FCC PART 15.247

TEST REPORT

For

Birdi

1479 Folsom st, San Francisco, CA, 94103

FCC ID: 2AJMX-Z1A

Report Type:	Product Type:
Original Report	Birdi Smart Detector

Report Number: RSZ161013003-00

Report Date: 2016-11-24

Reviewed By: Jesse Huang, Manager

Prepared By:

Bay Area Compliance Laboratories Corp. (Kunshan)
Chenghu Road, Kunshan Development Zone No.248,
Kunshan, Jiangsu, 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)

The *Birdi.*'s product, model number: *Z1A(FCC ID: 2AJMX-Z1A)* or the "EUT" in this report was a *Birdi Smart Detector,* which was measured approximately: 14.4cm (L) × 14.4cm (W) × 3.6 cm (H), rated with input voltage: DC 3*1.5V battery.

**All measurement and test data in this report was gathered from production sample serial number: 1603433. (Assigned by Kunshan BACL).The EUT supplied by the applicant was received on 2016-10-13.*

Objective

This report is prepared on behalf of *Birdi* in accordance with Part 2-Subpart J, Part 15-Subparts A, B and C of the Federal Communication Commission's rules.

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

Related Submittal(s)/Grant(s)

No Related Submittals.

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.

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
RF conducted test with spectrum		±0.9dB
RF Output Power with Power meter		±0.5dB
Radiated emission	30MHz~1GHz	±5.91dB
	Above 1G	±4.92dB
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 Chenghu Lake Road, Kunshan Development Zone No.248, Kunshan, Jiangsu, China

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

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

SYSTEM TEST CONFIGURATION

Description of Test Configuration

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

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

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

For BLE mode, 40 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	21	2444
2	2406	22	2446
3	2408	23	2448
4	2410	24	2450
5	2412	25	2452
6	2414	26	2454
7	2416	27	2456
8	2418	28	2458
9	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

EUT was tested with Channel 0, 19 and 39.

Duty Cycle Information

Band	Duty Cycle (%)	T(us)	1/T(kHz)	VBW Setting	10log(1/x)
802.11b	100	-	-	10Hz	0
802.11g	100	-	-	10Hz	0
802.11n-HT20	100	-	-	10Hz	0
BLE	62.4	395	2.55	3kHz	2.05

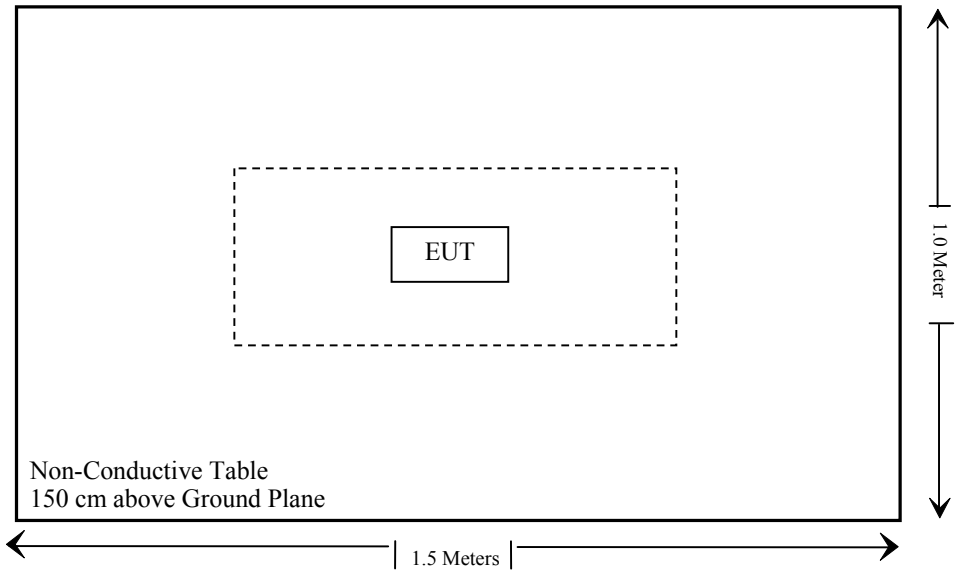
Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

The software "SmartRF_Studio_7-2.2.1" was used.

Block Diagram of Test Setup



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	Not Applicable
§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

Not Applicable: The EUT is powered by battery only.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiation test					
Sonoma Instrunent	Amplifier	330	171377	2016-10-21	2017-10-21
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2015-11-12	2016-11-11
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-09-08	2017-09-08
EMCO	Horn Antenna	3116	9510-2384	2015-11-07	2018-11-06
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2015-11-12	2016-11-11
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2016-09-20	2017-09-20
ETS	Horn Antenna	3115	9311-4159	2016-01-11	2019-01-10
R&S	Auto test Software	EMC32	V 09.10.0	NCR	NCR
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-15	2016-12-15
Ducommun technologies	RF Cable	104PEA	218124002	2016-04-22	2017-04-22
RF Conducted test					
BACL	TS 8997 Cable-01	T-KS-EMC086	T-KS-EMC086	2015-12-10	2016-12-09
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15
WEINSCHEL	3dB Attenuator	5326	N/A	2016-06-18	2017-06-18
Agilent	Power Meter	N1912A	MY5000492	2015-11-18	2016-11-17
Agilent	Power Sensor	N1921A	MY54210024	2015-11-18	2016-11-17
Rohde & Schwarz	OSP120 BASE UNIT	OSP120	101247	2016-07-04	2017-07-03
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131	2016-09-21	2017-09-21

*** 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) & §1.1307 (b) (1) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247 (i) and subpart 1.1307 (b)(1), 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

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

Result

Calculated Formulary:

Predication of MPE limit at a given distance

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

S = power density (in appropriate units, e.g. mW/cm2)
P = power input to the antenna (in appropriate units, e.g., mW).
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

Frequency (MHz)	**Antenna Gain**		**Conducted Power**		**Evaluation Distance (cm)**	**Power Density (mW/cm^2)**	**MPE Limit (mW/cm^2)**
	(dBi)	**(numeric)**	**(dBm)**	**(mW)**			
2412-2462	1.5	1.41	16.5	44.67	20	0.0125	1
2402-2480	1.5	1.41	-1.5	0.71	20	0.0002	1

Note: To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliance

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.
And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT has one ceramic chip antenna for BLE and the other is PCB antenna for WIFI, all of those antenna gain are 1.5 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

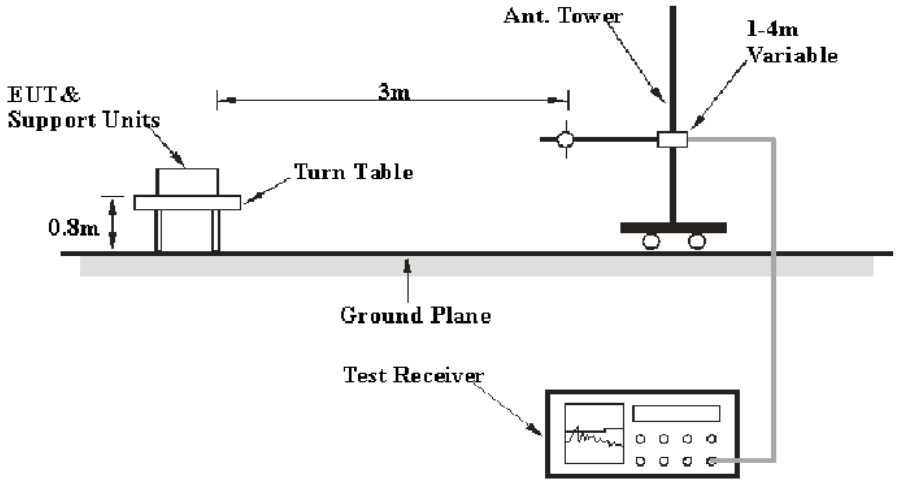
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

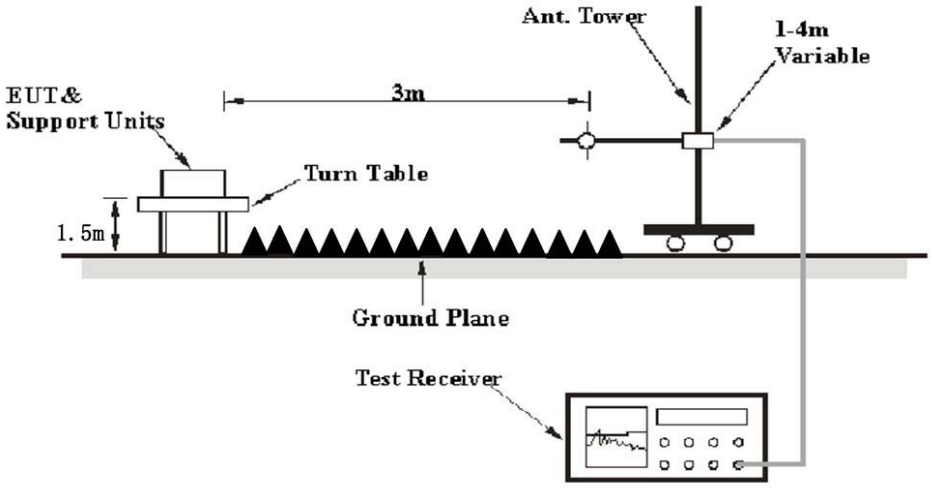
FCC §15.247 (d); §15.209; §15.205;

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	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz Note 1	/	Ave.
	1MHz	＞1/T Hz Note 2	/	Ave.

Note 1: when duty cycle is no less than 98%
Note 2: when duty cycle is less than 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.

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

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

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

Test Data

Environmental Conditions

Temperature:	23 ℃
Relative Humidity:	48 %
ATM Pressure:	101.0 kPa

The testing was performed by Layne Li on 2016-10-31.

EUT operation mode: Transmitting

30 MHz-25 GHz:

For Wi-Fi:

802.11b Mode:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel (2412 MHz)									
255.15	47.18	QP	313	2.4	V	-11.81	35.37	46	10.63
2412.00	110.55	PK	20	2.2	H	-3.04	107.51	/	/
2412.00	102.76	Ave.	20	2.2	H	-3.04	99.72	/	/
2412.00	104.03	PK	12	2.3	V	-3.04	100.99	/	/
2412.00	95.84	Ave.	12	2.3	V	-3.04	92.80	/	/
2380.70	56.59	PK	205	1.7	V	-3.06	53.53	74	20.47
2380.70	47.46	Ave.	205	1.7	V	-3.06	44.40	54	9.60
2385.03	59.14	PK	41	1.6	H	-3.05	56.09	74	17.91
2385.03	47.83	Ave.	41	1.6	H	-3.05	44.78	54	9.22
2492.26	47.14	PK	251	1.8	H	-2.98	44.16	74	29.84
2492.26	34.13	Ave.	251	1.8	H	-2.98	31.15	54	22.85
4824.00	42.87	PK	242	1.7	H	7.19	50.06	74	23.94
4824.00	26.45	Ave.	242	1.7	H	7.19	33.64	54	20.36

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Middle Channel (2437 MHz)									
255.15	46.24	QP	185	1.2	V	-11.81	34.43	46	11.57
2437.00	108.93	PK	28	2.0	H	-3.02	105.91	/	/
2437.00	100.80	Ave.	28	2.0	H	-3.02	97.78	/	/
2437.00	103.05	PK	44	2.3	V	-3.02	100.03	/	/
2437.00	94.78	Ave.	44	2.3	V	-3.02	91.76	/	/
2315.02	53.07	PK	123	1.0	V	-3.10	49.97	74	24.03
2315.02	42.19	Ave.	123	1.0	V	-3.10	39.09	54	14.91
2486.74	49.52	PK	337	2.4	H	-2.99	46.53	74	27.47
2486.74	36.27	Ave.	337	2.4	H	-2.99	33.28	54	20.72
2489.65	48.01	PK	199	1.4	H	-2.99	45.02	74	28.98
2489.65	35.42	Ave.	199	1.4	H	-2.99	32.43	54	21.57
4874.00	42.57	PK	230	1.9	H	7.27	49.84	74	24.16
4874.00	27.14	Ave.	230	1.9	H	7.27	34.41	54	19.59
High Channel (2462 MHz)									
255.15	45.68	QP	61	1.8	V	-11.81	33.87	46	12.13
2462.00	108.64	PK	297	1.9	H	-3.00	105.64	/	/
2462.00	100.05	AV	297	1.9	H	-3.00	97.05	/	/
2462.00	102.63	PK	342	1.7	V	-3.00	99.63	/	/
2462.00	94.40	AV	342	1.7	V	-3.00	91.40	/	/
2311.12	51.96	PK	50	1.0	V	-3.10	48.86	74	25.14
2311.12	40.87	AV	50	1.0	V	-3.10	37.77	54	16.23
2489.15	56.30	PK	29	1.5	H	-2.99	53.31	74	20.69
2489.15	44.47	AV	29	1.5	H	-2.99	41.48	54	12.52
2490.01	54.38	PK	276	1.6	H	-2.99	51.39	74	22.61
2490.01	44.08	AV	276	1.6	H	-2.99	41.09	54	12.91
4924.00	42.57	PK	272	1.7	H	7.34	49.91	74	24.09
4924.00	27.07	AV	272	1.7	H	7.34	34.41	54	19.59

802.11g Mode:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel (2412 MHz)									
255.15	46.38	QP	128	2.5	V	-11.81	34.57	46	11.43
2412.00	106.62	PK	36	2.0	H	-3.04	103.58	/	/
2412.00	93.68	Ave.	36	2.0	H	-3.04	90.64	/	/
2412.00	100.96	PK	175	1.9	V	-3.04	97.92	/	/
2412.00	89.23	Ave.	175	1.9	V	-3.04	86.19	/	/
2384.46	64.41	PK	312	1.5	V	-3.05	61.36	74	12.64
2384.46	47.50	Ave.	312	1.5	V	-3.05	44.45	54	9.55
2386.23	65.19	PK	75	2.0	H	-3.05	62.14	74	11.86
2386.23	49.29	Ave.	75	2.0	H	-3.05	46.24	54	7.76
2492.89	54.37	PK	274	1.7	H	-2.98	51.39	74	22.61
2492.89	40.27	Ave.	274	1.7	H	-2.98	37.29	54	16.71
4824.00	43.40	PK	210	2.3	H	7.19	50.59	74	23.41
4824.00	26.45	Ave.	210	2.3	H	7.19	33.64	54	20.36
Middle Channel (2437MHz)									
255.15	45.90	QP	338	1.9	V	-11.81	34.09	46	11.91
2437.00	105.90	PK	138	1.3	H	-3.02	102.88	/	/
2437.00	90.43	Ave.	138	1.3	H	-3.02	87.41	/	/
2437.00	99.85	PK	214	2.5	V	-3.02	96.83	/	/
2437.00	87.64	Ave.	214	2.5	V	-3.02	84.62	/	/
2359.37	56.08	PK	238	2.3	V	-3.07	53.01	74	20.99
2359.37	40.14	Ave.	238	2.3	V	-3.07	37.07	54	16.93
2386.31	56.72	PK	59	2.1	H	-3.05	53.67	74	20.33
2386.31	41.14	Ave.	59	2.1	H	-3.05	38.09	54	15.91
2486.40	55.80	PK	257	1.4	H	-2.99	52.81	74	21.19
2486.40	40.28	Ave.	257	1.4	H	-2.99	37.29	54	16.71
4874.00	43.48	PK	244	1.7	H	7.27	50.75	74	23.25
4874.00	27.14	Ave.	244	1.7	H	7.27	34.41	54	19.59

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
High Channel (2462 MHz)									
255.15	45.54	QP	59	1.7	V	-11.81	33.73	46	12.27
2462.00	105.17	PK	65	1.8	H	-3.00	102.17	/	/
2462.00	92.87	Ave.	65	1.8	H	-3.00	89.87	/	/
2462.00	99.56	PK	124	2.1	V	-3.00	96.56	/	/
2462.00	87.44	Ave.	124	2.1	V	-3.00	84.44	/	/
2315.13	55.55	PK	112	2.2	V	-3.10	52.45	74	21.55
2315.13	39.85	Ave.	112	2.2	V	-3.10	36.75	54	17.25
2484.65	64.07	PK	231	1.2	H	-2.99	61.08	74	12.92
2484.65	46.32	Ave.	231	1.2	H	-2.99	43.33	54	10.67
2484.95	62.70	PK	69	2.3	H	-2.99	59.71	74	14.29
2484.95	45.82	Ave.	69	2.3	H	-2.99	42.83	54	11.17
4924.00	42.81	PK	59	2.0	H	7.34	50.15	74	23.85
4924.00	27.07	Ave.	59	2.0	H	7.34	34.41	54	19.59

802.11n-HT20 Mode:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel (2412 MHz)									
255.15	46.21	QP	218	1.2	V	-11.81	34.40	46	11.60
2412.00	104.54	PK	200	1.7	H	-3.04	101.50	/	/
2412.00	91.50	Ave.	200	1.7	H	-3.04	88.46	/	/
2412.00	98.35	PK	252	1.6	V	-3.04	95.31	/	/
2412.00	85.90	Ave.	252	1.6	V	-3.04	82.86	/	/
2388.79	64.77	PK	241	2.1	V	-3.05	61.72	74	12.28
2388.79	46.63	Ave.	241	2.1	V	-3.05	43.58	54	10.42
2389.83	65.10	PK	155	2.2	H	-3.05	62.05	74	11.95
2389.83	47.50	Ave.	155	2.2	H	-3.05	44.45	54	9.55
2490.01	53.64	PK	120	1.5	H	-2.99	50.65	74	23.35
2490.01	39.28	Ave.	120	1.5	H	-2.99	36.29	54	17.71
4824.00	43.01	PK	327	1.6	H	7.19	50.20	74	23.80
4824.00	26.45	Ave.	327	1.6	H	7.19	33.64	54	20.36
Middle Channel (2437MHz)									
255.15	45.94	QP	243	1.1	V	-11.81	34.13	46	11.87
2437.00	104.21	PK	137	2.0	H	-3.02	101.19	/	/
2437.00	90.88	Ave.	137	2.0	H	-3.02	87.86	/	/
2437.00	98.13	PK	231	2.0	V	-3.02	95.11	/	/
2437.00	85.60	Ave.	231	2.0	V	-3.02	82.58	/	/
2316.09	54.64	PK	93	1.6	V	-3.10	51.54	74	22.46
2316.09	39.85	Ave.	93	1.6	V	-3.10	36.75	54	17.25
2339.49	54.18	PK	181	1.1	H	-3.08	51.10	74	22.90
2339.49	39.83	Ave.	181	1.1	H	-3.08	36.75	54	17.25
2488.59	54.04	PK	27	1.2	H	-2.99	51.05	74	22.95
2488.59	39.28	Ave.	27	1.2	H	-2.99	36.29	54	17.71
4874.00	43.27	PK	50	2.2	H	7.27	50.54	74	23.46
4874.00	27.14	Ave.	50	2.2	H	7.27	34.41	54	19.59

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
High Channel (2462 MHz)									
255.15	45.61	QP	170	1.2	V	-11.81	33.80	46	12.20
2462.00	103.08	PK	0	1.4	H	-3.00	100.08	/	/
2462.00	90.26	Ave.	216	2.0	H	-3.00	87.26	/	/
2462.00	97.20	PK	301	2.5	V	-3.00	94.20	/	/
2462.00	85.41	Ave.	301	2.5	V	-3.00	82.41	/	/
2319.61	53.39	PK	289	1.7	V	-3.10	50.29	74	23.71
2319.61	38.83	Ave.	289	1.7	V	-3.10	35.73	54	18.27
2483.51	58.81	PK	252	1.7	H	-2.99	55.82	74	18.18
2483.51	44.74	Ave.	252	1.7	H	-2.99	41.75	54	12.25
2484.52	58.44	PK	128	2.4	H	-2.99	55.45	74	18.55
2484.52	43.49	Ave.	128	2.4	H	-2.99	40.50	54	13.50
4924.00	42.60	PK	138	2.4	H	7.34	49.94	74	24.06
4924.00	27.07	Ave.	138	2.4	H	7.34	34.41	54	19.59

BLE Mode:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel (2402 MHz)									
255.15	46.00	QP	273	1.3	V	-11.81	34.19	46	11.81
2402.00	93.58	PK	13	1.1	H	-3.04	90.54	/	/
2402.00	89.45	Ave.	13	1.1	H	-3.04	86.41	/	/
2402.00	85.88	PK	95	1.6	V	-3.04	82.84	/	/
2402.00	81.90	Ave.	95	1.6	V	-3.04	78.86	/	/
2359.85	57.72	PK	319	2.1	H	-3.07	54.65	74	19.35
2359.85	29.14	Ave.	319	2.1	H	-3.07	26.07	54	27.93
2389.03	58.97	PK	57	1.4	H	-3.05	55.92	74	18.08
2389.03	30.14	Ave.	57	1.4	H	-3.05	27.09	54	26.91
2485.51	43.11	PK	151	2.0	V	-2.99	40.12	74	33.88
2485.51	29.28	Ave.	151	2.0	V	-2.99	26.29	54	27.71
4804.00	50.96	PK	204	1.8	H	7.16	58.12	74	15.88
4804.00	43.63	Ave.	204	1.8	H	7.16	50.79	54	3.21
Middle Channel (2440 MHz)									
255.15	46.51	QP	348	2.1	V	-11.81	34.70	46	11.30
2440.00	92.81	PK	66	1.3	H	-3.02	89.79	/	/
2440.00	88.91	Ave.	66	1.3	H	-3.02	85.89	/	/
2440.00	86.36	PK	90	1.2	V	-3.02	83.34	/	/
2440.00	82.41	Ave.	90	1.2	V	-3.02	79.39	/	/
2351.68	41.18	PK	266	1.2	V	-3.07	38.11	74	35.89
2351.68	27.98	Ave.	266	1.2	V	-3.07	24.91	54	29.09
2387.43	43.94	PK	229	2.0	H	-3.05	40.89	74	33.11
2387.43	29.12	Ave.	229	2.0	H	-3.05	26.07	54	27.93
2483.53	46.17	PK	207	1.2	V	-2.99	43.18	74	30.82
2483.53	29.28	Ave.	207	1.2	V	-2.99	26.29	54	27.71
4880.00	49.32	PK	21	2.0	H	7.28	56.60	74	17.40
4880.00	41.45	Ave.	21	2.0	H	7.28	48.73	54	5.27

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
High Channel (2480 MHz)									
255.15	45.63	QP	176	2.0	V	-11.81	33.82	46	12.18
2480.00	92.05	PK	90	1.3	H	-2.99	89.06	/	/
2480.00	87.92	Ave.	90	1.3	H	-2.99	84.93	/	/
2480.00	83.90	PK	65	2.5	V	-2.99	80.91	/	/
2480.00	79.77	Ave.	65	2.5	V	-2.99	76.78	/	/
2331.80	41.98	PK	246	1.3	V	-3.09	38.89	74	35.11
2331.80	27.66	Ave.	246	1.3	V	-3.09	24.57	54	29.43
2483.51	60.28	PK	18	1.4	H	-2.99	57.29	74	16.71
2483.51	44.47	Ave.	18	1.4	H	-2.99	41.48	54	12.52
2483.66	59.13	PK	289	1.3	H	-2.99	56.14	74	17.86
2483.66	43.04	Ave.	289	1.3	H	-2.99	40.05	54	13.95
4960.00	51.01	PK	234	1.9	H	7.40	58.41	74	15.59
4960.00	42.66	Ave.	234	1.9	H	7.40	50.06	54	3.94

Note:
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Limit - Corrected. Amplitude
The other spurious emission which is 20dB to the limit was not recorded.

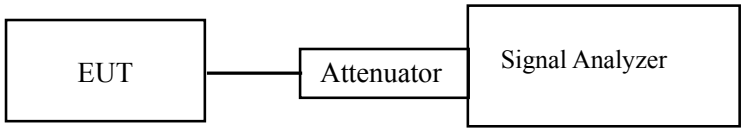
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

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:	25~26 ℃
Relative Humidity:	49~50 %
ATM Pressure:	101 kPa

The testing was performed by Chris Wang from 2016-10-27 to 2016-10-28.

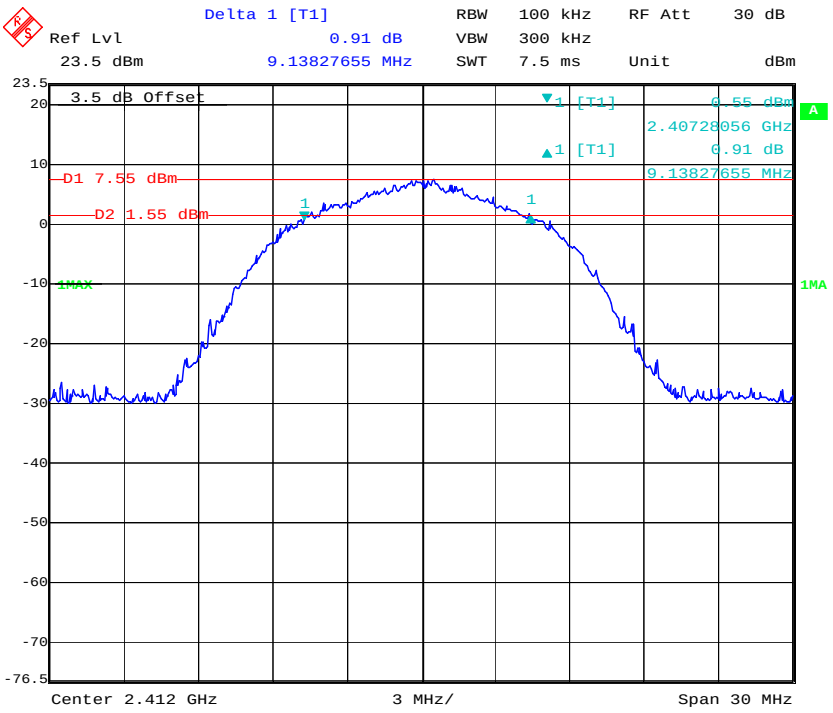
Test Result: Compliance.

EUT operation mode: Transmitting

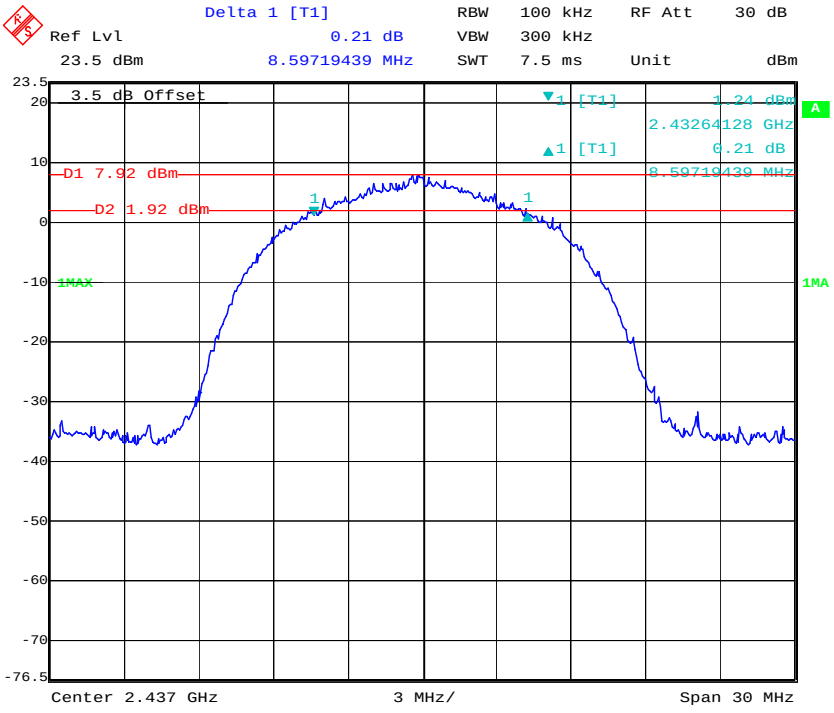
Please refer to following table and plots.

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (kHz)
802.11b mode			
Low	2412	9.14	≥500
Middle	2437	8.60	≥500
High	2462	9.20	≥500
802.11g			
Low	2412	16.47	≥500
Middle	2437	16.47	≥500
High	2462	16.47	≥500
802.11n-HT20 mode			
Low	2412	17.68	≥500
Middle	2437	17.74	≥500
High	2462	17.74	≥500
BLE mode			
Low	2402	0.733	≥500
Middle	2440	0.729	≥500
High	2480	0.733	≥500

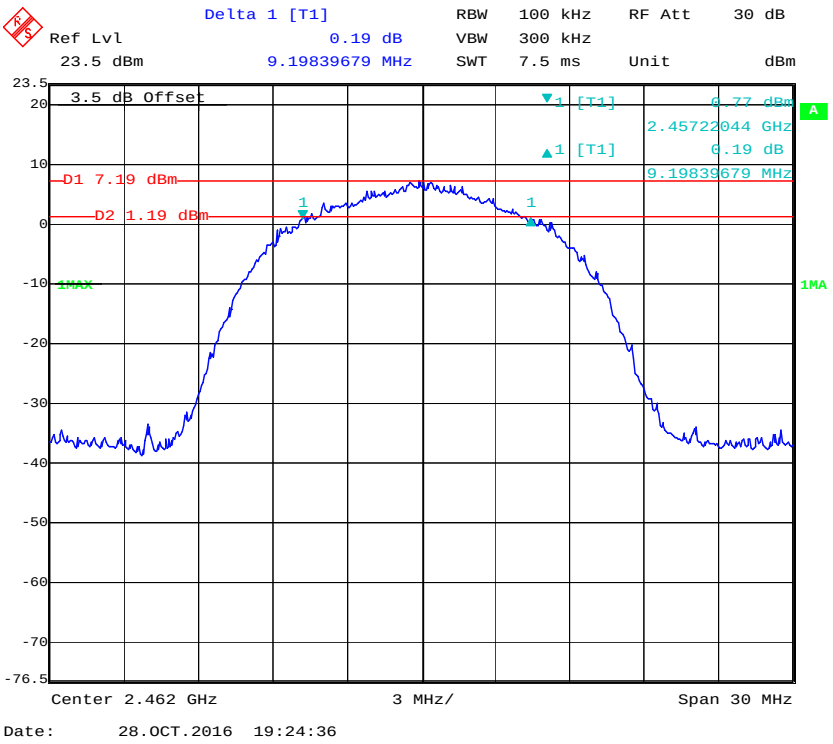
802.11b Low Channel



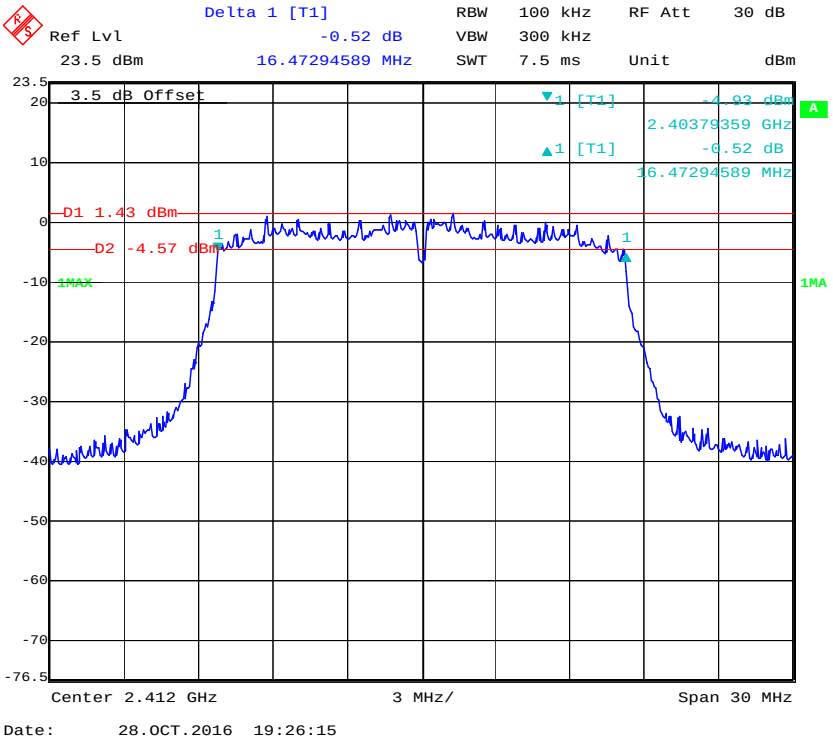
802.11b Middle Channel



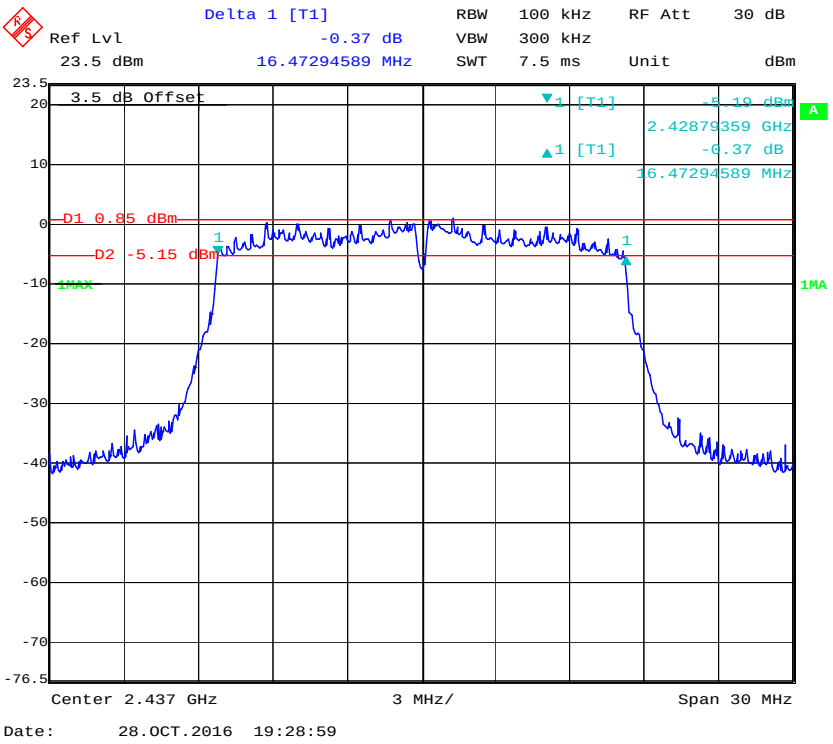
802.11b High Channel



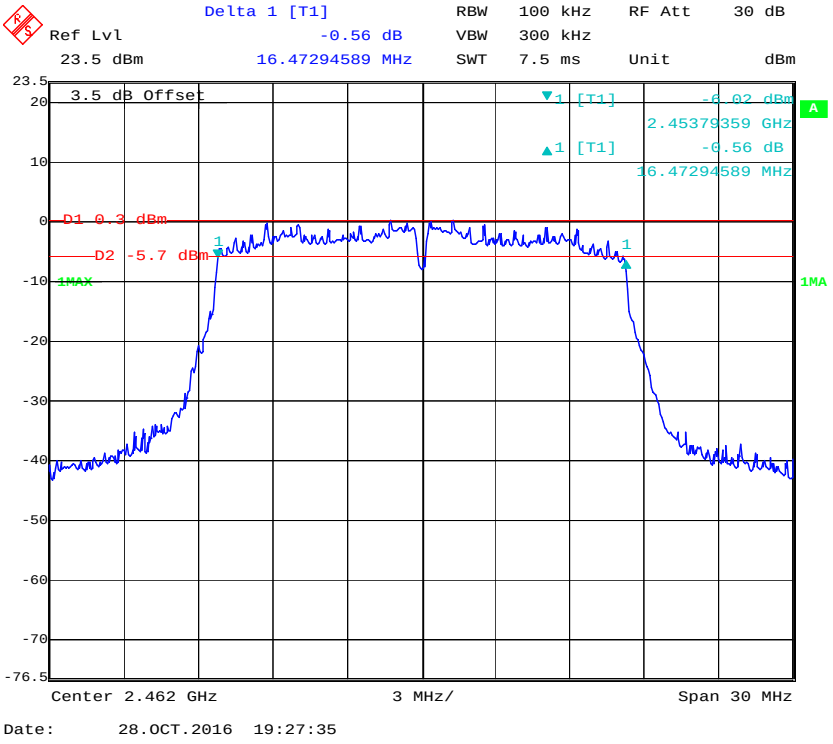
802.11g Low Channel



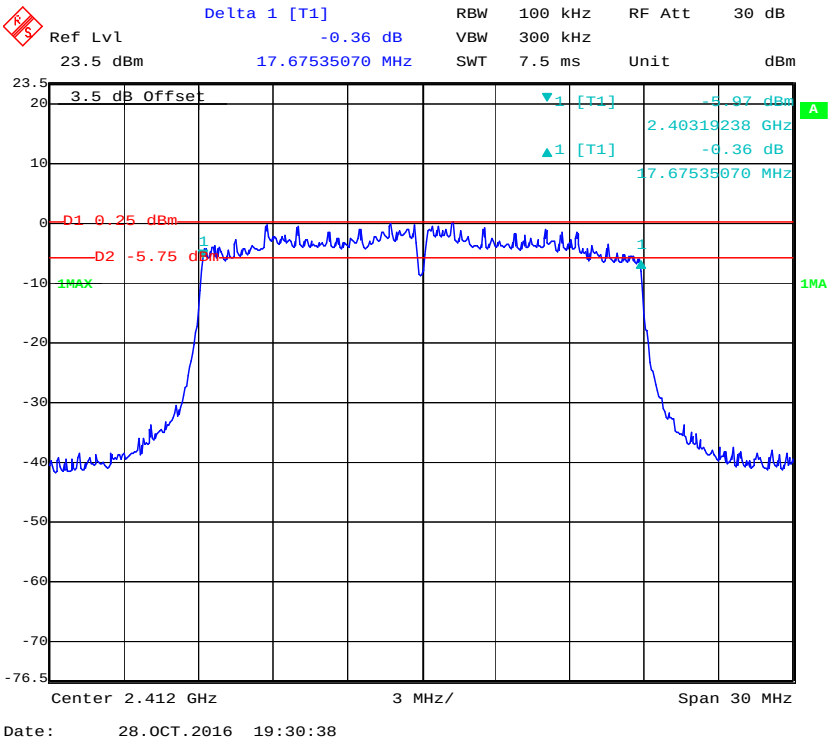
802.11g Middle Channel



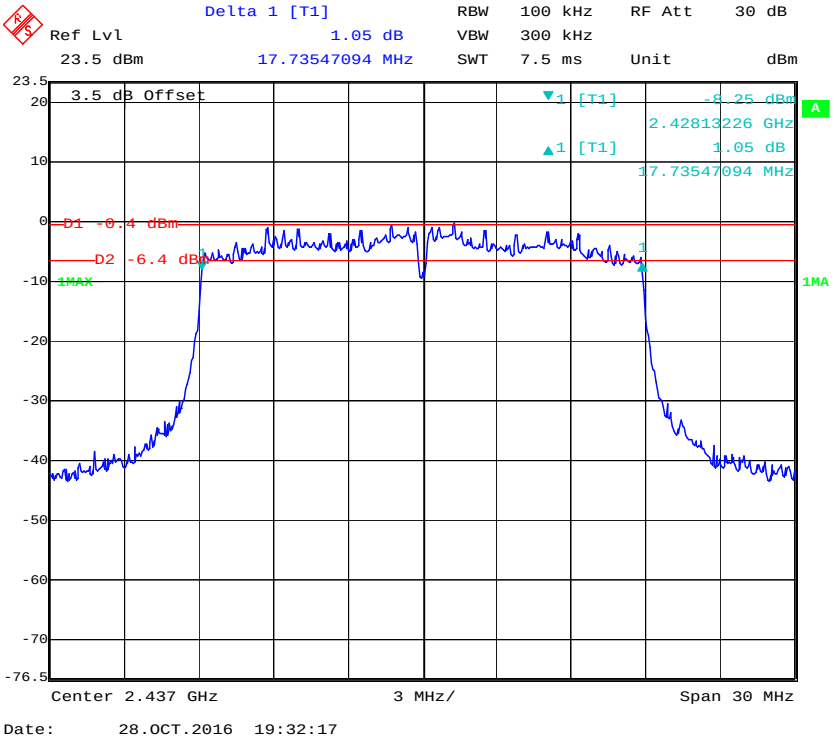
802.11g High Channel



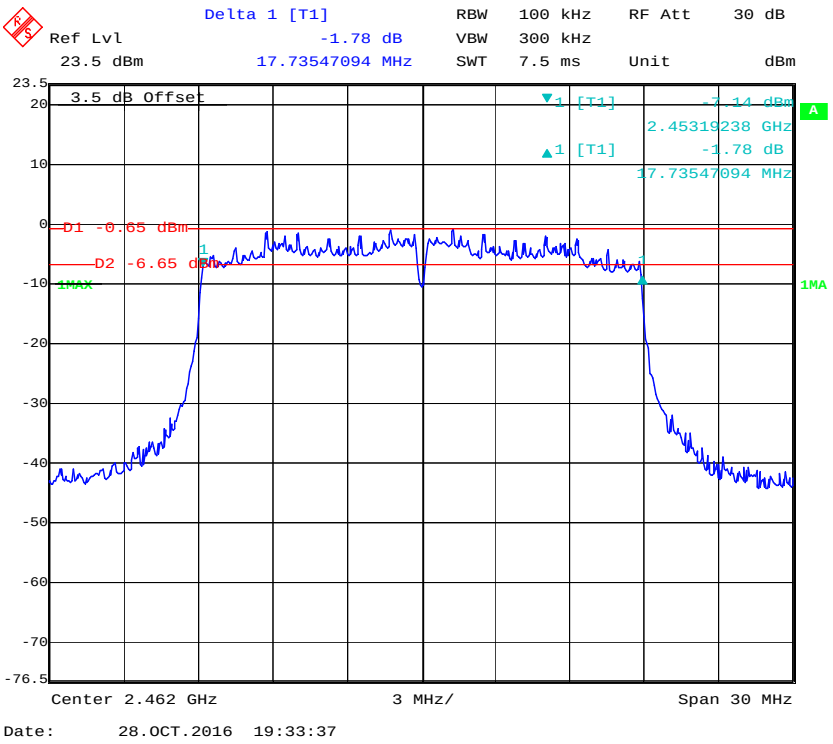
802.11n-HT20 Low Channel



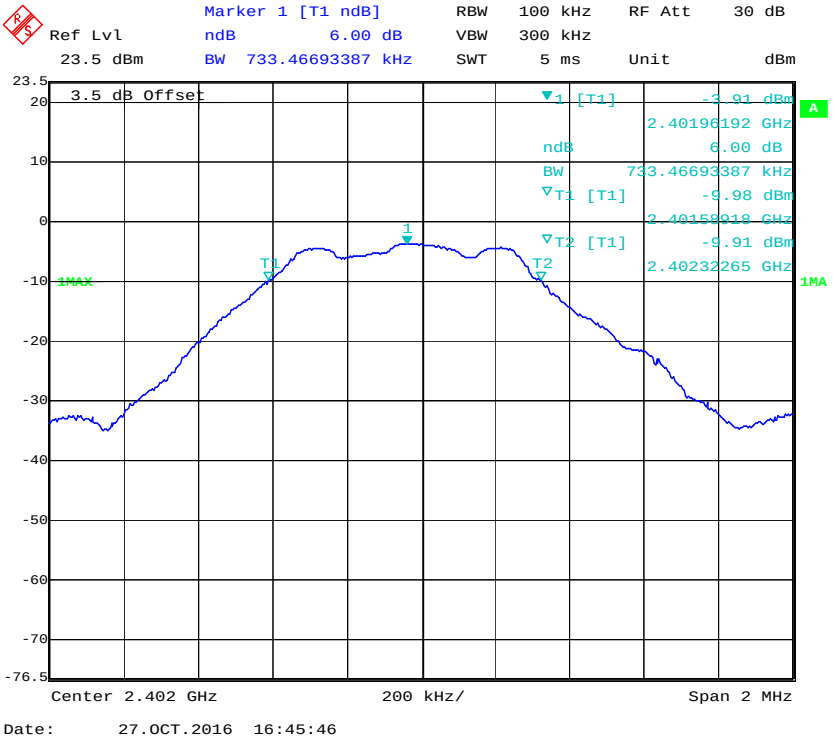
802.11n-HT20 Middle Channel



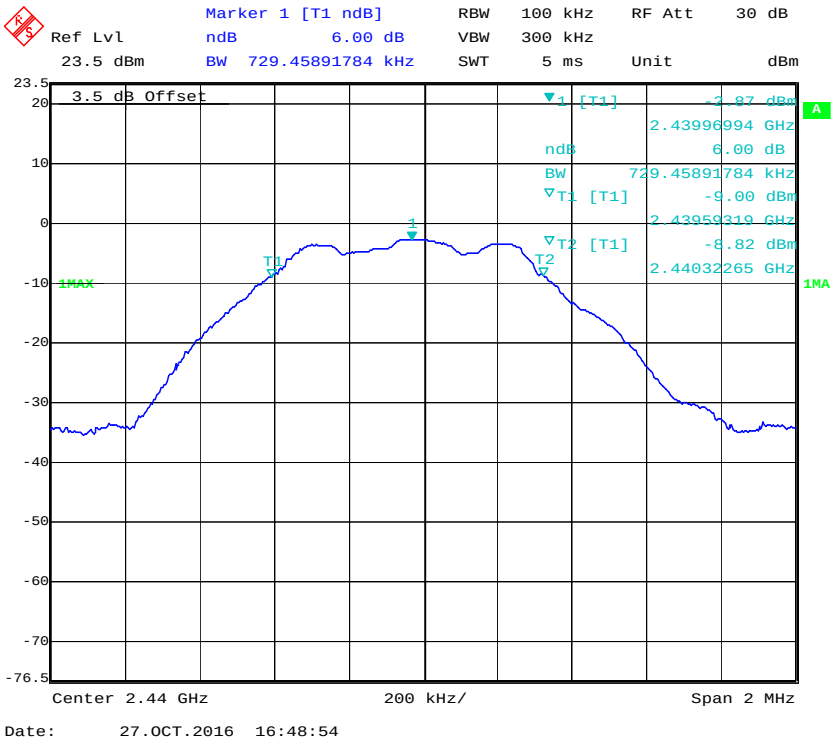
802.11n-HT20 High Channel



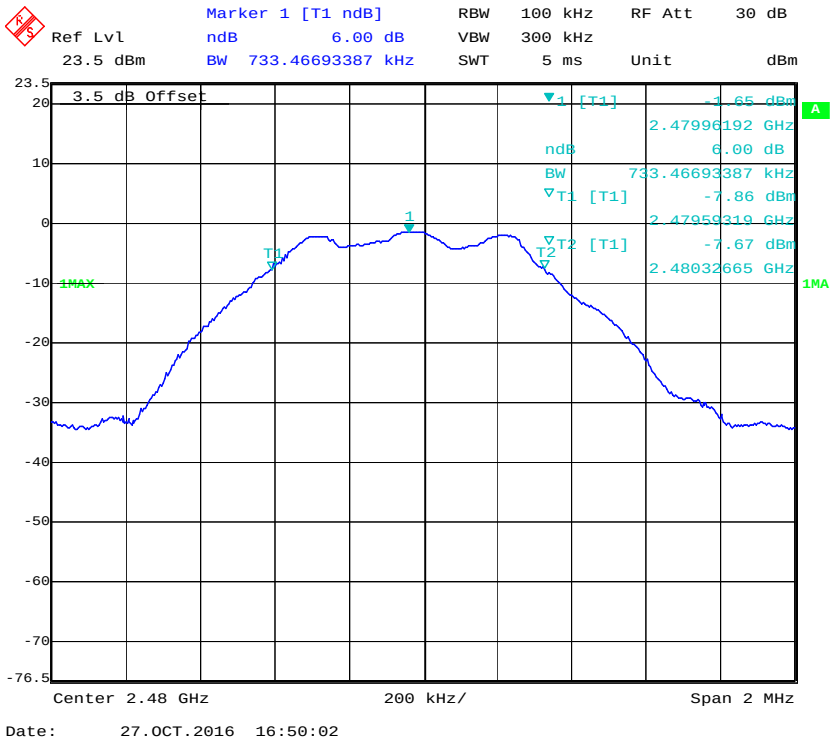
BLE Low Channel



BLE Middle Channel



BLE High Channel



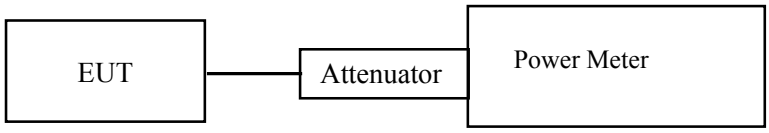
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

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:	24 ℃
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

The testing was performed by Chris Wang on 2016-10-27.

Test Result: Compliance.

EUT operation mode: Transmitting

Please refer to following table and plots.

Wi-Fi mode

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Max Conducted Average Output Power (dBm)	Limit (dBm)
802.11b				
Low	2412	21.78	16.20	30
Middle	2437	20.90	15.61	30
High	2462	20.64	15.07	30
802.11g				
Low	2412	19.63	12.00	30
Middle	2437	19.45	11.41	30
High	2462	18.92	11.10	30
802.11n HT20				
Low	2412	18.51	10.59	30
Middle	2437	17.90	10.43	30
High	2462	17.63	9.85	30

BLE mode

Channel	Frequency (MHz)	Max Peak Output Power (dBm)	Limit (dBm)	Result
Low	2402	-4.16	30	Pass
Middle	2440	-3.08	30	Pass
High	2480	-1.89	30	Pass

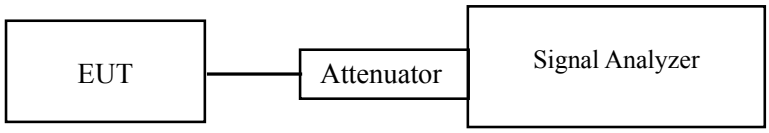
FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

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:	25~26 ℃
Relative Humidity:	49~50 %
ATM Pressure:	101.0 kPa

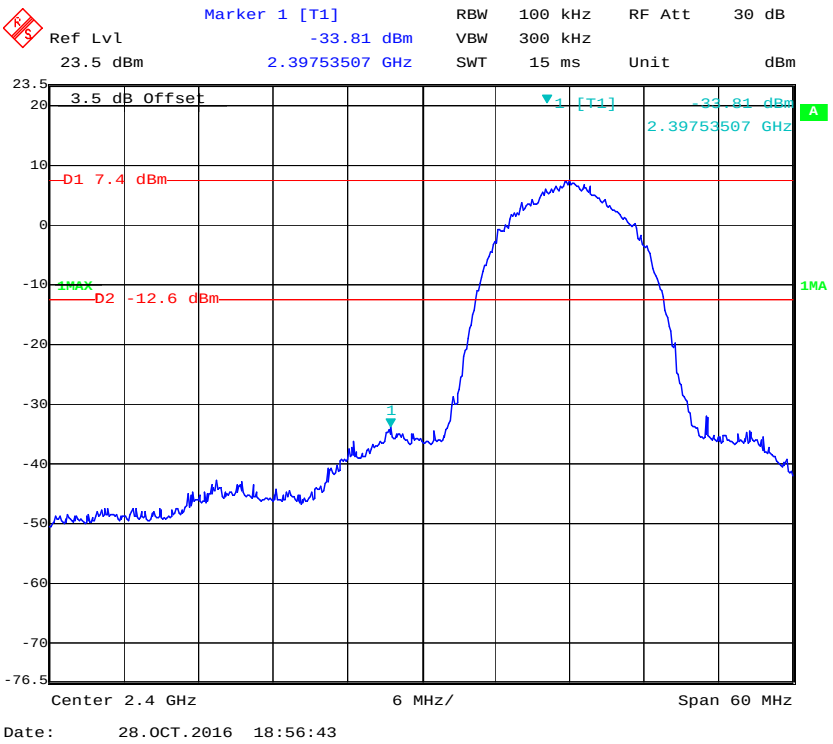
The testing was performed by Chris Wang from 2016-10-27 to 2016-10-28.

Test Result: Compliance.

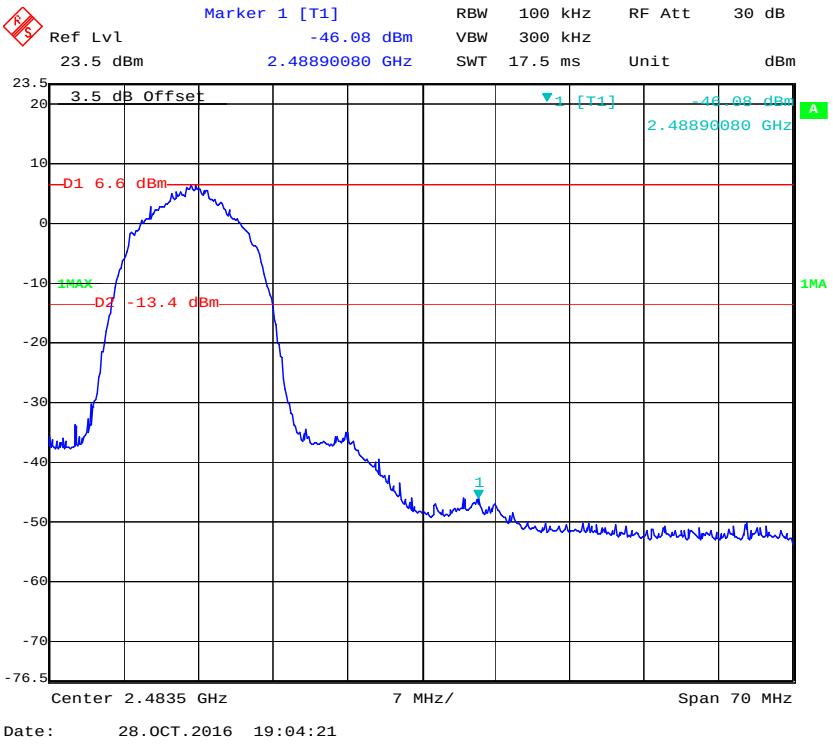
EUT operation mode: Transmitting

Please refer to the following plots:

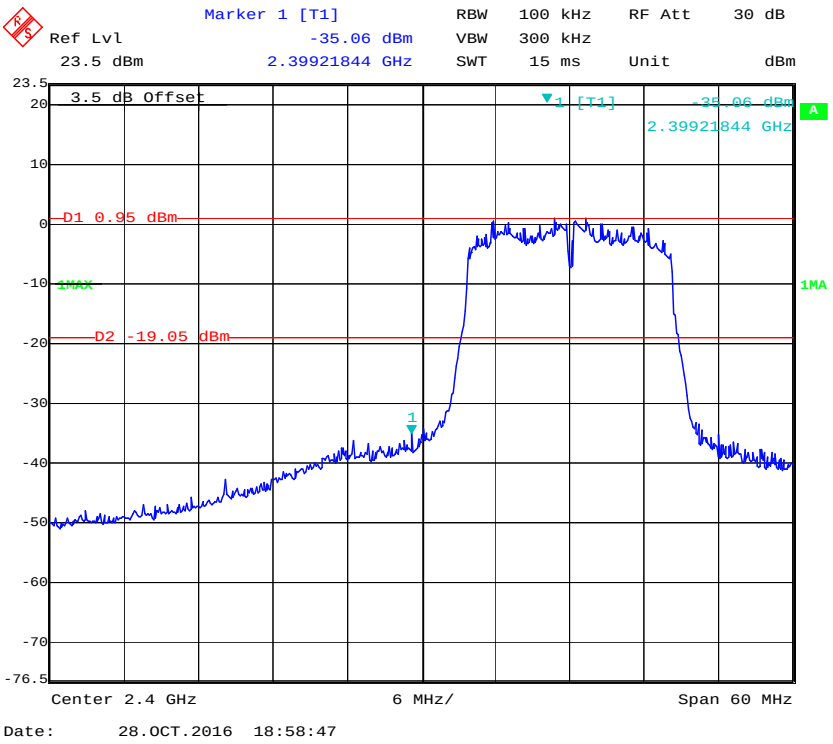
802.11b: Band Edge, Left Side



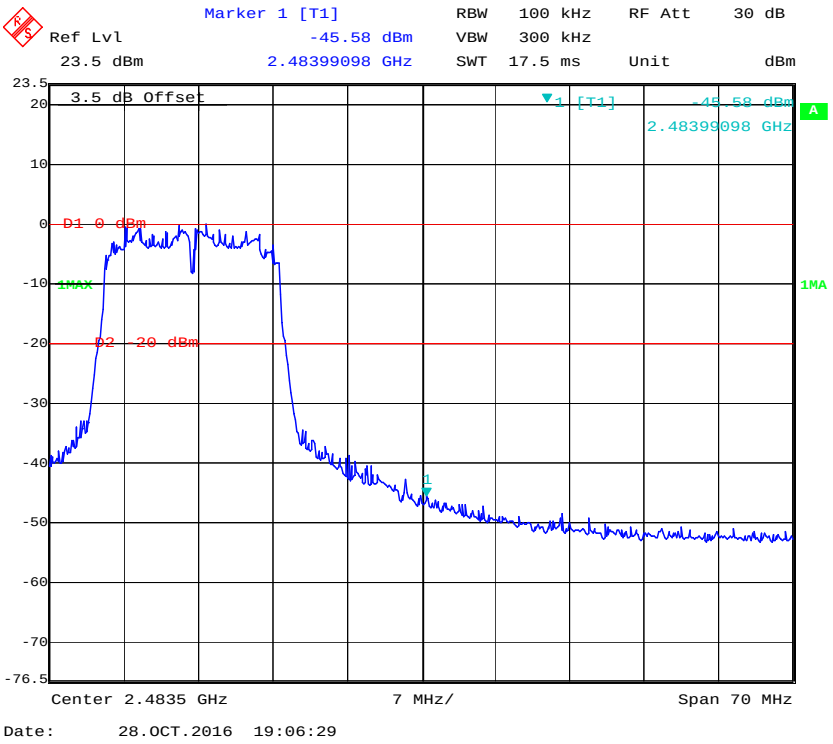
802.11b: Band Edge, Right Side



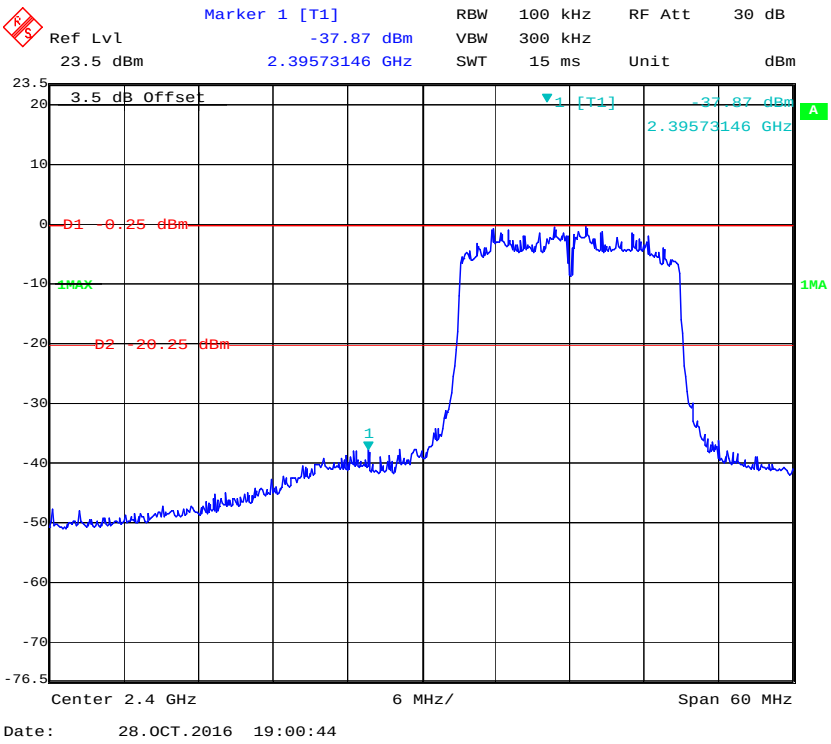
802.11g: Band Edge, Left Side



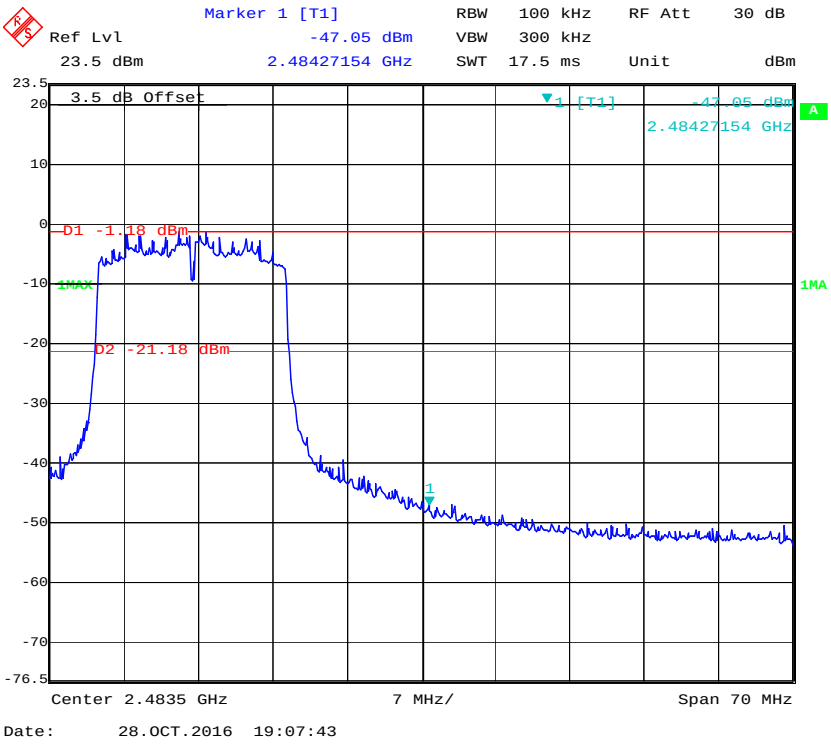
802.11g: Band Edge, Right Side



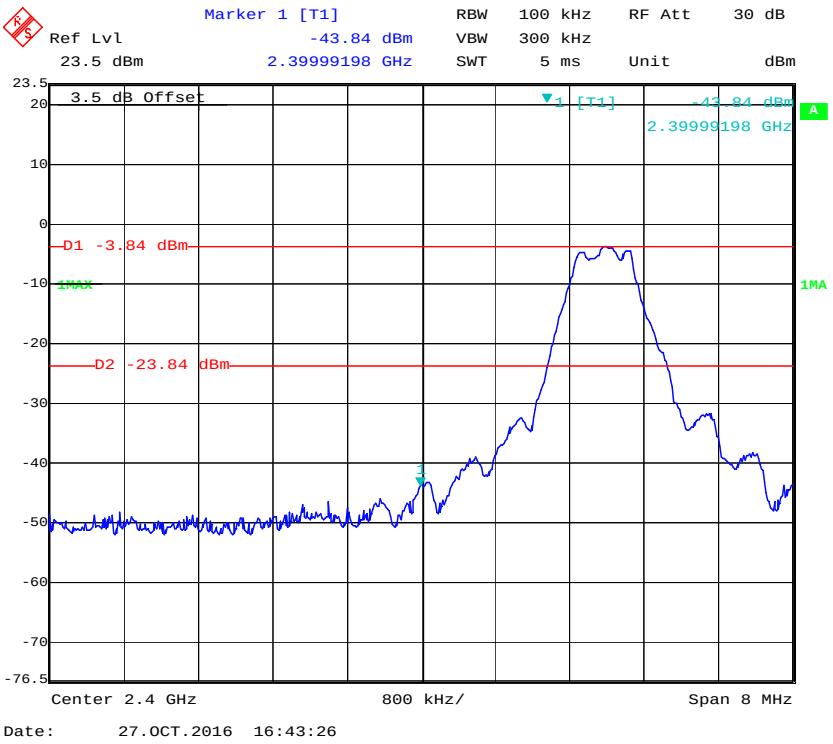
802.11n-HT20: Band Edge, Left Side



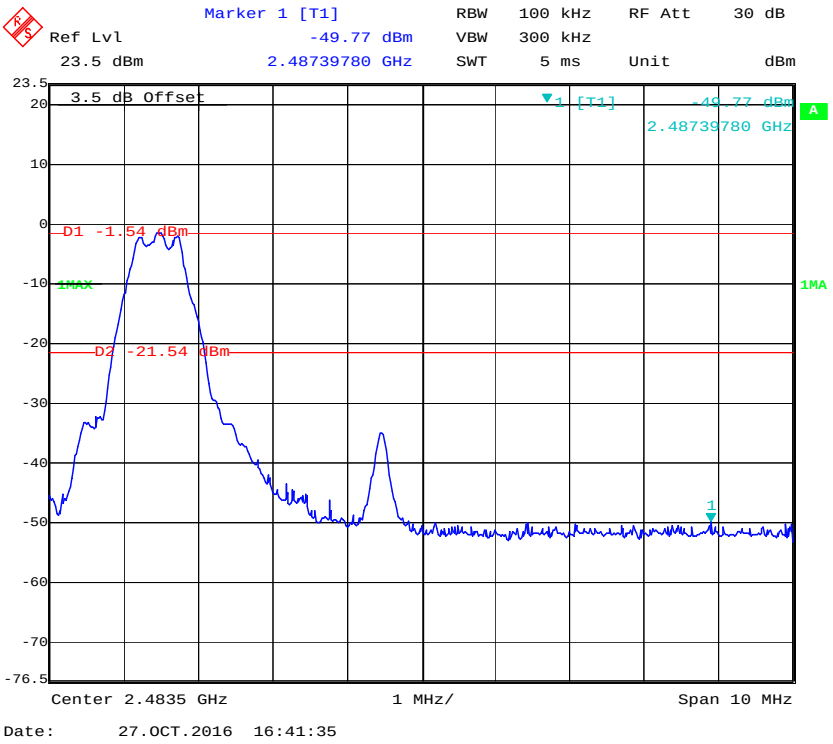
802.11n-HT20: Band Edge, Right Side



BLE: Band Edge, Left Side



BLE: Band Edge, Right Side



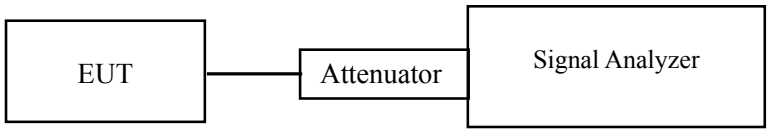
FCC §15.247(e) - POWER SPECTRAL DENSITY

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

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:	25~26 ℃
Relative Humidity:	49~50 %
ATM Pressure:	101.0 kPa

The testing was performed by Chris Wang from 2016-10-27 to 2016-10-28.

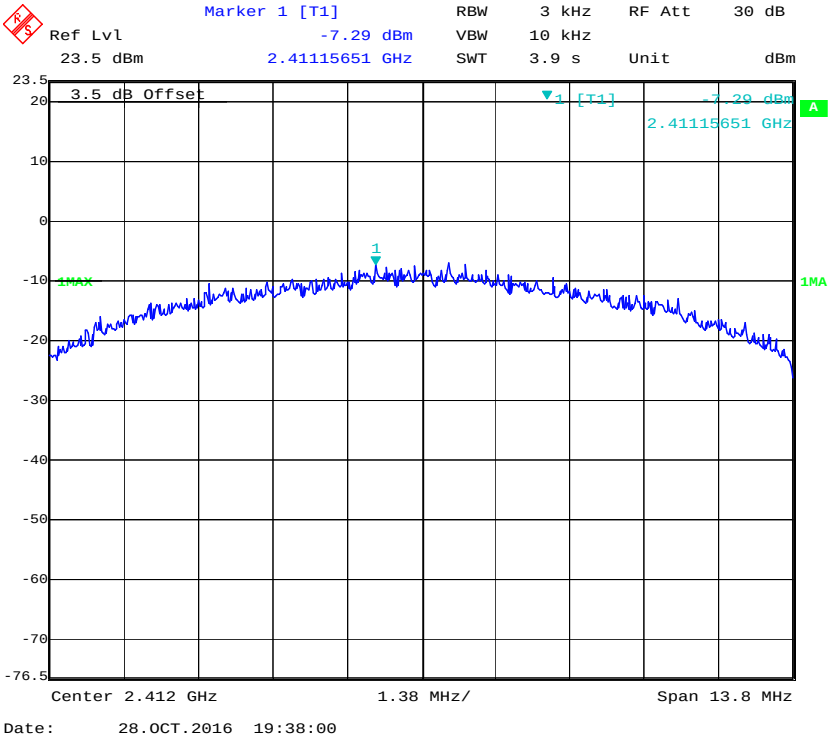
Test Result: Compliance.

EUT operation mode: Transmitting

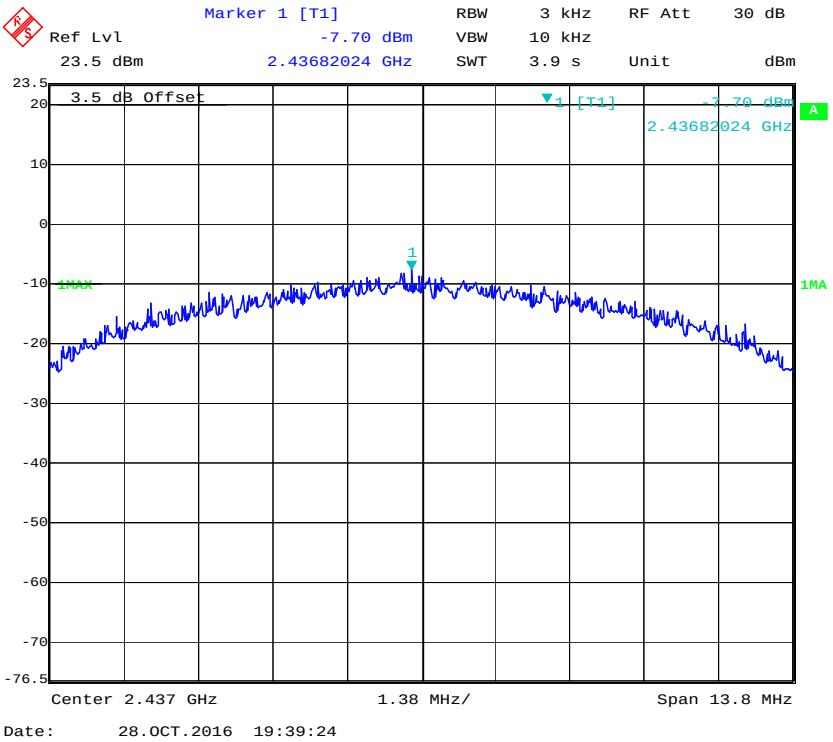
Please refer to following table and plots.

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
802.11b mode			
Low	2412	-7.29	≤8
Middle	2437	-7.70	≤8
High	2462	-7.95	≤8
802.11g mode			
Low	2412	-12.13	≤8
Middle	2437	-13.61	≤8
High	2462	-13.63	≤8
802.11n-HT20 mode			
Low	2412	-14.69	≤8
Middle	2437	-15.16	≤8
High	2462	-15.61	≤8
BLE mode			
Low	2402	-16.85	≤8
Middle	2440	-14.58	≤8
High	2480	-13.98	≤8

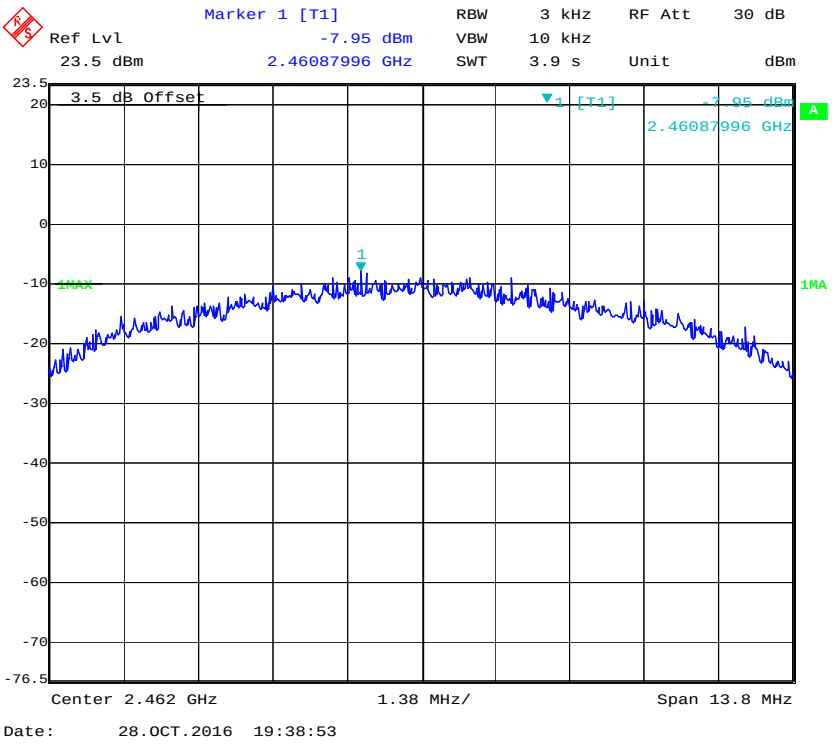
Power Spectral Density, 802.11b Low Channel



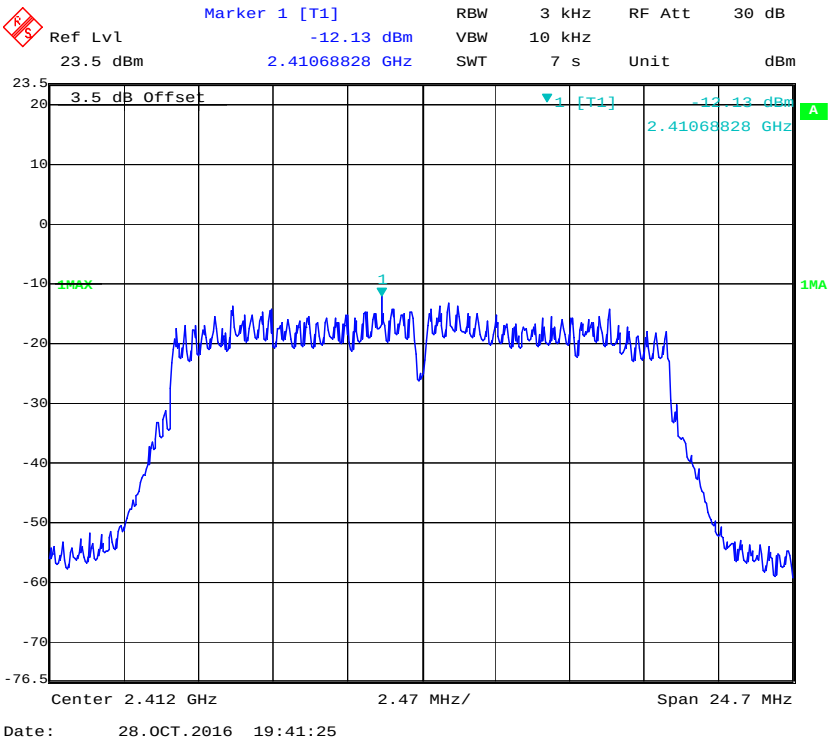
Power Spectral Density, 802.11b Middle Channel



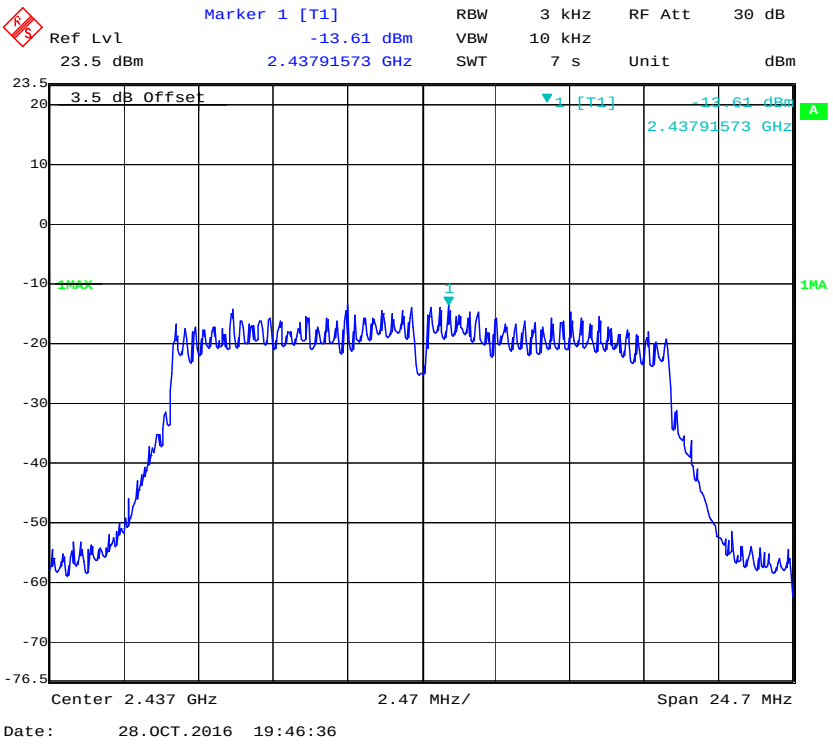
Power Spectral Density, 802.11b High Channel



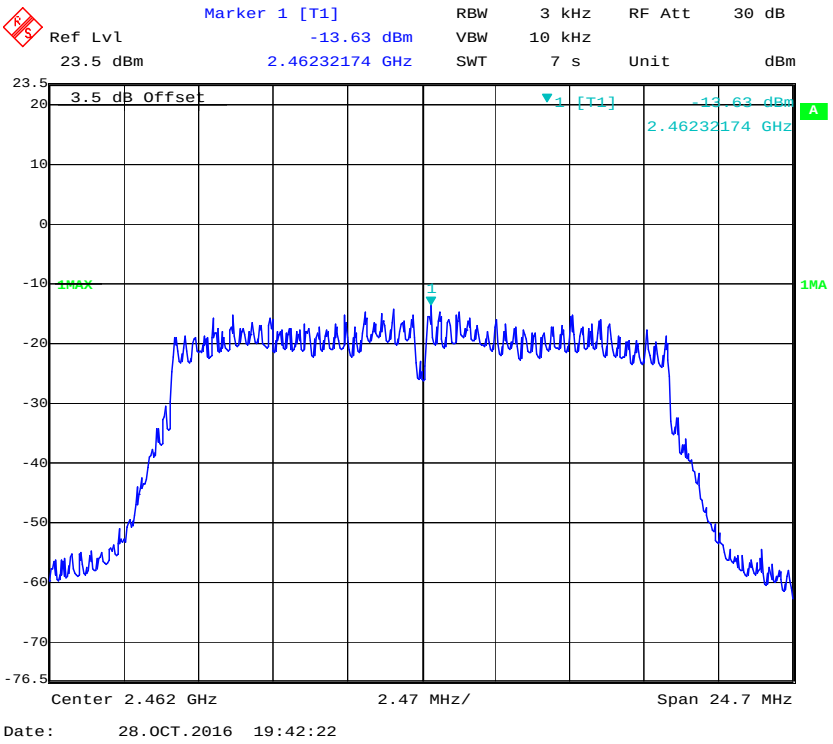
Power Spectral Density, 802.11g Low Channel



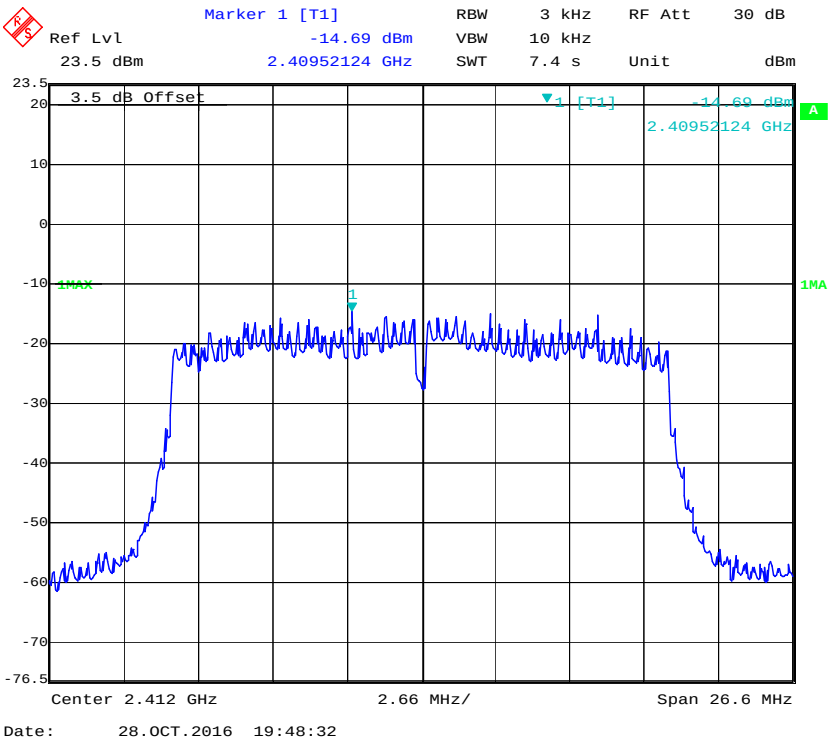
Power Spectral Density, 802.11g Middle Channel



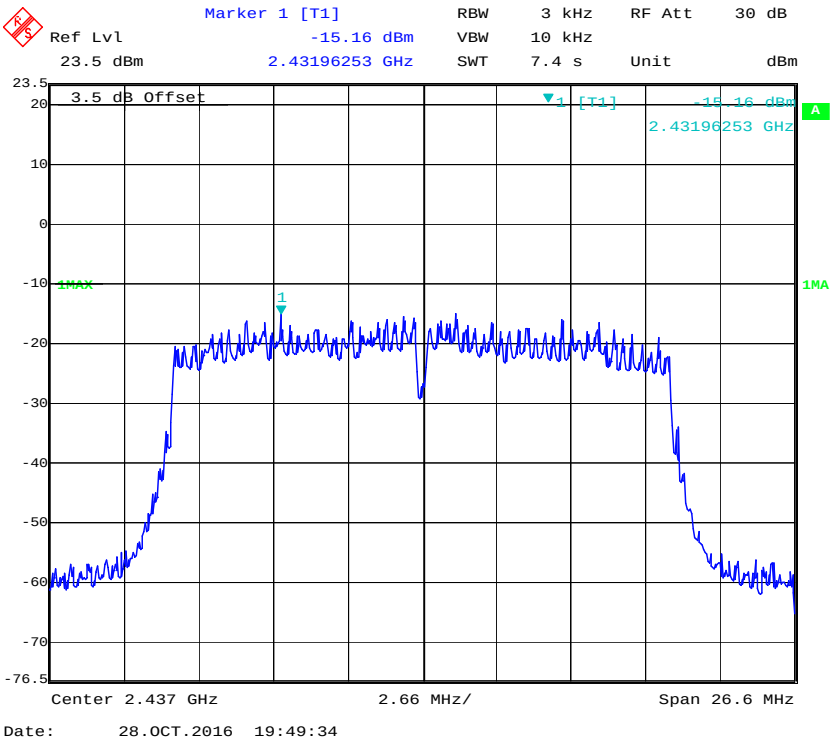
Power Spectral Density, 802.11g High Channel



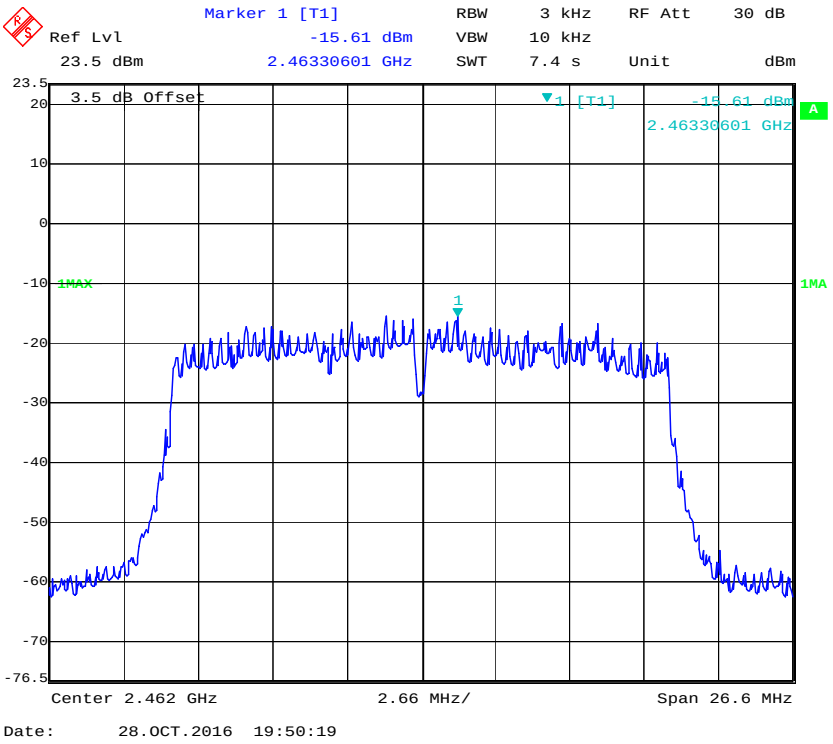
Power Spectral Density, 802.11n-HT20 Low Channel



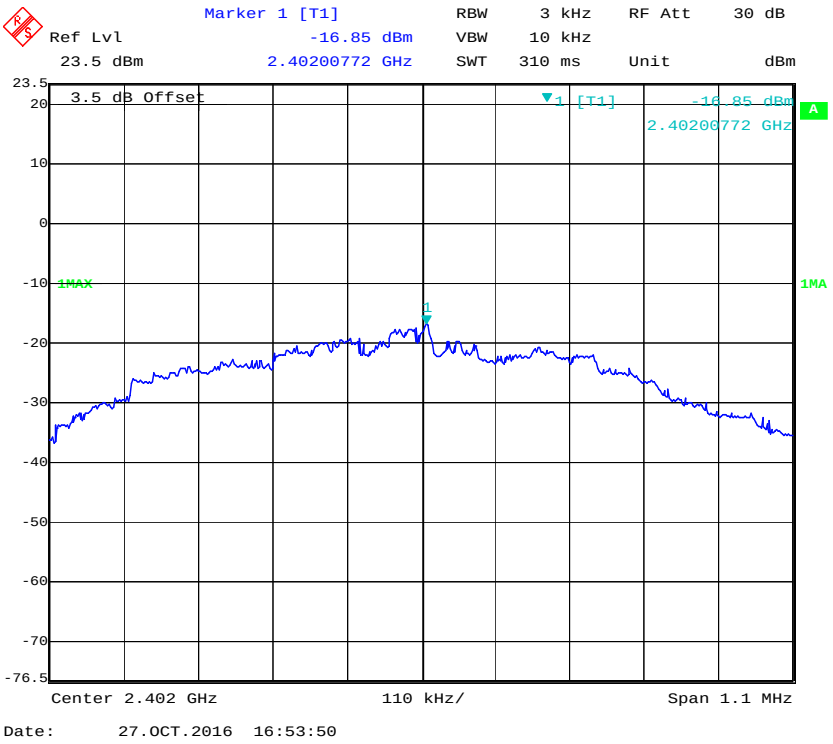
Power Spectral Density, 802.11n-HT20 Middle Channel



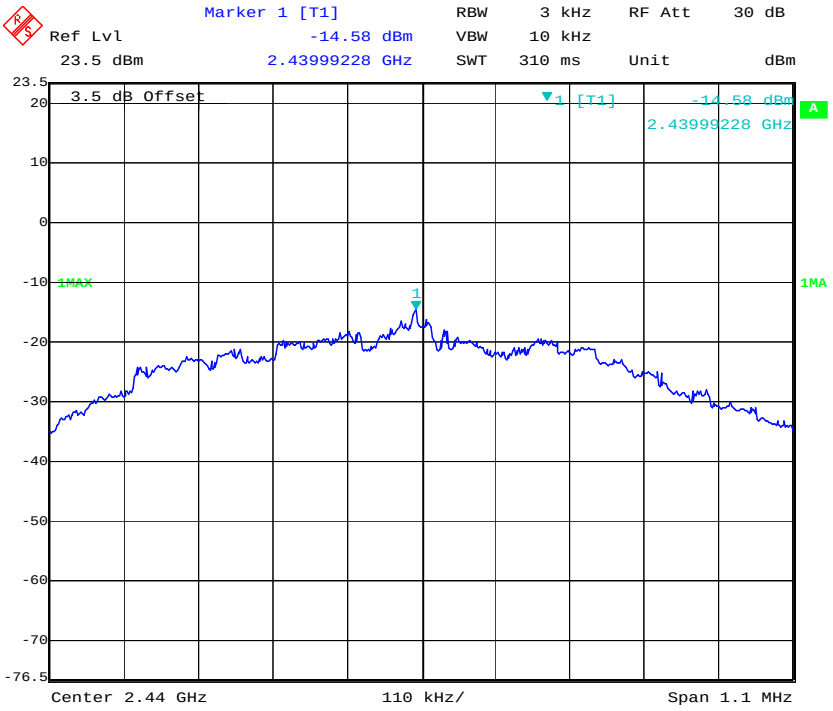
Power Spectral Density, 802.11n-HT20 High Channel



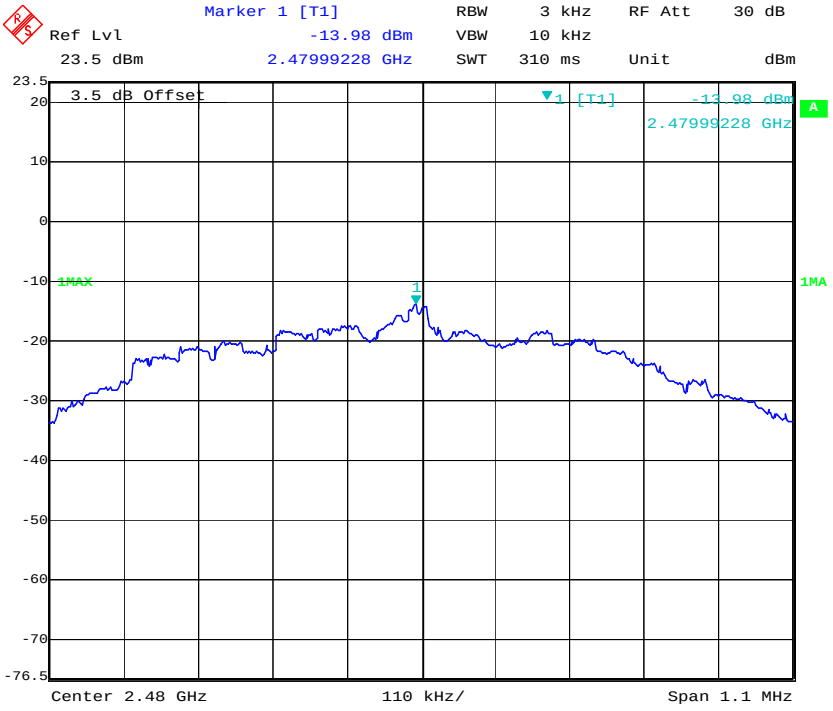
Power Spectral Density, BLE Low Channel



Power Spectral Density, BLE Middle Channel



Power Spectral Density, BLE High Channel



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