FCC Part 15.407

TEST REPORT

For

Chengdu Vantron Technology, Ltd.

No.5 GaoPeng Road, Hi-Tech Zone, Chengdu, SiChuan, P.R. China

FCC ID: 2AAGE-VTDONGLE

Report Type	**Original Report**
Product Name:	**Gateway**
Model Name:	**VT-IoT-Dongle**
Series Model Name:	**VT-IoT-Dongle-CATM**
Report Number :	**RLK190919004-00C**
Report Date :	**2019/10/05**
Reviewed By :	**Zeus Chen** Zeus Chen
Prepared By: **Bay Area Compliance Laboratories Corp.(Linkou Laboratory)** **No. 6, Wende 2Rd., Guishan Dist., Taoyuan City 33382, Taiwan (R.O.C.)** **Tel: +886 (3)3961072; Fax: +886 (3) 3961027** **www.bacl.com.tw**	

Revision History

Revision	Report Number	Issue Date	Description
1.0	RLK190919004-00C	2019/10/05	Original Report

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1 General Information

1.1 Product Description for Equipment under Test (EUT)

Applicant	**Chengdu Vantron Technology, Ltd.** No.5 GaoPeng Road, Hi-Tech Zone, Chengdu, SiChuan, P.R. China
Manufacturer	**Chengdu Vantron Technology, Ltd.** No.5 GaoPeng Road, Hi-Tech Zone, Chengdu, SiChuan, P.R. China
Product (Equipment)	**Gateway**
Model Name	**VT-IoT-Dongle**
Series Model Name	**VT-IoT-Dongle-CATM**
EUT Function	IEEE 802.11 an(HT20/HT40) + ac(VHT20/VHT40/VHT80)
Frequency Range	UNII-1: 5150 MHz ~ 5250 MHz UNII-3: 5745 MHz ~ 5850 MHz
Number of Channels	**For UNII-1:** IEEE 802.11a/n HT20/ac VHT20: 4 Channels IEEE 802.11n HT40/ac VHT40: 2 Channels IEEE 802.11ac VHT80: 1 Channels **For UNII-3:** IEEE 802.11a/n HT20/ac VHT20: 5 Channels IEEE 802.11n HT40/ac VHT40: 2 Channels IEEE 802.11ac VHT80: 1 Channels
Output Power	**For UNII-1:** IEEE 802.11a Mode: 19.01 dBm (0.0796 W) IEEE 802.11n HT20 Mode: 18.87 dBm (0.0771 W) IEEE 802.11n HT40 Mode: 18.24 dBm (0.0667 W) IEEE 802.11ac VHT20 Mode: 18.95 dBm (0.0785 W) IEEE 802.11ac VHT40 Mode: 18.41 dBm (0.0693 W) IEEE 802.11ac VHT80 Mode: 14.97 dBm (0.0314 W) **For UNII-3**: IEEE 802.11a Mode: 20.15 dBm (0.1035 W) IEEE 802.11n HT20 Mode: 19.88 dBm (0.0973 W) IEEE 802.11n HT40 Mode: 19.81 dBm (0.0957 W) IEEE 802.11ac VHT20 Mode: 19.96 dBm (0.0991 W) IEEE 802.11ac VHT40 Mode: 20.02 dBm (0.1005 W) IEEE 802.11ac VHT80 Mode: 14.44 dBm (0.0278 W)
Modulation Type	OFDM
Received Date	Sep. 23, 2019
Date of Test	Sep. 25, 2019 - Oct. 03, 2019
Related Submittal(s)/Grant(s)	**FCC Part 15.247 DSS with FCC ID : 2AAGE-VTDONGLE** **FCC Part 15.247 DTS with FCC ID : 2AAGE-VTDONGLE**

**All measurement and test data in this report was gathered from production sample serial number: 1803009 (Assigned by BACL, LinKou).*

**Model Discrepancy: Difference was LTE module use and contain FCC ID (Card Plug-in)*

Model Name	Discrepancy
VT-IoT-Dongle	**Contain LTE module FCC ID RI7LE910NAV2** Note 1
VT-IoT-Dongle-CATM	**Contain LTE module FCC ID 2AJYU-SIM7000A** Note 1

Note 1: LTE Module have already get FCC Grants

The major electrical and mechanical constructions of series models are identical to the basic model, except different Market segmentation. The model, VT-IoT-Dongle is the testing sample, and the final test data are shown on this test report.

1.2 Operation Condition of EUT

Power Operation (Voltage Range)	☒ AC 120 V/60 Hz ☒ Adapter (Not for Sale) via power Cable to connector port ☐ By Power Cord.
	☒ DC Type ☒ DC Power Supply: 5Vdc to connector port ☐ Battery ☐ External from USB Cable 5Vdc ☐ External DC Adapter
	☐ Host System

1.3 Objective

The Objective of this Test Report was to document the compliance of the Chengdu Vantron Technology, Ltd. Appliance (Model: VT-IoT-Dongle, Series Model: VT-IoT-Dongle-CATM) to the requirements of the following Standards:

-Part 2, Subpart J, Part 15 Subparts A and E of the Federal Communication Commission's rules.

-KDB 662911 D01 Multiple Transmitter Output v02r01

-KDB 789033 D02 General U-NII Test Procedures New Rules v02r01

- ANSI C63.10-2013 of t American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

1.4 Measurement Uncertainty

Parameter	Expanded Measurement uncertainty
RF output power with Power Meter	± 0.55 dB
Occupied Channel Bandwidth	± 4.54 Hz
RF Conducted test with Spectrum	± 1.45 dB
AC Power Line Conducted Emission	± 2.66 dB
Radiated Below 1G	± 3.57 dB
Radiated Above 1G-18G	± 4.29 dB
Radiated Above 18G-40G	± 4.67 dB

1.5 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Linkou) to collect test data is located on

☒ No.6, Wende 2Rd., Guishan Dist., Taoyuan City 33382, Taiwan (R.O.C.).

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database. The FCC Registration No.: 0027578244. Designation No.: TW3546. The Test Firm Registration No.: 181430.

2 System Test Configuration

2.1 Description of Test Configuration

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

No special accessory, No modification was made to the EUT and No special equipment used during test.

IEEE 802.11 a/n HT20/ac VHT20			
Channel	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**
36	**5180**	**149**	**5745**
40	**5200**	153	5765
44	5220	**157**	**5785**
48	**5240**	161	5805
-	-	**165**	**5825**

For UNII-1: Channel 36, 40 and 48 were tested.

For UNII-3: Channel 149, 157 and 165 were tested.

IEEE 802.11 n HT40/ac VHT40			
Channel	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**
38	**5190**	**151**	**5755**
46	**5230**	**159**	**5795**

For UNII-1: Channel 38 and 46 were tested.

For UNII-3: Channel 151 and 159 were tested.

IEEE 802.11 ac VHT80			
Channel	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**
42	**5210**	**155**	**5775**

For UNII-1: Channel 42 was tested. For UNII-3: Channel 155 was tested.

Modulation Used for Conformance Test			
Configuration	**N_{TX}**	**Data Rate**	**Worst Data Rate**
802.11a mode	**1**	6-54 Mbps	6 Mbps
802.11n HT20 mode	**4**	MCS 0-32	MCS 0
802.11n HT40 mode	**4**	MCS 0-32	MCS 0
802.11ac VHT20 mode	**4**	MCS 0-10 NSS4	MCS 0
802.11ac VHT40 mode	**4**	MCS 0-10 NSS4	MCS 0
802.11ac VHT80 mode	**4**	MCS 0-10 NSS4	MCS 0

Worst Case of Power Setting					
EUT Exercise Software			Command via Putty		
Configuration	**N_{TX}**	**UNII Band**	**Low CH**	**Mid CH**	**High CH**
802.11a mode	**1**	**UNII-1**	16	18	17
		UNII-3	20	20	20
802.11n HT20 mode	**1**	**UNII-1**	16	18	17
		UNII-3	20	20	20
802.11n HT40 mode	**1**	**UNII-1**	15	-	17
		UNII-3	17	-	20
802.11ac VHT20 mode	**1**	**UNII-1**	16	18	17
		UNII-3	20	20	20
802.11ac VHT40 mode	**1**	**UNII-1**	15	-	17
		UNII-3	17	-	20
802.11ac VHT80 mode	**1**	**UNII-1**	-	14	-
		UNII-3	-	17	-

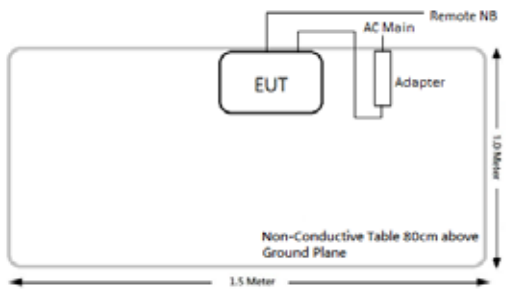
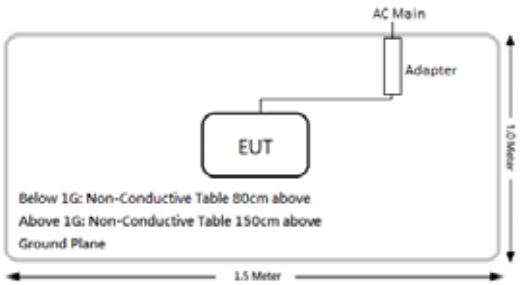
- The worst-case data rates are determined to be as follows for each mode based upon investigation by measuring the Peak power and PSD across all date rates bandwidths, and modulations. Radiated below 1G were tested worst output power mode.
- Due to 802.11n HT20/T40 mode output power are less than 802.11ac VHT20/40. Therefore, 802.11ac VHT20/VHT40 cover 802.11n HT20/40 in the test, Include conducted and radiated, except power test.
- VT-IoT-Dongle and VT-IoT-Dongle-CATM all have two mode Wlan + WWan or BT + WWan for Co-location.
  AC Line put the worst case co-location mode in the report. Radiation co-location we put the worst case co-location mode (Wlan +WWan (FCC ID: RI7LE910NAV2)) in this Report.

2.2 Support Equipment and External Cable List

No.	Description	Manufacturer	Model Number
A	Notebook PC	DELL	Latitude E6410
B	Notebook PC	Lenovo	Y520-151KBN
C	Notebook PC	APPLE	A1706
D	Adapter	FLEX	A1718 (Apple)
E	Adapter	Chicony Power	ADL135NCC3A (Lenovo)
F	Adapter	MYCELL	AC-B04
G	DC Power Source	GW Instek	SPS-2415

No.	Cable Description	Shielding Type	Length (m)	From	To
1	Connector Cable	Non-Shielded	1	EUT	Power Apply

2.3 Block Diagram of Test Setup

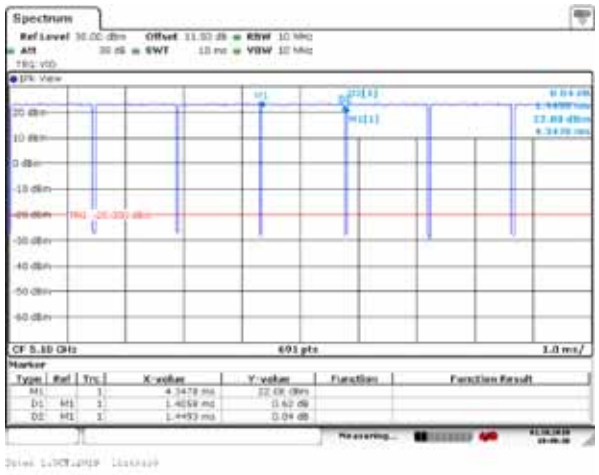
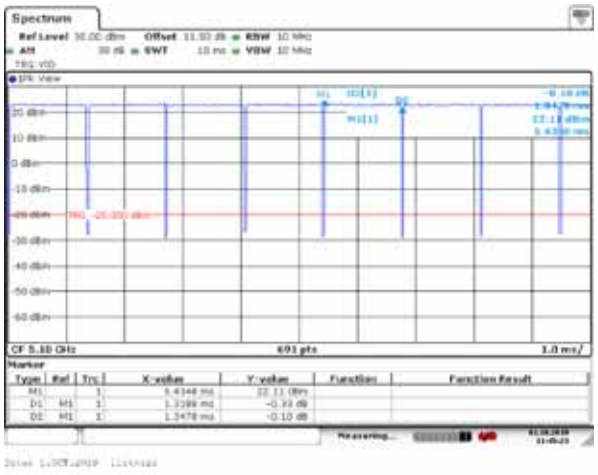
Conduction	Radiation
	

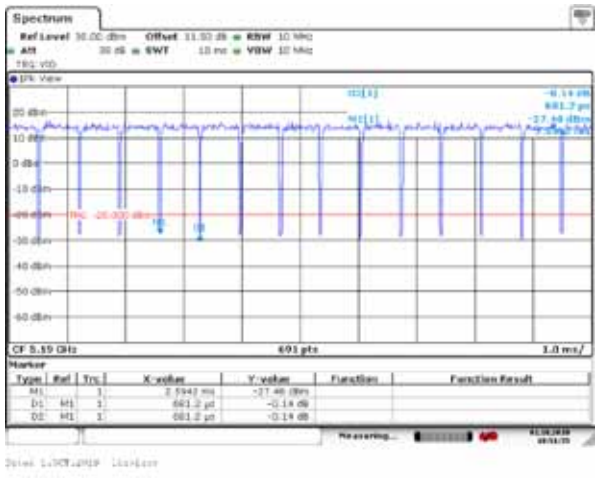
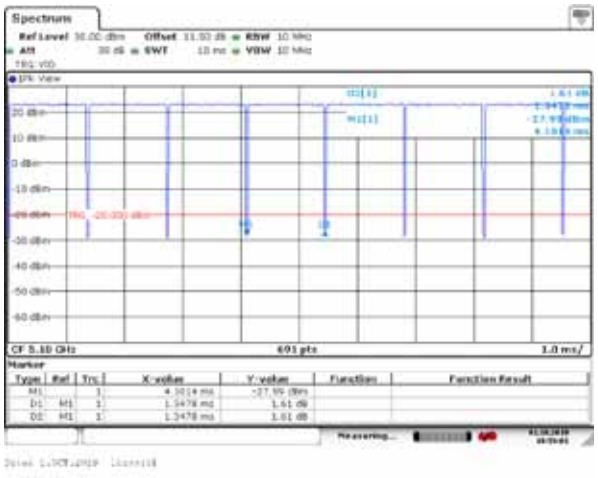
2.4 Duty Cycle

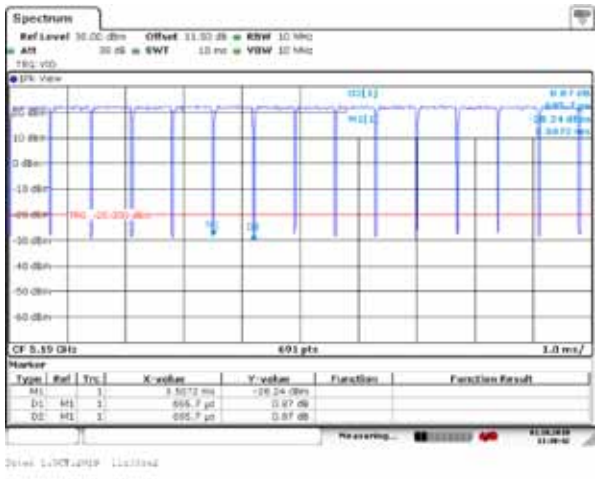
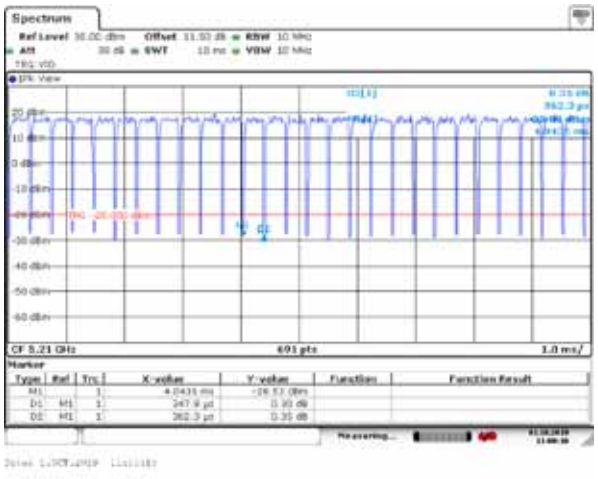
According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01 section B:

All measurements are to be performed with the EUT transmitting at 100% duty cycle at its maximum power control level; however, if 100% duty cycle cannot be achieved, measurements of duty cycle, x, and maximum power transmission duration, T, are required for each tested mode of operation.

Configuration	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Factor (dB)
802.11a mode	1.40	1.44	97.22	0.12
802.11n HT20-BF mode	1.31	1.34	97.76	0.10
802.11n HT40-BF mode	0.62	0.69	89.86	0.46
802.11ac VHT20-BF mode	1.31	1.34	97.76	0.10
802.11ac VHT40-BF mode	0.62	0.69	89.86	0.46
802.11ac VHT80-BF mode	0.27	0.33	81.82	0.87

802.11a mode	802.11n HT20 mode
	

802.11n HT40 mode	802.11ac VHT20 mode
	

802.11ac VHT40 mode	802.11ac VHT80 mode
	

3 Summary of Test Results

FCC Rules	Description of Test	Result
§1.1310, §2.1091, §15.407 (f)	Maximum Permissible Exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a), §15.407(b)(6)	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.407(b)	Spurious Emissions	Compliance
§15.407(a)(e)	Emission Bandwidth	Compliance
§15.407(a)(1)	Maximum Peak Output Power	Compliance
§15.407(a)(1)(5)	Power Spectral Density	Compliance

4 FCC §1.1310, §2.1091, §15.407(f) - Maximum Permissible Exposure (MPE)

4.1 Applicable Standard

According to §15.407(f), U-NII devices are subject to the radio frequency radiation exposure requirements specified in § 1.1307(b), and 2.1091 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request

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);

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

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

4.2 RF Exposure Evaluation Result

MPE Evaluation:

Mode	Frequency Range (MHz)	Antenna Gain		Target Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
Wi-Fi 2.4G	2412-2462	3.00	1.995	25.00	316.2278	20	0.1256	1.0
BLE	2402-2480	3.00	1.995	4.00	2.5119	20	0.0010	1.0
BR+EDR	2402-2480	3.00	1.995	9.00	7.9433	20	0.0032	1.0
Wi-Fi 5G UNII-1	5150-5250	3.00	1.995	20.00	100.0000	20	0.0397	1.0
Wi-Fi 5G UNII-3	5745-5850	3.00	1.995	21.00	125.8925	20	0.0500	1.0

LTE module FCC ID: 2AJYU-SIM7000A

Mode	Frequency Range (MHz)	Antenna Gain		Target Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
LTE B2	1850-1910	0.48	1.117	25.70	371.54	20	0.0826	1.0
LTE B4	1710-1755	-0.73	0.845	25.70	371.54	20	0.0625	1.0
LTE B12	699-716	2.11	1.626	25.70	371.54	20	0.1202	0.466
LTE B13	777-787	2.11	1.626	25.70	371.54	20	0.1202	0.518

LTE module FCC ID: RI7LE910NAV2

Mode	Frequency Range (MHz)	Antenna Gain		Target Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
LTE B2	1850-1910	0.48	1.117	24.00	251.189	20	0.0558	1.0
LTE B4	1710-1755	-0.73	0.845	24.00	251.189	20	0.0422	1.0
LTE B5	824-849	2.65	1.841	24.00	251.189	20	0.0920	0.550
LTE B12	699-716	2.11	0.845	24.00	251.189	20	0.0812	0.466
LTE B13	777-787	2.11	1.626	24.00	251.189	20	0.0812	0.518
LTE B17	704-716	2.11	0.845	24.00	251.189	20	0.0812	0.469

MPE evaluation for simultaneous transmission:

Note:

1. **Wi-Fi (2.4G) or Wi-Fi 5G and BT can't transmit simultaneously.**
2. **Wi-Fi (2.4G) and Wi-Fi 5G can't transmit simultaneously**

Wi-Fi or BT & WWAN can transmit simultaneously, MPE evaluation is as below formula:

PD1/Limit1+PD2/Limit2+……＜1, PD (Power Density)

The worst case is as below:

Max MPE of Wi-Fi + Max MPE of LTE
= 0.1256/1.0+0.1202/0.466 =0.3835＜1.0

Result: MPE evaluation of single and simultaneous transmission meet the requirement of standard.

5 FCC §15.203 – Antenna Requirements

5.1 Applicable Standard

According to § 15.203 and § 15.407(a)(3),

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.

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.

5.2 Antenna List and Details

Brand	Model	Antenna Type	Antenna Gain	Result
Jinchang	JCW425	PIFA	3.00 dBi	Compliance

The EUT has an internal antenna arrangement, which was permanently attached, fulfill the requirement of this section.

6 FCC §15.207 - AC Line Conducted Emissions

6.1 Applicable Standard

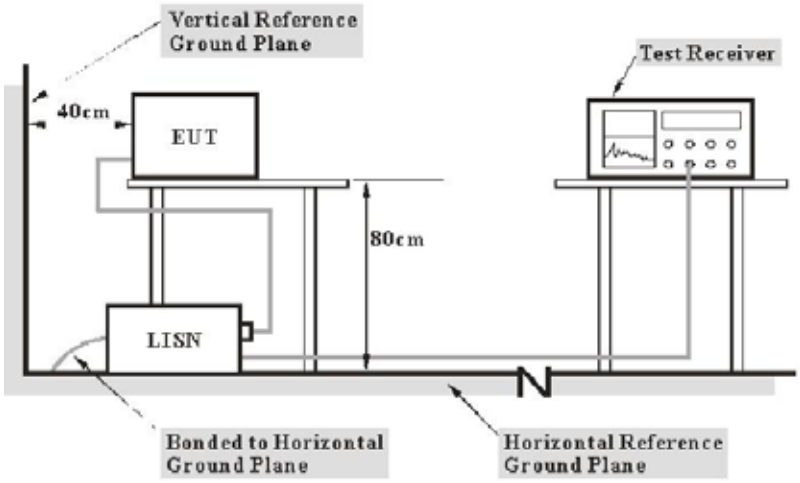
According to FCC §15.207 and §15.407(b)(6),

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 Note 1	56 to 46 Note 2
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency. Note 2: A linear average detector is required

6.2 EUT Setup and Test Procedure



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

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

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz. During the conducted emission test, the EMI test receiver was set with the following configurations

Frequency Range	Receiver RBW
150 kHz - 30 MHz	9 kHz

During the conducted emission test, the adapter was connected to the outlet of the LISN. Maximizing procedure was performed on the six (6) highest emissions of the EUT. All data was recorded in the Quasi-peak and average detection mode.

6.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conduction Room					
LISN	Rohde & Schwarz	ENV216	100010	2019/09/02	2020/09/01
EMI Test Receiver	Rohde & Schwarz	ESR3	102430	2019/03/27	2020/03/26
Pulse Limiter	SCHWARZBECK	VSTD 9561-F	00432	2019/08/28	2020/08/27
RF Cable	EMCI	EMCCFD300-BM-BM-8000	180526	2019/08/08	2020/08/07
Software	Audix	e3 v9	E3LK-03	N.C.R	N.C.R

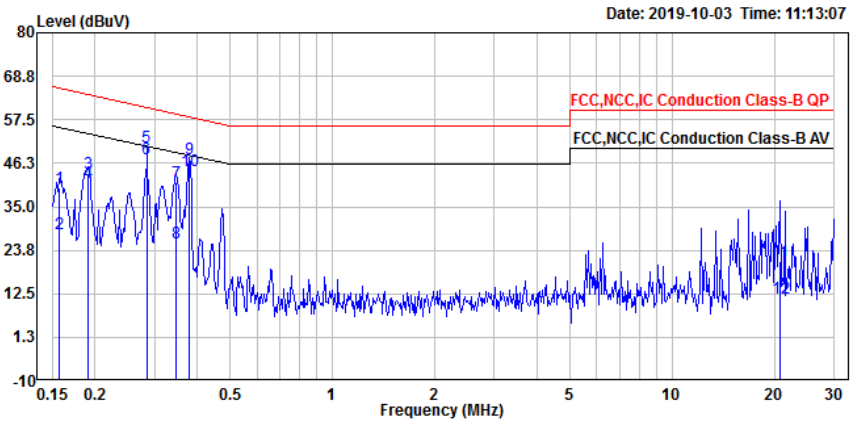
***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).*

6.4 Test Environmental Conditions

Temperature:	25 ℃	**Relative Humidity:**	62 %
ATM Pressure:	1010 hPa	**Test Engineer:**	Ray Huang
Test Date:	2019-10-03		

6.5 Test Data and Test Plot

Mode: AC 120 V/60 Hz, Co-location mode (Wi-Fi + WWan(FCC ID: RI7LE910NAV2)), Line



	Freq	Read Level	Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	
1	0.157	20.04	39.98	19.94	65.60	-25.62	QP
2	0.157	8.02	27.96	19.94	55.60	-27.64	Average
3	0.191	23.75	43.69	19.94	64.01	-20.32	QP
4	0.191	21.18	41.12	19.94	54.01	-12.89	Average
5	0.284	30.40	50.33	19.93	60.71	-10.38	QP
6	0.284	27.45	47.38	19.93	50.71	-3.33	Average
7	0.346	21.29	41.24	19.95	59.05	-17.81	QP
8	0.346	5.76	25.71	19.95	49.05	-23.34	Average
9	0.378	27.50	47.46	19.96	58.32	-10.86	QP
10	0.378	24.40	44.36	19.96	48.32	-3.96	Average
11	20.795	0.63	20.80	20.17	60.00	-39.20	QP
12	20.795	-8.63	11.54	20.17	50.00	-38.46	Average

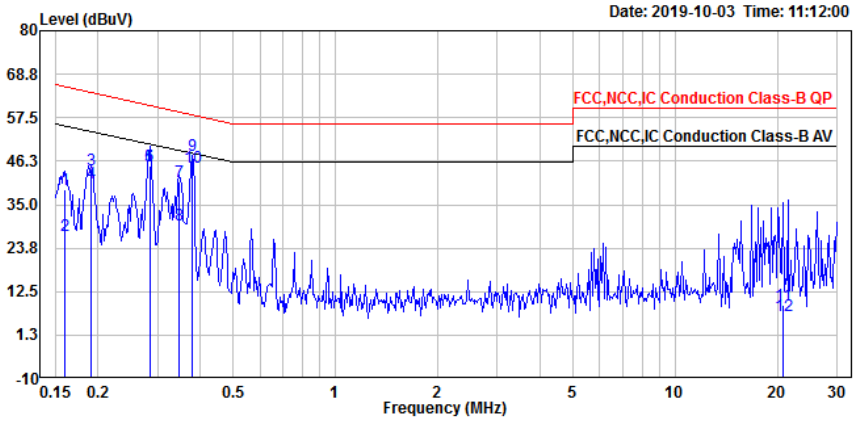
Note:

Level = Read Level + Factor

Over Limit (Margin) = Level – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

Mode: AC 120V/60 Hz, Co-location mode (Wi-Fi + WWan(FCC ID: RI7LE910NAV2)), Neutral



	Freq	Read Level	Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	
1	0.160	18.90	38.85	19.95	65.47	-26.62	QP
2	0.160	6.93	26.88	19.95	55.47	-28.59	Average
3	0.191	24.02	43.96	19.94	64.01	-20.05	QP
4	0.191	20.53	40.47	19.94	54.01	-13.54	Average
5	0.284	25.22	45.16	19.94	60.71	-15.55	QP
6	0.284	25.00	44.94	19.94	50.71	-5.77	Average
7	0.346	21.04	41.00	19.96	59.05	-18.05	QP
8	0.346	9.83	29.79	19.96	49.05	-19.26	Average
9	0.378	27.69	47.66	19.97	58.32	-10.66	QP
10	0.378	24.73	44.70	19.97	48.32	-3.62	Average
11	20.795	-11.22	9.10	20.32	60.00	-50.90	QP
12	20.795	-13.94	6.38	20.32	50.00	-43.62	Average

Note:

Level = Read Level + Factor

Over Limit (Margin) = Level – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

7 FCC §15.209, §15.205 & §15.407(b) – Unwanted Emission

7.1 Applicable Standard

According to 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.

(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further.

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

(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1MHz.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

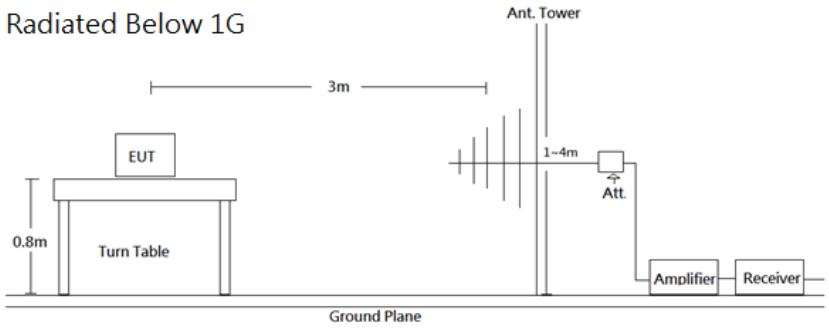
MHz	MHz	MHz	GHz
0.090-0.110	13.36-13.41	399.9-410	4.5-5.15
0.495-0.505	16.42-16.423	608-614	5.35-5.46
2.1735-2.1905	16.69475-16.69525	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6

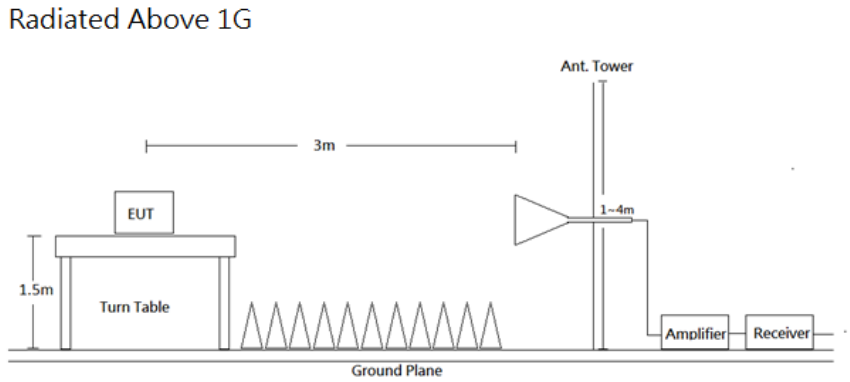
As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

7.2 EUT Setup and Test Procedure





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 Part 15.209 and FCC 15.407 Limits.

The system was investigated from 30 MHz to 40 GHz. During the radiated emission test, the EMI test receiver was set with the following configurations measurement method 6.3 in ANSI C63.10-2013.

Frequency Range	RBW	VBW	Detector	Duty cycle	Measurement method
30-1000 MHz	120 kHz	/	QP	-	QP
Above 1 GHz	1 MHz	3 MHz	PK	-	PK
	1 MHz	3 MHz	RMS	>98%	Ave
	1 MHz	1/T	PK	<98%	Ave

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations. All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

7.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
966A Room					
Active Loop Antenna	EMCO	6502	0001-3322	2019/03/15	2020/03/14
Bilog Antenna/6 dB Attenuator	SUNOL SCIENCES & EMEC /EMCI	JB3/N-6-06	A111513/AT-N0668	2019/03/29	2020/03/28
Horn Antenna	ETS-Lindgren	3115	00109141	2019/07/05	2020/07/04
Horn Antenna	ETS-Lindgren	3160-09	00123852	2019/07/11	2020/07/10
Horn Antenna	ETS-Lindgren	3160-10	00123855	2019/07/12	2020/07/11
Preamplifier	A.H. Systems	PAM-0118P	478	2019/03/28	2020/03/27
Preamplifier	A.H. Systems	PAM-1840VH	174	2019/02/18	2020/02/17
Signal and Spectrum Analyzer	Rohde & Schwarz	FSV40	101434	2019/04/17	2019/04/16
Microflex Cable (1m)	EMCI	EMC106-SM-SM-2000	180515	2019/08/07	2019/08/06
Microflex Cable (2m)	MTJ	H0919	00000-MT28A-100	2019/08/07	2019/08/06
Microflex Cable (8m)	UTIFLEX	UFA210A-1-3149-300300	MFR 64639 232490-001	2019/08/07	2019/08/06
Turn Table	Chaintek	T-200-S-1	003501	N.C.R	N.C.R
Antenna Tower	Chaintek	MBD-400-1	003504	N.C.R	N.C.R
Controller	Chaintek	3000-1	003507	N.C.R	N.C.R
Software	Audix	e3 v9	E3LK-01	N.C.R	N.C.R

***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).*

7.4 Test Environmental Conditions

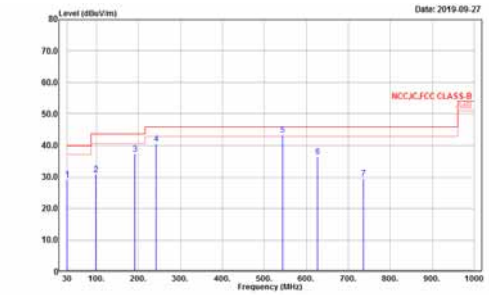
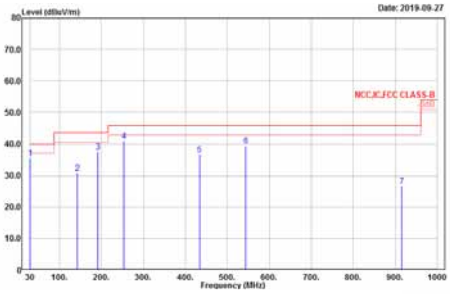
Temperature:	25℃	**Relative Humidity:**	55 %
ATM Pressure:	1011hPa	**Test Engineer:**	Leo Chang
Test Date:	2019-09-25 to 2019-09-27	-	-

7.5 Test Data and Test Plot

Wi-Fi 5G Mode:

Transmitting mode (Pre-scan with three orthogonal axis, and worse case as Y axis)

Below 1G (30 MHz-1 GHz) test the output power worst mode

Horizontal	Vertical
	

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1	30.000	29.29	40.00	-10.71	35.12	-5.83	Peak	horizontal
2	98.870	30.78	43.50	-12.72	51.56	-20.78	Peak	horizontal
3	191.020	37.19	43.50	-6.31	57.02	-19.83	Peak	horizontal
4	242.430	40.45	46.00	-5.55	59.84	-19.39	QP	horizontal
5 !	543.130	43.45	46.00	-2.55	56.36	-12.91	QP	horizontal
6	626.550	36.41	46.00	-9.59	47.88	-11.47	Peak	horizontal
7	735.190	29.41	46.00	-16.59	39.43	-10.02	Peak	horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1	30.000	35.48	40.00	-4.52	41.31	-5.83	Peak	vertical
2	142.520	30.69	43.50	-12.81	48.49	-17.80	Peak	vertical
3	191.020	37.61	43.50	-5.89	57.44	-19.83	Peak	vertical
4	254.070	40.96	46.00	-5.04	60.23	-19.27	Peak	vertical
5	433.520	36.68	46.00	-9.32	51.62	-14.94	Peak	vertical
6	543.130	39.41	46.00	-6.57	52.34	-12.91	QP	vertical
7	914.640	26.66	46.00	-19.34	34.68	-8.02	Peak	vertical

Level = Read Level + Factor

Over Limit = Level – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported

Above 1G (1 GHz-40 GHz) in UNII-1:

802.11a mode:

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5147.217	52.90	54.00	-1.10	52.55	0.35	Average
5147.217	69.39	74.00	-4.61	69.04	0.35	Peak
5178.391	96.94			96.69	0.25	Average
5178.391	107.05			106.80	0.25	Peak
2020.000	42.73	68.20	-25.47	50.26	-7.53	Peak
10360.000	47.45	68.20	-20.75	38.18	9.27	Peak
15540.000	44.67	54.00	-9.33	30.48	14.19	Average
15540.000	56.33	74.00	-17.67	42.14	14.19	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5146.696	52.05	54.00	-1.95	51.70	0.35	Average
5146.696	67.50	74.00	-6.50	67.15	0.35	Peak
5178.391	96.17			95.92	0.25	Average
5178.391	106.29			106.04	0.25	Peak
2020.000	41.00	68.20	-27.20	48.53	-7.53	Peak
10360.000	48.45	68.20	-19.75	39.18	9.27	Peak
15540.000	44.59	54.00	-9.41	30.40	14.19	Average
15540.000	56.09	74.00	-17.91	41.90	14.19	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5150.000	51.73	54.00	-2.27	51.39	0.34	Average
5150.000	65.69	74.00	-8.31	65.35	0.34	Peak
5198.261	100.23			99.97	0.26	Average
5198.261	110.14			109.88	0.26	Peak
5383.478	47.03	54.00	-6.97	46.86	0.17	Average
5383.478	60.60	74.00	-13.40	60.43	0.17	Peak
2020.000	42.69	68.20	-25.51	50.22	-7.53	Peak
10400.000	47.34	68.20	-20.86	37.95	9.39	Peak
15600.000	44.22	54.00	-9.78	30.05	14.17	Average
15600.000	57.25	74.00	-16.75	43.08	14.17	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5150.000	50.82	54.00	-3.18	50.48	0.34	Average
5150.000	64.73	74.00	-9.27	64.39	0.34	Peak
5198.261	99.78			99.52	0.26	Average
5198.261	109.66			109.40	0.26	Peak
5385.652	46.92	54.00	-7.08	46.77	0.15	Average
5385.652	60.88	74.00	-13.12	60.73	0.15	Peak
2020.000	41.18	68.20	-27.02	48.71	-7.53	Peak
10400.000	47.13	68.20	-21.07	37.74	9.39	Peak
15600.000	44.38	54.00	-9.62	30.21	14.17	Average
15600.000	57.40	74.00	-16.60	43.23	14.17	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5144.783	47.62	54.00	-6.38	47.26	0.36	Average
5144.783	61.26	74.00	-12.74	60.90	0.36	Peak
5238.261	101.61			101.37	0.24	Average
5238.261	111.61			111.37	0.24	Peak
5356.087	47.44	54.00	-6.56	47.24	0.20	Average
5356.087	60.60	74.00	-13.40	60.40	0.20	Peak
2020.000	44.08	68.20	-24.12	51.61	-7.53	Peak
10480.000	48.19	68.20	-20.01	39.00	9.19	Peak
15720.000	44.43	54.00	-9.57	30.13	14.30	Average
15720.000	59.67	74.00	-14.33	45.37	14.30	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5146.087	47.61	54.00	-6.39	47.25	0.36	Average
5146.087	61.40	74.00	-12.60	61.04	0.36	Peak
5238.261	100.15			99.91	0.24	Average
5238.261	110.15			109.91	0.24	Peak
5377.391	47.11	54.00	-6.89	46.93	0.18	Average
5377.391	60.56	74.00	-13.44	60.38	0.18	Peak
2020.000	40.37	68.20	-27.83	47.90	-7.53	Peak
10480.000	48.29	68.20	-19.91	39.10	9.19	Peak
15720.000	45.82	54.00	-8.18	31.52	14.30	Average
15720.000	60.66	74.00	-13.34	46.36	14.30	Peak

802.11ac VHT20 mode:

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5148.240	52.77	54.00	-1.23	52.42	0.35	Average
5148.240	69.72	74.00	-4.28	69.37	0.35	Peak
5182.170	96.01			95.76	0.25	Average
5182.170	107.41			107.16	0.25	Peak
2020.000	41.29	68.20	-26.91	48.82	-7.53	Peak
10360.000	48.36	68.20	-19.84	39.14	9.22	Peak
15540.000	44.62	54.00	-9.38	30.43	14.19	Average
15540.000	56.54	74.00	-17.46	42.35	14.19	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5149.320	51.05	54.00	-2.95	50.70	0.35	Average
5149.320	66.83	74.00	-7.17	66.48	0.35	Peak
5178.030	93.57		7	93.32	0.25	Average
5178.030	105.58		8	105.33	0.25	Peak
2020.000	40.83	68.20	-27.37	48.36	-7.53	Peak
10360.000	47.98	68.20	-20.22	38.76	9.22	Peak
15540.000	44.68	54.00	-9.32	30.49	14.19	Average
15540.000	56.55	74.00	-17.45	42.36	14.19	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5147.700	51.69	54.00	-2.31	51.34	0.35	Average
5147.700	66.11	74.00	-7.89	65.76	0.35	Peak
5198.400	99.67			99.42	0.25	Average
5198.400	110.34			110.09	0.25	Peak
5388.000	46.67	54.00	-7.33	46.52	0.15	Average
5388.000	60.53	74.00	-13.47	60.38	0.15	Peak
2020.000	41.52	68.20	-26.68	49.05	-7.53	Peak
10400.000	49.20	68.20	-19.00	39.81	9.39	Peak
15600.000	44.50	54.00	-9.50	30.33	14.17	Average
15600.000	57.55	74.00	-16.45	43.38	14.17	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5149.200	49.86	54.00	-4.14	49.51	0.35	Average
5149.200	63.86	74.00	-10.14	63.51	0.35	Peak
5199.600	97.10		9	96.85	0.25	Average
5199.600	107.99		9	107.74	0.25	Peak
5380.200	46.67	54.00	-7.33	46.49	0.18	Average
5380.200	60.74	74.00	-13.26	60.56	0.18	Peak
2020.000	38.44	68.20	-29.76	45.97	-7.53	Peak
10400.000	48.49	68.20	-19.71	39.10	9.39	Peak
15600.000	45.50	54.00	-8.50	31.33	14.17	Average
15600.000	57.51	74.00	-16.49	43.34	14.17	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5148.900	47.61	54.00	-6.39	47.26	0.35	Average
5148.900	62.72	74.00	-11.28	62.37	0.35	Peak
5238.300	100.42			100.18	0.24	Average
5238.300	111.42			111.18	0.24	Peak
5354.700	46.74	54.00	-7.26	46.52	0.22	Average
5354.700	61.30	74.00	-12.70	61.08	0.22	Peak
2020.000	41.91	68.20	-26.29	49.44	-7.53	Peak
10480.000	48.66	68.20	-19.54	39.47	9.19	Peak
15720.000	45.44	54.00	-8.56	31.14	14.30	Average
15720.000	59.24	74.00	-14.76	44.94	14.30	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5149.200	47.45	54.00	-6.55	47.10	0.35	Average
5149.200	62.15	74.00	-11.85	61.80	0.35	Peak
5237.700	98.44		1	98.20	0.24	Average
5237.700	109.64		1	109.40	0.24	Peak
5369.400	46.92	54.00	-7.08	46.74	0.18	Average
5369.400	61.50	74.00	-12.50	61.32	0.18	Peak
2020.000	40.63	68.20	-27.57	48.16	-7.53	Peak
10480.000	47.97	68.20	-20.23	38.78	9.19	Peak
15720.000	45.93	54.00	-8.07	31.63	14.30	Average
15720.000	59.90	74.00	-14.10	45.60	14.30	Peak

802.11ac VHT40 mode:

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5146.310	52.26	54.00	-1.74	51.90	0.36	Average
5146.310	70.45	74.00	-3.55	70.09	0.36	Peak
5192.070	91.89	68.20			0.25	Average
5192.070	104.10	68.20			0.25	Peak
2020.000	40.46	68.20	-27.74	47.99	-7.53	Peak
10380.000	48.41	68.20	-19.79	39.05	9.36	Peak
15570.000	44.86	54.00	-9.14	30.68	14.18	Average
15570.000	57.44	74.00	-16.56	43.26	14.18	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5146.420	50.68	54.00	-3.32	50.32	0.36	Average
5146.420	69.03	74.00	-4.97	68.67	0.36	Peak
5187.780	89.35			89.10	0.25	Average
5187.780	101.67			101.42	0.25	Peak
2020.000	40.89	68.20	-27.31	48.42	-7.53	Peak
10380.000	49.56	68.20	-18.64	40.20	9.36	Peak
15570.000	45.13	54.00	-8.87	30.95	14.18	Average
15570.000	57.14	74.00	-16.86	42.96	14.18	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5149.500	50.89	54.00	-3.11	50.54	0.35	Average
5149.500	65.58	74.00	-8.42	65.23	0.35	Peak
5226.000	95.08	68.20			0.28	Average
5226.000	107.51	68.20			0.28	Peak
5373.000	46.73	54.00	-7.27	46.55	0.18	Average
5373.000	60.91	74.00	-13.09	60.73	0.18	Peak
2020.000	40.19	68.20	-28.01	47.72	-7.53	Peak
10460.000	48.82	68.20	-19.38	39.54	9.28	Peak
15690.000	45.78	54.00	-8.22	31.48	14.30	Average
15690.000	59.89	74.00	-14.11	45.59	14.30	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5147.700	49.16	54.00	-4.84	48.81	0.35	Average
5147.700	62.54	74.00	-11.46	62.19	0.35	Peak
5226.000	92.58	68.20			0.28	Average
5226.000	104.93	68.20			0.28	Peak
5365.800	46.73	54.00	-7.27	46.54	0.19	Average
5365.800	60.60	74.00	-13.40	60.41	0.19	Peak
2020.000	39.40	68.20	-28.80	46.93	-7.53	Peak
10460.000	48.78	68.20	-19.42	39.50	9.28	Peak
15690.000	45.42	54.00	-8.58	31.12	14.30	Average
15690.000	59.47	74.00	-14.53	45.17	14.30	Peak

802.11ac VHT80 mode:

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5147.850	52.52	54.00	-1.48	52.17	0.35	Average
5147.850	68.25	74.00	-5.75	67.90	0.35	Peak
5212.650	86.02			85.76	0.26	Average
5212.650	100.51			100.25	0.26	Peak
2020.000	41.86	68.20	-26.34	49.39	-7.53	Peak
10420.000	49.68	68.20	-18.52	40.25	9.43	Peak
15630.000	45.29	54.00	-8.71	31.13	14.16	Average
15630.000	57.98	74.00	-16.02	43.82	14.16	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5139.900	50.73	54.00	-3.27	50.35	0.38	Average
5139.900	66.24	74.00	-7.76	65.86	0.38	Peak
5213.400	83.24			82.97	0.27	Average
5213.400	97.04			96.77	0.27	Peak
2020.000	40.67	68.20	-27.53	48.20	-7.53	Peak
10420.000	49.12	68.20	-19.08	39.69	9.43	Peak
15630.000	45.33	54.00	-8.67	31.17	14.16	Average
15630.000	57.88	74.00	-16.12	43.72	14.16	Peak

Above 1G (1 GHz-40 GHz) in UNII-3:

802.11a mode:

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5649.960	61.16	68.20	-7.04	60.14	1.02	Peak
5652.120	61.59	69.78	-8.19	60.56	1.03	Peak
5702.520	74.44	105.91	-31.47	73.12	1.32	Peak
5745.720	110.96	122.20	-11.24	109.68	1.28	Peak
5874.240	64.35	105.41	-41.06	62.23	2.12	Peak
5925.000	64.22	68.20	-3.98	61.74	2.48	Peak
5967.120	64.39	68.20	-3.81	61.95	2.44	Peak
2020.000	42.71	68.20	-25.49	50.24	-7.53	Peak
11490.000	40.55	54.00	-13.45	29.85	10.70	Average
11490.000	51.52	74.00	-22.48	40.82	10.70	Peak
17235.000	57.93	68.20	-10.27	40.96	16.97	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5643.840	61.97	68.20	-6.23	60.99	0.98	Peak
5651.040	61.33	68.97	-7.64	60.30	1.03	Peak
5701.800	69.30	105.70	-36.40	67.98	1.32	Peak
5743.200	107.58	122.20	-14.62	106.30	1.28	Peak
5874.960	63.64	105.21	-41.57	61.51	2.13	Peak
5924.280	63.54	68.73	-5.19	61.06	2.48	Peak
5967.120	64.17	68.20	-4.03	61.73	2.44	Peak
2020.000	41.87	68.20	-26.33	49.40	-7.53	Peak
11490.000	39.84	54.00	-14.16	29.14	10.70	Average
11490.000	50.84	74.00	-23.16	40.14	10.70	Peak
17235.000	57.06	68.20	-11.14	40.09	16.97	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5639.880	61.69	68.20	-6.51	60.74	0.95	Peak
5650.680	60.98	68.71	-7.73	59.95	1.03	Peak
5701.440	62.36	105.60	-43.24	61.04	1.32	Peak
5783.520	109.95	122.20	-12.25	108.61	1.34	Peak
5874.600	63.76	105.31	-41.55	61.63	2.13	Peak
5923.920	64.84	69.00	-4.16	62.36	2.48	Peak
5959.560	64.28	68.20	-3.92	61.84	2.44	Peak
2020.000	41.51	68.20	-26.69	49.04	-7.53	Peak
11570.000	41.02	54.00	-12.98	30.26	10.76	Average
11570.000	50.56	74.00	-23.44	39.80	10.76	Peak
17355.000	58.00	68.20	-10.20	40.29	17.71	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5633.760	61.68	68.20	-6.52	60.77	0.91	Peak
5651.040	61.74	68.97	-7.23	60.71	1.03	Peak
5700.720	62.28	105.40	-43.12	60.95	1.33	Peak
5783.520	107.19	122.20	-15.01	105.85	1.34	Peak
5874.960	64.39	105.21	-40.82	62.26	2.13	Peak
5925.000	64.00	68.20	-4.20	61.52	2.48	Peak
5940.120	64.95	68.20	-3.25	62.47	2.48	Peak
2020.000	39.25	68.20	-28.95	46.78	-7.53	Peak
11570.000	40.92	54.00	-13.08	30.16	10.76	Average
11570.000	51.62	74.00	-22.38	40.86	10.76	Peak
17355.000	57.22	68.20	-10.98	39.51	17.71	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5643.480	61.74	68.20	-6.46	60.76	0.98	Peak
5651.040	60.76	68.97	-8.21	59.73	1.03	Peak
5701.080	61.09	105.50	-44.41	59.76	1.33	Peak
5823.480	109.53	122.20	-12.67	108.02	1.51	Peak
5874.960	66.93	105.21	-38.28	64.80	2.13	Peak
5924.640	63.73	68.47	-4.74	61.25	2.48	Peak
5931.480	64.61	68.20	-3.59	62.12	2.49	Peak
2020.000	42.00	68.20	-26.20	49.53	-7.53	Peak
11650.000	41.27	54.00	-12.73	30.37	10.90	Average
11650.000	51.39	74.00	-22.61	40.49	10.90	Peak
17475.000	57.13	68.20	-11.07	39.07	18.06	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5632.320	62.08	68.20	-6.12	61.17	0.91	Peak
5651.040	60.83	68.97	-8.14	59.80	1.03	Peak
5700.360	62.01	105.30	-43.29	60.68	1.33	Peak
5823.840	106.35	122.20	-15.85	104.83	1.52	Peak
5874.600	65.00	105.31	-40.31	62.87	2.13	Peak
5923.560	64.16	69.26	-5.10	61.68	2.48	Peak
5934.360	64.50	68.20	-3.70	62.02	2.48	Peak
2020.000	41.03	68.20	-27.17	48.56	-7.53	Peak
11650.000	41.47	54.00	-12.53	30.57	10.90	Average
11650.000	51.51	74.00	-22.49	40.61	10.90	Peak
17475.000	58.02	68.20	-10.18	39.96	18.06	Peak

802.11ac VHT20 mode:

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5648.520	61.99	68.20	-6.21	60.98	1.01	Peak
5653.200	61.86	70.58	-8.72	60.81	1.05	Peak
5700.720	74.18	105.40	-31.22	72.85	1.33	Peak
5743.200	111.01	122.20	-11.19	109.73	1.28	Peak
5872.800	63.98	105.82	-41.84	61.89	2.09	Peak
5924.640	63.56	68.47	-4.91	61.08	2.48	Peak
5947.320	64.80	68.20	-3.40	62.33	2.47	Peak
2020.000	41.74	68.20	-26.46	49.27	-7.53	Peak
11490.000	41.53	54.00	-12.47	30.83	10.70	Average
11490.000	51.59	74.00	-22.41	40.89	10.70	Peak
17235.000	57.08	68.20	-11.12	40.11	16.97	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5630.880	61.88	68.20	-6.32	60.99	0.89	Peak
5650.680	60.90	68.71	-7.81	59.87	1.03	Peak
5701.800	70.80	105.70	-34.90	69.48	1.32	Peak
5746.080	107.93	122.20	-14.27	106.65	1.28	Peak
5874.960	63.71	105.21	-41.50	61.58	2.13	Peak
5924.280	63.82	68.73	-4.91	61.34	2.48	Peak
5950.200	64.68	68.20	-3.52	62.22	2.46	Peak
2020.000	40.68	68.20	-27.52	48.21	-7.53	Peak
11490.000	41.18	54.00	-12.82	30.48	10.70	Average
11490.000	51.45	74.00	-22.55	40.75	10.70	Peak
17235.000	57.16	68.20	-11.04	40.19	16.97	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5636.280	61.65	68.20	-6.55	60.71	0.94	Peak
5654.280	61.16	71.38	-10.22	60.10	1.06	Peak
5701.440	64.26	105.60	-41.34	62.94	1.32	Peak
5787.480	110.25	122.20	-11.95	108.93	1.32	Peak
5874.600	63.47	105.31	-41.84	61.34	2.13	Peak
5924.640	63.77	68.47	-4.70	61.29	2.48	Peak
5927.880	65.25	68.20	-2.95	62.76	2.49	Peak
2020.000	42.33	68.20	-25.87	49.86	-7.53	Peak
11570.000	41.22	54.00	-12.78	30.46	10.76	Average
11570.000	51.47	74.00	-22.53	40.71	10.76	Peak
17355.000	57.35	68.20	-10.85	39.64	17.71	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5649.960	61.78	68.20	-6.42	60.76	1.02	Peak
5652.120	61.22	69.78	-8.56	60.19	1.03	Peak
5703.960	62.60	106.31	-43.71	61.28	1.32	Peak
5787.480	107.00	122.20	-15.20	105.68	1.32	Peak
5874.960	62.82	105.21	-42.39	60.69	2.13	Peak
5922.840	63.68	69.79	-6.11	61.20	2.48	Peak
5949.120	64.72	68.20	-3.48	62.26	2.46	Peak
2020.000	40.20	68.20	-28.00	47.73	-7.53	Peak
11570.000	41.20	54.00	-12.80	30.44	10.76	Average
11570.000	51.91	74.00	-22.09	41.15	10.76	Peak
17355.000	57.31	68.20	-10.89	39.60	17.71	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5647.800	62.04	68.20	-6.16	61.03	1.01	Peak
5650.680	61.58	68.71	-7.13	60.55	1.03	Peak
5702.520	62.89	105.91	-43.02	61.57	1.32	Peak
5826.000	110.28	122.20	-11.92	108.74	1.54	Peak
5873.880	68.69	105.51	-36.82	66.57	2.12	Peak
5923.200	64.30	69.53	-5.23	61.82	2.48	Peak
5950.200	64.83	68.20	-3.37	62.37	2.46	Peak
2020.000	41.71	68.20	-26.49	49.24	-7.53	Peak
11650.000	42.18	54.00	-11.82	31.28	10.90	Average
11650.000	51.56	74.00	-22.44	40.66	10.90	Peak
17475.000	57.73	68.20	-10.47	39.67	18.06	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5643.480	61.74	68.20	-6.46	60.76	0.98	Peak
5650.680	60.98	68.71	-7.73	59.95	1.03	Peak
5701.800	61.59	105.70	-44.11	60.27	1.32	Peak
5823.840	106.43	122.20	-15.77	104.91	1.52	Peak
5873.520	64.33	105.61	-41.28	62.22	2.11	Peak
5924.640	63.35	68.47	-5.12	60.87	2.48	Peak
5942.640	64.35	68.20	-3.85	61.88	2.47	Peak
2020.000	39.77	68.20	-28.43	47.30	-7.53	Peak
11650.000	42.59	54.00	-11.41	31.69	10.90	Average
11650.000	51.70	74.00	-22.30	40.80	10.90	Peak
17475.000	57.65	68.20	-10.55	39.59	18.06	Peak

802.11ac VHT40 mode:

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5647.440	64.70	68.20	-3.50	63.69	1.01	Peak
5650.320	65.10	68.44	-3.34	64.07	1.03	Peak
5705.400	83.24	106.71	-23.47	81.91	1.33	Peak
5753.640	107.60	122.20	-14.60	106.31	1.29	Peak
5878.920	63.72	102.29	-38.57	61.54	2.18	Peak
5923.560	63.82	69.26	-5.44	61.34	2.48	Peak
5929.320	65.15	68.20	-3.05	62.66	2.49	Peak
2020.000	41.71	68.20	-26.49	49.24	-7.53	Peak
11510.000	41.87	54.00	-12.13	31.14	10.73	Average
11510.000	51.37	74.00	-22.63	40.64	10.73	Peak
17265.000	57.86	68.20	-10.34	40.77	17.09	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5647.440	63.28	68.20	-4.92	62.27	1.01	Peak
5653.200	63.54	70.58	-7.04	62.49	1.05	Peak
5706.840	82.26	107.12	-24.86	80.94	1.32	Peak
5753.640	105.03	122.20	-17.17	103.74	1.29	Peak
5874.600	65.09	105.31	-40.22	62.96	2.13	Peak
5923.560	63.88	69.26	-5.38	61.40	2.48	Peak
5938.320	64.28	68.20	-3.92	61.80	2.48	Peak
2020.000	40.97	68.20	-27.23	48.50	-7.53	Peak
11510.000	41.58	54.00	-12.42	30.85	10.73	Average
11510.000	51.17	74.00	-22.83	40.44	10.73	Peak
17265.000	57.51	68.20	-10.69	40.42	17.09	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5645.640	63.17	68.20	-5.03	62.18	0.99	Peak
5652.120	62.38	69.78	-7.40	61.35	1.03	Peak
5700.000	70.50	105.20	-34.70	69.17	1.33	Peak
5793.960	107.49	122.20	-14.71	106.18	1.31	Peak
5872.440	68.45	105.92	-37.47	66.36	2.09	Peak
5922.480	65.16	70.06	-4.90	62.68	2.48	Peak
5925.720	65.76	68.20	-2.44	63.28	2.48	Peak
2020.000	41.52	68.20	-26.68	49.05	-7.53	Peak
11590.000	41.76	54.00	-12.24	30.99	10.77	Average
11590.000	51.70	74.00	-22.30	40.93	10.77	Peak
17385.000	58.21	68.20	-9.99	40.42	17.79	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5647.440	61.81	68.20	-6.39	60.80	1.01	Peak
5651.400	61.77	69.24	-7.47	60.74	1.03	Peak
5700.720	67.69	105.40	-37.71	66.36	1.33	Peak
5796.840	104.41	122.20	-17.79	103.09	1.32	Peak
5872.440	65.61	105.92	-40.31	63.52	2.09	Peak
5921.040	64.12	71.12	-7.00	61.65	2.47	Peak
5925.000	65.16	68.20	-3.04	62.68	2.48	Peak
2020.000	40.65	68.20	-27.55	48.18	-7.53	Peak
11590.000	41.83	54.00	-12.17	31.06	10.77	Average
11590.000	51.83	74.00	-22.17	41.06	10.77	Peak
17385.000	58.58	68.20	-9.62	40.79	17.79	Peak

802.11ac VHT80 mode:

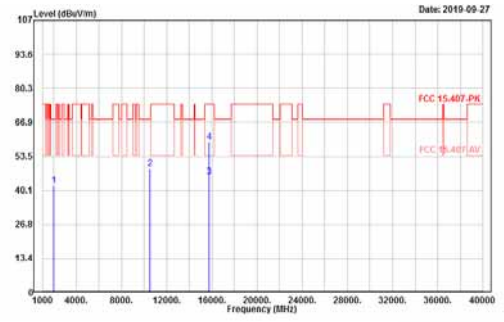
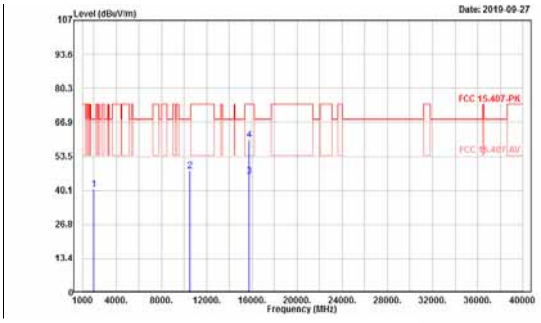
Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5648.880	64.06	68.20	-4.14	63.04	1.02	Peak
5648.880	64.06	68.20	-4.14	63.04	1.02	Peak
5651.760	63.27	69.51	-6.24	62.24	1.03	Peak
5651.760	63.27	69.51	-6.24	62.24	1.03	Peak
5704.680	77.75	106.51	-28.76	76.43	1.32	Peak
5777.400	102.47	122.20	-19.73	101.14	1.33	Peak
5864.160	72.05	108.23	-36.18	70.05	2.00	Peak
5922.840	64.38	69.79	-5.41	61.90	2.48	Peak
5928.240	64.74	68.20	-3.46	62.25	2.49	Peak
2020.000	41.34	68.20	-26.86	48.87	-7.53	Peak
11550.000	42.17	54.00	-11.83	31.42	10.75	Average
11550.000	51.73	74.00	-22.27	40.98	10.75	Peak
17325.000	57.93	68.20	-10.27	40.34	17.59	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5646.000	63.49	68.20	-4.71	62.50	0.99	Peak
5651.400	62.24	69.24	-7.00	61.21	1.03	Peak
5703.600	74.05	106.21	-32.16	72.72	1.33	Peak
5777.400	99.81	122.20	-22.39	98.48	1.33	Peak
5875.680	65.46	104.69	-39.23	63.33	2.13	Peak
5921.400	64.15	70.85	-6.70	61.69	2.46	Peak
5947.680	64.81	68.20	-3.39	62.35	2.46	Peak
2020.000	41.34	68.20	-26.86	48.87	-7.53	Peak
11550.000	41.52	54.00	-12.48	30.77	10.75	Average
11550.000	50.79	74.00	-23.21	40.04	10.75	Peak
17325.000	57.63	68.20	-10.57	40.04	17.59	Peak

Above 1G (1 GHz-40 GHz): test the worst mode:

Horizontal	Vertical
	

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1	2020.000	41.91	68.20	-26.29	49.44	-7.53	Peak	horizontal
2	!10480.000	48.66	68.20	-19.54	39.47	9.19	Peak	horizontal
3	!15720.000	45.44	54.00	-8.56	31.14	14.30	Average	horizontal
4	!15720.000	59.24	74.00	-14.76	44.94	14.30	Peak	horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1	2020.000	40.63	68.20	-27.57	48.16	-7.53	Peak	vertical
2	!10480.000	47.97	68.20	-20.23	38.78	9.19	Peak	vertical
3	!15720.000	45.93	54.00	-8.07	31.63	14.30	Average	vertical
4	!15720.000	59.90	74.00	-14.10	45.60	14.30	Peak	vertical

Level = Read Level + Factor

Over Limit = Level – Limit

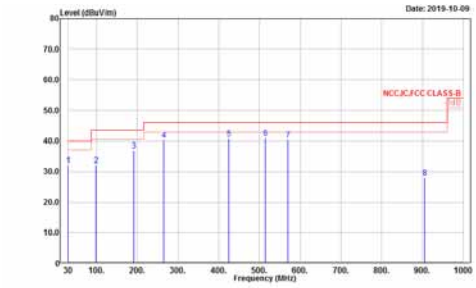
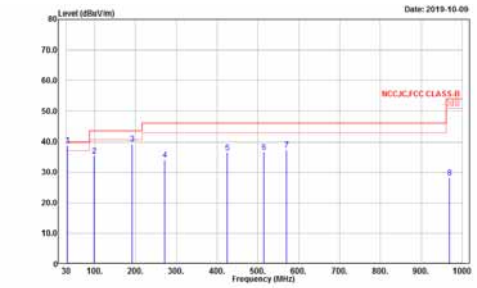
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported

Co-location mode (Wi-Fi +WWan (FCC ID: RI7LE910NAV2)):

VT-IoT-Dongle:

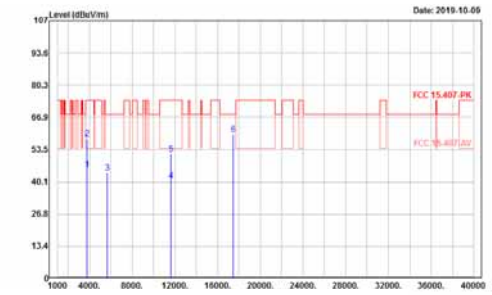
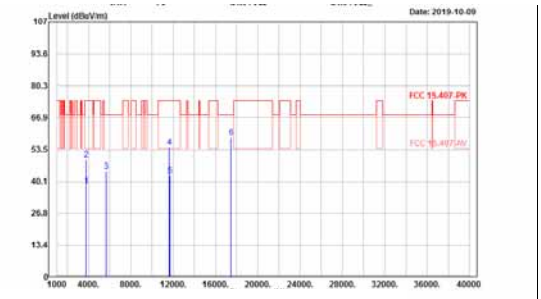
Below 1G

Horizontal	Vertical
	

	Freq	Level	Line	Limit	Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1	30.970	32.06	40.00	-7.94	38.62	-6.56	Peak	horizontal
2	98.870	32.11	43.50	-11.39	52.89	-20.78	Peak	horizontal
3	191.020	36.91	43.50	-6.59	56.74	-19.83	Peak	horizontal
4	264.740	40.28	46.00	-5.72	58.86	-18.58	Peak	horizontal
5	423.820	40.67	46.00	-5.33	55.78	-15.11	QP	horizontal
6	514.030	41.00	46.00	-5.00	54.36	-13.36	Peak	horizontal
7	569.320	40.40	46.00	-5.60	52.88	-12.48	Peak	horizontal
8	905.910	27.94	46.00	-18.06	36.08	-8.14	Peak	horizontal

	Freq	Level	Line	Limit	Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1	32.910	38.83	40.00	-1.17	46.85	-8.02	QP	vertical
2	98.870	35.26	43.50	-8.24	56.04	-20.78	Peak	vertical
3	191.020	39.26	43.50	-4.24	59.09	-19.83	Peak	vertical
4	271.530	34.10	46.00	-11.90	52.15	-18.05	Peak	vertical
5	423.820	36.35	46.00	-9.65	51.46	-15.11	Peak	vertical
6	514.030	36.71	46.00	-9.29	50.07	-13.36	Peak	vertical
7	569.320	37.36	46.00	-8.64	49.84	-12.48	Peak	vertical
8	968.960	28.13	54.00	-25.87	35.35	-7.22	Peak	vertical

Above 1G

Horizontal	Vertical
	

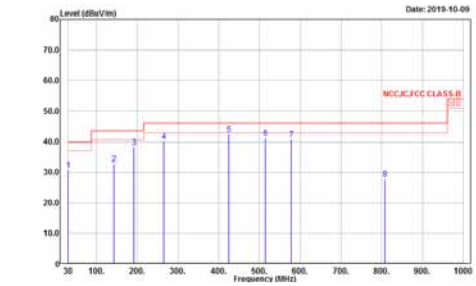
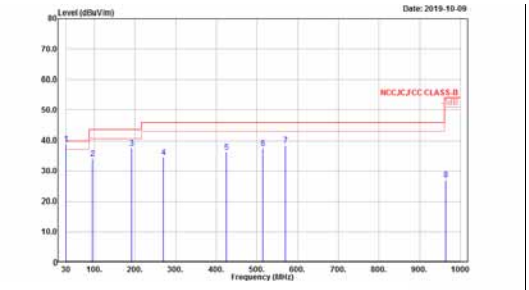
	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1	3757.000	45.22	54.00	-8.78	47.75	-2.53	Average	horizontal
2	3757.000	58.00	74.00	-16.00	60.53	-2.53	Peak	horizontal
3	5640.000	43.64	68.20	-24.56	42.69	0.95	Peak	horizontal
4	11650.000	40.54	54.00	-13.46	29.64	10.90	Average	horizontal
5	11650.000	51.66	74.00	-22.34	40.76	10.90	Peak	horizontal
6	17475.000	59.87	68.20	-8.33	41.81	18.06	Peak	horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1	3760.000	38.16	54.00	-15.84	40.69	-2.53	Average	vertical
2	3760.000	49.16	74.00	-24.84	51.69	-2.53	Peak	vertical
3	5640.000	44.49	68.20	-23.71	43.54	0.95	Peak	vertical
4	11650.000	54.62	74.00	-19.38	43.67	10.95	Peak	vertical
5	11659.000	42.61	54.00	-11.39	31.66	10.95	Average	vertical
6	17475.000	58.64	68.20	-9.56	40.58	18.06	Peak	vertical

Co-location mdoe (Wi-Fi +WWan (FCC ID 2AJYU-SIM7000A))

VT-IoT-Dongle-CATM:

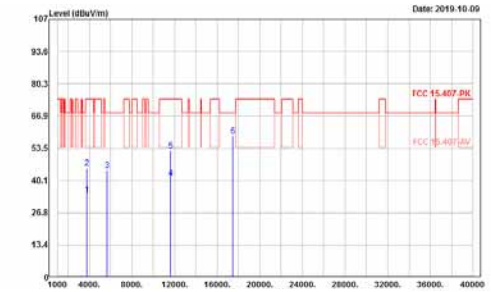
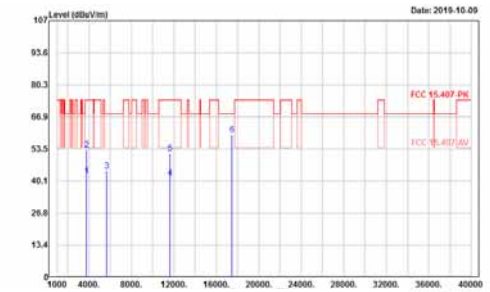
Below 1G

Horizontal	Vertical
	

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1	30.970	30.76	40.00	-9.24	37.32	-6.56	Peak	horizontal
2	142.520	32.67	43.50	-10.83	50.47	-17.80	Peak	horizontal
3	191.020	38.06	43.50	-5.44	57.89	-19.83	Peak	horizontal
4	264.740	40.15	46.00	-5.85	58.73	-18.58	Peak	horizontal
5	423.820	42.44	46.00	-3.56	57.55	-15.11	Peak	horizontal
6	514.030	41.19	46.00	-4.81	54.55	-13.36	Peak	horizontal
7	578.050	40.73	46.00	-5.27	53.09	-12.36	Peak	horizontal
8	806.970	27.77	46.00	-18.23	36.76	-8.99	Peak	horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1 !	30.000	38.83	40.00	-1.17	44.66	-5.83	QP	vertical
2	94.990	34.09	43.50	-9.41	55.77	-21.68	Peak	vertical
3	191.020	37.60	43.50	-5.90	57.43	-19.83	Peak	vertical
4	269.590	34.43	46.00	-11.57	52.54	-18.11	Peak	vertical
5	423.820	36.15	46.00	-9.85	51.26	-15.11	Peak	vertical
6	514.030	37.53	46.00	-8.47	50.89	-13.36	Peak	vertical
7	569.320	38.37	46.00	-7.63	50.85	-12.48	Peak	vertical
8	964.110	27.08	54.00	-26.92	34.37	-7.29	Peak	vertical

Above 1G

Horizontal	Vertical
	

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1 !	3754.000	34.33	54.00	-19.67	36.86	-2.53	Average	Horizontal
2	3760.000	45.16	74.00	-28.84	47.69	-2.53	Peak	Horizontal
3	5640.000	44.48	68.20	-23.72	43.53	0.95	Peak	Horizontal
4 !	11650.000	41.09	54.00	-12.91	30.19	10.90	Average	Horizontal
5	11650.000	52.62	74.00	-21.38	41.72	10.90	Peak	Horizontal
6 !	17475.000	58.61	68.20	-9.59	40.55	18.06	Peak	Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1 !	3757.000	42.20	54.00	-11.80	44.70	-2.50	Average	Vertical
2	3757.000	53.10	74.00	-20.90	55.60	-2.50	Peak	Vertical
3	5640.000	44.22	68.20	-23.98	43.27	0.95	Peak	Vertical
4 !	11650.000	41.33	54.00	-12.67	30.43	10.90	Average	Vertical
5	11650.000	51.76	74.00	-22.24	40.86	10.90	Peak	Vertical
6 !	17475.000	59.41	68.20	-8.79	41.35	18.06	Peak	Vertical

8 FCC §15.407(a)(e) –Emission Bandwidth and Occupied Bandwidth

8.1 Applicable Standard

According to FCC §15.407(a),

The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

As per FCC §15.407(e): for equipment operating in the band 5725 – 5850 MHz, the minimum 6 dB bandwidth of U-NII devices shall be 500 kHz.

8.2 Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01,

Emission Bandwidth (EBW)

a) Set RBW = approximately 1% of the emission bandwidth; b) Set the VBW > RBW; c) Detector = Peak;

d) Trace mode = max hold; e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%;

99% Occupied Bandwidth

The 99% occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5 % of the total mean power of the given emission. Measurement of the 99% occupied bandwidth is *required* only as a condition for using the optional band-edge measurement techniques described in II.G.3.d). Measurements of 99% occupied bandwidth may also optionally be used in lieu of the EBW to define the minimum frequency range over which the spectrum is integrated when measuring maximum conducted output power as described in II.E. However, the EBW must be measured to determine bandwidth dependent limits on maximum conducted output power in accordance with 15.407(a).

The following procedure shall be used for measuring (99 %) power bandwidth:

1. Set center frequency to the nominal EUT channel center frequency.

2. Set span = 1.5 times to 5.0 times the OBW.

3. Set RBW = 1 % to 5 % of the OBW

4. Set VBW ≥ 3 · RBW

5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

6. Use the 99 % power bandwidth function of the instrument (if available).

7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

8.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSV40-N	100406	2019/09/11	2019/09/10
Cable	MTJ	MT40S	620620-MT40S-100	2018/12/28	2019/12/28

***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).*

8.4 Test Environmental Conditions

Temperature:	22.9°C	**Relative Humidity:**	57 %
ATM Pressure:	1015hPa	**Test Engineer:**	Ian Tu
Test Date:	2019-10-01	-	-

8.5 Test Data and Test Plot

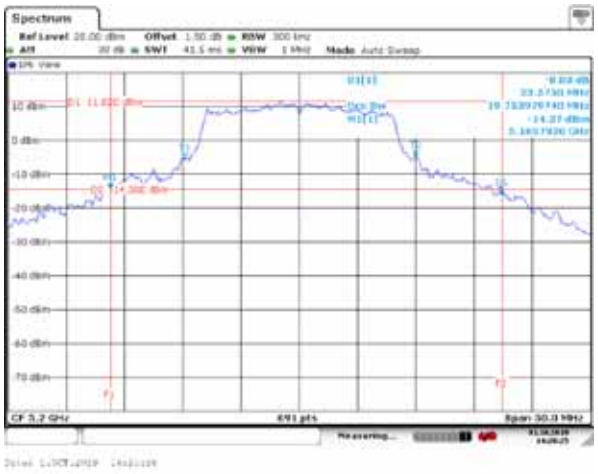
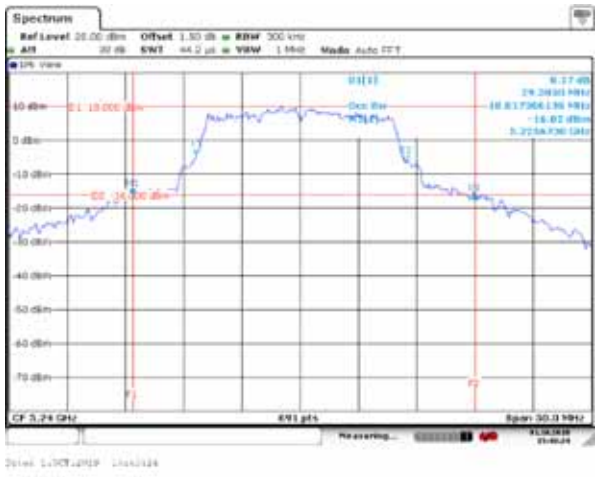
UNII Band	Mode	Channel	Frequency (MHz)	26dB Emission Bandwidth (MHz)
UNII-1	802.11a	36	5180	23.8780
		40	5200	33.5750
		48	5240	29.3050
UNII-1	802.11ac20	36	5180	28.5820
		40	5200	37.3370
		48	5240	31.9100
UNII-1	802.11ac 40	38	5190	58.0000
		46	5230	75.1100
UNII-1	802.11ac 80	42	5210	91.0000

UNII Band	Mode	Channel	Frequency (MHz)	6dB Emission Bandwidth (MHz)	Limit (MHz)
UNII-3	802.11a	149	5745	16.3240	>0.5
		157	5785	16.3240	>0.5
		165	5825	16.3240	>0.5
	802.11ac20	149	5745	17.5980	>0.5
		157	5785	17.5980	>0.5
		165	5825	17.5400	>0.5
	802.11ac 40	151	5755	36.2100	>0.5
		159	5795	36.2400	>0.5
	802.11ac 80	155	5775	75.5700	>0.5

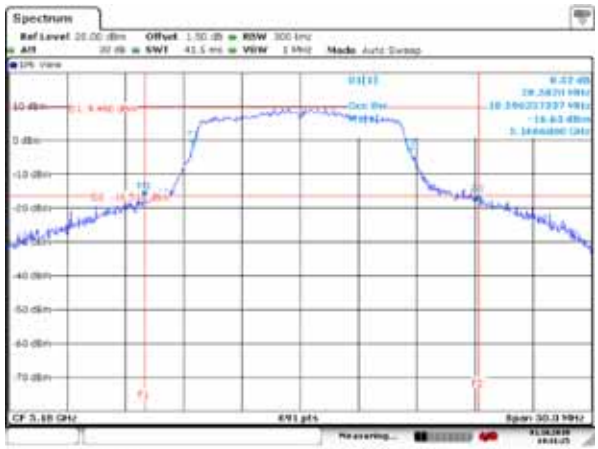
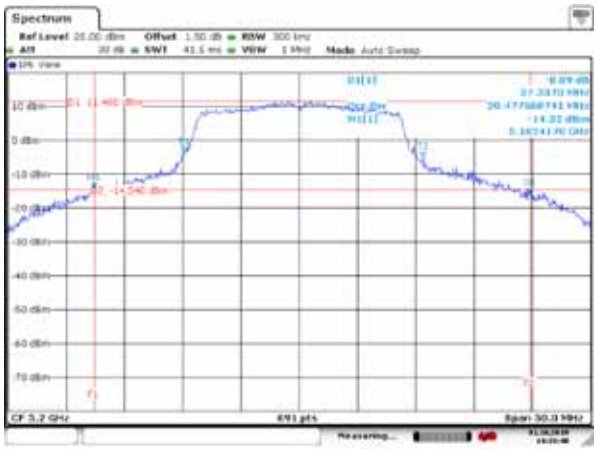
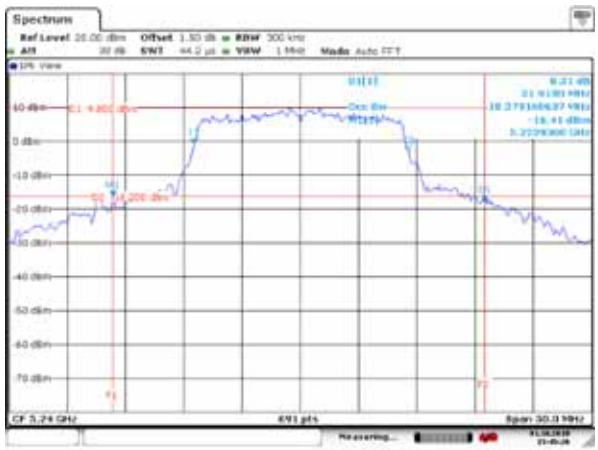
UNII Band	Mode	Channel	Frequency (MHz)	99% Emission Bandwidth (MHz)
UNII-1	802.11a	36	5180	17.5832
		40	5200	19.7540
		48	5240	18.0174
UNII-3		149	5745	31.4038
		157	5785	30.3907
		165	5825	31.0420
UNII-1	802.11ac20	36	5180	18.5962
		40	5200	20.4476
		48	5240	18.3792
UNII-3		149	5745	33.6469
		157	5785	33.2851
		165	5825	34.2258
UNII-1	802.11ac 40	38	5190	37.2793
		46	5230	40.6657
UNII-3		151	5755	42.1129
		159	5795	65.7019
UNII-1	802.11ac 80	42	5210	76.4110
UNII-3		155	5775	78.1476

For UNII-1

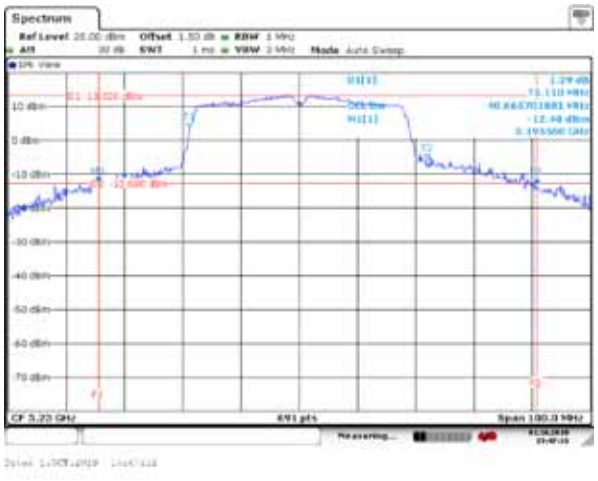
802.11a mode

Low CH	Middle CH
	
High CH	**-**
	-

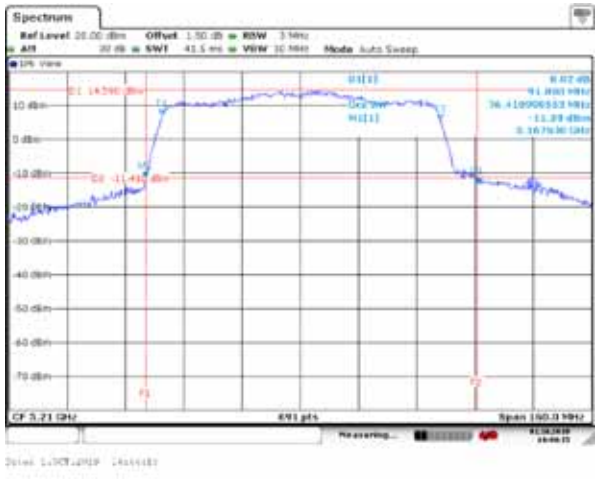
802.11ac VHT20 mode:

Low CH	Middle CH
	
High CH	**-**
	-

802.11ac VHT40 mode:

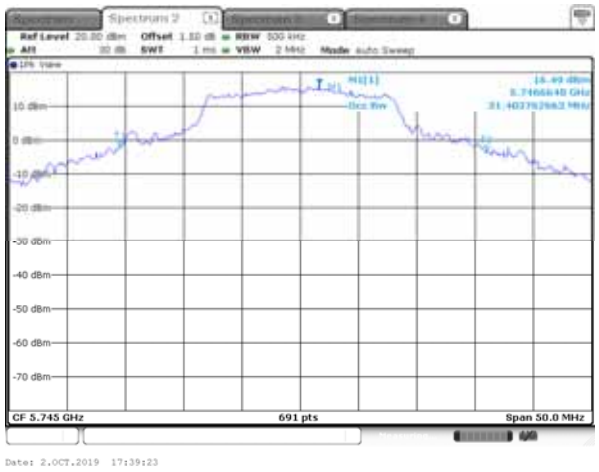
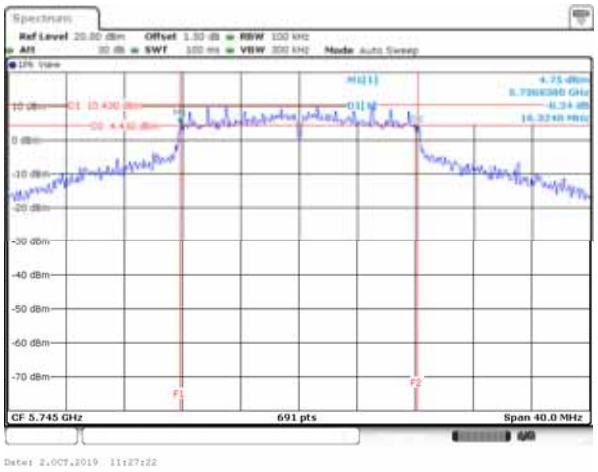
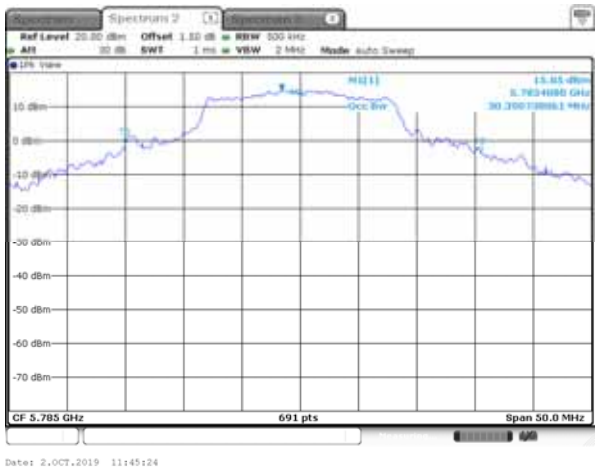
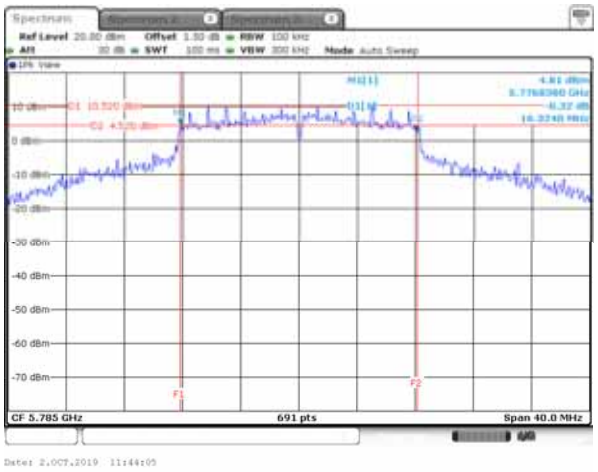
Low CH	High CH
	

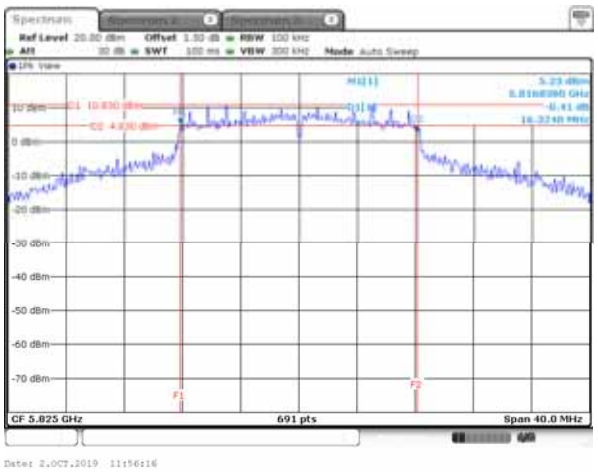
802.11ac VHT80 mode:

Middle CH	-
	-

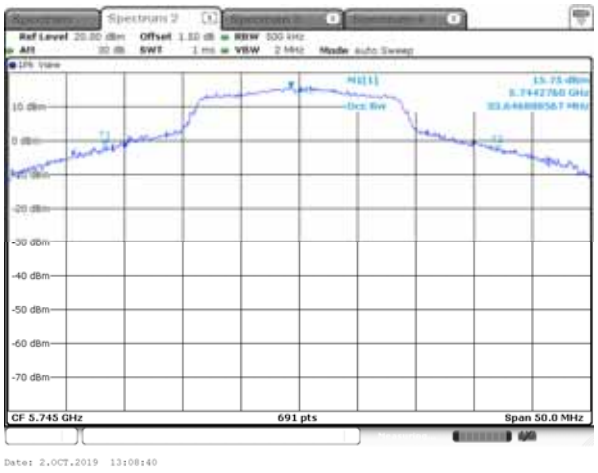
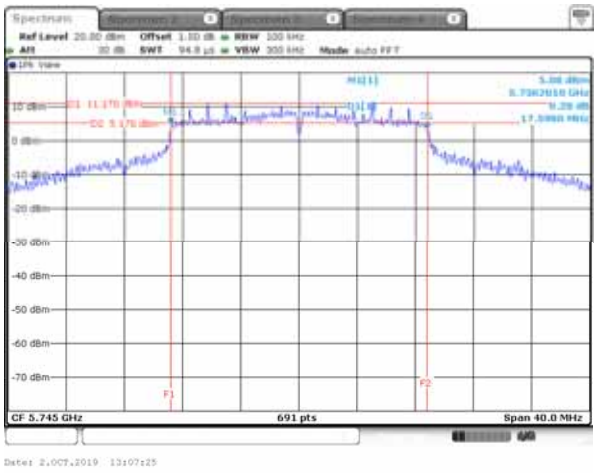
For UNII-3

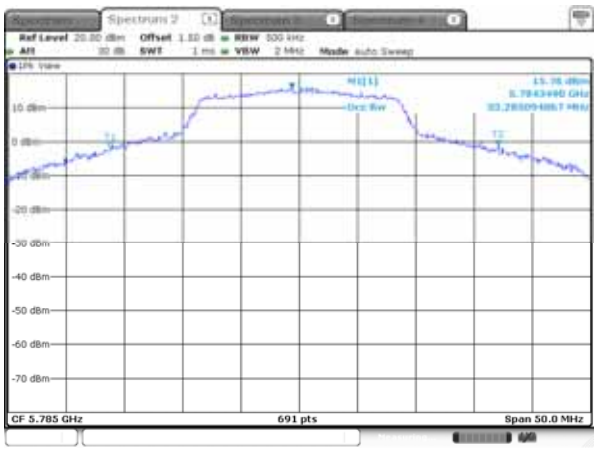
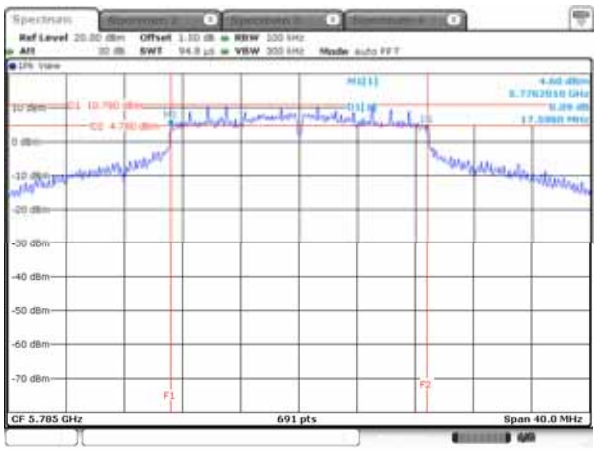
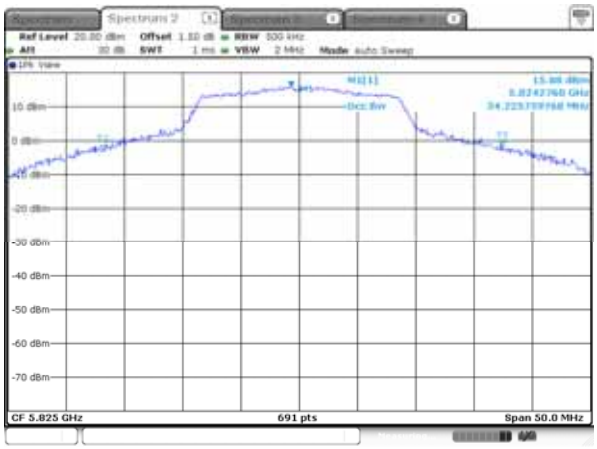
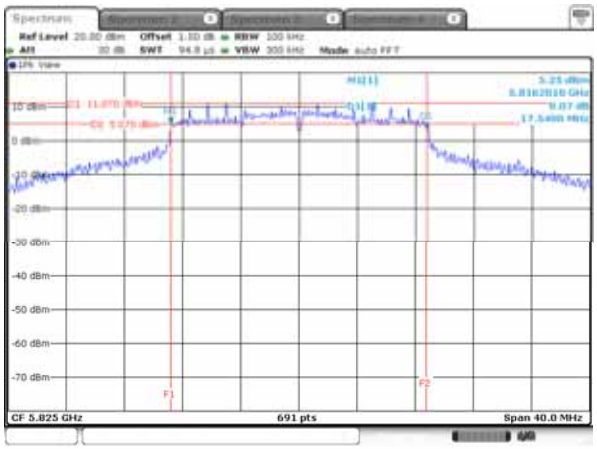
802.11a mode

Low CH-99%	Low CH-6dB BW
	
Middle CH-99%	**Middle CH-6dB BW**
	

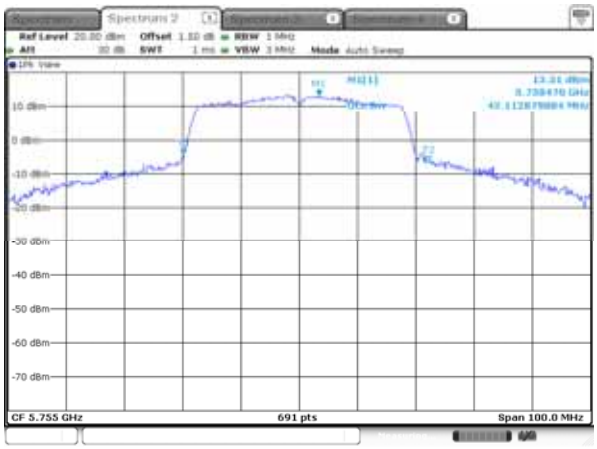
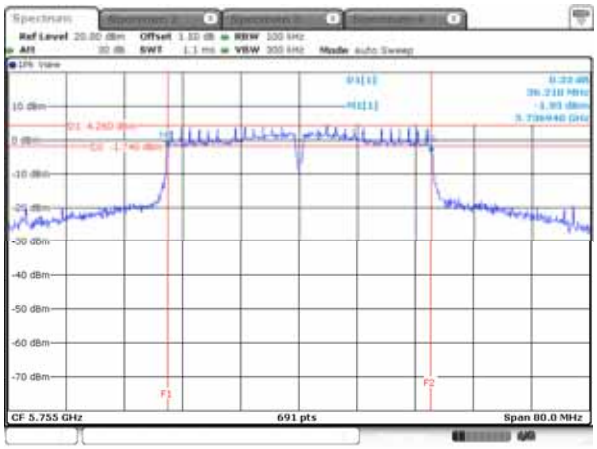
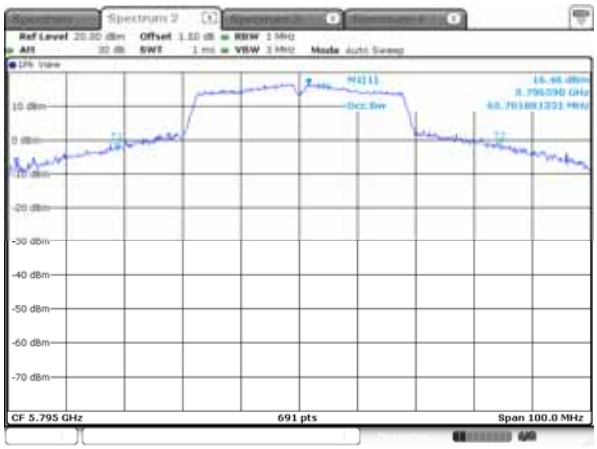
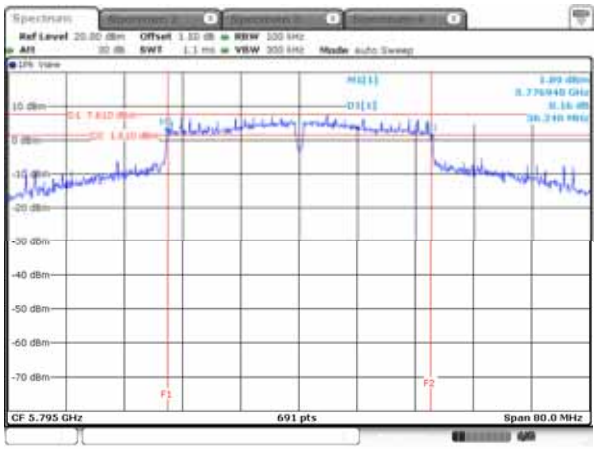
High CH-99%	High CH-6dB BW
	

802.11ac VHT20 mode:

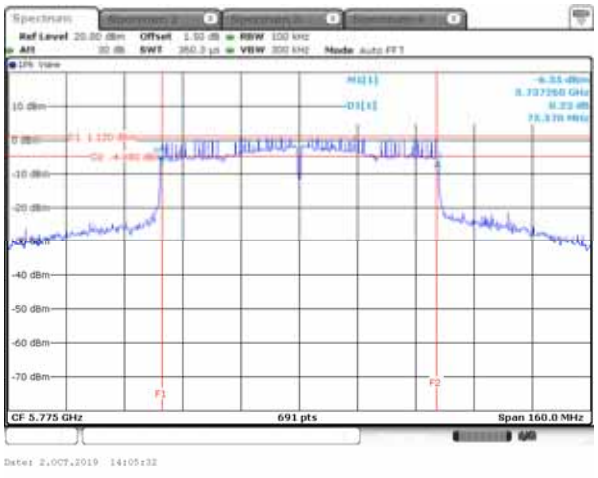
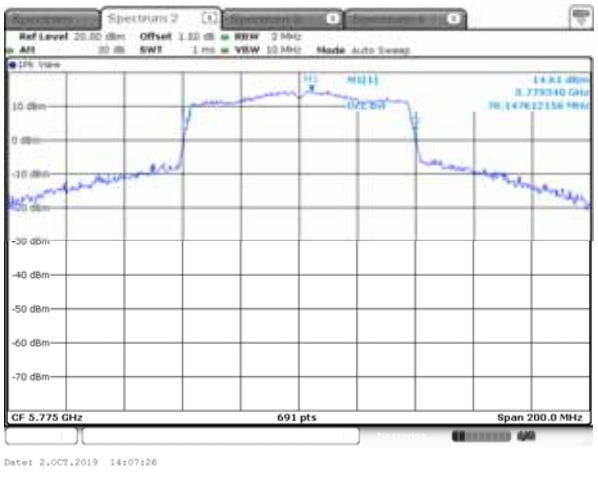
Low CH-99%	Low CH-6dB BW
	

Middle CH-99%	Middle CH-6dB BW
	
High CH-99%	**High CH-6dB BW**
	

802.11ac VHT40 mode:

Low CH-99%	Low CH-6dB BW
	
High CH-99%	**High CH-6dB BW**
	

802.11ac VHT80 mode:

High CH-99%	High CH-6dB BW
	

9 FCC §15.407(a)(1) – Maximum Output Power

9.1 Applicable Standard

According to FCC §15.407(a),

For 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.

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.

9.2 Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01,

The use Power Meter

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a Power sensor.

9.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSV40-N	100406	2019/09/11	2019/09/10
Cable	MTJ	MT40S	620620-MT40S-100	2018/12/28	2019/12/28

***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).*

9.4 Test Environmental Conditions

Temperature:	22.9°C	**Relative Humidity:**	57 %
ATM Pressure:	1015hPa	**Test Engineer:**	Ian Tu
Test Date:	2019-10-01	-	-

9.5 Test Data

Channel	Frequency (MHz)	Average Output Power (dBm)	Limit (dBm)
IEEE 802.11a mode			
36	**5180**	17.23	24.00
40	**5200**	19.01	24.00
48	**5240**	17.96	24.00
149	**5745**	20.08	30.00
157	**5785**	19.97	30.00
165	**5825**	20.15	30.00
IEEE 802.11n HT20 mode			
36	**5180**	16.71	24.00
40	**5200**	18.87	24.00
48	**5240**	17.75	24.00
149	**5745**	19.75	30.00
157	**5785**	19.77	30.00
165	**5825**	19.88	30.00
IEEE 802.11n HT40 mode			
38	**5190**	16.01	24.00
46	**5230**	18.24	24.00
151	**5755**	17.59	30.00
159	**5795**	19.81	30.00

Channel	Frequency (MHz)	Average Output Power (dBm)	Limit (dBm)
IEEE 802.11ac VHT20 mode			
36	**5180**	16.83	24.00
40	**5200**	18.95	24.00
48	**5240**	17.89	24.00
149	**5745**	19.86	30.00
157	**5785**	19.91	30.00
165	**5825**	19.96	30.00
IEEE 802.11ac VHT40 mode			
38	**5190**	16.08	24.00
46	**5230**	18.41	24.00
151	**5755**	17.80	30.00
159	**5795**	20.02	30.00
IEEE 802.11ac VHT80 mode			
42	**5210**	14.97	24.00
155	**5775**	14.44	30.00

10 FCC §15.407(a) – Power Spectral Density

10.1 Applicable Standard

According to FCC §15.407(a),

For 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.

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.

10.2 Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01 and ANSI 63.10: 2013 Sec 10.3.7.

For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in Section 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, "provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:

a) Set the RBW to 1 MHz.

b) Set the VBW to be at least 1 MHz (a VBW of 3 MHz is desirable).

c) Set the frequency span to examine the spectrum across a convenient frequency segment

(e.g., 600 MHz).

d) Select the power averaging (rms) detector.

e) Set the sweep time so that there is no more than a 1 ms integration period over each

measurement bin.

f) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

10.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2018/11/14	2019/11/13
Cable	WOKEN	SFL402	S02-160323-07	2019/02/11	2020/02/10

***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).*

10.4 Test Environmental Conditions

Temperature:	22.9°C	**Relative Humidity:**	57 %
ATM Pressure:	1015hPa	**Test Engineer:**	Ian Tu
Test Date:	2019-10-01	-	-

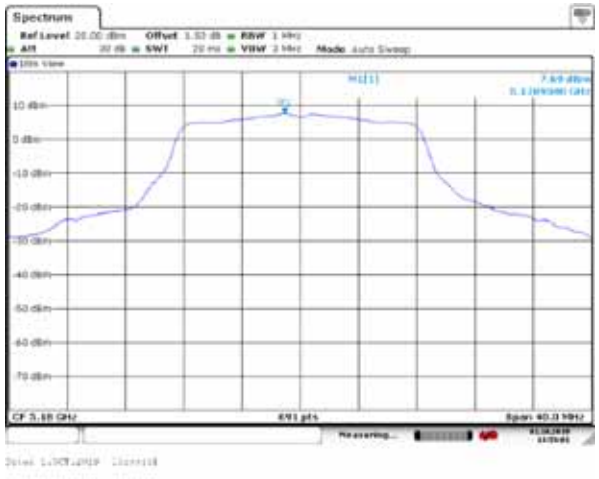
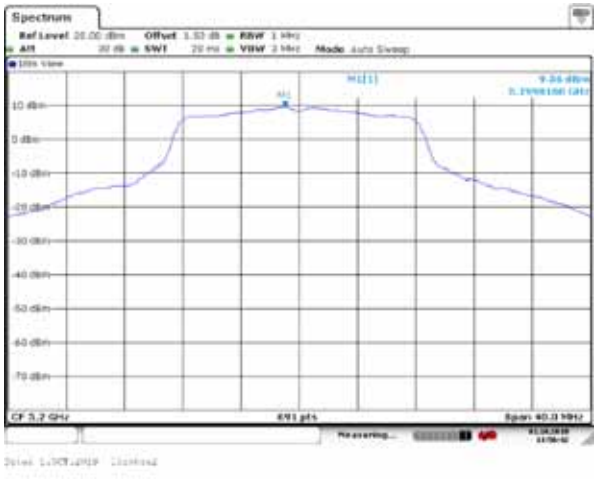
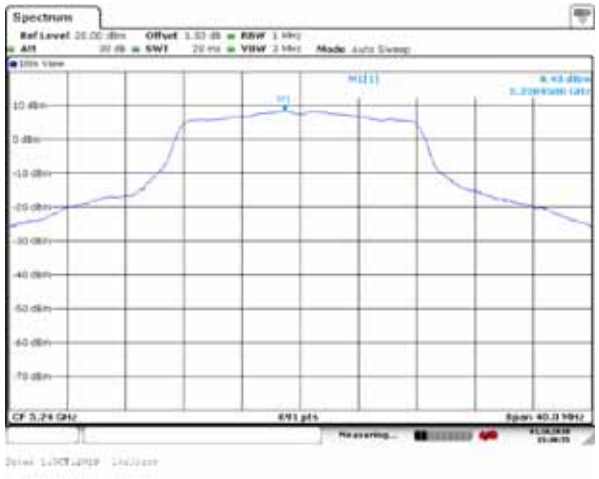
10.5 Test Data and Test Plot

UNII Band	Mode	Channel	Frequency (MHz)	Power Spectral Density (dBm/MHz)	Duty Factor (dB)	Total Power Spectral Density (dBm/MHz)	Limit (dBm/MHz)
UNII-1	802.11a	36	5180	7.69	0.12	7.81	11.00
		40	5200	9.56	0.12	9.68	11.00
		48	5240	8.43	0.12	8.55	11.00
UNII-1	802.11ac VHT20	36	5180	7.30	0.10	7.40	11.00
		40	5200	9.32	0.10	9.42	11.00
		48	5240	8.28	0.10	8.38	11.00
UNII-1	802.11ac VHT40	38	5190	3.46	0.46	3.92	11.00
		46	5230	5.67	0.46	6.13	11.00
UNII-1	802.11ac VHT80	42	5210	-0.79	0.87	0.08	11.00

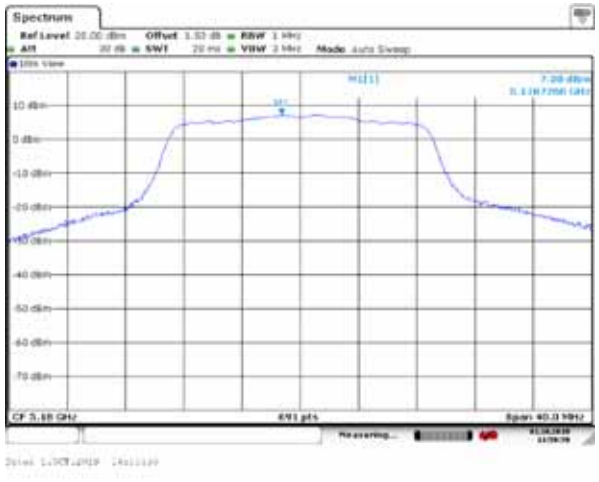
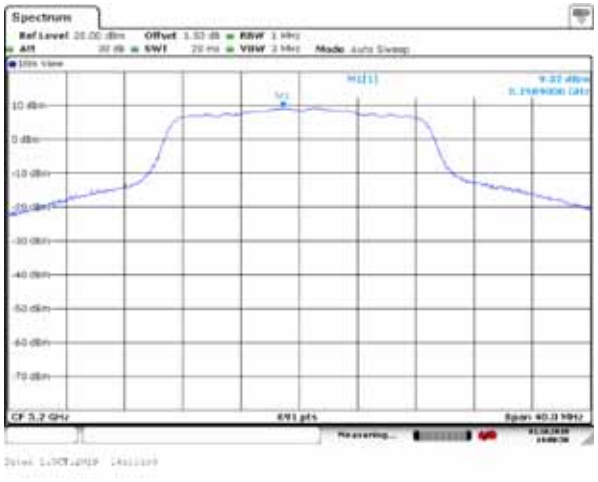
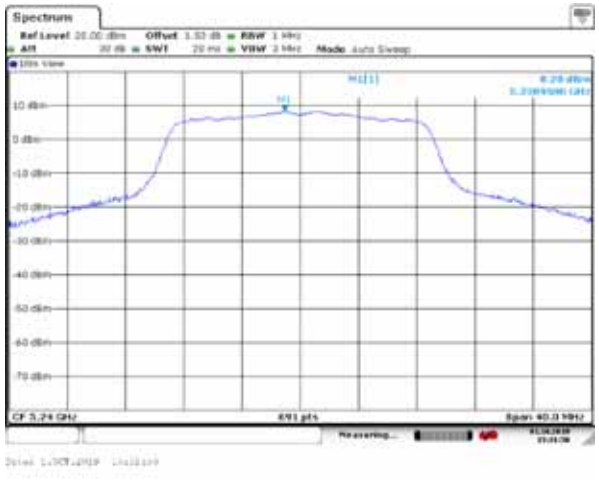
UNII Band	Mode	Channel	Frequency (MHz)	Power Spectral Density (dBm/500 kHz)	Limit (dBm/500 kHz)
UNII-3	802.11a	149	5745	15.07	30.00
		157	5785	15.15	30.00
		165	5825	15.75	30.00
UNII-3	802.11ac VHT20	149	5745	15.65	30.00
		157	5785	15.91	30.00
		165	5825	16.21	30.00
UNII-3	802.11ac VHT40	151	5755	9.51	30.00
		159	5795	12.80	30.00
UNII-3	802.11ac VHT80	155	5775	6.70	30.00

For UNII-1:

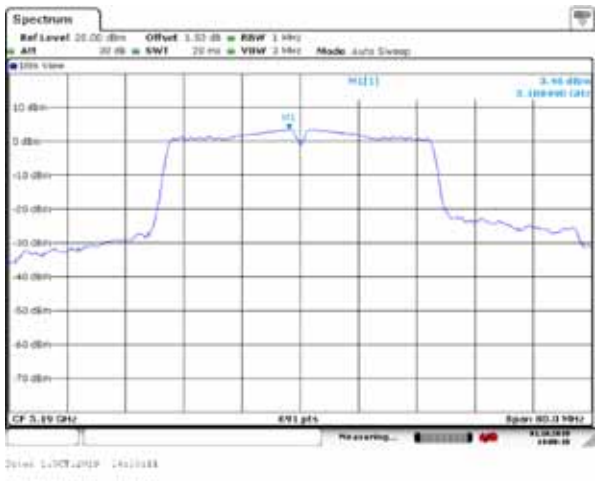
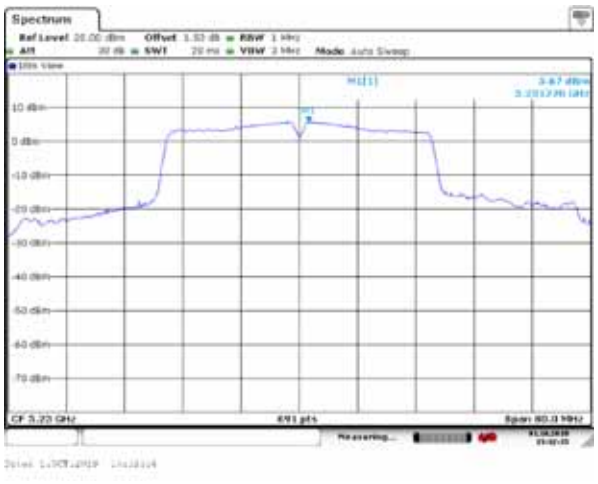
802.11a mode

Low CH	Middle CH
	
High CH	**-**
	-

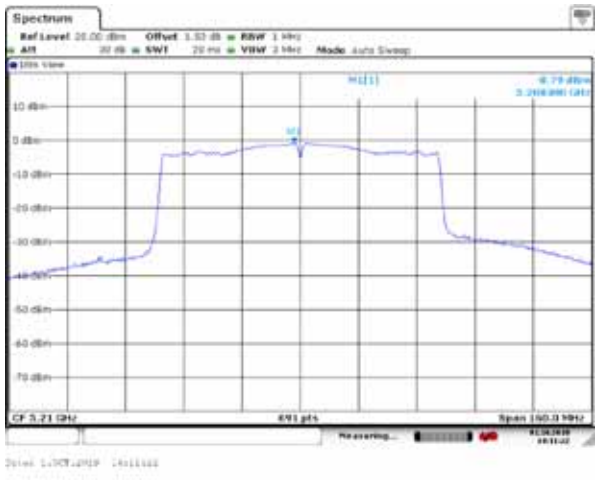
802.11ac VHT20 mode:

Low CH	Middle CH
	
High CH	**-**
	-

802.11ac VHT40 mode:

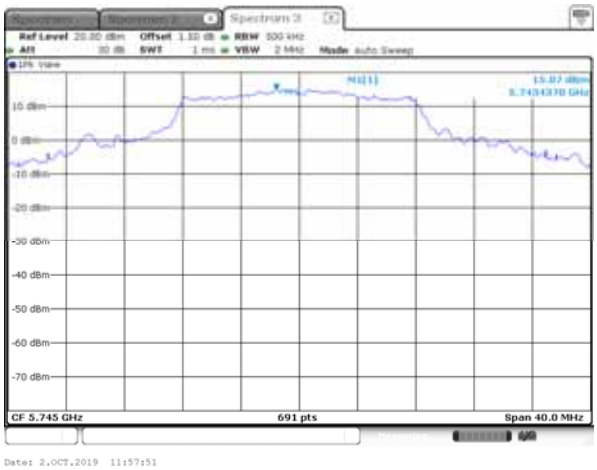
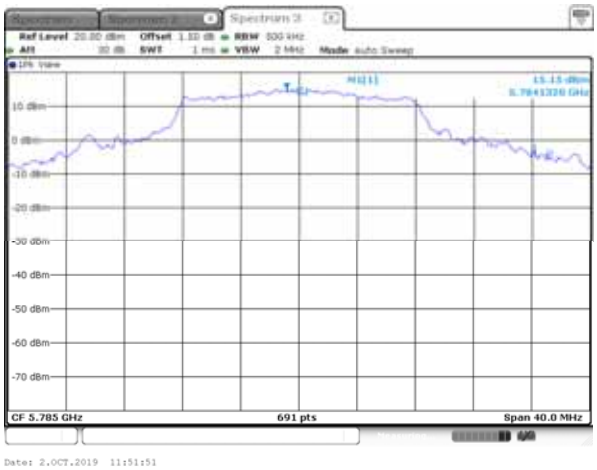
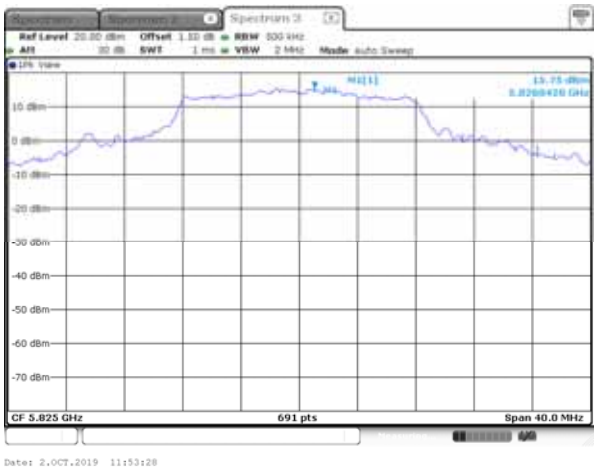
Low CH	High CH
	

802.11ac VHT80 mode

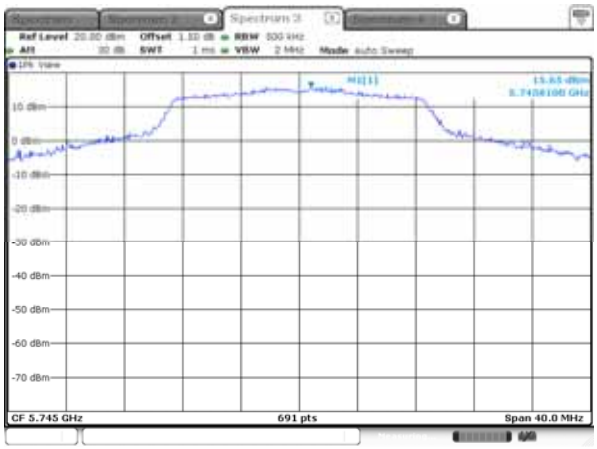
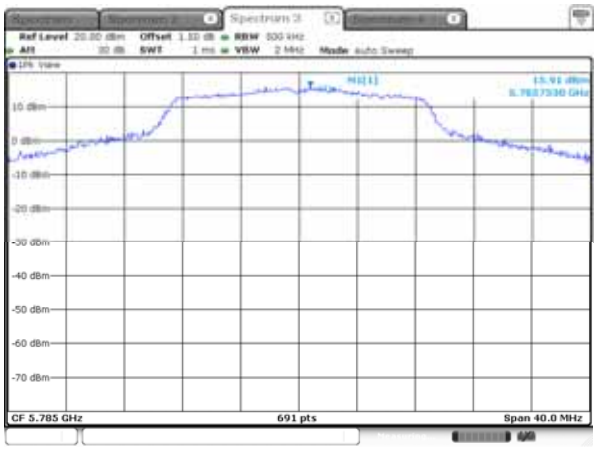
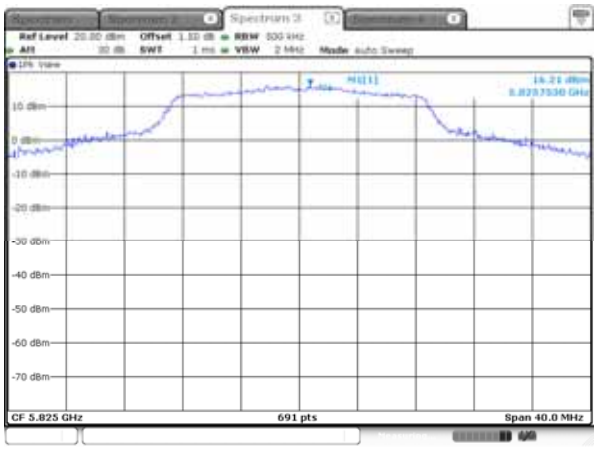
Middle	-
	-

For UNII-3:

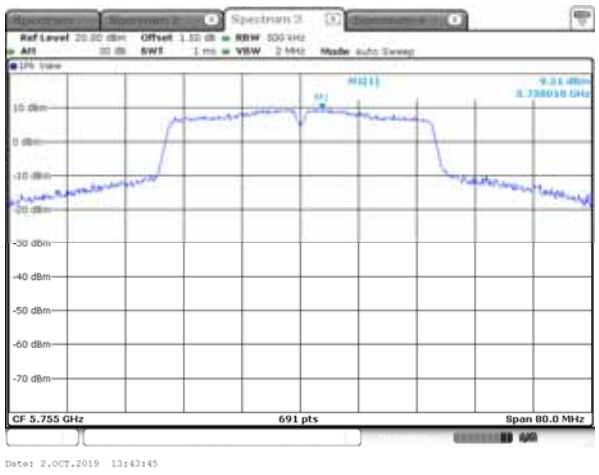
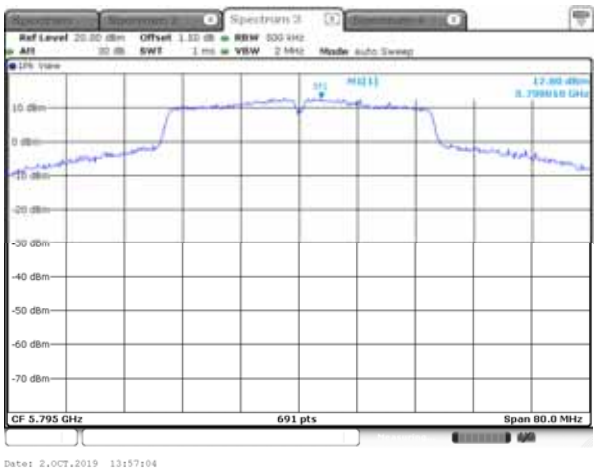
802.11a mode:

Low CH	Middle CH
	
High CH	**-**
	-

802.11ac VHT20 mode:

Low CH	Middle CH
	
High CH	**-**
	-

802.11ac VHT40 mode:

Low CH	High CH
	

802.11ac VHT80 mode

Middle CH	-
	-

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