



TESTING LABORATORY
CERTIFICATE #4820.01



FCC PART 15.247

TEST REPORT

For

QUANTUM NETWORKS (SG) PTE.LTD.

8 UBI ROAD 2 #08-10 ZERVEX SINGAPORE(408538), SINGAPORE, Singapore

FCC ID: 2AMQU-QN-H-220

Report Type: Original Report	Product Name: High Performance 802.11ac (2x2) Wave 2 Indoor(Room) Access Point
Report Number:	RDG191126003-00A
Report Date:	2020-01-19
Reviewed By:	Ivan Cao Assistant manager 
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

TABLE OF CONTENTS

GENERAL INFORMATION.....	4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	4
OBJECTIVE	4
RELATED SUBMITTAL(S)/GRANT(S).....	4
TEST METHODOLOGY	4
MEASUREMENT UNCERTAINTY	5
TEST FACILITY	5
DECLARATIONS	5
SYSTEM TEST CONFIGURATION.....	6
DESCRIPTION OF TEST CONFIGURATION	6
EUT EXERCISE SOFTWARE	6
EQUIPMENT MODIFICATIONS	9
LOCAL SUPPORT EQUIPMENT LIST AND DETAILS	9
SUPPORT CABLE LIST AND DETAILS	9
CONFIGURATION OF TEST SETUP	10
SUMMARY OF TEST RESULTS.....	11
FCC §15.247 (i) & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE).....	12
APPLICABLE STANDARD	12
FCC §15.203 - ANTENNA REQUIREMENT.....	14
APPLICABLE STANDARD	14
ANTENNA CONNECTOR CONSTRUCTION	14
FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS	15
APPLICABLE STANDARD	15
EUT SETUP	15
EMI TEST RECEIVER SETUP.....	15
TEST PROCEDURE	16
CORRECTED AMPLITUDE & MARGIN CALCULATION	16
TEST EQUIPMENT LIST AND DETAILS.....	16
TEST DATA	16
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS.....	21
APPLICABLE STANDARD	21
EUT SETUP	21
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP	22
TEST PROCEDURE	22
CORRECTED AMPLITUDE & MARGIN CALCULATION	22
TEST EQUIPMENT LIST AND DETAILS.....	23
TEST DATA	23
FCC §15.247(a) (2)–6 dB EMISSION BANDWIDTH.....	36
APPLICABLE STANDARD	36
TEST PROCEDURE	36
TEST EQUIPMENT LIST AND DETAILS.....	36
TEST DATA	36
FCC §15.247(b) (3) - MAXIMUM PEAK CONDUCTED OUTPUT POWER.....	44
APPLICABLE STANDARD	44
TEST PROCEDURE	44

TEST EQUIPMENT LIST AND DETAILS.....	44
TEST DATA	44
FCC §15.247(d)– 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE.....	46
APPLICABLE STANDARD	46
TEST PROCEDURE	46
TEST EQUIPMENT LIST AND DETAILS.....	46
TEST DATA	46
FCC §15.247(e) - POWER SPECTRAL DENSITY	55
APPLICABLE STANDARD	55
TEST PROCEDURE	55
TEST EQUIPMENT LIST AND DETAILS.....	55
TEST DATA	55

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:	High Performance 802.11ac (2x2) Wave 2 Indoor(Room) Access Point
EUT Model:	QN-H-220
Operation Frequency:	2412-2462 MHz(802.11b/g/n ht20) 2422-2452 MHz(802.11n ht40)
Maximum Peak Output Power (Conducted):	24.24 dBm
Modulation Type:	DSSS, OFDM
Rated Input Voltage:	DC 12V from DC adapter or DC 48V from PoE Adapter
Serial Number:	RDG191126003-RF-S1
EUT Received Date:	2019.11.26
EUT Received Status:	Good

Objective

This report is prepared on behalf of *QUANTUM NETWORKS (SG) PTE.LTD.* in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communications Commission's rules.

The tests were performed in order to determine the compliance of the EUT with FCC Rules Part 15-Subpart C, section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

FCC Part 15E NII submissions with FCC ID: 2AMQU-QN-H-220.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices. And 558074 D01 15.247 Meas Guidance v05r02.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.61dB
Power Spectral Density, conducted	±0.61 dB
Unwanted Emissions, radiated	30M~200MHz: 4.55 dB, 200M~1GHz: 5.92 dB, 1G~6GHz: 4.98 dB, 6G~18GHz: 5.89 dB, 18G~26.5G: 5.47 dB, 26.5G~40G: 5.63 dB
Unwanted Emissions, conducted	±1.5 dB
Temperature	±1 °C
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.12 dB (150 kHz to 30 MHz)

Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier : CN0022.

Declarations

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol “ Δ ”. Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

This report cannot be reproduced except in full, without prior written approval of the Company.

This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

This report must not be used by the customer to claim product certification, approval, or endorsement by A2LA, or any agency of the U.S. Government.

This report may contain data that are not covered by the accreditation scope and shall be marked with an asterisk “★”.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in Engineering Mode, which was provided by the manufacturer.

For 2.4GHz band, total 11 channels are provided:

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, 802.11g, and 802.11n ht20 modes were test with channel 1,6,11. For 802.11n ht40 mode was tested with channel 3, 6, 9.

The worst-case data rates are determined to be as follows for each mode based upon investigations by measuring the average power and PSD across all data rates bandwidths, and modulations. The device supports SISO in all modes, and MIMO in 802.11n modes, per pretest, MIMO mode was the worst mode and reported for 802.11n modes.

EUT Exercise Software

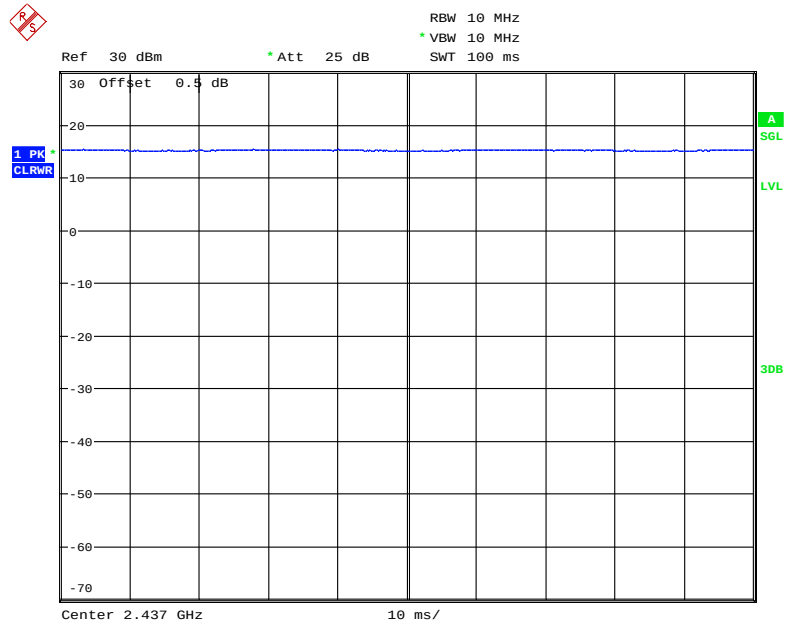
The software “artgui” was used for testing, which was provided by manufacturer. The maximum power was configured as below table, that provided by the manufacturer:

Mode	Channel	Frequency (MHz)	Data rate	Power level Setting
802.11 b	Low	2412	1Mbps	Default
	Middle	2437	1Mbps	Default
	High	2462	1Mbps	Default
802.11 g	Low	2412	6Mbps	Default
	Middle	2437	6Mbps	Default
	High	2462	6Mbps	Default
802.11n ht20	Low	2412	MCS8	Default
	Middle	2437	MCS8	Default
	High	2462	MCS8	Default
802.11n ht40	Low	2422	MCS8	Default
	Middle	2437	MCS8	Default
	High	2452	MCS8	Default

The maximum duty cycle as following table:

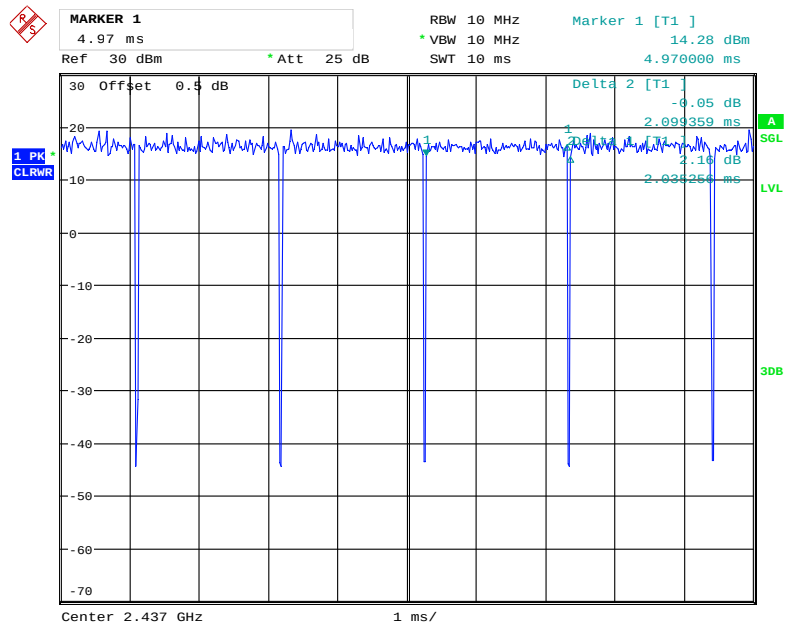
Test mode	T _{on} (ms)	T _{on+off} (ms)	Duty Cycle (%)
802.11b	100	100	100
802.11g	2.035	2.099	96.95
802.11n ht20	1.862	1.952	95.39
802.11n ht40	0.933	0.982	95.01

802.11b



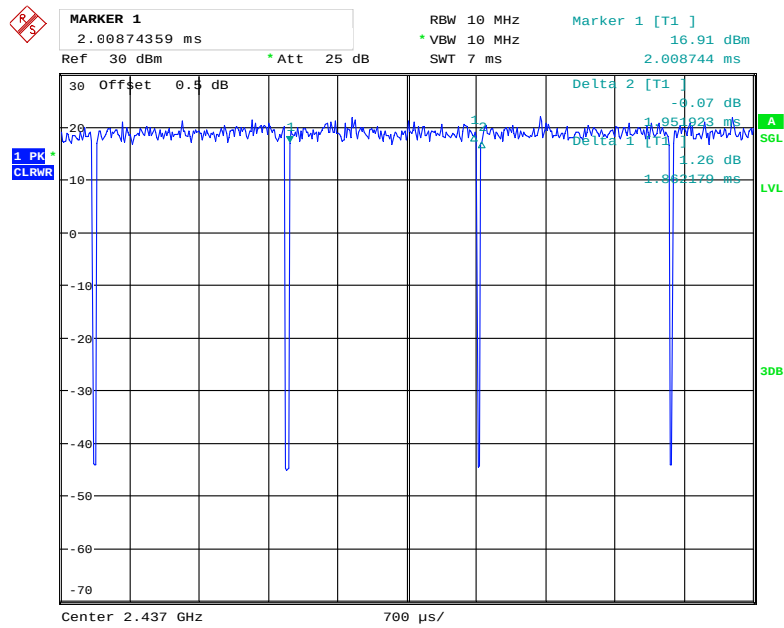
Date: 30.NOV.2019 00:34:09

802.11g



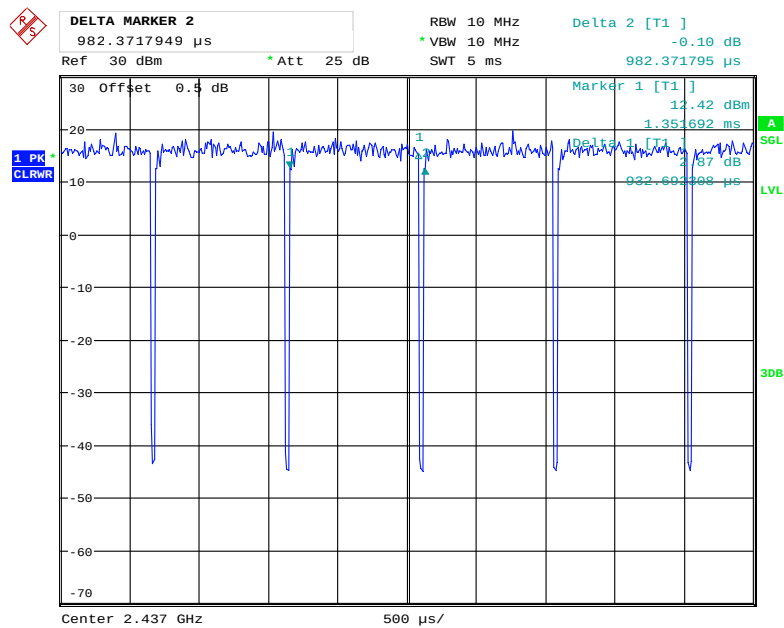
Date: 30.NOV.2019 00:35:28

802.11n ht20



Date: 30.NOV.2019 00:31:31

802.11n ht40



Date: 30.NOV.2019 00:32:33

Equipment Modifications

No modification was made to the EUT.

Local Support Equipment List and Details

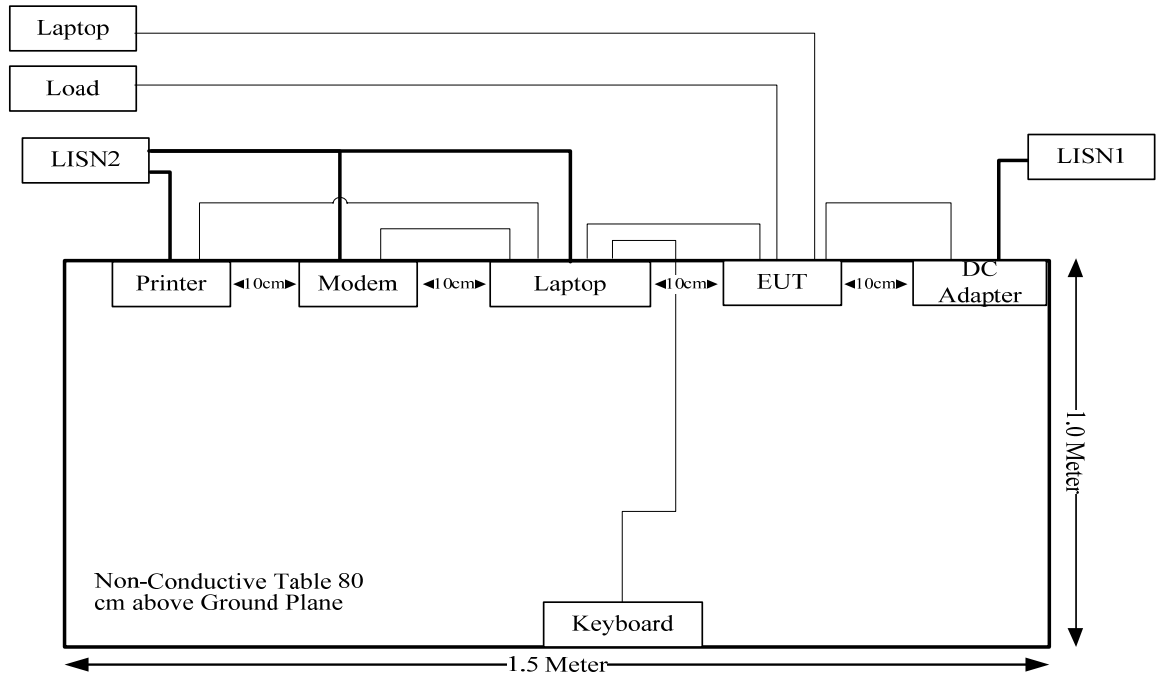
Manufacturer	Description	Model	Serial Number
DELL	Laptop	PP11L	QDS-BRCM1232
DELL	Laptop	PP11L	QDS-BRCM1017
HP	Printer	C3941A	JPTVOB2337
DELL	Keyboard	L100	CNORH656658907BL05DC
SAST	Modem	AEM-2100	293
Unknown	RJ45 Resistance Dummy Load	/	/
Huawei	POE Adapter	PoE35-54A	/
QUANTUM	AC/DC Adapter	GM85-480200-F	1312127102

Support Cable List and Details

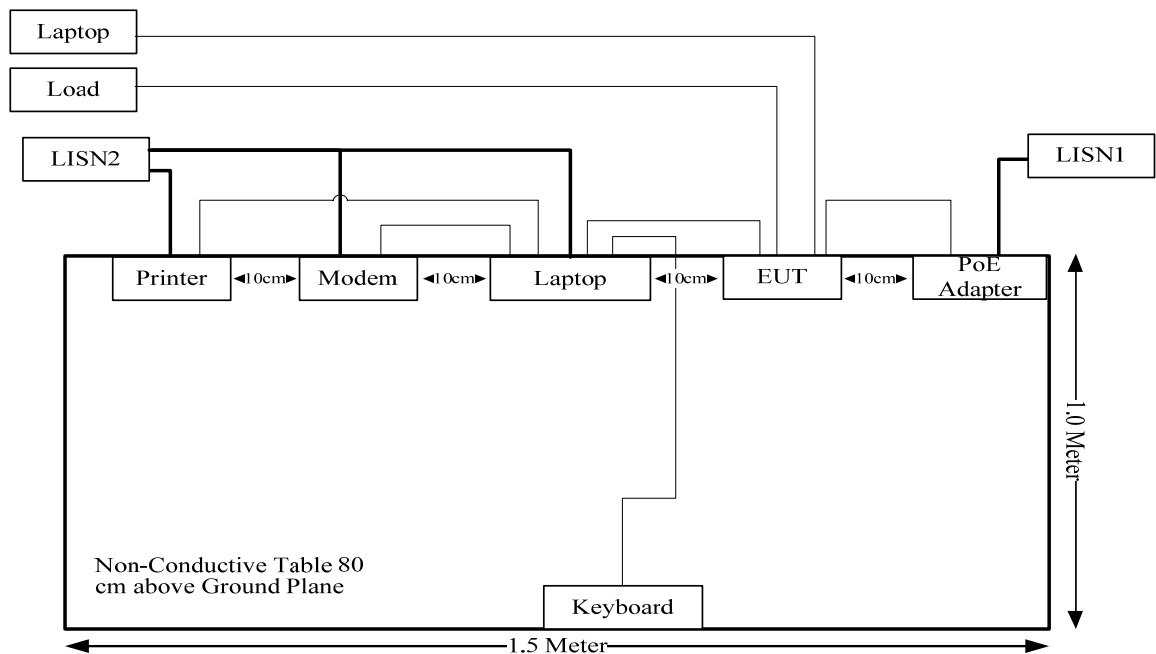
Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Adapter Cable	No	No	1.2	AC/DC Adapter	EUT
RJ45 Cable	Yes	No	1.0	EUT	Laptop
RJ45 Cable	Yes	No	10	EUT/PoE Adapter	Laptop
RJ45 Cable*4	No	No	10	EUT	Load
RJ45 Cable	Yes	No	1.0	PoE Adapter	EUT

Configuration of Test Setup

AC/DC Adapter Power mode:



PoE Power Mode:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §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 Bandwidth	Compliance
§15.247(b)(3)	Maximum Conducted Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

FCC §15.247 (i) & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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.

Calculation formula:

Prediction of power density at the distance of the applicable MPE limit

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm²);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

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

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

Calculated Data:

Mode	Frequency (MHz)	Antenna Gain		Conducted output power including Tune-up Tolerance		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
WLAN	2412-2462	3	2.00	25	316.23	20.00	0.13	1.0
WLAN	5150-5250	3	2.00	23	199.53	20.00	0.08	1.0
WLAN	5725-5850	3	2.00	22	158.49	20.00	0.06	1.0

The WLAN 2.4G and 5G can transmit simultaneously:

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

$$=S_{2.4}/S_{limit-2.4}+ S_5/S_{limit-5}$$

$$=0.13/1+0.08/1$$

$$=0.21$$

$$< 1.0$$

Result: The device meet FCC MPE at 20 cm distance

FCC §15.203 - ANTENNA REQUIREMENT

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. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.
- c. Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

Antenna Connector Construction

The EUT has 2 internal antenna for 2.4G WLAN and 2 internal antenna for 5G WLAN, fulfill the requirement of this section. Please refer to the EUT photos and below information:

Antenna	Antenna Type	input impedance (Ohm)	Antenna Gain /Frequency Range
2.4G Chain 0	FPC	50	3 dBi/2.4-2.5GHz
2.4G Chain 1	FPC	50	3 dBi/2.4-2.5GHz
5G Chain 0	FPC	50	3 dBi/5.15-5.85GHz
5G Chain 1	FPC	50	3 dBi/5.15-5.85GHz

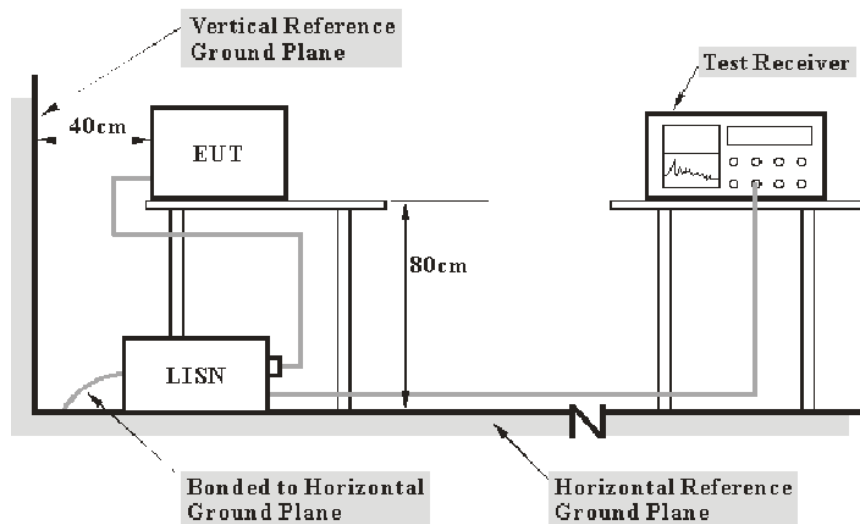
Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207(a)

EUT Setup



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.

The spacing between the peripherals was 10 cm.

The adapter was connected to the main lisn with a 120 V/60 Hz AC power source.

EMI Test Receiver Setup

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	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the first 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.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$V_C = V_R + A_C + VDF$$

$$C_f = A_C + VDF$$

Herein,

V_C (cord. Reading): corrected voltage amplitude

V_R : reading voltage amplitude

A_C : attenuation caused by cable loss

VDF: voltage division factor of AMN

C_f : Correction Factor

The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-01	2019-09-05	2020-09-05
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A
R&S	Two-line V-network	ENV 216	101614	2019-12-10	2020-12-10
R&S	EMI Test Receiver	ESPI	100120	2019-05-09	2020-05-09
R&S	L.I.S.N	ESH2-Z5	892107/021	2019-09-19	2020-09-19

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

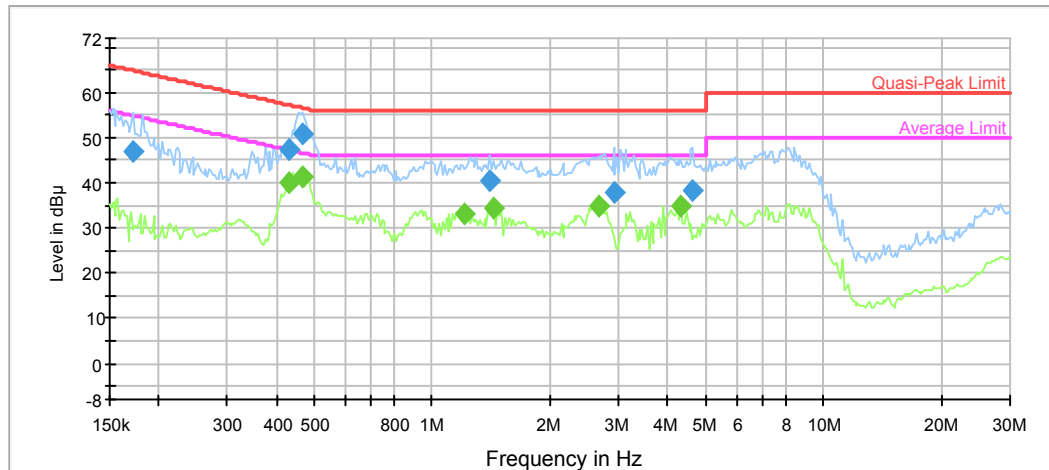
Environmental Conditions

Temperature:	23.9 °C
Relative Humidity:	42%
ATM Pressure:	100.9 kPa
Tester:	Sern Xiang
Test Date:	2019-12-02

Test Mode: Transmitting (Wi-Fi mode 802.11b middle channel was the worst)

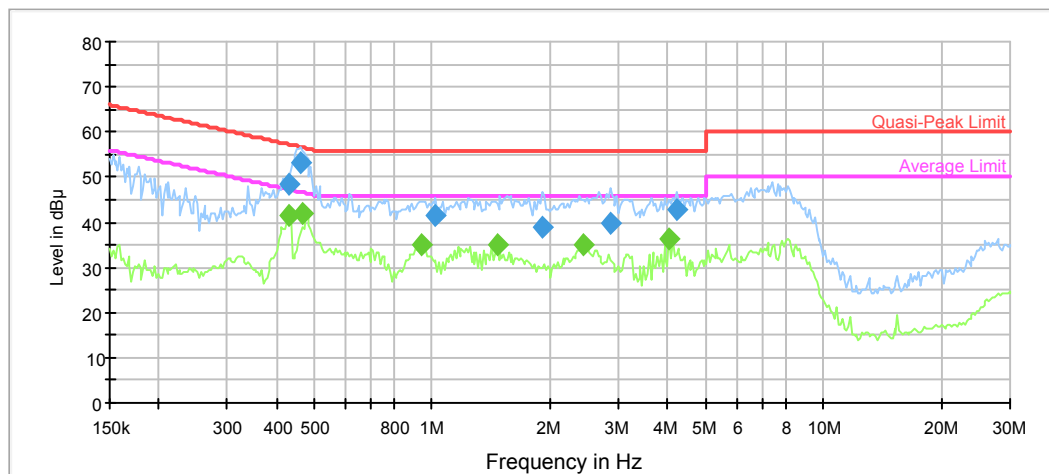
AC/DC Adapter Mode:

AC120 V, 60 Hz, Line:



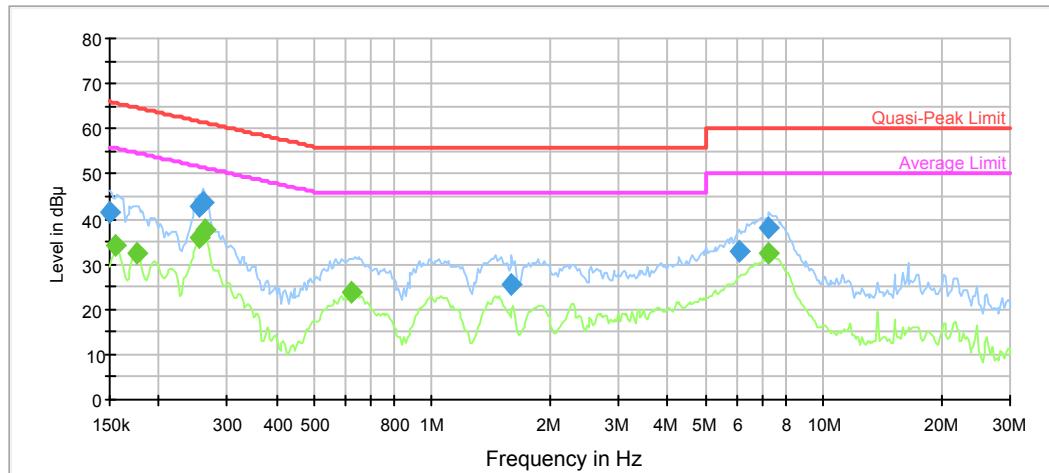
Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.172421	46.7	9.000	L1	10.9	18.1	64.8
0.430682	47.5	9.000	L1	9.9	9.7	57.2
0.466367	50.6	9.000	L1	9.9	6.0	56.6
1.407345	40.6	9.000	L1	9.8	15.4	56.0
2.909785	37.8	9.000	L1	9.8	18.2	56.0
4.644784	38.4	9.000	L1	9.8	17.6	56.0

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.430682	40.1	9.000	L1	9.9	7.1	47.2
0.466367	41.5	9.000	L1	9.9	5.1	46.6
1.212216	33.2	9.000	L1	9.8	12.8	46.0
1.435633	34.6	9.000	L1	9.8	11.4	46.0
2.660533	35.0	9.000	L1	9.8	11.0	46.0
4.332274	34.7	9.000	L1	9.8	11.3	46.0

AC120 V, 60 Hz, Neutral:

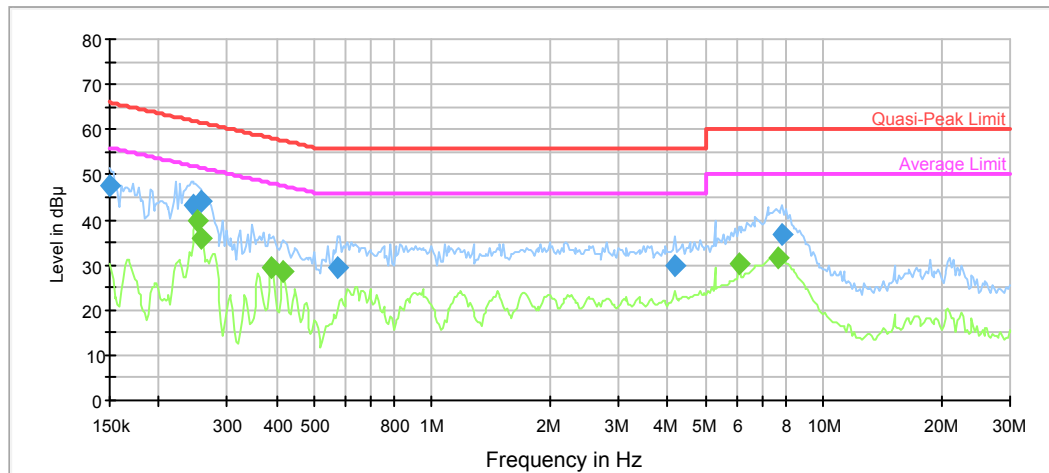
Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.430682	48.4	9.000	N	9.9	8.8	57.2
0.461750	53.1	9.000	N	9.9	3.6	56.7
1.023568	41.7	9.000	N	9.8	14.3	56.0
1.915858	39.1	9.000	N	9.8	16.9	56.0
2.852451	39.8	9.000	N	9.8	16.2	56.0
4.204862	42.7	9.000	N	9.8	13.3	56.0

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.430682	41.6	9.000	N	9.9	5.6	47.2
0.466367	42.0	9.000	N	9.9	4.6	46.6
0.935889	34.9	9.000	N	9.8	11.1	46.0
1.464489	34.9	9.000	N	9.8	11.1	46.0
2.432631	34.8	9.000	N	9.8	11.2	46.0
4.040790	36.4	9.000	N	9.8	9.6	46.0

PoE Adapter Mode:**AC120 V, 60 Hz, Line:**

Frequency (MHz)	QuasiPeak (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.150000	41.7	9.000	L1	11.2	24.3	66.0
0.254170	42.7	9.000	L1	10.3	18.9	61.6
0.259279	43.6	9.000	L1	10.3	17.9	61.5
1.601690	25.7	9.000	L1	9.7	30.3	56.0
6.076347	32.9	9.000	L1	9.8	27.1	60.0
7.268208	37.9	9.000	L1	9.8	22.1	60.0

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.156091	34.0	9.000	L1	11.1	21.7	55.7
0.175887	32.6	9.000	L1	10.8	22.1	54.7
0.254170	35.7	9.000	L1	10.3	15.9	51.6
0.261872	37.5	9.000	L1	10.3	13.9	51.4
0.622369	24.0	9.000	L1	9.8	22.0	46.0
7.268208	32.3	9.000	L1	9.8	17.7	50.0

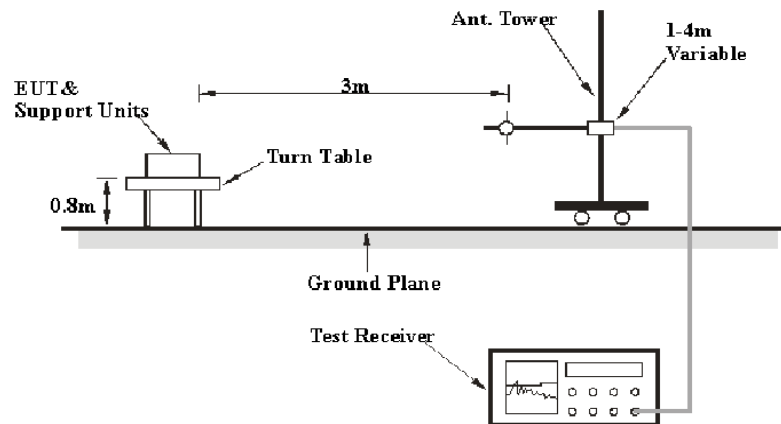
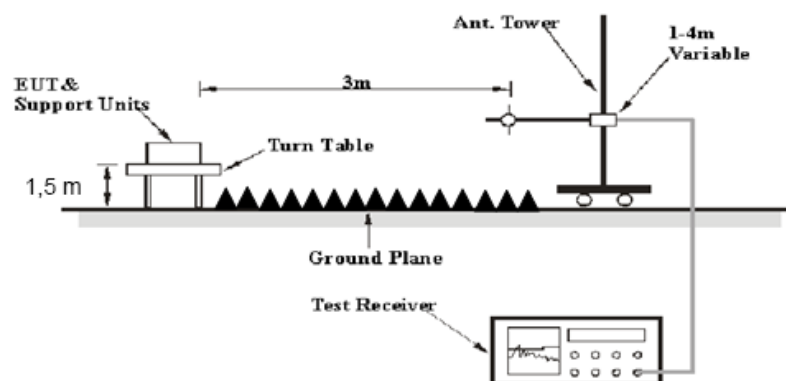
AC120 V, 60 Hz, Neutral:

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	47.5	9.000	N	11.2	18.5	66.0
0.244252	43.1	9.000	N	10.3	18.9	62.0
0.256712	44.2	9.000	N	10.3	17.3	61.5
0.574747	29.4	9.000	N	9.8	26.6	56.0
4.163230	29.9	9.000	N	9.8	26.1	56.0
7.870427	36.9	9.000	N	9.8	23.1	60.0

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.251654	39.7	9.000	N	10.3	12.0	51.7
0.256712	36.0	9.000	N	10.3	15.5	51.5
0.389891	29.6	9.000	N	10.0	18.5	48.1
0.418016	28.4	9.000	N	9.9	19.1	47.5
6.076347	30.1	9.000	N	9.8	19.9	50.0
7.638959	31.6	9.000	N	9.8	18.4	50.0

FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS**Applicable Standard**

FCC §15.247 (d); §15.209; §15.205;

EUT Setup**Below 1GHz:****Above 1GHz:**

The radiated emission Below 1GHz tests were performed in the 10 meters chamber test site, above 1GHz tests were performed in the 3 meters chamber test site A, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

The spacing between the peripherals was 10 cm.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

30MHz-1000MHz:

Measurement	RBW	Video B/W	IF B/W
QP	120 kHz	300 kHz	120kHz

1GHz- 25GHz:

Measurement	Duty cycle	RBW	Video B/W
PK	Any	1MHz	3 MHz
AV	>98%	1MHz	10 Hz
	<98%	1MHz	1/T

Note: T is minimum transmission duration

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiation Below 1GHz					
R&S	EMI Test Receiver	ESCI	100035	2019-08-03	2020-08-03
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Sunol Sciences	Antenna	JB3	A060611-2	2017-08-25	2020-08-25
Unknown	Coaxial Cable	C-NJNJ-50	C-1000-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-02	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0530-01	2019-09-24	2020-09-24
Sonoma	Amplifier	310N	185914	2019-10-13	2020-10-13
Radiation Above 1GHz					
R&S	Spectrum Analyzer	FSP 38	100478	2018-12-10	2019-12-10
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
TDK RF	Horn Antenna	HRN-0118	130 084	2018-10-12	2021-10-12
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2019-09-05	2020-09-05
MICRO-COAX	Coaxial Cable	UFA147-1-2362-100100	64639 231029-001	2019-02-24	2020-02-24
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-01 1304	2017-12-06	2020-12-05
Unknown	Coaxial Cable	C-2.4J2.4J-50	C-0700-02	2019-06-27	2020-06-27
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2019-06-27	2020-06-27
E-Microwave	Band-stop Filters	OBSF-2400-2483.5-S	OE01601525	2019-06-16	2020-06-16
Micro-tronics	High Pass Filter	HPM50111	S/N-G217	2019-06-16	2020-06-16

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

Test Items	Radiation Below 1GHz	Radiation Above 1GHz
Temperature:	22.9 °C	22.9 °C
Relative Humidity:	46%	46%
ATM Pressure:	100.9 kPa	100.9 kPa
Tester:	Ade Xiao	Ade Xiao
Test Date:	2019-12-02	2019-12-02

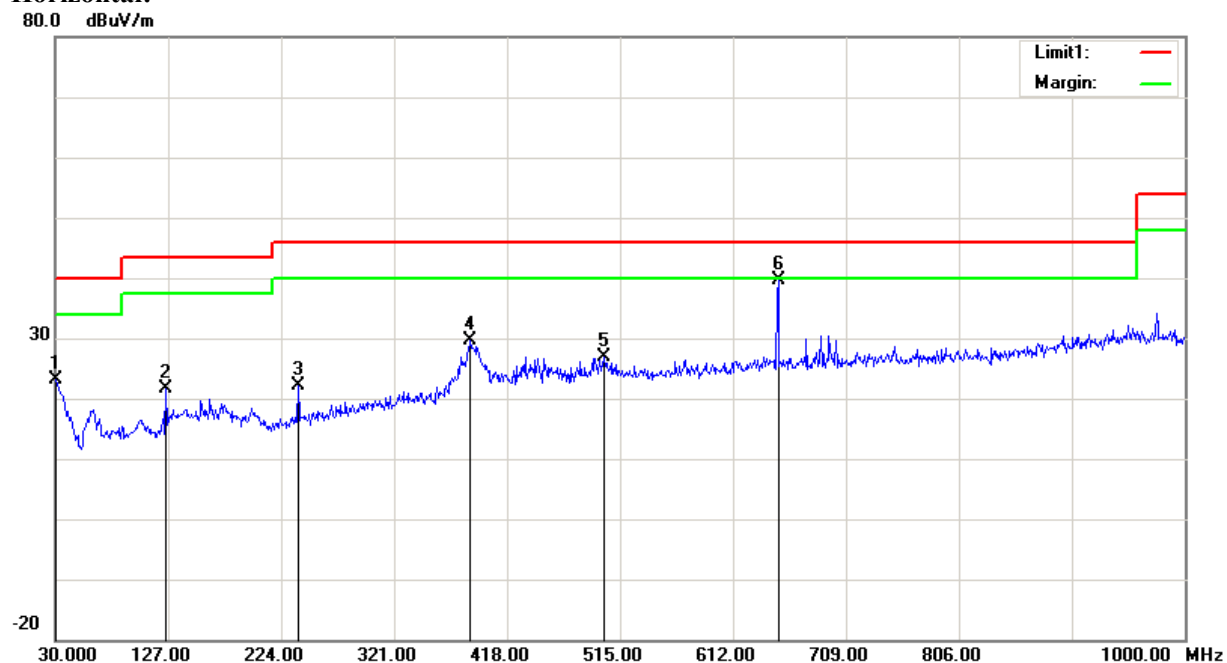
Test Result: Compliance, please Refer to the following data

Test Mode: Transmitting

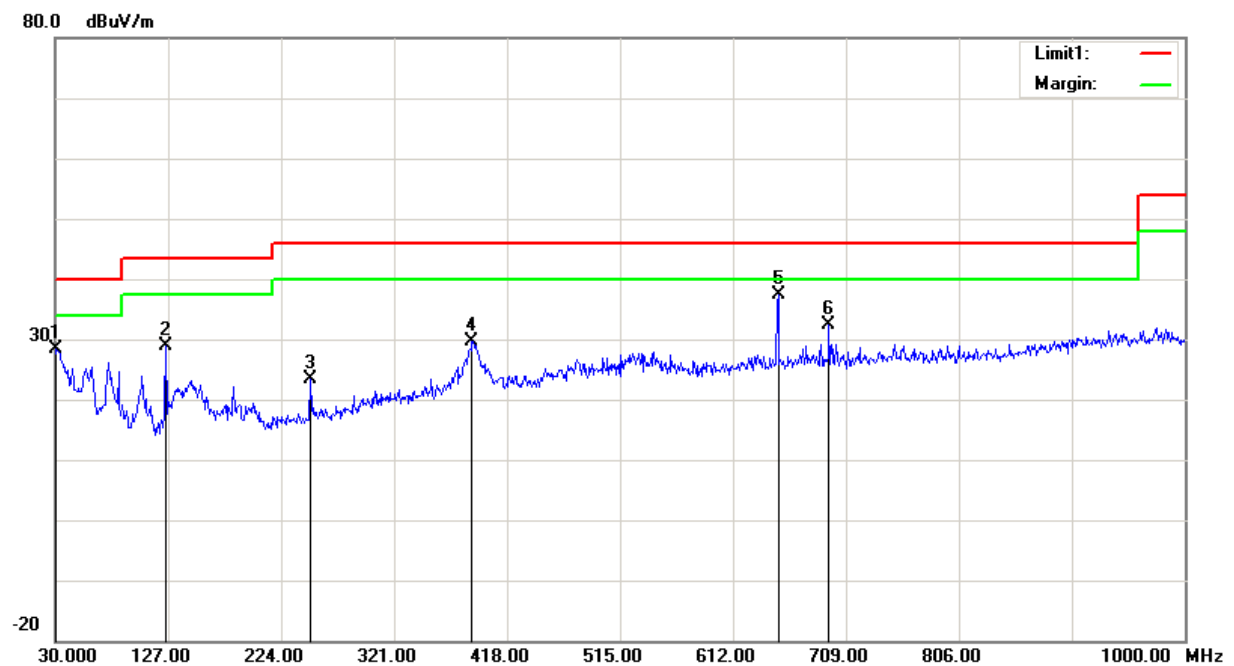
1) 30MHz-1GHz(802.11b,Chain 0 Low channel was the worst)

AC/DC adapter mode:

Horizontal:



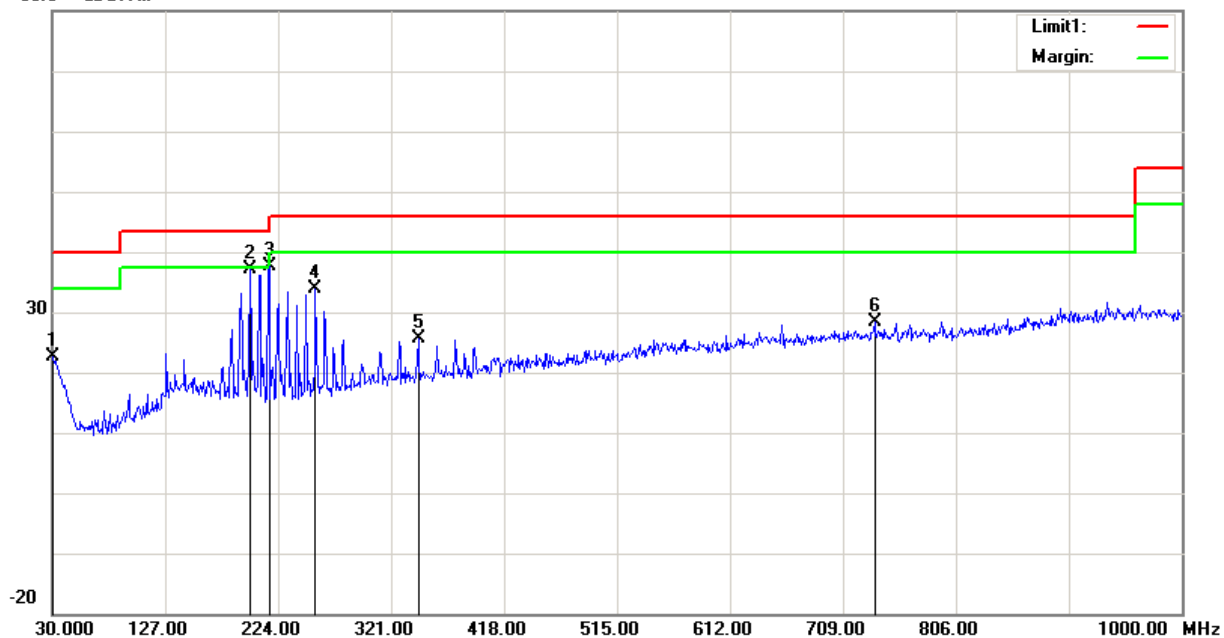
Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.9700	28.07	peak	-4.88	23.19	40.00	16.81
125.0600	32.92	peak	-11.41	21.51	43.50	21.99
238.5500	32.27	peak	-10.15	22.12	46.00	23.88
385.9900	35.30	peak	-5.71	29.59	46.00	16.41
501.4200	30.30	peak	-3.38	26.92	46.00	19.08
650.8000	39.94	peak	-0.42	39.52	46.00	6.48

Vertical:

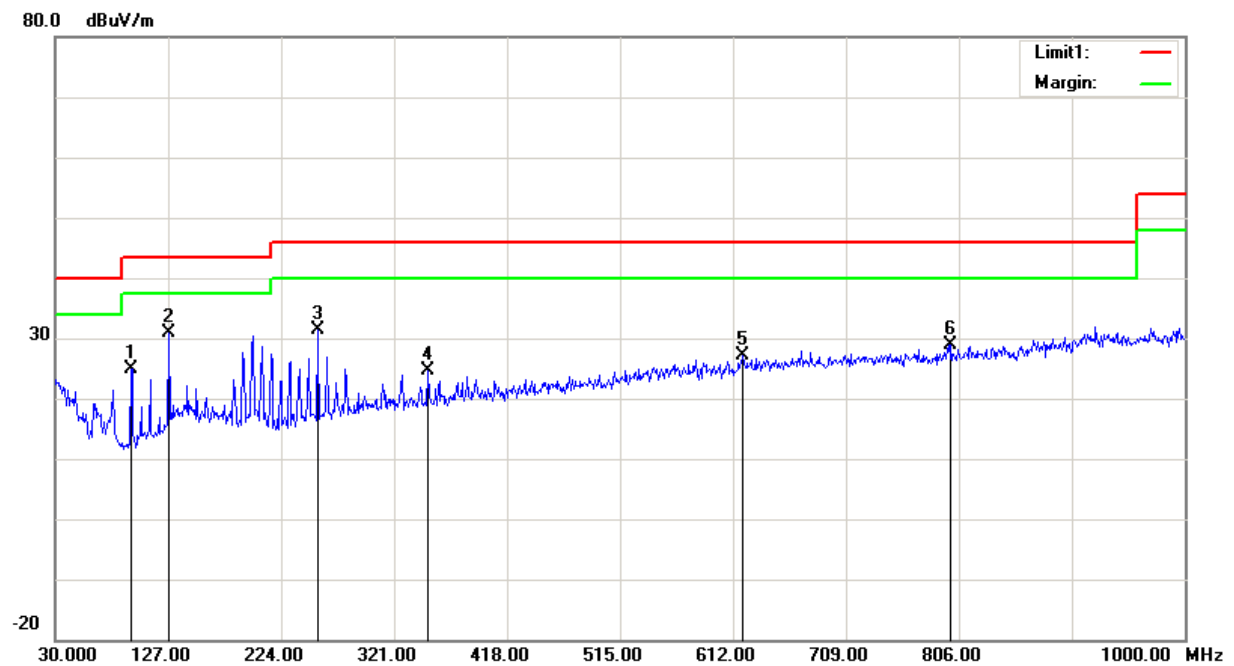
Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.9700	33.24	peak	-4.88	28.36	40.00	11.64
125.0600	40.34	peak	-11.41	28.93	43.50	14.57
249.2200	33.35	peak	-9.90	23.45	46.00	22.55
387.9300	35.39	peak	-5.65	29.74	46.00	16.26
650.8000	37.89	peak	-0.42	37.47	46.00	8.53
694.4500	32.17	peak	0.23	32.40	46.00	13.60

PoE adapter mode:**Horizontal:**

80.0 dBuV/m



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.9700	27.52	peak	-4.88	22.64	40.00	17.36
199.7500	46.51	peak	-9.39	37.12	43.50	6.38
216.2400	48.95	peak	-11.24	37.71	46.00	8.29
256.0100	43.54	peak	-9.63	33.91	46.00	12.09
344.2800	32.31	peak	-6.65	25.66	46.00	20.34
736.1600	27.53	peak	0.78	28.31	46.00	17.69

Vertical:

Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
94.9900	39.72	peak	-14.75	24.97	43.50	18.53
127.9700	41.34	peak	-10.52	30.82	43.50	12.68
255.0400	41.08	peak	-9.60	31.48	46.00	14.52
350.1000	31.20	peak	-6.45	24.75	46.00	21.25
620.7300	27.77	peak	-0.53	27.24	46.00	18.76
799.2100	27.90	peak	1.09	28.99	46.00	17.01

2) 1-25GHz(PoE adapter mode was the worst):
802.11b Mode, Chain 0

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2412 MHz									
2412.00	78.10	PK	H	24.84	3.35	0.00	106.29	N/A	N/A
2412.00	73.60	AV	H	24.84	3.35	0.00	101.79	N/A	N/A
2412.00	71.60	PK	V	24.84	3.35	0.00	99.79	N/A	N/A
2412.00	66.81	AV	V	24.84	3.35	0.00	95.00	N/A	N/A
2390.00	36.21	PK	H	24.80	3.33	0.00	64.34	74.00	9.66
2390.00	22.28	AV	H	24.80	3.33	0.00	50.41	54.00	3.59
4824.00	45.85	PK	H	29.75	4.58	27.41	52.77	74.00	21.23
4824.00	42.03	AV	H	29.75	4.58	27.41	48.95	54.00	5.05
7236.00	41.02	PK	H	33.98	5.62	27.22	53.40	74.00	20.60
7236.00	38.13	AV	H	33.98	5.62	27.22	50.51	54.00	3.49
Middle Channel: 2437 MHz									
2437.00	78.21	PK	H	24.89	3.36	0.00	106.46	N/A	N/A
2437.00	74.79	AV	H	24.89	3.36	0.00	103.04	N/A	N/A
2437.00	71.75	PK	V	24.89	3.36	0.00	100.00	N/A	N/A
2437.00	67.37	AV	V	24.89	3.36	0.00	95.62	N/A	N/A
4874.00	48.76	PK	H	29.85	4.57	27.54	55.64	74.00	18.36
4874.00	41.97	AV	H	29.85	4.57	27.54	48.85	54.00	5.15
7311.00	41.25	PK	H	34.10	5.68	27.28	53.75	74.00	20.25
7311.00	26.05	AV	H	34.10	5.68	27.28	38.55	54.00	15.45
High Channel: 2462 MHz									
2462.00	77.26	PK	H	24.93	3.37	0.00	105.56	N/A	N/A
2462.00	73.60	AV	H	24.93	3.37	0.00	101.90	N/A	N/A
2462.00	72.57	PK	V	24.93	3.37	0.00	100.87	N/A	N/A
2462.00	68.38	AV	V	24.93	3.37	0.00	96.68	N/A	N/A
2483.50	35.15	PK	H	24.97	3.38	0.00	63.50	74.00	10.50
2483.50	21.73	AV	H	24.97	3.38	0.00	50.08	54.00	3.92
4924.00	49.54	PK	H	29.95	4.57	27.51	56.55	74.00	17.45
4924.00	43.27	AV	H	29.95	4.57	27.51	50.28	54.00	3.72
7386.00	37.19	PK	H	34.22	5.74	27.18	49.97	74.00	24.03
7386.00	23.75	AV	H	34.22	5.74	27.18	36.53	54.00	17.47

802.11b Mode, Chain 1:

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2412 MHz									
2412.00	81.54	PK	H	24.84	3.35	0.00	109.73	N/A	N/A
2412.00	76.95	AV	H	24.84	3.35	0.00	105.14	N/A	N/A
2412.00	72.29	PK	V	24.84	3.35	0.00	100.48	N/A	N/A
2412.00	67.90	AV	V	24.84	3.35	0.00	96.09	N/A	N/A
2390.00	39.68	PK	H	24.80	3.33	0.00	67.81	74.00	6.19
2390.00	22.13	AV	H	24.80	3.33	0.00	50.26	54.00	3.74
4824.00	42.26	PK	H	29.75	4.58	27.41	49.18	74.00	24.82
4824.00	32.16	AV	H	29.75	4.58	27.41	39.08	54.00	14.92
7236.00	47.86	PK	H	33.98	5.62	27.22	60.24	74.00	13.76
7236.00	36.94	AV	H	33.98	5.62	27.22	49.32	54.00	4.68
Middle Channel: 2437 MHz									
2437.00	79.36	PK	H	24.89	3.36	0.00	107.61	N/A	N/A
2437.00	75.18	AV	H	24.89	3.36	0.00	103.43	N/A	N/A
2437.00	70.36	PK	V	24.89	3.36	0.00	98.61	N/A	N/A
2437.00	65.82	AV	V	24.89	3.36	0.00	94.07	N/A	N/A
4848.00	43.51	PK	H	29.80	4.57	27.47	50.41	74.00	23.59
4848.00	21.75	AV	H	29.80	4.57	27.47	28.65	54.00	25.35
7311.00	46.76	PK	H	34.10	5.68	27.28	59.26	74.00	14.74
7311.00	37.33	AV	H	34.10	5.68	27.28	49.83	54.00	4.17
High Channel: 2462 MHz									
2462.00	78.78	PK	H	24.93	3.37	0.00	107.08	N/A	N/A
2462.00	74.82	AV	H	24.93	3.37	0.00	103.12	N/A	N/A
2462.00	69.32	PK	V	24.93	3.37	0.00	97.62	N/A	N/A
2462.00	65.35	AV	V	24.93	3.37	0.00	93.65	N/A	N/A
2483.50	34.14	PK	H	24.97	3.38	0.00	62.49	74.00	11.51
2483.50	21.98	AV	H	24.97	3.38	0.00	50.33	54.00	3.67
4924.00	46.68	PK	H	29.95	4.57	27.51	53.69	74.00	20.31
4924.00	43.02	AV	H	29.95	4.57	27.51	50.03	54.00	3.97
7386.00	42.26	PK	H	34.22	5.74	27.18	55.04	74.00	18.96
7386.00	32.00	AV	H	34.22	5.74	27.18	44.78	54.00	9.22

802.11g Mode, Chain 0:

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2412 MHz									
2412.00	79.84	PK	H	24.84	3.35	0.00	108.03	N/A	N/A
2412.00	69.72	AV	H	24.84	3.35	0.00	97.91	N/A	N/A
2412.00	69.56	PK	V	24.84	3.35	0.00	97.75	N/A	N/A
2412.00	64.10	AV	V	24.84	3.35	0.00	92.29	N/A	N/A
2390.00	42.11	PK	H	24.80	3.33	0.00	70.24	74.00	3.76
2390.00	23.78	AV	H	24.80	3.33	0.00	51.91	54.00	2.09
4824.00	46.72	PK	H	29.75	4.58	27.41	53.64	74.00	20.36
4824.00	32.39	AV	H	29.75	4.58	27.41	39.31	54.00	14.69
7236.00	41.82	PK	H	33.98	5.62	27.22	54.20	74.00	19.80
7236.00	28.93	AV	H	33.98	5.62	27.22	41.31	54.00	12.69
Middle Channel: 2437 MHz									
2437.00	79.58	PK	H	24.89	3.36	0.00	107.83	N/A	N/A
2437.00	69.51	AV	H	24.89	3.36	0.00	97.76	N/A	N/A
2437.00	73.59	PK	V	24.89	3.36	0.00	101.84	N/A	N/A
2437.00	63.05	AV	V	24.89	3.36	0.00	91.30	N/A	N/A
4874.00	48.75	PK	H	29.85	4.57	27.54	55.63	74.00	18.37
4874.00	34.62	AV	H	29.85	4.57	27.54	41.50	54.00	12.50
7311.00	39.29	PK	H	34.10	5.68	27.28	51.79	74.00	22.21
7311.00	26.20	AV	H	34.10	5.68	27.28	38.70	54.00	15.30
High Channel: 2462 MHz									
2462.00	79.37	PK	H	24.93	3.37	0.00	107.67	N/A	N/A
2462.00	68.64	AV	H	24.93	3.37	0.00	96.94	N/A	N/A
2462.00	73.20	PK	V	24.93	3.37	0.00	101.50	N/A	N/A
2462.00	62.95	AV	V	24.93	3.37	0.00	91.25	N/A	N/A
2483.50	41.82	PK	H	24.97	3.38	0.00	70.17	74.00	3.83
2483.50	23.10	AV	H	24.97	3.38	0.00	51.45	54.00	2.55
4924.00	49.21	PK	H	29.95	4.57	27.51	56.22	74.00	17.78
4924.00	35.25	AV	H	29.95	4.57	27.51	42.26	54.00	11.74
7386.00	37.85	PK	H	34.22	5.74	27.18	50.63	74.00	23.37
7386.00	24.22	AV	H	34.22	5.74	27.18	37.00	54.00	17.00

802.11g Mode, Chain 1

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2412 MHz									
2412.00	83.25	PK	H	24.84	3.35	0.00	111.44	N/A	N/A
2412.00	72.82	AV	H	24.84	3.35	0.00	101.01	N/A	N/A
2412.00	74.03	PK	V	24.84	3.35	0.00	102.22	N/A	N/A
2412.00	63.24	AV	V	24.84	3.35	0.00	91.43	N/A	N/A
2390.00	34.64	PK	H	24.80	3.33	0.00	62.77	74.00	11.23
2390.00	22.89	AV	H	24.80	3.33	0.00	51.02	54.00	2.98
4824.00	39.75	PK	H	29.75	4.58	27.41	46.67	74.00	27.33
4824.00	25.53	AV	H	29.75	4.58	27.41	32.45	54.00	21.55
7236.00	41.89	PK	H	33.98	5.62	27.22	54.27	74.00	19.73
7236.00	36.78	AV	H	33.98	5.62	27.22	49.16	54.00	4.84
Middle Channel: 2437 MHz									
2437.00	78.22	PK	H	24.89	3.36	0.00	106.47	N/A	N/A
2437.00	67.65	AV	H	24.89	3.36	0.00	95.90	N/A	N/A
2437.00	72.72	PK	V	24.89	3.36	0.00	100.97	N/A	N/A
2437.00	61.20	AV	V	24.89	3.36	0.00	89.45	N/A	N/A
4874.00	39.88	PK	H	29.85	4.57	27.54	46.76	74.00	27.24
4874.00	25.60	AV	H	29.85	4.57	27.54	32.48	54.00	21.52
7311.00	53.27	PK	H	34.10	5.68	27.28	65.77	74.00	8.23
7311.00	33.47	AV	H	34.10	5.68	27.28	45.97	54.00	8.03
High Channel: 2462 MHz									
2462.00	80.56	PK	H	24.93	3.37	0.00	108.86	N/A	N/A
2462.00	70.67	AV	H	24.93	3.37	0.00	98.97	N/A	N/A
2462.00	72.93	PK	V	24.93	3.37	0.00	101.23	N/A	N/A
2462.00	62.47	AV	V	24.93	3.37	0.00	90.77	N/A	N/A
2483.50	41.65	PK	H	24.97	3.38	0.00	70.00	74.00	4.00
2483.50	21.94	AV	H	24.97	3.38	0.00	50.29	54.00	3.71
4924.00	42.25	PK	V	29.95	4.57	27.51	49.26	74.00	24.74
4924.00	27.81	AV	H	29.95	4.57	27.51	34.82	54.00	19.18
7386.00	54.47	PK	H	34.22	5.74	27.18	67.25	74.00	6.75
7386.00	33.83	AV	H	34.22	5.74	27.18	46.61	54.00	7.39

802.11n ht20 Mode(MIMO was the worst):

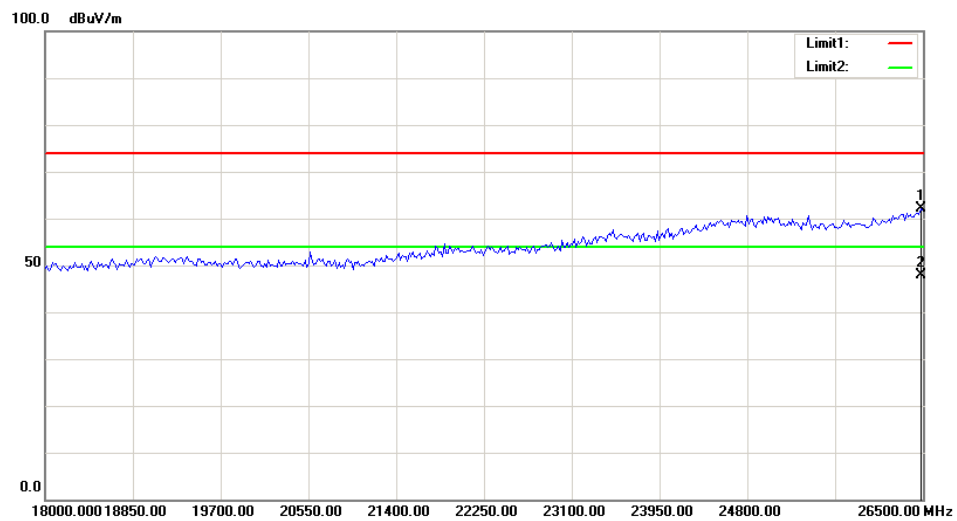
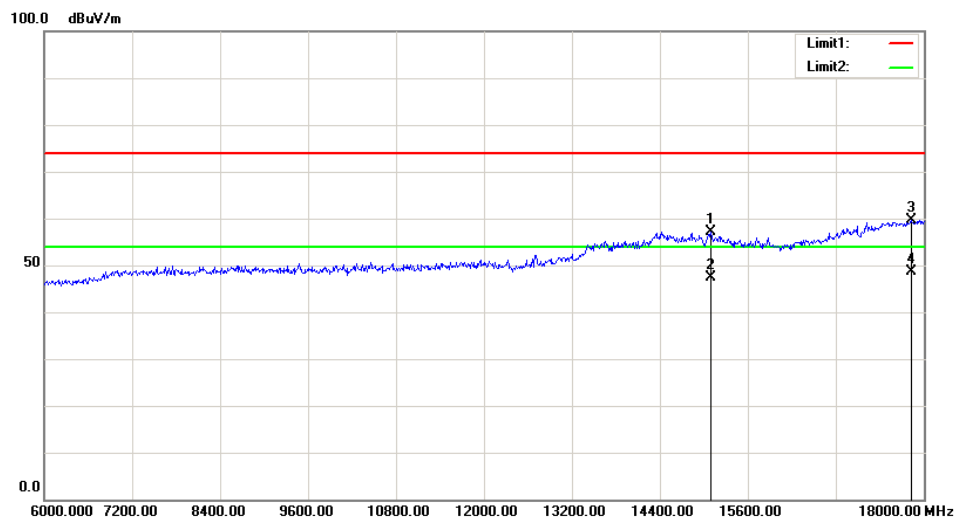
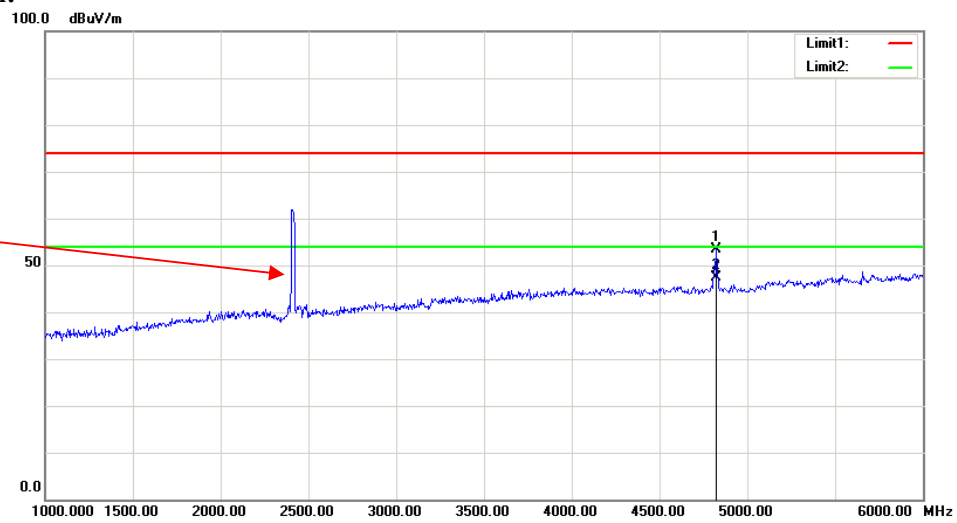
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2412 MHz									
2412.00	78.23	PK	H	24.84	3.35	0.00	106.42	N/A	N/A
2412.00	67.75	AV	H	24.84	3.35	0.00	95.94	N/A	N/A
2412.00	72.08	PK	V	24.84	3.35	0.00	100.27	N/A	N/A
2412.00	52.10	AV	V	24.84	3.35	0.00	80.29	N/A	N/A
2390.00	34.72	PK	H	24.80	3.33	0.00	62.85	74.00	11.15
2390.00	21.03	AV	H	24.80	3.33	0.00	49.16	54.00	4.84
4824.00	55.33	PK	H	29.75	4.58	27.41	62.25	74.00	11.75
4824.00	40.70	AV	H	29.75	4.58	27.41	47.62	54.00	6.38
7236.00	46.67	PK	H	33.98	5.62	27.22	59.05	74.00	14.95
7236.00	28.45	AV	H	33.98	5.62	27.22	40.83	54.00	13.17
Middle Channel: 2437 MHz									
2437.00	81.53	PK	H	24.89	3.36	0.00	109.78	N/A	N/A
2437.00	71.91	AV	H	24.89	3.36	0.00	100.16	N/A	N/A
2437.00	75.73	PK	V	24.89	3.36	0.00	103.98	N/A	N/A
2437.00	66.10	AV	V	24.89	3.36	0.00	94.35	N/A	N/A
4864.00	50.29	PK	H	29.83	4.57	27.51	57.18	74.00	16.82
4864.00	40.08	AV	H	29.83	4.57	27.51	46.97	54.00	7.03
7314.00	57.27	PK	H	34.10	5.68	27.27	69.78	74.00	4.22
7314.00	37.17	AV	H	34.10	5.68	27.27	49.68	54.00	4.32
High Channel: 2462 MHz									
2462.00	79.82	PK	H	24.93	3.37	0.00	108.12	N/A	N/A
2462.00	69.56	AV	H	24.93	3.37	0.00	97.86	N/A	N/A
2462.00	74.36	PK	V	24.93	3.37	0.00	102.66	N/A	N/A
2462.00	64.22	AV	V	24.93	3.37	0.00	92.52	N/A	N/A
2483.50	41.88	PK	H	24.97	3.38	0.00	70.23	74.00	3.77
2483.50	23.96	AV	H	24.97	3.38	0.00	52.31	54.00	1.69
4924.00	52.42	PK	H	29.95	4.57	27.51	59.43	74.00	14.57
4924.00	36.36	AV	H	29.95	4.57	27.51	43.37	54.00	10.63
7386.00	56.62	PK	H	34.22	5.74	27.18	69.40	74.00	4.60
7386.00	36.75	AV	H	34.22	5.74	27.18	49.53	54.00	4.47

802.11n ht40 Mode(MIMO was the worst):

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2422 MHz									
2422.00	76.71	PK	H	24.86	3.35	0.00	104.92	N/A	N/A
2422.00	67.00	AV	H	24.86	3.35	0.00	95.21	N/A	N/A
2422.00	69.70	PK	V	24.86	3.35	0.00	97.91	N/A	N/A
2422.00	59.63	AV	V	24.86	3.35	0.00	87.84	N/A	N/A
2390.00	37.69	PK	H	24.80	3.33	0.00	65.82	74.00	8.18
2390.00	23.05	AV	H	24.80	3.33	0.00	51.18	54.00	2.82
4844.00	52.89	PK	H	29.79	4.57	27.46	59.79	74.00	14.21
4844.00	37.95	AV	H	29.79	4.57	27.46	44.85	54.00	9.15
7266.00	52.91	PK	H	34.03	5.64	27.25	65.33	74.00	8.67
7266.00	37.20	AV	H	34.03	5.64	27.25	49.62	54.00	4.38
Middle Channel: 2437 MHz									
2437.00	76.71	PK	H	24.89	3.36	0.00	104.96	N/A	N/A
2437.00	67.00	AV	H	24.89	3.36	0.00	95.25	N/A	N/A
2437.00	69.70	PK	V	24.89	3.36	0.00	97.95	N/A	N/A
2437.00	59.63	AV	V	24.89	3.36	0.00	87.88	N/A	N/A
4874.00	50.28	PK	H	29.85	4.57	27.54	57.16	74.00	16.84
4874.00	34.05	AV	H	29.85	4.57	27.54	40.93	54.00	13.07
7311.00	51.62	PK	H	34.10	5.68	27.28	64.12	74.00	9.88
7311.00	35.53	AV	H	34.10	5.68	27.28	48.03	54.00	5.97
High Channel: 2452 MHz									
2452.00	78.71	PK	H	24.91	3.37	0.00	106.99	N/A	N/A
2452.00	69.00	AV	H	24.91	3.37	0.00	97.28	N/A	N/A
2452.00	71.70	PK	V	24.91	3.37	0.00	99.98	N/A	N/A
2452.00	61.63	AV	V	24.91	3.37	0.00	89.91	N/A	N/A
2483.50	38.87	PK	H	24.97	3.38	0.00	67.22	74.00	6.78
2483.50	23.10	AV	H	24.97	3.38	0.00	51.45	54.00	2.55
4904.00	45.37	PK	H	29.91	4.56	27.58	52.26	74.00	21.74
4904.00	32.59	AV	H	29.91	4.56	27.58	39.48	54.00	14.52
7356.00	48.45	PK	H	34.17	5.72	27.22	61.12	74.00	12.88
7356.00	35.63	AV	H	34.17	5.72	27.22	48.30	54.00	5.70

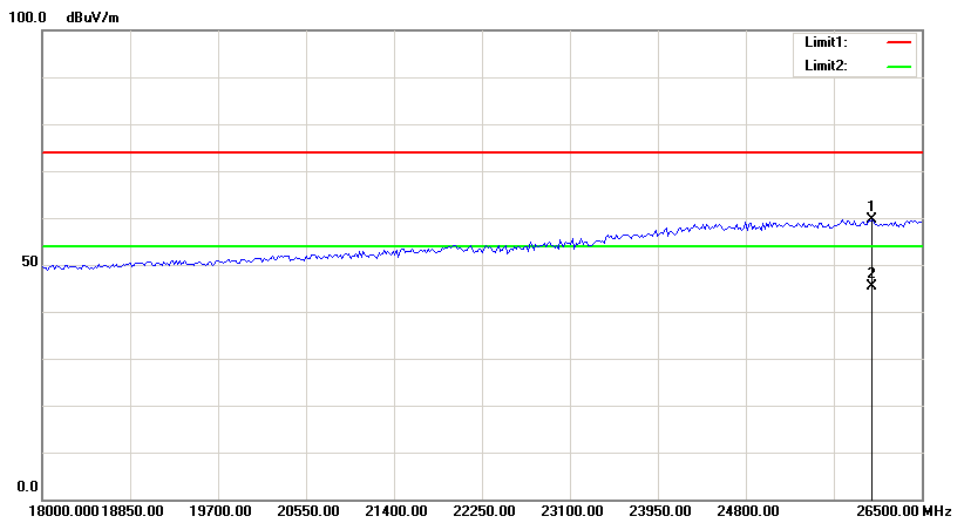
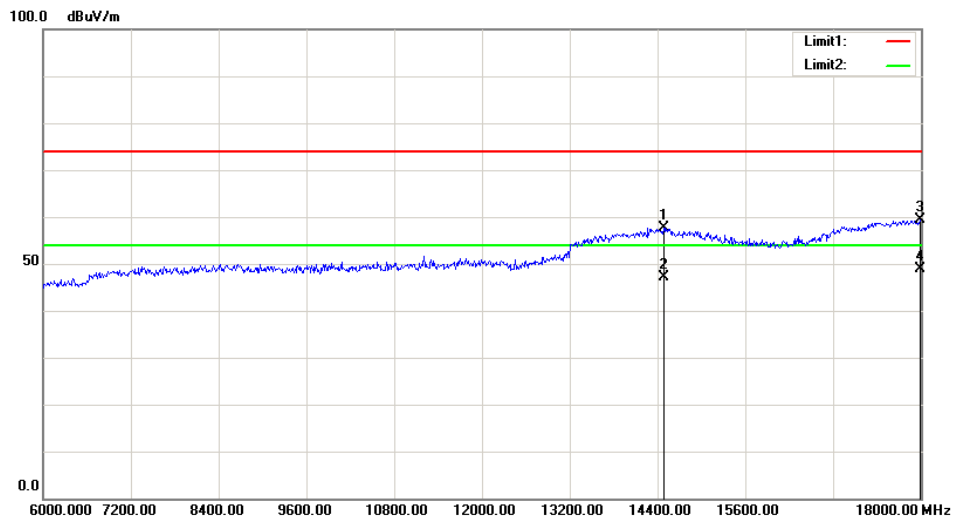
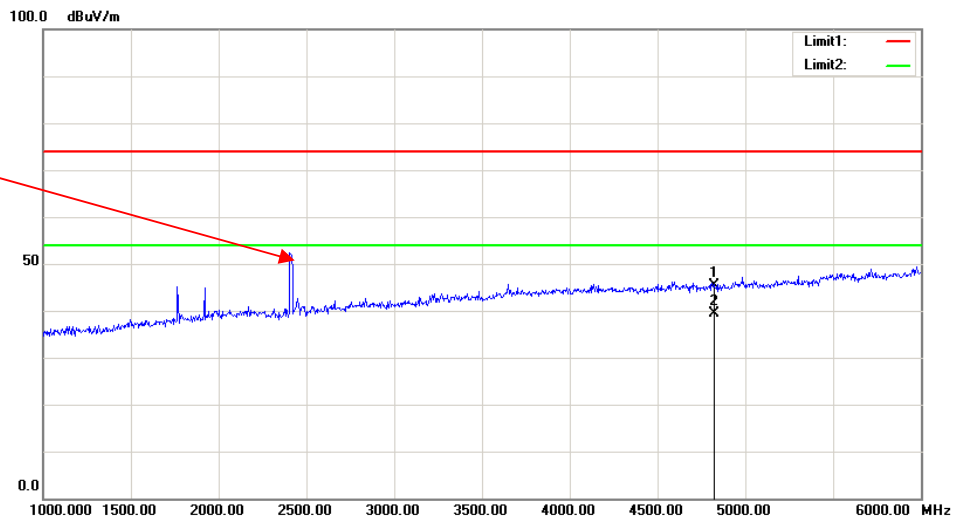
Test plots(Chain 0, 802.11b mode Low channel was the worst)
Horizontal:

Fundamental
Test with Band
Rejection Filter



Vertical:

Fundamental
Test with Band
Rejection Filter



FCC §15.247(a) (2)–6 dB EMISSION BANDWIDTH

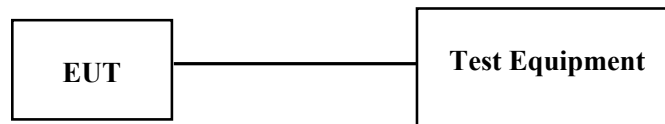
Applicable Standard

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.

Test Procedure

- Set RBW = 100 kHz.
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- 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.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU 26	200256	2019-05-09	2020-05-09
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41010012	Each time	/

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

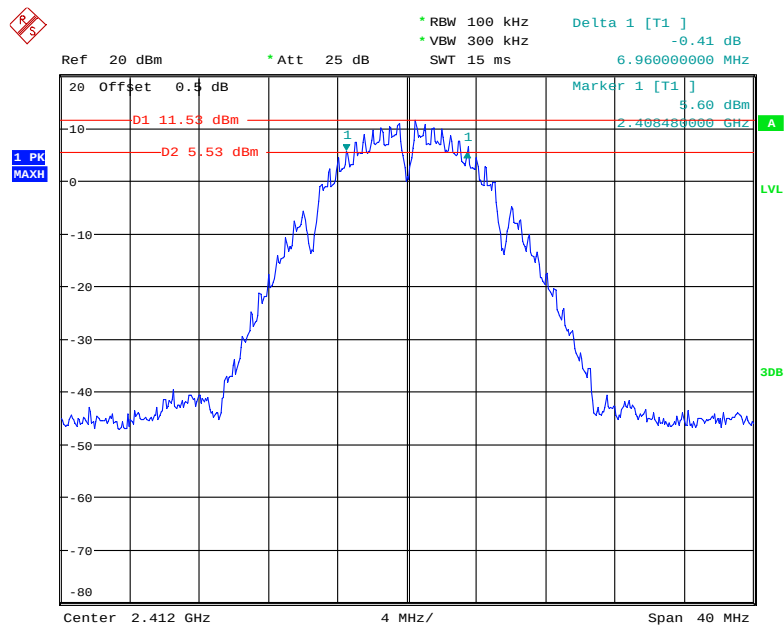
Temperature:	24.5°C
Relative Humidity:	42%
ATM Pressure:	102.5kPa
Test by:	Severn Zhu
Test Date:	2019-11-29

Test Mode: Transmitting

Test Result: Compliant. Test only performed at chain 0, please refer to the following table and plots.

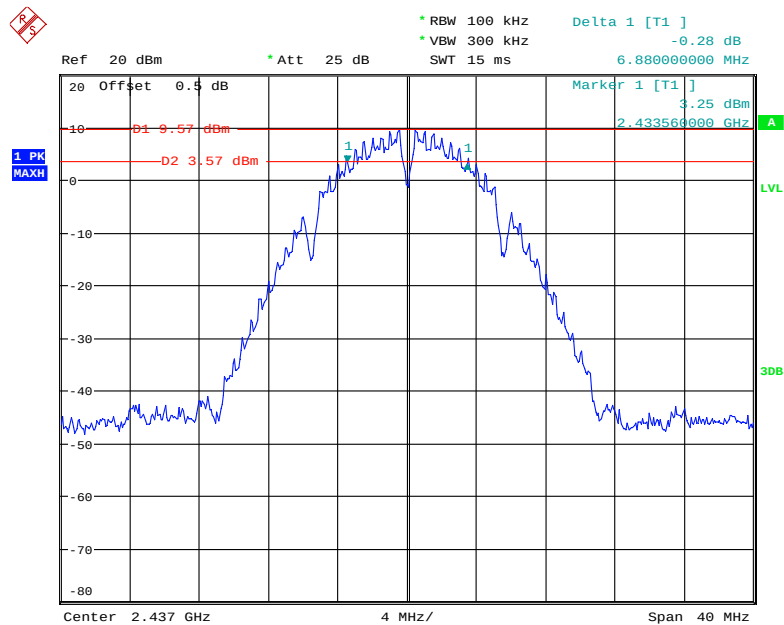
Test mode	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)
802.11b	Low	2412	6.960	≥ 0.5
	Middle	2437	6.880	≥ 0.5
	High	2462	6.560	≥ 0.5
802.11g	Low	2412	15.040	≥ 0.5
	Middle	2437	15.040	≥ 0.5
	High	2462	15.040	≥ 0.5
802.11n ht20	Low	2412	15.040	≥ 0.5
	Middle	2437	14.080	≥ 0.5
	High	2462	14.880	≥ 0.5
802.11n ht40	Low	2422	32.640	≥ 0.5
	Middle	2437	33.920	≥ 0.5
	High	2452	33.920	≥ 0.5

802.11b Low Channel

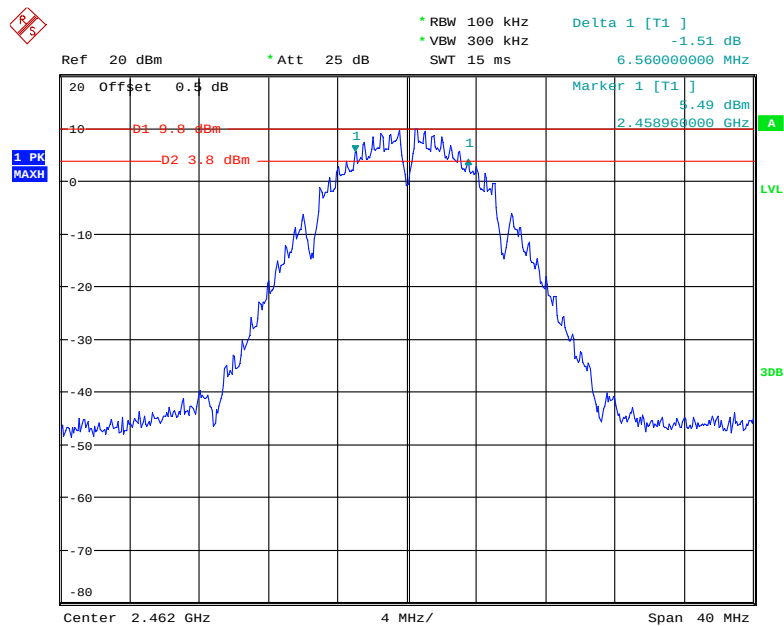


Date: 29.NOV.2019 21:53:45

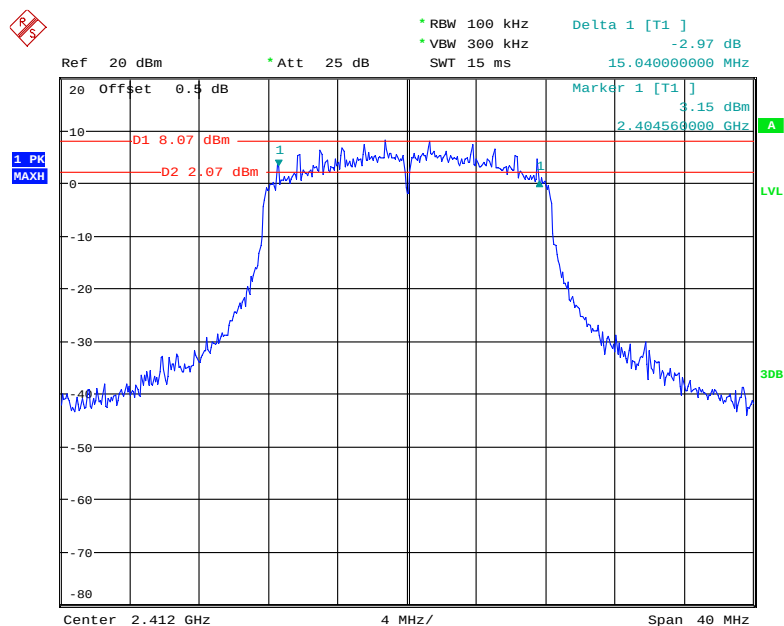
802.11b Middle Channel



Date: 29.NOV.2019 21:55:48

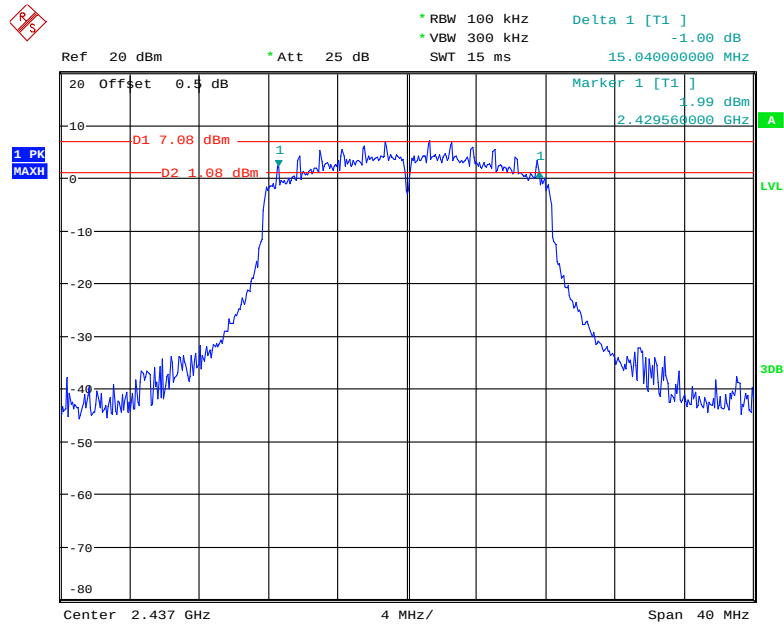
802.11b High Channel

Date: 29.NOV.2019 21:57:44

802.11g Low Channel

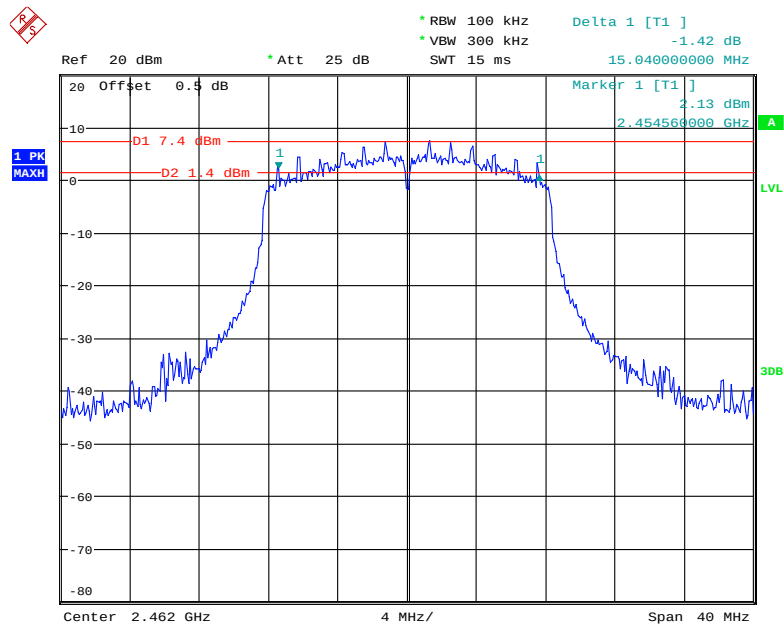
Date: 29.NOV.2019 22:02:14

802.11g Middle Channel



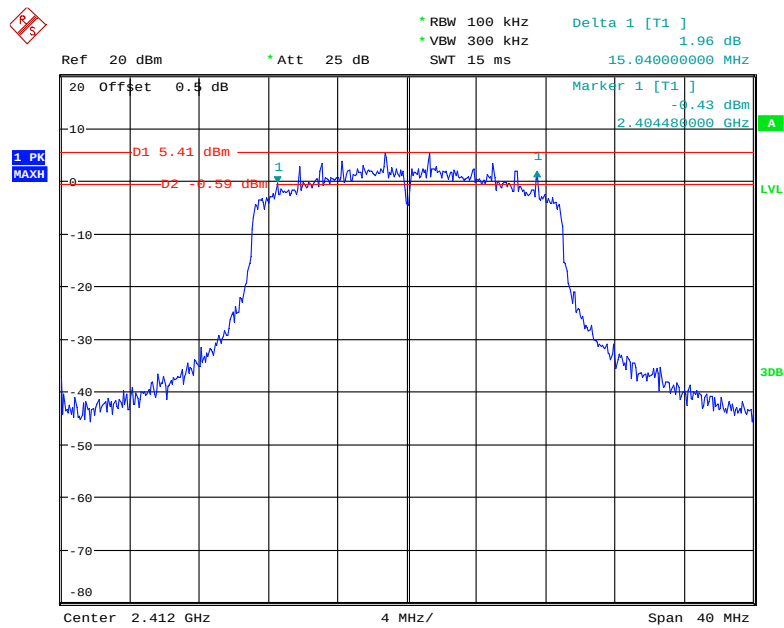
Date: 29.NOV.2019 22:04:43

802.11g High Channel



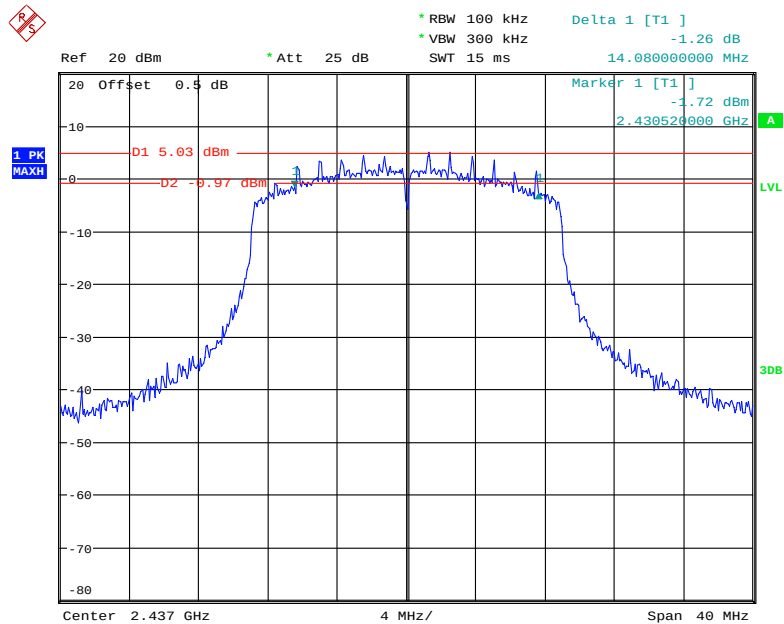
Date: 29.NOV.2019 22:06:57

802.11n ht20 Low Channel



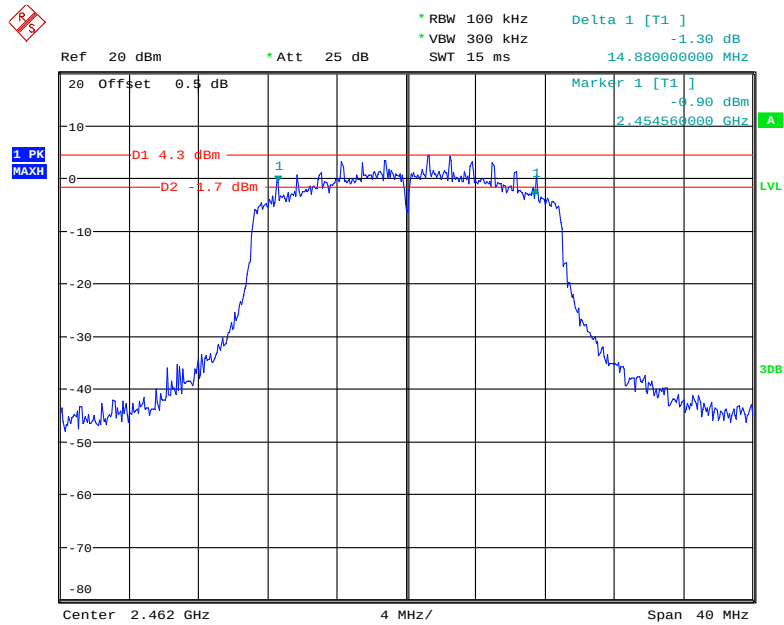
Date: 29.NOV.2019 23:49:58

802.11n ht20 Middle Channel



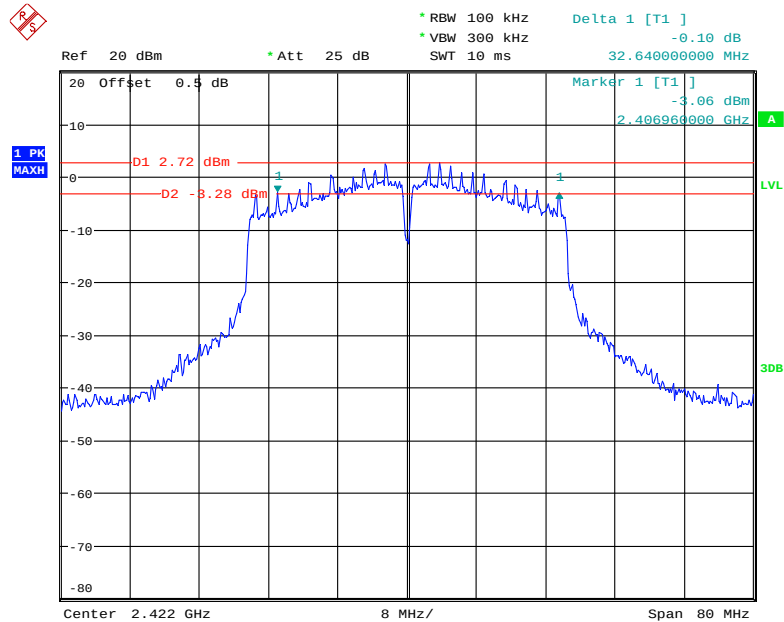
Date: 29.NOV.2019 23:51:44

802.11n ht20 High Channel



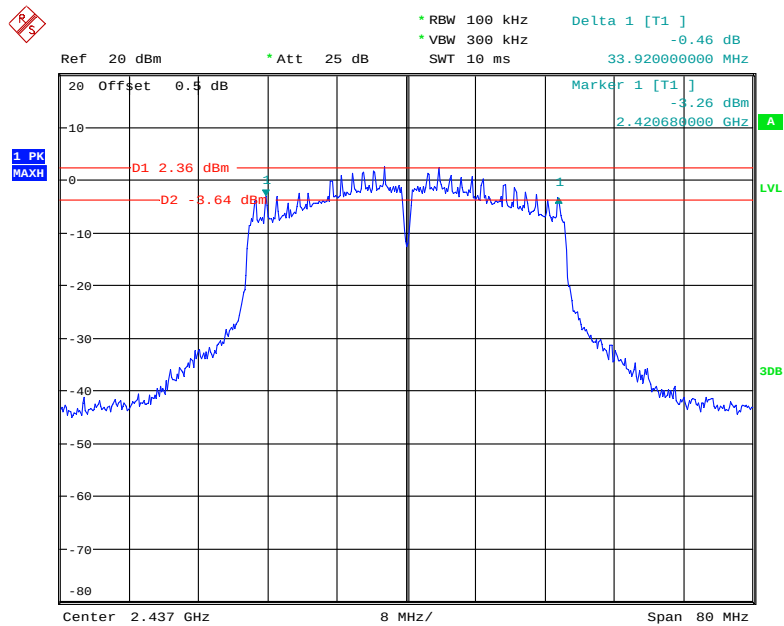
Date: 29.NOV.2019 23:53:16

802.11n ht40 Low Channel



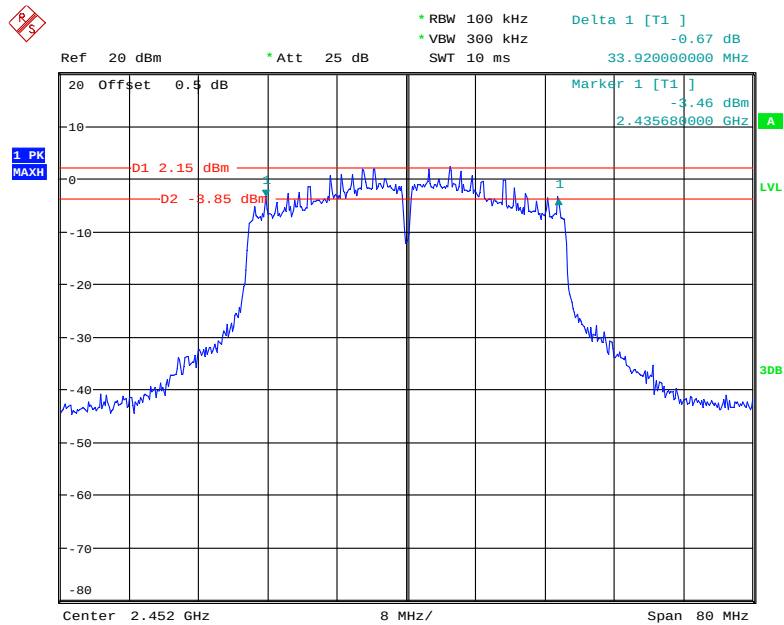
Date: 29.NOV.2019 23:57:10

802.11n ht40 Middle Channel



Date: 29.NOV.2019 23:59:36

802.11n ht40 High Channel



Date: 30.NOV.2019 00:02:06

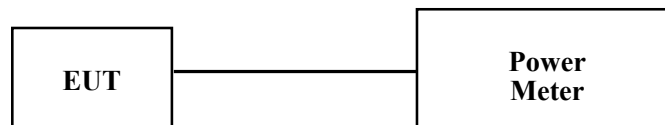
FCC §15.247(b) (3) - MAXIMUM PEAK CONDUCTED OUTPUT POWER

Applicable Standard

According to FCC §15.247(b) (3), for 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.

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 test equipment.
3. Add a correction factor to the display.
4. Set the power Meter to test Peak output power, record the result as peak power.
5. Set the power meter to test average output power, record the result as average power.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41010012	Each time	/
Agilent	USB Wideband Power Sensor	U2022XA	MY5417006	2019-09-23	2020-09-23

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	24.5°C
Relative Humidity:	42%
ATM Pressure:	102.5kPa
Test by:	Severn Zhu
Test Date:	2019-11-29

Test Mode: Transmitting

Test Result: Compliant. Please refer to the following table.

Test mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)			Limit (dBm)
			Chain 0	Chain 1	Total	
802.11b	Low	2412	19.49	19.48	N/A	30
	Middle	2437	19.21	18.54	N/A	30
	High	2462	18.30	18.10	N/A	30
802.11g	Low	2412	24.19	24.24	N/A	30
	Middle	2437	24.11	23.43	N/A	30
	High	2462	23.43	23.26	N/A	30
802.11n ht20	Low	2412	19.92	19.61	22.78	30
	Middle	2437	19.89	19.23	22.58	30
	High	2462	19.56	19.04	22.32	30
802.11n ht40	Low	2422	20.22	20.29	23.27	30
	Middle	2437	19.71	19.50	22.62	30
	High	2452	20.07	19.11	22.63	30

Note:

The maximum antenna gain is 3 dBi. The device employed Cyclic Delay Diversity (CDD) for 802.11 MIMO transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01, for power measurements on IEEE 802.11 devices:

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

So:

Directional gain = $G_{ANT} + \text{Array Gain} = 3 \text{ dBi} < 6 \text{ dBi}$

FCC §15.247(d)– 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

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)).

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.
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU 26	200256	2019-05-09	2020-05-09
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41010012	Each time	/

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

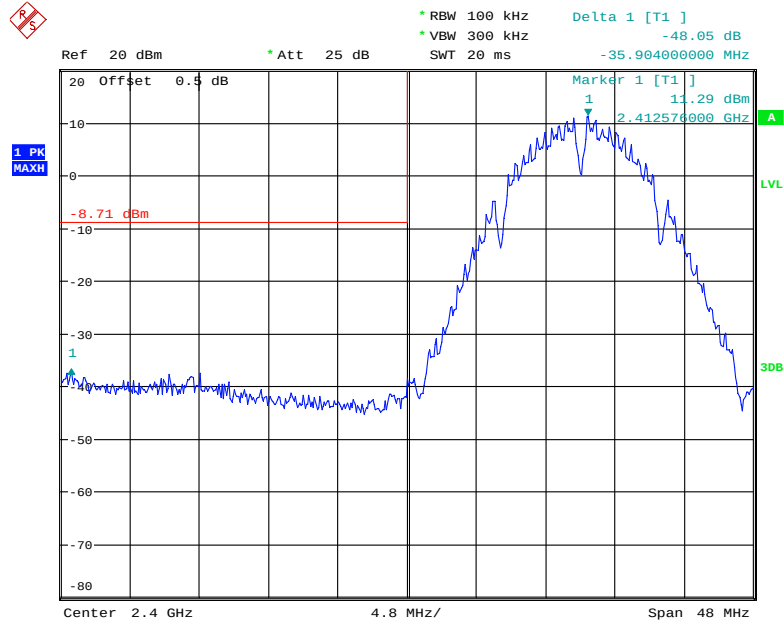
Test Data

Environmental Conditions

Temperature:	24.1~24.5°C
Relative Humidity:	39~42%
ATM Pressure:	102.3~ 102.5kPa
Test by:	Severn Zhu
Test Date:	2019-11-29~2019-11-30

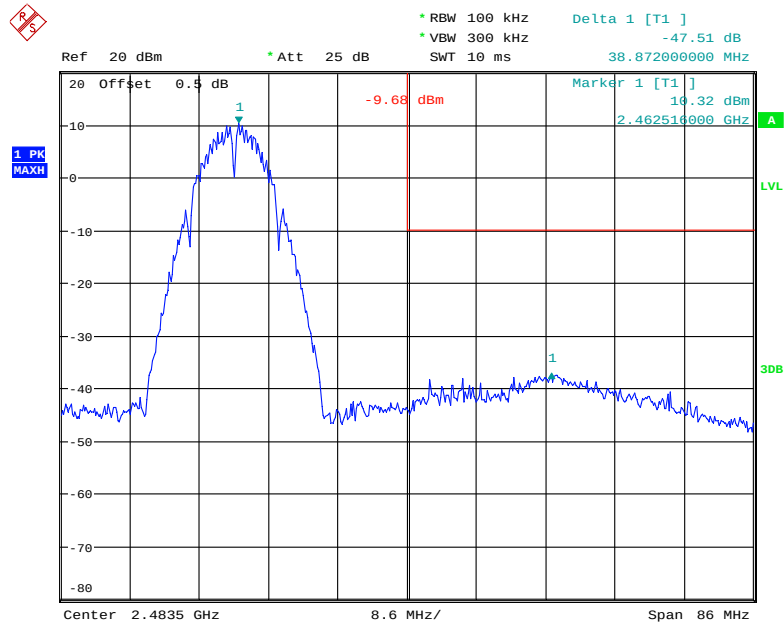
Test mode: Transmitting
Test Result: Compliant. Please refer to following plots.
Chain 0

802.11b: Band Edge, Left Side



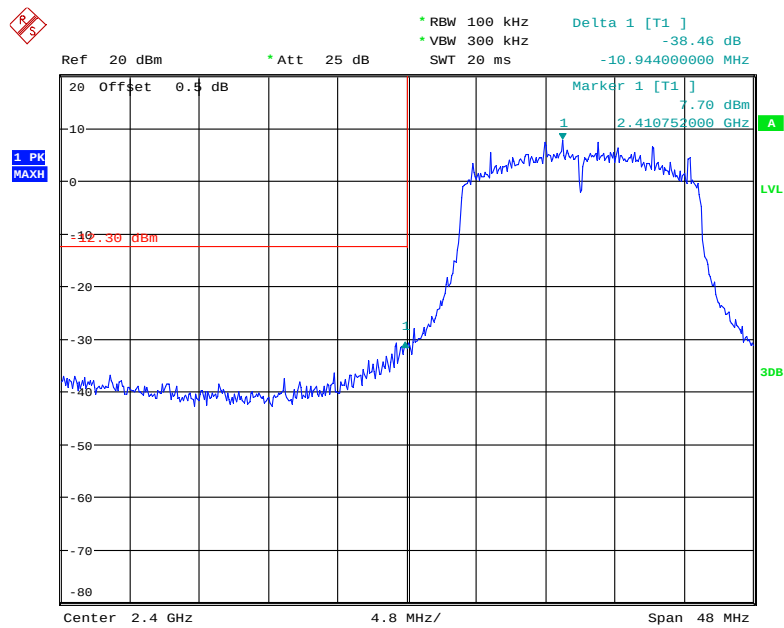
Date: 29.NOV.2019 23:06:09

802.11b: Band Edge, Right Side



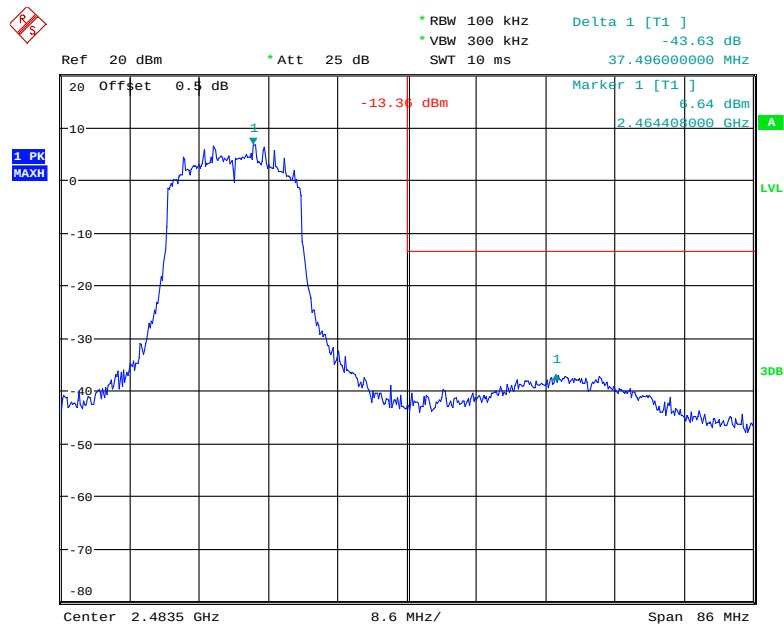
Date: 29.NOV.2019 23:09:35

802.11g: Band Edge, Left Side



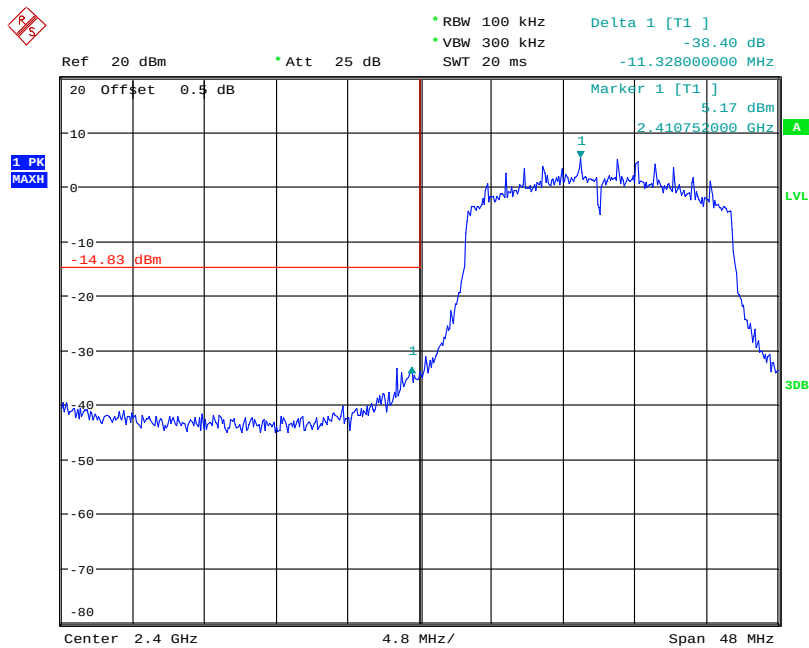
Date: 29.NOV.2019 23:11:40

802.11g: Band Edge, Right Side



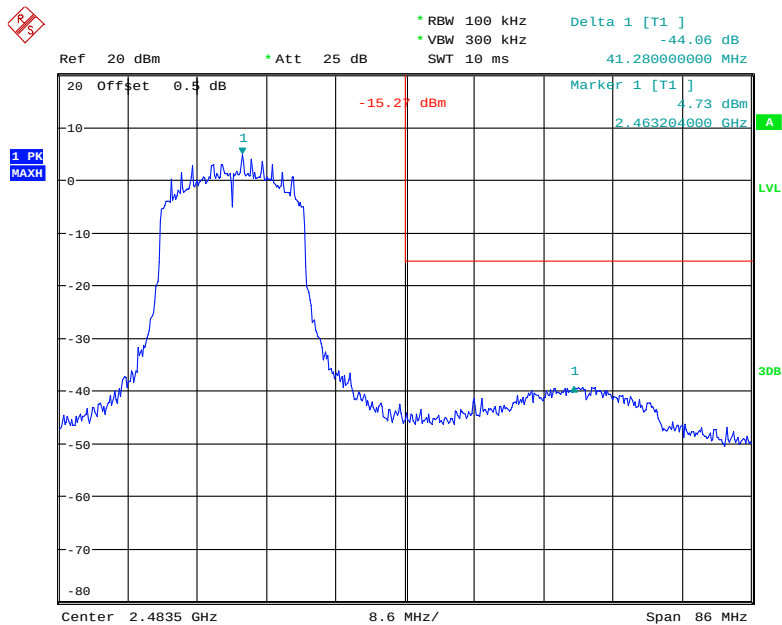
Date: 29.NOV.2019 23:14:38

802.11n ht20 Band Edge, Left Side



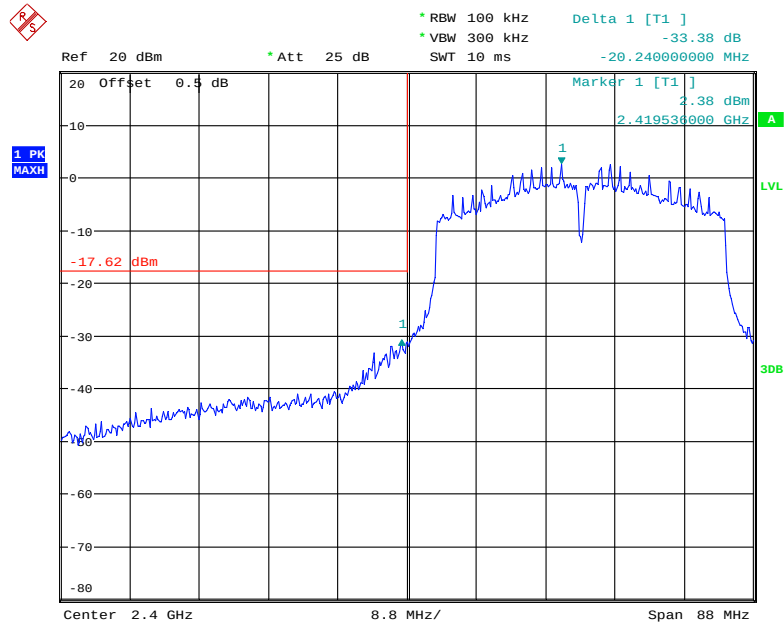
Date: 29.NOV.2019 23:50:58

802.11n ht20 Band Edge, Right Side



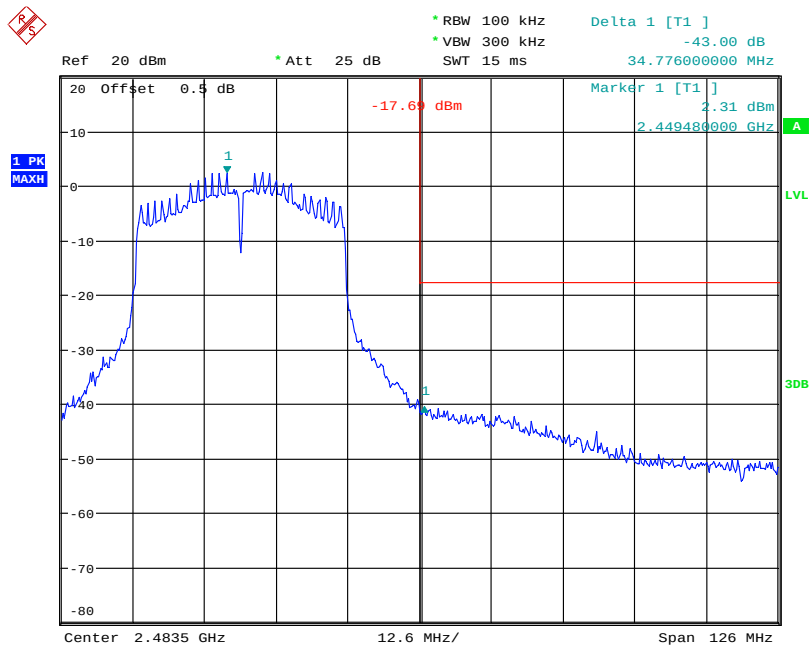
Date: 29.NOV.2019 23:54:18

802.11n ht40: Band Edge, Left Side



Date: 29.NOV.2019 23:58:55

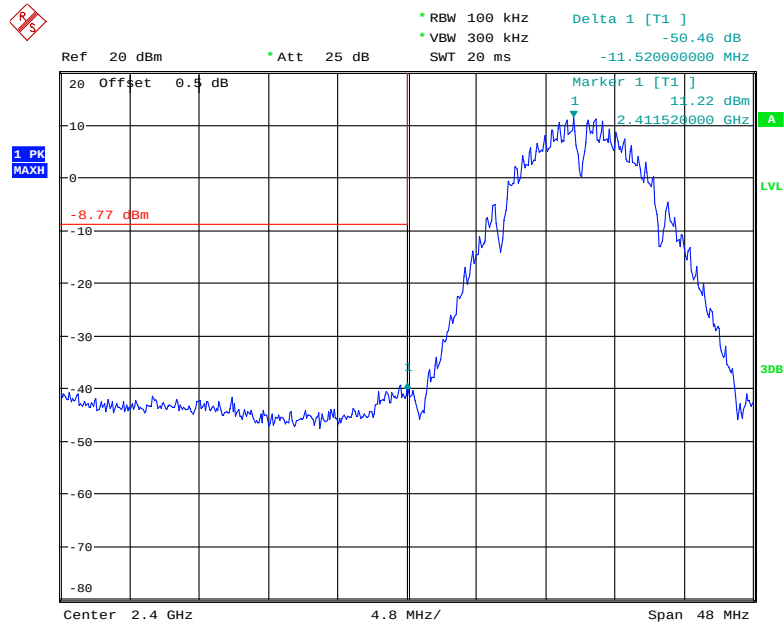
802.11n ht40 Band Edge, Right Side



Date: 30.NOV.2019 00:03:54

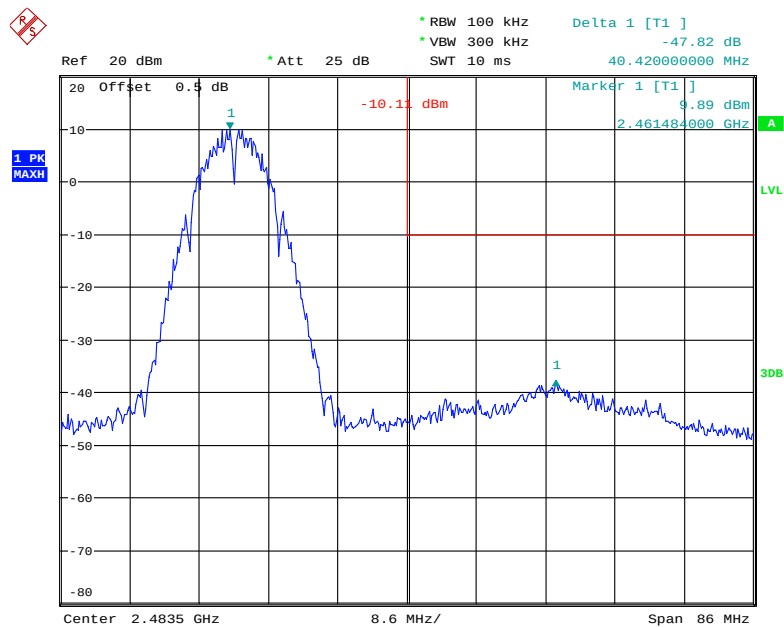
Chain 1

802.11b: Band Edge, Left Side



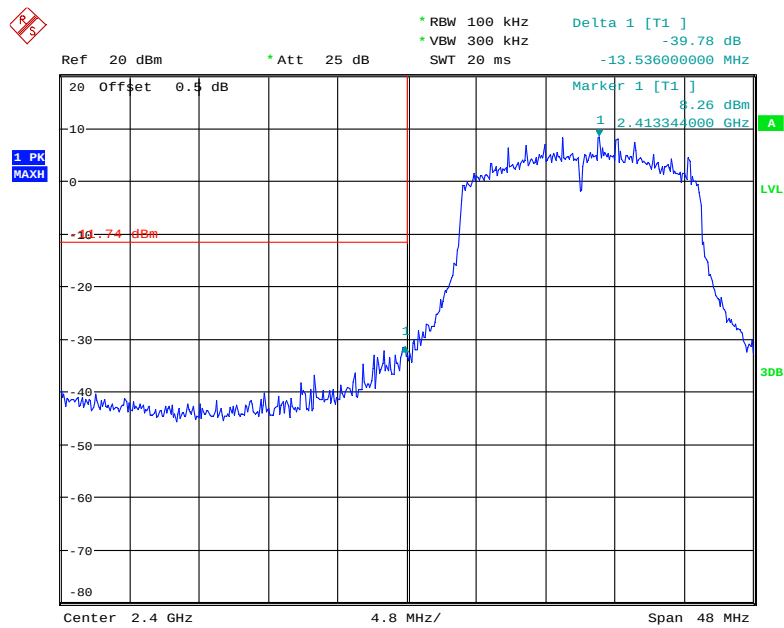
Date: 29.NOV.2019 21:54:54

802.11b: Band Edge, Right Side



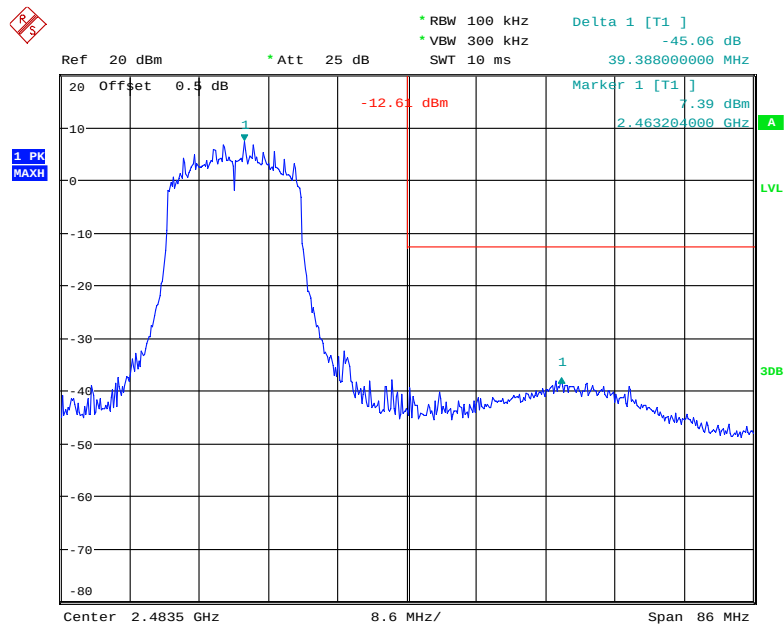
Date: 29.NOV.2019 21:58:51

802.11g: Band Edge, Left Side



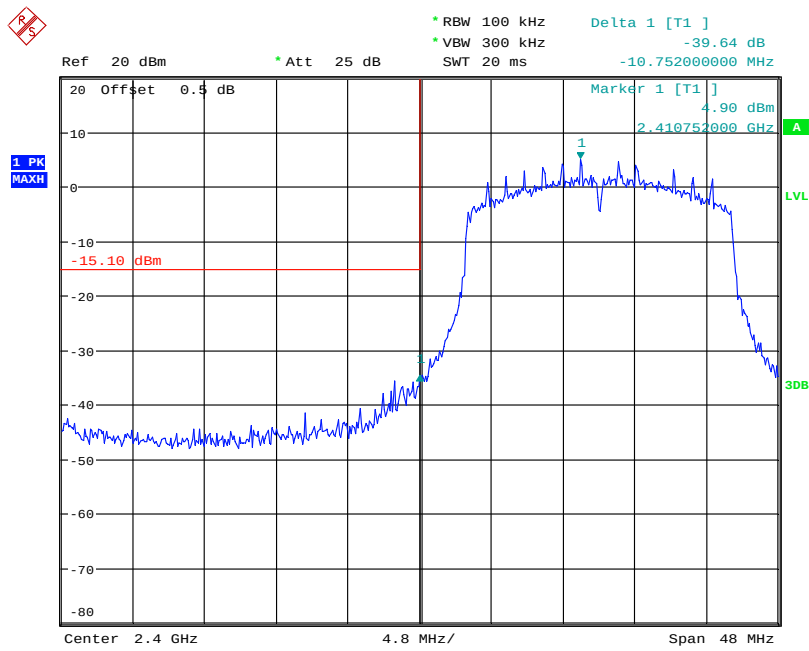
Date: 29.NOV.2019 22:03:42

802.11g: Band Edge, Right Side



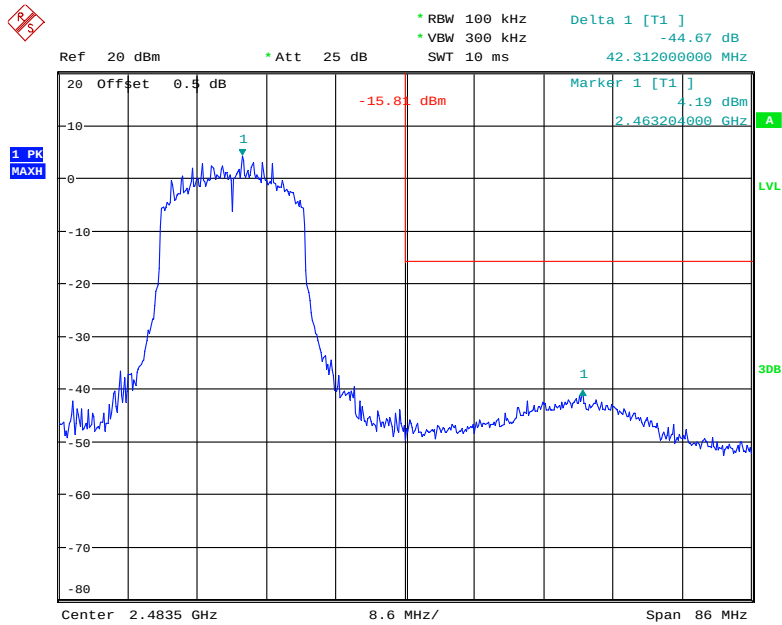
Date: 29.NOV.2019 22:08:29

802.11n ht20 Band Edge, Left Side



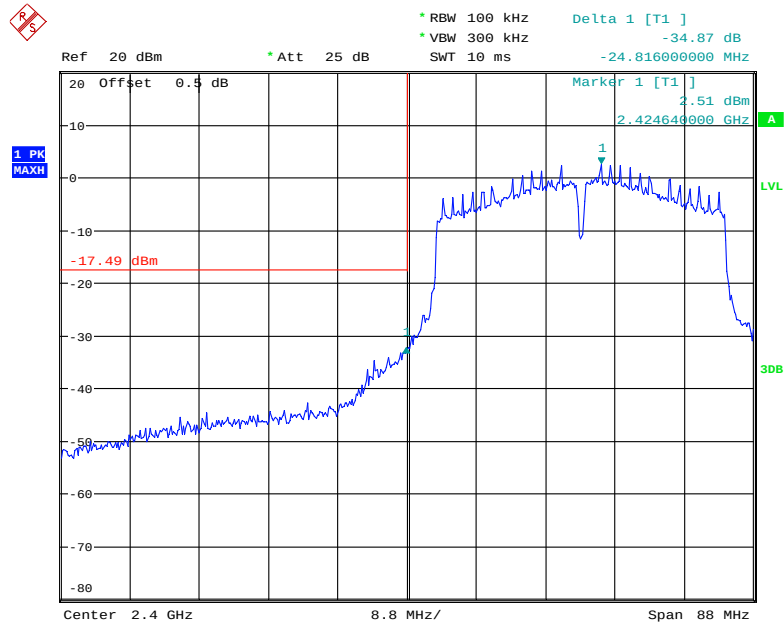
Date: 30.NOV.2019 00:23:07

802.11n ht20 Band Edge, Right Side



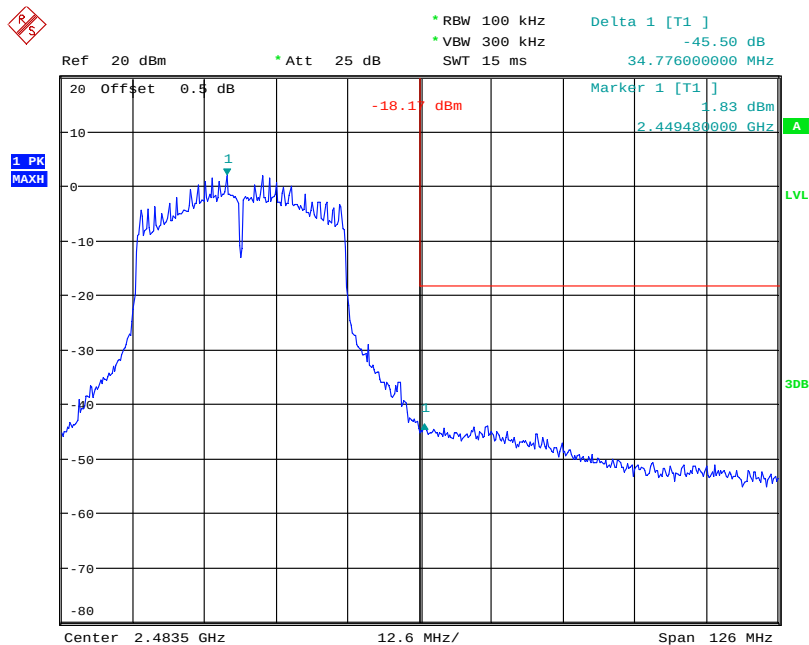
Date: 30.NOV.2019 00:25:20

802.11n ht40: Band Edge, Left Side



Date: 30.NOV.2019 00:17:49

802.11n ht40 Band Edge, Right Side



Date: 30.NOV.2019 00:20:38

FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

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.

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 was set 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 the RBW = 3 kHz, VBW = 10 kHz, Set the span to 1.5 times the DTS bandwidth.
4. Use the peak marker function to determine the maximum amplitude level.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU 26	200256	2019-05-09	2020-05-09
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41010012	Each time	/

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	24.5°C
Relative Humidity:	42%
ATM Pressure:	102.5kPa
Test by:	Severn Zhu
Test Date:	2019-11-29

Test Result: Compliance

Test Mode: Transmitting

Test Result: Compliant. Please refer to the following table and plots

Test mode	Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)			Limit (dBm/3kHz)
			Chain 0	Chain 1	Total	
802.11b	Low	2412	-3.02	-3.98	/	≤8
	Middle	2437	-3.66	-3.91	/	≤8
	High	2462	-4.08	-4.03	/	≤8
802.11g	Low	2412	-5.37	-6.35	/	≤8
	Middle	2437	-5.68	-6.20	/	≤8
	High	2462	-6.23	-6.42	/	≤8
802.11n ht20	Low	2412	-9.12	-8.67	-5.87	≤8
	Middle	2437	-8.87	-9.71	-6.25	≤8
	High	2462	-9.83	-10.10	-6.95	≤8
802.11n ht40	Low	2422	-11.15	-10.86	-7.99	≤8
	Middle	2437	-11.20	-11.78	-8.47	≤8
	High	2452	-11.25	-11.37	-8.30	≤8

Note 1: The maximum antenna gain is 3 dBi. The device employed Cyclic Delay Diversity (CDD) for 802.11 MIMO transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01, for power spectral density (PSD) measurements on the devices:

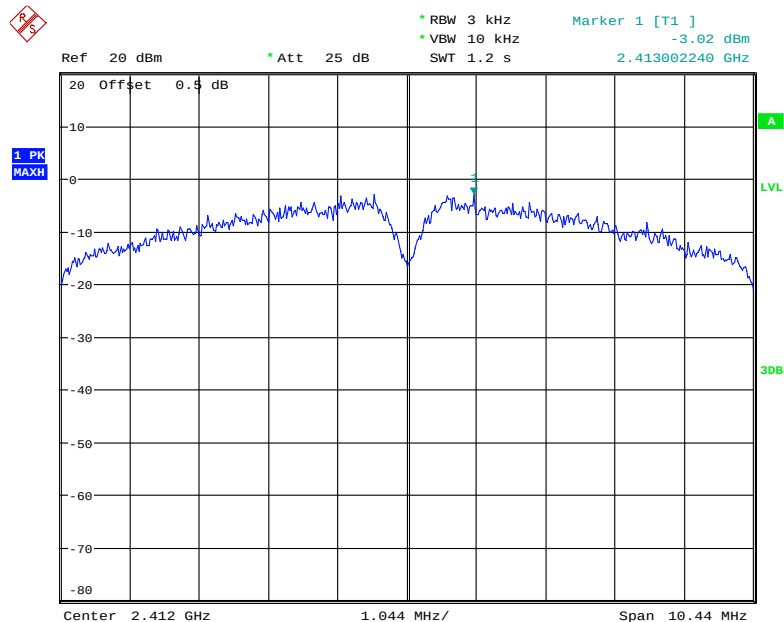
$$\text{Array Gain} = 10 \log(N_{\text{ANT}}/N_{\text{SS}}) \text{ dB.}$$

So:

$$\text{Directional gain} = G_{\text{ANT}} + \text{Array Gain} = 3\text{dBi} + 10 \cdot \log(2/1) = 6 \text{ dBi}$$

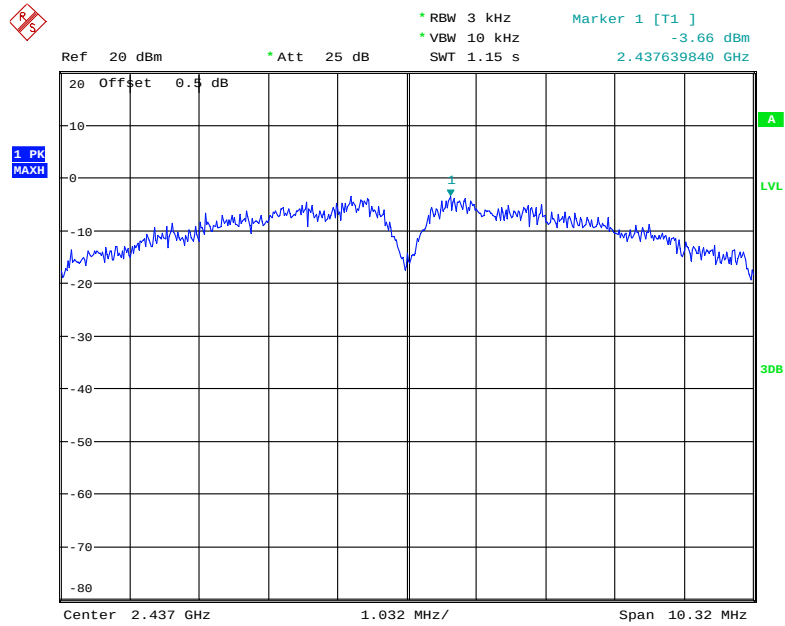
Chain 0

Power Spectral Density, 802.11b Low Channel



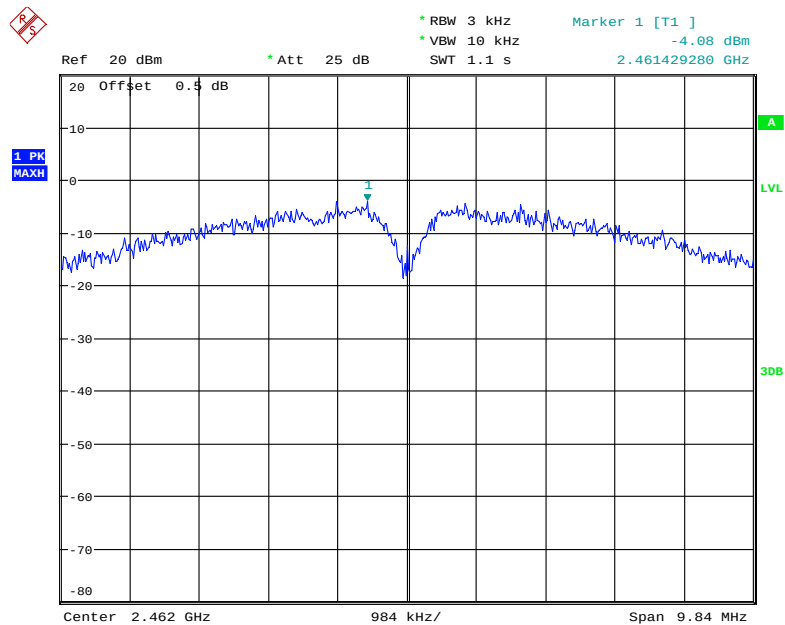
Date: 29.NOV.2019 23:05:56

Power Spectral Density, 802.11b Middle Channel



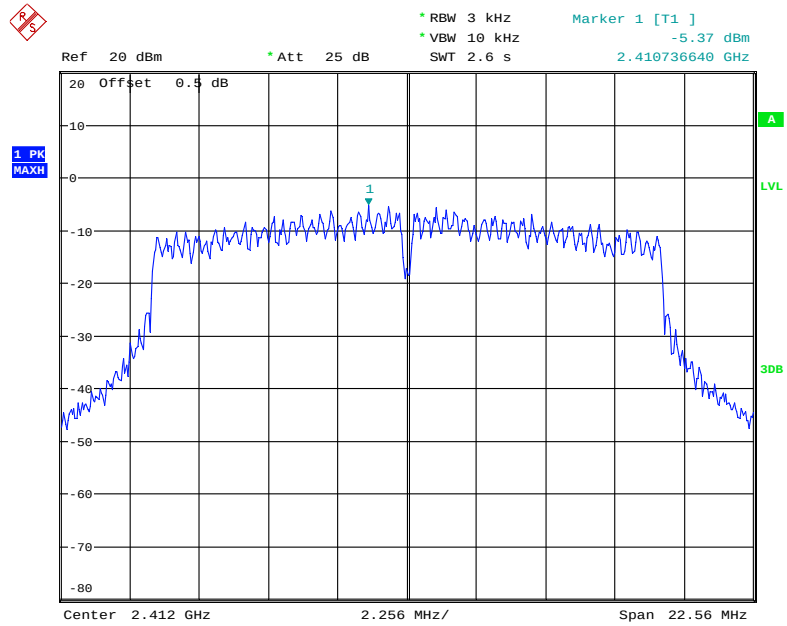
Date: 29.NOV.2019 23:08:13

Power Spectral Density, 802.11b High Channel



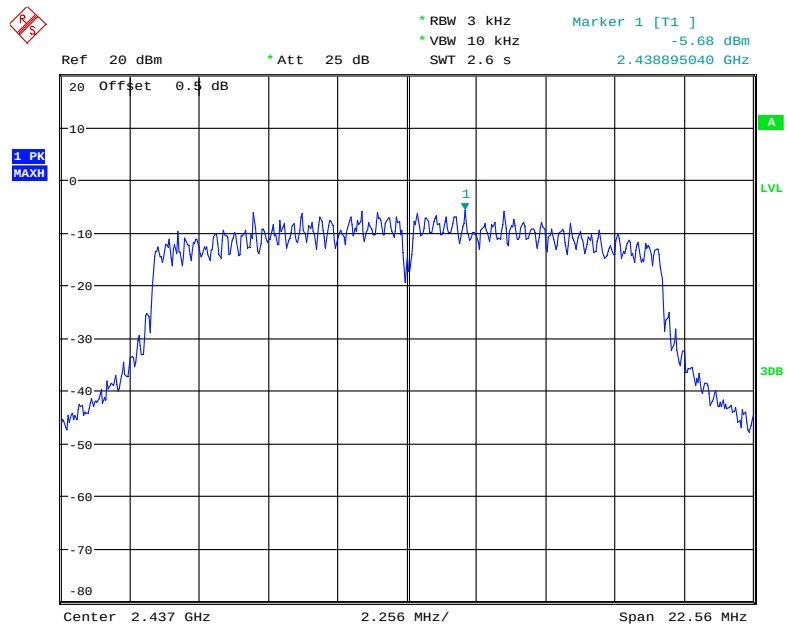
Date: 29.NOV.2019 23:09:22

Power Spectral Density, 802.11g Low Channel



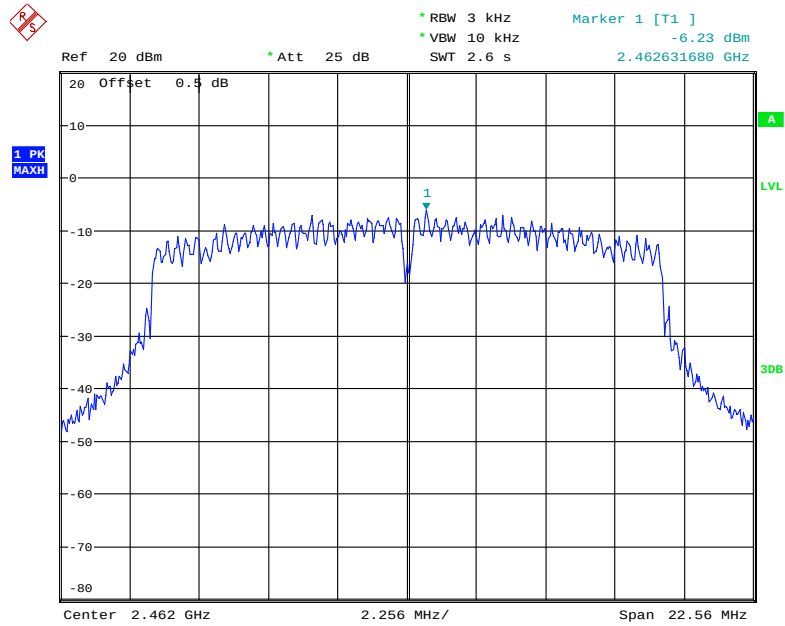
Date: 29.NOV.2019 23:11:28

Power Spectral Density, 802.11g Middle Channel



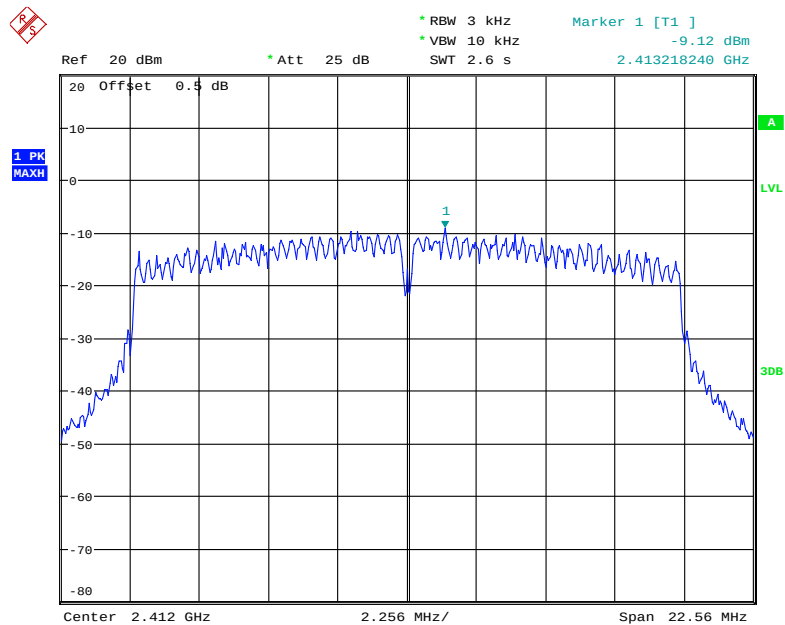
Date: 29.NOV.2019 23:12:56

Power Spectral Density, 802.11g High Channel

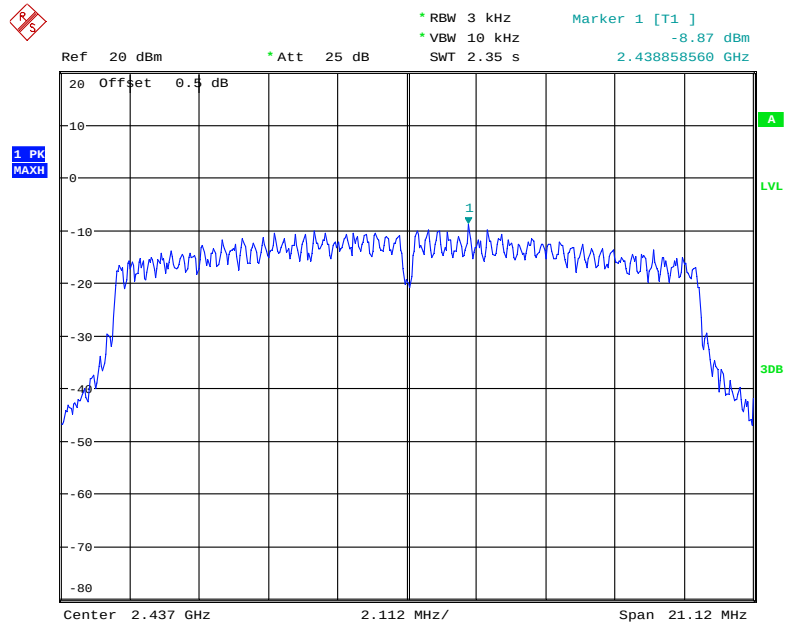


Date: 29.NOV.2019 23:14:26

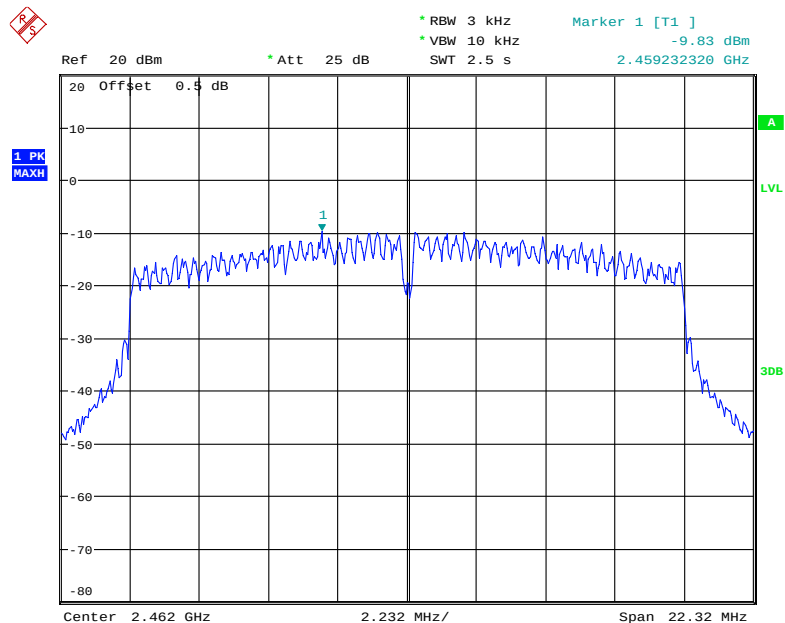
Power Spectral Density, 802.11n ht20 Low Channel



Date: 29.NOV.2019 23:50:42

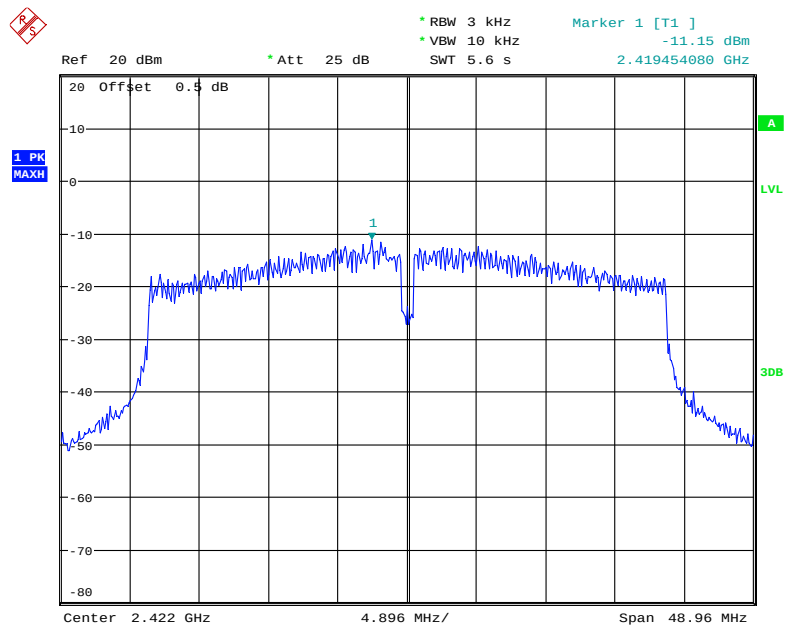
Power Spectral Density, 802.11n ht20 Middle Channel

Date: 29.NOV.2019 23:52:41

Power Spectral Density, 802.11n ht20 High Channel

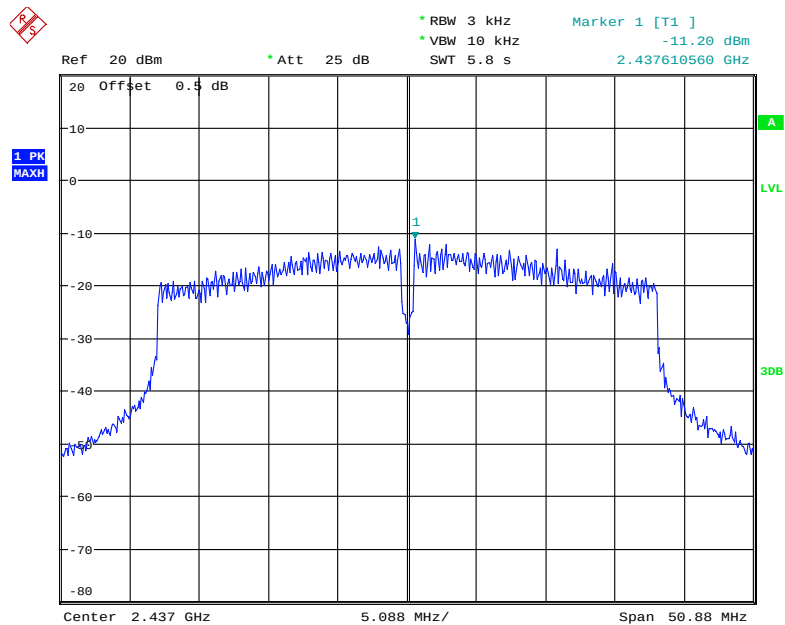
Date: 29.NOV.2019 23:54:05

Power Spectral Density, 802.11n ht40 Low Channel



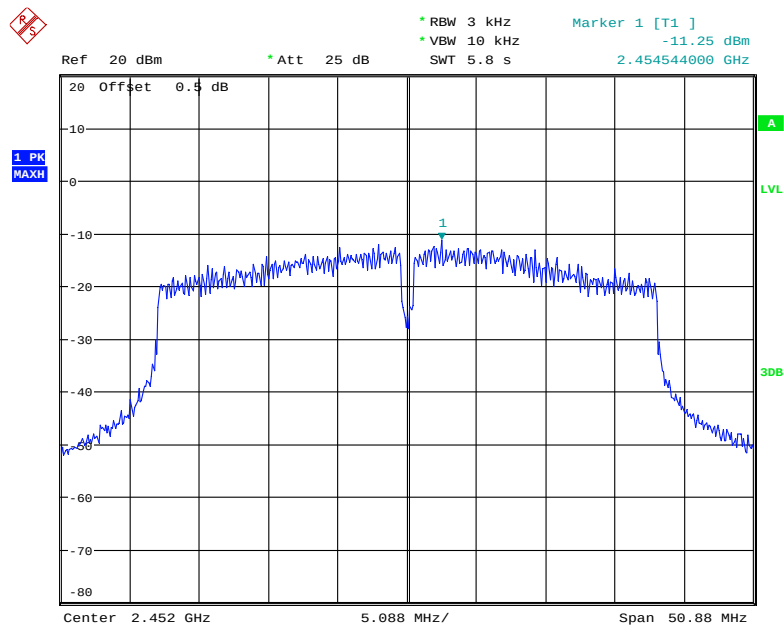
Date: 29.NOV.2019 23:58:42

Power Spectral Density, 802.11n ht40 Middle Channel



Date: 30.NOV.2019 00:00:55

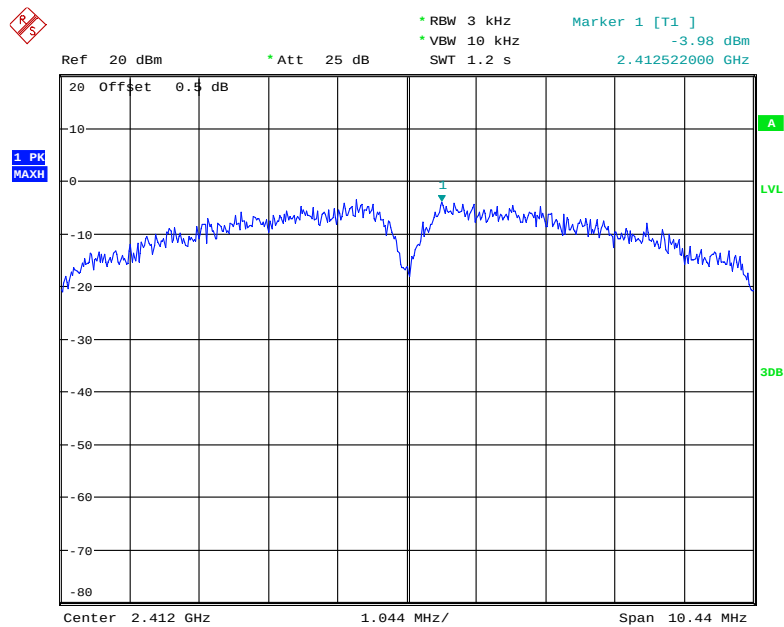
Power Spectral Density, 802.11n ht40 High Channel



Date: 30.NOV.2019 00:03:41

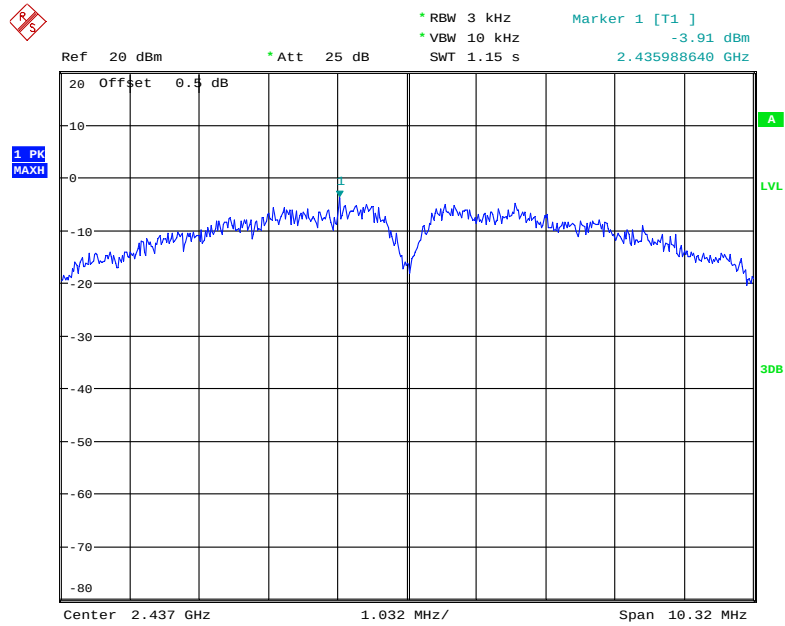
Chain 1

Power Spectral Density, 802.11b Low Channel



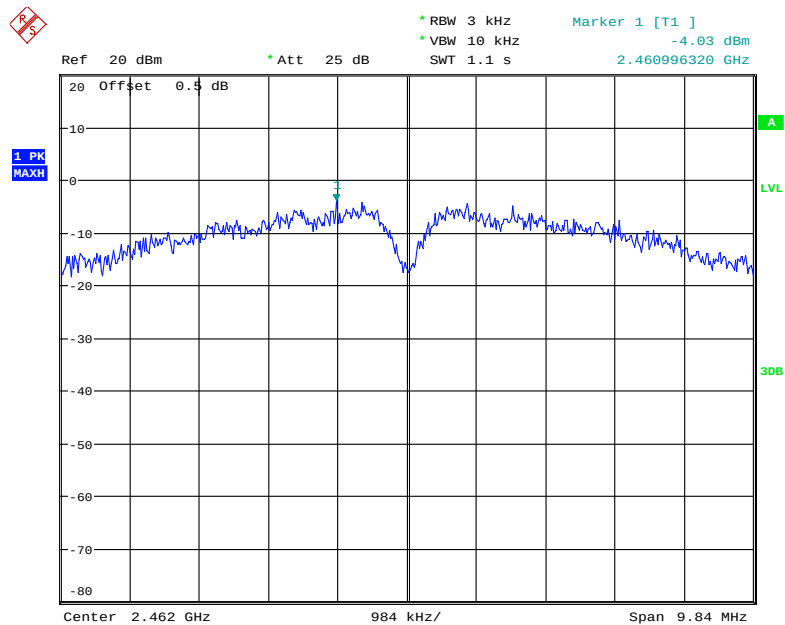
Date: 29.NOV.2019 22:00:13

Power Spectral Density, 802.11b Middle Channel



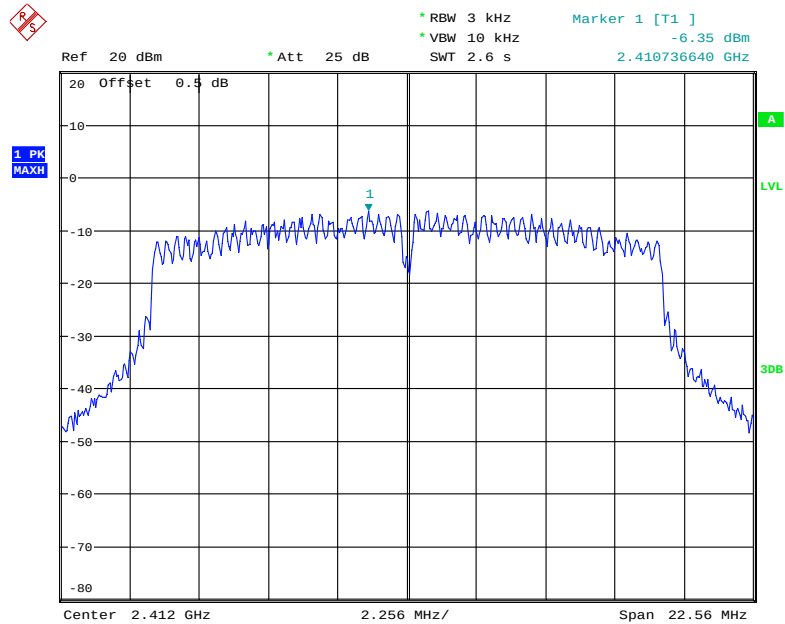
Date: 29.NOV.2019 21:56:43

Power Spectral Density, 802.11b High Channel



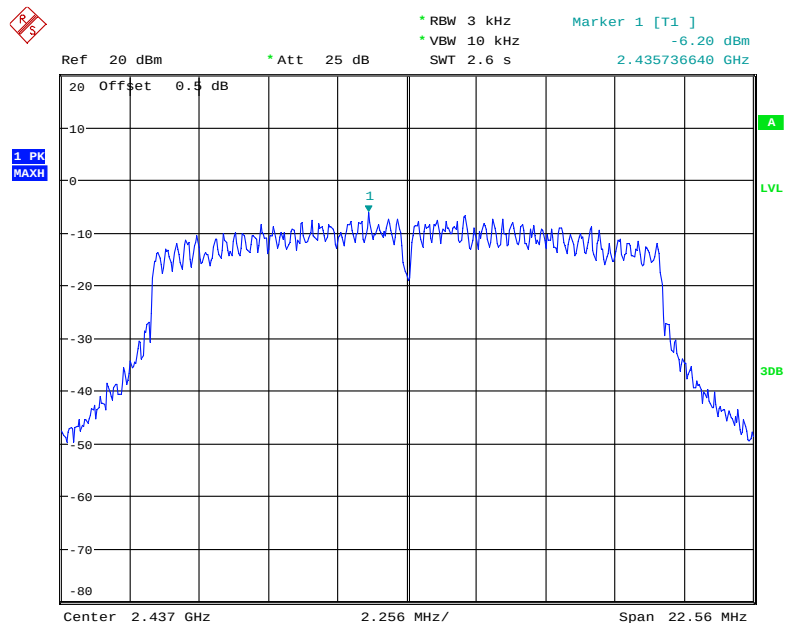
Date: 29.NOV.2019 21:58:39

Power Spectral Density, 802.11g Low Channel



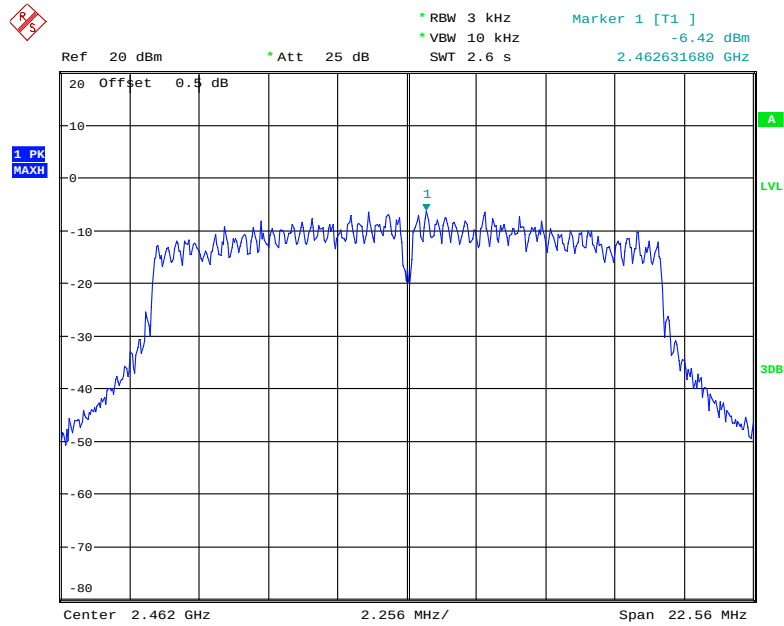
Date: 29.NOV.2019 22:03:30

Power Spectral Density, 802.11g Middle Channel



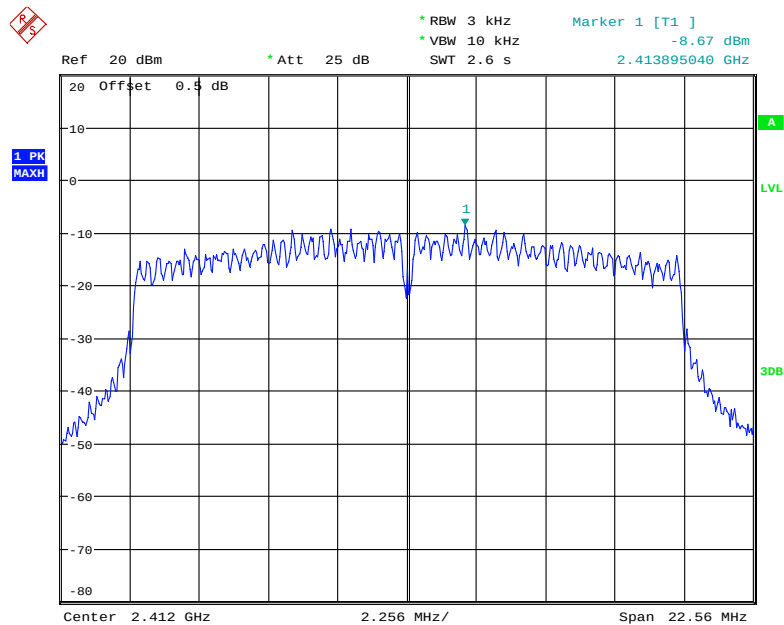
Date: 29.NOV.2019 22:06:02

Power Spectral Density, 802.11g High Channel



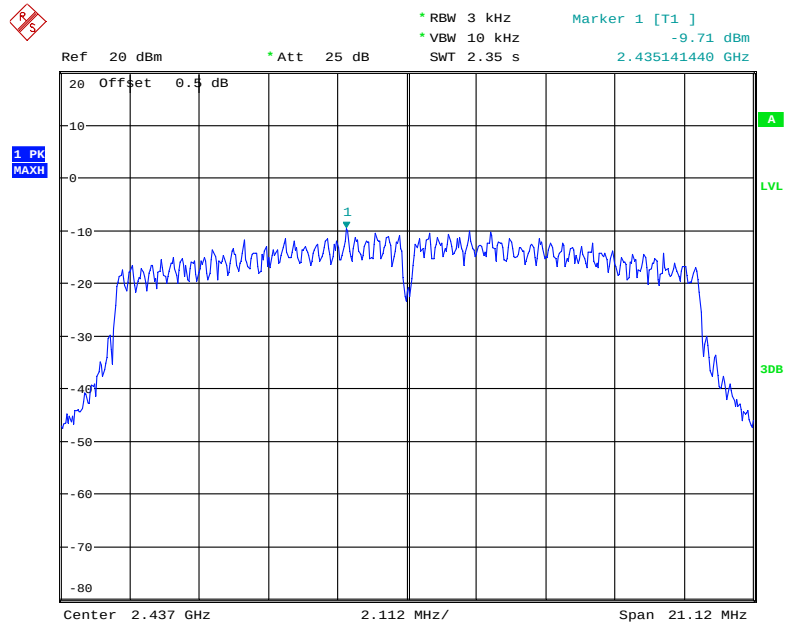
Date: 29.NOV.2019 22:08:13

Power Spectral Density, 802.11n ht20 Low Channel



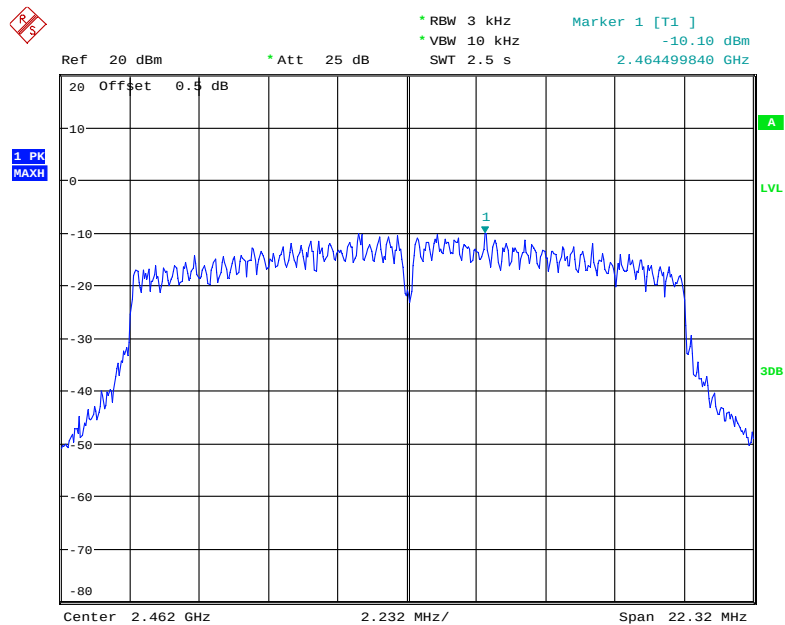
Date: 30.NOV.2019 00:22:54

Power Spectral Density, 802.11n ht20 Middle Channel



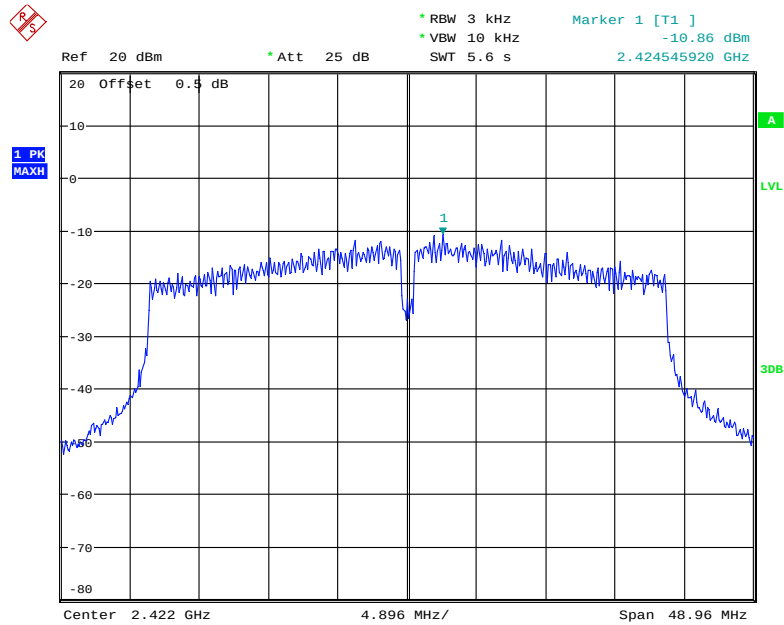
Date: 30.NOV.2019 00:23:57

Power Spectral Density, 802.11n ht20 High Channel



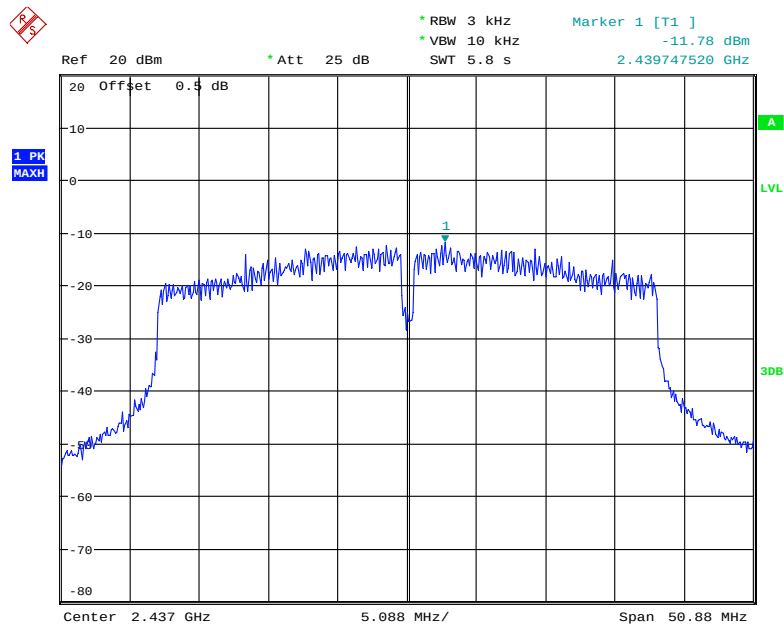
Date: 30.NOV.2019 00:25:08

Power Spectral Density, 802.11n ht40 Low Channel



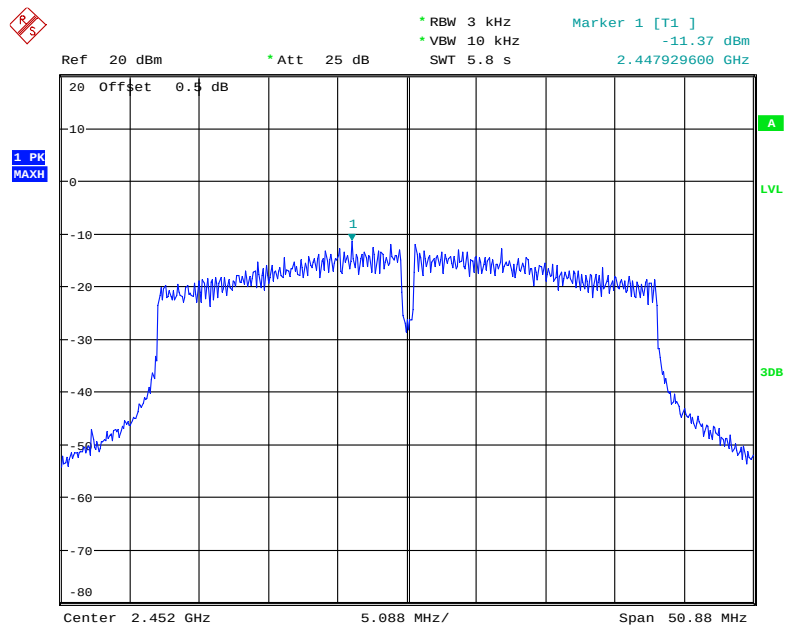
Date: 30.NOV.2019 00:17:37

Power Spectral Density, 802.11n ht40 Middle Channel



Date: 30.NOV.2019 00:13:52

Power Spectral Density, 802.11n ht40 High Channel



Date: 30.NOV.2019 00:20:25

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