TESTING LABORATORY
CERTIFICATE#4323.01

FCC PART 15.247

TEST REPORT

For

Factory Method LLC

1441 9TH AVE, SUITE 710, SAN DIEGO, California, United States, 92101

FCC ID: 2AO6TZING-1W

Report Type:	Product Type:
Original Report	Zing

Test Engineer:	Max Min
Report Number:	RSHA180118004-00A
Report Date:	2018-07-20
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant:	Factory Method LLC
Tested Model:	ZING-1W
Product Type:	Zing
Dimension:	88 mm (L) * 88 mm (W) * 37 mm(H)
Power Supply:	1. DC 3.7V by battery and DC 5.0V charging from adapter 2. DC 3.7V by battery and AC 120V charging from AC source

*****_All measurement and test data in this report was gathered from production sample serial number: 20180118004. (Assigned by the BACL. The EUT supplied by the applicant was received on 2018-01-18)_

Objective

This report is prepared on behalf of *Factory Method LLC* in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commissions rules.

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

Related Submittal(s)/Grant(s)

No related submittal/grant.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and FCC KDB558074 D01 DTS Meas Guidance v04.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19dB
RF conducted test with spectrum		0.9dB
RF Output Power with Power meter		0.5dB
Radiated emission	30MHz~1GHz	6.11dB
	1GHz~6GHz	4.45dB
	6GHz~18GHz	5.23dB
	18GHz~40GHz	5.65dB
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
Humidity		6%

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

Test channel list is as below:

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

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 BLE mode, EUT was tested with channel 0, 19 and 39.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	…	…
…	…	…	…
…	…	…	…
18	2438	38	2478
19	2440	39	2480

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

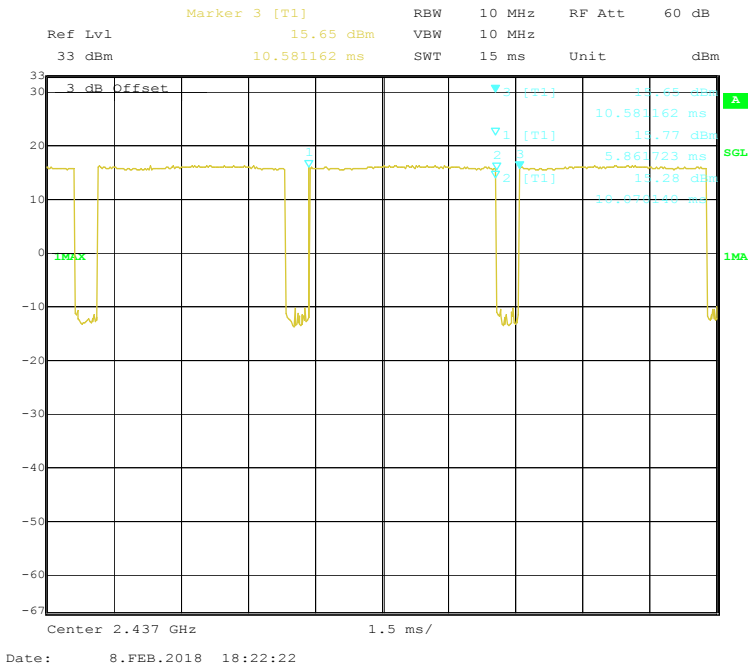
RF test tool: SecureCRT (For Wi-Fi test); µEnergy Test (For BLE test)

Pre-scan with all the data rates, and the worst case was performed as below:

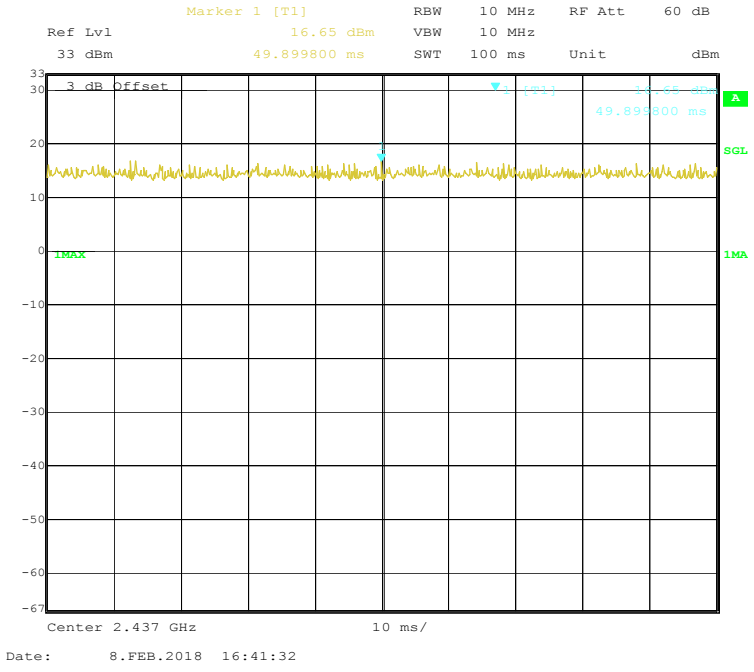
Mode	Data Rate	Channel	Power Level
802.11b	1 Mbps	Low	0
		Middle	0
		High	0
802.11g	6 Mbps	Low	8
		Middle	16
		High	8
802.11n-HT20	MCS0	Low	12
		Middle	12
		High	8
BLE	1Mbps	/	7

Duty Cycle:

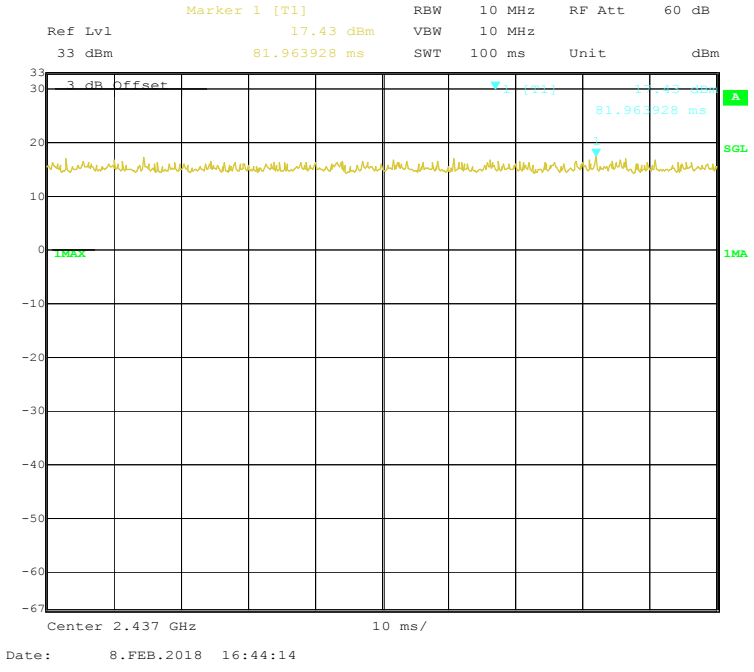
802.11b Mode Middle Channel



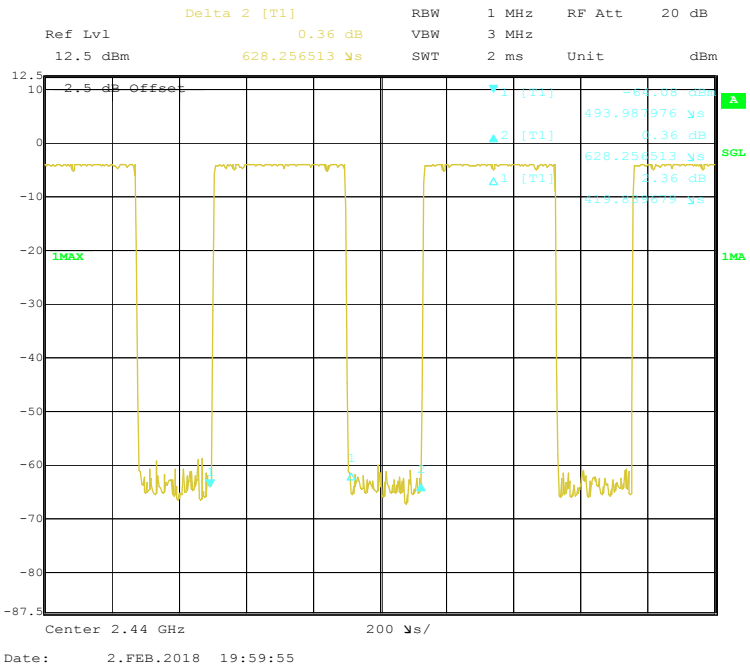
802.11g Mode Middle Channel



802.11n-HT20 Mode Middle Channel



BLE Mode Middle Channel



Mode	Duty Cycle (%)	T(us)	1/T(kHz)	10log(1/x)
802.11b	95.17	10070	0.10	0.21
802.11g	100	/	/	0
802.11n-HT20	100	/	/	0
BLE	66.88	420	2.38	1.75

Note: “x” means the Duty Cycle.

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
SHENZHEN TIANYIN ELECTRONICS CO., LTD	Adapter Input: AC100-240V, 50/60Hz, 0.3A Output: DC 5.0V, 2000mA	TPA-46050200UU	/

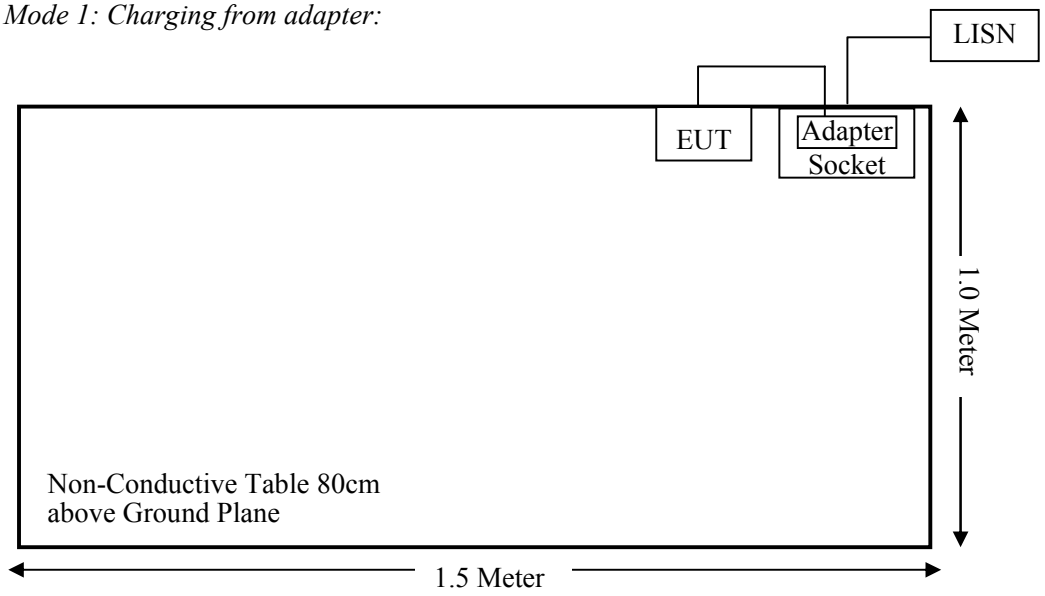
External I/O Cable

Cable Description	Length (m)	From Port	To
USB Cable	0.8	EUT	Adapter

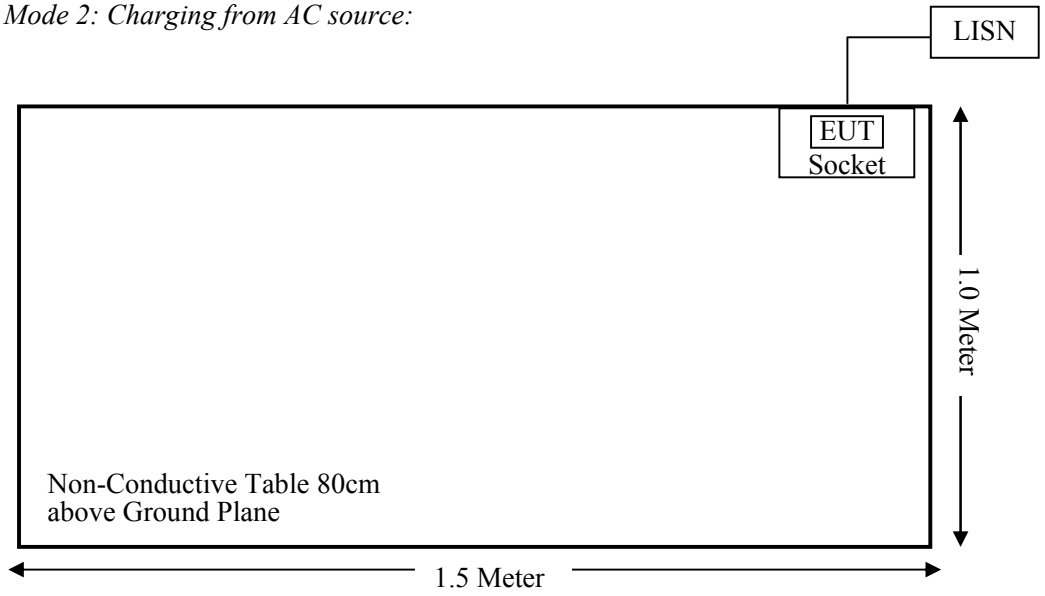
Block Diagram of Test Setup

For Conducted Emissions:

Mode 1: Charging from adapter:

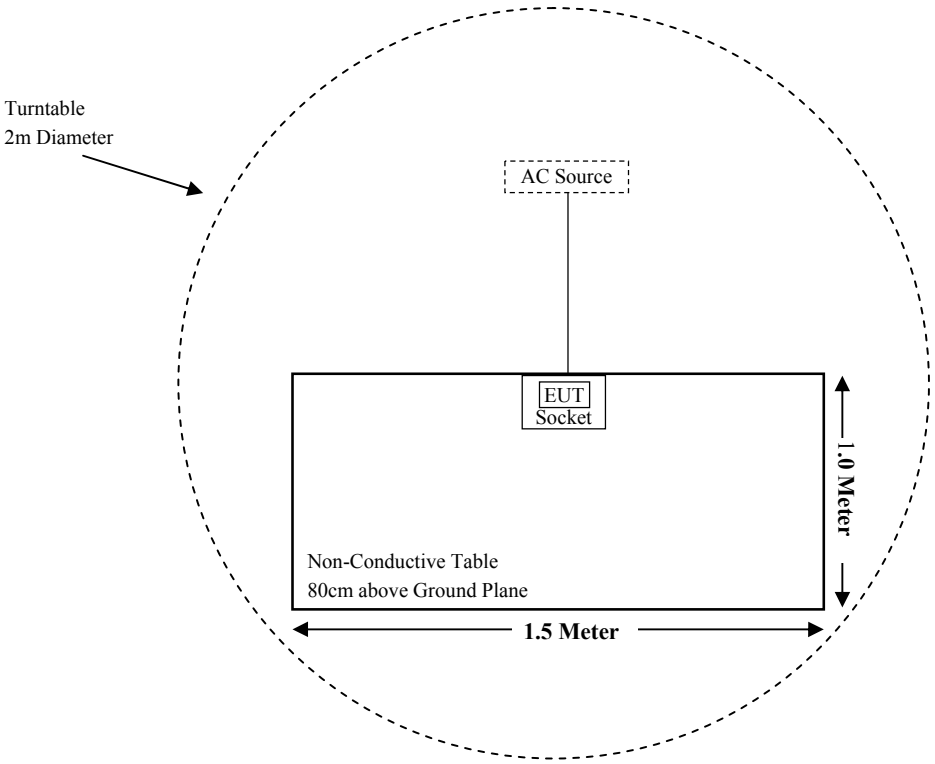


Mode 2: Charging from AC source:



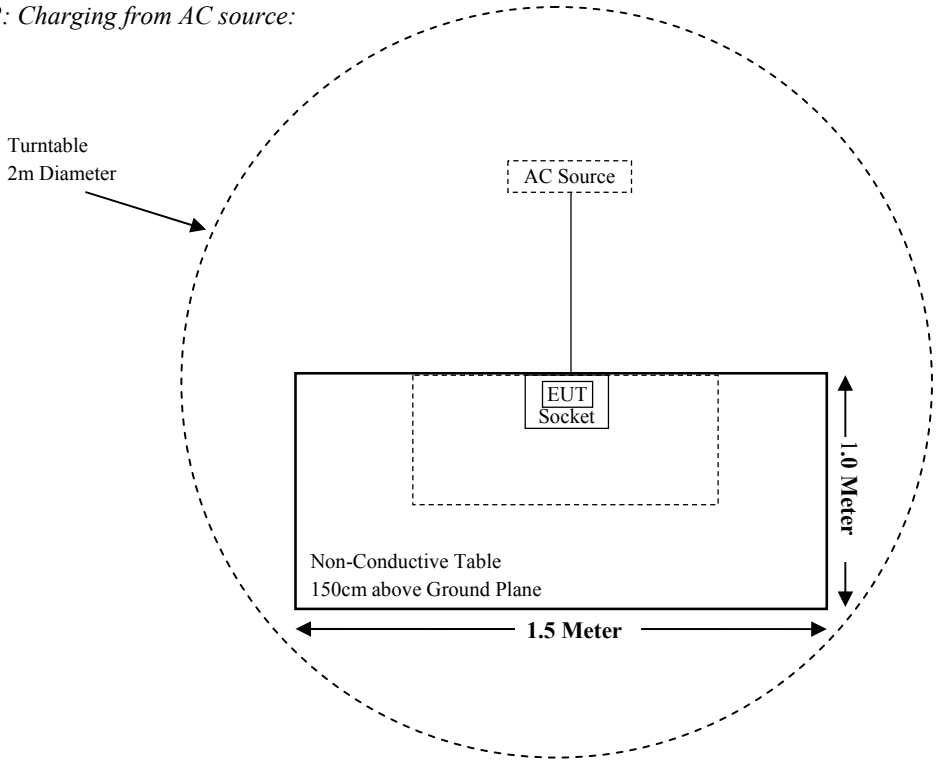
For Radiated Emissions(Below 1GHz):

Mode 2: Charging from AC source:



For Radiated Emissions(Above 1GHz):

Mode 2: Charging from AC source:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1310 & §2.1091	MAXIMUM PERMISSIBLE EXPOSURE (MPE)	Compliant
§15.203	Antenna Requirement	Compliant
§15.207 (a)	AC Line Conducted Emissions	Compliant
§15.247(d)	Spurious Emissions at Antenna Port	Compliant
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliant
§15.247(b)(3)	Maximum Conducted Output Power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test（Chamber 1#）					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2017-11-12	2018-11-11
Sunol Sciences	Broadband Antenna	JB3	A090413-1	2016-12-26	2019-12-25
Sonoma Instrunent	Pre-amplifier	310N	171205	2017-08-15	2018-08-14
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-8	008	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2017-08-15	2018-08-14
Radiated Emission Test（Chamber 2#）					
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2017-08-27	2018-08-26
ETS-LINDGREN	Horn Antenna	3115	6229	2016-01-11	2019-01-10
ETS-LINDGREN	Horn Antenna	3116	00084159	2016-10-18	2019-10-17
Mini-Circuits	Amplifier	ZVA-183W-S+	220701818	2018-05-20	2019-05-19
EM Electronics Corporation	Amplifier	EM18G40G	060726	2018-03-22	2019-03-21
MICRO-TRONICS	Band notch Filter	BRM50702	/	2017-08-05	2018-08-04
Narda	Attenuator/10dB	10dB	/	2017-08-15	2018-08-14
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-11	011	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2017-08-15	2018-08-14
RF Conducted Test					
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2017-09-21	2018-09-20
Narda	Attenuator/2dB	2dB	/	2017-08-15	2018-08-14
Factory Method LLC	RF Cable-1	/	/	Each Time	/
Factory Method LLC	RF Cable-2	/	/	Each Time	/
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCS30	834115/007	2017-11-12	2018-11-11
Rohde & Schwarz	LISN	ENV216	3560655016	2017-11-15	2018-11-14
BACL	Auto test Software	BACL-EMC	CE001	/	/
Narda	Attenuator/6dB	10690812-2	26850-6	2018-01-10	2019-01-09
MICRO-COAX	Coaxial Cable	Cable-15	015	2017-08-15	2018-08-14

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §1.1310 & §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart §2.1091 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.

Calculated Formulary:
Predication of MPE limit at a given distance
$S = PG/4\pi R^2$ = 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:

Mode	Frequency Range (MHz)	Antenna Gain		Target Output Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)	MPE Ratio
		(dBi)	(numeric)	(dBm)	(mW)				
802.11b	2412~2462	2.00	1.58	16.50	44.67	20	0.0140	1.0	0.0140
802.11g		2.00	1.58	17.50	56.23	20	0.0177	1.0	0.0177
802.11 n-HT20		2.00	1.58	18.50	70.79	20	0.0222	1.0	**0.0222**
BLE	2402~2480	2.00	1.58	-3.50	0.45	20	0.0001	1.0	**0.0001**

Note:

(1) The target output power was declared by the manufacturer.

(2) Wi-Fi and BLE can transmit simultaneously, t he worst condition is 802.11g mode of Wi-Fi & BLE mode as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0222/1.0+0.0001/1.0=0.0222+0.0001=0.0223 < 1.0$$

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

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

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

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

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

Antenna Connector Construction

The EUT has a PCB antenna for Wi-Fi & a ceramic antenna for BLE, and the antenna gains are 2dBi for Wi-Fi & 2dBi for BLE, which were permanently attached, fulfill the requirement of this section. Please refer to the EUT photos.

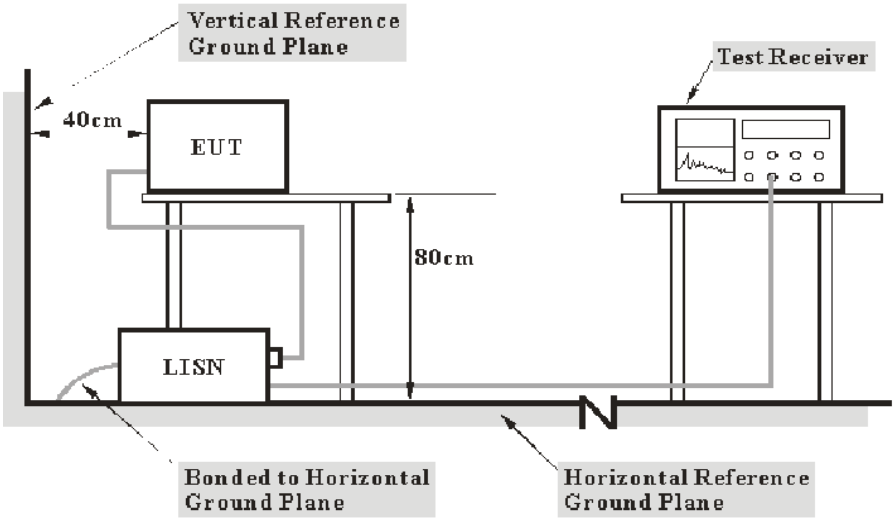
Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a)

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 measurement procedure of EUT setup is according with ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

The spacing between the peripherals was 10 cm.

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

ANSI C63.10-2013 clause 6.2

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Corrected Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)

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

Margin (dB) = Limit (dBμV) – Corrected Amplitude (dBμV)

Test Results Summary

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

Test Data

Environmental Conditions

Temperature:	20.2 ℃
Relative Humidity:	51 %
ATM Pressure:	101.3 kPa

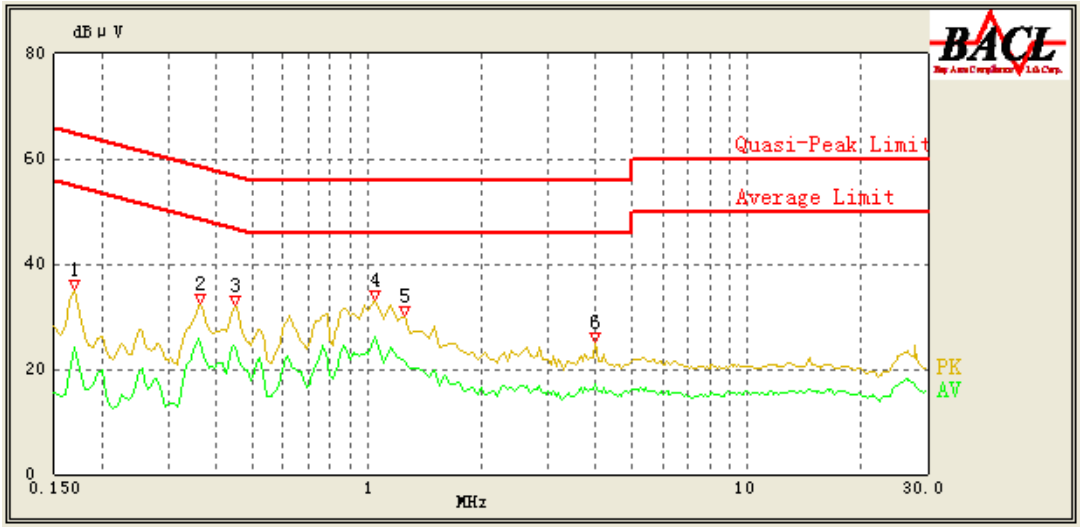
The testing was performed by Max Min on 2018-06-08 & 2018-07-20.

Mode 1: Charging from adapter

Data for Wi-Fi:

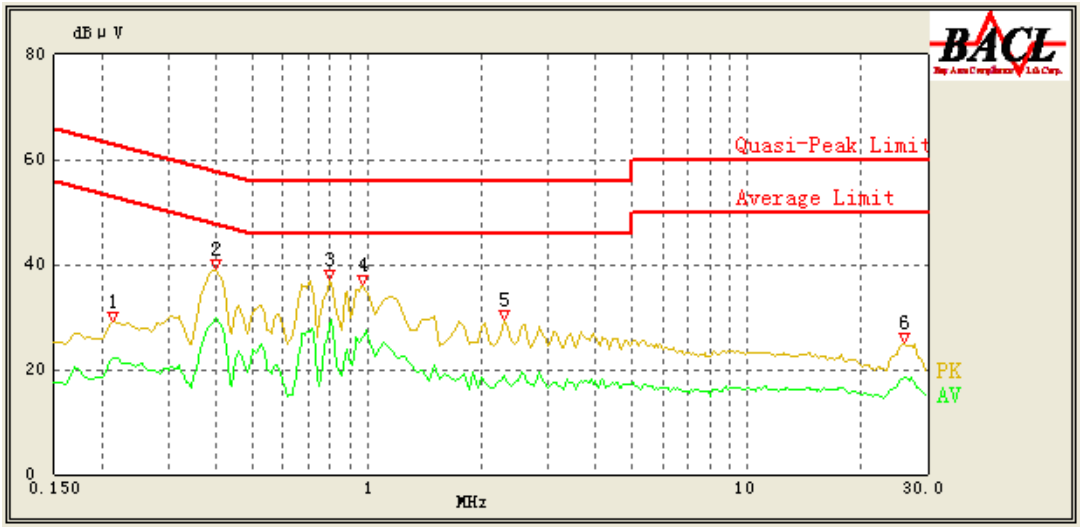
EUT operation mode: Transmitting in 802.11n-HT20 mode low channel (worst case)

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Limit (dBµV)	Margin (dB)	Comment
0.170	35.21	QP	9.000	L1	16.04	65.43	30.22	Compliance
0.170	24.12	AV	9.000	L1	16.04	55.43	31.31	Compliance
0.365	32.54	QP	9.000	L1	16.05	59.86	27.32	Compliance
0.365	25.24	AV	9.000	L1	16.05	49.86	24.62	Compliance
0.450	32.13	QP	9.000	L1	16.07	57.43	25.30	Compliance
0.450	24.57	AV	9.000	L1	16.07	47.57	23.00	Compliance
1.050	33.23	QP	9.000	L1	15.88	56.00	22.77	Compliance
1.050	26.17	AV	9.000	L1	15.88	46.00	19.83	Compliance
1.250	30.18	QP	9.000	L1	15.87	56.00	25.82	Compliance
1.250	21.40	AV	9.000	L1	15.87	46.00	24.60	Compliance
4.000	25.08	QP	9.000	L1	15.85	56.00	30.92	Compliance
4.000	17.31	AV	9.000	L1	15.85	46.00	28.69	Compliance

AC 120V/60 Hz, Neutral



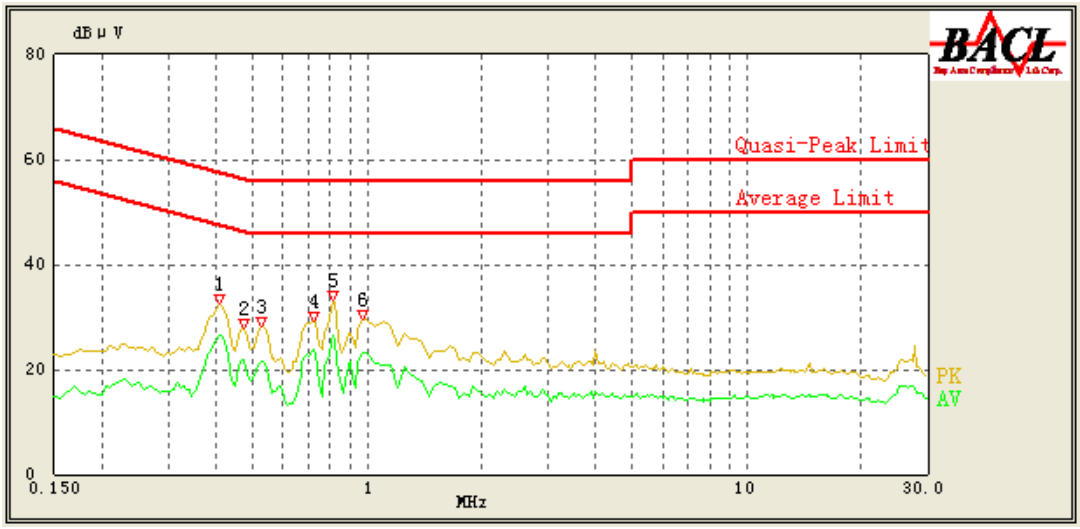
Frequency (MHz)	Corrected Amplitude (dBµV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Limit (dBµV)	Margin (dB)	Comment
0.215	29.17	QP	9.000	N	16.05	64.14	34.97	Compliance
0.215	22.01	AV	9.000	N	16.05	54.14	32.13	Compliance
0.400	39.05	QP	9.000	N	16.09	58.86	19.81	Compliance
0.400	29.99	AV	9.000	N	16.09	48.86	18.87	Compliance
0.800	37.20	QP	9.000	N	15.97	56.00	18.80	Compliance
0.800	29.34	AV	9.000	N	15.97	46.00	16.66	Compliance
0.970	36.24	QP	9.000	N	15.94	56.00	19.76	Compliance
0.970	26.08	AV	9.000	N	15.94	46.00	19.92	Compliance
2.300	29.34	QP	9.000	N	15.91	56.00	26.66	Compliance
2.300	18.71	AV	9.000	N	15.91	46.00	27.29	Compliance
25.900	25.02	QP	9.000	N	16.26	60.00	34.98	Compliance
25.900	18.17	AV	9.000	N	16.25	50.00	31.83	Compliance

Note:
1) Corrected Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)
2) Margin (dB) = Limit (dBµV) – Corrected Amplitude (dBµV)

Data for BLE:

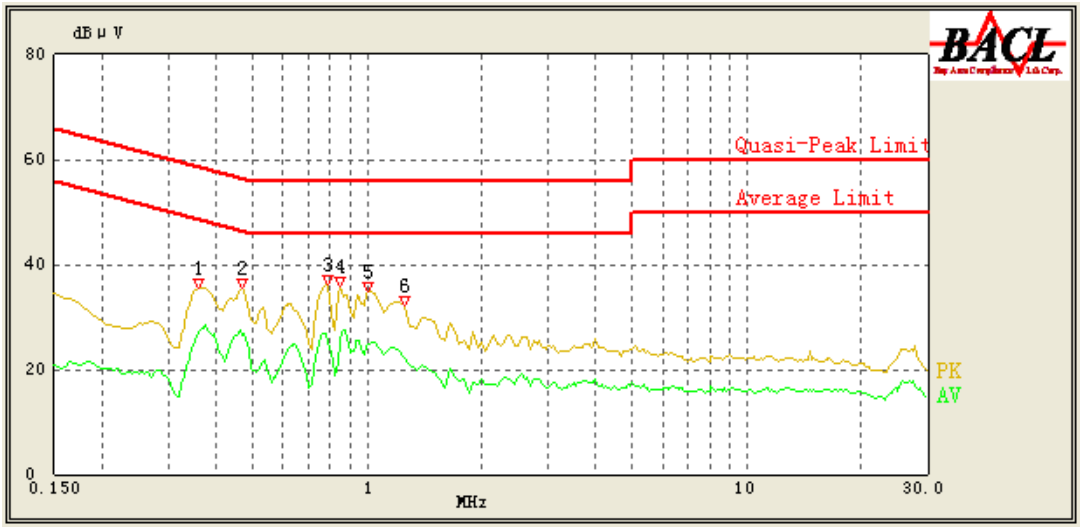
EUT operation mode: Transmitting in high channel (worst case)

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Limit (dBµV)	Margin (dB)	Comment
0.410	32.34	QP	9.000	L1	16.06	58.57	26.23	Compliance
0.410	26.42	AV	9.000	L1	16.06	48.57	22.15	Compliance
0.475	27.85	QP	9.000	L1	16.07	56.71	28.86	Compliance
0.475	21.71	AV	9.000	L1	16.07	46.71	25.00	Compliance
0.525	28.23	QP	9.000	L1	16.06	56.00	27.77	Compliance
0.525	21.45	AV	9.000	L1	16.06	46.00	24.55	Compliance
0.720	29.30	QP	9.000	L1	15.95	56.00	26.70	Compliance
0.720	23.82	AV	9.000	L1	15.95	46.00	22.18	Compliance
0.815	33.33	QP	9.000	L1	15.92	56.00	22.67	Compliance
0.815	26.58	AV	9.000	L1	15.92	46.00	19.42	Compliance
0.975	29.64	QP	9.000	L1	15.89	56.00	26.36	Compliance
0.975	23.31	AV	9.000	L1	15.88	46.00	22.69	Compliance

AC 120V/60 Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Limit (dBµV)	Margin (dB)	Comment
0.360	35.58	QP	9.000	N	16.08	60.00	24.42	Compliance
0.360	26.91	AV	9.000	N	16.08	50.00	23.09	Compliance
0.470	35.47	QP	9.000	N	16.10	56.86	21.39	Compliance
0.470	26.63	AV	9.000	N	16.10	46.86	20.23	Compliance
0.785	36.19	QP	9.000	N	15.98	56.00	19.81	Compliance
0.785	26.70	AV	9.000	N	15.98	46.00	19.30	Compliance
0.845	35.84	QP	9.000	N	15.97	56.00	20.16	Compliance
0.845	25.59	AV	9.000	N	15.97	46.00	20.41	Compliance
1.000	34.97	QP	9.000	N	15.94	56.00	21.03	Compliance
1.000	24.76	AV	9.000	N	15.94	46.00	21.24	Compliance
1.250	32.32	QP	9.000	N	15.93	56.00	23.68	Compliance
1.250	22.14	AV	9.000	N	15.93	46.00	23.86	Compliance

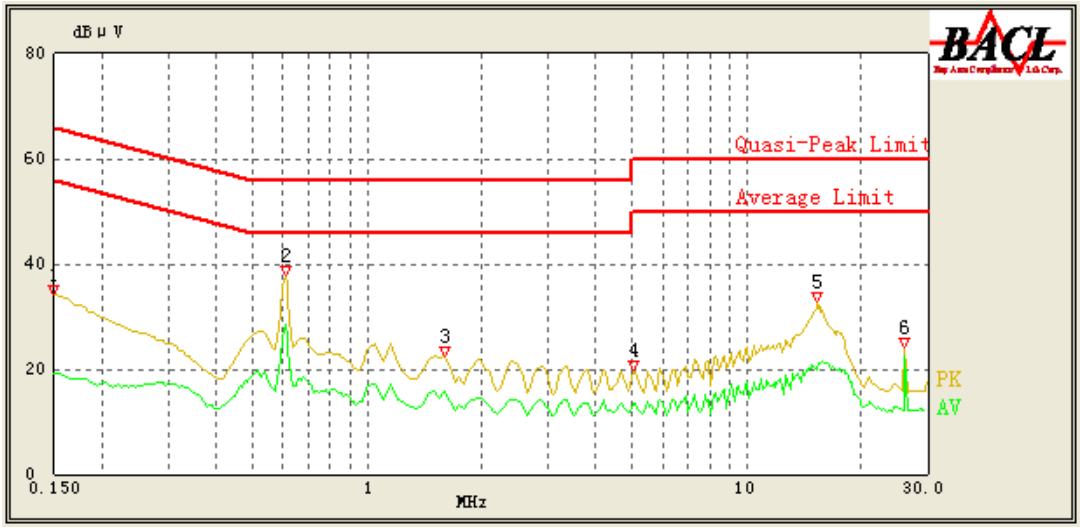
Note:
1) Corrected Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)
2) Margin (dB) = Limit (dBµV) – Corrected Amplitude (dBµV)

Mode 2: Charging from AC source

Data for Wi-Fi:

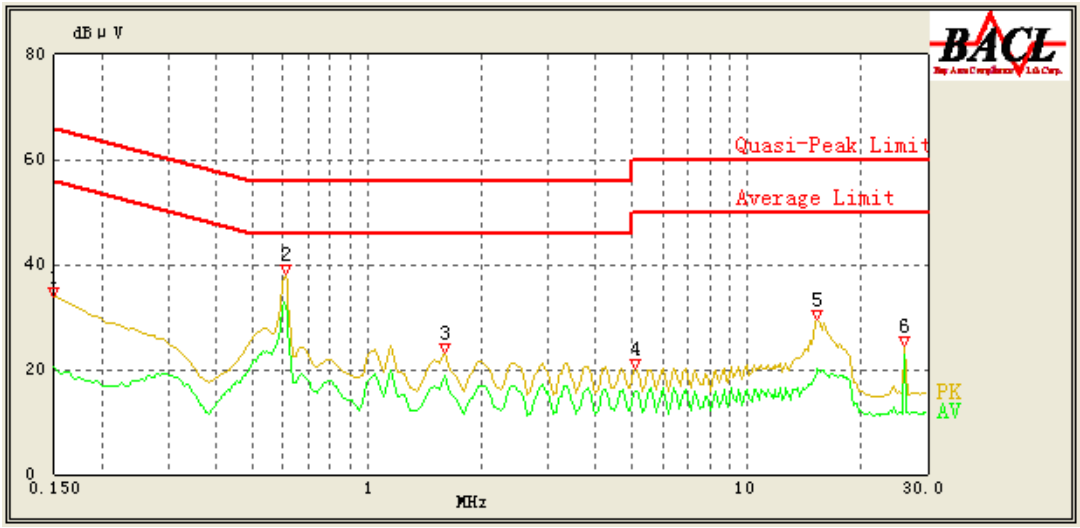
EUT operation mode: Transmitting in 802.11n-HT20 mode low channel (worst case)

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Limit (dBµV)	Margin (dB)	Comment
0.150	34.04	QP	9.000	L1	16.06	66.00	31.96	Compliance
0.150	19.29	AV	9.000	L1	16.06	56.00	36.71	Compliance
0.610	37.70	QP	9.000	L1	16.01	56.00	18.30	Compliance
0.610	28.66	AV	9.000	L1	16.01	46.00	17.34	Compliance
1.600	22.59	QP	9.000	L1	15.86	56.00	33.41	Compliance
1.600	15.70	AV	9.000	L1	15.86	46.00	30.30	Compliance
5.050	19.79	QP	9.000	L1	15.85	60.00	40.21	Compliance
5.050	13.49	AV	9.000	L1	15.85	50.00	36.51	Compliance
15.300	32.86	QP	9.000	L1	16.22	60.00	27.14	Compliance
15.300	21.33	AV	9.000	L1	16.23	50.00	28.67	Compliance
26.000	24.31	QP	9.000	L1	16.49	60.00	35.69	Compliance
26.000	22.56	AV	9.000	L1	16.49	50.00	27.44	Compliance

AC 120V/60 Hz, Neutral



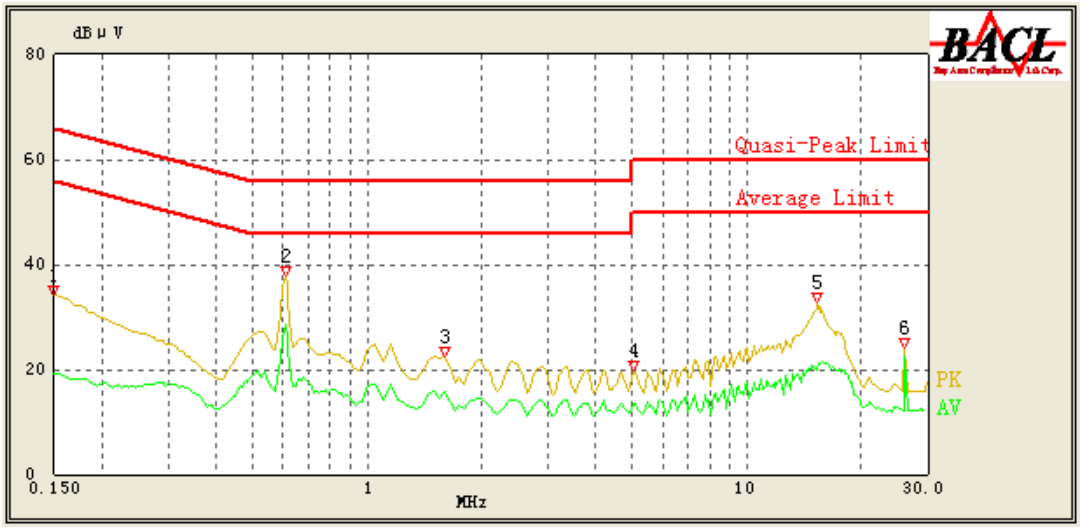
Frequency (MHz)	Corrected Amplitude (dBµV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Limit (dBµV)	Margin (dB)	Comment
0.150	33.79	QP	9.000	N	16.06	66.00	32.21	Compliance
0.150	20.65	AV	9.000	N	16.06	56.00	35.35	Compliance
0.610	38.12	QP	9.000	N	16.04	56.00	17.88	Compliance
0.610	32.94	AV	9.000	N	16.05	46.00	13.06	Compliance
1.600	23.02	QP	9.000	N	15.92	56.00	32.98	Compliance
1.600	18.73	AV	9.000	N	15.92	46.00	27.27	Compliance
5.100	20.17	QP	9.000	N	15.87	60.00	39.83	Compliance
5.100	15.94	AV	9.000	N	15.87	50.00	34.06	Compliance
15.300	29.53	QP	9.000	N	16.02	60.00	30.47	Compliance
15.300	20.07	AV	9.000	N	16.02	50.00	29.93	Compliance
26.000	24.39	QP	9.000	N	16.26	60.00	35.61	Compliance
26.000	22.89	AV	9.000	N	16.26	50.00	27.11	Compliance

Note:
1) Corrected Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)
2) Margin (dB) = Limit (dBµV) – Corrected Amplitude (dBµV)

Data for BLE:

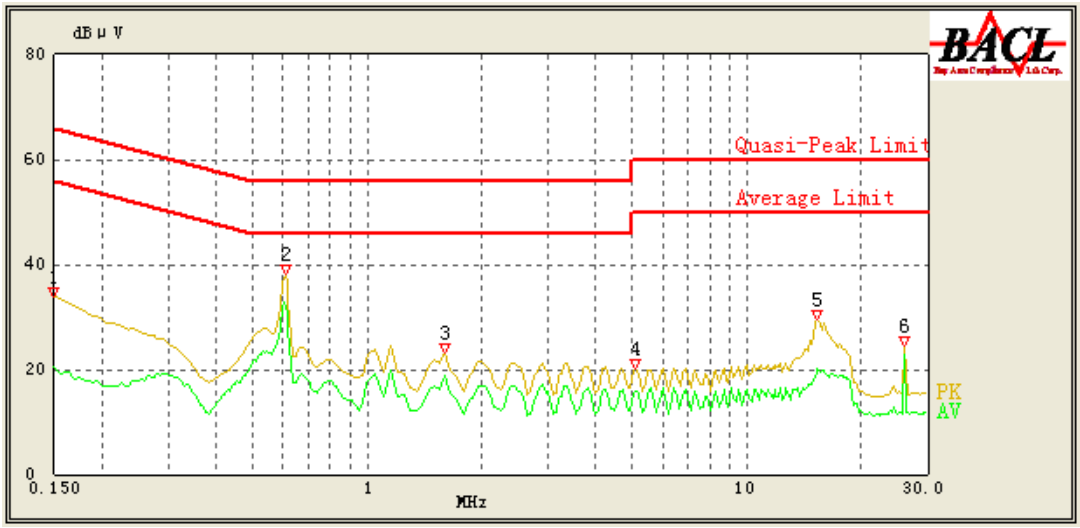
EUT operation mode: Transmitting in high channel (worst case)

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Limit (dBµV)	Margin (dB)	Comment
0.160	39.46	QP	9.000	L1	16.05	65.71	26.25	Compliance
0.160	23.62	AV	9.000	L1	16.05	55.71	32.09	Compliance
0.610	35.40	QP	9.000	L1	16.01	56.00	20.60	Compliance
0.610	30.11	AV	9.000	L1	16.01	46.00	15.89	Compliance
1.150	21.93	QP	9.000	L1	15.88	56.00	34.07	Compliance
1.150	17.87	AV	9.000	L1	15.88	46.00	28.13	Compliance
7.350	21.57	QP	9.000	L1	15.99	60.00	38.43	Compliance
7.300	16.28	AV	9.000	L1	15.99	50.00	33.72	Compliance
16.000	32.01	QP	9.000	L1	16.26	60.00	27.99	Compliance
15.900	19.62	AV	9.000	L1	16.25	50.00	30.38	Compliance
26.000	24.17	QP	9.000	L1	16.49	60.00	35.83	Compliance
26.000	22.56	AV	9.000	L1	16.49	50.00	27.44	Compliance

AC 120V/60 Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Limit (dBµV)	Margin (dB)	Comment
0.150	34.29	QP	9.000	N	16.06	66.00	31.71	Compliance
0.150	17.69	AV	9.000	N	16.06	56.00	38.31	Compliance
0.605	26.44	QP	9.000	N	16.05	56.00	29.56	Compliance
0.605	21.30	AV	9.000	N	16.05	46.00	24.70	Compliance
1.050	17.43	QP	9.000	N	15.94	56.00	38.57	Compliance
1.050	12.91	AV	9.000	N	15.94	46.00	33.09	Compliance
2.850	15.40	QP	9.000	N	15.90	56.00	40.60	Compliance
2.850	11.27	AV	9.000	N	15.90	46.00	34.73	Compliance
8.300	24.03	QP	9.000	N	15.95	60.00	35.97	Compliance
8.300	14.32	AV	9.000	N	15.95	50.00	35.68	Compliance
15.750	31.00	QP	9.000	N	16.03	60.00	29.00	Compliance
15.850	19.02	AV	9.000	N	16.04	50.00	30.98	Compliance

Note:
1) Corrected Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)
2) Margin (dB) = Limit (dBµV) – Corrected Amplitude (dBµV)

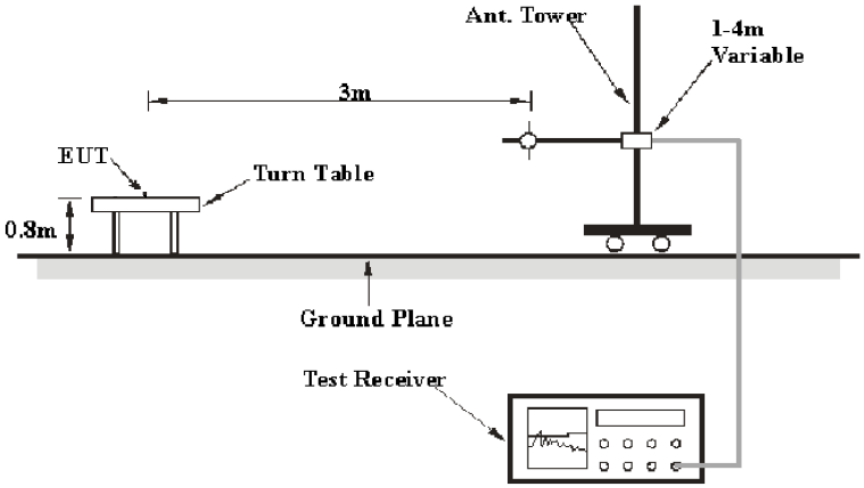
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

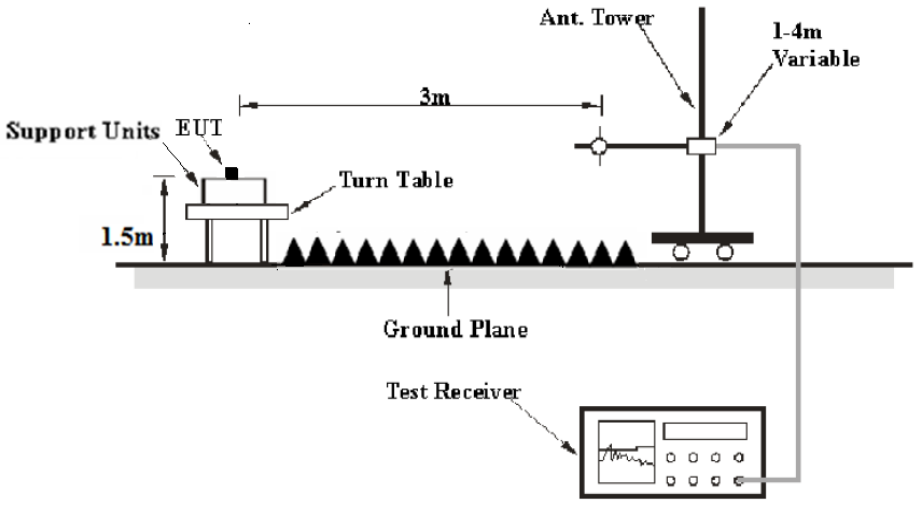
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

EMI Test Receiver Setup

The system was investigated from 30 MHz to 25 GHz.

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

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1GHz	1MHz	3 MHz	/	PK
	1MHz	3 MHz	/	Ave.

Test Procedure

According to KDB558074 D01 DTS Meas Guidance v04 sub-clause 12.1 and 12.2. and ANSI C63.10-2013 clause 6.5, 6.6 and 6.7.

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 mode for frequencies above 1 GHz.

Corrected Amplitude & Margin Calculation

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

Corrected Amplitude (dBμV /m) = Meter Reading (dBμV) + Antenna Factor (dB/m) + Cable Loss (dB) - Amplifier Gain (dB)

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 (dB) = Limit (dBμV/m) – Corrected Amplitude (dBμV /m)

Test Results Summary

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

Test Data

Environmental Conditions

Temperature:	24.1 ℃
Relative Humidity:	50 %
ATM Pressure:	101.2kPa

RF conducted test was performed by Max Min from 2018-02-02 to 2018-02-08; Radiated emission test was performed by Max Min from 2018-07-14 to 2018-07-16.

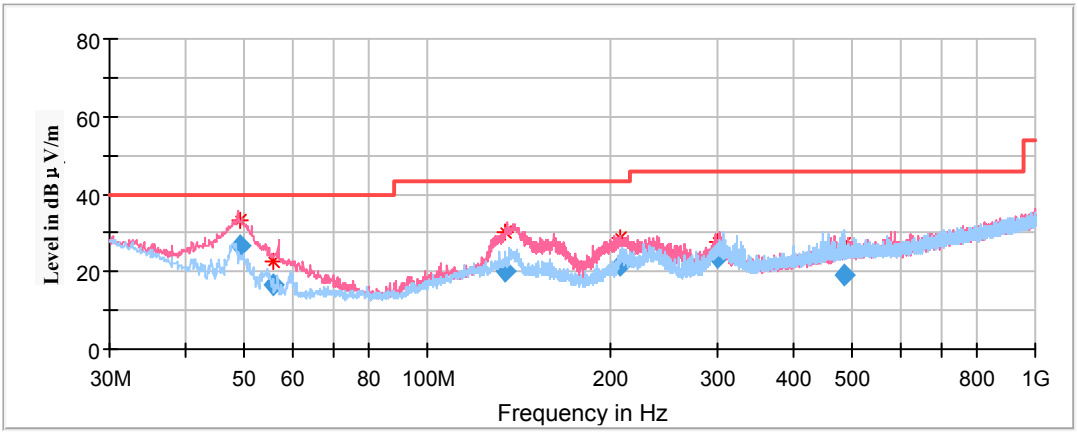
*EUT operation mode: Transmitting (Mode 1 & mode2 have been tested, data for **the worst case mode 2** was recorded.)*

Data for Wi-Fi:

Spurious Emission Test:

30MHz-1GHz:

*Pre-scan with 802.11b, 802.11g and 802.11n-HT20 modes of operation in the X,Y and Z axes of orientation, the worst case **low channel of 802.11n-HT20 mode in X-axis of orientation** was recorded*



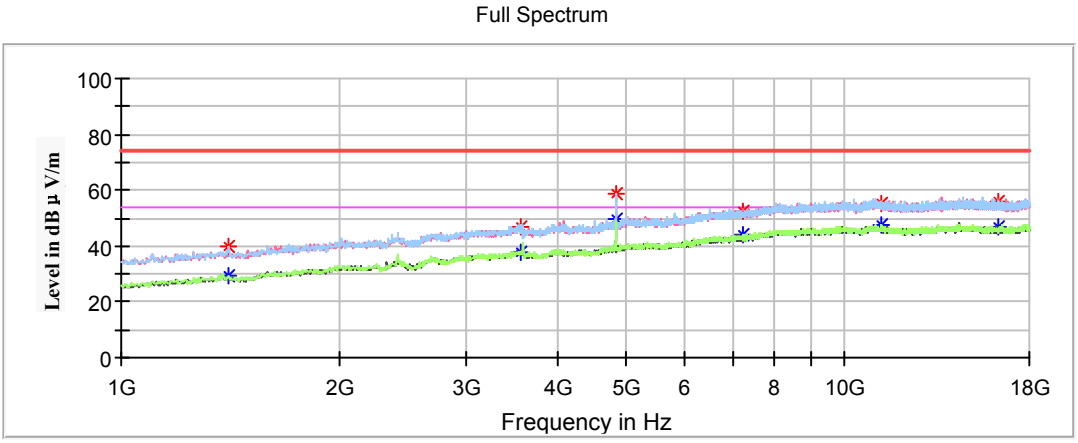
Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	QuasiPeak (dBµV/m)	Height (cm)	Polar (H/V)				
49.077200	26.45	101.0	V	175.0	-17.3	40.00	13.55
55.872350	16.62	101.0	V	0.0	-18.2	40.00	23.38
134.257400	20.19	101.0	V	170.0	-12.2	43.50	23.31
208.033700	21.84	101.0	V	2.0	-12.7	43.50	21.66
300.612400	23.62	101.0	V	303.0	-11.0	46.00	22.38
485.133650	18.90	198.0	H	112.0	-6.5	46.00	27.10

1GHz-18GHz:

802.11b Mode:
*(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded)*

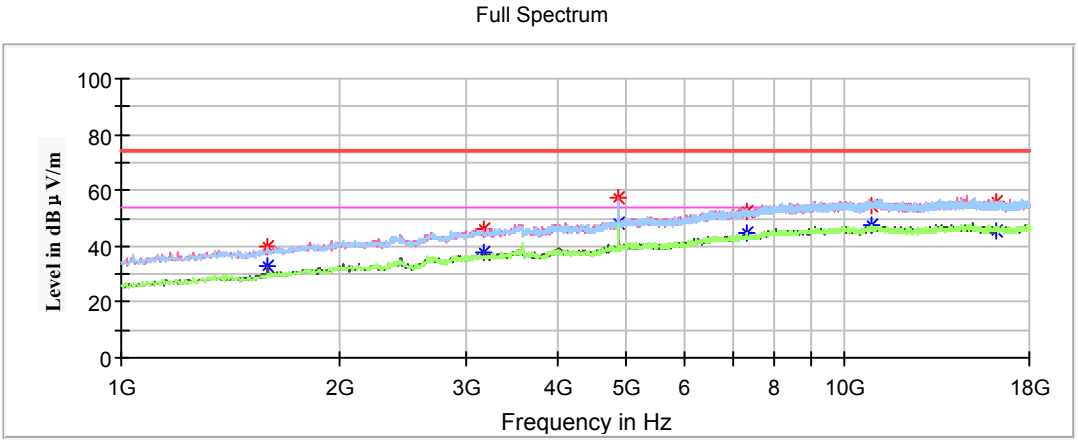
Note:
1. This test was performed with the 2.4-2.5GHz notch filter.
2. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) – Amplifier Factor (dB)
   Corrected Amplitude (dBμV /m) = Corrected Factor (dB/m) + Reading (dBμV)
   Margin (dB) = Limit (dBμV/m) – Corrected Amplitude (dBμV /m)

Low Channel: 2412MHz



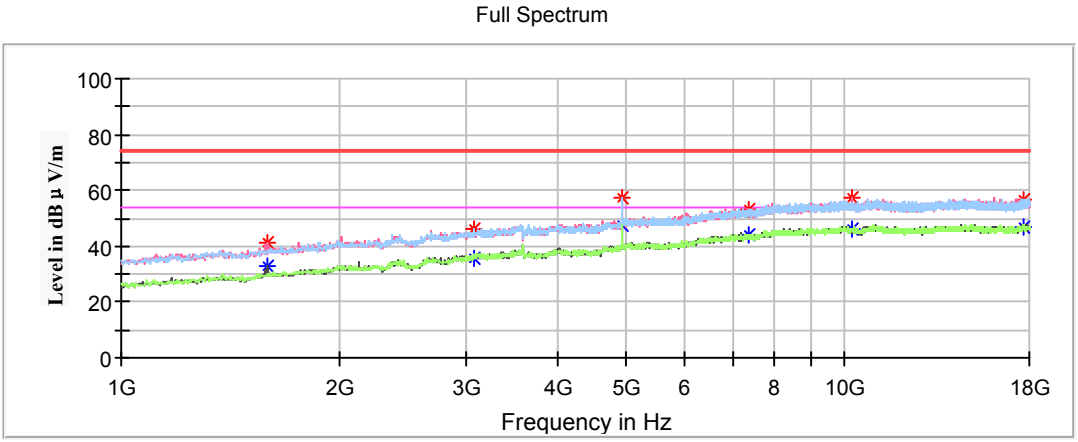
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV /m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
1408.000000	39.62	---	150.0	H	154.0	-1.8	74.00	34.38
1408.000000	---	29.20	150.0	H	154.0	-1.8	54.00	24.80
3563.600000	---	38.04	100.0	V	280.0	7.5	54.00	15.96
3563.600000	46.99	---	100.0	V	280.0	7.5	74.00	27.01
4824.000000	---	49.48	150.0	V	260.0	10.8	54.00	4.52
4824.000000	58.83	---	150.0	V	260.0	10.8	74.00	15.17
7236.000000	52.48	---	100.0	V	248.0	15.3	74.00	21.52
7236.000000	---	44.16	100.0	V	248.0	15.3	54.00	9.84
11213.600000	55.35	---	100.0	H	196.0	18.8	74.00	18.65
11213.600000	---	47.71	100.0	H	196.0	18.8	54.00	6.29
16259.200000	55.74	---	200.0	V	137.0	18.2	74.00	18.26
16259.200000	---	46.75	200.0	V	137.0	18.2	54.00	7.25

Middle Channel: 2437MHz



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1595.000000	---	32.70	150.0	V	207.0	-0.6	54.00	21.30
1595.000000	39.92	---	150.0	V	207.0	-0.6	74.00	34.08
3165.800000	---	37.49	150.0	V	68.0	6.4	54.00	16.51
3165.800000	45.98	---	150.0	V	68.0	6.4	74.00	28.02
4874.000000	---	48.02	200.0	V	244.0	11.1	54.00	5.98
4874.000000	57.69	---	200.0	V	244.0	11.1	74.00	16.31
7311.000000	52.36	---	200.0	V	335.0	15.4	74.00	21.64
7311.000000	---	45.01	200.0	V	335.0	15.4	54.00	8.99
10917.800000	54.63	---	200.0	H	143.0	18.8	74.00	19.37
10921.200000	---	47.56	200.0	H	143.0	18.9	54.00	6.44
16242.200000	---	45.37	100.0	H	174.0	18.2	54.00	8.63
16242.200000	55.89	---	100.0	H	174.0	18.2	74.00	18.11

High Channel: 2462MHz

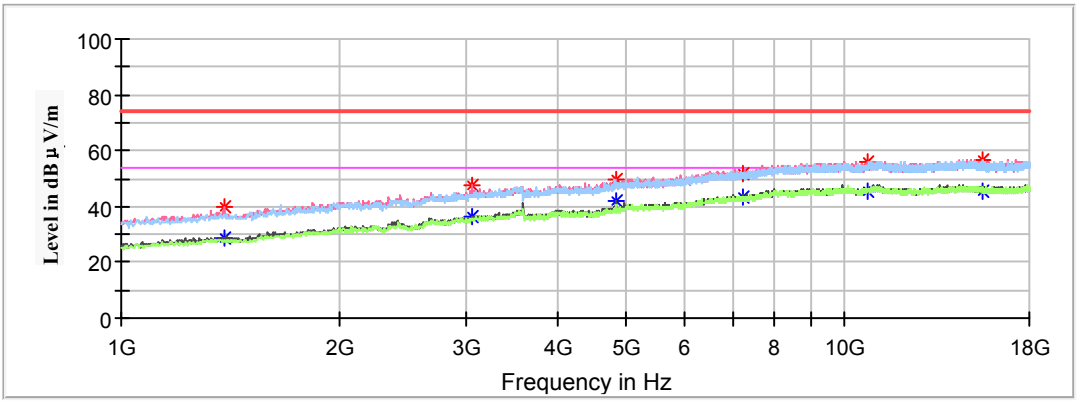


Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1591.600000	---	33.06	200.0	V	185.0	-0.6	54.00	20.94
1591.600000	41.36	---	200.0	V	185.0	-0.6	74.00	32.64
3077.400000	---	35.82	200.0	H	239.0	6.2	54.00	18.18
3077.400000	45.83	---	200.0	H	239.0	6.2	74.00	28.17
4924.000000	---	47.49	100.0	V	1.0	11.3	54.00	6.51
4924.000000	57.08	---	100.0	V	1.0	11.3	74.00	16.92
7386.000000	---	44.15	200.0	V	359.0	15.5	54.00	9.85
7386.000000	52.86	---	200.0	V	359.0	15.5	74.00	21.14
10254.800000	---	45.94	150.0	V	11.0	18.0	54.00	8.06
10254.800000	57.19	---	150.0	V	11.0	18.0	74.00	16.81
17721.200000	---	46.97	100.0	H	271.0	18.8	54.00	7.03
17721.200000	56.85	---	100.0	H	271.0	18.8	74.00	17.15

802.11g Mode:
*(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded)*

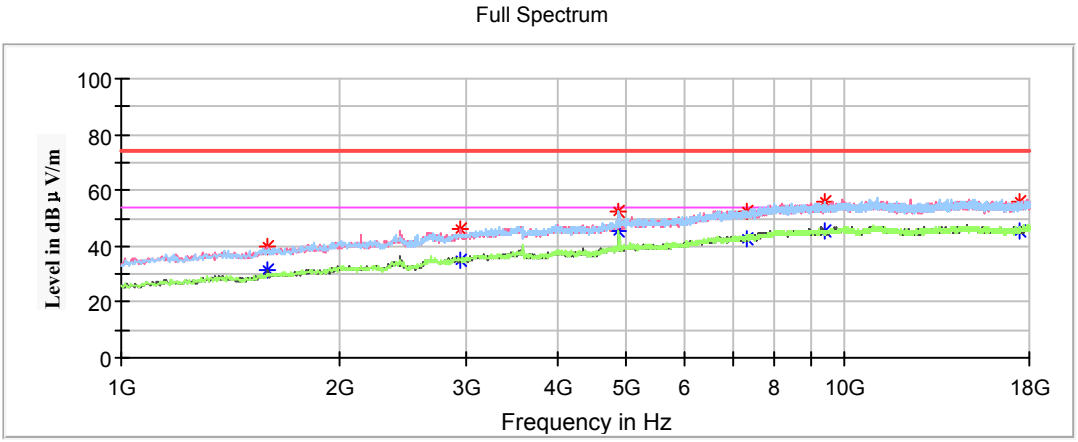
Note:
1. This test was performed with the 2.4-2.5GHz notch filter.
2. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) – Amplifier Factor (dB)
   Corrected Amplitude (dBμV /m) = Corrected Factor (dB/m) + Reading (dBμV)
   Margin (dB) = Limit (dBμV/m) – Corrected Amplitude (dBμV /m)

Low Channel: 2412MHz



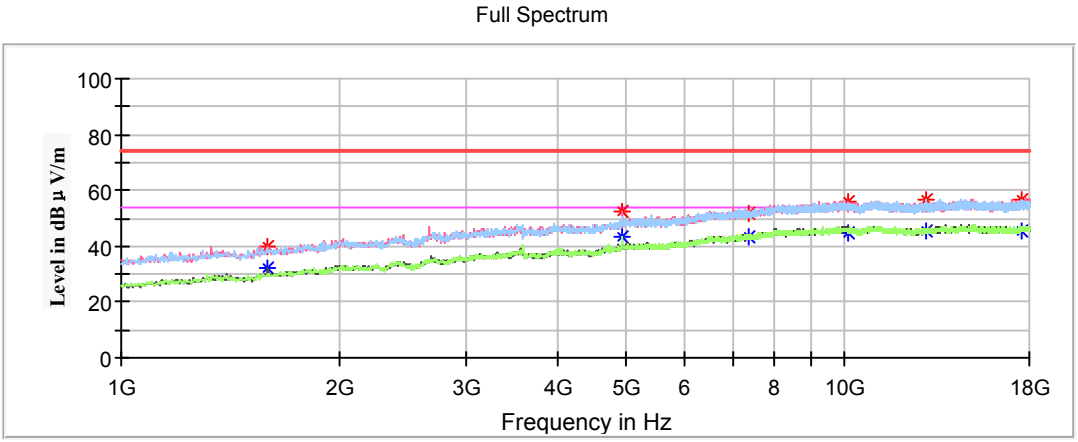
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV /m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
1387.600000	---	28.50	150.0	V	11.0	-1.9	54.00	25.50
1387.600000	39.89	---	150.0	V	11.0	-1.9	74.00	34.11
3050.200000	---	36.34	150.0	V	217.0	6.1	54.00	17.66
3050.200000	47.21	---	150.0	V	217.0	6.1	74.00	26.79
4824.000000	49.57	---	150.0	V	73.0	10.8	74.00	24.43
4824.000000	---	41.65	150.0	V	73.0	10.8	54.00	12.35
7236.000000	---	43.48	250.0	H	341.0	15.3	54.00	10.52
7236.000000	52.03	---	250.0	H	341.0	15.3	74.00	21.97
10754.600000	---	45.59	150.0	V	105.0	18.4	54.00	8.41
10754.600000	56.22	---	150.0	V	105.0	18.4	74.00	17.78
15545.200000	---	45.12	150.0	H	245.0	18.1	54.00	8.88
15545.200000	56.44	---	150.0	H	245.0	18.1	74.00	17.56

Middle Channel: 2437MHz



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1595.000000	---	31.56	200.0	V	172.0	-0.6	54.00	22.44
1595.000000	39.58	---	200.0	V	172.0	-0.6	74.00	34.42
2948.200000	---	35.26	200.0	V	44.0	5.7	54.00	18.74
2948.200000	46.25	---	200.0	V	44.0	5.7	74.00	27.75
4874.000000	---	45.59	200.0	H	352.0	11.1	54.00	8.41
4874.000000	52.20	---	200.0	H	352.0	11.1	74.00	21.80
7311.000000	---	42.92	150.0	V	334.0	15.4	54.00	11.08
7311.000000	52.33	---	150.0	V	334.0	15.4	74.00	21.67
9391.200000	---	45.40	200.0	H	35.0	17.7	54.00	8.60
9391.200000	56.26	---	200.0	H	35.0	17.7	74.00	17.74
17503.600000	---	45.76	100.0	V	325.0	18.5	54.00	8.24
17503.600000	56.19	---	100.0	V	325.0	18.5	74.00	17.81

High Channel: 2462MHz

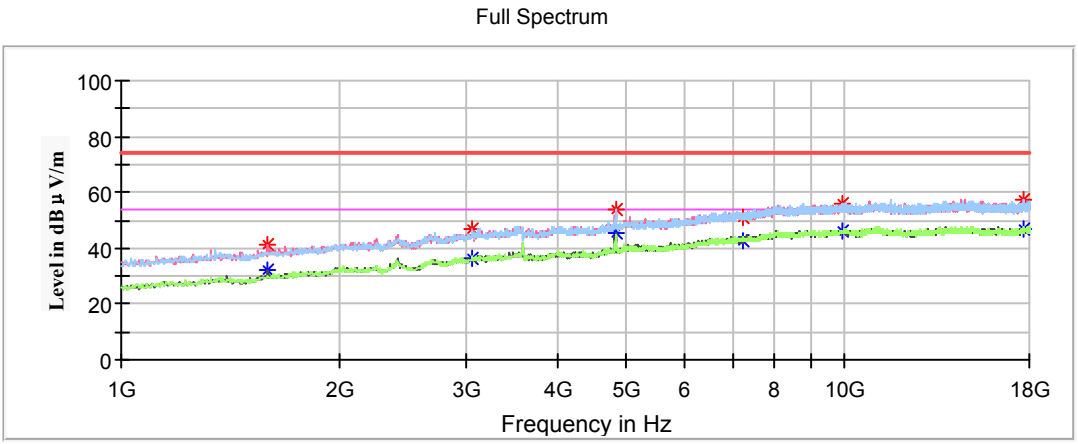


Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1595.000000	---	31.97	200.0	V	174.0	-0.6	54.00	22.03
1595.000000	39.94	---	200.0	V	174.0	-0.6	74.00	34.06
4924.000000	---	43.02	200.0	V	263.0	11.3	54.00	10.98
4924.000000	52.33	---	200.0	V	263.0	11.3	74.00	21.67
7386.000000	---	43.59	150.0	V	290.0	15.5	54.00	10.41
7386.000000	52.04	---	150.0	V	290.0	15.5	74.00	21.96
10112.000000	---	45.01	150.0	V	110.0	18.2	54.00	8.99
10112.000000	55.64	---	150.0	V	110.0	18.2	74.00	18.36
12934.000000	---	45.12	150.0	H	8.0	17.7	54.00	8.88
12934.000000	56.42	---	150.0	H	8.0	17.7	74.00	17.58
17507.000000	---	45.42	150.0	H	354.0	18.5	54.00	8.58
17507.000000	56.84	---	150.0	H	354.0	18.5	74.00	17.16

802.11n-HT20 Mode:
*(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded)*

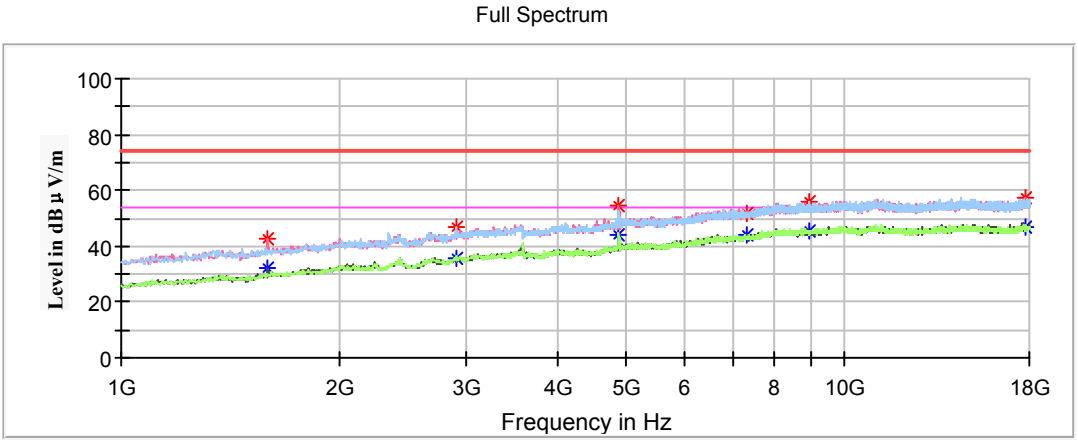
Note:
1. This test was performed with the 2.4-2.5GHz notch filter.
2. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) – Amplifier Factor (dB)
   Corrected Amplitude (dBμV /m) = Corrected Factor (dB/m) + Reading (dBμV)
   Margin (dB) = Limit (dBμV/m) – Corrected Amplitude (dBμV /m)

Low Channel: 2412MHz



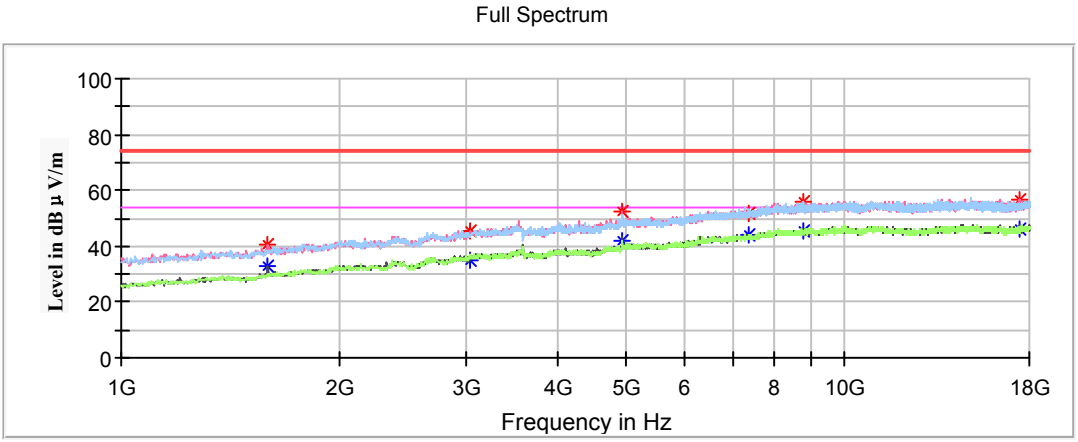
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV /m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
1595.000000	41.20	---	200.0	V	193.0	-0.6	74.00	32.80
1595.000000	---	32.08	200.0	V	193.0	-0.6	54.00	21.92
3053.600000	46.63	---	100.0	V	6.0	6.1	74.00	27.37
3053.600000	---	36.41	100.0	V	6.0	6.1	54.00	17.59
4824.000000	54.07	---	200.0	V	355.0	10.8	74.00	19.93
4824.000000	---	45.35	200.0	V	355.0	10.8	54.00	8.65
7236.000000	---	42.71	100.0	V	252.0	15.3	54.00	11.29
7236.000000	51.15	---	100.0	V	252.0	15.3	74.00	22.85
9894.400000	---	46.42	150.0	V	174.0	18.2	54.00	7.58
9894.400000	56.27	---	150.0	V	174.0	18.2	74.00	17.73
17677.000000	---	46.53	200.0	H	174.0	18.7	54.00	7.47
17677.000000	57.12	---	200.0	H	174.0	18.7	74.00	16.88

Middle Channel: 2437MHz



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1595.000000	---	32.36	200.0	V	181.0	-0.6	54.00	21.64
1595.000000	42.38	---	200.0	V	181.0	-0.6	74.00	31.62
2897.200000	---	35.77	100.0	H	321.0	5.4	54.00	18.23
2897.200000	46.60	---	100.0	H	321.0	5.4	74.00	27.40
4874.000000	---	44.21	100.0	V	270.0	11.1	54.00	9.79
4874.000000	54.61	---	100.0	V	270.0	11.1	74.00	19.39
7311.000000	---	43.73	150.0	V	315.0	15.4	54.00	10.27
7311.000000	51.63	---	150.0	V	315.0	15.4	74.00	22.37
8918.600000	---	45.78	200.0	H	128.0	17.5	54.00	8.22
8918.600000	55.75	---	200.0	H	128.0	17.5	74.00	18.25
17809.600000	---	46.66	200.0	V	0.0	18.9	54.00	7.34
17809.600000	57.48	---	200.0	V	0.0	18.9	74.00	16.52

High Channel: 2462MHz

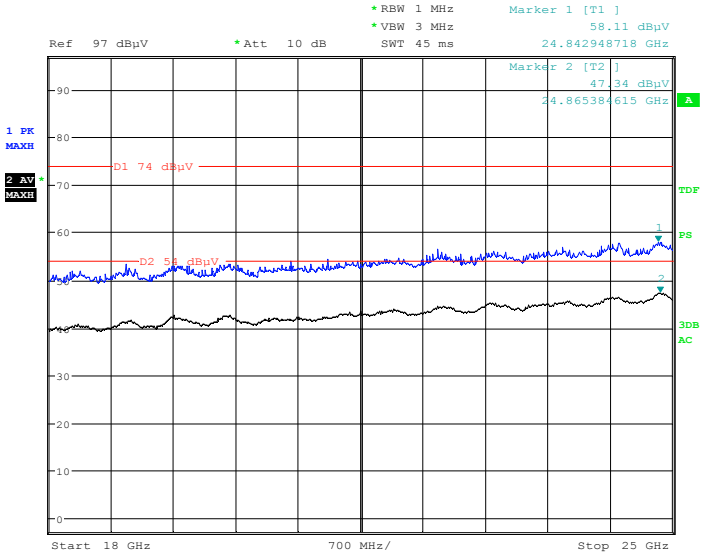


Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1595.000000	---	32.67	200.0	V	186.0	-0.6	54.00	21.33
1595.000000	40.63	---	200.0	V	186.0	-0.6	74.00	33.37
3043.400000	---	35.11	100.0	V	40.0	6.1	54.00	18.89
3043.400000	45.39	---	100.0	V	40.0	6.1	74.00	28.61
4924.000000	---	42.15	100.0	V	264.0	11.4	54.00	11.85
4924.000000	52.53	---	100.0	V	264.0	11.4	74.00	21.47
7386.000000	---	43.83	150.0	V	349.0	15.5	54.00	10.17
7386.000000	51.46	---	150.0	V	339.0	15.5	74.00	22.54
8758.800000	---	45.36	100.0	H	40.0	17.4	54.00	8.64
8758.800000	55.96	---	100.0	H	40.0	17.4	74.00	18.04
17486.600000	---	46.11	200.0	V	244.0	18.4	54.00	7.89
17486.600000	56.81	---	200.0	V	244.0	18.4	74.00	17.19

18GHz-25GHz:

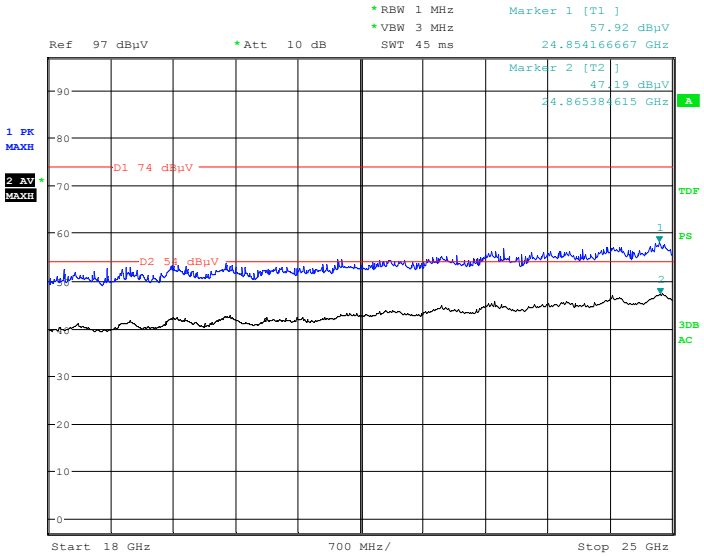
*Pre-scan with 802.11b, 802.11g and 802.11n-HT20 modes of operation in the X,Y and Z axes of orientation, the worst case **low channel of 802.11n-HT20 mode in X-axis of orientation** was recorded*

Horizontal



Date: 16.JUL.2018 12:12:08

Vertical



Date: 16.JUL.2018 12:23:16

Fundamental Test & Restricted Bands Emissions Test:

Note:
1. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) – Amplifier Factor (dB)
   Corrected Amplitude (dBμV /m) = Corrected Factor (dB/m) + Reading (dBμV)
   Margin (dB) = Limit (dBμV/m) – Corrected Amplitude (dBμV /m)

802.11b Mode: *(Pre-scan in the X, Y and Z axes of orientation, the worst case X-axis of orientation was recorded)*

Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV /m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
Low Channel: 2412MHz								
2412.000000	105.92	---	250.0	V	26.0	2.9	/	/
2412.000000	---	98.74	250.0	V	26.0	2.9	/	/
2412.000000	103.25	---	200.0	H	36.0	2.9	/	/
2412.000000	---	96.03	200.0	H	36.0	2.9	/	/
2390.000000	52.16	---	200.0	V	267.0	2.8	74.00	21.84
2390.000000	---	42.63	200.0	V	267.0	2.8	54.00	11.37
Middle Channel: 2437MHz								
2437.000000	106.18	---	200.0	V	168.0	3.0	/	/
2437.000000	---	98.92	200.0	V	168.0	3.0	/	/
2437.000000	103.52	---	200.0	H	64.0	3.0	/	/
2437.000000	---	96.19	200.0	H	64.0	3.0	/	/
High Channel: 2462MHz								
2462.000000	105.63	---	200.0	V	101.0	3.0	/	/
2462.000000	---	98.72	200.0	V	101.0	3.0	/	/
2462.000000	102.98	---	150.0	H	142.0	3.0	/	/
2462.000000	---	96.03	150.0	H	142.0	3.0	/	/
2483.500000	53.51	---	200.0	V	106.0	3.0	74.00	20.49
2483.500000	---	45.43	200.0	V	106.0	3.0	54.00	8.57

802.11g Mode: *(Pre-scan in the X, Y and Z axes of orientation, the worst case X-axis of orientation was recorded)*

Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV /m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
Low Channel: 2412MHz								
2412.000000	99.64	---	250.0	V	261.0	2.9	/	/
2412.000000	---	92.48	250.0	V	261.0	2.9	/	/
2412.000000	97.00	---	200.0	H	359.0	2.9	/	/
2412.000000	---	89.93	200.0	H	359.0	2.9	/	/
2390.000000	52.27	---	150.0	V	8.0	2.8	74.00	21.73
2390.000000	---	43.54	150.0	V	8.0	2.8	54.00	10.46
Middle Channel: 2437MHz								
2437.000000	100.33	---	200.0	V	273.0	3.0	/	/
2437.000000	---	93.21	200.0	V	273.0	3.0	/	/
2437.000000	97.79	---	250.0	H	352.0	3.0	/	/
2437.000000	---	90.70	250.0	H	352.0	3.0	/	/
High Channel: 2462MHz								
2462.000000	98.87	---	200.0	V	342.0	3.0	/	/
2462.000000	---	91.49	200.0	V	342.0	3.0	/	/
2462.000000	96.30	---	200.0	H	253.0	3.0	/	/
2462.000000	---	88.88	200.0	H	253.0	3.0	/	/
2483.500000	55.38	---	200.0	V	348.0	3.0	74.00	18.62
2483.500000	---	46.66	200.0	V	348.0	3.0	54.00	7.34

802.11n-HT20 Mode: *(Pre-scan in the X,Y and Z axes of orientation, the worst case X-axis of orientation was recorded)*

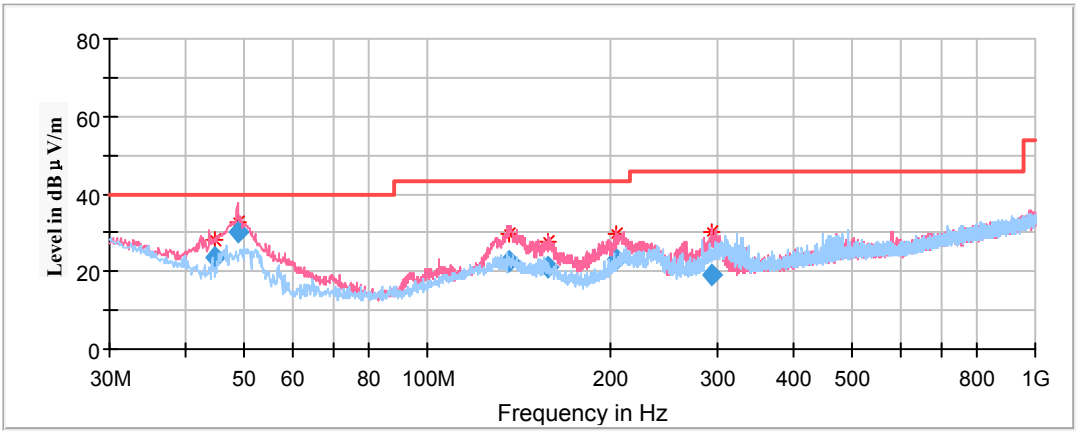
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV /m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
Low Channel: 2412MHz								
2412.000000	99.24	---	200.0	V	59.0	2.9	/	/
2412.000000	---	91.62	200.0	V	59.0	2.9	/	/
2412.000000	96.78	---	250.0	H	152.0	2.9	/	/
2412.000000	---	89.10	250.0	H	152.0	2.9	/	/
2390.000000	52.23	---	200.0	V	174.0	2.8	74.00	21.77
2390.000000	---	44.84	200.0	V	174.0	2.8	54.00	9.16
Middle Channel: 2437MHz								
2437.000000	101.08	---	200.0	V	240.0	3.0	/	/
2437.000000	---	93.41	200.0	V	240.0	3.0	/	/
2437.000000	98.57	---	200.0	H	17.0	3.0	/	/
2437.000000	---	90.82	200.0	H	17.0	3.0	/	/
High Channel: 2462MHz								
2462.000000	98.91	---	150.0	V	64.0	3.0	/	/
2462.000000	---	91.31	150.0	V	64.0	3.0	/	/
2462.000000	96.45	---	150.0	H	19.0	3.0	/	/
2462.000000	---	88.82	150.0	H	19.0	3.0	/	/
2483.500000	54.39	---	250.0	V	21.0	3.0	74.00	19.61
2483.500000	---	46.88	250.0	V	21.0	3.0	54.00	7.12

Data for BLE:

Spurious Emission Test:

30MHz-1GHz

(Pre-scan with low, middle and high channels of operation in the X,Y and Z axes of orientation, the worst case ***high channel of operation in the X axis of orientation*** *was recorded)*



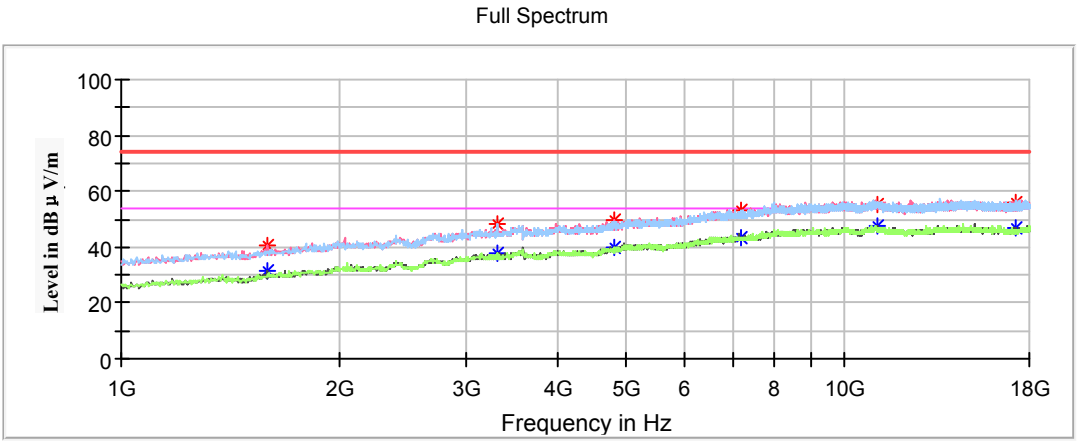
Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	QuasiPeak (dB µ V/m)	Height (cm)	Polar (H/V)				
44.663400	23.64	101.0	V	0.0	-14.3	40.00	16.36
48.667100	29.96	101.0	V	69.0	-17.1	40.00	10.04
136.385850	22.81	101.0	V	147.0	-12.3	43.50	20.69
157.373550	21.33	101.0	V	173.0	-13.1	43.50	22.17
204.639850	23.14	101.0	V	137.0	-12.8	43.50	20.36
293.061100	18.99	101.0	V	105.0	-11.2	46.00	27.01

1GHz-18GHz

*(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded)*

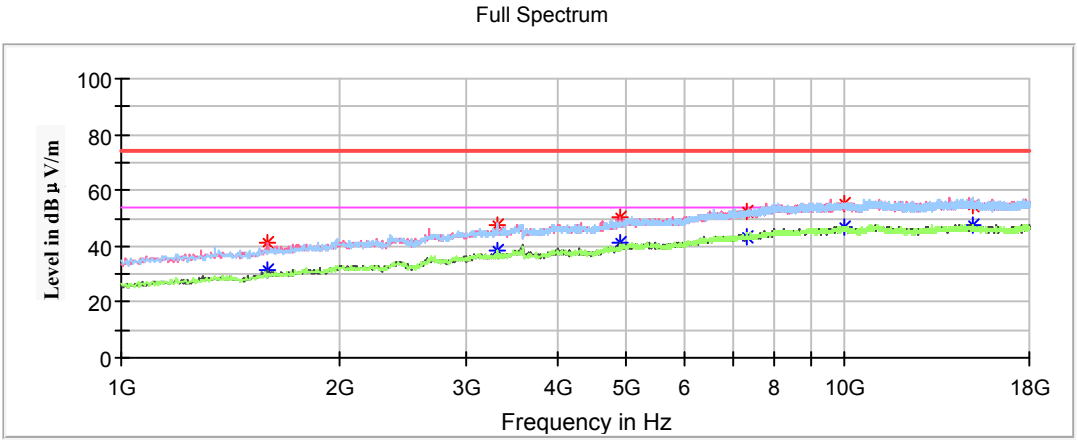
Note:
1. This test was performed with the 2.4-2.5GHz notch filter.
2. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) – Amplifier Factor (dB)
   Corrected Amplitude (dBμV /m) = Corrected Factor (dB/m) + Reading (dBμV)
   Margin (dB) = Limit (dBμV/m) – Corrected Amplitude (dBμV /m)

Low Channel: 2402MHz



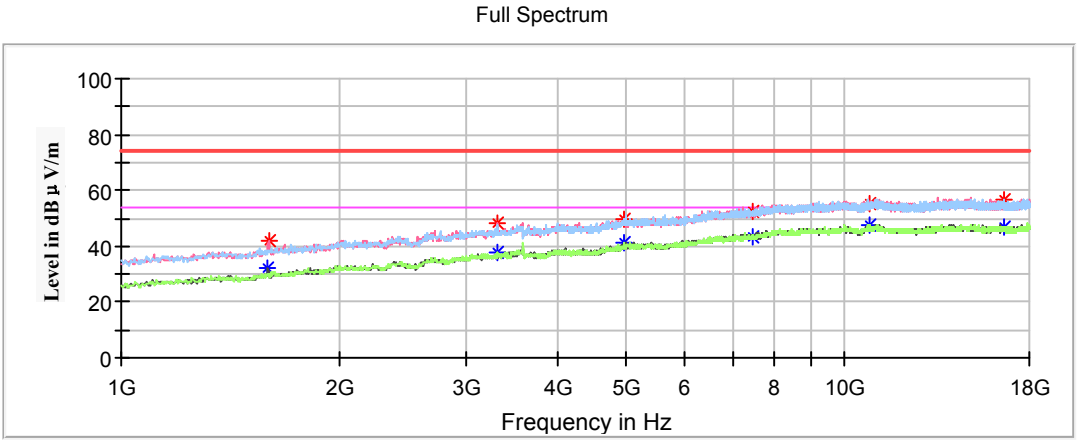
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV /m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
1591.600000	---	31.23	150.0	V	179.0	-0.6	54.00	22.77
1591.600000	40.29	---	150.0	V	179.0	-0.6	74.00	33.71
3308.600000	---	38.08	200.0	V	349.0	6.8	54.00	15.92
3308.600000	48.12	---	200.0	V	349.0	6.8	74.00	25.88
4804.000000	---	39.82	150.0	V	212.0	10.7	54.00	14.18
4804.000000	49.30	---	150.0	V	212.0	10.7	74.00	24.70
7206.000000	---	43.49	200.0	V	250.0	15.2	54.00	10.51
7206.000000	52.84	---	200.0	V	250.0	15.2	74.00	21.16
11087.800000	55.31	---	100.0	V	54.0	18.9	74.00	18.69
11087.800000	---	47.90	100.0	V	54.0	18.9	54.00	6.10
17228.200000	55.75	---	100.0	V	273.0	18.3	74.00	18.25
17228.200000	---	46.65	100.0	V	273.0	18.3	54.00	7.35

Middle Channel: 2440MHz



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1591.600000	---	31.70	200.0	V	196.0	-0.6	54.00	22.30
1591.600000	41.11	---	200.0	V	196.0	-0.6	74.00	32.89
3308.600000	47.53	---	200.0	V	342.0	6.8	74.00	26.47
3308.600000	---	38.41	200.0	V	342.0	6.8	54.00	15.59
4880.000000	---	41.13	200.0	V	207.0	11.1	54.00	12.87
4880.000000	50.27	---	150.0	V	207.0	11.1	74.00	23.73
7320.000000	---	43.02	200.0	V	228.0	15.4	54.00	10.98
7320.000000	52.18	---	150.0	V	228.0	15.4	74.00	21.82
10003.200000	55.52	---	100.0	V	42.0	18.3	74.00	18.48
10003.200000	---	47.01	100.0	V	42.0	18.3	54.00	6.99
15035.200000	54.82	---	200.0	H	26.0	18.8	74.00	19.18
15035.200000	---	47.79	100.0	H	26.0	18.8	54.00	6.21

High Channel: 2480MHz

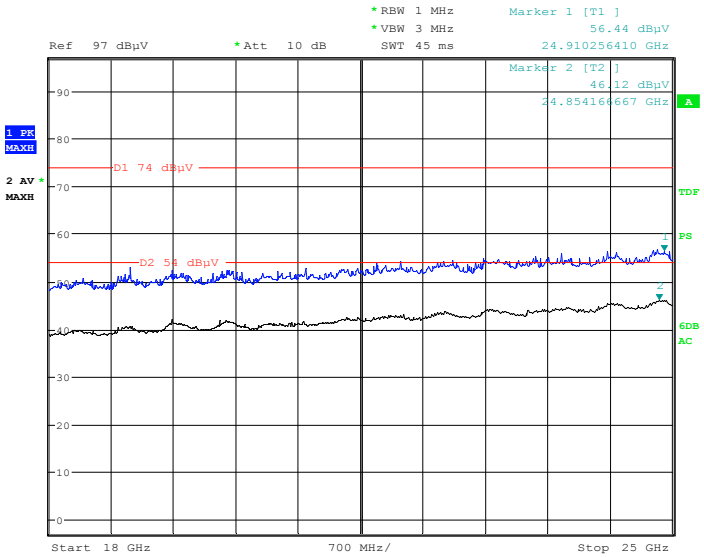


Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
1595.000000	---	31.97	150.0	V	179.0	-0.6	54.00	22.03
1598.400000	41.92	---	150.0	V	179.0	-0.6	74.00	32.08
3308.600000	---	37.84	150.0	H	234.0	6.8	54.00	16.16
3308.600000	47.97	---	150.0	H	234.0	6.8	74.00	26.03
4960.000000	---	40.92	150.0	H	96.0	11.5	54.00	13.08
4960.000000	49.90	---	150.0	H	96.0	11.5	74.00	24.10
7440.000000	52.30	---	200.0	V	79.0	15.6	74.00	21.70
7440.000000	---	43.44	200.0	V	79.0	15.6	54.00	10.56
10809.000000	---	47.74	100.0	H	355.0	18.6	54.00	6.26
10812.400000	55.32	---	100.0	H	355.0	18.6	74.00	18.68
16585.600000	56.91	---	200.0	H	340.0	18.1	74.00	17.09
16585.600000	---	46.88	200.0	H	340.0	18.1	54.00	7.12

18GHz-25GHz

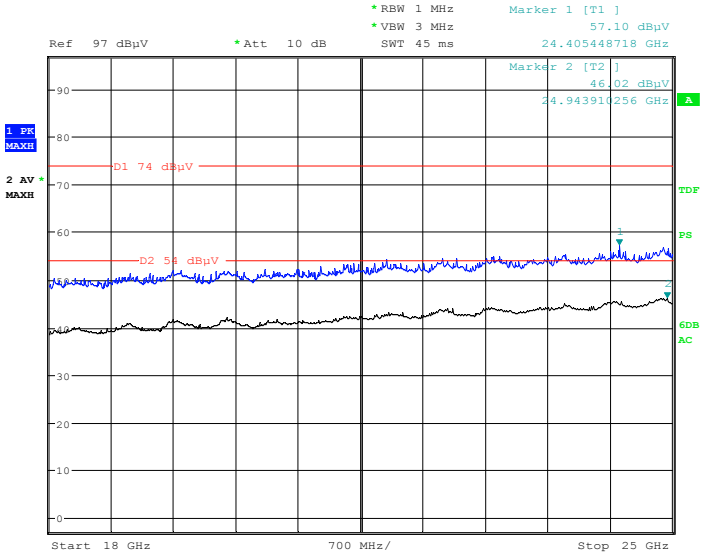
*(Pre-scan with low, middle and high channels of operation in the X,Y and Z axes of orientation, the worst case **high channel of operation in the X axis of orientation** was recorded)*

Horizontal Plot



Date: 14.JUL.2018 19:38:50

Vertical Plot



Date: 14.JUL.2018 19:50:37

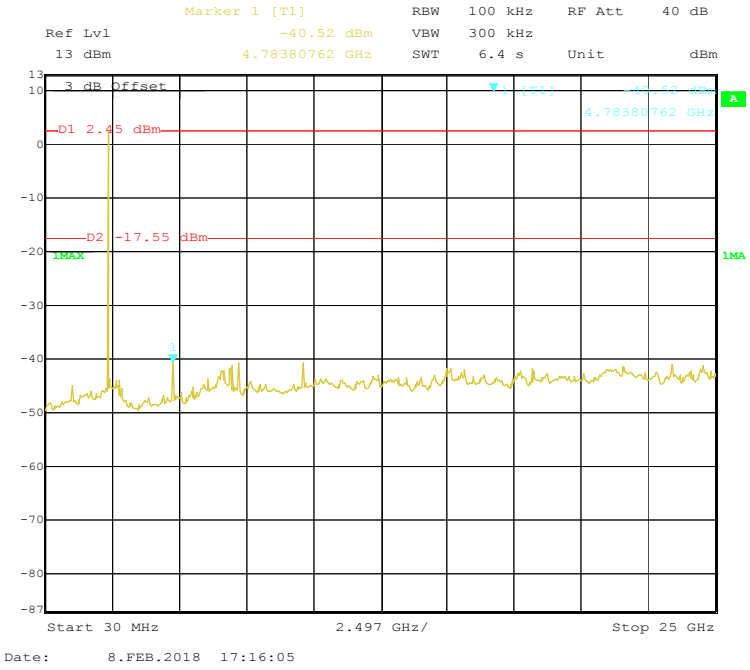
Fundamental Test & Restricted Bands Emissions Test:
*(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded)*

Note:
1. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) – Amplifier Factor (dB)
Corrected Amplitude (dBμV /m) = Corrected Factor (dB/m) + Reading (dBμV)
Margin (dB) = Limit (dBμV/m) – Corrected Amplitude (dBμV /m)

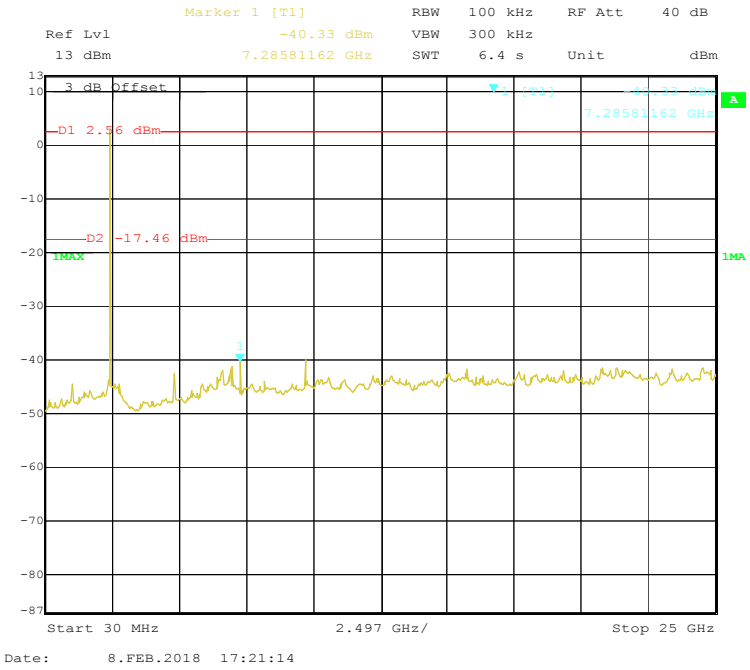
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV /m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
Low Channel: 2402MHz								
2402.000000	91.40	---	250.0	V	13.0	2.9	/	/
2402.000000	---	90.66	250.0	V	13.0	2.9	/	/
2402.000000	89.84	---	250.0	H	139.0	2.9	/	/
2402.000000	---	89.12	250.0	H	139.0	2.9	/	/
2390.000000	43.92	---	200.0	V	247.0	2.8	74.00	30.08
2390.000000	---	39.62	200.0	V	247.0	2.8	54.00	14.38
Middle Channel: 2440MHz								
2440.000000	91.53	---	250.0	V	113.0	3.0	/	/
2440.000000	---	90.61	250.0	V	113.0	3.0	/	/
2440.000000	89.98	---	150.0	H	210.0	3.0	/	/
2440.000000	---	89.03	150.0	H	210.0	3.0	/	/
High Channel: 2480MHz								
2480.000000	91.34	---	200.0	V	329.0	3.0	/	/
2480.000000	---	90.63	200.0	V	329.0	3.0	/	/
2480.000000	89.78	---	200.0	H	248.0	3.0	/	/
2480.000000	---	89.11	200.0	H	248.0	3.0	/	/
2483.500000	44.90	---	200.0	V	84.0	3.0	74.00	29.10
2483.500000	---	40.00	200.0	V	84.0	3.0	54.00	14.00

Conducted Spurious Emissions at Antenna Port

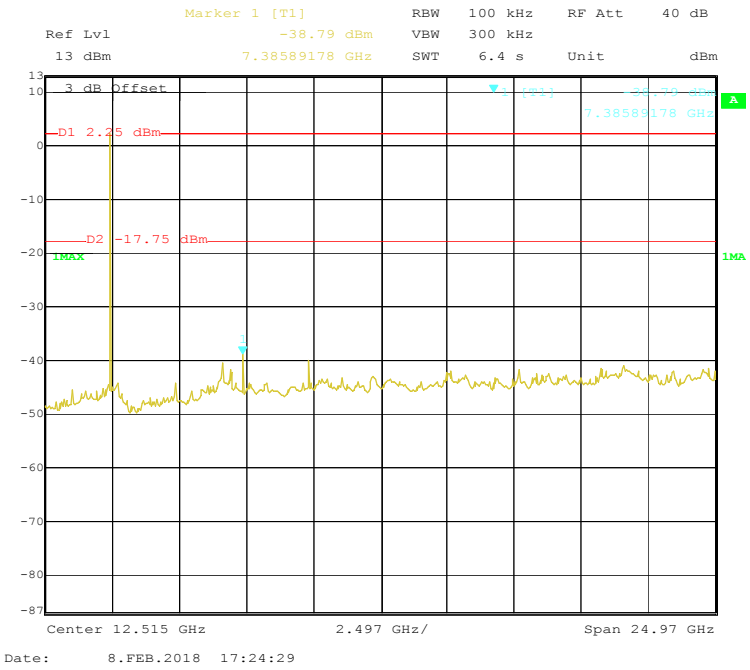
802.11b Mode Low Channel



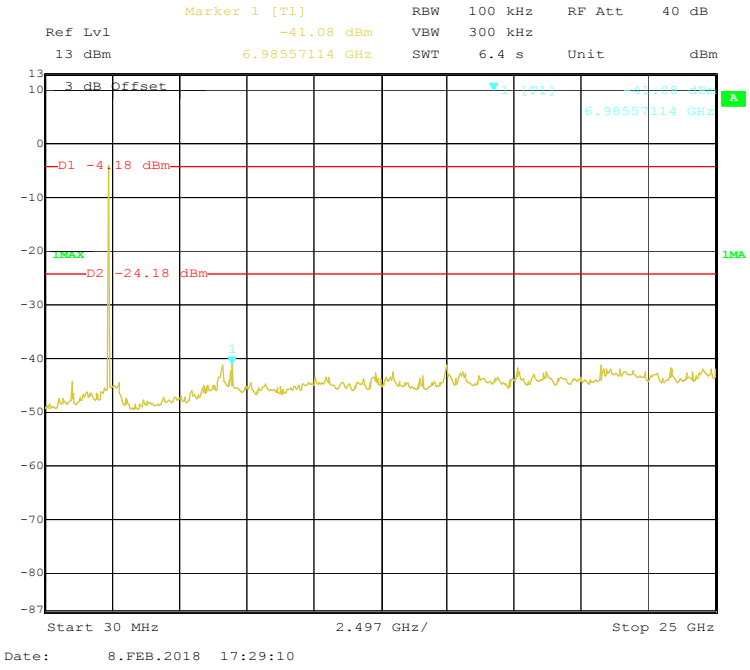
802.11b Mode Middle Channel



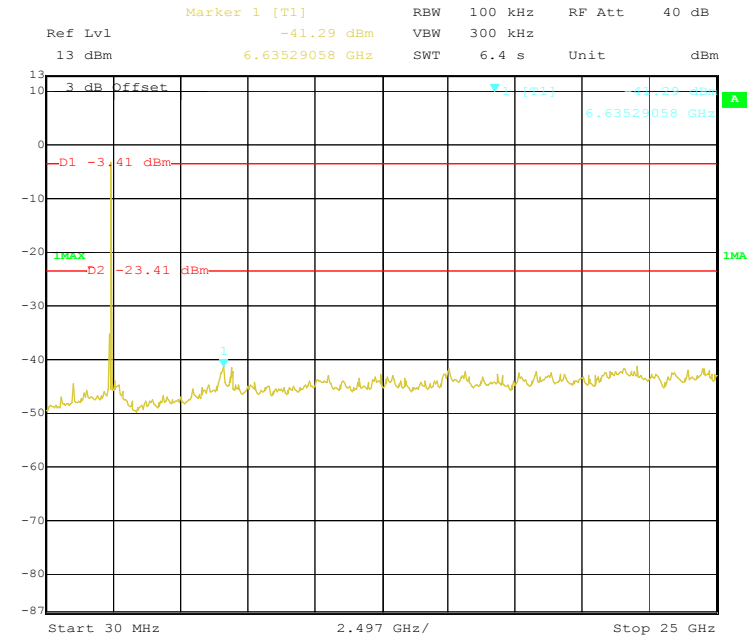
802.11b Mode High Channel



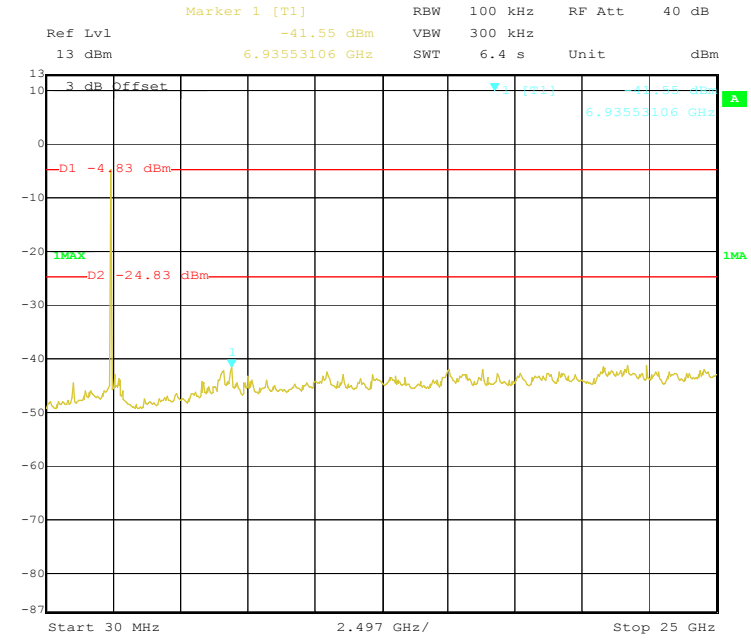
802.11g Mode Low Channel



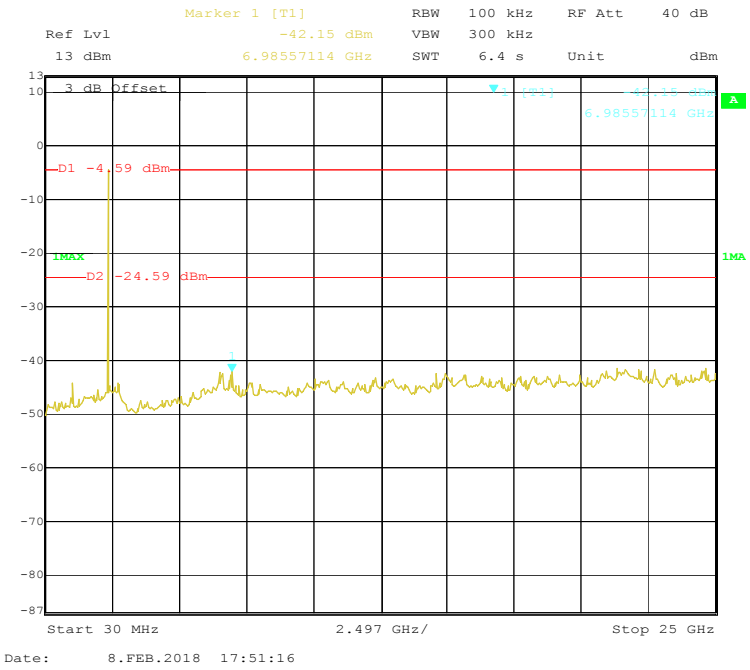
802.11g Mode Middle Channel



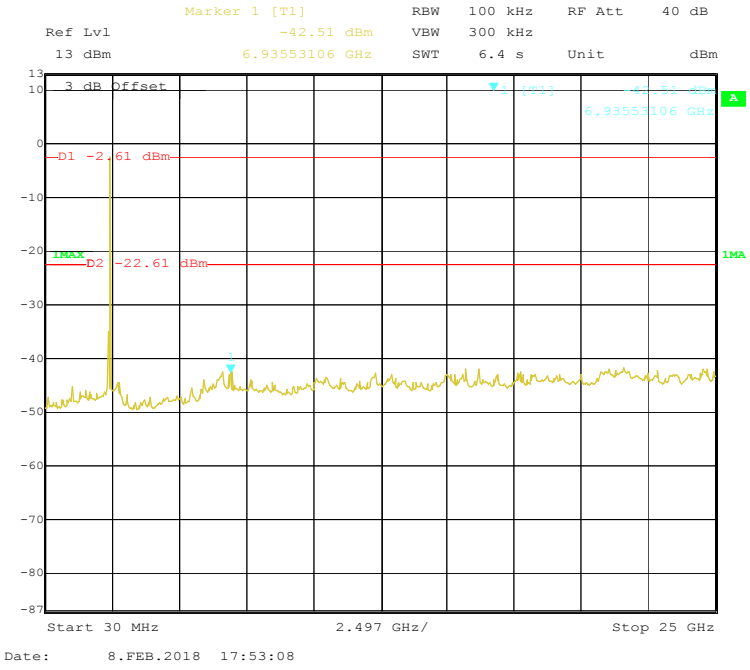
802.11g Mode High Channel



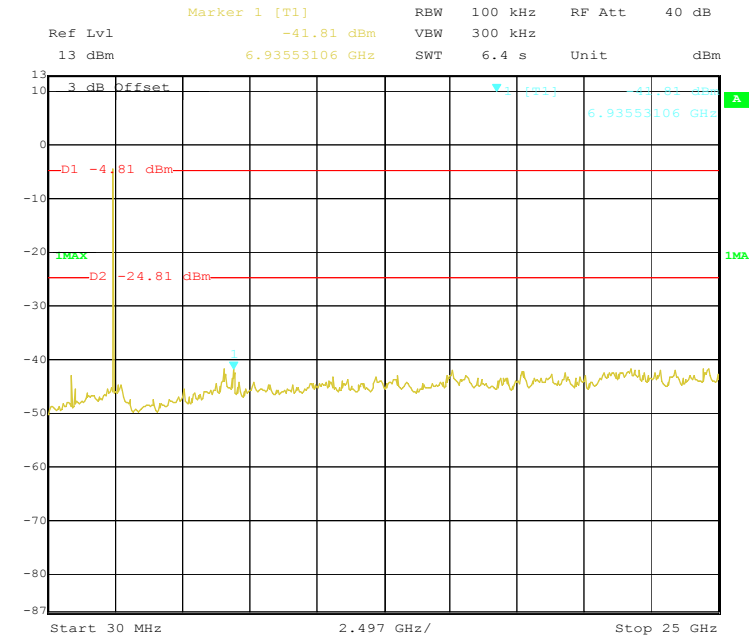
802.11n-HT20 Mode Low Channel



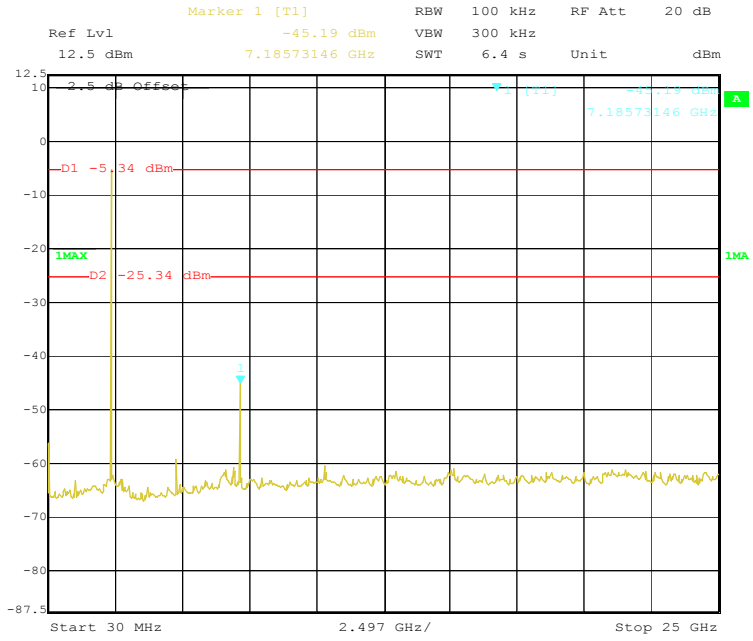
802.11n-HT20 Mode Middle Channel



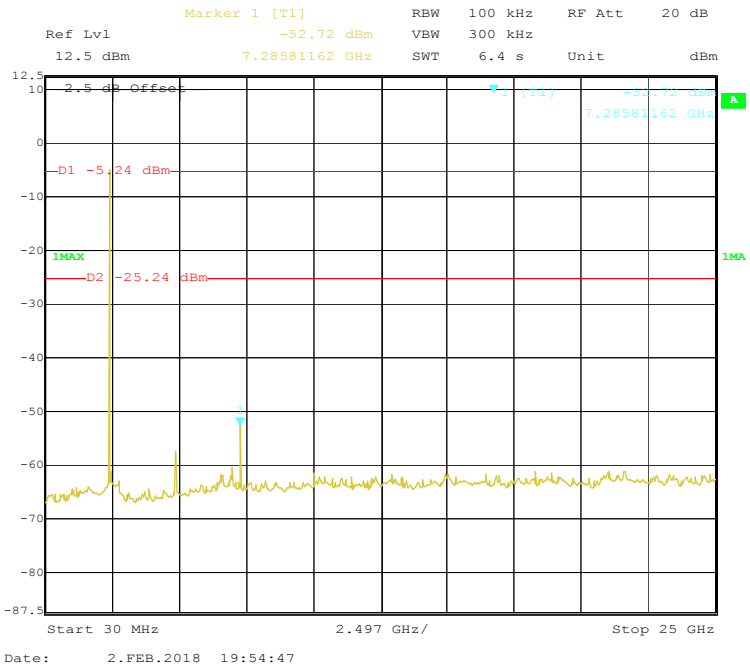
802.11n-HT20 Mode High Channel



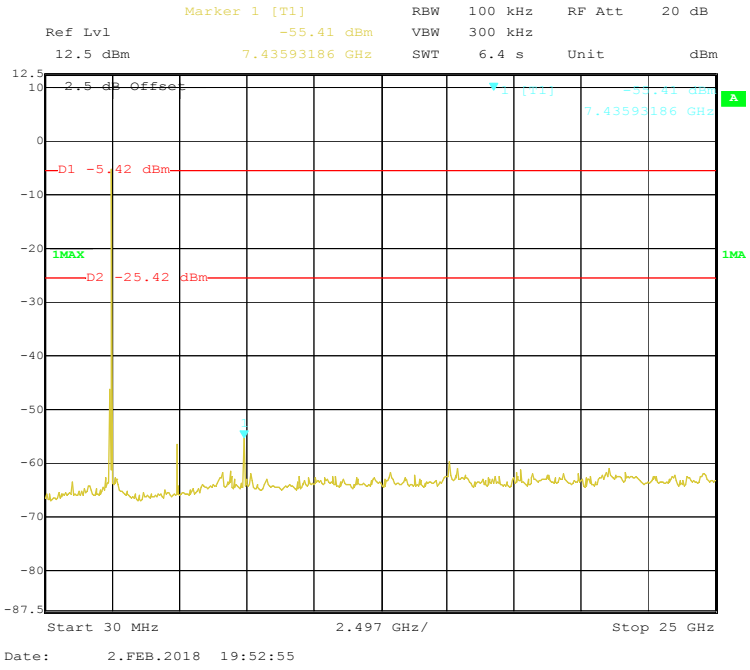
BLE Mode Low Channel



BLE Mode Middle Channel



BLE Mode High Channel



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

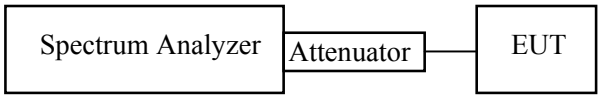
Applicable Standard

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

According to KDB558074 D01 DTS Meas Guidance v04 sub-clause 8.1

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 * RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. 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:	24 ℃
Relative Humidity:	51 %
ATM Pressure:	101.3 kPa

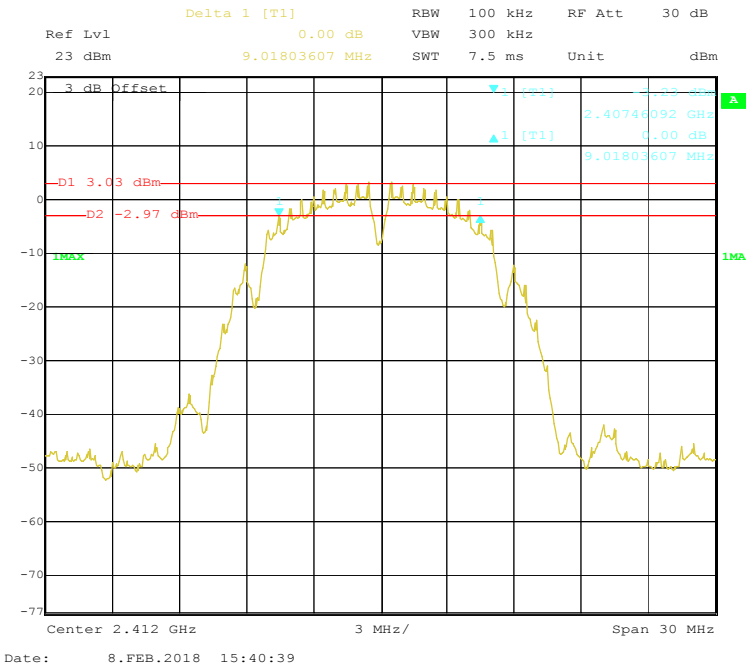
The testing was performed by Max Min on 2018-02-02 & 2018-02-08.

EUT operation mode: Transmitting

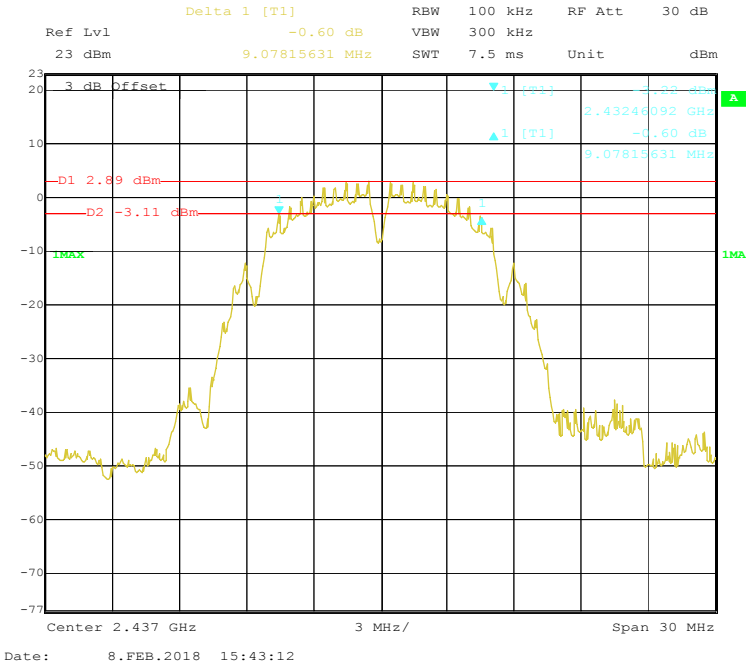
Test Result: Pass

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (MHz)
802.11b Mode			
Low	2412	9.018	≥ 0.5
Middle	2437	9.078	≥ 0.5
High	2462	9.078	≥ 0.5
802.11g Mode			
Low	2412	16.413	≥ 0.5
Middle	2437	16.293	≥ 0.5
High	2462	16.172	≥ 0.5
802.11n-HT20 Mode			
Low	2412	17.014	≥ 0.5
Middle	2437	17.134	≥ 0.5
High	2462	17.134	≥ 0.5
BLE Mode			
Low	2402	0.721	≥ 0.5
Middle	2440	0.727	≥ 0.5
High	2480	0.739	≥ 0.5

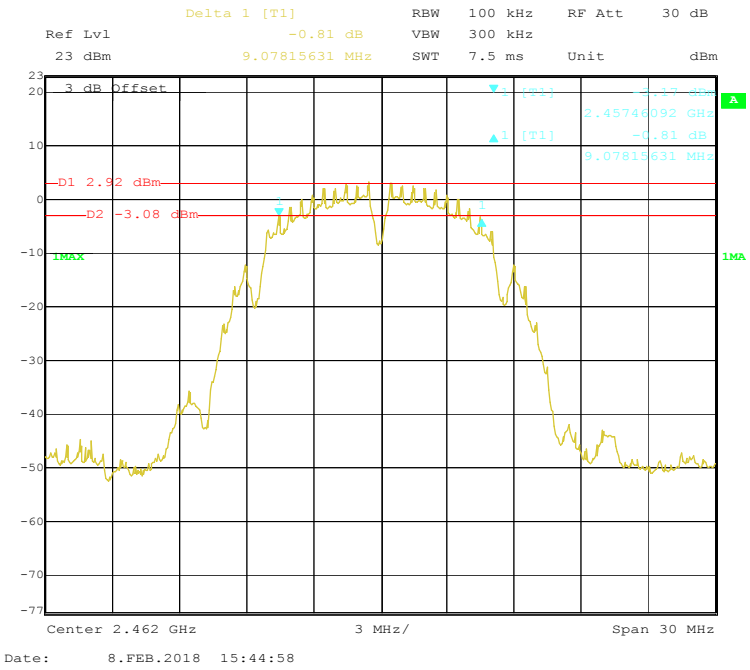
802.11b Mode Low Channel



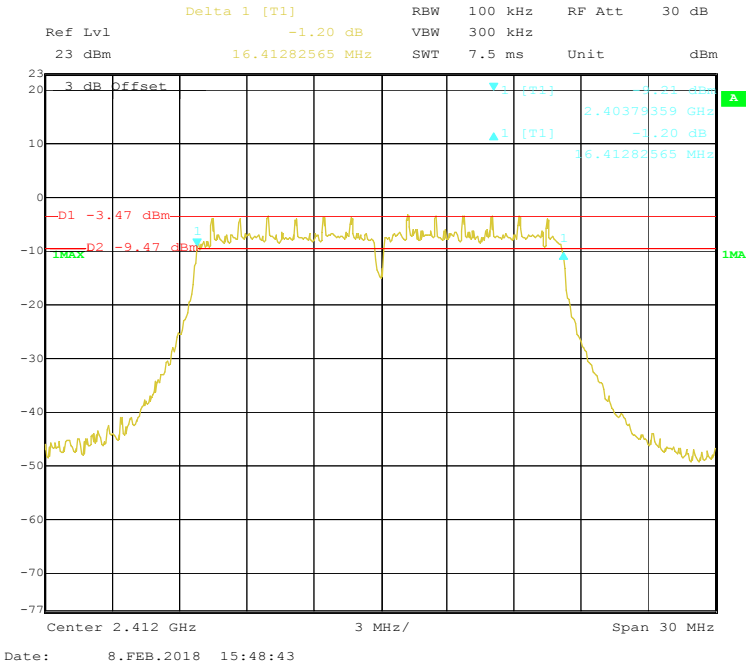
802.11b Mode Middle Channel



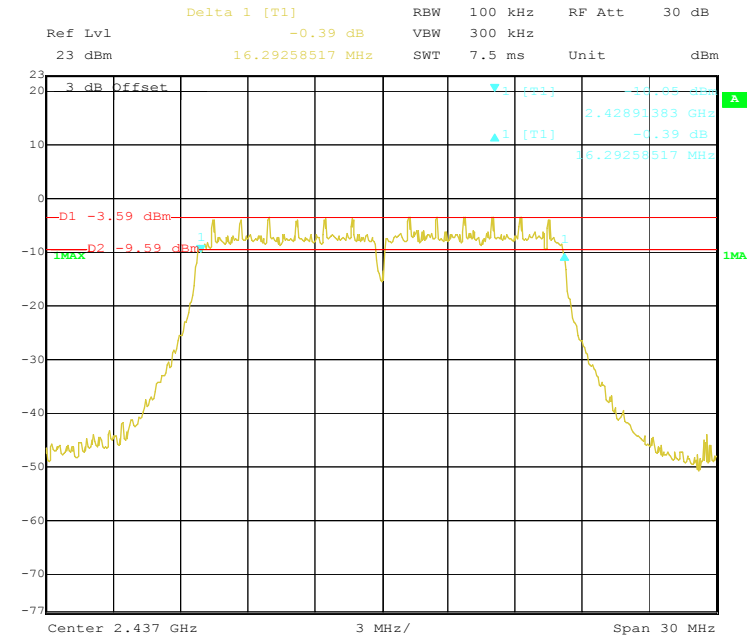
802.11b Mode High Channel



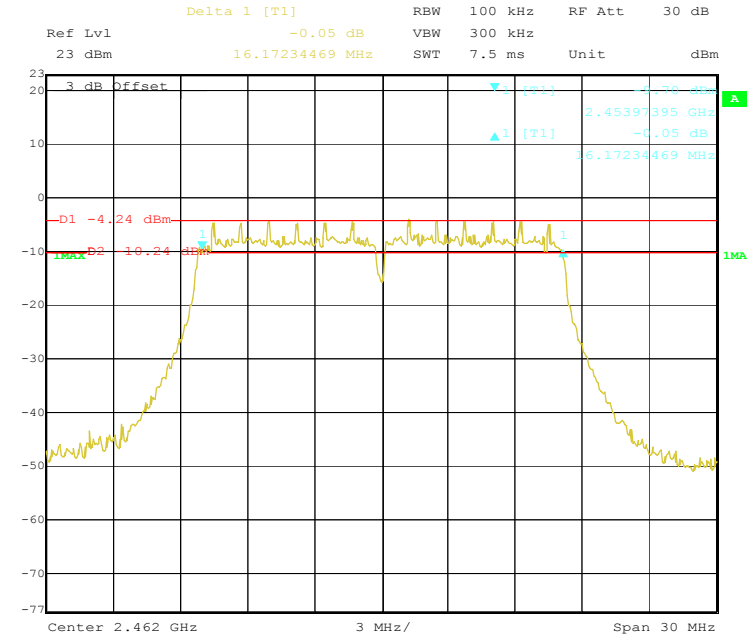
802.11g Mode Low Channel



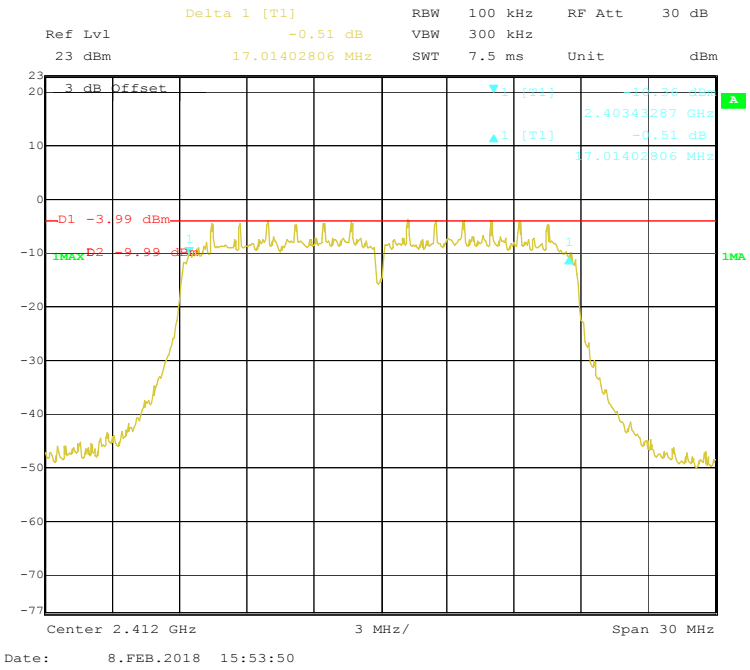
802.11g Mode Middle Channel



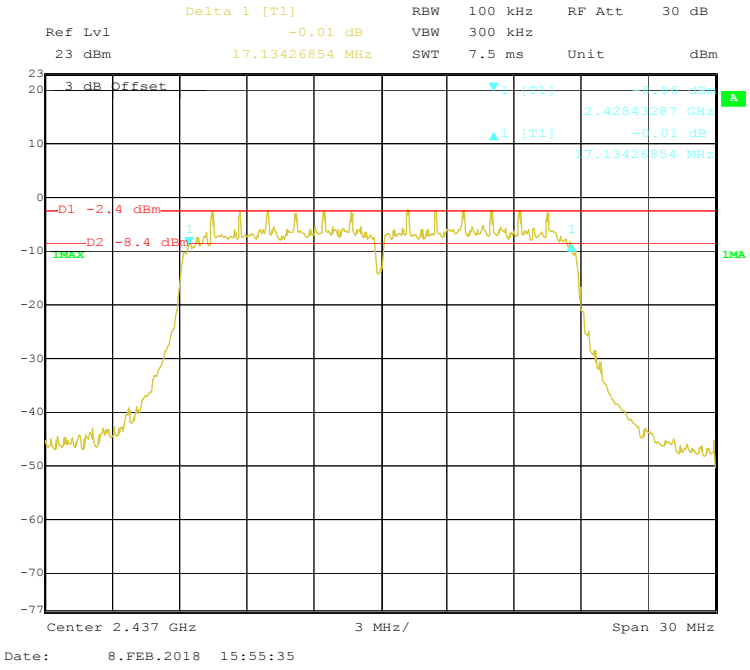
802.11g Mode High Channel



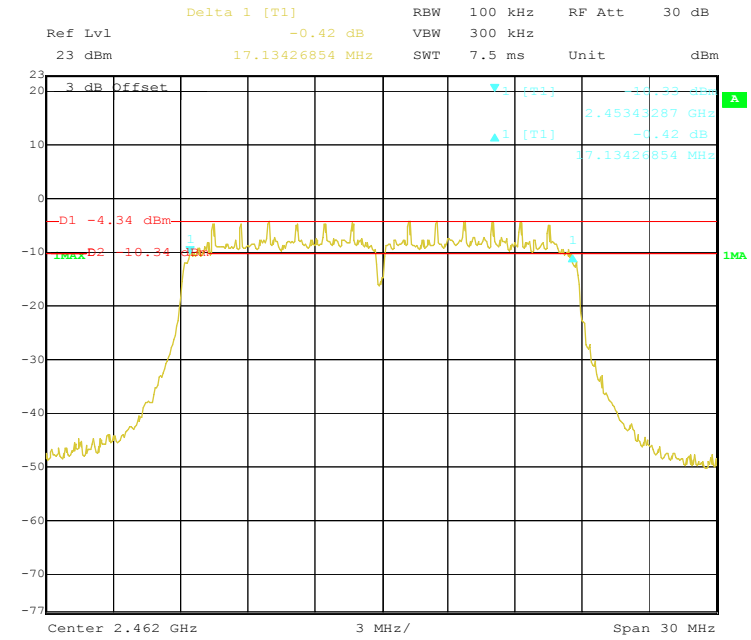
802.11n-HT20 Mode Low Channel



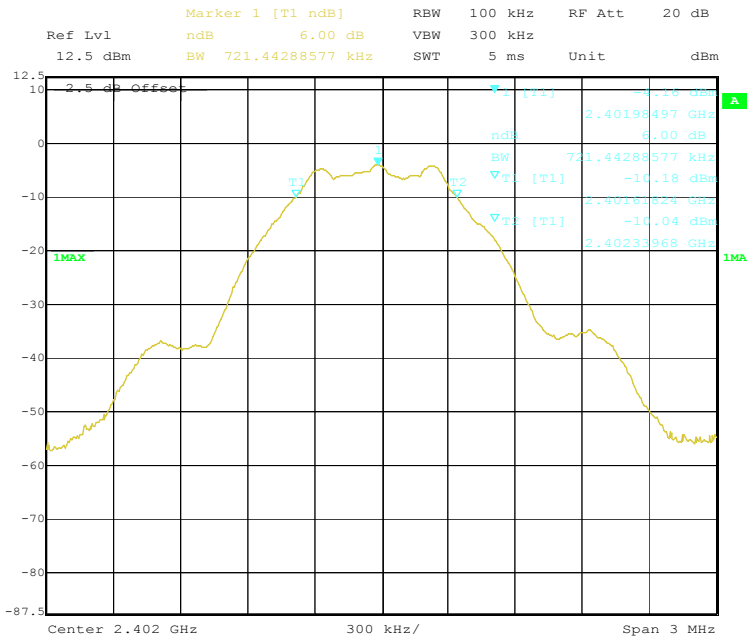
802.11n-HT20 Mode Middle Channel



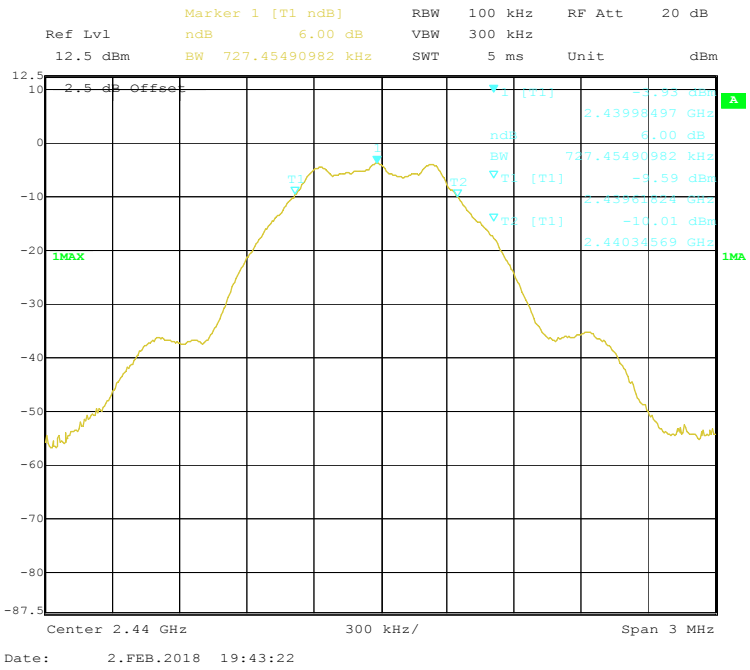
802.11n-HT20 Mode High Channel



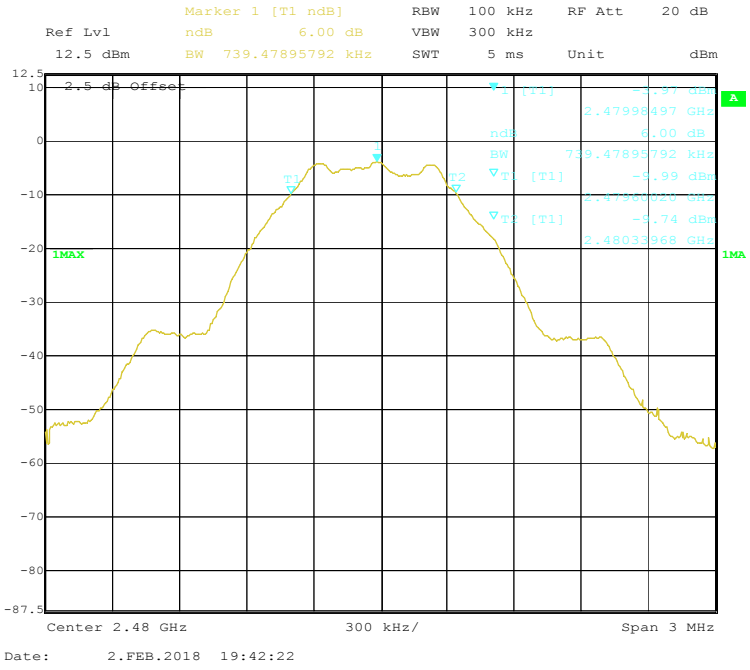
BLE Mode Low Channel



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.

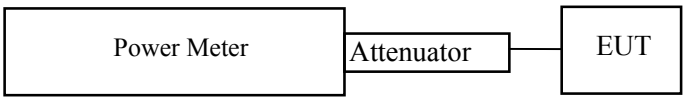
Test Procedure

According to KDB558074 D01 DTS Meas Guidance v04

For Wi-Fi:

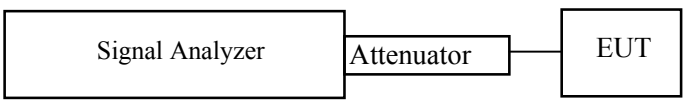
The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall use a fast-responding diode detector.

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



For BLE:

1. Set the RBW ≥ DTS bandwidth.
2. Set VBW ≥ 3 x RBW.
3. Set span ≥ 3 x RBW
4. Sweep time = auto couple.
5. Detector = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use peak marker function to determine the peak amplitude level.



Test Data

Environmental Conditions

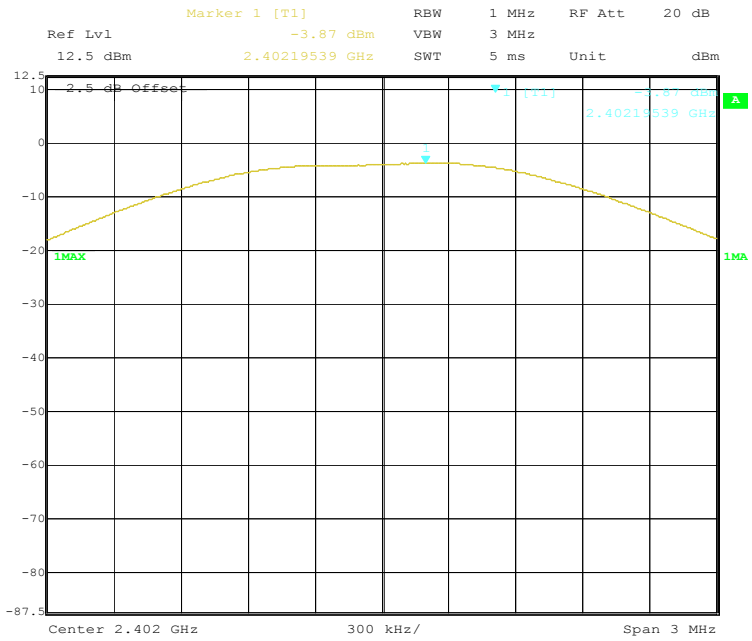
Temperature:	23.8℃
Relative Humidity:	54 %
ATM Pressure:	101.2 kPa

The testing was performed by Max Min on 2018-02-02.

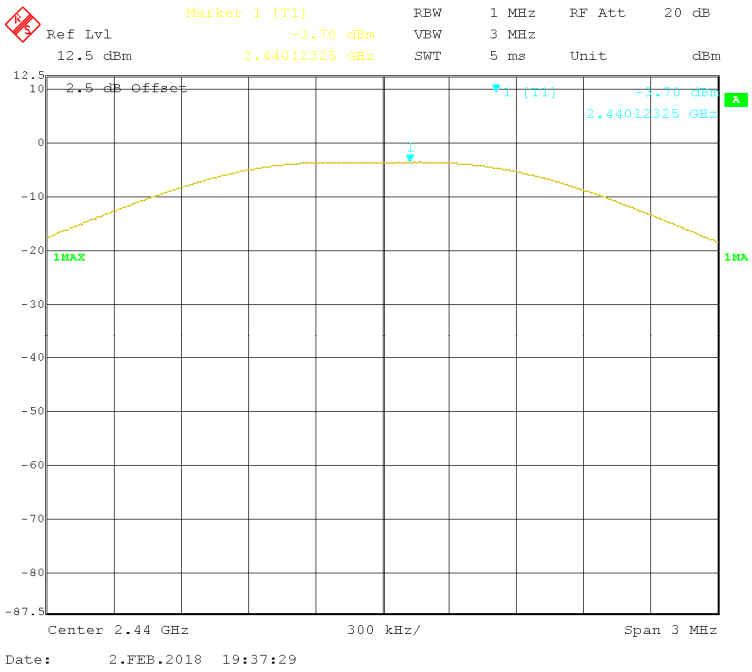
EUT operation mode: Transmitting

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Limit (dBm)	Result
802.11b Mode				
Low	2412	16.11	30	Pass
Middle	2437	15.97	30	Pass
High	2462	16.08	30	Pass
802.11g Mode				
Low	2412	17.30	30	Pass
Middle	2437	17.25	30	Pass
High	2462	16.58	30	Pass
802.11n-HT20 Mode				
Low	2412	18.44	30	Pass
Middle	2437	17.16	30	Pass
High	2462	18.28	30	Pass
BLE				
Low	2402	-3.87	30	Pass
Middle	2440	-3.70	30	Pass
High	2480	-3.62	30	Pass

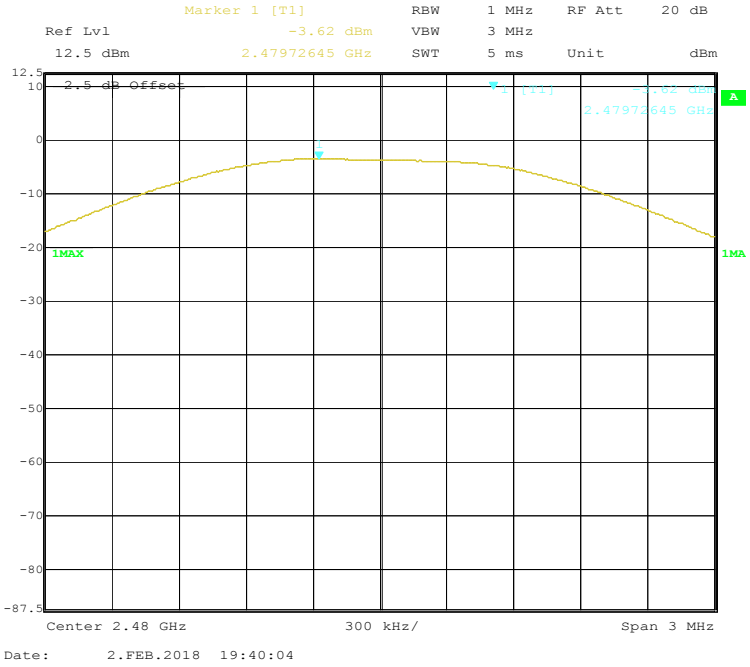
BLE Mode Low Channel



BLE Mode Middle Channel



BLE Mode High Channel



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

According to KDB558074 D01 DTS Meas Guidance v04 sub-clause 13.2 and ANSI C63.10-2013 clause 6.10.

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

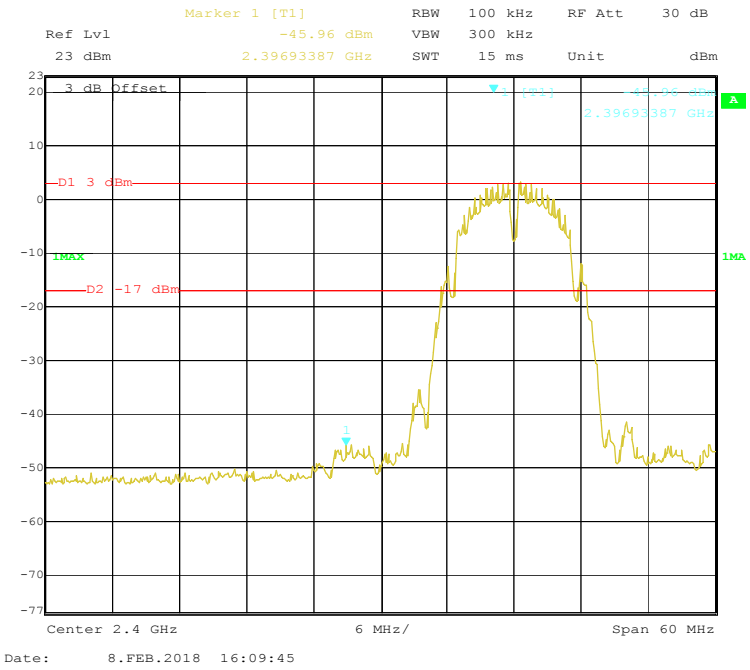
Temperature:	24.3 ℃
Relative Humidity:	50 %
ATM Pressure:	101.3 kPa

The testing was performed by Max Min on 2018-02-02 & 2018-02-08.

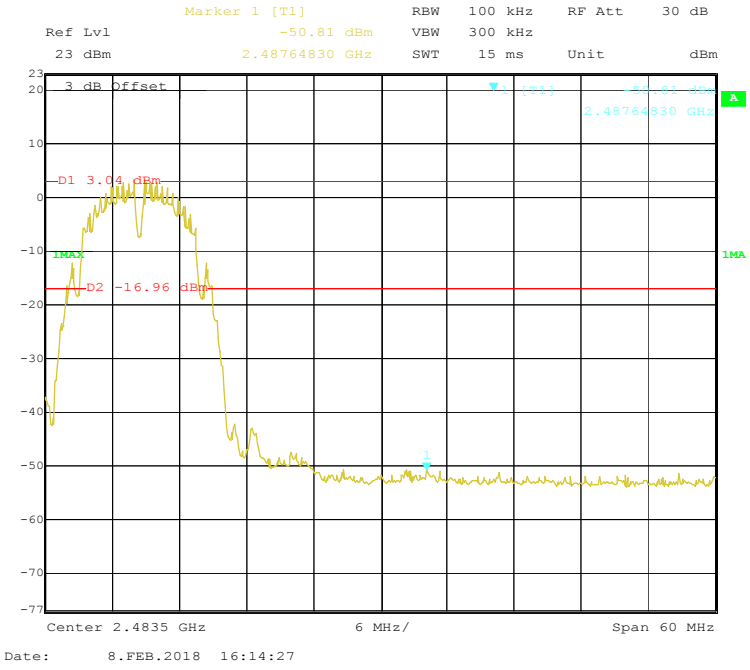
EUT operation mode: Transmitting

Test Result: Compliance

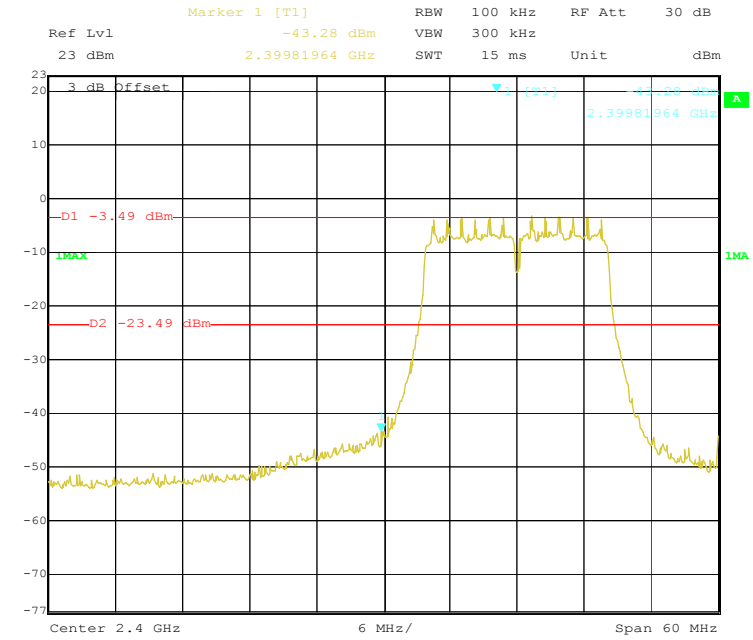
802.11b Mode Left Side



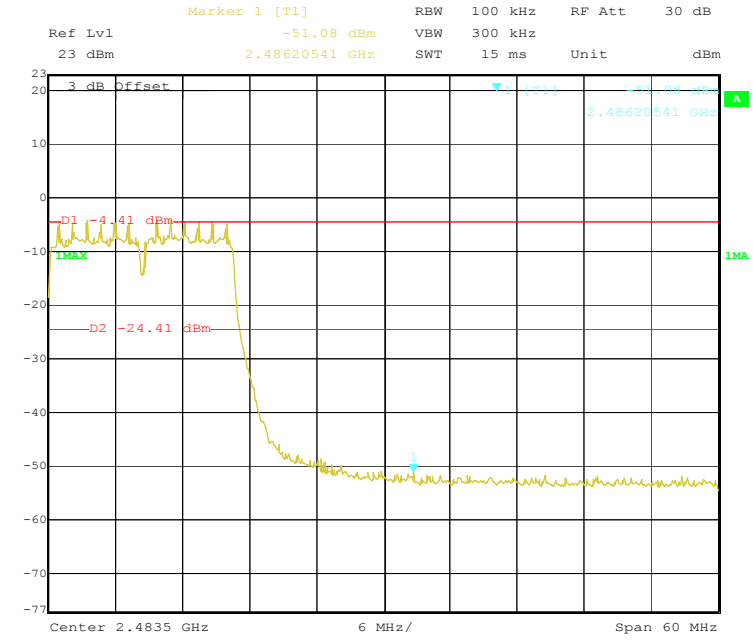
802.11b Mode Right Side



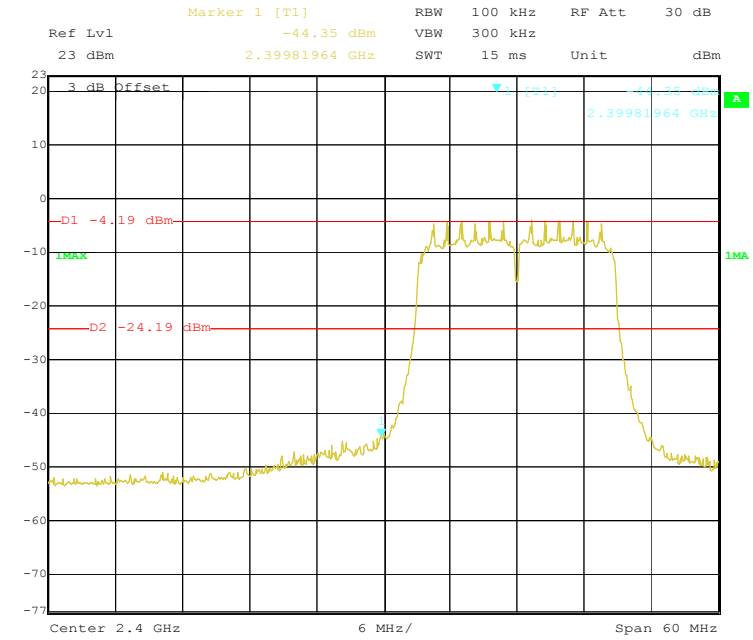
802.11g Mode Left Side



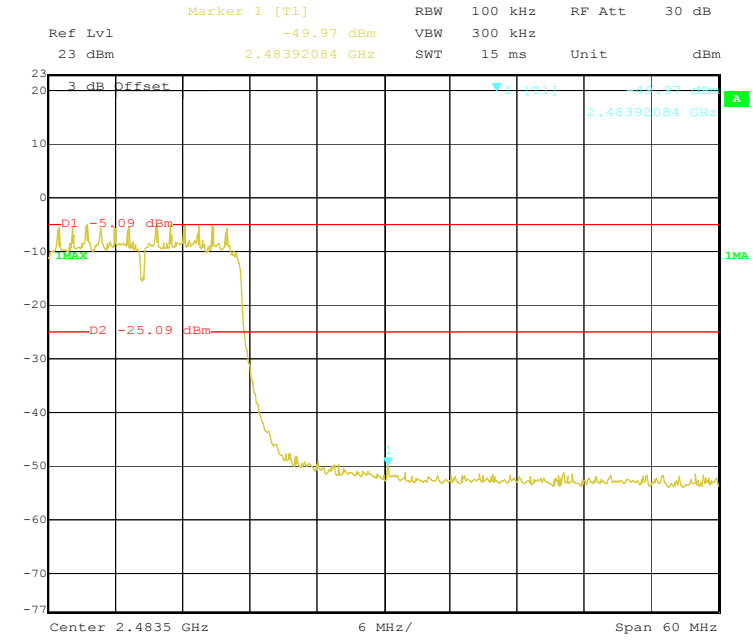
802.11g Mode Right Side



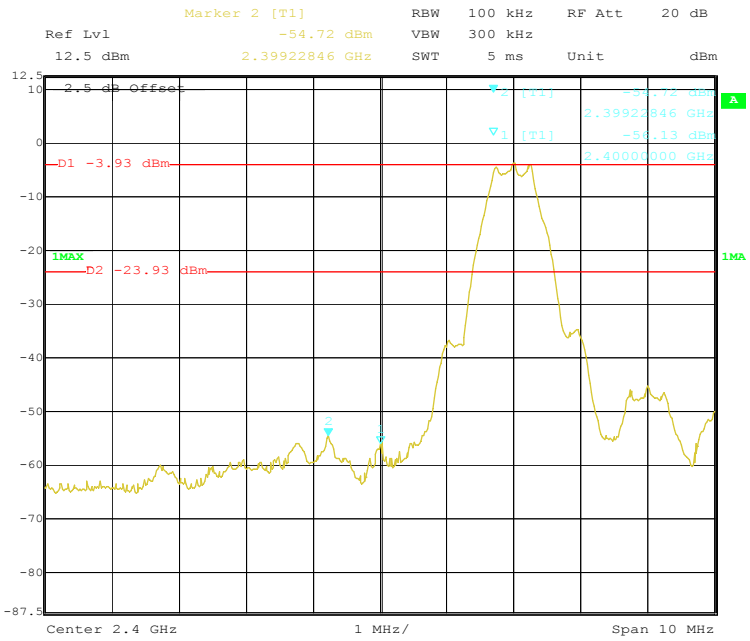
802.11n-HT20 Mode Left Side



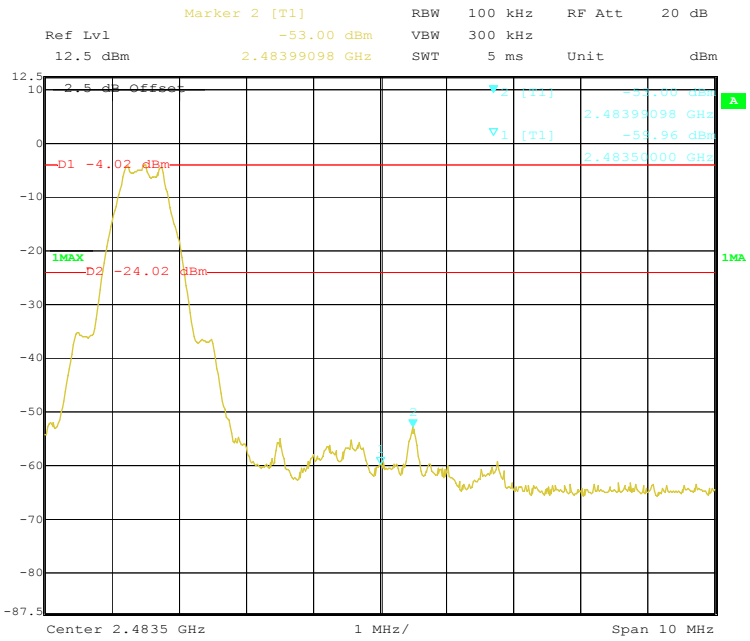
802.11n-HT20 Mode Right Side



BLE Mode Left Side



BLE Mode 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

According to KDB558074 D01 DTS Meas Guidance v04 sub-clause 10.2

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate Compliance.
2. Set the RBW to: 3kHz≤ RBW≤100 kHz.
3. Set the VBW ≥ 3xRBW.
4. Set the span to 1.5 times the DTS bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Test Data

Environmental Conditions

Temperature:	24.1 ℃
Relative Humidity:	50%
ATM Pressure:	101.3 kPa

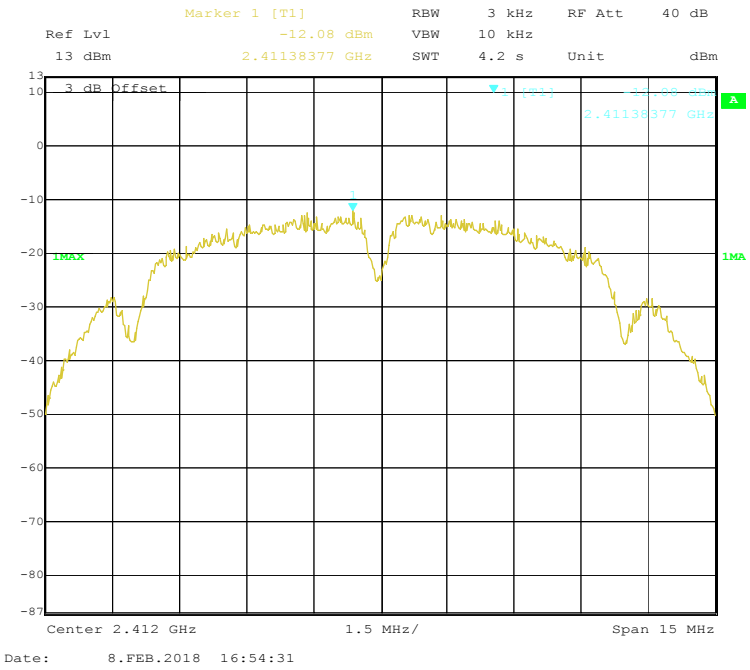
The testing was performed by Max Min on 2018-02-02 & 2018-02-08.

EUT operation mode: Transmitting

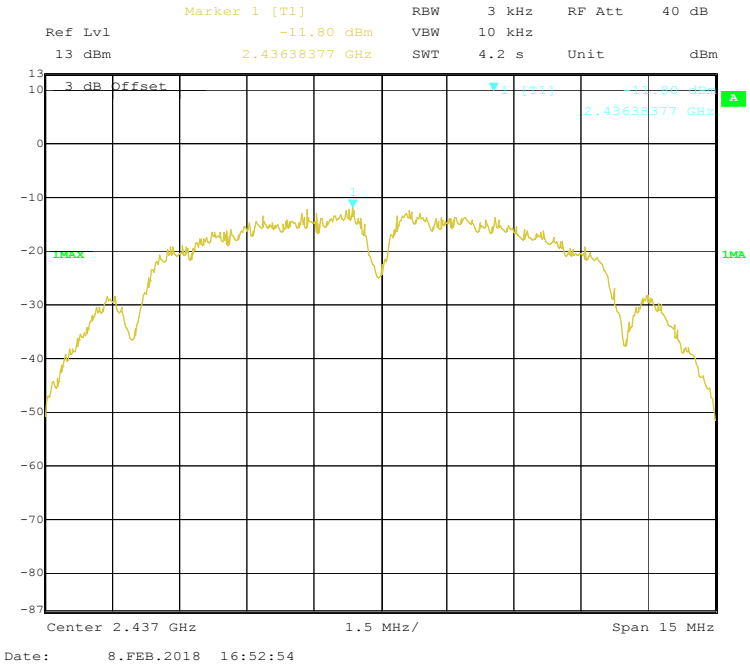
Test Result: Pass

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
802.11b Mode			
Low	2412	-12.08	≤ 8
Middle	2437	-11.80	≤ 8
High	2462	-11.74	≤ 8
802.11g Mode			
Low	2412	-17.91	≤ 8
Middle	2437	-17.70	≤ 8
High	2462	18.99	≤ 8
802.11n-HT20 mode			
Low	2412	-19.10	≤ 8
Middle	2437	-17.14	≤ 8
High	2462	-18.98	≤ 8
BLE Mode			
Low	2402	-19.94	≤ 8
Middle	2440	-19.63	≤ 8
High	2480	-19.27	≤ 8

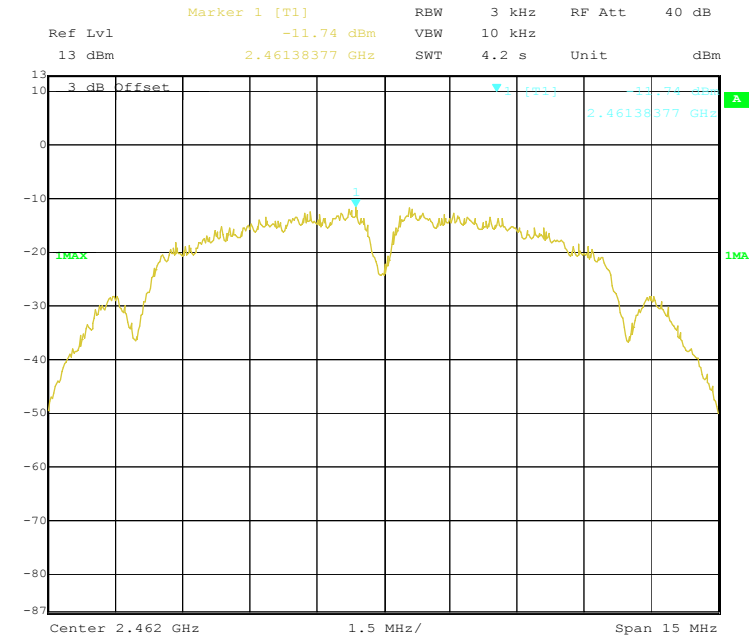
802.11b Mode Low Channel



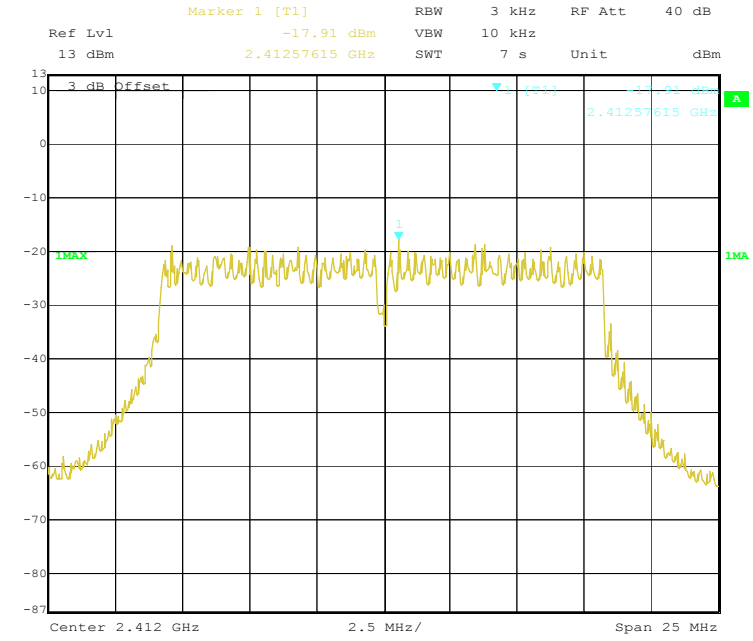
802.11b Mode Middle Channel



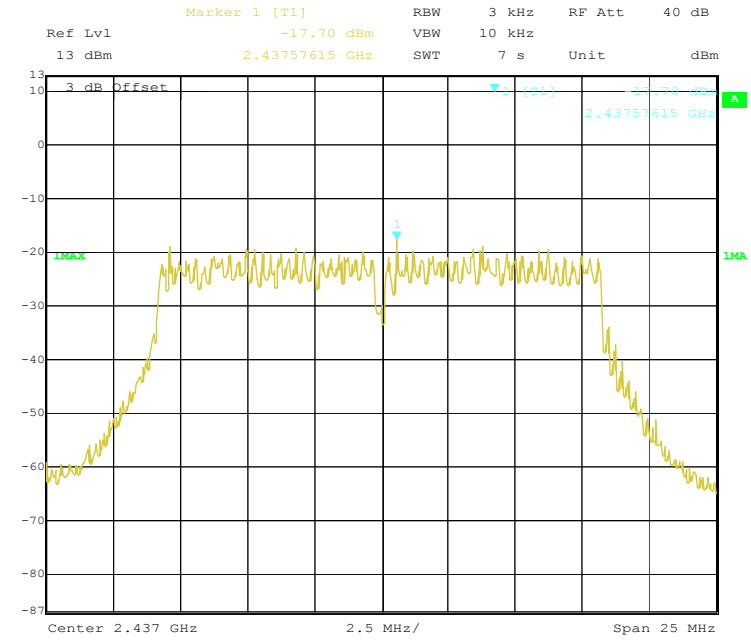
802.11b Mode High Channel



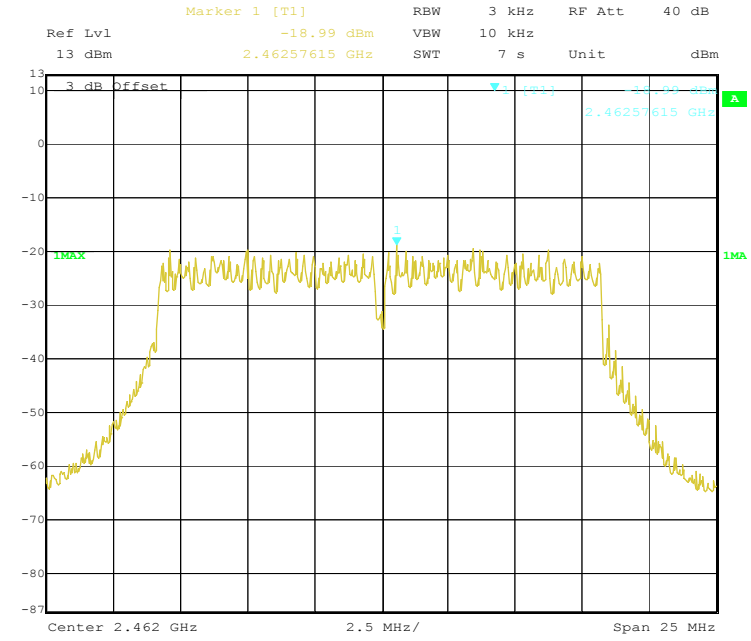
802.11g Mode Low Channel



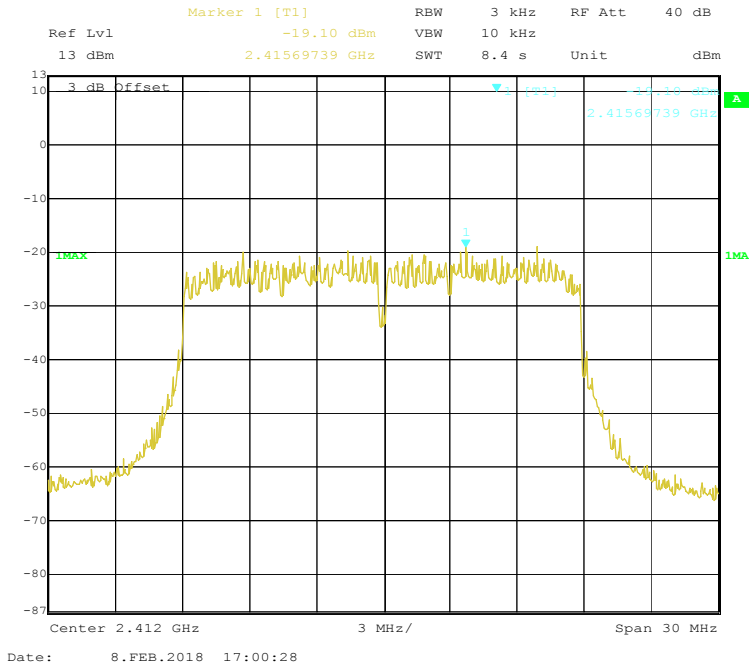
802.11g Mode Middle Channel



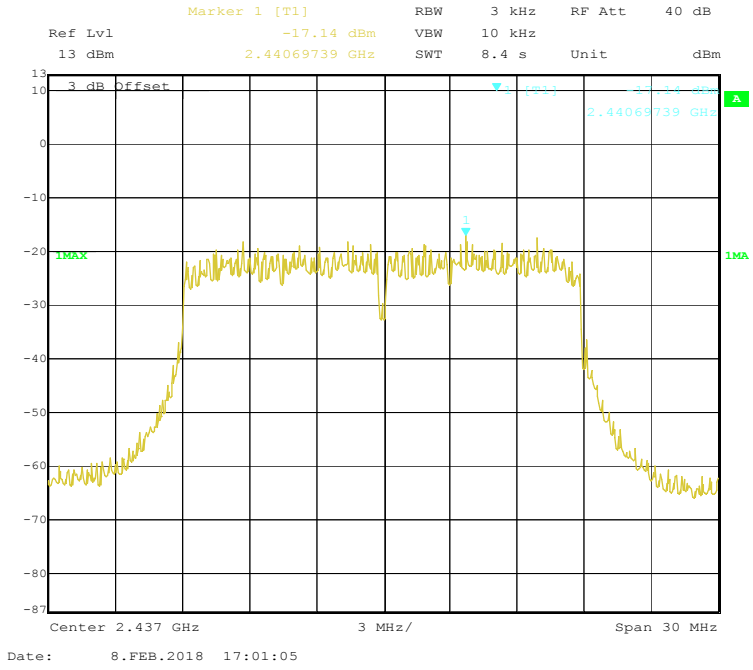
802.11g Mode High Channel



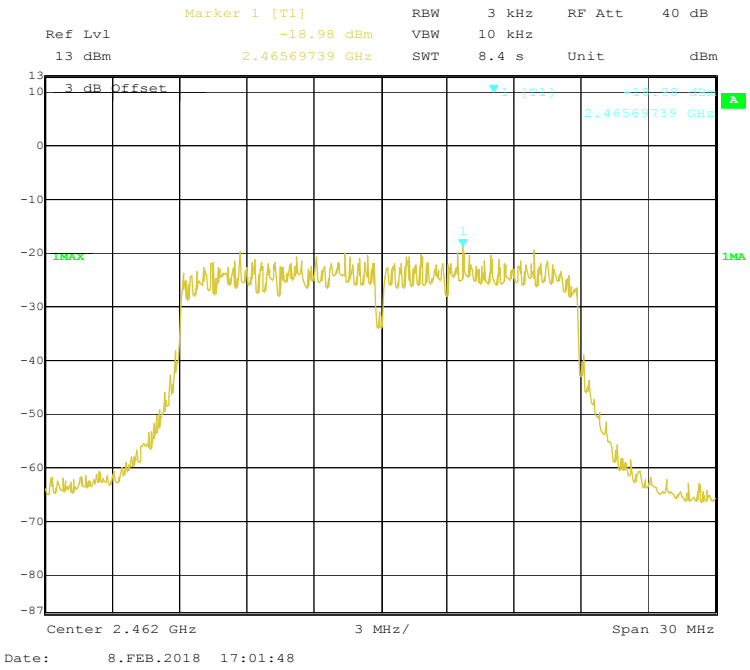
802.11n-HT20 Mode Low Channel



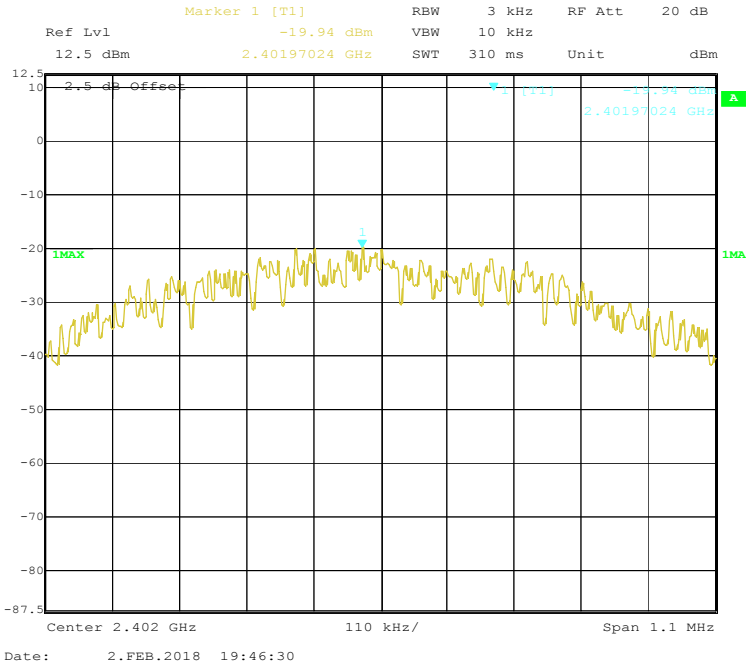
802.11n-HT20 Mode Middle Channel



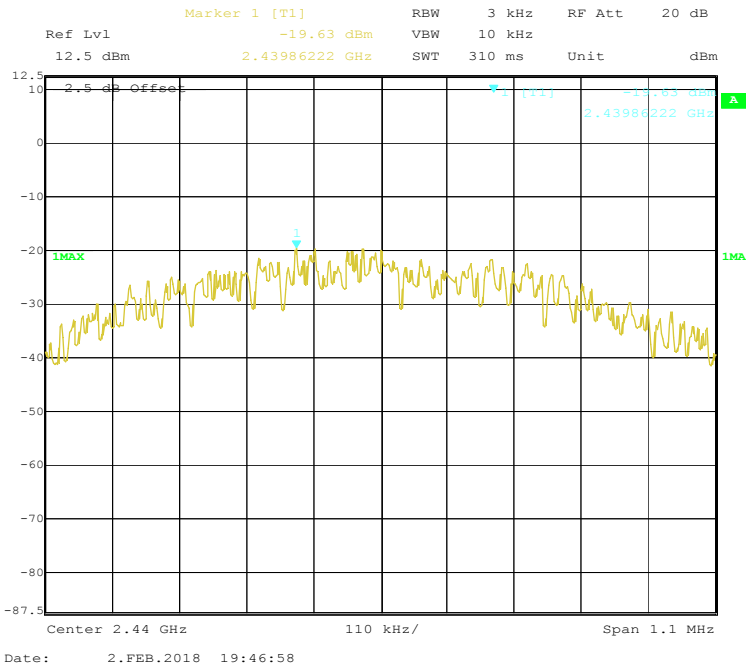
802.11n-HT20 Mode High Channel



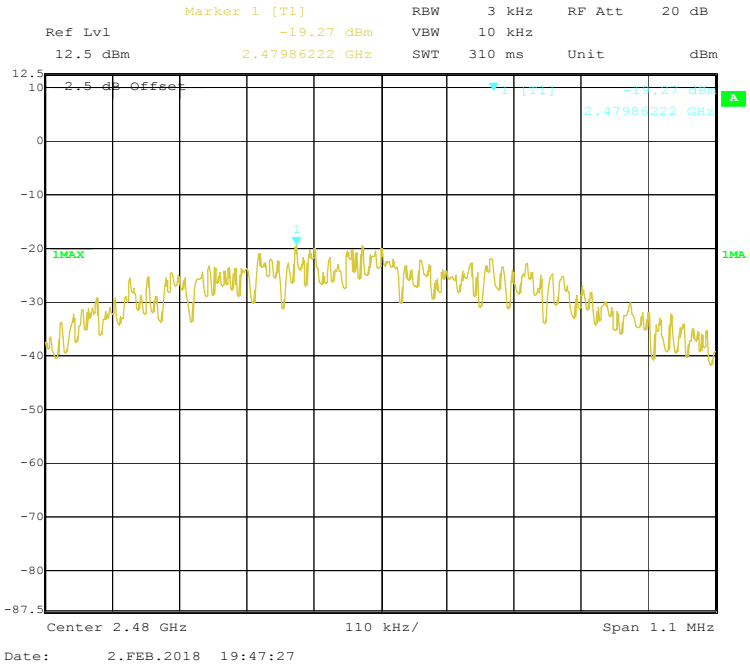
BLE Mode Low Channel



BLE Mode Middle Channel



BLE Mode High Channel



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