FCC PART 15.247

TEST REPORT

For

Zhejiang Flashforge 3D Technology CO., Ltd.

No. 518, Xianyuan Road Jinhua, Zhejiang, China

FCC ID: 2AKLL-GUIDERII

Report Type:	Product Type:
Original Report	3D printer

Test Engineer:	Chris Wang
Report Number:	RKS170601002-00A
Report Date:	2017-07-04
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)

Applicant	Zhejiang Flashforge 3D Technology CO., Ltd.
Tested Model	Guider Ⅱ
Product Type	3D printer
Dimension	490 mm(L)×550 mm(W)×560 mm(H)
Power Supply	100~240VAC

**All measurement and test data in this report was gathered from production sample serial number:20170601001. (Assigned by the BACL. The EUT supplied by the applicant was received on 2017-06-01)*

Objective

This report is prepared on behalf of Zhejiang Flashforge 3D 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)

FCC Part15B JBP submissions with FCC ID: 2AKLL-GUIDERII.

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
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.

For 802.11n-HT40 mode, 7 channels are provided to testing

Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	8	2447
4	2427	9	2452
5	2432	/	/
6	2437	/	/
7	2442	/	/

EUT was tested with Channel 3, 6 and 9.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

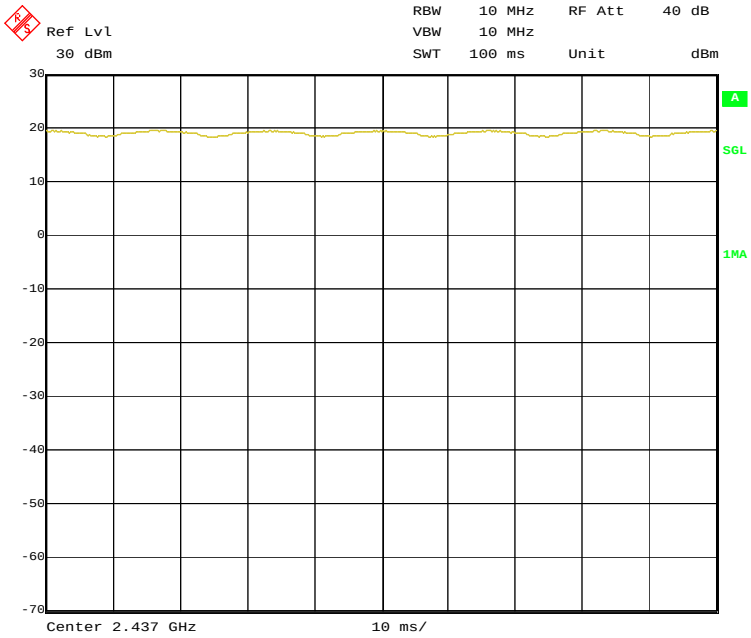
REALTEK 11n 8188EUS USB WLAN NIC Massproduction Kit

The device was tested with 100% duty cycle and the worst case was performed as below:

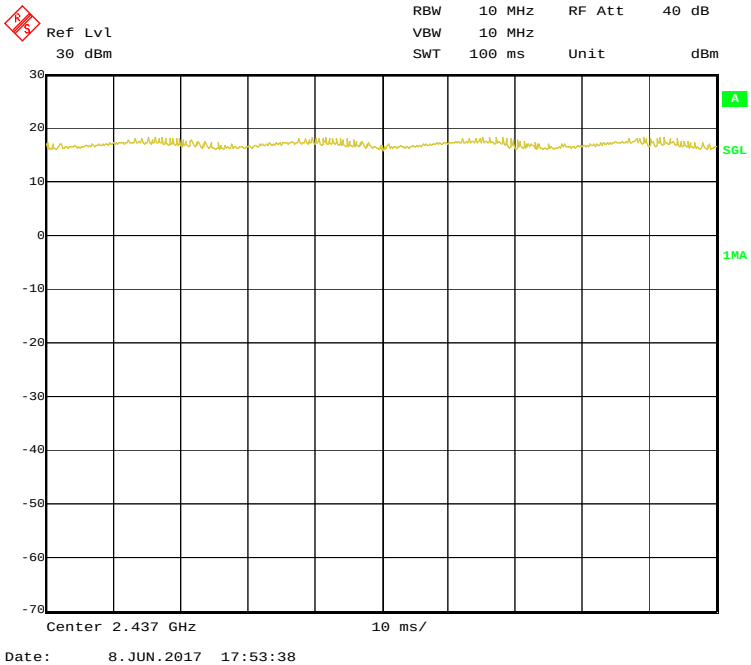
802.11b: Data rate:1 Mbps, Power level: 50
802.11g: Data rate: 6 Mbps, Power level: 50
802.11n-HT20: Data rate: MCS0, Power level: 50
802.11n-HT40: Data rate: MCS0, Power level: 50

Duty Cycle

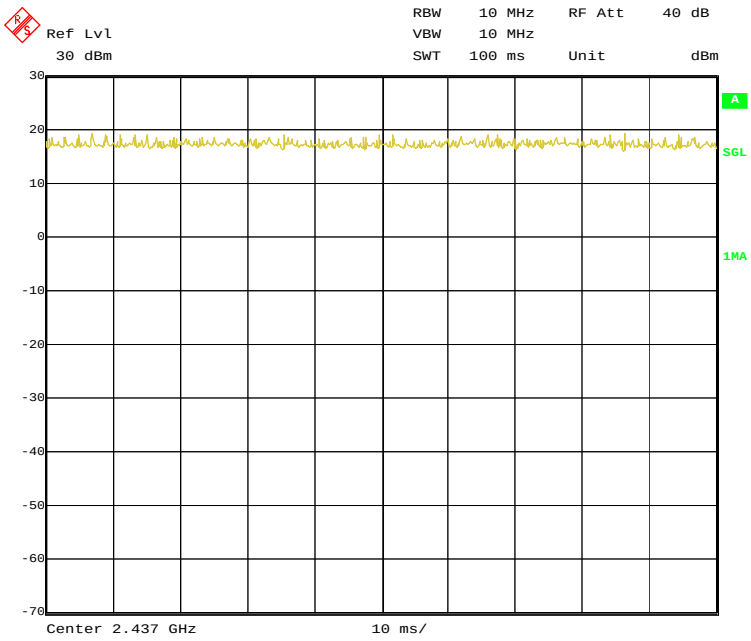
802.11b Mode Middle Channel Duty Cycle



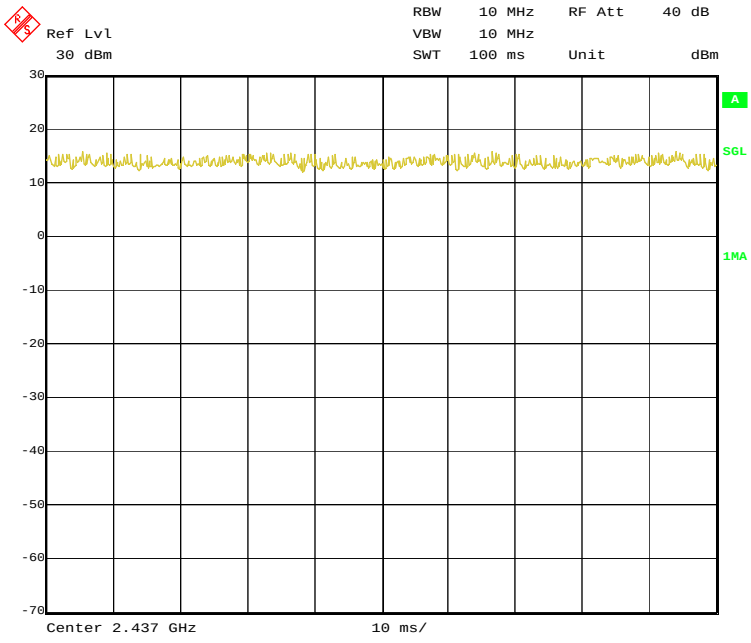
802.11g Mode Middle Channel Duty Cycle



802.11n20 Mode Middle Channel Duty Cycle



802.11n40 Mode Middle Channel Duty Cycle



Band	Duty Cycle (%)	T(ms)	1/T(kHz)	VBW Setting	10log(1/x)
802.11b	100%	/	/	10Hz	0
802.11g	100%	/	/	10Hz	0
802.11n-HT20	100%	/	/	10Hz	0
802.11n-HT40	100%	/	/	10Hz	0

Support Equipment List and Details

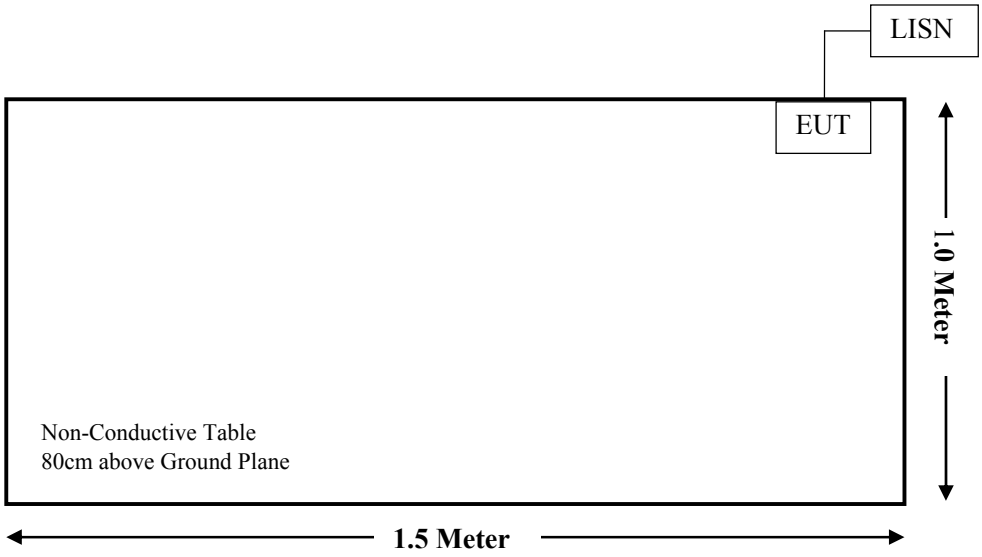
Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

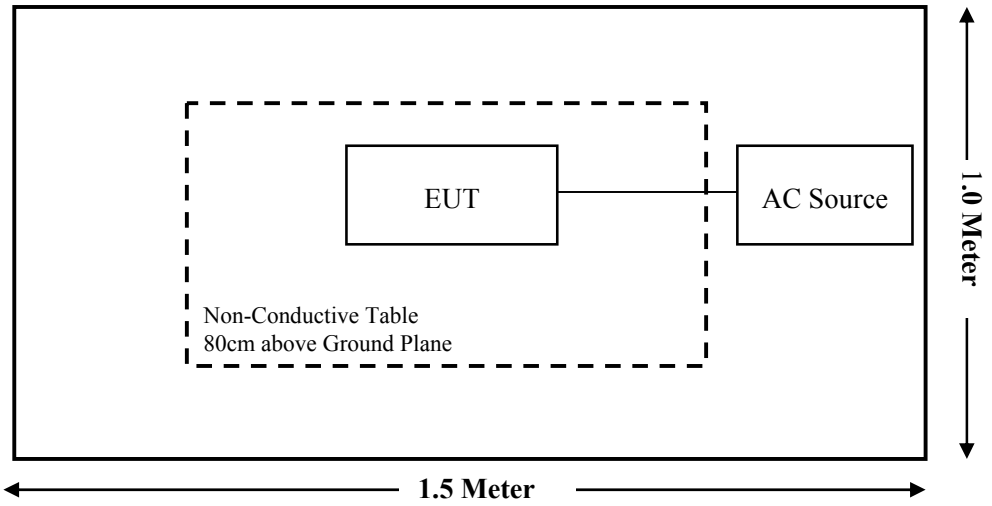
Cable Description	Length (m)	From Port	To
/	/	/	/

Block Diagram of Test Setup

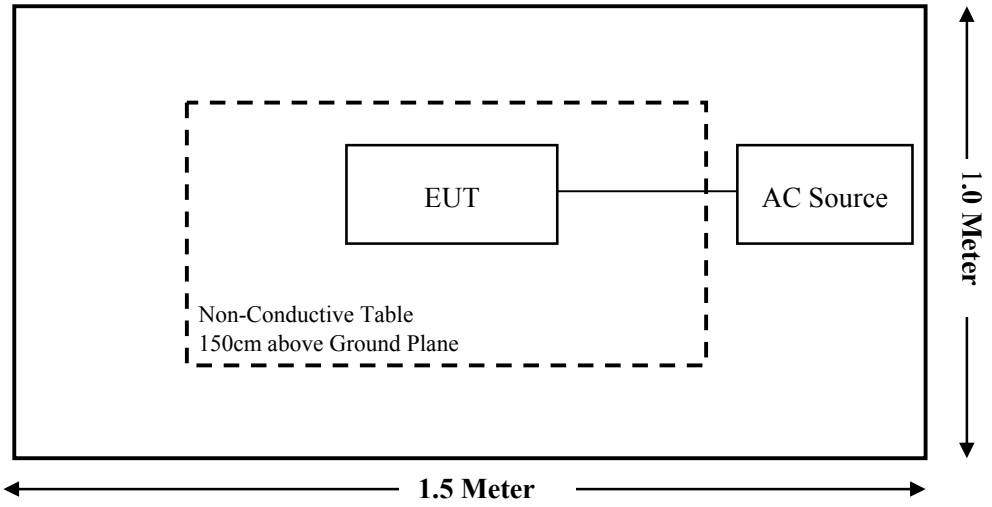
For Conducted Emissions:



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
ETS-LINDGREN	Horn Antenna	3116	00084159	2016-10-18	2019-10-17
Sonoma Instrunent	Amplifier	330	171377	2016-12-12	2017-12-11
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-12-12	2017-12-11
Heatsink Required	Amplifier	QLW-18405536-J0	15964001009	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
Agilent	Power Meter	N1912A	MY5000492	2016-11-18	2017-11-17
Agilent	Power Sensor	N1921A	MY54210024	2016-11-18	2017-11-17
Zhejiang Flashforge	RF Cable	N/A	N/A	2017-06-08	2018-06-07
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	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		Target Output Power	Output Power		Evaluation Distance	Power Density	MPE Limit
	(MHz)	(dBi)	(numeric)	(dBm)	(dBm)	(mW)	(cm)	(mW/cm^2)	(mW/cm^2)
802.11b	2412~2462	2.0	1.58	15±0.5	15.50	35.48	20	0.0112	1
802.11g		2.0	1.58	11.5±1	12.50	17.78	20	0.0056	1
802.11 n-HT20		2.0	1.58	11.5±1	12.50	17.78	20	0.0056	1
802.11 n-HT40	2422~2452	2.0	1.58	10.5±1	11.50	14.13	20	0.0045	1

Note: For the above target output power are all 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 Wi-Fi, which the antenna gain is 2.0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

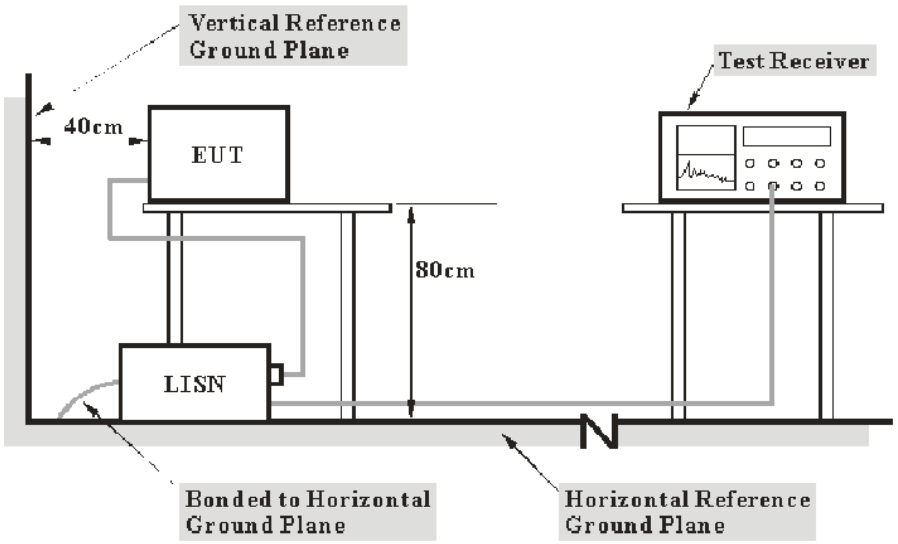
Result: Compliance.

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.

Test Data

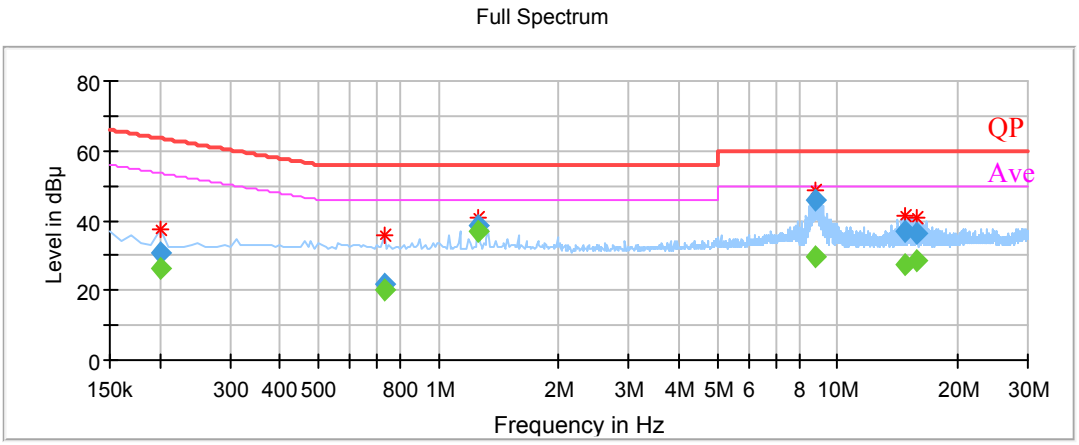
Environmental Conditions

Temperature:	20.4℃
Relative Humidity:	54 %
ATM Pressure:	101.3 kPa

The testing was performed by Chris Wang on 2017-06-25.

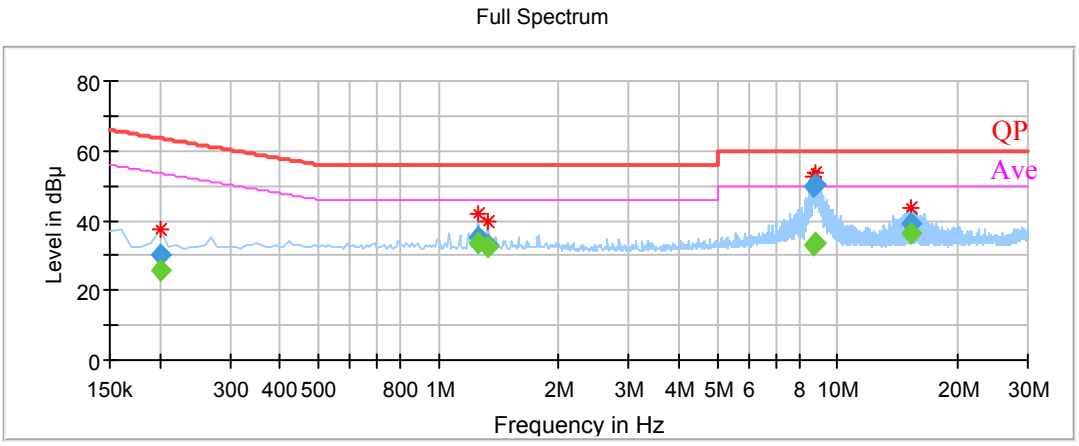
EUT operation mode: Transmitting in 802.11g High channel (worst case)

AC 120V/60 Hz, Line



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.200000	---	26.06	9.000	L1	10.2	27.55	53.61	Compliance
0.200000	30.58	---	9.000	L1	10.2	33.03	63.61	Compliance
0.730000	---	20.41	9.000	L1	9.9	25.59	46.00	Compliance
0.730000	21.97	---	9.000	L1	9.9	34.03	56.00	Compliance
1.260000	---	36.99	9.000	L1	9.9	9.01	46.00	Compliance
1.260000	38.35	---	9.000	L1	9.9	17.65	56.00	Compliance
8.820000	---	29.76	9.000	L1	10.0	20.24	50.00	Compliance
8.820000	46.10	---	9.000	L1	10.0	13.90	60.00	Compliance
14.720000	---	27.39	9.000	L1	10.0	22.61	50.00	Compliance
14.720000	36.88	---	9.000	L1	10.0	23.12	60.00	Compliance
15.850000	---	28.56	9.000	L1	10.0	21.44	50.00	Compliance
15.850000	36.32	---	9.000	L1	10.0	23.68	60.00	Compliance

AC 120V/60 Hz, Neutral



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.200000	---	26.00	9.000	N	10.1	27.61	53.61	Compliance
0.200000	30.34	---	9.000	N	10.1	33.27	63.61	Compliance
1.260000	---	33.68	9.000	N	9.9	12.32	46.00	Compliance
1.260000	35.07	---	9.000	N	9.9	20.93	56.00	Compliance
1.330000	33.28	---	9.000	N	9.9	22.72	56.00	Compliance
1.330000	---	32.33	9.000	N	9.9	13.67	46.00	Compliance
8.690000	49.55	---	9.000	N	10.0	10.45	60.00	Compliance
8.690000	---	33.16	9.000	N	10.0	16.84	50.00	Compliance
8.820000	50.54	---	9.000	N	10.0	9.46	60.00	Compliance
8.820000	---	33.43	9.000	N	10.0	16.57	50.00	Compliance
15.190000	---	36.43	9.000	N	10.0	13.57	50.00	Compliance
15.190000	39.01	---	9.000	N	10.0	20.99	60.00	Compliance

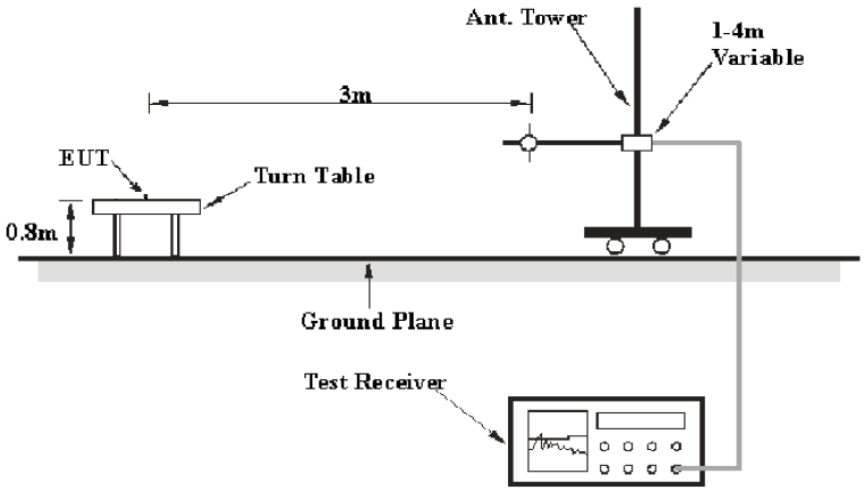
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

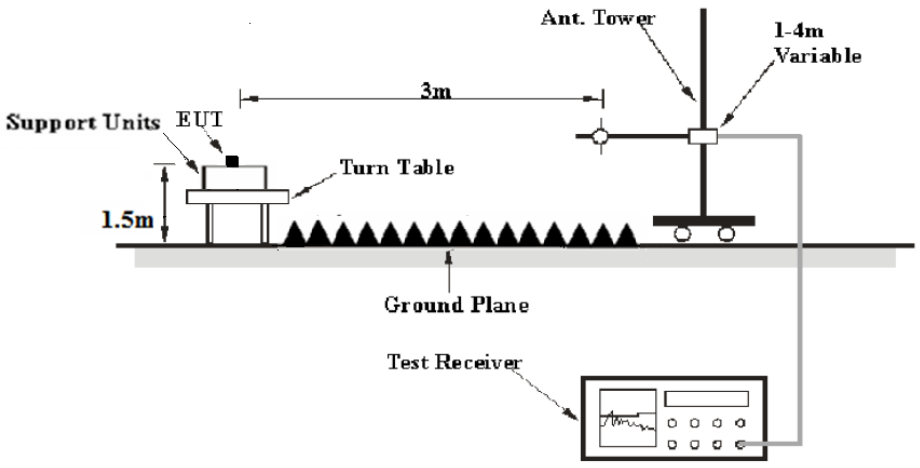
FCC §15.247 (d); §15.209; §15.205;

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:	20.4℃
Relative Humidity:	54 %
ATM Pressure:	101.3 kPa

The testing was performed by Chris Wang on 2017-06-08.

EUT operation mode: Transmitting

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)									
86.50	42.01	QP	191	100	V	-5.74	36.27	40	3.73
173.04	40.45	QP	326	199	H	-1.68	38.77	43.5	4.73
2412.00	114.99	PK	262	150	V	-6.17	108.82	/	/
2412.00	105.99	Ave	262	150	V	-6.17	99.82	/	/
2412.00	110.55	PK	75	211	H	-6.17	104.38	/	/
2412.00	101.52	Ave	75	211	H	-6.17	95.35	/	/
2390.00	41.73	PK	134	180	V	-6.22	35.51	74	38.49
2390.00	25.04	Ave	134	180	V	-6.22	18.82	54	35.18
2400.00	55.73	PK	60	110	V	-6.19	49.54	74	24.46
2400.00	44.98	Ave	60	110	V	-6.19	38.79	54	15.21
1594.88	53.18	PK	50	183	V	-9.01	44.17	74	29.83
1594.88	36.74	Ave	50	183	V	-9.01	27.73	54	26.27
4824.00	44.62	PK	138	238	H	1.66	46.28	74	27.72
4824.00	34.75	Ave	138	238	H	1.66	36.41	54	17.59
7236.00	39.46	PK	55	168	V	7.58	47.04	74	26.96
7236.00	25.86	Ave	55	168	V	7.58	33.44	54	20.56
Middle Channel (2437 MHz)									
86.50	42.04	QP	54	151	V	-5.74	36.30	40	3.70
173.04	40.66	QP	175	210	H	-1.68	38.98	43.5	4.52
2437.00	114.90	PK	339	217	V	-6.11	108.79	/	/
2437.00	105.74	Ave	339	217	V	-6.11	99.63	/	/
2437.00	111.89	PK	310	117	H	-6.11	105.78	/	/
2437.00	102.94	Ave	310	117	H	-6.11	96.83	/	/
1203.82	59.45	PK	210	112	H	-11.23	48.22	74	25.78
1203.82	37.78	Ave	210	112	H	-11.23	26.55	54	27.45
3322.05	43.70	PK	193	188	V	-2.40	41.30	74	32.70
3322.05	30.17	Ave	193	188	V	-2.40	27.77	54	26.23
4874.00	46.71	PK	76	223	H	1.77	48.48	74	25.52
4874.00	36.07	Ave	76	223	H	1.77	37.84	54	16.16
6674.76	43.00	PK	302	232	V	6.41	49.41	74	24.59
6674.76	29.60	Ave	302	232	V	6.41	36.01	54	17.99
7311.00	39.07	PK	316	111	V	7.66	46.73	74	27.27
7311.00	25.12	Ave	316	111	V	7.66	32.78	54	21.22

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)									
86.50	42.29	QP	39	130	V	-5.74	36.55	40	3.45
173.04	40.43	QP	208	156	H	-1.68	38.75	43.5	4.75
2462.00	114.81	PK	254	173	V	-6.06	108.75	/	/
2462.00	105.95	Ave	254	173	V	-6.06	99.89	/	/
2462.00	110.70	PK	30	109	H	-6.06	104.64	/	/
2462.00	101.86	Ave	30	109	H	-6.06	95.80	/	/
2483.50	48.34	PK	119	236	V	-6.01	42.33	74	31.67
2483.50	31.54	Ave	119	236	V	-6.01	25.53	54	28.47
1204.12	59.51	PK	111	218	H	-11.23	48.28	74	25.72
1204.12	37.59	Ave	111	218	H	-11.23	26.36	54	27.64
4924.00	55.21	PK	265	106	H	1.89	57.10	74	16.90
4924.00	45.74	Ave	265	106	H	1.89	47.63	54	6.37
6675.06	42.82	PK	174	238	V	6.41	49.23	74	24.77
6675.06	29.58	Ave	174	238	V	6.41	35.99	54	18.01
7386.00	39.94	PK	330	202	V	7.73	47.67	74	26.33
7386.00	26.03	Ave	330	202	V	7.73	33.76	54	20.24

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)									
86.50	42.60	QP	346	143	V	-5.74	36.86	40	3.14
173.04	40.68	QP	102	175	H	-1.68	39.00	43.5	4.50
2412.00	112.43	PK	125	184	V	-6.17	106.26	/	/
2412.00	100.92	Ave	125	184	V	-6.17	94.75	/	/
2412.00	107.88	PK	119	194	H	-6.17	101.71	/	/
2412.00	96.67	Ave	119	194	H	-6.17	90.50	/	/
2390.00	56.80	PK	88	238	V	-6.22	50.58	74	23.42
2390.00	33.55	Ave	88	238	V	-6.22	27.33	54	26.67
2400.00	62.12	PK	81	159	V	-6.19	55.93	74	18.07
2400.00	38.39	Ave	81	159	V	-6.19	32.20	54	21.80
1126.25	46.73	PK	146	198	V	-11.70	35.03	74	38.97
1126.25	31.54	Ave	146	198	V	-11.70	19.84	54	34.16
4824.00	54.21	PK	128	123	H	1.66	55.87	74	18.13
4824.00	32.36	Ave	128	123	H	1.66	34.02	54	19.98
7236.00	42.66	PK	329	231	H	7.58	50.24	74	23.76
7236.00	26.72	Ave	329	231	H	7.58	34.30	54	19.70
Middle Channel (2437 MHz)									
86.50	42.33	QP	320	188	V	-5.74	36.59	40	3.41
173.04	40.38	QP	344	170	H	-1.68	38.70	43.5	4.80
2437.00	111.98	PK	14	135	V	-6.11	105.87	/	/
2437.00	99.78	Ave	14	135	V	-6.11	93.67	/	/
2437.00	108.78	PK	356	218	H	-6.11	102.67	/	/
2437.00	97.01	Ave	356	218	H	-6.11	90.90	/	/
1680.86	52.53	PK	286	108	H	-8.60	43.93	74	30.07
1680.86	32.30	Ave	286	108	H	-8.60	23.70	54	30.30
3360.82	48.33	PK	210	159	V	-2.30	46.03	74	27.97
3360.82	31.05	Ave	210	159	V	-2.30	28.75	54	25.25
4874.00	56.46	PK	223	114	H	1.77	58.23	74	15.77
4874.00	34.25	Ave	223	114	H	1.77	36.02	54	17.98
6328.66	42.29	PK	351	116	H	5.28	47.57	74	26.43
6328.66	28.46	Ave	351	116	H	5.28	33.74	54	20.26
7311.00	42.28	PK	92	150	H	7.66	49.94	74	24.06
7311.00	25.47	Ave	92	150	H	7.66	33.13	54	20.87

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)									
86.50	42.66	QP	94	151	V	-5.74	36.92	40	3.08
173.04	40.80	QP	223	200	H	-1.68	39.12	43.5	4.38
2462.00	112.60	PK	155	161	V	-6.06	106.54	/	/
2462.00	100.31	Ave	155	161	V	-6.06	94.25	/	/
2462.00	107.93	PK	107	181	H	-6.06	101.87	/	/
2462.00	95.33	Ave	107	181	H	-6.06	89.27	/	/
2483.50	56.76	PK	184	120	V	-6.01	50.75	74	23.25
2483.50	33.56	Ave	184	120	V	-6.01	27.55	54	26.45
1201.38	58.18	PK	167	238	H	-11.25	46.93	74	27.07
1201.38	37.74	Ave	167	238	H	-11.25	26.49	54	27.51
4924.00	54.64	PK	63	217	H	1.89	56.53	74	17.47
4924.00	31.95	Ave	63	217	H	1.89	33.84	54	20.16
6079.16	42.70	PK	340	206	H	4.36	47.06	74	26.94
6079.16	28.57	Ave	340	206	H	4.36	32.93	54	21.07
7386.00	45.64	PK	59	122	H	7.73	53.37	74	20.63
7386.00	26.61	Ave	59	122	H	7.73	34.34	54	19.66

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)									
86.50	42.56	QP	285	206	V	-5.74	36.82	40	3.18
173.04	40.49	QP	48	238	H	-1.68	38.81	43.5	4.69
2412.00	112.61	PK	341	173	V	-6.17	106.44	/	/
2412.00	100.54	Ave	341	173	V	-6.17	94.37	/	/
2412.00	106.89	PK	58	131	H	-6.17	100.72	/	/
2412.00	95.71	Ave	58	131	H	-6.17	89.54	/	/
2390.00	56.50	PK	167	225	V	-6.22	50.28	74	23.72
2390.00	33.48	Ave	167	225	V	-6.22	27.26	54	26.74
2400.00	61.99	PK	18	121	V	-6.19	55.80	74	18.20
2400.00	38.40	Ave	18	121	V	-6.19	32.21	54	21.79
1201.11	58.63	PK	266	230	H	-11.25	47.38	74	26.62
1201.11	37.64	Ave	266	230	H	-11.25	26.39	54	27.61
4824.00	52.72	PK	51	184	H	1.66	54.38	74	19.62
4824.00	27.74	Ave	51	184	H	1.66	29.40	54	24.60
7236.00	41.01	PK	360	153	H	7.58	48.59	74	25.41
7236.00	25.62	Ave	360	153	H	7.58	33.20	54	20.80
Middle Channel (2437 MHz)									
86.50	42.08	QP	108	232	V	-5.74	36.34	40	3.66
173.04	40.42	QP	260	227	H	-1.68	38.74	43.5	4.76
2437.00	112.27	PK	181	222	V	-6.11	106.16	/	/
2437.00	99.84	Ave	181	222	V	-6.11	93.73	/	/
2437.00	108.36	PK	252	199	H	-6.11	102.25	/	/
2437.00	95.78	Ave	252	199	H	-6.11	89.67	/	/
1201.18	58.55	PK	79	128	H	-11.25	47.30	74	26.70
1201.18	37.60	Ave	79	128	H	-11.25	26.35	54	27.65
3072.24	46.14	PK	128	161	V	-3.05	43.09	74	30.91
3072.24	36.97	Ave	128	161	V	-3.05	33.92	54	20.08
4874.00	53.60	PK	203	216	H	1.77	55.37	74	18.63
4874.00	28.76	Ave	203	216	H	1.77	30.53	54	23.47
6467.64	42.57	PK	22	248	H	5.79	48.36	74	25.64
6467.64	29.17	Ave	22	248	H	5.79	34.96	54	19.04
7311.00	41.78	PK	308	218	H	7.66	49.44	74	24.56
7311.00	25.43	Ave	308	218	H	7.66	33.09	54	20.91

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)									
86.50	42.75	QP	200	239	V	-5.74	37.01	40	2.99
173.04	40.38	QP	107	123	H	-1.68	38.70	43.50	4.80
2462.00	112.05	PK	260	184	V	-6.06	105.99	/	/
2462.00	100.55	Ave	260	184	V	-6.06	94.49	/	/
2462.00	107.62	PK	49	154	H	-6.06	101.56	/	/
2462.00	94.77	Ave	49	154	H	-6.06	88.71	/	/
2483.50	56.75	PK	39	142	V	-6.01	50.74	74	23.26
2483.50	33.50	Ave	39	142	V	-6.01	27.49	54	26.51
1200.90	58.33	PK	261	181	H	-11.25	47.08	74	26.92
1200.90	37.85	Ave	261	181	H	-11.25	26.60	54	27.40
4924.00	53.55	PK	238	190	H	1.89	55.44	74	18.56
4924.00	29.52	Ave	238	190	H	1.89	31.41	54	22.59
6653.21	43.07	PK	133	182	V	6.35	49.42	74	24.58
6653.21	29.43	Ave	133	182	V	6.35	35.78	54	18.22
7386.00	43.97	PK	268	228	H	7.73	51.70	74	22.30
7386.00	26.28	Ave	268	228	H	7.73	34.01	54	19.99

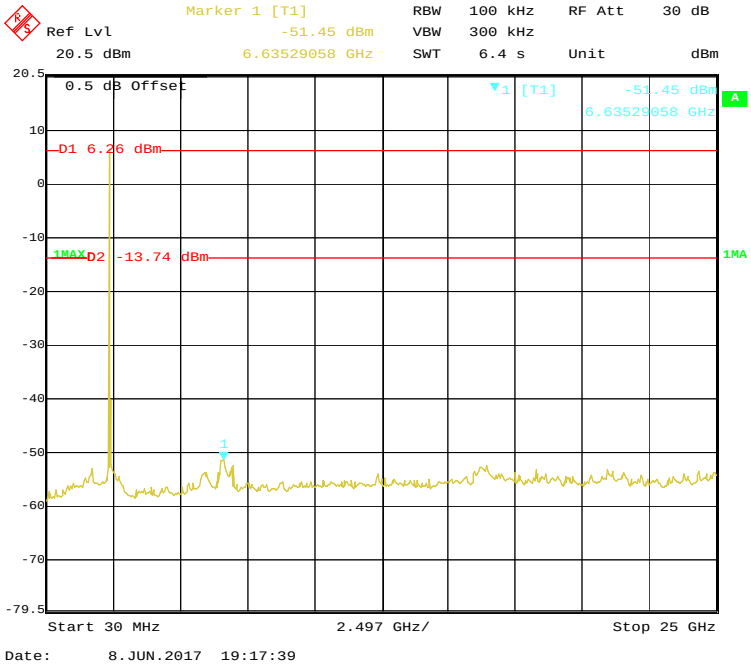
802.11n-HT40 Mode:

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 (2422 MHz)									
86.50	42.47	QP	80	106	V	-5.74	36.73	40	3.27
173.04	40.51	QP	63	233	H	-1.68	38.83	43.5	4.67
2422.00	108.71	PK	194	210	V	-6.14	102.57	/	/
2422.00	95.70	Ave	194	210	V	-6.14	89.56	/	/
2422.00	101.99	PK	60	245	H	-6.14	95.85	/	/
2422.00	90.70	Ave	60	245	H	-6.14	84.56	/	/
2390.00	55.85	PK	321	178	V	-6.22	49.63	74	24.37
2390.00	35.41	Ave	321	178	V	-6.22	29.19	54	24.81
2400.00	57.36	PK	12	177	V	-6.19	51.17	74	22.83
2400.00	35.62	Ave	12	177	V	-6.19	29.43	54	24.57
1200.90	57.90	PK	192	232	H	-11.25	46.65	74	27.35
1200.90	37.50	Ave	192	232	H	-11.25	26.25	54	27.75
4844.00	47.67	PK	33	144	H	1.70	49.37	74	24.63
4844.00	26.07	Ave	33	144	H	1.70	27.77	54	26.23
7266.00	39.06	PK	295	103	H	7.61	46.67	74	27.33
7266.00	24.93	Ave	295	103	H	7.61	32.54	54	21.46

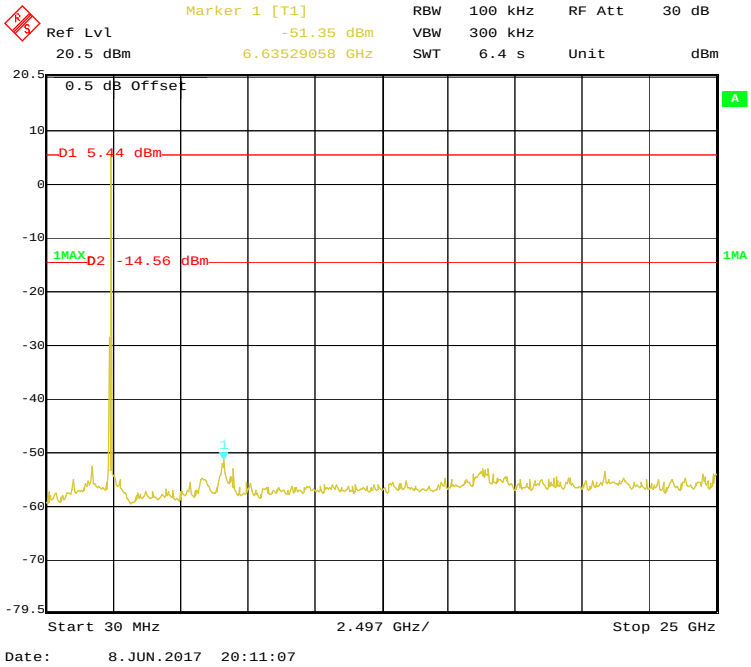
Frequency	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/205/209	
	Reading	Detector		Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
Middle Channel (2437 MHz)									
86.50	42.16	QP	280	234	V	-5.74	36.42	40	3.58
173.04	40.89	QP	302	135	H	-1.68	39.21	43.5	4.29
2437.00	108.60	PK	348	205	V	-6.11	102.49	/	/
2437.00	96.53	Ave	348	205	V	-6.11	90.42	/	/
2437.00	103.71	PK	295	110	H	-6.11	97.60	/	/
2437.00	91.23	Ave	295	110	H	-6.11	85.12	/	/
1200.90	58.00	PK	54	235	H	-11.25	46.75	74	27.25
1200.90	37.64	Ave	54	235	H	-11.25	26.39	54	27.61
3072.24	45.67	PK	158	121	V	-3.05	42.62	74	31.38
3072.24	36.83	Ave	158	121	V	-3.05	33.78	54	20.22
4874.00	49.69	PK	87	239	H	1.77	51.46	74	22.54
4874.00	25.22	Ave	87	239	H	1.77	26.99	54	27.01
6467.64	42.10	PK	184	208	H	5.79	47.89	74	26.11
6467.64	29.19	Ave	184	208	H	5.79	34.98	54	19.02
7311.00	39.76	PK	307	175	H	7.66	47.42	74	26.58
7311.00	24.90	Ave	307	175	H	7.66	32.56	54	21.44
High Channel (2452 MHz)									
86.50	42.45	QP	13	182	V	-5.74	36.71	40	3.29
173.04	40.63	QP	109	226	H	-1.68	38.95	43.5	4.55
2452.00	107.63	PK	145	199	V	-6.08	101.55	/	/
2452.00	94.61	Ave	145	199	V	-6.08	88.53	/	/
2452.00	102.50	PK	5	198	H	-6.08	96.42	/	/
2452.00	90.53	Ave	5	198	H	-6.08	84.45	/	/
2483.50	55.51	PK	101	188	V	-6.01	49.50	74	24.50
2483.50	33.52	Ave	101	188	V	-6.01	27.51	54	26.49
1200.90	58.10	PK	54	243	H	-11.25	46.85	74	27.15
1200.90	37.79	Ave	54	243	H	-11.25	26.54	54	27.46
4904.00	51.08	PK	354	152	H	1.84	52.92	74	21.08
4904.00	26.84	Ave	354	152	H	1.84	28.68	54	25.32
6467.64	42.61	PK	252	191	H	5.79	48.40	74	25.60
6467.64	29.59	Ave	252	191	H	5.79	35.38	54	18.62
7356.00	41.57	PK	186	153	H	7.70	49.27	74	24.73
7356.00	25.09	Ave	186	153	H	7.70	32.79	54	21.21

Conducted Spurious Emissions at Antenna Port

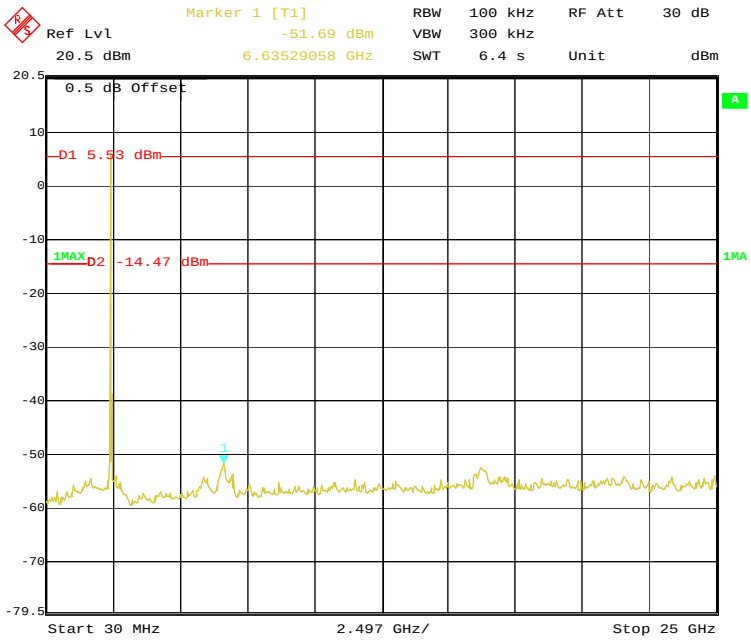
802.11b Low Channel



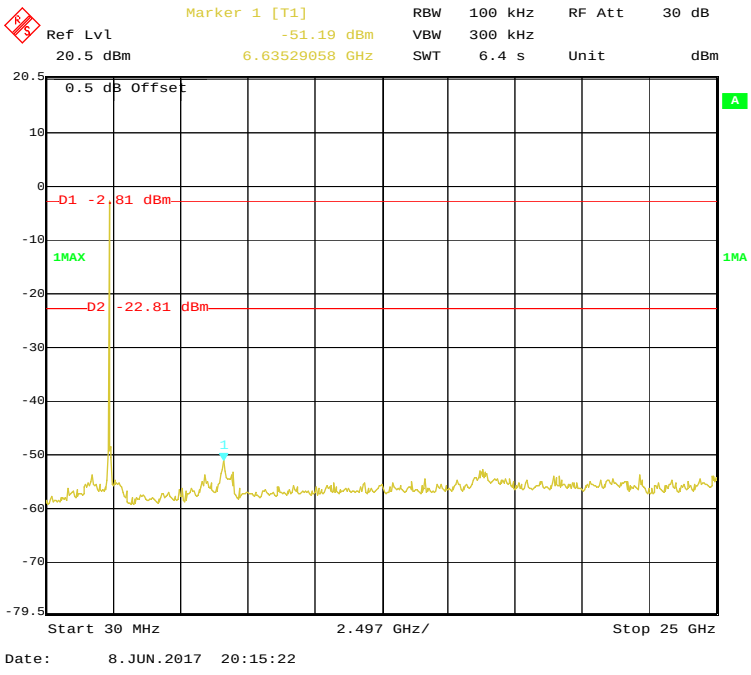
802.11b Middle Channel



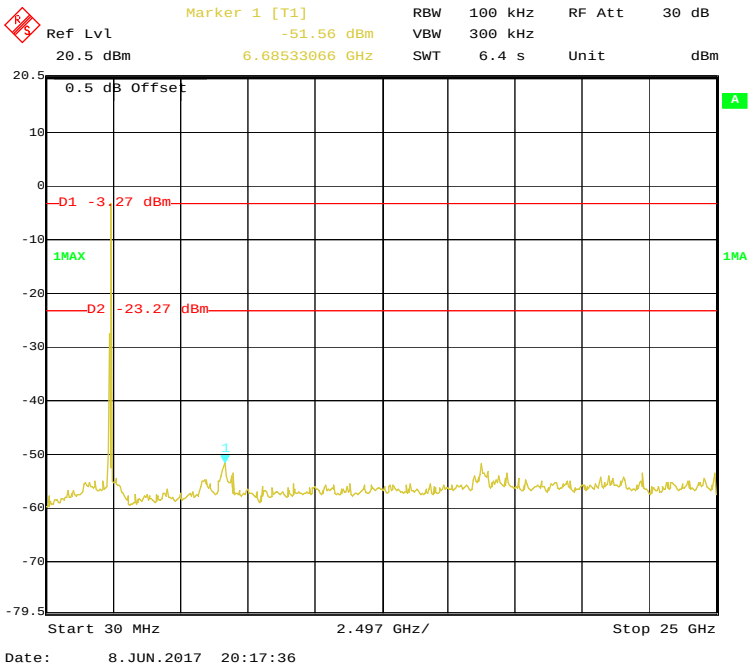
802.11b High Channel



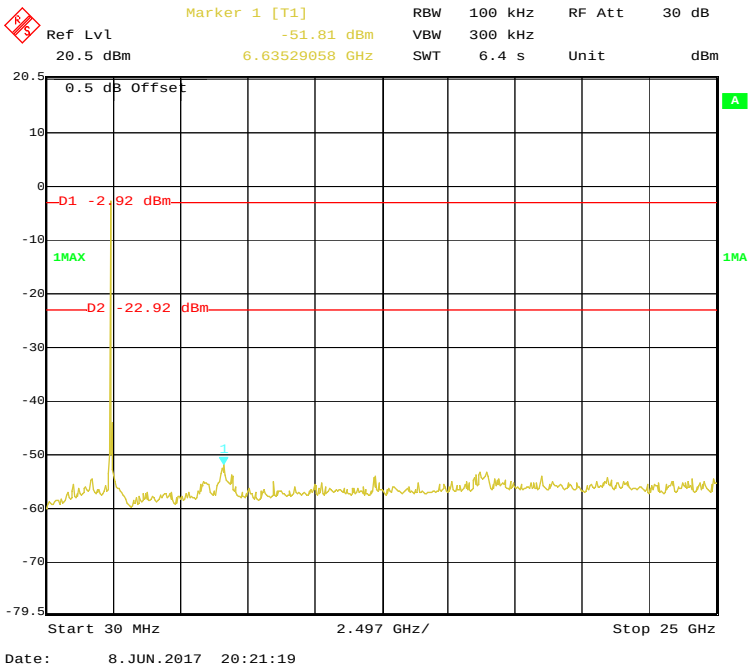
802.11g Low Channel



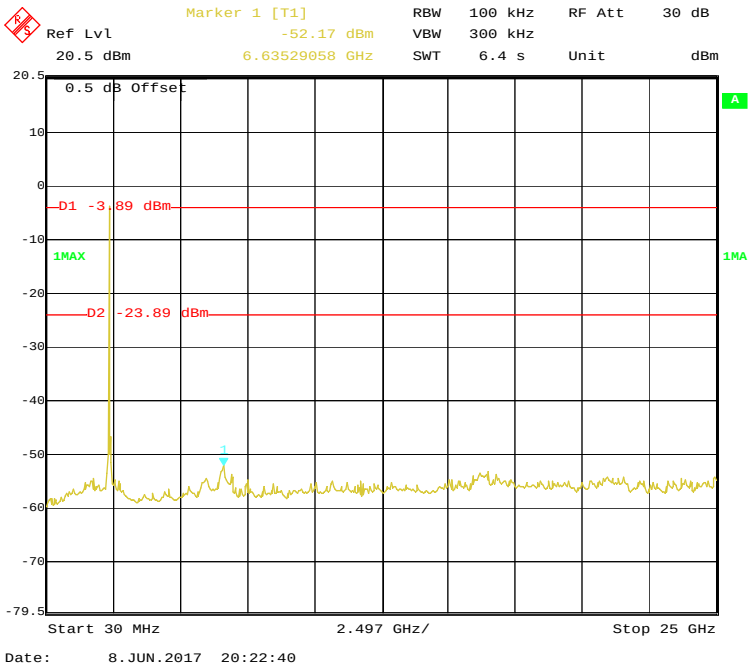
802.11g Middle Channel



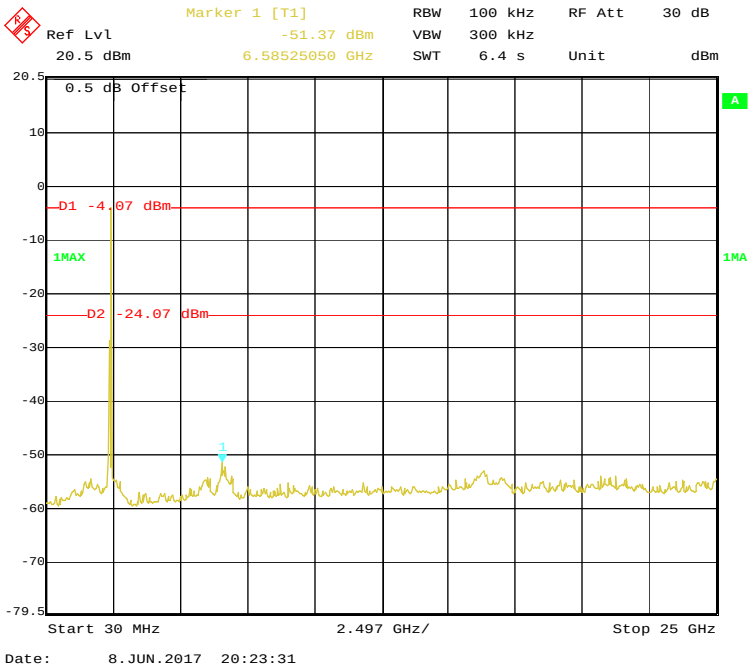
802.11g High Channel



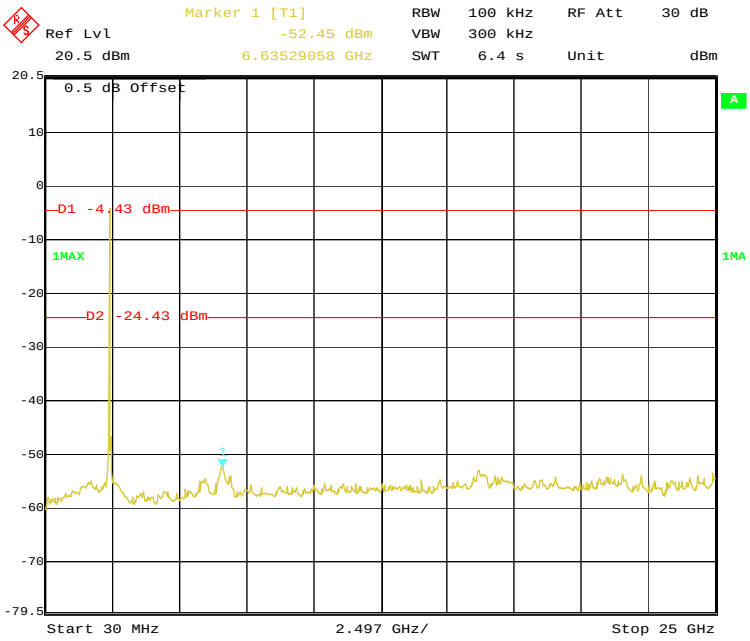
802.11n-HT20 Low Channel



802.11n-HT20 Middle Channel



802.11n-HT20 High Channel



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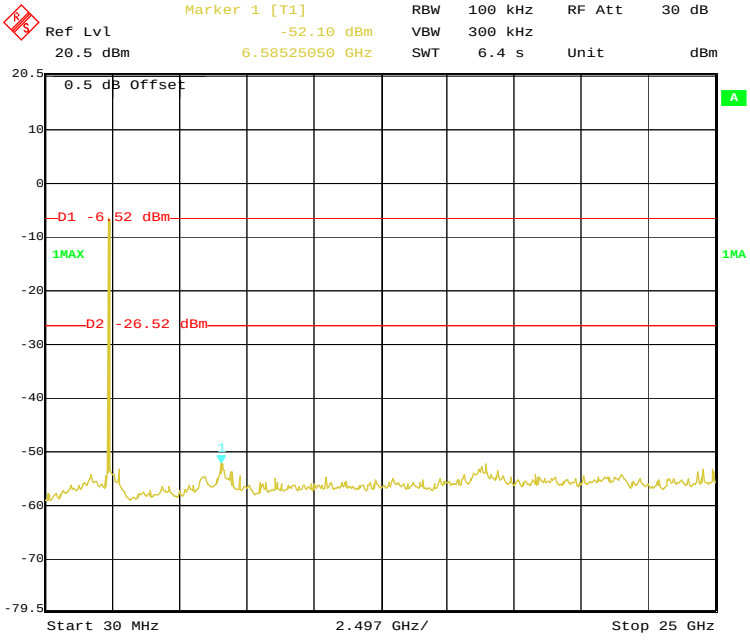
802.11n-HT40 Low Channel



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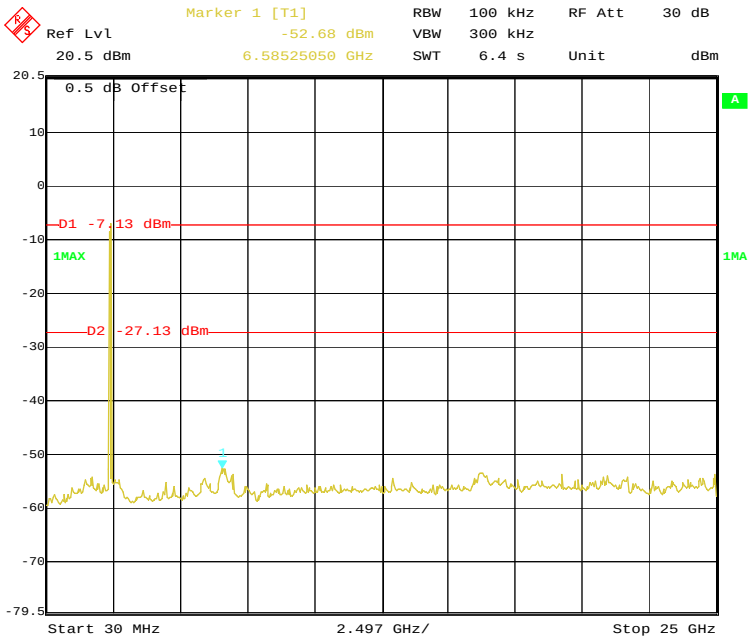
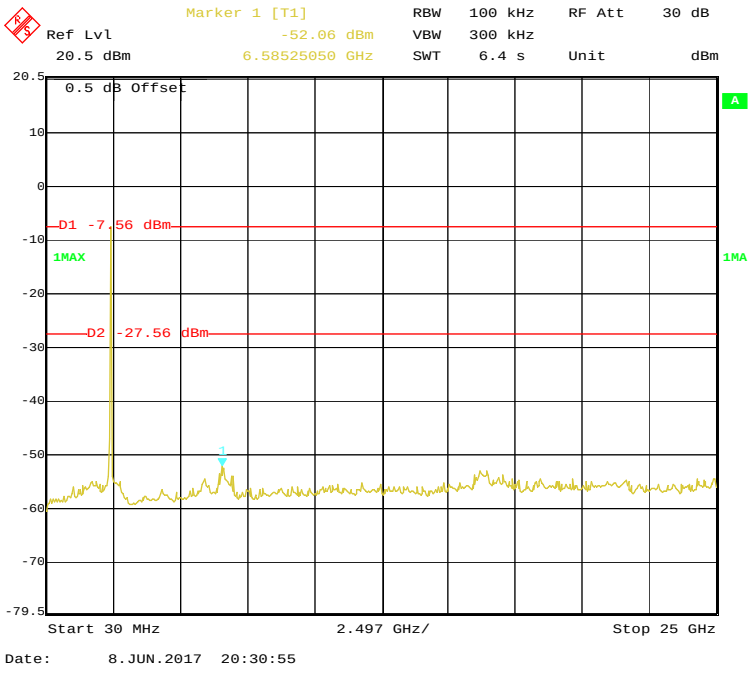
802.11n-HT40 Middle Channel



802.11n-HT40 High Channel



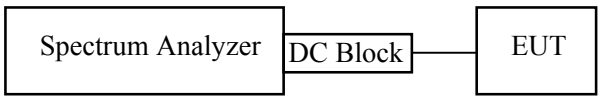
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

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:	20.3℃
Relative Humidity:	54 %
ATM Pressure:	101.3 kPa

The testing was performed by Chris Wang on 2017-06-08.

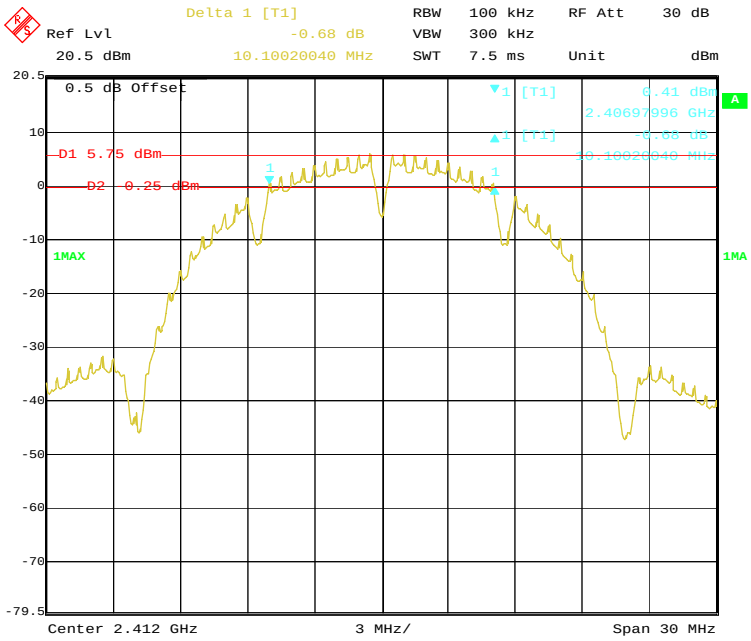
Test Result: Pass.

Please refer to the following tables and plots.

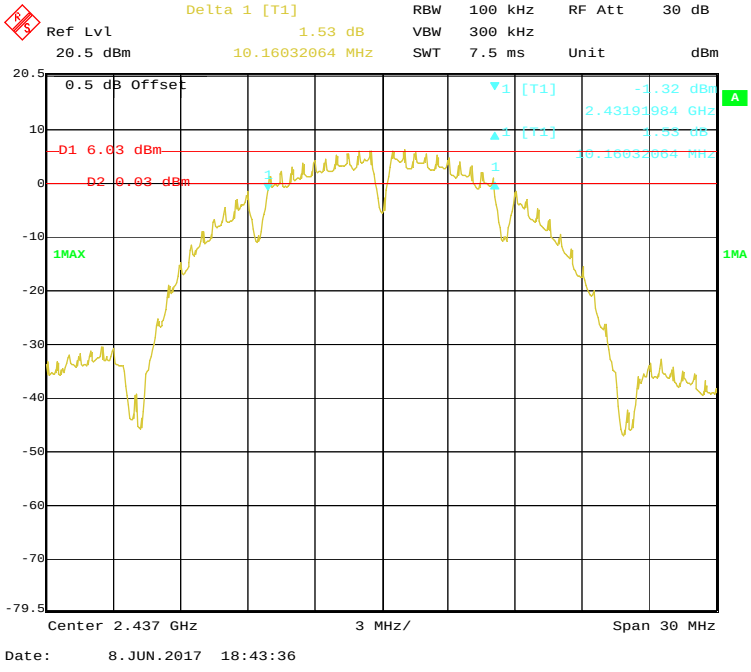
EUT operation mode: Transmitting

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (MHz)
802.11b mode			
Low	2412	10.10	≥0.5
Middle	2437	10.16	≥0.5
High	2462	10.10	≥0.5
802.11g mode			
Low	2412	16.65	≥0.5
Middle	2437	16.65	≥0.5
High	2462	16.65	≥0.5
802.11n-HT20 mode			
Low	2412	17.92	≥0.5
Middle	2437	17.92	≥0.5
High	2462	17.92	≥0.5
802.11n-HT40 mode			
Low	2422	36.43	≥0.5
Middle	2437	36.43	≥0.5
High	2452	36.43	≥0.5

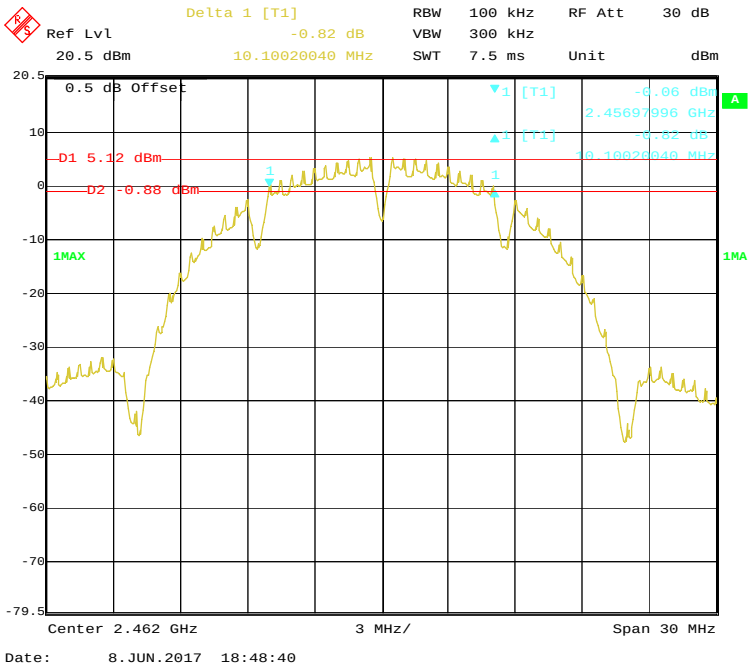
802.11b Low Channel



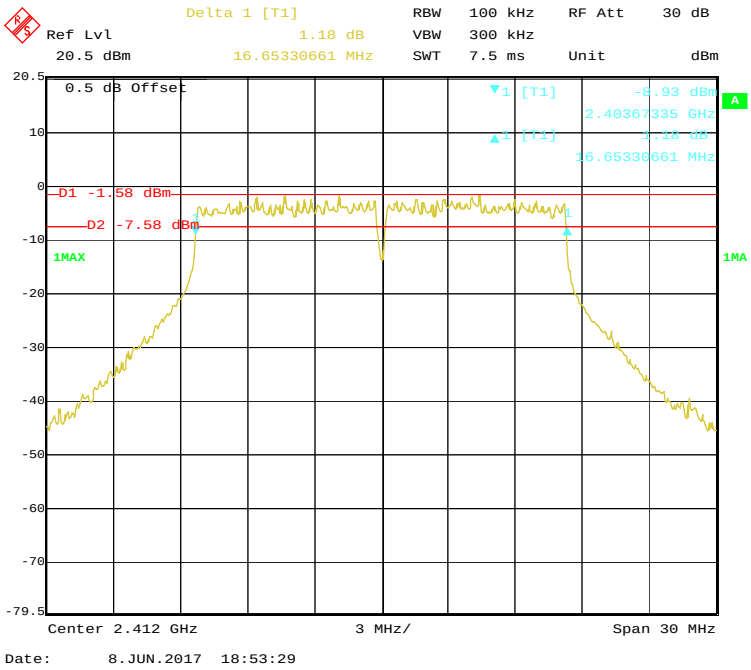
802.11b Middle Channel



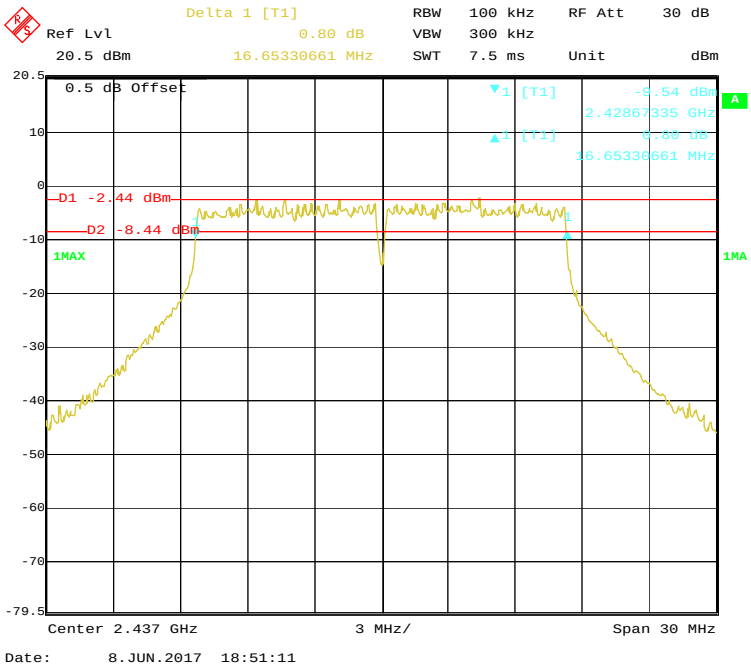
802.11b High Channel



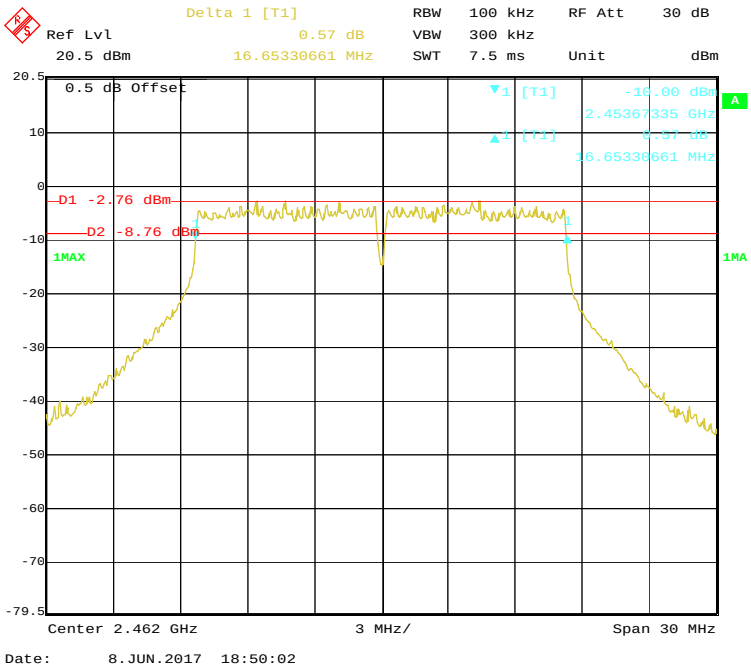
802.11g Low Channel



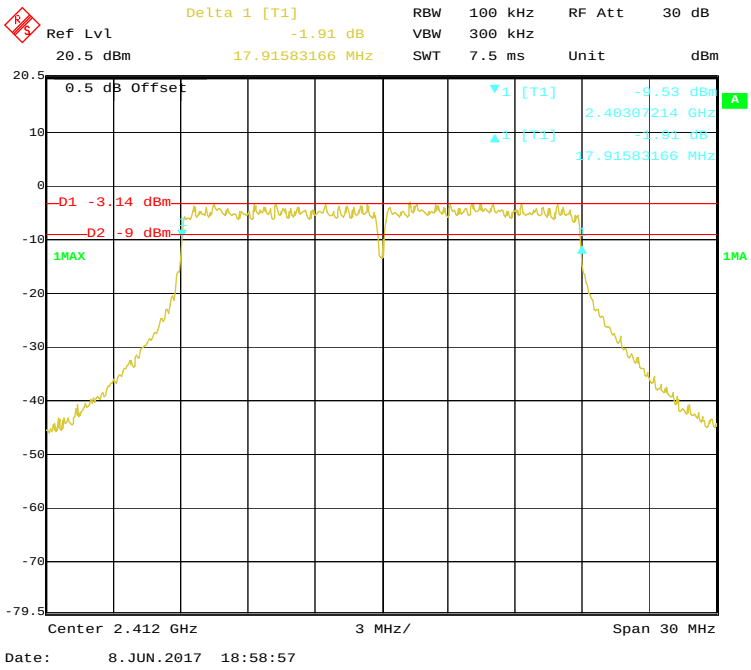
802.11g Middle Channel



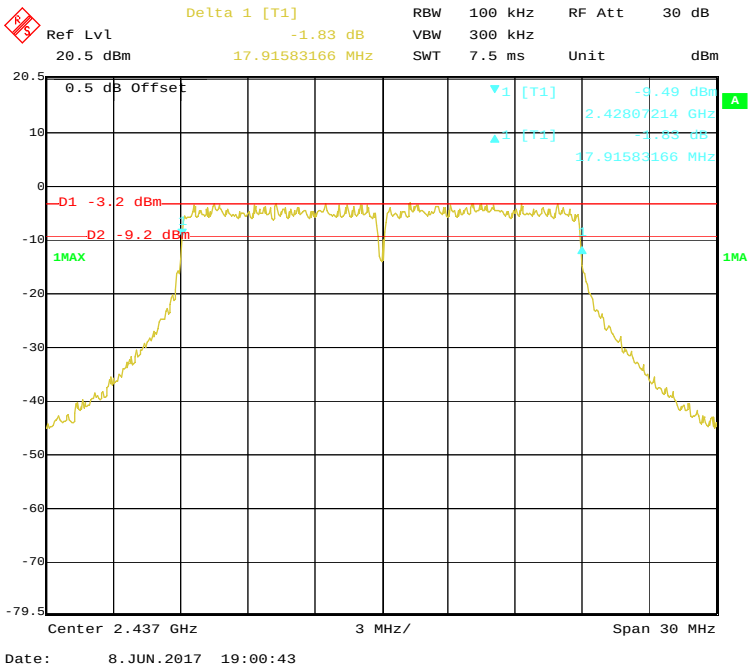
802.11g High Channel



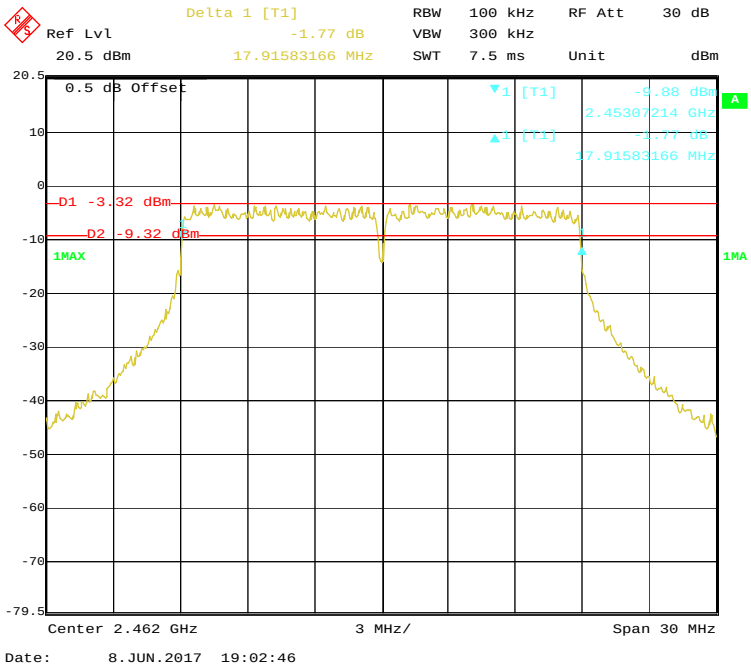
802.11n-HT20 Low Channel



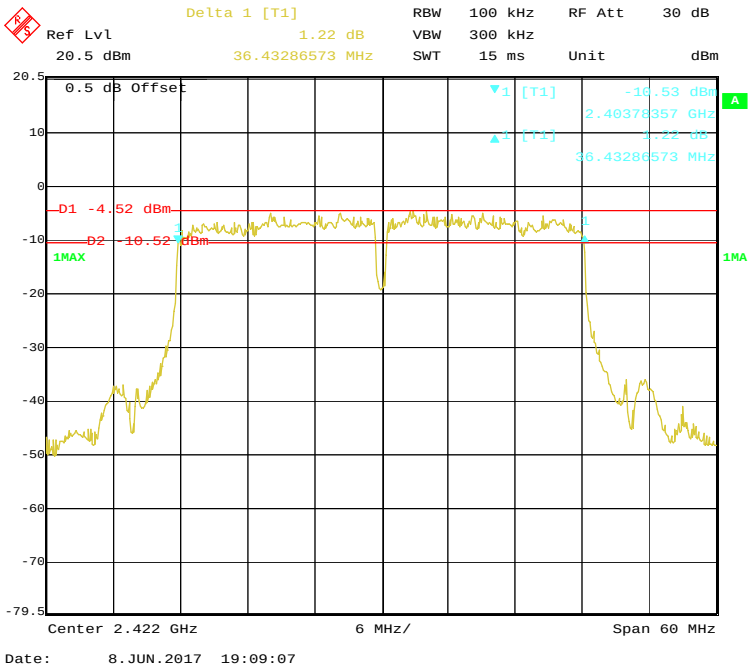
802.11n-HT20 Middle Channel



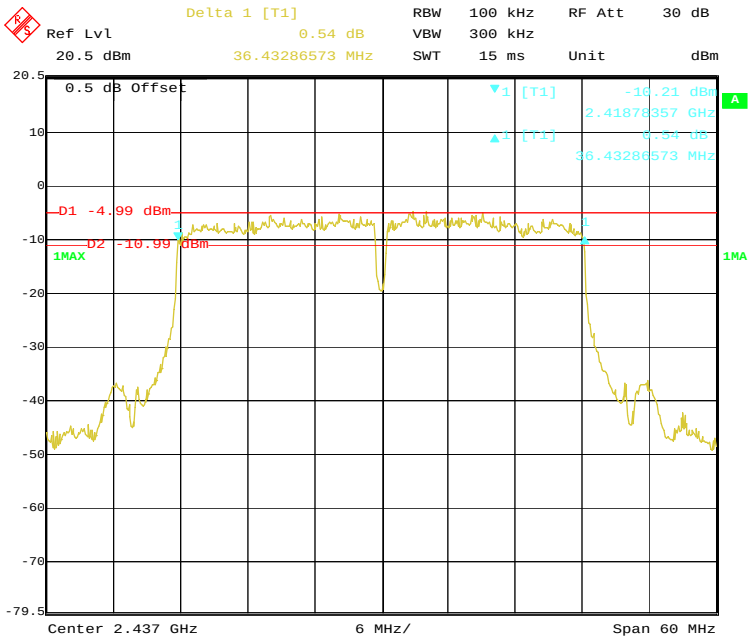
802.11n-HT20 High Channel



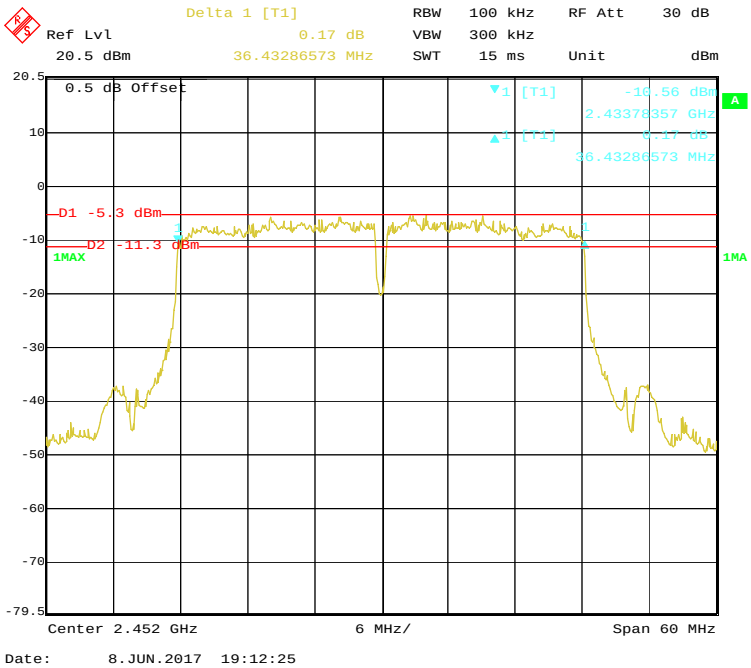
802.11n-HT40 Low Channel



802.11n-HT40 Middle Channel



802.11n-HT40 High Channel



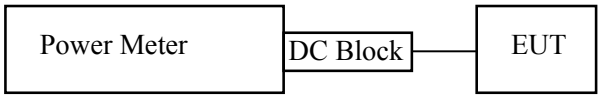
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

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:	20.3℃
Relative Humidity:	54 %
ATM Pressure:	101.3 kPa

The testing was performed by Chris Wang on 2017-06-08.

EUT operation mode: Transmitting

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Max Conducted Average Output Power (dBm)	Limit (dBm)	Result
802.11b					
Low	2412	18.42	15.37	30	Pass
Middle	2437	19.37	15.24	30	Pass
High	2462	18.46	15.45	30	Pass
802.11g					
Low	2412	18.39	11.33	30	Pass
Middle	2437	18.47	12.05	30	Pass
High	2462	18.64	11.15	30	Pass
802.11n-HT20					
Low	2412	18.08	12.13	30	Pass
Middle	2437	18.38	11.12	30	Pass
High	2462	17.28	10.95	30	Pass
802.11n-HT40					
Low	2422	18.65	11.15	30	Pass
Middle	2437	17.43	11.39	30	Pass
High	2452	17.56	10.48	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

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

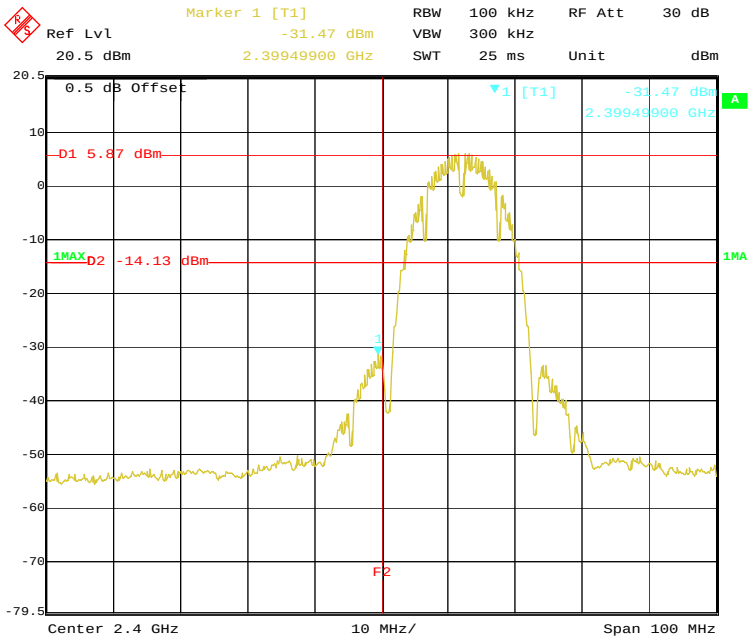
Temperature:	20.3℃
Relative Humidity:	54 %
ATM Pressure:	101.3 kPa

The testing was performed by Chris Wang on 2017-06-08.

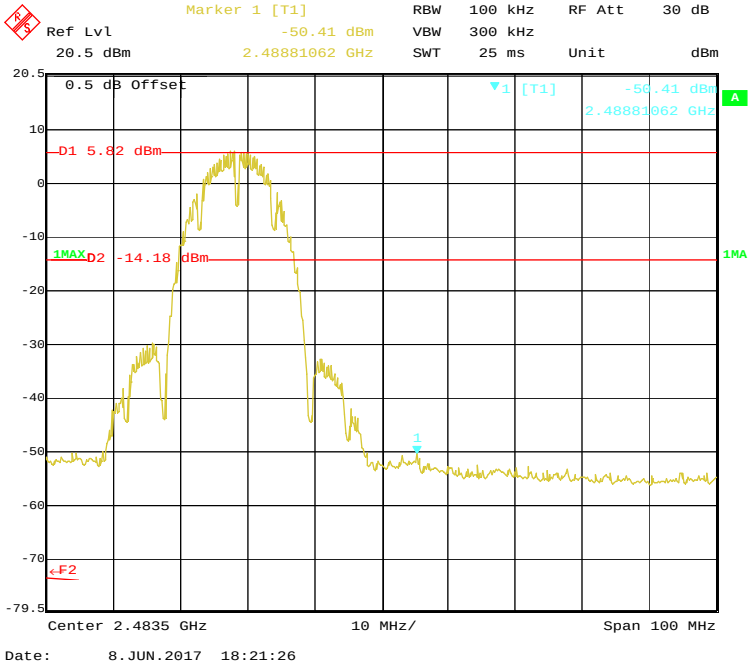
Test Result: *Compliance*

Please refer to the following table and plots.

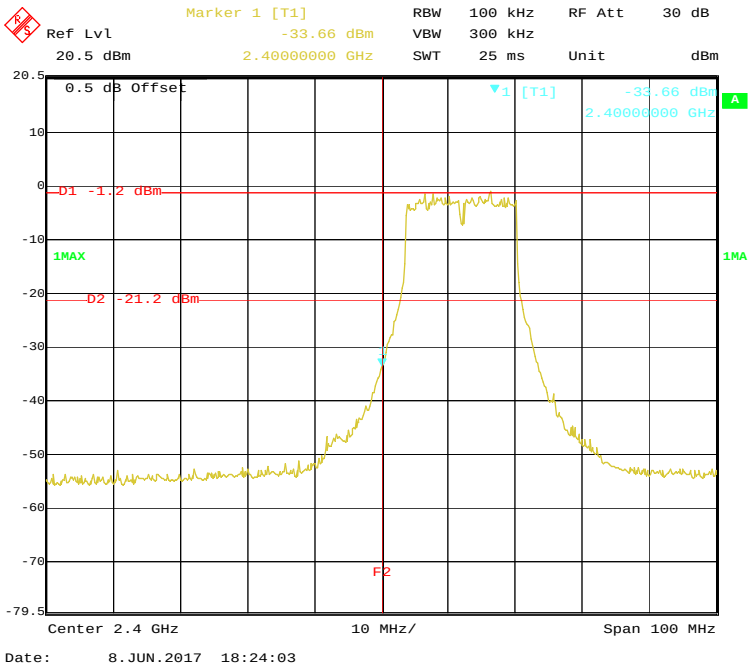
802.11b: Band Edge, Left Side



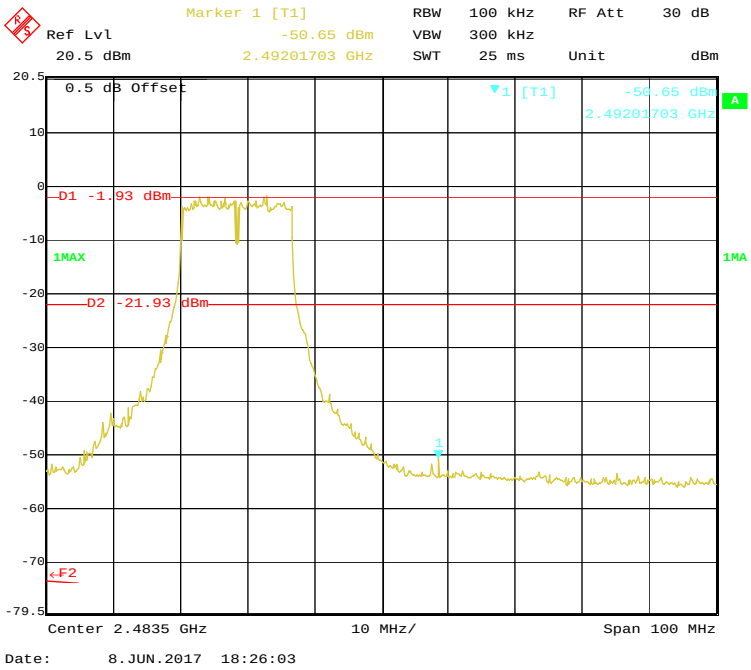
802.11b: Band Edge, Right Side



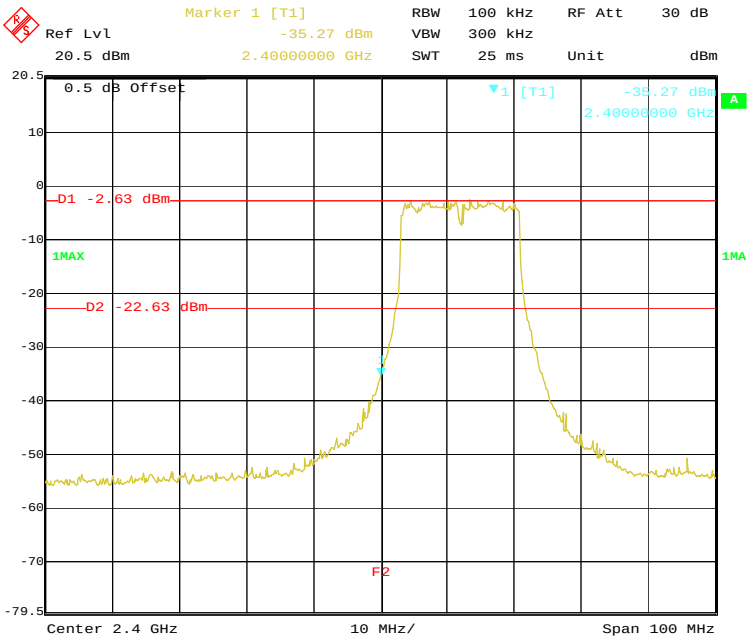
802.11g: Band Edge, Left Side



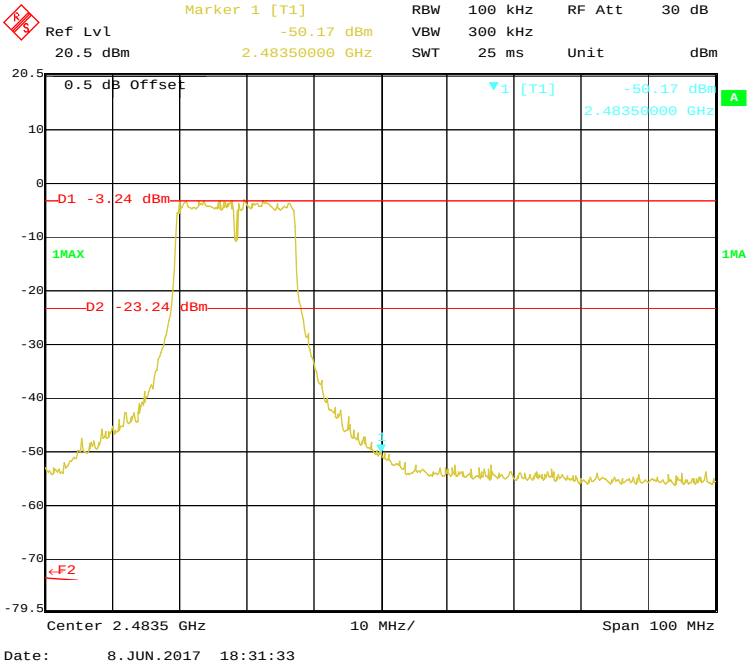
802.11g: Band Edge, Right Side



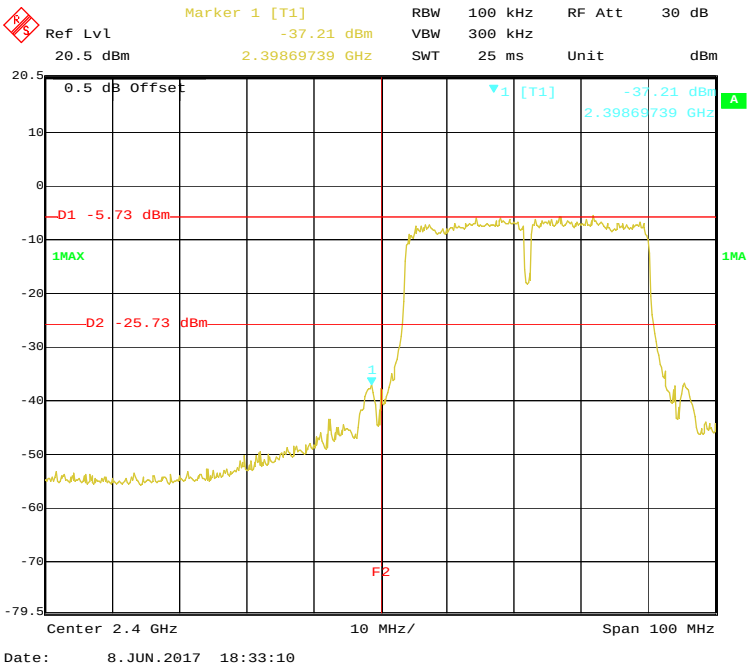
802.11n-HT20: Band Edge, Left Side



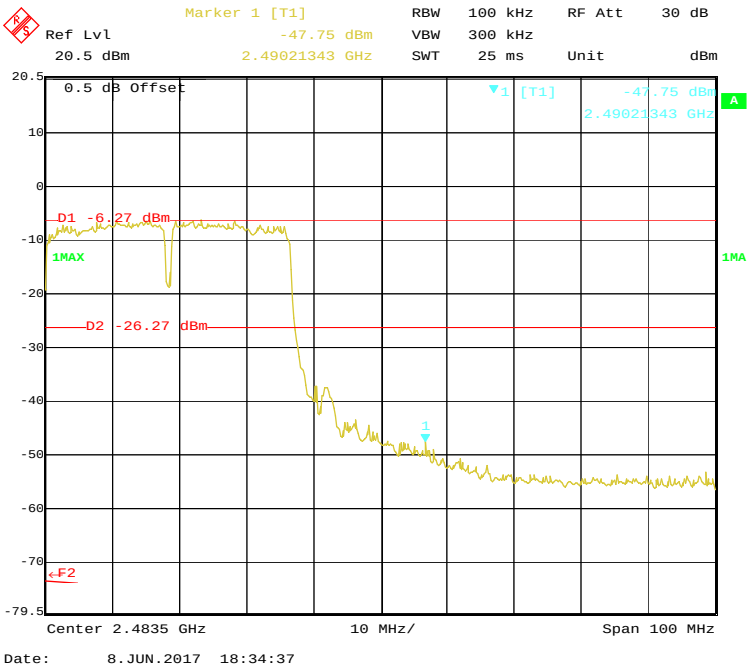
802.11n-HT20: Band Edge, Right Side



802.11n-HT40: Band Edge, Left Side



802.11n-HT40: 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 v04.

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:	20.4℃
Relative Humidity:	54 %
ATM Pressure:	101.3 kPa

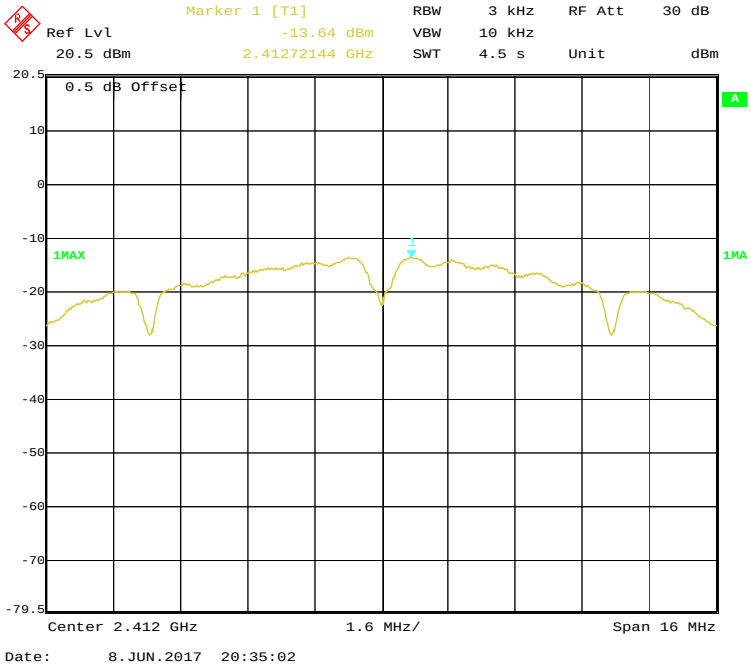
The testing was performed by Chris Wang on 2017-06-08.

EUT operation mode: Transmitting

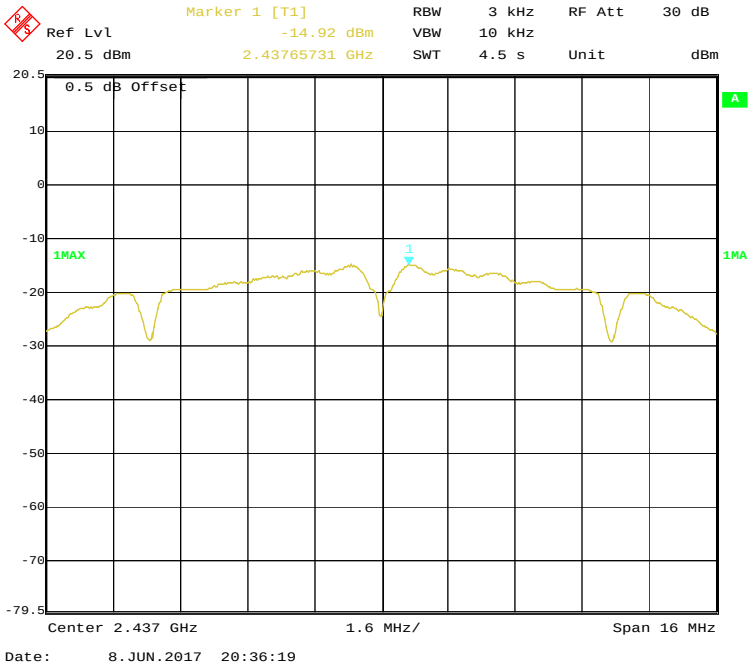
Test Result: Pass

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
802.11b mode			
Low	2412	-13.64	≤8
Middle	2437	-14.92	≤8
High	2462	-15.27	≤8
802.11g mode			
Low	2412	-17.51	≤8
Middle	2437	-17.96	≤8
High	2462	-17.97	≤8
802.11n-HT20 mode			
Low	2412	-18.14	≤8
Middle	2437	-18.48	≤8
High	2462	-18.07	≤8
802.11n-HT40 mode			
Low	2422	-19.61	≤8
Middle	2437	-19.65	≤8
High	2452	-19.65	≤8

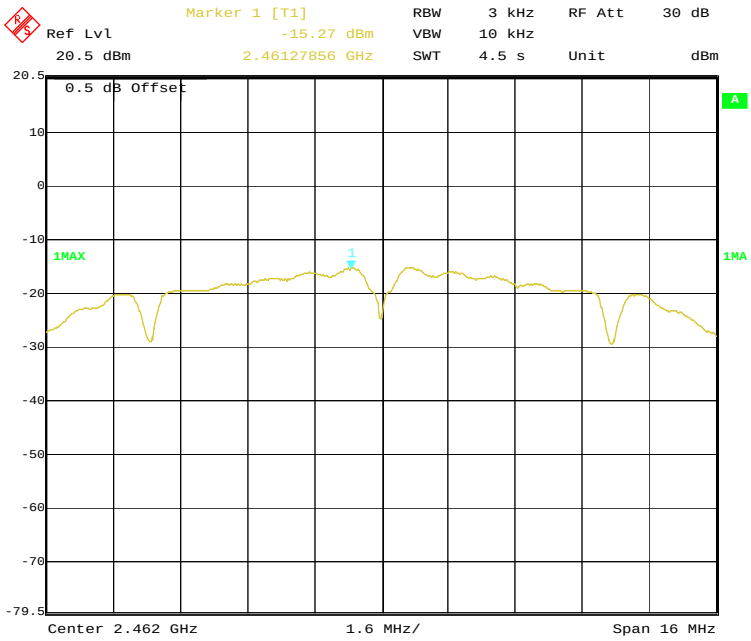
Power Spectral Density , 802.11b Low Channel



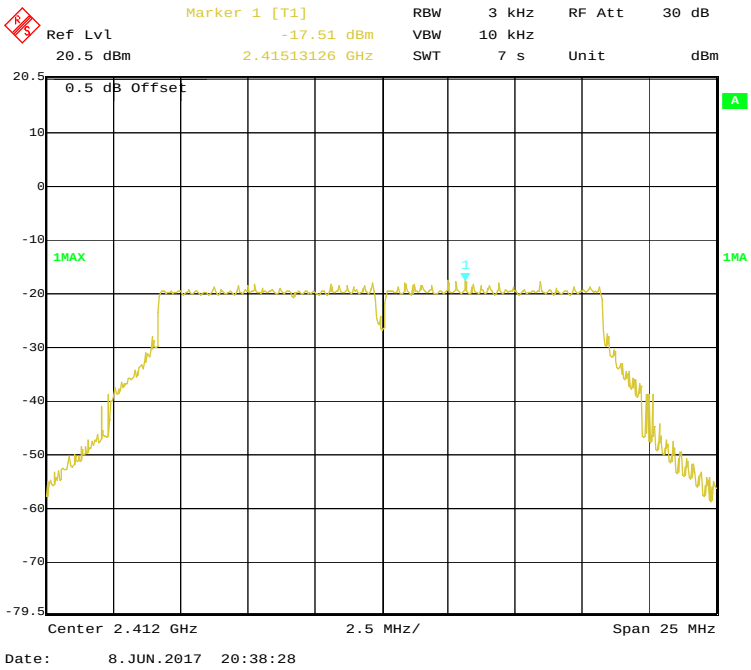
Power Spectral Density , 802.11b Middle Channel



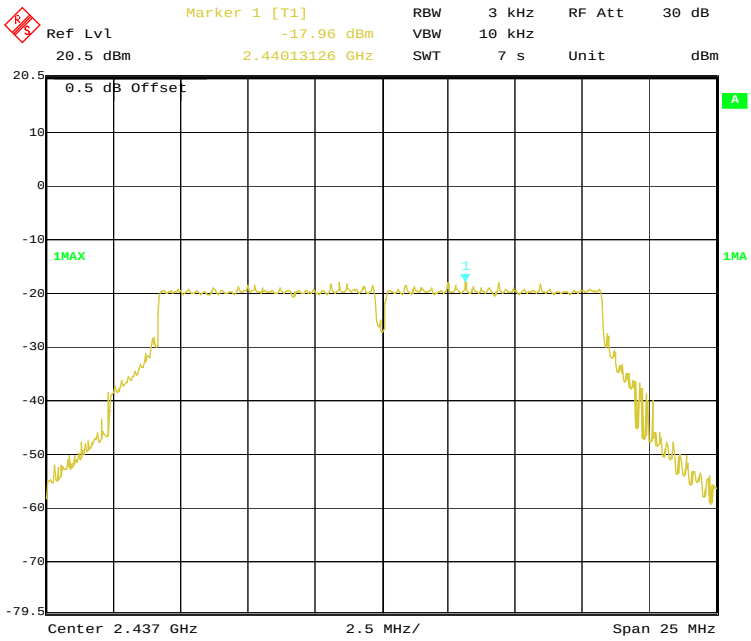
Power Spectral Density , 802.11b High Channel



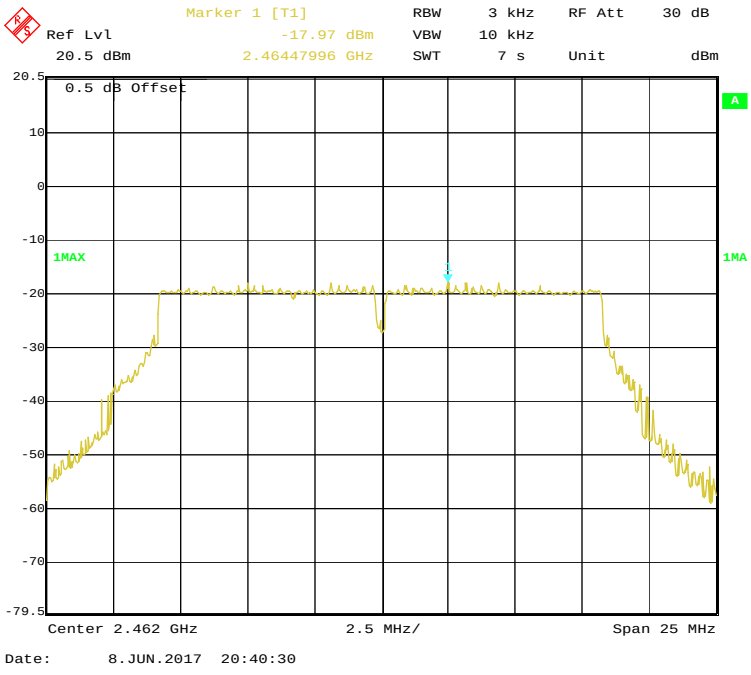
Power Spectral Density , 802.11g Low Channel



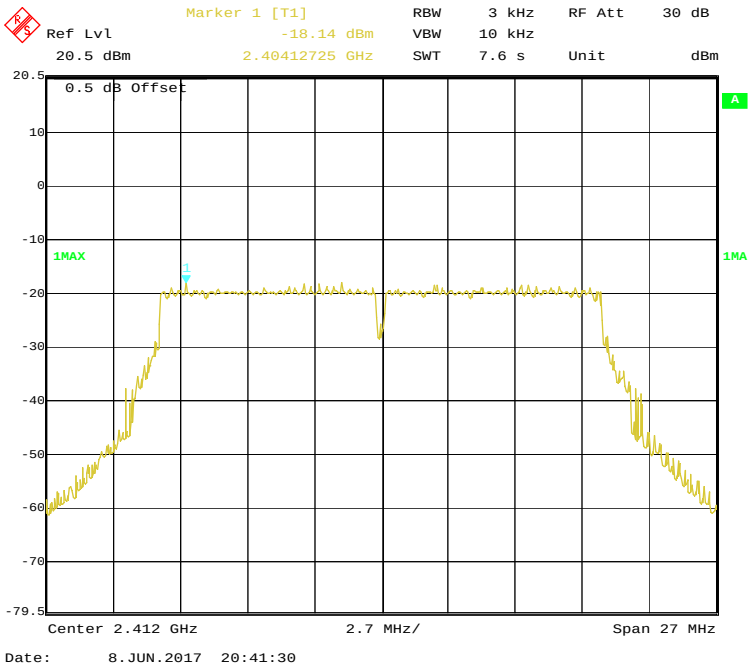
Power Spectral Density , 802.11g Middle Channel



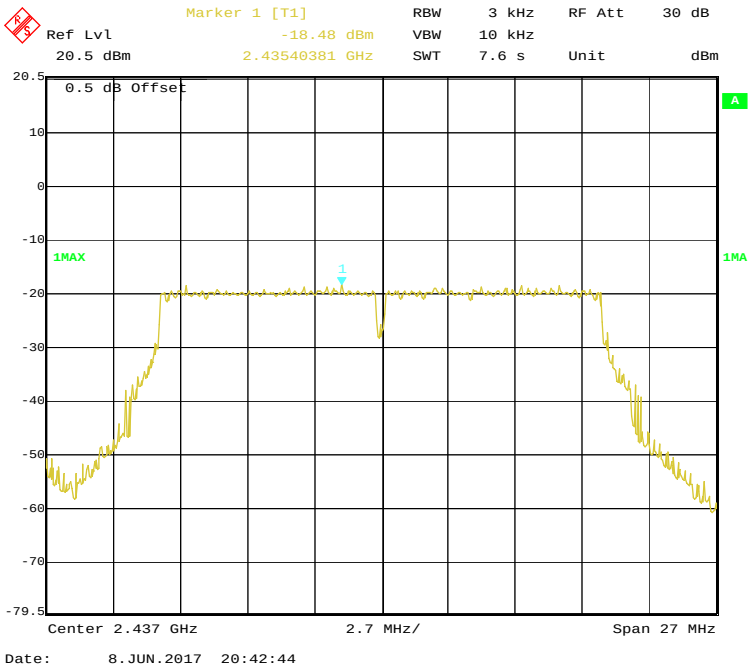
Power Spectral Density , 802.11g High Channel



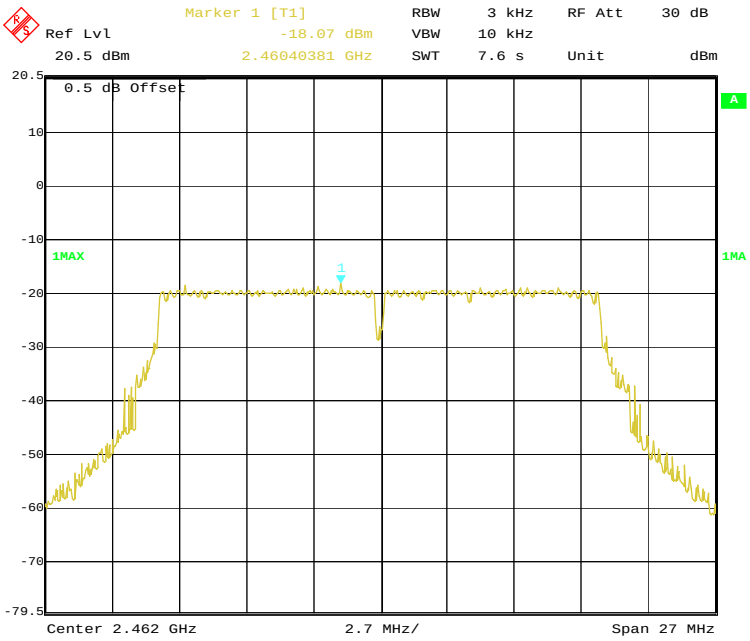
Power Spectral Density , 802.11n-HT20 Low Channel



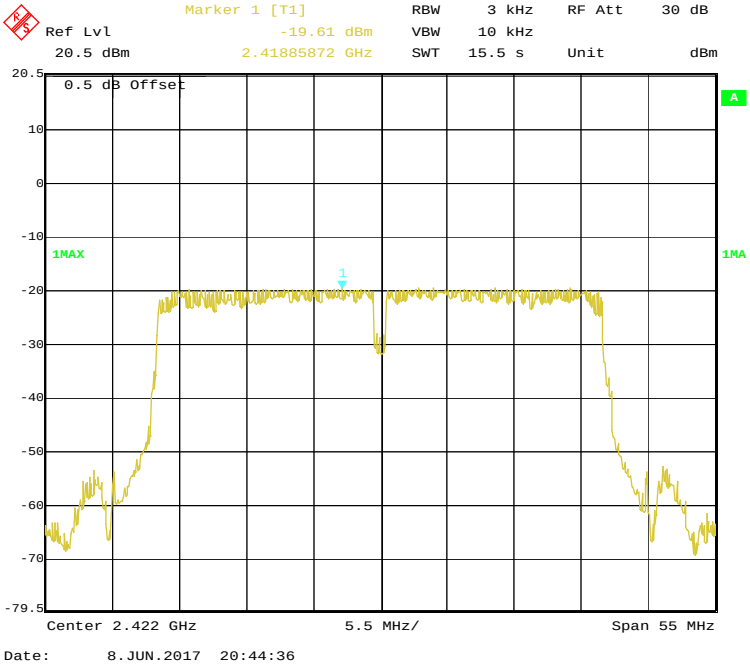
Power Spectral Density , 802.11n-HT20 Middle Channel



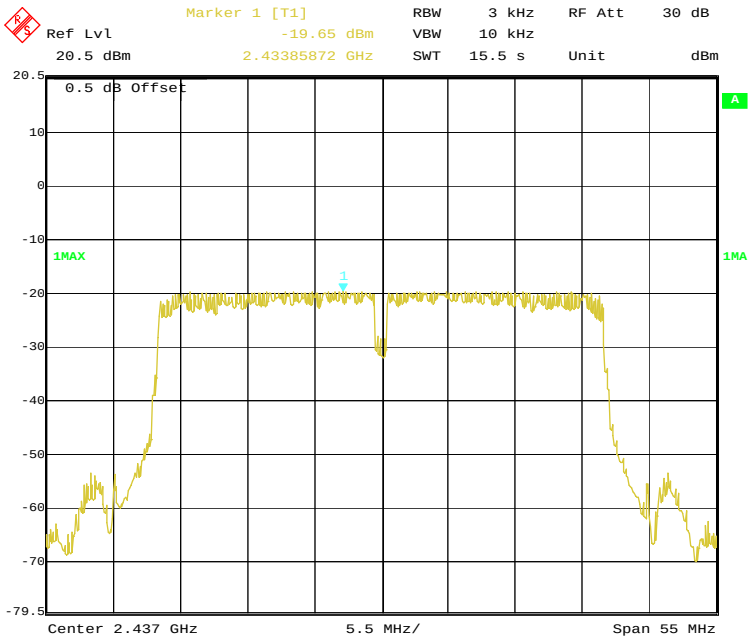
Power Spectral Density , 802.11n-HT20 High Channel



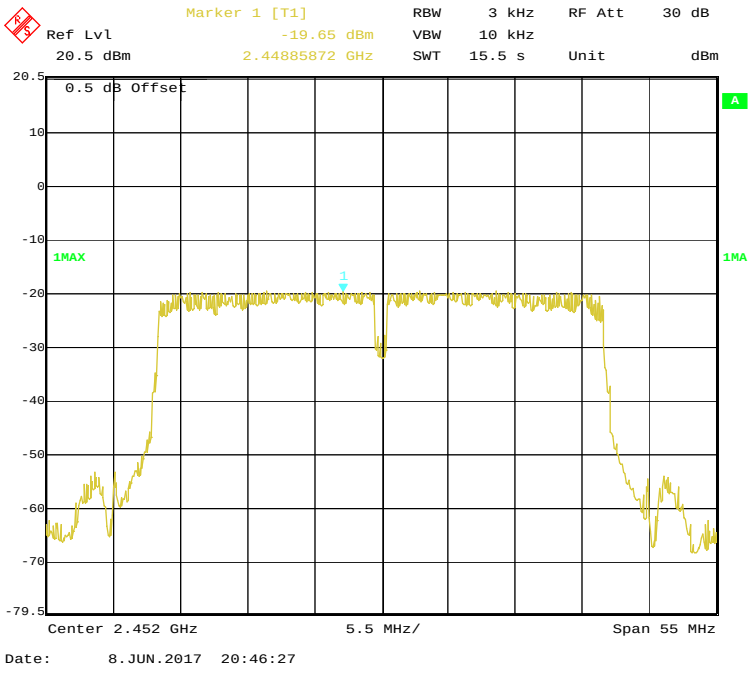
Power Spectral Density , 802.11n-HT40 Low Channel



Power Spectral Density , 802.11n-HT40 Middle Channel



Power Spectral Density , 802.11n-HT40 High Channel



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