until April 1, 2018 for certification. Certified devices that do not comply with emission limits in this section shall not be manufactured, imported, distributed, leased, offered for sale or sold after April 1, 2020.

Devices operating in the band 5725-5850 MHz shall have e.i.r.p. of unwanted emissions comply with the following:

- a) 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edges;
- b) 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;
- c) 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm/MHz at 75 MHz above or below the band edges; and
- d) -27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

### Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v01r04.

### 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           |
| Unknown         | RF Cable        | Unknown | C-2           | Each Time        | /                    |

\* **Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B "Implementation of traceability policy in accredited laboratories".

### Test Data

#### Environmental Conditions

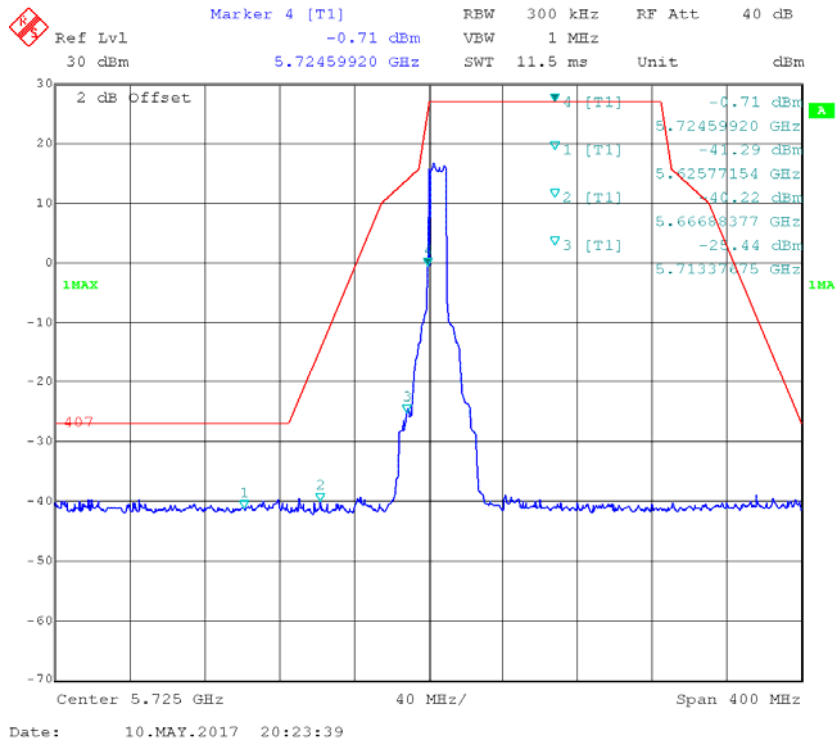
|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 26.3°C    |
| <b>Relative Humidity:</b> | 50 %      |
| <b>ATM Pressure:</b>      | 100.1 kPa |

*The testing was performed by Lorin Bian from 2017-05-10.*

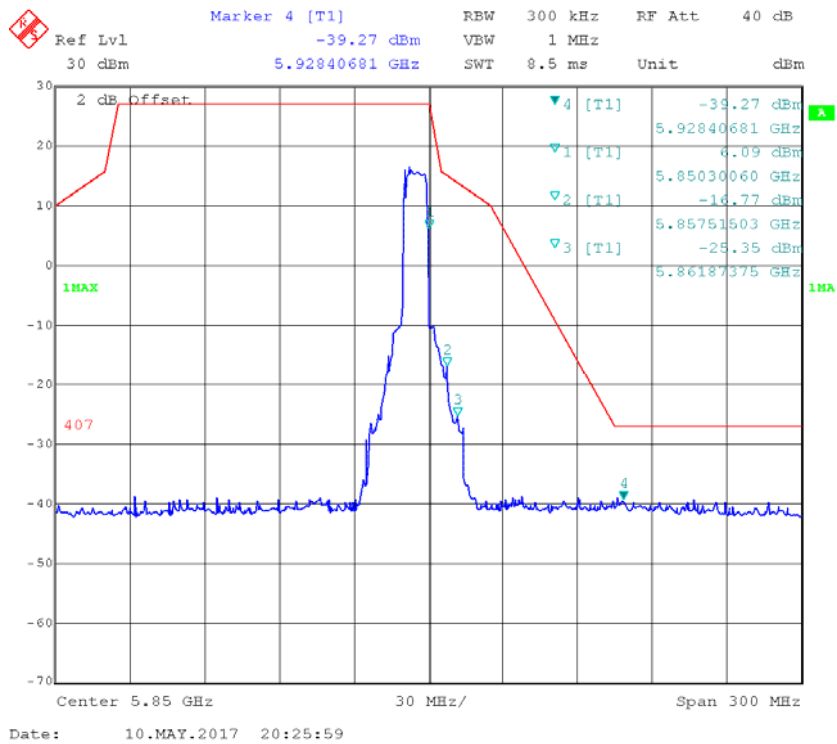
**Test Result:** Pass.

Note: The test performed at chain 0 and 1, Since per output power test, Chain 0 and 1 was the maximum output, The antenna gain and cable loss was offset in the display, and all emissions under limit 3dBc, Please refer to the following tables and plots.

### Low Channel – Chain 0

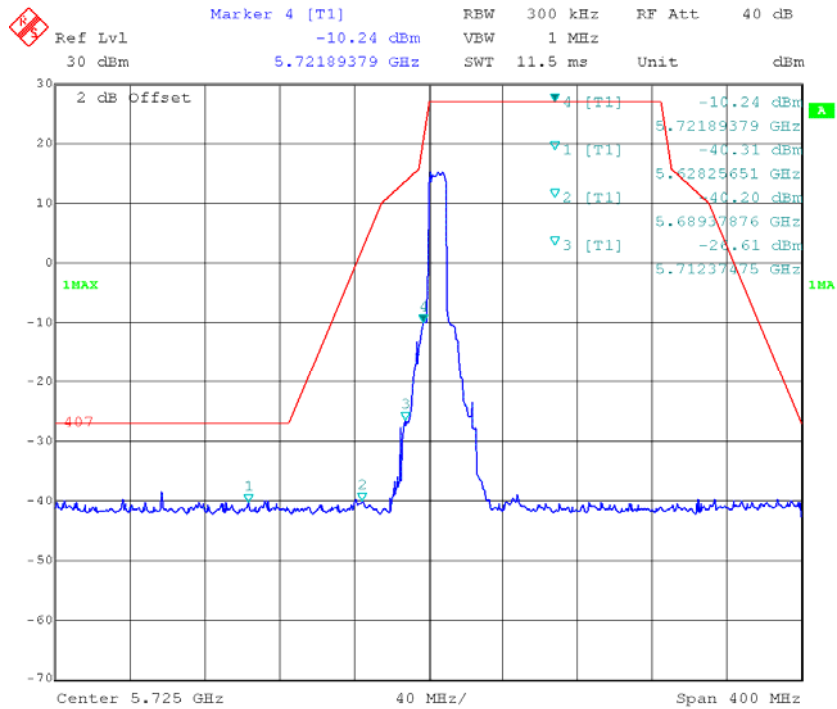


### High Channel – Chain 0



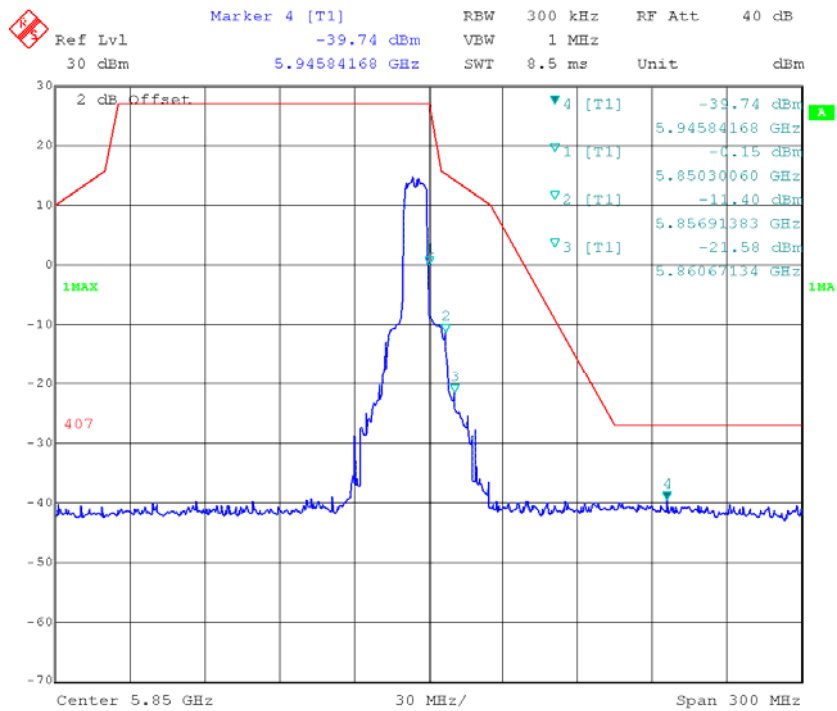


### Low Channel – Chain 1



Date: 10.MAY.2017 20:30:53

### High Channel – Chain 1



Date: 10.MAY.2017 20:29:22

## FCC §15.407(g) – FREQUENCY STABILITY

### Applicable Standard

FCC §15.407

(g) Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

### Test Procedure

According to C63.10-2013 clause 6.8.

### 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           |
| Unknown         | RF Cable                      | Unknown | C-2           | Each Time        | /                    |
| FLUKE           | Multimeter                    | 1587    | 27870099      | 2016-12-30       | 2017-12-29           |
| BACL            | High Temperature Test Chamber | BTH-150 | 30024         | 2016-12-02       | 2017-12-01           |

\* **Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B “Implementation of traceability policy in accredited laboratories”.

### Test Data

#### Environmental Conditions

|                           |          |
|---------------------------|----------|
| <b>Temperature:</b>       | 22.6 °C  |
| <b>Relative Humidity:</b> | 58 %     |
| <b>ATM Pressure:</b>      | 98.6 kPa |

*The testing was performed by Lorin Bian on 2017-05-23.*

Test mode: Transmitting(Test was performed at chain 0)

**Test Result:** Compaint

| Temperature | Voltage         | f <sub>L</sub> at Low Test Channel | F <sub>H</sub> at High Test Channel | Limit   |
|-------------|-----------------|------------------------------------|-------------------------------------|---|
| °C          | V <sub>DC</sub> | MHz                                | MHz                                 |   |
| -10         | 22.8            | 5725.2906                          | 5849.7499                           | f <sub>L</sub> and f <sub>H</sub> Within<br>5725~5850MHz<br>range |
| 0           |                 | 5725.2921                          | 5849.7495                           |   |
| 10          |                 | 5725.2912                          | 5849.7485                           |   |
| 20          |                 | 5725.2914                          | 5849.7477                           |   |
| 30          |                 | 5725.2916                          | 5849.7499                           |   |
| 40          |                 | 5725.2918                          | 5849.7486                           |   |
| 25          | 18              | 5725.2922                          | 5849.7487                           |   |
| 25          | 26.1            | 5725.2909                          | 5849.7494                           |   |

Note: the f<sub>L</sub> and f<sub>H</sub> determined by 99% Occupied bandwidth low edge at Low test channel and High edge at High test channel.

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