FCC PART 15.247
RSS-GEN, ISSUE 4, NOVEMBER 2014
RSS-247, ISSUE 2, FEBRUARY 2017

TEST REPORT

For

Hammerhead Navigation Inc.

450 W 33rd Street, 12th Floor New York, NY 10001 United States

FCC ID: 2ADMX-HK1
IC: 12534A-HK1

Report Type:	**Product Name:**
Original Report	Hammerhead Karoo

Report Number:	RDG171206006-00B
Report Date:	2018-01-20
Reviewed By:	Jerry Zhang EMC Manager
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

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. (Dongguan).

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:	Hammerhead Karoo
EUT Model:	Karoo
FCC ID:	2ADMX-HK1
IC:	12534A-HK1
Rated Input Voltage:	DC3.8V from battery or DC 5V from USB port
External Dimension:	Length (99.4mm)*Width (72mm)*High (27.8mm)
Serial Number:	171206006
EUT Received Date:	2017.12.13

Objective

This report is prepared on behalf of ***Hammerhead Navigation Inc.*** in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communications Commission's rules and RSS-247, Issue 2, February 2017, RSS-Gen Issue 4, November 2014 of the Innovation, Science and Economic Development Canada.

The tests were performed in order to determine the compliance of the EUT with FCC Rules Part 15-Subpart C, section 15.203, 15.205, 15.207, 15.209 and 15.247 rules and RSS-247, Issue 2, February 2017, RSS-Gen Issue 4, November 2014 of the Innovation, Science and Economic Development Canada.

Related Submittal(s)/Grant(s)

FCC Part 15C DSS submissions with FCC ID: 2ADMX-HK1
FCC Part 22H, 24E PCB submissions with FCC ID: 2ADMX-HK1
FCC Part 15.249 DXX submission with FCC ID: 2ADMX-HK1
RSS-247 DSSs,FHSs, RSS-132, RSS-133, RSS-210 submissions with IC: 12534A-HK1

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 KDB 558074 D01 DTS Meas Guidance v04, RSS-247, Issue 2, February 2017, RSS-Gen Issue 4, November 2014 of the Innovation, Science and Economic Development Canada.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.61dB
Power Spectral Density, conducted	±0.61 dB
Unwanted Emissions, radiated	30M~200MHz: 4.58 dB for Horizontal, 4.59 dB for Vertical 200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical 1G~6GHz: 4.45 dB, 6G~26.5GHz: 5.23 dB
Unwanted Emissions, conducted	±1.5 dB
Temperature	±1℃
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.12 dB (150 kHz to 30 MHz)

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218,the FCC Designation No. : CN1220.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062D.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in Engineering Mode, which was provided by the manufacturer.

For 2.4GHz band, total 11 channels are provided:

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

For 802.11b, 802.11g, and 802.11 n20 modes were test with channel 1,6,11. For 802.11n ht40 mode was tested with channel 3, 6, 9.

The worst-case data rates are determined to be as follows for each mode based upon investigations by measuring the average power and PSD across all data rates bandwidths, and modulations.

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

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

EUT was tested with channel 0, 19 and 39.

EUT Exercise Software

The software "Engineering mode" was used for testing, which was provided by manufacturer. The maximum power was configured as below table, that provided by the manufacturer:

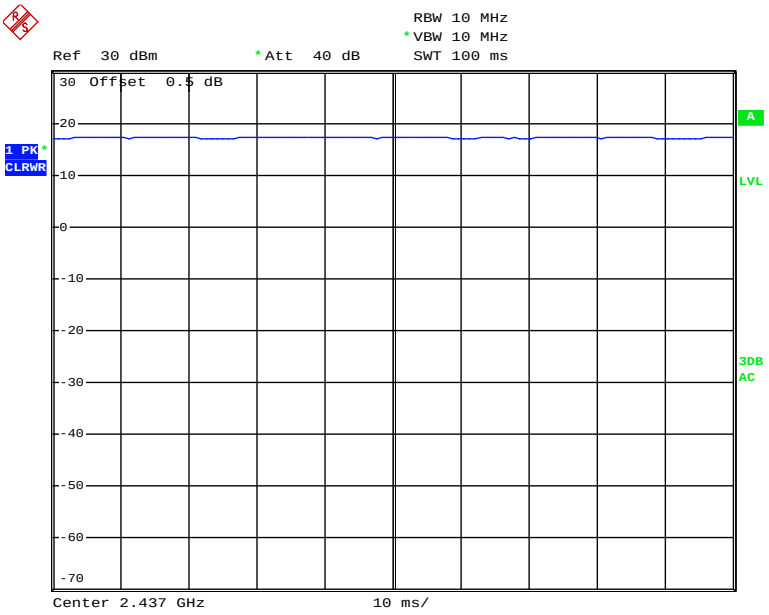
Test Mode	Test Software Version	Engineer Mode		
802.11b	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	1Mbps	1Mbps	1Mbps
	Power Level Setting	19	19	19
802.11g	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	6Mbps	6Mbps	6Mbps
	Power Level Setting	17	17	17
802.11n ht20	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	MCS0	MCS0	MCS0
	Power Level Setting Chain0	17	17	17
802.11n ht40	Test Frequency	2422MHz	2437MHz	2452MHz
	Data Rate	MCS0	MCS0	MCS0
	Power Level Setting Chain0	16.5	16.5	16.5

Bluetooth LE mode was configured by the system default setting

The maximum duty cycle as following table:

Test mode	T_{on} (ms)	T_{on+off} (ms)	Duty Cycle (%)
802.11b	100	100	100
802.11g	100	100	100
802.11n ht20	100	100	100
802.11n ht40	100	100	100
BLE	0.417	0.621	67.1

802.11b



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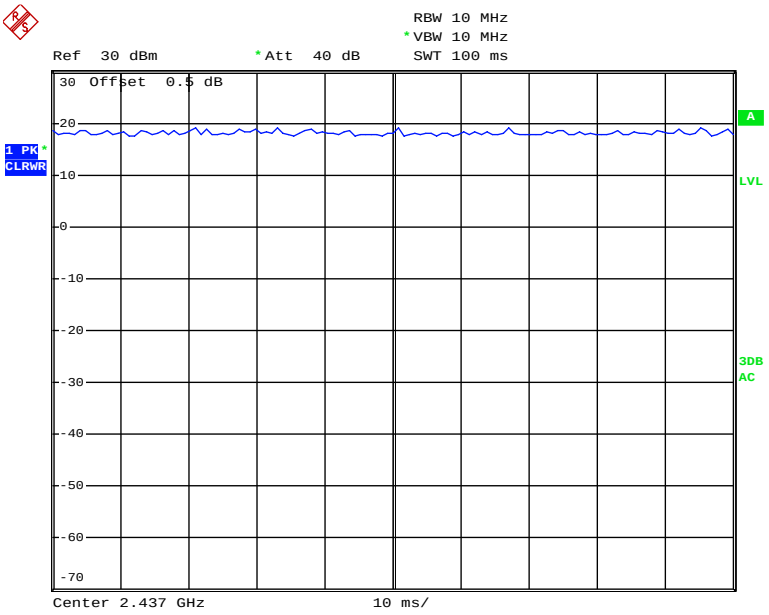
802.11g



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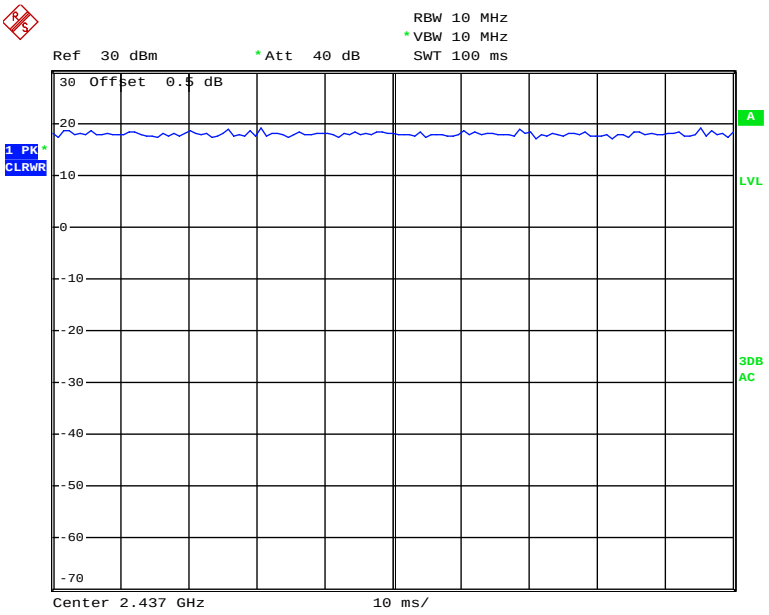
802.11n ht20



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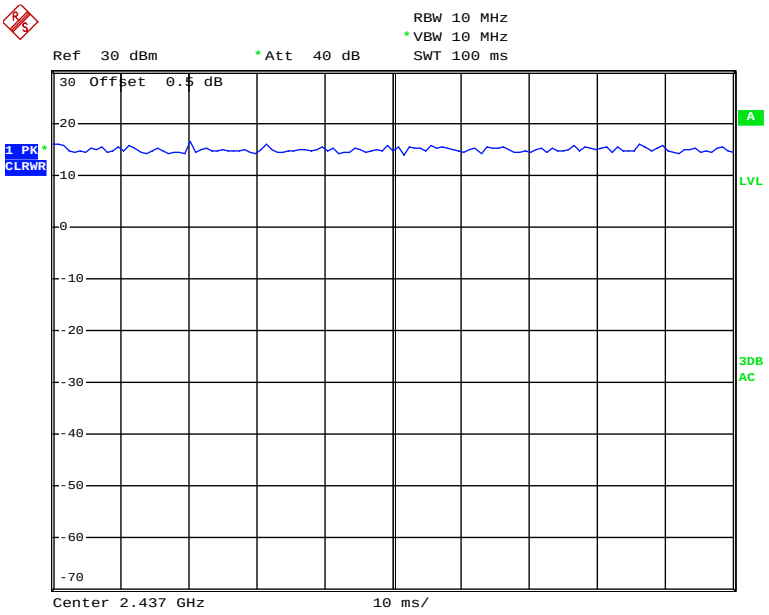
802.11n ht40



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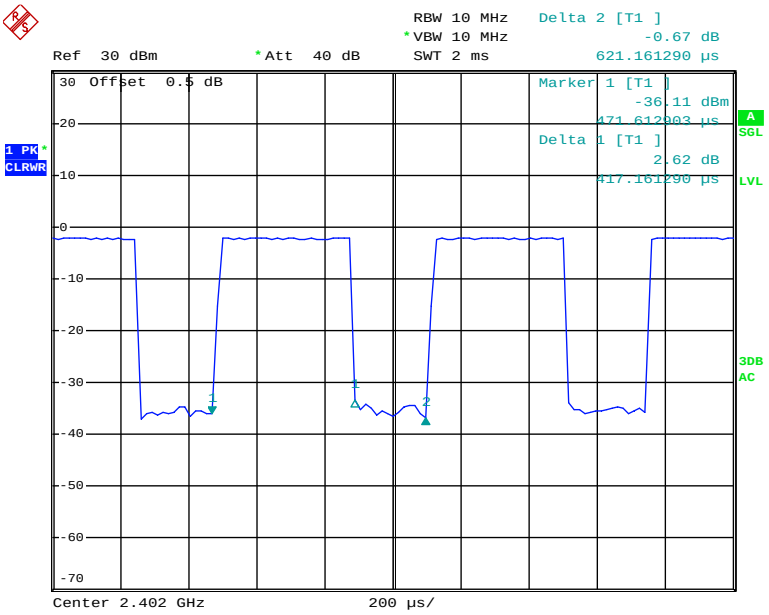
BLE



Equipment Modifications

No modification was made to the EUT.

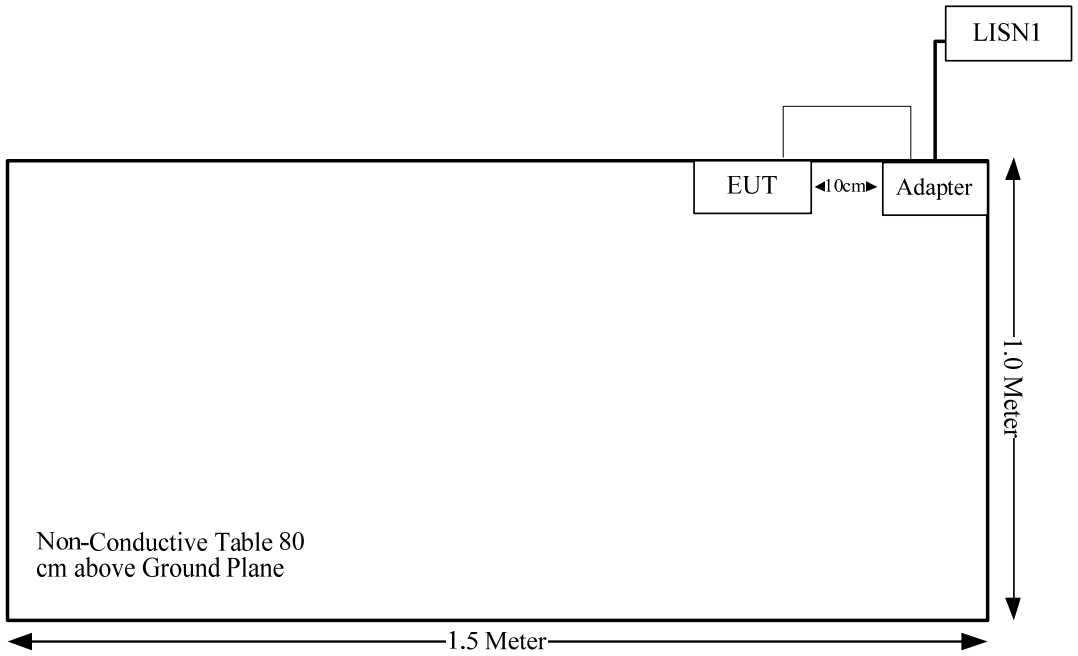
Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Huawei	Adapter	HW-050100C3W	N/A

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From	To
USB Cable	Yes	No	1.0	Adapter	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

Rules	Description of Test	Result
FCC§15.247 (i) & §1.1310 & §2.1093	RF Exposure	Compliance
RSS-102 Clause 2.5.1	Exemption Limits for Routine Evaluation -SAR Evaluation	Compliance
FCC§15.203 RSS-Gen Clause 8.3	Antenna Requirement	Compliance
§15.207 (a) RSS-Gen Clause 8.8	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d) RSS-247 Clause 5.5 RSS-Gen Clause 8.10	Spurious Emissions	Compliance
§15.247 (a)(2) RSS-247 Clause 5.2 a)	6 dB Emission Bandwidth And 99% Occupied Bandwidth	Compliance
§15.247(b)(3) RSS-247 Clause 5.4 d)	Maximum Conducted Output Power	Compliance
§15.247(d) RSS-247 Clause5.5	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247 (e) RSS-247 Clause5.2 b)	Power Spectral Density	Compliance

FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE

Applicable Standard

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

According to KDB447498 D01 General RF Exposure Guidance v06:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

Measurement Result

For Bluetooth LE mode:
The max conducted power including tune-up tolerance is -2.0 dBm (0.63 mW).
[(max. power of channel, mW)/(min. test separation distance, mm)][√f(GHz)]
= 0.63/5*(√2.480) = 0.2< 3.0

For WLAN mode:

please refer to the SAR report: RDG171206006-20.

RSS-102 § 2.5.1 EXEMPTION LIMITS FOR ROUTINE EVALUATION – SAR EVALUATION

Applicable Standard

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5.

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance[4,5]

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

Measurement Result:

For Bluetooth LE mode:
The maximum conducted output power including tune up tolerance is -2.0 dBm(0.63mW), which was declared by manufacturer. The antenna gain is 0.72 dBi, EIRP= -1.28 dBm(0.74mW)

The exemption power(P) limits for routine evaluation in 2402-2480MHz is:
(2480-2450)/(3500-2450)=(4-P)/(4-2)
=>P=3.96 mW@2480MHz
> 0.74 mW

So the SAR evaluation can be exempted.

For WLAN mode:
please refer to the SAR report: RDG171206006-20.

FCC §15.203 & RSS-GEN§8.3 - 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.
c. Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

According to RSS-Gen §8.3, The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.
Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level.9 When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

Antenna Connector Construction

The EUT has one internal antenna arrangement for BT/WLAN, and the antenna gain is 0.72 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

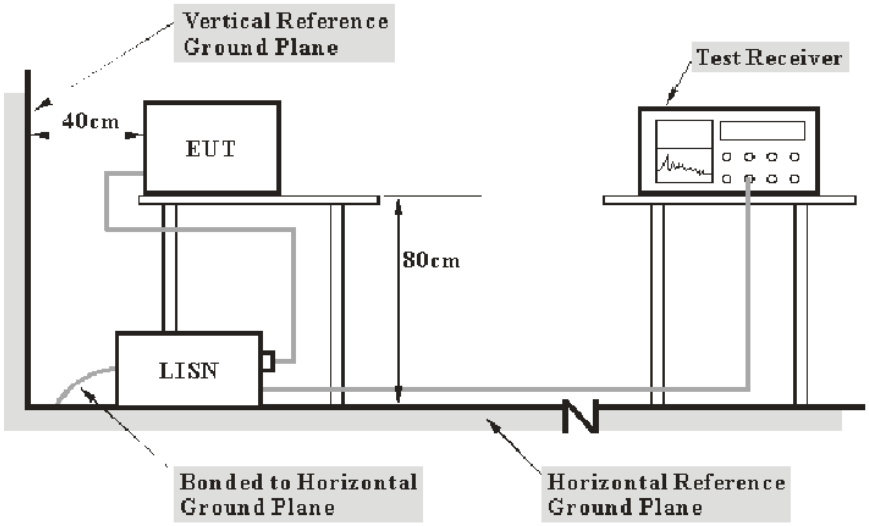
Result: Compliance.

FCC §15.207 (a) & RSS-Gen §8.8– AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207(a) and RSS-Gen§8.8

EUT Setup



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

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

The spacing between the peripherals was 10 cm.

The adapter was connected to the main lisn with a 120 V/60 Hz AC power source.

EMI Test Receiver Setup

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

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

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

Test Procedure

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

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

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

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$V_C = V_R + A_C + VDF$
$C_f = A_C + VDF$

Herein,
V_C (cord. Reading): corrected voltage amplitude
V_R: reading voltage amplitude
A_c: attenuation caused by cable loss
VDF: voltage division factor of AMN
C_f: Correction Factor

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

Margin = Limit – Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCS 30	830245/006	2017-12-11	2018-12-11
R&S	L.I.S.N	ESH2-Z5	892107/021	2017-09-25	2018-09-25
R&S	Two-line V-network	ENV 216	101614	2017-12-08	2018-12-08
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A
N/A	Coaxial Cable	C-NJNJ-50	C-0200-01	2017-09-05	2018-09-05

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

Test Data

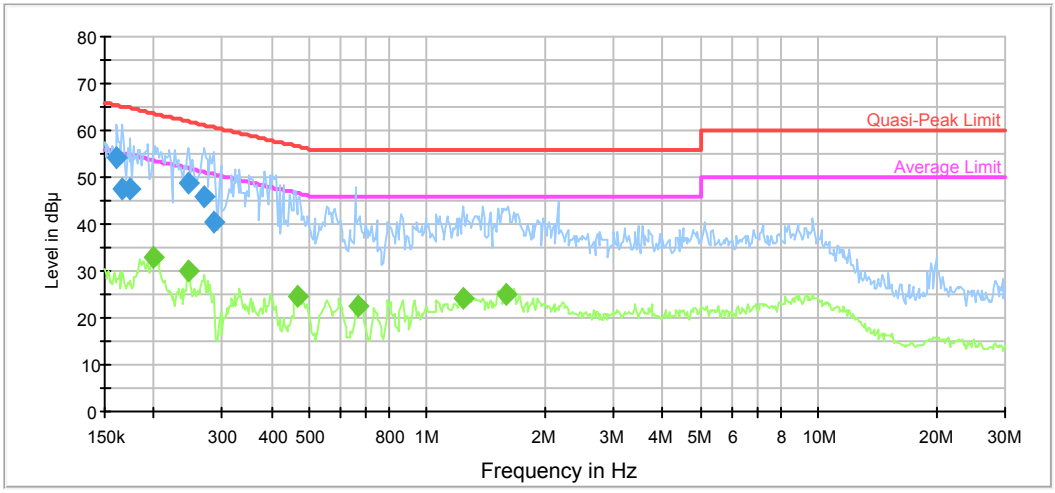
Environmental Conditions

Temperature:	25.1 °C
Relative Humidity:	35 %
ATM Pressure:	101.2 kPa

The testing was performed by Alex You on 2017-12-13.

Test Mode: Transmitting (Wi-Fi 802.11b mode high channel was the worst)

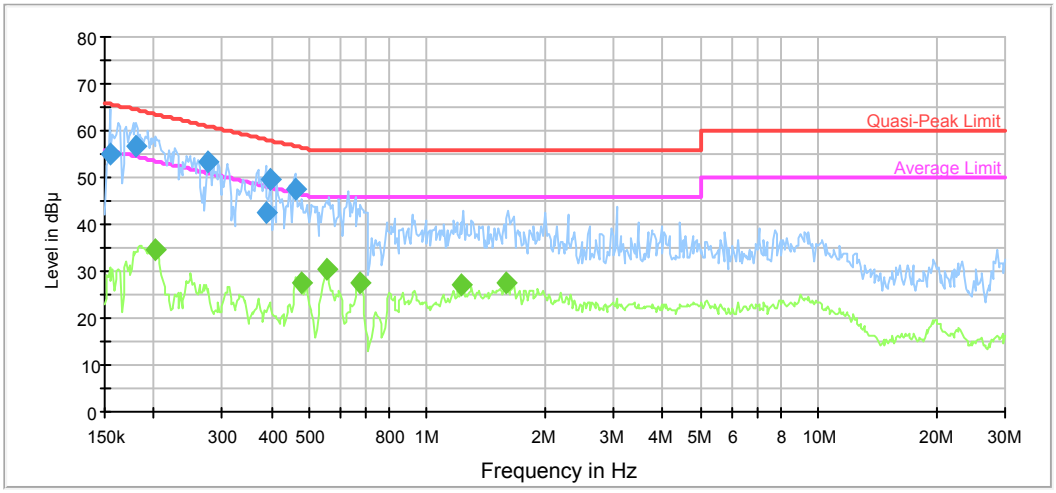
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.161152	54.4	9.000	L1	11.0	11.0	65.4	Compliance
0.166371	47.3	9.000	L1	11.0	17.8	65.1	Compliance
0.174519	47.6	9.000	L1	10.9	17.1	64.7	Compliance
0.245835	48.8	9.000	L1	10.3	13.1	61.9	Compliance
0.270502	45.9	9.000	L1	10.3	15.2	61.1	Compliance
0.286019	40.3	9.000	L1	10.2	20.3	60.6	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.199835	33.1	9.000	L1	10.6	20.5	53.6	Compliance
0.245835	30.2	9.000	L1	10.3	21.7	51.9	Compliance
0.468757	24.7	9.000	L1	9.9	21.8	46.5	Compliance
0.665597	22.5	9.000	L1	9.8	23.5	46.0	Compliance
1.239175	24.3	9.000	L1	9.8	21.7	46.0	Compliance
1.599078	25.1	9.000	L1	9.7	20.9	46.0	Compliance

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.154858	54.9	9.000	N	11.1	10.8	65.7	Compliance
0.180171	56.9	9.000	N	10.8	7.6	64.5	Compliance
0.277046	53.5	9.000	N	10.2	7.4	60.9	Compliance
0.387164	42.3	9.000	N	10.0	15.8	58.1	Compliance
0.399703	49.5	9.000	N	10.0	8.4	57.9	Compliance
0.461346	47.3	9.000	N	9.9	9.4	56.7	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.201433	34.7	9.000	N	10.6	18.9	53.6	Compliance
0.476287	27.6	9.000	N	9.9	18.8	46.4	Compliance
0.554139	30.5	9.000	N	9.9	15.5	46.0	Compliance
0.670921	27.7	9.000	N	9.8	18.3	46.0	Compliance
1.229340	27.1	9.000	N	9.8	18.9	46.0	Compliance
1.599078	27.7	9.000	N	9.7	18.3	46.0	Compliance

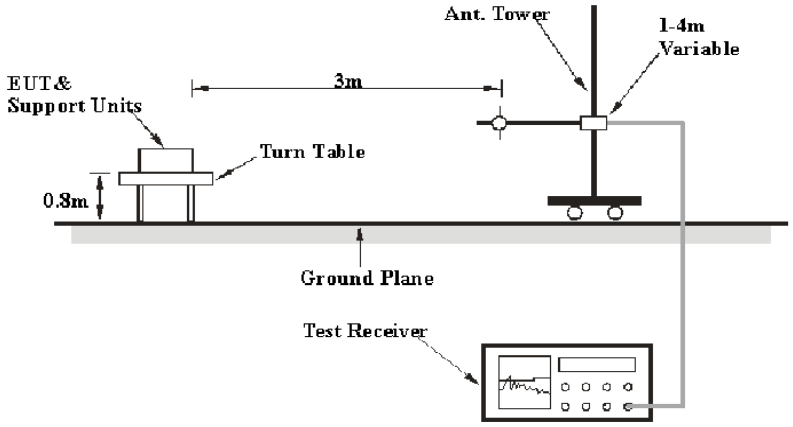
FCC §15.209, §15.205 & §15.247(d) & RSS-247 §5.5&RSS-GEN§8.10 - SPURIOUS EMISSIONS

Applicable Standard

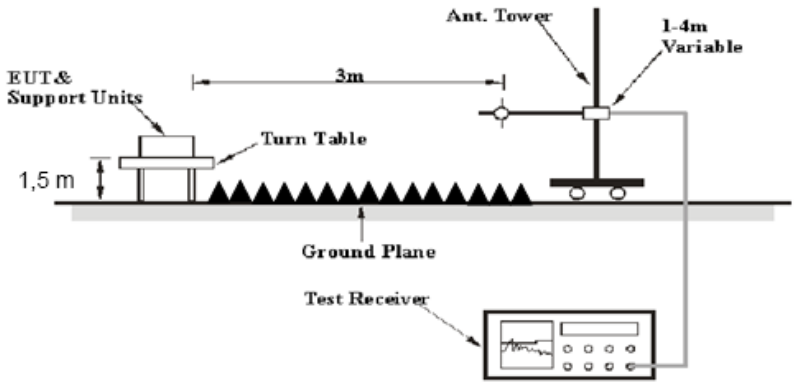
FCC §15.247 (d); §15.209; §15.205; and RSS-247 §5.5, RSS-GEN §8.10

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters distance, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits and RSS-247 §5.5,RSS-Gen §8.10 limits.

The spacing between the peripherals was 10 cm.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

30MHz-1000MHz:

Measurement	RBW	Video B/W	IF B/W
QP	120 kHz	300 kHz	120kHz

1GHz- 25GHz:

Measurement	Duty cycle	RBW	Video B/W
PK	Any	1MHz	3 MHz
AV	>98%	1MHz	10 Hz
	<98%	1MHz	1/T

Note: T is minimum transmission duration

Test Procedure

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

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

Emission under limit more than 20dB or under noise floor have not been recorded in the report.

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 = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

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

Margin = Limit – Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2017-12-11	2018-12-11
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
HP	Amplifier	8447D	2727A05902	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-NJNJ-50	C-0400-01	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-NJNJ-50	C-0075-01	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-NJNJ-50	C-1000-01	2017-09-05	2018-09-05
R&S	Spectrum Analyzer	FSEM	831259/019	2017-07-18	2018-07-18
TDK RF	Horn Antenna	HRN-0118	130 084	2016-01-05	2019-01-04
Mini-Circuit	Amplifier	ZVA-183-S+	596001149	2017-09-05	2018-09-05
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2017-06-27	2018-06-27
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-02 1304	2016-11-18	2019-11-18
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Chengdu Ouli	Band Rejection Filter	2400-2483.5	002	2017-09-05	2018-09-05

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

Test Data

Environmental Conditions

Temperature:	23.4~23.7 °C
Relative Humidity:	41~43 %
ATM Pressure:	101.3~102 kPa

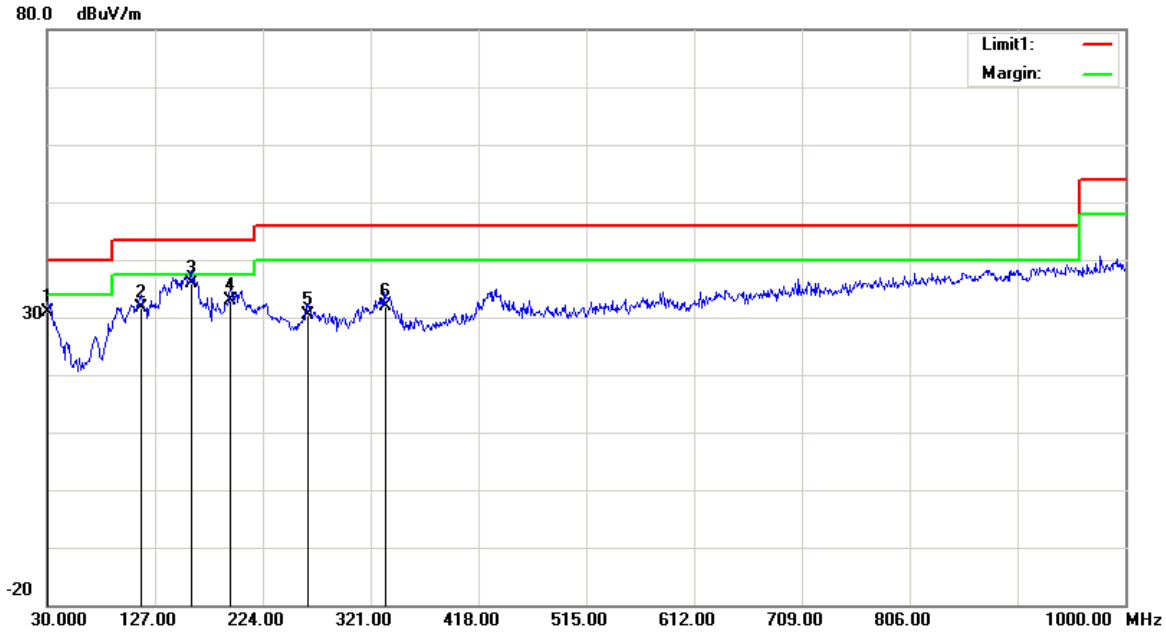
** The testing was performed by Blake Yang from 2017-12-14 to 2017-12-15.*

Test Result: Compliance, please Refer to the following data

Test Mode: Transmitting

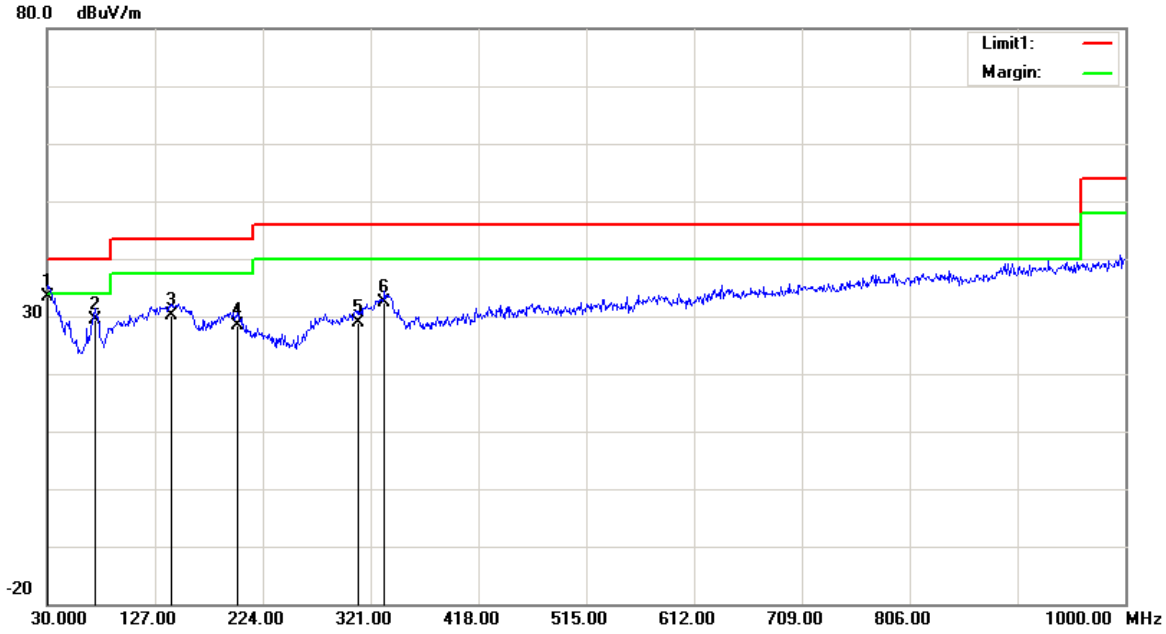
1) 30MHz-1GHz(802.11b mode High channel was the worst)

Horizontal:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.9700	30.55	QP	0.35	30.90	40.00	9.10
114.3900	36.99	QP	-5.29	31.70	43.50	11.80
159.9800	42.62	QP	-6.62	36.00	43.50	7.50
194.9000	39.88	QP	-7.08	32.80	43.50	10.70
264.7400	34.72	QP	-4.42	30.30	46.00	15.70
334.5800	35.50	QP	-3.60	31.90	46.00	14.10

Vertical:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.0000	32.32	QP	1.08	33.40	40.00	6.60
72.6800	40.48	QP	-11.18	29.30	40.00	10.70
141.5500	36.47	QP	-6.27	30.20	43.50	13.30
201.6900	34.66	QP	-6.16	28.50	43.50	15.00
310.3300	33.38	QP	-4.58	28.80	46.00	17.20
333.6100	35.92	QP	-3.62	32.30	46.00	13.70

2) 1-25GHz:

802.11b Mode:

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB/m)					
Low Channel: 2412 MHz									
2412.00	71.74	PK	H	24.84	5.41	0.00	101.99	N/A	N/A
2412.00	66.68	AV	H	24.84	5.41	0.00	96.93	N/A	N/A
2412.00	76.64	PK	V	24.84	5.41	0.00	106.89	N/A	N/A
2412.00	71.61	AV	V	24.84	5.41	0.00	101.86	N/A	N/A
2390.00	34.45	PK	V	24.80	5.36	0.00	64.61	74.00	9.39
2390.00	18.65	AV	V	24.80	5.36	0.00	48.81	54.00	5.19
4824.00	39.54	PK	V	29.75	7.34	27.41	49.22	74.00	24.78
4824.00	29.25	AV	V	29.75	7.34	27.41	38.93	54.00	15.07
7236.00	41.31	PK	V	33.98	9.08	27.22	57.15	74.00	16.85
7236.00	32.45	AV	V	33.98	9.08	27.22	48.29	54.00	5.71
Middle Channel: 2437 MHz									
2437.00	71.84	PK	H	24.89	5.41	0.00	102.14	N/A	N/A
2437.00	65.67	AV	H	24.89	5.41	0.00	95.97	N/A	N/A
2437.00	76.83	PK	V	24.89	5.41	0.00	107.13	N/A	N/A
2437.00	70.72	AV	V	24.89	5.41	0.00	101.02	N/A	N/A
4874.00	40.62	PK	V	29.85	7.56	27.54	50.49	74.00	23.51
4874.00	30.27	AV	V	29.85	7.56	27.54	40.14	54.00	13.86
7311.00	41.03	PK	V	34.10	9.33	27.28	57.18	74.00	16.82
7311.00	30.95	AV	V	34.10	9.33	27.28	47.10	54.00	6.9
High Channel: 2462 MHz									
2462.00	71.65	PK	H	24.93	5.41	0.00	101.99	N/A	N/A
2462.00	65.26	AV	H	24.93	5.41	0.00	95.60	N/A	N/A
2462.00	76.32	PK	V	24.93	5.41	0.00	106.66	N/A	N/A
2462.00	70.17	AV	V	24.93	5.41	0.00	100.51	N/A	N/A
2483.50	35.28	PK	V	24.97	5.41	0.00	65.66	74.00	8.34
2483.50	18.67	AV	V	24.97	5.41	0.00	49.05	54.00	4.95
4924.00	40.64	PK	V	29.95	7.65	27.51	50.73	74.00	23.27
4924.00	30.88	AV	V	29.95	7.65	27.51	40.97	54.00	13.03
7386.00	40.98	PK	V	34.22	9.08	27.18	57.10	74.00	16.9
7386.00	31.37	AV	V	34.22	9.08	27.18	47.49	54.00	6.51

802.11g Mode:

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB/m)					
Low Channel: 2412 MHz									
2412.00	71.47	PK	H	24.84	5.41	0.00	101.72	N/A	N/A
2412.00	62.37	AV	H	24.84	5.41	0.00	92.62	N/A	N/A
2412.00	76.66	PK	V	24.84	5.41	0.00	106.91	N/A	N/A
2412.00	66.38	AV	V	24.84	5.41	0.00	96.63	N/A	N/A
2390.00	34.74	PK	V	24.80	5.36	0.00	64.90	74.00	9.10
2390.00	19.56	AV	V	24.80	5.36	0.00	49.72	54.00	4.28
4824.00	39.66	PK	V	29.75	7.34	27.41	49.34	74.00	24.66
4824.00	29.85	AV	V	29.75	7.34	27.41	39.53	54.00	14.47
7236.00	41.52	PK	V	33.98	9.08	27.22	57.36	74.00	16.64
7386.00	32.05	AV	V	34.22	9.08	27.18	48.17	54.00	5.83
Middle Channel: 2437 MHz									
2437.00	71.84	PK	H	24.89	5.41	0.00	102.14	N/A	N/A
2437.00	62.14	AV	H	24.89	5.41	0.00	92.44	N/A	N/A
2437.00	76.60	PK	V	24.89	5.41	0.00	106.90	N/A	N/A
2437.00	67.12	AV	V	24.89	5.41	0.00	97.42	N/A	N/A
4874.00	40.44	PK	V	29.85	7.56	27.54	50.31	74.00	23.69
4874.00	30.86	AV	V	29.85	7.56	27.54	40.73	54.00	13.27
7311.00	41.08	PK	V	34.10	9.33	27.28	57.23	74.00	16.77
7311.00	31.34	AV	V	34.10	9.33	27.28	47.49	54.00	6.51
High Channel: 2462 MHz									
2462.00	72.05	PK	H	24.93	5.41	0.00	102.39	N/A	N/A
2462.00	61.93	AV	H	24.93	5.41	0.00	92.27	N/A	N/A
2462.00	76.14	PK	V	24.93	5.41	0.00	106.48	N/A	N/A
2462.00	65.93	AV	V	24.93	5.41	0.00	96.27	N/A	N/A
2483.50	35.32	PK	V	24.97	5.41	0.00	65.70	74.00	8.3
2483.50	18.81	AV	V	24.97	5.41	0.00	49.19	54.00	4.81
4924.00	40.77	PK	V	29.95	7.65	27.51	50.86	74.00	23.14
4924.00	30.81	AV	V	29.95	7.65	27.51	40.90	54.00	13.1
7386.00	41.52	PK	V	34.22	9.08	27.18	57.64	74.00	16.36
7386.00	32.05	AV	V	34.22	9.08	27.18	48.17	54.00	5.83

802.11n ht20 Mode:

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB/m)					
Low Channel: 2412 MHz									
2412.00	71.61	PK	H	24.84	5.41	0.00	101.86	N/A	N/A
2412.00	61.60	AV	H	24.84	5.41	0.00	91.85	N/A	N/A
2412.00	76.60	PK	V	24.84	5.41	0.00	106.85	N/A	N/A
2412.00	66.27	AV	V	24.84	5.41	0.00	96.52	N/A	N/A
2390.00	35.15	PK	V	24.80	5.36	0.00	65.31	74.00	8.69
2390.00	18.01	AV	V	24.80	5.36	0.00	48.17	54.00	5.83
4824.00	39.06	PK	V	29.75	7.34	27.41	48.74	74.00	25.26
4824.00	29.50	AV	V	29.75	7.34	27.41	39.18	54.00	14.82
7236.00	41.72	PK	V	33.98	9.08	27.22	57.56	74.00	16.44
7236.00	31.49	AV	V	33.98	9.08	27.22	47.33	54.00	6.67
Middle Channel: 2437 MHz									
2437.00	71.63	PK	H	24.89	5.41	0.00	101.93	N/A	N/A
2437.00	61.97	AV	H	24.89	5.41	0.00	92.27	N/A	N/A
2437.00	76.93	PK	V	24.89	5.41	0.00	107.23	N/A	N/A
2437.00	67.38	AV	V	24.89	5.41	0.00	97.68	N/A	N/A
4874.00	40.29	PK	V	29.85	7.56	27.54	50.16	74.00	23.84
4874.00	30.46	AV	V	29.85	7.56	27.54	40.33	54.00	13.67
7311.00	40.84	PK	V	34.10	9.33	27.28	56.99	74.00	17.01
7311.00	31.48	AV	V	34.10	9.33	27.28	47.63	54.00	6.37
High Channel: 2462 MHz									
2462.00	71.90	PK	H	24.93	5.41	0.00	102.24	N/A	N/A
2462.00	61.56	AV	H	24.93	5.41	0.00	91.90	N/A	N/A
2462.00	77.02	PK	V	24.93	5.41	0.00	107.36	N/A	N/A
2462.00	66.71	AV	V	24.93	5.41	0.00	97.05	N/A	N/A
2483.50	34.13	PK	V	24.97	5.41	0.00	64.51	74.00	9.49
2483.50	18.33	AV	V	24.97	5.41	0.00	48.71	54.00	5.29
4924.00	41.15	PK	V	29.95	7.65	27.51	51.24	74.00	22.76
4924.00	31.30	AV	V	29.95	7.65	27.51	41.39	54.00	12.61
7386.00	40.65	PK	V	34.22	9.08	27.18	56.77	74.00	17.23
7386.00	31.46	AV	V	34.22	9.08	27.18	47.58	54.00	6.42

802.11n ht40 Mode:

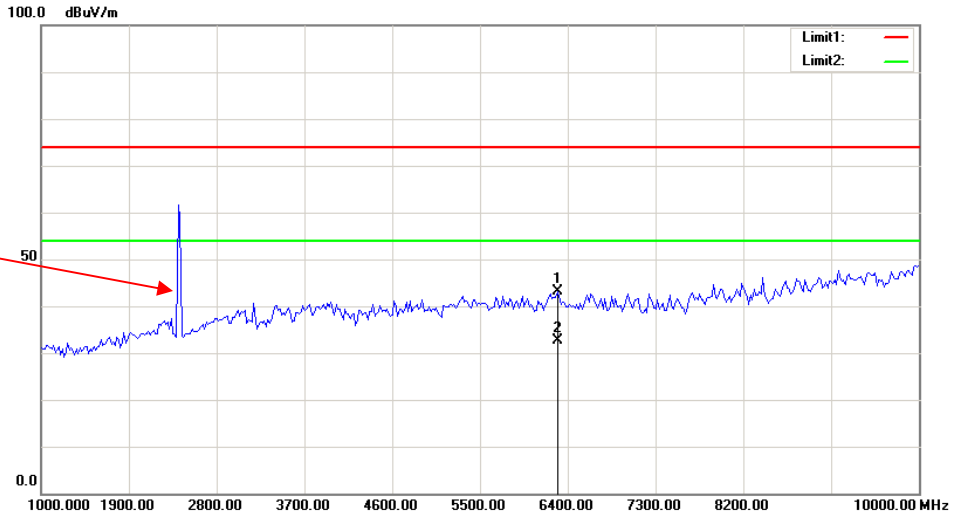
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB/m)					
Low Channel: 2422 MHz									
2422.00	65.98	PK	H	24.86	5.41	0.00	96.25	N/A	N/A
2422.00	55.82	AV	H	24.86	5.41	0.00	86.09	N/A	N/A
2422.00	70.01	PK	V	24.86	5.41	0.00	100.28	N/A	N/A
2422.00	60.50	AV	V	24.86	5.41	0.00	90.77	N/A	N/A
2390.00	35.49	PK	V	24.80	5.36	0.00	65.65	74.00	8.35
2390.00	17.40	AV	V	24.80	5.36	0.00	47.56	54.00	6.44
4844.00	39.83	PK	V	29.79	7.42	27.46	49.58	74.00	24.42
4844.00	28.87	AV	V	29.79	7.42	27.46	38.62	54.00	15.38
7266.00	41.31	PK	V	34.03	9.21	27.25	57.30	74.00	16.70
7266.00	32.19	AV	V	34.03	9.21	27.25	48.18	54.00	5.82
Middle Channel: 2437 MHz									
2437.00	65.46	PK	H	24.89	5.41	0.00	95.76	N/A	N/A
2437.00	56.34	AV	H	24.89	5.41	0.00	86.64	N/A	N/A
2437.00	70.56	PK	V	24.89	5.41	0.00	100.86	N/A	N/A
2437.00	60.80	AV	V	24.89	5.41	0.00	91.10	N/A	N/A
4874.00	40.47	PK	V	29.85	7.56	27.54	50.34	74.00	23.66
4874.00	30.38	AV	V	29.85	7.56	27.54	40.25	54.00	13.75
7311.00	40.82	PK	V	34.10	9.33	27.28	56.97	74.00	17.03
7311.00	31.40	AV	V	34.10	9.33	27.28	47.55	54.00	6.45
High Channel: 2452 MHz									
2452.00	66.78	PK	H	24.91	5.41	0.00	97.10	N/A	N/A
2452.00	56.02	AV	H	24.91	5.41	0.00	86.34	N/A	N/A
2452.00	70.28	PK	V	24.91	5.41	0.00	100.60	N/A	N/A
2452.00	59.86	AV	V	24.91	5.41	0.00	90.18	N/A	N/A
2483.50	33.66	PK	V	24.97	5.41	0.00	64.04	74.00	9.96
2483.50	20.25	AV	V	24.97	5.41	0.00	50.63	54.00	3.37
4904.00	40.41	PK	V	29.91	7.67	27.58	50.41	74.00	23.59
4904.00	31.48	AV	V	29.91	7.67	27.58	41.48	54.00	12.52
7356.00	40.65	PK	V	34.17	9.18	27.22	56.78	74.00	17.22
7356.00	31.91	AV	V	34.17	9.18	27.22	48.04	54.00	5.96

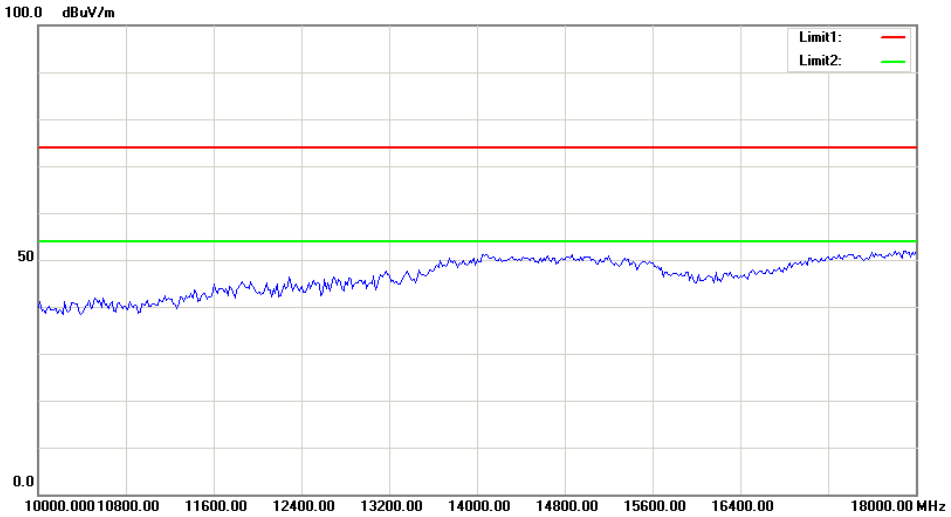
BLE Mode:

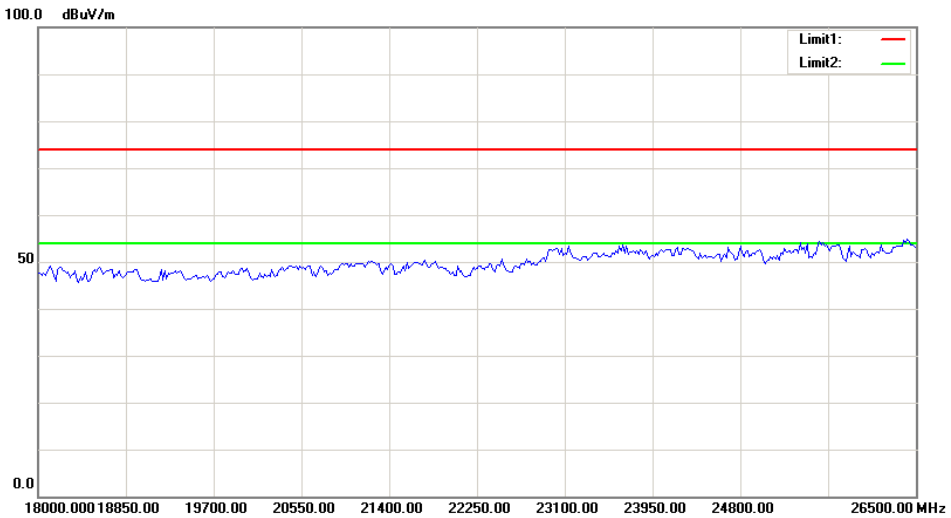
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2402 MHz									
2402.00	50.70	PK	H	24.82	5.41	0.00	80.93	N/A	N/A
2402.00	45.40	AV	H	24.82	5.41	0.00	75.63	N/A	N/A
2402.00	59.96	PK	V	24.82	5.41	0.00	90.19	N/A	N/A
2402.00	54.91	AV	V	24.82	5.41	0.00	85.14	N/A	N/A
2390.00	23.56	PK	V	24.80	5.36	0.00	53.72	74.00	20.28
2390.00	10.84	AV	V	24.80	5.36	0.00	41.00	54.00	13.00
4804.00	40.42	PK	V	29.71	7.25	27.36	50.02	74.00	23.98
4804.00	27.14	AV	V	29.71	7.25	27.36	36.74	54.00	17.26
7206.00	40.56	PK	V	33.93	8.94	27.19	56.24	74.00	17.76
7206.00	28.64	AV	V	33.93	8.94	27.19	44.32	54.00	9.68
5320.00	45.23	PK	V	30.74	7.62	26.95	56.64	74.00	17.36
5320.00	34.58	AV	V	30.74	7.62	26.95	45.99	54.00	8.01
Middle Channel: 2440 MHz									
2440.00	50.46	PK	H	24.89	5.41	0.00	80.76	N/A	N/A
2440.00	45.21	AV	H	24.89	5.41	0.00	75.51	N/A	N/A
2440.00	59.37	PK	V	24.89	5.41	0.00	89.67	N/A	N/A
2440.00	54.03	AV	V	24.89	5.41	0.00	84.33	N/A	N/A
4880.00	41.02	PK	V	29.86	7.58	27.55	50.91	74.00	23.09
4880.00	28.74	AV	V	29.86	7.58	27.55	38.63	54.00	15.37
7320.00	40.28	PK	V	34.11	9.30	27.26	56.43	74.00	17.57
7320.00	27.43	AV	V	34.11	9.30	27.26	43.58	54.00	10.42
High Channel: 2480 MHz									
2480.00	51.04	PK	H	24.96	5.41	0.00	81.41	N/A	N/A
2480.00	46.12	AV	H	24.96	5.41	0.00	76.49	N/A	N/A
2480.00	59.83	PK	V	24.96	5.41	0.00	90.20	N/A	N/A
2480.00	54.41	AV	V	24.96	5.41	0.00	84.78	N/A	N/A
2483.50	26.56	PK	V	24.97	5.41	0.00	56.94	74.00	17.06
2483.50	12.35	AV	V	24.97	5.41	0.00	42.73	54.00	11.27
4960.00	40.87	PK	V	30.02	7.63	27.37	51.15	74.00	22.85
4960.00	28.17	AV	V	30.02	7.63	27.37	38.45	54.00	15.55
7440.00	40.28	PK	V	34.30	9.09	27.22	56.45	74.00	17.55
7440.00	27.74	AV	V	34.30	9.09	27.22	43.91	54.00	10.09

Test plots(802.11b mode High channel was the worst)
Horizontal:

Fundamental
Test with Band
Rejection Filter

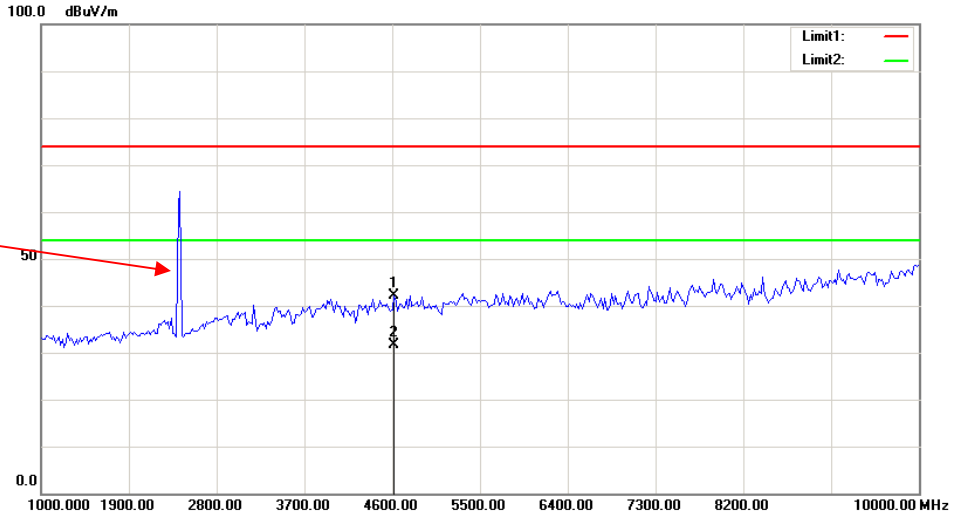


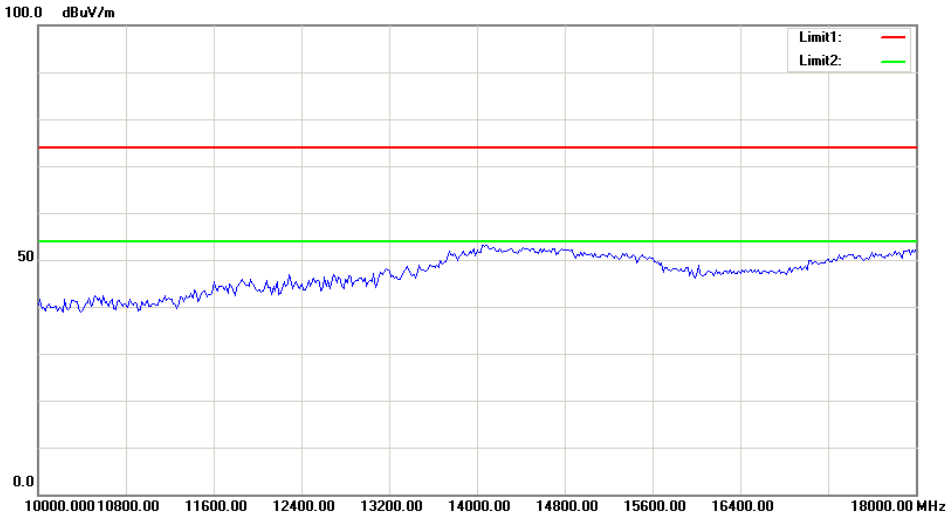


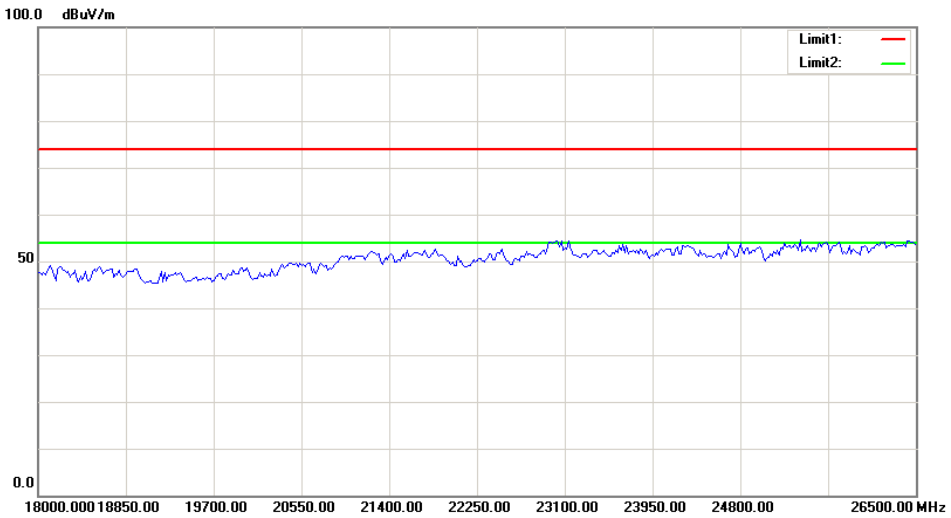


Vertical:

Fundamental Test with Band Rejection Filter







FCC §15.247(a) (2)& RSS-247 §5.2 a) &RSS-247 §5.2 a) &RSS-GEN§6.6 –6 dB EMISSION BANDWIDTH AND 99% OCCUPIED BANDWIDTH

Applicable Standard

According to FCC §15.247(a) (2)

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.

According to RSS-247 §5.2 a)

The minimum 6 dB bandwidth shall be 500 kHz.

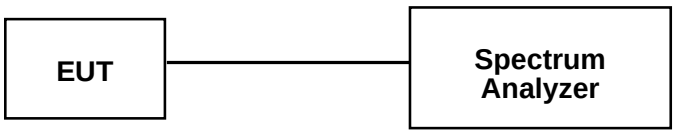
According to RSS-Gen §6.6

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth.

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

Test Procedure

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3×RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.
h) Measure the 99% bandwidth use OBW test function.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	101121	2017-03-02	2018-03-02
N/A	Coaxial Cable	C-SJ00-0010	C0010/01	Each Time	/

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

Test Data

Environmental Conditions

Temperature:	22.3 °C
Relative Humidity:	35 %
ATM Pressure:	102.2 kPa

** The testing was performed by Emma Zhang on 2017-12-18.*

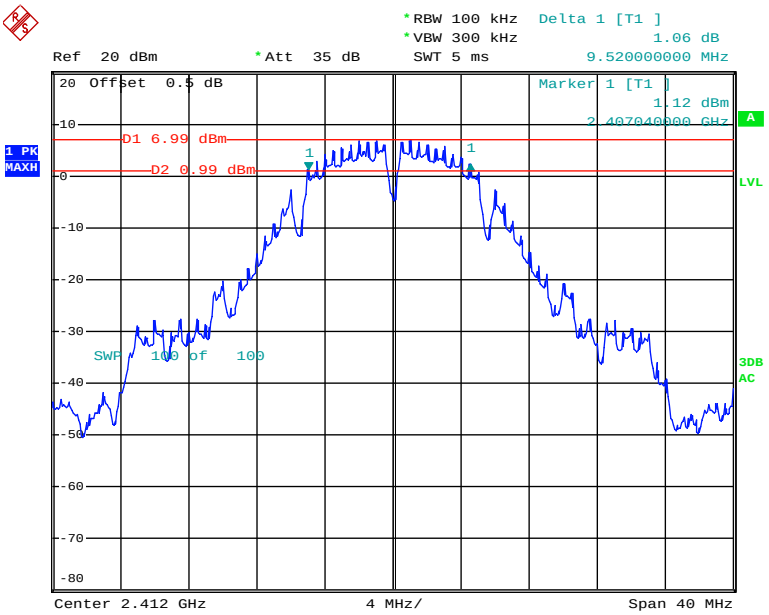
Test Mode: Transmitting

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

Test mode	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Limit (MHz)
802.11b	Low	2412	9.52	13.2	≥0.5
	Middle	2437	9.6	12.8	≥0.5
	High	2462	9.52	12.72	≥0.5
802.11g	Low	2412	15.28	17.12	≥0.5
	Middle	2437	15.52	17.2	≥0.5
	High	2462	15.68	17.12	≥0.5
802.11n ht20	Low	2412	15.52	17.84	≥0.5
	Middle	2437	16.16	18	≥0.5
	High	2462	16.24	17.92	≥0.5
802.11n ht40	Low	2422	35.36	36.96	≥0.5
	Middle	2437	35.52	36.8	≥0.5
	High	2452	35.68	36.96	≥0.5
BLE	Low	2402	0.68	1.02	≥0.5
	Middle	2440	0.69	1.01	≥0.5
	High	2480	0.7	1.02	≥0.5

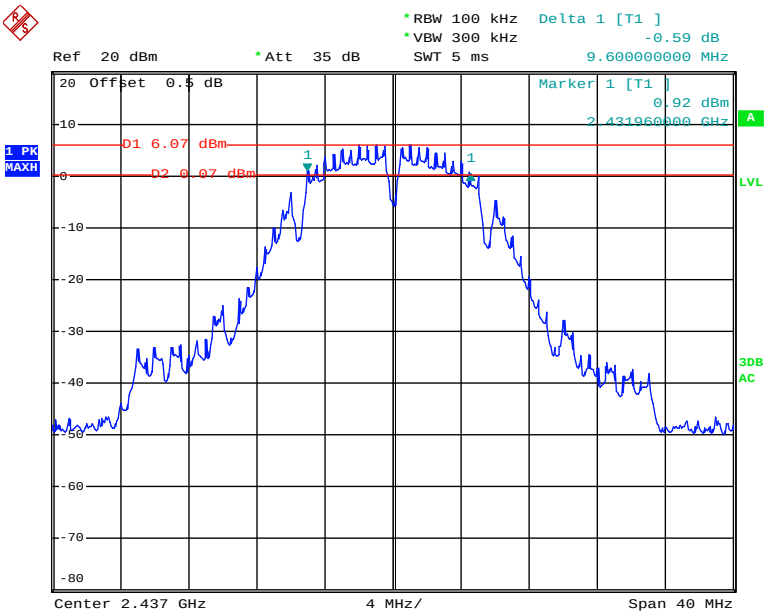
6dB bandwidth:

802.11b Low Channel



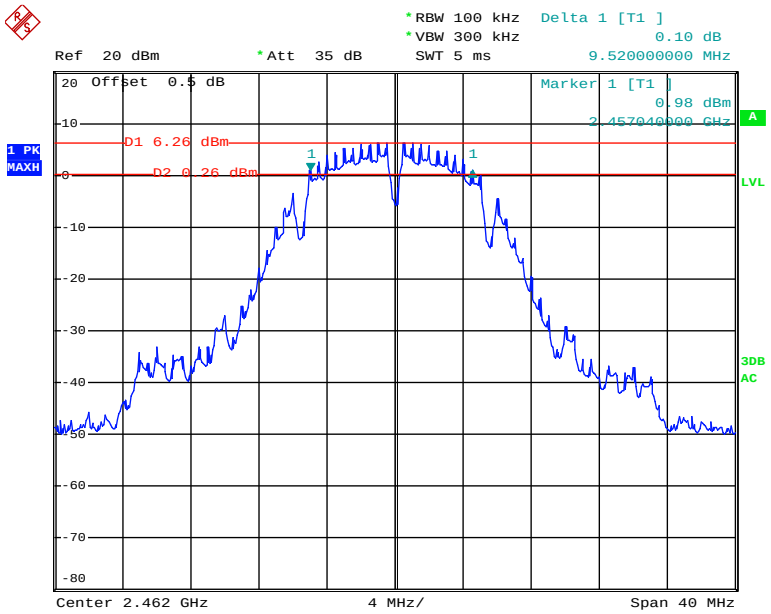
Date: 18.DEC.2017 15:26:22

802.11b Middle Channel



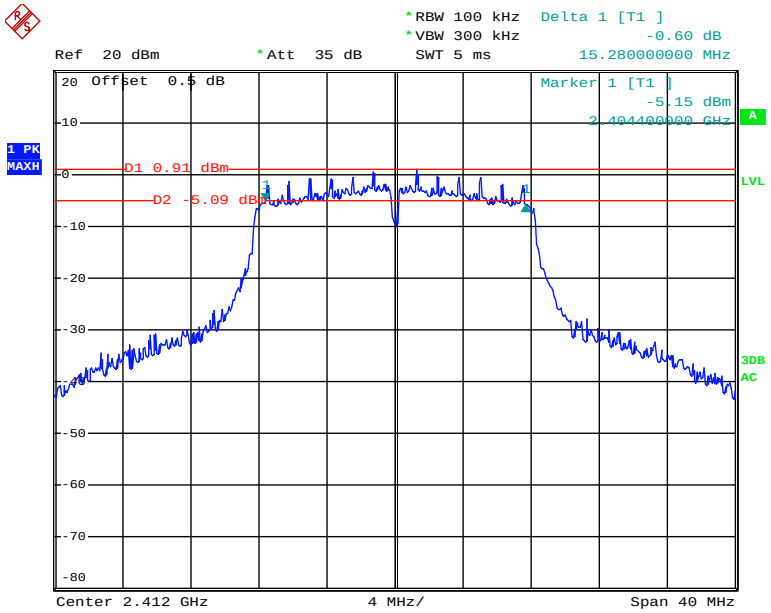
Date: 18.DEC.2017 15:29:09

802.11b High Channel



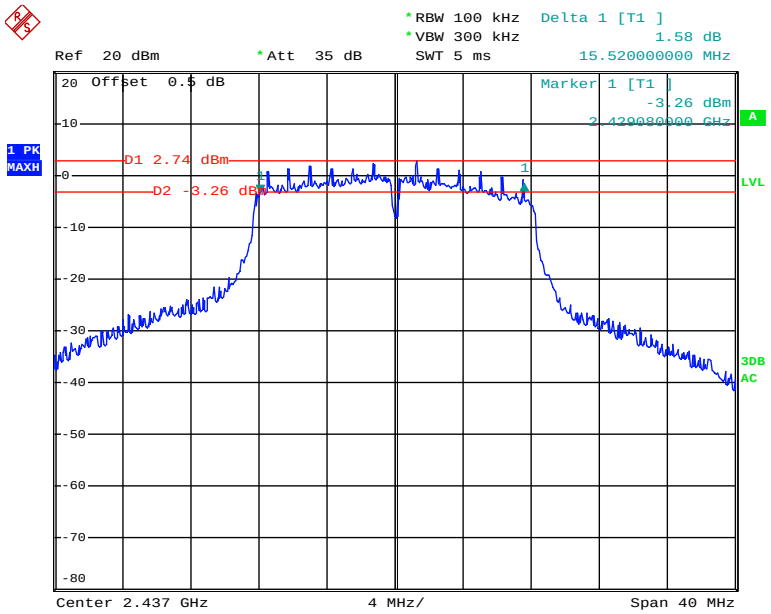
Date: 18.DEC.2017 15:34:10

802.11g Low Channel



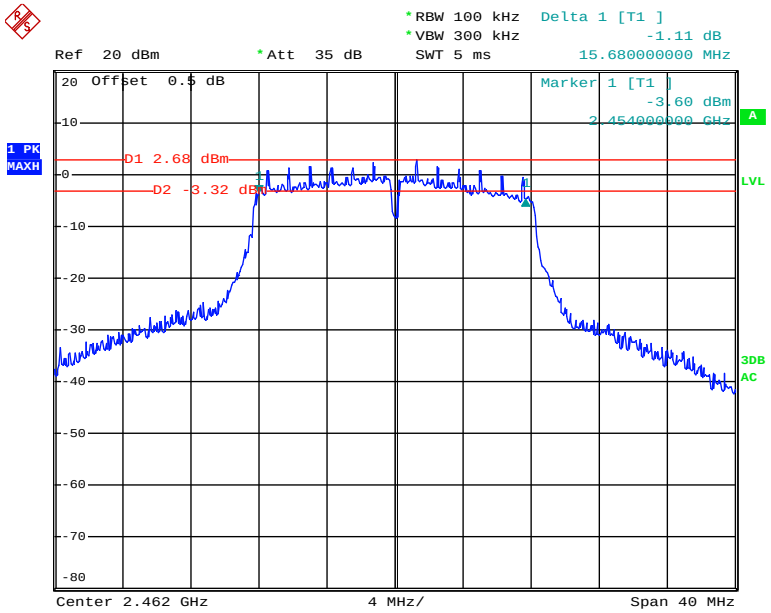
Date: 18.DEC.2017 15:37:19

802.11g Middle Channel



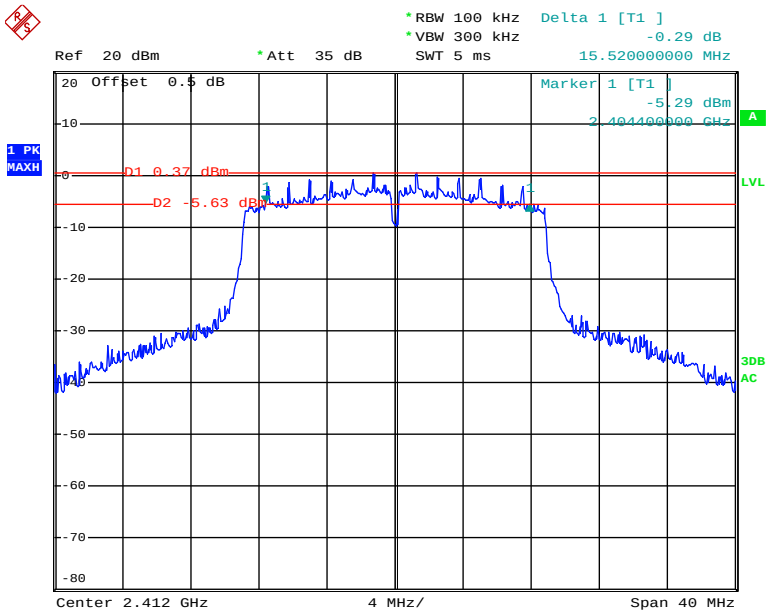
Date: 18.DEC.2017 15:40:48

802.11g High Channel



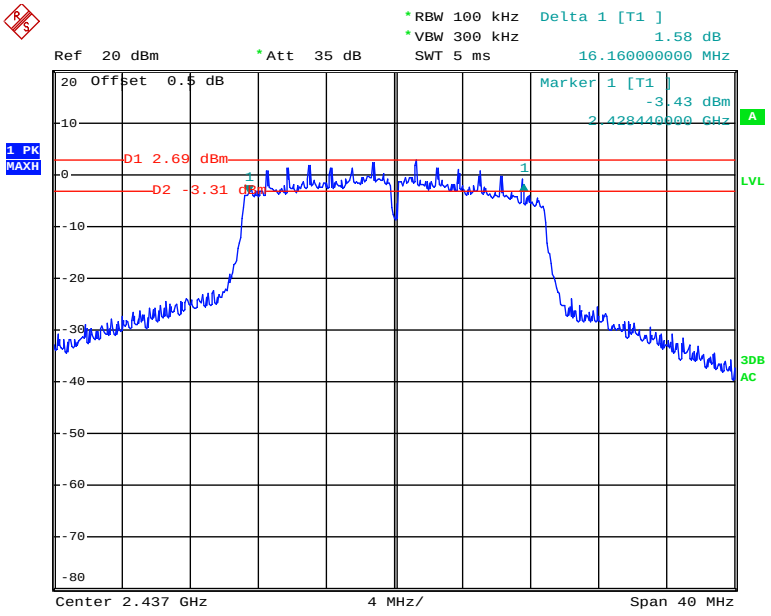
Date: 18.DEC.2017 15:43:45

802.11n ht20 Low Channel



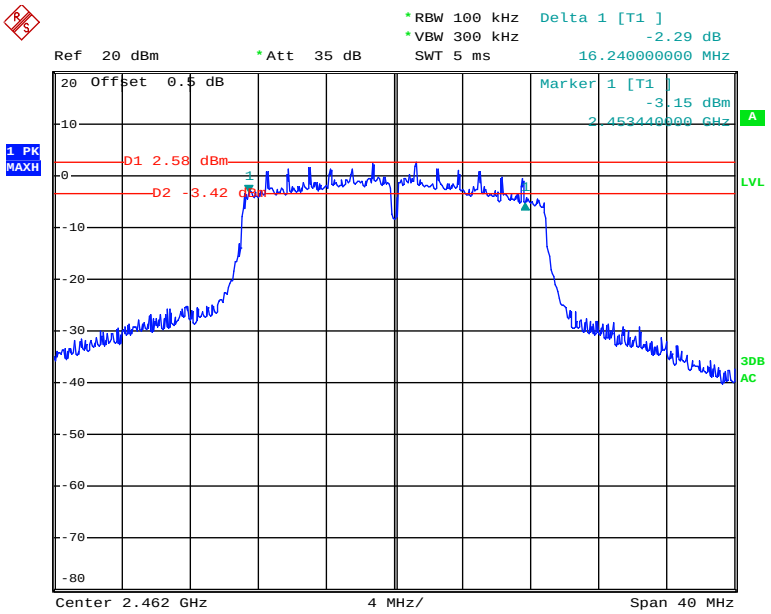
Date: 18.DEC.2017 15:47:35

802.11n ht20 Middle Channel



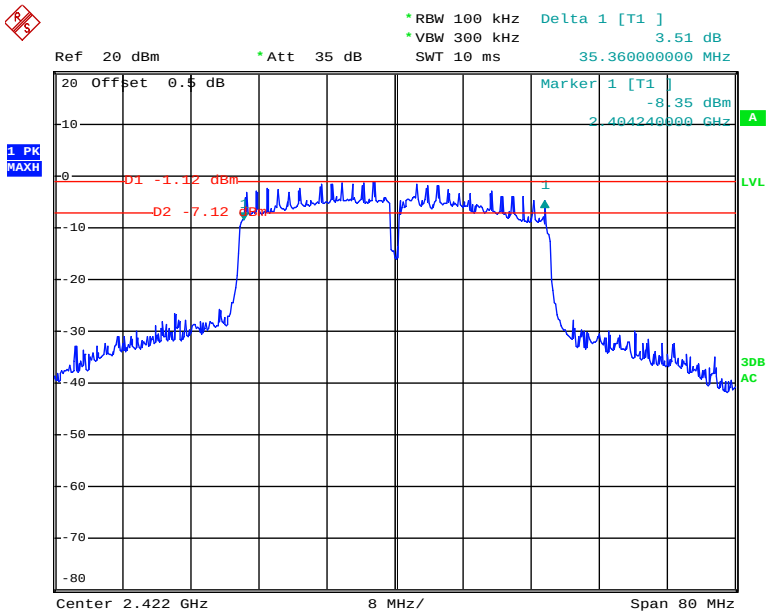
Date: 18.DEC.2017 15:51:20

802.11n ht20 High Channel



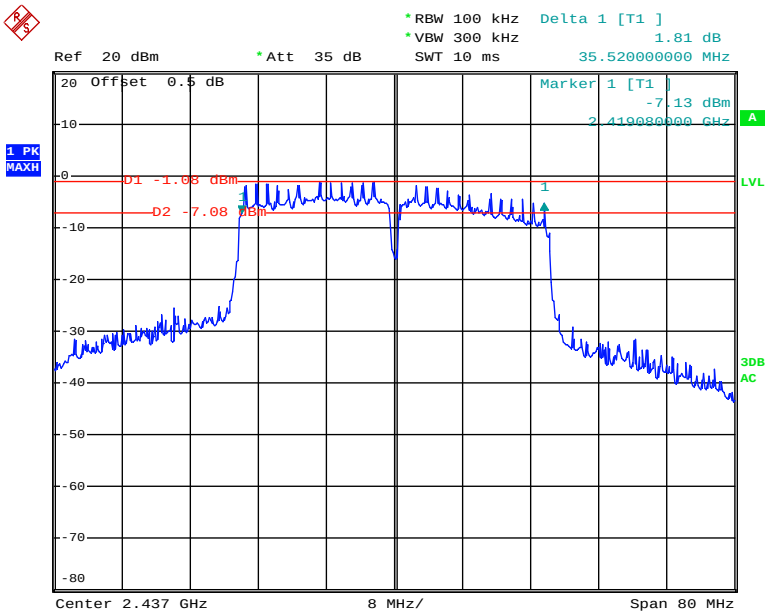
Date: 18.DEC.2017 15:54:55

802.11n ht40 Low Channel



Date: 18.DEC.2017 15:59:06

802.11n ht40 Middle Channel



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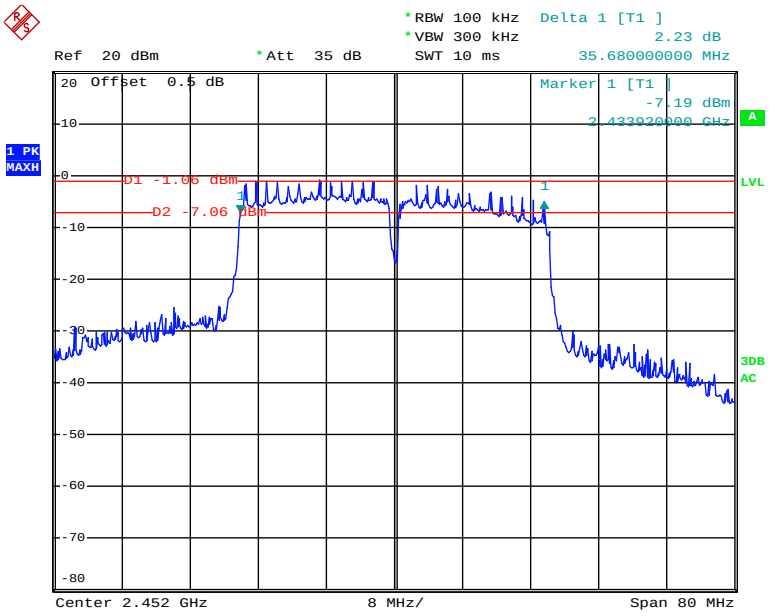
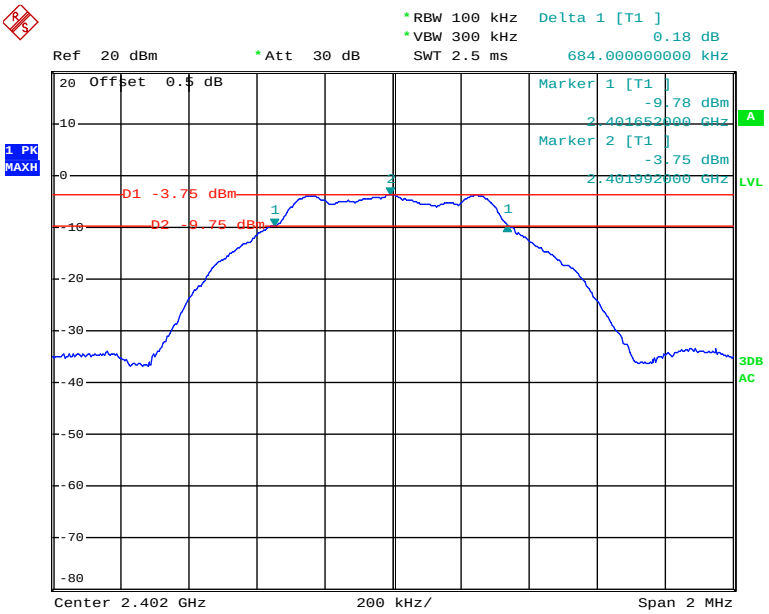
802.11n ht40 High Channel



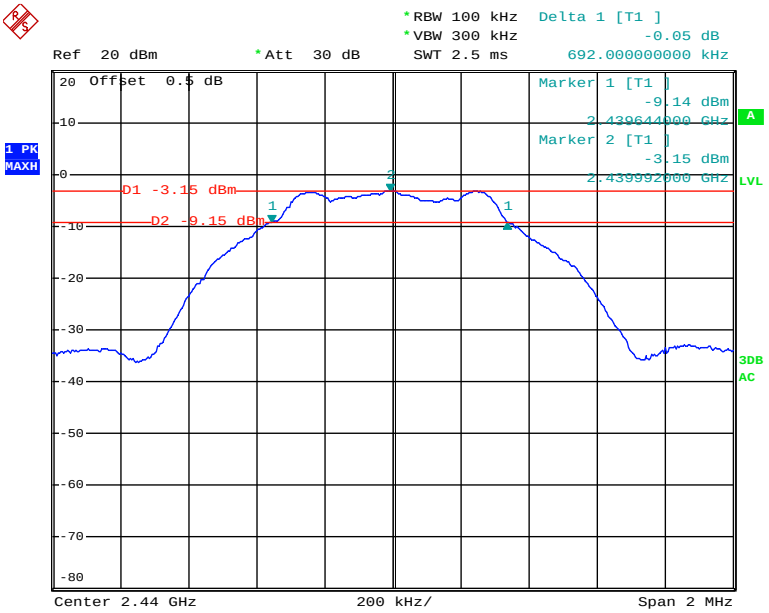
Date: 18.DEC.2017 16:08:19

BLE Low Channel



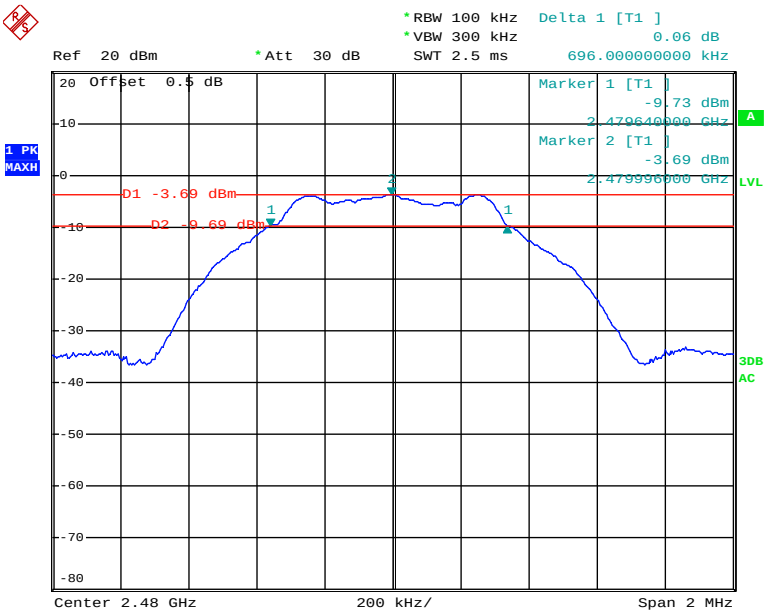
Date: 18.DEC.2017 14:10:13

BLE Middle Channel



Date: 18.DEC.2017 14:14:05

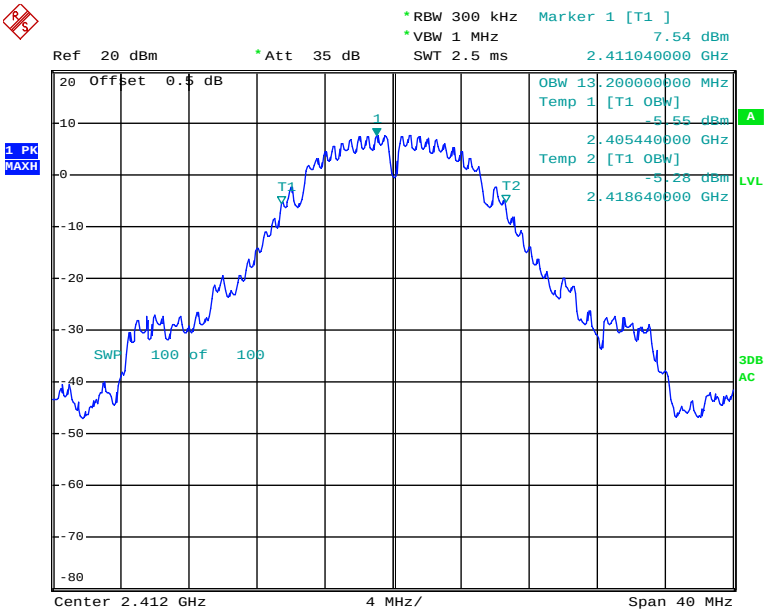
BLE High Channel



Date: 18.DEC.2017 14:12:24

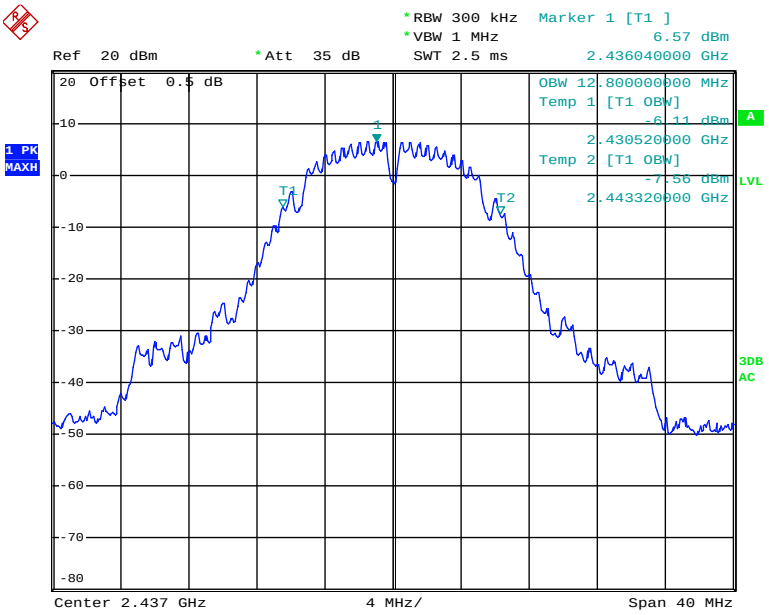
99% Occupied bandwidth:

802.11b Low Channel



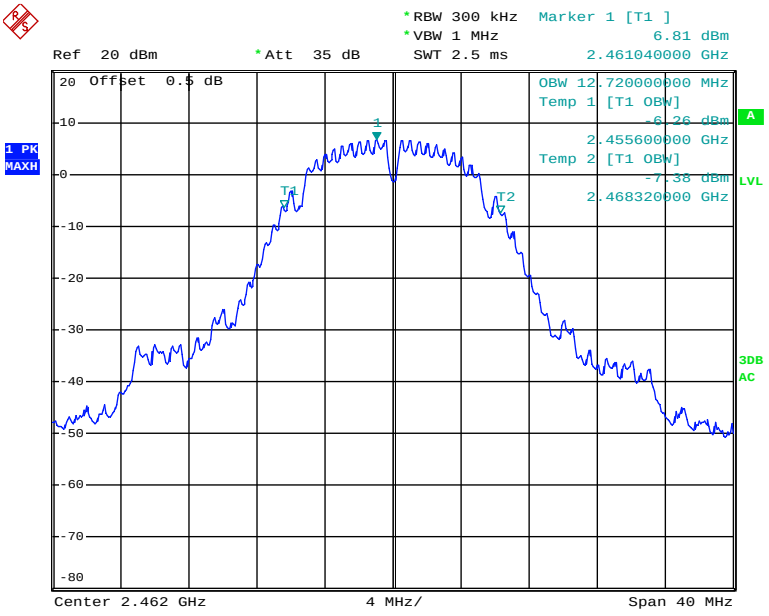
Date: 18.DEC.2017 15:26:45

802.11b Middle Channel



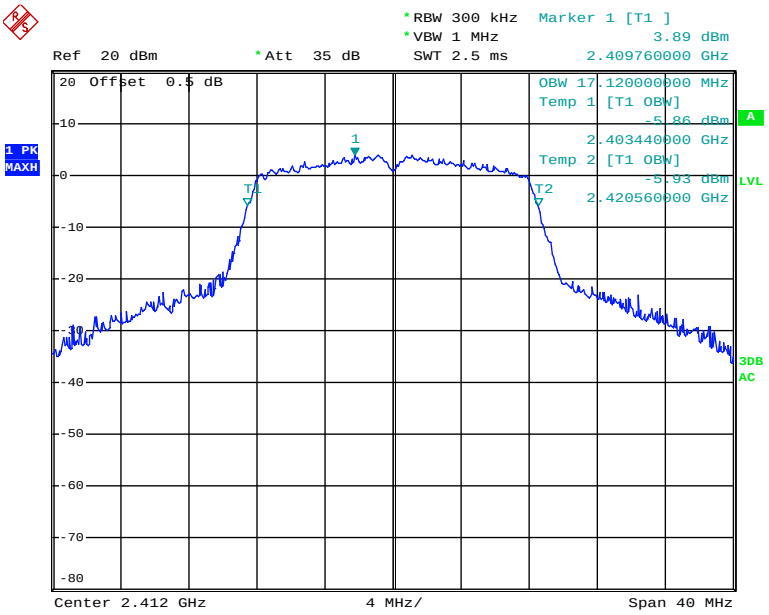
Date: 18.DEC.2017 15:29:25

802.11b High Channel



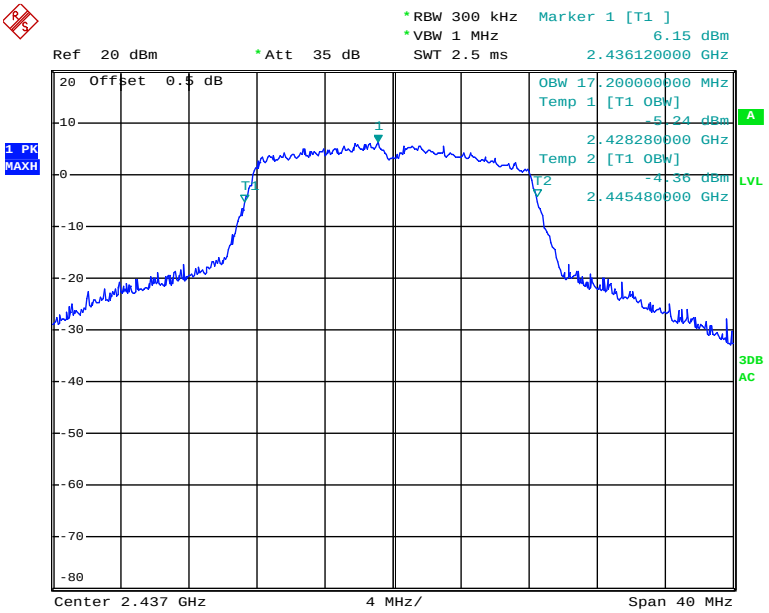
Date: 18.DEC.2017 15:34:33

802.11g Low Channel



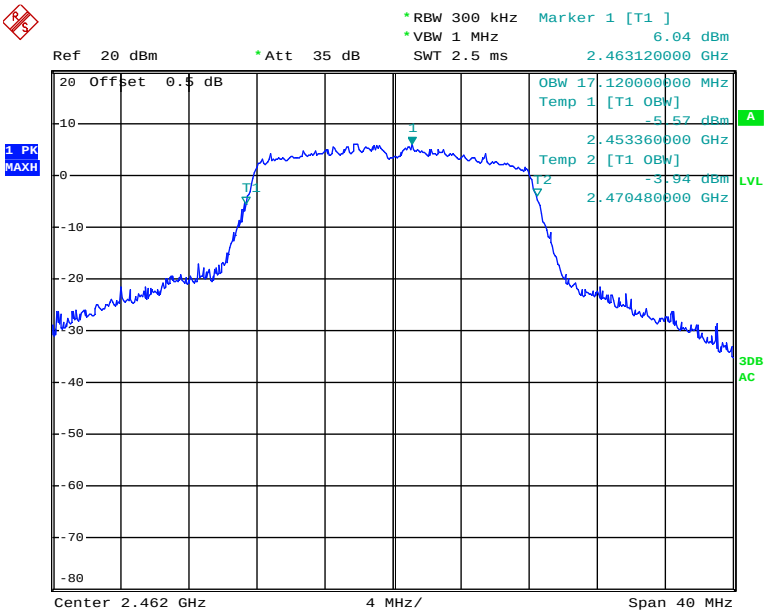
Date: 18.DEC.2017 15:37:53

802.11g Middle Channel



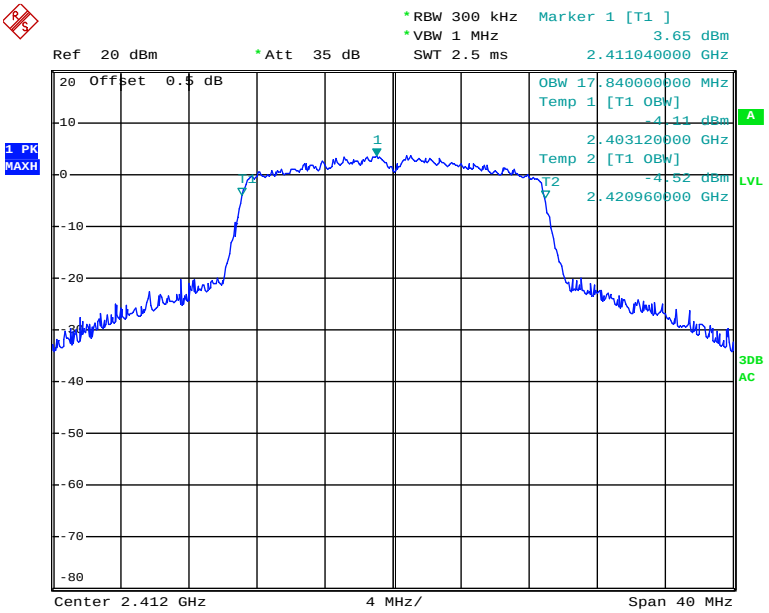
Date: 18.DEC.2017 15:41:25

802.11g High Channel



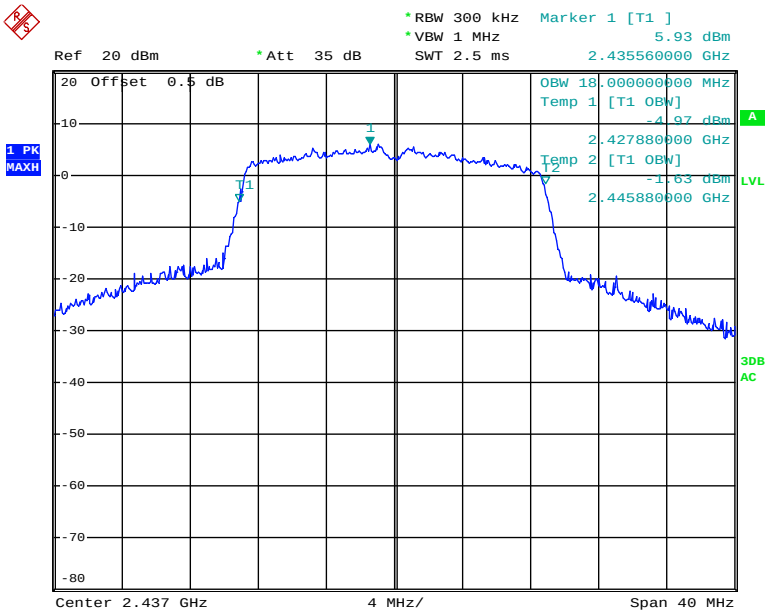
Date: 18.DEC.2017 15:44:22

802.11n ht20 Low Channel



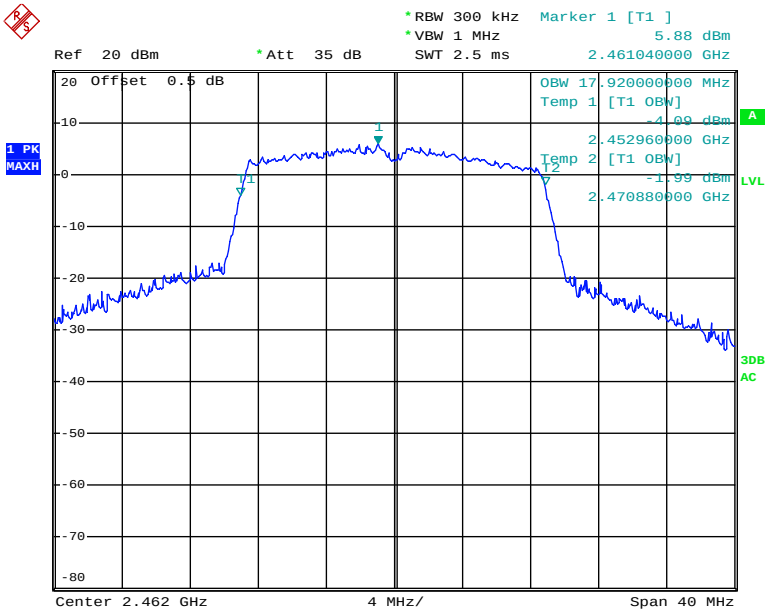
Date: 18.DEC.2017 15:48:09

802.11n ht20 Middle Channel



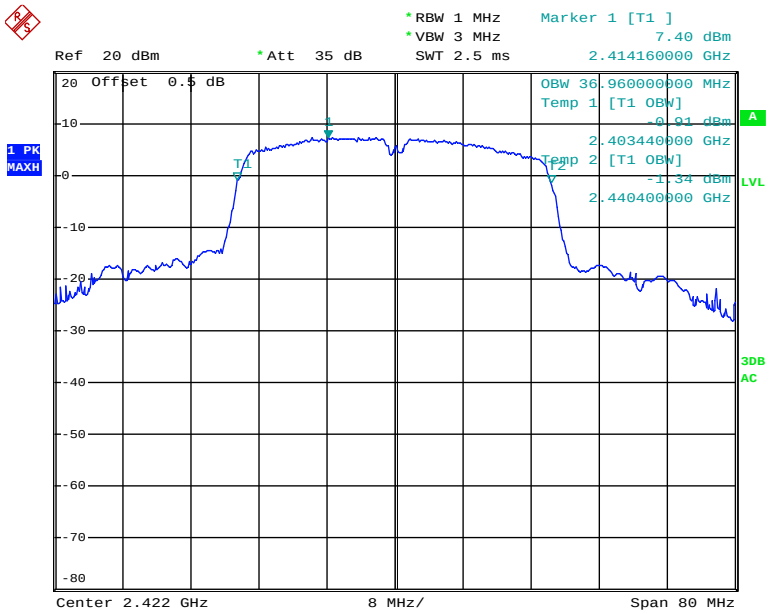
Date: 18.DEC.2017 15:51:54

802.11n ht20 High Channel



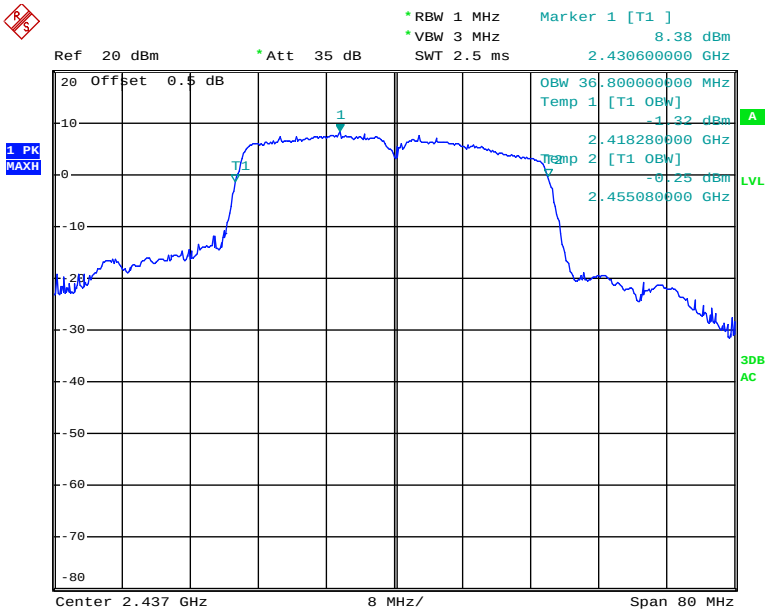
Date: 18.DEC.2017 15:55:25

802.11n ht40 Low Channel



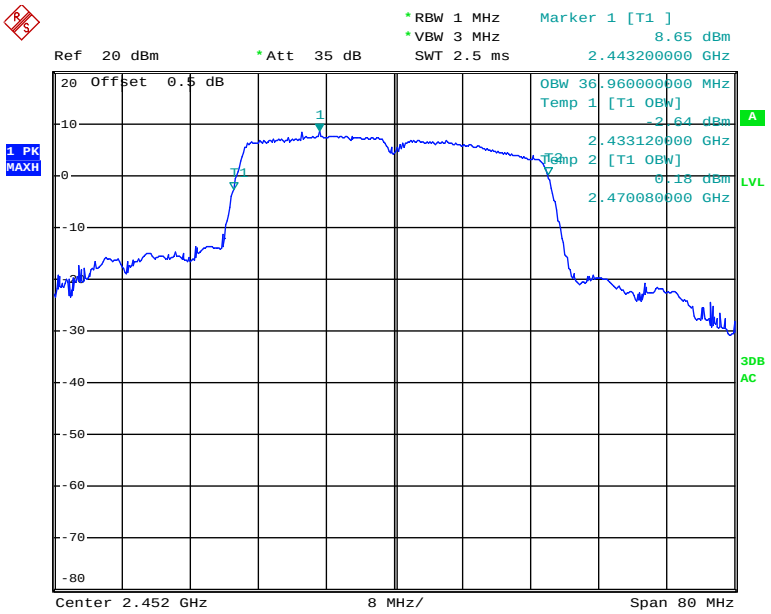
Date: 18.DEC.2017 15:59:32

802.11n ht40 Middle Channel



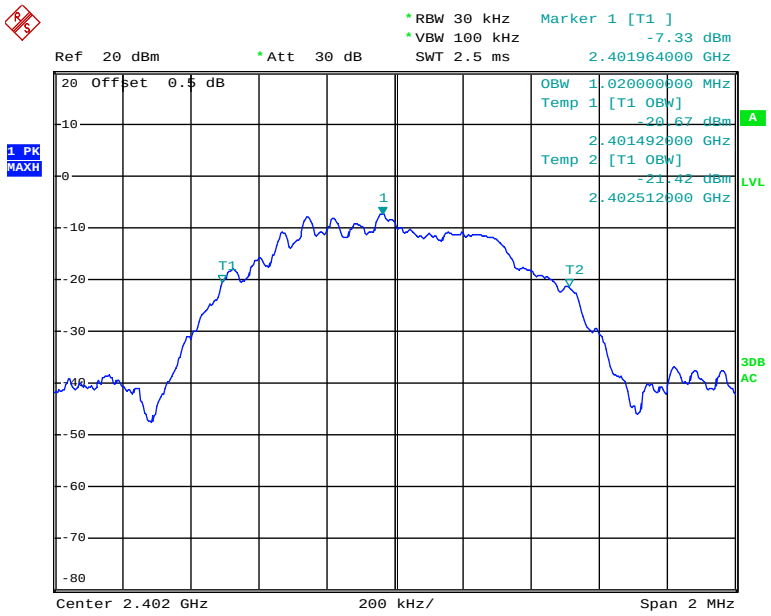
Date: 18.DEC.2017 16:02:46

802.11n ht40 High Channel



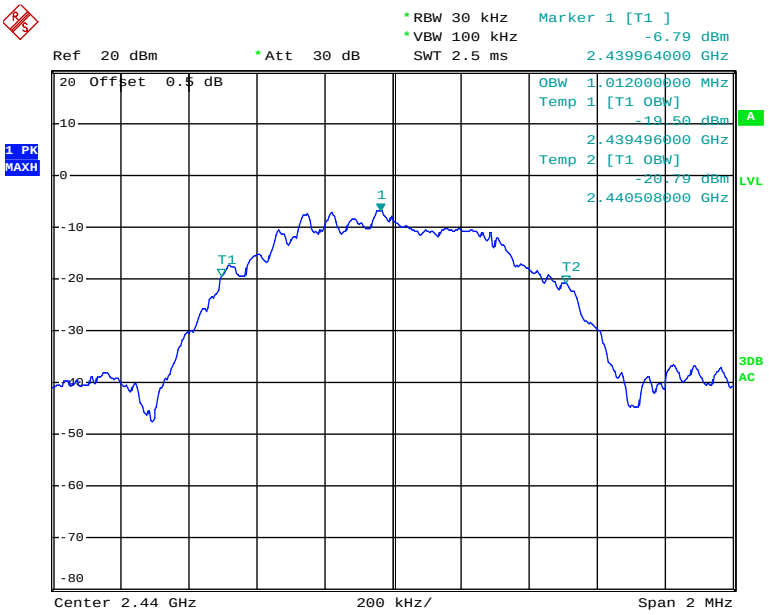
Date: 18.DEC.2017 16:08:49

BLE Low Channel



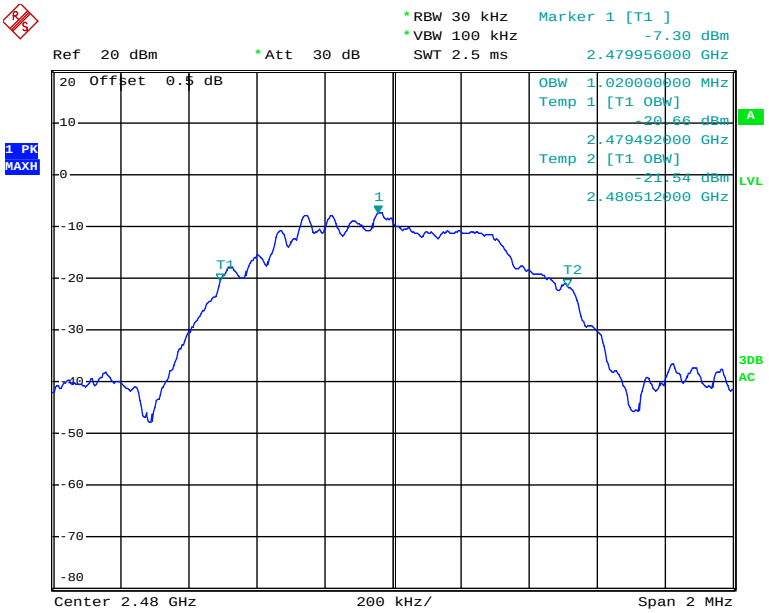
Date: 18.DEC.2017 14:10:22

BLE Middle Channel



Date: 18.DEC.2017 14:14:14

BLE High Channel



Date: 18.DEC.2017 14:12:33

FCC §15.247(b) (3) &RSS-247 §5.4 d) - MAXIMUM PEAK CONDUCTED OUTPUT POWER

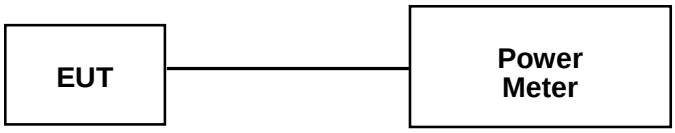
Applicable Standard

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.

According to RSS-247§5.4 d) For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(e), the e.i.r.p. shall not exceed 4 W.
As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling 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 transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to test equipment.
3. Add a correction factor to the display.
4. Set the power Meter to test Peak output power, record the result as peak power.
5. Set the power meter to test average output power, record the result as average power.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Wideband Power Sensor	N1921A	MY54210016	2017-11-03	2018-11-03
Agilent	Wideband Power Sensor	N1921A	MY54170013	2017-11-03	2018-11-03
Agilent	P-Series Power Meter	N1912A	MY5000448	2017-11-03	2018-11-03
N/A	Coaxial Cable	C-SJ00-0010	C0010/01	Each Time	/

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

Test Data

Environmental Conditions

Temperature:	22.3 °C
Relative Humidity:	35 %
ATM Pressure:	102.2 kPa

** The testing was performed by Emma Zhang on 2017-12-18.*

Test Mode: Transmitting

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

Test mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)	Max Conducted Average Output Power (dBm)	Limit (dBm)
802.11b	Low	2412	18.72	15.05	30
	Middle	2437	17.9	14.1	30
	High	2462	17.85	14.24	30
802.11g	Low	2412	18.97	9.66	30
	Middle	2437	20.79	11.42	30
	High	2462	20.81	11.42	30
802.11n ht20	Low	2412	18.8	9.59	30
	Middle	2437	20.69	11.32	30
	High	2462	20.74	11.42	30
802.11n ht40	Low	2422	20.49	9.93	30
	Middle	2437	20.58	10.15	30
	High	2452	20.83	10.04	30
BLE	Low	2402	-2.74	/	30
	Middle	2440	-2.1	/	30
	High	2480	-2.68	/	30

FCC §15.247(d) &RSS-247 §5.5– 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

Applicable Standard

According to FCC§15.247(d):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)).

According to RSS-247 §5.5:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	101121	2017-03-02	2018-03-02
N/A	Coaxial Cable	C-SJ00-0010	C0010/01	Each Time	/

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

Test Data

Environmental Conditions

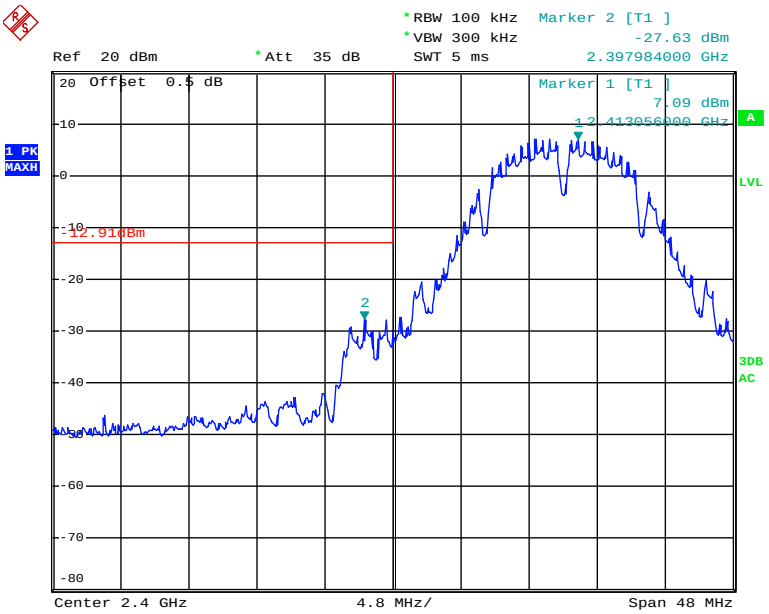
Temperature:	22.3 °C
Relative Humidity:	35 %
ATM Pressure:	102.2 kPa

** The testing was performed by Emma Zhang on 2017-12-18.*

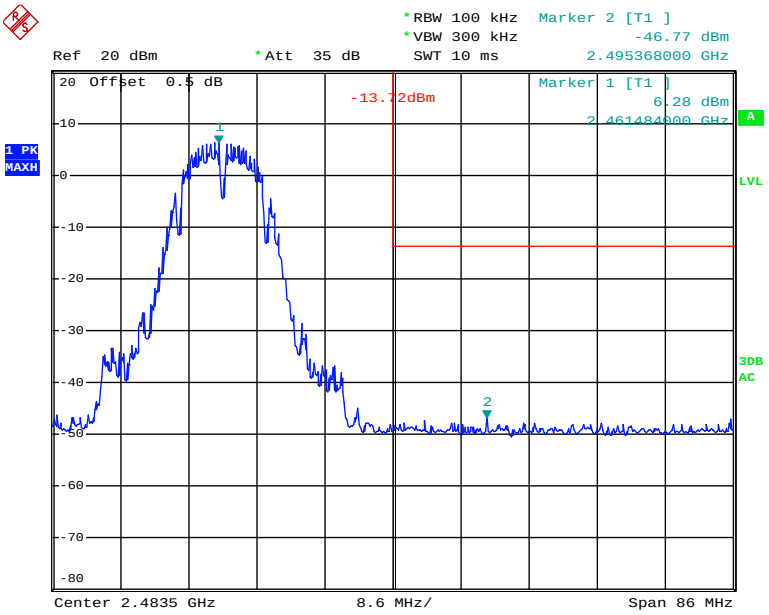
Test mode: Transmitting

Test Result: Compliant. Please refer to following plots.

802.11b: Band Edge, Left Side

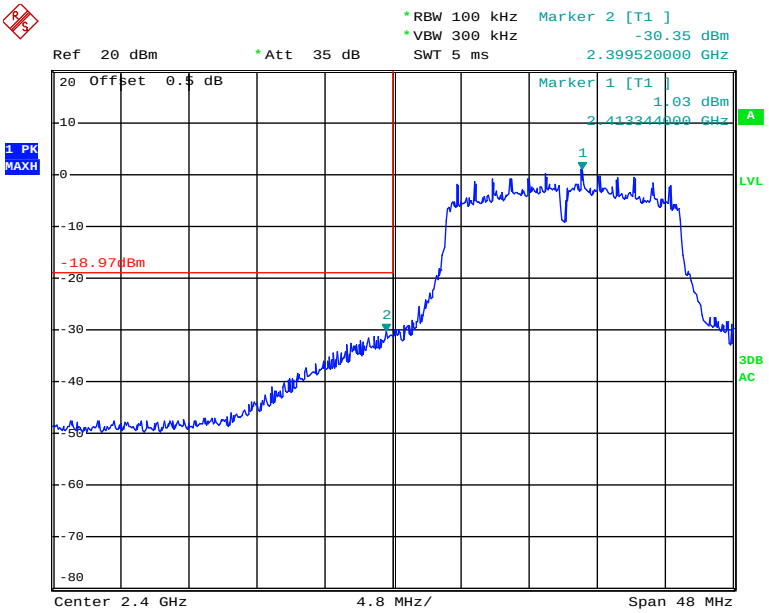


802.11b: Band Edge, Right Side



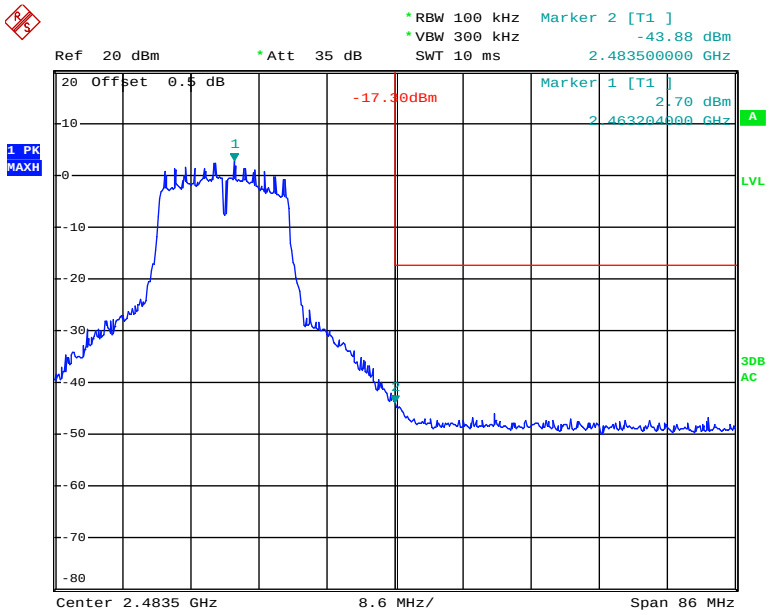
Date: 18.DEC.2017 15:36:21

802.11g: Band Edge, Left Side



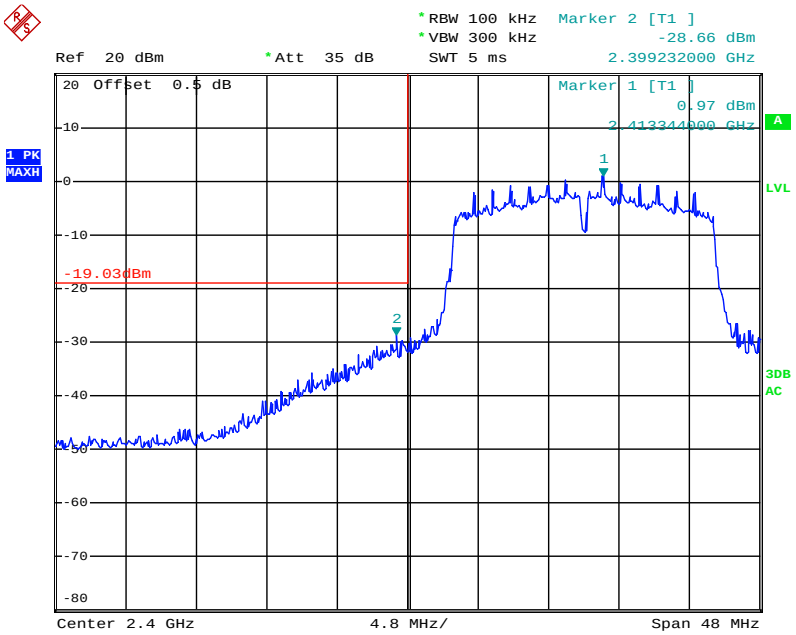
Date: 18.DEC.2017 15:39:44

802.11g: Band Edge, Right Side



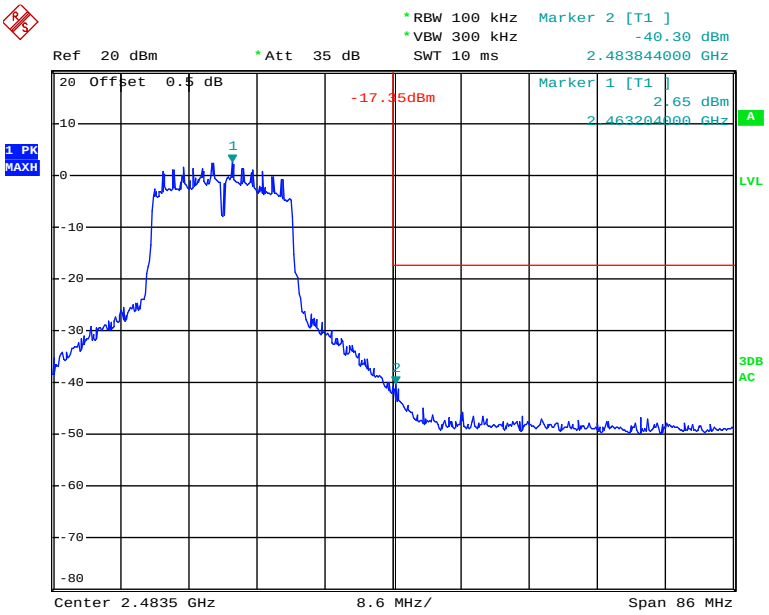
Date: 18.DEC.2017 15:46:24

802.11n ht20 Band Edge, Left Side



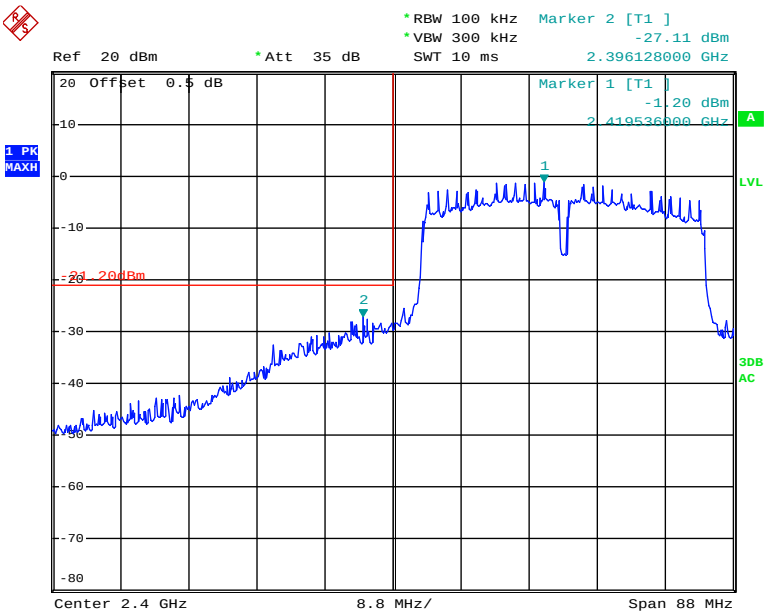
Date: 18.DEC.2017 15:50:07

802.11n ht20 Band Edge, Right Side



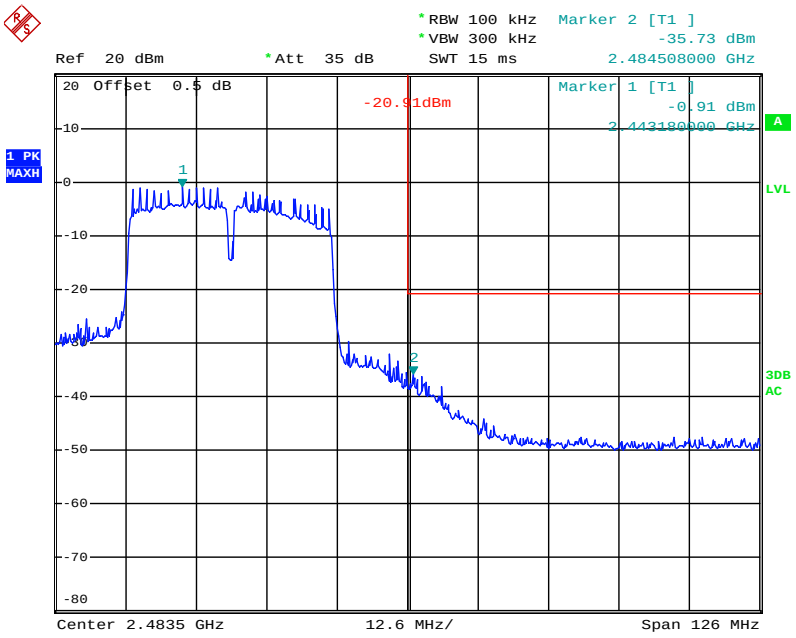
Date: 18.DEC.2017 15:57:29

802.11n ht40: Band Edge, Left Side



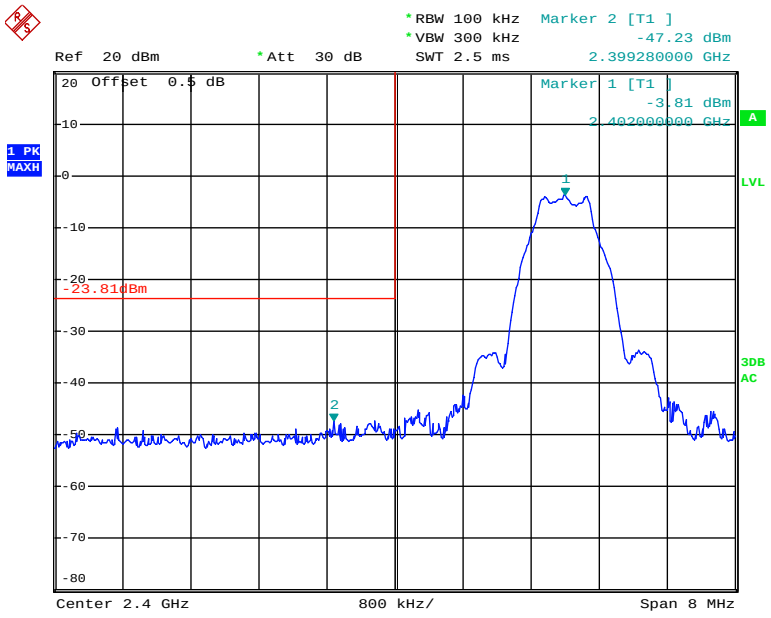
Date: 18.DEC.2017 16:01:11

802.11n ht40 Band Edge, Right Side



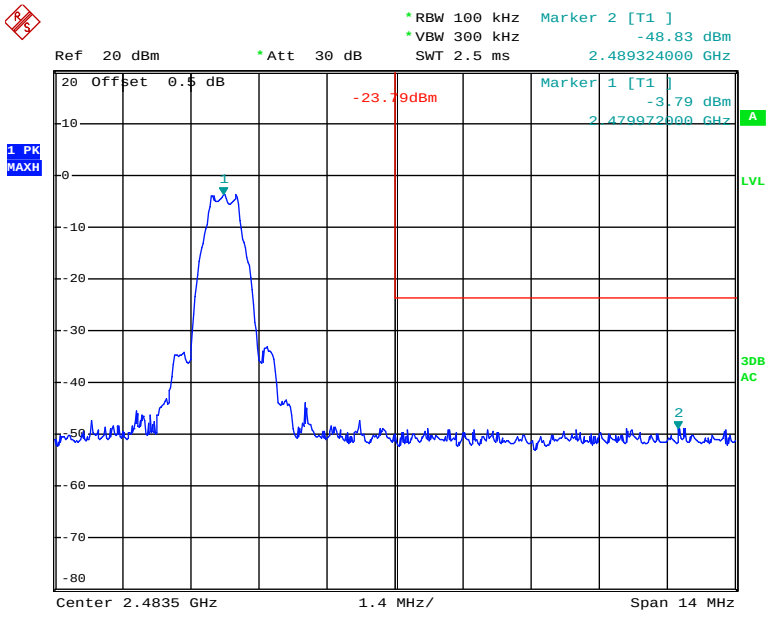
Date: 18.DEC.2017 16:11:09

BLE Band Edge, Left Side



Date: 18.DEC.2017 14:10:55

BLE Band Edge, Right Side



Date: 18.DEC.2017 14:13:06

FCC §15.247(e) &RSS-247 §5.2 b) - POWER SPECTRAL DENSITY

Applicable Standard

According to FCC§15.247(e): 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.

According to RSS-247 §5.2 b):

b) The transmitter power spectral density conducted from the transmitter 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 section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the RBW = 3 kHz, VBW = 10 kHz, Set the span to 1.5 times the DTS bandwidth.
4. Use the peak marker function to determine the maximum amplitude level.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	101121	2017-03-02	2018-03-02
N/A	Coaxial Cable	C-SJ00-0010	C0010/01	Each Time	/

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

Test Data

Environmental Conditions

Temperature:	22.3 °C
Relative Humidity:	35 %
ATM Pressure:	102.2 kPa

** The testing was performed by Emma Zhang from 2017-12-18 to 2018-01-19.*

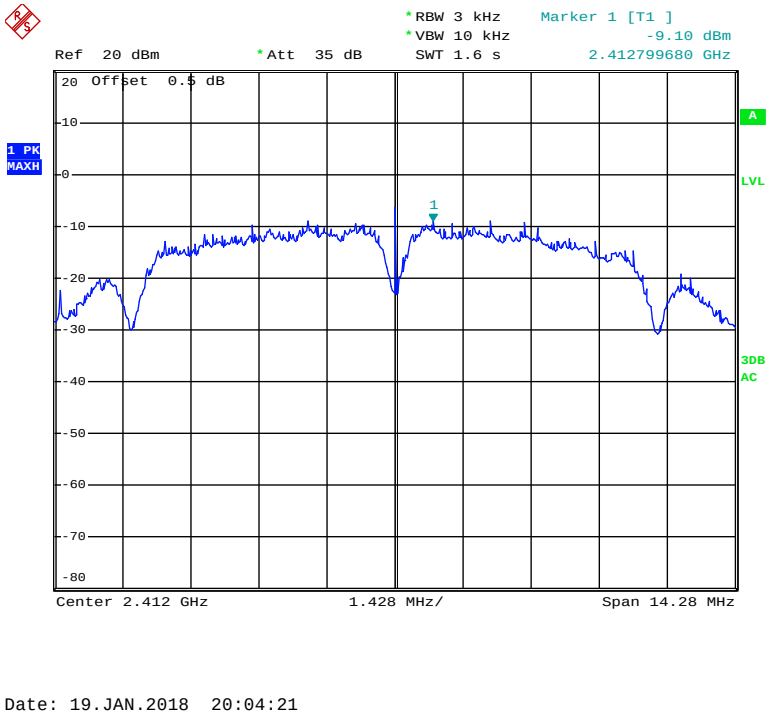
Test Result: Compliance

Test Mode: Transmitting

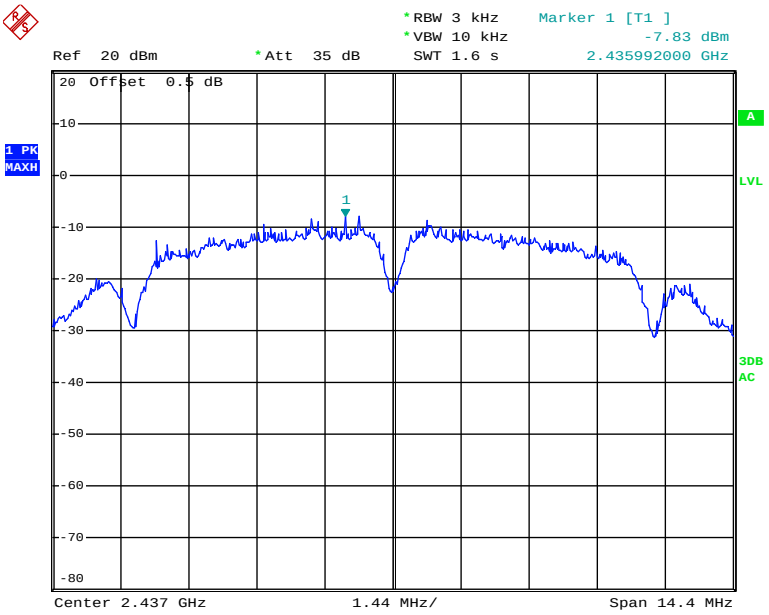
Test Result: Compliant. Please refer to the following table and plots

Test mode	Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
802.11b	Low	2412	-9.1	≤8
	Middle	2437	-7.83	≤8
	High	2462	-9.15	≤8
802.11g	Low	2412	-14.69	≤8
	Middle	2437	-12.31	≤8
	High	2462	-12.19	≤8
802.11n ht20	Low	2412	-14.46	≤8
	Middle	2437	-11.78	≤8
	High	2462	-12.55	≤8
802.11n ht40	Low	2422	-15.51	≤8
	Middle	2437	-16.07	≤8
	High	2452	-15.71	≤8
BLE	Low	2402	-18.29	≤8
	Middle	2440	-17.77	≤8
	High	2480	-18.3	≤8

Power Spectral Density, 802.11b Low Channel

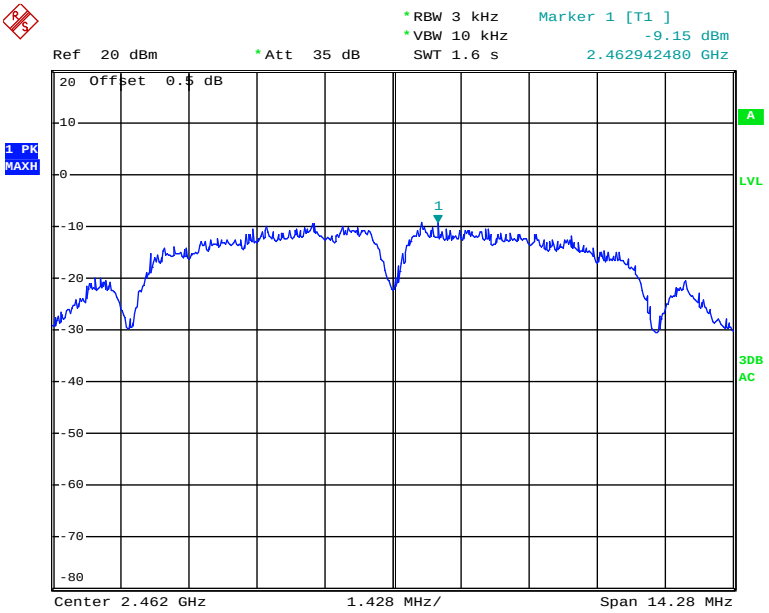


Power Spectral Density, 802.11b Middle Channel



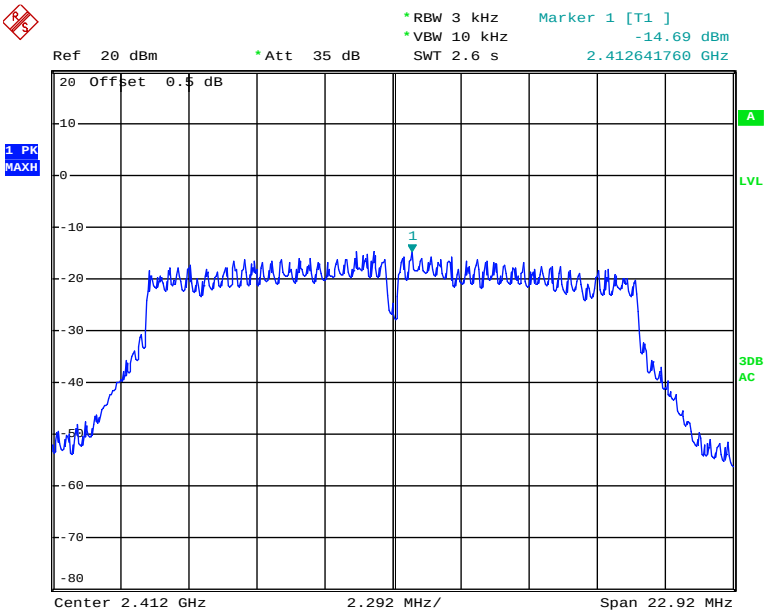
Date: 19.JAN.2018 20:08:32

Power Spectral Density, 802.11b High Channel



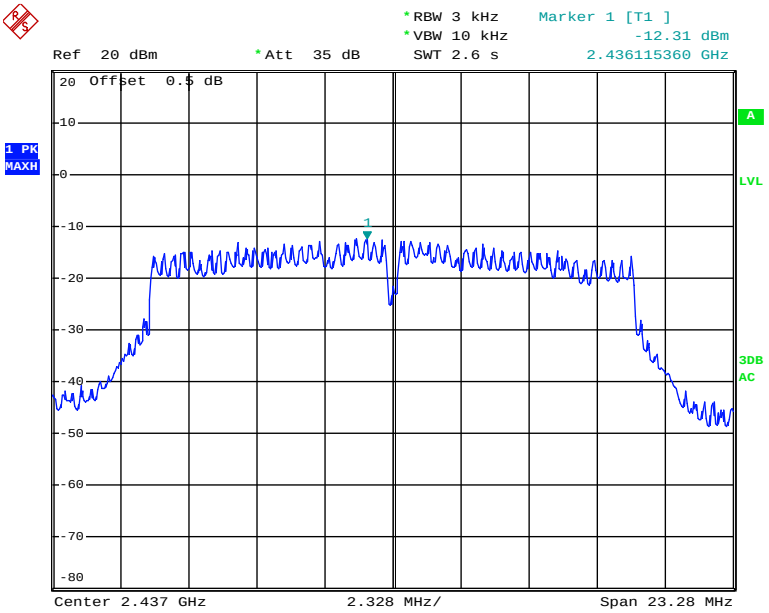
Date: 19.JAN.2018 20:09:40

Power Spectral Density, 802.11g Low Channel



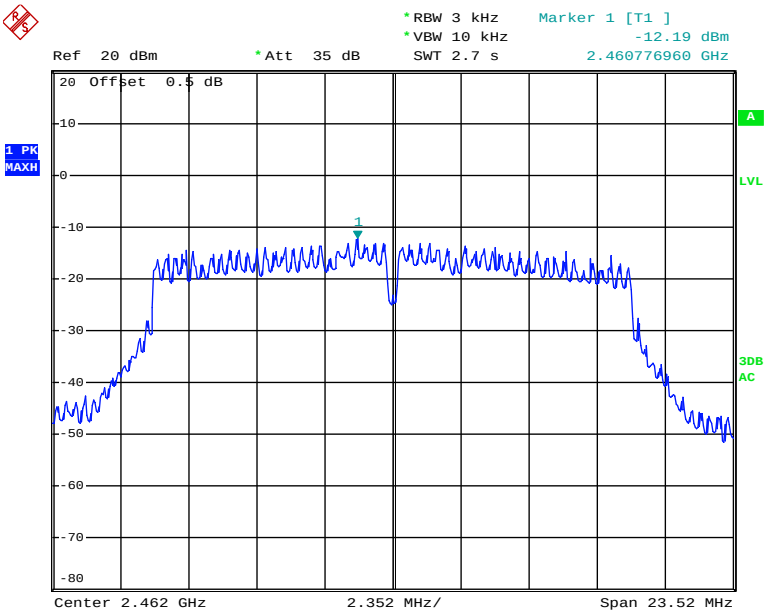
Date: 19.JAN.2018 20:11:43

Power Spectral Density, 802.11g Middle Channel



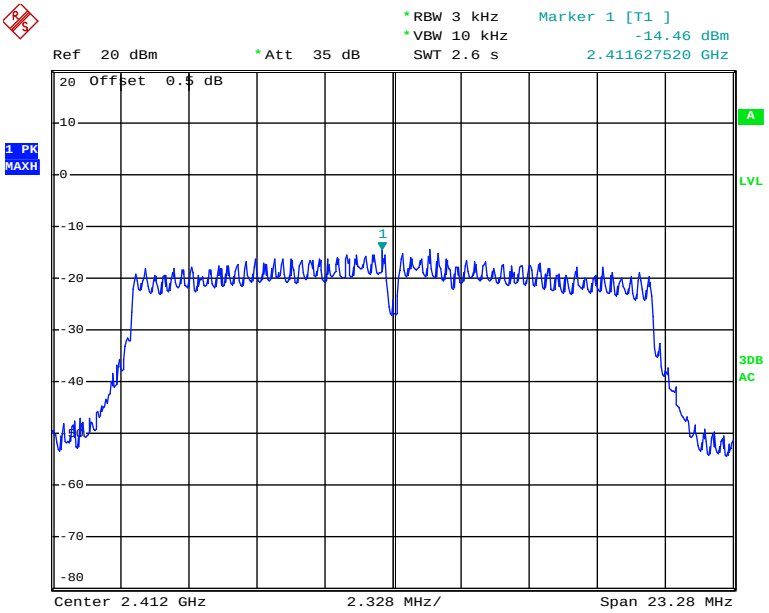
Date: 19.JAN.2018 20:15:25

Power Spectral Density, 802.11g High Channel



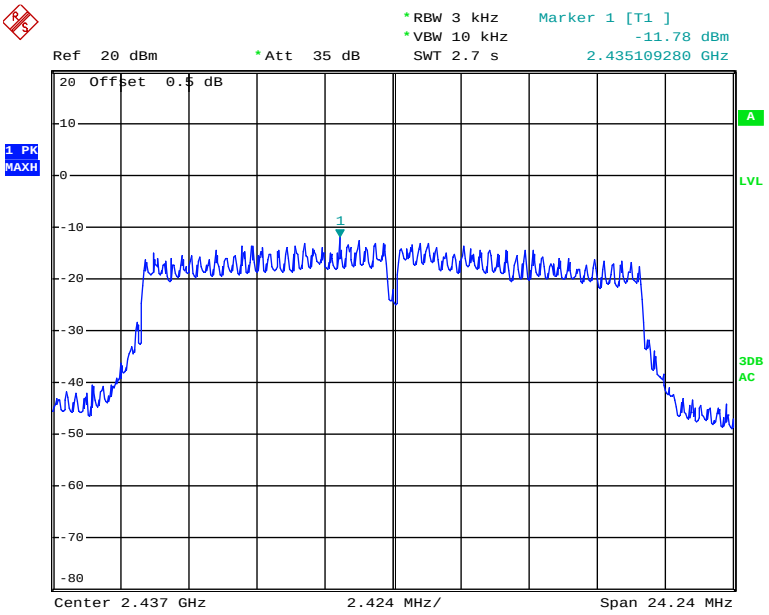
Date: 19.JAN.2018 20:17:13

Power Spectral Density, 802.11n ht20 Low Channel



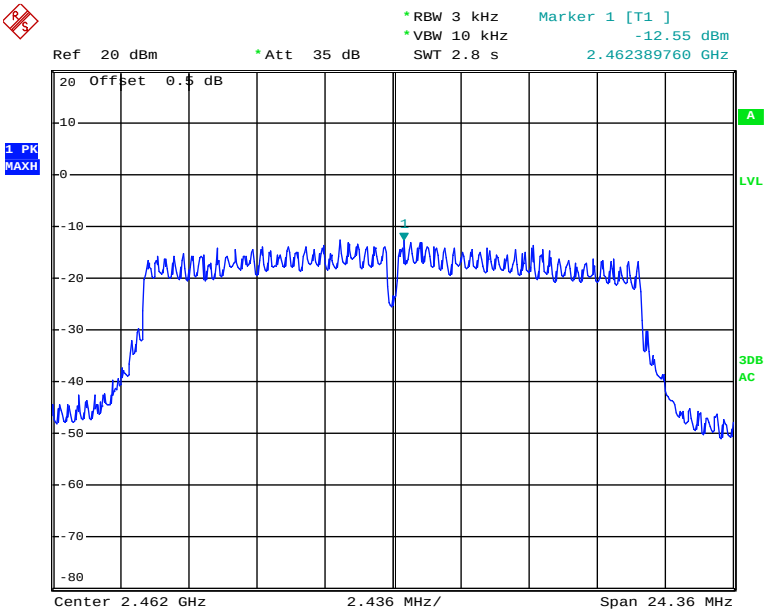
Date: 19.JAN.2018 20:19:22

Power Spectral Density, 802.11n ht20 Middle Channel



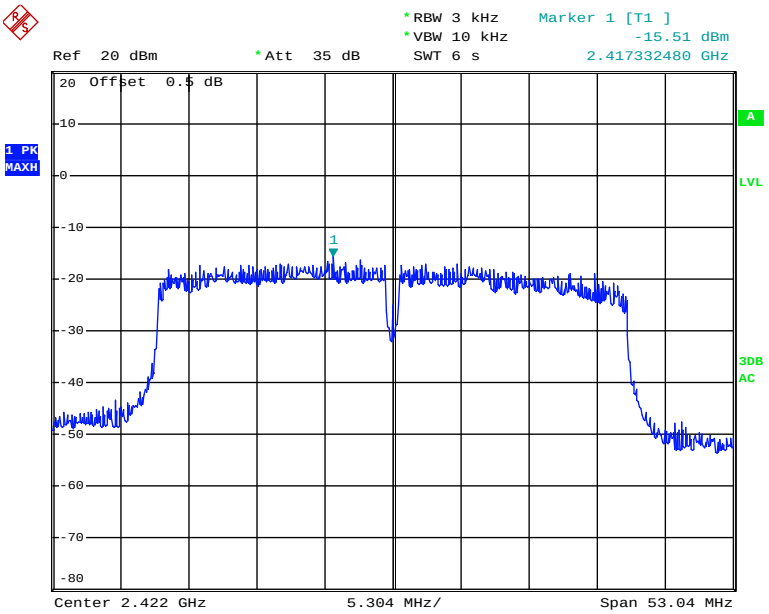
Date: 19.JAN.2018 20:21:11

Power Spectral Density, 802.11n ht20 High Channel



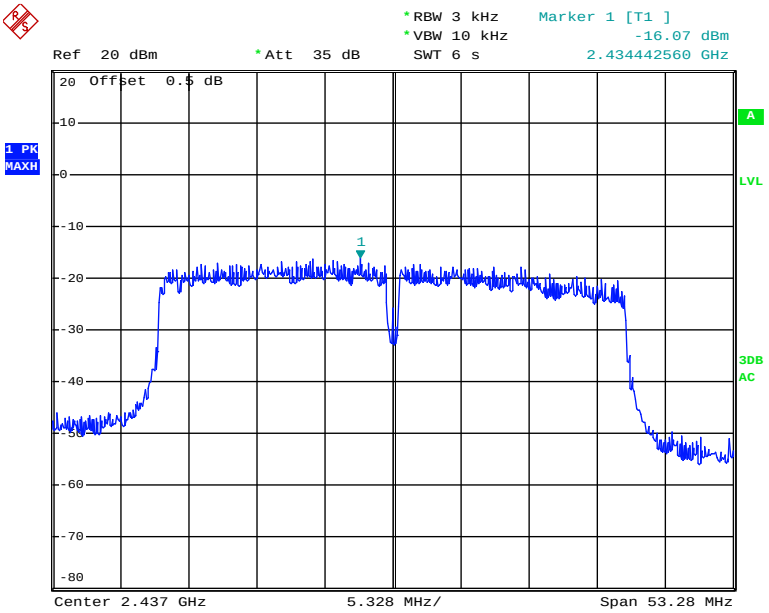
Date: 19.JAN.2018 20:23:17

Power Spectral Density, 802.11n ht40 Low Channel



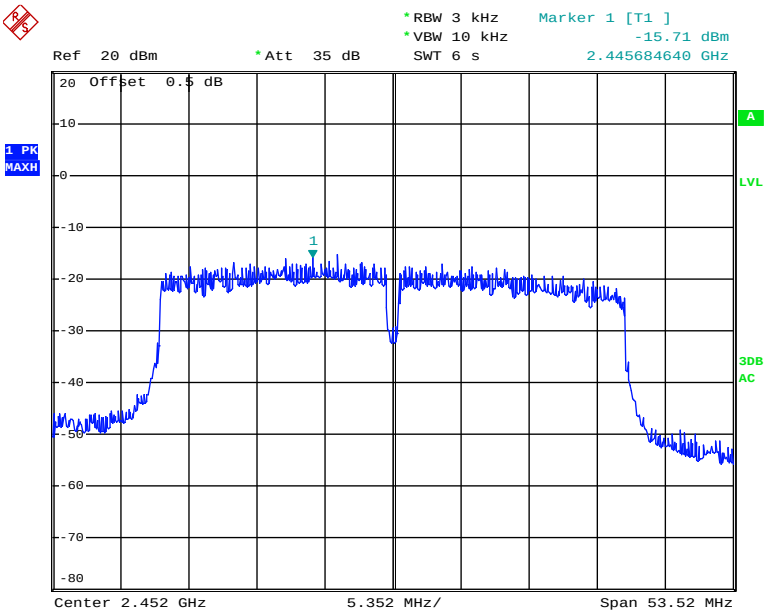
Date: 19.JAN.2018 20:26:51

Power Spectral Density, 802.11n ht40 Middle Channel



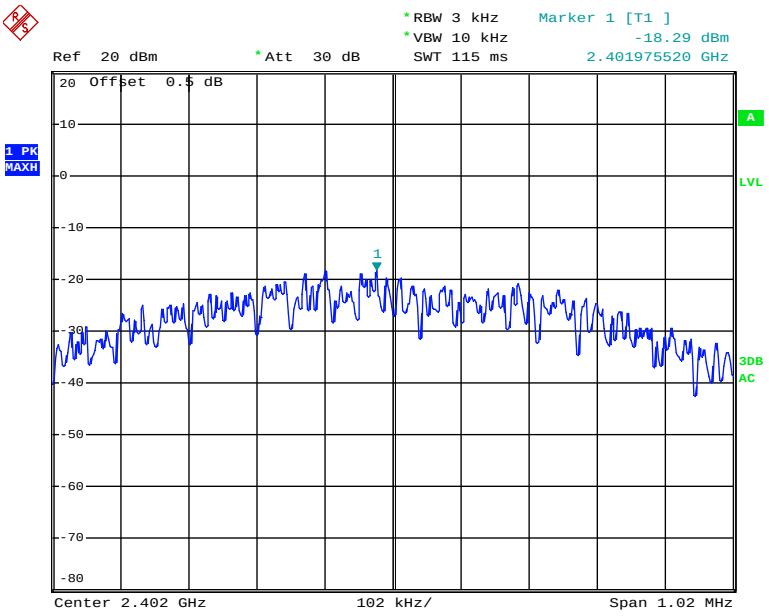
Date: 19.JAN.2018 20:31:15

Power Spectral Density, 802.11n ht40 High Channel



Date: 19.JAN.2018 20:38:26

Power Spectral Density, BLE Low Channel



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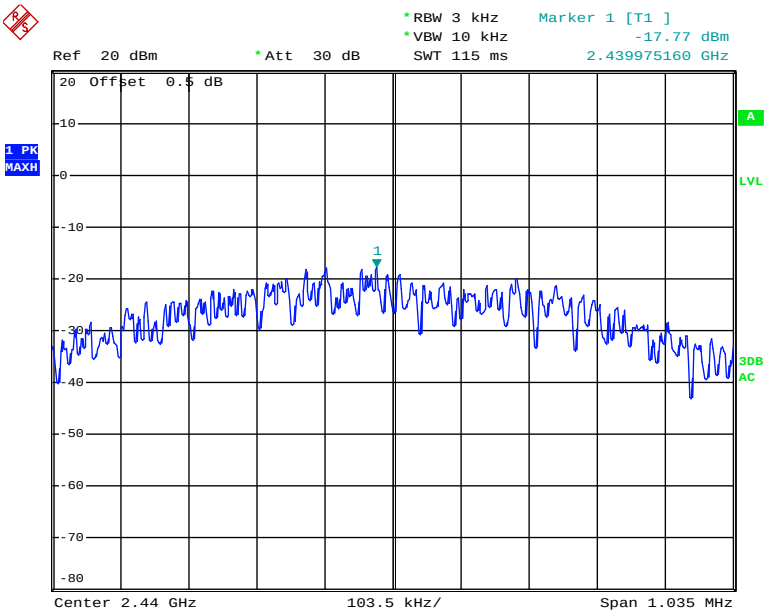
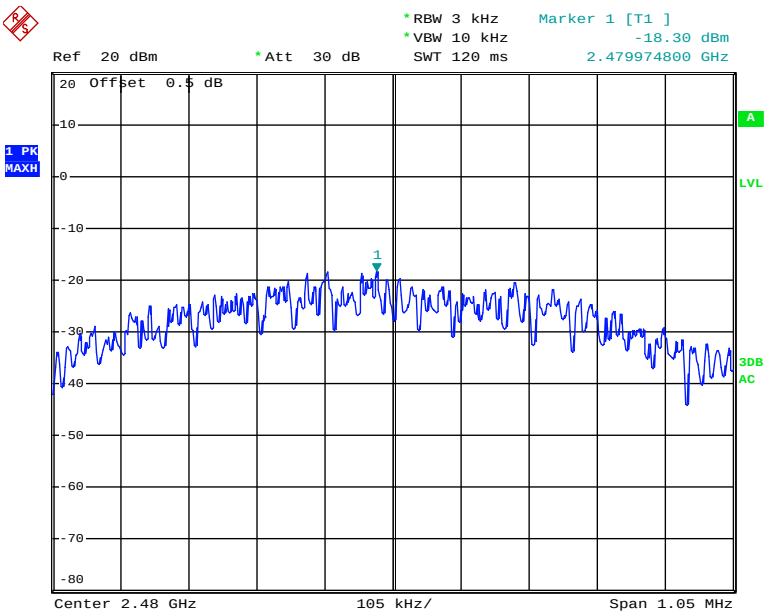
Power Spectral Density, BLE Middle Channel



Date: 18.DEC.2017 14:14:32

Power Spectral Density, BLE High Channel



Date: 18.DEC.2017 14:12:51

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