



FCC PART 15.407

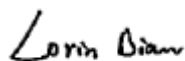

TEST REPORT

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-WM331A1704

Report Type: Original Report	Product Name: Phantom 4 Pro
Test Engineer:	<u>Lorin Bian</u> 
Report Number:	<u>RDG170329005C-A1</u>
Report Date:	<u>2017-04-11</u>
Reviewed By:	Henry Ding  EMC Leader
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Chengdu) No.5040, Huilongwan Plaza, No.1, Shawan Road, Jinniu District, Chengdu, Sichuan, China Tel: 028-65523123, Fax: 028-65525125 www.baclcorp.com

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

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The **SZ DJI TECHNOLOGY CO., LTD's** product, model number: **WM331A (FCC ID: SS3-WM331A1704)** (or the "EUT") in this report was a **Phantom 4 Pro**, which was measured approximately: 500 mm (L) x 500 mm (W) x 185 mm(H), rated input voltage: DC 15.2V from lithium battery.

**All measurement and test data in this report was gathered from final production sample, serial number: 170329005 (assigned by the BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2017-03-20, 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, B and E of the Federal Communications Commission's rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart E, section 15.203, 15.205, 15.209 and 15.407 rules.

This is the second application for model number: **WM331A**, the first application was certified with FCC ID: **SS3-WM331A1609**, granted on 2016-10-28, the difference between the original device and the current one is as follows:

1. Increased one channel in Sub 1G Mode:
Previous: 49 channels from 915.938MHz-925.538MHz, 200kHz channel separation.
Current: 50 channels from 915.938MHz-925.738MHz, 200kHz channel separation.
2. Increased the output power for Sub 1G mode.
3. employed FHSS for the Sub 1G mode.

The change made to the device will not affect the results of NII bands.

Related Submittal(s)/Grant(s)

FCC Part 15C DSS submissions with FCC ID: SS3-WM331A1704.
FCC Part 15C DTS submissions with FCC ID: SS3-WM331A1704.
Part of system granted with FCC ID: SS3-GL300E1609.

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.62dB
Power Spectral Density, conducted	±0.62 dB
Unwanted Emissions, radiated	30M~200MHz: 4.7 dB for Horizontal, 4.7 dB for Vertical 200M~1GHz: 6.0 dB for Horizontal, 6.0 for Vertical 1G~6GHz: 5.13 dB, 6G~18GHz: 5.47 dB
Temperature	±1°C
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.17 dB (150 kHz to 30 MHz)

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.

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.407 (f) & §1.1310 & §2.1091	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§15.407(b)(6)& §15.207(a)	Conducted Emissions	Not Applicable
§15.205& §15.209 &§15.407(b) (1),(6),(7)	Undesirable Emission& Restricted Bands	Compliant*
§15.407(b) (1),(2),(3),(4)	Out Of Band Emissions	Compliant*
§15.407(a)	6 dB Bandwidth	Compliant*
§15.407(a)(1),	Conducted Transmitter Output Power	Compliant*
§15.407 (a)(1),(5)	Power Spectral Density	Compliant*

Note:

Compliant*: The changes made to the device have not affected the results, please refer to the first application report: RDG160820002C, Issued on 2016-10-20, by Bay Area Compliance Laboratories Corp. (Chengdu).

Not Applicable: the device was powered by battery.

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) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	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.

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/cm²);

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);

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

Calculated Data:

Frequency Range (MHz)	Antenna Gain		Maximum Power Including Tolerance		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	(numeric)	(dBm)	(mW)			
915.938-927.738	-0.46	0.90	12	15.85	20.00	0.0028	0.6173
2406.5-2476.5	1.60	1.45	29	794.33	20.00	0.2285	1.0
5730-5845	0.79	1.20	26	398.11	20.00	0.0950	1.0

Note: The Maximum Power Including Tolerance was declared by manufacturer. 2.4GHz and 5.8GHz can't transmission simultaneously.

The maximum simultaneously transmit is Sub 1G+2.4G mode:

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

$$=S_{sub}/S_{limit-sub} + S_{2.4G}/S_{limit-2.4G}$$

$$=0.0028/0.6173+0.2285/1$$

$$=0.23$$

$$< 1.0$$

Result: The device meet FCC MPE at 20 cm distance

FCC §15.203 – ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to FCC 47 CFR section 15.407 (a)(1), if transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT has 4 internal antennas arrangement for 5.8GHz band, all the antennas gain are 0.79 dBi @ 5.8GHz, fulfill the requirement of the item. Please refer to the internal photos.

Result: Compliance.

BELOW IS THE FIRST APPLICATION REPORT



FCC PART 15.407

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-WM331A1609

Report Type: Original Report	Product Name: Phantom 4 Pro
Test Engineer: <u>Lorin Bian</u>	
Report Number: <u>RDG160820002C</u>	
Report Date: <u>2016-10-20</u>	
Reviewed By: <u>Henry Ding</u> EMC Leader	
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Chengdu) 5040, HuiLongWan Plaza, No. 1, ShaWan Road, JinNiu District, ChengDu, China Tel: 028-65523123, Fax: 028-65525125 www.baclcorp.com

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The **SZ DJI TECHNOLOGY CO., LTD**'s product, model number: **WM331A (FCC ID: SS3-WM331A1609)** or (the "EUT") in this report was a **Phantom 4 Pro**, which was measured approximately: 500 mm (L) x 500 mm (W) x 185 mm(H), rated input voltage: DC 15.2V from lithium battery.

**All measurement and test data in this report was gathered from final production sample, serial number: 160820002 (assigned by the BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2016-08-20, 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, B and E of the Federal Communications Commission's rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart E, section 15.203, 15.205, 15.209 and 15.407 rules.

Related Submittal(s)/Grant(s)

FCC Part 15C DTS submissions with FCC ID: SS3-WM331A1609.
FCC Part 15C DXX submissions with FCC ID: SS3-WM331A1609.
Part of system submissions with FCC ID: SS3-GL300E1609.

Test Methodology

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

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

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

30M~200MHz: ± 4.7 dB;
200M~1GHz: ± 6.0 dB;
1G-6GHz: ± 5.13 dB;
6G~25GHz: ± 5.47 dB;

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

Test Facility

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

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

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

FINAL

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in Engineering Mode, which was provided by the manufacturer.

For 5.8GHz band, 24 channels are provided:

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

3 channels were tested: 5730MHz, 5790MHz, 5845MHz

The device employed 4 internal antennas, support 2T2R MIMO mode, the system configures two of them transmitting and two receiving depending on better performance by the system automatically recognizes.

For antenna port conducted test items, based on output power testing, the two highest power ports were chosen for full test.

EUT Exercise Software

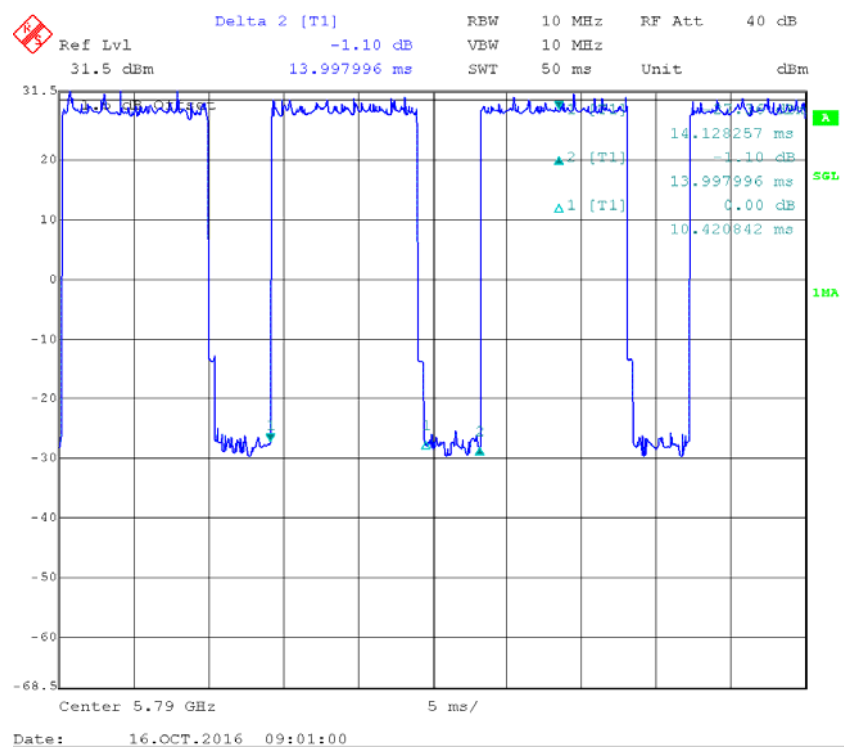
The software "DJI-RF Certification" was used for testing, which was provided by manufacturer. The maximum power and duty cycle was configured by system default setting. The default setting level is as below:

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

The duty cycle is as below:

T _{on} (ms)	T _{on+off} (ms)	Duty Cycle (%)
10.42	14.0	74.29%

The minimum transmission duration(T) is 10.42ms.

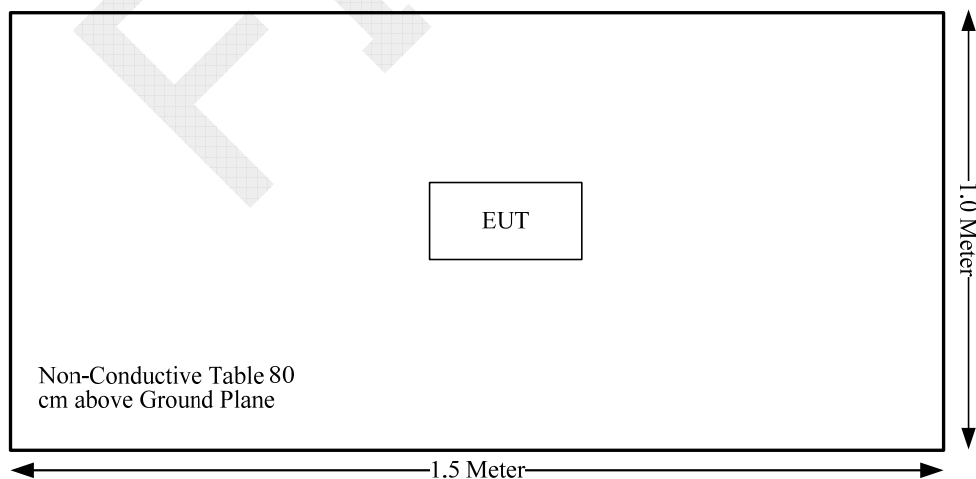


Equipment Modifications

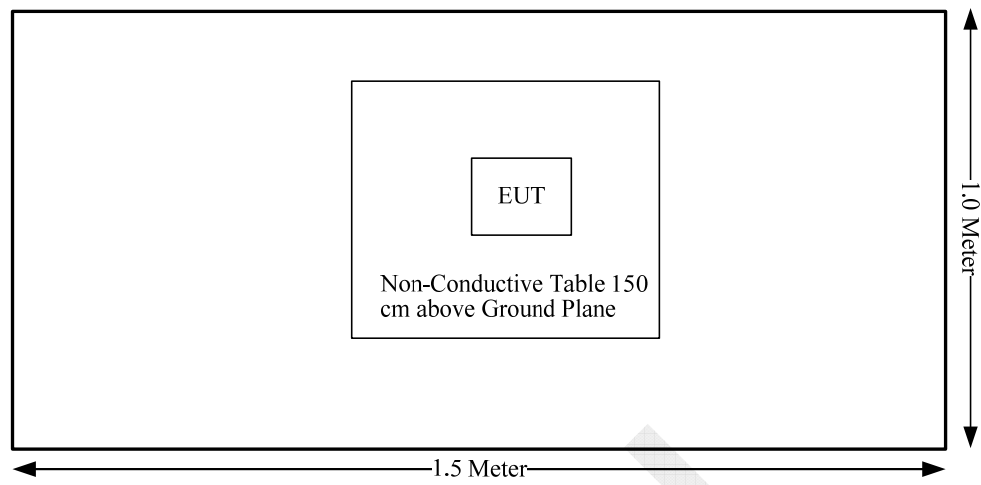
No modification was made to the EUT.

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 & §2.1091	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§15.407(b)(6)& §15.207(a)	Conducted Emissions	Not Applicable
§15.205& §15.209 &§15.407(b) (1),(6),(7)	Undesirable Emission& Restricted Bands	Compliant
§15.407(b) (1),(2),(3),(4)	Out Of Band Emissions	Compliant
§15.407(a)	6 dB Bandwidth	Compliant
§15.407(a)(1),	Conducted Transmitter Output Power	Compliant
§15.407 (a)(1),(5)	Power Spectral Density	Compliant

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) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	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.

Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm²);

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 (MHz)	Antenna Gain		Maximum Tune-up Power including Tolerance		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	(numeric)	(dBm)	(mW)			
5730-5845	0.79	1.20	26	398.11	20.00	0.0950	1.0

Note: The Maximum Power Including Tolerance was declared by manufacturer. 2.4GHz and 5.8GHz can't transmission simultaneously.

Result: The device meet FCC MPE at 20 cm distance

FCC §15.203 – ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to FCC 47 CFR section 15.407 (a)(1), if transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT has 4 internal antennas arrangement for 5.8GHz band, all the antennas gain are 0.79 dBi @ 5.8GHz, fulfill the requirement of the item. Please refer to the internal photos.

Result: Compliance.

FCC §15.209, §15.205 & §15.407(b) (1) (6) (7) –UNWANTED EMISSION

Applicable Standard

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:

(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.

(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.

Measurement Uncertainty

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

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

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

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

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

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

30M~200MHz: ± 4.7 dB ;

200M~1GHz: ± 6.0 dB ;

1G-6GHz: ± 5.13 dB;

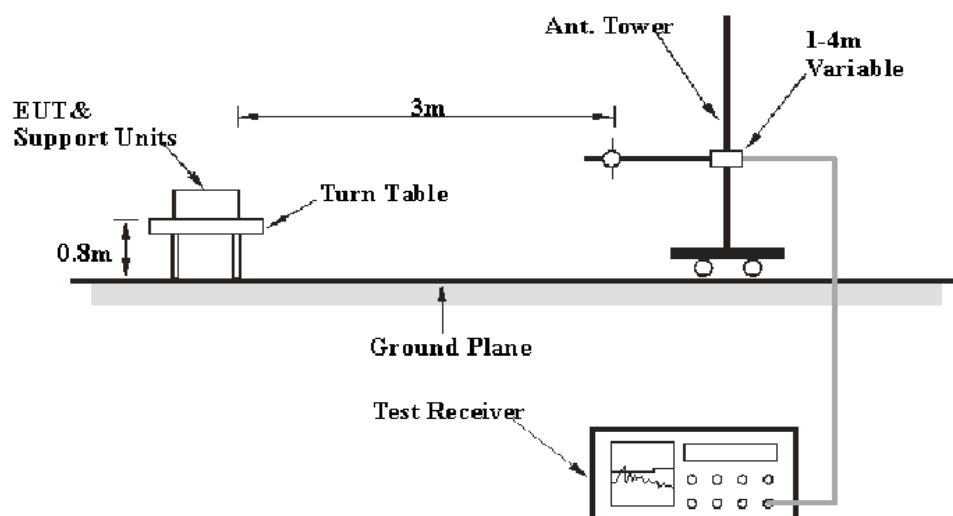
6G~25GHz: ± 5.47 dB;

Table 1 – Values of U_{cisp}

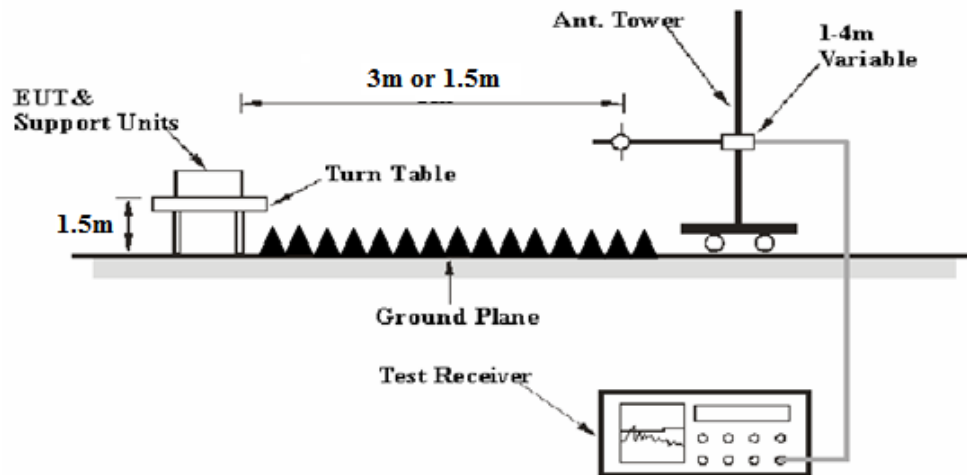
Measurement	U_{cisp}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

EUT Setup

Below 1 GHz:



Above 1 GHz:



The radiated emission tests were performed in the 3 meters chamber, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.407 limits.

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:

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	/	Ave.

Test Procedure

During the radiated emission test, the adapter was connected to the first AC floor outlet and the other support equipments were connected to the second AC floor outlet.

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 v01r03, 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 (dBμV/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:

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Amplifier	8447D	2944A10442	2015-12-02	2016-12-01
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2015-12-02	2016-12-01
Sunol Sciences	Broadband Antenna	JB3	A101808	2016-04-10	2019-04-09
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2015-12-02	2016-12-01
EM TEST	Horn Antenna	3115	003-6076	2015-12-02	2016-12-01
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-0113024	2014-06-16	2017-06-15
Mini-circuits	Amplifier	ZVA-183-S+	771001215	2016-05-20	2017-05-19
EMCT	Semi-Anechoic Chamber	966	N/A	2015-04-24	2018-04-23
N/A	RF Cable (below 1GHz)	NO.1	N/A	2015-11-10	2016-11-09
N/A	RF Cable (below 1GHz)	NO.4	N/A	2015-11-10	2016-11-09
N/A	RF Cable (above 1GHz)	NO.2	N/A	2015-11-10	2016-11-09
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-011315	2016-08-18	2017-08-18
Ducommun Technologies	Horn Antenna	ARH-2823-02	1007726-011312	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) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	26.9 °C
Relative Humidity:	39 %
ATM Pressure:	100.7 kPa

The testing was performed by Lorin Bian on 2016-09-22.

Test Mode: Transmitting

2) 30MHz-40GHz(Test performed at 3.0m distance EUT to antenna)

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)					
Low Channel:5730 MHz									
5730	70.89	PK	H	32.58	5.72	0.00	109.19	N/A	N/A
5730	58.71	AV	H	32.58	5.72	0.00	97.01	N/A	N/A
5730	78.54	PK	V	32.58	5.72	0.00	116.84	N/A	N/A
5730	65.87	AV	V	32.58	5.72	0.00	104.17	N/A	N/A
5725	53.69	PK	V	32.57	5.72	0.00	91.98	122.20	30.22
5720	46.87	PK	V	32.56	5.71	0.00	85.14	110.80	25.66
5700	29.58	PK	V	32.54	5.70	26.63	41.19	105.20	64.01
5650	27.64	PK	V	32.48	5.65	26.63	39.14	68.20	29.06
11460	33.06	PK	V	37.97	8.22	26.02	53.23	74.00	20.77
11460	21.69	AV	V	37.97	8.22	26.02	41.86	54.00	12.14
17190	33.95	PK	V	42.77	10.75	25.93	61.54	74.00	12.46
17190	22.69	AV	V	42.77	10.75	25.93	50.28	54.00	3.72
3240	34.57	PK	V	25.54	3.79	26.50	37.40	74.00	36.60
3240	22.74	AV	V	25.54	3.79	26.50	25.57	54.00	28.43
3714	33.41	PK	V	27.86	4.50	26.57	39.20	74.00	34.80
3714	22.96	AV	V	27.86	4.50	26.57	28.75	54.00	25.25
299.66	45.31	QP	V	14.10	1.03	27.54	32.90	46.00	13.10
338.46	39.91	QP	V	14.78	1.14	27.71	28.12	46.00	17.88
Middle Channel:5790 MHz									
5790	70.98	PK	H	32.65	5.78	0.00	109.41	N/A	N/A
5790	59.07	AV	H	32.65	5.78	0.00	97.50	N/A	N/A
5790	79.14	PK	V	32.65	5.78	0.00	117.57	N/A	N/A
5790	66.01	AV	V	32.65	5.78	0.00	104.44	N/A	N/A
11580	33.85	PK	V	38.03	8.21	26.00	54.09	74.00	19.91
11580	22.67	AV	V	38.03	8.21	26.00	42.91	54.00	11.09
17370	33.69	PK	V	43.60	11.05	26.19	62.15	74.00	11.85
17370	21.07	AV	V	43.60	11.05	26.19	49.53	54.00	4.47
3240	35.25	PK	V	25.54	3.79	26.50	38.08	74.00	35.92
3240	24.54	AV	V	25.54	3.79	26.50	27.37	54.00	26.63
3745	32.17	PK	V	27.98	4.54	26.57	38.12	74.00	35.88
3745	21.69	AV	V	27.98	4.54	26.57	27.64	54.00	26.36
299.66	46.81	QP	V	14.10	1.03	27.54	34.40	46.00	11.60
338.46	40.28	QP	V	14.78	1.14	27.71	28.49	46.00	17.51

High Channel:5845 MHz									
5845	70.89	PK	H	32.71	5.82	0.00	109.42	N/A	N/A
5845	58.34	AV	H	32.71	5.82	0.00	96.87	N/A	N/A
5845	79.24	PK	V	32.71	5.82	0.00	117.77	N/A	N/A
5845	67.65	AV	V	32.71	5.82	0.00	106.18	N/A	N/A
5850	51.69	PK	V	32.72	5.83	0.00	90.24	122.20	31.96
5855	45.61	PK	V	32.73	5.83	0.00	84.17	110.80	26.63
5875	27.67	PK	V	32.75	5.85	0.00	66.27	105.20	38.93
5925	27.86	PK	V	32.81	5.89	0.00	66.56	68.20	1.64
11690	32.42	PK	V	38.08	8.19	25.97	52.72	74.00	21.28
11690	20.91	AV	V	38.08	8.19	25.97	41.21	54.00	12.79
17535	33.43	PK	V	44.31	11.22	26.33	62.63	74.00	11.37
17535	22.61	AV	V	44.31	11.22	26.33	51.81	54.00	2.19
3158	33.97	PK	V	25.08	3.67	26.47	36.25	74.00	37.75
3158	23.25	AV	V	25.08	3.67	26.47	25.53	54.00	28.47
4240	34.2	PK	V	29.38	5.09	26.69	41.98	74.00	32.02
4240	21.42	AV	V	29.38	5.09	26.69	29.20	54.00	24.80
299.66	47.28	QP	V	14.10	1.03	27.54	34.87	46.00	11.13
338.46	41.27	QP	V	14.78	1.14	27.71	29.48	46.00	16.52

FCC §15.407(a) –EMISSION BANDWIDTH

Applicable Standard

15.407(a) (e)

Test Equipment List and Details

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

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

Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v01r03

Test Data

Environmental Conditions

Temperature:	27.3 °C
Relative Humidity:	32 %
ATM Pressure:	100.6 kPa

The testing was performed by Lorin Bian on 2016-10-16.

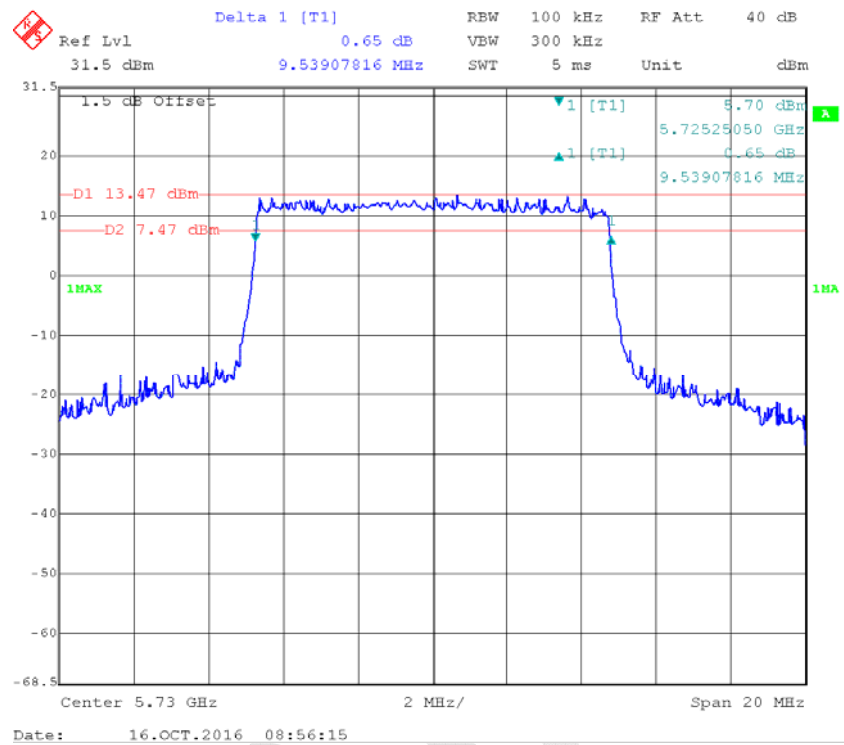
Test Result: Pass. Please refer to the following tables and plots.

Test mode: Transmitting(Test performed at Chain 0)

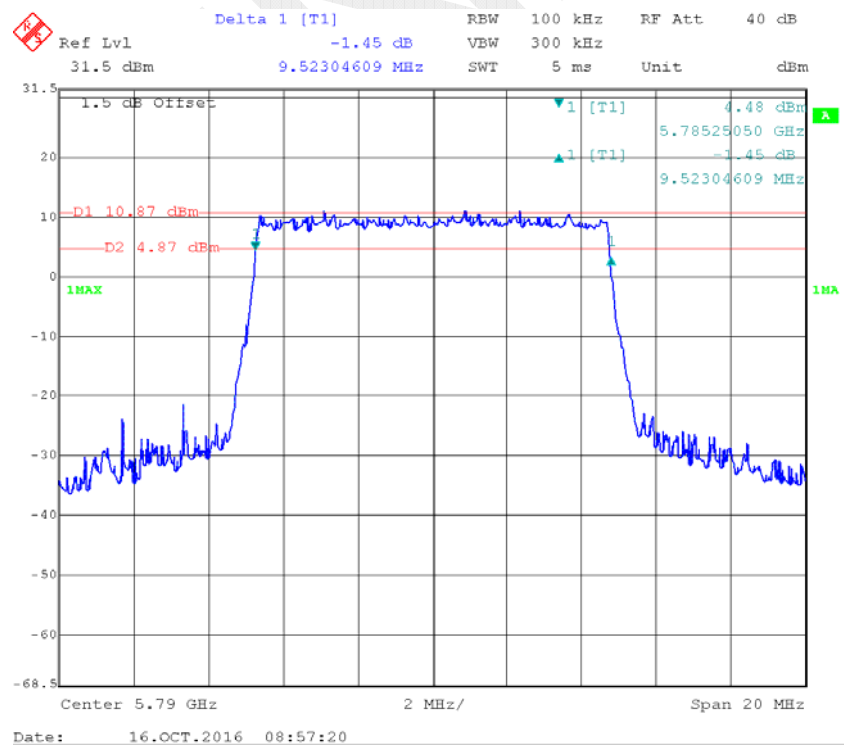
Channel	Frequency (MHz)	6dB Emission Bandwidth (MHz)	Limits (MHz)	Result
Low	5730	9.54	0.5	PASS
Middle	5790	9.52	0.5	PASS
High	5845	9.53	0.5	PASS

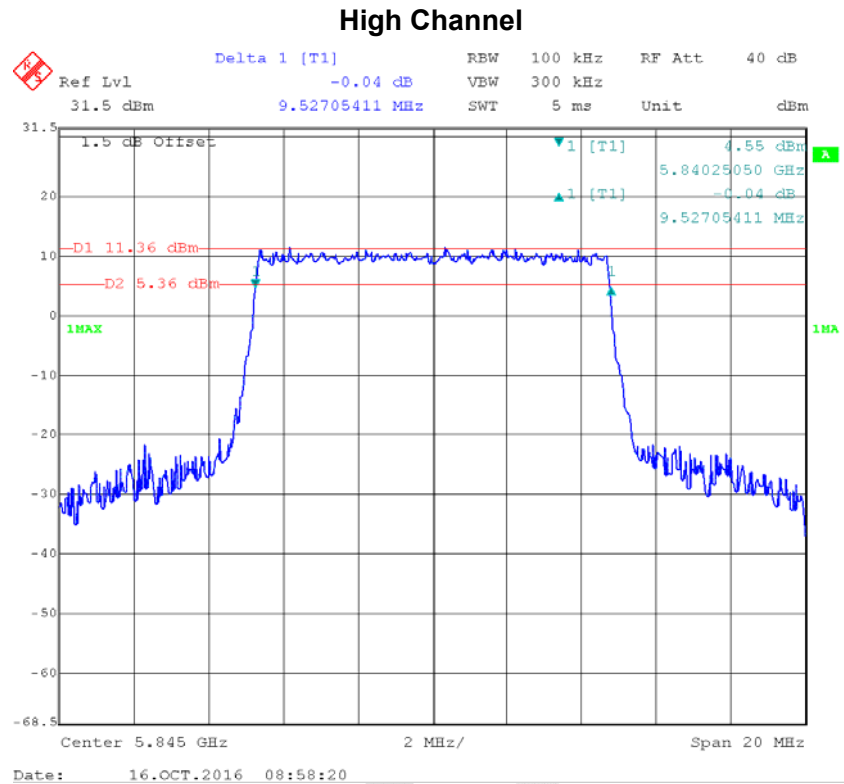
6dB Emission Bandwidth

Low Channel



Middle Channel





FCC §15.407(a) –MAXIMUM CONDUCTED OUTPUT POWER

Applicable Standard

(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 colocated 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 $10 \log B$ dBm, 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 colocated 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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Wideband Power Sensor	N1921A	MY54170074	2016-01-03	2017-01-03
Agilent	P-Series Power Meter	N1912A	MY5000798	2016-01-03	2017-01-03
N/A	RF Cable	N/A	N/A	Each Time	/

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

Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v01r03

Test Data

Environmental Conditions

Temperature:	29.4 °C
Relative Humidity:	52 %
ATM Pressure:	100.7 kPa

The testing was performed by Lorin Bian on 2016-10-16.

Test Mode: Transmitting

Channel	Frequency (MHz)	Maximum Conducted Output Power (dBm)				Maximum Total Power (dBm)	Limits (dBm)	Result
		Chain 0	Chain 1	Chain 2	Chain 3			
Low	5730	22.41	22.32	23.38	22.31	25.93	30	PASS
Middle	5790	22.58	22.11	22.15	22.14	25.38	30	PASS
High	5845	21.38	21.16	21.95	21.29	24.68	30	PASS

Note: the device support 2T2R MIMO mode, Maximum total power was combined two highest antenna ports.

FCC §15.407(a) - POWER SPECTRAL DENSITY

Applicable Standard

(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 colocated 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 colocated 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.

Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v01r03

Test Equipment List and Details

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

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

Test Data

Environmental Conditions

Temperature:	27.3 °C
Relative Humidity:	32 %
ATM Pressure:	100.6 kPa

The testing was performed by Lorin Bian on 2016-10-16.

Test Mode: Transmitting

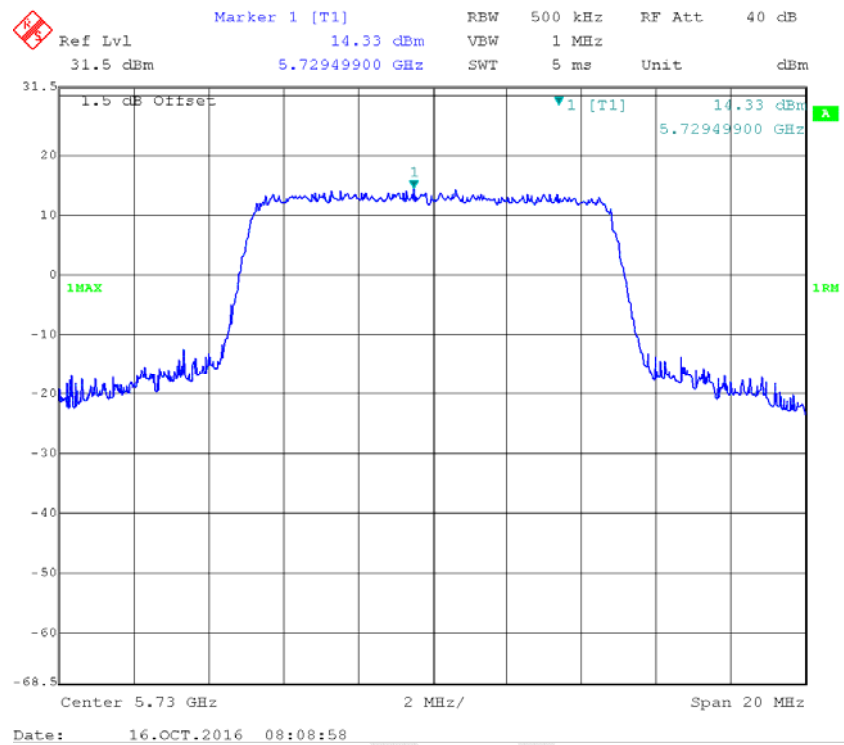
Test Result: Compliance. Please refer to the following table and plot.

Channel	Frequency (MHz)	PSD (dBm/300kHz)				Total (dBm/300kHz)	Total (dBm/500kHz)	Limit (dBm/500kHz)
		Chain 0	Chain 1	Chain 2	Chain 3			
Low	5730	14.33	14.07	14.44	13.94	17.40	19.60	30
Middle	5790	12.96	11.11	13.25	11.42	16.12	18.32	30
High	5845	12.89	11.78	13.14	12.04	16.03	18.23	30

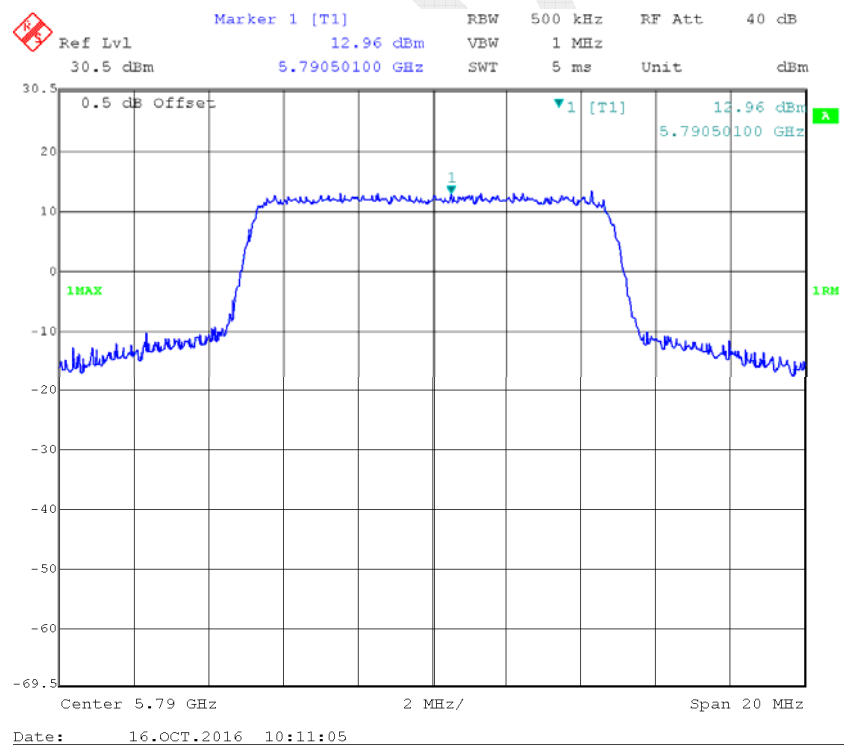
The measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10\log(500\text{kHz}/\text{RBW})$ to the measured result, whereas RBW (< 500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement:

$$10*\log(500\text{kHz}/\text{RBW})=10*\log(500\text{kHz}/300\text{kHz})=2.2\text{dB}$$

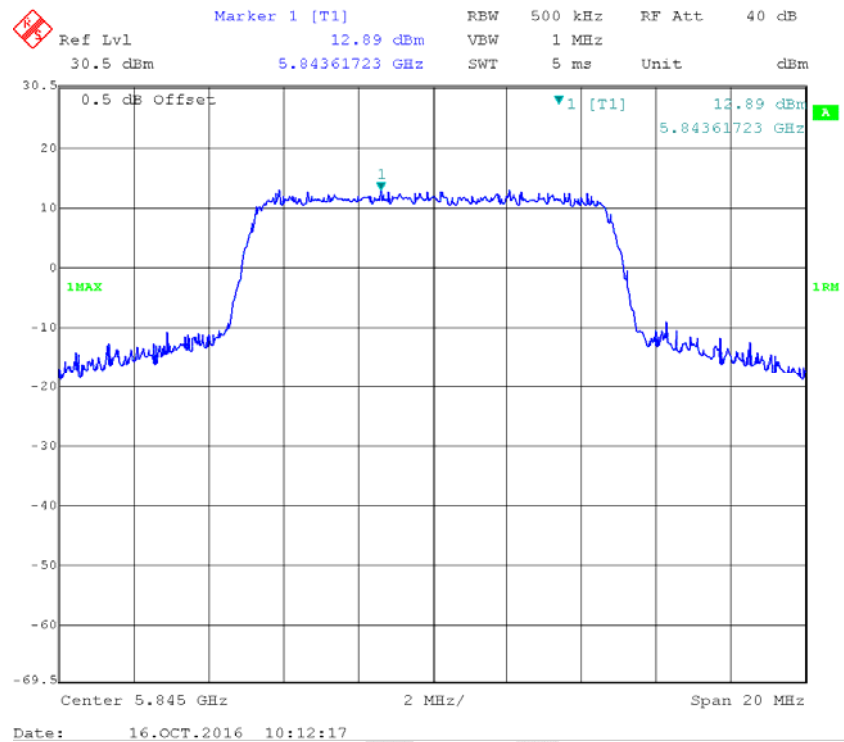
Chain 0, Low Channel



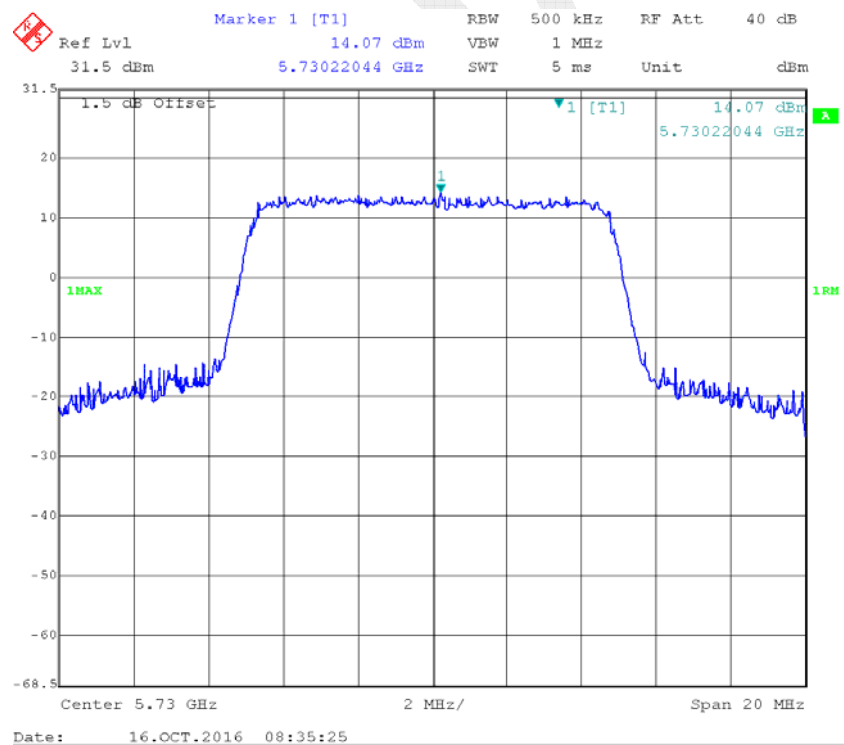
Chain 0, Middle Channel



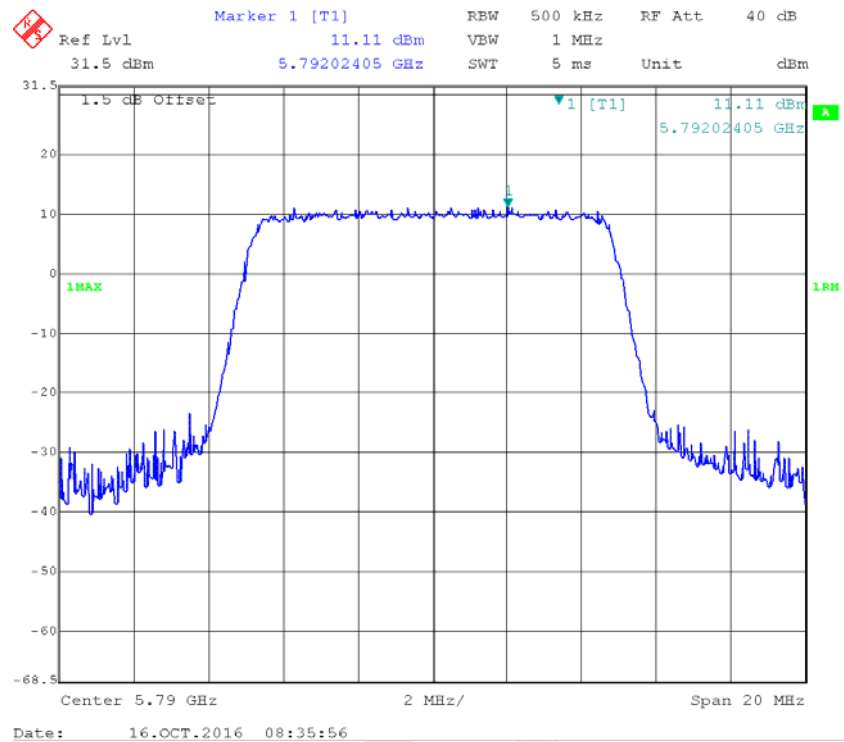
Chain 0, High Channel



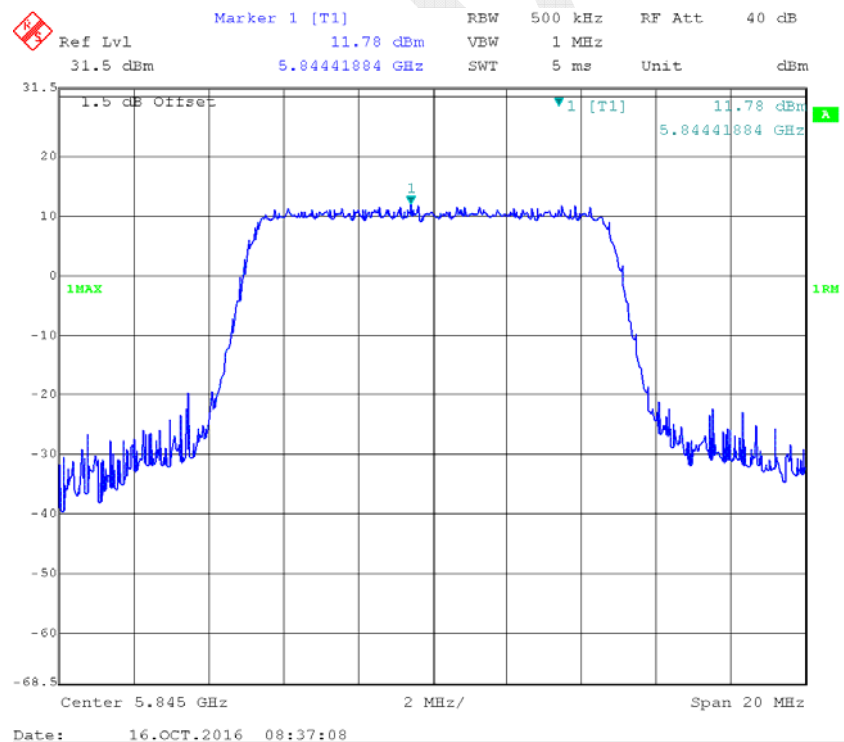
Chain 1, Low Channel



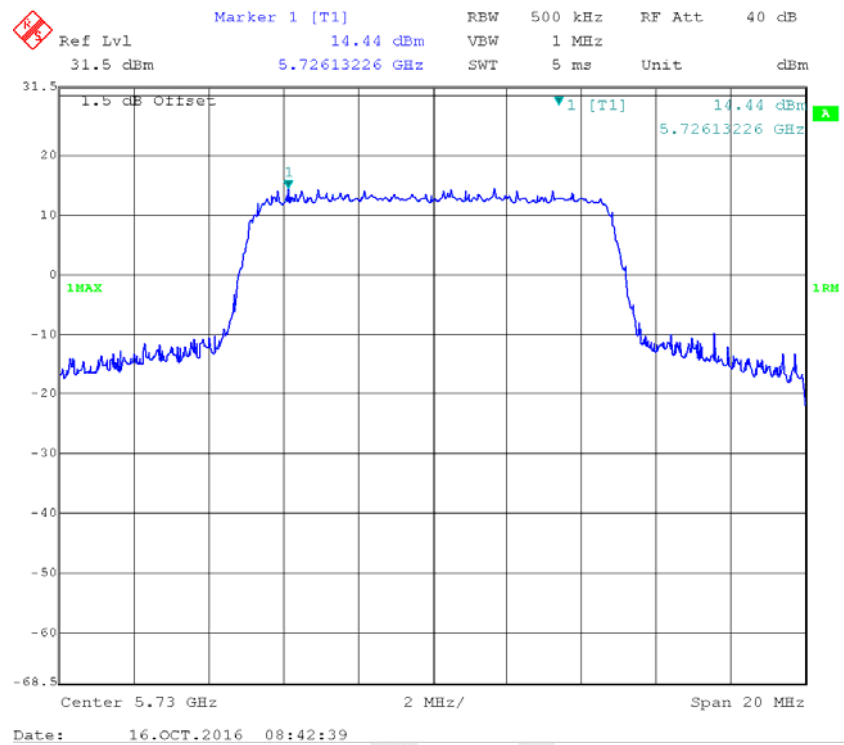
Chain 1, Middle Channel



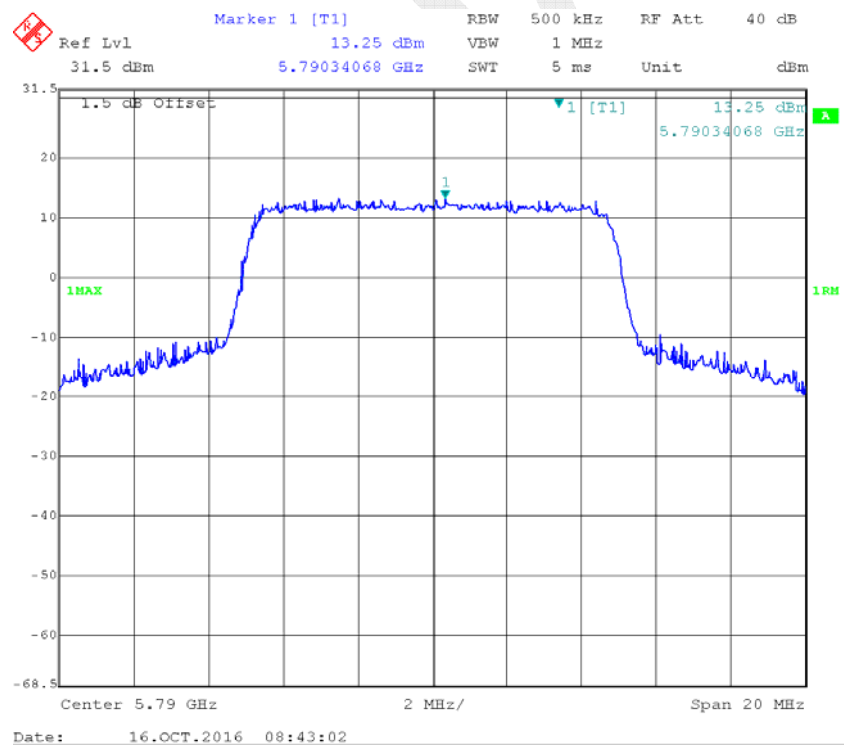
Chain 1, High Channel



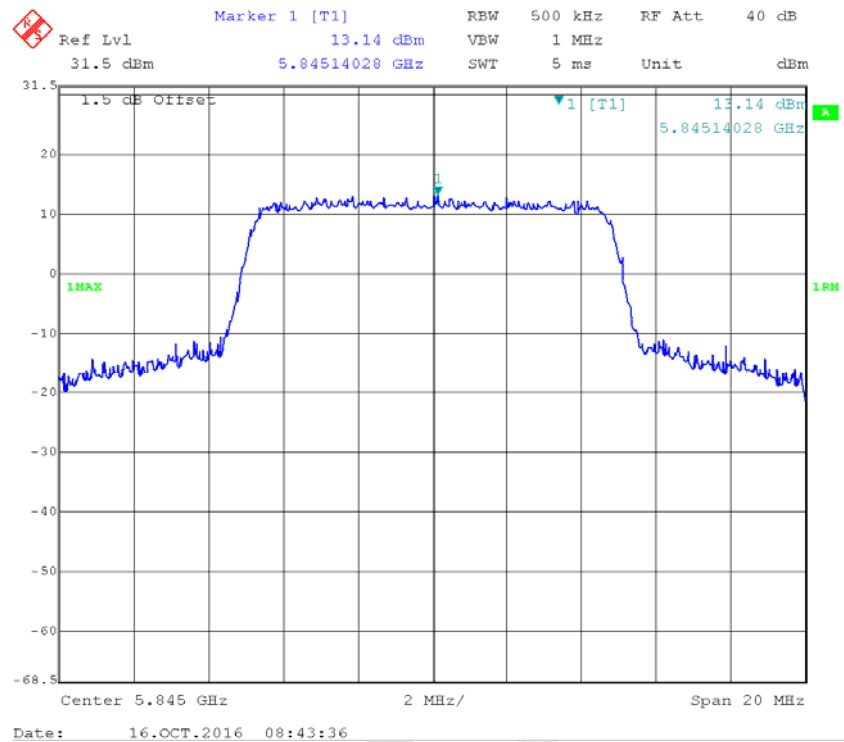
Chain 2, Low Channel



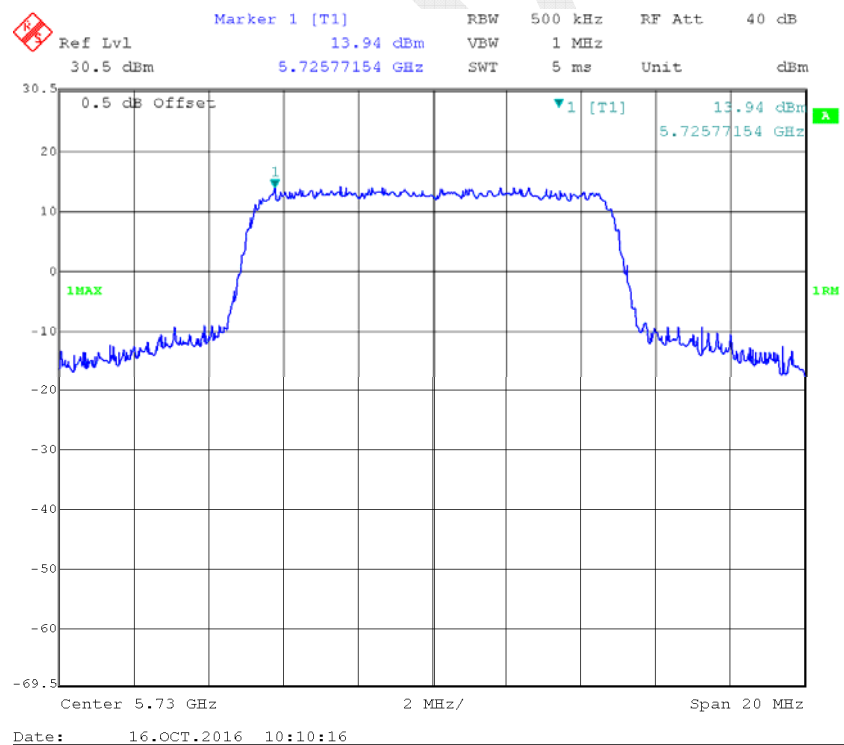
Chain 2, Middle Channel



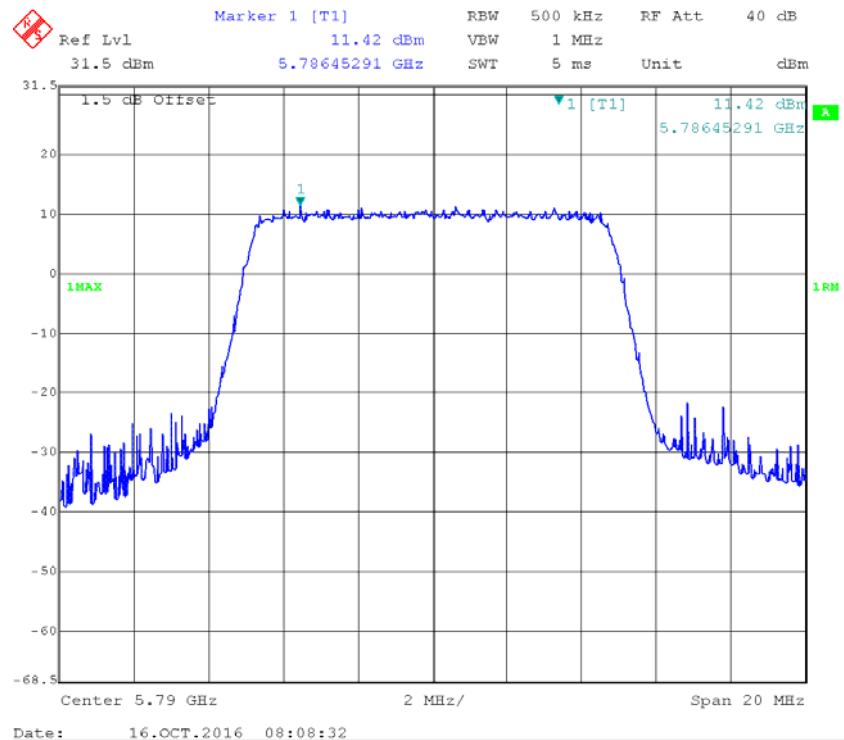
Chain 1, High Channel



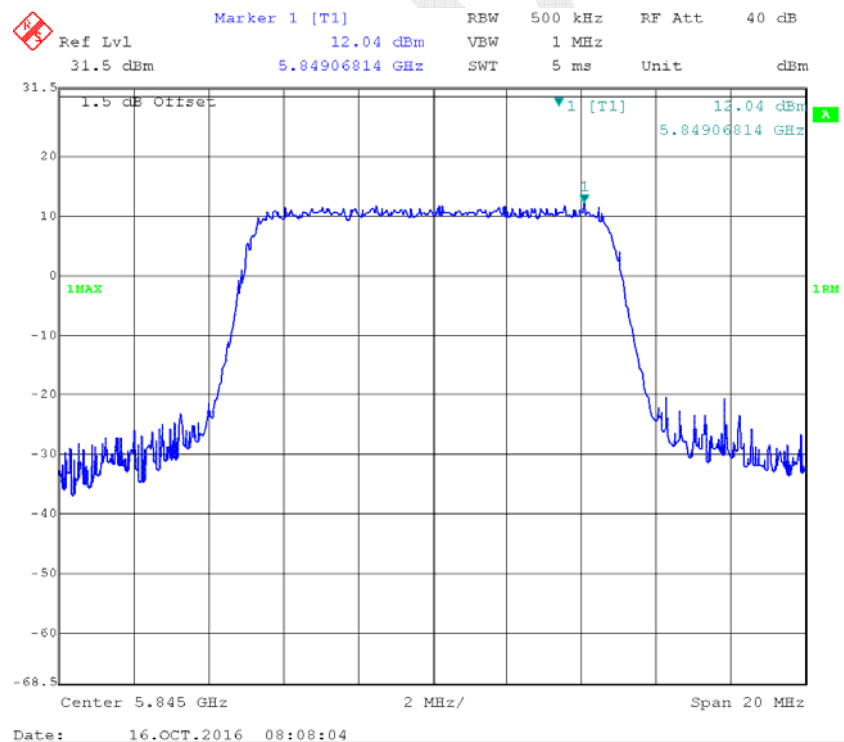
Chain 3, Low Channel



Chain 3, Middle Channel



Chain 3, High Channel



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