TESTING LABORATORY
CERTIFICATE #4820.01

FCC PART 15.247

TEST REPORT

For

Xiamen Ursalink Technology Co., Ltd.

4/F,NO. 63-2 Wanghai Road, 2nd Software Park,Xiamen ,China

FCC ID: 2AOSV-UR52-5

Report Type:	**Product Name:**
Original Report	Industrial Cellular Router

Report Number:	RXM180313053-00B
Report Date:	2018-08-21
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:		Industrial Cellular Router
EUT Model:		UR55
Multiple Model:		UR52
FCC ID:		2AOSV-UR52-5
Rated Input Voltage:		DC 12V from adapter
Adapter Information	**Model:**	OH-1015A1201000U1-UL
	Input:	100-240V~50/60Hz 350mA
	Output:	DC 12V 1A
External Dimension:		132mm(L)*103.8mm(W)*45mm(H)
Serial Number:		180313053-1(UR55) 180313053-2(UR52)
EUT Received Date:		2018.04.29

Note: The series product, model UR52 is electrically identical with model UR55, we selected UR55 for fully testing, the differences details was explained in the declaration letter.

Objective

This report is prepared on behalf of ***Xiamen Ursalink Technology Co., Ltd.*** in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communications Commission's rules.

The tests were performed in order to determine the compliance of the EUT with FCC Rules Part 15-Subpart C, section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

FCC Part 15E NII submissions with FCC ID: 2AOSV-UR52-5.
FCC Part 15B JBP submissions with FCC ID: 2AOSV-UR52-5.

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.

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: 4.55 dB,200M~1GHz: 5.92 dB,1G~6GHz: 4.98 dB, 6G~18GHz: 5.89 dB,18G~26.5G:5.47 dB,26.5G~40G:5.63 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.

The device has an external antenna for 2.4GHz and 5GHz. For 2.4GHz band, 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 802.11n ht20 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.

EUT Exercise Software

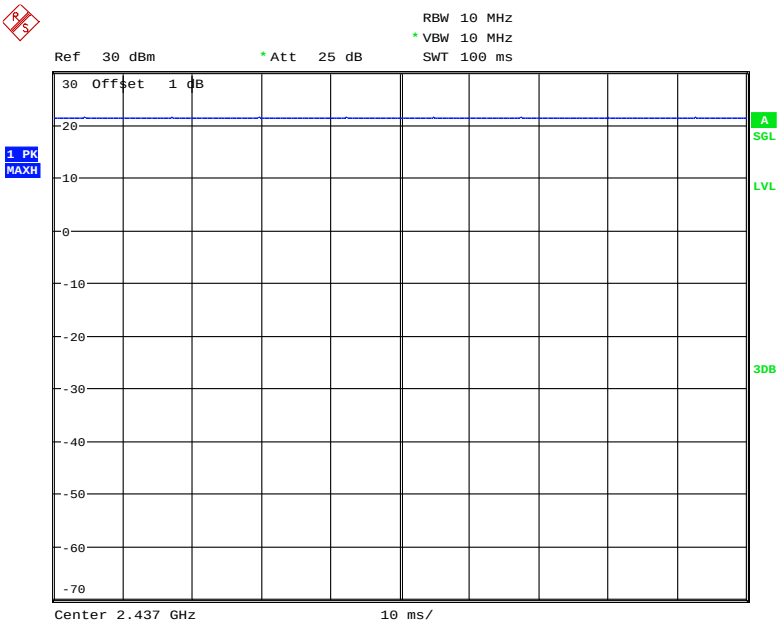
The software "QRCT Version3.0.265.0" was used for testing, which was provided by manufacturer. The maximum power was configured as below table, that provided by the manufacturer:

Software and version			QRCT Version3.0.265.0	
Mode	Channel	Frequency (MHz)	Data Rate	Power Level setting
802.11b	Low	2412	1 Mbps	17
	Middle	2437	1 Mbps	17
	High	2462	1 Mbps	17
802.11g	Low	2412	6 Mbps	17
	Middle	2437	6 Mbps	18
	High	2462	6 Mbps	16
802.11n ht20	Low	2412	MCS0	15
	Middle	2437	MCS0	18
	High	2462	MCS0	15
802.11n ht40	Low	2422	MCS0	13
	Middle	2437	MCS0	16
	High	2452	MCS0	13

The maximum duty cycle as following table:

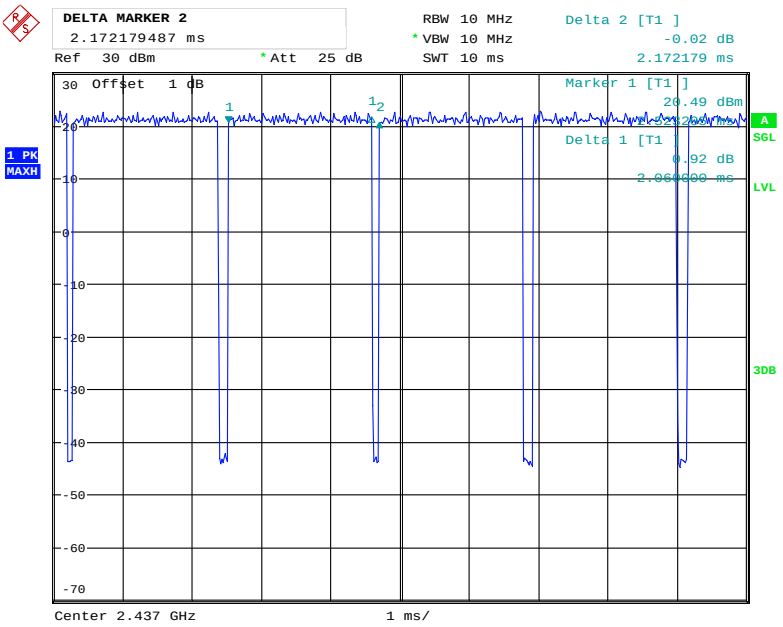
Test mode	T_{on} (ms)	T_{on+off} (ms)	Duty Cycle (%)
802.11b	100	100	100
802.11g	2.060	2.172	94.8
802.11n ht20	1.913	2.041	93.7
802.11n ht40	0.978	1.066	91.7

802.11b



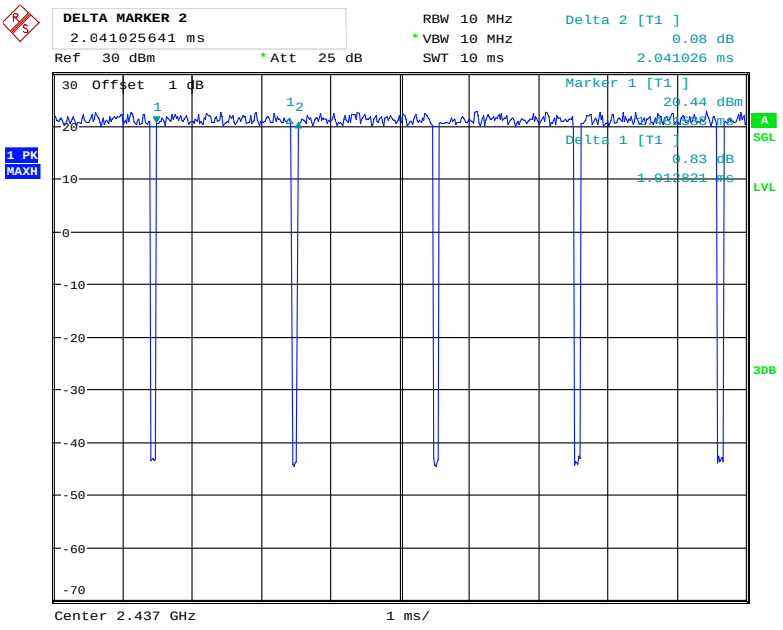
Date: 18.JUL.2018 22:14:33

802.11g



Date: 18.JUL.2018 22:13:35

802.11n ht20



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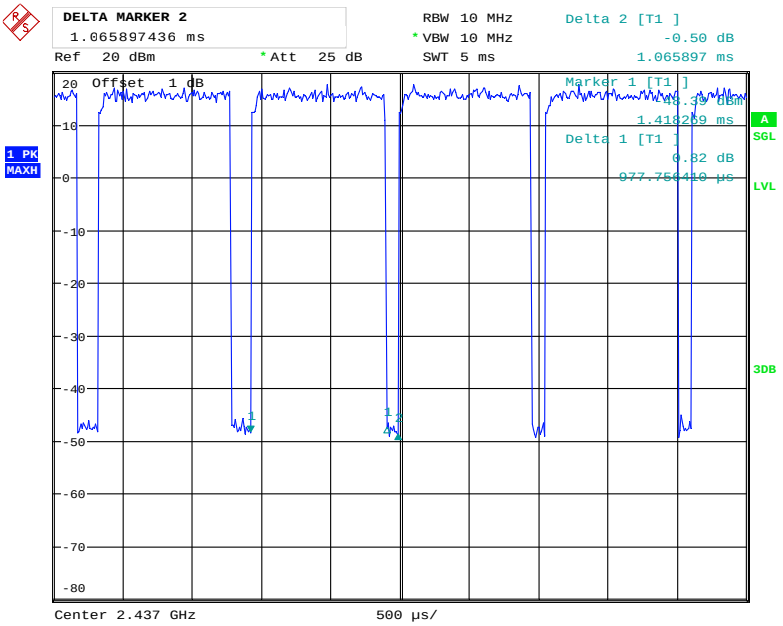
802.11n ht40



Equipment Modifications

No modification was made to the EUT.

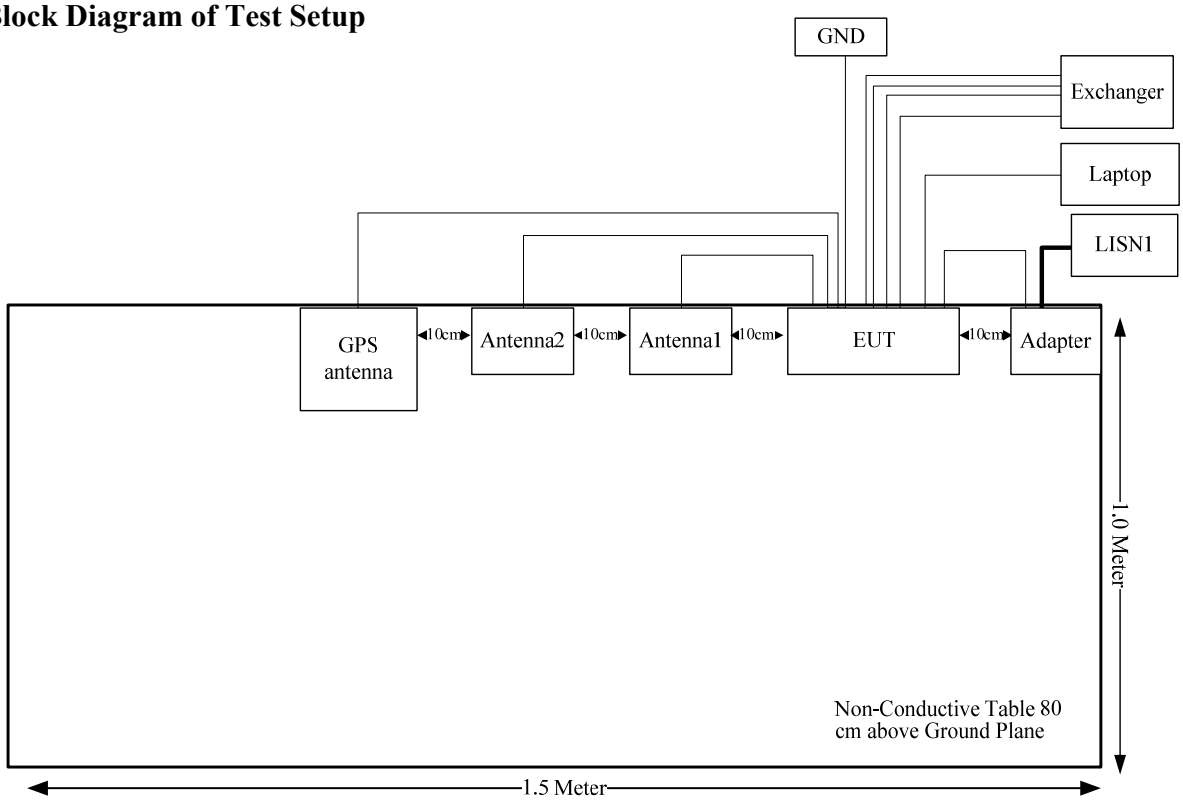
Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
DELL	Laptop	PP11L	HLKYGB1
TP-LINK	Exchanger	TL-SF1008P	114A297001782

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
RJ45 Cable	No	No	5	RJ45 Port of EUT	Laptop
RJ45 Cable	No	No	5	RJ45 Port of EUT	Exchanger
RJ45 Cable	No	No	5	RJ45 Port of EUT	Exchanger
RJ45 Cable	No	No	5	RJ45 Port of EUT	Exchanger
RJ45 Cable	No	No	5	RJ45 Port of EUT	Exchanger
Ground line	No	No	1.5	Gnd Port of EUT	ground
Antenna Cable	No	No	1.5	Antenna Port of EUT	Antenna 1
Antenna Cable	No	No	1.5	Antenna Port of EUT	Antenna 2
GPS antenna Cable	No	No	3	GPS Port of EUT	GPS antenna
Adapter Cable	No	Yes	1.5	Adapter	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

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

FCC §15.247 (i) & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

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

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

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f²)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

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

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

Calculation formula:

Prediction of power density at the distance of the applicable MPE limit
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

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

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

Calculated Data:

Frequency (MHz)	Antenna Gain		Conducted output power including Tune-up Tolerance		Evaluation Distance (cm)	Power Density (mW/cm^2)	S_{limit} (mW/cm^2)	S_i/S_{limit}
	(dBi)	(numeric)	(dBm)	(mW)				
2412-2462	3	2.00	24	251.19	20.00	0.10	1.00	0.10
824-849	2.5	1.78	23.5	223.87	20.00	0.08	0.55	0.14
1850-1910	3	2.00	24	251.19	20.00	0.10	1.00	0.10
1710-1755	3	2.00	24	251.19	20.00	0.10	1.00	0.10

The Wi-Fi function and LTE Module can transmit simultaneously.

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

$=S_{Wi\text{-}Fi}/S_{Wi\text{-}Fi}+ S_{WAN}/S_{limit\ WAN}$

$= 0.10+0.14=0.24<1$

Result: The device meet FCC MPE at 20 cm distance

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

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

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.
c. Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

Antenna Connector Construction

The EUT have one external antenna, and the antenna gain is 3dBi, the EUT requires professional installation. Please refer to the professional installation statement letter.

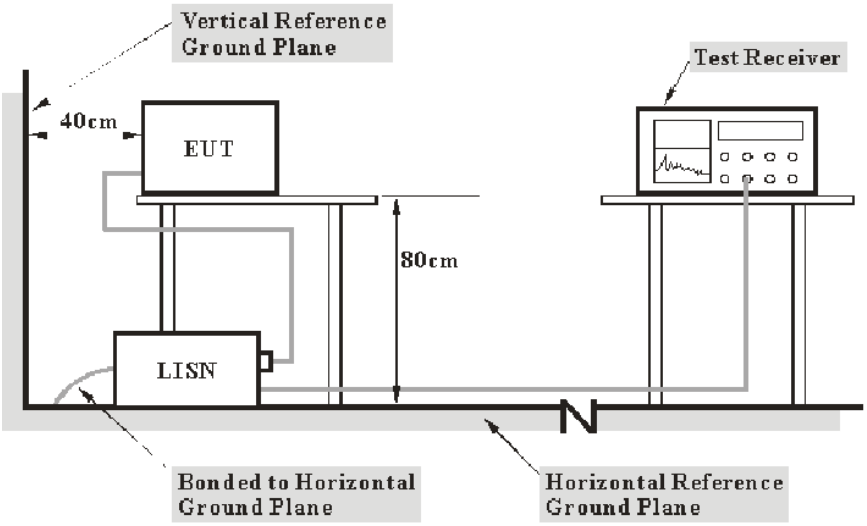
Result: Compliance.

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

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	3560.6550.12	2017-12-08	2018-12-08
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A
Unknown	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

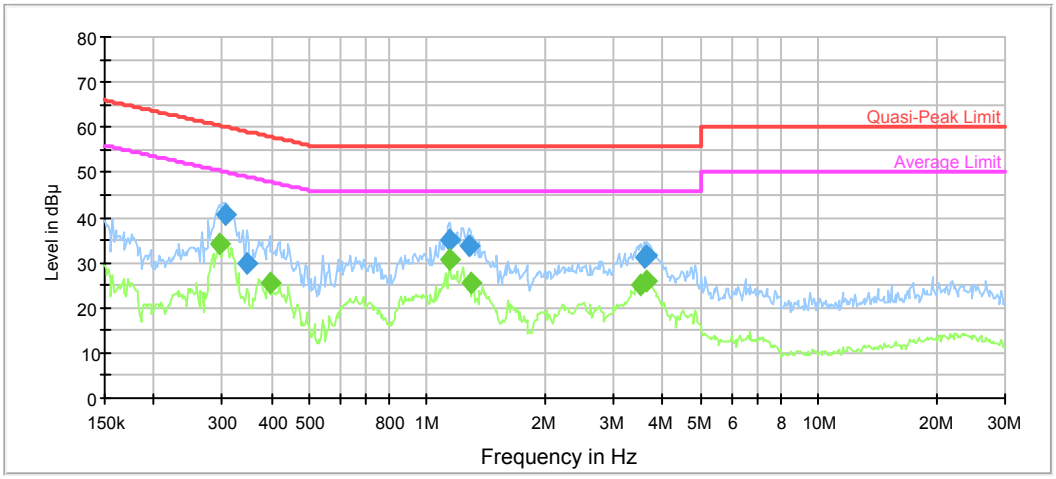
Temperature:	28.6 °C
Relative Humidity:	58 %
ATM Pressure:	100 kPa

The testing was performed by Alex You on 2018-07-13.

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

Model: UR55

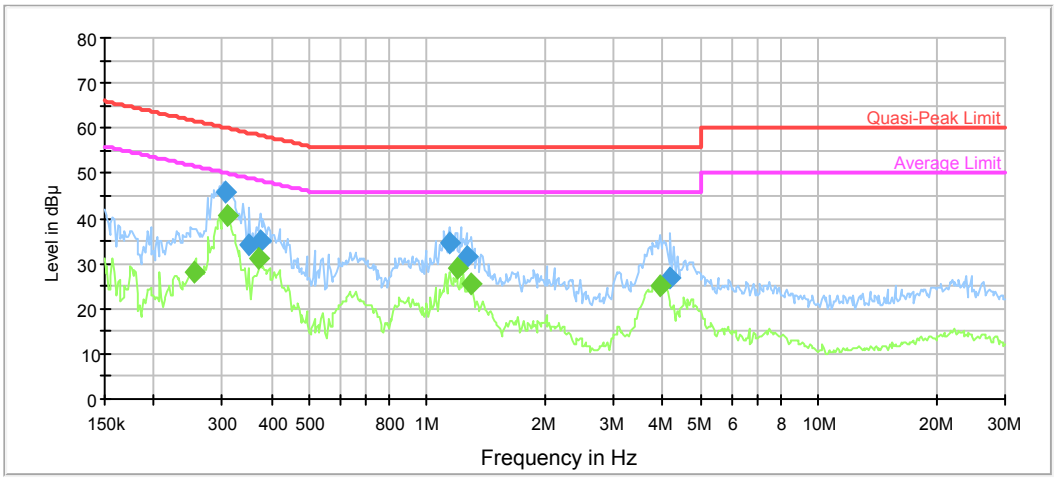
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.304845	40.7	9.000	L1	10.1	19.4	60.1	Compliance
0.346296	29.9	9.000	L1	10.0	29.1	59.1	Compliance
1.144267	34.9	9.000	L1	9.8	21.1	56.0	Compliance
1.279307	33.7	9.000	L1	9.8	22.3	56.0	Compliance
3.575883	31.2	9.000	L1	9.8	24.8	56.0	Compliance
3.633326	31.8	9.000	L1	9.8	24.2	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.295282	34.2	9.000	L1	10.2	16.1	50.4	Compliance
0.396530	25.4	9.000	L1	10.0	22.6	47.9	Compliance
1.144267	30.6	9.000	L1	9.8	15.4	46.0	Compliance
1.289541	25.4	9.000	L1	9.8	20.6	46.0	Compliance
3.519348	25.3	9.000	L1	9.8	20.7	46.0	Compliance
3.633326	25.9	9.000	L1	9.8	20.1	46.0	Compliance

AC120 V, 60 Hz, Neutral:

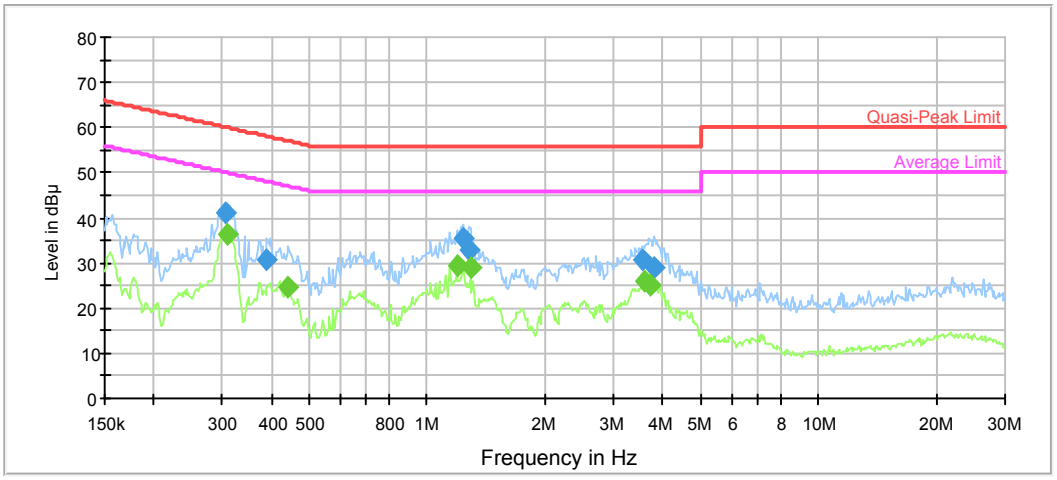


Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.304845	45.8	9.000	N	10.1	14.3	60.1	Compliance
0.351859	34.4	9.000	N	10.0	24.5	58.9	Compliance
0.375019	35.1	9.000	N	10.0	23.3	58.4	Compliance
1.144267	34.4	9.000	N	9.8	21.6	56.0	Compliance
1.259081	31.6	9.000	N	9.8	24.4	56.0	Compliance
4.193667	26.8	9.000	N	9.8	29.2	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.253797	27.9	9.000	N	10.3	23.7	51.6	Compliance
0.307284	40.7	9.000	N	10.1	9.3	50.0	Compliance
0.372042	31.0	9.000	N	10.0	17.4	48.5	Compliance
1.190776	29.0	9.000	N	9.8	17.0	46.0	Compliance
1.289541	25.6	9.000	N	9.8	20.4	46.0	Compliance
3.934683	25.0	9.000	N	9.8	21.0	46.0	Compliance

Model: UR52

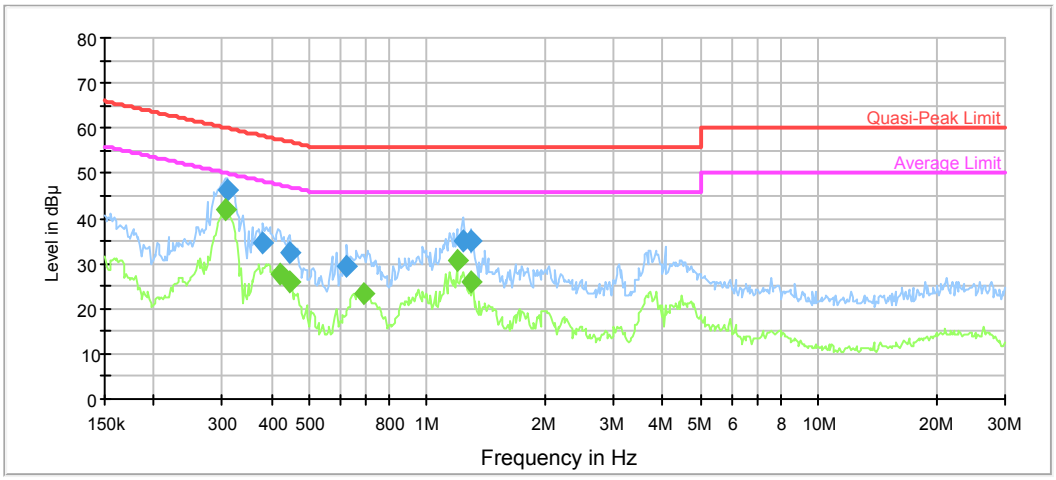
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.304845	41.2	9.000	L1	10.1	18.9	60.1	Compliance
0.390261	30.5	9.000	L1	10.0	27.6	58.1	Compliance
1.239175	35.4	9.000	L1	9.8	20.6	56.0	Compliance
1.279307	33.0	9.000	L1	9.8	23.0	56.0	Compliance
3.547503	30.7	9.000	L1	9.8	25.3	56.0	Compliance
3.811251	28.9	9.000	L1	9.8	27.1	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.307284	36.5	9.000	L1	10.1	13.5	50.0	Compliance
0.443327	24.8	9.000	L1	9.9	22.2	47.0	Compliance
1.190776	29.3	9.000	L1	9.8	16.7	46.0	Compliance
1.289541	29.0	9.000	L1	9.8	17.0	46.0	Compliance
3.575883	26.1	9.000	L1	9.8	19.9	46.0	Compliance
3.721226	25.0	9.000	L1	9.8	21.0	46.0	Compliance

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.307284	46.2	9.000	N	10.1	13.8	60.0	Compliance
0.381043	34.8	9.000	N	10.0	23.5	58.3	Compliance
0.446873	32.6	9.000	N	9.9	24.3	56.9	Compliance
0.624492	29.3	9.000	N	9.8	26.7	56.0	Compliance
1.239175	35.0	9.000	N	9.8	21.0	56.0	Compliance
1.289541	35.0	9.000	N	9.8	21.0	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.304845	41.9	9.000	N	10.1	8.2	50.1	Compliance
0.422630	27.8	9.000	N	9.9	19.6	47.4	Compliance
0.446873	26.0	9.000	N	9.9	20.9	46.9	Compliance
0.687153	23.2	9.000	N	9.8	22.8	46.0	Compliance
1.190776	30.7	9.000	N	9.8	15.3	46.0	Compliance
1.289541	26.1	9.000	N	9.8	19.9	46.0	Compliance

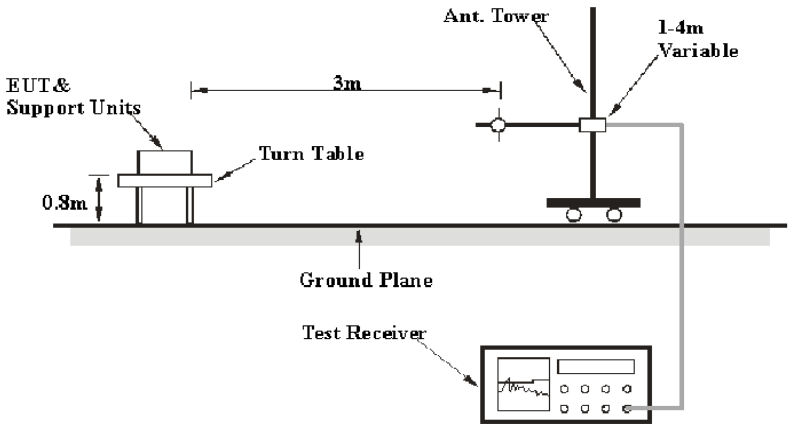
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

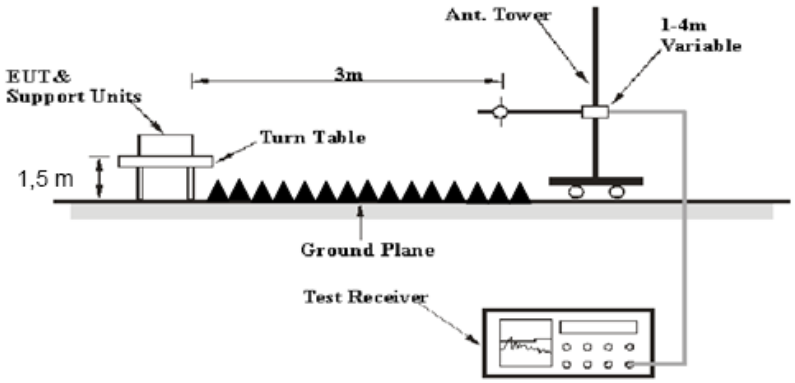
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission Below 1GHz tests were performed in the 10 meters chamber, above 1GHz tests were performed in the 3 meters chamber test site B, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 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.

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	100035	2017-08-04	2018-08-04
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Sunol Sciences	Antenna	JB3	A060611-3	2017-07-21	2019-07-21
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-02	2017-09-05	2018-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-02	2017-09-05	2018-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-2200-01	2017-09-05	2018-09-05
HP	Amplifier	8447F	2443A01912	2017-09-05	2018-09-05
Agilent	Spectrum Analyzer	E4440A	SG43360054	2018-01-04	2019-01-04
R&S	Spectrum Analyzer	FSP 38	100478	2017-12-08	2018-12-08
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
ETS-Lindgren	Horn Antenna	3115	000 527 35	2016-01-05	2019-01-04
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-01 1304	2016-11-18	2019-11-18
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2017-09-05	2018-09-05
Unknown	Coaxial Cable	C-2.4J2.4J-50	C-0700-02	2018-06-27	2019-06-27
MITEQ	Amplifier	AFS42-00101800-25-S-42	2001271	2017-09-05	2018-09-05
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2018-06-27	2019-06-27
Sinoscite	Bandstop Filters	BSF5150-5850MN-0899-003	0899003	2018-05-06	2019-05-06
Mini Circuits	High Pass Filter	VHF-6010+	31118	2018-06-16	2019-06-16

*** 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:	26.1~26.7 °C
Relative Humidity:	39~58 %
ATM Pressure:	100.1~101.1 kPa

** The testing was performed by Vito Chen & Tyler Pan from 2018-07-17 to 2018-07-19.*

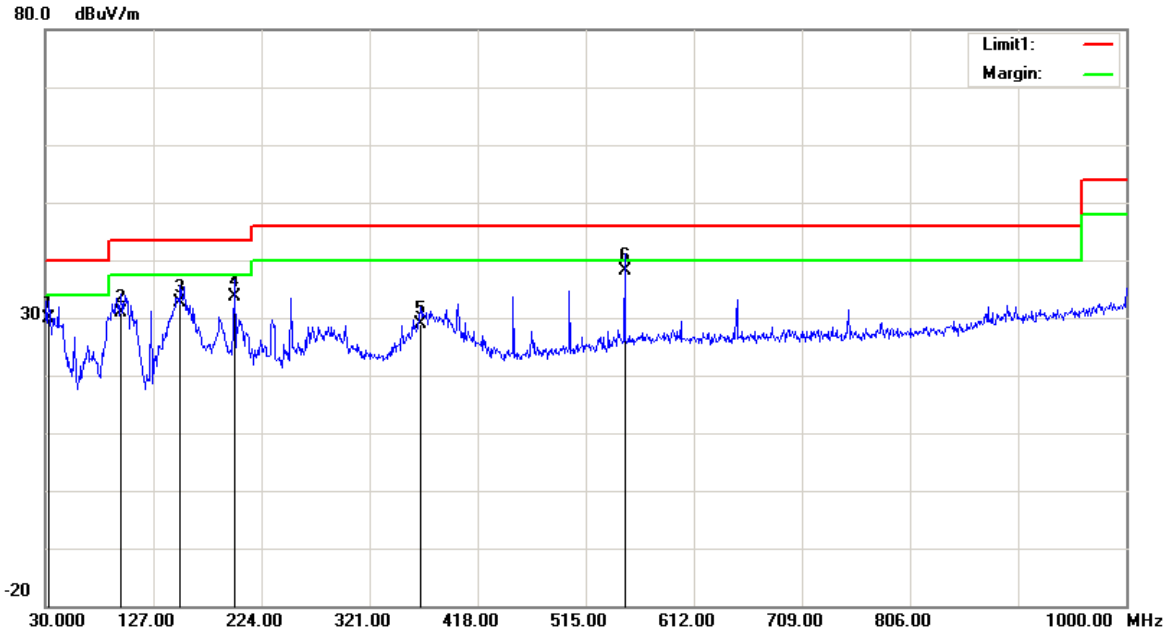
Test Result: Compliance, please Refer to the following data

Test Mode: Transmitting

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

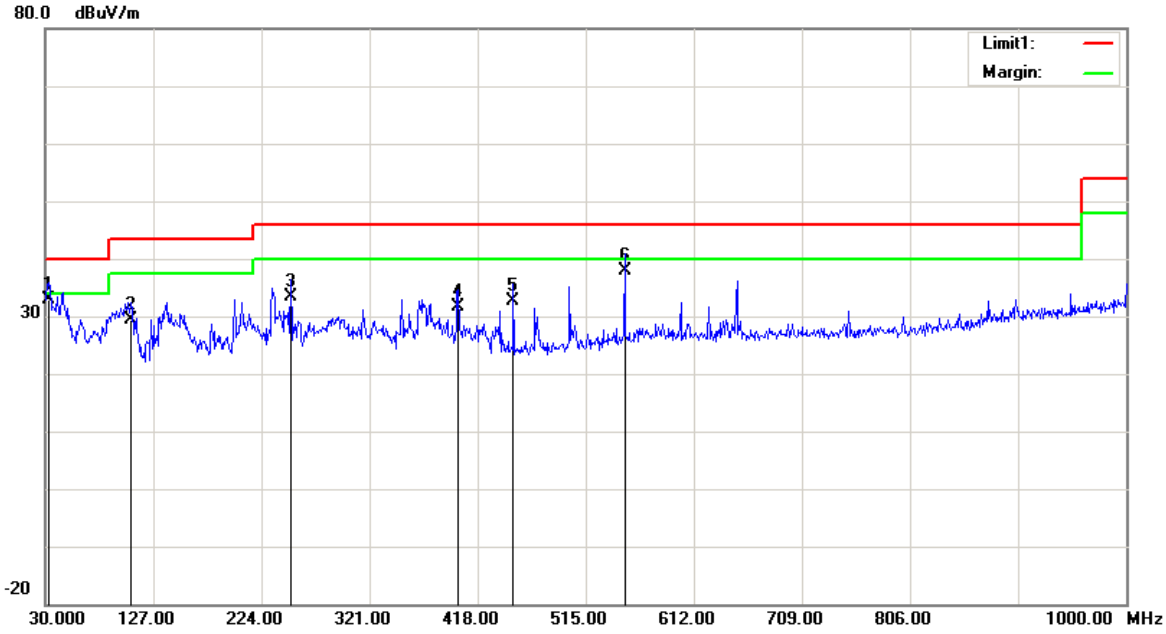
Model: UR55

Horizontal:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
32.9100	33.32	QP	-3.42	29.90	40.00	10.10
97.9000	42.88	QP	-11.88	31.00	43.50	12.50
151.2500	39.61	QP	-6.91	32.70	43.50	10.80
199.7500	40.46	QP	-6.86	33.60	43.50	9.90
366.5900	31.97	QP	-3.07	28.90	46.00	17.10
549.9200	36.34	QP	1.76	38.10	46.00	7.90

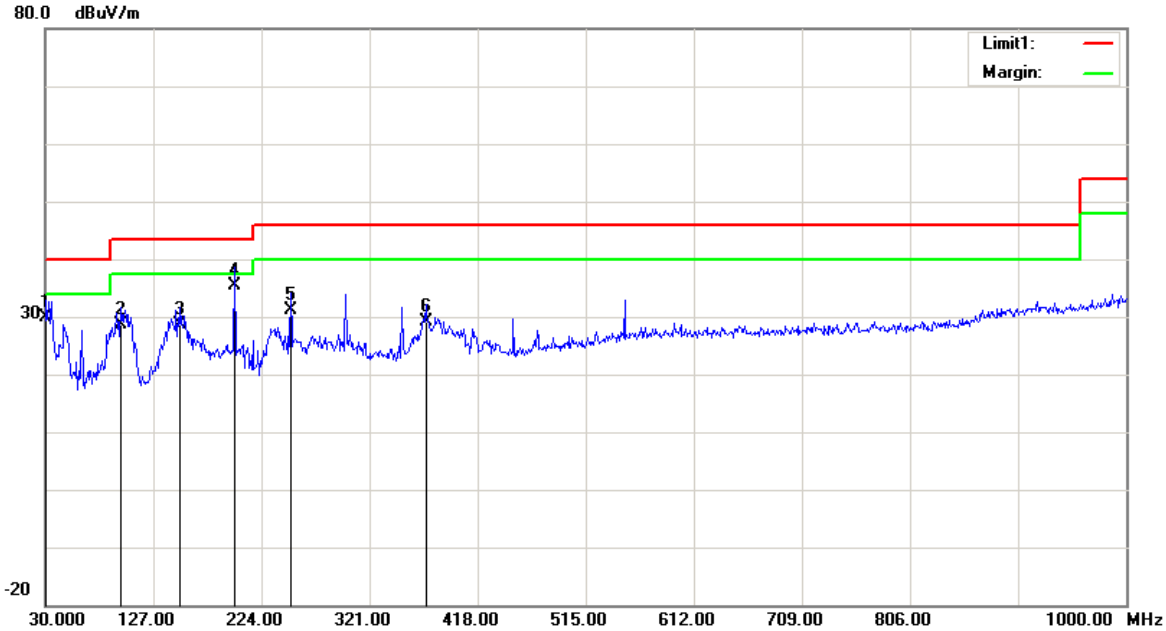
Vertical:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
32.9100	36.42	QP	-3.42	33.00	40.00	7.00
106.6300	40.55	QP	-11.25	29.30	43.50	14.20
250.1900	41.09	QP	-7.59	33.50	46.00	12.50
400.5400	33.99	QP	-2.29	31.70	46.00	14.30
450.0100	34.11	QP	-1.51	32.60	46.00	13.40
549.9200	36.14	QP	1.76	37.90	46.00	8.10

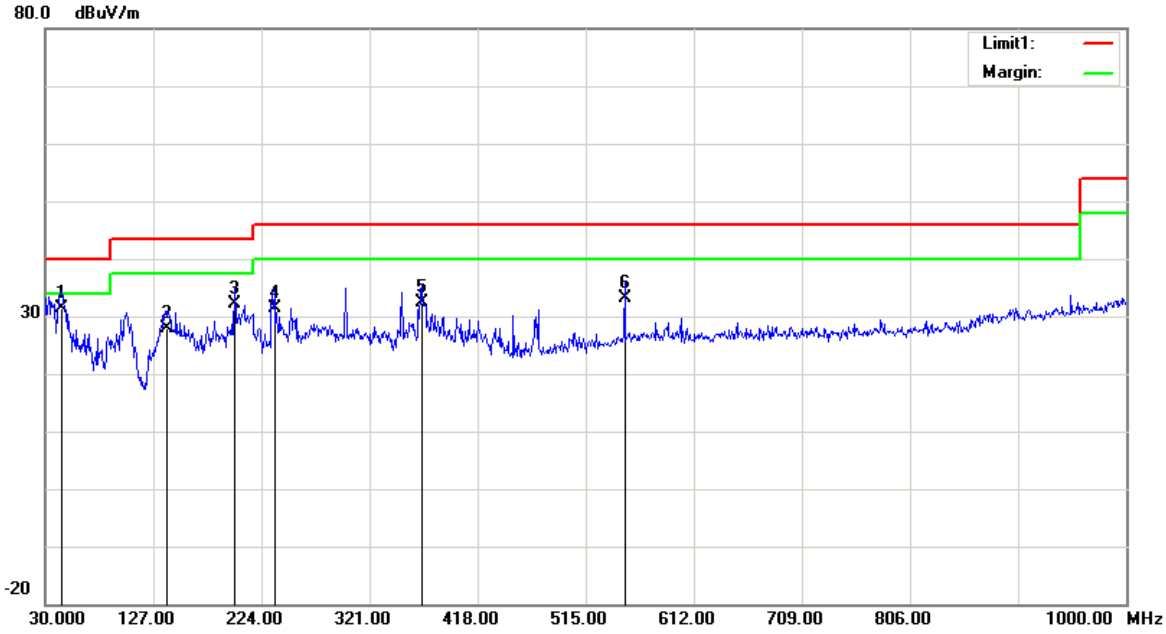
Model: UR52

Horizontal:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.0000	31.89	QP	-1.99	29.90	40.00	10.10
97.9000	40.58	QP	-11.88	28.70	43.50	14.80
151.2500	35.51	QP	-6.91	28.60	43.50	14.90
199.7500	42.36	QP	-6.86	35.50	43.50	8.00
250.1900	38.69	QP	-7.59	31.10	46.00	14.90
371.4400	32.02	QP	-2.92	29.10	46.00	16.90

Vertical:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
44.5500	41.01	QP	-9.71	31.30	40.00	8.70
138.6400	34.62	QP	-6.82	27.80	43.50	15.70
199.7500	38.96	QP	-6.86	32.10	43.50	11.40
235.6400	39.40	QP	-7.90	31.50	46.00	14.50
367.5600	35.52	QP	-3.02	32.50	46.00	13.50
549.9200	31.44	QP	1.76	33.20	46.00	12.80

2) 1-25GHz:

UR55 was the worst case

802.11b

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Measurement	Polar (H/V)	Factor (dB/m)					
Low Channel: 2412 MHz									
2412.00	69.15	PK	H	28.12	1.81	0.00	99.08	N/A	N/A
2412.00	65.79	AV	H	28.12	1.81	0.00	95.72	N/A	N/A
2412.00	81.29	PK	V	28.12	1.81	0.00	111.22	N/A	N/A
2412.00	77.97	AV	V	28.12	1.81	0.00	107.90	N/A	N/A
2390.00	28.81	PK	V	28.08	1.80	0.00	58.69	74.00	15.31
2390.00	16.87	AV	V	28.08	1.80	0.00	46.75	54.00	7.25
4824.00	52.76	PK	V	32.95	3.19	37.20	51.70	74.00	22.30
4824.00	48.50	AV	V	32.95	3.19	37.20	47.44	54.00	6.56
7236.00	47.08	PK	V	35.81	4.77	37.27	50.39	74.00	23.61
7236.00	34.83	AV	V	35.81	4.77	37.27	38.14	54.00	15.86
Middle Channel: 2437 MHz									
2437.00	68.76	PK	H	28.17	1.82	0.00	98.75	N/A	N/A
2437.00	65.31	AV	H	28.17	1.82	0.00	95.30	N/A	N/A
2437.00	80.99	PK	V	28.17	1.82	0.00	110.98	N/A	N/A
2437.00	77.64	AV	V	28.17	1.82	0.00	107.63	N/A	N/A
4874.00	52.43	PK	V	33.05	3.26	37.21	51.53	74.00	22.47
4874.00	48.21	AV	V	33.05	3.26	37.21	47.31	54.00	6.69
7311.00	46.89	PK	V	36.01	4.64	37.36	50.18	74.00	23.82
7311.00	34.65	AV	V	36.01	4.64	37.36	37.94	54.00	16.06
High Channel: 2462 MHz									
2462.00	68.76	PK	H	28.22	1.83	0.00	98.81	N/A	N/A
2462.00	63.41	AV	H	28.22	1.83	0.00	93.46	N/A	N/A
2462.00	81.06	PK	V	28.22	1.83	0.00	111.11	N/A	N/A
2462.00	77.89	AV	V	28.22	1.83	0.00	107.94	N/A	N/A
2483.50	30.10	PK	V	28.27	1.84	0.00	60.21	74.00	13.79
2483.50	18.53	AV	V	28.27	1.84	0.00	48.64	54.00	5.36
4924.00	52.54	PK	V	33.15	3.27	37.22	51.74	74.00	22.26
4924.00	48.24	AV	V	33.15	3.27	37.22	47.44	54.00	6.56
7386.00	46.92	PK	V	36.20	4.51	37.46	50.17	74.00	23.83
7386.00	34.62	AV	V	36.20	4.51	37.46	37.87	54.00	16.13

802.11g

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Measurement	Polar (H/V)	Factor (dB/m)					
Low Channel: 2412 MHz									
2412.00	71.04	PK	H	28.12	1.81	0.00	100.97	N/A	N/A
2412.00	62.72	AV	H	28.12	1.81	0.00	92.65	N/A	N/A
2412.00	82.76	PK	V	28.12	1.81	0.00	112.69	N/A	N/A
2412.00	73.86	AV	V	28.12	1.81	0.00	103.79	N/A	N/A
2390.00	31.54	PK	V	28.08	1.80	0.00	61.42	74.00	12.58
2390.00	22.03	AV	V	28.08	1.80	0.00	51.91	54.00	2.09
4824.00	51.19	PK	V	32.95	3.19	37.20	50.13	74.00	23.87
4824.00	38.89	AV	V	32.95	3.19	37.20	37.83	54.00	16.17
7236.00	46.37	PK	V	35.81	4.77	37.27	49.68	74.00	24.32
7236.00	34.01	AV	V	35.81	4.77	37.27	37.32	54.00	16.68
Middle Channel: 2437 MHz									
2437.00	71.38	PK	H	28.17	1.82	0.00	101.37	N/A	N/A
2437.00	63.05	AV	H	28.17	1.82	0.00	93.04	N/A	N/A
2437.00	85.54	PK	V	28.17	1.82	0.00	115.53	N/A	N/A
2437.00	77.19	AV	V	28.17	1.82	0.00	107.18	N/A	N/A
4874.00	51.39	PK	V	33.05	3.26	37.21	50.49	74.00	23.51
4874.00	39.40	AV	V	33.05	3.26	37.21	38.50	54.00	15.50
7311.00	47.52	PK	V	36.01	4.64	37.36	50.81	74.00	23.19
7311.00	35.16	AV	V	36.01	4.64	37.36	38.45	54.00	15.55
High Channel: 2462 MHz									
2462.00	68.82	PK	H	28.22	1.83	0.00	98.87	N/A	N/A
2462.00	60.01	AV	H	28.22	1.83	0.00	90.06	N/A	N/A
2462.00	81.76	PK	V	28.22	1.83	0.00	111.81	N/A	N/A
2462.00	73.02	AV	V	28.22	1.83	0.00	103.07	N/A	N/A
2483.50	32.26	PK	V	28.27	1.84	0.00	62.37	74.00	11.63
2483.50	21.27	AV	V	28.27	1.84	0.00	51.38	54.00	2.62
4924.00	50.99	PK	V	33.15	3.27	37.22	50.19	74.00	23.81
4924.00	38.74	AV	V	33.15	3.27	37.22	37.94	54.00	16.06
7386.00	46.86	PK	V	36.20	4.51	37.46	50.11	74.00	23.89
7386.00	34.54	AV	V	36.20	4.51	37.46	37.79	54.00	16.21

802.11n ht20

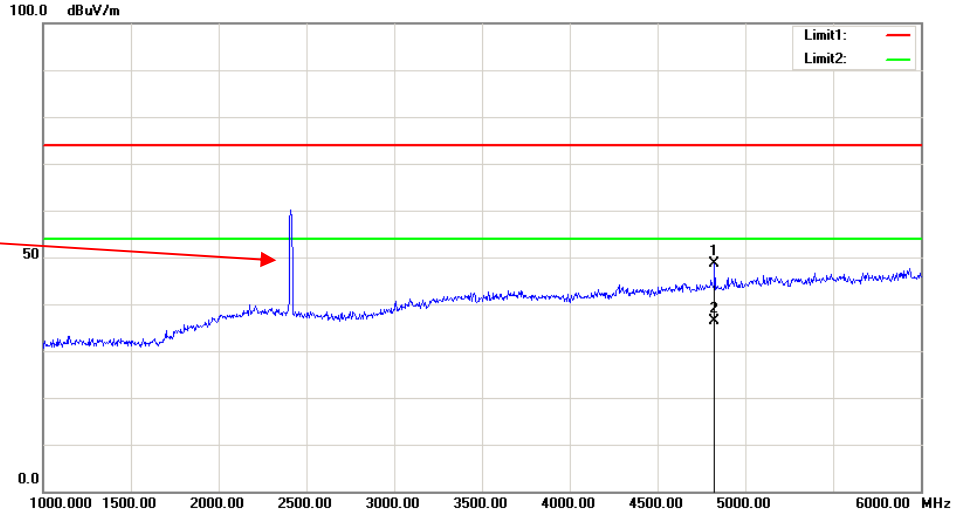
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Measurement	Polar (H/V)	Factor (dB/m)					
Low Channel: 2412 MHz									
2412.00	69.15	PK	H	28.12	1.81	0.00	99.08	N/A	N/A
2412.00	59.70	AV	H	28.12	1.81	0.00	89.63	N/A	N/A
2412.00	81.16	PK	V	28.12	1.81	0.00	111.09	N/A	N/A
2412.00	71.76	AV	V	28.12	1.81	0.00	101.69	N/A	N/A
2390.00	33.64	PK	V	28.08	1.80	0.00	63.52	74.00	10.48
2390.00	21.27	AV	V	28.08	1.80	0.00	51.15	54.00	2.85
4824.00	47.93	PK	V	32.95	3.19	37.20	46.87	74.00	27.13
4824.00	35.46	AV	V	32.95	3.19	37.20	34.40	54.00	19.60
7236.00	46.54	PK	V	35.81	4.77	37.27	49.85	74.00	24.15
7236.00	34.13	AV	V	35.81	4.77	37.27	37.44	54.00	16.56
Middle Channel: 2437 MHz									
2437.00	70.24	PK	H	28.17	1.82	0.00	100.23	N/A	N/A
2437.00	60.88	AV	H	28.17	1.82	0.00	90.87	N/A	N/A
2437.00	84.05	PK	V	28.17	1.82	0.00	114.04	N/A	N/A
2437.00	74.61	AV	V	28.17	1.82	0.00	104.60	N/A	N/A
4874.00	51.14	PK	V	33.05	3.26	37.21	50.24	74.00	23.76
4874.00	39.20	AV	V	33.05	3.26	37.21	38.30	54.00	15.70
7311.00	47.88	PK	V	36.01	4.64	37.36	51.17	74.00	22.83
7311.00	35.37	AV	V	36.01	4.64	37.36	38.66	54.00	15.34
High Channel: 2462 MHz									
2462.00	68.17	PK	H	28.22	1.83	0.00	98.22	N/A	N/A
2462.00	58.81	AV	H	28.22	1.83	0.00	88.86	N/A	N/A
2462.00	80.92	PK	V	28.22	1.83	0.00	110.97	N/A	N/A
2462.00	71.64	AV	V	28.22	1.83	0.00	101.69	N/A	N/A
2483.50	33.05	PK	V	28.27	1.84	0.00	63.16	74.00	10.84
2483.50	20.16	AV	V	28.27	1.84	0.00	50.27	54.00	3.73
4924.00	48.13	PK	V	33.15	3.27	37.22	47.33	74.00	26.67
4924.00	35.83	AV	V	33.15	3.27	37.22	35.03	54.00	18.97
7386.00	47.20	PK	V	36.20	4.51	37.46	50.45	74.00	23.55
7386.00	34.75	AV	V	36.20	4.51	37.46	38.00	54.00	16.00

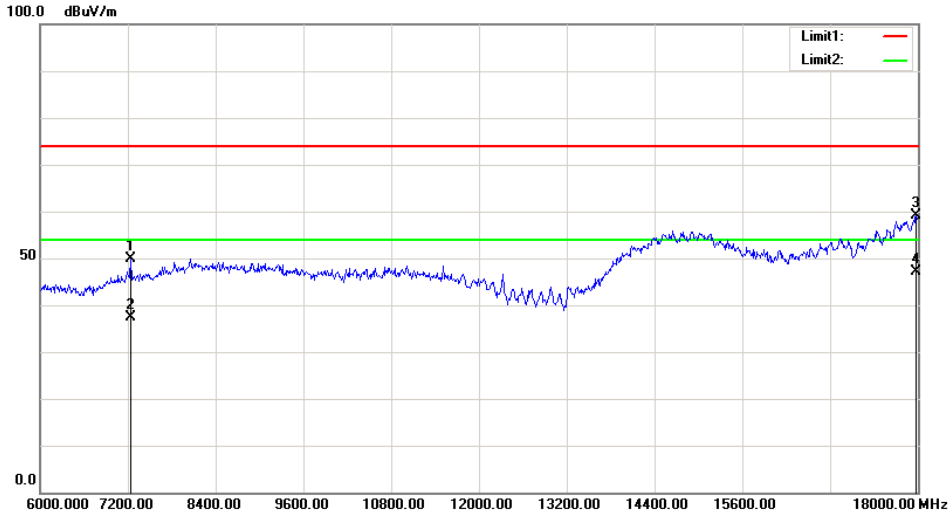
802.11n ht40

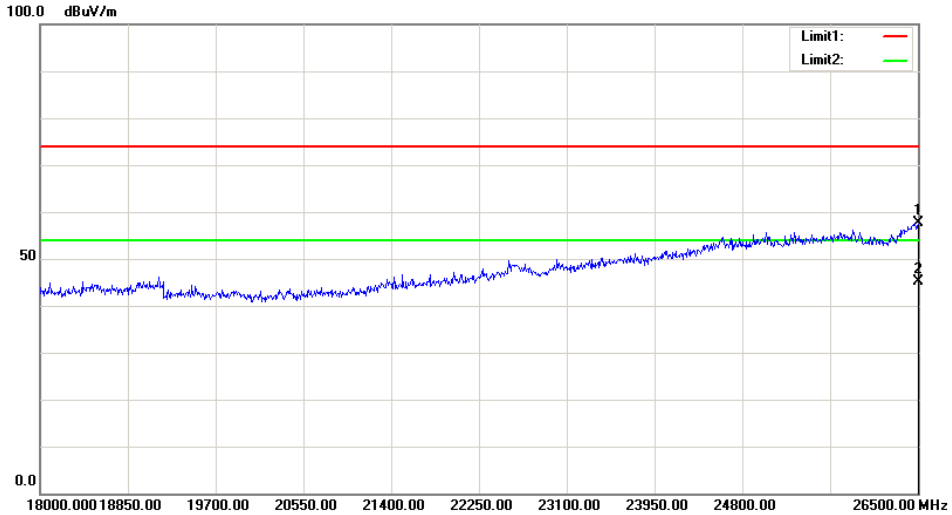
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Measurement	Polar (H/V)	Factor (dB/m)					
Low Channel: 2422 MHz									
2422.00	61.59	PK	H	28.14	1.81	0.00	91.54	N/A	N/A
2422.00	53.07	AV	H	28.14	1.81	0.00	83.02	N/A	N/A
2422.00	75.66	PK	V	28.14	1.81	0.00	105.61	N/A	N/A
2422.00	67.01	AV	V	28.14	1.81	0.00	96.96	N/A	N/A
2390.00	40.56	PK	V	28.08	1.80	0.00	70.44	74.00	3.56
2390.00	22.04	AV	V	28.08	1.80	0.00	51.92	54.00	2.08
4844.00	47.10	PK	V	32.99	3.22	37.20	46.11	74.00	27.89
4844.00	34.55	AV	V	32.99	3.22	37.20	33.56	54.00	20.44
7266.00	46.30	PK	V	35.89	4.72	37.31	49.60	74.00	24.40
7266.00	33.79	AV	V	35.89	4.72	37.31	37.09	54.00	16.91
Middle Channel: 2437 MHz									
2437.00	66.22	PK	H	28.17	1.82	0.00	96.21	N/A	N/A
2437.00	57.84	AV	H	28.17	1.82	0.00	87.83	N/A	N/A
2437.00	79.73	PK	V	28.17	1.82	0.00	109.72	N/A	N/A
2437.00	71.07	AV	V	28.17	1.82	0.00	101.06	N/A	N/A
4874.00	48.06	PK	V	33.05	3.26	37.21	47.16	74.00	26.84
4874.00	35.41	AV	V	33.05	3.26	37.21	34.51	54.00	19.49
7311.00	46.76	PK	V	36.01	4.64	37.36	50.05	74.00	23.95
7311.00	34.38	AV	V	36.01	4.64	37.36	37.67	54.00	16.33
High Channel: 2452 MHz									
2452.00	61.88	PK	H	28.20	1.83	0.00	91.91	N/A	N/A
2452.00	53.36	AV	H	28.20	1.83	0.00	83.39	N/A	N/A
2452.00	75.74	PK	V	28.20	1.83	0.00	105.77	N/A	N/A
2452.00	67.25	AV	V	28.20	1.83	0.00	97.28	N/A	N/A
2483.50	36.63	PK	V	28.27	1.84	0.00	66.74	74.00	7.26
2483.50	21.42	AV	V	28.27	1.84	0.00	51.53	54.00	2.47
4904.00	47.25	PK	V	33.11	3.30	37.21	46.45	74.00	27.55
4904.00	34.67	AV	V	33.11	3.30	37.21	33.87	54.00	20.13
7356.00	46.30	PK	V	36.13	4.56	37.42	49.57	74.00	24.43
7356.00	33.74	AV	V	36.13	4.56	37.42	37.01	54.00	16.99

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

Fundamental Test with Band Rejection Filter

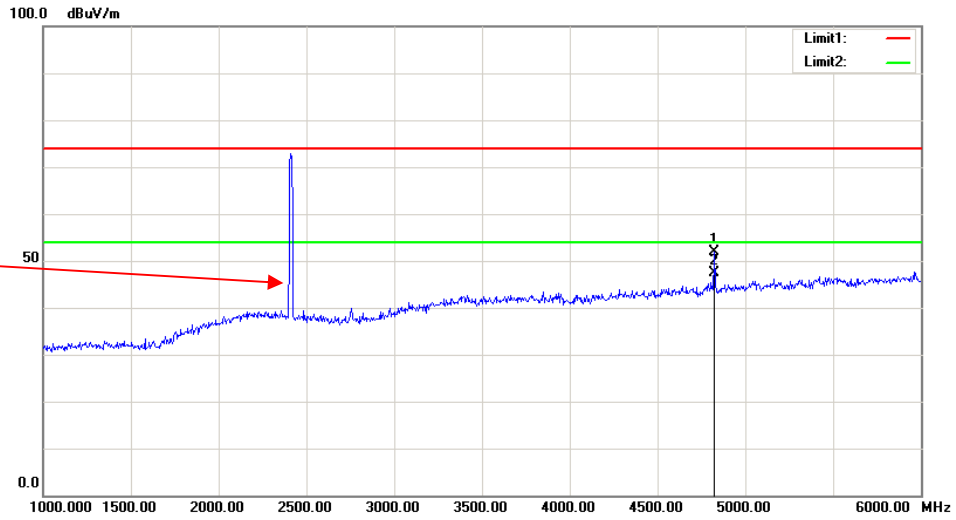


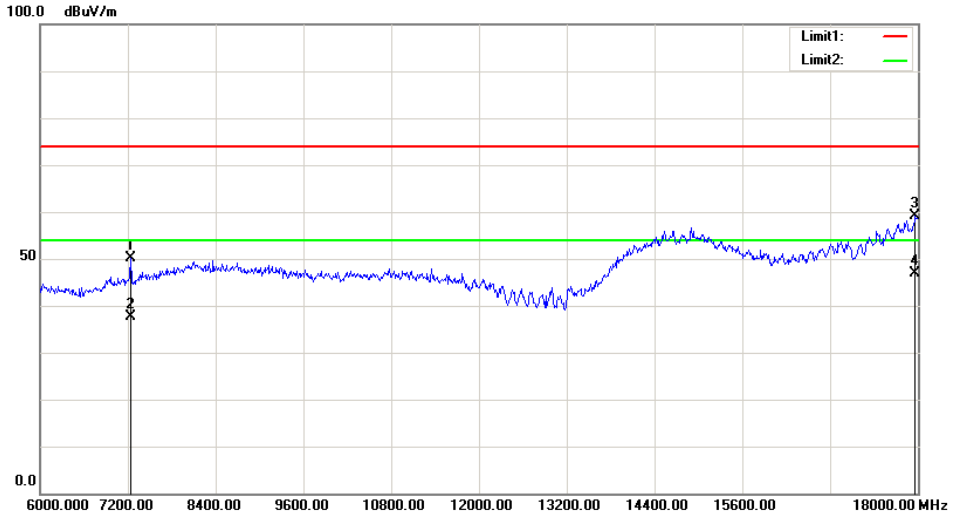


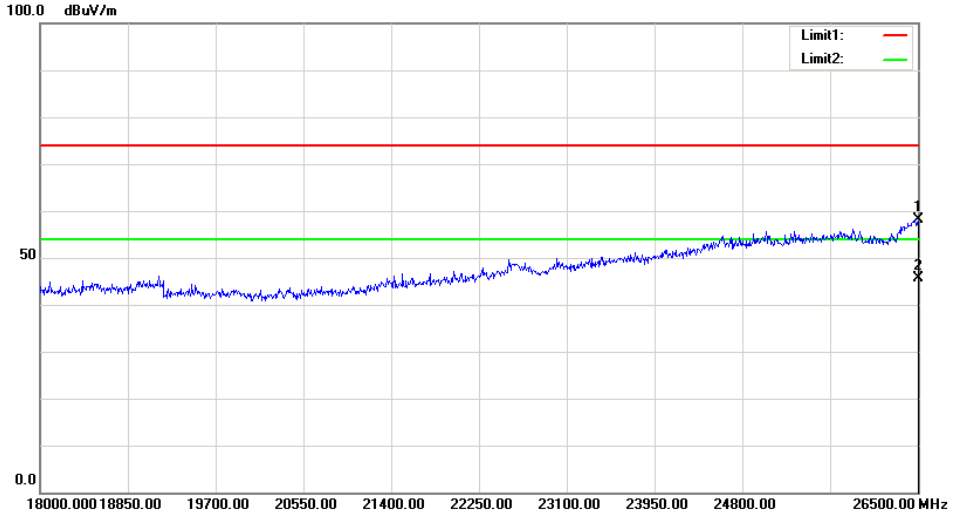


Vertical:

Fundamental Test with Band Rejection Filter







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

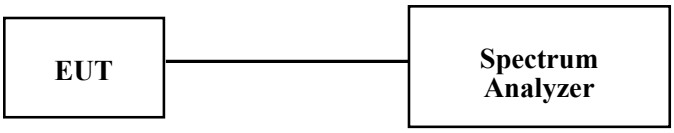
Applicable Standard

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.

Test Procedure

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



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU 26	200256	2018-01-04	2019-01-04
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A

*** 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:	28.8°C
Relative Humidity:	61 %
ATM Pressure:	99.8 kPa

** The testing was performed by Andy Huang on 2018-07-18.*

Test Mode: Transmitting

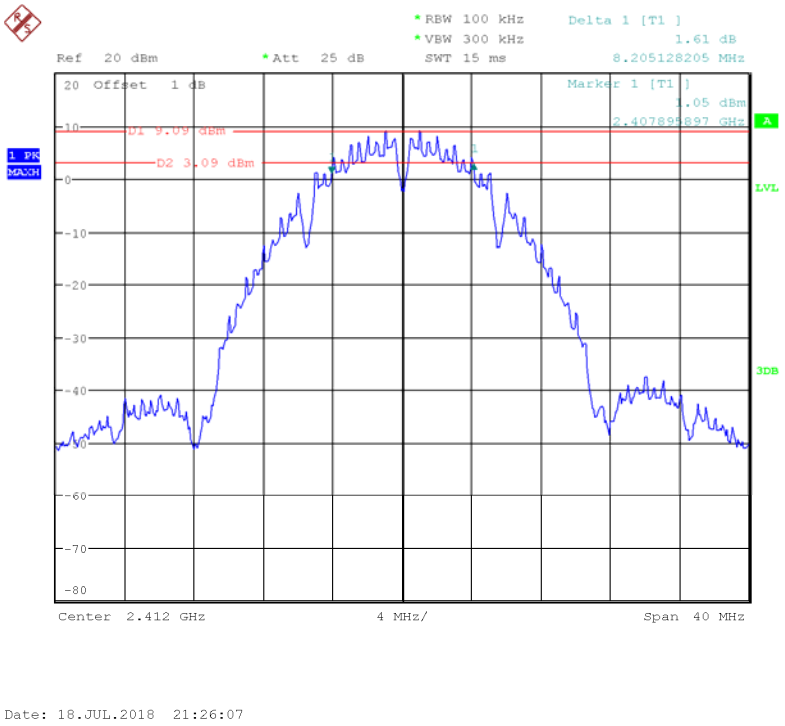
Test Result: Compliant.

please refer to the following table and plots.

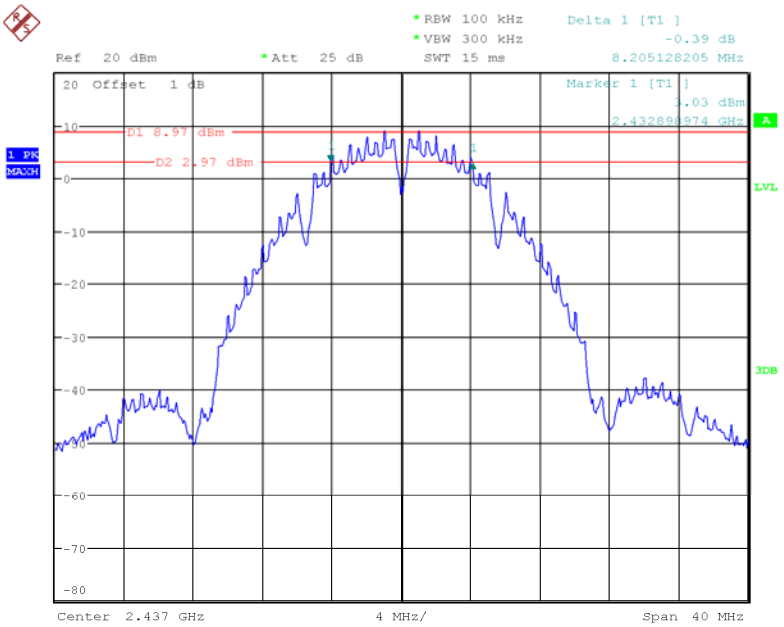
Test mode	Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)
802.11b	2412	8.21	≥0.5
	2437	8.21	≥0.5
	2462	8.14	≥0.5
802.11g	2412	15.51	≥0.5
	2437	15.45	≥0.5
	2462	15.45	≥0.5
802.11n ht20	2412	15.71	≥0.5
	2437	15.71	≥0.5
	2462	15.64	≥0.5
802.11n ht40	2422	35.51	≥0.5
	2437	35.51	≥0.5
	2452	35.51	≥0.5

6dB bandwidth:

802.11b Low Channel

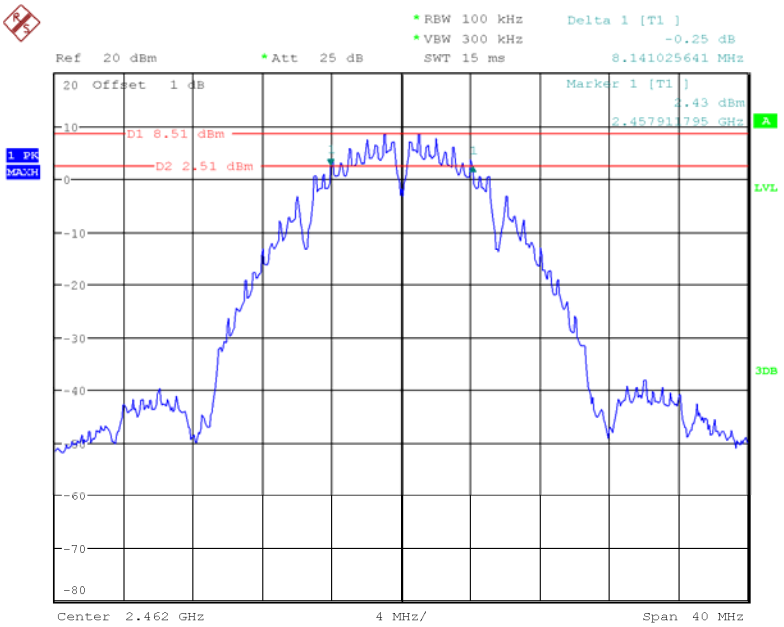


802.11b Middle Channel



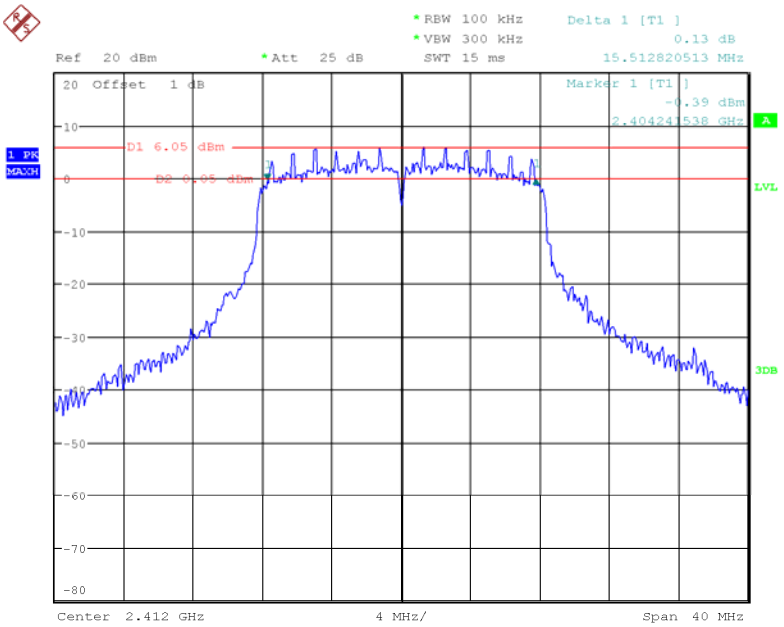
Date: 18.JUL.2018 21:27:32

802.11b High Channel



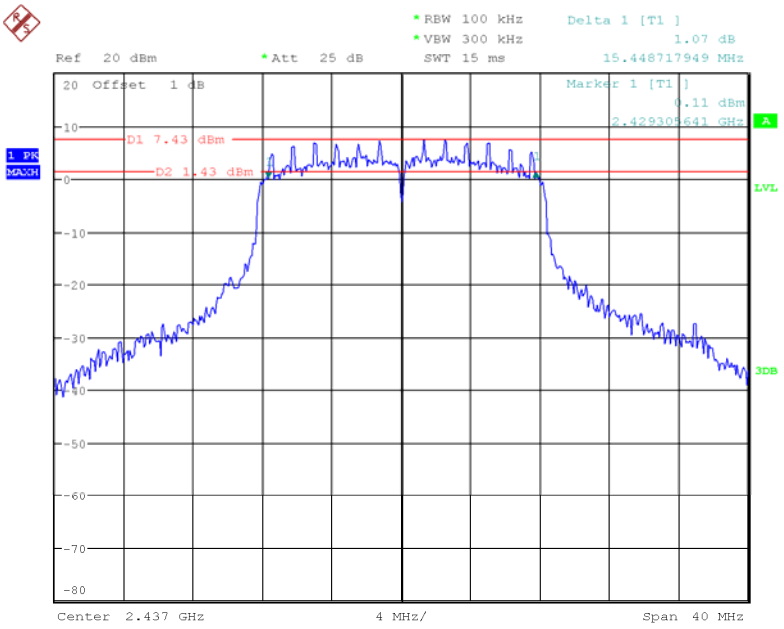
Date: 18.JUL.2018 21:29:18

802.11g Low Channel



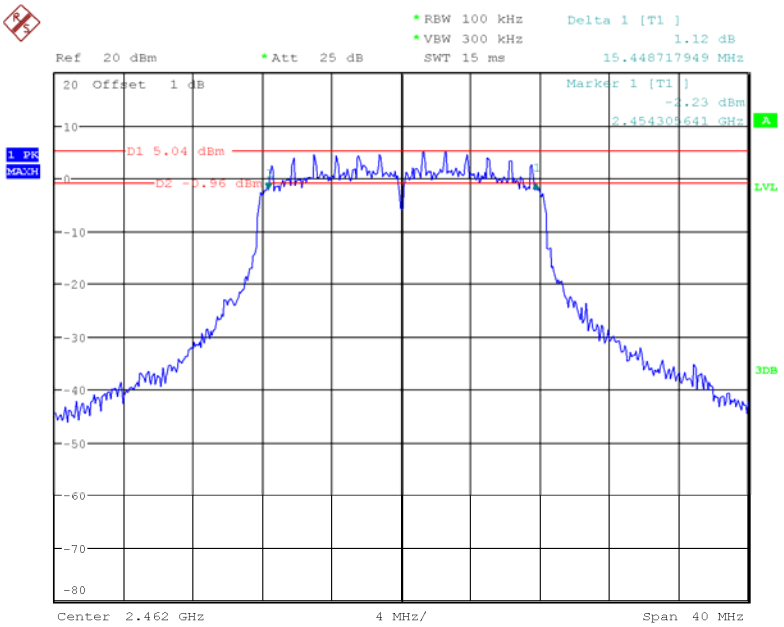
Date: 18.JUL.2018 21:30:33

802.11g Middle Channel



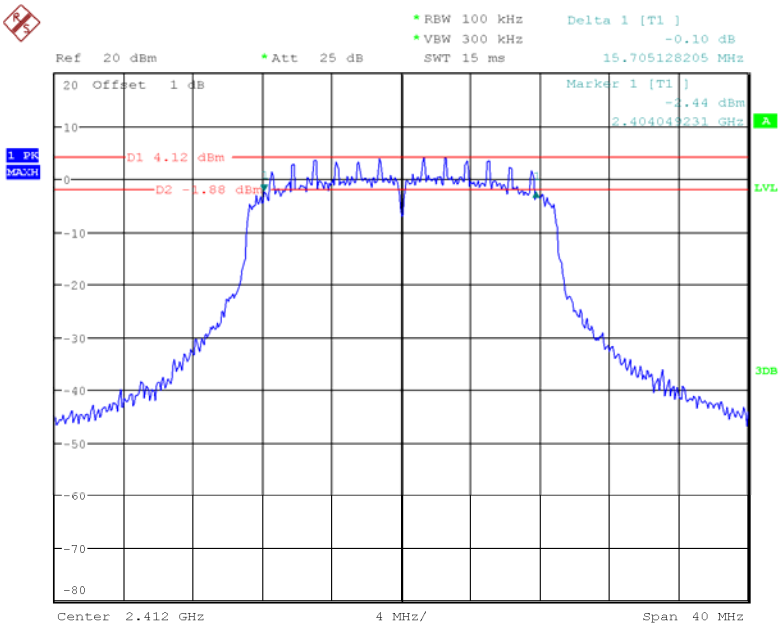
Date: 18.JUL.2018 21:31:37

802.11g High Channel



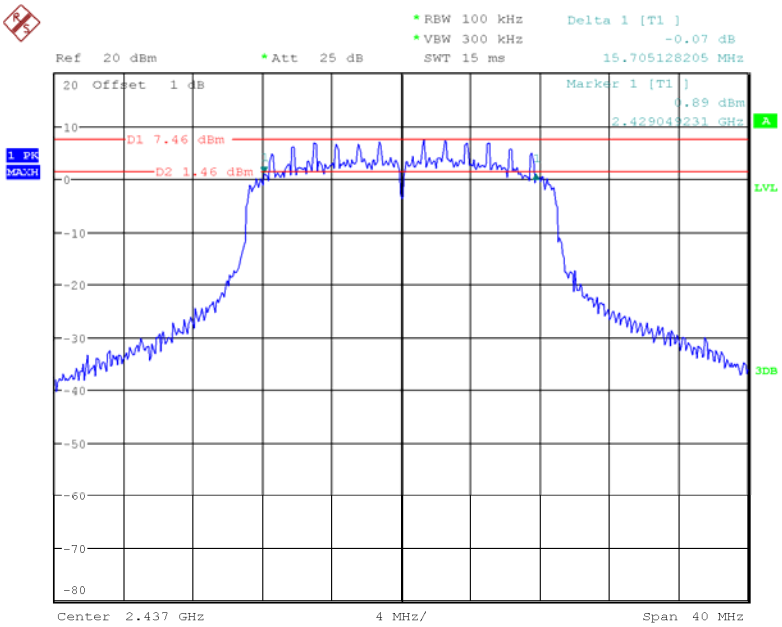
Date: 18.JUL.2018 21:33:01

802.11n ht20 Low Channel



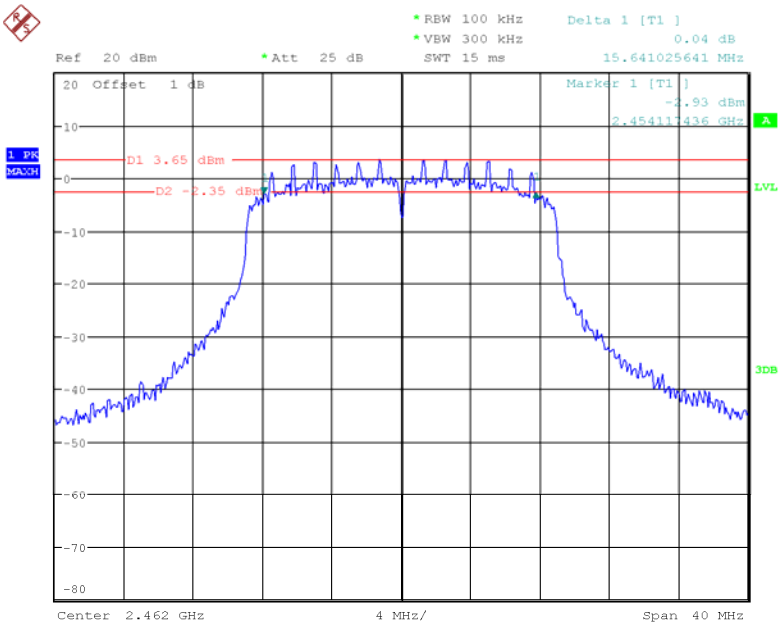
Date: 18.JUL.2018 21:34:59

802.11n ht20 Middle Channel



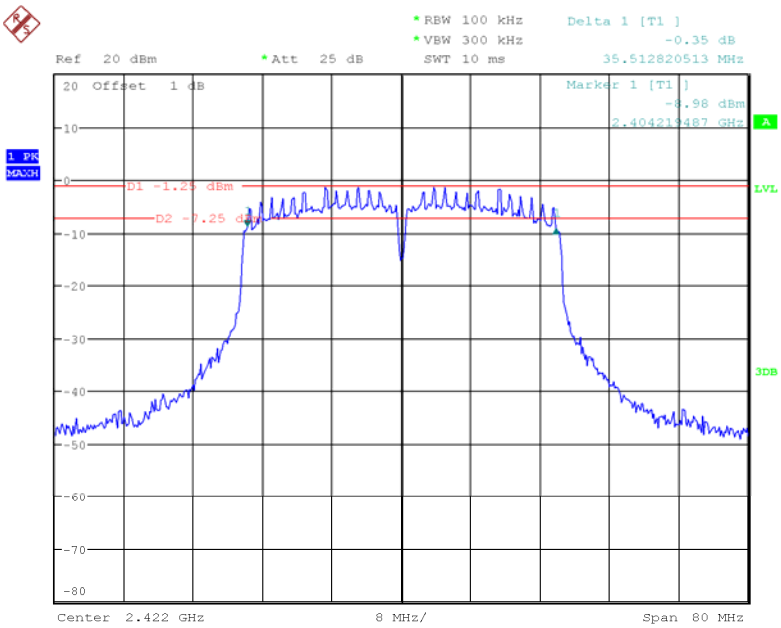
Date: 18.JUL.2018 21:36:49

802.11n ht20 High Channel



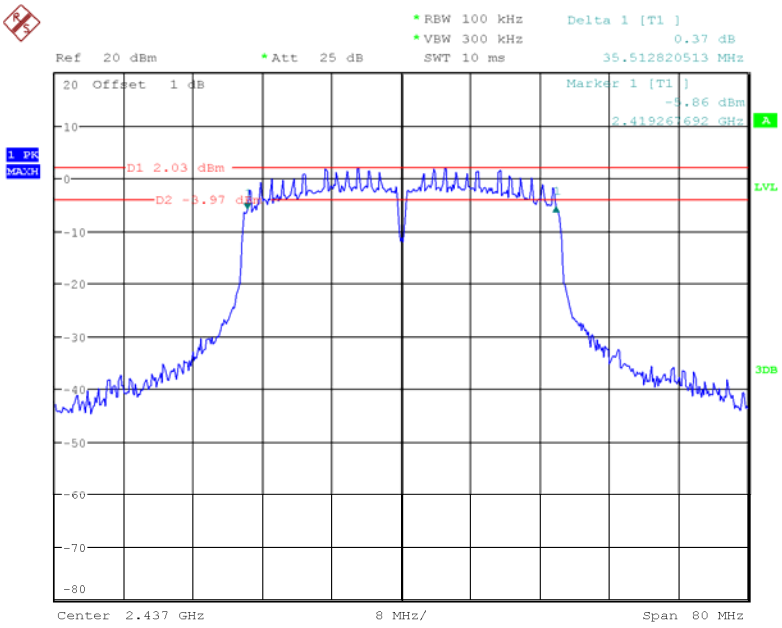
Date: 18.JUL.2018 21:40:49

802.11n ht40 Low Channel



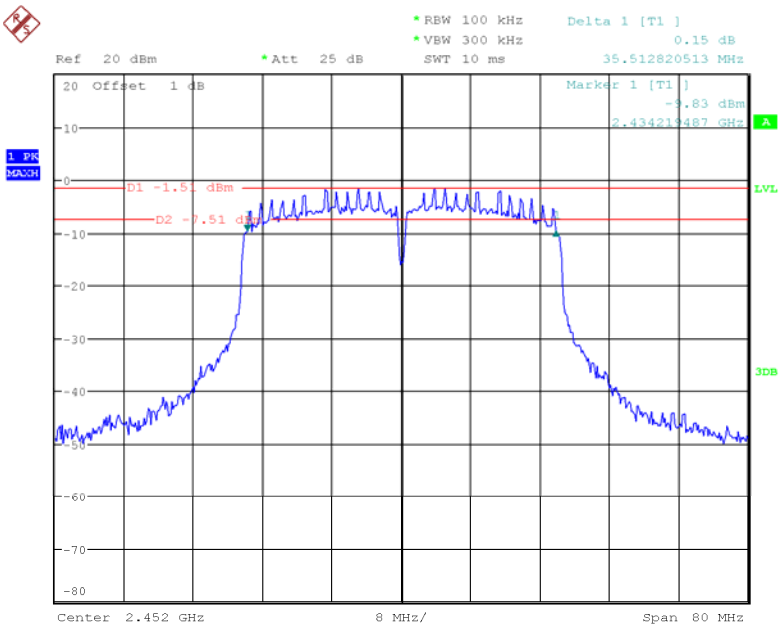
Date: 18.JUL.2018 21:43:20

802.11n ht40 Middle Channel



Date: 18.JUL.2018 21:44:38

802.11n ht40 High Channel



Date: 18.JUL.2018 21:45:44

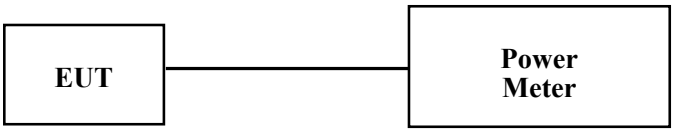
FCC §15.247(b) (3) - MAXIMUM PEAK CONDUCTED OUTPUT POWER

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.

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	USB Wideband Power Sensor	U2022XA	MY5417006	2017-12-11	2018-12-11
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A

*** 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:	28.8°C
Relative Humidity:	61 %
ATM Pressure:	99.8 kPa

** The testing was performed by Andy Huang on 2018-07-18.*

Test Mode: Transmitting

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

Test mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)	Limit (dBm)
802.11b	Low	2412	19.90	30
	Middle	2437	19.78	30
	High	2462	19.37	30
802.11g	Low	2412	22.19	30
	Middle	2437	23.25	30
	High	2462	21.41	30
802.11n ht20	Low	2412	20.83	30
	Middle	2437	23.64	30
	High	2462	20.60	30
802.11n ht40	Low	2422	18.64	30
	Middle	2437	21.86	30
	High	2452	18.56	30

FCC §15.247(d)– 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)).

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	Spectrum Analyzer	FSU 26	200256	2018-01-04	2019-01-04
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A

*** 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

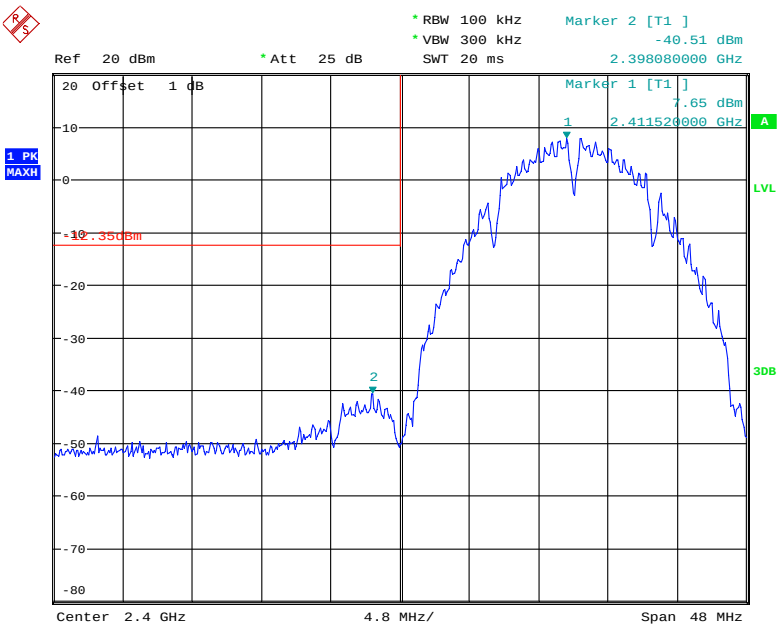
Temperature:	28.8°C
Relative Humidity:	61 %
ATM Pressure:	99.8 kPa

** The testing was performed by Andy Huang from 2018-07-18 to 2018-08-07.*

Test mode: Transmitting

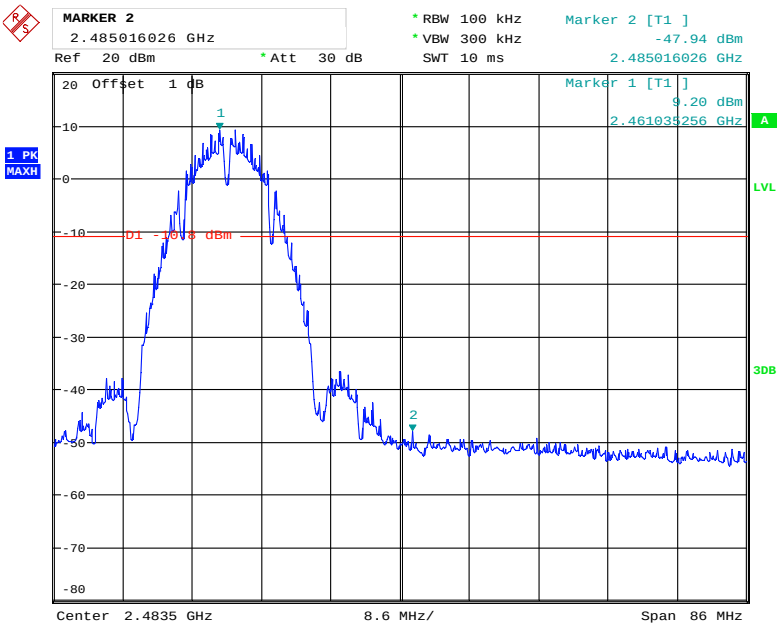
Test Result: Compliant. Please refer to following plots.

802.11b: Band Edge, Left Side



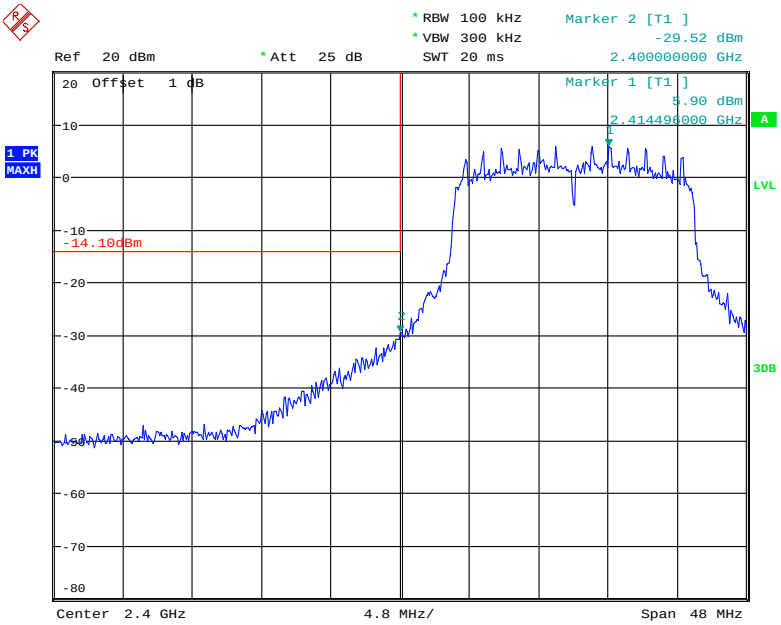
Date: 18.JUL.2018 20:42:57

802.11b: Band Edge, Right Side



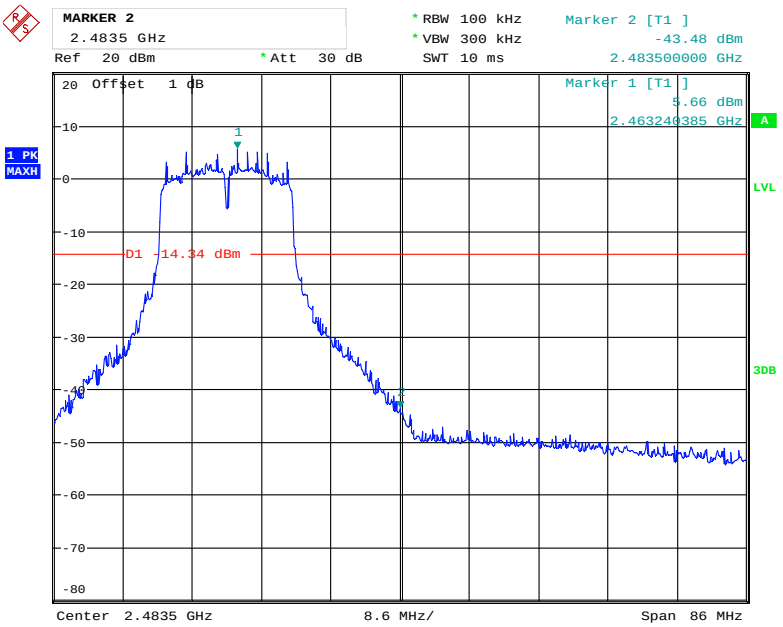
Date: 7.AUG.2018 17:13:44

802.11g: Band Edge, Left Side



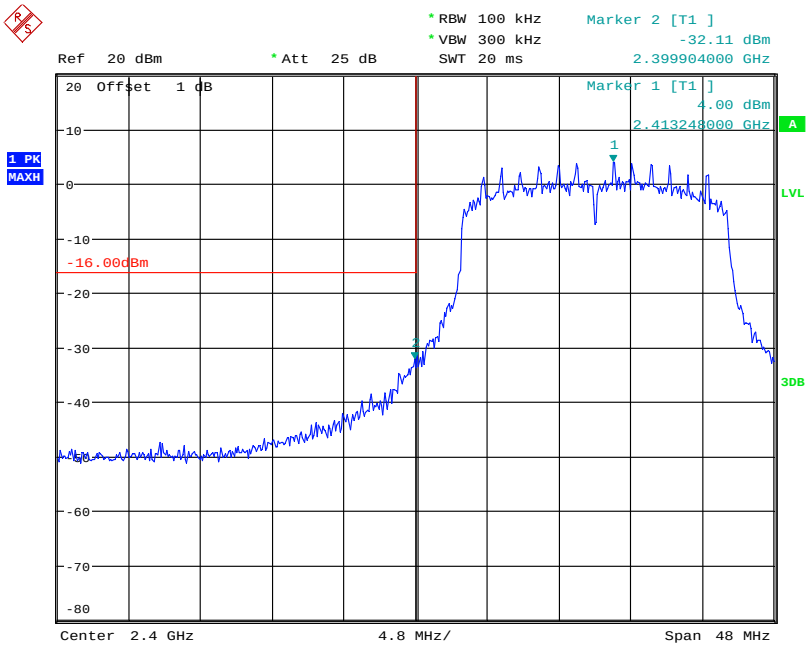
Date: 18.JUL.2018 20:49:57

802.11g: Band Edge, Right Side



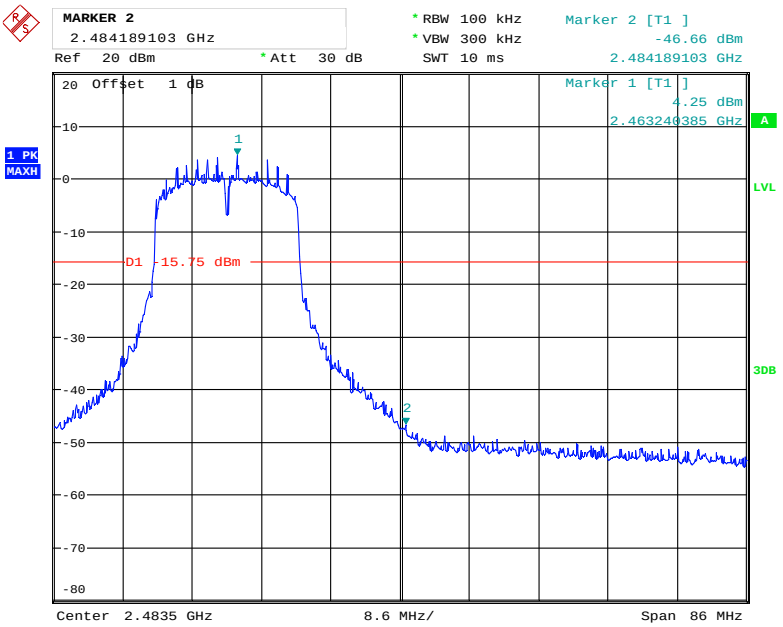
Date: 7.AUG.2018 17:15:19

802.11n ht20 Band Edge, Left Side



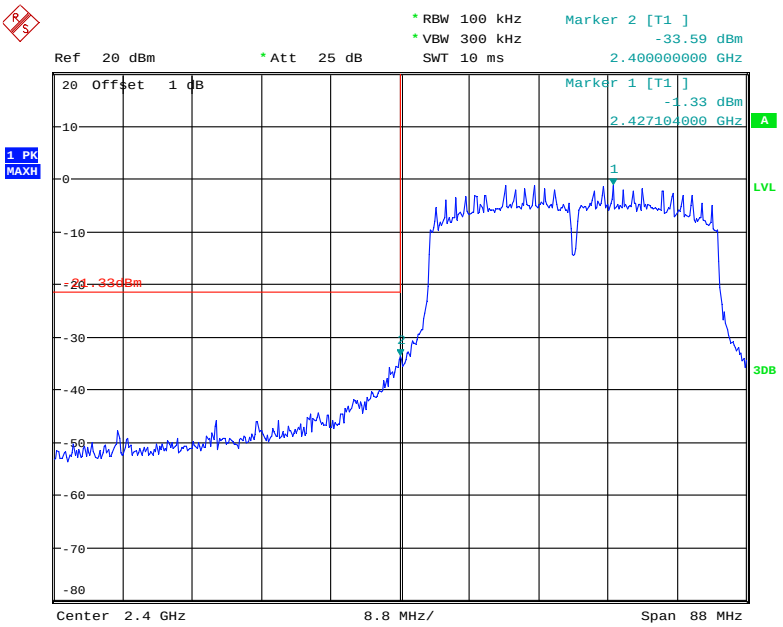
Date: 18.JUL.2018 20:58:31

802.11n ht20 Band Edge, Right Side



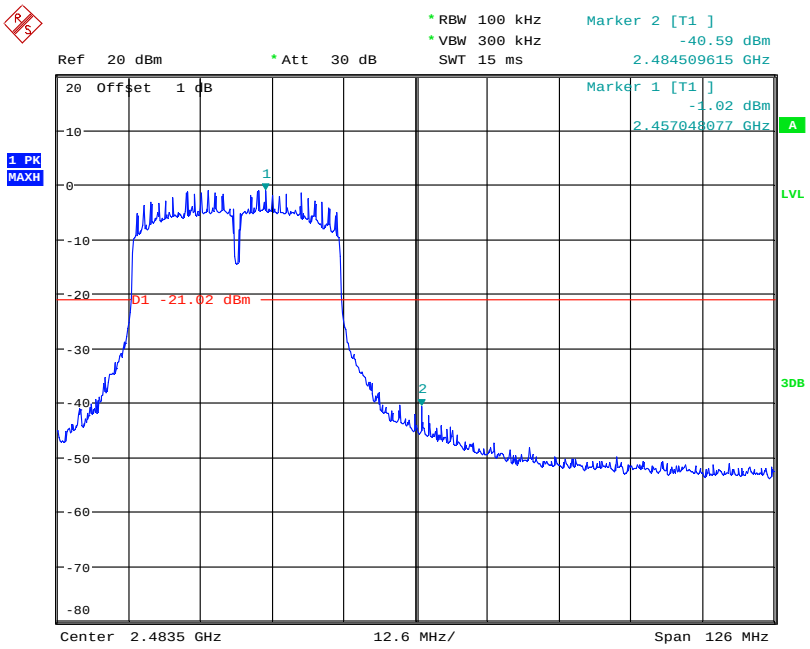
Date: 7.AUG.2018 17:16:37

802.11n ht40: Band Edge, Left Side



Date: 18.JUL.2018 21:13:42

802.11n ht40 Band Edge, Right Side



Date: 7.AUG.2018 17:07:59

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

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	Spectrum Analyzer	FSU 26	200256	2018-01-04	2019-01-04
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A

*** 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:	28.1~28.8°C
Relative Humidity:	58~61 %
ATM Pressure:	99.8~99.9 kPa

** The testing was performed by Andy Huang on 2018-07-18, 2018-08-17.*

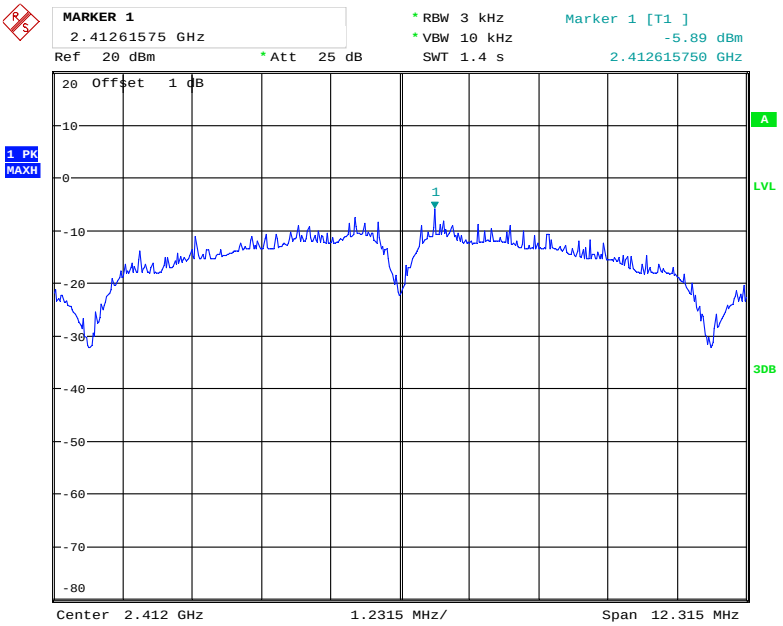
Test Result: Compliance

Test Mode: Transmitting

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

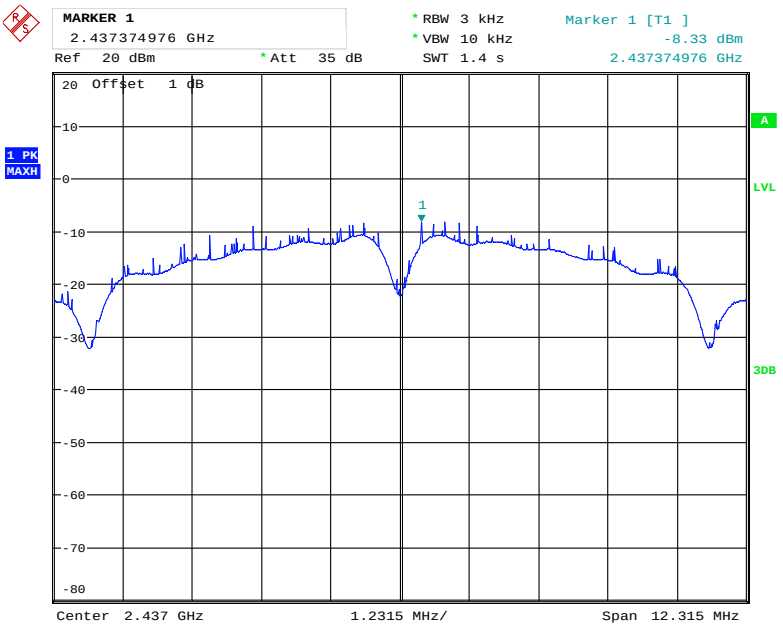
Test mode	Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
802.11b	Low	2412	-5.89	≤8
	Middle	2437	-8.33	≤8
	High	2462	-7.89	≤8
802.11g	Low	2412	-10.40	≤8
	Middle	2437	-8.92	≤8
	High	2462	-11.32	≤8
802.11n ht20	Low	2412	-11.74	≤8
	Middle	2437	-9.05	≤8
	High	2462	-11.54	≤8
802.11n ht40	Low	2422	-15.74	≤8
	Middle	2437	-12.78	≤8
	High	2452	-16.23	≤8

Power Spectral Density, 802.11b Low Channel



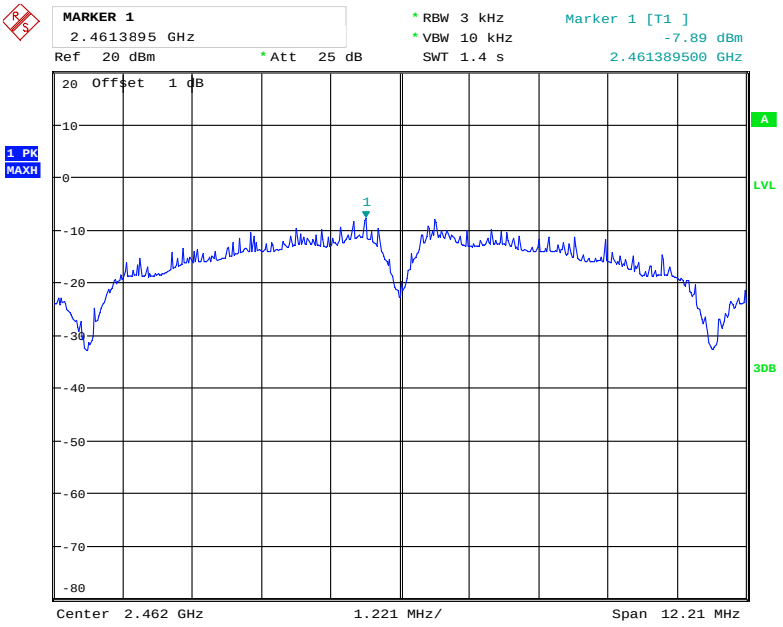
Date: 18.JUL.2018 21:51:47

Power Spectral Density, 802.11b Middle Channel



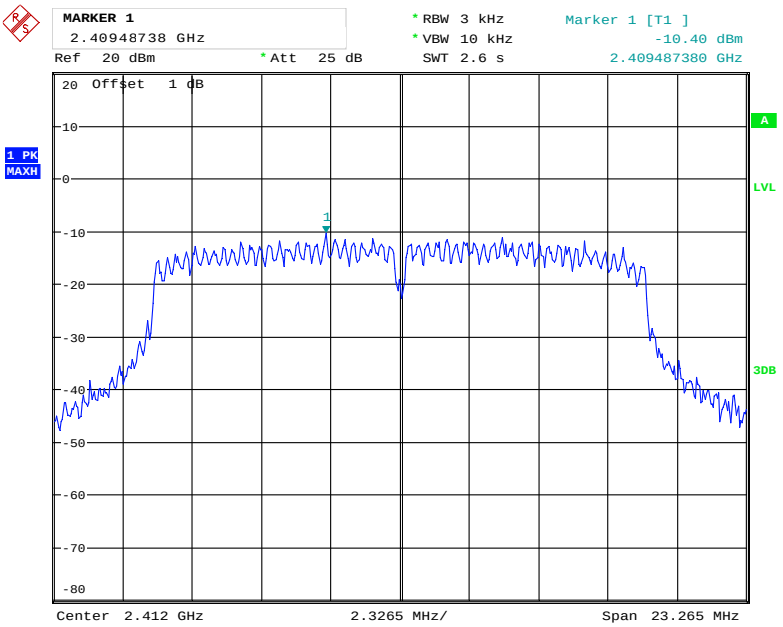
Date: 17.AUG.2018 20:10:51

Power Spectral Density, 802.11b High Channel



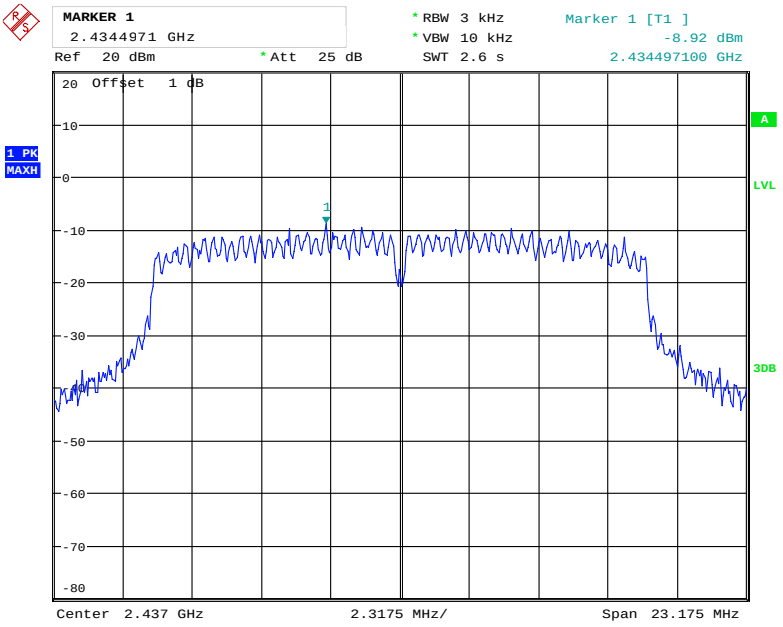
Date: 18.JUL.2018 21:53:58

Power Spectral Density, 802.11g Low Channel



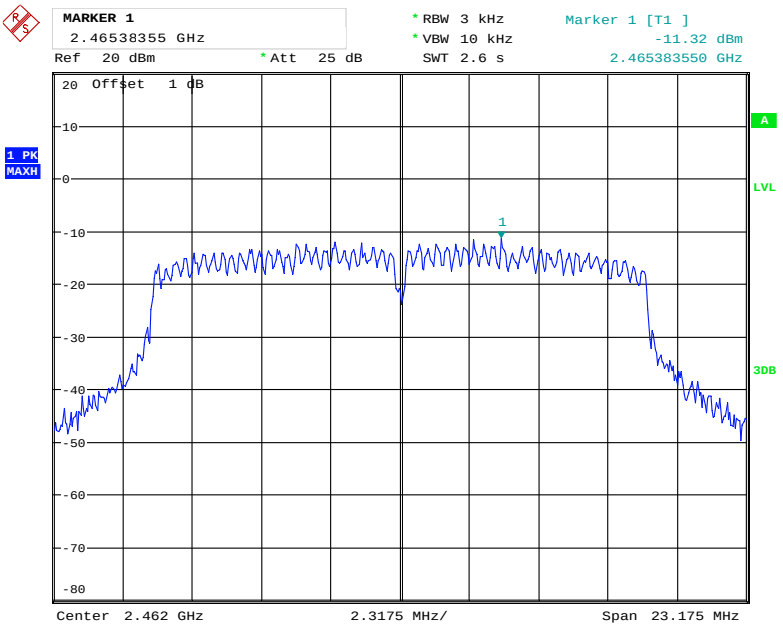
Date: 18.JUL.2018 21:55:07

Power Spectral Density, 802.11g Middle Channel



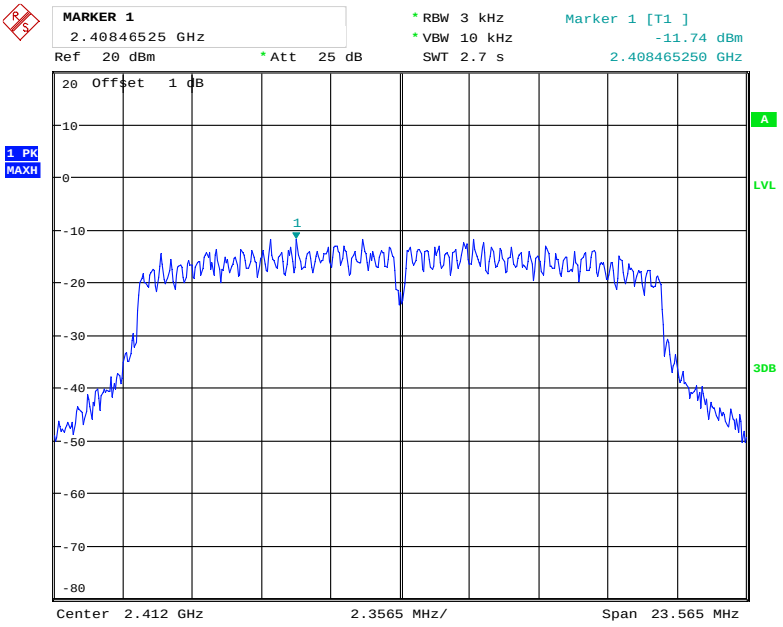
Date: 18.JUL.2018 21:56:01

Power Spectral Density, 802.11g High Channel



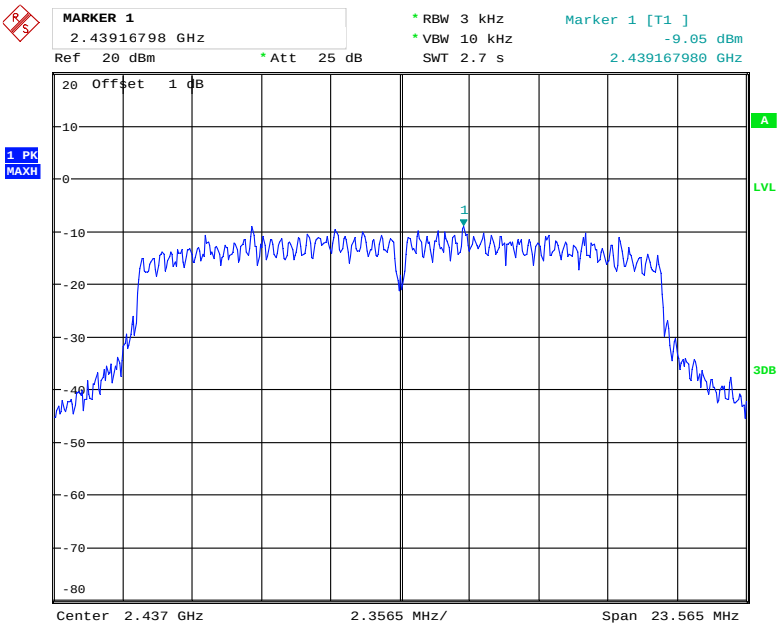
Date: 18.JUL.2018 21:56:39

Power Spectral Density, 802.11n ht20 Low Channel



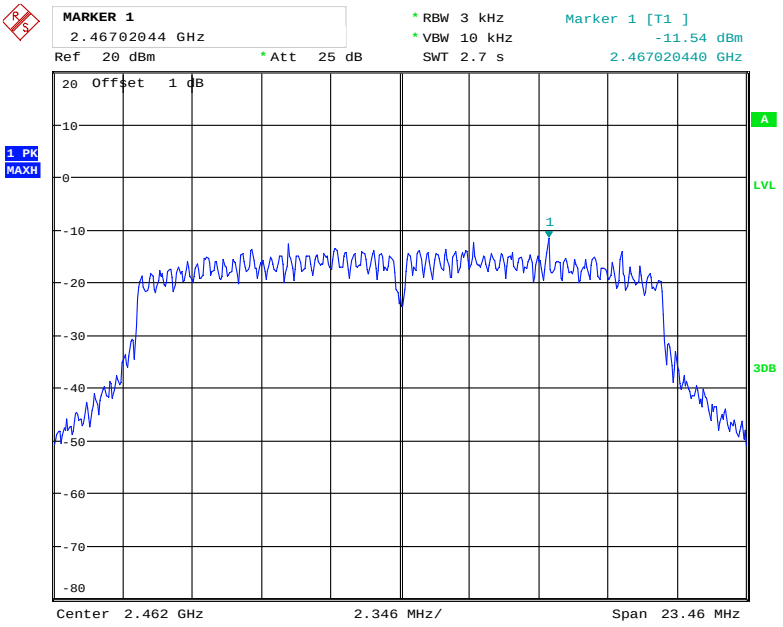
Date: 18.JUL.2018 21:58:19

Power Spectral Density, 802.11n ht20 Middle Channel



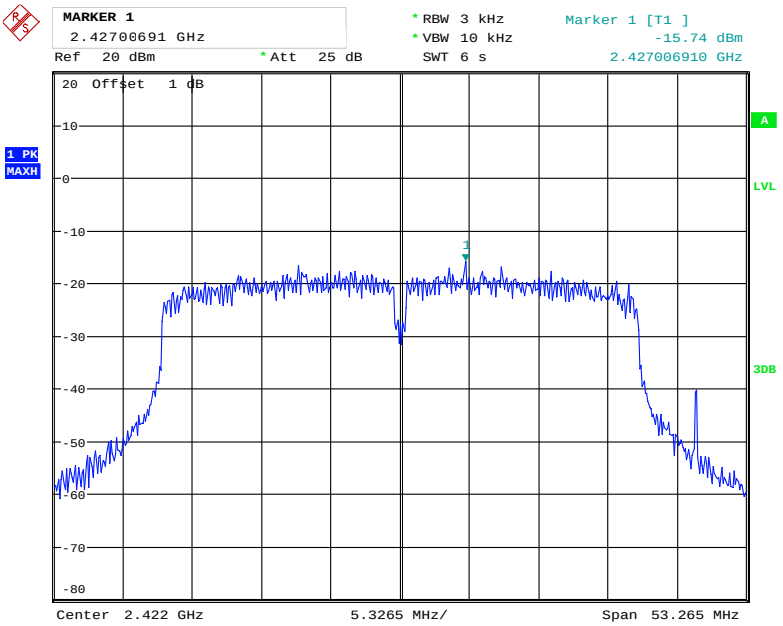
Date: 18.JUL.2018 21:58:57

Power Spectral Density, 802.11n ht20 High Channel



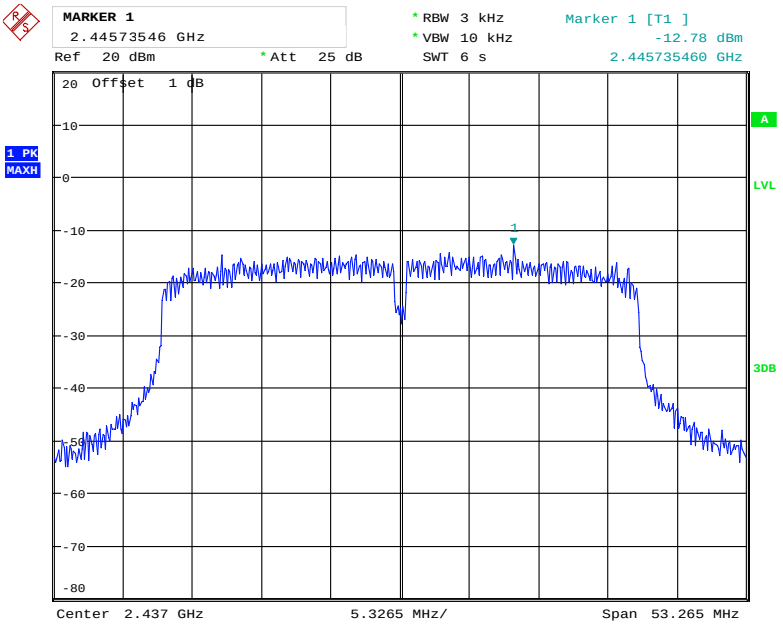
Date: 18.JUL.2018 22:01:33

Power Spectral Density, 802.11n ht40 Low Channel



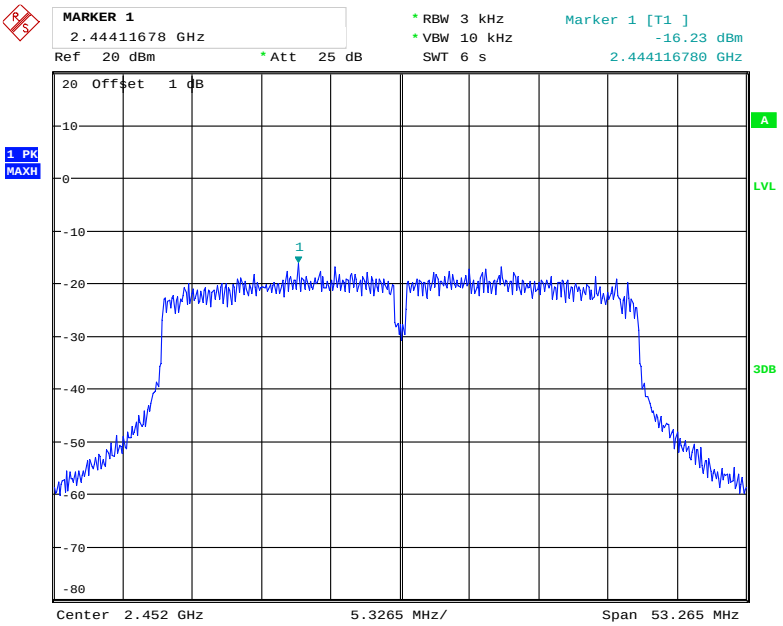
Date: 18.JUL.2018 22:02:45

Power Spectral Density, 802.11n ht40 Middle Channel



Date: 18.JUL.2018 22:03:35

Power Spectral Density, 802.11n ht40 High Channel



Date: 18.JUL.2018 22:05:37

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