FCC Part 15.247

TEST REPORT

For

Brainchild Electronic Co., Ltd.

No. 209, Chongyang Rd., Nangang Dist., Taipei 11573, Taiwan

FCC ID: 2AKAZ-DB12

Report Type Original Report	**Product Type:** Video Doorbell
Report Number :	**RLK1811001-00B**
Report Date :	**2019/05/09**
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***Note**: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Taiwan)*

Revision History

Revision	Report Number	Issue Date	Description	Author/Revised by
1.0	RLK1811001-00B	2019/05/09	Original Report	Himiko Chen

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1 General Information

1.1 Product Description for Equipment under Test (EUT)

Applicant	**Brainchild Electronic Co., Ltd.** 8920 Business Park Drive #250, AUSTIN, TX 78759 USA
Manufacturer	**Brainchild Electronic Co., Ltd.** 8920 Business Park Drive #250, AUSTIN, TX 78759 USA
Brand(Trade) Name	brilong
Product (Equipment)	Video Doorbell
Model Name	DB12
EUT Function	IEEE 802.11 b/g/n HT20/n HT40
Frequency Range	IEEE 802.11 b/g/n HT20/n HT40 mode: 2412 ~ 2462 MHz IEEE 802.11 n HT40 mode: 2422 ~ 2452 MHz
Number of Channels	IEEE 802.11 b/g/n HT20 mode: 11 Channels IEEE 802.11 n HT40 mode: 9 Channels
Output Power	IEEE 802.11b mode: 20.50 dBm (0.1122 W) IEEE 802.11g mode: 24.45 dBm (0.2786 W) IEEE 802.11n HT20 mode: 24.12 dBm (0.2582 W) IEEE 802.11n HT40 mode: 20.87 dBm (0.1221 W)
Received Date	Nov. 02, 2018.
Date of Test	Apr. 11, 2019 ~ Apr. 29, 2019
Modulation Type	IEEE 802.11b mode: DSSS IEEE 802.11g/n HT20/n HT40 mode: OFDM
Related Submittal(s)/Grant(s)	N/A

**All measurement and test data in this report was gathered from production sample serial number: 1811001 (Assigned by BACL, Taiwan).*

1.2 Operation Condition of EUT

Power Operation (Voltage Range)	☒ AC 12-24V/60Hz ☐ Adapter ☒ By AC Line.
	☒ DC Type ☐ DC Power Supply ☒ Battery: Rechargeable Li-ion 3.7V ⎓ 230mAh. ☐ External from USB Cable ☐ External DC Adapter
	☐ Host System

1.3 Objective and Test Methodology

The Objective of this Test Report was to document the compliance of the Brainchild Electronic Co., Ltd. Appliance (Model: DB12) 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.

- KDB 558074 of "GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUMSYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES"

1.4 Measurement Uncertainty

Parameter	Expanded Measurement uncertainty
RF output power with Power Meter	± 0.55 dB
Occupied Channel Bandwidth	± 4.45 %
RF Conducted test with Spectrum	± 1.45 dB
AC Power Line Conducted Emission	± 2.66 dB
Radiated Below 1G	±3.57 dB
Radiated Above 1G-18G	± 4.29 dB
Radiated Above 18G-40G	± 4.67 dB

1.5 Test Facility

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

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

☒ 68-3, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database. The FCC Registration No.: 974454. Designation No.: TW3180

2 System Test Configuration

2.1 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 mode. The mode AC-24V was worst that evaluation with AC-12V and AC-24V.

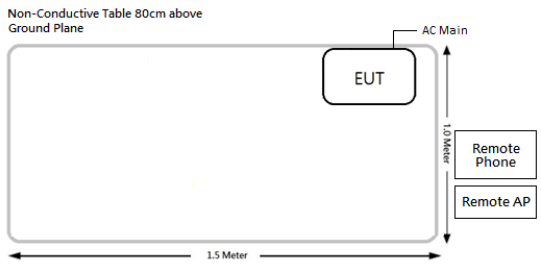
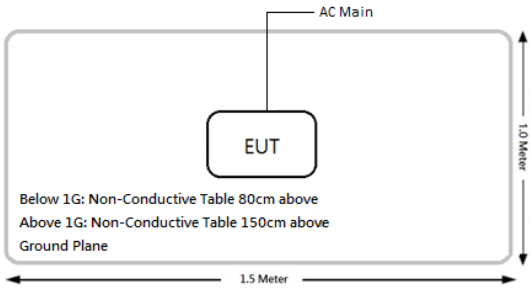
Modulation Used for Conformance Test			
Configuration	**NTX**	**Data Rate**	**Worst Data Rate**
802.11b mode	1	1-11 Mbps	1 Mbps
802.11g mode	1	6-54 Mbps	6 Mbps
802.11n HT 20 mode	1	MCS 0-7	MCS 0
802.11n HT 40 mode	1	MCS 0-7	MCS 0

Worst Case of Power Setting				
EUT Exercise Software		MT7601 USB QA		
Configuration	**NTX**	**Low CH**	**Mid CH**	**High CH**
802.11b mode	1	Default	Default	Default
802.11g mode	1	Default	Default	Default
802.11n HT 20 mode	1	Default	Default	Default
802.11n HT 40 mode	1	Default	Default	Default

2.2 Support Equipment List and External Cable List

No.	Description	Manufacturer	Model Number	BSMI	FCC ID / DoC
A	Mobile phone	SONY	X1	NA	NA
B	AP	D-Link	DIR-880L	N/A	N/A

2.3 Block Diagram of Test Setup

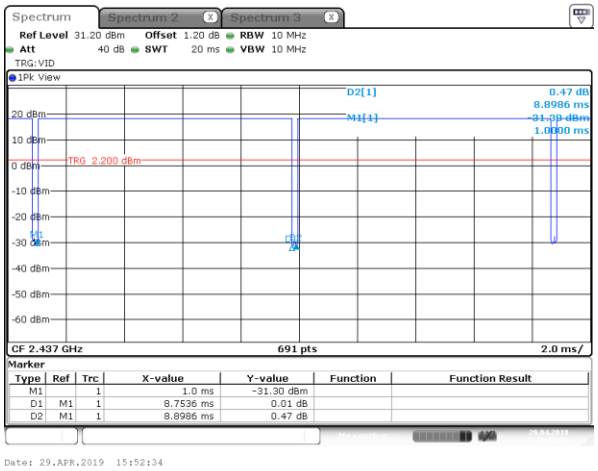
Conduction	Radiation
	

2.4 Duty Cycle

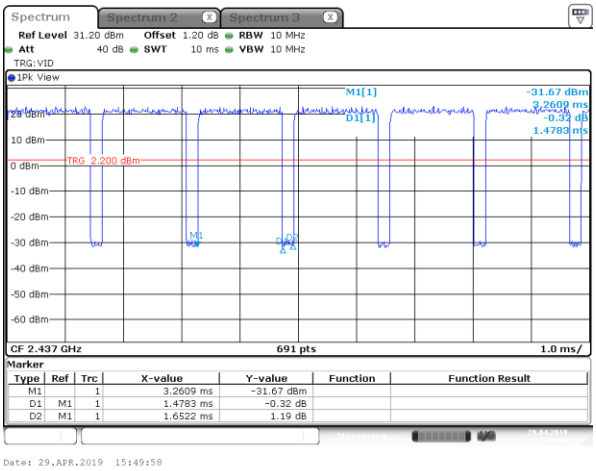
According to KDB 558074 D01 15.247 Meas Guidance v05r02:
All measurements are to be performed with the EUT transmitting at 100% duty cycle at its maximum power control level; however, if 100% duty cycle cannot be achieved, measurements of duty cycle, x, and maximum power transmission duration, T, are required for each tested mode of operation.

Configuration	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Factor (dB)
802.11b mode	8.7536	8.8986	98.37	0.07
802.11g mode	1.4783	1.6522	89.47	0.48
802.11n HT20 mode	1.3913	1.5507	89.72	0.47
802.11n HT40 mode	0.6957	0.8696	80.00	0.97

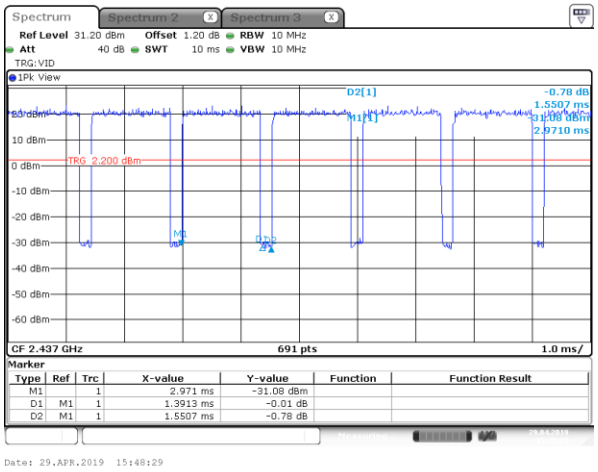
802.11b mode



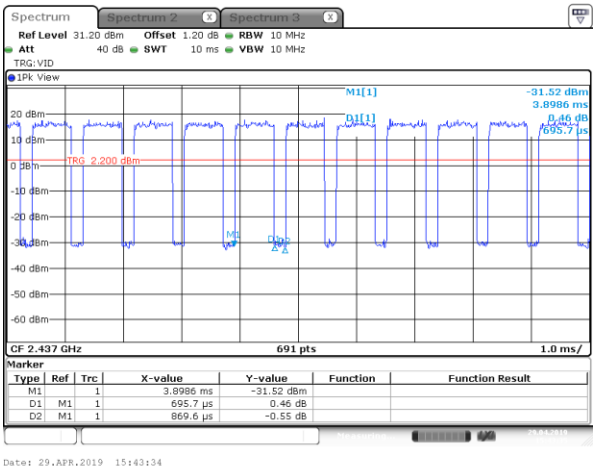
802.11g mode



802.11n HT20 mode



802.11n HT40 mode



**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), §1.1310, § 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/4πR^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	5.2	3.311	25.00	316.228	20	0.2084	1

Result: MPE evaluation meet 20 cm 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

Manufacturer	Model	Antenna Type	Antenna Gain	Result
WANSHIH	DB12	PIFA Antenna	5.2	Compliance

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

6 FCC §15.207 - AC Line Conducted Emissions

6.1 Applicable Standard

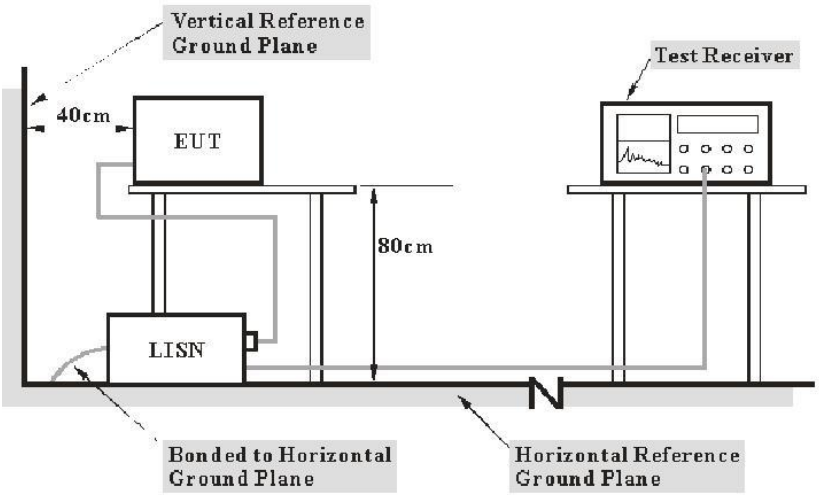
According to FCC §15.207

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.

Channel	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 30MHz. 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	101612	2019/02/21	2020/02/20
LISN	Rohde & Schwarz	ENV216	101248	2018/06/27	2019/06/26
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2018/10/23	2019/10/22
Pulse Limiter	Rohde & Schwarz	ESH3Z2	TXZEM104	2018/08/03	2019/08/02
RF Cable	EMEC	EM-CB5D	001	2018/07/02	2019/07/01
Software	AUDIX	e3	V9.150826k	N.C.R	N.C.R

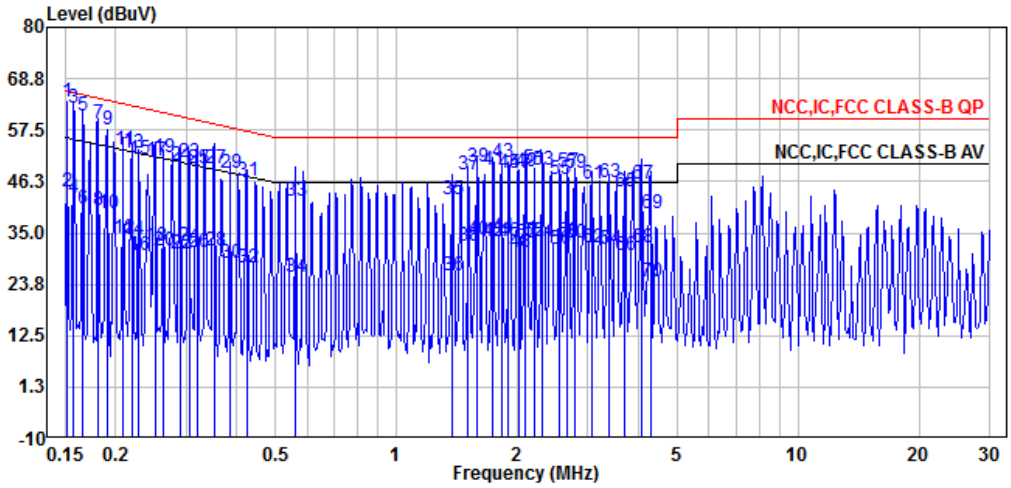
***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units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

6.4 Test Environmental Conditions

Temperature:	24~25 ℃	**Relative Humidity:**	42~45 %
ATM Pressure:	1010hPa	**Test Engineer:**	Ray Huang
Test Date:	2019-04-11		

6.5 AC Line Conducted Emission Test Plot and Data

Mode: AC 24V/60 Hz, Wi-Fi mode, Line



	Freq	Read Level	Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	
1	0.151	43.77	63.64	19.87	65.93	-2.29	QP
2	0.151	24.02	43.89	19.87	55.93	-12.04	Average
3	0.157	42.40	62.27	19.87	65.60	-3.33	QP
4	0.157	22.81	42.68	19.87	55.60	-12.92	Average
5	0.165	40.70	60.57	19.87	65.21	-4.64	QP
6	0.165	20.24	40.11	19.87	55.21	-15.10	Average
7	0.182	39.07	58.93	19.86	64.41	-5.48	QP
8	0.182	20.17	40.03	19.86	54.41	-14.38	Average
9	0.191	37.87	57.73	19.86	64.01	-6.28	QP
10	0.191	19.48	39.34	19.86	54.01	-14.67	Average
11	0.210	33.47	53.33	19.86	63.22	-9.89	QP
12	0.210	14.03	33.89	19.86	53.22	-19.33	Average
13	0.220	32.49	52.35	19.86	62.82	-10.47	QP
14	0.220	13.66	33.52	19.86	52.82	-19.30	Average
15	0.229	31.32	51.18	19.86	62.49	-11.31	QP
16	0.229	10.32	30.18	19.86	52.49	-22.31	Average
17	0.252	30.95	50.82	19.87	61.70	-10.88	QP
18	0.252	12.38	32.25	19.87	51.70	-19.45	Average

19	0.264	31.74	51.61	19.87	61.30	-9.69	QP
20	0.264	11.10	30.97	19.87	51.30	-20.33	Average
21	0.291	29.74	49.61	19.87	60.51	-10.90	QP
22	0.291	10.68	30.55	19.87	50.51	-19.96	Average
23	0.305	30.54	50.41	19.87	60.11	-9.70	QP
24	0.305	12.23	32.10	19.87	50.11	-18.01	Average
25	0.320	29.17	49.04	19.87	59.71	-10.67	QP
26	0.320	10.97	30.84	19.87	49.71	-18.87	Average
27	0.352	29.13	49.00	19.87	58.92	-9.92	QP
28	0.352	11.28	31.15	19.87	48.92	-17.77	Average
29	0.387	28.09	47.96	19.87	58.13	-10.17	QP
30	0.387	8.57	28.44	19.87	48.13	-19.69	Average
31	0.426	26.67	46.54	19.87	57.33	-10.79	QP
32	0.426	7.61	27.48	19.87	47.33	-19.85	Average
33	0.563	22.05	41.93	19.88	56.00	-14.07	QP
34	0.563	5.32	25.20	19.88	46.00	-20.80	Average
35	1.374	22.55	42.47	19.92	56.00	-13.53	QP
36	1.374	5.81	25.73	19.92	46.00	-20.27	Average
37	1.512	27.85	47.79	19.94	56.00	-8.21	QP
38	1.512	12.07	32.01	19.94	46.00	-13.99	Average
39	1.586	29.62	49.56	19.94	56.00	-6.44	QP
40	1.586	13.57	33.51	19.94	46.00	-12.49	Average
41	1.731	28.65	48.60	19.95	56.00	-7.40	QP
42	1.731	13.24	33.19	19.95	46.00	-12.81	Average
43	1.831	30.44	50.39	19.95	56.00	-5.61	QP
44	1.831	14.17	34.12	19.95	46.00	-11.88	Average
45	1.905	28.21	48.17	19.96	56.00	-7.83	QP
46	1.905	13.08	33.04	19.96	46.00	-12.96	Average
47	2.014	28.15	48.11	19.96	56.00	-7.89	QP
48	2.014	10.94	30.90	19.96	46.00	-15.10	Average
49	2.096	28.38	48.34	19.96	56.00	-7.66	QP
50	2.096	12.74	32.70	19.96	46.00	-13.30	Average
51	2.199	29.23	49.19	19.96	56.00	-6.81	QP
52	2.199	13.26	33.22	19.96	46.00	-12.78	Average
53	2.306	28.87	48.84	19.97	56.00	-7.16	QP
54	2.306	13.26	33.23	19.97	46.00	-12.77	Average
55	2.538	26.74	46.71	19.97	56.00	-9.29	QP
56	2.538	11.41	31.38	19.97	46.00	-14.62	Average
57	2.662	28.42	48.39	19.97	56.00	-7.61	QP
58	2.662	13.17	33.14	19.97	46.00	-12.86	Average
59	2.792	28.06	48.04	19.98	56.00	-7.96	QP
60	2.792	12.90	32.88	19.98	46.00	-13.12	Average
61	3.073	25.71	45.70	19.99	56.00	-10.30	QP
62	3.073	11.64	31.63	19.99	46.00	-14.37	Average
63	3.381	25.87	45.87	20.00	56.00	-10.13	QP
64	3.381	11.43	31.43	20.00	46.00	-14.57	Average
65	3.691	24.06	44.06	20.00	56.00	-11.94	QP
66	3.691	9.95	29.95	20.00	46.00	-16.05	Average
67	4.093	25.71	45.72	20.01	56.00	-10.28	QP
68	4.093	11.66	31.67	20.01	46.00	-14.33	Average
69	4.294	19.40	39.41	20.01	56.00	-16.59	QP
70	4.294	4.26	24.27	20.01	46.00	-21.73	Average

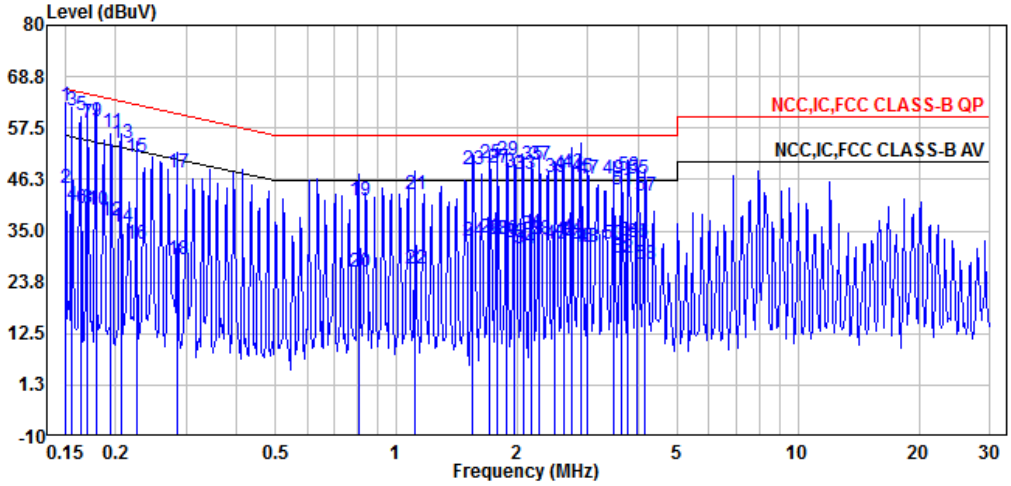
Note:

Level = Read Level + Factor

Over Limit (Margin) = Level – Limit Line

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

Mode: AC 24V/60 Hz, Wi-Fi mode, Neutral



	Freq	Read Level	Level	Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	
1	0.150	42.41	62.28	19.87	66.00	-3.72	QP
2	0.150	24.35	44.22	19.87	56.00	-11.78	Average
3	0.156	41.54	61.41	19.87	65.67	-4.26	QP
4	0.156	20.73	40.60	19.87	55.67	-15.07	Average
5	0.164	40.45	60.32	19.87	65.27	-4.95	QP
6	0.164	19.89	39.76	19.87	55.27	-15.51	Average
7	0.170	38.79	58.66	19.87	64.94	-6.28	QP
8	0.170	20.06	39.93	19.87	54.94	-15.01	Average
9	0.179	38.96	58.82	19.86	64.54	-5.72	QP
10	0.179	19.74	39.60	19.86	54.54	-14.94	Average
11	0.195	36.86	56.72	19.86	63.82	-7.10	QP
12	0.195	17.49	37.35	19.86	53.82	-16.47	Average
13	0.206	34.38	54.24	19.86	63.35	-9.11	QP
14	0.206	15.99	35.85	19.86	53.35	-17.50	Average
15	0.225	31.13	50.99	19.86	62.63	-11.64	QP
16	0.225	12.24	32.10	19.86	52.63	-20.53	Average
17	0.286	28.01	47.87	19.86	60.64	-12.77	QP
18	0.286	8.87	28.73	19.86	50.64	-21.91	Average

19	0.806	21.78	41.67	19.89	56.00	-14.33	QP
20	0.806	5.97	25.86	19.89	46.00	-20.14	Average
21	1.117	22.97	42.88	19.91	56.00	-13.12	QP
22	1.117	6.80	26.71	19.91	46.00	-19.29	Average
23	1.549	28.53	48.47	19.94	56.00	-7.53	QP
24	1.549	12.87	32.81	19.94	46.00	-13.19	Average
25	1.704	29.81	49.76	19.95	56.00	-6.24	QP
26	1.704	13.57	33.52	19.95	46.00	-12.48	Average
27	1.787	28.87	48.82	19.95	56.00	-7.18	QP
28	1.787	13.15	33.10	19.95	46.00	-12.90	Average
29	1.875	30.57	50.53	19.96	56.00	-5.47	QP
30	1.875	13.05	33.01	19.96	46.00	-12.99	Average
31	1.967	27.61	47.57	19.96	56.00	-8.43	QP
32	1.967	12.35	32.31	19.96	46.00	-13.69	Average
33	2.079	27.57	47.53	19.96	56.00	-8.47	QP
34	2.079	11.10	31.06	19.96	46.00	-14.94	Average
35	2.164	29.32	49.28	19.96	56.00	-6.72	QP
36	2.164	14.08	34.04	19.96	46.00	-11.96	Average
37	2.270	29.33	49.30	19.97	56.00	-6.70	QP
38	2.270	13.19	33.16	19.97	46.00	-12.84	Average
39	2.478	26.82	46.79	19.97	56.00	-9.21	QP
40	2.478	12.03	32.00	19.97	46.00	-14.00	Average
41	2.620	27.57	47.54	19.97	56.00	-8.46	QP
42	2.620	12.79	32.76	19.97	46.00	-13.24	Average
43	2.726	27.65	47.63	19.98	56.00	-8.37	QP
44	2.726	13.38	33.36	19.98	46.00	-12.64	Average
45	2.883	26.66	46.65	19.99	56.00	-9.35	QP
46	2.883	11.31	31.30	19.99	46.00	-14.70	Average
47	3.000	26.41	46.40	19.99	56.00	-9.60	QP
48	3.000	11.43	31.42	19.99	46.00	-14.58	Average
49	3.463	26.45	46.45	20.00	56.00	-9.55	QP
50	3.463	12.22	32.22	20.00	46.00	-13.78	Average
51	3.632	24.13	44.13	20.00	56.00	-11.87	QP
52	3.632	9.01	29.01	20.00	46.00	-16.99	Average
53	3.780	26.99	47.00	20.01	56.00	-9.00	QP
54	3.780	12.84	32.85	20.01	46.00	-13.15	Average
55	3.965	26.53	46.54	20.01	56.00	-9.46	QP
56	3.965	12.36	32.37	20.01	46.00	-13.63	Average
57	4.159	22.70	42.71	20.01	56.00	-13.29	QP
58	4.159	7.57	27.58	20.01	46.00	-18.42	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, §15.247(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

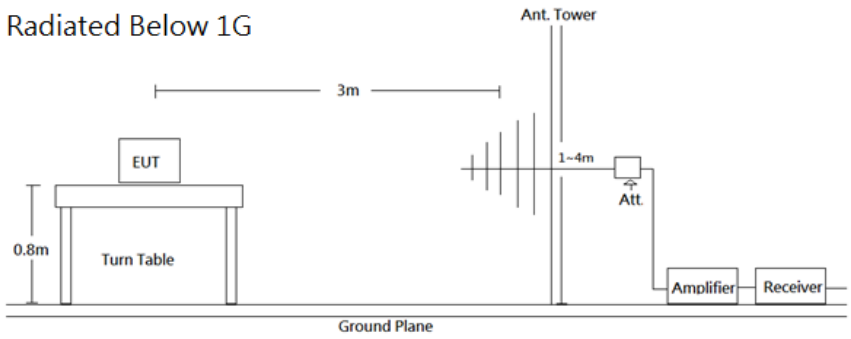
As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

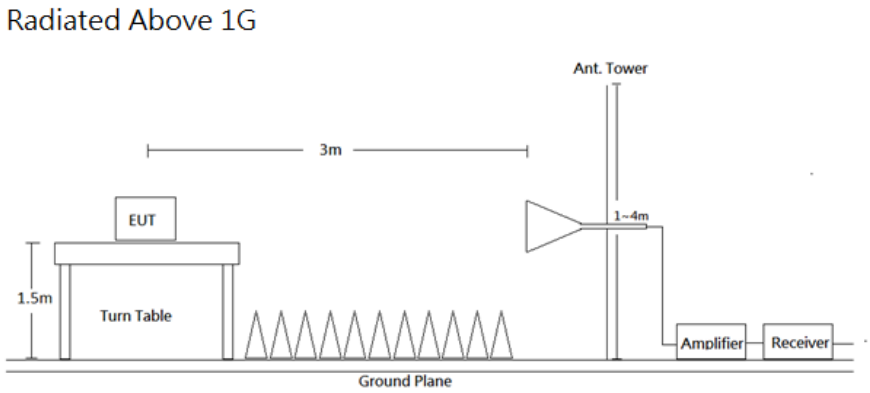
Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

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

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

7.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
966A Room					
Bilog Antenna with 6 dB Attenuator	SUNOL SCIENCES & MINI-CIRCUITS	JB6/UNAT-6+	A050115/15542_01	2018/12/11	2019/12/10
Horn Antenna	ETS-Lindgren	3115	00040736	2019/03/22	2020/03/21
Horn Antenna	ETS-Lindgren	3116	62638	2018/08/29	2019/08/28
Preamplifier	Sonoma	310N	130602	2018/07/04	2019/07/03
Preamplifier	EM Electronics Corp.	EM01G18G	060657	2018/12/07	2019/12/06
Microware Preamplifier	EM Electronics Corporation	EM18G40G	060656	2019/01/11	2020/01/10
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2018/10/23	2019/10/22
Signal Analyzer	Rohde & Schwarz	FSV40	101435	2019/02/14	2020/02/13
Micro flex Cable	UTIFLEX	FSCM 64639 / (2M)	93D0127	2018/07/31	2019/07/30
Micro flex Cable	UTIFLEX	UFA210A-1-3149-300300	MFR64639 226389-001	2018/11/16	2019/11/15
Micro flex Cable	ROSNOL	K1K50-UP0264-K1K50-450CM	160309-1	2019/03/04	2020/03/03
Micro flex Cable	ROSNOL	K1K50-UP0264-K1K50-80CM	160309-2	2019/01/16	2020/01/15
Turn Table	Champro	TT-2000	060772-T	N.C.R	N.C.R
Antenna Tower	Champro	AM-BS-4500-B	060772-A	N.C.R	N.C.R
Controller	Champro	EM1000	60772	N.C.R	N.C.R
Software	AUDIX	e3	E3LK-01	N.C.R	N.C.R
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2018/11/22	2019/11/21
Cable	WOKEN	SFL402	S02-160323-07	2019/02/11	2020/02/10

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

7.4 Test Environmental Conditions

Temperature:	24~26 ℃	**Relative Humidity:**	54~56 %
ATM Pressure:	1014hPa	**Test Engineer:**	Leo Chang
Conducted Test Date:	2019-04-29	**Radiated Test Date:**	2019-04-19~2019-04-23

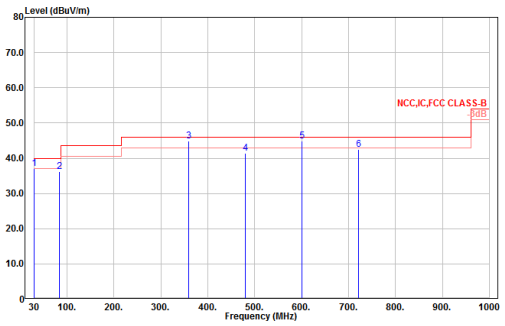
7.5 Radiated Emission Test Plot and Data

Wi-Fi Mode:

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

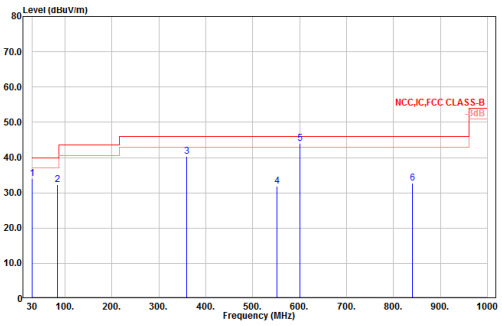
Below 1G (30 MHz-1 GHz) test the output power worst mode: 802.11g mode Middle Channel

Horizontal



	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1 !	30.000	37.08	40.00	-2.92	42.91	-5.83	QP	horizontal
2	83.350	36.15	40.00	-3.85	58.76	-22.61	QP	horizontal
3 !	359.800	44.78	46.00	-1.22	61.23	-16.45	QP	horizontal
4	480.080	41.50	46.00	-4.50	55.49	-13.99	QP	horizontal
5 !	600.360	44.85	46.00	-1.15	56.99	-12.14	QP	horizontal
6	720.640	42.41	46.00	-3.59	52.62	-10.21	QP	horizontal

Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1	30.000	33.94	40.00	-6.06	39.77	-5.83	Peak	vertical
2	83.350	32.31	40.00	-7.69	54.92	-22.61	Peak	vertical
3	359.800	40.23	46.00	-5.77	56.68	-16.45	Peak	vertical
4	551.860	31.76	46.00	-14.24	44.52	-12.76	Peak	vertical
5 !	600.360	43.98	46.00	-2.02	56.12	-12.14	QP	vertical
6	839.950	32.80	46.00	-13.20	41.44	-8.64	Peak	vertical

Result = Reading + Correct Factor

Margin = Result – 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	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2388.736	44.17	54.00	-9.83	51.60	-7.43	Average
2388.736	56.01	74.00	-17.99	63.44	-7.43	Peak
2409.680	104.03			111.51	-7.48	Average
2409.680	106.61			114.09	-7.48	Peak
4824.000	53.04	54.00	-0.96	52.27	0.77	Average
4824.000	55.28	74.00	-18.72	54.51	0.77	Peak
7236.000	34.84	54.00	-19.16	29.54	5.30	Average
7236.000	47.54	74.00	-26.46	42.24	5.30	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2369.472	40.11	54.00	-13.89	47.52	-7.41	Average
2369.472	52.65	74.00	-21.35	60.06	-7.41	Peak
2409.680	99.97			107.45	-7.48	Average
2409.680	102.58			110.06	-7.48	Peak
4824.000	51.60	54.00	-2.40	50.83	0.77	Average
4824.000	54.47	74.00	-19.53	53.70	0.77	Peak
7236.000	33.94	54.00	-20.06	28.64	5.30	Average
7236.000	47.69	74.00	-26.31	42.39	5.30	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2368.322	38.93	54.00	-15.07	46.34	-7.41	Average
2368.322	52.02	74.00	-21.98	59.43	-7.41	Peak
2440.196	102.10			109.60	-7.50	Average
2440.196	104.28			111.78	-7.50	Peak
2504.326	39.21	54.00	-14.79	46.72	-7.51	Average
2504.326	51.99	74.00	-22.01	59.50	-7.51	Peak
4874.000	49.90	54.00	-4.10	48.95	0.95	Average
4874.000	53.40	74.00	-20.60	52.45	0.95	Peak
7311.000	34.17	54.00	-19.83	28.58	5.59	Average
7311.000	47.67	74.00	-26.33	42.08	5.59	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2384.052	37.96	54.00	-16.04	45.38	-7.42	Average
2384.052	51.39	74.00	-22.61	58.81	-7.42	Peak
2440.196	97.12			104.62	-7.50	Average
2440.196	99.58			107.08	-7.50	Peak
2500.212	37.76	54.00	-16.24	45.28	-7.52	Average
2500.212	51.60	74.00	-22.40	59.12	-7.52	Peak
4874.000	53.61	54.00	-0.39	52.66	0.95	Average
4874.000	55.66	74.00	-18.34	54.71	0.95	Peak
7311.000	33.94	54.00	-20.06	28.44	5.50	Average
7311.000	48.98	74.00	-25.02	43.48	5.50	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2459.600	99.13			106.62	-7.49	Average
2459.600	101.79			109.28	-7.49	Peak
2489.500	40.00	54.00	-14.00	47.49	-7.49	Average
2489.500	52.30	74.00	-21.70	59.79	-7.49	Peak
4924.000	49.52	54.00	-4.48	48.51	1.01	Average
4924.000	52.64	74.00	-21.36	51.63	1.01	Peak
7386.000	34.35	54.00	-19.65	28.42	5.93	Average
7386.000	47.43	74.00	-26.57	41.50	5.93	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2459.600	95.95			103.44	-7.49	Average
2459.600	97.35			104.84	-7.49	Peak
2501.200	38.89	54.00	-15.11	46.41	-7.52	Average
2501.200	51.86	74.00	-22.14	59.38	-7.52	Peak
4924.000	53.87	54.00	-0.13	52.86	1.01	Average
4924.000	57.81	74.00	-16.19	56.80	1.01	Peak
7386.000	33.81	54.00	-20.19	27.88	5.93	Average
7386.000	46.92	74.00	-27.08	40.99	5.93	Peak

802.11g mode:

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2390.000	52.37	54.00	-1.63	59.80	-7.43	Average
2390.000	71.85	74.00	-2.15	79.28	-7.43	Peak
2407.664	95.95			103.42	-7.47	Average
2407.664	107.73			115.20	-7.47	Peak
4824.000	36.51	54.00	-17.49	35.74	0.77	Average
4824.000	50.44	74.00	-23.56	49.67	0.77	Peak
7236.000	33.55	54.00	-20.45	28.25	5.30	Average
7236.000	49.54	74.00	-24.46	44.24	5.30	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2389.856	43.87	54.00	-10.13	51.30	-7.43	Average
2389.856	61.80	74.00	-12.20	69.23	-7.43	Peak
2407.664	91.63			99.10	-7.47	Average
2407.664	102.87			110.34	-7.47	Peak
4824.000	39.99	54.00	-14.01	39.22	0.77	Average
4824.000	57.90	74.00	-16.10	57.13	0.77	Peak
7236.000	33.87	54.00	-20.13	28.57	5.30	Average
7236.000	47.70	74.00	-26.30	42.40	5.30	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2357.674	39.57	54.00	-14.43	46.97	-7.40	Average
2357.674	53.61	74.00	-20.39	61.01	-7.40	Peak
2432.694	95.14			102.64	-7.50	Average
2432.694	107.17			114.67	-7.50	Peak
2495.372	38.80	54.00	-15.20	46.31	-7.51	Average
2495.372	52.50	74.00	-21.50	60.01	-7.51	Peak
4874.000	41.46	54.00	-12.54	40.51	0.95	Average
4874.000	59.53	74.00	-14.47	58.58	0.95	Peak
7311.000	34.03	54.00	-19.97	28.44	5.59	Average
7311.000	47.49	74.00	-26.51	41.90	5.59	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2356.222	38.01	54.00	-15.99	45.41	-7.40	Average
2356.222	51.66	74.00	-22.34	59.06	-7.40	Peak
2432.694	91.39			98.89	-7.50	Average
2432.694	103.36			110.86	-7.50	Peak
2495.856	38.11	54.00	-15.89	45.62	-7.51	Average
2495.856	51.14	74.00	-22.86	58.65	-7.51	Peak
4874.000	48.26	54.00	-5.74	47.31	0.95	Average
4874.000	65.52	74.00	-8.48	64.57	0.95	Peak
7311.000	34.18	54.00	-19.82	28.59	5.59	Average
7311.000	48.18	74.00	-25.82	42.59	5.59	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2457.400	93.96			101.45	-7.49	Average
2457.400	105.43			112.92	-7.49	Peak
2484.100	53.11	54.00	-0.89	60.59	-7.48	Average
2484.100	73.31	74.00	-0.69	80.79	-7.48	Peak
4924.000	44.52	54.00	-9.48	43.51	1.01	Average
4924.000	59.91	74.00	-14.09	58.90	1.01	Peak
7386.000	34.73	54.00	-19.27	28.80	5.93	Average
7386.000	47.83	74.00	-26.17	41.90	5.93	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2457.500	90.14			97.63	-7.49	Average
2457.500	101.19			108.68	-7.49	Peak
2483.500	48.06	54.00	-5.94	55.54	-7.48	Average
2483.500	69.91	74.00	-4.09	77.39	-7.48	Peak
4924.000	48.99	54.00	-5.01	47.98	1.01	Average
4924.000	64.86	74.00	-9.14	63.85	1.01	Peak
7386.000	34.20	54.00	-19.80	28.27	5.93	Average
7386.000	47.96	74.00	-26.04	42.03	5.93	Peak

802.11n HT20 mode:

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2389.520	52.46	54.00	-1.54	59.89	-7.43	Average
2389.520	73.86	74.00	-0.14	81.29	-7.43	Peak
2406.432	94.24			101.71	-7.47	Average
2406.432	105.99			113.46	-7.47	Peak
4824.000	35.70	54.00	-18.30	34.93	0.77	Average
4824.000	52.56	74.00	-21.44	51.79	0.77	Peak
7236.000	33.94	54.00	-20.06	28.64	5.30	Average
7236.000	47.07	74.00	-26.93	41.77	5.30	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2389.968	43.88	54.00	-10.12	51.31	-7.43	Average
2389.968	63.63	74.00	-10.37	71.06	-7.43	Peak
2405.536	89.75			97.22	-7.47	Average
2405.536	101.29			108.76	-7.47	Peak
4824.000	37.01	54.00	-16.99	36.28	0.73	Average
4824.000	56.43	74.00	-17.57	55.70	0.73	Peak
7236.000	33.43	54.00	-20.57	28.13	5.30	Average
7236.000	46.62	74.00	-27.38	41.32	5.30	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2370.016	39.21	54.00	-14.79	46.62	-7.41	Average
2370.016	53.19	74.00	-20.81	60.60	-7.41	Peak
2443.342	93.48			100.98	-7.50	Average
2443.342	105.40			112.90	-7.50	Peak
2493.678	38.64	54.00	-15.36	46.15	-7.51	Average
2493.678	51.78	74.00	-22.22	59.29	-7.51	Peak
4874.000	39.93	54.00	-14.07	38.98	0.95	Average
4874.000	59.48	74.00	-14.52	58.53	0.95	Peak
7311.000	33.74	54.00	-20.26	28.15	5.59	Average
7311.000	46.70	74.00	-27.30	41.11	5.59	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2332.264	38.01	54.00	-15.99	45.40	-7.39	Average
2332.264	51.51	74.00	-22.49	58.90	-7.39	Peak
2430.758	90.12			97.63	-7.51	Average
2430.758	102.18			109.69	-7.51	Peak
2489.322	37.90	54.00	-16.10	45.39	-7.49	Average
2489.322	51.34	74.00	-22.66	58.83	-7.49	Peak
4874.000	45.48	54.00	-8.52	44.53	0.95	Average
4874.000	64.70	74.00	-9.30	63.75	0.95	Peak
7311.000	33.73	54.00	-20.27	28.14	5.59	Average
7311.000	47.59	74.00	-26.41	42.00	5.59	Peak

High CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2467.800	92.38			99.87	-7.49	Average
2467.800	103.98			111.47	-7.49	Peak
2485.300	53.77	54.00	-0.23	61.26	-7.49	Average
2485.300	73.41	74.00	-0.59	80.90	-7.49	Peak
4924.000	42.55	54.00	-11.45	41.54	1.01	Average
4924.000	60.69	74.00	-13.31	59.68	1.01	Peak
7386.000	34.65	54.00	-19.35	28.72	5.93	Average
7386.000	46.72	74.00	-27.28	40.79	5.93	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2456.400	88.99			96.48	-7.49	Average
2456.400	100.83			108.32	-7.49	Peak
2484.100	48.37	54.00	-5.63	55.85	-7.48	Average
2484.100	67.91	74.00	-6.09	75.39	-7.48	Peak
4924.000	47.52	54.00	-6.48	46.51	1.01	Average
4924.000	65.53	74.00	-8.47	64.52	1.01	Peak
7386.000	34.25	54.00	-19.75	28.32	5.93	Average
7386.000	48.32	74.00	-25.68	42.39	5.93	Peak

802.11n HT40 mode:

Low CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2387.880	52.92	54.00	-1.08	60.35	-7.43	Average
2387.880	72.43	74.00	-1.57	79.86	-7.43	Peak
2416.788	85.57			93.06	-7.49	Average
2416.788	101.94			109.43	-7.49	Peak
4844.000	33.13	54.00	-20.87	32.29	0.84	Average
4844.000	47.41	74.00	-26.59	46.57	0.84	Peak
7266.000	33.86	54.00	-20.14	28.51	5.35	Average
7266.000	47.78	74.00	-26.22	42.43	5.35	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2386.560	43.84	54.00	-10.16	51.27	-7.43	Average
2386.560	61.90	74.00	-12.10	69.33	-7.43	Peak
2439.360	81.87			89.37	-7.50	Average
2439.360	97.07			104.57	-7.50	Peak
4844.000	35.50	54.00	-18.50	34.66	0.84	Average
4844.000	50.68	74.00	-23.32	49.84	0.84	Peak
7266.000	33.48	54.00	-20.52	28.13	5.35	Average
7266.000	48.30	74.00	-25.70	42.95	5.35	Peak

Middle CH

Horizontal

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2389.134	43.54	54.00	-10.46	50.97	-7.43	Average
2389.134	60.38	74.00	-13.62	67.81	-7.43	Peak
2431.968	85.03			92.54	-7.51	Average
2431.968	101.47			108.98	-7.51	Peak
2484.724	45.96	54.00	-8.04	53.45	-7.49	Average
2484.724	63.89	74.00	-10.11	71.38	-7.49	Peak
4874.000	35.19	54.00	-18.81	34.24	0.95	Average
4874.000	50.46	74.00	-23.54	49.51	0.95	Peak
7311.000	33.49	54.00	-20.51	27.90	5.59	Average
7311.000	47.28	74.00	-26.72	41.69	5.59	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2390.000	39.52	54.00	-14.48	46.95	-7.43	Average
2390.000	56.90	74.00	-17.10	64.33	-7.43	Peak
2441.890	81.12			88.62	-7.50	Average
2441.890	96.11			103.61	-7.50	Peak
2484.966	40.36	54.00	-13.64	47.85	-7.49	Average
2484.966	57.13	74.00	-16.87	64.62	-7.49	Peak
4874.000	39.69	54.00	-14.31	38.74	0.95	Average
4874.000	56.54	74.00	-17.46	55.59	0.95	Peak
7311.000	34.00	54.00	-20.00	28.41	5.59	Average
7311.000	47.08	74.00	-26.92	41.49	5.59	Peak

High CH

Horizontal

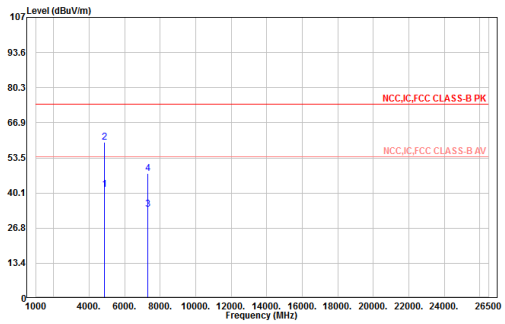
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2446.760	85.17			92.66	-7.49	Average
2446.760	101.42			108.91	-7.49	Peak
2484.680	53.83	54.00	-0.17	61.32	-7.49	Average
2484.680	73.72	74.00	-0.28	81.21	-7.49	Peak
4904.000	37.53	54.00	-16.47	36.52	1.01	Average
4904.000	52.89	74.00	-21.11	51.88	1.01	Peak
7356.000	34.27	54.00	-19.73	28.46	5.81	Average
7356.000	47.32	74.00	-26.68	41.51	5.81	Peak

Vertical

Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
2435.840	81.87			89.38	-7.51	Average
2435.840	97.77			105.28	-7.51	Peak
2484.800	49.51	54.00	-4.49	57.00	-7.49	Average
2484.800	69.00	74.00	-5.00	76.49	-7.49	Peak
4904.000	42.59	54.00	-11.41	41.58	1.01	Average
4904.000	59.70	74.00	-14.30	58.69	1.01	Peak
7356.000	34.05	54.00	-19.95	28.24	5.81	Average
7356.000	45.07	74.00	-28.93	39.26	5.81	Peak

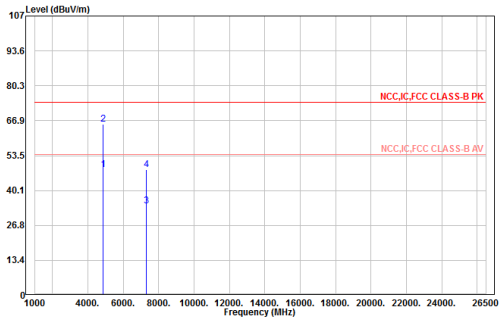
Above 1G (1 GHz-26.5 GHz): test the output power worst mode: 802.11g mode Middle Channel

Horizontal



		Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1	!	4874.000	41.46	54.00	-12.54	40.51	0.95	Average	horizontal
2	!	4874.000	59.53	74.00	-14.47	58.58	0.95	Peak	horizontal
3	!	7311.000	34.03	54.00	-19.97	28.44	5.59	Average	horizontal
4		7311.000	47.49	74.00	-26.51	41.90	5.59	Peak	horizontal

Vertical



		Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Pol/Phase
		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		
1	!	4874.000	48.26	54.00	-5.74	47.31	0.95	Average	vertical
2	!	4874.000	65.52	74.00	-8.48	64.57	0.95	Peak	vertical
3	!	7311.000	34.18	54.00	-19.82	28.59	5.59	Average	vertical
4		7311.000	48.18	74.00	-25.82	42.59	5.59	Peak	vertical

Result = Reading + Correct Factor

Margin = Result – Limit

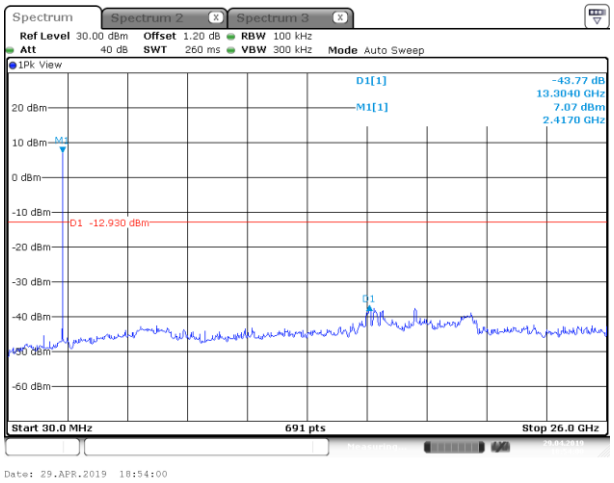
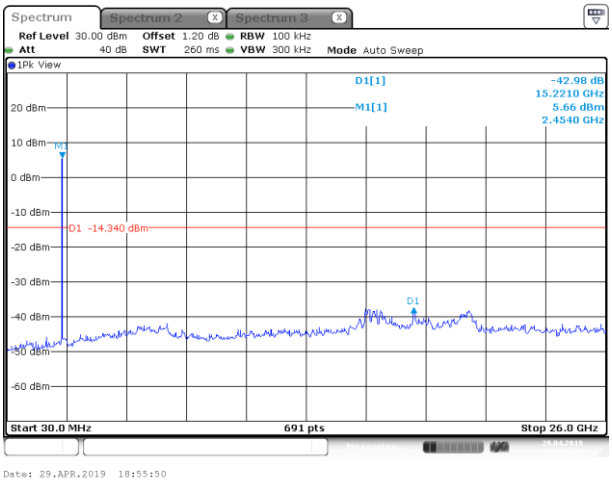
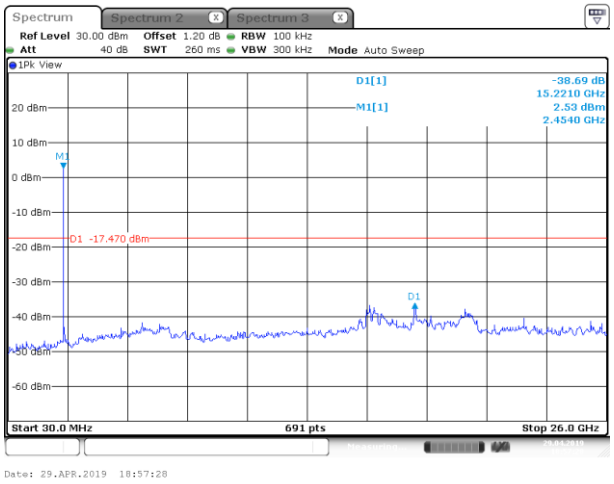
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

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

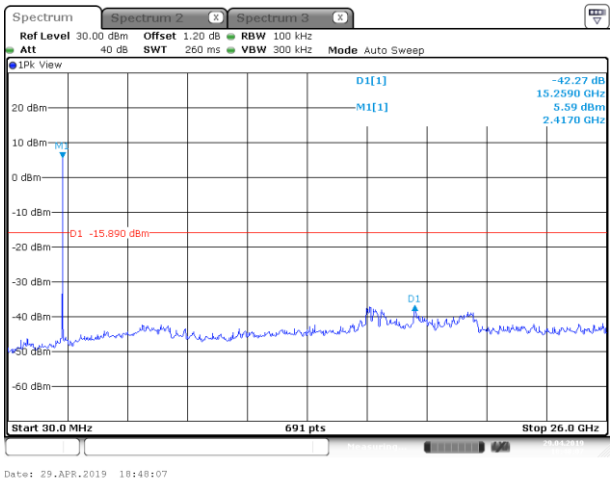
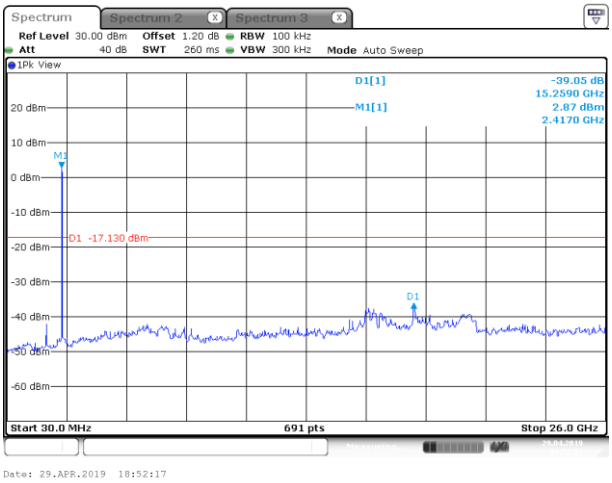
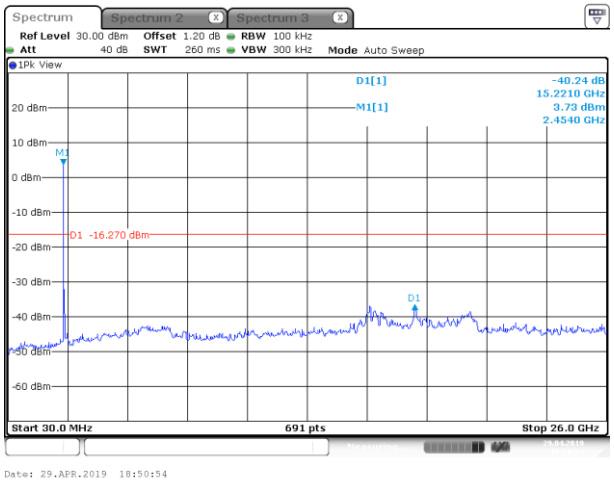
Conducted Spurious Emissions:

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
802.11b mode				
Low	2412	43.77	≥ 20	Compliance
Mid	2437	42.98	≥ 20	Compliance
High	2462	38.69	≥ 20	Compliance
802.11g mode				
Low	2412	42.27	≥ 20	Compliance
Mid	2437	39.05	≥ 20	Compliance
High	2462	40.24	≥ 20	Compliance
802.11n HT20 mode				
Low	2412	38.34	≥ 20	Compliance
Mid	2437	40.00	≥ 20	Compliance
High	2462	38.83	≥ 20	Compliance
802.11n HT40 mode				
Low	2422	37.13	≥ 20	Compliance
Mid	2437	36.71	≥ 20	Compliance
High	2452	35.27	≥ 20	Compliance

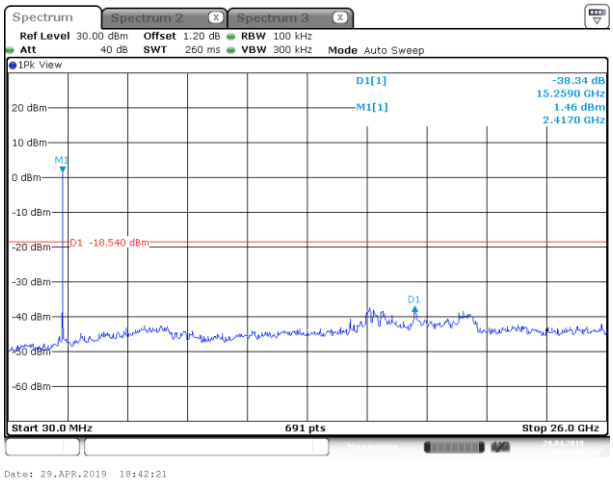
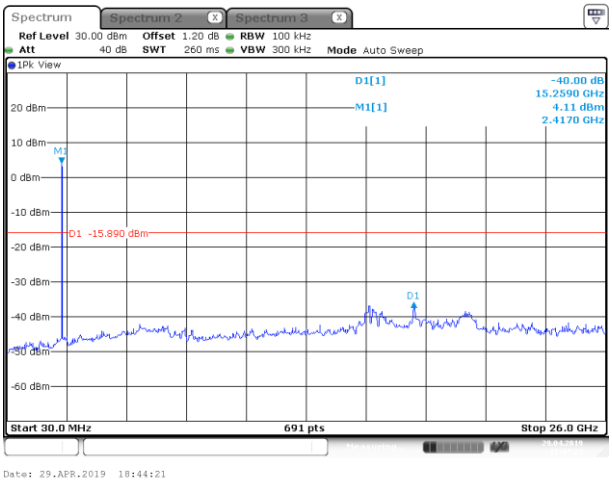
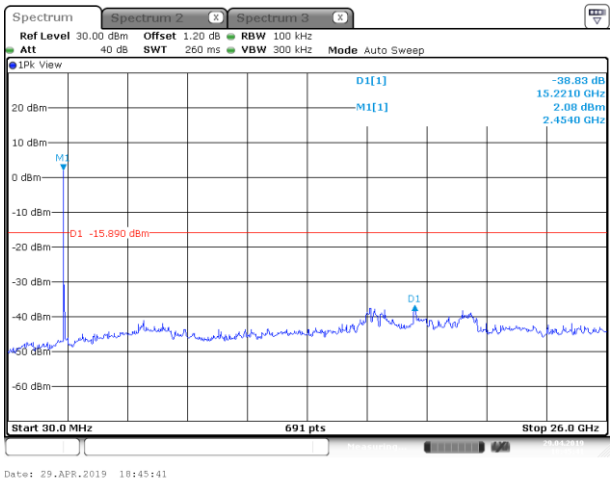
802.11b mode:

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

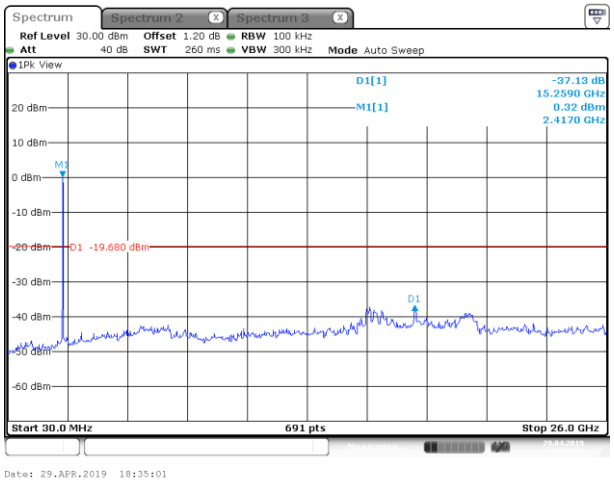
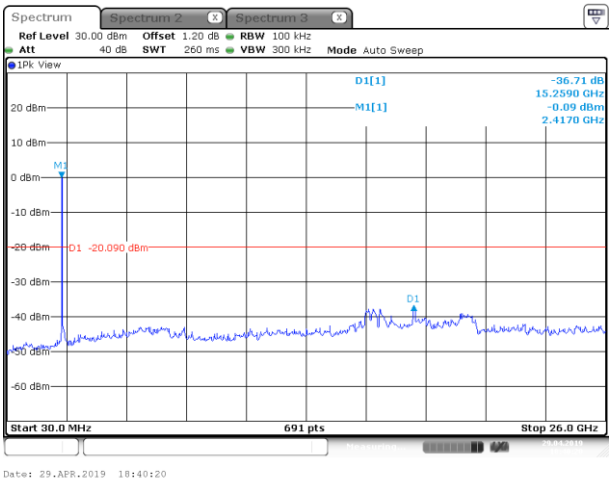
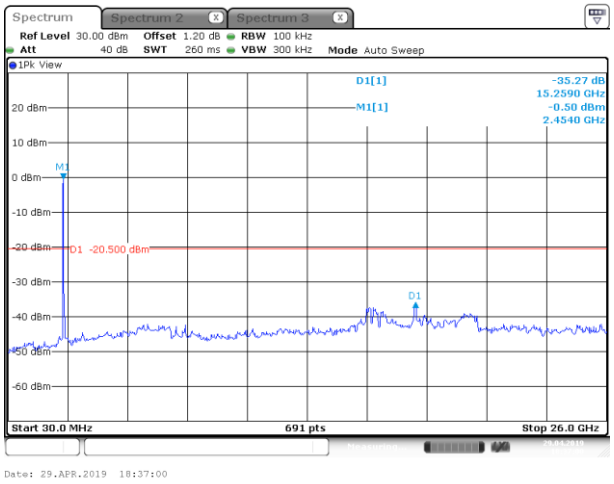
802.11g mode:

Low CH	Middle CH
	
High CH	**-**
	

802.11n HT20 mode:

Low CH	Middle CH
	
High CH	**-**
	

802.11n HT40 mode:

Low CH	Middle 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					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2018/11/14	2019/11/13
Cable	WOKEN	SFL402	S02-160323-07	2019/02/11	2020/02/10

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

8.4 Test Environmental Conditions

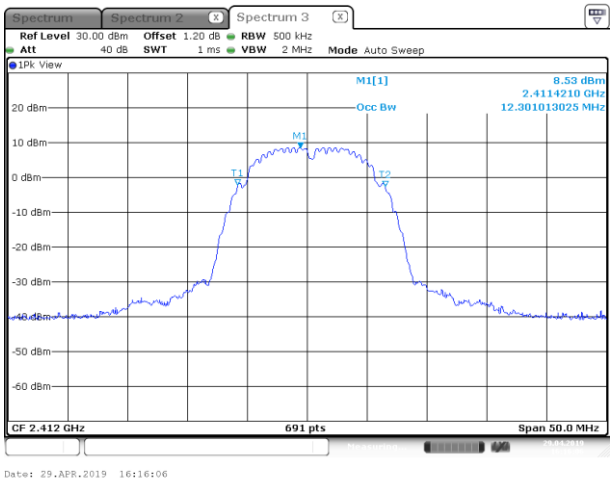
Temperature:	23~24 ℃	**Relative Humidity:**	61~62 %
ATM Pressure:	1015hPa	**Test Engineer:**	Leo Cheng
Conducted Test Date:	2019-04-29	-	-

8.5 Test Results

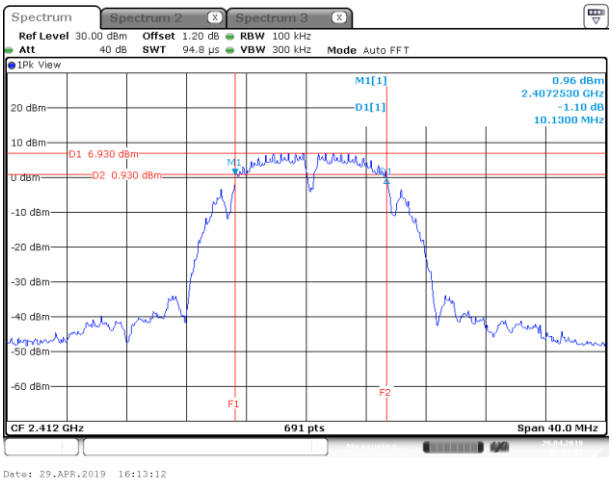
Channel	Frequency (MHz)	99% OBW (MHz)	6 dB BW (MHz)	6dB Limit (MHz)	Result
802.11b mode					
Low	2412	12.30	10.13	> 0.5	Compliance
Middle	2437	12.30	10.02	> 0.5	Compliance
High	2462	12.30	10.01	> 0.5	Compliance
802.11g mode					
Low	2412	17.51	16.38	> 0.5	Compliance
Middle	2437	17.51	16.39	> 0.5	Compliance
High	2462	17.43	16.40	> 0.5	Compliance
802.11n HT20 mode					
Low	2412	18.16	17.37	> 0.5	Compliance
Middle	2437	18.16	17.54	> 0.5	Compliance
High	2462	18.08	17.38	> 0.5	Compliance
802.11n HT40 mode					
Low	2422	36.90	36.31	> 0.5	Compliance
Middle	2437	36.90	36.24	> 0.5	Compliance
High	2452	36.90	36.29	> 0.5	Compliance

802.11b mode:

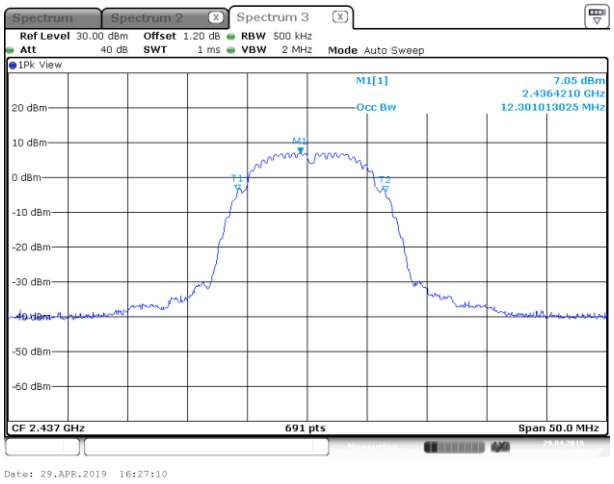
99% OBW Low CH



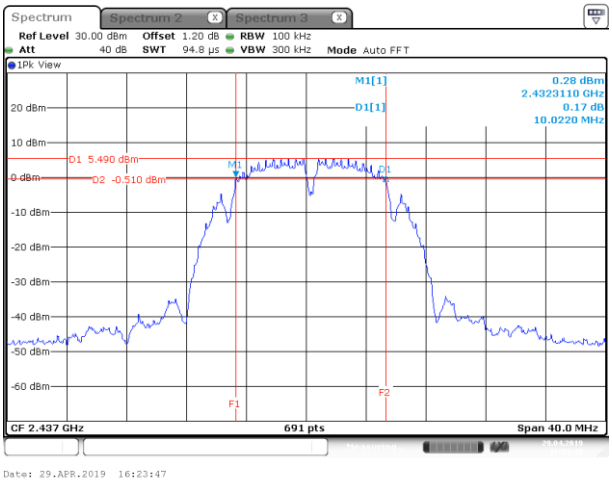
6 dB BW Low CH



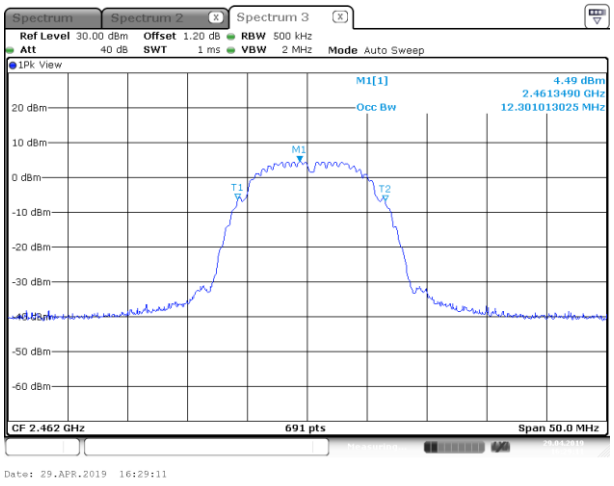
99% OBW Middle CH



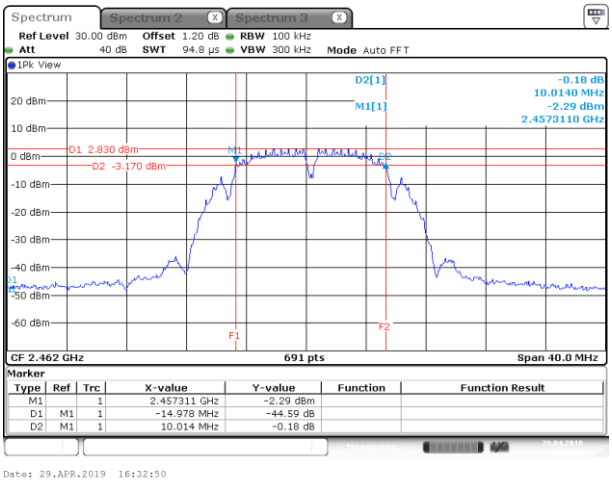
6 dB BW Middle CH



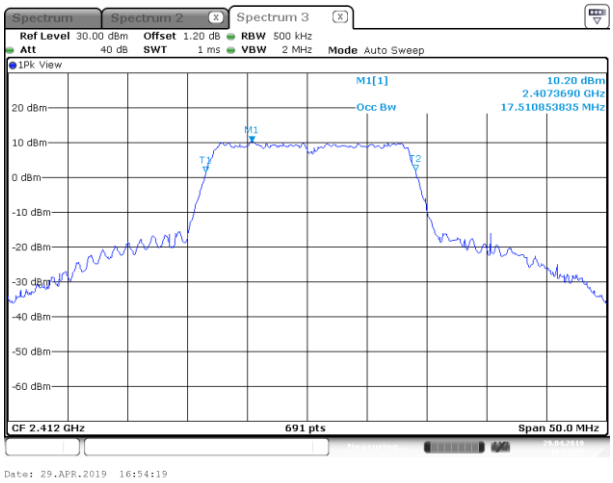
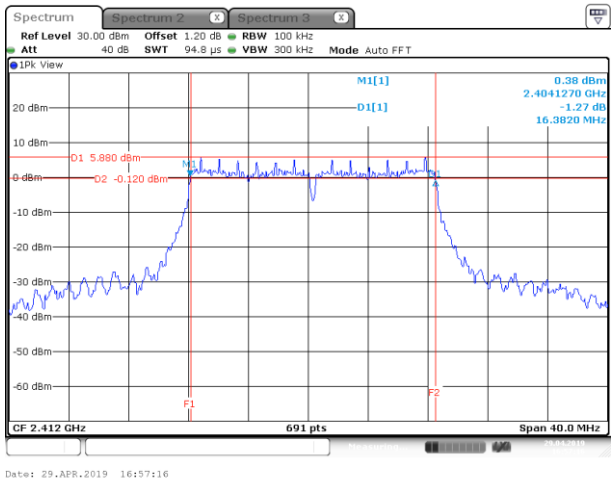
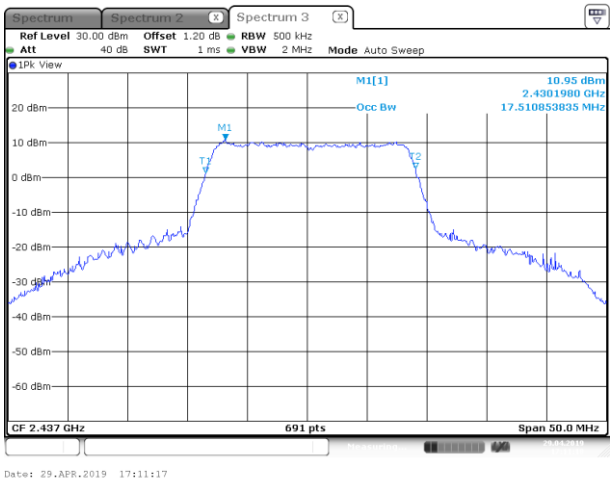
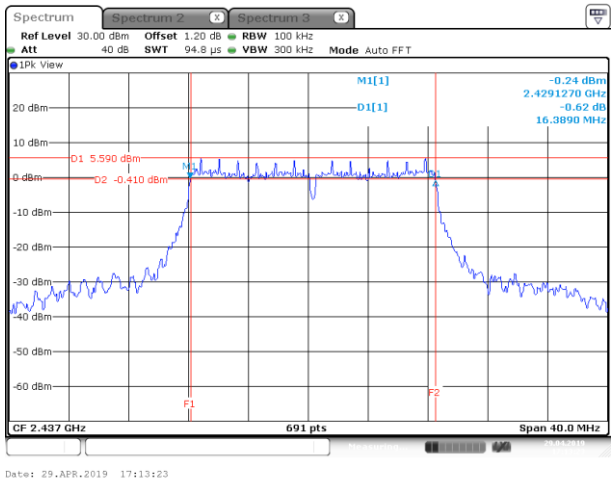
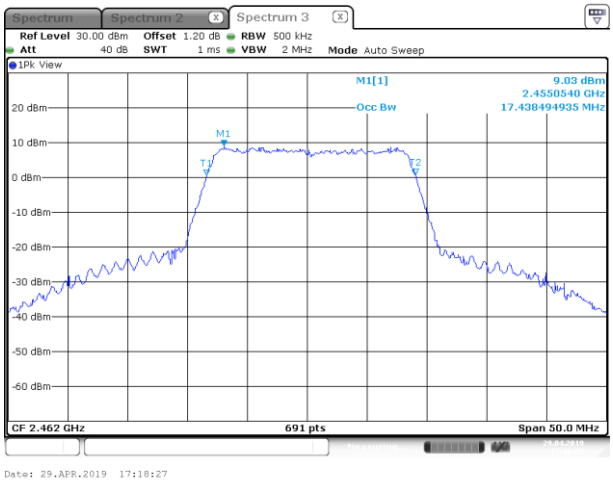
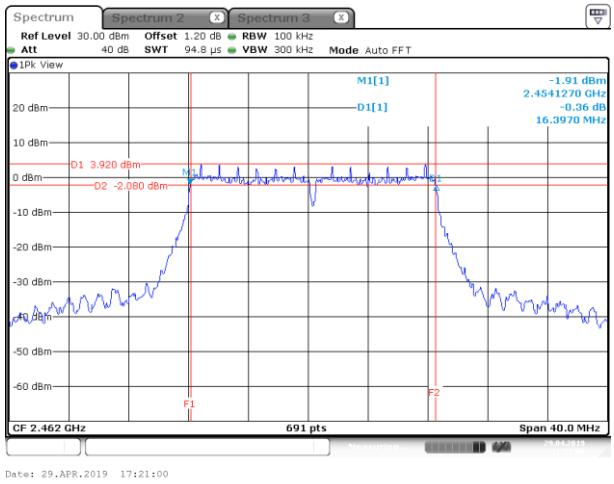
99% OBW High CH



6 dB BW High CH

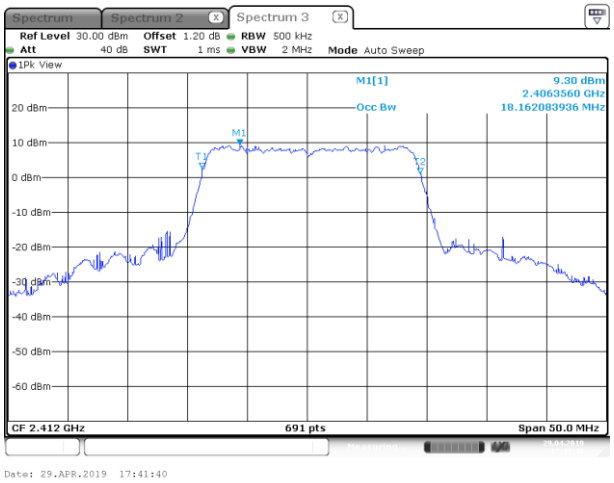


802.11g mode:

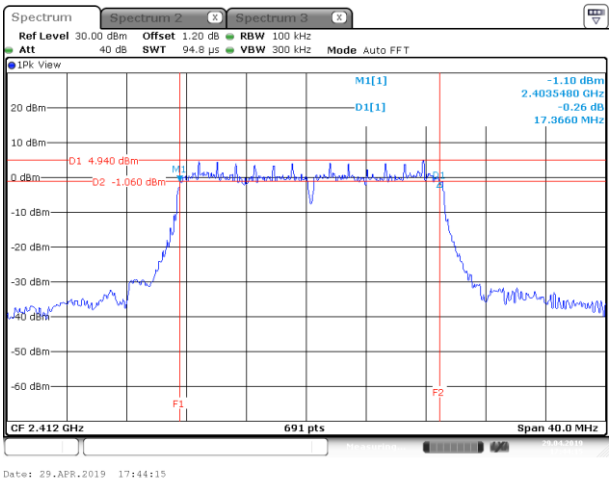
99% OBW Low CH	6 dB BW Low CH
	
99% OBW Middle CH	6 dB BW Middle CH
	
99% OBW High CH	6 dB BW High CH
	

802.11n HT20 mode:

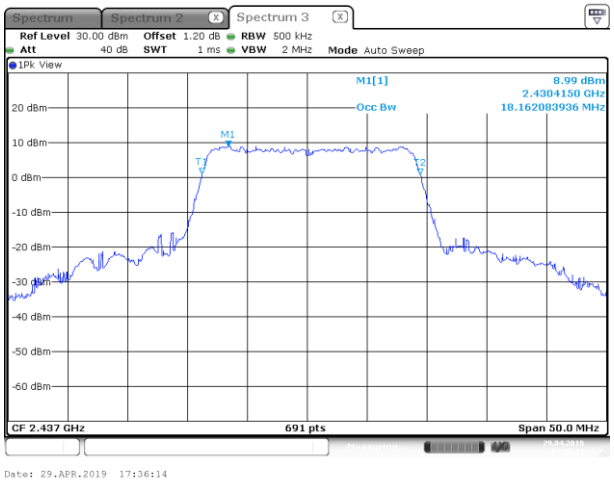
99% OBW Low CH



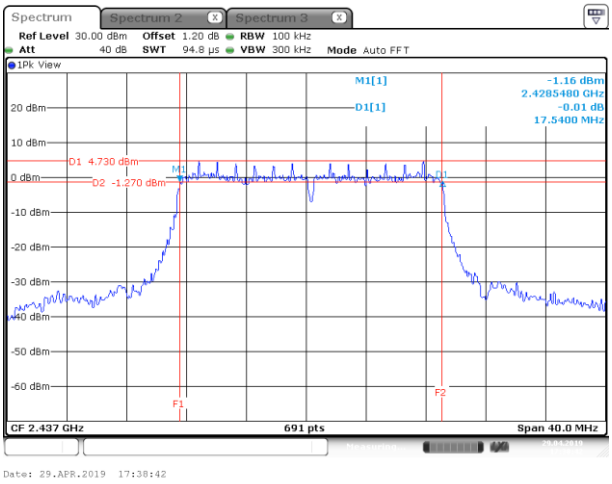
6 dB BW Low CH



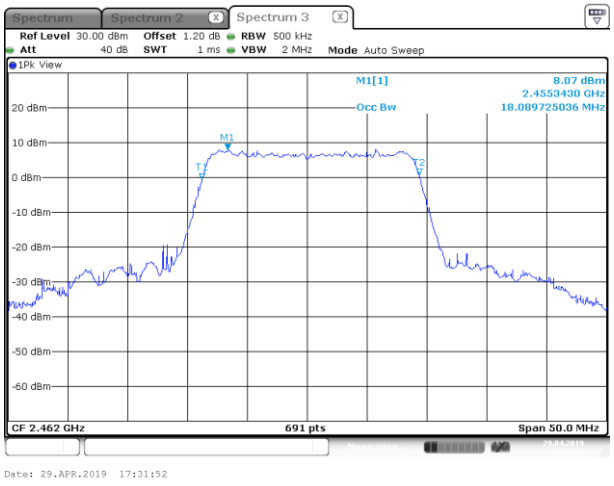
99% OBW Middle CH



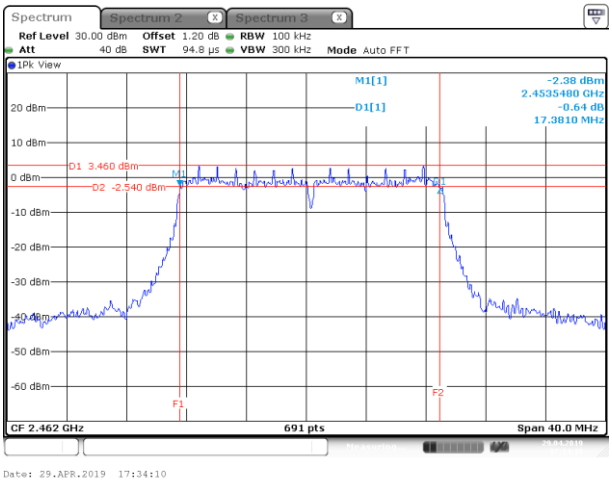
6 dB BW Middle CH



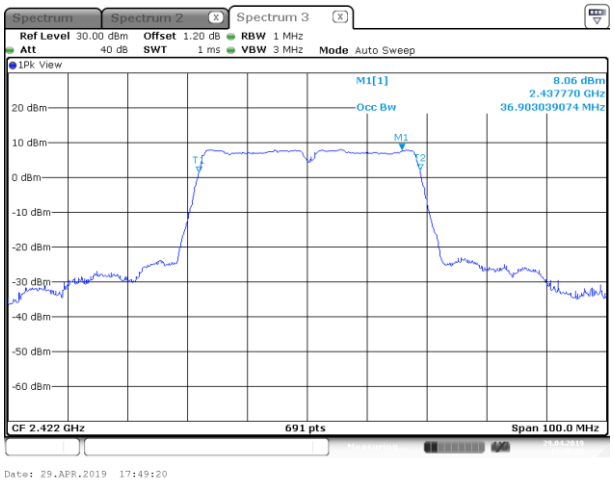
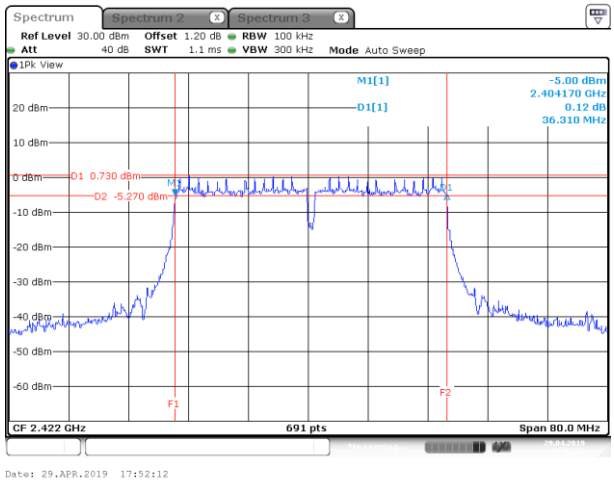
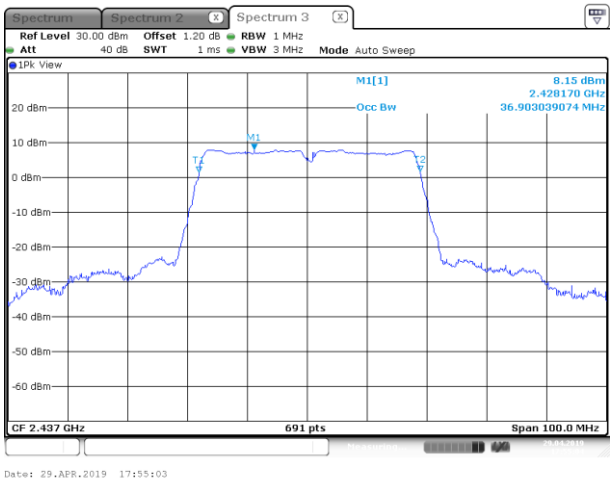
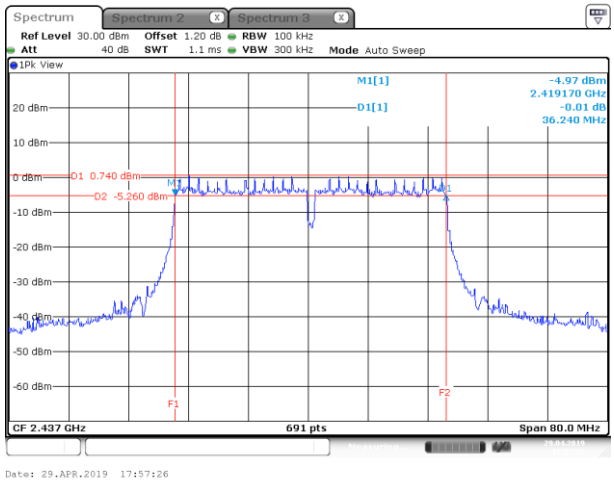
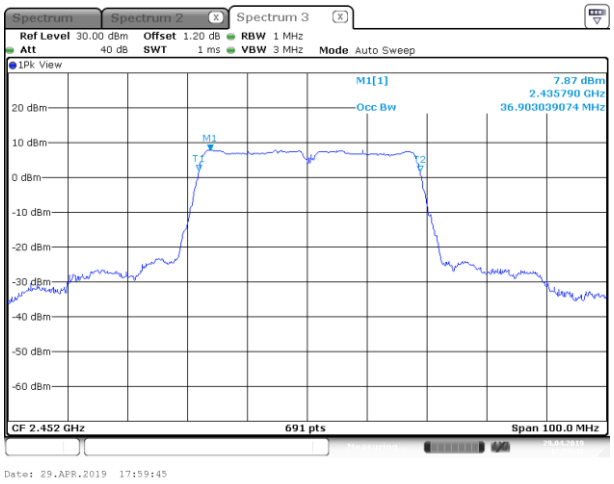
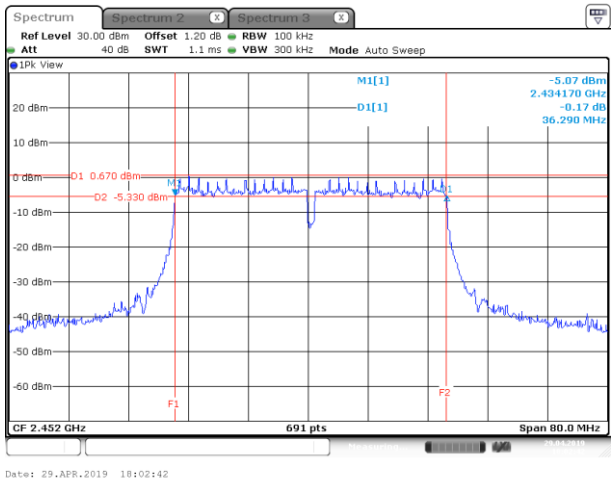
99% OBW High CH



6 dB BW High CH



802.11n HT40 mode:

99% OBW Low CH	6 dB BW Low CH
	
99% OBW Middle CH	6 dB BW Middle CH
	
99% OBW High CH	6 dB BW 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					
Power Sensor	KEYSIGHT	U2021XA	MY54080018	2019/03/06	2020/03/05
Cable	WOKEN	SFL402	S02-160323-07	2019/02/11	2020/02/10

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

9.4 Test Environmental Conditions

Temperature:	23~24 ℃	**Relative Humidity:**	61~62 %
ATM Pressure:	1015hPa	**Test Engineer:**	Leo Cheng
Conducted Test Date:	2019-04-29	-	-

9.5 Test Results

Channel	Frequency (MHz)	Peak Output Power (dBm)	Total Peak Output Power (W)	Limit (dBm)	Result
802.11b mode					
Low	2412	20.50	0.1122	30	Compliance
Middle	2437	18.99	0.0792	30	Compliance
High	2462	16.20	0.0417	30	Compliance
802.11g mode					
Low	2412	24.45	0.2786	30	Compliance
Middle	2437	24.38	0.2742	30	Compliance
High	2462	22.96	0.1977	30	Compliance
802.11n HT20 mode					
Low	2412	24.12	0.2582	30	Compliance
Middle	2437	23.82	0.2410	30	Compliance
High	2462	22.80	0.1905	30	Compliance
802.11n HT40 mode					
Low	2422	20.87	0.1222	30	Compliance
Middle	2437	20.86	0.1219	30	Compliance
High	2452	20.53	0.1130	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					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2018/11/14	2019/11/13
Cable	WOKEN	SFL402	S02-160323-07	2019/02/11	2020/02/10

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

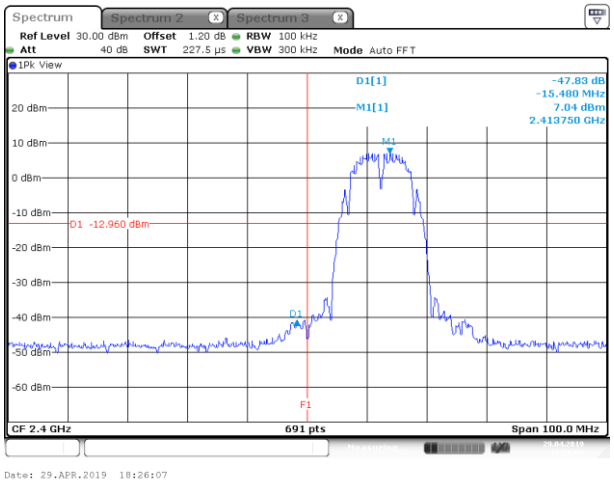
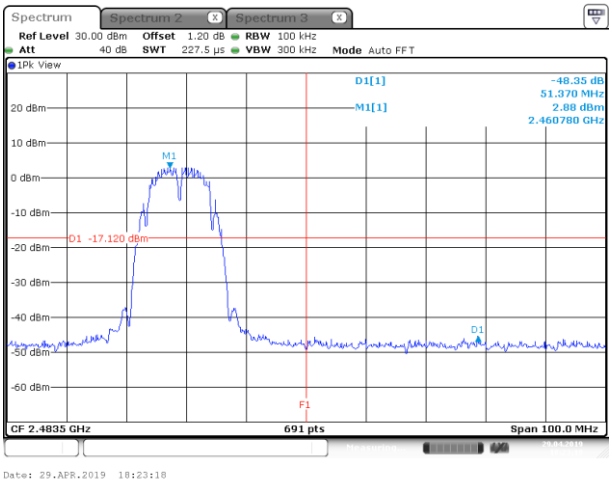
10.4 Test Environmental Conditions

Temperature:	23~24 ℃	**Relative Humidity:**	61~62 %
ATM Pressure:	1015hPa	**Test Engineer:**	Leo Cheng
Conducted Test Date:	2019-04-29	-	-

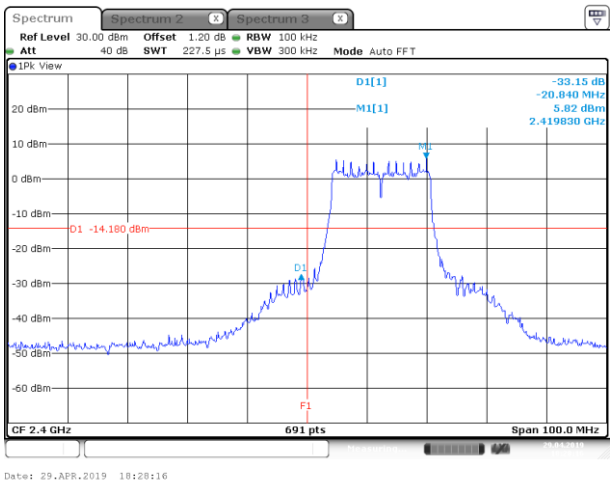
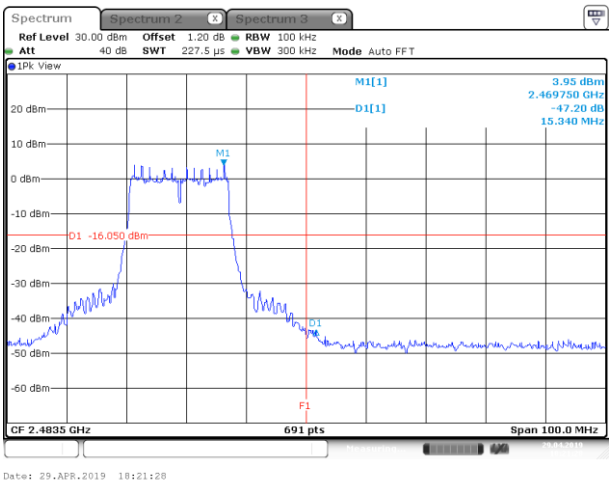
10.5 Test Results

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
802.11b mode				
Low	2412	47.83	≥ 20	Compliance
High	2462	48.35	≥ 20	Compliance
802.11g mode				
Low	2412	33.15	≥ 20	Compliance
High	2462	47.20	≥ 20	Compliance
802.11n HT20 mode				
Low	2412	38.10	≥ 20	Compliance
High	2462	46.57	≥ 20	Compliance
802.11n HT40 mode				
Low	2422	34.89	≥ 20	Compliance
High	2452	39.23	≥ 20	Compliance

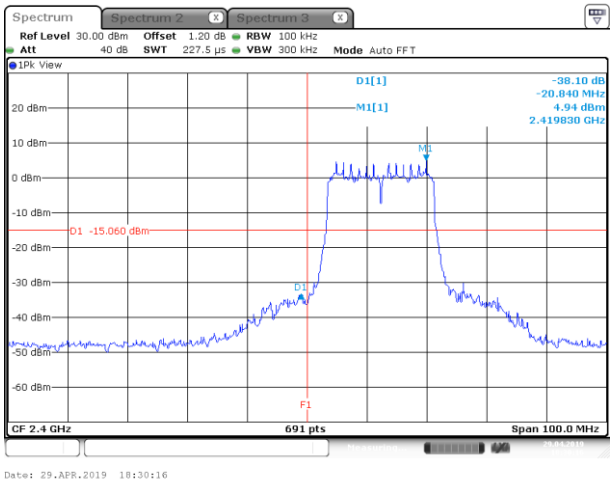
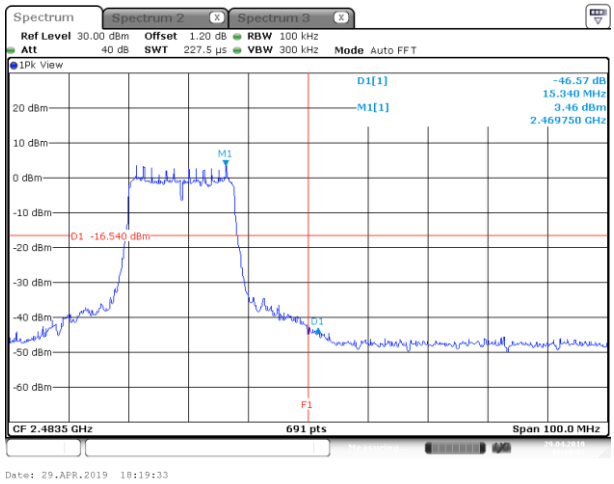
802.11b mode:

Left Side	Right Side
	

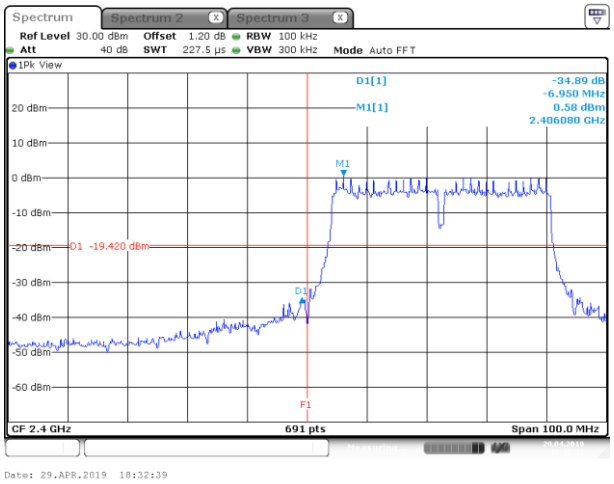
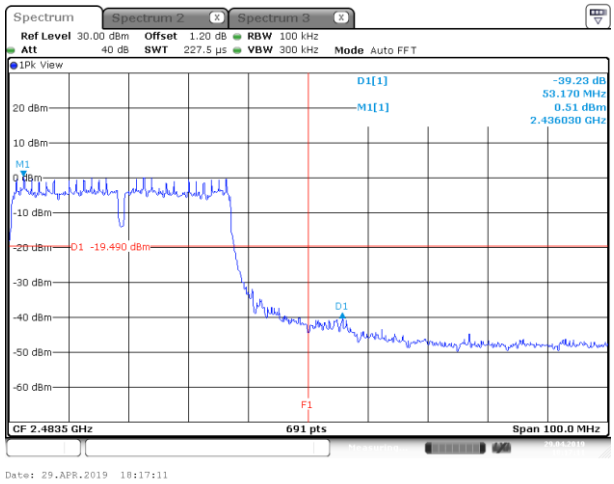
802.11g mode:

Left Side	Right Side
	

802.11n HT20 mode:

Left Side	Right Side
	

802.11n HT40 mode:

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					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2018/11/14	2019/11/13
Cable	WOKEN	SFL402	S02-160323-07	2019/02/11	2020/02/10

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

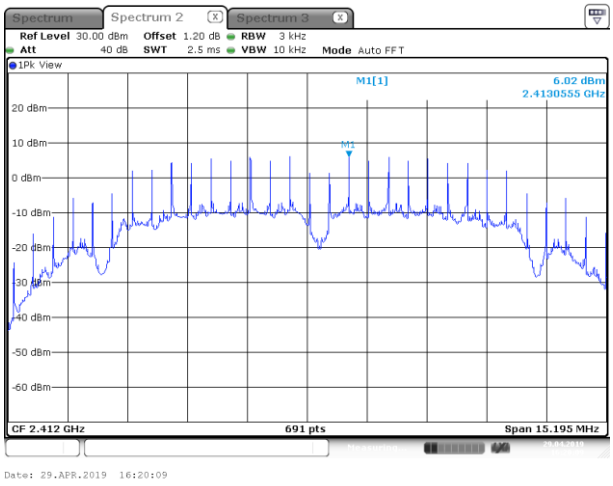
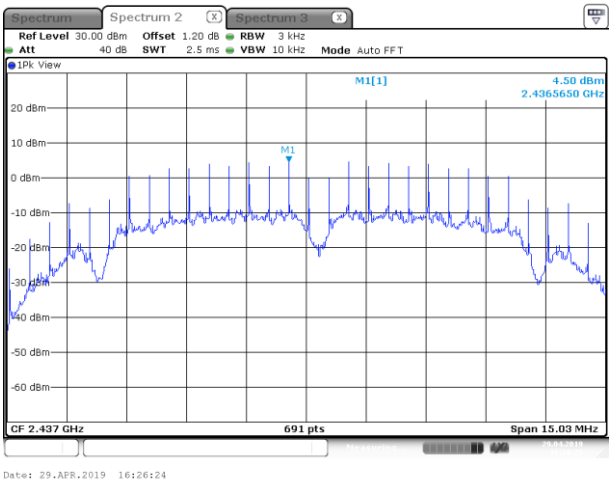
11.4 Test Environmental Conditions

Temperature:	23~24 ℃	**Relative Humidity:**	61~62 %
ATM Pressure:	1015hPa	**Test Engineer:**	Leo Cheng
Conducted Test Date:	2019-04-29	-	-

11.5 Test Results

Channel	Frequency (MHz)	PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Result
802.11b mode				
Low	2412	6.02	8	Compliance
Middle	2437	4.50	8	Compliance
High	2462	1.92	8	Compliance
802.11g mode				
Low	2412	-8.45	8	Compliance
Middle	2437	-9.29	8	Compliance
High	2462	-10.68	8	Compliance
802.11n HT20 mode				
Low	2412	-8.88	8	Compliance
Middle	2437	-9.55	8	Compliance
High	2462	-10.26	8	Compliance
802.11n HT40 mode				
Low	2422	-13.79	8	Compliance
Middle	2437	-14.67	8	Compliance
High	2452	-13.80	8	Compliance

802.11b mode:

Low CH	Middle CH
	
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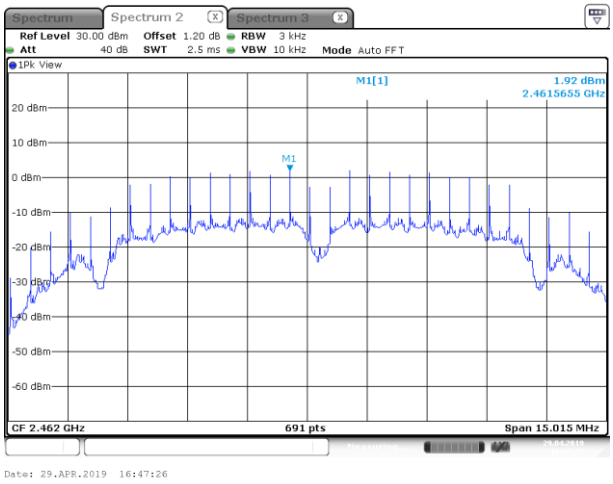
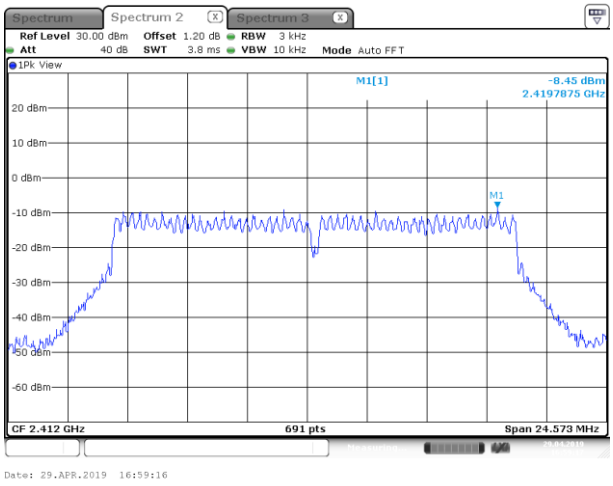
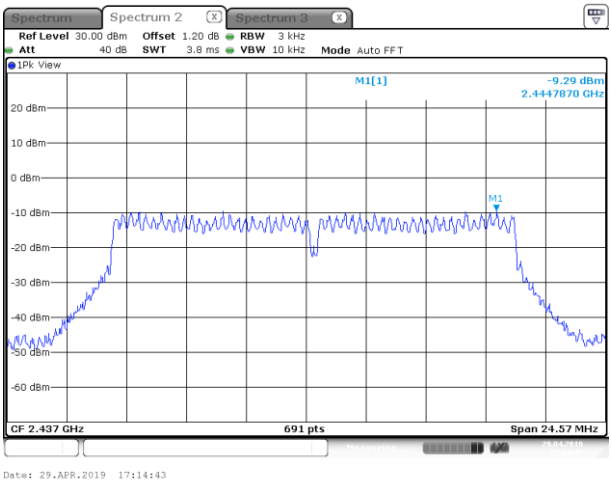
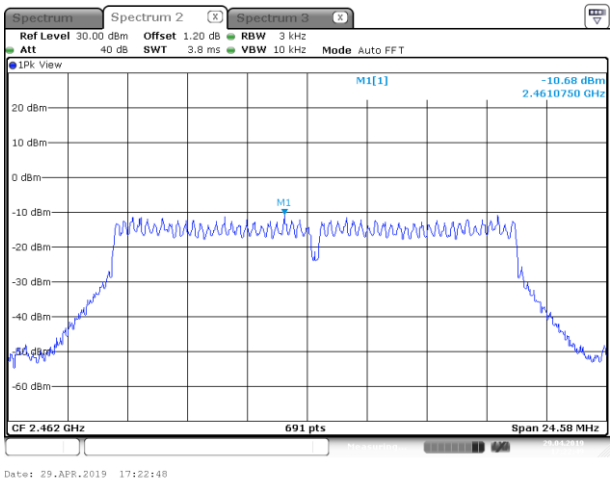
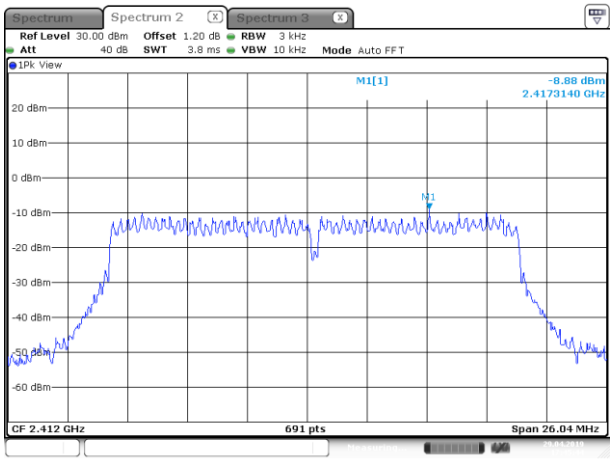
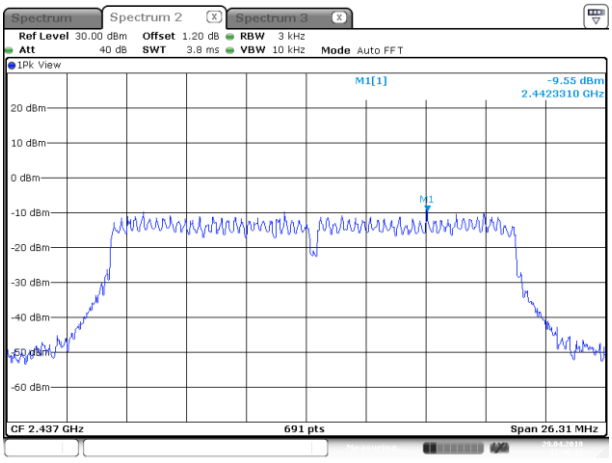
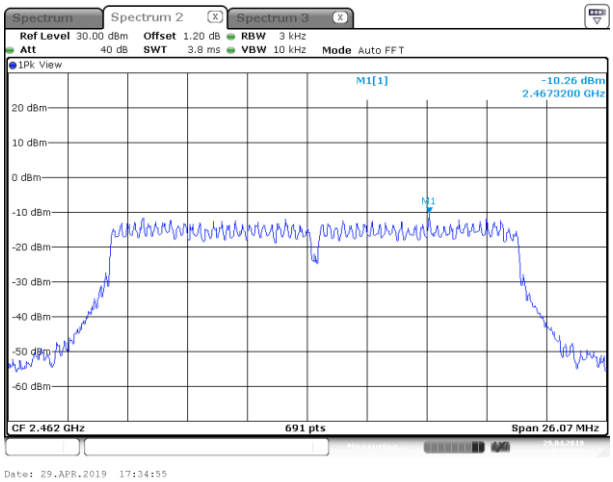
	-

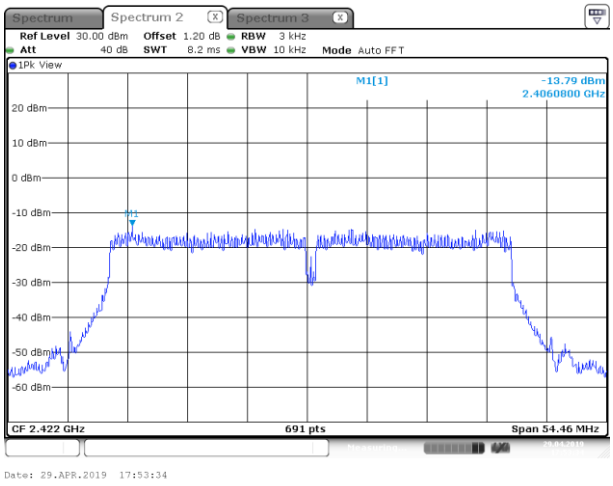
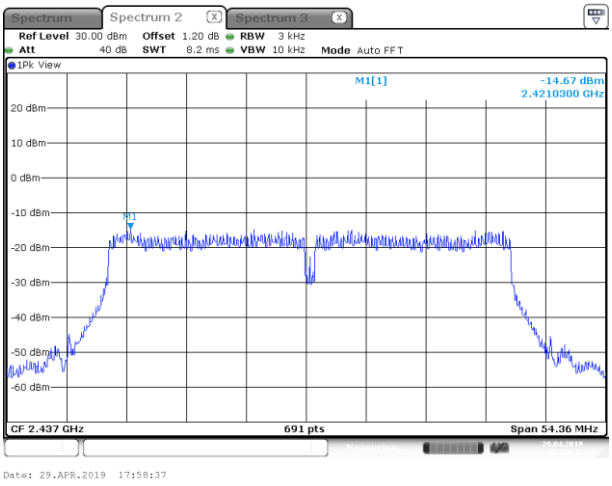
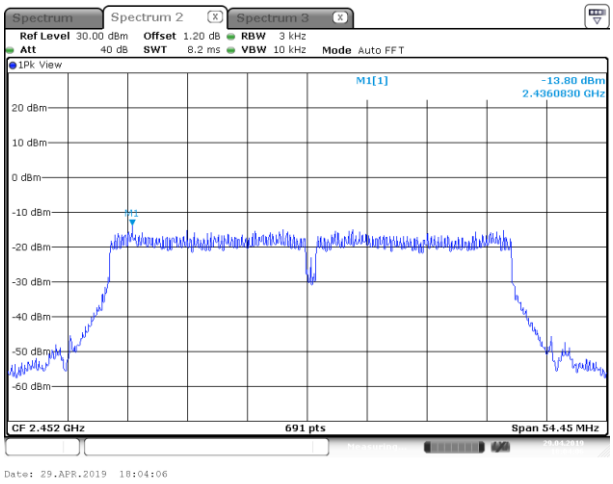
802.11g mode:

Low CH	Middle CH
	
High CH	**-**
	

802.11n HT20 mode:

Low CH	Middle CH
	
High CH	**-**
	

802.11n HT40 mode:

Low CH	Middle CH
	
High CH	**-**
	

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