FCC Part 15.407

TEST REPORT

For

WOM ASIA CO., LTD

4F., NO.86-2, YIWEN 1ST ST., TAOYUAN DIST., TAOYUAN, 33045, TAIWAN (R.O.C.)

FCC ID: 2AXAMWA512GM

Report Type	**Original Report**
Product Name:	**WLAN AP/Router**
Model Name:	**WA512GM-D**
Series Model Name:	**WA512GM-IP67**
Report Number :	**RXZ200708002-00C**
Report Date :	**2020/09/24**
Reviewed By :	**Zeus Chen** Zeus Chen
Prepared By: **Bay Area Compliance Laboratories Corp.(Linkou Laboratory)** **No. 6, Wende 2Rd., Guishan Dist., Taoyuan City 33382, Taiwan (R.O.C.)** **Tel: +886 (3)3961072; Fax: +886 (3) 3961027** **www.bacl.com.tw**	

Revision History

Revision	Report Number	Issue Date	Description
1.0	RXZ200708002-00C	2020/09/24	Original Report

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1 General Information

1.1 Product Description for Equipment under Test (EUT)

Applicant	**WOM ASIA CO., LTD** 4F., NO.86-2, YIWEN 1ST ST., TAOYUAN DIST., TAOYUAN, 33045, TAIWAN (R.O.C.)
Manufacturer	**WOM ASIA CO., LTD** 4F., NO.86-2, YIWEN 1ST ST., TAOYUAN DIST., TAOYUAN, 33045, TAIWAN (R.O.C.)
Brand Name	WoMaster
Product (Equipment)	WLAN AP/Router
Model Name	WA512GM-D
Series Model Name	WA512GM-IP67
Model Discrepancy	1. Different appearance, same PCB 2. WA512GM-D AC,DC input 3. WA512GM-IP67 only AC input
EUT Function	IEEE 802.11 an(HT20/HT40) + ac(VHT20/VHT40/VHT80)
Frequency Range	UNII-1: 5150 MHz - 5250 MHz UNII-3: 5745 MHz - 5850 MHz
Number of Channels	**For UNII-1:** IEEE 802.11a/n HT20/ac VHT20: 4 Channels IEEE 802.11n HT40/ac VHT40: 2 Channels IEEE 802.11ac VHT80: 1 Channels **For UNII-3:** IEEE 802.11a/n HT20/ac VHT20: 5 Channels IEEE 802.11n HT40/ac VHT40: 2 Channels IEEE 802.11ac VHT80: 1 Channels
Output Power	**For UNII-1:** IEEE 802.11a Mode: 16.65 dBm (0.0462 W) IEEE 802.11n HT20 Mode: 16.51 dBm (0.0448 W) IEEE 802.11n HT40 Mode: 16.78 dBm (0.0476 W) IEEE 802.11ac VHT20 Mode: 16.48 dBm (0.0445 W) IEEE 802.11ac VHT40 Mode: 16.73 dBm (0.0471 W) IEEE 802.11ac VHT80 Mode: 11.79 dBm (0.0151 W) **For UNII-3**: IEEE 802.11a Mode: 21.87 dBm (0.1538 W) IEEE 802.11n HT20 Mode: 21.77 dBm (0.1503 W) IEEE 802.11n HT40 Mode: 21.38 dBm (0.1374 W) IEEE 802.11ac VHT20 Mode: 21.74 dBm (0.1493 W) IEEE 802.11ac VHT40 Mode: 21.33 dBm (0.1358 W) IEEE 802.11ac VHT80 Mode: 21.23 dBm (0.1327 W)
Modulation Type	OFDM
Received Date	Jul. 20, 2020
Date of Test	Aug. 29, 2020 ~ Sep. 14, 2020
Related Submittal(s)/Grant(s)	**FCC Part 15.247 DTS with FCC ID: 2AXAMWA512GM**

**All measurement and test data in this report was gathered from production sample serial number: 200708002 (Assigned by BACL, LinKou).*

1.2 Operation Condition of EUT

Power Operation (Voltage Range)	☐ AC 120 V/60 Hz ☐ Adapter ☐ By Power Cord.
	☒ DC Type ☒ DC Power Supply: DC24V ☒ PoE ☐ External from USB Cable ☐ External DC Adapter

1.3 Objective

The Objective of this Test Report was to document the compliance of the WOM ASIA CO., LTD Appliance (Model:WA512GM-D, Series Model: WA512GM-IP67) to the requirements of the following Standards:

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

-KDB 662911 D01 Multiple Transmitter Output v02r01

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

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

1.4 Measurement Uncertainty

Parameter	Expanded Measurement uncertainty
RF output power	± 1.488 dB
Occupied Channel Bandwidth	± 453.927 Hz
RF Conducted Emission test	± 2.77 dB
AC Power Line Conducted Emission	± 2.66 dB
Radiated Below 1G	± 3.57 dB
Radiated Above 1G	± 5.32 dB

The test results with statement of conformity, the decision rules are based on the specifications and standards. The test results will not take the measurement uncertainty into account.

1.5 Test Facility

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

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

Bay Area Compliance Laboratories Corp. (Linkou Laboratory) Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3546) by Mutual Recognition Agreement (MRA). The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database. The FCC Registration No.: 0027578244. Designation No.: TW1119. The Test Firm Registration No.: 311381. ISED#: 25102 and CAB identifier is TW3546

2 System Test Configuration

2.1 Description of Test Configuration

The system was configured for testing in testing mode which was provided by manufacturer.
No special accessory, No modification was made to the EUT and No special equipment used during test.

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

For UNII-1: Channel 36, 40 and 48 were tested. For UNII-3: Channel 149, 157 and 165 were tested.

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

For UNII-1: Channel 38 and 46 were tested. For UNII-3: Channel 151 and 159 were tested.

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

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

Modulation Used for Conformance Test			
Configuration	**N_{TX}**	**Data Rate**	**Worst Data Rate**
802.11a mode	**2**	6-54 Mbps	6 Mbps
802.11n HT20 mode	**2**	MCS 0-32	MCS 0
802.11n HT40 mode	**2**	MCS 0-32	MCS 0
802.11ac VHT20 mode	**2**	MCS 0-10 NSS4	MCS 0
802.11ac VHT40 mode	**2**	MCS 0-10 NSS4	MCS 0
802.11ac VHT80 mode	**2**	MCS 0-10 NSS4	MCS 0

Worst Case of Power Setting					
EUT Exercise Software			QRCT		
Configuration	**N_{TX}**	**UNII Band**	**Low CH**	**Mid CH**	**High CH**
802.11a mode	**2**	**UNII-1**	17	17	17
		UNII-3	25	25	25

Worst Case of Power Setting					
EUT Exercise Software			QRCT		
802.11n HT20 mode	2	UNII-1	17	17	17
		UNII-3	25	25	25
802.11n HT40 mode	2	UNII-1	14	-	17
		UNII-3	25	-	25
802.11ac VHT20 mode	2	UNII-1	17	17	17
		UNII-3	25	25	25
802.11ac VHT40 mode	2	UNII-1	14	-	17
		UNII-3	25	-	25
802.11ac VHT80 mode	2	UNII-1	-	12.5	-
		UNII-3	-	23	-

- The worst-case data rates are determined to be as follows for each mode based upon investigation by measuring the Peak power and PSD across all date rates bandwidths, and modulations. Radiated below 1G were tested worst output power mode.
- The conduction and radiation below 1G test WA512GM-IP67 and WA512GM-D, and WA512GM-D below 1G PoE mode was worst than DC in mode, so the result record PoE mode. And before the pre-scan, above 1G test the worst model WA512GM-IP67. And conducted only test one that because is the same board.
- 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.

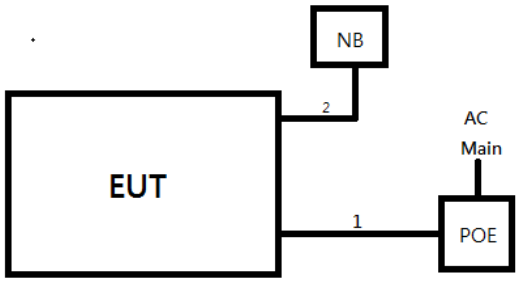
2.2 Support Equipment and External Cable List

No.	Description	Manufacturer	Model Number
A	Notebook	DELL	Latitude E6410
B	PoE	ITE	APoE48V-1G

No.	Description	Manufacturer	Model Number
1	LAN Cable	BACL	1m
2	LAN Cable	BACL	3m

2.3 Block Diagram of Test Setup

Conduction/ Radiation

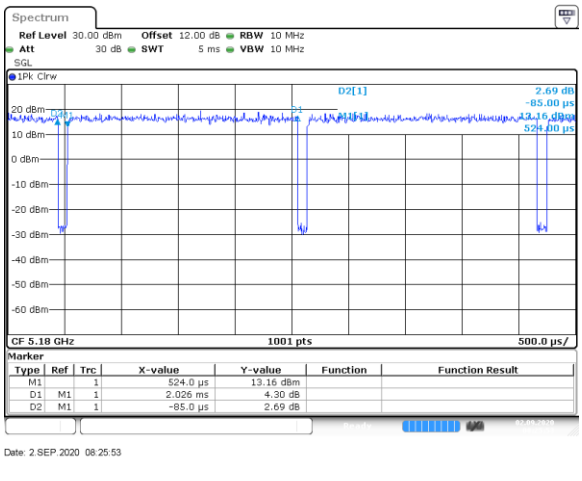
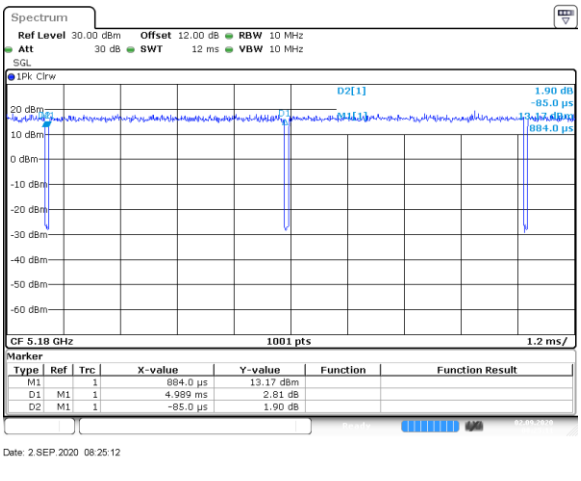


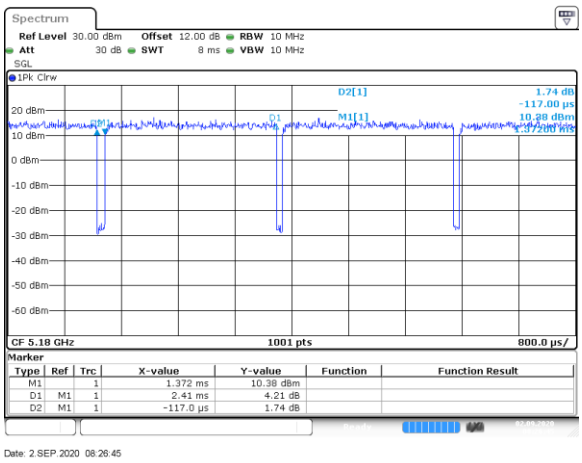
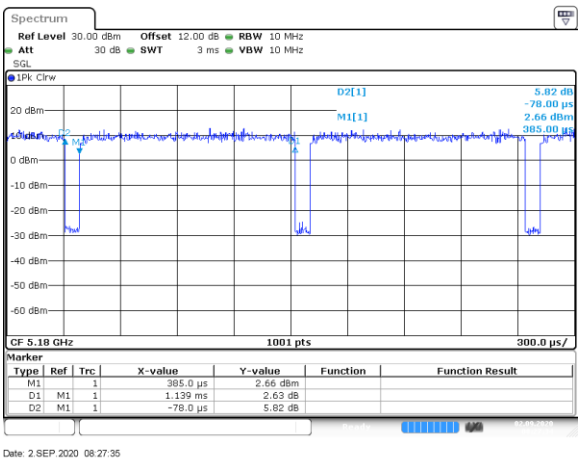
2.4 Duty Cycle

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	2.026	2.111	95.97	0.18
802.11n HT20/ac VHT20	4.989	5.074	98.32	0.07
802.11n HT40/ac VHT40	2.410	2.527	95.37	0.21
802.11ac VHT80	1.139	1.217	93.59	0.29

802.11a	802.11n HT20/ac VHT20
	

802.11n HT40/ac VHT40	802.11ac VHT80
	

2.5 Environmental Conditions and Test Date

Test Site	Test Date	Temperature (°C)	Relative Humidity (%)	Test Engineer
Conduction (Con-01)	Sep. 14, 2020	22.9	60	David Lee
Radiated (966A)	Aug. 29, 2020 ~ Sep. 14, 2020	21.1~23.1	51~54	Boris Kao
Conducted (TH-02)	Sep. 01, 2020	23.4	60	Boris Kao

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	4.35	2.7227	29.00	794.3282	20	0.4305	1.0
UNII-1	5150-5250	8.16	6.5464	17.00	50.1187	20	0.0653	1.0
UNII-3	5745-5850	6.87	4.8641	22.00	158.4893	20	0.1534	1.0

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

$=S_{2.4G}/Slimit_{2.4G} + S_{5G}/Slimit_{5G} = 0.4305 + 0.1534 = 0.5839 < 1.0$

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

5 FCC §15.203 – Antenna Requirements

5.1 Applicable Standard

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

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited.

If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

5.2 Antenna List and Details

Type	Brand	Model	Gain	Note	Result
Dipole	Master Wave	98615PNXX004	8.16 dBi	UNII-1	Compliance
			6.87 dBi	UNII-3	Compliance
Dipole	Cortec	AN2450-5006WRS	3.36 dBi	UNII-1	Compliance
			2.88 dBi	UNII-3	Compliance

Note1: The EUT (WA512GM-D) have two external dedicated antennas arrangement and the connector type is RP-SMA Male, fulfill the requirement of this section.

Note2: The EUT (WA512GM-IP67) have two external dedicated antennas arrangement and the connector type is N Type, and this is professional Installation, fulfill the requirement of this section.

6 FCC §15.207 - AC Line Conducted Emissions

6.1 Applicable Standard

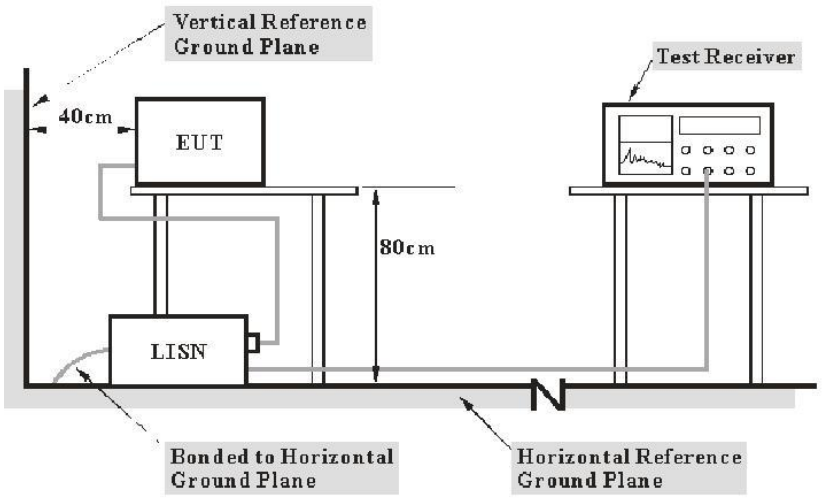
According to FCC §15.207 and §15.407(b)(6),

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

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

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

6.2 EUT Setup and Test Procedure



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

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

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

Frequency Range	Receiver RBW
150 kHz - 30 MHz	9 kHz

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

6.3 Test Equipment List and Details

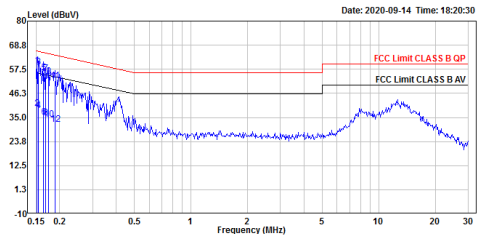
Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conduction Room					
LISN	Rohde & Schwarz	ENV216	100010	2020/09/14	2021/09/13
EMI Test Receiver	Rohde & Schwarz	ESR3	102430	2020/05/07	2021/05/06
RF Cable	EMCI	EMCCFD300-BM-BM-8000	180526	2020/08/07	2021/08/06
Software	Audix	e3 v9	E3LK-03	N.C.R	N.C.R
LISN	Rohde & Schwarz	ENV216	100010	2020/09/14	2021/09/13

***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 Data and Test Plot

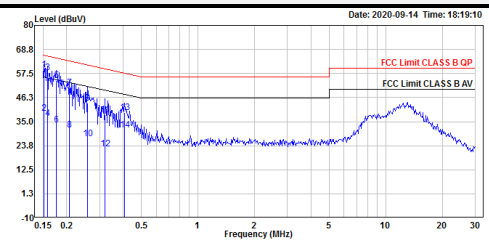
WA512GM-D

Line



	Freq	Read Level	Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	
1	0.151	39.33	59.18	19.85	65.93	-6.75	QP
2	0.151	19.47	39.32	19.85	55.93	-16.61	Average
3	0.154	38.87	58.72	19.85	65.80	-7.08	QP
4	0.154	18.39	38.24	19.85	55.80	-17.56	Average
5	0.164	36.12	55.97	19.85	65.27	-9.30	QP
6	0.164	15.25	35.10	19.85	55.27	-20.17	Average
7	0.169	35.60	55.45	19.85	65.01	-9.56	QP
8	0.169	14.88	34.73	19.85	55.01	-20.28	Average
9	0.175	34.48	54.33	19.85	64.74	-10.41	QP
10	0.175	14.38	34.23	19.85	54.74	-20.51	Average
11	0.189	32.30	52.16	19.86	64.08	-11.92	QP
12	0.189	11.78	31.64	19.86	54.08	-22.44	Average

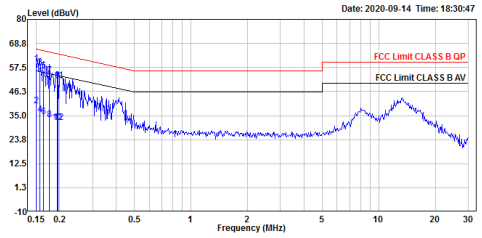
Neutral



	Freq	Read Level	Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	
1	0.151	39.43	59.29	19.86	65.93	-6.64	QP
2	0.151	19.21	39.07	19.86	55.93	-16.86	Average
3	0.159	37.99	57.85	19.86	65.54	-7.69	QP
4	0.159	16.51	36.37	19.86	55.54	-19.17	Average
5	0.176	34.48	54.34	19.86	64.68	-10.34	QP
6	0.176	13.77	33.63	19.86	54.68	-21.05	Average
7	0.206	30.97	50.84	19.87	63.35	-12.51	QP
8	0.206	11.13	31.00	19.87	53.35	-22.35	Average
9	0.258	23.77	43.64	19.87	61.50	-17.86	QP
10	0.258	7.05	26.92	19.87	51.50	-24.58	Average
11	0.320	18.26	38.13	19.87	59.71	-21.58	QP
12	0.320	2.48	22.35	19.87	49.71	-27.36	Average
13	0.406	19.49	39.36	19.87	57.73	-18.37	QP
14	0.406	11.30	31.17	19.87	47.73	-16.56	Average

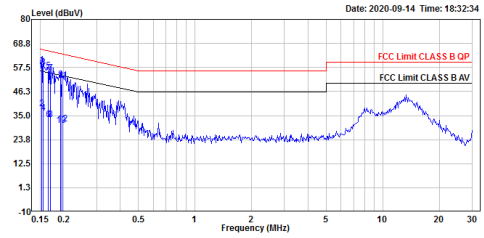
WA512GM-IP67

Line



	Freq	Read Level	Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	
1	0.150	39.41	59.26	19.85	66.00	-6.74	QP
2	0.150	19.71	39.56	19.85	56.00	-16.44	Average
3	0.157	37.88	57.73	19.85	65.60	-7.87	QP
4	0.157	15.70	35.55	19.85	55.60	-20.05	Average
5	0.164	35.92	55.77	19.85	65.27	-9.50	QP
6	0.164	14.59	34.44	19.85	55.27	-20.83	Average
7	0.176	34.14	53.99	19.85	64.68	-10.69	QP
8	0.176	13.44	33.29	19.85	54.68	-21.39	Average
9	0.194	31.45	51.31	19.86	63.88	-12.57	QP
10	0.194	11.88	31.74	19.86	53.88	-22.14	Average
11	0.197	31.67	51.53	19.86	63.75	-12.22	QP
12	0.197	11.87	31.73	19.86	53.75	-22.02	Average

Neutral



	Freq	Read Level	Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	
1	0.152	38.70	58.56	19.86	65.87	-7.31	QP
2	0.152	18.42	38.28	19.86	55.87	-17.59	Average
3	0.156	37.73	57.59	19.86	65.67	-8.08	QP
4	0.156	16.37	36.23	19.86	55.67	-19.44	Average
5	0.165	36.03	55.89	19.86	65.21	-9.32	QP
6	0.165	13.11	32.97	19.86	55.21	-22.24	Average
7	0.170	34.96	54.82	19.86	64.94	-10.12	QP
8	0.170	13.38	33.24	19.86	54.94	-21.70	Average
9	0.192	31.89	51.76	19.87	63.95	-12.19	QP
10	0.192	10.54	30.41	19.87	53.95	-23.54	Average
11	0.197	31.66	51.53	19.87	63.75	-12.22	QP
12	0.197	11.08	30.95	19.87	53.75	-22.80	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:

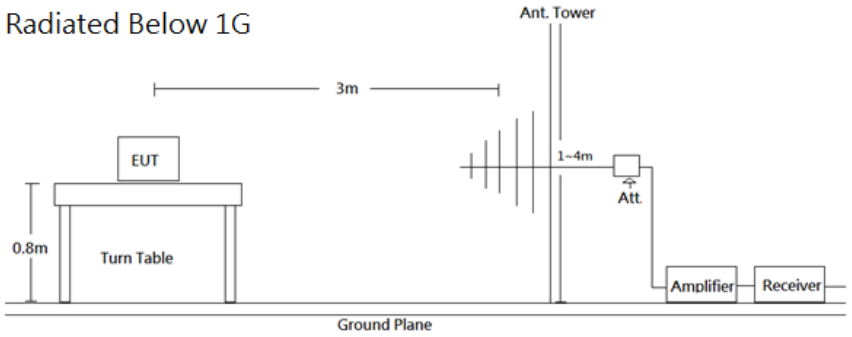
MHz	MHz	MHz	GHz
0.090-0.110	13.36-13.41	399.9-410	4.5-5.15
0.495-0.505	16.42-16.423	608-614	5.35-5.46
2.1735-2.1905	16.69475-16.69525	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	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

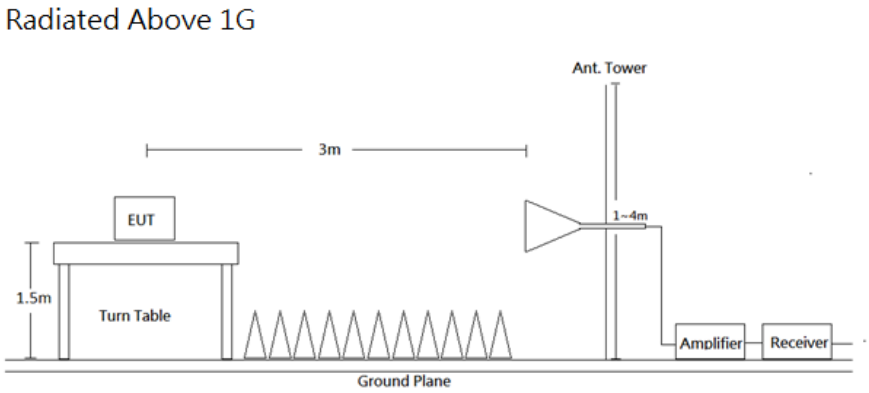
As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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.
Radiation 3M Room (966A)					
Active Loop	EMCO	6502	0001-3322	2020/03/16	2021/03/15
Bilog Antenna/6 dB Attenuator	SUNOL SCIENCES & EMEC /EMCI	JB3/N-6-06	A111513 & AT-N0668	2020/03/19	2021/03/18
Horn Antenna	ETS-Lindgren	3115	2058	2020/03/24	2021/03/23
Horn Antenna	ETS-Lindgren	3160-09	00123852	2020/07/07	2021/07/06
Horn Antenna	ETS-Lindgren	3160-10	00123855	2020/07/07	2021/07/06
Preamplifier	A.H. Systems	PAM-0118P	470	2020/03/16	2021/03/15
Preamplifier	A.H. Systems	PAM-1840VH	174	2020/03/25	2021/03/24
Signal Analyzer 40GHZ	Rohde & Schwarz	FSV40-N	101456	2020/06/03	2021/06/02
Microflex Cable (1m)	EMCI	EMC102-KM-KM-1000	180524	2020/08/06	2021/08/05
Microflex Cable (2m)	EMCI	EMC106-SM-SM-2000	180516	2020/08/06	2021/08/05
Microflex Cable (8m)	UTIFLEX	UFA210A-1-3149-300300	MFR 64639 232490-002	2020/08/06	2021/08/05
Turn Table	Chaintek	T-200-S-1	003502	N.C.R	N.C.R
Antenna Tower	Chaintek	MBD-400-1	003505	N.C.R	N.C.R
Controller	Chaintek	3000-1	003508	N.C.R	N.C.R
Software	Audix	e3 v9	E3LK-02	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 Data and Test Plot

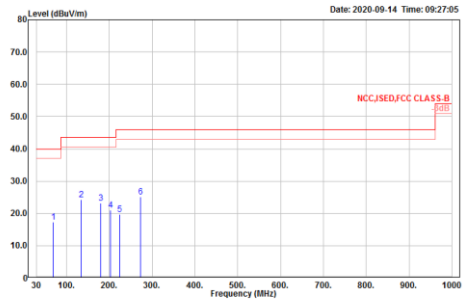
Wi-Fi 5G Mode:

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

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

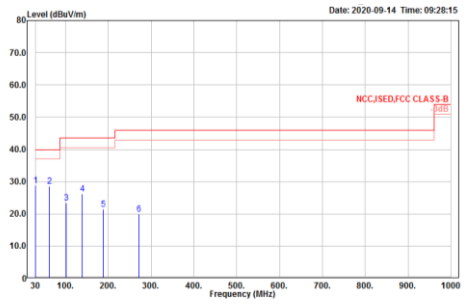
WA512GM-D

Horizontal



	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
1	68.880	17.43	40.00	-22.57	41.73	-24.30	Peak
2	133.790	24.25	43.50	-19.25	43.79	-19.54	Peak
3	179.380	23.28	43.50	-20.22	45.51	-22.23	Peak
4	203.630	21.07	43.50	-22.43	42.37	-21.30	Peak
5	224.000	19.65	46.00	-26.35	41.92	-22.27	Peak
6	272.500	25.15	46.00	-20.85	45.54	-20.39	Peak

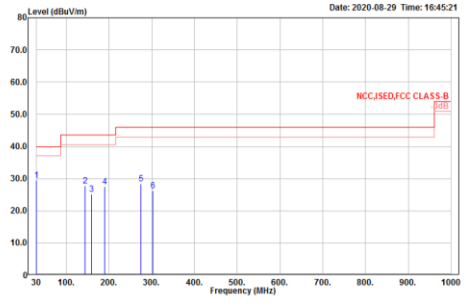
Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
1	30.000	28.84	40.00	-11.16	37.60	-8.76	Peak
2	62.980	28.70	40.00	-11.30	53.07	-24.37	Peak
3	101.780	23.35	43.50	-20.15	45.53	-22.18	Peak
4	139.610	26.18	43.50	-17.32	46.13	-19.95	Peak
5	188.110	21.46	43.50	-22.04	43.80	-22.34	Peak
6	271.530	20.05	46.00	-25.95	40.47	-20.42	Peak

WA512GM-IP67

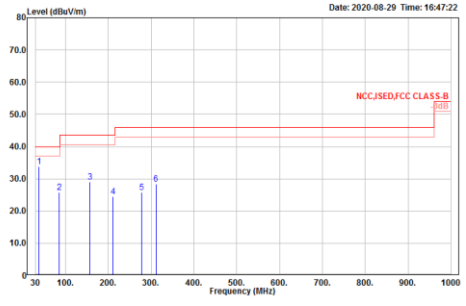
Horizontal



al

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
1	30.000	29.49	40.00	-10.51	38.25	-8.76	Peak
2	144.460	27.66	43.50	-15.84	47.88	-20.22	Peak
3	159.010	25.19	43.50	-18.31	45.98	-20.79	Peak
4	190.050	27.57	43.50	-15.93	49.92	-22.35	Peak
5	274.440	28.39	46.00	-17.61	48.76	-20.37	Peak
6	301.600	26.16	46.00	-19.84	46.49	-20.33	Peak

Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
1	37.760	33.71	40.00	-6.29	48.74	-15.03	Peak
2	85.290	25.88	40.00	-14.12	50.91	-25.03	Peak
3	158.040	29.12	43.50	-14.38	49.89	-20.77	Peak
4	210.420	24.59	43.50	-18.91	47.25	-22.66	Peak
5	278.320	25.70	46.00	-20.30	46.01	-20.31	Peak
6	311.300	28.32	46.00	-17.68	48.41	-20.09	Peak

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:

Before the pre-scan, test the worst model WA512GM-IP67

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	
5124.250	40.15	54.00	-13.85	42.05	-1.90	Average
5124.250	51.98	74.00	-22.02	53.88	-1.90	Peak
5183.050	84.64			86.44	-1.80	Average
5183.050	93.41			95.21	-1.80	Peak
10360.000	46.28	68.20	-21.92	39.72	6.56	Peak
15540.000	39.35	54.00	-14.65	29.73	9.62	Average
15540.000	49.25	74.00	-24.75	39.63	9.62	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5146.000	43.56	54.00	-10.44	45.42	-1.86	Average
5146.000	56.78	74.00	-17.22	58.64	-1.86	Peak
5175.700	101.60			103.41	-1.81	Average
5175.700	110.98			112.79	-1.81	Peak
10360.000	46.08	68.20	-22.12	39.52	6.56	Peak
15540.000	39.24	54.00	-14.76	29.62	9.62	Average
15540.000	49.91	74.00	-24.09	40.29	9.62	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5150.000	40.10	54.00	-13.90	41.95	-1.85	Average
5150.000	51.83	68.20	-16.37	53.68	-1.85	Peak
5195.200	85.49			87.28	-1.79	Average
5195.200	94.32			96.11	-1.79	Peak
5416.800	40.43	54.00	-13.57	41.86	-1.43	Average
5416.800	51.93	74.00	-22.07	53.36	-1.43	Peak
10400.000	45.58	68.20	-22.62	38.97	6.61	Peak
15600.000	39.24	54.00	-14.76	29.61	9.63	Average
15600.000	51.37	74.00	-22.63	41.74	9.63	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5132.000	41.40	54.00	-12.60	43.29	-1.89	Average
5132.000	52.59	74.00	-21.41	54.48	-1.89	Peak
5205.600	101.33			103.10	-1.77	Average
5205.600	110.26			112.03	-1.77	Peak
5380.400	41.63	54.00	-12.37	43.12	-1.49	Average
5380.400	52.91	74.00	-21.09	54.40	-1.49	Peak
10400.000	45.16	68.20	-23.04	38.55	6.61	Peak
15600.000	39.41	54.00	-14.59	29.78	9.63	Average
15600.000	51.91	74.00	-22.09	42.28	9.63	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5070.000	39.95	54.00	-14.05	41.94	-1.99	Average
5070.000	53.15	74.00	-20.85	55.14	-1.99	Peak
5244.400	85.26			86.97	-1.71	Average
5244.400	94.26			95.97	-1.71	Peak
5438.000	40.51	54.00	-13.49	41.91	-1.40	Average
5438.000	52.39	74.00	-21.61	53.79	-1.40	Peak
10480.000	46.33	68.20	-21.87	39.58	6.75	Peak
15720.000	39.22	54.00	-14.78	29.64	9.58	Average
15720.000	53.13	74.00	-20.87	43.55	9.58	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5144.800	40.98	54.00	-13.02	42.85	-1.87	Average
5144.800	52.26	74.00	-21.74	54.13	-1.87	Peak
5244.800	101.10			102.81	-1.71	Average
5244.800	109.99			111.70	-1.71	Peak
5424.400	41.90	54.00	-12.10	43.31	-1.41	Average
5424.400	52.80	74.00	-21.20	54.21	-1.41	Peak
10480.000	45.53	68.20	-22.67	38.78	6.75	Peak
15720.000	39.42	54.00	-14.58	29.84	9.58	Average
15720.000	53.40	74.00	-20.60	43.82	9.58	Peak

802.11ac VHT20 mode:

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5149.000	40.02	54.00	-13.98	41.87	-1.85	Average
5149.000	52.01	74.00	-21.99	53.86	-1.85	Peak
5176.900	84.49			86.30	-1.81	Average
5176.900	93.80			95.61	-1.81	Peak
10360.000	45.61	68.20	-22.59	39.05	6.56	Peak
15540.000	39.24	54.00	-14.76	29.62	9.62	Average
15540.000	50.36	74.00	-23.64	40.74	9.62	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5149.900	43.74	54.00	-10.26	45.59	-1.85	Average
5149.900	55.95	74.00	-18.05	57.80	-1.85	Peak
5183.050	101.29			103.09	-1.80	Average
5183.050	110.35			112.15	-1.80	Peak
10360.000	45.05	68.20	-23.15	38.49	6.56	Peak
15540.000	39.39	54.00	-14.61	29.77	9.62	Average
15540.000	49.38	74.00	-24.62	39.76	9.62	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5150.000	40.05	54.00	-13.95	41.90	-1.85	Average
5150.000	51.61	68.20	-16.59	53.46	-1.85	Peak
5198.800	85.27			87.05	-1.78	Average
5198.800	94.22			96.00	-1.78	Peak
5383.200	40.40	54.00	-13.60	41.89	-1.49	Average
5383.200	52.41	74.00	-21.59	53.90	-1.49	Peak
10400.000	45.46	68.20	-22.74	38.85	6.61	Peak
15600.000	39.29	54.00	-14.71	29.66	9.63	Average
15600.000	51.44	74.00	-22.56	41.81	9.63	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5143.600	41.61	54.00	-12.39	43.48	-1.87	Average
5143.600	53.23	74.00	-20.77	55.10	-1.87	Peak
5201.200	101.27			103.05	-1.78	Average
5201.200	110.47			112.25	-1.78	Peak
5426.400	41.62	54.00	-12.38	43.03	-1.41	Average
5426.400	52.60	74.00	-21.40	54.01	-1.41	Peak
10400.000	46.30	68.20	-21.90	39.69	6.61	Peak
15600.000	39.35	54.00	-14.65	29.72	9.63	Average
15600.000	52.04	74.00	-21.96	42.41	9.63	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5113.600	40.05	54.00	-13.95	41.96	-1.91	Average
5113.600	52.14	74.00	-21.86	54.05	-1.91	Peak
5243.600	84.50			86.21	-1.71	Average
5243.600	93.52			95.23	-1.71	Peak
5410.800	40.45	54.00	-13.55	41.90	-1.45	Average
5410.800	52.18	74.00	-21.82	53.63	-1.45	Peak
10480.000	45.69	68.20	-22.51	38.94	6.75	Peak
15720.000	39.46	54.00	-14.54	29.88	9.58	Average
15720.000	52.44	74.00	-21.56	42.86	9.58	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5068.400	40.74	54.00	-13.26	42.73	-1.99	Average
5068.400	52.19	74.00	-21.81	54.18	-1.99	Peak
5241.200	100.76			102.48	-1.72	Average
5241.200	109.34			111.06	-1.72	Peak
5449.600	41.60	54.00	-12.40	42.98	-1.38	Average
5449.600	52.87	74.00	-21.13	54.25	-1.38	Peak
10480.000	46.01	68.20	-22.19	39.26	6.75	Peak
15720.000	39.41	54.00	-14.59	29.83	9.58	Average
15720.000	52.80	74.00	-21.20	43.22	9.58	Peak

802.11ac VHT40 mode:

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5149.360	40.97	54.00	-13.03	42.82	-1.85	Average
5149.360	52.42	74.00	-21.58	54.27	-1.85	Peak
5193.200	79.67			81.46	-1.79	Average
5193.200	87.94			89.73	-1.79	Peak
10380.000	45.24	68.20	-22.96	38.65	6.59	Peak
15570.000	39.40	54.00	-14.60	29.79	9.61	Average
15570.000	51.58	74.00	-22.42	41.97	9.61	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5149.680	52.95	54.00	-1.05	54.80	-1.85	Average
5149.680	68.48	74.00	-5.52	70.33	-1.85	Peak
5192.400	96.15			97.94	-1.79	Average
5192.400	104.76			106.55	-1.79	Peak
10380.000	46.34	68.20	-21.86	39.75	6.59	Peak
15570.000	39.53	54.00	-14.47	29.92	9.61	Average
15570.000	53.04	74.00	-20.96	43.43	9.61	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5071.200	39.96	54.00	-14.04	41.94	-1.98	Average
5071.200	52.55	74.00	-21.45	54.53	-1.98	Peak
5227.200	83.35			85.10	-1.75	Average
5227.200	91.98			93.73	-1.75	Peak
5420.400	40.45	54.00	-13.55	41.88	-1.43	Average
5420.400	51.95	74.00	-22.05	53.38	-1.43	Peak
10460.000	45.74	68.20	-22.46	39.05	6.69	Peak
15690.000	39.21	54.00	-14.79	29.63	9.58	Average
15690.000	52.70	74.00	-21.30	43.12	9.58	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5149.600	42.34	54.00	-11.66	44.19	-1.85	Average
5149.600	54.45	74.00	-19.55	56.30	-1.85	Peak
5233.200	98.60			100.34	-1.74	Average
5233.200	106.99			108.73	-1.74	Peak
5440.800	41.60	54.00	-12.40	43.00	-1.40	Average
5440.800	52.59	74.00	-21.41	53.99	-1.40	Peak
10460.000	45.88	68.20	-22.32	39.19	6.69	Peak
15690.000	39.19	54.00	-14.81	29.61	9.58	Average
15690.000	53.30	74.00	-20.70	43.72	9.58	Peak

802.11ac VHT80 mode:

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5091.000	40.92	54.00	-13.08	42.87	-1.95	Average
5091.000	52.31	74.00	-21.69	54.26	-1.95	Peak
5229.600	75.00			76.74	-1.74	Average
5229.600	84.07			85.81	-1.74	Peak
10420.000	44.84	68.20	-23.36	38.22	6.62	Peak
15630.000	39.37	54.00	-14.63	29.71	9.66	Average
15630.000	52.05	74.00	-21.95	42.39	9.66	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5149.400	52.80	54.00	-1.20	54.65	-1.85	Average
5149.400	64.76	74.00	-9.24	66.61	-1.85	Peak
5173.800	90.88			92.69	-1.81	Average
5173.800	99.55			101.36	-1.81	Peak
10420.000	45.92	68.20	-22.28	39.30	6.62	Peak
15630.000	39.22	54.00	-14.78	29.56	9.66	Average
15630.000	51.50	74.00	-22.50	41.84	9.66	Peak

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

Before the pre-scan, test the worst model WA512GM-IP67

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	
5628.360	52.04	68.20	-16.16	53.12	-1.08	Peak
5691.360	52.57	98.83	-46.26	53.55	-0.98	Peak
5720.160	63.87	111.17	-47.30	64.80	-0.93	Peak
5739.600	95.38			96.27	-0.89	Peak
5874.240	53.59	105.41	-51.82	54.27	-0.68	Peak
5886.120	53.52	96.94	-43.42	54.19	-0.67	Peak
5932.920	53.65	68.20	-14.55	54.25	-0.60	Peak
11490.000	36.20	54.00	-17.80	28.77	7.43	Average
11490.000	47.77	74.00	-26.23	40.34	7.43	Peak
17235.000	53.92	68.20	-14.28	39.04	14.88	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5639.880	52.86	68.20	-15.34	53.93	-1.07	Peak
5700.000	64.19	105.20	-41.01	65.15	-0.96	Peak
5719.800	81.51	110.74	-29.23	82.44	-0.93	Peak
5743.920	112.58			113.46	-0.88	Peak
5869.920	52.96	106.62	-53.66	53.66	-0.70	Peak
5911.320	54.02	78.29	-24.27	54.64	-0.62	Peak
5926.440	53.50	68.20	-14.70	54.11	-0.61	Peak
11490.000	36.20	54.00	-17.80	28.77	7.43	Average
11490.000	46.97	74.00	-27.03	39.54	7.43	Peak
17235.000	54.04	68.20	-14.16	39.16	14.88	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5621.160	52.28	68.20	-15.92	53.38	-1.10	Peak
5675.160	53.25	86.86	-33.61	54.25	-1.00	Peak
5712.600	52.34	108.73	-56.39	53.27	-0.93	Peak
5788.560	95.22			96.04	-0.82	Peak
5856.960	53.21	110.25	-57.04	53.92	-0.71	Peak
5920.680	53.87	71.38	-17.51	54.49	-0.62	Peak
5934.720	52.98	68.20	-15.22	53.58	-0.60	Peak
11570.000	35.72	54.00	-18.28	28.14	7.58	Average
11570.000	46.58	74.00	-27.42	39.00	7.58	Peak
17355.000	55.68	68.20	-12.52	39.91	15.77	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5631.960	52.95	68.20	-15.25	54.02	-1.07	Peak
5678.400	53.14	89.26	-36.12	54.14	-1.00	Peak
5720.160	53.25	111.17	-57.92	54.18	-0.93	Peak
5784.240	111.51			112.33	-0.82	Peak
5864.520	54.15	108.13	-53.98	54.85	-0.70	Peak
5898.720	54.06	87.61	-33.55	54.71	-0.65	Peak
5937.240	52.95	68.20	-15.25	53.54	-0.59	Peak
11570.000	35.20	54.00	-18.80	27.62	7.58	Average
11570.000	46.84	74.00	-27.16	39.26	7.58	Peak
17355.000	54.99	68.20	-13.21	39.22	15.77	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5633.400	51.78	68.20	-16.42	52.85	-1.07	Peak
5664.360	52.51	78.86	-26.35	53.54	-1.03	Peak
5706.840	52.61	107.12	-54.51	53.57	-0.96	Peak
5829.600	95.87			96.63	-0.76	Peak
5854.800	57.17	111.26	-54.09	57.89	-0.72	Peak
5904.480	53.31	83.35	-30.04	53.96	-0.65	Peak
5961.000	54.01	68.20	-14.19	54.56	-0.55	Peak
11650.000	36.23	54.00	-17.77	28.42	7.81	Average
11650.000	46.46	74.00	-27.54	38.65	7.81	Peak
17475.000	55.26	68.20	-12.94	38.41	16.85	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5644.920	52.62	68.20	-15.58	53.67	-1.05	Peak
5690.640	53.34	98.30	-44.96	54.32	-0.98	Peak
5706.480	52.15	107.02	-54.87	53.11	-0.96	Peak
5828.880	111.95			112.71	-0.76	Peak
5854.800	69.52	111.26	-41.74	70.24	-0.72	Peak
5875.320	58.48	104.96	-46.48	59.15	-0.67	Peak
5969.640	53.37	68.20	-14.83	53.91	-0.54	Peak
11650.000	36.13	54.00	-17.87	28.32	7.81	Average
11650.000	46.74	74.00	-27.26	38.93	7.81	Peak
17475.000	55.63	68.20	-12.57	38.78	16.85	Peak

802.11ac VHT20 mode:

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5640.960	52.95	68.20	-15.25	54.02	-1.07	Peak
5694.240	52.82	100.95	-48.13	53.79	-0.97	Peak
5720.160	65.18	111.17	-45.99	66.11	-0.93	Peak
5741.760	95.62			96.50	-0.88	Peak
5858.760	53.80	109.75	-55.95	54.50	-0.70	Peak
5882.880	53.68	99.35	-45.67	54.35	-0.67	Peak
5951.280	53.13	68.20	-15.07	53.69	-0.56	Peak
11490.000	35.66	54.00	-18.34	28.23	7.43	Average
11490.000	46.15	74.00	-27.85	38.72	7.43	Peak
17235.000	53.83	68.20	-14.37	38.95	14.88	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5637.720	53.08	68.20	-15.12	54.15	-1.07	Peak
5700.000	61.79	105.20	-43.41	62.75	-0.96	Peak
5720.160	83.22	111.17	-27.95	84.15	-0.93	Peak
5741.040	113.17			114.06	-0.89	Peak
5865.240	53.59	107.93	-54.34	54.29	-0.70	Peak
5899.440	53.40	87.08	-33.68	54.05	-0.65	Peak
5958.840	53.57	68.20	-14.63	54.12	-0.55	Peak
11490.000	35.53	54.00	-18.47	28.10	7.43	Average
11490.000	47.30	74.00	-26.70	39.87	7.43	Peak
17235.000	53.98	68.20	-14.22	39.10	14.88	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5635.200	52.69	68.20	-15.51	53.76	-1.07	Peak
5685.600	52.88	94.58	-41.70	53.88	-1.00	Peak
5714.760	51.94	109.33	-57.39	52.87	-0.93	Peak
5780.640	96.01			96.83	-0.82	Peak
5856.240	53.39	110.45	-57.06	54.10	-0.71	Peak
5906.640	53.60	81.75	-28.15	54.24	-0.64	Peak
5948.760	53.25	68.20	-14.95	53.82	-0.57	Peak
11570.000	35.93	54.00	-18.07	28.35	7.58	Average
11570.000	46.04	74.00	-27.96	38.46	7.58	Peak
17355.000	55.07	68.20	-13.13	39.30	15.77	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5631.240	52.25	68.20	-15.95	53.32	-1.07	Peak
5695.680	53.78	102.02	-48.24	54.75	-0.97	Peak
5718.000	53.87	110.24	-56.37	54.80	-0.93	Peak
5786.400	112.06			112.88	-0.82	Peak
5869.920	52.86	106.62	-53.76	53.56	-0.70	Peak
5910.960	53.59	78.56	-24.97	54.21	-0.62	Peak
5947.680	53.96	68.20	-14.24	54.54	-0.58	Peak
11570.000	35.90	54.00	-18.10	28.32	7.58	Average
11570.000	46.48	74.00	-27.52	38.90	7.58	Peak
17355.000	55.06	68.20	-13.14	39.29	15.77	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	53.09	68.20	-15.11	54.16	-1.07	Peak
5651.040	53.05	68.97	-15.92	54.09	-1.04	Peak
5708.640	52.25	107.62	-55.37	53.20	-0.95	Peak
5822.760	95.57			96.34	-0.77	Peak
5862.000	53.26	108.84	-55.58	53.96	-0.70	Peak
5912.400	53.89	77.49	-23.60	54.51	-0.62	Peak
5946.960	52.81	68.20	-15.39	53.39	-0.58	Peak
11650.000	36.02	54.00	-17.98	28.21	7.81	Average
11650.000	46.82	74.00	-27.18	39.01	7.81	Peak
17475.000	55.26	68.20	-12.94	38.41	16.85	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5625.840	53.03	68.20	-15.17	54.11	-1.08	Peak
5670.840	52.67	83.66	-30.99	53.68	-1.01	Peak
5719.800	52.56	110.74	-58.18	53.49	-0.93	Peak
5826.720	111.05			111.81	-0.76	Peak
5860.560	67.10	109.24	-42.14	67.80	-0.70	Peak
5875.320	54.13	104.96	-50.83	54.80	-0.67	Peak
5953.080	53.29	68.20	-14.91	53.85	-0.56	Peak
11650.000	36.29	54.00	-17.71	28.48	7.81	Average
11650.000	46.69	74.00	-27.31	38.88	7.81	Peak
17475.000	55.20	68.20	-13.00	38.35	16.85	Peak

802.11ac VHT40 mode:

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5628.720	52.17	68.20	-16.03	53.25	-1.08	Peak
5697.480	56.72	103.34	-46.62	57.69	-0.97	Peak
5717.640	70.95	110.14	-39.19	71.88	-0.93	Peak
5752.560	91.92			92.79	-0.87	Peak
5867.400	53.10	107.33	-54.23	53.80	-0.70	Peak
5891.880	53.19	92.67	-39.48	53.84	-0.65	Peak
5936.160	53.63	68.20	-14.57	54.23	-0.60	Peak
11510.000	35.78	54.00	-18.22	28.32	7.46	Average
11510.000	46.53	74.00	-27.47	39.07	7.46	Peak
17265.000	54.59	68.20	-13.61	39.47	15.12	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5642.040	56.00	68.20	-12.20	57.06	-1.06	Peak
5698.200	74.96	103.87	-28.91	75.93	-0.97	Peak
5717.280	88.69	110.04	-21.35	89.62	-0.93	Peak
5751.480	109.80			110.67	-0.87	Peak
5861.640	55.97	108.94	-52.97	56.67	-0.70	Peak
5875.320	54.88	104.96	-50.08	55.55	-0.67	Peak
5942.640	53.26	68.20	-14.94	53.84	-0.58	Peak
11510.000	35.98	54.00	-18.02	28.52	7.46	Average
11510.000	46.00	74.00	-28.00	38.54	7.46	Peak
17265.000	54.73	68.20	-13.47	39.61	15.12	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5646.720	52.03	68.20	-16.17	53.08	-1.05	Peak
5687.760	52.23	96.17	-43.94	53.22	-0.99	Peak
5718.000	52.58	110.24	-57.66	53.51	-0.93	Peak
5789.280	92.89			93.71	-0.82	Peak
5855.520	55.44	110.65	-55.21	56.15	-0.71	Peak
5901.600	53.61	85.48	-31.87	54.26	-0.65	Peak
5941.920	53.92	68.20	-14.28	54.50	-0.58	Peak
11590.000	36.00	54.00	-18.00	28.37	7.63	Average
11590.000	46.43	74.00	-27.57	38.80	7.63	Peak
17385.000	54.42	68.20	-13.78	38.39	16.03	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5640.240	53.77	68.20	-14.43	54.84	-1.07	Peak
5697.840	60.03	103.61	-43.58	61.00	-0.97	Peak
5719.800	65.85	110.74	-44.89	66.78	-0.93	Peak
5793.240	109.34			110.14	-0.80	Peak
5855.880	67.97	110.55	-42.58	68.68	-0.71	Peak
5876.760	57.95	103.89	-45.94	58.62	-0.67	Peak
5966.400	54.16	68.20	-14.04	54.70	-0.54	Peak
11590.000	35.85	54.00	-18.15	28.22	7.63	Average
11590.000	46.08	74.00	-27.92	38.45	7.63	Peak
17385.000	54.63	68.20	-13.57	38.60	16.03	Peak

802.11ac VHT80 mode:

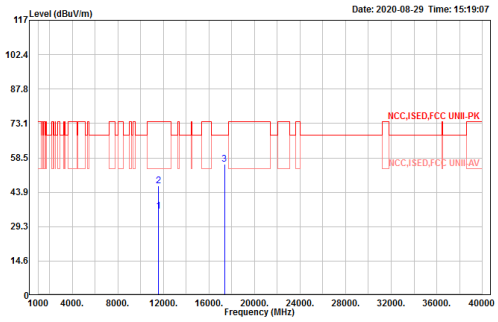
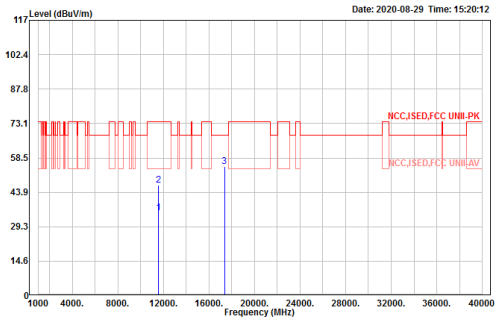
Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5634.840	55.39	68.20	-12.81	56.46	-1.07	Peak
5694.960	67.38	101.49	-34.11	68.35	-0.97	Peak
5716.200	71.20	109.74	-38.54	72.13	-0.93	Peak
5787.480	89.11			89.93	-0.82	Peak
5854.800	66.60	111.26	-44.66	67.32	-0.72	Peak
5876.040	61.27	104.43	-43.16	61.94	-0.67	Peak
5944.800	53.72	68.20	-14.48	54.30	-0.58	Peak
11550.000	35.82	54.00	-18.18	28.27	7.55	Average
11550.000	46.53	74.00	-27.47	38.98	7.55	Peak
17325.000	55.17	68.20	-13.03	39.64	15.53	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5637.720	67.16	68.20	-1.04	68.23	-1.07	Peak
5693.520	86.08	100.42	-14.34	87.05	-0.97	Peak
5712.240	88.48	108.63	-20.15	89.41	-0.93	Peak
5750.040	106.30			107.17	-0.87	Peak
5855.880	82.21	110.55	-28.34	82.92	-0.71	Peak
5876.400	75.55	104.16	-28.61	76.22	-0.67	Peak
5929.320	59.47	68.20	-8.73	60.08	-0.61	Peak
11550.000	35.84	54.00	-18.16	28.29	7.55	Average
11550.000	46.78	74.00	-27.22	39.23	7.55	Peak
17325.000	54.75	68.20	-13.45	39.22	15.53	Peak

Above 1G (1 GHz-40 GHz): test the worst mode: IEEE 802.11a 5785 MHz

Horizontal	Vertical
	

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
1	11570.000	35.72	54.00	-18.28	28.14	7.58	Average
2	11570.000	46.58	74.00	-27.42	39.00	7.58	Peak
3	17355.000	55.68	68.20	-12.52	39.91	15.77	Peak

	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
1	11570.000	35.20	54.00	-18.80	27.62	7.58	Average
2	11570.000	46.84	74.00	-27.16	39.26	7.58	Peak
3	17355.000	54.99	68.20	-13.21	39.22	15.77	Peak

Level = Read Level + Factor

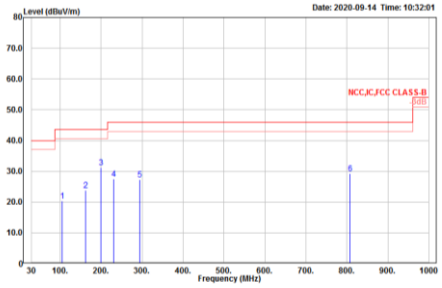
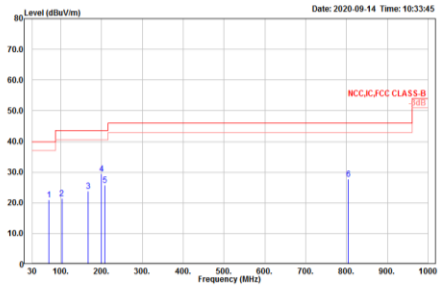
Over Limit = Level – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

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

Co-Location

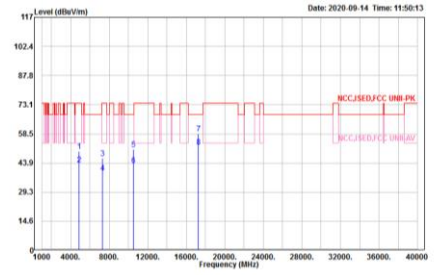
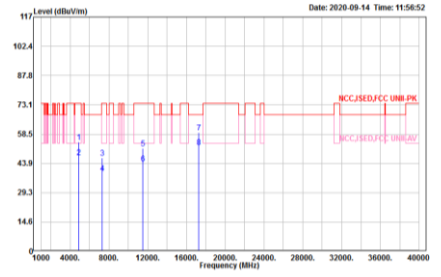
Below 1G

Horizontal	Vertical
	

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1	104.690	39.13	-18.73	20.40	43.50	-23.10	Peak
2	161.920	42.07	-18.27	23.80	43.50	-19.70	Peak
3	199.750	49.05	-17.79	31.26	43.50	-12.24	Peak
4	230.790	46.99	-19.38	27.61	46.00	-18.39	Peak
5	294.810	44.60	-17.37	27.23	46.00	-18.77	Peak
6	806.970	37.87	-8.56	29.31	46.00	-16.69	Peak

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1	70.740	42.74	-21.67	21.07	40.00	-18.93	Peak
2	102.750	40.74	-19.28	21.46	43.50	-22.04	Peak
3	166.770	42.42	-18.49	23.93	43.50	-19.57	Peak
4	199.750	47.26	-17.79	29.47	43.50	-14.03	Peak
5	207.510	45.58	-19.79	25.79	43.50	-17.71	Peak
6	805.030	36.41	-8.56	27.85	46.00	-18.15	Peak

Above 1G

Horizontal	Vertical
	

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1	4874.000	48.10	1.63	49.73	74.00	-24.27	Peak
2	4874.000	41.46	1.63	43.09	74.00	-30.91	Average
3	7311.000	39.06	7.17	46.23	74.00	-27.77	Peak
4	7311.000	31.85	7.17	39.02	74.00	-34.98	Average
5	10490.000	39.68	11.17	50.85	68.20	-17.35	Peak
6	10490.000	31.53	11.17	42.70	68.20	-25.50	Average
7	17235.000	39.67	19.06	58.73	68.20	-9.47	Peak
8	17235.000	32.97	19.06	52.03	68.20	-16.17	Average

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1	4874.000	52.95	1.63	54.58	74.00	-19.42	Peak
2	4874.000	45.20	1.63	46.83	74.00	-27.17	Average
3	7311.000	39.54	7.17	46.71	74.00	-27.29	Peak
4	7311.000	31.90	7.17	39.07	74.00	-34.93	Average
5	11490.000	38.84	12.57	51.41	74.00	-22.59	Peak
6	11490.000	31.22	12.57	43.79	74.00	-30.21	Average
7	17235.000	40.15	19.06	59.21	68.20	-8.99	Peak
8	17235.000	33.00	19.06	52.06	68.20	-16.14	Average

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					
Signal Analyzer 40GHZ	Rohde & Schwarz	FSV40	101456	2020/06/03	2021/06/02
Cable	MTJ	MT40S	620620-MT40S-100	Each Use	-

***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 Data and Test Plot

UNII-1

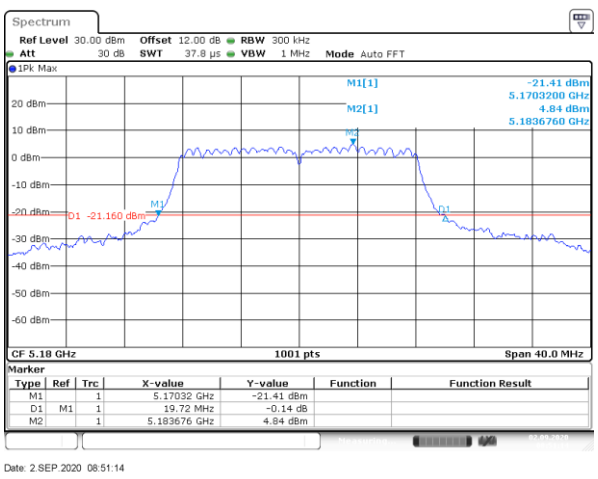
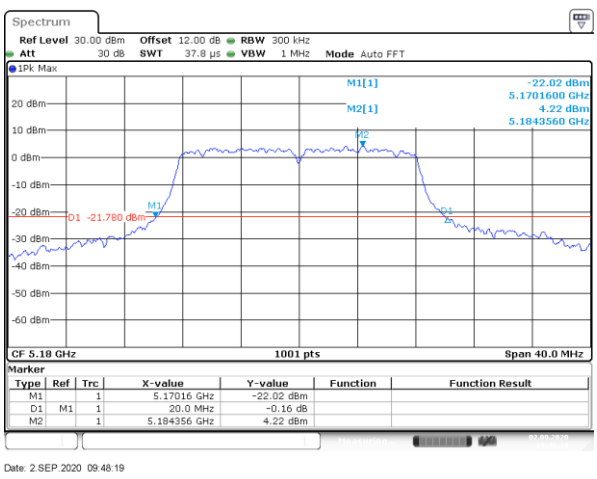
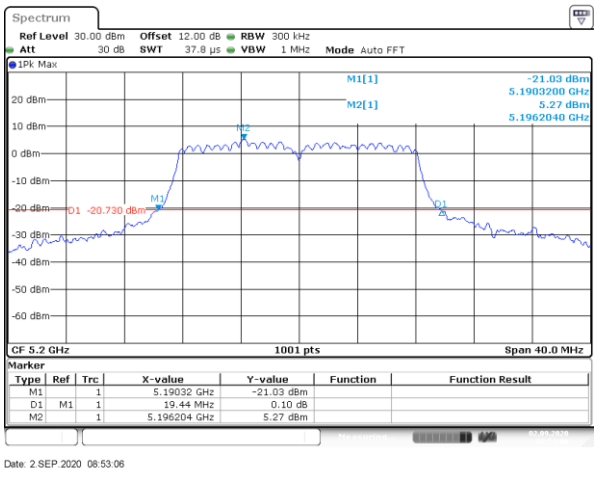
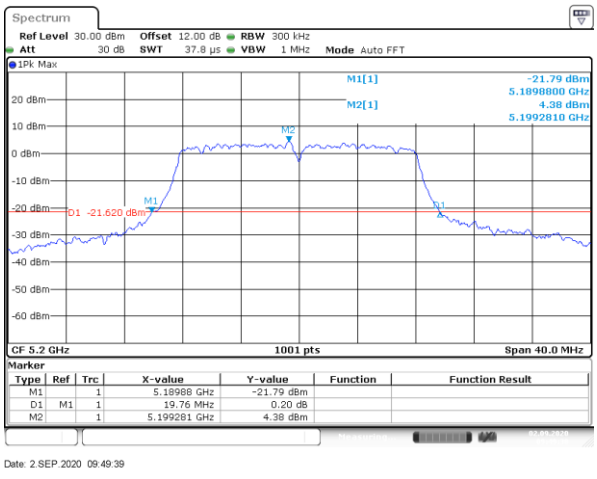
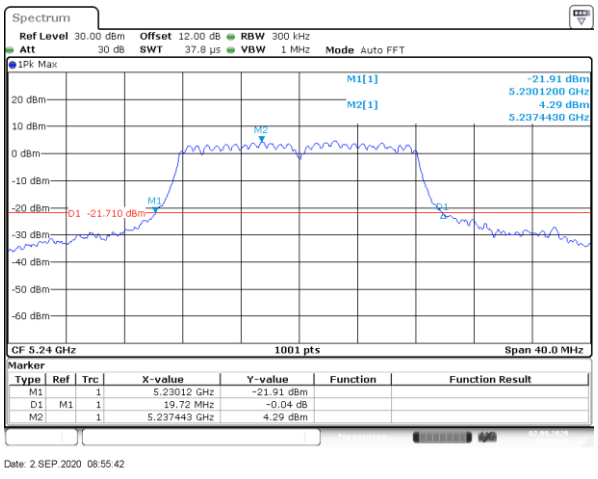
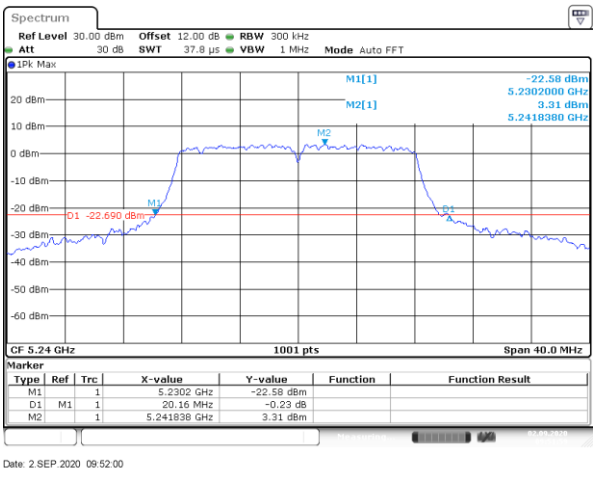
Mode	Channel	Frequency (MHz)	26dB Emission Bandwidth (MHz)	
			Ant. 1	Ant. 2
802.11a	36	5180	19.72	20.00
	40	5200	19.44	19.76
	48	5240	19.72	20.16
802.11ac20	36	5180	21.48	21.40
	40	5200	20.84	20.96
	48	5240	21.40	20.64
802.11ac 40	38	5190	39.92	40.08
	46	5230	40.48	40.32
802.11ac 80	42	5210	83.36	84.00

UNII-3

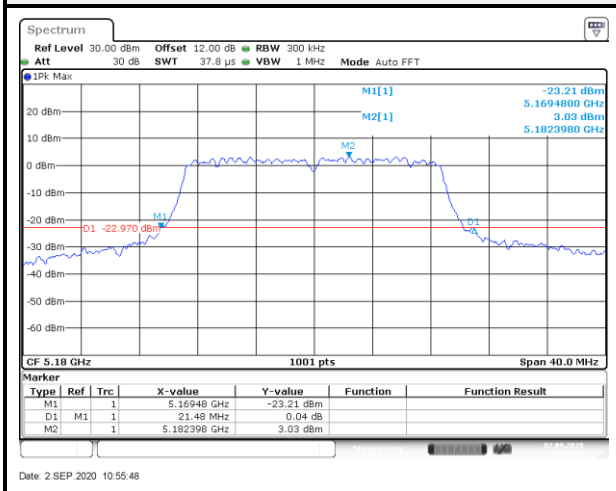
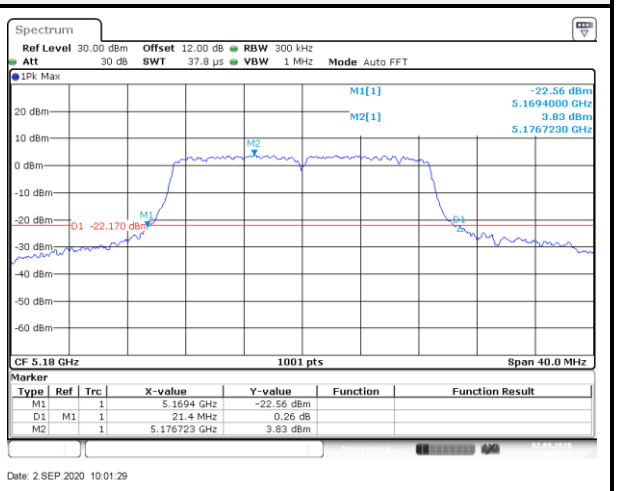
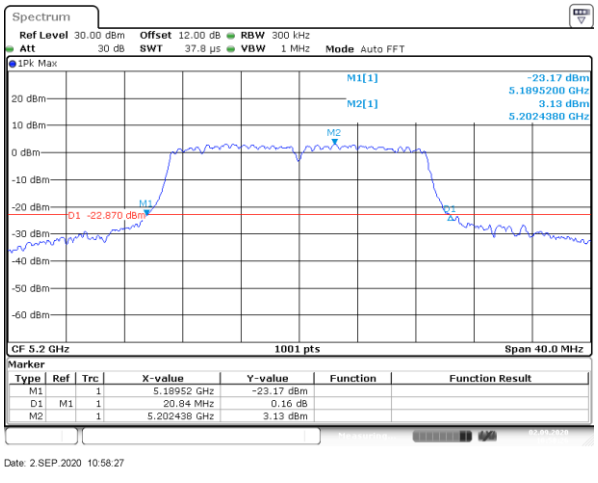
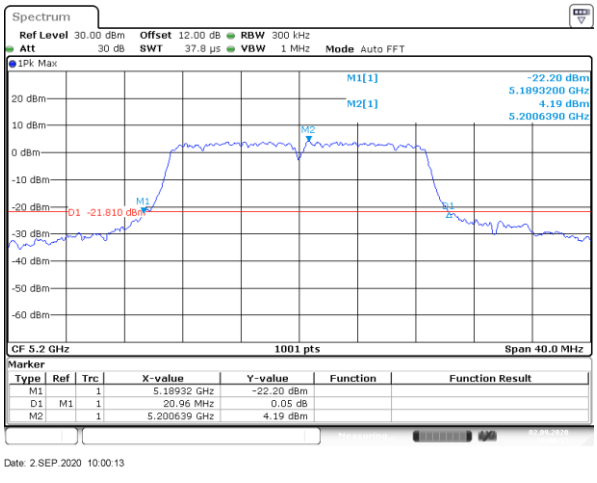
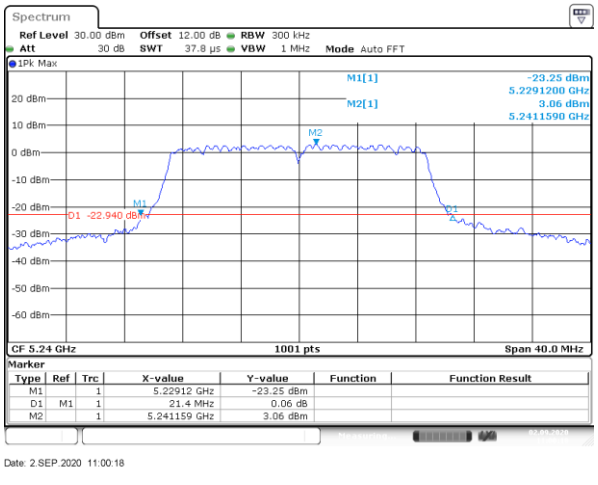
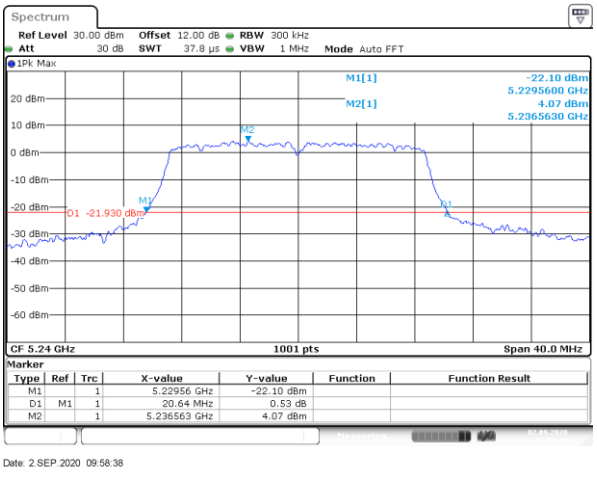
Mode	Channel	Frequency (MHz)	6dB Emission Bandwidth (MHz)		Limit (MHz)
			Ant. 1	Ant. 2	
802.11a	149	5745	16.36	16.36	>0.5
	157	5785	16.32	16.36	>0.5
	165	5825	16.32	16.36	>0.5
802.11ac20	149	5745	17.60	17.56	>0.5
	157	5785	17.60	17.60	>0.5
	165	5825	17.60	17.60	>0.5
802.11ac 40	151	5755	35.12	35.36	>0.5
	159	5795	35.20	35.68	>0.5
802.11ac 80	155	5775	75.04	75.68	>0.5

For UNII-1

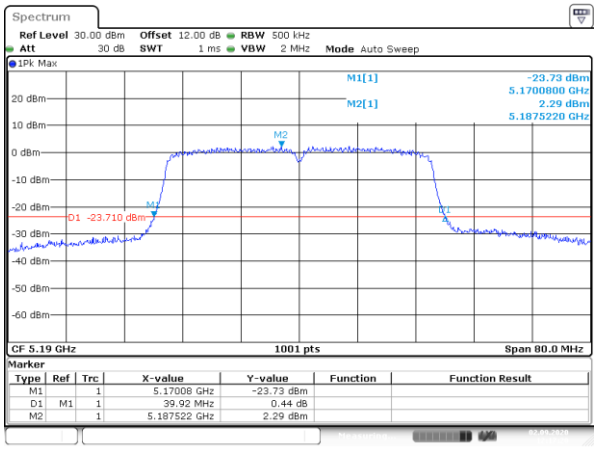
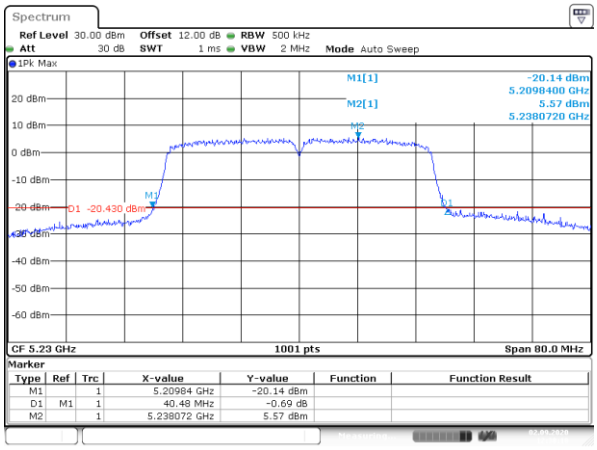
802.11a mode

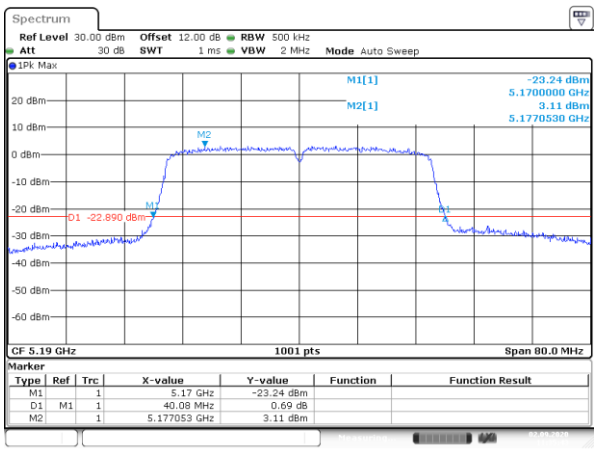
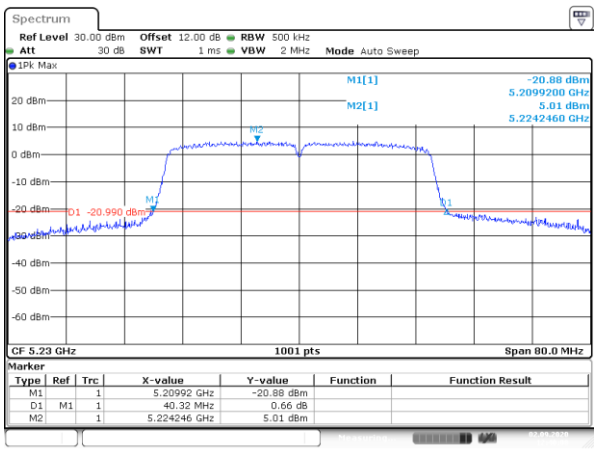
Ant. 1	Ant. 2
Low CH	**Low CH**
	
Middle CH	**Middle CH**
	
High CH	**High CH**
	

802.11ac VHT20 mode:

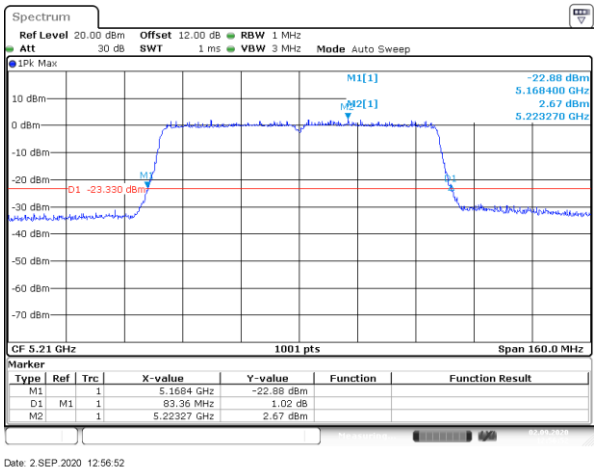
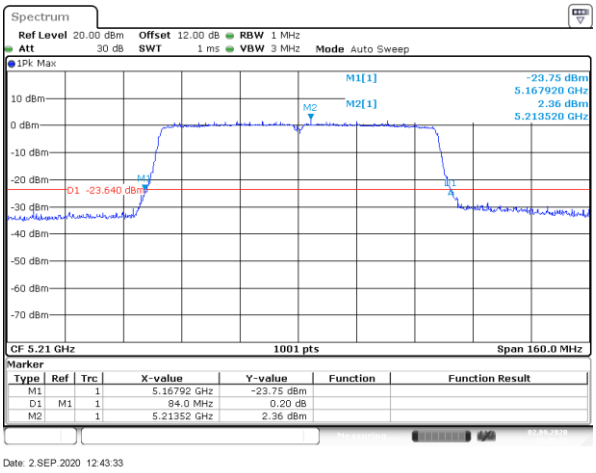
Ant. 1	Ant. 2
Low CH	Low CH
	
Middle CH	Middle CH
	
High CH	High CH
	

802.11ac VHT40 mode:

Ant. 1	
Low CH	**High CH**
	

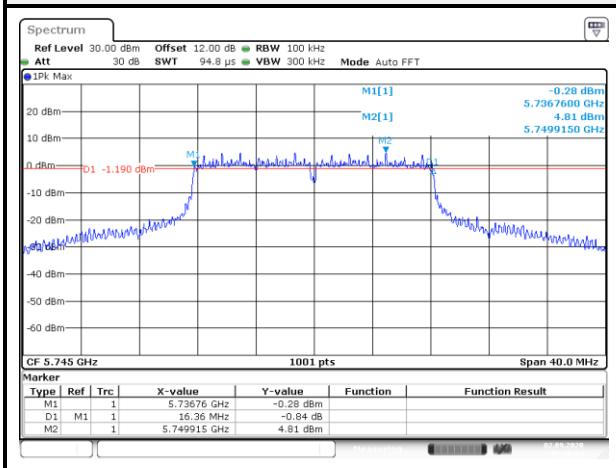
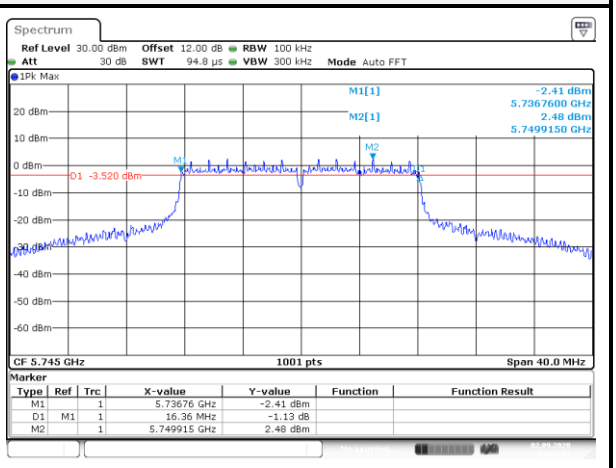
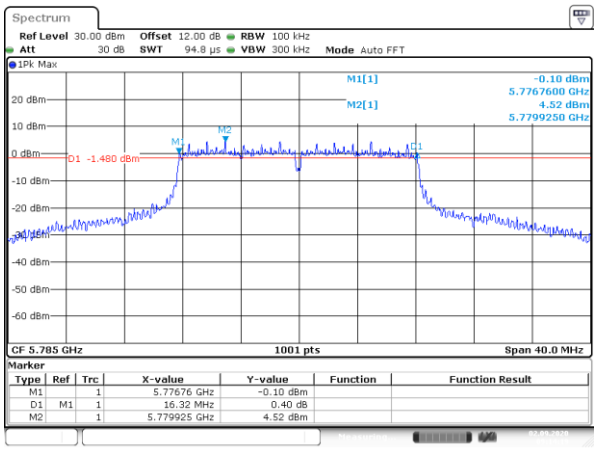
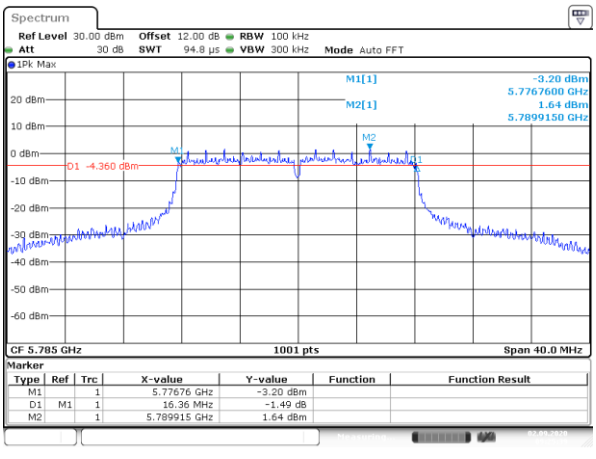
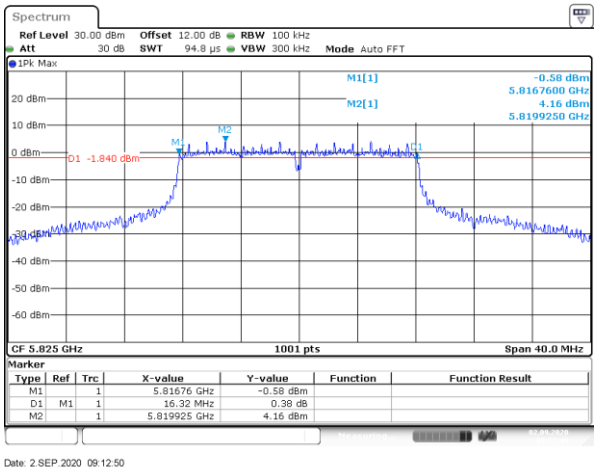
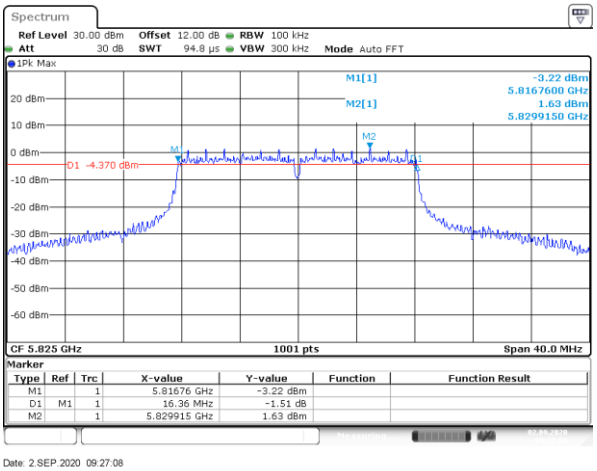
Ant. 2	
Low CH	**High CH**
	

802.11ac VHT80 mode:

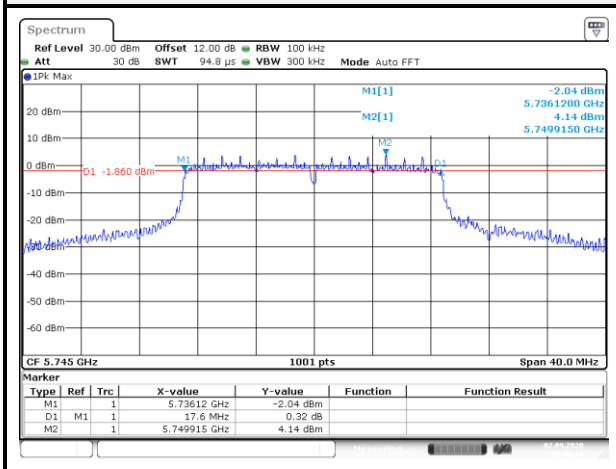
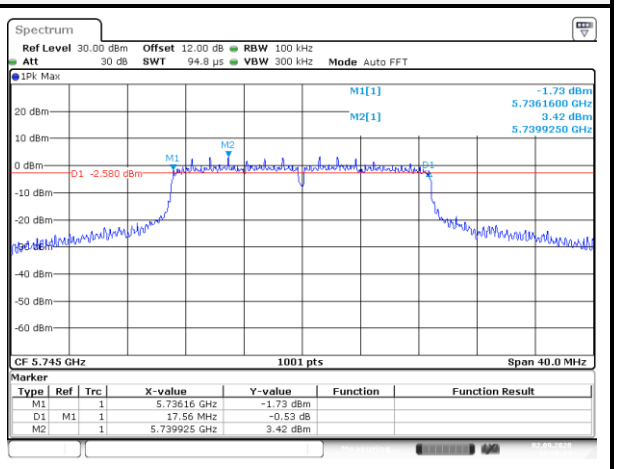
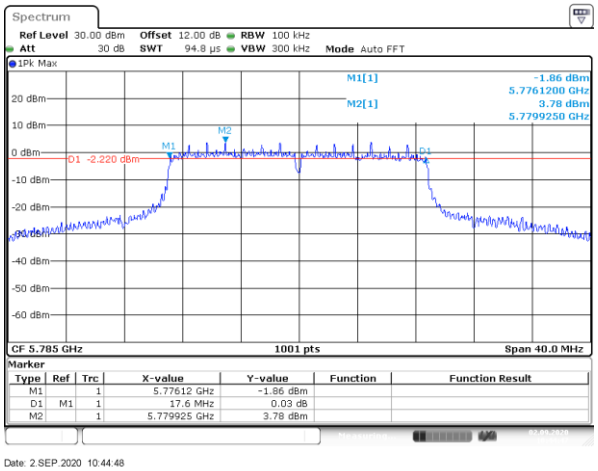
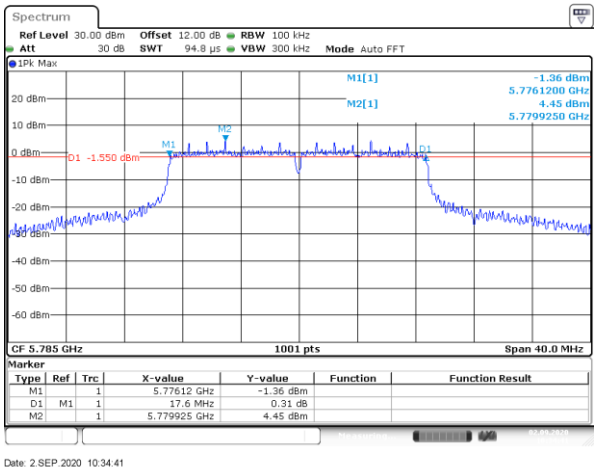
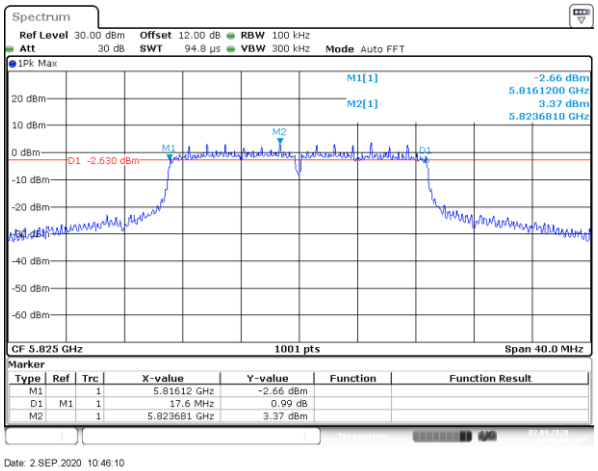
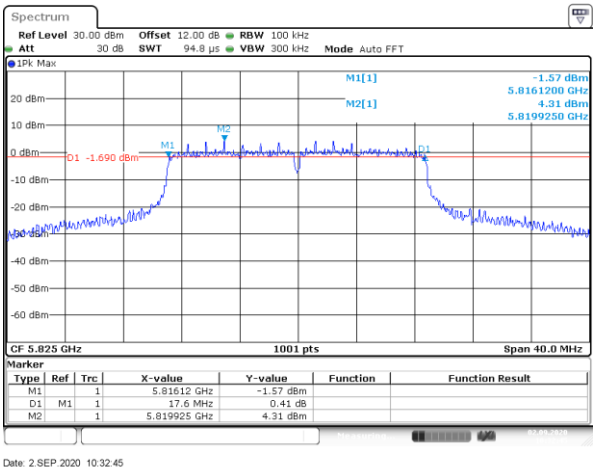
Ant. 1	Ant. 2
Middle CH	**Middle CH**
	

For UNII-3

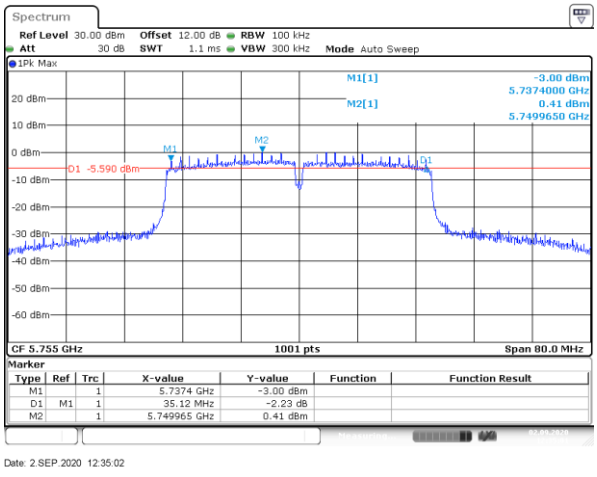
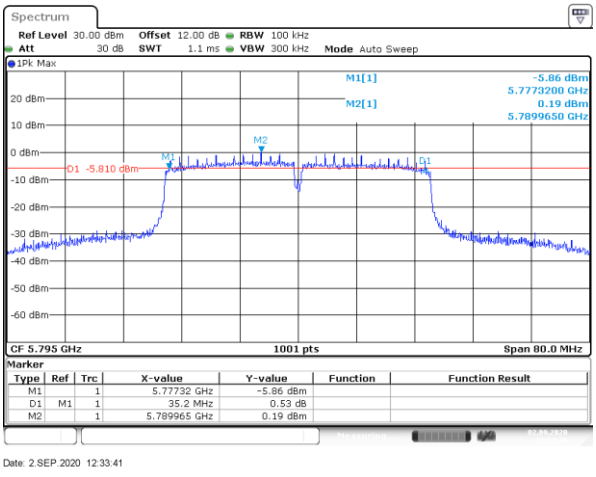
802.11a mode

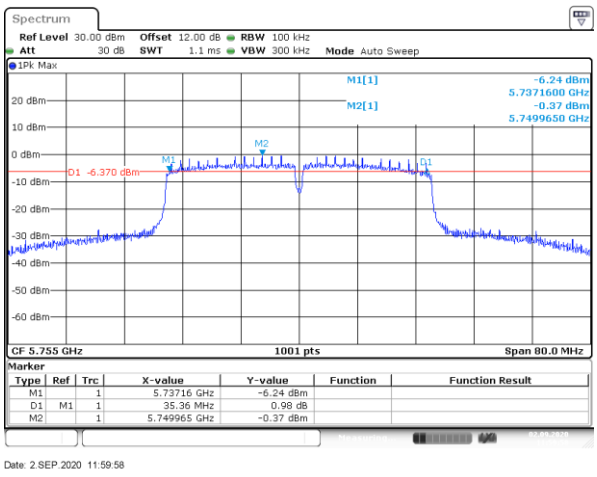
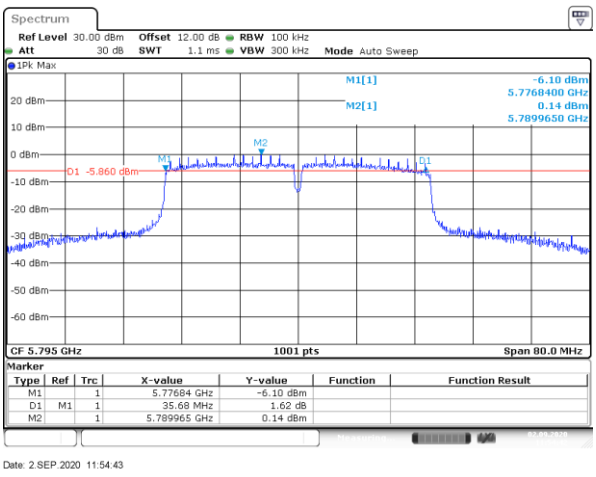
Ant. 1	Ant. 2
Low CH	**Low CH**
	
Middle CH	**Middle CH**
	
High CH	**High CH**
	

802.11ac VHT20 mode:

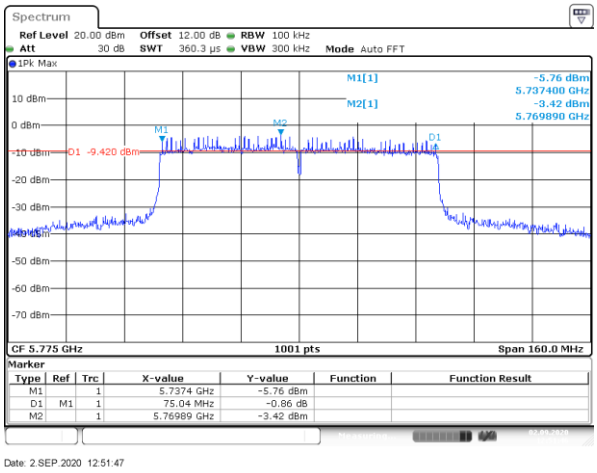
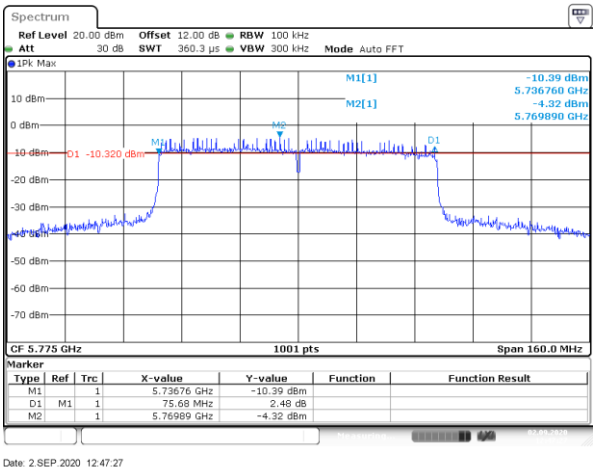
Ant. 1	Ant. 2
Low CH	Low CH
	
Middle CH	Middle CH
	
High CH	High CH
	

802.11ac VHT40 mode:

Ant. 1	
Low CH	**High CH**
	

Ant. 2	
Low CH	**High CH**
	

802.11ac VHT80 mode:

Ant. 1	Ant. 2
Middle CH	**Middle CH**
	

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	MTJ	MT40S	620620-MT40S-100	Each Use	-
USB Wideband Power Sensor	Agilent	U2021XA	MY52500008	2020/01/06	2021/01/05

***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 Data

Channel	Frequency (MHz)	Average Output Power (dBm)			Limit (dBm)
		Ant. 1	Ant. 2	Sum	
IEEE 802.11a mode					
36	**5180**	13.78	13.41	16.61	27.84
40	**5200**	13.75	13.38	16.58	27.84
48	**5240**	13.81	13.47	16.65	27.84
149	**5745**	18.88	18.83	21.87	29.13
157	**5785**	18.75	18.72	21.75	29.13
165	**5825**	18.67	18.64	21.67	29.13
IEEE 802.11n HT20 mode					
36	**5180**	13.53	13.42	16.49	27.84
40	**5200**	13.46	13.37	16.43	27.84
48	**5240**	13.55	13.45	16.51	27.84
149	**5745**	18.80	18.71	21.77	29.13
157	**5785**	18.51	18.43	21.48	29.13
165	**5825**	18.02	17.78	20.91	29.13
IEEE 802.11n HT40 mode					
38	**5190**	10.88	10.66	13.78	27.84
46	**5230**	13.90	13.64	16.78	27.84
151	**5755**	18.25	18.21	21.24	29.13
159	**5795**	18.38	18.36	21.38	29.13

Note:
UNII-1: Power DG Gain is 8.16 dBi and the power limit is 30 – (8.16-6) = 27.84 dBm.
UNII-3: Power DG Gain is 6.87 dBi and the power limit is 30 – (6.87-6) = 29.13 dBm

Channel	Frequency (MHz)	Average Output Power (dBm)			Limit (dBm)
		Ant. 1	Ant. 2	Sum	
IEEE 802.11ac VHT20 mode					
36	**5180**	13.46	13.41	16.45	27.84
40	**5200**	13.40	13.34	16.38	27.84
48	**5240**	13.50	13.43	16.48	27.84
149	**5745**	18.77	18.69	21.74	29.13
157	**5785**	18.42	18.37	21.41	29.13
165	**5825**	17.85	17.75	20.81	29.13
IEEE 802.11ac VHT40 mode					
38	**5190**	10.72	10.61	13.68	27.84
46	**5230**	13.88	13.62	16.76	27.84
151	**5755**	18.21	18.16	21.20	29.13
159	**5795**	18.31	18.32	21.33	29.13
IEEE 802.11ac VHT80 mode					
42	**5210**	8.99	8.56	11.79	27.84
155	**5775**	18.28	18.15	21.23	29.13

Note:
UNII-1: Power DG Gain is 8.16 dBi and the power limit is 30 – (8.16-6) = 27.84 dBm
UNII-3: Power DG Gain is 6.87 dBi and the power limit is 30 – (6.87-6) = 29.13 dBm

10 FCC §15.407(a) – Power Spectral Density

10.1 Applicable Standard

According to FCC §15.407(a),

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

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

10.2 Test Procedure

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

For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in Section 15.407(a)(5).

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

a) Set the RBW to 1 MHz.

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

c) Set the frequency span to examine the spectrum across a convenient frequency segment (e.g., 600 MHz).

d) Select the power averaging (rms) detector.

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

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

10.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conducted Room					
Signal Analyzer 40GHZ	Rohde & Schwarz	FSV40	101456	2020/06/03	2021/06/02
Cable	MTJ	MT40S	620620-MT40S-100	Each Use	-

***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 Data and Test Plot

UNII-1

Mode	Channel	Frequency (MHz)	PSD (dBm/MHz)		Total PSD (dBm/MHz)	Duty Factor (dB)	Limit (dBm/MHz)
			Ant. 1	Ant. 2			
802.11a	36	5180	8.53	8.16	11.36	0.18	11.83
	40	5200	9.01	8.21	11.64	0.18	11.83
	48	5240	8.68	8.24	11.48	0.18	11.83
802.11ac VHT20	36	5180	8.67	8.37	11.53	0.09	11.83
	40	5200	8.72	8.47	11.61	0.09	11.83
	48	5240	8.63	8.39	11.52	0.09	11.83
802.11ac VHT40	38	5190	4.24	4.10	7.18	0.22	11.83
	46	5230	7.29	7.01	10.16	0.22	11.83
802.11ac VHT80	42	5210	-0.22	-1.14	2.35	0.32	11.83

Note: Power DG Gain is 8.16 dBi, and PSD DG Gain = Power DG Gain + Array Gain = 8.16 + 3.01 = 11.17 dBi. Due to above, the PSD limit is 17 – (11.17-6) = 11.83 dBm/MHz

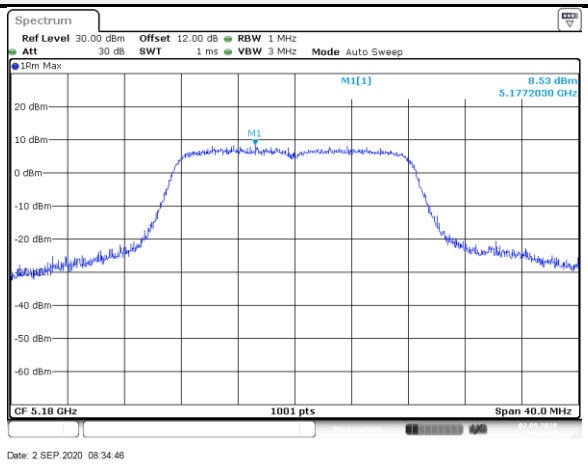
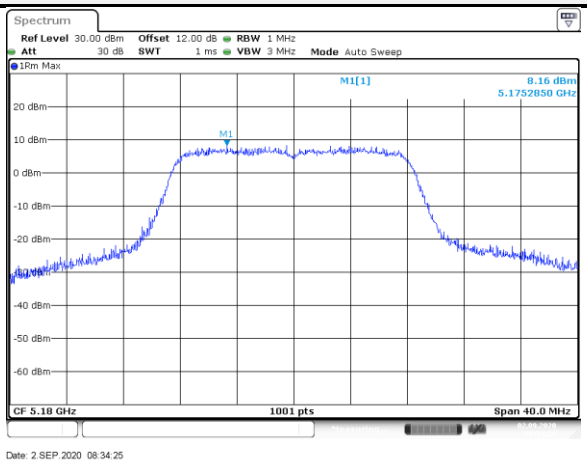
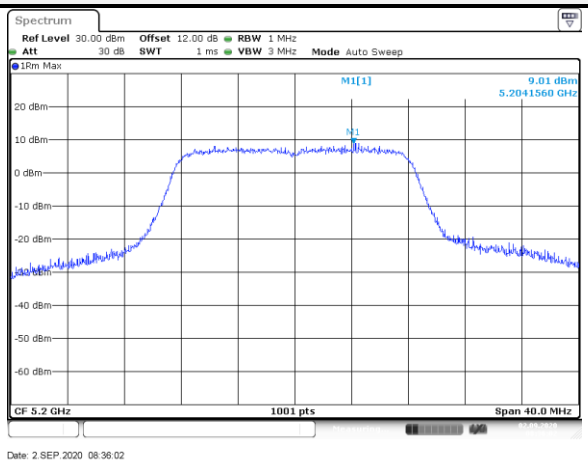
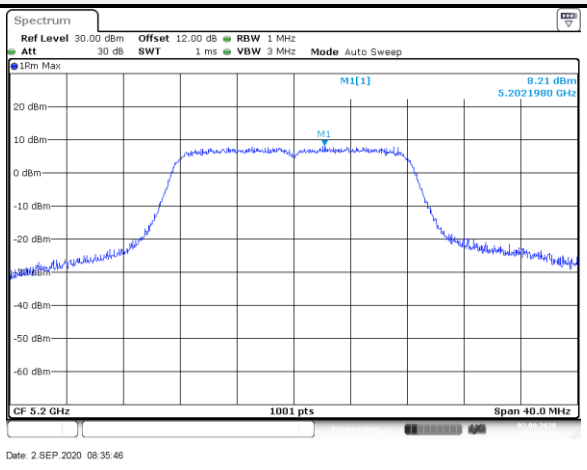
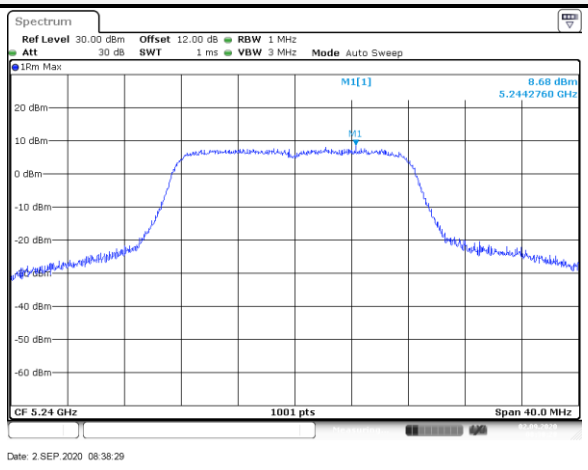
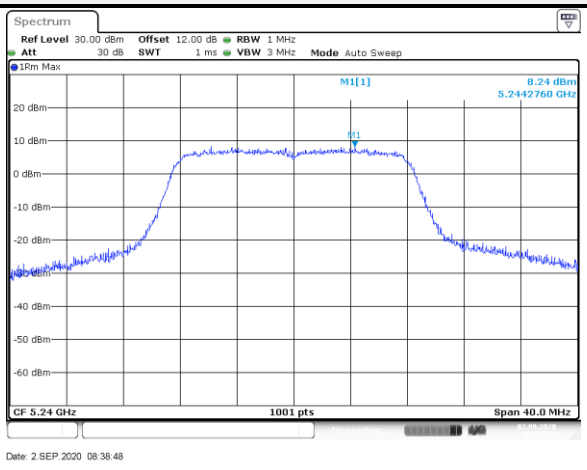
UNII-3

Mode	Channel	Frequency (MHz)	PSD (dBm/500 kHz)		Total PSD (dBm/500 kHz)	Duty Factor (dB)	Limit (dBm/500 kHz)
			Ant. 1	Ant. 2			
802.11a	149	5745	13.84	11.80	15.95	0.18	30.00
	157	5785	13.82	11.65	15.88	0.18	30.00
	165	5825	13.30	11.63	15.56	0.18	30.00
802.11ac VHT20	149	5745	13.47	11.45	15.59	0.09	30.00
	157	5785	13.21	11.41	15.41	0.09	30.00
	165	5825	12.91	11.30	15.19	0.09	30.00
802.11ac VHT40	151	5755	9.57	8.45	12.06	0.22	30.00
	159	5795	9.61	8.85	12.26	0.22	30.00
802.11ac VHT80	155	5775	6.60	5.08	8.92	0.32	30.00

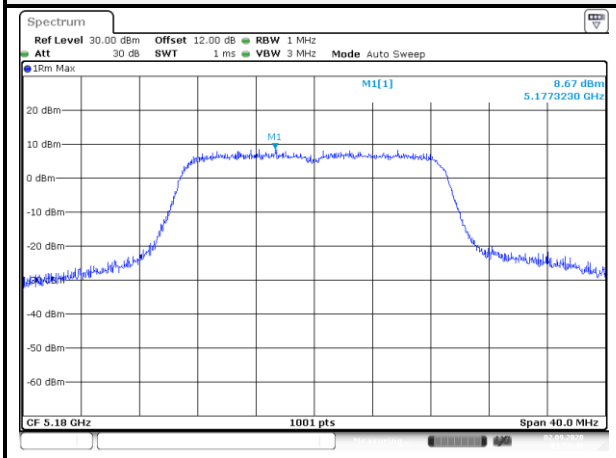
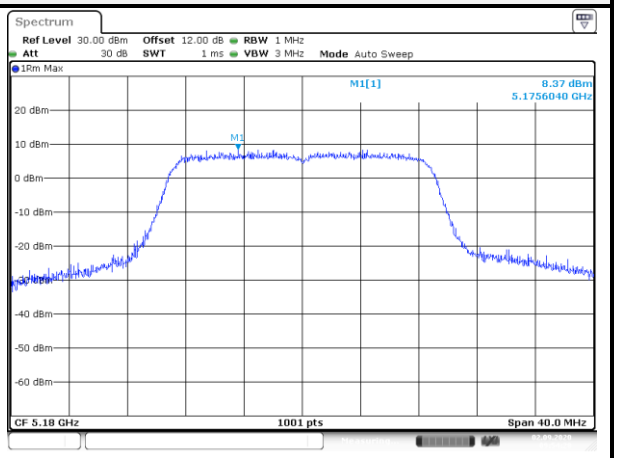
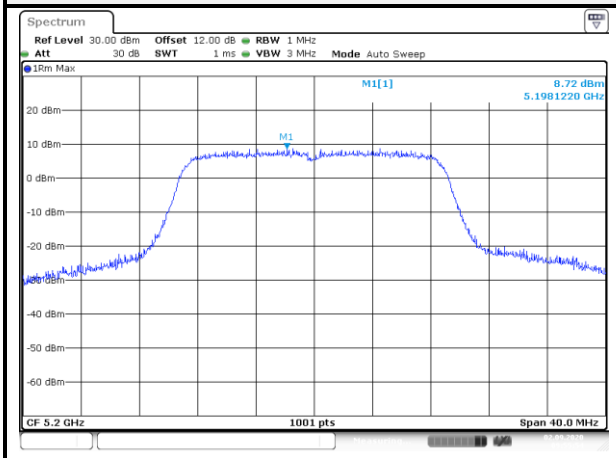
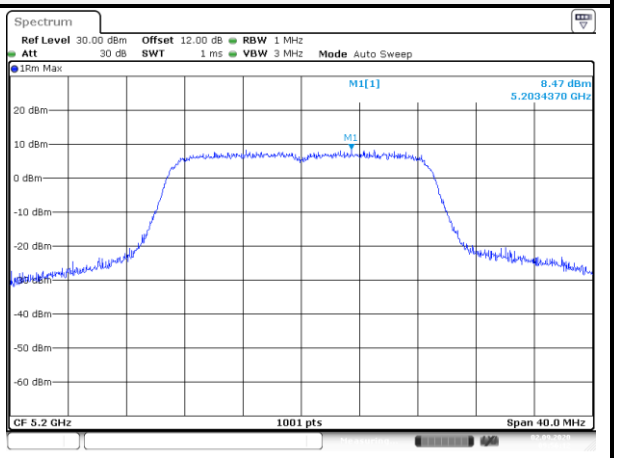
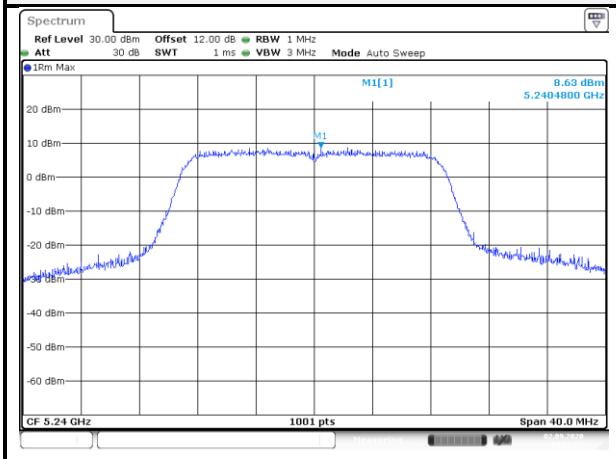
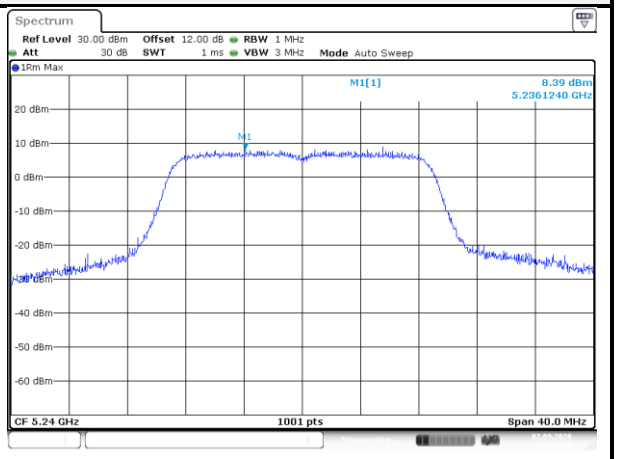
Note: Power DG Gain is 6.87 dBi, and PSD DG Gain = Power DG Gain + Array Gain = 6.87 + 3.01 = 9.88 dBi. Due to above, the PSD limit is 30 – (9.88-6) = 26.12 dBm/500 kHz

For UNII-1:

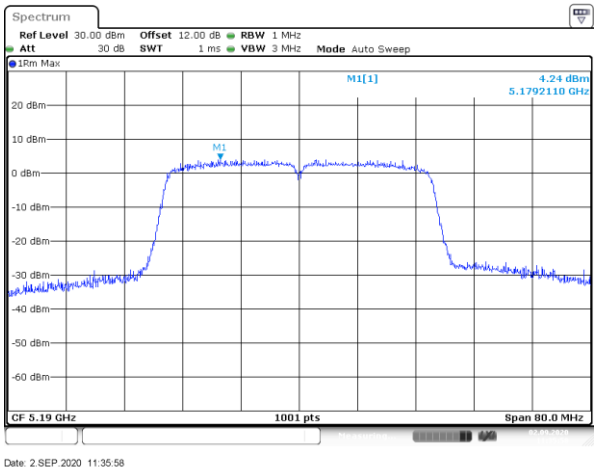
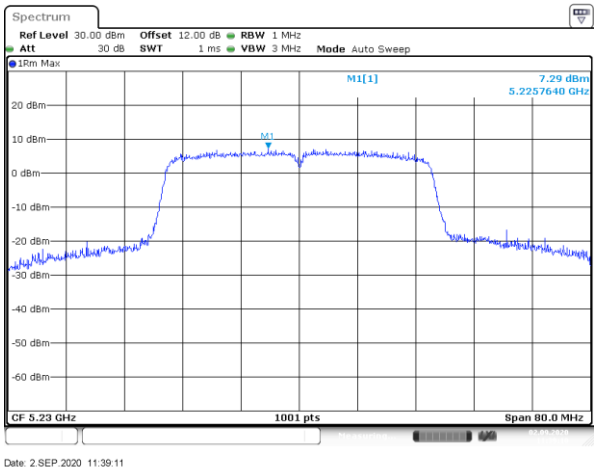
802.11a mode

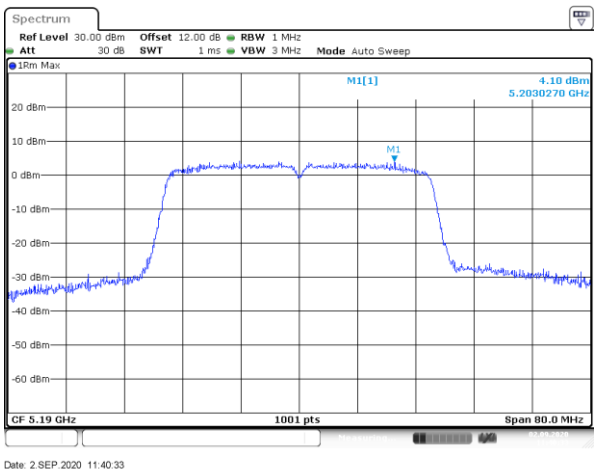
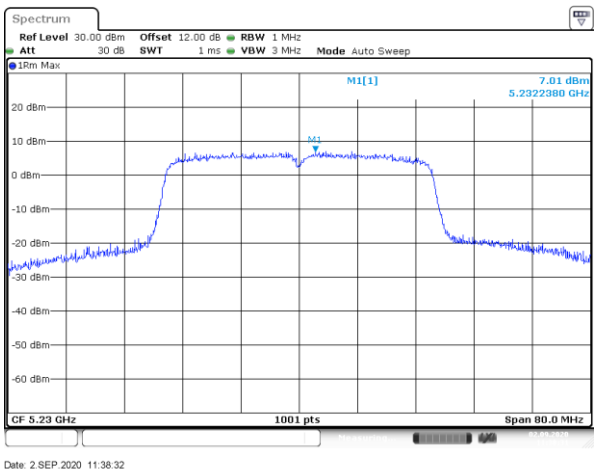
Ant. 1	Ant. 2
Low CH	Low CH
	
Middle CH	Middle CH
	
High CH	High CH
	

802.11ac VHT20 mode:

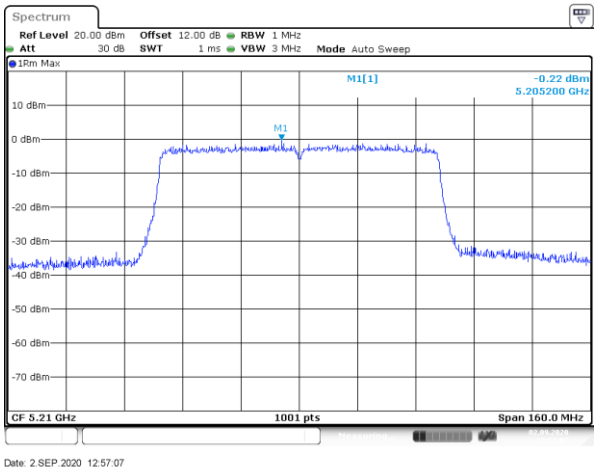
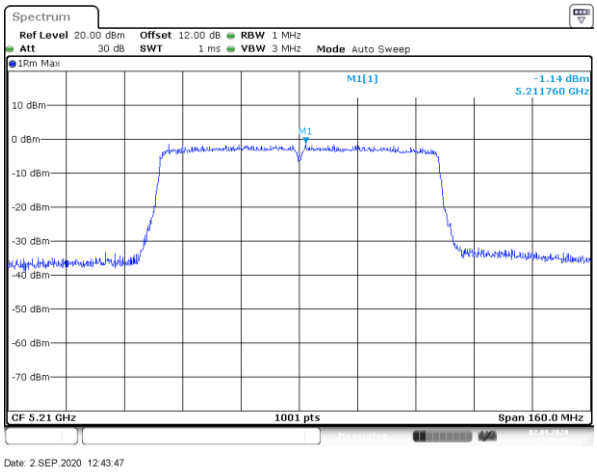
Ant. 1	Ant. 2
Low CH	**Low CH**
	
Middle CH	**Middle CH**
	
High CH	**High CH**
	

802.11ac VHT40 mode:

Ant. 1	
Low CH	**High CH**
	

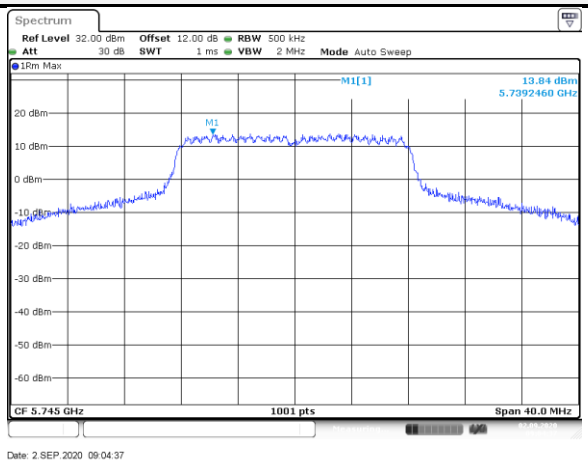
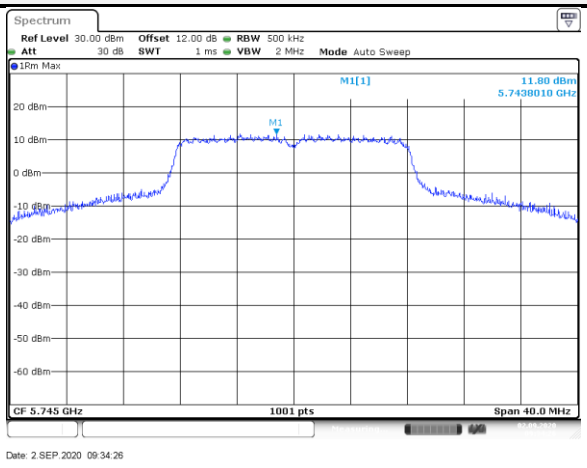
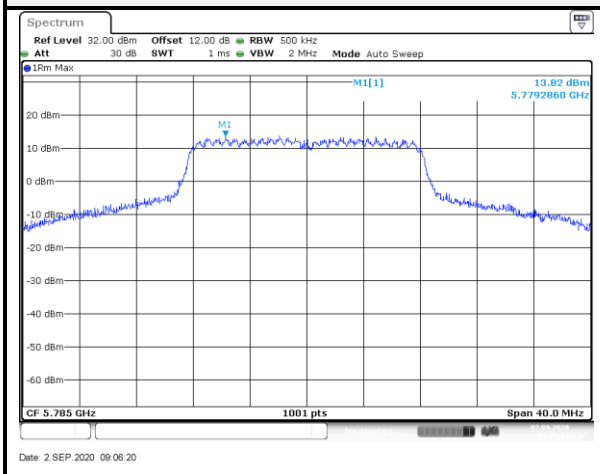
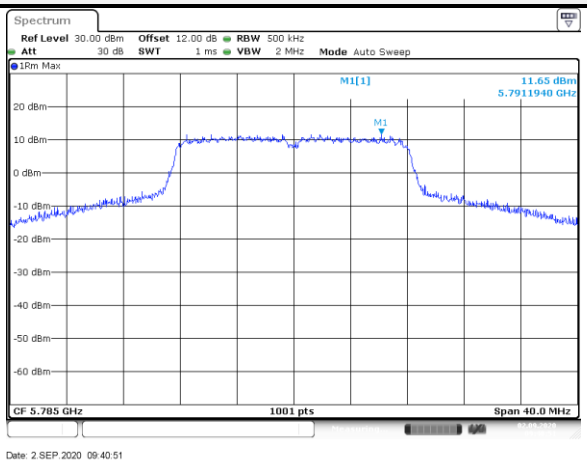
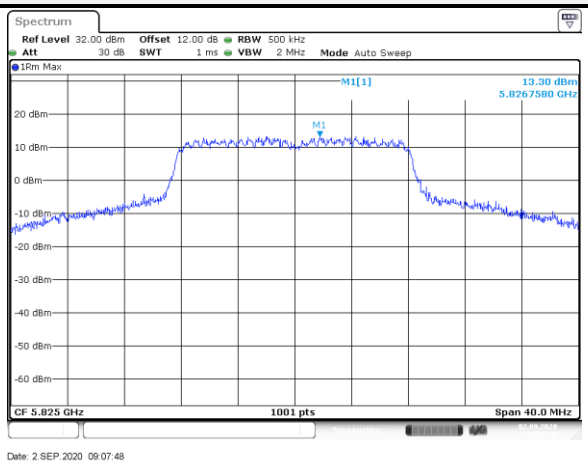
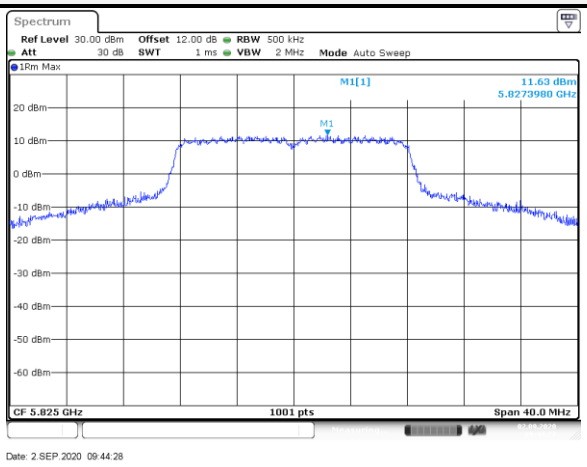
Ant. 2	
Low CH	**High CH**
	

802.11ac VHT80 mode

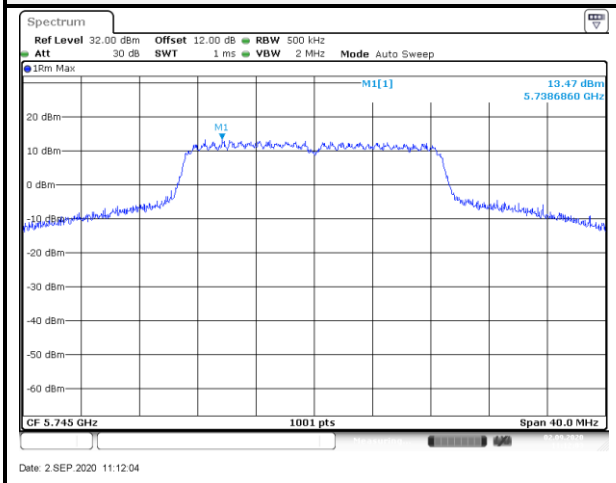
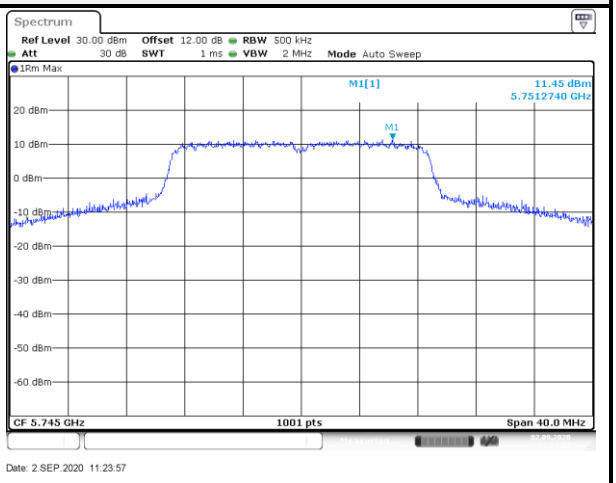
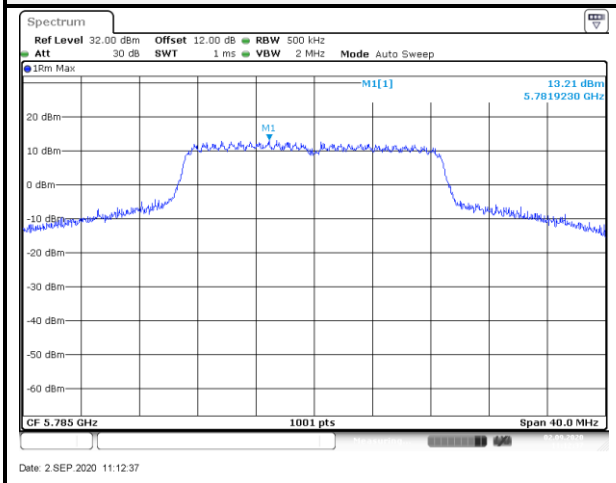
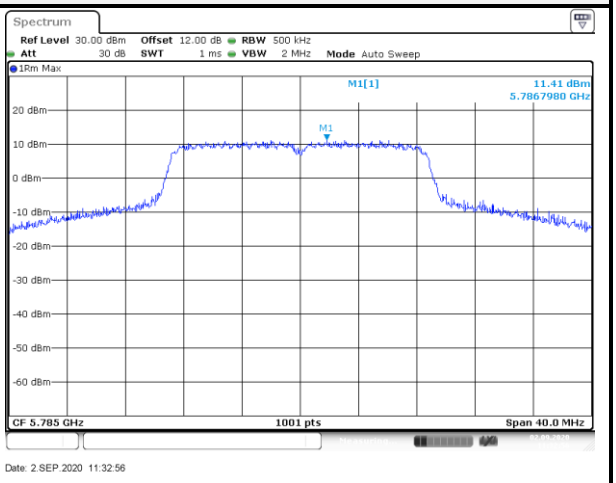
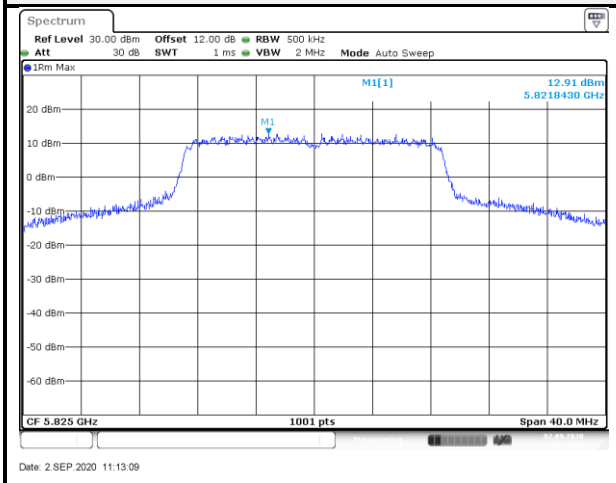
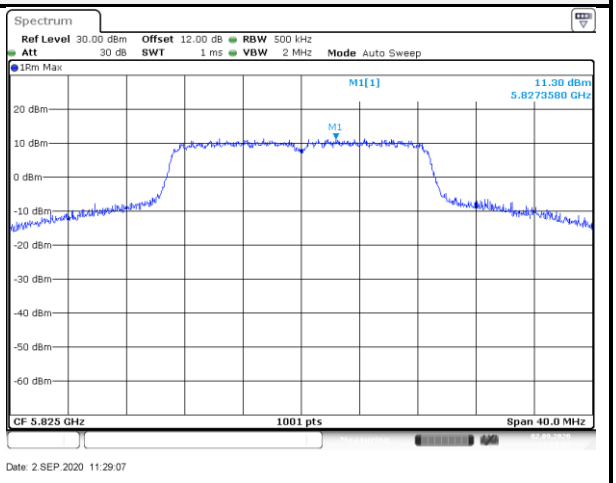
Ant. 1	Ant. 2
Middle	Middle
	

For UNII-3:

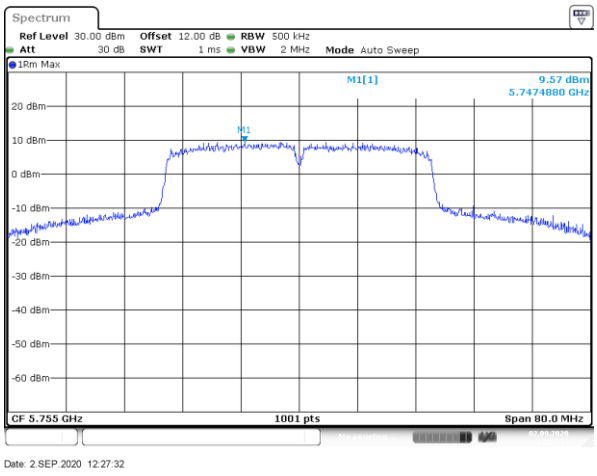
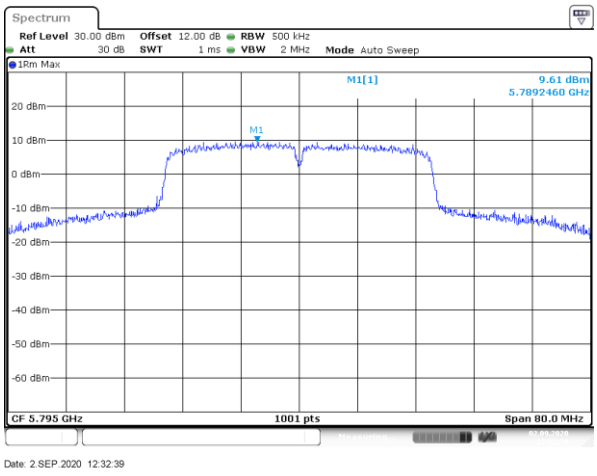
802.11a mode:

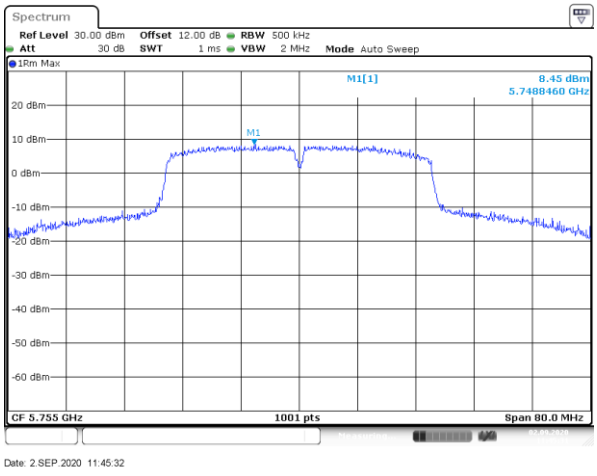
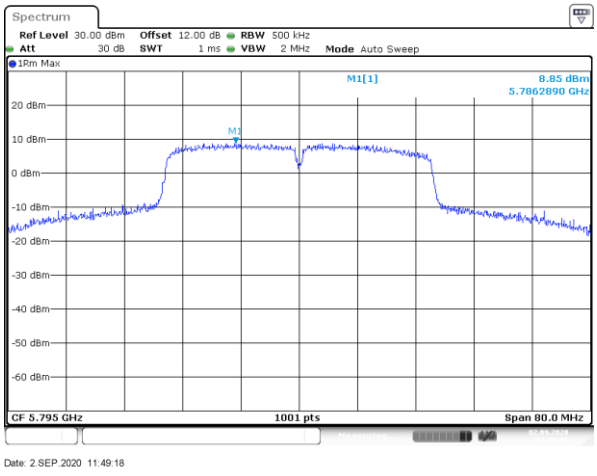
Ant. 1	Ant. 2
Low CH	Low CH
	
Middle CH	Middle CH
	
High CH	High CH
	

802.11ac VHT20 mode:

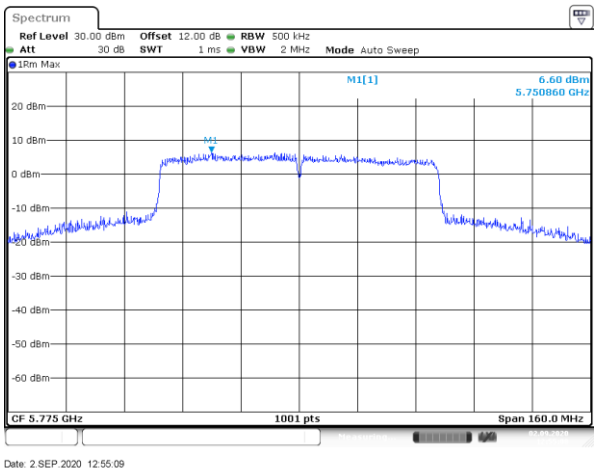
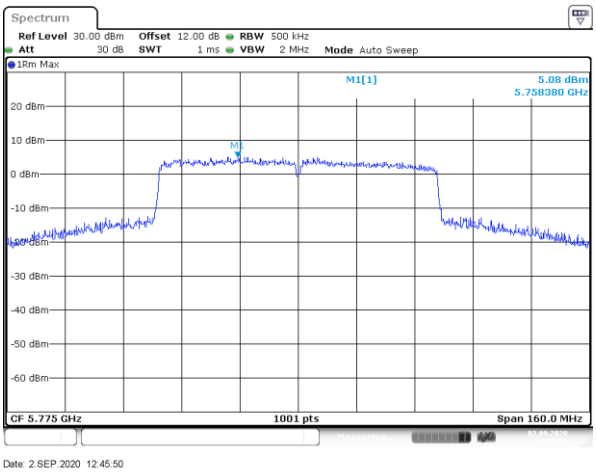
Ant. 1	Ant. 2
Low CH	**Low CH**
	
Middle CH	**Middle CH**
	
High CH	**High CH**
	

802.11ac VHT40 mode:

Ant. 1	
Low CH	**High CH**
	

Ant. 2	
Low CH	**High CH**
	

802.11ac VHT80 mode

Ant. 1	Ant. 2
Middle	Middle
	

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