



TESTING LABORATORY  
CERTIFICATE #4820.01



# FCC PART 15.247


## TEST REPORT

For

### SHENZHEN IP-COM NETWORKS CO.,LTD.

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China. 518052

**FCC ID:2ABZM-IUAPACM**

<b>Report Type:</b> Original Report	<b>Product Name:</b> 802.11AC Indoor/Outdoor Wi-Fi Access Point
<b>Report Number:</b>	<u>RDG200528002-00A</u>
<b>Report Date:</b>	<u>2020-06-19</u>
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## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

<b>EUT Name:</b>		802.11AC Indoor/Outdoor Wi-Fi Access Point
<b>EUT Model:</b>		iUAP-AC-M
<b>Operation Frequency:</b>		2412-2462 MHz(802.11b/g/n ht20), 2422-2452 MHz(802.11n ht40)
<b>Maximum Peak Output Power (Conducted):</b>		27.26 dBm
<b>Modulation Type:</b>		DSSS, OFDM
<b>Adapter Information</b>	<b>Model:</b>	BN060-P12024
	<b>Input:</b>	AC 100-240V 50/60Hz 0.4A
	<b>Output:</b>	DC 24V, 0.5A
<b>Rated Input Voltage:</b>		DC 24V from POE Adapter
<b>Serial Number:</b>		RDG200528002-RF-S1
<b>EUT Received Date:</b>		2020.05.29
<b>EUT Received Status:</b>		Good

### Objective

This report is prepared on behalf of **SHENZHEN IP-COM NETWORKS CO.,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: 2ABZM-IUAPACM.

### 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 “△”. 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.

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## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

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

The system supports Beamforming and Non-beamforming modes at 802.11n. The two modes have same output power, and the Beamforming gain is 3 dBi, which are declared by manufacturer. Therefore, the all RF conducted test were performed at Non-beamforming mode only.

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 modes were test 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, 2TX mode was the worst mode and reported for 802.11n modes.

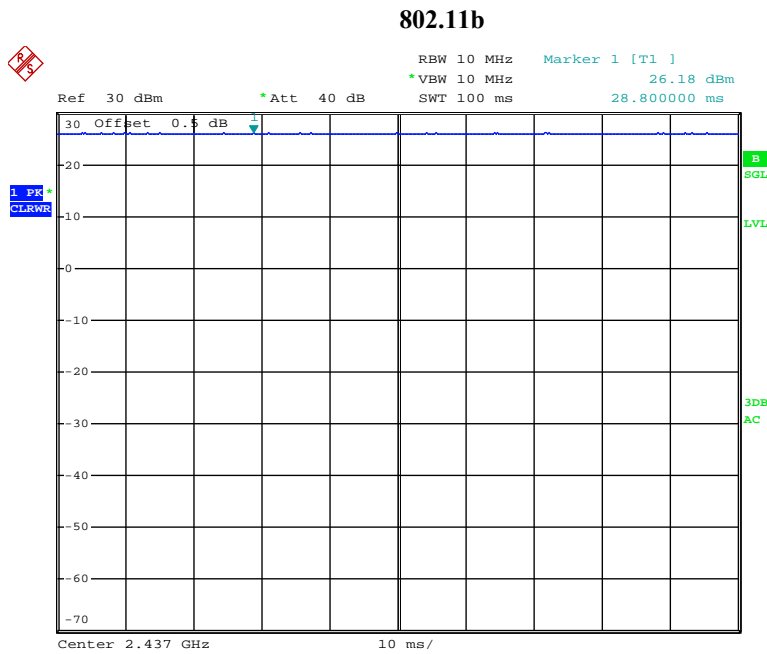
### EUT Exercise Software

The software “cmd.exe” 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	
				Chain 0	Chain 1
802.11 b	Low	2412	1Mbps	24	24
	Middle	2437	1Mbps	24	24
	High	2462	1Mbps	24	24
802.11 g	Low	2412	6Mbps	17	17
	Middle	2437	6Mbps	17	17
	High	2462	6Mbps	17	17
802.11n ht20	Low	2412	MCS8	15	15
	Middle	2437	MCS8	15	15
	High	2462	MCS8	15	15
802.11n ht40	Low	2422	MCS8	15	15
	Middle	2437	MCS8	15	15
	High	2452	MCS8	15	15

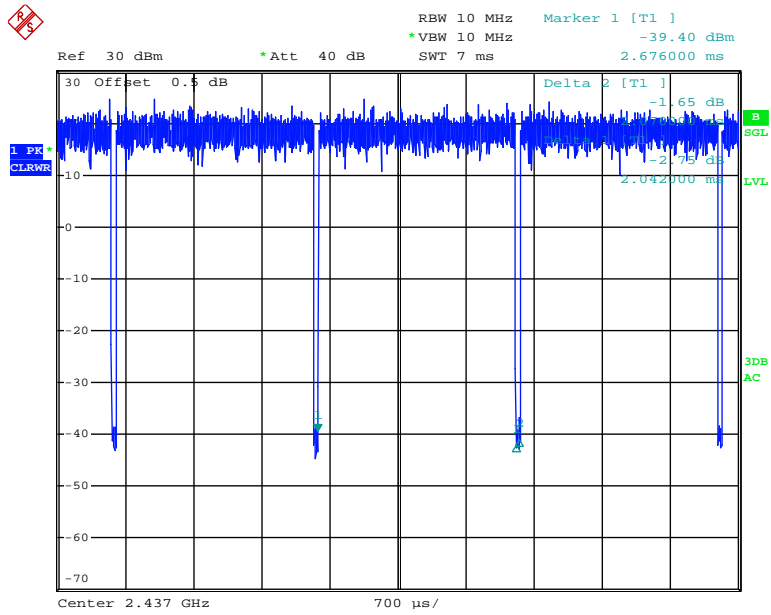
The maximum duty cycle as following table:

Test mode	T <sub>on</sub> (ms)	T <sub>on+off</sub> (ms)	Duty Cycle (%)
802.11b	100	100	100
802.11g	2.042	2.070	98.65
802.11n ht20	0.980	1.020	96.08
802.11n ht40	0.496	0.528	93.94



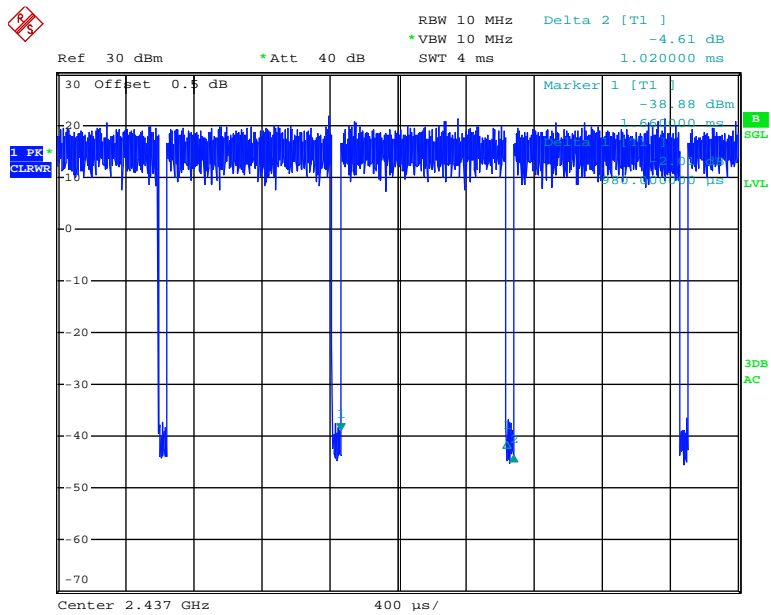
Date: 3.JUN.2020 12:31:08

### 802.11g



Date: 3.JUN.2020 12:37:20

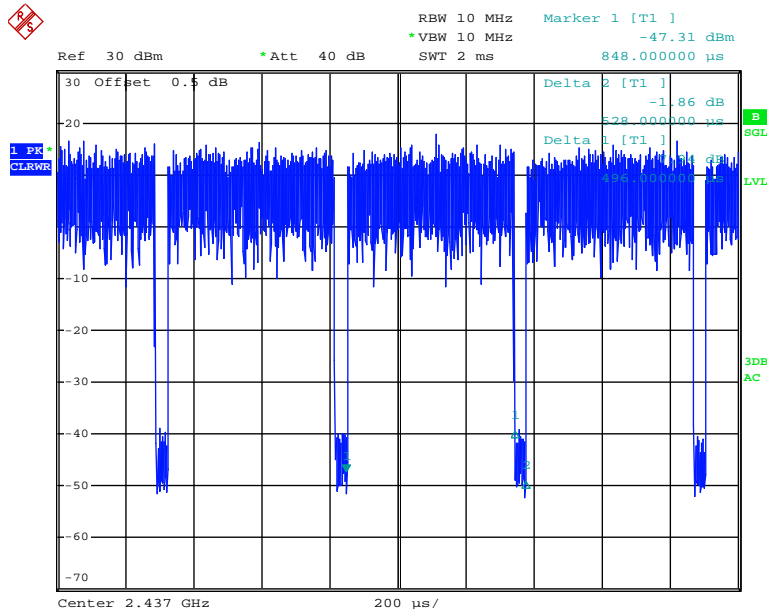
### 802.11n ht20



Date: 3.JUN.2020 12:45:22



802.11n ht40



Date: 3 JUN. 2020 12:53:32

**Equipment Modifications**

No modification was made to the EUT.

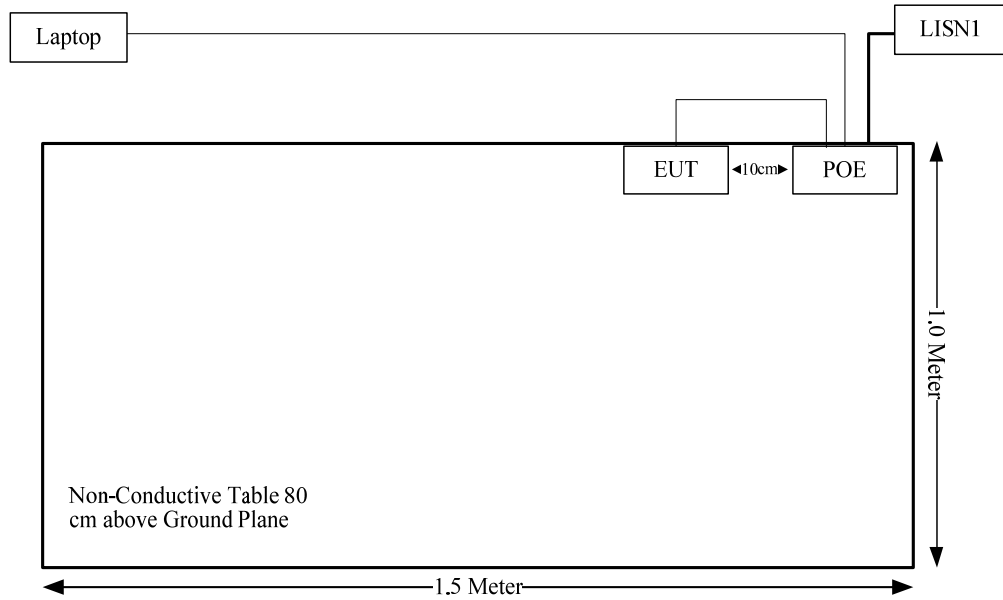
**Local Support Equipment List and Details**

Manufacturer	Description	Model	Serial Number
DELL	Laptop	PP11L	QDS-BRCM1017

**Support Cable List and Details**

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
RJ45 Cable	Yes	No	1.2	PoE Adapter	EUT
RJ45 Cable	Yes	No	10	PoE Adapter	Laptop

### Block Diagram of Test Setup



**SUMMARY OF TEST RESULTS**

<b>FCC Rules</b>	<b>Description of Test</b>	<b>Result</b>
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>(B) Limits for General Population/Uncontrolled Exposure</b>				
<b>Frequency Range (MHz)</b>	<b>Electric Field Strength (V/m)</b>	<b>Magnetic Field Strength (A/m)</b>	<b>Power Density (mW/cm<sup>2</sup>)</b>	<b>Averaging Time (minutes)</b>
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f <sup>2</sup> )	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/cm<sup>2</sup>);

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 <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
		(dBi)	(numeric)	(dBm)	(mW)			
WLAN	2412-2462	7	5.01	28	630.96	20.00	0.63	1.0
WLAN	5150-5250	7	5.01	23	199.53	20.00	0.20	1.0
WLAN	5725-5850	7	5.01	25	316.23	20.00	0.32	1.0

The WLAN 2.4G and 5G can transmit simultaneously:

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

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

$$=0.63/1+0.32/1$$

$$=0.95$$

$$< 1.0$$

**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 antenna for 2.4G and 5G WLAN. The antennas use a unique type of connector to attach to the EUT, 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
Chain 0	Dipole	50	4 dBi/2.4-2.5GHz 4 dBi/5.15-5.85GHz
Chain 1	Dipole	50	4 dBi/2.4-2.5GHz 4 dBi/5.15-5.85GHz

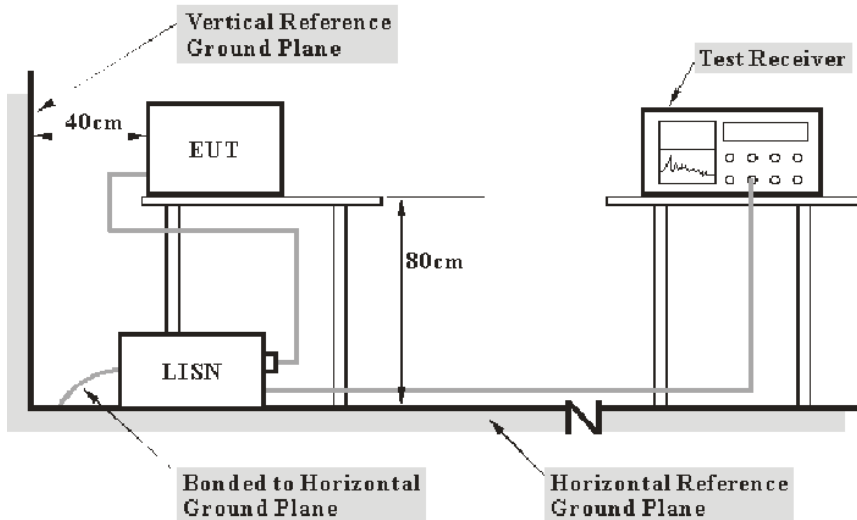
**Result:** Compliance.

**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 limits.

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, the report shall list the six emissions with the smallest margin relative to the limit, unless the margin is greater than 20 dB.

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	LISN	ENV 216	101614	2019-09-12	2020-09-12
R&S	EMI Test Receiver	ESCI	101121	2020-05-09	2021-05-09

\* **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).



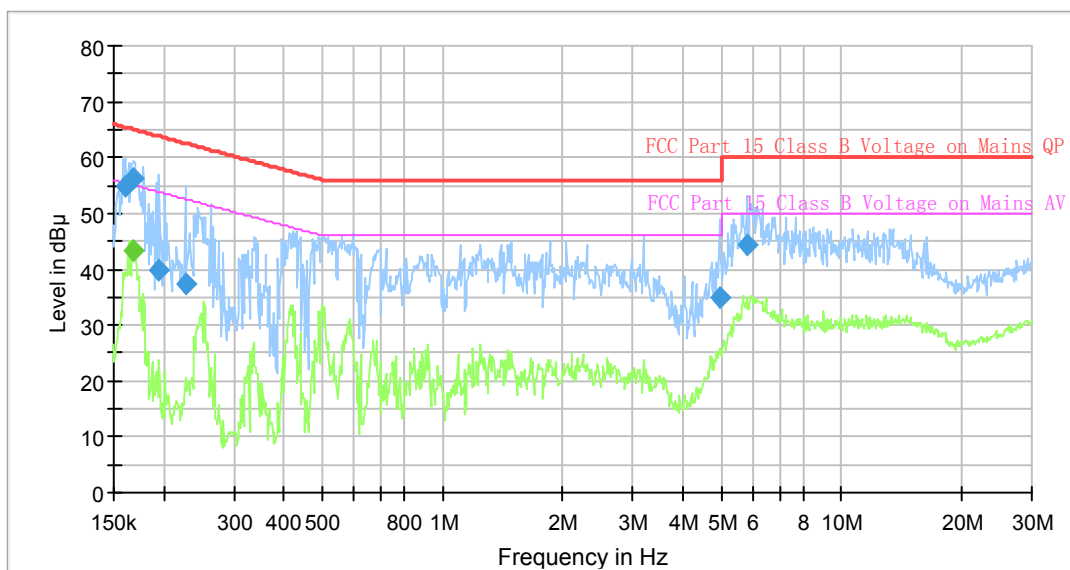
**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	26.9°C
<b>Relative Humidity:</b>	67%
<b>ATM Pressure:</b>	100.4kPa
<b>Tester:</b>	Barry Yang
<b>Test Date:</b>	2020-06-03

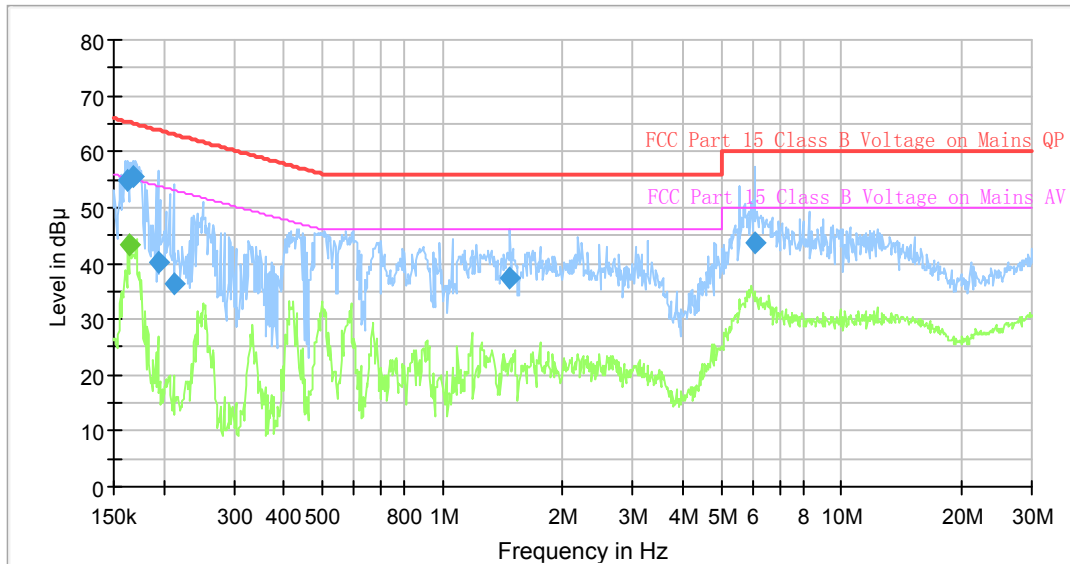
Test Mode: Transmitting(802.11b mode chain 1 high channel was the worst)

**AC120 V, 60 Hz, Line:**



Frequency (MHz)	QuasiPeak (dB μV)	Average (dB μV)	Limit (dB μV)	Margin (dB)	Bandwidth (kHz)	Line	Filter
0.160048	54.91	---	65.46	10.55	9.000	L1	ON
0.168233	---	43.17	55.05	11.88	9.000	L1	ON
0.168233	56.15	---	65.05	8.90	9.000	L1	ON
0.195386	39.74	---	63.80	24.06	9.000	L1	ON
0.226921	37.24	---	62.56	25.32	9.000	L1	ON
4.948807	34.96	---	56.00	21.04	9.000	L1	ON
5.805164	44.32	---	60.00	15.68	9.000	L1	ON

**AC120 V, 60 Hz, Neutral:**



Frequency (MHz)	QuasiPeak (dB µ V)	Average (dB µ V)	Limit (dB µ V)	Margin (dB)	Bandwidth (kHz)	Line	Filter
0.162461	54.80	---	65.34	10.54	9.000	N	ON
0.164089	---	43.45	55.25	11.80	9.000	N	ON
0.167396	55.51	---	65.09	9.58	9.000	N	ON
0.193446	40.29	---	63.89	23.60	9.000	N	ON
0.211616	36.26	---	63.14	26.88	9.000	N	ON
1.472813	37.26	---	56.00	18.74	9.000	N	ON
6.071683	43.67	---	60.00	16.33	9.000	N	ON

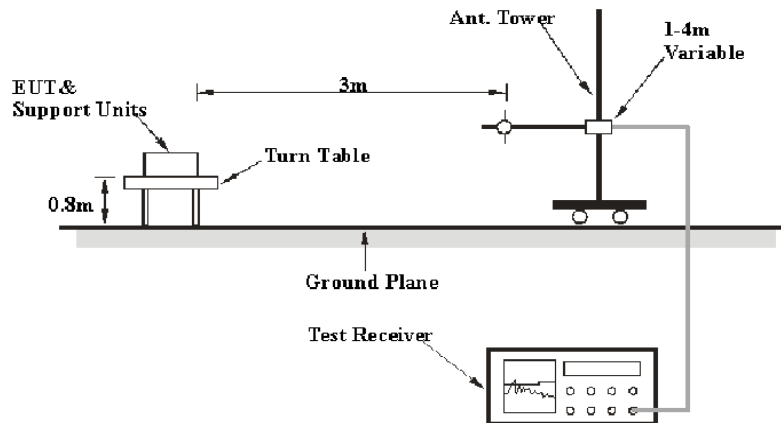
## FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

### Applicable Standard

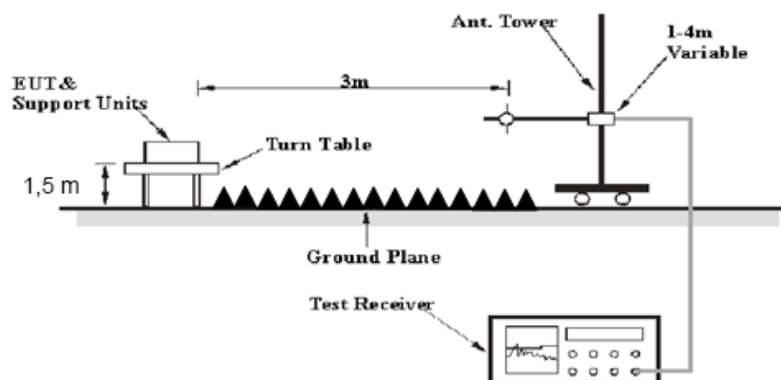
FCC §15.247 (d); §15.209; §15.205;

### EUT Setup

#### Below 1GHz:



#### Above 1GHz:



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

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

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					
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
R&S	EMI Test Receiver	ESR3	102453	2019-09-12	2020-09-12
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1400-01	2020-05-06	2021-05-06
HP	Amplifier	8447D	2727A05902	2019-09-05	2020-09-05
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Radiation Above 1GHz					
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-01 1304	2017-12-06	2020-12-05
Agilent	Spectrum Analyzer	E4440A	SG43360054	2020-05-09	2021-05-09
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-2.4J2.4J-50	C-0700-02	2019-06-27	2020-06-27
Mini-Circuit	Amplifier	ZVA-213-S+	54201245	2019-09-05	2020-09-05
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**

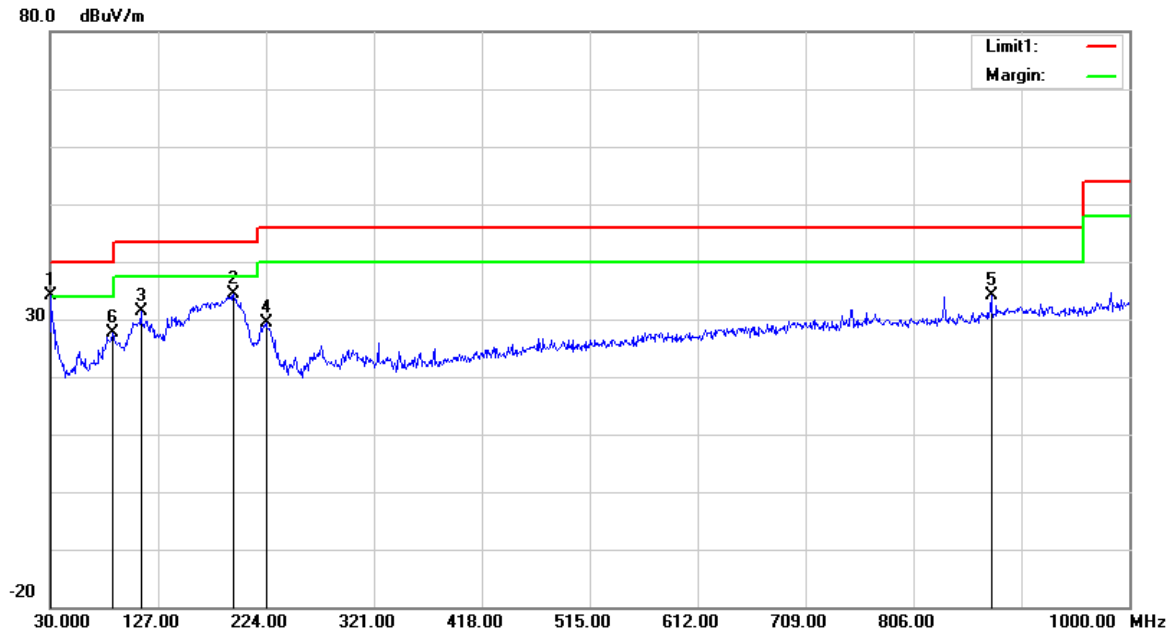
Test Items	Radiation Below 1GHz	Radiation Above 1GHz
<b>Temperature:</b>	25.5°C	23.6°C
<b>Relative Humidity:</b>	53 %	53%
<b>ATM Pressure:</b>	100.1kPa	100.9kPa
<b>Tester:</b>	Leo Long	Felix Wang
<b>Test Date:</b>	2020-06-12	2020-06-04

*Test Result: Compliance, please Refer to the following data*

*Test Mode: Transmitting*

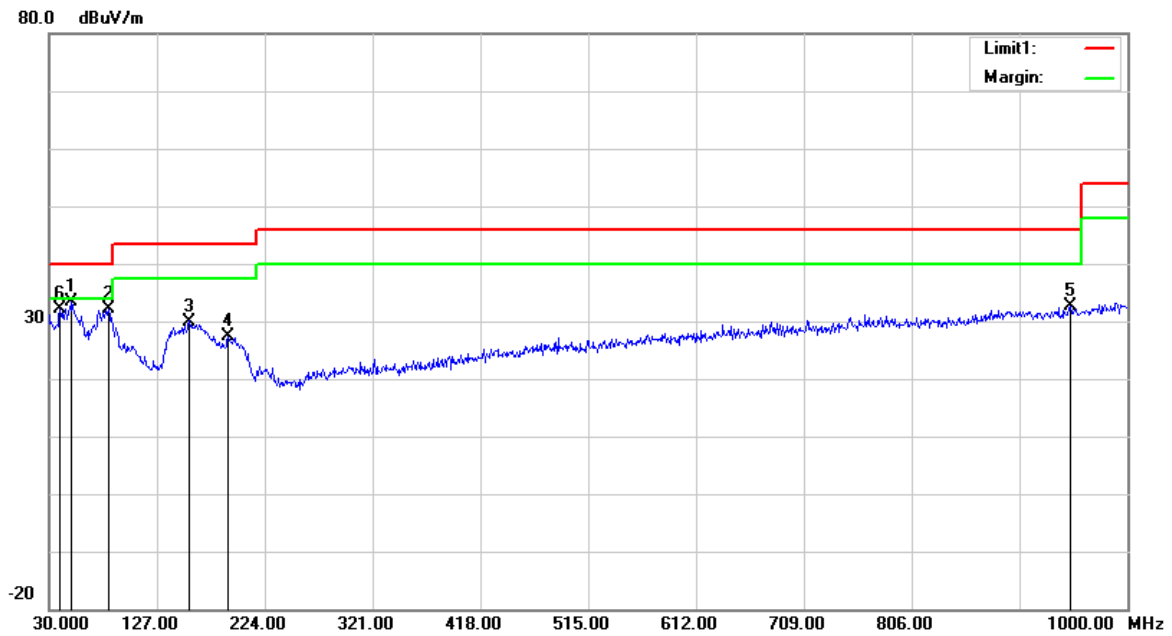
1) 30MHz-1GHz(802.11b\_Chain 1 High channel was the worst)

Horizontal:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.0000	32.53	peak	1.72	34.25	40.00	5.75
194.9000	40.98	peak	-6.70	34.28	43.50	9.22
111.4800	37.36	peak	-6.03	31.33	43.50	12.17
224.0000	36.24	peak	-6.79	29.45	46.00	16.55
875.8400	34.80	peak	-0.60	34.20	46.00	11.80
86.2600	39.06	peak	-11.42	27.64	40.00	12.36

**Vertical:**



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
50.3700	44.61	peak	-11.27	33.34	40.00	6.66
83.3500	43.43	peak	-11.34	32.09	40.00	7.91
156.1000	35.83	peak	-5.83	30.00	43.50	13.50
191.0200	34.51	peak	-7.07	27.44	43.50	16.06
948.5900	31.74	peak	0.85	32.59	46.00	13.41
39.7000	37.74	peak	-5.66	32.08	40.00	7.92

**2) 1-25GHz:  
802.11b Mode:  
Chain 0**

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
	Reading (dB $\mu$ V)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2412 MHz									
2412.00	78.13	PK	H	28.12	1.81	0.00	108.06	N/A	N/A
2412.00	75.03	AV	H	28.12	1.81	0.00	104.96	N/A	N/A
2412.00	86.98	PK	V	28.12	1.81	0.00	116.91	N/A	N/A
2412.00	83.81	AV	V	28.12	1.81	0.00	113.74	N/A	N/A
2390.00	37.26	PK	V	28.08	1.80	0.00	67.14	74.00	6.86
2390.00	24.04	AV	V	28.08	1.80	0.00	53.92	54.00	0.08
4824.00	36.46	PK	V	32.95	3.19	25.62	46.98	74.00	27.02
4824.00	24.32	AV	V	32.95	3.19	25.62	34.84	54.00	19.16
7236.00	36.69	PK	V	35.81	4.77	25.64	51.63	74.00	22.37
7236.00	24.43	AV	V	35.81	4.77	25.64	39.37	54.00	14.63
Middle Channel: 2437 MHz									
2437.00	78.02	PK	H	28.17	1.82	0.00	108.01	N/A	N/A
2437.00	74.88	AV	H	28.17	1.82	0.00	104.87	N/A	N/A
2437.00	86.71	PK	V	28.17	1.82	0.00	116.70	N/A	N/A
2437.00	82.95	AV	V	28.17	1.82	0.00	112.94	N/A	N/A
4874.00	36.41	PK	V	33.05	3.26	25.65	47.07	74.00	26.93
4874.00	24.28	AV	V	33.05	3.26	25.65	34.94	54.00	19.06
7311.00	35.90	PK	V	36.01	4.64	25.71	50.84	74.00	23.16
7311.00	23.88	AV	V	36.01	4.64	25.71	38.82	54.00	15.18
High Channel: 2462 MHz									
2462.00	77.68	PK	H	28.22	1.83	0.00	107.73	N/A	N/A
2462.00	74.27	AV	H	28.22	1.83	0.00	104.32	N/A	N/A
2462.00	86.10	PK	V	28.22	1.83	0.00	116.15	N/A	N/A
2462.00	83.10	AV	V	28.22	1.83	0.00	113.15	N/A	N/A
2483.50	32.41	PK	V	28.27	1.84	0.00	62.52	74.00	11.48
2483.50	19.50	AV	V	28.27	1.84	0.00	49.61	54.00	4.39
4924.00	36.33	PK	V	33.15	3.27	25.65	47.10	74.00	26.90
4924.00	24.23	AV	V	33.15	3.27	25.65	35.00	54.00	19.00
7386.00	36.25	PK	V	36.20	4.51	25.79	51.17	74.00	22.83
7386.00	24.18	AV	V	36.20	4.51	25.79	39.10	54.00	14.90



**Chain 1:**

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
	Reading (dB $\mu$ V)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2412 MHz									
2412.00	80.55	PK	H	28.12	1.81	0.00	110.48	N/A	N/A
2412.00	77.48	AV	H	28.12	1.81	0.00	107.41	N/A	N/A
2412.00	84.59	PK	V	28.12	1.81	0.00	114.52	N/A	N/A
2412.00	81.66	AV	V	28.12	1.81	0.00	111.59	N/A	N/A
2390.00	32.17	PK	V	28.08	1.80	0.00	62.05	74.00	11.95
2390.00	17.92	AV	V	28.08	1.80	0.00	47.80	54.00	6.20
4824.00	41.41	PK	V	32.95	3.19	25.62	51.93	74.00	22.07
4824.00	36.64	AV	V	32.95	3.19	25.62	47.16	54.00	6.84
7236.00	37.96	PK	V	35.81	4.77	25.64	52.90	74.00	21.10
7236.00	27.20	AV	V	35.81	4.77	25.64	42.14	54.00	11.86
Middle Channel: 2437 MHz									
2437.00	80.63	PK	H	28.17	1.82	0.00	110.62	N/A	N/A
2437.00	77.57	AV	H	28.17	1.82	0.00	107.56	N/A	N/A
2437.00	84.62	PK	V	28.17	1.82	0.00	114.61	N/A	N/A
2437.00	81.46	AV	V	28.17	1.82	0.00	111.45	N/A	N/A
4874.00	43.62	PK	V	33.05	3.26	25.65	54.28	74.00	19.72
4874.00	39.40	AV	V	33.05	3.26	25.65	50.06	54.00	3.94
7311.00	38.34	PK	V	36.01	4.64	25.71	53.28	74.00	20.72
7311.00	30.14	AV	V	36.01	4.64	25.71	45.08	54.00	8.92
High Channel: 2462 MHz									
2462.00	80.59	PK	H	28.22	1.83	0.00	110.64	N/A	N/A
2462.00	77.32	AV	H	28.22	1.83	0.00	107.37	N/A	N/A
2462.00	84.63	PK	V	28.22	1.83	0.00	114.68	N/A	N/A
2462.00	81.62	AV	V	28.22	1.83	0.00	111.67	N/A	N/A
2483.50	30.30	PK	V	28.27	1.84	0.00	60.41	74.00	13.59
2483.50	18.21	AV	V	28.27	1.84	0.00	48.32	54.00	5.68
4924.00	44.02	PK	V	33.15	3.27	25.65	54.79	74.00	19.21
4924.00	40.32	AV	V	33.15	3.27	25.65	51.09	54.00	2.91
7386.00	37.60	PK	V	36.20	4.51	25.79	52.52	74.00	21.48
7386.00	27.34	AV	V	36.20	4.51	25.79	42.26	54.00	11.74

**802.11g Mode:  
Chain 0**

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
	Reading (dB $\mu$ V)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2412 MHz									
2412.00	73.99	PK	H	28.12	1.81	0.00	103.92	N/A	N/A
2412.00	63.87	AV	H	28.12	1.81	0.00	93.80	N/A	N/A
2412.00	83.57	PK	V	28.12	1.81	0.00	113.50	N/A	N/A
2412.00	73.72	AV	V	28.12	1.81	0.00	103.65	N/A	N/A
2390.00	43.54	PK	V	28.08	1.80	0.00	73.42	74.00	0.58
2390.00	19.59	AV	V	28.08	1.80	0.00	49.47	54.00	4.53
4824.00	36.00	PK	V	32.95	3.19	25.62	46.52	74.00	27.48
4824.00	23.22	AV	V	32.95	3.19	25.62	33.74	54.00	20.26
7236.00	36.67	PK	V	35.81	4.77	25.64	51.61	74.00	22.39
7236.00	23.48	AV	V	35.81	4.77	25.64	38.42	54.00	15.58
Middle Channel: 2437 MHz									
2437.00	72.86	PK	H	28.17	1.82	0.00	102.85	N/A	N/A
2437.00	62.76	AV	H	28.17	1.82	0.00	92.75	N/A	N/A
2437.00	82.72	PK	V	28.17	1.82	0.00	112.71	N/A	N/A
2437.00	72.69	AV	V	28.17	1.82	0.00	102.68	N/A	N/A
4874.00	36.03	PK	V	33.05	3.26	25.65	46.69	74.00	27.31
4874.00	23.26	AV	V	33.05	3.26	25.65	33.92	54.00	20.08
7311.00	36.81	PK	V	36.01	4.64	25.71	51.75	74.00	22.25
7311.00	23.74	AV	V	36.01	4.64	25.71	38.68	54.00	15.32
High Channel: 2462 MHz									
2462.00	71.23	PK	H	28.22	1.83	0.00	101.28	N/A	N/A
2462.00	60.69	AV	H	28.22	1.83	0.00	90.74	N/A	N/A
2462.00	81.12	PK	V	28.22	1.83	0.00	111.17	N/A	N/A
2462.00	70.80	AV	V	28.22	1.83	0.00	100.85	N/A	N/A
2483.50	43.05	PK	V	28.27	1.84	0.00	73.16	74.00	0.84
2483.50	16.50	AV	V	28.27	1.84	0.00	46.61	54.00	7.39
4924.00	35.56	PK	V	33.15	3.27	25.65	46.33	74.00	27.67
4924.00	22.87	AV	V	33.15	3.27	25.65	33.64	54.00	20.36
7386.00	35.88	PK	V	36.20	4.51	25.79	50.80	74.00	23.20
7386.00	23.11	AV	V	36.20	4.51	25.79	38.03	54.00	15.97

**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	75.58	PK	H	28.12	1.81	0.00	105.51	N/A	N/A
2412.00	66.23	AV	H	28.12	1.81	0.00	96.16	N/A	N/A
2412.00	80.81	PK	V	28.12	1.81	0.00	110.74	N/A	N/A
2412.00	71.10	AV	V	28.12	1.81	0.00	101.03	N/A	N/A
2390.00	42.01	PK	V	28.08	1.80	0.00	71.89	74.00	2.11
2390.00	15.72	AV	V	28.08	1.80	0.00	45.60	54.00	8.40
4824.00	36.03	PK	V	32.95	3.19	25.62	46.55	74.00	27.45
4824.00	23.33	AV	V	32.95	3.19	25.62	33.85	54.00	20.15
7236.00	36.76	PK	V	35.81	4.77	25.64	51.70	74.00	22.30
7236.00	23.77	AV	V	35.81	4.77	25.64	38.71	54.00	15.29
Middle Channel: 2437 MHz									
2437.00	76.42	PK	H	28.17	1.82	0.00	106.41	N/A	N/A
2437.00	66.37	AV	H	28.17	1.82	0.00	96.36	N/A	N/A
2437.00	81.55	PK	V	28.17	1.82	0.00	111.54	N/A	N/A
2437.00	71.63	AV	V	28.17	1.82	0.00	101.62	N/A	N/A
4874.00	36.08	PK	V	33.05	3.26	25.65	46.74	74.00	27.26
4874.00	23.38	AV	V	33.05	3.26	25.65	34.04	54.00	19.96
7311.00	35.53	PK	V	36.01	4.64	25.71	50.47	74.00	23.53
7311.00	23.12	AV	V	36.01	4.64	25.71	38.06	54.00	15.94
High Channel: 2462 MHz									
2462.00	75.32	PK	H	28.22	1.83	0.00	105.37	N/A	N/A
2462.00	65.34	AV	H	28.22	1.83	0.00	95.39	N/A	N/A
2462.00	80.58	PK	V	28.22	1.83	0.00	110.63	N/A	N/A
2462.00	70.66	AV	V	28.22	1.83	0.00	100.71	N/A	N/A
2483.50	43.39	PK	V	28.27	1.84	0.00	73.50	74.00	0.50
2483.50	16.41	AV	V	28.27	1.84	0.00	46.52	54.00	7.48
4924.00	35.97	PK	V	33.15	3.27	25.65	46.74	74.00	27.26
4924.00	23.22	AV	V	33.15	3.27	25.65	33.99	54.00	20.01
7386.00	35.90	PK	V	36.20	4.51	25.79	50.82	74.00	23.18
7386.00	23.18	AV	V	36.20	4.51	25.79	38.10	54.00	15.90

**802.11n ht20 Mode (2Tx Beamforming mode was the worst):**

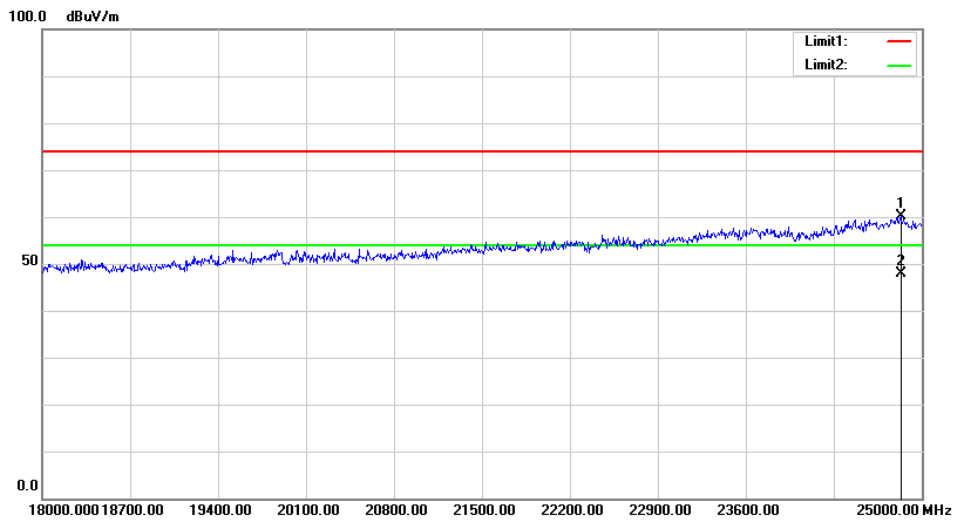
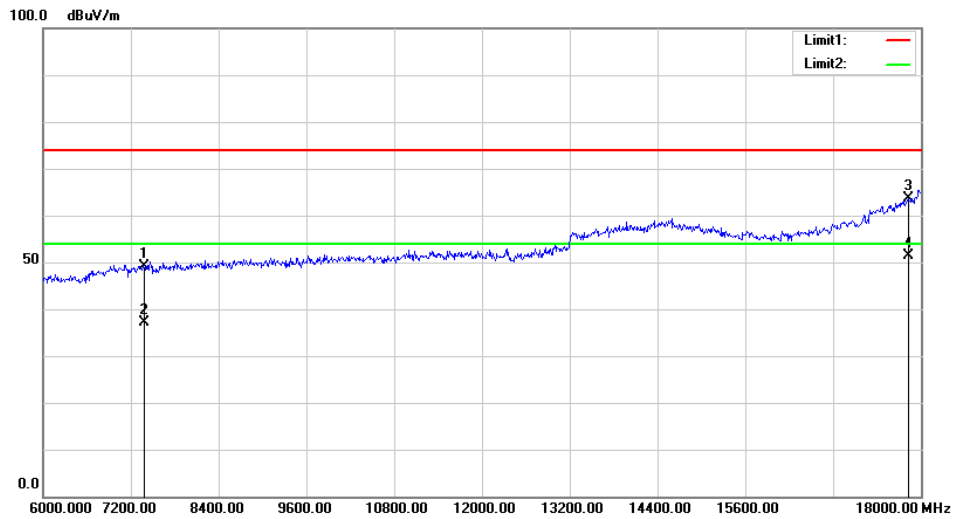
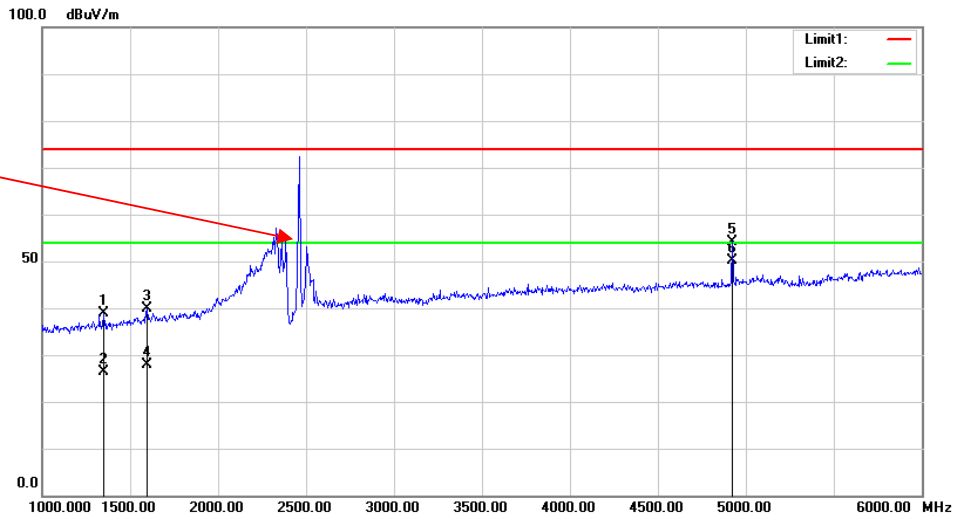
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
	Reading (dB $\mu$ V)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2412 MHz									
2412.00	73.28	PK	H	28.12	1.81	0.00	103.21	N/A	N/A
2412.00	63.57	AV	H	28.12	1.81	0.00	93.50	N/A	N/A
2412.00	83.03	PK	V	28.12	1.81	0.00	112.96	N/A	N/A
2412.00	73.35	AV	V	28.12	1.81	0.00	103.28	N/A	N/A
2390.00	43.14	PK	V	28.08	1.80	0.00	73.02	74.00	0.98
2390.00	21.60	AV	V	28.08	1.80	0.00	51.48	54.00	2.52
4824.00	36.07	PK	V	32.95	3.19	25.62	46.59	74.00	27.41
4824.00	23.39	AV	V	32.95	3.19	25.62	33.91	54.00	20.09
7236.00	35.93	PK	V	35.81	4.77	25.64	50.87	74.00	23.13
7236.00	23.15	AV	V	35.81	4.77	25.64	38.09	54.00	15.91
Middle Channel: 2437 MHz									
2437.00	73.65	PK	H	28.17	1.82	0.00	103.64	N/A	N/A
2437.00	63.58	AV	H	28.17	1.82	0.00	93.57	N/A	N/A
2437.00	83.57	PK	V	28.17	1.82	0.00	113.56	N/A	N/A
2437.00	73.69	AV	V	28.17	1.82	0.00	103.68	N/A	N/A
4874.00	35.89	PK	V	33.05	3.26	25.65	46.55	74.00	27.45
4874.00	23.08	AV	V	33.05	3.26	25.65	33.74	54.00	20.26
7311.00	35.62	PK	V	36.01	4.64	25.71	50.56	74.00	23.44
7311.00	22.87	AV	V	36.01	4.64	25.71	37.81	54.00	16.19
High Channel: 2462 MHz									
2462.00	72.78	PK	H	28.22	1.83	0.00	102.83	N/A	N/A
2462.00	62.73	AV	H	28.22	1.83	0.00	92.78	N/A	N/A
2462.00	82.58	PK	V	28.22	1.83	0.00	112.63	N/A	N/A
2462.00	72.52	AV	V	28.22	1.83	0.00	102.57	N/A	N/A
2483.50	43.18	PK	V	28.27	1.84	0.00	73.29	74.00	0.71
2483.50	18.51	AV	V	28.27	1.84	0.00	48.62	54.00	5.38
4924.00	35.91	PK	V	33.15	3.27	25.65	46.68	74.00	27.32
4924.00	23.12	AV	V	33.15	3.27	25.65	33.89	54.00	20.11
7386.00	36.25	PK	V	36.20	4.51	25.79	51.17	74.00	22.83
7386.00	23.83	AV	V	36.20	4.51	25.79	38.75	54.00	15.25

**802.11n ht40 Mode (2Tx Beamforming mode was the worst):**

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
	Reading (dB $\mu$ V)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2422 MHz									
2422.00	71.49	PK	H	28.14	1.81	0.00	101.44	N/A	N/A
2422.00	61.38	AV	H	28.14	1.81	0.00	91.33	N/A	N/A
2422.00	80.67	PK	V	28.14	1.81	0.00	110.62	N/A	N/A
2422.00	70.59	AV	V	28.14	1.81	0.00	100.54	N/A	N/A
2390.00	43.11	PK	V	28.08	1.80	0.00	72.99	74.00	1.01
2390.00	19.70	AV	V	28.08	1.80	0.00	49.58	54.00	4.42
4844.00	36.11	PK	V	32.99	3.22	25.63	46.69	74.00	27.31
4844.00	23.54	AV	V	32.99	3.22	25.63	34.12	54.00	19.88
7266.00	35.91	PK	V	35.89	4.72	25.67	50.85	74.00	23.15
7266.00	23.21	AV	V	35.89	4.72	25.67	38.15	54.00	15.85
Middle Channel: 2437 MHz									
2437.00	70.64	PK	H	28.17	1.82	0.00	100.63	N/A	N/A
2437.00	60.52	AV	H	28.17	1.82	0.00	90.51	N/A	N/A
2437.00	79.74	PK	V	28.17	1.82	0.00	109.73	N/A	N/A
2437.00	69.57	AV	V	28.17	1.82	0.00	99.56	N/A	N/A
4874.00	36.32	PK	V	33.05	3.26	25.65	46.98	74.00	27.02
4874.00	23.65	AV	V	33.05	3.26	25.65	34.31	54.00	19.69
7311.00	36.01	PK	V	36.01	4.64	25.71	50.95	74.00	23.05
7311.00	23.17	AV	V	36.01	4.64	25.71	38.11	54.00	15.89
High Channel: 2452 MHz									
2452.00	71.53	PK	H	28.20	1.83	0.00	101.56	N/A	N/A
2452.00	61.45	AV	H	28.20	1.83	0.00	91.48	N/A	N/A
2452.00	80.71	PK	V	28.20	1.83	0.00	110.74	N/A	N/A
2452.00	70.66	AV	V	28.20	1.83	0.00	100.69	N/A	N/A
2483.50	42.33	PK	V	28.27	1.84	0.00	72.44	74.00	1.56
2483.50	20.18	AV	V	28.27	1.84	0.00	50.29	54.00	3.71
4904.00	36.46	PK	V	33.11	3.30	25.67	47.20	74.00	26.80
4904.00	23.77	AV	V	33.11	3.30	25.67	34.51	54.00	19.49
7356.00	36.54	PK	V	36.13	4.56	25.76	51.47	74.00	22.53
7356.00	23.82	AV	V	36.13	4.56	25.76	38.75	54.00	15.25

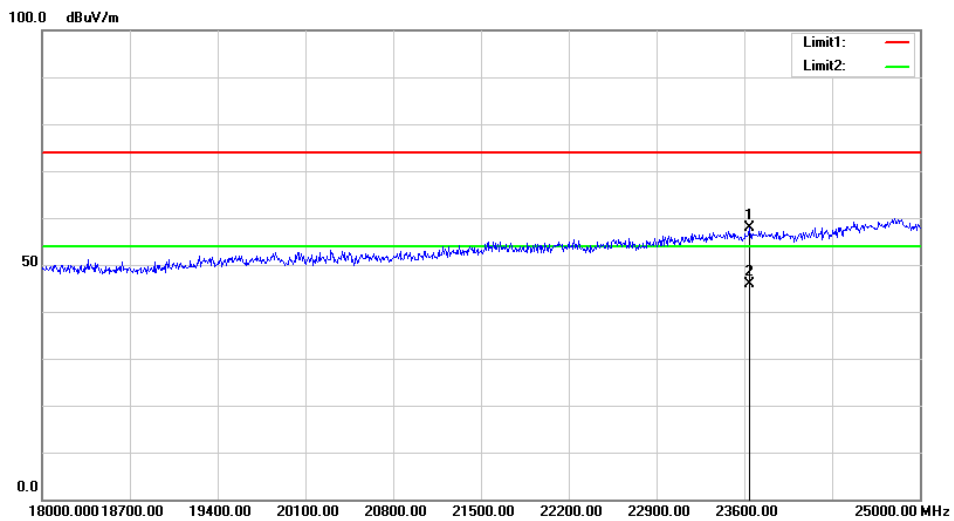
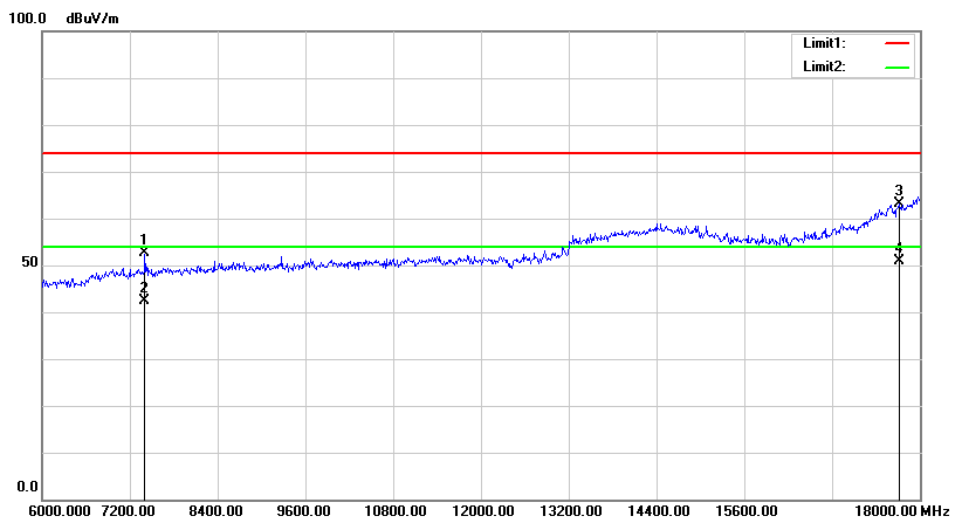
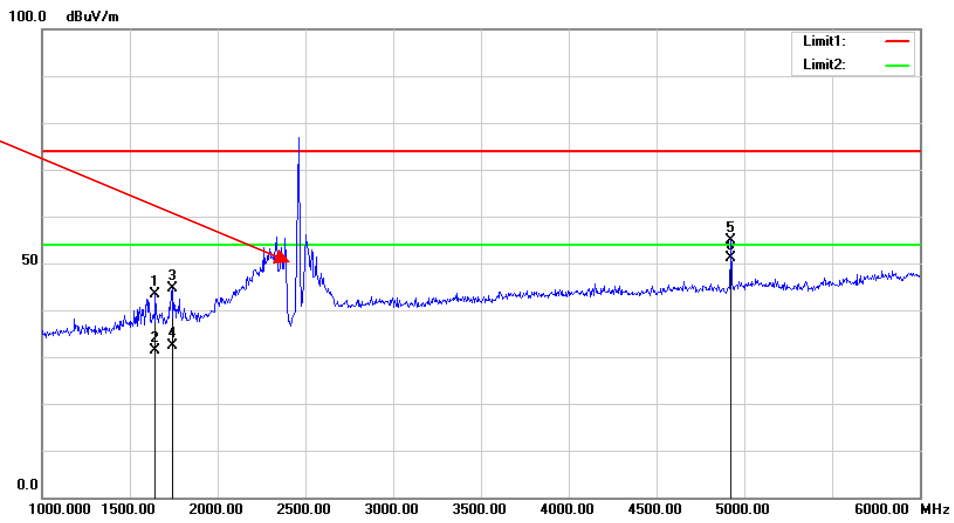
**Test plots(802.11b Chain 1, High channel was the worst)  
Horizontal:**

Fundamental  
Test with Band  
Rejection Filter



Vertical:

Fundamental Test with Band Rejection Filter



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

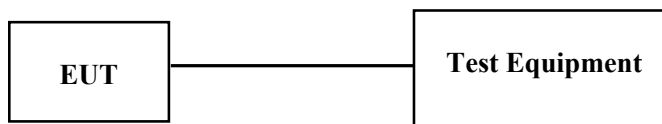
### Applicable Standard

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

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) 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	EMI Test Receiver	ESCI	100035	2019-09-19	2020-09-19
Unknown	Coaxial Cable	C-SJ00-0010	C0010/03	Each time	N/A

\* **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:	27.6 °C
Relative Humidity:	71%
ATM Pressure:	100.4 kPa
Test by:	Chris Mo
Test Date:	2020-06-03



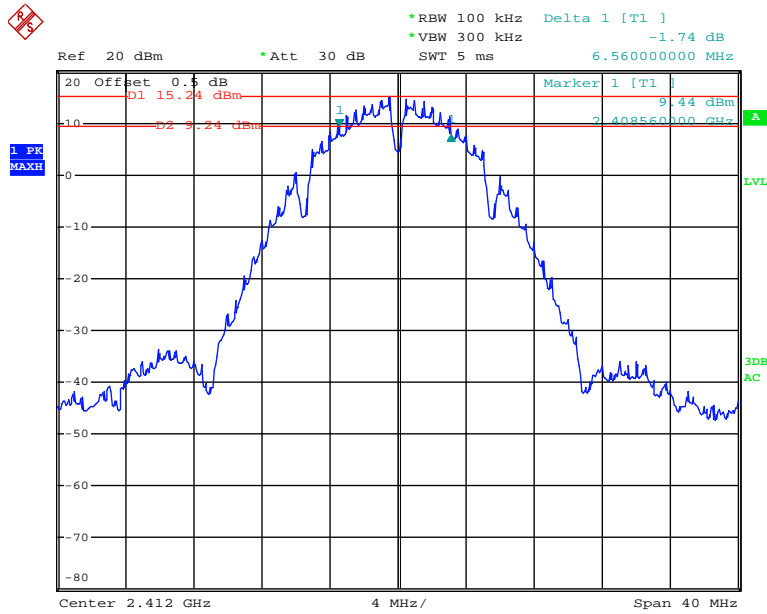
*Test Mode: Transmitting*

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

Test mode	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Limit (MHz)
802.11b	Low	2412	6.560	11.840	$\geq 0.5$
	Middle	2437	6.960	11.840	$\geq 0.5$
	High	2462	6.640	12.000	$\geq 0.5$
802.11g	Low	2412	15.120	16.240	$\geq 0.5$
	Middle	2437	14.640	16.240	$\geq 0.5$
	High	2462	15.200	16.240	$\geq 0.5$
802.11n ht20	Low	2412	15.200	17.360	$\geq 0.5$
	Middle	2437	15.200	17.360	$\geq 0.5$
	High	2462	15.200	17.360	$\geq 0.5$
802.11n ht40	Low	2422	32.480	36.640	$\geq 0.5$
	Middle	2437	32.480	36.480	$\geq 0.5$
	High	2452	31.200	36.480	$\geq 0.5$

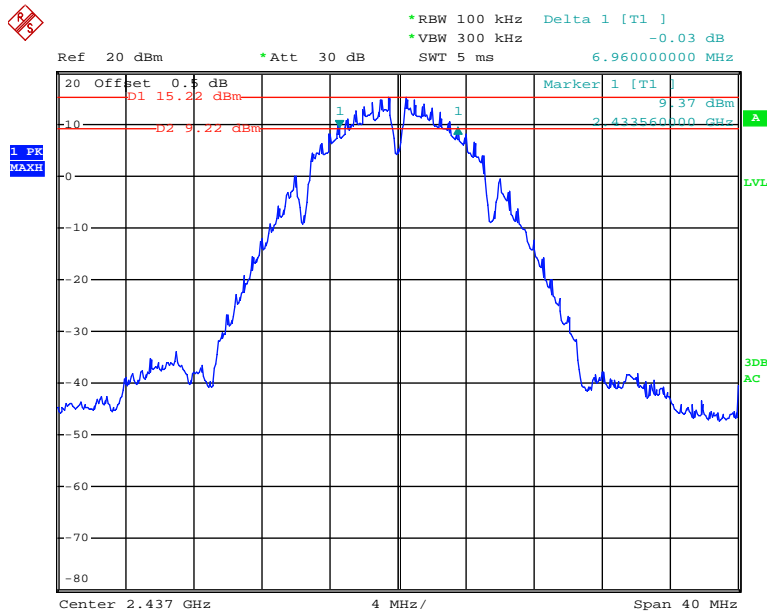
6dB Emission Bandwidth:

802.11b Low Channel



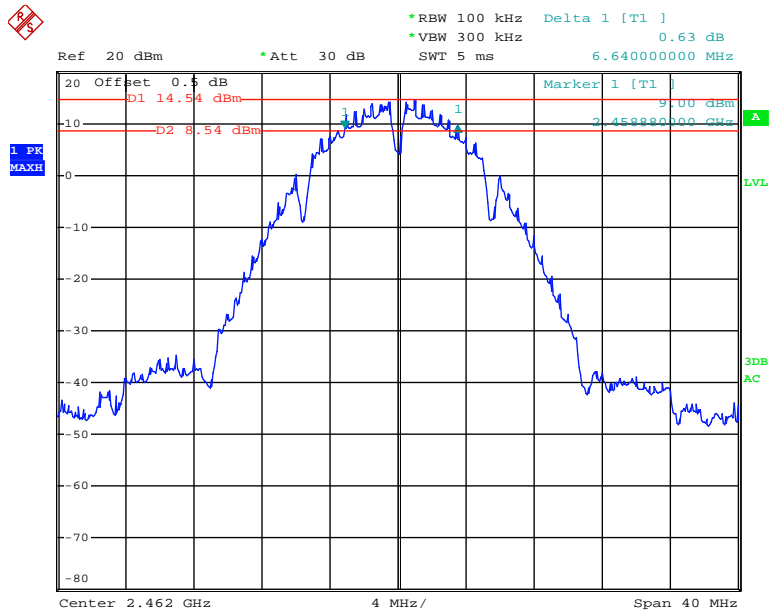
Date: 3.JUN.2020 12:26:31

802.11b Middle Channel



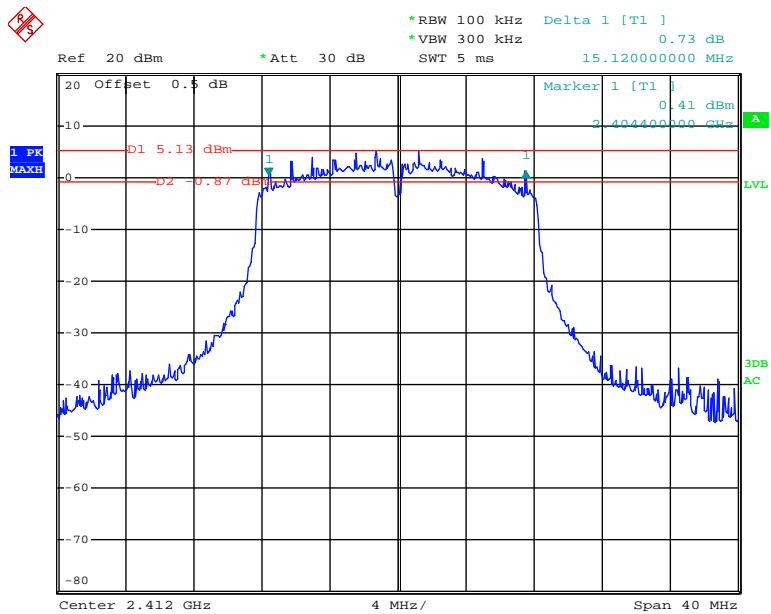
Date: 3.JUN.2020 12:28:06

### 802.11b High Channel



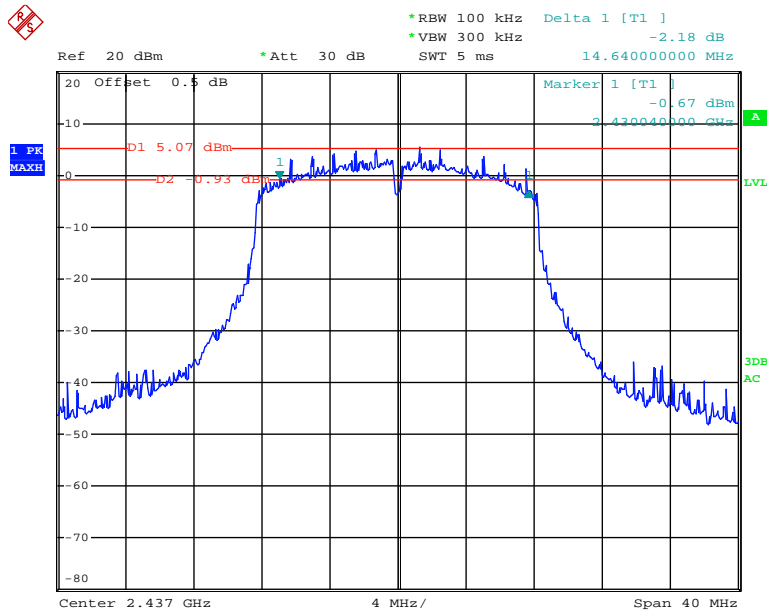
Date: 3.JUN.2020 12:40:13

### 802.11g Low Channel



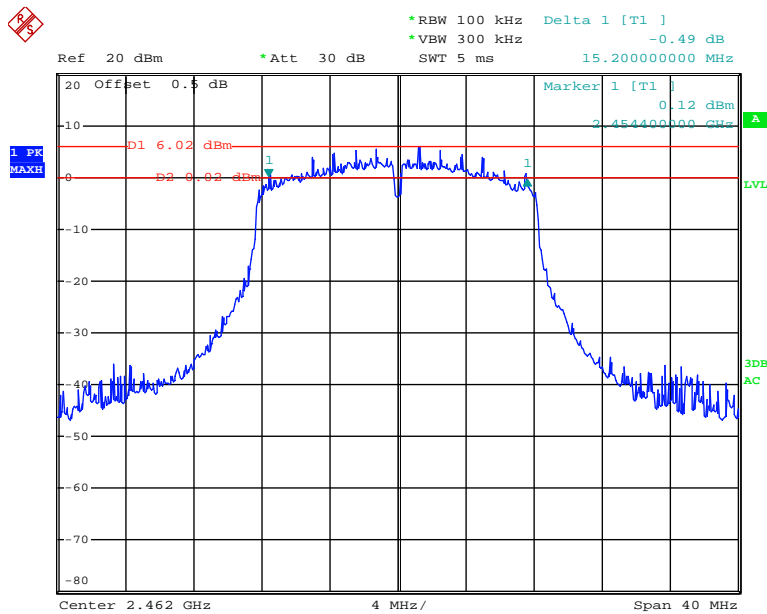
Date: 3.JUN.2020 12:32:06

### 802.11g Middle Channel



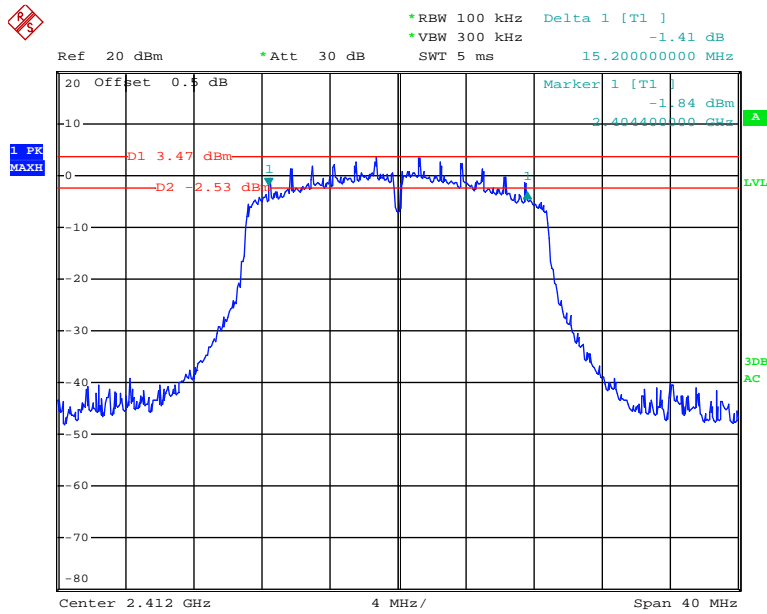
Date: 3.JUN.2020 12:34:13

### 802.11g High Channel



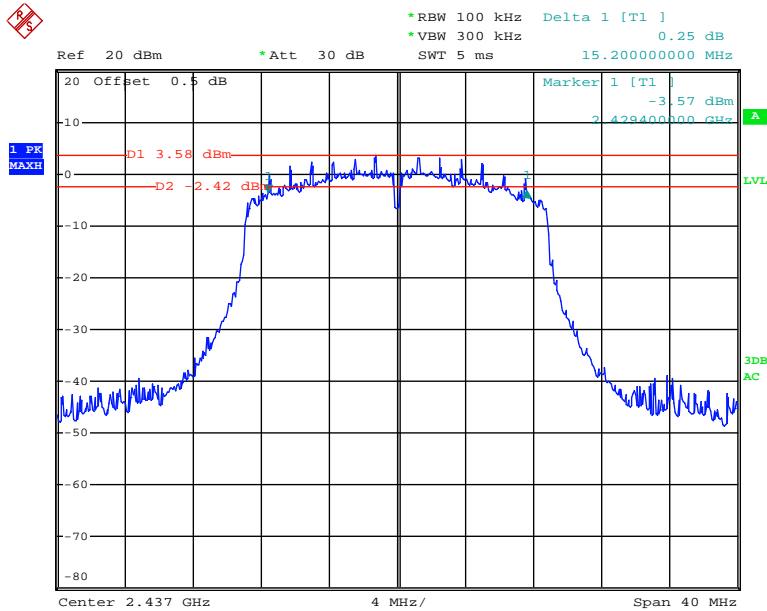
Date: 3.JUN.2020 12:37:59

### 802.11n ht20 Low Channel



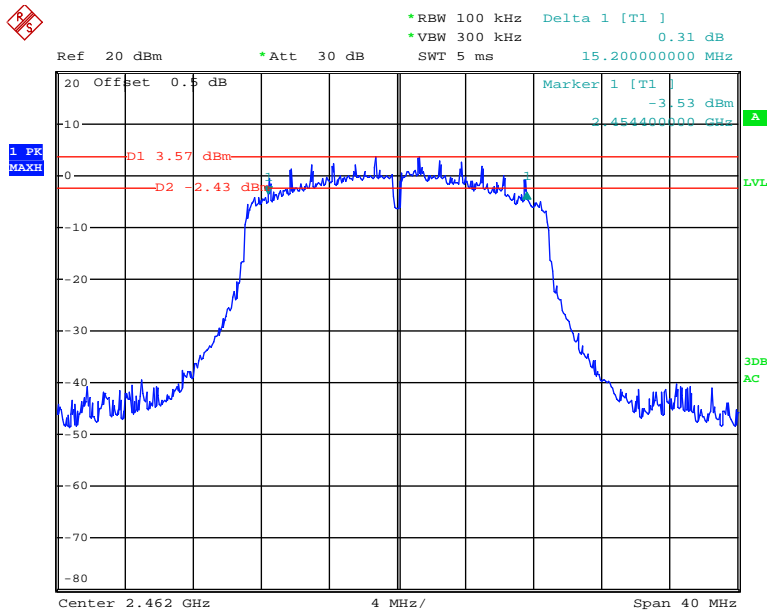
Date: 3.JUN.2020 12:41:50

### 802.11n ht20 Middle Channel



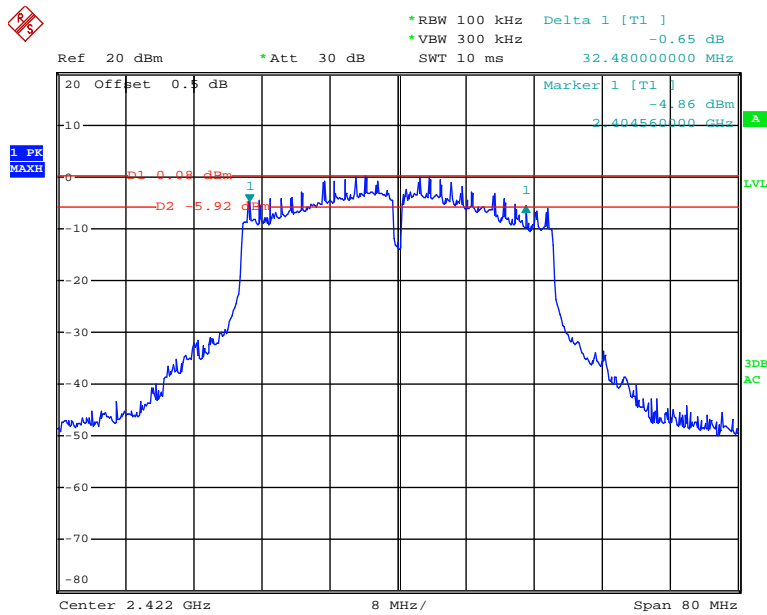
Date: 3.JUN.2020 12:43:34

### 802.11n ht20 High Channel



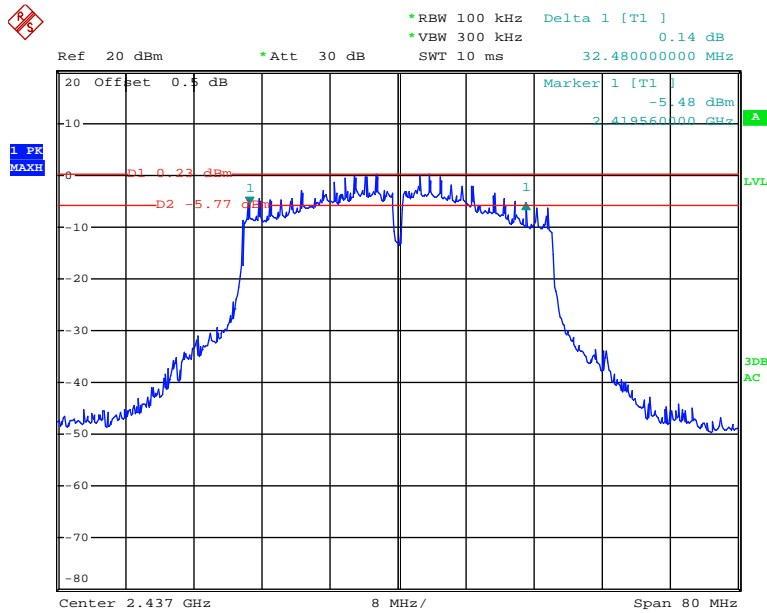
Date: 3.JUN.2020 12:46:04

### 802.11n ht40 Low Channel



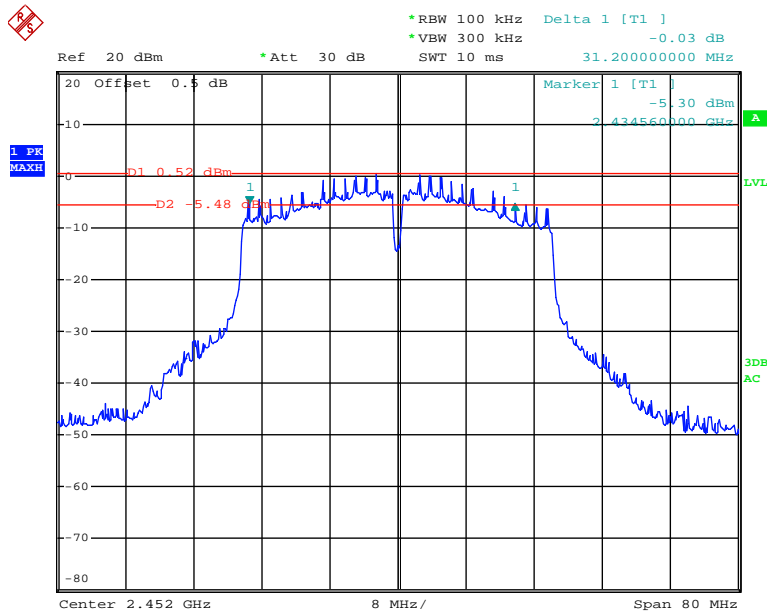
Date: 3.JUN.2020 12:48:40

### 802.11n ht40 Middle Channel



Date: 3.JUN.2020 12:51:15

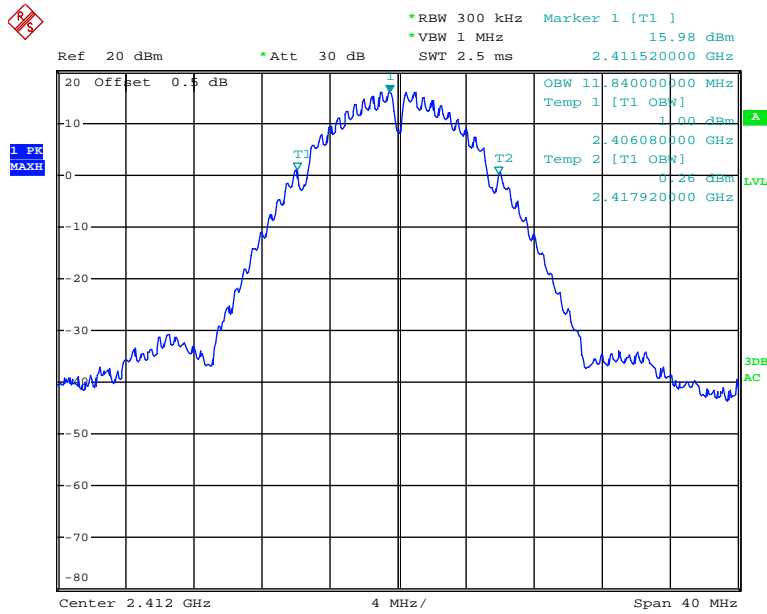
### 802.11n ht40 High Channel



Date: 3.JUN.2020 12:54:15

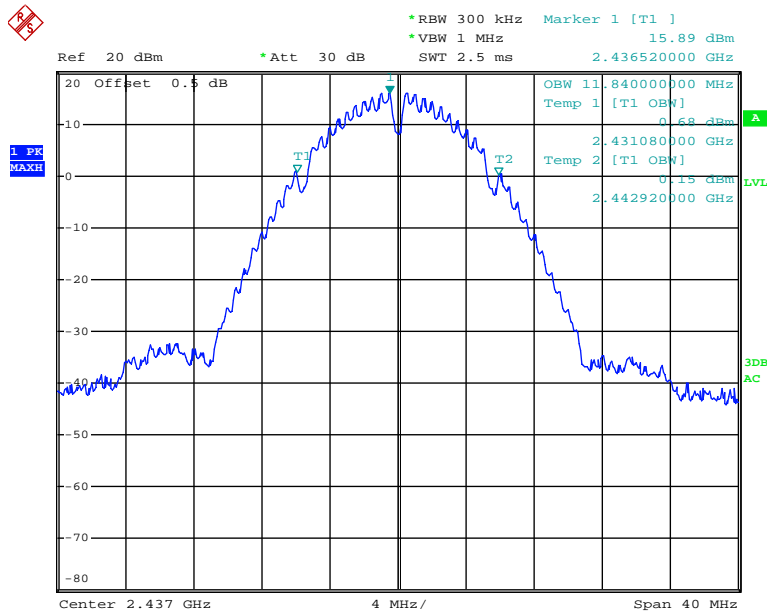
99% Occupied Bandwidth:

802.11b Low Channel



Date: 3.JUN.2020 12:26:44

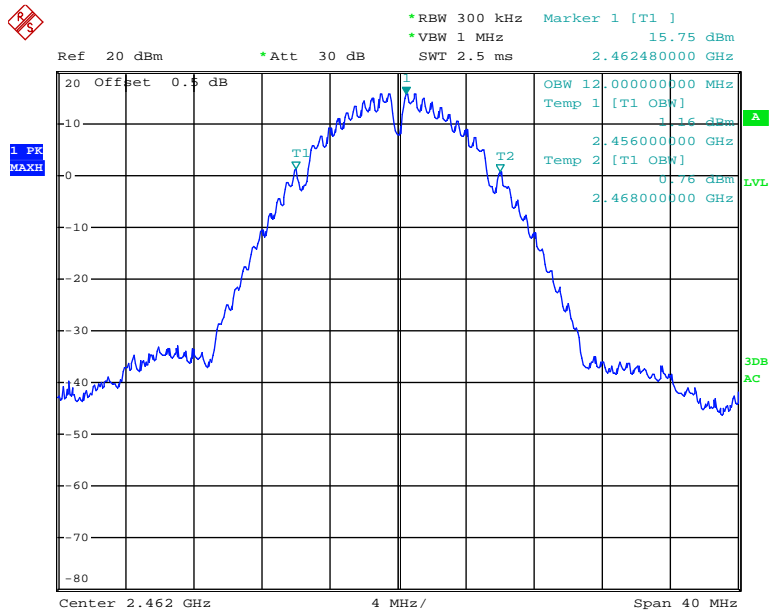
802.11b Middle Channel



Date: 3.JUN.2020 12:28:15

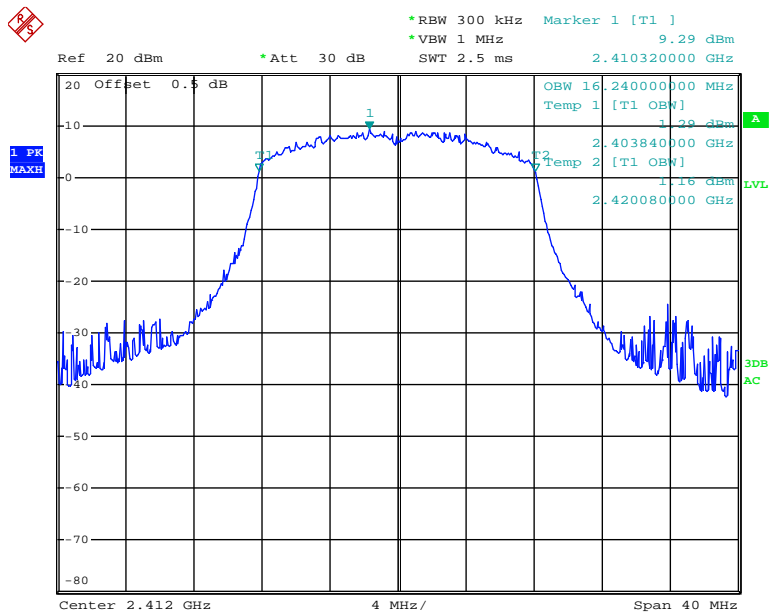


### 802.11b High Channel



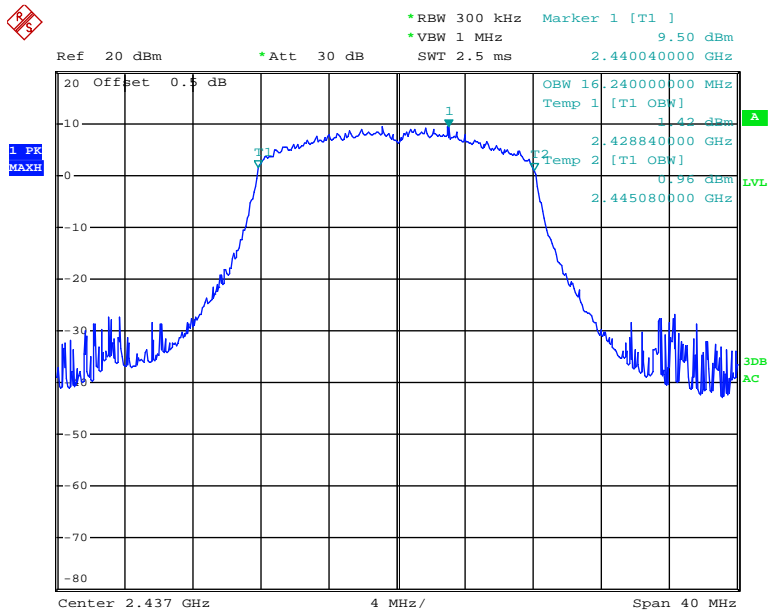
Date: 3.JUN.2020 12:40:22

### 802.11g Low Channel



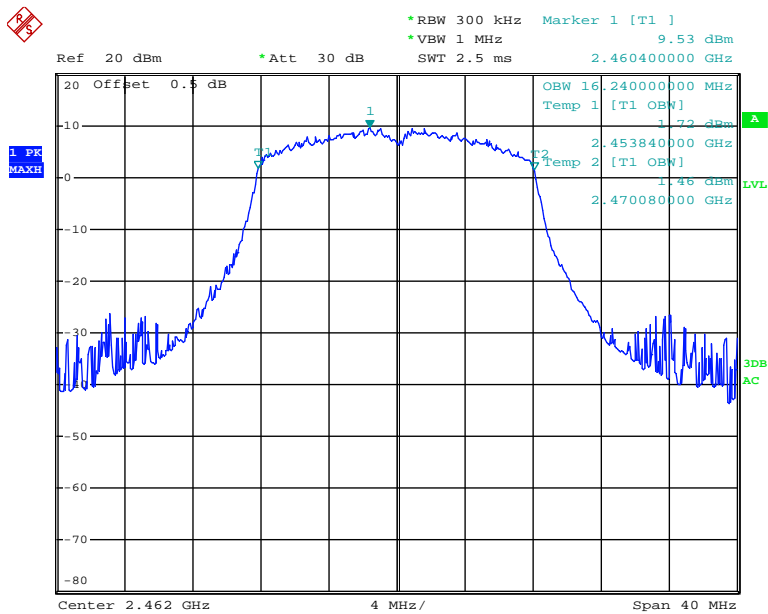
Date: 3.JUN.2020 12:32:28

### 802.11g Middle Channel



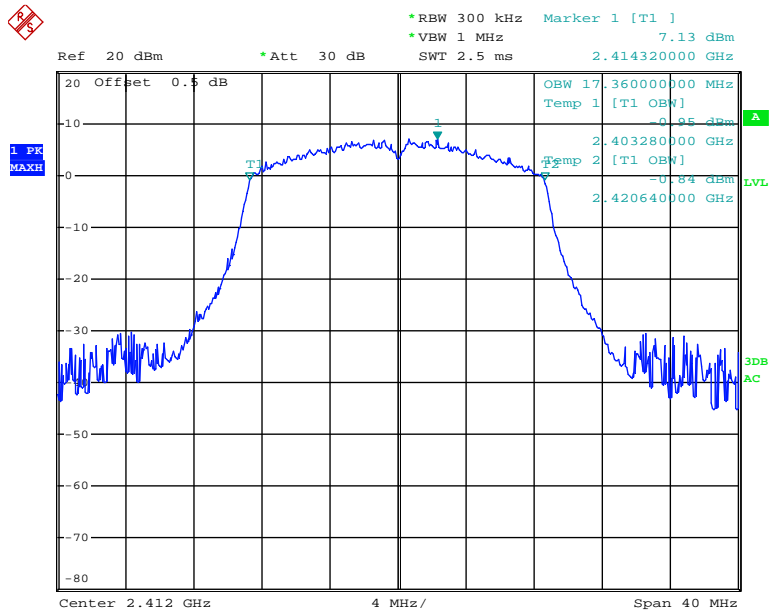
Date: 3.JUN.2020 12:34:32

### 802.11g High Channel



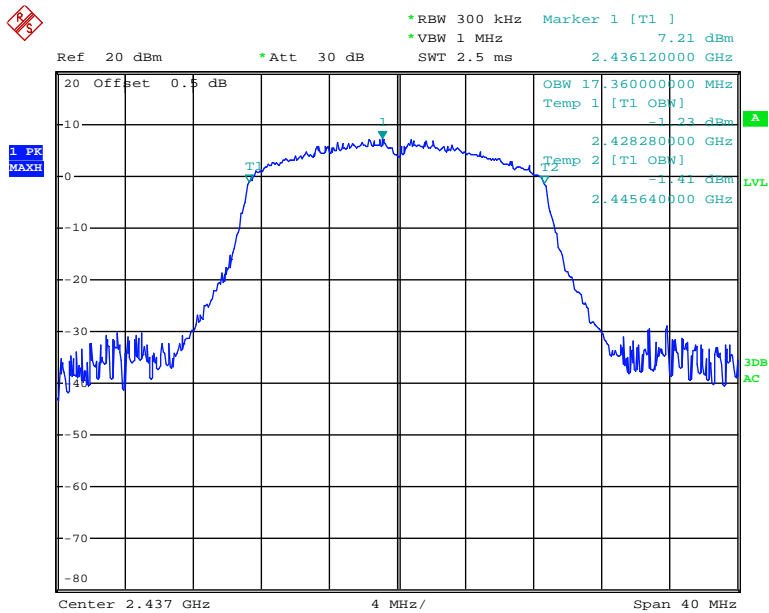
Date: 3.JUN.2020 12:38:18

### 802.11n ht20 Low Channel



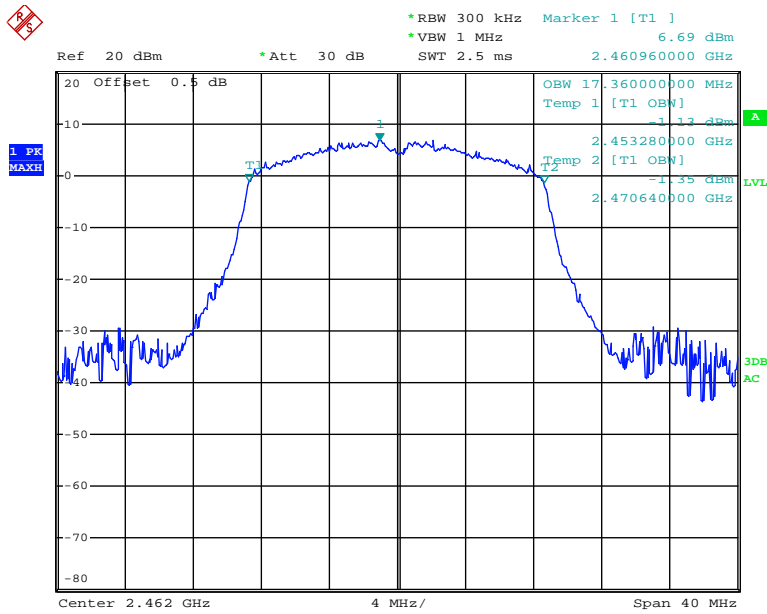
Date: 3.JUN.2020 12:42:06

### 802.11n ht20 Middle Channel



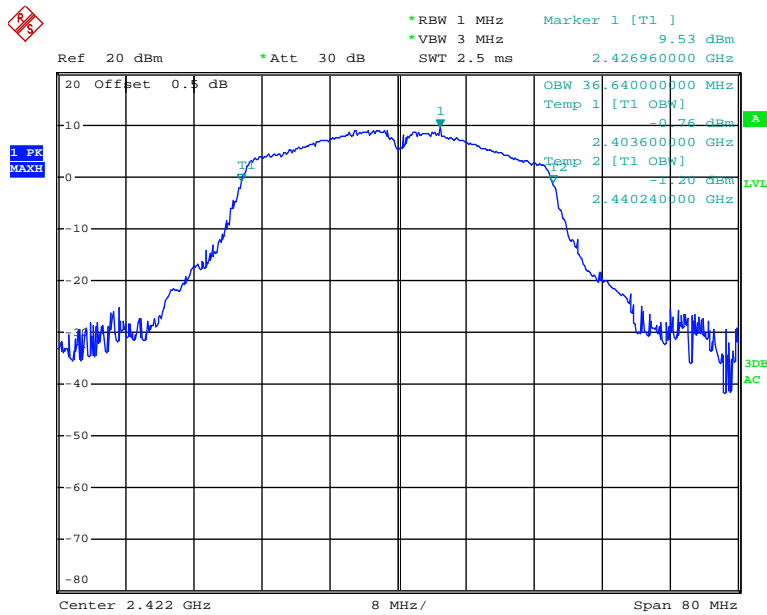
Date: 3.JUN.2020 12:43:57

### 802.11n ht20 High Channel



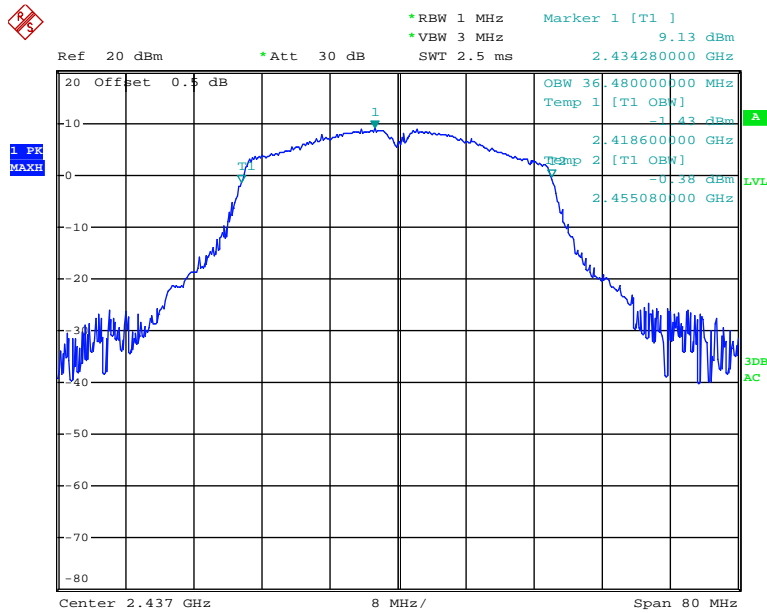
Date: 3.JUN.2020 12:46:30

### 802.11n ht40 Low Channel



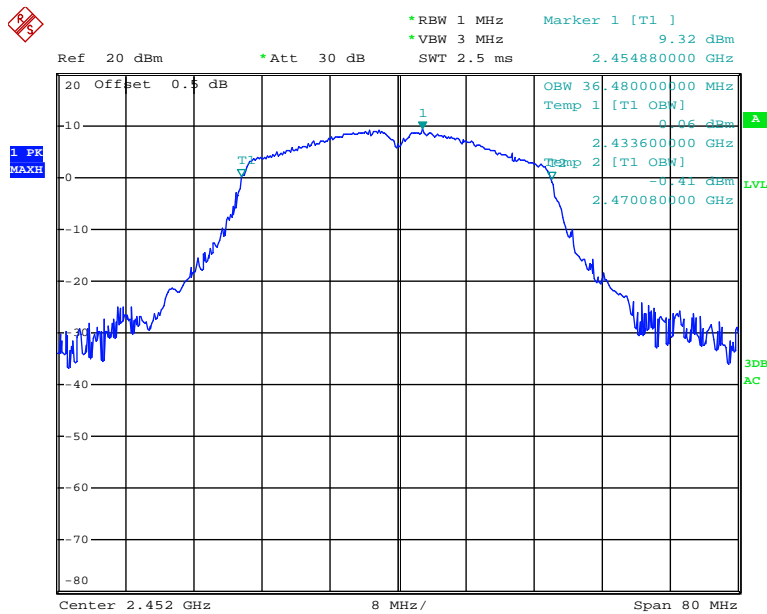
Date: 3.JUN.2020 12:48:59

### 802.11n ht40 Middle Channel



Date: 3.JUN.2020 12:51:31

### 802.11n ht40 High Channel



Date: 3.JUN.2020 12:54:37

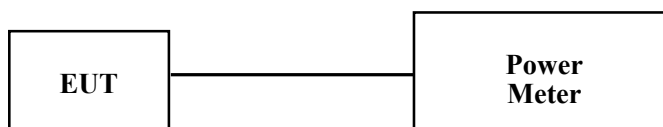
## **FCC §15.247(b) (3) - MAXIMUM PEAK CONDUCTED OUTPUT POWER**

### **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 average output power, record the result as average power.



### **Test Equipment List and Details**

<b>Manufacturer</b>	<b>Description</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration Date</b>	<b>Calibration Due Date</b>
Unknown	Attenuator	UNAT-3+	15529	Each time	N/A
Unknown	Coaxial Cable	C-SJ00-0010	C0010/03	Each time	N/A
Agilent	USB Wideband Power Sensor	U2021XA	MY5425009	2020-05-09	2021-05-09

\* **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**

<b>Temperature:</b>	27.6 °C
<b>Relative Humidity:</b>	71 %
<b>ATM Pressure:</b>	100.4 kPa
<b>Test by:</b>	Chris Mo
<b>Test Date:</b>	2020-06-03

*Test Mode: Transmitting*

*Test Result: Compliance. Please refer to the following table.*

Mode	Channel	Frequency (MHz)	Conducted Peak Output Power (dBm)			Limit For Non-beamforming (dBm)	Limit For Beamforming (dBm)
			Chain 0	Chain 1	Total		
802.11 b	Low	2412	27.17	26.51	/	30	/
	Middle	2437	27.07	27.07	/	30	/
	High	2462	27.12	26.98	/	30	/
802.11 g	Low	2412	26.53	27.19	/	30	/
	Middle	2437	26.48	27.12	/	30	/
	High	2462	26.72	27.26	/	30	/
802.11n ht20	Low	2412	23.93	23.34	26.66	30	29
	Middle	2437	23.98	23.86	26.93	30	29
	High	2462	23.81	23.78	26.81	30	29
802.11n ht40	Low	2422	22.45	22.31	25.39	30	29
	Middle	2437	22.29	22.89	25.61	30	29
	High	2452	22.11	23.16	25.68	30	29

Note:

The maximum antenna gain is 4dBi in 2.4GHz band. 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:

For Non-beamforming mode:

Directional gain = 4dBi

For Beamforming mode:

Directional gain = 4+3 =7 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**

<b>Manufacturer</b>	<b>Description</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration Date</b>	<b>Calibration Due Date</b>
R&S	EMI Test Receiver	ESCI	100035	2019-09-19	2020-09-19
Unknown	Coaxial Cable	C-SJ00-0010	C0010/03	Each time	N/A

\* **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**

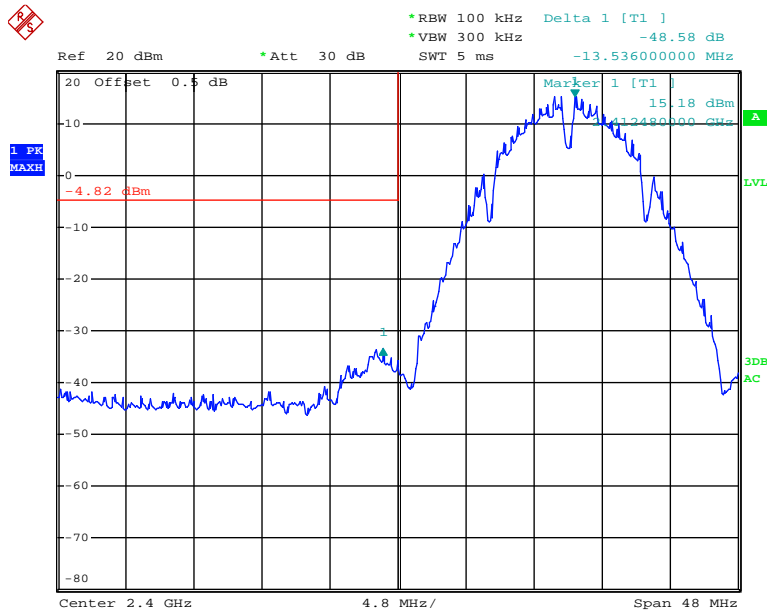
**Environmental Conditions**

<b>Temperature:</b>	27.6 °C
<b>Relative Humidity:</b>	71%
<b>ATM Pressure:</b>	100.4 kPa
<b>Test by:</b>	Chris Mo
<b>Test Date:</b>	2020-06-03

Test mode: Transmitting

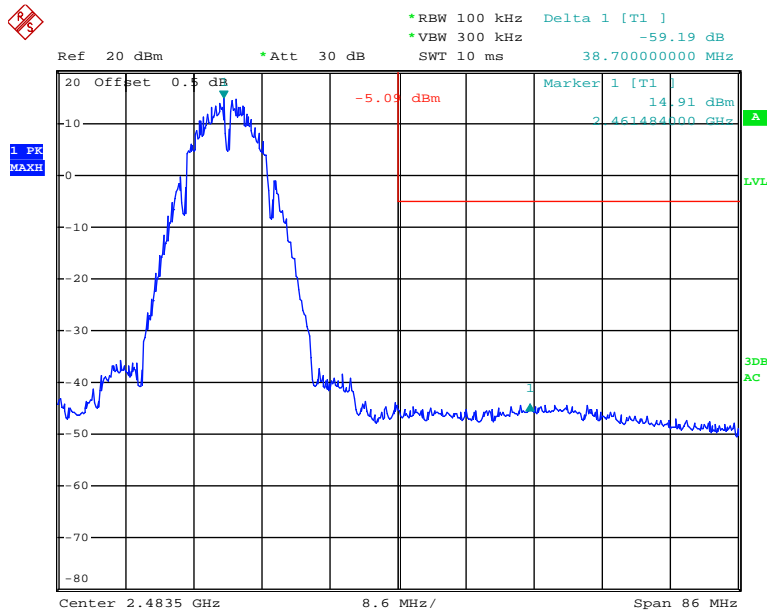
Test Result: Compliance. Please refer to following plots.

**Chain 0, 802.11b: Band Edge, Left Side**



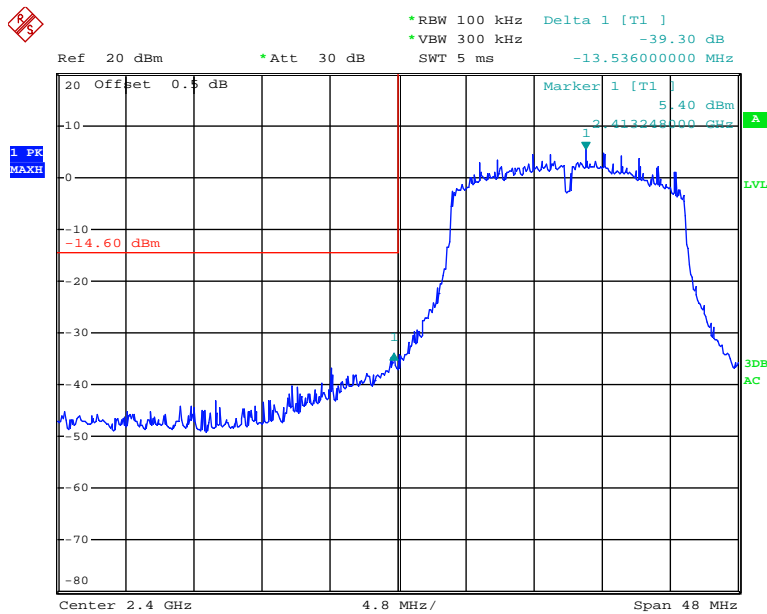
Date: 3.JUN.2020 12:27:14

### Chain 0,802.11b: Band Edge, Right Side



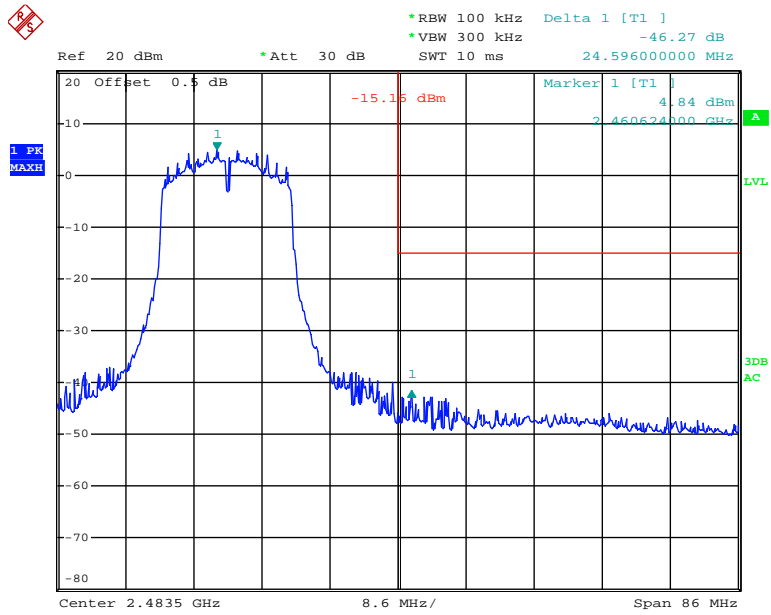
Date: 3.JUN.2020 12:40:53

### Chain 0,802.11g: Band Edge, Left Side



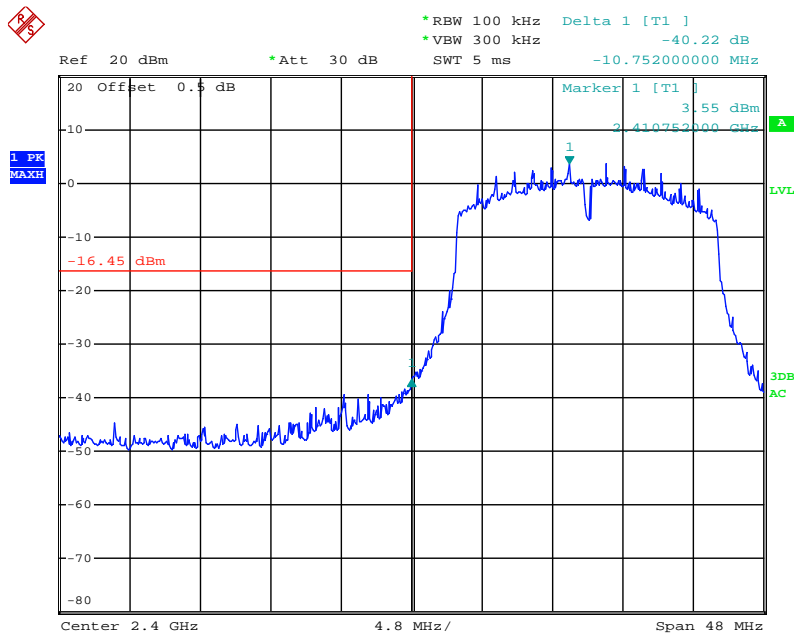
Date: 3.JUN.2020 12:33:25

### Chain 0,802.11g: Band Edge, Right Side



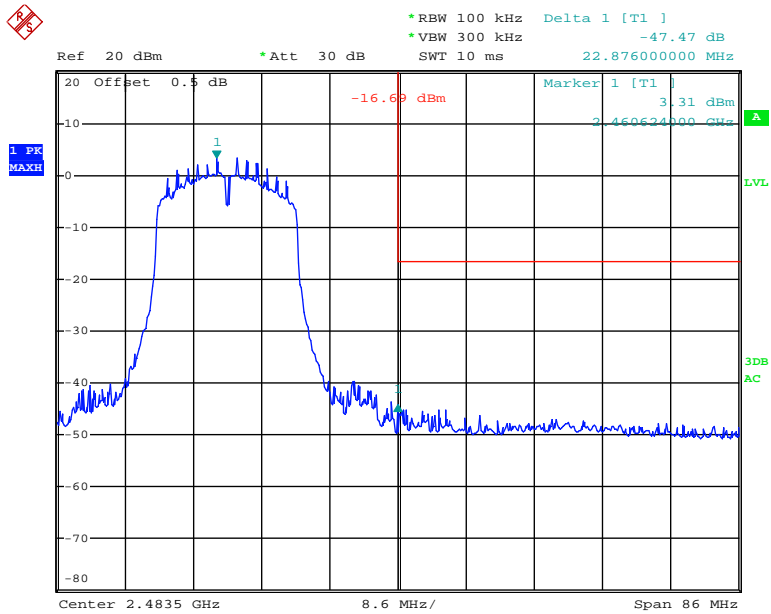
Date: 3.JUN.2020 12:39:06

### Chain 0,802.11n ht20 Band Edge, Left Side



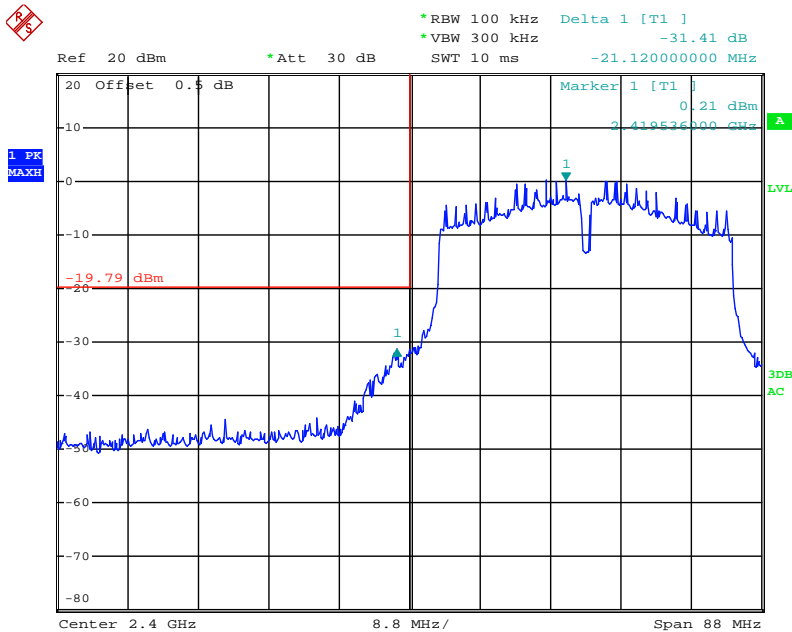
Date: 3.JUN.2020 12:42:54

**Chain 0,802.11n ht20 Band Edge, Right Side**



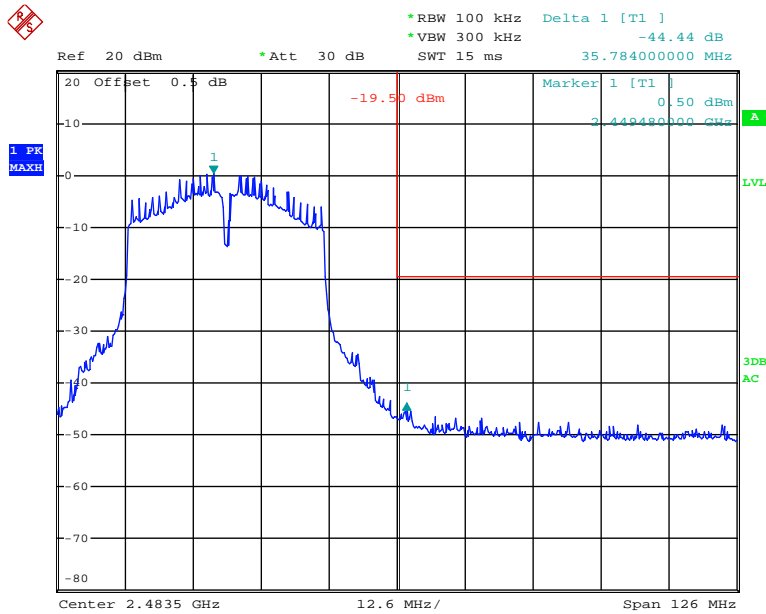
Date: 3.JUN.2020 12:47:26

**Chain 0,802.11n ht40 Band Edge, Left Side**



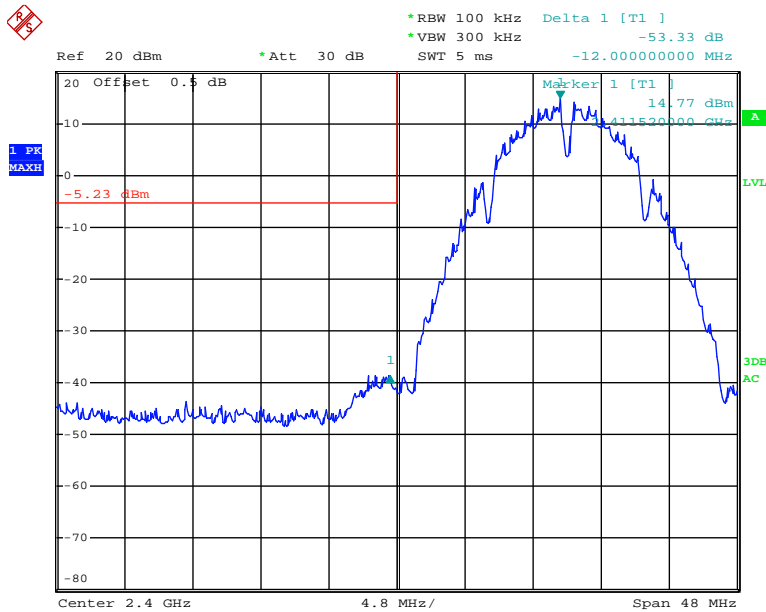
Date: 3.JUN.2020 12:50:14

### Chain 0,802.11n ht40 Band Edge, Right Side



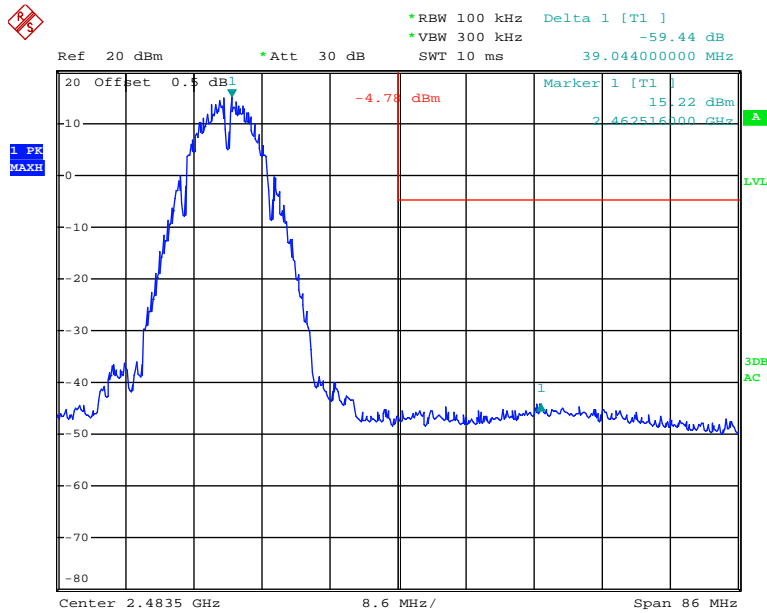
Date: 3.JUN.2020 12:55:48

### Chain 1, 802.11b: Band Edge, Left Side



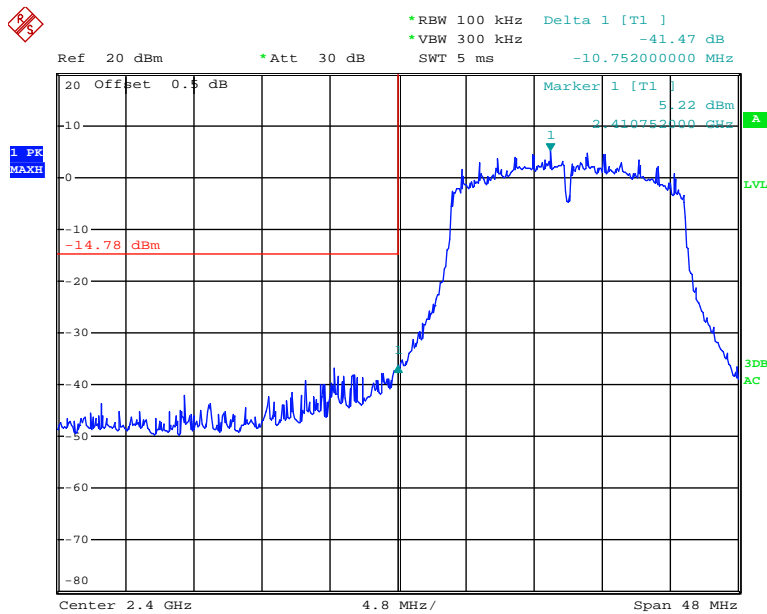
Date: 3.JUN.2020 14:20:10

### Chain 1,802.11b: Band Edge, Right Side



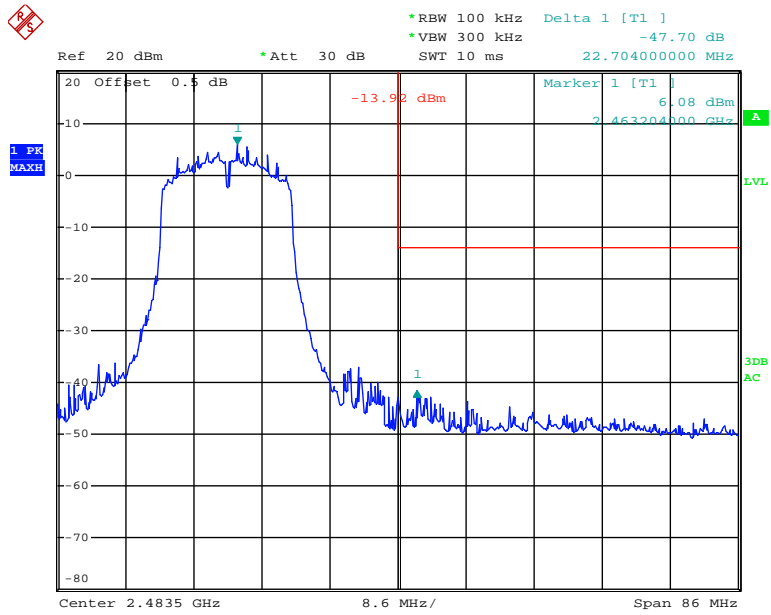
Date: 3.JUN.2020 14:22:02

### Chain 1,802.11g: Band Edge, Left Side



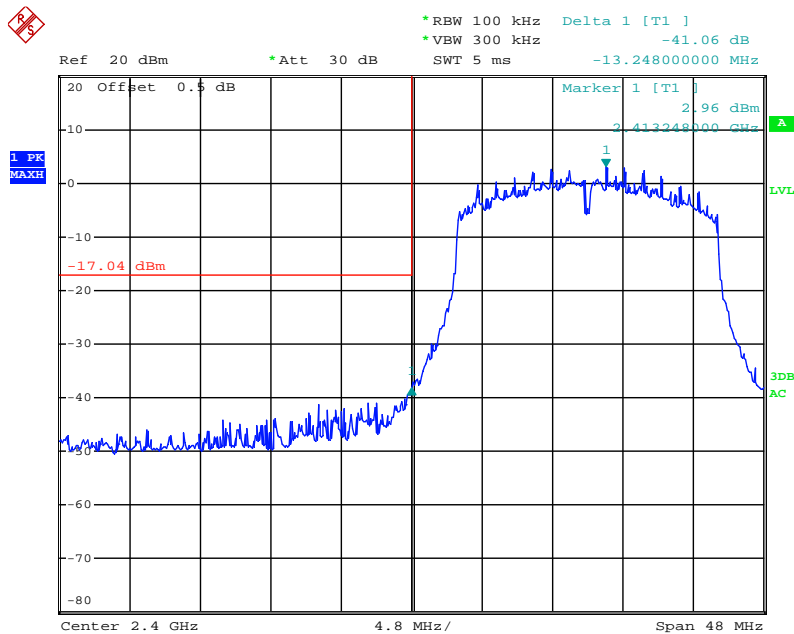
Date: 3.JUN.2020 14:16:02

### Chain 1,802.11g: Band Edge, Right Side



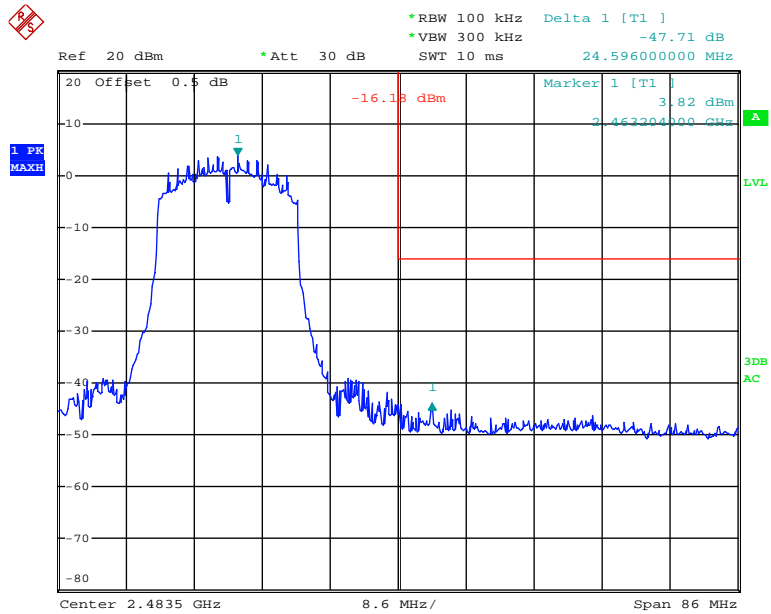
Date: 3.JUN.2020 14:18:16

### Chain 1,802.11n ht20 Band Edge, Left Side



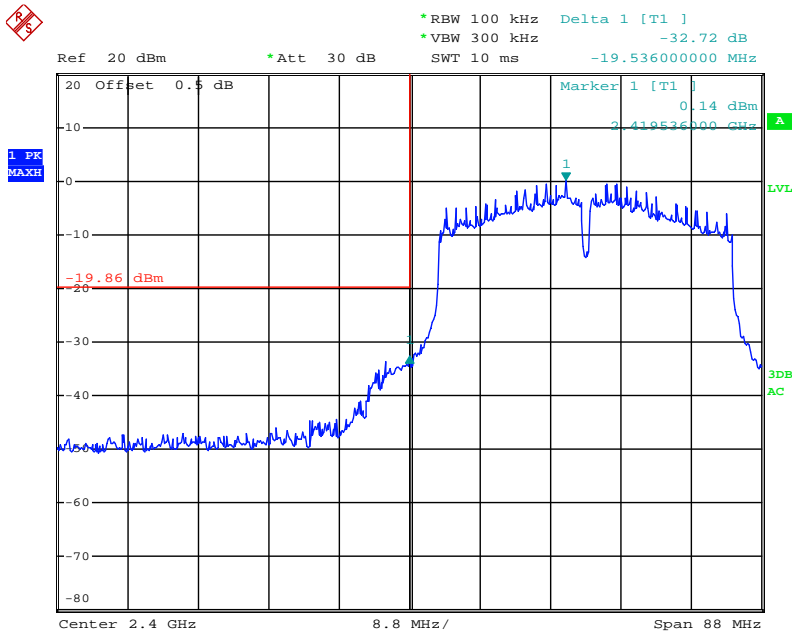
Date: 3.JUN.2020 14:12:20

### Chain 1,802.11n ht20 Band Edge, Right Side



Date: 3.JUN.2020 14:14:23

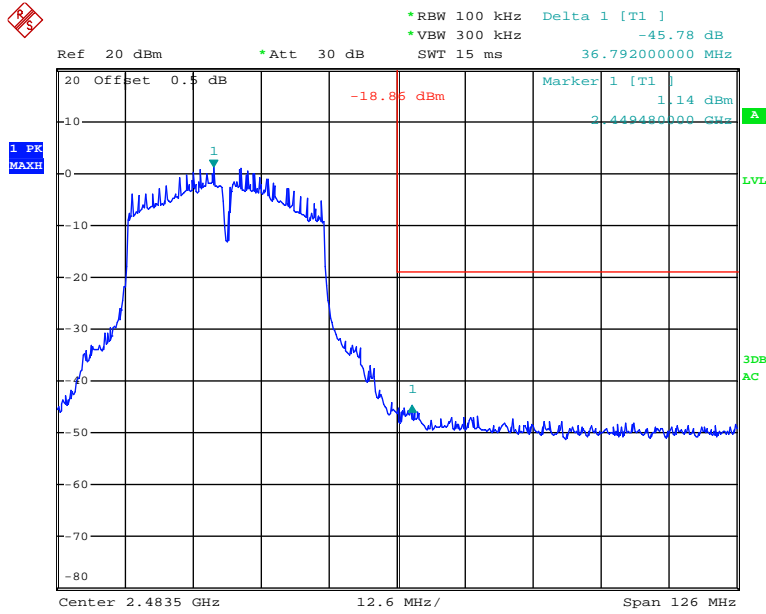
### Chain 1,802.11n ht40 Band Edge, Left Side



Date: 3.JUN.2020 14:10:53



### Chain 1,802.11n ht40 Band Edge, Right Side



Date: 3.JUN.2020 12:59:03

## 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	EMI Test Receiver	ESCI	100035	2019-09-19	2020-09-19
Unknown	Coaxial Cable	C-SJ00-0010	C0010/04	Each time	N/A

\* **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:	27.6 °C
Relative Humidity:	71%
ATM Pressure:	100.4 kPa
Test by:	Chris Mo
Test Date:	2020-06-03

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

Test Mode: Transmitting

Test mode	Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)			Limit (dBm/3kHz)
			Chain 0	Chain 1	Total	
802.11b	Low	2412	0.58	0.69	/	≤8
	Middle	2437	0.78	1.31	/	≤8
	High	2462	0.69	0.51	/	≤8
802.11g	Low	2412	-8.11	-8.16	/	≤8
	Middle	2437	-7.76	-6.63	/	≤8
	High	2462	-8.20	-7.59	/	≤8
802.11n ht20	Low	2412	-11.03	-10.68	-7.84	≤4
	Middle	2437	-10.66	-9.83	-7.21	≤4
	High	2462	-10.29	-10.04	-7.15	≤4
802.11n ht40	Low	2422	-13.38	-14.33	-10.82	≤4
	Middle	2437	-13.05	-13.31	-10.17	≤4
	High	2452	-14.03	-13.18	-10.57	≤4

Note 1: The maximum antenna gain is 4 dBi. And beamforming gain is 3dBi. 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:

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

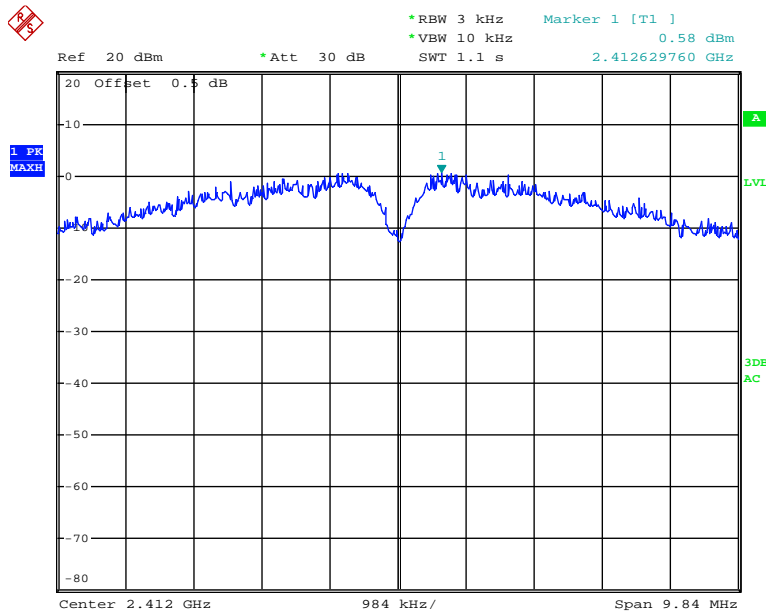
So:

Directional gain =  $G_{\text{ANT}} + \text{Array Gain} = 4 + 10 * \log(2/1) = 7 \text{ dBi}$  for Non-beamforming mode

Directional gain =  $G_{\text{ANT}} + \text{Array Gain} = 4 + 3 + 10 * \log(2/1) = 10 \text{ dBi}$  for Beamforming mode

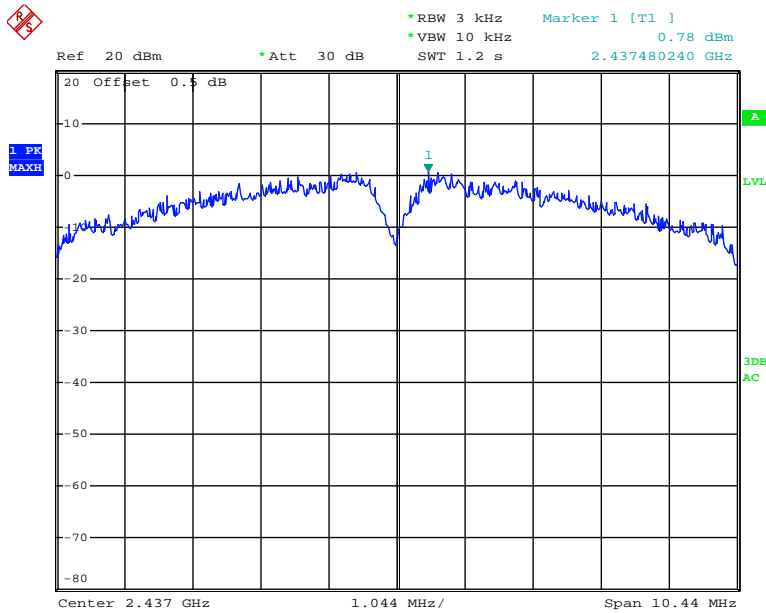
The worst limit Beamforming mode was used in the table.

### Chain 0, Power Spectral Density, 802.11b Low Channel



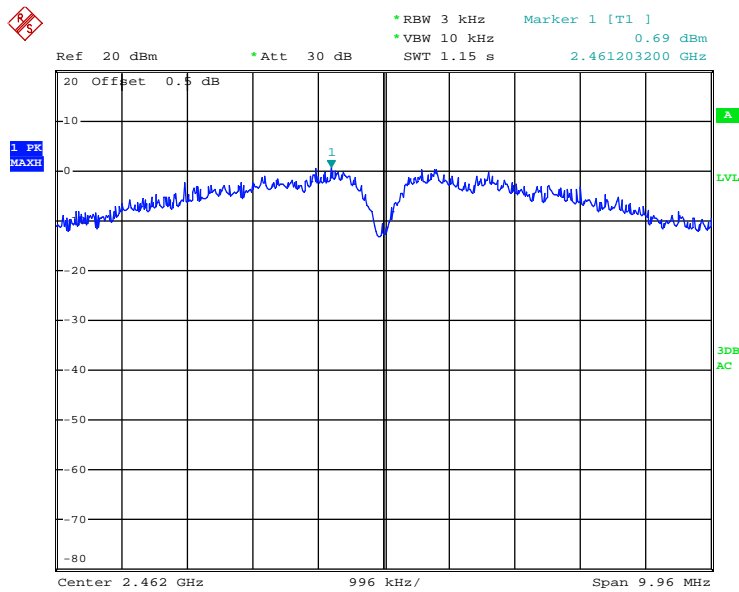
Date: 3.JUN.2020 12:27:01

### Chain 0, Power Spectral Density, 802.11b Middle Channel



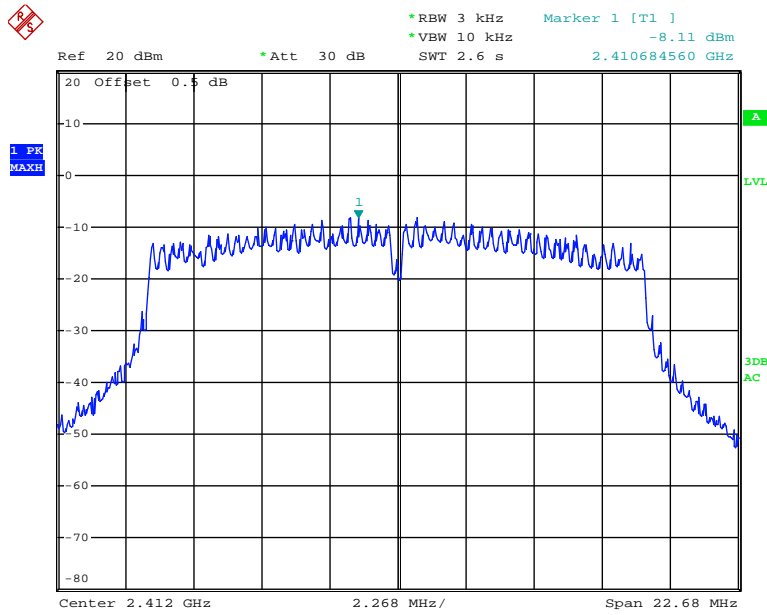
Date: 3.JUN.2020 12:28:37

### Chain 0, Power Spectral Density, 802.11b High Channel



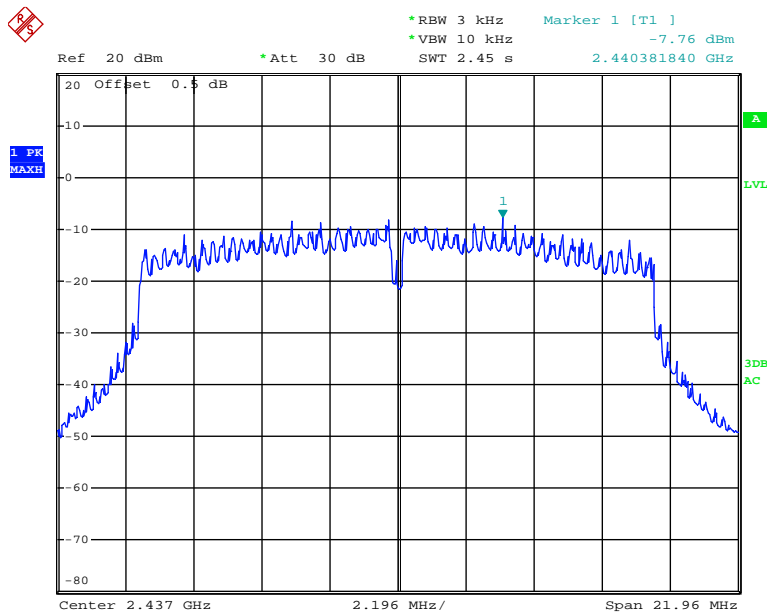
Date: 3.JUN.2020 12:40:40

### Chain 0,Power Spectral Density, 802.11g Low Channel



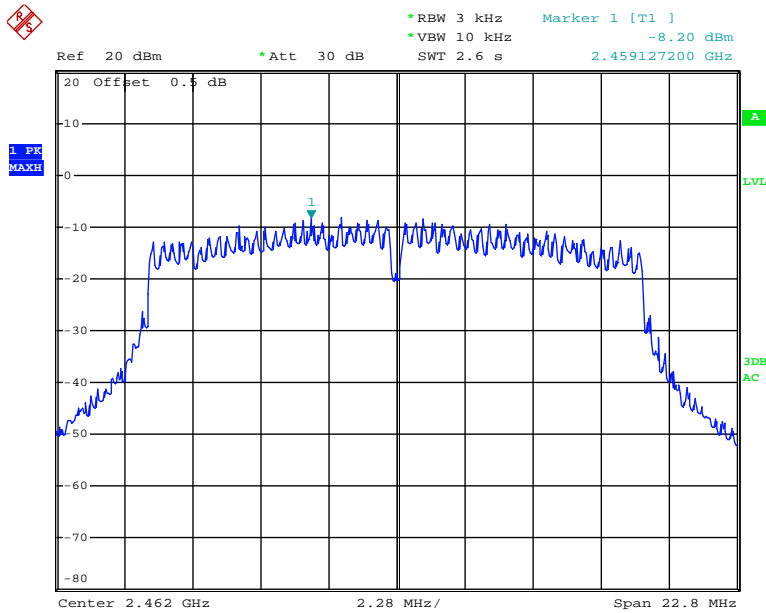
Date: 3.JUN.2020 12:33:09

### Chain 0,Power Spectral Density, 802.11g Middle Channel



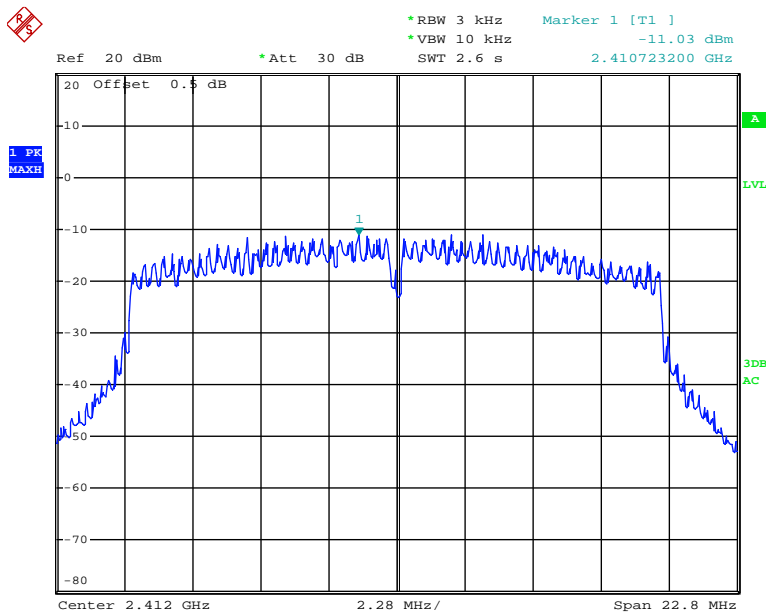
Date: 3.JUN.2020 12:35:03

### Chain 0, Power Spectral Density, 802.11g High Channel



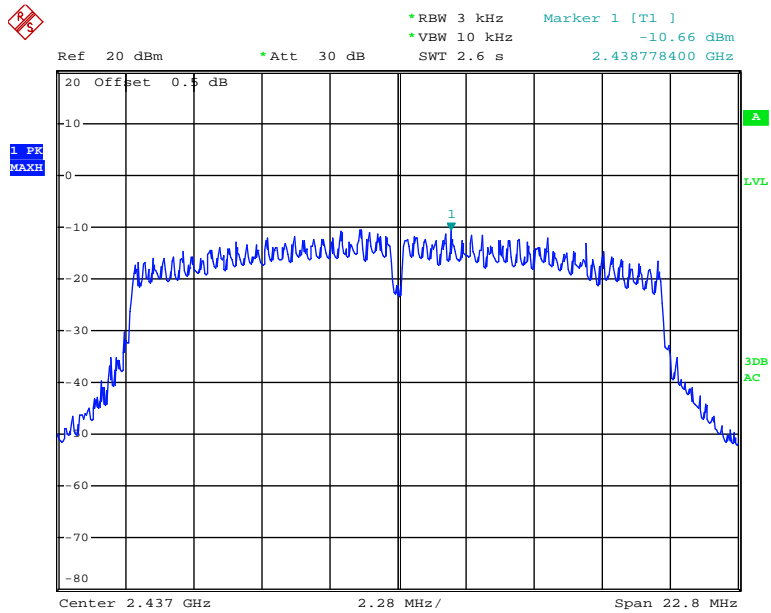
Date: 3.JUN.2020 12:38:50

### Chain 0, Power Spectral Density, 802.11n ht20 Low Channel



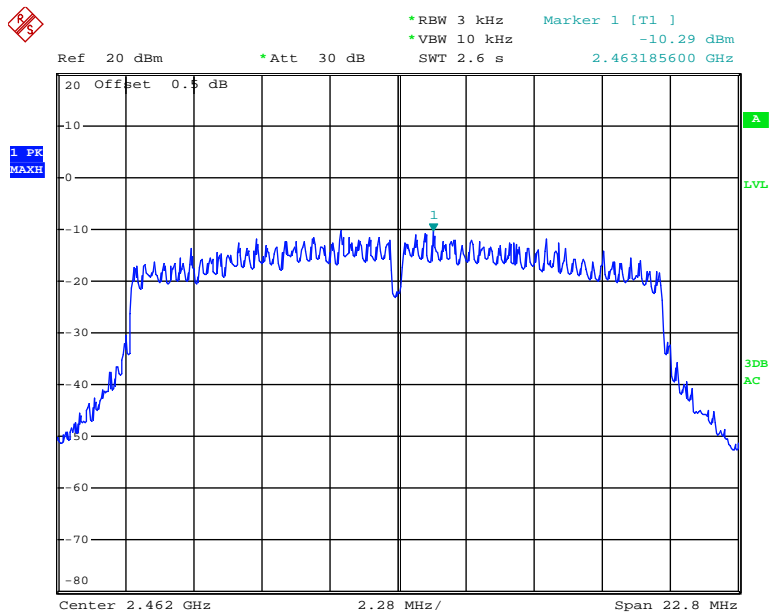
Date: 3.JUN.2020 12:42:38

### Chain 0, Power Spectral Density, 802.11n ht20 Middle Channel



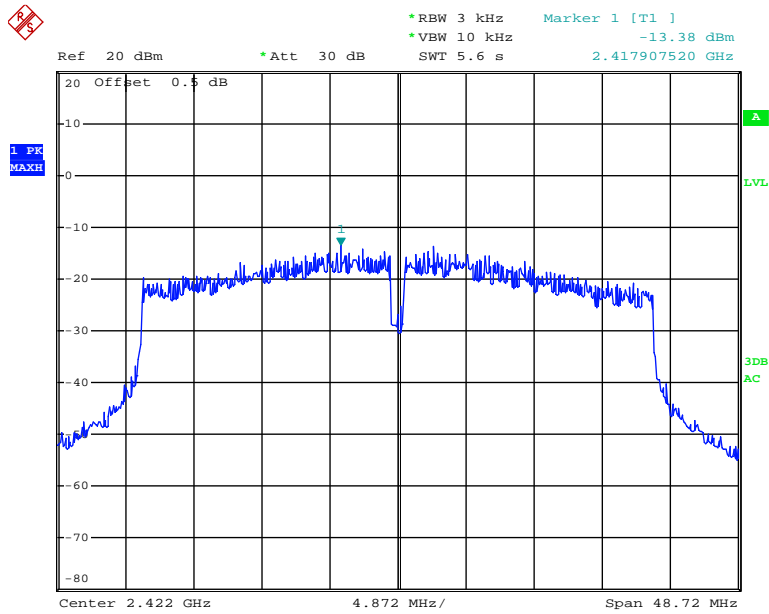
Date: 3.JUN.2020 12:44:29

### Chain 0, Power Spectral Density, 802.11n ht20 High Channel



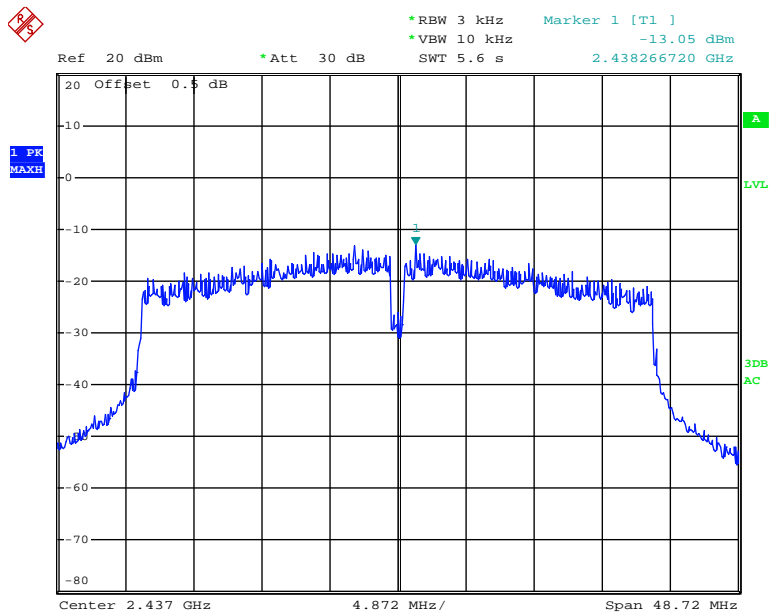
Date: 3.JUN.2020 12:47:10

### Chain 0, Power Spectral Density, 802.11n ht40 Low Channel



Date: 3.JUN.2020 12:50:01

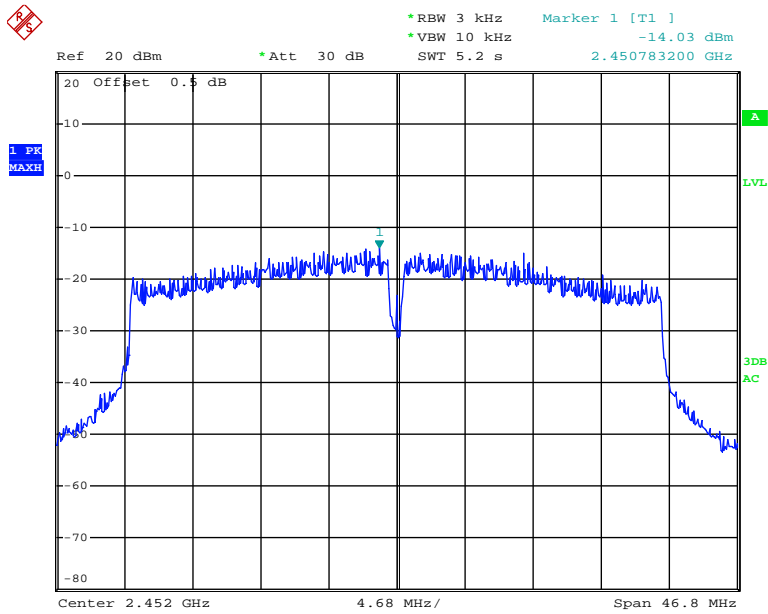
### Chain 0, Power Spectral Density, 802.11n ht40 Middle Channel



Date: 3.JUN.2020 12:52:33

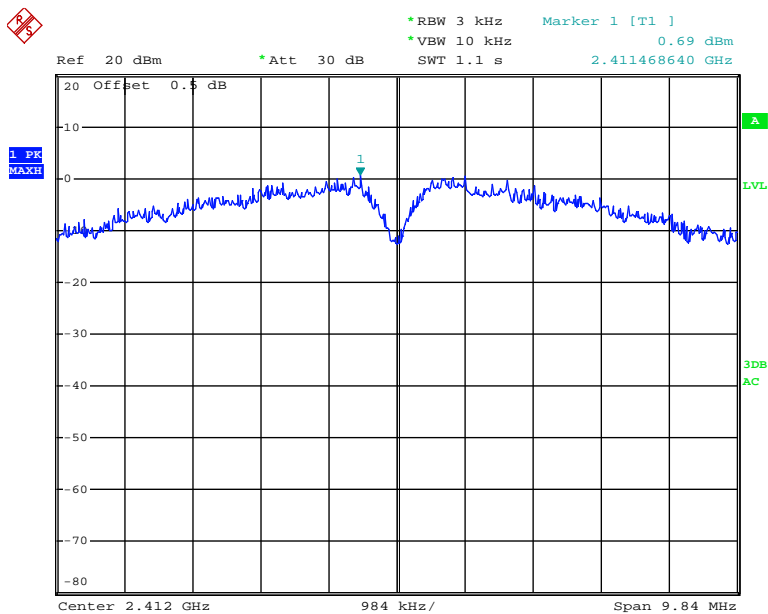


### Chain 0, Power Spectral Density, 802.11n ht40 High Channel



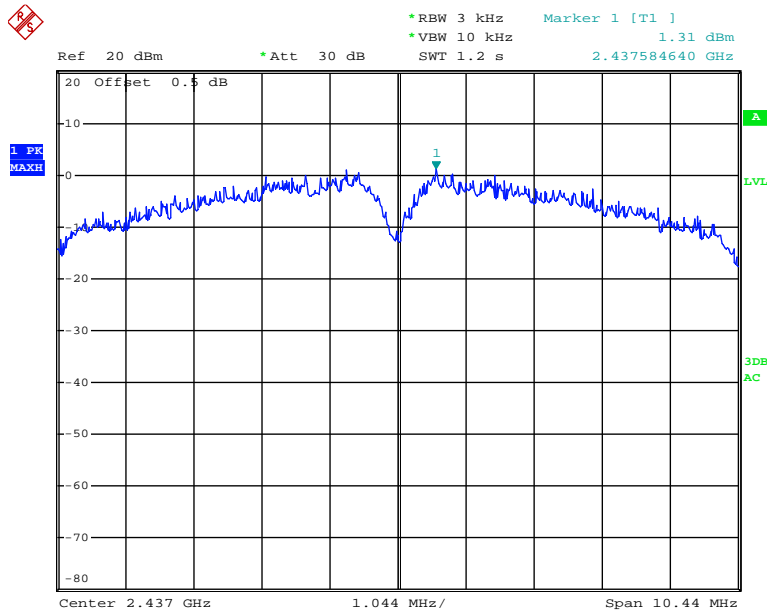
Date: 3.JUN.2020 12:55:35

### Chain 1, Power Spectral Density, 802.11b Low Channel



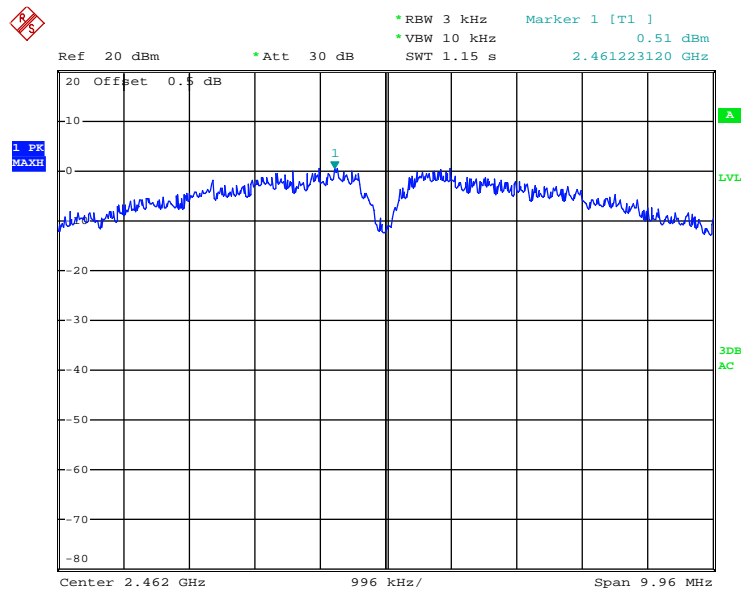
Date: 3.JUN.2020 14:19:29

### Chain 1, Power Spectral Density, 802.11b Middle Channel



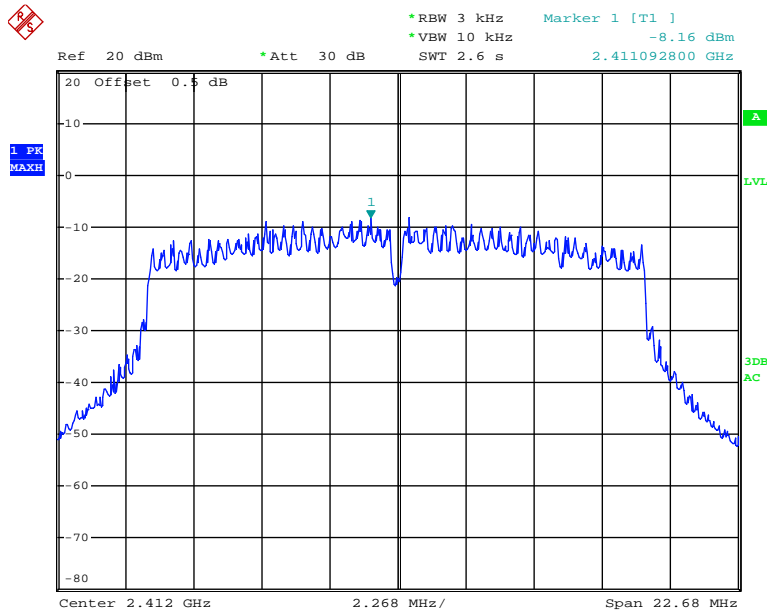
Date: 3.JUN.2020 14:21:05

### Chain 1, Power Spectral Density, 802.11b High Channel



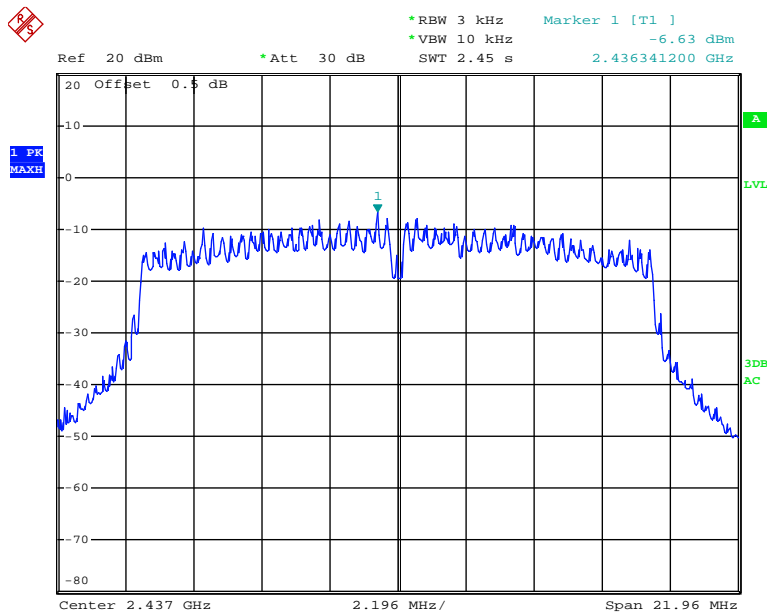
Date: 3.JUN.2020 14:21:46

### Chain1,Power Spectral Density, 802.11g Low Channel



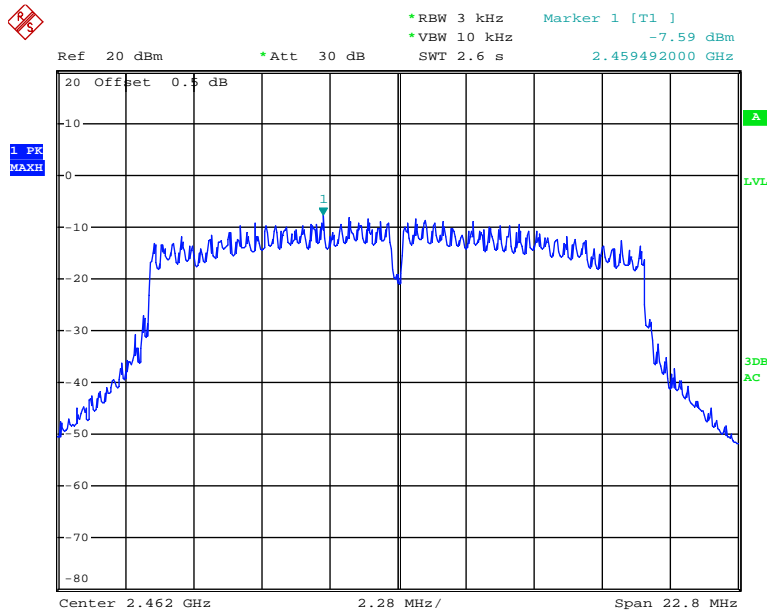
Date: 3.JUN.2020 14:15:46

### Chain 1,Power Spectral Density, 802.11g Middle Channel



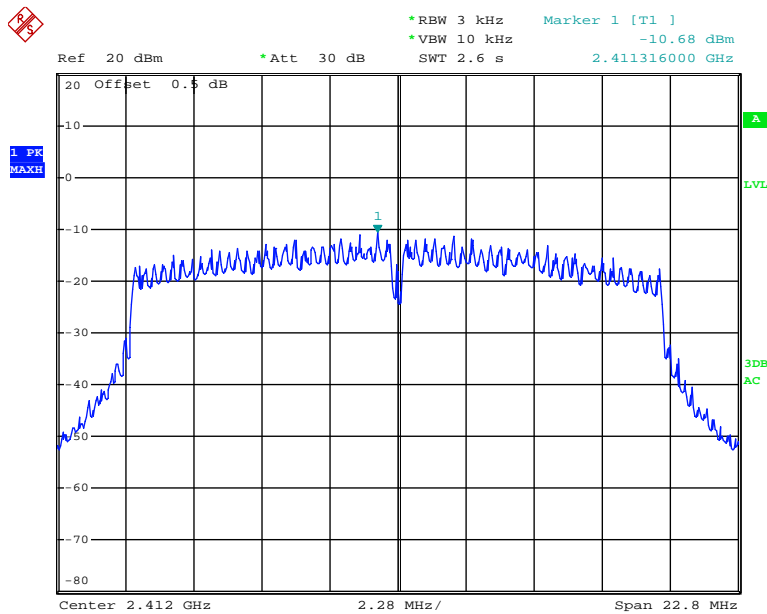
Date: 3.JUN.2020 14:16:51

### Chain1, Power Spectral Density, 802.11g High Channel



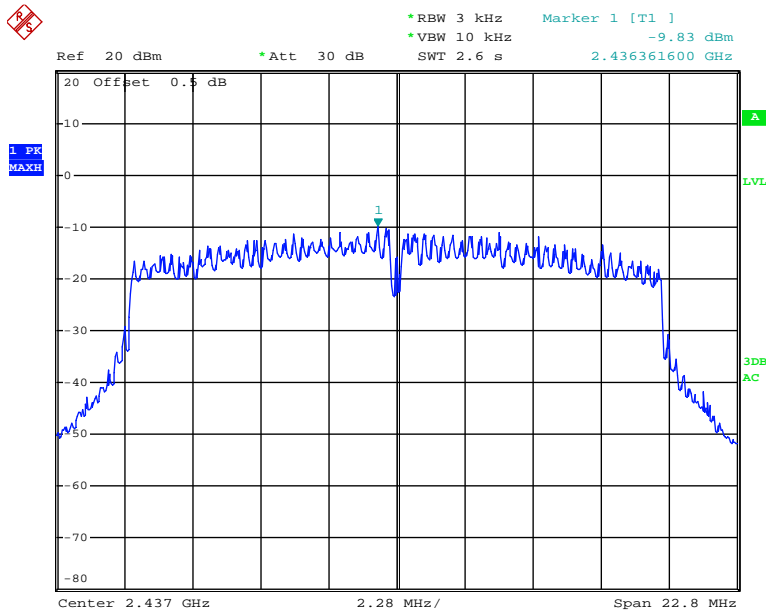
Date: 3.JUN.2020 14:18:00

### Chain1, Power Spectral Density, 802.11n ht20 Low Channel



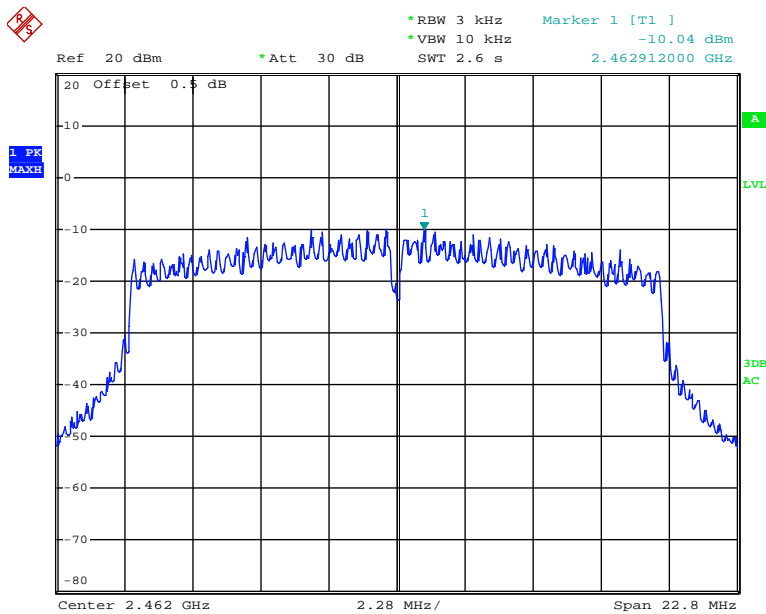
Date: 3.JUN.2020 14:12:04

### Chain 1, Power Spectral Density, 802.11n ht20 Middle Channel



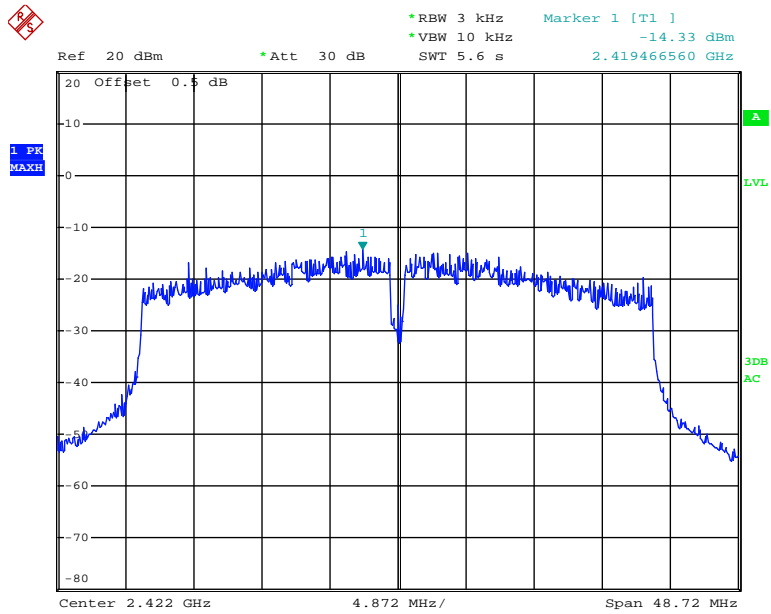
Date: 3.JUN.2020 14:13:15

### Chain 1, Power Spectral Density, 802.11n ht20 High Channel



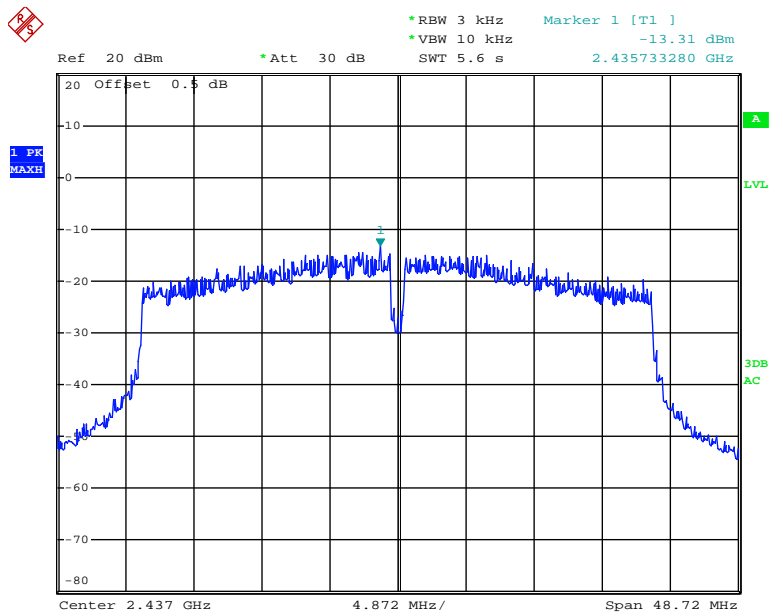
Date: 3.JUN.2020 14:14:04

### Chain 1, Power Spectral Density, 802.11n ht40 Low Channel



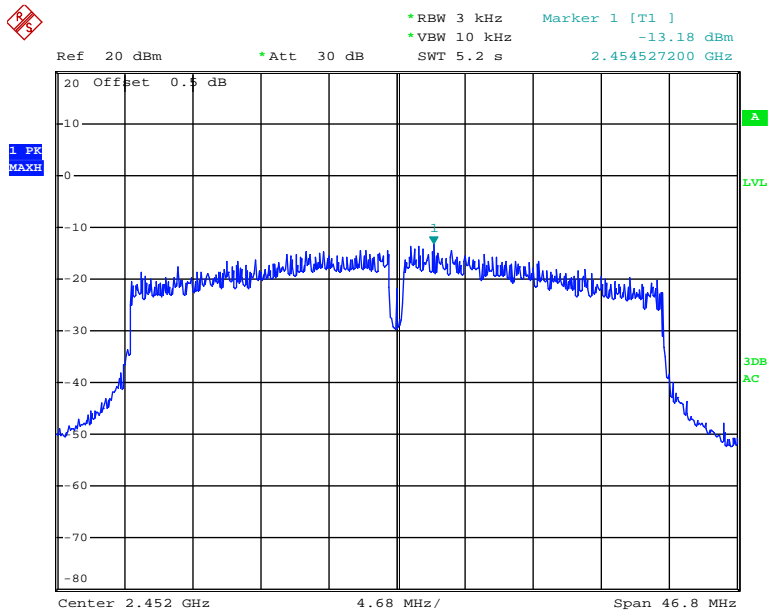
Date: 3.JUN.2020 14:10:39

### Chain 1, Power Spectral Density, 802.11n ht40 Middle Channel



Date: 3.JUN.2020 13:00:47

### Chain 1, Power Spectral Density, 802.11n ht40 High Channel



Date: 3.JUN.2020 12:58:47

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