FCC PART 15.247

TEST REPORT

For

ABOVE ALL LIGHTING INC.

1501 Industrial Way N.Toms River,NJ 08755

FCC ID: 2AK5A-CR24GW

Report Type:	**Product Type:**
Original Report	WiFi LED Controller

Test Engineer:	Chris Wang
Report Number:	RKS170103005-00B
Report Date:	2017-03-13
Reviewed By:	Oscar Ye RF Leader
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road,Kunshan,Jiangsu province,China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Manufacturer	ABOVE ALL LIGHTING INC.
Tested Model	CR24GW
Product Type	WiFi LED Controller
Dimension	61.3 mm(L)×61.3 mm(W)×19.9 mm(H)
Power Supply	DC5.0V From Adapter

Adapter information:
Model: MX520U
Input: 100-240 V 50-60Hz 0.35A
Output: 5.0V, 2.0A

**All measurement and test data in this report was gathered from production sample serial number: 20170104001. (Assigned by BACL, Kunshan). The EUT was received on 2017-01-04.*

Objective

This report is prepared on behalf of ABOVE ALL LIGHTING INC. 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)

FCC Part15.249 DXX submissions with FCC ID: 2AK5A-CR24GW.

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 FCC KDB558074 D01 DTS Meas Guidance v03r05.

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

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19dB
RF conducted test with spectrum		0.9dB
RF Output Power with Power meter		0.5dB
Radiated emission	30MHz~1GHz	6.11dB
	1GHz~6GHz	4.45dB
	6GHz~18GHz	5.23dB
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
Humidity		6%

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road,Kunshan,Jiangsu province,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 C63.4-2014.

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	/	/

EUT was tested with Channel 1, 6 and 11.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

SecureCRT

The worst case was performed under:

802.11b: Data rate:1 Mbps, Power level: 20
802.11g: Data rate: 6 Mbps, Power level: 19
802.11n-HT20: Data rate: MCS0, Power level: 19

Support Equipment List and Details

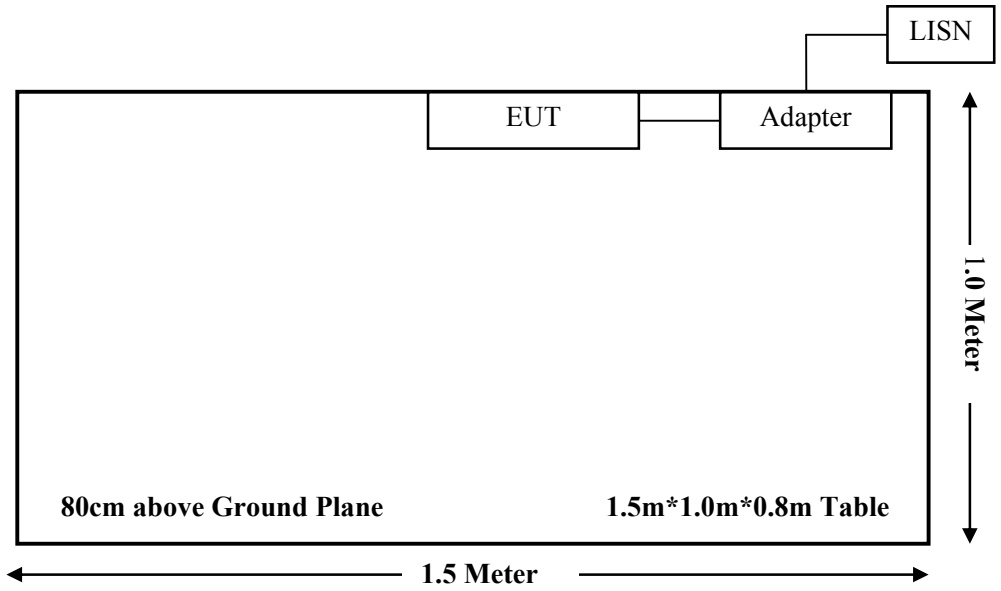
Manufacturer	Description	Model	Serial Number
ABOVE ALL	Adapter	MX520U	/

External I/O Cable

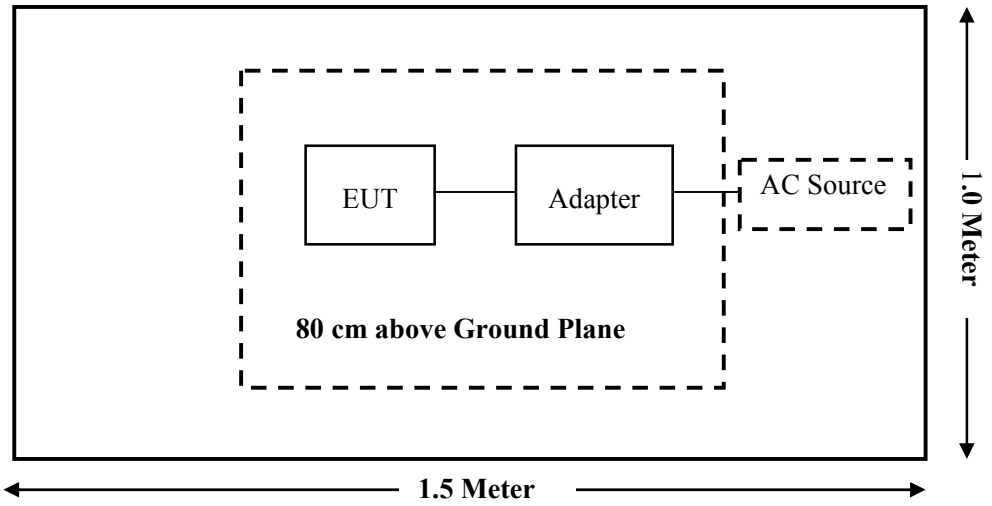
Cable Description	Length (m)	From Port	To
USB Cable	0.8	EUT	Adapter

Block Diagram of Test Setup

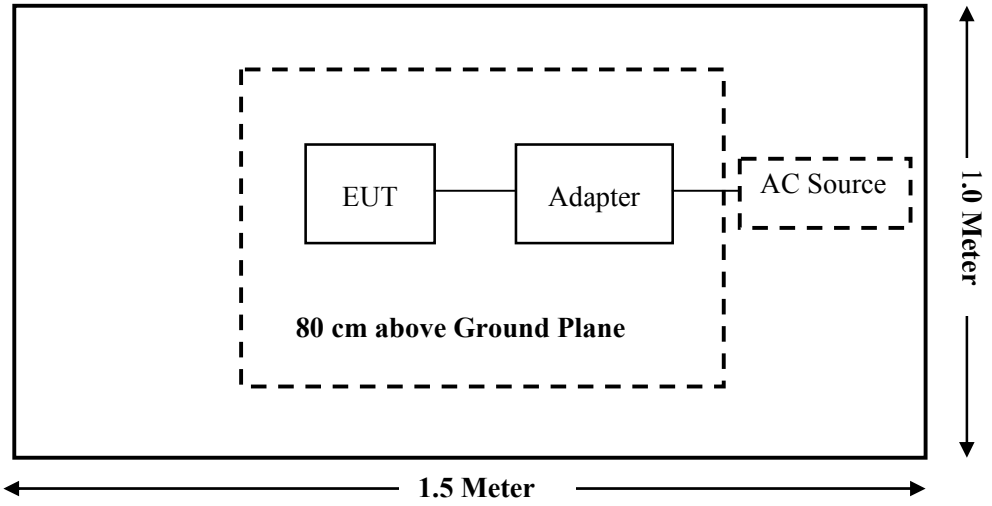
For Conducted Emissions:



For Radiated Emissions (Below 1GHz):



For Radiated Emissions (Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1307 (b) (1)& §2.1091	MAXIMUM PERMISSIBLE EXPOSURE (MPE)	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

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2016-11-25	2017-11-24
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2016-11-25	2017-11-24
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
ETS-LINDGREN	Horn Antenna	3115	6229	2016-01-11	2019-01-10
Sonoma Instrunent	Amplifier	330	171377	2016-12-12	2017-12-11
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-12-12	2017-12-11
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
Haojintech	Coaxial Cable	Cable-1	001	2016-12-12	2017-12-11
Haojintech	Coaxial Cable	Cable-2	002	2016-12-12	2017-12-11
Haojintech	Coaxial Cable	Cable-3	003	2016-12-12	2017-12-11
MICRO-COAX	Coaxial Cable	Cable-4	004	2016-12-12	2017-12-11
MICRO-COAX	Coaxial Cable	Cable-5	005	2016-12-12	2017-12-11
RF Conducted Test					
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2016-09-21	2017-09-20
ABOVE ALL	RF Cable	N/A	N/A	2017-02-18	2018-02-17
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCS30	834115/007	2016-11-25	2017-11-24
Rohde & Schwarz	LISN	ESH3-Z5	862770/011	2016-10-10	2017-10-09
Rohde & Schwarz	LISN	ENV216	3560655016	2016-11-25	2017-11-24
Rohde & Schwarz	CE Test software	EMC 32	100357	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2016-09-08	2017-09-07

*** 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).

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/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm).

Calculated Data:

Mode	Frequency Range	Antenna Gain		Output Power		Evaluation Distance	Power Density	MPE Limit
	(MHz)	(dBi)	(numeric)	(dBm)	(mW)	(cm)	(mW/cm^2)	(mW/cm^2)
802.11b	2412-2462	3.0	2.00	20.00	100.00	20	0.0398	1.0
802.11g	2412-2462	3.0	2.00	19.00	79.43	20	0.0316	1.0
802.11n HT20	2412-2462	3.0	2.00	19.00	79.43	20	0.0316	1.0

Note: The target output power:
802.11b： 19±1 dBm, which declared by the Manufacturer.
802.11g： 18±1dBm, which declared by the Manufacturer.
802.11n HT20： 18±1dBm, which declared by the Manufacturer.

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 a PCB antenna arrangement for wifi, which the antenna gain is 3.0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

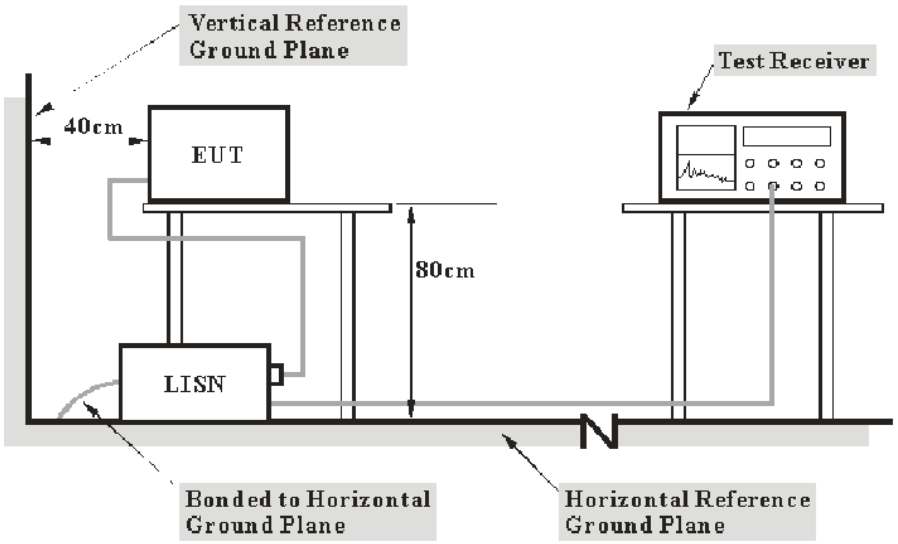
Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

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.

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.

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:

Correction Factor = LISN VDF + 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:

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

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

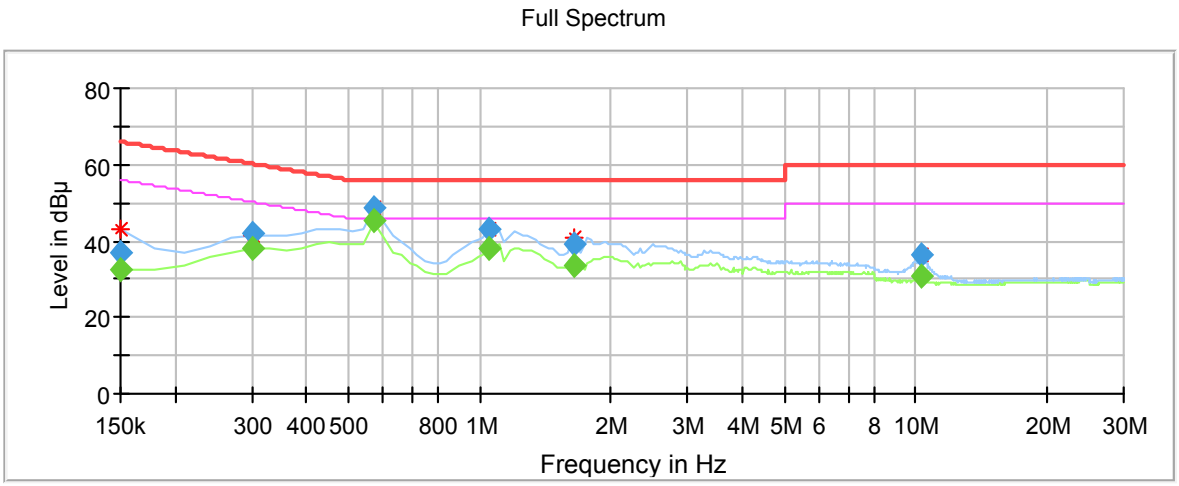
Environmental Conditions

Temperature:	23 ℃
Relative Humidity:	55 %
ATM Pressure:	101.1kPa

The testing was performed by Chris Wang on 2017-03-10.

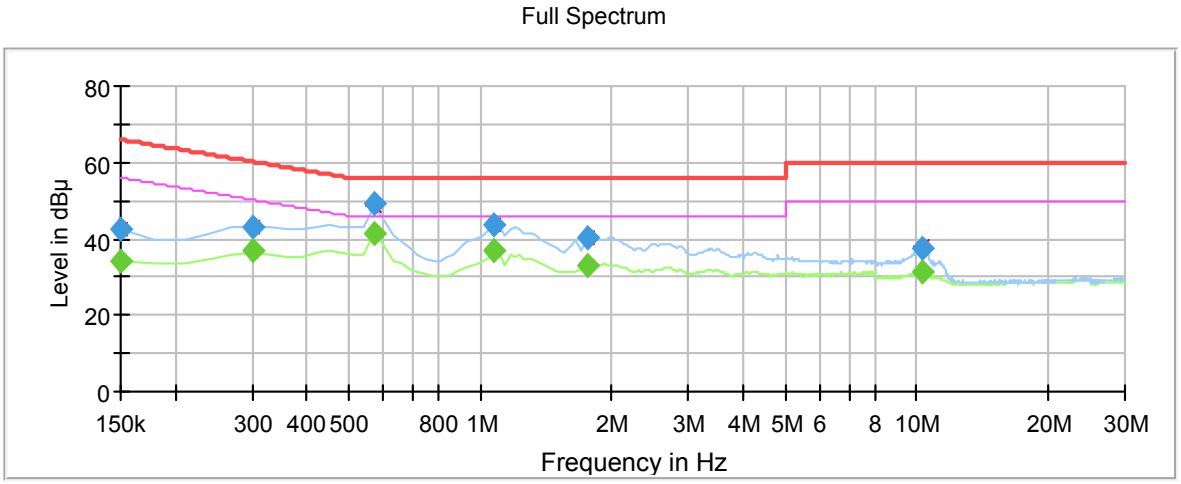
EUT operation mode: Transmitting in low channel of 802.11b mode(Worst case)

AC 120V/60 Hz, Line



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.150000	---	32.46	9.000	L1	10.1	23.54	56.00	Compliance
0.150000	36.89	---	9.000	L1	10.1	29.11	66.00	Compliance
0.300000	---	38.31	9.000	L1	10.0	11.93	50.24	Compliance
0.300000	41.87	---	9.000	L1	10.0	18.37	60.24	Compliance
0.570000	---	45.10	9.000	L1	10.0	0.90	46.00	Compliance
0.570000	48.68	---	9.000	L1	10.0	7.32	56.00	Compliance
1.050000	---	38.13	9.000	L1	9.8	7.87	46.00	Compliance
1.050000	42.97	---	9.000	L1	9.8	13.03	56.00	Compliance
1.650000	---	33.44	9.000	L1	9.8	12.56	46.00	Compliance
1.650000	39.30	---	9.000	L1	9.8	16.70	56.00	Compliance
10.350000	---	30.86	9.000	L1	10.1	19.14	50.00	Compliance
10.350000	36.13	---	9.000	L1	10.1	23.87	60.00	Compliance

AC 120V/60 Hz, Neutral



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.150000	---	34.32	9.000	N	10.1	21.68	56.00	Compliance
0.150000	42.43	---	9.000	N	10.1	23.57	66.00	Compliance
0.300000	---	36.71	9.000	N	10.1	13.53	50.24	Compliance
0.300000	43.23	---	9.000	N	10.1	17.01	60.24	Compliance
0.570000	---	41.20	9.000	N	10.1	4.80	46.00	Compliance
0.570000	49.02	---	9.000	N	10.1	6.98	56.00	Compliance
1.080000	---	36.98	9.000	N	9.9	9.02	46.00	Compliance
1.080000	43.41	---	9.000	N	9.9	12.59	56.00	Compliance
1.770000	---	33.19	9.000	N	9.9	12.81	46.00	Compliance
1.770000	40.48	---	9.000	N	9.9	15.52	56.00	Compliance
10.260000	---	31.49	9.000	N	10.0	18.51	50.00	Compliance
10.260000	37.37	---	9.000	N	10.0	22.63	60.00	Compliance

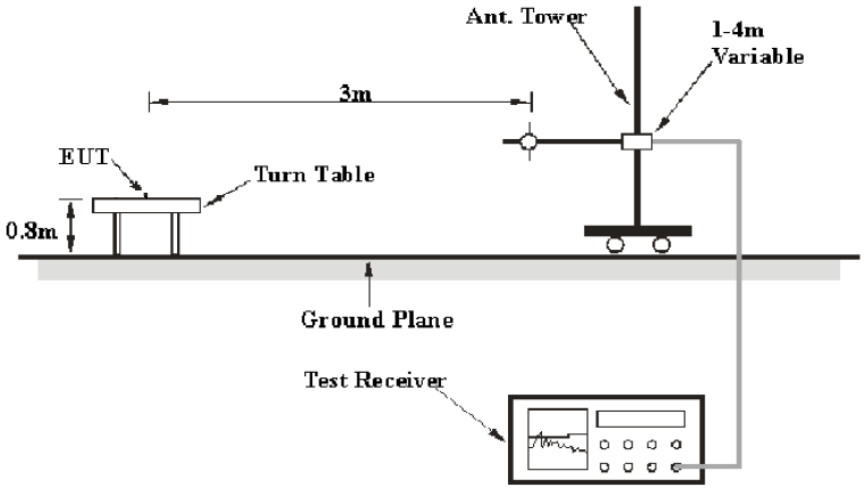
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

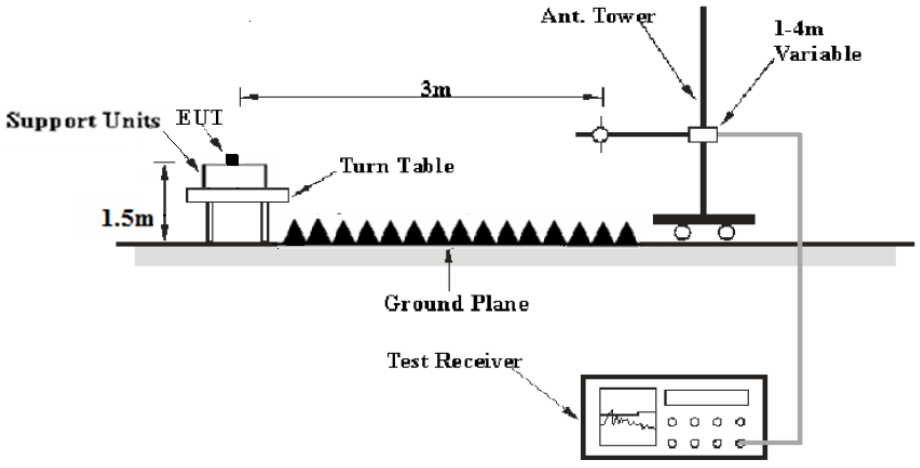
FCC §15.247 (d); §15.209; §15.205;

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 C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

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	120 kHz	300 kHz	120 kHz	QP

Frequency Range	RBW	Video B/W	Duty cycle	Detector
1GHz – 25GHz	1MHz	3 MHz	Any	PK
	1MHz	10 Hz	>98%	Ave.
	1MHz	1/T	<98%	

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 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.

Test Data

Environmental Conditions

Temperature:	24.1 ℃
Relative Humidity:	54 %
ATM Pressure:	101.2kPa

The testing was performed by Chris Wang on 2017-03-13.

EUT operation mode: Transmitting (Scan with X-Axis, Y-Axis and Z-Axis position, the worst case was recorded)

30MHz-25GHz

802.11b Mode:

Frequency	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/205/209	
	Reading	Detector		Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
Low Channel (2412 MHz)									
30.73	20.99	QP	328	101	V	0.30	21.29	40.00	18.71
138.64	22.26	QP	99	58	V	-5.80	16.46	43.50	27.04
2412.00	111.46	PK	72	119	V	-6.17	105.29	/	/
2412.00	108.35	Ave	72	119	V	-6.17	102.18	/	/
2412.00	111.08	PK	151	107	H	-6.17	104.91	/	/
2412.00	107.56	Ave	151	107	H	-6.17	101.39	/	/
2390.00	42.78	PK	86	187	V	-6.22	36.56	74.00	37.44
2390.00	30.90	Ave	86	187	V	-6.22	24.68	54.00	29.32
2400.00	54.43	PK	177	220	V	-6.19	48.24	74.00	25.76
2400.00	44.59	Ave	177	220	V	-6.19	38.40	54.00	15.60
4824.00	61.61	PK	325	218	V	1.66	63.27	74.00	10.73
4824.00	48.43	Ave	325	218	V	1.66	50.09	54.00	3.91
6653.31	42.01	PK	207	170	H	6.35	48.36	74.00	25.64
6653.31	29.73	Ave	207	170	H	6.35	36.08	54.00	17.92
7236.00	60.84	PK	299	108	H	7.58	68.42	74.00	5.58
7236.00	43.05	Ave	299	108	H	7.58	50.63	54.00	3.37
Middle Channel (2437 MHz)									
30.73	20.38	QP	168	136	V	0.30	20.68	40.00	19.32
138.64	22.32	QP	32	152	V	-5.80	16.52	43.50	26.98
2437.00	111.63	PK	151	116	V	-6.11	105.52	/	/
2437.00	108.18	Ave	151	116	V	-6.11	102.07	/	/
2437.00	110.04	PK	38	107	H	-6.11	103.93	/	/
2437.00	107.64	Ave	38	107	H	-6.11	101.53	/	/
3314.63	48.30	PK	353	221	H	-0.71	47.59	74.00	26.41
3314.63	35.01	Ave	353	221	H	-0.71	34.30	54.00	19.70
4647.29	48.95	PK	114	177	V	1.26	50.21	74.00	23.79
4647.29	31.26	Ave	114	177	V	1.26	32.52	54.00	21.48
4874.00	61.39	PK	131	249	V	1.77	63.16	74.00	10.84
4874.00	48.12	Ave	131	249	V	1.77	49.89	54.00	4.11
5993.99	48.48	PK	269	236	H	4.05	52.53	74.00	21.47
5993.99	33.51	Ave	269	236	H	4.05	37.56	54.00	16.44
7311.00	61.26	PK	169	234	H	7.66	68.92	74.00	5.08
7311.00	43.20	Ave	169	234	H	7.66	50.86	54.00	3.14

Frequency	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/205/209	
	Reading	Detector		Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
High Channel (2462 MHz)									
30.73	21.02	QP	306	135	V	0.30	21.32	40.00	18.68
138.64	23.61	QP	58	192	V	-5.80	17.81	43.50	25.69
2462.00	111.60	PK	251	157	V	-6.06	105.54	/	/
2462.00	108.19	Ave	251	157	V	-6.06	102.13	/	/
2462.00	109.63	PK	207	213	H	-6.06	103.57	/	/
2462.00	107.21	Ave	207	213	H	-6.06	101.15	/	/
2483.50	42.51	PK	160	249	V	-6.01	36.50	74.00	37.50
2483.50	30.99	Ave	160	249	V	-6.01	24.98	54.00	29.02
3973.95	44.90	PK	275	158	H	-0.39	44.51	74.00	29.49
3973.95	31.61	Ave	275	158	H	-0.39	31.22	54.00	22.78
4924.00	58.18	PK	308	102	V	1.89	60.07	74.00	13.93
4924.00	47.93	Ave	308	102	V	1.89	49.82	54.00	4.18
5993.99	48.77	PK	192	187	H	4.05	52.82	74.00	21.18
5993.99	33.85	Ave	192	187	H	4.05	37.90	54.00	16.10
7386.00	60.03	PK	277	117	H	7.73	67.76	74.00	6.24
7386.00	43.74	Ave	277	117	H	7.73	51.47	54.00	2.53

802.11g Mode:

Frequency	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/205/209	
	Reading	Detector		Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
Low Channel (2412 MHz)									
30.73	20.14	QP	341	128	V	0.30	20.44	40.00	19.56
138.64	22.95	QP	19	199	V	-5.80	17.15	43.50	26.35
2412.00	108.61	PK	167	112	V	-6.17	102.44	/	/
2412.00	100.56	Ave	167	112	V	-6.17	94.39	/	/
2412.00	108.06	PK	10	190	H	-6.17	101.89	/	/
2412.00	99.98	Ave	10	190	H	-6.17	93.81	/	/
2390.00	42.82	PK	345	160	V	-6.22	36.60	74.00	37.40
2390.00	30.78	Ave	345	160	V	-6.22	24.56	54.00	29.44
2400.00	54.53	PK	342	240	V	-6.19	48.34	74.00	25.66
2400.00	44.53	Ave	342	240	V	-6.19	38.34	54.00	15.66
4824.00	61.06	PK	165	213	V	1.66	62.72	74.00	11.28
4824.00	48.30	Ave	165	213	V	1.66	49.96	54.00	4.04
6653.31	42.13	PK	335	121	V	6.35	48.48	74.00	25.52
6653.31	29.64	Ave	335	121	V	6.35	35.99	54.00	18.01
7236.00	59.97	PK	332	164	H	7.58	67.55	74.00	6.45
7236.00	43.00	Ave	332	164	H	7.58	50.58	54.00	3.42
Middle Channel (2437 MHz)									
30.73	20.13	QP	328	189	V	0.30	20.43	40.00	19.57
138.64	23.34	QP	99	169	V	-5.80	17.54	43.50	25.96
2437.00	108.57	PK	333	111	V	-6.11	102.46	/	/
2437.00	100.21	Ave	333	111	V	-6.11	94.10	/	/
2437.00	108.68	PK	193	223	H	-6.11	102.57	/	/
2437.00	99.52	Ave	193	223	H	-6.11	93.41	/	/
3314.63	48.32	PK	289	213	V	-0.71	47.61	74.00	26.39
3314.63	34.89	Ave	289	213	V	-0.71	34.18	54.00	19.82
4647.29	48.13	PK	279	127	V	1.26	49.39	74.00	24.61
4647.29	31.53	Ave	279	127	V	1.26	32.79	54.00	21.21
4874.00	61.25	PK	241	226	V	1.77	63.02	74.00	10.98
4874.00	48.24	Ave	241	226	V	1.77	50.01	54.00	3.99
5993.99	48.56	PK	201	134	V	4.05	52.61	74.00	21.39
5993.99	33.51	Ave	201	134	V	4.05	37.56	54.00	16.44
7311.00	59.86	PK	145	249	H	7.66	67.52	74.00	6.48
7311.00	42.61	Ave	145	249	H	7.66	50.27	54.00	3.73

Frequency	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/205/209	
	Reading	Detector		Height	Polar			Limit	Margin
(MHz)	(dBµV)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dBµV/m)	(dB µ V/m)	(dB)
High Channel (2462 MHz)									
30.73	21.39	QP	268	105	V	0.30	21.69	40.00	18.31
138.64	22.45	QP	52	206	V	-5.80	16.65	43.50	26.85
2462.00	108.59	PK	130	145	V	-6.06	102.53	/	/
2462.00	100.14	Ave	130	145	V	-6.06	94.08	/	/
2462.00	107.87	PK	261	111	H	-6.06	101.81	/	/
2462.00	99.64	Ave	261	111	H	-6.06	93.58	/	/
2483.50	42.61	PK	113	155	V	-6.01	36.60	74.00	37.40
2483.50	30.88	Ave	113	155	V	-6.01	24.87	54.00	29.13
3973.95	44.56	PK	284	155	V	-0.39	44.17	74.00	29.83
3973.95	31.65	Ave	284	155	V	-0.39	31.26	54.00	22.74
4924.00	58.08	PK	177	141	V	1.89	59.97	74.00	14.03
4924.00	47.14	Ave	177	141	V	1.89	49.03	54.00	4.97
5993.99	48.20	PK	356	214	V	4.05	52.25	74.00	21.75
5993.99	33.84	Ave	356	214	V	4.05	37.89	54.00	16.11
7386.00	59.95	PK	42	144	H	7.73	67.68	74.00	6.32
7386.00	42.75	Ave	42	144	H	7.73	50.48	54.00	3.52

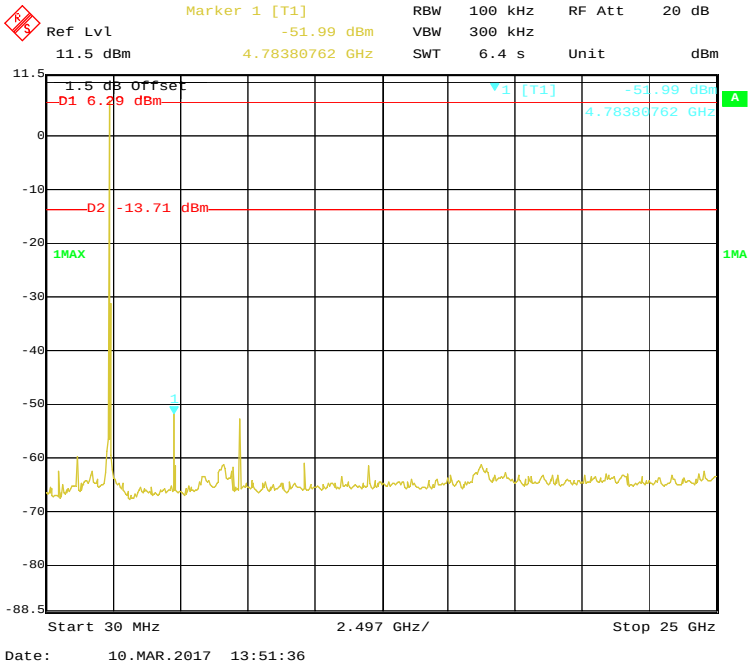
802.11n-HT20 Mode:

Frequency	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/205/209	
	Reading	Detector		Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
Low Channel (2412 MHz)									
30.73	21.01	QP	258	185	V	0.30	21.31	40.00	18.69
138.64	23.37	QP	65	169	V	-5.80	17.57	43.50	25.93
2412.00	108.92	PK	334	102	V	-6.17	102.75	/	/
2412.00	100.79	Ave	334	102	V	-6.17	94.62	/	/
2412.00	109.65	PK	209	141	H	-6.17	103.48	/	/
2412.00	100.89	Ave	209	141	H	-6.17	94.72	/	/
2390.00	42.90	PK	270	158	V	-6.22	36.68	74.00	37.32
2390.00	31.21	Ave	270	158	V	-6.22	24.99	54.00	29.01
2400.00	54.46	PK	122	204	V	-6.19	48.27	74.00	25.73
2400.00	44.55	Ave	122	204	V	-6.19	38.36	54.00	15.64
4824.00	61.52	PK	69	184	V	1.66	63.18	74.00	10.82
4824.00	48.26	Ave	69	184	V	1.66	49.92	54.00	4.08
6653.31	42.14	PK	291	228	H	6.35	48.49	74.00	25.51
6653.31	29.65	Ave	291	228	H	6.35	36.00	54.00	18.00
7236.00	60.10	PK	318	141	H	7.58	67.68	74.00	6.32
7236.00	43.09	Ave	318	141	H	7.58	50.67	54.00	3.33
Middle Channel (2437 MHz)									
30.73	20.12	QP	296	132	V	0.30	20.42	40.00	19.58
138.64	23.09	QP	168	207	V	-5.80	17.29	43.50	26.21
2437.00	108.84	PK	151	191	V	-6.11	102.73	/	/
2437.00	100.68	Ave	151	191	V	-6.11	94.57	/	/
2437.00	109.62	PK	121	123	H	-6.11	103.51	/	/
2437.00	100.96	Ave	121	123	H	-6.11	94.85	/	/
3314.63	48.23	PK	302	194	V	-0.71	47.52	74.00	26.48
3314.63	34.54	Ave	302	194	V	-0.71	33.83	54.00	20.17
4647.29	48.58	PK	356	166	V	1.26	49.84	74.00	24.16
4647.29	31.92	Ave	356	166	V	1.26	33.18	54.00	20.82
4874.00	61.65	PK	79	235	V	1.77	63.42	74.00	10.58
4874.00	48.64	Ave	79	235	V	1.77	50.41	54.00	3.59
5993.99	48.55	PK	275	168	H	4.05	52.60	74.00	21.40
5993.99	33.62	Ave	275	168	V	4.05	37.67	54.00	16.33
7311.00	60.05	PK	107	158	H	7.66	67.71	74.00	6.29
7311.00	43.15	Ave	107	158	H	7.66	50.81	54.00	3.19

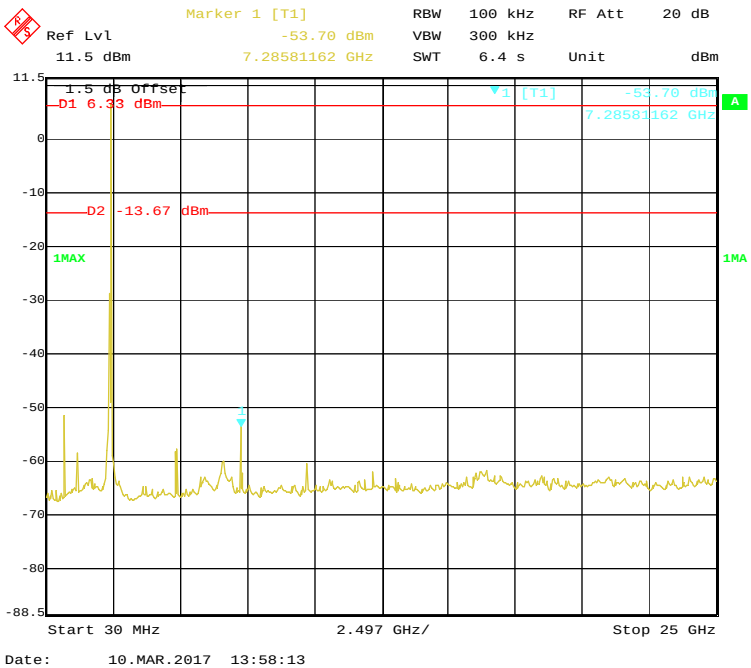
Frequency	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/205/209	
	Reading	Detector		Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
High Channel (2462 MHz)									
30.73	20.58	QP	257	167	V	0.30	20.88	40.00	19.12
138.64	22.71	QP	152	132	V	-5.80	16.91	43.50	26.59
2462.00	108.90	PK	255	175	V	-6.06	102.84	/	/
2462.00	100.64	Ave	255	175	V	-6.06	94.58	/	/
2462.00	109.63	PK	158	108	H	-6.06	103.57	/	/
2462.00	100.94	Ave	158	108	H	-6.06	94.88	/	/
2483.50	42.32	PK	333	115	V	-6.01	36.31	74.00	37.69
2483.50	30.79	Ave	333	115	V	-6.01	24.78	54.00	29.22
3973.95	44.63	PK	348	176	V	-0.39	44.24	74.00	29.76
3973.95	31.61	Ave	348	176	V	-0.39	31.22	54.00	22.78
4924.00	58.05	PK	248	140	V	1.89	59.94	74.00	14.06
4924.00	48.56	Ave	248	140	V	1.89	50.45	54.00	3.55
5993.99	48.23	PK	146	183	H	4.05	52.28	74.00	21.72
5993.99	33.14	Ave	146	183	H	4.05	37.19	54.00	16.81
7386.00	59.99	PK	268	205	H	7.73	67.72	74.00	6.28
7386.00	43.11	Ave	268	205	H	7.73	50.84	54.00	3.16

Conducted Spurious Emissions at Antenna Port

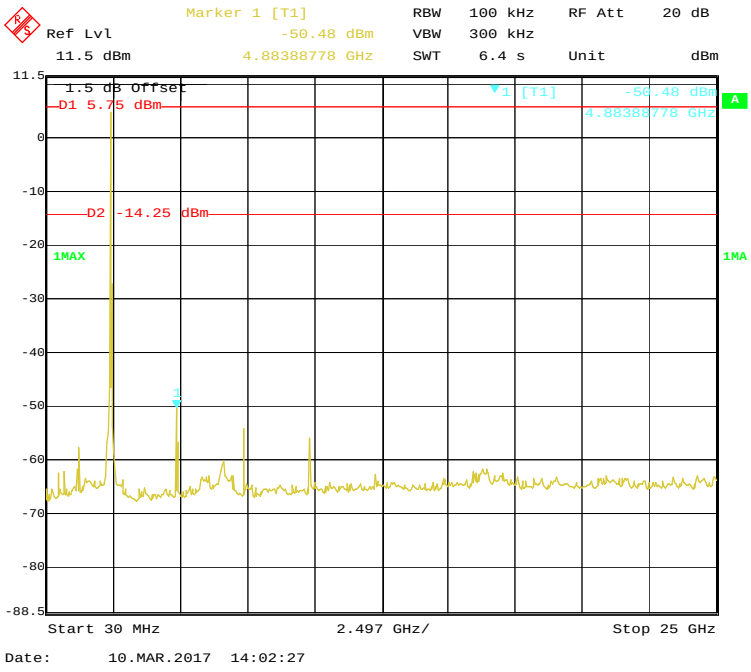
802.11b Low Channel



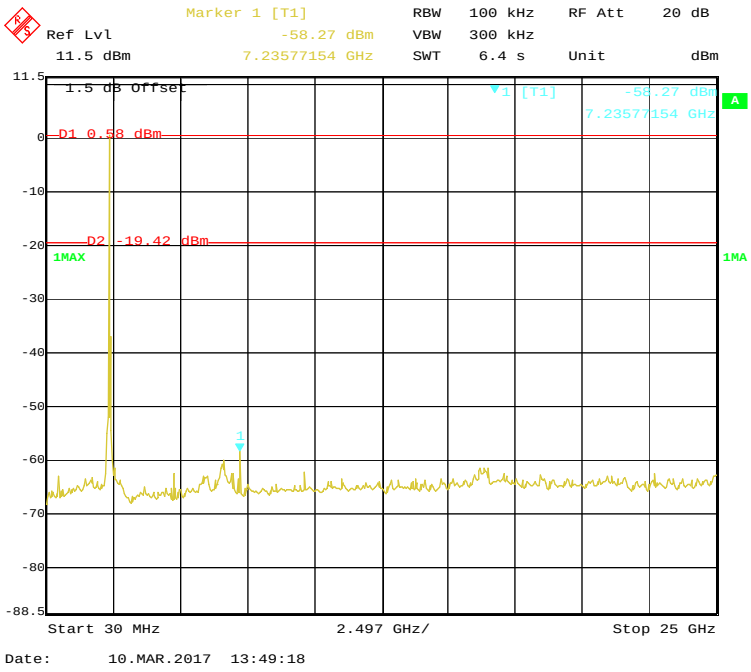
802.11b Middle Channel



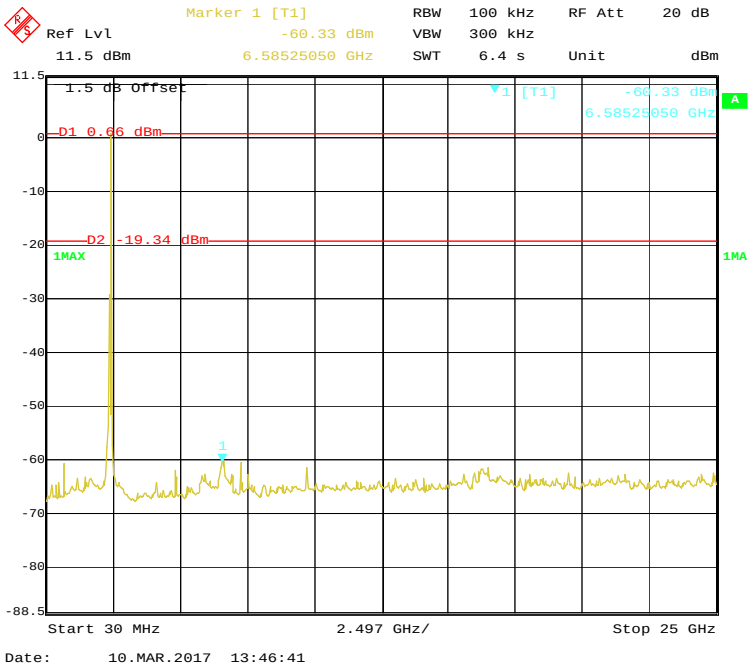
802.11b High Channel



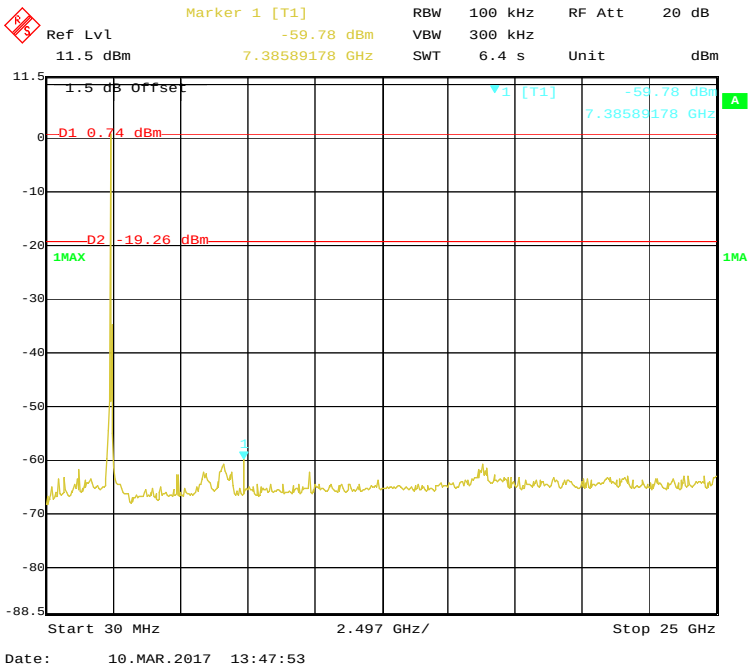
802.11g Low Channel



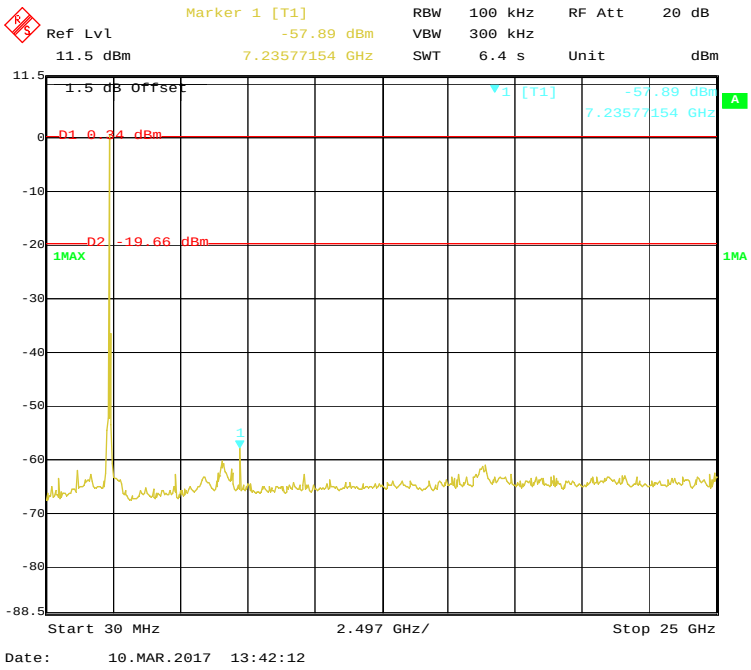
802.11g Middle Channel



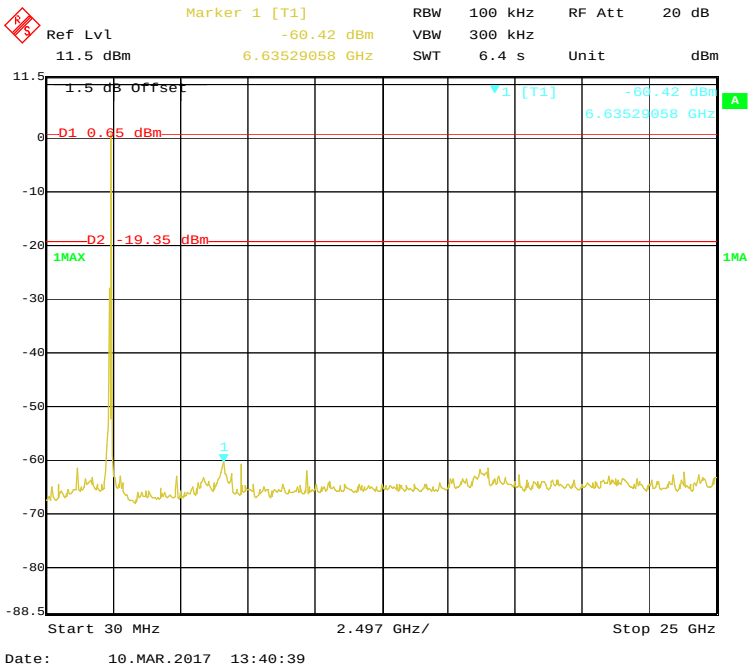
802.11g High Channel



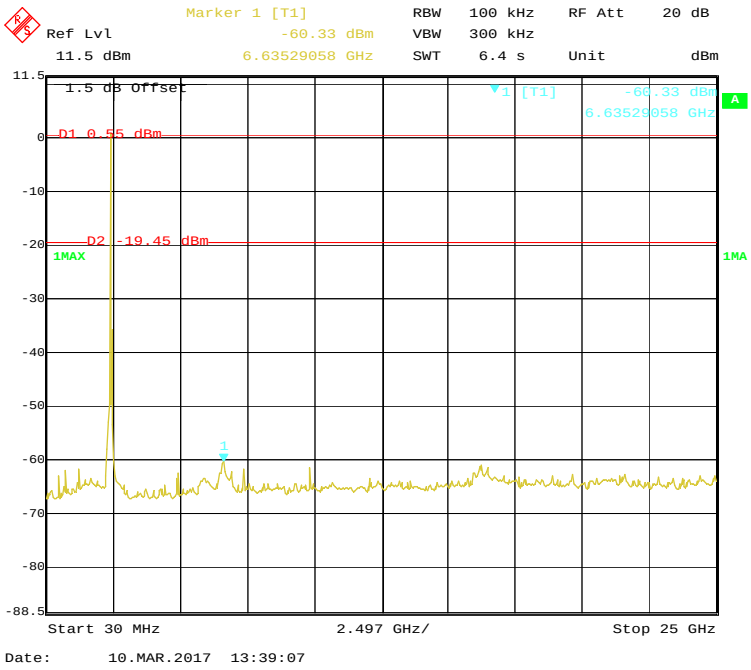
802.11n-HT20 Low Channel



802.11n-HT20 Middle Channel



802.11n-HT20 High Channel



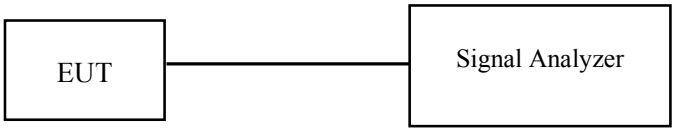
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

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 Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Chris Wang on 2017-03-10.

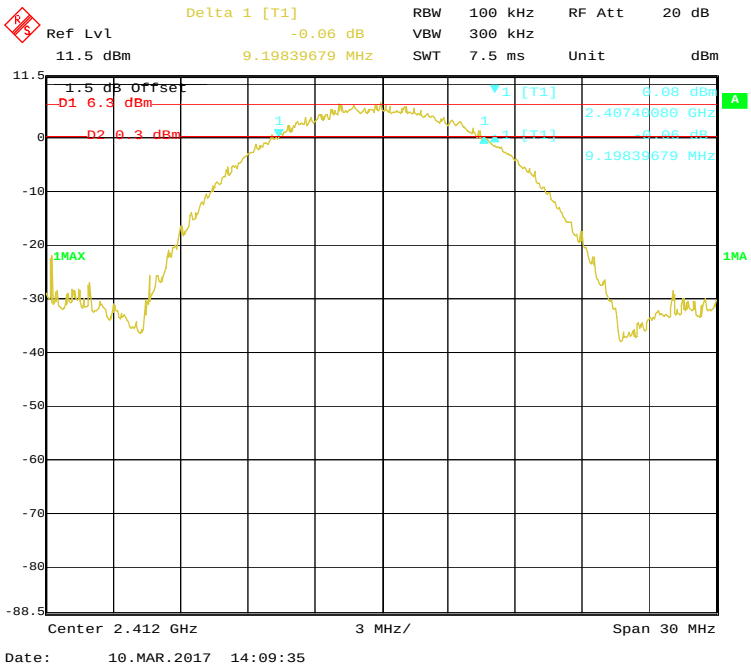
Test Result: Pass.

Please refer to the following tables and plots.

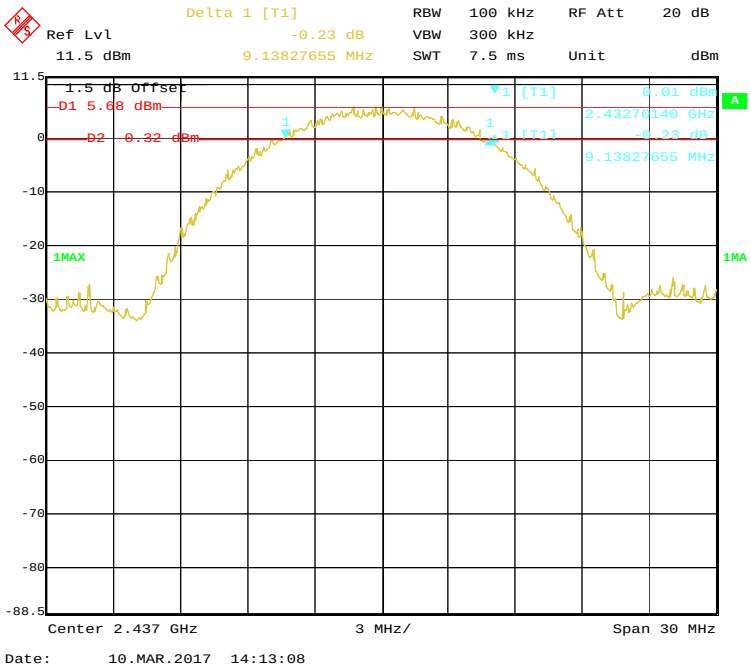
EUT operation mode: Transmitting

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (MHz)
802.11b mode			
Low	2412	9.20	≥0.5
Middle	2437	9.14	≥0.5
High	2462	9.26	≥0.5
802.11g mode			
Low	2412	15.27	≥0.5
Middle	2437	15.21	≥0.5
High	2462	15.21	≥0.5
802.11n-HT20 mode			
Low	2412	15.21	≥0.5
Middle	2437	15.21	≥0.5
High	2462	15.21	≥0.5

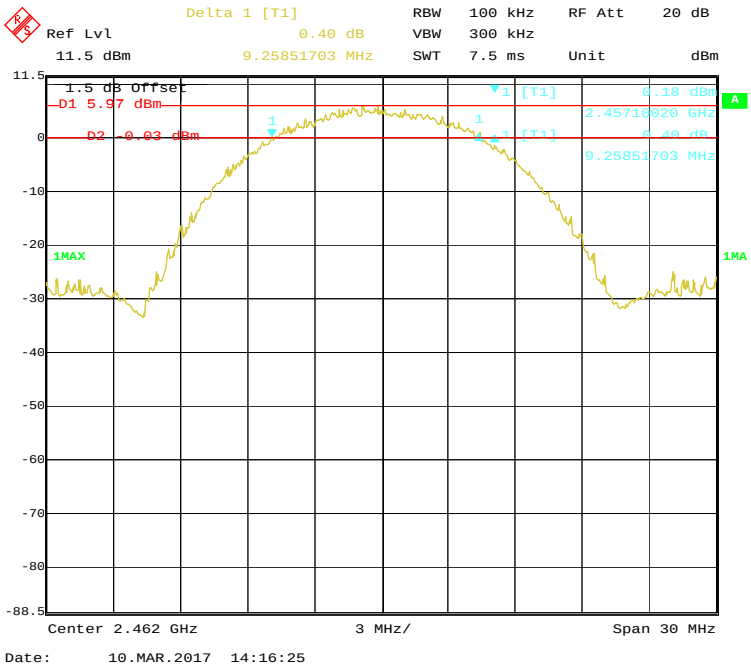
802.11b Low Channel



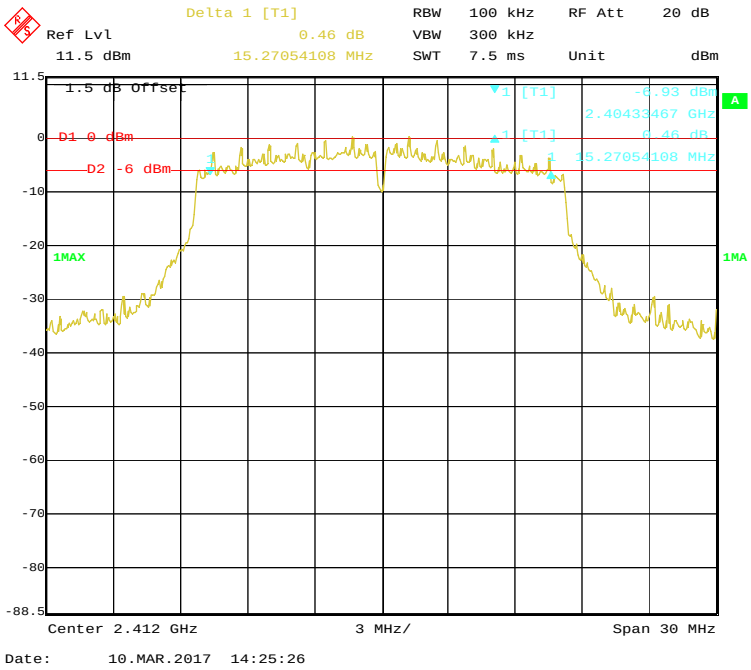
802.11b Middle Channel



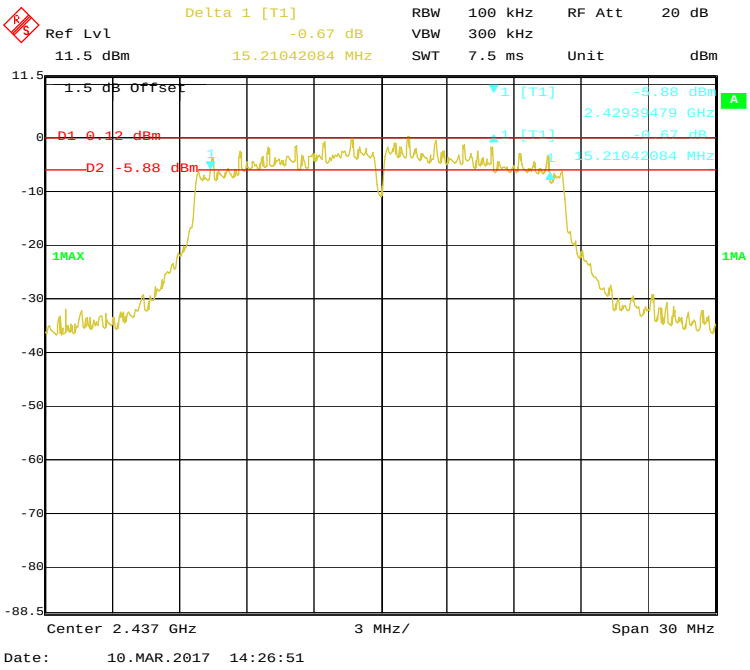
802.11b High Channel



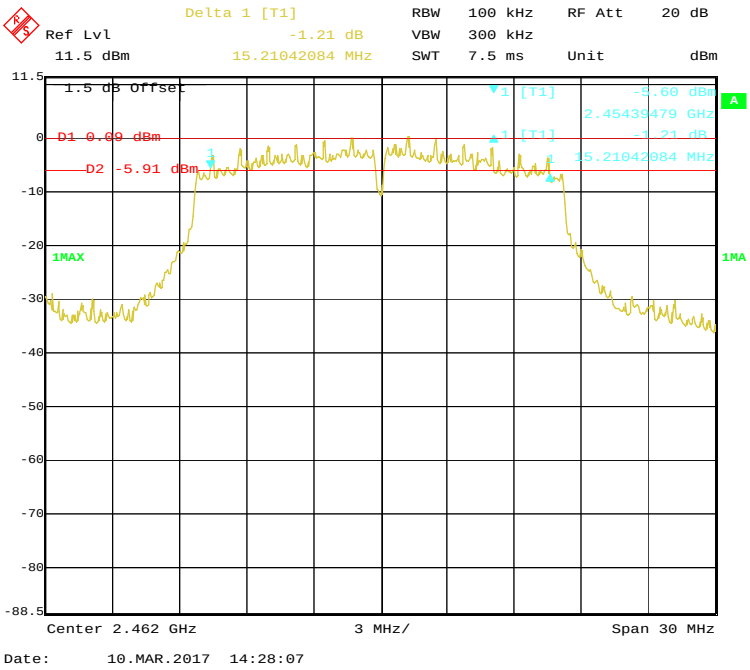
802.11g Low Channel



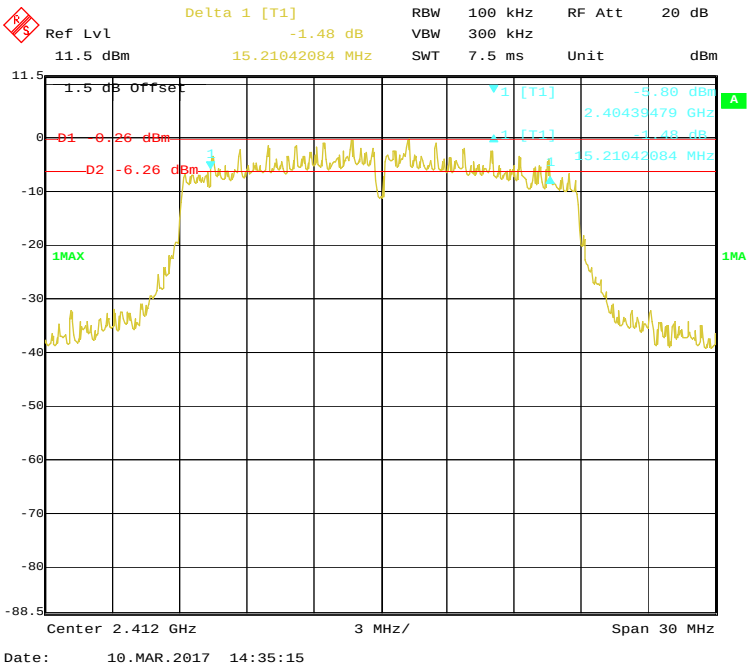
802.11g Middle Channel



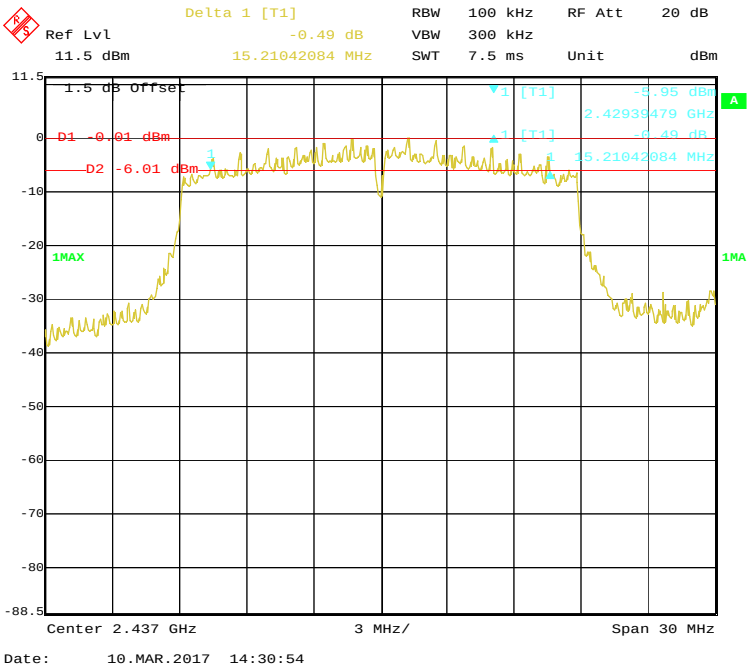
802.11g High Channel



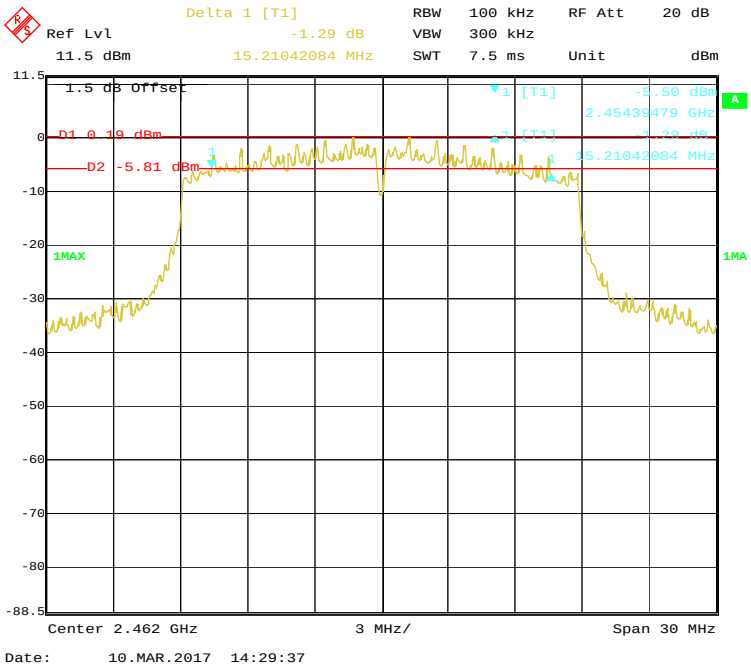
802.11n-HT20 Low Channel



802.11n-HT20 Middle Channel



802.11n-HT20 High Channel



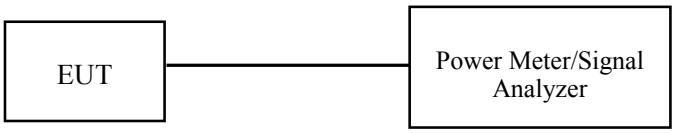
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

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 Data

Environmental Conditions

Temperature:	23.8℃
Relative Humidity:	54 %
ATM Pressure:	101.2 kPa

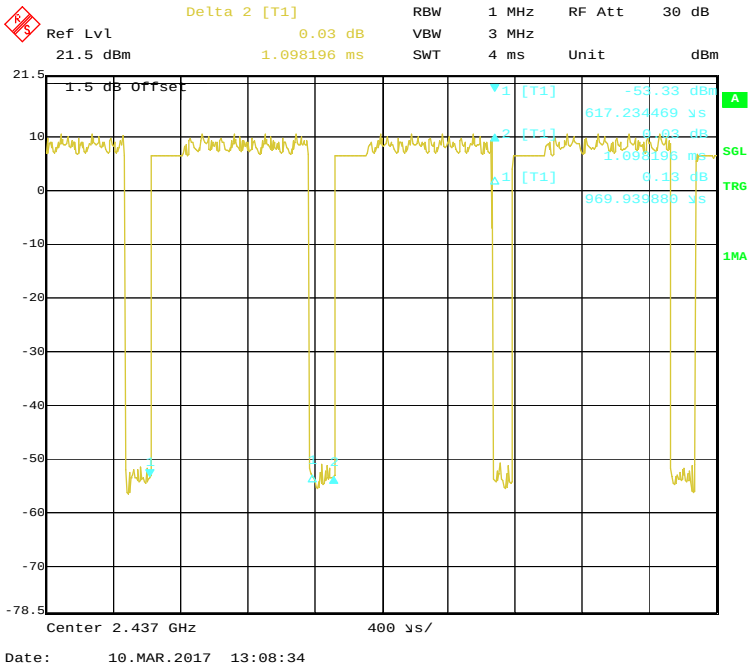
The testing was performed by Chris Wang on2017-03-10.

EUT operation mode: Transmitting

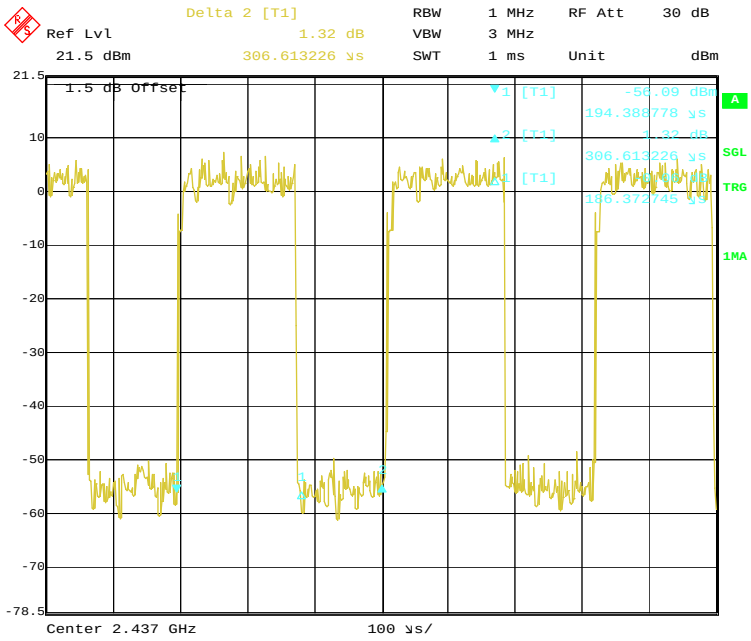
Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Conducted Average Output Power Reading (dBm)	Corrected Factor 10log(1/x) (dB)	Conducted Average Output Power (dBm)	Limit (dBm)	Result
802.11b							
Low	2412	19.66	14.44	0.54	14.98	30	Pass
Middle	2437	19.26	13.99	0.54	14.53	30	Pass
High	2462	19.40	14.32	0.54	14.86	30	Pass
802.11g							
Low	2412	18.31	11.41	2.18	13.59	30	Pass
Middle	2437	18.12	10.92	2.18	13.10	30	Pass
High	2462	18.39	11.05	2.18	13.23	30	Pass
802.11n-HT20							
Low	2412	18.44	11.57	2.05	13.62	30	Pass
Middle	2437	17.99	10.96	2.05	13.01	30	Pass
High	2462	17.77	10.95	2.05	13.00	30	Pass

Note: x is the duty cycle. For 802.11b: x=0.883, 802.11g: x=0.606, 802.11n20: x=0.624
Conducted Average Output Power= Reading+ Corrected Factor
The reading value is reading from the test software.

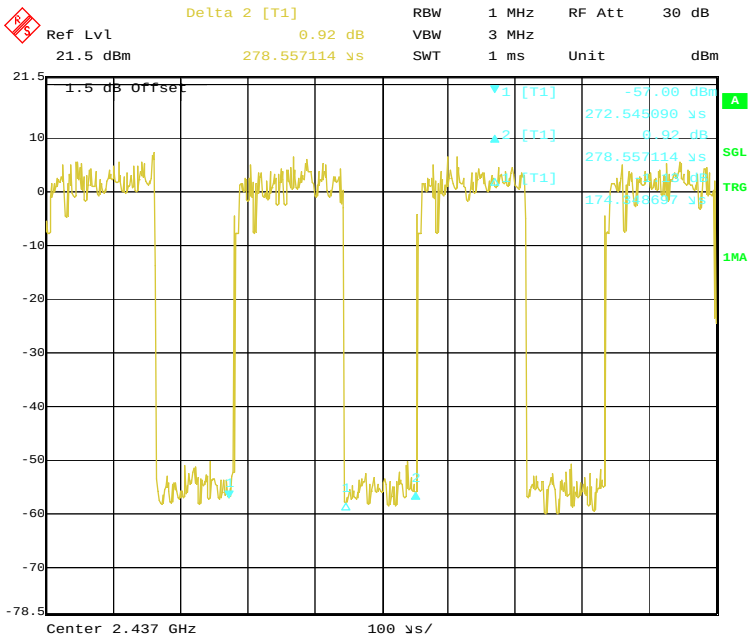
802.11b Mode Middle Channel duty cycle



802.11g Mode Middle Channel duty cycle



802.11n20 Mode Middle Channel duty cycle



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 Data

Environmental Conditions

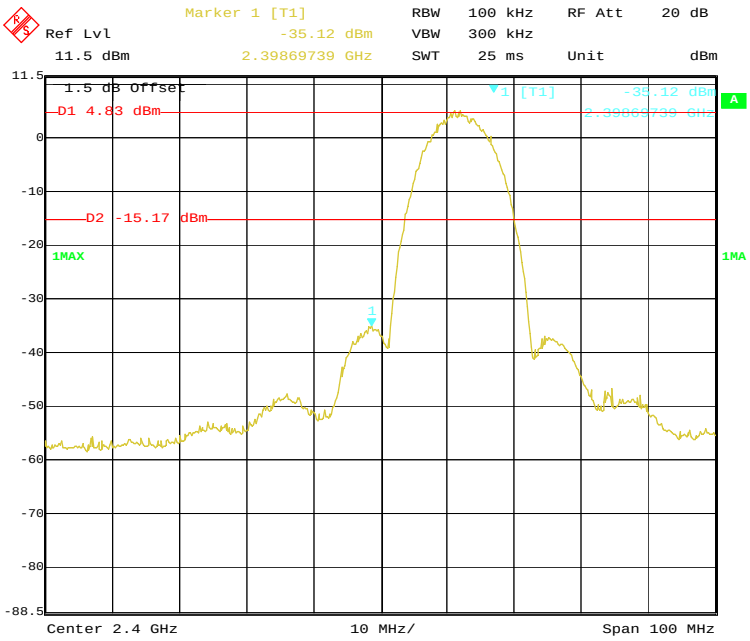
Temperature:	24.3 ℃
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

The testing was performed by Chris Wang on 2017-03-10.

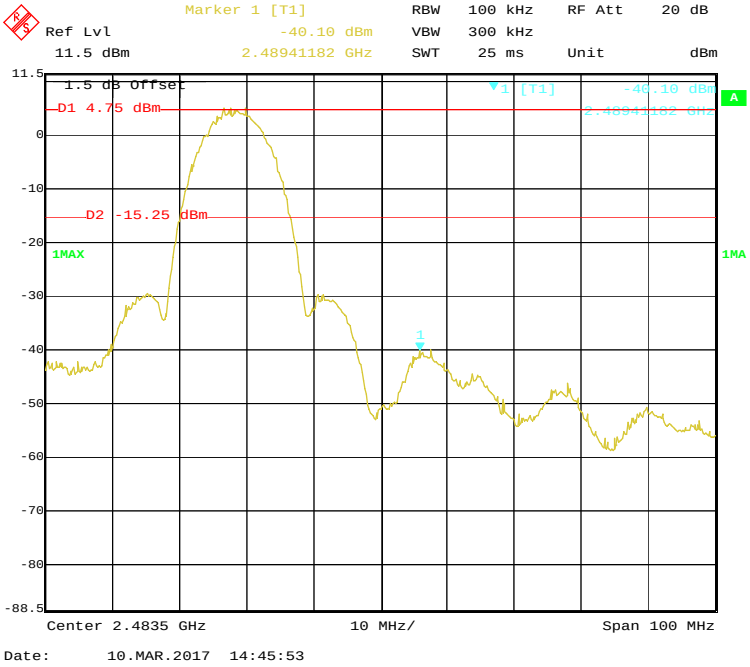
Test Result: *Compliance*

Please refer to the following table and plots.

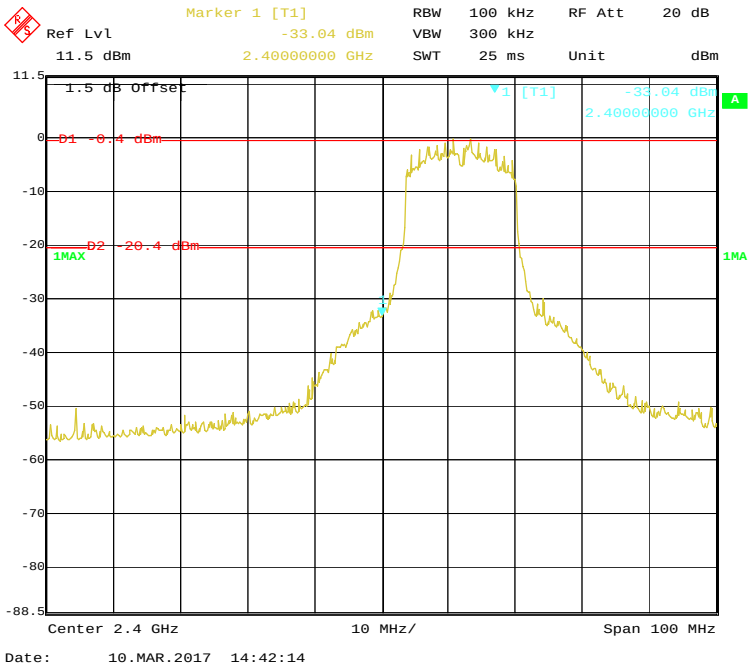
802.11b: Band Edge, Left Side



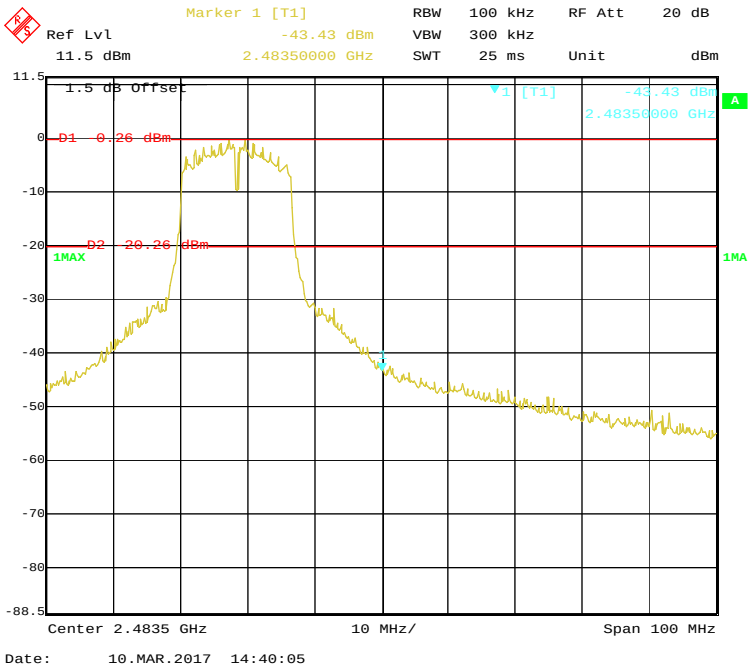
802.11b: Band Edge, Right Side



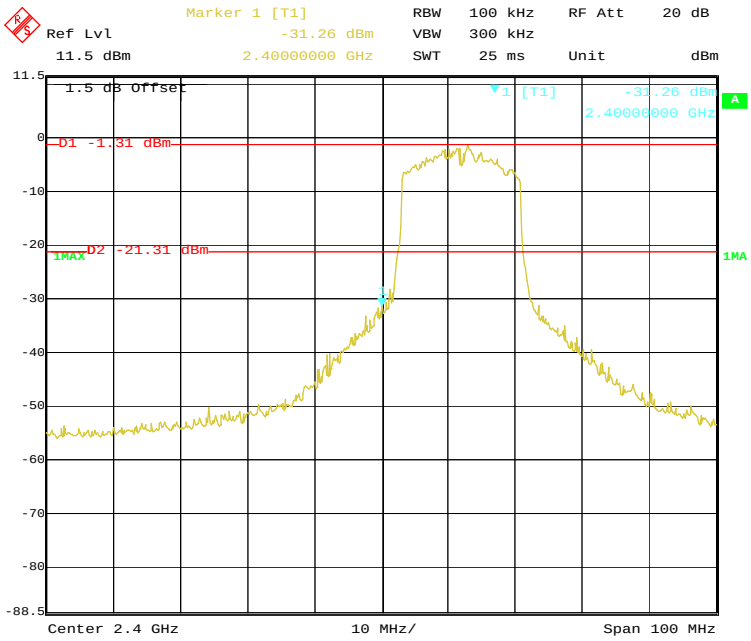
802.11g: Band Edge, Left Side



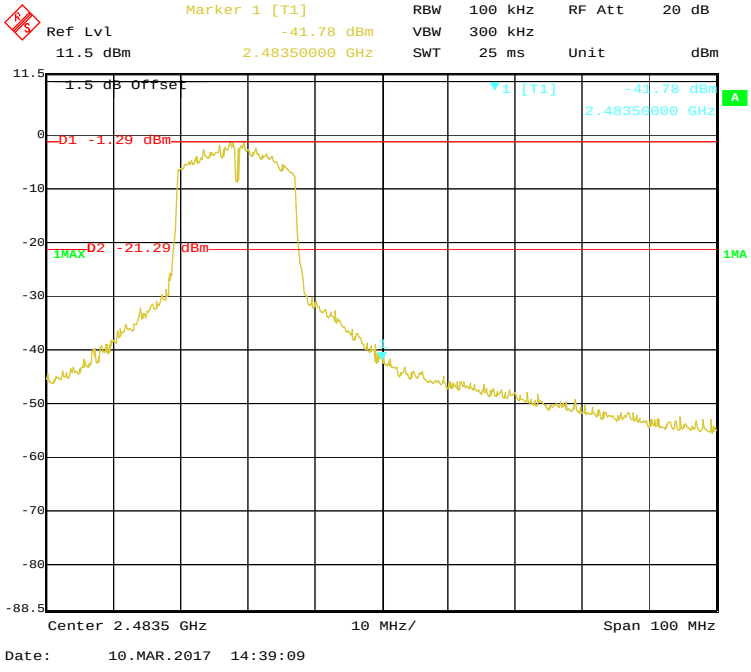
802.11g: Band Edge, Right Side



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 v03r05.

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: 3kHz≤ RBW≤100 kHz.
3. Set the VBW ≥ 3×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 Data

Environmental Conditions

Temperature:	22 ℃
Relative Humidity:	54 %
ATM Pressure:	101.3 kPa

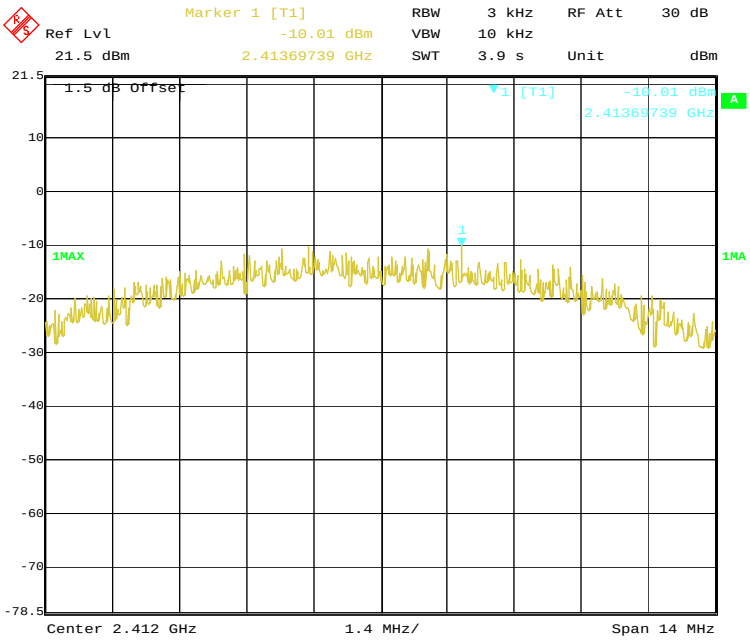
The testing was performed by Chris Wang on 2017-03-10.

EUT operation mode: Transmitting

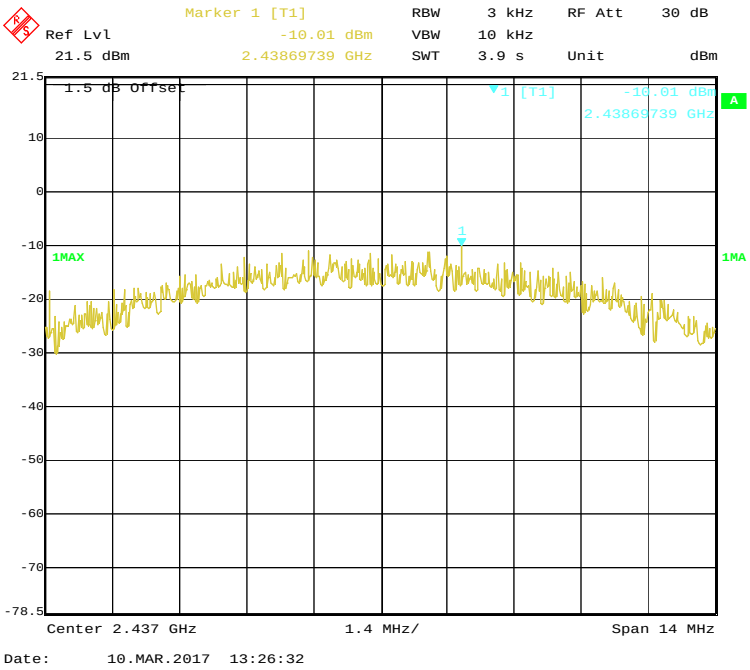
Test Result: Pass

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
802.11b mode			
Low	2412	-10.01	≤8
Middle	2437	-10.01	≤8
High	2462	-9.29	≤8
802.11g mode			
Low	2412	-15.94	≤8
Middle	2437	-15.78	≤8
High	2462	-15.94	≤8
802.11n-HT20 mode			
Low	2412	-15.38	≤8
Middle	2437	-15.96	≤8
High	2462	-15.63	≤8

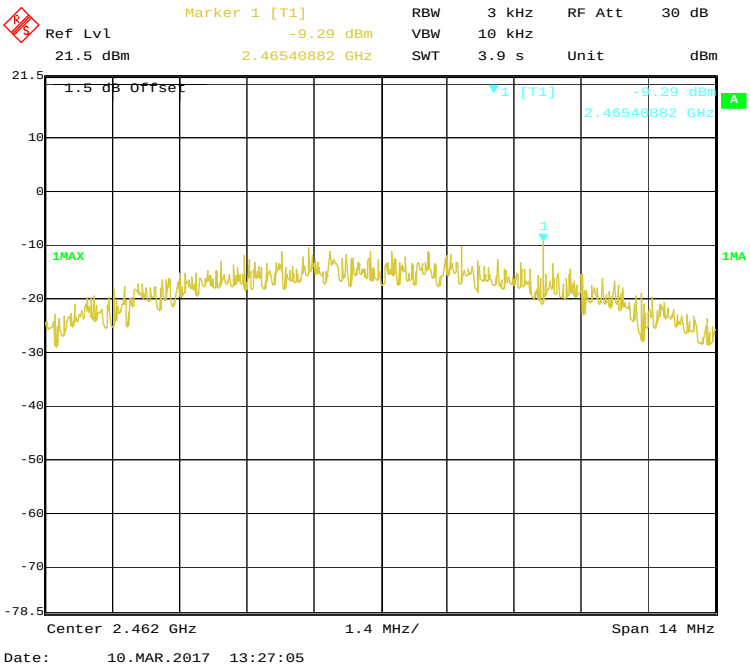
Power Spectral Density , 802.11b Low Channel



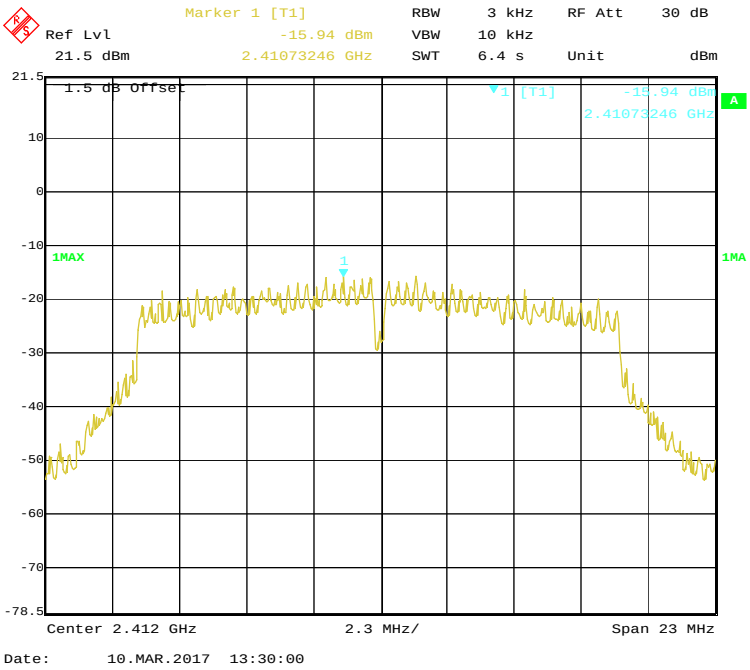
Power Spectral Density , 802.11b Middle Channel



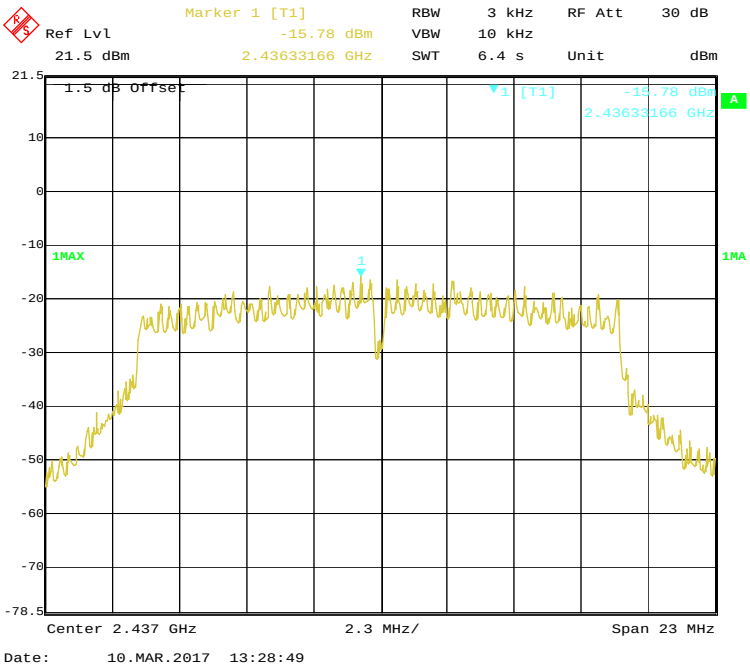
Power Spectral Density , 802.11b High Channel



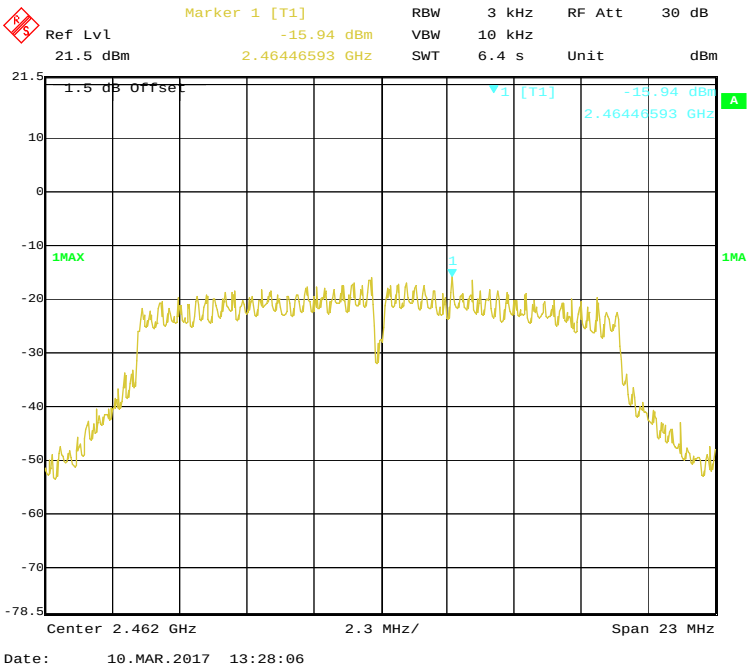
Power Spectral Density , 802.11g Low Channel



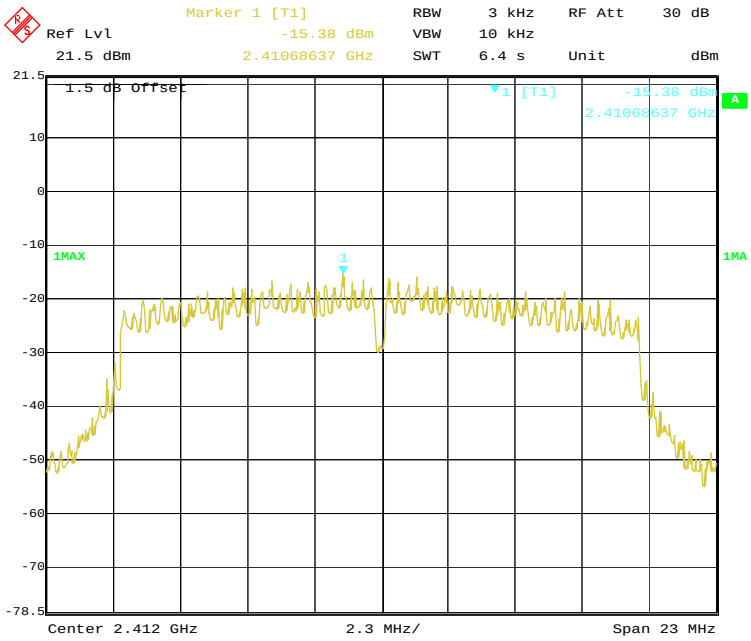
Power Spectral Density , 802.11g Middle Channel



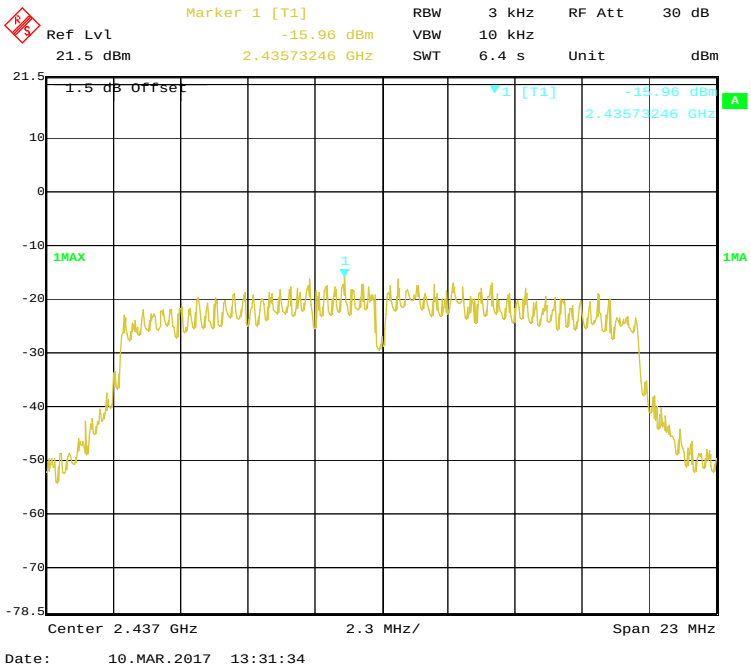
Power Spectral Density , 802.11g High Channel



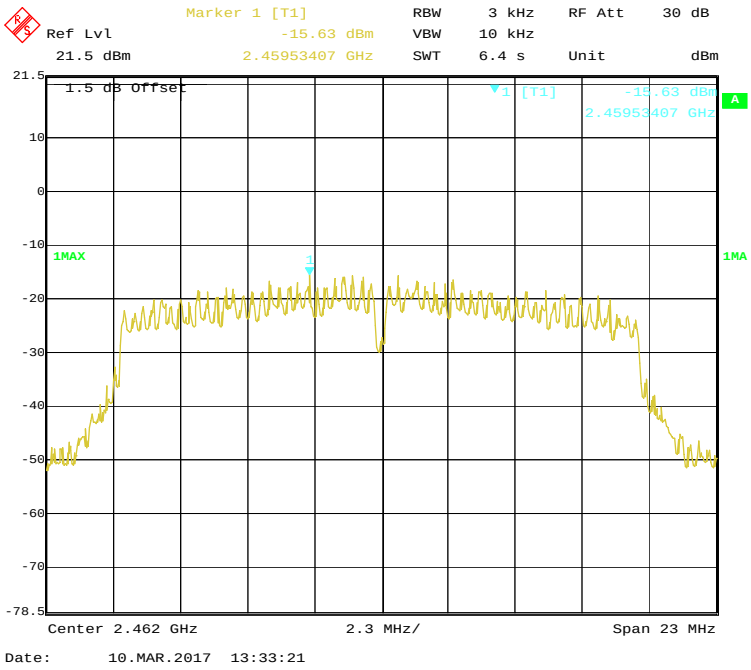
Power Spectral Density , 802.11n-HT20 Low Channel



Power Spectral Density , 802.11n-HT20 Middle Channel



Power Spectral Density , 802.11n-HT20 High Channel



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