FCC PART 15.247

TEST REPORT

For

Keysight Technologies, Inc.

2221 South Clark Street Suite 11023 Arlington, Virginia 22202

FCC ID: 2AK5OR1605-80001

Report Type:	**Product Name:**
Orginal Report	PLUM

Test Engineer:	Tom Tang
Report Number:	RSC170125002B
Report Date:	2017-02-09
Reviewed By:	Henry Ding EMC Leader
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Chengdu) No.5040, Huilongwan Plaza, No. 1, Shawan Road, Jinniu District, Chengdu, Sichuan, China Tel: 028-65523123, Fax: 028-65525125 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The **Keysight Technologies, Inc.**'s product, model number: **R1605-80001 (FCC ID: 2AK5OR1605-80001)** or the "EUT" as referred to in this report was the PLUM, which has a plasitic enclosure.

Mechanical Description of EUT

The EUT was measured approximately 100 mm (L) x 60 mm (W) x 43 mm (H).

Rated input voltage: AC 85-265V/50~60Hz.

**All measurement and test data in this report was gathered from final production sample, serial number: 170125002/01 (assigned by the BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2017-01-18, and EUT complied to test requirement.*

Objective

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

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

Related Submittal(s)/Grant(s)

FCC Part 15C DSS submissions with FCC ID: 2AK5OR1605-80001.

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.

The uncertainty of any RF tests which use conducted method measurement is ±3.17 dB, the uncertainty of any radiation on emissions measurement is:

30M~200MHz: ±4.7 dB;
200M~1GHz: ±6.0 dB;
1G-6GHz: ±5.13dB;
6G~25GHz: ±5.47dB;

And the uncertainty will not be taken into consideration for all test data recorded in the report.

Test Facility

The test site used by BACL to collect test data is located No.5040, Huilongwan Plaza, No. 1, Shawan Road, Jinniu District, Chengdu, Sichuan, China.

Test site at BACL 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, 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.: 560332.

BACL's test facility has been fully described in reports on file and registered with the Innovation, Science and Economic Development Canada under Registration Numbers: 3062C-1.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in testing mode, which was provided by manufacturer.
For 2.4GHz band, 11 channels are provided to testing:

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

For 802.11b, 802.11g, and 802.11n ht20 modes were tested with channel 1, 6 and 11.

The worst-case data rates are determined to be as follows for each mode based upon investigations by measuring the average power and PSD across all data rates bandwidths, and modulations.

For Bluetooth LE mode, 40 channels are provided for testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	…	…
…	…	…	…
…	…	…	…
..	…	38	2478
19	2440	39	2480

EUT was tested with channel 0, 19 and 39.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

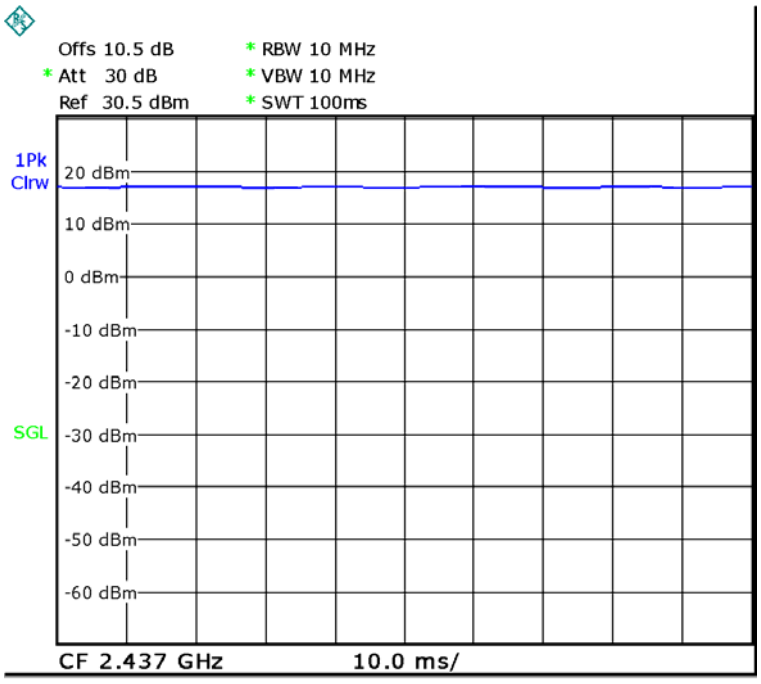
The worst condition (maximum power with maximum duty cycle) was setting by the software as following table:

Test Mode	Test Software Version	Putty-V0.63.043510830		
802.11b	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	1Mbps	1Mbps	1Mbps
	Power Level Setting	1	1	1
802.11g	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	6Mbps	6Mbps	6Mbps
	Power Level Setting	1	1	1
802.11n ht20	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	MCS0	MCS0	MCS0
	Power Level Setting	1	1	1
BLE	Test Frequency	2402MHz	2440MHz	2480MHz
	Data Rate	/	/	/
	Power Level Setting	/	/	/

Duty Cycle information is below:

Mode	Duty Cycle (100%)	T(μs)	1/T(kHz)	VBW setting	10log(1/X)
802.11b	100	-	-	10Hz	0
802.11g	100	-	-	10Hz	0
802.11n20	100	-	-	10Hz	0
BLE	66.99	418	2.392	3kHz	1.74

802.11b



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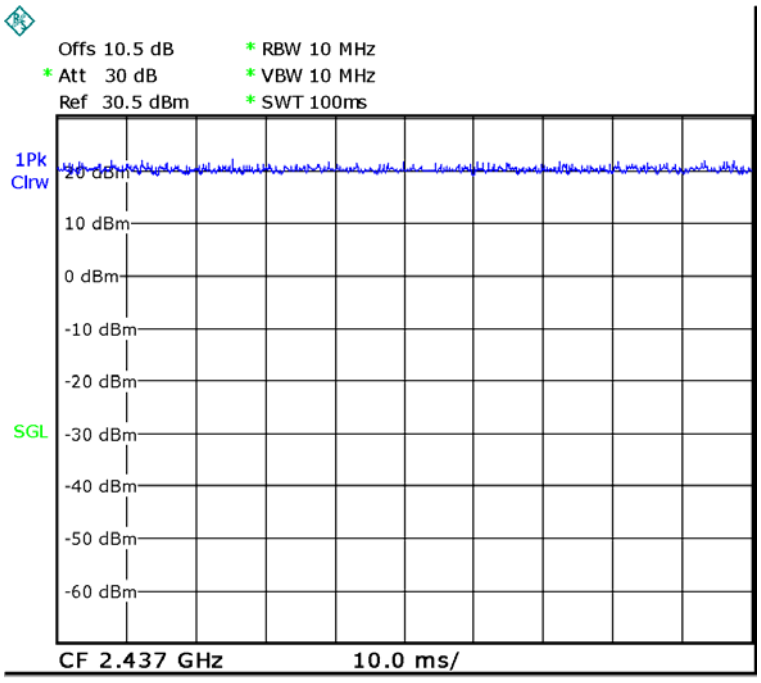
802.11g



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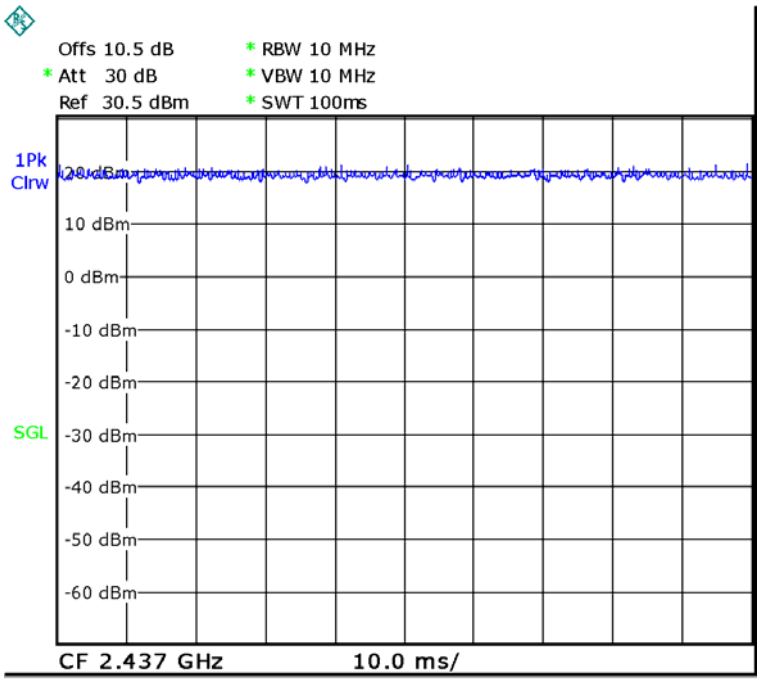
802.11n ht20



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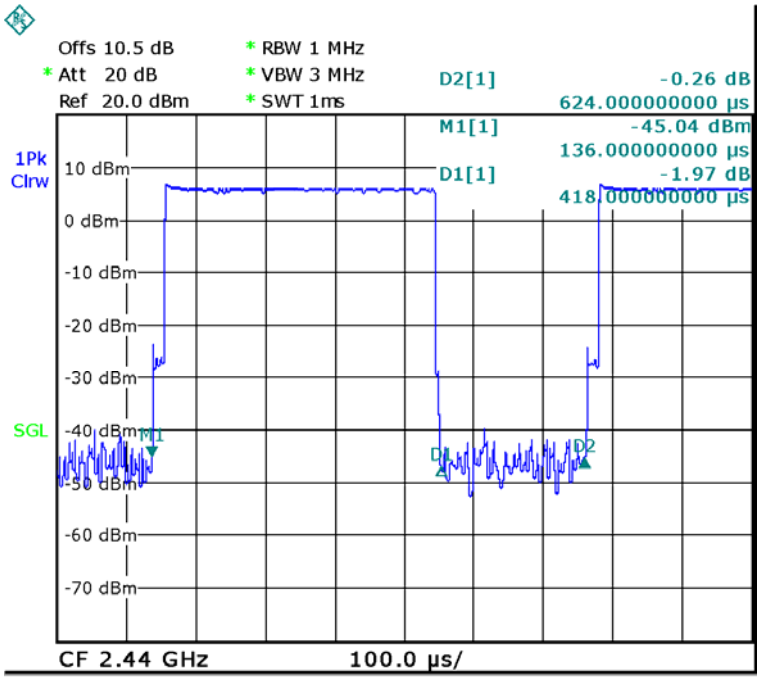
Duty Cycle(worst cace) of Bluetooth LE mode as follows:



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Support Equipment List and Details

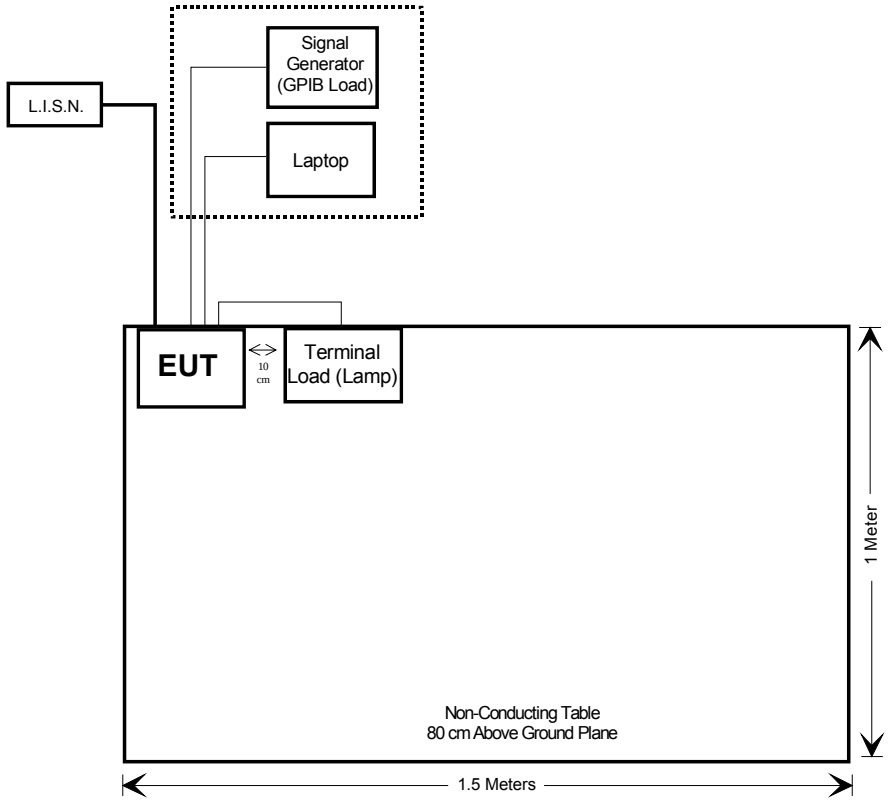
Manufacturer	Description	Model	Serial Number
Philips	Terminal Load (Lamp)	L2G230-1000	NA
HP	Signal Generator (GPIB Load)	8648C	3623A04150
Dell	Laptop	E6410	37417629385

External I/O Cable

Cable Description	Length (m)	From	To
Unshielded Power Cable	0.2	EUT	Terminal Load (Lamp)
Shielded GPIB Cable	2.0	EUT	Signal Generator (GPIB Load)
Unshielded RJ45 Cable	8.0	EUT	Laptop

Block Diagram of Test Setup

AC power line conducted emission test



SUMMARY OF TEST RESULTS

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

FCC §15.247 (I), §2.1091 & §1.1307(B)(1) - 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/f²)	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

$$S = PG/4\pi R^2$$

Where:
S = 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**	**Antenna Gain**		**Tune-up Conducted Power**		**Evaluation Distance**	**Power Density**	**Limit**
	MHz	**dBi**	**numeric**	**dBm**	**mW**	**cm**	**mW/cm^2**	**mW/cm^2**
Wi-Fi	2412-2462	2.5	1.78	23.0	199.53	20	0.0707	1.0
BLE	2402-2480	2.5	1.78	6.0	3.98	20	0.0014	1.0

Note: 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.

Antenna Connector Construction

The EUT has one internal antenna with IPEX connector and the antenna gain is 2.5 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

Measurement Uncertainty

Compliance or non- compliance with a disturbance limit shall be determined in the following manner：

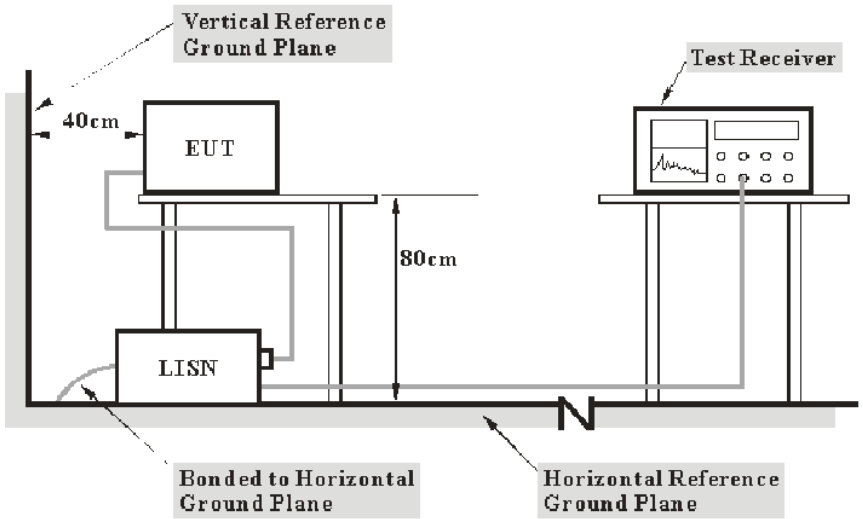
If U_{lab} is less than or equal to U_{cispr} of Table 1, then:
–compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
–non - compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.
If U_{lab} is greater than U_{cispr} of Table 1, then:
–compliance is deemed to occur if no measured disturbance level, increased by (U_{lab} − U_{cispr}), exceeds the disturbance limit;
–non - compliance is deemed to occur if any measured disturbance level, increased by (U_{lab} − U_{cispr}), exceeds the disturbance limit.

Based on CISPR 16-4-2:2011, measurement uncertainty of conducted disturbance at mains port using AMN at Bay Area Compliance Laboratories Corp. (Chengdu) is ±3.17 dB (150 kHz to 30 MHz).

Table 1 – Values of U_{cispr}

Measurement	U_{cispr}
Conducted disturbance at mains port using AMN (150 kHz to 30 MHz)	3.4 dB

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.

The spacing between the peripherals was 10 cm.

The EUT was connected to a 120 V/60 Hz AC power source.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the EUT was connected to the first 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 Amplitude & Margin Calculation

The basic equation is as follows:

$V_C = V_R + A_C + VDF$
$C_f = A_C + VDF$

Herein,
V_C (cord. Reading): corrected voltage amplitude
V_R: reading voltage amplitude
A_c: attenuation caused by cable loss
VDF: voltage division factor of AMN
C_f: Correction Factor

The "**Margin**" column of the following data tables indicates the degree of compliance within 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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS 30	836858/0016	2016-12-02	2017-12-01
Rohde & Schwarz	L.I.S.N.	ENV216	100018	2016-12-02	2017-12-01
Rohde & Schwarz	PULSE LIMITER	ESH3Z2	DE14781	2016-10-31	2017-10-30
N/A	Conducted Cable	NO.5	N/A	2016-11-10	2017-11-09
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A

*** Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

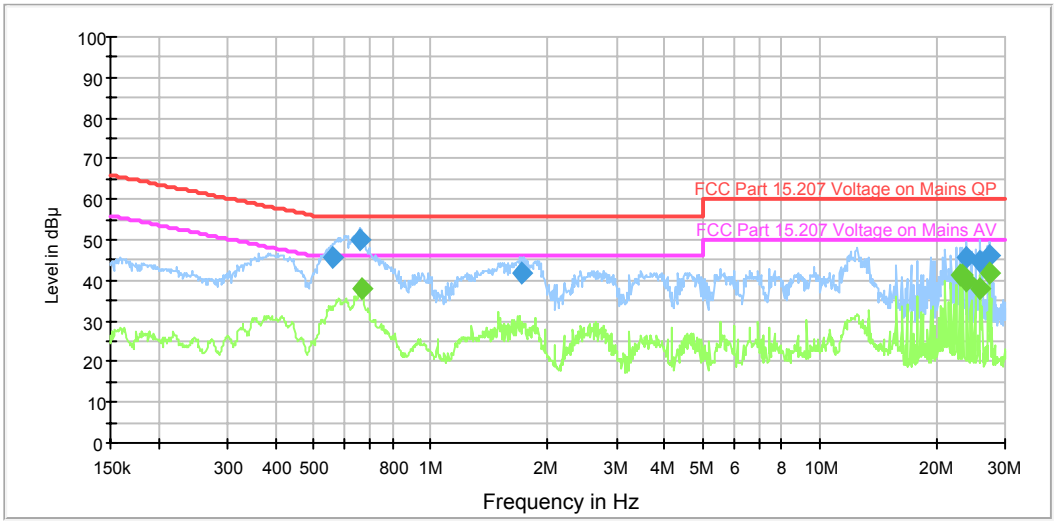
Environmental Conditions

Temperature:	21 °C
Relative Humidity:	48 %
ATM Pressure:	96.2 kPa

The testing was performed by Tom Tang on 2017-01-22.

Test Mode: Transmitting (Wi-Fi)

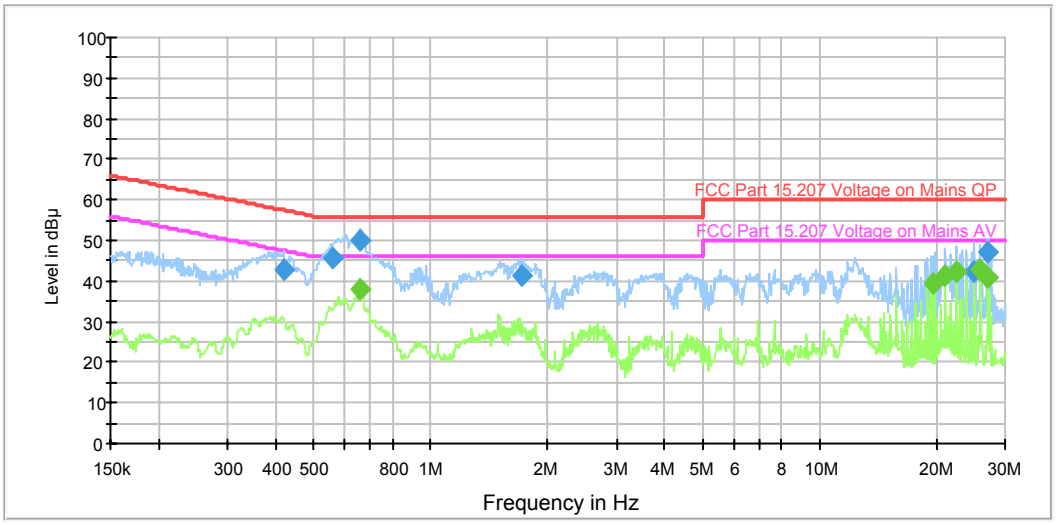
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.562277	45.7	9.000	L1	19.6	10.3	56.0
0.659628	50.2	9.000	L1	19.6	5.8	56.0
1.719452	41.7	9.000	L1	19.7	14.3	56.0
23.872990	45.6	9.000	L1	20.0	14.4	60.0
25.960604	44.8	9.000	L1	20.0	15.2	60.0
27.343434	46.3	9.000	L1	20.1	13.7	60.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.662266	37.9	9.000	L1	19.6	8.1	46.0
22.938747	41.4	9.000	L1	20.0	8.6	50.0
23.401207	41.3	9.000	L1	20.0	8.7	50.0
23.872990	40.1	9.000	L1	20.0	9.9	50.0
25.960604	38.0	9.000	L1	20.0	12.0	50.0
27.343434	42.0	9.000	L1	20.1	8.0	50.0

AC120 V, 60 Hz, Neutral:

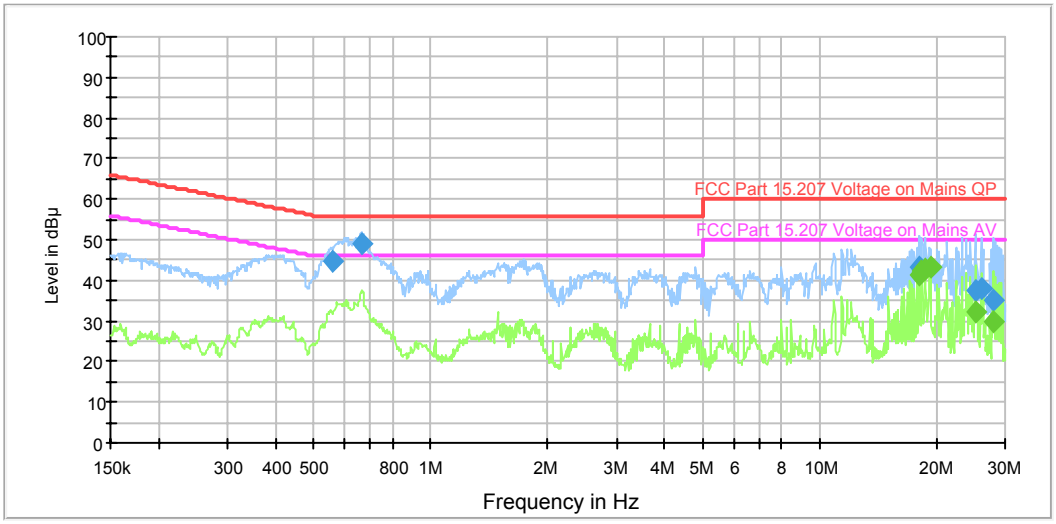


Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.416795	42.6	9.000	N	19.7	14.9	57.5
0.562277	45.9	9.000	N	19.7	10.1	56.0
0.659628	50.1	9.000	N	19.7	5.9	56.0
1.719452	41.4	9.000	N	19.7	14.6	56.0
25.044443	42.4	9.000	N	20.2	17.6	60.0
27.125992	47.1	9.000	N	20.2	12.9	60.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.659628	37.9	9.000	N	19.7	8.1	46.0
19.475448	39.3	9.000	N	20.0	10.7	50.0
21.094135	41.6	9.000	N	20.1	8.4	50.0
22.485426	42.2	9.000	N	20.1	7.8	50.0
25.960604	42.6	9.000	N	20.2	7.4	50.0
27.125992	40.8	9.000	N	20.2	9.2	50.0

Test Mode: Transmitting (BLE)

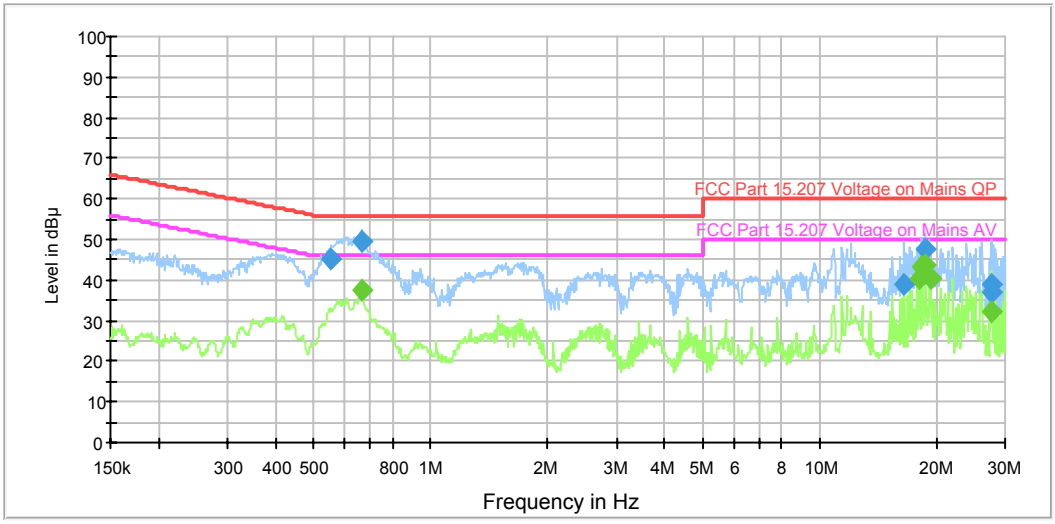
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.560037	44.6	9.000	L1	19.6	11.4	56.0
0.662266	49.2	9.000	L1	19.6	6.8	56.0
18.052898	43.2	9.000	L1	19.9	16.8	60.0
25.144620	37.6	9.000	L1	20.0	22.4	60.0
26.064446	38.0	9.000	L1	20.0	22.0	60.0
27.894695	35.0	9.000	L1	20.1	25.0	60.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
18.052898	41.1	9.000	L1	19.9	8.9	50.0
18.343482	42.5	9.000	L1	19.9	7.5	50.0
18.713298	42.9	9.000	L1	19.9	7.1	50.0
19.243600	43.1	9.000	L1	19.9	6.9	50.0
25.144620	32.2	9.000	L1	20.0	17.8	50.0
28.118299	30.0	9.000	L1	20.1	20.0	50.0

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.555584	45.2	9.000	N	19.7	10.8	56.0
0.662266	49.3	9.000	N	19.7	6.7	56.0
16.535040	38.8	9.000	N	20.1	21.2	60.0
18.713298	47.5	9.000	N	20.0	12.5	60.0
27.562619	39.0	9.000	N	20.3	21.0	60.0
27.783561	37.0	9.000	N	20.3	23.0	60.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.662266	37.3	9.000	N	19.7	8.7	46.0
18.052898	40.6	9.000	N	20.0	9.4	50.0
18.343482	43.2	9.000	N	20.0	6.8	50.0
18.713298	43.6	9.000	N	20.0	6.4	50.0
19.243600	40.4	9.000	N	20.0	9.6	50.0
27.562619	32.0	9.000	N	20.3	18.0	50.0

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

Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

Measurement Uncertainty

Compliance or non- compliance with a disturbance limit shall be determined in the following manner：

If U_{lab} is less than or equal to U_{cispr} of Table 2, then:
–compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
–non - compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.
If U_{lab} is greater than U_{cispr} of Table 2, then:
–compliance is deemed to occur if no measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit;
–non - compliance is deemed to occur if any measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit.

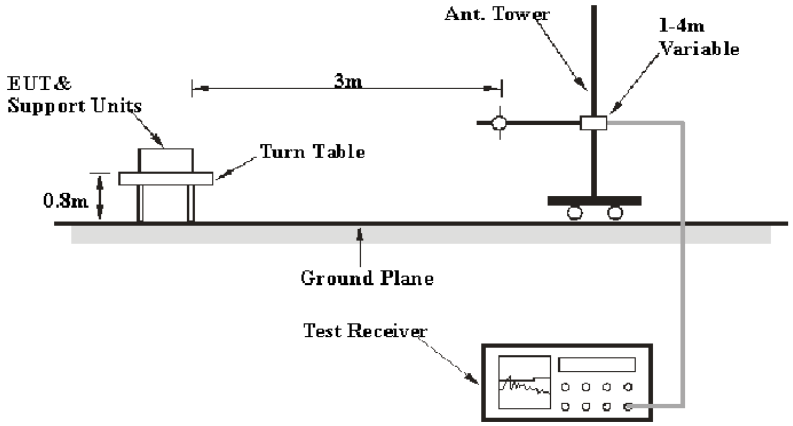
Based on CISPR 16-4-2-2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Chengdu) is:
30M~200MHz: ±4.7 dB;
200M~1GHz: ±6.0 dB;
1G-6GHz: ±5.13dB;
6G~25GHz: ±5.47 dB;

Table 2 – Values of U_{cispr}

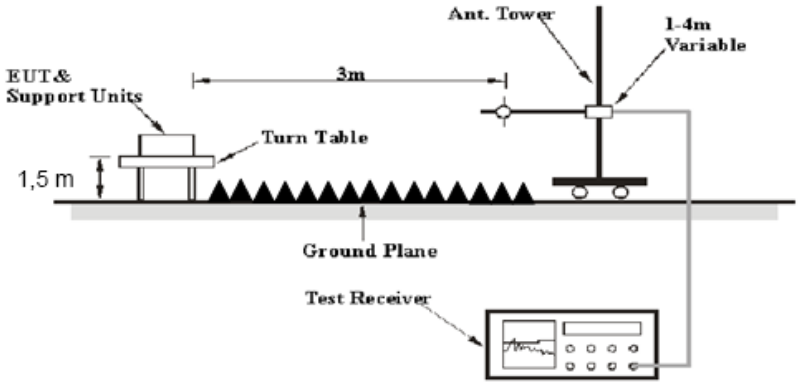
Measurement		U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC)	(30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR)	(1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR)	(6 GHz to 18 GHz)	5.5 dB

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters chamber 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.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

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
Above 1 GHz	1MHz	3 MHz	Any	PK
	1MHz	10Hz	>98%	AV
	1MHz	1/T	<98%	AV

Note: T is Transmission Duration

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 Loss and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude = Meter Reading + Antenna Loss + 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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Amplifier	8447D	2944A10442	2016-12-02	2017-12-01
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
Sunol Sciences	Broadband Antenna	JB3	A121808	2016-04-10	2019-04-09
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2016-12-02	2017-12-01
ETS	Horn Antenna	3115	003-6076	2016-12-02	2017-12-01
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-0113024	2014-06-16	2017-06-15
Mini-circuits	Amplifier	ZVA-183-S+	771001215	2016-05-20	2017-05-19
HP	Amplifier	8449B	3008A00277	2016-12-02	2017-12-01
EMCT	Semi-Anechoic Chamber	966	N/A	2015-04-24	2018-04-23
N/A	RF Cable (below 1GHz)	NO.1	N/A	2016-11-10	2017-11-09
N/A	RF Cable (below 1GHz)	NO.4	N/A	2016-11-10	2017-11-09
N/A	RF Cable (above 1GHz)	NO.2	N/A	2016-11-10	2017-11-09

*** Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

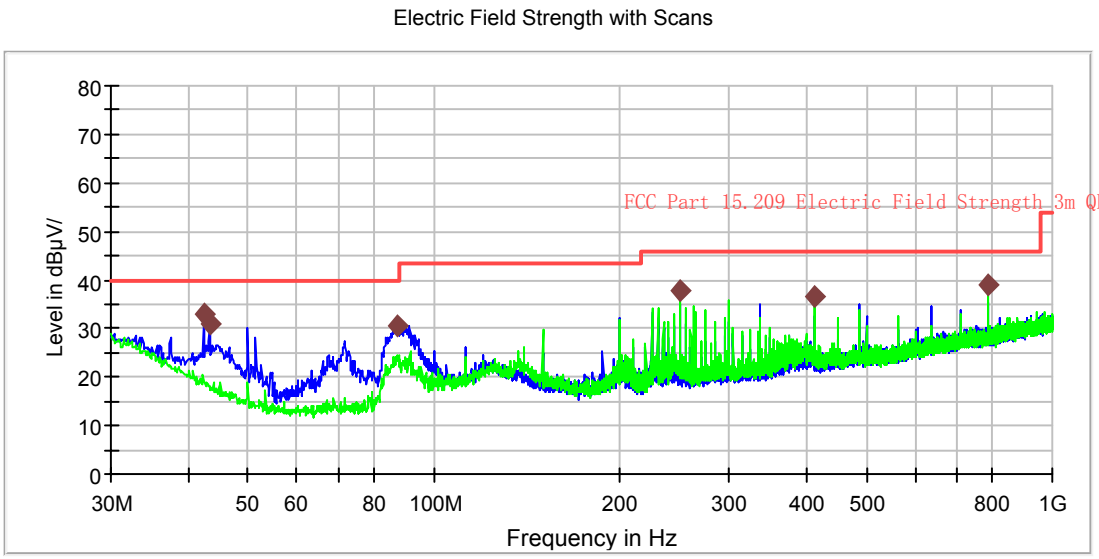
Temperature:	21 °C
Relative Humidity:	48 %
ATM Pressure:	96.2 kPa

** The testing was performed by Tom Tang on 2017-01-22.*

Test Mode: Transmitting

Wi-Fi mode

1)30 MHz to 1 GHz:



Frequency (MHz)	Quasi Peak (dBµV/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
42.367500	32.8	V	-8.2	7.2	40.0
43.337500	31.1	V	-8.9	8.9	40.0
87.230000	30.6	V	-12.7	9.4	40.0
250.068750	37.9	H	-7.5	8.1	46.0
412.543750	36.5	H	-3.7	9.5	46.0
787.691250	39.1	H	2.4	6.9	46.0

2)1GHz-25GHz:

802.11b Mode

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Detector	Polar	Factor					
MHz	dBµV	PK/QP/AV	H/V	dB(1/m)	dB	dB	dBµV/m	dBµV/m	dB
2412 MHz									
2412	71.12	PK	H	23.50	3.00	0.00	97.62	N/A	N/A
2412	66.87	AV	H	23.50	3.00	0.00	93.37	N/A	N/A
2412	70.51	PK	V	23.50	3.00	0.00	97.01	N/A	N/A
2412	65.77	AV	V	23.50	3.00	0.00	92.27	N/A	N/A
2390	30.69	PK	H	23.57	3.00	0.00	57.26	74.00	16.74
2390	17.25	AV	H	23.57	3.00	0.00	43.82	54.00	10.18
4824	41.00	PK	H	30.84	5.11	26.87	50.08	74.00	23.92
4824	35.41	AV	H	30.84	5.11	26.87	44.49	54.00	9.51
7236	33.05	PK	H	34.77	6.18	26.36	47.64	74.00	26.36
7236	17.41	AV	H	34.77	6.18	26.36	32.00	54.00	22.00
2437 MHz									
2437	69.94	PK	H	23.41	3.00	0.00	96.35	N/A	N/A
2437	65.21	AV	H	23.41	3.00	0.00	91.62	N/A	N/A
2437	69.05	PK	V	23.41	3.00	0.00	95.46	N/A	N/A
2437	64.52	AV	V	23.41	3.00	0.00	90.93	N/A	N/A
4874	40.13	PK	H	31.00	5.09	26.87	49.35	74.00	24.65
4874	33.85	AV	H	31.00	5.09	26.87	43.07	54.00	10.93
7311	32.61	PK	H	34.92	6.21	26.40	47.34	74.00	26.66
7311	17.38	AV	H	34.92	6.21	26.40	32.11	54.00	21.89
2462 MHz									
2462	69.00	PK	H	23.33	2.99	0.00	95.32	N/A	N/A
2462	62.57	AV	H	23.33	2.99	0.00	88.89	N/A	N/A
2462	67.48	PK	V	23.33	2.99	0.00	93.80	N/A	N/A
2462	63.25	AV	V	23.33	2.99	0.00	89.57	N/A	N/A
2483.5	30.85	PK	H	23.26	2.99	0.00	57.10	74.00	16.90
2483.5	15.41	AV	H	23.26	2.99	0.00	41.66	54.00	12.34
4924	38.48	PK	H	31.16	5.07	26.88	47.83	74.00	26.17
4924	32.32	AV	H	31.16	5.07	26.88	41.67	54.00	12.33
7386	32.28	PK	H	35.07	6.25	26.43	47.17	74.00	26.83
7386	17.35	AV	H	35.07	6.25	26.43	32.24	54.00	21.76

802.11g Mode

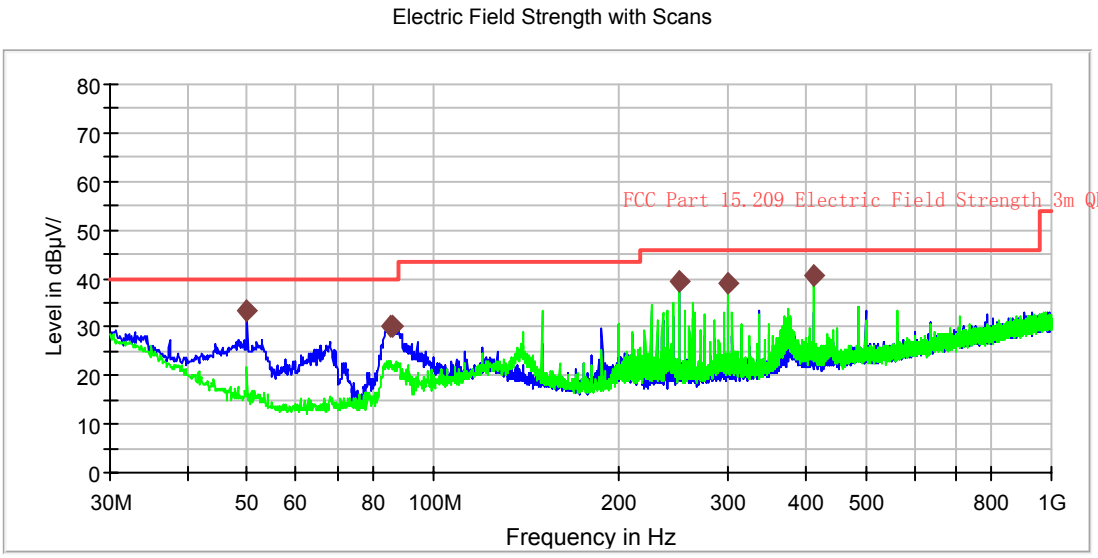
Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Detector	Polar	Factor					
MHz	dBµV	PK/QP/AV	H/V	dB(1/m)	dB	dB	dBµV/m	dBµV/m	dB
2412 MHz									
2412	72.43	PK	H	23.50	3.00	0.00	98.93	N/A	N/A
2412	62.28	AV	H	23.50	3.00	0.00	88.78	N/A	N/A
2412	71.46	PK	V	23.50	3.00	0.00	97.96	N/A	N/A
2412	60.87	AV	V	23.50	3.00	0.00	87.37	N/A	N/A
2390	33.50	PK	H	23.57	3.00	0.00	60.07	74.00	13.93
2390	18.34	AV	H	23.57	3.00	0.00	44.91	54.00	9.09
4824	38.06	PK	H	30.84	5.11	26.87	47.14	74.00	26.86
4824	24.26	AV	H	30.84	5.11	26.87	33.34	54.00	20.66
7236	32.83	PK	H	34.77	6.18	26.36	47.42	74.00	26.58
7236	17.45	AV	H	34.77	6.18	26.36	32.04	54.00	21.96
2437 MHz									
2437	71.86	PK	H	23.41	3.00	0.00	98.27	N/A	N/A
2437	61.45	AV	H	23.41	3.00	0.00	87.86	N/A	N/A
2437	70.53	PK	V	23.41	3.00	0.00	96.94	N/A	N/A
2437	59.85	AV	V	23.41	3.00	0.00	86.26	N/A	N/A
4874	37.49	PK	H	31.00	5.09	26.87	46.71	74.00	27.29
4874	22.36	AV	H	31.00	5.09	26.87	31.58	54.00	22.42
7311	32.41	PK	H	34.92	6.21	26.40	47.14	74.00	26.86
7311	17.41	AV	H	34.92	6.21	26.40	32.14	54.00	21.86
2462 MHz									
2462	71.04	PK	H	23.33	2.99	0.00	97.36	N/A	N/A
2462	60.81	AV	H	23.33	2.99	0.00	87.13	N/A	N/A
2462	69.81	PK	V	23.33	2.99	0.00	96.13	N/A	N/A
2462	59.88	AV	V	23.33	2.99	0.00	86.20	N/A	N/A
2483.5	38.37	PK	H	23.26	2.99	0.00	64.62	74.00	9.38
2483.5	17.57	AV	H	23.26	2.99	0.00	43.82	54.00	10.18
4924	36.98	PK	H	31.16	5.07	26.88	46.33	74.00	27.67
4924	20.34	AV	H	31.16	5.07	26.88	29.69	54.00	24.31
7386	32.14	PK	H	35.07	6.25	26.43	47.03	74.00	26.97
7386	17.44	AV	H	35.07	6.25	26.43	32.33	54.00	21.67

802.11n ht20 Mode

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Detector	Polar	Factor					
MHz	dBµV	PK/QP/AV	H/V	dB(1/m)	dB	dB	dBµV/m	dBµV/m	dB
2412 MHz									
2412	71.32	PK	H	23.50	3.00	0.00	97.82	N/A	N/A
2412	59.65	AV	H	23.50	3.00	0.00	86.15	N/A	N/A
2412	69.77	PK	V	23.50	3.00	0.00	96.27	N/A	N/A
2412	58.37	AV	V	23.50	3.00	0.00	84.87	N/A	N/A
2390	37.67	PK	H	23.57	3.00	0.00	64.24	74.00	9.76
2390	17.38	AV	H	23.57	3.00	0.00	43.95	54.00	10.05
4824	36.46	PK	H	30.84	5.11	26.87	45.54	74.00	28.46
4824	23.02	AV	H	30.84	5.11	26.87	32.10	54.00	21.90
7236	32.59	PK	H	34.77	6.18	26.36	47.18	74.00	26.82
7236	17.43	AV	H	34.77	6.18	26.36	32.02	54.00	21.98
2437 MHz									
2437	70.61	PK	H	23.41	3.00	0.00	97.02	N/A	N/A
2437	58.53	AV	H	23.41	3.00	0.00	84.94	N/A	N/A
2437	69.63	PK	V	23.41	3.00	0.00	96.04	N/A	N/A
2437	57.81	AV	V	23.41	3.00	0.00	84.22	N/A	N/A
4874	36.11	PK	H	31.00	5.09	26.87	45.33	74.00	28.67
4874	21.36	AV	H	31.00	5.09	26.87	30.58	54.00	23.42
7311	32.29	PK	H	34.92	6.21	26.40	47.02	74.00	26.98
7311	17.50	AV	H	34.92	6.21	26.40	32.23	54.00	21.77
2462 MHz									
2462	70.15	PK	H	23.33	2.99	0.00	96.47	N/A	N/A
2462	58.32	AV	H	23.33	2.99	0.00	84.64	N/A	N/A
2462	69.14	PK	V	23.33	2.99	0.00	95.46	N/A	N/A
2462	57.31	AV	V	23.33	2.99	0.00	83.63	N/A	N/A
2483.5	37.26	PK	H	23.26	2.99	0.00	63.51	74.00	10.49
2483.5	15.41	AV	H	23.26	2.99	0.00	41.66	54.00	12.34
4924	35.98	PK	H	31.16	5.07	26.88	45.33	74.00	28.67
4924	19.50	AV	H	31.16	5.07	26.88	28.85	54.00	25.15
7386	32.15	PK	H	35.07	6.25	26.43	47.04	74.00	26.96
7386	17.39	AV	H	35.07	6.25	26.43	32.28	54.00	21.72

BLE mode

1)30 MHz to 1 GHz:



Frequency (MHz)	QuasiPeak (dBµV/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
50.006250	33.5	V	-12.6	6.5	40.0
85.290000	30.2	V	-12.8	9.8	40.0
86.017500	30.1	V	-12.8	9.9	40.0
249.947500	39.4	H	-7.5	6.6	46.0
300.023750	39.1	H	-5.5	6.9	46.0
412.543750	40.6	H	-3.7	5.4	46.0

2)1GHz-25GHz:

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Detector	Polar	Factor					
MHz	dBμV	PK/QP/AV	H/V	dB(1/m)	dB	dB	dBμV/m	dBμV/m	dB
2402 MHz									
2402	66.53	PK	H	23.53	3.00	0.00	93.06	N/A	N/A
2402	61.43	AV	H	23.53	3.00	0.00	87.96	N/A	N/A
2402	68.01	PK	V	23.53	3.00	0.00	94.54	N/A	N/A
2402	62.97	AV	V	23.53	3.00	0.00	89.50	N/A	N/A
2390	30.18	PK	V	23.57	3.00	0.00	56.75	74.00	17.25
2390	17.34	AV	V	23.57	3.00	0.00	43.91	54.00	10.09
4804	46.55	PK	V	30.77	5.12	26.87	55.57	74.00	18.43
4804	35.06	AV	V	30.77	5.12	26.87	44.08	54.00	9.92
7206	32.44	PK	V	34.71	6.16	26.35	46.96	74.00	27.04
7206	17.46	AV	V	34.71	6.16	26.35	31.98	54.00	22.02
2440 MHz									
2440	64.85	PK	H	23.40	3.00	0.00	91.25	N/A	N/A
2440	58.23	AV	H	23.40	3.00	0.00	84.63	N/A	N/A
2440	64.86	PK	V	23.40	3.00	0.00	91.26	N/A	N/A
2440	59.15	AV	V	23.40	3.00	0.00	85.55	N/A	N/A
4880	41.56	PK	V	31.02	5.09	26.87	50.80	74.00	23.20
4880	27.63	AV	V	31.02	5.09	26.87	36.87	54.00	17.13
7320	32.3	PK	V	34.94	6.22	26.40	47.06	74.00	26.94
7320	17.39	AV	V	34.94	6.22	26.40	32.15	54.00	21.85
2480 MHz									
2480	61.93	PK	H	23.27	2.99	0.00	88.19	N/A	N/A
2480	56.32	AV	H	23.27	2.99	0.00	82.58	N/A	N/A
2480	62.75	PK	V	23.27	2.99	0.00	89.01	N/A	N/A
2480	57.24	AV	V	23.27	2.99	0.00	83.50	N/A	N/A
2483.5	30.64	PK	V	23.26	2.99	0.00	56.89	74.00	17.11
2483.5	17.18	AV	V	23.26	2.99	0.00	43.43	54.00	10.57
4960	36.38	PK	V	31.27	5.05	26.88	45.82	74.00	28.18
4960	19.95	AV	V	31.27	5.05	26.88	29.39	54.00	24.61
7440	31.95	PK	V	35.18	6.27	26.45	46.95	74.00	27.05
7440	17.33	AV	V	35.18	6.27	26.45	32.33	54.00	21.67

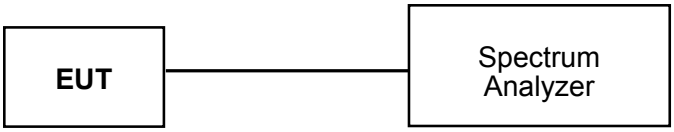
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

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

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3×RBW
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) 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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSL18	100180	2016-12-02	2017-12-01
WEINSCHEL ENGINEERING	Attenuator	1A10dB	AA4135	2016-11-10	2017-11-09
N/A	RF Cable	N/A	N/A	Each Time	/

*** Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	19 °C & 20 °C
Relative Humidity:	44 % & 52%
ATM Pressure:	95.8 kPa & 95.4 kPa

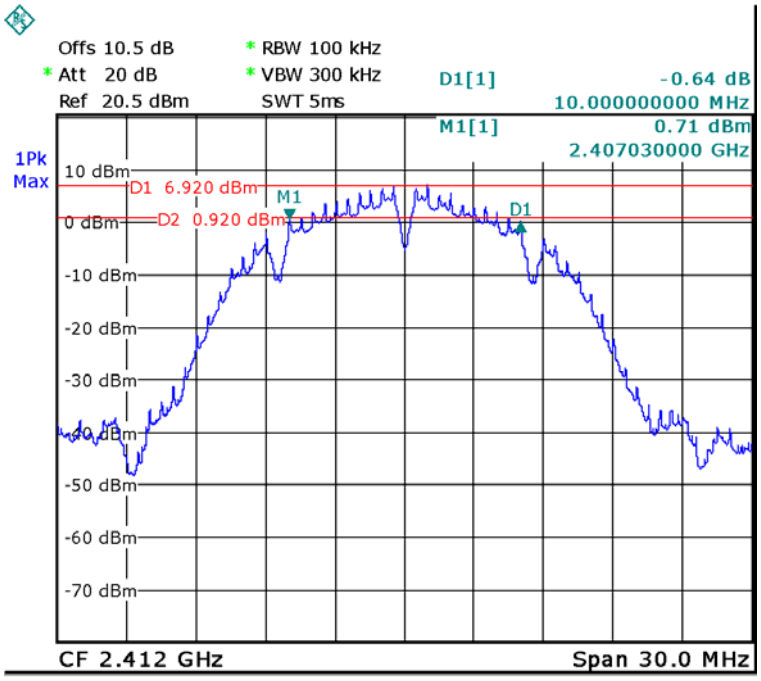
** The testing was performed by Tom Tang on 2017-01-20 & 2017-02-06.*

Test Mode: Transmitting

Test Result: Compliance. Please refer to the following table and plots.

Test mode	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)
802.11b	Low	2412	10.00	≥0.5
	Middle	2437	10.00	≥0.5
	High	2462	10.00	≥0.5
802.11g	Low	2412	16.287	≥0.5
	Middle	2437	16.287	≥0.5
	High	2462	16.287	≥0.5
802.11n ht20	Low	2412	17.804	≥0.5
	Middle	2437	17.804	≥0.5
	High	2462	17.804	≥0.5
BLE	Low	2402	0.695	≥0.5
	Middle	2440	0.683	≥0.5
	High	2480	0.677	≥0.5

802.11b Low Channel



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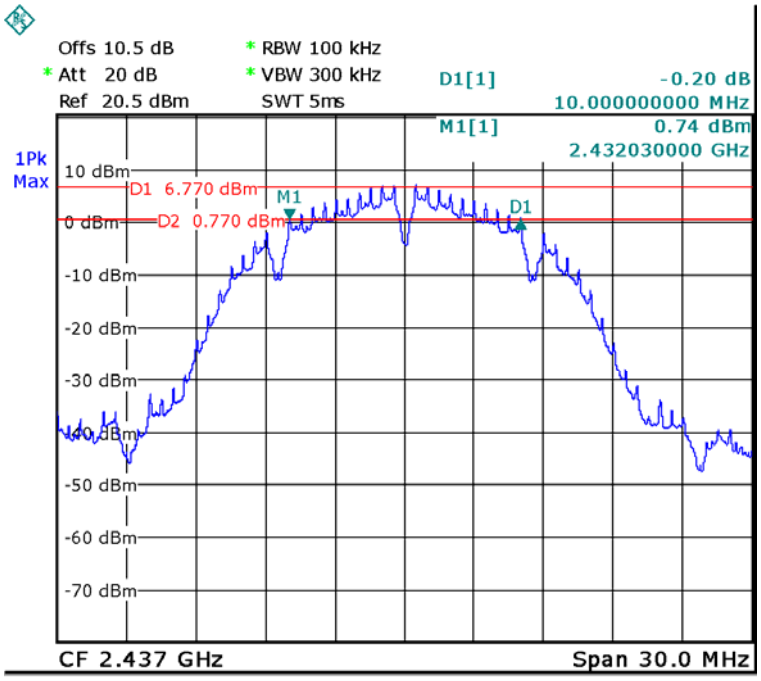
802.11b Middle Channel



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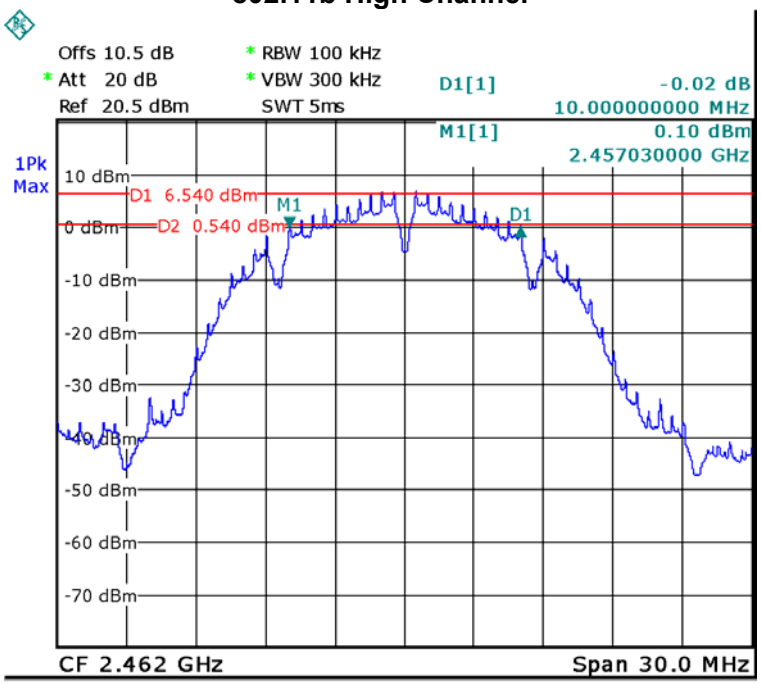
802.11b High Channel



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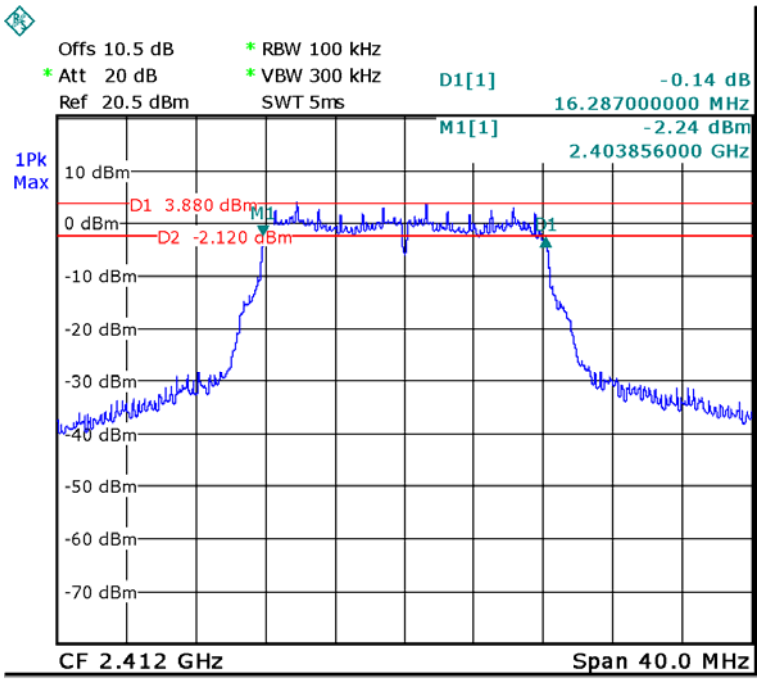
802.11g Low Channel



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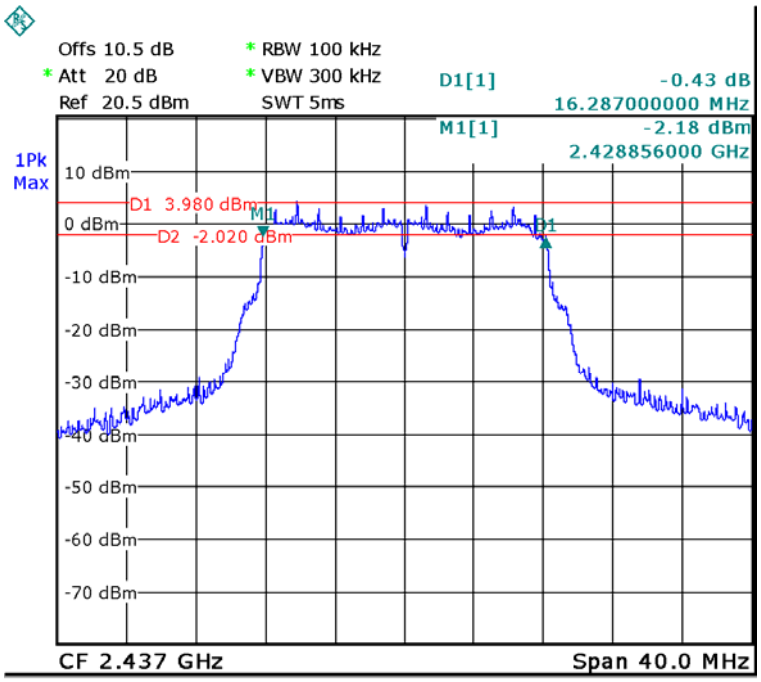
802.11g Middle Channel



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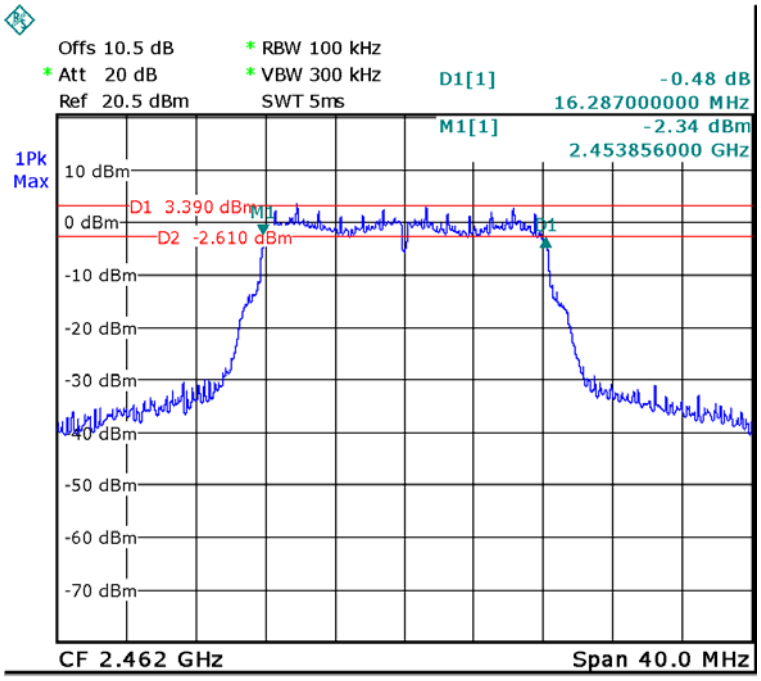
802.11g High Channel



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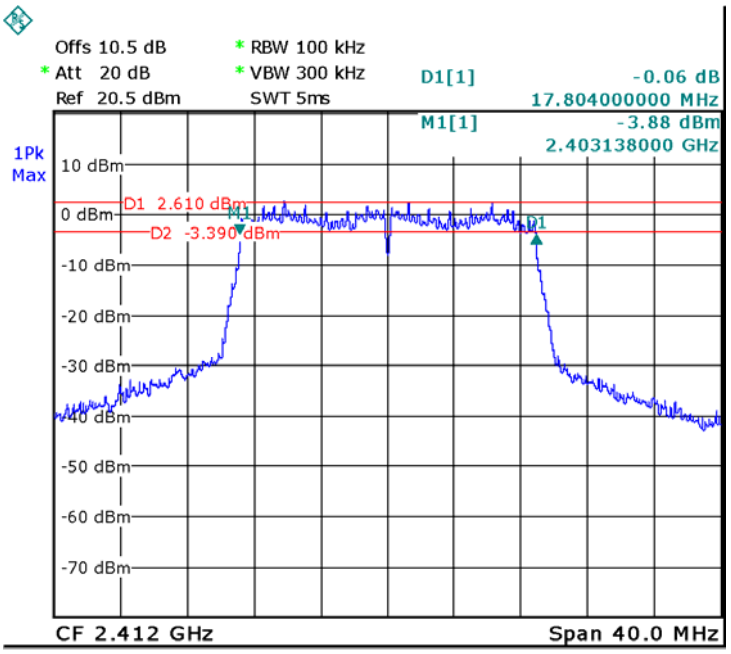
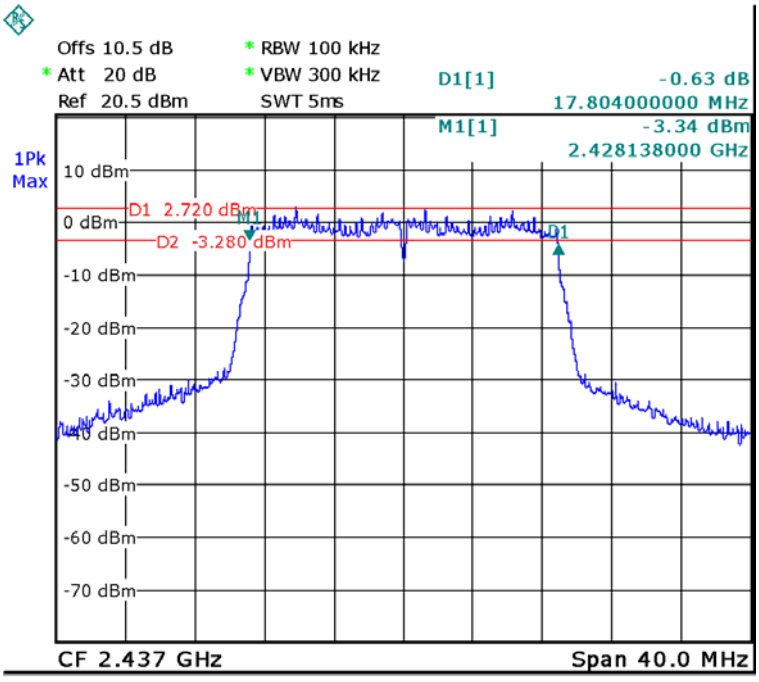
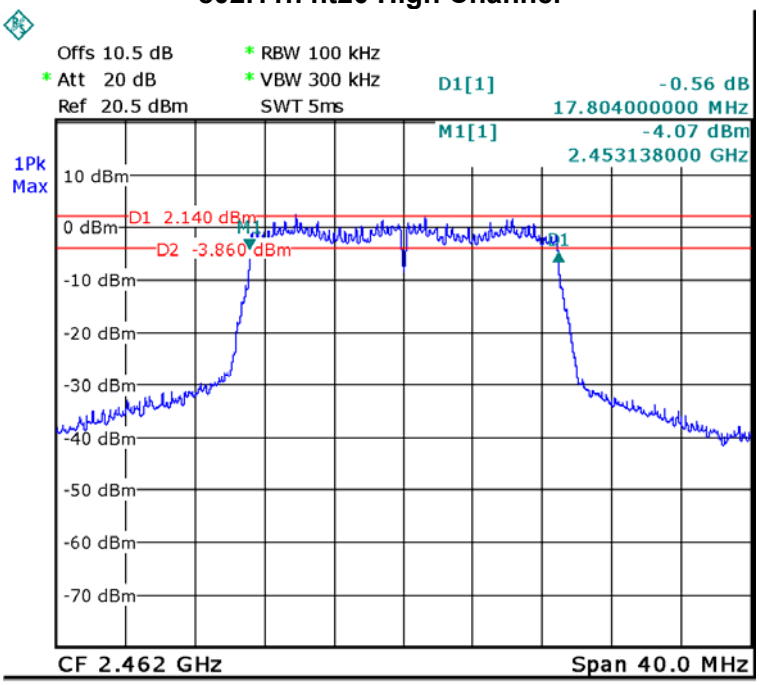
802.11n ht20 Low Channel



802.11n ht20 Middle Channel



802.11n ht20 High Channel



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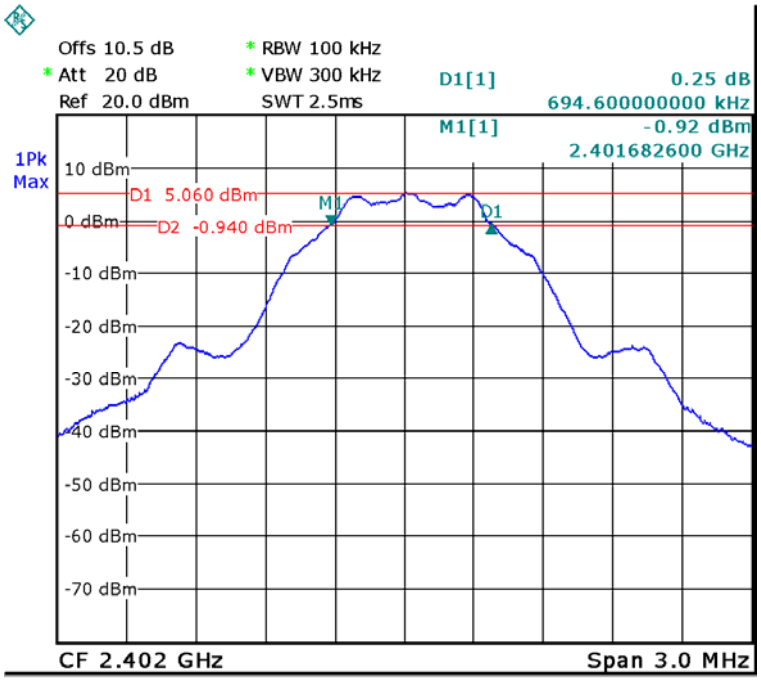
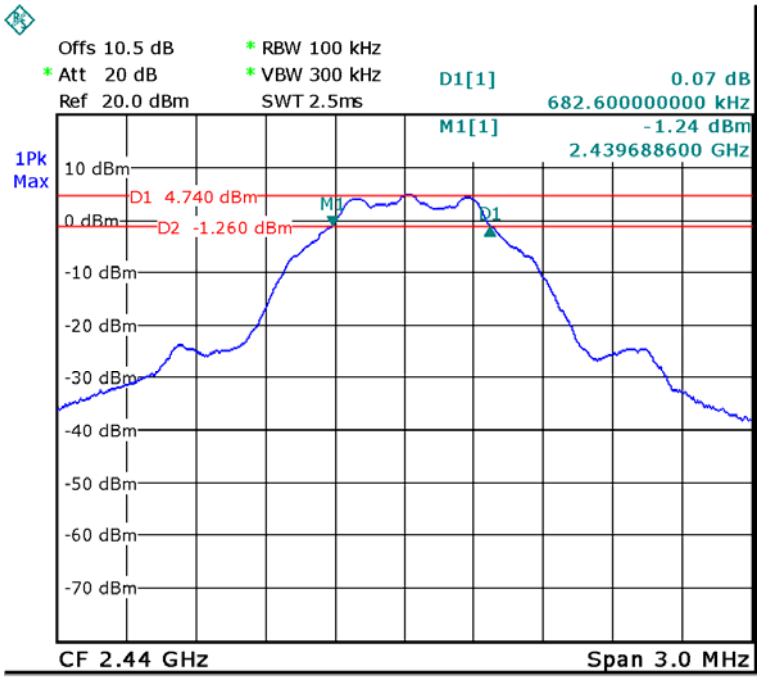
BLE Low Channel



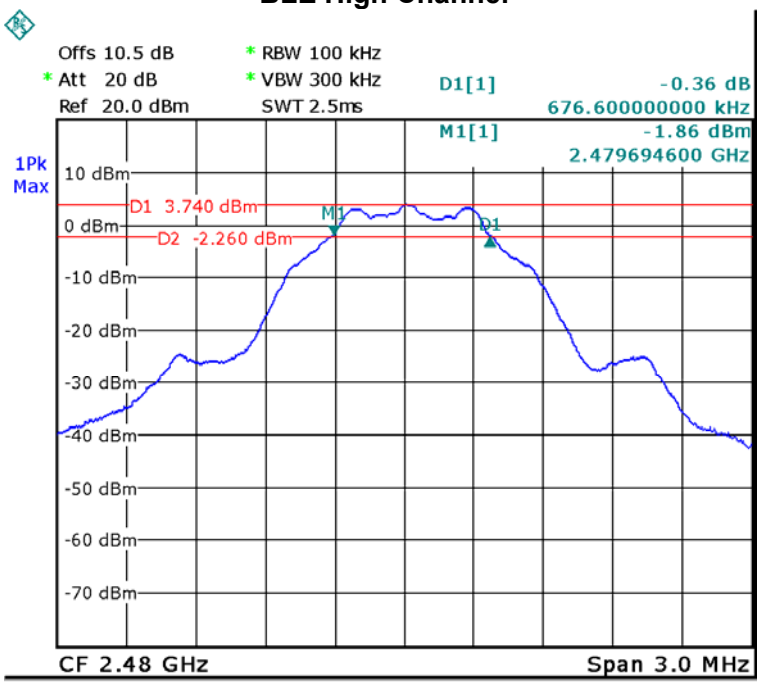
Date: 6.FEB.2017 12:38:10

BLE Middle Channel



Date: 6.FEB.2017 12:41:08

BLE High Channel



Date: 6.FEB.2017 12:44:41

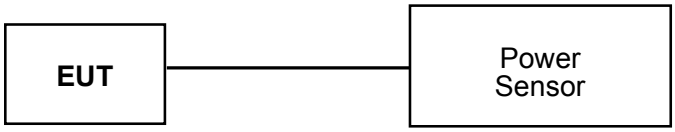
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

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



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	USB Wideband Power Sensor	U2021XA	MY53320008	2016-12-02	2017-12-01
N/A	RF Cable	NO.3	N/A	2016-11-10	2017-11-09
WEINSCHEL ENGINEERING	Attenuator	1A10dB	AA4135	2016-11-10	2017-11-09

*** Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	20 °C
Relative Humidity:	52 %
ATM Pressure:	95.4 kPa

** The testing was performed by Tom Tang on 2017-02-06.*

Test Mode: Transmitting

Test Result: Compliance. Please refer to the following table.

Test mode	Channel	Frequency	Max Peak Conducted Output Power	Max Conducted Average Output Power	Limit
		(MHz)	(dBm)	(dBm)	(dBm)
802.11b	Low	2412	18.54	15.16	30
	Middle	2437	18.37	15.00	30
	High	2462	17.95	14.60	30
802.11g	Low	2412	22.83	14.43	30
	Middle	2437	22.60	14.27	30
	High	2462	22.35	13.87	30
802.11n20	Low	2412	22.29	12.52	30
	Middle	2437	22.05	12.42	30
	High	2462	21.85	11.95	30
BLE	Low	2402	5.58	/	30
	Middle	2440	5.43	/	30
	High	2480	4.65	/	30

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

Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSL18	100180	2016-12-02	2017-12-01
WEINSCHEL ENGINEERING	Attenuator	1A10dB	AA4135	2016-11-10	2017-11-09
N/A	RF Cable	N/A	N/A	Each Time	/

*** Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

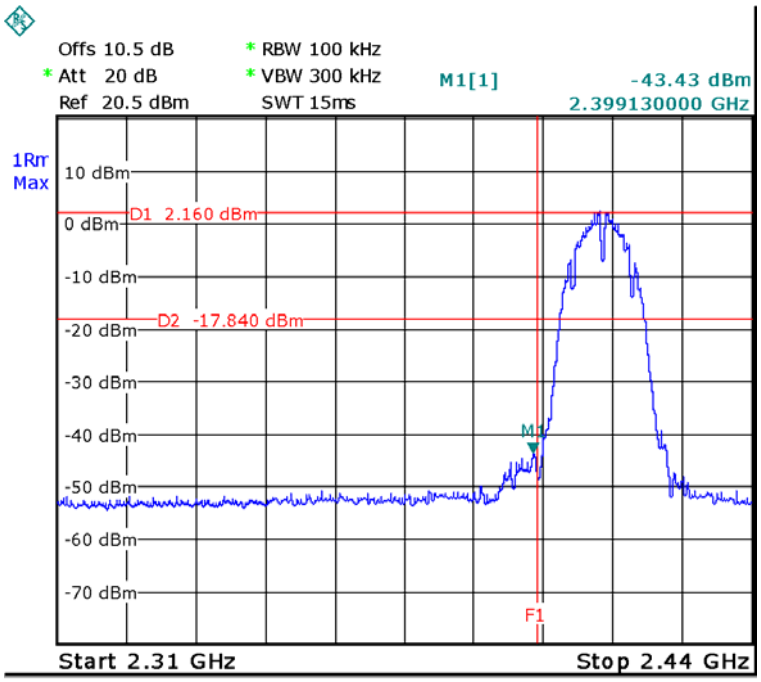
Temperature:	19 °C & 20 °C
Relative Humidity:	44 % & 52%
ATM Pressure:	95.8 kPa & 95.4 kPa

** The testing was performed by Tom Tang on 2017-01-20 & 2017-02-06.*

Test mode: Transmitting

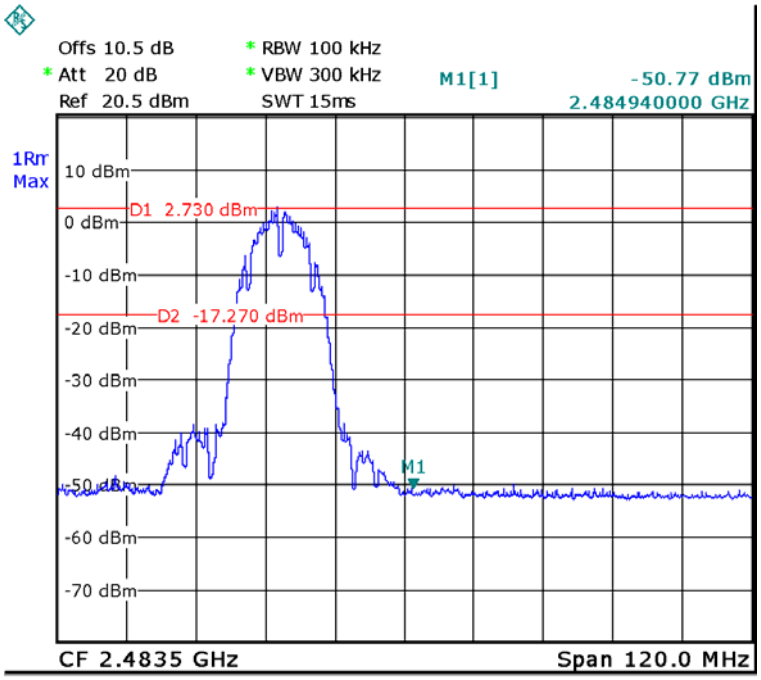
Test Result: Compliance. Please refer to following plots.

802.11b: Band Edge, Left Side



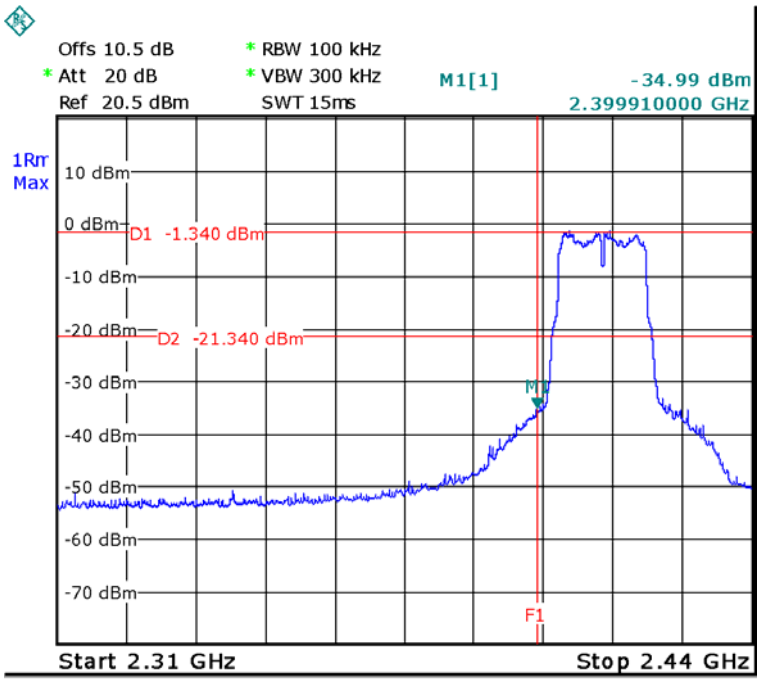
Date: 20.JAN.2017 17:46:56

802.11b: Band Edge, Right Side



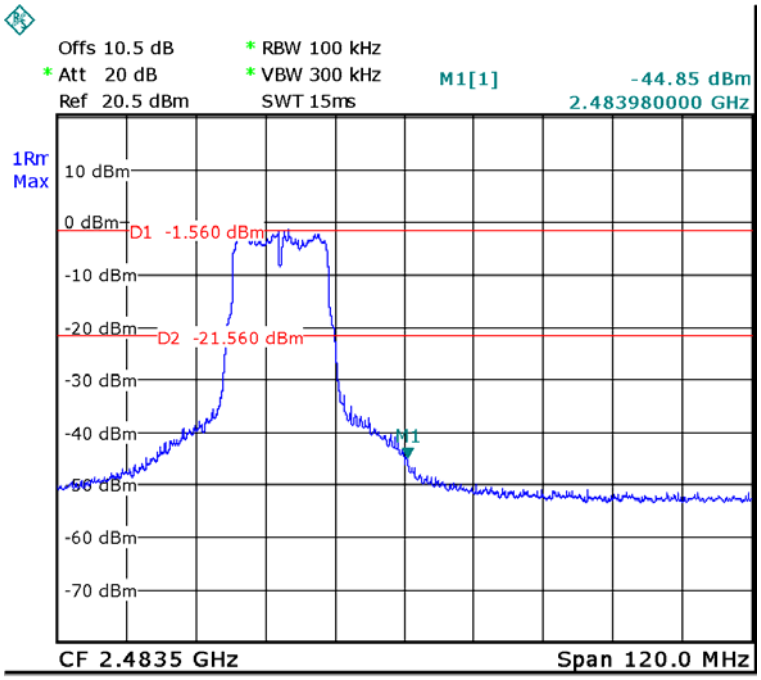
Date: 20.JAN.2017 18:11:42

802.11g: Band Edge, Left Side



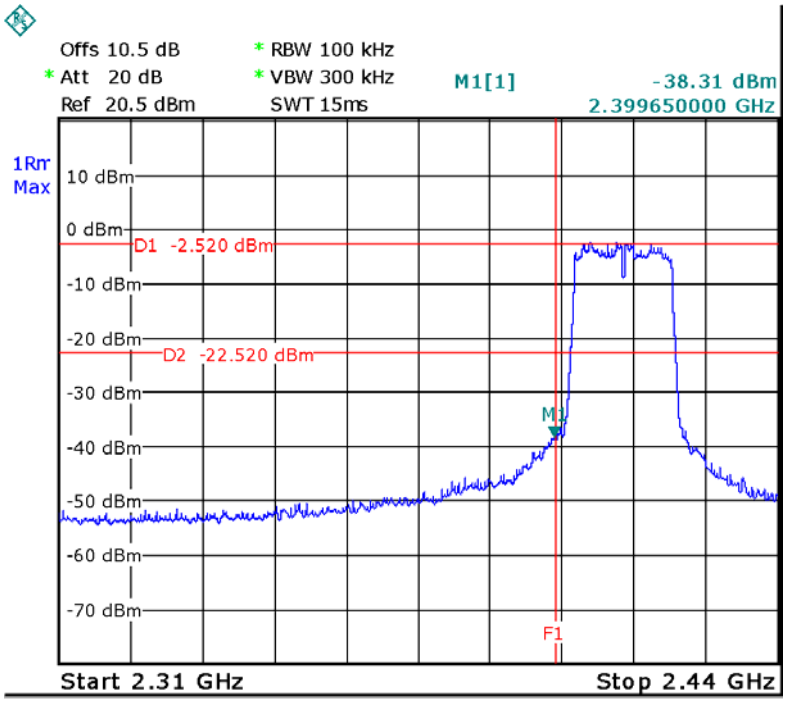
Date: 20.JAN.2017 17:56:55

802.11g: Band Edge, Right Side



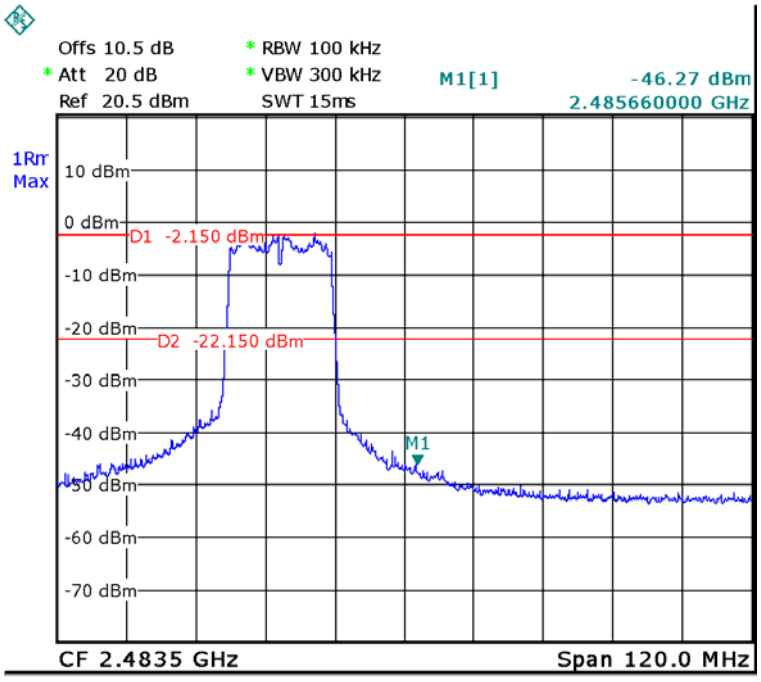
Date: 20.JAN.2017 18:07:05

802.11n ht20 Band Edge, Left Side



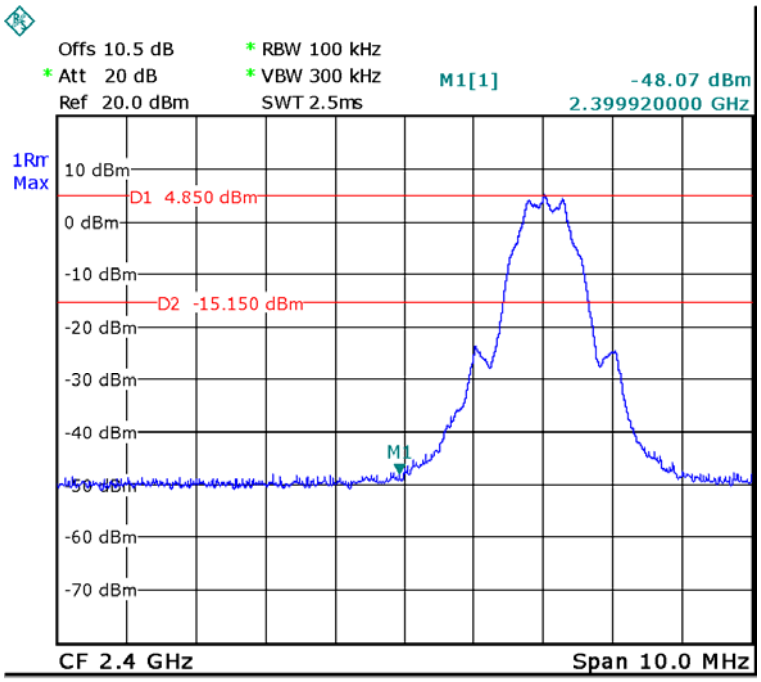
Date: 20.JAN.2017 18:15:55

802.11n ht20 Band Edge, Right Side



Date: 20.JAN.2017 18:34:30

BLE Band Edge, Left Side



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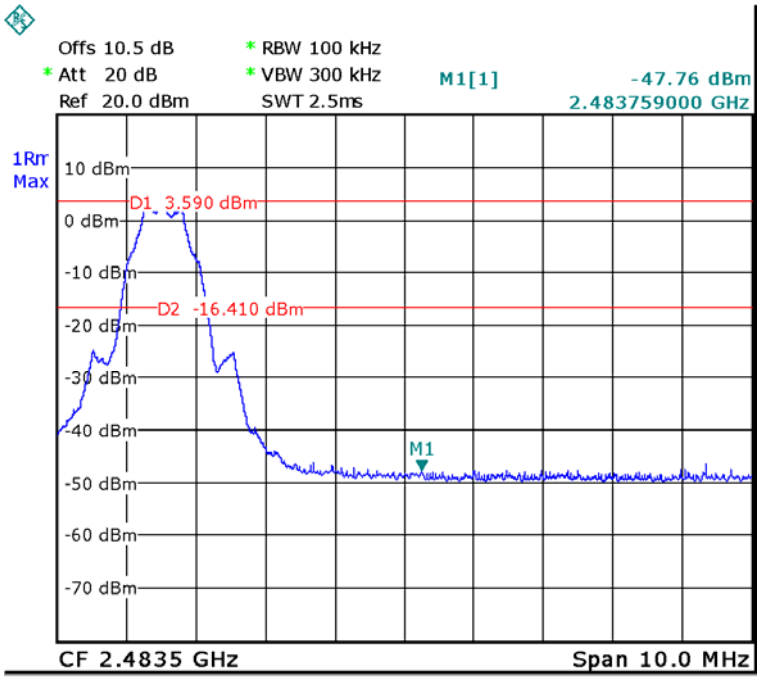
BLE Band Edge, Right Side



Date: 6.FEB.2017 12:51:08

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

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3×RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSL18	100180	2016-12-02	2017-12-01
WEINSCHEL ENGINEERING	Attenuator	1A10dB	AA4135	2016-11-10	2017-11-09
N/A	RF Cable	N/A	N/A	Each Time	/

*** Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	19 °C & 20 °C
Relative Humidity:	44 % & 52%
ATM Pressure:	95.8 kPa & 95.4 kPa

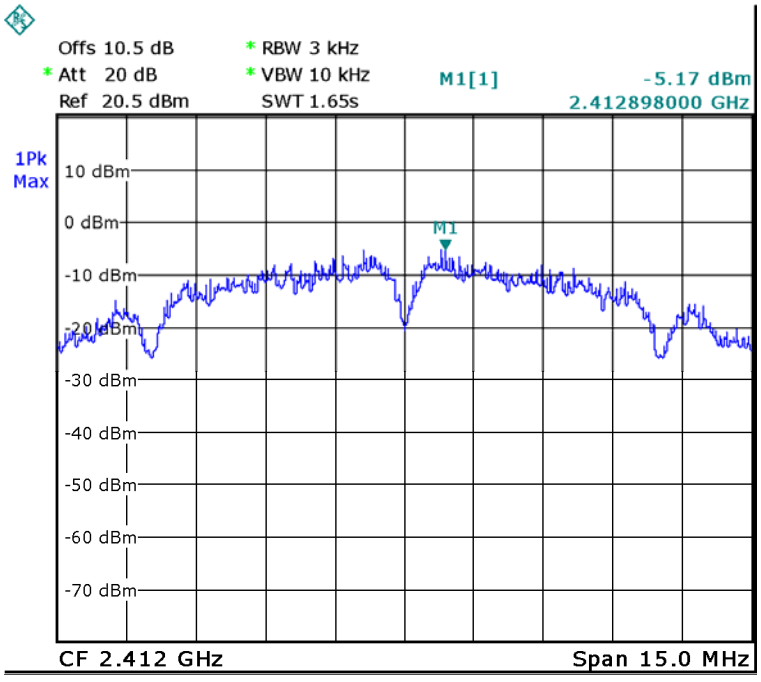
** The testing was performed by Tom Tang on 2017-01-20 & 2017-02-06.*

Test Mode: Transmitting

Test Result: Compliance. Please refer to the following table and plots

Test mode	Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
802.11b	Low	2412	-5.17	≤8
	Middle	2437	-7.01	≤8
	High	2462	-6.66	≤8
802.11g	Low	2412	-10.82	≤8
	Middle	2437	-10.59	≤8
	High	2462	-10.78	≤8
802.11n20	Low	2412	-11.14	≤8
	Middle	2437	-11.4	≤8
	High	2462	-11.7	≤8
BLE	Low	2402	-8.66	≤8
	Middle	2440	-9.09	≤8
	High	2480	-10.13	≤8

Power Spectral Density, 802.11b Low Channel



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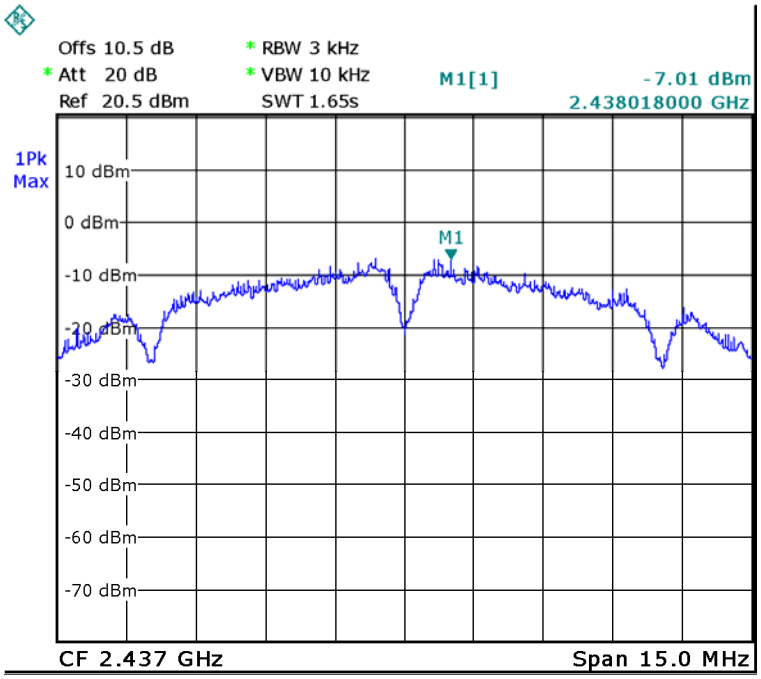
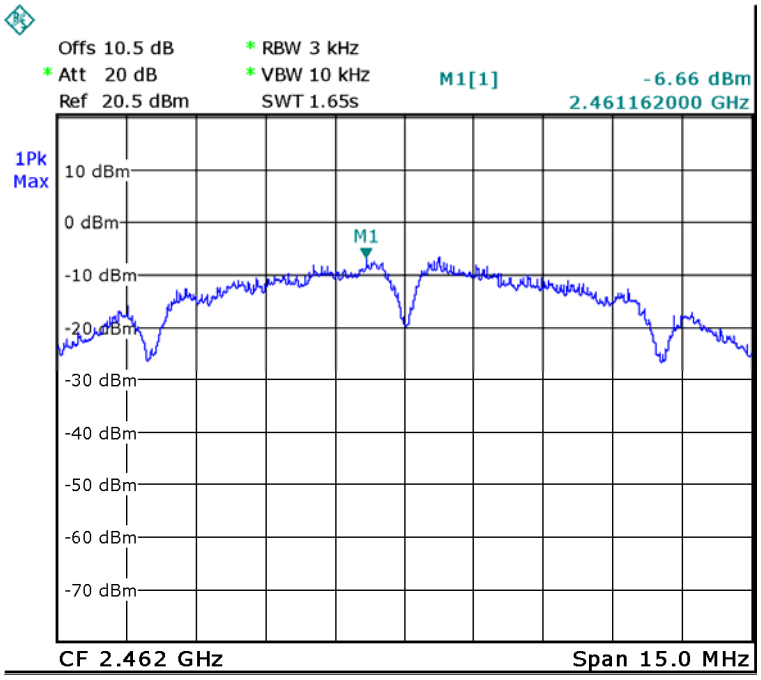
Power Spectral Density, 802.11b Middle Channel



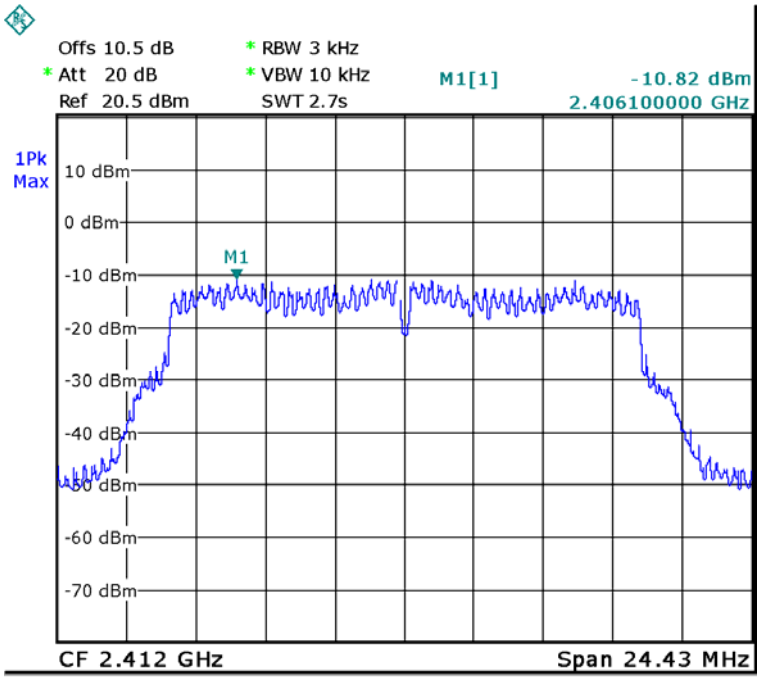
Date: 20.JAN.2017 17:30:00

Power Spectral Density, 802.11b High Channel



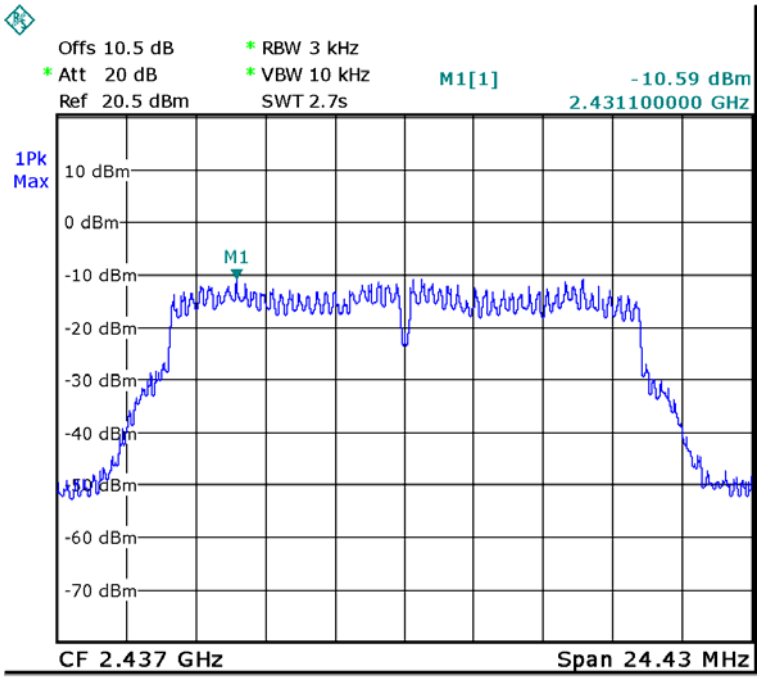
Date: 20.JAN.2017 17:32:37

Power Spectral Density, 802.11g Low Channel



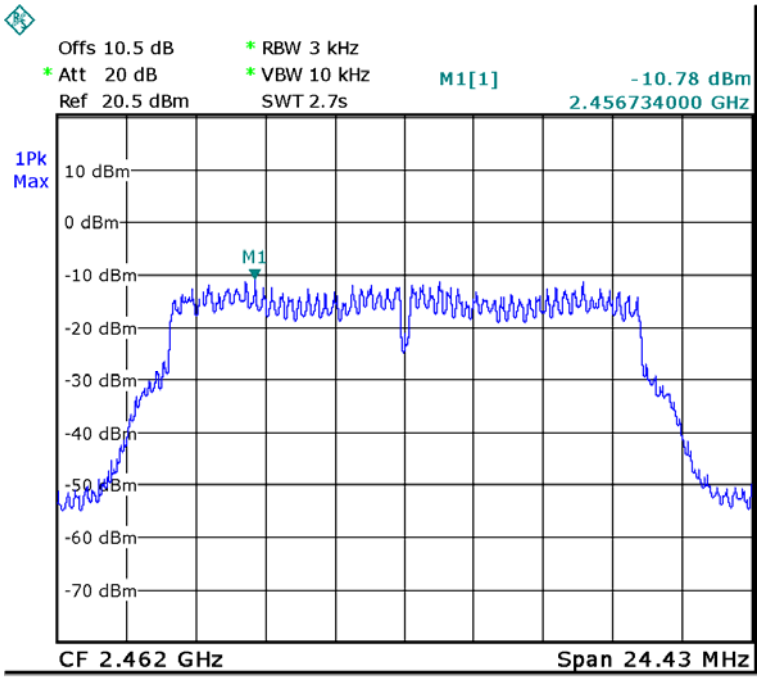
Date: 20.JAN.2017 17:26:53

Power Spectral Density, 802.11g Middle Channel



Date: 20.JAN.2017 17:27:54

Power Spectral Density, 802.11g High Channel



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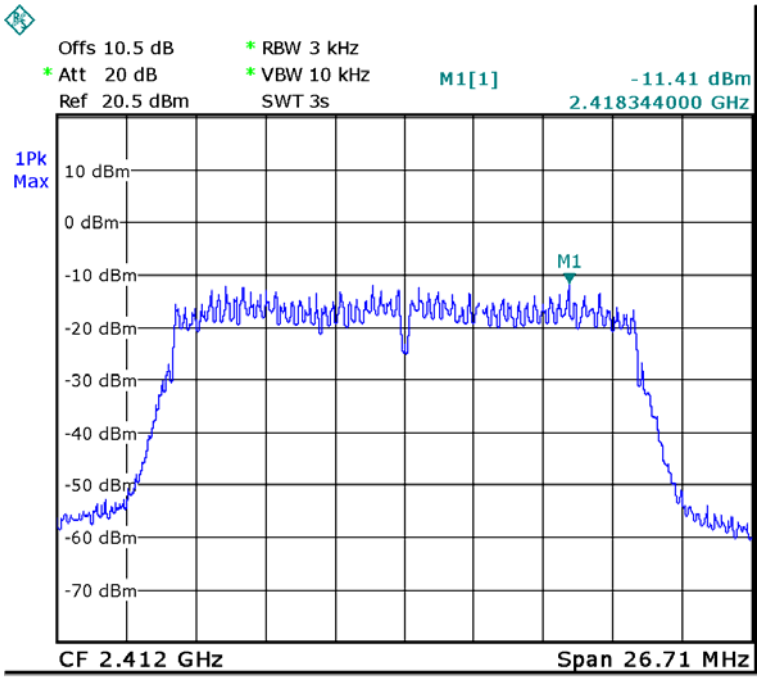
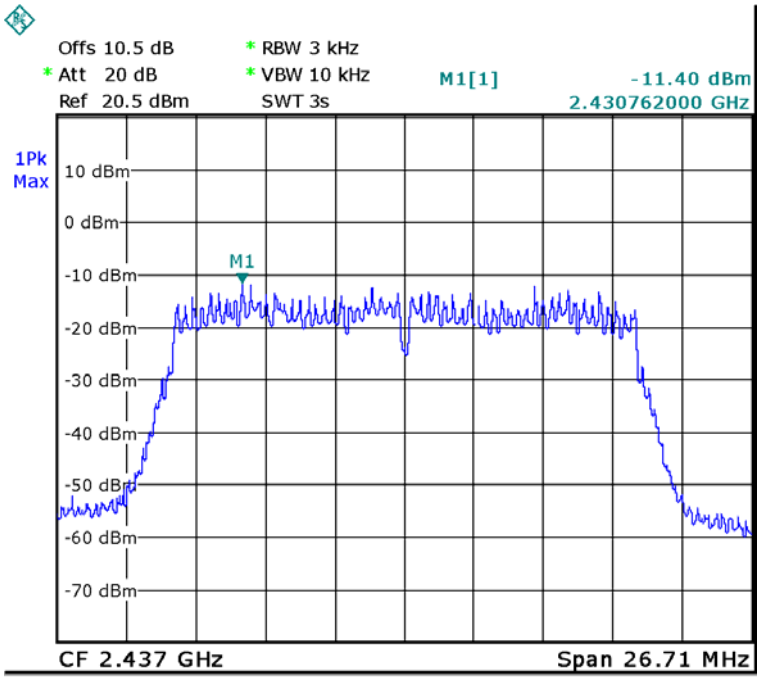
Power Spectral Density, 802.11n ht20 Low Channel



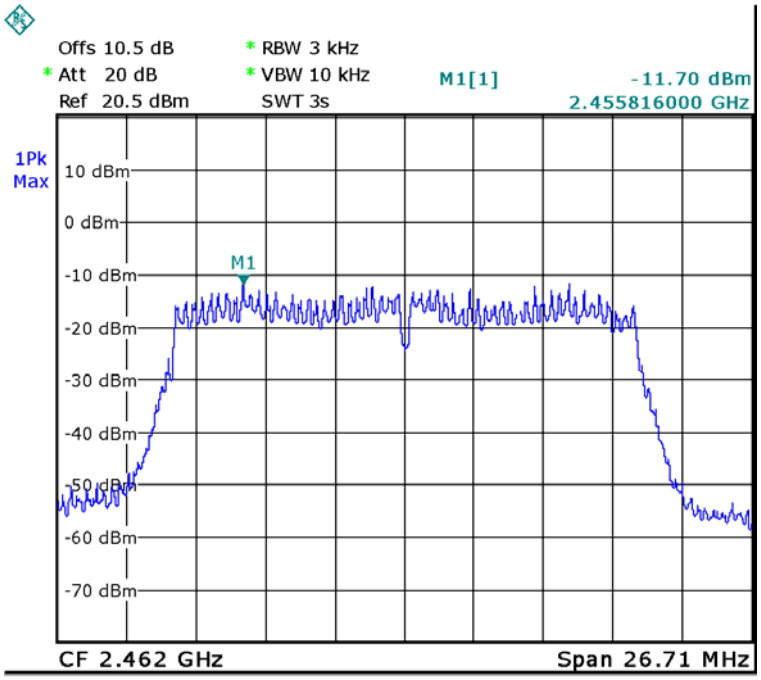
Date: 20.JAN.2017 17:34:48

Power Spectral Density, 802.11n ht20 Middle Channel



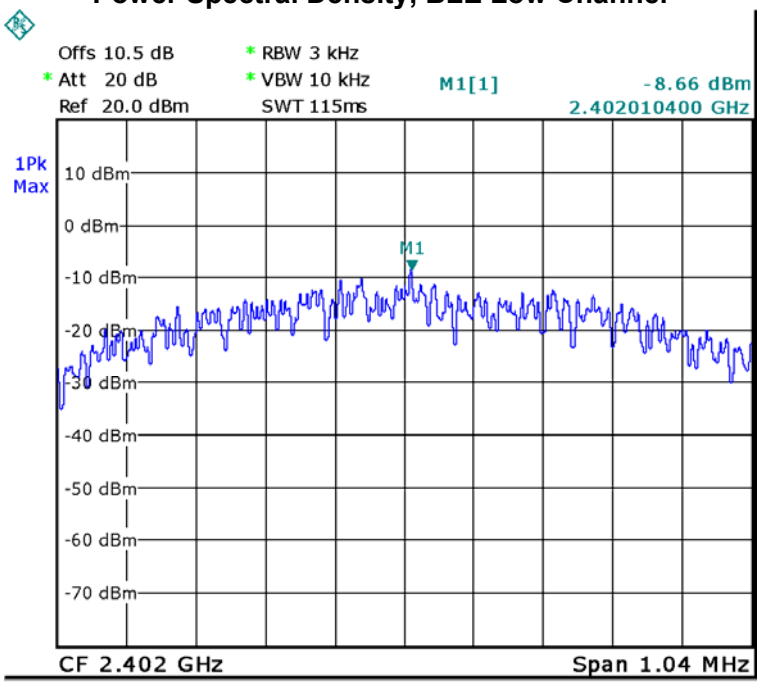
Date: 20.JAN.2017 17:35:50

Power Spectral Density, 802.11n ht20 High Channel



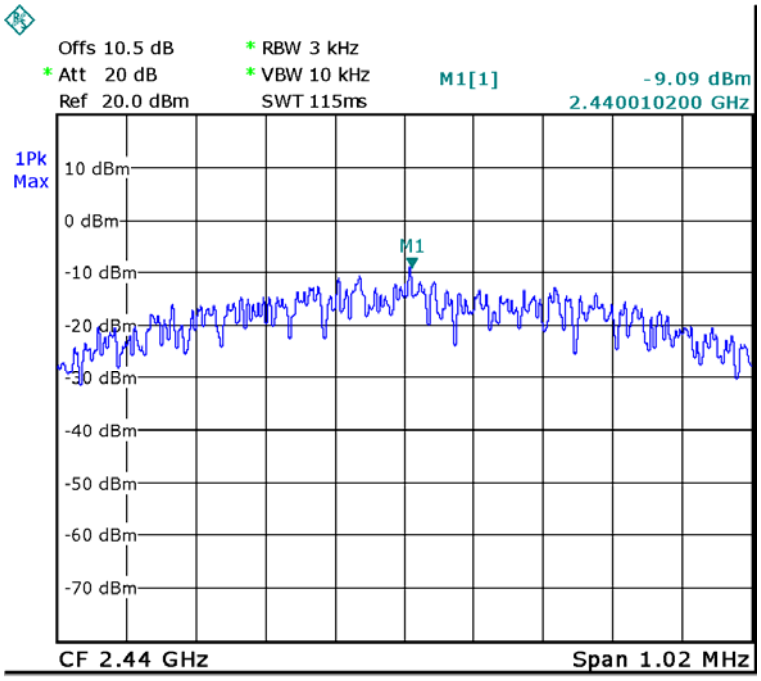
Date: 20.JAN.2017 17:38:23

Power Spectral Density, BLE Low Channel



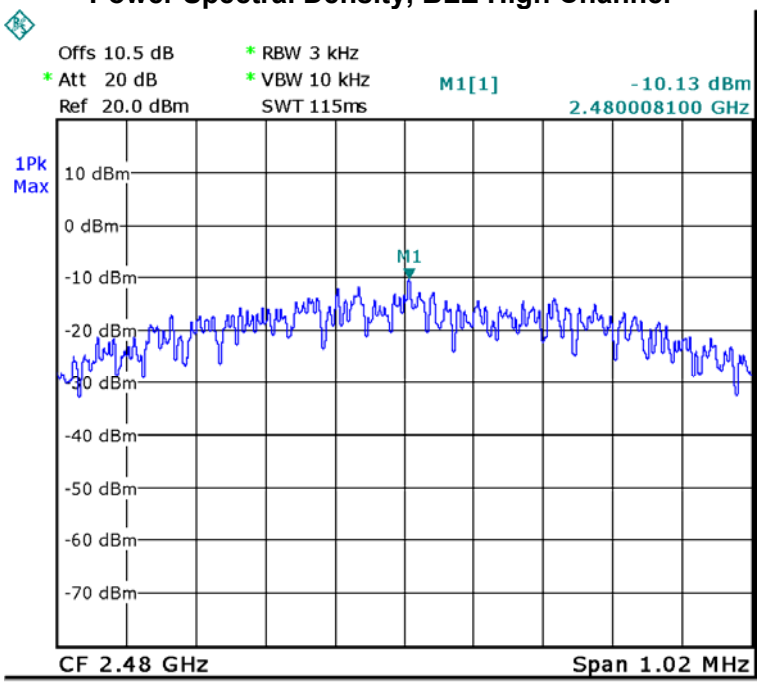
Date: 6.FEB.2017 13:04:05

Power Spectral Density, BLE Middle Channel



Date: 6.FEB.2017 13:06:00

Power Spectral Density, BLE High Channel



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