FCC PART 15.407

TEST REPORT

For

Huawei Technologies Co., Ltd

Administration Building, Headquarters of Huawei Technologies Co.,Ltd., Bantian,Longgang District, Shenzhen, 518129, P.R.C, China

FCC ID: QISR230D

Report Type:	Product Type:
Original Report	Remote Radio Unit

Test Engineer:	Edison Hu
Report Number:	RKS161113002-00C
Report Date:	2016-11-10
Reviewed By:	Jesse Huang EMC Engineer
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road,Kunshan, Jiangsu province,China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The Huawei Technologies Co.,Ltd's product, model number: R230D (FCC ID: QISR230D) (the "EUT") in this report was a ***Remote Radio Unit***, which was measured approximately: 120 mm x 86 mm x 26 mm, rated input voltage: DC 54V from form POE adapter.

POE Adapter Information:
MODEL: PoE35-54A
INPUT: 100-240V~50/60Hz 1.0A MAX
OUTPUT: 54V, 0.65A

Manufacture information:
HUAWEI TECHNOLOGIES CO.,LTD / Administration Building,Headquarters of Huawei Technologies Co.,Ltd., Bantian,Longgang District, Shenzhen, 518129, P.R.C

**All measurement and test data in this report was gathered from production sample serial number: 20161001001 (Assigned by BACL, Kunshan). The EUT was received on 2016-10-01.*

Antenna information

Chain	Antenna Type	Max. Antenna Gain
0	PCB antenna	4.0dBi
1	PCB antenna	4.0dBi

Objective

This type approval report is prepared on behalf of Huawei Technologies Co., Ltd in accordance with Part 2-Subpart J, Part 15-Subparts A, B and E of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart E, section 15.203, 15.205, 15.207, 15.209 and 15.407 rules.

Related Submittal(s)/Grant(s)

FCC Part 15B JBP and FCC Part 15.247 DTS and submission with FCC ID: QISR230D.

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 789033 D02 General UNII Test Procedures New Rules v01r03

662911 D01 Multiple Transmitter Output v02r01

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

Test Facility

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

Test site at Bay Area Compliance Laboratories Corp. (Kunshan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on November 06, 2014. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 815570. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The EUT was configured for testing in an engineering mode which was provided by the manufacturer.

The system support 802.11a/n ht20/n ht40/ac vht20/ac vht40/ac vht80, the vh20/vht40 were reduced since the identical parameters with 802.11n ht20 and ht40. 802.11n and 802.11ac supports both beamforming and non-beamforming modes.

For 5725~5850MHz band, 8 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	157	5785
151	5755	159	5795
153	5765	161	5805
155	5775	165	5825

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.Preliminary tests were perfrmed in difference data rate and all the possible configurations, the worst cases as below table and shown in the report.

Configurations	Test Mode	Data Rate	Channel	Antenna Chain
1TX	802.11a	6Mbps	149, 157, 165	0, 1
	802.11n ht20	MCS0_20	149, 157, 165	0, 1
	802.11n ht40	MCS0_40	151, 159	0, 1
	802.11ac 80	AC-MCS0_80	155	0, 1
2TX Non-Beamforming	802.11a	6Mbps	149, 157, 165	0+1
	802.11n ht20	MCS0_20	149, 157, 165	0+1
	802.11n ht40	MCS0_40	151, 159	0+1
	802.11ac 80	AC-MCS0_80	155	0+1
2TX Beamforming	802.11n ht20	MCS0_20	149, 157, 165	0+1
	802.11n ht40	MCS0_40	151, 159	0+1
	802.11ac 80	AC-MCS0_80	155	0+1

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

The IPOR&QSPR was used for testing, and the commands were provided by manufacturer. The maximum power and duty cycle was set by commands as following table:

1TX:

Software and version			IPOR&QSPR		
Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Power Level	
				Chain 0	Chain 1
802.11 a	Low	5745	6	15	15
	Middle	5785	6	15	15
	High	5825	6	15	15
802.11 n20	Low	5745	MCS0_20	15	15
	Middle	5785	MCS0_20	15	15
	High	5825	MCS0_20	15	15
802.11 n40	Low	5755	MCS0_40	14	14
	High	5795	MCS0_40	14	14
802.11ac80	Middle	5775	AC-MCS0_80	13	13

2TX Non-beamforming:

Software and version			IPOR&QSPR	
Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Power Level
				Chain 0&1
802.11 a	Low	5745	6	15
	Middle	5785	6	15
	High	5825	6	15
802.11 n20	Low	5745	MCS0_20	15
	Middle	5785	MCS0_20	15
	High	5825	MCS0_20	15
802.11 n40	Low	5755	MCS0_40	14
	High	5795	MCS0_40	14
802.11ac80	Middle	5775	AC-MCS0_80	13

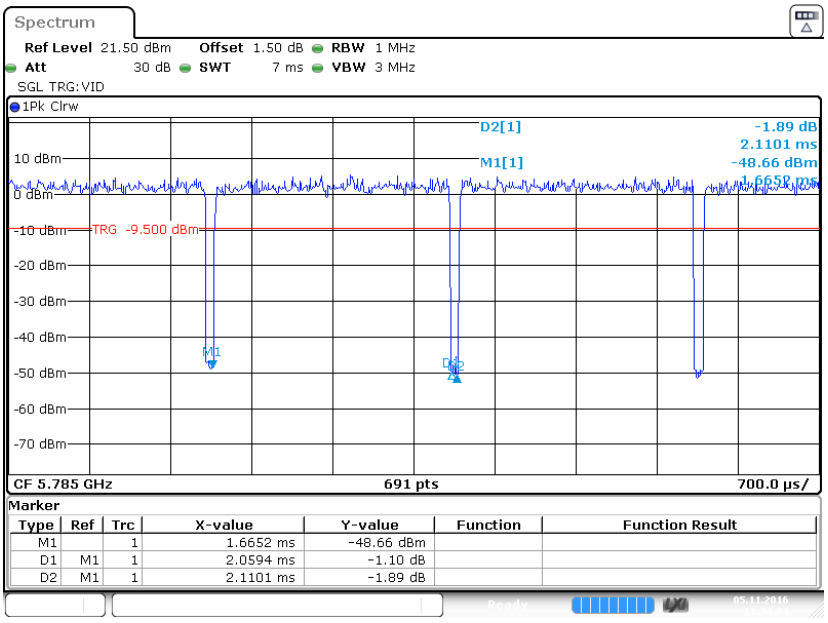
2TX With beamforming:

Software and version			IPOR&QSPR	
Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Power Level
				Chain 0&1
802.11 n20	Low	5745	MCS0_20	15
	Middle	5785	MCS0_20	15
	High	5825	MCS0_20	15
802.11 n40	Low	5755	MCS0_40	14
	High	5795	MCS0_40	14
802.11ac80	Middle	5775	AC-MCS0_80	13

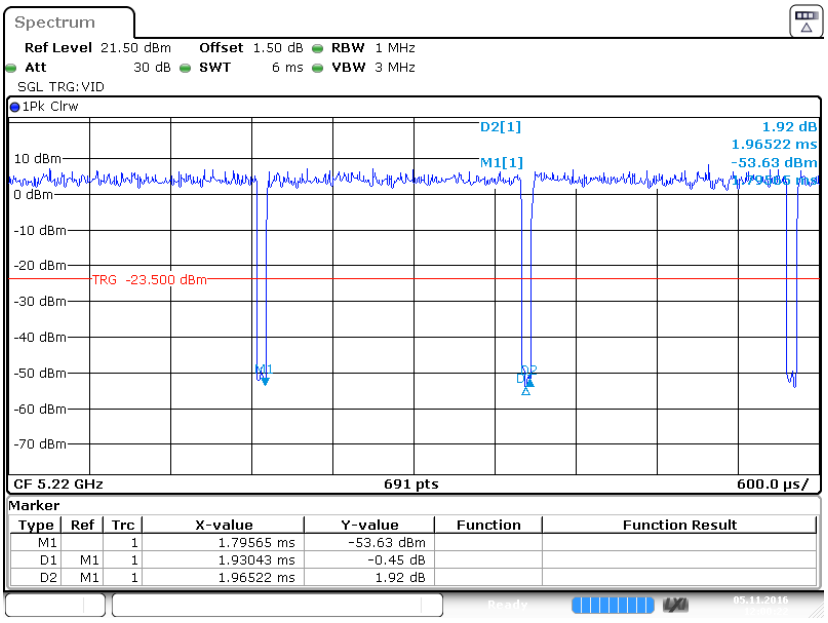
The duty cycle as below:

Mode	T_{on} (ms)	T_{on+off} (ms)	Duty Cycle (%)	Minimum Transmission Duration (T) (ms)
802.11a	2.06	2.11	98	2.06
802.11n ht20	1.93	1.97	98	1.93
802.11n ht40	0.94	1.00	94	0.94
802.11 ac80	0.94	1.00	94	0.94

802.11a



802.11n ht20



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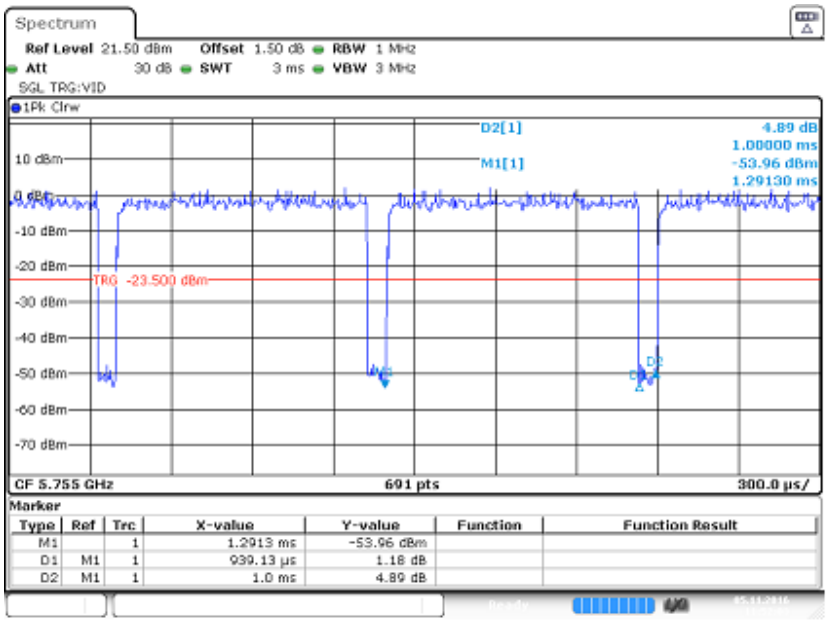
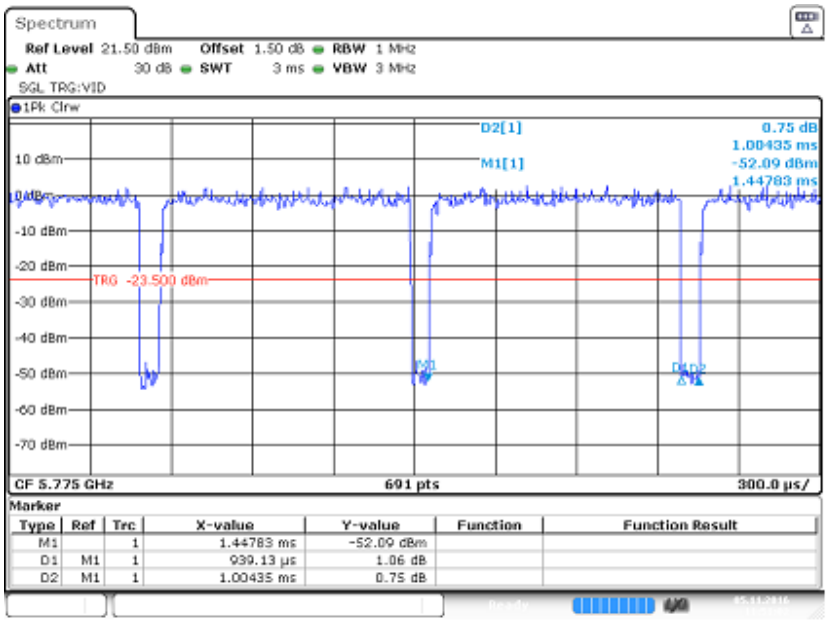


802.11ac80



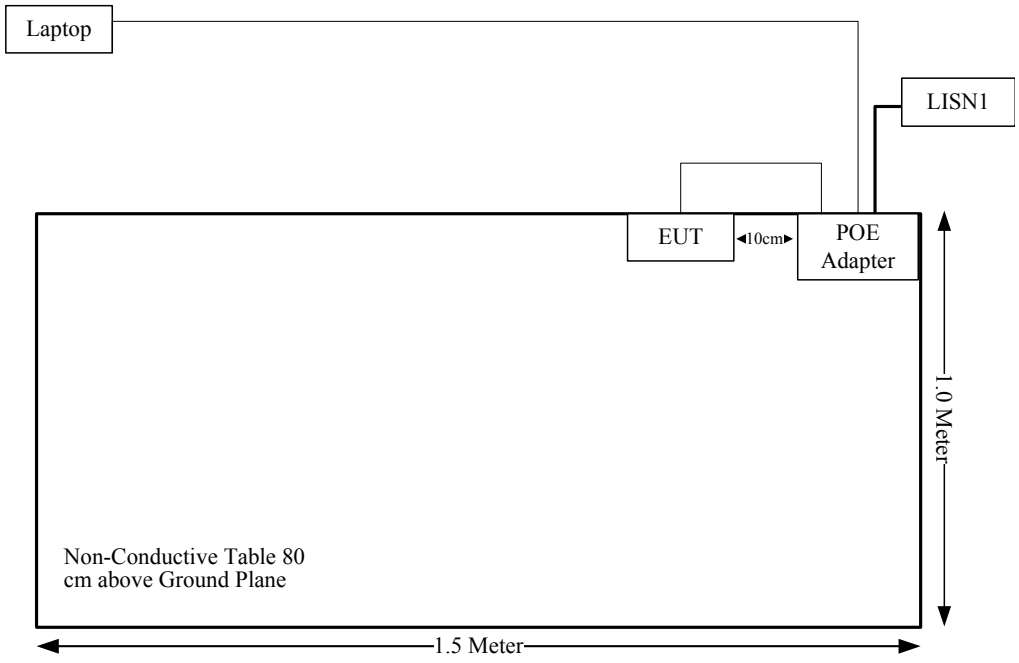
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
HP	Notebook	5600U	5CG6240ZH1

External I/O Cable

Cable Description	Length (m)	From/Port	To
RJ45	1.8	EUT	POE Adapter
RJ45	10	POE Adapter	Notebook

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.407(f) & §2.1091	Maximum Permissible Exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
FCC §15.207 & §15.407(b) (6)	AC Power Line Conducted Emissions	Compliance
§ 15.205 & §15.209 & §15.407(b)	undesirable emission & restricted bands	Compliance
§15.407(b)	Band Edge	Compliance
§15.407(a) & §15.407 (e)	Emission Bandwidth	Compliance
§15.407 (a)	Conducted Transmitter Output Power	Compliance
§15.407 (a)	Power Spectral Density	Compliance

FCC §15.407(f) & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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.

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

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

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

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

Calculated Formulary:

Predication of MPE limit at a given distance
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. $mW/cm2$);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

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

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

Calculated Data:

Frequency Band	Maximum Directional Gain		Maximum power including turn-up tolerance		Evaluation Distance (cm)	Power Density (mW/cm2)	MPE Limit (mW/cm2)
	(dBi)	(numeric)	(dBm)	(mW)			
2.4GHz	3	2.00	21	125.89	20.00	0.05	1
5.8GHz	4	2.51	19	79.43	20.00	0.04	1

The 2.4GHz and 5GHz band can transmit simultaneously:

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

$=S_{2.4}/S_{limit\text{-}2.4} + S_5/S_{limit\text{-}5}$

$=0.05/1+0.04/1$

$=0.09$

< 1.0

Result: The device meet FCC MPE at 20 cm distance

FCC §15.203 – ANTENNA REQUIREMENT

Applicable Standard

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

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

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

Antenna Connector Construction

The EUT have 2 internal PCB antennas the gain of each antenna is 4.0 dBi in 2.4GHz band, fulfill the requirement of this section. Please refer to the EUT photos

Result: Compliance.

FCC §15.407 (b) (6) §15.207 (a) –AC Power Line Conducted Emissions

Applicable Standard

FCC §15.207, §15.407(b) (6)

Measurement Uncertainty

Compliance or non- compliance with a disturbance limit shall be determined in the following manner：

If U_{lab} is less than or equal to U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

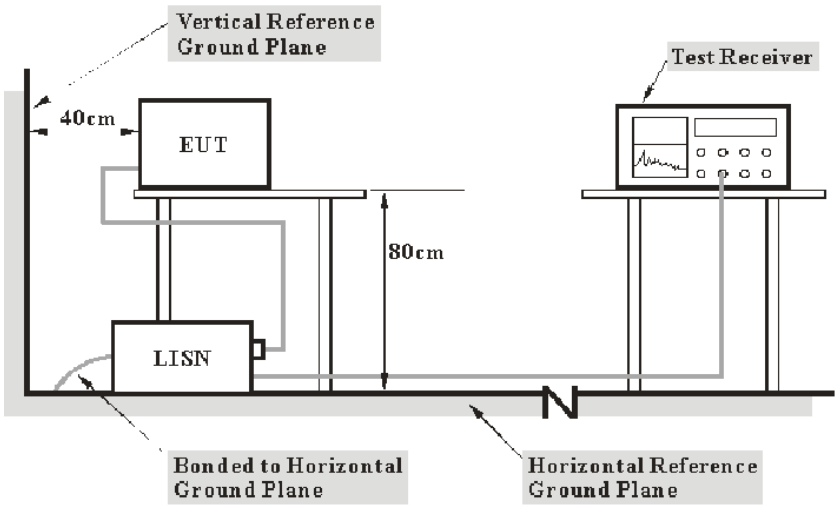
If U_{lab} is greater than U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit.

Based on CISPR 16-4-2: 2011, measurement uncertainty of conducted disturbance at mains port using AMN at Bay Area Compliance Laboratories Corp. (Kunshan) is 3.46 dB (150 kHz to 30 MHz).

Table 1 – Values of U_{cispr}

Measurement	U_{cispr}
Conducted disturbance at mains port using AMN (150 kHz to 30 MHz)	3.4 dB

EUT Setup



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

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

The spacing between the peripherals was 10 cm.

The adapter was connected to a 120VAC/60 Hz 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

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 maximum 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
Rohde & Schwarz	EMI Test Receiver	ESCS30	934115/007	2016-11-12	2017-11-11
Rohde & Schwarz	LISN	ESH3-Z5	862770/011	2016-11-12	2017-11-11
Rohde & Schwarz	LISN	ESH3-Z5	892239/018	2016-07-04	2017-07-03
Rohde & Schwarz	Pulse limiter	ESH3-Z2	879940/0058	2016-06-19	2017-06-18
MICRO-COAX	Coaxial line	UFB-293B-1-0480-50X50	97F0173	2016-09-08	2017-09-08
Rohde & Schwarz	CE Test software	EMC 32	V 09.10.0	--	--

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

Test Procedure

During the conducted emission test, the adapter was connected to the first LISN and the other support equipments were connected to the outlet of the second 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.

Test Results Summary

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

Test Data

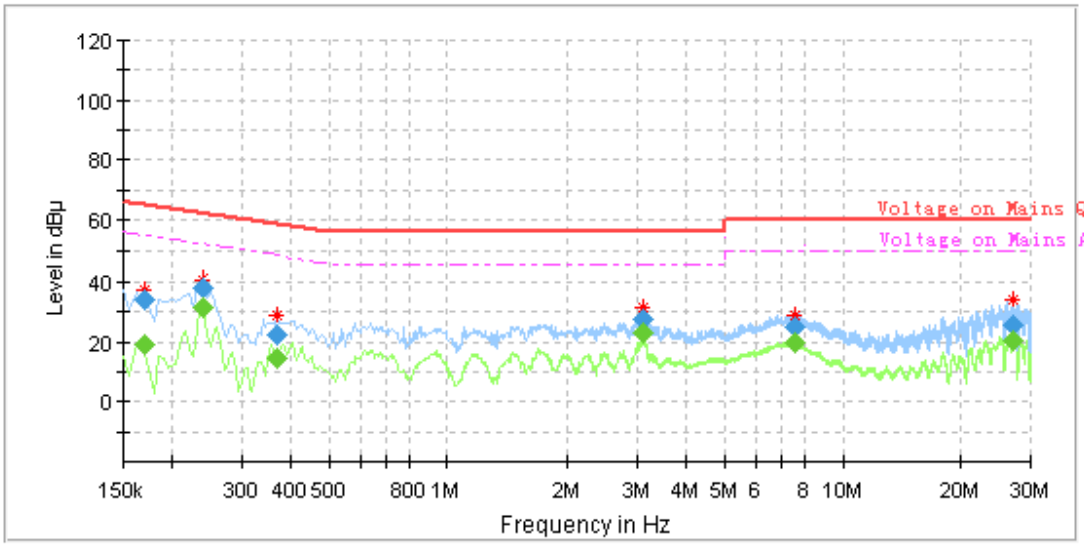
Environmental Conditions

Temperature:	23.5 °C
Relative Humidity:	55 %
ATM Pressure:	100.3 kPa

The testing was performed by Edison Hu on 2016-10-31.

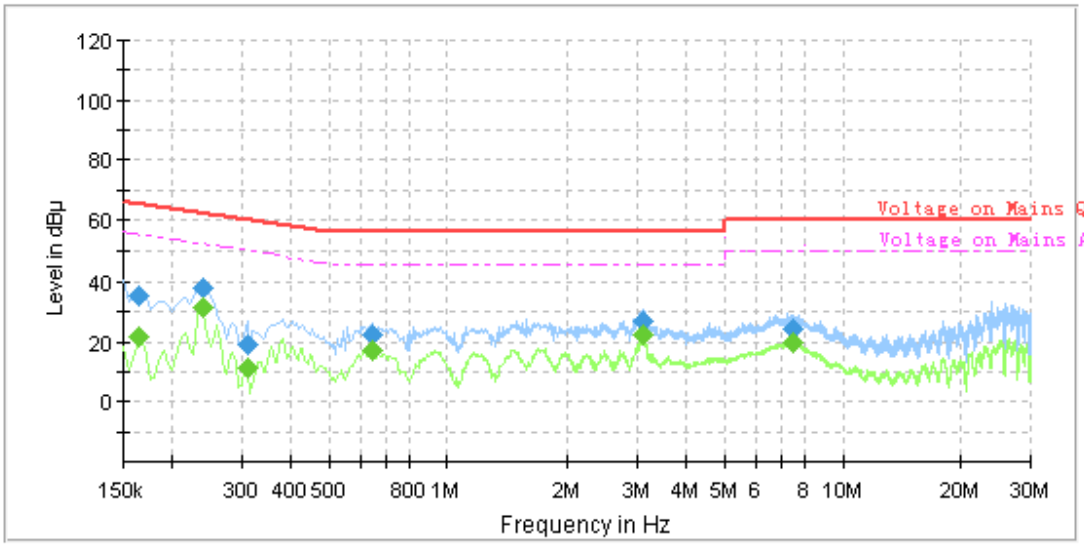
Test Mode: Transmitting

AC 120V/60 Hz, Line



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.170000	---	18.78	9.000	L1	---	36.18	54.96	Compliance
0.170000	33.88	---	9.000	L1	33.88	31.08	64.96	Compliance
0.240000	---	31.53	9.000	L1	---	20.57	52.10	Compliance
0.240000	38.12	---	9.000	L1	38.12	23.98	62.10	Compliance
0.370000	---	14.67	9.000	L1	---	33.83	48.50	Compliance
0.370000	22.44	---	9.000	L1	22.44	36.06	58.50	Compliance
3.105000	---	22.79	9.000	L1	---	23.21	46.00	Compliance
3.105000	27.24	---	9.000	L1	27.24	28.76	56.00	Compliance
7.555000	---	19.76	9.000	L1	---	30.24	50.00	Compliance
7.555000	24.61	---	9.000	L1	24.61	35.39	60.00	Compliance
27.165000	---	20.40	9.000	L1	---	29.60	50.00	Compliance
27.165000	25.27	---	9.000	L1	25.27	34.73	60.00	Compliance

AC 120V/60 Hz, Neutral



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.165000	---	21.81	9.000	N	10.3	33.40	55.21	Compliance
0.165000	35.27	---	9.000	N	10.3	29.94	65.21	Compliance
0.240000	---	31.43	9.000	N	10.3	20.67	52.10	Compliance
0.240000	37.83	---	9.000	N	10.3	24.27	62.10	Compliance
0.310000	---	11.07	9.000	N	10.3	38.90	49.97	Compliance
0.310000	19.14	---	9.000	N	10.3	40.83	59.97	Compliance
0.645000	---	16.99	9.000	N	10.3	29.01	46.00	Compliance
0.645000	22.11	---	9.000	N	10.3	33.89	56.00	Compliance
3.105000	---	22.58	9.000	N	10.5	23.42	46.00	Compliance
3.105000	27.12	---	9.000	N	10.5	28.88	56.00	Compliance
7.430000	---	19.47	9.000	N	10.6	30.53	50.00	Compliance
7.430000	24.05	---	9.000	N	10.6	35.95	60.00	Compliance

Note:

1) Corr.=LISN VDF (Voltage Division Factor) + Cable Loss
2) Corrected Amplitude = Reading + Corr.
3) Margin = Limit –Corrected Amplitude

§15.205 & §15.209 & §15.407(B) (1),(6),(7) – UNDESIRABLE EMISSION & RESTRICTED BANDS

Applicable Standard

FCC §15.407 (b) (1), (6), (7); §15.209; §15.205;

For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27dBm/MHz

For transmitters operating in the 5.25–5.35 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz. Devices operating in the 5.25–5.35 GHz band that generate emissions in the 5.15–5.25 GHz band must meet all applicable technical requirements for operation in the 5.15–5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of –27 dBm/MHz in the 5.15–5.25 GHz band.

For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of −27 dBm/MHz.

For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

As per FCC §15.35(d):Unless otherwise specified, on any frenquency or frequencies above 1000MHz,the radiated emission limits are based on the use of measurement instrunmentation employing an average detector function. Unless otherwise specified, measurements above 1000MHz shall be performed using a minimum resolution bandwidth of 1MHz.

According to KDB 789033 D02 General UNII Test Procedures New Rules v01, emission shall be computed as: E [dBμV/m] = EIRP[dBm] + 95.2, for d = 3 meters.

Measurement Uncertainty

Compliance or non- compliance with a disturbance limit shall be determined in the following manner：

If U_{lab} is less than or equal to U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{lab} is greater than U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit.

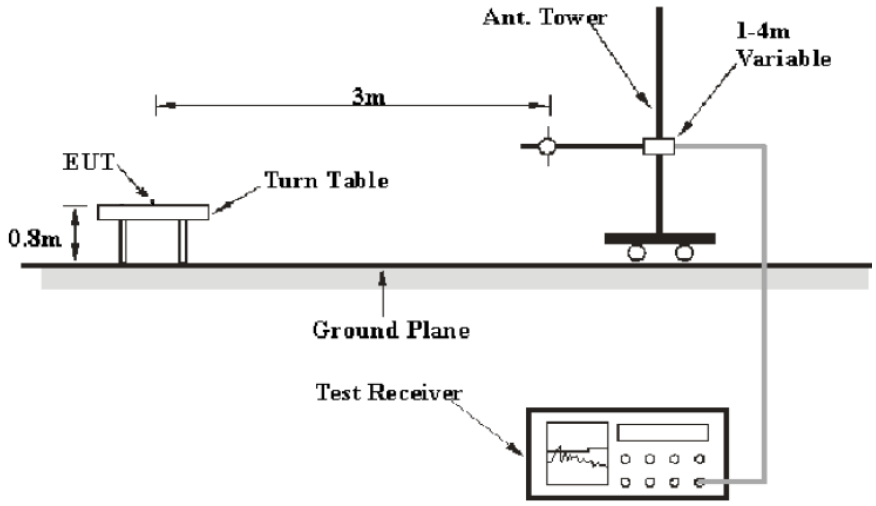
Based on CISPR 16-4-2: 2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Kunshan) is:
30M~200MHz: 5.0 dB
200M~1GHz: 6.2 dB
1G~6GHz: 4.45 dB
6G~18GHz: 5.23 dB

Table 1 – Values of U_{cispr}

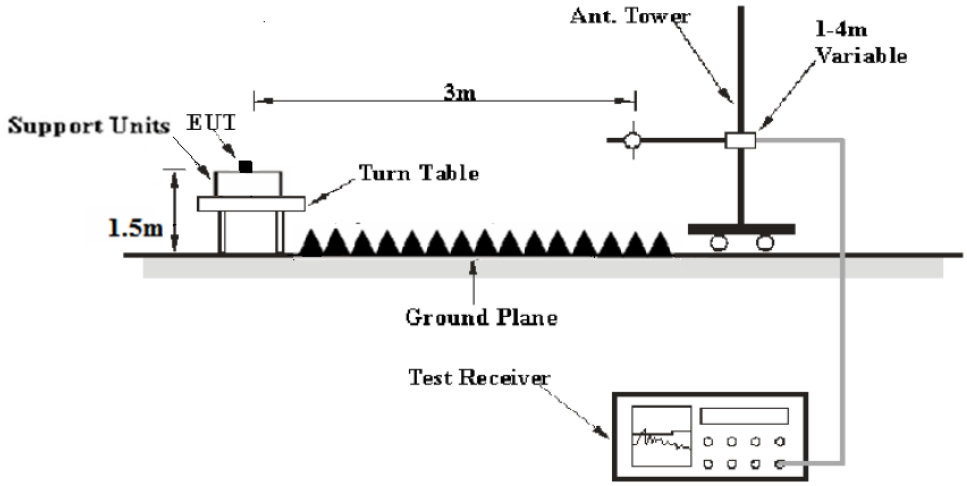
Measurement	U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

EUT Setup

Below 1 G:



Above 1 G:



The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC 15.209 and FCC 15.407 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

The adapter was connected to a 120 VAC/60 Hz power source.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 40 GHz.

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

30-1000MHz:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP

1GHz- 25GHz:

Detector	Duty cycle	RBW	Video B/W
PK	Any	1MHz	3 MHz
Ave.	>98%	1MHz	10 Hz
	<98%	1MHz	1/T

Note: T is Minimum Transmission Duration

Test Procedure

During the radiated emission test, the adapter was connected to the first AC floor outlet and the other support equipments were connected to the second AC floor outlet.

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-1GHz, peak and Average detection modes for frequencies above 1GHz.

The Radiated measurements was performed, The EIRP converted to field strength as follows:

According to C63.4, the above 1G test result shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade from 3m to 1.5m
Distance extrapolation factor =20 log (specific distance [3m]/test distance [1.5m]) dB
Extrapolation result = Corrected Amplitude (dBμV/m) - distance extrapolation factor (6dB)
or Limit line = Specific limits(dBμV) + distance extrapolation factor (6dB)

Corrected Amplitude & Margin Calculation

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

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

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

Margin = Limit –Extrapolation result

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sonoma Instrunent	Amplifier	330	171377	2016-10-21	2017-10-21
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2015-11-12	2016-11-11
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
ETS	Horn Antenna	3115	6229	2015-11-07	2016-11-06
EMCO	Horn Antenna	3116	9510-2384	2015-11-07	2016-11-06
Rohde & Schwarz	SIGNALANALYZER	FSV40	101116	2016-07-04	2017-07-03
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2015-11-12	2016-11-11
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-09-08	2017-09-08
DUCOMMUN	Pre-amplifier	ALN-22093530-01	990147	2016-09-16	2017-09-16
champrotek	Chamber	Chamber A	1#	2016-09-17	2017-09-17
R&S	Auto test Software	EMC32	V 09.10.0	/	/
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15
BACL	RF cable	KS-LAB-010	KS-LAB-010	2015-12-16	2016-12-15

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

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, Section 15.205, 15.209 and 15.407

Test Data

Environmental Conditions

Temperature:	23.5 °C
Relative Humidity:	62 %
ATM Pressure:	99.9 kPa

The testing was performed by Edison Hu on 2016-10-31

Mode: Transmitting

Note: For above 1GHz, the test distance is 1.5m.

30MHz~40GHz
Non-beamforming mode:
802.11a Mode(2TX mode was the worst):

Frequency	Receiver		Turntable Degree	Rx Antenna		Corrected Factor	Corrected Amplitude	Extrapolation result	Limit	Margin
	Reading	Detector		Height	Polar					
(MHz)	(dBμV)	(PK/QP/AV)		(cm)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dBμV/m)	(dB)
Low Channel:5745 MHz										
5745.0	105.44	PK	120	150	V	10.3	115.74	109.74	/	/
5745.0	101.21	AV	120	150	V	10.3	111.51	105.51	/	/
5745.0	102.52	PK	66	200	H	10.3	112.82	106.82	/	/
5745.0	99.52	AV	66	200	H	10.3	109.82	103.82	/	/
5725.0	39.69	PK	212	150	V	10.3	49.99	43.99	74	30.01
5725.0	35.32	AV	212	150	V	10.3	45.62	39.62	54	14.38
11490.0	32.90	PK	76	150	V	21.1	54.00	48.00	74	26.00
11490.0	26.54	AV	76	150	V	21.1	47.64	41.64	54	12.36
17235.0	26.31	PK	0	200	H	30.8	57.11	51.11	74	22.89
17235.0	15.37	AV	0	200	H	30.8	46.17	40.17	54	13.83
6650.0	32.16	PK	310	150	V	14.1	46.26	40.26	74	33.74
6650.0	24.74	AV	310	150	V	14.1	38.84	32.84	54	21.16
499.98	41.34	QP	258	100	H	-5.6	35.74	35.74	46	10.26
Middle Channel:5785MHz										
5785.0	103.44	PK	151	150	V	10.3	113.74	107.74	/	/
5785.0	97.89	AV	151	150	V	10.3	108.19	102.19	/	/
5785.0	99.83	PK	48	200	H	10.3	110.13	104.13	/	/
5785.0	95.68	AV	48	200	H	10.3	105.98	99.98	/	/
11570.0	37.37	PK	145	150	V	21.1	58.47	52.47	74	21.53
11570.0	27.42	AV	145	150	V	21.1	48.52	42.52	54	11.48
17355.0	27.10	PK	12	200	H	30.8	57.90	51.90	74	22.10
17355.0	17.64	AV	12	200	H	30.8	48.44	42.44	54	11.56
6662.0	31.37	PK	345	150	V	14.1	45.47	39.47	74	34.53
6662.0	22.97	AV	345	150	V	14.1	37.07	31.07	54	22.93
7551.0	37.43	PK	341	150	H	17.2	54.63	48.63	74	25.37
7551.0	30.93	AV	341	150	H	17.2	48.13	42.13	54	11.87
499.98	42.72	QP	240	100	H	-5.6	37.12	37.12	46	8.88
High Channel:5825MHz										
5825.0	105.01	PK	120	150	V	10.3	115.31	109.31	/	/
5825.0	99.32	AV	120	150	V	10.3	109.62	103.62	/	/
5825.0	102.16	PK	66	200	H	10.3	112.46	106.46	/	/
5825.0	98.43	AV	66	200	H	10.3	108.73	102.73	/	/
5850.0	38.63	PK	212	150	V	10.3	48.93	42.93	74	31.07
5850.0	34.41	AV	212	150	V	10.3	44.71	38.71	54	15.29
11650.0	32.07	PK	76	150	V	21.1	53.17	47.17	74	26.83
11650.0	25.64	AV	76	150	V	21.1	46.74	40.74	54	13.26
17475.0	29.64	PK	0	200	H	30.8	60.44	54.44	74	19.56
17475.0	16.14	AV	0	200	H	30.8	46.94	40.94	54	13.06
6659.0	30.19	PK	310	150	V	14.1	44.29	38.29	74	35.71
6659.0	24.13	AV	310	150	V	14.1	38.23	32.23	54	21.77
499.98	41.36	QP	258	100	H	-5.6	35.76	35.76	46	10.24

802.11n ht20 Mode: (2TX mode was the worst):

Frequency	Receiver		Turntable Degree	Rx Antenna		Corrected Factor	Corrected Amplitude	Extrapolation result	Limit	Margin
	Reading	Detector		Height	Polar					
(MHz)	(dBμV)	(PK/QP/AV)		(cm)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dBμV/m)	(dB)
Low Channel:5745 MHz										
5745.0	104.62	PK	120	150	H	10.3	114.92	108.92	/	/
5745.0	99.05	AV	120	150	H	10.3	109.35	103.35	/	/
5745.0	100.94	PK	66	200	V	10.3	111.24	105.24	/	/
5745.0	96.26	AV	66	200	V	10.3	106.56	100.56	/	/
5725.0	36.28	PK	212	150	H	10.3	46.58	40.58	74	33.42
5725.0	33.08	AV	212	150	H	10.3	43.38	37.38	54	16.62
11490.0	31.04	PK	76	150	V	21.1	52.14	46.14	74	27.86
11490.0	25.93	AV	76	150	V	21.1	47.03	41.03	54	12.97
17235.0	27.79	PK	0	200	H	30.8	58.59	52.59	74	21.41
17235.0	14.76	AV	0	200	H	30.8	45.56	39.56	54	14.44
6650.0	30.47	PK	310	150	V	14.1	44.57	38.57	74	35.43
6650.0	25.69	AV	310	150	V	14.1	39.79	33.79	54	20.21
499.98	41.29	QP	258	100	H	-5.6	35.69	35.69	46	10.31
Middle Channel:5785MHz										
5785.0	104.19	PK	151	150	H	10.3	114.49	108.49	/	/
5785.0	99.20	AV	151	150	H	10.3	109.50	103.50	/	/
5785.0	100.33	PK	48	200	V	10.3	110.63	104.63	/	/
5785.0	97.13	AV	48	200	V	10.3	107.43	101.43	/	/
11570.0	39.47	PK	145	150	V	21.1	60.57	54.57	74	19.43
11570.0	26.67	AV	145	150	V	21.1	47.77	41.77	54	12.23
17355.0	26.90	PK	12	200	H	30.8	57.70	51.70	74	22.30
17355.0	17.56	AV	12	200	H	30.8	48.36	42.36	54	11.64
6662.0	30.06	PK	345	150	V	14.1	44.16	38.16	74	35.84
6662.0	22.03	AV	345	150	V	14.1	36.13	30.13	54	23.87
7551.0	35.64	PK	341	150	H	17.2	52.84	46.84	74	27.16
7551.0	29.11	AV	341	150	H	17.2	46.31	40.31	54	13.69
499.98	42.51	QP	240	100	H	-5.6	36.91	36.91	46	9.09
High Channel:5825MHz										
5825.0	104.88	PK	120	150	H	10.3	115.18	109.18	/	/
5825.0	100.21	AV	120	150	H	10.3	110.51	104.51	/	/
5825.0	101.18	PK	66	200	V	10.3	111.48	105.48	/	/
5825.0	97.60	AV	66	200	V	10.3	107.90	101.90	/	/
5850.0	36.90	PK	212	150	H	10.3	47.20	41.20	74	32.80
5850.0	32.97	AV	212	150	H	10.3	43.27	37.27	54	16.73
11650.0	29.05	PK	76	150	V	21.1	50.15	44.15	74	29.85
11650.0	23.67	AV	76	150	V	21.1	44.77	38.77	54	15.23
17475.0	29.86	PK	0	200	H	30.8	60.66	54.66	74	19.34
17475.0	15.58	AV	0	200	H	30.8	46.38	40.38	54	13.62
6659.0	32.48	PK	310	150	V	14.1	46.58	40.58	74	33.42
6659.0	22.11	AV	310	150	V	14.1	36.21	30.21	54	23.79
499.98	42.46	QP	258	100	H	-5.6	36.86	36.86	46	9.14

802.11n ht40 Mode (2TX mode was the worst)

Frequency	Receiver		Turntable Degree	Rx Antenna		Corrected Factor	Corrected	Extrapolation	Limit	Margin
	Reading	Detector		Height	Polar		Amplitude	result		
(MHz)	(dBµV)	(PK/QP/AV)		(cm)	(H/V)	(dB)	(dBµV/m)	(dBµV/m)	(dBµV/m)	(dB)
Low Channel:5755 MHz										
5755.0	103.91	PK	120	150	H	10.3	114.21	108.21	/	/
5755.0	97.95	AV	120	150	H	10.3	108.25	102.25	/	/
5755.0	100.97	PK	66	200	V	10.3	111.27	105.27	/	/
5755.0	97.45	AV	66	200	V	10.3	107.75	101.75	/	/
5725.0	36.27	PK	212	150	H	10.3	46.57	40.57	74	33.43
5725.0	31.39	AV	212	150	H	10.3	41.69	35.69	54	18.31
11490.0	30.11	PK	76	150	V	21.1	51.21	45.21	74	28.79
11490.0	23.29	AV	76	150	V	21.1	44.39	38.39	54	15.61
17235.0	26.63	PK	0	200	H	30.8	57.43	51.43	74	22.57
17235.0	16.37	AV	0	200	H	30.8	47.17	41.17	54	12.83
6650.0	31.47	PK	310	150	V	14.1	45.57	39.57	74	34.43
6650.0	22.86	AV	310	150	V	14.1	36.96	30.96	54	23.04
499.98	41.87	QP	258	100	H	-5.6	36.27	36.27	46	9.73
High Channel:5795MHz										
5795.0	103.38	PK	120	150	H	10.3	113.68	107.68	/	/
5795.0	97.55	AV	120	150	H	10.3	107.85	101.85	/	/
5795.0	99.57	PK	66	200	V	10.3	109.87	103.87	/	/
5795.0	95.28	AV	66	200	V	10.3	105.58	99.58	/	/
5850.0	39.72	PK	212	150	H	10.3	50.02	44.02	74	29.98
5850.0	35.53	AV	212	150	H	10.3	45.83	39.83	54	14.17
11650.0	32.16	PK	76	150	V	21.1	53.26	47.26	74	26.74
11650.0	26.14	AV	76	150	V	21.1	47.24	41.24	54	12.76
17475.0	28.39	PK	0	200	H	30.8	59.19	53.19	74	20.81
17475.0	16.11	AV	0	200	H	30.8	46.91	40.91	54	13.09
6659.0	30.72	PK	310	150	V	14.1	44.82	38.82	74	35.18
6659.0	24.65	AV	310	150	V	14.1	38.75	32.75	54	21.25
499.98	41.41	QP	258	100	H	-5.6	35.81	35.81	46	10.19

802.11ac80 Mode (2TX mode was the worst)

Frequency	Receiver		Turntable Degree	Rx Antenna		Corrected Factor	Corrected	Extrapolation	Limit	Margin
	Reading	Detector		Height	Polar		Amplitude	result		
(MHz)	(dBµV)	(PK/QP/AV)		(cm)	(H/V)	(dB)	(dBµV/m)	(dBµV/m)	(dBµV/m)	(dB)
5775 MHz										
5775	102.54	PK	120	150	H	10.3	112.84	106.84	N/A	N/A
5775	97.85	AV	120	150	H	10.3	108.15	102.15	N/A	N/A
5775	99.18	PK	66	200	V	10.3	109.48	103.48	N/A	N/A
5775	95.75	AV	66	200	V	10.3	106.05	100.05	N/A	N/A
5850	37.88	PK	212	150	H	21.1	58.98	52.98	74	21.02
5850	28.48	AV	212	150	H	21.1	49.58	43.58	54	10.42
11550	32.65	PK	76	150	V	30.8	63.45	57.45	74	16.55
11550	20.15	AV	76	150	V	30.8	50.95	44.95	54	9.05
17325	30.58	PK	0	200	H	14.1	44.68	38.68	74	35.32
17325	22.19	AV	0	200	H	14.1	36.29	30.29	54	23.71
6694	33.25	PK	310	150	V	17.2	50.45	44.45	74	29.55
6694	23.04	AV	310	150	V	17.2	40.24	34.24	54	19.76
499.98	43.58	QP	258	100	H	-5.6	37.98	37.98	46	8.02

Beamforming Mode:
802.11n ht20 mode

Frequency	Receiver		Turntable Degree	Rx Antenna		Corrected Factor	Corrected Amplitude	Extrapolation result	Limit	Margin
	Reading	Detector		Height	Polar					
(MHz)	(dBμV)	(PK/QP/AV)		(cm)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dBμV/m)	(dB)
Low Channel:5745 MHz										
5745.0	104.60	PK	120	150	H	10.3	114.90	108.90	/	/
5745.0	98.83	AV	120	150	H	10.3	109.13	103.13	/	/
5745.0	101.61	PK	66	200	V	10.3	111.91	105.91	/	/
5745.0	97.42	AV	66	200	V	10.3	107.72	101.72	/	/
5725.0	37.36	PK	212	150	H	10.3	47.66	41.66	74	32.34
5725.0	33.12	AV	212	150	H	10.3	43.42	37.42	54	16.58
11490.0	30.01	PK	76	150	V	21.1	51.11	45.11	74	28.89
11490.0	24.21	AV	76	150	V	21.1	45.31	39.31	54	14.69
17235.0	27.20	PK	0	200	H	30.8	58.00	52.00	74	22.00
17235.0	16.04	AV	0	200	H	30.8	46.84	40.84	54	13.16
6650.0	31.26	PK	310	150	V	14.1	45.36	39.36	74	34.64
6650.0	24.72	AV	310	150	V	14.1	38.82	32.82	54	21.18
499.98	41.89	QP	258	100	H	-5.6	36.29	36.29	46	9.71
Middle Channel:5785MHz										
5785.0	104.56	PK	151	150	H	10.3	114.86	108.86	/	/
5785.0	99.48	AV	151	150	H	10.3	109.78	103.78	/	/
5785.0	100.76	PK	48	200	V	10.3	111.06	105.06	/	/
5785.0	97.39	AV	48	200	V	10.3	107.69	101.69	/	/
11570.0	38.15	PK	145	150	V	21.1	59.25	53.25	74	20.75
11570.0	26.57	AV	145	150	V	21.1	47.67	41.67	54	12.33
17355.0	27.38	PK	12	200	H	30.8	58.18	52.18	74	21.82
17355.0	15.50	AV	12	200	H	30.8	46.30	40.30	54	13.70
6662.0	32.41	PK	345	150	V	14.1	46.51	40.51	74	33.49
6662.0	22.92	AV	345	150	V	14.1	37.02	31.02	54	22.98
7551.0	31.33	PK	341	150	H	17.2	48.53	42.53	74	31.47
7551.0	23.30	AV	341	150	H	17.2	40.50	34.50	54	19.50
499.98	41.03	QP	240	100	H	-5.6	35.43	35.43	46	10.57
High Channel:5825MHz										
5825.0	103.29	PK	120	150	H	10.3	113.59	107.59	/	/
5825.0	97.96	AV	120	150	H	10.3	108.26	102.26	/	/
5825.0	100.41	PK	66	200	V	10.3	110.71	104.71	/	/
5825.0	96.81	AV	66	200	V	10.3	107.11	101.11	/	/
5850.0	39.91	PK	212	150	H	10.3	50.21	44.21	74	29.79
5850.0	36.32	AV	212	150	H	10.3	46.62	40.62	54	13.38
11650.0	32.87	PK	76	150	V	21.1	53.97	47.97	74	26.03
11650.0	26.15	AV	76	150	V	21.1	47.25	41.25	54	12.75
17475.0	29.76	PK	0	200	H	30.8	60.56	54.56	74	19.44
17475.0	18.37	AV	0	200	H	30.8	49.17	43.17	54	10.83
6659.0	31.21	PK	310	150	V	14.1	45.31	39.31	74	34.69
6659.0	23.28	AV	310	150	V	14.1	37.38	31.38	54	22.62
499.98	41.72	QP	240	100	H	-5.6	36.12	36.12	46	9.88

802.11n ht40 mode:

Frequency	Receiver		Turntable Degree	Rx Antenna		Corrected Factor	Corrected	Extrapolation	Limit	Margin
	Reading	Detector		Height	Polar		Amplitude	result		
(MHz)	(dBμV)	(PK/QP/AV)		(cm)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dBμV/m)	(dB)
Low Channel:5755 MHz										
5755.0	103.00	PK	120	150	H	10.3	113.30	107.30	/	/
5755.0	98.54	AV	120	150	H	10.3	108.84	102.84	/	/
5755.0	100.32	PK	66	200	V	10.3	110.62	104.62	/	/
5755.0	97.10	AV	66	200	V	10.3	107.40	101.40	/	/
5725.0	39.79	PK	212	150	H	10.3	50.09	44.09	74	29.91
5725.0	36.25	AV	212	150	H	10.3	46.55	40.55	54	13.45
11490.0	32.65	PK	76	150	V	21.1	53.75	47.75	74	26.25
11490.0	27.27	AV	76	150	V	21.1	48.37	42.37	54	11.63
17235.0	26.22	PK	0	200	H	30.8	57.02	51.02	74	22.98
17235.0	16.39	AV	0	200	H	30.8	47.19	41.19	54	12.81
6650.0	30.36	PK	310	150	V	14.1	44.46	38.46	74	35.54
6650.0	23.50	AV	310	150	V	14.1	37.60	31.60	54	22.40
499.98	42.77	QP	258	100	H	-5.6	37.17	37.17	46	8.83
High Channel:5795MHz										
5795.0	102.81	PK	120	150	H	10.3	113.11	107.11	/	/
5795.0	97.30	AV	120	150	H	10.3	107.60	101.60	/	/
5795.0	99.17	PK	66	200	V	10.3	109.47	103.47	/	/
5795.0	94.41	AV	66	200	V	10.3	104.71	98.71	/	/
5850.0	37.42	PK	212	150	H	10.3	47.72	41.72	74	32.28
5850.0	33.76	AV	212	150	H	10.3	44.06	38.06	54	15.94
11650.0	31.26	PK	76	150	V	21.1	52.36	46.36	74	27.64
11650.0	25.80	AV	76	150	V	21.1	46.90	40.90	54	13.10
17475.0	28.31	PK	0	200	H	30.8	59.11	53.11	74	20.89
17475.0	14.83	AV	0	200	H	30.8	45.63	39.63	54	14.37
6659.0	31.05	PK	310	150	V	14.1	45.15	39.15	74	34.85
6659.0	24.71	AV	310	150	V	14.1	38.81	32.81	54	21.19
499.98	43.18	QP	258	100	H	-5.6	37.58	37.58	46	8.42

802.11ac80 Mode

Frequency	Receiver		Turntable Degree	Rx Antenna		Corrected Factor	Corrected	Extrapolation	Limit	Margin
	Reading	Detector		Height	Polar		Amplitude	result		
(MHz)	(dBµV)	(PK/QP/AV)		(cm)	(H/V)	(dB)	(dBµV/m)	(dBµV/m)	(dBµV/m)	(dB)
High Channel:5775MHz										
5775.0	101.21	PK	120	150	H	10.3	111.51	105.51	/	/
5775.0	96.24	AV	120	150	H	10.3	106.54	100.54	/	/
5775.0	98.02	PK	66	200	V	10.3	108.32	102.32	/	/
5775.0	94.46	AV	66	200	V	10.3	104.76	98.76	/	/
5850.0	36.51	PK	212	150	H	21.1	57.61	51.61	74	22.39
5850.0	27.26	AV	212	150	H	21.1	48.36	42.36	54	11.64
11550.0	32.27	PK	76	150	V	30.8	63.07	57.07	74	16.93
11550.0	19.01	AV	76	150	V	30.8	49.81	43.81	54	10.19
17325.0	29.72	PK	0	200	H	14.1	43.82	37.82	74	36.18
17325.0	21.37	AV	0	200	H	14.1	35.47	29.47	54	24.53
6694.0	32.48	PK	310	150	V	17.2	49.68	43.68	74	30.32
6694.0	22.58	AV	310	150	V	17.2	39.78	33.78	54	20.22
499.98	42.91	QP	258	100	H	-5.6	37.31	37.31	46	8.69

Co-location (2.4GHz band and 5.8GHz band transmit simultaneously):
(2.4GHz 2TX N40 Non-beamforming mode 2437MHz + 5.8GHz 2TX AC80 5775MHz Non-beamforming was the worst, the test performing at 3m distance):

Frequency (MHz)	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247	
	Reading	Detector		Height	Polar			Limit	Margin
	(dBµV)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dBµV/m)	(dBµV/m)	(dB)
2.4GHz band 802.11n ht40 2452MHz+5GHz band 802.11ac80 5775MHz is worse									
4874.0	32.49	PK	12	229	V	7.3	39.79	74	34.21
4874.0	25.40	Ave	12	229	V	7.3	32.70	54	21.30
2563.0	42.30	PK	74	192	V	4.2	46.50	74	27.50
2563.0	36.11	Ave	74	192	V	4.2	40.31	54	13.69
7356.00	38.36	PK	212	221	H	7.70	46.06	74	27.94
7356.00	30.02	Ave	212	221	H	7.70	37.72	54	16.28
11490.0	32.65	PK	76	150	V	21.1	53.75	74	20.25
11490.0	27.27	AV	76	150	V	21.1	48.37	54	5.63
17235	26.22	PK	0	200	H	30.8	57.02	74	16.98
17235	16.39	AV	0	200	H	30.8	47.19	54	6.81
6650	30.36	PK	310	150	V	14.1	44.46	74	29.54
6650	23.5	AV	310	150	V	14.1	37.6	54	16.4
499.98	42.46	QP	258	100	H	-5.6	36.86	46	9.14

FCC §15.407(b) (1) (2) (3) (4) –BAND EDGE

Applicable Standard

FCC §15.407 (b) (1), (2), (3), (4);

For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of -27dBm/MHz

For transmitters operating in the 5.25–5.35 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz. Devices operating in the 5.25–5.35 GHz band that generate emissions in the 5.15–5.25 GHz band must meet all applicable technical requirements for operation in the 5.15–5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of –27 dBm/MHz in the 5.15–5.25 GHz band.

For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of −27 dBm/MHz.

For transmitters operating in the 5.725–5.850 GHz band: all emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibration 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 measuremen 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 1 MHz and VBW to 3MHz of spectrum analyzer. Offset the antenna gain and cable loss.
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
Rohde & Schwarz	SIGNALANALYZER	FSV40	101116	2016-07-04	2017-07-03
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15

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

Test Data

Environmental Conditions

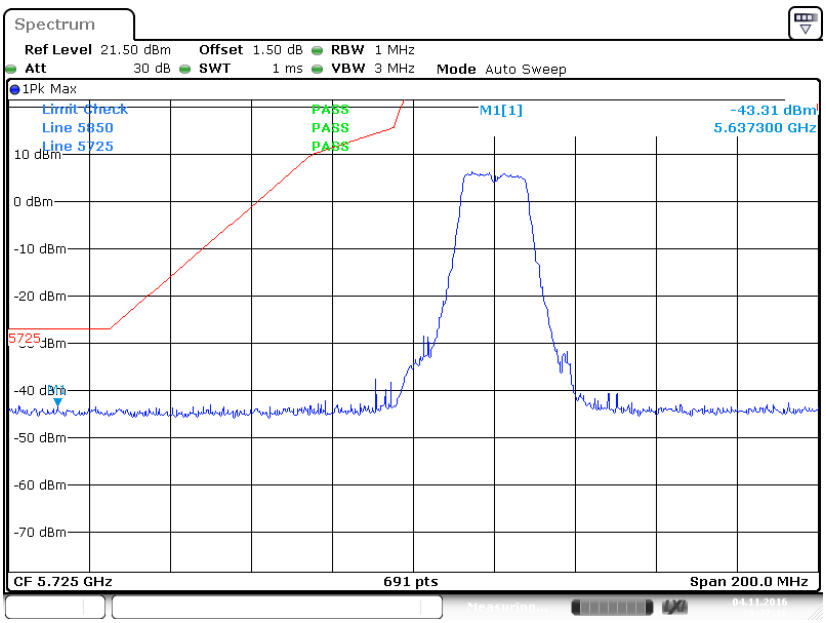
Temperature:	23.5 °C
Relative Humidity:	60 %
ATM Pressure:	99.9 kPa

The testing was performed by Edison Hu on 2016-11-04.

Test Result: Compliance (SISO mode was tested since maximum power per chain, all emissions under limit 7dBc, so combined two chains are compliance with the requirement)

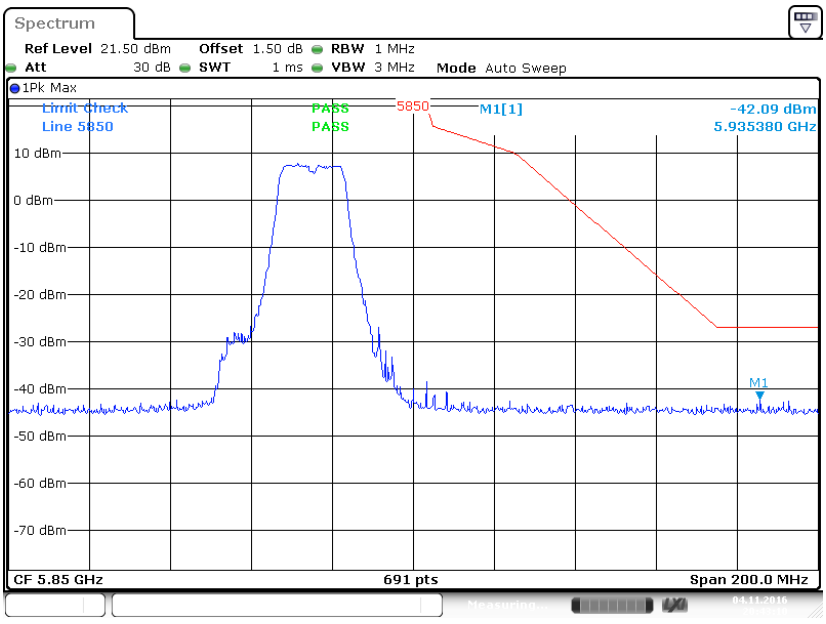
Please refer to the following tables and plots.

802.11a Chain0 Band Edge, Left Side



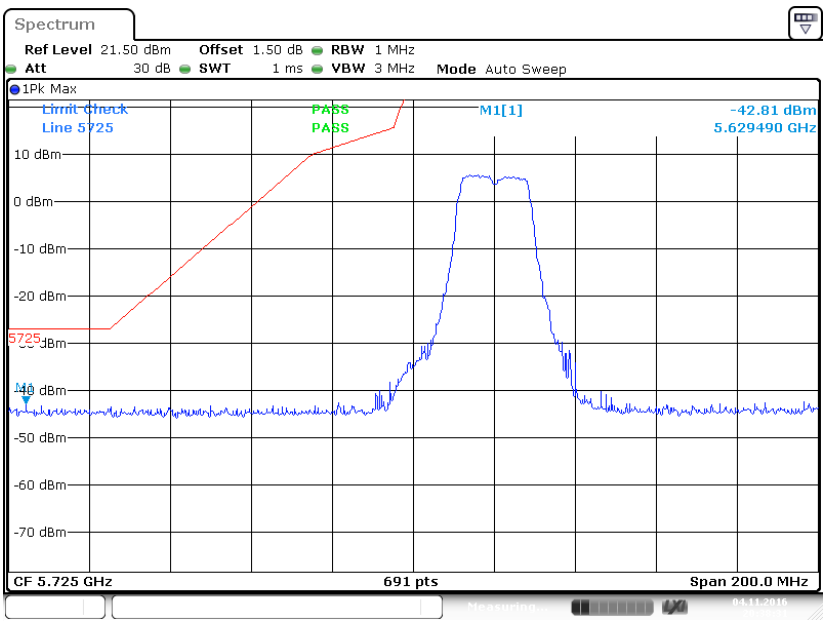
Date:4.NOV.2016 20:27:16

802.11a Chain0 Band Edge, Right Side



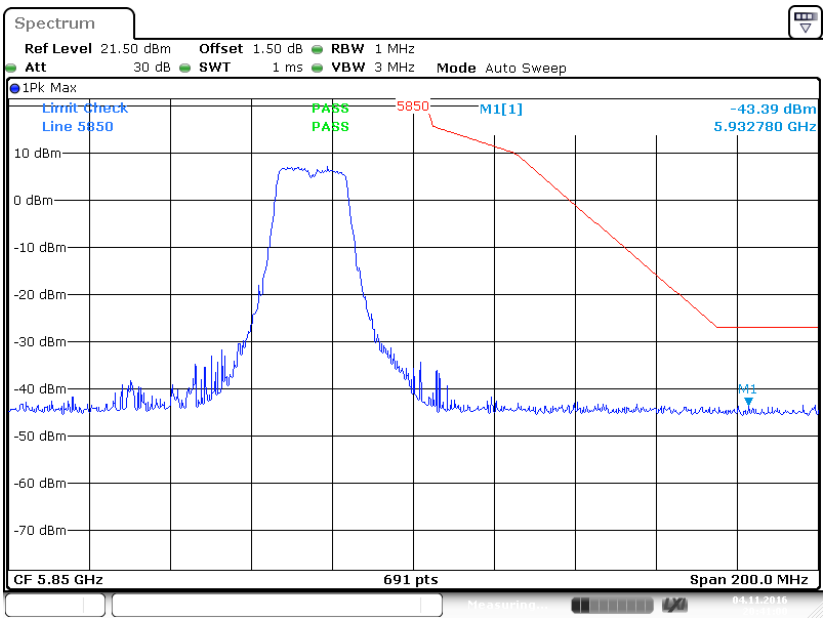
Date:4.NOV.2016 20:43:10

802.11n Chain0 ht20 Band Edge, Left Side



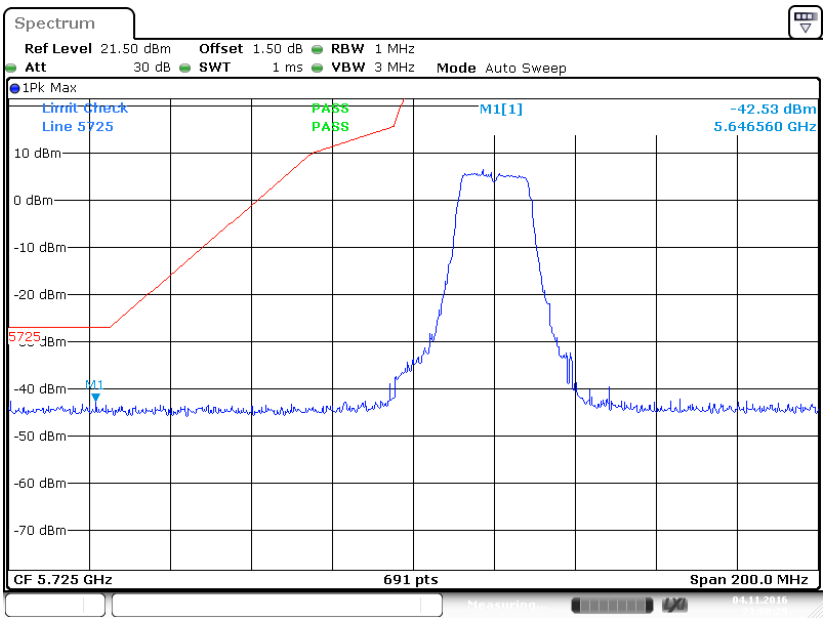
Date: 4.NOV.2016 20:38:31

802.11n Chain0 ht20 Band Edge, Right Side



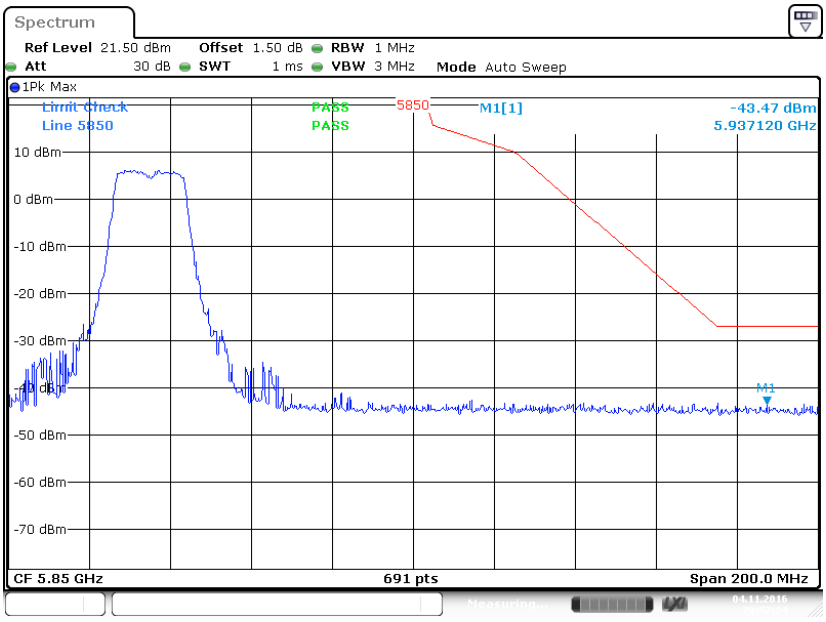
Date: 4.NOV.2016 20:41:00

802.11n Chain0 ht40 Band Edge, Left Side



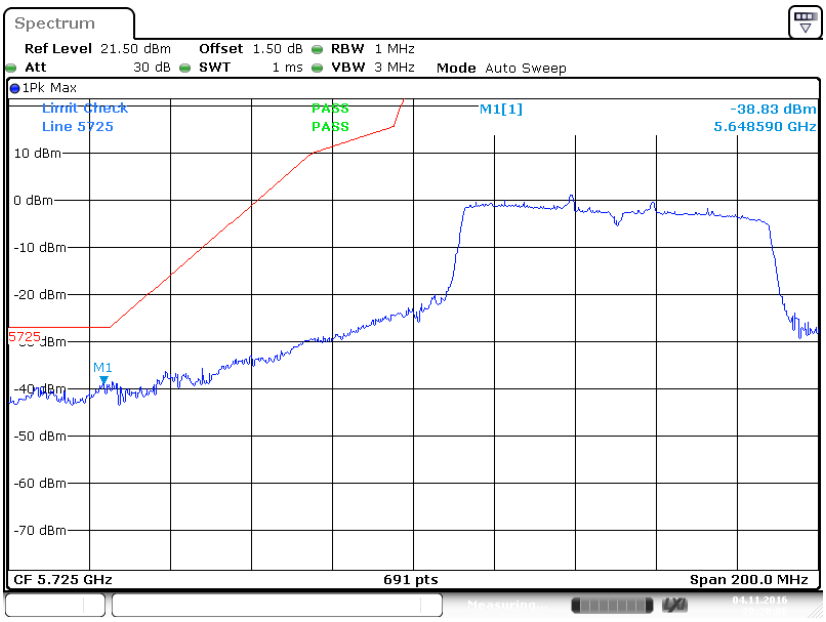
Date:4.NOV.2016 21:00:30

802.11n Chain0 ht40 Band Edge, Right Side



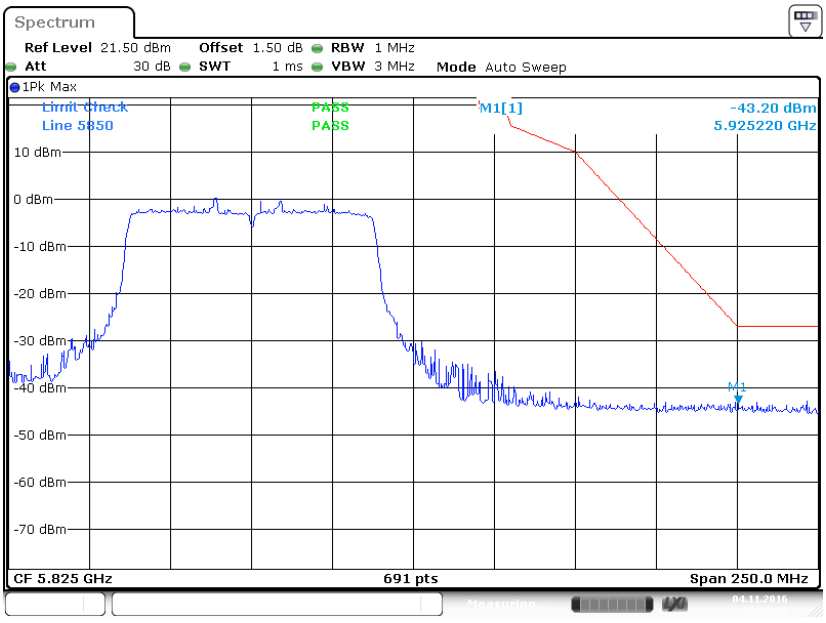
Date:4.NOV.2016 20:57:23

802.11ac80 Chain0 Band Edge, Left Side



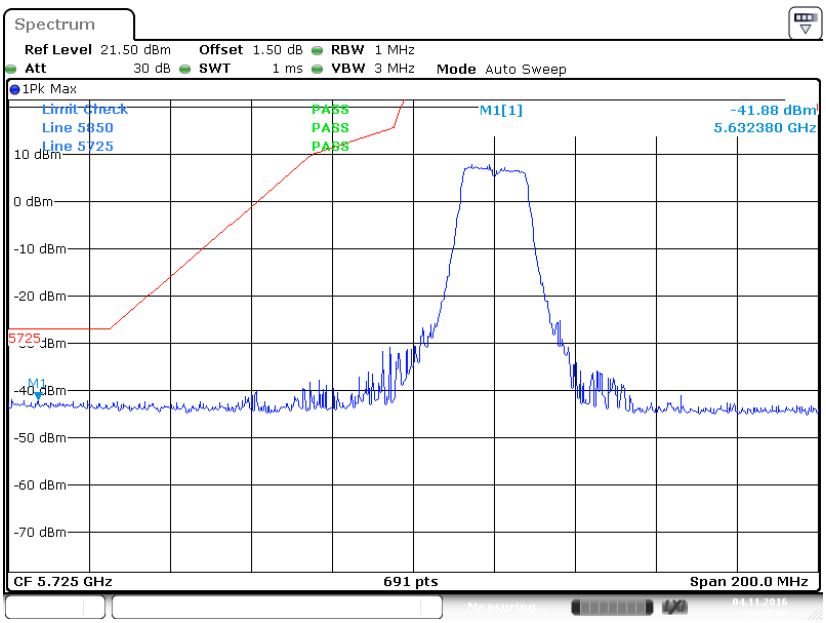
Date: 4.NOV.2016 20:20:05

802.11ac80 Chain0 Band Edge, Right Side



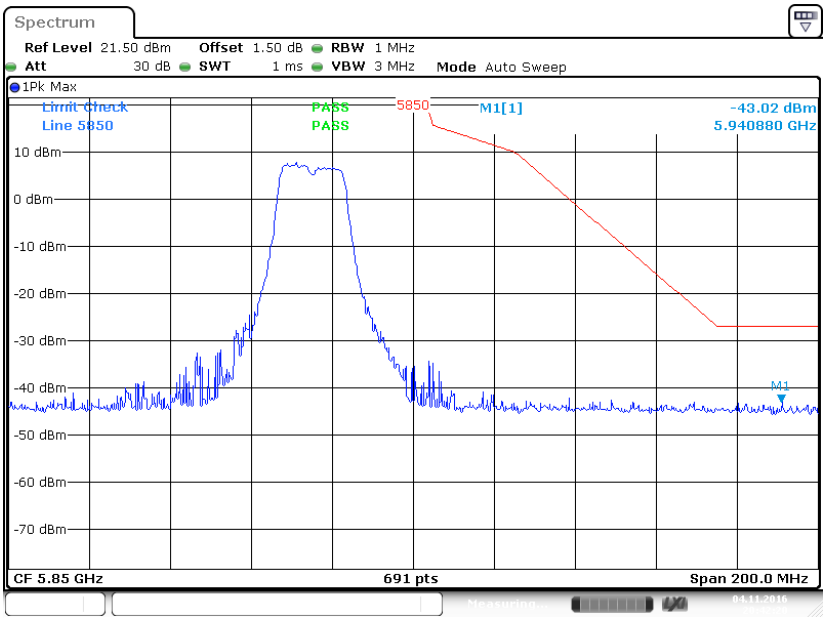
Date: 4.NOV.2016 20:24:39

802.11a Chain1 Band Edge, Left Side



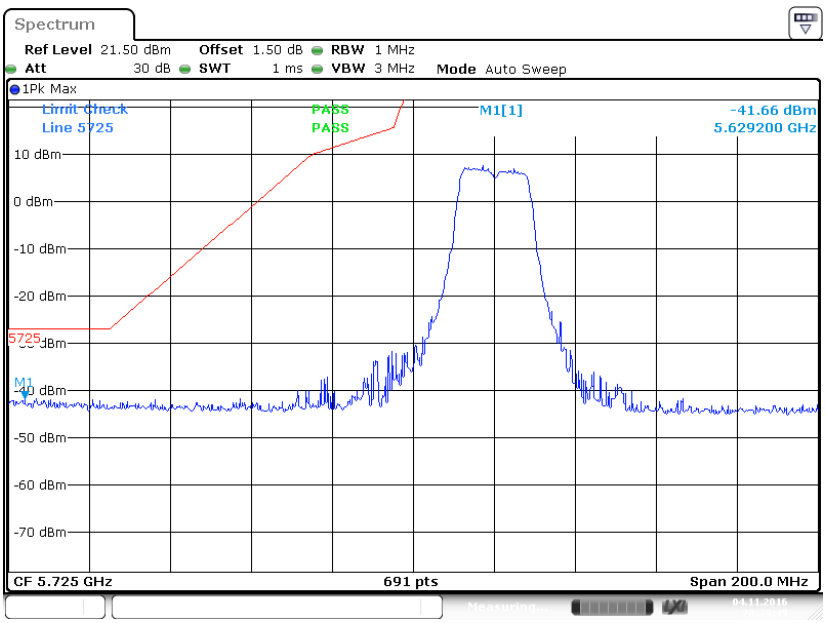
Date: 4.NOV.2016 20:28:46

802.11a Chain1 Band Edge, Right Side



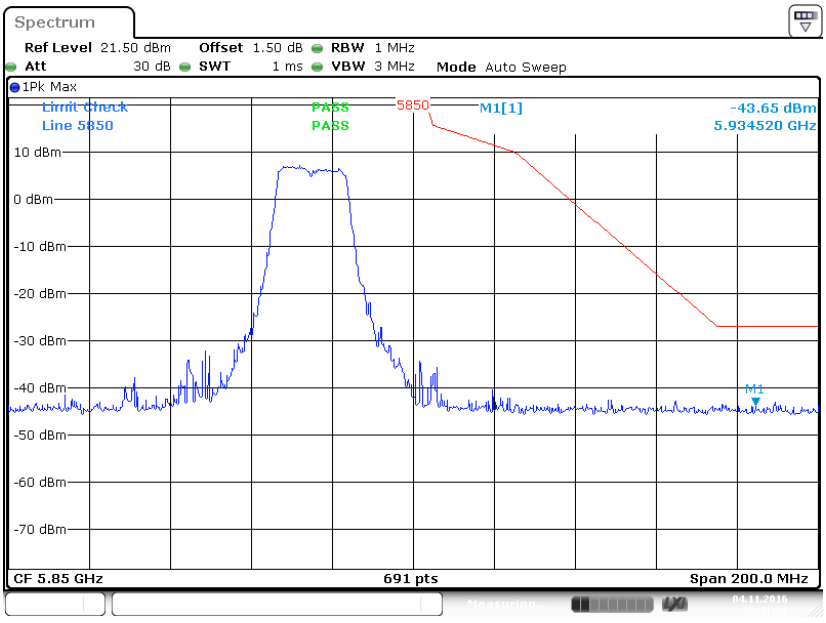
Date: 4.NOV.2016 20:42:20

802.11n ht20 Chain1 Band Edge, Left Side



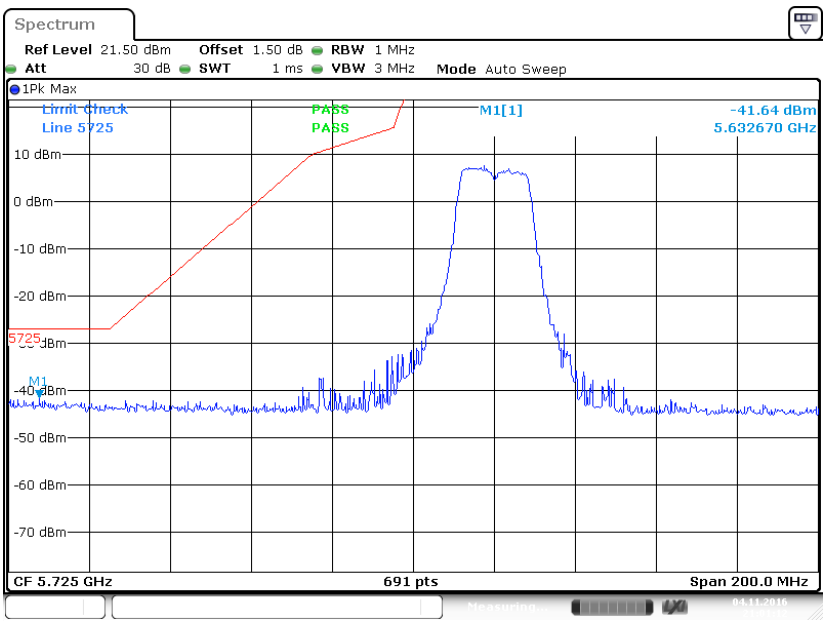
Date: 4.NOV.2016 20:39:45

802.11n ht20 Chain1 Band Edge, Right Side



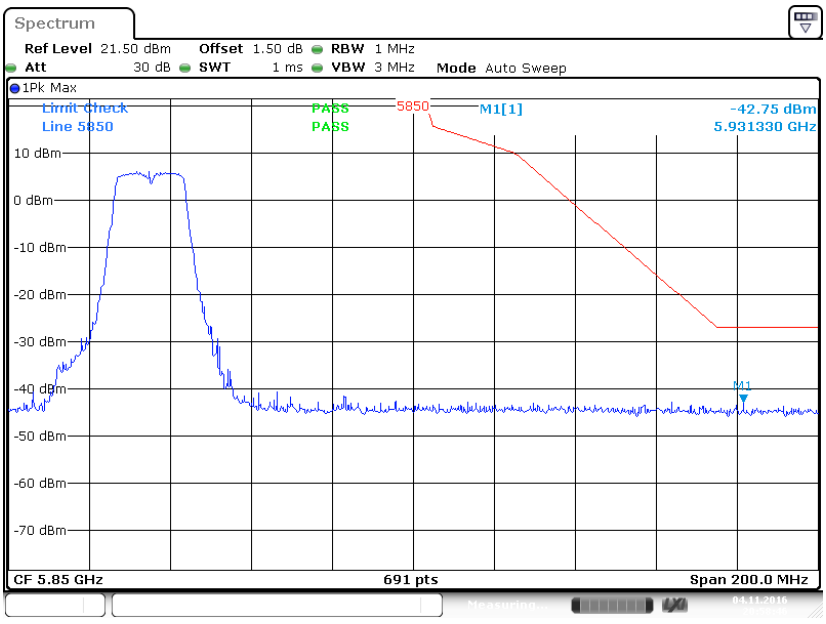
Date: 4.NOV.2016 20:41:21

802.11n ht40 Chain1 Band Edge, Left Side



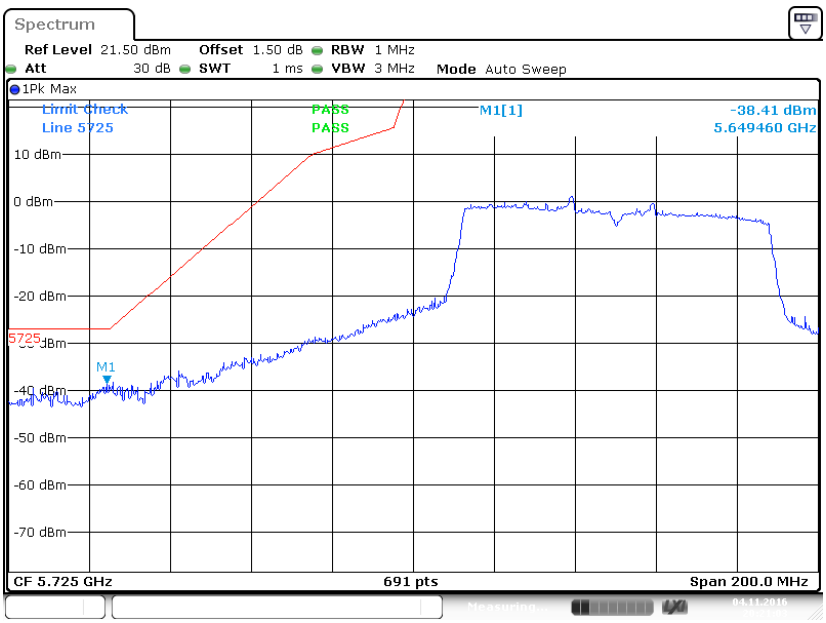
Date: 4.NOV.2016 21:01:12

802.11n ht40 Chain1 Band Edge, Right Side



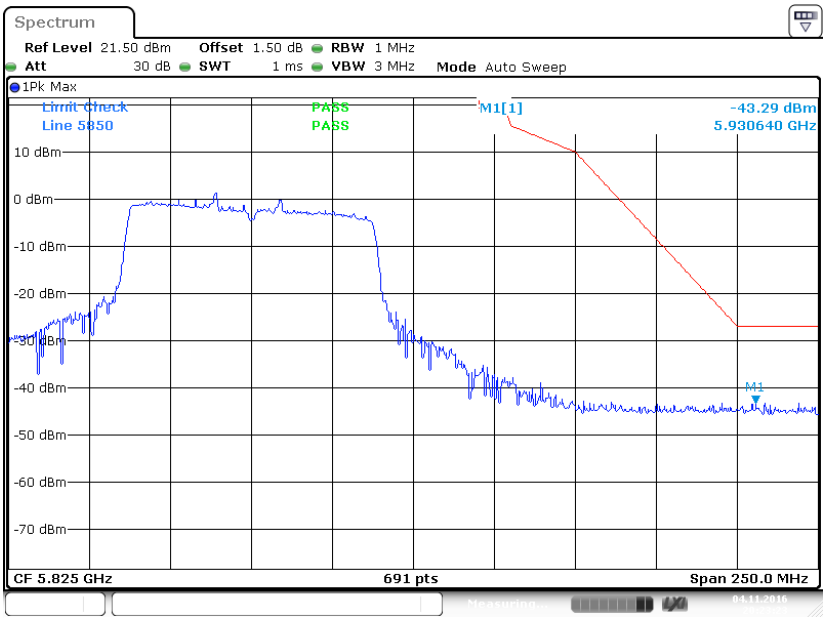
Date: 4.NOV.2016 20:58:46

802.11ac80 Chain1 Band Edge, Left Side



Date: 4.NOV.2016 20:21:04

802.11ac80 Chain1 Band Edge, Right Side



Date: 4.NOV.2016 20:23:24

FCC §15.407(a) &§15.407(e)–EMISSION BANDWIDTH

Applicable Standard

.
The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in the 5.15-5.25 GHz is made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	SIGNALANALYZER	FSV40	101116	2016-07-04	2017-07-03
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15

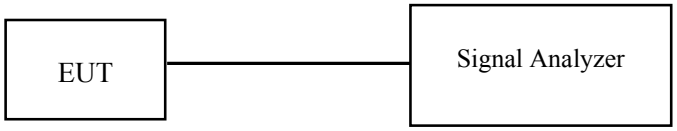
*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Procedure

1. Emission Bandwidth (EBW)
a) Set RBW = approximately 1% of the emission bandwidth.
b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

2. **Minimum Emission Bandwidth for the band 5.725-5.85 GHz**
Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.725-5.85 GHz. The following procedure shall be used for measuring this bandwidth:
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.

g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



Test Data

Environmental Conditions

Temperature:	23.5 °C
Relative Humidity:	60 %
ATM Pressure:	99.9 kPa

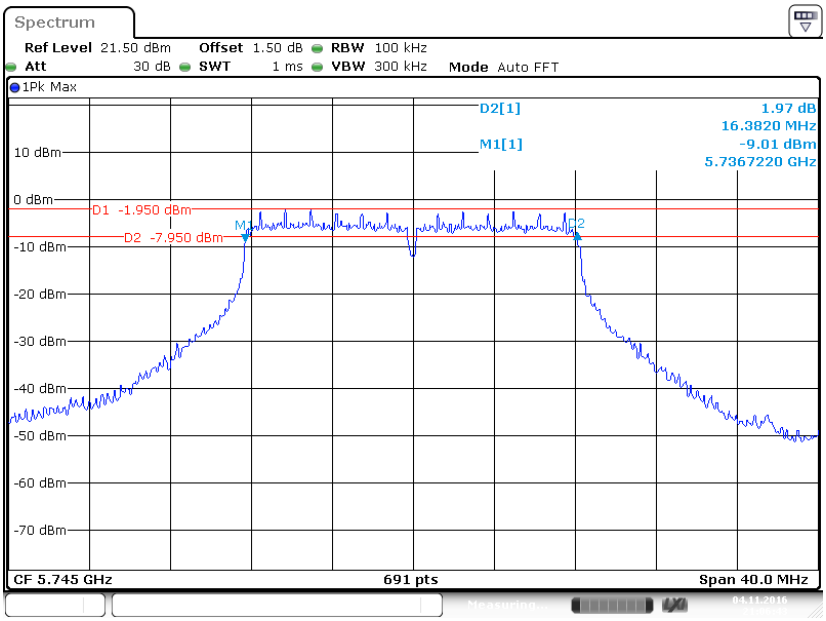
The testing was performed by Edison Hu on 2016-11-04 and 2016-11-05.

Test Result: Pass.

Please refer to the following tables and plots.

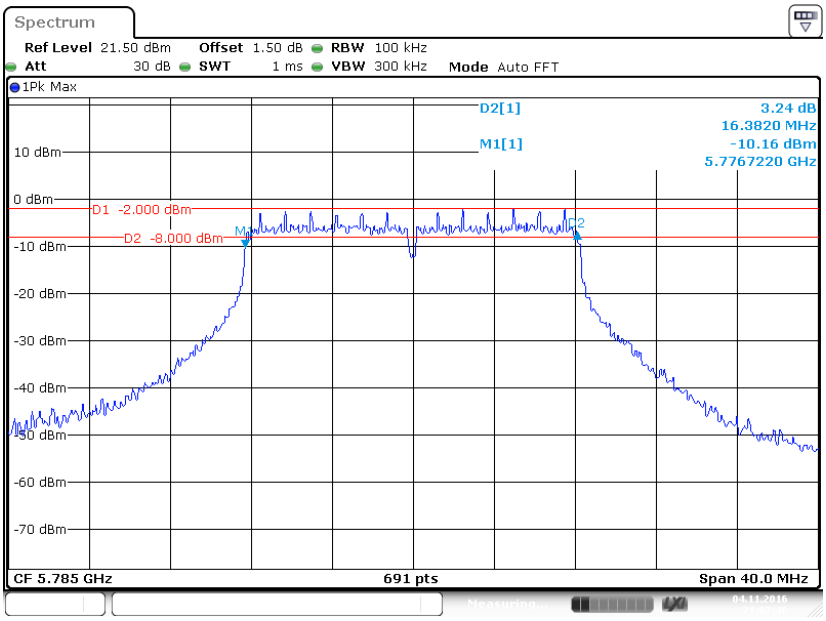
Test mode	Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
802.11a	Low	5745	16.38	≥0.5
	Middle	5785	16.38	≥0.5
	High	5825	16.38	≥0.5
802.11n ht20	Low	5745	17.60	≥0.5
	Middle	5785	17.60	≥0.5
	High	5825	17.48	≥0.5
802.11n ht40	Low	5755	36.35	≥0.5
	High	5795	36.24	≥0.5
802.11ac80	Middle	5775	75.72	≥0.5

802.11a mode, Chain 0: 6 Bandwidth-5745MHz



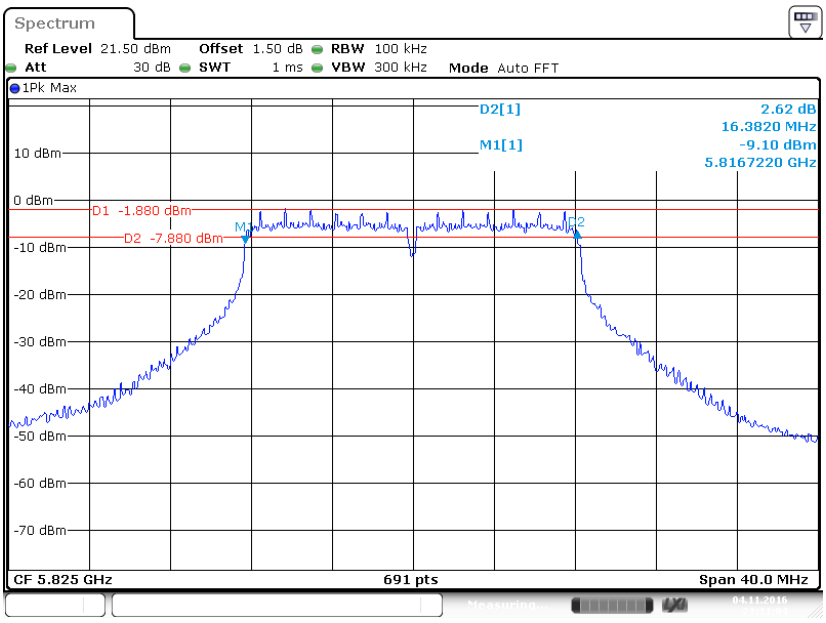
Date: 4.NOV.2016 21:06:44

802.11a mode, Chain 0: 6 Bandwidth-5785MHz



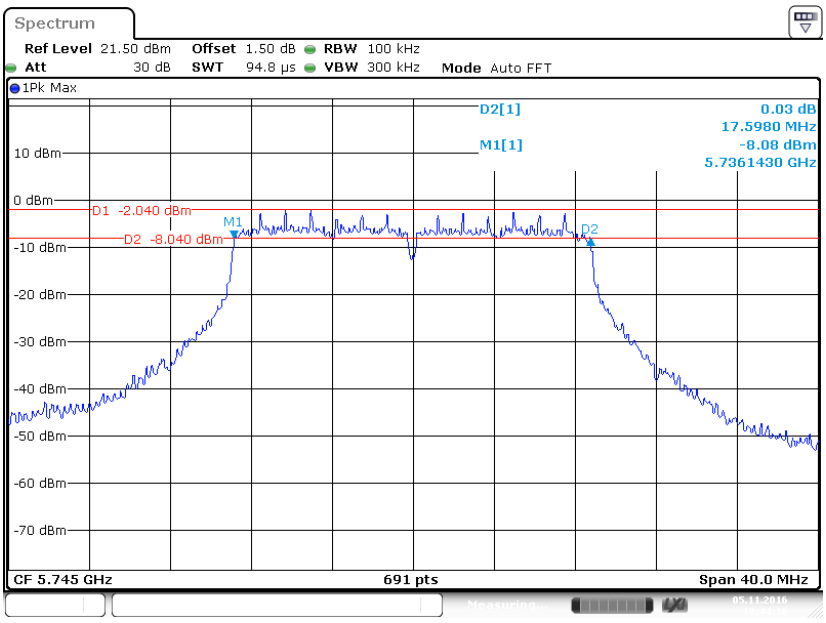
Date: 4.NOV.2016 21:07:47

802.11a mode, Chain 0: 6 Bandwidth-5825MHz



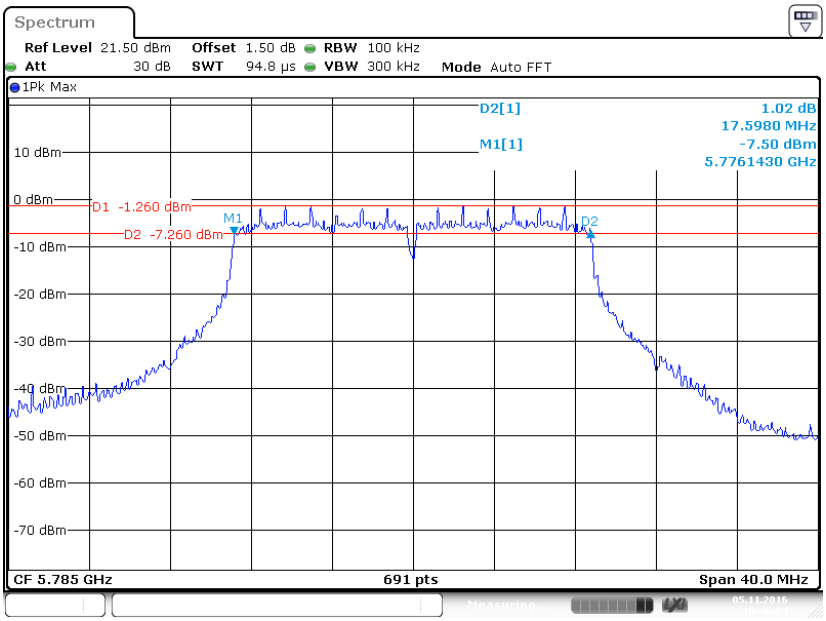
Date:4.NOV.2016 21:11:04

802.11n ht20 mode, Chain 0: 6 Bandwidth-5745MHz



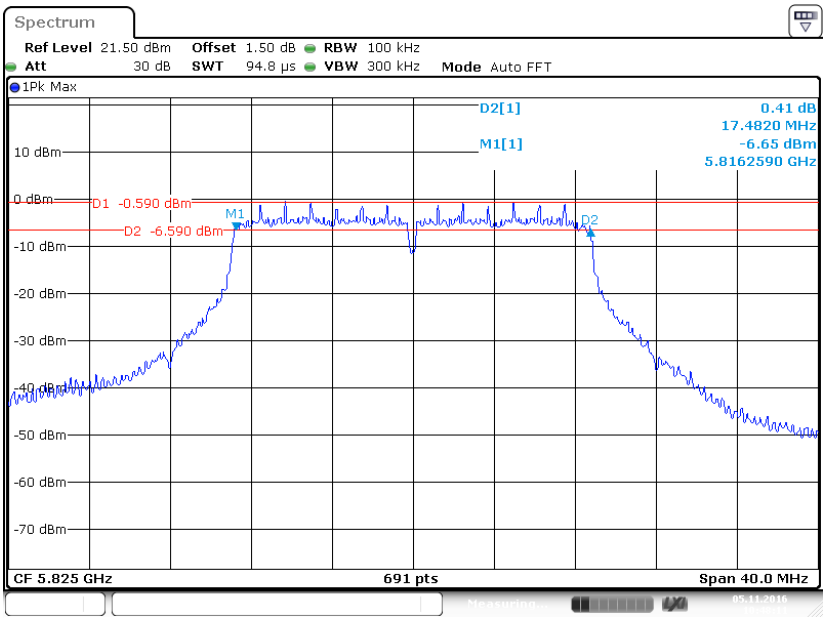
Date:5.NOV.2016 10:44:17

802.11n ht20 mode, Chain 0: 6 Bandwidth-5785MHz



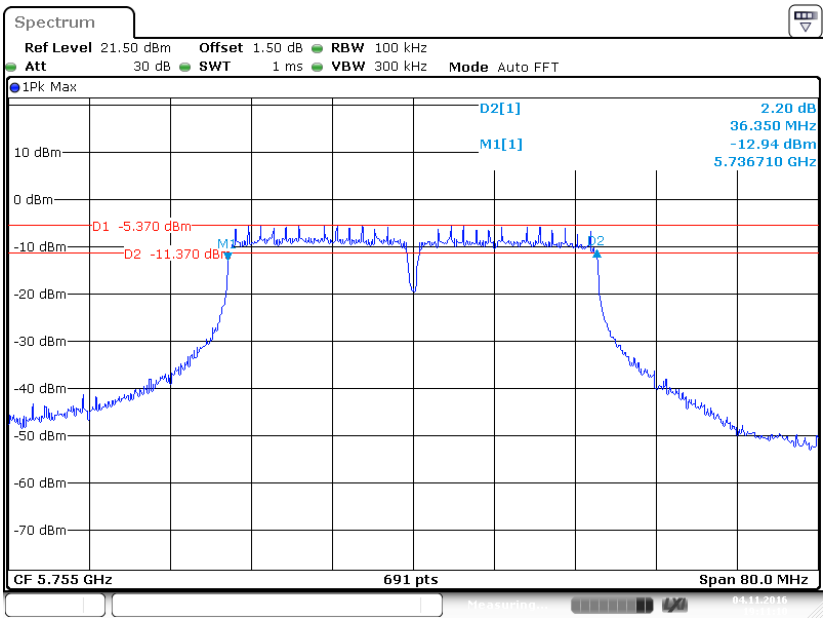
Date:5.NOV.2016 10:46:24

802.11n ht20 mode, Chain 0: 6 Bandwidth-5825MHz



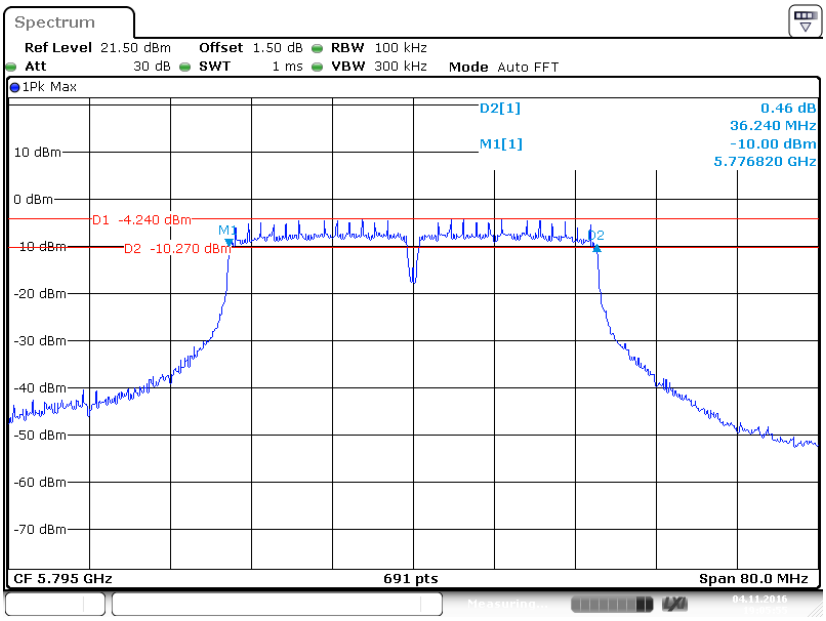
Date:5.NOV.2016 10:48:11

802.11n ht40 mode, Chain 0: 6 Bandwidth-5755MHz



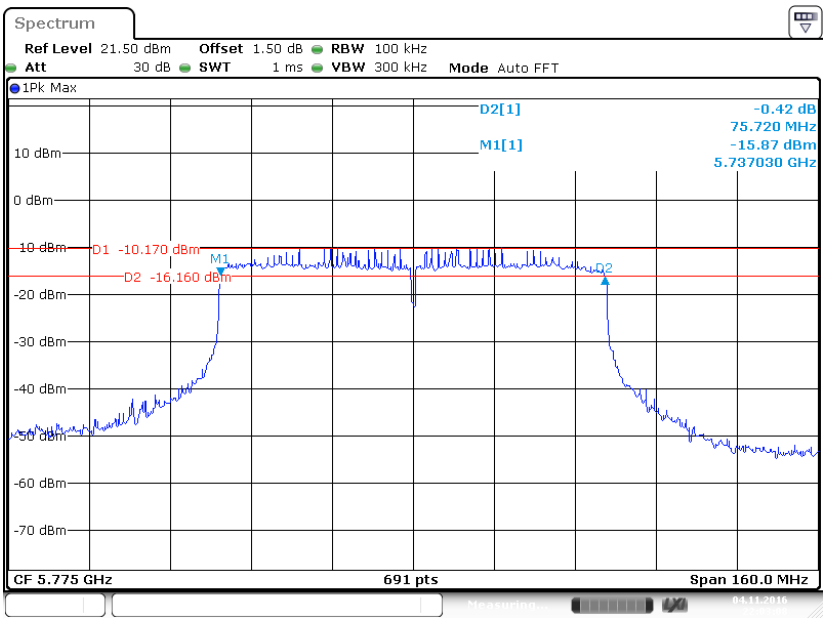
Date: 4.NOV.2016 19:11:10

802.11n ht40 mode, Chain 0: 6 Bandwidth-5795MHz



Date: 4.NOV.2016 19:05:55

802.11ac80 mode, Chain 0: 6 Bandwidth-5775MHz



FCC §15.407(a) (1) – CONDUCTED TRANSMITTER OUTPUT POWER

Applicable Standard

For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

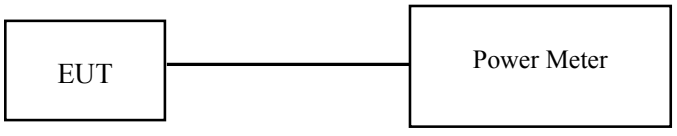
Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	OSP120 BASE UNIT	OSP120	101247	2016-07-04	2017-07-03
Rohde & Schwarz	Power Sensor	NRP-Z91	200014	20150-08-01	2017-07-31
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15

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

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 one test equipment.
3. Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	23.5 °C
Relative Humidity:	60 %
ATM Pressure:	99.9 kPa

The testing was performed by Edison Hu on 2016-11-05.

Test Mode: Transmitting

1TX:

Channel	Frequency (MHz)	Maximum Conducted Output Power (dBm)		Limit (dBm)	Result
		Chain 0	Chain 1		
802.11a					
Low	5745	14.98	14.97	30	Pass
Middle	5785	14.78	14.85	30	Pass
High	5825	14.78	15.26	30	Pass
802.11n ht20					
Low	5745	14.74	14.85	30	Pass
Middle	5785	15.25	15.42	30	Pass
High	5825	14.85	14.98	30	Pass
802.11n-ht40					
Low	5755	13.99	14. 25	30	Pass
High	5795	14.54	14.27	30	Pass
802.11ac 80					
Middle	5775	12.75	13.27	30	Pass

2TX, Non-beamforming:

Channel	Frequency (MHz)	Maximum Conducted Output Power (dBm)			Limit (dBm)	Result
		Chain 0	Chain 1	Total		
802.11b						
Low	5745	14.53	14.54	17.55	30	Pass
Middle	5785	14.51	14.59	17.56	30	Pass
High	5825	14.63	15.00	17.83	30	Pass
802.11g						
Low	5745	14.53	14.57	17.56	30	Pass
Middle	5785	14.96	15.01	18.00	30	Pass
High	5825	14.55	14.74	17.66	30	Pass
802.11n-HT20						
Low	5755	13.65	13.84	16.76	30	Pass
High	5795	14.02	13.87	16.96	30	Pass
802.11n-HT40						
Middle	5775	12.54	12.95	15.76	30	Pass

2TX With-beamforming mode

Channel	Frequency (MHz)	Maximum Conducted Output Power (dBm)			Limit (dBm)	Result
		Chain 0	Chain 1	Total		
802.11n-HT20						
Low	5745	14.23	14.17	17.21	30	Pass
Middle	5785	14.34	14.18	17.27	30	Pass
High	5825	14.14	14.25	17.21	30	Pass
802.11n-HT40						
Low	5755	13.29	13.31	16.31	30	Pass
High	5795	13.54	13.43	16.50	30	Pass
Middle	5775	12.21	12.33	15.28	30	Pass

FCC §15.407(a) (1) (5) - POWER SPECTRAL DENSITY

Applicable Standard

According to § 15.407(a)(1)

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

According to § 15.407(a)(2)

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to § 15.407(a)(3)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

Test Procedure

The measurements are base on FCC KDB 789033 D02 General UNII Test Procedyres New Rules v01:Guidelines for Compliance Testing of Unlicensed National Information Infrastructure(U-NII)Devices section F: Maximum power spectral density(PPSD)

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	SIGNALANALYZER	FSV40	101116	2016-07-04	2017-07-03
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15

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

Test Data

Environmental Conditions

Temperature:	23.5 °C
Relative Humidity:	60 %
ATM Pressure:	99.9 kPa

The testing was performed byEdison Hu on 2016-11-04

Test Mode: Transmitting

Mode	Channel	Frequency MHz	PSD (dBm/500kHz)			Limit (dBm/500kHz)	Result
			Chain0	Chain1	Total		
802.11a	Low	5745	1.66	2.11	4.90	29	PASS
	Middle	5785	3.09	1.68	5.45	29	PASS
	High	5825	2.43	2.67	5.56	29	PASS
802.11n20	Low	5745	1.50	1.40	4.46	29	PASS
	Middle	5785	2.40	2.67	5.55	29	PASS
	High	5825	2.00	2.44	5.24	29	PASS
802.11n40	Low	5755	-1.39	-1.81	1.42	29	PASS
	High	5795	-0.56	-0.51	2.48	29	PASS
802.11ac80	Middle	5775	-4.97	-4.39	-1.66	29	PASS

Note: the device is a master device. the 2 antenna maximum atenna gain are 4.0 dBi, per KDB 662911 D01 Multiple Transmitter Output v02r01, for power spectral density (PSD) measurements on the devices:

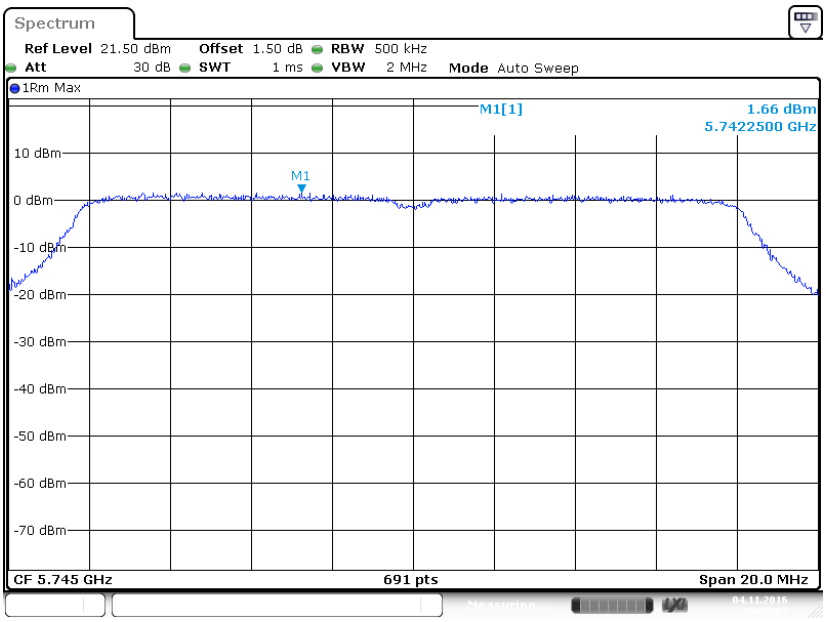
Array Gain = 10 log(NANT/NSS) dB.

So:

Directional gain = GANT + Array Gain =4.0+10*log(3) =7 dBi

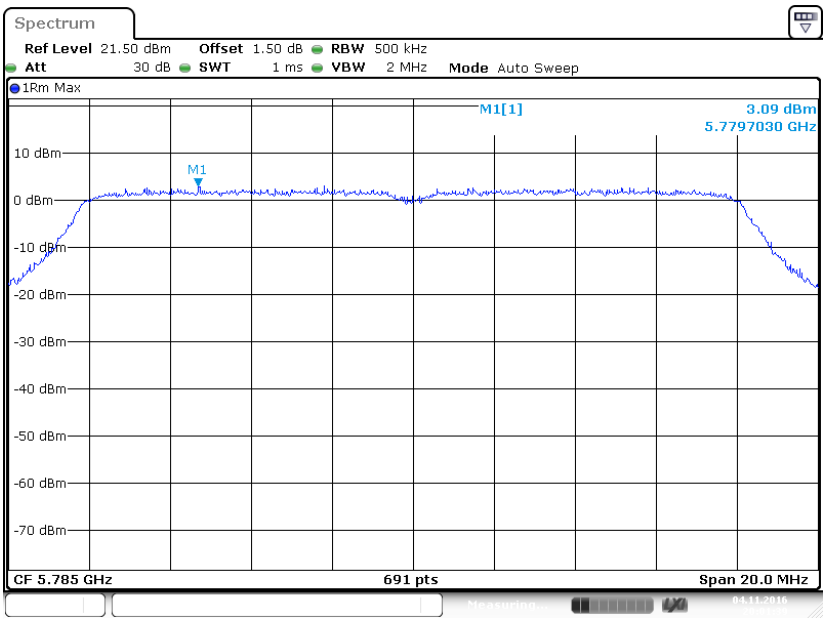
The Power density Limits was reduce 1dBc

802.11a mode, Chain 0: Power spectral density-5745MHz



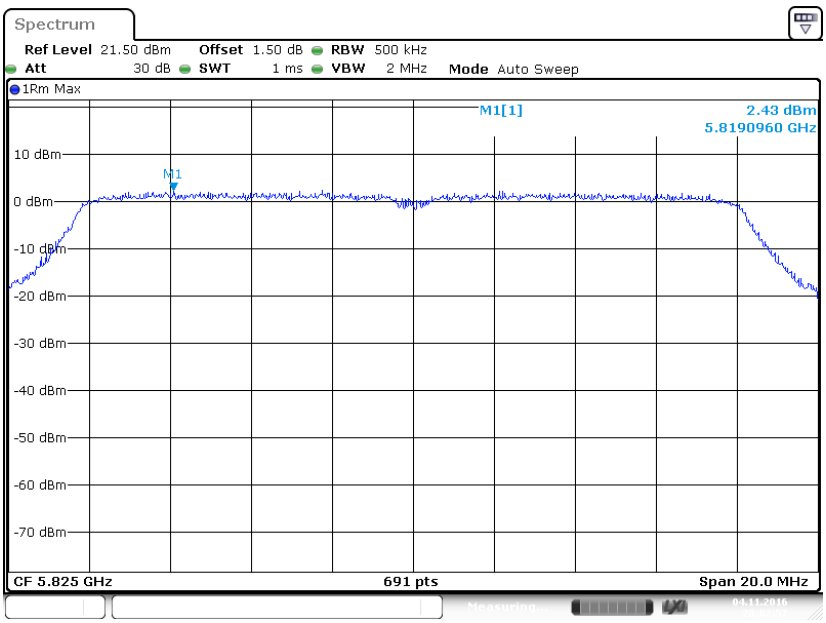
Date:4.NOV.2016 20:00:03

802.11a mode, Chain 0: Power spectral density-5785MHz



Date:4.NOV.2016 20:01:39

802.11a mode, Chain 0: Power spectral density-5825MHz



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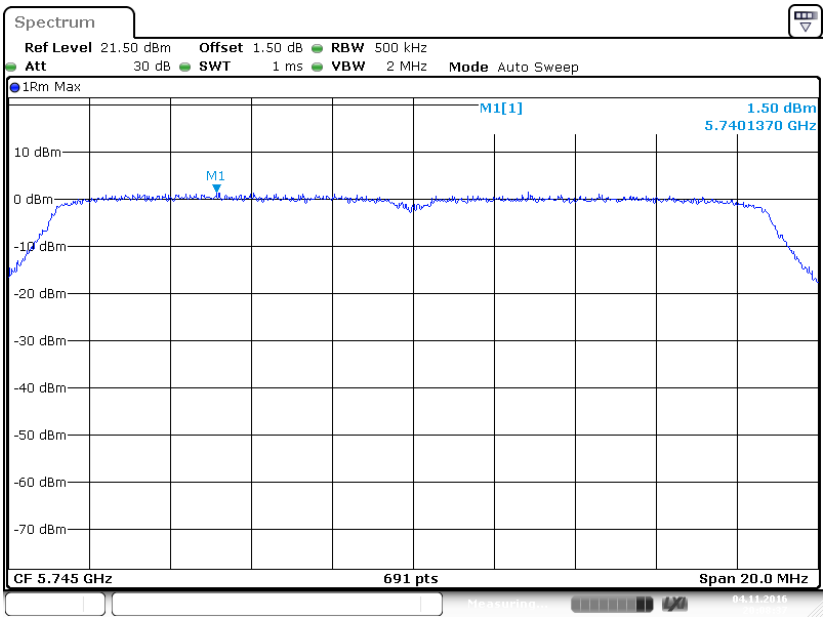
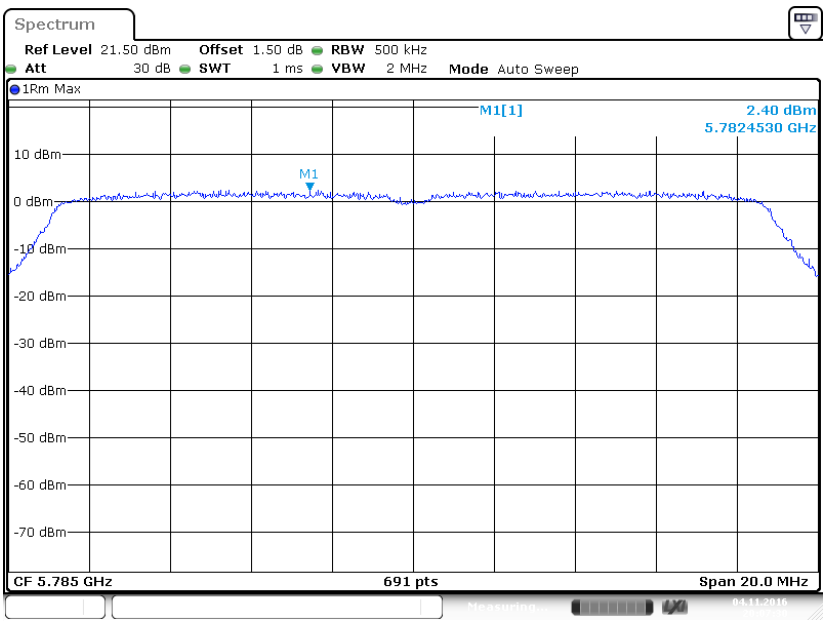
802.11n ht20 mode, Chain 0: Power spectral density-5745MHz

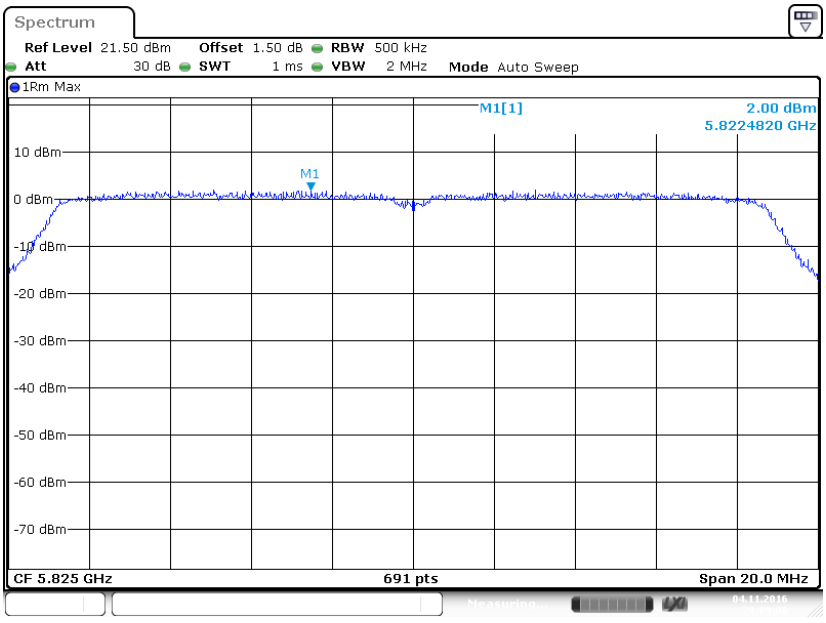


Date: 4.NOV.2016 20:08:38

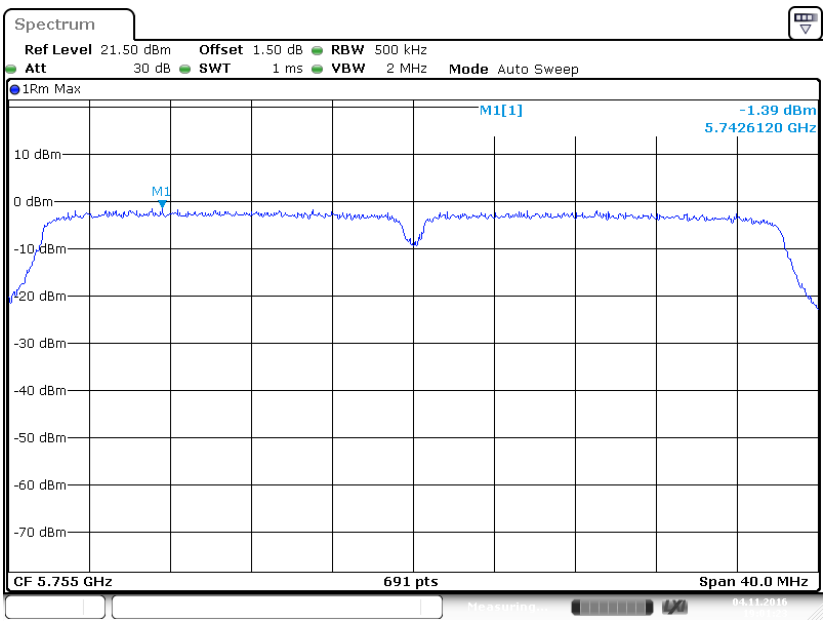
802.11n ht20 mode, Chain 0: Power spectral density-5785MHz



802.11n ht20 mode, Chain 0: Power spectral density-5825MHz



802.11n ht40 mode, Chain 0: Power spectral density-5755MHz



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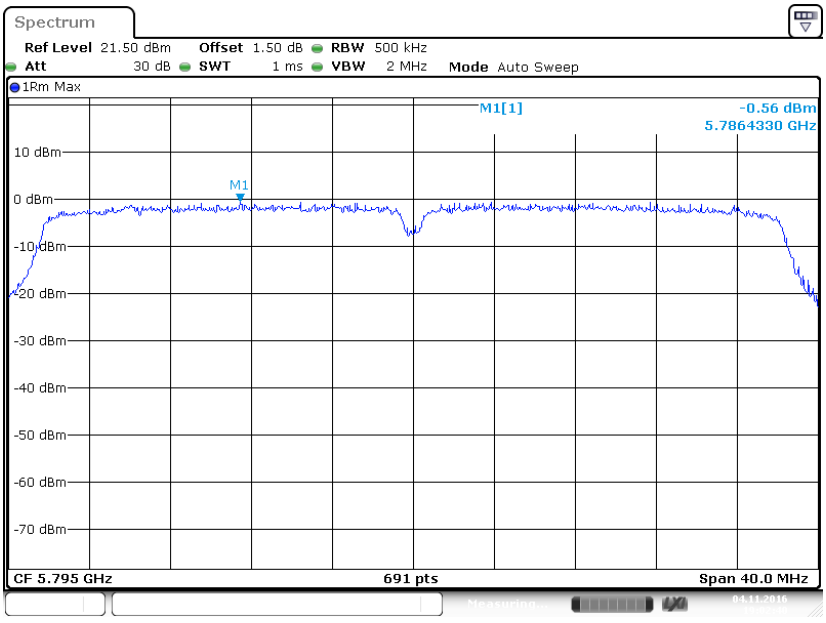
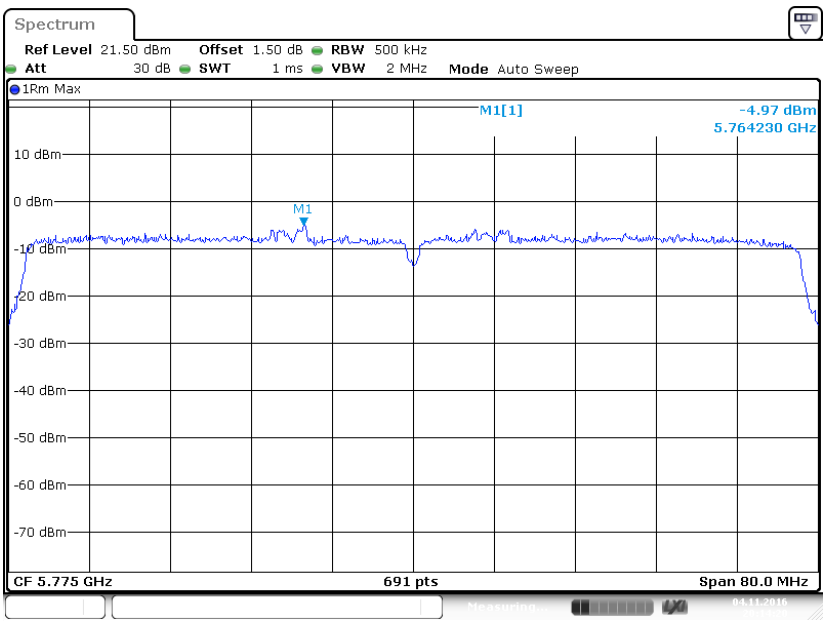
802.11n ht40 mode, Chain 0: Power spectral density-5795MHz

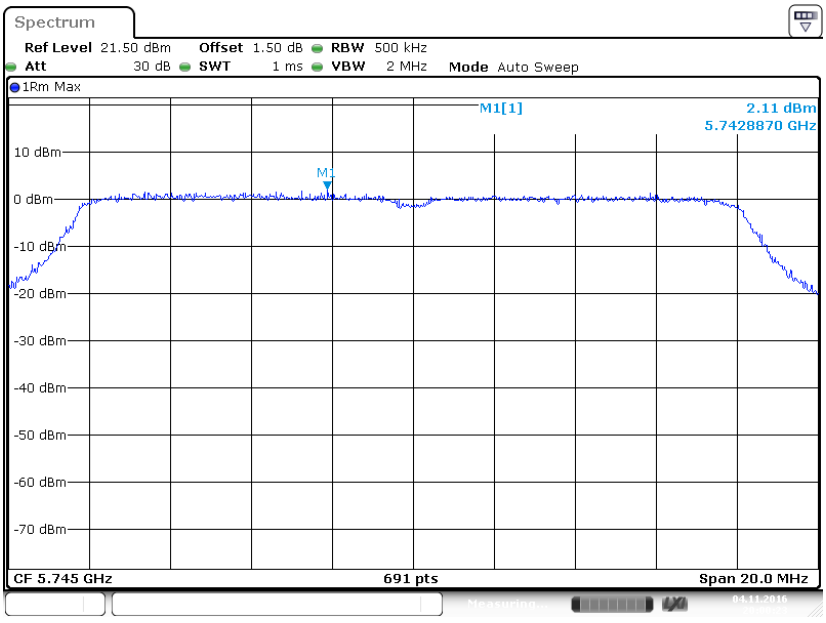


Date: 4.NOV.2016 19:02:39

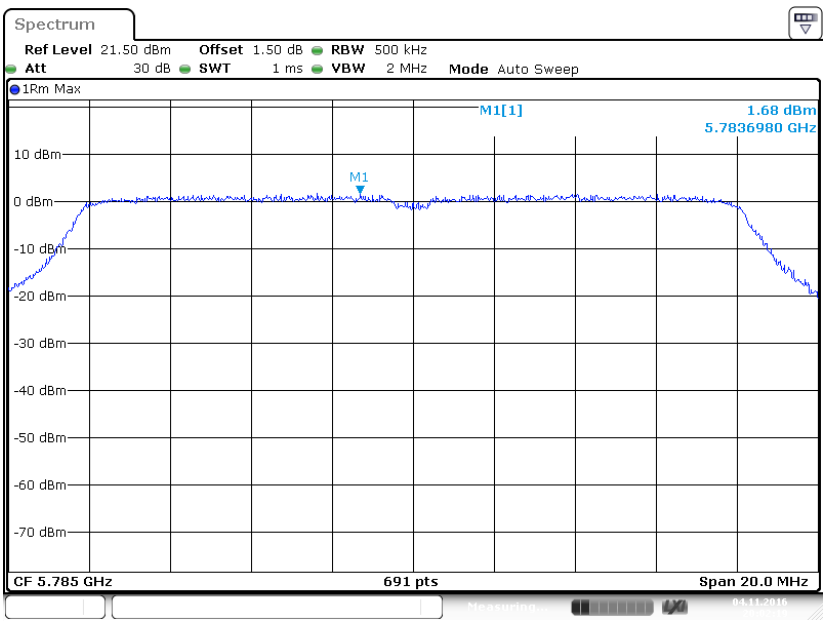
802.11ac80 mode, Chain 0: Power spectral density-5775MHz



802.11a mode, Chain 1: Power spectral density-5745MHz



802.11a mode, Chain 1: Power spectral density-5785MHz



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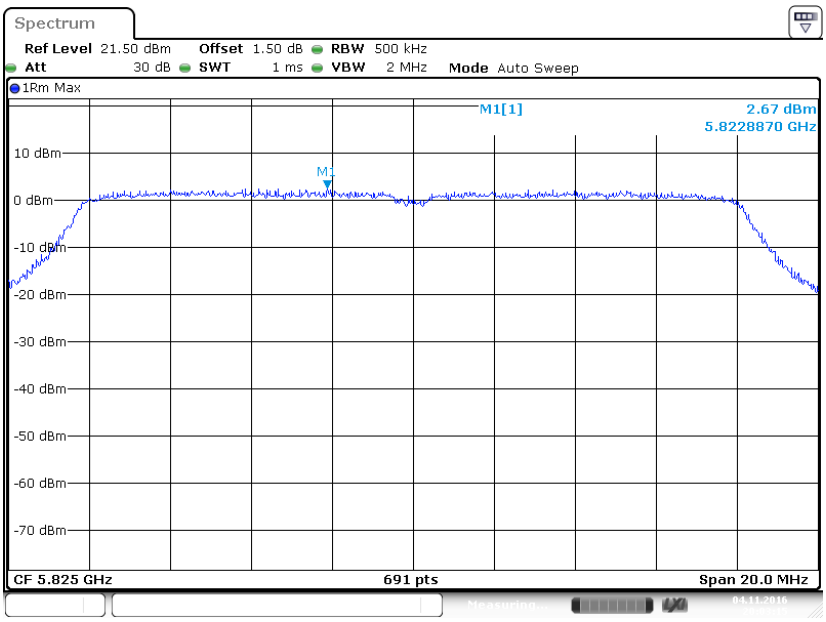
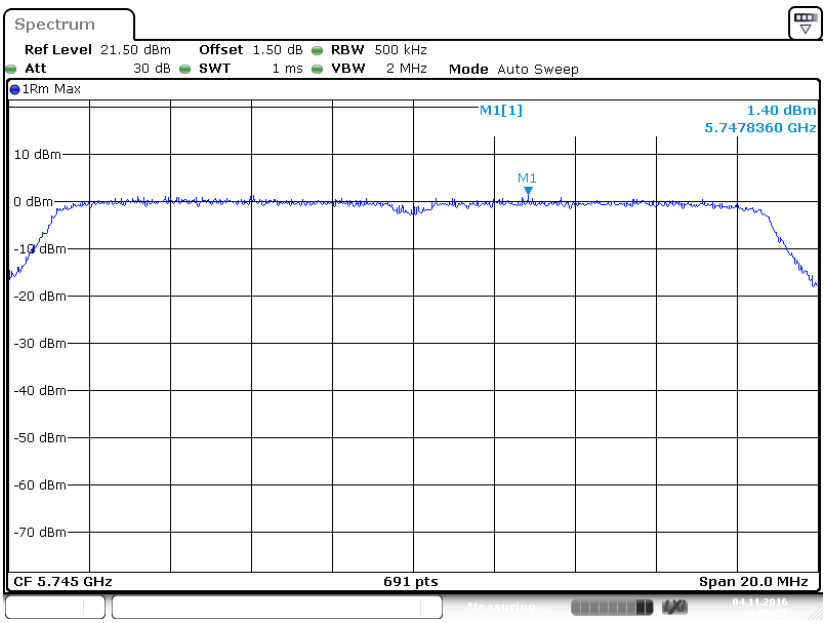
802.11a mode, Chain 1: Power spectral density-5825MHz



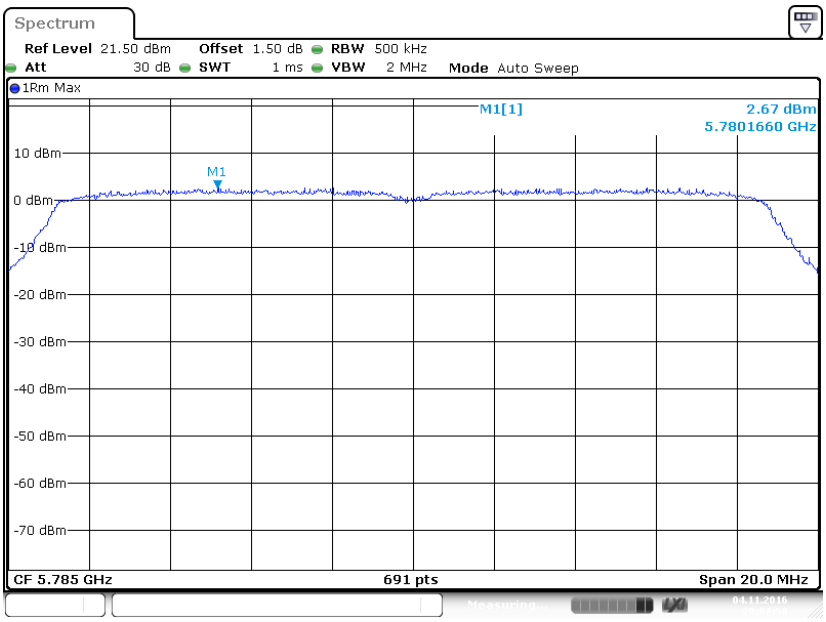
Date:4.NOV.2016 20:03:15

802.11n ht20 mode, Chain 1: Power spectral density-5745MHz



Date: 4.NOV.2016 20:08:27

802.11n ht20 mode, Chain 1: Power spectral density-5785MHz



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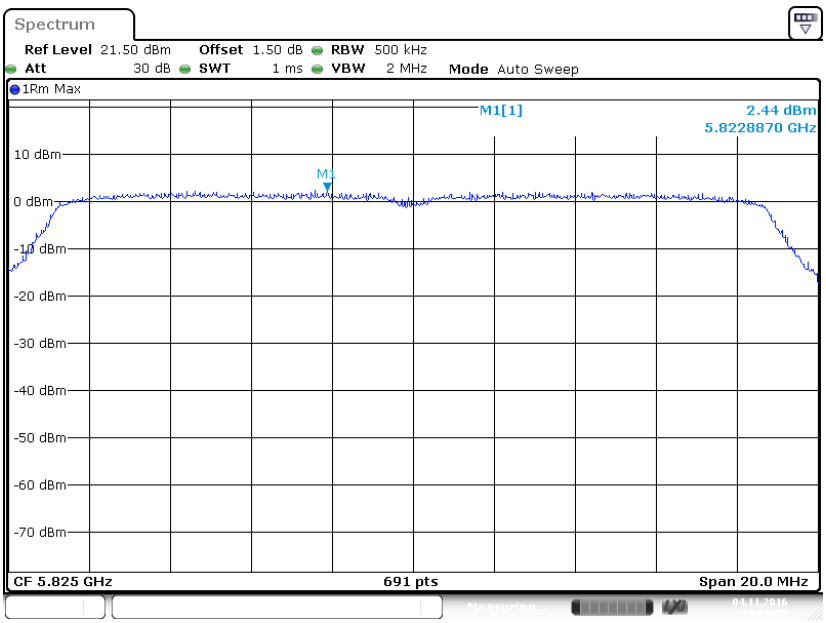
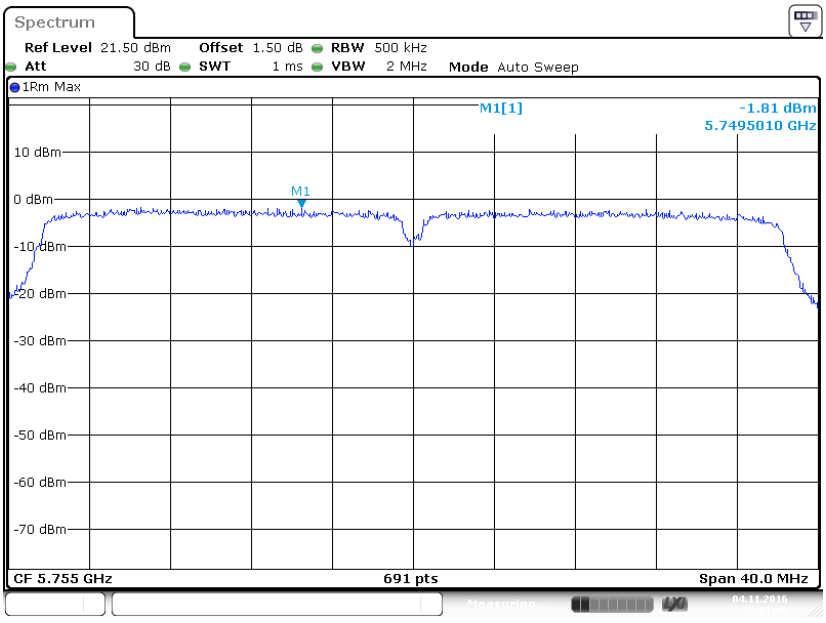
802.11n ht20 mode, Chain 1: Power spectral density-5825MHz



Date: 4.NOV.2016 20:09:25

802.11n ht40 mode, Chain 1: Power spectral density-5755MHz



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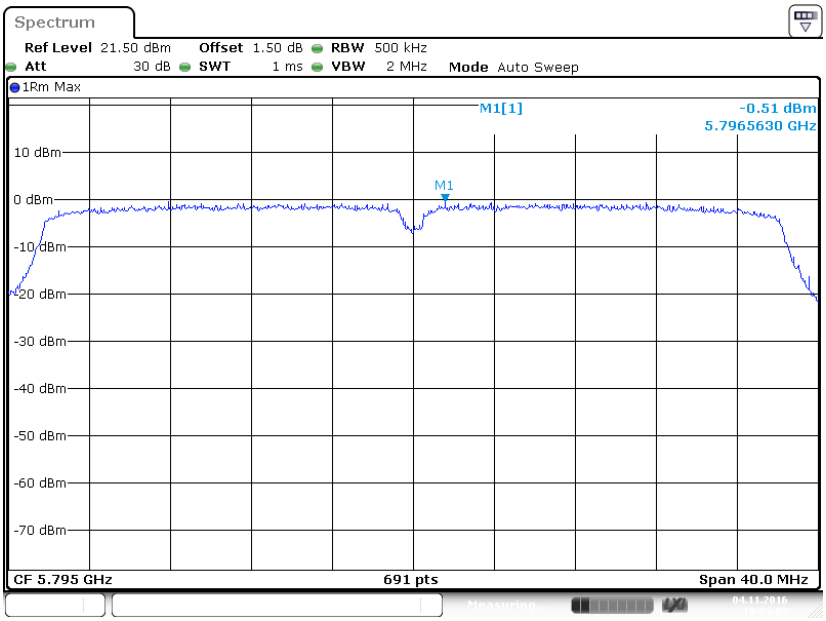
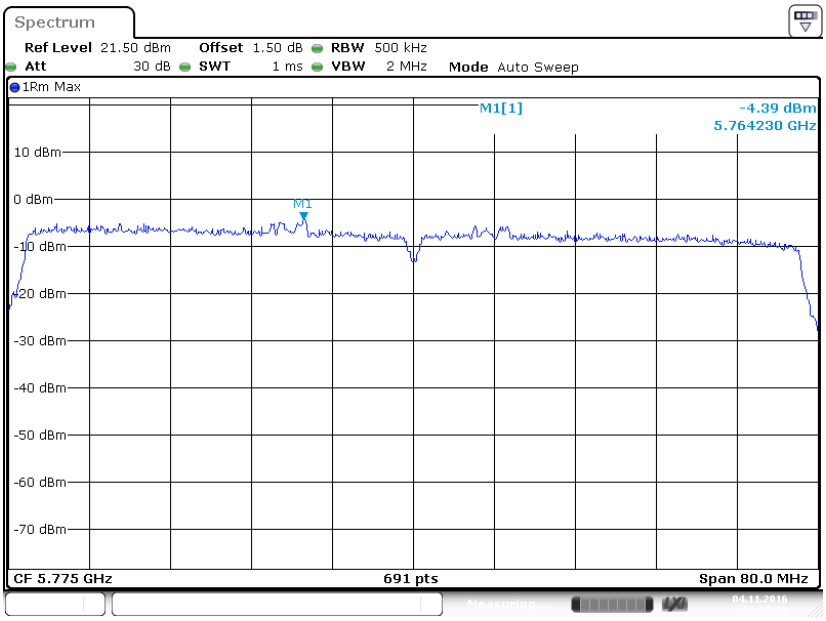
802.11n ht40 mode, Chain 1: Power spectral density-5795MHz



Date: 4.NOV.2016 19:03:03

802.11ac80 mode, Chain 1: Power spectral density-5775MHz



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