FCC PART 15.247

TEST REPORT

For

Chengdu XGimi Technology Co., Ltd.

5F, Building A7, Tianfu Software Park, Tianfu Avenue, Hi-tech Zone, Chengdu, China

FCC ID: 2AFENG03V

Report Type: Original Report	**Product Name:** LED Projector

Report Number:	RSC170825002C
Report Date:	2017-10-09
Reviewed By:	Sula Huang EMC Director
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Chengdu) No.5040, Huilongwan Plaza, No. 1, Shawan Road, Jinniu District, Chengdu, Sichuan, China Tel: +86-28-65525123 Fax: +86-28-65525125 www.baclcorp.com

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The **Chengdu XGimi Technology Co., Ltd.**, model number: **G03V (FCC ID: 2AFENG03V)** or the "EUT" as referred to in this report was one **LED Projector**.

Mechanical Description of EUT

The EUT was measured approximately: 138 mm (L) x 135 mm (W) x 119 mm (H).
Rated input voltage: DC10.89V from rechargeable Li-ion battery or DC 17.5V from adapter.

AC/DC Adapter information:
Model: ADP-60HD B
Input: 100-240V AC, 50/60Hz, 1.5A
Output: 17.5V DC, 3.42A

Note: The products, test model: G03V, multiple models: G02V, G04V, G05V, G06V, G07V. Their differences were presented in Product Difference Statement provided by the applicant of this report. So, we selected model G03V to fully test.

**All measurement and test data in this report was gathered from final production sample, serial number: 170825002/02 (assigned by the BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2017-08-11, and EUT conformed to test requirement.*

Objective

This report is prepared on behalf of ***Chengdu XGimi Technology Co., Ltd.*** 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)

FCC Part 15.247 DSS submissions with FCC ID: 2AFENG03V
FCC Part 15.407 NII submissions with FCC ID: 2AFENG03V
FCC Part 15.247 DTS submissions with FCC ID: 2AFENB914C

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-40GHz		5.48 dB
Conducted RF Power			±0.61dB
Power Spectrum Density			±0.61dB
Occupied Bandwidth			±5%
Conducted Emission			±1.5dB
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

BACL(Chengdu) is accredited by A2LA in accordance with the recognized international standard ISO/IEC 17025, A2LA cert No.: 4324.01. The Federal communications commission has on file and is listed under FCC Test Firm Registration No.: 910975.

BACL(Chengdu) 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 in testing mode, which was provided by manufacturer.

For Wi-Fi mode, 802.11b, 802.11g, and 802.11n-HT20 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.

802.11b/g supports SISO, 802.11n supports SISO and MIMO mode. For Radiated Emission, according to pretest, the worst case for 802.11b/g is antenna 1, the worst case for 802.11n is MIMO mode. So 802.11b/g antenna 1 & 802.11n MIMO mode test data were recorded in the report.

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

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

EUT was tested with channel 0, 19 and 39.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

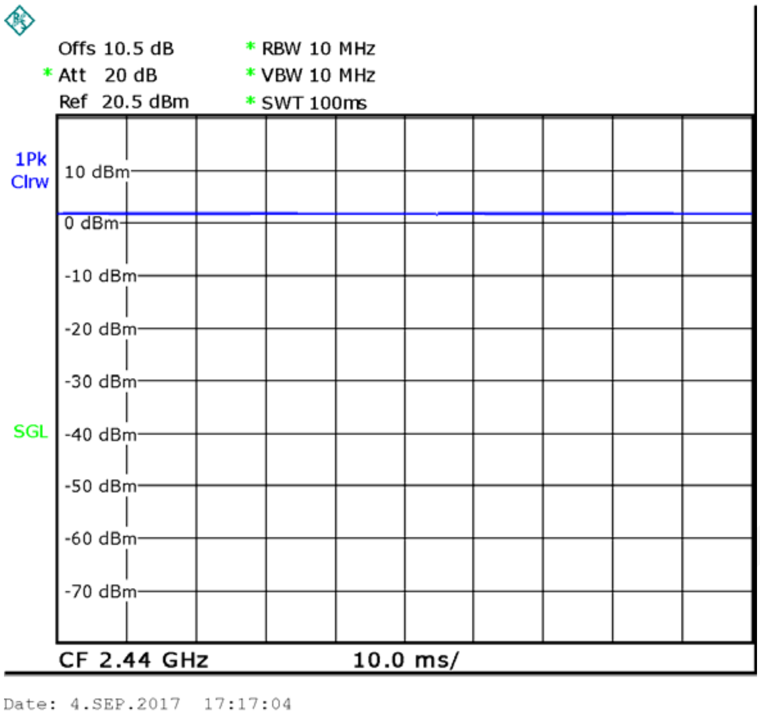
The worst condition (maximum power with maximum duty cycle) was setting by the software as following table:

Test Mode	**Test Software Version**	RF Tool		
802.11b	**Test Frequency**	2412MHz	2437MHz	2462MHz
	Data Rate	CCK 1M	CCK 1M	CCK 1M
	Power Level Setting Antenna 0	Default	Default	Default
	Power Level Setting Antenna 1	Default	Default	Default
802.11g	**Test Frequency**	2412MHz	2437MHz	2462MHz
	Data Rate	OFDM 6M	OFDM 6M	OFDM 6M
	Power Level Setting Antenna 0	Default	Default	Default
	Power Level Setting Antenna 1	Default	Default	Default
802.11n HT20	**Test Frequency**	2412MHz	2437MHz	2462MHz
	Data Rate	MCS0	MCS0	MCS0
	Power Level Setting Antenna 0	Default	Default	Default
	Power Level Setting Antenna 1	Default	Default	Default
BLE	**Test Frequency**	2402MHz	2440MHz	2480MHz
	Data Rate	Default	Default	Default
	Power Level Setting	Default	Default	Default

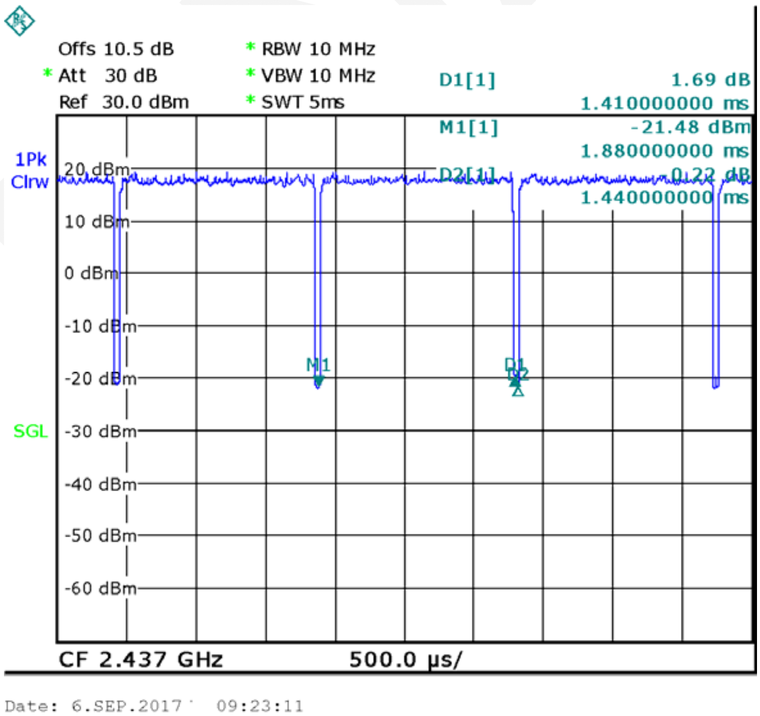
Duty Cycle information is below:

Mode	**T_{on} (ms)**	**T_{on+off} (ms)**	**Duty Cycle (%)**
802.11b	100	100	100
802.11g	1.41	1.44	97.92
802.11n-HT20	1.32	1.35	97.78
BLE	100	100	100

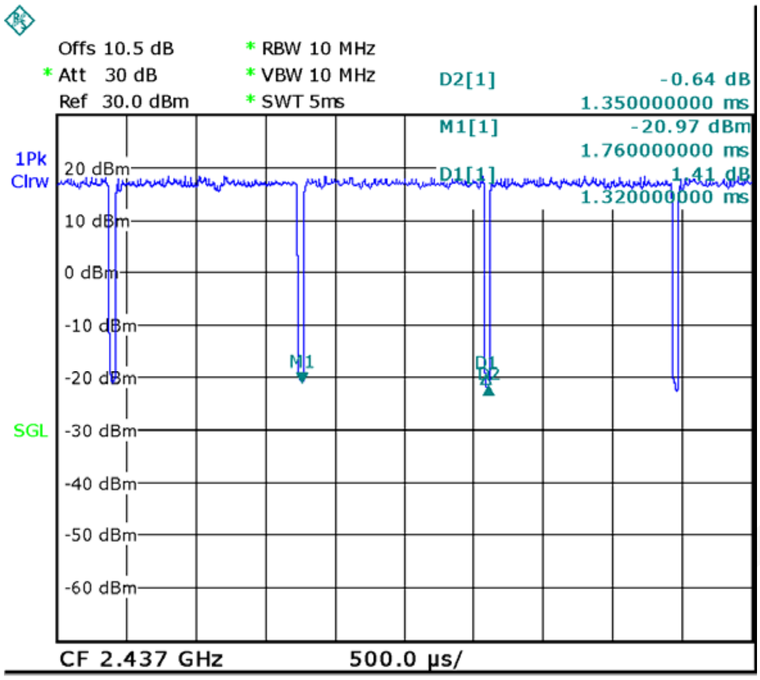
802.11b



802.11g

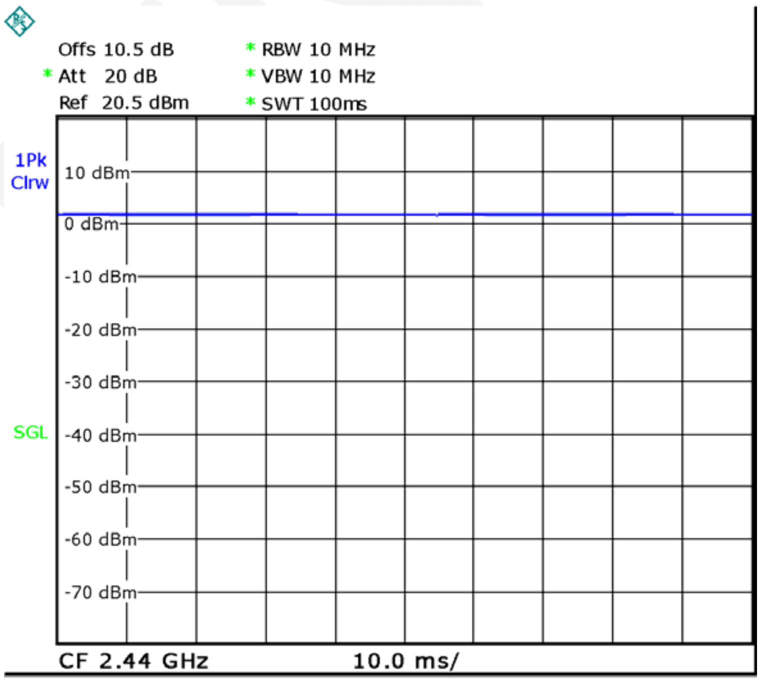


802.11n-HT20



Date: 6.SEP.2017 09:25:49

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



Date: 4.SEP.2017 17:17:04

Support Equipment List and Details

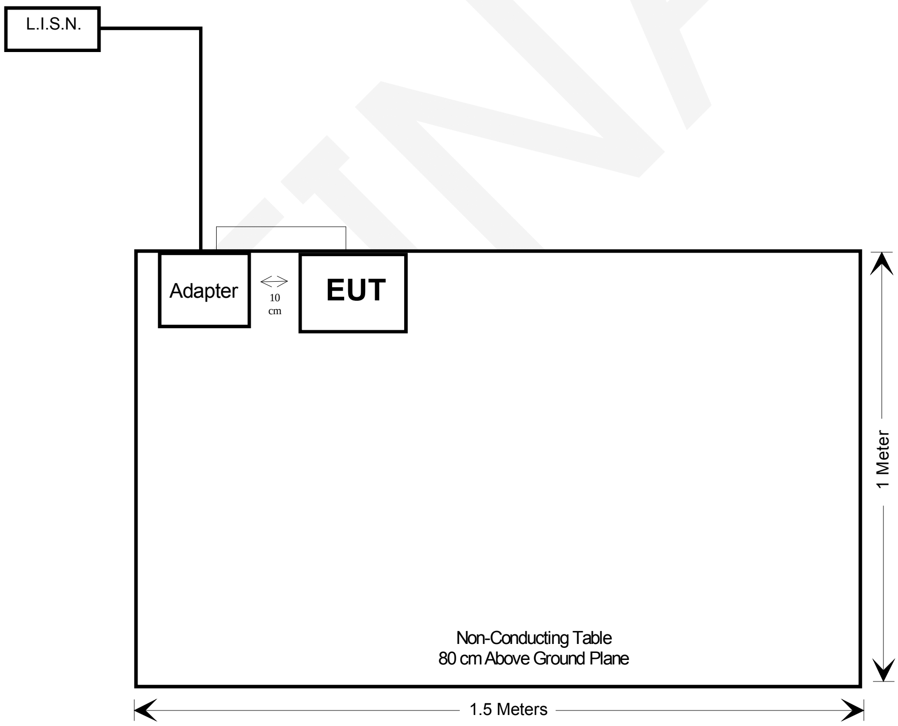
Manufacturer	Description	Model	Serial Number
-	-	-	-

External I/O Cable

Cable Description	Length (m)	From	To
Adapter DC cable	1.70	Adapter	EUT

Block Diagram of Test Setup

AC power line conducted emission test



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
Sinoscite.,Co Ltd	Reject Band Filter	BSF 2402-2480MN	0898-005	2016-11-10	2017-11-09
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
Agilent	USB Wideband Power Sensor	U2021XA	MY53320008	2016-12-02	2017-12-01
WEINSCHEL ENGINEERING	Attenuator	1A10dB	AA4135	2016-11-10	2017-11-09
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
FCC §15.247 & §1.1310 & §2.1091	Maximum Permissible Exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	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 & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247 and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Per 447498 D01 General RF Exposure Guidance v05r02**,** simultaneous transmission MPE test exclusion applies when the sum of the MPE for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0.

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:

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

Calculated Data:

MPE evaluation for single transmission:

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
WLAN	2412-2462	2.81	1.91	25.0	316.23	20	0.120	1.0
	5180-5240	3.66	2.32	15.0	31.62	20	0.015	1.0
	5745-5825	3.66	2.32	15.0	31.62	20	0.015	1.0
Bluetooth	2402-2480	2.55	1.80	5.0	3.16	20	0.001	1.0

Note: Wi-Fi (2.4G) & Bluetooth or Wi-Fi (5G) &Bluetooth can transmit simultaneously.

MPE evaluation for simultaneous transmission:

The MPE evaluation is as below formula:

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

MPE evaluation (Worst case):

Wi-Fi (2.4G) &Bluetooth:

Max MPE of Wi-Fi (2.4G) + Max MPE of Bluetooth = 0.12/1+0.001/1=0.121＜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 used three internal FPC antennas and with I-PEX connector, two of them are for Wi-Fi (2.4GHz/5GHz), the other is for Bluetooth, which were permanently attached, fulfill the requirement of this section. Please refer to the EUT internal photos and the below table for detail.

Antenna Information

Antenna Model Number	Manufacturer	Band	Antenna Gain	Antenna type	Connector
AG-041533-1144 FPC(26mm*25mm)	ZHONGSHAN B&T TECHONOLOGY Co.,Ltd	Wi-Fi 2.4GHz	2.58dBi	Omni-directional	IPEX
		Wi-Fi 5GHz	3.55dBi	Omni-directional	IPEX
AG-041533-1145 FPC(42mm*7mm)	ZHONGSHAN B&T TECHONOLOGY Co.,Ltd	Wi-Fi 2.4GHz	2.81dBi	Omni-directional	IPEX
		Wi-Fi 5GHz	3.66dBi	Omni-directional	IPEX
AG-041300-1146 FPC(21.3mm*20.3mm)	ZHONGSHAN B&T TECHONOLOGY Co.,Ltd	Bluetooth 2.4GHz	2.55dBi	Omni-directional	IPEX

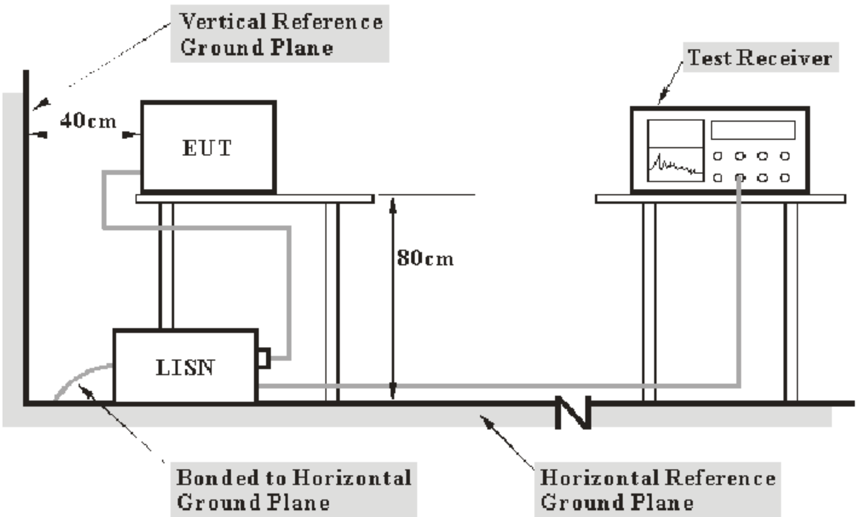
Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

EUT Setup



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

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

The spacing between the peripherals was 10 cm.

The adapter was connected to AC 120V/60Hz.

EMI Test Receiver Setup

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

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

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

Test Procedure

During the conducted emission test, the adapter was connected to the first L.I.S.N.

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

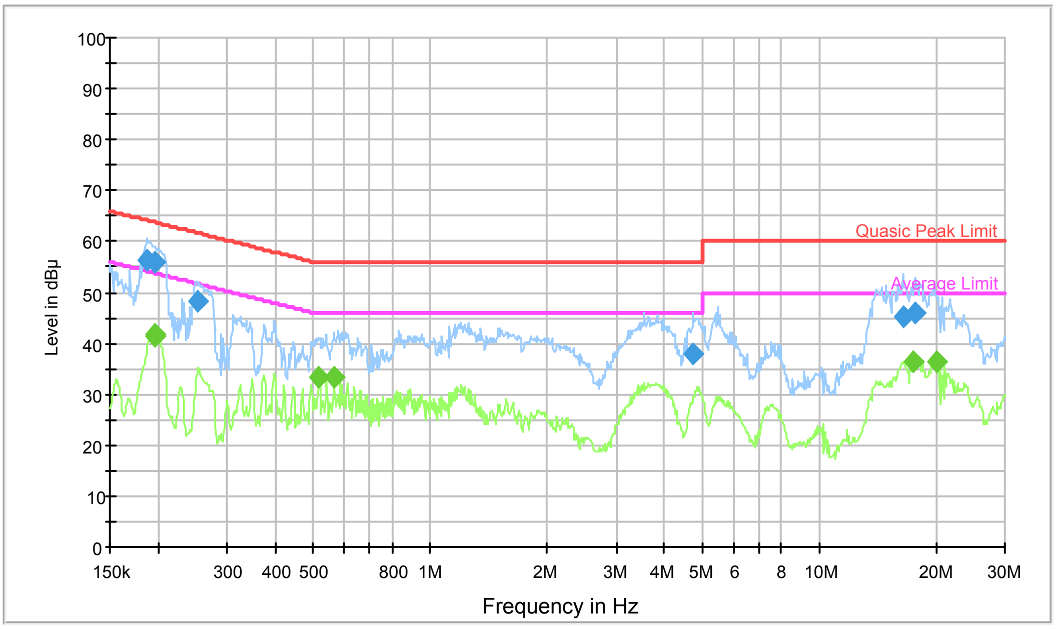
Temperature:	28 °C
Relative Humidity:	50 %
ATM Pressure:	95.5 kPa

The testing was performed by Tom Tang on 2017-09-12.

Test Mode: Transmitting

Wi-Fi Mode

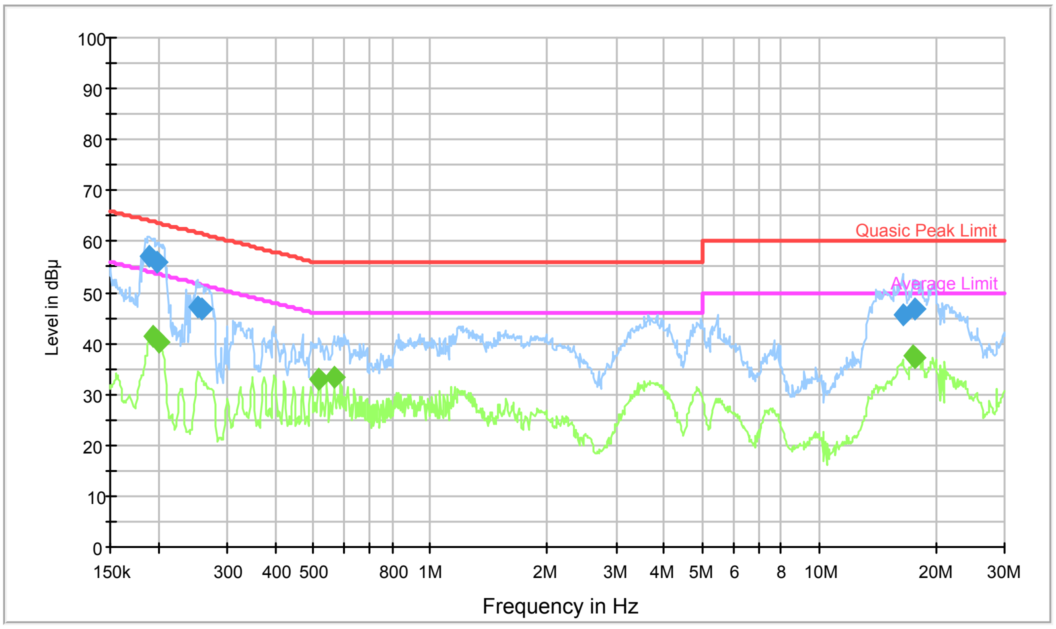
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.186809	56.5	9.000	L1	15.3	7.7	64.2
0.196363	56.1	9.000	L1	15.1	7.7	63.8
0.250724	48.4	9.000	L1	14.5	13.3	61.7
4.731581	37.9	9.000	L1	13.5	18.1	56.0
16.381575	45.3	9.000	L1	14.9	14.7	60.0
17.742412	46.1	9.000	L1	15.0	13.9	60.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.195386	41.6	9.000	L1	15.1	12.2	53.8
0.196363	41.5	9.000	L1	15.1	12.2	53.8
0.516743	33.3	9.000	L1	13.4	12.7	46.0
0.565280	33.4	9.000	L1	13.4	12.6	46.0
17.478915	36.5	9.000	L1	15.0	13.5	50.0
19.998533	36.3	9.000	L1	15.2	13.7	50.0

AC120 V, 60 Hz, Neutral:



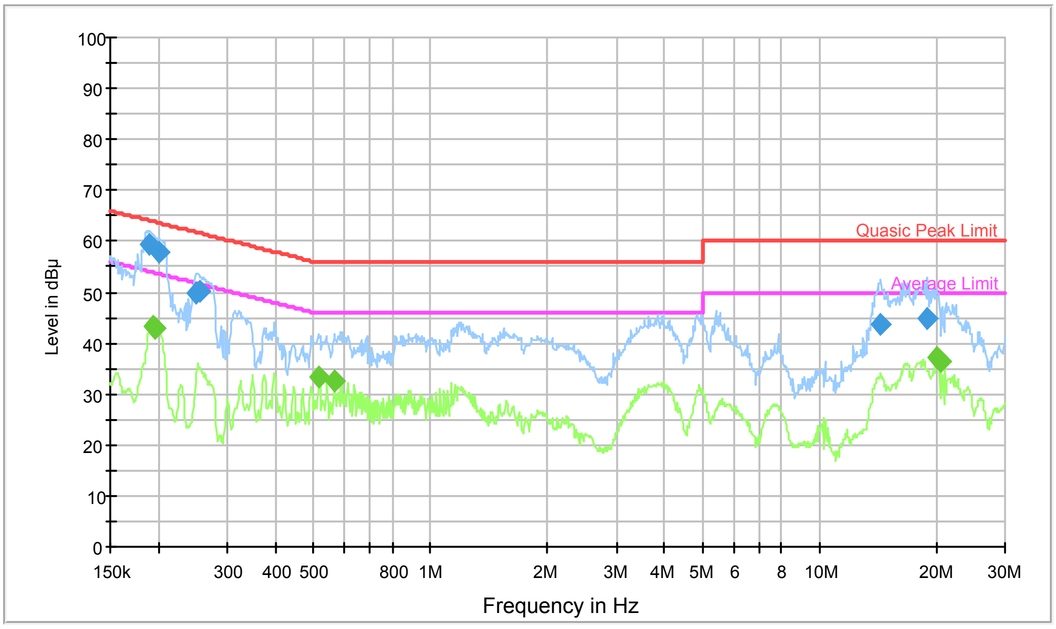
Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.188682	57.1	9.000	N	15.2	7.0	64.1
0.198331	55.8	9.000	N	15.0	7.9	63.7
0.250724	47.3	9.000	N	14.5	14.4	61.7
0.257055	46.8	9.000	N	14.4	14.8	61.5
16.381575	45.5	9.000	N	14.9	14.5	60.0
17.742412	46.7	9.000	N	15.0	13.3	60.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.194414	41.5	9.000	N	15.1	12.4	53.8
0.199323	40.4	9.000	N	15.0	13.3	53.6
0.516743	32.9	9.000	N	13.4	13.1	46.0
0.565280	33.2	9.000	N	13.4	12.8	46.0
17.478915	37.5	9.000	N	15.0	12.5	50.0
17.742412	37.3	9.000	N	15.0	12.7	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

BLE Mode

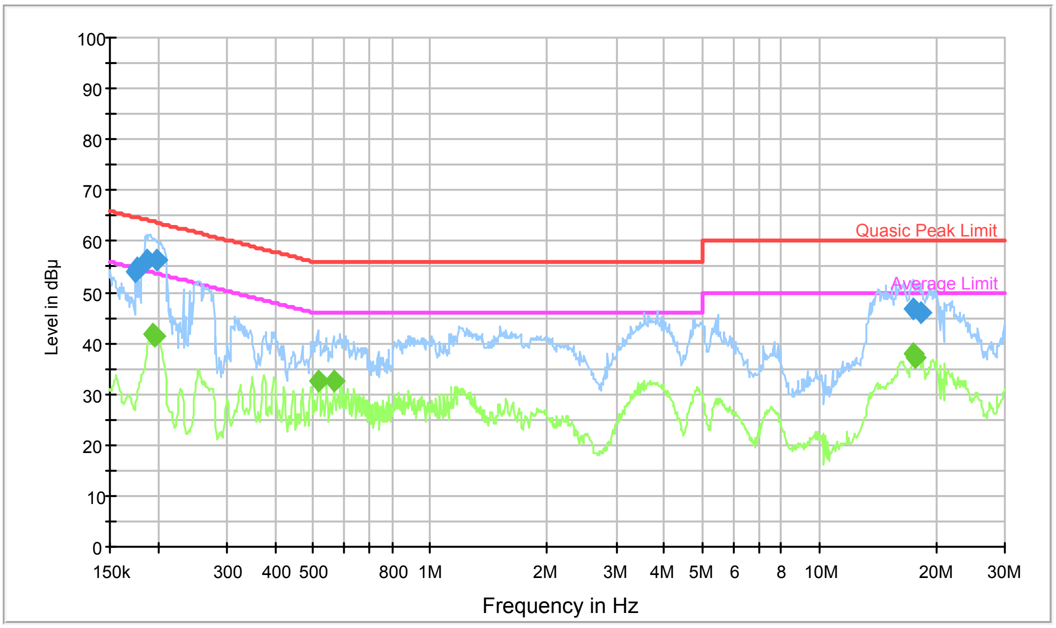
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.188682	59.5	9.000	L1	15.2	4.6	64.1
0.200319	57.8	9.000	L1	15.0	5.8	63.6
0.248235	49.8	9.000	L1	14.5	12.0	61.8
0.255776	50.2	9.000	L1	14.4	11.3	61.6
14.389247	43.6	9.000	L1	14.6	16.4	60.0
18.930908	44.8	9.000	L1	15.1	15.2	60.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.193446	43.3	9.000	L1	15.1	10.6	53.9
0.196363	42.9	9.000	L1	15.1	10.9	53.8
0.516743	33.2	9.000	L1	13.4	12.8	46.0
0.565280	32.7	9.000	L1	13.4	13.3	46.0
19.998533	37.1	9.000	L1	15.2	12.9	50.0
20.503521	36.4	9.000	L1	15.3	13.6	50.0

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.174210	54.1	9.000	N	15.5	10.6	64.8
0.176836	54.6	9.000	N	15.5	10.0	64.6
0.186809	56.5	9.000	N	15.3	7.7	64.2
0.197344	56.2	9.000	N	15.1	7.6	63.7
17.478915	46.8	9.000	N	15.0	13.2	60.0
18.190430	45.8	9.000	N	15.1	14.2	60.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.192484	41.7	9.000	N	15.2	12.2	53.9
0.196363	41.2	9.000	N	15.1	12.5	53.8
0.516743	32.7	9.000	N	13.4	13.3	46.0
0.565280	32.5	9.000	N	13.4	13.5	46.0
17.478915	37.9	9.000	N	15.0	12.1	50.0
17.742412	37.3	9.000	N	15.0	12.7	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

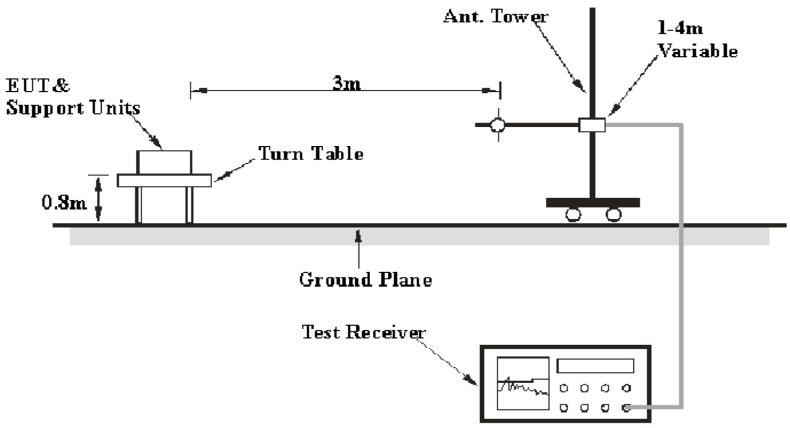
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

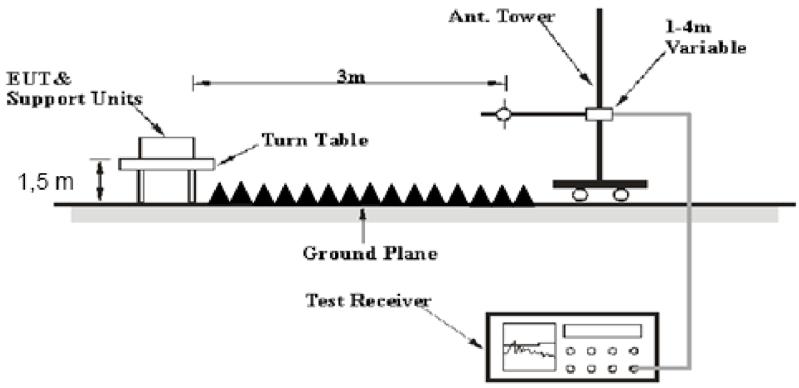
FCC §15.247 (d); §15.209; §15.205;

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 spacing between the peripherals was 10 cm.

The adapter was connected to AC 120V/60Hz.

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	Measurement
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP

Frequency Range	RBW	Video B/W	Duty Cycle	Measurement
Above 1 GHz	1MHz	3 MHz	Any	PK
	1MHz	10Hz	>98%	AV
	1MHz	1/T	<98%	AV

Note: T is Transmission Duration

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Loss and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude = Meter Reading + Antenna Loss + Cable Loss - Amplifier Gain

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

Margin = Limit –Corrected Amplitude

Test Data

Environmental Conditions

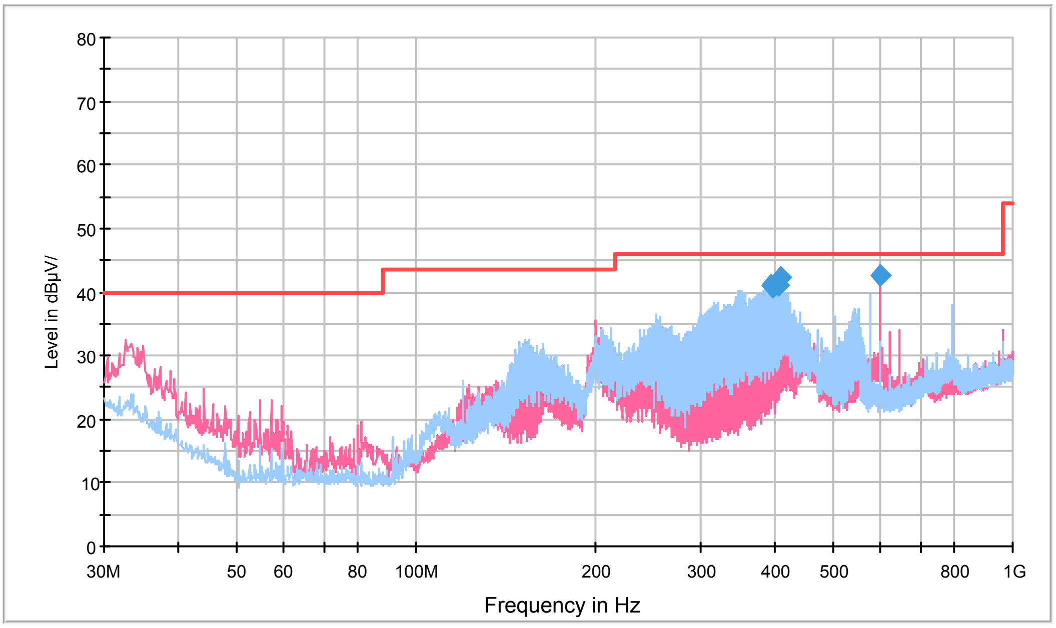
Temperature:	29 °C
Relative Humidity:	55 %
ATM Pressure:	95.5 kPa

** The testing was performed by Tom Tang on 2017-09-12.*

Test Mode: Transmitting

Wi-Fi Mode

30 MHz to 1 GHz



Frequency (MHz)	QuasicPeak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corrected Factor (dB/m)	Margin (dB)	Limit (dBµV/m)
392.416250	40.9	100.0	H	246.0	-9.0	*5.1	46.0
394.962500	40.7	150.0	H	238.0	-9.0	*5.3	46.0
399.691250	41.0	170.0	H	238.0	-8.9	*5.0	46.0
404.420000	41.1	100.0	H	229.0	-8.8	*4.9	46.0
407.936250	42.4	200.0	H	246.0	-8.8	*3.6	46.0
600.117500	42.5	100.0	V	354.0	-4.8	*3.5	46.0

**Within measurement uncertainty!*

Above 1 GHz

802.11b Mode (SISO)

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Measurement	Polar	Factor					
MHz	dBμV	PK/AV	H/V	(dB/m)	dB	dB	dBμV/m	dBμV/m	dB
frequency: 2412MHz									
2412	78.62	PK	H	28.74	3.00	0.00	110.36	N/A	N/A
2412	74.13	AV	H	28.74	3.00	0.00	105.87	N/A	N/A
2412	68.27	PK	V	28.74	3.00	0.00	100.01	N/A	N/A
2412	63.86	AV	V	28.74	3.00	0.00	95.60	N/A	N/A
2390	32.87	PK	H	28.67	3.00	0.00	64.54	74.00	9.46
2390	19.89	AV	H	28.67	3.00	0.00	51.56	54.00	*2.44
4824	39.91	PK	H	33.91	5.11	26.87	52.06	74.00	21.94
4824	34.69	AV	H	33.91	5.11	26.87	46.84	54.00	7.16
7236	33.09	PK	H	36.43	6.18	26.36	49.34	74.00	24.66
7236	19.51	AV	H	36.43	6.18	26.36	35.76	54.00	18.24
frequency: 2437MHz									
2437	77.84	PK	H	28.81	3.00	0.00	109.65	N/A	N/A
2437	73.43	AV	H	28.81	3.00	0.00	105.24	N/A	N/A
2437	67.93	PK	V	28.81	3.00	0.00	99.74	N/A	N/A
2437	63.50	AV	V	28.81	3.00	0.00	95.31	N/A	N/A
4874	40.09	PK	H	34.05	5.09	26.87	52.36	74.00	21.64
4874	35.04	AV	H	34.05	5.09	26.87	47.31	54.00	6.69
7311	33.05	PK	H	36.54	6.21	26.40	49.40	74.00	24.60
7311	20.79	AV	H	36.54	6.21	26.40	37.14	54.00	16.86
frequency: 2462MHz									
2462	77.12	PK	H	28.89	2.99	0.00	109.00	N/A	N/A
2462	72.94	AV	H	28.89	2.99	0.00	104.82	N/A	N/A
2462	68.02	PK	V	28.89	2.99	0.00	99.90	N/A	N/A
2462	63.58	AV	V	28.89	2.99	0.00	95.46	N/A	N/A
2483.5	31.86	PK	H	28.95	2.99	0.00	63.80	74.00	10.20
2483.5	19.17	AV	H	28.95	2.99	0.00	51.11	54.00	*2.89
4924	40.66	PK	H	34.19	5.07	26.88	53.04	74.00	20.96
4924	35.92	AV	H	34.19	5.07	26.88	48.30	54.00	5.70
7386	33.48	PK	H	36.64	6.25	26.43	49.94	74.00	24.06
7386	22.26	AV	H	36.64	6.25	26.43	38.72	54.00	15.28

**Within measurement uncertainty!*

802.11g Mode (SISO)

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Measurement	Polar	Factor					
MHz	dBμV	PK/AV	H/V	(dB/m)	dB	dB	dBμV/m	dBμV/m	dB
frequency: 2412MHz									
2412	78.76	PK	H	28.74	3.00	0.00	110.50	N/A	N/A
2412	68.77	AV	H	28.74	3.00	0.00	100.51	N/A	N/A
2412	66.58	PK	V	28.74	3.00	0.00	98.32	N/A	N/A
2412	56.52	AV	V	28.74	3.00	0.00	88.26	N/A	N/A
2390	36.86	PK	H	28.67	3.00	0.00	68.53	74.00	5.47
2390	20.09	AV	H	28.67	3.00	0.00	51.76	54.00	*2.24
4824	36.14	PK	H	33.91	5.11	26.87	48.29	74.00	25.71
4824	22.26	AV	H	33.91	5.11	26.87	34.41	54.00	19.59
7236	32.01	PK	H	36.43	6.18	26.36	48.26	74.00	25.74
7236	15.67	AV	H	36.43	6.18	26.36	31.92	54.00	22.08
frequency: 2437MHz									
2437	78.18	PK	H	28.81	3.00	0.00	109.99	N/A	N/A
2437	67.94	AV	H	28.81	3.00	0.00	99.75	N/A	N/A
2437	67.19	PK	V	28.81	3.00	0.00	99.00	N/A	N/A
2437	57.21	AV	V	28.81	3.00	0.00	89.02	N/A	N/A
4874	36.89	PK	H	34.05	5.09	26.87	49.16	74.00	24.84
4874	22.73	AV	H	34.05	5.09	26.87	35.00	54.00	19.00
7311	32.30	PK	H	36.54	6.21	26.40	48.65	74.00	25.35
7311	16.73	AV	H	36.54	6.21	26.40	33.08	54.00	20.92
frequency: 2462MHz									
2462	77.62	PK	H	28.89	2.99	0.00	109.50	N/A	N/A
2462	67.49	AV	H	28.89	2.99	0.00	99.37	N/A	N/A
2462	68.17	PK	V	28.89	2.99	0.00	100.05	N/A	N/A
2462	58.10	AV	V	28.89	2.99	0.00	89.98	N/A	N/A
2483.5	33.01	PK	H	28.95	2.99	0.00	64.95	74.00	9.05
2483.5	19.51	AV	H	28.95	2.99	0.00	51.45	54.00	*2.55
4924	37.76	PK	H	34.19	5.07	26.88	50.14	74.00	23.86
4924	23.71	AV	H	34.19	5.07	26.88	36.09	54.00	17.91
7386	32.77	PK	H	36.64	6.25	26.43	49.23	74.00	24.77
7386	18.34	AV	H	36.64	6.25	26.43	34.80	54.00	19.20

**Within measurement uncertainty!*

802.11n-HT20 Mode (MIMO)

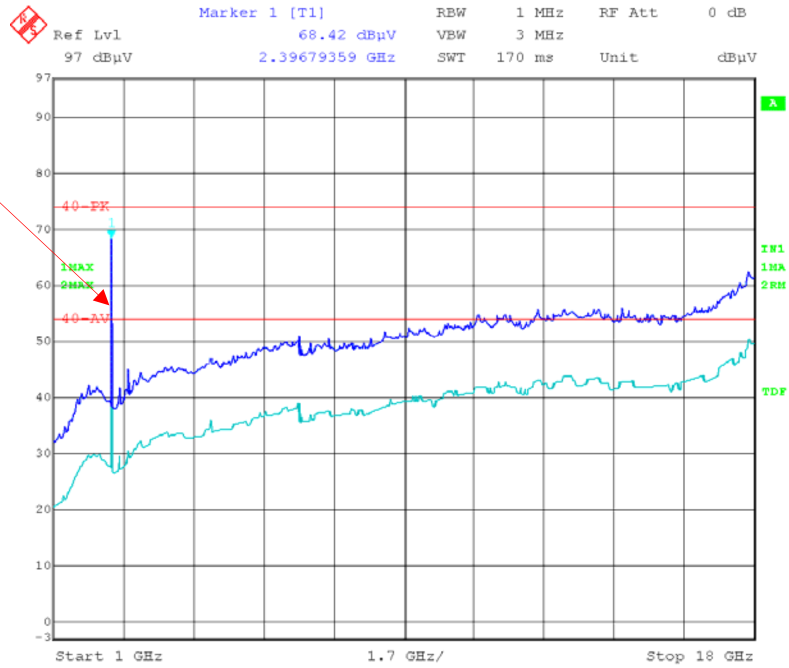
Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Measurement	Polar	Factor					
MHz	dBμV	PK/AV	H/V	(dB/m)	dB	dB	dBμV/m	dBμV/m	dB
frequency: 2412MHz									
2412	79.54	PK	H	28.74	3.00	0.00	111.28	N/A	N/A
2412	68.36	AV	H	28.74	3.00	0.00	100.10	N/A	N/A
2412	66.95	PK	V	28.74	3.00	0.00	98.69	N/A	N/A
2412	56.35	AV	V	28.74	3.00	0.00	88.09	N/A	N/A
2390	38.89	PK	H	28.67	3.00	0.00	70.56	74.00	*3.44
2390	21.08	AV	H	28.67	3.00	0.00	52.75	54.00	*1.25
4824	38.21	PK	H	33.91	5.11	26.87	50.36	74.00	23.64
4824	22.26	AV	H	33.91	5.11	26.87	34.41	54.00	19.59
7236	32.41	PK	H	36.43	6.18	26.36	48.66	74.00	25.34
7236	17.23	AV	H	36.43	6.18	26.36	33.48	54.00	20.52
frequency: 2437MHz									
2437	79.58	PK	H	28.81	3.00	0.00	111.39	N/A	N/A
2437	67.81	AV	H	28.81	3.00	0.00	99.62	N/A	N/A
2437	71.09	PK	V	28.81	3.00	0.00	102.90	N/A	N/A
2437	57.43	AV	V	28.81	3.00	0.00	89.24	N/A	N/A
4874	37.70	PK	H	34.05	5.09	26.87	49.97	74.00	24.03
4874	22.28	AV	H	34.05	5.09	26.87	34.55	54.00	19.45
7311	33.01	PK	H	36.54	6.21	26.40	49.36	74.00	24.64
7311	18.03	AV	H	36.54	6.21	26.40	34.38	54.00	19.62
frequency: 2462MHz									
2462	79.22	PK	H	28.89	2.99	0.00	111.10	N/A	N/A
2462	67.12	AV	H	28.89	2.99	0.00	99.00	N/A	N/A
2462	74.71	PK	V	28.89	2.99	0.00	106.59	N/A	N/A
2462	57.97	AV	V	28.89	2.99	0.00	89.85	N/A	N/A
2483.5	34.47	PK	H	28.95	2.99	0.00	66.41	74.00	7.59
2483.5	19.82	AV	H	28.95	2.99	0.00	51.76	54.00	*2.24
4924	36.99	PK	H	34.19	5.07	26.88	49.37	74.00	24.63
4924	22.26	AV	H	34.19	5.07	26.88	34.64	54.00	19.36
7386	33.57	PK	H	36.64	6.25	26.43	50.03	74.00	23.97
7386	18.34	AV	H	36.64	6.25	26.43	34.80	54.00	19.20

**Within measurement uncertainty!*

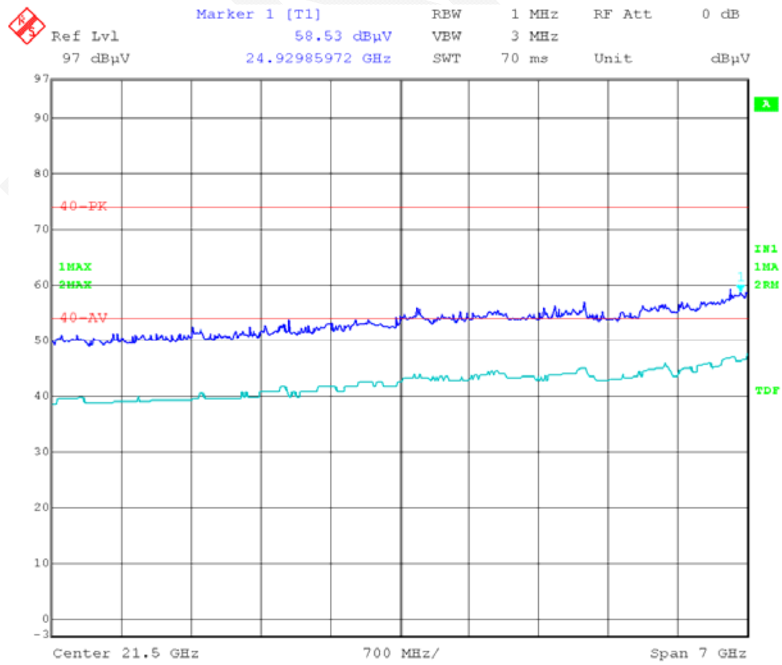
Please refer to the below pre-scan plot of worst case:

802.11b Mode: Low Channel_Horizontal_1GHz-18GHz

Fundamental with Reject Band Filter

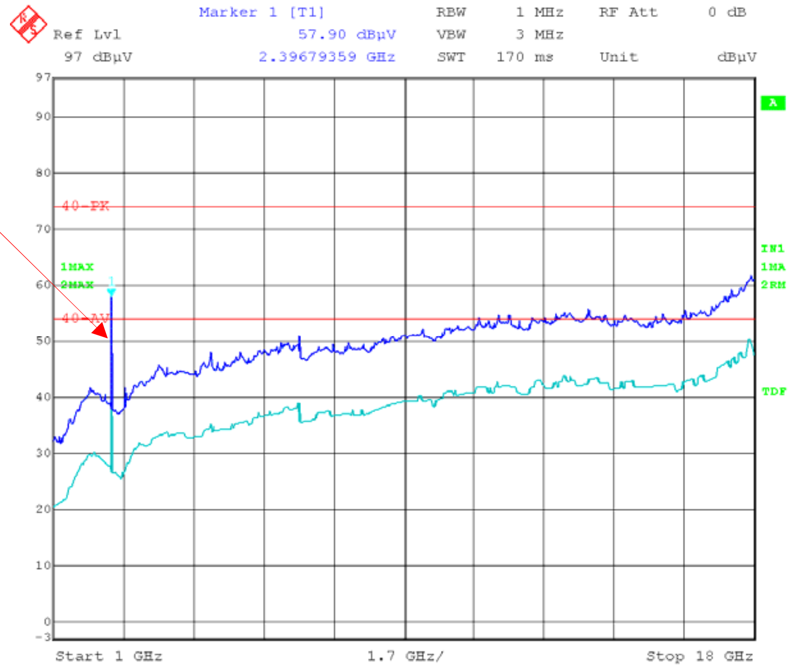


802.11b Mode: Low Channel_Horizontal_18GHz-25GHz

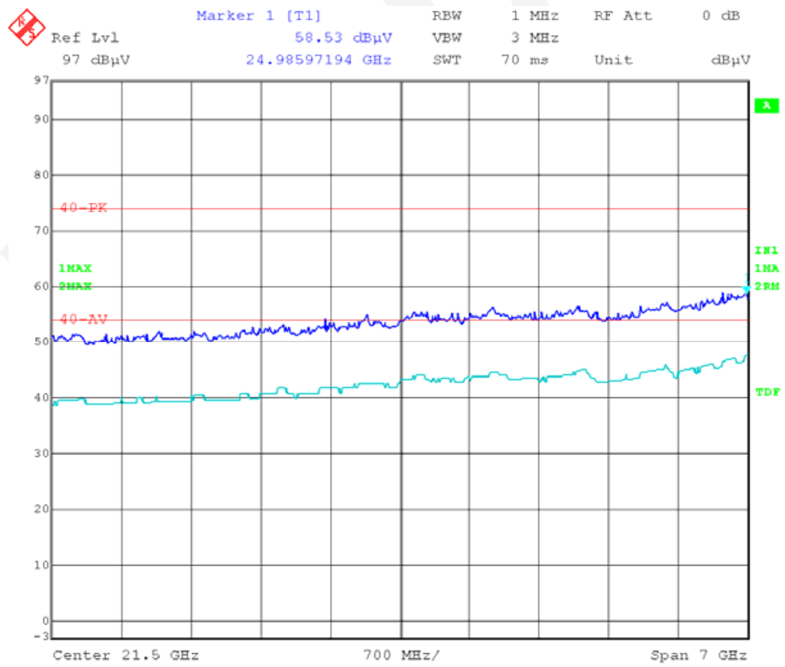


802.11b Mode: Low Channel_Vertical_1GHz-18GHz

Fundamental with Reject Band Filter

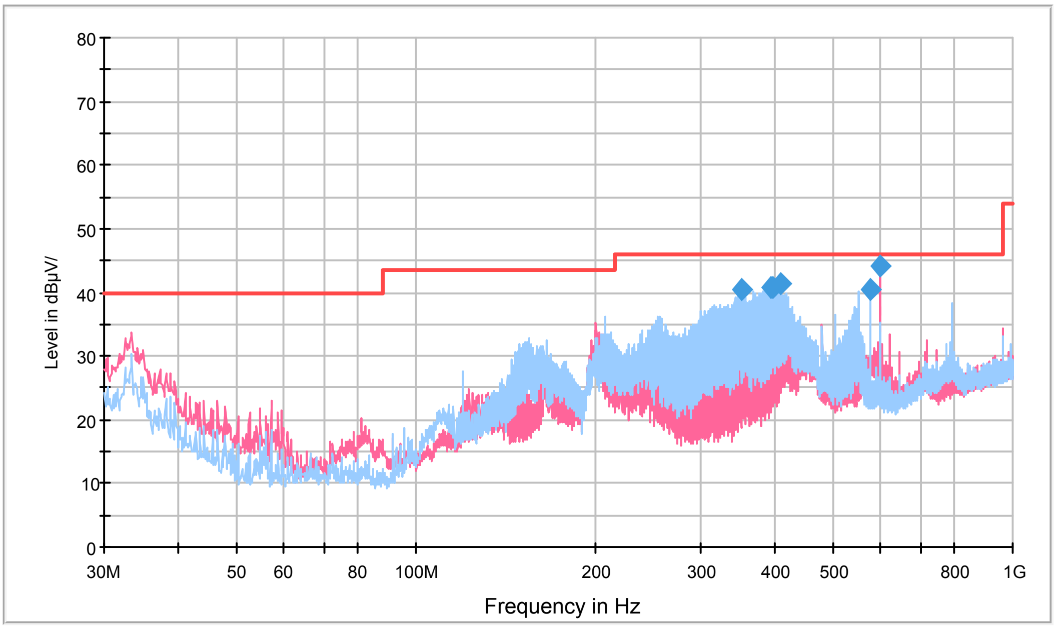


802.11b Mode: Low Channel_Vertical_18GHz-25GHz



BLE Mode

30 MHz to 1 GHz



Frequency (MHz)	QuasicPeak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corrected Factor (dB/m))	Margin (dB)	Limit (dBµV/m)
351.918750	40.6	100.0	H	230.0	-9.9	*5.4	46.0
393.750000	40.7	100.0	H	238.0	-9.0	*5.3	46.0
394.841250	40.8	150.0	H	238.0	-9.0	*5.2	46.0
408.057500	41.2	100.0	H	264.0	-8.8	*4.8	46.0
575.988750	40.5	175.0	H	13.0	-5.3	*5.5	46.0
599.996250	44.0	100.0	V	0.0	-4.9	*3.0	46.0

**Within measurement uncertainty!*

Above 1 GHz

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Measurement	Polar	Factor					
MHz	dBμV	PK/AV	H/V	(dB/m)	dB	dB	dBμV/m	dBμV/m	dB
frequency: 2402MHz									
2402	63.42	PK	H	28.71	3.00	0.00	95.13	N/A	N/A
2402	58.52	AV	H	28.71	3.00	0.00	90.23	N/A	N/A
2402	59.76	PK	V	28.71	3.00	0.00	91.47	N/A	N/A
2402	55.53	AV	V	28.71	3.00	0.00	87.24	N/A	N/A
2390	29.89	PK	H	28.67	3.00	0.00	61.56	74.00	12.44
2390	16.32	AV	H	28.67	3.00	0.00	47.99	54.00	6.01
4804	36.30	PK	H	33.85	5.12	26.87	48.40	74.00	25.60
4804	19.46	AV	H	33.85	5.12	26.87	31.56	54.00	22.44
7206	32.37	PK	H	36.39	6.16	26.35	48.57	74.00	25.43
7206	18.40	AV	H	36.39	6.16	26.35	34.60	54.00	19.40
frequency: 2440MHz									
2440	66.07	PK	H	28.82	3.00	0.00	97.89	N/A	N/A
2440	60.89	AV	H	28.82	3.00	0.00	92.71	N/A	N/A
2440	57.60	PK	V	28.82	3.00	0.00	89.42	N/A	N/A
2440	53.08	AV	V	28.82	3.00	0.00	84.90	N/A	N/A
4880	35.86	PK	H	34.06	5.09	26.87	48.14	74.00	25.86
4880	20.26	AV	H	34.06	5.09	26.87	32.54	54.00	21.46
7320	32.84	PK	H	36.55	6.22	26.40	49.21	74.00	24.79
7320	20.18	AV	H	36.55	6.22	26.40	36.55	54.00	17.45
frequency: 2480MHz									
2480	64.51	PK	H	28.94	2.99	0.00	96.44	N/A	N/A
2480	59.78	AV	H	28.94	2.99	0.00	91.71	N/A	N/A
2480	58.61	PK	V	28.94	2.99	0.00	90.54	N/A	N/A
2480	53.35	AV	V	28.94	2.99	0.00	85.28	N/A	N/A
2483.5	32.69	PK	H	28.95	2.99	0.00	64.63	74.00	9.37
2483.5	18.67	AV	H	28.95	2.99	0.00	50.61	54.00	*3.39
4960	35.49	PK	H	34.29	5.05	26.88	47.95	74.00	26.05
4960	20.89	AV	H	34.29	5.05	26.88	33.35	54.00	20.65
7440	32.67	PK	H	36.72	6.27	26.45	49.21	74.00	24.79
7440	19.47	AV	H	36.72	6.27	26.45	36.01	54.00	17.99

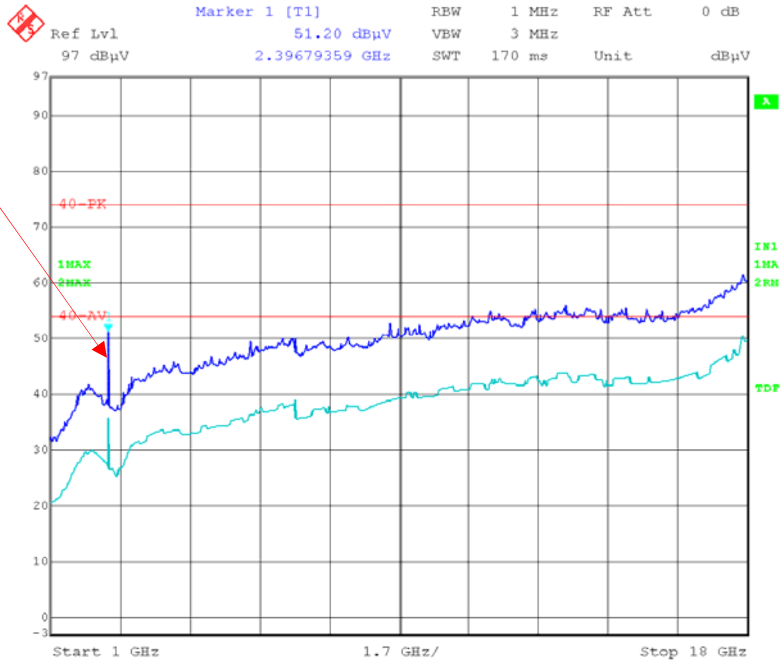
**Within measurement uncertainty!*

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.

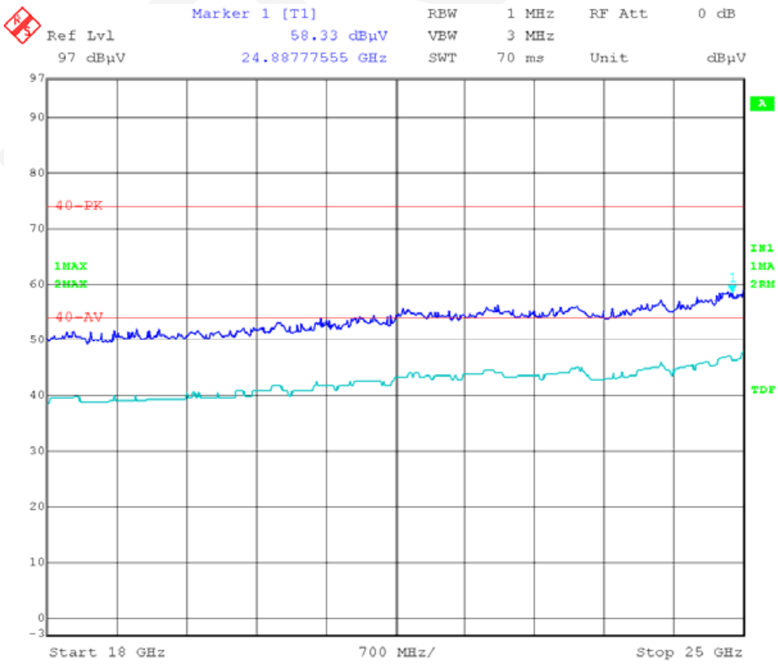
Please refer to the below pre-scan plot of worst case:

Low Channel_Horizontal_1GHz-18GHz

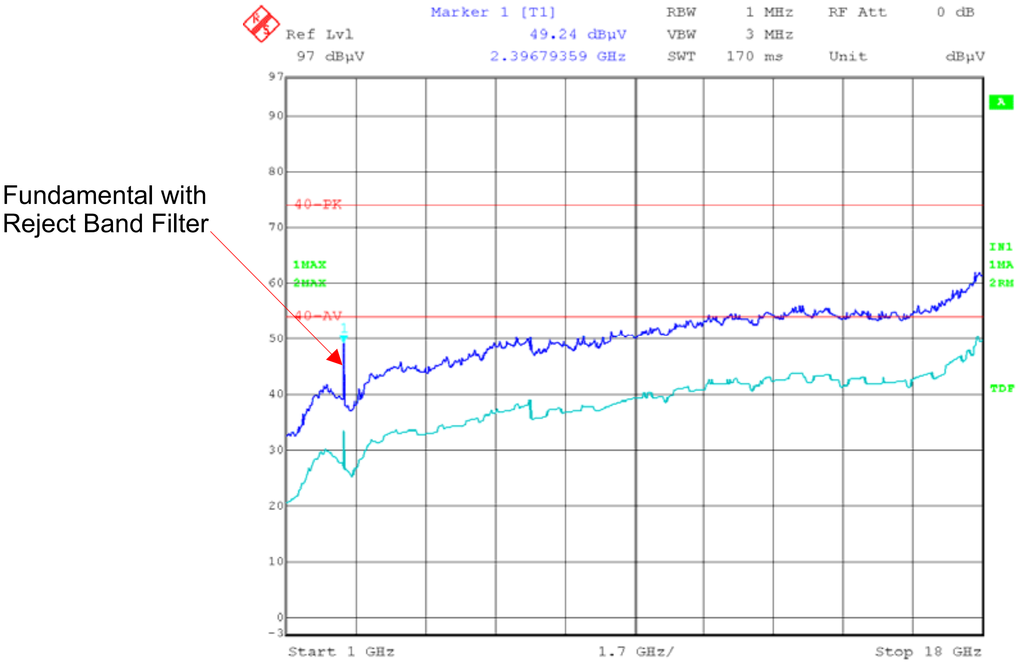
Fundamental with Reject Band Filter



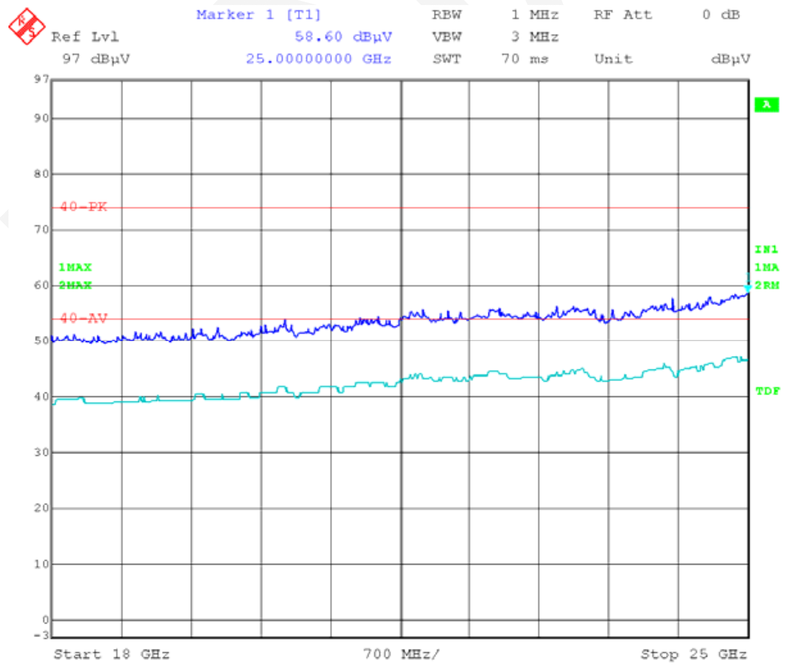
Low Channel_Horizontal_18GHz-25GHz



Low Channel_Vertical_1GHz-18GHz



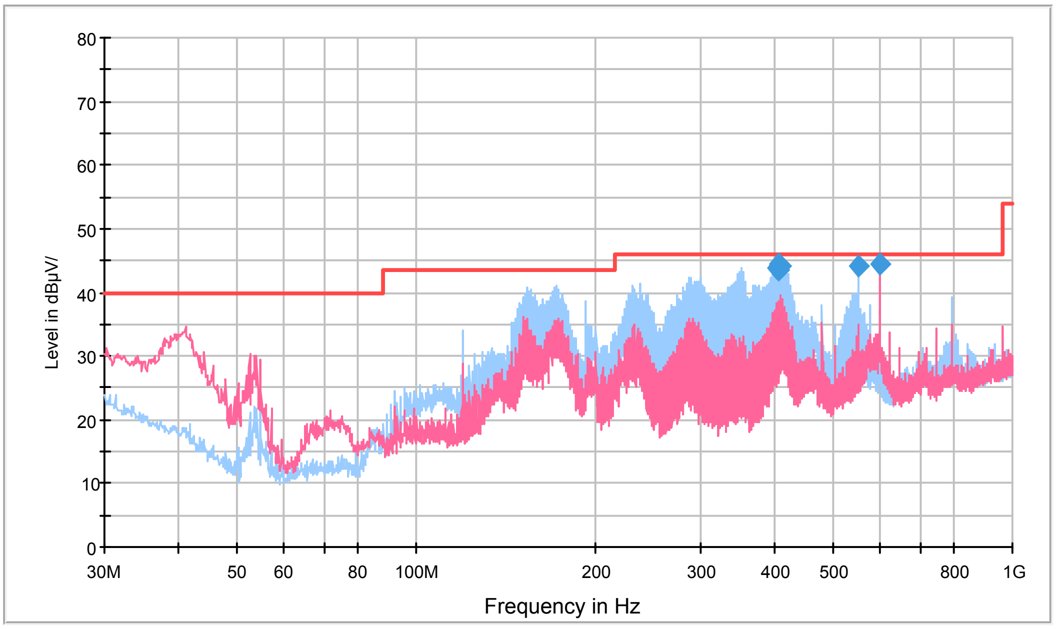
Low Channel_Vertical_18GHz-25GHz



Co-location evaluation data

2.4 GHz Wi-Fi & Bluetooth work simultaneously (Worst Case).

30 MHz to 1 GHz



Frequency (MHz)	QuasicPeak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corrected Factor (dB/m)	Margin (dB)	Limit (dBµV/m)
403.450000	43.8	100.0	H	255.0	-8.9	*2.2	46.0
404.420000	43.5	165.0	H	248.0	-8.8	*2.5	46.0
405.753750	44.5	100.0	H	255.0	-8.8	*1.5	46.0
408.057500	44.2	200.0	H	248.0	-8.8	*1.8	46.0
552.102500	44.0	150.0	H	3.0	-5.7	*2.0	46.0
599.996250	44.3	100.0	V	0.0	-4.9	*1.7	46.0

**Within measurement uncertainty*

Above 1 GHz

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Measurement	Polar	Factor					
MHz	dBμV	PK/AV	H/V	(dB/m)	dB	dB	dBμV/m	dBμV/m	dB
1343.00	56.55	PK	V	24.62	2.45	26.48	57.14	74.00	16.86
1343.00	32.92	AV	V	24.62	2.45	26.48	33.51	54.00	20.49
1750.00	49.40	PK	V	26.25	2.86	26.58	51.93	74.00	22.07
1750.00	30.27	AV	V	26.25	2.86	26.58	32.80	54.00	21.20
2110.00	44.48	PK	V	27.83	3.04	26.84	48.51	74.00	25.49
2110.00	31.32	AV	V	27.83	3.04	26.84	35.35	54.00	18.65
1343.00	55.62	PK	H	24.62	2.45	26.48	56.21	74.00	17.79
1343.00	34.64	AV	H	24.62	2.45	26.48	35.23	54.00	18.77
1820.00	45.04	PK	H	26.60	2.91	26.64	47.91	74.00	26.09
1820.00	24.47	AV	H	26.60	2.91	26.64	27.34	54.00	26.66
2206.00	42.92	PK	H	28.12	3.03	26.85	47.22	74.00	26.78
2206.00	28.12	AV	H	28.12	3.03	26.85	32.42	54.00	21.58

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.

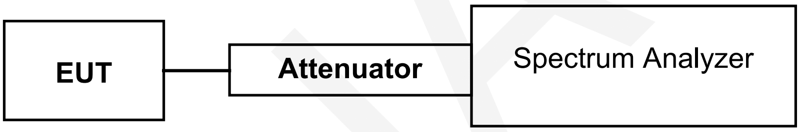
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

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:	26 ~ 27 °C
Relative Humidity:	58 ~ 62 %
ATM Pressure:	95.3 ~ 95.5 kPa

** The testing was performed by Tom Tang on 2017-09-04 & 2017-09-06.*

Test Mode: Transmitting

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

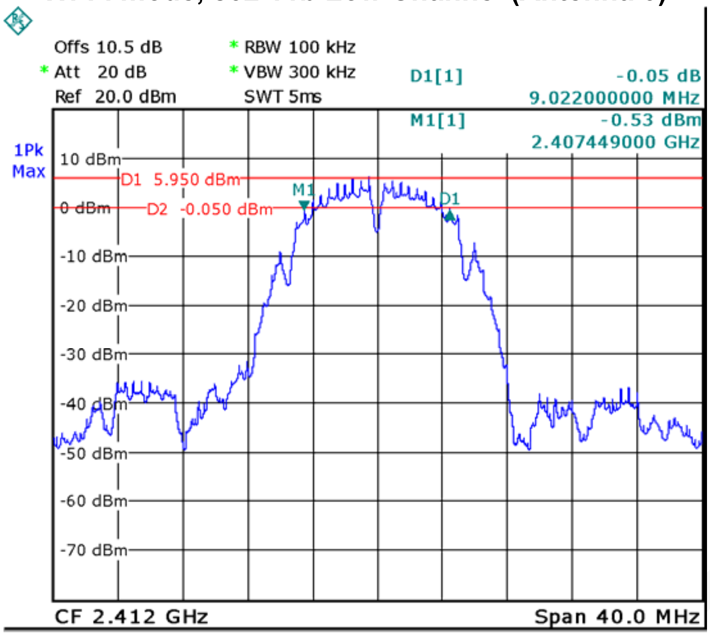
Wi-Fi mode

Mode	Channel	Frequency (MHz)	6dB OBW (MHz)		Limit (MHz)
			Antenna 0	Antenna 1	
802.11b	Low	2412	9.02	9.02	≥0.50
	Middle	2437	9.02	9.02	≥0.50
	High	2462	9.02	9.02	≥0.50
802.11g	Low	2412	16.37	16.37	≥0.50
	Middle	2437	16.37	16.37	≥0.50
	High	2462	16.37	16.37	≥0.50
802.11n HT20	Low	2412	17.65	17.65	≥0.50
	Middle	2437	17.65	17.65	≥0.50
	High	2462	17.65	17.65	≥0.50

BLE mode

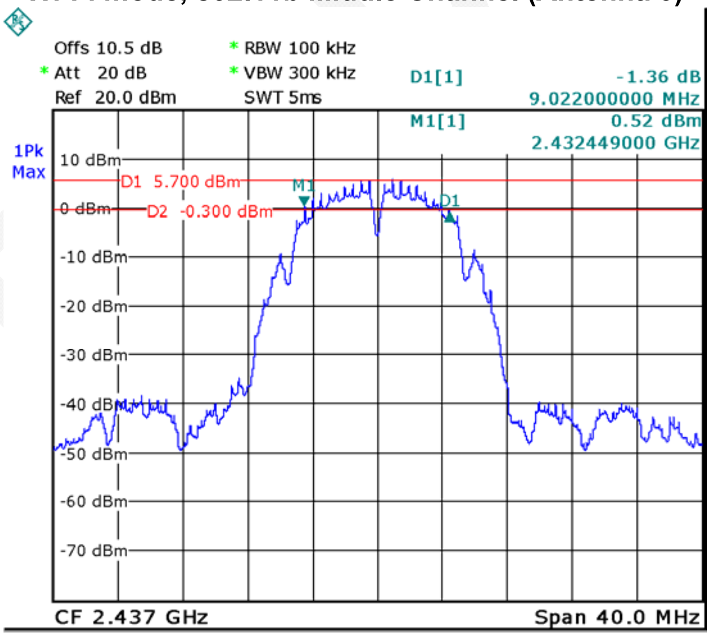
Mode	Channel	Frequency (MHz)	6dB OBW (MHz)	Limit (MHz)
BLE	Low	2402	0.72	≥0.50
	Middle	2440	0.72	≥0.50
	High	2480	0.71	≥0.50

Wi-Fi mode, 802.11b Low Channel (Antenna 0)



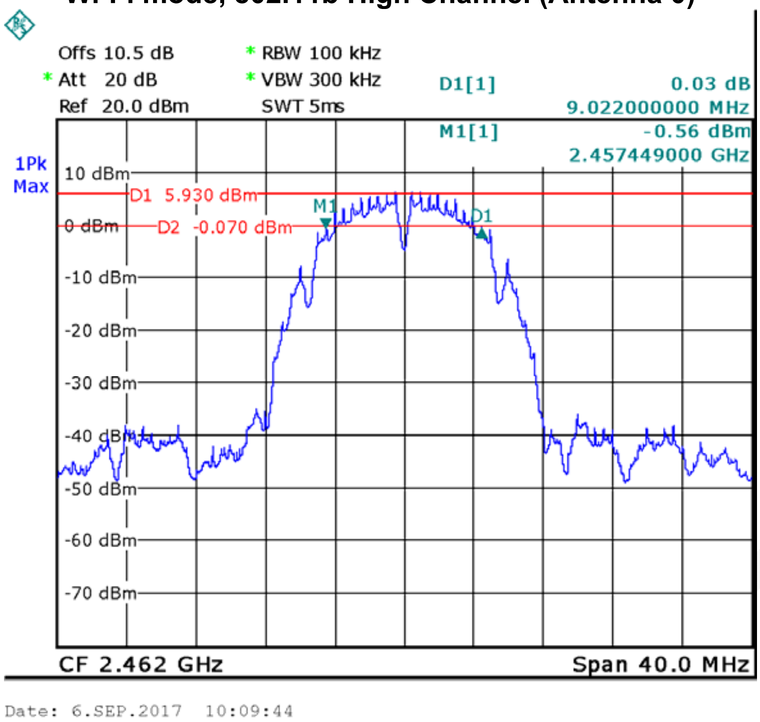
Date: 6.SEP.2017 10:07:23

Wi-Fi mode, 802.11b Middle Channel (Antenna 0)

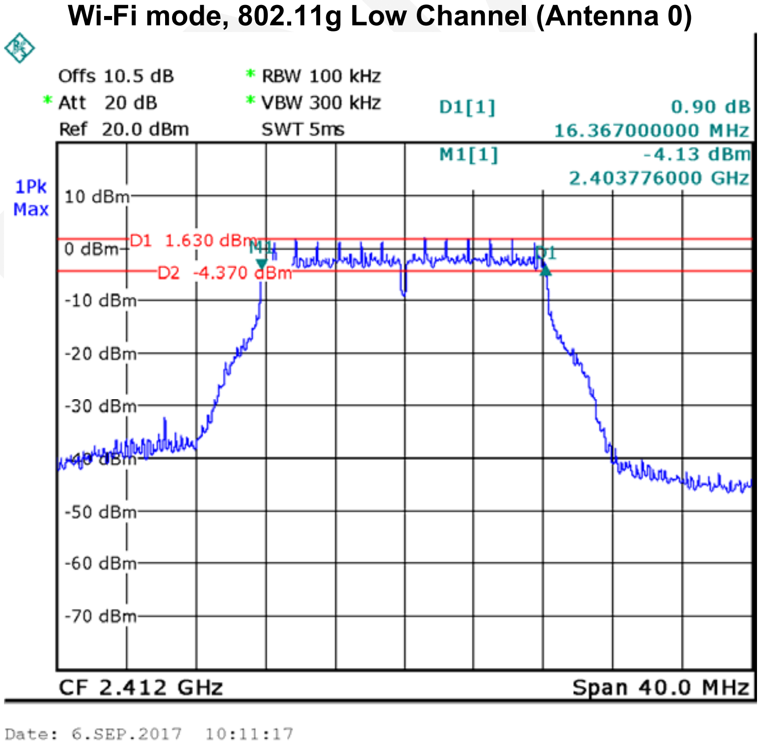


Date: 6.SEP.2017 10:08:38

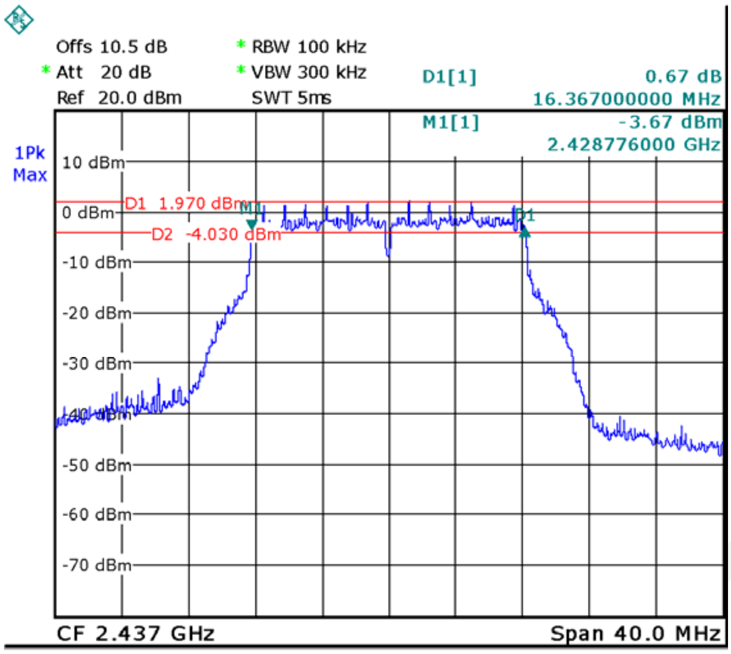
Wi-Fi mode, 802.11b High Channel (Antenna 0)



Wi-Fi mode, 802.11g Low Channel (Antenna 0)

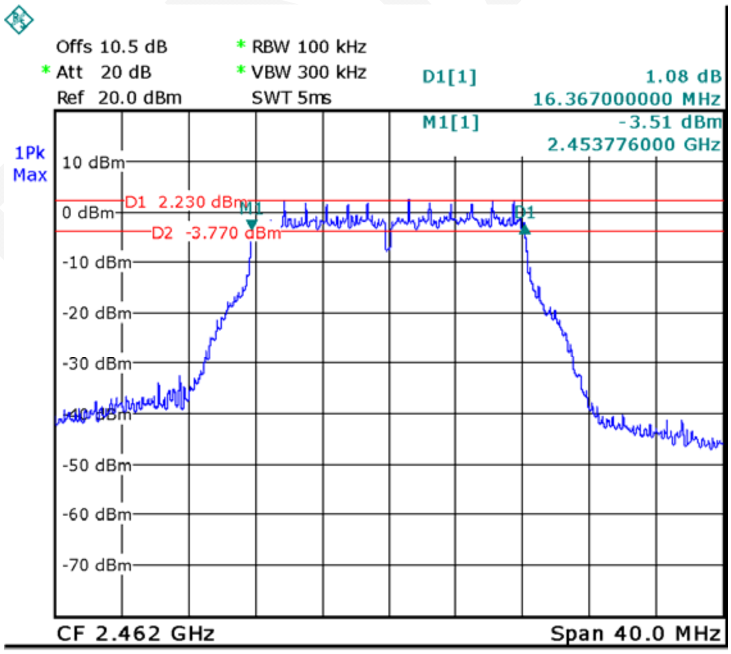


Wi-Fi mode, 802.11g Middle Channel (Antenna 0)



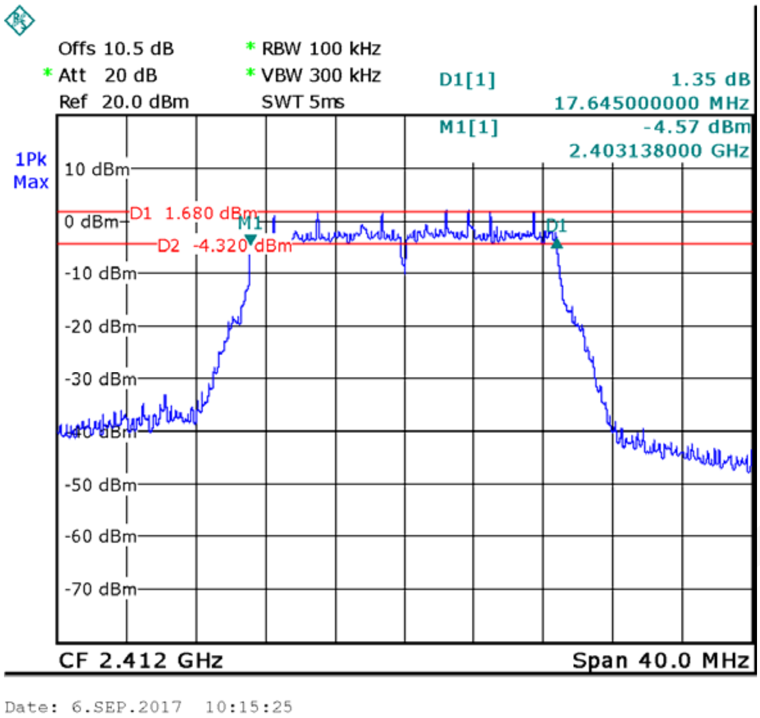
Date: 6.SEP.2017 10:12:37

Wi-Fi mode, 802.11g High Channel (Antenna 0)

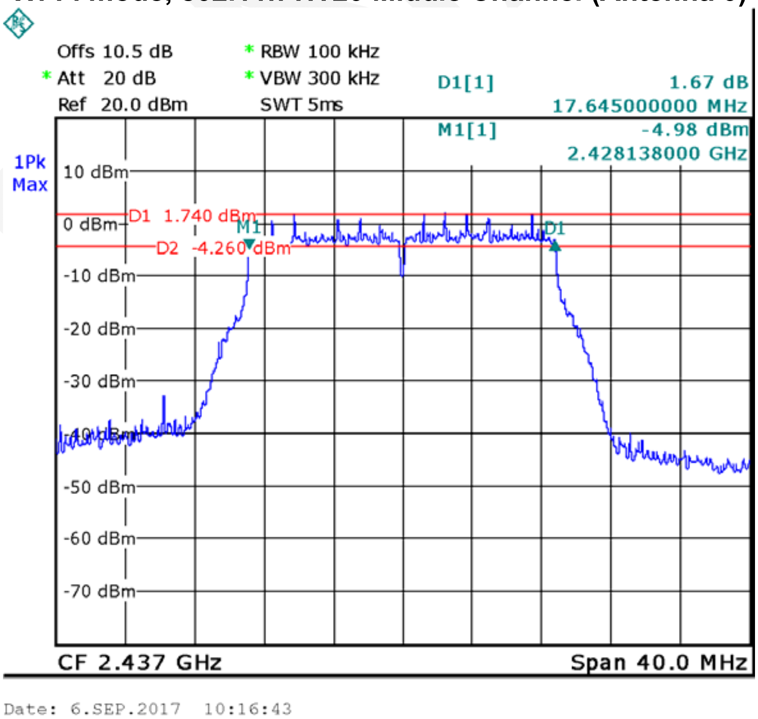


Date: 6.SEP.2017 10:13:58

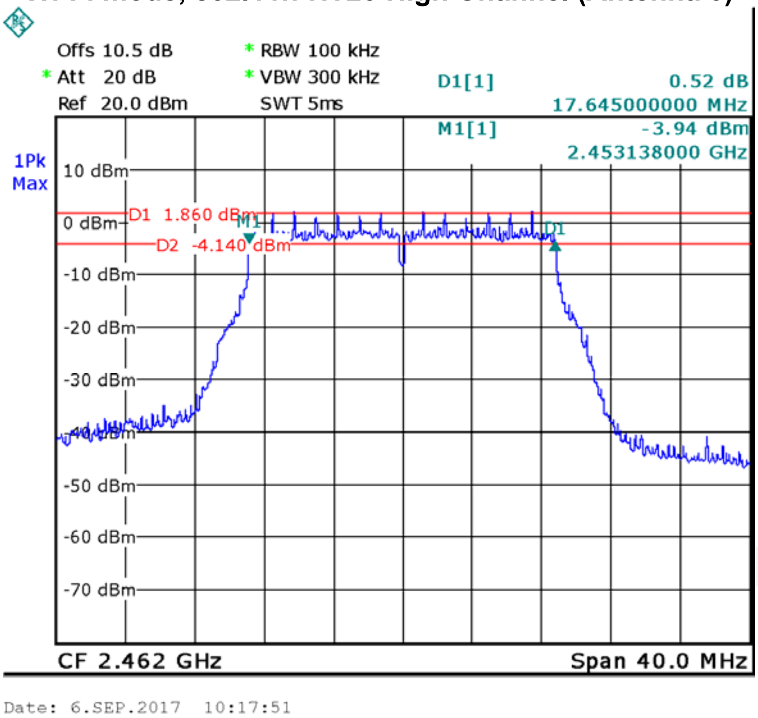
Wi-Fi mode, 802.11n-HT20 Low Channel (Antenna 0)



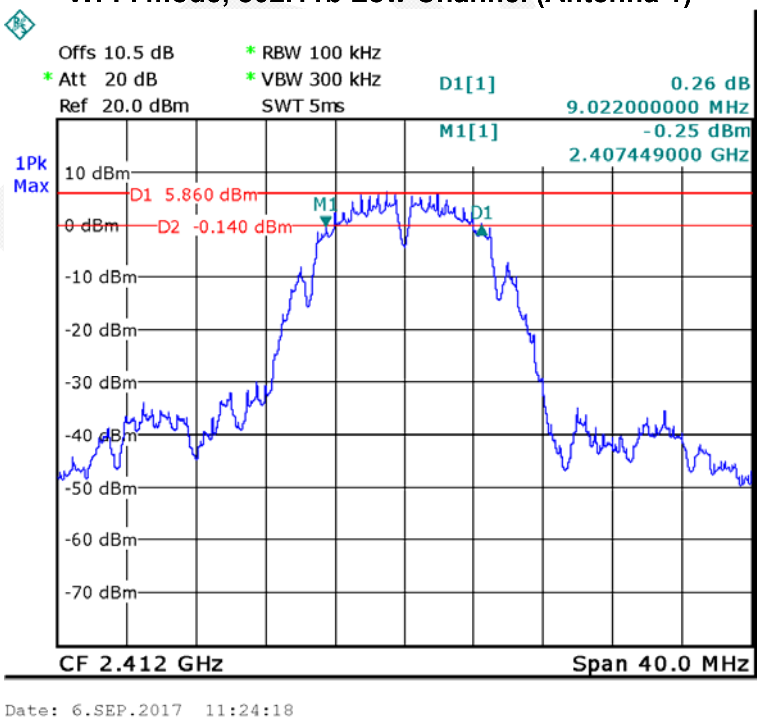
Wi-Fi mode, 802.11n-HT20 Middle Channel (Antenna 0)



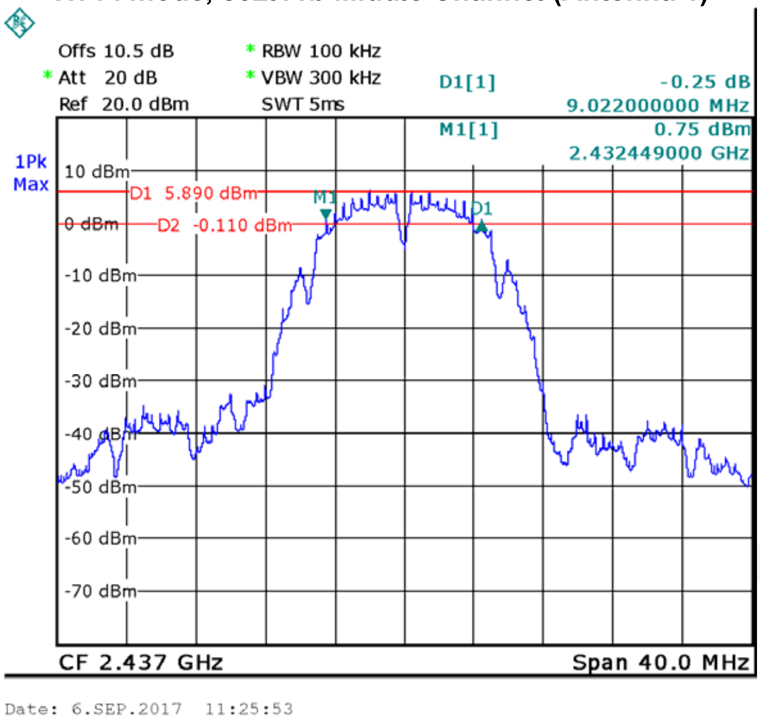
Wi-Fi mode, 802.11n-HT20 High Channel (Antenna 0)



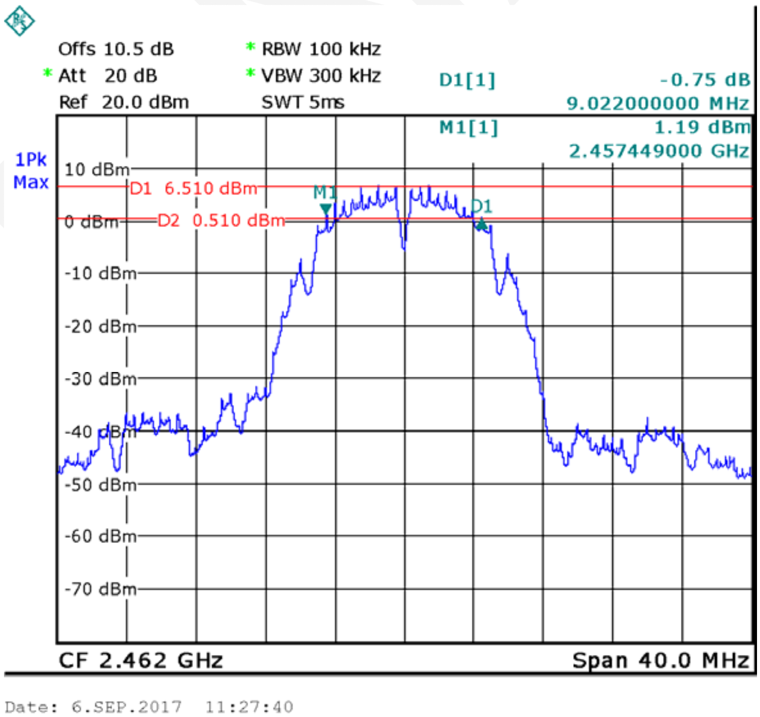
Wi-Fi mode, 802.11b Low Channel (Antenna 1)



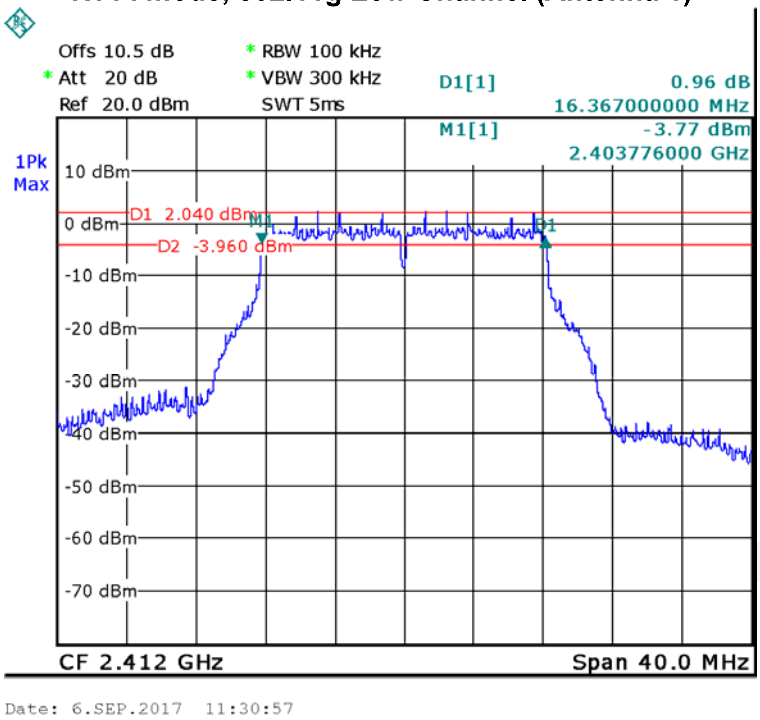
Wi-Fi mode, 802.11b Middle Channel (Antenna 1)



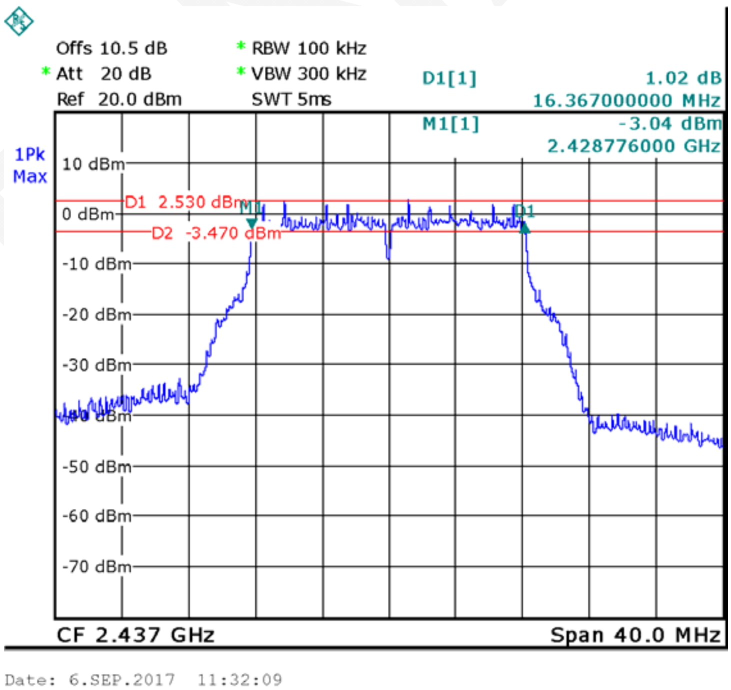
Wi-Fi mode, 802.11b High Channel (Antenna 1)



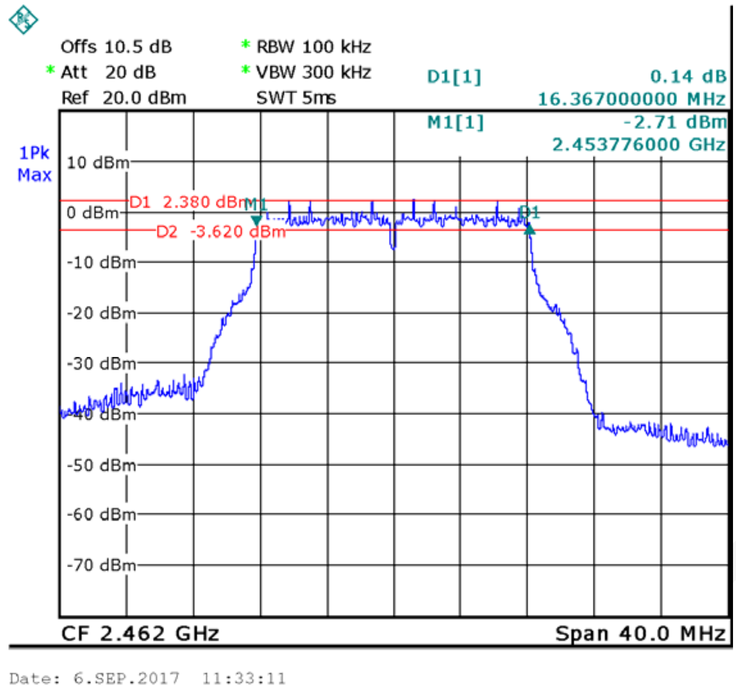
Wi-Fi mode, 802.11g Low Channel (Antenna 1)



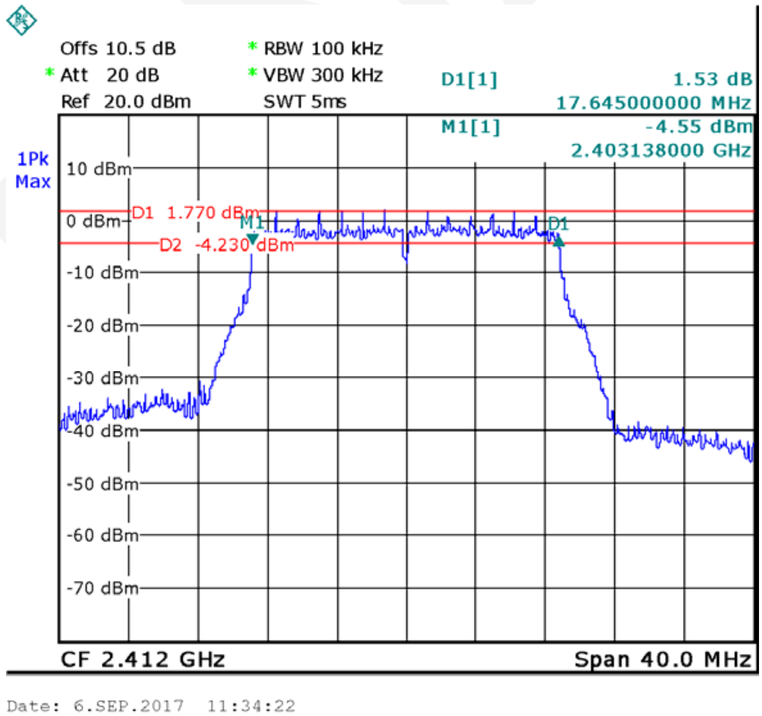
Wi-Fi mode, 802.11g Middle Channel (Antenna 1)



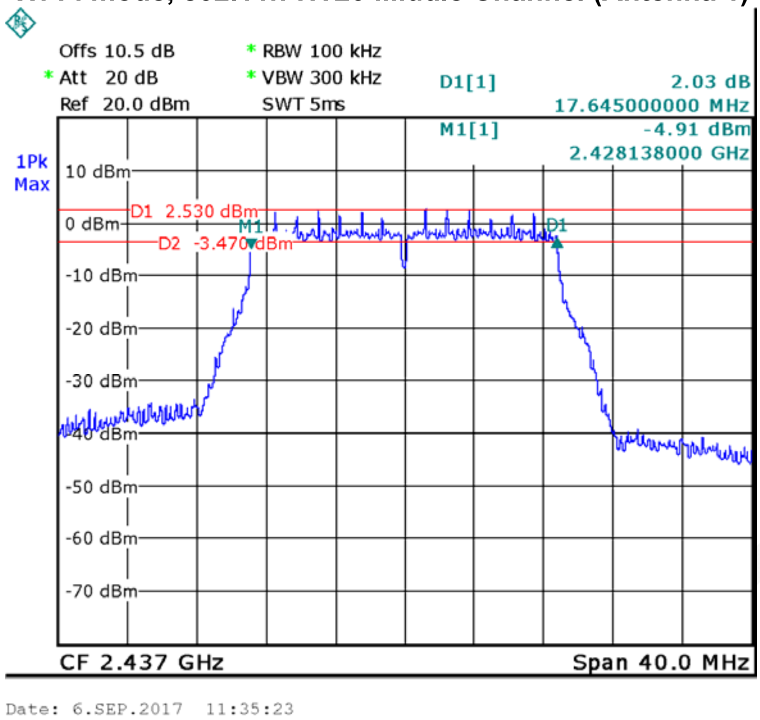
Wi-Fi mode, 802.11g High Channel (Antenna 1)



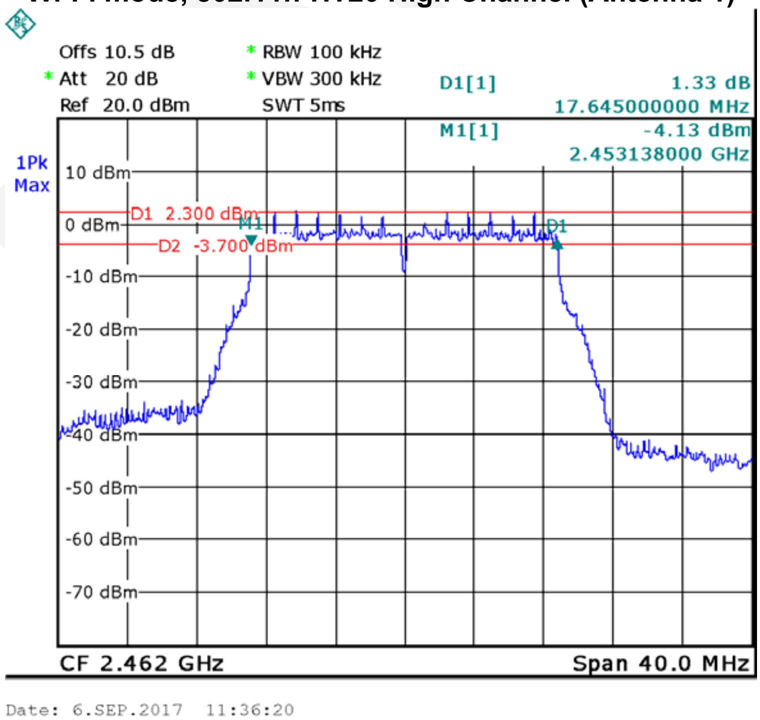
Wi-Fi mode, 802.11n-HT20 Low Channel (Antenna 1)



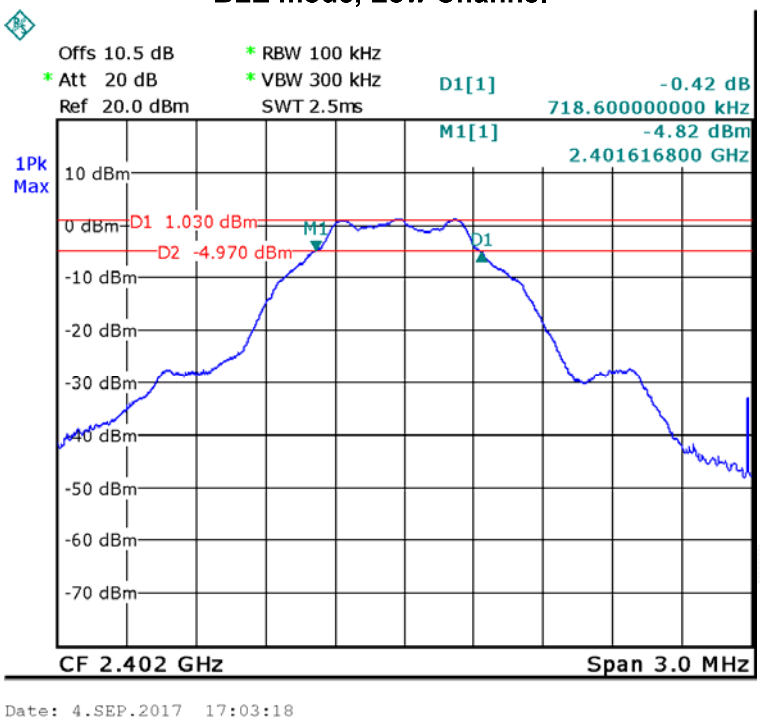
Wi-Fi mode, 802.11n-HT20 Middle Channel (Antenna 1)



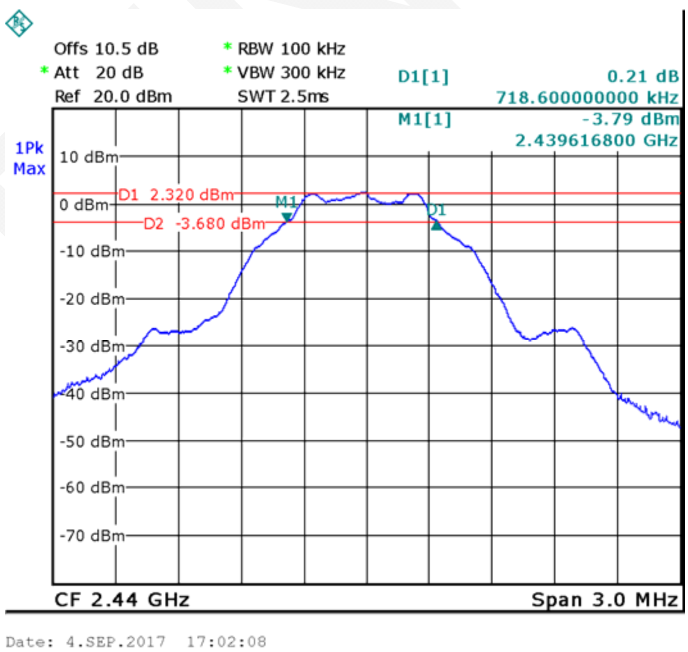
Wi-Fi mode, 802.11n-HT20 High Channel (Antenna 1)



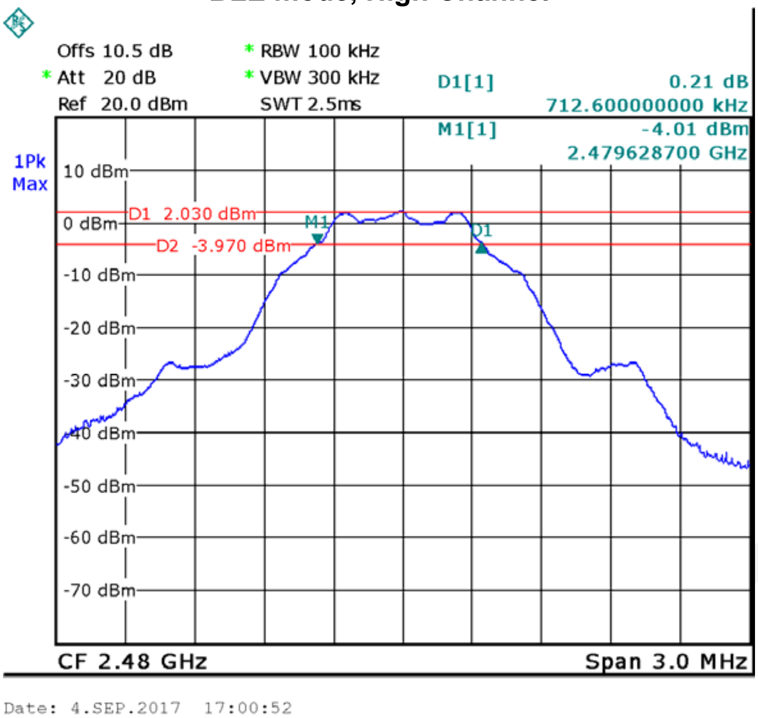
BLE mode, Low Channel



BLE mode, Middle Channel



BLE mode, High Channel



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

Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to test equipment.
3. Add a correction factor to the display.

Test Data

Environmental Conditions

Temperature:	26 ~ 27 °C
Relative Humidity:	58 ~ 62 %
ATM Pressure:	95.3 ~ 95.5 kPa

** The testing was performed by Tom Tang on 2017-09-04 & 2017-09-06.*

Test Mode: Transmitting

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

Wi-Fi mode

Mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)		Total (dBm)	Limit (dBm)
			Antenna 0	Antenna 1		
802.11b	Low	2412	17.94	18.50	/	30
	Middle	2437	17.80	18.38	/	30
	High	2462	18.09	18.37	/	30
802.11g	Low	2412	21.32	21.59	/	30
	Middle	2437	21.29	21.78	/	30
	High	2462	21.58	22.00	/	30
802.11n-HT20	Low	2412	21.40	21.50	24.46	30
	Middle	2437	21.38	21.63	24.52	30
	High	2462	21.90	22.03	24.98	30

Mode	Channel	Frequency (MHz)	Max Conducted Average Output Power (dBm)		Total (dBm)	Limit (dBm)
			Antenna 0	Antenna 1		
802.11b	Low	2412	14.58	15.13	/	30
	Middle	2437	14.63	15.27	/	30
	High	2462	14.70	15.20	/	30
802.11g	Low	2412	12.90	13.47	/	30
	Middle	2437	13.01	13.68	/	30
	High	2462	13.11	13.56	/	30
802.11n-HT20	Low	2412	12.80	13.40	16.12	30
	Middle	2437	12.97	13.51	16.26	30
	High	2462	13.02	13.34	16.19	30

Note: The device employed Cyclic Delay Diversity (CDD) for 802.11 MIMO transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01, for power measurements on IEEE 802.11 devices:

Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4;

So:

Directional gain = GANT + Array Gain = 2.81 dBi < 6dBi

BLE mode

Mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)	Limit (dBm)
BLE	Low	2402	1.76	30
	Middle	2440	3.08	30
	High	2480	2.81	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:	26 ~ 27 °C
Relative Humidity:	58 ~ 62 %
ATM Pressure:	95.3 ~ 95.5 kPa

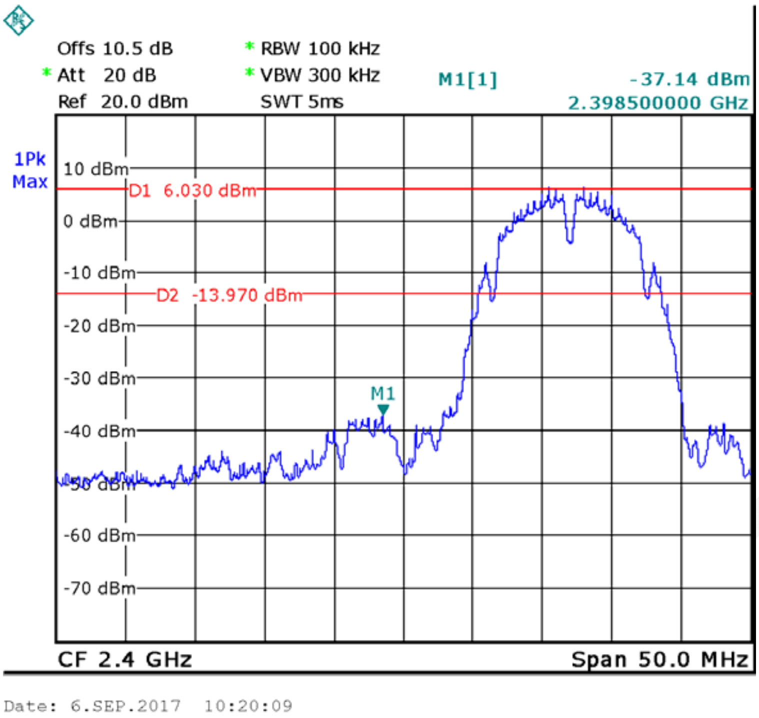
** The testing was performed by Tom Tang on 2017-09-04 & 2017-09-06.*

Test mode: Transmitting

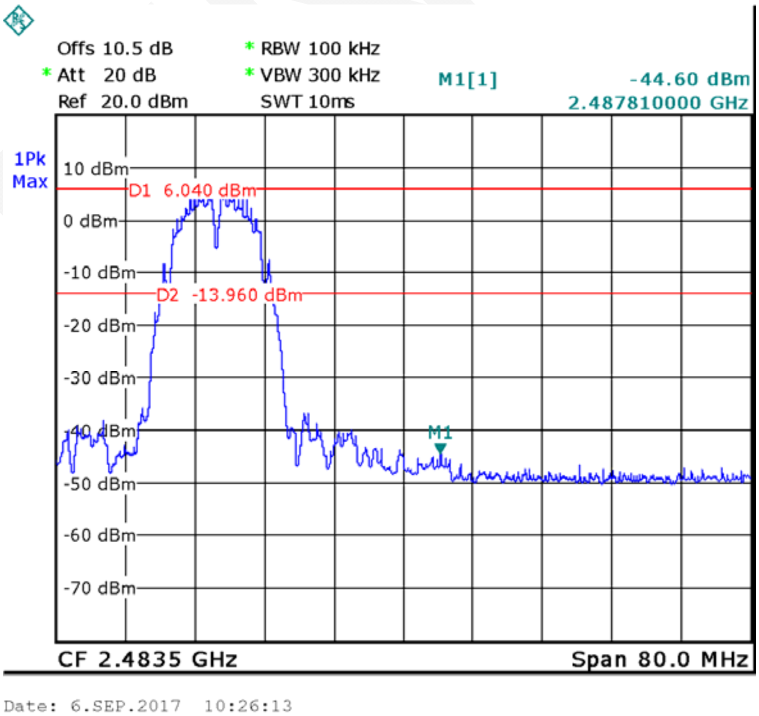
Test Result: Compliance. Please refer to following plots.

Wi-Fi mode

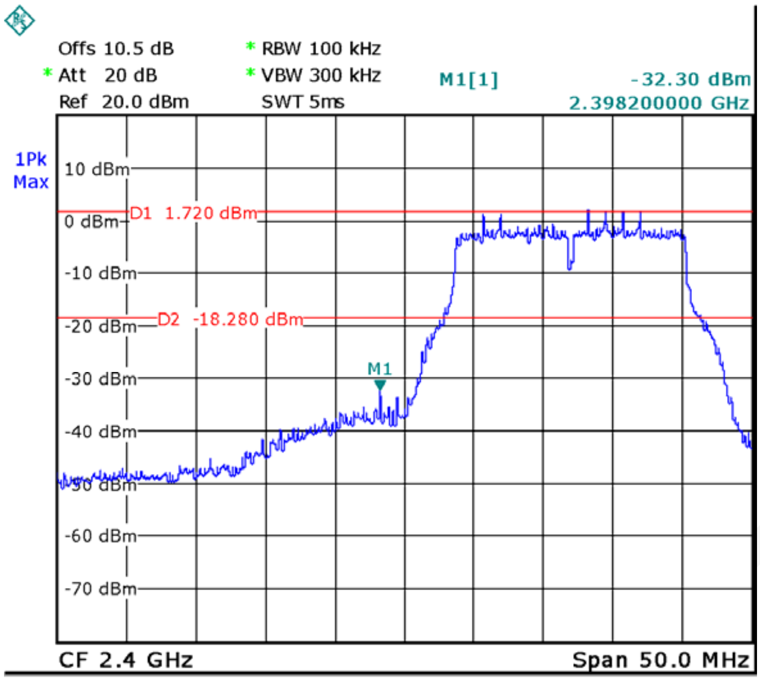
802.11b: Band Edge, Left Side (Antenna 0)



802.11b: Band Edge, Right Side (Antenna 0)

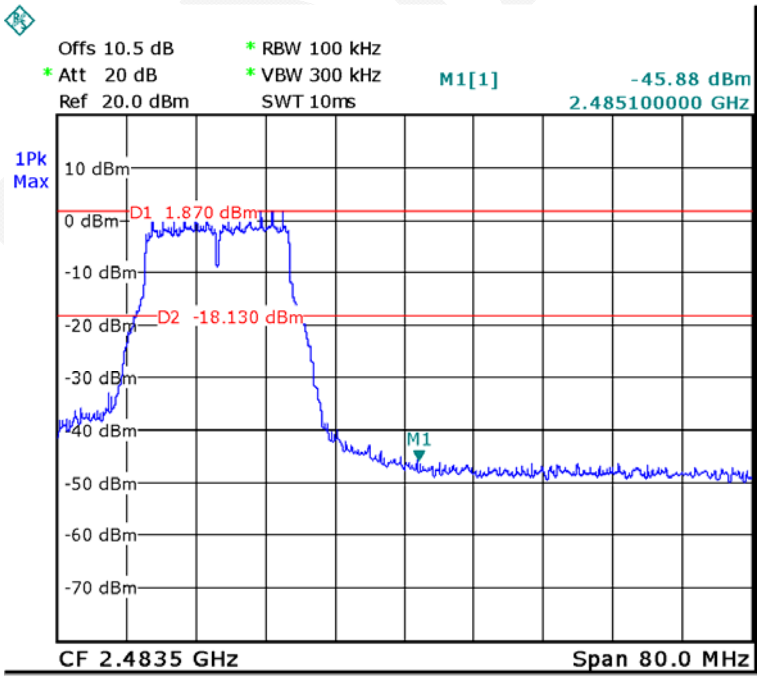


802.11g: Band Edge, Left Side (Antenna 0)



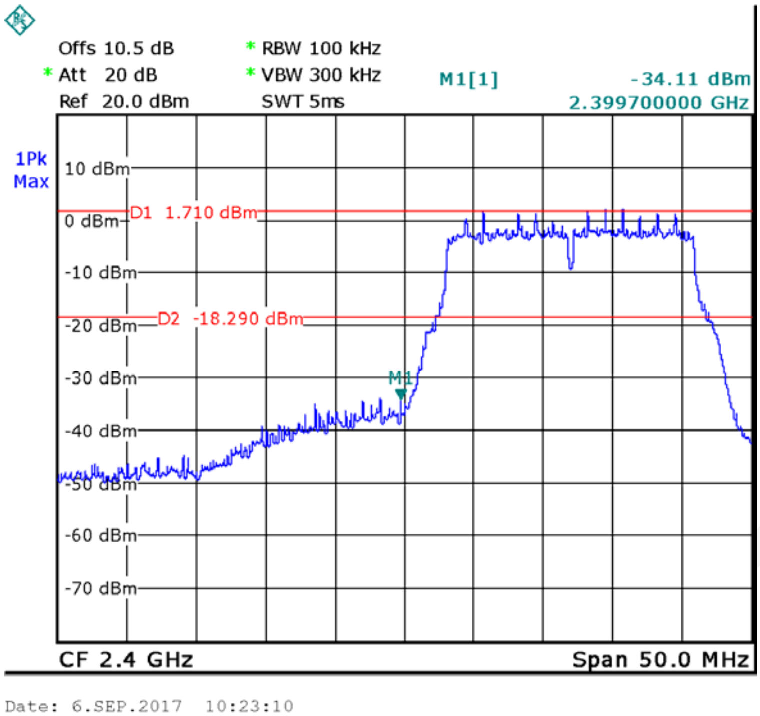
Date: 6.SEP.2017 10:21:27

802.11g: Band Edge, Right Side (Antenna 0)

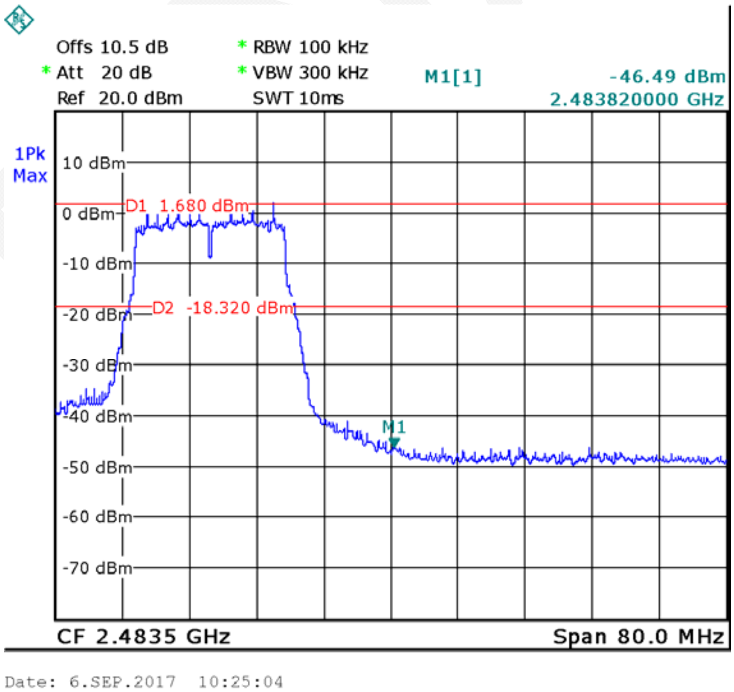


Date: 6.SEP.2017 10:27:43

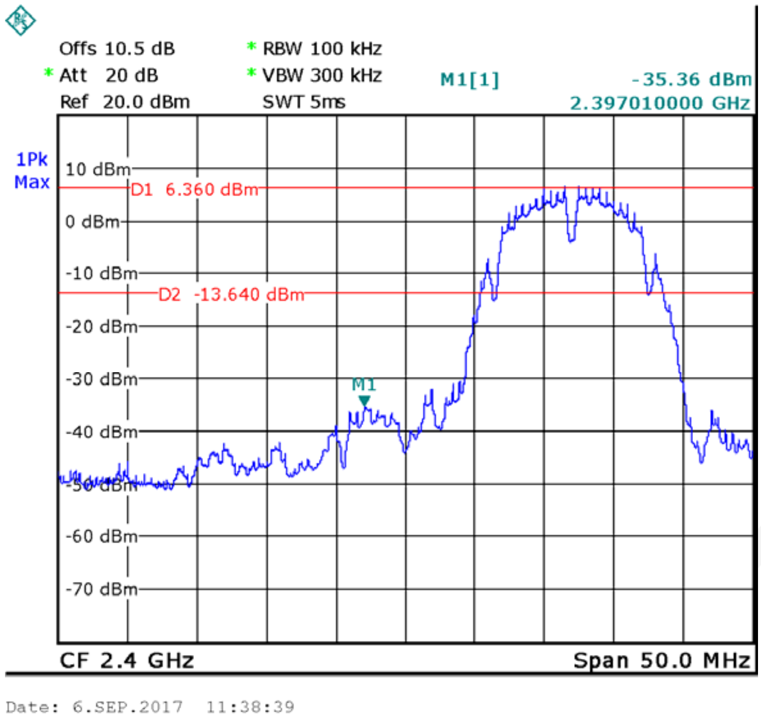
802.11n-HT20 Band Edge, Left Side (Antenna 0)



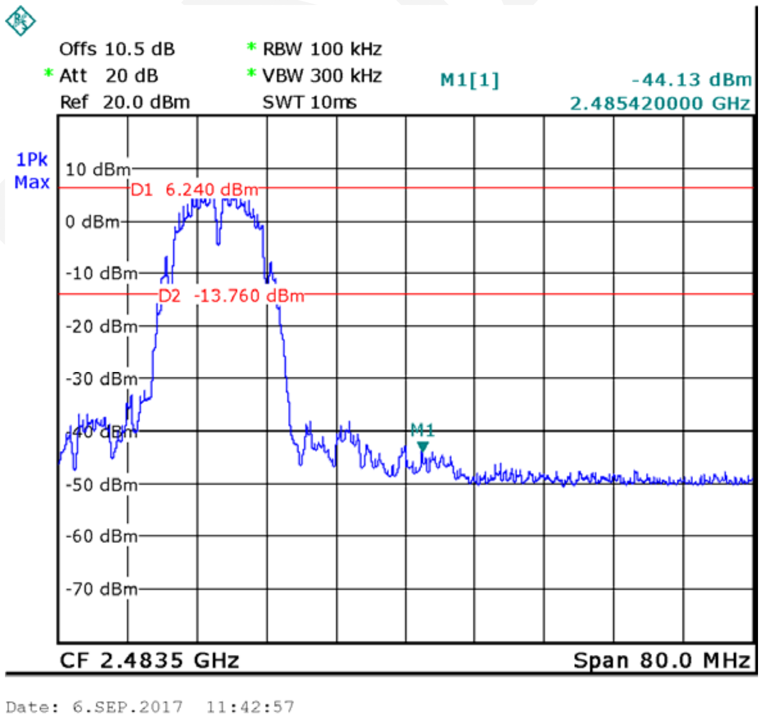
802.11n-HT20 Band Edge, Right Side (Antenna 0)



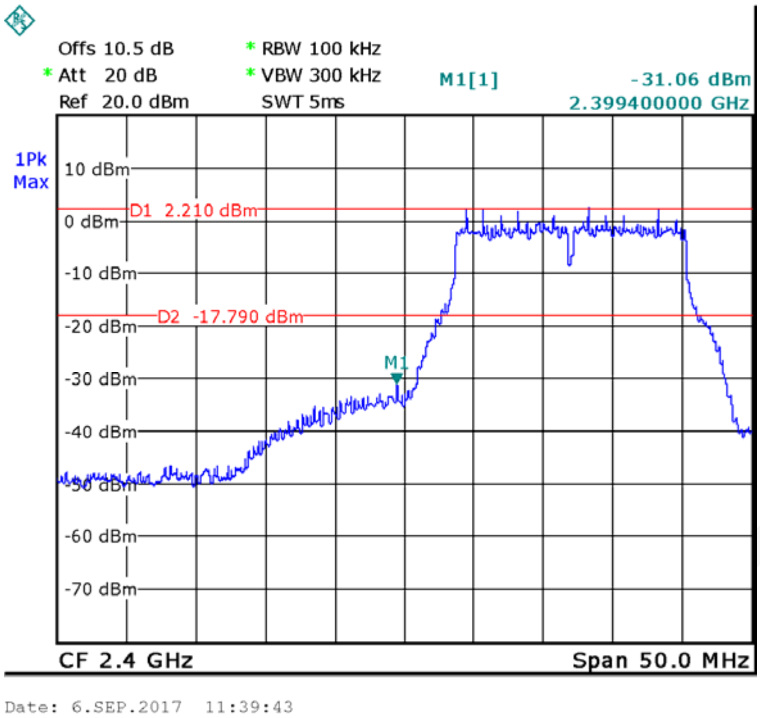
802.11b: Band Edge, Left Side (Antenna 1)



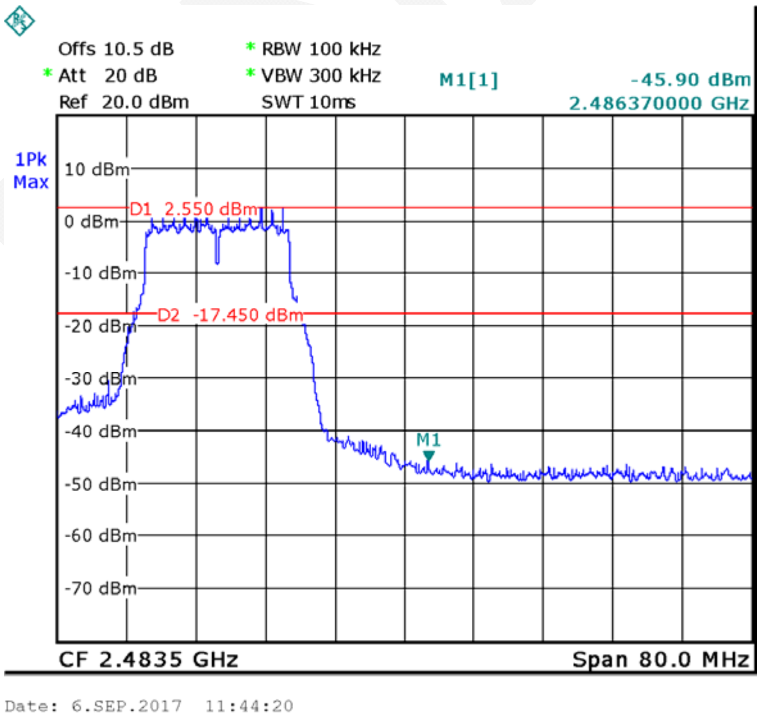
802.11b: Band Edge, Right Side (Antenna 1)



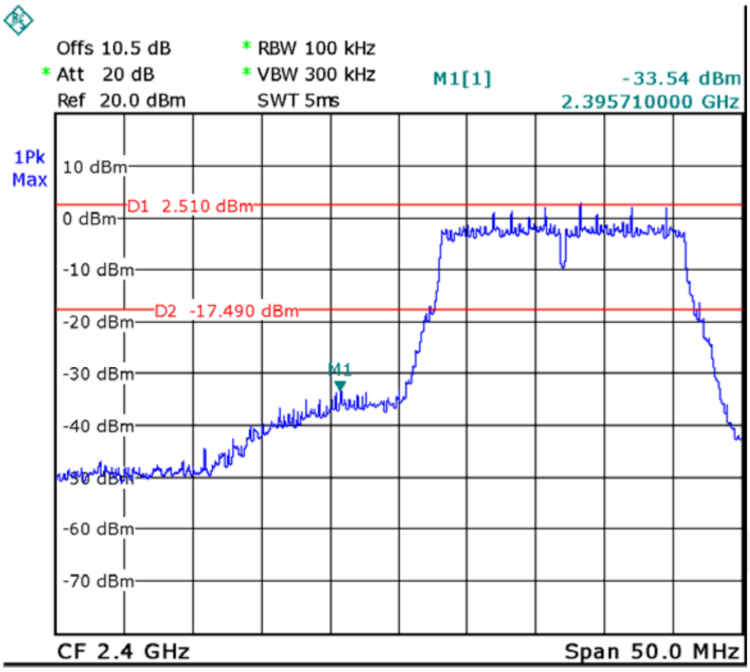
802.11g: Band Edge, Left Side (Antenna 1)



802.11g: Band Edge, Right Side (Antenna 1)

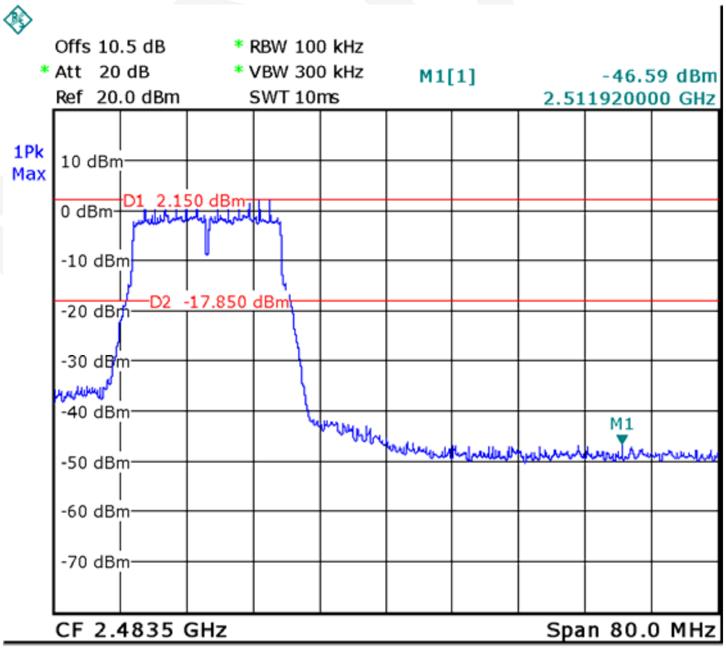


802.11n-HT20 Band Edge, Left Side (Antenna 1)



Date: 6.SEP.2017 11:40:41

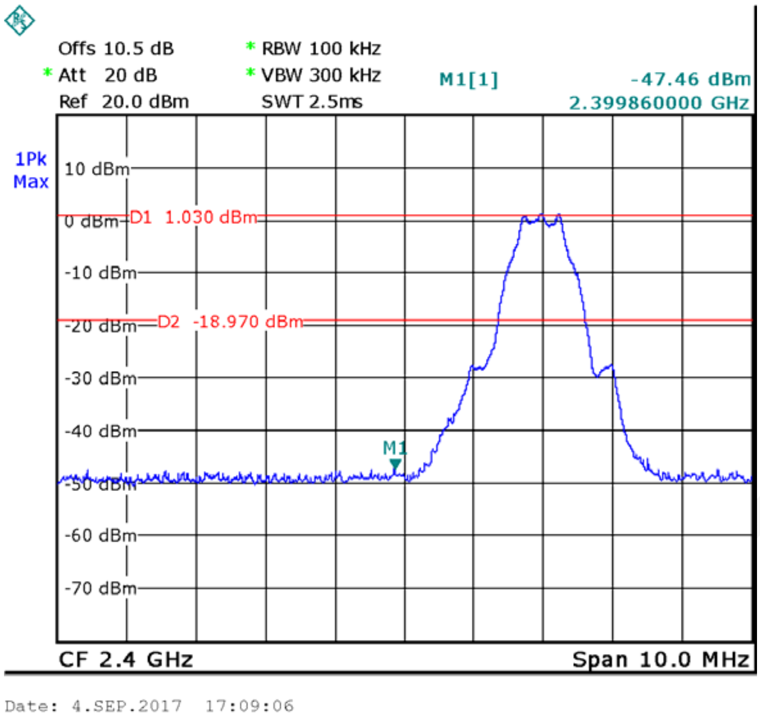
802.11n-HT20 Band Edge, Right Side (Antenna 1)



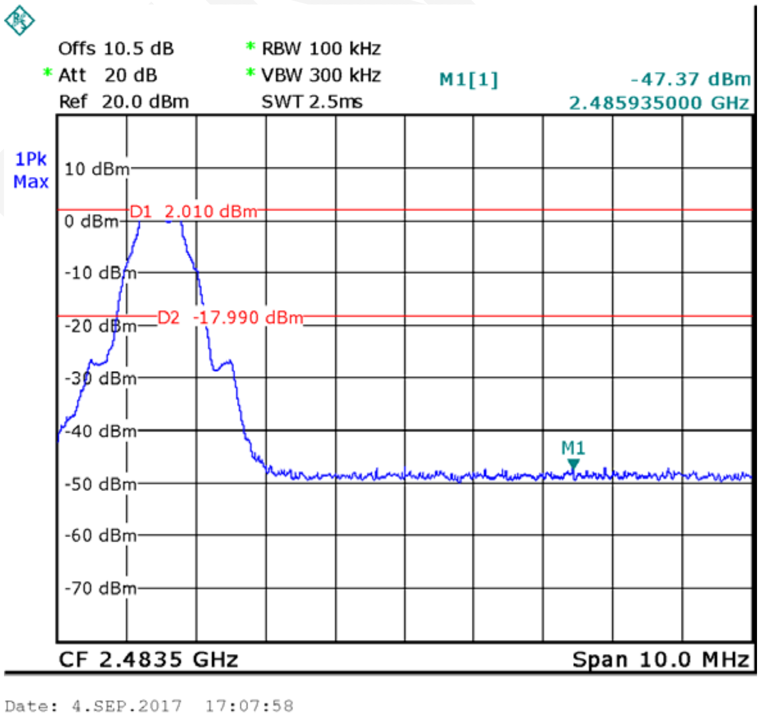
Date: 6.SEP.2017 11:42:01

BLE mode

Band Edge, Left Side



Band Edge, Right Side



FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Procedure

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:	26 ~ 27 °C
Relative Humidity:	58 ~ 62 %
ATM Pressure:	95.3 ~ 95.5 kPa

** The testing was performed by Tom Tang on 2017-09-04 & 2017-09-06.*

Test Mode: Transmitting

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

Wi-Fi mode

Mode	Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)		Total (dBm/3kHz)	Limit (dBm/3kHz)
			Antenna 0	Antenna 1		
802.11b	Low	2412	-8.19	-8.23	/	8
	Middle	2437	-8.13	-7.99	/	8
	High	2462	-8.21	-7.95	/	8
802.11g	Low	2412	-12.14	-11.63	/	8
	Middle	2437	-12.45	-12.13	/	8
	High	2462	-12.23	-12.33	/	8
802.11n-HT20	Low	2412	-13.56	-13.61	-10.57	8
	Middle	2437	-13.13	-12.98	-10.04	8
	High	2462	-13.36	-13.17	-10.25	8

Note: The device employed Cyclic Delay Diversity (CDD) for 802.11 MIMO transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01, for power spectral density (PSD) measurements on the devices:

Array Gain = 10 log(NANT/NSS) dB.

So:

Directional gain = GANT + Array Gain = 2.81+10*log(2) =5.81dBi<6dBi

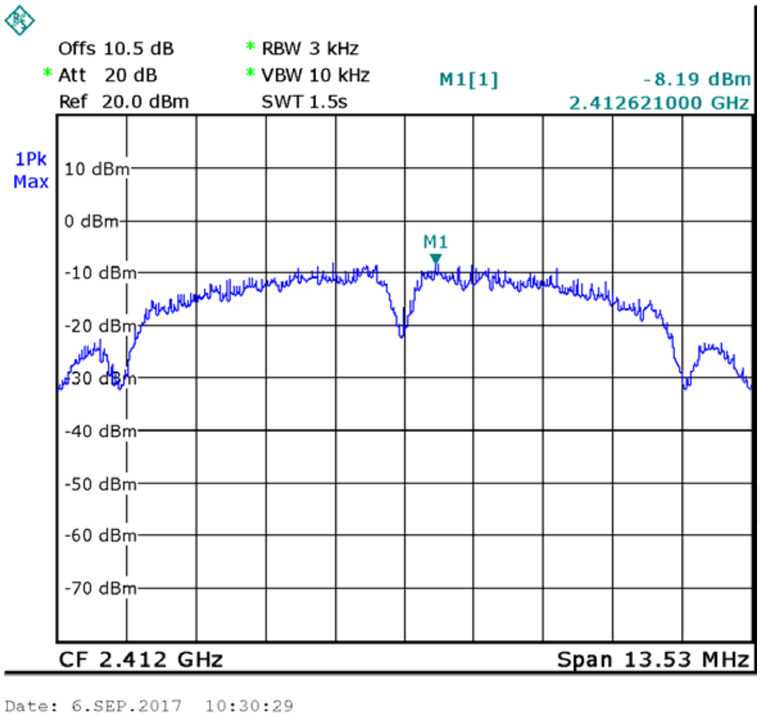
No power density Limits was reduced in MIMO mode

BLE mode

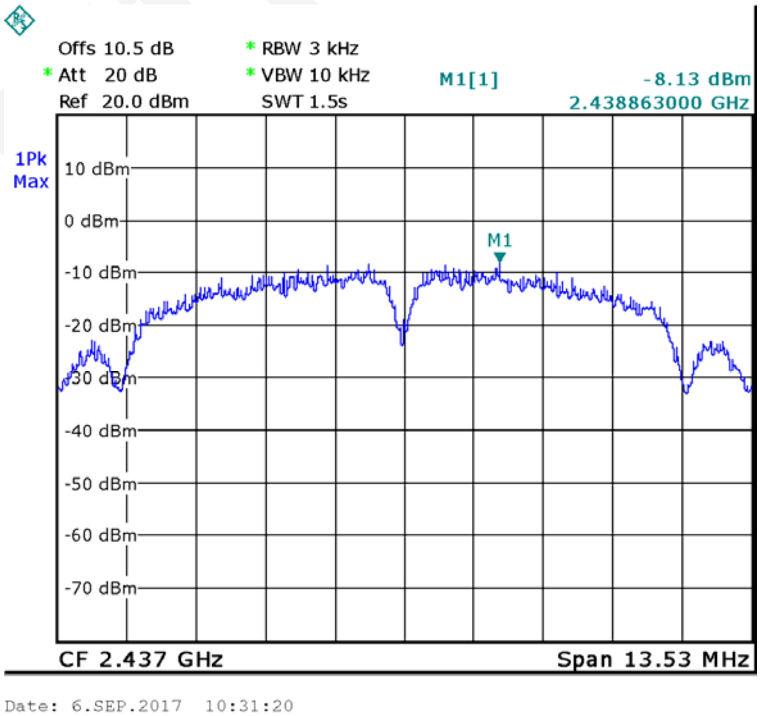
Mode	Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
BLE	Low	2402	-12.83	8
	Middle	2440	-11.50	8
	High	2480	-11.89	8

Wi-Fi mode

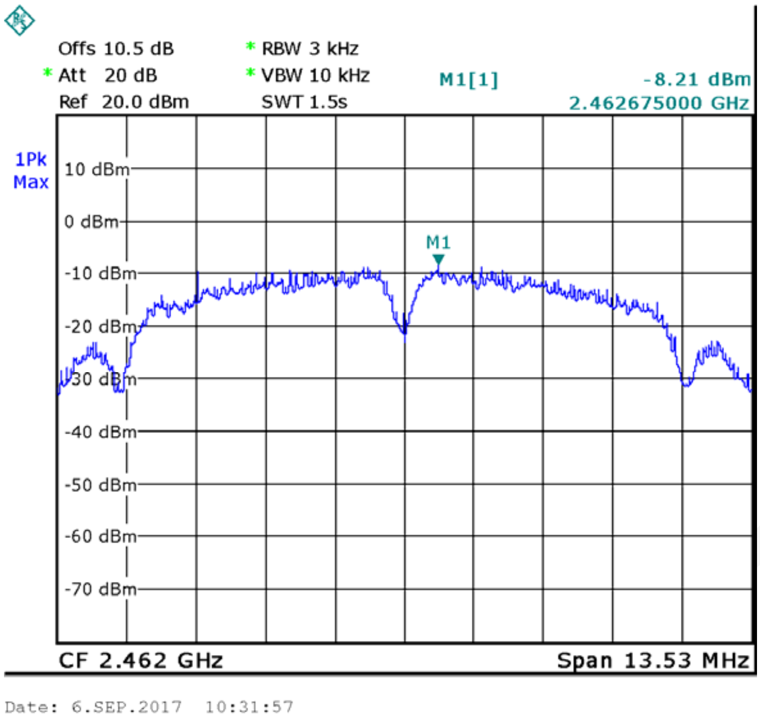
Power Spectral Density, 802.11b Low Channel (Antenna 0)



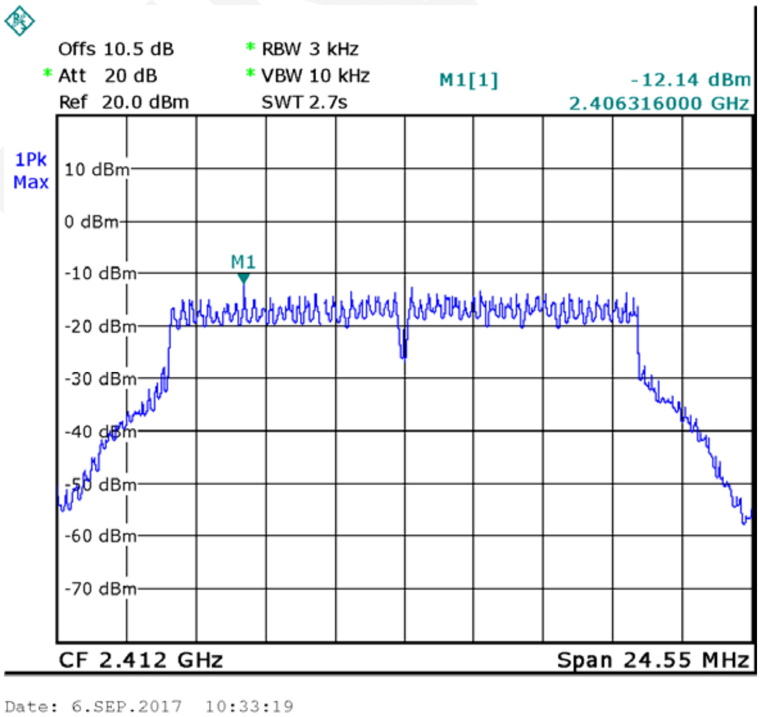
Power Spectral Density, 802.11b Middle Channel (Antenna 0)



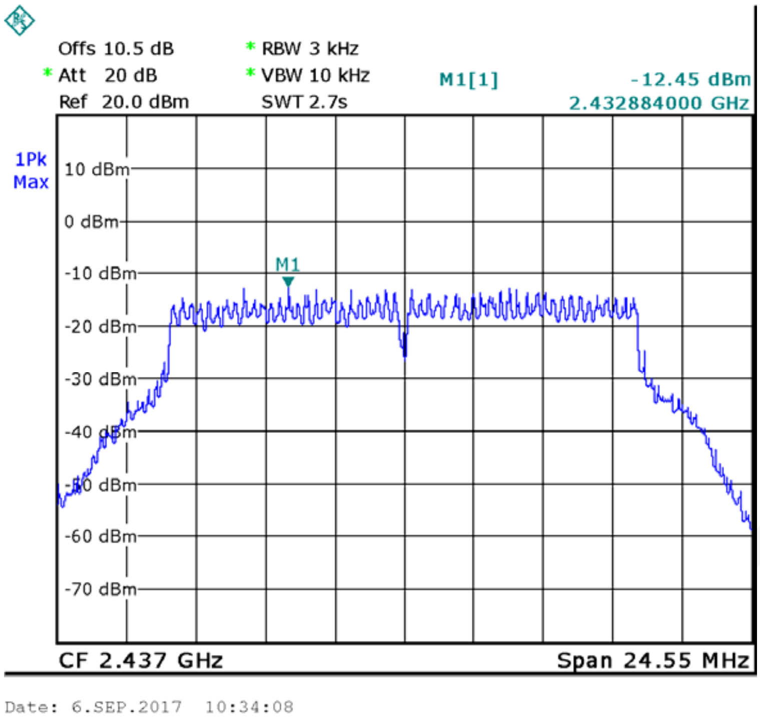
Power Spectral Density, 802.11b High Channel (Antenna 0)



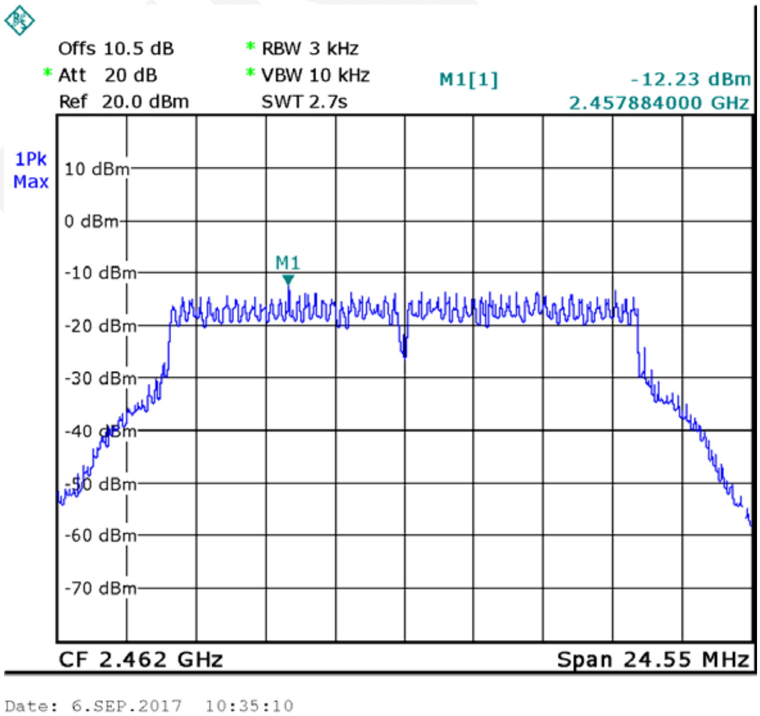
Power Spectral Density, 802.11g Low Channel (Antenna 0)



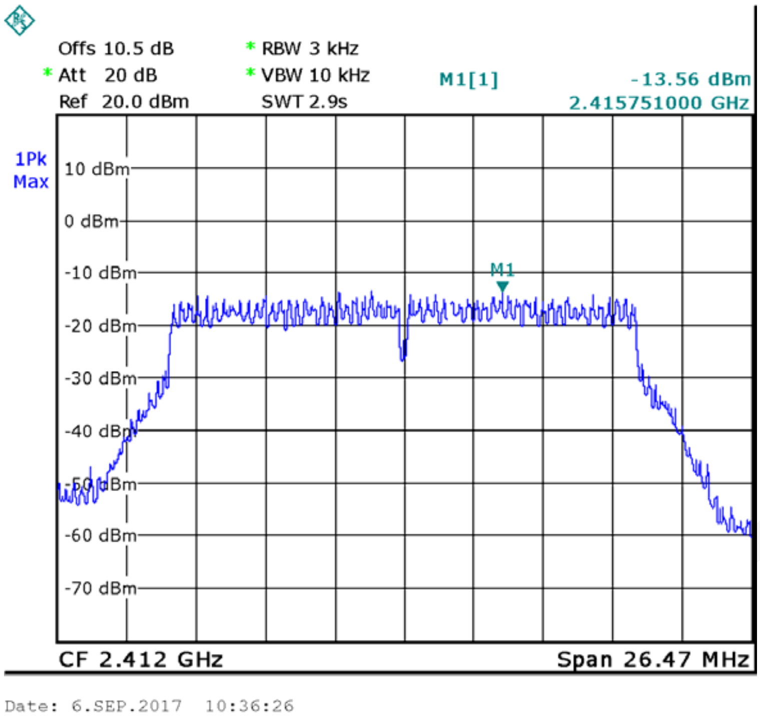
Power Spectral Density, 802.11g Middle Channel (Antenna 0)



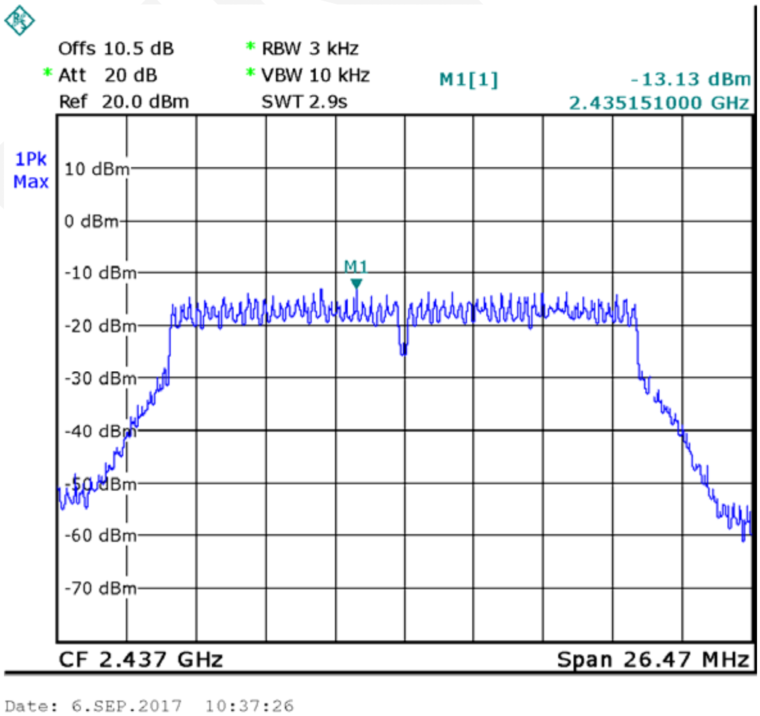
Power Spectral Density, 802.11g High Channel (Antenna 0)



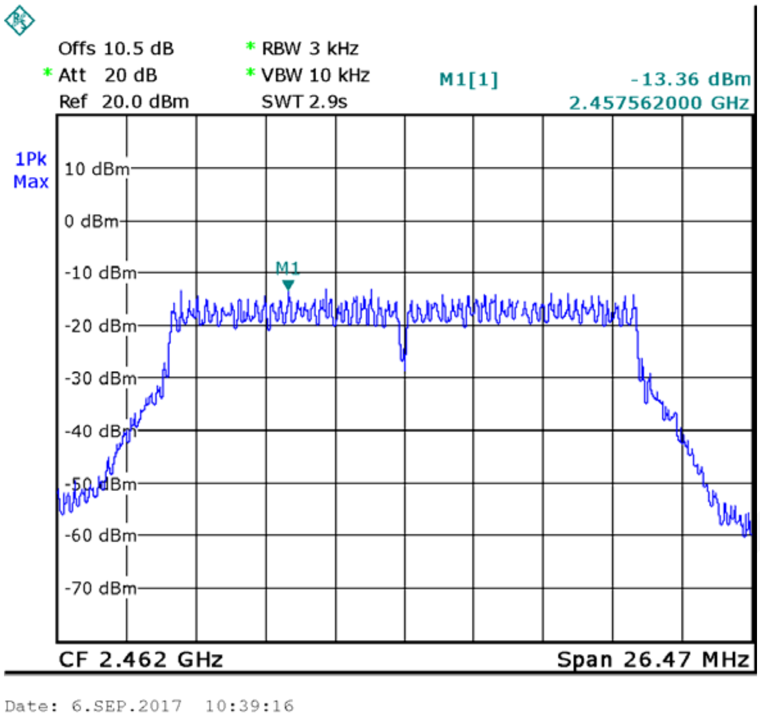
Power Spectral Density, 802.11n-HT20 Low Channel (Antenna 0)



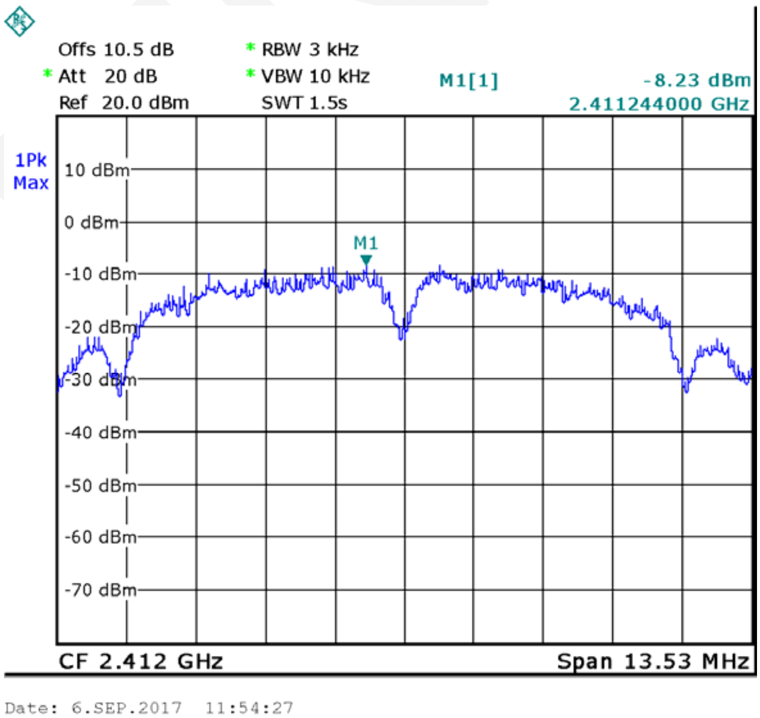
Power Spectral Density, 802.11n-HT20 Middle Channel (Antenna 0)



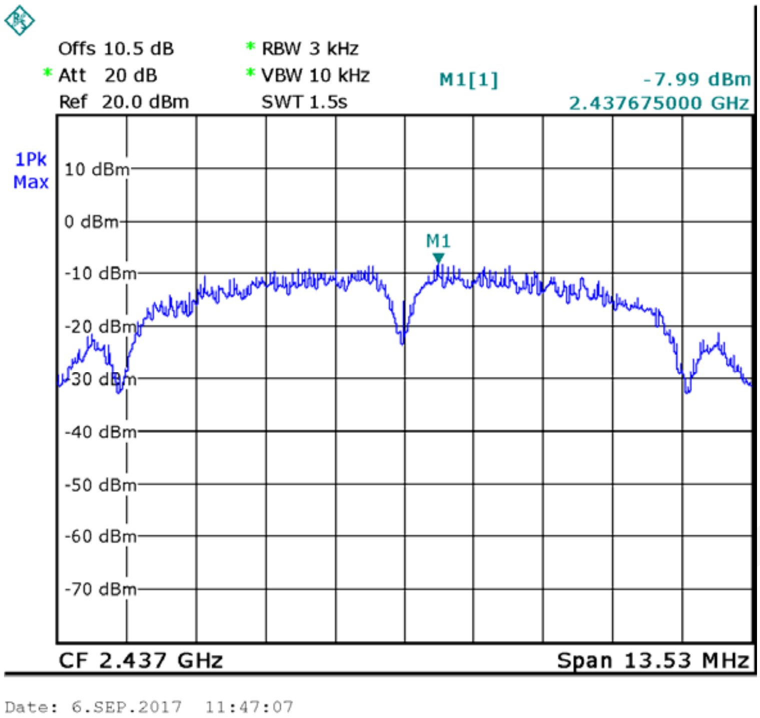
Power Spectral Density, 802.11n-HT20 High Channel (Antenna 0)



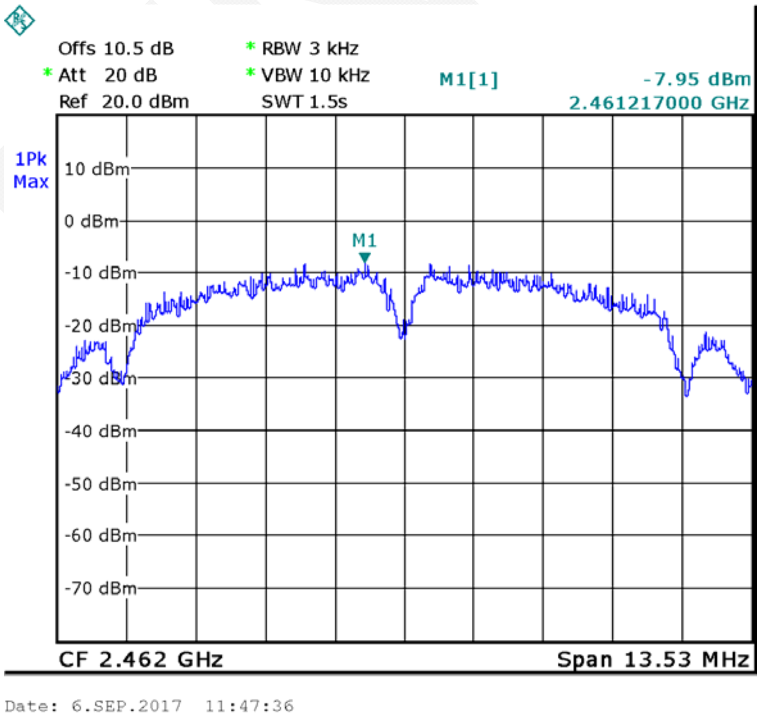
Power Spectral Density, 802.11b Low Channel (Antenna 1)



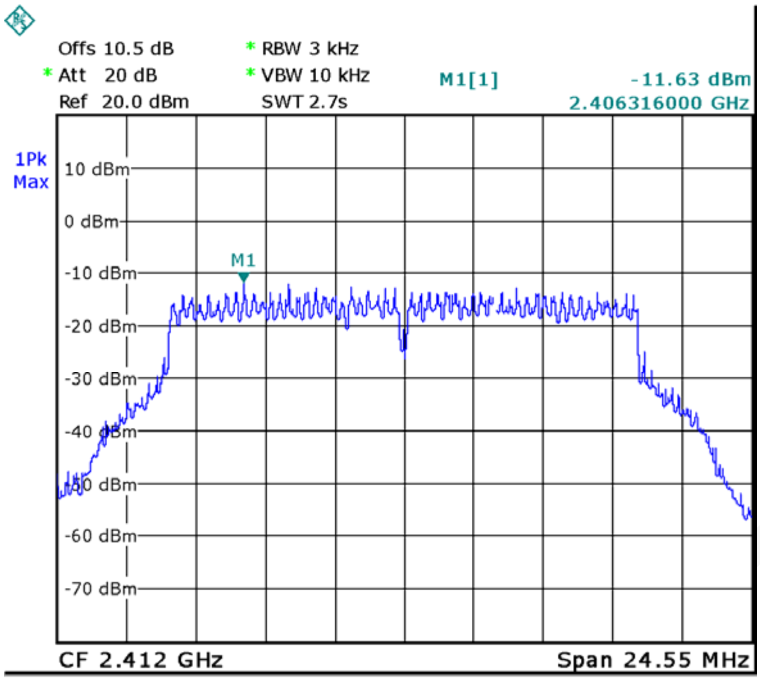
Power Spectral Density, 802.11b Middle Channel (Antenna 1)



Power Spectral Density, 802.11b High Channel (Antenna 1)

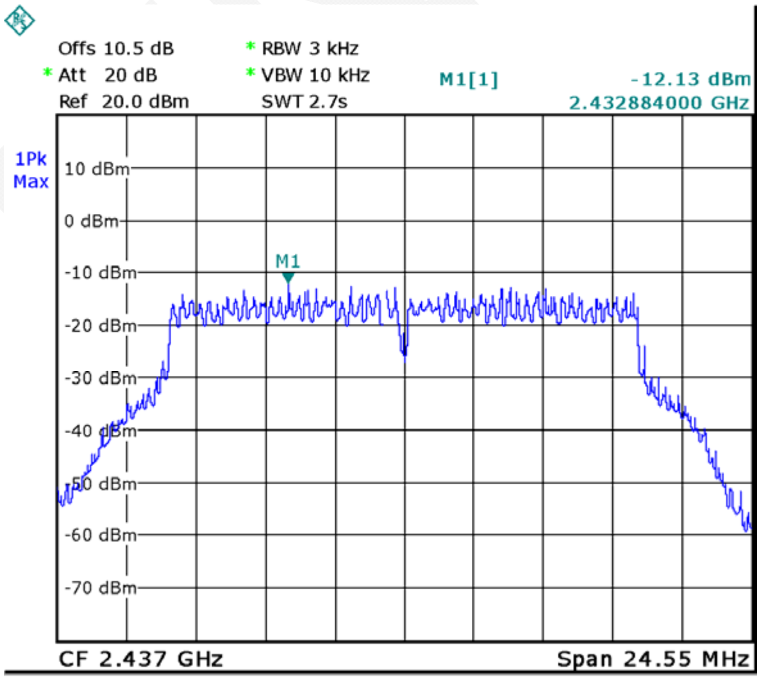


Power Spectral Density, 802.11g Low Channel (Antenna 1)



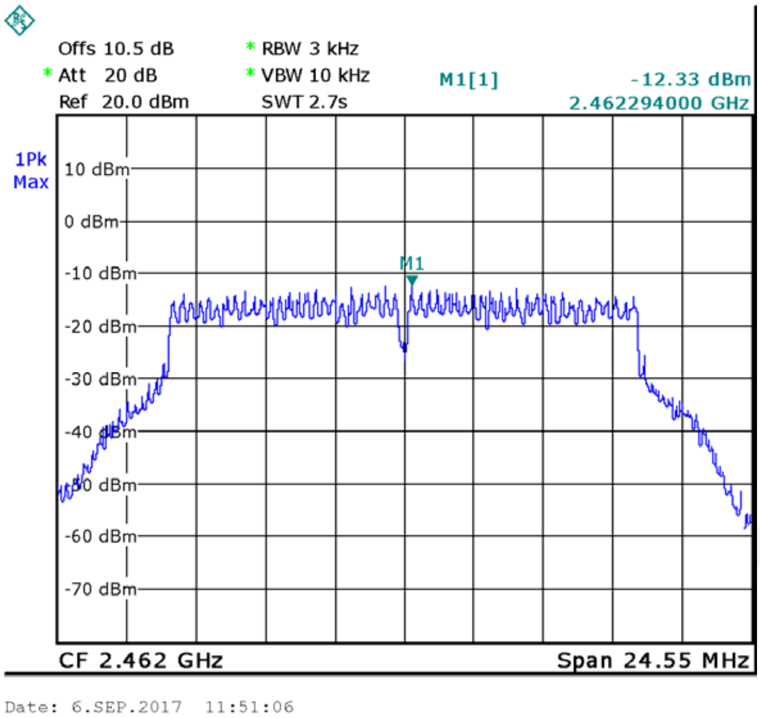
Date: 6.SEP.2017 11:48:44

Power Spectral Density, 802.11g Middle Channel (Antenna 1)

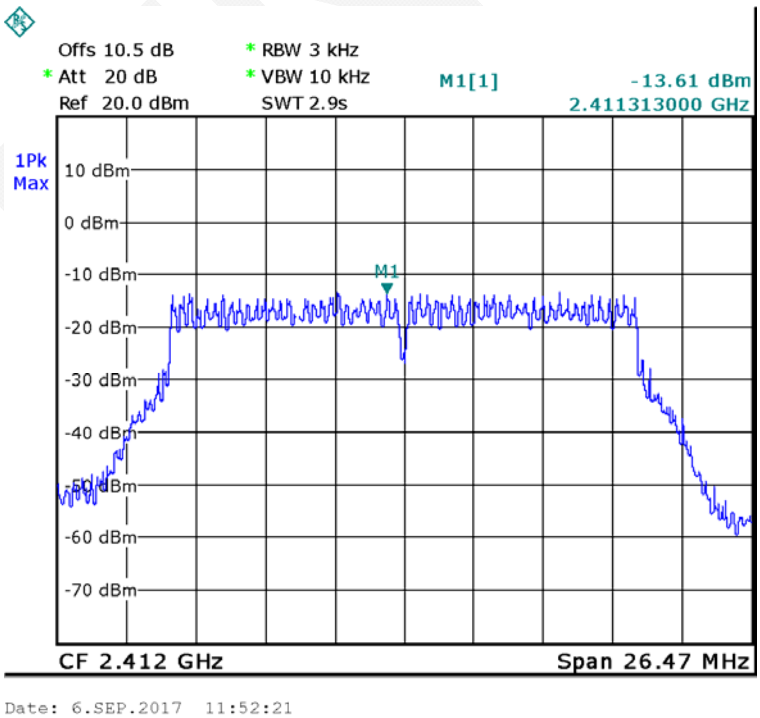


Date: 6.SEP.2017 11:50:10

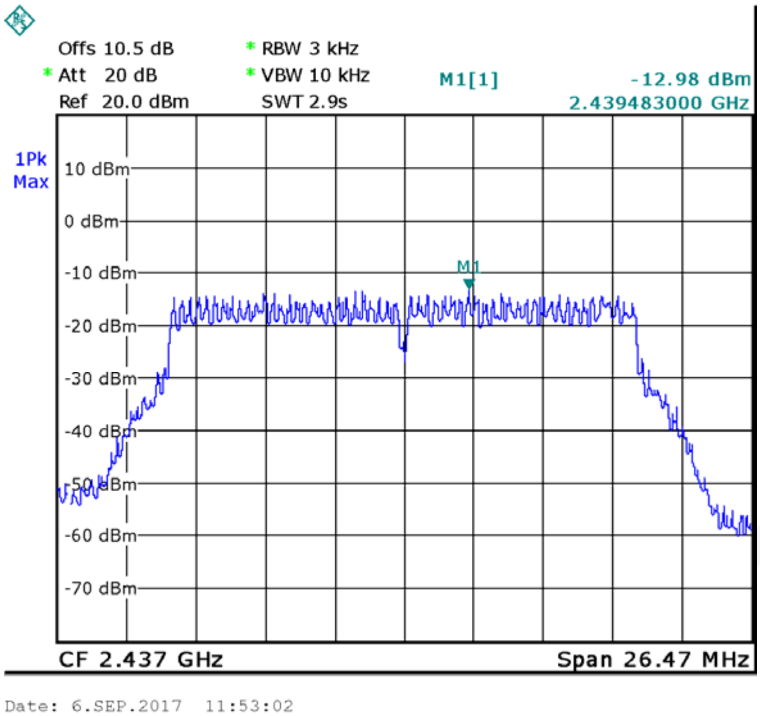
Power Spectral Density, 802.11g High Channel (Antenna 1)



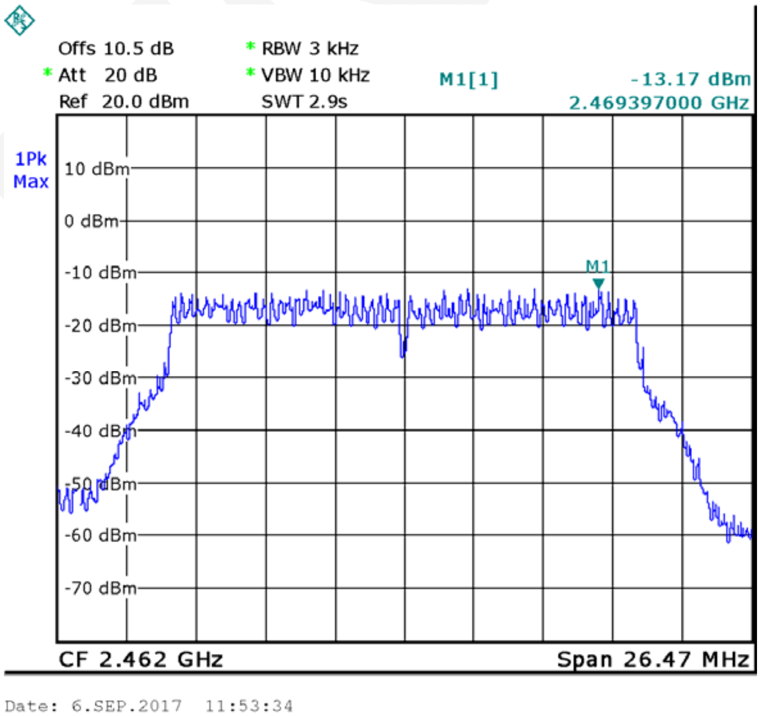
Power Spectral Density, 802.11n-HT20 Low Channel (Antenna 1)



Power Spectral Density, 802.11n-HT20 Middle Channel (Antenna 1)

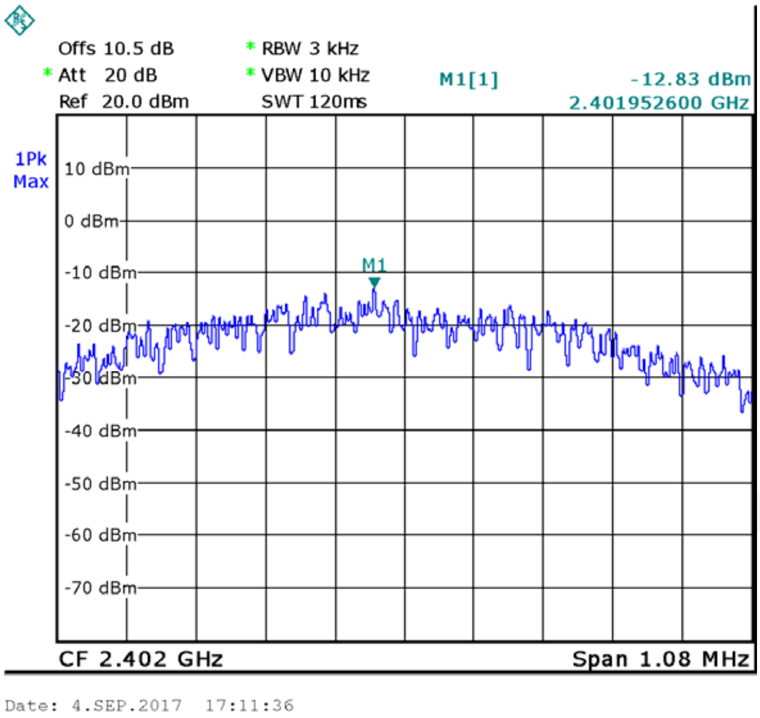


Power Spectral Density, 802.11n-HT20 High Channel (Antenna 1)

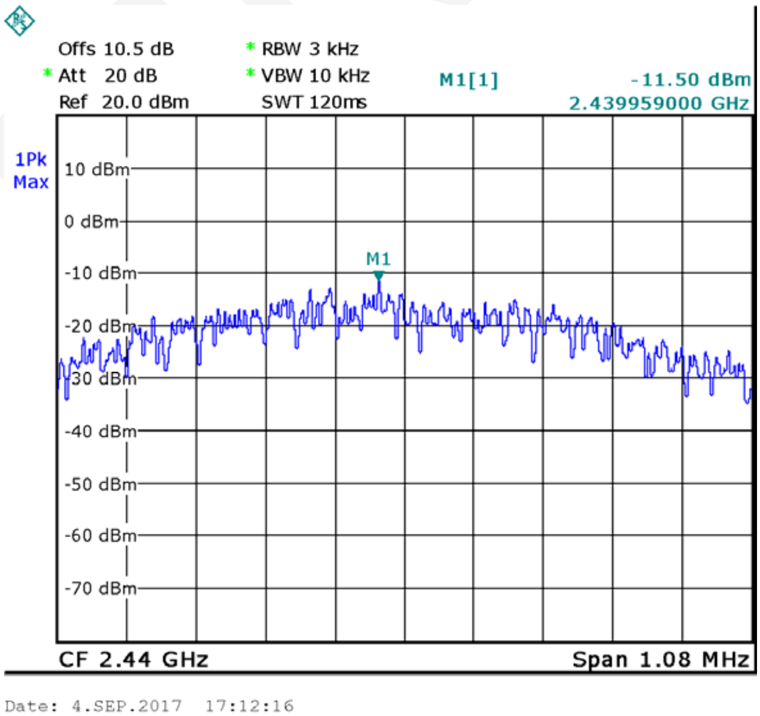


BLE mode

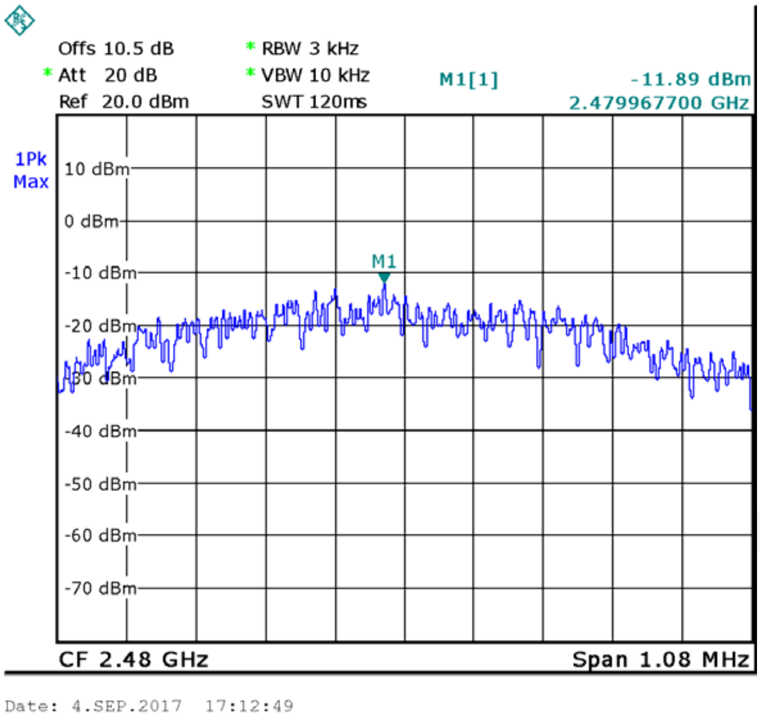
Power Spectral Density, Low Channel



Power Spectral Density, Middle Channel



Power Spectral Density, High Channel



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