FCC Part 15.407

TEST REPORT

For

AirTies Wireless Networks

Mithat Uluünlü Sokak No 23, Esentepe, Şişli, ISTANBULI, 34394 Turkey

FCC ID: Z3WAIR7430

Report Type	**Original Report**
Product Type:	**UHD Wireless Set-Top Box**
Report Number :	**RLK1810008-00C**
Report Date :	**2019/06/06**
Reviewed By:	**Jerry Chang**
Prepared By: **Bay Area Compliance Laboratories Corp.(Taiwan)** **70, Lane 169, Sec. 2, Datong Road, Xizhi Dist.,** **New Taipei City 22183, Taiwan, R.O.C.** **Tel: +886 (2)2647 6898 Fax: +886 (2) 2647 6895** **www.bacl.com.tw**	

***Note**: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Taiwan)*

Revision History

Revision	Report Number	Issue Date	Description	Author/Revised by
1.0	RLK1810008-00C	2019/06/06	Original Report	Himiko Chen

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1 General Information

1.1 Product Description for Equipment under Test (EUT)

Applicant	**AirTies Wireless Networks** Mithat Uluünlü Sokak No 23, Esentepe, Şişli, ISTANBULI, 34394 Turkey
Manufacturer	**XAVi Technologies Corp.** 3F-1, No. 27, Puding Rd., Hsinchu City 300, Taiwan
Brand(Trade) Name	**AirTies**
Product (Equipment)	**UHD Wireless Set-Top Box**
Model Name	**Air7430**
EUT Function	IEEE 802.11 an(HT20/HT40) + ac(VHT20/VHT40/VHT80) Note: A mode non-Beamforming and n/ac only Beamforming mode.
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: 21.08 dBm (0.1513 W) IEEE 802.11n HT20-BF Mode: 22.48 dBm (0.1770 W) IEEE 802.11n HT40-BF Mode: 22.60 dBm (0.1819 W) IEEE 802.11ac VHT20-BF Mode: 22.78 dBm (0.1896 W) IEEE 802.11ac VHT40-BF Mode: 22.87 dBm (0.1936 W) IEEE 802.11ac VHT80-BF Mode: 20.71 dBm (0.1177 W) **For UNII-3**: IEEE 802.11a Mode: 24.50 dBm (0.2818 W) IEEE 802.11n HT20-BF Mode: 26.17 dBm (0.4140 W) IEEE 802.11n HT40-BF Mode: 26.01 dBm (0.4335 W) IEEE 802.11ac VHT20-BF Mode: 26.36 dBm (0.4325 W) IEEE 802.11ac VHT40-BF Mode: 26.75 dBm (0.4731 W) IEEE 802.11ac VHT80-BF Mode: 25.48 dBm (0.3531 W)
Modulation Type	OFDM
Received Date	Oct. 26, 2018.
Date of Test	Dec 02, 2018 to Jun 04, 2019
Related Submittal(s)/Grant(s)	**FCC Part 15.247 DSS with FCC ID : Z3WAIR7430** **FCC Part 15.247 DTS with FCC ID : Z3WAIR7430**

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

1.2 Operation Condition of EUT

Power Operation (Voltage Range)	☒ AC 120V/60Hz ☒ Adapter *Brand Name: MOSO* *Model: MSA-C2000IS12.0-24Y-US* *I/P: 100-240Vac,0.7A* *O/P: 12Vdc,2A* ☐ By Power Core

1.3 Objective

The Objective of this Test Report was to document the compliance of the AirTies Wireless Networks Appliance (Model: Air7430) to the requirements of the following Standards:

-Part 2, Subpart J, Part 15 Subparts A and Part 15 Subparts 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	± 4.45 %
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. (Taiwan) to collect test data is located on

☒ 70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

☒ 68-3, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, 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.: 974454. Designation No.: TW3180

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-BF/ac VHT20 with BF			
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-BF/ac VHT40 with BF			
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 with BF			
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-BF mode	**4**	MCS 0-32	MCS 0
802.11n HT40-BF mode	**4**	MCS 0-32	MCS 0
802.11ac VHT20-BF mode	**4**	MCS 0-10 NSS4	MCS 0
802.11ac VHT40-BF mode	**4**	MCS 0-10 NSS4	MCS 0
802.11ac VHT80-BF mode	**4**	MCS 0-10 NSS4	MCS 0

Worst Case of Power Setting					
EUT Exercise Software			Command and iperf via Putty		
Configuration	**N_{TX}**	**UNII Band**	**Low CH**	**Mid CH**	**High CH**
802.11a mode	**1**	**UNII-1**	86	86	86
		UNII-3	98	100	98
802.11n HT20-BF mode	**4**	**UNII-1**	66	66	66
		UNII-3	80	80	80
802.11n HT40-BF mode	**4**	**UNII-1**	60	-	66
		UNII-3	80	-	80
802.11ac VHT20-BF mode	**4**	**UNII-1**	66	66	66
		UNII-3	80	80	80
802.11ac VHT40-BF mode	**4**	**UNII-1**	60	-	66
		UNII-3	80	-	80
802.11ac VHT80-BF mode	**4**	**UNII-1**	-	60	-
		UNII-3	-	76	-

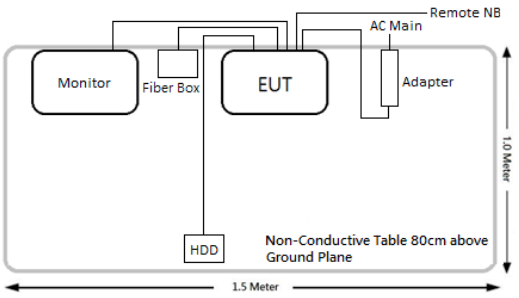
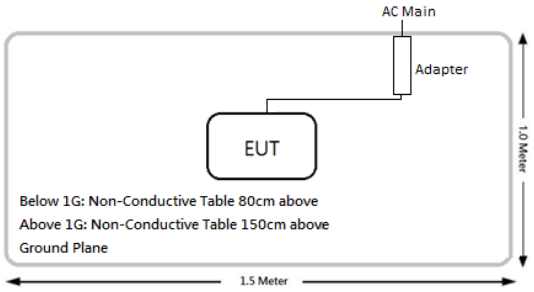
- The worst-case data rates are determined to be as follows for each mode based upon investigation by measuring the Peak power and PSD across all date rates bandwidths, and modulations. Radiation and conducted test had been pre-test, and the Antenna Chain 0 was worst chain for 802.11a mode, and recording the worst data and plot in the report. Radiated below 1G were tested worst output power mode.
- This Device a mode only Non-Beamforming mode and n/ac only Beamforming 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.
- In the Bandwidth test, record all test data, and put the worst chain plot in the report.

2.2 Support Equipment and External Cable List

No.	Description	Manufacturer	Model Number	BSMI	FCC ID / DoC
A	Monitor	DELL	PP27LA	R33038	DoC
B	HDD	WD	WESNWDBUZG0014BBK	D33015	DoC
C	Fiber BOX	SPDIF	2RCA	NA	NA
D	Notebook PC	DELL	Latitude E5470	R33002	DoC

No.	Cable Description	Shielding Type	Length (m)	From	To
1	HDMI Cable	Shielded	1.8	EUT	Monitor
2	USB Cable	Shielded	1	EUT	HDD
3	Fiber Cable	Non- Shielded	0.6	EUT	Fiber BOX
4	LAN Cable	Non- Shielded	10	EUT	NB

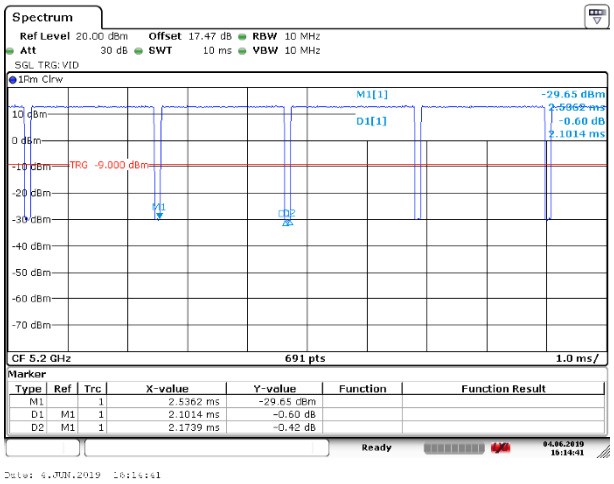
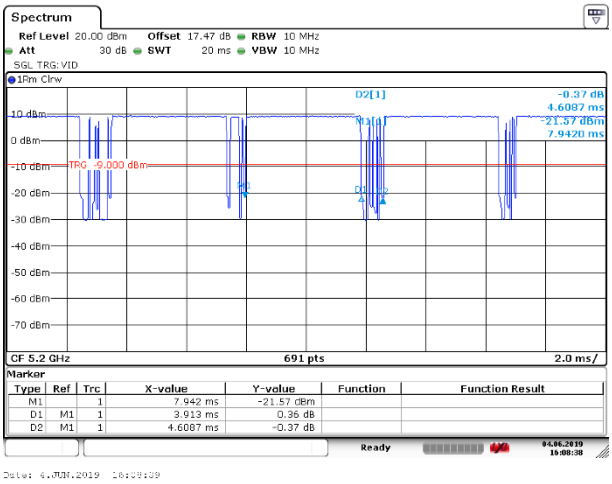
2.3 Block Diagram of Test Setup

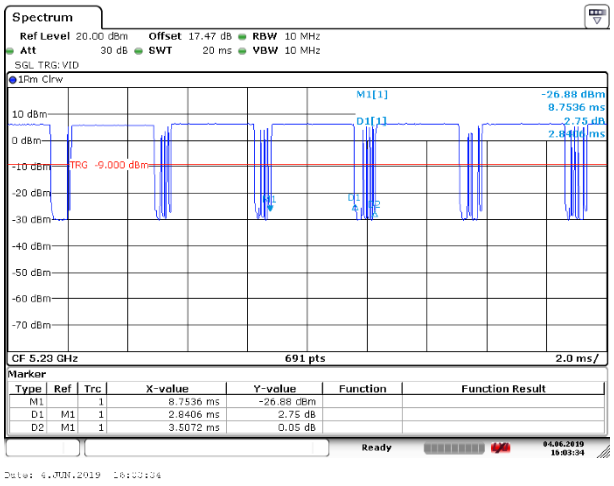
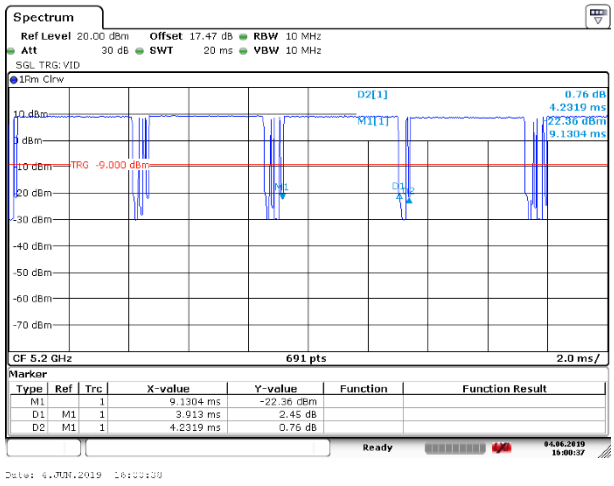
Conduction	Radiation
	

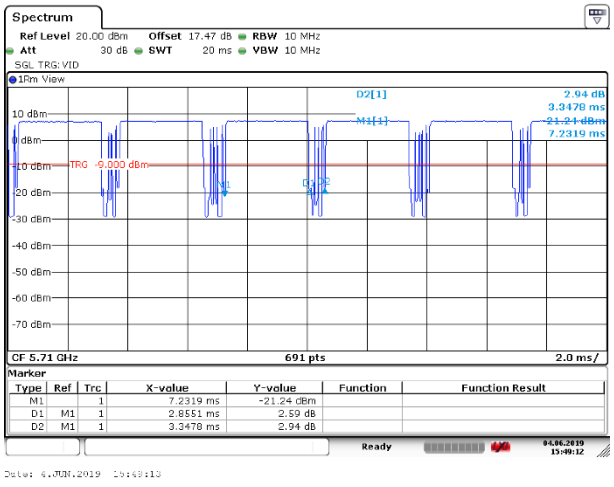
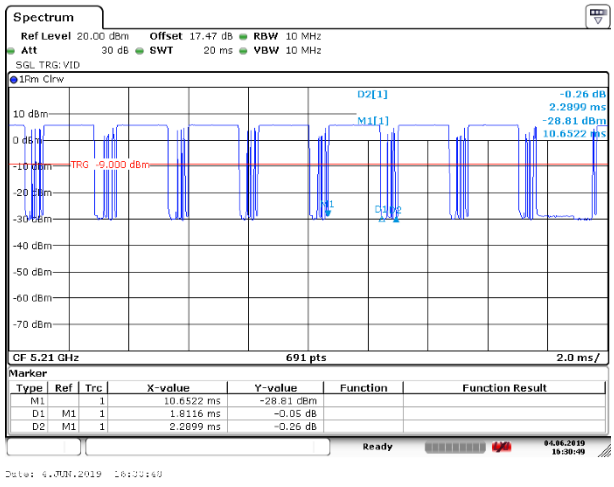
2.4 Duty Cycle

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	2.10	2.17	96.77	0.14
802.11n HT20-BF mode	3.91	4.60	85.00	0.71
802.11n HT40-BF mode	2.84	3.50	81.14	0.91
802.11ac VHT20-BF mode	3.91	4.23	92.43	0.34
802.11ac VHT40-BF mode	2.85	3.34	85.33	0.69
802.11ac VHT80-BF mode	1.81	2.28	79.39	1.00

802.11a mode	802.11n HT20-BF mode
	

802.11n HT40-BF mode	802.11ac VHT20-BF mode
	

802.11ac VHT40-BF mode	802.11ac VHT80-BF 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	3.60	2.291	27.00	501.187	25	0.1463	1
BLE	2402-2480	-4.30	0.372	8.00	6.310	25	0.0003	1
BR+EDR	2402-2480	-4.30	0.372	11.00	12.589	25	0.0006	1
Wi-Fi 5G UNII-1	5150-5250	9.44	8.790	23.00	199.526	25	0.2234	1
Wi-Fi 5G UNII-2a	5250-5350	9.44	8.790	21.00	158.489	25	0.1409	1
Wi-Fi 5G UNII-2c	5470-5725	9.78	9.506	19.00	79.433	25	0.0961	1
Wi-Fi 5G UNII-3	5745-5850	9.03	7.999	27.00	501.187	25	0.5107	1

The Wi-Fi 2.4G, BT and Wi-Fi 5G can transmit simultaneously:

$= S_{2.4G}/S_{limit\text{-}2.4G} + S_{BR+EDR}/S_{limit\text{-}BR+EDR} + S_{5G\ UNII\text{-}3}/S_{limit\text{-}5G\ UNII\text{-}3}$

$= 0.1463/1 + 0.0006/1 + 0.5107/1 = 0.6576 < 1.0$

Result: MPE evaluation meet 25 cm 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 (Per Channel)					Result
			5180 MHz	5260 MHz	5500 MHz	5660 MHz	5750 MHz	
AirTies	Wi-Fi Ant-1	PCB Antenna	3.30	3.42	2.86	3.76	3.01	Compliance
AirTies	Wi-Fi Ant-2	PCB Antenna	3.30	3.42	2.86	3.76	3.01	Compliance
AirTies	Wi-Fi Ant-3	PCB Antenna	3.30	3.42	2.86	3.76	3.01	Compliance
AirTies	Wi-Fi Ant-4	PCB Antenna	3.30	3.42	2.86	3.76	3.01	Compliance

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

Per KDB 662911 D01 Multiple Transmitter Output v02r01, for 802.11n BF mode and 802.11ac BF mode:

1. *Power Directional Gain: = Antenna + 10log(N_{ANT})*

   = 10log(((10^(Ant-1)/10) + (10^(Ant-2)/10) + (10^(Ant-3)/10) + 10^(Ant-4)/10))/4)) + 10log(N_{ANT})

2. *Power Density Directional Gain = Antenna + Array Gain*

   = 10log(((10^(Ant-1)/10) + (10^(Ant-2)/10) + (10^(Ant-3)/10) + 10^(Ant-4)/10))/4)) + 10log(N_{TX}/N_{SS})

For 802.11 n mode / ac mode with BF (Per Channel) calculated Result please refer as below table:

Frequency (MHz)	Gain (dBi)	10log(N_{ANT})/ Array Gain (dBi)	Power Directional Gain (dBi)	Power Density Directional Gain (dBi)
5180	3.30	6.02	9.32	9.32
5190	3.30	6.02	9.32	9.32
5200	3.30	6.02	9.32	9.32
5210	3.30	6.02	9.32	9.32
5230	3.42	6.02	9.44	9.44
5240	3.42	6.02	9.44	9.44
5260	3.42	6.02	9.44	9.44
5270	3.42	6.02	9.44	9.44
5290	3.42	6.02	9.44	9.44
5300	3.42	6.02	9.44	9.44
5310	3.42	6.02	9.44	9.44
5500	2.86	6.02	8.88	8.88
5510	2.86	6.02	8.88	8.88
5530	2.86	6.02	8.88	8.88
5550	2.86	6.02	8.88	8.88
5580	2.86	6.02	8.88	8.88
5610	3.76	6.02	9.78	9.78
5670	3.76	6.02	9.78	9.78
5700	3.76	6.02	9.78	9.78
5745	3.01	6.02	9.03	9.03
5755	3.01	6.02	9.03	9.03
5775	3.01	6.02	9.03	9.03
5785	3.01	6.02	9.03	9.03
5795	3.01	6.02	9.03	9.03
5825	3.01	6.02	9.03	9.03

6 FCC §15.207 - AC Line Conducted Emissions

6.1 Applicable Standard

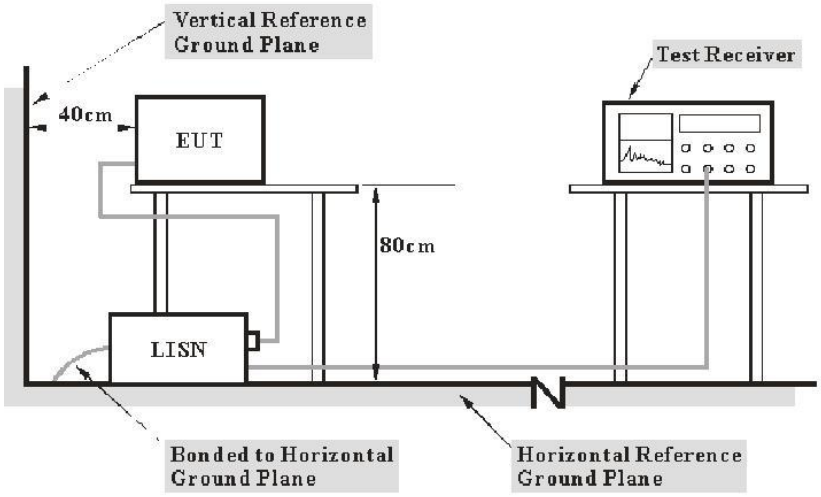
According to FCC §15.207 and §15.407(b)(6),

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	101248	2018/06/27	2019/06/26
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2018/10/23	2019/10/22
Pulse Limiter	Rohde & Schwarz	ESH3Z2	TXZEM104	2018/08/03	2019/08/02
RF Cable	EMEC	EM-CB5D	001	2018/07/02	2019/07/01
Software	AUDIX	e3	V9.150826k	N.C.R	N.C.R

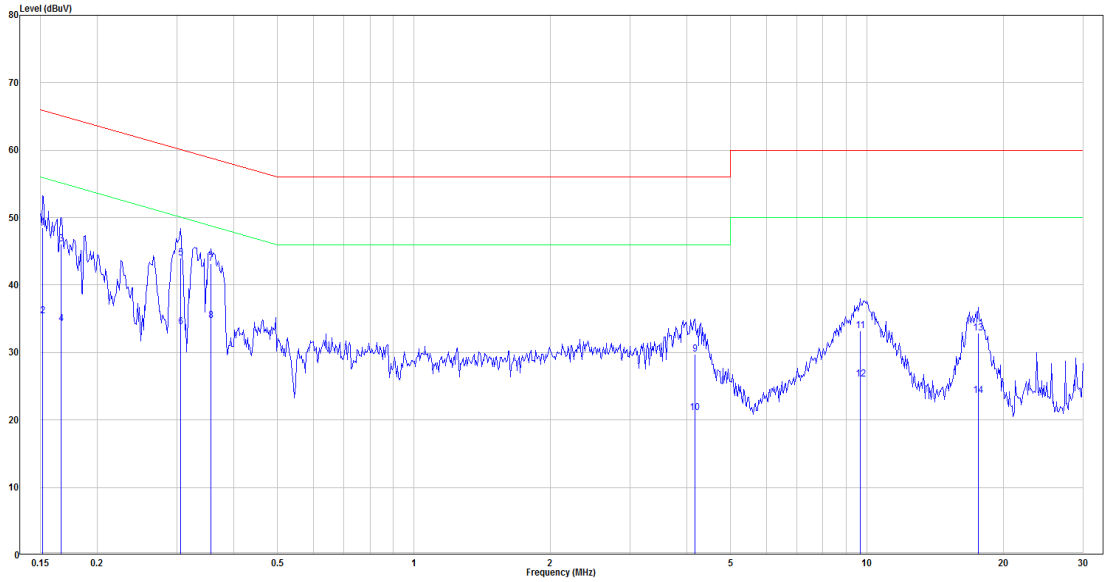
***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units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

6.4 Test Environmental Conditions

Temperature:	25 ℃	**Relative Humidity:**	45 %
ATM Pressure:	1010 hPa	**Test Engineer:**	Ray Huang
Test Date:	2018-12-07		

6.5 Test Data and Test Plot

Mode: AC 120 V/60 Hz, Wi-Fi 5G mode, Line



No.	Frequency	Reading	Correct	Result	Limit	Over limit	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.152	29.11	19.45	48.56	65.92	-17.36	QP
2	0.152	15.92	19.45	35.37	55.92	-20.55	Average
3	0.167	26.57	19.45	46.02	65.13	-19.11	QP
4	0.167	14.85	19.45	34.30	55.13	-20.83	Average
5	0.306	24.54	19.47	44.01	60.08	-16.07	QP
6	0.306	14.35	19.47	33.82	50.08	-16.26	Average
7	0.357	23.73	19.47	43.20	58.80	-15.60	QP
8	0.357	15.25	19.47	34.72	48.80	-14.08	Average
9	4.168	10.12	19.59	29.71	56.00	-26.29	QP
10	4.168	1.49	19.59	21.08	46.00	-24.92	Average
11	9.677	13.55	19.71	33.26	60.00	-26.74	QP
12	9.677	6.30	19.71	26.01	50.00	-23.99	Average
13	17.600	13.08	19.78	32.86	60.00	-27.14	QP
14	17.600	3.89	19.78	23.67	50.00	-26.33	Average

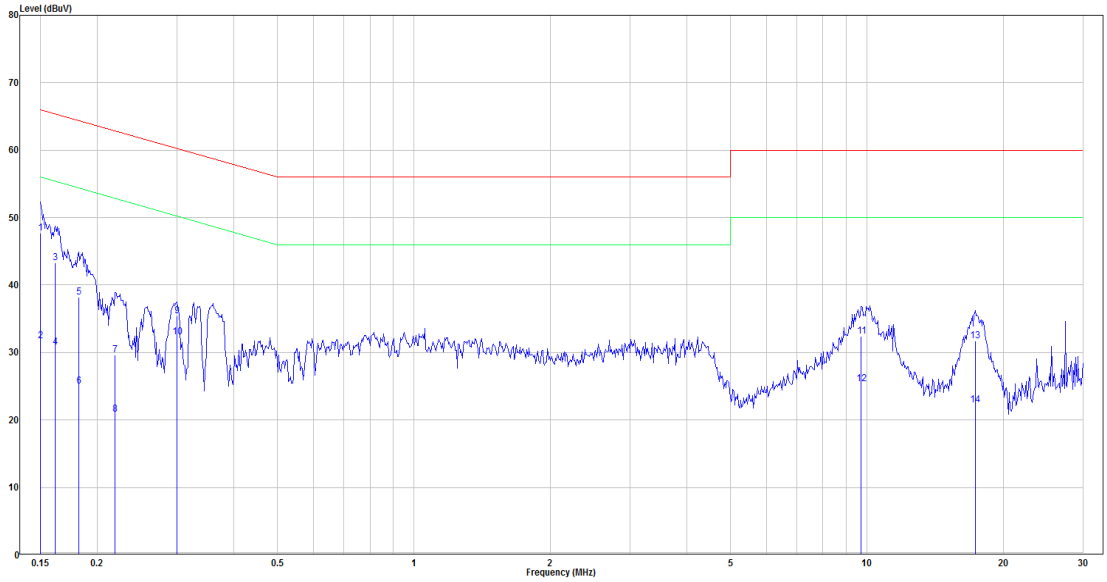
Note:

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, Wi-Fi 5G mode, Line



No.	Frequency	Reading	Correct	Result	Limit	Over limit	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.150	28.30	19.44	47.74	66.00	-18.26	QP
2	0.150	12.28	19.44	31.72	56.00	-24.28	Average
3	0.162	23.89	19.45	43.34	65.38	-22.04	QP
4	0.162	11.35	19.45	30.80	55.38	-24.58	Average
5	0.182	18.76	19.45	38.21	64.39	-26.18	QP
6	0.182	5.50	19.45	24.95	54.39	-29.44	Average
7	0.219	10.22	19.46	29.68	62.85	-33.17	QP
8	0.219	1.43	19.46	20.89	52.85	-31.96	Average
9	0.300	16.02	19.46	35.48	60.25	-24.77	QP
10	0.300	12.88	19.46	32.34	50.25	-17.91	Average
11	9.725	12.66	19.71	32.37	60.00	-27.63	QP
12	9.725	5.63	19.71	25.34	50.00	-24.66	Average
13	17.338	11.87	19.80	31.67	60.00	-28.33	QP
14	17.338	2.46	19.80	22.26	50.00	-27.74	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:

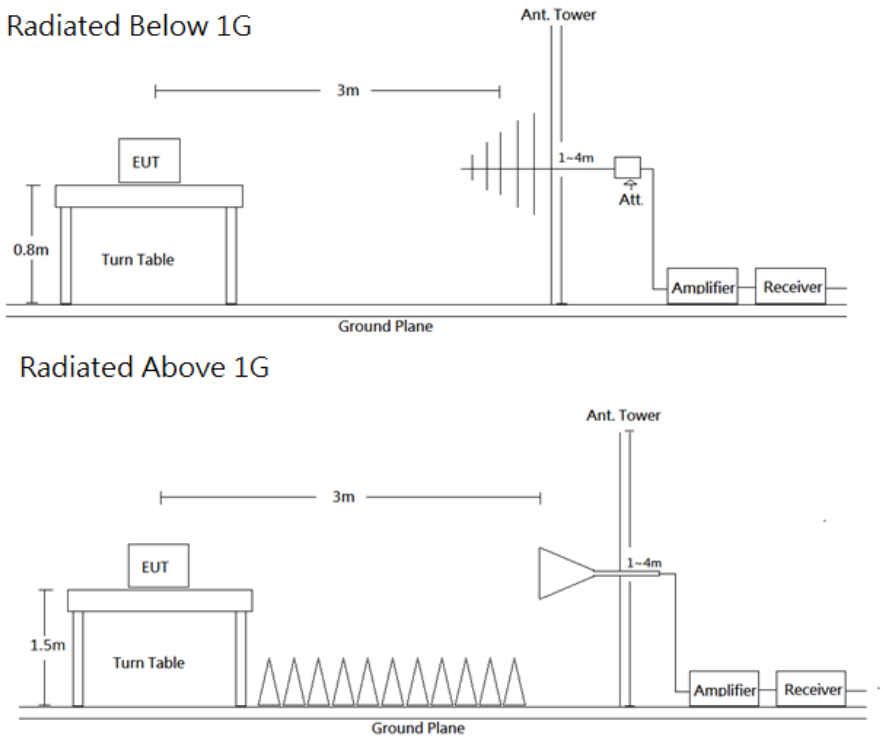
MHz	MHz	MHz	GHz
0.090-0.110	13.36-13.41	399.9-410	4.5-5.15
0.495-0.505	16.42-16.423	608-614	5.35-5.46
2.1735-2.1905	16.69475-16.69525	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	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	ETS-Lindgren	6502	00035796	2018/03/13	2019/03/12
Active Loop Antenna	ETS-Lindgren	6502	00035796	2019/03/12	2020/03/11
Bilog Antenna with 6 dB Attenuator	SUNOL SCIENCES & MINI-CIRCUITS	JB6/UNAT-6+	A050115/15542_01	2017/12/20	2018/12/19
Bilog Antenna with 6 dB Attenuator	SUNOL SCIENCES & MINI-CIRCUITS	JB6/UNAT-6+	A050115/15542_01	2018/12/11	2019/12/10
Horn Antenna	EMCO	3115	9311-4158	2018/04/20	2019/04/19
Horn Antenna	EMCO	3115	9311-4158	2019/04/17	2020/04/16
Horn Antenna	ETS-Lindgren	3116	62638	2018/08/29	2019/08/28
Preamplifier	Sonoma	310N	130602	2018/07/04	2019/07/03
Preamplifier	EM Electronics Corp.	EM01G18G	060657	2017/12/14	2018/12/13
Preamplifier	EM Electronics Corp.	EM01G18G	060657	2018/12/07	2019/12/06
Microware Preamplifier	EM Electronics Corporation	EM18G40G	060656	2018/01/15	2019/01/14
Microware Preamplifier	EM Electronics Corporation	EM18G40G	060656	2019/01/11	2020/01/10
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2018/10/23	2019/10/22
Spectrum Analyzer	Spectrum Analyzer	FSV40	101435	2018/02/12	2019/02/11
Spectrum Analyzer	Spectrum Analyzer	FSV40	101435	2019/02/11	2020/02/10
Micro flex Cable	UTIFLEX	FSCM 64639 / (2M)	93D0127	2018/07/31	2019/07/30
Micro flex Cable	UTIFLEX	UFA210A-1-3149-300300	MFR64639 226389-002	2018/11/06	2019/11/05
Micro flex Cable	ROSNOL	K1K50-UP0264-K1K50-450CM	160309-1	2018/03/05	2019/03/04
Micro flex Cable	ROSNOL	K1K50-UP0264-K1K50-450CM	160309-1	2019/03/04	2020/03/03
Micro flex Cable	ROSNOL	K1K50-UP0264-K1K50-80CM	160309-2	2018/01/17	2019/01/16
Micro flex Cable	ROSNOL	K1K50-UP0264-K1K50-80CM	160309-2	2019/01/16	2020/01/15
Turn Table	Champro	TT-2000	060772-T	N.C.R	N.C.R
Antenna Tower	Champro	AM-BS-4500-B	060772-A	N.C.R	N.C.R
Controller	Champro	EM1000	60772	N.C.R	N.C.R
Software	AUDIX	e3	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:	20-25℃	Relative Humidity:	45-55 %
ATM Pressure:	1014hPa	Test Engineer:	Leo Chang
Test Date:	2018-12-07~2019-04-30	-	-

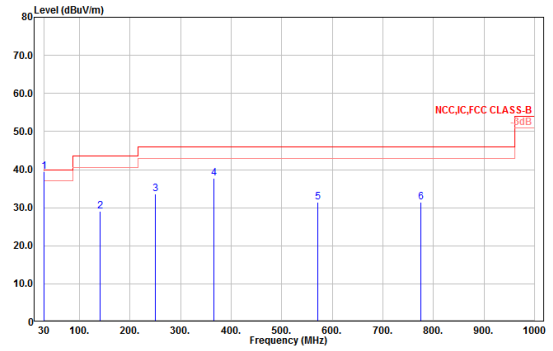
7.5 Test Data and Test Plot

Wi-Fi 5G Mode:

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

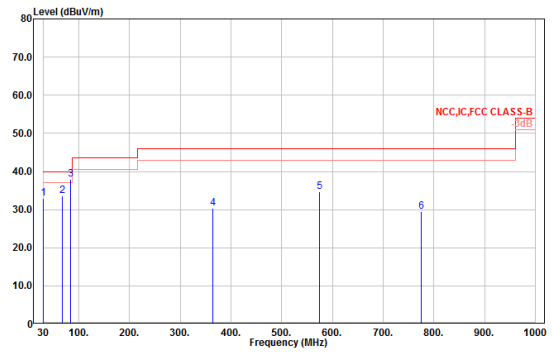
Below 1G (30 MHz-1 GHz) test the output power worst mode

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	39.47	40.00	-0.53	45.35	-5.88	QP	horizontal
2	140.580	29.07	43.50	-14.43	46.93	-17.86	Peak	horizontal
3	250.190	33.54	46.00	-12.46	53.29	-19.75	Peak	horizontal
4	365.620	37.73	46.00	-8.27	54.49	-16.76	Peak	horizontal
5	571.260	31.53	46.00	-14.47	44.63	-13.10	Peak	horizontal
6	774.960	31.53	46.00	-14.47	41.76	-10.23	Peak	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	32.92	40.00	-7.08	38.80	-5.88	Peak	vertical
2	67.830	33.56	40.00	-6.44	55.70	-22.14	Peak	vertical
3 !	84.320	37.84	40.00	-2.16	60.65	-22.81	QP	vertical
4	364.650	30.35	46.00	-15.65	47.14	-16.79	Peak	vertical
5	574.170	34.69	46.00	-11.31	47.74	-13.05	Peak	vertical
6	774.960	29.51	46.00	-16.49	39.74	-10.23	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	
5149.800	53.00	54.00	-1.00	54.19	-1.19	Average
5149.800	73.07	74.00	-0.93	74.26	-1.19	Peak
5178.300	104.20			105.44	-1.24	Average
5178.300	114.58			115.82	-1.24	Peak
10360.000	48.64	68.20	-19.56	42.36	6.28	Peak
15540.000	43.75	54.00	-10.25	32.87	10.88	Average
15540.000	56.78	74.00	-17.22	45.90	10.88	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5149.400	46.32	54.00	-7.68	47.51	-1.19	Average
5149.400	61.28	74.00	-12.72	62.47	-1.19	Peak
5186.600	90.60			91.84	-1.24	Average
5186.600	101.17			102.41	-1.24	Peak
10360.000	48.14	68.20	-20.06	41.86	6.28	Peak
15540.000	43.42	54.00	-10.58	32.54	10.88	Average
15540.000	57.34	74.00	-16.66	46.46	10.88	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5148.300	47.71	54.00	-6.29	48.90	-1.19	Average
5148.300	61.86	74.00	-12.14	63.05	-1.19	Peak
5198.400	104.48			105.72	-1.24	Average
5198.400	114.64			115.88	-1.24	Peak
5357.700	48.63	54.00	-5.37	50.20	-1.57	Average
5357.700	61.78	74.00	-12.22	63.35	-1.57	Peak
10399.000	49.50	68.20	-18.70	43.10	6.40	Peak
15600.000	44.47	54.00	-9.53	33.63	10.84	Average
15600.000	57.33	74.00	-16.67	46.49	10.84	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5134.500	45.21	54.00	-8.79	46.37	-1.16	Average
5134.500	58.62	74.00	-15.38	59.78	-1.16	Peak
5206.800	90.61			91.85	-1.24	Average
5206.800	101.01			102.25	-1.24	Peak
5359.500	44.75	54.00	-9.25	46.32	-1.57	Average
5359.500	58.41	74.00	-15.59	59.98	-1.57	Peak
10399.000	48.05	68.20	-20.15	41.65	6.40	Peak
15600.000	44.38	54.00	-9.62	33.54	10.84	Average
15600.000	57.28	74.00	-16.72	46.44	10.84	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	47.41	54.00	-6.59	48.60	-1.19	Average
5149.500	60.84	74.00	-13.16	62.03	-1.19	Peak
5238.300	103.99			105.23	-1.24	Average
5238.300	114.65			115.89	-1.24	Peak
5397.000	46.61	54.00	-7.39	48.30	-1.69	Average
5397.000	60.55	74.00	-13.45	62.24	-1.69	Peak
10480.000	48.42	68.20	-19.78	41.85	6.57	Peak
15720.000	45.51	54.00	-8.49	34.82	10.69	Average
15720.000	58.79	74.00	-15.21	48.10	10.69	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5139.600	45.26	54.00	-8.74	46.43	-1.17	Average
5139.600	58.91	74.00	-15.09	60.08	-1.17	Peak
5238.300	91.62			92.86	-1.24	Average
5238.300	102.18			103.42	-1.24	Peak
5382.900	44.83	54.00	-9.17	46.48	-1.65	Average
5382.900	58.17	74.00	-15.83	59.82	-1.65	Peak
10480.000	50.73	68.20	-17.47	44.16	6.57	Peak
15720.000	45.23	54.00	-8.77	34.54	10.69	Average
15720.000	58.77	74.00	-15.23	48.08	10.69	Peak

802.11ac VHT20-BF mode:

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5149.300	53.85	54.00	-0.15	53.21	0.64	Average
5149.300	73.42	74.00	-0.58	72.78	0.64	Peak
5176.600	106.56			105.99	0.57	Average
5176.600	116.98			116.41	0.57	Peak
10360.000	54.94	68.20	-13.26	45.64	9.30	Peak
15540.000	47.69	54.00	-6.31	33.42	14.27	Average
15540.000	62.26	74.00	-11.74	47.99	14.27	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5123.800	49.80	54.00	-4.20	49.10	0.70	Average
5123.800	63.56	74.00	-10.44	62.86	0.70	Peak
5186.050	100.89			100.33	0.56	Average
5186.050	111.82			111.26	0.56	Peak
10360.000	55.14	68.20	-13.06	45.84	9.30	Peak
15540.000	48.06	54.00	-5.94	33.79	14.27	Average
15540.000	61.95	74.00	-12.05	47.68	14.27	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5144.000	52.02	54.00	-1.98	51.37	0.65	Average
5144.000	64.64	74.00	-9.36	63.99	0.65	Peak
5206.400	108.79			108.22	0.57	Average
5206.400	119.01			118.44	0.57	Peak
5365.200	51.45	54.00	-2.55	51.21	0.24	Average
5365.200	63.86	74.00	-10.14	63.62	0.24	Peak
10400.000	55.16	68.20	-13.04	45.68	9.48	Peak
15600.000	48.66	54.00	-5.34	34.43	14.23	Average
15600.000	62.71	74.00	-11.29	48.48	14.23	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5081.600	50.45	54.00	-3.55	49.65	0.80	Average
5081.600	63.64	74.00	-10.36	62.84	0.80	Peak
5203.200	102.68			102.11	0.57	Average
5203.200	113.30			112.73	0.57	Peak
5448.000	49.85	54.00	-4.15	49.74	0.11	Average
5448.000	63.03	74.00	-10.97	62.92	0.11	Peak
10400.000	52.79	68.20	-15.41	43.31	9.48	Peak
15600.000	48.98	54.00	-5.02	34.75	14.23	Average
15600.000	63.26	74.00	-10.74	49.03	14.23	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5078.400	52.61	54.00	-1.39	51.79	0.82	Average
5078.400	64.22	74.00	-9.78	63.40	0.82	Peak
5235.200	111.13			110.53	0.60	Average
5235.200	121.28			120.68	0.60	Peak
5391.200	50.87	54.00	-3.13	50.75	0.12	Average
5391.200	63.74	74.00	-10.26	63.62	0.12	Peak
10480.000	55.49	68.20	-12.71	46.21	9.28	Peak
15720.000	48.58	54.00	-5.42	34.28	14.30	Average
15720.000	61.97	74.00	-12.03	47.67	14.30	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5135.200	49.90	54.00	-4.10	49.22	0.68	Average
5135.200	63.57	74.00	-10.43	62.89	0.68	Peak
5244.400	102.51			101.95	0.56	Average
5244.400	112.88			112.32	0.56	Peak
5384.800	49.26	54.00	-4.74	49.10	0.16	Average
5384.800	63.72	74.00	-10.28	63.56	0.16	Peak
10480.000	54.40	68.20	-13.80	45.12	9.28	Peak
15720.000	49.16	54.00	-4.84	34.86	14.30	Average
15720.000	62.18	74.00	-11.82	47.88	14.30	Peak

802.11ac VHT40-BF mode:

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5149.680	53.24	54.00	-0.76	52.60	0.64	Average
5149.680	73.96	74.00	-0.04	73.32	0.64	Peak
5181.360	103.80	54.00			0.55	Average
5181.360	115.55	74.00			0.55	Peak
10380.000	54.05	68.20	-14.15	44.61	9.44	Peak
15570.000	47.68	54.00	-6.32	33.43	14.25	Average
15570.000	63.39	74.00	-10.61	49.14	14.25	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5146.000	50.10	54.00	-3.90	49.45	0.65	Average
5146.000	64.44	74.00	-9.56	63.79	0.65	Peak
5197.680	97.10	54.00			0.58	Average
5197.680	108.67	74.00			0.58	Peak
10380.000	53.52	68.20	-14.68	44.08	9.44	Peak
15570.000	48.86	54.00	-5.14	34.61	14.25	Average
15570.000	62.44	74.00	-11.56	48.19	14.25	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5077.200	53.67	54.00	-0.33	52.86	0.81	Average
5077.200	67.44	74.00	-6.56	66.63	0.81	Peak
5237.600	107.36	54.00			0.58	Average
5237.600	118.07	74.00			0.58	Peak
5394.800	53.11	54.00	-0.89	53.00	0.11	Average
5394.800	66.30	74.00	-7.70	66.19	0.11	Peak
10460.000	53.46	68.20	-14.74	44.08	9.38	Peak
15690.000	49.17	54.00	-4.83	34.85	14.32	Average
15690.000	63.20	74.00	-10.80	48.88	14.32	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5059.600	51.12	54.00	-2.88	50.27	0.85	Average
5059.600	63.86	74.00	-10.14	63.01	0.85	Peak
5235.600	99.03	54.00			0.59	Average
5235.600	109.97	74.00			0.59	Peak
5392.000	50.18	54.00	-3.82	50.05	0.13	Average
5392.000	63.75	74.00	-10.25	63.62	0.13	Peak
10460.000	53.73	68.20	-14.47	44.35	9.38	Peak
15690.000	48.86	54.00	-5.14	34.54	14.32	Average
15690.000	63.49	74.00	-10.51	49.17	14.32	Peak

802.11ac VHT80-BF mode:

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5140.160	53.81	54.00	-0.19	53.15	0.66	Average
5140.160	70.83	74.00	-3.17	70.17	0.66	Peak
5231.360	102.26			101.65	0.61	Average
5231.360	112.46			111.85	0.61	Peak
5351.360	52.40	54.00	-1.60	52.10	0.30	Average
5351.360	64.90	74.00	-9.10	64.60	0.30	Peak
10420.000	54.09	68.20	-14.11	44.57	9.52	Peak
15630.000	47.36	54.00	-6.64	33.15	14.21	Average
15630.000	62.03	74.00	-11.97	47.82	14.21	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5147.840	50.27	54.00	-3.73	49.63	0.64	Average
5147.840	65.87	74.00	-8.13	65.23	0.64	Peak
5206.880	93.80			93.22	0.58	Average
5206.880	105.31			104.73	0.58	Peak
5437.280	49.72	54.00	-4.28	49.63	0.09	Average
5437.280	63.22	74.00	-10.78	63.13	0.09	Peak
10420.000	53.05	68.20	-15.15	43.53	9.52	Peak
15630.000	47.65	54.00	-6.35	33.44	14.21	Average
15630.000	62.40	74.00	-11.60	48.19	14.21	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	
5698.370	92.34	104.00	-11.66	92.84	-0.50	Peak
5719.370	101.73	110.62	-8.89	102.22	-0.49	Peak
5724.830	107.18	121.81	-14.63	107.66	-0.48	Peak
5748.630	120.34	122.20	-1.86	120.78	-0.44	Peak
11490.000	38.52	54.00	-15.48	30.40	8.12	Average
11490.000	51.93	74.00	-22.07	43.81	8.12	Peak
17235.000	54.65	68.20	-13.55	41.93	12.72	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5698.370	82.59	104.00	-21.41	83.09	-0.50	Peak
5719.300	92.26	110.60	-18.34	92.75	-0.49	Peak
5724.830	97.47	121.81	-24.34	97.95	-0.48	Peak
5748.700	111.40	122.20	-10.80	111.84	-0.44	Peak
11490.000	41.40	54.00	-12.60	33.28	8.12	Average
11490.000	55.49	74.00	-18.51	47.37	8.12	Peak
17235.000	55.52	68.20	-12.68	42.80	12.72	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5718.530	86.14	110.39	-24.25	86.62	-0.48	Peak
5724.140	86.13	120.24	-34.11	86.61	-0.48	Peak
5788.740	120.63	122.20	-1.57	121.06	-0.43	Peak
5852.320	86.05	116.91	-30.86	85.96	0.09	Peak
5858.100	85.06	109.93	-24.87	84.91	0.15	Peak
11570.000	38.23	54.00	-15.77	29.97	8.26	Average
11570.000	52.11	74.00	-21.89	43.85	8.26	Peak
17355.000	56.55	68.20	-11.65	43.34	13.21	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5719.210	74.25	110.58	-36.33	74.74	-0.49	Peak
5724.140	73.52	120.24	-46.72	74.00	-0.48	Peak
5777.860	109.67	122.20	-12.53	110.10	-0.43	Peak
5850.280	73.47	121.56	-48.09	73.40	0.07	Peak
5857.930	73.39	109.98	-36.59	73.24	0.15	Peak
11570.000	42.05	54.00	-11.95	33.79	8.26	Average
11570.000	55.14	74.00	-18.86	46.88	8.26	Peak
17355.000	55.23	68.20	-12.97	42.02	13.21	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5828.585	120.41	122.20	-1.79	120.58	-0.17	Peak
5851.960	103.25	117.73	-14.48	103.16	0.09	Peak
5857.295	99.85	110.16	-10.31	99.71	0.14	Peak
11650.000	38.34	54.00	-15.66	29.78	8.56	Average
11650.000	50.70	74.00	-23.30	42.14	8.56	Peak
17475.000	56.08	68.20	-12.12	41.87	14.21	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5828.640	109.47	122.20	-12.73	109.64	-0.17	Peak
5852.015	90.20	117.60	-27.40	90.11	0.09	Peak
5863.730	86.83	108.35	-21.52	86.63	0.20	Peak
11650.000	42.03	54.00	-11.97	33.47	8.56	Average
11650.000	54.53	74.00	-19.47	45.97	8.56	Peak
17475.000	56.04	68.20	-12.16	41.83	14.21	Peak

802.11ac VHT20-BF mode:

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5642.400	64.15	68.20	-4.05	63.20	0.95	Peak
5700.000	72.68	105.20	-32.52	71.25	1.43	Peak
5718.360	85.57	110.34	-24.77	84.12	1.45	Peak
5742.480	121.92	122.20	-0.28	120.46	1.46	Peak
5872.440	65.49	105.92	-40.43	63.30	2.19	Peak
5906.640	66.53	81.75	-15.22	64.02	2.51	Peak
5932.560	65.49	68.20	-2.71	62.95	2.54	Peak
11490.000	44.25	54.00	-9.75	33.45	10.80	Average
11490.000	57.61	74.00	-16.39	46.81	10.80	Peak
17235.000	60.17	68.20	-8.03	43.78	16.39	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5628.000	63.77	68.20	-4.43	62.93	0.84	Peak
5689.920	64.64	97.77	-33.13	63.29	1.35	Peak
5719.440	70.95	110.64	-39.69	69.51	1.44	Peak
5752.560	112.78	122.20	-9.42	111.30	1.48	Peak
5860.560	66.22	109.24	-43.02	64.15	2.07	Peak
5913.480	65.74	76.70	-10.96	63.21	2.53	Peak
5968.920	66.65	68.20	-1.55	64.20	2.45	Peak
11490.000	47.25	54.00	-6.75	36.45	10.80	Average
11490.000	61.15	74.00	-12.85	50.35	10.80	Peak
17235.000	60.41	68.20	-7.79	44.02	16.39	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5629.080	65.56	68.20	-2.64	64.72	0.84	Peak
5688.840	66.20	96.97	-30.77	64.85	1.35	Peak
5711.520	68.57	108.43	-39.86	67.14	1.43	Peak
5787.840	121.40	122.20	-0.80	119.90	1.50	Peak
5862.360	67.80	108.74	-40.94	65.72	2.08	Peak
5880.000	66.37	101.49	-35.12	64.08	2.29	Peak
5957.040	67.08	68.20	-1.12	64.59	2.49	Peak
11570.000	43.48	54.00	-10.52	32.54	10.94	Average
11570.000	55.73	74.00	-18.27	44.79	10.94	Peak
17355.000	62.33	68.20	-5.87	45.07	17.26	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5620.080	63.60	68.20	-4.60	62.82	0.78	Peak
5686.320	64.89	95.11	-30.22	63.56	1.33	Peak
5703.960	65.15	106.31	-41.16	63.73	1.42	Peak
5782.800	112.67	122.20	-9.53	111.16	1.51	Peak
5858.040	65.92	109.95	-44.03	63.89	2.03	Peak
5891.520	66.25	92.94	-26.69	63.84	2.41	Peak
5962.440	65.88	68.20	-2.32	63.41	2.47	Peak
11570.000	47.26	54.00	-6.74	36.32	10.94	Average
11570.000	61.84	74.00	-12.16	50.90	10.94	Peak
17355.000	61.94	68.20	-6.26	44.68	17.26	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5630.520	64.08	68.20	-4.12	63.23	0.85	Peak
5667.600	65.33	81.26	-15.93	64.16	1.17	Peak
5710.800	65.95	108.23	-42.28	64.51	1.44	Peak
5833.200	120.85	122.20	-1.35	119.10	1.75	Peak
5855.520	82.05	110.65	-28.60	80.04	2.01	Peak
5876.400	69.03	104.16	-35.13	66.78	2.25	Peak
5967.120	66.69	68.20	-1.51	64.23	2.46	Peak
11650.000	43.69	54.00	-10.31	32.51	11.18	Average
11650.000	55.62	74.00	-18.38	44.44	11.18	Peak
17475.000	64.19	68.20	-4.01	46.46	17.73	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5648.520	64.51	68.20	-3.69	63.51	1.00	Peak
5669.040	64.67	82.33	-17.66	63.48	1.19	Peak
5715.840	63.75	109.64	-45.89	62.30	1.45	Peak
5820.240	111.64	122.20	-10.56	110.01	1.63	Peak
5855.160	69.32	110.76	-41.44	67.32	2.00	Peak
5899.080	66.25	87.34	-21.09	63.76	2.49	Peak
5936.880	66.25	68.20	-1.95	63.72	2.53	Peak
11650.000	44.34	54.00	-9.66	33.16	11.18	Average
11650.000	59.69	74.00	-14.31	48.51	11.18	Peak
17475.000	61.41	68.20	-6.79	43.68	17.73	Peak

802.11ac VHT40-BF mode:

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5646.720	67.34	68.20	-0.86	66.34	1.00	Peak
5699.640	79.98	104.93	-24.95	78.55	1.43	Peak
5720.000	92.84	110.80	-17.96	91.40	1.44	Peak
5751.480	121.17	122.20	-1.03	119.70	1.47	Peak
5751.480	121.17	122.20	-1.03	119.70	1.47	Peak
5859.120	70.13	109.64	-39.51	68.09	2.04	Peak
5878.560	67.44	102.56	-35.12	65.17	2.27	Peak
5950.560	67.23	68.20	-0.97	64.73	2.50	Peak
11510.000	41.70	54.00	-12.30	30.86	10.84	Average
11510.000	56.39	74.00	-17.61	45.55	10.84	Peak
17265.000	62.76	68.20	-5.44	46.22	16.54	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5632.320	63.81	68.20	-4.39	62.93	0.88	Peak
5697.120	70.18	103.08	-32.90	68.77	1.41	Peak
5717.640	85.97	110.14	-24.17	84.53	1.44	Peak
5750.040	110.69	122.20	-11.51	109.22	1.47	Peak
5868.120	65.85	107.12	-41.27	63.70	2.15	Peak
5884.680	66.00	98.01	-32.01	63.67	2.33	Peak
5945.880	65.69	68.20	-2.51	63.17	2.52	Peak
11510.000	44.55	54.00	-9.45	33.71	10.84	Average
11510.000	58.73	74.00	-15.27	47.89	10.84	Peak
17265.000	62.47	68.20	-5.73	45.93	16.54	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5640.240	65.04			64.11	0.93	Peak
5692.800	69.65	99.89	-30.24	68.28	1.37	Peak
5711.160	74.56	108.33	-33.77	73.12	1.44	Peak
5780.640	119.84	122.20	-2.36	118.33	1.51	Peak
5854.800	78.92	111.26	-32.34	76.93	1.99	Peak
5887.200	72.85	96.14	-23.29	70.49	2.36	Peak
5944.080	67.13	68.20	-1.07	64.62	2.51	Peak
11590.000	43.51	54.00	-10.49	32.53	10.98	Average
11590.000	57.24	74.00	-16.76	46.26	10.98	Peak
17385.000	63.17	68.20	-5.03	45.80	17.37	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5611.440	64.95			64.22	0.73	Peak
5699.640	65.21	104.93	-39.72	63.78	1.43	Peak
5709.000	66.17	107.72	-41.55	64.74	1.43	Peak
5787.480	110.95	122.20	-11.25	109.46	1.49	Peak
5862.720	68.12	108.64	-40.52	66.03	2.09	Peak
5904.120	66.39	83.61	-17.22	63.89	2.50	Peak
5928.240	66.36	68.20	-1.84	63.81	2.55	Peak
11590.000	44.44	54.00	-9.56	33.46	10.98	Average
11590.000	59.70	74.00	-14.30	48.72	10.98	Peak
17385.000	63.40	68.20	-4.80	46.03	17.37	Peak

802.11ac VHT80-BF mode:

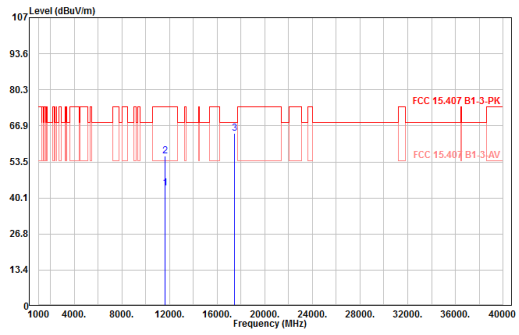
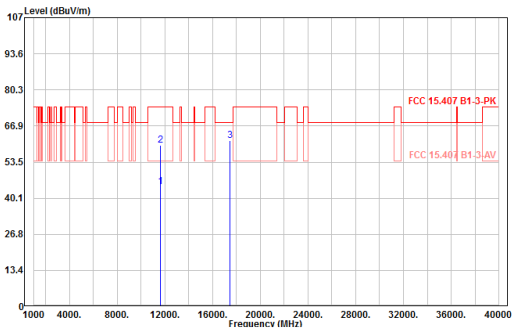
Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5647.080	67.88	68.20	-0.32	66.88	1.00	Peak
5681.280	83.07	91.39	-8.32	81.78	1.29	Peak
5701.440	88.01	105.60	-17.59	86.58	1.43	Peak
5751.840	118.96	122.20	-3.24	117.49	1.47	Peak
5856.240	82.47	110.45	-27.98	80.46	2.01	Peak
5874.600	74.01	105.31	-31.30	71.78	2.23	Peak
5927.520	68.00	68.20	-0.20	65.45	2.55	Peak
11550.000	40.56	54.00	-13.44	29.65	10.91	Average
11550.000	54.07	74.00	-19.93	43.16	10.91	Peak
17325.000	62.97	68.20	-5.23	45.86	17.11	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5631.960	64.57	68.20	-3.63	63.70	0.87	Peak
5697.840	76.61	103.61	-27.00	75.20	1.41	Peak
5710.800	80.50	108.23	-27.73	79.06	1.44	Peak
5740.320	106.65	122.20	-15.55	105.18	1.47	Peak
5859.120	71.89	109.64	-37.75	69.85	2.04	Peak
5877.480	67.71	103.36	-35.65	65.46	2.25	Peak
5924.640	66.36	68.47	-2.11	63.82	2.54	Peak
11550.000	40.48	54.00	-13.52	29.57	10.91	Average
11550.000	53.80	74.00	-20.20	42.89	10.91	Peak
17325.000	61.24	68.20	-6.96	44.13	17.11	Peak

Above 1G (1 GHz-40 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	!11650.000	43.69	54.00	-10.31	32.51	11.18	Average	horizontal
2	!11650.000	55.62	74.00	-18.38	44.44	11.18	Peak	horizontal
3	!17475.000	64.19	68.20	-4.01	46.46	17.73	Peak	horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1	!11650.000	44.34	54.00	-9.66	33.16	11.18	Average	vertical
2	!11650.000	59.69	74.00	-14.31	48.51	11.18	Peak	vertical
3	!17475.000	61.41	68.20	-6.79	43.68	17.73	Peak	vertical

Level = Read Level + Factor

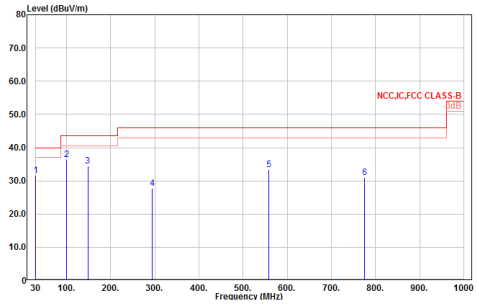
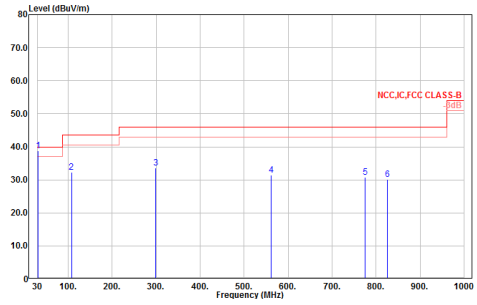
Over Limit = Level – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

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

Co-location:

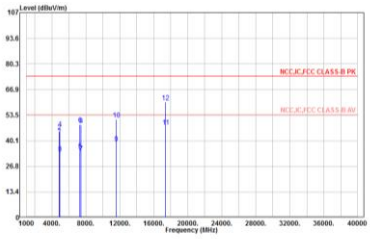
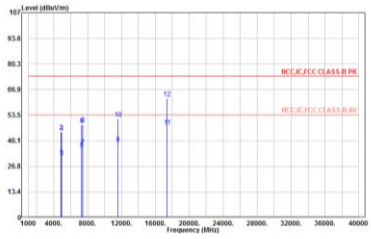
Below 1G (30 MHz – 1 GHz):

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	31.56	40.00	-8.44	37.39	-5.83	Peak	horizontal
2	99.840	36.33	43.50	-7.17	56.86	-20.53	Peak	horizontal
3	148.340	34.43	43.50	-9.07	52.63	-18.20	Peak	horizontal
4	294.810	27.80	46.00	-18.20	45.65	-17.85	Peak	horizontal
5	558.650	33.28	46.00	-12.72	45.93	-12.65	Peak	horizontal
6	774.960	30.91	46.00	-15.09	40.37	-9.46	Peak	horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1 !	31.940	38.75	40.00	-1.25	46.04	-7.29	QP	vertical
2	107.600	32.39	43.50	-11.11	50.96	-18.57	Peak	vertical
3	298.690	33.57	46.00	-12.43	51.38	-17.81	Peak	vertical
4	561.560	31.46	46.00	-14.54	44.06	-12.60	Peak	vertical
5	774.960	30.83	46.00	-15.17	40.29	-9.46	Peak	vertical
6	825.400	30.18	46.00	-15.82	39.01	-8.83	Peak	vertical

Above 1G (1 GHz – 40 GHz):

Horizontal	Vertical
	

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1	4874.000	32.95	54.00	-21.05	32.15	0.80	Average	horizontal
2	4874.000	45.07	74.00	-28.93	44.27	0.80	Peak	horizontal
3	4960.000	33.53	54.00	-20.47	32.72	0.81	Average	horizontal
4	4960.000	46.57	74.00	-27.43	45.76	0.81	Peak	horizontal
5 !	7311.000	35.21	54.00	-18.79	29.57	5.64	Average	horizontal
6	7311.000	48.60	74.00	-25.40	42.96	5.64	Peak	horizontal
7	7440.000	33.99	54.00	-20.01	27.93	6.06	Average	horizontal
8	7440.000	48.39	74.00	-25.61	42.33	6.06	Peak	horizontal
9	11570.000	38.89	54.00	-15.11	28.13	10.76	Average	horizontal
10	11570.000	51.23	74.00	-22.77	40.47	10.76	Peak	horizontal
11	17355.000	47.67	54.00	-6.33	29.96	17.71	Average	horizontal
12	17355.000	60.29	74.00	-13.71	42.58	17.71	Peak	horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1	4874.000	31.61	54.00	-22.39	30.82	0.79	Average	vertical
2	4874.000	44.87	74.00	-29.13	44.08	0.79	Peak	vertical
3	4960.000	31.63	54.00	-22.37	30.82	0.81	Average	vertical
4	4960.000	44.23	74.00	-29.77	43.42	0.81	Peak	vertical
5 !	7311.000	35.79	54.00	-18.21	30.15	5.64	Average	vertical
6	7311.000	48.39	74.00	-25.61	42.75	5.64	Peak	vertical
7 !	7440.000	37.04	54.00	-16.96	30.98	6.06	Average	vertical
8	7440.000	48.82	74.00	-25.18	42.76	6.06	Peak	vertical
9	11570.000	38.71	54.00	-15.29	27.94	10.77	Average	vertical
10	11574.000	51.56	74.00	-22.44	40.79	10.77	Peak	vertical
11	17355.000	47.62	54.00	-6.38	29.91	17.71	Average	vertical
12	17355.000	62.24	74.00	-11.76	44.53	17.71	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.

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	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).*

8.4 Test Environmental Conditions

Temperature:	25 ℃	**Relative Humidity:**	45 %
ATM Pressure:	1015hPa	**Test Engineer:**	Leo Chang
Test Date:	2019-02-11~2019-02-12	-	-

8.5 Test Data and Test Plot

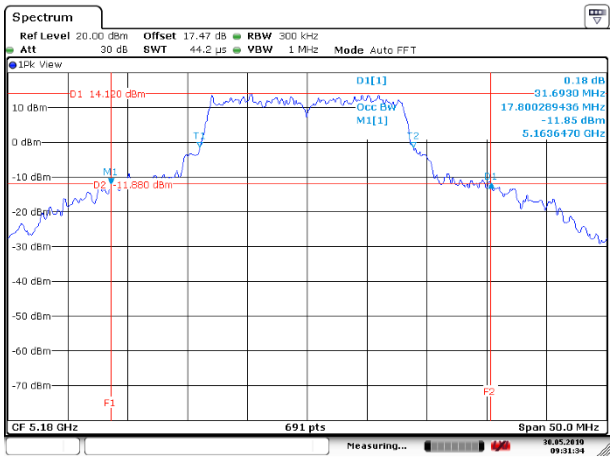
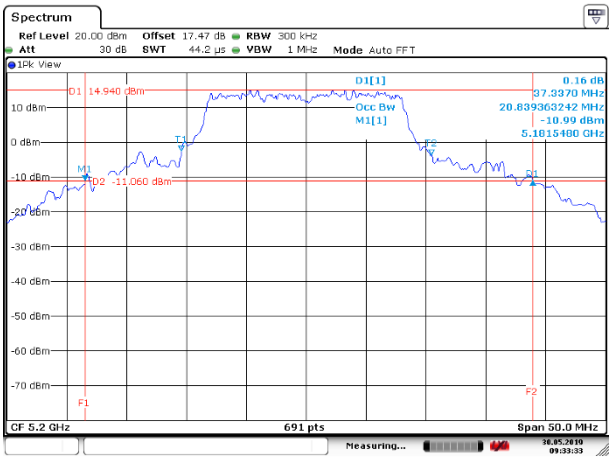
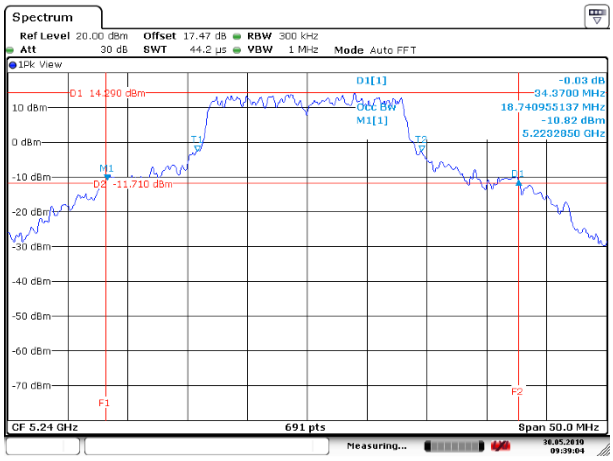
UNII Band	Mode	Channel	Frequency (MHz)	26dB Emission Bandwidth (MHz)			
				Chain 0	Chain 1	Chain 2	Chain 3
UNII-1	802.11a	36	5180	31.69	-	-	-
		40	5200	37.33	-	-	-
		48	5240	34.37	-	-	-
UNII-1	802.11ac20	36	5180	21.56	21.70	21.78	21.70
		40	5200	21.78	21.49	21.34	21.41
		48	5240	21.56	21.20	21.56	21.05
UNII-1	802.11ac 40	38	5190	41.22	40.52	40.64	40.64
		46	5230	54.41	53.49	53.60	56.15
UNII-1	802.11ac 80	42	5210	83.82	83.82	83.82	84.05

UNII Band	Mode	Channel	Frequency (MHz)	99% Emission Bandwidth (MHz)				Remark
				Chain 0	Chain 1	Chain 2	Chain 3	
UNII-1	802.11a	36	5180	17.80	-	-	-	No transmitted signal in the 99% bandwidth extends into the U-NII-2 band
		40	5200	20.83	-	-	-	
		48	5240	18.74	-	-	-	
UNII-3		149	5745	37.51	-	-	-	
		157	5785	54.06	-	-	-	
		165	5825	38.66	-	-	-	
UNII-1	802.11ac20	36	5180	18.16	18.23	18.16	18.30	
		40	5200	18.16	17.94	18.08	18.08	
		48	5240	18.30	18.16	17.94	17.87	
UNII-3		149	5745	19.82	20.33	21.41	19.39	
		157	5785	19.45	19.79	19.73	19.85	
		165	5825	19.97	20.04	19.89	19.39	
UNII-1	802.11ac 40	38	5190	36.81	36.58	36.70	36.70	
		46	5230	37.27	37.27	37.16	37.51	
UNII-3		151	5755	41.09	38.06	39.50	37.91	
		159	5795	38.63	37.62	38.78	37.48	
UNII-1	802.11ac 80	42	5210	75.48	75.48	75.48	75.71	
UNII-3		155	5775	76.98	76.70	76.98	76.70	

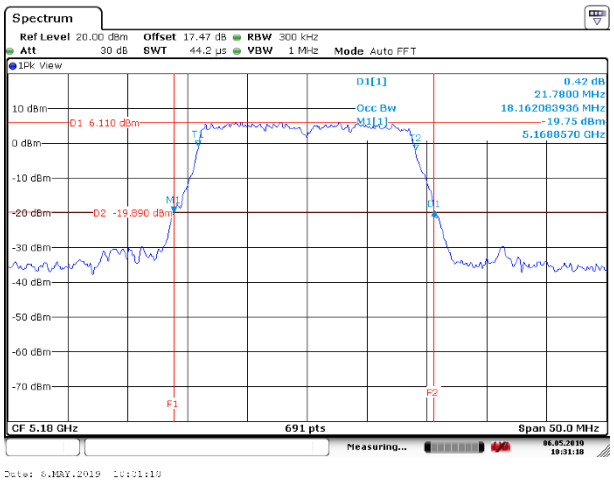
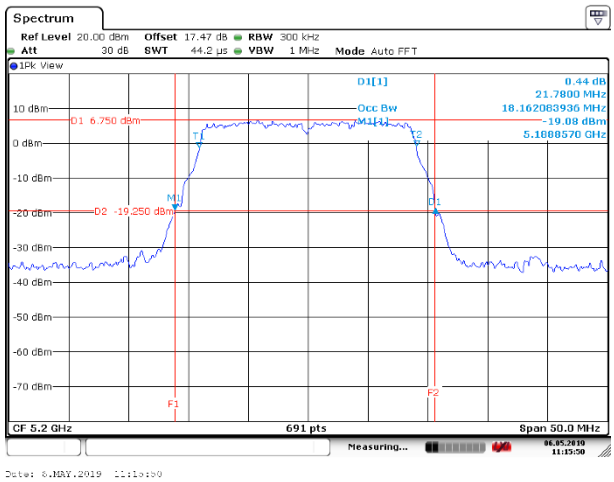
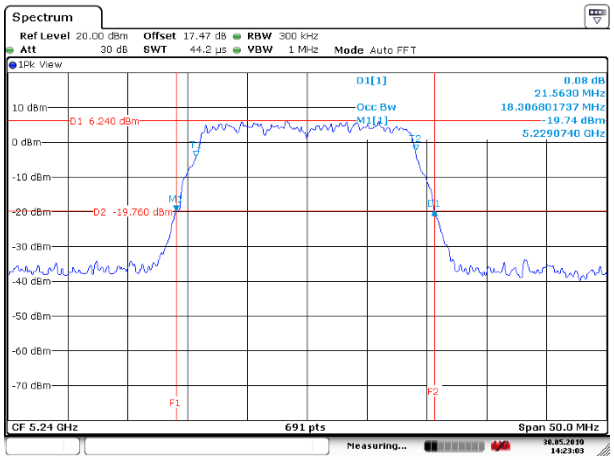
UNII Band	Mode	Channel	Frequency (MHz)	6dB Emission Bandwidth (MHz)				Limit (MHz)
				Chain 0	Chain 1	Chain 2	Chain 3	
UNII-3	802.11a	149	5745	16.38	-	-	-	>0.5
		157	5785	16.44	-	-	-	>0.5
		165	5825	16.32	-	-	-	>0.5
	802.11ac20	149	5745	17.77	17.71	17.59	17.65	>0.5
		157	5785	17.65	17.59	17.71	17.59	>0.5
		165	5825	17.77	17.71	17.65	17.65	>0.5
	802.11ac 40	151	5755	36.35	36.35	36.35	36.35	>0.5
		159	5795	36.35	36.35	36.35	36.35	>0.5
	802.11ac 80	155	5775	76.18	75.95	76.18	75.95	>0.5

For UNII-1

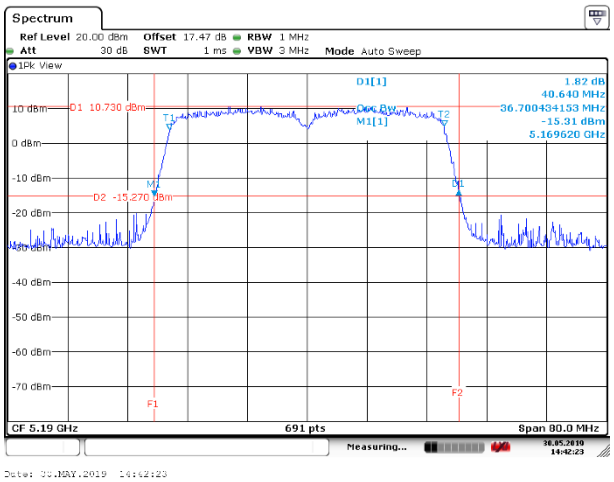
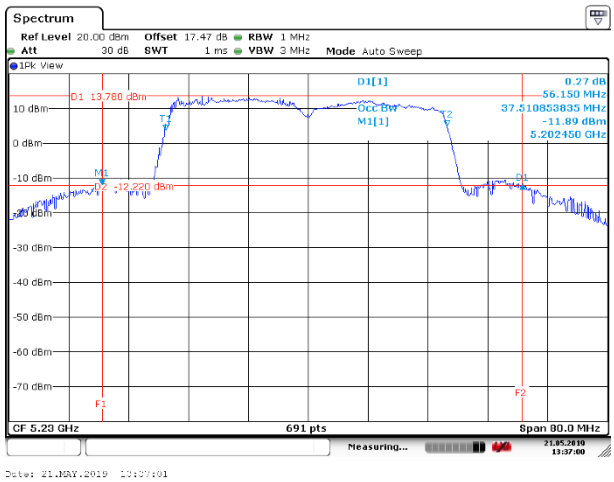
802.11a mode Chain 0:

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

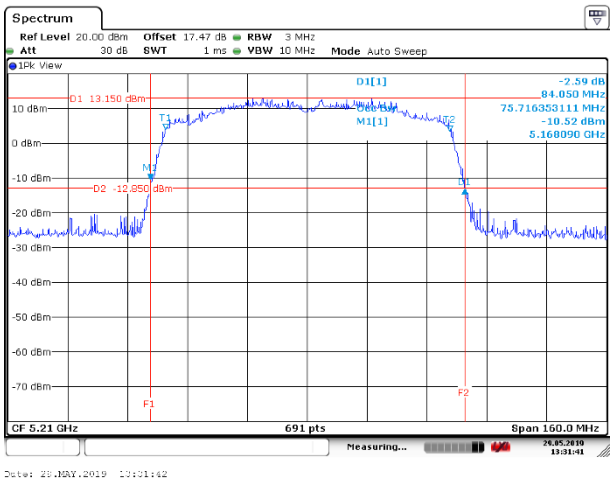
802.11ac VHT20-BF mode:

Low CH (Chain 2)	Middle CH (Chain 0)
	
High CH (Chain 0)	**-**
	-

802.11ac VHT40-BF mode:

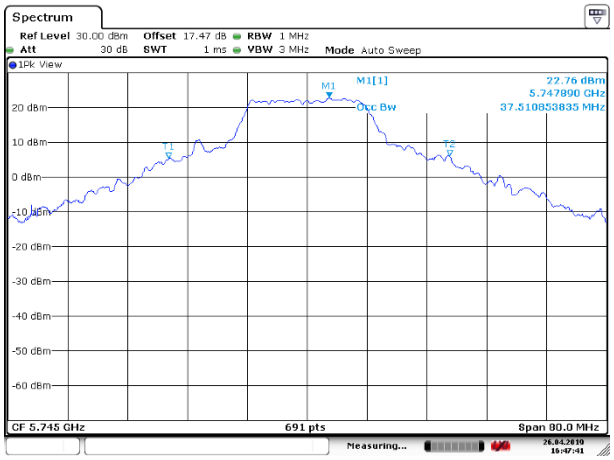
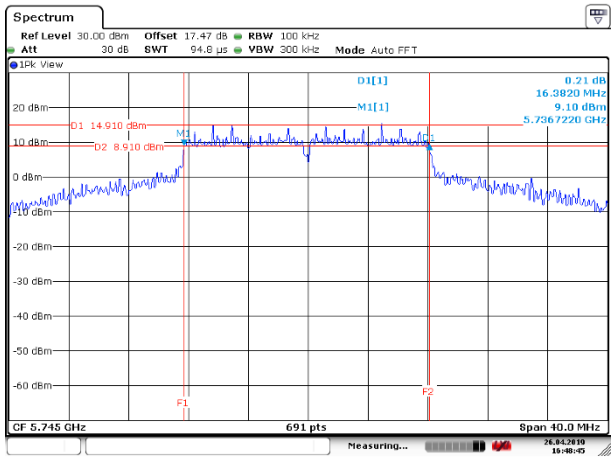
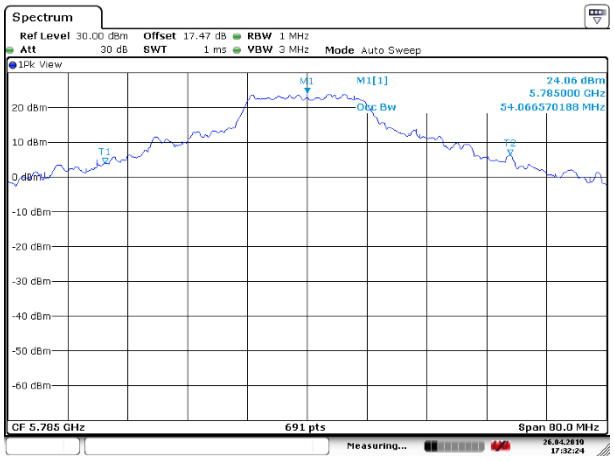
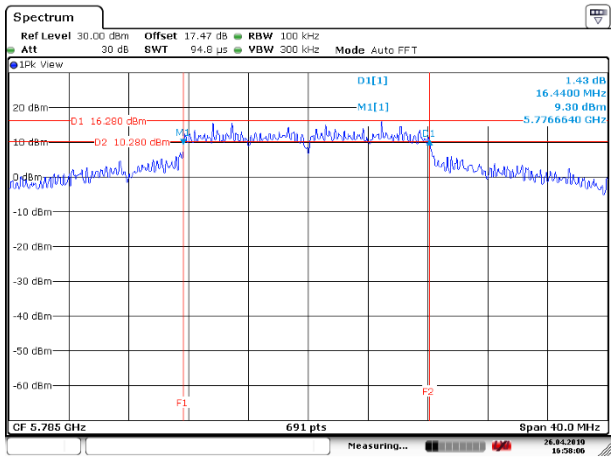
Low CH (Chain 0)	High CH (Chain 3)
	

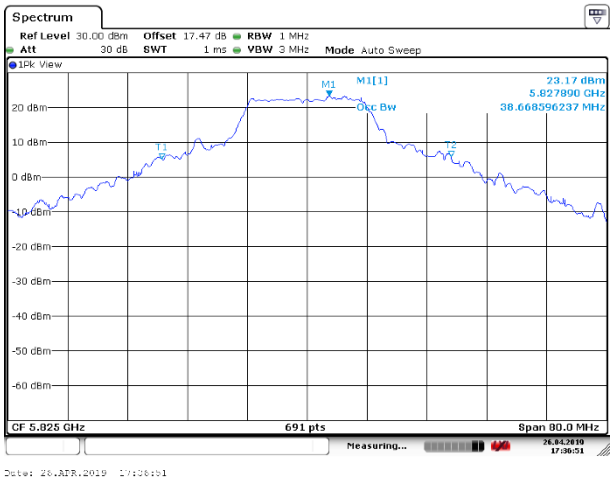
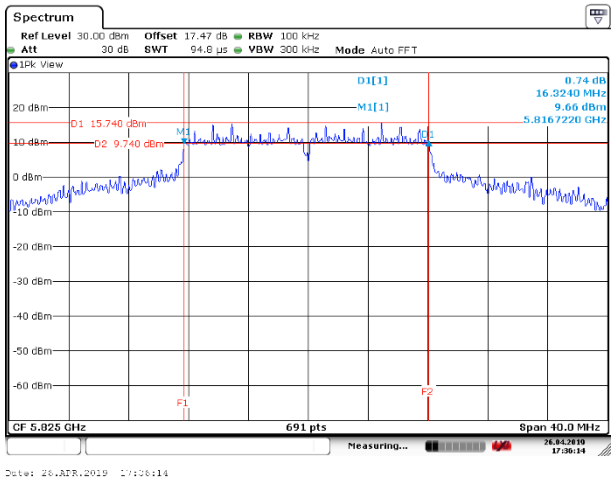
802.11ac VHT80-BF mode:

Middle CH (Chain 3)	-
	-

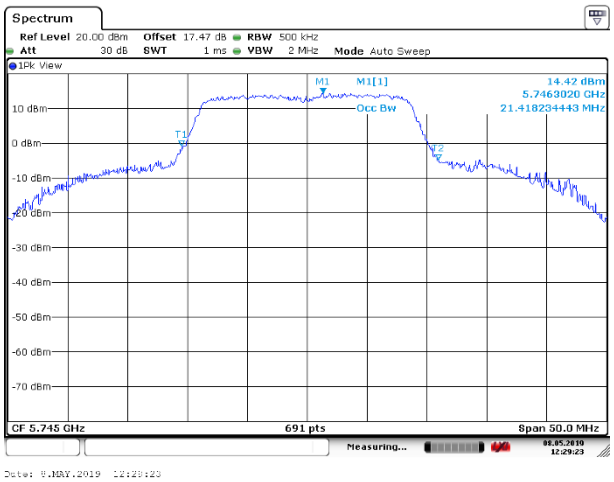
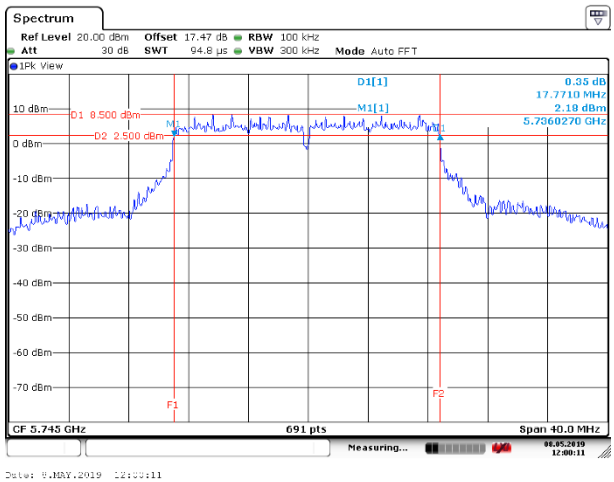
For UNII-3

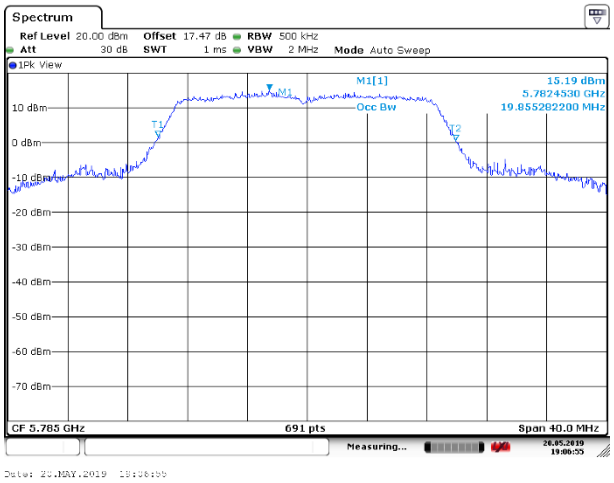
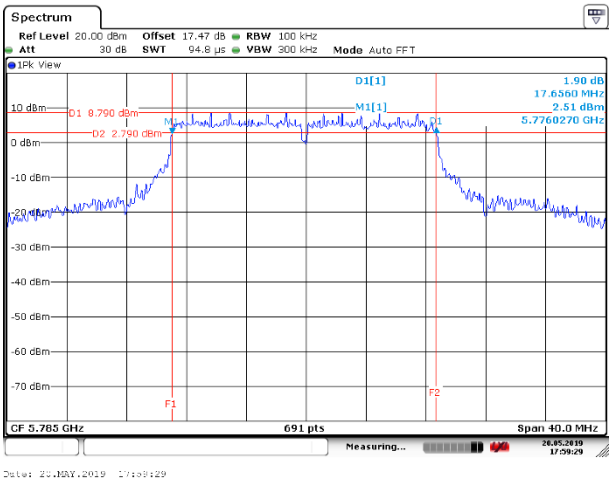
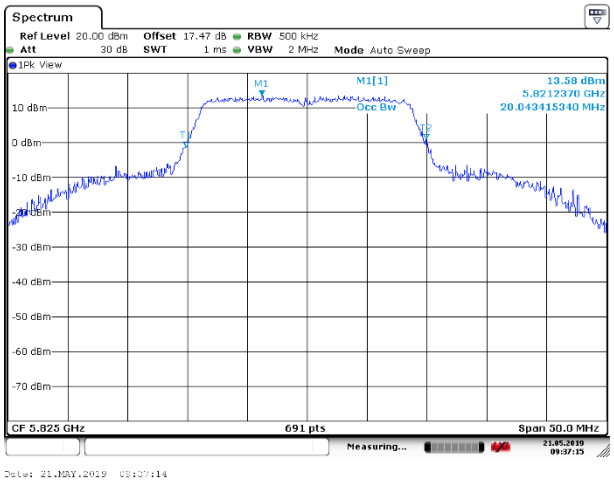
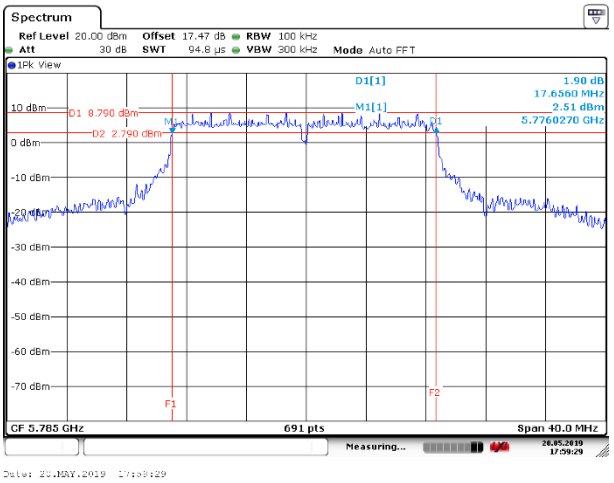
802.11a mode (Chain 0):

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

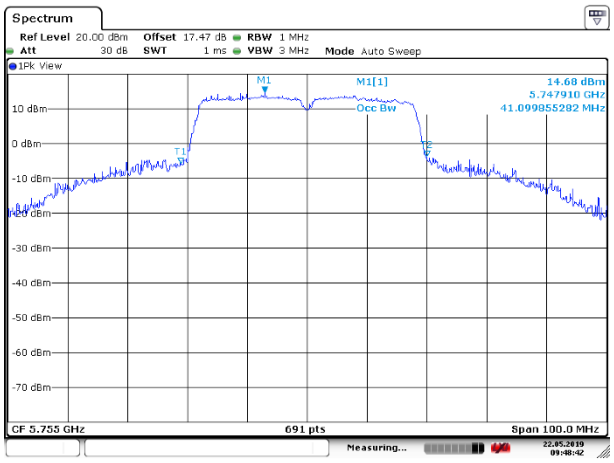
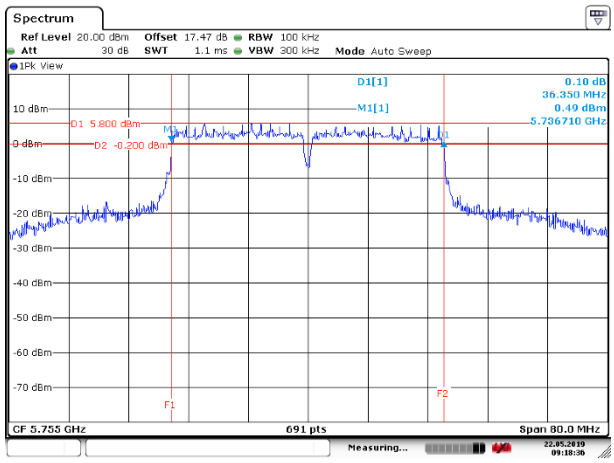
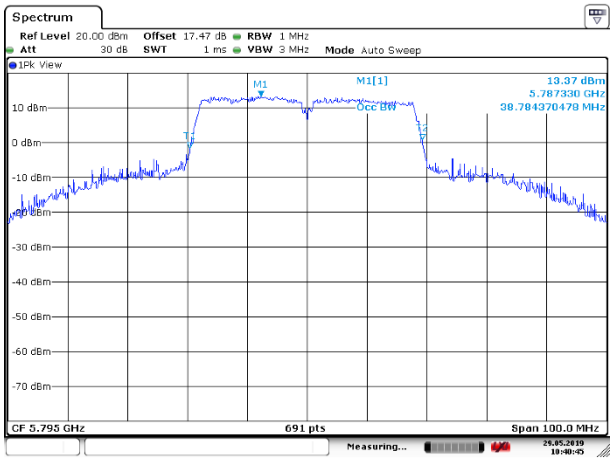
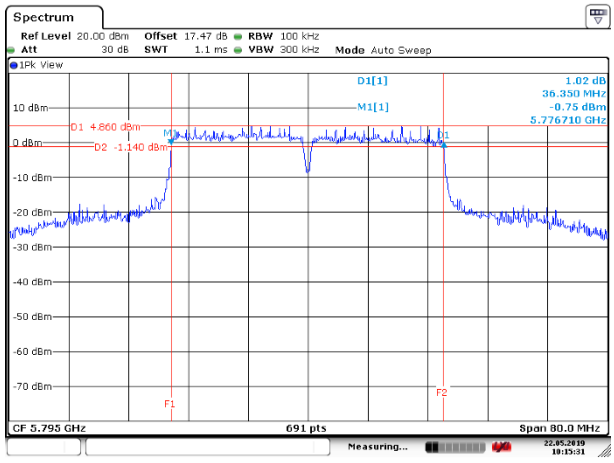
High CH-99%	High CH-6dB BW
	

802.11ac VHT20-BF mode:

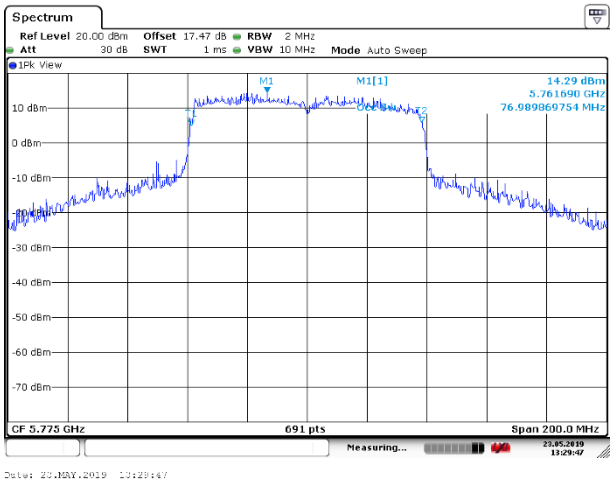
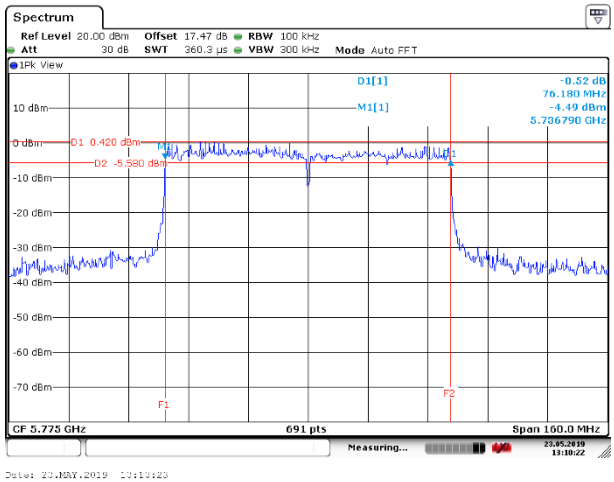
Low CH-99% (Chain 0)	Low CH-6dB BW (Chain 0)
	

Middle CH-99% (Chain 2)	Middle CH-6dB BW (Chain 2)
	
High CH-99% (Chain 0)	**High CH-6dB BW (Chain 0)**
	

802.11ac VHT40-BF mode:

Low CH-99% (Chain 0)	Low CH-6dB BW (Chain 0)
	
High CH-99% (Chain 2)	**High CH-6dB BW (Chain 2)**
	

802.11ac VHT80-BF mode:

High CH-99% (Chain 0)	High CH-6dB BW (Chain 0)
	

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

9.1 Applicable Standard

According to FCC §15.407(a),

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.

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					
Cable	WOKEN	SFL402	S02-160323-07	2019/02/11	2020/02/10
Power Sensor	Keysight	U2021XA	MY54080018	2018/03/07	2019/03/06

***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:	25 ℃	**Relative Humidity:**	45 %
ATM Pressure:	1015hPa	**Test Engineer:**	Leo Chang
Test Date:	2019-02-11~2019-06-04	-	-

9.5 Test Data

Channel	Freq. (MHz)	Maximum Conducted Average Output Power(dBm)					Power DG (dBi)	Limit (dBm)
		Chain 0	Chain 1	Chain 2	Chain 3	Sum Chain		
IEEE 802.11a mode								
36	**5180**	21.87	-	-	-	21.87	3.30	30
40	**5200**	21.76	-	-	-	21.76	3.30	30
48	**5240**	22.17	-	-	-	22.17	3.42	30
149	**5745**	23.83	-	-	-	23.83	3.01	30
157	**5785**	25.25	-	-	-	25.25	3.01	30
165	**5825**	24.61	-	-	-	24.61	3.01	30
IEEE 802.11n HT20-BF mode								
36	**5180**	15.65	16.62	15.59	17.18	22.33	9.32	26.68
40	**5200**	16.37	16.49	16.28	16.52	22.43	9.32	26.68
48	**5240**	16.39	16.51	16.30	16.66	22.48	9.44	26.56
149	**5745**	20.02	20.25	19.92	20.37	26.16	9.03	26.97
157	**5785**	20.02	20.11	19.78	20.67	26.17	9.03	26.97
165	**5825**	19.83	20.25	19.71	20.44	26.08	9.03	26.97
IEEE 802.11n HT40-BF mode								
38	**5190**	15.13	15.24	14.99	15.39	21.21	9.32	26.68
46	**5230**	16.52	16.64	16.43	16.74	22.60	9.44	26.56
151	**5755**	20.25	20.36	20.09	20.68	26.37	9.03	26.97
159	**5795**	20.05	20.17	19.87	20.71	26.23	9.03	26.97

Note: In 802.11 n/ac mode.

For CH 36, 38 and 40. Due to Antenna with DG greater than 6 dBi. Therefore, Limit = 30 - (DG-6) = 30 - (9.32 – 6) = 26.68 dBm

For CH 46 and 48. Due to Antenna with DG greater than 6 dBi. Therefore, Limit = 30 - (DG-6) = 30 - (9.44 – 6) = 26.56 dBm

For CH 149, 151, 155, 157, 159 and 165. Due to Antenna with DG greater than 6 dBi. Therefore, Limit = 30 - (DG-6) = 30 - (9.03 – 6) = 26.56 dBm

Channel	Freq. (MHz)	Maximum Conducted Average Output Power(dBm)					Power DG (dBi)	Limit (dBm)
		Chain 0	Chain 1	Chain 2	Chain 3	Sum Chain		
IEEE 802.11ac VHT20-BF mode								
36	**5180**	16.14	16.75	15.71	17.25	22.52	9.32	26.68
40	**5200**	16.49	16.54	16.43	16.65	22.55	9.32	26.68
48	**5240**	16.71	16.76	16.65	16.89	22.78	9.44	26.56
149	**5745**	20.07	20.57	20.05	20.62	26.36	9.03	26.97
157	**5785**	20.07	20.14	19.89	20.77	26.25	9.03	26.97
165	**5825**	19.86	20.39	19.79	20.72	26.23	9.03	26.97
IEEE 802.11ac VHT40-BF mode								
38	**5190**	15.33	15.45	15.20	15.57	21.41	9.38	26.68
46	**5230**	16.79	16.98	16.60	17.02	**22.87***	**9.44***	26.56
151	**5755**	20.44	20.96	20.41	21.06	**26.75***	**9.03***	26.97
159	**5795**	20.21	20.92	20.11	21.20	26.65	9.03	26.97
IEEE 802.11ac VHT80-BF mode								
42	**5210**	14.61	14.70	13.90	15.41	20.71	9.32	26.68
155	**5775**	19.26	19.37	19.24	19.92	25.48	9.03	26.97

Note: In 802.11 n/ac mode.

For CH 36, 38, 40 and 42. Due to Antenna with DG greater than 6 dBi. Therefore, Limit = 30 - (DG-6) = 30 - (9.32 – 6) = 26.68 dBm

For CH 46 and 48. Due to Antenna with DG greater than 6 dBi. Therefore, Limit = 30 - (DG-6) = 30 - (9.44 – 6) = 26.56 dBm

For CH 149, 151, 155, 157, 159 and 165. Due to Antenna with DG greater than 6 dBi. Therefore, Limit = 30 - (DG-6) = 30 - (9.03 – 6) = 26.56 dBm

10 FCC §15.407(a) – Power Spectral Density

10.1 Applicable Standard

According to FCC §15.407(a),

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.

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:	25 ℃	**Relative Humidity:**	45 %
ATM Pressure:	1015hPa	**Test Engineer:**	Leo Chang
Test Date:	2019-02-21~2019-06-04	-	-

10.5 Test Data and Test Plot

UNII Band	Mode	Channel	Frequency (MHz)	Duty Factor (dB)	Maximum Power Spectral Density (dBm/MHz)					PSD-DG (dBi)	Limit (dBm/MHz)
					Chain 0	Chain 1	Chain 2	Chain 3	Total		
UNII-1	802.11a	36	5180	0.14	11.48	-	-	-	11.48	3.30	17.00
		40	5200	0.14	11.42	-	-	-	11.42	3.30	17.00
		48	5240	0.14	11.39	-	-	-	11.39	3.42	17.00
UNII-1	802.11ac VHT20	36	5180	0.34	7.12	7.14	6.58	8.29	13.35	9.32	13.68
		40	5200	0.34	6.79	7.01	6.44	7.19	12.89	9.32	13.68
		48	5240	0.34	6.80	6.95	6.61	7.17	12.91	9.44	13.56
UNII-1	802.11ac VHT40	38	5190	0.69	5.18	5.25	4.98	5.32	11.20	9.32	13.68
		46	5230	0.69	6.71	6.85	6.51	7.04	12.80	9.44	13.56
UNII-1	802.11ac VHT80	42	5210	1.00	-0.29	-0.24	-0.54	0.27	5.83	9.32	13.68
UNII Band	Mode	Channel	Frequency (MHz)	Duty Factor (dB)	Maximum Power Spectral Density (dBm/500kHz)					PSD-DG (dBi)	Limit (dBm/500kHz)
					Chain 0	Chain 1	Chain 2	Chain 3	Total		
UNII-3	802.11a	149	5745	0.14	18.55	-	-	-	18.55	3.01	30.00
		157	5785	0.14	19.58	-	-	-	19.58	3.01	30.00
		165	5825	0.14	18.76	-	-	-	18.76	3.01	30.00
UNII-3	802.11ac VHT20	149	5745	0.34	16.39	17.31	16.17	17.37	22.87	9.03	26.97
		157	5785	0.34	16.27	16.48	15.68	17.44	22.54	9.03	26.97
		165	5825	0.34	16.06	16.99	15.93	17.35	22.65	9.03	26.97
UNII-3	802.11ac VHT40	151	5755	0.69	15.29	15.61	14.90	16.18	21.54	9.03	26.97
		159	5795	0.69	15.44	15.53	14.60	16.59	21.62	9.03	26.97
UNII-3	802.11ac VHT80	155	5775	1.00	8.25	8.51	8.23	9.09	14.56	9.03	26.97

Note:

- *802.11ac mode in UNII-1:*

For CH 36, 38 and 40. Due to Antenna with DG greater than 6 dBi. Therefore, Limit = 30 - (DG-6) = 30 - (9.32 – 6) = 13.68 dBm/MHz

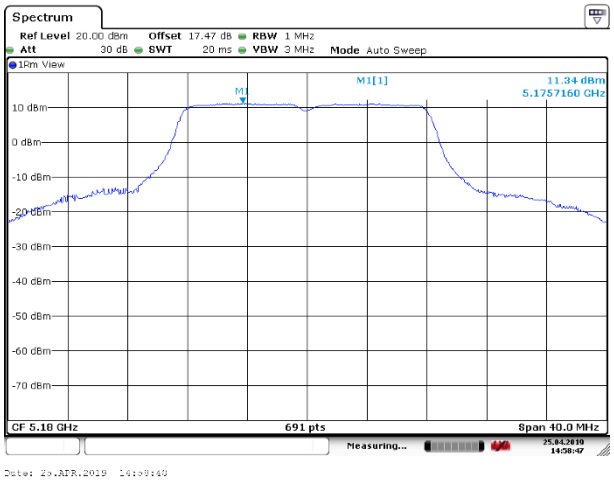
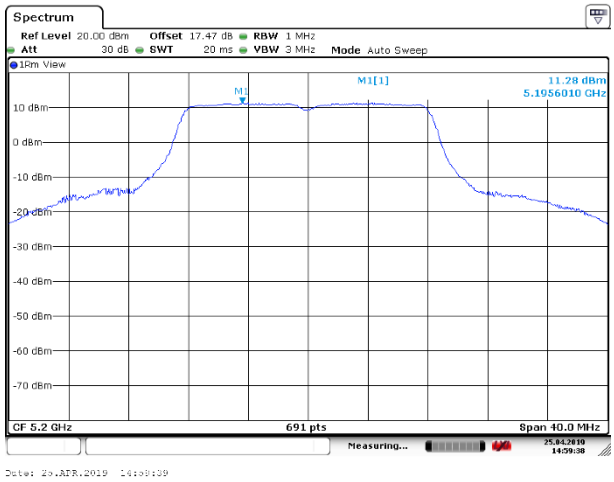
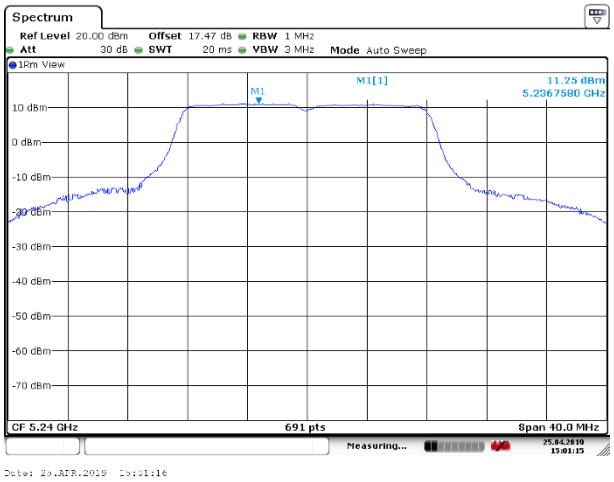
For CH 46 and 48. Due to Antenna with DG greater than 6 dBi. Therefore, Limit = 30 - (DG-6) = 30 - (9.44 – 6) = 13.56 dBm/MHz

- *802.11ac mode in UNII-3:*

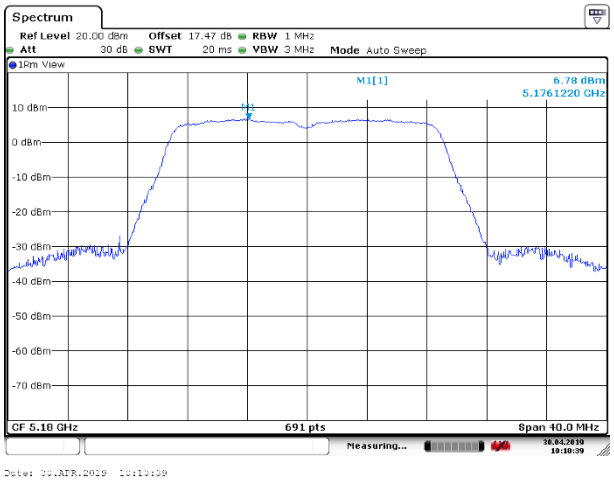
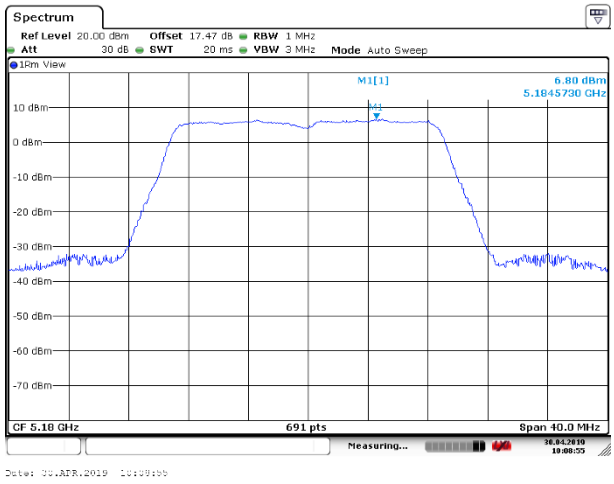
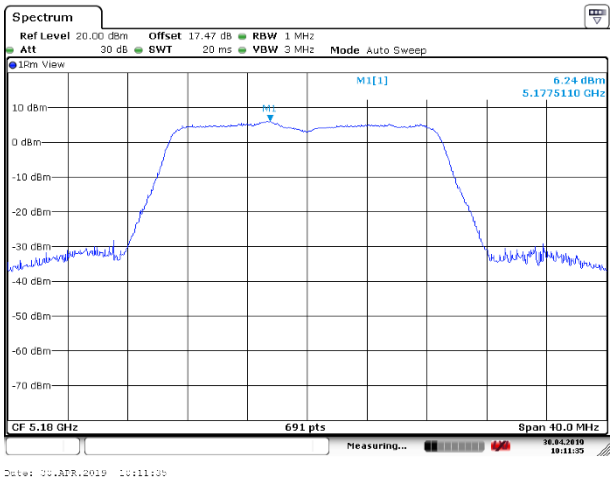
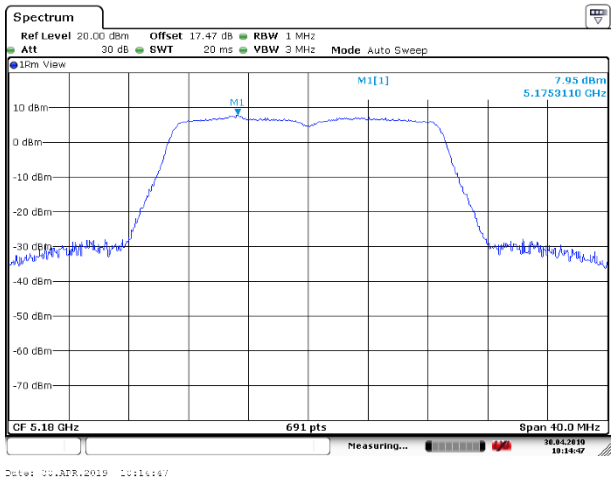
For CH 149, 151, 155, 157, 159 and 165. Due to Antenna with DG greater than 6 dBi. Therefore, Limit = 30 - (DG-6) = 30 - (9.03 – 6) = 9.03 dBm/500kHz

For UNII-1:

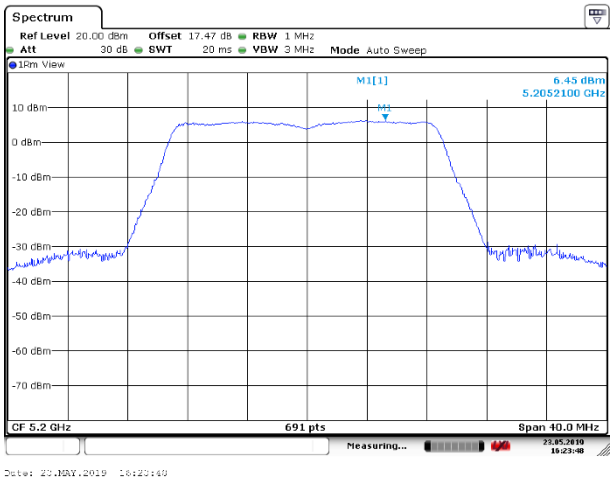
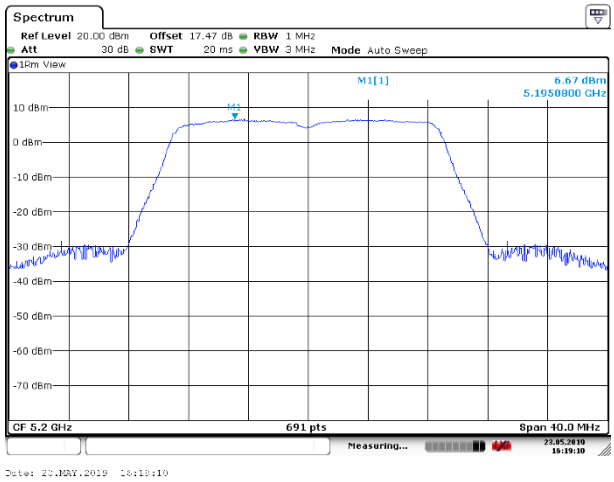
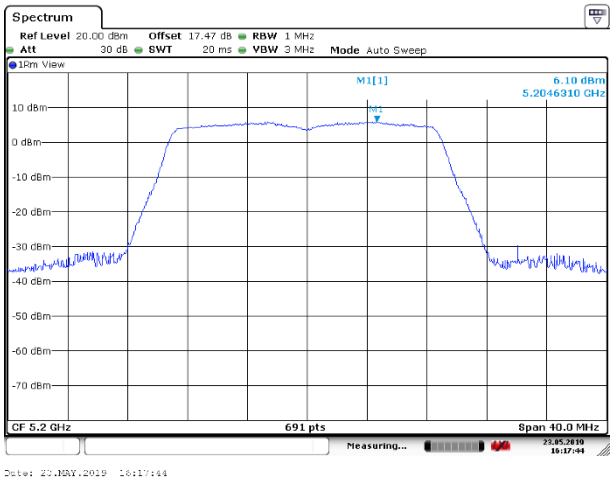
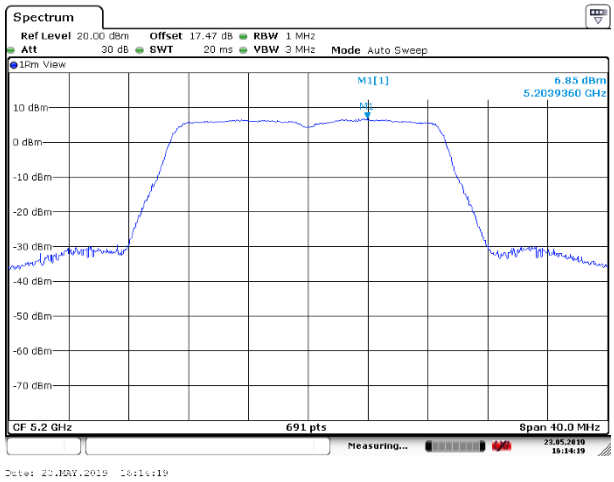
802.11a mode Chain0:

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

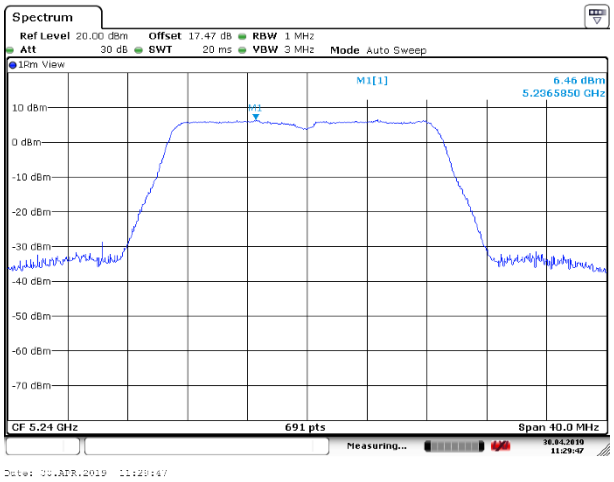
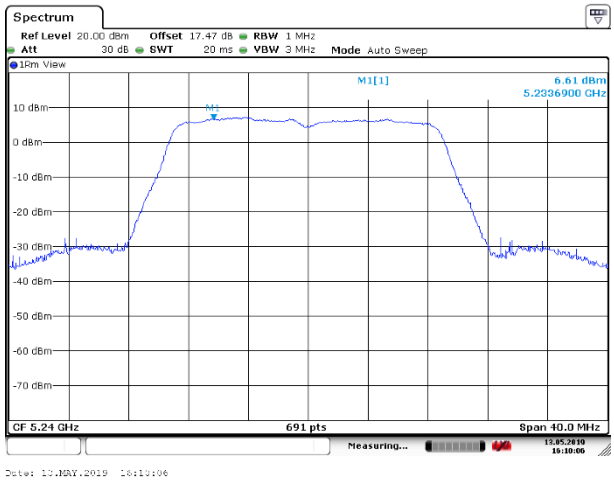
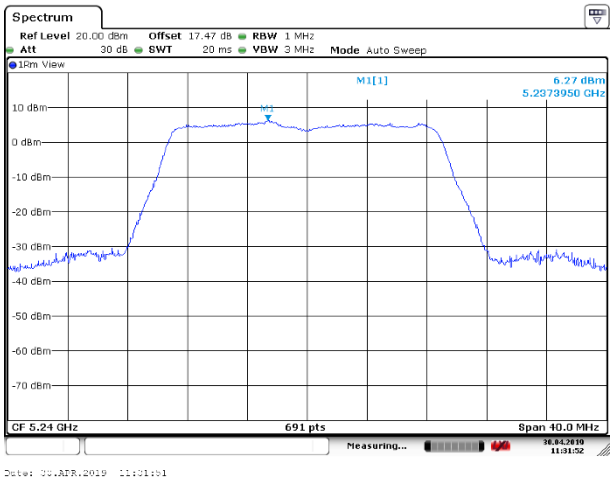
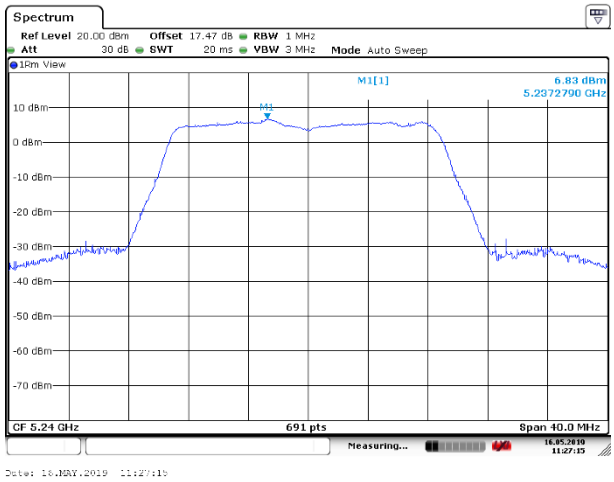
802.11ac VHT20-BF mode: Low Channel

Chain 0	Chain 1
	
Chain 2	**Chain 3**
	

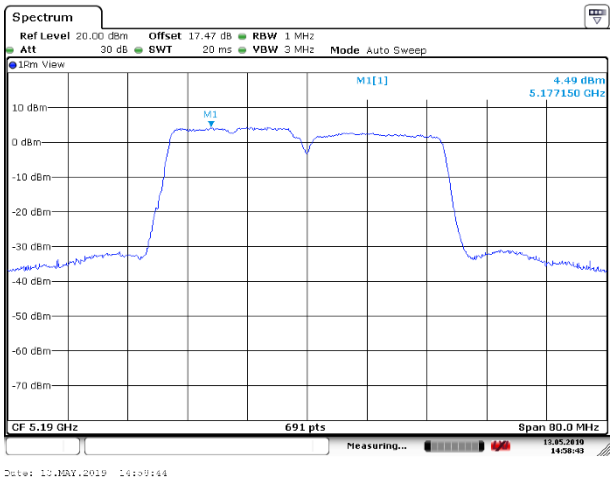
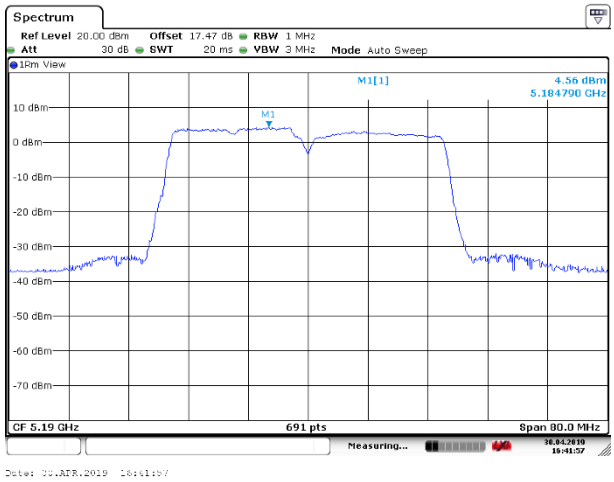
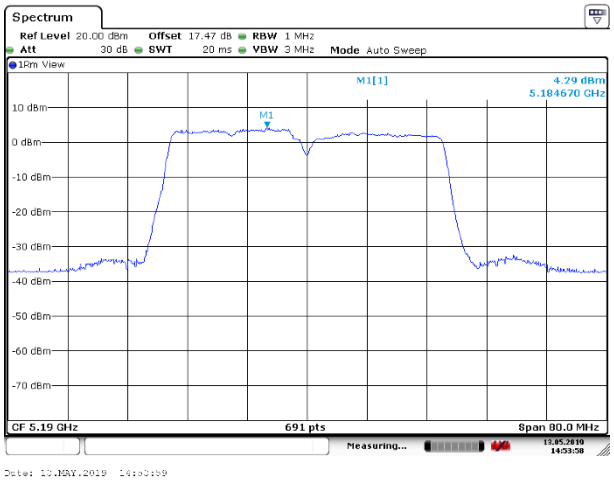
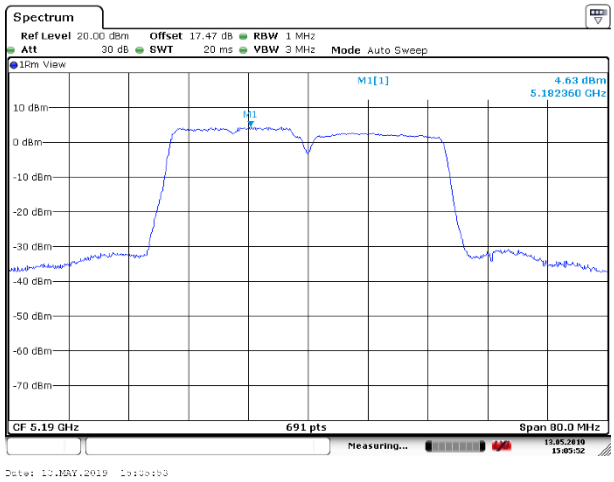
802.11ac VHT20-BF mode: Middle Channel

Chain 0	Chain 1
	
Chain 2	**Chain 3**
	

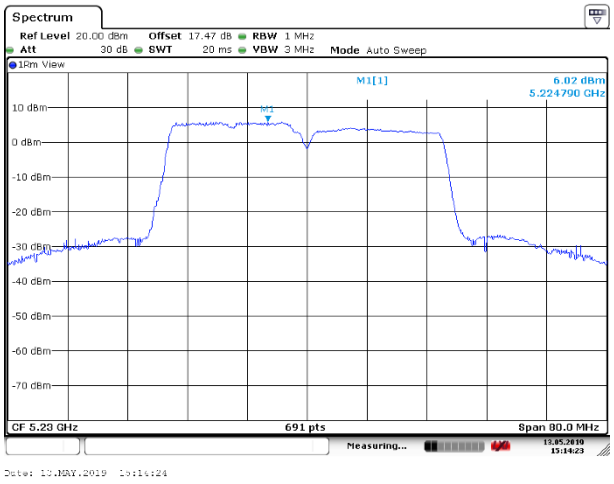
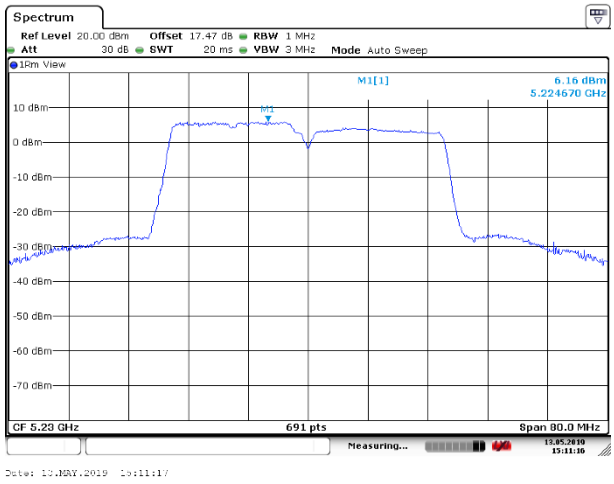
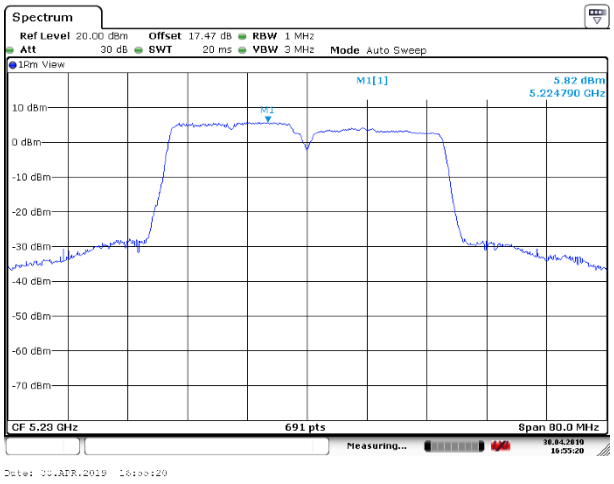
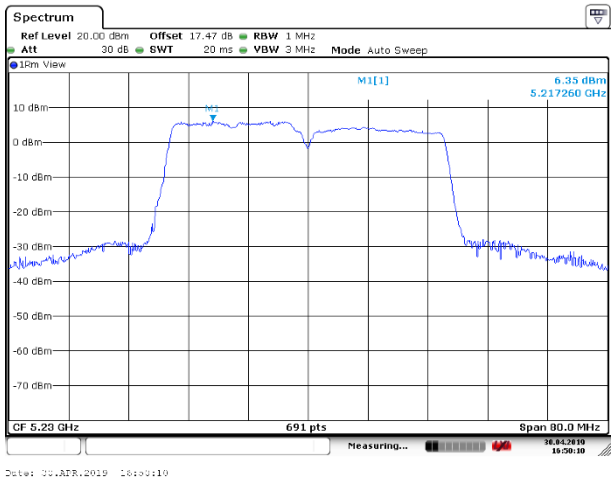
802.11ac VHT20-BF mode: High Channel

Chain 0	Chain 1
	
Chain 2	**Chain 3**
	

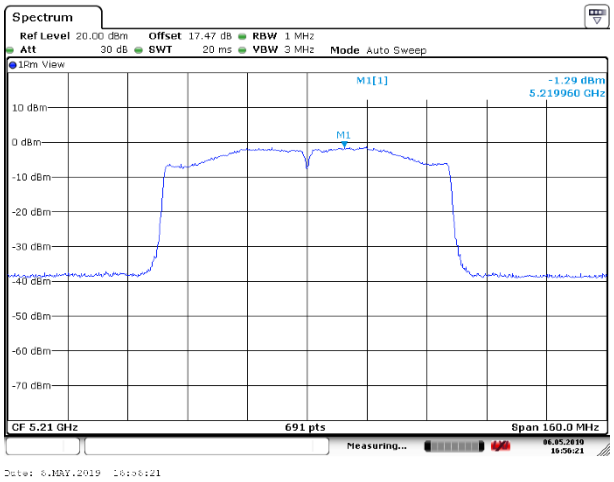
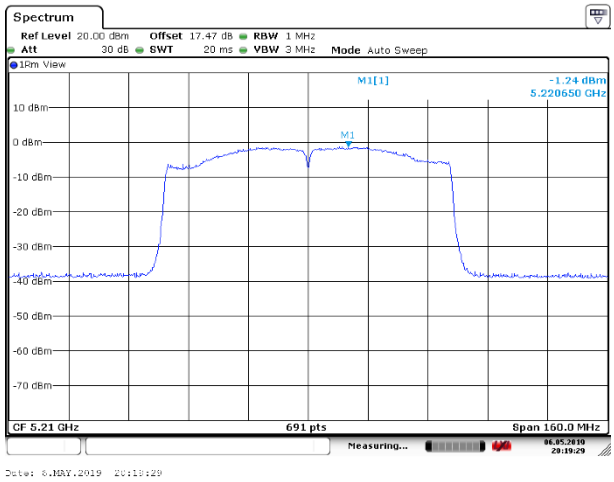
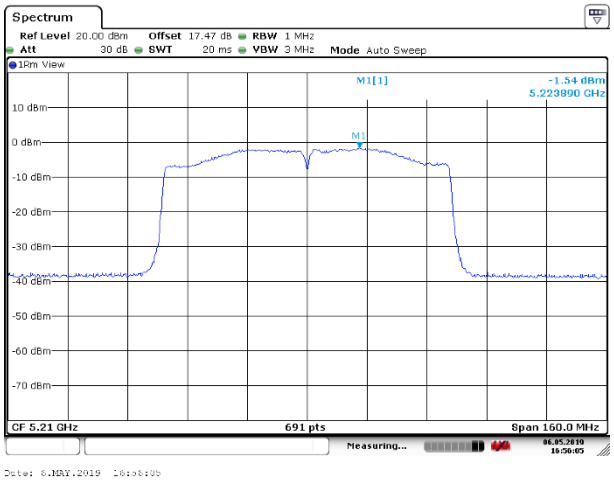
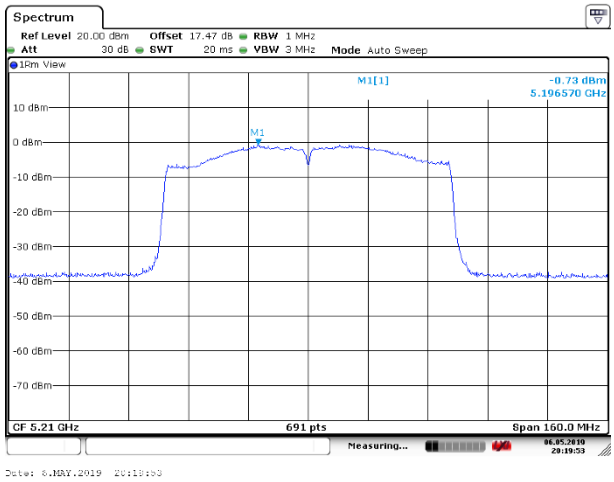
802.11ac VHT40-BF mode: Low Channel

Chain 0	Chain 1
	
Chain 2	**Chain 3**
	

802.11ac VHT40-BF mode: High Channel

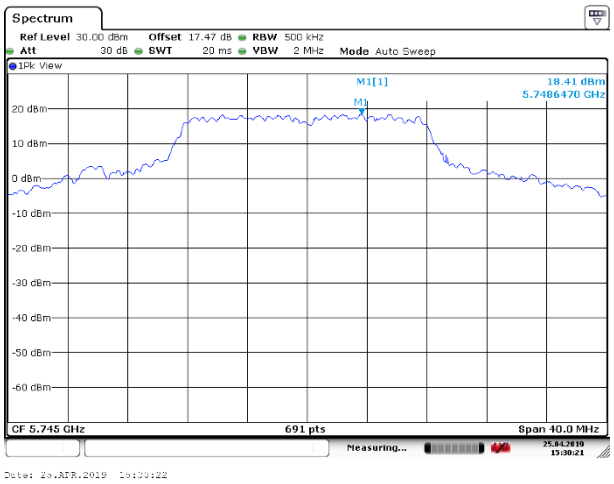
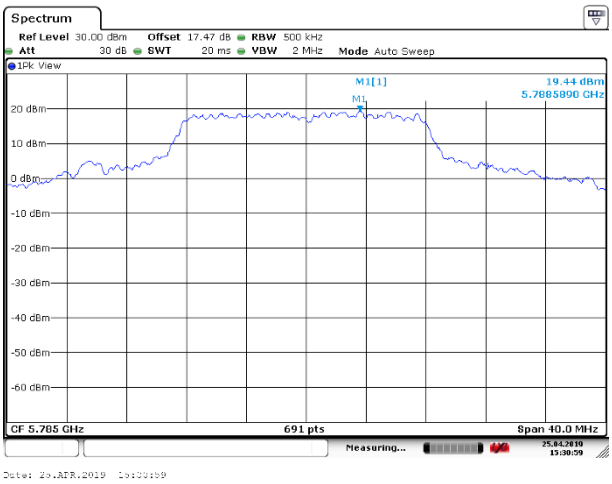
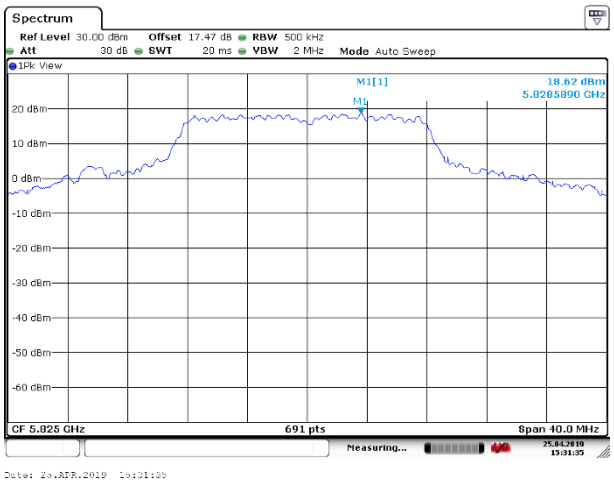
Chain 0	Chain 1
	
Chain 2	**Chain 3**
	

802.11ac VHT80-BF mode

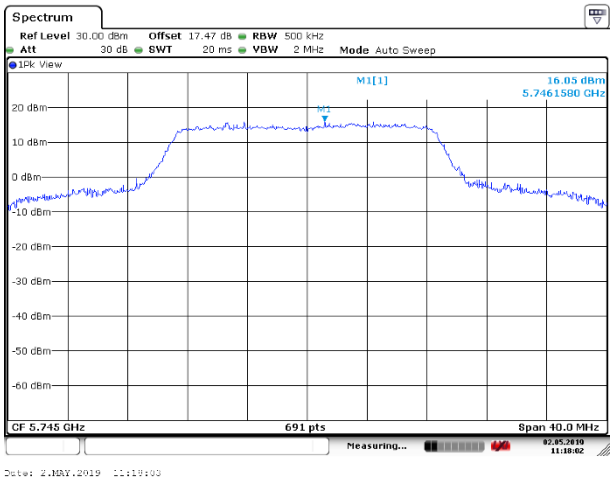
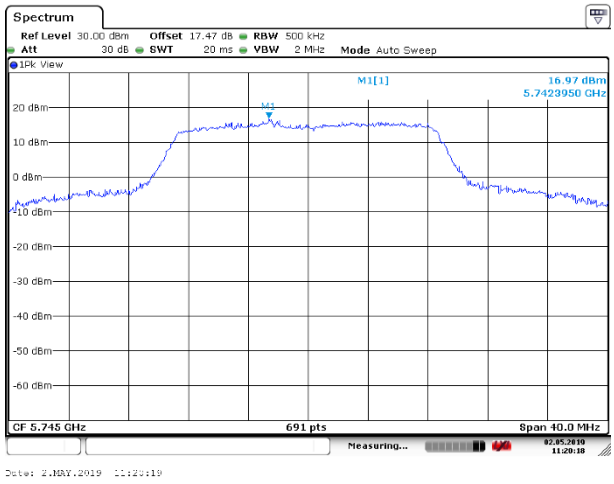
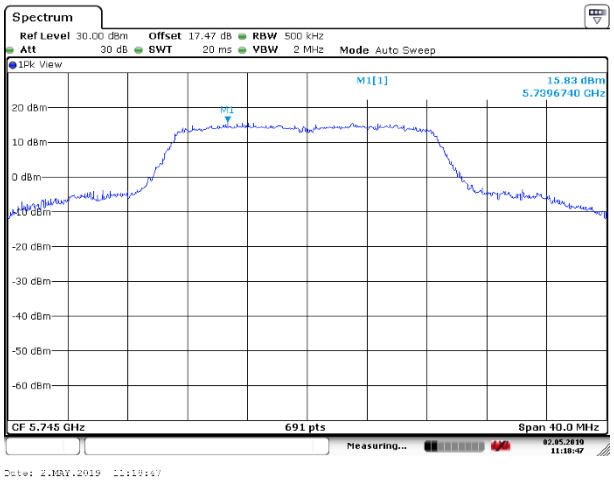
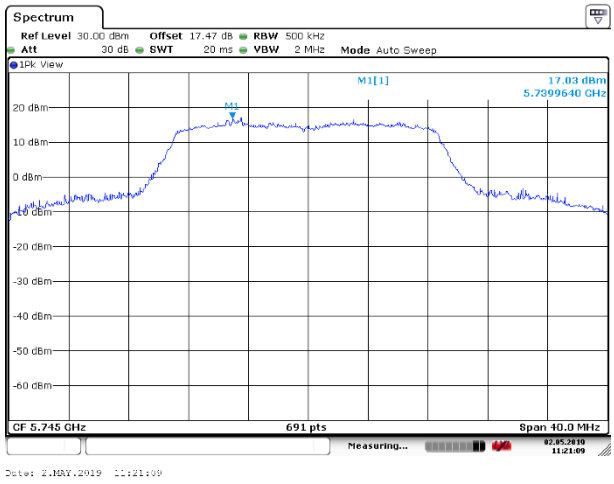
Chain 0	Chain 1
	
Chain 2	**Chain 3**
	

For UNII-3:

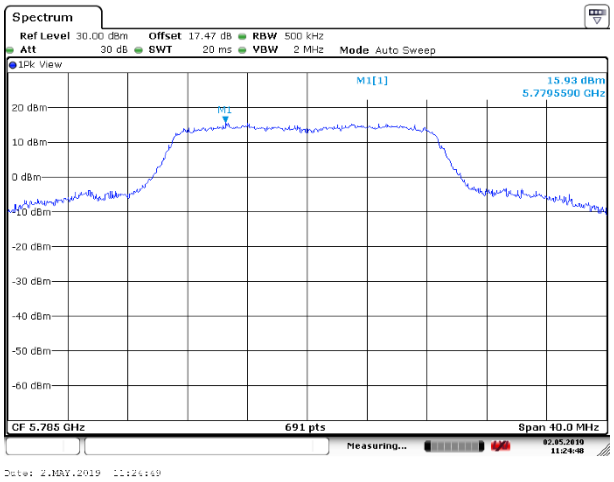
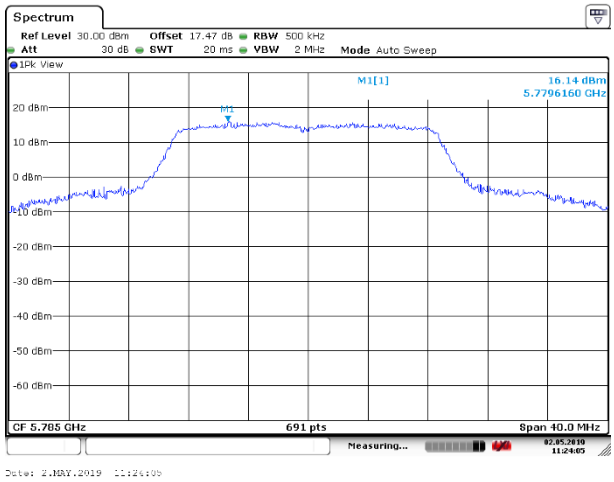
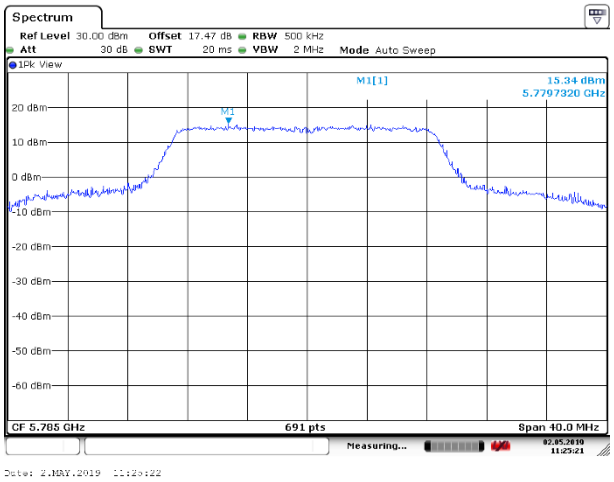
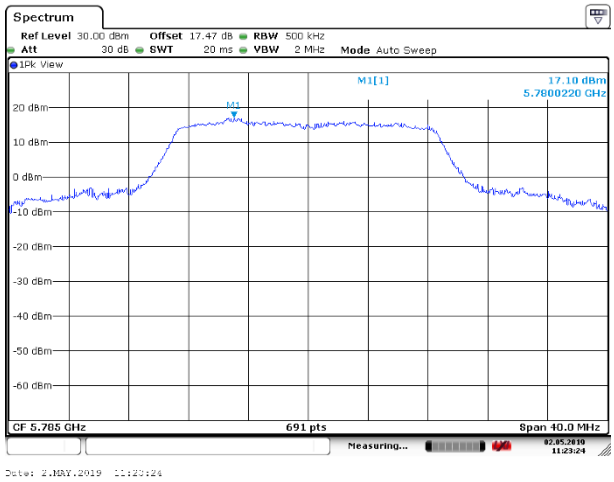
802.11a mode Chain0:

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

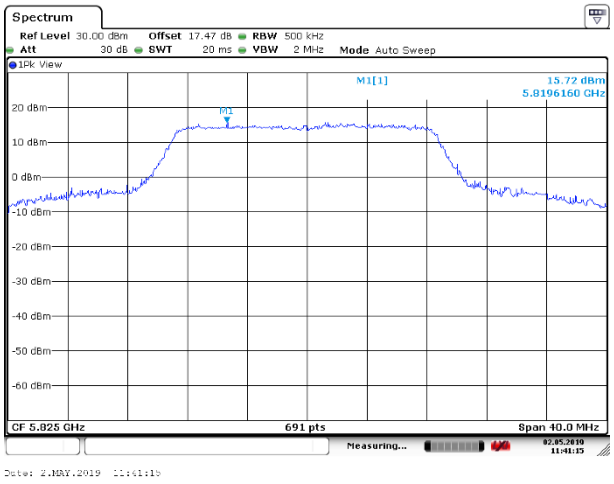
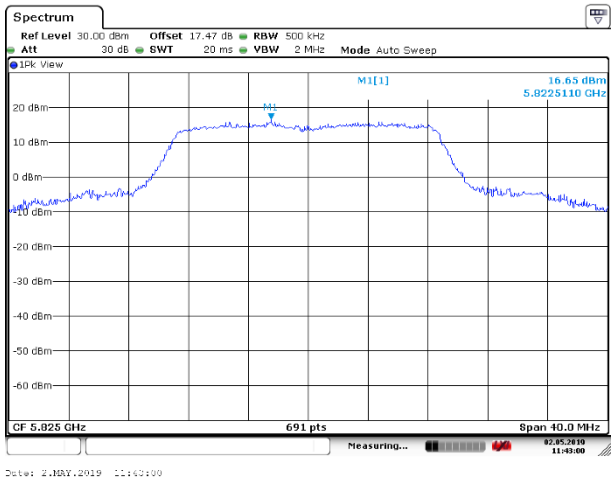
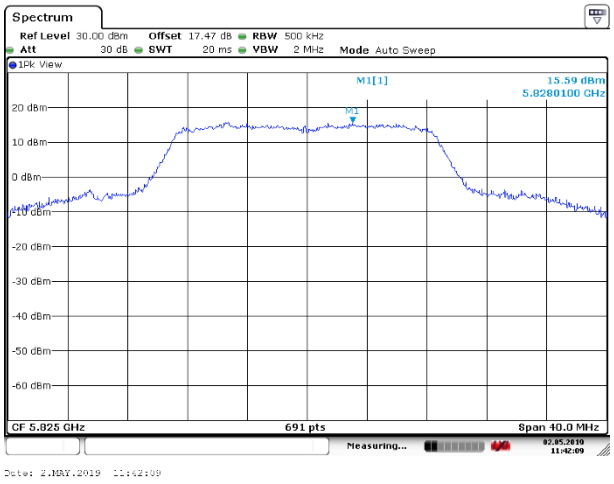
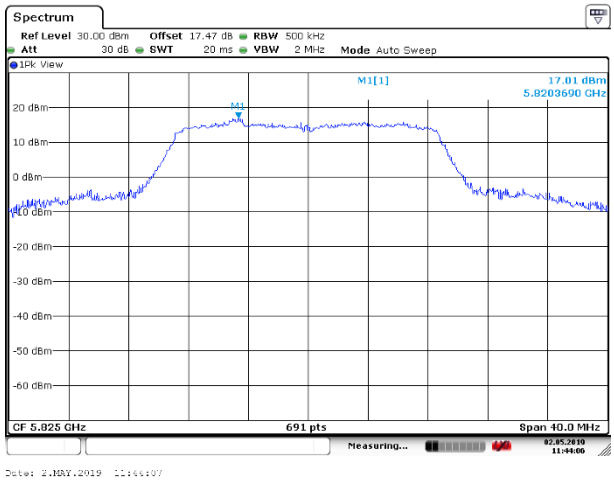
802.11ac VHT20-BF mode: Low Channel

Chain 0	Chain 1
	
Chain 2	**Chain 3**
	

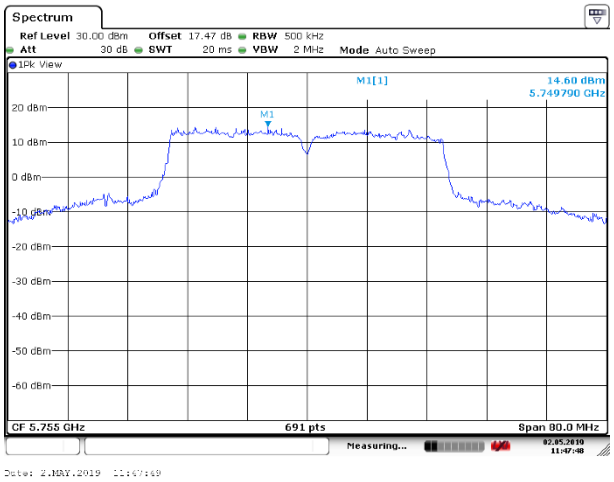
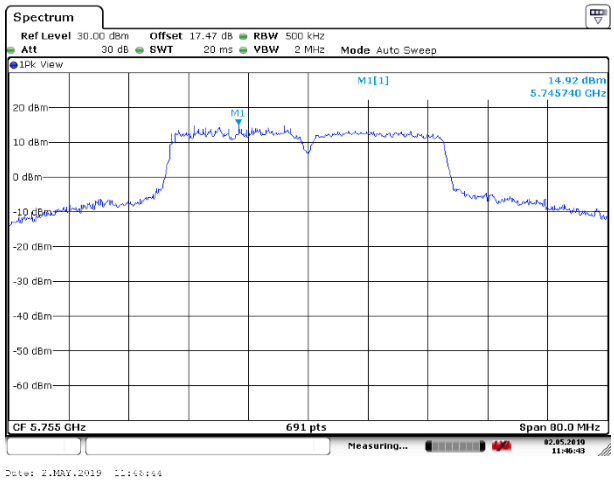
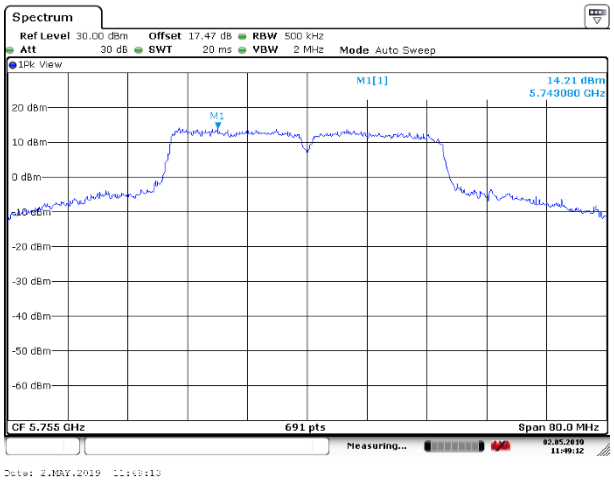
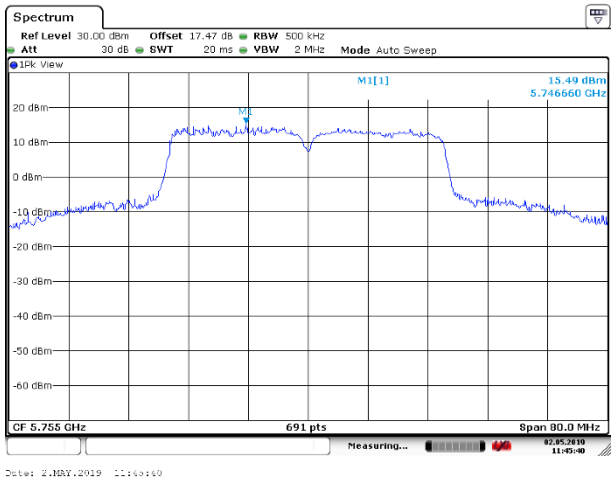
802.11ac VHT20-BF mode: Middle Channel

Chain 0	Chain 1
	
Chain 2	**Chain 3**
	

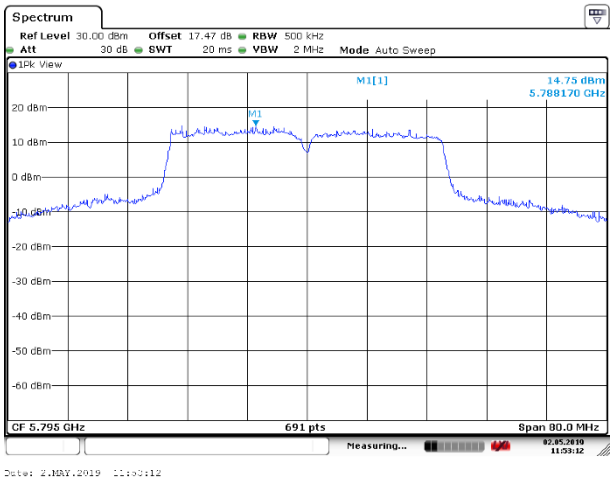
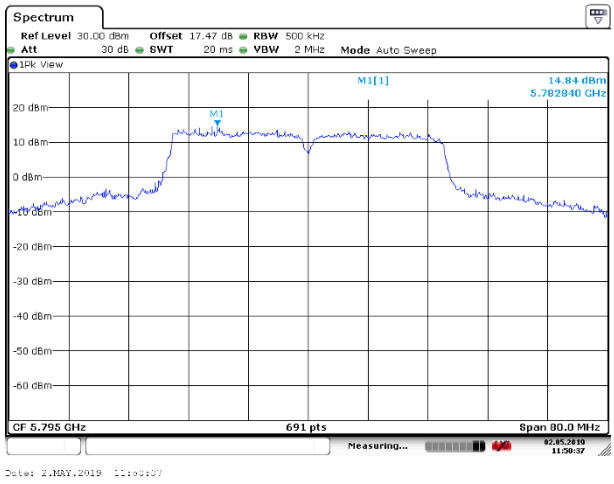
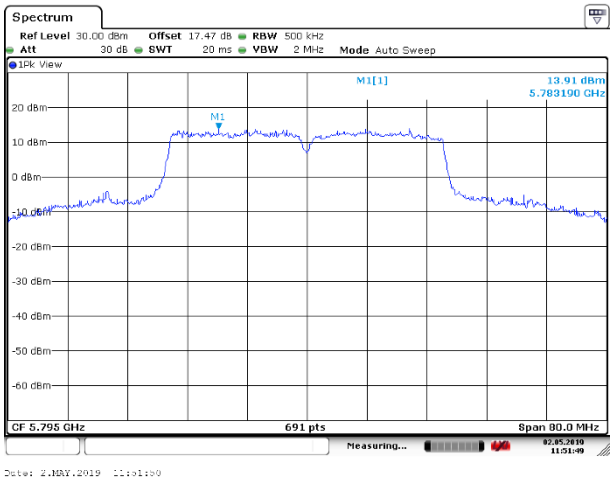
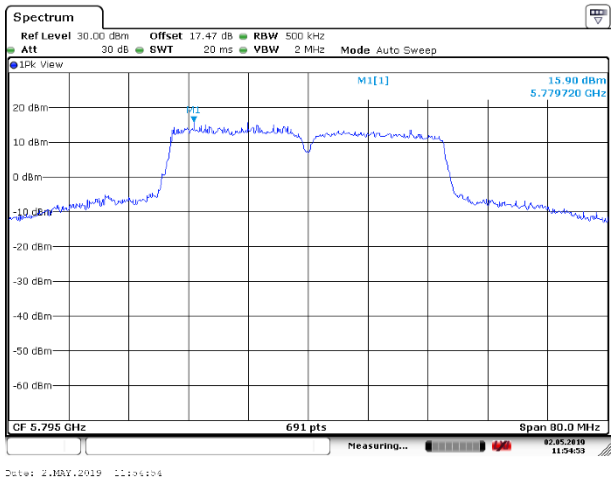
802.11ac VHT20-BF mode: High Channel

Chain 0	Chain 1
	
Chain 2	**Chain 3**
	

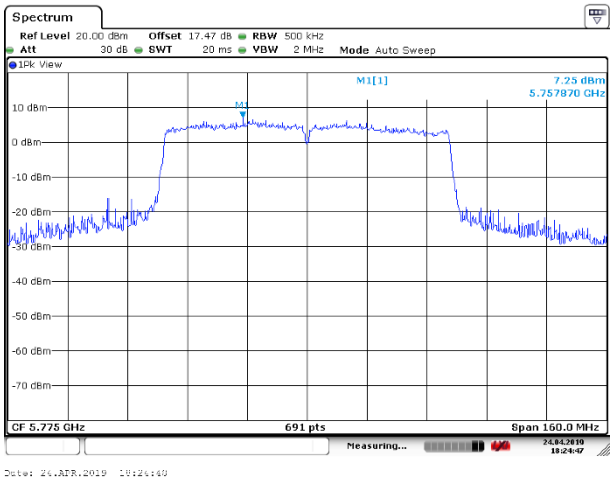
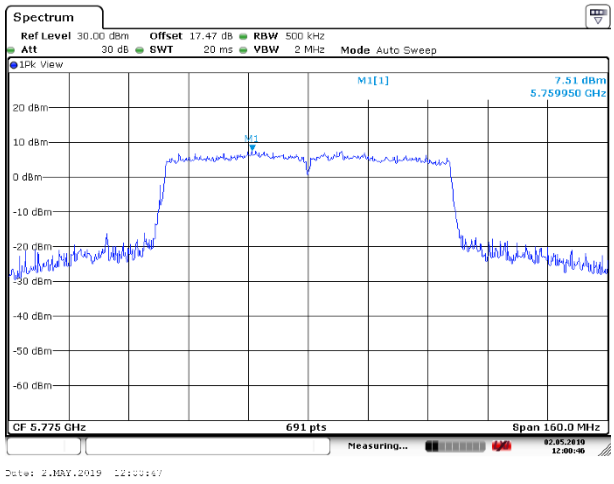
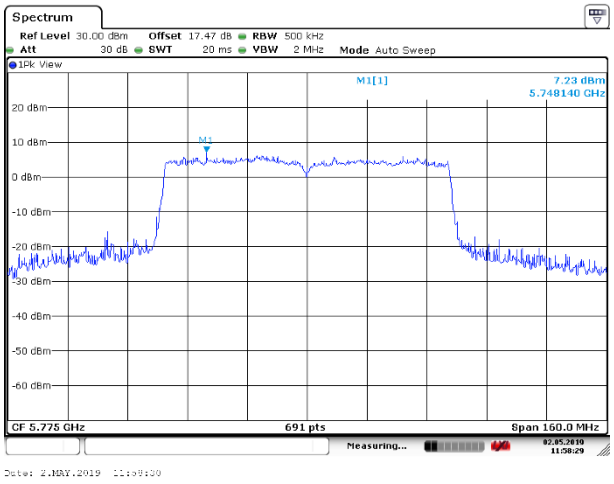
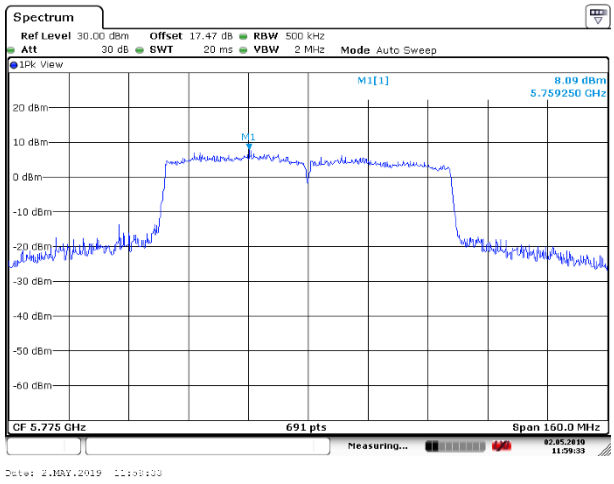
802.11ac VHT40-BF mode: Low Channel

Chain 0	Chain 1
	
Chain 2	**Chain 3**
	

802.11ac VHT40-BF mode: High Channel

Chain 0	Chain 1
	
Chain 2	**Chain 3**
	

802.11ac VHT80-BF mode

Chain 0	Chain 1
	
Chain 2	**Chain 3**
	

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