FCC Part 15.247

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**
Serial Model Name:	**WA512GM-IP67**
Report Number :	**RXZ200708002-00B**
Report Date :	**2020/09/24**
Reviewed By :	**Zeus Chen**

Prepared By:

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Revision History

Revision	Report Number	Issue Date	Description
1.0	RXZ200708002-00B	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
Serial Model Name	WA512GM-IP67
Model Discrepancy	1. Different appearance, same PCB 2. WA512GM-D AC,DC input 3. WA512GM-IP67 only AC input
Frequency Range	IEEE 802.11b/g/n HT20: 2412 - 2462 MHz; IEEE 802.11n HT40: 2422 - 2452 MHz
Number of Channels	IEEE 802.11b/g/n HT20: 11 Channels; IEEE 802.11n HT40: 7 Channels
Output Power	IEEE 802.11b: 26.98 dBm (0.4989 W) IEEE 802.11g: 28.77 dBm (0.7534 W) IEEE 802.11n HT20: 28.58 dBm (0.7211 W) IEEE 802.11n HT40: 26.20 dBm (0.4169 W)
Modulation Type	IEEE 802.11b: DSSS IEEE 802.11g/n HT 20/HT40: OFDM
Related Submittal(s)/Grant(s)	**FCC Part 15.407 NII with FCC ID: 2AXAMWA512GM**
Received Date	Jul. 20, 2020
Date of Test	Aug. 31, 2020 - Sep. 14, 2020

All measurement and test data in this report was gathered from production sample serial number: 200708002-IP67 and 200708002-D.

Assigned by BACL, Linkou Laboratory.

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 and Test Methodology

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

- Part 2, Subpart J, Part 15, Subparts A and C, section 15.247 of the Federal Communication Commission's rules.
- 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.

1.6 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 (966B)	Aug. 31, 2020 ~ Sep. 14, 2020	24.4~25.1	56~57	David Lee
Conducted (TH-02)	Sep. 01, 2020	23.4	60	Boris Kao

2 System Test Configuration

2.1 Test Channels and Description of Worst 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.

For Wi-Fi 2.4G mode, there are totally 11 channels.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	**2412**	7	2442
2	2417	8	2447
3	**2422**	**9**	**2452**
4	2427	10	2457
5	2432	**11**	**2462**
6	**2437**	-	-

For 802.11b/g/n HT20: Channel **1**, **6** and **11** were tested. For 802.11n HT40: Channel **3**, **6** and 9 were tested.

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.

And 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.

Modulation Used for Conformance Test			
Configuration	**N_{TX}**	**Data Rate**	**Worst Data Rate**
802.11b	2	1-11 Mbps	1 Mbps
802.11g	2	6-54 Mbps	6 Mbps
802.11n HT 20	2	MCS 0-15	MCS 0
802.11n HT 40	2	MCS 0-15	MCS 0

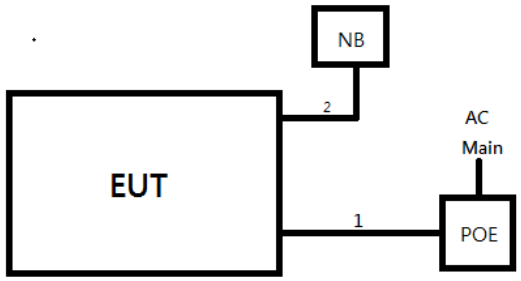
Worst Case of Power Setting				
EUT Exercise Software		Command		
Configuration	**N_{TX}**	**Low CH**	**Mid CH**	**High CH**
802.11b	2	21	23	21
802.11g	2	16	23	15
802.11n HT 20	2	15	22	13
802.11n HT 40	2	12	16	11

2.2 Support Equipment List and External Cable List

No.	Description	Manufacturer	Model Number	Serial Number
A	Notebook	DELL	Latitude E6410	Y520-15IKBN
B	PoE	ITE	APoE48V-1G	N/A

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

2.3 Block Diagram of Test Setup

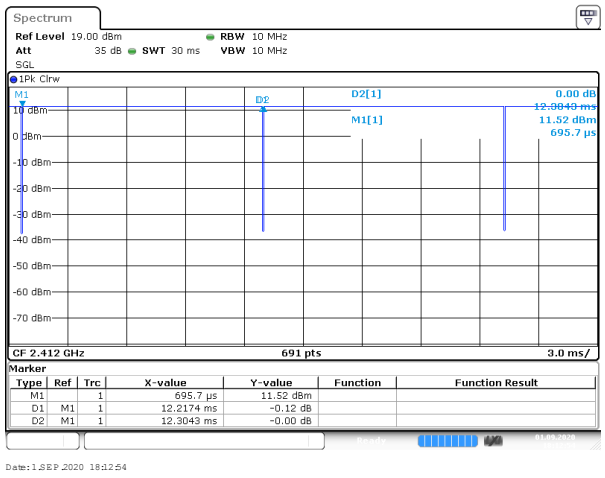
Conduction/ Radiation


2.4 Duty Cycle

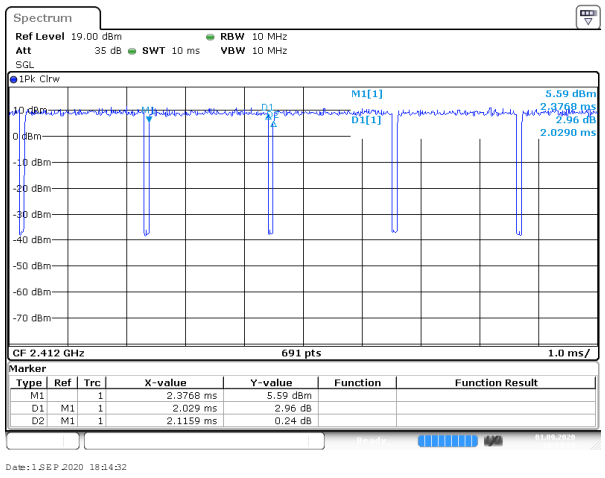
All measurements are to be performed with the EUT transmitting at 100% duty cycle at its maximum power control level; however, if 100% duty cycle cannot be achieved, measurements of duty cycle, x, and maximum power transmission duration, T, are required for each tested mode of operation.

Configuration	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Factor (dB)
802.11b	12.22	12.30	99.00	0.04
802.11g	2.03	2.16	96.00	0.18
802.11n HT20	4.97	5.04	98.00	0.09
802.11n HT40	2.41	2.49	97.00	0.13

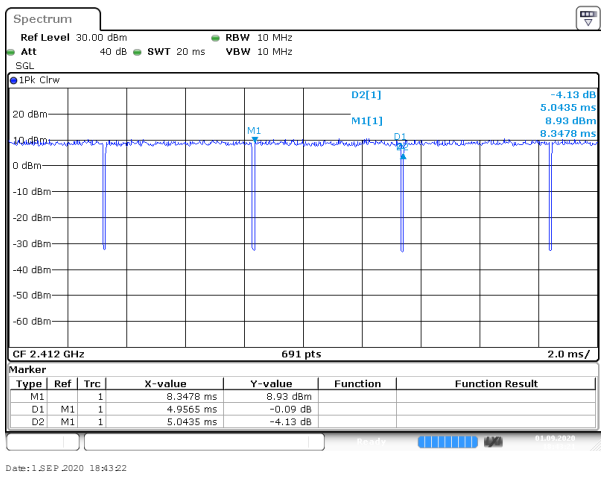
802.11b



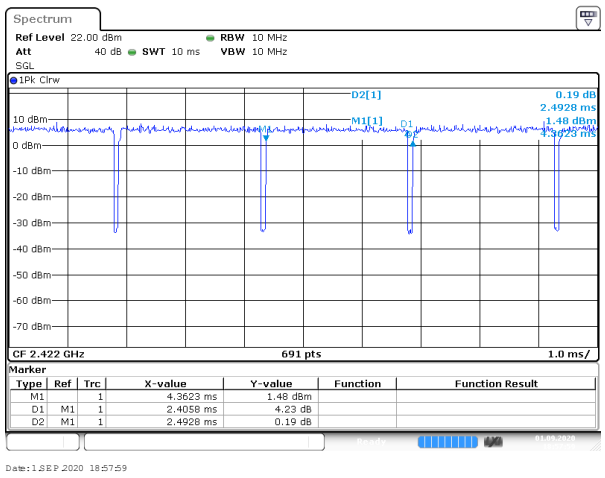
802.11g



802.11n HT20



802.11n HT40



*Note: Duty Factor = 10*log (1/Duty cycle)

3 Summary of Test Results

FCC Rules	Description of Test	Result
§15.247(i), §1.1310, §2.1091	Maximum Permissible Exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247(a)(2)	6 dB Emission Bandwidth	Compliance
§15.247(b)(3)	Maximum Peak Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

4 FCC§15.247(i), §1.1307, § 2.1091 – Maximum Permissible Exposure (MPE)

4.1 Applicable Standard

According to subpart 15.247(i)and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^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/cm^2);

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, 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.

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna does not exceed 6dBi

5.2 Antenna List and Details

Type	Brand	Model	Gain	Result
Dipole	Master Wave	98615PNXX004	4.35 dBi	Compliance
Dipole	Cortec	AN2450-5006WRS	1.92 dBi	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

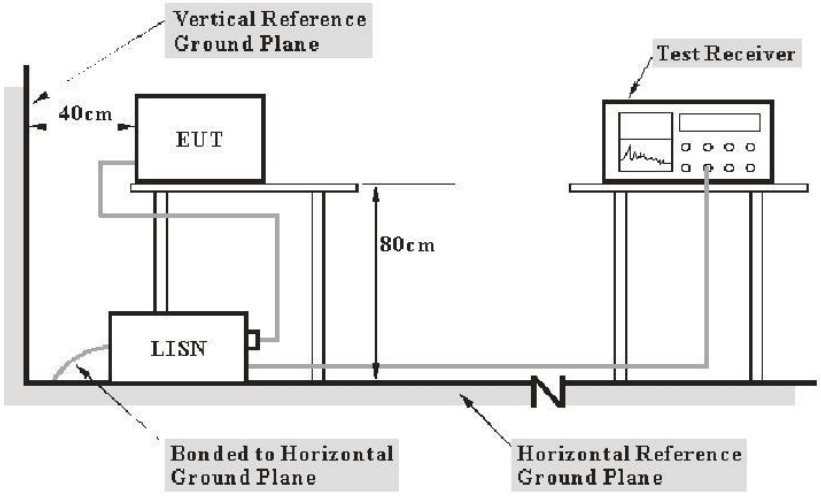
According to FCC §15.207,

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

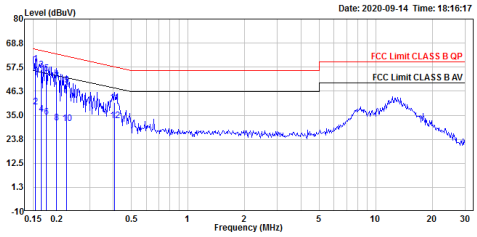
Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
AC Line Conduction Room (CON-01)					
LISN	Rohde & Schwarz	ENV216	100010	2020/09/14	2021/09/13
EMI Test Receiver	Rohde & Schwarz	ESR3	102430	2020/05/07	2021/05/06
RF Cable	EMCI	EMCCFD300-BM-BM-8000	180526	2020/08/07	2021/08/06
Software	Audix	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 Result

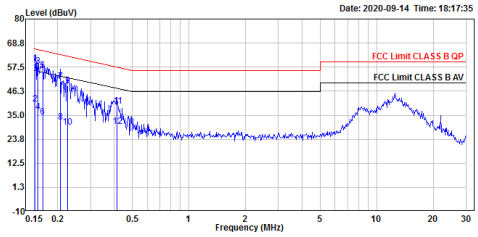
WA512GM-D

Line



	Freq	Read Level	Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	
1	0.154	39.04	58.89	19.85	65.80	-6.91	QP
2	0.154	18.92	38.77	19.85	55.80	-17.03	Average
3	0.165	36.48	56.33	19.85	65.21	-8.88	QP
4	0.165	15.60	35.45	19.85	55.21	-19.76	Average
5	0.176	34.63	54.48	19.85	64.68	-10.20	QP
6	0.176	14.36	34.21	19.85	54.68	-20.47	Average
7	0.200	30.77	50.63	19.86	63.62	-12.99	QP
8	0.200	11.64	31.50	19.86	53.62	-22.12	Average
9	0.227	29.22	49.08	19.86	62.56	-13.48	QP
10	0.227	11.09	30.95	19.86	52.56	-21.61	Average
11	0.406	21.25	41.11	19.86	57.73	-16.62	QP
12	0.406	12.72	32.58	19.86	47.73	-15.15	Average

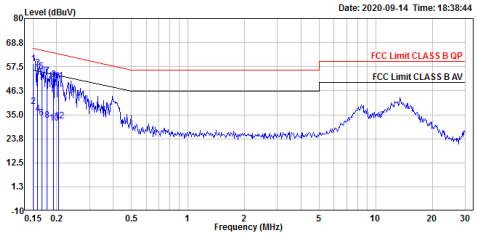
Neutral



	Freq	Read Level	Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	
1	0.151	39.36	59.22	19.86	65.93	-6.71	QP
2	0.151	20.24	40.10	19.86	55.93	-15.83	Average
3	0.157	38.23	58.09	19.86	65.60	-7.51	QP
4	0.157	16.56	36.42	19.86	55.60	-19.18	Average
5	0.166	36.19	56.05	19.86	65.14	-9.09	QP
6	0.166	14.22	34.08	19.86	55.14	-21.06	Average
7	0.206	31.06	50.93	19.87	63.35	-12.42	QP
8	0.206	11.75	31.62	19.87	53.35	-21.73	Average
9	0.225	29.00	48.87	19.87	62.63	-13.76	QP
10	0.225	9.38	29.25	19.87	52.63	-23.38	Average
11	0.416	19.28	39.15	19.87	57.53	-18.38	QP
12	0.416	9.82	29.69	19.87	47.53	-17.84	Average

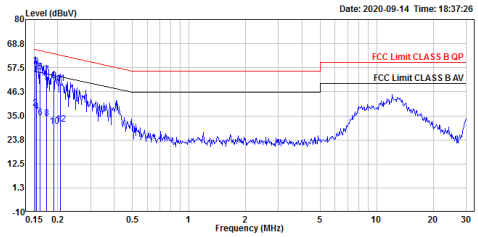
WA512GM-IP67

Line



	Freq	Read Level	Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	
1	0.150	39.05	58.90	19.85	66.00	-7.10	QP
2	0.150	18.92	38.77	19.85	56.00	-17.23	Average
3	0.159	37.05	56.90	19.85	65.54	-8.64	QP
4	0.159	15.66	35.51	19.85	55.54	-20.03	Average
5	0.166	35.26	55.11	19.85	65.14	-10.03	QP
6	0.166	13.77	33.62	19.85	55.14	-21.52	Average
7	0.177	33.24	53.09	19.85	64.61	-11.52	QP
8	0.177	12.60	32.45	19.85	54.61	-22.16	Average
9	0.192	31.66	51.52	19.86	63.95	-12.43	QP
10	0.192	11.20	31.06	19.86	53.95	-22.89	Average
11	0.205	30.89	50.75	19.86	63.42	-12.67	QP
12	0.205	12.39	32.25	19.86	53.42	-21.17	Average

Neutral



	Freq	Read Level	Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	
1	0.151	38.72	58.58	19.86	65.93	-7.35	QP
2	0.151	18.54	38.40	19.86	55.93	-17.53	Average
3	0.155	37.99	57.85	19.86	65.74	-7.89	QP
4	0.155	17.03	36.89	19.86	55.74	-18.85	Average
5	0.161	35.60	55.46	19.86	65.40	-9.94	QP
6	0.161	14.39	34.25	19.86	55.40	-21.15	Average
7	0.175	34.28	54.14	19.86	64.74	-10.60	QP
8	0.175	13.82	33.68	19.86	54.74	-21.06	Average
9	0.191	31.71	51.58	19.87	64.01	-12.43	QP
10	0.191	10.35	30.22	19.87	54.01	-23.79	Average
11	0.206	30.41	50.28	19.87	63.35	-13.07	QP
12	0.206	11.13	31.00	19.87	53.35	-22.35	Average

Note1: Transmit mode

Note2:

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, §15.247(d) – Spurious Emissions

7.1 Applicable Standard

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

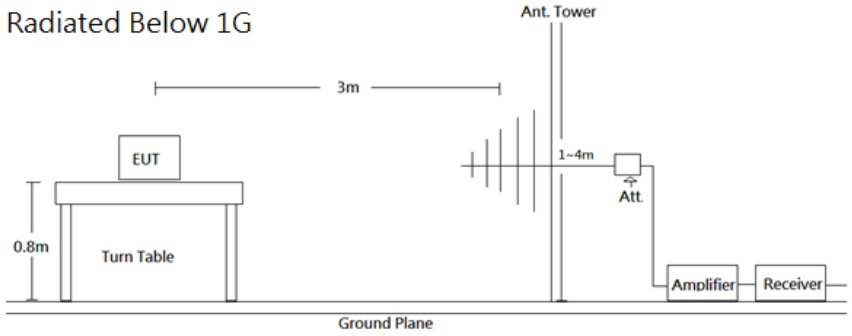
As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

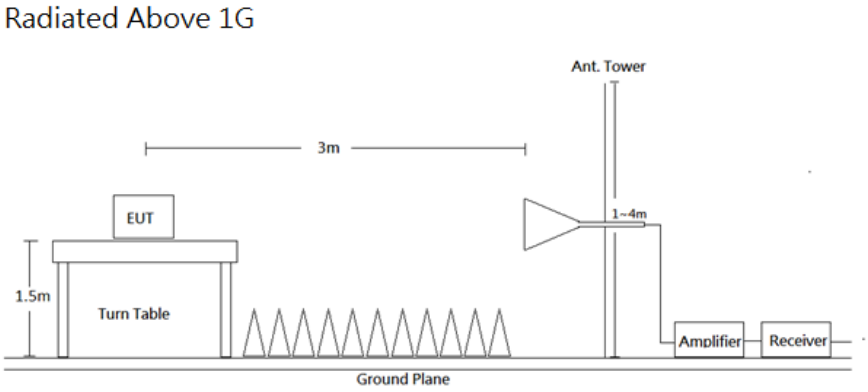
Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** 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.

As per FCC §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c).

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 15.247 Limits.

The system was investigated from 30 MHz to 26.5 GHz. During the radiated emission test, the EMI test receiver was set with the following configurations measurement method 6.3 in ANSI C63.10.

Frequency Range	RBW	VBW	Duty cycle	Measurement method
30-1000 MHz	120 kHz	/	-	QP
Above 1 GHz	1 MHz	3 MHz	-	PK
	1 MHz	10 Hz	>98%	Ave
	1 MHz	1/T	<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
Conducted Room(TH-02)					
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).*

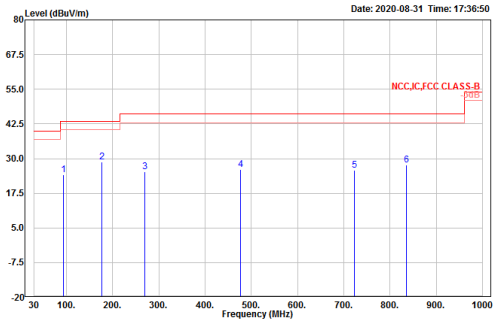
7.4 Test Result

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

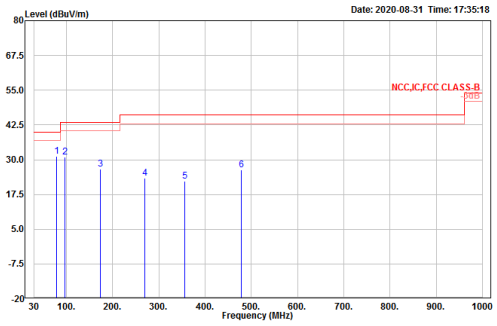
WA512GM-D

Horizontal



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1	94.020	45.93	-21.64	24.29	43.50	-19.21	Peak
2	176.470	48.12	-19.40	28.72	43.50	-14.78	Peak
3	269.590	42.59	-17.27	25.32	46.00	-20.68	Peak
4	476.200	39.14	-13.16	25.98	46.00	-20.02	Peak
5	722.580	35.47	-9.65	25.82	46.00	-20.18	Peak
6	835.100	35.93	-8.10	27.83	46.00	-18.17	Peak

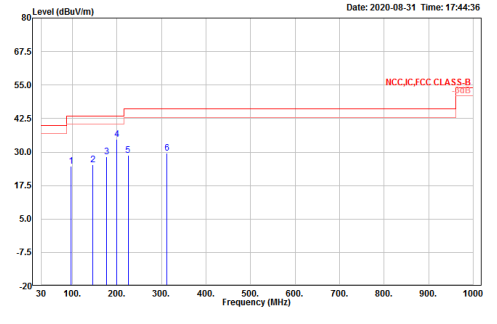
Vertical



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1	78.500	53.36	-22.16	31.20	40.00	-8.80	Peak
2	96.930	51.92	-20.90	31.02	43.50	-12.48	Peak
3	173.560	45.75	-19.15	26.60	43.50	-16.90	Peak
4	269.590	40.71	-17.27	23.44	46.00	-22.56	Peak
5	355.920	38.22	-15.93	22.29	46.00	-23.71	Peak
6	478.140	39.33	-13.11	26.22	46.00	-19.78	Peak

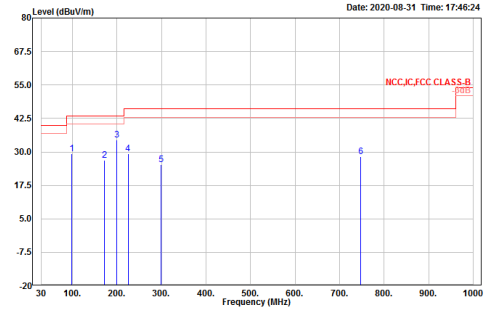
WA512GM-IP67

Horizontal



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1	96.930	45.51	-20.90	24.61	43.50	-18.89	Peak
2	145.430	42.96	-17.81	25.15	43.50	-18.35	Peak
3	176.470	47.69	-19.40	28.29	43.50	-15.21	Peak
4	199.750	52.60	-17.79	34.81	43.50	-8.69	Peak
5	224.970	48.39	-19.61	28.78	46.00	-17.22	Peak
6	312.270	46.43	-16.72	29.71	46.00	-16.29	Peak

Vertical



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1	97.900	49.86	-20.54	29.32	43.50	-14.18	Peak
2	172.590	45.90	-19.03	26.87	43.50	-16.63	Peak
3	199.750	52.26	-17.79	34.47	43.50	-9.03	Peak
4	224.970	48.82	-19.61	29.21	46.00	-16.79	Peak
5	298.690	42.49	-17.22	25.27	46.00	-20.73	Peak
6	746.830	37.71	-9.39	28.32	46.00	-17.68	Peak

Note1: Transmit with MIMO mode

Note2:

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-26.5 GHz)

802.11b mode:

Low CH

Horizontal

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2373.728	65.11	-6.10	59.01	74.00	-14.99	Peak
2373.728	52.06	-6.10	45.96	54.00	-8.04	Average
2411.248	103.69	-5.90	97.79			Peak
2411.248	102.26	-5.90	96.36			Average
4824.000	45.32	1.09	46.41	74.00	-27.59	Peak
4824.000	34.84	1.09	35.93	54.00	-18.07	Average
7236.000	42.24	8.01	50.25	74.00	-23.75	Peak
7236.000	29.56	8.01	37.57	54.00	-16.43	Average

Vertical

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2387.280	68.83	-6.04	62.79	74.00	-11.21	Peak
2387.280	58.96	-6.04	52.92	54.00	-1.08	Average
2411.248	122.40	-5.90	116.50			Peak
2411.248	121.05	-5.90	115.15			Average
4824.000	48.02	1.09	49.11	74.00	-24.89	Peak
4824.000	40.95	1.09	42.04	54.00	-11.96	Average
7236.000	41.49	8.01	49.50	74.00	-24.50	Peak
7236.000	29.33	8.01	37.34	54.00	-16.66	Average

Middle CH

Horizontal

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2373.646	63.88	-6.10	57.78	74.00	-16.22	Peak
2373.646	52.03	-6.10	45.93	54.00	-8.07	Average
2436.324	107.46	-5.72	101.74			Peak
2436.324	105.99	-5.72	100.27			Average
2497.550	63.45	-5.53	57.92	74.00	-16.08	Peak
2497.550	52.10	-5.53	46.57	54.00	-7.43	Average
4874.000	48.70	1.18	49.88	74.00	-24.12	Peak
4874.000	43.53	1.18	44.71	54.00	-9.29	Average
7311.000	43.66	8.15	51.81	74.00	-22.19	Peak
7311.000	29.65	8.15	37.80	54.00	-16.20	Average

Vertical

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2355.738	64.76	-6.18	58.58	74.00	-15.42	Peak
2355.738	53.46	-6.18	47.28	54.00	-6.72	Average
2436.324	124.09	-5.72	118.37			Peak
2436.324	122.72	-5.72	117.00			Average
2491.016	64.25	-5.54	58.71	74.00	-15.29	Peak
2491.016	52.73	-5.54	47.19	54.00	-6.81	Average
4874.000	53.45	1.18	54.63	74.00	-19.37	Peak
4874.000	49.73	1.18	50.91	54.00	-3.09	Average
7311.000	40.94	8.15	49.09	74.00	-24.91	Peak
7311.000	30.11	8.15	38.26	54.00	-15.74	Average

High CH

Horizontal

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2461.100	105.38	-5.59	99.79			Peak
2461.100	104.01	-5.59	98.42			Average
2493.800	63.94	-5.54	58.40	74.00	-15.60	Peak
2493.800	52.17	-5.54	46.63	54.00	-7.37	Average
4924.000	44.06	1.28	45.34	74.00	-28.66	Peak
4924.000	30.78	1.28	32.06	54.00	-21.94	Average
7386.000	39.65	8.26	47.91	74.00	-26.09	Peak
7386.000	27.77	8.26	36.03	54.00	-17.97	Average

Vertical

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2461.100	122.01	-5.59	116.42			Peak
2461.100	120.67	-5.59	115.08			Average
2486.800	67.63	-5.55	62.08	74.00	-11.92	Peak
2486.800	58.48	-5.55	52.93	54.00	-1.07	Average
4924.000	46.61	1.28	47.89	74.00	-26.11	Peak
4924.000	37.72	1.28	39.00	54.00	-15.00	Average
7386.000	40.10	8.26	48.36	74.00	-25.64	Peak
7386.000	27.68	8.26	35.94	54.00	-18.06	Average

802.11g mode:

Low CH

Horizontal

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2313.696	64.80	-6.04	58.76	74.00	-15.24	Peak
2313.696	52.42	-6.04	46.38	54.00	-7.62	Average
2416.512	102.31	-5.86	96.45			Peak
2416.512	92.99	-5.86	87.13			Average
4824.000	44.11	1.09	45.20	74.00	-28.80	Peak
4824.000	31.25	1.09	32.34	54.00	-21.66	Average
7236.000	41.54	8.01	49.55	74.00	-24.45	Peak
7236.000	29.55	8.01	37.56	54.00	-16.44	Average

Vertical

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2389.968	72.49	-6.03	66.46	74.00	-7.54	Peak
2389.968	59.02	-6.03	52.99	54.00	-1.01	Average
2410.912	120.60	-5.90	114.70			Peak
2410.912	111.26	-5.90	105.36			Average
4824.000	45.82	1.09	46.91	74.00	-27.09	Peak
4824.000	32.90	1.09	33.99	54.00	-20.01	Average
7236.000	41.29	8.01	49.30	74.00	-24.70	Peak
7236.000	29.49	8.01	37.50	54.00	-16.50	Average

Middle CH

Horizontal

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2322.826	63.96	-6.09	57.87	74.00	-16.13	Peak
2322.826	52.59	-6.09	46.50	54.00	-7.50	Average
2435.598	111.44	-5.73	105.71			Peak
2435.598	102.46	-5.73	96.73			Average
2485.208	64.03	-5.55	58.48	74.00	-15.52	Peak
2485.208	52.71	-5.55	47.16	54.00	-6.84	Average
4874.000	50.72	1.18	51.90	74.00	-22.10	Peak
4874.000	35.97	1.18	37.15	54.00	-16.85	Average
7311.000	41.53	8.15	49.68	74.00	-24.32	Peak
7311.000	29.53	8.15	37.68	54.00	-16.32	Average

Vertical

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2377.276	71.04	-6.08	64.96	74.00	-9.04	Peak
2377.276	57.34	-6.08	51.26	54.00	-2.74	Average
2442.374	126.63	-5.67	120.96			Peak
2442.374	117.52	-5.67	111.85			Average
2487.628	76.70	-5.55	71.15	74.00	-2.85	Peak
2487.628	58.37	-5.55	52.82	54.00	-1.18	Average
4874.000	57.13	1.18	58.31	74.00	-15.69	Peak
4874.000	41.22	1.18	42.40	54.00	-11.60	Average
7311.000	41.33	8.15	49.48	74.00	-24.52	Peak
7311.000	29.59	8.15	37.74	54.00	-16.26	Average

High CH

Horizontal

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2460.200	103.66	-5.60	98.06			Peak
2460.200	94.52	-5.60	88.92			Average
2486.400	64.26	-5.55	58.71	74.00	-15.29	Peak
2486.400	52.77	-5.55	47.22	54.00	-6.78	Average
4924.000	44.19	1.28	45.47	74.00	-28.53	Peak
4924.000	30.65	1.28	31.93	54.00	-22.07	Average
7386.000	40.52	8.26	48.78	74.00	-25.22	Peak
7386.000	27.95	8.26	36.21	54.00	-17.79	Average

Vertical

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2466.100	119.81	-5.59	114.22			Peak
2466.100	110.34	-5.59	104.75			Average
2484.200	72.59	-5.55	67.04	74.00	-6.96	Peak
2484.200	57.67	-5.55	52.12	54.00	-1.88	Average
4924.000	44.00	1.28	45.28	74.00	-28.72	Peak
4924.000	30.93	1.28	32.21	54.00	-21.79	Average
7386.000	40.98	8.26	49.24	74.00	-24.76	Peak
7386.000	28.04	8.26	36.30	54.00	-17.70	Average

802.11n HT20 mode:

Low CH

Horizontal

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2323.664	64.97	-6.09	58.88	74.00	-15.12	Peak
2323.664	52.51	-6.09	46.42	54.00	-7.58	Average
2415.392	98.56	-5.87	92.69			Peak
2415.392	89.30	-5.87	83.43			Average
4824.000	44.80	1.09	45.89	74.00	-28.11	Peak
4824.000	31.24	1.09	32.33	54.00	-21.67	Average
7236.000	41.93	8.01	49.94	74.00	-24.06	Peak
7236.000	29.48	8.01	37.49	54.00	-16.51	Average

Vertical

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2389.968	71.55	-6.03	65.52	74.00	-8.48	Peak
2389.968	58.92	-6.03	52.89	54.00	-1.11	Average
2409.344	121.13	-5.91	115.22			Peak
2409.344	110.95	-5.91	105.04			Average
4824.000	45.80	1.09	46.89	74.00	-27.11	Peak
4824.000	32.53	1.09	33.62	54.00	-20.38	Average
7236.000	42.00	8.01	50.01	74.00	-23.99	Peak
7236.000	29.53	8.01	37.54	54.00	-16.46	Average

Middle CH

Horizontal

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2338.072	64.17	-6.15	58.02	74.00	-15.98	Peak
2338.072	52.42	-6.15	46.27	54.00	-7.73	Average
2435.356	109.23	-5.73	103.50			Peak
2435.356	100.31	-5.73	94.58			Average
2490.532	63.50	-5.54	57.96	74.00	-16.04	Peak
2490.532	52.58	-5.54	47.04	54.00	-6.96	Average
4874.000	47.42	1.18	48.60	74.00	-25.40	Peak
4874.000	32.98	1.18	34.16	54.00	-19.84	Average
7311.000	41.02	8.15	49.17	74.00	-24.83	Peak
7311.000	29.67	8.15	37.82	54.00	-16.18	Average

Vertical

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2384.536	69.57	-6.05	63.52	74.00	-10.48	Peak
2384.536	56.70	-6.05	50.65	54.00	-3.35	Average
2434.388	126.13	-5.73	120.40			Peak
2434.388	117.14	-5.73	111.41			Average
2484.482	71.58	-5.55	66.03	74.00	-7.97	Peak
2484.482	57.67	-5.55	52.12	54.00	-1.88	Average
4874.000	52.65	1.18	53.83	74.00	-20.17	Peak
4874.000	37.35	1.18	38.53	54.00	-15.47	Average
7311.000	41.84	8.15	49.99	74.00	-24.01	Peak
7311.000	29.63	8.15	37.78	54.00	-16.22	Average

High CH

Horizontal

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2454.700	101.25	-5.60	95.65			Peak
2454.700	91.99	-5.60	86.39			Average
2490.100	64.30	-5.54	58.76	74.00	-15.24	Peak
2490.100	52.50	-5.54	46.96	54.00	-7.04	Average
4924.000	44.13	1.28	45.41	74.00	-28.59	Peak
4924.000	30.76	1.28	32.04	54.00	-21.96	Average
7386.000	40.60	8.26	48.86	74.00	-25.14	Peak
7386.000	28.06	8.26	36.32	54.00	-17.68	Average

Vertical

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2459.400	118.41	-5.60	112.81			Peak
2459.400	108.32	-5.60	102.72			Average
2483.700	70.46	-5.55	64.91	74.00	-9.09	Peak
2483.700	57.58	-5.55	52.03	54.00	-1.97	Average
4924.000	43.79	1.28	45.07	74.00	-28.93	Peak
4924.000	30.82	1.28	32.10	54.00	-21.90	Average
7386.000	40.87	8.26	49.13	74.00	-24.87	Peak
7386.000	28.04	8.26	36.30	54.00	-17.70	Average

802.11n HT40 mode:

Low CH

Horizontal

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2314.488	64.00	-6.05	57.95	74.00	-16.05	Peak
2314.488	52.12	-6.05	46.07	54.00	-7.93	Average
2425.368	96.92	-5.80	91.12			Peak
2425.368	89.16	-5.80	83.36			Average
4844.000	44.45	1.15	45.60	74.00	-28.40	Peak
4844.000	30.61	1.15	31.76	54.00	-22.24	Average
7266.000	42.08	8.12	50.20	74.00	-23.80	Peak
7266.000	29.50	8.12	37.62	54.00	-16.38	Average

Vertical

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2388.144	70.60	-6.04	64.56	74.00	-9.44	Peak
2388.144	58.90	-6.04	52.86	54.00	-1.14	Average
2429.592	114.52	-5.76	108.76			Peak
2429.592	105.70	-5.76	99.94			Average
4844.000	44.13	1.15	45.28	74.00	-28.72	Peak
4844.000	30.75	1.15	31.90	54.00	-22.10	Average
7266.000	41.62	8.12	49.74	74.00	-24.26	Peak
7266.000	29.54	8.12	37.66	54.00	-16.34	Average

Middle CH

Horizontal

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2356.464	64.24	-6.17	58.07	74.00	-15.93	Peak
2356.464	52.56	-6.17	46.39	54.00	-7.61	Average
2449.634	101.76	-5.61	96.15			Peak
2449.634	93.49	-5.61	87.88			Average
2487.144	63.79	-5.55	58.24	74.00	-15.76	Peak
2487.144	52.68	-5.55	47.13	54.00	-6.87	Average
4874.000	43.71	1.18	44.89	74.00	-29.11	Peak
4874.000	30.56	1.18	31.74	54.00	-22.26	Average
7311.000	42.16	8.15	50.31	74.00	-23.69	Peak
7311.000	29.52	8.15	37.67	54.00	-16.33	Average

Vertical

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2389.860	72.91	-6.03	66.88	74.00	-7.12	Peak
2389.860	58.71	-6.03	52.68	54.00	-1.32	Average
2433.904	118.25	-5.74	112.51			Peak
2433.904	109.00	-5.74	103.26			Average
2483.756	69.87	-5.55	64.32	74.00	-9.68	Peak
2483.756	57.56	-5.55	52.01	54.00	-1.99	Average
4874.000	44.00	1.18	45.18	74.00	-28.82	Peak
4874.000	31.11	1.18	32.29	54.00	-21.71	Average
7311.000	41.18	8.15	49.33	74.00	-24.67	Peak
7311.000	29.56	8.15	37.71	54.00	-16.29	Average

High CH

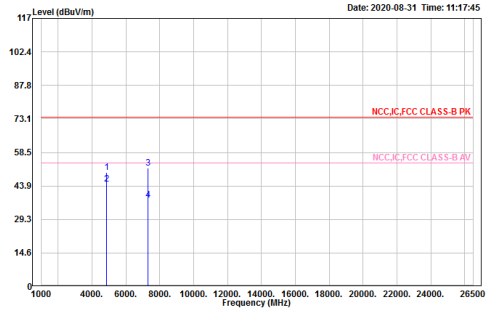
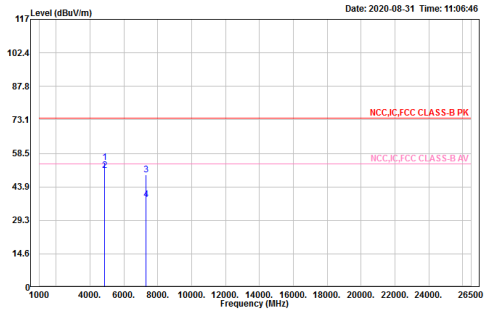
Horizontal

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2443.280	97.59	-5.66	91.93			Peak
2443.280	88.62	-5.66	82.96			Average
2485.280	64.13	-5.55	58.58	74.00	-15.42	Peak
2485.280	52.60	-5.55	47.05	54.00	-6.95	Average
4904.000	44.14	1.23	45.37	74.00	-28.63	Peak
4904.000	30.61	1.23	31.84	54.00	-22.16	Average
7356.000	40.22	8.26	48.48	74.00	-25.52	Peak
7356.000	28.88	8.26	37.14	54.00	-16.86	Average

Vertical

Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
2449.040	113.08	-5.62	107.46			Peak
2449.040	104.33	-5.62	98.71			Average
2486.120	71.57	-5.55	66.02	74.00	-7.98	Peak
2486.120	57.59	-5.55	52.04	54.00	-1.96	Average
4904.000	44.20	1.23	45.43	74.00	-28.57	Peak
4904.000	30.67	1.23	31.90	54.00	-22.10	Average
7356.000	40.70	8.26	48.96	74.00	-25.04	Peak
7356.000	28.77	8.26	37.03	54.00	-16.97	Average

Above 1G (1 GHz-26.5 GHz): The worst mode: IEEE 802.11b Middle CH

Horizontal	Vertical
	

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1	4874.000	48.70	1.18	49.88	74.00	-24.12	Peak
2	4874.000	43.53	1.18	44.71	54.00	-9.29	Average
3	7311.000	43.66	8.15	51.81	74.00	-22.19	Peak
4	7311.000	29.65	8.15	37.80	54.00	-16.20	Average

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1	4874.000	53.45	1.18	54.63	74.00	-19.37	Peak
2	4874.000	49.73	1.18	50.91	54.00	-3.09	Average
3	7311.000	40.94	8.15	49.09	74.00	-24.91	Peak
4	7311.000	30.11	8.15	38.26	54.00	-15.74	Average

Note1: Transmit with MIMO mode

Note2:

Level = Read Level + Factor

Over Limit = Level – Limit

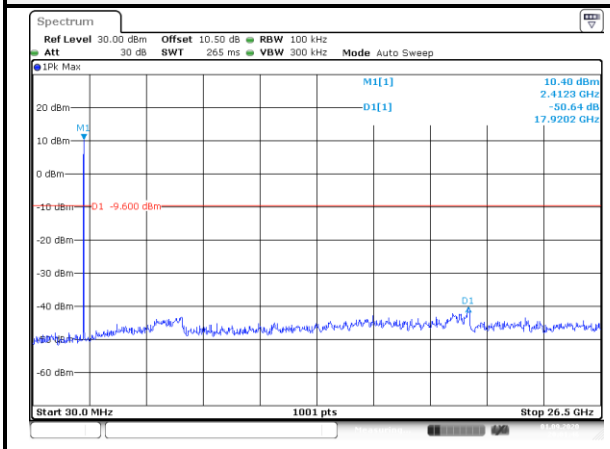
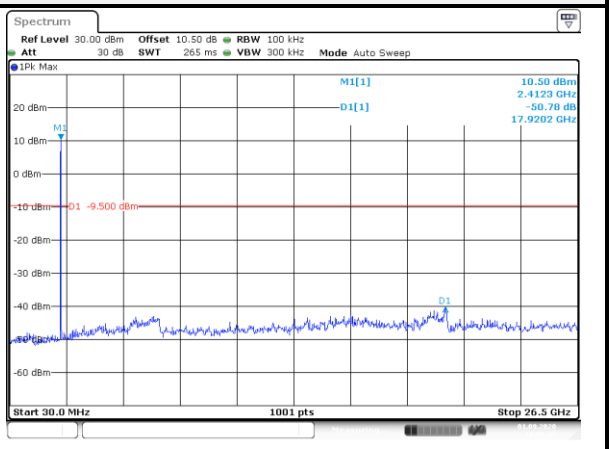
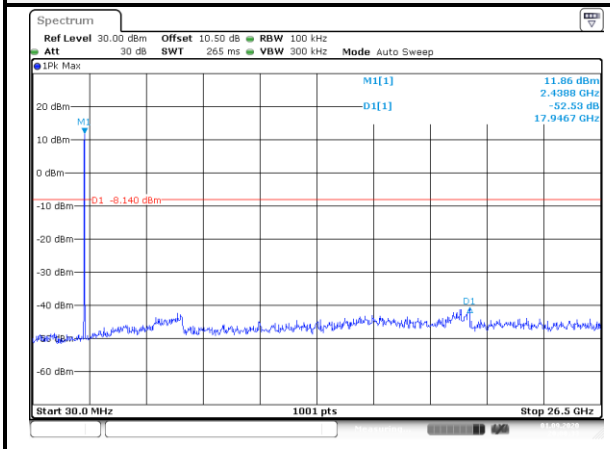
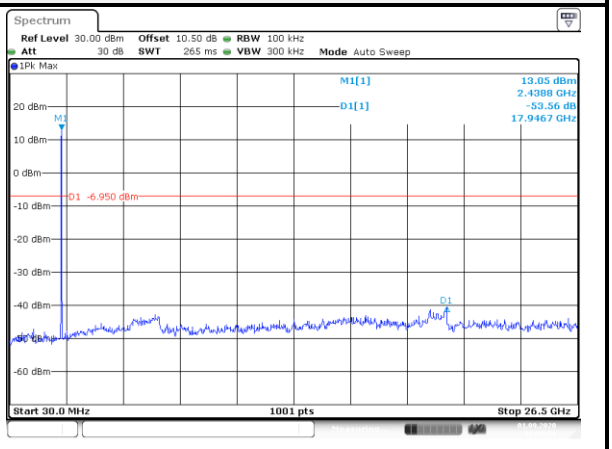
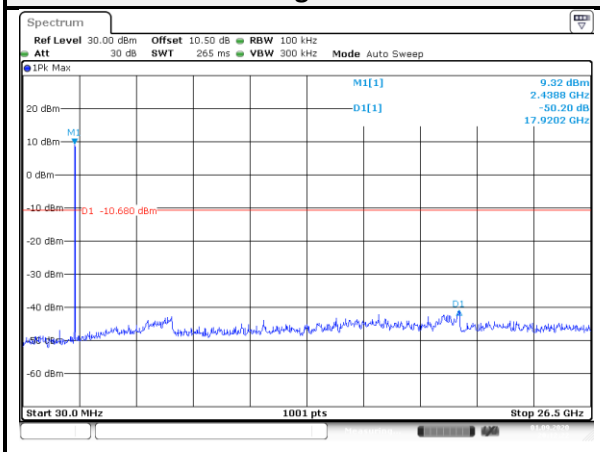
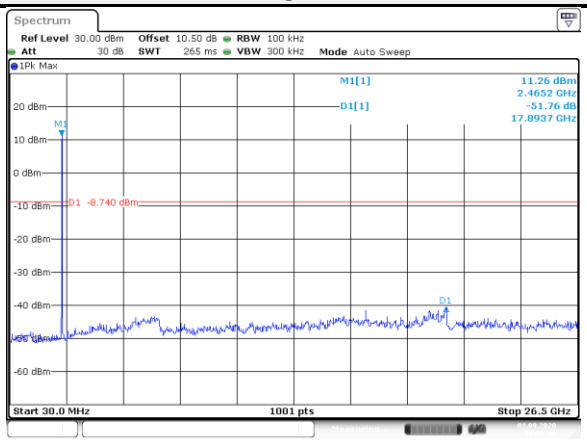
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

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

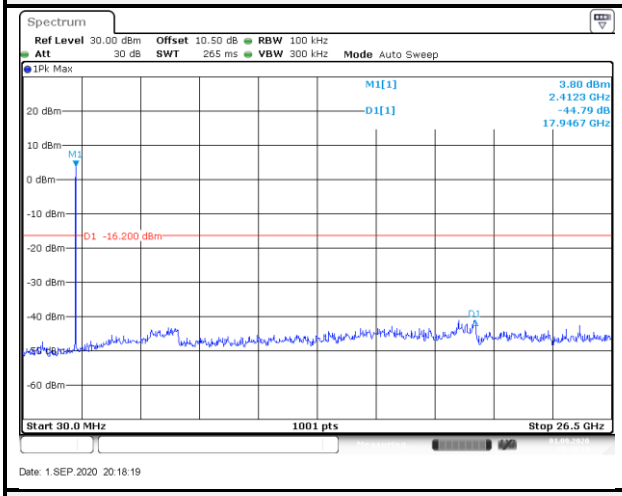
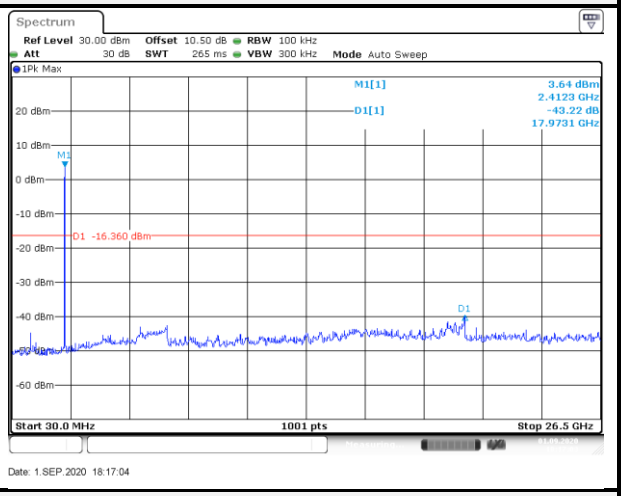
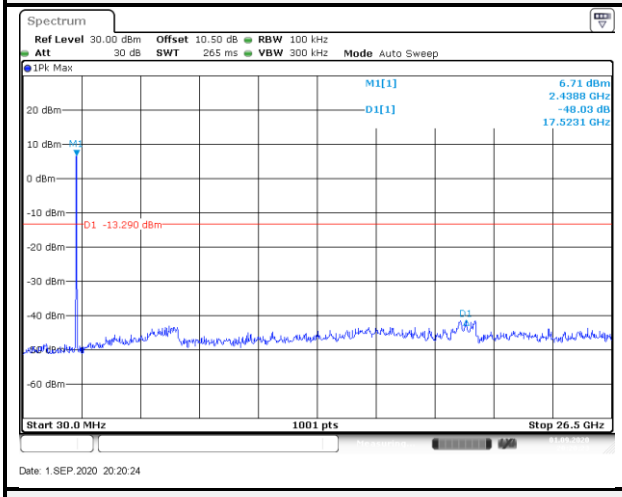
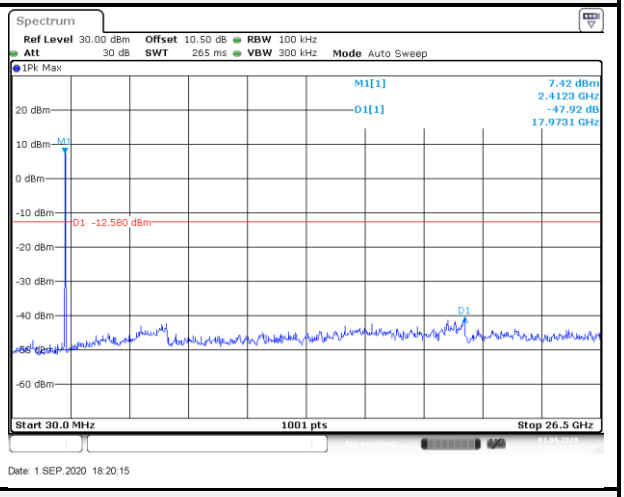
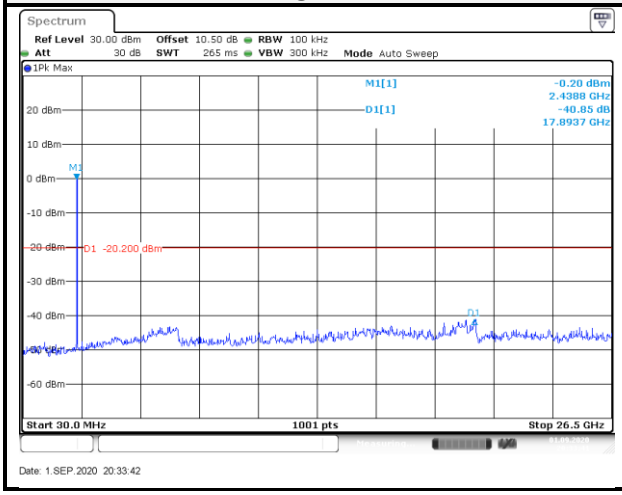
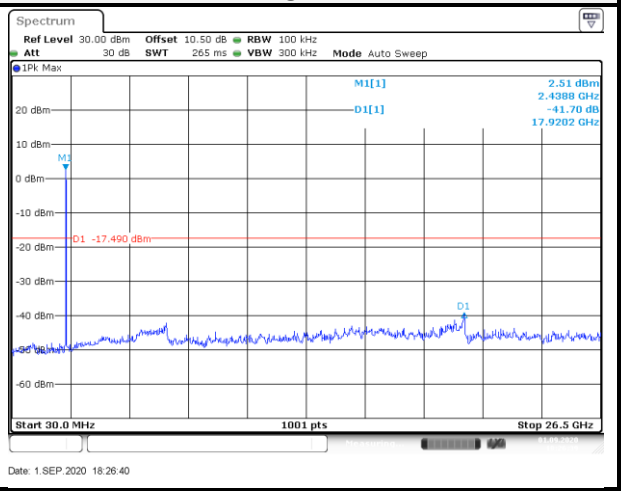
Conducted Spurious Emissions:

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)		Limit (dBc)	Result
		Ant. 1	Ant. 2		
802.11b mode					
Low	2412	50.64	50.78	≥ 20	Compliance
Mid	2437	52.53	53.56	≥ 20	Compliance
High	2462	50.20	51.76	≥ 20	Compliance
802.11g mode					
Low	2412	44.79	43.22	≥ 20	Compliance
Mid	2437	48.03	47.92	≥ 20	Compliance
High	2462	40.85	41.70	≥ 20	Compliance
802.11n HT20 mode					
Low	2412	41.44	39.03	≥ 20	Compliance
Mid	2437	45.84	48.03	≥ 20	Compliance
High	2462	38.17	40.32	≥ 20	Compliance
802.11n HT40 mode					
Low	2422	34.48	38.71	≥ 20	Compliance
Mid	2437	38.54	44.09	≥ 20	Compliance
High	2452	35.47	39.17	≥ 20	Compliance

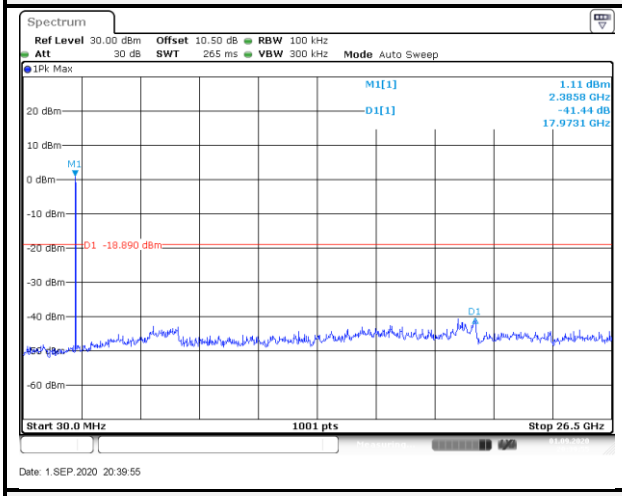
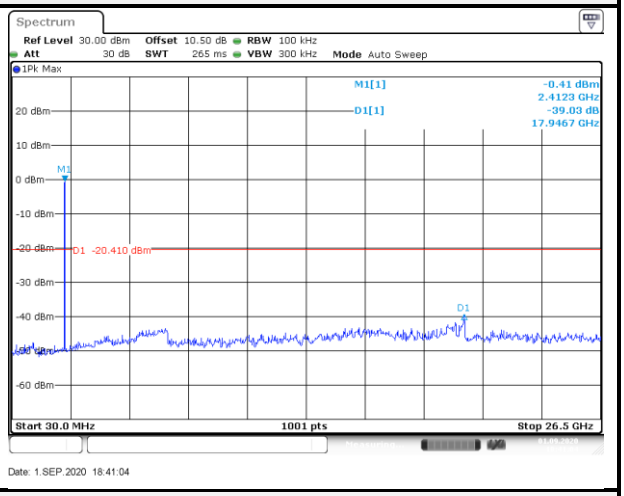
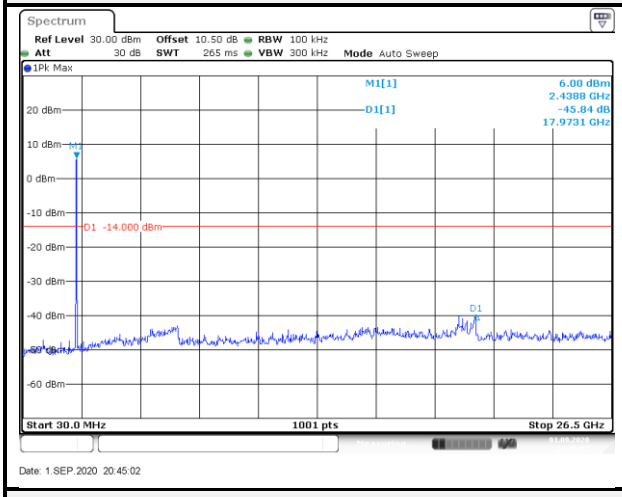
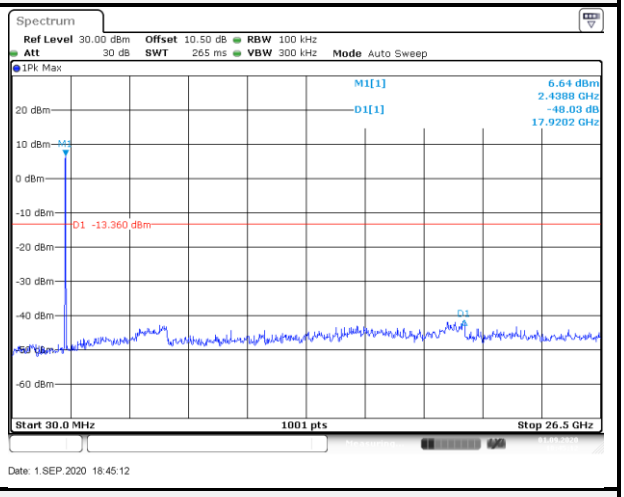
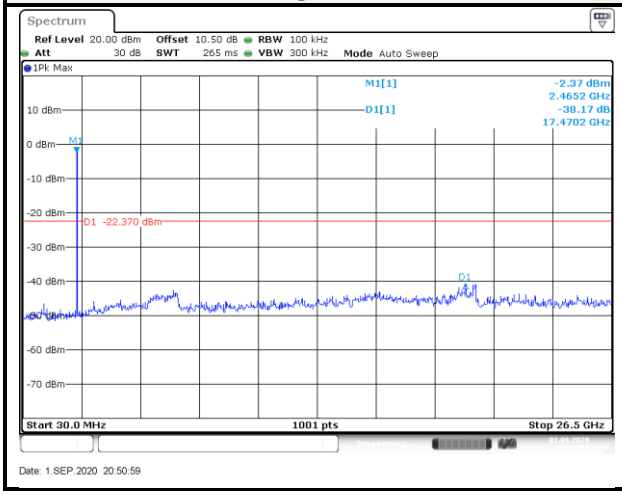
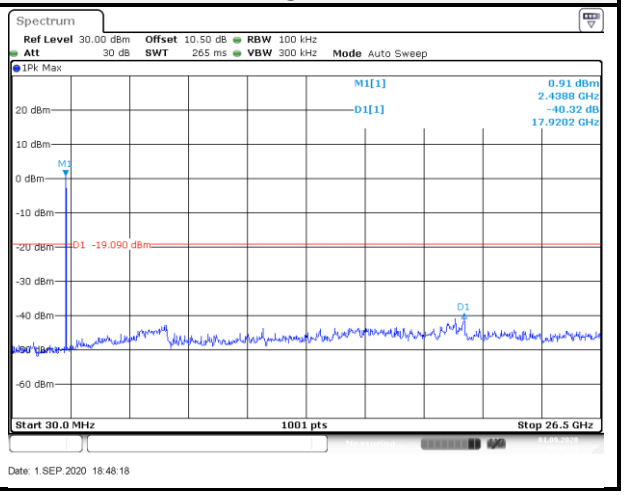
802.11b mode

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

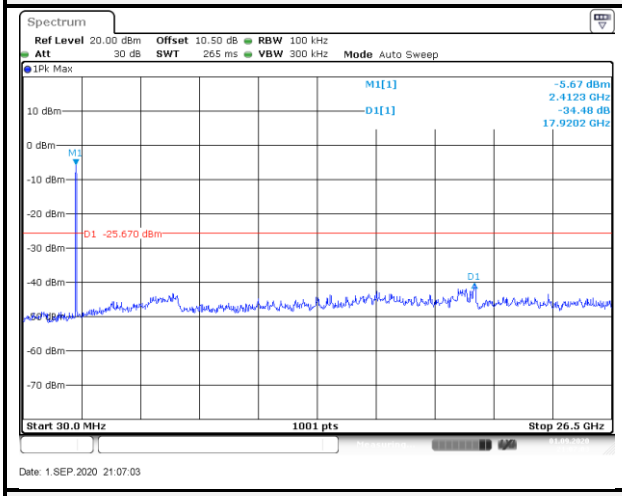
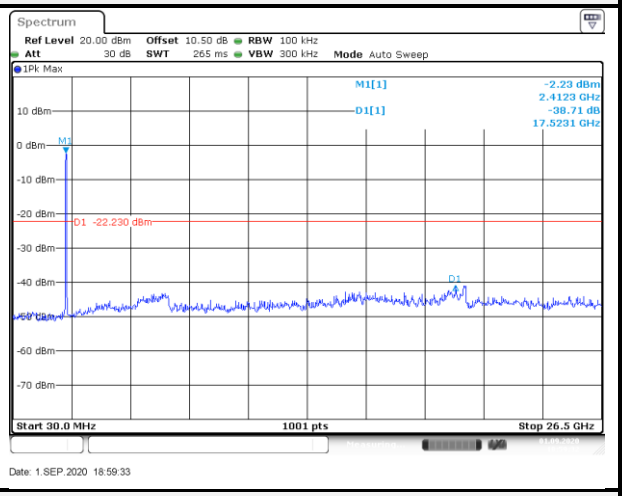
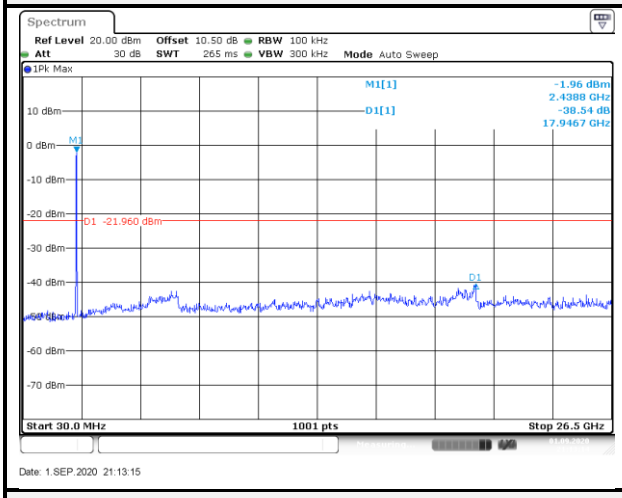
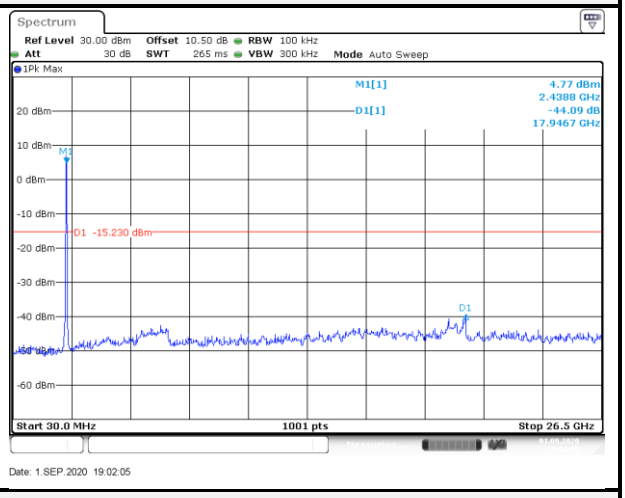
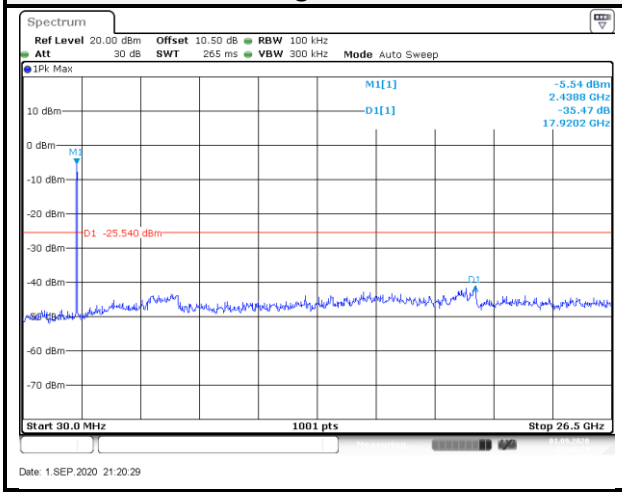
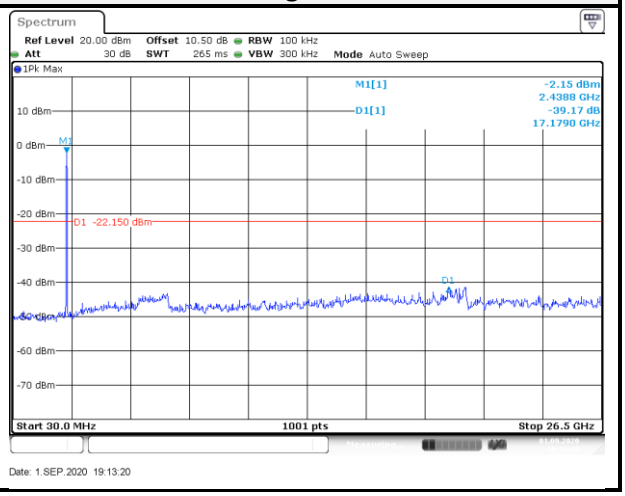
802.11g mode

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

802.11n HT20 mode:

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

802.11n HT40 Mode

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

8 FCC §15.247(a)(2) – 6 dB Emission Bandwidth

8.1 Applicable Standard

According to FCC §15.247(a) (2),

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

8.2 Test Procedure

According to ANSI C63.10-2013, the steps for the first option are as follows:

(1) Set RBW = 100 kHz. (2) Set the VBW ≥ [3 × RBW]. (3) Detector = peak. (4) Trace mode = max hold.

(5) Sweep = auto couple. (6) Allow the trace to stabilize. (7) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

8.3 Test Equipment List and Details

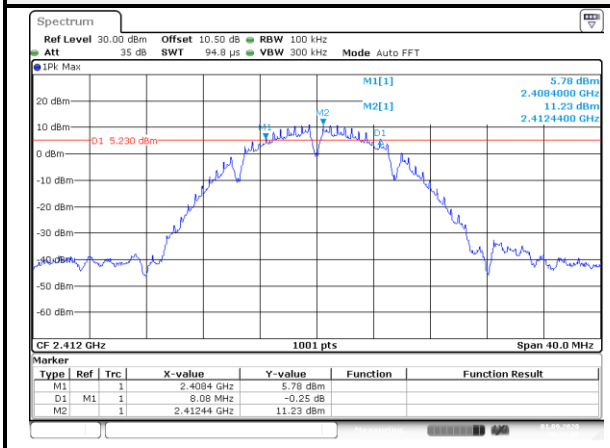
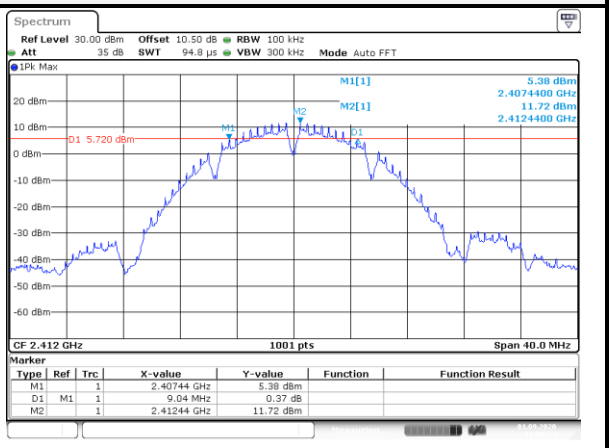
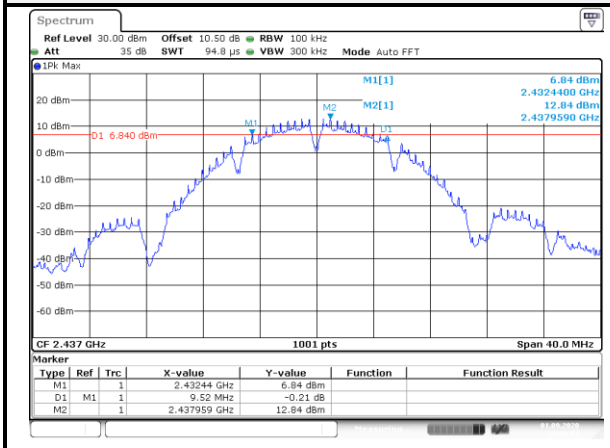
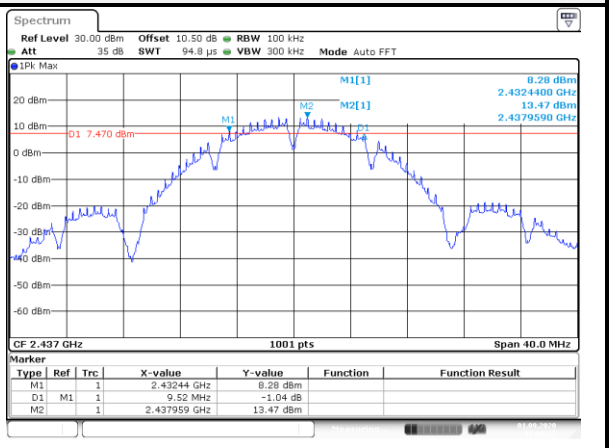
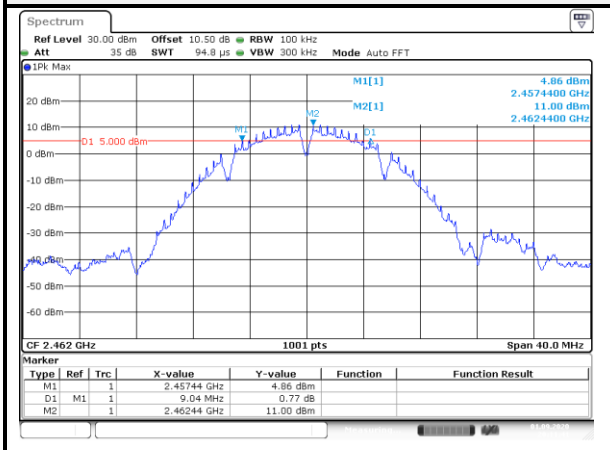
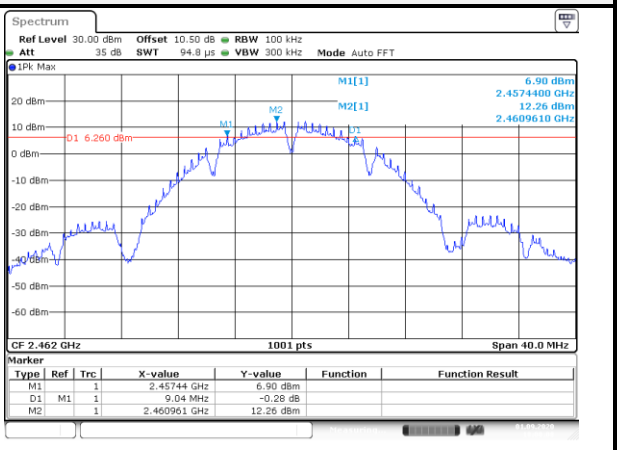
Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conducted Room(TH-02)					
Signal Analyzer 40GHZ	Rohde & Schwarz	FSV40	101456	2020/06/03	2021/06/02
Cable	MTJ	MT40S	620620-MT40S-100	Each Use	-

***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).*

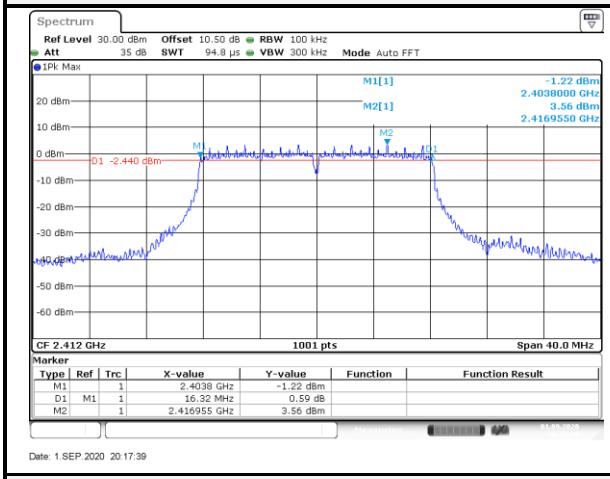
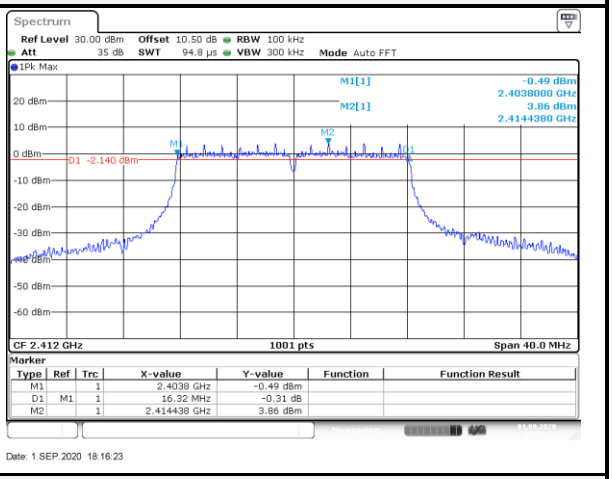
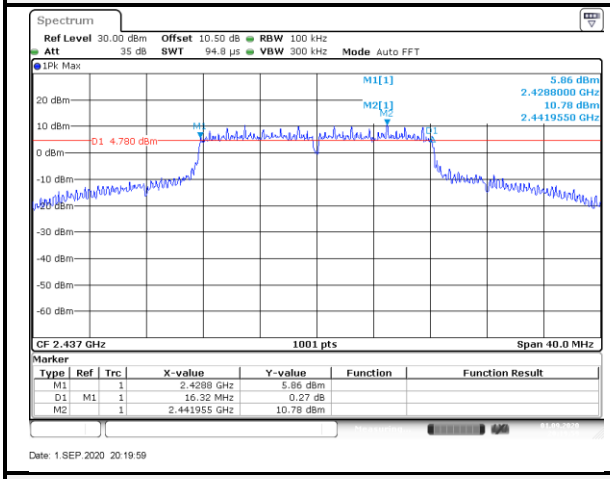
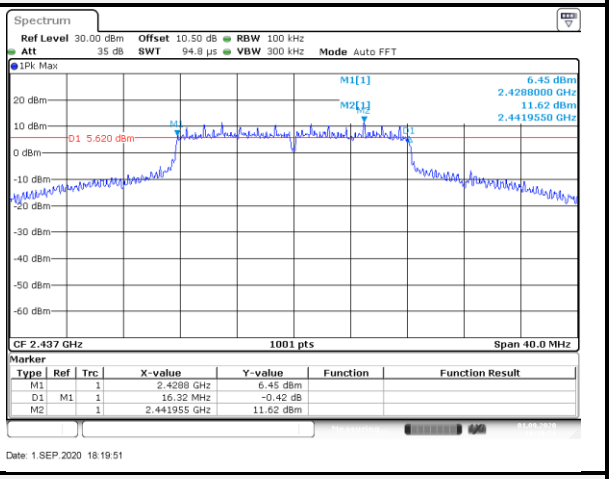
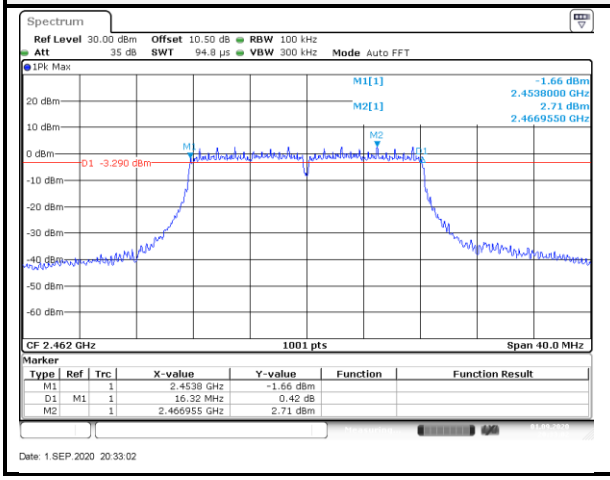
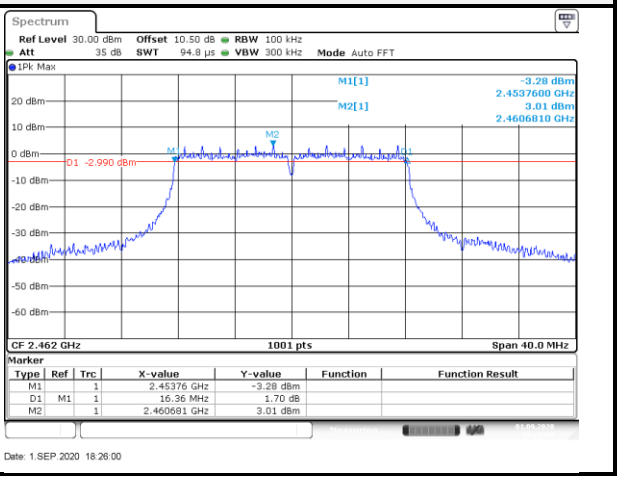
8.4 Test Results

Channel	Frequency (MHz)	6 dB BW (MHz)		6dB Limit (MHz)	Result
		Ant. 1	Ant. 2		
802.11b mode					
Low	2412	8.08	9.04	> 0.5	Compliance
Middle	2437	9.52	9.52	> 0.5	Compliance
High	2462	9.04	9.04	> 0.5	Compliance
802.11g mode					
Low	2412	16.32	16.32	> 0.5	Compliance
Middle	2437	16.32	16.32	> 0.5	Compliance
High	2462	16.32	16.36	> 0.5	Compliance
802.11n HT20 mode					
Low	2412	17.60	17.56	> 0.5	Compliance
Middle	2437	17.60	17.56	> 0.5	Compliance
High	2462	17.60	17.60	> 0.5	Compliance
802.11n HT40 mode					
Low	2422	35.68	35.28	> 0.5	Compliance
Middle	2437	35.36	35.44	> 0.5	Compliance
High	2452	35.68	35.44	> 0.5	Compliance

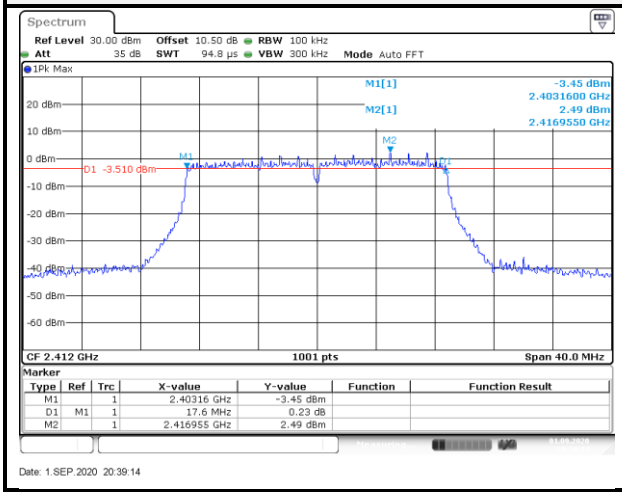
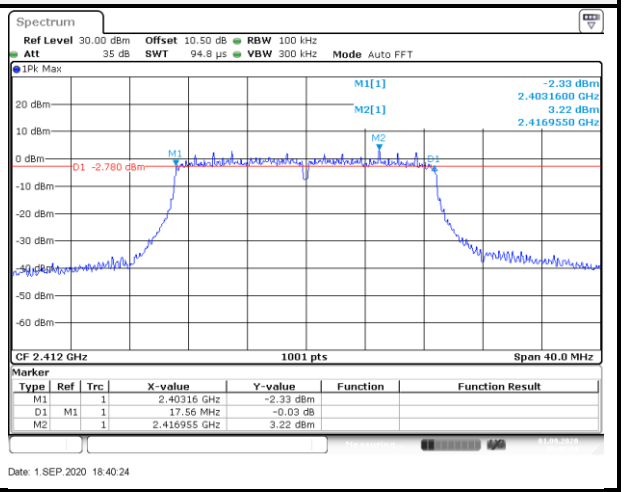
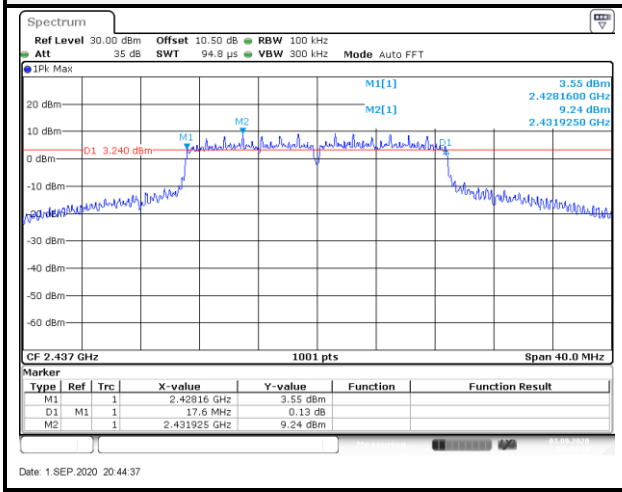
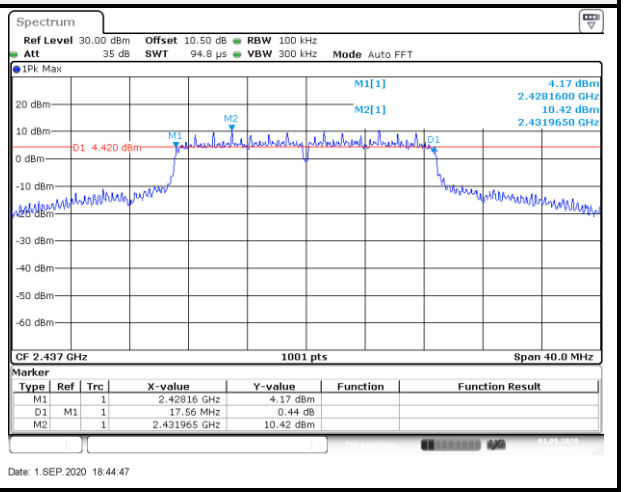
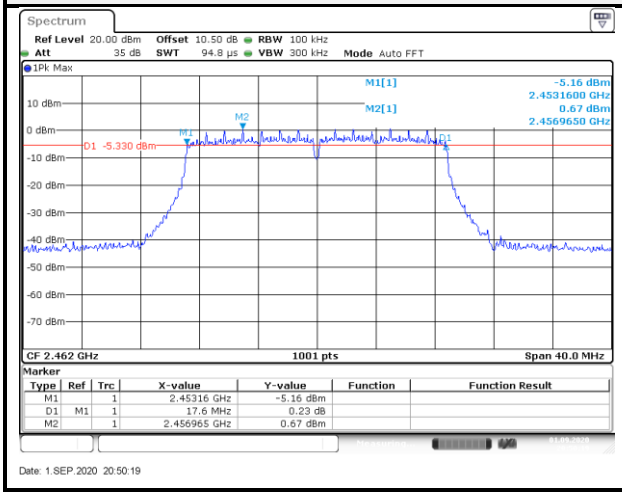
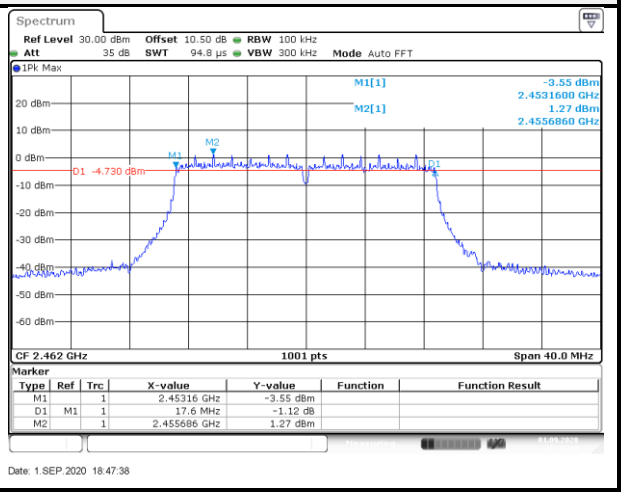
802.11b mode:

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

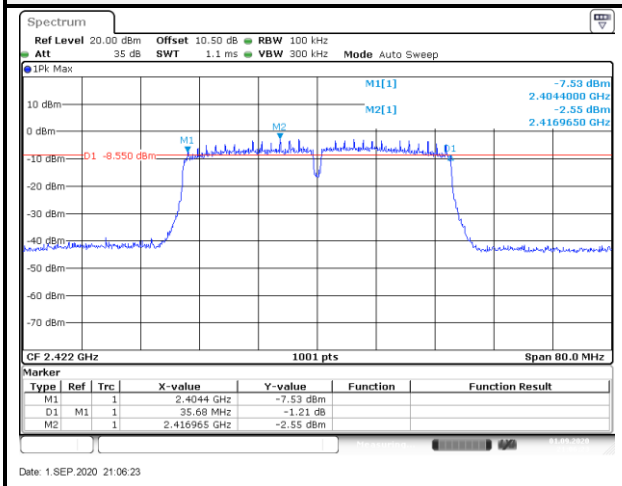
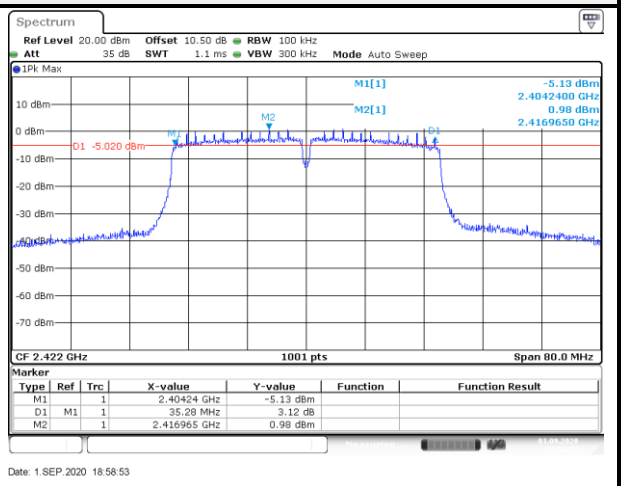
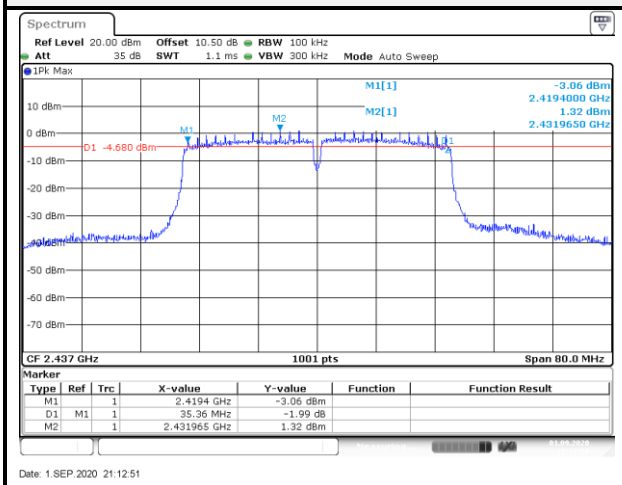
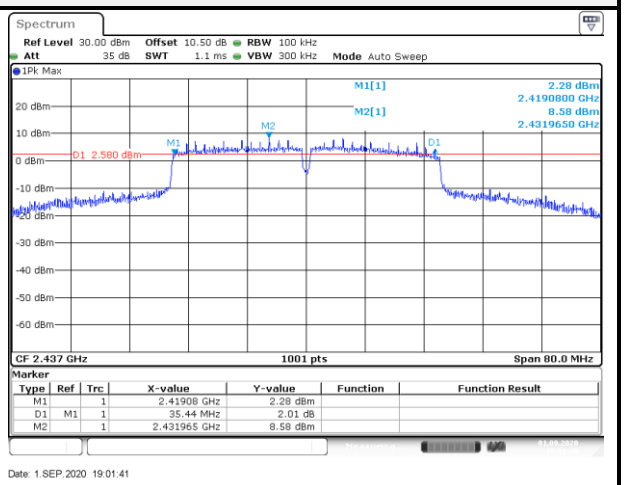
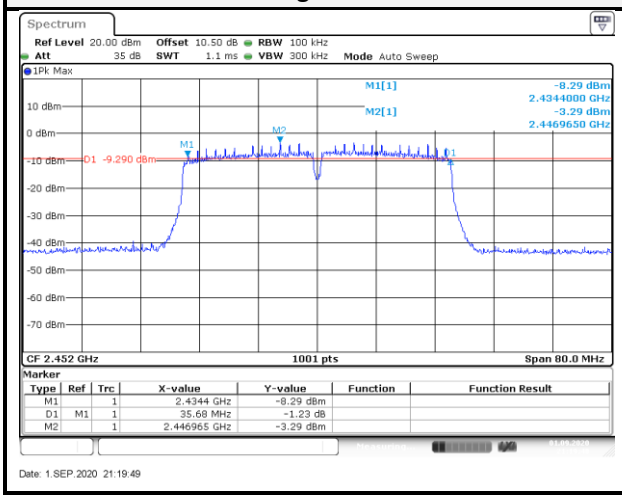
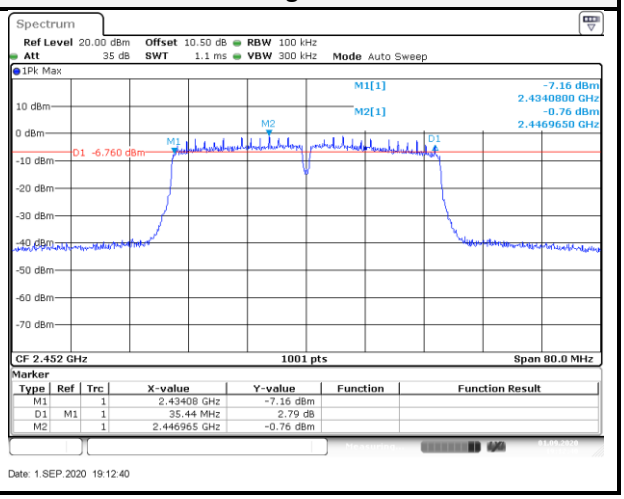
802.11g mode:

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

802.11n HT20 mode:

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

802.11n HT40 mode:

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

9 FCC §15.247(b) (3) – Maximum Output Power

9.1 Applicable Standard

According to FCC §15.247(b) (3),

Systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

9.2 Test Procedure

(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 measuring equipment.

(3). Add a correction factor to the display.

9.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conducted Room(TH-02)					
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 Results

Channel	Frequency (MHz)	Maximum Peak Output Power (dBm)			Maximum Peak Output Power (W)	Limit (dBm)	Result
		Ant. 1	Ant. 2	Sum			
802.11b mode:							
Low	2412	22.01	22.56	25.30	0.3388	30	Compliance
Middle	2437	23.71	24.21	26.98	0.4989	30	Compliance
High	2462	21.81	23.36	25.66	0.3681	30	Compliance
802.11g mode:							
Low	2412	22.88	23.08	25.99	0.3972	30	Compliance
Middle	2437	25.63	25.88	28.77	0.7534	30	Compliance
High	2462	22.68	22.96	25.83	0.3828	30	Compliance
802.11n HT20 mode:							
Low	2412	22.26	22.63	25.46	0.3516	30	Compliance
Middle	2437	25.32	25.81	28.58	0.7211	30	Compliance
High	2462	20.88	21.09	24.00	0.2512	30	Compliance
802.11n HT40 mode:							
Low	2422	20.13	20.35	23.25	0.2113	30	Compliance
Middle	2437	23.08	23.29	26.20	0.4169	30	Compliance
High	2452	18.87	19.25	22.07	0.1611	30	Compliance

10 FCC §15.247(d) – 100 kHz Bandwidth of Frequency Band Edge

10.1 Applicable Standard

According to FCC §15.247(d),

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

10.2 Test Procedure

(1) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
(2) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
(3) Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
(4) Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.

10.3 Test Equipment List and Details

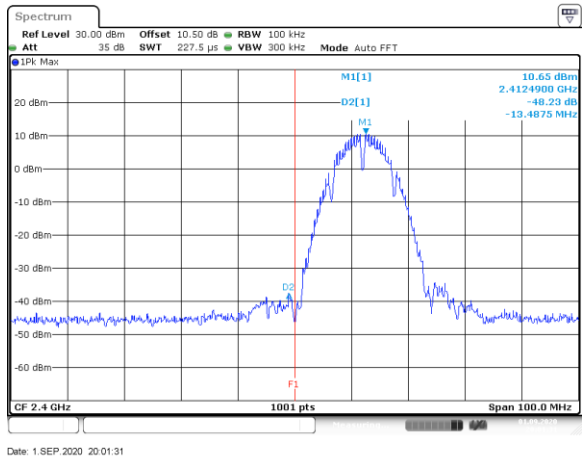
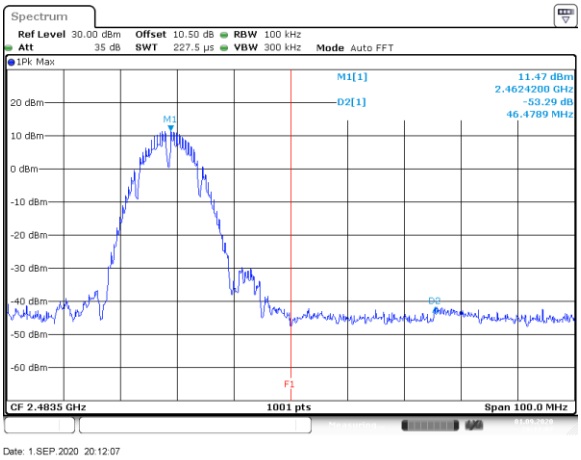
Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conducted Room(TH-02)					
Signal Analyzer 40GHZ	Rohde & Schwarz	FSV40	101456	2020/06/03	2021/06/02
Cable	MTJ	MT40S	620620-MT40S-100	Each Use	-

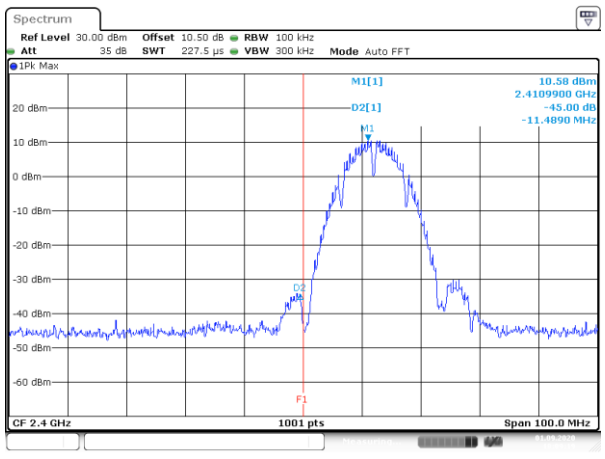
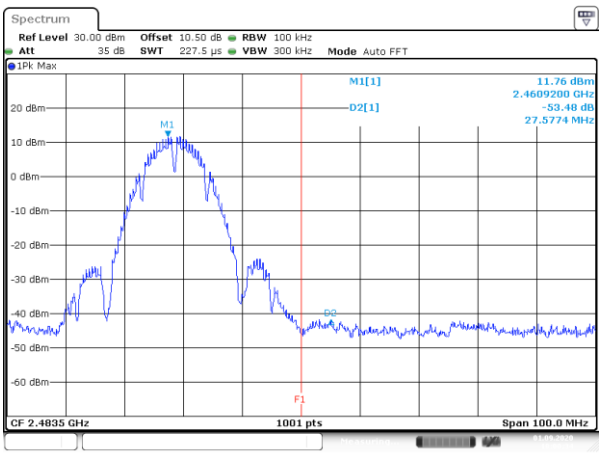
***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units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

10.4 Test Results

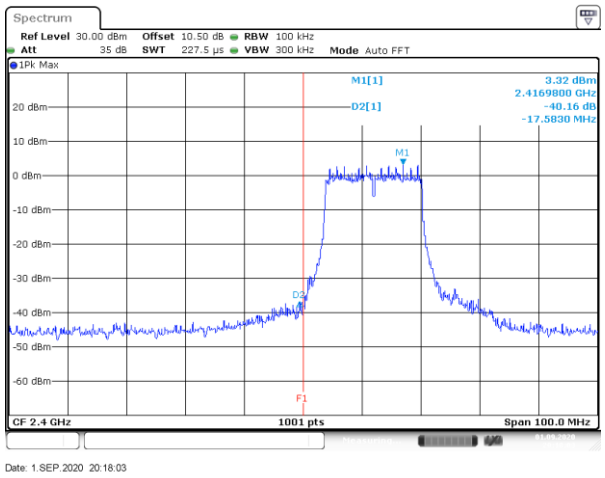
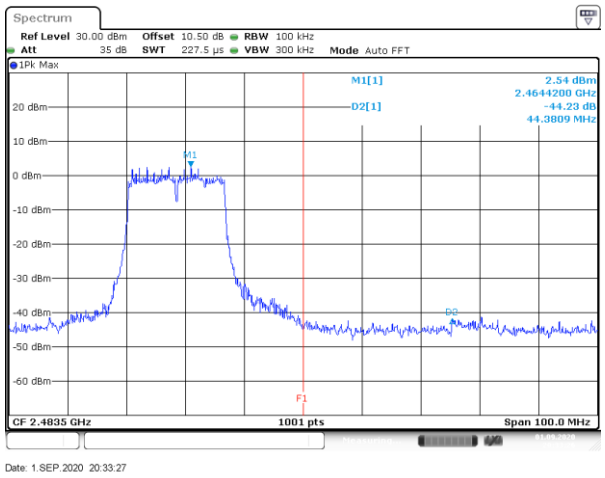
Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)		Limit (dBc)	Result
		Ant. 1	Ant. 2		
802.11b mode					
Low	2412	48.23	45.00	≥ 20	Compliance
High	2462	53.29	53.48	≥ 20	Compliance
802.11g mode					
Low	2412	40.16	36.33	≥ 20	Compliance
High	2462	44.23	43.92	≥ 20	Compliance
802.11n HT20 mode					
Low	2412	41.26	39.44	≥ 20	Compliance
High	2462	42.49	42.82	≥ 20	Compliance
802.11n HT40 mode					
Low	2422	36.82	36.84	≥ 20	Compliance
High	2452	37.29	38.97	≥ 20	Compliance

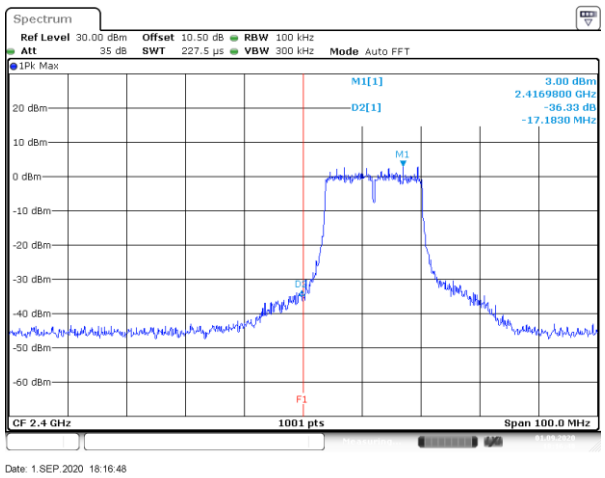
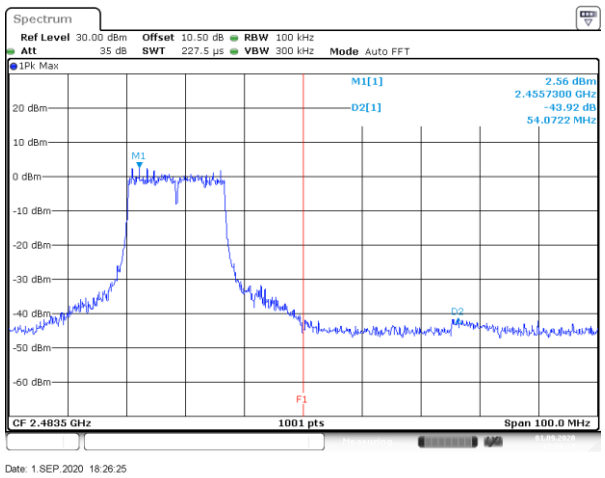
802.11b mode:

Ant. 1	
Left Side	**Right Side**
	

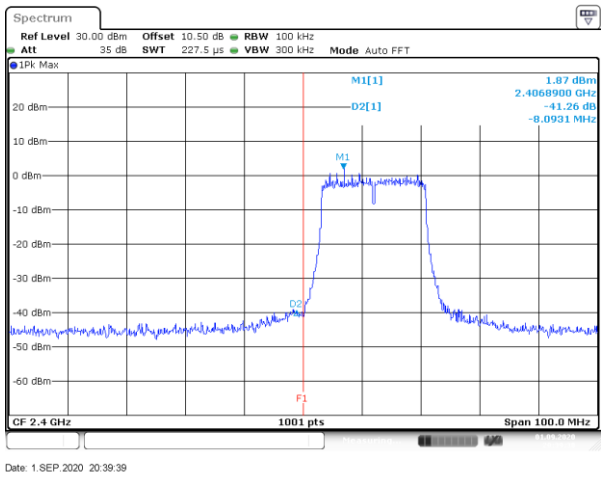
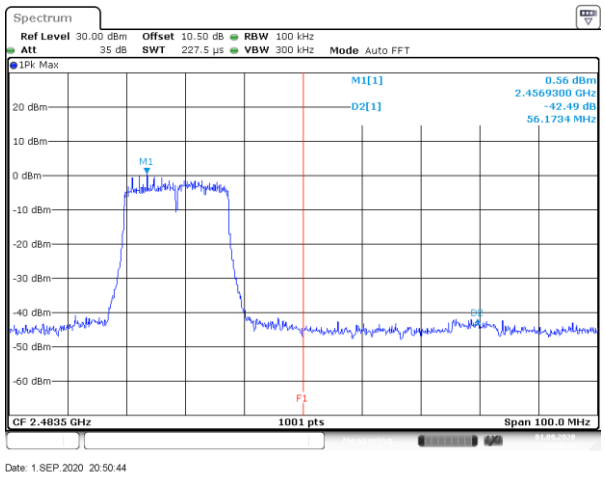
Ant. 2	
Left Side	**Right Side**
	

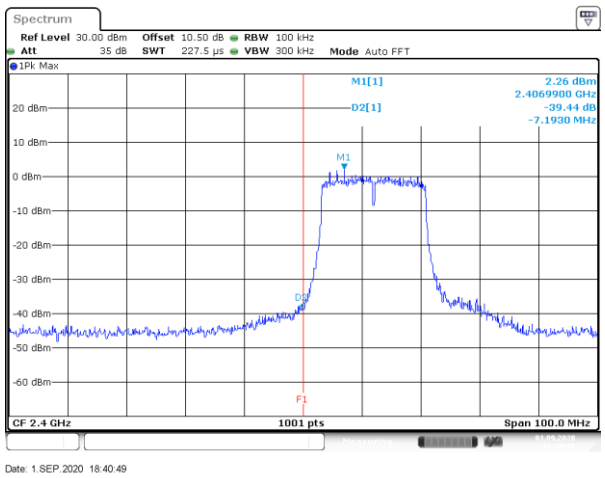
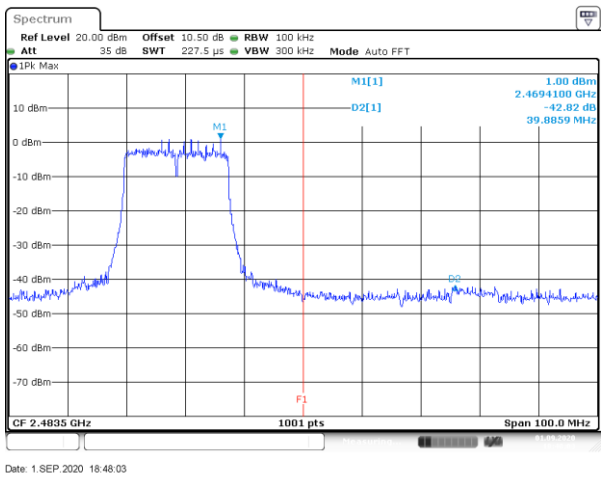
802.11g mode:

Ant. 1	
Left Side	**Right Side**
	

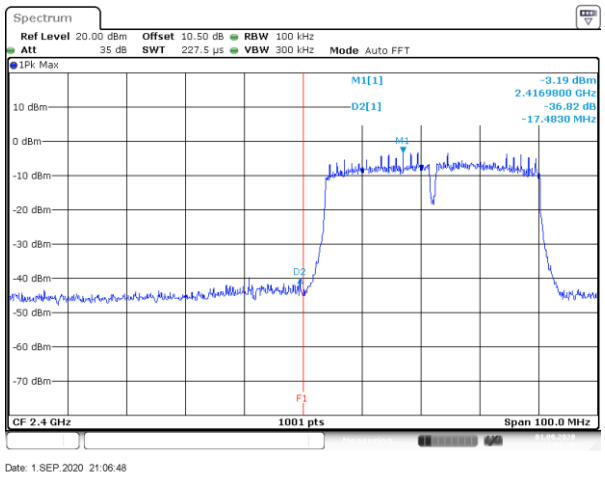
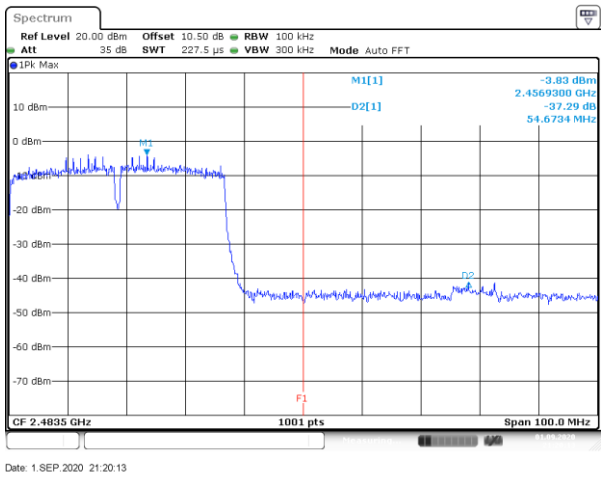
Ant. 2	
Left Side	**Right Side**
	

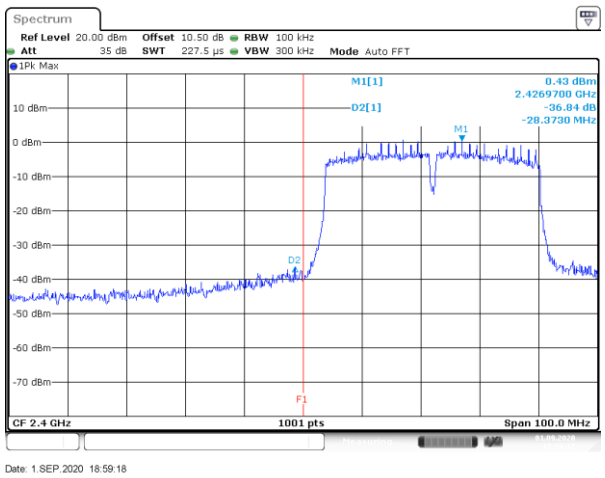
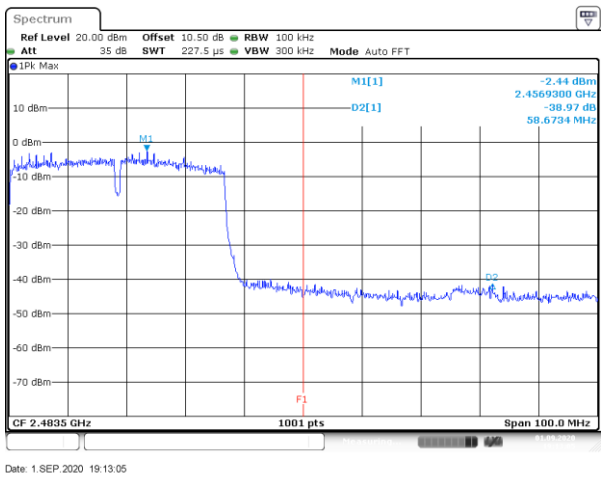
802.11n HT20 mode:

Ant. 1	
Left Side	**Right Side**
	

Ant. 2	
Left Side	**Right Side**
	

802.11n HT40 mode:

Ant. 1	
Left Side	**Right Side**
	

Ant. 2	
Left Side	**Right Side**
	

11 FCC §15.247(e) – Power Spectral Density

11.1 Applicable Standard

According to FCC §15.247(e),

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

11.2 Test Procedure

According to ANSI C63.10-2013,

(1) Set analyzer center frequency to DTS channel center frequency.

(2) Set the span to 1.5 times the DTS bandwidth. (3) Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz.

(4) Set the VBW ≥ [3 × RBW]. (5) Detector = peak. (6) Sweep time = auto couple.

(7) Trace mode = max hold. (8) Allow trace to fully stabilize.

(9) Use the peak marker function to determine the maximum amplitude level within the RBW.

(10) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

11.3 Test Equipment List and Details

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

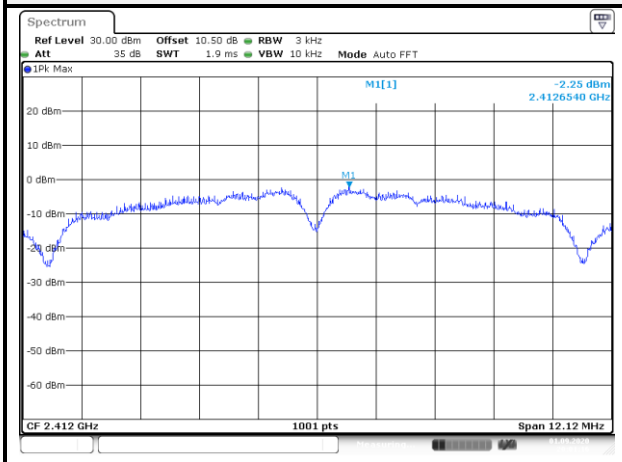
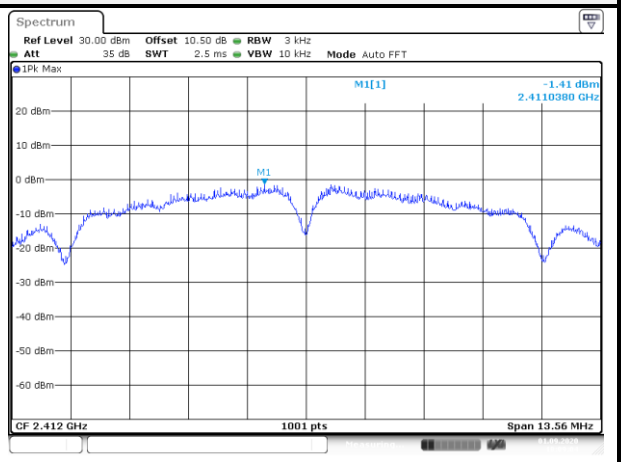
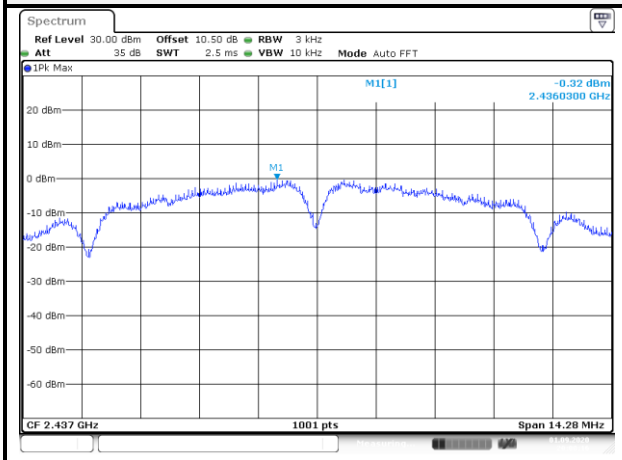
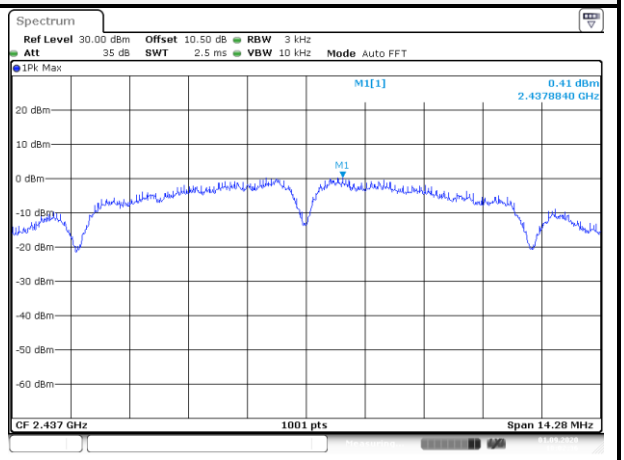
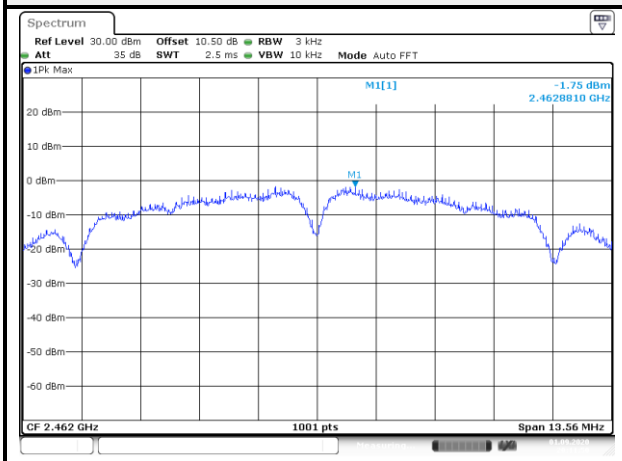
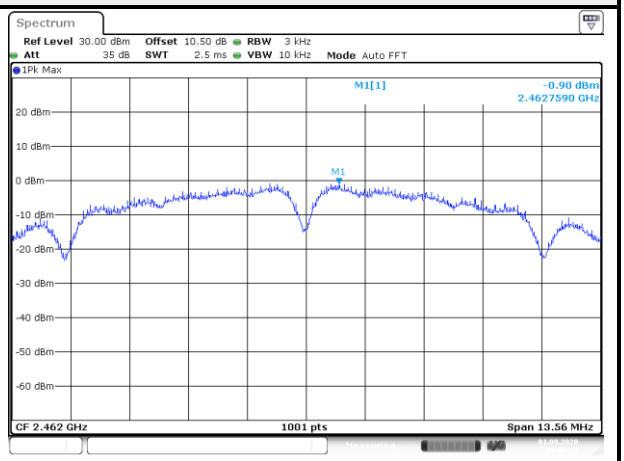
***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units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

11.4 Test Results

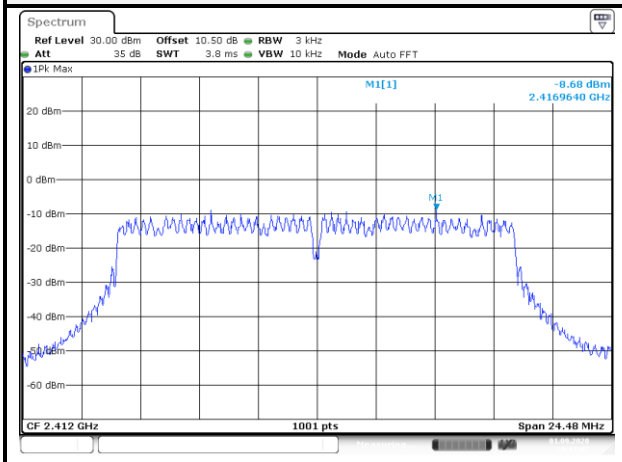
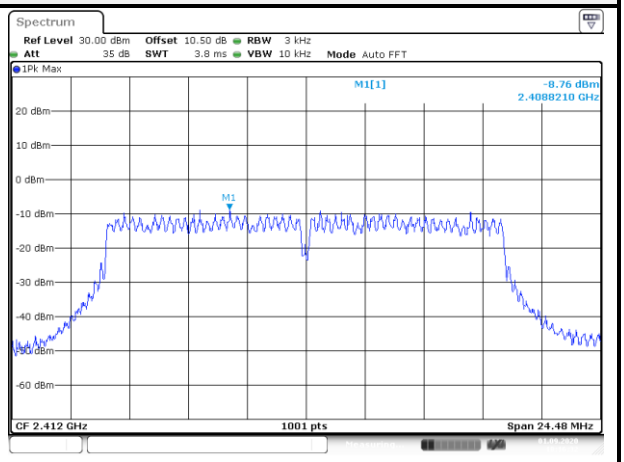
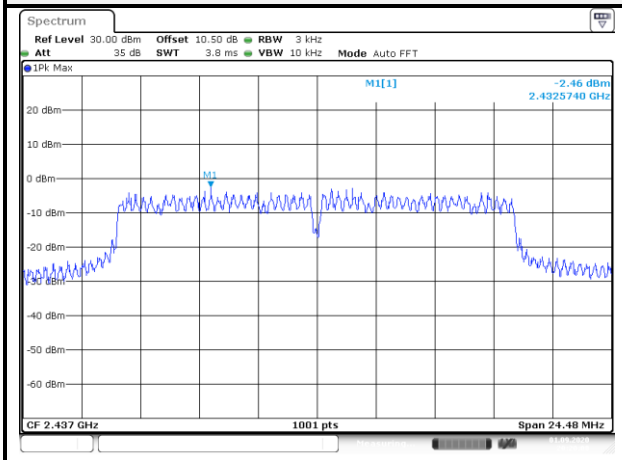
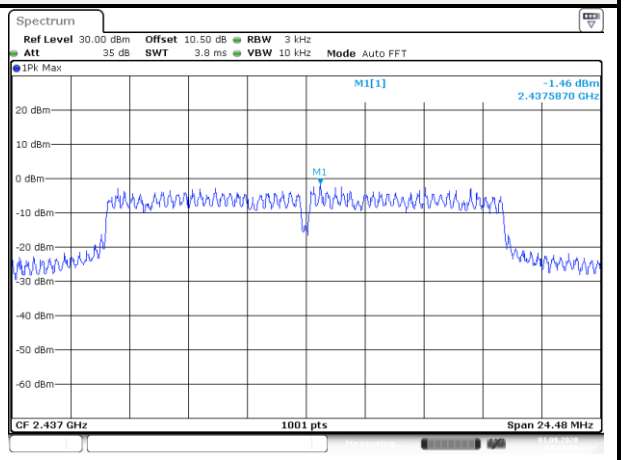
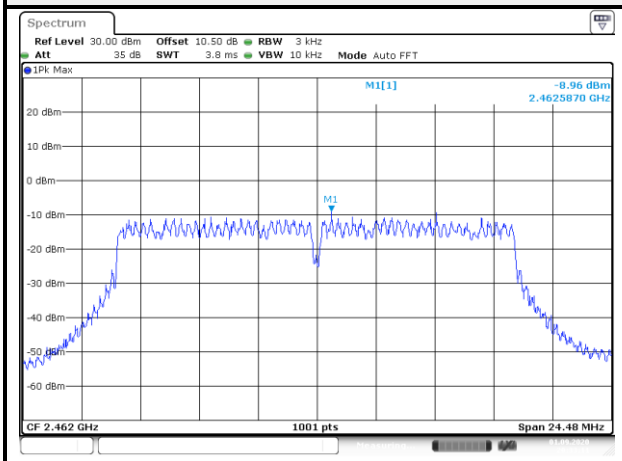
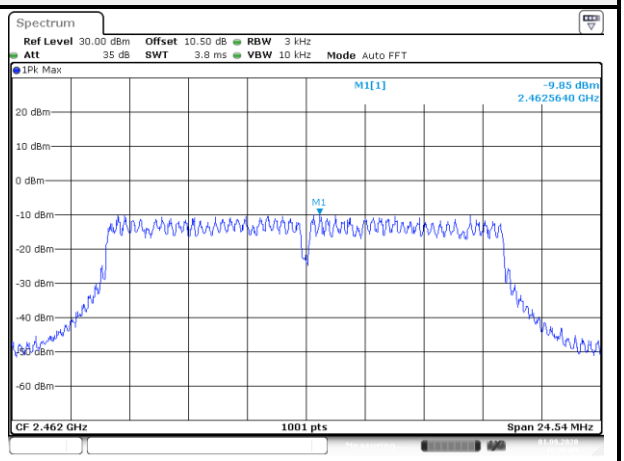
Channel	Frequency (MHz)	PSD (dBm/3 kHz)			Limit (dBm/3 kHz)	Result
		Ant. 1	Ant. 2	Sum.		
802.11b mode						
Low	2412	-2.25	-1.41	1.20	6.64	Compliance
Middle	2437	-0.32	0.41	3.07	6.64	Compliance
High	2462	-1.75	-0.90	1.71	6.64	Compliance
802.11g mode						
Low	2412	-8.68	-8.76	-5.71	6.64	Compliance
Middle	2437	-2.46	-1.46	1.08	6.64	Compliance
High	2462	-8.96	-9.85	-6.37	6.64	Compliance
802.11n HT20 mode						
Low	2412	-9.94	-10.10	-9.94	6.64	Compliance
Middle	2437	-4.91	-3.44	-4.91	6.64	Compliance
High	2462	-13.00	-11.79	-13.00	6.64	Compliance
802.11n HT40 mode						
Low	2422	-16.18	-12.89	-16.18	6.64	Compliance
Middle	2437	-12.58	-5.57	-12.58	6.64	Compliance
High	2452	-16.15	-14.65	-16.15	6.64	Compliance

Note: Power DG Gain is 4.35 dBi, and PSD DG Gain = Power DG Gain + Array Gain = 4.35 + 3.01 = 7.36 dBi. Due to above, the PSD limit is 8 – (7.36-6) = 6.64 dBm/3 kHz

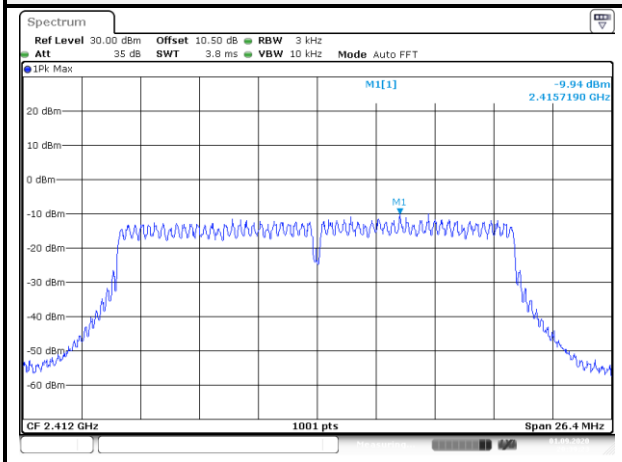
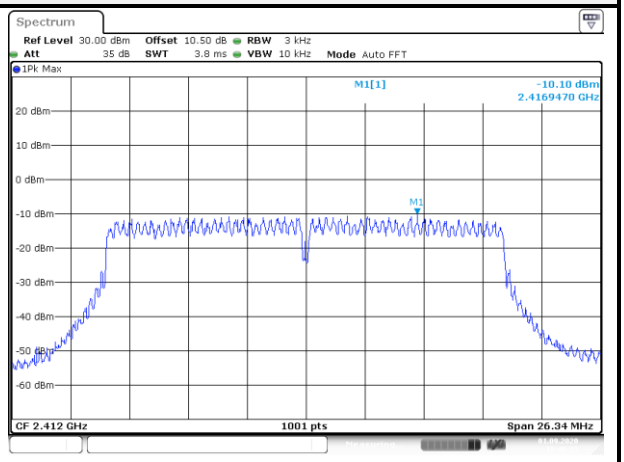
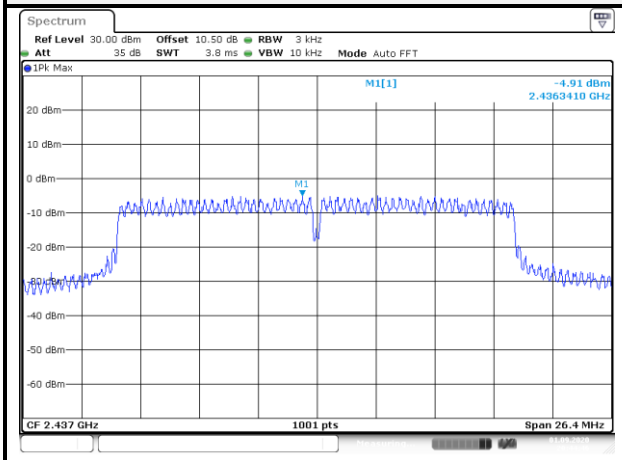
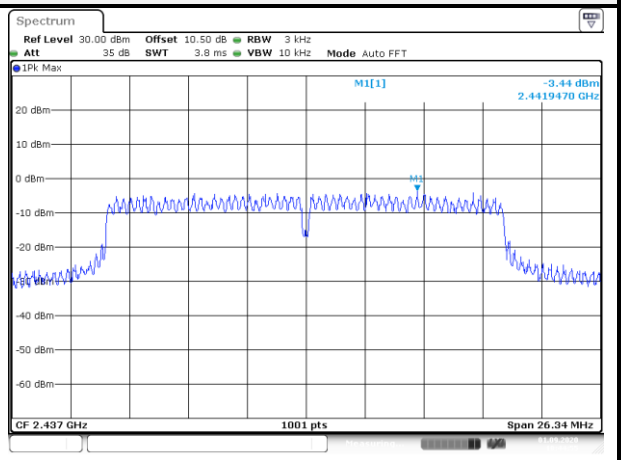
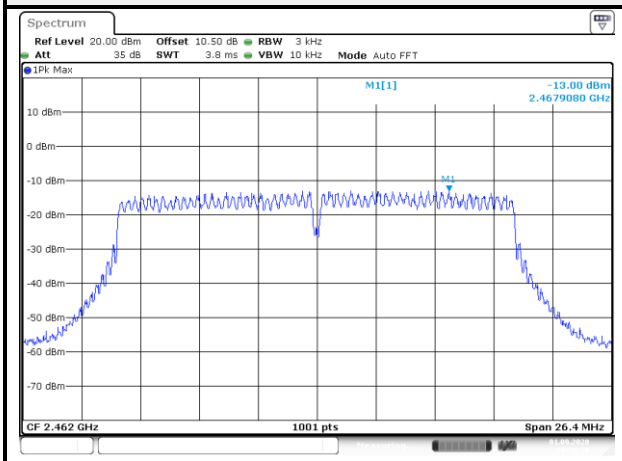
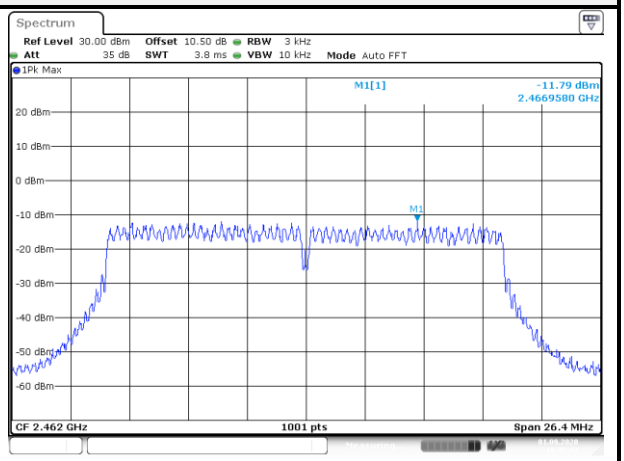
802.11b mode:

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

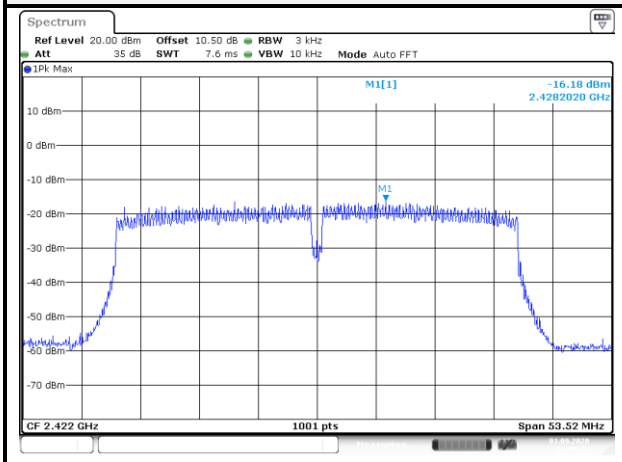
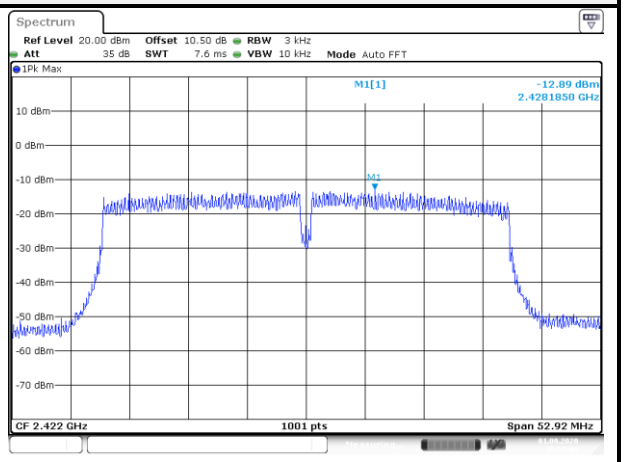
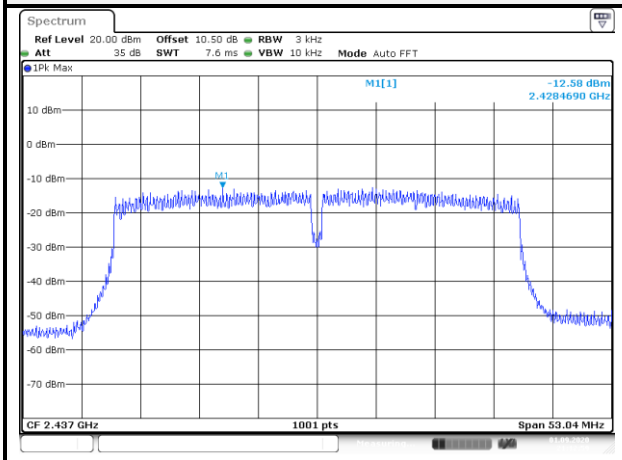
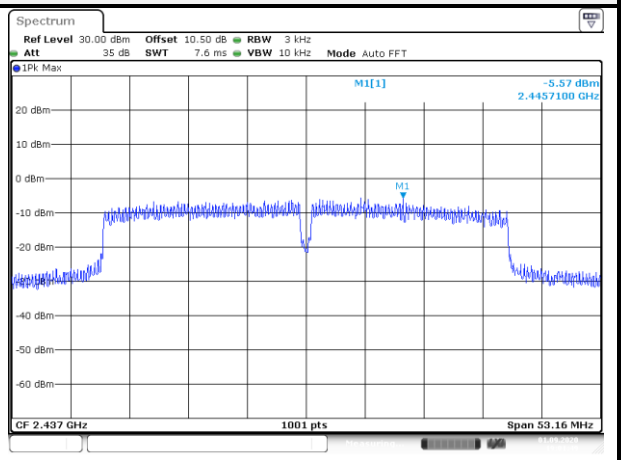
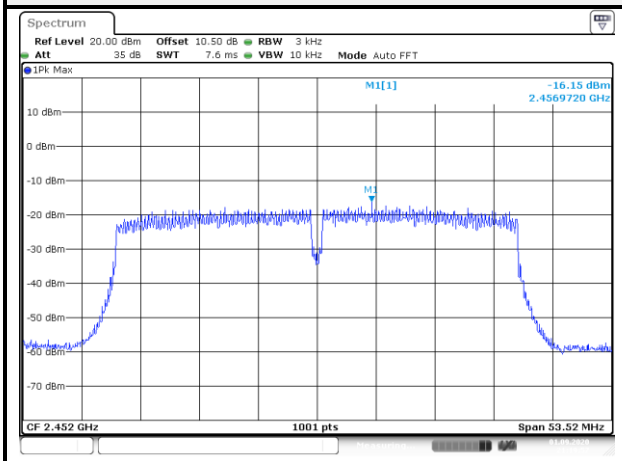
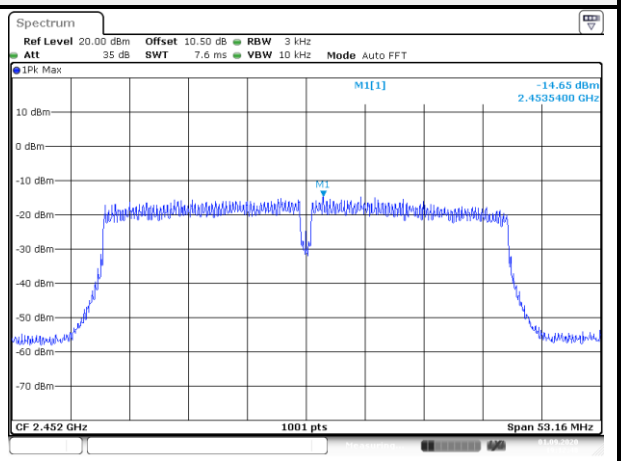
802.11g mode:

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

802.11n HT20 mode:

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

802.11n HT40 mode:

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

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