FCC PART 15.247

TEST REPORT

For

SHENZHEN TENDA TECHNOLOGY CO., LTD.

6-8 Floor, Tower E3, No. 1001, Zhongshanyuan Road, Nanshan District, Shenzhen, China. 518052

Test Model: HG305-G
FCC ID: V7THG305-GP

Report Type:	**Product Name:**
Original Report	N300 Wireless VoIP GPON Router

Report Number:	RDG170817001-00
Report Date:	2017-08-23
Reviewed By:	Jerry Zhang EMC Manager Jerry Zhang
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The ***SHENZHEN TENDA TECHNOLOGY CO., LTD.***'s product, model number: ***HG305-G (FCC ID: V7THG305-GP)*** (the "EUT") in this report was a ***N300 Wireless VoIP GPON Router,*** which was measured approximately: 19.0 cm (L) x 14.3 cm (W) x 3.1 cm (H), rated input voltage: DC 12V from adapter.

Adapter Information:
Model:BN036-A12012U
INPUT:AC100-240~50/60Hz, 0.4A
OUTPUT:DC12V 1.0A

**All measurement and test data in this report was gathered from final production sample, serial number: 170817001 (assigned by the BACL, Dongguan). The EUT was received on 2017-08-17.*

Objective

This report is prepared on behalf of *SHENZHEN TENDA TECHNOLOGY 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)

No related submittal(s)/grant(s).

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.

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: 4.58 dB for Horizontal, 4.59 dB for Vertical 200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical 1G~6GHz: 4.45 dB, 6G~25GHz: 5.23 dB
Unwanted Emissions	±1.5 dB
Temperature	±1℃
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)

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

Bay Area Compliance Laboratories Corp. (Dongguan) has been accredited to ISO 17025 by CNAS(Lab code: L5662). And accredited to ISO 17025 by NVLAP(Test Laboratory Accreditation Certificate Number 500069-0), the FCC Designation No. CN5002 under the KDB 974614 D01.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Bay Area Compliance Laboratories Corp. (Dongguan) was registered with ISED Canada under ISED Canada Registration Number 3062D.

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 802.11 n20 modes were test with channel 1,6,11.
For 802.11 n40 mode was test with channel 3,6,9.

EUT Exercise Software

The software "cmd.exe" was used for testing, the commands were provided by manufacturer. 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 date rates bandwidths, and modulations. For 802.11n mode, the device support MIMO and SISO modes, per pretest, MIMO mode was the worst and reported in the report.

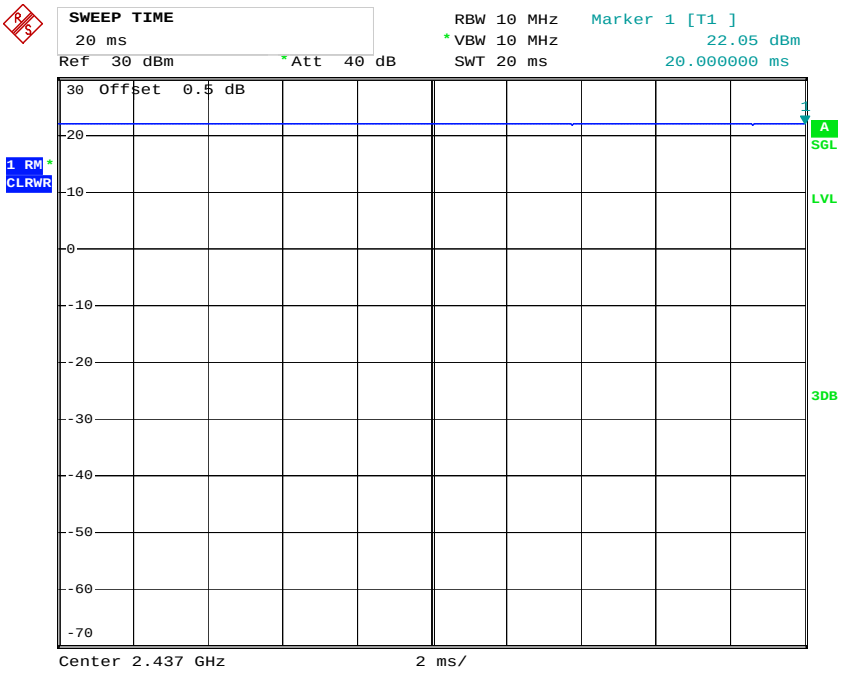
The maximum power levels were configured as below table, that provided by the manufacturer:

Test Mode	Test Software Version	Cmd command		
802.11b	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	1Mbps	1Mbps	1Mbps
	Chain 0	40	50	50
	Chain 1	40	50	40
802.11g	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	6Mbps	6Mbps	6Mbps
	Chain 0	50	50	50
	Chain 1	50	50	50
802.11n20	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	MCS8	MCS8	MCS8
	Chain 0&1	50	50	50
802.11n40	Test Frequency	2422MHz	2437MHz	2452MHz
	Data Rate	MCS8	MCS8	MCS8
	Chain 0&1	40	40	40

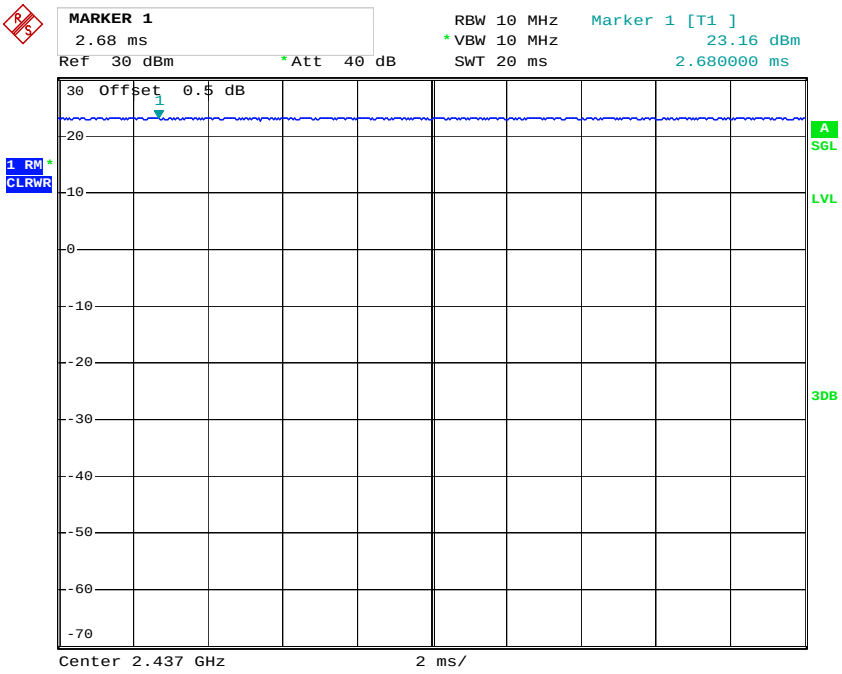
The maximum duty cycle as below:

Mode	T_{on} (ms)	T_{on+off} (ms)	Duty Cycle (%)
802.11b	20	20	100
802.11g	20	20	100
802.11 n20	20	20	100
802.11 n40	20	20	100

802.11b



802.11g



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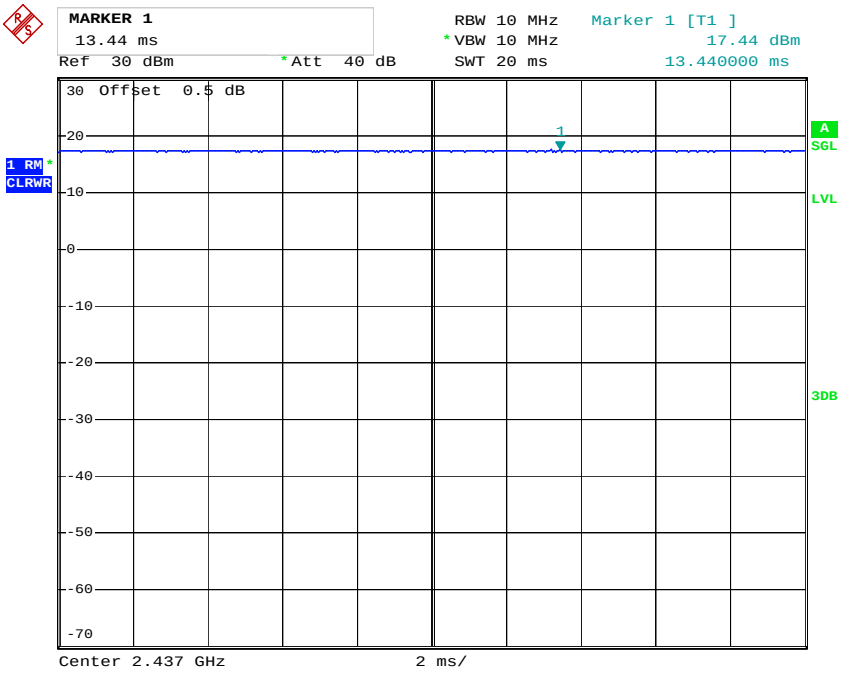
802.11 n20



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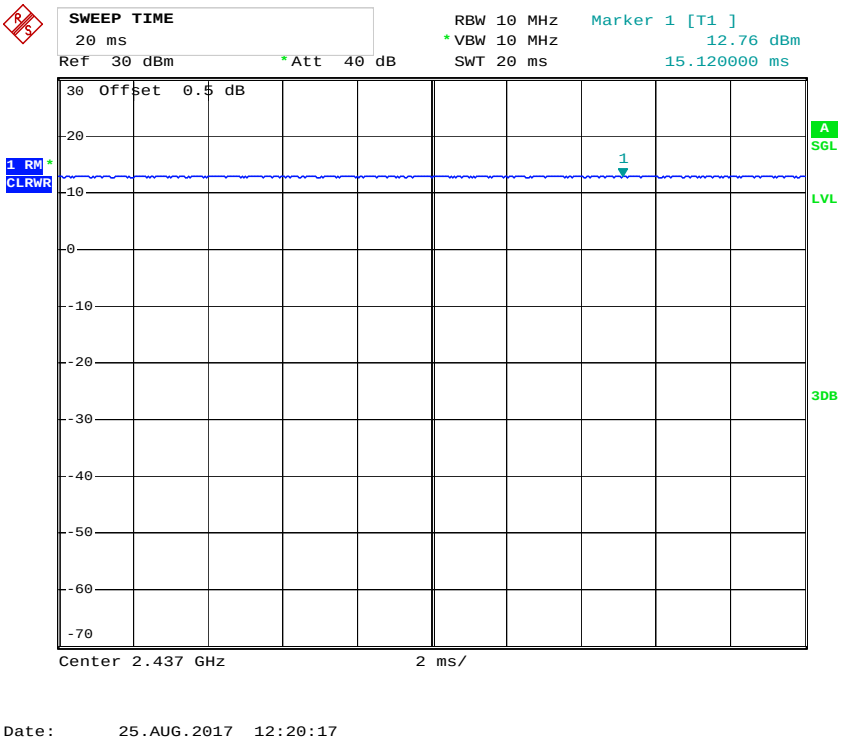
802.11 n40



Equipment Modifications

No modification was made to the EUT.

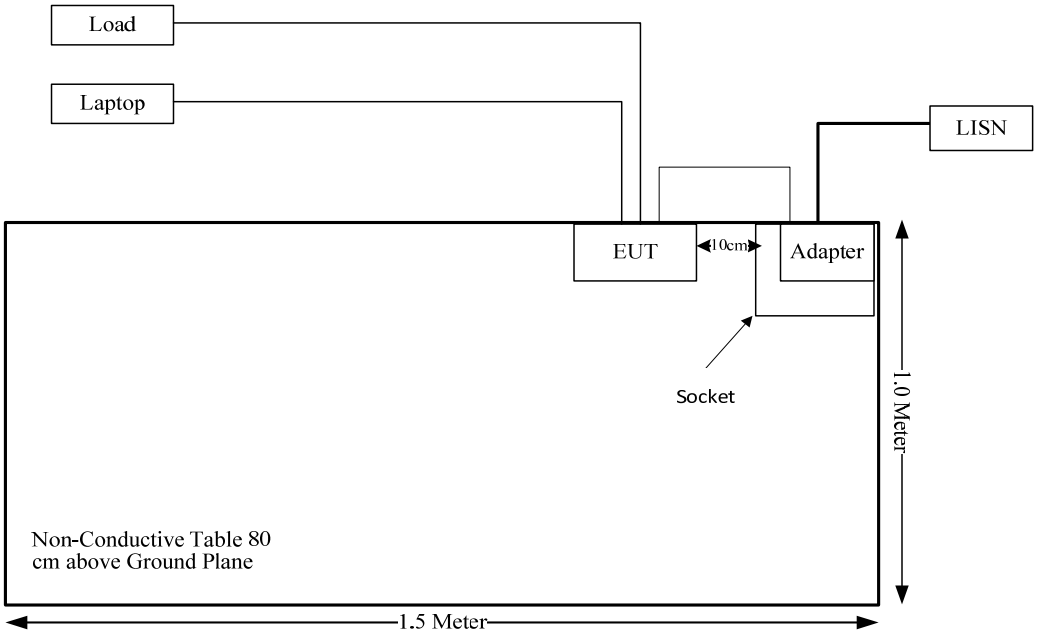
Local Support Equipment List and Details

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	No	No	10	EUT	Laptop
RJ45 cable*2	No	No	10	EUT	Load
Adapter Cable	No	No	1.3	Adapter	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247 (i) & §1.1310 & §2.1091	Maximum Permissable 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/f²)	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^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Data:

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)**			
2412-2462	5	3.16	28	630.96	20.00	0.3971	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 external antennas permanently attached to the EUT, both antenna gains are 5.0 dBi. Please refer to the EUT photos.

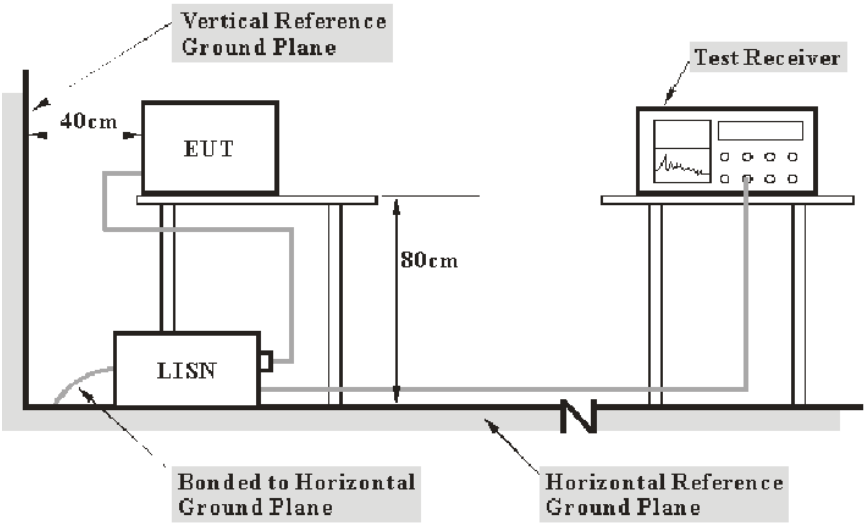
Result: Compliance.

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:

Margin = Limit – Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCS 30	830245/006	2016-12-08	2017-12-08
R&S	L.I.S.N	ESH2-Z5	892107/021	2016-09-01	2017-09-01
R&S	Two-line V-network	ENV 216	3560.6550.12	2016-12-08	2017-12-08
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A
Unknown	Coaxial Cable	2m	Con-1	2016-09-01	2017-09-01

*** 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

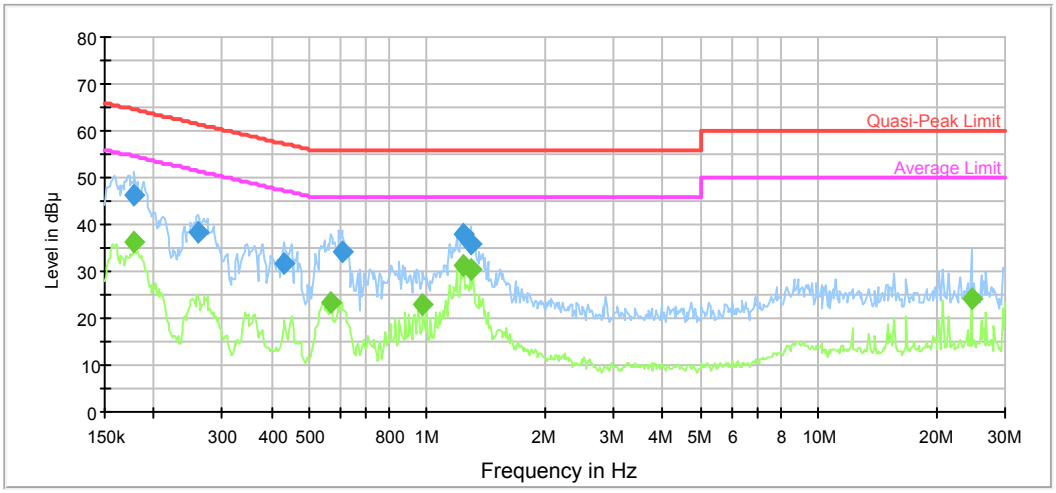
Environmental Conditions

Temperature:	26.5 °C
Relative Humidity:	52 %
ATM Pressure:	99.9 kPa

The testing was performed by Gaochao Gong on 2017-08-21.

Test Mode: Transmitting

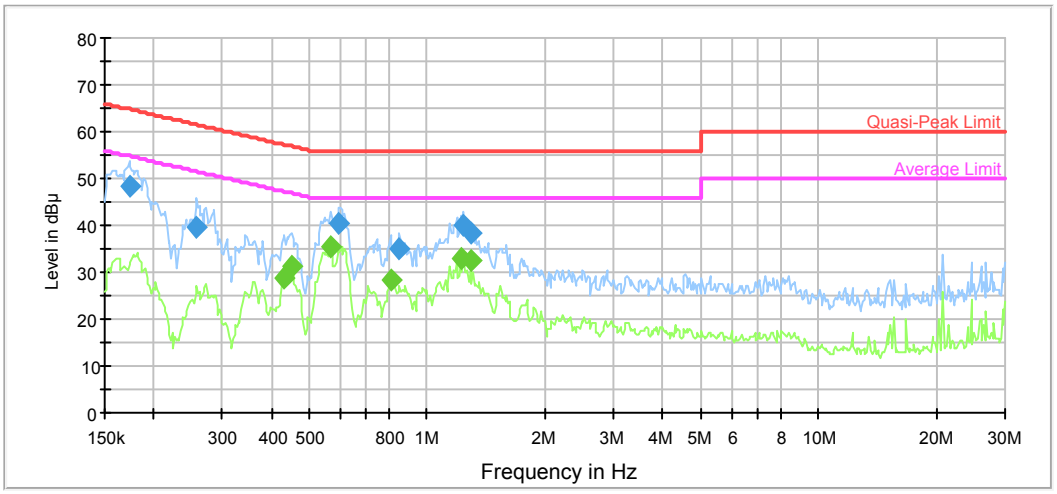
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.178741	46.0	9.000	L1	10.8	18.5	64.5	Compliance
0.259937	38.2	9.000	L1	10.3	23.2	61.4	Compliance
0.432855	31.5	9.000	L1	9.9	25.7	57.2	Compliance
0.604902	34.2	9.000	L1	9.8	21.8	56.0	Compliance
1.239175	37.8	9.000	L1	9.7	18.2	56.0	Compliance
1.289541	36.0	9.000	L1	9.7	20.0	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.178741	36.2	9.000	L1	10.8	18.3	54.5	Compliance
0.567545	23.2	9.000	L1	9.8	22.8	46.0	Compliance
0.975701	22.9	9.000	L1	9.8	23.1	46.0	Compliance
1.239175	31.5	9.000	L1	9.7	14.5	46.0	Compliance
1.289541	30.3	9.000	L1	9.7	15.7	46.0	Compliance
24.594166	24.3	9.000	L1	10.1	25.7	50.0	Compliance

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.173134	48.2	9.000	N	10.9	16.6	64.8	Compliance
0.257874	39.4	9.000	N	10.3	22.1	61.5	Compliance
0.595338	40.4	9.000	N	9.8	15.6	56.0	Compliance
0.852094	35.1	9.000	N	9.8	20.9	56.0	Compliance
1.239175	40.1	9.000	N	9.7	15.9	56.0	Compliance
1.289541	38.3	9.000	N	9.7	17.7	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.429420	28.8	9.000	N	9.9	18.5	47.3	Compliance
0.450448	31.1	9.000	N	9.9	15.8	46.9	Compliance
0.567545	35.6	9.000	N	9.8	10.4	46.0	Compliance
0.812315	28.2	9.000	N	9.8	17.8	46.0	Compliance
1.219583	32.9	9.000	N	9.7	13.1	46.0	Compliance
1.289541	32.6	9.000	N	9.7	13.4	46.0	Compliance

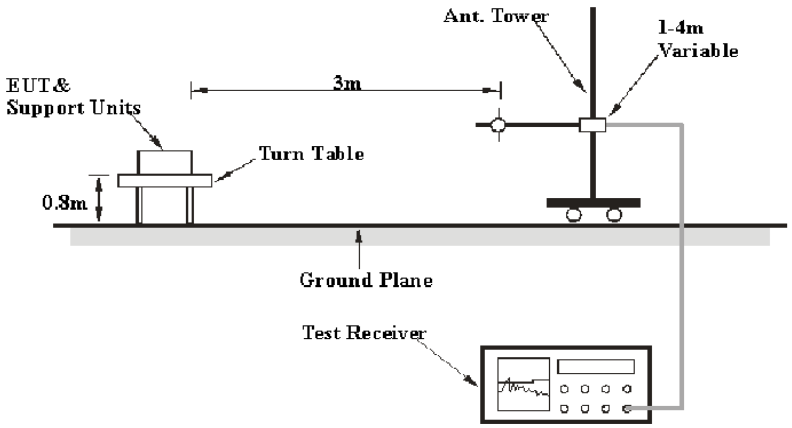
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

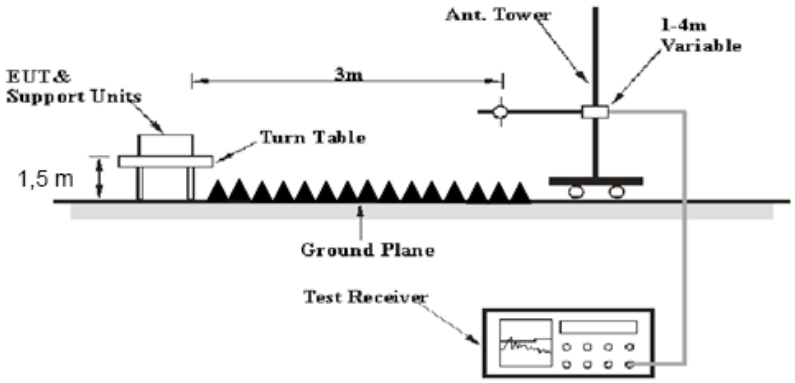
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters distance, 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:

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

1GHz- 25GHz:

Detector	Duty cycle	RBW	Video B/W
PK	Any	1MHz	3 MHz
Ave.	>98%	1MHz	10 Hz
	<98%	1MHz	1/T

Note: T is minimum transmission duration

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:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - 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:

Margin = Limit – Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2016-09-01	2017-08-31
Sunol Sciences	Antenna	JB3	A060611-1	2014-11-06	2017-11-05
HP	Amplifier	8447E	2434A02181	2016-09-01	2017-09-01
R&S	Spectrum Analyzer	FSU 26	200256	2016-12-08	2017-12-08
ETS-Lindgren	Horn Antenna	3115	000 527 35	2016-01-05	2019-01-04
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-02 1304	2017-06-16	2020-06-15
Mini-Circuit	Amplifier	ZVA-213-S+	SN054201245	2017-02-19	2018-02-19
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2016-09-06	2017-09-06
Unknown	Coaxial Cable	Chamber A-1	4m	2016-09-01	2017-09-01
Unknown	Coaxial Cable	Chamber B-1	0.75m	2016-09-01	2017-09-01
Unknown	Coaxial Cable	Chamber A-2	10m	2016-09-01	2017-09-01
Unknown	Coaxial Cable	Chamber B-2	8m	2016-09-01	2017-09-01
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	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:	28.5~30.0 °C
Relative Humidity:	43~48 %
ATM Pressure:	99.9~100.5 kPa

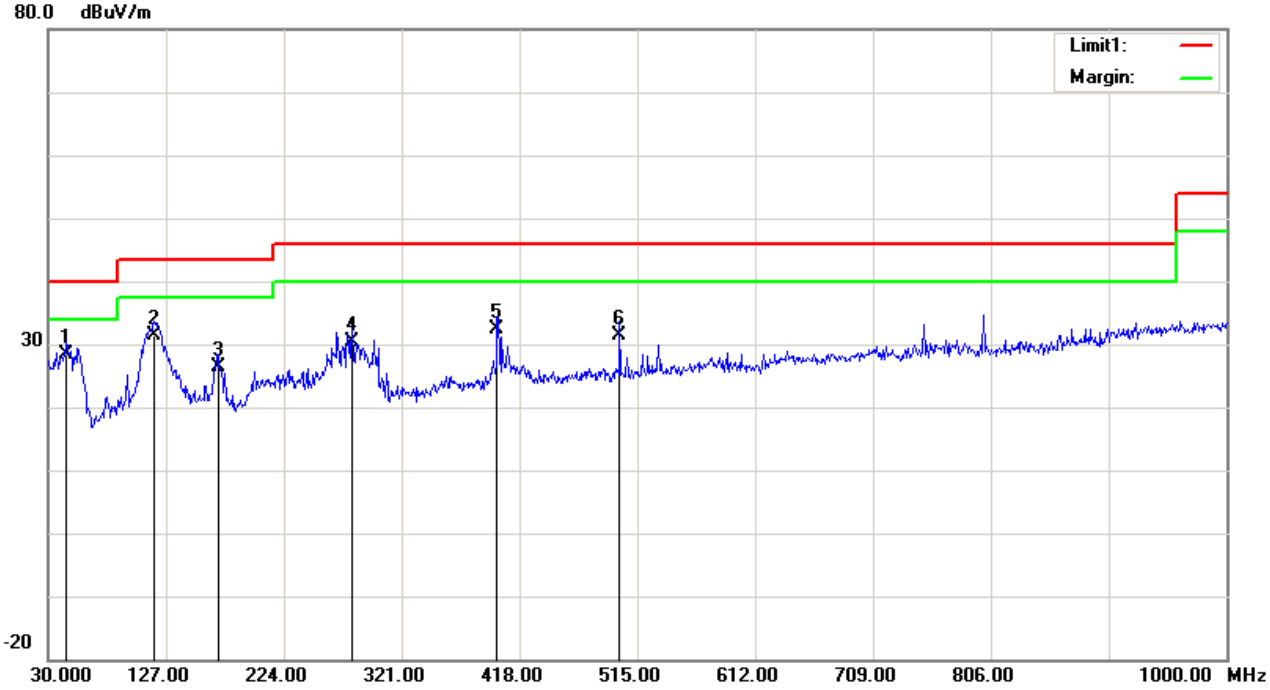
The testing was performed by Calvin Chen on 2017-08-19 and 2017-08-21.

Test Result: Compliance, please Refer to the following data

Test Mode: Transmitting

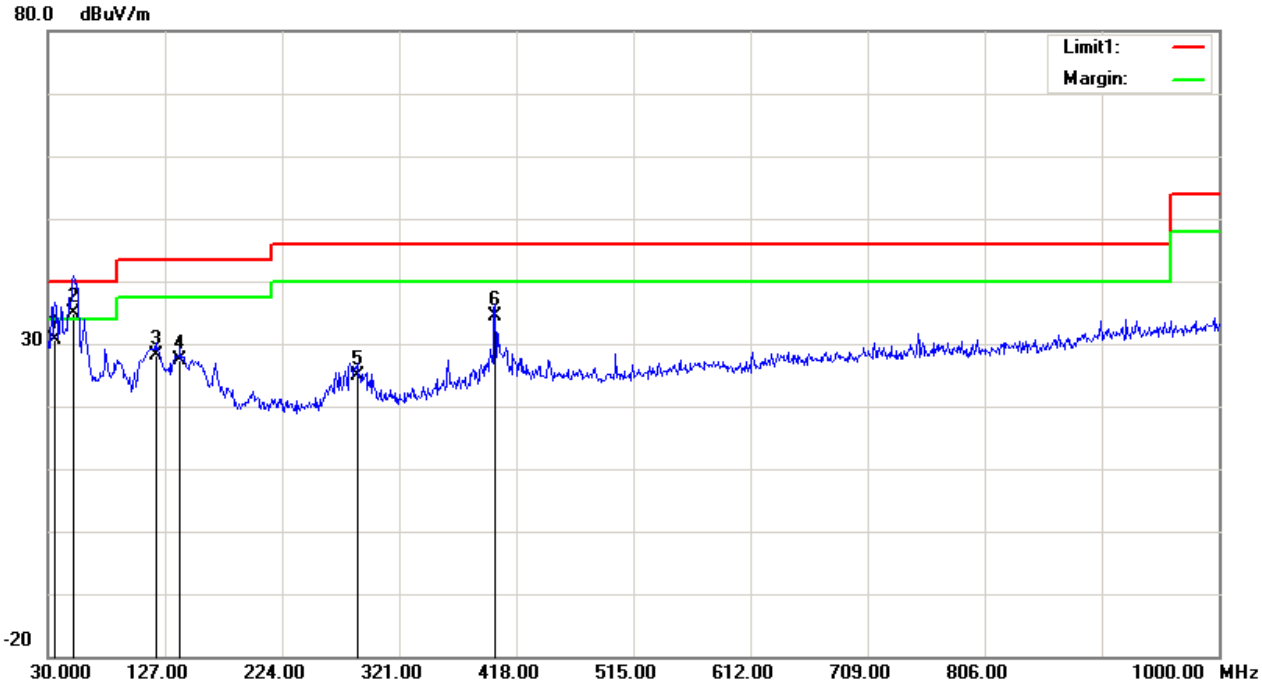
1) 30MHz-1GHz(802.11b mode Middle channel was the worst)**:**

Horizontal:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
44.5500	37.94	QP	-9.54	28.40	40.00	11.60
117.3000	36.49	QP	-4.99	31.50	43.50	12.00
169.6800	33.79	QP	-7.29	26.50	43.50	17.00
280.2600	34.08	QP	-3.78	30.30	46.00	15.70
399.5700	34.85	QP	-2.45	32.40	46.00	13.60
500.4500	32.61	QP	-1.11	31.50	46.00	14.50

Vertical:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
35.8200	33.83	QP	-3.13	30.70	40.00	9.30
51.3400	46.88	QP	-11.98	34.90	40.00	5.10
119.2400	33.01	QP	-4.91	28.10	43.50	15.40
139.6100	33.54	QP	-6.24	27.30	43.50	16.20
286.0800	28.92	QP	-4.02	24.90	46.00	21.10
400.5400	36.73	QP	-2.43	34.30	46.00	11.70

2) 1-25GHz:

802.11b (Chain 0 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 (PK/QP/AV)	Polar (H/V)	Factor (dB)					
Low Channel: 2412 MHz									
2412	66.61	PK	H	28.12	3.11	0.00	97.84	N/A	N/A
2412	60.63	AV	H	28.12	3.11	0.00	91.86	N/A	N/A
2412	77.58	PK	V	28.12	3.11	0.00	108.81	N/A	N/A
2412	71.67	AV	V	28.12	3.11	0.00	102.90	N/A	N/A
2390	33.52	PK	V	28.08	3.10	0.00	64.70	74.00	9.30
2390	19.52	AV	V	28.08	3.10	0.00	50.70	54.00	3.30
4824	57.29	PK	V	32.95	4.33	35.49	59.08	74.00	14.92
4824	49.64	AV	V	32.95	4.33	35.49	51.43	54.00	2.57
7236	51.81	PK	V	35.81	5.47	35.97	57.12	74.00	16.88
7236	40.32	AV	V	35.81	5.47	35.97	45.63	54.00	8.37
3589	45.52	PK	V	31.50	3.72	35.10	45.64	74.00	28.36
3589	34.56	AV	V	31.50	3.72	35.10	34.68	54.00	19.32
Middle Channel: 2437 MHz									
2437	69.26	PK	H	28.17	3.11	0.00	100.54	N/A	N/A
2437	64.13	AV	H	28.17	3.11	0.00	95.41	N/A	N/A
2437	82.28	PK	V	28.17	3.11	0.00	113.56	N/A	N/A
2437	76.95	AV	V	28.17	3.11	0.00	108.23	N/A	N/A
4874	56.11	PK	V	33.05	4.39	35.53	58.02	74.00	15.98
4874	48.02	AV	V	33.05	4.39	35.53	49.93	54.00	4.07
7311	53.56	PK	V	36.01	5.52	35.97	59.12	74.00	14.88
7311	43.57	AV	V	36.01	5.52	35.97	49.13	54.00	4.87
3625	45.51	PK	V	31.58	3.73	35.12	45.70	74.00	28.30
3625	34.15	AV	V	31.58	3.73	35.12	34.34	54.00	19.66
4121	46.25	PK	V	32.38	3.99	35.33	47.29	74.00	26.71
4121	34.47	AV	V	32.38	3.99	35.33	35.51	54.00	18.49
High Channel: 2462 MHz									
2462	70.32	PK	H	28.22	3.10	0.00	101.64	N/A	N/A
2462	65.58	AV	H	28.22	3.10	0.00	96.90	N/A	N/A
2462	83.51	PK	V	28.22	3.10	0.00	114.83	N/A	N/A
2462	77.64	AV	V	28.22	3.10	0.00	108.96	N/A	N/A
2483.5	34.17	PK	V	28.27	3.10	0.00	65.54	74.00	8.46
2483.5	20.04	AV	V	28.27	3.10	0.00	51.41	54.00	2.59
4924	54.16	PK	V	33.15	4.42	35.57	56.16	74.00	17.84
4924	40.23	AV	V	33.15	4.42	35.57	42.23	54.00	11.77
7386	54.17	PK	V	36.20	5.57	35.98	59.96	74.00	14.04
7386	41.11	AV	V	36.20	5.57	35.98	46.90	54.00	7.10
3541	45.57	PK	V	31.39	3.69	35.07	45.58	74.00	28.42
3541	33.59	AV	V	31.39	3.69	35.07	33.60	54.00	20.40

802.11g (Chain 0 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 (PK/QP/AV)	Polar (H/V)	Factor (dB)					
Low Channel: 2412 MHz									
2412	71.05	PK	H	28.12	3.11	0.00	102.28	N/A	N/A
2412	60.12	AV	H	28.12	3.11	0.00	91.35	N/A	N/A
2412	75.14	PK	V	28.12	3.11	0.00	106.37	N/A	N/A
2412	63.53	AV	V	28.12	3.11	0.00	94.76	N/A	N/A
2390	35.52	PK	V	28.08	3.10	0.00	66.70	74.00	7.30
2390	20.26	AV	V	28.08	3.10	0.00	51.44	54.00	2.56
4824	56.87	PK	V	32.95	4.33	35.49	58.66	74.00	15.34
4824	43.82	AV	V	32.95	4.33	35.49	45.61	54.00	8.39
7236	51.74	PK	V	35.81	5.47	35.97	57.05	74.00	16.95
7236	39.28	AV	V	35.81	5.47	35.97	44.59	54.00	9.41
3965	46.26	PK	V	32.32	3.89	35.34	47.13	74.00	26.87
3965	34.17	AV	V	32.32	3.89	35.34	35.04	54.00	18.96
Middle Channel: 2437 MHz									
2437	71.23	PK	H	28.17	3.11	0.00	102.51	N/A	N/A
2437	60.24	AV	H	28.17	3.11	0.00	91.52	N/A	N/A
2437	78.37	PK	V	28.17	3.11	0.00	109.65	N/A	N/A
2437	66.31	AV	V	28.17	3.11	0.00	97.59	N/A	N/A
4874	56.61	PK	V	33.05	4.39	35.53	58.52	74.00	15.48
4874	44.64	AV	V	33.05	4.39	35.53	46.55	54.00	7.45
7311	52.01	PK	V	36.01	5.52	35.97	57.57	74.00	16.43
7311	40.32	AV	V	36.01	5.52	35.97	45.88	54.00	8.12
4152	46.33	PK	V	32.37	4.00	35.32	47.38	74.00	26.62
4152	34.45	AV	V	32.37	4.00	35.32	35.50	54.00	18.50
4568	46.25	PK	V	32.44	4.35	35.29	47.75	74.00	26.25
4568	34.86	AV	V	32.44	4.35	35.29	36.36	54.00	17.64
High Channel: 2462 MHz									
2462	71.07	PK	H	28.22	3.10	0.00	102.39	N/A	N/A
2462	59.84	AV	H	28.22	3.10	0.00	91.16	N/A	N/A
2462	79.41	PK	V	28.22	3.10	0.00	110.73	N/A	N/A
2462	67.12	AV	V	28.22	3.10	0.00	98.44	N/A	N/A
2483.5	38.71	PK	V	28.27	3.10	0.00	70.08	74.00	3.92
2483.5	20.74	AV	V	28.27	3.10	0.00	52.11	54.00	1.89
4924	57.57	PK	V	33.15	4.42	35.57	59.57	74.00	14.43
4924	45.01	AV	V	33.15	4.42	35.57	47.01	54.00	6.99
7386	51.34	PK	V	36.20	5.57	35.98	57.13	74.00	16.87
7386	40.22	AV	V	36.20	5.57	35.98	46.01	54.00	7.99
3697	46.32	PK	V	31.73	3.73	35.17	46.61	74.00	27.39
3697	34.16	AV	V	31.73	3.73	35.17	34.45	54.00	19.55

802.11 n20 (2TX mode 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 (PK/QP/AV)	Polar (H/V)	Factor (dB)					
Low Channel: 2412 MHz									
2412	69.06	PK	H	28.12	3.11	0.00	100.29	N/A	N/A
2412	61.24	AV	H	28.12	3.11	0.00	92.47	N/A	N/A
2412	73.67	PK	V	28.12	3.11	0.00	104.90	N/A	N/A
2412	65.61	AV	V	28.12	3.11	0.00	96.84	N/A	N/A
2390	34.56	PK	V	28.08	3.10	0.00	65.74	74.00	8.26
2390	20.71	AV	V	28.08	3.10	0.00	51.89	54.00	2.11
4824	57.19	PK	V	32.95	4.33	35.49	58.98	74.00	15.02
4824	48.52	AV	V	32.95	4.33	35.49	50.31	54.00	3.69
7236	51.29	PK	V	35.81	5.47	35.97	56.60	74.00	17.40
7236	41.48	AV	V	35.81	5.47	35.97	46.79	54.00	7.21
3454	45.58	PK	V	31.19	3.62	35.06	45.33	74.00	28.67
3454	33.56	AV	V	31.19	3.62	35.06	33.31	54.00	20.69
Middle Channel: 2437 MHz									
2437	69.04	PK	H	28.17	3.11	0.00	100.32	N/A	N/A
2437	60.99	AV	H	28.17	3.11	0.00	92.27	N/A	N/A
2437	77.17	PK	V	28.17	3.11	0.00	108.45	N/A	N/A
2437	69.63	AV	V	28.17	3.11	0.00	100.91	N/A	N/A
4874	57.15	PK	V	33.05	4.39	35.53	59.06	74.00	14.94
4874	47.89	AV	V	33.05	4.39	35.53	49.80	54.00	4.20
7311	50.24	PK	V	36.01	5.52	35.97	55.80	74.00	18.20
7311	39.69	AV	V	36.01	5.52	35.97	45.25	54.00	8.75
3352	45.36	PK	V	30.94	3.56	35.12	44.74	74.00	29.26
3352	33.58	AV	V	30.94	3.56	35.12	32.96	54.00	21.04
4117	46.31	PK	V	32.38	3.99	35.33	47.35	74.00	26.65
4117	34.21	AV	V	32.38	3.99	35.33	35.25	54.00	18.75
High Channel: 2462 MHz									
2462	69.29	PK	H	28.22	3.10	0.00	100.61	N/A	N/A
2462	60.78	AV	H	28.22	3.10	0.00	92.10	N/A	N/A
2462	77.46	PK	V	28.22	3.10	0.00	108.78	N/A	N/A
2462	69.93	AV	V	28.22	3.10	0.00	101.25	N/A	N/A
2483.5	34.03	PK	V	28.27	3.10	0.00	65.40	74.00	8.60
2483.5	21.23	AV	V	28.27	3.10	0.00	52.60	54.00	1.40
4924	56.36	PK	V	33.15	4.42	35.57	58.36	74.00	15.64
4924	47.18	AV	V	33.15	4.42	35.57	49.18	54.00	4.82
7386	49.97	PK	V	36.20	5.57	35.98	55.76	74.00	18.24
7386	39.59	AV	V	36.20	5.57	35.98	45.38	54.00	8.62
3665	45.35	PK	V	31.66	3.73	35.15	45.59	74.00	28.41
3665	46.29	AV	V	31.66	3.73	35.15	46.53	54.00	7.47

802.11 n40 (2TX mode 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 (PK/QP/AV)	Polar (H/V)	Factor (dB)					
Low Channel: 2422 MHz									
2422	65.24	PK	H	28.14	3.11	0.00	96.49	N/A	N/A
2422	56.38	AV	H	28.14	3.11	0.00	87.63	N/A	N/A
2422	72.51	PK	V	28.14	3.11	0.00	103.76	N/A	N/A
2422	59.35	AV	V	28.14	3.11	0.00	90.60	N/A	N/A
2390	33.55	PK	V	28.08	3.10	0.00	64.73	74.00	9.27
2390	20.35	AV	V	28.08	3.10	0.00	51.53	54.00	2.47
4844	54.11	PK	V	32.99	4.35	35.51	55.94	74.00	18.06
4844	43.59	AV	V	32.99	4.35	35.51	45.42	54.00	8.58
7266	47.59	PK	V	35.89	5.49	35.97	53.00	74.00	21.00
7266	36.69	AV	V	35.89	5.49	35.97	42.10	54.00	11.90
3524	45.52	PK	V	31.35	3.68	35.06	45.49	74.00	28.51
3524	34.57	AV	V	31.35	3.68	35.06	34.54	54.00	19.46
Middle Channel: 2437 MHz									
2437	64.28	PK	H	28.17	3.11	0.00	95.56	N/A	N/A
2437	55.72	AV	H	28.17	3.11	0.00	87.00	N/A	N/A
2437	73.29	PK	V	28.17	3.11	0.00	104.57	N/A	N/A
2437	64.25	AV	V	28.17	3.11	0.00	95.53	N/A	N/A
4874	53.32	PK	V	33.05	4.39	35.53	55.23	74.00	18.77
4874	43.22	AV	V	33.05	4.39	35.53	45.13	54.00	8.87
7311	48.21	PK	V	36.01	5.52	35.97	53.77	74.00	20.23
7311	37.21	AV	V	36.01	5.52	35.97	42.77	54.00	11.23
4226	46.51	PK	V	32.35	4.00	35.31	47.55	74.00	26.45
4226	34.25	AV	V	32.35	4.00	35.31	35.29	54.00	18.71
3579	45.52	PK	V	31.47	3.72	35.09	45.62	74.00	28.38
3579	33.29	AV	V	31.47	3.72	35.09	33.39	54.00	20.61
High Channel: 2452 MHz									
2452	65.21	PK	H	28.20	3.10	0.00	96.51	N/A	N/A
2452	58.86	AV	H	28.20	3.10	0.00	90.16	N/A	N/A
2452	73.73	PK	V	28.20	3.10	0.00	105.03	N/A	N/A
2452	60.09	AV	V	28.20	3.10	0.00	91.39	N/A	N/A
2483.5	33.82	PK	V	28.27	3.10	0.00	65.19	74.00	8.81
2483.5	20.46	AV	V	28.27	3.10	0.00	51.83	54.00	2.17
4904	53.06	PK	V	33.11	4.42	35.56	55.03	74.00	18.97
4904	44.01	AV	V	33.11	4.42	35.56	45.98	54.00	8.02
7356	49.28	PK	V	36.13	5.55	35.98	54.98	74.00	19.02
7356	36.26	AV	V	36.13	5.55	35.98	41.96	54.00	12.04
3874	46.21	PK	V	32.12	3.81	35.28	46.86	74.00	27.14
3874	33.25	AV	V	32.12	3.81	35.28	33.90	54.00	20.10

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

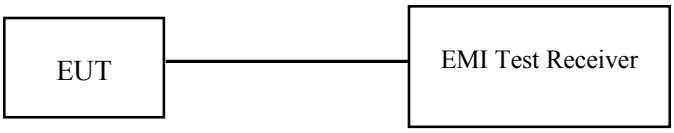
Applicable Standard

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) ≥ 3×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	ESPI	100120	2016-12-08	2017-12-08
Unknown	Coaxial Cable	0.1m	C-1	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:	25.6 °C
Relative Humidity:	47 %
ATM Pressure:	100.5 kPa

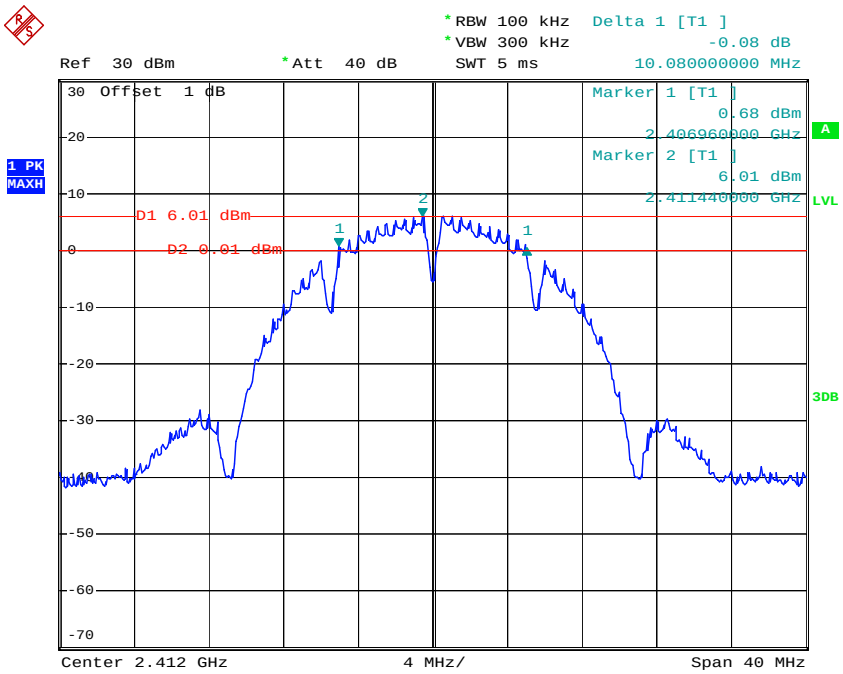
The testing was performed by Calvin Chen on 2017-08-19.

Test Mode: Transmitting (Test only was performed at chain 0)

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

Test mode	Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (MHz)
802.11b	Low	2412	10.08	≥0.5
	Middle	2437	10.08	≥0.5
	High	2462	10.08	≥0.5
802.11g	Low	2412	16.64	≥0.5
	Middle	2437	16.64	≥0.5
	High	2462	16.64	≥0.5
802.11 n20	Low	2412	17.84	≥0.5
	Middle	2437	17.92	≥0.5
	High	2462	17.92	≥0.5
802.11 n40	Low	2422	36.64	≥0.5
	Middle	2437	36.48	≥0.5
	High	2452	36.48	≥0.5

802.11b Low Channel



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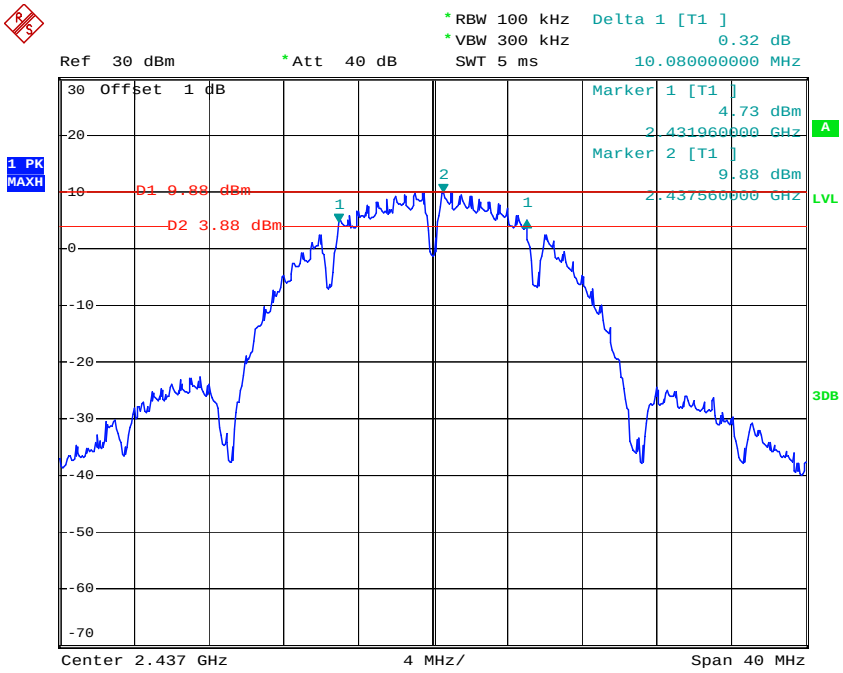
802.11b Middle Channel



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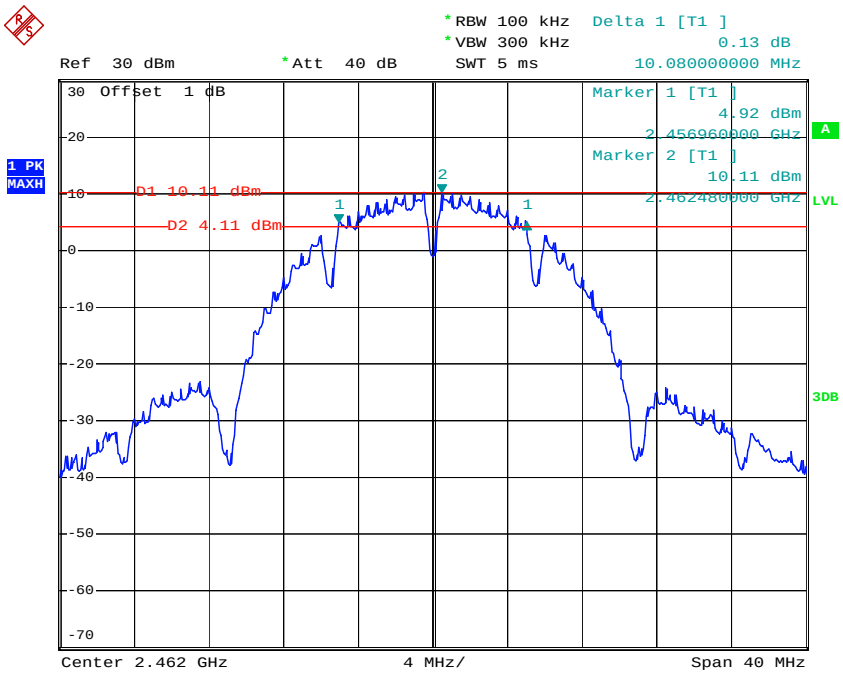
802.11b High Channel



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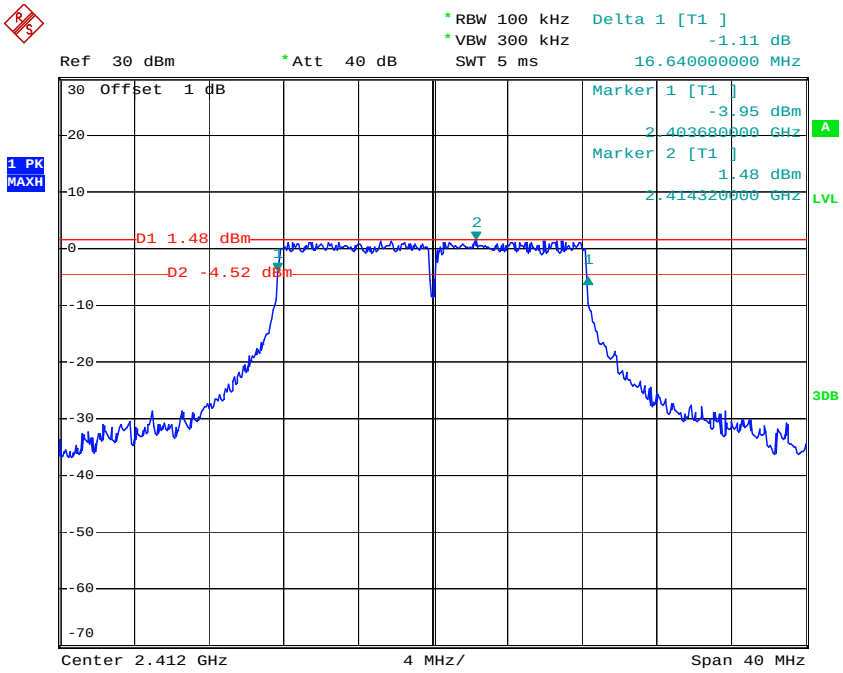
802.11g Low Channel



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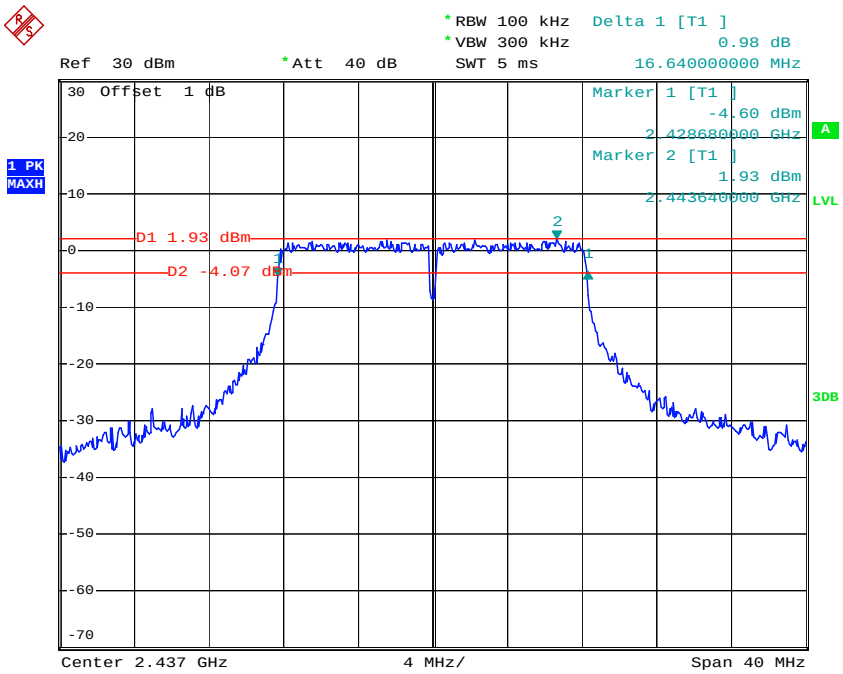
802.11g Middle Channel



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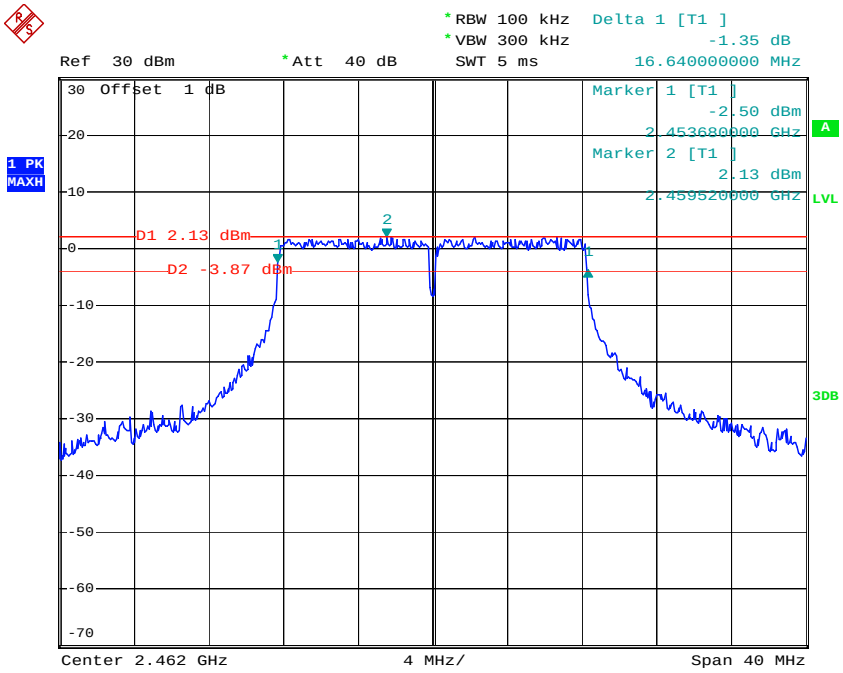
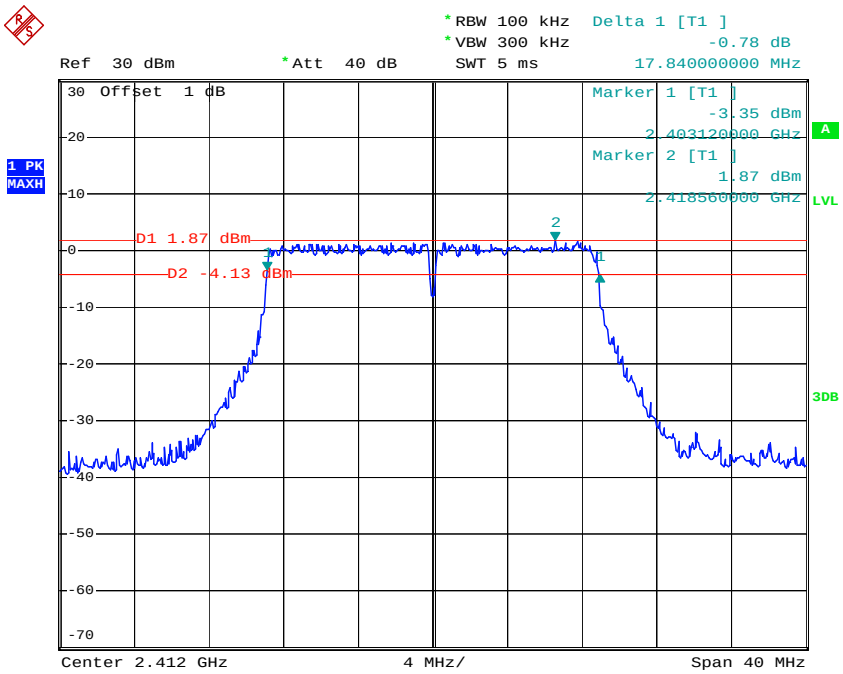
802.11g High Channel



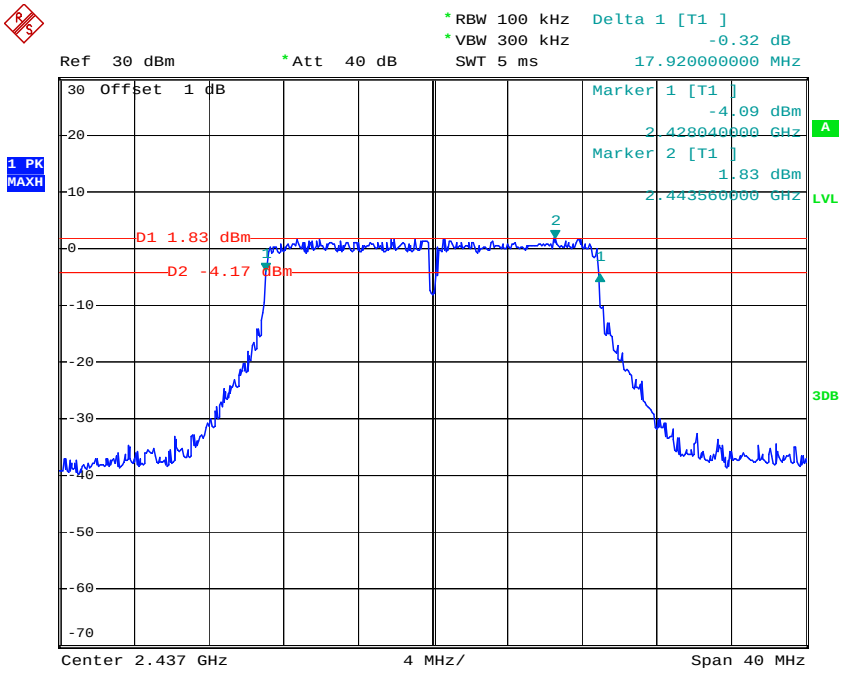
Date: 19.AUG.2017 15:53:15

802.11 n20 Low Channel



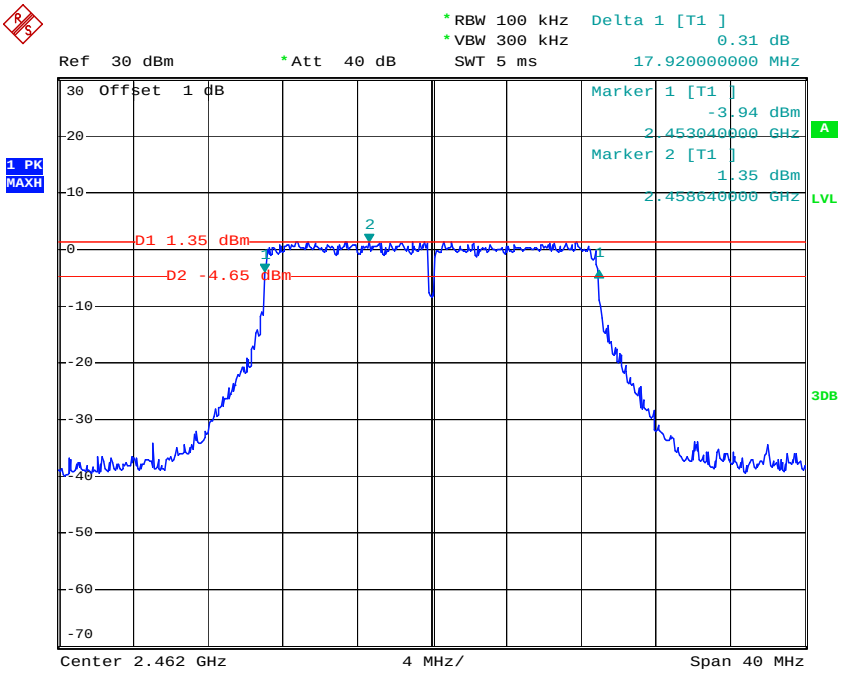
Date: 19.AUG.2017 18:05:11

802.11 n20 Middle Channel



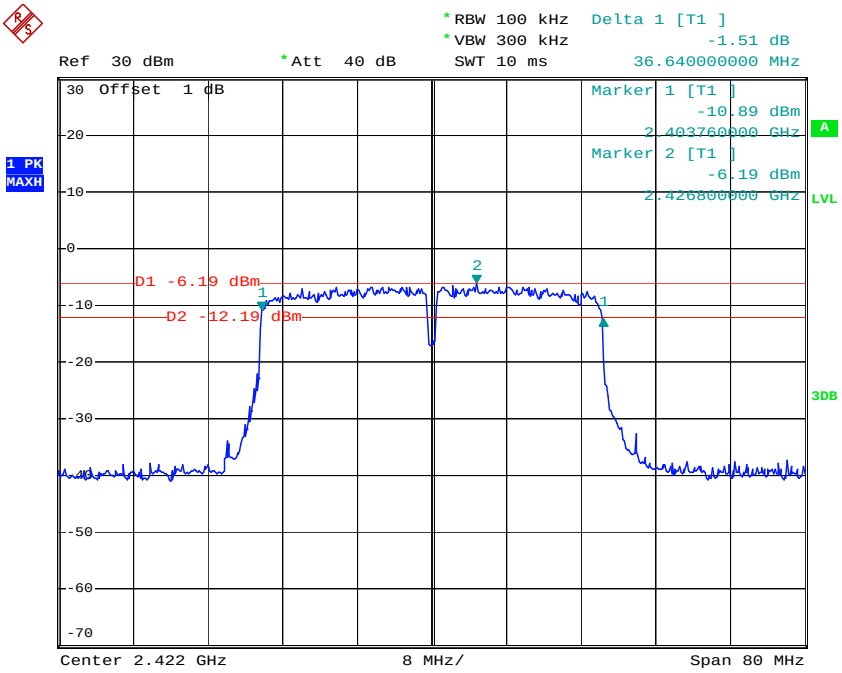
Date: 19.AUG.2017 18:08:15

802.11 n20 High Channel



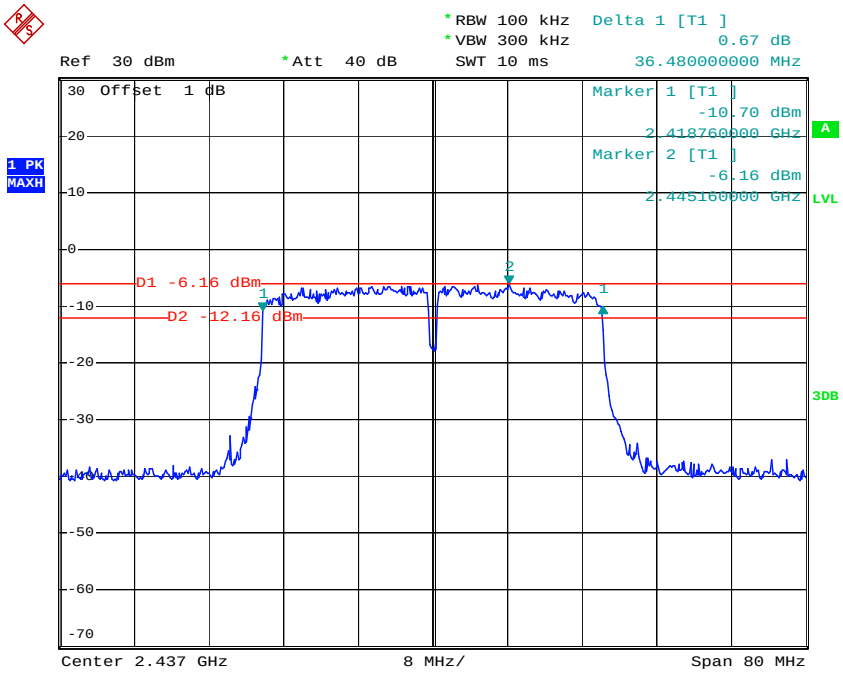
Date: 19.AUG.2017 18:13:57

802.11 n40 Low Channel



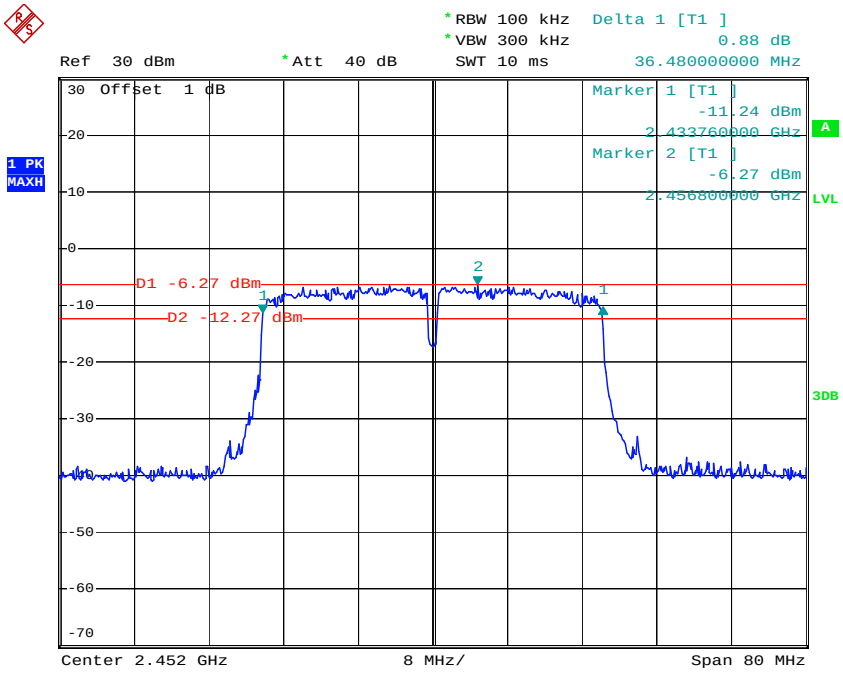
Date: 19.AUG.2017 18:16:32

802.11 n40 Middle Channel



Date: 19.AUG.2017 18:29:15

802.11 n40 High Channel



Date: 19.AUG.2017 18:32:05

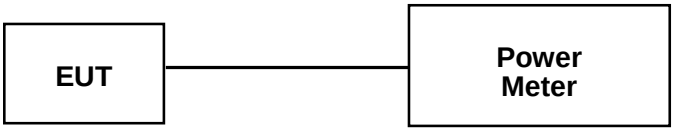
FCC §15.247(b) (3) - MAXIMUM PEAK CONDUCTED OUTPUT POWER

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
Agilent	Wideband Power Sensor	N1921A	MY54210016	2016-11-03	2017-11-03
Agilent	Wideband Power Sensor	N1921A	MY54170013	2016-11-03	2017-11-03
Agilent	P-Series Power Meter	N1912A	MY5000448	2016-11-03	2017-11-03
Unknown	Coaxial Cable	0.1m	C-1	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:	25.6 °C
Relative Humidity:	47 %
ATM Pressure:	100.5 kPa

The testing was performed by Calvin Chen on 2017-08-19.

Test Mode: Transmitting

SISO:

Test mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)		Limit (dBm)
			Chain 0	Chain 1	
802.11b	Low	2412	19.42	19.52	30
	Middle	2437	23.31	24.2	30
	High	2462	23.57	19.86	30
802.11g	Low	2412	24.07	25.05	30
	Middle	2437	24.34	25.41	30
	High	2462	24.58	25.63	30

MIMO:

Test mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)		Total (dBm)	Limit (dBm)
			Chain 0	Chain 1		
802.11 n20	Low	2412	24.44	24.64	27.55	30
	Middle	2437	24.59	24.57	27.59	30
	High	2462	24.56	24.75	27.67	30
802.11 n40	Low	2422	19.38	19.44	22.42	30
	Middle	2437	19.47	19.41	22.45	30
	High	2452	19.23	19.29	22.27	30

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	EMI Test Receiver	ESPI	100120	2016-12-08	2017-12-08
Unknown	Coaxial Cable	0.1m	C-1	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

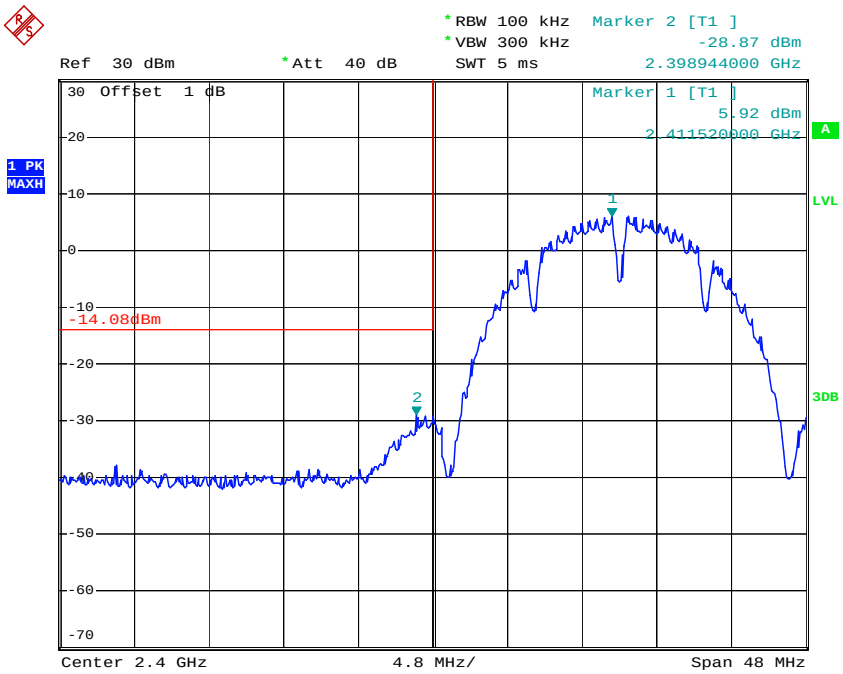
Temperature:	25.6 °C
Relative Humidity:	47 %
ATM Pressure:	100.5 kPa

The testing was performed by Calvin Chen on 2017-08-19.

Test mode: Transmitting

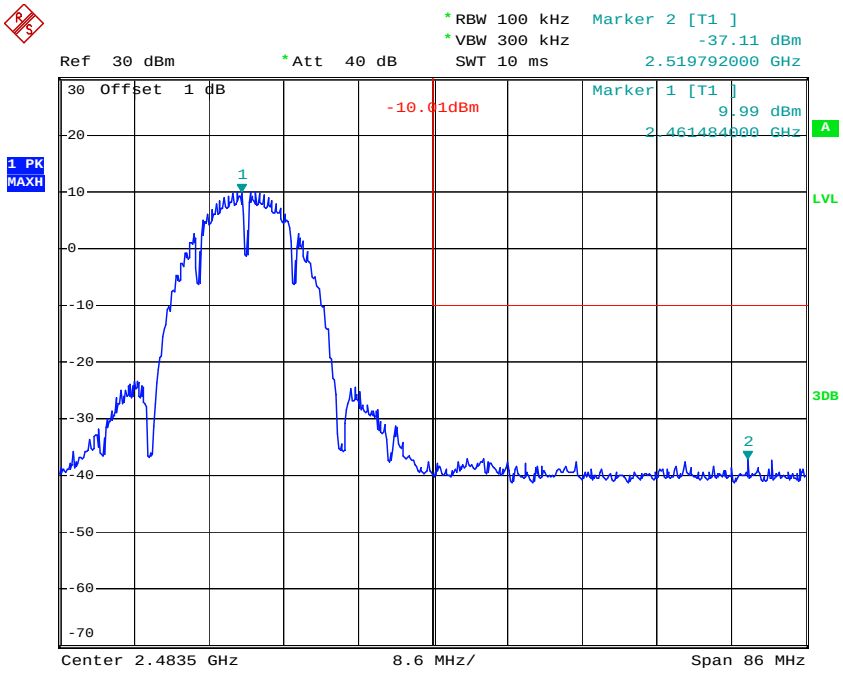
Test Result: Compliant. Please refer to following plots.

Chain 0, 802.11b: Band Edge, Left Side



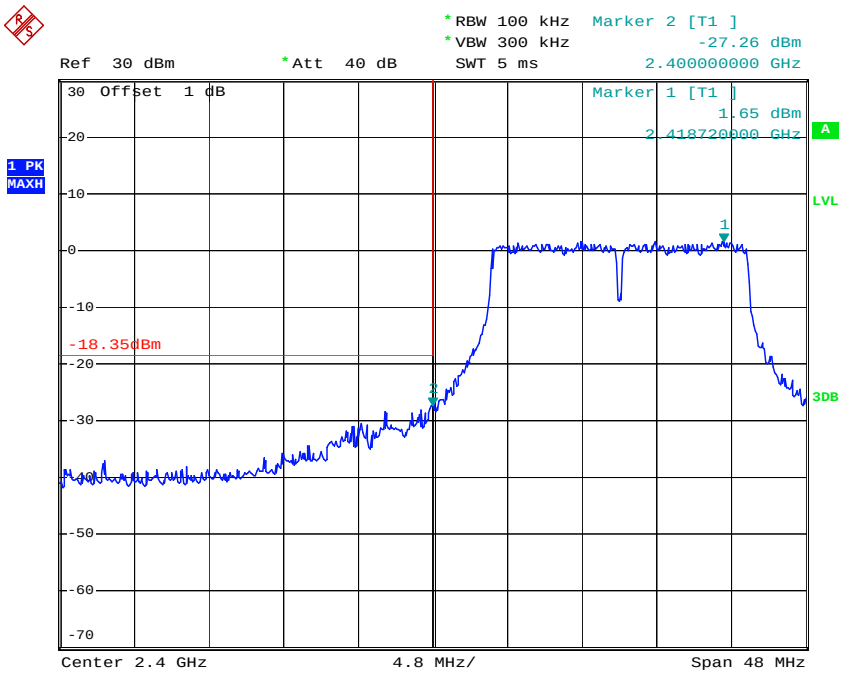
Date: 19.AUG.2017 14:51:48

Chain 0, 802.11b: Band Edge, Right Side



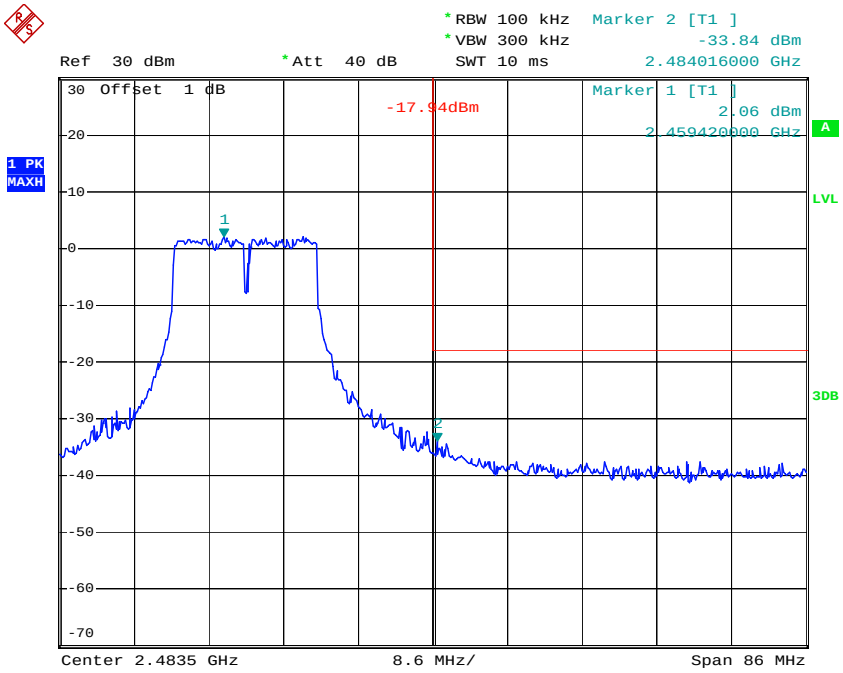
Date: 19.AUG.2017 14:45:36

Chain 0, 802.11g: Band Edge, Left Side



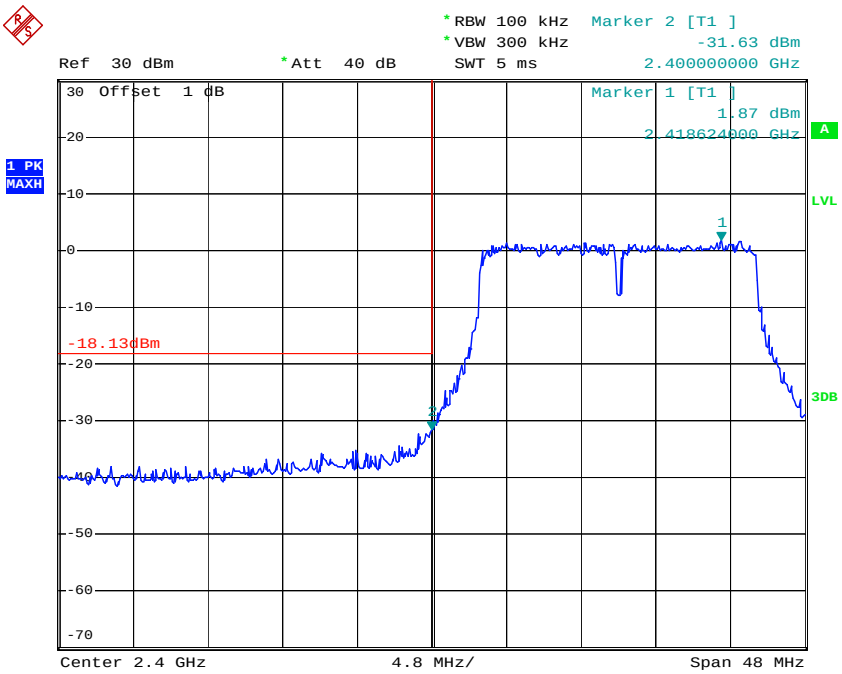
Date: 19.AUG.2017 15:49:36

Chain 0, 802.11g: Band Edge, Right Side



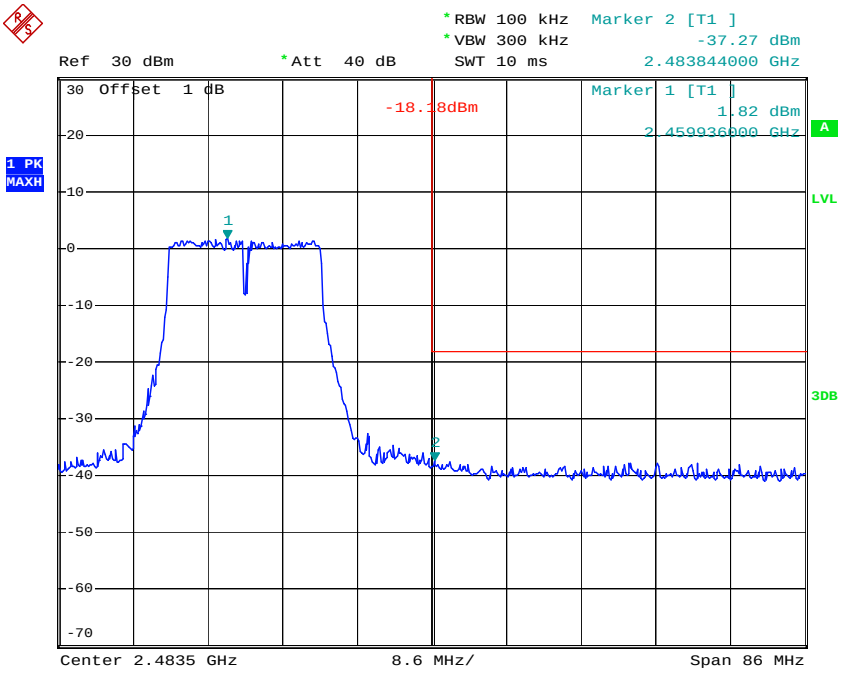
Date: 19.AUG.2017 15:54:41

Chain 0, 802.11 n20 Band Edge, Left Side



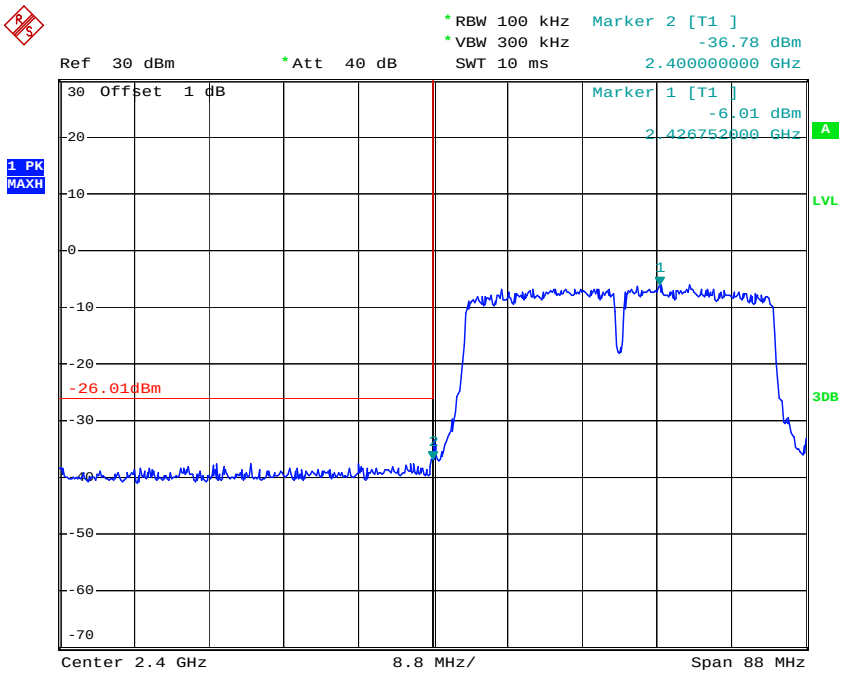
Date: 19.AUG.2017 18:06:31

Chain 0, 802.11 n20 Band Edge, Right Side



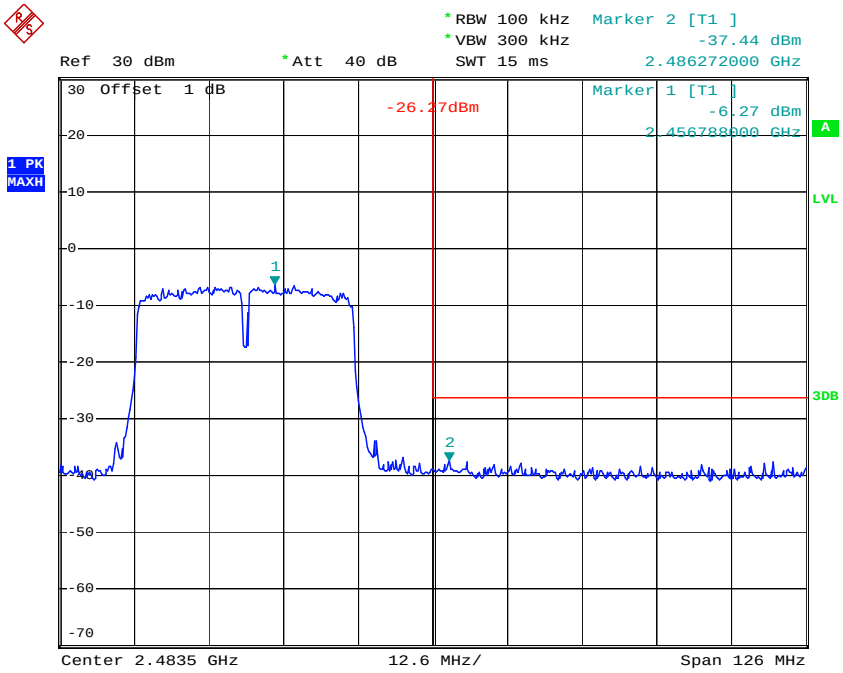
Date: 19.AUG.2017 18:15:25

Chain 0, 802.11 n40 Band Edge, Left Side



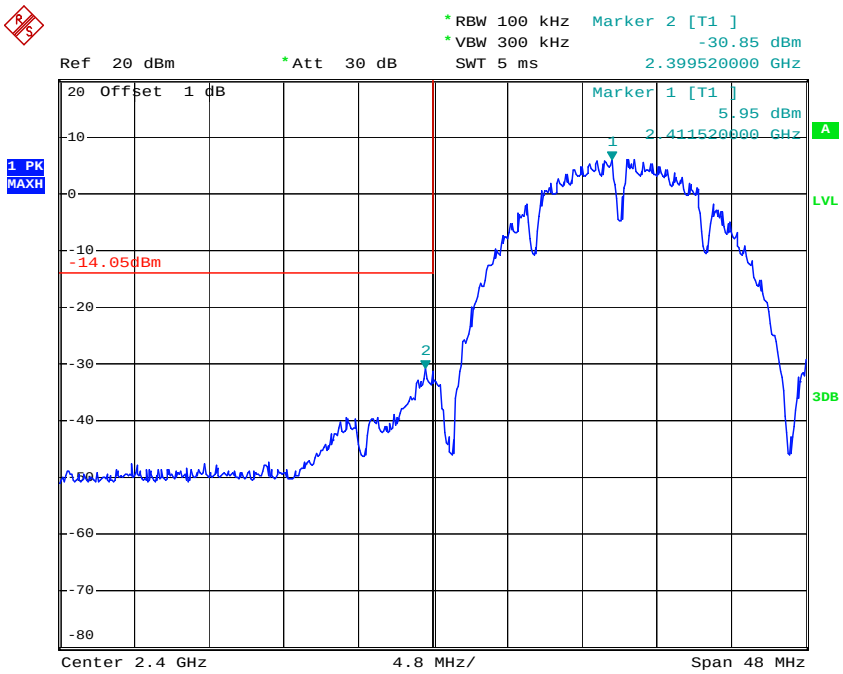
Date: 19.AUG.2017 18:18:10

Chain 0, 802.11 n40 Band Edge, Right Side



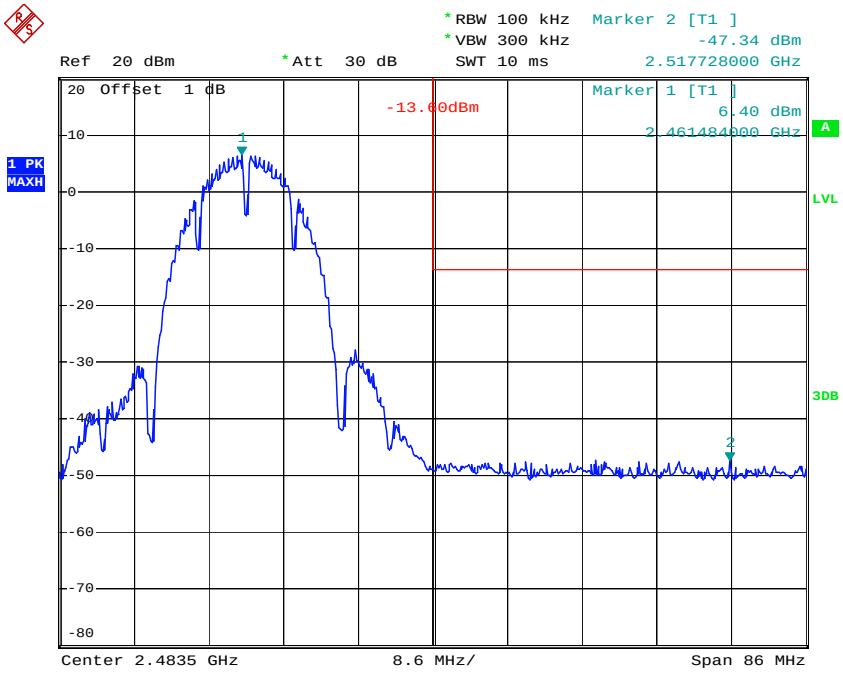
Date: 19.AUG.2017 18:33:35

Chain 1, 802.11b: Band Edge, Left Side



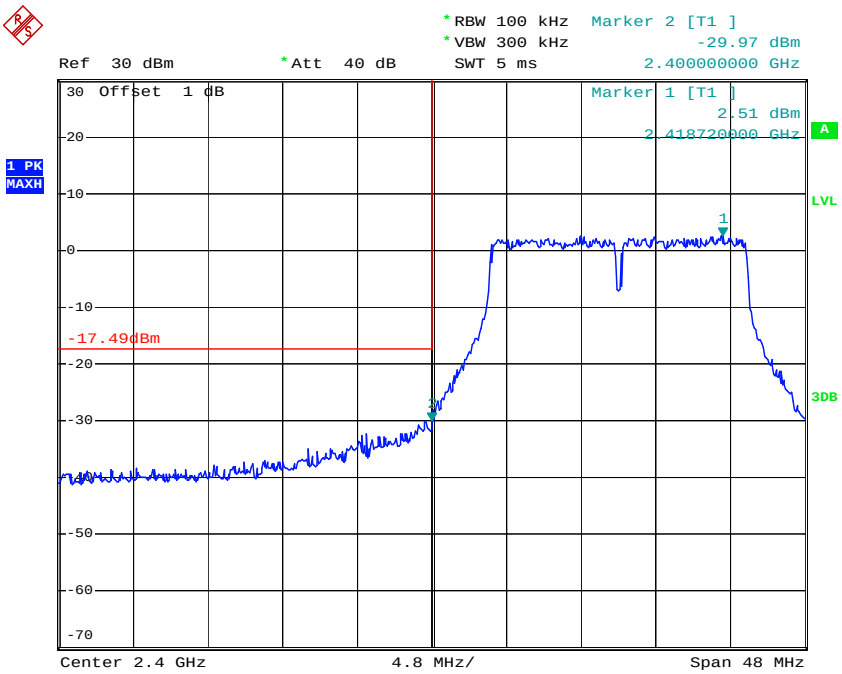
Date: 19.AUG.2017 14:33:19

Chain 1, 802.11b: Band Edge, Right Side



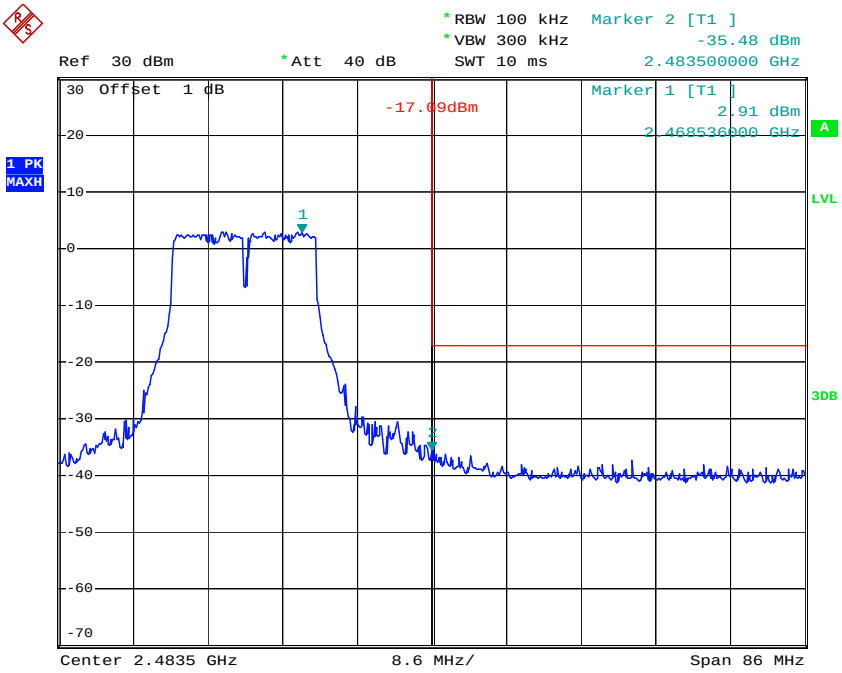
Date: 19.AUG.2017 14:37:57

Chain 1, 802.11g: Band Edge, Left Side



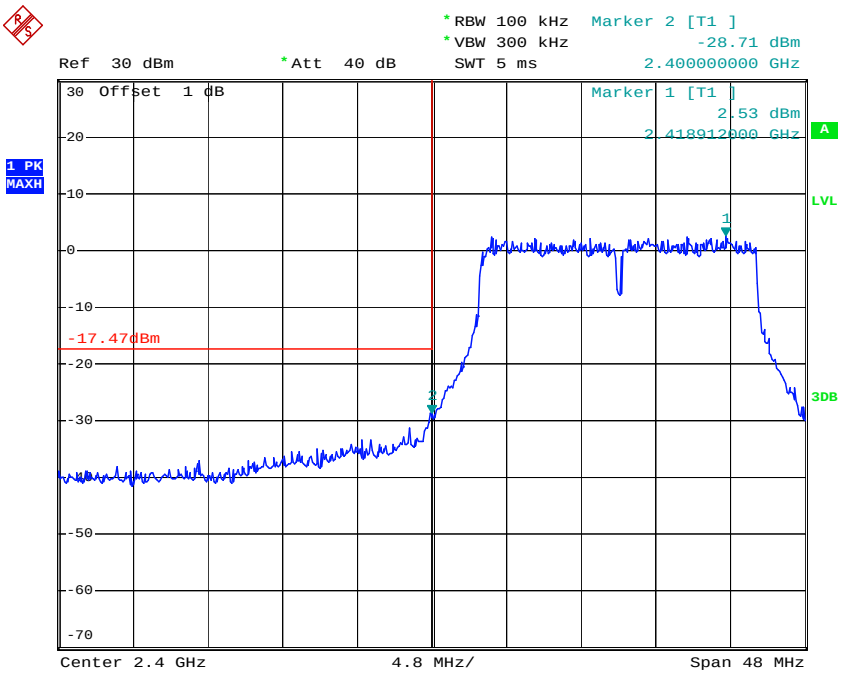
Date: 19.AUG.2017 18:00:09

Chain 1, 802.11g: Band Edge, Right Side



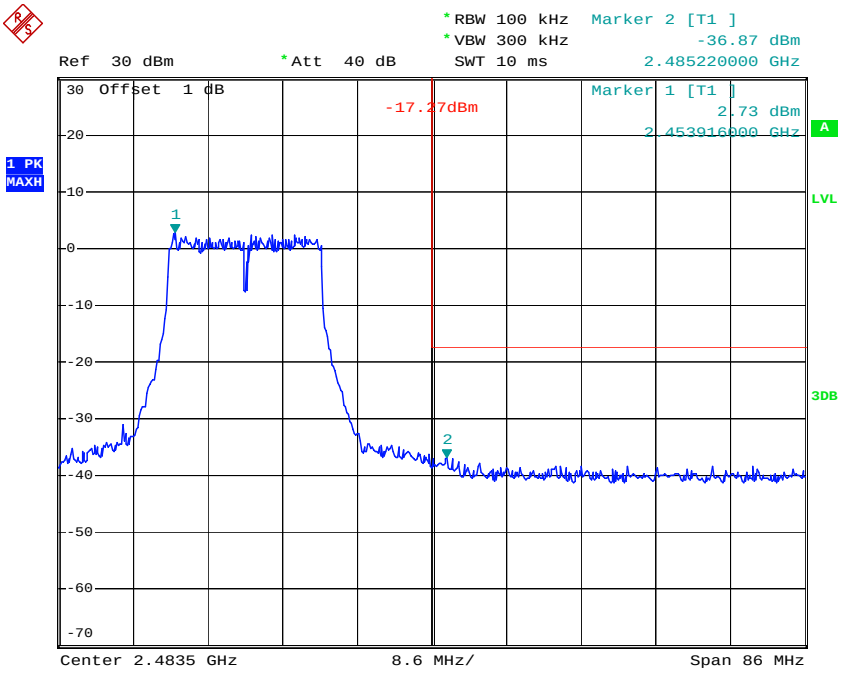
Date: 19.AUG.2017 17:55:54

Chain 1, 802.11 n20 Band Edge, Left Side



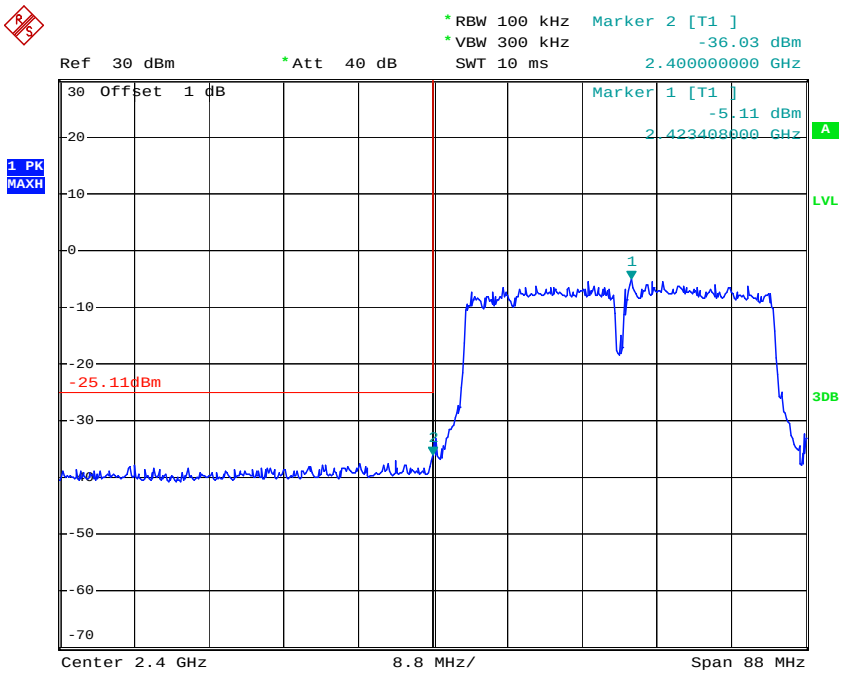
Date: 19.AUG.2017 18:04:06

Chain 1, 802.11 n20 Band Edge, Right Side



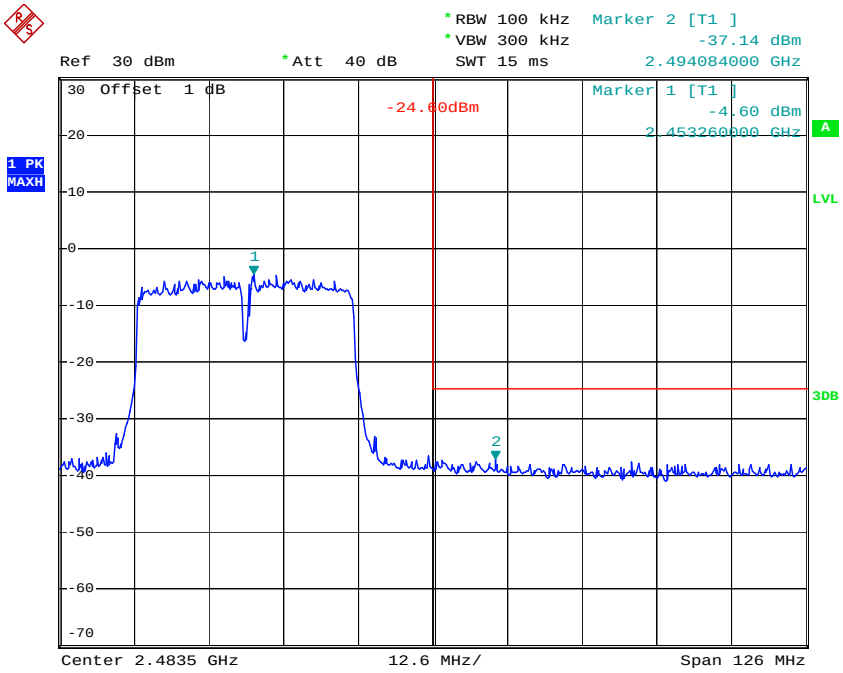
Date: 19.AUG.2017 18:12:55

Chain 1, 802.11 n40 Band Edge, Left Side



Date: 19.AUG.2017 18:22:48

Chain 1, 802.11 n40 Band Edge, Right Side



Date: 19.AUG.2017 18:36:51

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	ESPI	100120	2016-12-08	2017-12-08
Unknown	Coaxial Cable	0.1m	C-1	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:	25.6 °C
Relative Humidity:	47 %
ATM Pressure:	100.5 kPa

The testing was performed by Calvin Chen on 2017-08-19 .

Test Result: Compliance

Test Mode: Transmitting

SISO:

Test mode	Channel	Frequency (MHz)	PSD (dBm/3kHz)		Limit (dBm/3kHz)
			Chain 0	Chain 1	
802.11b	Low	2412	-14.05	-14.11	≤8
	Middle	2437	-10.22	-9.45	≤8
	High	2462	-10.09	-13.7	≤8
802.11g	Low	2412	-12.86	-11.67	≤8
	Middle	2437	-12.73	-11.12	≤8
	High	2462	-12.03	-11.38	≤8

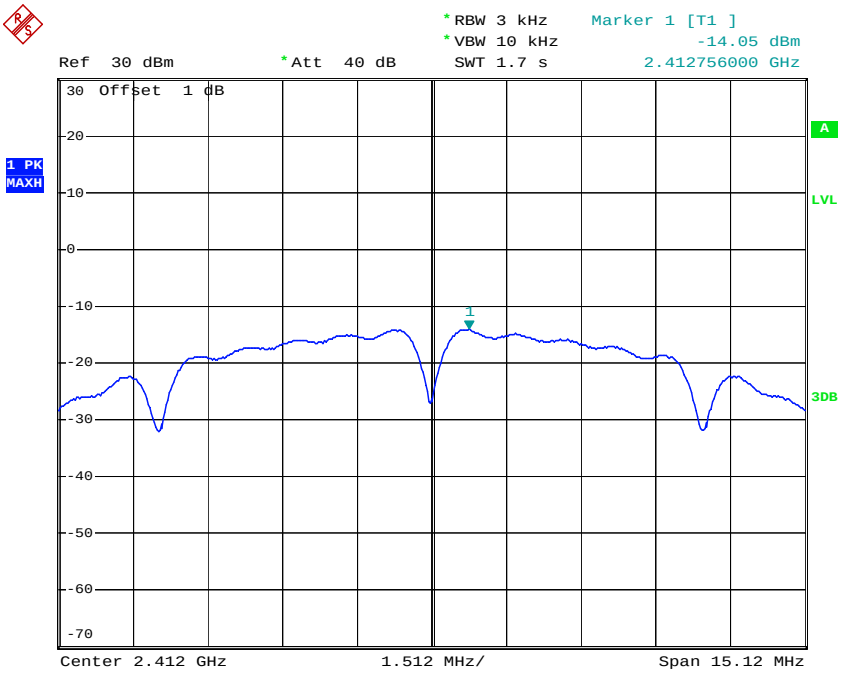
MIMO:

Test mode	Channel	Frequency (MHz)	PSD (dBm/3kHz)		Total (dBm/3kHz)	Limit (dBm/3kHz)
			Chain 0	Chain 1		
802.11 n20	Low	2412	-11.33	-11.82	-8.56	≤8
	Middle	2437	-10.75	-12.42	-8.49	≤8
	High	2462	-10.75	-11.89	-8.27	≤8
802.11 n40	Low	2422	-19.26	-19.88	-16.55	≤8
	Middle	2437	-19.35	-18.96	-16.14	≤8
	High	2452	-18.68	-19.56	-16.09	≤8

Please refer to the following plots

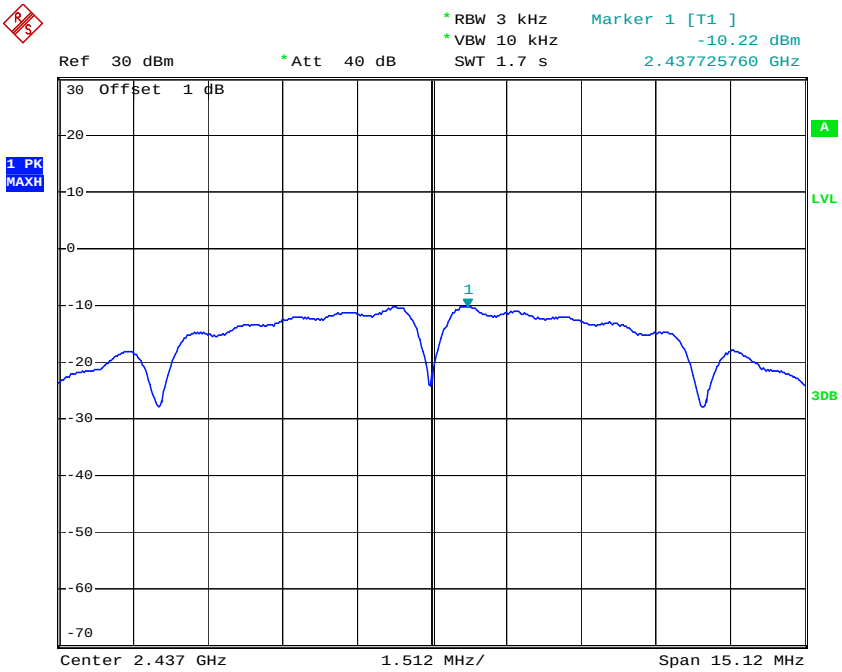
Chain 0:

Power Spectral Density, 802.11b Low Channel



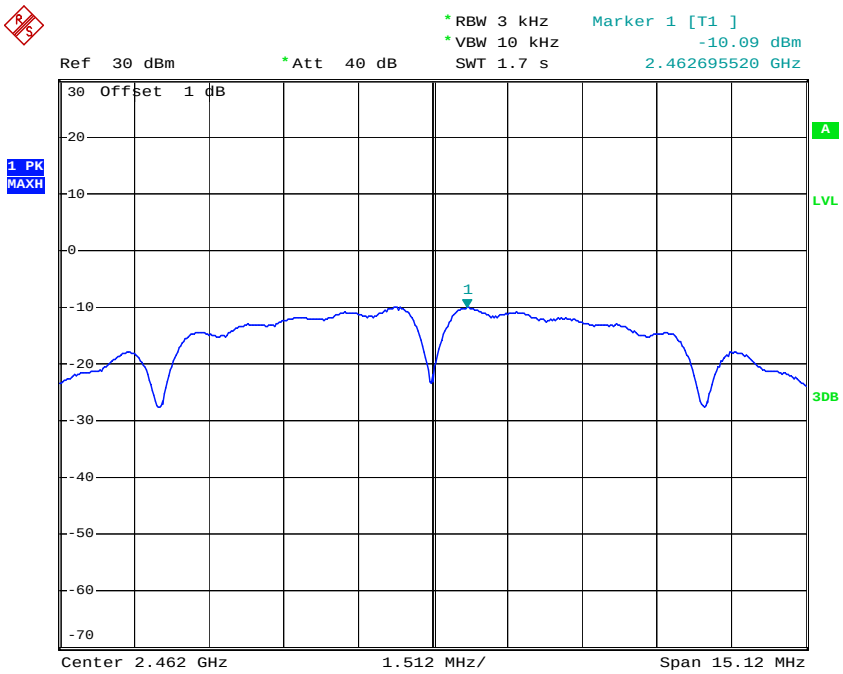
Date: 19.AUG.2017 14:51:31

Power Spectral Density, 802.11b Middle Channel



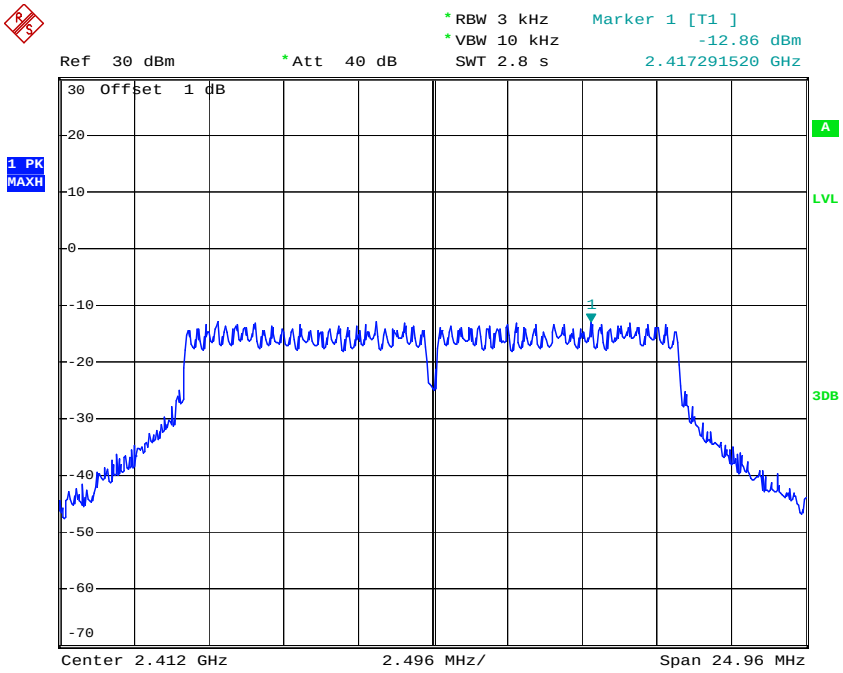
Date: 19.AUG.2017 14:47:16

Power Spectral Density, 802.11b High Channel



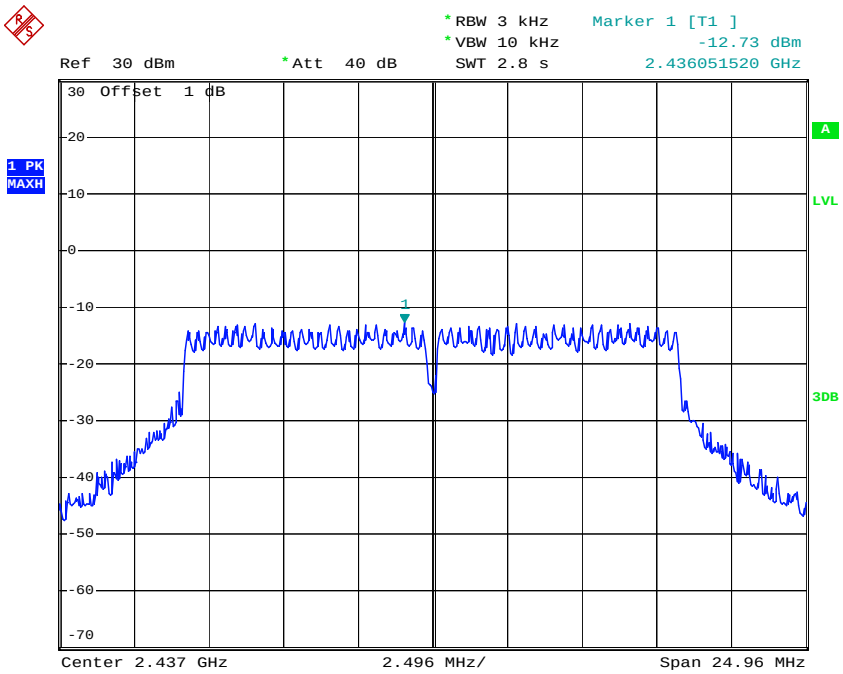
Date: 19.AUG.2017 14:45:18

Power Spectral Density, 802.11g Low Channel



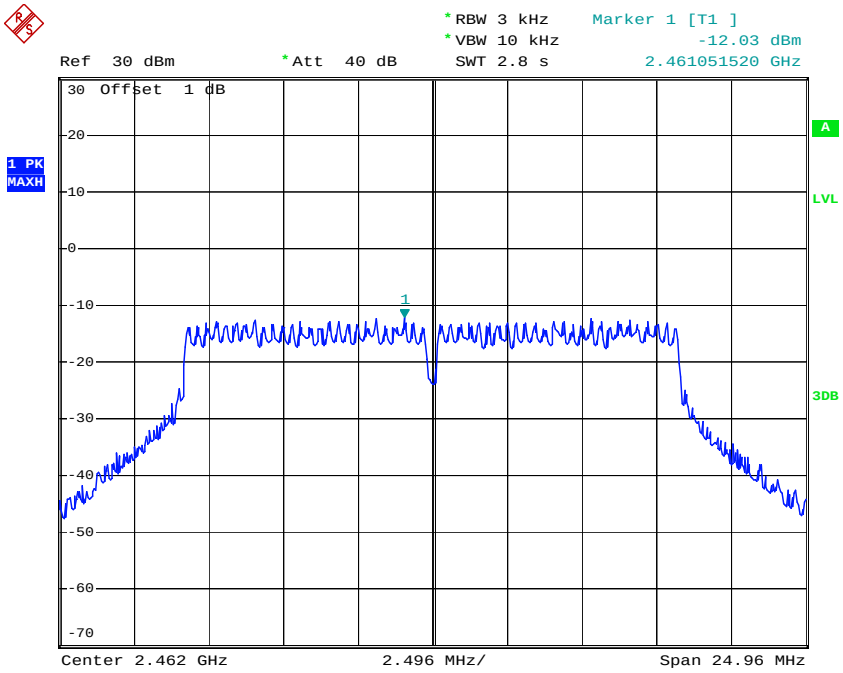
Date: 19.AUG.2017 15:49:19

Power Spectral Density, 802.11g Middle Channel



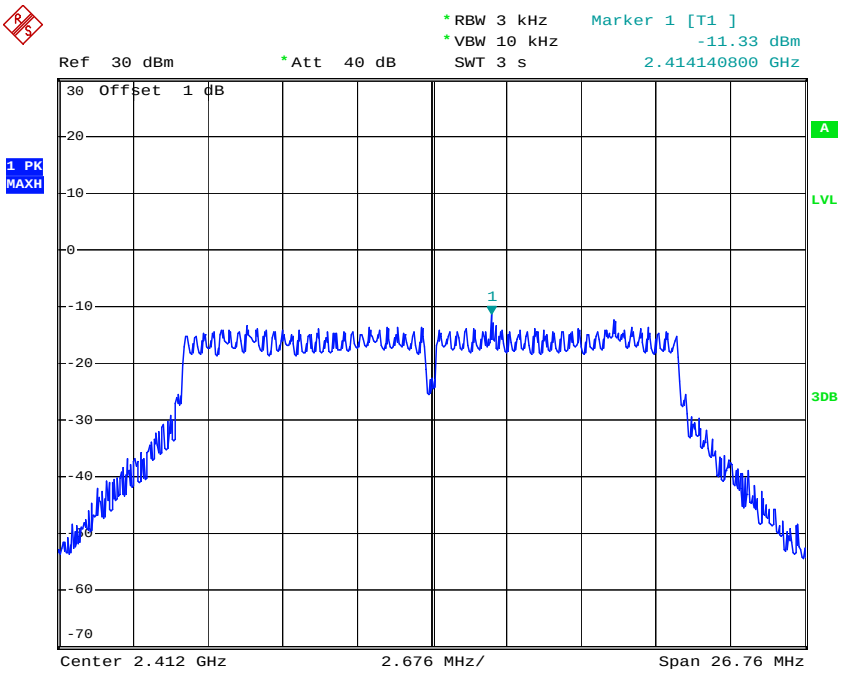
Date: 19.AUG.2017 15:52:10

Power Spectral Density, 802.11g High Channel



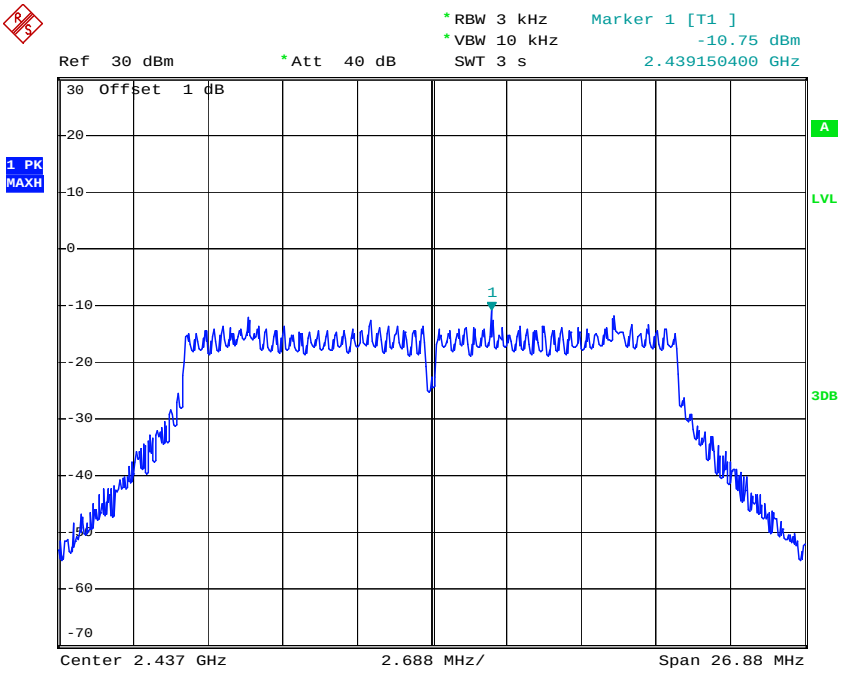
Date: 19.AUG.2017 15:54:17

Power Spectral Density, 802.11 n20 Low Channel



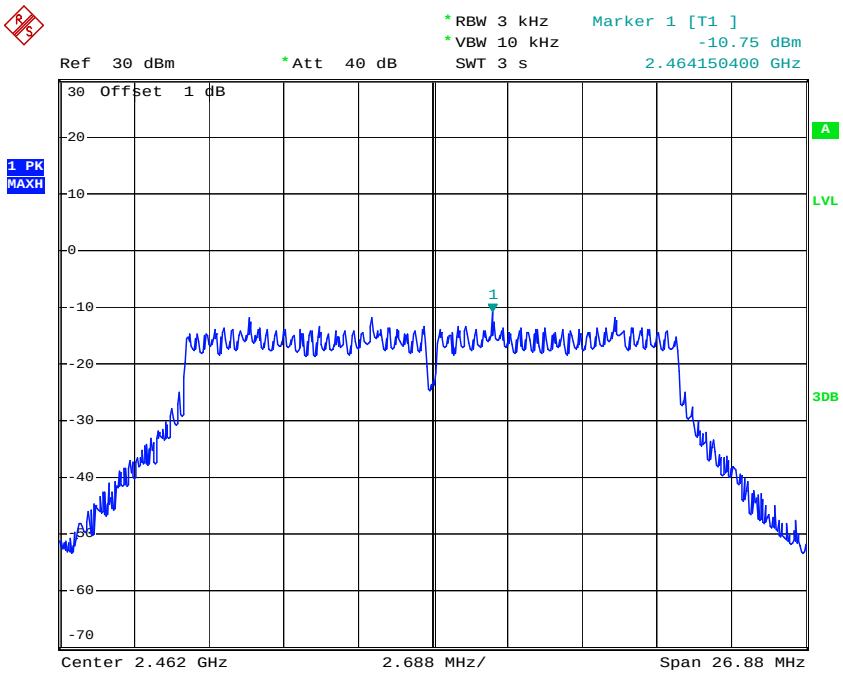
Date: 19.AUG.2017 18:06:05

Power Spectral Density, 802.11 n20 Middle Channel



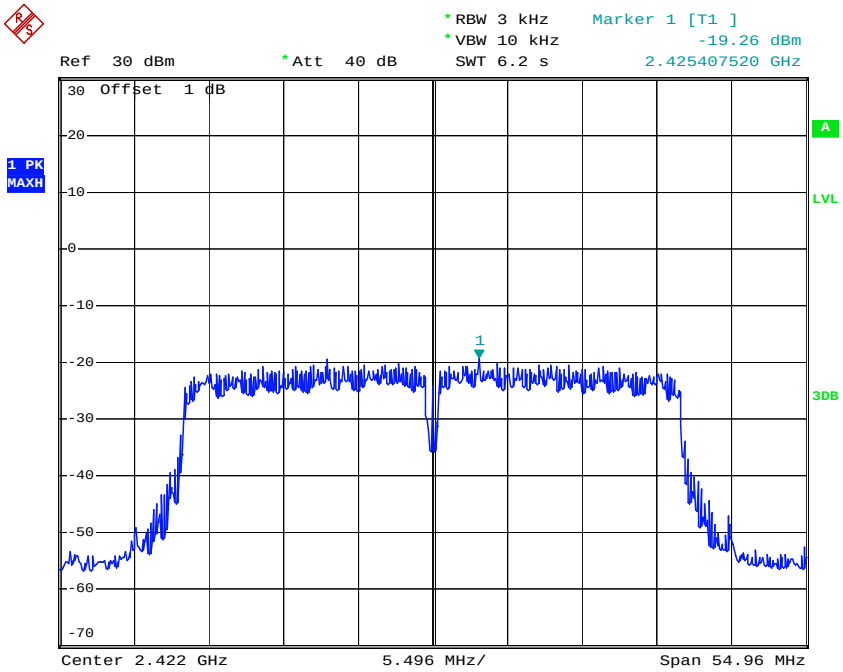
Date: 19.AUG.2017 18:09:08

Power Spectral Density, 802.11 n20 High Channel



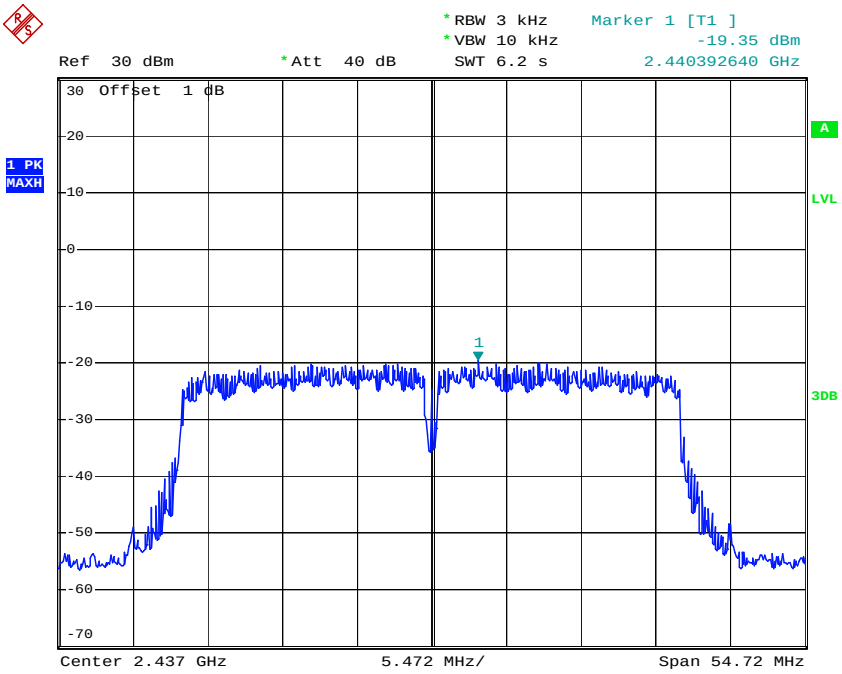
Date: 19.AUG.2017 18:15:00

Power Spectral Density, 802.11 n40 Low Channel



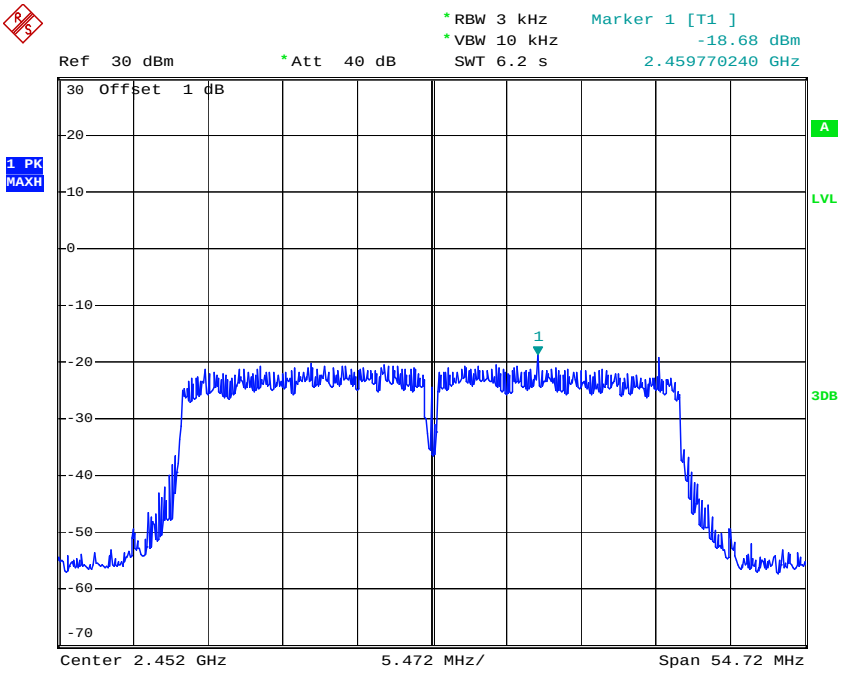
Date: 19.AUG.2017 18:17:40

Power Spectral Density, 802.11 n40 Middle Channel



Date: 19.AUG.2017 18:30:33

Power Spectral Density, 802.11 n40 High Channel



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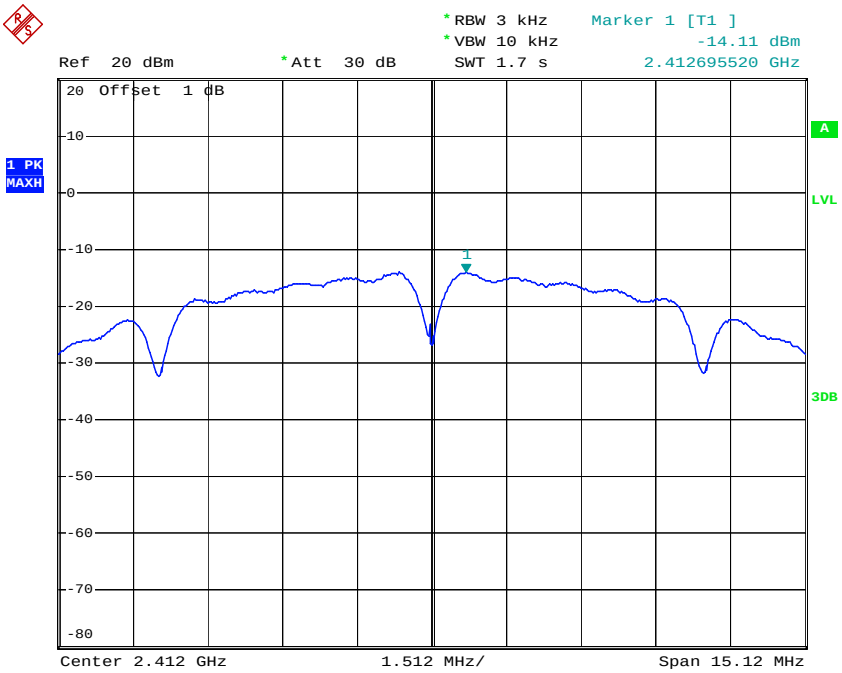
Chain 1:

Power Spectral Density, 802.11b Low Channel



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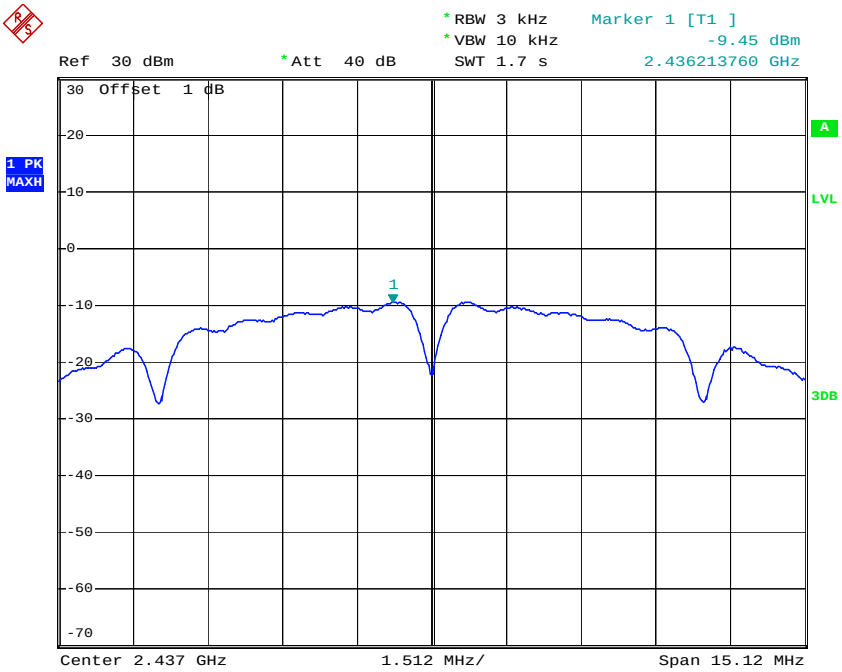
Power Spectral Density, 802.11b Middle Channel



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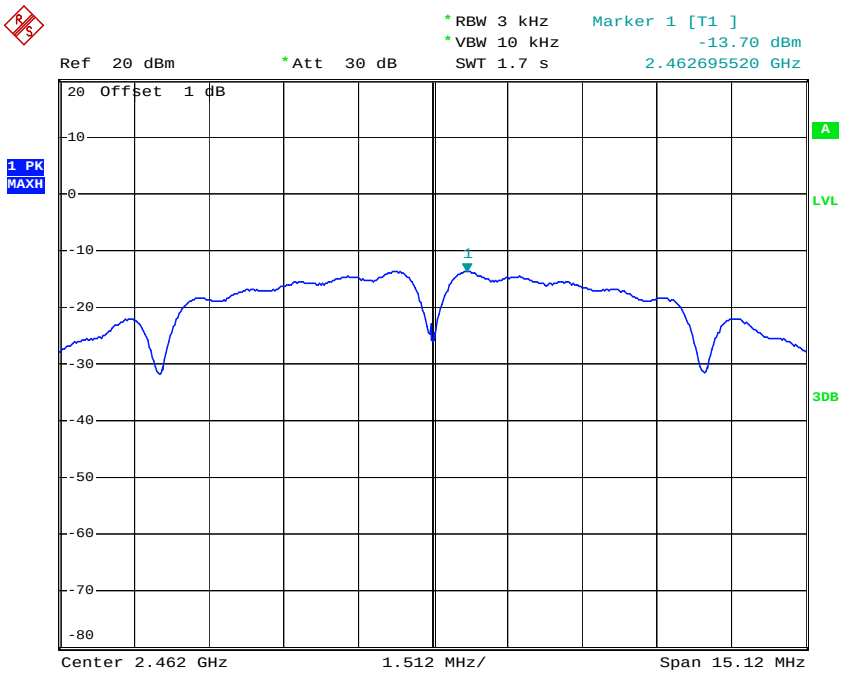
Power Spectral Density, 802.11b High Channel



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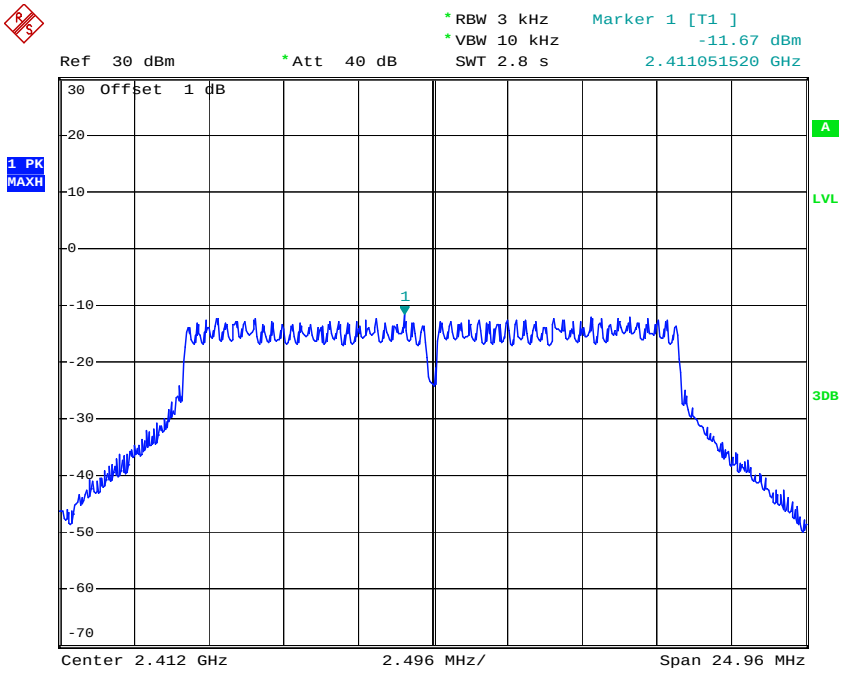
Power Spectral Density, 802.11g Low Channel



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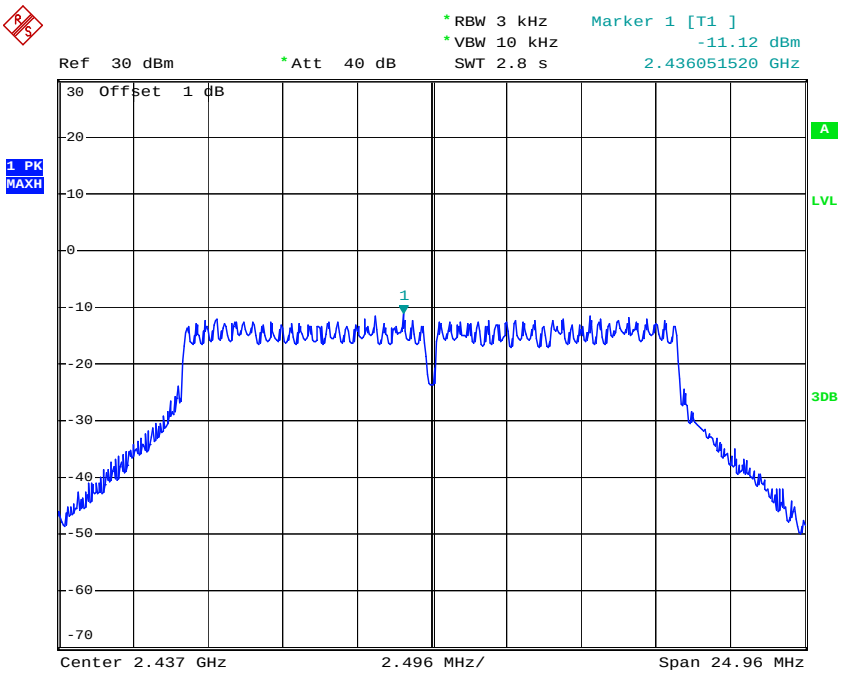
Power Spectral Density, 802.11g Middle Channel



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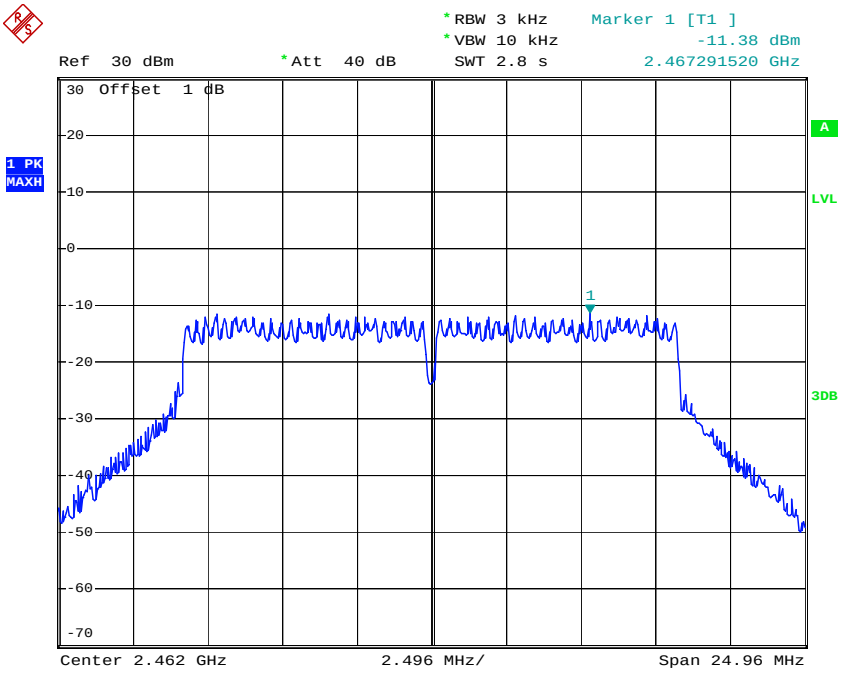
Power Spectral Density, 802.11g High Channel



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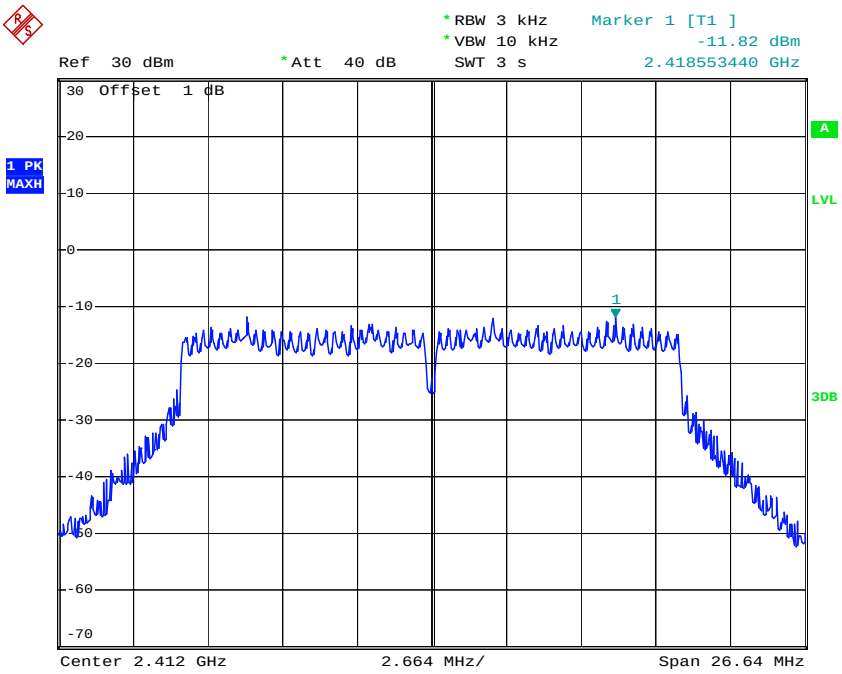
Power Spectral Density, 802.11 n20 Low Channel



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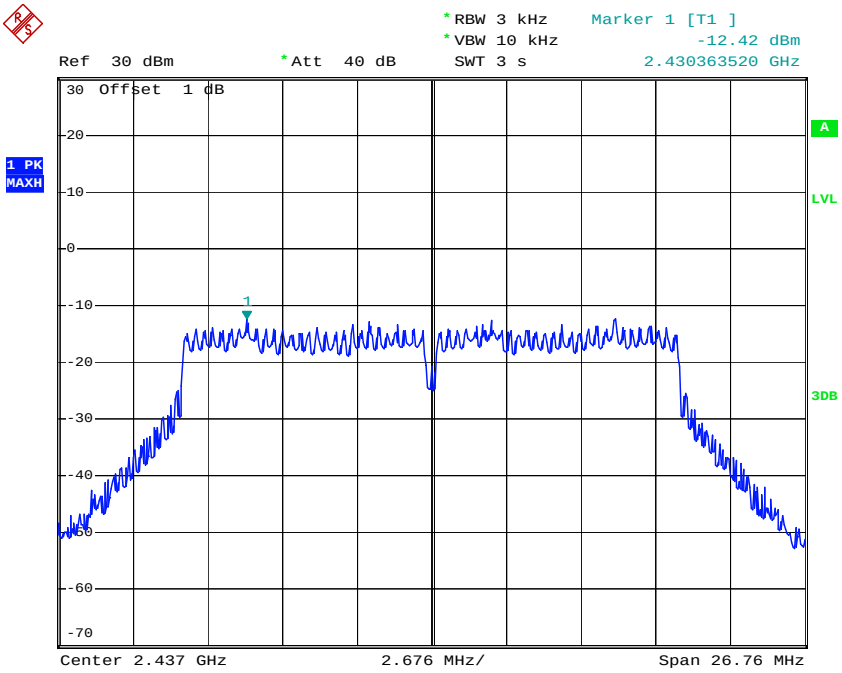
Power Spectral Density, 802.11 n20 Middle Channel



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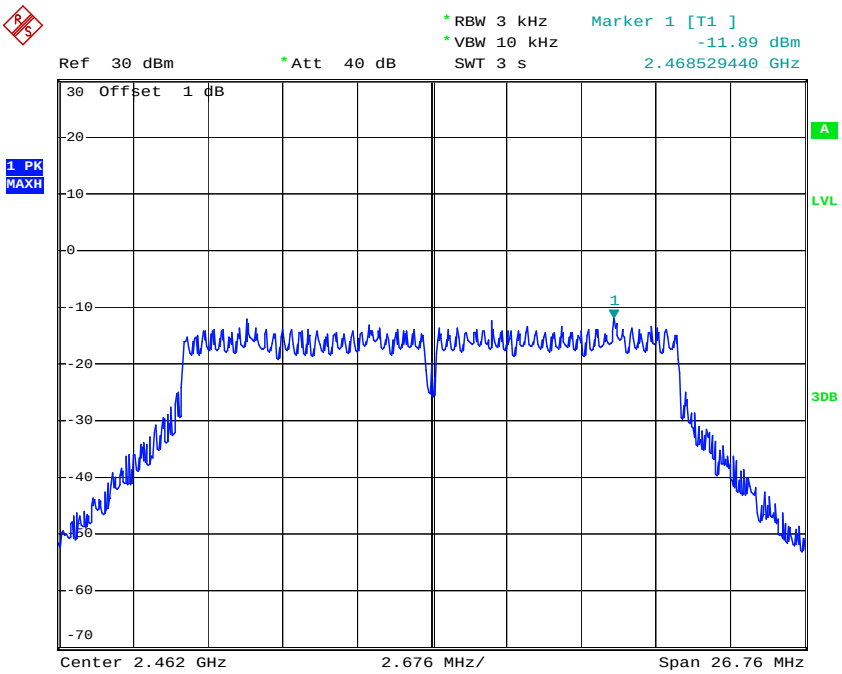
Power Spectral Density, 802.11 n20 High Channel



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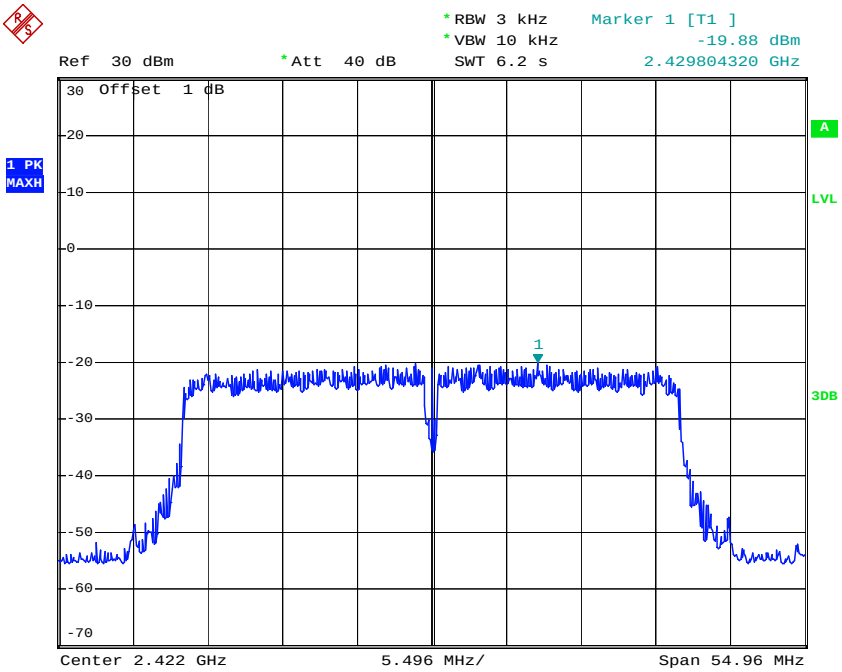
Power Spectral Density, 802.11 n40 Low Channel



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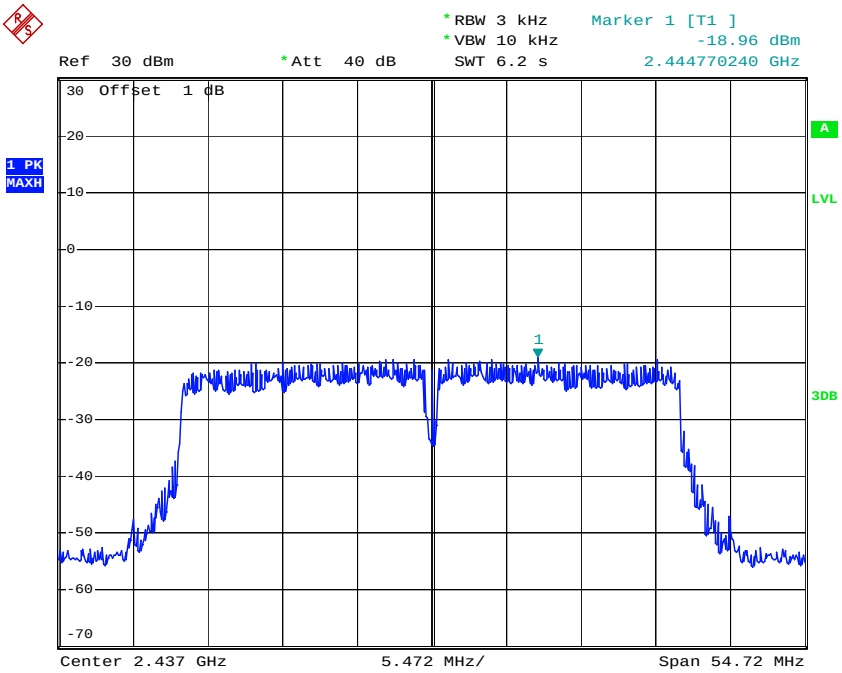
Power Spectral Density, 802.11 n40 Middle Channel



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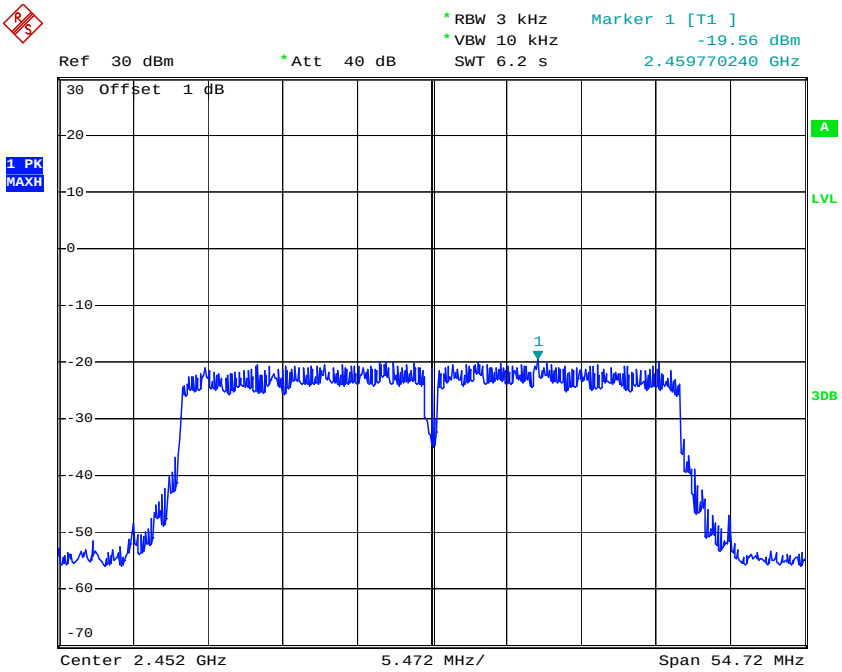
Power Spectral Density, 802.11 n40 High Channel



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