FCC PART 15.247

TEST REPORT

For

ZIONCOM ELECTRONICS (SHENZHEN) LTD.

Building A1-A2, Lantian Science and Technology Park, Xinyu Road, Xinqiao Henggang Block, Shajing Street, Baoan District, Shenzhen, China

FCC ID: X7DWL0306

Report Type:	**Product Name:**
Original Report	AC650 Wireless Dual Band USB Adapter

Report Number:	RDG171206016-00A
Report Date:	2017-12-22
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)

EUT Name:	AC650 Wireless Dual Band USB Adapter
EUT Model:	A650UA
Multiple Models:	WL0306
FCC ID:	X7DWL0306
Rated Input Voltage:	DC 5V from USB port
External Dimension:	Length (24.8cm)*Width (1.7cm)*High (1.3cm)
Serial Number:	171206016
EUT Received Date:	2017.12.06

Note: The series product, models A650UA, WL0306 are electrically identical, the differences between them just the model name for marketing purpose, we selected A650UA for fully test , and please refer to the declaration letter for details.

Objective

This report is prepared on behalf of ***ZIONCOM ELECTRONICS (SHENZHEN) 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: X7DWL0306.

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 KDB 558074 D01 DTS Meas Guidance v04.

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~26.5GHz: 5.23 dB
Unwanted Emissions, conducted	±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/IEC 17025 by CNAS(Lab code: L5662). And accredited to ISO/IEC 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 , 11 channels are provided:

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

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

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

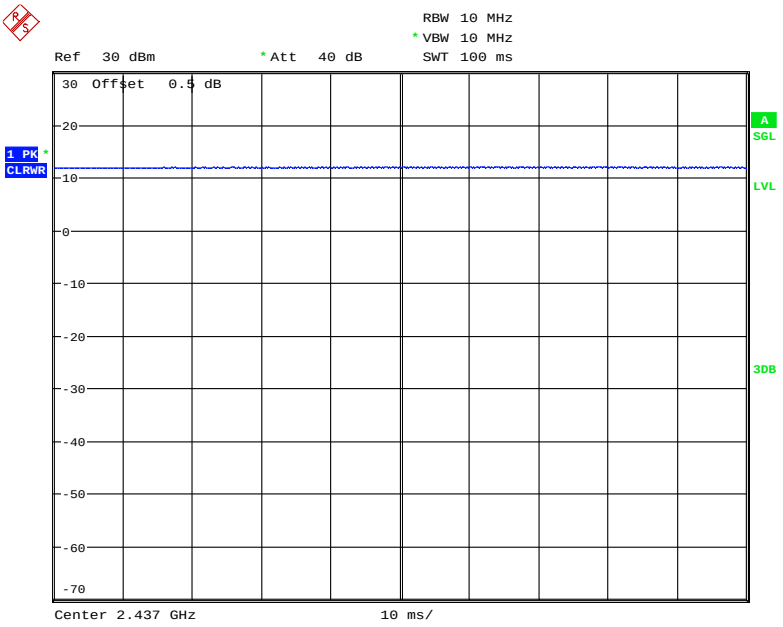
The software "MPTOOL" was used for testing, which was provided by manufacturer. The worst-case data rates are determined to be as follows for each mode based upon investigations by measuring the average power and PSD across all date rates bandwidths, and modulations. The maximum power was configured as below table, that provided by the manufacturer:

Test Mode	Test Software Version	MPTOOL		
802.11b	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	1Mbps	1Mbps	1Mbps
	Power Level Setting	25	24	25
802.11g	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	6Mbps	6Mbps	6Mbps
	Power Level Setting	35	35	36
802.11n ht20	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	MCS0	MCS0	MCS0
	Power Level Setting	35	35	35
802.11n ht40	Test Frequency	2422MHz	2437MHz	2452MHz
	Data Rate	MCS0	MCS0	MCS0
	Power Level Setting	35	35	35

The duty cycle as below:

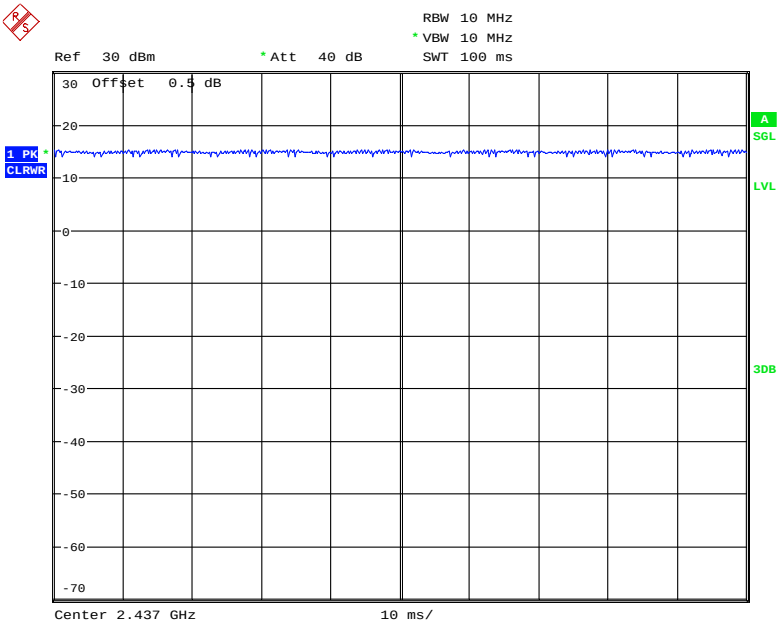
Mode	T_{on} (ms)	T_{on+off} (ms)	Duty Cycle (%)
802.11b	100	100	100
802.11g	100	100	100
802.11n ht20	100	100	100
802.11n ht40	100	100	100

802.11b



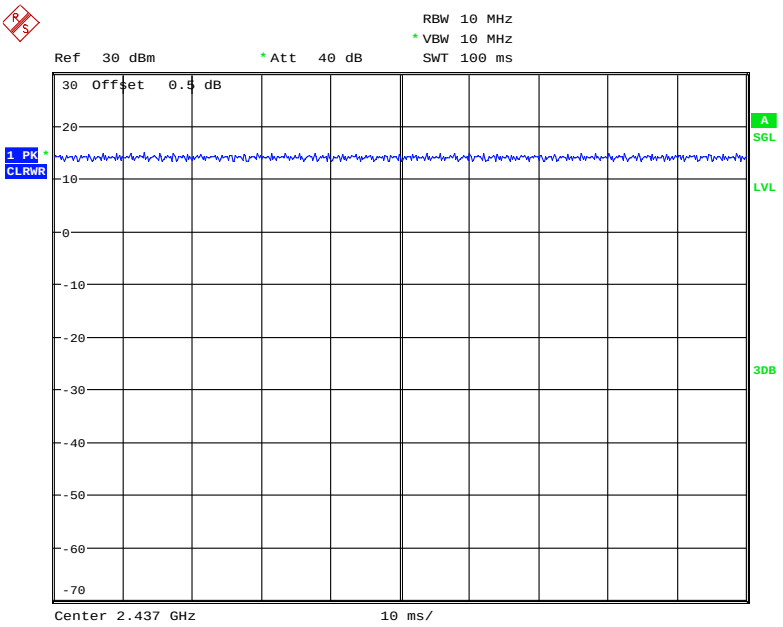
Date: 16.DEC.2017 17:31:47

802.11g



Date: 16.DEC.2017 17:30:55

802.11n ht20



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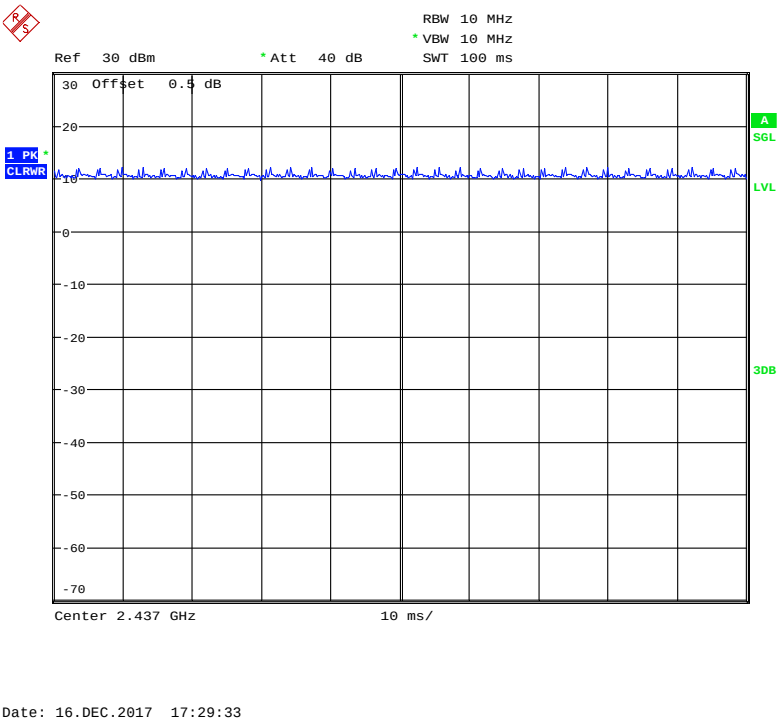
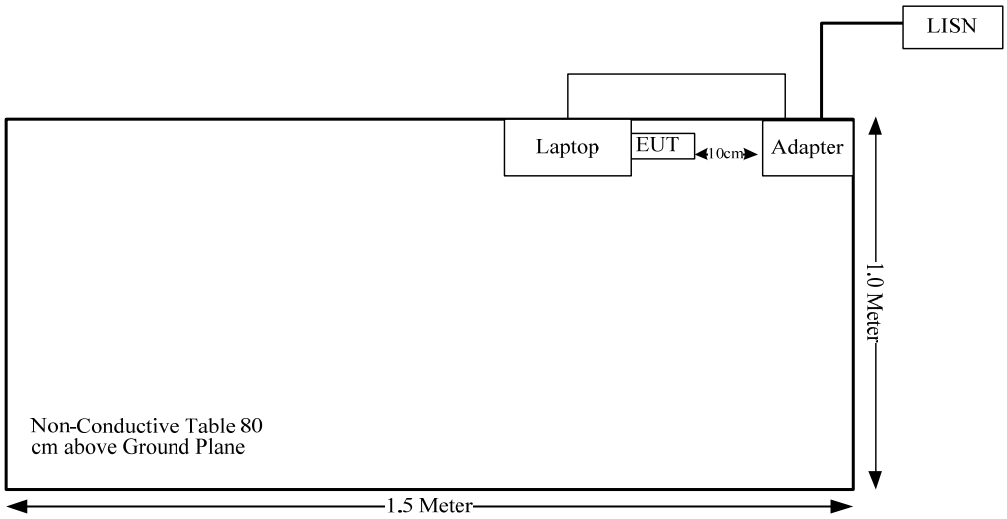
802.11n ht40



Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
DELL	Laptop	PP11L	QDS-BRCM1017

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i) & §1.1310 & §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliant
§15.207 (a)	AC Line Conducted Emissions	Compliant
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliant
§15.247(b)(3)	Maximum conducted output power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE

Applicable Standard

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

According to KDB447498 D01 General RF Exposure Guidance v06:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

Measurement Result

The max conducted power including tune-up tolerance is 8.0 dBm (6.31 mW).
[(max. power of channel, mW)/(min. test separation distance, mm)][√f(GHz)]
=6.31/5*(√2.462) = 1.98< 3.0

Note: 2.4GHz and 5GHz can`t transmitting simultaneously.

So the stand-alone SAR evaluation is not necessary.

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.

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 have an external antenna for 2.4G Band and 5G band permanently attached to the unit, the antenna gain is 5dBi in 2.4G and 5G band. Please refer to the EUT photo.

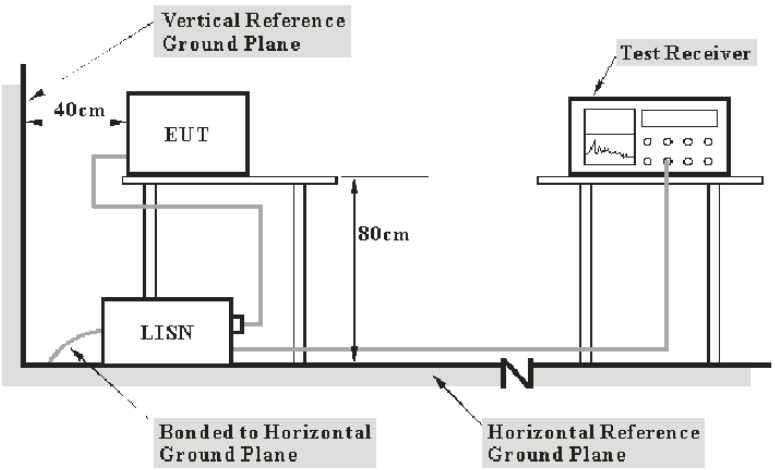
Result: Compliance.

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 AC 120 V/60 Hz 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	2017-12-11	2018-12-11
R&S	L.I.S.N	ESH2-Z5	892107/021	2017-09-25	2018-09-25
R&S	Two-line V-network	ENV 216	101614	2017-12-08	2018-12-08
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A
N/A	Coaxial Cable	C-NJNJ-50	C-0200-01	2017-09-05	2018-09-05

*** 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

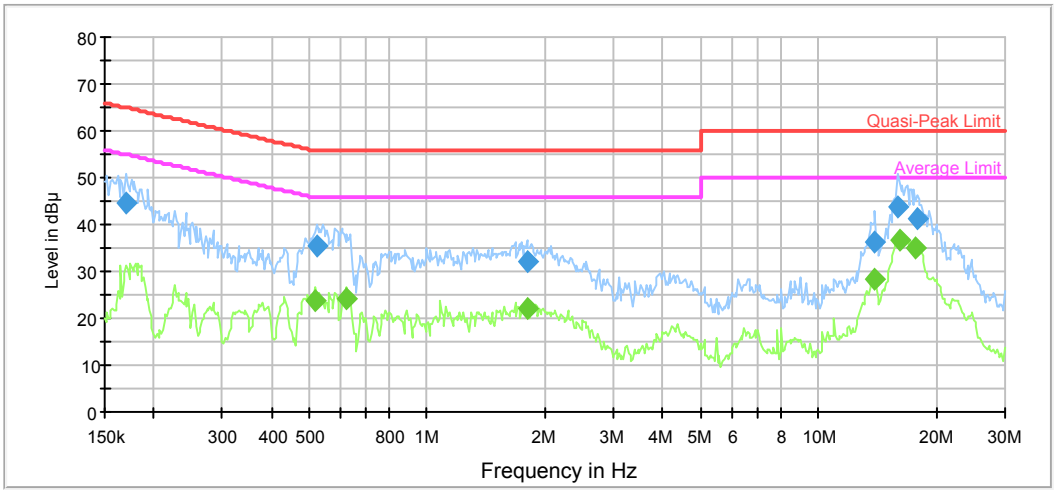
Environmental Conditions

Temperature:	25.3°C
Relative Humidity:	35 %
ATM Pressure:	102.0 kPa

The testing was performed by Gaochao Gong on 2017-12-16.

Test Mode: Transmitting

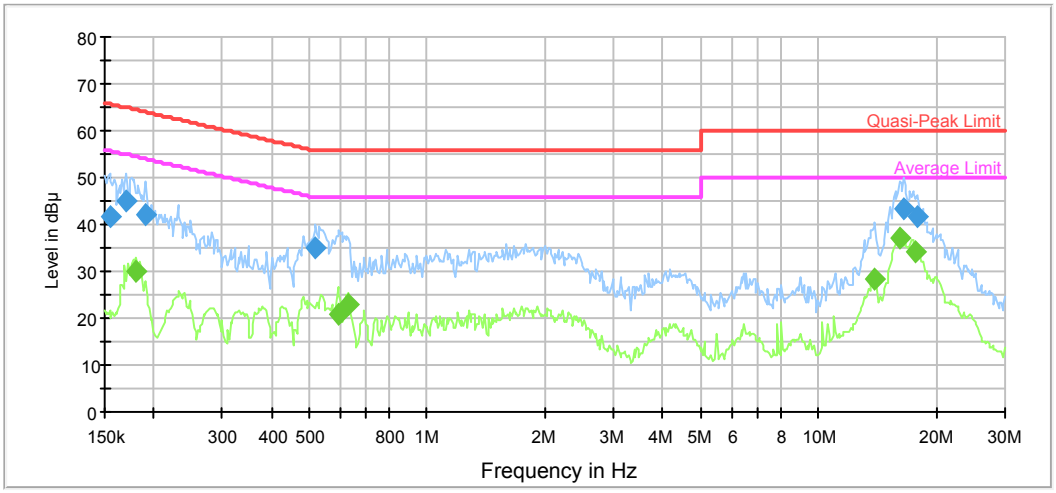
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.170396	44.6	9.000	L1	10.9	20.3	64.9	Compliance
0.524077	35.6	9.000	L1	9.9	20.4	56.0	Compliance
1.802095	32.3	9.000	L1	9.7	23.7	56.0	Compliance
13.968003	36.4	9.000	L1	9.9	23.6	60.0	Compliance
15.994231	43.8	9.000	L1	10.0	16.2	60.0	Compliance
17.881783	41.1	9.000	L1	10.0	18.9	60.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.519918	23.7	9.000	L1	9.9	22.3	46.0	Compliance
0.624492	24.0	9.000	L1	9.8	22.0	46.0	Compliance
1.802095	22.0	9.000	L1	9.7	24.0	46.0	Compliance
13.857146	28.4	9.000	L1	9.9	21.6	50.0	Compliance
16.122185	36.8	9.000	L1	10.0	13.2	50.0	Compliance
17.739864	35.0	9.000	L1	10.0	15.0	50.0	Compliance

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.154858	41.5	9.000	N	11.1	24.2	65.7	Compliance
0.170396	44.9	9.000	N	10.9	20.0	64.9	Compliance
0.190505	41.9	9.000	N	10.7	22.1	64.0	Compliance
0.519918	35.1	9.000	N	9.9	20.9	56.0	Compliance
16.512221	43.3	9.000	N	10.0	16.7	60.0	Compliance
17.881783	41.5	9.000	N	10.0	18.5	60.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.180171	30.0	9.000	N	10.8	24.5	54.5	Compliance
0.590613	20.8	9.000	N	9.8	25.2	46.0	Compliance
0.629488	22.7	9.000	N	9.8	23.3	46.0	Compliance
13.857146	28.3	9.000	N	9.9	21.7	50.0	Compliance
16.122185	37.0	9.000	N	10.0	13.0	50.0	Compliance
17.739864	34.0	9.000	N	10.0	16.0	50.0	Compliance

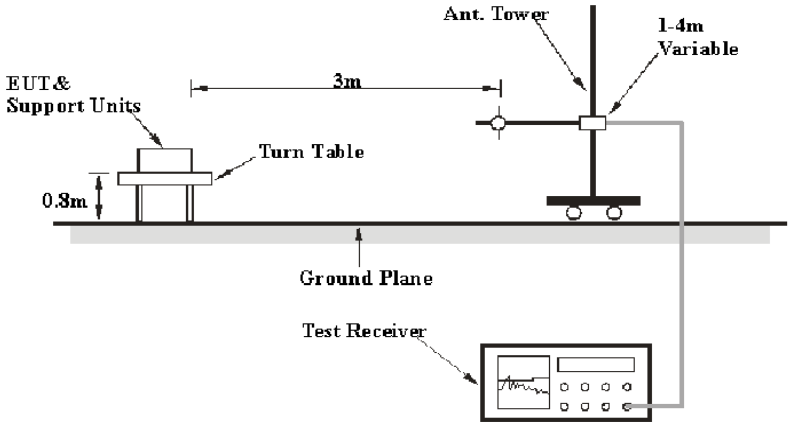
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

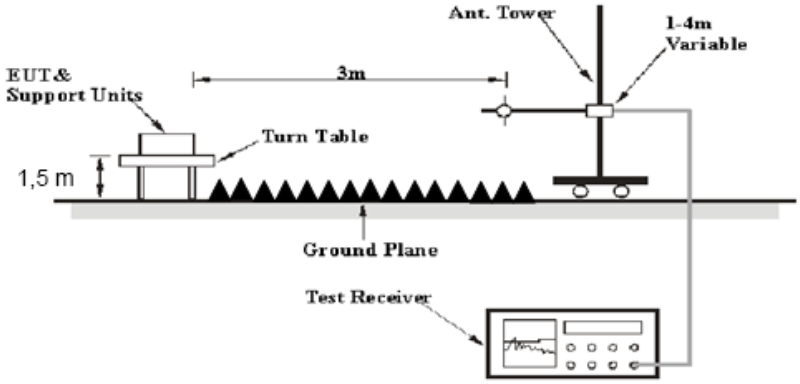
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters chamber test site, 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
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	2017-09-01	2018-09-01
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2018-11-10
HP	Amplifier	8447D	2727A05902	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-NJNJ-50	C-0400-01	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-NJNJ-50	C-0075-01	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-NJNJ-50	C-1000-01	2017-09-05	2018-09-05
Agilent	Spectrum Analyzer	E4440A	SG43360054	2017-12-08	2018-12-08
ETS-Lindgren	Horn Antenna	3115	000 527 35	2016-01-05	2019-01-05
MITEQ	Amplifier	AFS42-00101800-25-S-42	2001271	2017-09-05	2018-09-05
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-02 1304	2016-11-18	2019-11-18
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2017-06-27	2018-06-27
N/A	Coaxial Cable	C-SJSJ-50	C-0800-01	2017-09-05	2018-09-05
Chengdu Ouli	Band Rejection Filter	2400-2483.5	002	2017-09-05	2018-09-05
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

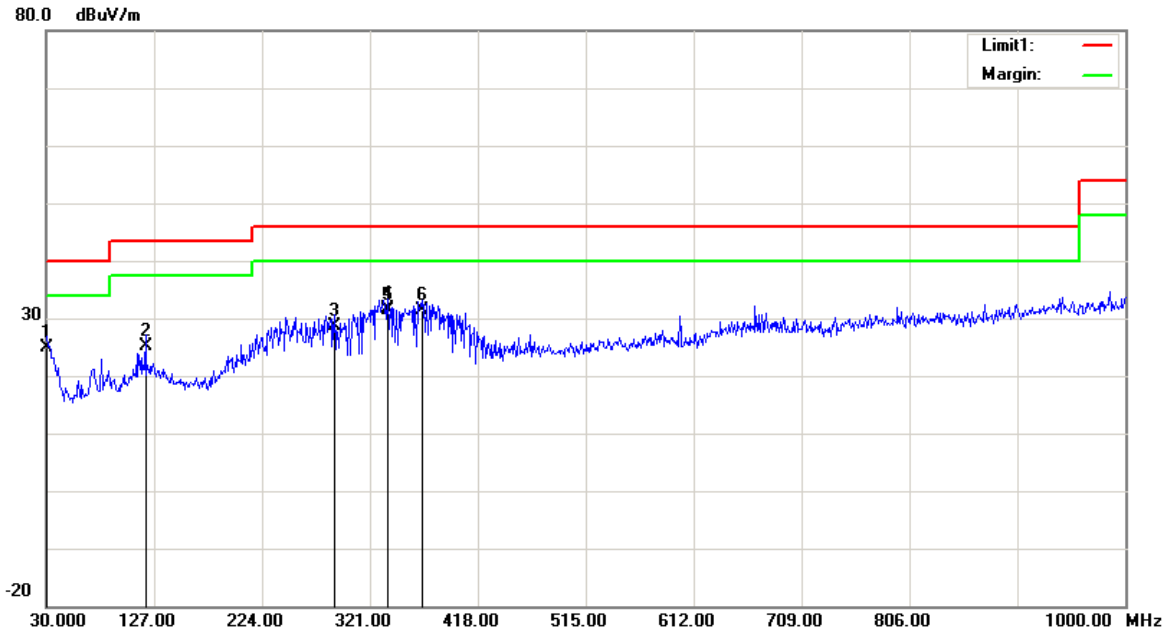
Temperature:	20.2~25.8 °C
Relative Humidity:	30.8~31 %
ATM Pressure:	101.5~102.9 kPa

** The testing was performed by Blake Yang and Kakaxi Chen from 2017-12-19 to 2017-12-20.*

Test Mode: Transmitting

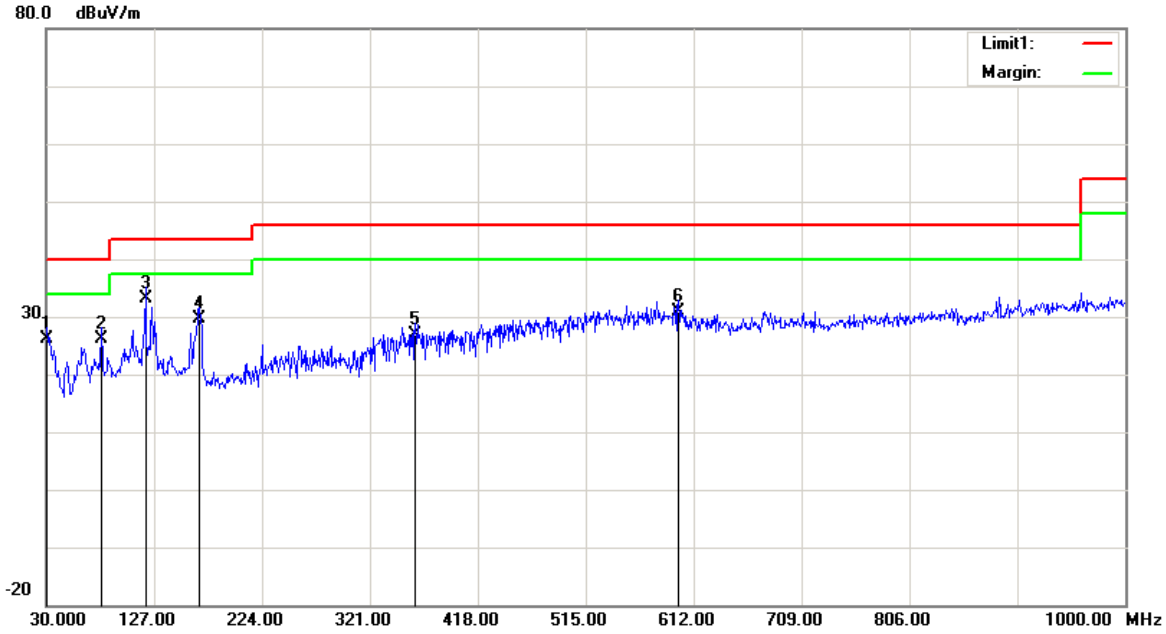
1) **Below 1GHz**(802.11b Low channel was the worst):

Horizontal



Frequency (MHz)	Receiver Reading (dBµV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30.9700	24.55	QP	0.35	24.90	40.00	15.10
119.2400	30.03	QP	-4.93	25.10	43.50	18.40
288.9900	32.61	QP	-3.91	28.70	46.00	17.30
337.4900	35.16	QP	-3.56	31.60	46.00	14.40
337.4900	34.96	QP	-3.56	31.40	46.00	14.60
367.5600	34.15	QP	-2.85	31.30	46.00	14.70

Vertical



Frequency (MHz)	Receiver Reading (dBµV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30.9700	25.85	QP	0.35	26.20	40.00	13.80
79.4700	37.21	QP	-11.11	26.10	40.00	13.90
119.2400	38.03	QP	-4.93	33.10	43.50	10.40
167.7400	36.79	QP	-7.09	29.70	43.50	13.80
361.7400	29.70	QP	-2.90	26.80	46.00	19.20
598.4200	30.60	QP	0.20	30.80	46.00	15.20

802.11b

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									
2412.00	64.02	PK	H	28.12	1.81	0.00	93.95	N/A	N/A
2412.00	59.67	AV	H	28.12	1.81	0.00	89.60	N/A	N/A
2412.00	71.36	PK	V	28.12	1.81	0.00	101.29	N/A	N/A
2412.00	67.55	AV	V	28.12	1.81	0.00	97.48	N/A	N/A
2390.00	26.21	PK	V	28.08	1.80	0.00	56.09	74.00	17.91
2390.00	13.47	AV	V	28.08	1.80	0.00	43.35	54.00	10.65
4824.00	48.52	PK	V	32.95	3.19	37.20	47.46	74.00	26.54
4824.00	39.45	AV	V	32.95	3.19	37.20	38.39	54.00	15.61
7236.00	45.29	PK	V	35.81	4.77	37.27	48.60	74.00	25.40
7236.00	36.29	AV	V	35.81	4.77	37.27	39.60	54.00	14.40
3191.00	51.87	PK	V	30.56	2.20	36.98	47.65	74.00	26.35
3191.00	41.38	AV	V	30.56	2.20	36.98	37.16	54.00	16.84
Middle Channel: 2437 MHz									
2437.00	64.15	PK	H	28.17	1.82	0.00	94.14	N/A	N/A
2437.00	59.44	AV	H	28.17	1.82	0.00	89.43	N/A	N/A
2437.00	71.24	PK	V	28.17	1.82	0.00	101.23	N/A	N/A
2437.00	67.56	AV	V	28.17	1.82	0.00	97.55	N/A	N/A
4874.00	48.36	PK	V	33.05	3.26	37.21	47.46	74.00	26.54
4874.00	37.89	AV	V	33.05	3.26	37.21	36.99	54.00	17.01
7311.00	44.98	PK	V	36.01	4.64	37.36	48.27	74.00	25.73
7311.00	34.57	AV	V	36.01	4.64	37.36	37.86	54.00	16.14
3191.00	52.21	PK	V	30.56	2.20	36.98	47.99	74.00	26.01
3191.00	43.26	AV	V	30.56	2.20	36.98	39.04	54.00	14.96
High Channel: 2462 MHz									
2462.00	64.49	PK	H	28.22	1.83	0.00	94.54	N/A	N/A
2462.00	59.89	AV	H	28.22	1.83	0.00	89.94	N/A	N/A
2462.00	72.32	PK	V	28.22	1.83	0.00	102.37	N/A	N/A
2462.00	68.15	AV	V	28.22	1.83	0.00	98.20	N/A	N/A
2483.50	26.42	PK	V	28.27	1.84	0.00	56.53	74.00	17.47
2483.50	13.67	AV	V	28.27	1.84	0.00	43.78	54.00	10.22
4924.00	48.36	PK	V	33.15	3.27	37.22	47.56	74.00	26.44
4924.00	38.41	AV	V	33.15	3.27	37.22	37.61	54.00	16.39
7386.00	45.47	PK	V	36.20	4.51	37.46	48.72	74.00	25.28
7386.00	35.61	AV	V	36.20	4.51	37.46	38.86	54.00	15.14
3191.00	54.26	PK	V	30.56	2.20	36.98	50.04	74.00	23.96
3191.00	45.68	AV	V	30.56	2.20	36.98	41.46	54.00	12.54

802.11g

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									
2412.00	65.82	PK	H	28.12	1.81	0.00	95.75	N/A	N/A
2412.00	57.06	AV	H	28.12	1.81	0.00	86.99	N/A	N/A
2412.00	72.85	PK	V	28.12	1.81	0.00	102.78	N/A	N/A
2412.00	64.71	AV	V	28.12	1.81	0.00	94.64	N/A	N/A
2390.00	26.01	PK	V	28.08	1.80	0.00	55.89	74.00	18.11
2390.00	13.84	AV	V	28.08	1.80	0.00	43.72	54.00	10.28
4824.00	48.32	PK	V	32.95	3.19	37.20	47.26	74.00	26.74
4824.00	37.89	AV	V	32.95	3.19	37.20	36.83	54.00	17.17
7236.00	45.16	PK	V	35.81	4.77	37.27	48.47	74.00	25.53
7236.00	35.74	AV	V	35.81	4.77	37.27	39.05	54.00	14.95
3191.00	53.14	PK	V	30.56	2.20	36.98	48.92	74.00	25.08
3191.00	44.26	AV	V	30.56	2.20	36.98	40.04	54.00	13.96
Middle Channel: 2437 MHz									
2437.00	66.87	PK	H	28.17	1.82	0.00	96.86	N/A	N/A
2437.00	58.34	AV	H	28.17	1.82	0.00	88.33	N/A	N/A
2437.00	73.93	PK	V	28.17	1.82	0.00	103.92	N/A	N/A
2437.00	65.77	AV	V	28.17	1.82	0.00	95.76	N/A	N/A
4874.00	48.35	PK	V	33.05	3.26	37.21	47.45	74.00	26.55
4874.00	37.65	AV	V	33.05	3.26	37.21	36.75	54.00	17.25
7311.00	45.49	PK	V	36.01	4.64	37.36	48.78	74.00	25.22
7311.00	35.61	AV	V	36.01	4.64	37.36	38.90	54.00	15.10
3191.00	52.36	PK	V	30.56	2.20	36.98	48.14	74.00	25.86
3191.00	43.28	AV	V	30.56	2.20	36.98	39.06	54.00	14.94
High Channel: 2462 MHz									
2462.00	67.17	PK	H	28.22	1.83	0.00	97.22	N/A	N/A
2462.00	58.63	AV	H	28.22	1.83	0.00	88.68	N/A	N/A
2462.00	74.86	PK	V	28.22	1.83	0.00	104.91	N/A	N/A
2462.00	66.01	AV	V	28.22	1.83	0.00	96.06	N/A	N/A
2483.50	26.34	PK	V	28.27	1.84	0.00	56.45	74.00	17.55
2483.50	13.59	AV	V	28.27	1.84	0.00	43.70	54.00	10.30
4924.00	48.59	PK	V	33.15	3.27	37.22	47.79	74.00	26.21
4924.00	38.16	AV	V	33.15	3.27	37.22	37.36	54.00	16.64
7386.00	45.46	PK	V	36.20	4.51	37.46	48.71	74.00	25.29
7386.00	35.29	AV	V	36.20	4.51	37.46	38.54	54.00	15.46
3191.00	54.94	PK	V	30.56	2.20	36.98	50.72	74.00	23.28
3191.00	45.67	AV	V	30.56	2.20	36.98	41.45	54.00	12.55

802.11n ht20

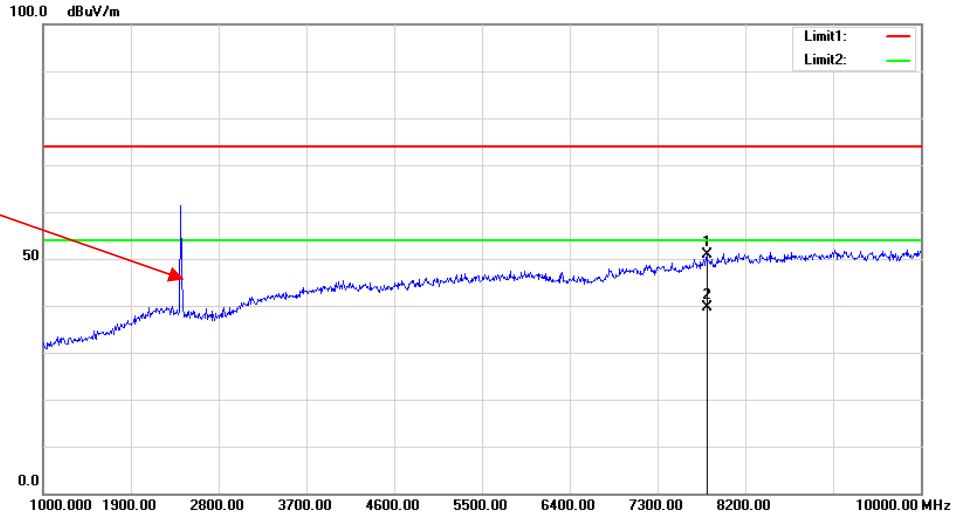
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)					
Low Channel: 2412 MHz									
2412.00	66.02	PK	H	28.12	1.81	0.00	95.95	N/A	N/A
2412.00	57.33	AV	H	28.12	1.81	0.00	87.26	N/A	N/A
2412.00	73.10	PK	V	28.12	1.81	0.00	103.03	N/A	N/A
2412.00	64.50	AV	V	28.12	1.81	0.00	94.43	N/A	N/A
2390.00	26.97	PK	V	28.08	1.80	0.00	56.85	74.00	17.15
2390.00	13.95	AV	V	28.08	1.80	0.00	43.83	54.00	10.17
4824.00	48.44	PK	V	32.95	3.19	37.20	47.38	74.00	26.62
4824.00	38.51	AV	V	32.95	3.19	37.20	37.45	54.00	16.55
7236.00	45.67	PK	V	35.81	4.77	37.27	48.98	74.00	25.02
7236.00	35.61	AV	V	35.81	4.77	37.27	38.92	54.00	15.08
3191.00	52.37	PK	V	30.56	2.20	36.98	48.15	74.00	25.85
3191.00	43.45	AV	V	30.56	2.20	36.98	39.23	54.00	14.77
Middle Channel: 2437 MHz									
2437.00	66.45	PK	H	28.17	1.82	0.00	96.44	N/A	N/A
2437.00	57.21	AV	H	28.17	1.82	0.00	87.20	N/A	N/A
2437.00	73.25	PK	V	28.17	1.82	0.00	103.24	N/A	N/A
2437.00	65.14	AV	V	28.17	1.82	0.00	95.13	N/A	N/A
4874.00	48.44	PK	V	33.05	3.26	37.21	47.54	74.00	26.46
4874.00	38.51	AV	V	33.05	3.26	37.21	37.61	54.00	16.39
7311.00	45.21	PK	V	36.01	4.64	37.36	48.50	74.00	25.50
7311.00	35.42	AV	V	36.01	4.64	37.36	38.71	54.00	15.29
3191.00	51.34	PK	V	30.56	2.20	36.98	47.12	74.00	26.88
3191.00	42.68	AV	V	30.56	2.20	36.98	38.46	54.00	15.54
High Channel: 2462 MHz									
2462.00	67.24	PK	H	28.22	1.83	0.00	97.29	N/A	N/A
2462.00	58.31	AV	H	28.22	1.83	0.00	88.36	N/A	N/A
2462.00	74.18	PK	V	28.22	1.83	0.00	104.23	N/A	N/A
2462.00	65.98	AV	V	28.22	1.83	0.00	96.03	N/A	N/A
2483.50	26.35	PK	V	28.27	1.84	0.00	56.46	74.00	17.54
2483.50	13.49	AV	V	28.27	1.84	0.00	43.60	54.00	10.40
4924.00	48.33	PK	V	33.15	3.27	37.22	47.53	74.00	26.47
4924.00	37.88	AV	V	33.15	3.27	37.22	37.08	54.00	16.92
7386.00	45.27	PK	V	36.20	4.51	37.46	48.52	74.00	25.48
7386.00	35.28	AV	V	36.20	4.51	37.46	38.53	54.00	15.47
3191.00	52.36	PK	V	30.56	2.20	36.98	48.14	74.00	25.86
3191.00	43.02	AV	V	30.56	2.20	36.98	38.80	54.00	15.20

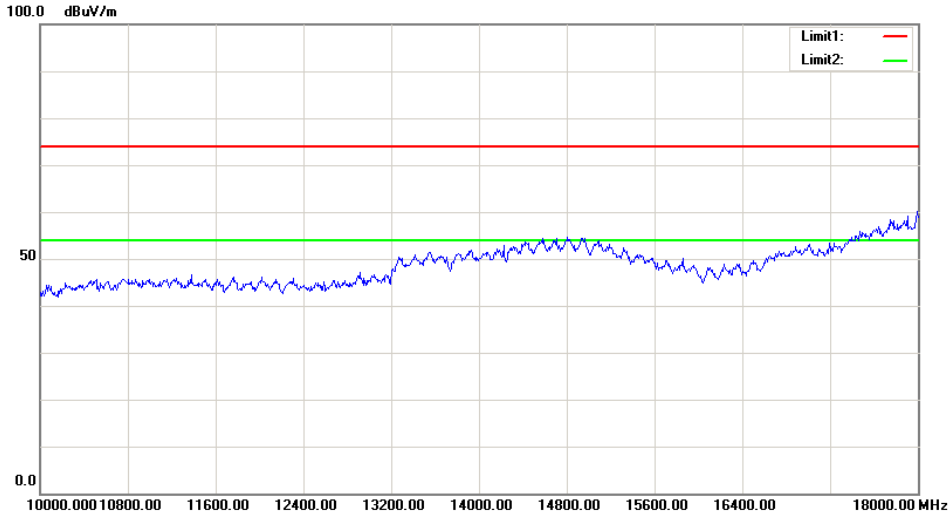
802.11n ht40

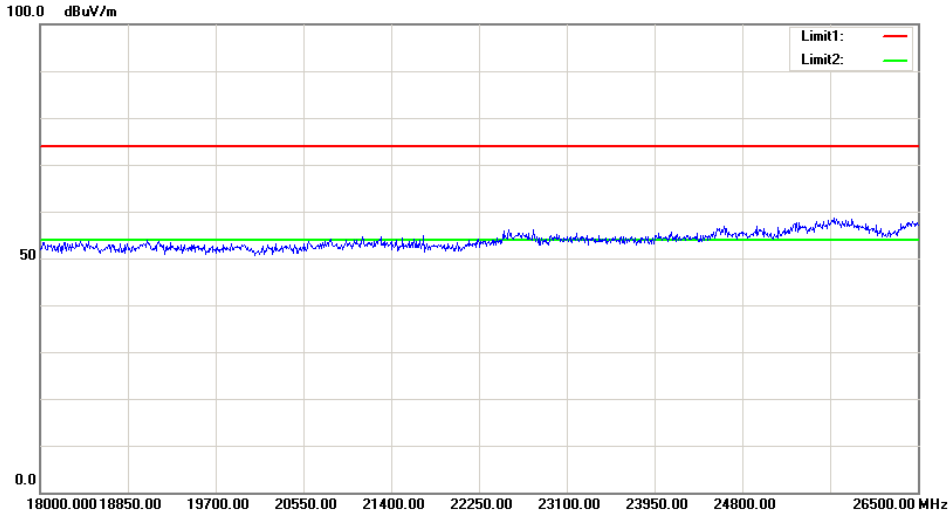
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)					
Low Channel: 2422 MHz									
2422.00	66.54	PK	H	28.14	1.81	0.00	96.49	N/A	N/A
2422.00	57.34	AV	H	28.14	1.81	0.00	87.29	N/A	N/A
2422.00	73.14	PK	V	28.14	1.81	0.00	103.09	N/A	N/A
2422.00	64.41	AV	V	28.14	1.81	0.00	94.36	N/A	N/A
2390.00	26.57	PK	V	28.08	1.80	0.00	56.45	74.00	17.55
2390.00	13.49	AV	V	28.08	1.80	0.00	43.37	54.00	10.63
4844.00	48.54	PK	V	32.99	3.22	37.20	47.55	74.00	26.45
4844.00	37.69	AV	V	32.99	3.22	37.20	36.70	54.00	17.30
7266.00	45.35	PK	V	35.89	4.72	37.31	48.65	74.00	25.35
7266.00	36.54	AV	V	35.89	4.72	37.31	39.84	54.00	14.16
3191.00	54.34	PK	V	30.56	2.20	36.98	50.12	74.00	23.88
3191.00	48.00	AV	V	30.56	2.20	36.98	43.78	54.00	10.22
Middle Channel: 2437 MHz									
2437.00	66.24	PK	H	28.17	1.82	0.00	96.23	N/A	N/A
2437.00	57.19	AV	H	28.17	1.82	0.00	87.18	N/A	N/A
2437.00	73.41	PK	V	28.17	1.82	0.00	103.40	N/A	N/A
2437.00	65.14	AV	V	28.17	1.82	0.00	95.13	N/A	N/A
4874.00	48.51	PK	V	33.05	3.26	37.21	47.61	74.00	26.39
4874.00	37.49	AV	V	33.05	3.26	37.21	36.59	54.00	17.41
7311.00	45.31	PK	V	36.01	4.64	37.36	48.60	74.00	25.40
7311.00	36.42	AV	V	36.01	4.64	37.36	39.71	54.00	14.29
3191.00	54.24	PK	V	30.56	2.20	36.98	50.02	74.00	23.98
3191.00	47.98	AV	V	30.56	2.20	36.98	43.76	54.00	10.24
High Channel: 2452 MHz									
2452.00	64.54	PK	H	28.20	1.83	0.00	94.57	N/A	N/A
2452.00	56.21	AV	H	28.20	1.83	0.00	86.24	N/A	N/A
2452.00	74.99	PK	V	28.20	1.83	0.00	105.02	N/A	N/A
2452.00	66.34	AV	V	28.20	1.83	0.00	96.37	N/A	N/A
2483.50	26.57	PK	V	28.27	1.84	0.00	56.68	74.00	17.32
2483.50	13.54	AV	V	28.27	1.84	0.00	43.65	54.00	10.35
4904.00	48.70	PK	V	33.11	3.30	37.21	47.90	74.00	26.10
4904.00	37.88	AV	V	33.11	3.30	37.21	37.08	54.00	16.92
7356.00	45.32	PK	V	36.13	4.56	37.42	48.59	74.00	25.41
7356.00	36.48	AV	V	36.13	4.56	37.42	39.75	54.00	14.25
3191.00	54.21	PK	V	30.56	2.20	36.98	49.99	74.00	24.01
3191.00	48.04	AV	V	30.56	2.20	36.98	43.82	54.00	10.18

Worst plots(802.11b Low channel)
Horizontal

Fundamental Test with Band Rejection Filter

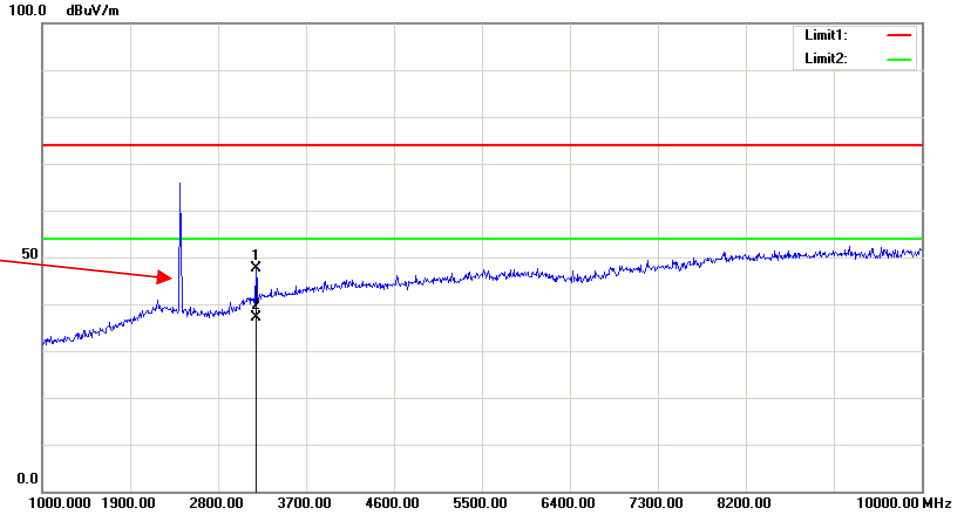


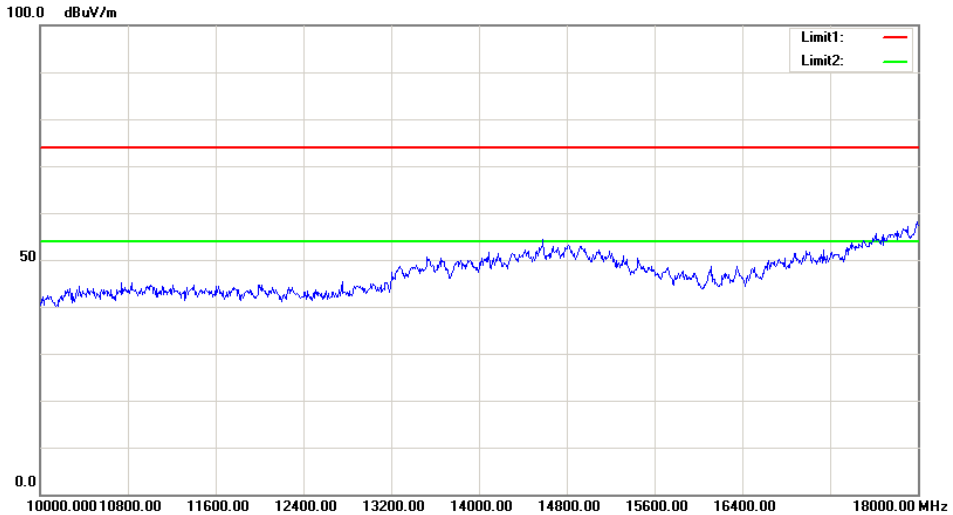


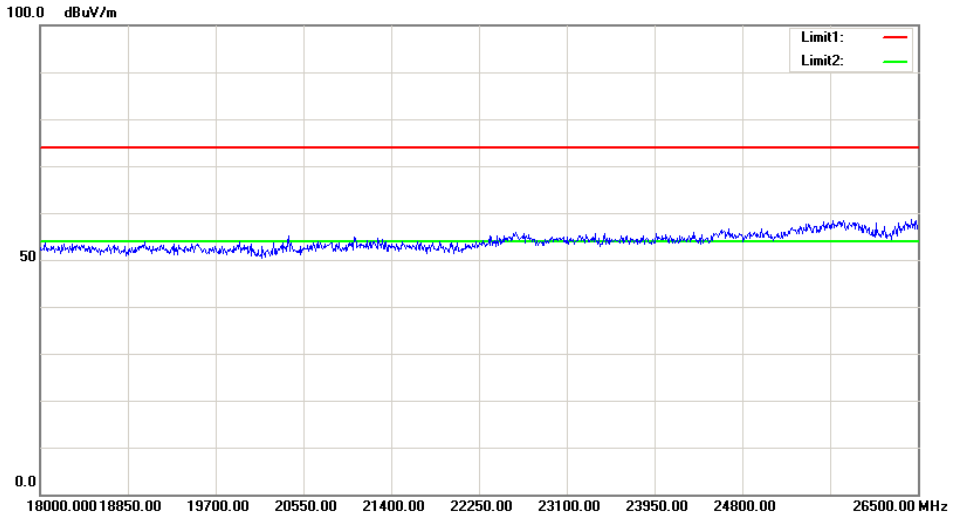


Vertical

Fundamental Test with Band Rejection Filter







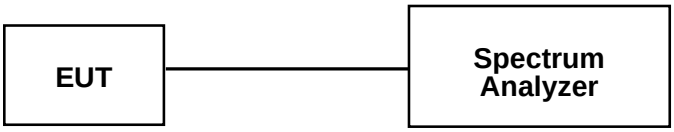
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

Applicable Standard

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	Spectrum Analyzer	FSU 26	200256	2017-12-08	2018-12-08
N/A	Coaxial Cable	C-SJ00-0010	C0010/04	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:	25.3 °C
Relative Humidity:	35 %
ATM Pressure:	102 kPa

** The testing was performed by George Pang on 2017-12-16.*

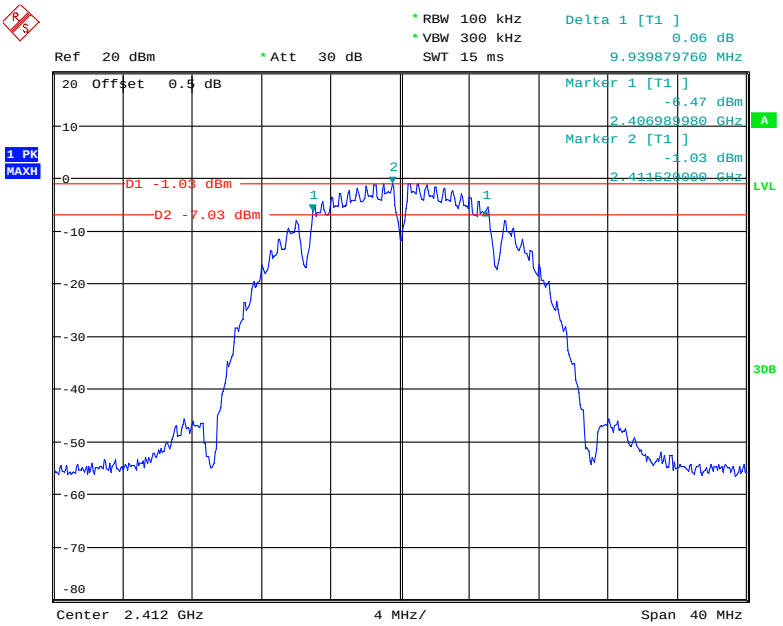
Test Mode: Transmitting

Test Result: Compliant

Test performed at chain 0, please refer to the following table and plots.

Test mode	Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (MHz)
802.11b	Low	2412	9.94	≥0.5
	Middle	2437	9.94	≥0.5
	High	2462	9.94	≥0.5
802.11g	Low	2412	16.27	≥0.5
	Middle	2437	16.51	≥0.5
	High	2462	16.27	≥0.5
802.11n ht20	Low	2412	17.56	≥0.5
	Middle	2437	17.56	≥0.5
	High	2462	17.56	≥0.5
802.11n ht40	Low	2422	36.23	≥0.5
	Middle	2437	36.23	≥0.5
	High	2452	36.23	≥0.5

802.11b – Low Channel



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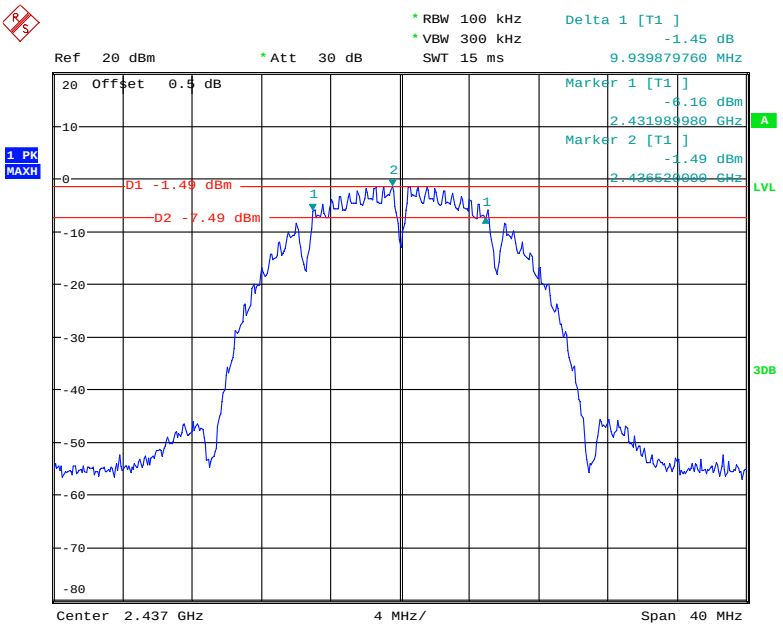
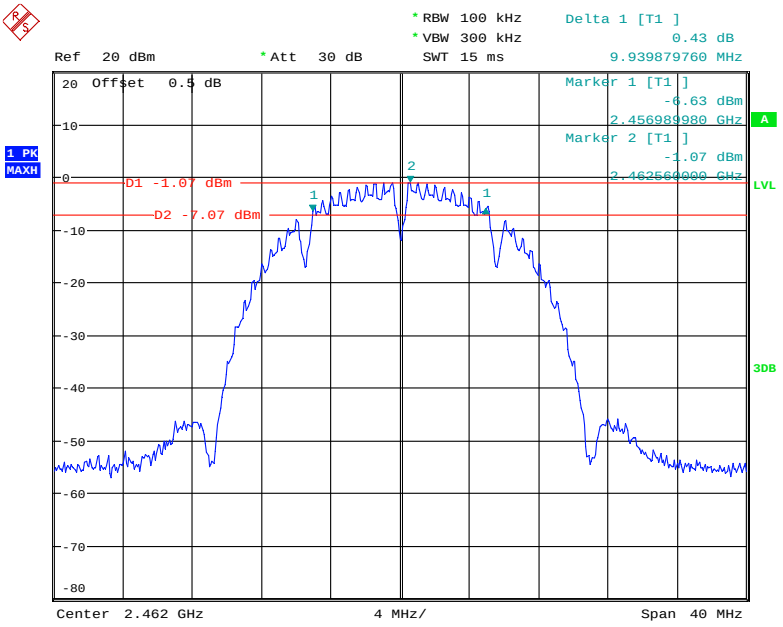
802.11b – Middle Channel



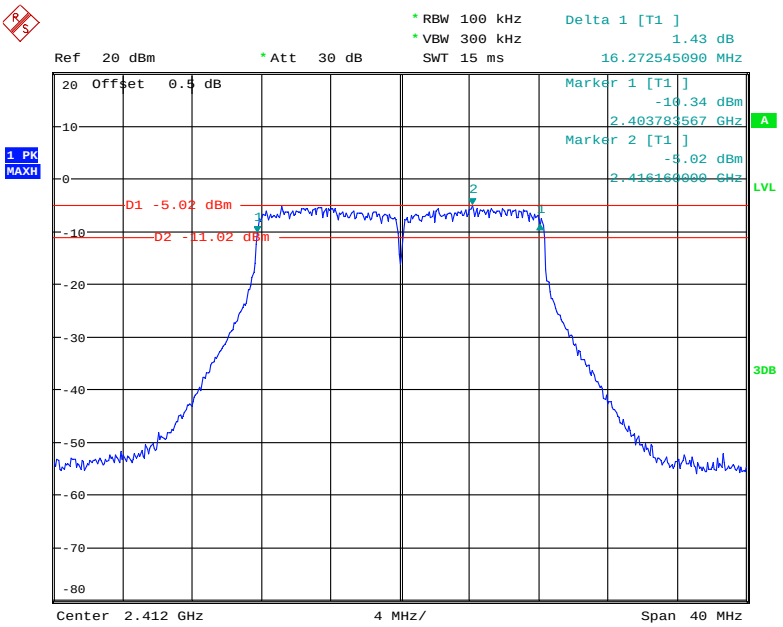
Date: 16.DEC.2017 17:02:20

802.11b – High Channel



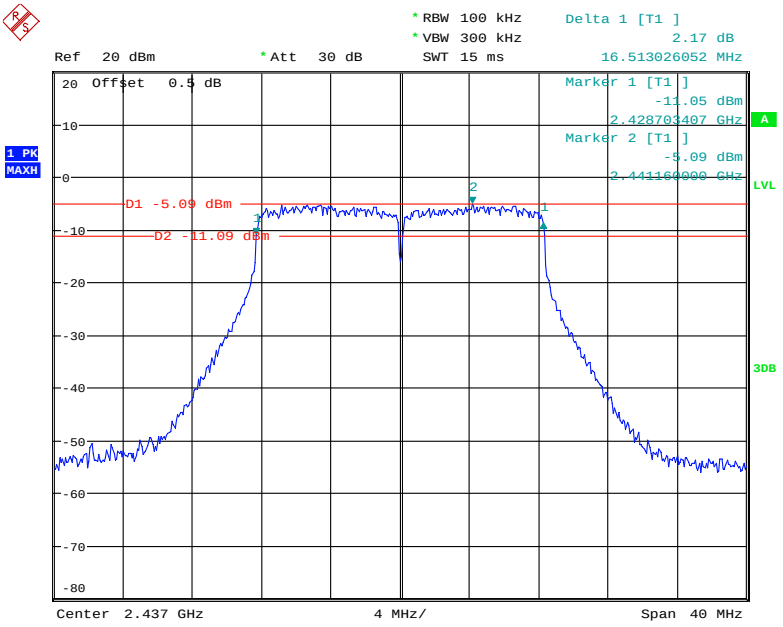
Date: 16.DEC.2017 17:04:09

802.11g – Low Channel



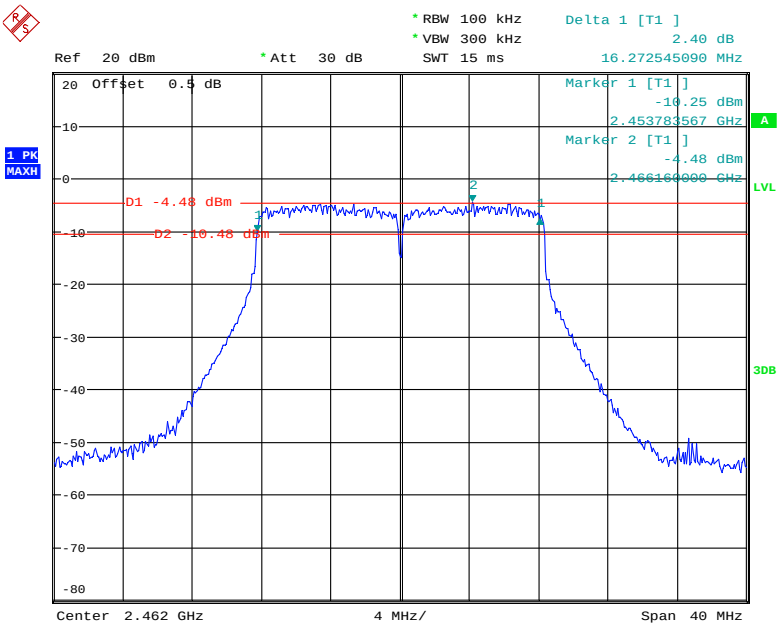
Date: 16.DEC.2017 17:06:36

802.11g – Middle Channel



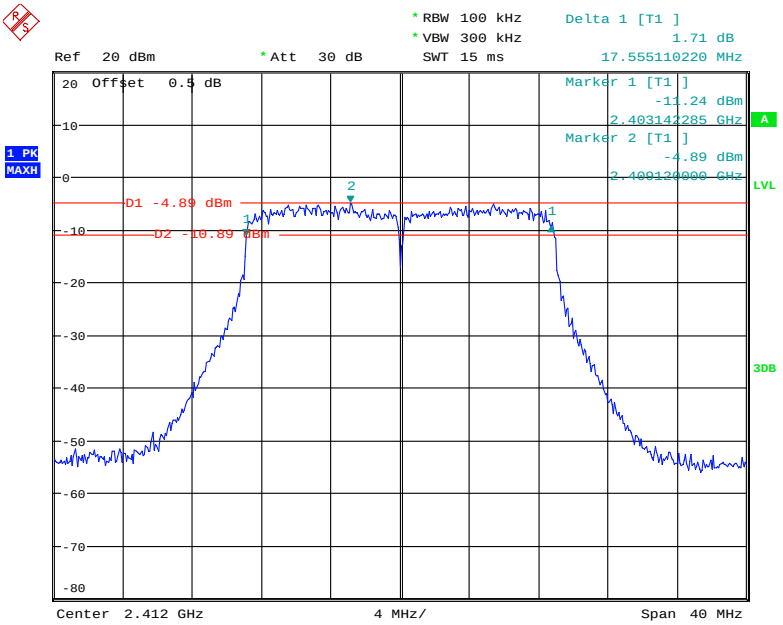
Date: 16.DEC.2017 17:08:30

802.11g – High Channel



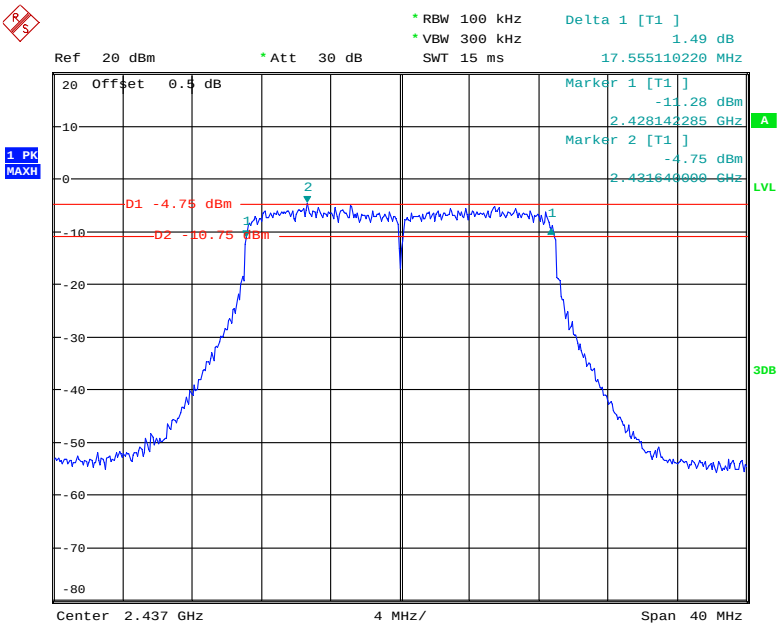
Date: 16.DEC.2017 17:10:09

802.11n ht20 – Low Channel



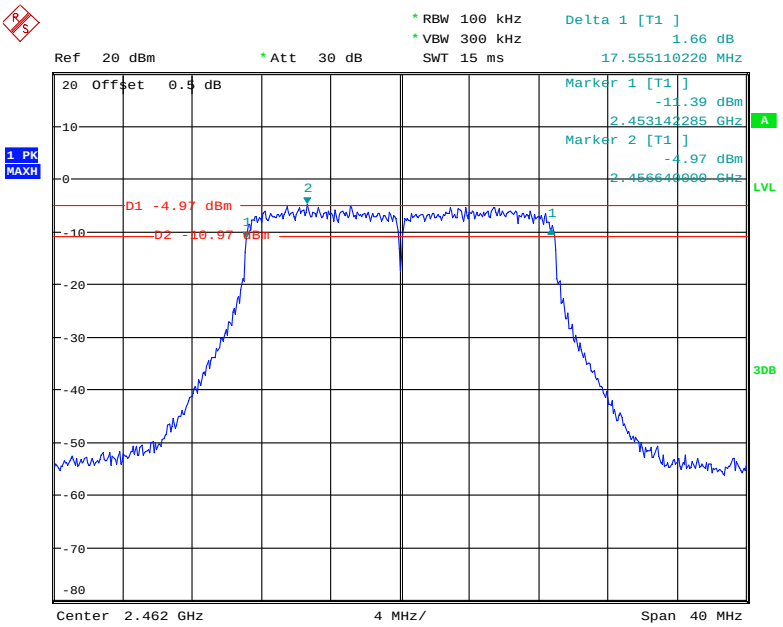
Date: 16.DEC.2017 17:12:32

802.11n ht20 – Middle Channel



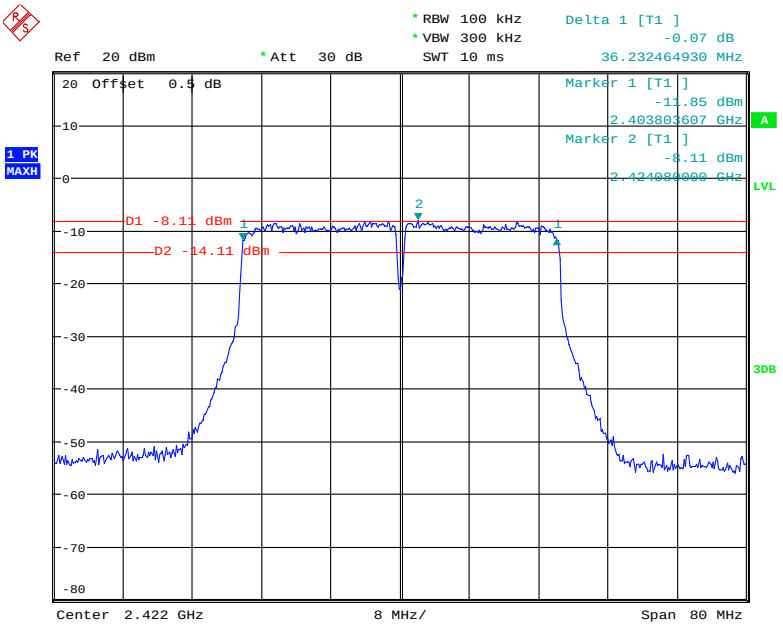
Date: 16.DEC.2017 17:14:22

802.11n ht20 – High Channel



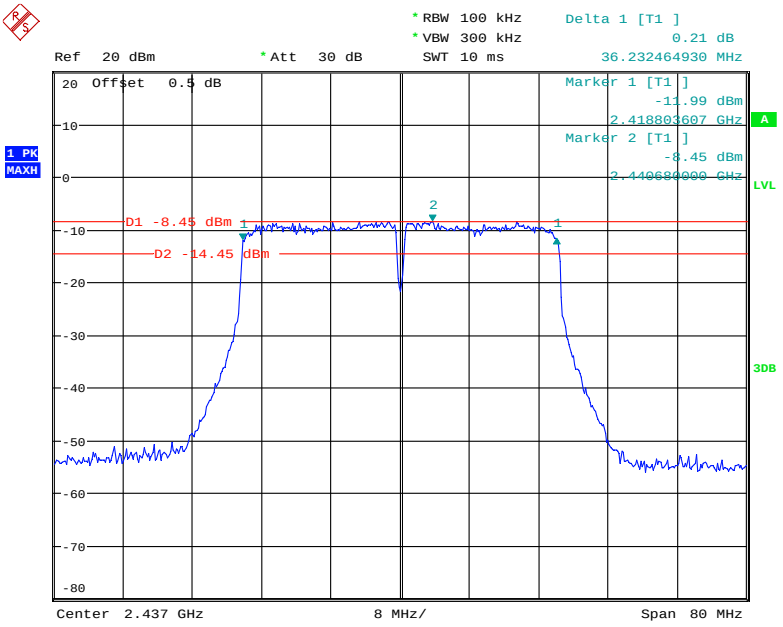
Date: 16.DEC.2017 17:16:02

802.11n ht40 – Low Channel



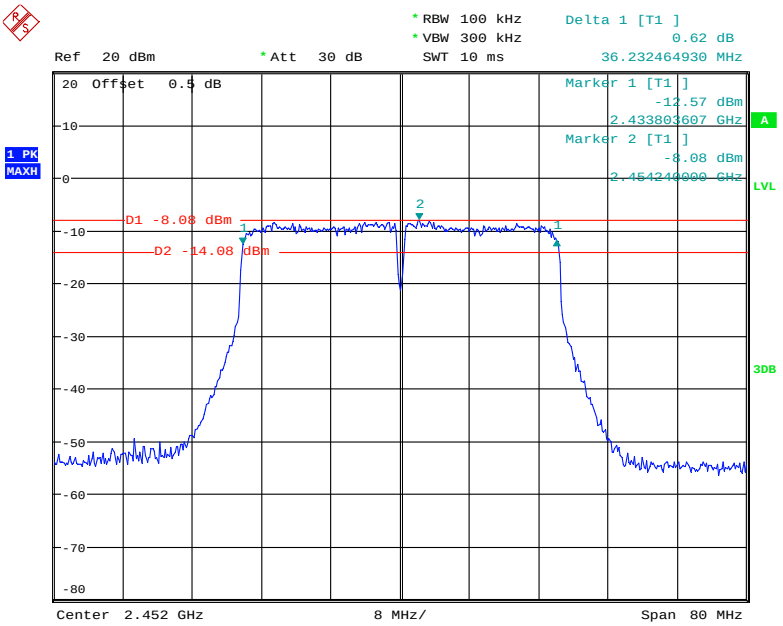
Date: 16.DEC.2017 17:18:07

802.11n ht40 – Middle Channel



Date: 16.DEC.2017 17:20:20

802.11n ht40 – High Channel



Date: 16.DEC.2017 17:22:21

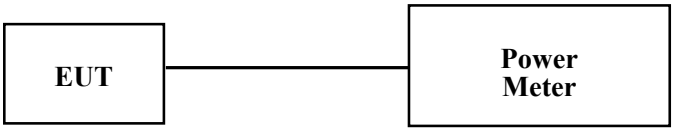
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

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.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Wideband Power Sensor	N1921A	MY54210016	2017-11-03	2018-11-03
Agilent	P-Series Power Meter	N1912A	MY5000448	2017-11-03	2018-11-03
N/A	Coaxial Cable	C-SJ00-0010	C0010/04	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:	25.3 °C
Relative Humidity:	35 %
ATM Pressure:	102 kPa

** The testing was performed by George Pang on 2017-12-16.*

Test Mode: Transmitting

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

Test mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)	Max Average Conducted Output Power (dBm)	Limit (dBm)
802.11b	Low	2412	9.82	7.37	30
	Middle	2437	9.44	7.02	30
	High	2462	9.71	7.28	30
802.11g	Low	2412	15.03	6.92	30
	Middle	2437	15.28	7.08	30
	High	2462	15.52	7.4	30
802.11n ht20	Low	2412	15.71	7.15	30
	Middle	2437	15.66	7.04	30
	High	2462	15.63	7.03	30
802.11n ht40	Low	2422	15.74	7.32	30
	Middle	2437	15.66	7.2	30
	High	2452	15.71	7.25	30

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

Applicable Standard

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

Test Procedure

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU 26	200256	2017-12-08	2018-12-08
N/A	Coaxial Cable	C-SJ00-0010	C0010/04	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

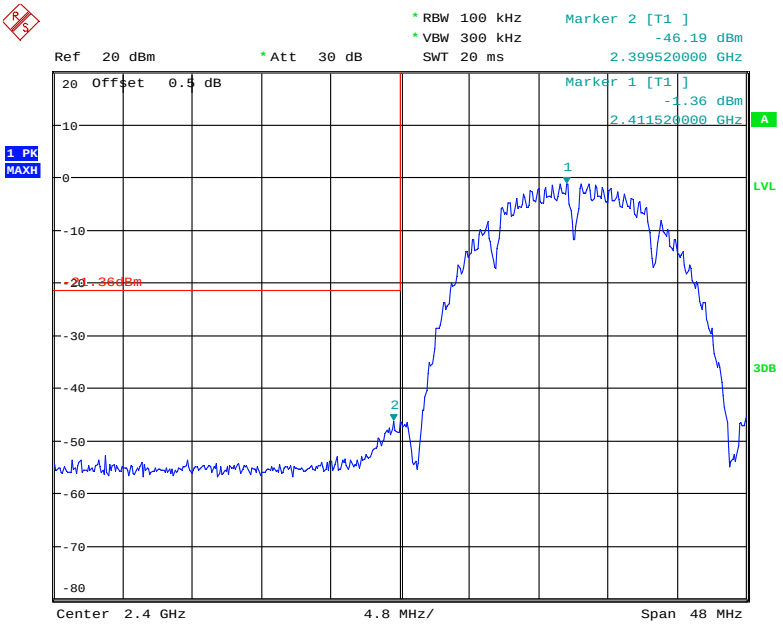
Temperature:	25.3 °C
Relative Humidity:	35 %
ATM Pressure:	102 kPa

** The testing was performed by George Pang on 2017-12-16.*

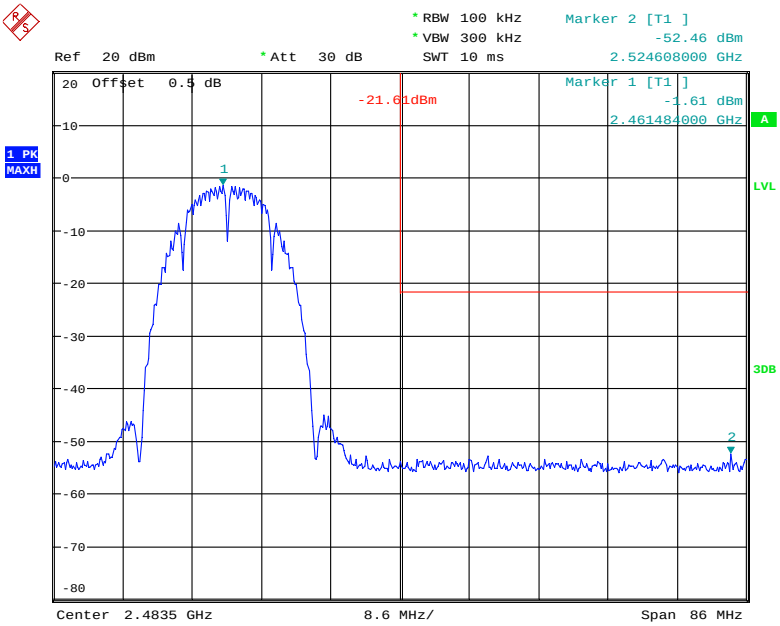
Test mode: Transmitting

Test Result: Compliant. Please refer to following plots.

802.11b: Band Edge, Left Side

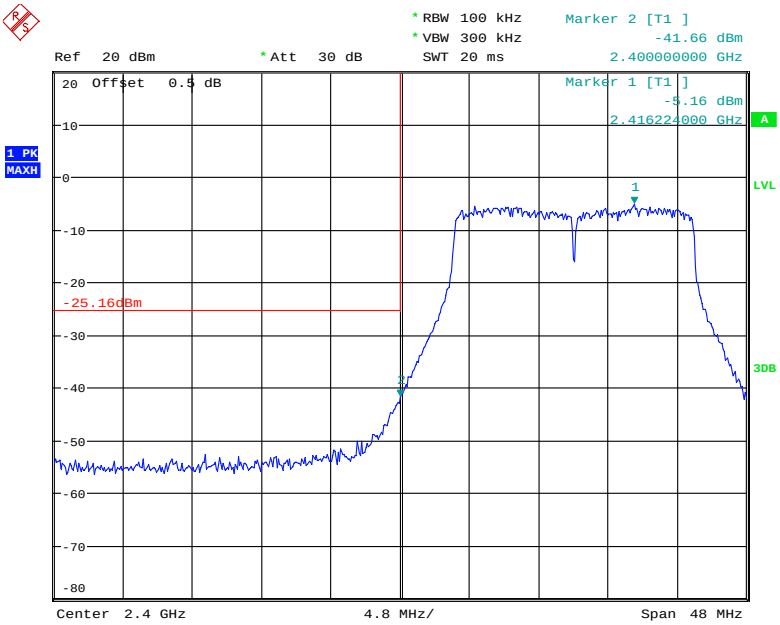


802.11b: Band Edge, Right Side



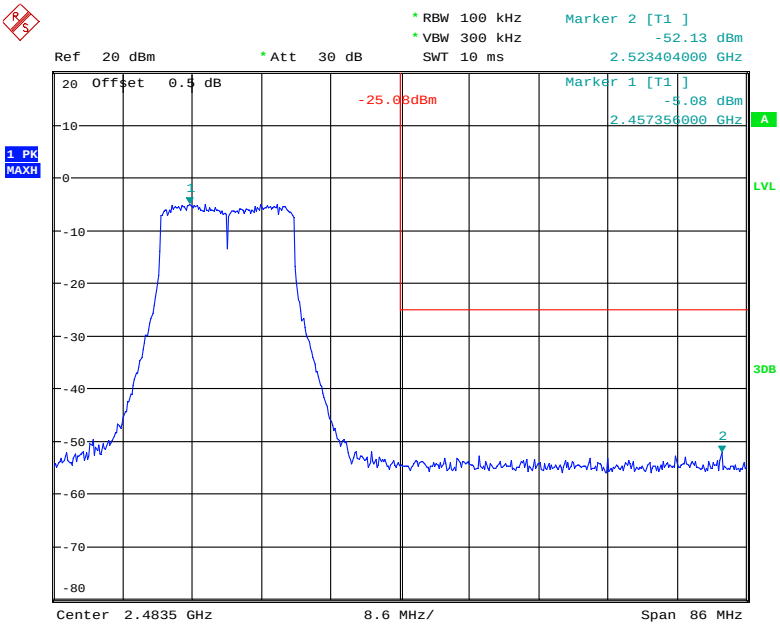
Date: 16.DEC.2017 17:05:24

802.11g: Band Edge, Left Side



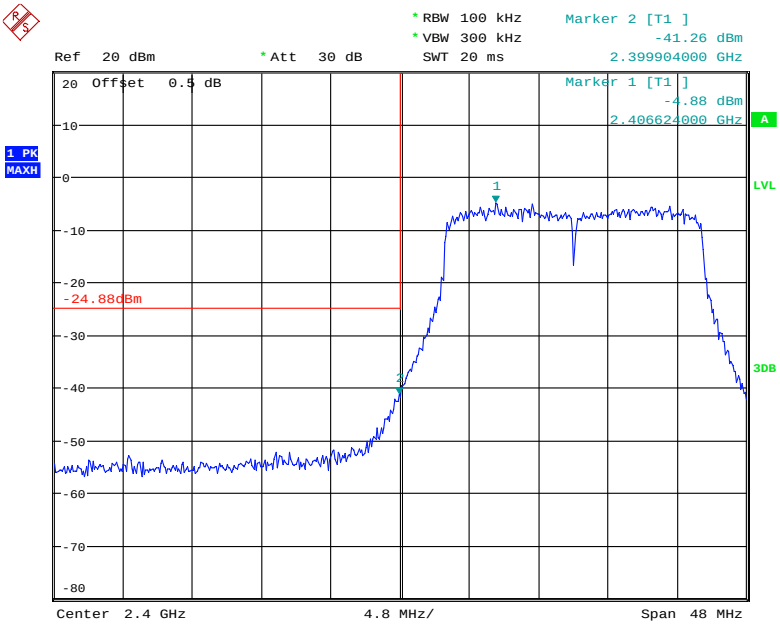
Date: 16.DEC.2017 17:07:50

802.11g: Band Edge, Right Side



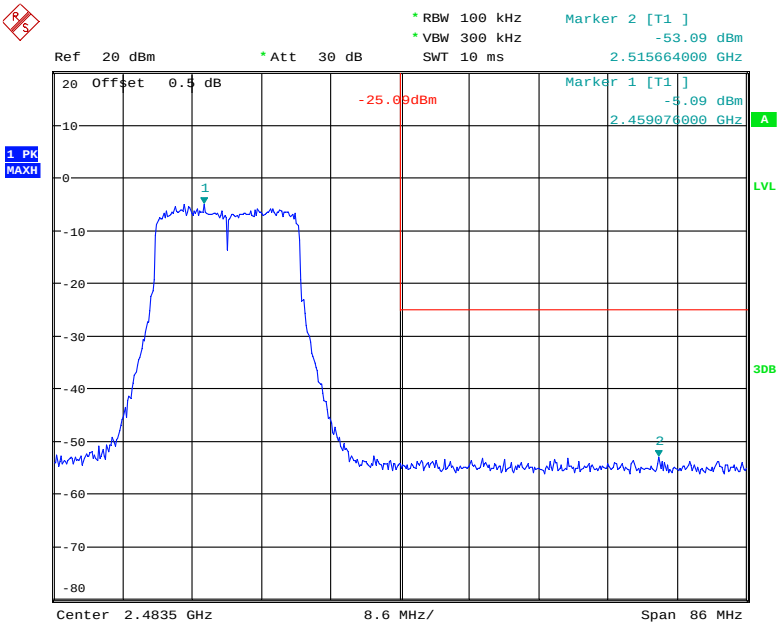
Date: 16.DEC.2017 17:11:27

802.11n ht20 Band Edge, Left Side



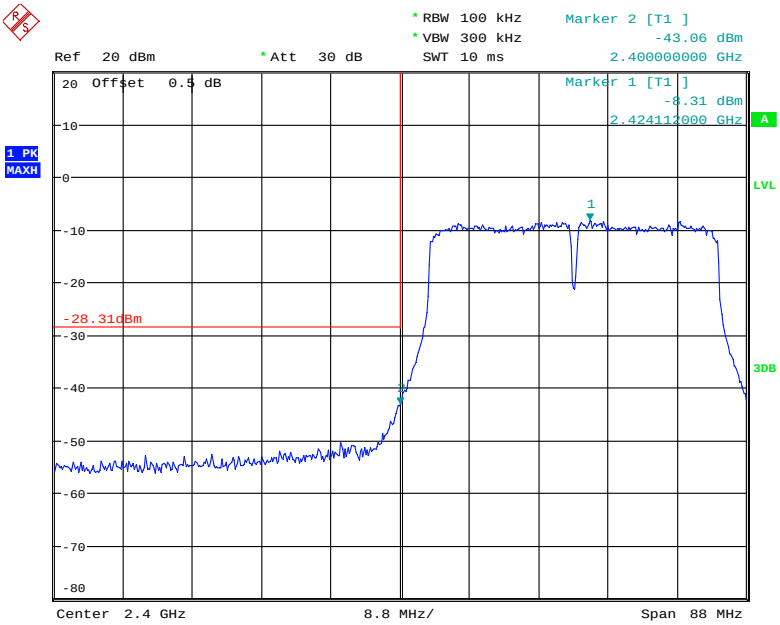
Date: 16.DEC.2017 17:13:46

802.11n ht20 Band Edge, Right Side



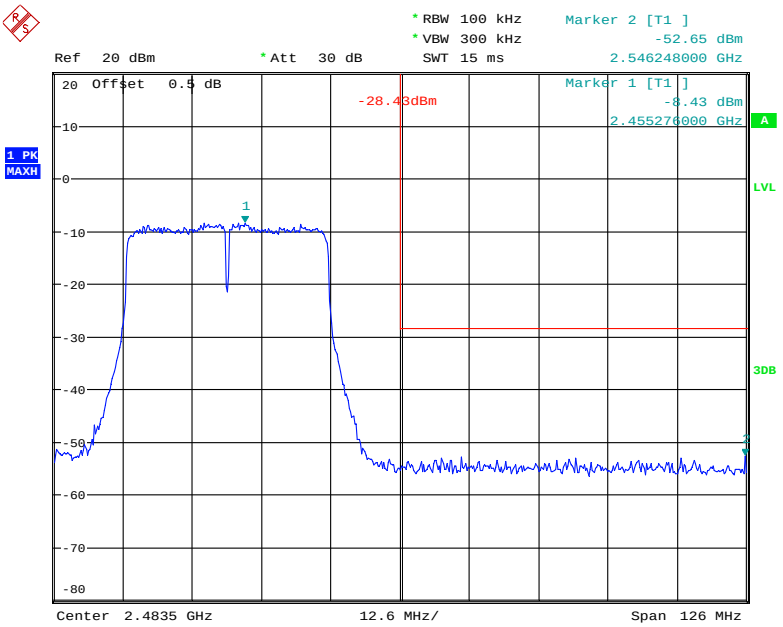
Date: 16.DEC.2017 17:17:19

802.11n ht40 Band Edge, Left Side



Date: 16.DEC.2017 17:19:38

802.11n ht40 Band Edge, Right Side



Date: 16.DEC.2017 17:23:56

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

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3×RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU 26	200256	2017-12-08	2018-12-08
N/A	Coaxial Cable	C-SJ00-0010	C0010/04	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:	25.3 °C
Relative Humidity:	35 %
ATM Pressure:	102 kPa

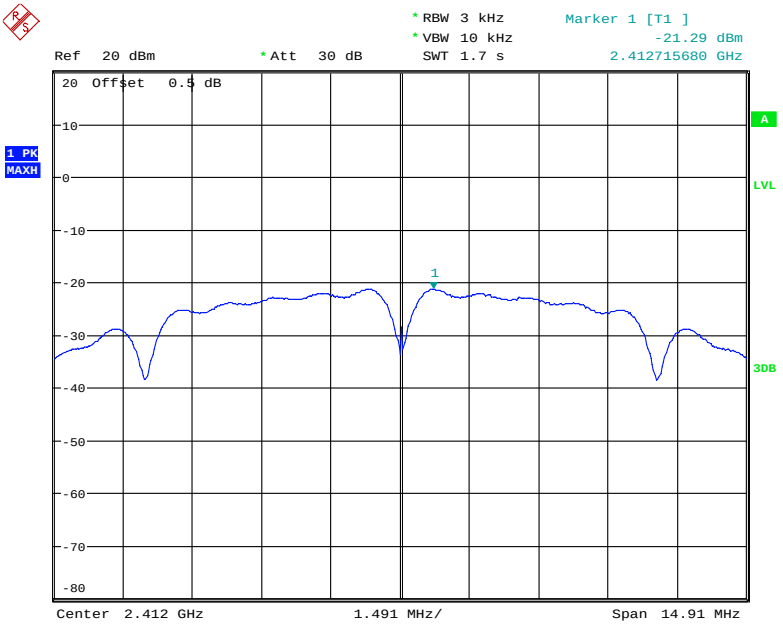
** The testing was performed by George Pang on 2017-12-16.*

Test Mode: Transmitting

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

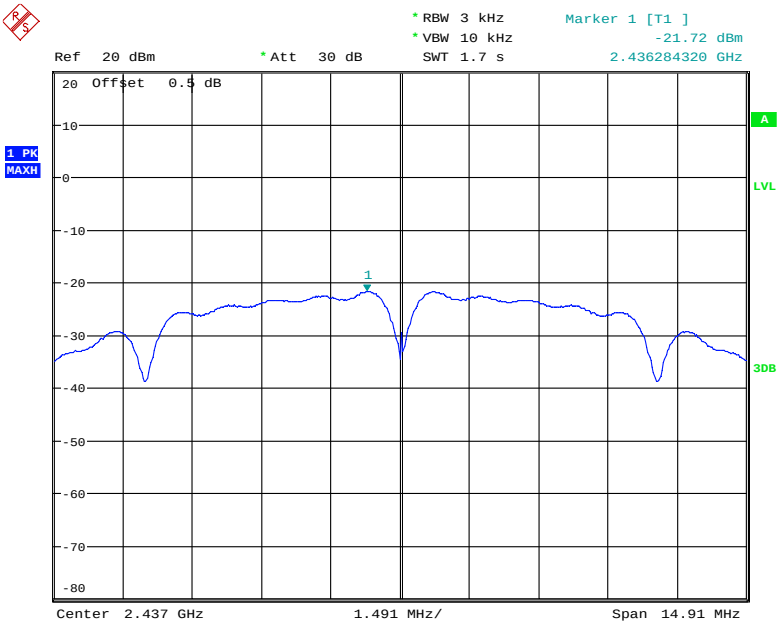
Test mode	Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
802.11b	Low	2412	-21.29	≤8
	Middle	2437	-21.72	≤8
	High	2462	-21.46	≤8
802.11g	Low	2412	-19.19	≤8
	Middle	2437	-19.71	≤8
	High	2462	-19.18	≤8
802.11n ht20	Low	2412	-19.29	≤8
	Middle	2437	-18.27	≤8
	High	2462	-18.38	≤8
802.11n ht40	Low	2422	-21.59	≤8
	Middle	2437	-20.08	≤8
	High	2452	-21.15	≤8

Power Spectral Density, 802.11b, Low Channel



Date: 16.DEC.2017 17:01:19

Power Spectral Density, 802.11b, Middle Channel



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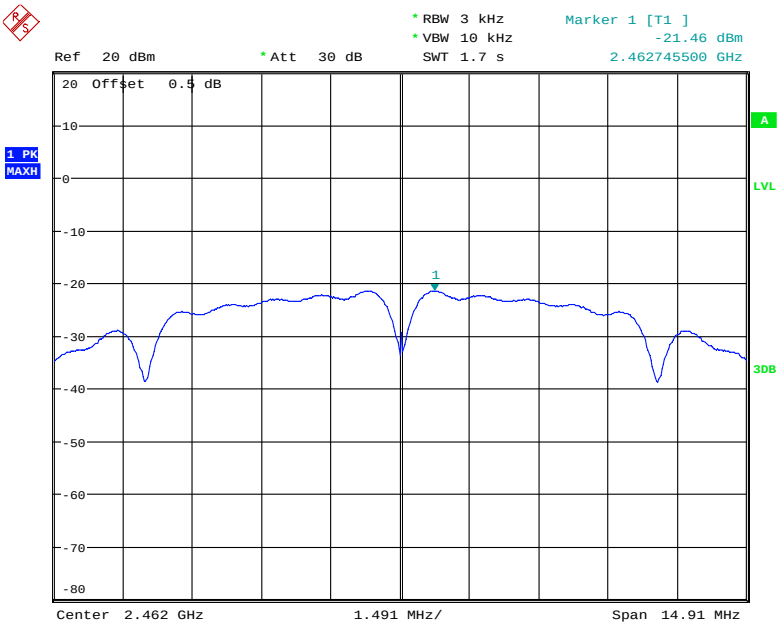
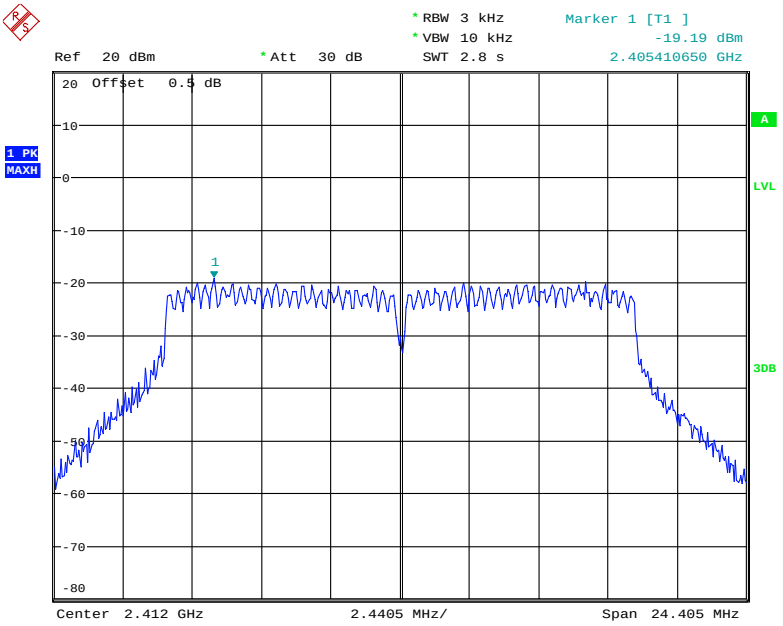
Power Spectral Density, 802.11b, High Channel



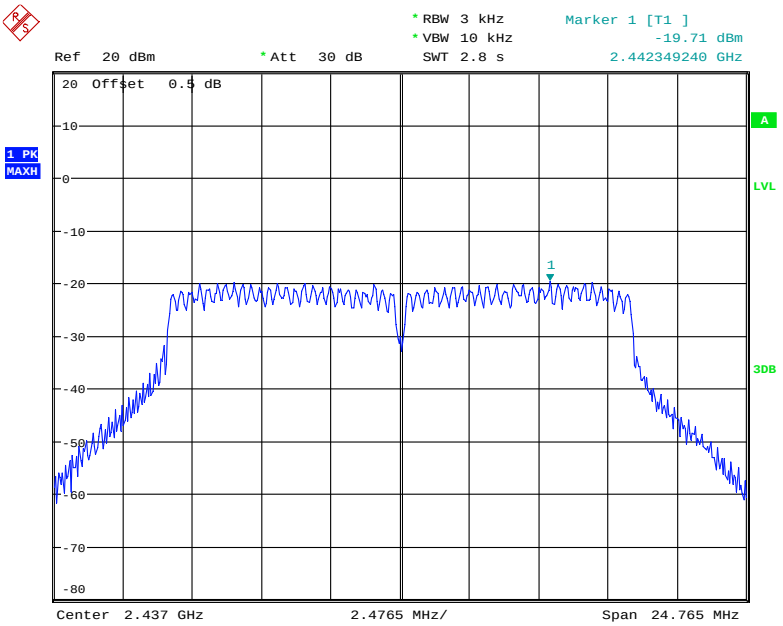
Date: 16.DEC.2017 17:05:01

Power Spectral Density, 802.11g, Low Channel



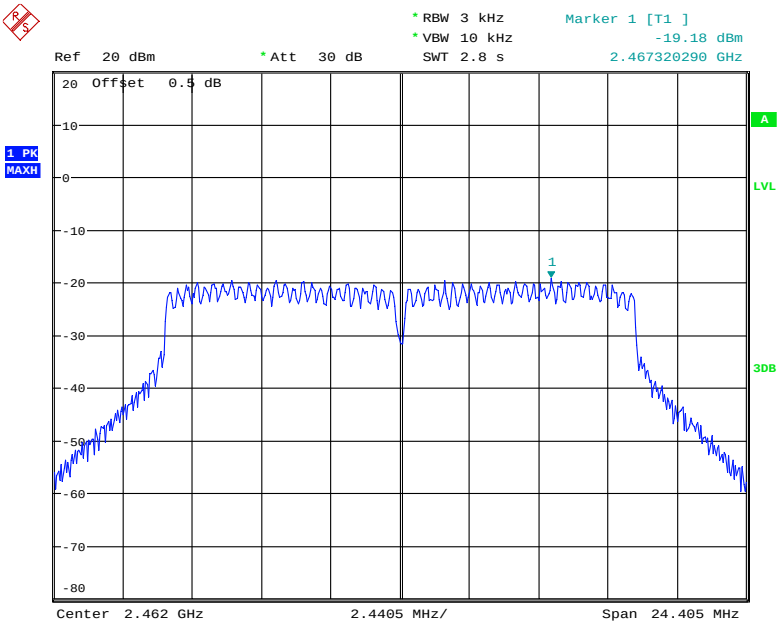
Date: 16.DEC.2017 17:07:27

Power Spectral Density, 802.11g, Middle Channel



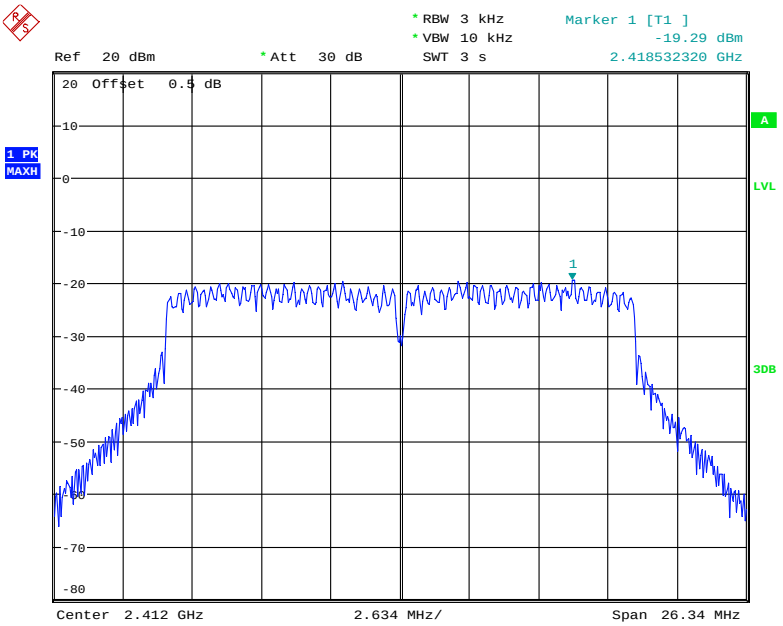
Date: 16.DEC.2017 17:09:26

Power Spectral Density, 802.11g, High Channel



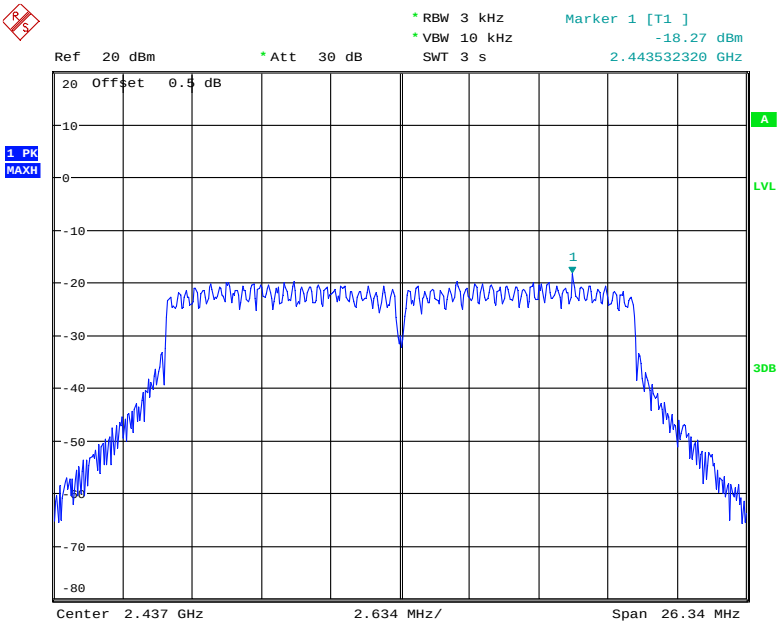
Date: 16.DEC.2017 17:11:04

Power Spectral Density, 802.11n ht20, Low Channel



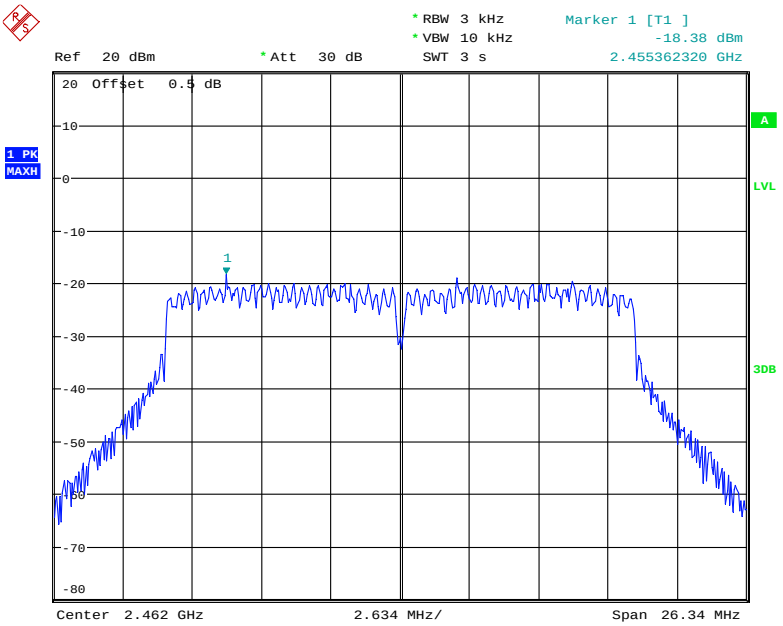
Date: 16.DEC.2017 17:13:29

Power Spectral Density, 802.11n ht20, Middle Channel



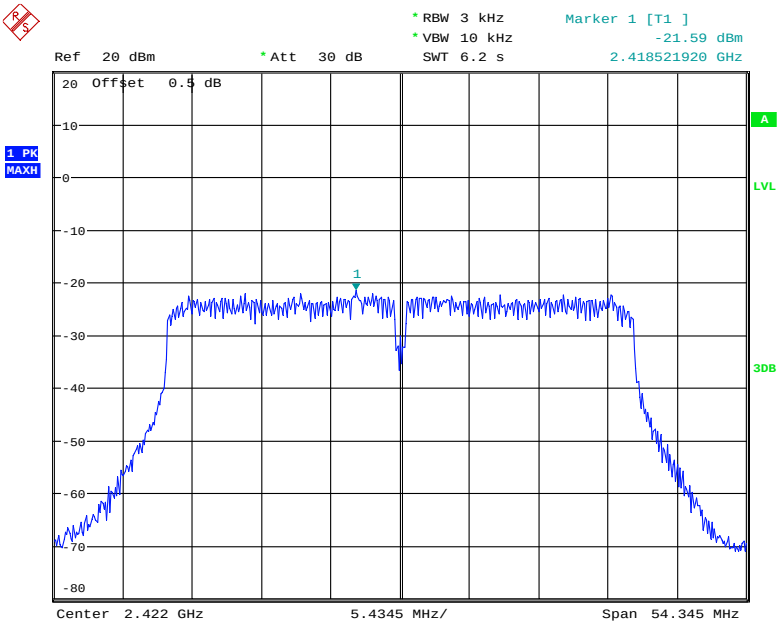
Date: 16.DEC.2017 17:15:19

Power Spectral Density, 802.11n ht20, High Channel



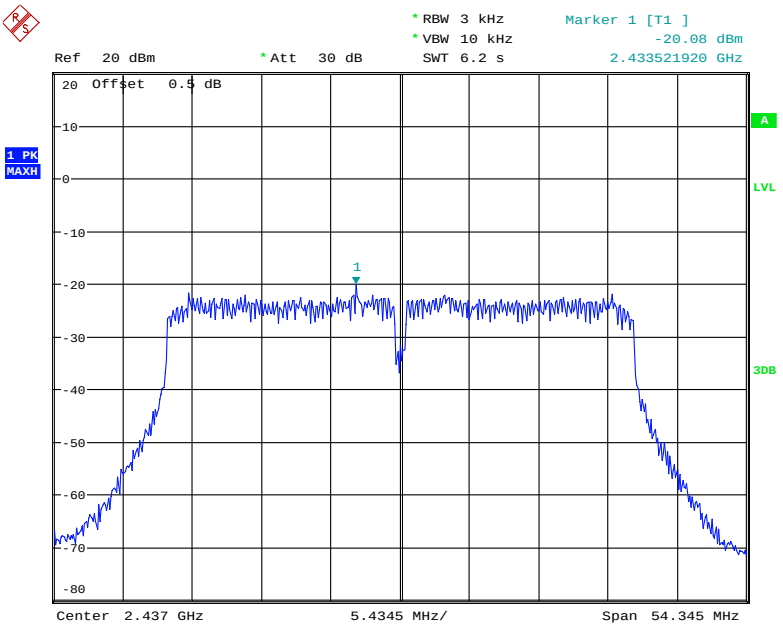
Date: 16.DEC.2017 17:17:01

Power Spectral Density, 802.11n ht40 Low Channel



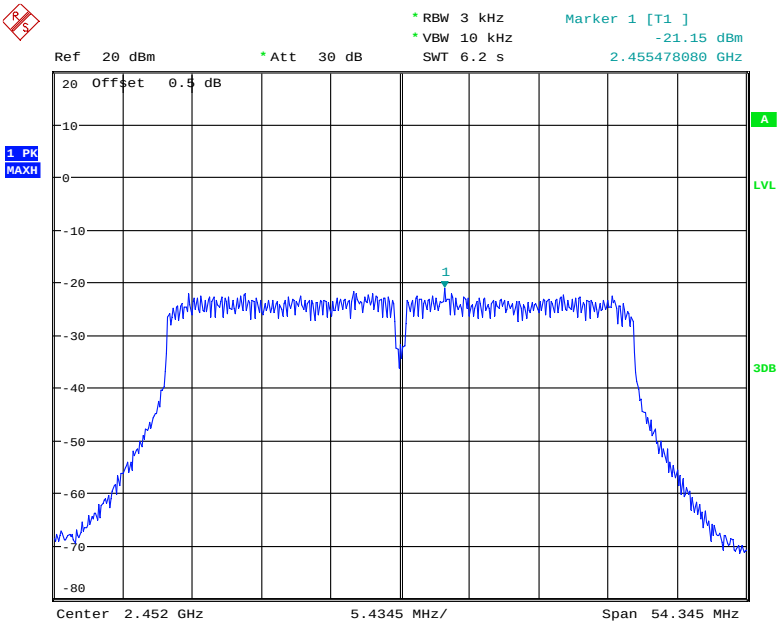
Date: 16.DEC.2017 17:19:15

Power Spectral Density, 802.11n ht40 Middle Channel



Date: 16.DEC.2017 17:21:37

Power Spectral Density, 802.11n ht40 High Channel



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