



TESTING LABORATORY
CERTIFICATE#4323.01



FCC PART 15.247

TEST REPORT

For

Pycom Ltd

High Point 9 Sydenham Road, Guildford Surrey GU1 3RX, Surrey, United Kingdom

FCC ID: 2AJMTGPY01R

Report Type: Original Report	Product Type: GPy
Test Engineer: Max Min	<i>Max Min</i>
Report Number: RSHA180108008-00C	
Report Date: 2018-06-30	
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

TABLE OF CONTENTS

GENERAL INFORMATION.....4

 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)4

 OBJECTIVE4

 RELATED SUBMITTAL(S)/GRANT(S).....4

 TEST METHODOLOGY4

 MEASUREMENT UNCERTAINTY5

 TEST FACILITY5

SYSTEM TEST CONFIGURATION6

 DESCRIPTION OF TEST CONFIGURATION6

 EQUIPMENT MODIFICATIONS6

 EUT EXERCISE SOFTWARE6

 SUPPORT EQUIPMENT LIST AND DETAILS10

 EXTERNAL I/O CABLE.....10

 BLOCK DIAGRAM OF TEST SETUP10

SUMMARY OF TEST RESULTS12

TEST EQUIPMENT LIST13

FCC §1.1307 & §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE)14

FCC §15.203 - ANTENNA REQUIREMENT.....17

 APPLICABLE STANDARD17

 ANTENNA CONNECTOR CONSTRUCTION17

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS18

 APPLICABLE STANDARD18

 EUT SETUP18

 EMI TEST RECEIVER SETUP.....18

 TEST PROCEDURE18

 CORRECTED FACTOR & MARGIN CALCULATION19

 TEST RESULTS SUMMARY19

 TEST DATA19

FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS.....24

 APPLICABLE STANDARD24

 EUT SETUP24

 EMI TEST RECEIVER SETUP.....25

 TEST PROCEDURE25

 CORRECTED AMPLITUDE & MARGIN CALCULATION25

 TEST RESULTS SUMMARY25

 TEST DATA26

FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH.....58

 APPLICABLE STANDARD58

 TEST PROCEDURE58

 TEST DATA58

FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER.....68

 APPLICABLE STANDARD68

 TEST PROCEDURE68

 TEST DATA69

FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE.....72

APPLICABLE STANDARD	72
TEST PROCEDURE	72
TEST DATA	72
FCC §15.247(e) - POWER SPECTRAL DENSITY	78
APPLICABLE STANDARD	78
TEST PROCEDURE	78
TEST DATA	78

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Pycom Ltd
Tested Model	GPy 1.0
Product Type	GPy
Dimension	55mm (L)* 20 mm (W)*10 mm(H)
Power Supply	DC 3.5V-5.5V

**All measurement and test data in this report was gathered from production sample serial number: 20180108008. (Assigned by the BACL. The EUT supplied by the applicant was received on 2018-01-08)*

Objective

This report is prepared on behalf of *Pycom Ltd* 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)

FCC Part 15.247 DSS and Part 27 TNB submissions with FCC ID: 2AJMTGPY01R.

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°C
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;

For 802.11n-HT40 mode, EUT was tested with Channel 3, 6 and 9.

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

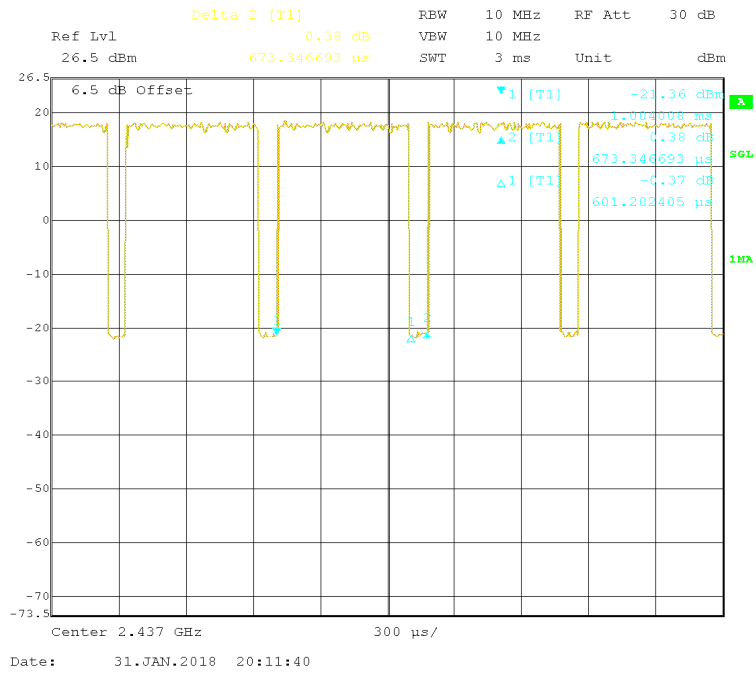
RF test tool: putty

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

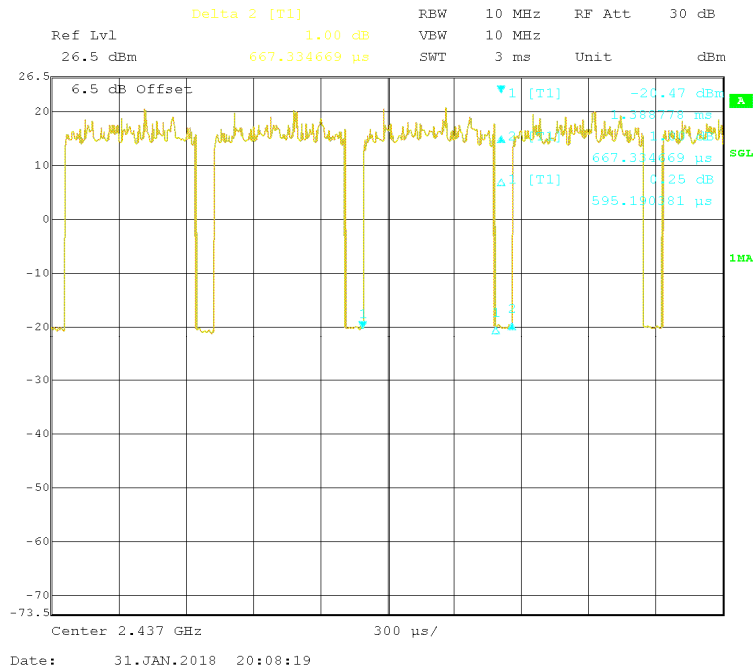
Mode	Data Rate	Power Level
802.11b	1 Mbps	4
802.11g	6 Mbps	16
802.11n-HT20	MCS0	16
802.11n-HT40	MCS0	20
BLE	1Mbps	7

Duty Cycle:

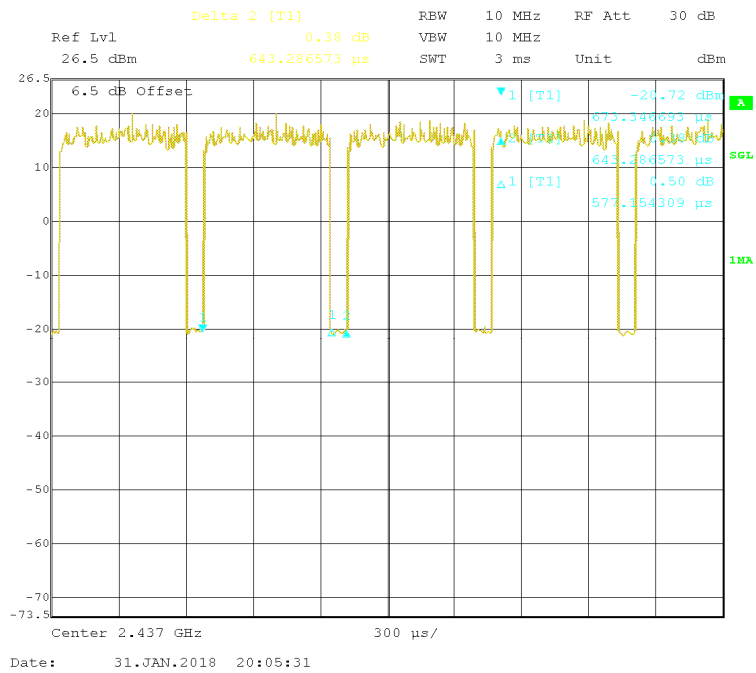
802.11b Mode Middle Channel



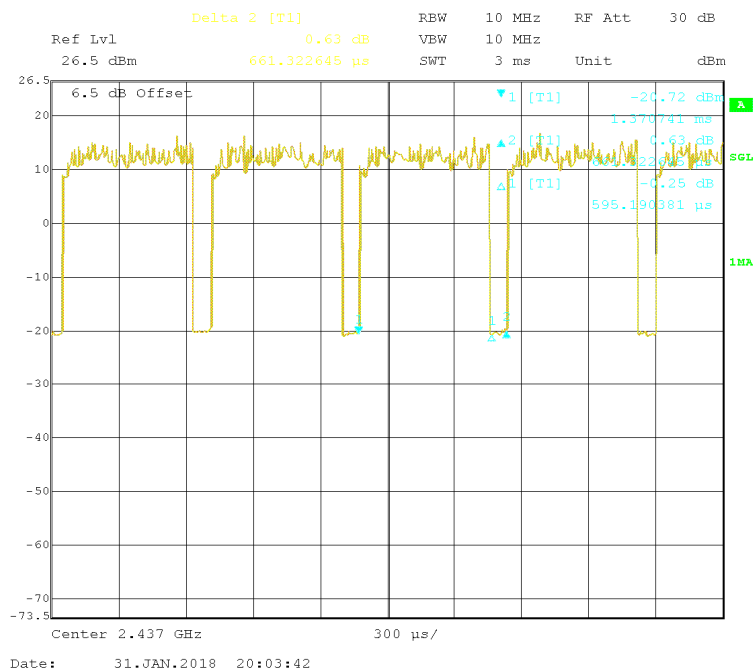
802.11g Mode Middle Channel



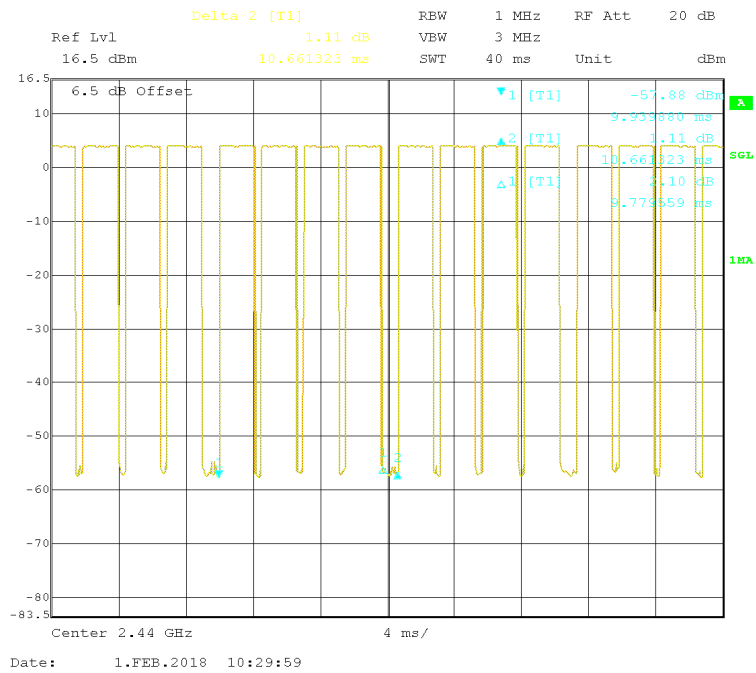
802.11n-HT20 Mode Middle Channel



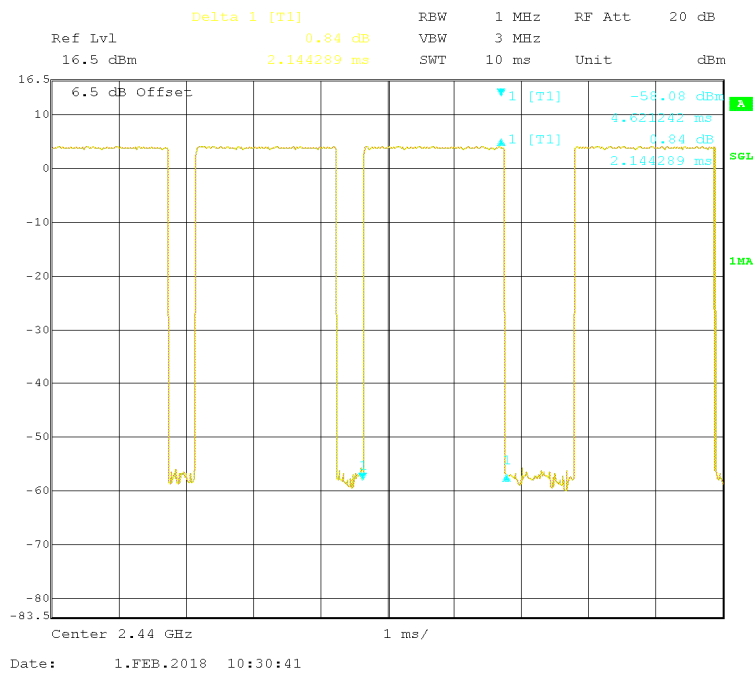
802.11n-HT40 Mode Middle Channel



BLE Mode Middle Channel-1



BLE Mode Middle Channel-2



Mode	Duty Cycle (%)	T(us)	1/T(kHz)	10log(1/x)
802.11b	89.30	601	1.66	0.49
802.11g	89.21	595	1.68	0.50
802.11n-HT20	89.74	577	1.73	0.47
802.11n-HT40	90.02	595	1.68	0.46
BLE	80.44	2144	0.47	0.95

Note: “x” means the Duty Cycle.

Support Equipment List and Details

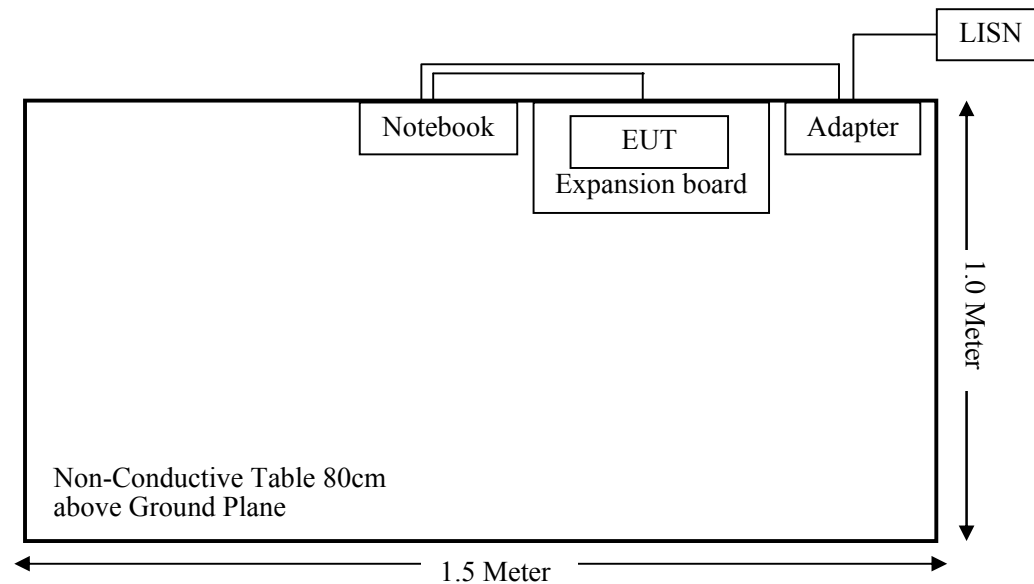
Manufacturer	Description	Model	Serial Number
DELL	Notebook	GX620	D65874152
DELL	Adapter	LA65NS0-00	DF263
Pycom Ltd	Expansion board	V2.1A	1630000932

External I/O Cable

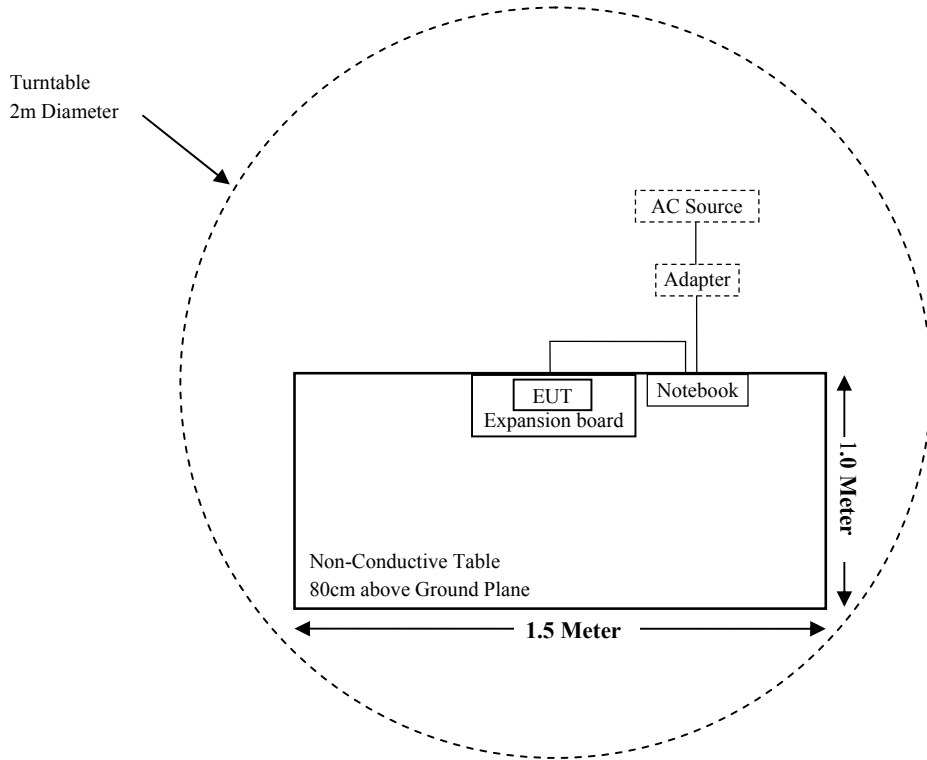
Cable Description	Length (m)	From Port	To
USB Cable	0.8	Expansion board	Notebook

Block Diagram of Test Setup

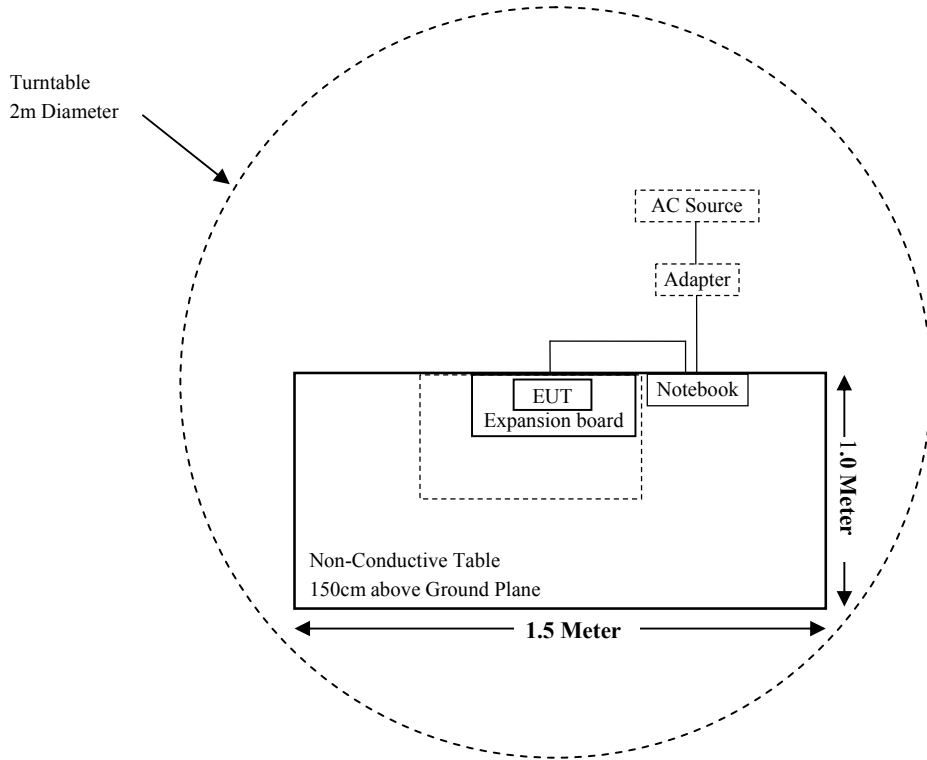
For Conducted Emissions:



For Radiated Emissions(Below 1GHz):



For Radiated Emissions(Above 1GHz):



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 Instrument	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
Narda	Pre-amplifier	AFS42-00101800	2001270	2017-10-22	2018-10-21
QuinStar	Amplifier	QLW-18405536-J0	15964001009	2017-10-22	2018-10-21
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
Agilent	Power Meter	N1912A	MY5000492	2017-11-18	2018-11-17
Agilent	Power Sensor	N1921A	MY54210024	2017-11-18	2018-11-17
Narda	Attenuator/6dB	10690812-2	26850-6	2018-01-10	2019-01-09
Pycom Ltd	RF Cable	/	/	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 §1.1307 & §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/cm²)	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/4πR² = power density (in appropriate units, e.g. mW/cm²);

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		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)	MPE ratio
		(dBi)	(numeric)	(dBm)	(mW)				
802.11b	2412~2462	1.30	1.35	23.0	199.53	20	0.0536	1.0000	0.0536
802.11g		1.30	1.35	21.0	125.89	20	0.0338	1.0000	0.0338
802.11n-HT20		1.30	1.35	21.0	125.89	20	0.0338	1.0000	0.0338
802.11n-HT40	2422~2452	1.30	1.35	21.0	125.89	20	0.0338	1.0000	0.0338
BLE	2402-2480	1.30	1.35	5.0	3.16	20	0.0008	1.0000	0.0008
BT 3.0	2402~2480	1.30	1.35	6.5	4.47	20	0.0012	1.0000	0.0012

Calculation of maximum antenna gain based on ERP/EIRP

Mode	Max Tune-up power (dBm)	ERP/EIRP Limit (dBm)	Max Antenna Gain (dBi)
FDD (Band 4)	23.00	30.00	7.00
FDD (Band 12)	23.50	34.77	11.27
FDD (Band 13)	23.00	34.77	11.77

Calculation of maximum antenna gain based on MPE Ratio

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)	MPE ratio
		(dBi)	(numeric)	(dBm)	(mW)				
FDD (Band 4)	1710~1755	13.77	23.82	23.00	199.53	20	0.9454	1.0000	0.9454
FDD (Band 12)	699~716	9.95	9.89	23.50	223.87	20	0.4404	0.4660	0.9451
FDD (Band 13)	777~787	10.91	12.33	23.00	199.53	20	0.4894	0.5180	0.9448

Note: Wi-Fi and FDD can transmit simultaneously; the worst condition is 802.11b of Wi-Fi & FDD (Band 4), as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0536 + 0.9454 = \mathbf{0.9990} < \mathbf{1.0}$$

Mode	Max Allow Antenna Gain (dBi)
FDD (Band 4) Uplink Frequency: 1710 MHz~1755 MHz	7.00
FDD (Band 12) Uplink Frequency: 699 MHz~716MHz	9.95
FDD (Band 13) Uplink Frequency: 777 MHz~787 MHz	10.91

Result: For FDD mode, to meet RF exposure & ERP/ERIP, the maximum net gains of antennas allowed are 7.00 dBi @ FDD (Band 4), 9.95 @ FDD (Band 12) and 10.91 @ FDD (Band 13). The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

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 with a ceramic antenna for Wi-Fi & BLE, which the antenna gain is 1.3 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

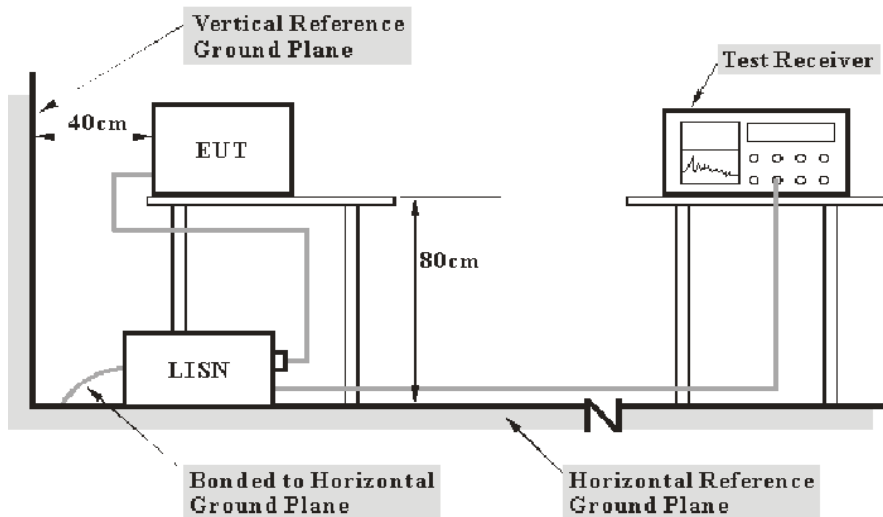
Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(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:

$$\text{Corrected Factor (dB)} = \text{LISN VDF (dB)} + \text{Cable Loss (dB)} + \text{Transient Limiter Attenuation (dB)}$$

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:

$$\text{Margin (dB)} = \text{Limit (dB}\mu\text{V)} - \text{Corrected Amplitude (dB}\mu\text{V)}$$

Test Results Summary

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

Test Data

Environmental Conditions

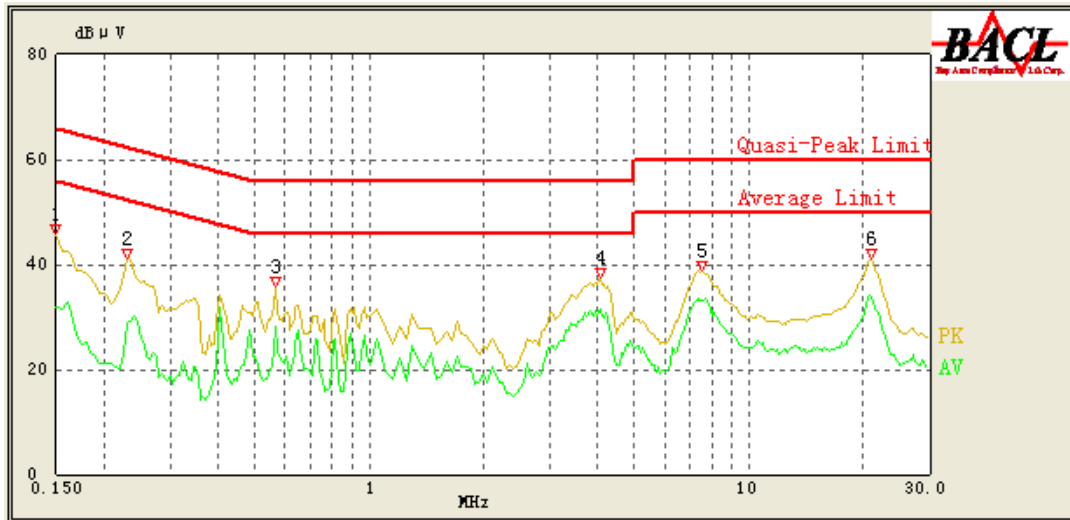
Temperature:	20.2 °C
Relative Humidity:	51 %
ATM Pressure:	101.3 kPa

The testing was performed by Max Min on 2018-02-22.

For Wi-Fi Mode:

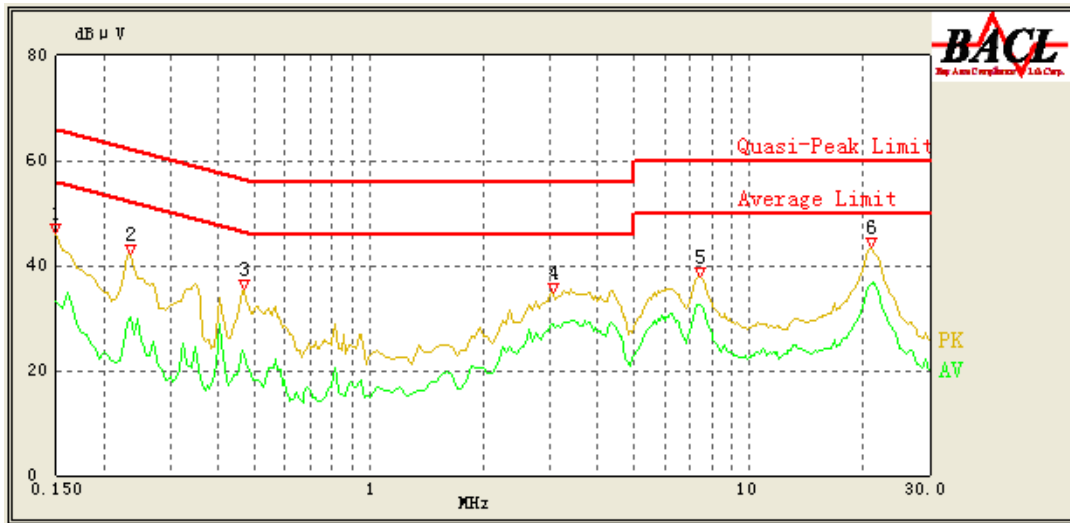
EUT operation mode: Transmitting in 802.11b mode low channel (worst case)

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	45.92	QP	9.000	L1	16.06	66.00	20.08	Compliance
0.150	31.82	AV	9.000	L1	16.06	56.00	24.18	Compliance
0.230	41.08	QP	9.000	L1	16.02	63.71	22.63	Compliance
0.230	28.99	AV	9.000	L1	16.02	53.71	24.72	Compliance
0.570	35.77	QP	9.000	L1	16.03	56.00	20.23	Compliance
0.565	28.07	AV	9.000	L1	16.04	46.00	17.93	Compliance
4.050	37.61	QP	9.000	L1	15.85	56.00	18.39	Compliance
4.050	31.37	AV	9.000	L1	15.85	46.00	14.63	Compliance
7.500	38.77	QP	9.000	L1	15.99	60.00	21.23	Compliance
7.500	33.32	AV	9.000	L1	15.99	50.00	16.68	Compliance
21.100	41.07	QP	9.000	L1	16.44	60.00	18.93	Compliance
21.000	33.98	AV	9.000	L1	16.44	50.00	16.02	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	46.01	QP	9.000	N	16.06	66.00	19.99	Compliance
0.150	33.31	AV	9.000	N	16.06	56.00	22.69	Compliance
0.235	42.06	QP	9.000	N	16.06	63.57	21.51	Compliance
0.235	30.15	AV	9.000	N	16.06	53.57	23.42	Compliance
0.470	35.36	QP	9.000	N	16.10	56.86	21.50	Compliance
0.470	23.02	AV	9.000	N	16.10	46.86	23.84	Compliance
3.050	34.74	QP	9.000	N	15.90	56.00	21.26	Compliance
3.050	28.97	AV	9.000	N	15.90	46.00	17.03	Compliance
7.450	38.00	QP	9.000	N	15.93	60.00	22.00	Compliance
7.450	32.45	AV	9.000	N	15.93	50.00	17.55	Compliance
21.100	43.34	QP	9.000	N	16.18	60.00	16.66	Compliance
21.250	36.56	AV	9.000	N	16.18	50.00	13.44	Compliance

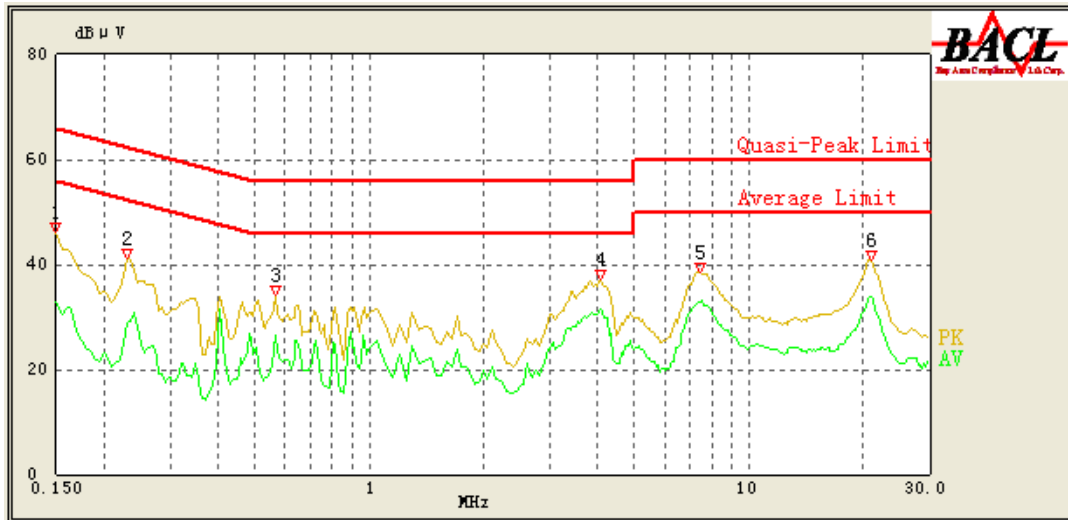
Note:

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

For BLE Mode:

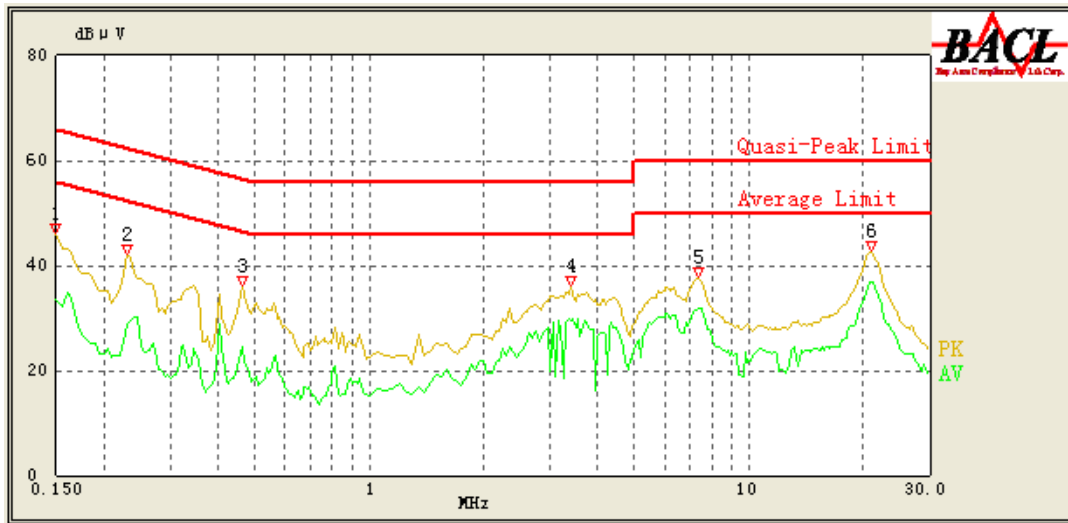
EUT operation mode: Transmitting in high channel (worst case)

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
0.150	46.06	QP	9.000	L1	16.06	66.00	19.94	Compliance
0.150	32.86	AV	9.000	L1	16.06	56.00	23.14	Compliance
0.230	41.12	QP	9.000	L1	16.02	63.71	22.59	Compliance
0.230	28.74	AV	9.000	L1	16.02	53.71	24.97	Compliance
0.570	34.23	QP	9.000	L1	16.03	56.00	21.77	Compliance
0.565	26.53	AV	9.000	L1	16.04	46.00	19.47	Compliance
4.050	37.14	QP	9.000	L1	15.85	56.00	18.86	Compliance
4.050	31.54	AV	9.000	L1	15.85	46.00	14.46	Compliance
7.450	38.50	QP	9.000	L1	15.99	60.00	21.50	Compliance
7.450	32.82	AV	9.000	L1	15.99	50.00	17.18	Compliance
21.000	40.87	QP	9.000	L1	16.44	60.00	19.13	Compliance
21.200	33.50	AV	9.000	L1	16.44	50.00	16.50	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	46.03	QP	9.000	N	16.06	66.00	19.97	Compliance
0.150	33.46	AV	9.000	N	16.06	56.00	22.54	Compliance
0.230	42.33	QP	9.000	N	16.06	63.71	21.38	Compliance
0.230	28.88	AV	9.000	N	16.06	53.71	24.83	Compliance
0.465	36.09	QP	9.000	N	16.10	57.00	20.91	Compliance
0.465	24.44	AV	9.000	N	16.10	47.00	22.56	Compliance
3.400	36.22	QP	9.000	N	15.89	56.00	19.78	Compliance
3.400	29.49	AV	9.000	N	15.89	46.00	16.51	Compliance
7.350	37.88	QP	9.000	N	15.93	60.00	22.12	Compliance
7.300	31.48	AV	9.000	N	15.93	50.00	18.52	Compliance
21.000	42.72	QP	9.000	N	16.18	60.00	17.28	Compliance
21.200	36.70	AV	9.000	N	16.18	50.00	13.30	Compliance

Note:

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

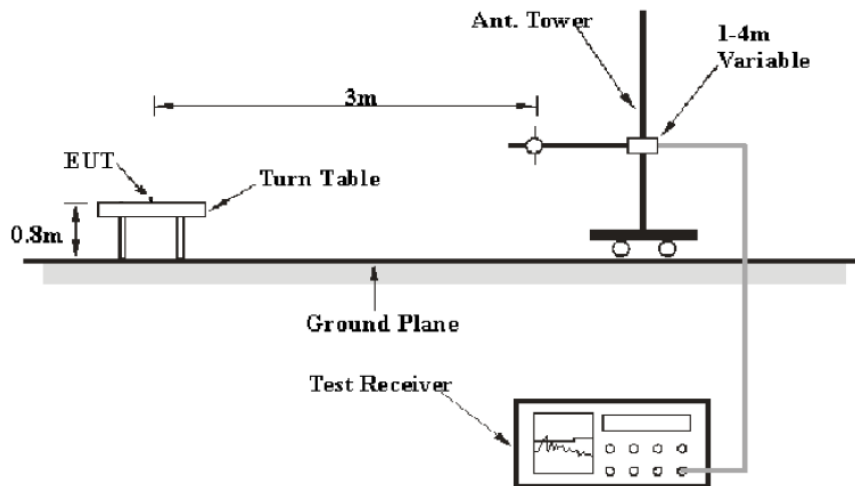
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

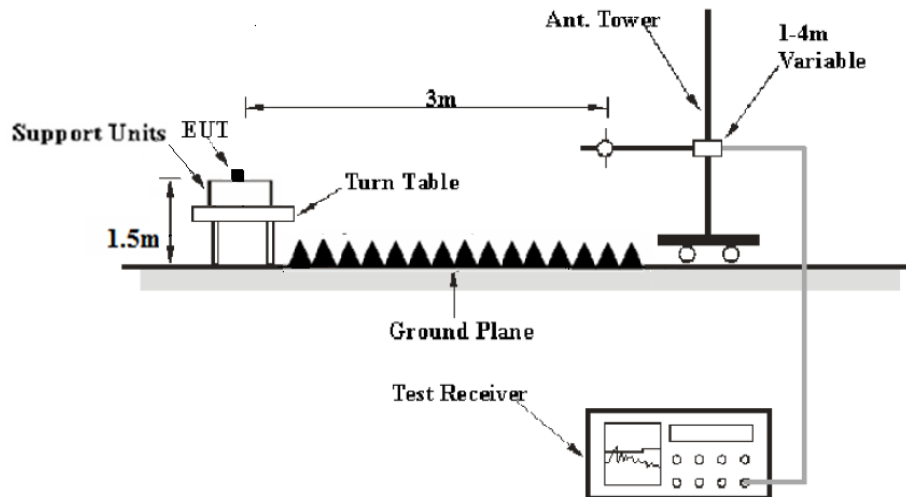
FCC §15.247 (d); §15.209; §15.205;

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.

Note: When duty cycle less than 98%, a correction factor shall be added to the average measurement results. Correction factor is $20 \cdot \log(1/x)$, where “x” is the duty cycle.

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:

$$\text{Corrected Amplitude (dB}\mu\text{V /m)} = \text{Meter Reading (dB}\mu\text{V)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Amplifier Gain (dB)}$$

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:

$$\text{Margin (dB)} = \text{Limit (dB}\mu\text{V/m)} - \text{Corrected Amplitude (dB}\mu\text{V /m)}$$

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 °C
Relative Humidity:	50 %
ATM Pressure:	101.2kPa

The testing was performed by Max Min from 2018-02-01 to 2018-06-29.

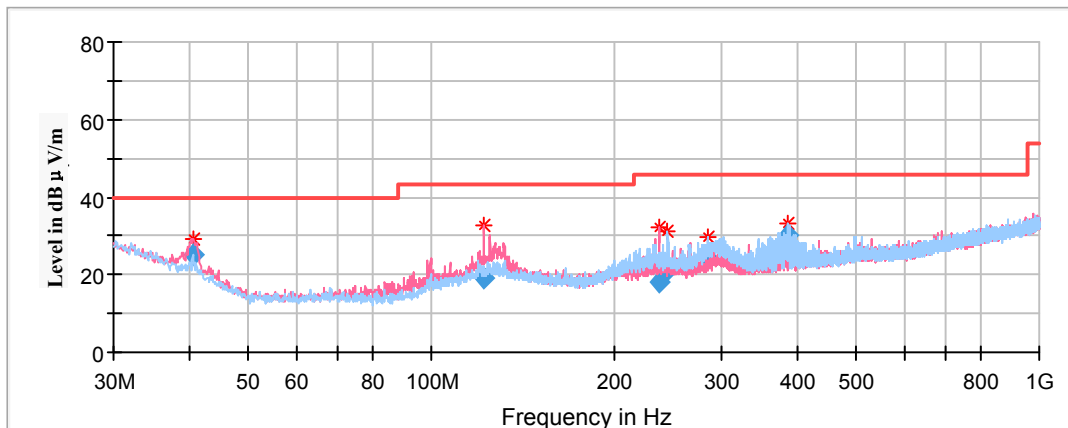
EUT operation mode: Transmitting

For Wi-Fi Mode:

Spurious Emission Test:

30MHz-1GHz:

Pre-scan with 802.11b, 802.11g, 802.11n-HT20 and 802.11n-HT40 modes of operation in the X,Y and Z axes of orientation, the worst case **low channel of 802.11b 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)				
40.670000	25.10	101.0	V	309.0	-11.6	40.00	14.90
122.271250	18.91	101.0	V	342.0	-11.7	43.50	24.59
236.367500	18.12	199.0	V	211.0	-12.6	46.00	27.88
244.855000	21.17	101.0	H	280.0	-12.6	46.00	24.83
284.261250	24.39	101.0	H	257.0	-11.5	46.00	21.61
387.081250	30.00	101.0	H	190.0	-8.9	46.00	16.00

1GHz-18GHz:

802.11b Mode:

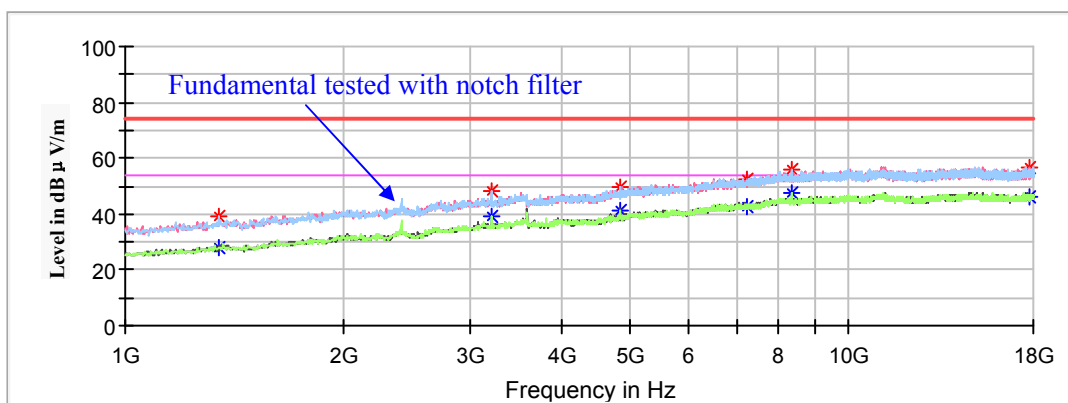
(Pre-scan in the X,Y and Z axes of orientation, the worst case X-axis of orientation was recorded)

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

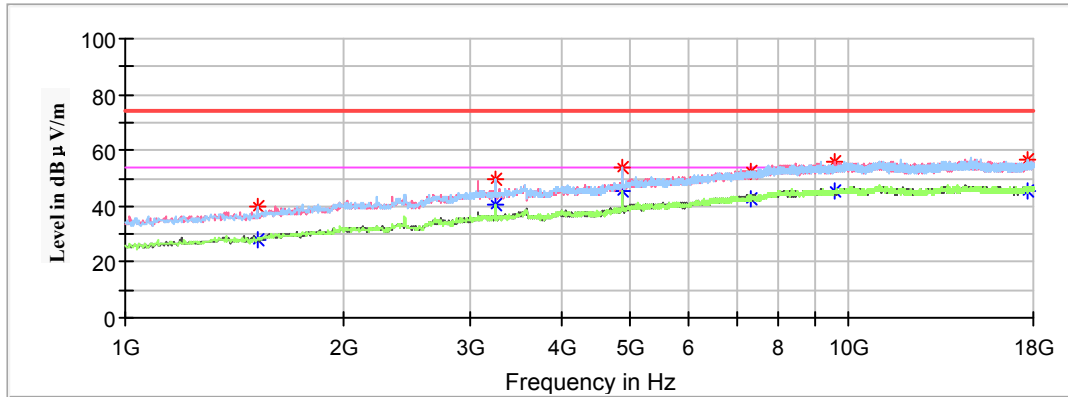
Full Spectrum



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)				
1346.800000	---	27.96	100.0	H	33.0	-2.1	54.00	26.04
1346.800000	39.38	---	100.0	H	33.0	-2.1	74.00	34.62
3213.400000	---	38.91	100.0	H	212.0	6.6	54.00	15.09
3213.400000	48.58	---	100.0	H	212.0	6.6	74.00	25.42
4824.000000	---	40.94	200.0	V	197.0	10.8	54.00	13.06
4824.000000	49.35	---	200.0	V	197.0	10.8	74.00	24.65
7236.000000	---	42.89	100.0	V	106.0	15.3	54.00	11.11
7236.000000	52.40	---	100.0	V	106.0	15.3	74.00	21.60
8330.400000	---	47.30	250.0	H	167.0	17.2	54.00	6.70
8330.400000	55.80	---	250.0	H	167.0	17.2	74.00	18.20
17806.200000	---	46.31	100.0	V	320.0	18.9	54.00	7.69
17806.200000	56.59	---	100.0	V	320.0	18.9	74.00	17.41

Middle Channel: 2437MHz

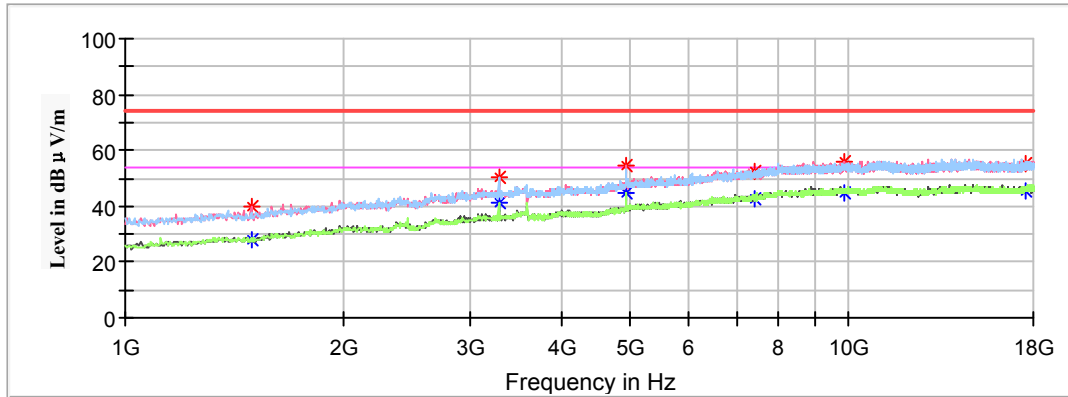
Full Spectrum



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)				
1520.200000	39.84	---	200.0	H	351.0	-1.1	74.00	34.16
1520.200000	---	27.90	200.0	H	351.0	-1.1	54.00	26.10
3247.400000	49.46	---	100.0	H	120.0	6.6	74.00	24.54
3247.400000	---	40.87	100.0	H	120.0	6.6	54.00	13.13
4874.000000	---	45.65	100.0	V	97.0	11.1	54.00	8.35
4874.000000	54.05	---	100.0	V	97.0	11.1	74.00	19.95
7311.000000	52.28	---	200.0	V	202.0	15.4	74.00	21.72
7311.000000	---	42.65	200.0	V	202.0	15.4	54.00	11.35
9544.200000	---	45.22	150.0	V	350.0	17.8	54.00	8.78
9544.200000	56.17	---	150.0	V	350.0	17.8	74.00	17.83
17639.600000	56.59	---	250.0	H	52.0	18.7	74.00	17.41
17639.600000	---	45.55	250.0	H	52.0	18.7	54.00	8.45

High Channel: 2462MHz

Full Spectrum



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)				
1493.000000	---	28.06	150.0	V	67.0	-1.3	54.00	25.94
1493.000000	39.57	---	150.0	V	67.0	-1.3	74.00	34.43
3281.400000	50.22	---	100.0	H	116.0	6.7	74.00	23.78
3281.400000	---	40.95	100.0	H	116.0	6.7	54.00	13.05
4924.000000	54.44	---	200.0	V	71.0	11.3	74.00	19.56
4924.000000	---	44.97	200.0	V	71.0	11.3	54.00	9.03
7386.000000	---	42.34	100.0	V	8.0	15.5	54.00	11.66
7386.000000	52.60	---	100.0	V	8.0	15.5	74.00	21.40
9874.000000	---	45.09	200.0	V	147.0	18.2	54.00	8.91
9874.000000	55.72	---	200.0	V	147.0	18.2	74.00	18.28
17612.400000	---	45.70	100.0	V	169.0	18.6	54.00	8.30
17612.400000	55.28	---	100.0	V	169.0	18.6	74.00	18.72

802.11g Mode:

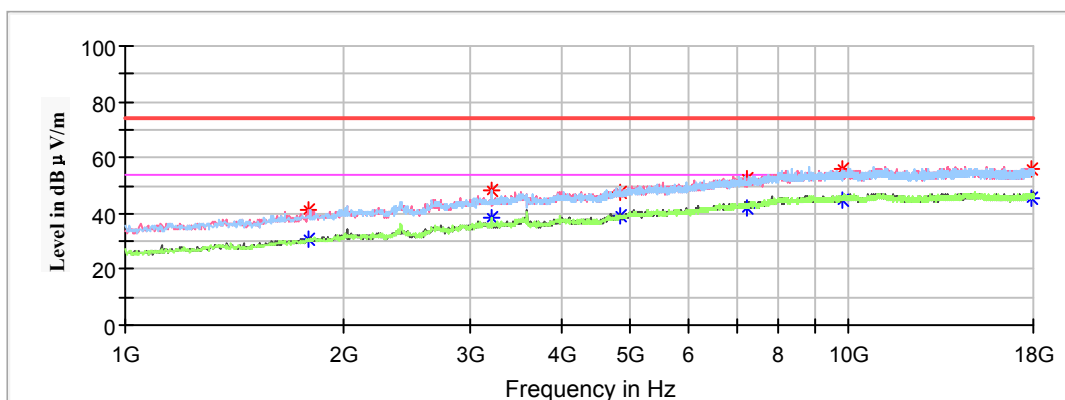
(Pre-scan in the X,Y and Z axes of orientation, the worst case X-axis of orientation was recorded)

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

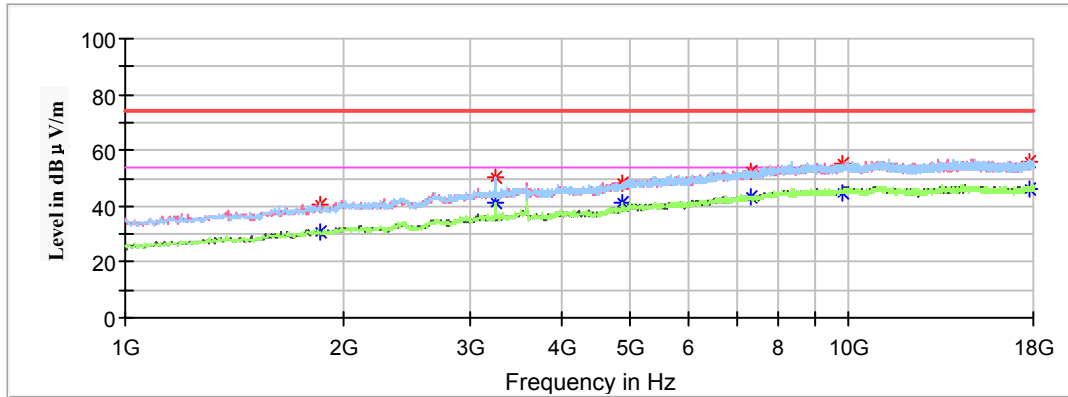
Full Spectrum



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)				
1792.200000	---	30.68	200.0	V	241.0	0.8	54.00	23.32
1792.200000	41.23	---	200.0	V	241.0	0.8	74.00	32.77
3213.400000	48.53	---	100.0	H	343.0	6.6	74.00	25.47
3213.400000	---	38.49	100.0	H	343.0	6.6	54.00	15.51
4824.000000	47.87	---	150.0	V	337.0	10.8	74.00	26.13
4824.000000	---	39.13	150.0	V	337.0	10.8	54.00	14.87
7236.000000	52.43	---	200.0	V	306.0	15.3	74.00	21.57
7236.000000	---	42.27	200.0	V	306.0	15.3	54.00	11.73
9823.000000	---	45.04	150.0	V	234.0	18.1	54.00	8.96
9823.000000	55.79	---	150.0	V	234.0	18.1	74.00	18.21
17915.000000	56.18	---	250.0	H	133.0	19.1	74.00	17.82
17915.000000	---	45.63	250.0	H	133.0	19.1	54.00	8.37

Middle Channel: 2437MHz

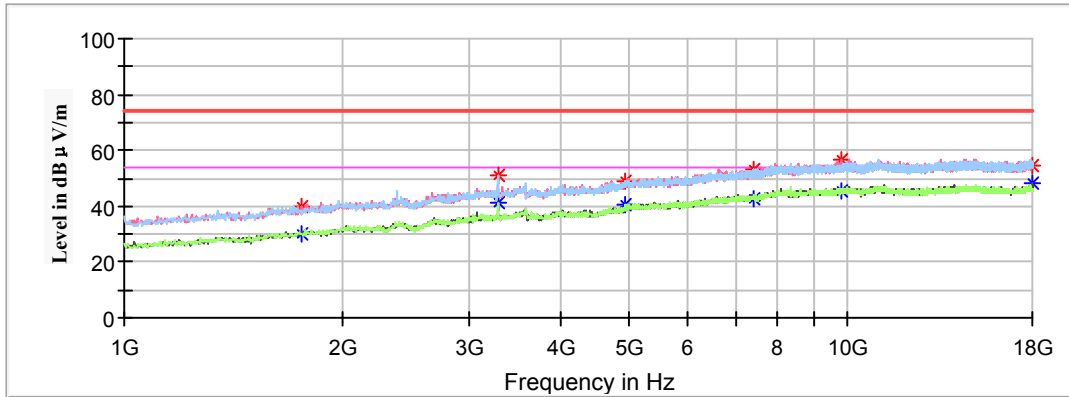
Full Spectrum



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)				
1856.800000	---	30.61	100.0	V	213.0	1.2	54.00	23.39
1856.800000	40.89	---	100.0	V	213.0	1.2	74.00	33.11
3247.400000	50.14	---	100.0	H	7.0	6.6	74.00	23.86
3247.400000	---	41.23	100.0	H	7.0	6.6	54.00	12.77
4874.000000	---	41.53	200.0	V	170.0	11.1	54.00	12.47
4874.000000	48.20	---	200.0	V	170.0	11.1	74.00	25.80
7311.000000	---	43.16	100.0	V	46.0	15.4	54.00	10.84
7311.000000	52.65	---	100.0	V	46.0	15.4	74.00	21.35
9782.200000	---	44.87	250.0	V	155.0	18.1	54.00	9.13
9782.200000	55.20	---	250.0	V	155.0	18.1	74.00	18.80
17731.400000	---	46.14	100.0	H	171.0	18.8	54.00	7.86
17731.400000	56.10	---	100.0	H	171.0	18.8	74.00	17.90

High Channel: 2462MHz

Full Spectrum



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)				
1758.200000	---	30.09	200.0	V	207.0	0.5	54.00	23.91
1758.200000	40.10	---	200.0	V	207.0	0.5	74.00	33.90
3281.400000	---	41.48	100.0	H	41.0	6.7	54.00	12.52
3281.400000	50.72	---	100.0	H	41.0	6.7	74.00	23.28
4924.000000	---	40.24	100.0	V	101.0	11.3	54.00	13.76
4924.000000	48.69	---	100.0	V	101.0	11.3	74.00	25.31
7386.000000	---	42.57	200.0	V	5.0	15.5	54.00	11.43
7386.000000	53.11	---	200.0	V	5.0	15.5	74.00	20.89
9806.000000	---	45.11	100.0	V	158.0	18.1	54.00	8.89
9806.000000	56.36	---	100.0	V	158.0	18.1	74.00	17.64
17955.800000	54.89	---	200.0	V	327.0	19.1	74.00	19.11
17955.800000	---	48.12	200.0	V	327.0	19.1	54.00	5.88

802.11n-HT20 Mode:

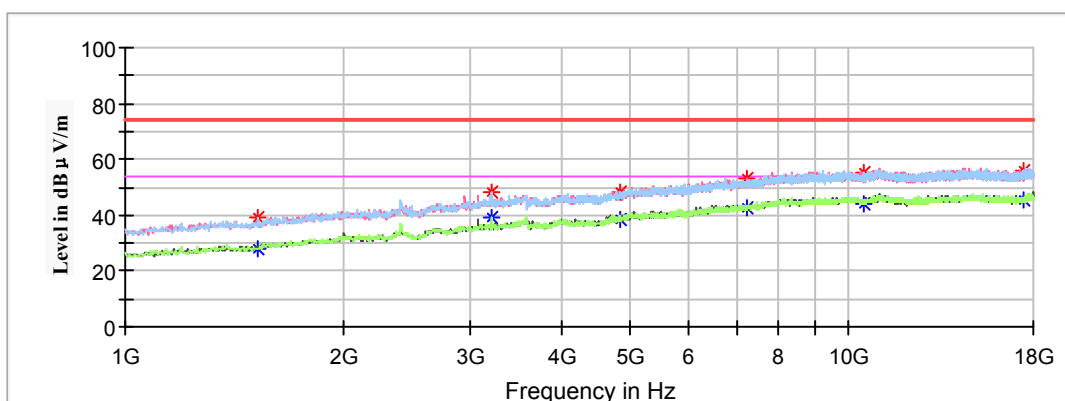
(Pre-scan in the X,Y and Z axes of orientation, the worst case X-axis of orientation was recorded)

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

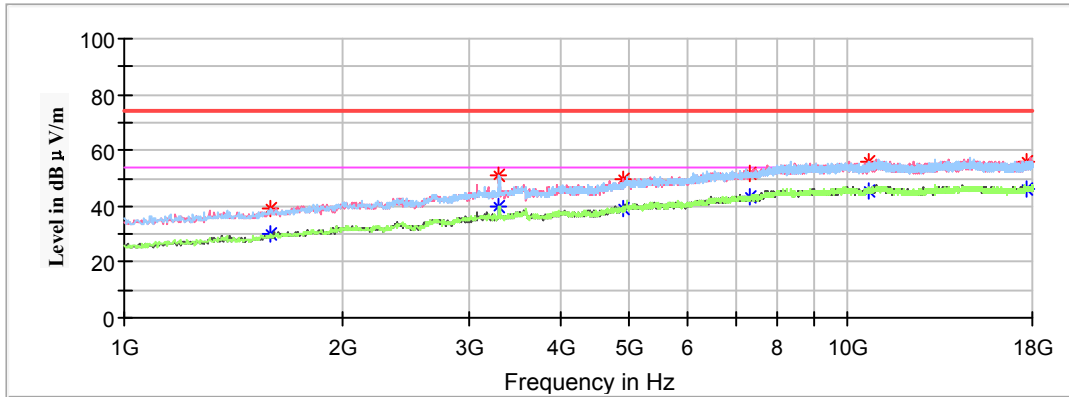
Full Spectrum



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)				
1527.000000	---	28.16	150.0	H	86.0	-1.1	54.00	25.84
1527.000000	39.05	---	150.0	H	86.0	-1.1	74.00	34.95
3213.400000	---	39.43	150.0	H	85.0	6.6	54.00	14.57
3213.400000	48.12	---	150.0	H	85.0	6.6	74.00	25.88
4824.000000	---	38.41	250.0	V	277.0	10.8	54.00	15.59
4824.000000	48.51	---	250.0	V	277.0	10.8	74.00	25.49
7236.000000	---	42.75	100.0	V	289.0	15.3	54.00	11.25
7236.000000	52.83	---	100.0	V	289.0	15.3	74.00	21.17
10516.600000	---	44.27	200.0	H	308.0	17.7	54.00	9.73
10516.600000	55.35	---	200.0	H	308.0	17.7	74.00	18.65
17442.400000	---	45.75	100.0	V	204.0	18.4	54.00	8.25
17442.400000	56.20	---	100.0	V	204.0	18.4	74.00	17.80

Middle Channel: 2437MHz

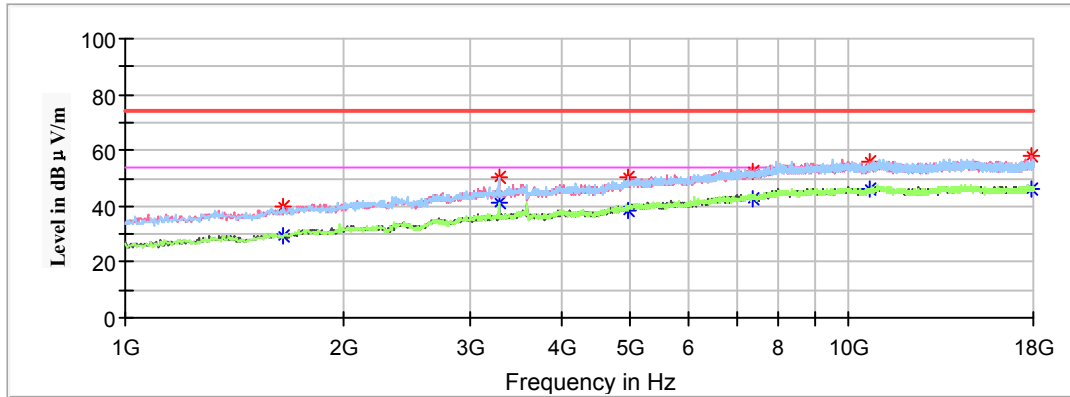
Full Spectrum



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	---	29.97	100.0	H	272.0	-0.6	54.00	24.03
1595.000000	39.07	---	100.0	H	272.0	-0.6	74.00	34.93
3298.400000	---	39.82	100.0	H	225.0	6.8	54.00	14.18
3298.400000	51.25	---	100.0	H	225.0	6.8	74.00	22.75
4874.000000	---	39.07	200.0	V	206.0	11.1	54.00	14.93
4874.000000	49.37	---	200.0	V	206.0	11.1	74.00	24.63
7311.000000	---	43.70	100.0	V	154.0	15.4	54.00	10.30
7311.000000	51.83	---	100.0	V	154.0	15.4	74.00	22.17
10673.000000	---	45.40	200.0	H	274.0	18.2	54.00	8.60
10673.000000	55.64	---	200.0	H	274.0	18.2	74.00	18.36
17656.600000	---	46.44	150.0	H	287.0	18.7	54.00	7.56
17656.600000	55.80	---	150.0	H	287.0	18.7	74.00	18.20

High Channel: 2462MHz

Full Spectrum



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)				
1656.200000	---	29.71	100.0	H	204.0	-0.1	54.00	24.29
1656.200000	40.09	---	100.0	H	204.0	-0.1	74.00	33.91
3281.400000	50.64	---	100.0	H	215.0	6.7	74.00	23.36
3281.400000	---	41.16	100.0	H	215.0	6.7	54.00	12.84
4924.000000	---	38.81	200.0	V	77.0	11.3	54.00	15.19
4924.000000	50.07	---	200.0	V	77.0	11.3	74.00	23.93
7386.000000	---	42.43	150.0	V	195.0	15.5	54.00	11.57
7386.000000	52.42	---	150.0	V	195.0	15.5	74.00	21.58
10686.600000	---	46.08	200.0	V	85.0	18.2	54.00	7.92
10686.600000	55.82	---	200.0	V	85.0	18.2	74.00	18.18
17843.600000	---	45.82	100.0	V	10.0	19.0	54.00	8.18
17843.600000	57.94	---	100.0	V	10.0	19.0	74.00	16.06

802.11n-HT40 Mode:

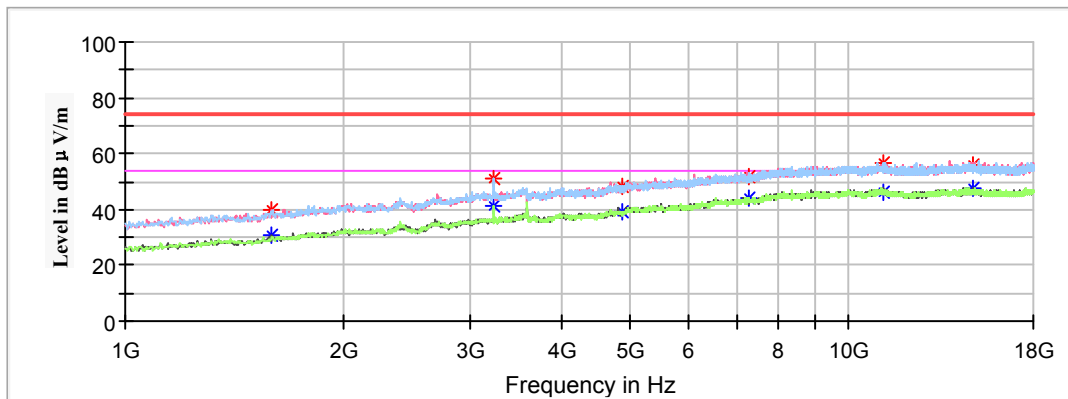
(Pre-scan in the X,Y and Z axes of orientation, the worst case X-axis of orientation was recorded)

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: 2422MHz

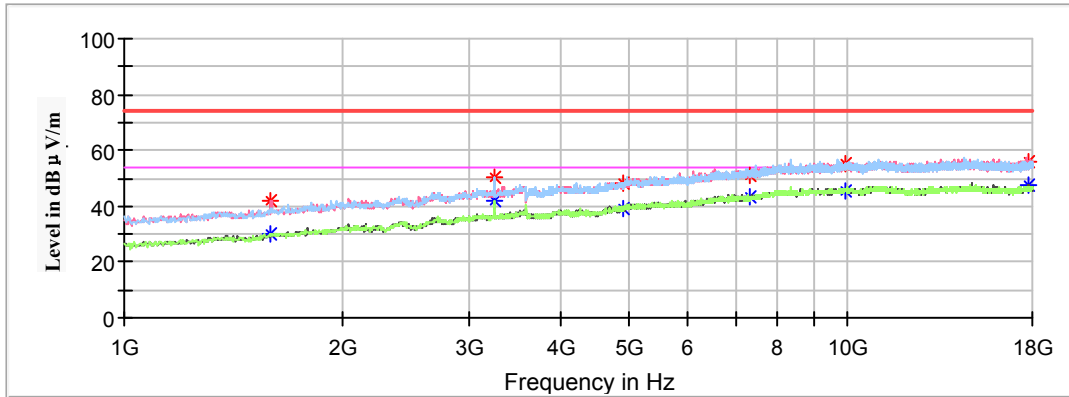
Full Spectrum



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	---	31.11	100.0	V	106.0	-0.6	54.00	22.89
1595.000000	39.85	---	100.0	V	106.0	-0.6	74.00	34.15
3227.000000	---	41.41	100.0	H	178.0	6.6	54.00	12.59
3227.000000	51.13	---	100.0	H	178.0	6.6	74.00	22.87
4844.000000	---	39.50	250.0	V	319.0	11.0	54.00	14.50
4844.000000	48.05	---	250.0	V	319.0	11.0	74.00	25.95
7266.000000	---	43.92	100.0	V	74.0	15.3	54.00	10.08
7266.000000	51.76	---	100.0	V	74.0	15.3	74.00	22.24
11149.000000	56.74	---	200.0	H	282.0	18.8	74.00	17.26
11152.400000	---	46.20	200.0	H	282.0	18.8	54.00	7.80
14855.000000	---	47.36	150.0	V	129.0	18.9	54.00	6.64
14865.200000	56.12	---	150.0	V	129.0	18.9	74.00	17.88

Middle Channel: 2437MHz

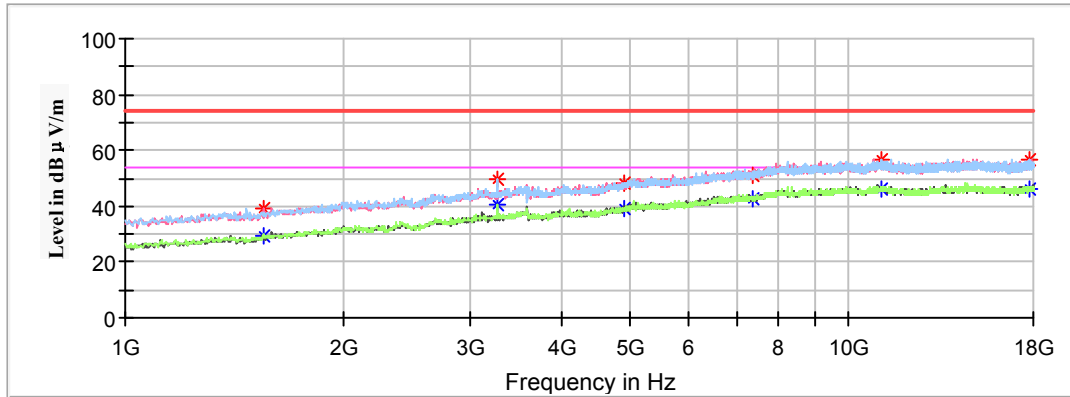
Full Spectrum



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	41.82	---	200.0	H	272.0	-0.6	74.00	32.18
1595.000000	---	30.26	200.0	H	272.0	-0.6	54.00	23.74
3247.400000	50.21	---	100.0	H	139.0	6.6	74.00	23.79
3247.400000	---	42.01	100.0	H	139.0	6.6	54.00	11.99
4874.000000	---	39.10	100.0	V	21.0	11.1	54.00	14.90
4874.000000	48.52	---	100.0	V	21.0	11.1	74.00	25.48
7311.000000	50.77	---	200.0	V	344.0	15.4	74.00	23.23
7311.000000	---	43.28	200.0	V	344.0	15.4	54.00	10.72
9897.800000	55.35	---	100.0	V	197.0	18.2	74.00	18.65
9897.800000	---	45.33	100.0	V	197.0	18.2	54.00	8.67
17768.800000	55.72	---	200.0	V	191.0	18.9	74.00	18.28
17768.800000	---	47.30	200.0	V	191.0	18.9	54.00	6.70

High Channel: 2452MHz

Full Spectrum

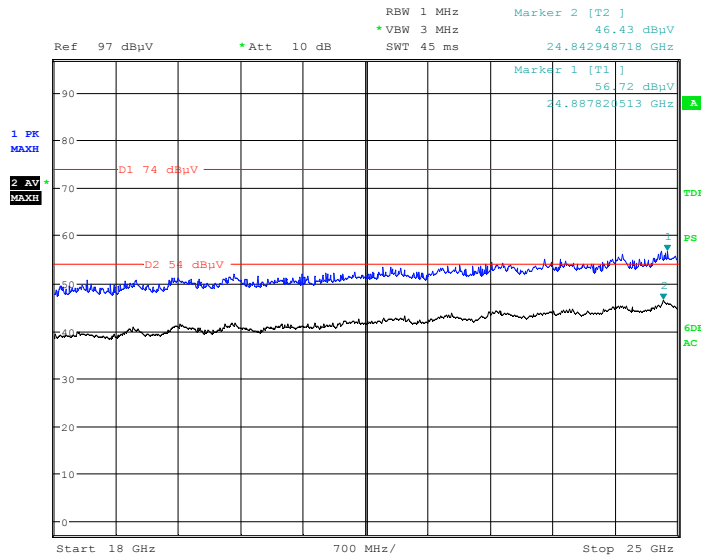


Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV /m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
1554.200000	---	29.33	100.0	V	232.0	-0.9	54.00	24.67
1554.200000	38.84	---	100.0	V	232.0	-0.9	74.00	35.16
3267.800000	---	40.50	100.0	H	212.0	6.7	54.00	13.50
3267.800000	49.86	---	100.0	H	212.0	6.7	74.00	24.14
4904.000000	---	38.94	200.0	V	75.0	11.2	54.00	15.06
4904.000000	48.09	---	200.0	V	75.0	11.2	74.00	25.91
7356.000000	---	42.34	150.0	V	132.0	15.4	54.00	11.66
7356.000000	51.33	---	150.0	V	132.0	15.4	74.00	22.67
11074.200000	---	46.46	200.0	H	216.0	19.0	54.00	7.54
11074.200000	56.65	---	200.0	H	216.0	19.0	74.00	17.35
17738.200000	---	46.39	100.0	V	350.0	18.8	54.00	7.61
17738.200000	56.81	---	100.0	V	350.0	18.8	74.00	17.19

18GHz-25GHz:

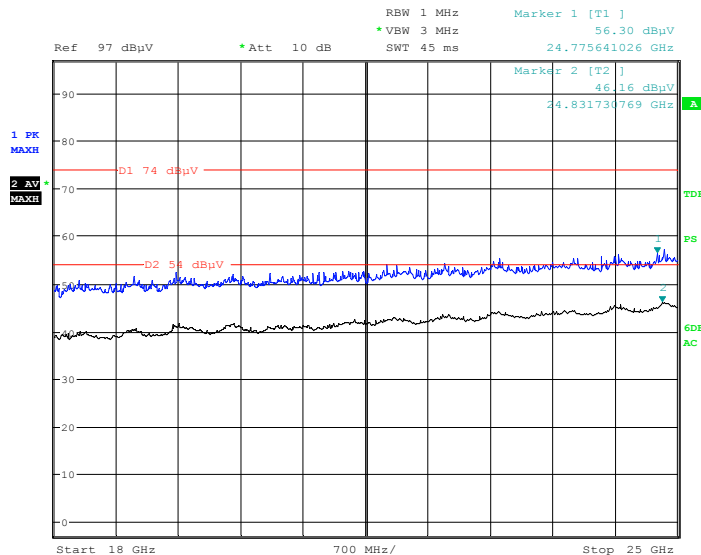
Pre-scan with 802.11b, 802.11g, 802.11n-HT20 and 802.11n-HT40 modes of operation in the X,Y and Z axes of orientation, the worst case **low channel of 802.11b mode in X-axis of orientation** was recorded

Horizontal



Date: 13.JUN.2018 20:21:13

Vertical



Date: 13.JUN.2018 20:30:46

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	108.96	---	100.0	V	275.0	5.1	/	/
2412.000000	---	101.71	100.0	V	275.0	5.1	/	/
2412.000000	106.80	---	150.0	H	172.0	5.1	/	/
2412.000000	---	99.57	150.0	H	172.0	5.1	/	/
2390.000000	49.39	---	200.0	V	81.0	5.1	74.00	24.61
2390.000000	---	41.38	200.0	V	81.0	5.1	54.00	12.62
Middle Channel: 2437MHz								
2437.000000	108.81	---	200.0	V	30.0	5.2	/	/
2437.000000	---	101.50	200.0	V	30.0	5.2	/	/
2437.000000	106.65	---	200.0	H	37.0	5.2	/	/
2437.000000	---	99.37	200.0	H	37.0	5.2	/	/
High Channel: 2462MHz								
2462.000000	108.69	---	200.0	V	295.0	5.2	/	/
2462.000000	---	101.36	200.0	V	295.0	5.2	/	/
2462.000000	106.57	---	250.0	H	53.0	5.2	/	/
2462.000000	---	99.22	250.0	H	53.0	5.2	/	/
2483.500000	50.80	---	250.0	V	125.0	5.3	74.00	23.20
2483.500000	---	43.68	250.0	V	125.0	5.3	54.00	10.32

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	105.22	---	150.0	V	93.0	5.1	/	/
2412.000000	---	97.94	150.0	V	93.0	5.1	/	/
2412.000000	103.05	---	150.0	H	110.0	5.1	/	/
2412.000000	---	95.80	150.0	H	110.0	5.1	/	/
2390.000000	57.82	---	100.0	V	122.0	5.1	74.00	16.18
2390.000000	---	44.82	100.0	V	122.0	5.1	54.00	9.18
Middle Channel: 2437MHz								
2437.000000	104.23	---	200.0	V	193.0	5.2	/	/
2437.000000	---	96.87	200.0	V	193.0	5.2	/	/
2437.000000	102.07	---	100.0	H	19.0	5.2	/	/
2437.000000	---	94.75	100.0	H	19.0	5.2	/	/
High Channel: 2462MHz								
2462.000000	103.51	---	100.0	V	110.0	5.3	/	/
2462.000000	---	96.17	100.0	V	110.0	5.3	/	/
2462.000000	101.39	---	100.0	H	287.0	5.3	/	/
2462.000000	---	94.02	100.0	H	287.0	5.3	/	/
2483.500000	60.00	---	250.0	V	293.0	5.3	74.00	14.00
2483.500000	---	47.34	250.0	V	293.0	5.3	54.00	6.66

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	103.82	---	250.0	V	18.0	5.1	/	/
2412.000000	---	96.56	250.0	V	18.0	5.1	/	/
2412.000000	101.71	---	200.0	H	95.0	5.1	/	/
2412.000000	---	94.42	200.0	H	95.0	5.1	/	/
2390.000000	59.22	---	200.0	V	88.0	5.1	74.00	14.78
2390.000000	---	44.18	200.0	V	88.0	5.1	54.00	9.82
Middle Channel: 2437MHz								
2437.000000	103.42	---	100.0	V	352.0	5.2	/	/
2437.000000	---	96.17	100.0	V	352.0	5.2	/	/
2437.000000	101.26	---	150.0	H	308.0	5.2	/	/
2437.000000	---	94.05	150.0	H	308.0	5.2	/	/
High Channel: 2462MHz								
2462.000000	102.13	---	100.0	V	143.0	5.3	/	/
2462.000000	---	94.81	100.0	V	143.0	5.3	/	/
2462.000000	100.01	---	100.0	H	82.0	5.3	/	/
2462.000000	---	92.68	100.0	H	82.0	5.3	/	/
2483.500000	57.92	---	150.0	V	335.0	5.3	74.00	16.08
2483.500000	---	48.34	150.0	V	335.0	5.3	54.00	5.66

802.11n-HT40 Mode: (Pre-scan in the X, Y and Z axes of orientation, the worst case X-axis of orientation was recorded)

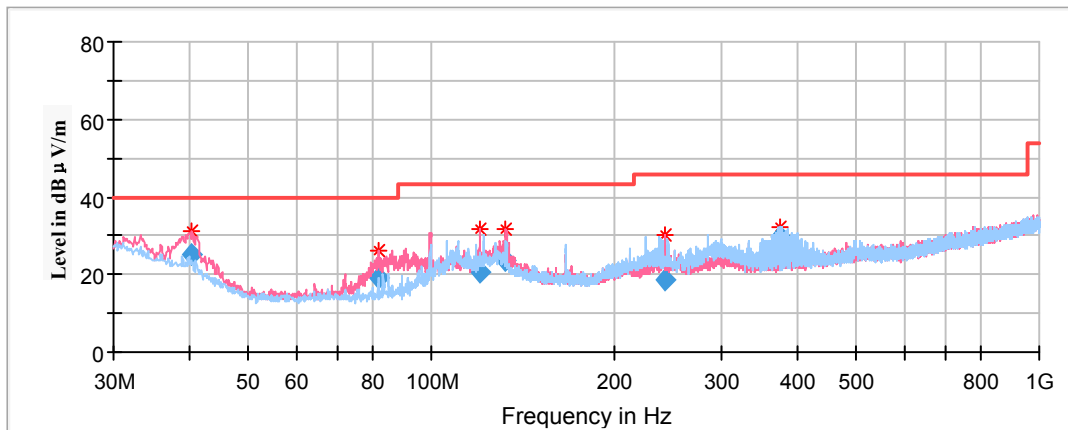
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
Low Channel: 2422MHz								
2422.000000	100.98	---	100.0	V	66.0	5.1	/	/
2422.000000	---	93.58	100.0	V	66.0	5.1	/	/
2422.000000	98.87	---	100.0	H	49.0	5.1	/	/
2422.000000	---	91.44	100.0	H	49.0	5.1	/	/
2390.000000	59.36	---	200.0	V	198.0	5.1	74.00	14.64
2390.000000	---	45.83	200.0	V	198.0	5.1	54.00	8.17
Middle Channel: 2437MHz								
2437.000000	101.22	---	250.0	V	113.0	5.2	/	/
2437.000000	---	93.87	250.0	V	113.0	5.2	/	/
2437.000000	99.06	---	150.0	H	210.0	5.2	/	/
2437.000000	---	91.74	150.0	H	210.0	5.2	/	/
High Channel: 2452MHz								
2452.000000	100.72	---	200.0	V	255.0	5.3	/	/
2452.000000	---	93.46	200.0	V	255.0	5.3	/	/
2452.000000	98.60	---	150.0	H	358.0	5.3	/	/
2452.000000	---	91.31	150.0	H	358.0	5.3	/	/
2483.500000	61.73	---	200.0	V	197.0	5.3	74.00	12.27
2483.500000	---	46.76	200.0	V	197.0	5.3	54.00	7.24

For BLE Mode:

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)				
40.427500	25.07	101.0	V	304.0	-11.5	40.00	14.93
82.016250	19.13	101.0	V	343.0	-18.1	40.00	20.87
120.331250	20.59	101.0	V	308.0	-11.6	43.50	22.91
132.698750	23.41	101.0	V	111.0	-12.1	43.50	20.09
242.793750	18.51	199.0	V	169.0	-12.6	46.00	27.49
374.107500	29.90	101.0	H	193.0	-9.2	46.00	16.10

1GHz-18GHz

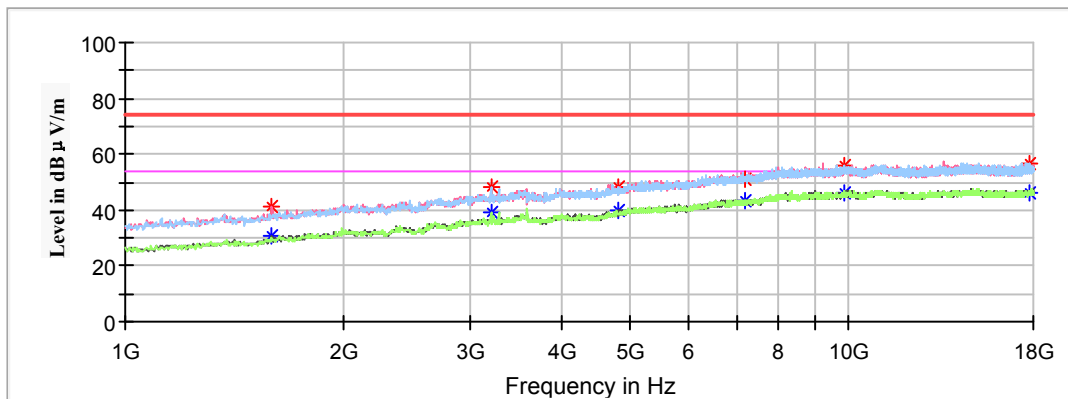
(Pre-scan in the X, Y and Z axes of orientation, the worst case X-axis of orientation was recorded)

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

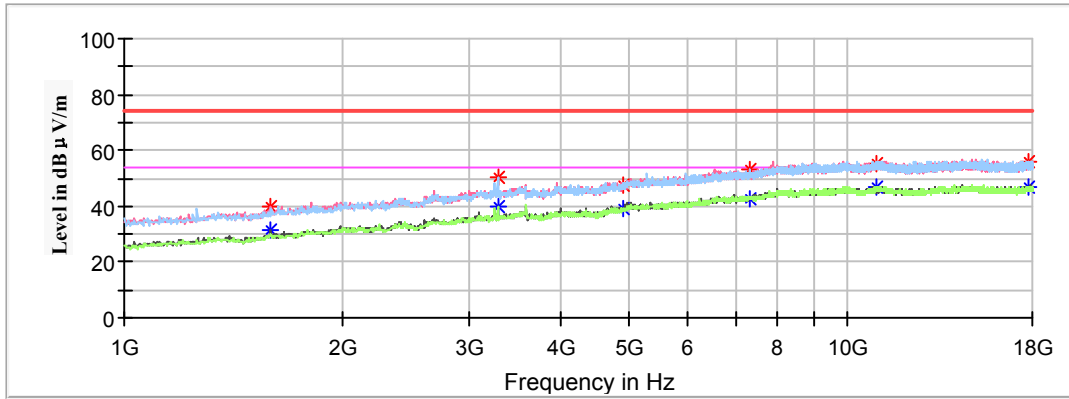
Full Spectrum



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	41.00	---	150.0	V	128.0	-0.6	74.00	33.00
1595.000000	---	30.72	150.0	V	128.0	-0.6	54.00	23.28
3199.800000	48.14	---	100.0	H	74.0	6.5	74.00	25.86
3199.800000	---	38.90	100.0	H	74.0	6.5	54.00	15.10
4804.000000	48.19	---	250.0	V	184.0	10.7	74.00	25.81
4804.000000	---	39.52	250.0	V	184.0	10.7	54.00	14.48
7206.000000	---	43.31	100.0	V	321.0	15.2	54.00	10.69
7206.000000	51.19	---	100.0	V	321.0	15.2	74.00	22.81
9874.000000	---	45.97	250.0	H	227.0	18.2	54.00	8.03
9874.000000	55.92	---	250.0	H	227.0	18.2	74.00	18.08
17826.600000	---	45.97	100.0	H	114.0	18.9	54.00	8.03
17826.600000	56.49	---	100.0	H	114.0	18.9	74.00	17.51

Middle Channel: 2440MHz

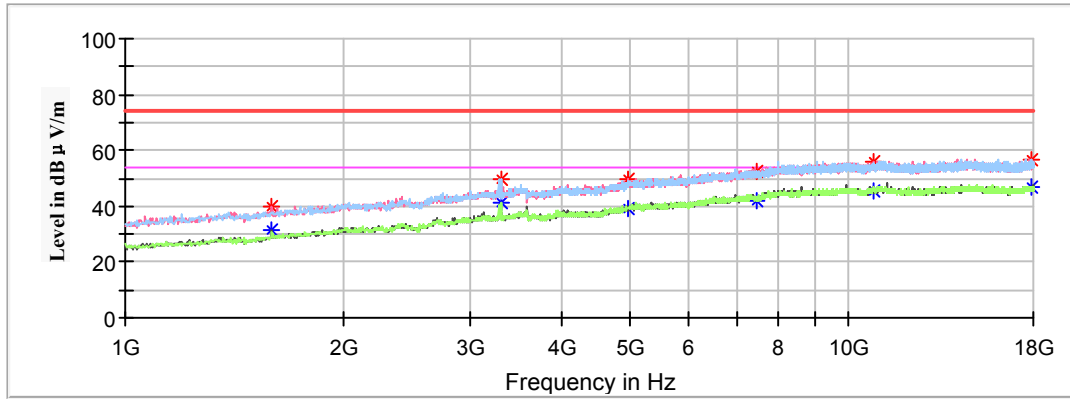
Full Spectrum



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	---	31.17	150.0	V	325.0	-0.6	54.00	22.83
1591.600000	39.66	---	150.0	V	325.0	-0.6	74.00	34.34
3281.400000	---	39.93	100.0	H	227.0	6.7	54.00	14.07
3281.400000	50.17	---	100.0	H	227.0	6.7	74.00	23.83
4880.000000	47.65	---	200.0	V	41.0	11.1	74.00	26.35
4880.000000	---	38.92	200.0	V	41.0	11.1	54.00	15.08
7320.000000	---	42.90	150.0	V	0.0	15.4	54.00	11.10
7320.000000	53.13	---	150.0	V	0.0	15.4	74.00	20.87
10962.000000	---	47.15	200.0	H	179.0	19.0	54.00	6.85
10962.000000	55.29	---	200.0	H	179.0	19.0	74.00	18.71
17813.000000	55.90	---	100.0	V	159.0	18.9	74.00	18.10
17813.000000	---	46.83	100.0	V	159.0	18.9	54.00	7.17

High Channel: 2480MHz

Full Spectrum

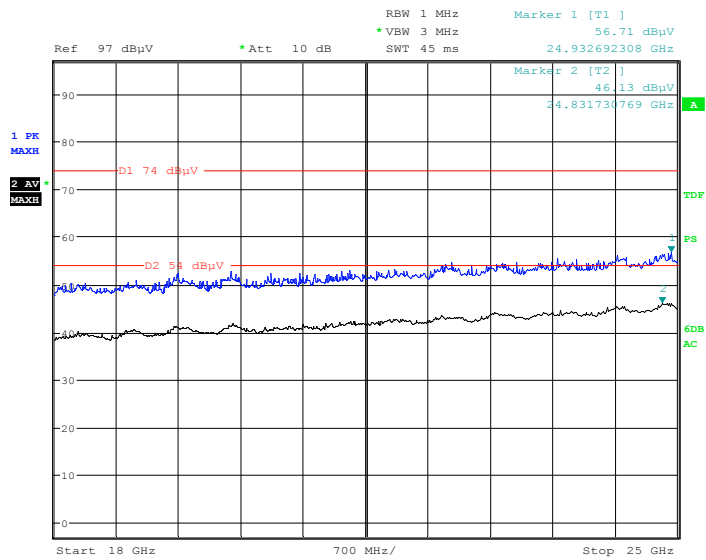


Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV /m)	Average (dBμV /m)	Height (cm)	Polar (H/V)				
1595.000000	---	31.14	100.0	V	309.0	-0.6	54.00	22.86
1595.000000	39.63	---	100.0	V	309.0	-0.6	74.00	34.37
3305.200000	---	41.25	100.0	H	248.0	6.8	54.00	12.75
3305.200000	49.65	---	100.0	H	248.0	6.8	74.00	24.35
4960.000000	---	39.23	250.0	V	25.0	11.5	54.00	14.77
4960.000000	49.57	---	250.0	V	25.0	11.5	74.00	24.43
7440.000000	---	42.15	100.0	V	31.0	15.6	54.00	11.85
7440.000000	52.16	---	100.0	V	31.0	15.6	74.00	21.84
10836.200000	---	45.35	250.0	V	352.0	18.6	54.00	8.65
10836.200000	56.15	---	250.0	V	352.0	18.6	74.00	17.85
17925.200000	---	46.85	100.0	H	167.0	19.1	54.00	7.15
17925.200000	56.62	---	100.0	H	167.0	19.1	74.00	17.38

18GHz-25GHz

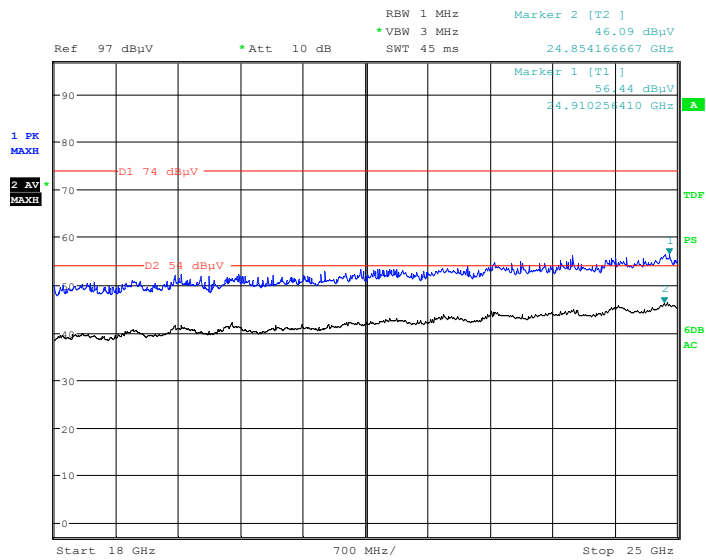
(Pre-scan with low, middle and high channels of operation in the X,Y and Z axes of orientation, the worst case **high** channel of operation in the X axis of orientation was recorded)

Horizontal Plot



Date: 13.JUN.2018 20:41:03

Vertical Plot



Date: 13.JUN.2018 20:50:46

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)

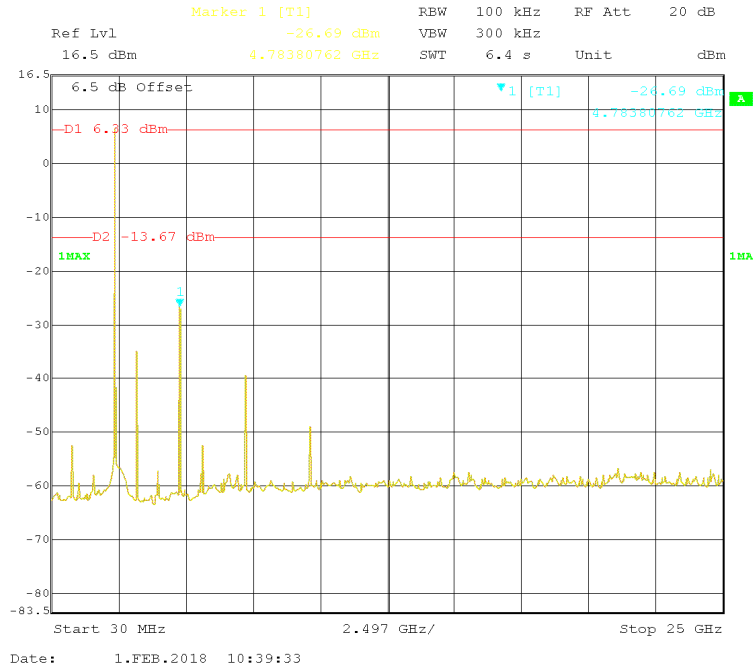
Note:

- 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)

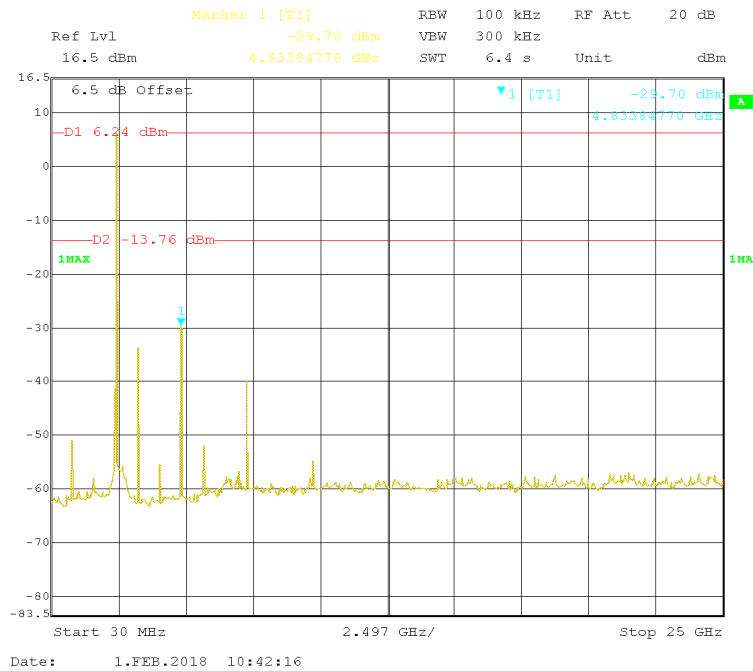
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV /m)	Average (dBµV /m)	Height (cm)	Polar (H/V)				
Low Channel: 2402MHz								
2402.000000	96.81	---	250.0	V	190.0	5.1	/	/
2402.000000	---	93.95	250.0	V	190.0	5.1	/	/
2402.000000	94.70	---	150.0	H	21.0	5.1	/	/
2402.000000	---	91.81	150.0	H	21.0	5.1	/	/
2390.000000	49.11	---	200.0	V	179.0	5.1	74.00	24.89
2390.000000	---	39.42	200.0	V	179.0	5.1	54.00	14.58
Middle Channel: 2440MHz								
2440.000000	97.71	---	150.0	V	263.0	5.2	/	/
2440.000000	---	94.83	150.0	V	263.0	5.2	/	/
2440.000000	95.58	---	150.0	H	168.0	5.2	/	/
2440.000000	---	92.74	150.0	H	168.0	5.2	/	/
High Channel: 2480MHz								
2480.000000	97.99	---	250.0	V	224.0	5.3	/	/
2480.000000	---	95.08	250.0	V	224.0	5.3	/	/
2480.000000	95.87	---	100.0	H	83.0	5.3	/	/
2480.000000	---	92.94	100.0	H	83.0	5.3	/	/
2483.500000	49.06	---	100.0	V	123.0	5.3	74.00	24.94
2483.500000	---	41.12	100.0	V	123.0	5.3	54.00	12.88

Conducted Spurious Emissions at Antenna Port

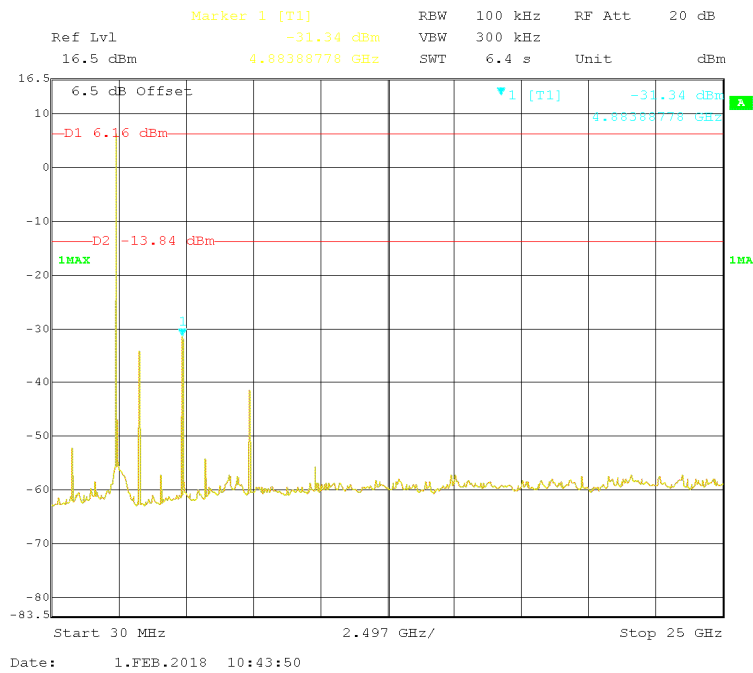
802.11b Mode Low Channel



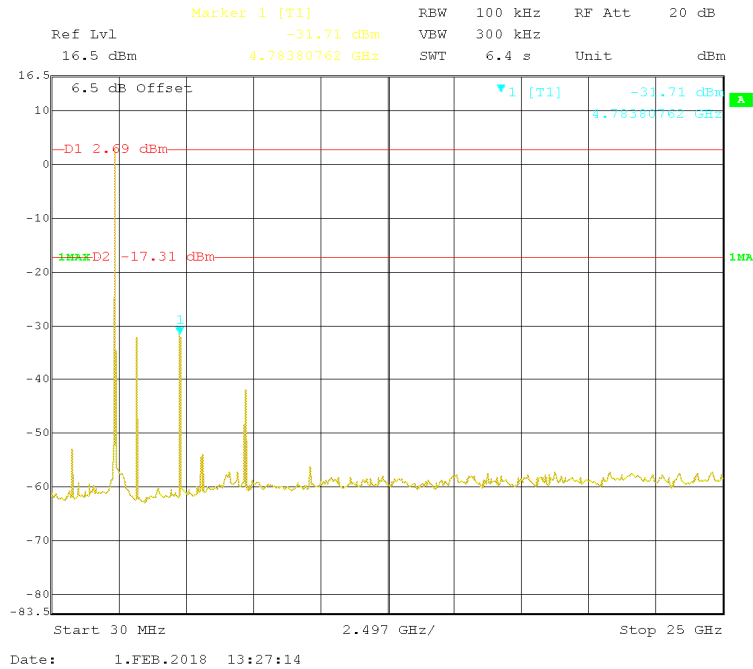
802.11b Mode Middle Channel



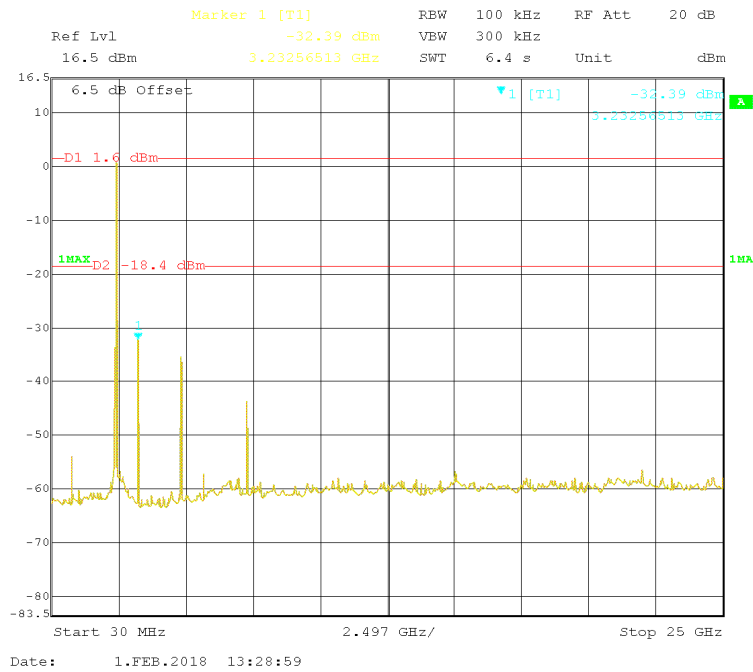
802.11b Mode High Channel



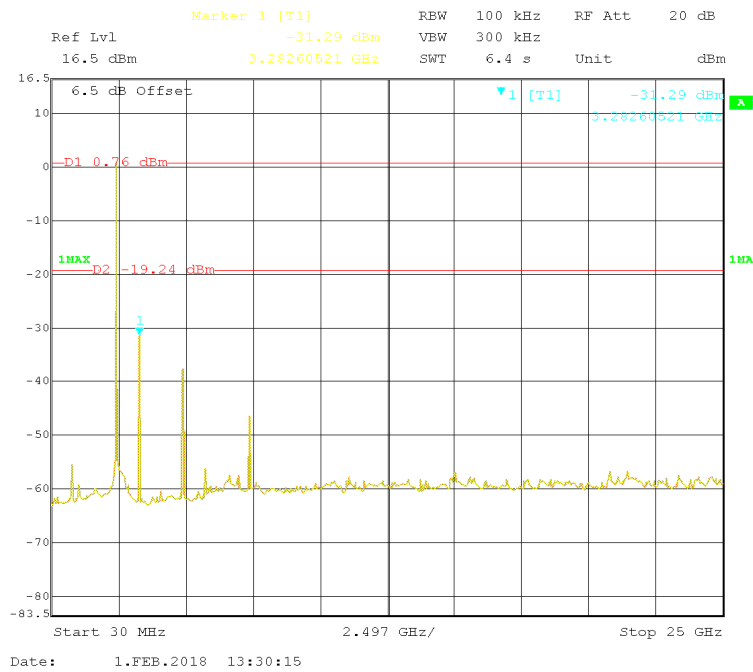
802.11g Mode Low Channel



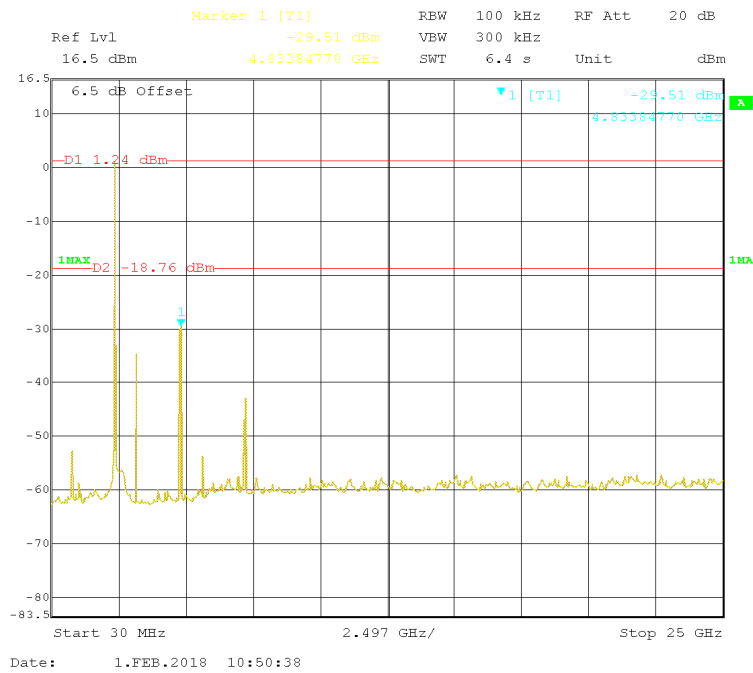
802.11g Mode Middle Channel



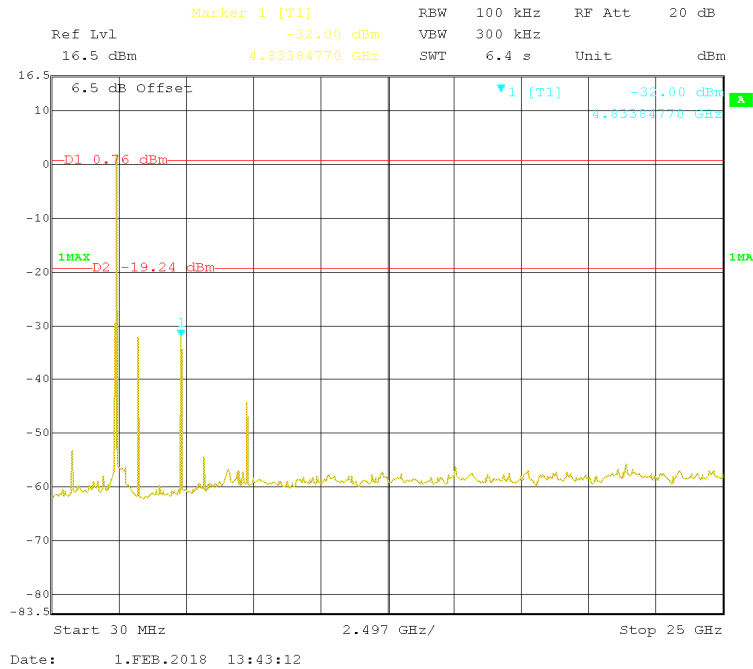
802.11g Mode High Channel



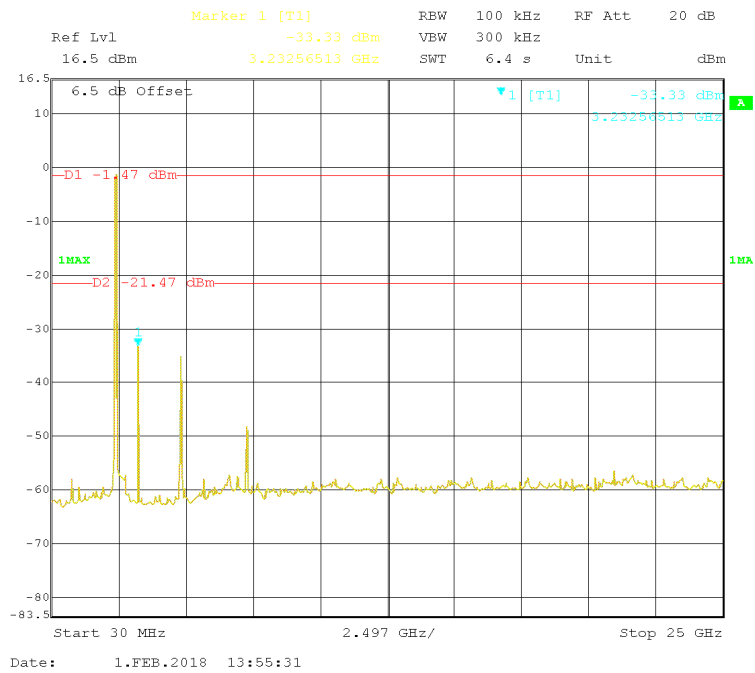
802.11n-HT20 Mode Low Channel



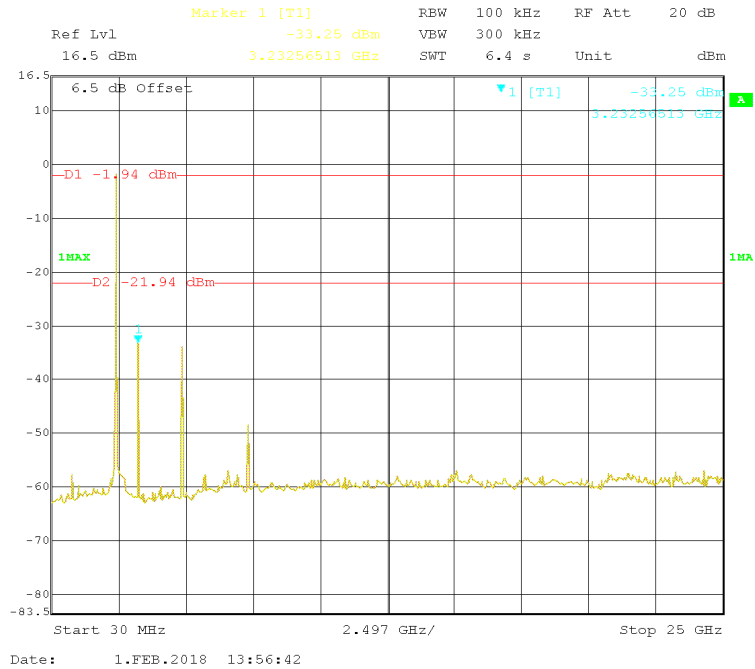
802.11n-HT20 Mode Middle Channel



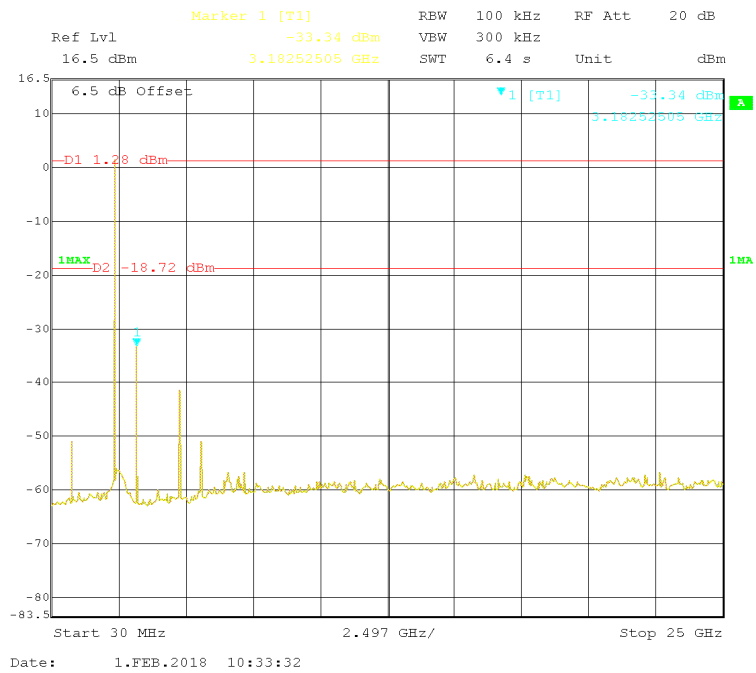
802.11n-HT40 Mode Middle Channel



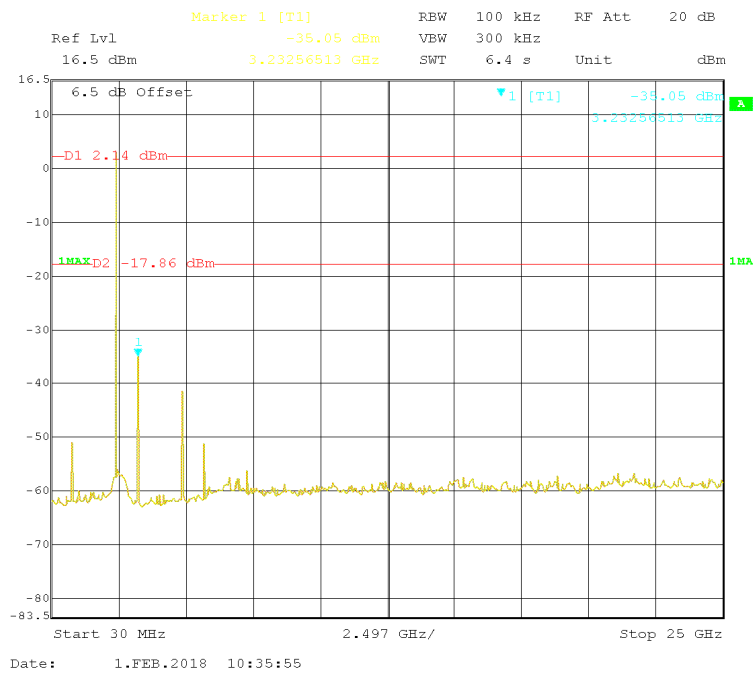
802.11n-HT40 Mode High Channel



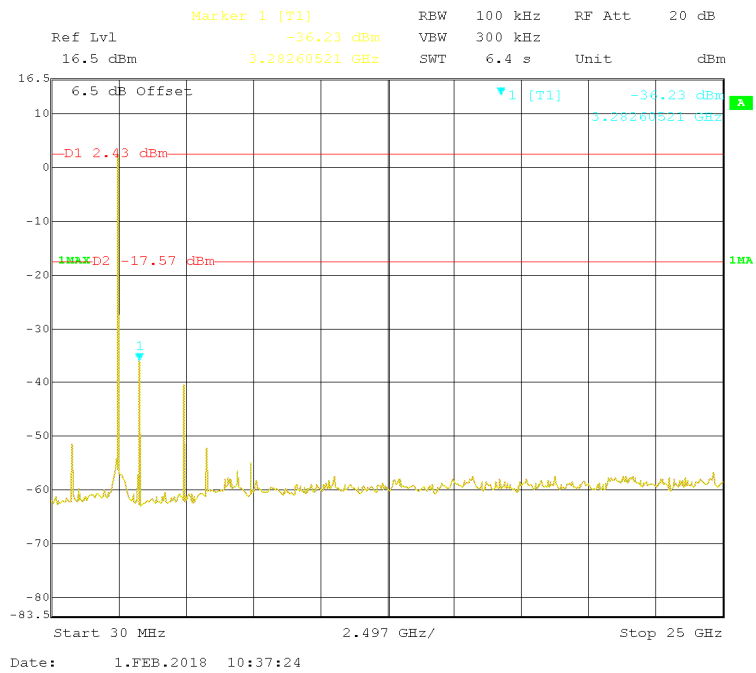
BLE Mode Low Channel



BLE Mode Middle Channel



BLE Mode High Channel



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

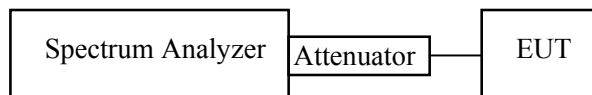
Applicable Standard

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) $\geq 3 * RBW$.
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 °C
Relative Humidity:	51 %
ATM Pressure:	101.3 kPa

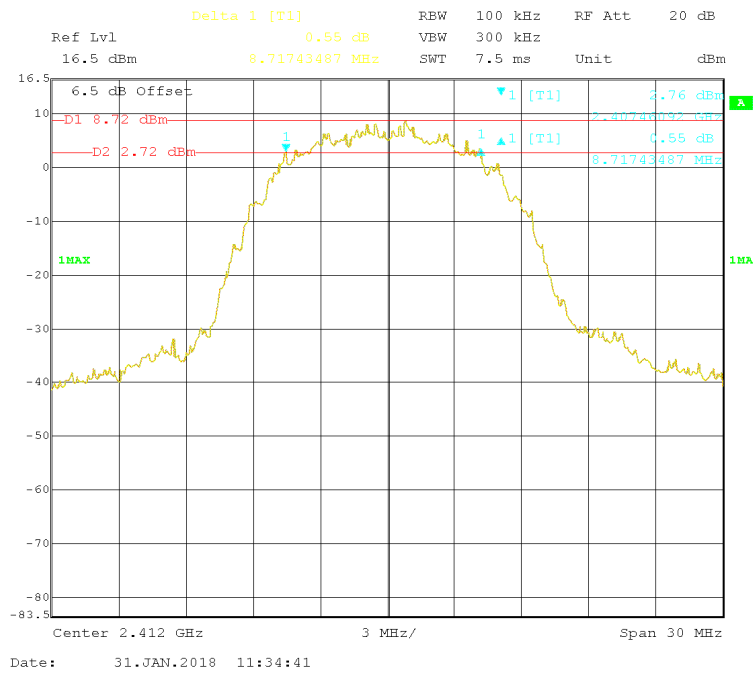
The testing was performed by Max Min on 2018-01-31 & 2018-02-01.

EUT operation mode: Transmitting

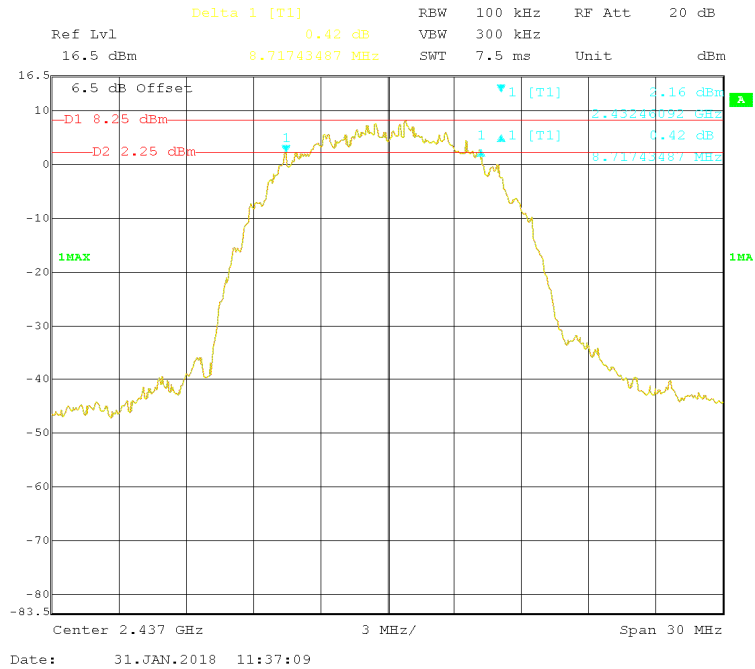
Test Result: Pass

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (MHz)
802.11b Mode			
Low	2412	8.717	≥ 0.5
Middle	2437	8.717	≥ 0.5
High	2462	8.717	≥ 0.5
802.11g Mode			
Low	2412	16.353	≥ 0.5
Middle	2437	16.413	≥ 0.5
High	2462	16.353	≥ 0.5
802.11n-HT20 Mode			
Low	2412	17.255	≥ 0.5
Middle	2437	17.261	≥ 0.5
High	2462	17.255	≥ 0.5
802.11n-HT40 Mode			
Low	2422	36.132	≥ 0.5
Middle	2437	36.174	≥ 0.5
High	2452	36.144	≥ 0.5
BLE Mode			
Low	2402	0.697	≥ 0.5
Middle	2440	0.697	≥ 0.5
High	2480	0.697	≥ 0.5

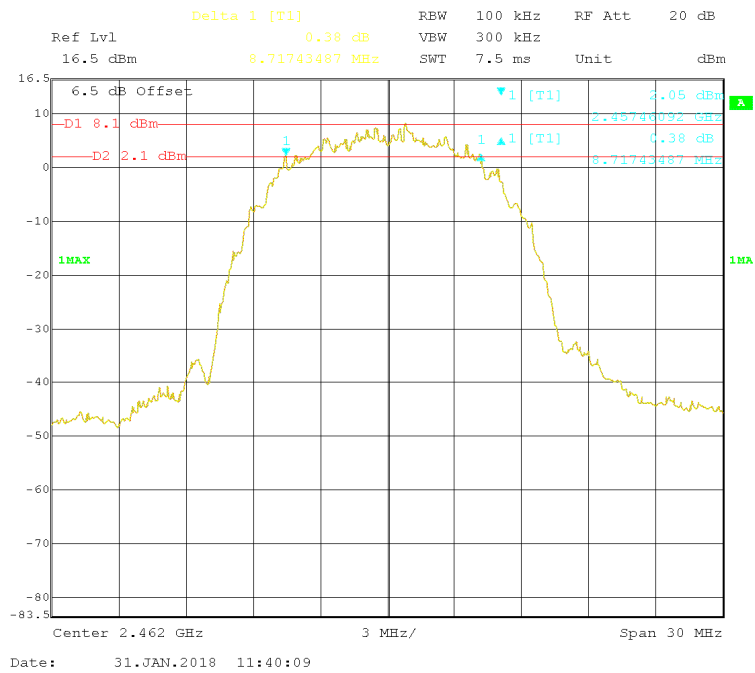
802.11b Mode Low Channel



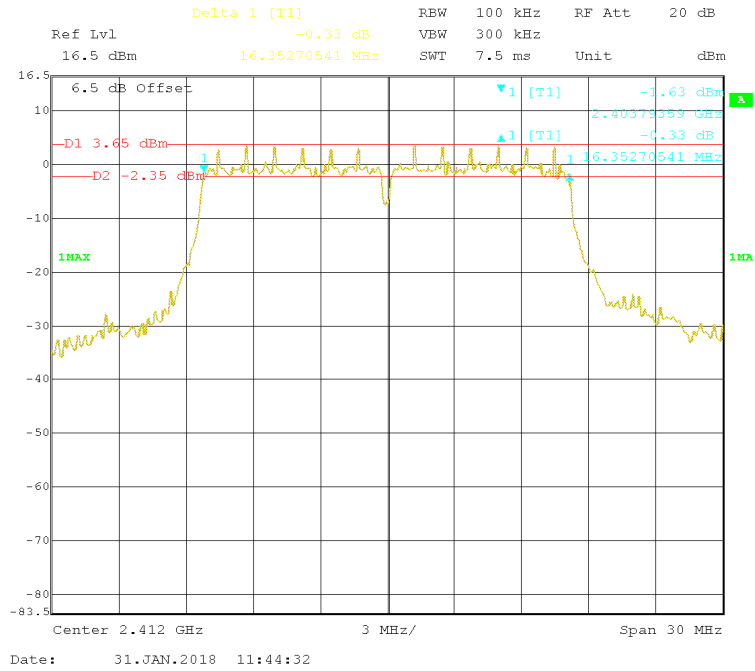
802.11b Mode Middle Channel



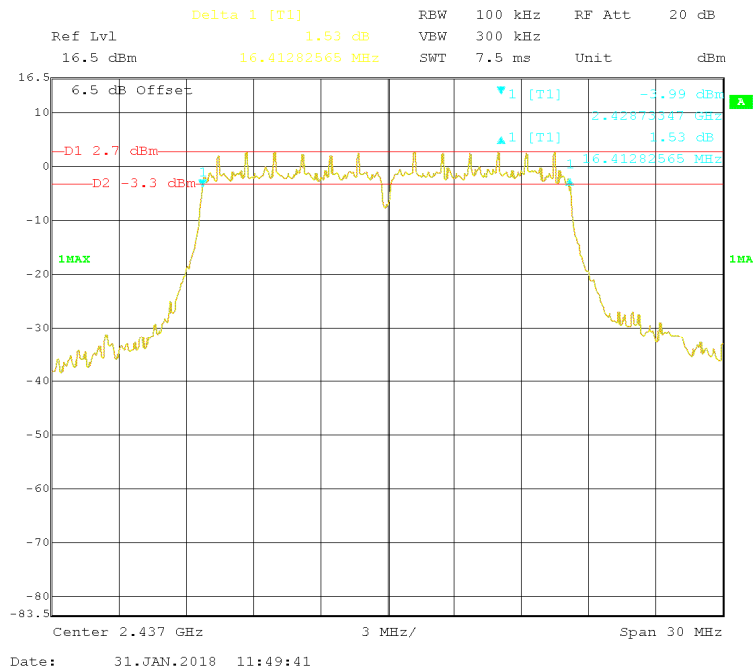
802.11b Mode High Channel



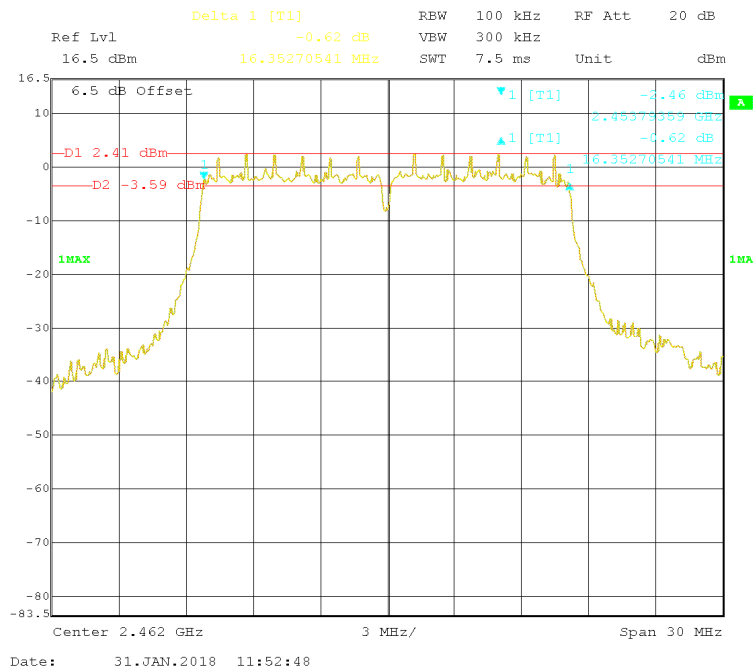
802.11g Mode Low Channel



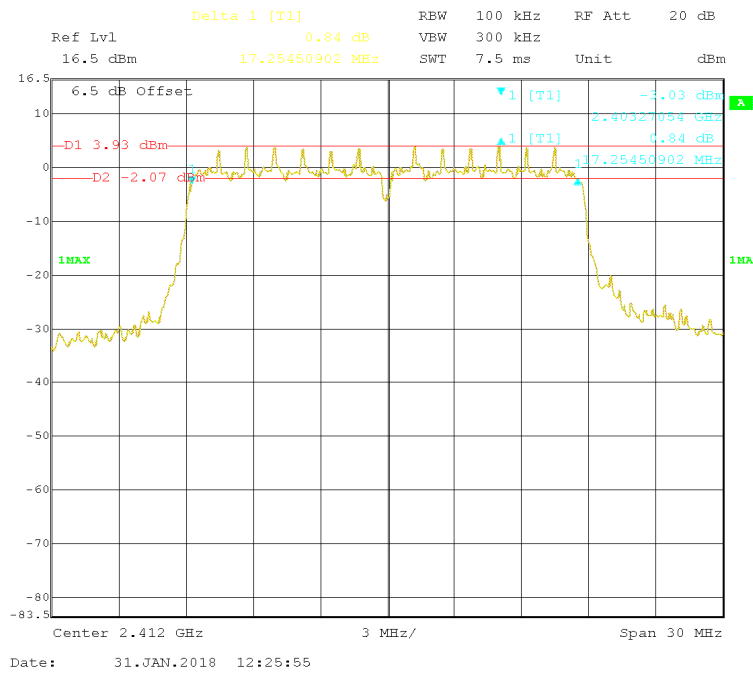
802.11g Mode Middle Channel



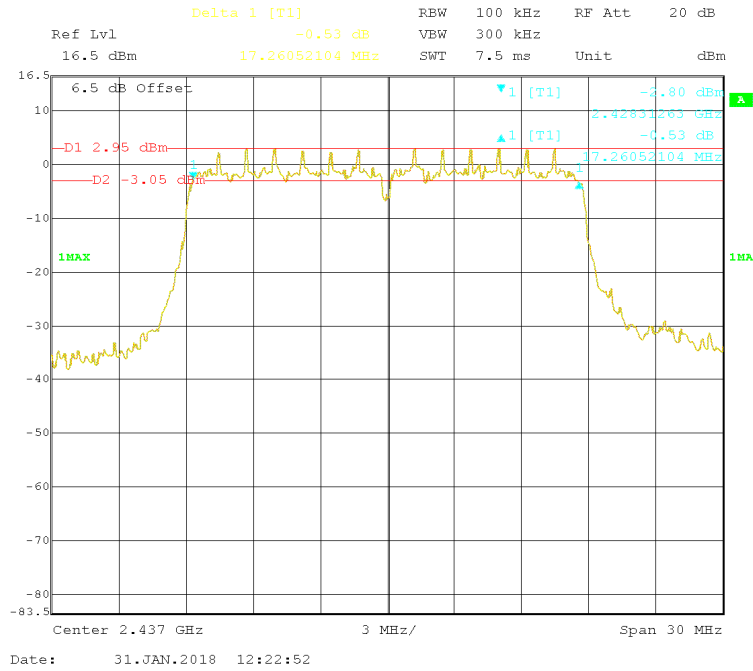
802.11g Mode High Channel



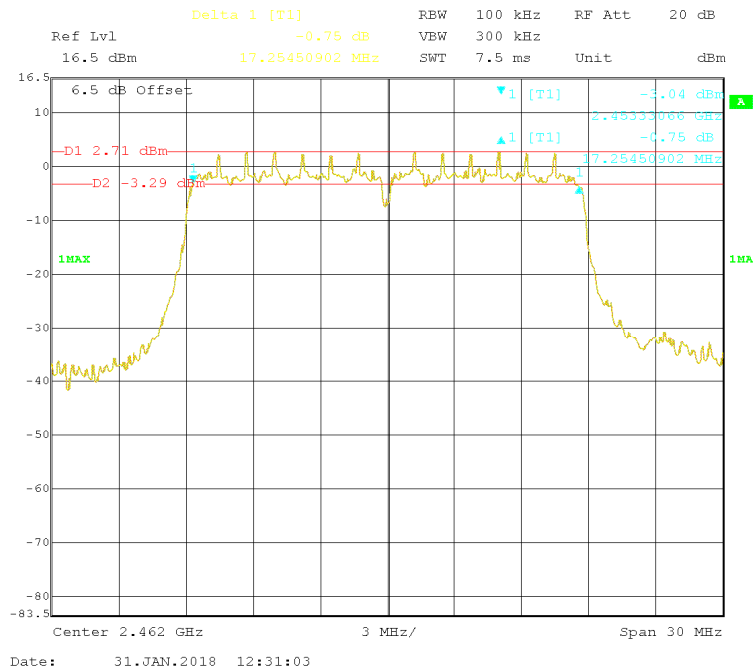
802.11n-HT20 Mode Low Channel



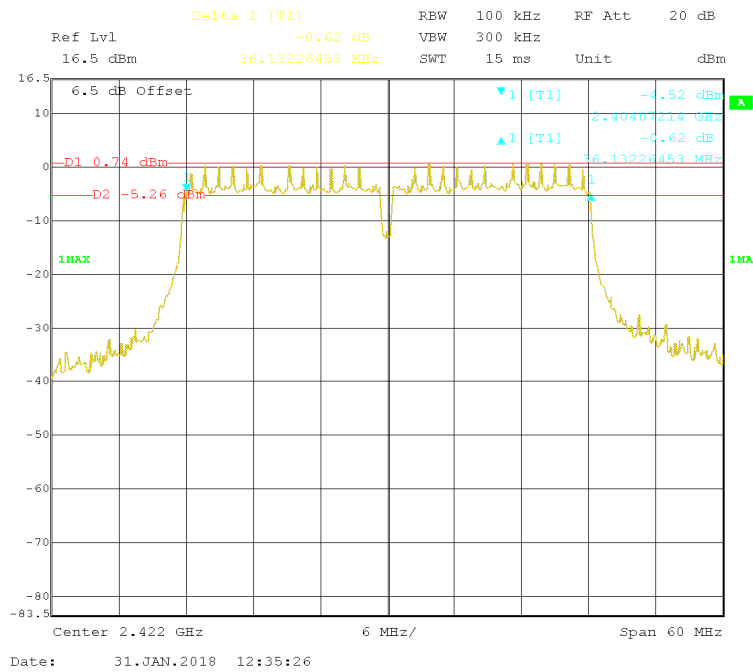
802.11n-HT20 Mode Middle Channel



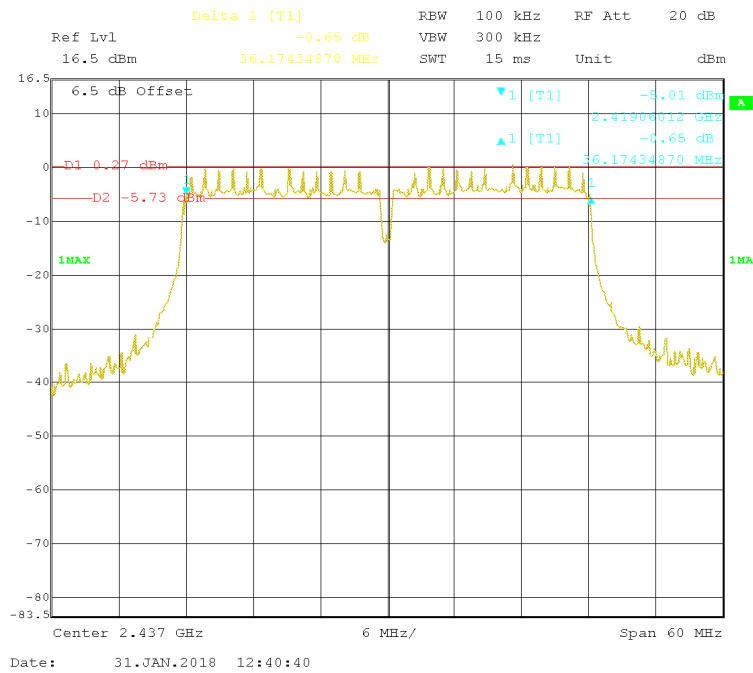
802.11n-HT20 Mode High Channel



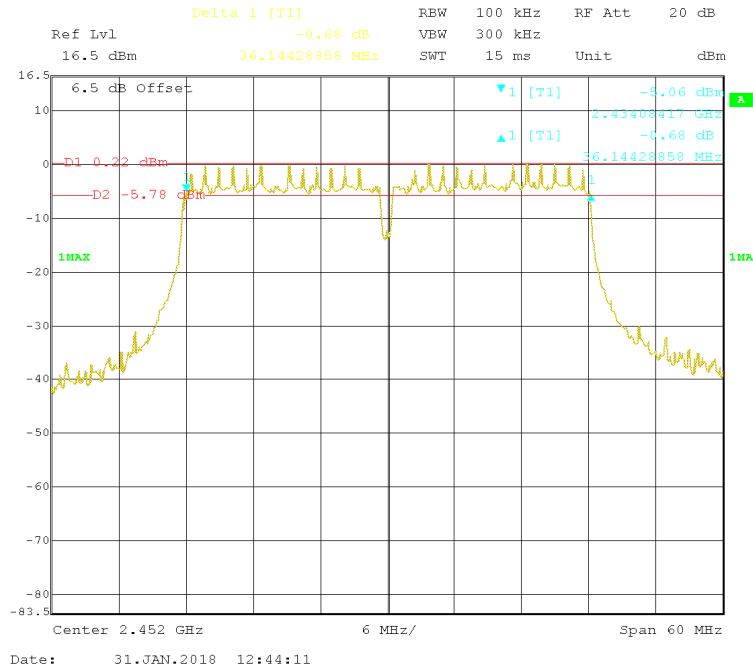
802.11n-HT40 Mode Low Channel



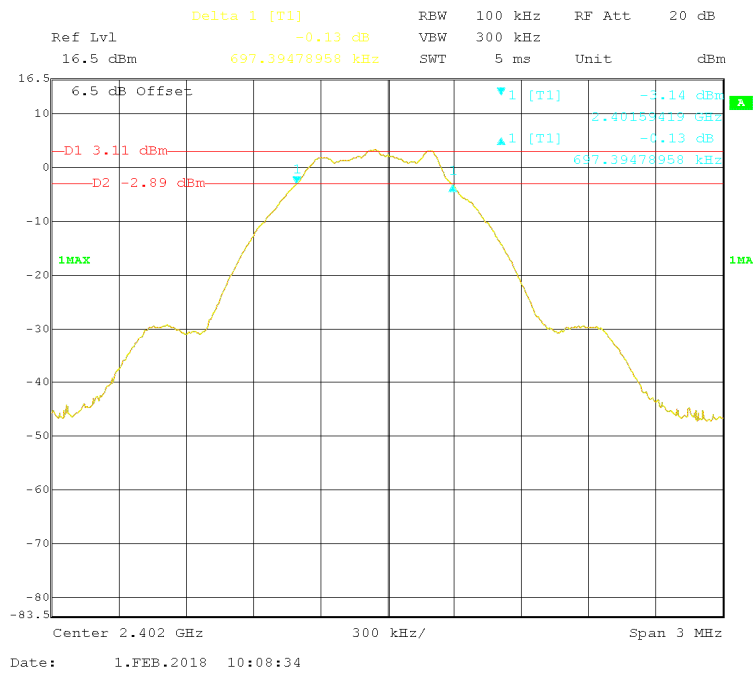
802.11n-HT40 Mode Middle Channel



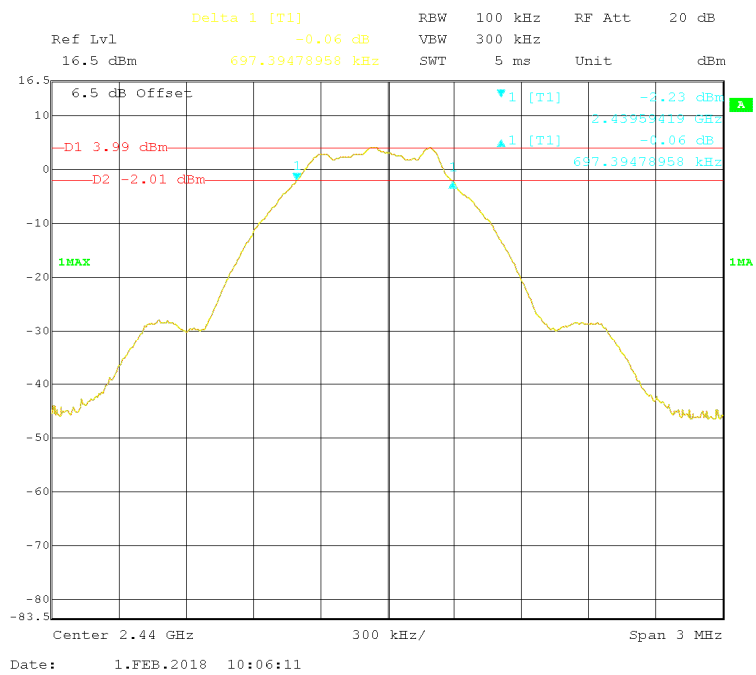
802.11n-HT40 Mode High Channel



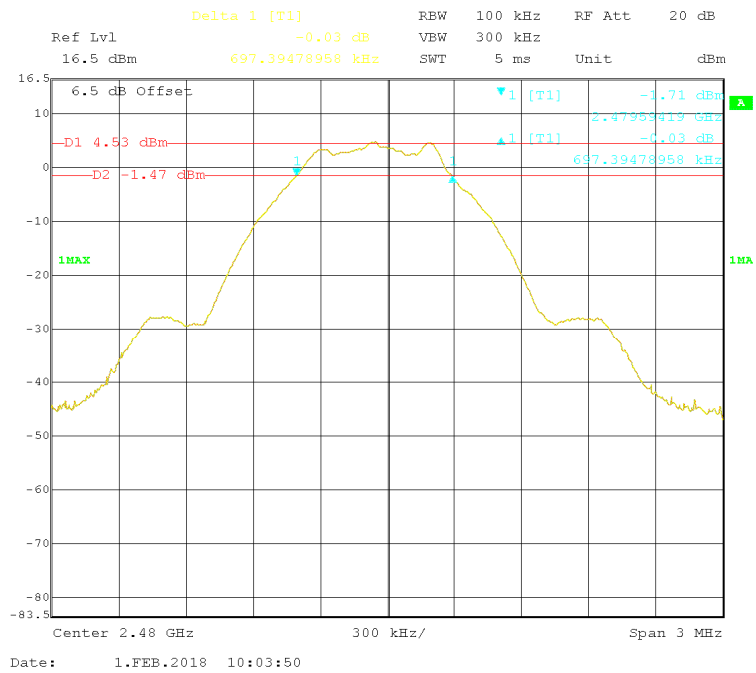
BLE Mode Low Channel



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 \geq DTS bandwidth.
2. Set VBW $\geq 3 \times$ RBW.
3. Set span $\geq 3 \times$ 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

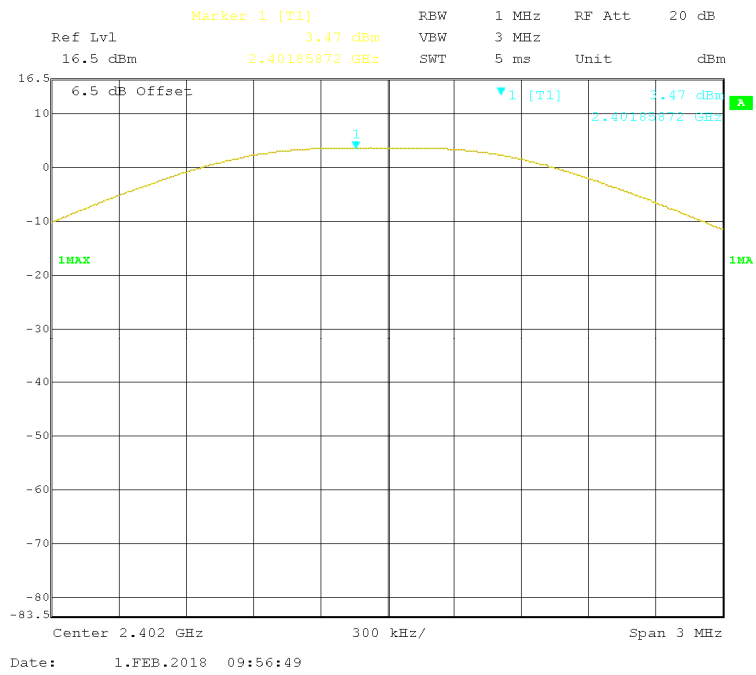
Temperature:	23.8°C
Relative Humidity:	54 %
ATM Pressure:	101.2 kPa

The testing was performed by Max Min on 2018-02-01.

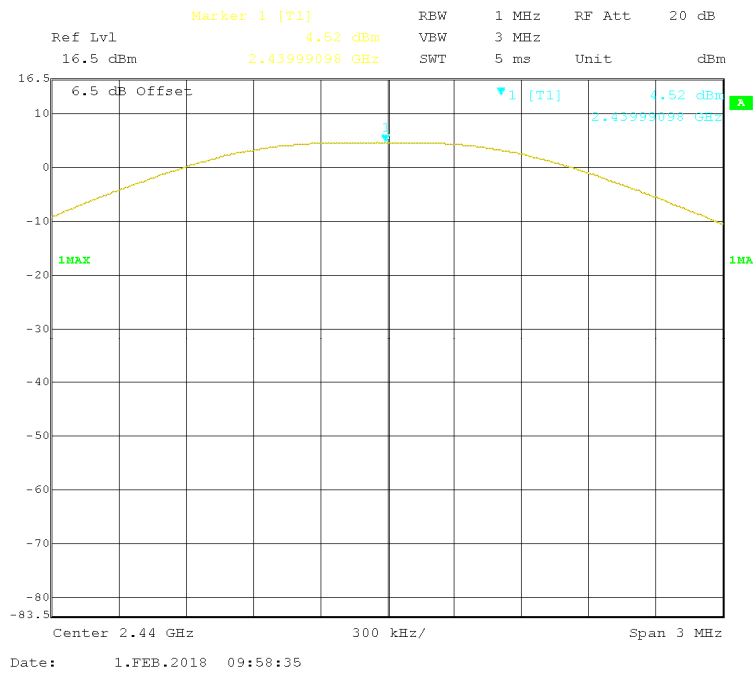
EUT operation mode: Transmitting

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Limit (dBm)	Result
802.11b Mode				
Low	2412	22.54	30	Pass
Middle	2437	21.81	30	Pass
High	2462	20.98	30	Pass
802.11g Mode				
Low	2412	21.00	30	Pass
Middle	2437	20.22	30	Pass
High	2462	19.61	30	Pass
802.11n-HT20 Mode				
Low	2412	20.94	30	Pass
Middle	2437	20.38	30	Pass
High	2462	19.69	30	Pass
802.11n-HT40 Mode				
Low	2422	20.73	30	Pass
Middle	2437	20.26	30	Pass
High	2452	19.93	30	Pass
BLE Mode				
Low	2402	3.47	30	Pass
Middle	2440	4.52	30	Pass
High	2480	4.89	30	Pass

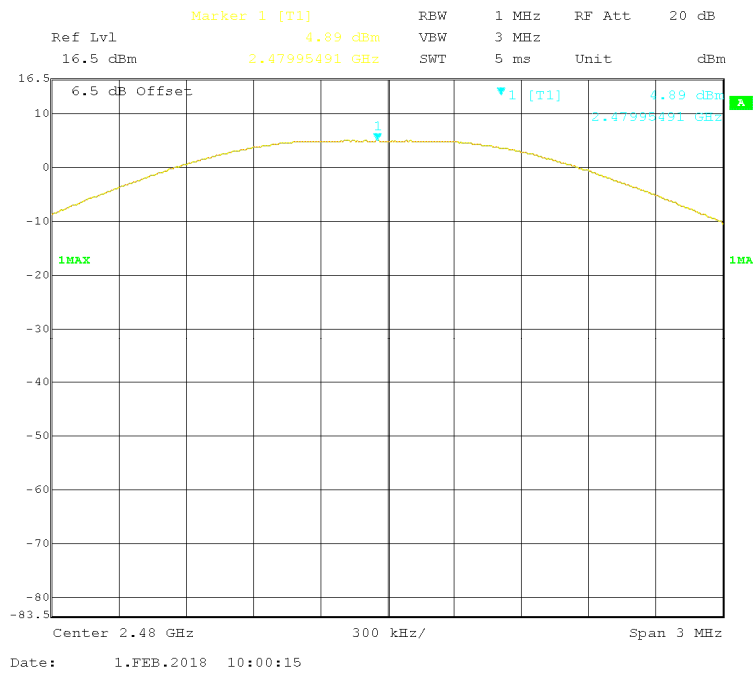
BLE Mode Low Channel



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

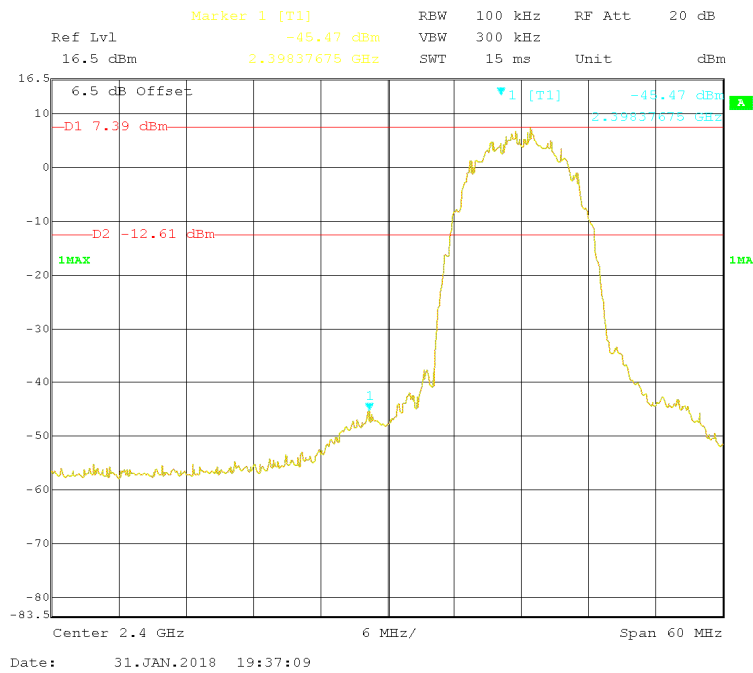
Temperature:	24.3 °C
Relative Humidity:	50 %
ATM Pressure:	101.3 kPa

The testing was performed by Max Min on 2018-01-31 & 2018-02-01.

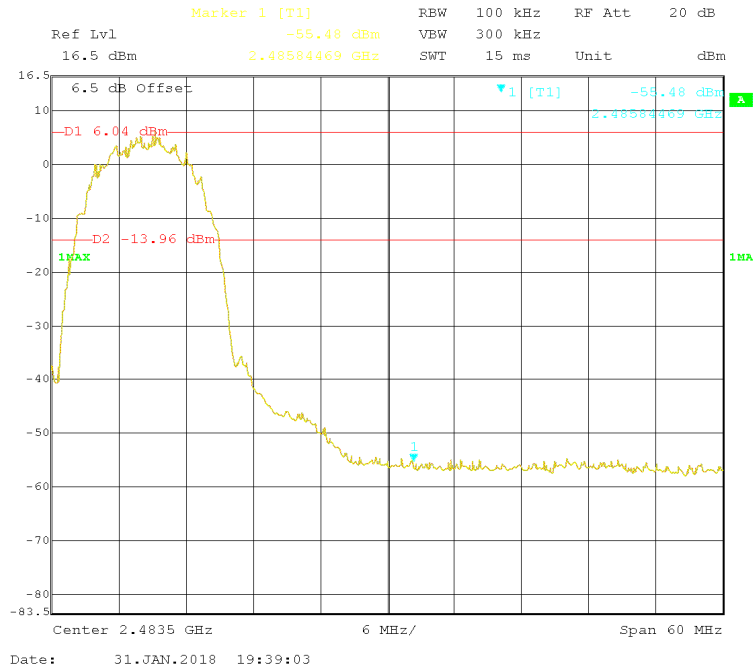
EUT operation mode: Transmitting

Test Result: Compliance

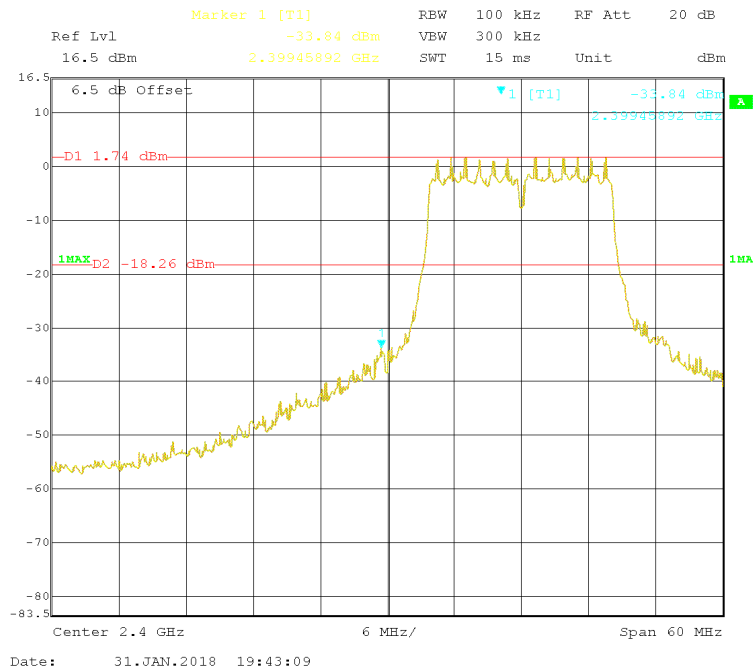
802.11b Mode Left Side



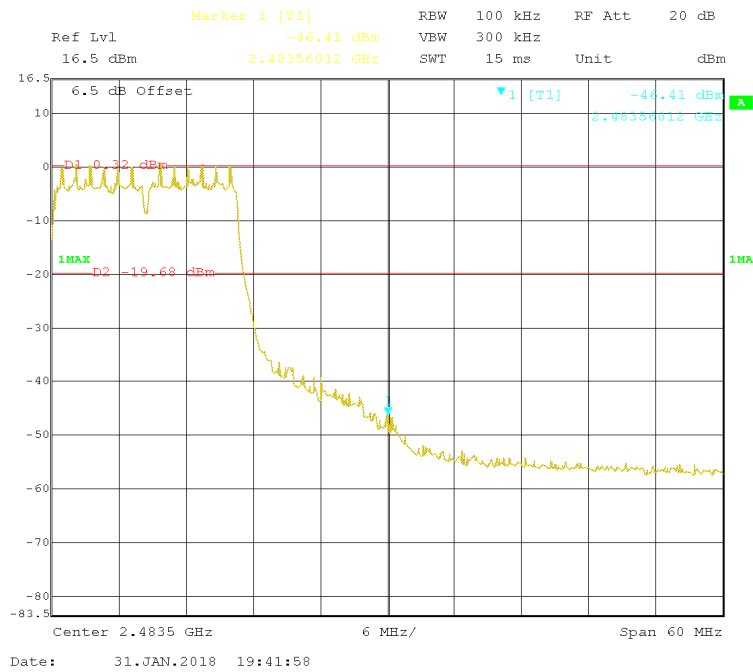
802.11b Mode Right Side



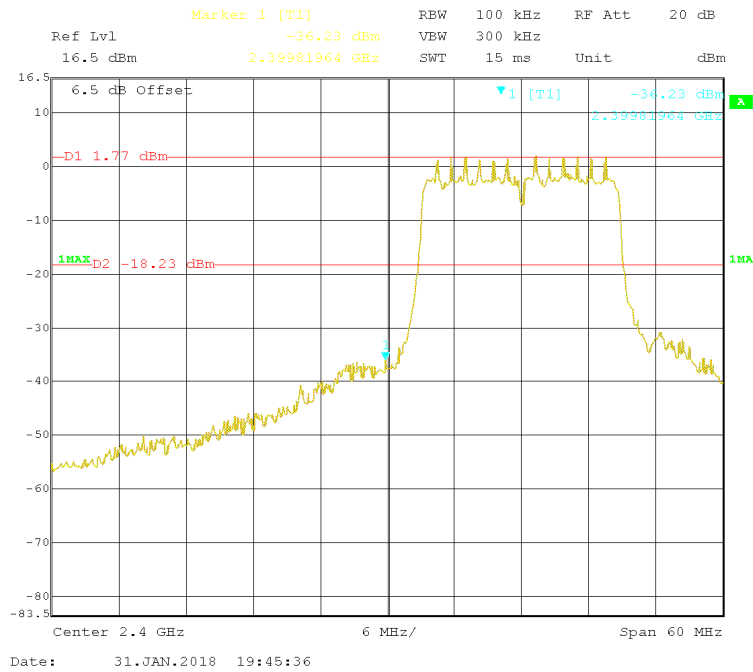
802.11g Mode Left Side



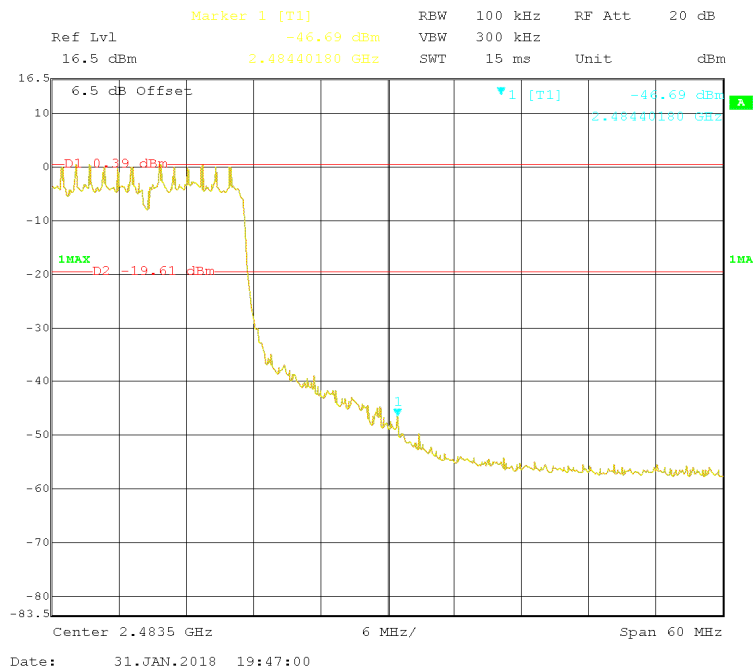
802.11g Mode Right Side



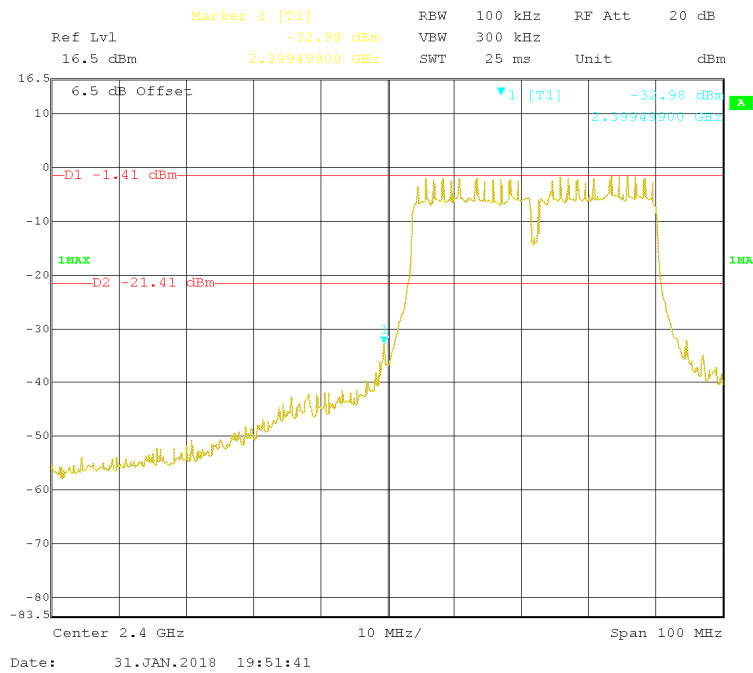
802.11n-HT20 Mode Left Side



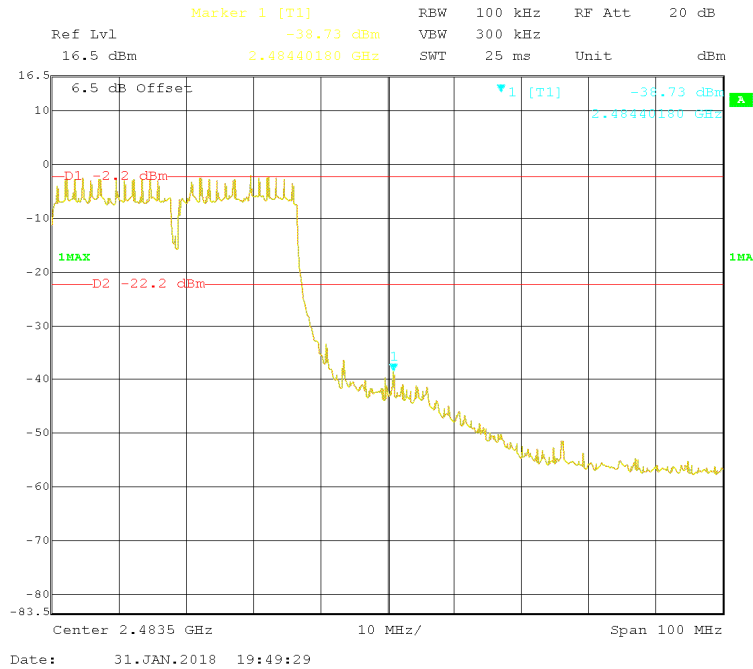
802.11n-HT20 Mode Right Side



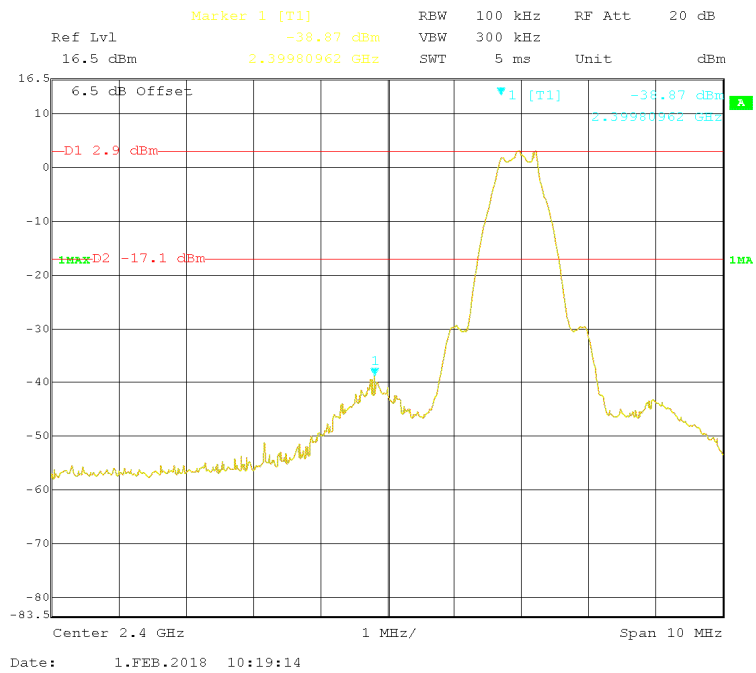
802.11n-HT40 Mode Left Side



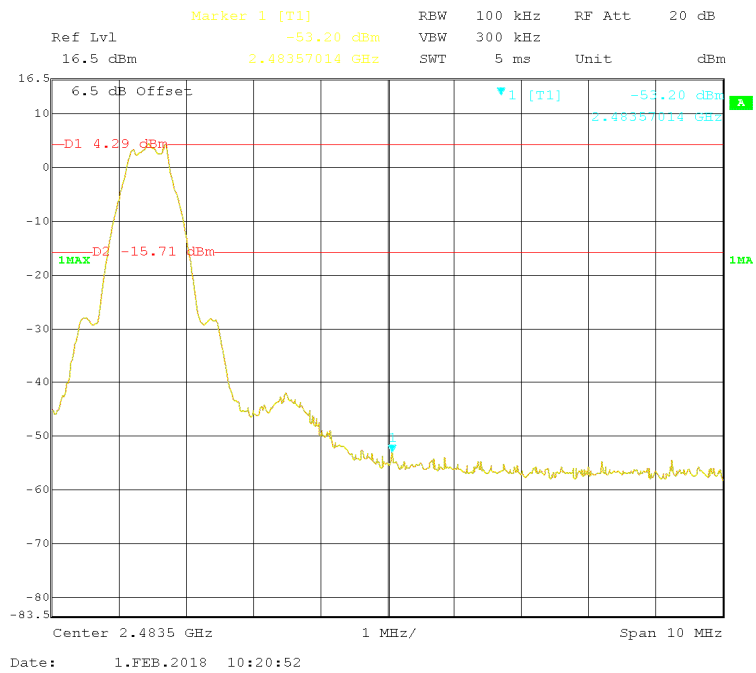
802.11n-HT40 Mode Right Side



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: $3\text{kHz} \leq \text{RBW} \leq 100\text{ kHz}$.
3. Set the VBW $\geq 3 \times \text{RBW}$.
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 °C
Relative Humidity:	50%
ATM Pressure:	101.3 kPa

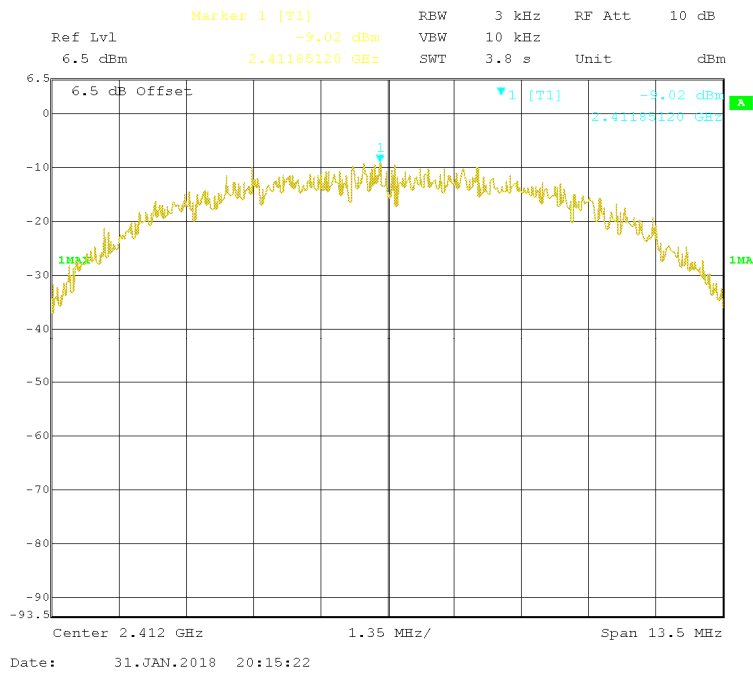
The testing was performed by Max Min on 2018-01-31 to 2018-02-01.

EUT operation mode: Transmitting

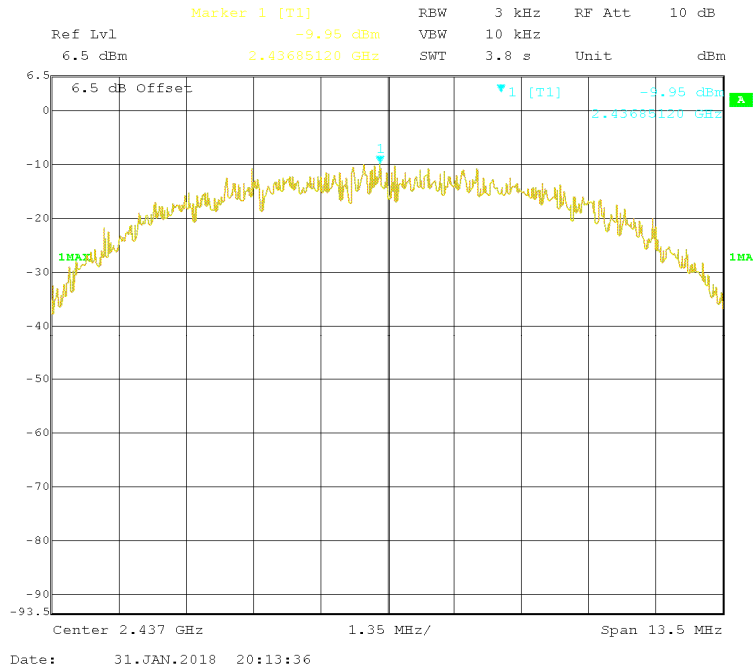
Test Result: Pass

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
802.11b Mode			
Low	2412	-9.02	≤ 8
Middle	2437	-9.95	≤ 8
High	2462	-10.50	≤ 8
802.11g Mode			
Low	2412	-13.59	≤ 8
Middle	2437	-14.50	≤ 8
High	2462	-15.15	≤ 8
802.11n-HT20 mode			
Low	2412	-14.13	≤ 8
Middle	2437	-14.60	≤ 8
High	2462	-15.42	≤ 8
802.11n-HT40 Mode			
Low	2422	-17.45	≤ 8
Middle	2437	-18.02	≤ 8
High	2452	-17.83	≤ 8
BLE Mode			
Low	2402	-12.22	≤ 8
Middle	2440	-10.84	≤ 8
High	2480	-10.63	≤ 8

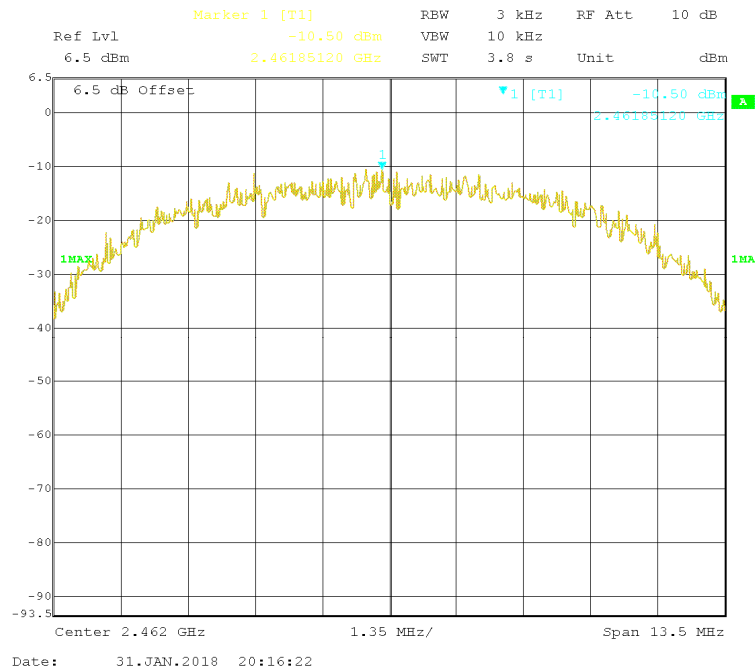
802.11b Mode Low Channel



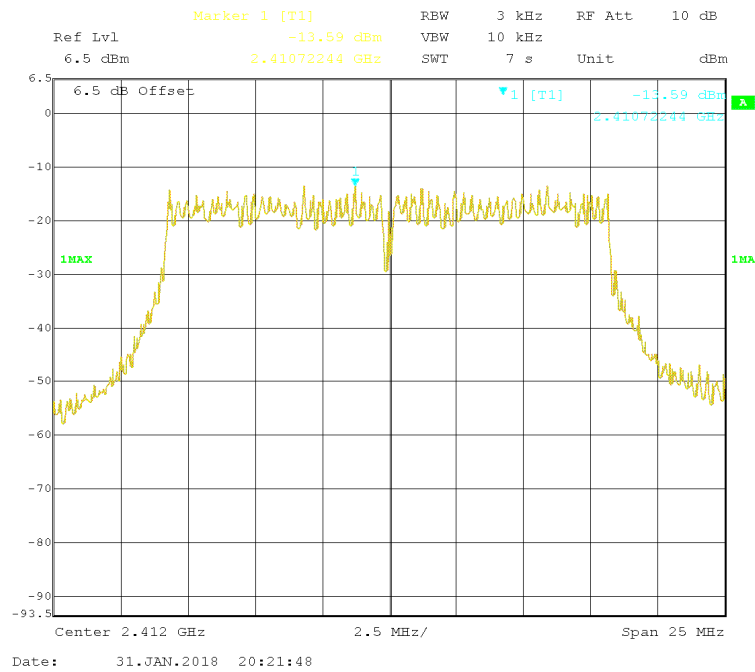
802.11b Mode Middle Channel



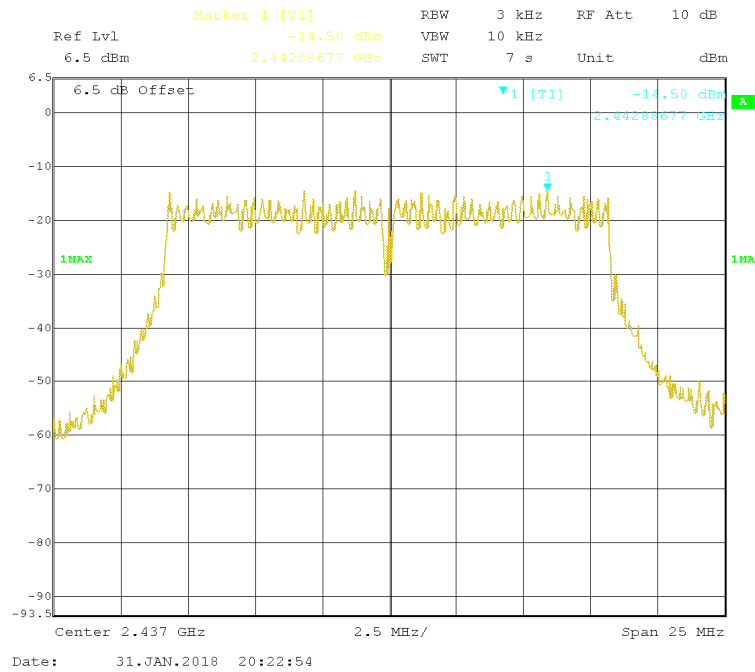
802.11b Mode High Channel



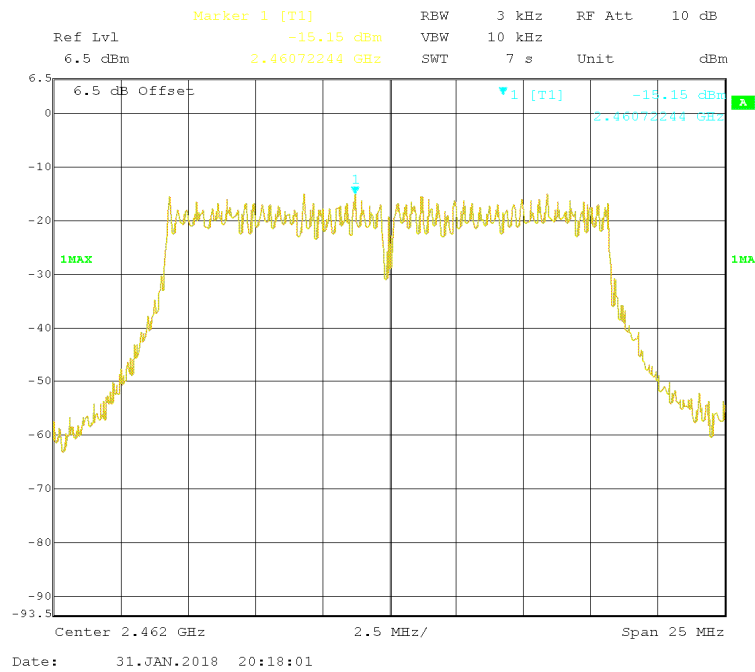
802.11g Mode Low Channel



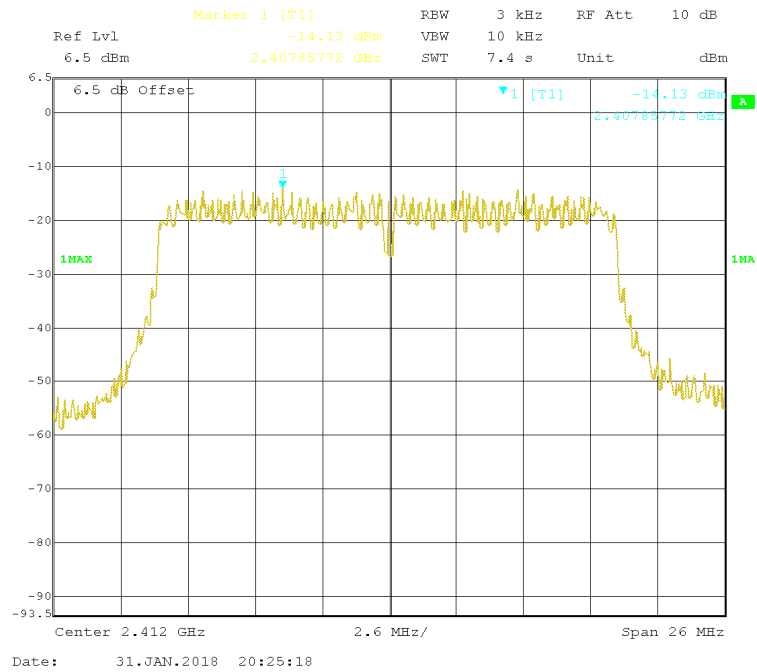
802.11g Mode Middle Channel



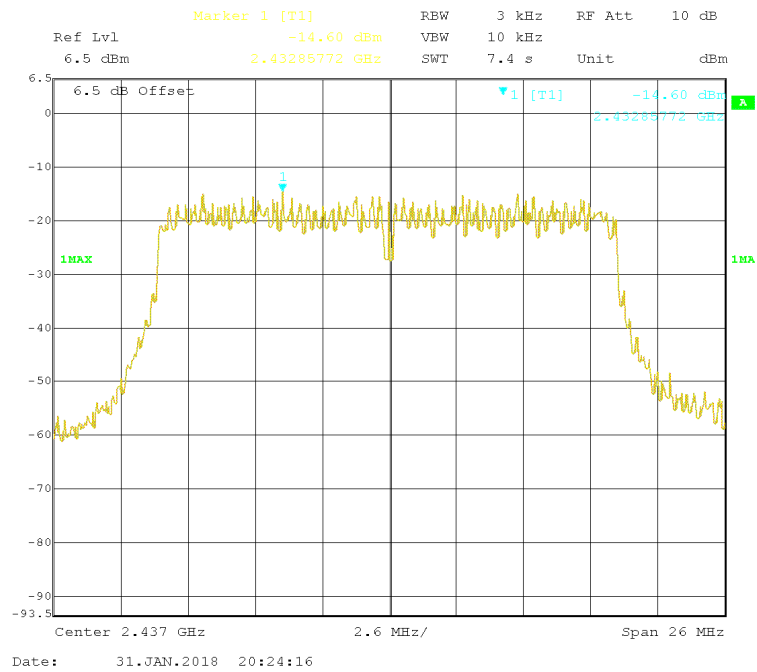
802.11g Mode High Channel



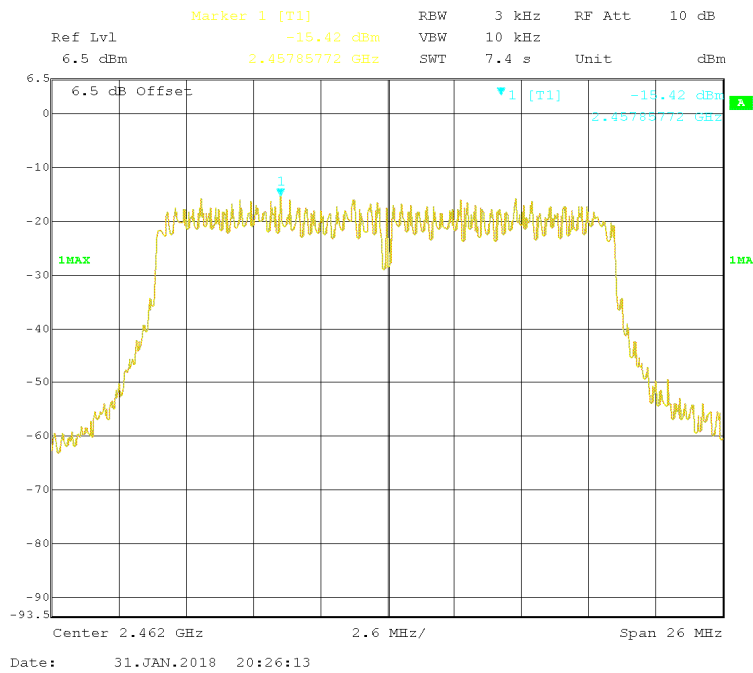
802.11n-HT20 Mode Low Channel



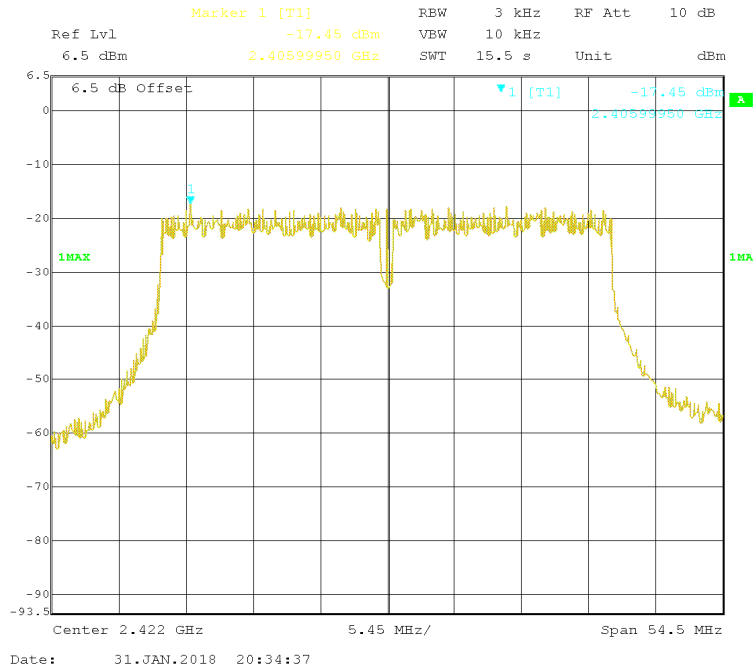
802.11n-HT20 Mode Middle Channel



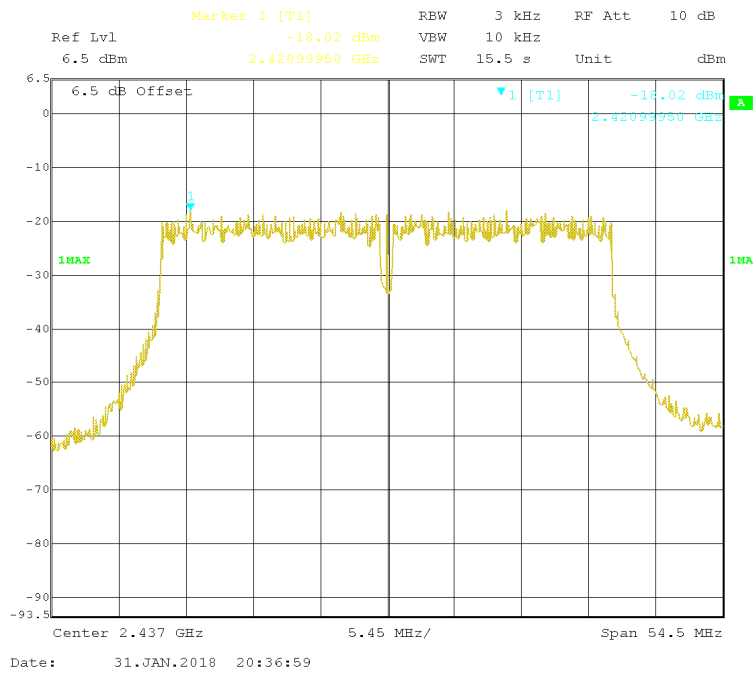
802.11n-HT20 Mode High Channel



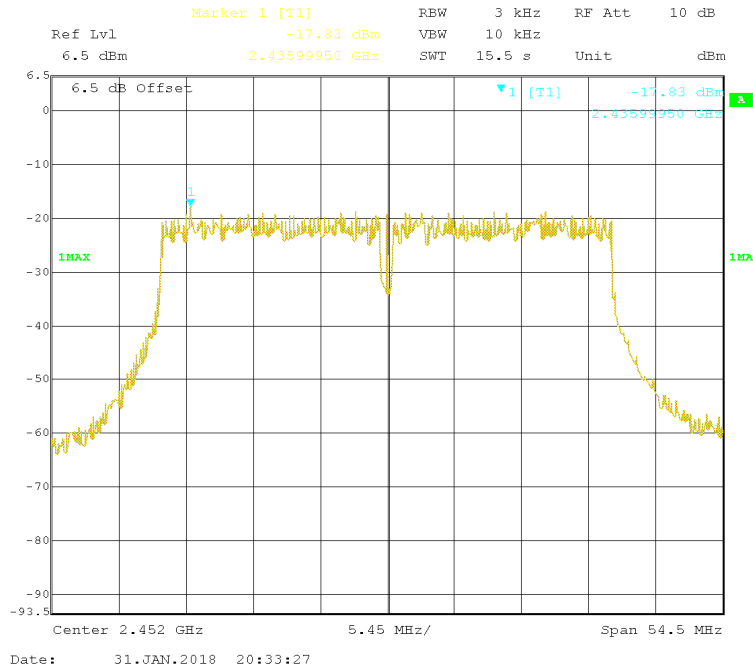
802.11n-HT40 Mode Low Channel



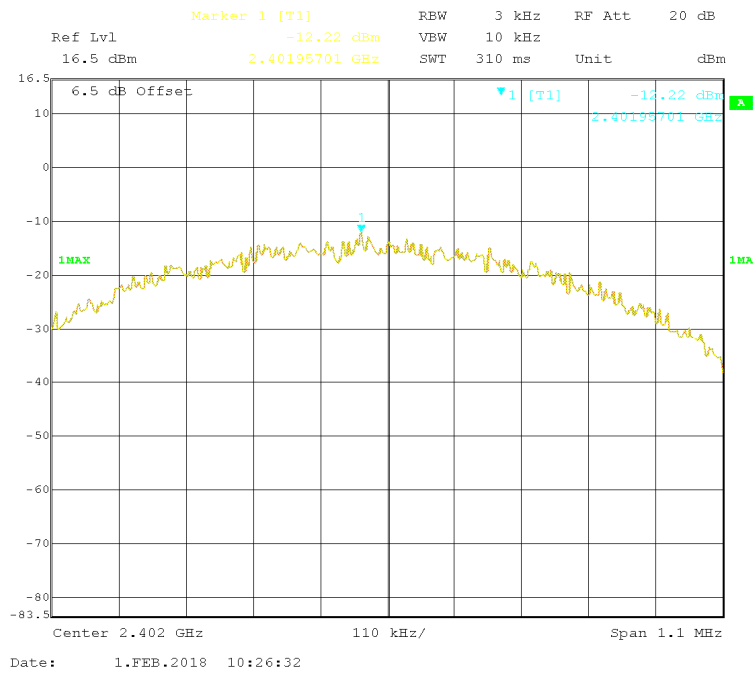
802.11n-HT40 Mode Middle Channel



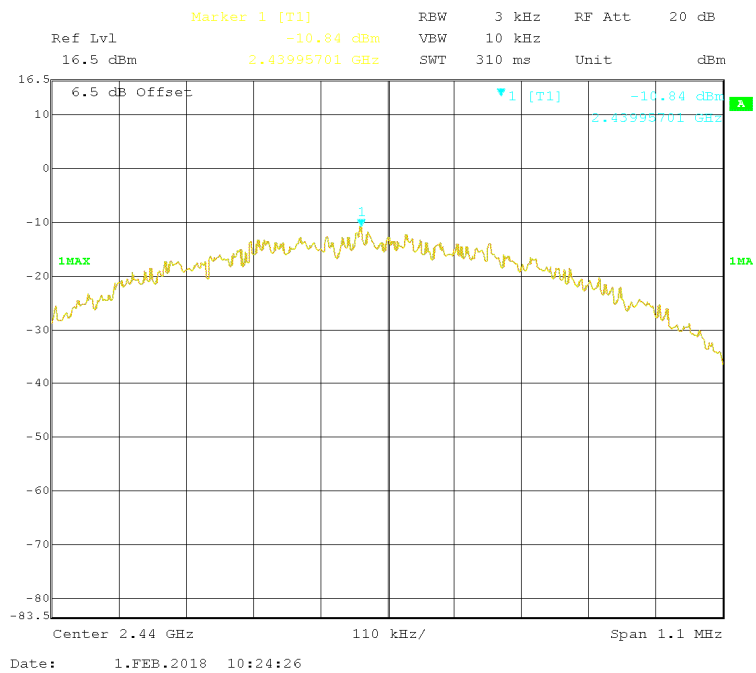
802.11n-HT40 Mode High Channel



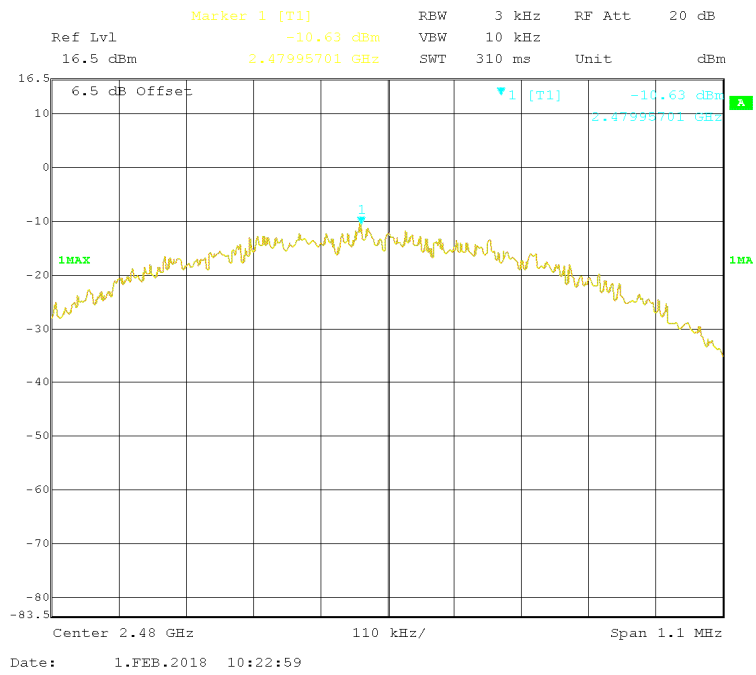
BLE Mode Low Channel



BLE Mode Middle Channel



BLE Mode High Channel



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