FCC PART 15.247

TEST REPORT

For

Qingdao Yeelink Information Technology Co., Ltd.

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FCC ID: 2ABEU-YLDP06YL

Report Type:	**Product Type:**
Original Report	YEELIGHT Smart LED Bulb (Color)

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Report Number:	RSHA171019001-00B
Report Date:	2018-02-26
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TABLE OF CONTENTS

GENERAL INFORMATION 4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) 4
OBJECTIVE 4
RELATED SUBMITTAL(S)/GRANT(S) 4
TEST METHODOLOGY 4
MEASUREMENT UNCERTAINTY 5
TEST FACILITY 5
SYSTEM TEST CONFIGURATION 6
DESCRIPTION OF TEST CONFIGURATION 6
EQUIPMENT MODIFICATIONS 6
EUT EXERCISE SOFTWARE 6
SUPPORT EQUIPMENT LIST AND DETAILS 8
EXTERNAL I/O CABLE 9
BLOCK DIAGRAM OF TEST SETUP 9
SUMMARY OF TEST RESULTS 11
TEST EQUIPMENT LIST 12
FCC §1.1310& §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE) 13
APPLICABLE STANDARD 13
CALCULATED DATA: 13
FCC §15.203 - ANTENNA REQUIREMENT 14
APPLICABLE STANDARD 14
ANTENNA CONNECTOR CONSTRUCTION 14
FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS 15
APPLICABLE STANDARD 15
EUT SETUP 15
EMI TEST RECEIVER SETUP 15
TEST PROCEDURE 16
CORRECTED FACTOR & MARGIN CALCULATION 16
TEST RESULTS SUMMARY 16
TEST DATA 16
FCC §15.209, §15.205 & §15.247(D) - SPURIOUS EMISSIONS & RESTRICTED FREQUENCY BANDS 19
APPLICABLE STANDARD 19
EUT SETUP 19
EMI TEST RECEIVER SETUP 20
TEST PROCEDURE 20
CORRECTED AMPLITUDE & MARGIN CALCULATION 20
TEST RESULTS SUMMARY 20
TEST DATA 21
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH 39
APPLICABLE STANDARD 39
TEST PROCEDURE 39
TEST DATA 39
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER 46
APPLICABLE STANDARD 46

TEST PROCEDURE 46
TEST DATA 46

FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE....48

APPLICABLE STANDARD 48
TEST PROCEDURE 48
TEST DATA 48

FCC §15.247(e) - POWER SPECTRAL DENSITY 52

APPLICABLE STANDARD 52
TEST PROCEDURE 52
TEST DATA 52

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Qingdao Yeelink Information Technology Co., Ltd.
Tested Model	YLDP06YL
Product Type	YEELIGHT Smart LED Bulb (Color)
Dimension	60mm(L) × 60mm(W)× 124mm(H)
Power Supply	AC120V

**All measurement and test data in this report was gathered from production sample serial number: 20171019001. (Assigned by BACL, Kunshan). The EUT was received on 2017-10-19.*

Objective

This report is prepared on behalf of *Qingdao Yeelink Information Technology Co., Ltd.* in accordance with Part 2-Subpart J, Part 15-Subparts A 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)

No Related Submittal(s)/Grant(s).

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and FCC KDB558074 D01 DTS Meas Guidance v04.

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
	18GHz~40GHz	5.65dB
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.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

Channel List for 802.11b, 802.11g and 802.11n-HT20 mode:

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

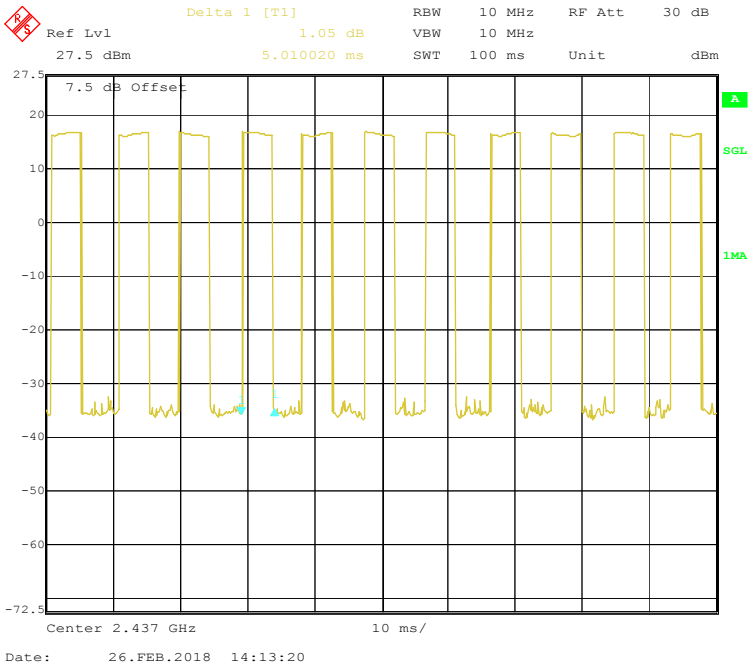
RF test tool: Labtool

Pre-scan with all the data rates, and the worst case was performed as below:

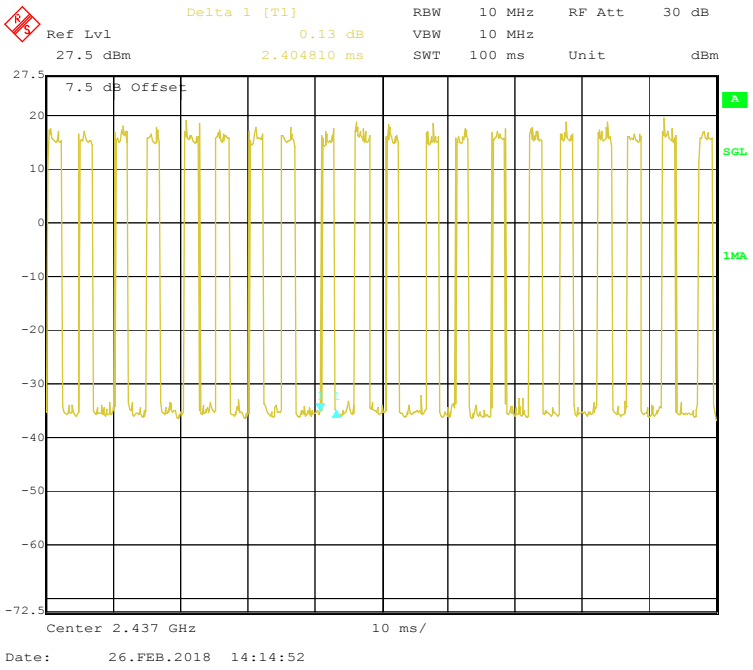
Mode	Data rate	Power level
802.11b	1 Mbps	12
802.11g	6 Mbps	8
802.11n-HT20	MCS0	6

Duty Cycle:

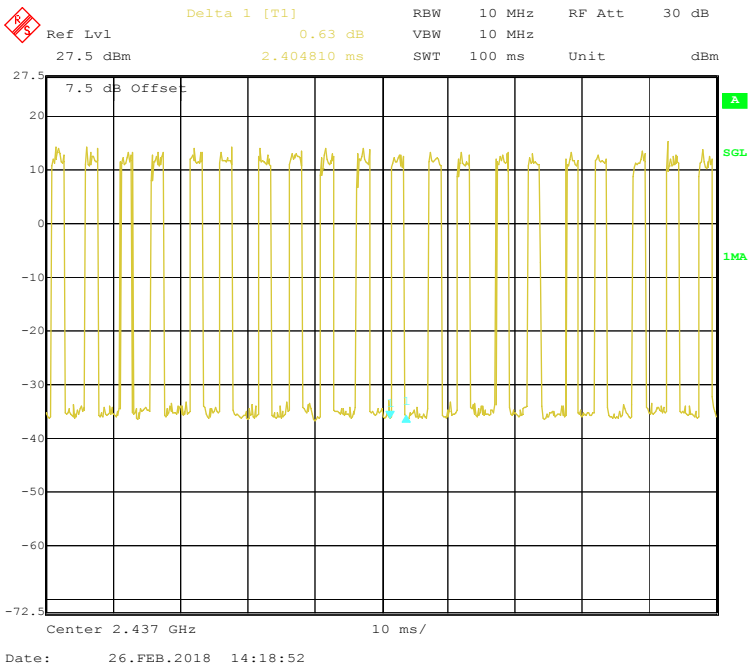
802.11b Mode Middle Channel



802.11g Mode Middle Channel



802.11n-HT20 Mode Middle Channel



Mode	Duty Cycle(%)	T(us)	1/T(kHz)	10log(1/x)
802.11b	55.11	5010	0.20	2.59
802.11g	48.10	2405	0.42	3.18
802.11n-HT20	48.10	2405	0.42	3.18

Note:“x” means the Duty Cycle.

Support Equipment List and Details

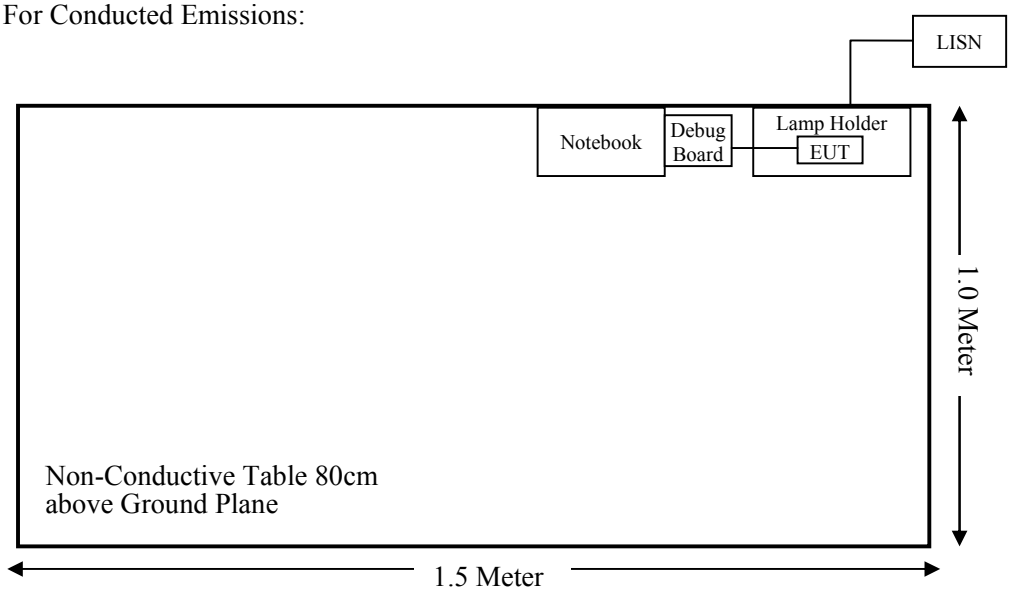
Manufacturer	Description	Model	Serial Number
DELL	Notebook	GX620	D65874152
DELL	Adapter	LA65NS0-00	DF263
Yeelink	Lamp Holder	/	/
Yeelink	Debug Board	/	/

External I/O Cable

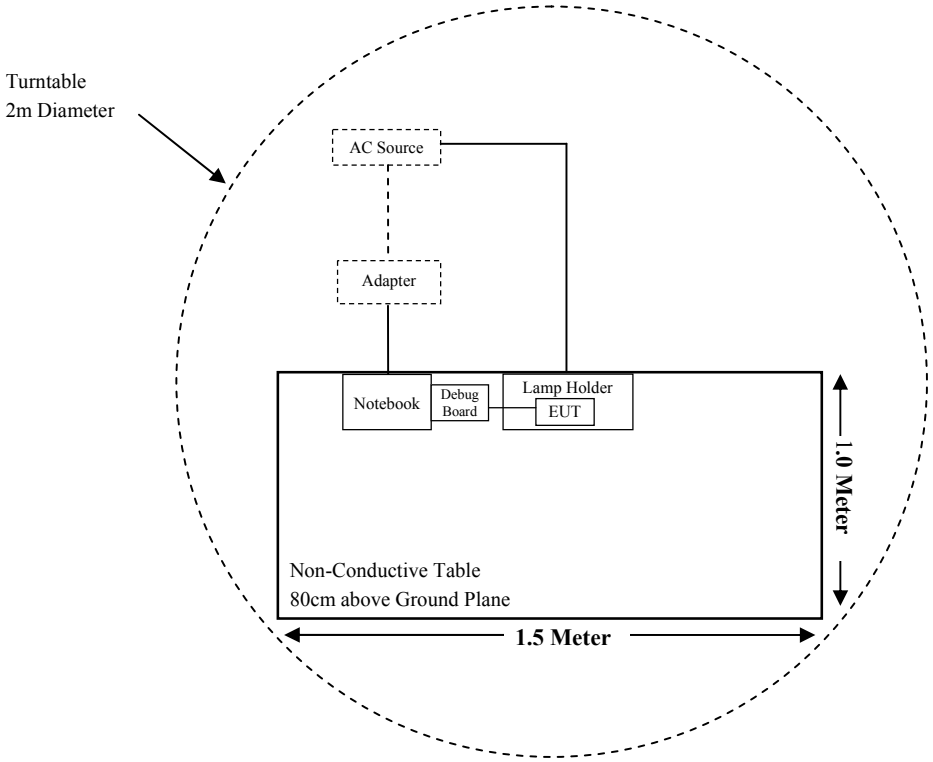
Cable Description	Shielding Type	Length (m)	From Port	To
Power Cable	Un-shielding	1.2	Lamp Holder	Socket/AC Source
USB Cable	Un-shielding	0.5	EUT	Notebook

Block Diagram of Test Setup

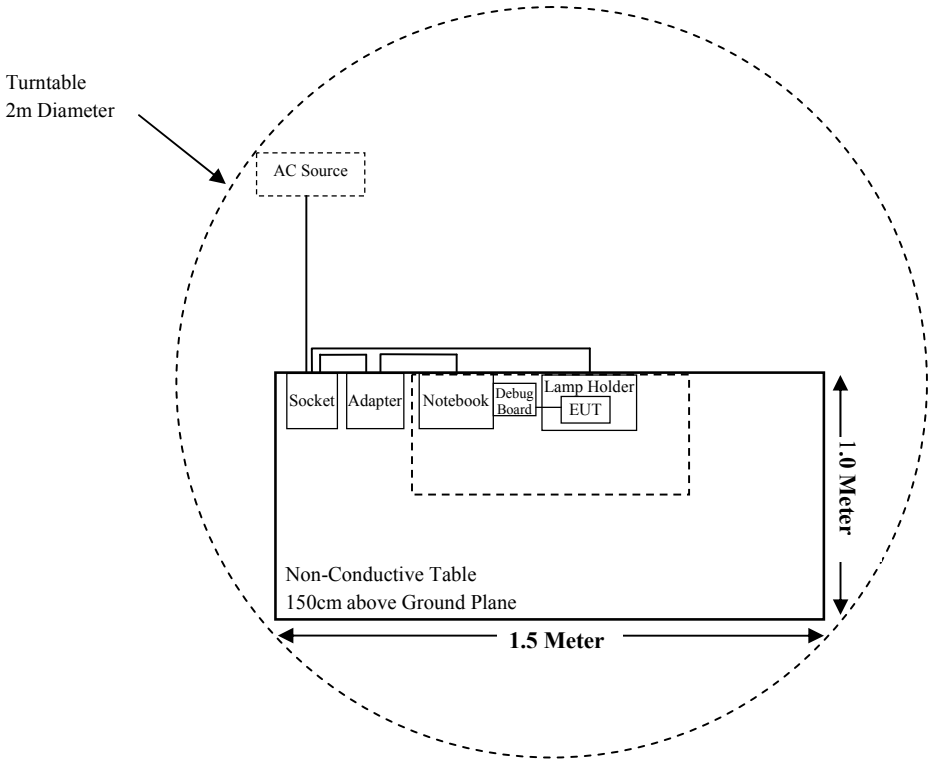
For Conducted Emissions:



For Radiated Emissions(Below 1GHz):



For Radiated Emissions(Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1310 & §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（Chamber 1#）					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2017-11-12	2018-11-11
Sunol Sciences	Broadband Antenna	JB3	A040914-2	2016-01-09	2019-01-08
Sonoma Instrunent	Pre-amplifier	310N	171205	2017-08-15	2018-08-14
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-8	008	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2017-08-15	2018-08-14
Radiated Emission Test（Chamber 2#）					
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2017-08-27	2018-08-26
ETS-LINDGREN	Horn Antenna	3115	6229	2016-01-11	2019-01-10
ETS-LINDGREN	Horn Antenna	3116	00084159	2016-10-18	2019-10-17
Narda	Pre-amplifier	AFS42-00101800	2001270	2017-12-12	2018-12-11
Heatsink Required	Amplifier	QLW-18405536-J0	15964001009	2017-12-12	2018-12-11
SINOSCITE	Band Reject Filter	BSF2400-2483MN-0995	/	2017-08-05	2018-08-04
Narda	Attenuator/10dB	10dB	/	/	/
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-11	011	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2017-08-15	2018-08-14
RF Conducted Test					
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2017-09-21	2018-09-20
Narda	Attenuator/6dB	10690812-2	26850-6	2018-01-10	2019-01-09
Agilent	Power Meter	N1912A	MY5000492	2017-11-18	2018-11-17
Agilent	Power Sensor	N1921A	MY54210024	2017-11-18	2018-11-17
Qingdao Yeelink	RF Cable	/	/	/	/
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2017-11-12	2018-11-11
Rohde & Schwarz	LISN	ESH3-Z5	862770/011	2017-11-12	2018-11-11
BACL	Auto test Software	BACL-EMC	CE001	/	/
Narda	Attenuator/6dB	10690812-2	26850-6	2018-01-10	2019-01-09
MICRO-COAX	Coaxial Cable	Cable-15	015	2017-08-15	2018-08-14

*** 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 §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 Data:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = PG/4 π 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);

Mode	Frequency Range (MHz)	Antenna Gain		Output Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
802.11b	2412~2462	0.00	1.00	15.50	35.48	20	0.0071	1
802.11g		0.00	1.00	15.00	31.62	20	0.0063	1
802.11n-HT20		0.00	1.00	13.50	22.39	20	0.0045	1

Note: The target output powers were declared by the manufacturer.

Result: The device meet FCC MPE at 20cm 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 for Wi-Fi, which the antenna gain is 0dBi, fulfill the requirement of this section. Please refer to the EUT photos.

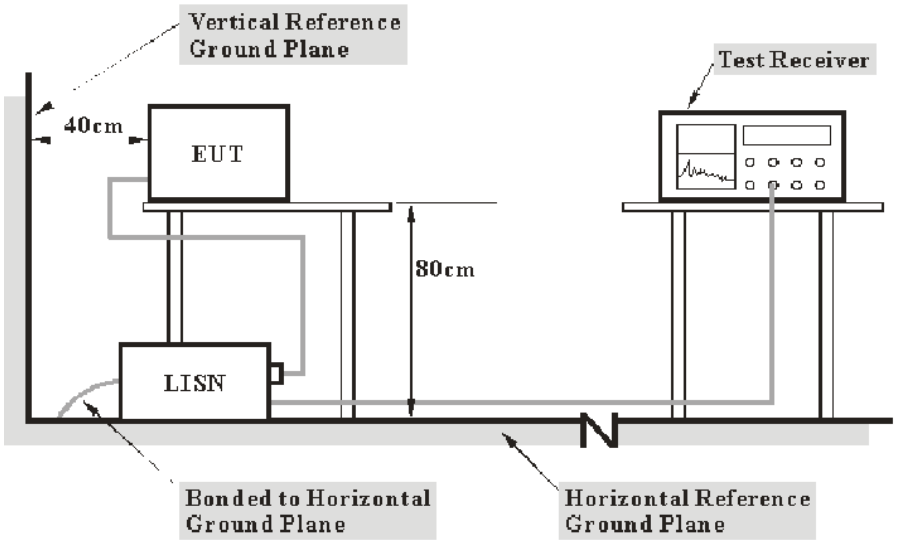
Result: Compliance.

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

ANSI C63.10-2013 clause 6.2

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 + Transient Limiter Attenuation

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 –Reading

Test Results Summary

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

Test Data

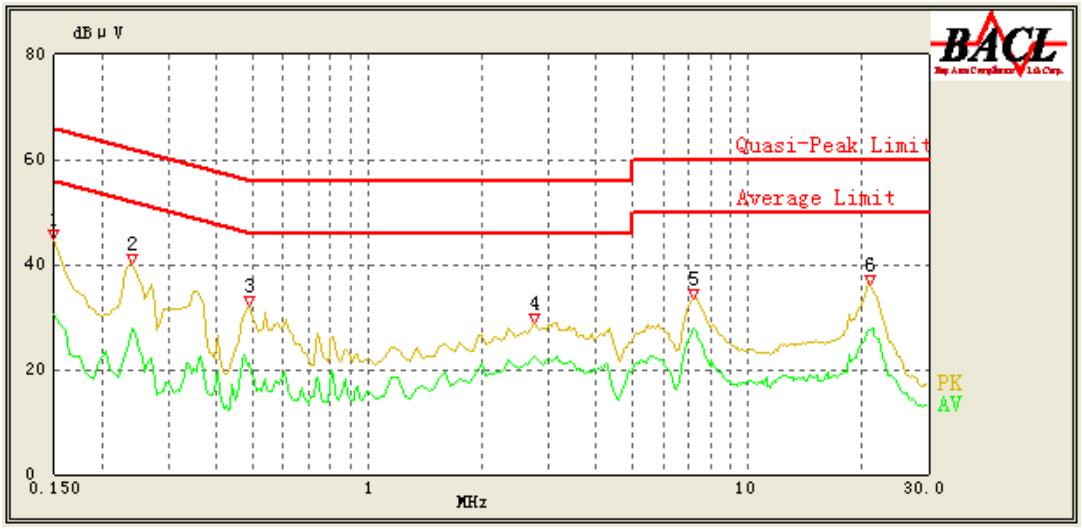
Environmental Conditions

Temperature:	24.2℃
Relative Humidity:	51 %
ATM Pressure:	101.1 kPa

The testing was performed by Aaron Wang on 2018-01-31.

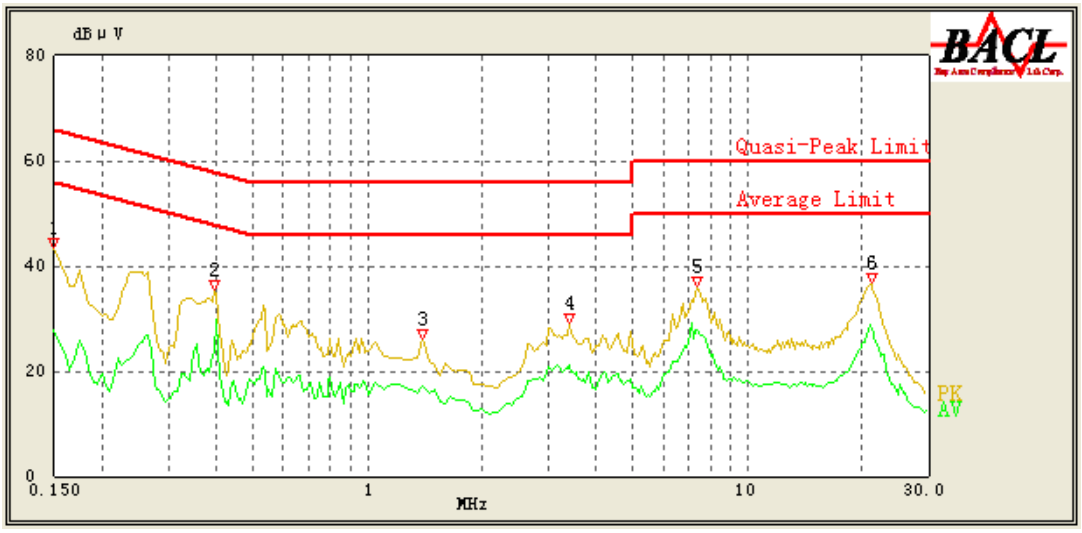
EUT operation mode: Transmitting in 802.11b mode high channel (Worst case)

AC 120V/60 Hz, Line



Frequency (MHz)	Reading (dBμV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Comment
0.150	44.74	QP	9.000	L1	16.06	66.00	21.26	Compliance
0.150	30.48	AV	9.000	L1	16.06	56.00	25.52	Compliance
0.240	40.15	QP	9.000	L1	16.02	63.43	23.28	Compliance
0.240	27.74	AV	9.000	L1	16.02	53.43	25.69	Compliance
0.490	32.21	QP	9.000	L1	16.08	56.29	24.08	Compliance
0.490	21.03	AV	9.000	L1	16.08	46.29	25.26	Compliance
2.750	28.77	QP	9.000	L1	15.85	56.00	27.23	Compliance
2.750	22.56	AV	9.000	L1	15.85	46.00	23.44	Compliance
7.250	33.48	QP	9.000	L1	15.99	60.00	26.52	Compliance
7.250	27.68	AV	9.000	L1	15.99	50.00	22.32	Compliance
21.050	36.29	QP	9.000	L1	16.44	60.00	23.71	Compliance
21.050	27.48	AV	9.000	L1	16.44	50.00	22.52	Compliance

AC 120V/60 Hz, Neutral



Frequency (MHz)	Reading (dBµV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Comment
0.150	43.65	QP	9.000	N	16.06	66.00	22.35	Compliance
0.150	27.76	AV	9.000	N	16.06	56.00	28.24	Compliance
0.395	35.65	QP	9.000	N	16.09	59.00	23.35	Compliance
0.395	23.37	AV	9.000	N	16.09	49.00	25.63	Compliance
1.400	26.02	QP	9.000	N	15.93	56.00	29.98	Compliance
1.400	17.26	AV	9.000	N	15.93	46.00	28.74	Compliance
3.400	29.13	QP	9.000	N	15.89	56.00	26.87	Compliance
3.400	21.13	AV	9.000	N	15.89	46.00	24.87	Compliance
7.400	36.05	QP	9.000	N	15.93	60.00	23.95	Compliance
7.400	28.00	AV	9.000	N	15.93	50.00	22.00	Compliance
21.250	36.89	QP	9.000	N	16.18	60.00	23.11	Compliance
21.000	28.83	AV	9.000	N	16.18	50.00	21.17	Compliance

Note:
1) Correction Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation
2) Margin = Limit – Reading

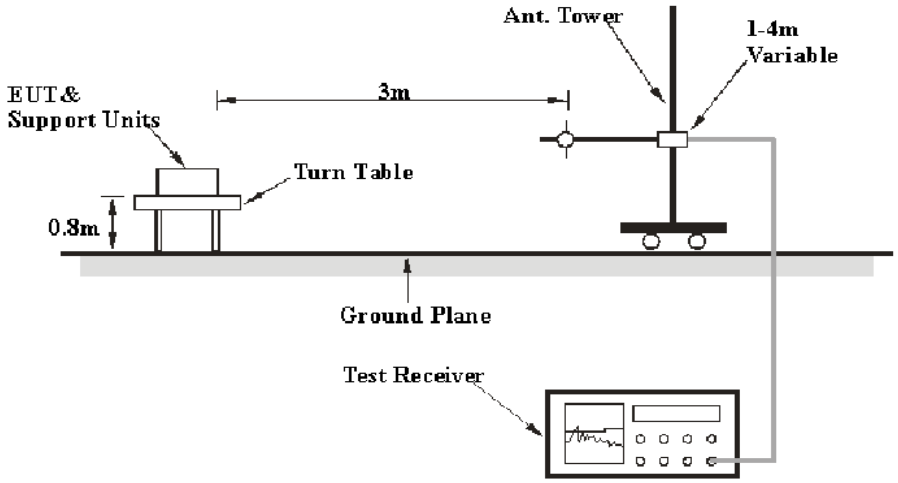
FCC §15.209, §15.205 & §15.247(D) - SPURIOUS EMISSIONS & RESTRICTED FREQUENCY BANDS

Applicable Standard

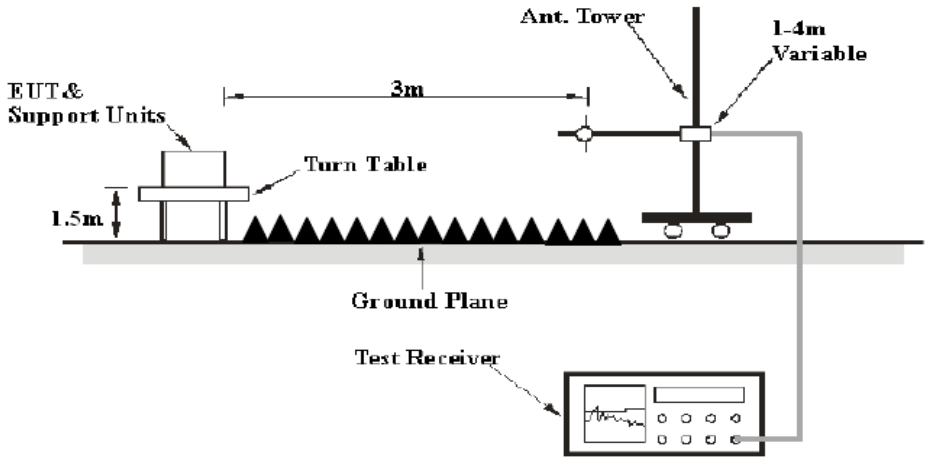
FCC §15.247 (d); §15.209; §15.205;

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 Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver 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
Above 1GHz	1MHz	3 MHz	/	PK
	1MHz	3 MHz	/	Ave

Test Procedure

According to KDB558074 D01 DTS Meas Guidance v04 sub-clause 12.1 and 12.2. and ANSI C63.10-2013 clause 6.5, 6.6 and 6.7.

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:	24.2℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

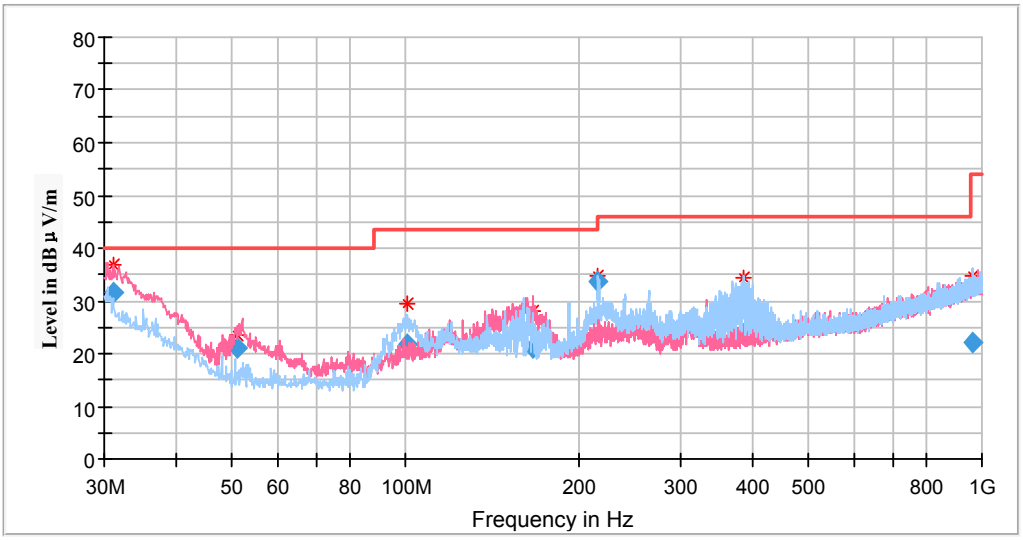
The testing was performed by Aaron Wang on 2018-01-30 & 2018-01-31.

EUT operation mode: Transmitting

Spurious Emission Test:

30MHz-1GHz:

Pre-scan with 802.11b, 802.11g and 802.11n-HT20 modes of operation in the X,Y and Z axes of orientation, the worst case ***802.11b mode(high channel:2462MHz) in X-axis of orientation*** *was recorded*



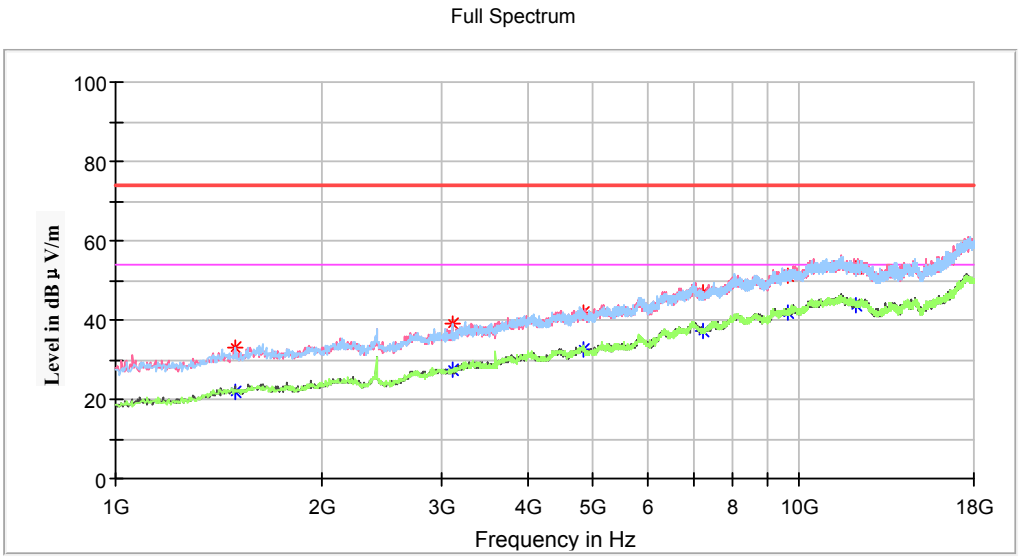
Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	QuasiPeak (dBµV/m)	Height (cm)	Polar (H/V)				
31.216720	31.73	101.0	V	297.0	-5.2	40.00	8.27
51.002920	20.91	101.0	V	44.0	-18.0	40.00	19.09
100.598050	21.92	199.0	H	207.0	-15.2	43.50	21.58
166.824550	21.04	101.0	V	128.0	-13.5	43.50	22.46
216.105790	33.67	199.0	H	210.0	-12.7	46.00	12.33
386.896840	29.60	101.0	H	204.0	-8.9	46.00	16.40

1GHz-18GHz:

802.11b Mode:
*(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded)*

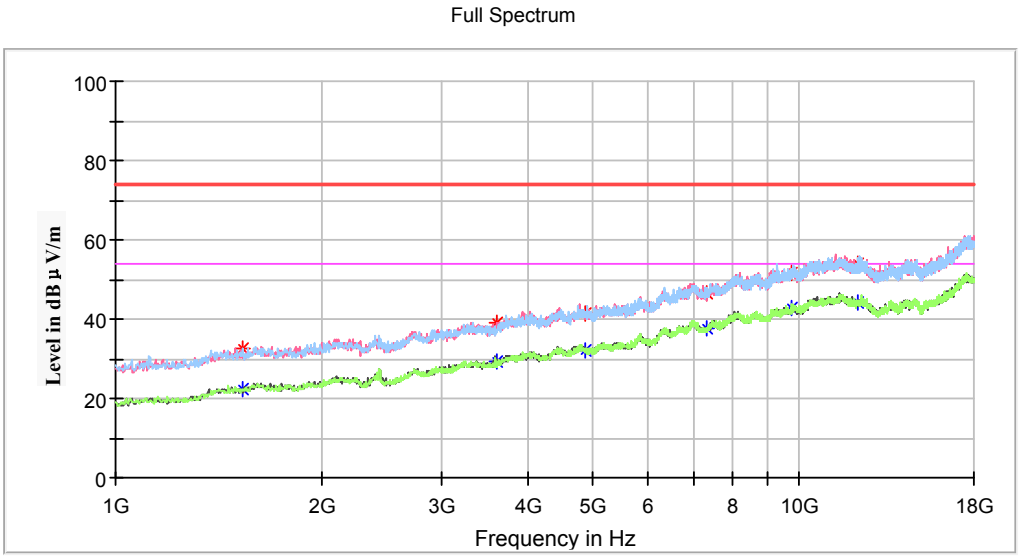
Note:
1. This test was performed with the 2.4-2.4835GHz band reject filter.
2. Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
3. Corrected Amplitude = Corrected Factor + Reading
4. Margin = Limit - Corrected. Amplitude

Low Channel: 2412MHz



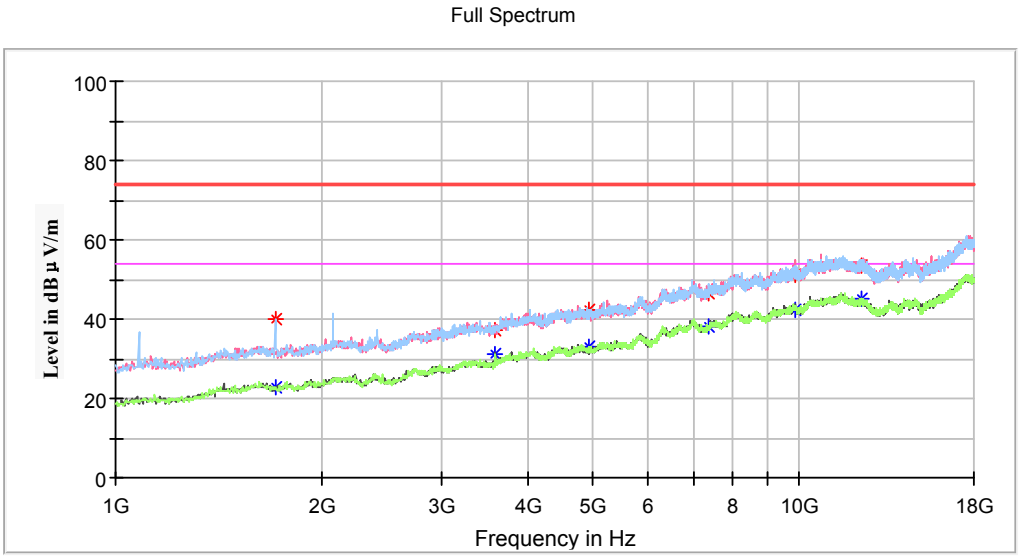
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1496.400000	---	22.03	150.0	H	119.0	-8.1	54.00	31.97
1496.400000	32.94	---	150.0	H	119.0	-8.1	74.00	41.06
3104.600000	---	27.39	250.0	H	260.0	-1.8	54.00	26.61
3104.600000	39.19	---	250.0	H	260.0	-1.8	74.00	34.81
4824.000000	41.80	---	150.0	H	56.0	2.5	74.00	32.20
4824.000000	---	32.37	150.0	H	56.0	2.5	54.00	21.63
7236.000000	---	37.28	100.0	H	0.0	9.8	54.00	16.72
7236.000000	46.93	---	100.0	H	0.0	9.8	74.00	27.07
9649.600000	---	42.02	150.0	V	311.0	14.9	54.00	11.98
9649.600000	51.00	---	150.0	V	311.0	14.9	74.00	23.00
12067.000000	---	43.71	200.0	H	260.0	16.6	54.00	10.29
12067.000000	52.86	---	200.0	H	260.0	16.6	74.00	21.14

Middle Channel: 2437MHz



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1533.800000	---	22.17	150.0	H	147.0	-7.9	54.00	31.83
1533.800000	32.47	---	150.0	H	147.0	-7.9	74.00	41.53
3601.000000	39.14	---	200.0	V	353.0	-0.6	74.00	34.86
3601.000000	---	29.44	200.0	V	353.0	-0.6	54.00	24.56
4874.000000	41.56	---	100.0	H	100.0	2.6	74.00	32.44
4874.000000	---	32.12	100.0	H	100.0	2.6	54.00	21.88
7236.000000	46.59	---	150.0	H	325.0	10.0	74.00	27.41
7236.000000	---	37.47	150.0	H	325.0	10.0	54.00	16.53
9748.200000	51.53	---	200.0	H	69.0	14.9	74.00	22.47
9748.200000	---	42.67	200.0	H	69.0	14.9	54.00	11.33
12186.000000	53.77	---	150.0	V	305.0	16.7	74.00	20.23
12186.000000	---	44.20	150.0	V	305.0	16.7	54.00	9.80

High Channel: 2462MHz

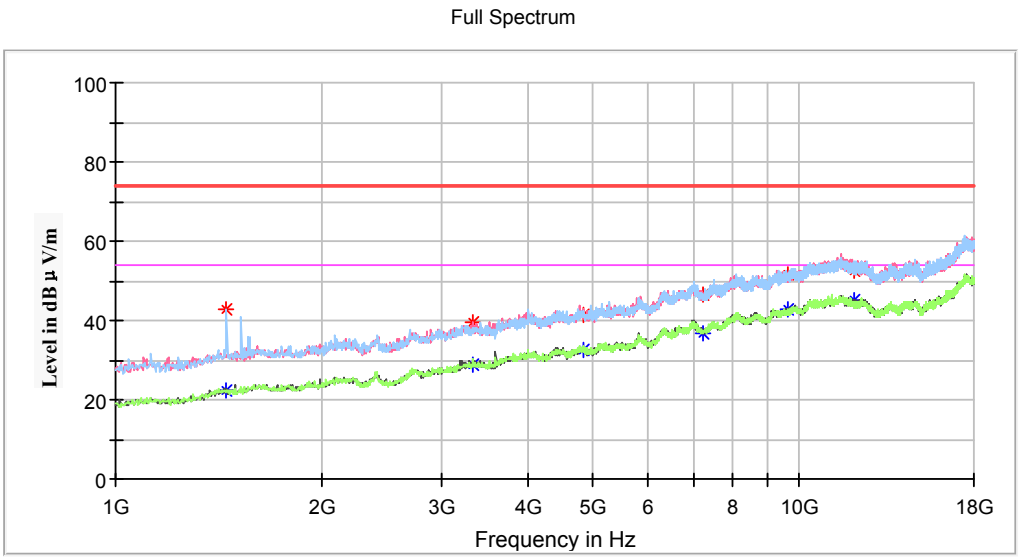


Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1710.600000	39.80	---	100.0	H	197.0	-7.1	74.00	34.20
1710.600000	---	22.90	100.0	H	197.0	-7.1	54.00	31.10
3597.600000	37.11	---	150.0	H	307.0	-0.6	74.00	36.89
3597.600000	---	31.32	150.0	H	307.0	-0.6	54.00	22.68
4924.000000	---	33.20	150.0	H	55.0	2.7	54.00	20.80
4924.000000	42.18	---	150.0	H	55.0	2.7	74.00	31.82
7386.000000	---	38.07	200.0	H	35.0	10.1	54.00	15.93
7386.000000	46.58	---	200.0	H	35.0	10.1	74.00	27.42
9846.800000	---	42.46	150.0	H	292.0	14.9	54.00	11.54
9846.800000	51.18	---	150.0	H	292.0	14.9	74.00	22.82
12311.800000	53.34	---	150.0	H	12.0	16.9	74.00	20.66
12311.800000	---	45.07	150.0	H	12.0	16.9	54.00	8.93

802.11g Mode:
*(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded)*

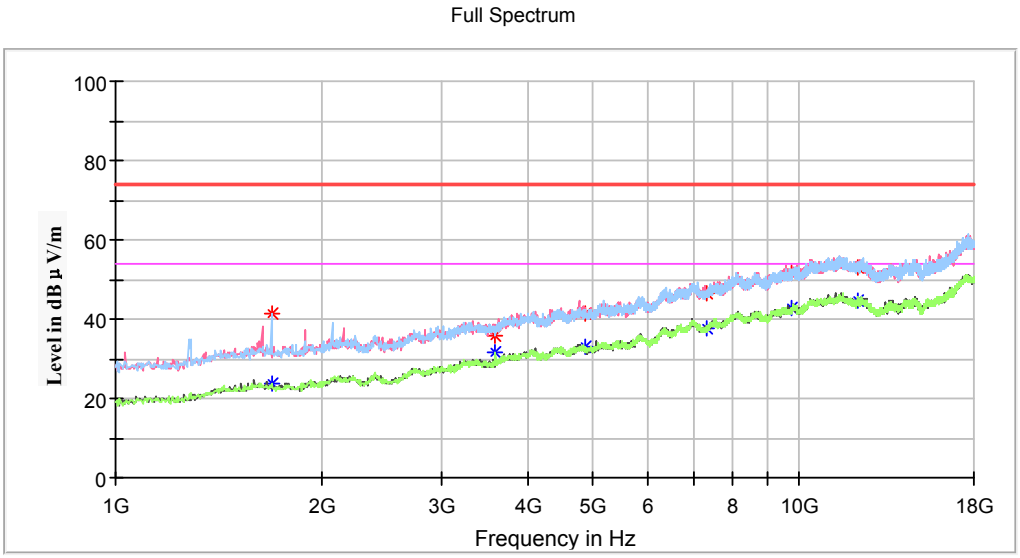
Note:
1. This test was performed with the 2.4-2.4835GHz band reject filter.
2. Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
3. Corrected Amplitude = Corrected Factor + Reading
4. Margin = Limit - Corrected. Amplitude

Low Channel: 2412MHz



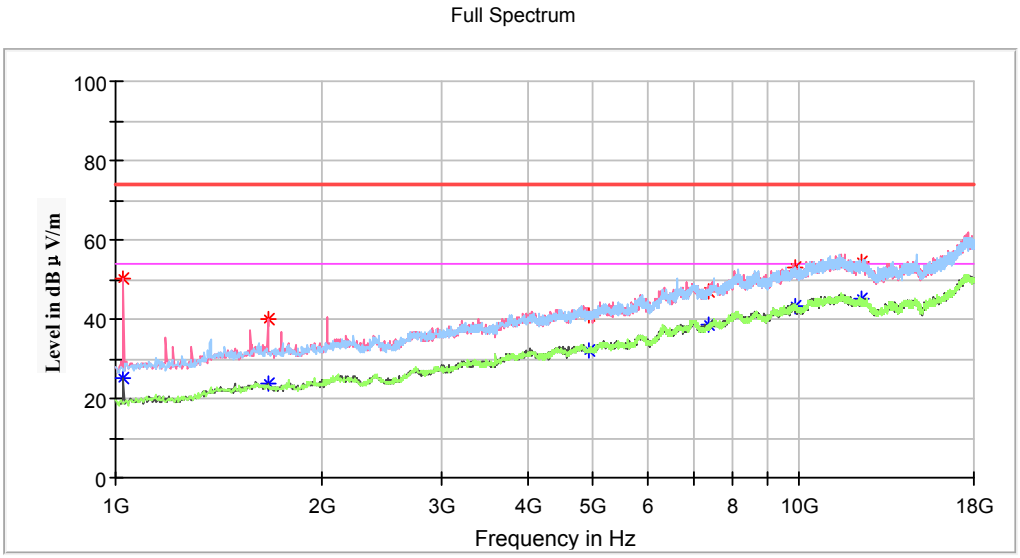
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1452.200000	42.89	---	150.0	H	18.0	-8.4	74.00	31.11
1452.200000	---	22.13	150.0	H	18.0	-8.4	54.00	31.87
3329.000000	39.72	---	200.0	V	197.0	-1.3	74.00	34.28
3329.000000	---	28.90	200.0	V	197.0	-1.3	54.00	25.10
4824.000000	41.48	---	150.0	H	325.0	2.5	74.00	32.52
4824.000000	---	32.51	150.0	H	325.0	2.5	54.00	21.49
7236.000000	---	36.86	150.0	H	80.0	9.8	54.00	17.14
7236.000000	46.45	---	150.0	H	80.0	9.8	74.00	27.55
9649.600000	51.60	---	200.0	V	100.0	14.9	74.00	22.40
9649.600000	---	42.68	200.0	V	100.0	14.9	54.00	11.32
12056.800000	52.59	---	150.0	V	147.0	16.5	74.00	21.41
12056.800000	---	45.08	150.0	V	147.0	16.5	54.00	8.92

Middle Channel: 2437MHz



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1690.200000	41.22	---	150.0	H	249.0	-7.2	74.00	32.78
1690.200000	---	23.58	150.0	H	249.0	-7.2	54.00	30.42
3597.600000	35.84	---	200.0	H	265.0	-0.6	74.00	38.16
3597.600000	---	31.68	200.0	H	265.0	-0.6	54.00	22.32
4874.000000	41.40	---	200.0	H	312.0	2.6	74.00	32.60
4874.000000	---	33.08	200.0	H	312.0	2.6	54.00	20.92
7236.000000	46.48	---	200.0	H	18.0	10.0	74.00	27.52
7236.000000	---	37.80	200.0	H	18.0	10.0	54.00	16.20
9748.200000	51.62	---	150.0	V	226.0	14.9	74.00	22.38
9748.200000	---	42.93	150.0	V	226.0	14.9	54.00	11.07
12186.000000	52.86	---	150.0	H	19.0	16.7	74.00	21.14
12186.000000	---	44.75	150.0	H	19.0	16.7	54.00	9.25

High Channel: 2462MHz

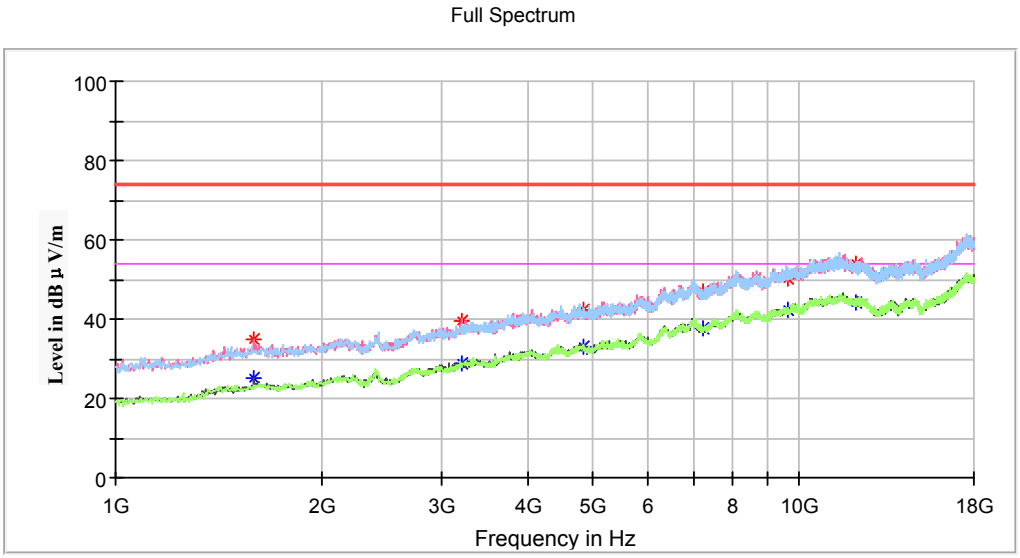


Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1027.200000	---	25.01	150.0	V	326.0	-11.9	54.00	28.99
1027.200000	50.01	---	150.0	V	326.0	-11.9	74.00	23.99
1669.800000	40.00	---	150.0	V	309.0	-7.3	74.00	34.00
1669.800000	---	23.54	150.0	V	309.0	-7.3	54.00	30.46
4924.000000	---	32.03	200.0	H	71.0	2.7	54.00	21.97
4924.000000	40.83	---	200.0	H	71.0	2.7	74.00	33.17
7386.000000	---	38.66	150.0	H	132.0	10.1	54.00	15.34
7386.000000	47.02	---	150.0	H	132.0	10.1	74.00	26.98
9846.800000	---	43.19	150.0	H	243.0	14.9	54.00	10.81
9846.800000	52.99	---	150.0	H	243.0	14.9	74.00	21.01
12322.000000	---	45.06	200.0	V	348.0	16.9	54.00	8.94
12322.000000	54.49	---	200.0	V	348.0	16.9	74.00	19.51

802.11n-HT20 Mode:
*(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded)*

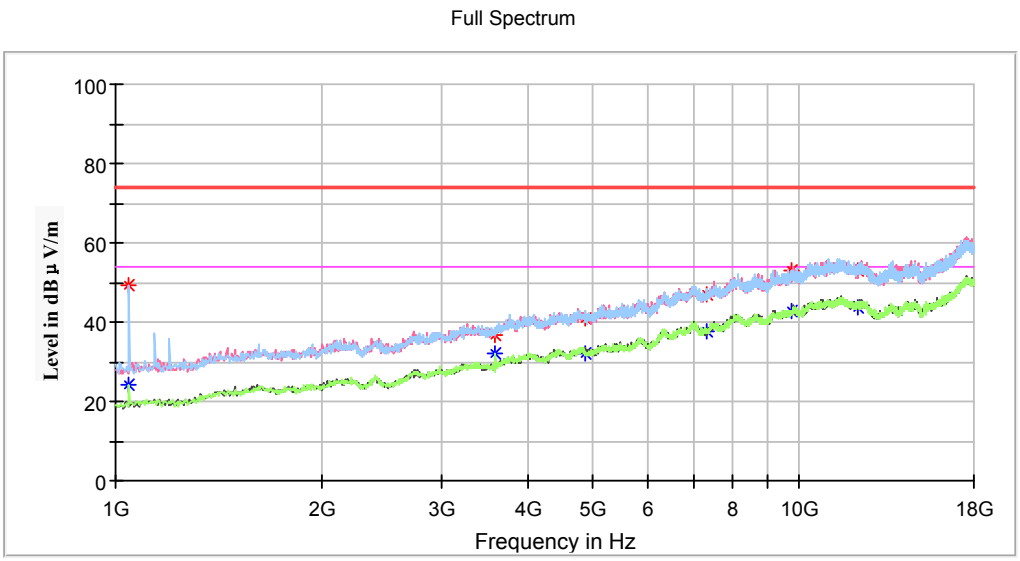
Note:
1. This test was performed with the 2.4-2.4835GHz band reject filter.
2. Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
3. Corrected Amplitude = Corrected Factor + Reading
4. Margin = Limit - Corrected. Amplitude

Low Channel: 2412MHz



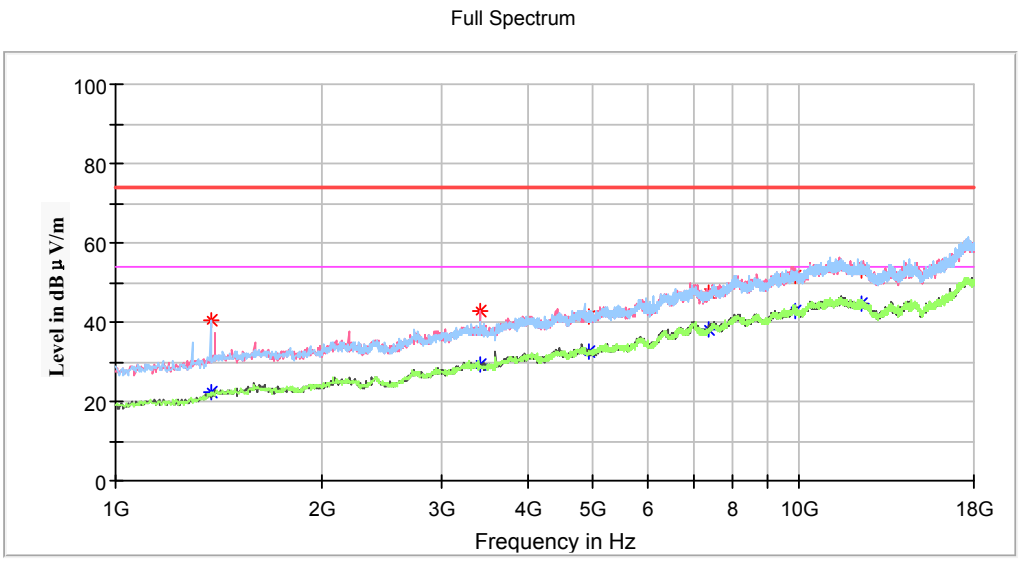
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1591.600000	34.76	---	100.0	V	259.0	-7.6	74.00	39.24
1591.600000	---	25.16	100.0	V	259.0	-7.6	54.00	28.84
3213.400000	39.63	---	150.0	V	70.0	-1.5	74.00	34.37
3213.400000	---	29.04	150.0	V	70.0	-1.5	54.00	24.96
4824.000000	42.45	---	150.0	H	180.0	2.5	74.00	31.55
4824.000000	---	32.97	150.0	H	180.0	2.5	54.00	21.03
7236.000000	---	37.76	200.0	H	274.0	9.8	54.00	16.24
7236.000000	46.91	---	200.0	H	274.0	9.8	74.00	27.09
9649.600000	---	42.49	150.0	V	336.0	14.9	54.00	11.51
9649.600000	50.44	---	150.0	V	336.0	14.9	74.00	23.56
12067.000000	---	44.04	200.0	H	70.0	16.6	54.00	9.96
12067.000000	53.78	---	200.0	H	70.0	16.6	74.00	20.22

Middle Channel: 2437MHz



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1047.600000	49.32	---	200.0	H	197.0	-11.7	74.00	24.68
1047.600000	---	24.07	200.0	H	197.0	-11.7	54.00	29.93
3597.600000	36.57	---	100.0	H	276.0	-0.6	74.00	37.43
3597.600000	---	32.08	100.0	H	276.0	-0.6	54.00	21.92
4874.000000	40.74	---	150.0	H	193.0	2.6	74.00	33.26
4874.000000	---	32.32	150.0	H	193.0	2.6	54.00	21.68
7236.000000	46.85	---	200.0	H	4.0	10.0	74.00	27.15
7236.000000	---	37.50	200.0	H	4.0	10.0	54.00	16.50
9748.200000	52.80	---	200.0	V	86.0	14.9	74.00	21.20
9748.200000	---	42.80	200.0	V	86.0	14.9	54.00	11.20
12186.000000	53.22	---	150.0	H	303.0	16.7	74.00	20.78
12186.000000	---	43.71	150.0	H	303.0	16.7	54.00	10.29

High Channel: 2462MHz

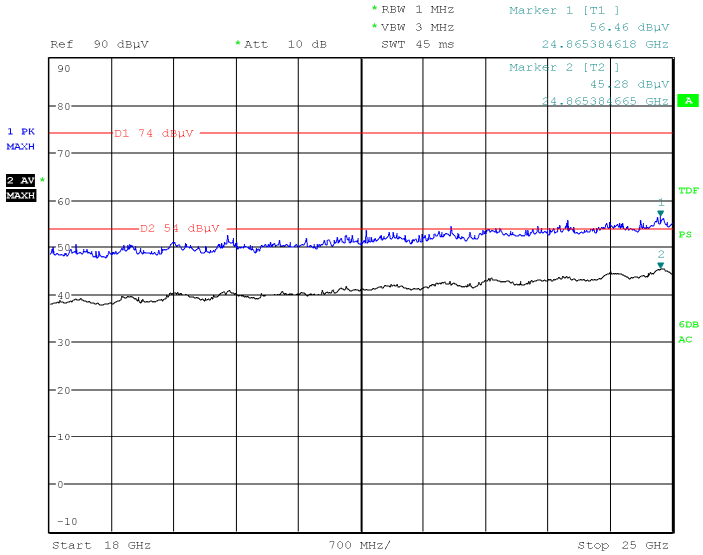


Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1377.400000	40.58	---	150.0	H	258.0	-9.0	74.00	33.42
1377.400000	---	22.22	150.0	H	258.0	-9.0	54.00	31.78
3414.000000	43.01	---	200.0	V	260.0	-1.1	74.00	30.99
3414.000000	---	29.26	200.0	V	260.0	-1.1	54.00	24.74
4924.000000	41.33	---	150.0	H	84.0	2.7	74.00	32.67
4924.000000	---	32.45	150.0	H	84.0	2.7	54.00	21.55
7386.000000	47.41	---	150.0	H	25.0	10.1	74.00	26.59
7386.000000	---	37.99	150.0	H	25.0	10.1	54.00	16.01
9850.200000	51.78	---	200.0	H	290.0	14.9	74.00	22.22
9850.200000	---	42.78	200.0	H	290.0	14.9	54.00	11.22
12311.800000	53.23	---	150.0	V	131.0	16.9	74.00	20.77
12311.800000	---	44.69	150.0	V	131.0	16.9	54.00	9.31

18GHz-25GHz:

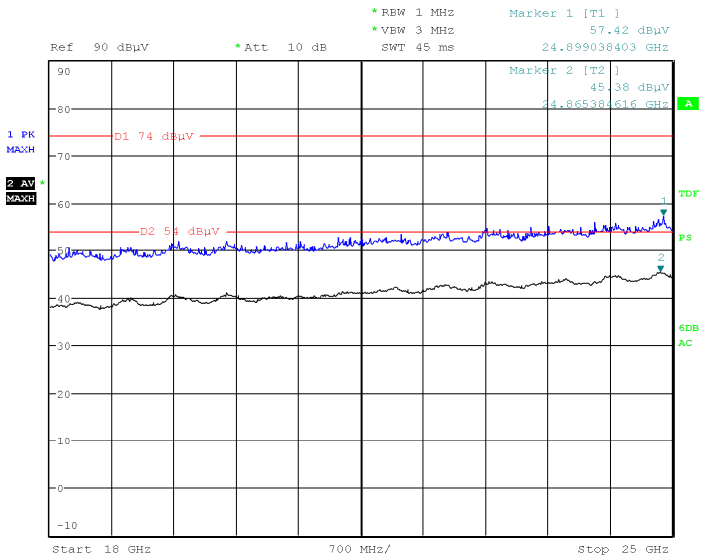
*Pre-scan with 802.11b, 802.11g and 802.11n-HT20 modes of operation in the X,Y and Z axes of orientation, the worst case **802.11b mode(high channel:2462MHz) in X-axis of orientation** was recorded*

Horizontal



Date: 31.JAN.2018 13:52:53

Vertical



Date: 31.JAN.2018 13:32:20

Fundamental Test & Restricted Bands Emissions Test:

Note:
1. Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
2.Corrected Amplitude = Corrected Factor + Reading
3.Margin = Limit - Corrected. Amplitude

802.11b Mode: *(Pre-scan in the X,Y and Z axes of orientation, the worst case X-axis of orientation was recorded)*

Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV /m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
Low Channel: 2412MHz								
2412.000000	---	98.83	100.0	H	97.0	5.1	/	/
2412.000000	102.95	---	100.0	H	97.0	5.1	/	/
2390.000000	48.79	---	150.0	H	279.0	5.1	74.00	25.21
2390.000000	---	44.13	150.0	H	279.0	5.1	54.00	9.87
Middle Channel: 2437MHz								
2437.000000	102.14	---	200.0	H	208.0	5.2	/	/
2437.000000	---	98.94	200.0	H	208.0	5.2	/	/
High Channel: 2462MHz								
2462.000000	---	98.72	100.0	H	221.0	5.2	/	/
2462.000000	102.82	---	100.0	H	221.0	5.2	/	/
2483.500000	47.63	---	150.0	H	276.0	5.3	74.00	26.37
2483.500000	---	43.09	150.0	H	276.0	5.3	54.00	10.91

802.11g Mode: *(Pre-scan in the X,Y and Z axes of orientation, the worst case X-axis of orientation was recorded)*

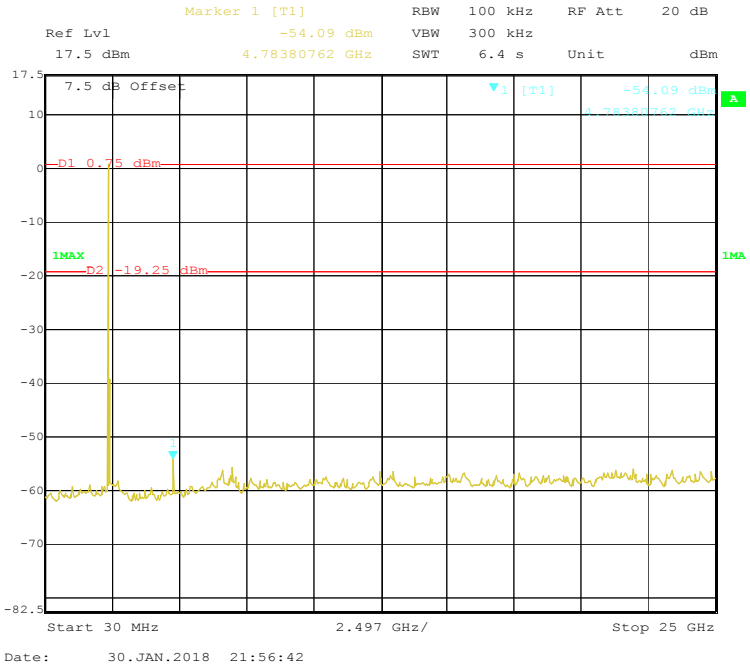
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV /m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
Low Channel: 2412MHz								
2412.000000	94.38	---	200.0	H	162.0	5.1	/	/
2412.000000	---	89.18	200.0	H	162.0	5.1	/	/
2390.000000	47.34	---	200.0	H	66.0	5.1	74.00	26.66
2390.000000	---	39.10	200.0	H	66.0	5.1	54.00	14.90
Middle Channel: 2437MHz								
2437.000000	94.74	---	250.0	H	134.0	5.2	/	/
2437.000000	---	89.52	250.0	H	134.0	5.2	/	/
High Channel: 2462MHz								
2462.000000	---	90.13	150.0	H	301.0	5.2	/	/
2462.000000	94.31	---	150.0	H	301.0	5.2	/	/
2483.500000	47.12	---	100.0	H	223.0	5.3	74.00	26.88
2483.500000	---	38.62	100.0	H	223.0	5.3	54.00	15.38

802.11n-HT20 Mode: *(Pre-scan in the X,Y and Z axes of orientation, the worst case X-axis of orientation was recorded)*

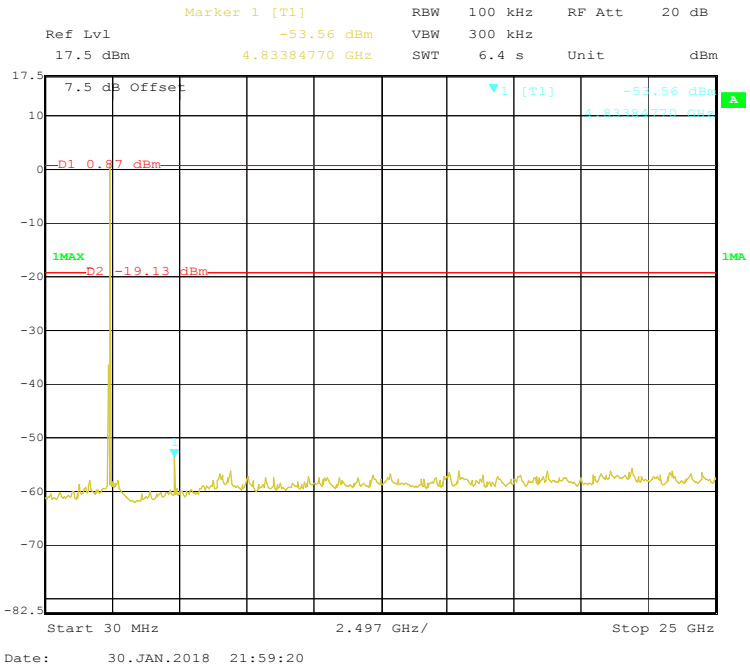
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
Low Channel: 2412MHz								
2412.000000	91.27	---	100.0	H	122.0	5.1	/	/
2412.000000	---	87.17	100.0	H	122.0	5.1	/	/
2390.000000	48.28	---	200.0	H	72.0	5.1	74.00	25.72
2390.000000	---	41.08	200.0	H	72.0	5.1	54.00	12.92
Middle Channel: 2437MHz								
2437.000000	92.51	---	200.0	H	111.0	5.2	/	/
2437.000000	---	87.40	200.0	H	111.0	5.2	/	/
High Channel: 2462MHz								
2462.000000	92.12	---	100.0	H	334.0	5.2	/	/
2462.000000	---	86.92	100.0	H	334.0	5.2	/	/
2483.500000	46.41	---	200.0	H	176.0	5.3	74.00	27.59
2483.500000	---	37.91	200.0	H	176.0	5.3	54.00	16.09

Conducted Spurious Emissions at Antenna Port

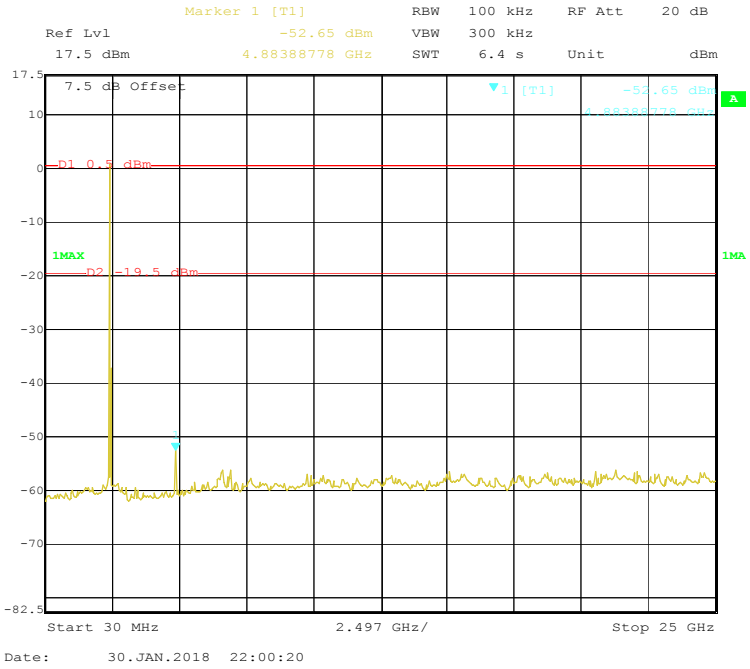
802.11b Low Channel



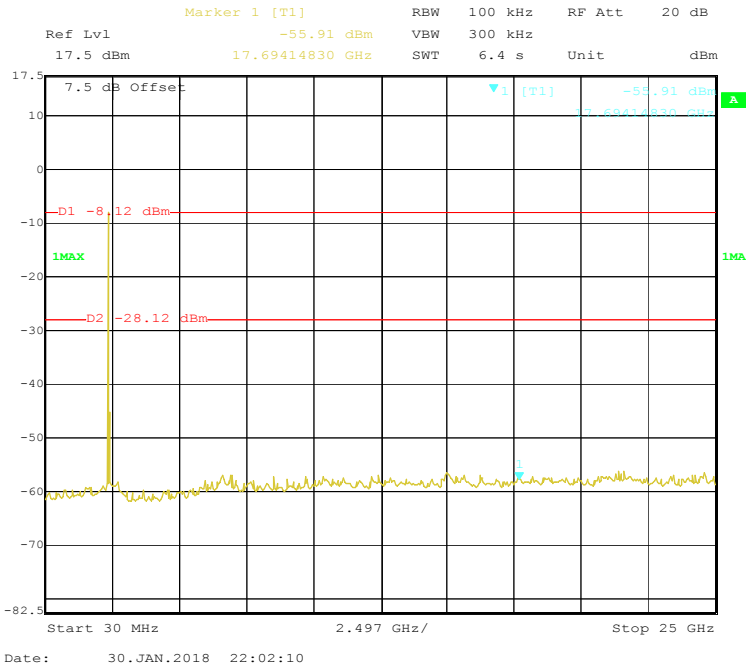
802.11b Middle Channel



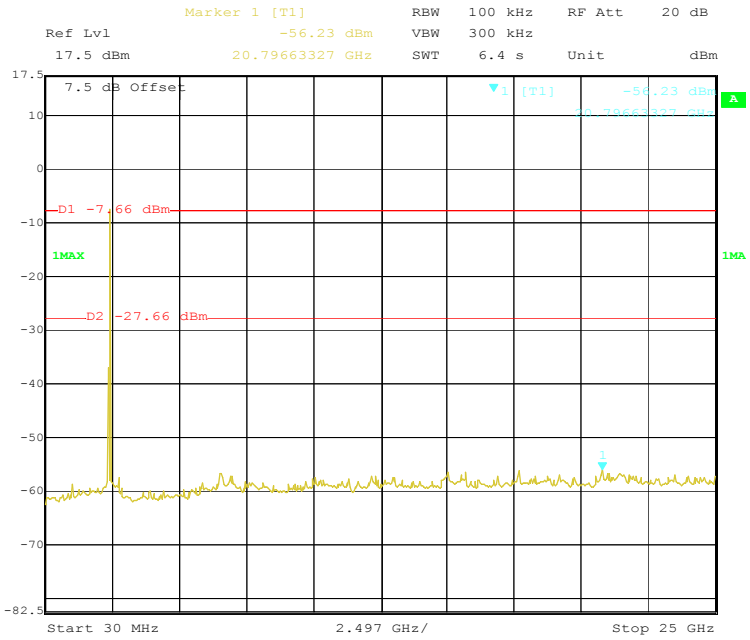
802.11b High Channel



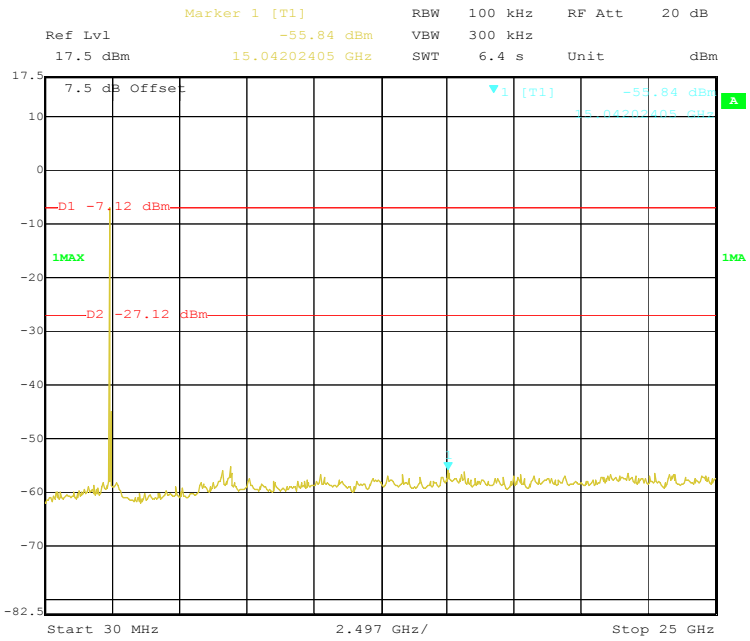
802.11g Low Channel



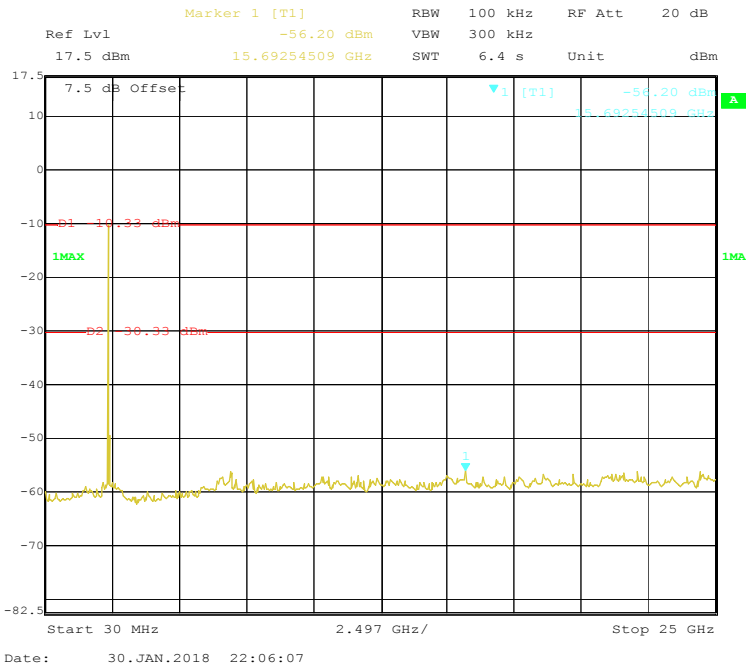
802.11g Middle Channel



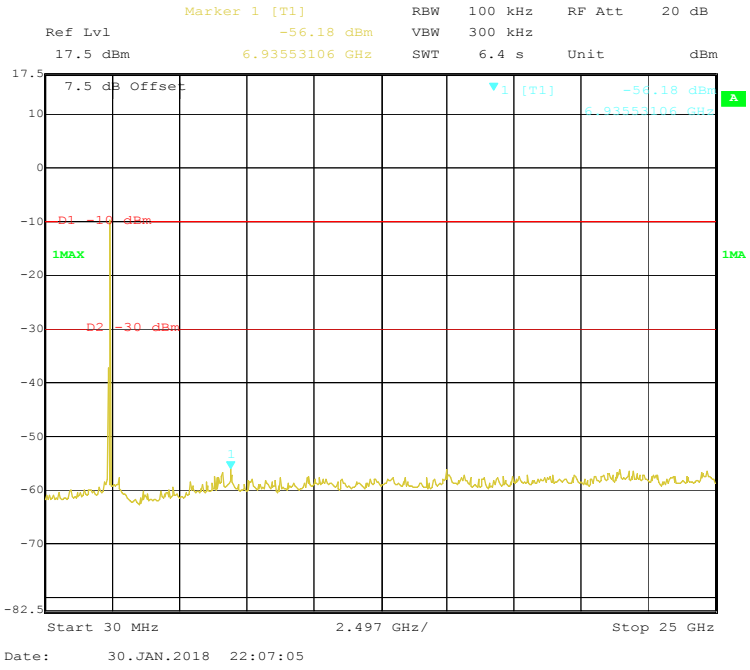
802.11g High Channel



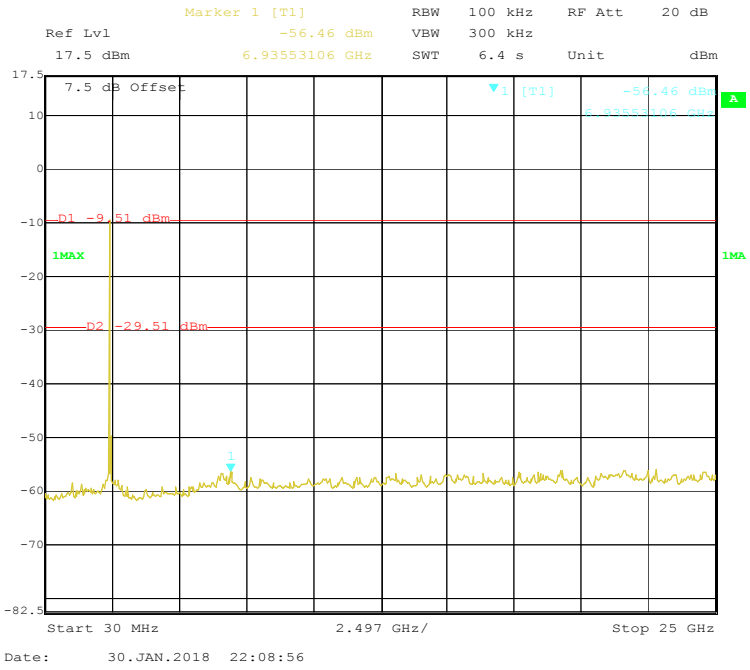
802.11n-HT20 Low Channel



802.11n-HT20 Middle Channel



802.11n-HT20 High Channel



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

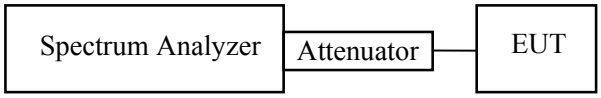
Applicable Standard

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

According to KDB558074 D01 DTS Meas Guidance v04 sub-clause 8.1

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3xRBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. 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 Data

Environmental Conditions

Temperature:	24.2℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

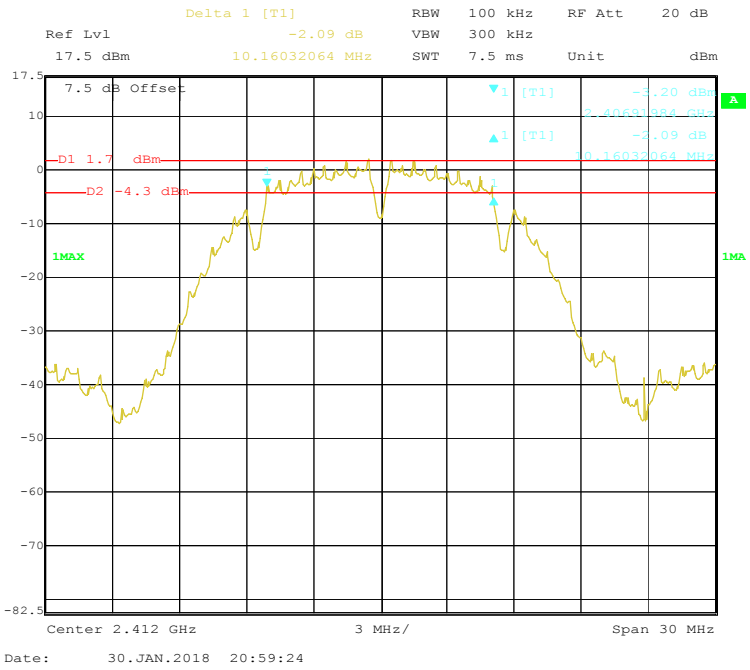
The testing was performed by Aaron Wang on 2018-01-30.

Test Result: Pass.

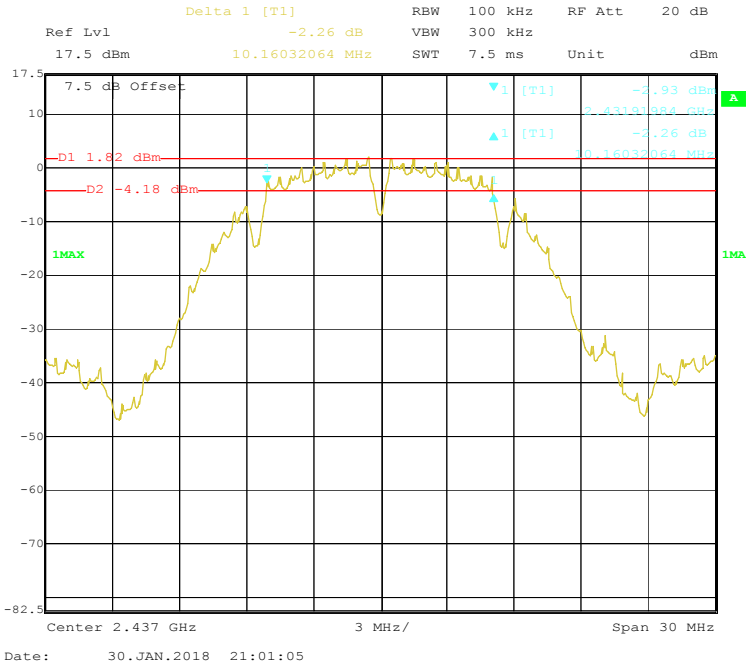
EUT operation mode: Transmitting

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (MHz)
802.11b mode			
Low	2412	10.16	≥0.5
Middle	2437	10.16	≥0.5
High	2462	10.04	≥0.5
802.11g mode			
Low	2412	16.65	≥0.5
Middle	2437	16.59	≥0.5
High	2462	16.59	≥0.5
802.11n-HT20 mode			
Low	2412	17.86	≥0.5
Middle	2437	17.86	≥0.5
High	2462	17.86	≥0.5

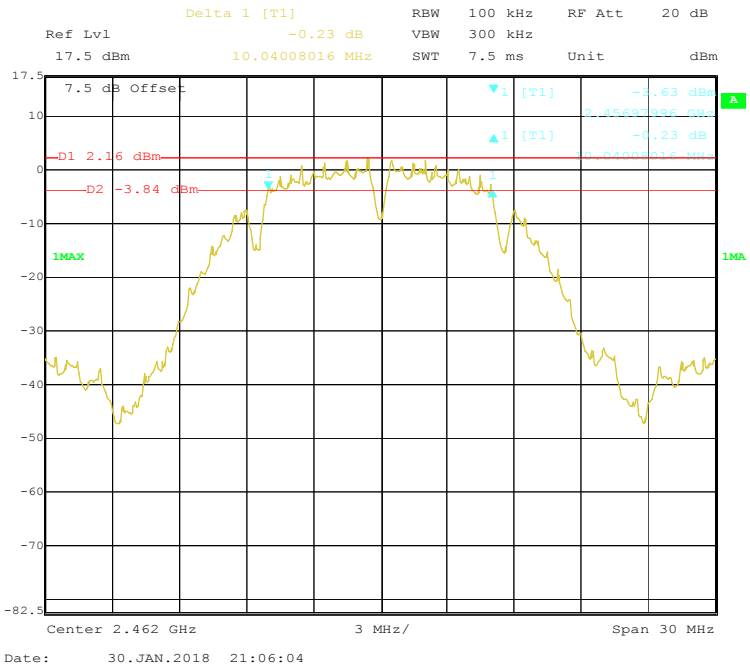
802.11b Low Channel



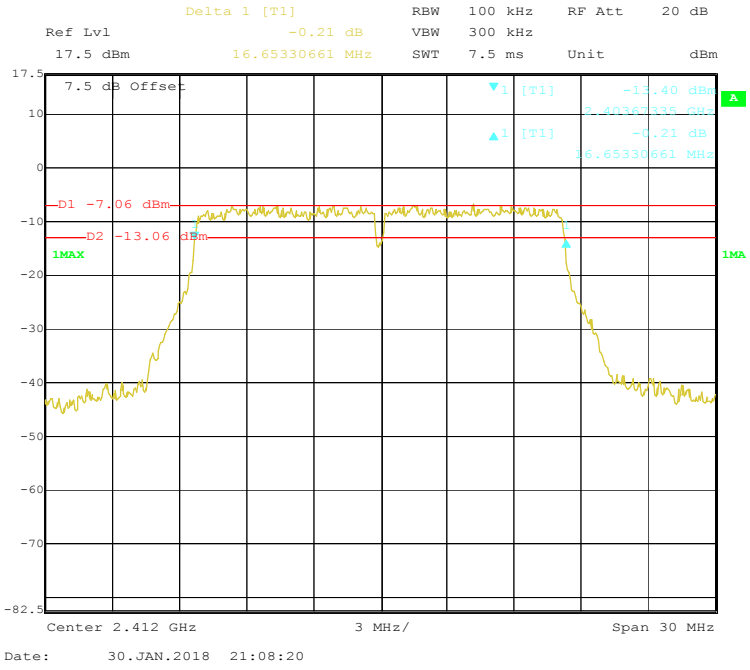
802.11b Middle Channel



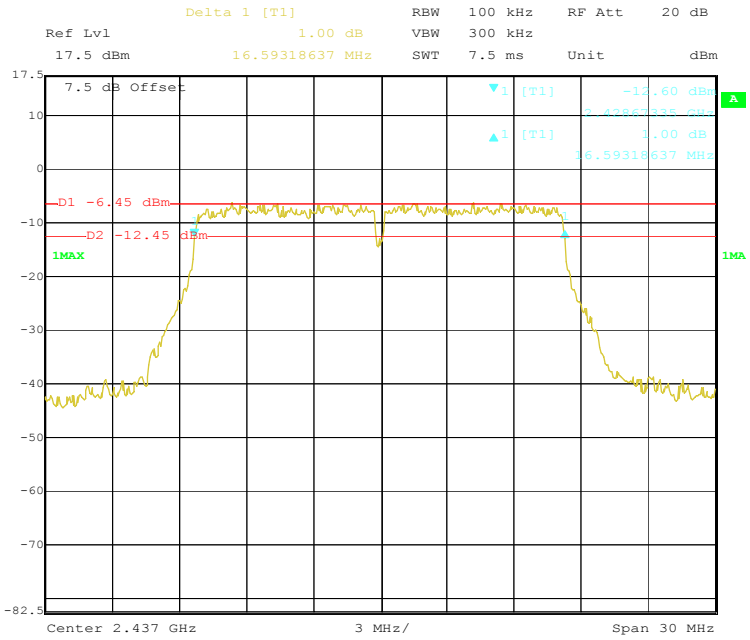
802.11b High Channel



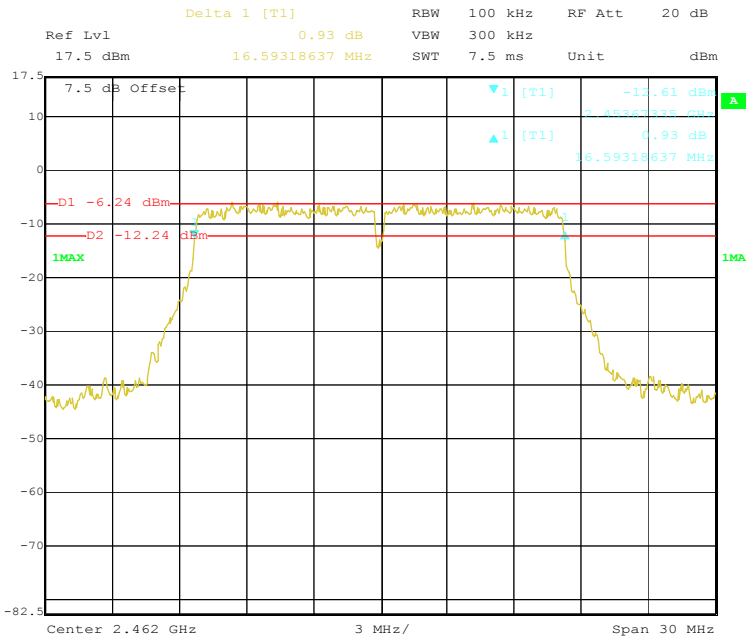
802.11g Low Channel



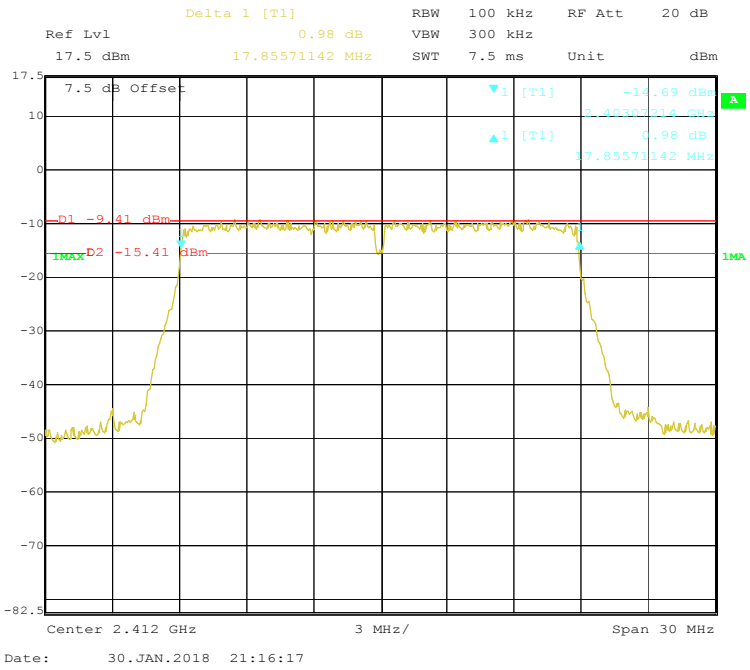
802.11g Middle Channel



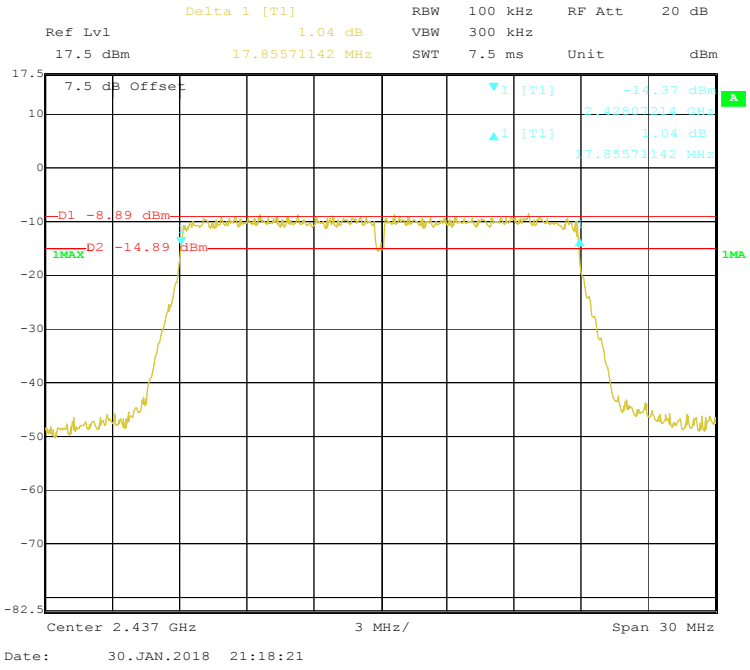
802.11g High Channel



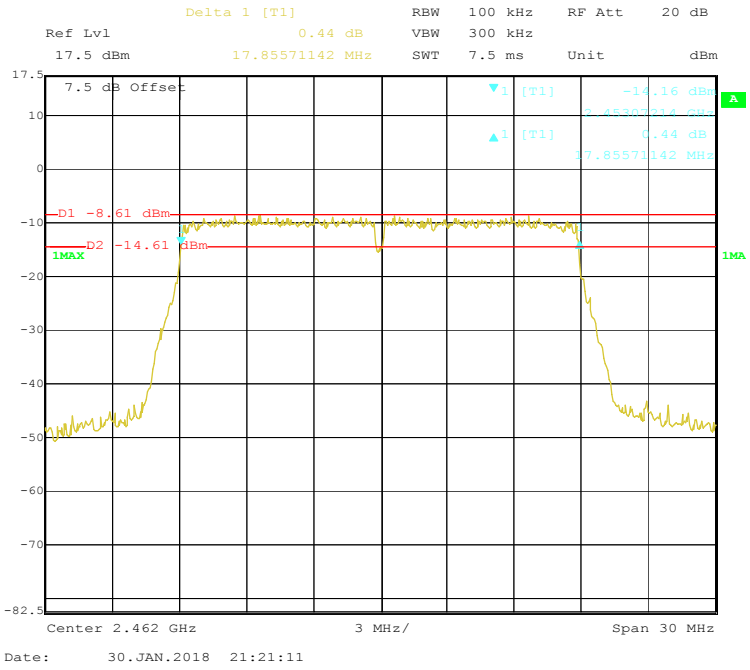
802.11n-HT20 Low Channel



802.11n-HT20 Middle Channel



802.11n-HT20 High Channel



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

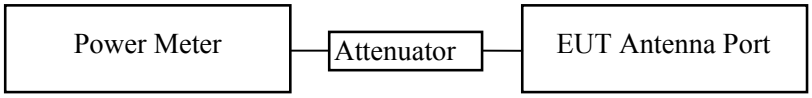
Applicable Standard

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

According to KDB558074 D01 DTS Meas Guidance v04 sub-clause 9.1.3

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall use a fast-responding diode detector.



Test Data

Environmental Conditions

Temperature:	24.2℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

The testing was performed by Aaron Wang on 2018-01-31.

EUT operation mode: Transmitting

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Limit (dBm)	Result
802.11b				
Low	2412	14.87	30	Pass
Middle	2437	15.09	30	Pass
High	2462	15.22	30	Pass
802.11g				
Low	2412	14.31	30	Pass
Middle	2437	14.29	30	Pass
High	2462	14.89	30	Pass
802.11n-HT20				
Low	2412	12.39	30	Pass
Middle	2437	12.86	30	Pass
High	2462	13.17	30	Pass

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

According to KDB558074 D01 DTS Meas Guidance v04 sub-clause 13.2 and ANSI C63.10-2013 clause 6.10.

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

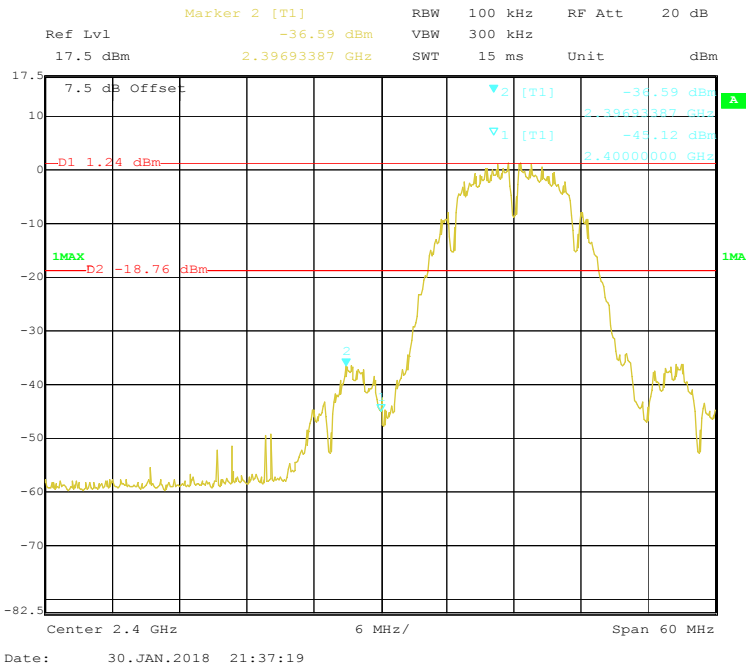
Environmental Conditions

Temperature:	24.2℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

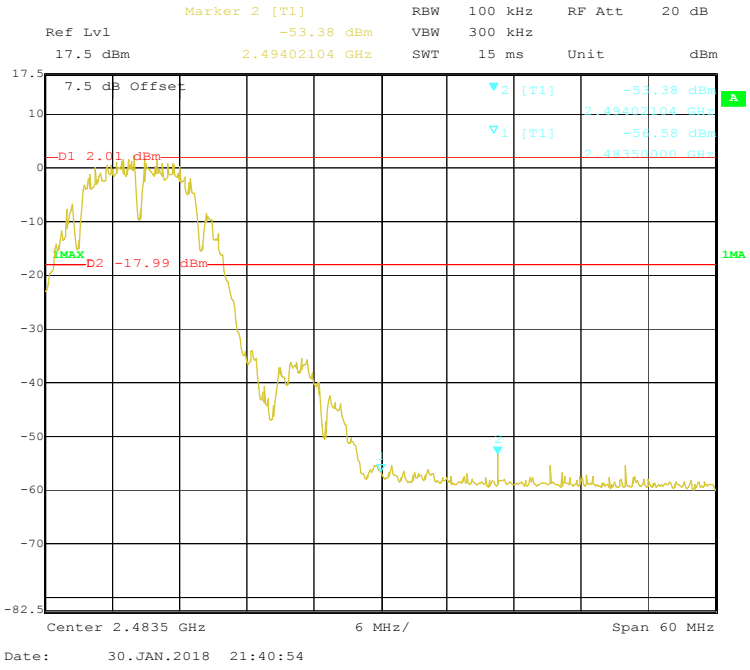
The testing was performed by Aaron Wang on 2018-01-30.

Test Result: *Compliance*

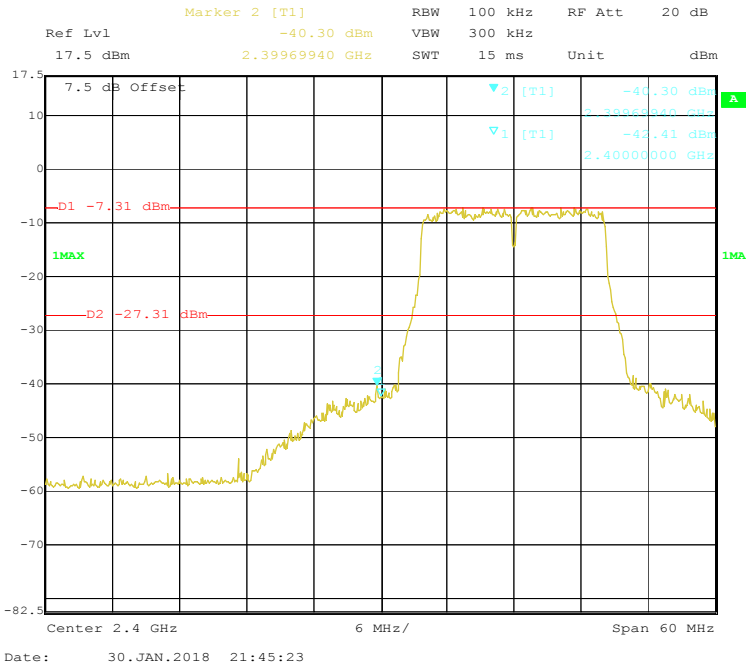
802.11b Mode Left Side



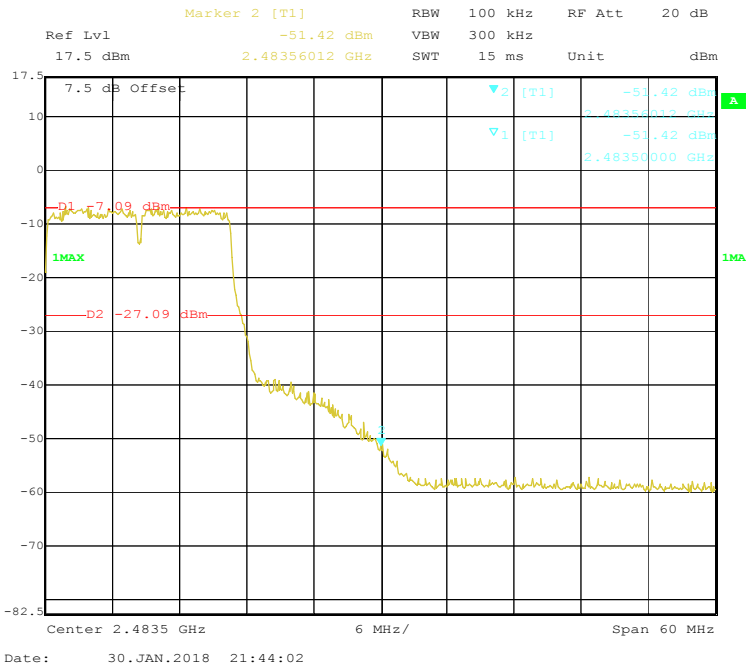
802.11b Mode Right Side



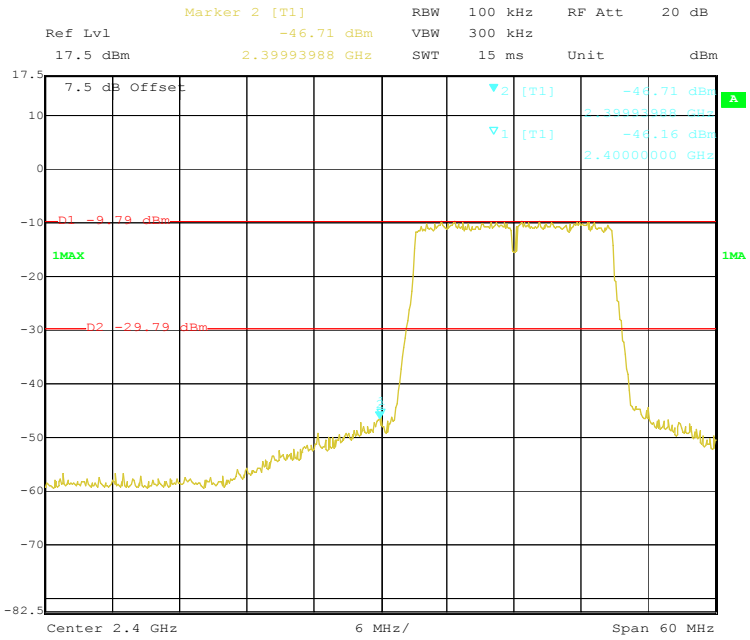
802.11g Mode Left Side



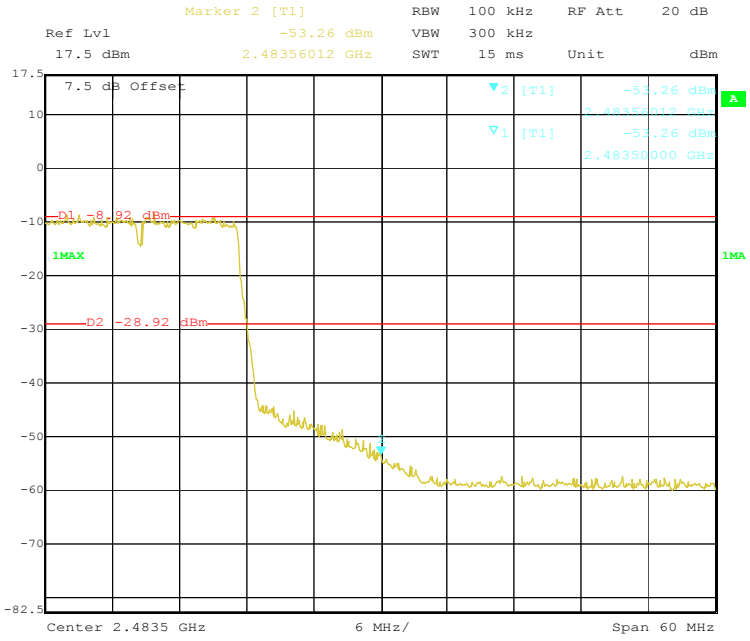
802.11g Mode Right Side



802.11n-HT20 Mode Left Side



802.11n-HT20 Mode 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 v04 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: 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:	24.2℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

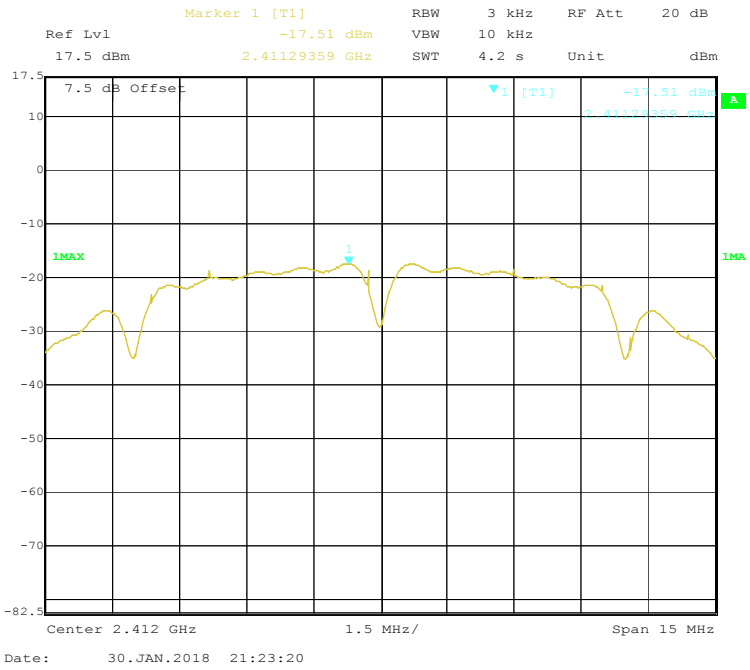
The testing was performed by Aaron Wang on 2018-01-30.

EUT operation mode: Transmitting

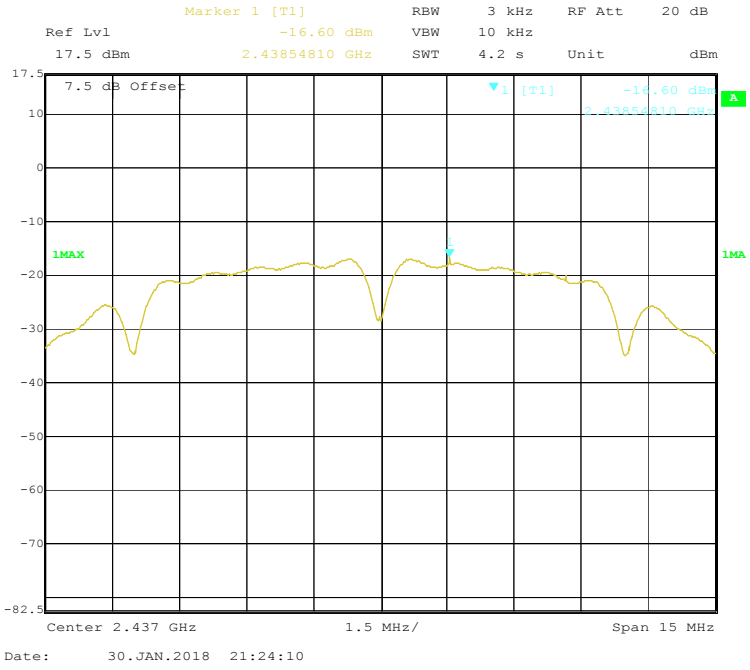
Test Result: Pass

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
802.11b mode			
Low	2412	-17.51	≤8
Middle	2437	-16.60	≤8
High	2462	-17.62	≤8
802.11g mode			
Low	2412	-21.92	≤8
Middle	2437	-21.21	≤8
High	2462	-21.58	≤8
802.11n-HT20 mode			
Low	2412	-22.02	≤8
Middle	2437	-20.54	≤8
High	2462	-21.45	≤8

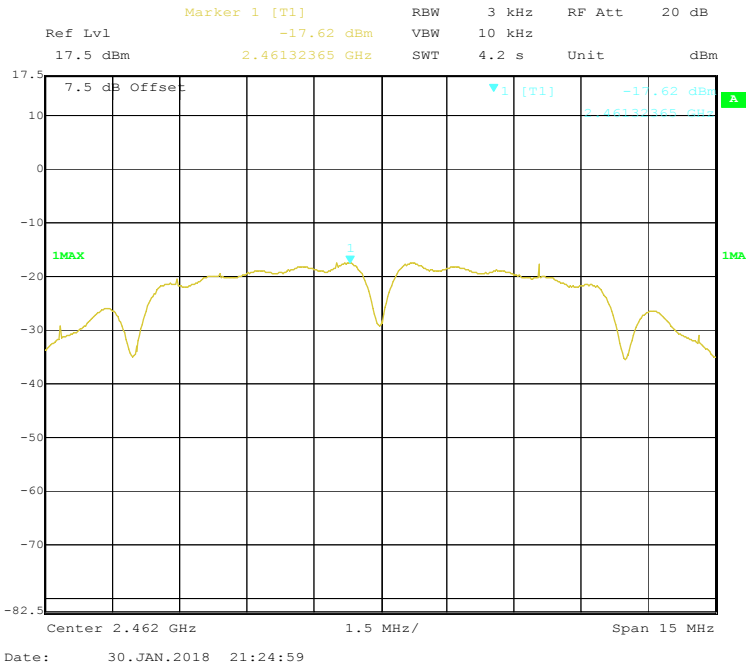
802.11b Low Channel



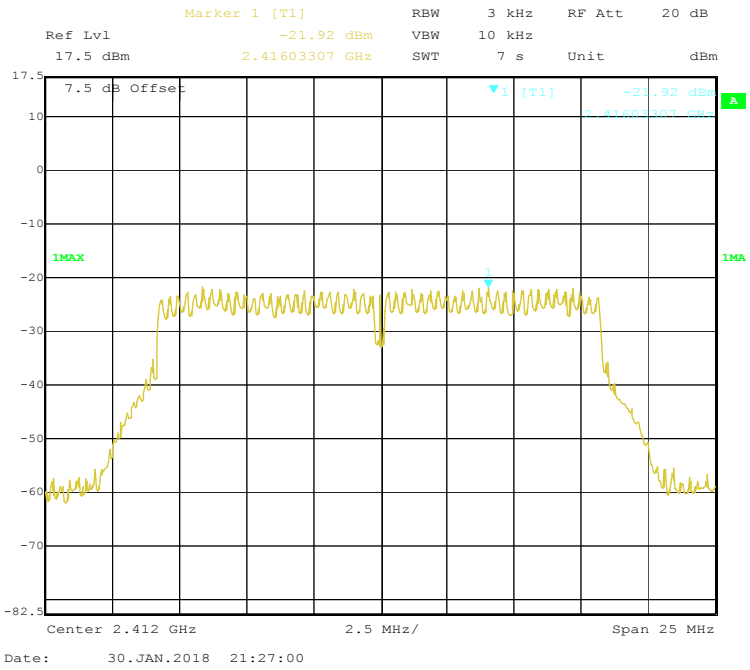
802.11b Middle Channel



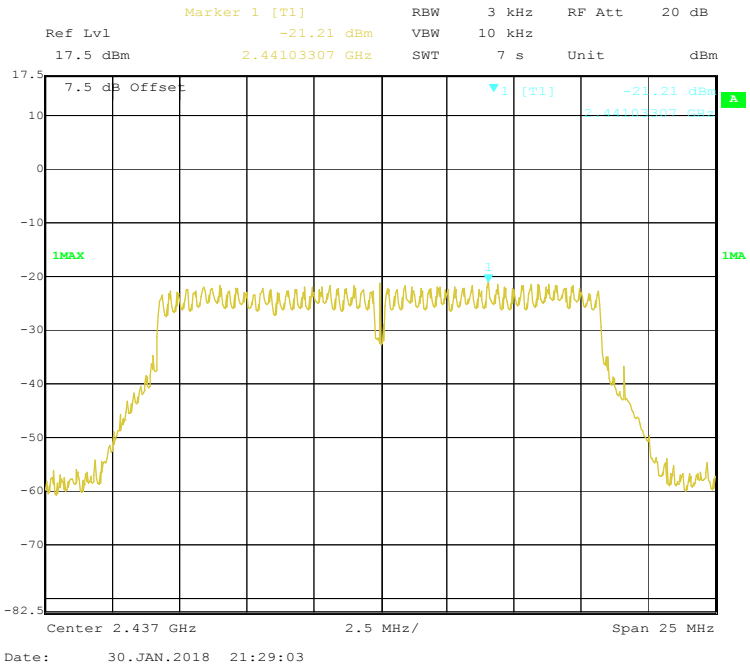
802.11b High Channel



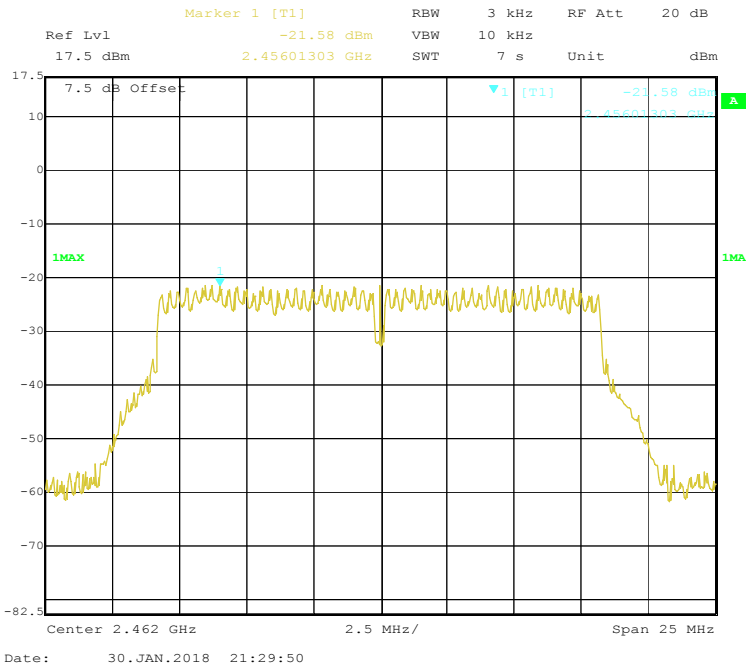
802.11g Low Channel



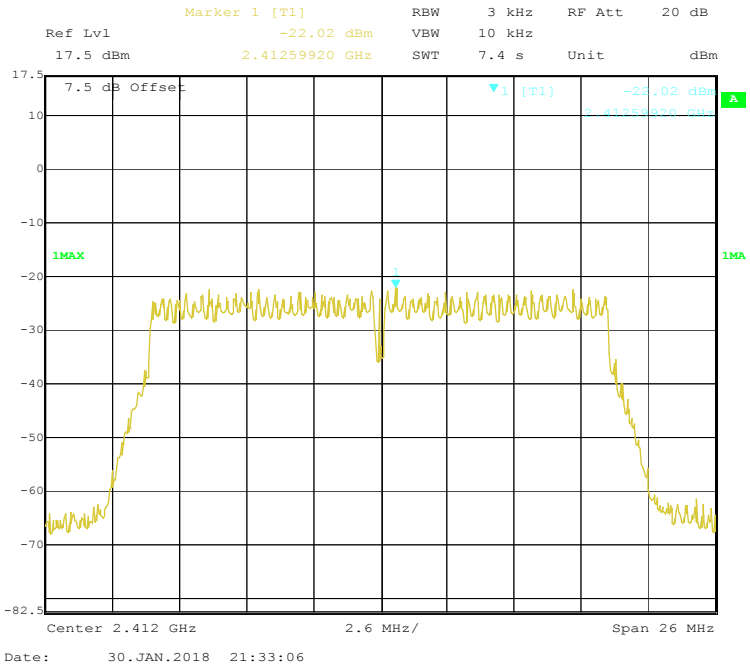
802.11g Middle Channel



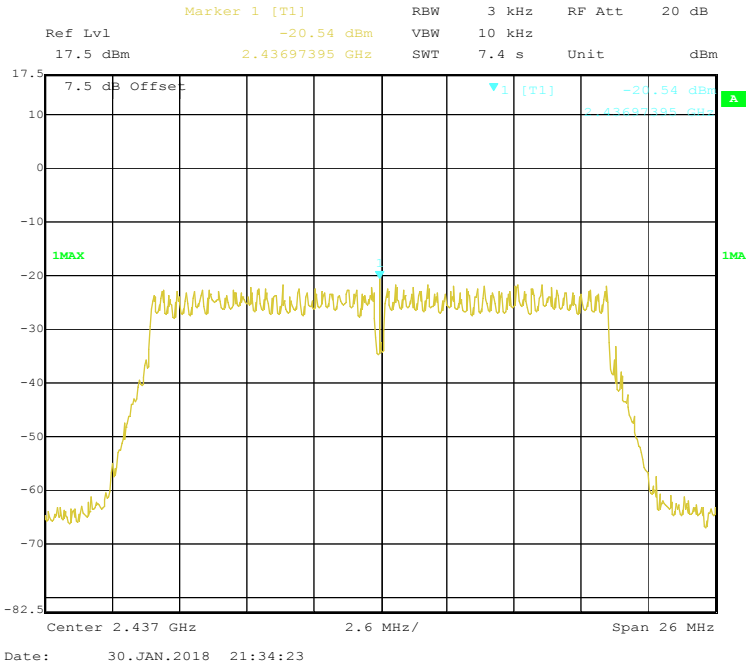
802.11g High Channel



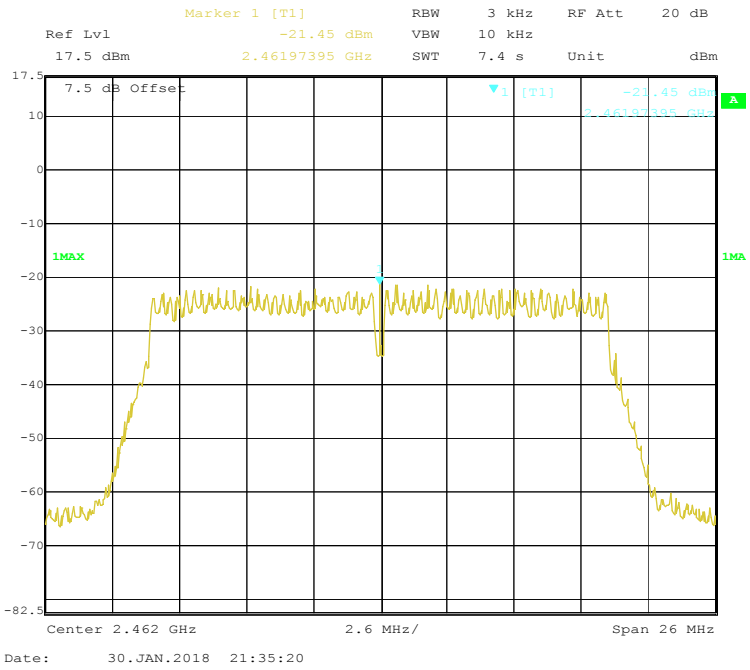
802.11n-HT20 Low Channel



802.11n-HT20 Middle Channel



802.11n-HT20 High Channel



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