FCC PART 15.247

TEST REPORT

For

Lumenari Technologies, Inc.

200-3071 No. 5 Road, Richmond, British Columbia, V6X 2T4, Canada

FCC ID: 2AM62SH07E26

Report Type:	**Product Name:**
Original Report	ELA Smart Hub

Report Number:	RSC170804002C
Report Date:	2017-08-07
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: 028-65525123 Fax: 028-65525125 www.baclcorp.com

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The **Lumenari Technologies, Inc.**, model number: **LUM-EAS-SH07E26 (FCC ID: 2AM62SH07E26)** or the "EUT" as referred to in this report was the **ELA Smart Hub**.

Mechanical Description of EUT

The EUT was measured approximately: 60 mm (L) x 112 mm (H).

Rated input voltage: 100-240V~50/60Hz

**All measurement and test data in this report were gathered from final production sample, serial number: 170616002/01 (assigned by BACL). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2017-06-13, and EUT complied with test requirement.*

Objective

This report is prepared on behalf of ***Lumenari Technologies, Inc.*** in accordance with Part 2, Subpart J, Part 15, Subparts A 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)

No.

Measurement Uncertainty

Item			Uncertainty
AC power line conducted emission			2.71 dB
Radiated Emission(Field Strength)	30MHz-200MHz	H	4.57 dB
		V	4.81 dB
	200MHz-1GHz	H	5.69 dB
		V	6.07 dB
	1GHz-6GHz		5.49 dB
	6GHz-18GHz		5.57 dB
	18GHz-25GHz		5.48 dB
Conducted RF Power			±0.61dB
Power Spectrum Density			±0.61dB
Occupied Bandwidth			±5%
Humidity			±5%
Temperature			±1℃

Test Methodology

All measurements contained in this report were conducted with:

1. ANSI C63.10-2013 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

2. KDB558074 D01 DTS Meas Guidance v04.

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

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

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

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

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

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

EUT was tested with Channel 3, 6 and 9.

For Zigbee mode, 15 channels are provided for testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
11	2405	19	2445
12	2410	20	2450
13	2415	21	2455
14	2420	22	2460
15	2425	23	2465
16	2430	24	2470
17	2435	25	2475
18	2440	-	-

EUT was tested with channel 11, 18 and 25.

For Wi-Fi mode:

802.11b/g support SISO mode, 802.11n supports SISO and MIMO mode, according to pretest, 802.11n MIMO mode was worst. So 802.11n MIMO mode test data was recorded in the report.

EUT Exercise Software

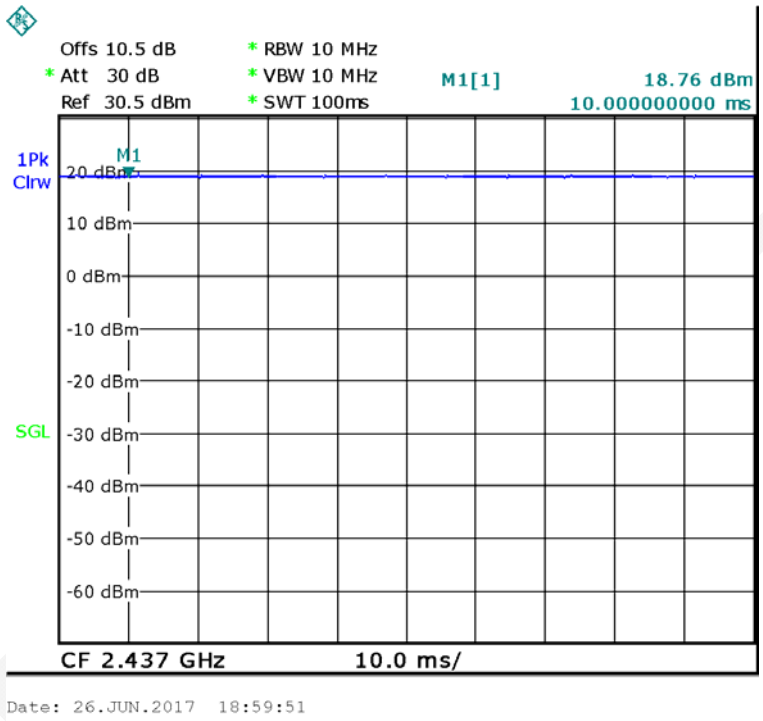
The software “Lettin” was used for testing, which was provided by manufacturer.
The worst-case data rates are determined to be as follows for each mode based upon investigations by measuring the average power and PSD across all date rates bandwidths, and modulations.
For 802.11b, 802.11g, 802.11n-HT20, 802.11n-HT40 & Zigbee mode, the maximum power setting provided by the manufacturer is below:

Test Mode	Test Software Version	Lettin		
802.11b	Test Frequency	2412 MHz	2437 MHz	2462 MHz
	Data Rate	1Mbps	1 Mbps	1 Mbps
	Power Level Antenna 0	12	12	12
	Power Level Antenna 1	13	13	13
802.11g	Test Frequency	2412 MHz	2437 MHz	2462 MHz
	Data Rate	6 Mbps	6 Mbps	6 Mbps
	Power Level Antenna 0	12	12	12
	Power Level Antenna 1	13	13	13
802.11n-HT20	Test Frequency	2412 MHz	2437 MHz	2462 MHz
	Data Rate	MCS0	MCS0	MCS0
	Power Level Antenna 0	12	12	12
	Power Level Antenna 1	13	13	13
802.11n-HT40	Test Frequency	2422 MHz	2437 MHz	2452 MHz
	Data Rate	MCS0	MCS0	MCS0
	Power Level Antenna 0	12	12	12
	Power Level Antenna 1	14	14	14
Zigbee	Test Frequency	2405 MHz	2440 MHz	2475 MHz
	Data Rate	Default	Default	Default
	Power Level	Default	Default	Default

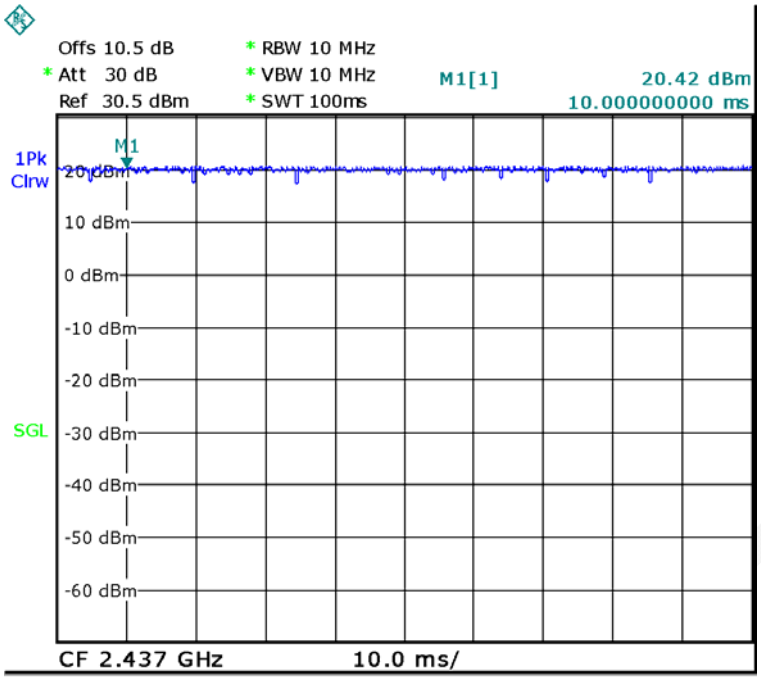
The software configured maximum duty cycle as below:

Mode	T_{on} (ms)	T_{on+off} (ms)	Duty Cycle (%)
802.11b	100	100	100
802.11g	100	100	100
802.11n-HT20	100	100	100
802.11n-HT40	100	100	100
Zigbee	10	10	100

802.11b mode



802.11g mode



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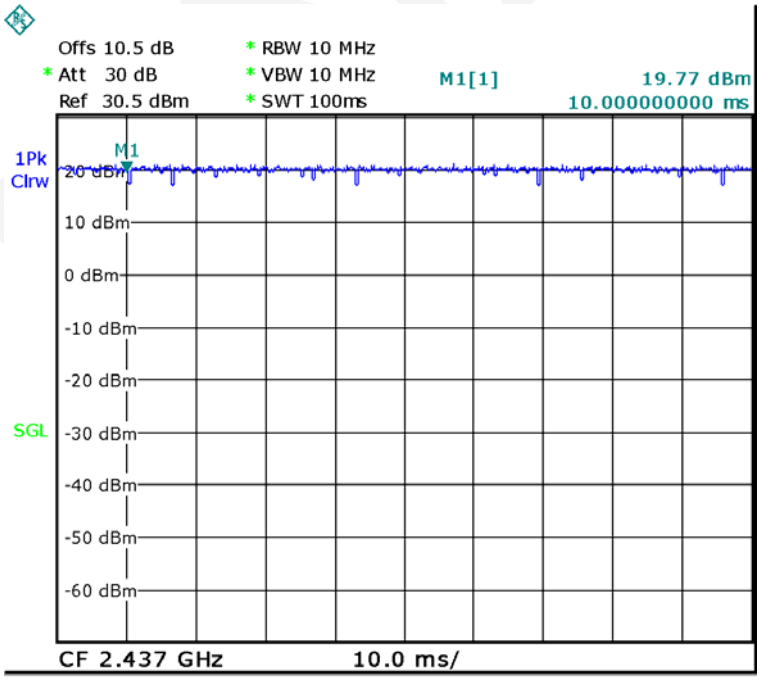
802.11n-HT20 mode



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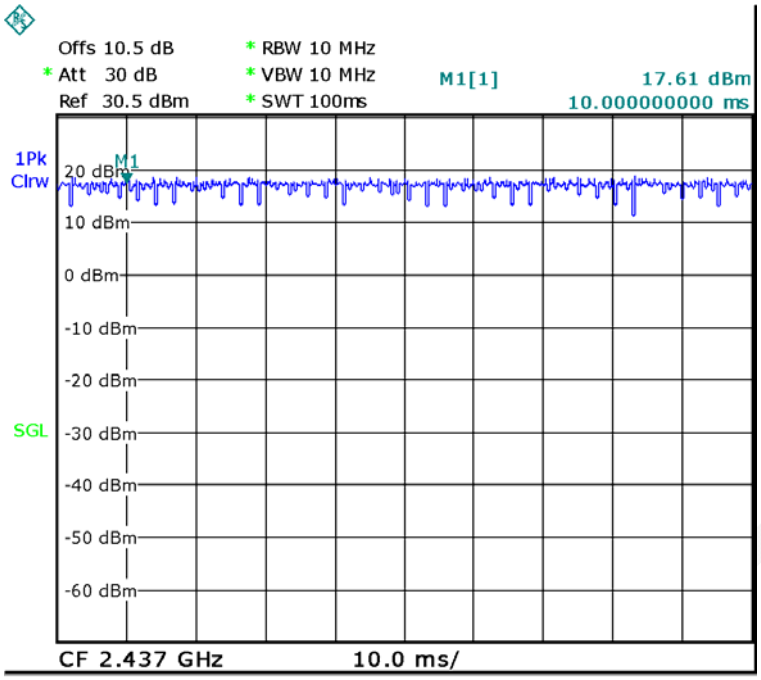
802.11n-HT40 mode



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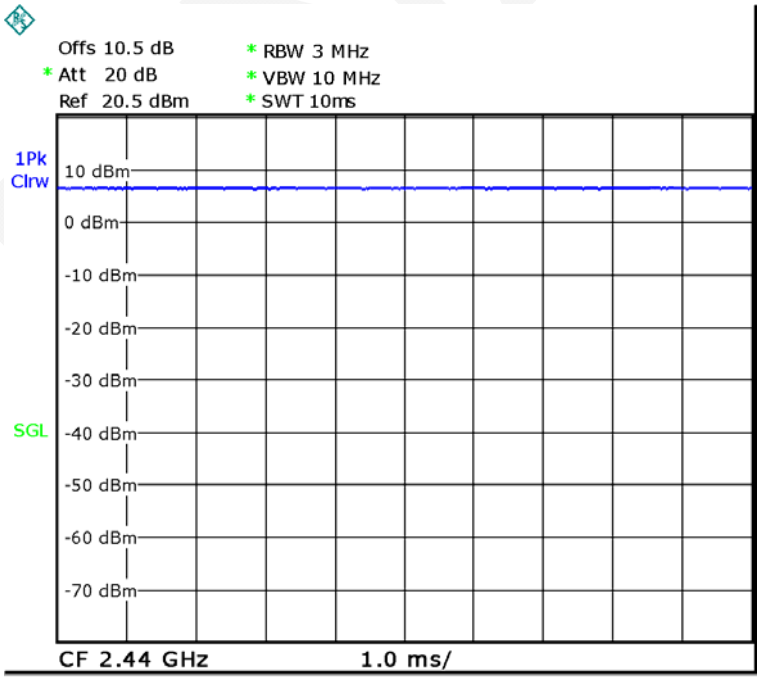
Zigbee mode



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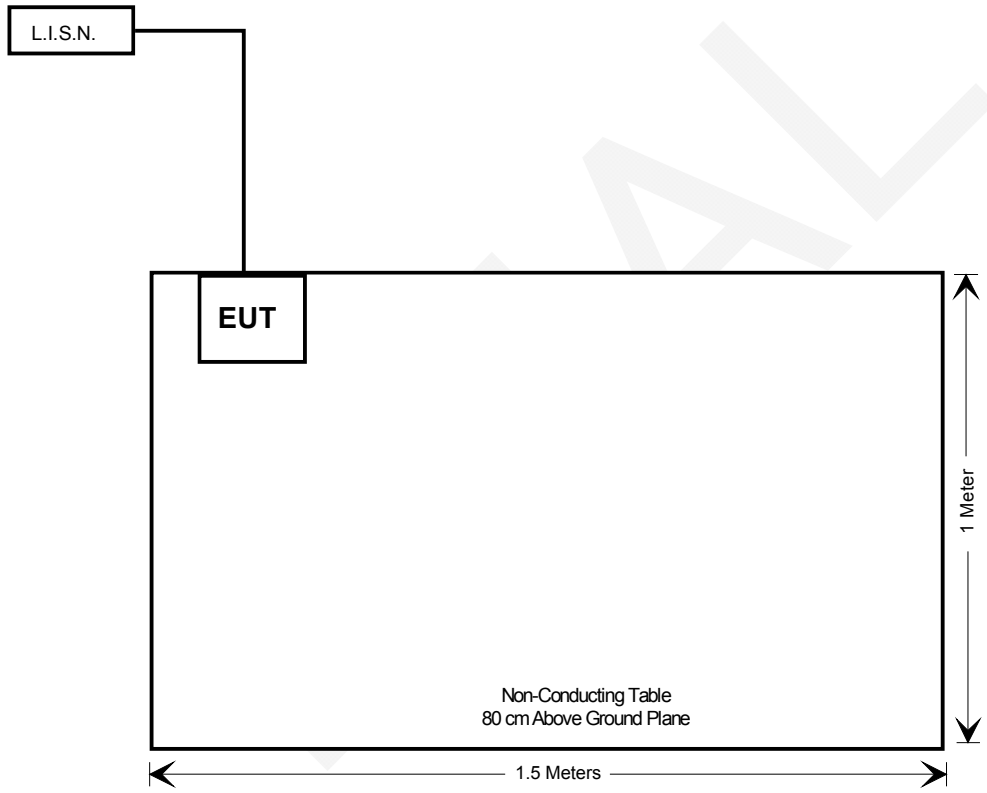
External I/O Cable

Cable Description	Length (m)	From	To
AC Power Cable	1.0	LISN	EUT

Block Diagram of Test Setup

AC Power Lines Conducted Emissions



Test Equipments List

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde & Schwarz	EMI Test Receiver	ESCS 30	836858/0016	2016-12-02	2017-12-01
Rohde & Schwarz	L.I.S.N.	ENV216	100018	2017-05-20	2018-05-19
Rohde & Schwarz	PULSE LIMITER	ESH3Z2	DE14781	2016-11-10	2017-11-09
N/A	Conducted Cable	NO.5	N/A	N/A	N/A
Rohde & Schwarz	EMC32	N/A	V 8.52.0	N/A	N/A
Radiated Emissions Test					
Agilent	Pre-Amplifier	8447D	2944A10442	2016-12-02	2017-12-01
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2017-05-20	2018-05-19
Sunol Sciences	Broadband Antenna	JB3	A121808	2017-05-18	2020-05-17
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2017-05-18	2018-05-17
ETS	Horn Antenna	3115	003-6076	2017-05-19	2020-05-18
A.H.Systems,inc	Horn Antenna	SAS-574	505	2016-12-02	2017-12-01
Mini-circuits	Pre-Amplifier	ZVA-183-S+	771001215	2017-05-20	2018-05-19
Quinstar	Pre-Amplifier	QLW-18405536-JO	15964004001	2017-05-20	2018-05-19
HP	Pre-Amplifier	8449B	3008A00277	2016-12-02	2017-12-01
INMET	Attenuator	N-6dB	/	2016-11-10	2017-11-09
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
Rohde & Schwarz	EMC32	N/A	V 8.52.0	N/A	N/A
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSL18	100180	2016-12-02	2017-12-01
WEINSCHEL ENGINEERING	Attenuator	1A10dB	AA4135	2016-11-10	2017-11-09
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
E-Microwave	DC Block	EMDCB-00036	OE01304225	Each Time	/
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).

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);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \le 1$$

The rated tune-up output power and antenna gain in the below table:

Calculated Data:

MPE evaluation for single transmission:

Mode	Frequency Range	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	0	1.0	26.0	398.11	20	0.079	1.0
Zigbee	2405-2475	1	1.26	4.5	2.82	20	0.0007	1.0

Note: The Wi-Fi and zigbee can transmit simultaneously.

MPE evaluation for simultaneous transmission:

Wi-Fi and Zigbee can transmit at the same time, MPE evaluation is as below formula:

PD1/Limit1+PD2/Limit2+……＜1, PD (Power Density)

MPE evaluation:

Wi-Fi and zigbee:

Max MPE of Wi-Fi + Max MPE of Zigbee = 0.079/1+0.0007/1=0.0797＜1.0

Result: MPE evaluation of single and simultaneous transmission meet the requirement of standard.

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 PFC Zigbee antenna and two PFC Wi-Fi antennas, which was permanently attached and Wi-Fi antenna gain is 0dBi, Zigbee antenna gain is 1dBi, fulfill the requirement of this section. Please refer to the EUT photos.

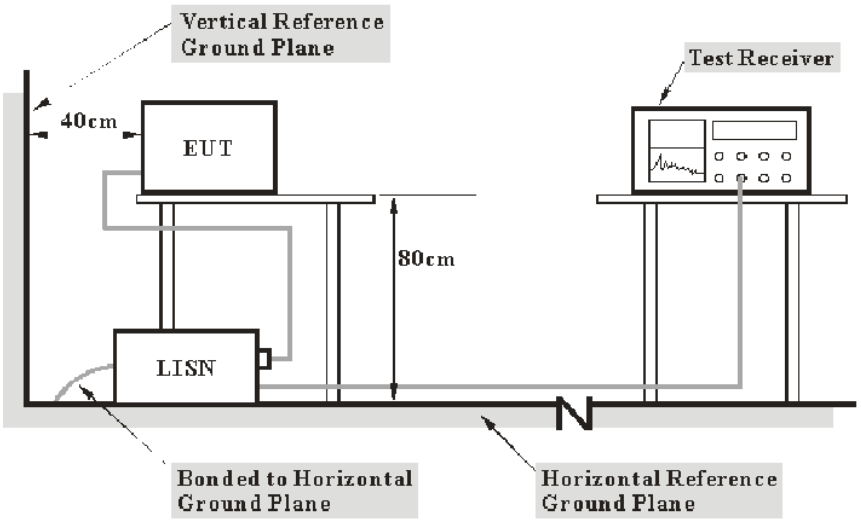
Result: Compliant.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

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 Data

Environmental Conditions

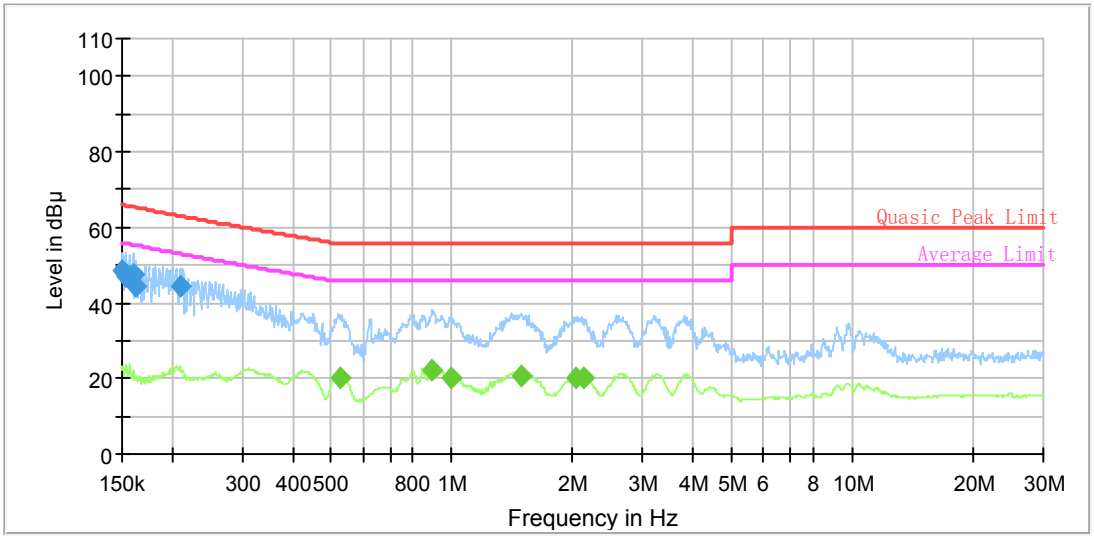
Temperature:	28 °C
Relative Humidity:	50 %
ATM Pressure:	94.8 kPa

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

Test Mode: Transmitting

For Wi-Fi Mode

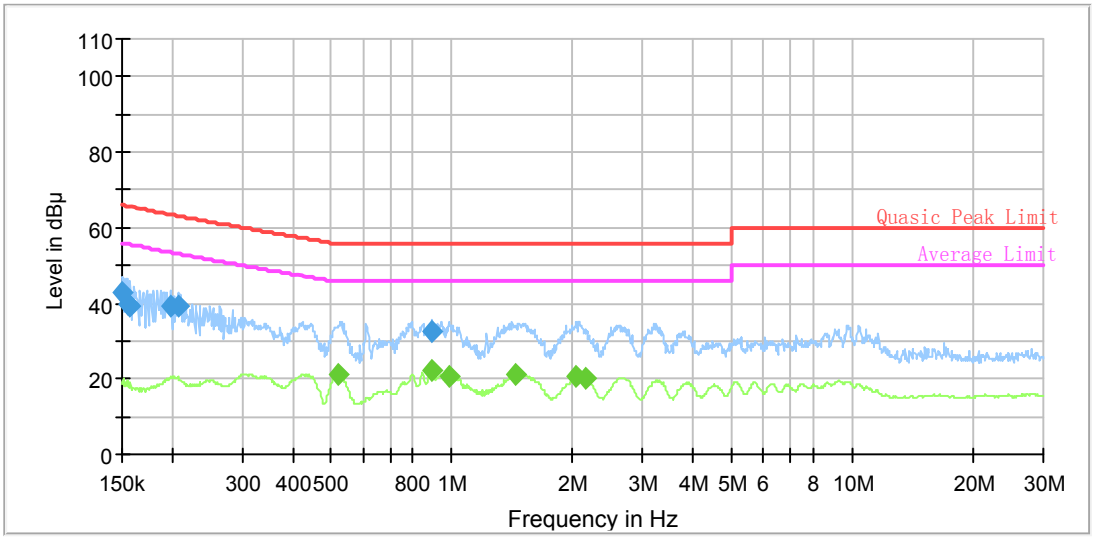
AC120V/60Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150600	48.5	9.000	L1	19.7	17.5	66.0
0.153636	47.2	9.000	L1	19.7	18.6	65.8
0.156734	47.1	9.000	L1	19.7	18.5	65.6
0.159894	47.3	9.000	L1	19.7	18.1	65.4
0.162467	44.2	9.000	L1	19.7	21.1	65.3
0.208925	44.2	9.000	L1	19.7	18.9	63.1

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.527486	20.2	9.000	L1	19.8	25.8	46.0
0.889872	22.1	9.000	L1	19.8	23.9	46.0
0.999091	20.3	9.000	L1	19.8	25.7	46.0
1.495237	20.6	9.000	L1	19.8	25.4	46.0
2.041455	20.3	9.000	L1	19.8	25.7	46.0
2.133097	19.9	9.000	L1	19.8	26.1	46.0

AC120V/60Hz, Neutral



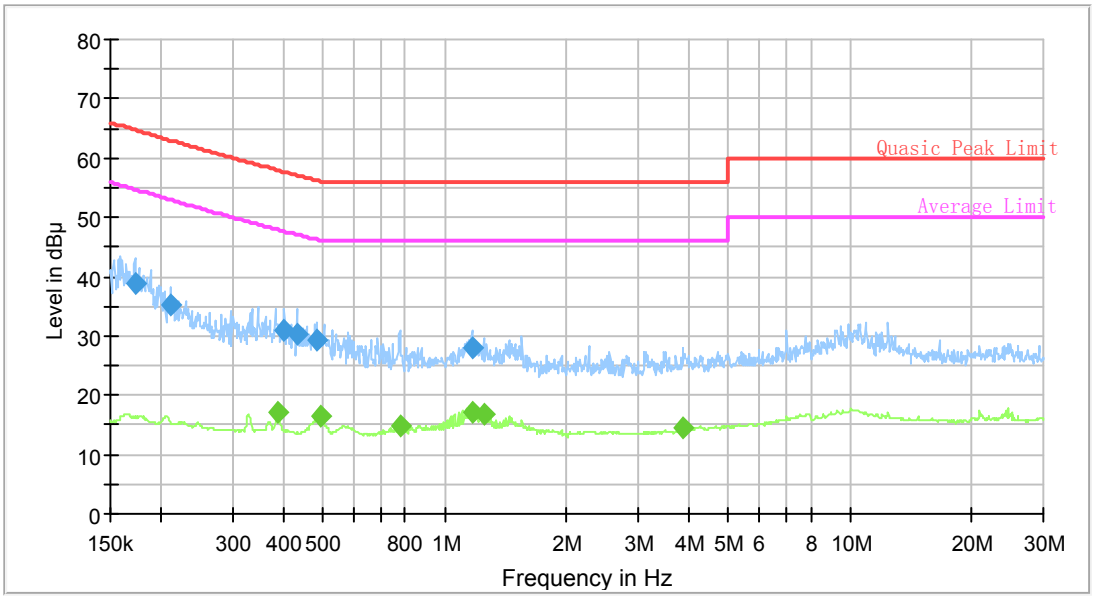
Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150600	42.8	9.000	N	19.6	23.2	66.0
0.154868	40.0	9.000	N	19.6	25.7	65.7
0.157361	39.0	9.000	N	19.6	26.6	65.6
0.198359	39.2	9.000	N	19.5	24.3	63.5
0.206437	39.0	9.000	N	19.5	24.2	63.2
0.893431	32.5	9.000	N	19.5	23.5	56.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.519130	21.2	9.000	N	19.5	24.8	46.0
0.889872	22.4	9.000	N	19.5	23.6	46.0
0.987197	20.8	9.000	N	19.5	25.2	46.0
1.442470	21.1	9.000	N	19.6	24.9	46.0
2.041455	20.7	9.000	N	19.6	25.3	46.0
2.150196	20.2	9.000	N	19.6	25.8	46.0

Note:
1) Correction Factor =LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter Attenuation
The corrected factor has been input into the transducer of the test software.
2) Corrected Amplitude = Reading + Correction Factor
3) Margin = Limit – Corrected Amplitude

For Zigbee Mode

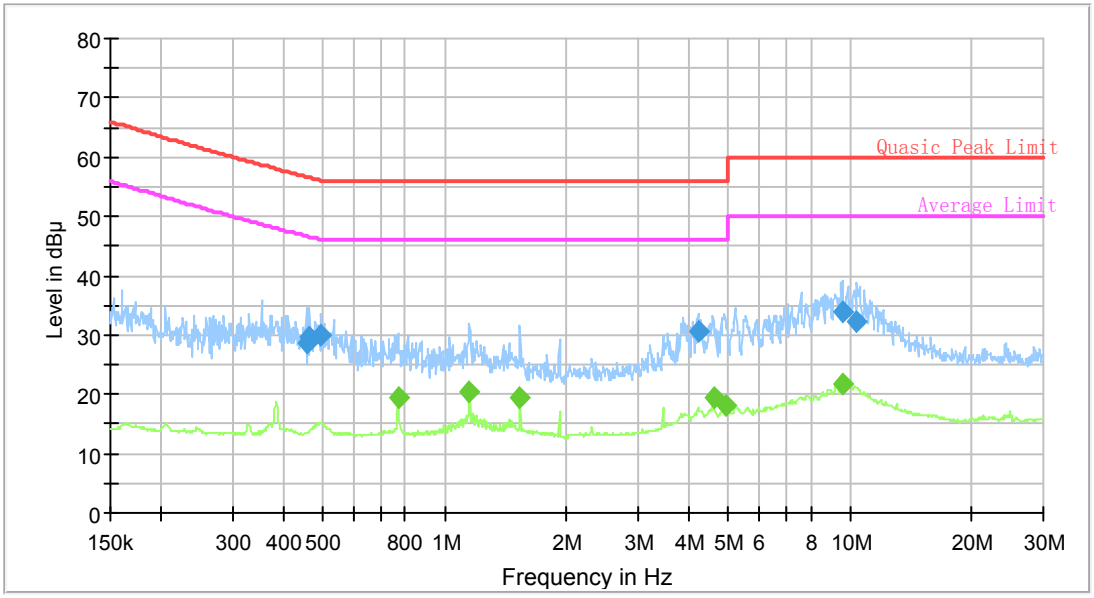
AC120V/60Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.172493	38.8	9.000	L1	19.7	26.0	64.8
0.211442	35.2	9.000	L1	19.7	27.8	63.0
0.402086	30.8	9.000	L1	19.8	26.9	57.7
0.432041	30.4	9.000	L1	19.8	26.7	57.1
0.485069	29.3	9.000	L1	19.8	26.9	56.2
1.167401	28.0	9.000	L1	19.8	28.0	56.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.387896	17.0	9.000	L1	19.8	31.0	47.9
0.492876	16.5	9.000	L1	19.8	29.6	46.1
0.776929	14.9	9.000	L1	19.8	31.1	46.0
1.167401	17.2	9.000	L1	19.8	28.8	46.0
1.249376	16.8	9.000	L1	19.8	29.2	46.0
3.882107	14.5	9.000	L1	19.9	31.5	46.0

AC120V/60Hz, Neutral



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.456875	28.6	9.000	N	19.6	28.1	56.7
0.466086	29.5	9.000	N	19.6	27.0	56.5
0.496827	30.0	9.000	N	19.6	26.0	56.0
4.238471	30.5	9.000	N	19.6	25.5	56.0
9.607719	33.8	9.000	N	19.8	26.2	60.0
10.406257	32.3	9.000	N	19.8	27.7	60.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.767680	19.5	9.000	N	19.5	26.5	46.0
1.153503	20.4	9.000	N	19.6	25.6	46.0
1.537610	19.4	9.000	N	19.6	26.6	46.0
4.609111	19.5	9.000	N	19.6	26.5	46.0
4.932763	18.1	9.000	N	19.6	27.9	46.0
9.607719	21.7	9.000	N	19.8	28.3	50.0

Note:
1) Correction Factor =LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter Attenuation
The corrected factor has been input into the transducer of the test software.
2) Corrected Amplitude = Reading + Correction Factor
3) Margin = Limit – Corrected Amplitude

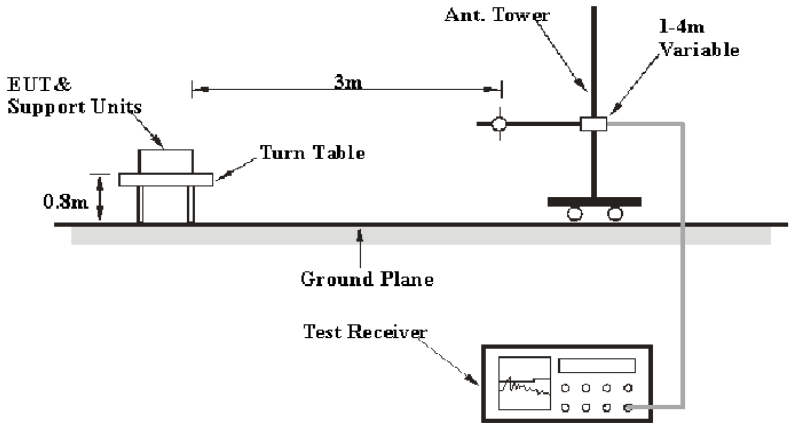
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

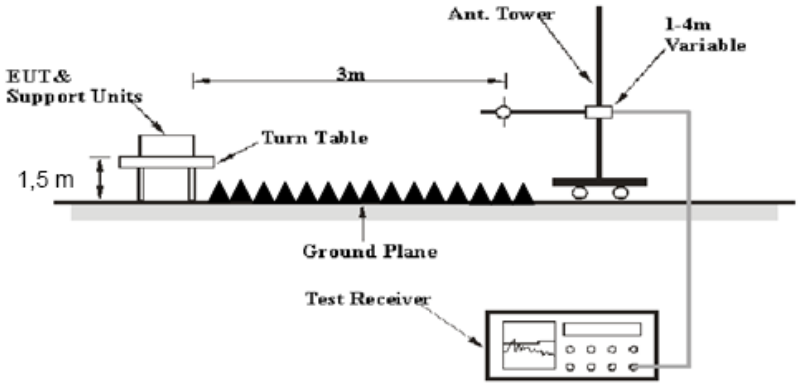
FCC §15.247 (d); §15.209; §15.205;

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 EUT was connected to a 120 V/60 Hz AC 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

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 Factor + Cable Loss - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit –Corrected Amplitude

Test Data

Environmental Conditions

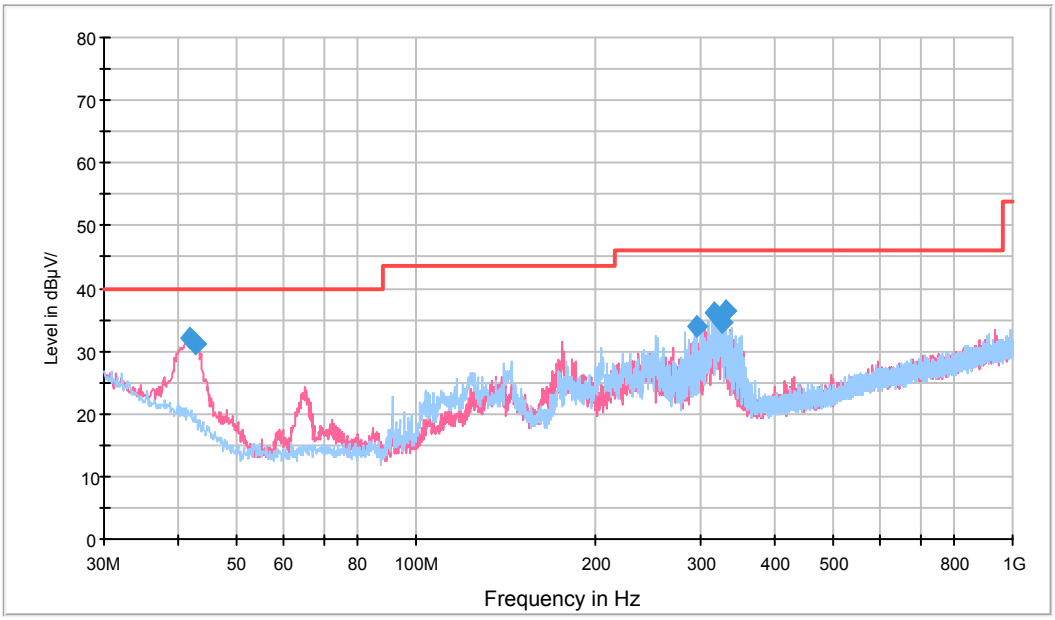
Temperature:	27 °C
Relative Humidity:	50 %
ATM Pressure:	95.6 kPa

The testing was performed by Tom Tang on 2017-06-27.

Test mode: Transmitting

For Wi-Fi Mode

30MHz-1GHz:



Frequency (MHz)	QuasicPeak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
41.640000	32.0	150.0	V	261.0	-8.2	8.0	40.0
42.610000	31.0	100.0	V	331.0	-8.8	9.0	40.0
294.930000	33.9	100.0	H	156.0	-6.1	12.1	46.0
316.998750	36.1	132.0	H	136.0	-5.6	9.9	46.0
325.001250	34.5	200.0	H	224.0	-5.5	11.5	46.0
331.427500	36.5	100.0	H	234.0	-5.4	9.5	46.0

1GHz-25GHz:

802.11b Mode
Antenna 0 (Worst Case)

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
Low Channel: 2412 MHz									
2412	69.51	PK	H	28.74	3.00	0.00	101.25	N/A	N/A
2412	64.46	AV	H	28.74	3.00	0.00	96.20	N/A	N/A
2412	64.03	PK	V	28.74	3.00	0.00	95.77	N/A	N/A
2412	58.85	AV	V	28.74	3.00	0.00	90.59	N/A	N/A
2390	30.41	PK	H	28.67	3.00	0.00	62.08	74.00	11.92
2390	15.41	AV	H	28.67	3.00	0.00	47.08	54.00	6.92
4824	42.39	PK	H	33.91	5.11	26.87	54.54	74.00	19.46
4824	35.07	AV	H	33.91	5.11	26.87	47.22	54.00	6.78
7236	32.57	PK	H	36.43	6.18	26.36	48.82	74.00	25.18
7236	17.48	AV	H	36.43	6.18	26.36	33.73	54.00	20.27
Middle Channel: 2437 MHz									
2437	71.73	PK	H	28.81	3.00	0.00	103.54	N/A	N/A
2437	66.95	AV	H	28.81	3.00	0.00	98.76	N/A	N/A
2437	67.86	PK	V	28.81	3.00	0.00	99.67	N/A	N/A
2437	62.71	AV	V	28.81	3.00	0.00	94.52	N/A	N/A
4874	41.73	PK	H	34.05	5.09	26.87	54.00	74.00	20.00
4874	34.46	AV	H	34.05	5.09	26.87	46.73	54.00	7.27
7311	32.79	PK	H	36.54	6.21	26.40	49.14	74.00	24.86
7311	17.61	AV	H	36.54	6.21	26.40	33.96	54.00	20.04
High Channel: 2462 MHz									
2462	73.78	PK	H	28.89	2.99	0.00	105.66	N/A	N/A
2462	68.81	AV	H	28.89	2.99	0.00	100.69	N/A	N/A
2462	71.37	PK	V	28.89	2.99	0.00	103.25	N/A	N/A
2462	66.21	AV	V	28.89	2.99	0.00	98.09	N/A	N/A
2483.5	30.07	PK	H	28.95	2.99	0.00	62.01	74.00	11.99
2483.5	15.57	AV	H	28.95	2.99	0.00	47.51	54.00	6.49
4924	40.59	PK	H	34.19	5.07	26.88	52.97	74.00	21.03
4924	33.18	AV	H	34.19	5.07	26.88	45.56	54.00	8.44
7386	32.89	PK	H	36.64	6.25	26.43	49.35	74.00	24.65
7386	17.69	AV	H	36.64	6.25	26.43	34.15	54.00	19.85

802.11g Mode
Antenna 0 (Worst Case)

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
Low Channel: 2412 MHz									
2412	73.55	PK	H	28.74	3.00	0.00	105.29	N/A	N/A
2412	61.97	AV	H	28.74	3.00	0.00	93.71	N/A	N/A
2412	67.36	PK	V	28.74	3.00	0.00	99.10	N/A	N/A
2412	55.73	AV	V	28.74	3.00	0.00	87.47	N/A	N/A
2390	33.69	PK	H	28.67	3.00	0.00	65.36	74.00	8.64
2390	17.21	AV	H	28.67	3.00	0.00	48.88	54.00	5.12
4824	45.57	PK	H	33.91	5.11	26.87	57.72	74.00	16.28
4824	32.56	AV	H	33.91	5.11	26.87	44.71	54.00	9.29
7236	32.47	PK	H	36.43	6.18	26.36	48.72	74.00	25.28
7236	17.57	AV	H	36.43	6.18	26.36	33.82	54.00	20.18
Middle Channel: 2437 MHz									
2437	74.09	PK	H	28.81	3.00	0.00	105.90	N/A	N/A
2437	62.90	AV	H	28.81	3.00	0.00	94.71	N/A	N/A
2437	69.26	PK	V	28.81	3.00	0.00	101.07	N/A	N/A
2437	58.19	AV	V	28.81	3.00	0.00	90.00	N/A	N/A
4874	44.55	PK	H	34.05	5.09	26.87	56.82	74.00	17.18
4874	31.28	AV	H	34.05	5.09	26.87	43.55	54.00	10.45
7311	32.29	PK	H	36.54	6.21	26.40	48.64	74.00	25.36
7311	17.26	AV	H	36.54	6.21	26.40	33.61	54.00	20.39
High Channel: 2462 MHz									
2462	74.93	PK	H	28.89	2.99	0.00	106.81	N/A	N/A
2462	64.09	AV	H	28.89	2.99	0.00	95.97	N/A	N/A
2462	72.05	PK	V	28.89	2.99	0.00	103.93	N/A	N/A
2462	61.22	AV	V	28.89	2.99	0.00	93.10	N/A	N/A
2483.5	36.21	PK	V	28.95	2.99	0.00	68.15	74.00	5.85
2483.5	18.34	AV	V	28.95	2.99	0.00	50.28	54.00	3.72
4924	43.86	PK	H	34.19	5.07	26.88	56.24	74.00	17.76
4924	30.68	AV	H	34.19	5.07	26.88	43.06	54.00	10.94
7386	32.79	PK	H	36.64	6.25	26.43	49.25	74.00	24.75
7386	17.47	AV	H	36.64	6.25	26.43	33.93	54.00	20.07

802.11n-HT20 Mode
MIMO mode (Worst Case)

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
Low Channel: 2412 MHz									
2412	72.12	PK	H	28.74	3.00	0.00	103.86	N/A	N/A
2412	61.09	AV	H	28.74	3.00	0.00	92.83	N/A	N/A
2412	66.21	PK	V	28.74	3.00	0.00	97.95	N/A	N/A
2412	54.86	AV	V	28.74	3.00	0.00	86.60	N/A	N/A
2390	37.71	PK	H	28.67	3.00	0.00	69.38	74.00	4.62
2390	18.34	AV	H	28.67	3.00	0.00	50.01	54.00	3.99
4824	44.82	PK	H	33.91	5.11	26.87	56.97	74.00	17.03
4824	30.06	AV	H	33.91	5.11	26.87	42.21	54.00	11.79
7236	33.01	PK	H	36.43	6.18	26.36	49.26	74.00	24.74
7236	17.87	AV	H	36.43	6.18	26.36	34.12	54.00	19.88
Middle Channel: 2437 MHz									
2437	73.29	PK	H	28.81	3.00	0.00	105.10	N/A	N/A
2437	62.60	AV	H	28.81	3.00	0.00	94.41	N/A	N/A
2437	68.96	PK	V	28.81	3.00	0.00	100.77	N/A	N/A
2437	57.56	AV	V	28.81	3.00	0.00	89.37	N/A	N/A
4874	44.50	PK	H	34.05	5.09	26.87	56.77	74.00	17.23
4874	30.28	AV	H	34.05	5.09	26.87	42.55	54.00	11.45
7311	32.59	PK	H	36.54	6.21	26.40	48.94	74.00	25.06
7311	17.45	AV	H	36.54	6.21	26.40	33.80	54.00	20.20
High Channel: 2462 MHz									
2462	73.88	PK	H	28.89	2.99	0.00	105.76	N/A	N/A
2462	62.99	AV	H	28.89	2.99	0.00	94.87	N/A	N/A
2462	70.71	PK	V	28.89	2.99	0.00	102.59	N/A	N/A
2462	59.52	AV	V	28.89	2.99	0.00	91.40	N/A	N/A
2483.5	37.98	PK	H	28.95	2.99	0.00	69.92	74.00	4.08
2483.5	18.56	AV	H	28.95	2.99	0.00	50.50	54.00	3.50
4924	43.95	PK	H	34.19	5.07	26.88	56.33	74.00	17.67
4924	30.06	AV	H	34.19	5.07	26.88	42.44	54.00	11.56
7386	32.44	PK	H	36.64	6.25	26.43	48.90	74.00	25.10
7386	17.21	AV	H	36.64	6.25	26.43	33.67	54.00	20.33

802.11n-HT40 Mode
MIMO Mode(Worst Case)

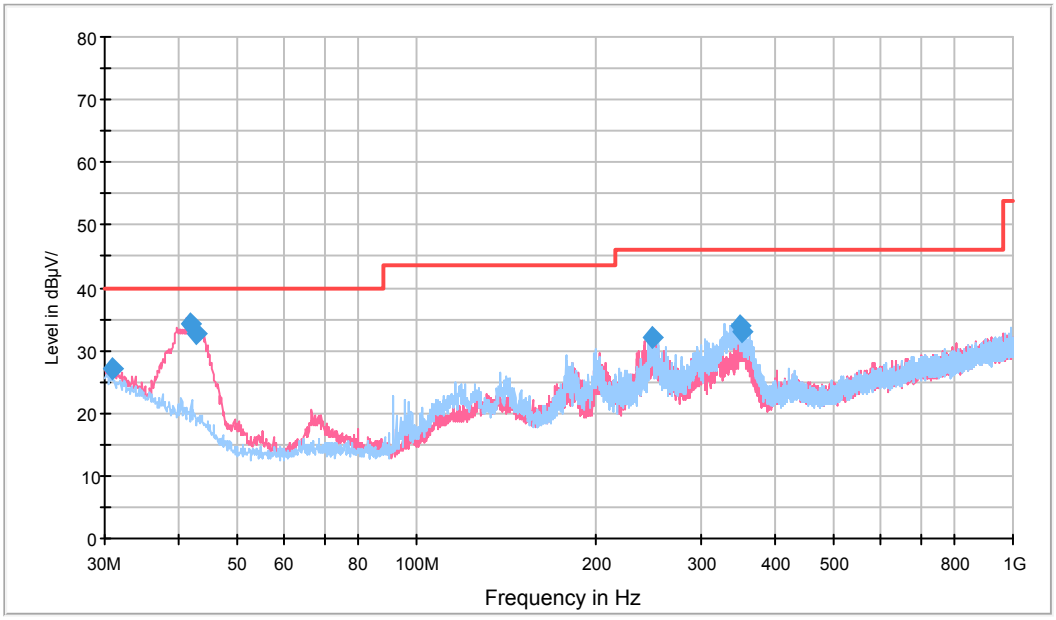
Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Detector	Polar	Factor					
MHz	dBµV	PK/QP/AV	H/V	dB(1/m)	dB	dB	dBµV/m	dBµV/m	dB
Low Channel: 2422 MHz									
2422	69.39	PK	H	28.77	3.00	0.00	101.16	N/A	N/A
2422	57.18	AV	H	28.77	3.00	0.00	88.95	N/A	N/A
2422	63.05	PK	V	28.77	3.00	0.00	94.82	N/A	N/A
2422	50.44	AV	V	28.77	3.00	0.00	82.21	N/A	N/A
2390	39.19	PK	H	28.67	3.00	0.00	70.86	74.00	3.14
2390	19.47	AV	H	28.67	3.00	0.00	51.14	54.00	2.86
4844	39.95	PK	H	33.96	5.10	26.87	52.14	74.00	21.86
4844	26.54	AV	H	33.96	5.10	26.87	38.73	54.00	15.27
7266	32.56	PK	H	36.47	6.19	26.38	48.84	74.00	25.16
7266	17.16	AV	H	36.47	6.19	26.38	33.44	54.00	20.56
Middle Channel: 2437 MHz									
2437	69.83	PK	H	28.81	3.00	0.00	101.64	N/A	N/A
2437	57.76	AV	H	28.81	3.00	0.00	89.57	N/A	N/A
2437	65.38	PK	V	28.81	3.00	0.00	97.19	N/A	N/A
2437	53.07	AV	V	28.81	3.00	0.00	84.88	N/A	N/A
4874	38.23	PK	H	34.05	5.09	26.87	50.50	74.00	23.50
4874	25.82	AV	H	34.05	5.09	26.87	38.09	54.00	15.91
7311	32.50	PK	H	36.54	6.21	26.40	48.85	74.00	25.15
7311	17.33	AV	H	36.54	6.21	26.40	33.68	54.00	20.32
High Channel: 2452 MHz									
2452	70.49	PK	H	28.86	3.00	0.00	102.35	N/A	N/A
2452	58.62	AV	H	28.86	3.00	0.00	90.48	N/A	N/A
2452	68.31	PK	V	28.86	3.00	0.00	100.17	N/A	N/A
2452	56.33	AV	V	28.86	3.00	0.00	88.19	N/A	N/A
2483.5	39.79	PK	H	28.95	2.99	0.00	71.73	74.00	2.27
2483.5	19.89	AV	H	28.95	2.99	0.00	51.83	54.00	2.17
4904	37.18	PK	H	34.13	5.08	26.87	49.52	74.00	24.48
4904	25.49	AV	H	34.13	5.08	26.87	37.83	54.00	16.17
7356	32.89	PK	H	36.60	6.23	26.42	49.30	74.00	24.70
7356	17.55	AV	H	36.60	6.23	26.42	33.96	54.00	20.04

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

Spurious emissions more than 20 dB below the limit were not reported.

For Zigbee Mode

30MHz-1GHz:



Frequency (MHz)	QuasicPeak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.848750	27.2	100.0	V	208.0	-1.6	12.8	40.0
41.882500	34.1	115.0	V	199.0	-8.3	5.9	40.0
42.731250	32.8	100.0	V	118.0	-8.8	7.2	40.0
248.735000	32.1	200.0	V	338.0	-8.0	13.9	46.0
348.766250	34.0	160.0	H	239.0	-5.3	12.0	46.0
350.585000	33.1	100.0	H	239.0	-5.3	12.9	46.0

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
Low Channel: 2405 MHz									
2405	66.51	PK	H	28.72	3.00	0.00	98.23	N/A	N/A
2405	63.18	AV	H	28.72	3.00	0.00	94.90	N/A	N/A
2405	70.59	PK	V	28.72	3.00	0.00	102.31	N/A	N/A
2405	68.18	AV	V	28.72	3.00	0.00	99.90	N/A	N/A
2390	30.02	PK	V	28.67	3.00	0.00	61.69	74.00	12.31
2390	15.67	AV	V	28.67	3.00	0.00	47.34	54.00	6.66
4810	39.47	PK	V	33.87	5.12	26.87	51.59	74.00	22.41
4810	29.73	AV	V	33.87	5.12	26.87	41.85	54.00	12.15
7215	32.89	PK	V	36.40	6.17	26.35	49.11	74.00	24.89
7215	20.52	AV	V	36.40	6.17	26.35	36.74	54.00	17.26
Middle Channel: 2440 MHz									
2440	65.79	PK	H	28.82	3.00	0.00	97.61	N/A	N/A
2440	63.24	AV	H	28.82	3.00	0.00	95.06	N/A	N/A
2440	70.17	PK	V	28.82	3.00	0.00	101.99	N/A	N/A
2440	67.26	AV	V	28.82	3.00	0.00	99.08	N/A	N/A
4880	37.83	PK	V	34.06	5.09	26.87	50.11	74.00	23.89
4880	26.56	AV	V	34.06	5.09	26.87	38.84	54.00	15.16
7320	32.62	PK	V	36.55	6.22	26.40	48.99	74.00	25.01
7320	18.57	AV	V	36.55	6.22	26.40	34.94	54.00	19.06
High Channel: 2475 MHz									
2475	65.55	PK	H	28.93	2.99	0.00	97.47	N/A	N/A
2475	63.15	AV	H	28.93	2.99	0.00	95.07	N/A	N/A
2475	69.53	PK	V	28.93	2.99	0.00	101.45	N/A	N/A
2475	66.2	AV	V	28.93	2.99	0.00	98.12	N/A	N/A
2483.5	30.12	PK	V	28.95	2.99	0.00	62.06	74.00	11.94
2483.5	15.69	AV	V	28.95	2.99	0.00	47.63	54.00	6.37
4950	35.93	PK	V	34.26	5.05	26.88	48.36	74.00	25.64
4950	23.17	AV	V	34.26	5.05	26.88	35.60	54.00	18.40
7425	32.07	PK	V	36.70	6.27	26.45	48.59	74.00	25.41
7425	17.26	AV	V	36.70	6.27	26.45	33.78	54.00	20.22

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

Spurious emissions more than 20 dB below the limit were not reported.

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 Data

Environmental Conditions

Temperature:	29 °C
Relative Humidity:	48 %
ATM Pressure:	94.6 kPa

The testing was performed by Tom Tang on 2017-06-26.

Test Mode: Transmitting

Test Result: Compliant. Please refer to the following tables and plots.

For Wi-Fi Mode

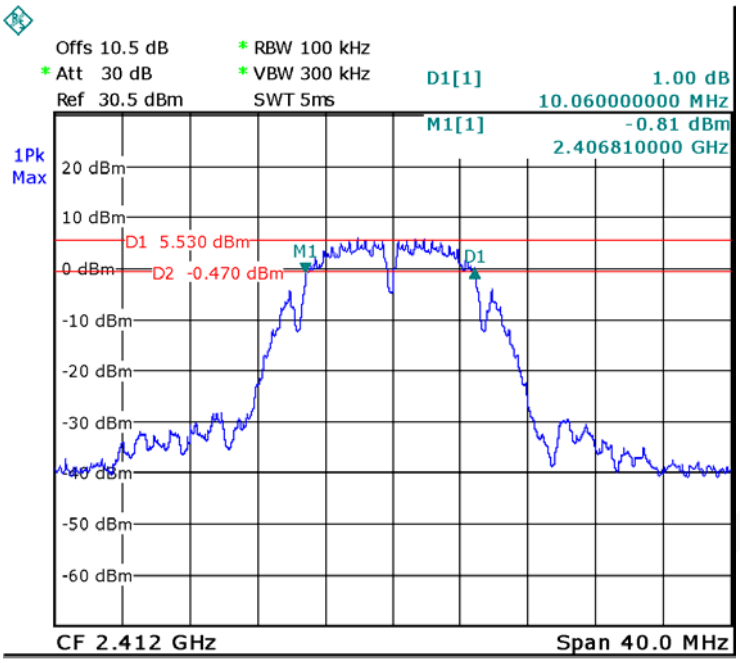
Test mode	Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)		Limit (MHz)
			Antenna 0	Antenna 1	
802.11b	Low	2412	10.060	10.060	≥0.5
	Middle	2437	10.060	10.060	≥0.5
	High	2462	10.060	10.060	≥0.5
802.11g	Low	2412	16.367	16.367	≥0.5
	Middle	2437	16.367	16.367	≥0.5
	High	2462	16.367	16.367	≥0.5
802.11n-HT20	Low	2412	16.926	16.926	≥0.5
	Middle	2437	16.926	16.926	≥0.5
	High	2462	16.926	16.926	≥0.5
802.11n-HT40	Low	2422	35.930	35.930	≥0.5
	Middle	2437	35.930	35.930	≥0.5
	High	2452	35.930	35.930	≥0.5

For Zigbee Mode

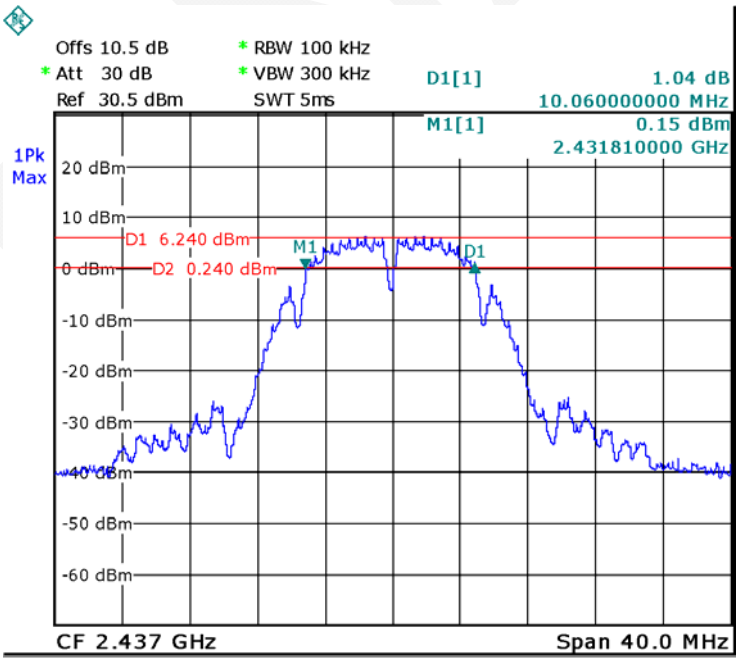
Test mode	Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (MHz)
Zigbee	Low	2405	1.607	≥0.5
	Middle	2440	1.607	≥0.5
	High	2475	1.607	≥0.5

For Wi-Fi Mode

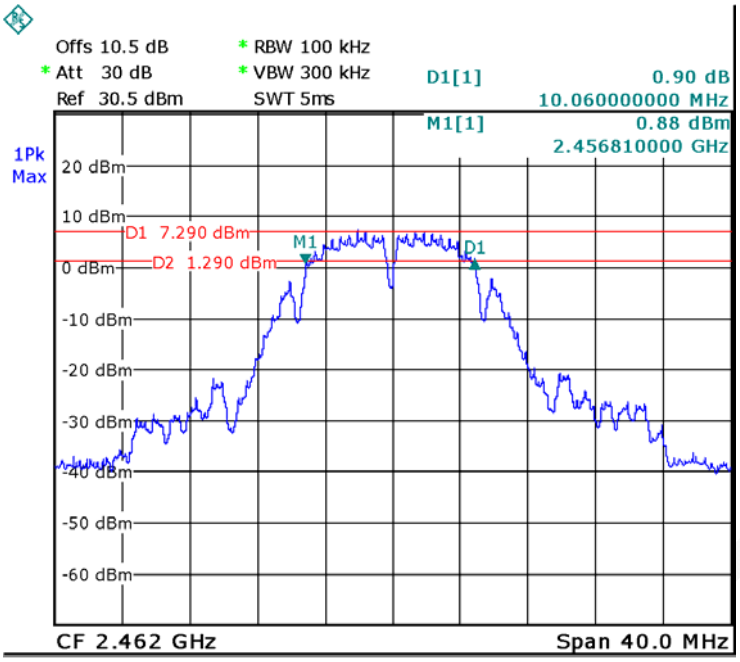
802.11b: Low Channel, Antenna 0



802.11b: Middle Channel, Antenna 0

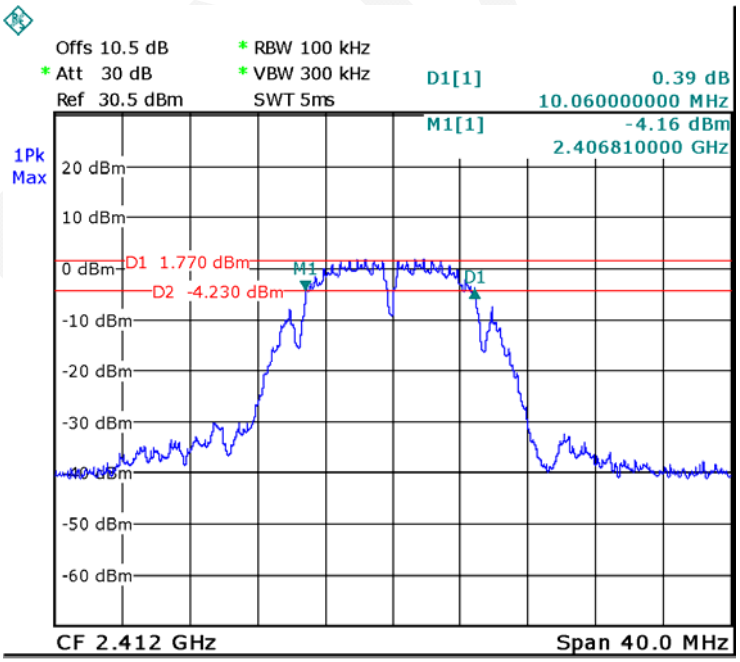


802.11b: High Channel, Antenna 0



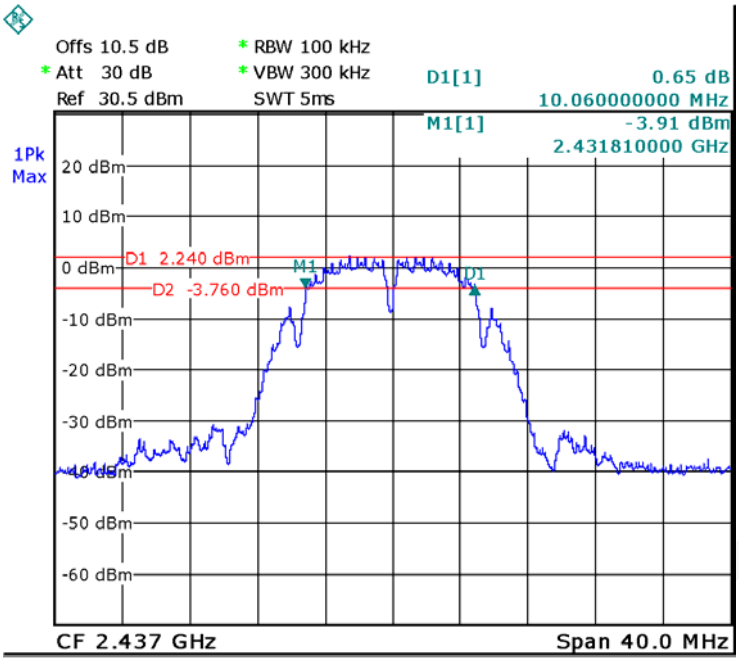
Date: 26.JUN.2017 19:55:41

802.11b: Low Channel, Antenna 1

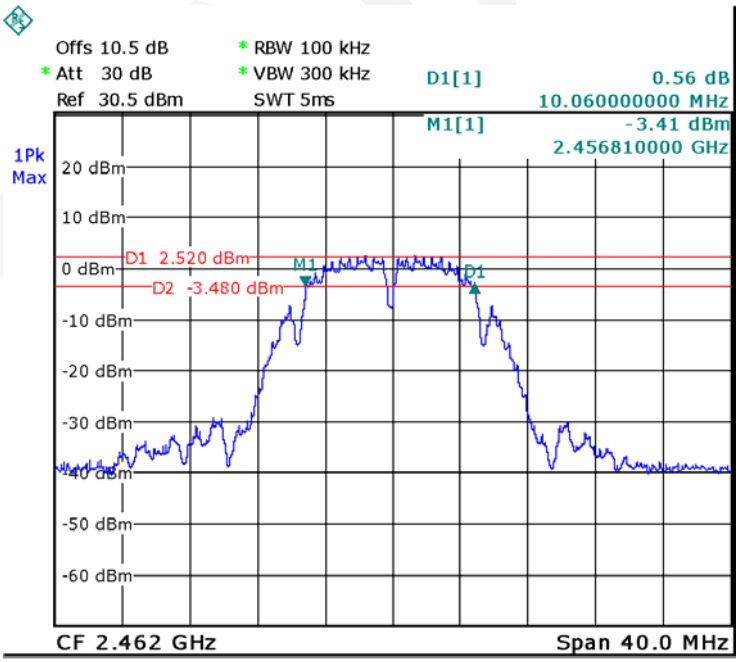


Date: 26.JUN.2017 10:55:48

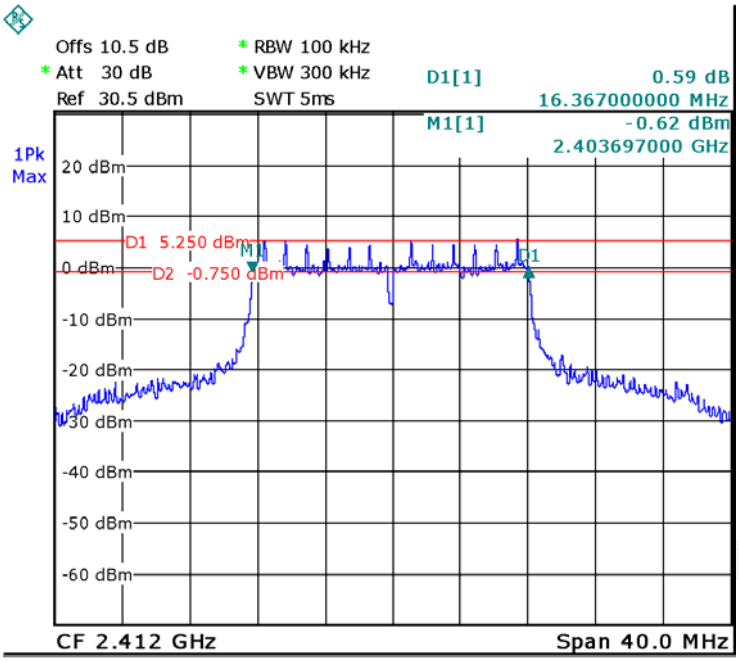
802.11b: Middle Channel, Antenna 1



802.11b: High Channel, Antenna 1

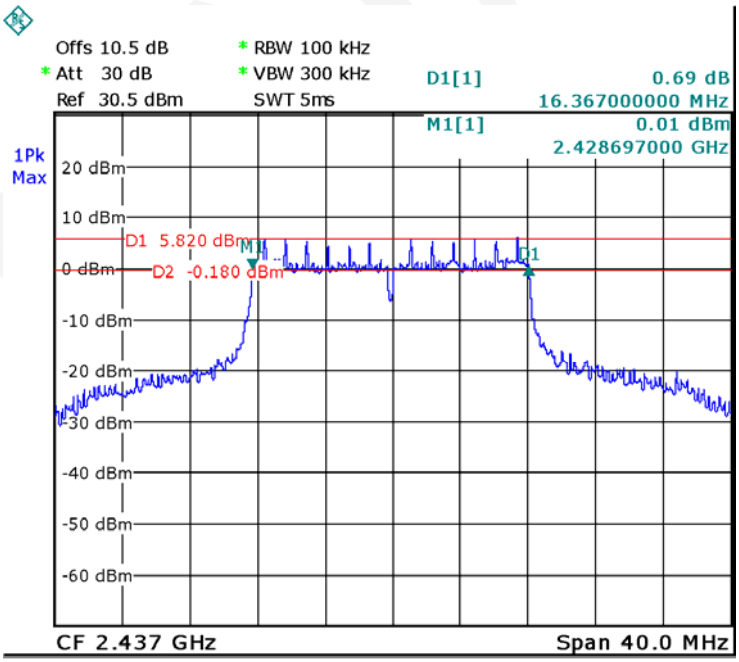


802.11g: Low Channel, Antenna 0



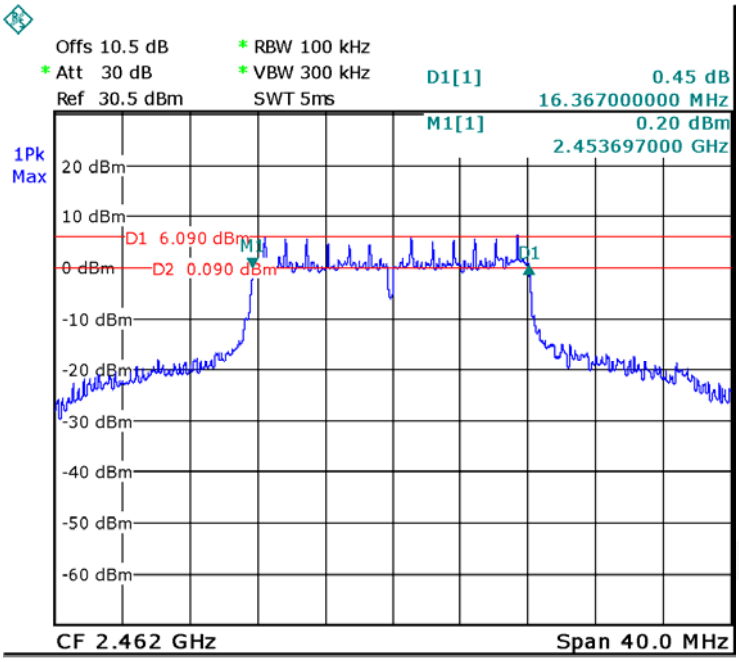
Date: 26.JUN.2017 20:19:59

802.11g: Middle Channel, Antenna 0



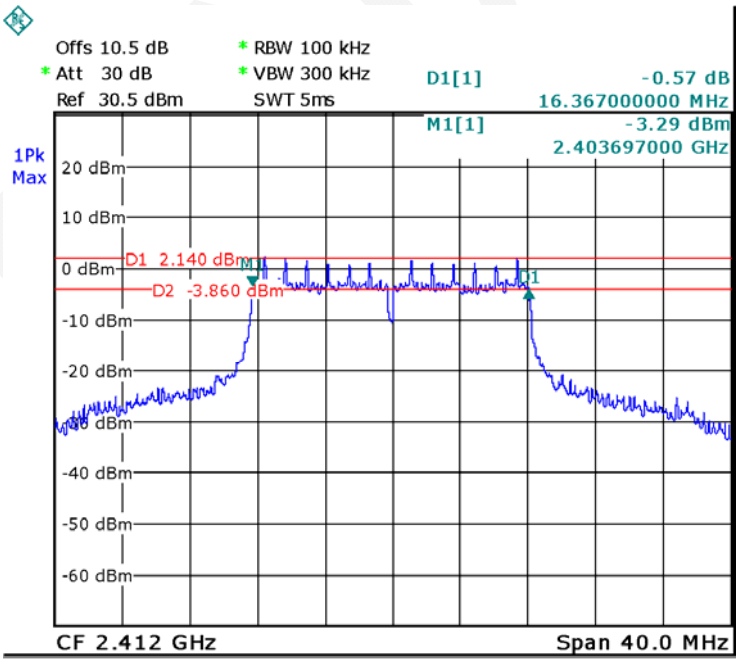
Date: 26.JUN.2017 20:18:24

802.11g: High Channel, Antenna 0



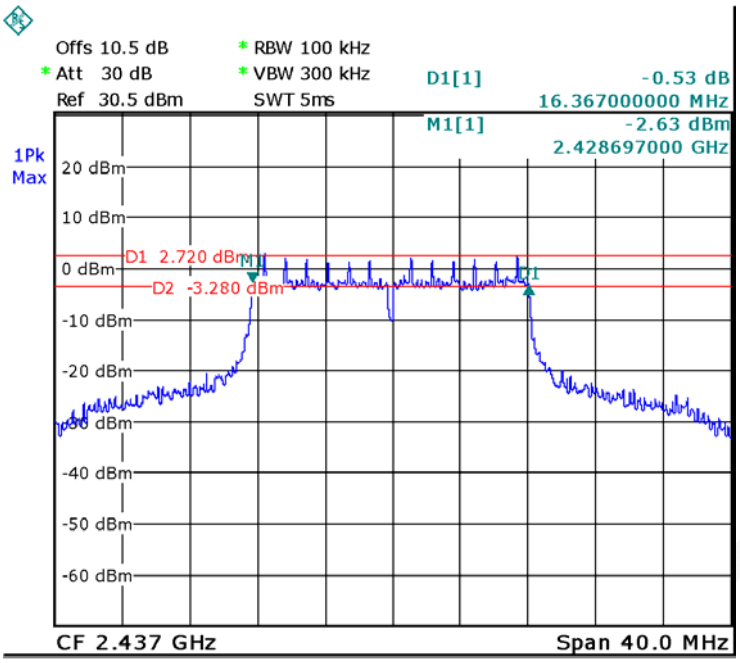
Date: 26.JUN.2017 20:16:54

802.11g: Low Channel, Antenna 1



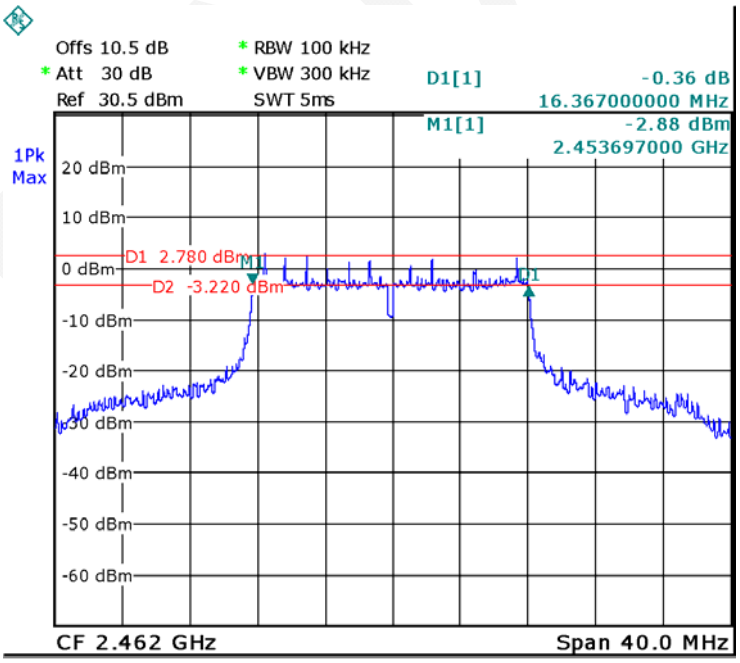
Date: 26.JUN.2017 11:05:49

802.11g: Middle Channel, Antenna 1



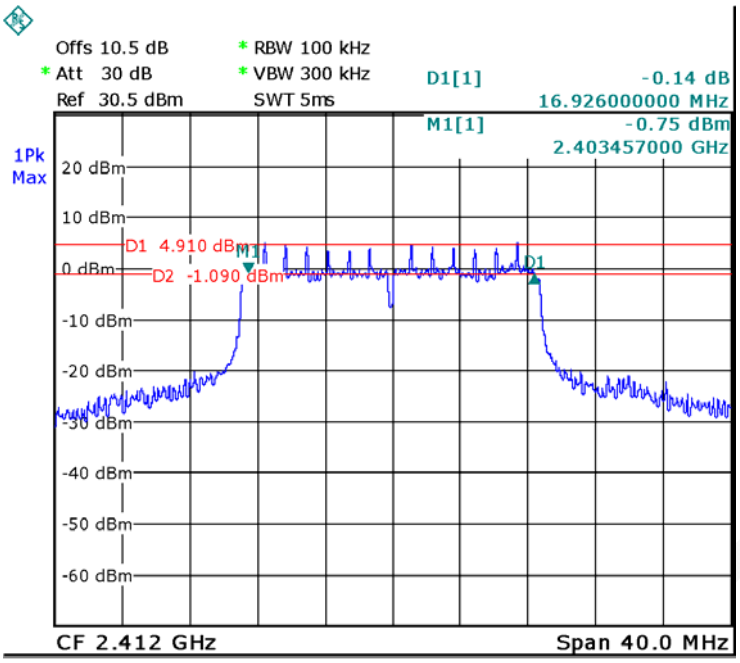
Date: 26.JUN.2017 11:02:49

802.11g: High Channel, Antenna 1



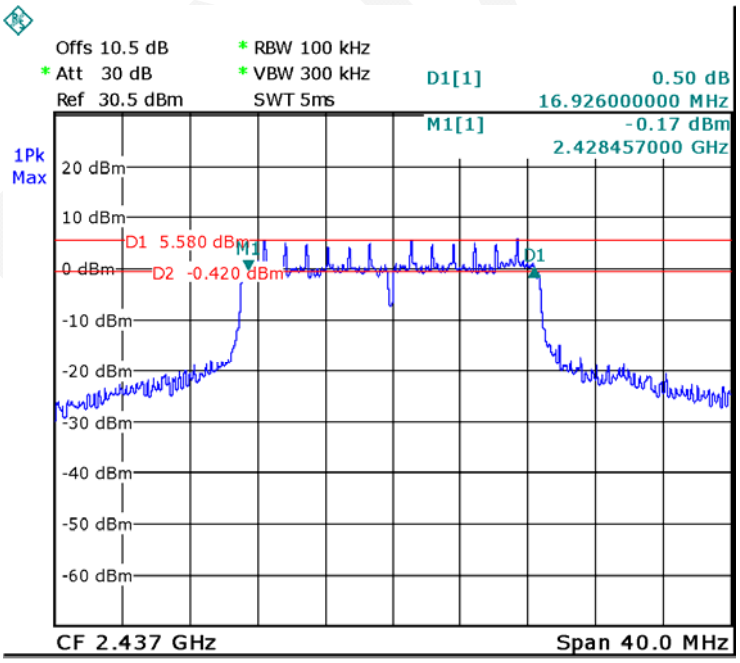
Date: 26.JUN.2017 11:00:58

802.11n-HT20: Low Channel, Antenna 0



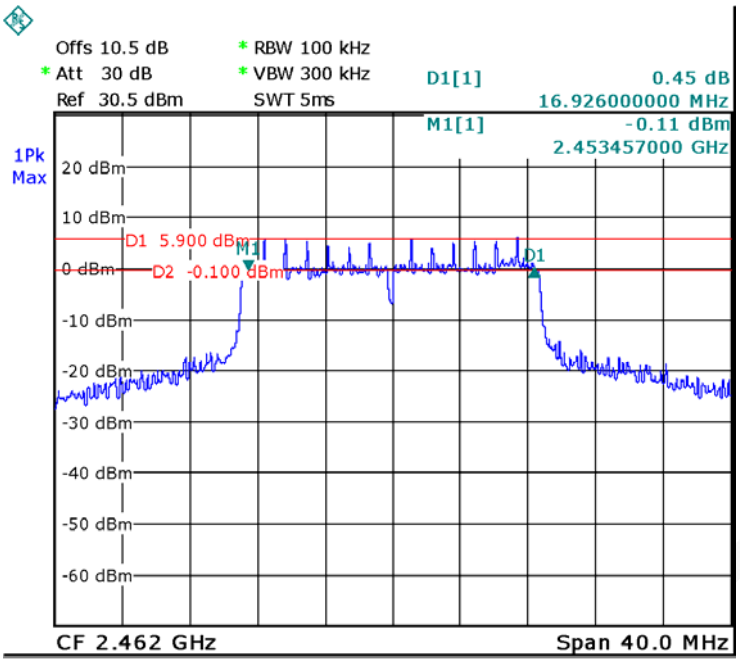
Date: 26.JUN.2017 20:40:22

802.11n-HT20: Middle Channel, Antenna 0



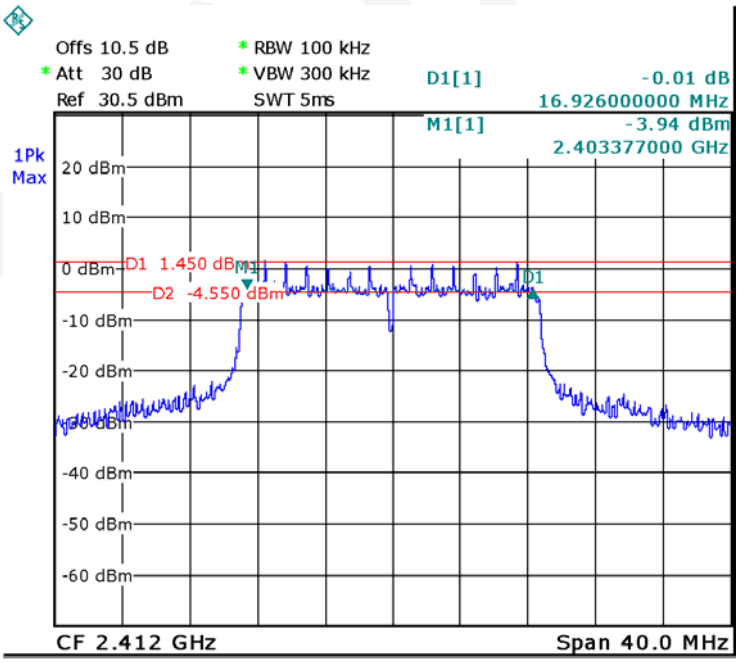
Date: 26.JUN.2017 20:38:36

802.11n-HT20: High Channel, Antenna 0



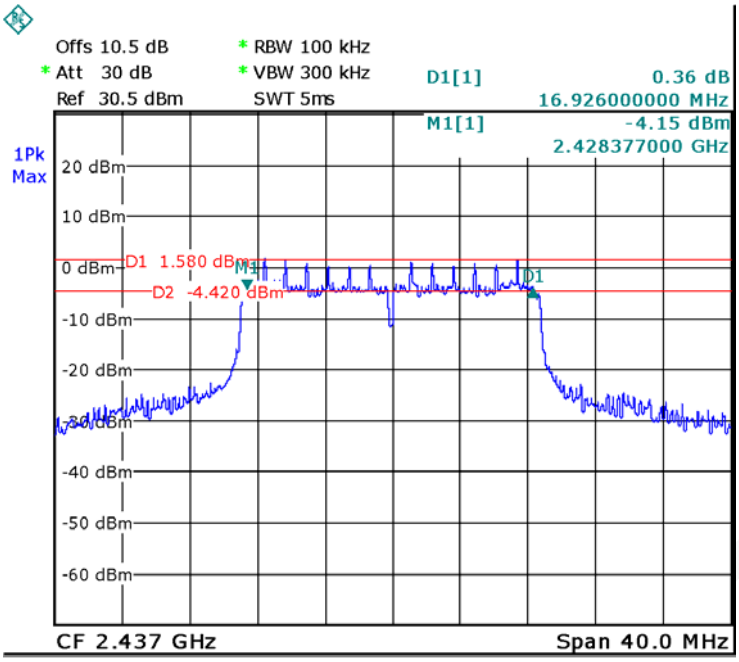
Date: 26.JUN.2017 20:35:25

802.11n-HT20: Low Channel, Antenna 1

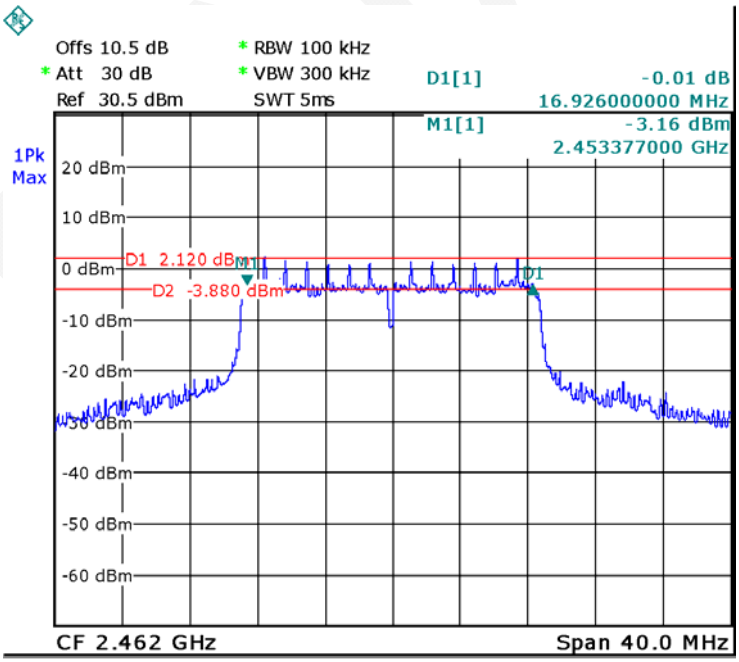


Date: 26.JUN.2017 11:12:48

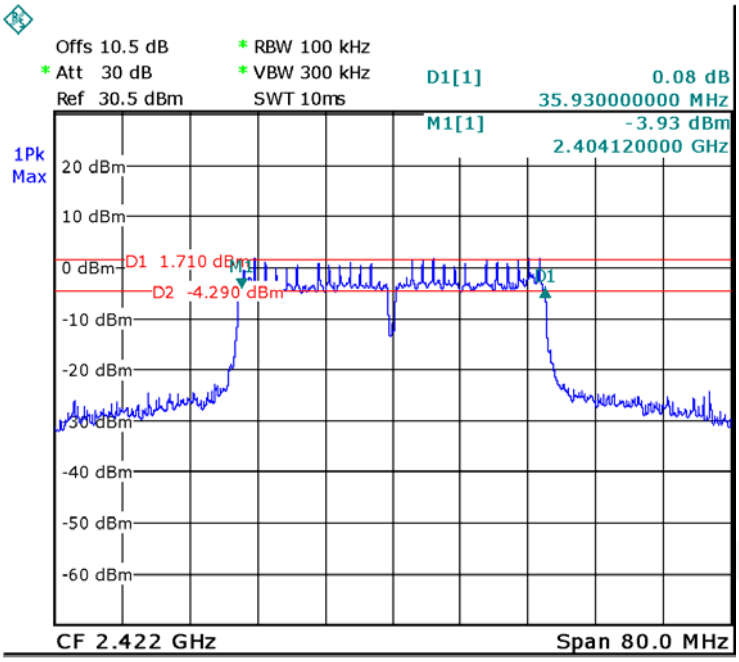
802.11n-HT20: Middle Channel, Antenna 1



802.11n-HT20: High Channel, Antenna 1

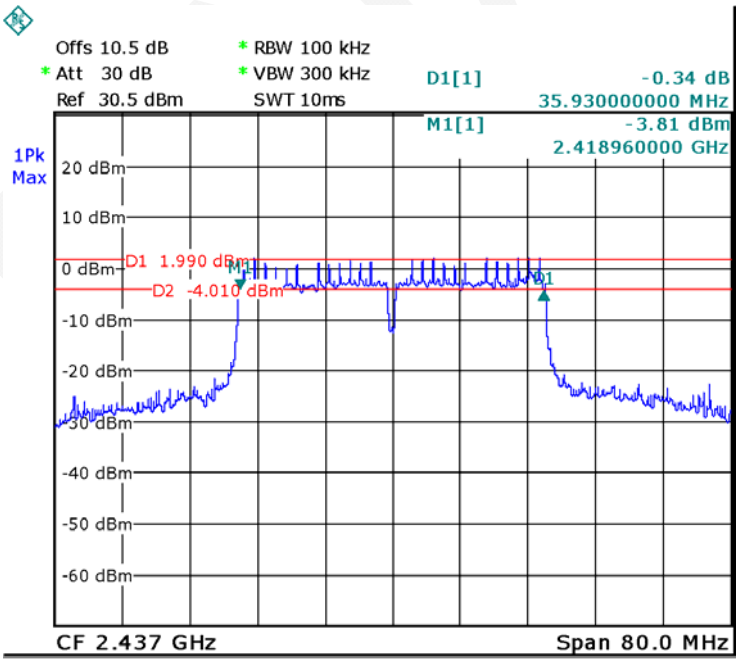


802.11n-HT40: Low Channel, Antenna 0



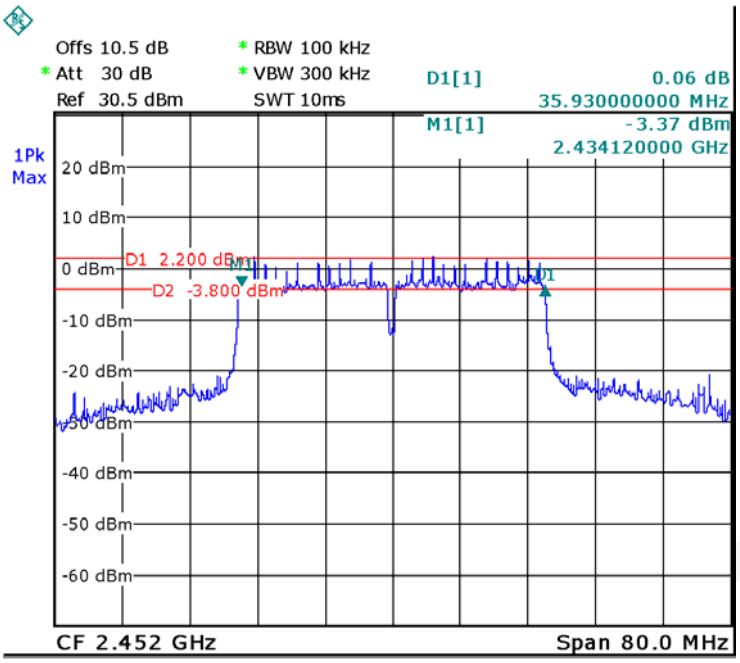
Date: 26.JUN.2017 20:57:37

802.11n-HT40: Middle Channel, Antenna 0



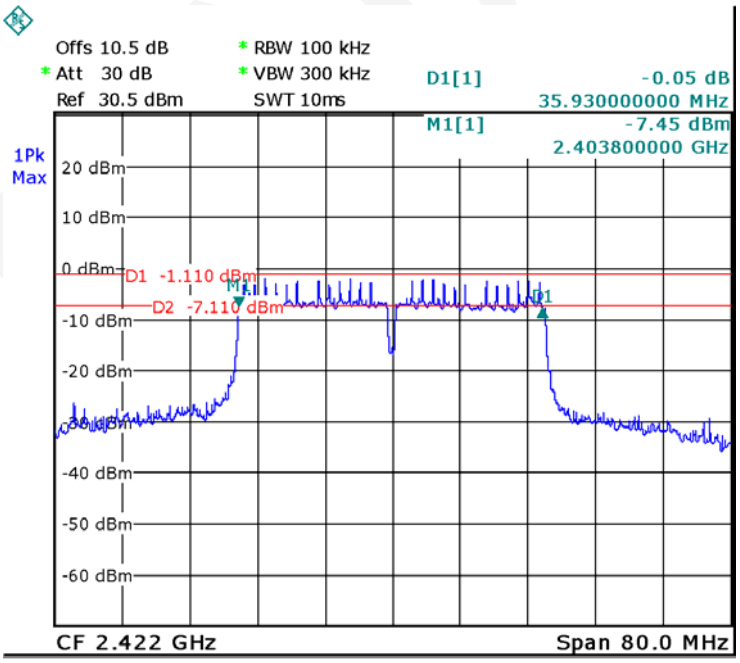
Date: 26.JUN.2017 20:55:21

802.11n-HT40: High Channel, Antenna 0



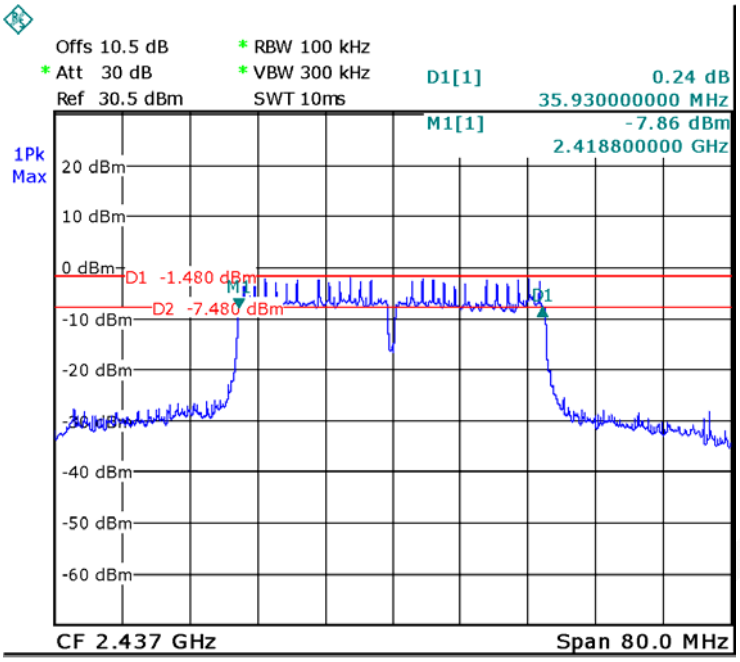
Date: 26.JUN.2017 20:53:29

802.11n-HT40: Low Channel, Antenna 1



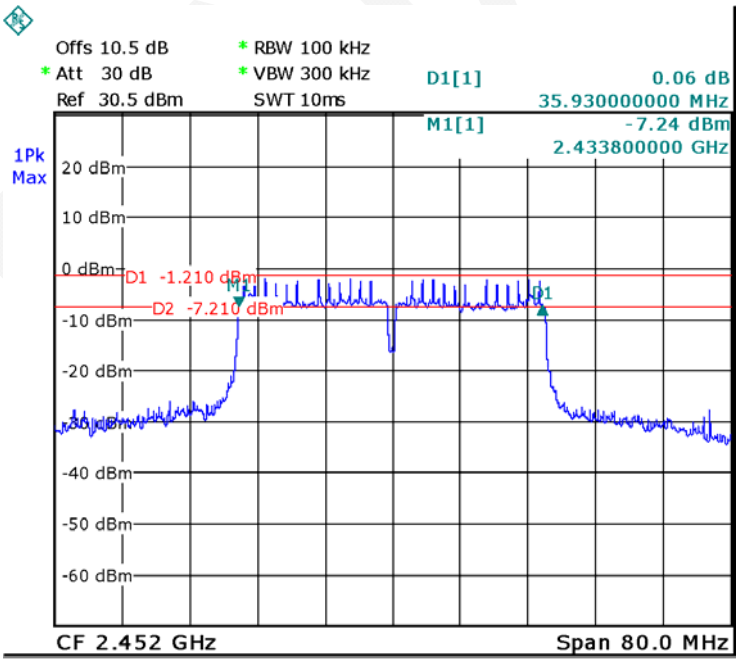
Date: 26.JUN.2017 11:15:18

802.11n-HT40: Middle Channel, Antenna 1



Date: 26.JUN.2017 11:17:18

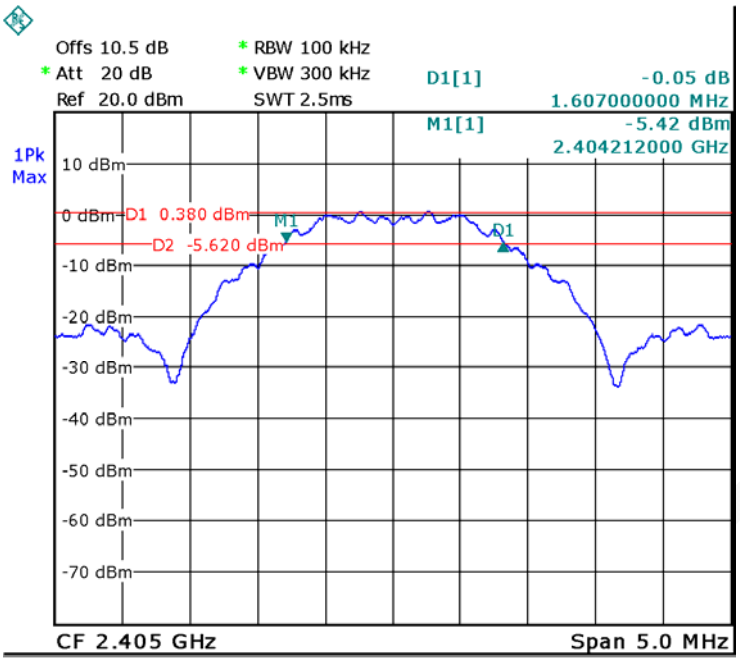
802.11n-HT40: High Channel, Antenna 1



Date: 26.JUN.2017 11:21:30

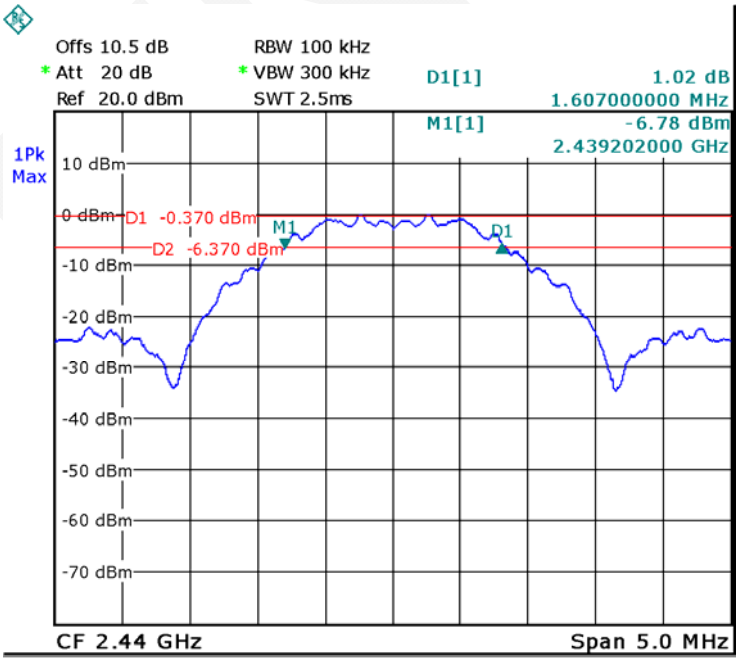
For Zigbee Mode

Low Channel



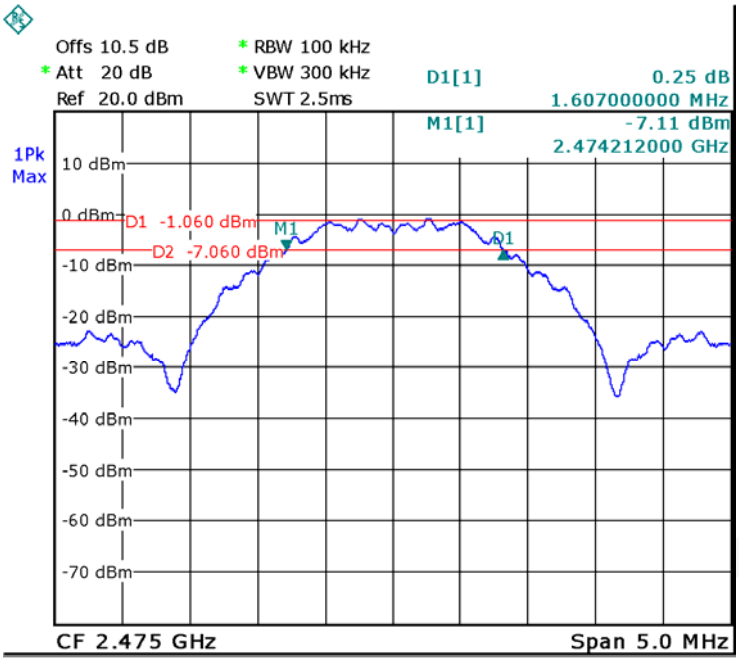
Date: 26.JUN.2017 17:44:54

Middle Channel



Date: 26.JUN.2017 17:56:24

High Channel



Date: 26.JUN.2017 18:02:51

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

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:

a) Set the RBW ⩾ DTS bandwidth.
b) Set VBW ⩾ 3×RBW
c) Set span ⩾ 3×RBW
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level

Test Data

Environmental Conditions

Temperature:	29 °C
Relative Humidity:	48 %
ATM Pressure:	94.6 kPa

The testing was performed by Tom Tang on 2017-06-26.

Test Mode: Transmitting

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

For Wi-Fi Mode

Test Mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)		Total (dBm)	Limits (dBm)
			Antenna 0	Antenna 1	Antenna 0 + Antenna 1	
802.11b	Low	2412	19.30	15.33	/	30
	Middle	2437	19.83	15.63	/	30
	High	2462	20.24	16.10	/	30
802.11g	Low	2412	23.61	20.01	/	30
	Middle	2437	24.03	20.22	/	30
	High	2462	24.38	20.64	/	30
802.11n-HT20	Low	2412	22.93	19.48	24.55	30
	Middle	2437	23.40	19.71	24.95	30
	High	2462	23.78	20.08	25.32	30
802.11n-HT40	Low	2422	22.99	19.37	24.56	30
	Middle	2437	23.23	19.42	24.74	30
	High	2452	23.47	19.59	24.96	30

Test Mode	Channel	Frequency (MHz)	Max Average Conducted Output Power (dBm)		Total (dBm)	Limits (dBm)
			Antenna 0	Antenna 1	Antenna 0 + Antenna 1	
802.11b	Low	2412	15.91	12.15	/	30
	Middle	2437	16.44	12.42	/	30
	High	2462	16.79	12.85	/	30
802.11g	Low	2412	14.68	11.39	/	30
	Middle	2437	15.15	11.61	/	30
	High	2462	15.50	11.99	/	30
802.11n-HT20	Low	2412	14.31	10.94	15.95	30
	Middle	2437	14.83	11.11	16.37	30
	High	2462	15.17	11.47	16.71	30
802.11n-HT40	Low	2422	13.81	10.22	15.39	30
	Middle	2437	14.08	10.33	15.61	30
	High	2452	14.33	10.53	15.84	30

Note: Directional gain = G_{ANT} + 10*log(N_{ANT}) =0 +10*log(2)=3.0dBi
So no power reduce in MIMO mode

For Zigbee Mode

Test Mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)	Limits (dBm)
Zigbee	Low	2405	4.29	30
	Middle	2440	3.36	30
	High	2475	2.78	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 Data

Environmental Conditions

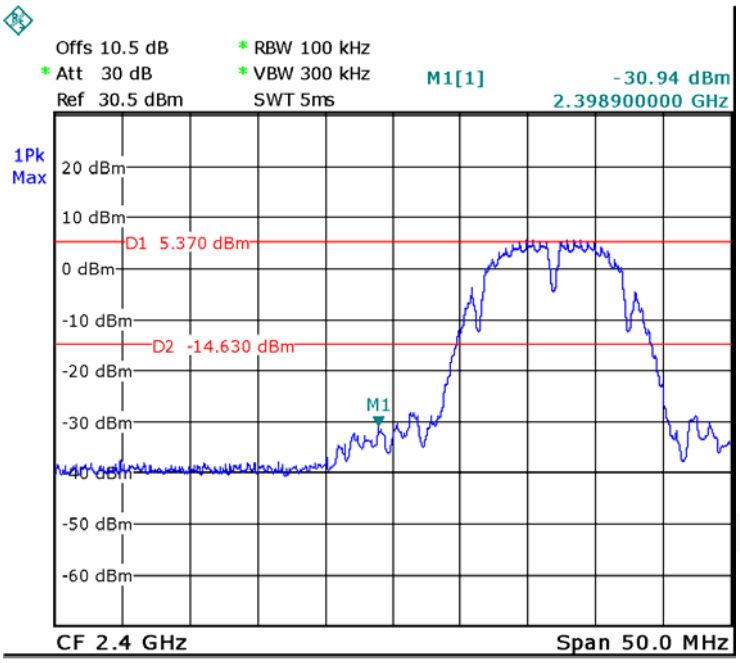
Temperature:	29 °C
Relative Humidity:	48 %
ATM Pressure:	94.6 kPa

** The testing was performed by Tom Tang on 2017-06-26.*

Test Result: Compliant. Please refer to following plots.

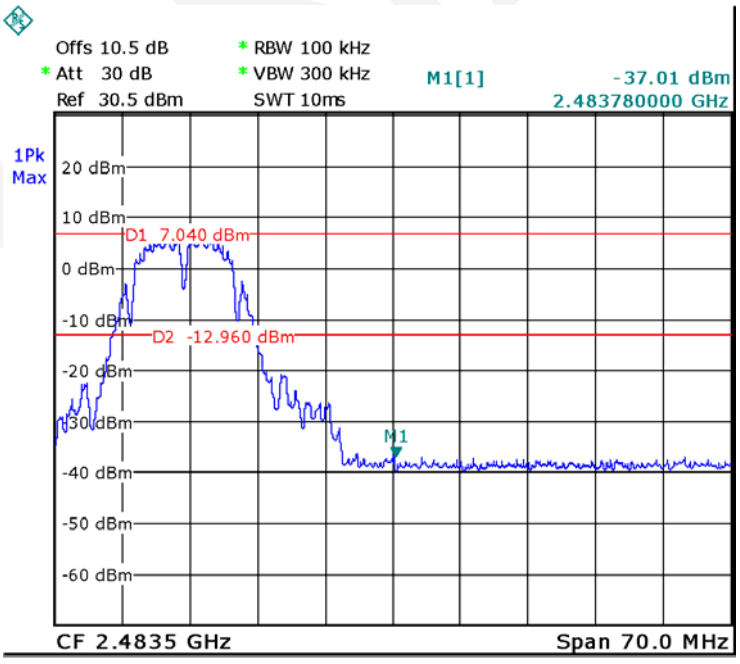
For Wi-Fi Mode

802.11b: Band Edge, Left Side, Antenna 0



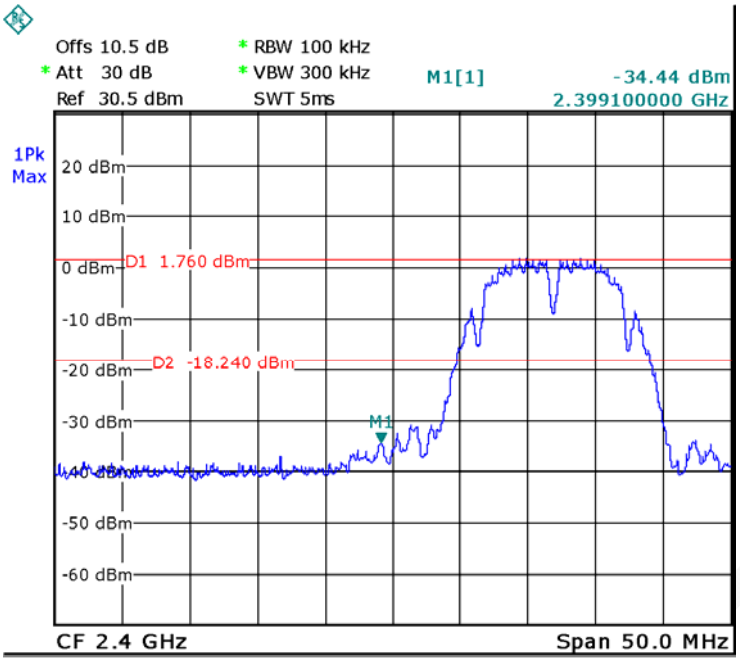
Date: 26.JUN.2017 20:02:31

802.11b: Band Edge, Right Side, Antenna 0



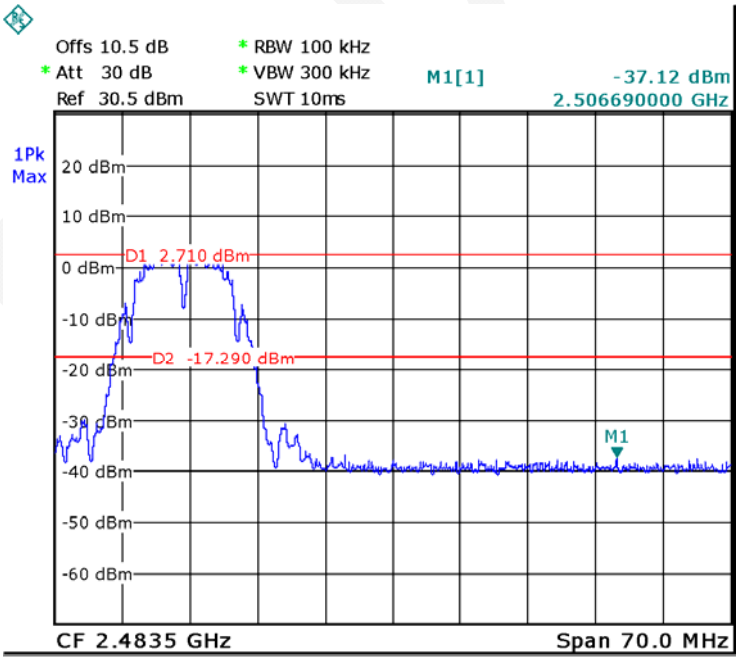
Date: 26.JUN.2017 20:06:13

802.11b: Band Edge, Left Side, Antenna 1



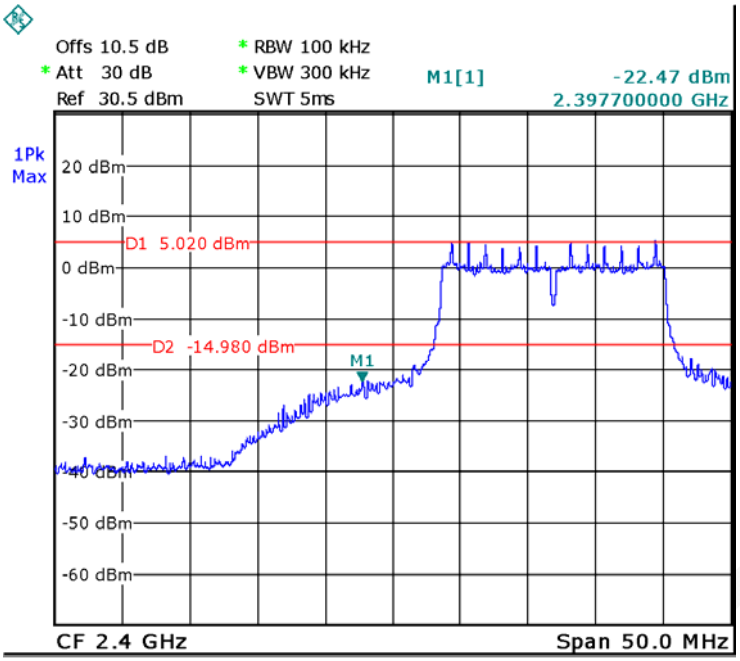
Date: 26.JUN.2017 11:33:25

802.11b: Band Edge, Right Side, Antenna 1



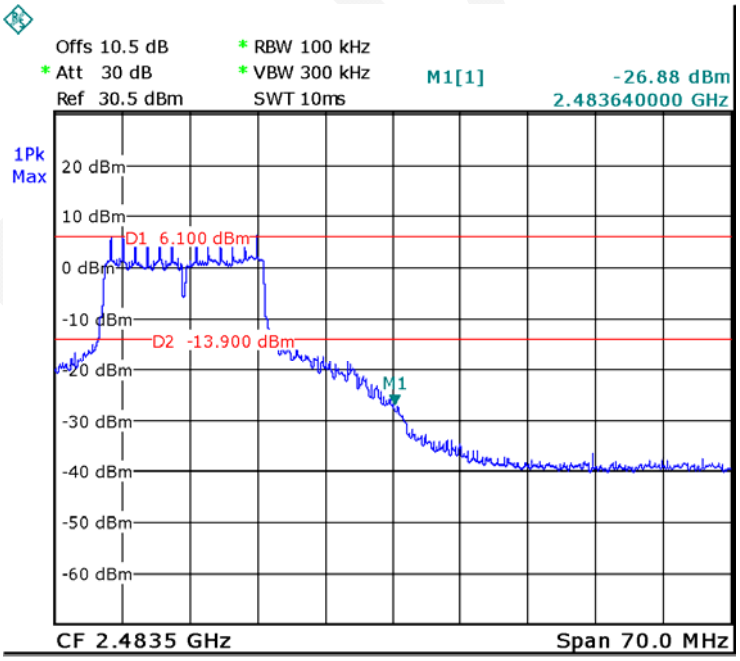
Date: 26.JUN.2017 11:34:48

802.11g: Band Edge, Left Side, Antenna 0



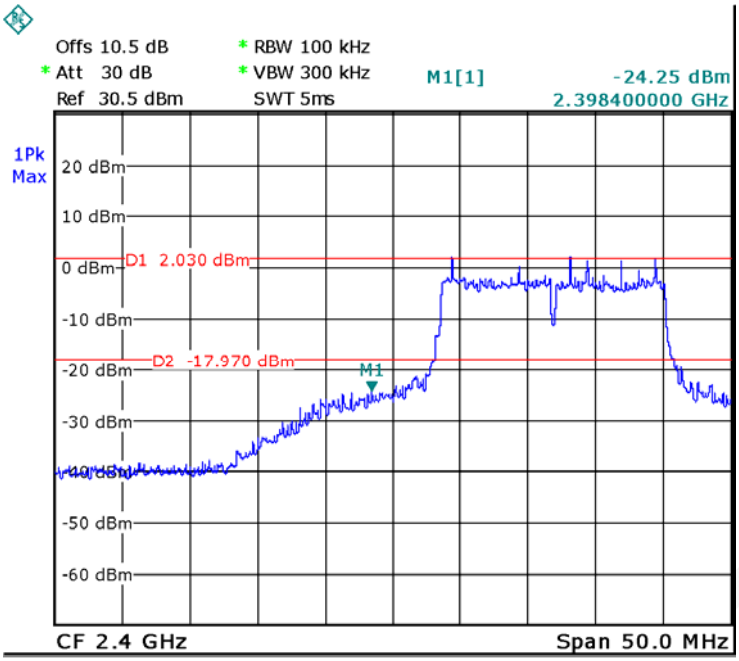
Date: 26.JUN.2017 20:22:58

802.11g: Band Edge, Right Side, Antenna 0



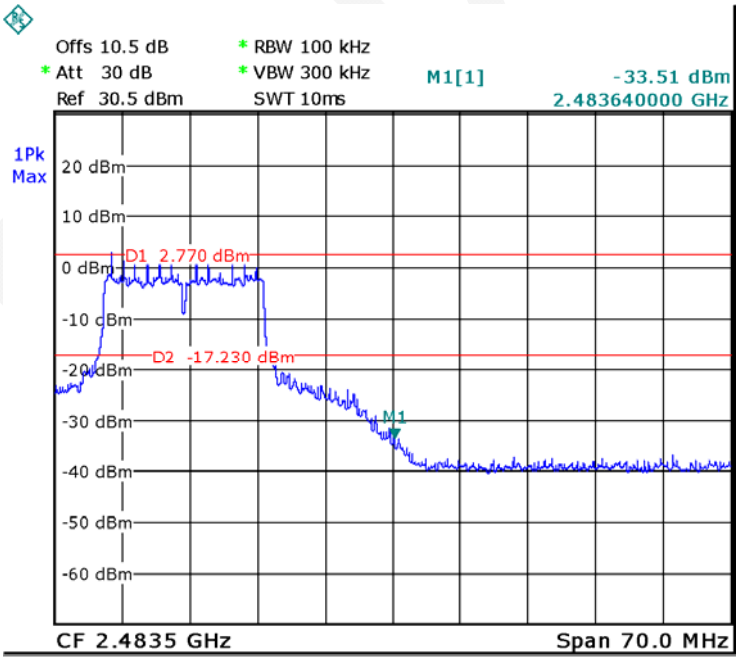
Date: 26.JUN.2017 20:24:51

802.11g: Band Edge, Left Side, Antenna 1



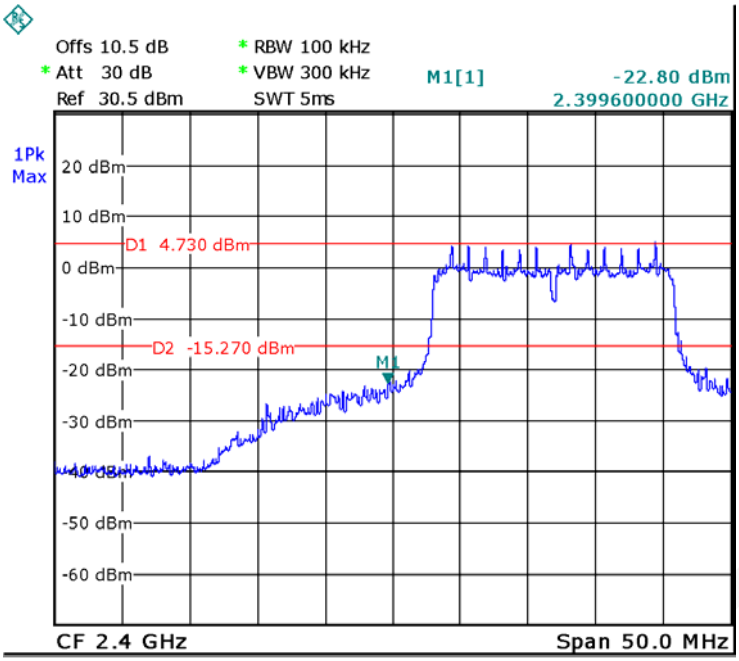
Date: 26.JUN.2017 11:32:14

802.11g: Band Edge, Right Side, Antenna 1



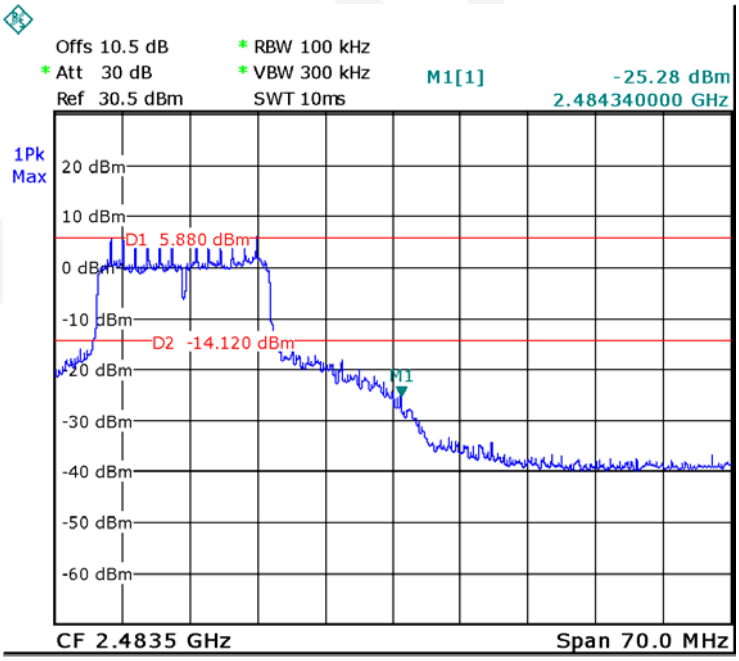
Date: 26.JUN.2017 11:30:59

802.11n-HT20: Band Edge, Left Side, Antenna 0



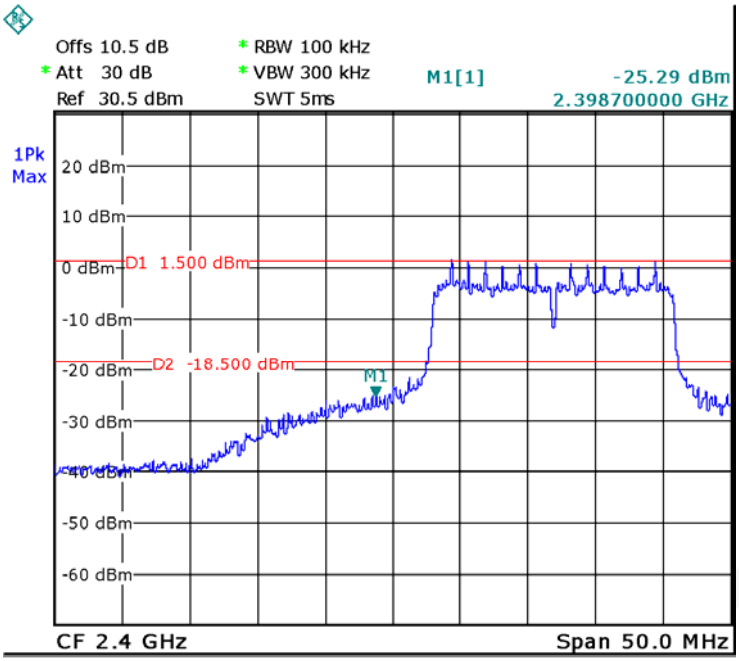
Date: 26.JUN.2017 20:41:46

802.11n-HT20: Band Edge, Right Side, Antenna 0



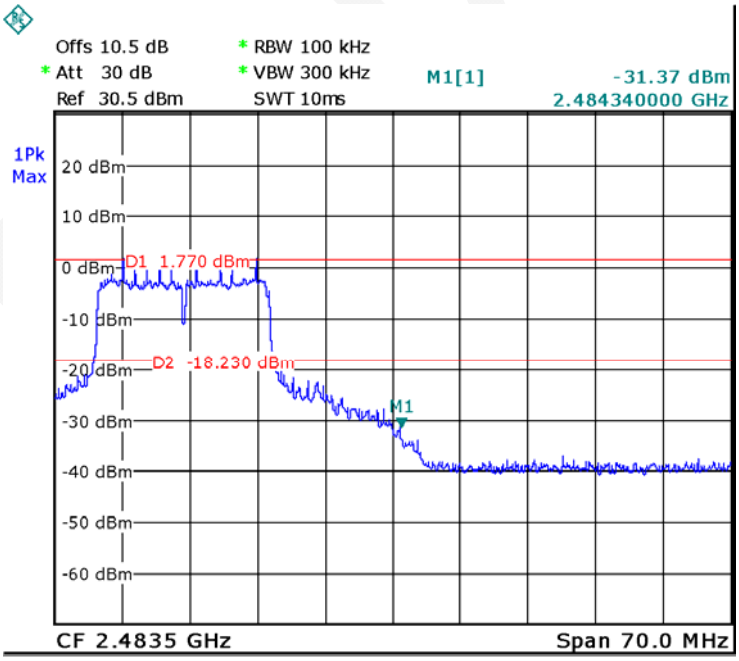
Date: 26.JUN.2017 20:43:22

802.11n-HT20: Band Edge, Left Side, Antenna 1



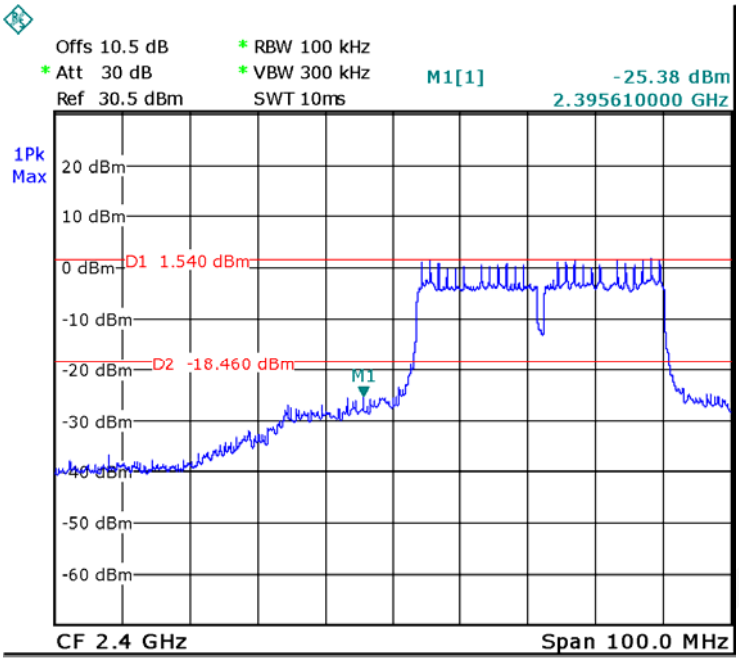
Date: 26.JUN.2017 11:28:17

802.11n-HT20: Band Edge, Right Side, Antenna 1



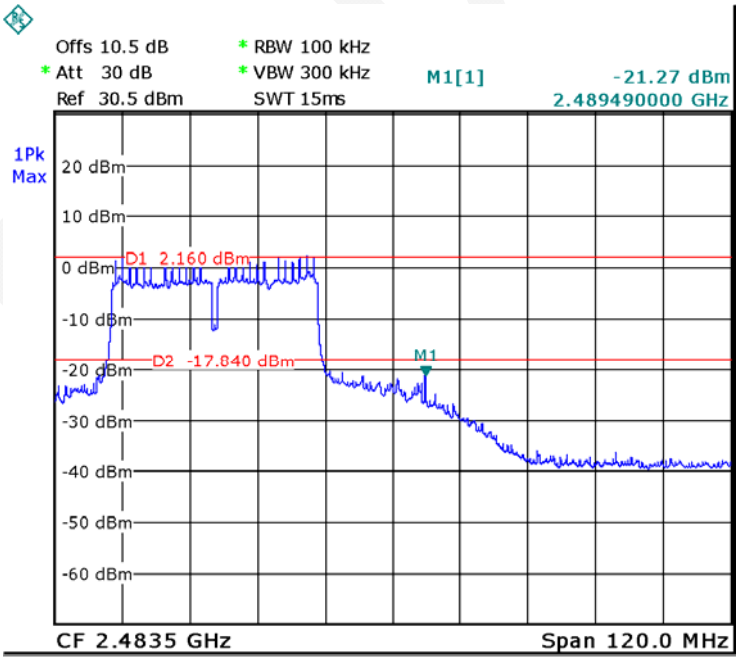
Date: 26.JUN.2017 11:29:27

802.11n-HT40: Band Edge, Left Side, Antenna 0



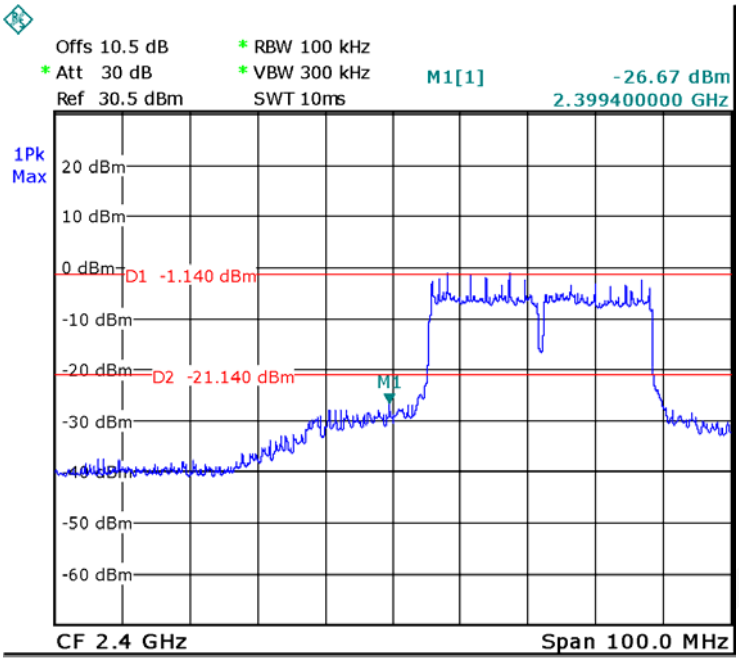
Date: 26.JUN.2017 21:00:10

802.11n-HT40: Band Edge, Right Side, Antenna 0



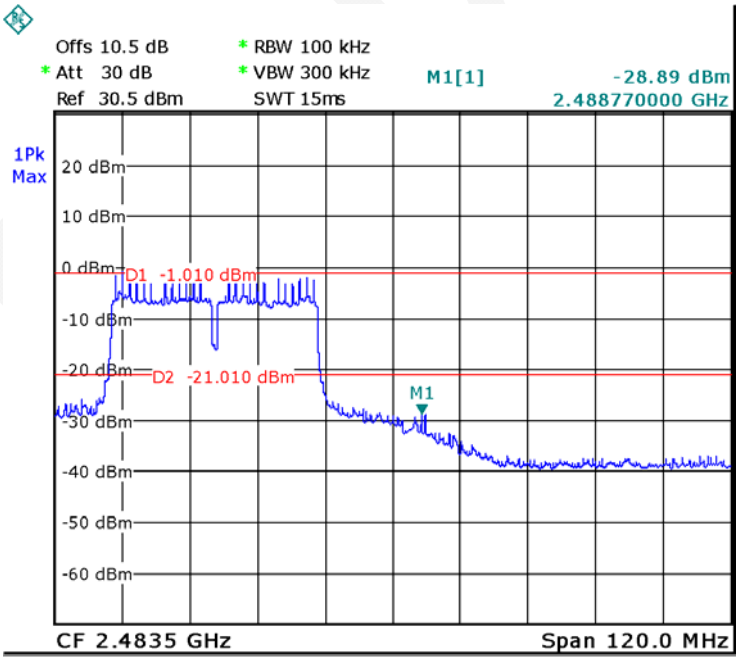
Date: 26.JUN.2017 21:02:11

802.11n-HT40: Band Edge, Left Side, Antenna 1



Date: 26.JUN.2017 17:08:08

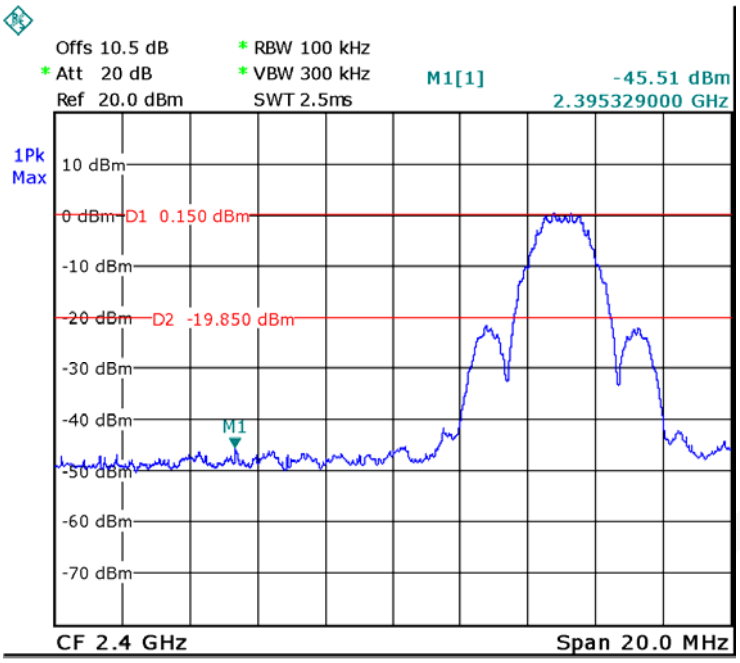
802.11n-HT40: Band Edge, Right Side, Antenna 1



Date: 26.JUN.2017 11:23:02

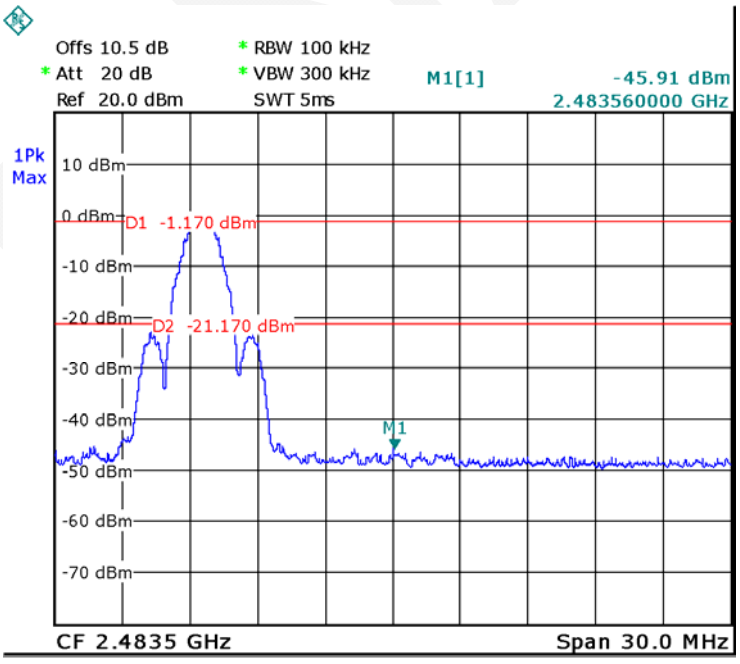
For Zigbee Mode

Band Edge, Left Side



Date: 26.JUN.2017 17:47:39

Band Edge, Right Side



Date: 26.JUN.2017 18:05:07

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 Data

Environmental Conditions

Temperature:	29 °C
Relative Humidity:	48 %
ATM Pressure:	94.6 kPa

** The testing was performed by Tom Tang on 2017-06-26.*

Test Mode: Transmitting

Test Result: Compliant. Please refer to the following tables and plots.

For Wi-Fi Mode

Test mode	Channel	Frequency (MHz)	PSD (dBm/3kHz)		Total PSD	Limit (dBm/3kHz)
			Antenna 0	Antenna 1	(dBm/3kHz)	
802.11b	Low	2412	-10.450	-13.850	/	≤8
	Middle	2437	-10.120	-14.060	/	≤8
	High	2462	-10.070	-13.420	/	≤8
802.11g	Low	2412	-12.150	-14.670	/	≤8
	Middle	2437	-11.500	-14.040	/	≤8
	High	2462	-10.490	-14.470	/	≤8
802.11n-HT20	Low	2412	-11.450	-15.810	-10.093	≤8
	Middle	2437	-11.490	-15.520	-10.045	≤8
	High	2462	-11.890	-15.300	-10.260	≤8
802.11n-HT40	Low	2422	-15.080	-18.760	-13.532	≤8
	Middle	2437	-14.410	-18.880	-13.081	≤8
	High	2452	-15.110	-18.950	-13.610	≤8

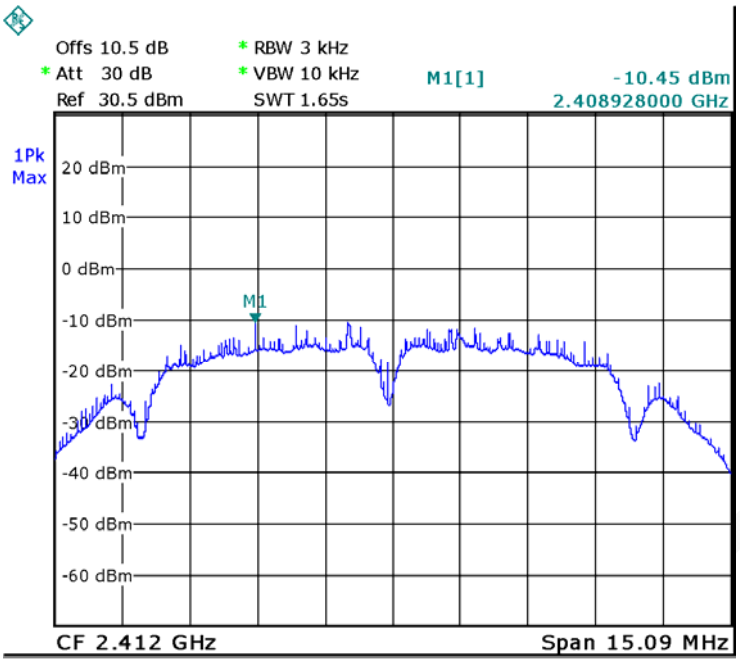
Note: Directional gain = G_{ANT} + 10*log(N_{ANT}) = 0+10*log(2)=3dBi
So no PSD reduce in MIMO mode

For Zigbee Mode

Test mode	Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
Zigbee	Low	2405	-11.300	≤8
	Middle	2440	-11.490	≤8
	High	2475	-12.820	≤8

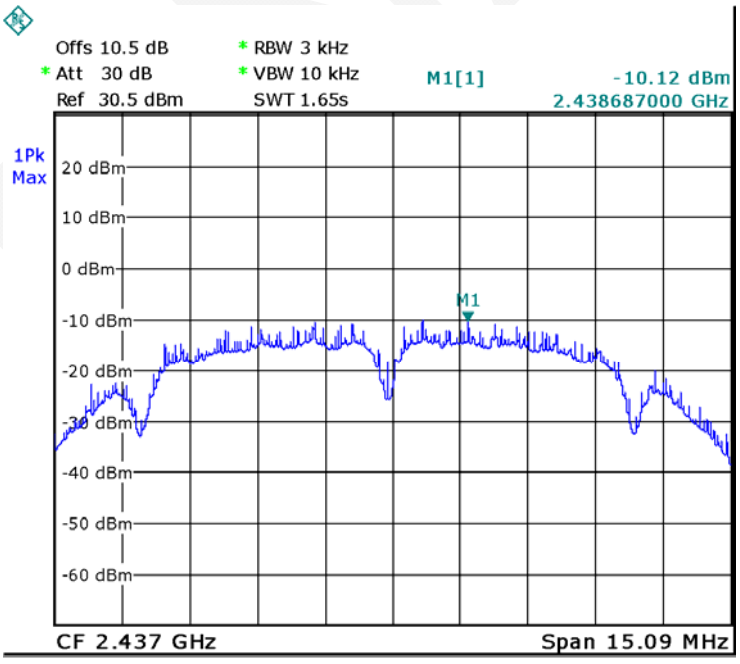
For Wi-Fi Mode

802.11b: Low Channel, Antenna 0



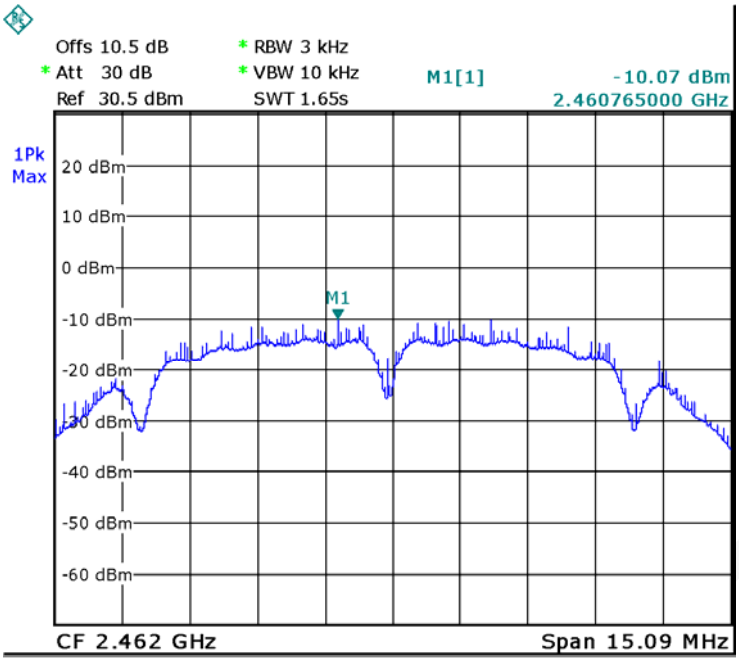
Date: 26.JUN.2017 21:10:45

802.11b: Middle Channel, Antenna 0



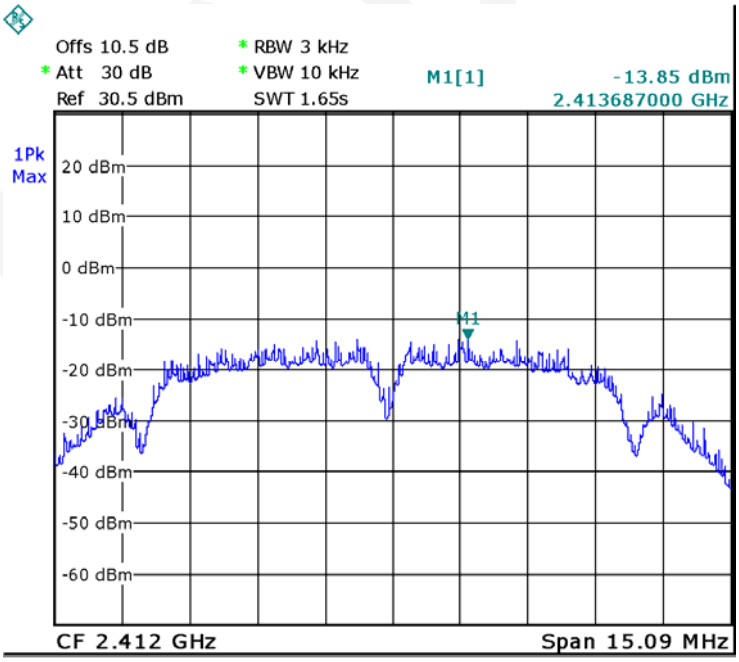
Date: 26.JUN.2017 21:12:13

802.11b: High Channel, Antenna 0



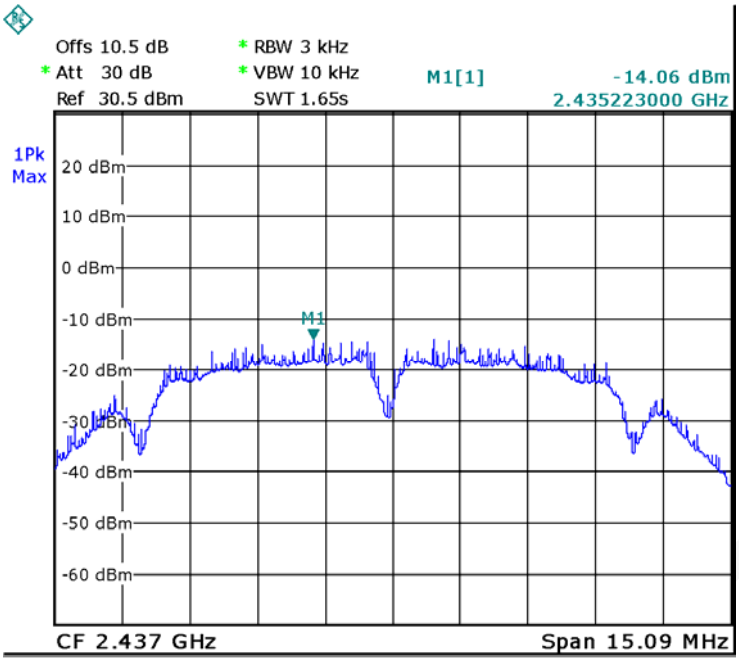
Date: 26.JUN.2017 21:13:17

802.11b: Low Channel, Antenna 1



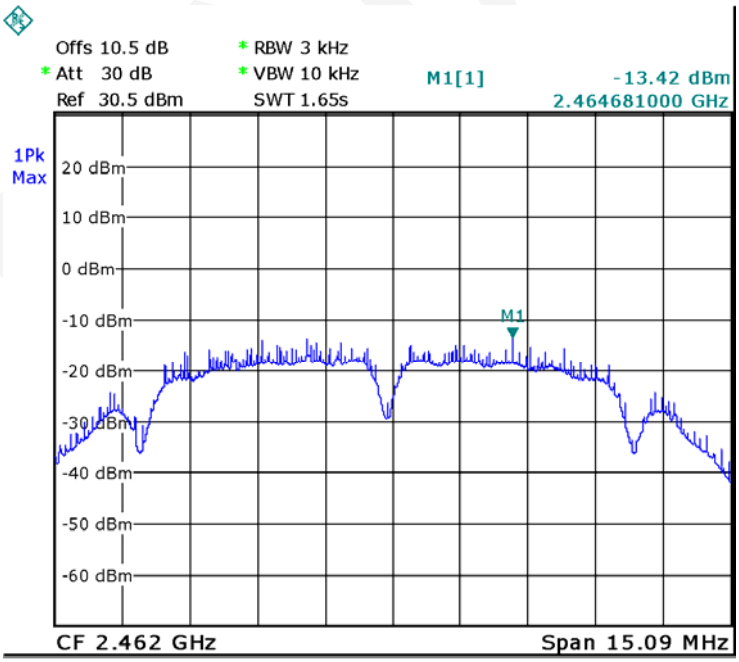
Date: 26.JUN.2017 11:38:35

802.11b: Middle Channel, Antenna 1



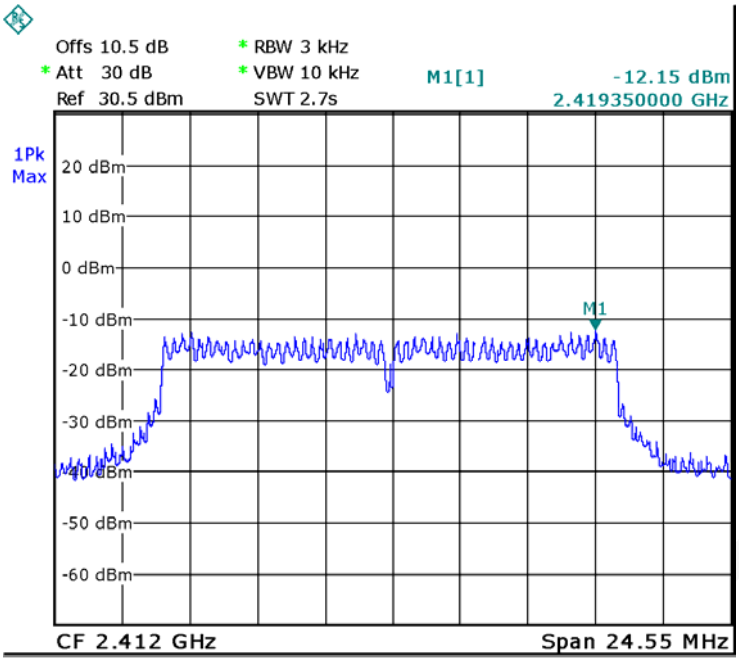
Date: 26.JUN.2017 11:39:56

802.11b: High Channel, Antenna 1

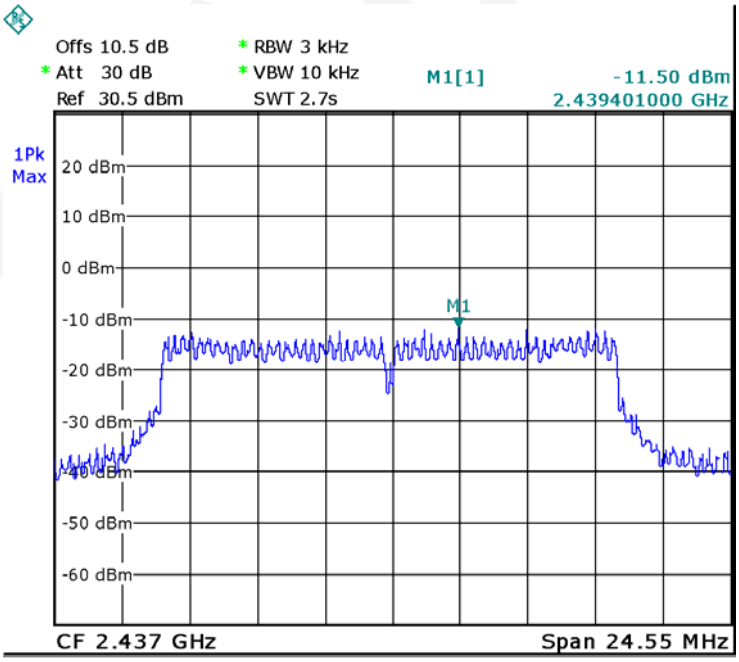


Date: 26.JUN.2017 11:41:48

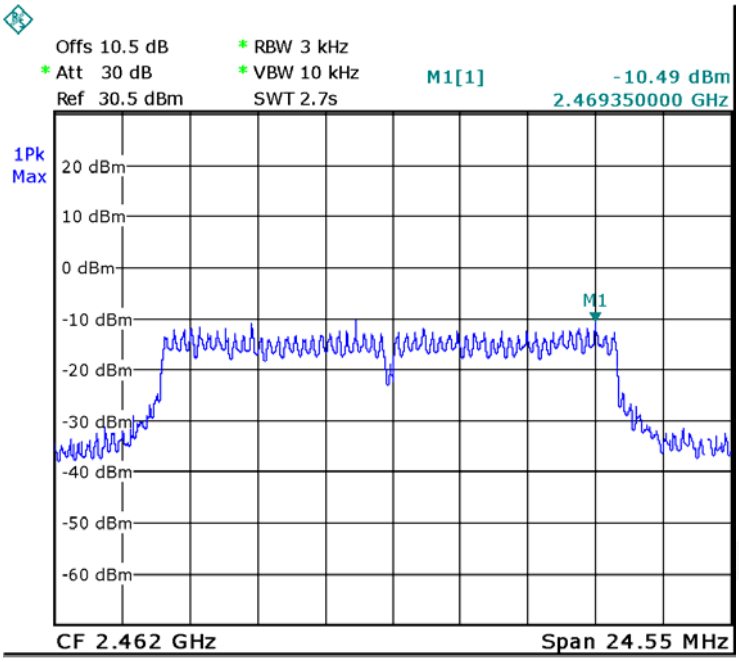
802.11g: Low Channel, Antenna 0



802.11g: Middle Channel, Antenna 0

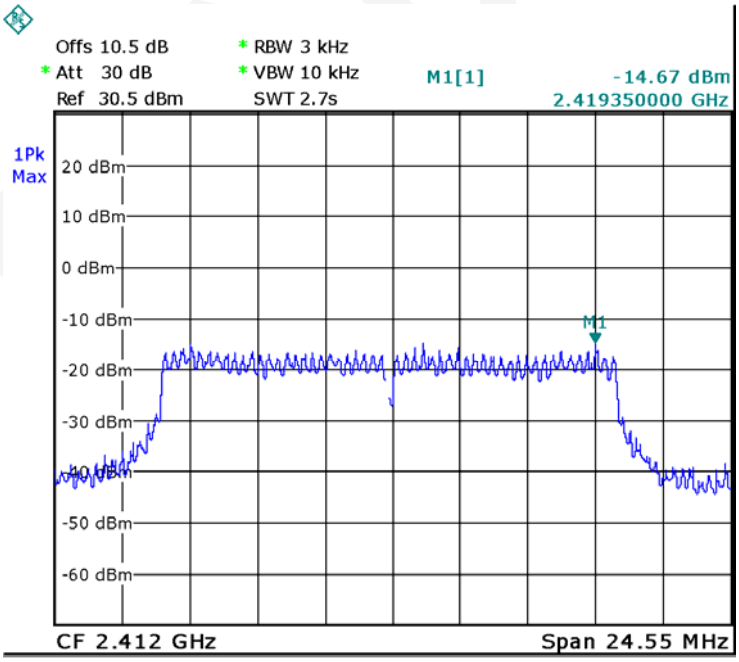


802.11g: High Channel, Antenna 0



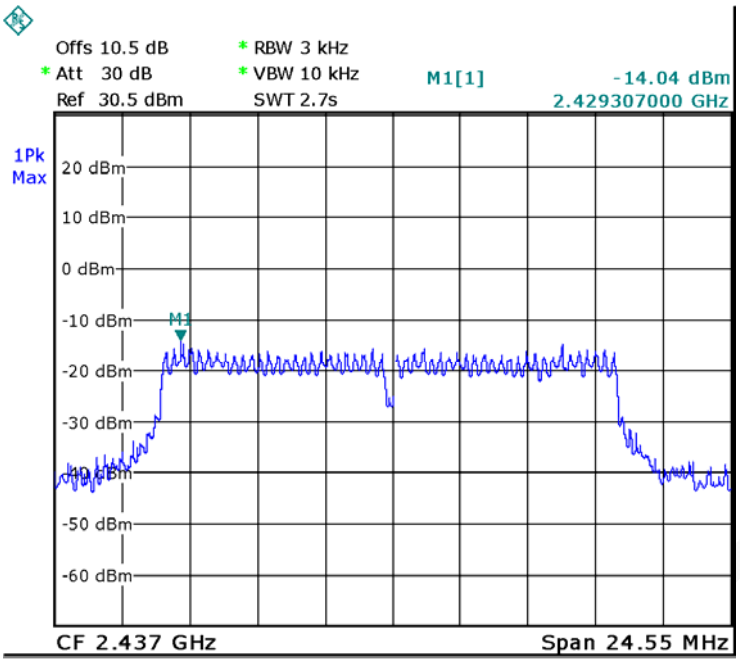
Date: 26.JUN.2017 20:26:48

802.11g: Low Channel, Antenna 1

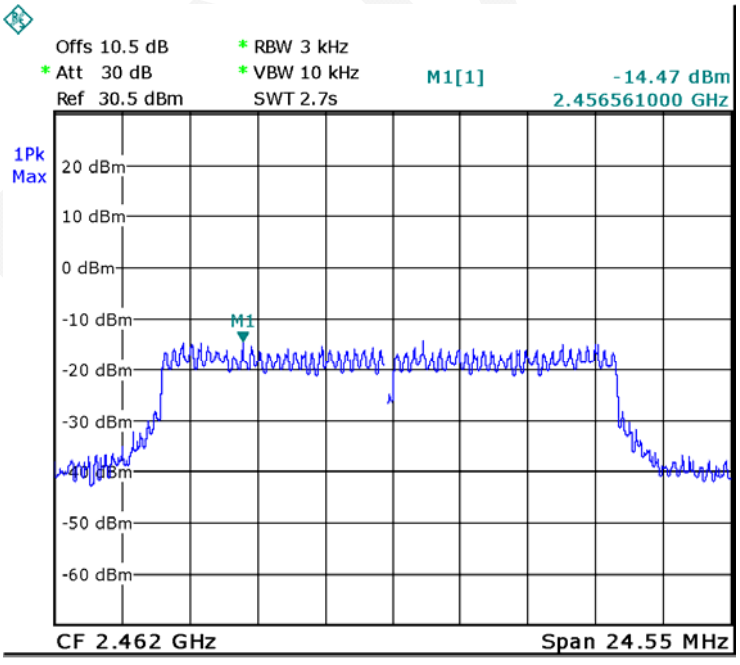


Date: 26.JUN.2017 11:45:34

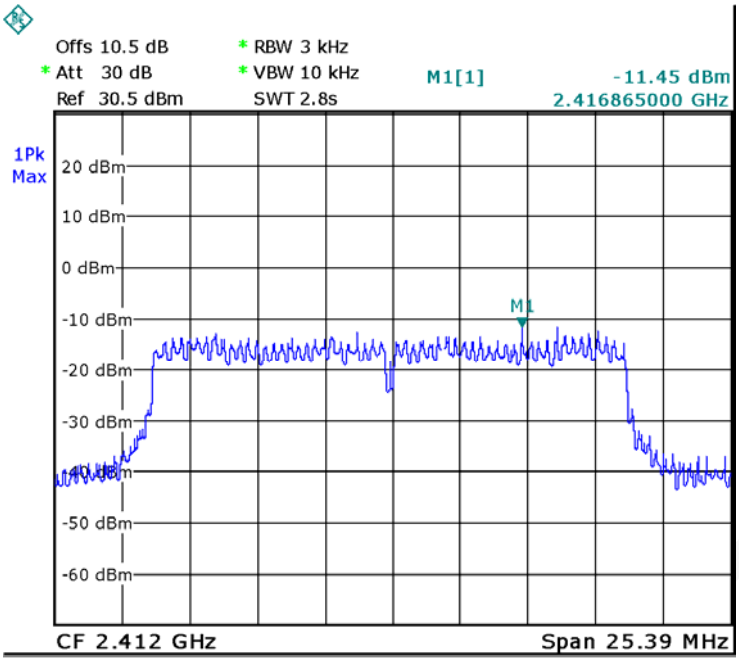
802.11g: Middle Channel, Antenna 1



802.11g: High Channel, Antenna 1

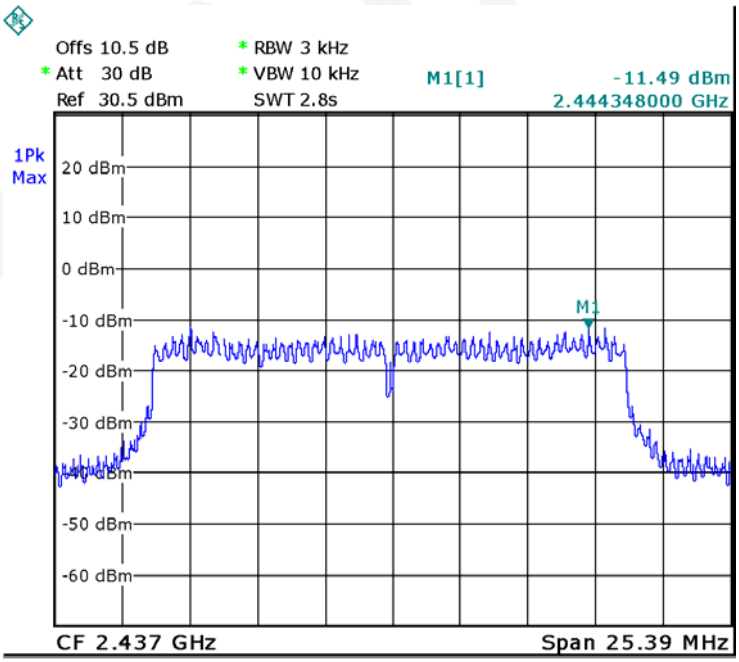


802.11n-HT20: Low Channel, Antenna 0



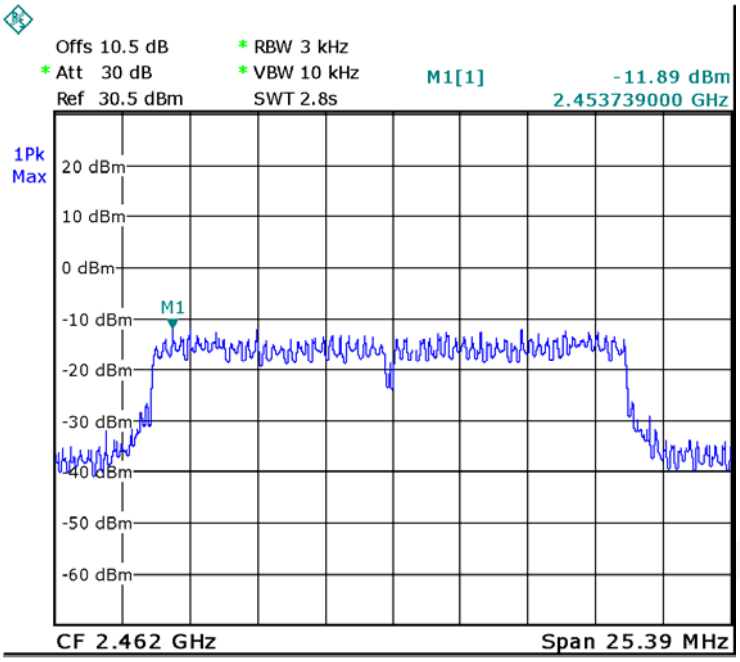
Date: 26.JUN.2017 20:48:53

802.11n-HT20: Middle Channel, Antenna 0

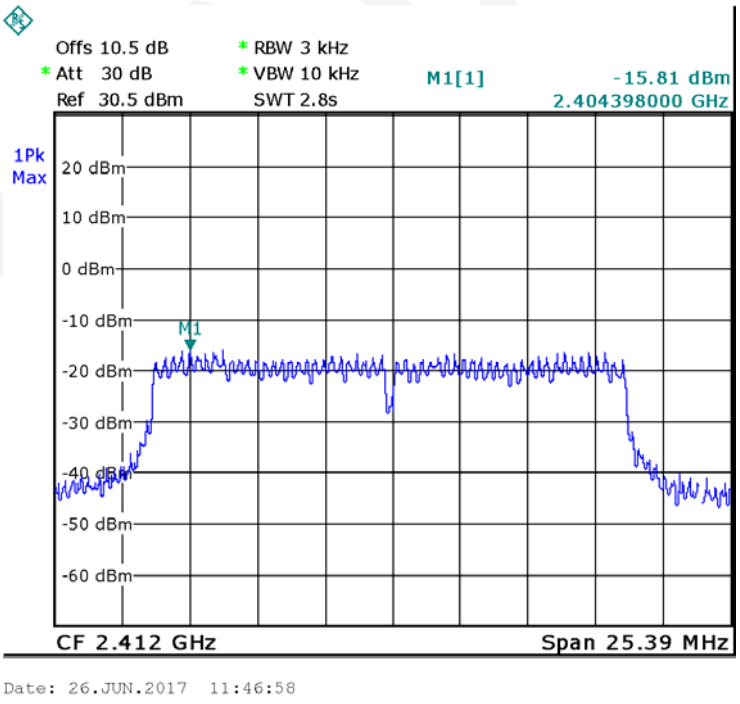


Date: 26.JUN.2017 20:46:37

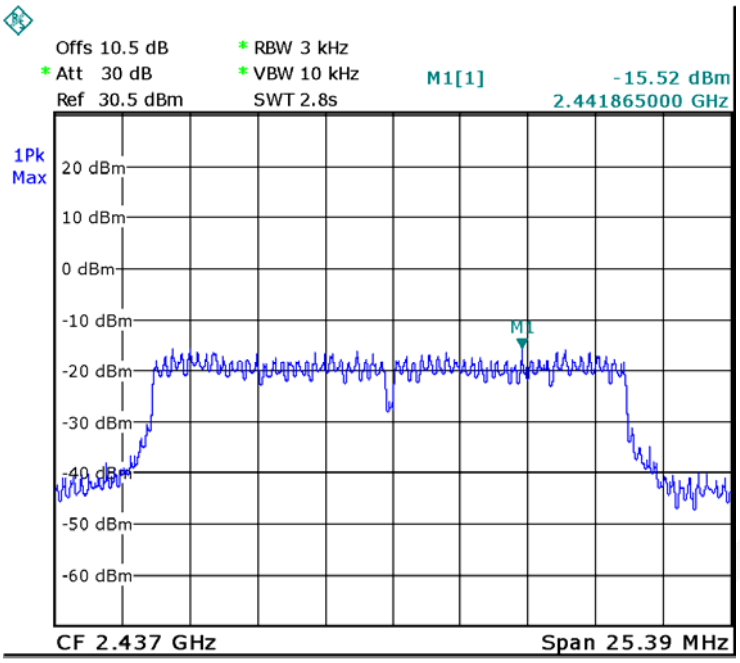
802.11n-HT20: High Channel, Antenna 0



802.11n-HT20: Low Channel, Antenna 1

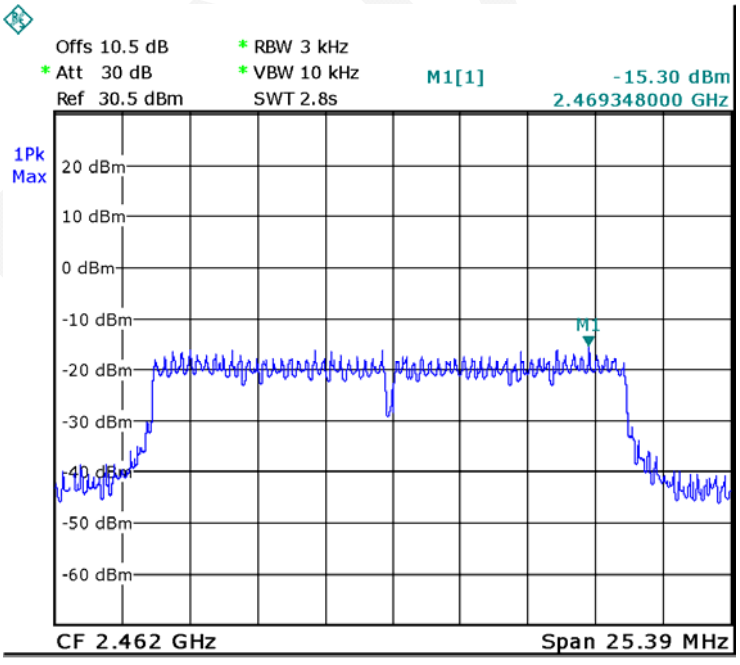


802.11n-HT20: Middle Channel, Antenna 1



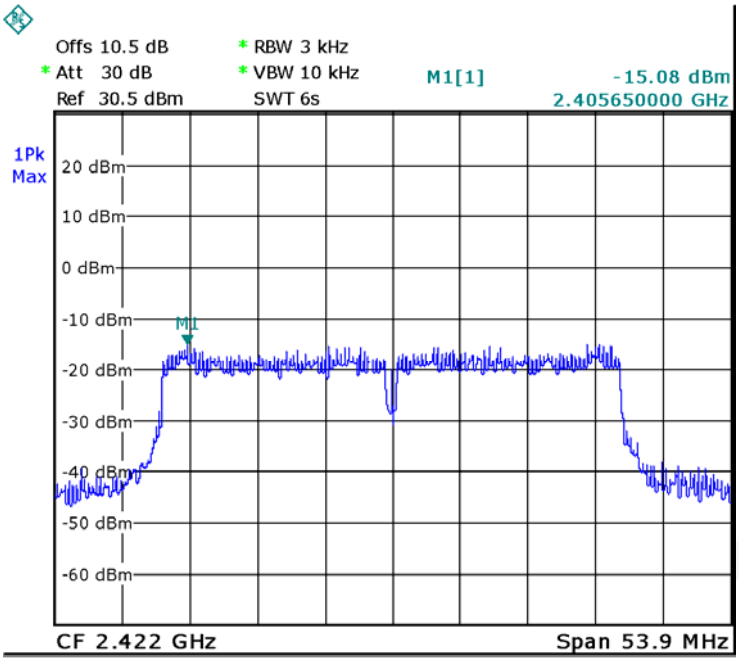
Date: 26.JUN.2017 11:47:50

802.11n-HT20: High Channel, Antenna 1



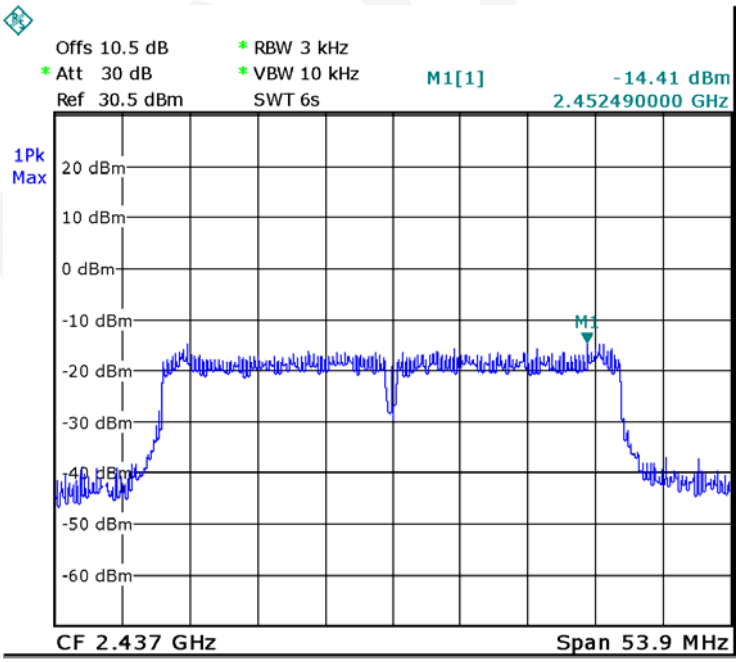
Date: 26.JUN.2017 11:50:24

802.11n-HT40: Low Channel, Antenna 0



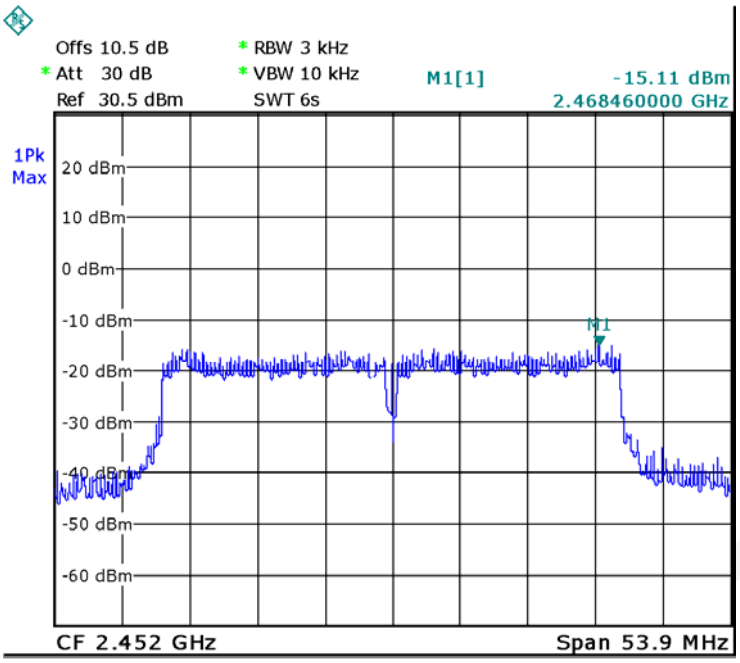
Date: 26.JUN.2017 21:06:41

802.11n-HT40: Middle Channel, Antenna 0



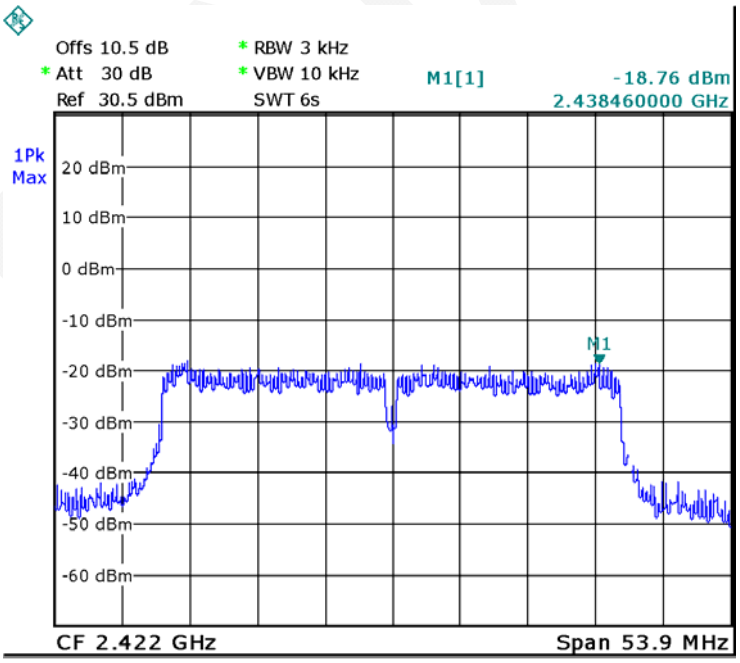
Date: 26.JUN.2017 21:05:27

802.11n-HT40: High Channel, Antenna 0



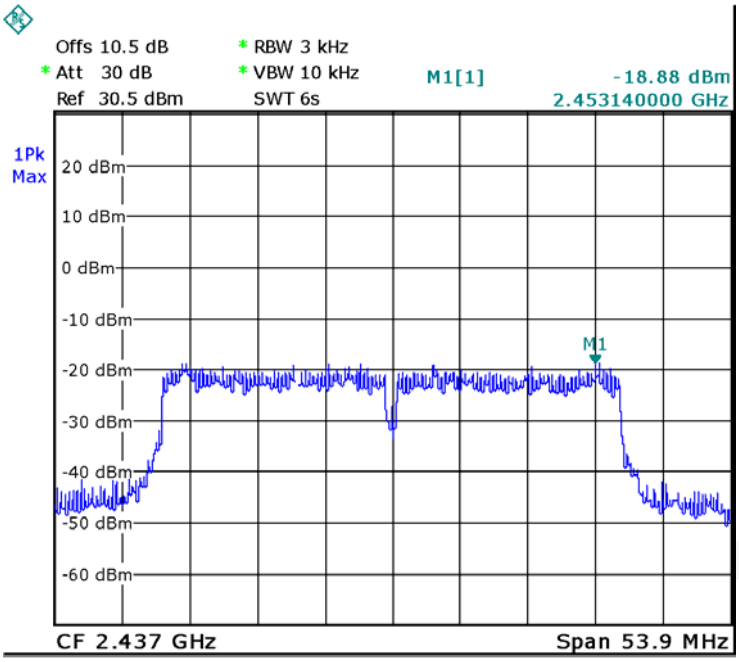
Date: 26.JUN.2017 21:04:42

802.11n-HT40: Low Channel, Antenna 1



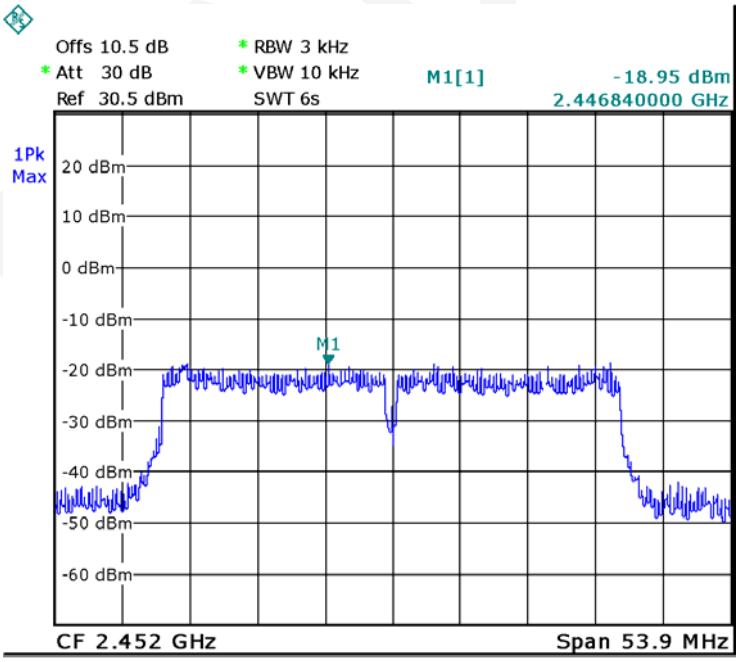
Date: 26.JUN.2017 11:54:43

802.11n-HT40: Middle Channel, Antenna 1



Date: 26.JUN.2017 11:55:41

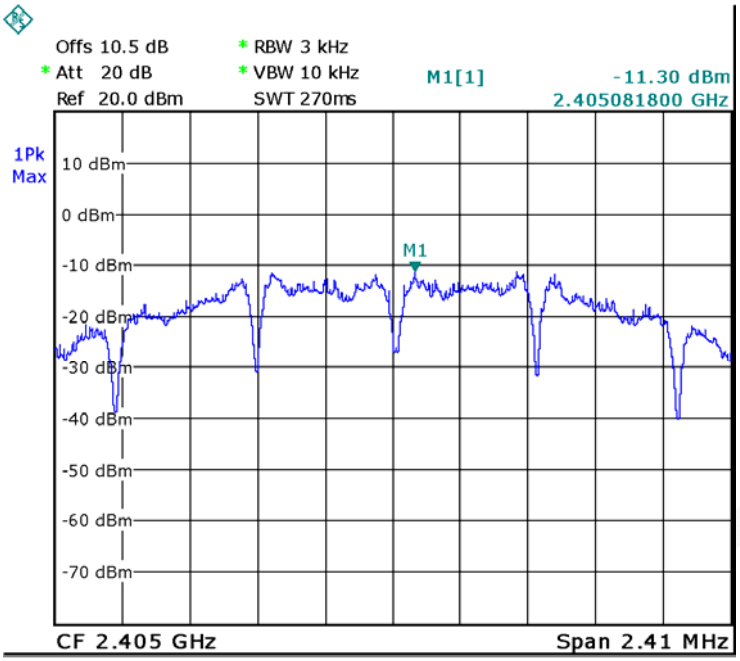
802.11n-HT40: High Channel, Antenna 1



Date: 26.JUN.2017 11:56:37

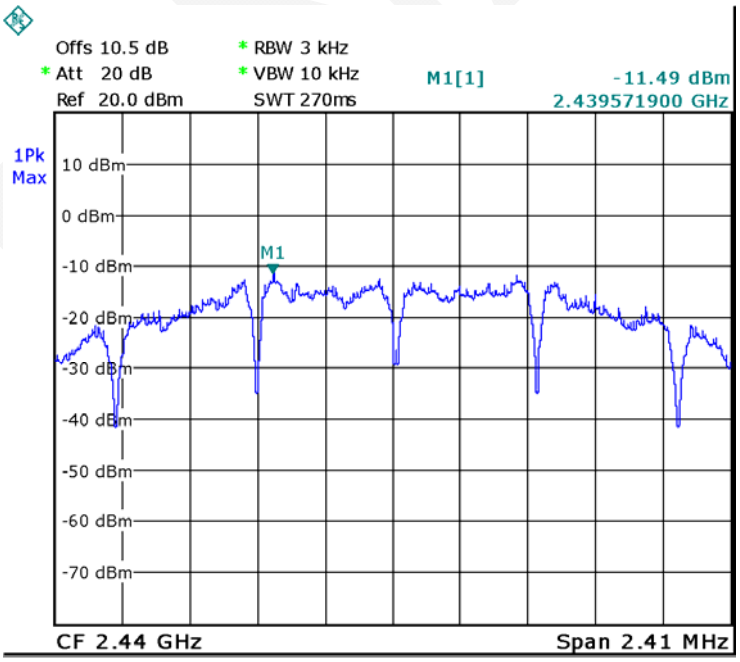
For Zigbee Mode

Low Channel



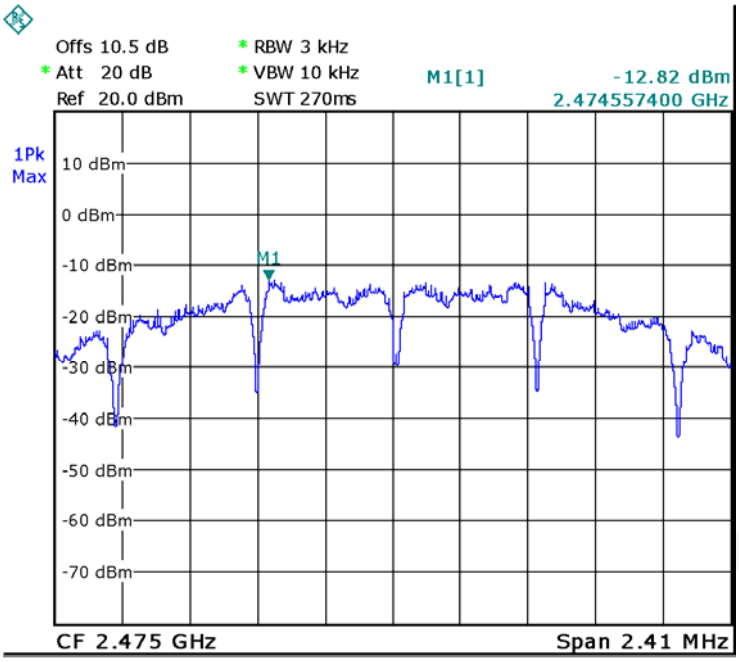
Date: 26.JUN.2017 17:49:06

Middle Channel



Date: 26.JUN.2017 17:58:32

High Channel



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