FCC PART 15.247

TEST REPORT

For

Proton Products International Ltd.

10 Aylesbury End, Beaconsfield, Buckinghamshire HP9 1LW, UNITED KINGDOM

FCC ID: 2AKS2SLMINI3060

Report Type:	**Product Name:**
Original Report	Speed and length Gauge

Test Engineer:	Tom Tang
Report Number:	RSC161220003
Report Date:	2017-01-06
Reviewed By:	Henry Ding EMC Leader
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Chengdu) 5040, HuiLongWan Plaza, No. 1, ShaWan Road, JinNiu District, ChengDu, China Tel: 028-65523123, Fax: 028-65525125 www.baclcorp.com

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The ***Proton Products International Ltd.***'s product, model number: ***SL mini 3060(FCC ID: 2AKS2SLMINI3060)*** *or* ("EUT") in this report was the ***Speed and length Gauge****,* which was measured approximately: 157 mm (L) x 105 mm (W) x 52 mm (H).
Rated input voltage: DC 24V from Power Supply and Mini Break out Box.

Power Supply and Mini Break out Box:
Manufacturer: Proton Products International Ltd.
Model: PSU-BOB mini
Input: AC 100-240V
Output: DC 24V

Note: The products, test model: SL mini 3060, multiple model: SL mini 1220. They have identical layout of PCB and internal structures, only different model name, stand-off distance and depth of field. So, we selected model SL mini 3060 to fully test, please refer to the Declaration Letter provided by the manufacturer.

**All measurement and test data in this report was gathered from final production sample, serial number: 161214003/01 (Assigned by BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2016-12-14, and EUT conformed to test requirement.*

Objective

This report is prepared on behalf of ***Proton Products International Ltd.*** In accordance with Part 2-Subpart J, Part 15-Subparts A, B and C of the Federal Communication Commissions rules.

The tests were performed in order to determine 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)

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 and Bay Area Compliance Laboratories Corp. (Chengdu). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

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 in 5040, HuiLongWan Plaza, No. 1, ShaWan Road, JinNiu District, ChengDu, 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 test in testing mode, which was provided by manufacturer.

For 2.4GHz Wi-Fi mode, 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, PSD across all data rate bandwidths and modulations.

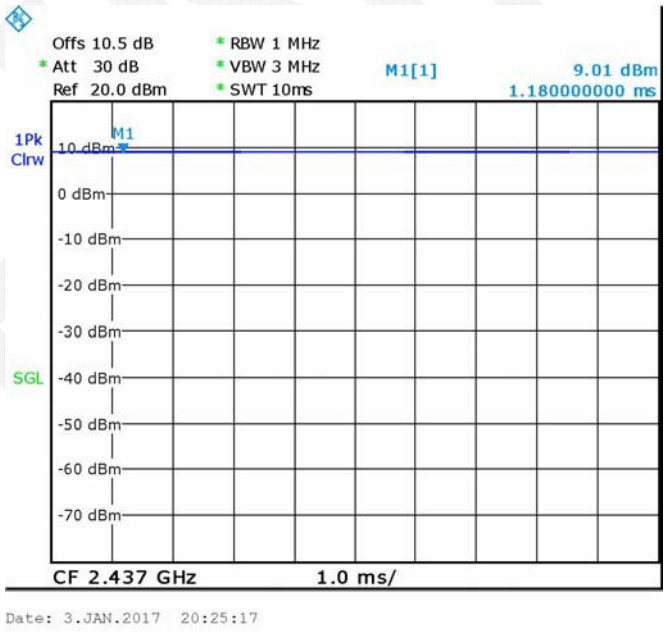
EUT Exercise Software

The software “PCIS-SLmini-V2.12” and specified command was used for testing, which was provided by manufacturer. The maximum power with duty cycle (100%) was set by as below.

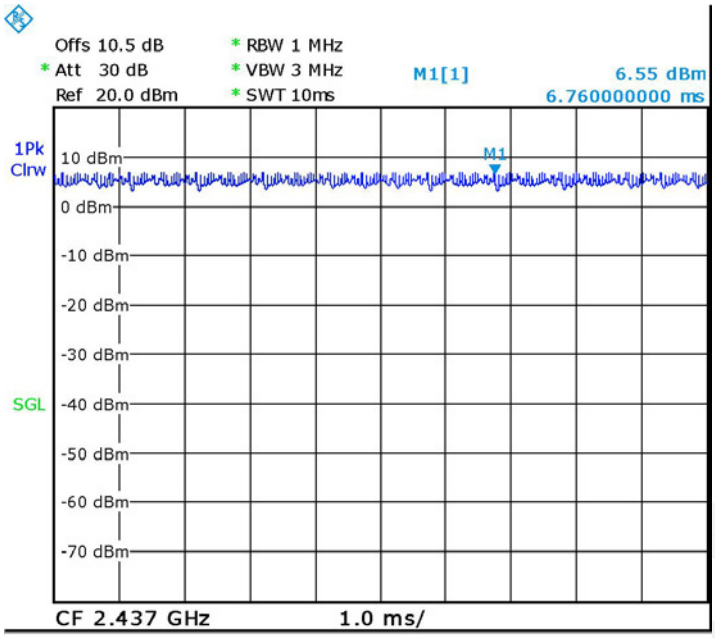
Test Mode	Test Software Version	PCIS-SLmini-V2.12		
802.11b	Test Frequency	2412	2437 MHz	2462 MHz
	Data Rate	1Mbps	1 Mbps	1 Mbps
	Power Level	17	17	17
802.11g	Test Frequency	2412 MHz	2437 MHz	2462 MHz
	Data Rate	6 Mbps	6 Mbps	6 Mbps
	Power Level	18	18	18
802.11n HT20	Test Frequency	2412 MHz	2437 MHz	2462 MHz
	Data Rate	MCS0	MCS0	MCS0
	Power Level	18	18	18

Duty Cycle (100%)

802.11 b

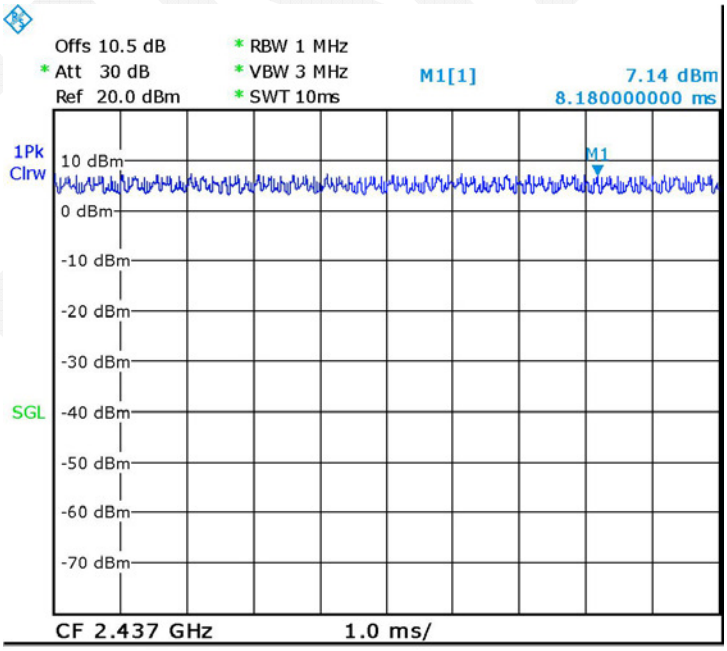


802.11g



Date: 3.JAN.2017 20:24:41

802.11n HT20



Date: 3.JAN.2017 20:24:03

Equipment Modifications

No modification was made to the EUT.

Support Equipment List and Details

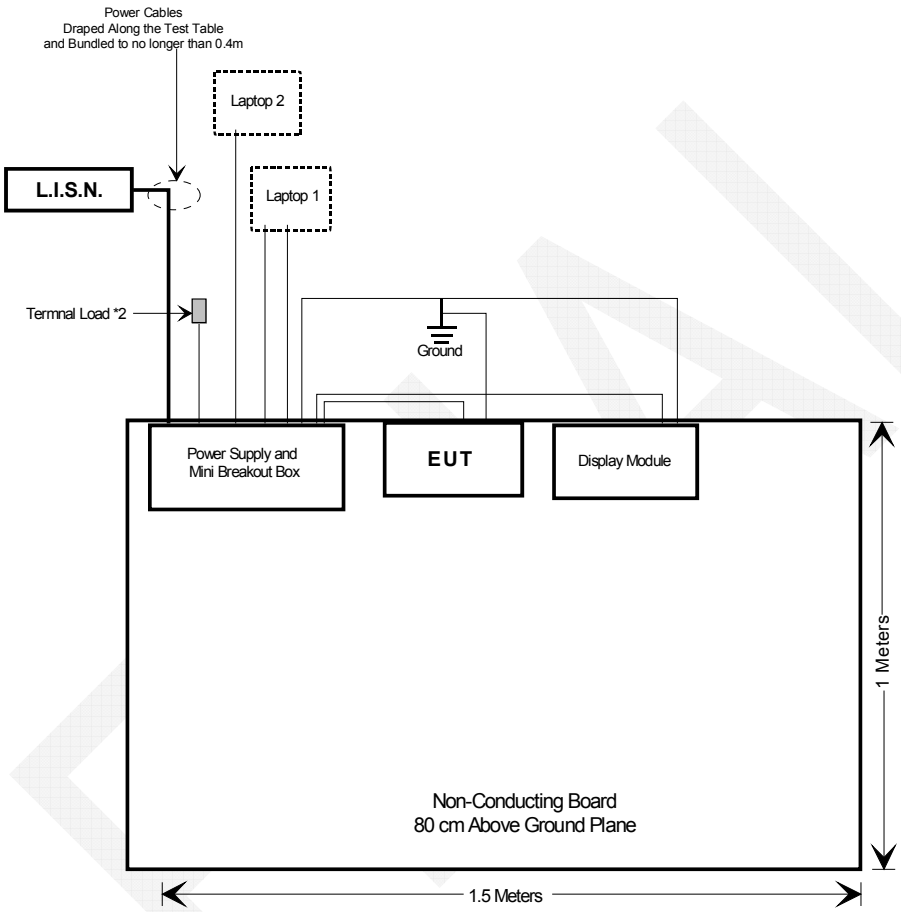
Manufacturer	Description	Model Number	Serial Number
Dell	Laptop 1	E6410	37417629385
Dell	Laptop 2	C640	5P804A00
Proton	Display Module	AIG2-SL	41K1034
/	Terminal Load	/	/

External I/O Cable

Cable Description	Length (m)	From/Port	To
Shielded DB925 Cable	3.0	DB25 Port / EUT	Power Supply and Mini Breakout Box
Unshielded RJ45 Cable	8.0	LAN port / Power Supply and Mini Break out Box	Laptop 1
Shielded RS232 Cable	3.0	RS232 port /Power Supply and Mini Break out Box	Laptop 1
Shielded RS232 Cable	3.0	I-bus port / Power Supply and Mini Break out Box	Laptop 2
Terminal Cable * 2	0.5	Power Supply and Mini Break out Box	Terminal Load
Unshielded DB9 Cable	1.0	CAN Port / Power Supply and Mini Breakout Box	Display Module

Block Diagram of Test Setup

AC power line conducted emissions：



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247(i), §2.1091 & §1.1307(b)(1)	Maximum Permissible exposure (MPE)	Compliant
§15.203	Antenna Requirement	Compliant
§15.207(a)	AC Line Conducted Emissions	Compliant
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliant
§15.247(b)(3)	Maximum Peak Output Power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

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);

Calculated Data:

Frequency Range (MHz)	**Antenna Gain**		**Tune-up Peak Conducted Power**		**Evaluation Distance (cm)**	**Power Density (mW/cm^2)**	**MPE Limit (mW/cm^2)**
	(dBi)	**(numeric)**	**(dBm)**	**(mW)**			
2412-2462	2.0	1.58	19.0	79.43	20	0.025	1.0

Result: The device meet FCC MPE at 20 cm distance.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to FCC §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 integrated antenna and maximum gain is 2.0dBi, which fulfill the requirement of the section. Please refer to the EUT internal photos.

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：

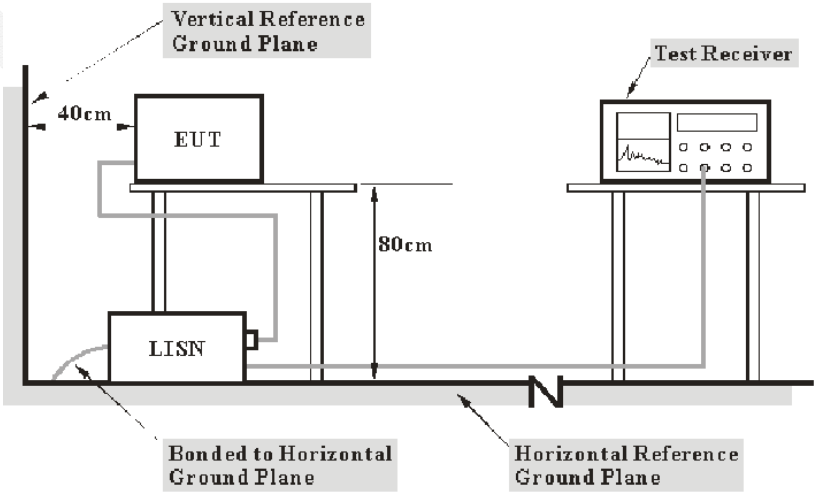
If U_{lab} is less than or equal to U_{cispr} of Table 1, then:
–compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
–non - compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.
If U_{lab} is greater than U_{cispr} of 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 was according to ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The power cables and 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.

The power supply and mini Break out box was connected to AC120V/60Hz 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

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:

$V_C = V_R + A_C + VDF$

Herein,s
V_C: corrected voltage amplitude
V_R: reading voltage amplitude
A_c: attenuation caused by cable loss
VDF: voltage division factor of AMN or ISN

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 Number	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	3560.6550.06	2016-12-02	2017-12-01
Rohde & Schwarz	PULSE LIMITER	ESH3Z2	357.8810.52	2016-10-31	2017-10-30
N/A	Conducted Cable	NO.5	N/A	2016-11-10	2017-11-09
Rohde & Schwarz	EMC32	N/A	V 8.54.0	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 Results Summary

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

Test Data

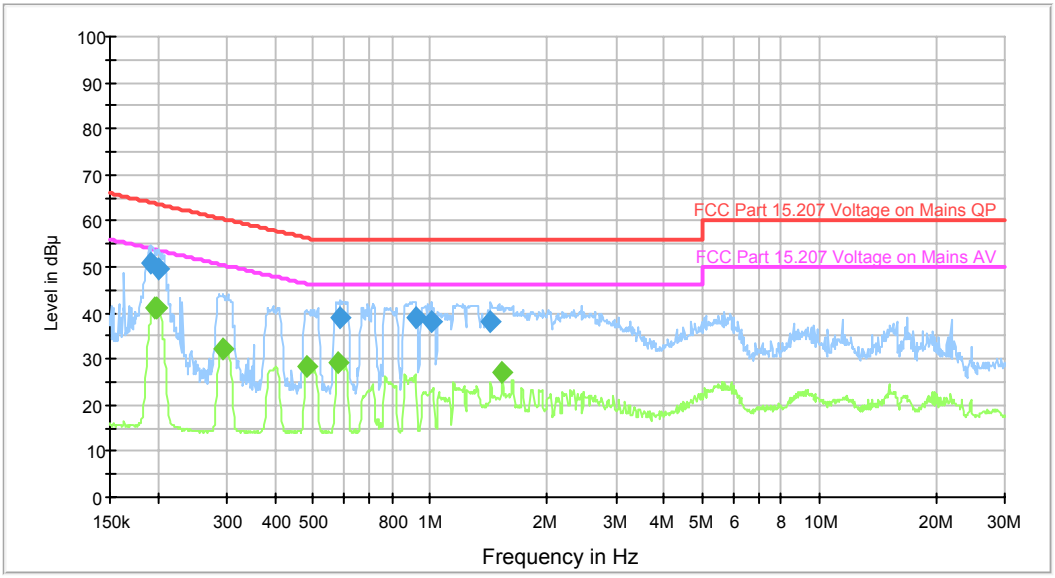
Environmental Conditions

Temperature:	22 °C
Relative Humidity:	52 %
ATM Pressure:	94.5 kPa

The testing was performed by Tom Tang on 2016-12-29.

Test Mode: Transmitting

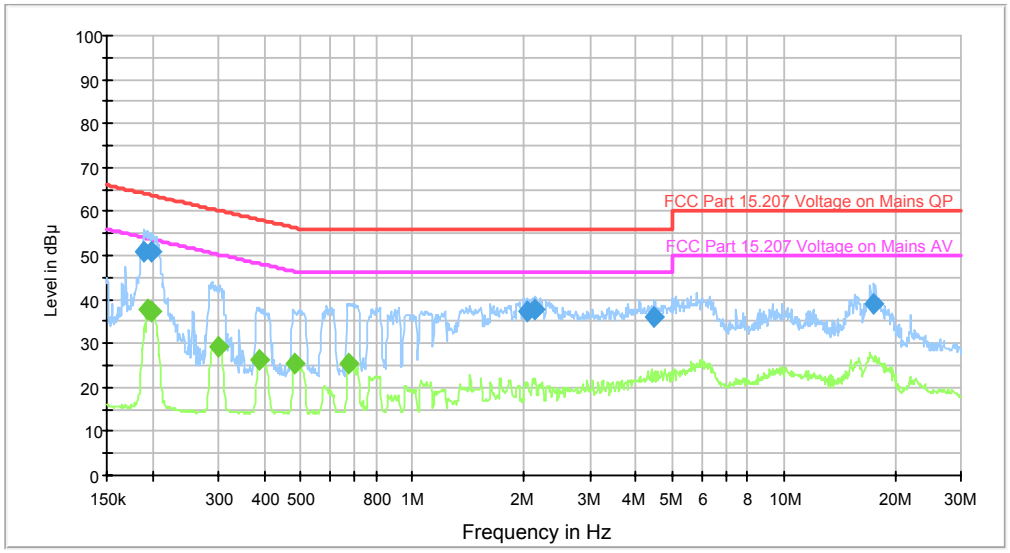
AC120V/60Hz, Line



Frequency (MHz)	Quasi Peak (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.192124	50.9	L1	19.6	13.0	63.9
0.200749	49.7	L1	19.6	13.9	63.6
0.587518	38.9	L1	19.6	17.1	56.0
0.915089	39.0	L1	19.7	17.0	56.0
1.007100	38.1	L1	19.7	17.9	56.0
1.430999	37.9	L1	19.6	18.1	56.0

Frequency (MHz)	Average (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.195217	41.1	L1	19.6	12.7	53.8
0.198359	41.1	L1	19.6	12.6	53.7
0.293329	32.0	L1	19.6	18.4	50.4
0.481211	28.2	L1	19.6	18.1	46.3
0.575908	29.1	L1	19.6	16.9	46.0
1.531484	27.2	L1	19.7	18.8	46.0

AC120V/60Hz, Neutral



Frequency (MHz)	Quasi Peak (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.189837	50.7	N	19.7	13.3	64.0
0.196781	51.0	N	19.7	12.7	63.7
2.041455	37.2	N	19.8	18.8	56.0
2.141629	37.6	N	19.8	18.4	56.0
4.482096	36.2	N	19.7	19.8	56.0
17.485466	39.0	N	20.1	21.0	60.0

Frequency (MHz)	Average (dB µ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.194439	37.5	N	19.7	16.3	53.8
0.197569	37.4	N	19.7	16.3	53.7
0.300440	29.4	N	19.7	20.8	50.2
0.386351	26.3	N	19.7	21.8	48.1
0.483136	25.5	N	19.7	20.8	46.3
0.672926	25.5	N	19.7	20.5	46.0

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.

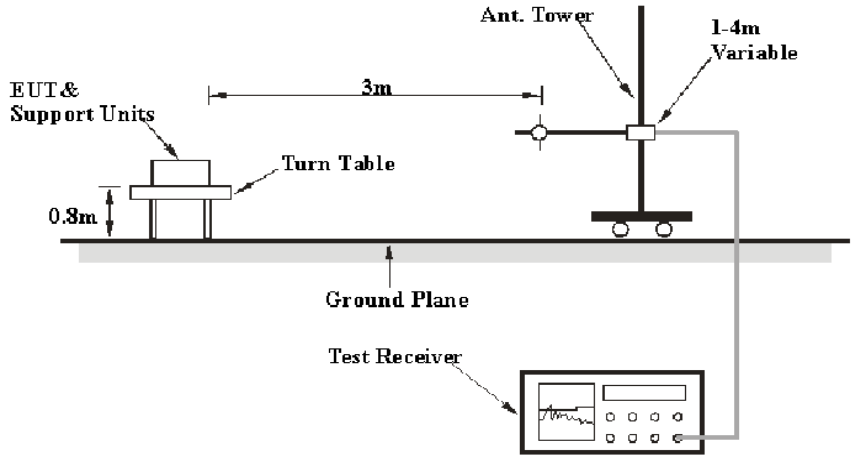
Based on CISPR 16-4-2-2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Chengdu) is:
30M~200MHz: 4.7 dB;
200M~1GHz: 6.0 dB;
1G-6GHz: 5.13dB;
6G~25GHz: 5.47 dB;

Table 2 – Values of U_{cispr}

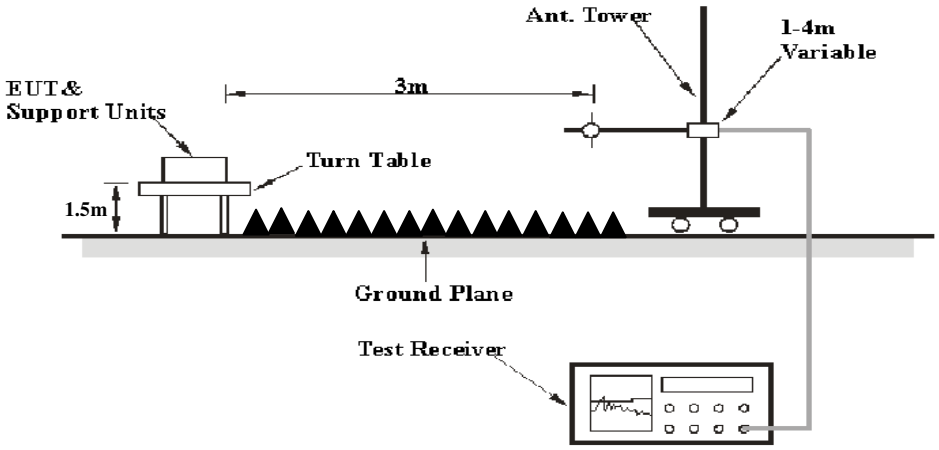
Measurement	U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

EUT Setup

Below 1 GHz:



Above 1 GHz:



The radiated emission tests were performed in the 3 meters Semi-Anechoic Chamber, using the setup in 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.

The power supply and mini Break out box was connected to AC120V/60Hz power source.

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
Above 1 GHz	1 MHz	3 MHz	/	PK
	1 MHz	10 Hz	/	Ave.

Test Procedure

Measurements are performed with the EUT over the x, y and z axis, until it shall be explored to maximize the measured emissions.

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 = Receiver Reading + Cable loss + Antenna Factor – 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 Number	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	A101808	2016-04-10	2019-04-09
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2016-12-02	2017-12-01
EM TEST	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	2016-5-20	2017-5-19
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
Narda	Attenuator(6dB)	757C	34289	2016-11-10	2017-11-09
Rohde & Schwarz	EMC32	N/A	V 8.54.0	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 Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Section 15.205, 15.209 and 15.247.

Test Data

Environmental Conditions

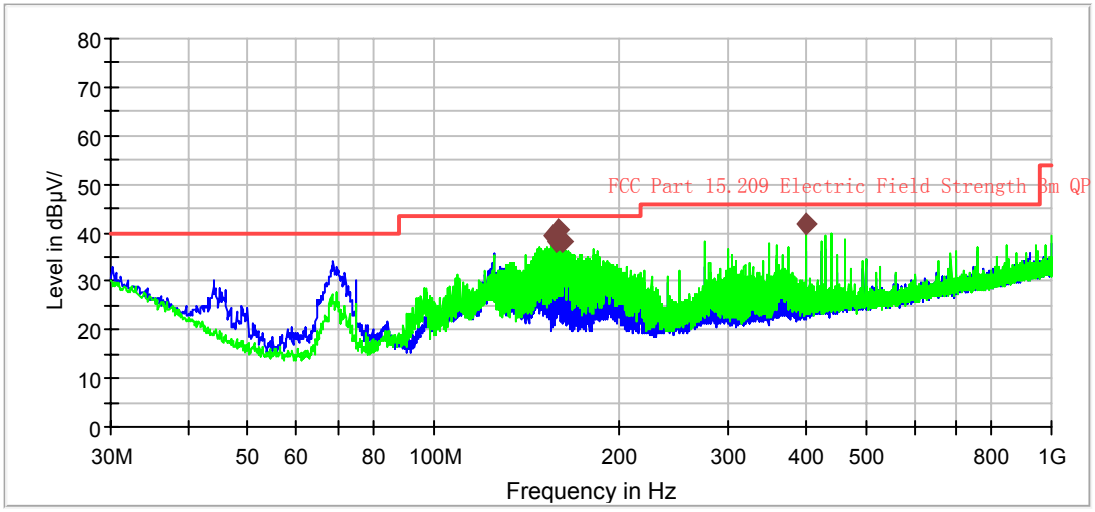
Temperature:	21°C
Relative Humidity:	54 %
ATM Pressure:	96.2 kPa

The testing was performed by Tom Tang on 2017-01-04.

Test Mode: Transmitting

30 MHz to 1 GHz:

Electric Field Strength with Scans



Frequency (MHz)	Quasi Peak (dBµV/m)	Height (cm)	Polarization	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
155.372500	39.2	200.0	H	-6.1	4.3	43.5
158.403750	38.2	200.0	H	-6.1	5.3	43.5
159.373750	40.7	200.0	H	-6.2	*2.8	43.5
159.858750	38.7	200.0	H	-6.2	4.8	43.5
161.313750	38.3	200.0	H	-6.3	5.2	43.5
400.055000	41.7	100.0	H	-2.1	4.3	46.0

** Within Measurement Uncertainty.*

1 GHz to 25 GHz:

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	75.31	PK	H	23.50	3.00	0.00	101.81	N/A	N/A
2412	71.05	AV	H	23.50	3.00	0.00	97.55	N/A	N/A
2412	72.74	PK	V	23.50	3.00	0.00	99.24	N/A	N/A
2412	69.43	AV	V	23.50	3.00	0.00	95.93	N/A	N/A
2390	34.38	PK	H	23.57	3.00	0.00	60.95	74.00	13.05
2390	22.46	AV	H	23.57	3.00	0.00	49.03	54.00	4.97
4824	41.28	PK	H	30.84	5.11	26.87	50.36	74.00	23.64
4824	37.89	AV	H	30.84	5.11	26.87	46.97	54.00	7.03
7236	33.78	PK	H	34.77	6.18	26.36	48.37	74.00	25.63
7236	22.36	AV	H	34.77	6.18	26.36	36.95	54.00	17.05
2437 MHz									
2437	75.15	PK	H	23.41	3.00	0.00	101.56	N/A	N/A
2437	68.72	AV	H	23.41	3.00	0.00	95.13	N/A	N/A
2437	72.21	PK	V	23.41	3.00	0.00	98.62	N/A	N/A
2437	66.54	AV	V	23.41	3.00	0.00	92.95	N/A	N/A
4874	40.81	PK	H	31.00	5.09	26.87	50.03	74.00	23.97
4874	36.95	AV	H	31.00	5.09	26.87	46.17	54.00	7.83
7311	34.05	PK	H	34.92	6.21	26.40	48.78	74.00	25.22
7311	21.36	AV	H	34.92	6.21	26.40	36.09	54.00	17.91
2462 MHz									
2462	73.62	PK	H	23.33	2.99	0.00	99.94	N/A	N/A
2462	69.43	AV	H	23.33	2.99	0.00	95.75	N/A	N/A
2462	70.42	PK	V	23.33	2.99	0.00	96.74	N/A	N/A
2462	66.12	AV	V	23.33	2.99	0.00	92.44	N/A	N/A
2483.5	31.76	PK	H	23.26	2.99	0.00	58.01	74.00	15.99
2483.5	18.45	AV	H	23.26	2.99	0.00	44.70	54.00	9.30
4924	40.33	PK	H	31.16	5.07	26.88	49.68	74.00	24.32
4924	35.17	AV	H	31.16	5.07	26.88	44.52	54.00	9.48
7386	34.16	PK	H	35.07	6.25	26.43	49.05	74.00	24.95
7386	22.06	AV	H	35.07	6.25	26.43	36.95	54.00	17.05

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	70.52	PK	H	23.50	3.00	0.00	97.02	N/A	N/A
2412	62.63	AV	H	23.50	3.00	0.00	89.13	N/A	N/A
2412	68.75	PK	V	23.50	3.00	0.00	95.25	N/A	N/A
2412	59.98	AV	V	23.50	3.00	0.00	86.48	N/A	N/A
2390	34.11	PK	H	23.57	3.00	0.00	60.68	74.00	13.32
2390	17.15	AV	H	23.57	3.00	0.00	43.72	54.00	10.28
4824	41.23	PK	H	30.84	5.11	26.87	50.31	74.00	23.69
4824	25.86	AV	H	30.84	5.11	26.87	34.94	54.00	19.06
7236	33.24	PK	H	34.77	6.18	26.36	47.83	74.00	26.17
7236	21.84	AV	H	34.77	6.18	26.36	36.43	54.00	17.57
2437 MHz									
2437	69.65	PK	H	23.41	3.00	0.00	96.06	N/A	N/A
2437	61.08	AV	H	23.41	3.00	0.00	87.49	N/A	N/A
2437	68.42	PK	V	23.41	3.00	0.00	94.83	N/A	N/A
2437	59.65	AV	V	23.41	3.00	0.00	86.06	N/A	N/A
4874	40.41	PK	H	31.00	5.09	26.87	49.63	74.00	24.37
4874	30.08	AV	H	31.00	5.09	26.87	39.30	54.00	14.70
7311	33.61	PK	H	34.92	6.21	26.40	48.34	74.00	25.66
7311	21.37	AV	H	34.92	6.21	26.40	36.10	54.00	17.90
2462 MHz									
2462	68.87	PK	H	23.33	2.99	0.00	95.19	N/A	N/A
2462	60.16	AV	H	23.33	2.99	0.00	86.48	N/A	N/A
2462	68.16	PK	V	23.33	2.99	0.00	94.48	N/A	N/A
2462	59.38	AV	V	23.33	2.99	0.00	85.70	N/A	N/A
2483.5	34.95	PK	H	23.26	2.99	0.00	61.20	74.00	12.80
2483.5	17.13	AV	H	23.26	2.99	0.00	43.38	54.00	10.62
4924	40.22	PK	H	31.16	5.07	26.88	49.57	74.00	24.43
4924	29.78	AV	H	31.16	5.07	26.88	39.13	54.00	14.87
7386	33.09	PK	H	35.07	6.25	26.43	47.98	74.00	26.02
7386	20.31	AV	H	35.07	6.25	26.43	35.20	54.00	18.80

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	71.39	PK	H	23.50	3.00	0.00	97.89	N/A	N/A
2412	60.68	AV	H	23.50	3.00	0.00	87.18	N/A	N/A
2412	68.66	PK	V	23.50	3.00	0.00	95.16	N/A	N/A
2412	57.96	AV	V	23.50	3.00	0.00	84.46	N/A	N/A
2390	36.99	PK	H	23.57	3.00	0.00	63.56	74.00	10.44
2390	17.14	AV	H	23.57	3.00	0.00	43.71	54.00	10.29
4824	40.52	PK	H	30.84	5.11	26.87	49.60	74.00	24.40
4824	29.83	AV	H	30.84	5.11	26.87	38.91	54.00	15.09
7236	33.13	PK	H	34.77	6.18	26.36	47.72	74.00	26.28
7236	22.23	AV	H	34.77	6.18	26.36	36.82	54.00	17.18
2437 MHz									
2437	70.41	PK	H	23.41	3.00	0.00	96.82	N/A	N/A
2437	60.22	AV	H	23.41	3.00	0.00	86.63	N/A	N/A
2437	67.68	PK	V	23.41	3.00	0.00	94.09	N/A	N/A
2437	57.4	AV	V	23.41	3.00	0.00	83.81	N/A	N/A
4874	40.18	PK	H	31.00	5.09	26.87	49.40	74.00	24.60
4874	29.22	AV	H	31.00	5.09	26.87	38.44	54.00	15.56
7311	33.96	PK	H	34.92	6.21	26.40	48.69	74.00	25.31
7311	21.45	AV	H	34.92	6.21	26.40	36.18	54.00	17.82
2462 MHz									
2462	69.77	PK	H	23.33	2.99	0.00	96.09	N/A	N/A
2462	59.37	AV	H	23.33	2.99	0.00	85.69	N/A	N/A
2462	68.25	PK	V	23.33	2.99	0.00	94.57	N/A	N/A
2462	58.57	AV	V	23.33	2.99	0.00	84.89	N/A	N/A
2483.5	34.24	PK	H	23.26	2.99	0.00	60.49	74.00	13.51
2483.5	15.52	AV	H	23.26	2.99	0.00	41.77	54.00	12.23
4924	39.96	PK	H	31.16	5.07	26.88	49.31	74.00	24.69
4924	28.47	AV	H	31.16	5.07	26.88	37.82	54.00	16.18
7386	33.57	PK	H	35.07	6.25	26.43	48.46	74.00	25.54
7386	21.31	AV	H	35.07	6.25	26.43	36.20	54.00	17.80

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 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
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:	21°C
Relative Humidity:	50 %
ATM Pressure:	96.3 kPa

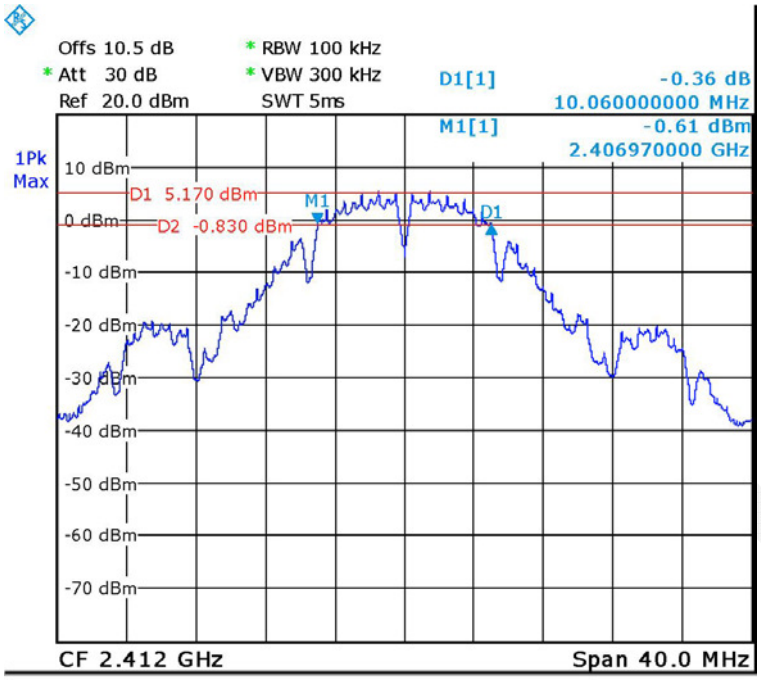
The testing was performed by Tom Tang on 2017-01-03.

Test Mode: Transmitting

Test Result: Compliant. Please refer to the below table and plots.

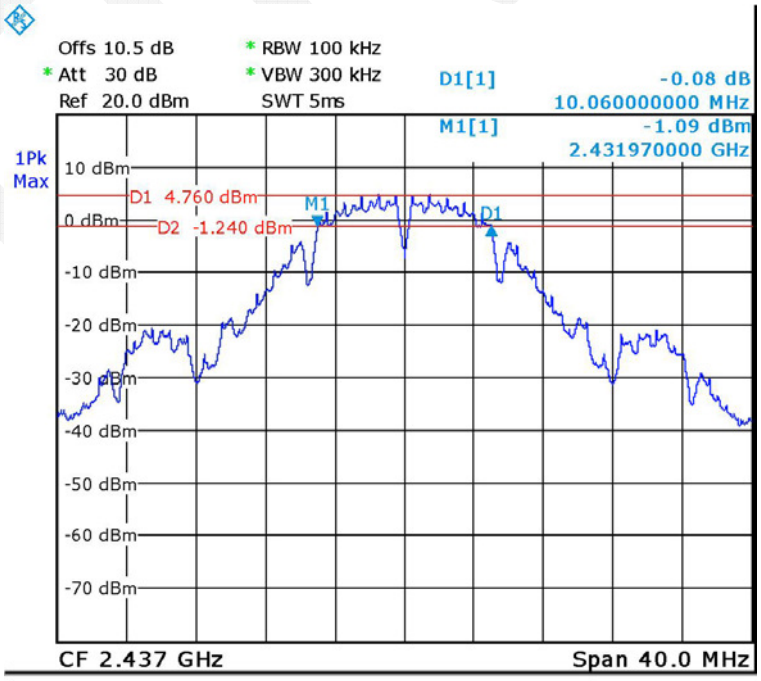
Mode	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)
802.11b	Low	2412	10.060	≥0.50
	Middle	2437	10.060	≥0.50
	High	2462	10.060	≥0.50
802.11g	Low	2412	16.447	≥0.50
	Middle	2437	16.447	≥0.50
	High	2462	16.447	≥0.50
802.11n-HT20	Low	2412	17.565	≥0.50
	Middle	2437	17.565	≥0.50
	High	2462	17.565	≥0.50

802.11b Low Channel



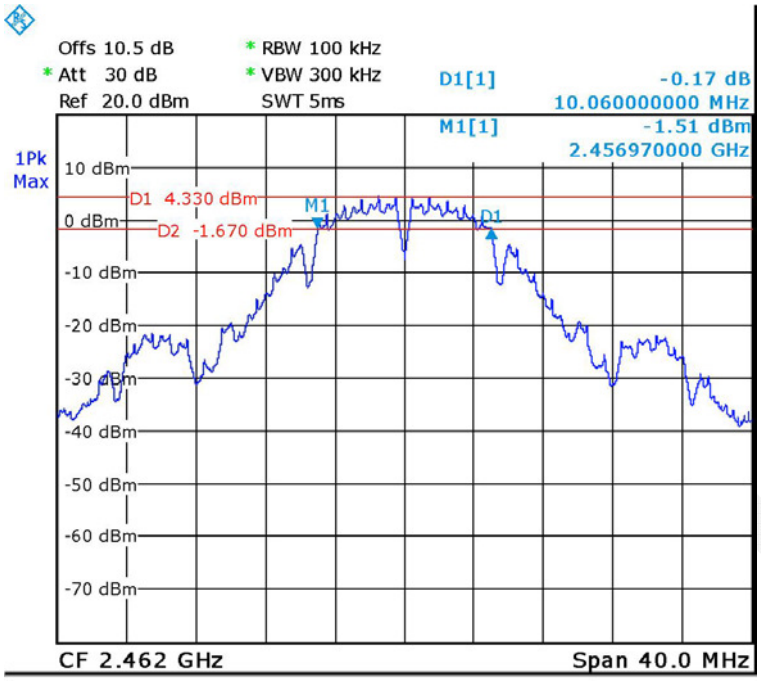
Date: 3.JAN.2017 19:02:32

802.11b Middle Channel



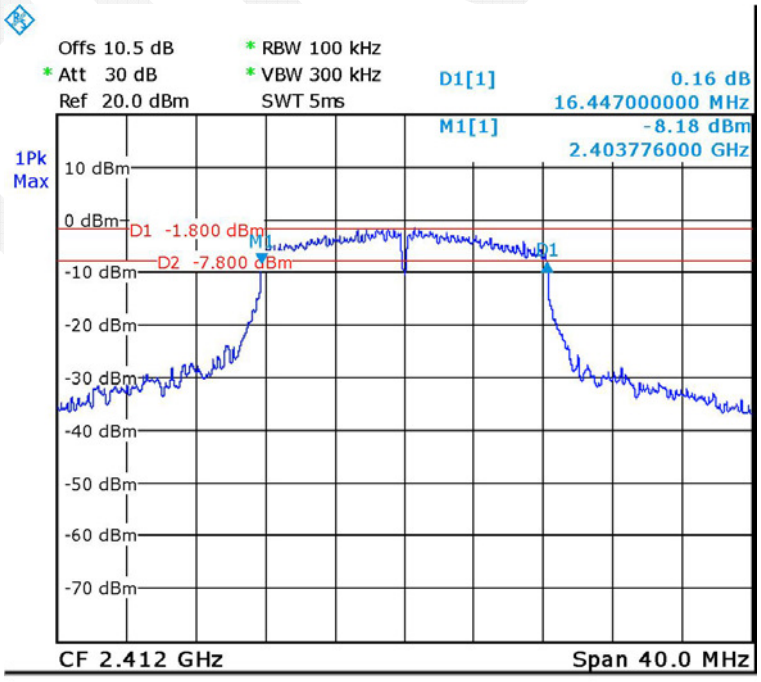
Date: 3.JAN.2017 19:06:02

802.11b High Channel



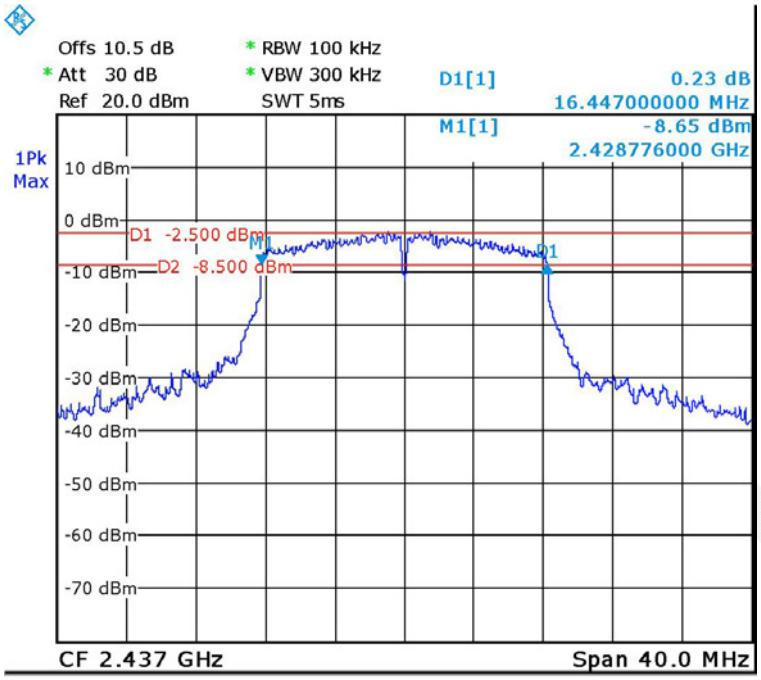
Date: 3.JAN.2017 19:08:32

802.11g Low Channel



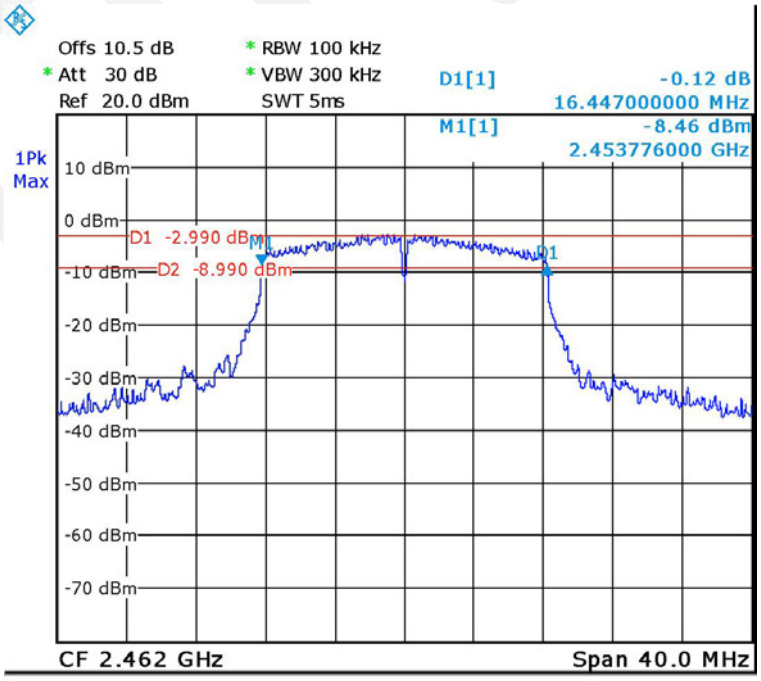
Date: 3.JAN.2017 19:13:58

802.11g Middle Channel



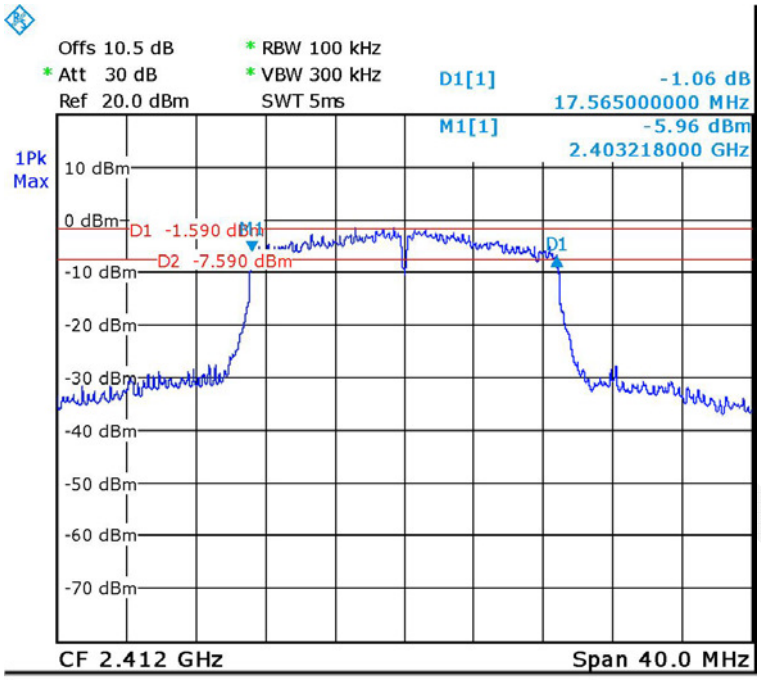
Date: 3.JAN.2017 19:32:32

802.11g High Channel



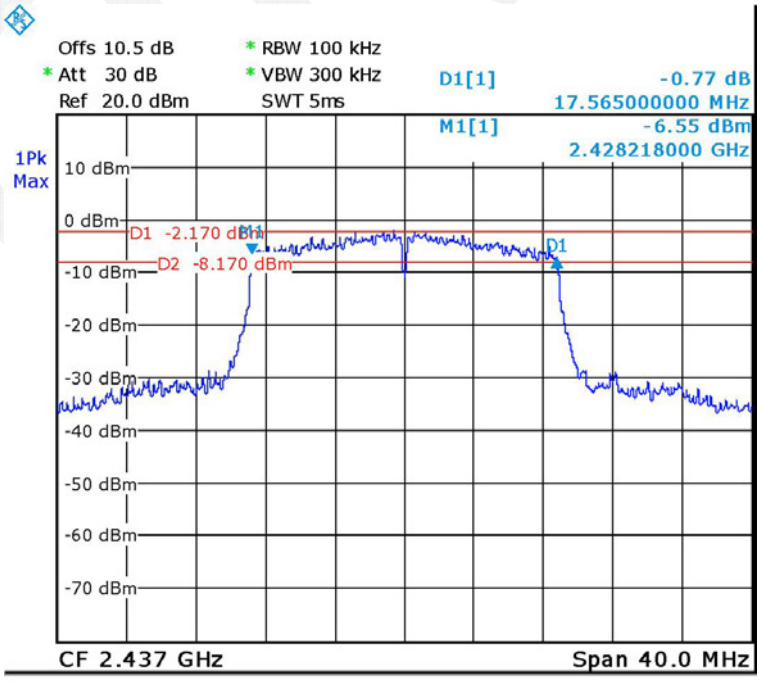
Date: 3.JAN.2017 19:34:54

802.11n ht20 Low Channel



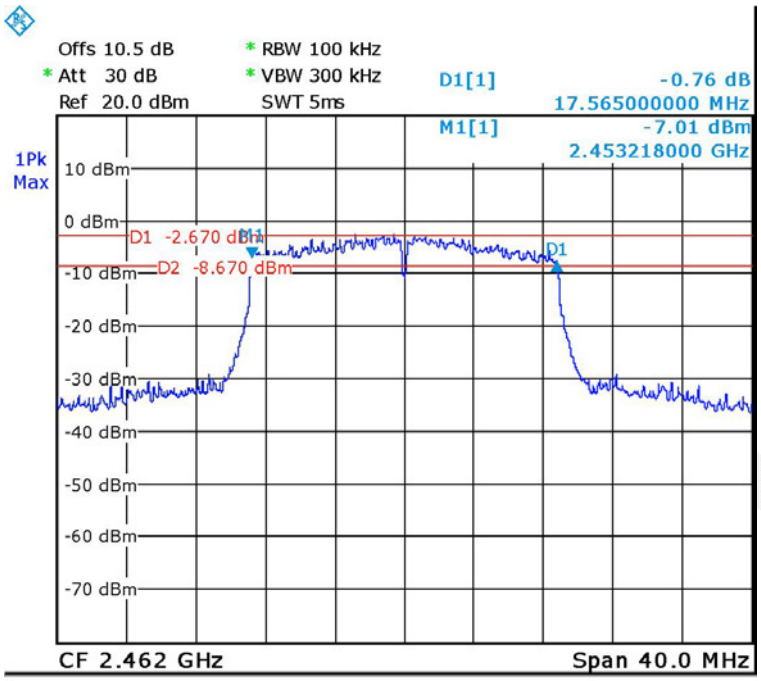
Date: 3.JAN.2017 19:38:53

802.11n ht20 Middle Channel



Date: 3.JAN.2017 19:42:23

802.11n ht20 High Channel



FCC §15.247(b) (3) - MAXIMUM PEAK 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 the USB Wideband Power Sensor.
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
Rohde & Schwarz	Spectrum Analyzer	FSL18	100180	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:	21°C
Relative Humidity:	50 %
zATM Pressure:	96.3 kPa

The testing was performed by Tom Tang on 2017-01-03.

Test Mode: Transmitting

Test Result: Compliant. Please refer to the below table.

Mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)	Limit (dBm)
802.11b	Low	2412	18.94	30
	Middle	2437	18.53	30
	High	2462	18.04	30
802.11g	Low	2412	18.89	30
	Middle	2437	18.55	30
	High	2462	18.09	30
802.11n-HT20	Low	2412	18.86	30
	Middle	2437	18.49	30
	High	2462	18.21	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
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

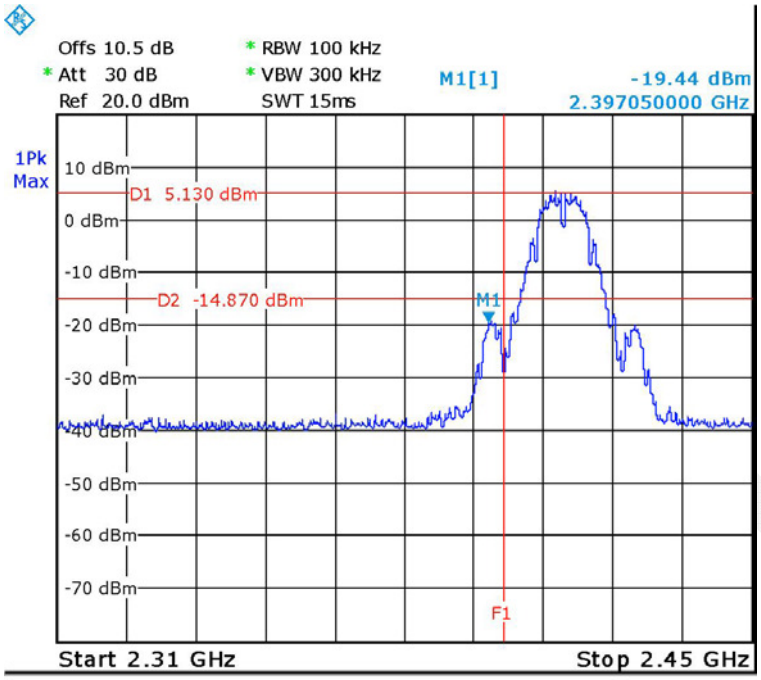
Temperature:	21 °C
Relative Humidity:	50 %
ATM Pressure:	96.3 kPa

The testing was performed by Tom Tang on 2017-01-03.

Test Mode: Transmitting

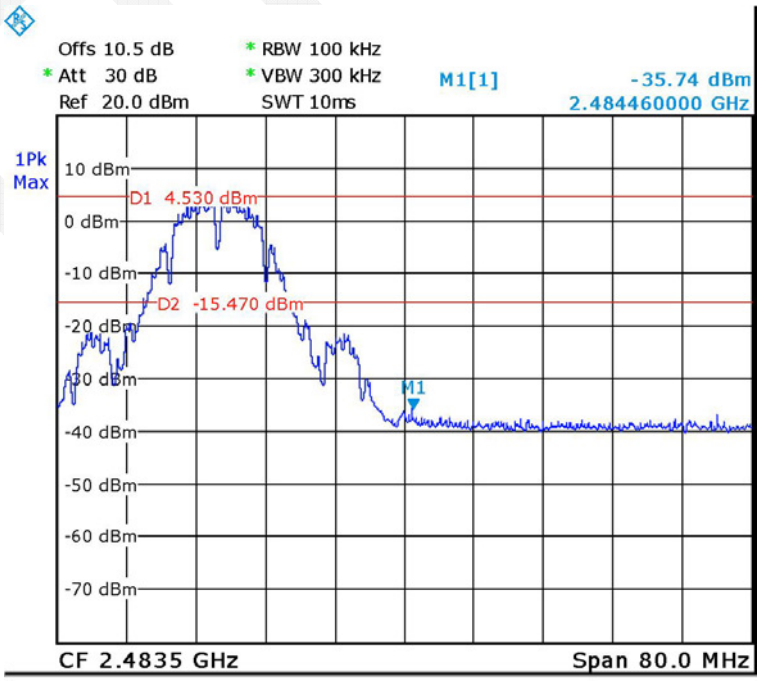
Test Result: Compliant. Please refer to the below plots.

802.11b: Band Edge, Left Side



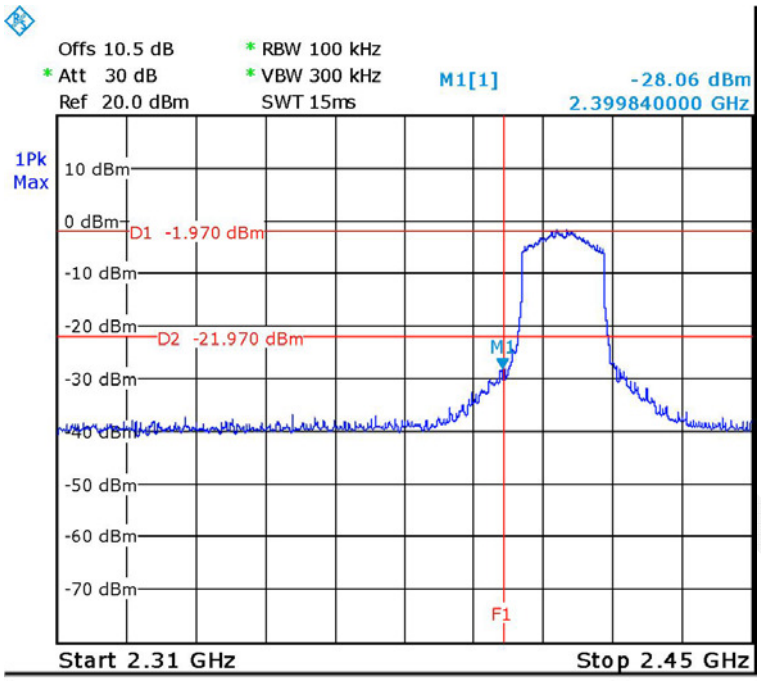
Date: 3.JAN.2017 20:02:14

802.11b: Band Edge, Right Side



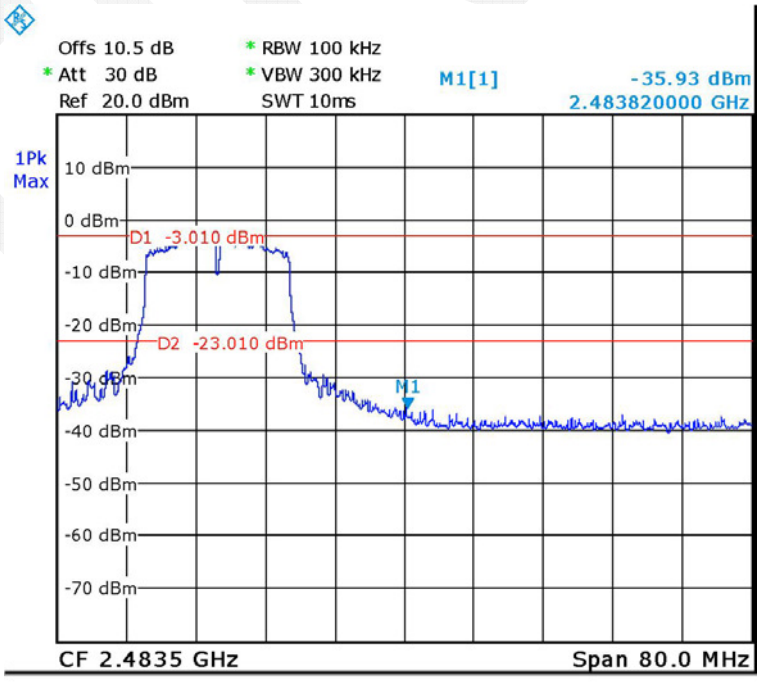
Date: 3.JAN.2017 20:12:24

802.11g: Band Edge, Left Side



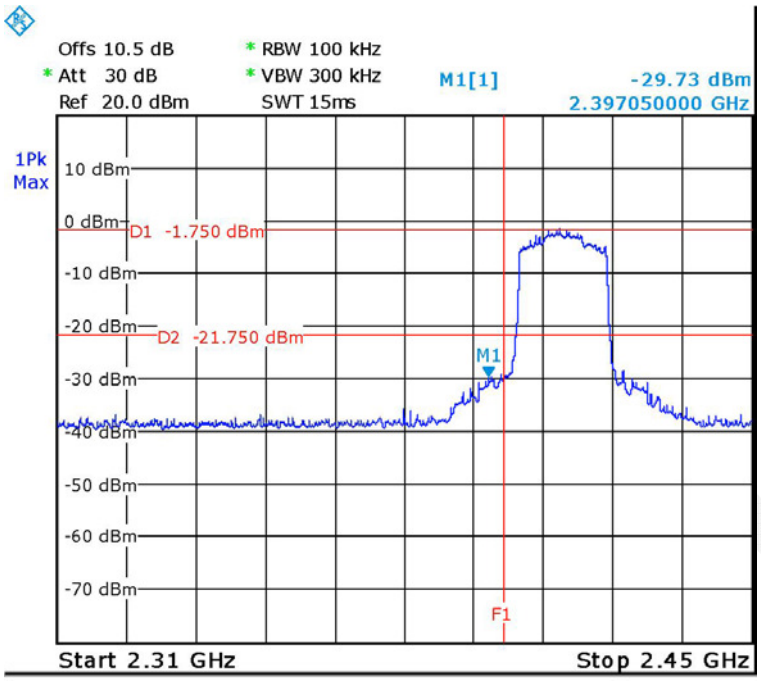
Date: 3.JAN.2017 20:03:33

802.11g: Band Edge, Right Side



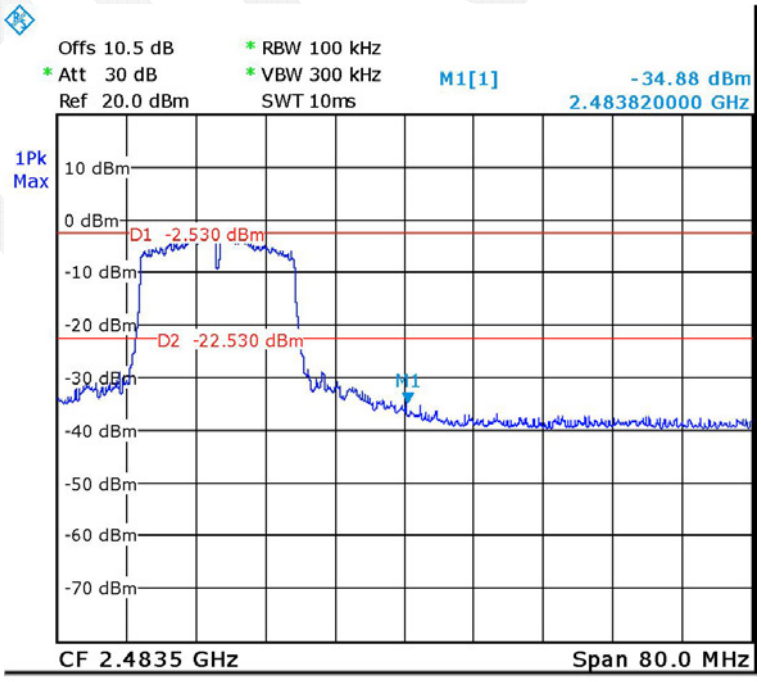
Date: 3.JAN.2017 20:14:28

802.11n HT20 Band Edge, Left Side



Date: 3.JAN.2017 20:09:54

802.11n HT20 Band Edge, Right Side



Date: 3.JAN.2017 20:16:59

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. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set 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. According to KDB 558074 D01 DTS Meas Guidance v03r05, set the RBW = 3 kHz, VBW = 10 kHz, Set the span to 1.5 times the DTS channel bandwidth.
4. Use the peak marker function to determine the maximum power level in any 3 kHz band segment within the fundamental EBW.

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
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:	21°C
Relative Humidity:	50 %
ATM Pressure:	96.3 kPa

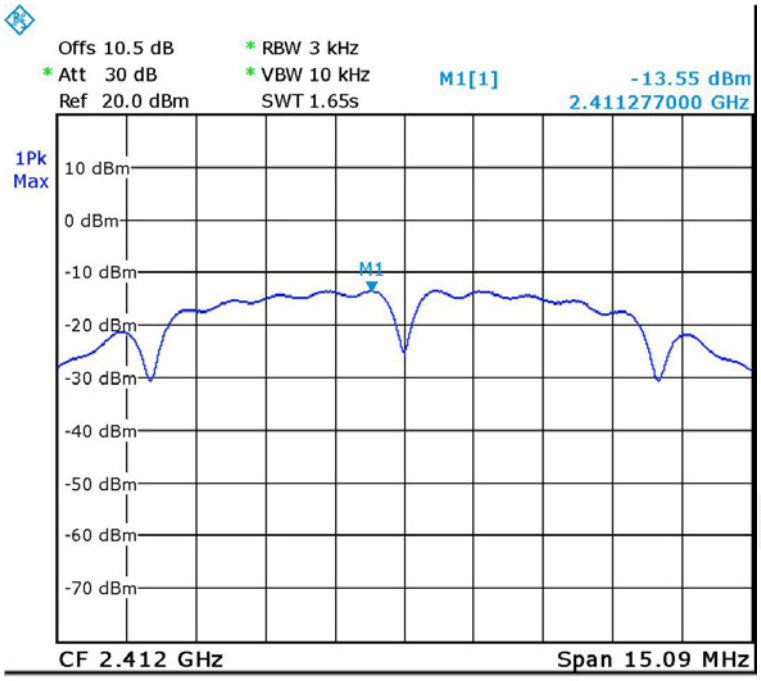
The testing was performed by Tom Tang on 2017-01-03.

Test Mode: Transmitting

Test Result: Compliant. Please refer to the below table and plots.

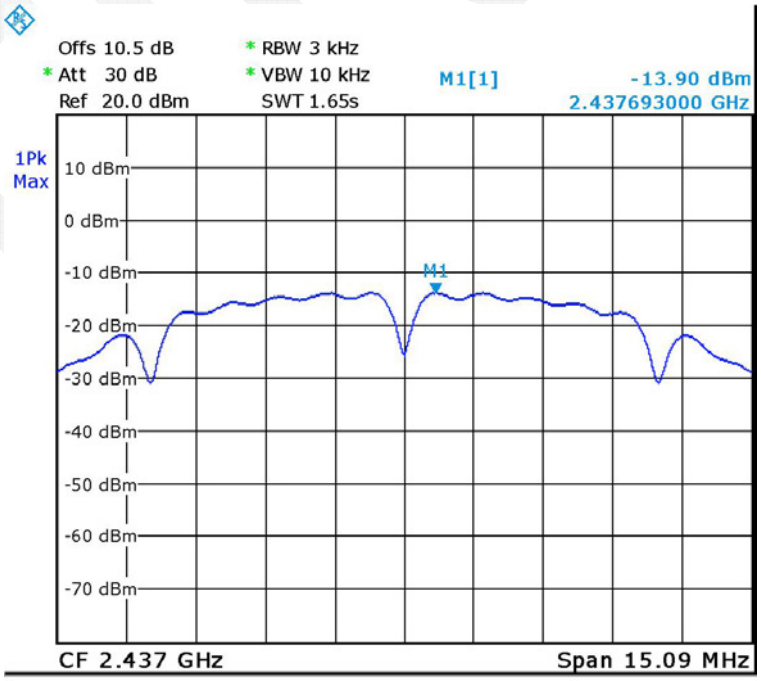
Mode	Channel	Frequency (MHz)	Power Spectral Density	Limit
			(dBm/3kHz)	dBm/3kHz
802.11b	Low	2412	-13.55	≤8
	Middle	2437	-13.90	≤8
	High	2462	-14.32	≤8
802.11g	Low	2412	-15.75	≤8
	Middle	2437	-16.25	≤8
	High	2462	-16.77	≤8
802.11n HT20	Low	2412	-16.18	≤8
	Middle	2437	-16.63	≤8
	High	2462	-17.38	≤8

Power Spectral Density, 802.11b Low Channel



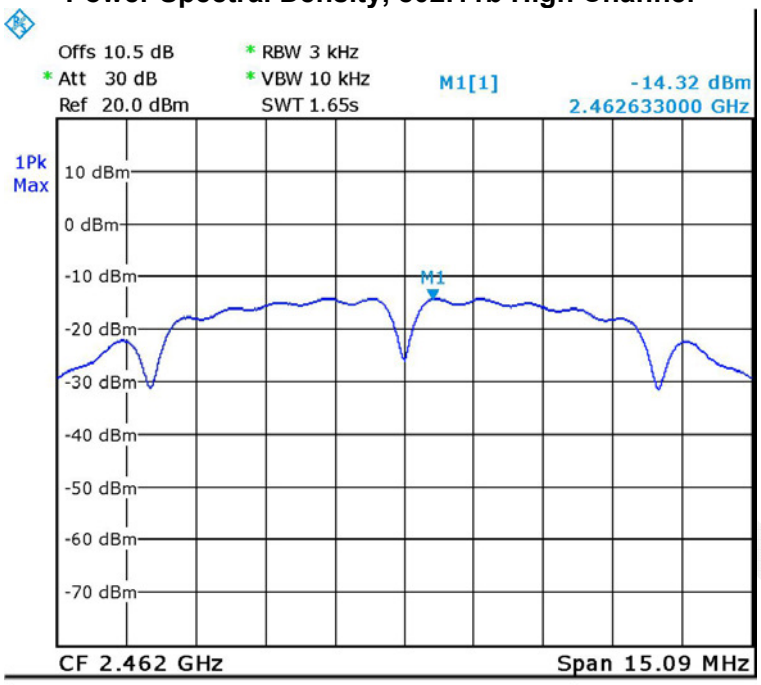
Date: 3.JAN.2017 19:48:11

Power Spectral Density, 802.11b Middle Channel



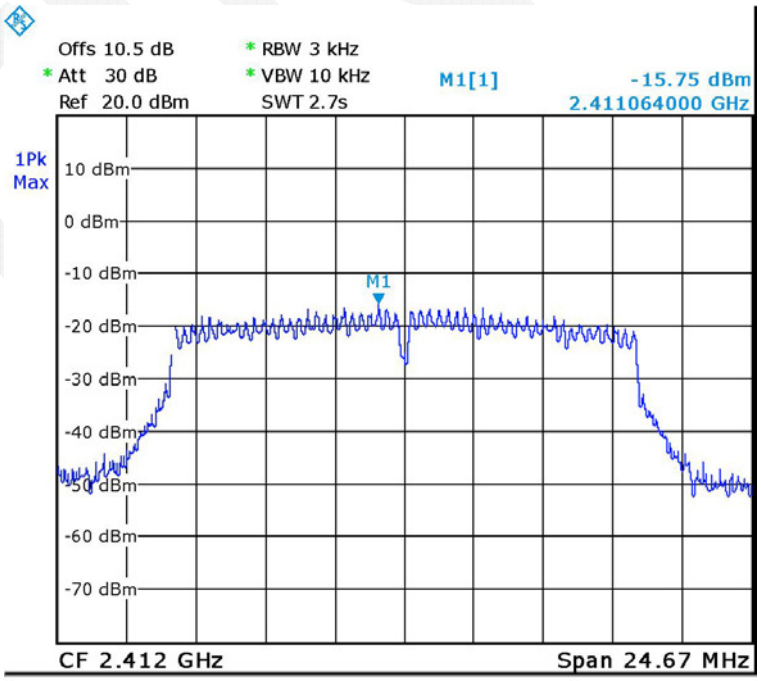
Date: 3.JAN.2017 19:48:50

Power Spectral Density, 802.11b High Channel



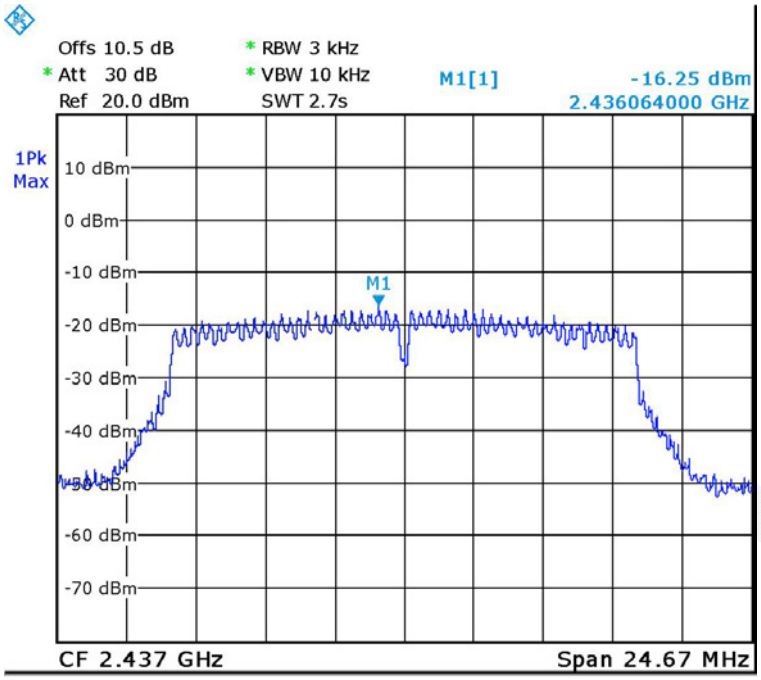
Date: 3.JAN.2017 19:49:27

Power Spectral Density, 802.11g Low Channel



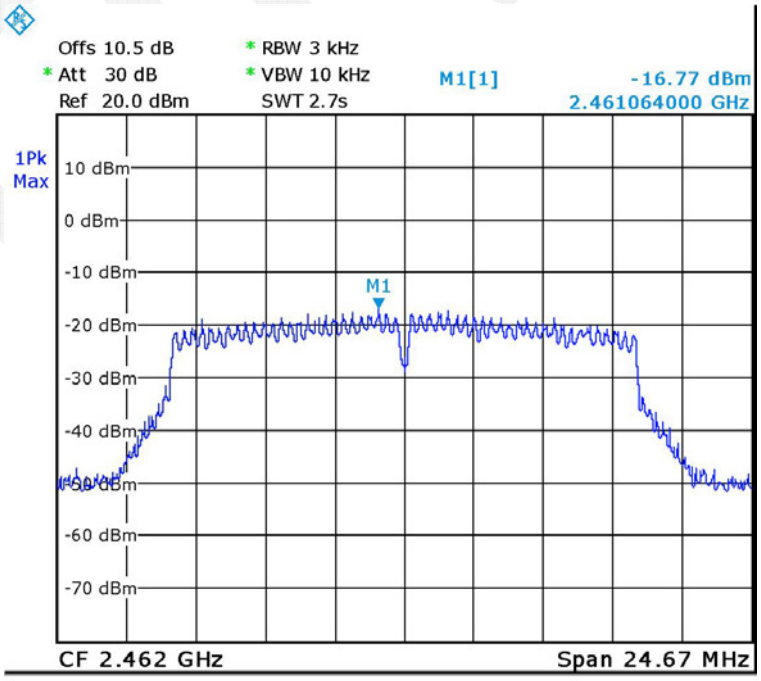
Date: 3.JAN.2017 19:50:50

Power Spectral Density, 802.11g Middle Channel



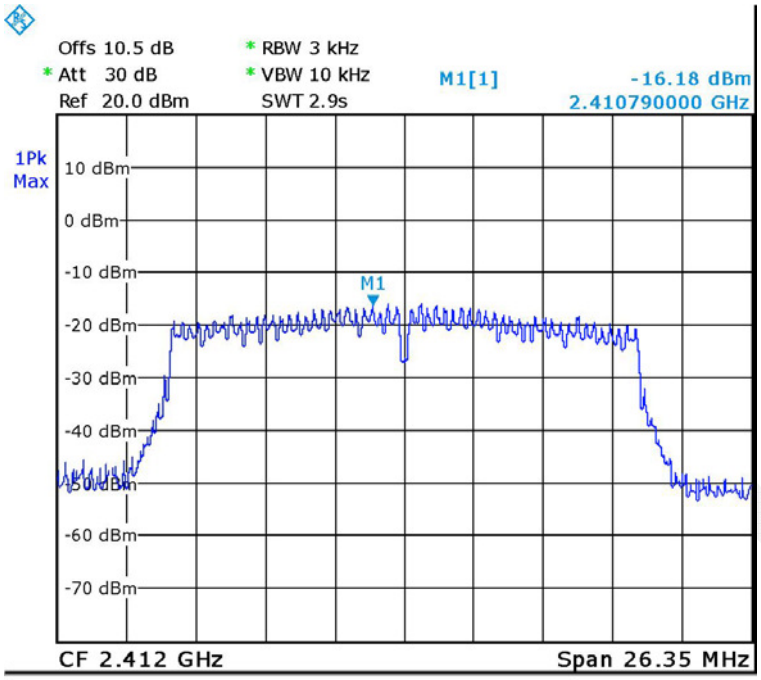
Date: 3.JAN.2017 19:54:30

Power Spectral Density, 802.11g High Channel



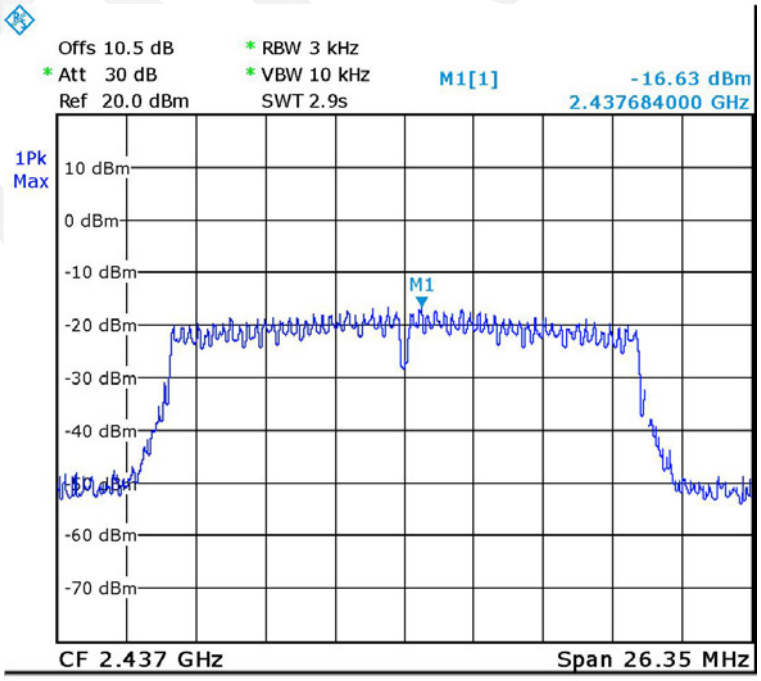
Date: 3.JAN.2017 19:53:12

Power Spectral Density, 802.11n HT20 Low Channel



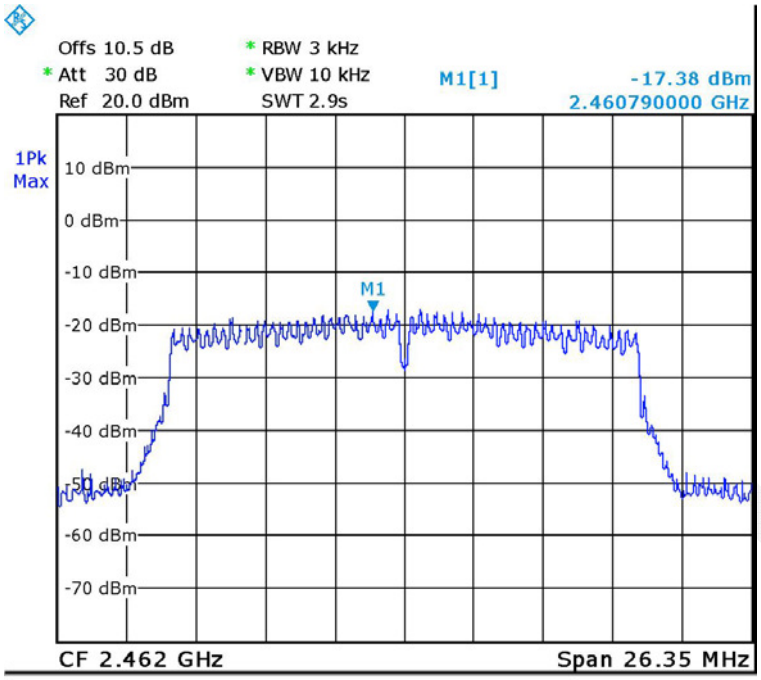
Date: 3.JAN.2017 19:55:43

Power Spectral Density, 802.11n HT20 Middle Channel



Date: 3.JAN.2017 19:56:37

Power Spectral Density, 802.11n HT20 High Channel



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