

FCC PART 15.247

TEST REPORT

For

Lierda Science & Technology Group Co., Ltd

Lierda Building, 425 Dengyun Road, Hangzhou, China

FCC ID:N8NLSD4WF-CC3200

Report Type: Original Report	Product Type: WIFI Module
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Note: This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The Lierda Science & Technology Group Co., Ltd's product,model number: LSD4WF-3221I5SS (FCC ID: N8NLS4WF-CC3200) or the "EUT" in this report was a Wi-Fi Module, which was measured approximately: 23.1mm*32.8mm*3.2mm, rated with input voltage: DC3.3V from mainboard.

**All measurement and test data in this report was gathered from production sample serial number: 00-95-69-15-C7-6E (Assigned by the Lierda Science & Technology Group Co., Ltd. The EUT supplied by the applicant was received on 2014-11-25)*

Objective

This report is prepared on behalf of Lierda Science & Technology Group Co., Ltd in accordance with Part 2-Subpart J, Part 15-Subparts A, B and C of the Federal Communication Commissions rules.

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

Related Submittal(s)/Grant(s)

N/A

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement uncertainty with RF radiated emission is 5.91 dB for 30MHz-1GHz.and 4.92 dB for above 1GHz, 1.95dB for conducted measurement.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the Chenghu Lake Road, Kunshan Development Zone No.248, Kunshan, Jiangsu, China

Test site at Bay Area Compliance Laboratories Corp. (Kunshan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on November 06, 2014. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2009.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 815570. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

For 802.11b, 802.11g and 802.11n-HT20 mode, 11 channels are provided to testing:

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

For 802.11b, 802.11g, 802.11n-HT20 mode, EUT was tested with Channel 1, 6 and 11.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

RF test tool(Radio tool GUI) built-in the EUT.

The worst case was performed under:

802.11b: Data rate: 11 Mbps, Power level: 6

802.11g: Data rate: 6 Mbps, Power level: 10

802.11n-HT20: Data rate: MCS0, Power level: 10

Support Equipment List and Details

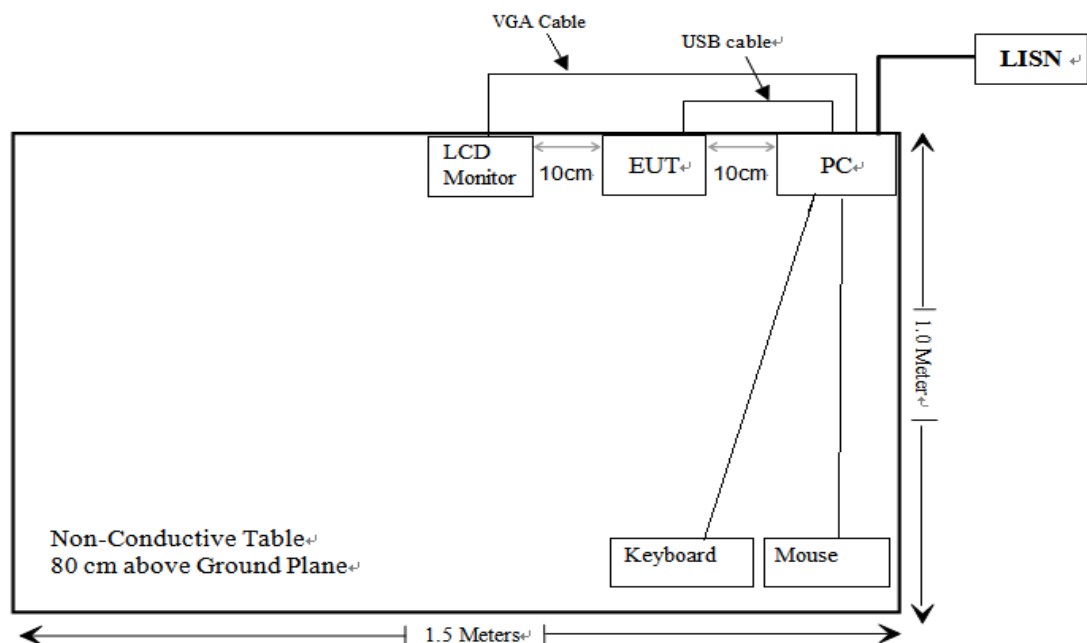
Manufacturer	Description	Model	Serial Number
DELL	PC	OPTIPLEX GX620	HB82W81
ViewSonic	LCD Monitor	VLCDS23895-3W	A1D030300468
iMicro	Keyboard	KB-BL619EB	IMKH012071013088
iMicro	Mouse	MO-1008BU	IMBT012082301098

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shielding Detachable USB Cable	0.9	EUT	PC
VGA Cable	1.5	PC	LCD Monitor
Keyboard Cable	1.8	PC	Keyboard
Mouse Cable	1.8	PC	Mouse

Block Diagram of Test Setup

For conducted emission



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1307 (b) (1)& §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Compliance
§15.247(d)	Spurious Emissions at Antenna Port	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliance
§15.247(b)(3)	Maximum Conducted Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

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

Applicable Standard

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

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/		f/1500	30
1500-100,000	/		1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance

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

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

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

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

Calculated Data:

Mode	Frequency (MHz)	Antenna Gain		Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
802.11b	2412	0.2	1.047	17.66	58.34	20	0.012	1.0
802.11g	2437	0.2	1.047	15.56	35.97	20	0.007	1.0
802.11n HT20	2437	0.2	1.047	14.34	27.16	20	0.006	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.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT has one integral antenna arrangement for wifi, which was permanently attached and the antenna gain is 0.2 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

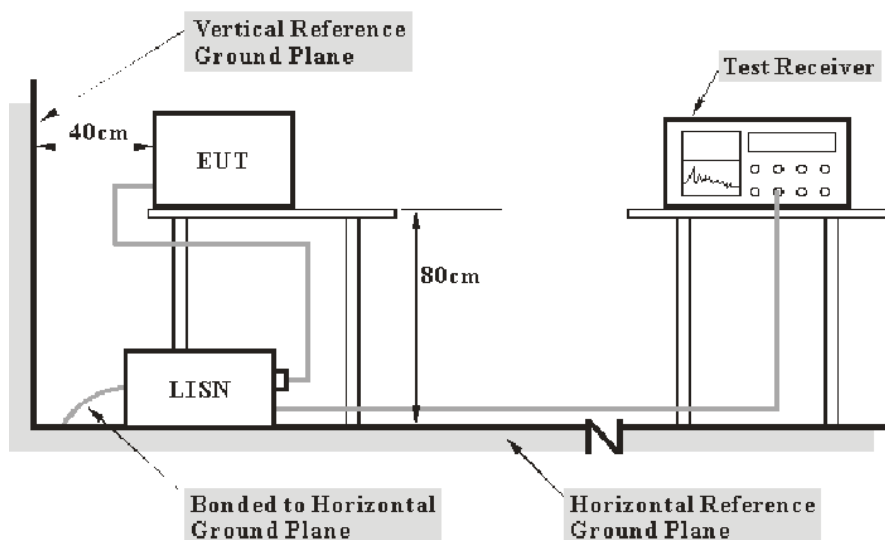
Measurement Uncertainty

Input quantities to be considered for conducted disturbance measurements may be receiver reading, attenuation of the connection between LISN and receiver, LISN voltage division factor, LISN VDF frequency interpolation and receiver related input quantities, etc.

Based on CISPR 16-4-2:2011, the expanded combined standard uncertainty of conducted disturbance test at Bay Area Compliance Laboratories Corp. (Kunshan) is shown as below. And the uncertainty will not be taken into consideration for the test data recorded in the report.

Port	Expanded Measurement uncertainty
AC Mains	3.26 dB (k=2, 95% level of confidence)
CAT 3	3.70 dB (k=2, 95% level of confidence)
CAT 5	3.86 dB (k=2, 95% level of confidence)
CAT 6	4.64 dB (k=2, 95% level of confidence)

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 C63.4-2009 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The adapter was connected to a 120 VAC/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 outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS30	831294/005	2014-09-16	2015-09-16
Rohde & Schwarz	LISN	ESH3-Z5	12005	2014-09-16	2015-09-16
Rohde & Schwarz	LISN	ESH3-Z5	12008	2014-09-16	2015-09-16
Rohde & Schwarz	CE Test software	EMC 32	V 09.10.0	--	--

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

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

$$\text{Correction Factor} = \text{LISN VDF} + \text{Cable Loss}$$

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

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

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207, the worst margin reading as below:

19.22 dB at 0.25 MHz in the Line conducted mode

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr} , if L_m is less than L_{lim} , it implies that the EUT complies with the limit.

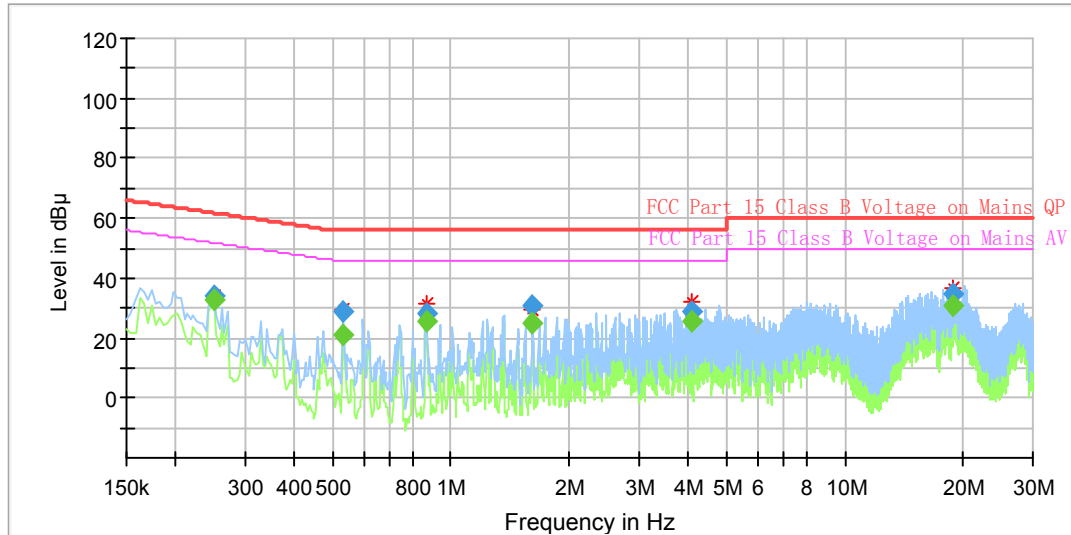
Test Data

Environmental Conditions

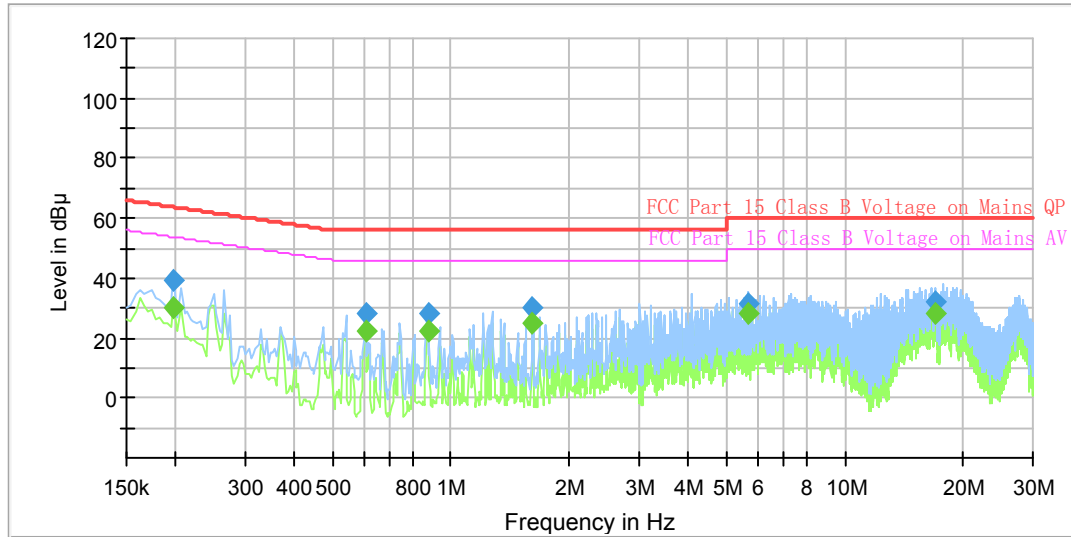
Temperature:	23 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Matt Yao on 2014-12-1.

EUT operation mode: Transmitting

AC 120V/60 Hz, Line

Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Limit (dB μ V)	Margin (dB)	Corr. (dB)
0.250000	---	32.54	51.76	19.22	1.0
0.250000	34.01	---	61.76	27.75	1.0
0.534000	---	20.98	46.00	25.02	1.0
0.534000	28.91	---	56.00	27.09	1.0
0.866000	---	25.75	46.00	20.25	1.1
0.866000	28.05	---	56.00	27.95	1.1
1.606000	---	24.83	46.00	21.17	1.1
1.606000	30.77	---	56.00	25.23	1.1
4.082000	---	25.62	46.00	20.38	1.3
4.082000	28.61	---	56.00	27.39	1.3
18.790000	---	30.57	50.00	19.43	1.4
18.790000	34.82	---	60.00	25.18	1.4

AC 120V/60 Hz, Neutral

Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Limit (dB μ V)	Margin (dB)	Corr. (dB)
0.198000	---	30.29	53.69	23.40	1.0
0.198000	39.24	---	63.69	24.45	1.0
0.606000	---	22.46	46.00	23.54	1.0
0.606000	28.45	---	56.00	27.55	1.0
0.874000	---	22.59	46.00	23.41	1.1
0.874000	28.00	---	56.00	28.00	1.1
1.610000	---	24.68	46.00	21.32	1.2
1.610000	30.01	---	56.00	25.99	1.2
5.702000	---	28.35	50.00	21.65	1.4
5.702000	31.24	---	60.00	28.76	1.4
16.978000	---	28.28	50.00	21.72	1.4
16.978000	32.08	---	60.00	27.92	1.4

Note:

- 1) Corr.=LISN VDF (Voltage Division Factor) + Cable Loss
- 2) Corrected Amplitude = Reading + Corr.
- 3) Margin = Limit –Corrected Amplitude

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

Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

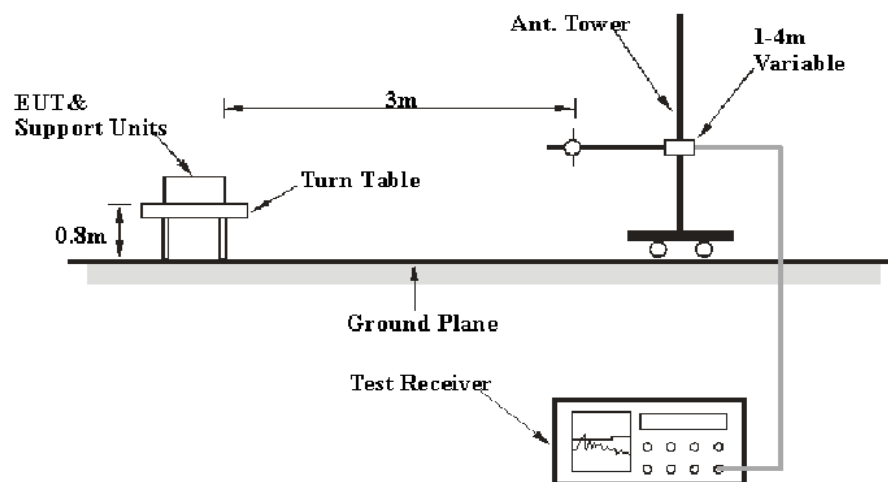
Measurement Uncertainty

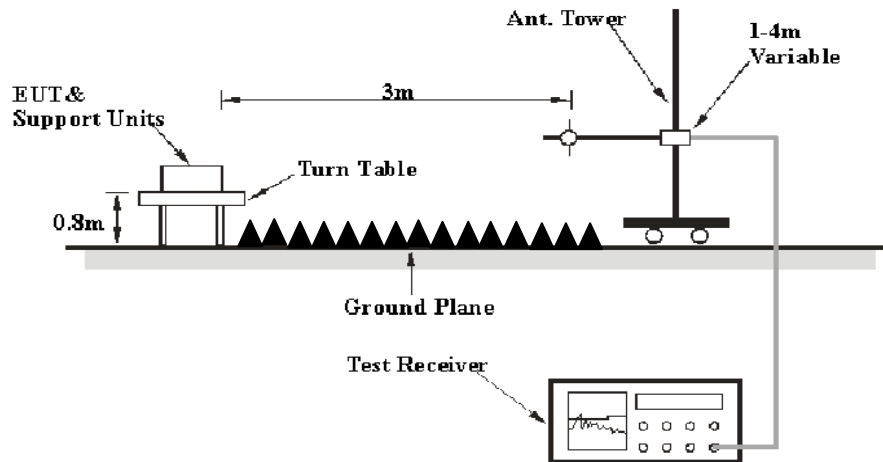
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR 16-4-2:2011, the expanded combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Kunshan) is 5.91 dB for 30MHz-1GHz and 4.92 dB for above 1GHz, 1.95dB for conducted measurement at antenna port. And the uncertainty will not be taken into consideration for the test data recorded in the report

EUT Setup

Below 1 GHz:



Above 1GHz:

The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.4-2009. The specification used was the FCC 15.209, and FCC 15.247 limits.

The adapter was connected to a 120 VAC/60 Hz power source.

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:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	Ave.

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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sonoma Instrunent	Amplifier	330	171377	2014-09-16	2015-09-16
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2014-09-16	2015-09-16
Sunol Sciences	Broadband Antenna	JB3	A090314-1	2014-09-12	2015-09-12
ETS	Horn Antenna	3115	6229	2014-09.-12	2015-09-12
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2014-09-16	2015-09-16
Mini	Pre-amplifier	ZVA-183-S+	857001418	2014-09-16	2015-09-16
champrotek	Chamber	Chamber A	1#	2014-09-17	2015-09-17
R&S	Auto test Software	EMC32	V 09.10.0	-	-

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

Corrected Amplitude & Margin Calculation

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

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

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

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

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247.

3.14 at 4874.048 MHz in the vertical polarization
for 802.11b mode

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr} , if L_m is less than L_{lim} , it implies that the EUT complies with the limit.

Test Data**Environmental Conditions**

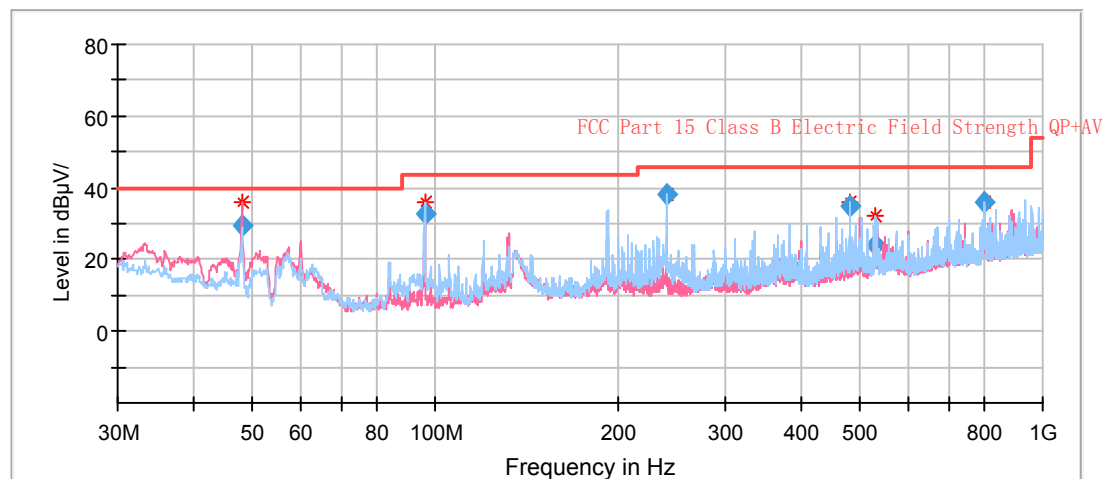
Temperature:	25 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Matt Yao on 2014-11-27.

EUT operation mode: Transmitting

30 MHz-1 GHz:

The worst case was performed under 802.11b mode

802.11b Mode:

Frequency (MHz)	QuasiPeak (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
47.945000	29.55	40.00	10.45	99.0	V	311.0	-15.2
96.081250	32.97	43.50	10.53	200.0	H	22.0	-16.9
240.005000	38.00	46.00	8.00	99.0	H	270.0	-11.9
479.958750	35.08	46.00	10.92	99.0	H	103.0	-6.0
531.853750	23.85	46.00	22.15	200.0	H	105.0	-5.3
800.907500	36.07	46.00	9.93	200.0	H	238.0	-1.4

802.11g Mode:

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
47.945000	29.08	40.00	10.92	99.0	V	211.0	-15.2
95.960000	34.81	43.50	8.69	201.0	H	206.0	-17.0
240.005000	35.65	46.00	10.35	201.0	H	257.0	-11.9
479.958750	33.54	46.00	12.46	99.0	H	110.0	-6.0
503.966250	29.63	46.00	16.37	99.0	H	97.0	-5.3
800.907500	34.24	46.00	11.76	201.0	H	232.0	-1.4

802.11n-HT20 Mode:

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
47.945000	30.55	40.00	9.45	99.0	V	291.0	-15.2
95.960000	33.83	43.50	9.67	201.0	H	2.0	-17.0
240.126250	36.91	46.00	9.09	99.0	H	277.0	-11.9
479.958750	34.81	46.00	11.19	99.0	H	88.0	-6.0
527.973750	27.49	46.00	18.51	201.0	H	92.0	-5.3
801.028750	29.97	46.00	16.03	201.0	V	183.0	-1.4

1GHz-25GHz**802.11b Mode:**

Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
Low Channel (2412 MHz)								
1490.981964	---	24.47	53.90	29.43	174.0	V	315.0	-0.8
1490.981964	37.14	---	73.90	36.76	174.0	V	315.0	-0.8
2330.020040	57.47	---	73.90	16.43	243.0	H	335.0	2.9
2330.020040	---	42.15	53.90	11.75	243.0	H	335.0	2.9
2390.060120	51.94	---	73.90	21.96	227.0	H	195.0	3.0
2390.060120	---	36.45	53.90	17.45	227.0	H	195.0	3.0
3216.432866	---	38.46	53.90	15.44	196.0	H	29.0	7.1
3216.432866	48.80	---	73.90	25.10	196.0	H	29.0	7.1
4016.032064	---	44.94	53.90	8.96	226.0	H	42.0	10.2
4016.032064	57.64	---	73.90	16.26	226.0	H	42.0	10.2
4829.659319	54.25	---	73.90	19.65	99.0	V	73.0	11.7
4829.659319	---	35.34	53.90	18.56	99.0	V	73.0	11.7
6428.857715	---	34.66	53.90	19.24	222.0	V	16.0	15.6
6428.857715	48.36	---	73.90	25.54	222.0	V	16.0	15.6
7270.541082	---	34.07	53.90	19.83	173.0	H	278.0	17.4
7270.541082	47.64	---	73.90	26.26	173.0	H	278.0	17.4
Middle Channel (2437MHz)								
1663.667334	46.27	---	73.90	27.63	130.0	V	339.0	0.2
1663.667334	---	39.99	53.90	13.91	130.0	V	339.0	0.2
3000.140281	---	40.98	53.90	12.92	204.0	H	127.0	6.5
3000.140281	45.98	---	73.90	27.92	204.0	H	127.0	6.5
4061.342685	---	45.28	53.90	8.62	227.0	H	35.0	10.3
4061.342685	58.45	---	73.90	15.45	227.0	H	35.0	10.3
4874.048096	60.88	---	73.90	13.02	99.0	V	75.0	11.7
4874.048096	---	50.76	53.90	3.14	99.0	V	75.0	11.7
6506.152305	49.21	---	73.90	24.69	171.0	H	52.0	15.7
6506.152305	---	35.73	53.90	18.17	171.0	H	52.0	15.7
7309.478958	48.91	---	73.90	24.99	148.0	H	44.0	17.4
7309.478958	---	34.79	53.90	19.11	148.0	H	44.0	17.4

Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
High Channel (2462 MHz)								
1288.076152	47.01	---	73.90	26.89	99.0	V	205.0	-2.3
1288.076152	---	30.99	53.90	22.91	99.0	V	205.0	-2.3
2483.527856	---	38.07	53.90	15.83	195.0	H	196.0	3.2
2483.527856	53.17	---	73.90	20.73	195.0	H	196.0	3.2
2571.783567	---	46.37	53.90	7.53	221.0	H	347.0	3.7
2571.783567	60.77	---	73.90	13.13	221.0	H	347.0	3.7
3000.180361	46.31	---	73.90	27.59	205.0	H	131.0	6.5
3000.180361	---	40.90	53.90	13.00	205.0	H	131.0	6.5
4101.903808	55.34	---	73.90	18.56	156.0	H	35.0	10.3
4101.903808	---	42.16	53.90	11.74	156.0	H	35.0	10.3
4924.148296	58.65	---	73.90	15.25	99.0	V	75.0	11.8
4924.148296	---	49.52	53.90	4.38	99.0	V	75.0	11.8
6565.470942	54.41	---	73.90	19.49	99.0	H	11.0	15.9
6565.470942	---	45.41	53.90	8.49	99.0	H	11.0	15.9
7292.444890	47.99	---	73.90	25.91	201.0	V	350.0	17.4
7292.444890	---	34.12	53.90	19.78	201.0	V	350.0	17.4

802.11g Mode:

Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
Low Channel (2412 MHz)								
1659.754509	37.30	---	73.90	36.60	212.0	H	310.0	0.1
1659.754509	---	24.40	53.90	29.50	212.0	H	310.0	0.1
2330.581162	52.56	---	73.90	21.34	236.0	H	350.0	2.9
2330.581162	---	35.62	53.90	18.28	236.0	H	350.0	2.9
2389.979559	52.33	---	73.90	21.57	251.0	H	195.0	3.0
2389.979559	---	33.45	53.90	20.45	251.0	H	195.0	3.0
2991.542084	---	28.07	53.90	25.83	106.0	V	155.0	6.4
2991.542084	42.63	---	73.90	31.27	106.0	V	155.0	6.4
4029.792585	---	29.24	53.90	24.66	163.0	H	36.0	10.2
4029.792585	43.96	---	73.90	29.94	163.0	H	36.0	10.2
4815.373748	---	41.04	53.90	12.86	197.0	V	62.0	11.6
4815.373748	63.24	---	73.90	10.66	197.0	V	62.0	11.6
6428.648296	---	34.66	53.90	19.24	123.0	V	28.0	15.6
6428.648296	50.57	---	73.90	23.33	123.0	V	28.0	15.6
7214.602205	47.81	---	73.90	26.09	221.0	H	341.0	17.3
7214.602205	---	33.97	53.90	19.93	221.0	H	341.0	17.3

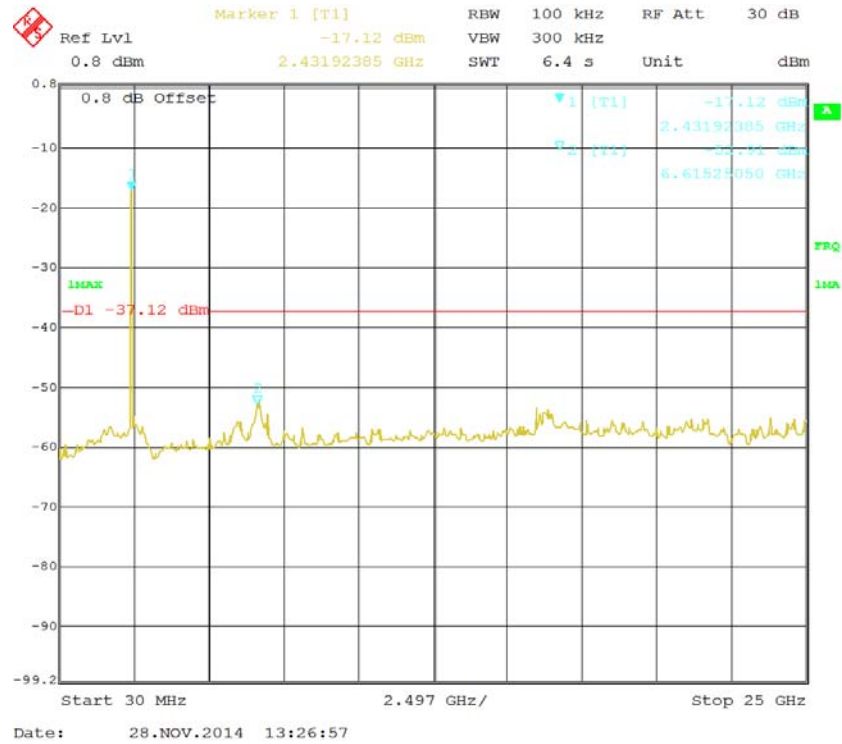
Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
Middle Channel (2437MHz)								
1266.131262	---	27.34	53.90	26.56	105.0	V	180.0	-2.5
1266.131262	49.99	---	73.90	23.91	105.0	V	180.0	-2.5
2991.850701	41.61	---	73.90	32.29	204.0	H	116.0	6.4
2991.850701	---	28.08	53.90	25.82	204.0	H	116.0	6.4
4058.518036	55.86	---	73.90	18.04	164.0	H	36.0	10.3
4058.518036	---	41.08	53.90	12.82	164.0	H	36.0	10.3
4886.055110	---	42.95	53.90	10.95	99.0	V	79.0	11.7
4886.055110	63.80	---	73.90	10.10	99.0	V	79.0	11.7
6513.197395	48.76	---	73.90	25.14	148.0	H	0.0	15.7
6513.197395	---	35.74	53.90	18.16	148.0	H	0.0	15.7
7312.143287	52.48	---	73.90	21.42	148.0	H	44.0	17.4
7312.143287	---	36.48	53.90	17.42	148.0	H	44.0	17.4
High Channel (2462 MHz)								
1490.852705	36.96	---	73.90	36.94	113.0	V	318.0	-0.8
1490.852705	---	23.69	53.90	30.21	113.0	V	318.0	-0.8
2483.507215	52.46	---	73.90	21.44	179.0	H	332.0	3.2
2483.507215	---	34.16	53.90	19.74	179.0	H	332.0	3.2
2593.266533	55.48	---	73.90	18.42	163.0	H	46.0	3.8
2593.266533	---	39.18	53.90	14.72	163.0	H	46.0	3.8
2991.606212	41.89	---	73.90	32.01	190.0	H	134.0	6.4
2991.606212	---	27.69	53.90	26.21	190.0	H	134.0	6.4
3286.195390	---	25.86	53.90	28.04	205.0	H	27.0	7.3
3286.195390	39.08	---	73.90	34.82	205.0	H	27.0	7.3
4100.393788	---	35.90	53.90	18.00	155.0	H	36.0	10.3
4100.393788	50.27	---	73.90	23.63	155.0	H	36.0	10.3
4927.550100	61.18	---	73.90	12.72	204.0	V	61.0	11.8
4927.550100	---	42.09	53.90	11.81	204.0	V	61.0	11.8
7452.626253	---	34.42	53.90	19.48	230.0	V	168.0	17.7
7452.626253	48.08	---	73.90	25.82	230.0	V	168.0	17.7

802.11n-HT20 Mode:

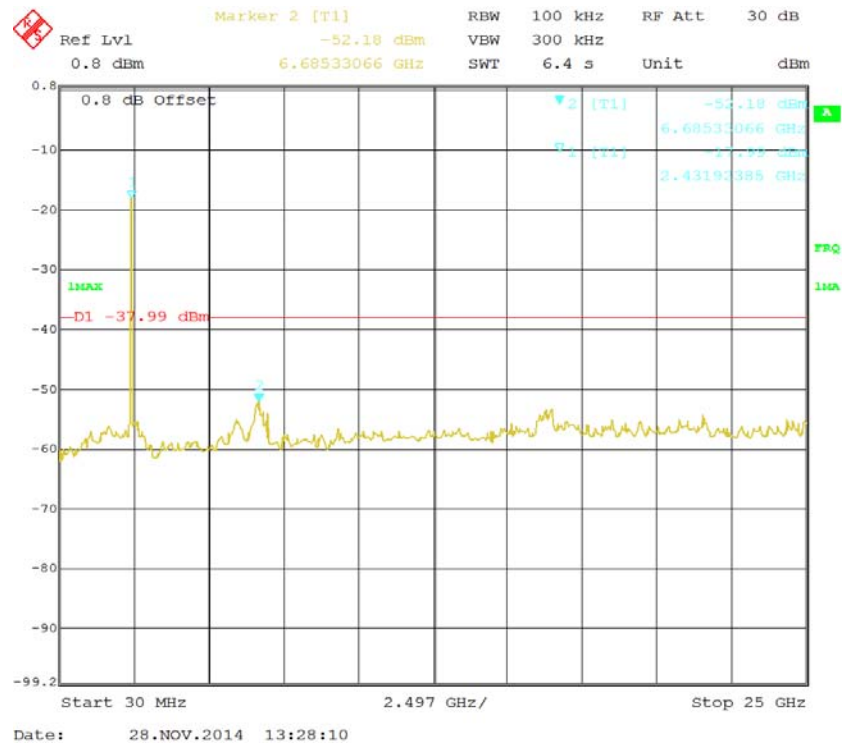
Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
Low Channel (2412 MHz)								
1294.644288	41.02	---	73.90	32.88	106.0	V	348.0	-2.3
1294.644288	---	24.82	53.90	29.08	106.0	V	348.0	-2.3
2312.344689	---	33.15	53.90	20.75	244.0	H	10.0	2.9
2312.344689	49.96	---	73.90	23.94	244.0	H	10.0	2.9
2390.060120	---	32.42	53.90	21.48	172.0	H	197.0	3.0
2390.060120	52.12	---	73.90	21.78	172.0	H	197.0	3.0
3216.077155	---	41.20	53.90	12.70	229.0	H	27.0	7.1
3216.077155	50.40	---	73.90	23.50	229.0	H	27.0	7.1
4015.786573	51.27	---	73.90	22.63	173.0	H	36.0	10.2
4015.786573	---	36.85	53.90	17.05	173.0	H	36.0	10.2
4830.023046	---	41.36	53.90	12.54	197.0	V	58.0	11.7
4830.023046	61.55	---	73.90	12.35	197.0	V	58.0	11.7
6428.558116	47.20	---	73.90	26.70	149.0	H	77.0	15.6
6428.558116	---	34.13	53.90	19.77	149.0	H	77.0	15.6
7284.433867	---	34.10	53.90	19.80	99.0	V	53.0	17.4
7284.433867	47.12	---	73.90	26.78	99.0	V	53.0	17.4
Middle Channel (2437MHz)								
1491.035070	36.62	---	73.90	37.28	148.0	V	358.0	-0.8
1491.035070	---	23.96	53.90	29.94	148.0	V	358.0	-0.8
3244.640281	42.45	---	73.90	31.45	222.0	H	18.0	7.2
3244.640281	---	27.67	53.90	26.23	222.0	H	18.0	7.2
4058.576152	---	37.56	53.90	16.34	163.0	H	36.0	10.3
4058.576152	52.11	---	73.90	21.79	163.0	H	36.0	10.3
4885.766533	---	40.66	53.90	13.24	99.0	V	78.0	11.7
4885.766533	60.62	---	73.90	13.28	99.0	V	78.0	11.7
6498.586172	---	48.20	53.90	5.70	149.0	H	36.0	15.7
6498.586172	56.15	---	73.90	17.75	149.0	H	36.0	15.7
7312.548097	51.91	---	73.90	21.99	205.0	H	41.0	17.4
7312.548097	---	35.40	53.90	18.50	205.0	H	41.0	17.4

Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
High Channel (2462 MHz)								
1490.510020	---	23.69	53.90	30.21	155.0	V	317.0	-0.9
1490.510020	37.09	---	73.90	36.81	155.0	V	317.0	-0.9
2483.500573	53.80	---	73.90	20.10	212.0	H	336.0	3.2
2483.500573	---	34.91	53.90	18.99	212.0	H	336.0	3.2
2586.853707	56.10	---	73.90	17.80	213.0	H	190.0	3.8
2586.853707	---	39.89	53.90	14.01	213.0	H	190.0	3.8
3272.604208	---	26.34	53.90	27.56	237.0	H	37.0	7.3
3272.604208	40.46	---	73.90	33.44	237.0	H	37.0	7.3
4100.257515	---	35.40	53.90	18.50	155.0	H	36.0	10.3
4100.257515	50.06	---	73.90	23.84	155.0	H	36.0	10.3
4942.197395	---	29.78	53.90	24.12	99.0	V	81.0	11.8
4942.197395	44.79	---	73.90	29.11	99.0	V	81.0	11.8
6568.660321	---	35.87	53.90	18.03	99.0	H	50.0	15.9
6568.660321	49.64	---	73.90	24.26	99.0	H	50.0	15.9
7383.205411	51.10	---	73.90	22.80	163.0	H	45.0	17.6
7383.205411	---	34.93	53.90	18.97	163.0	H	45.0	17.6

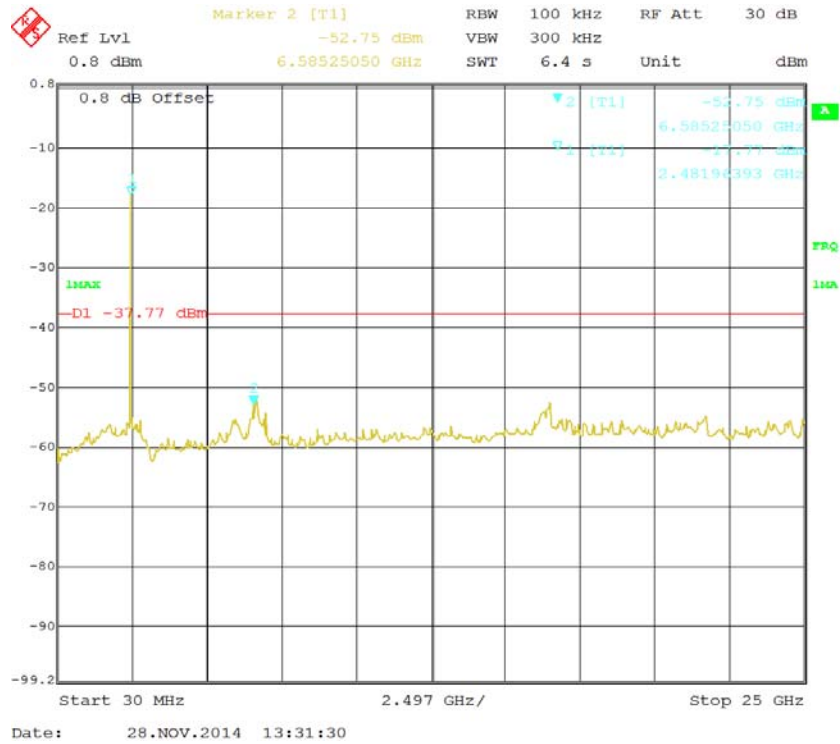
802.11b Low Channel



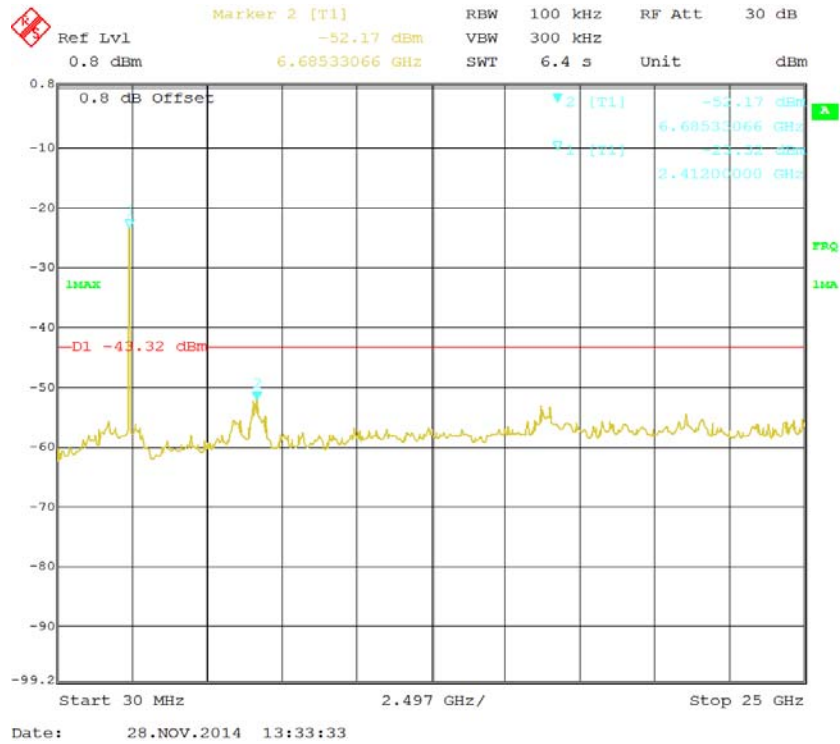
802.11b Middle Channel



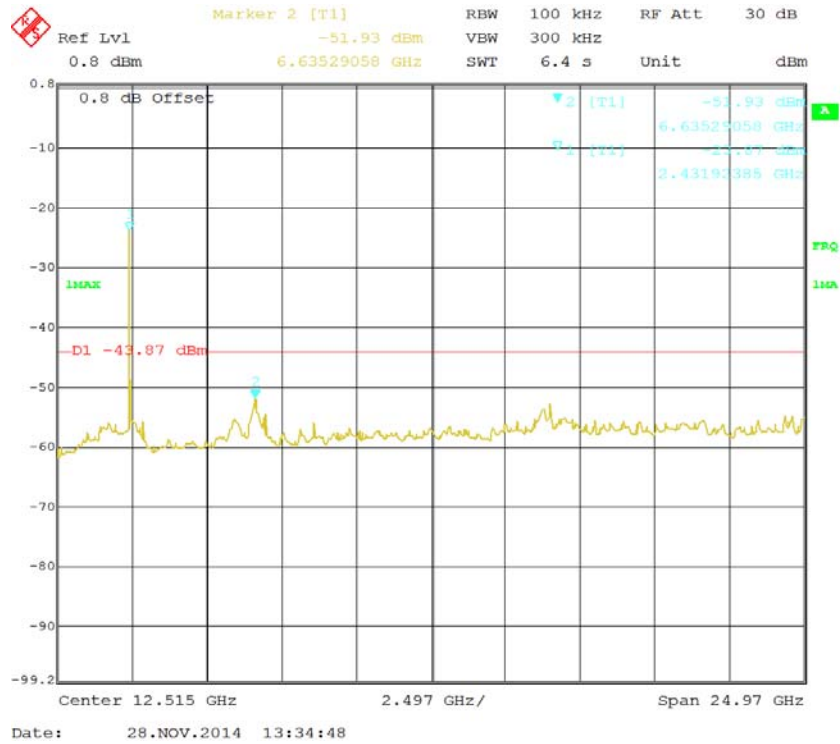
802.11b High Channel



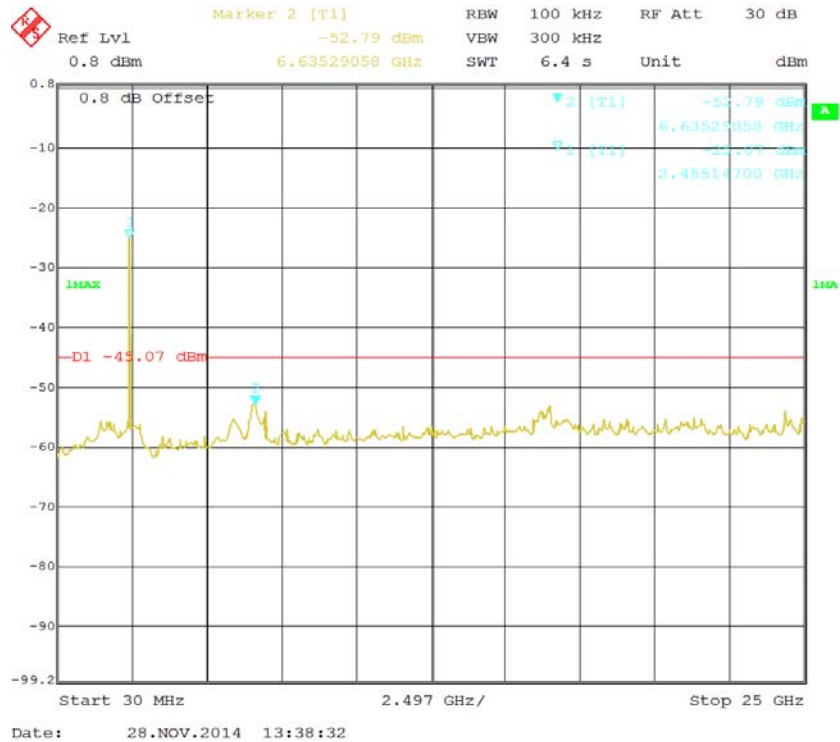
802.11g Low Channel



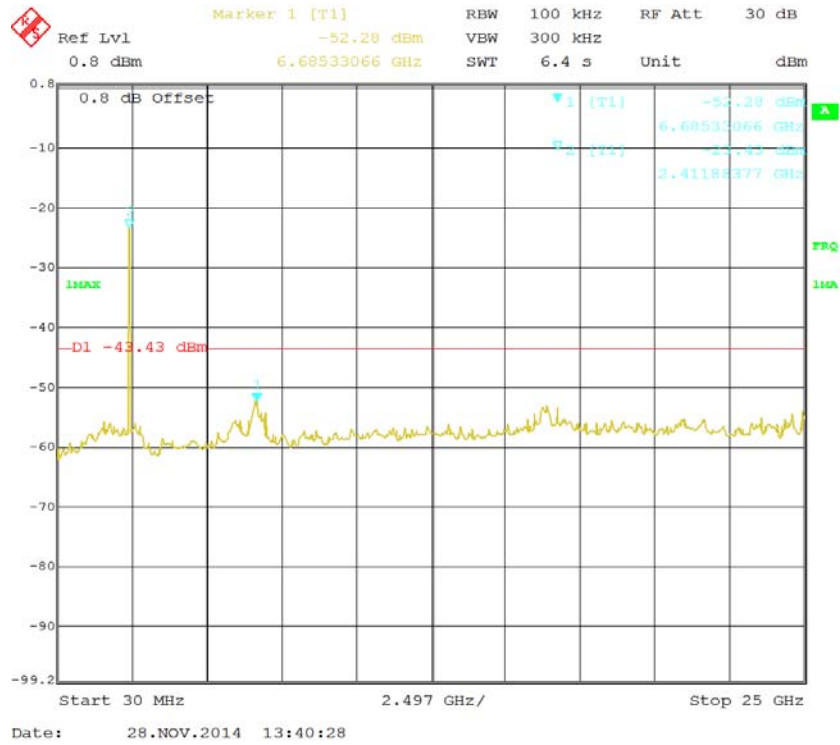
802.11g Middle Channel



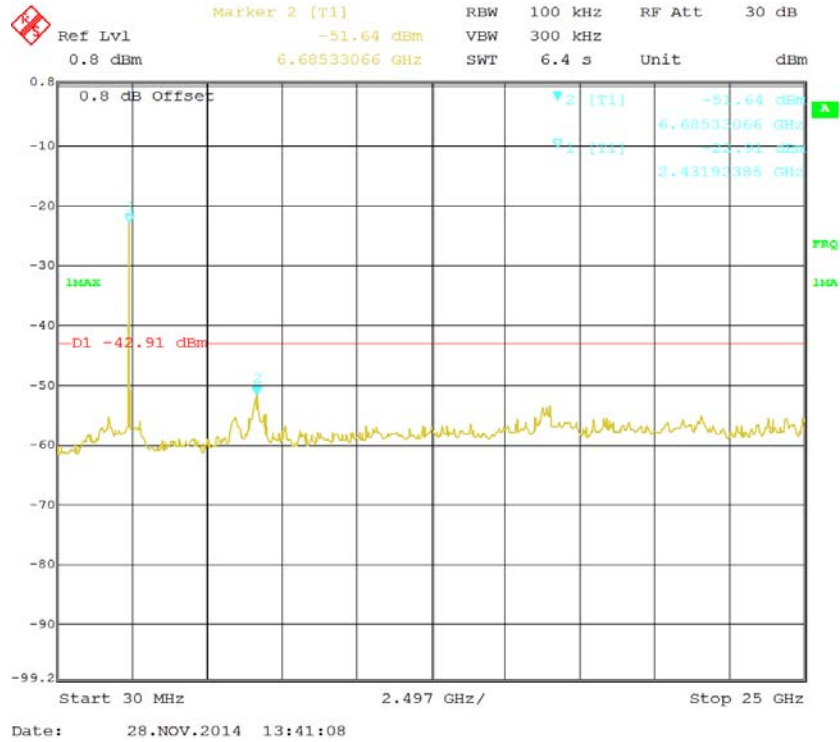
802.11g High Channel



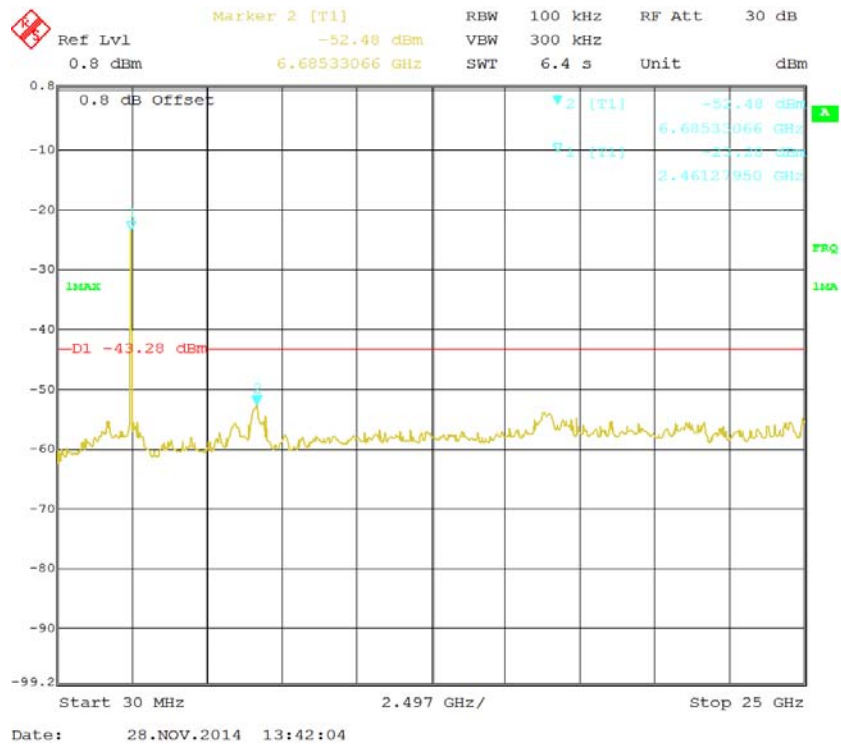
802.11n-HT20 Low Channel



802.11n-HT20 Middle Channel



802.11n-HT20 High Channel



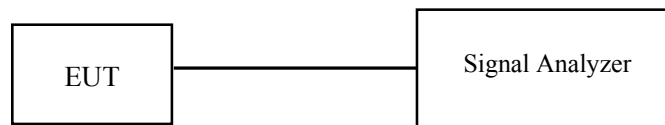
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

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

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 it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2014-09-16	2015-09-16

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

Test Data

Environmental Conditions

Temperature:	27 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Matt Yao on 2014-11-28.

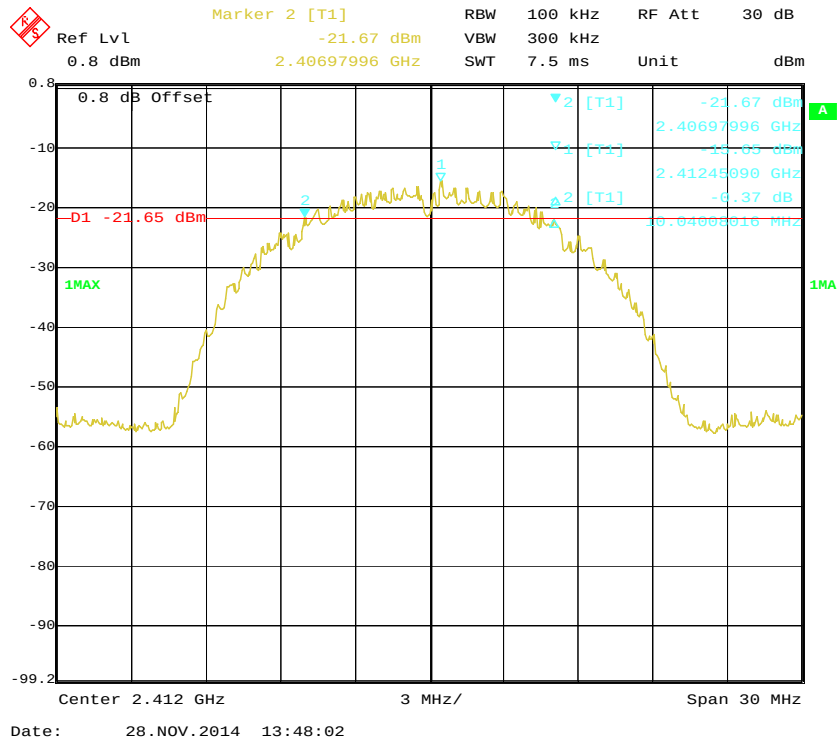
Test Result: Pass.

Please refer to the following tables and plots.

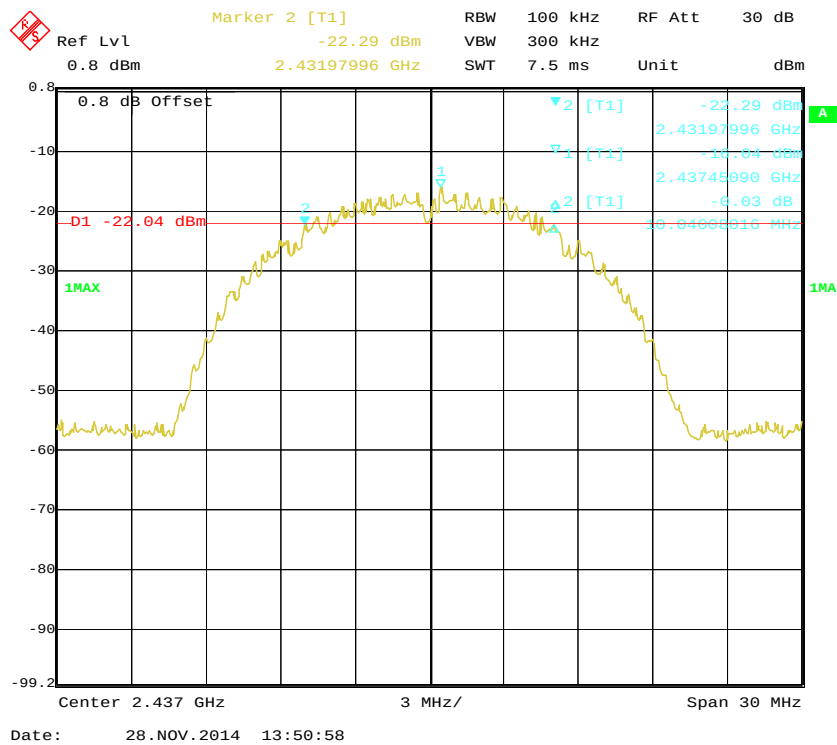
EUT operation mode: Transmitting

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (kHz)
802.11b mode			
Low	2412	10.04	≥ 500
Middle	2437	10.04	≥ 500
High	2462	9.98	≥ 500
802.11g mode			
Low	2412	15.27	≥ 500
Middle	2437	15.15	≥ 500
High	2462	15.15	≥ 500
802.11n-HT20 mode			
Low	2412	15.15	≥ 500
Middle	2437	15.15	≥ 500
High	2462	15.15	≥ 500

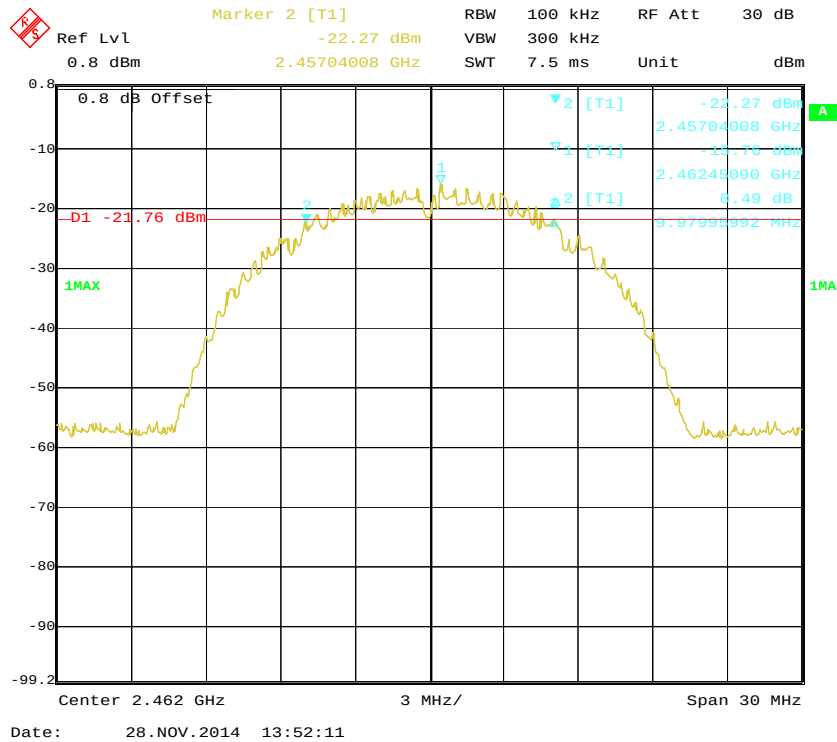
802.11b Low Channel



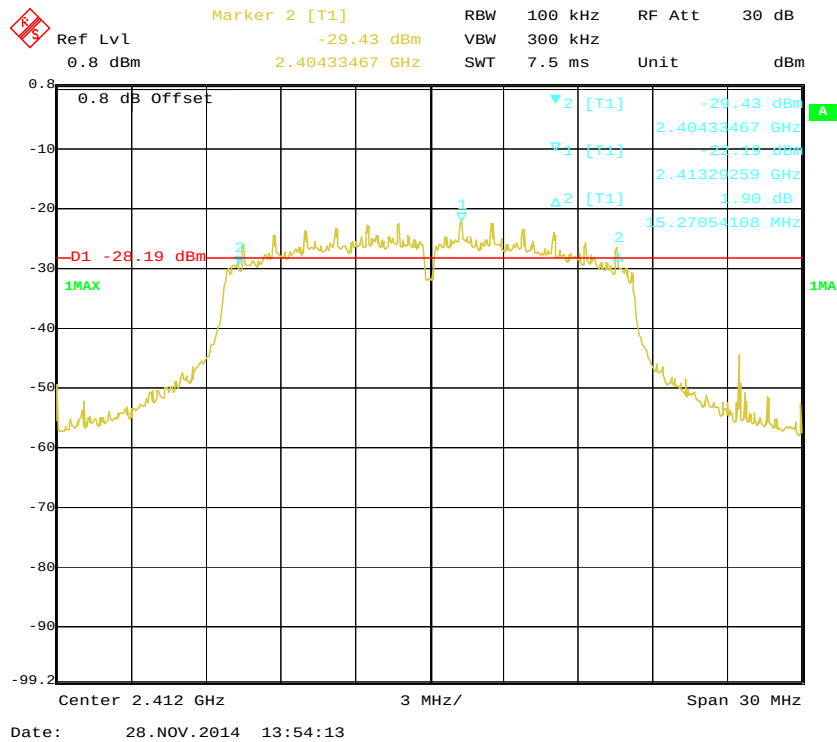
802.11b Middle Channel



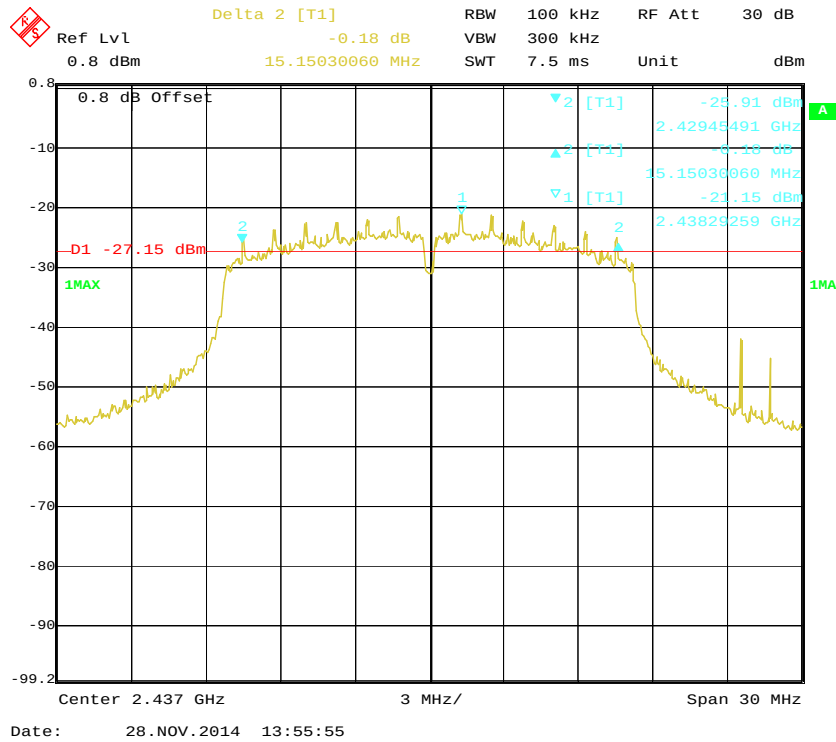
802.11b High Channel



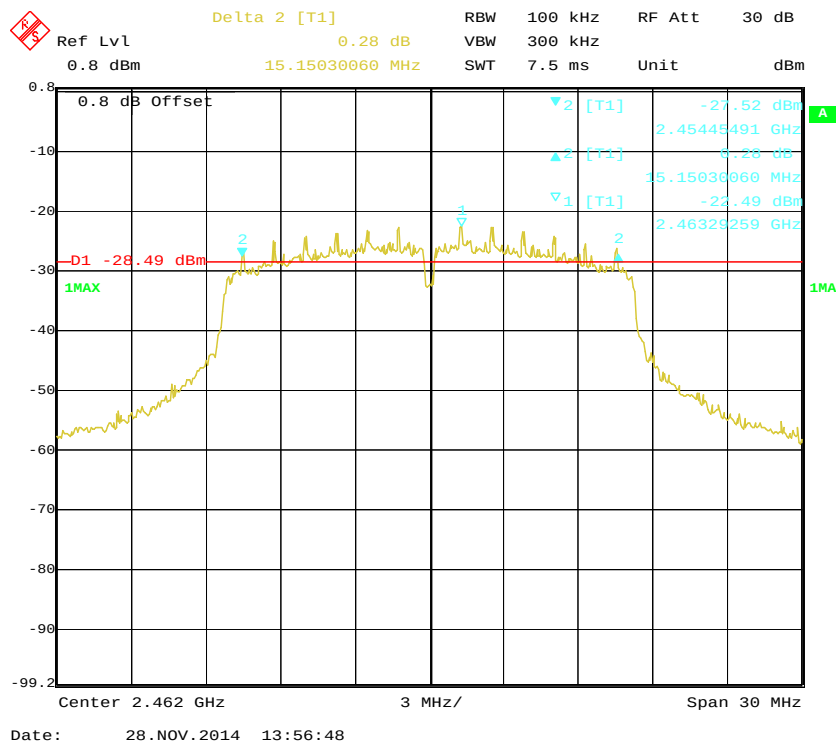
802.11g Low Channel



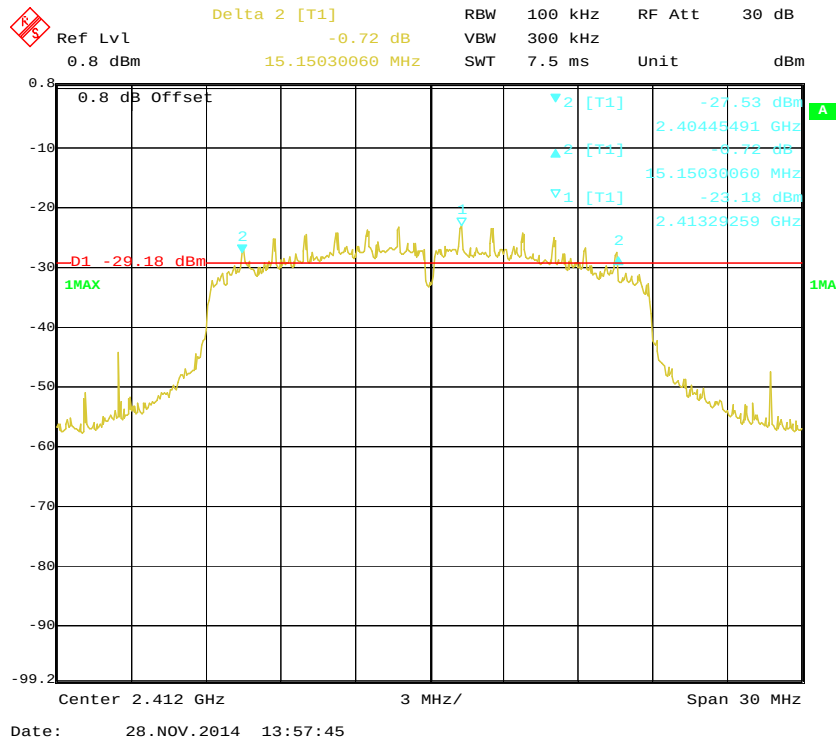
802.11g Middle Channel



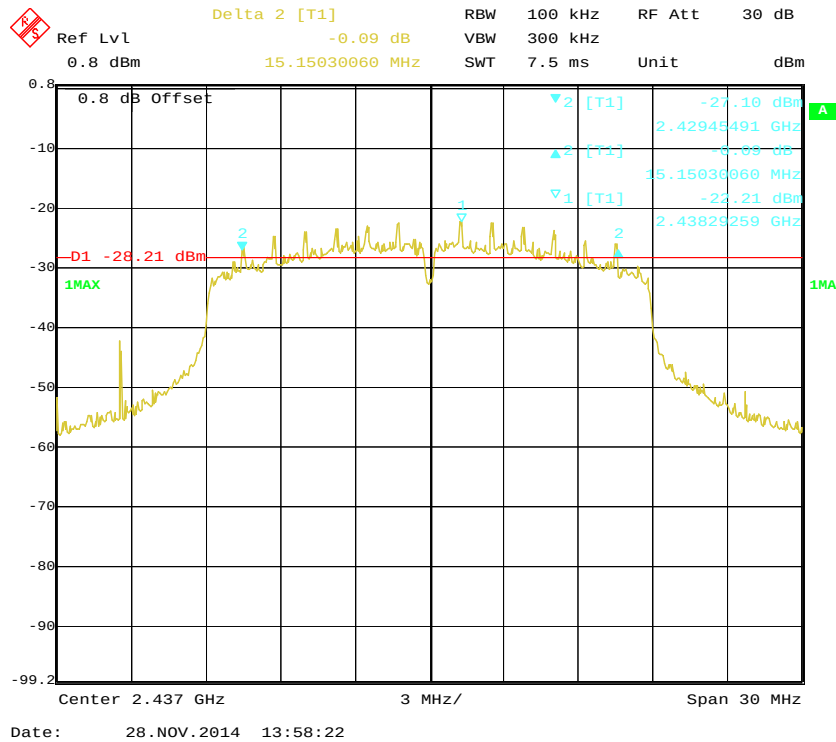
802.11g High Channel



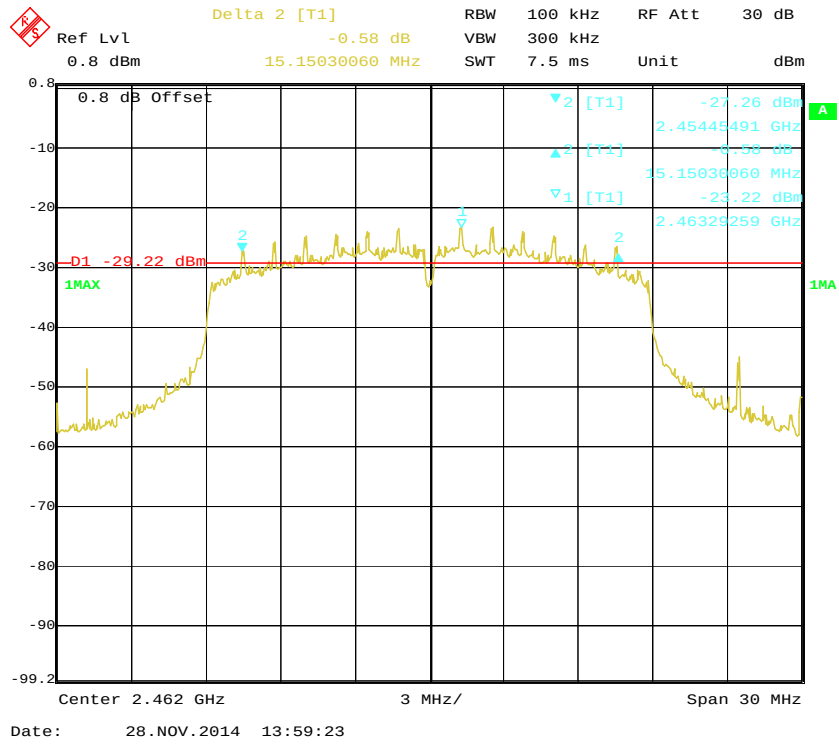
802.11n-HT20 Low Channel



802.11n-HT20 Middle Channel



802.11n-HT20 High Channel



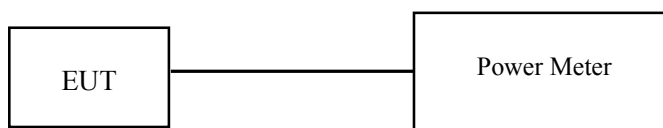
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

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 one test equipment.
3. Add a correction factor to the display.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Wideband Power Sensor	N1921A	MY54210016	2014-11-03	2015-11-03
Agilent	Wideband Power Sensor	N1921A	MY54210013	2014-11-03	2015-11-03
Agilent	P-Series Power Meter	N1921A	MY5000448	2014-11-03	2015-11-03

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

Test Data

Environmental Conditions

Temperature:	27 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Matt Yao on 2014-11-28

EUT operation mode: Transmitting

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Limit (dBm)
802.11b			
Low	2412	17.66	30
Middle	2437	17.44	30
High	2462	16.90	30
802.11g			
Low	2412	14.46	30
Middle	2437	15.56	30
High	2462	13.72	30
802.11n-HT20			
Low	2412	13.39	30
Middle	2437	14.34	30
High	2462	12.67	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
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2014-09-16	2015-09-16

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

Test Data**Environmental Conditions**

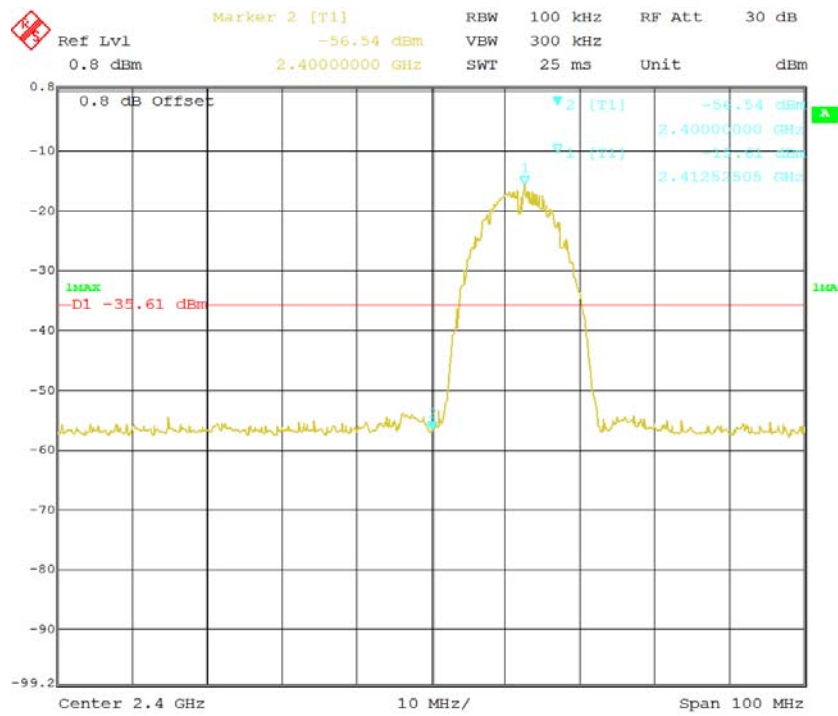
Temperature:	27 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Matt Yao on 2014-11-28.

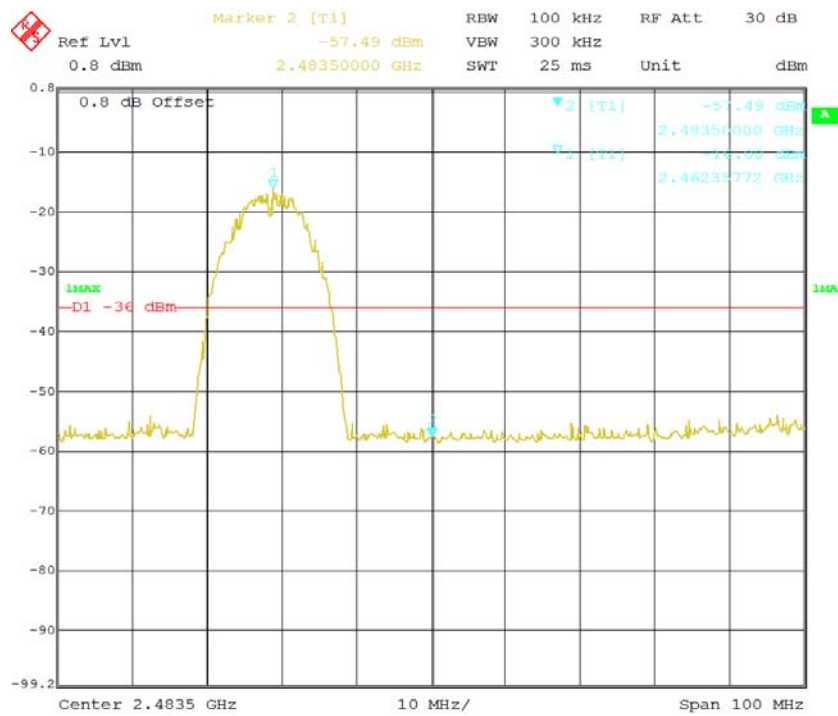
Test Result: Compliance

Please refer to the following table and plots.

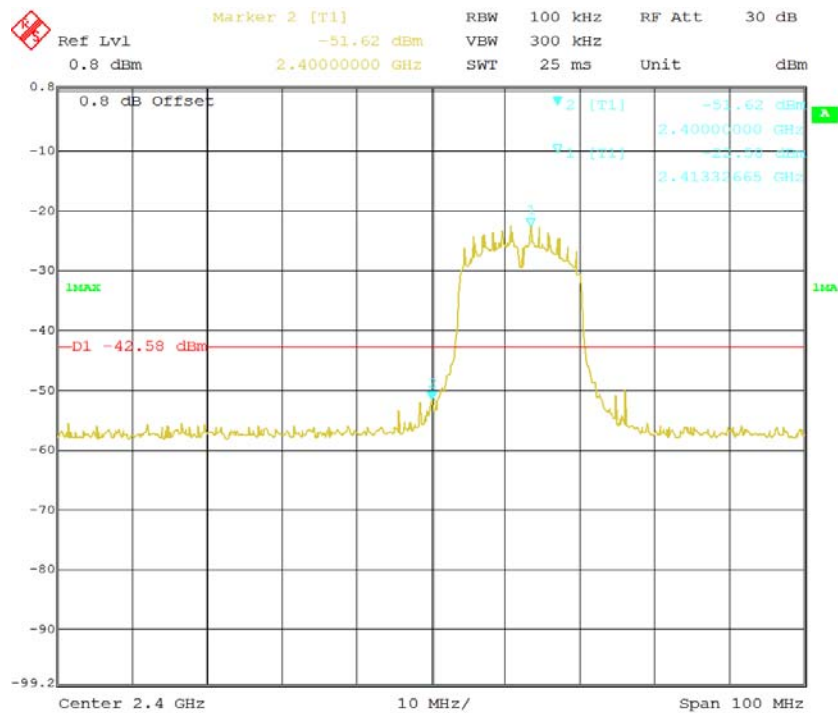
802.11b: Band Edge, Left Side



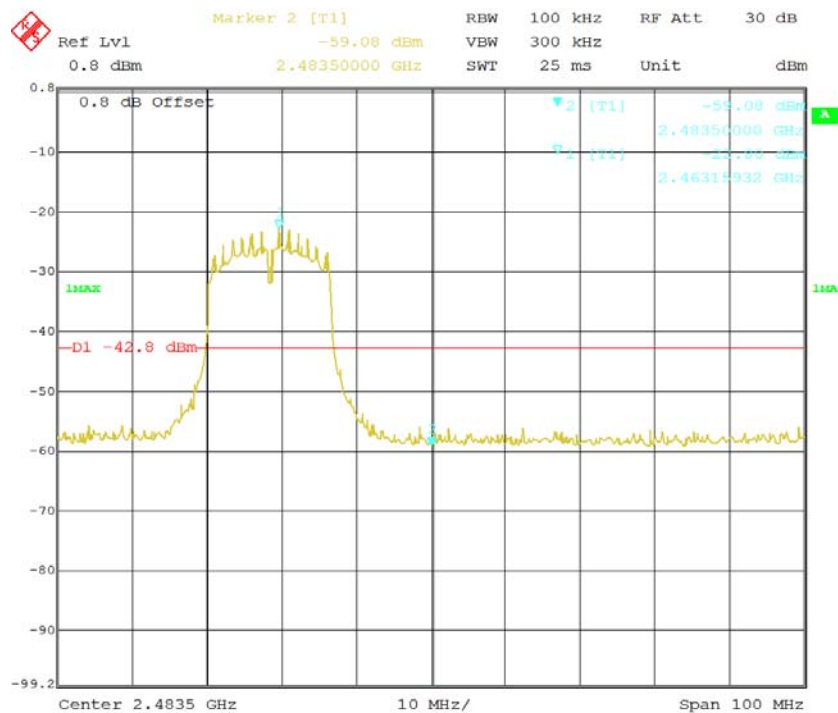
802.11b: Band Edge, Right Side



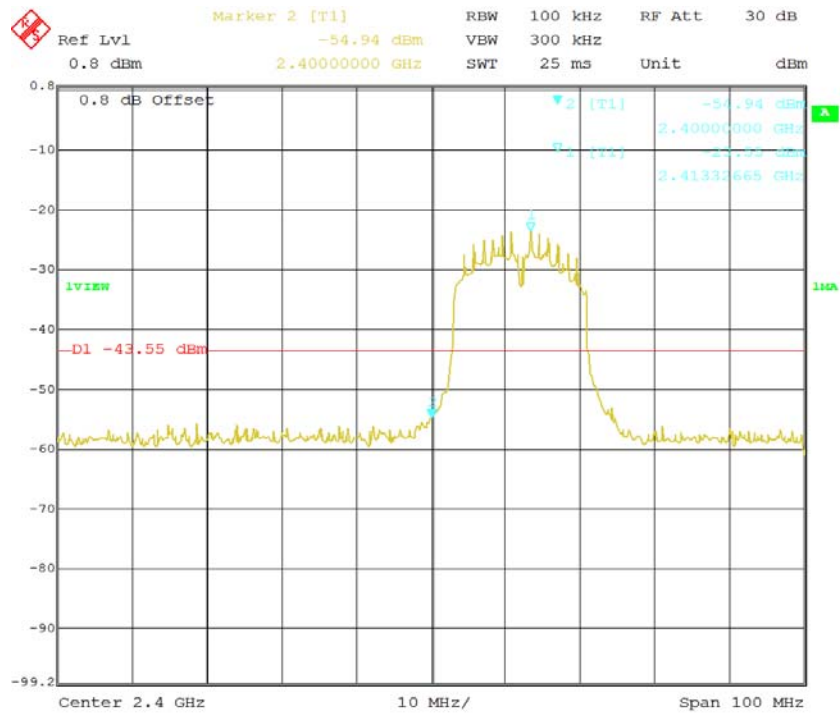
802.11g: Band Edge, Left Side



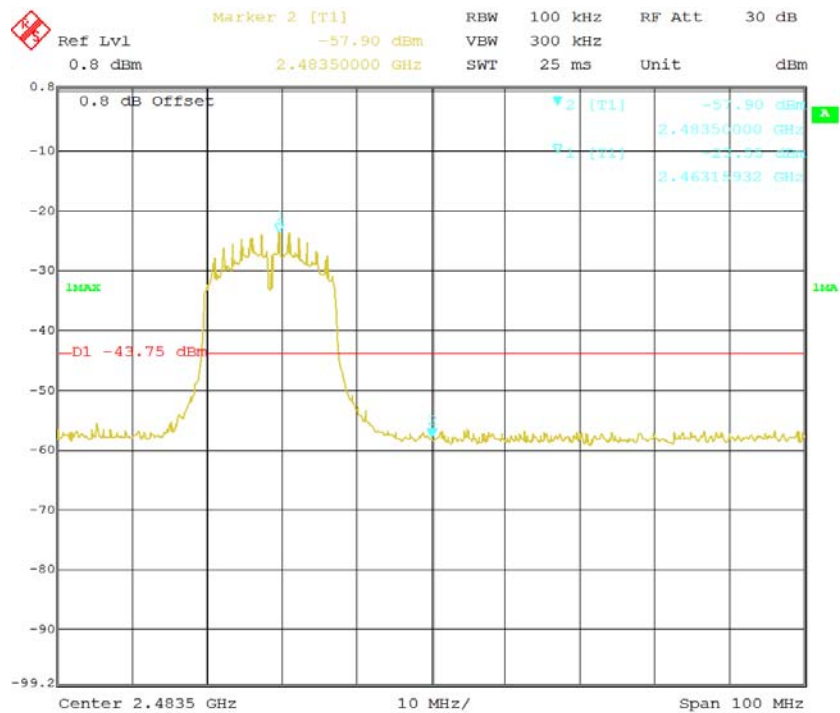
802.11g: Band Edge, Right Side



802.11n-HT20: Band Edge, Left Side



802.11n-HT20: Band Edge, Right Side



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

According to KDB558074 D01 DTS Meas Guidance v03r02 sub-clause 10.2

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW to: $3\text{ kHz} \leq \text{RBW} \leq 100\text{ kHz}$.
3. Set the VBW $\geq 3 \times \text{RBW}$.
4. Set the span to 1.5 times the DTS bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds 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
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2014-09-16	2015-09-16

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

Test Data**Environmental Conditions**

Temperature:	27 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

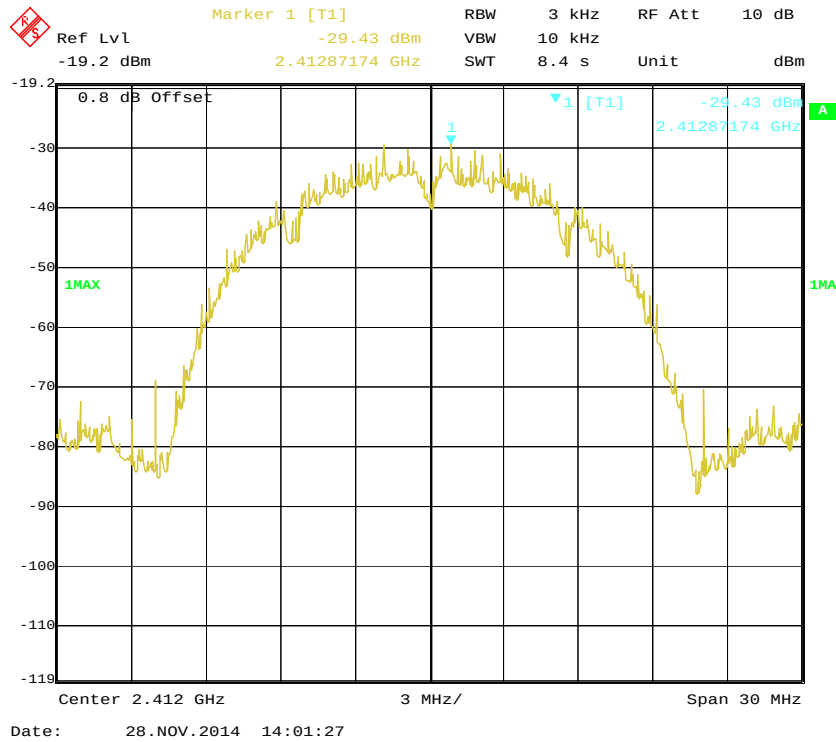
The testing was performed by Matt Yao on 2014-11-28.

EUT operation mode: Transmitting

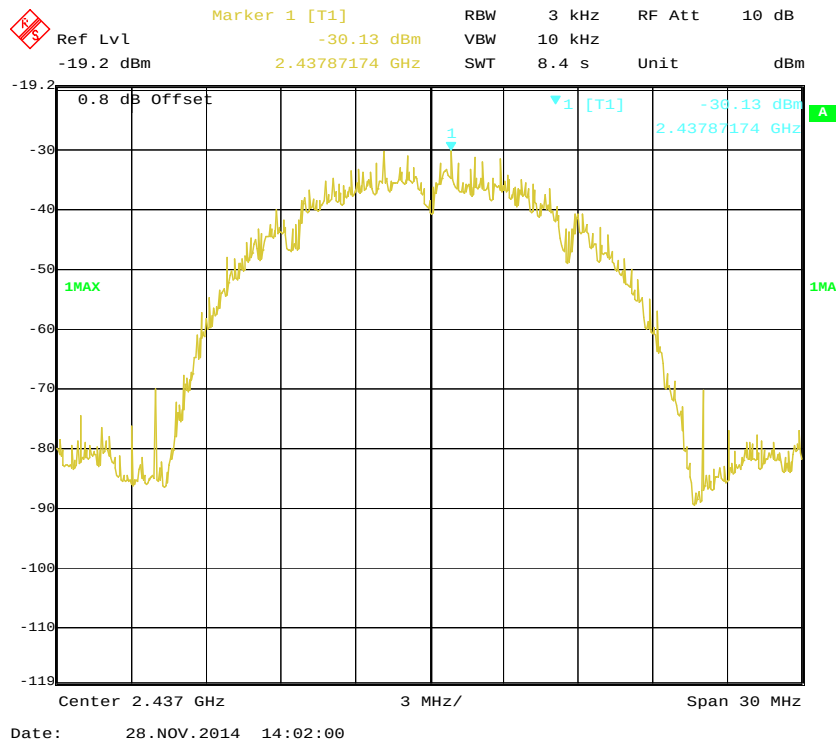
Test Result: Pass

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
802.11b mode			
Low	2412	-29.43	≤ 8
Middle	2437	-30.13	≤ 8
High	2462	-29.91	≤ 8
802.11g mode			
Low	2412	-38.78	≤ 8
Middle	2437	-36.89	≤ 8
High	2462	-38.93	≤ 8
802.11n-HT20 mode			
Low	2412	-38.60	≤ 8
Middle	2437	-38.66	≤ 8
High	2462	-38.84	≤ 8

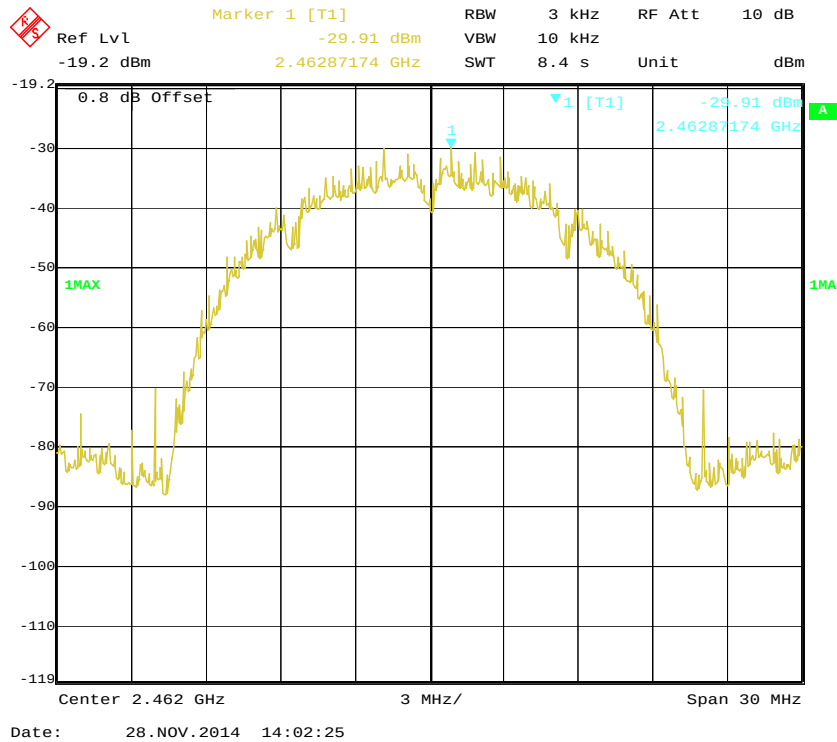
Power Spectral Density, 802.11b Low Channel



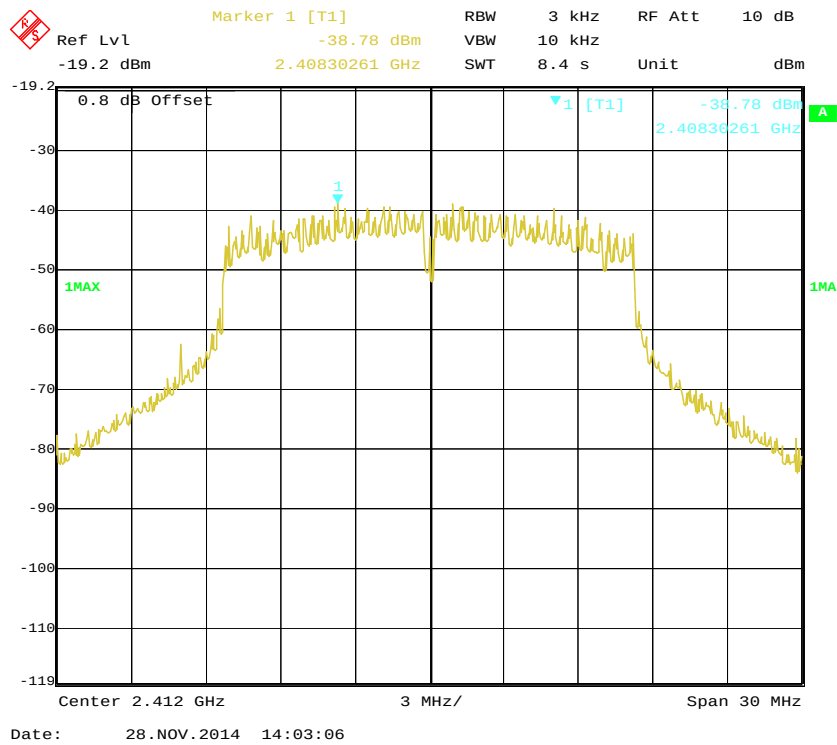
Power Spectral Density, 802.11b Middle Channel



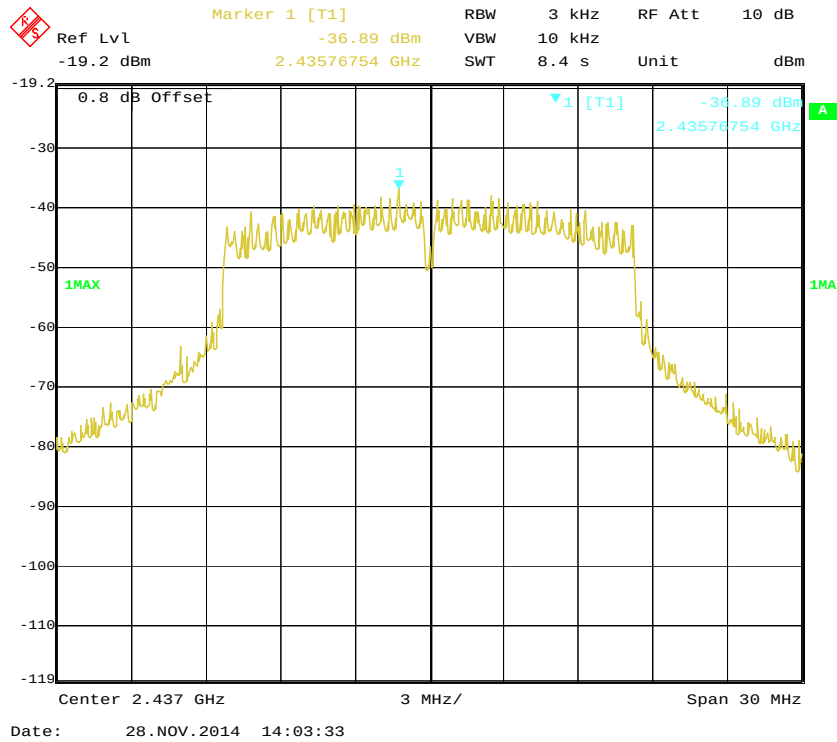
Power Spectral Density, 802.11b High Channel



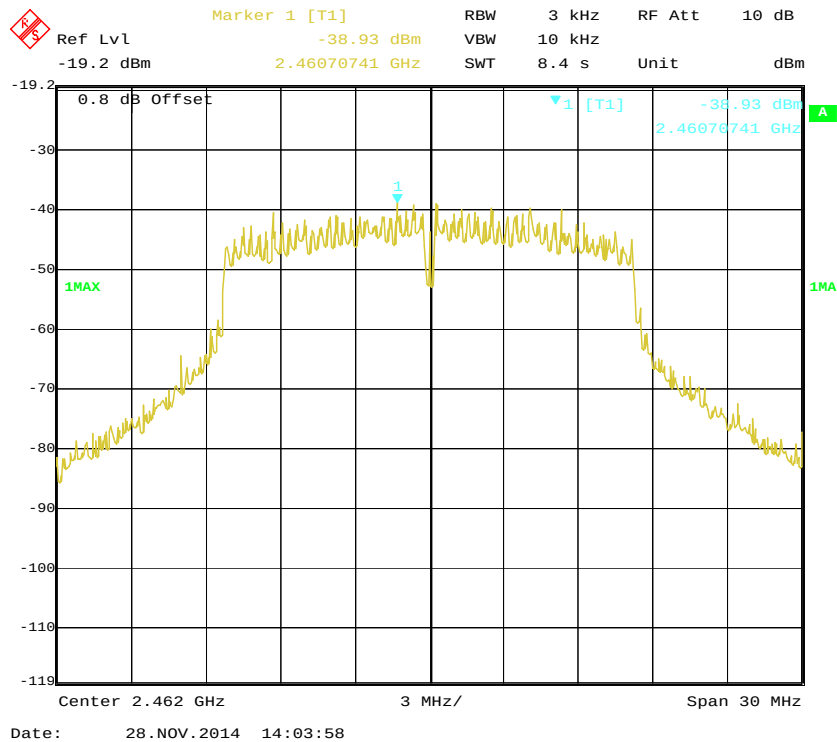
Power Spectral Density, 802.11g Low Channel



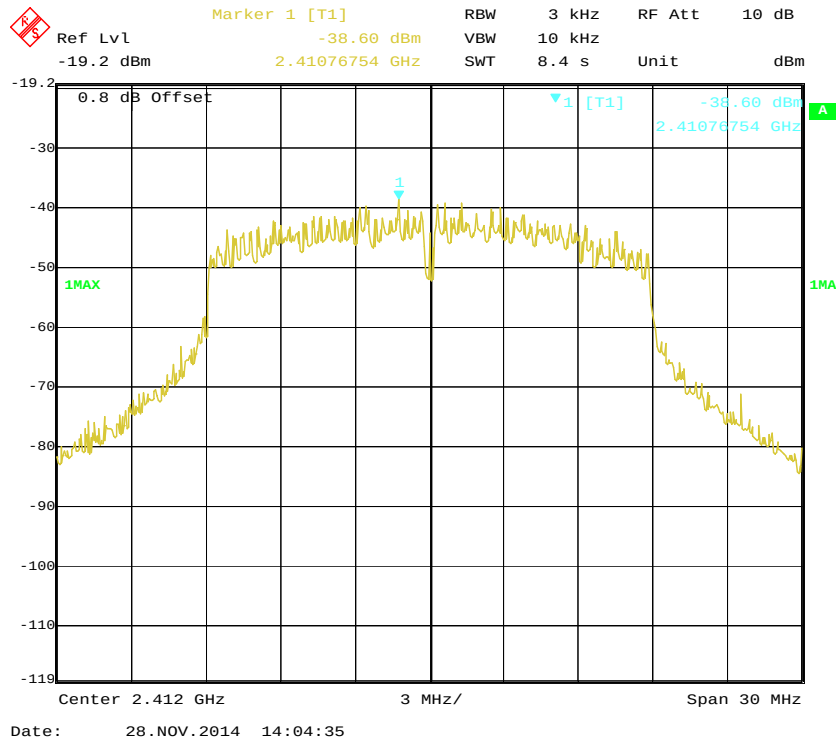
Power Spectral Density, 802.11g Middle Channel



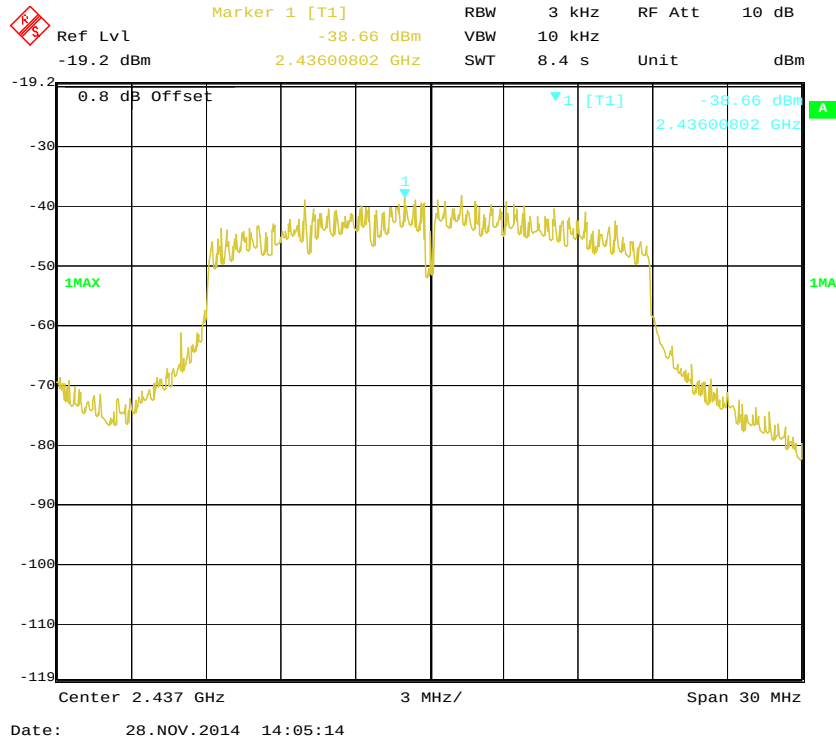
Power Spectral Density, 802.11g High Channel



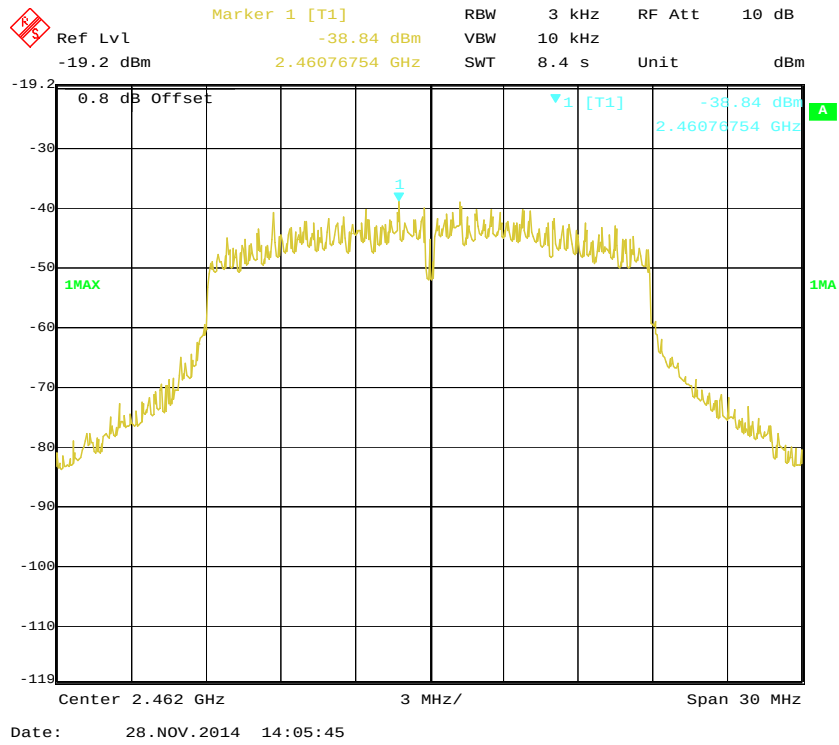
Power Spectral Density, 802.11n-HT20 Low Channel



Power Spectral Density, 802.11n-HT20 Middle Channel



Power Spectral Density, 802.11n-HT20 High Channel



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