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**TEST REPORT**

For

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**FCC ID: 2ANDR-R21708**  
**IC: 23060-R21708**

<b>Report Type:</b> Original Report	<b>Product Name:</b> RONIN 2
<b>Report Number:</b> <u>RDG170730002-00B</u>	
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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 (FCC ID: 2ANDR-R21708, IC: 23060-R21708)* ( the "EUT") in this report was a *RONIN 2*, which was measured approximately: 63 cm (L) x 41.6 cm (W) x 72 cm (H), rated input voltage: DC 22.8V from battery, the battery can be removed from the device and charged by charging Hub.

All measurement and test data in this report was gathered from production sample serial number: 170730002 (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, 15.209, 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 15.247 DTS, FCC ID: 2ANDR-R21708 .

FCC submissions with Part 15E NII, FCC ID: 2ANDR-R21708.

ISEDC submissions with RSS-247 DTSS and LE-LAN, IC: 23060-R21708.

Part of system submissions with FCC: 2ANDR-R2TX11708, IC: 23060-R2TX11708.

### 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/IEC 17025 by CNAS(Lab code: L5662). And accredited to ISO/IEC 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 in 2.4GHz band, 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

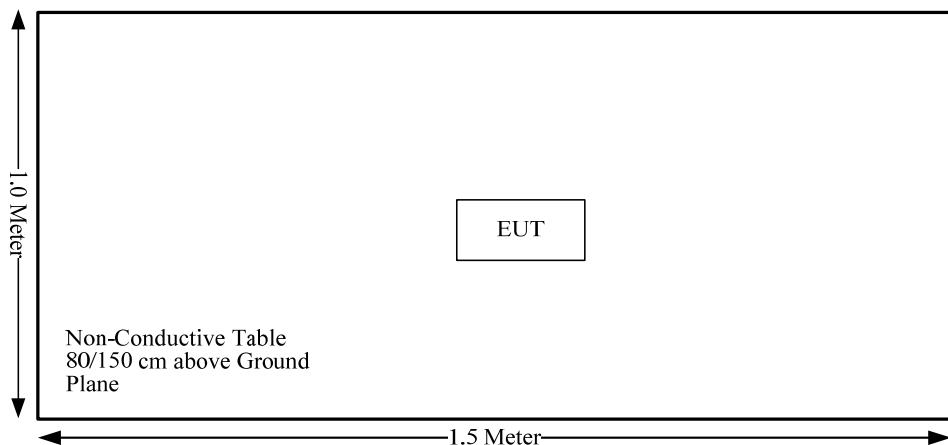
The software “RF Certification.exe” was used for testing, which was provided by manufacturer. The maximum power level was configured as below table:

Test Software Version	RF Certification.exe		
Test Frequency	2408MHz	2442.5MHz	2475.5MHz
Power Level Setting	45	45	45

### Equipment Modifications

No modification was made to the EUT.

### Block Diagram of Test Setup



## SUMMARY OF TEST RESULTS

Rules	Description of Test	Result
FCC §15.247 (i) & §1.1310 & §2.1091 RSS-102§4	Maximum Permissible Exposure (MPE)	Compliance
FCC§15.203 RSS-Gen Clause 8.3	Antenna Requirement	Compliance
FCC§15.207 (a) RSS-Gen Clause 8.8	Conducted Emissions	Not Applicable
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

Note:

Not Applicable: the device was powered by battery.

## FCC §15.247 (i) , §1.1310 , §2.1091& RSS-102 § 4- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

### Applicable Standard

According to subpart 15.247(i) 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) Limits for General Population/Uncontrolled Exposure				
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;

According to §1.1310 and §2.1091 RF exposure is calculated.

According to RSS-102 § 4Table 4, RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

**Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)**

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m <sup>2</sup> )	Reference Period (minutes)
0.003-10 <sup>21</sup>	83	90	-	Instantaneous*
0.1-10	-	0.73/ f	-	6**
1.1-10	87/ f <sup>0.5</sup>	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ f <sup>0.25</sup>	0.1540/ f <sup>0.25</sup>	8.944/ f <sup>0.5</sup>	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 f <sup>0.3417</sup>	0.008335 f <sup>0.3417</sup>	0.02619 f <sup>0.6834</sup>	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ f <sup>1.2</sup>
150000-300000	0.158 f <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> f <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> f	616000/ f <sup>1.2</sup>

Note: f is frequency in MHz.  
\*Based on nerve stimulation (NS).  
\*\* Based on specific absorption rate (SAR).

### 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);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

### Calculated Data:

Mode	Frequency (MHz)	Antenna Gain		Tune-up Power		Evaluation Distance (cm)	Power Density		MPE Limit	
		(dBi)	(numeric)	(dBm)	(mW)		(mW/cm <sup>2</sup> )	(W/m <sup>2</sup> )	FCC (mW/cm <sup>2</sup> )	RSS-102 (W/m <sup>2</sup> )
2.4G FHSS	2408-2475.5	2.81	1.91	21	125.89	20.00	0.0479	0.479	1.0	5.36
5.8G NII	5727-5845	4.59	2.88	17	50.12	20.00	0.0287	0.287	1.0	9.69
BLE	2402-2480	3.12	2.05	7	5.01	20.00	0.0020	0.02	1.0	5.35

Note: User may catch the hand-held loop to use, in this use condition, the radio antenna to the hand is more than 20cm(please refer to the EUT external photo), and the user body should keep more than 20cm from the radio antenna.

The 2.4G FHSS or 5.8G NII can transmit simultaneously with BLE, but 2.4G FHSS and 5.8G NII can't transmit simultaneously. So, the maximum ratio was 2.4G FHSS+ BLE:

### For FCC:

$$\sum_i \frac{S_i}{S_{Limit,i}}$$

$$=S_{FHSS}/S_{limit-FHSS} + S_{BLE}/S_{limit-BLE}$$

$$=0.0479/1+0.002/1$$

$$=0.0499$$

$$< 1.0$$

### For RSS-102:

$$\sum_i \frac{S_i}{S_{Limit,i}}$$

$$=S_{FHSS}/S_{limit-FHSS} + S_{BLE}/S_{limit-BLE}$$

$$=0.479/5.36+0.02/5.35$$

$$=0.0931$$

$$< 1.0$$

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

## **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).

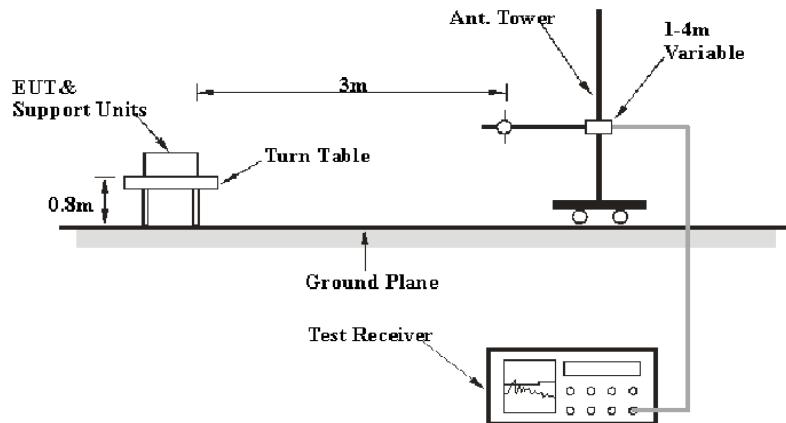
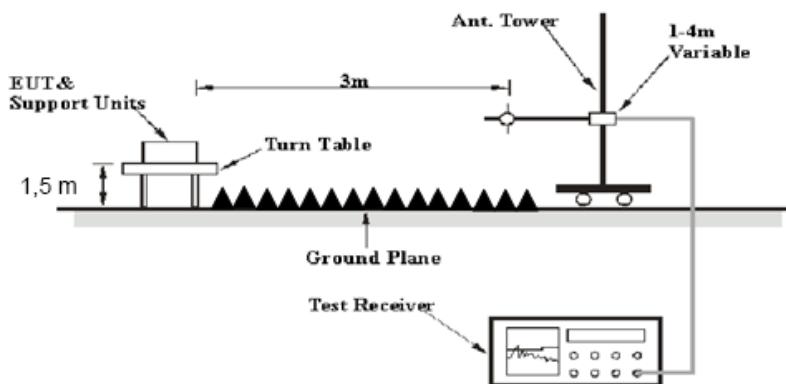
### **Antenna Connector Construction**

The EUT has two internal antenna arrangement for 2.4G FHSS mode, one for transmitting and another one for receiving, the antenna gain is 2.81 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

**Result:** 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

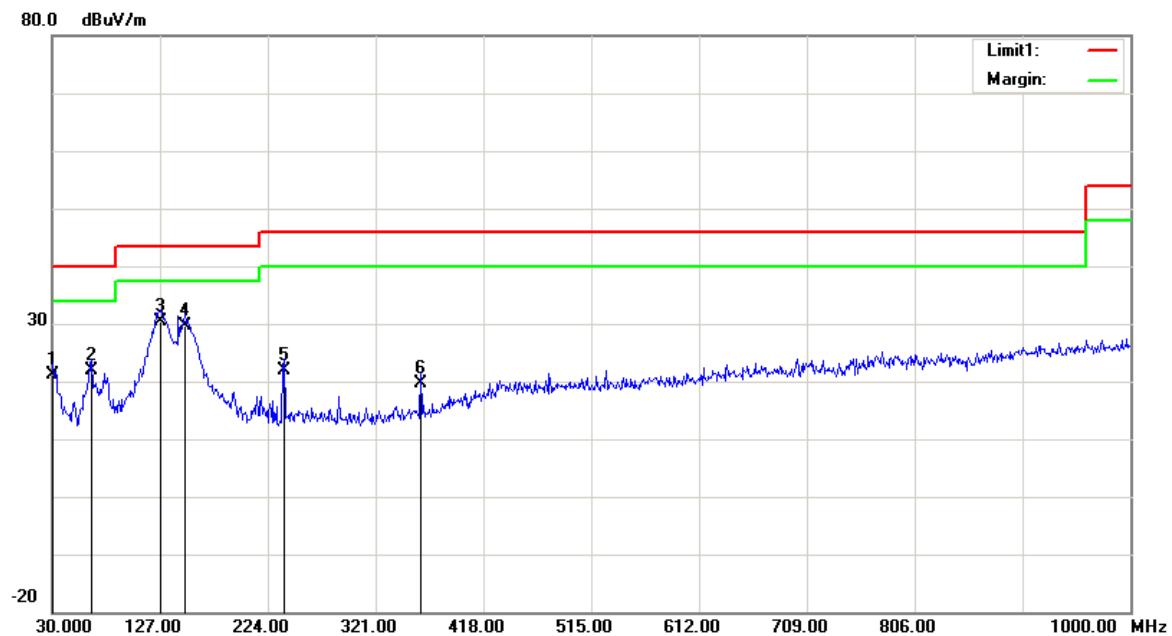
### Environmental Conditions

<b>Temperature:</b>	27.6 °C
<b>Relative Humidity:</b>	30 %
<b>ATM Pressure:</b>	100.1 kPa

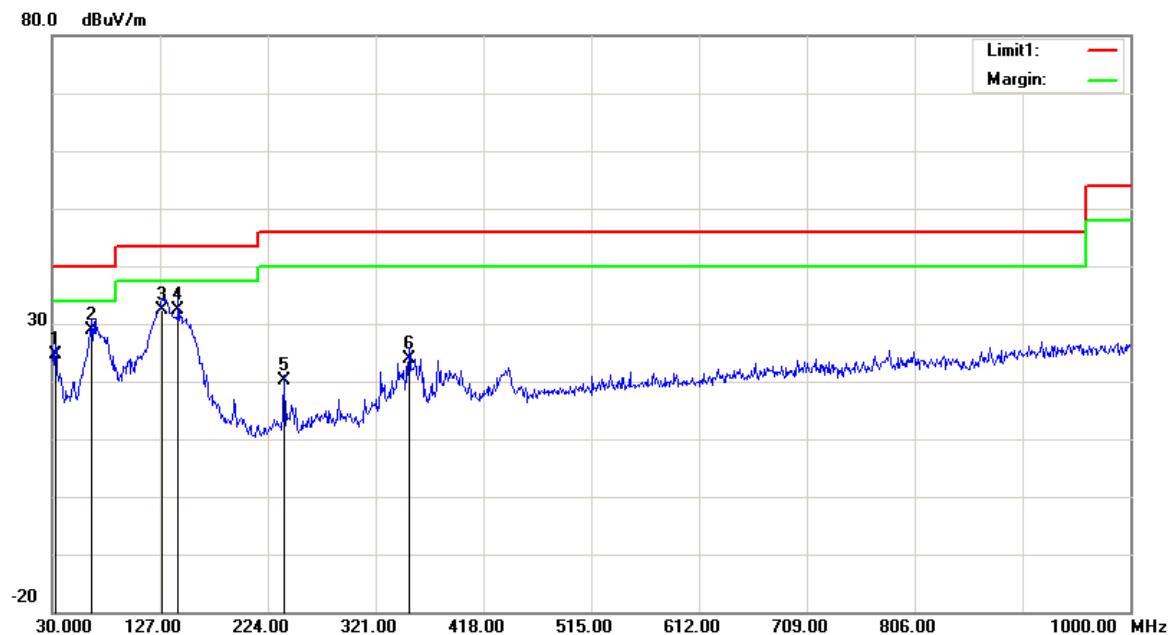
\* The testing was performed by Tony Zeng on 2017-08-11.

Test Mode: Transmitting

## 1) 30MHz-1GHz(Low Channel was the worst)::

**Horizontal:**

Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.9700	26.21	QP	-5.11	21.10	40.00	18.90
65.8900	39.57	QP	-17.77	21.80	40.00	18.20
127.9700	41.30	QP	-10.90	30.40	43.50	13.10
149.3100	41.80	QP	-12.20	29.60	43.50	13.90
238.5500	34.14	QP	-12.24	21.90	46.00	24.10
361.7400	28.58	QP	-8.98	19.60	46.00	26.40

**Vertical:**

Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
32.9100	31.18	QP	-6.58	24.60	40.00	15.40
65.8900	46.67	QP	-17.77	28.90	40.00	11.10
128.9400	43.45	QP	-10.95	32.50	43.50	11.00
143.4900	44.53	QP	-12.13	32.40	43.50	11.10
238.5500	32.34	QP	-12.24	20.10	46.00	25.90
351.0700	33.00	QP	-9.10	23.90	46.00	22.10

## 2) 1-25GHz:

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
	Reading (dB $\mu$ V)	Detector	Polar (H/V)	Factor (dB)					
Low Channel: 2408 MHz									
2408	79.88	PK	H	28.12	3.11	0.00	111.11	N/A	N/A
2408	73.51	AV	H	28.12	3.11	0.00	104.74	N/A	N/A
2408	82.55	PK	V	28.12	3.11	0.00	113.78	N/A	N/A
2408	75.74	AV	V	28.12	3.11	0.00	106.97	N/A	N/A
2390	22.32	PK	V	28.08	3.10	0.00	53.50	74.00	20.50
2390	13.64	AV	V	28.08	3.10	0.00	44.82	54.00	9.18
4816	48.59	PK	V	32.93	4.32	35.49	50.35	74.00	23.65
4816	33.42	AV	V	32.93	4.32	35.49	35.18	54.00	18.82
7224	48.16	PK	V	35.78	5.46	35.97	53.43	74.00	20.57
7224	33.27	AV	V	35.78	5.46	35.97	38.54	54.00	15.46
5715	47.52	PK	V	34.19	4.66	35.85	50.52	74.00	23.48
5715	32.34	AV	V	34.19	4.66	35.85	35.34	54.00	18.66
Middle Channel: 2442.5 MHz									
2442.5	79.68	PK	H	28.19	3.11	0.00	110.98	N/A	N/A
2442.5	72.36	AV	H	28.19	3.11	0.00	103.66	N/A	N/A
2442.5	81.98	PK	V	28.19	3.11	0.00	113.28	N/A	N/A
2442.5	73.49	AV	V	28.19	3.11	0.00	104.79	N/A	N/A
4885	48.76	PK	V	33.07	4.40	35.54	50.69	74.00	23.31
4885	33.64	AV	V	33.07	4.40	35.54	35.57	54.00	18.43
7327.5	48.23	PK	V	36.05	5.53	35.98	53.83	74.00	20.17
7327.5	32.68	AV	V	36.05	5.53	35.98	38.28	54.00	15.72
5955	47.51	PK	V	34.28	4.64	35.85	50.58	74.00	23.42
5955	32.63	AV	V	34.28	4.64	35.85	35.70	54.00	18.30
6315	47.85	PK	V	34.24	5.05	35.78	51.36	74.00	22.64
6315	32.76	AV	V	34.24	5.05	35.78	36.27	54.00	17.73
High Channel: 2475.5 MHz									
2475.5	77.98	PK	H	28.25	3.10	0.00	109.33	N/A	N/A
2475.5	72.56	AV	H	28.25	3.10	0.00	103.91	N/A	N/A
2475.5	82.31	PK	V	28.25	3.10	0.00	113.66	N/A	N/A
2475.5	73.94	AV	V	28.25	3.10	0.00	105.29	N/A	N/A
2483.5	27.29	PK	V	28.27	3.10	0.00	58.66	74.00	15.34
2483.5	13.36	AV	V	28.27	3.10	0.00	44.73	54.00	9.27
4951	48.67	PK	V	33.20	4.42	35.59	50.70	74.00	23.30
4951	33.26	AV	V	33.20	4.42	35.59	35.29	54.00	18.71
7426.5	48.35	PK	V	36.31	5.59	35.98	54.27	74.00	19.73
7426.5	33.05	AV	V	36.31	5.59	35.98	38.97	54.00	15.03
6445	47.59	PK	V	34.21	5.20	35.75	51.25	74.00	22.75
6445	32.46	AV	V	34.21	5.20	35.75	36.12	54.00	17.88

**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**

<b>Temperature:</b>	27.6°C
<b>Relative Humidity:</b>	47.5 %
<b>ATM Pressure:</b>	100.1kPa

\* The testing was performed by Sun Zhong on 2017-08-13.

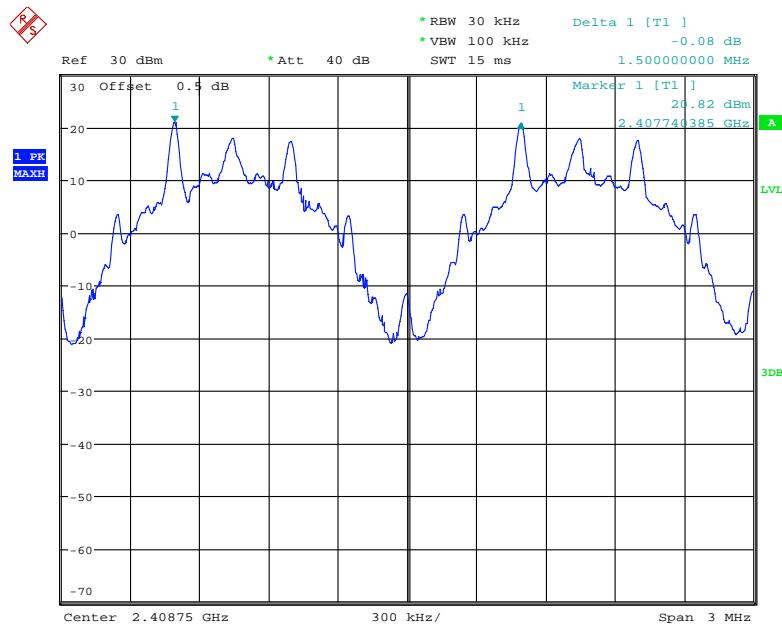
**Test Result:** Compliance.

Please refer to following tables and plots

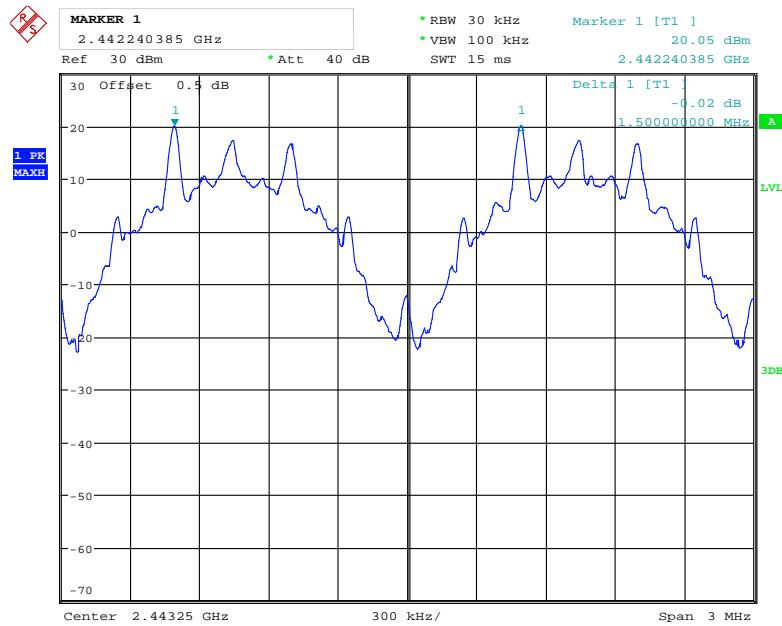
*Test Mode: Transmitting*

<b>Channel</b>	<b>Frequency</b>	<b>Channel Separation</b>	<b>Limit</b>
	<b>MHz</b>	<b>MHz</b>	<b>MHz</b>
Low	2408	1.5	0.68
Middle	2442.5	1.5	0.68
High	2475.5	1.5	0.68

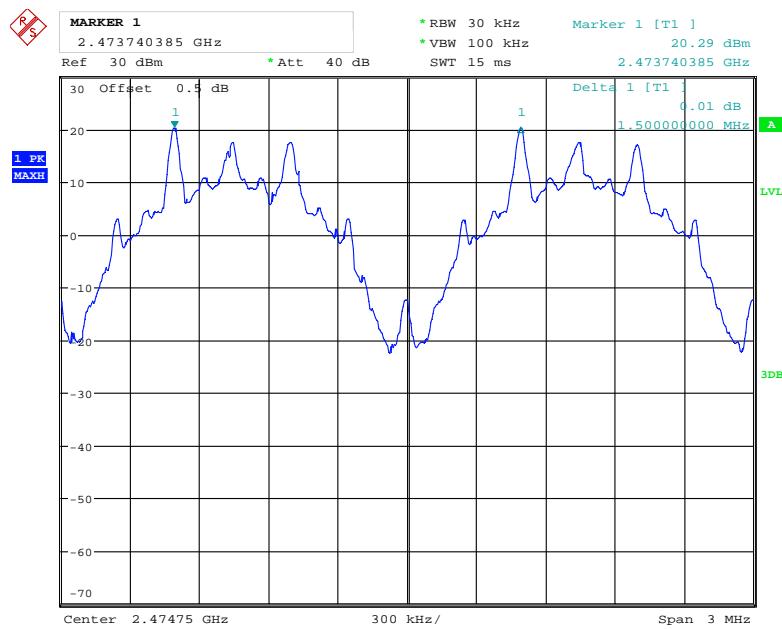
*Note: Limit= (2/3)× 20dB bandwidth*

**Low Channel**

Date: 13.AUG.2017 14:47:15

**Middle Channel**

Date: 13.AUG.2017 14:49:14

**High Channel**

Date: 13.AUG.2017 14:51:07

**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**

<b>Temperature:</b>	27.6°C
<b>Relative Humidity:</b>	47.5 %
<b>ATM Pressure:</b>	100.1kPa

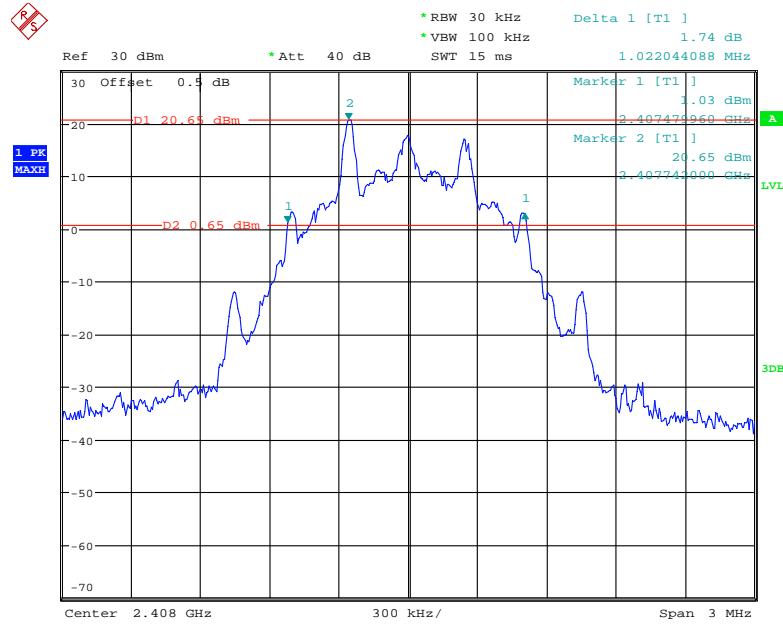
\* The testing was performed by Sun Zhong on 2017-08-13.

**Test Result:** Compliance.

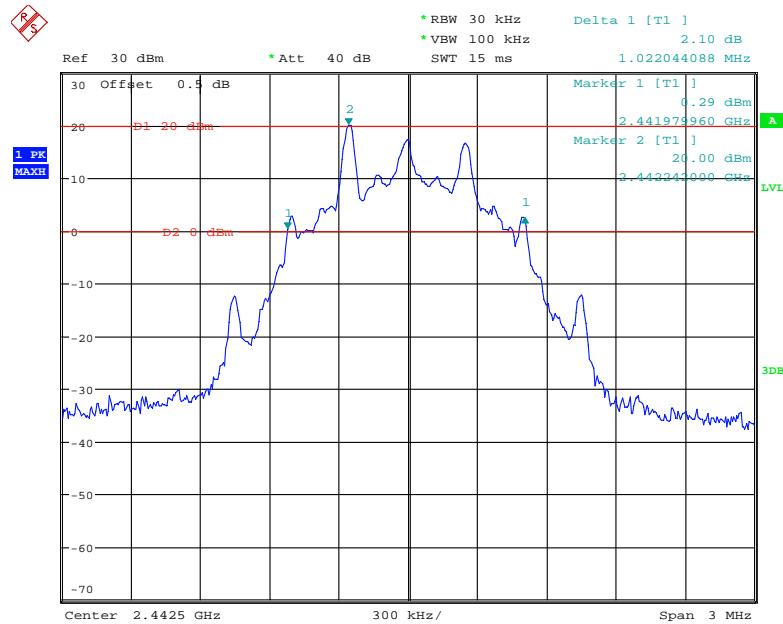
Please refer to following tables and plots

*Test Mode: Transmitting*

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% occupied Bandwidth (MHz)
Low	2408	1.02	0.98
Middle	2442.5	1.02	0.98
High	2475.5	1.02	0.98

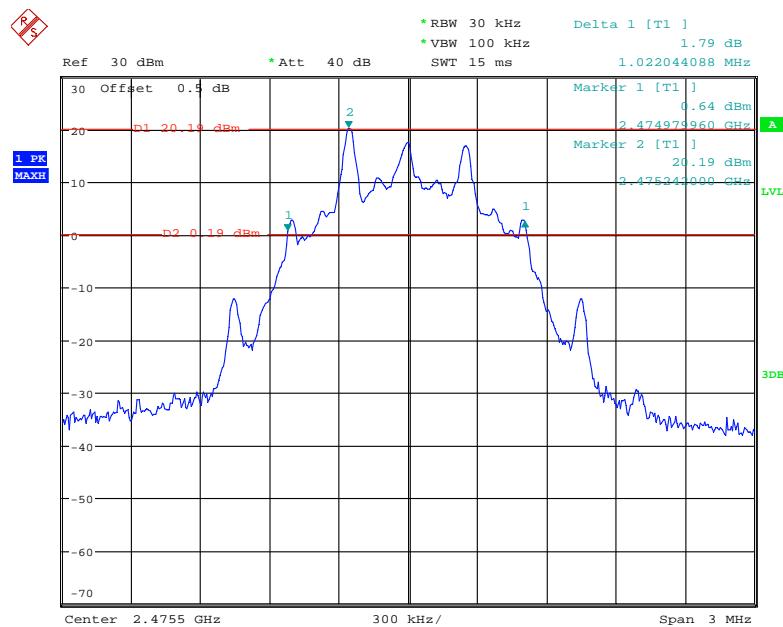
**20dB Bandwidth:****Low Channel**

Date: 13.AUG.2017 15:00:10

**Middle Channel**

Date: 13.AUG.2017 15:05:42

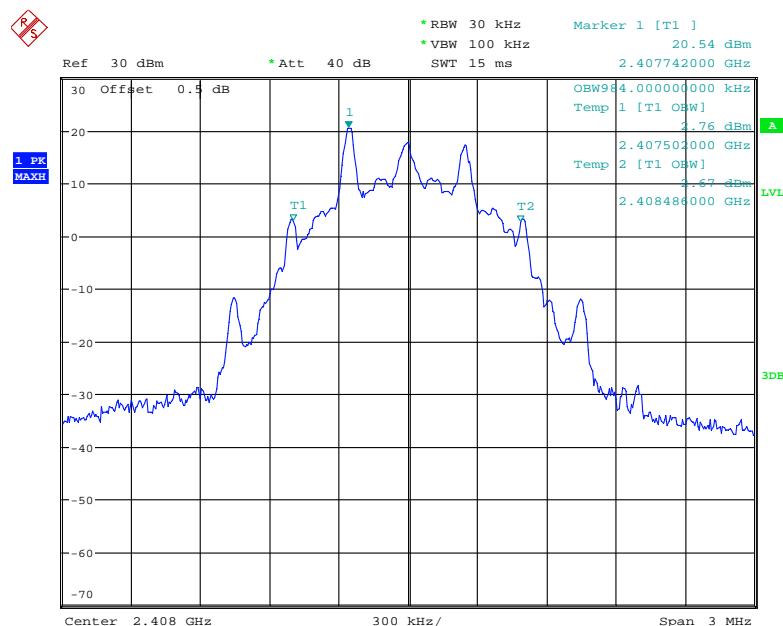
### High Channel



Date: 13.AUG.2017 15:08:20

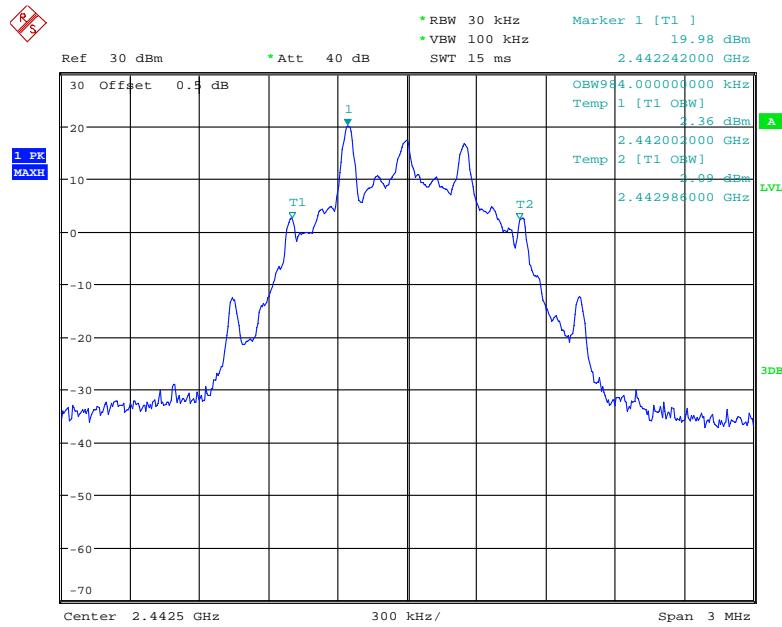
### 99% Occupied Bandwidth:

### Low Channel



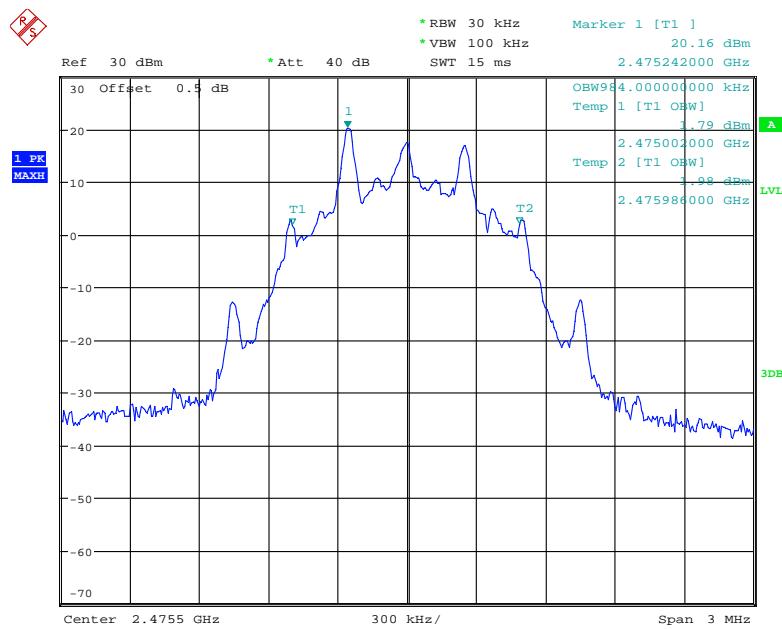
Date: 13.AUG.2017 15:04:39

## Middle Channel



Date: 13.AUG.2017 15:06:27

## High Channel



Date: 13.AUG.2017 15:09:01

## 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

<b>Temperature:</b>	27.6°C
<b>Relative Humidity:</b>	47.5 %
<b>ATM Pressure:</b>	100.1kPa

\* The testing was performed by Sun Zhong on 2017-08-13.

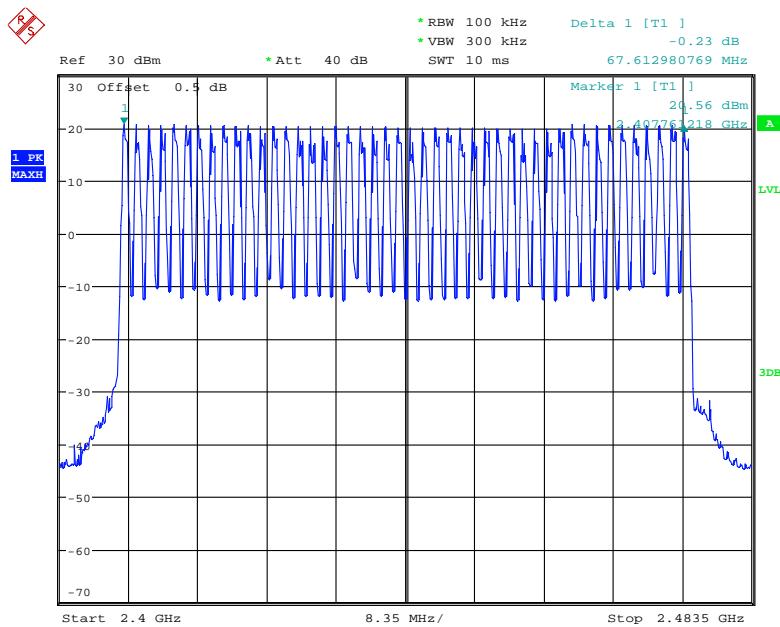
**Test Result:** Compliance.

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: 13.AUG.2017 14:56:43

## 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:	27.6°C
Relative Humidity:	47.5 %
ATM Pressure:	100.1kPa

\* The testing was performed by Sun Zhong on 2017-08-13.

**Test Result:** Compliance.

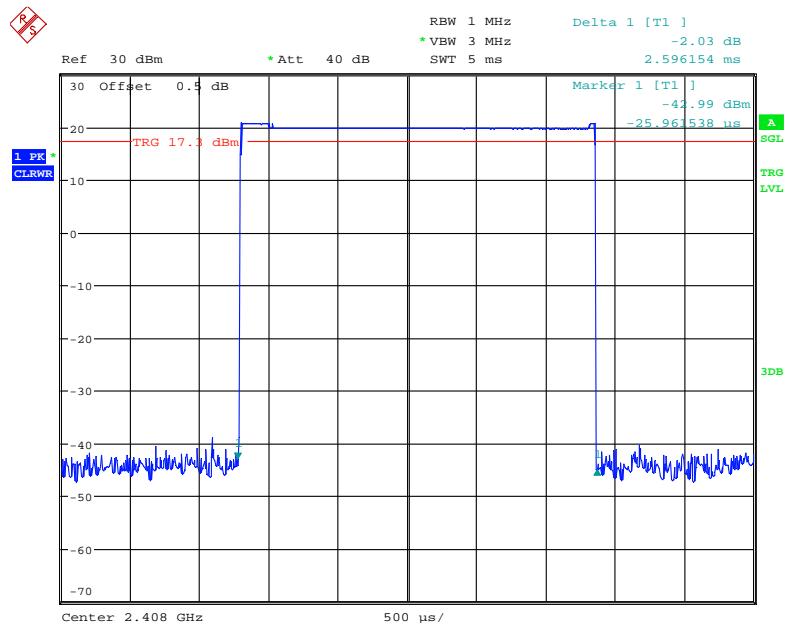
Please refer to following tables and plots

*Test Mode: Transmitting*

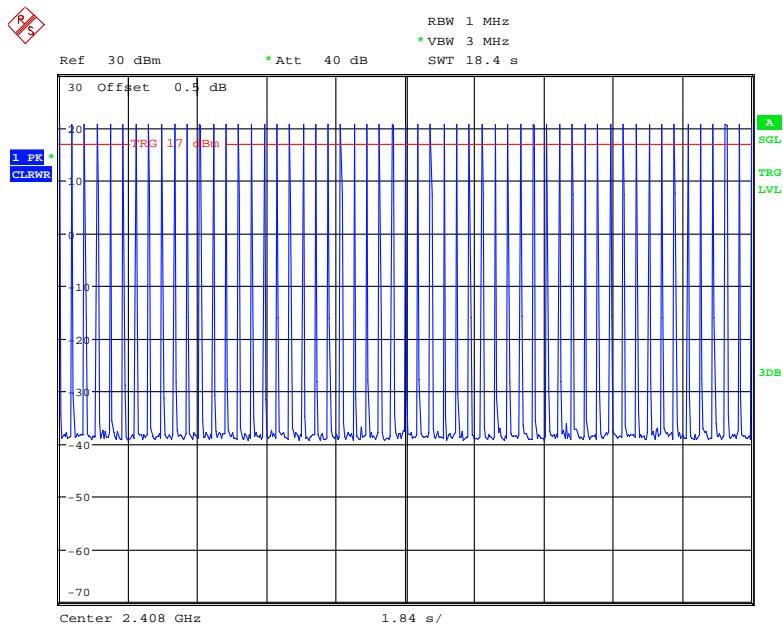
Channel	Pulse Width (ms)	Hopping numbers in during (Hopping channel number*0.4)	Dwell Time (s)	Limit (s)	Result
Low	2.596	54	0.14	0.4	Compliance
Middle	2.596	54	0.14	0.4	Compliance
High	2.596	54	0.14	0.4	Compliance

Note: Dwell time=Pulse time (ms) × hopping numbers in during  
During=Hopping channel number\*0.4

### Low Channel

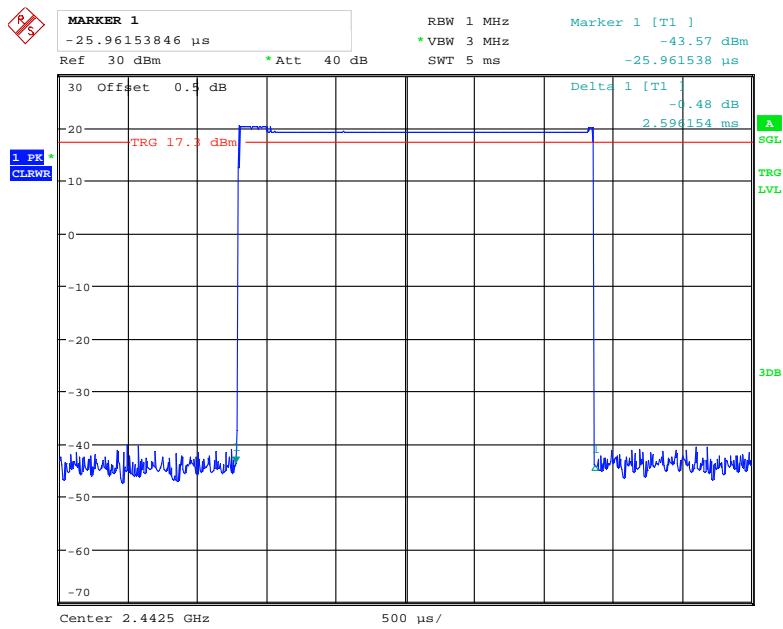


Date: 13.AUG.2017 14:41:11

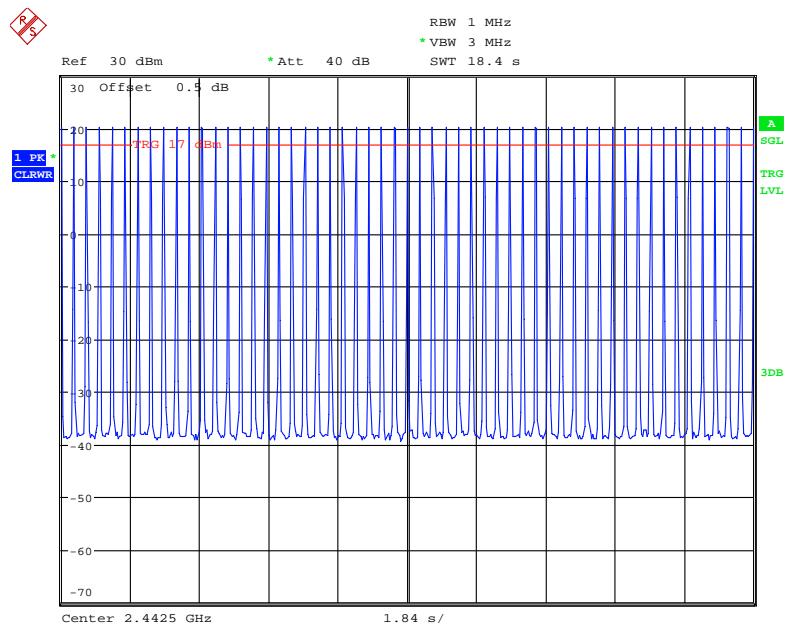


Date: 13.AUG.2017 15:15:18

### Middle Channel

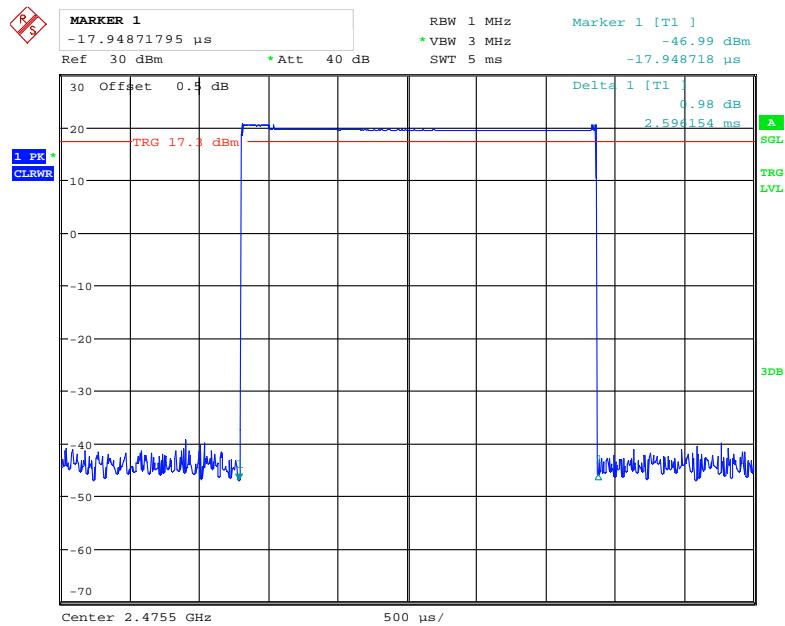


Date: 13.AUG.2017 14:41:44

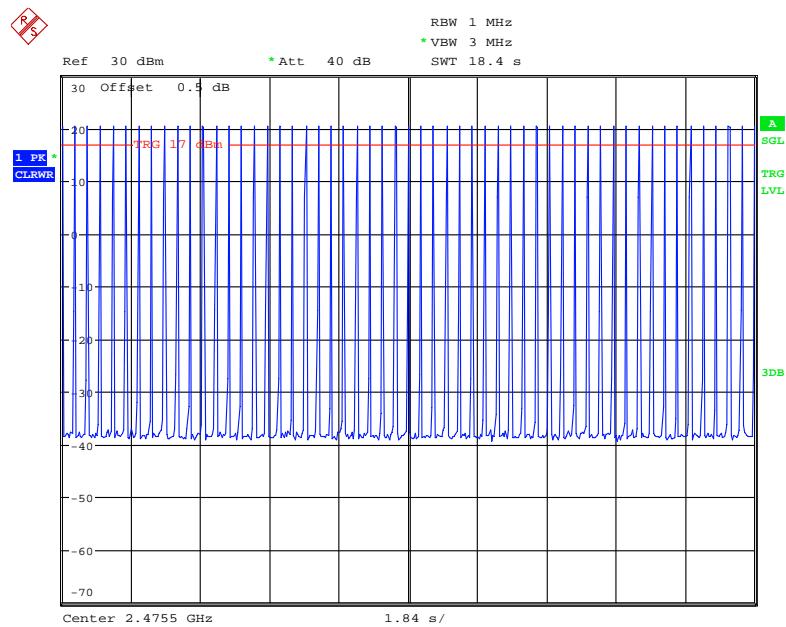


Date: 13.AUG.2017 15:16:22

### High Channel



Date: 13.AUG.2017 14:42:33



Date: 13.AUG.2017 15:16:55

## 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:	27.6°C
Relative Humidity:	47.5 %
ATM Pressure:	100.1kPa

\* The testing was performed by Sun Zhong on 2017-08-13.

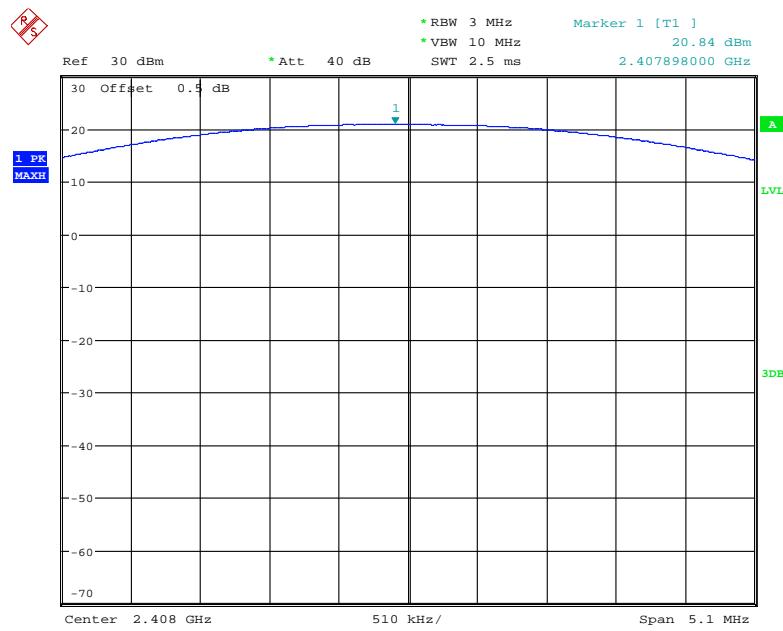
**Test Result:** Compliance.

*Test Mode: Transmitting*

Mode	Frequency (MHz)	Conducted Peak Output power (dBm)	Limit (dBm)
GFSK	2408	20.84	21
	2442.5	20.25	21
	2475.5	20.45	21

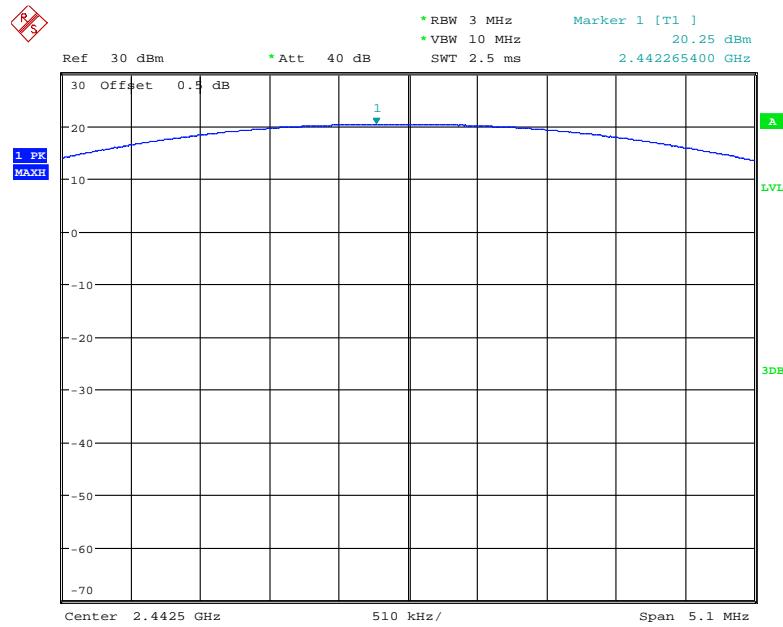
Note: The data above was tested in conducted mode, the antenn gain is 2.81dBi in 2.4GHz band.

### Low Channel



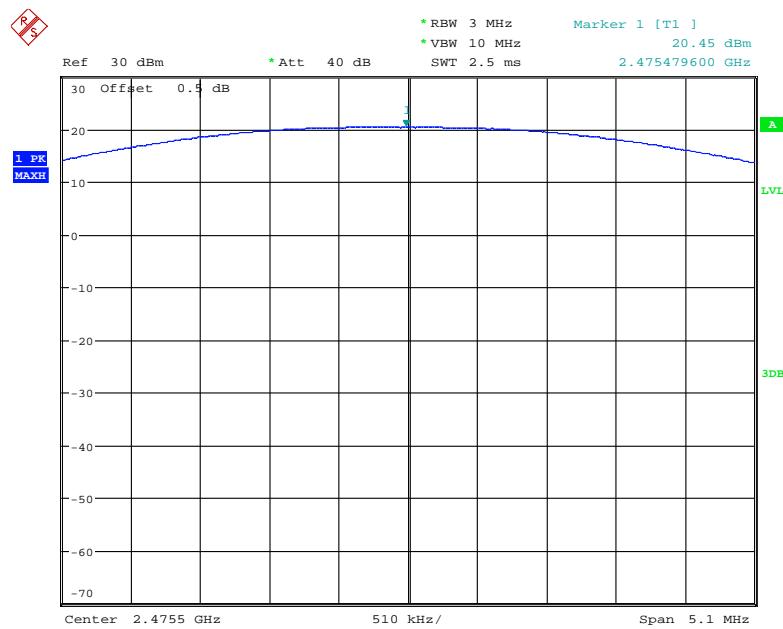
Date: 13.AUG.2017 15:02:44

### Middle Channel



Date: 13.AUG.2017 15:06:41

### High Channel



Date: 13.AUG.2017 15:09:14

## **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	/

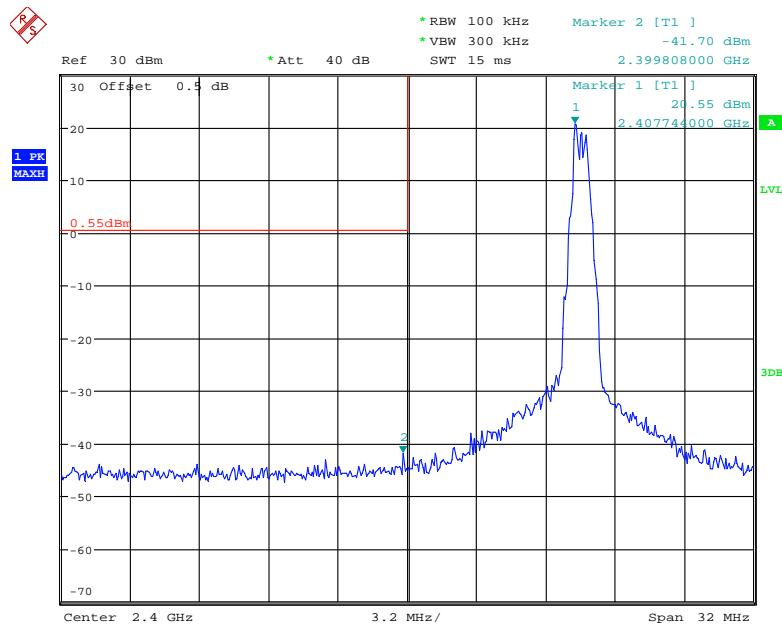
\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

**Test Data****Environmental Conditions**

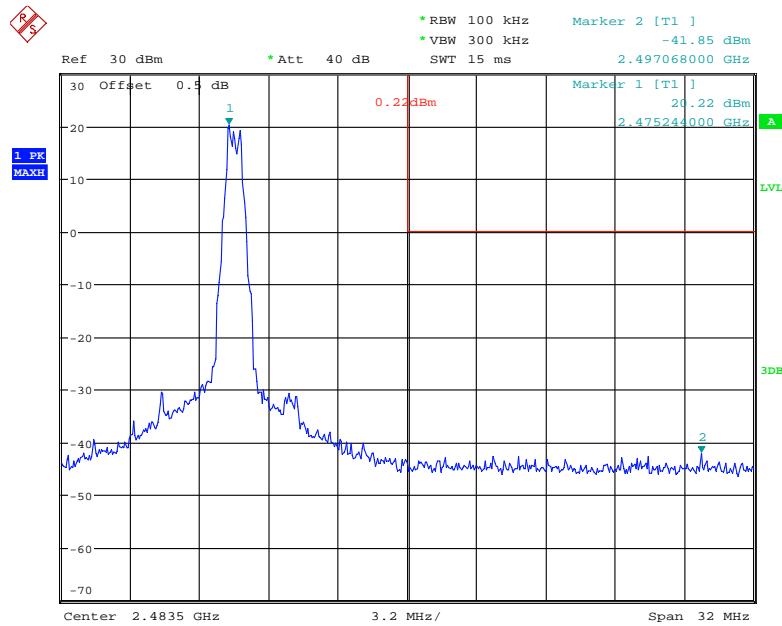
<b>Temperature:</b>	27.6°C
<b>Relative Humidity:</b>	47.5 %
<b>ATM Pressure:</b>	100.1kPa

\* The testing was performed by Sun Zhong on 2017-08-13.

**Test Result:** Compliance

**Band Edge, Left Side**

Date: 13.AUG.2017 15:03:25

**Band Edge, Right Side**

Date: 13.AUG.2017 15:10:06

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