FCC PART 15.247

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:	RKS161113002-00B
Report Date:	2017-01-20
Reviewed By:	Jesse Huang EMC Manager
Prepared By:	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	3.0dBi
1	PCB antenna	3.0dBi

Objective

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

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

Related Submittal(s)/Grant(s)

FCC Part 15B JBP and FCC Part 15.407 NII 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 FCC KDB558074 D01 DTS Meas Guidance v03r05.

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

Measurement uncertainty with RF radiated emission is 5.91 dB for 30MHz-1GHz.and 4.92 dB for above 1GHz, 1.95dB for conducted measurement.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the Chenghu Road, Kunshan Development Zone No.248,Kunshan, Jiangsu, 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 system was configured for testing in testing mode, which was provided by manufacturer.

The device support 1TX and 2TX for 802.11b, 802.11g and 802.11n system, 802.11n mode support both beamforming mode and Non-beamforming mode.

For 2.4G band, 11 channels are provided to testing:

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	/	/

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 performed 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
SISO	802.11b	1Mbps	1,6,11	0, 1
	802.11g	6Mbps	1,6,11	0, 1
	802.11 ht20	MCS0	1,6,11	0, 1
	802.11 ht40	MCS0	3,6,9	0, 1
2TX Non-beamforming	802.11b	1Mbps	1,6,11	0+1
	802.11g	6Mbps	1,6,11	0+1
	802.11 ht20	MCS0	1,6,11	0+1
	802.11 ht40	MCS0	3,6,9	0+1
2TX With beamforming	802.11 ht20	MCS0	1,6,11	0+1
	802.11 ht40	MCS0	3,6,9	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 b	Low	2412	1	18	18
	Middle	2437	1	18	18
	High	2462	1	18	18
802.11 g	Low	2412	6	17	17
	Middle	2437	6	17	17
	High	2462	6	17	17
802.11 n20	Low	2412	MCS0	16	16
	Middle	2437	MCS0	16	16
	High	2462	MCS0	16	16
802.11 n40	Low	2422	MCS0	15	15
	Middle	2437	MCS0	15	15
	High	2452	MCS0	15	15

2TX Non-beamforming:

Software and version			IPOR&QSPR	
Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Power Level
				Chain 0&1
802.11 b	Low	2412	1	18
	Middle	2437	1	18
	High	2462	1	18
802.11 g	Low	2412	6	17
	Middle	2437	6	17
	High	2462	6	17
802.11 n20	Low	2412	MCS0	16
	Middle	2437	MCS0	16
	High	2462	MCS0	16
802.11 n40	Low	2422	MCS0	15
	Middle	2437	MCS0	15
	High	2452	MCS0	15

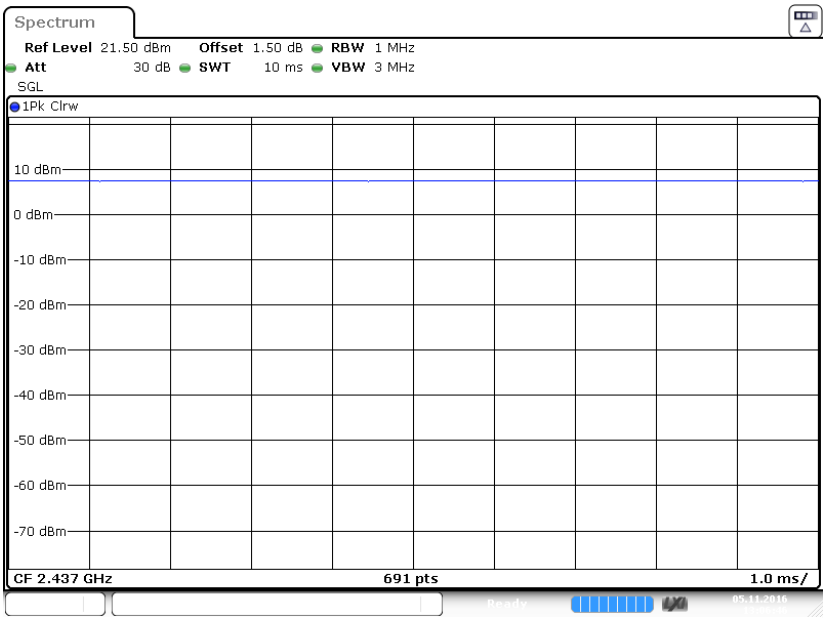
2TX With beamforming:

Software and version			IPOR&QSPR	
Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Power Level
				Chain 0&1
802.11 n20	Low	2412	MCS0	16
	Middle	2437	MCS0	16
	High	2462	MCS0	16
802.11 n40	Low	2422	MCS0	15
	Middle	2437	MCS0	15
	High	2452	MCS0	15

The duty cycle as below:

Mode	T_{on} (ms)	T_{on+off} (ms)	Duty Cycle (%)	Minimum Transmission Duration (T) (ms)
802.11b	10	10	100	/
802.11g	10	10	100	/
802.11n ht20	10	10	100	/
802.11n ht40	10	10	100	/

802.11b



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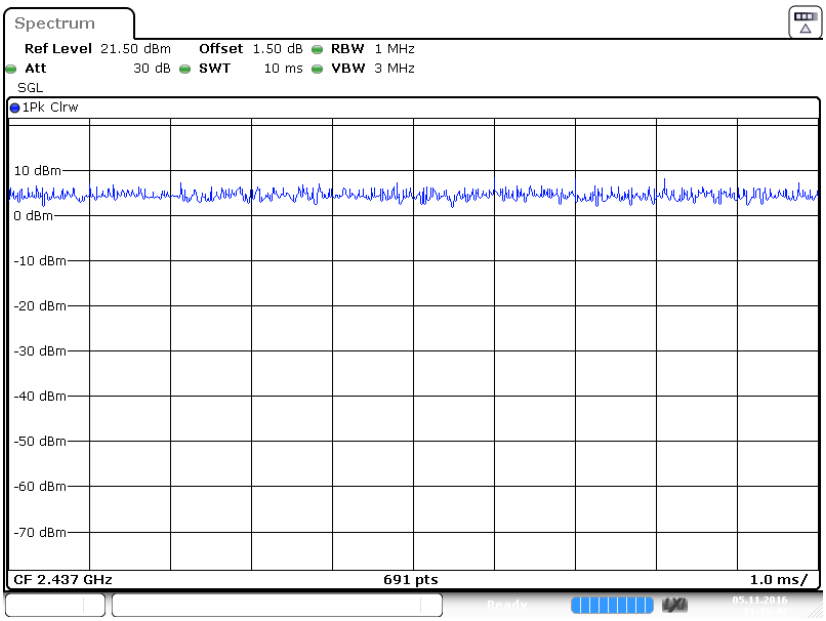
802.11g



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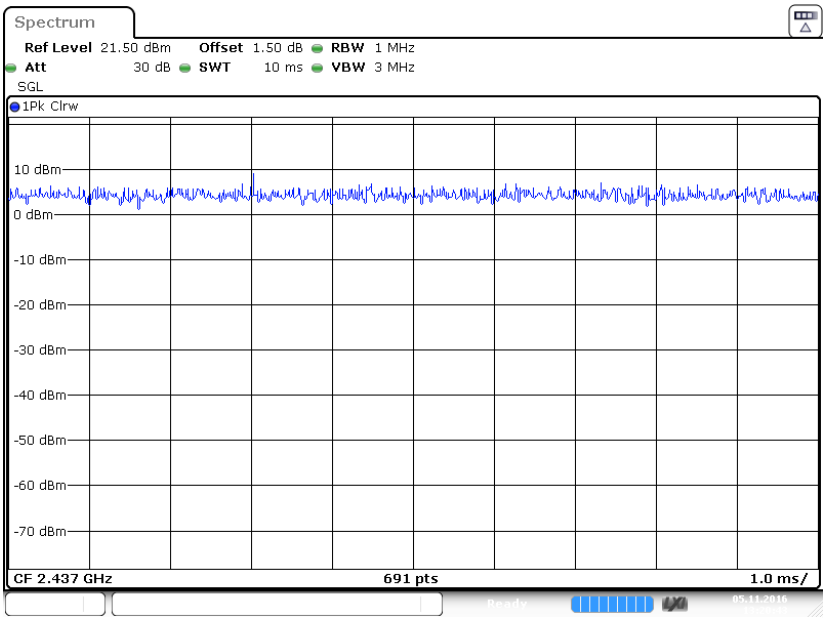

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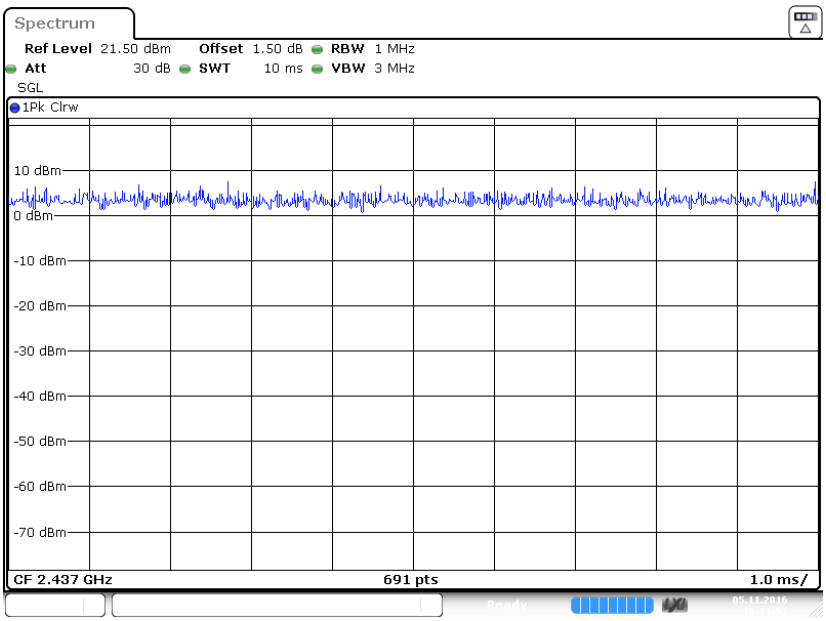
802.11n ht40



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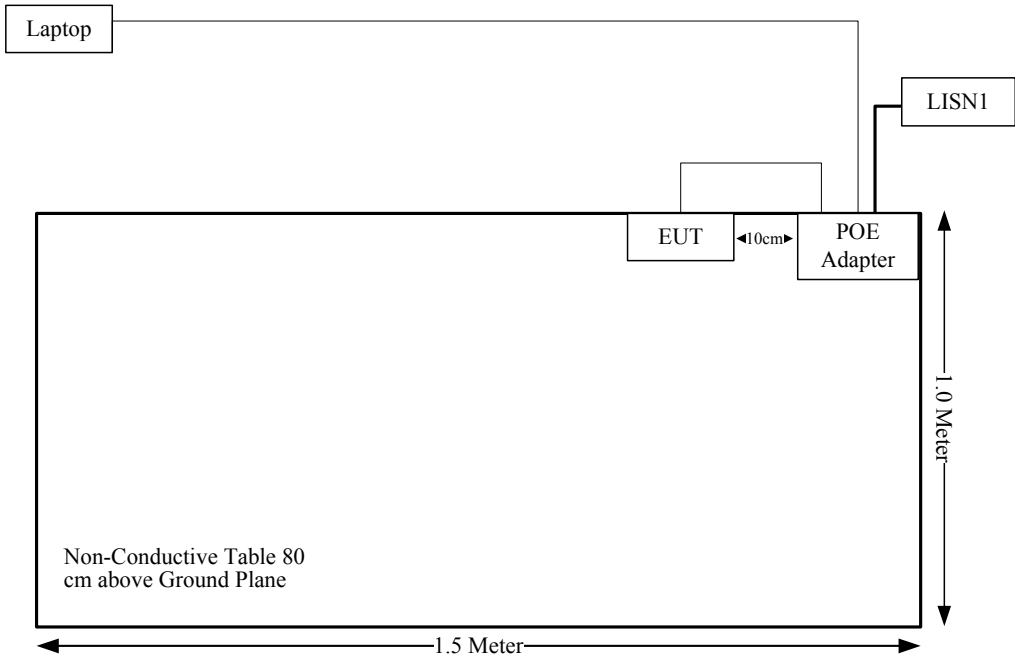
Support Equipment List and Details

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
§15.247 (i), §1.1307 (b) (1)& §2.1091	Maximum Permissible Exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Compliance
§15.247(d)	Spurious Emissions at Antenna Port	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(2)	6 dB Emission 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	*($180/f^2$)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

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

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

Calculated Formulary:

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

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

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

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 3.0 dBi in 2.4GHz band, fulfill the requirement of this section. Please refer to the EUT photos

Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

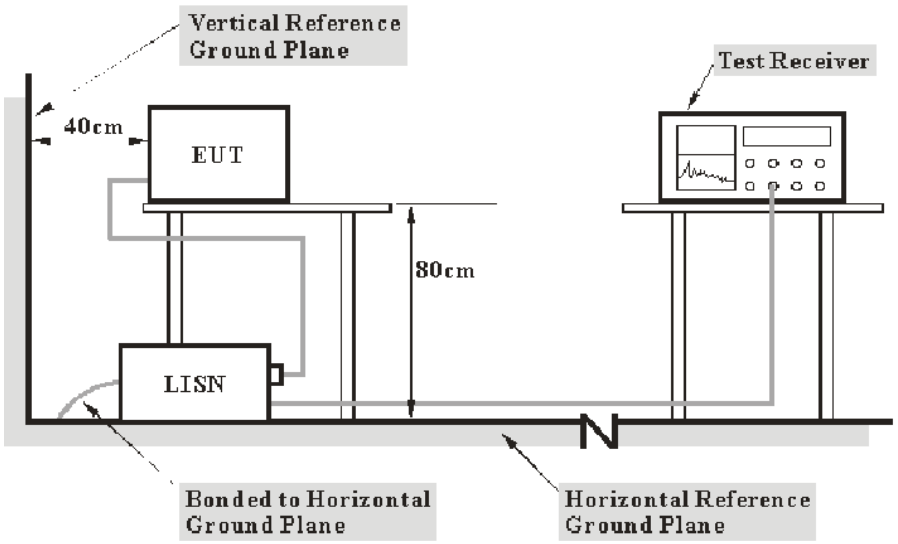
Measurement Uncertainty

Input quantities to be considered for conducted disturbance measurements maybe receiver reading, attenuation of the connection between LISN and receiver, LISN voltage division factor, LISN VDF frequency interpolation and receiver related input quantities, etc.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of conducted disturbance test at Bay Area Compliance Laboratories Corp. (Kunshan) is shown as below. And the uncertainty will not be taken into consideration for the test data recorded in the report.

Port	Expanded Measurement uncertainty
AC Mains	3.26 dB (k=2, 95% level of confidence)

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 adapter was connected to a 120 VAC/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

Test Procedure

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

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

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

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 in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Corrected Factor & Margin Calculation

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

Correction Factor = LISN VDF + Cable Loss

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

Margin = Limit – Corrected Amplitude

Test Results Summary

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

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

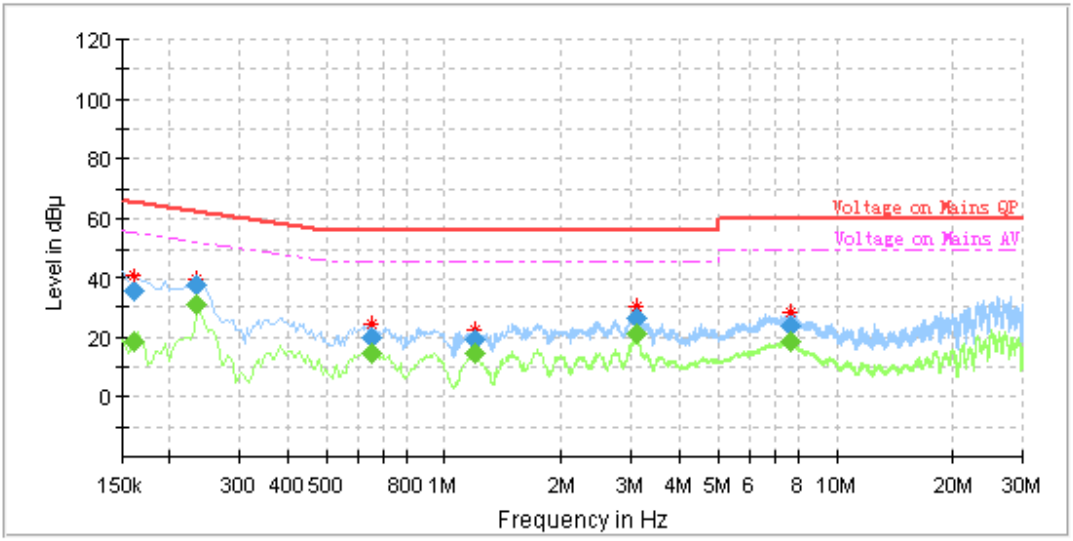
Environmental Conditions

Temperature:	23 ℃
Relative Humidity:	56 %
ATM Pressure:	101.2 kPa

The testing was performed by Edison Hu on 2016-10-27.

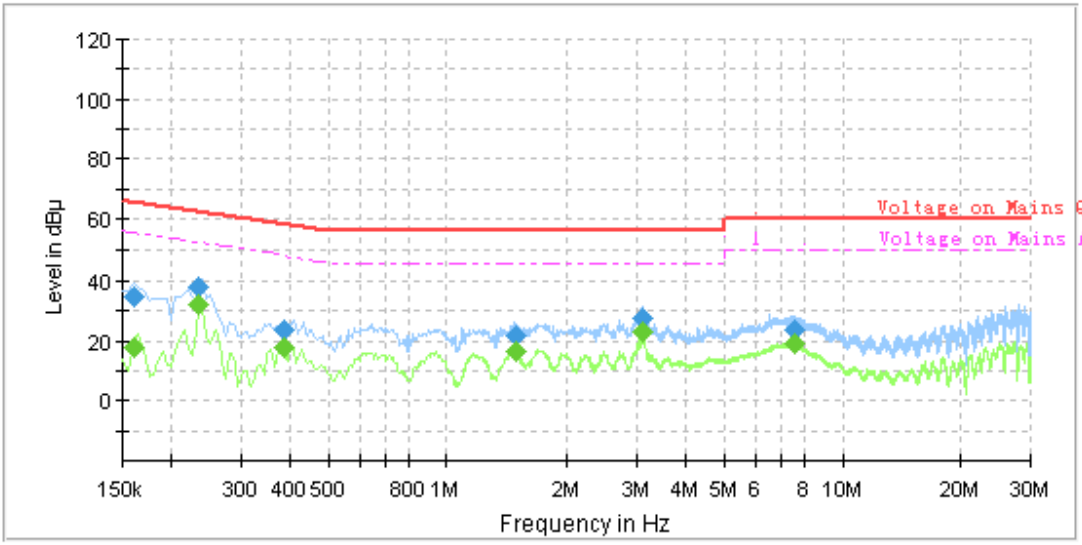
EUT operation mode: Transmitting

AC 120V/60 Hz, Line



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.160000	---	18.29	9.000	L1	10.3	37.17	55.46	Compliance
0.160000	35.41	---	9.000	L1	10.3	30.05	65.46	Compliance
0.235000	---	30.66	9.000	L1	10.3	21.61	52.27	Compliance
0.235000	37.92	---	9.000	L1	10.3	24.35	62.27	Compliance
0.655000	---	14.82	9.000	L1	10.3	31.18	46.00	Compliance
0.655000	20.04	---	9.000	L1	10.3	35.96	56.00	Compliance
1.195000	---	14.24	9.000	L1	10.3	31.76	46.00	Compliance
1.195000	19.02	---	9.000	L1	10.3	36.98	56.00	Compliance
3.110000	---	21.22	9.000	L1	10.5	24.78	46.00	Compliance
3.110000	26.49	---	9.000	L1	10.5	29.51	56.00	Compliance
7.680000	---	18.65	9.000	L1	10.5	31.35	50.00	Compliance
7.680000	23.46	---	9.000	L1	10.5	36.54	60.00	Compliance

AC 120V/60 Hz, Neutral



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.160000	---	17.45	9.000	N	10.3	38.01	55.46	Compliance
0.160000	34.38	---	9.000	N	10.3	31.08	65.46	Compliance
0.235000	---	31.91	9.000	N	10.3	20.36	52.27	Compliance
0.235000	38.25	---	9.000	N	10.3	24.02	62.27	Compliance
0.385000	---	17.54	9.000	N	10.3	30.63	48.17	Compliance
0.385000	23.66	---	9.000	N	10.3	34.51	58.17	Compliance
1.490000	---	16.60	9.000	N	10.4	29.40	46.00	Compliance
1.490000	21.61	---	9.000	N	10.4	34.39	56.00	Compliance
3.110000	---	23.26	9.000	N	10.5	22.74	46.00	Compliance
3.110000	27.32	---	9.000	N	10.5	28.68	56.00	Compliance
7.595000	---	18.98	9.000	N	10.6	31.02	50.00	Compliance
7.595000	23.73	---	9.000	N	10.6	36.27	60.00	Compliance

Note:

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

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

Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

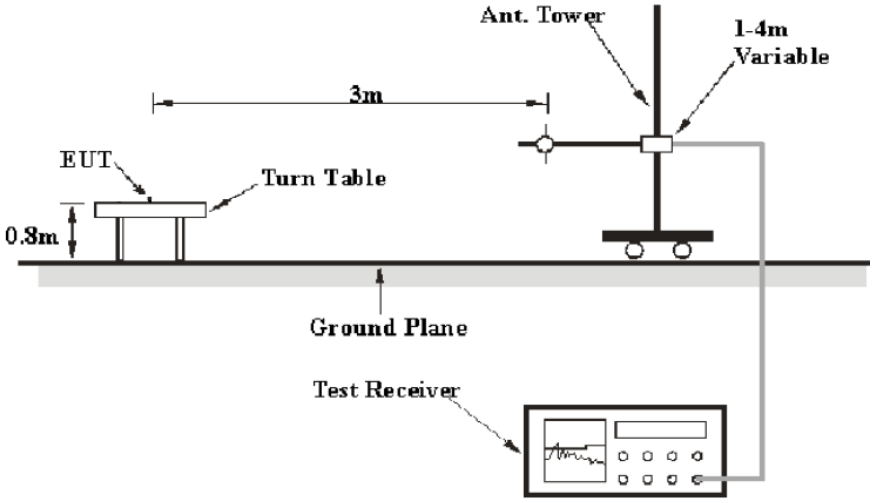
Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

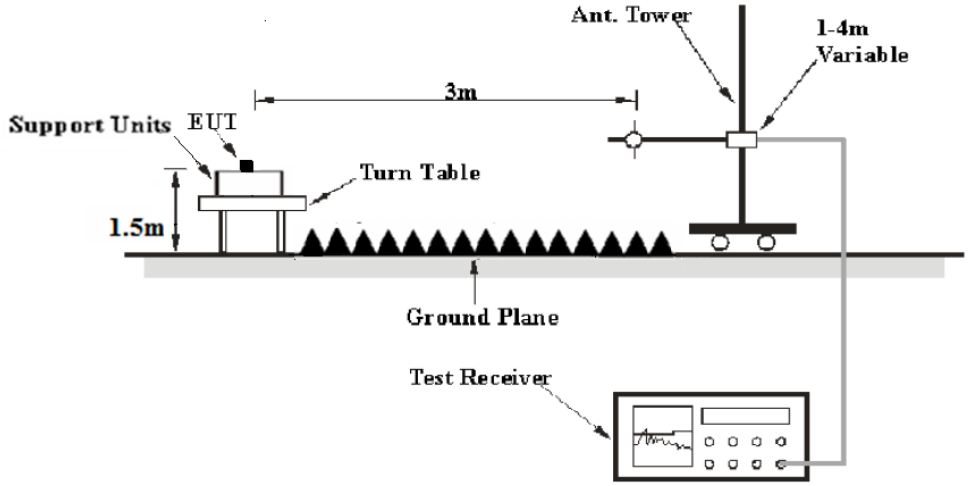
Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Kunshan) is 5.91 dB for 30MHz-1GHz and 4.92 dB for above 1GHz, 1.95dB for conducted measurement at antenna port. And the uncertainty will not be taken into consideration for the test data recorded in the report

EUT Setup

Below 1 GHz:



Above 1GHz:



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

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 25 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

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.

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	2016-11-07	2017-11-06
EMCO	Horn Antenna	3116	9510-2384	2016-11-07	2017-11-06
Rohde & Schwarz	Signal Analyzer	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 in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

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 Results Summary

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

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

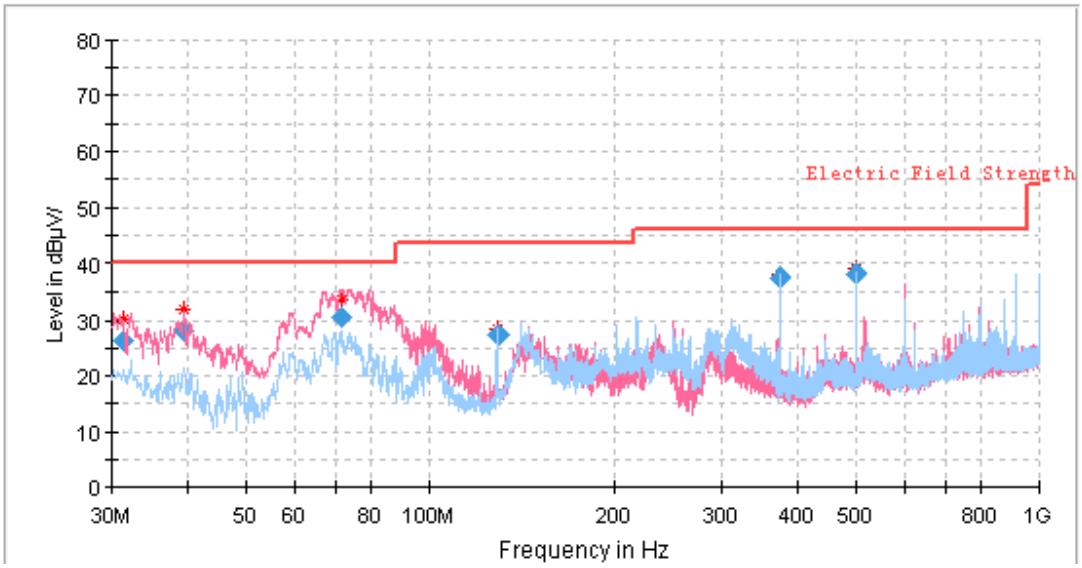
Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

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

30 MHz-1 GHz:

EUT operation mode: Transmitting(802.11b mode middle channel was the worst)



Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Detector (PK/QP/Ave.)		Height (cm)	Polar (H/V)				
31.393850	32.28	QP	220.0	100.0	V	-5.8	26.48	40.00	13.52
39.474700	38.18	QP	172.0	100.0	V	-10.0	28.18	40.00	11.82
71.433400	47.8	QP	133.0	100.0	V	-17.1	30.70	40.00	9.30
129.318650	40.94	QP	177.0	100.0	V	-13.5	27.44	43.50	16.06
375.016950	46.46	QP	75.0	100.0	H	-9.0	37.46	46.00	8.54
500.009100	43.76	QP	102.0	199.0	H	-5.6	38.16	46.00	7.84

1GHz-25GHz
Non-beamforming:
802.11b Mode(2TX was the worst):

Frequency	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
	Reading	Detector		Height	Polar				
(MHz)	(dBμV)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
Low Channel (2412 MHz)									
2412.0	109.30	PK	95	175	V	-3.0	106.30	/	/
2412.0	104.60	Ave	95	175	V	-3.0	101.60	/	/
2412.0	106.28	PK	158	155	H	-3.0	103.28	/	/
2412.0	101.67	Ave	158	155	H	-3.0	98.67	/	/
2390.0	42.85	PK	206	195	V	-3.0	39.85	74	34.15
2390.0	30.25	Ave	206	195	V	-3.0	27.25	54	26.75
4824.0	34.49	PK	298	148	H	7.2	41.69	74	32.31
4824.0	28.71	Ave	298	148	H	7.2	35.91	54	18.09
6620.0	30.02	PK	217	181	V	13.6	43.62	74	30.38
6620.0	23.96	Ave	217	181	V	13.6	37.56	54	16.44
7236.0	26.45	PK	190	199	H	16.0	42.45	74	31.55
7236.0	20.61	Ave	190	199	H	16.0	36.61	54	17.39
Middle Channel (2437 MHz)									
2437.0	109.61	PK	304	113	V	-3.0	106.61	/	/
2437.0	104.92	Ave	304	113	V	-3.0	101.92	/	/
2437.0	103.91	PK	236	193	H	-3.0	100.91	/	/
2437.0	99.83	Ave	236	193	H	-3.0	96.83	/	/
1477.0	44.84	PK	201	106	V	-7.0	37.84	74	36.16
1477.0	31.49	Ave	201	106	V	-7.0	24.49	54	29.51
4874.0	32.27	PK	273	246	V	7.3	39.57	74	34.43
4874.0	27.34	Ave	273	246	V	7.3	34.64	54	19.36
6677.0	30.64	PK	135	188	H	13.8	44.44	74	29.56
6677.0	23.65	Ave	135	188	H	13.8	37.45	54	16.55
7311.0	26.06	PK	273	248	H	16.3	42.36	74	31.64
7311.0	20.19	Ave	273	248	H	16.3	36.49	54	17.51
High Channel (2462 MHz)									
2462.0	108.74	PK	140	196	V	-3.0	105.74	/	/
2462.0	104.37	Ave	140	196	V	-3.0	101.37	/	/
2462.0	102.98	PK	333	161	H	-3.0	99.98	/	/
2462.0	98.49	Ave	333	161	H	-3.0	95.49	/	/
2483.5	44.30	PK	213	167	V	-3.0	41.30	74	32.70
2483.5	30.81	Ave	213	167	V	-3.0	27.81	54	26.19
4924.0	34.05	PK	171	185	H	14.0	48.05	74	25.95
4924.0	29.20	Ave	171	185	H	14.0	43.20	54	10.80
6681.0	30.15	PK	225	244	H	13.8	43.95	74	30.05
6681.0	21.14	Ave	225	244	H	13.8	34.94	54	19.06
7386.0	28.52	PK	50	164	H	16.7	45.22	74	28.78
7386.0	23.00	Ave	50	164	H	16.7	39.70	54	14.30

802.11g Mode (2TX was the worst):

Frequency	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
	Reading	Detector		Height	Polar				
(MHz)	(dBµV)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dBµV/m)	(dBµV/m)	(dB)
Low Channel (2412 MHz)									
2412.0	107.85	PK	293	150	V	-3.0	104.85	/	/
2412.0	103.36	Ave	293	150	V	-3.0	100.36	/	/
2412.0	104.56	PK	346	114	H	-3.0	101.56	/	/
2412.0	99.95	Ave	346	114	H	-3.0	96.95	/	/
2390.0	45.60	PK	109	118	V	-3.0	42.60	74	31.40
2390.0	33.64	Ave	109	118	V	-3.0	30.64	54	23.36
4824.0	34.60	PK	228	222	H	7.2	41.80	74	32.20
4824.0	29.67	Ave	228	222	H	7.2	36.87	54	17.13
6620.0	29.78	PK	222	235	V	13.6	43.38	74	30.62
6620.0	23.05	Ave	222	235	V	13.6	36.65	54	17.35
7236.0	26.28	PK	206	166	H	16.0	42.28	74	31.72
7236.0	21.30	Ave	206	166	H	16.0	104.85	54	16.70
Middle Channel (2437 MHz)									
2437.0	107.92	PK	278	117	V	-3.0	104.92	/	/
2437.0	103.05	Ave	278	117	V	-3.0	100.05	/	/
2437.0	103.18	PK	304	206	H	-3.0	100.18	/	/
2437.0	98.73	Ave	304	206	H	-3.0	95.73	/	/
1477.0	44.51	PK	275	137	V	-7.0	37.51	74	36.49
1477.0	33.16	Ave	275	137	V	-7.0	26.16	54	27.84
4874.0	33.34	PK	233	219	V	7.3	40.64	74	33.36
4874.0	28.08	Ave	233	219	V	7.3	35.38	54	18.62
6677.0	29.69	PK	95	148	H	13.8	43.49	74	30.51
6677.0	21.55	Ave	95	148	H	13.8	35.35	54	18.65
7311.0	27.20	PK	300	195	H	16.3	43.50	74	30.50
7311.0	21.60	Ave	300	195	H	16.3	37.90	54	16.10
High Channel (2462 MHz)									
2462.0	107.00	PK	325	222	V	-3.0	104.00	/	/
2462.0	102.81	Ave	325	222	V	-3.0	99.81	/	/
2462.0	101.67	PK	31	205	H	-3.0	98.67	/	/
2462.0	97.19	Ave	31	205	H	-3.0	94.19	/	/
2483.5	45.87	PK	10	185	V	-3.0	42.87	74	31.13
2483.5	30.85	Ave	10	185	V	-3.0	27.85	54	26.15
4924.0	32.77	PK	114	123	H	14.0	46.77	74	27.23
4924.0	28.40	Ave	114	123	H	14.0	42.40	54	11.60
6681.0	29.45	PK	187	145	H	13.8	43.25	74	30.75
6681.0	22.38	Ave	187	145	H	13.8	36.18	54	17.82
7386.0	28.41	PK	233	154	H	16.7	45.11	74	28.89
7386.0	24.26	Ave	233	154	H	16.7	40.96	54	13.04

802.11n-HT20 (2TX was the worst):

Frequency	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
	Reading	Detector		Height	Polar				
(MHz)	(dBμV)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
Low Channel (2412 MHz)									
2412.0	107.21	PK	198	190	V	-3.0	104.21	/	/
2412.0	102.63	Ave	198	190	V	-3.0	99.63	/	/
2412.0	103.16	PK	217	161	H	-3.0	100.16	/	/
2412.0	99.08	Ave	217	161	H	-3.0	96.08	/	/
2390.0	45.22	PK	48	219	V	-3.0	42.22	74	31.78
2390.0	30.55	Ave	48	219	V	-3.0	27.55	54	26.45
4824.0	32.13	PK	273	158	H	7.2	39.33	74	34.67
4824.0	26.68	Ave	273	158	H	7.2	33.88	54	20.12
6620.0	29.69	PK	240	167	V	13.6	43.29	74	30.71
6620.0	23.74	Ave	240	167	V	13.6	37.34	54	16.66
7236.0	26.34	PK	220	248	H	16.0	42.34	74	31.66
7236.0	20.49	Ave	220	248	H	16.0	104.21	54	17.51
Middle Channel (2437 MHz)									
2437.0	105.85	PK	289	149	V	-3.0	102.85	/	/
2437.0	101.71	Ave	289	149	V	-3.0	98.71	/	/
2437.0	101.61	PK	62	220	H	-3.0	98.61	/	/
2437.0	97.41	Ave	62	220	H	-3.0	94.41	/	/
1477.0	43.97	PK	110	198	V	-7.0	36.97	74	37.03
1477.0	30.33	Ave	110	198	V	-7.0	23.33	54	30.67
4874.0	33.63	PK	228	194	V	7.3	40.93	74	33.07
4874.0	28.24	Ave	228	194	V	7.3	35.54	54	18.46
6677.0	31.58	PK	350	246	H	13.8	45.38	74	28.62
6677.0	22.44	Ave	350	246	H	13.8	36.24	54	17.76
7311.0	26.48	PK	150	174	H	16.3	42.78	74	31.22
7311.0	22.22	Ave	150	174	H	16.3	38.52	54	15.48
High Channel (2462 MHz)									
2462.0	106.51	PK	116	167	V	-3.0	103.51	/	/
2462.0	101.59	Ave	116	167	V	-3.0	98.59	/	/
2462.0	103.34	PK	160	148	H	-3.0	100.34	/	/
2462.0	99.32	Ave	160	148	H	-3.0	96.32	/	/
2483.5	42.38	PK	275	206	V	-3.0	39.38	74	34.62
2483.5	33.13	Ave	275	206	V	-3.0	30.13	54	23.87
2563.0	44.45	PK	74	192	V	4.2	48.65	74	25.35
2563.0	37.93	Ave	74	192	V	4.2	42.13	54	11.87
4924.0	33.44	PK	6	123	H	14.0	47.44	74	26.56
4924.0	29.19	Ave	6	123	H	14.0	43.19	54	10.81
6681.0	29.74	PK	246	158	H	13.8	43.54	74	30.46
6681.0	21.38	Ave	246	158	H	13.8	35.18	54	18.82
7386.0	28.69	PK	165	149	H	16.7	45.39	74	28.61
7386.0	22.71	Ave	165	149	H	16.7	39.41	54	14.59

802.11n-HT40 (2TX was the worst):

Frequency	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
	Reading	Detector		Height	Polar				
(MHz)	(dBμV)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
Low Channel (2422 MHz)									
2422.0	102.09	PK	335	142	V	-3.0	99.09	/	/
2422.0	96.09	Ave	335	142	V	-3.0	93.09	/	/
2422.0	98.04	PK	81	134	H	-3.0	95.04	/	/
2422.0	91.92	Ave	81	134	H	-3.0	88.92	/	/
2390.0	42.96	PK	251	132	V	-3.0	39.96	74	34.04
2390.0	32.61	Ave	251	132	V	-3.0	29.61	54	24.39
4844.0	32.16	PK	358	122	H	7.2	39.36	74	34.64
4844.0	25.37	Ave	358	122	H	7.2	32.57	54	21.43
6620.0	31.67	PK	338	235	V	13.6	45.27	74	28.73
6620.0	21.81	Ave	338	235	V	13.6	35.41	54	18.59
7266.0	27.89	PK	167	239	H	16.0	43.89	74	30.11
7266.0	20.42	Ave	167	239	H	16.0	36.42	54	17.58
Middle Channel (2437 MHz)									
2437.0	103.42	PK	186	226	V	-3.0	100.42	/	/
2437.0	96.77	Ave	186	226	V	-3.0	93.77	/	/
2437.0	99.16	PK	253	225	H	-3.0	96.16	/	/
2437.0	93.03	Ave	253	225	H	-3.0	90.03	/	/
1477.0	43.90	PK	294	138	V	-7.0	36.90	74	37.10
1477.0	32.53	Ave	294	138	V	-7.0	25.53	54	28.47
4874.0	32.47	PK	12	229	V	7.3	39.77	74	34.23
4874.0	25.43	Ave	12	229	V	7.3	32.73	54	21.27
6677.0	31.27	PK	150	153	H	13.8	45.07	74	28.93
6677.0	22.97	Ave	150	153	H	13.8	36.77	54	17.23
7311.0	26.07	PK	14	197	H	16.3	42.37	74	31.63
7311.0	18.12	Ave	14	197	H	16.3	34.42	54	19.58
High Channel (2452 MHz)									
2452.0	96.36	PK	208	183	V	3.0	99.36	/	/
2452.0	89.95	Ave	208	183	V	3.0	92.95	/	/
2452.0	90.40	PK	221	175	H	3.0	93.40	/	/
2452.0	83.53	Ave	221	175	H	3.0	86.53	/	/
2483.5	43.31	PK	85	205	V	3.2	46.51	74	27.49
2483.5	30.36	Ave	85	205	V	3.2	33.56	54	20.44
4904.0	34.32	PK	285	203	H	14.0	48.32	74	25.68
4904.0	27.06	Ave	285	203	H	14.0	41.06	54	12.94
6681.0	31.36	PK	292	178	H	13.8	45.16	74	28.84
6681.0	23.56	Ave	292	178	H	13.8	37.36	54	16.64
7356.0	28.57	PK	310	186	H	16.7	45.27	74	28.73
7356.0	20.80	Ave	310	186	H	16.7	37.50	54	16.50

With Beamforming
802.11n-ht20:

Frequency	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
	Reading	Detector		Height	Polar				
(MHz)	(dBμV)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
Low Channel (2412 MHz)									
2412.0	104.50	PK	198	190	V	-3.0	101.50	/	/
2412.0	100.19	Ave	198	190	V	-3.0	97.19	/	/
2412.0	100.76	PK	217	161	H	-3.0	97.76	/	/
2412.0	96.71	Ave	217	161	H	-3.0	93.71	/	/
2390.0	42.71	PK	48	219	V	-3.0	39.71	74	34.29
2390.0	31.82	Ave	48	219	V	-3.0	28.82	54	25.18
4824.0	33.97	PK	273	158	H	7.2	41.17	74	32.83
4824.0	28.29	Ave	273	158	H	7.2	35.49	54	18.51
6620.0	29.83	PK	240	167	V	13.6	43.43	74	30.57
6620.0	22.14	Ave	240	167	V	13.6	35.74	54	18.26
7236.0	27.66	PK	220	248	H	16.0	43.66	74	30.34
7236.0	22.25	Ave	220	248	H	16.0	38.25	54	15.75
Middle Channel (2437 MHz)									
2437.0	106.51	PK	289	149	V	-3.0	103.51	/	/
2437.0	101.67	Ave	289	149	V	-3.0	98.67	/	/
2437.0	101.02	PK	62	220	H	-3.0	98.02	/	/
2437.0	96.24	Ave	62	220	H	-3.0	93.24	/	/
1477.0	42.27	PK	110	198	V	-7.0	35.27	74	38.73
1477.0	31.08	Ave	110	198	V	-7.0	24.08	54	29.92
1696.0	43.32	PK	297	209	H	-5.4	37.92	74	36.08
1696.0	34.18	Ave	297	209	H	-5.4	28.78	54	25.22
4874.0	34.65	PK	228	194	V	7.3	41.95	74	32.05
4874.0	28.84	Ave	228	194	V	7.3	36.14	54	17.86
6677.0	31.32	PK	350	246	H	13.8	45.12	74	28.88
6677.0	21.36	Ave	350	246	H	13.8	35.16	54	18.84
7311.0	26.78	PK	150	174	H	16.3	43.08	74	30.92
7311.0	22.64	Ave	150	174	H	16.3	38.94	54	15.06
High Channel (2462 MHz)									
2462.0	104.05	PK	116	167	V	-3.0	101.05	/	/
2462.0	99.56	Ave	116	167	V	-3.0	96.56	/	/
2462.0	98.37	PK	160	148	H	-3.0	95.37	/	/
2462.0	93.54	Ave	160	148	H	-3.0	90.54	/	/
2483.5	44.32	PK	275	206	V	-3.0	41.32	74	32.68
2483.5	32.75	Ave	275	206	V	-3.0	29.75	54	24.25
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
4924.0	34.04	PK	6	123	H	14.0	48.04	74	25.96
4924.0	29.33	Ave	6	123	H	14.0	43.33	54	10.67
6681.0	30.78	PK	246	158	H	13.8	44.58	74	29.42
6681.0	22.04	Ave	246	158	H	13.8	35.84	54	18.16
7386.0	26.95	PK	165	149	H	16.7	43.65	74	30.35
7386.0	21.14	Ave	165	149	H	16.7	37.84	54	16.16

802.11n-ht40:

Frequency	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
	Reading	Detector		Height	Polar				
(MHz)	(dBμV)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
Low Channel (2422 MHz)									
2422.0	101.11	PK	335	142	V	-3.0	98.11	/	/
2422.0	94.51	Ave	335	142	V	-3.0	91.51	/	/
2422.0	96.59	PK	81	134	H	-3.0	93.59	/	/
2422.0	90.24	Ave	81	134	H	-3.0	87.24	/	/
2390.0	45.23	PK	251	132	V	-3.0	42.23	74	31.77
2390.0	32.77	Ave	251	132	V	-3.0	29.77	54	24.23
4844.0	32.23	PK	358	122	H	7.2	39.43	74	34.57
4844.0	25.06	Ave	358	122	H	7.2	32.26	54	21.74
6620.0	30.43	PK	338	235	V	13.6	44.03	74	29.97
6620.0	22.34	Ave	338	235	V	13.6	35.94	54	18.06
7266.0	27.71	PK	167	239	H	16.0	43.71	74	30.29
7266.0	20.75	Ave	167	239	H	16.0	98.11	54	17.25
Middle Channel (2437 MHz)									
2437.0	102.68	PK	186	226	V	-3.0	99.68	/	/
2437.0	95.98	Ave	186	226	V	-3.0	92.98	/	/
2437.0	99.63	PK	253	225	H	-3.0	96.63	/	/
2437.0	93.10	Ave	253	225	H	-3.0	90.10	/	/
1477.0	44.17	PK	294	138	V	-7.0	37.17	74	36.83
1477.0	30.13	Ave	294	138	V	-7.0	23.13	54	30.87
1696.0	45.61	PK	82	200	H	-5.4	40.21	74	33.79
1696.0	36.63	Ave	82	200	H	-5.4	31.23	54	22.77
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
6677.0	30.78	PK	150	153	H	13.8	44.58	74	29.42
6677.0	22.41	Ave	150	153	H	13.8	36.21	54	17.79
7311.0	27.61	PK	14	197	H	16.3	43.91	74	30.09
7311.0	21.48	Ave	14	197	H	16.3	37.78	54	16.22
High Channel (2452 MHz)									
2452.0	97.16	PK	208	183	V	-3.0	94.16	/	/
2452.0	90.70	Ave	208	183	V	-3.0	87.70	/	/
2452.0	93.36	PK	221	175	H	-3.0	90.36	/	/
2452.0	87.12	Ave	221	175	H	-3.0	84.12	/	/
2483.5	42.03	PK	85	205	V	-3.2	38.83	74	35.17
2483.5	31.37	Ave	85	205	V	-3.2	28.17	54	25.83
2563.0	46.12	PK	274	185	V	4.2	50.32	74	23.68
2563.0	36.98	Ave	274	185	V	4.2	41.18	54	12.82
4904.0	33.27	PK	285	203	H	14.0	47.27	74	26.73
4904.0	27.02	Ave	285	203	H	14.0	41.02	54	12.98
6681.0	30.15	PK	292	178	H	13.8	43.95	74	30.05
6681.0	22.01	Ave	292	178	H	13.8	35.81	54	18.19
7356.0	28.92	PK	310	186	H	16.7	45.62	74	28.38
7356.0	21.29	Ave	310	186	H	16.7	94.16	54	16.01

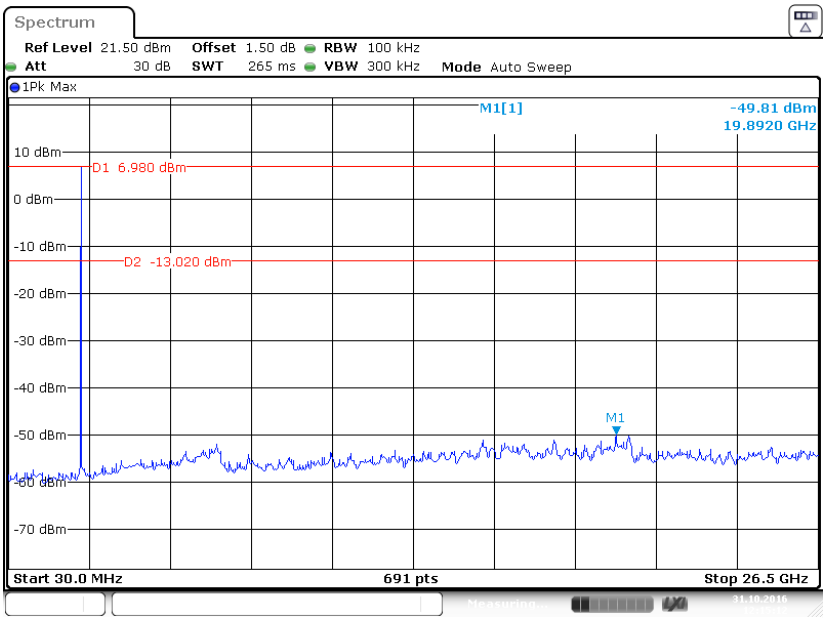
Co-location (2.4GHz band and 5.8GHz band transmit simultaneously):
(2.4GHz 2TX N40 Non-beamforming mode 2437MHz + 5.8GHz 2TX AC80 5775MHz Non-beamforming was the worst):

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

Conducted Spurious Emissions at Antenna Port

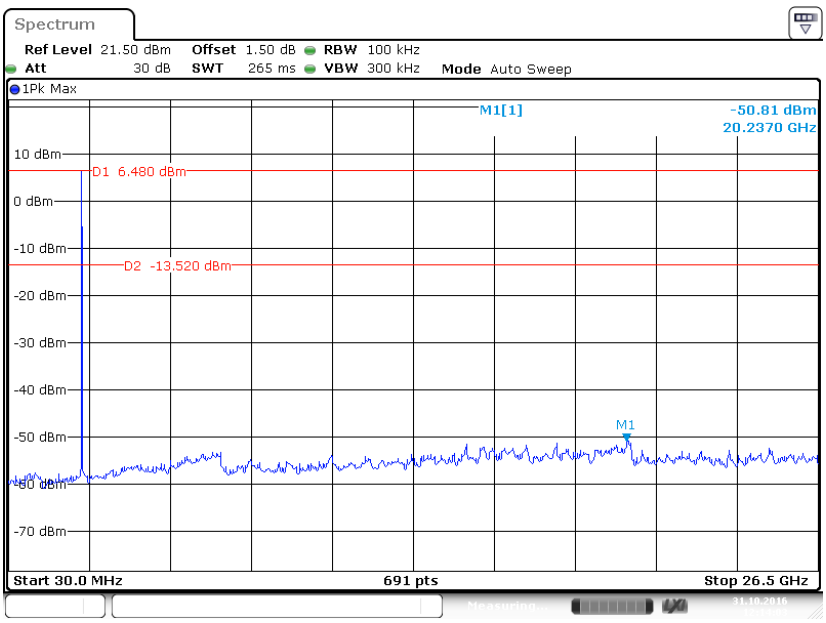
(SISO mode was test since maximum output power per chain, all emissions out of the operation band are under fundamental level 30dBc, please refer to the following plots.)

Chain 0 802.11b Low Channel



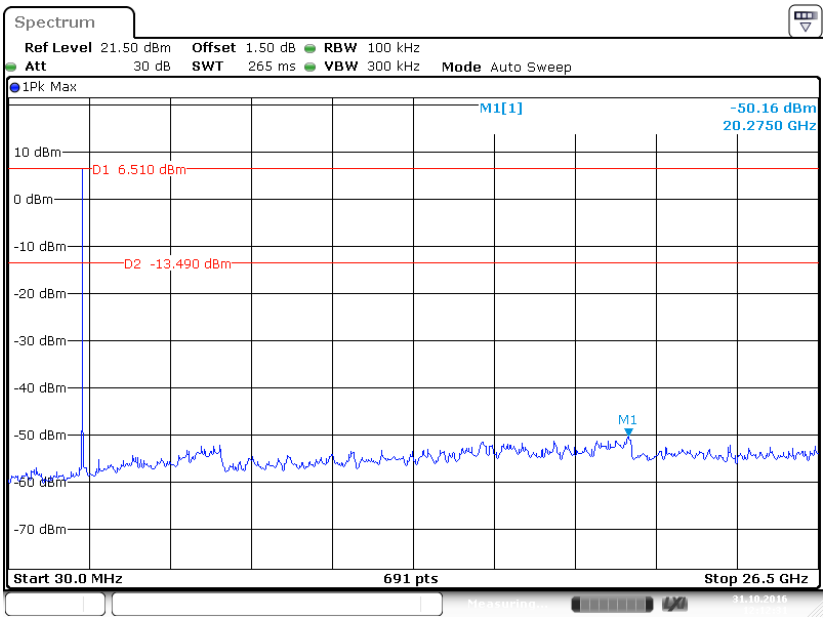
Date: 31.OCT.2016 12:15:13

Chain 0 802.11b Middle Channel



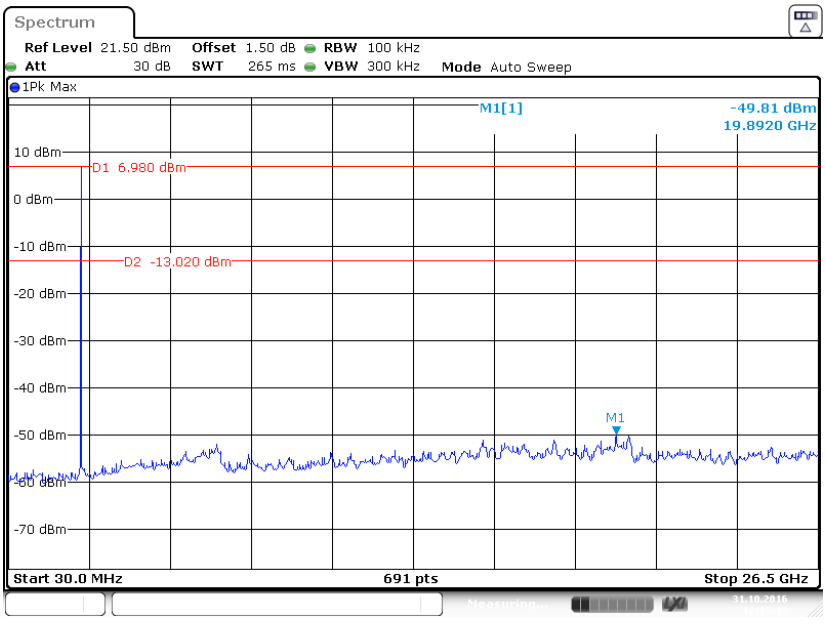
Date: 31.OCT.2016 12:14:04

Chain 0 802.11b High Channel



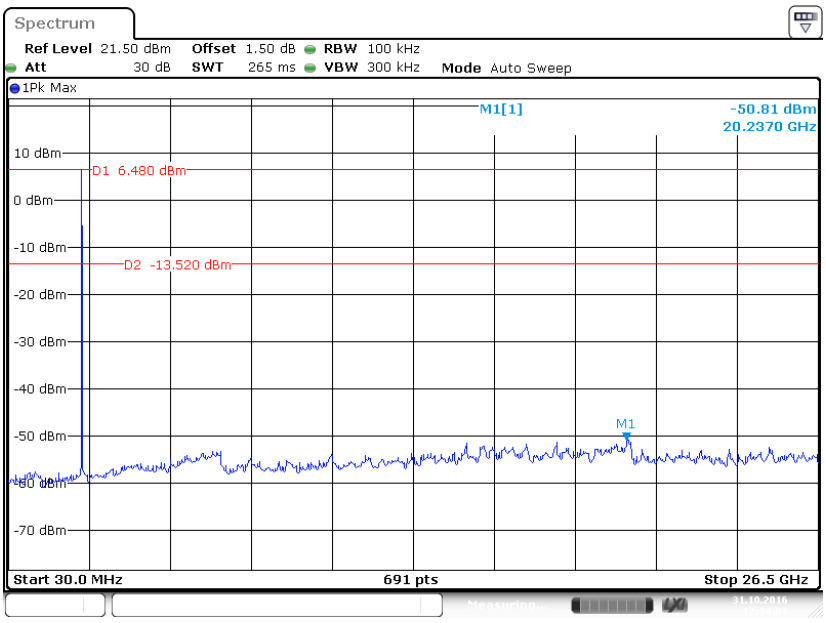
Date: 31.OCT.2016 12:12:31

Chain 0 802.11g Low Channel



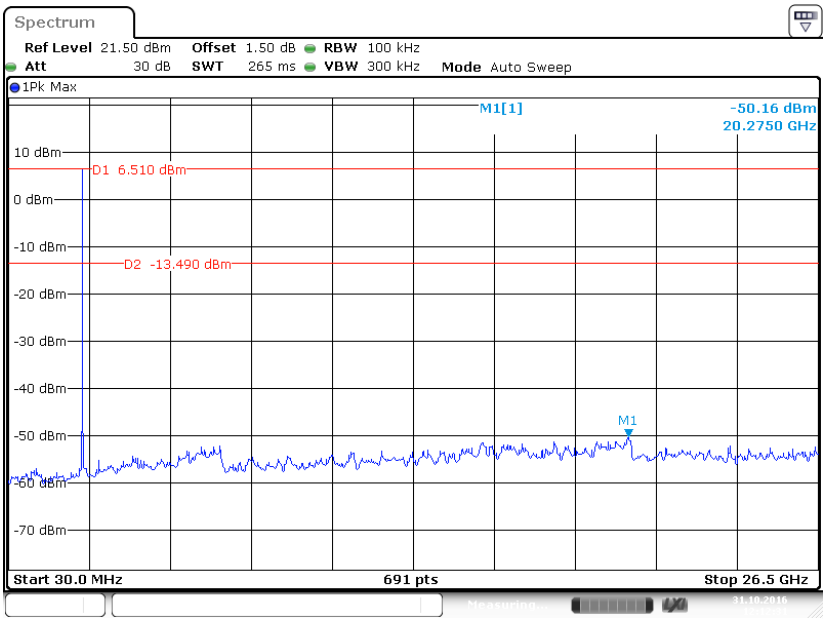
Date: 31.OCT.2016 12:15:13

Chain 0 802.11g Middle Channel



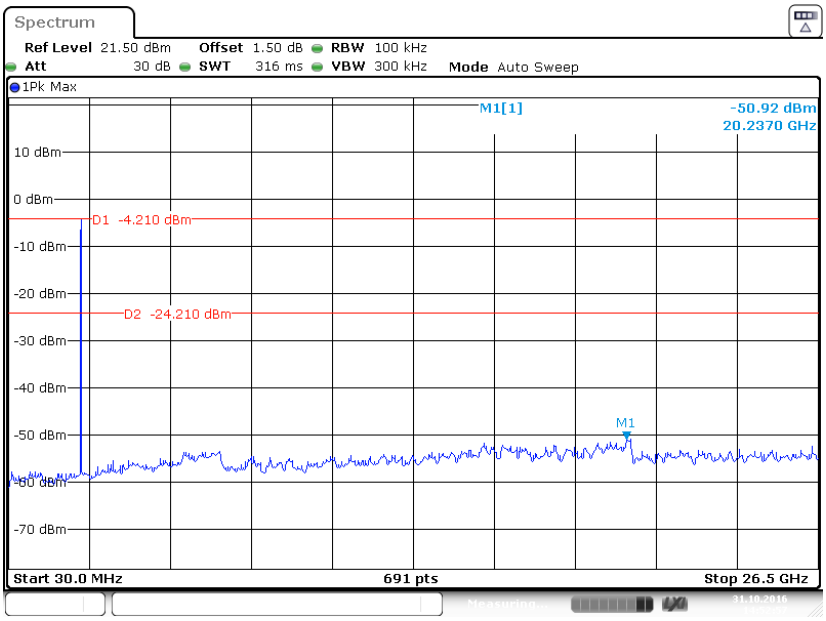
Date: 31.OCT.2016 12:14:04

Chain 0 802.11g High Channel



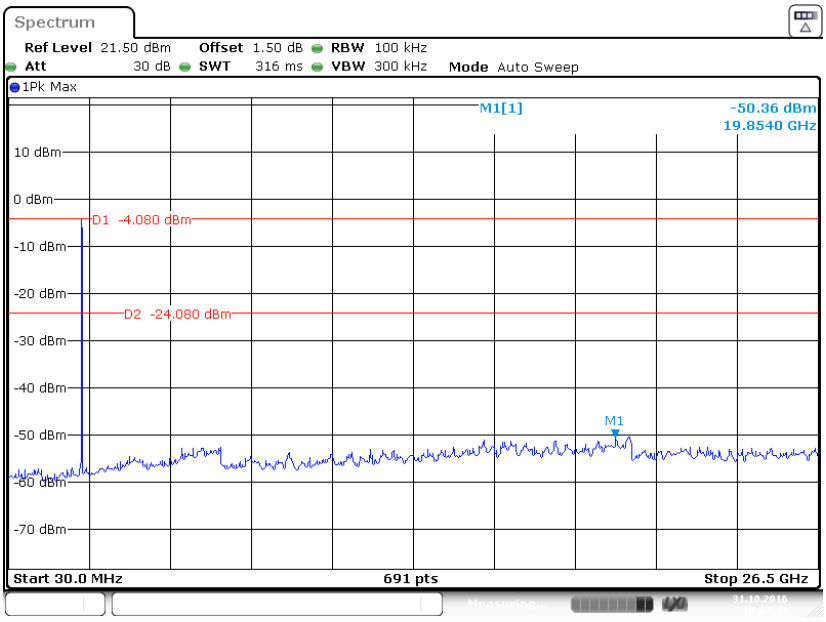
Date: 31.OCT.2016 12:12:31

Chain 0 802.11n-HT20 Low Channel



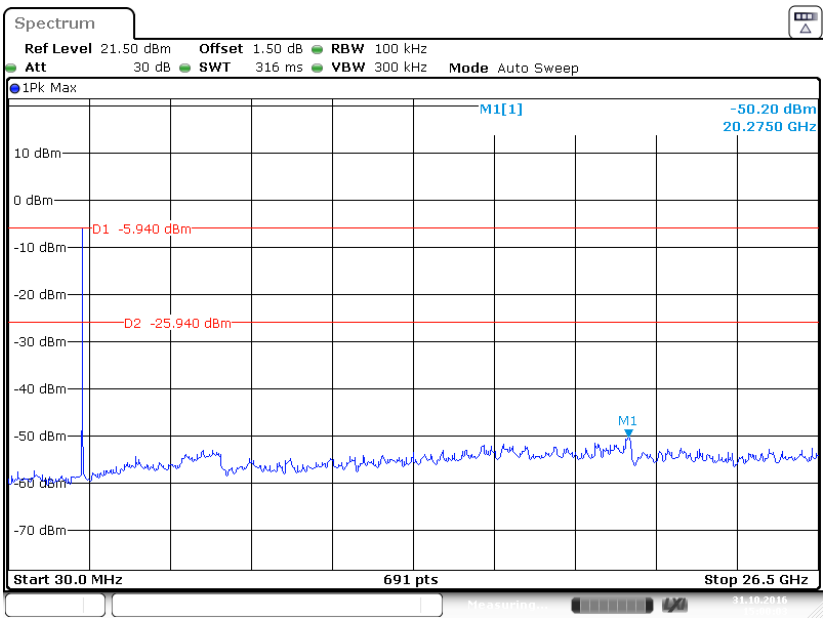
Date: 31.OCT.2016 14:52:57

Chain 0 802.11n-HT20 Middle Channel



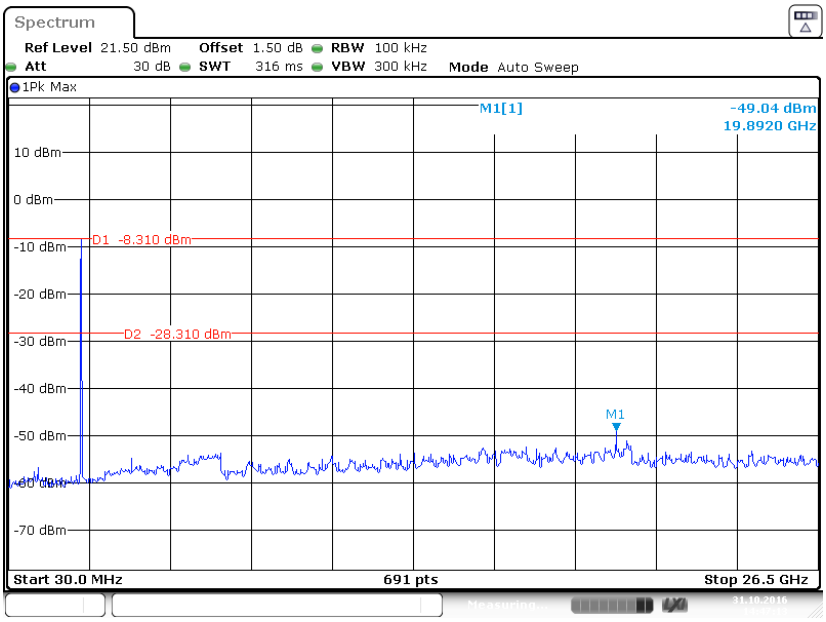
Date: 31.OCT.2016 14:57:49

Chain 0 802.11n-HT20 High Channel



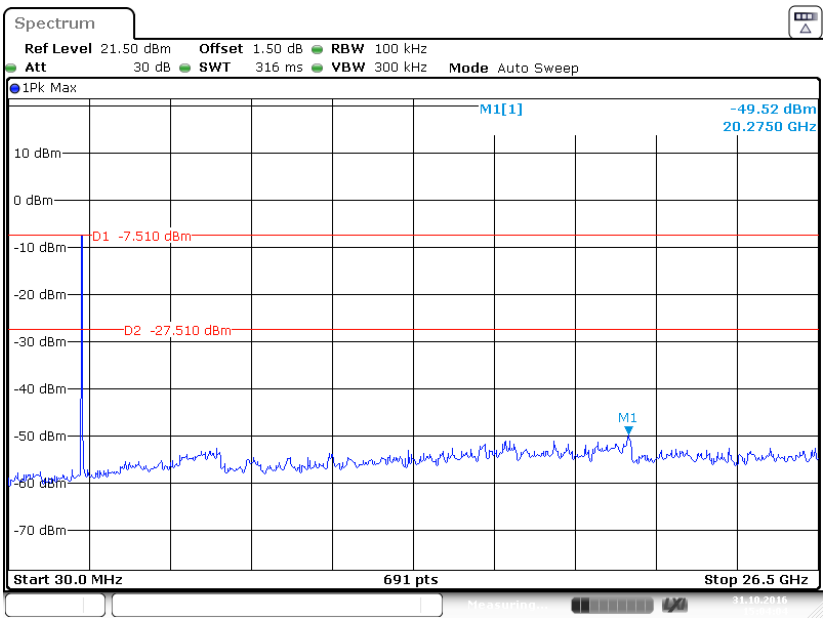
Date: 31.OCT.2016 15:00:03

Chain 0 802.11n-HT40 Low Channel



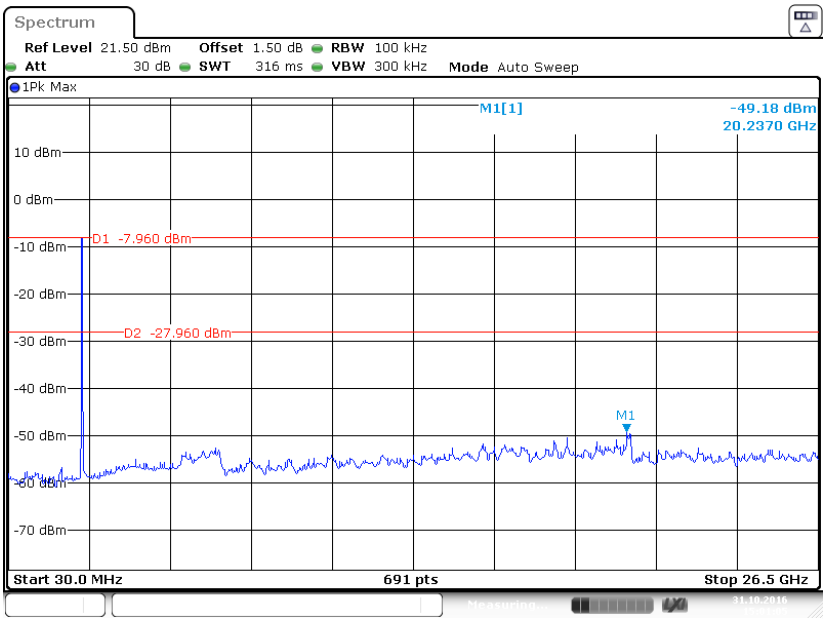
Date: 31.OCT.2016 14:47:13

Chain 0 802.11n-HT40 Middle Channel



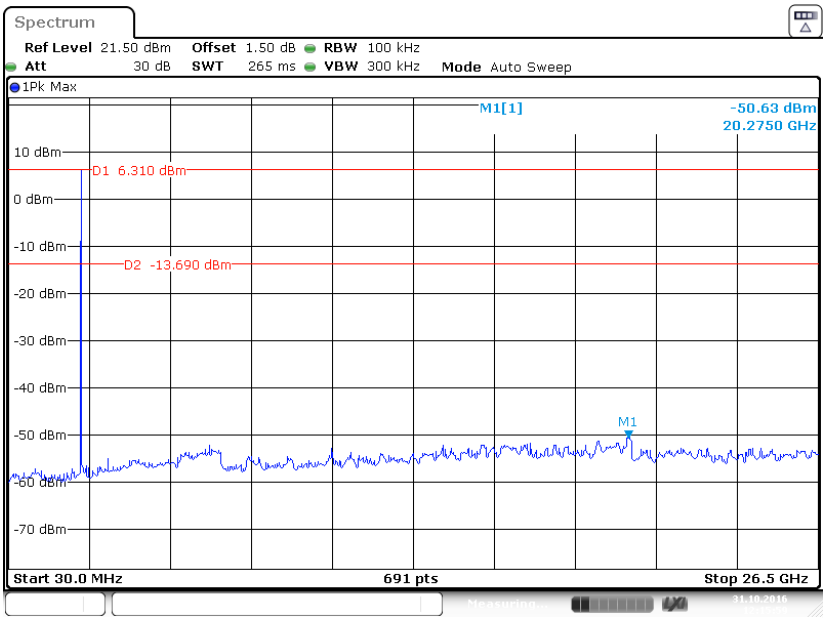
Date: 31.OCT.2016 15:04:05

Chain 0 802.11n-HT40 High Channel



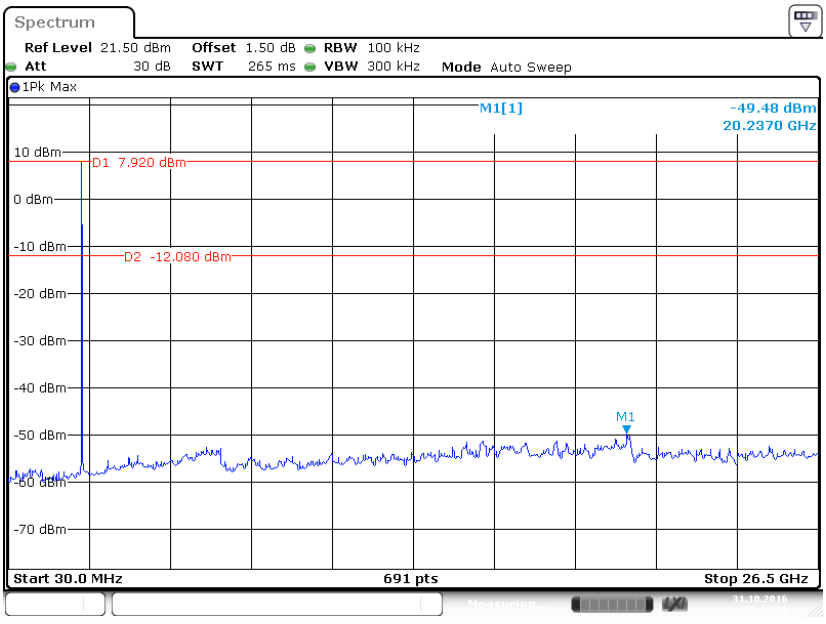
Date: 31.OCT.2016 15:01:05

Chain 1 802.11b Low Channel



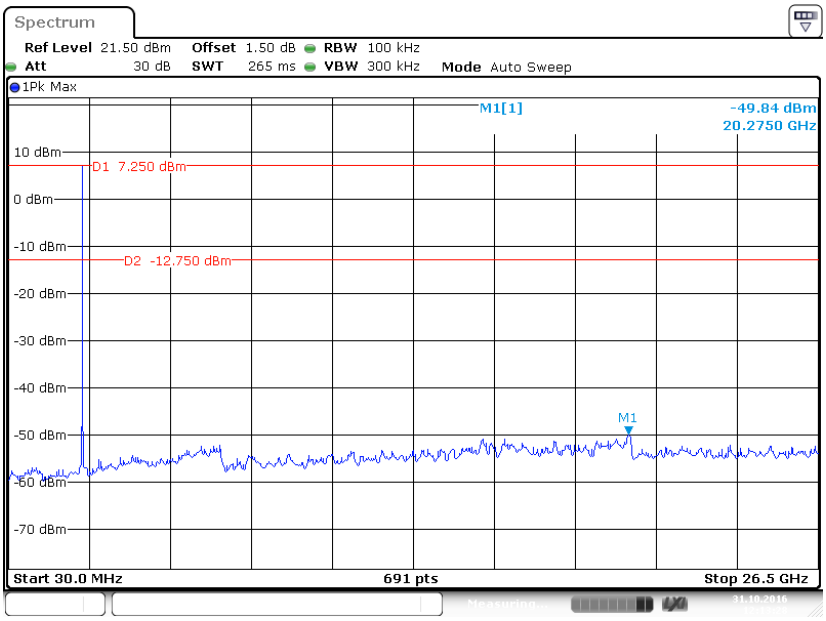
Date: 31.OCT.2016 12:15:59

Chain 1 802.11b Middle Channel



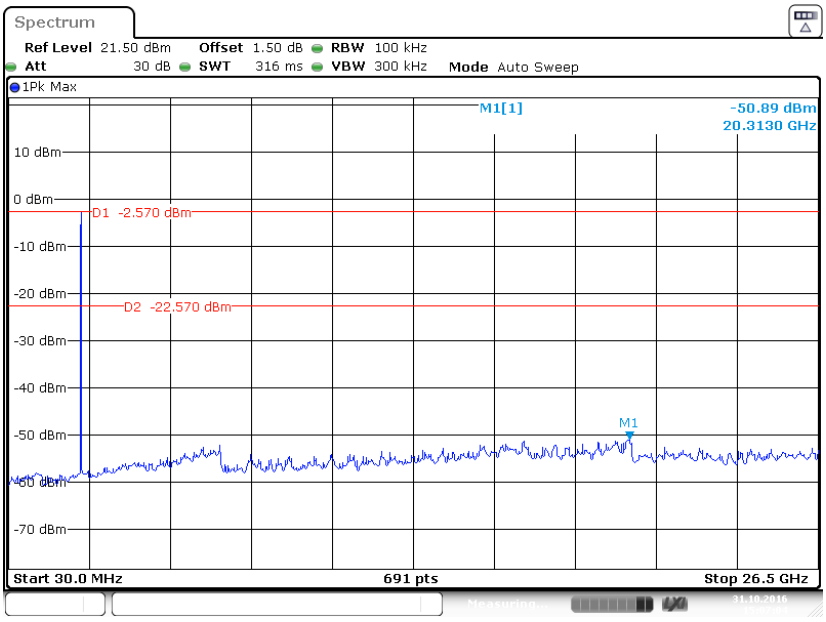
Date: 31.OCT.2016 12:14:30

Chain 1 802.11b High Channel



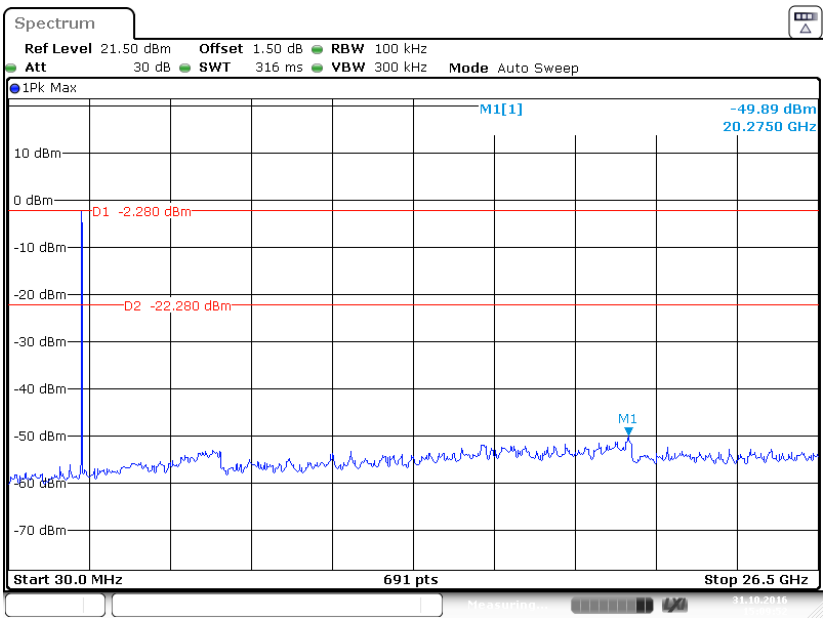
Date: 31.OCT.2016 12:13:28

Chain 1 802.11g Low Channel



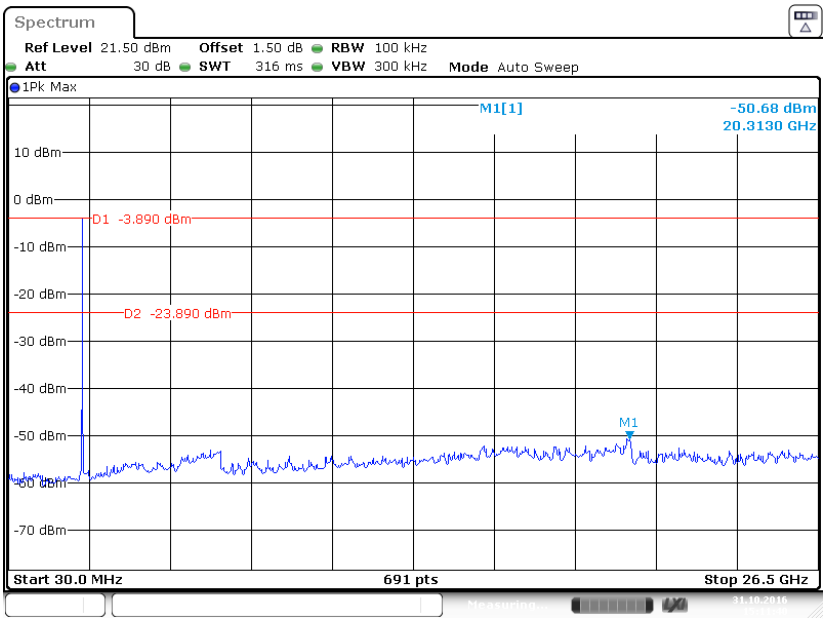
Date: 31.OCT.2016 15:07:04

Chain 1 802.11g Middle Channel



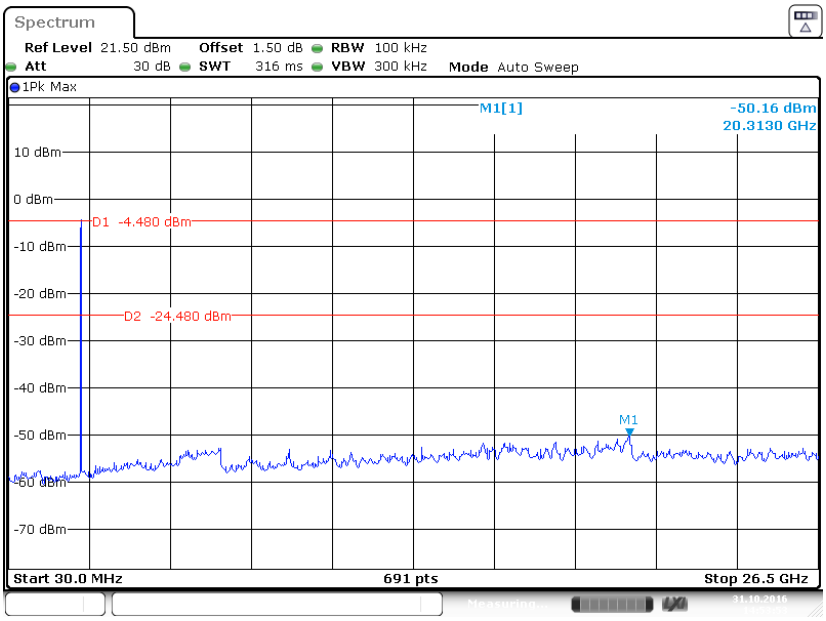
Date: 31.OCT.2016 15:09:52

Chain 1 802.11g High Channel



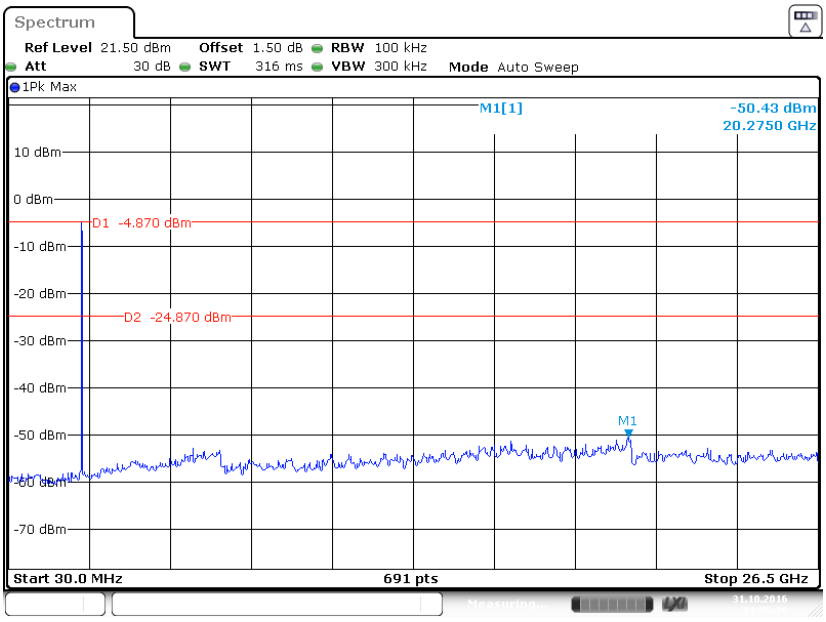
Date: 31.OCT.2016 15:11:41

Chain 1 802.11n-HT20 Low Channel



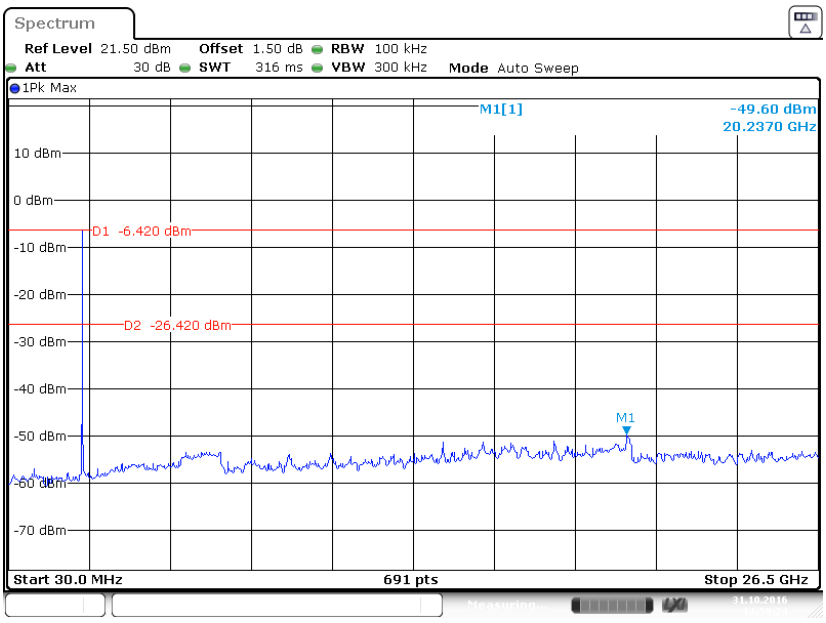
Date: 31.OCT.2016 14:53:52

Chain 1 802.11n-HT20 Middle Channel



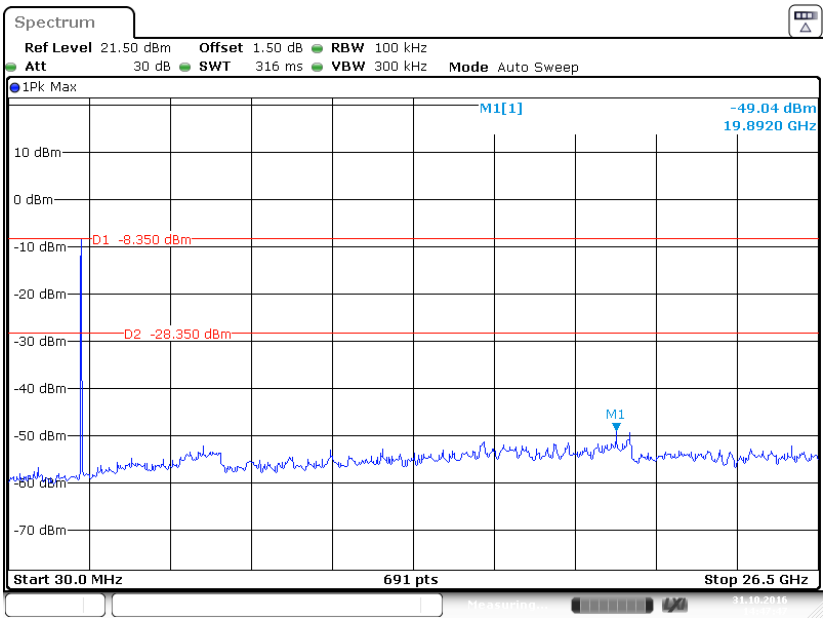
Date: 31.OCT.2016 14:56:39

Chain 1 802.11n-HT20 High Channel



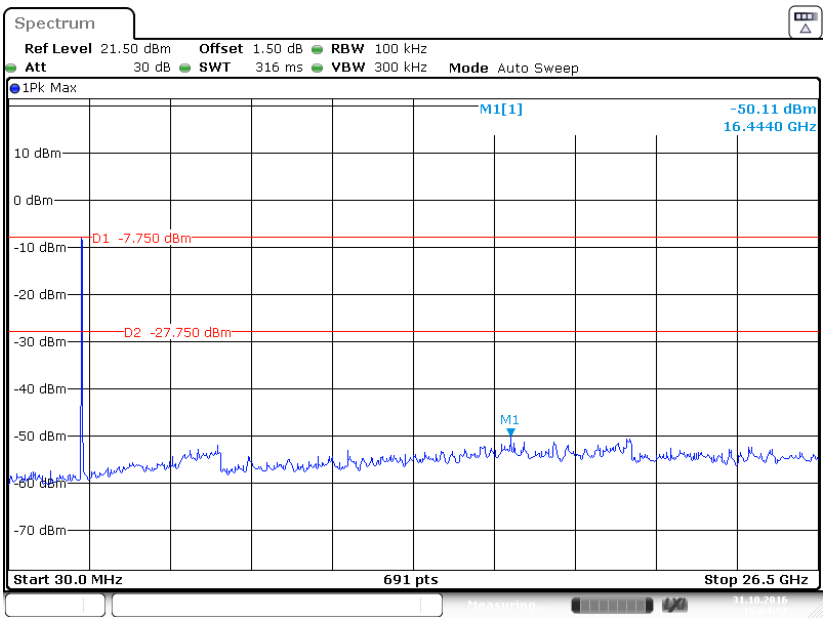
Date: 31.OCT.2016 14:59:24

Chain 1 802.11n-HT40 Low Channel



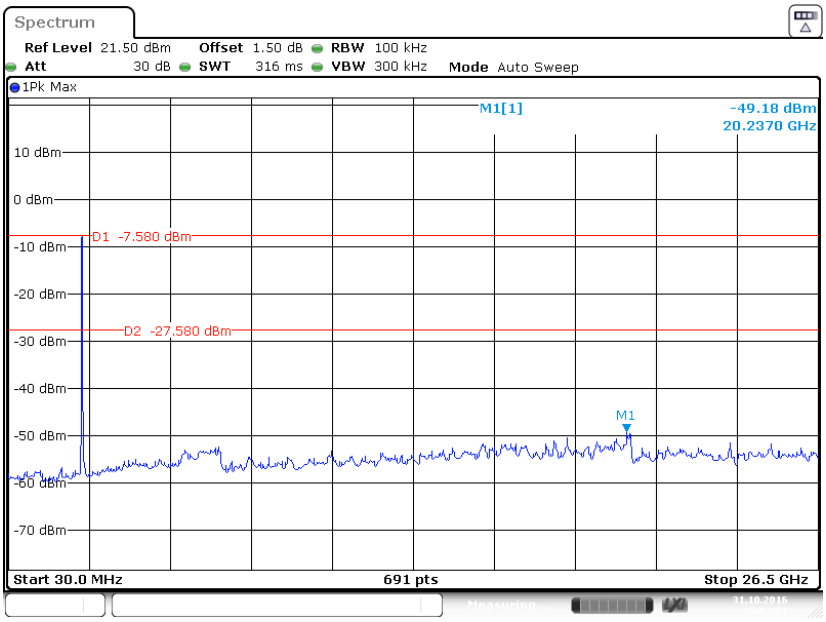
Date: 31.OCT.2016 14:47:47

Chain 1 802.11n-HT40 Middle Channel



Date: 31.OCT.2016 15:04:57

Chain 1 802.11n-HT40 High Channel



Date: 31.OCT.2016 15:02:01

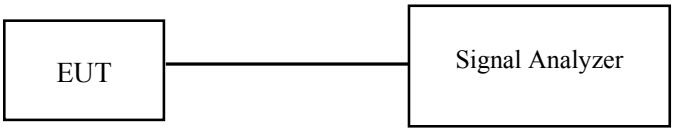
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

Applicable Standard

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Procedure

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 it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured 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 in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	23.5 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

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

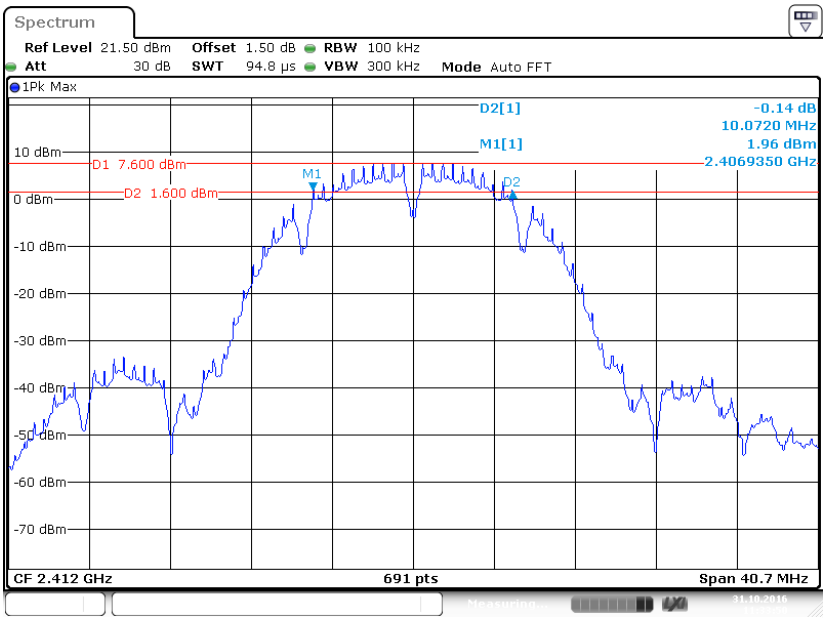
Test Result: Pass.

Please refer to the following tables and plots.

EUT operation mode: Transmitting(Test performed at SISO mode chain 0)

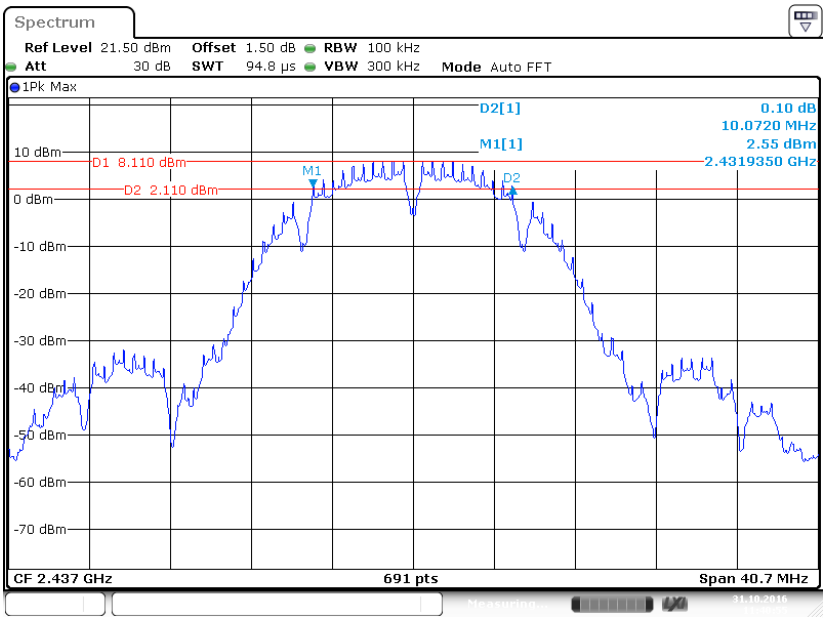
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (kHz)
802.11b			
Low	2412	10.07	≥500
Middle	2437	10.07	≥500
High	2462	10.01	≥500
802.11g			
Low	2412	16.43	≥500
Middle	2437	16.49	≥500
High	2462	16.43	≥500
802.11n-HT20			
Low	2412	17.73	≥500
Middle	2437	17.73	≥500
High	2462	17.73	≥500
802.11n-HT40			
Low	2422	36.47	≥500
Middle	2437	36.35	≥500
High	2452	36.35	≥500

Chain 0 802.11b Low Channel



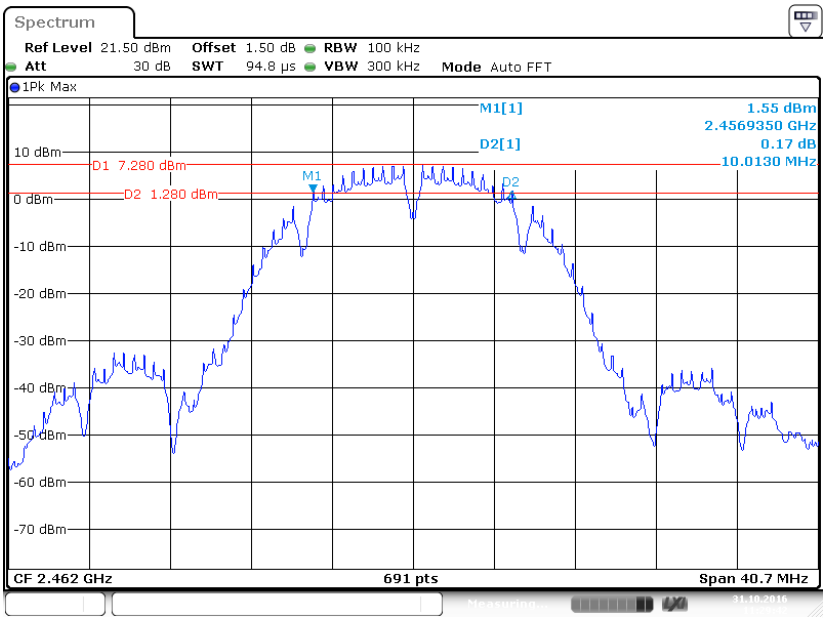
Date: 31.OCT.2016 11:33:50

Chain 0 802.11b Middle Channel



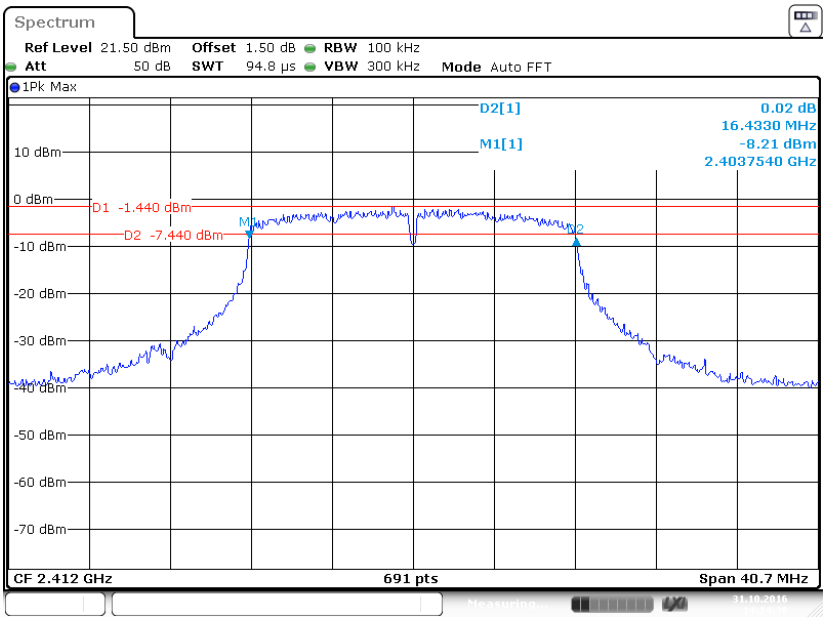
Date: 31.OCT.2016 11:40:55

Chain 0 802.11b High Channel



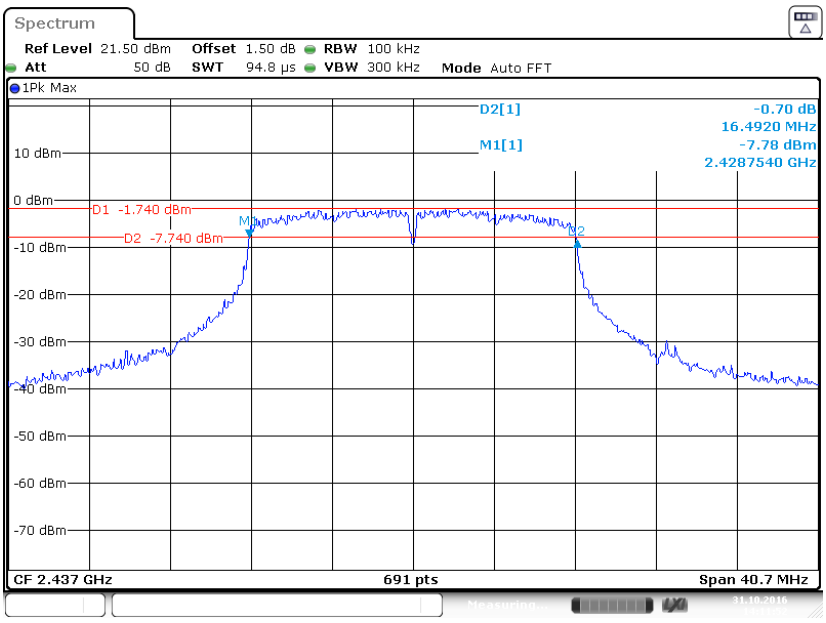
Date: 31.OCT.2016 11:29:43

Chain 0 802.11g Low Channel



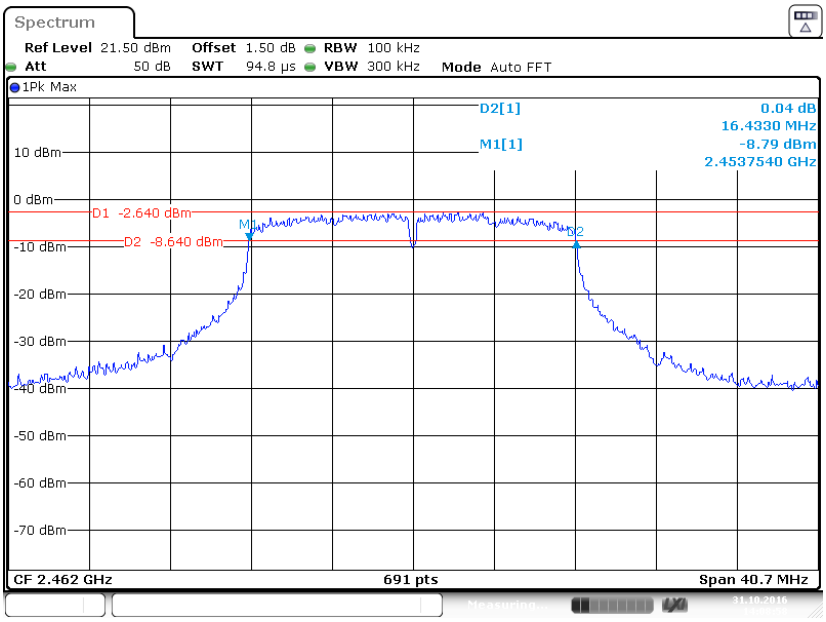
Date: 31.OCT.2016 14:14:39

Chain 0 802.11g Middle Channel



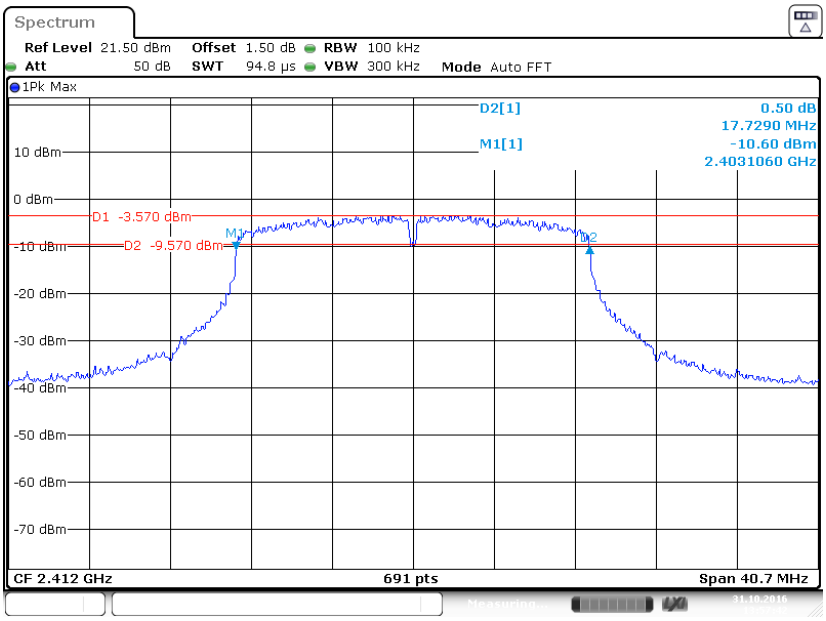
Date: 31.OCT.2016 14:11:52

Chain 0 802.11g High Channel



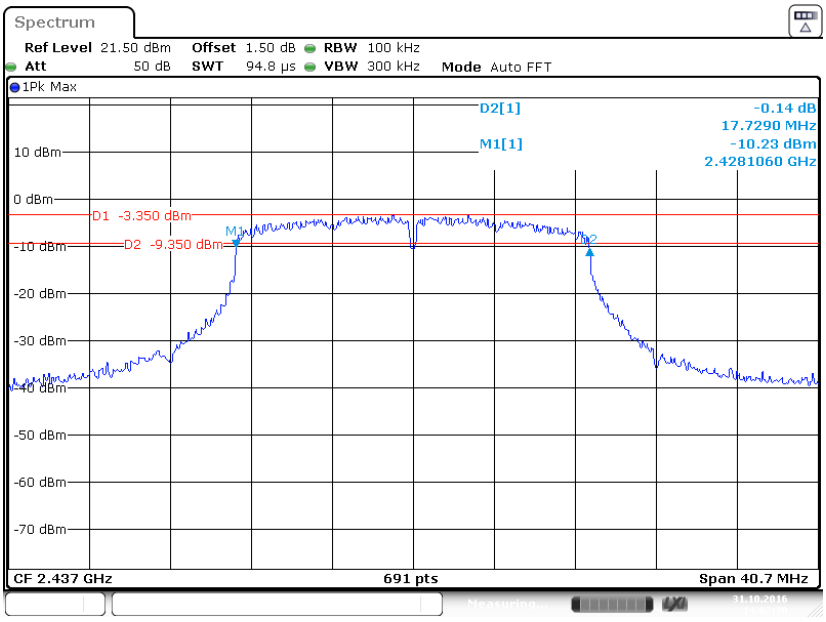
Date: 31.OCT.2016 14:08:59

Chain 0 802.11n-HT20 Low Channel



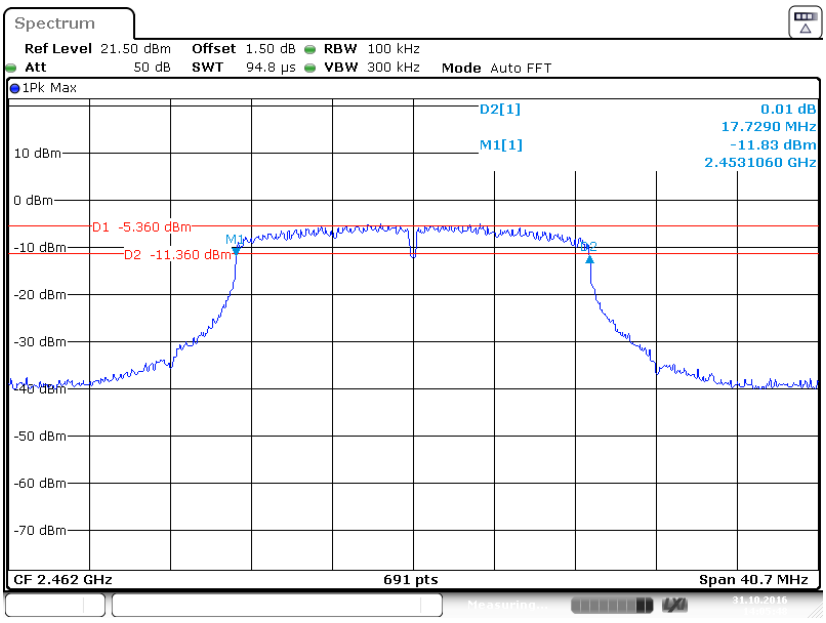
Date: 31.OCT.2016 13:57:42

Chain 0 802.11n-HT20 Middle Channel



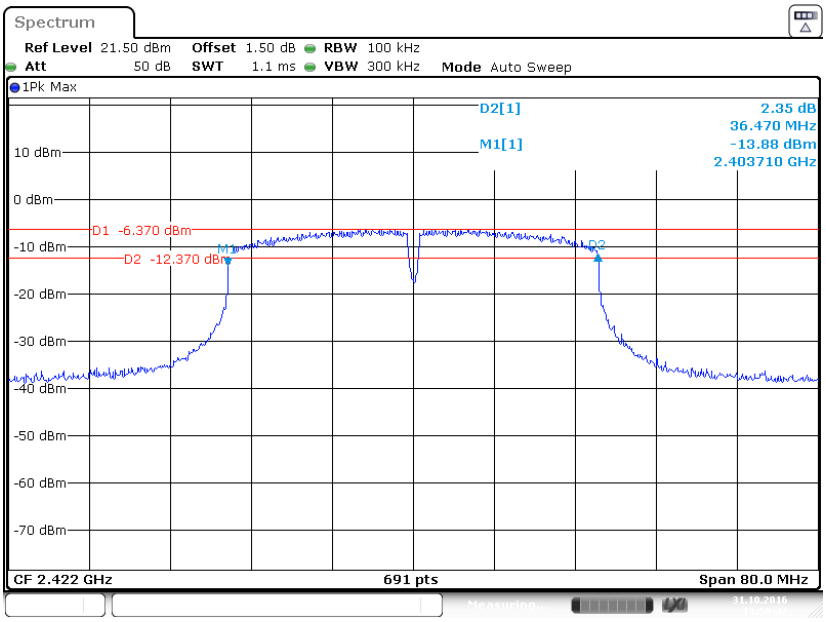
Date: 31.OCT.2016 14:02:31

Chain 0 802.11n-HT20 High Channel



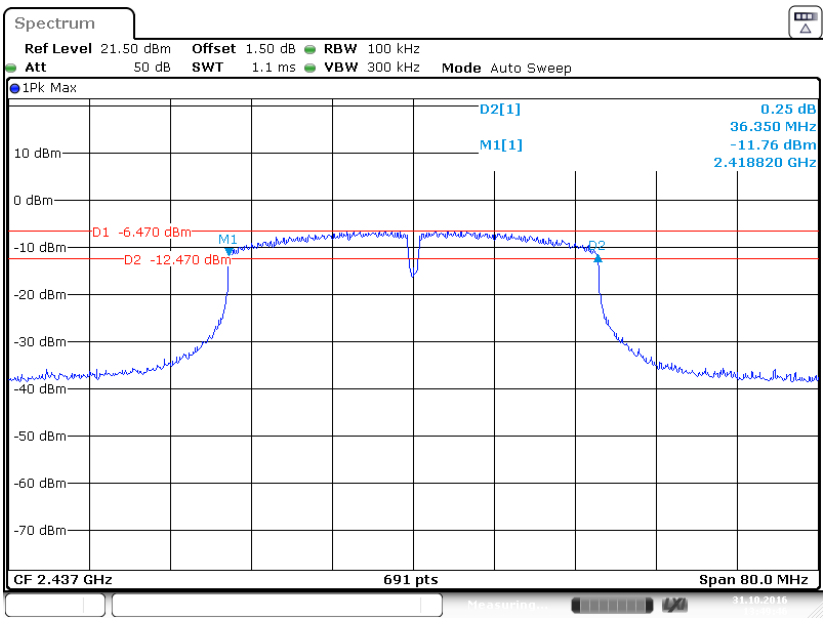
Date: 31.OCT.2016 14:05:48

Chain 0 802.11n-HT40 Low Channel



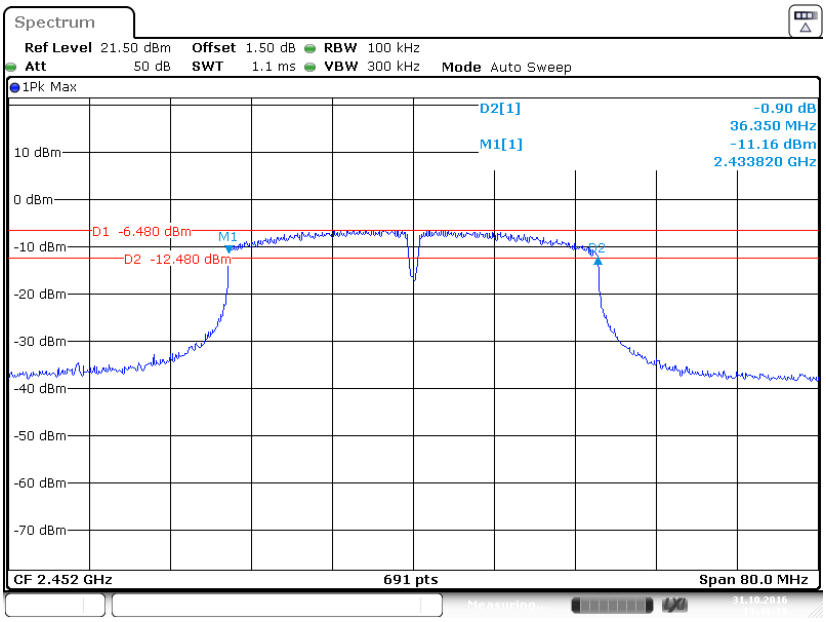
Date: 31.OCT.2016 13:50:42

Chain 0 802.11n-HT40 Middle Channel



Date: 31.OCT.2016 13:49:46

Chain 0 802.11n-HT40 High Channel



Date: 31.OCT.2016 13:46:19

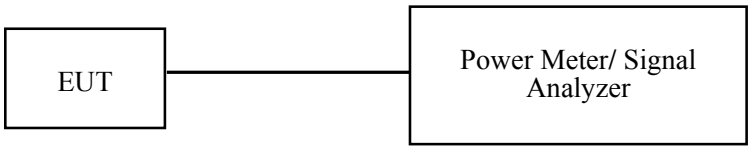
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Procedure

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 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	2016-07-04	2017-07-03
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2015-11-12	2016-11-11

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

Test Data

Environmental Conditions

Temperature:	23.1 ℃
Relative Humidity:	55 %
ATM Pressure:	100.9 kPa

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

EUT operation mode: Transmitting

1TX:

Channel	Frequency (MHz)	Max Conducted Average Output Power (dBm)		Limit (dBm)	Result
		Chain 0	Chain 1		
802.11b					
Low	2412	18.24	18.19	30	Pass
Middle	2437	**18.25**	**17.98**	30	Pass
High	2462	17.88	17.78	30	Pass
802.11g					
Low	2412	16.97	16.92	30	Pass
Middle	2437	**17.21**	**17.25**	30	Pass
High	2462	19.05	16.98	30	Pass
802.11n-HT20					
Low	2412	**15.81**	**16.02**	30	Pass
Middle	2437	15.67	15.82	30	Pass
High	2462	15.55	15.51	30	Pass
802.11n-HT40					
Low	2422	14.53	14.52	30	Pass
Middle	2437	**14.96**	**14.96**	30	Pass
High	2452	14.63	14.93	30	Pass

2TX, Non-beamforming:

Channel	Frequency (MHz)	Max Conducted Average Output Power (dBm)			Limit (dBm)	Result
		Chain 0	Chain 1	Total		
802.11b						
Low	2412	17.86	17.81	20.85	30	Pass
Middle	2437	**18.03**	**17.71**	**20.88**	30	Pass
High	2462	17.55	17.61	20.59	30	Pass
802.11g						
Low	2412	16.85	16.83	19.85	30	Pass
Middle	2437	**16.92**	**16.96**	**19.95**	30	Pass
High	2462	16.74	16.55	19.66	30	Pass
802.11n-HT20						
Low	2412	**15.37**	**15.30**	**18.35**	30	Pass
Middle	2437	15.23	15.21	18.23	30	Pass
High	2462	15.27	15.12	18.21	30	Pass
802.11n-HT40						
Low	2422	14.03	14.13	17.09	30	Pass
Middle	2437	**14.15**	**14.08**	**17.13**	30	Pass
High	2452	14.11	14.07	17.10	30	Pass

2TX With-beamforming mode

Channel	Frequency (MHz)	Max Conducted Average Output Power (dBm)			Limit (dBm)	Result
		Chain 0	Chain 1	Total		
802.11n-HT20						
Low	2412	**15.43**	**15.89**	**18.68**	30	Pass
Middle	2437	15.16	15.56	18.37	30	Pass
High	2462	15.27	15.23	18.26	30	Pass
802.11n-HT40						
Low	2422	14.05	14.15	17.11	30	Pass
Middle	2437	**14.11**	**14.46**	**17.30**	30	Pass
High	2452	14.24	14.37	17.32	30	Pass

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

Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

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
Rohde & Schwarz	SIGNALANALYZER	FSV40	101116	2016-07-04	2017-07-03
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2016-11-12	2017-11-11
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 in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	23 ℃, 24 ℃
Relative Humidity:	55 %, 56 %
ATM Pressure:	101.0 kPa, 101.0 kPa

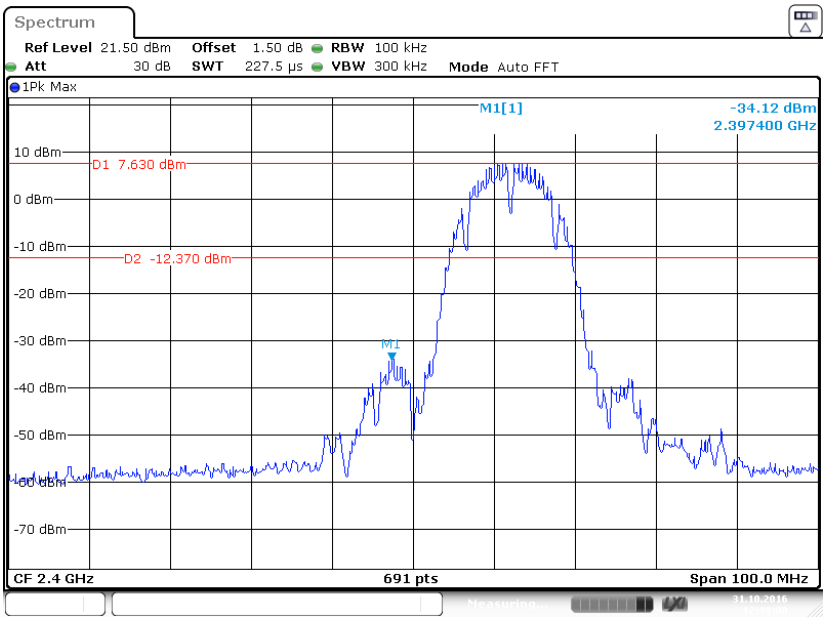
The testing was performed by Edison Hu on 2016-10-31 and 2017-01-20

Test Result: *Compliance (Test performed at SISO mode since maximum power per chain)*

Antenna Chain	Test Mode	Bandedge	Fundamental Level (dBm/100kHz)	Worst Bandedge Level (dBm/100kHz)	Delta (dBc)	Limits (dBc)
0	802.11b	Left	7.63	-34.12	41.75	30
		Right	6.88	-36.42	43.3	30
	802.11g	Left	1.96	-31.15	33.11	30
		Right	-3.31	-49.79	46.48	30
	802.11n ht20	Left	-2.27	-32.60	30.33	30
		Right	-4.89	-52.41	47.52	30
	802.11n ht40	Left	-7.5	-37.67	30.17	30
		Right	-7.01	-44	36.99	30
1	802.11b	Left	7.59	-33.93	41.52	30
		Right	7.3	-36.7	44	30
	802.11g	Left	-1.08	-32.45	31.37	30
		Right	-2.94	-50.46	47.52	30
	802.11n ht20	Left	-2.56	-32.64	30.08	30
		Right	-4.72	-52.41	47.69	30
	802.11n ht40	Left	-7.38	-37.76	30.38	30
		Right	-7.16	-42.54	35.38	30

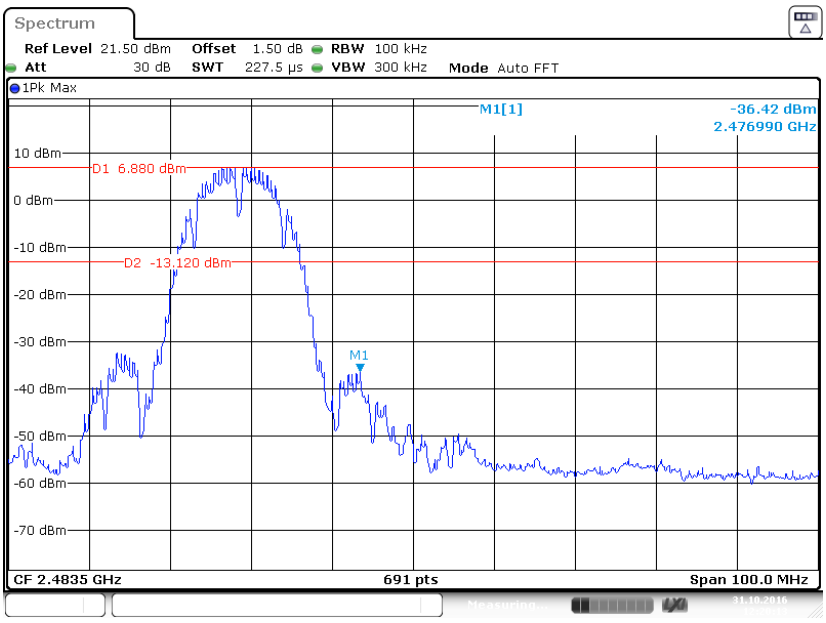
Please refer to the following table and plots.

Chain 0 802.11b:Band Edge, Left Side



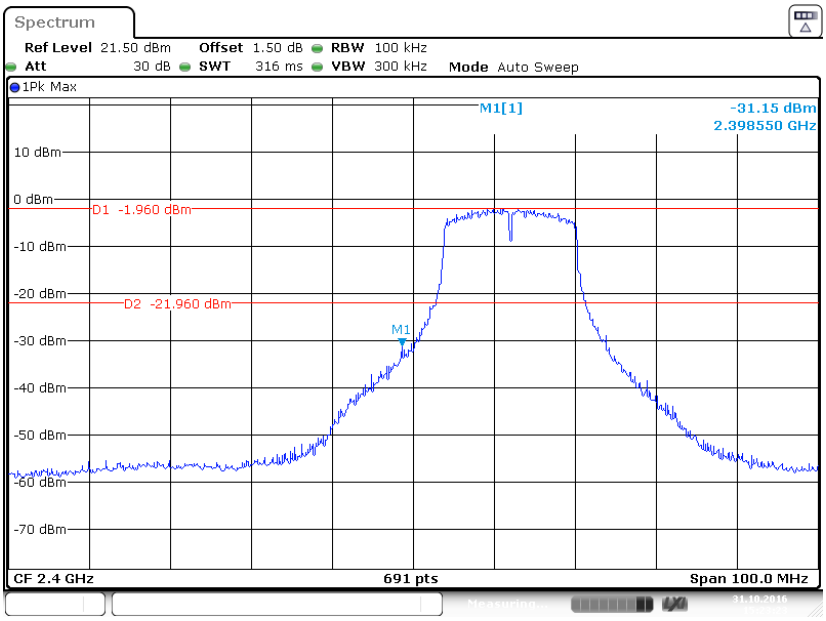
Date: 31.OCT.2016 12:18:00

Chain 0 802.11b:Band Edge, Right Side



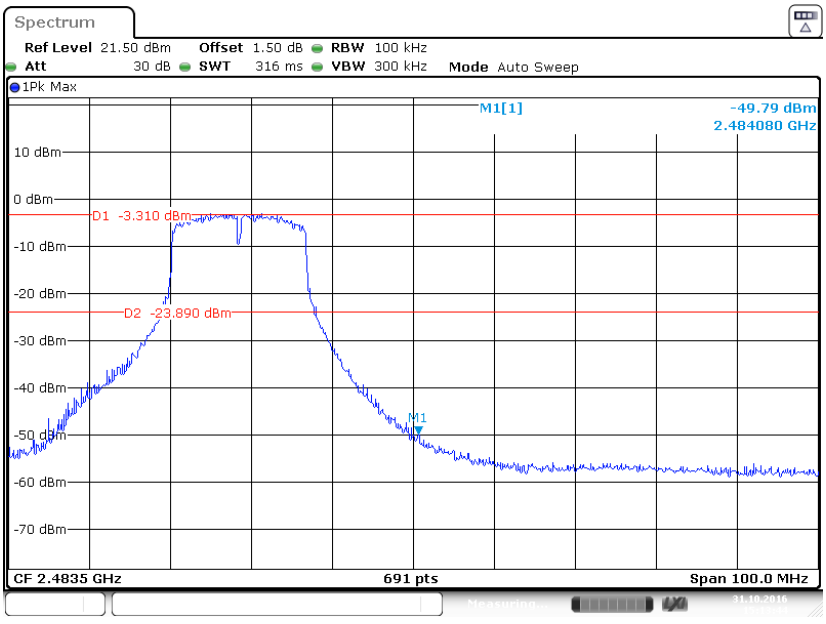
Date: 31.OCT.2016 12:20:14

Chain 0 802.11g:Band Edge, Left Side



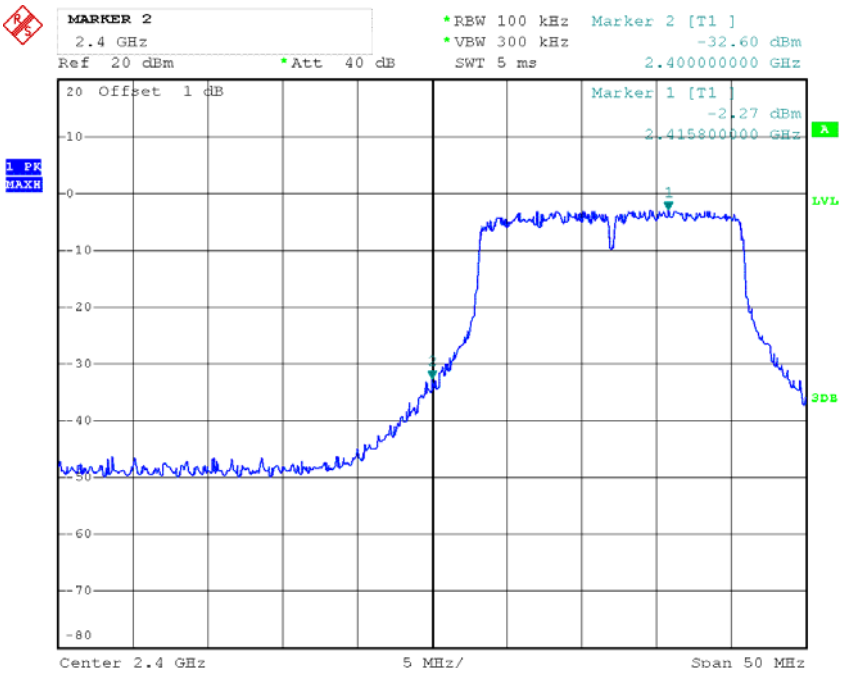
Date: 31.OCT.2016 15:23:24

Chain 0 802.11g:Band Edge, Right Side

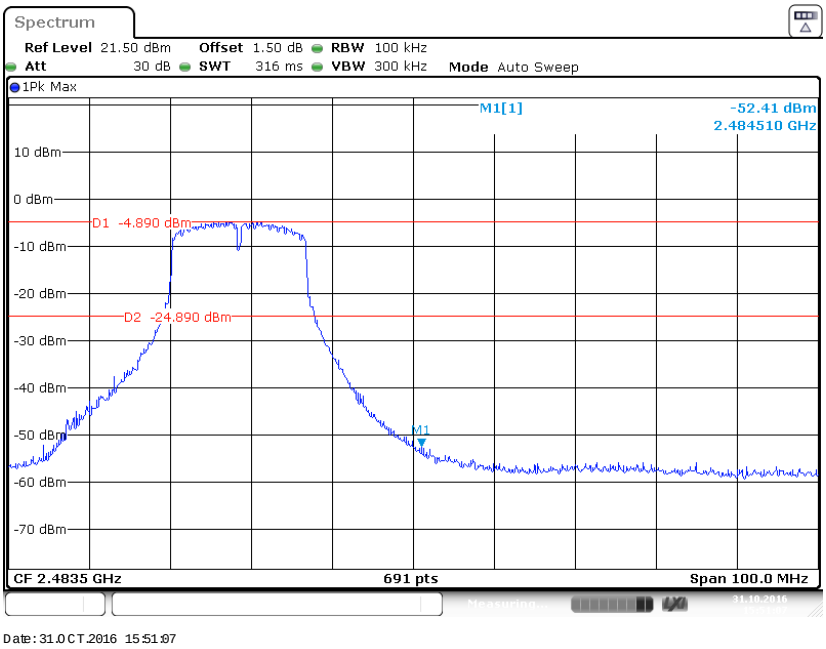


Date: 31.OCT.2016 15:13:45

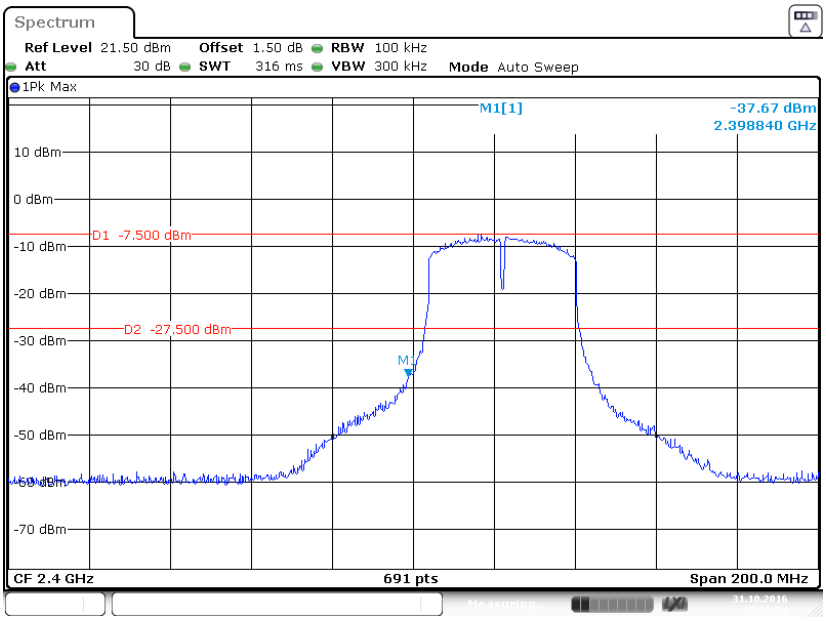
Chain 0 802.11n-HT20:Band Edge, Left Side



Chain 0 802.11n-HT20:Band Edge, Right Side

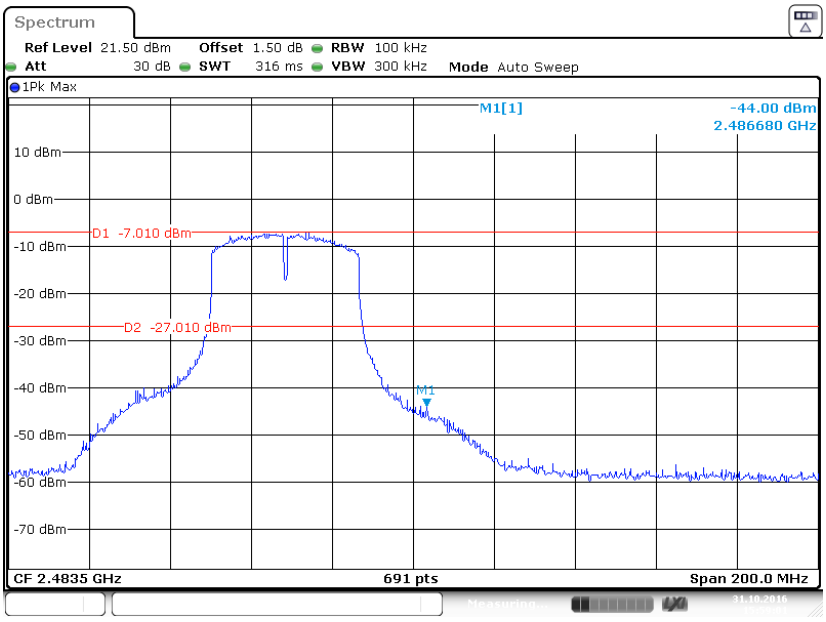


Chain 0 802.11n-HT40:Band Edge, Left Side



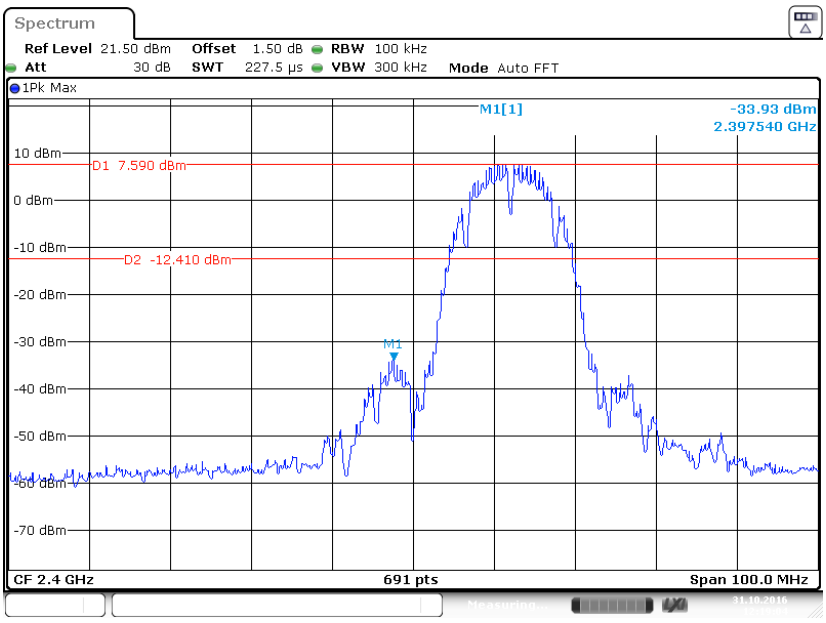
Date: 31.OCT.2016 15:56:54

Chain 0 802.11n-HT40:Band Edge, Right Side



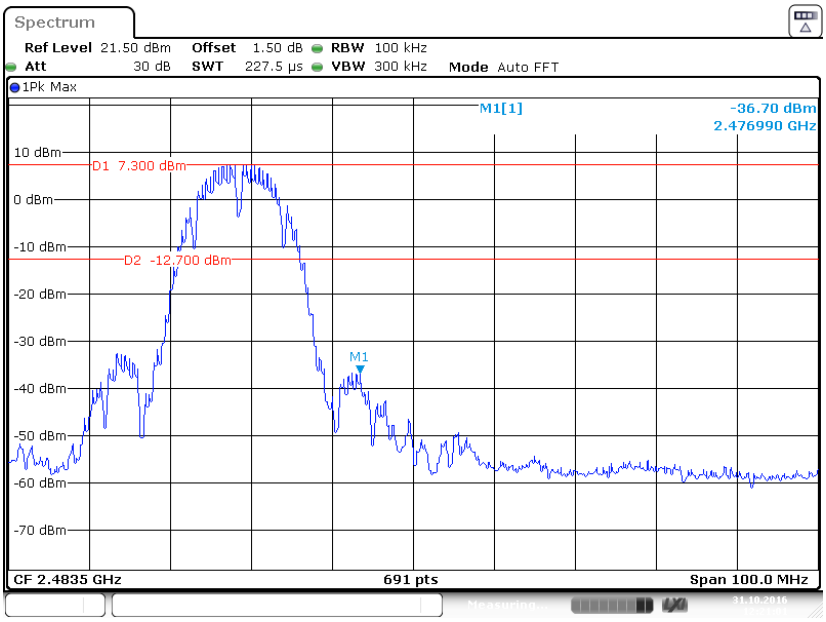
Date: 31.OCT.2016 15:59:00

Chain 1 802.11b:Band Edge, Left Side



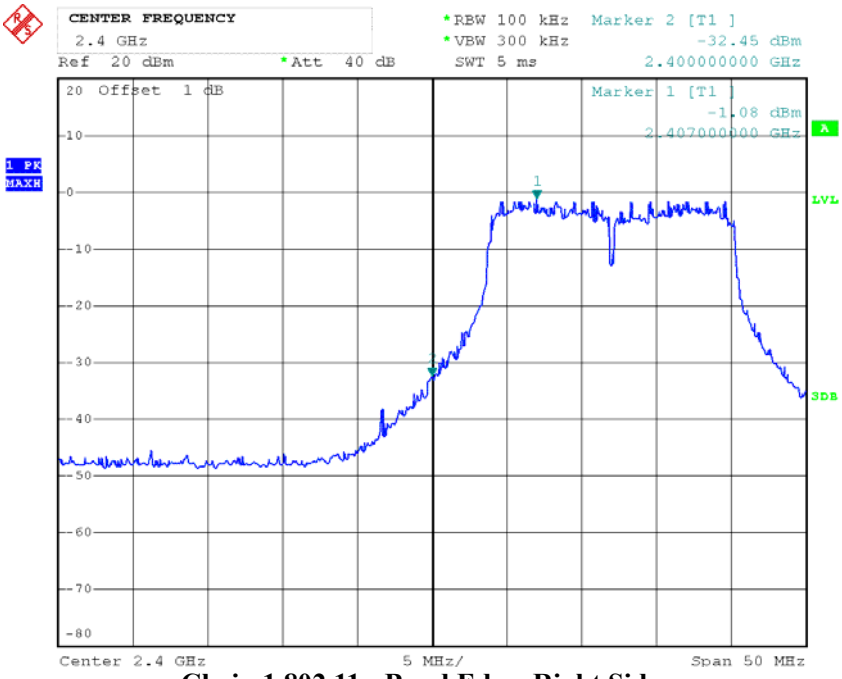
Date: 31.OCT.2016 12:19:05

Chain 1 802.11b:Band Edge, Right Side

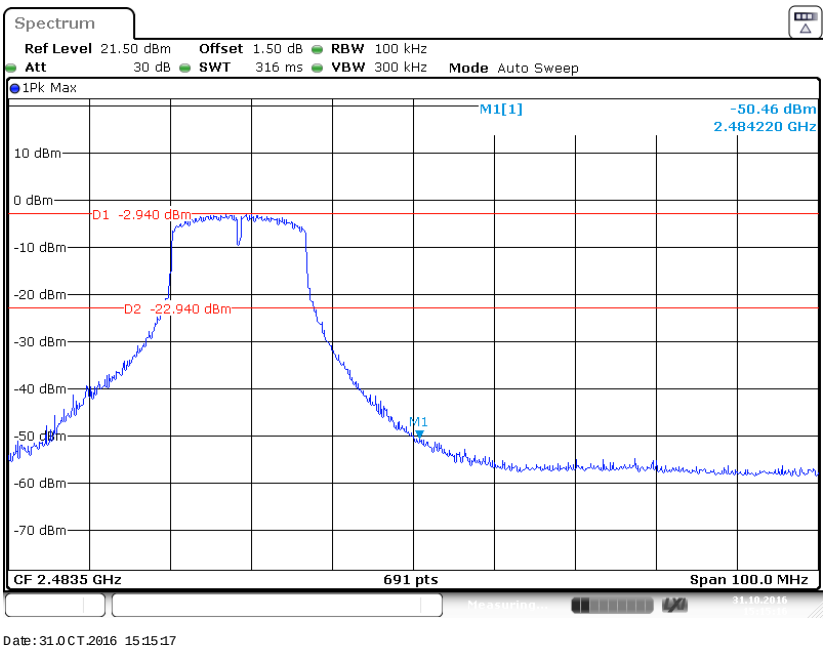


Date: 31.OCT.2016 12:21:01

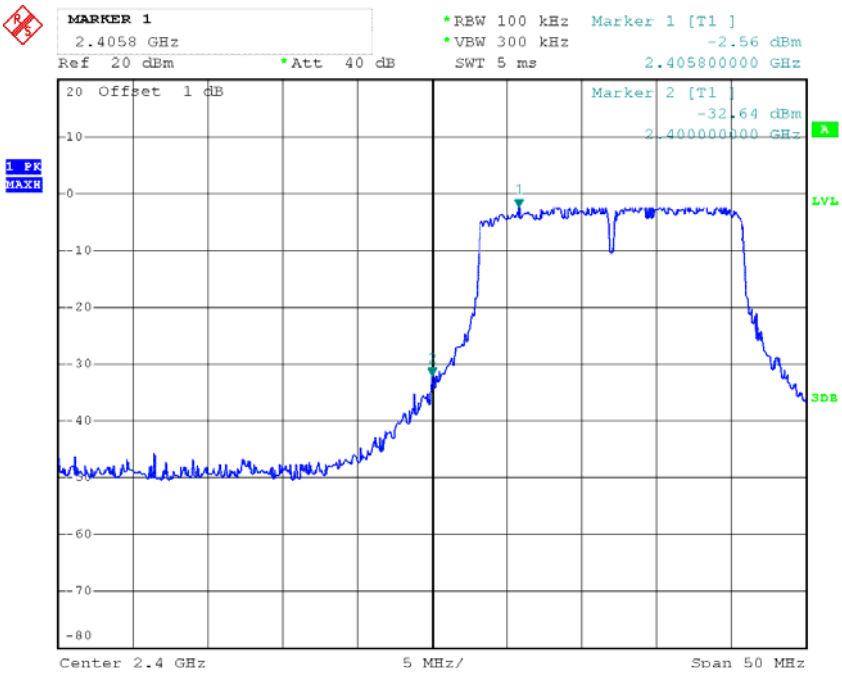
Chain 1 802.11g:Band Edge, Left Side



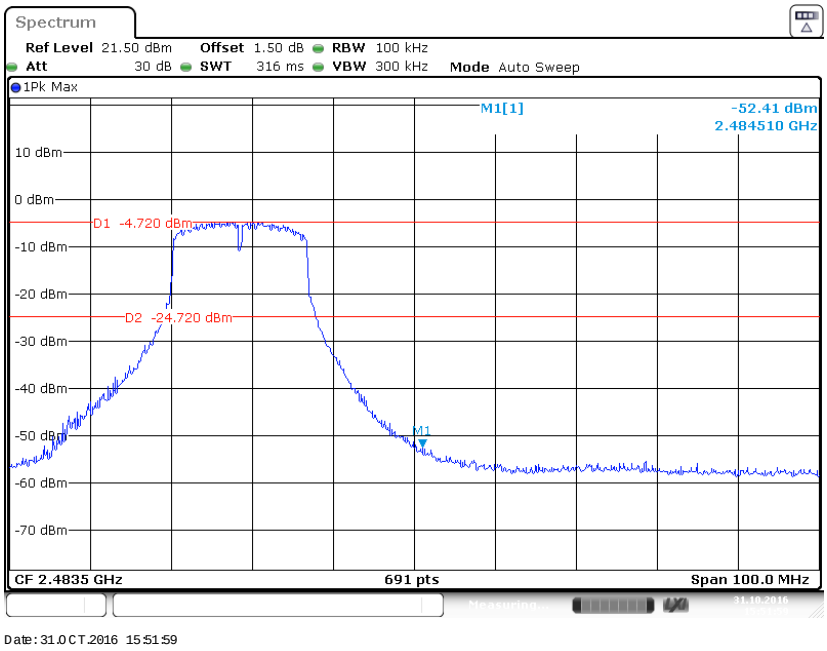
Chain 1 802.11g:Band Edge, Right Side



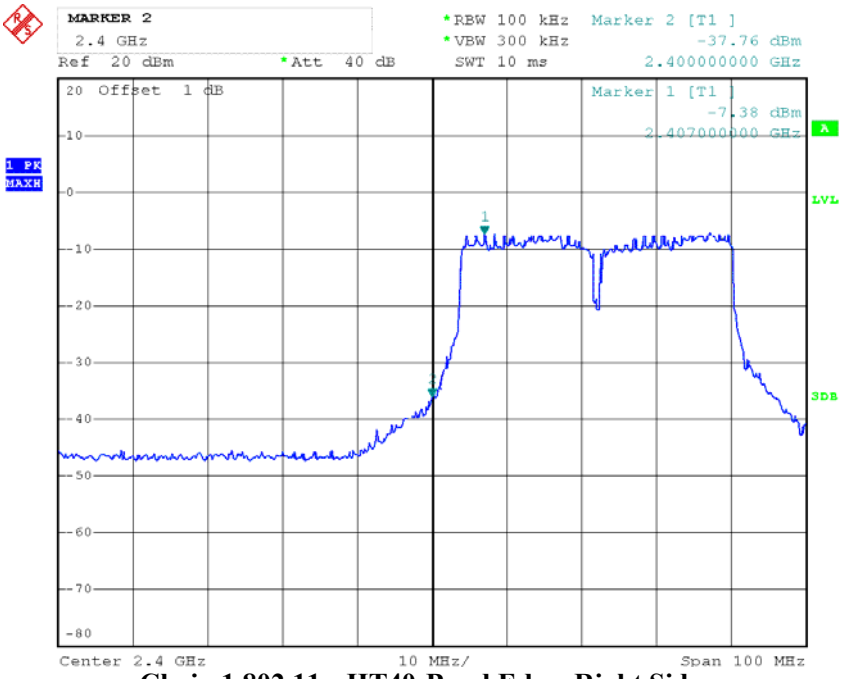
Chain 1 802.11n-HT20:Band Edge, Left Side



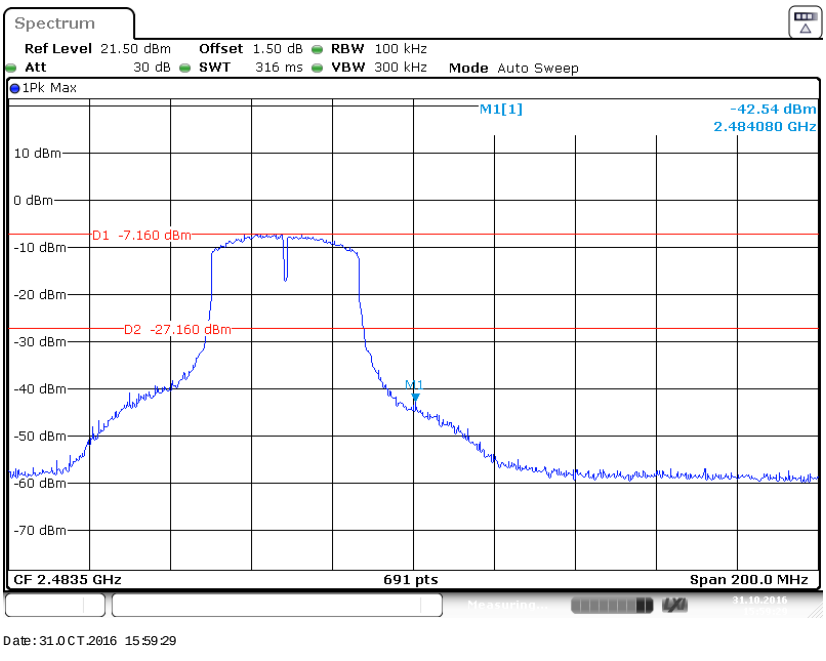
Chain 1 802.11n-HT20:Band Edge, Right Side



Chain 1 802.11n-HT40:Band Edge, Left Side



Chain 1 802.11n-HT40:Band Edge, Right Side



FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Procedure

According to KDB558074 D01 DTS Meas Guidance v03r05 sub-clause 10.2

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

Test 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 in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	23 ℃
Relative Humidity:	56 %
ATM Pressure:	101.1 kPa

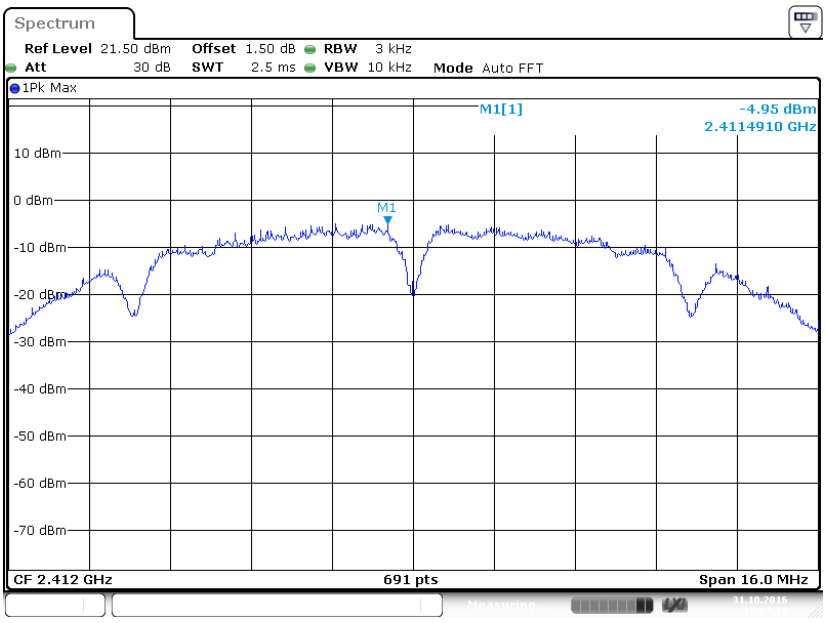
The testing was performed by Edison Hu on 2016-10-31.

EUT operation mode: Transmitting

Test Result: Pass(test was performed at SISO mode Since the maximum power mode per chain)

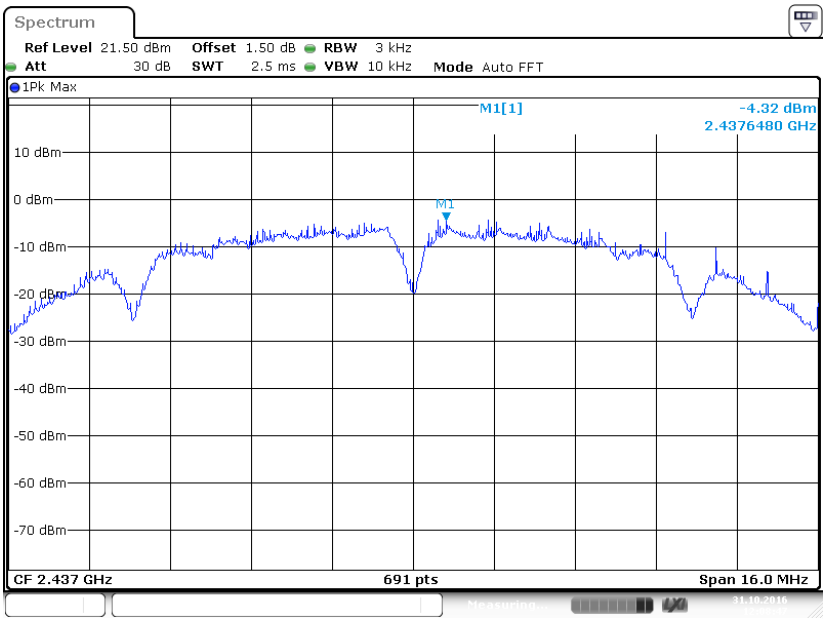
Channel	Frequency (MHz)	PSD (dBm/3kHz)			Limit (dBm/3kHz)
		Chain 0	Chain 1	Total	
802.11b					
Low	2412	-4.95	-2.20	-0.35	≤8
Middle	2437	-4.32	-4.71	-1.50	≤8
High	2462	-5.06	-5.80	-2.40	≤8
802.11g					
Low	2412	-12.10	-11.85	-8.96	≤8
Middle	2437	-11.51	-11.17	-8.33	≤8
High	2462	-13.13	-13.00	-10.05	≤8
802.11n-HT20					
Low	2412	-12.69	-13.30	-9.97	≤8
Middle	2437	-13.55	-14.19	-10.85	≤8
High	2462	-15.85	-15.63	-12.73	≤8
802.11n-HT40					
Low	2422	-17.64	-17.59	-14.60	≤8
Middle	2437	-16.95	-16.40	-13.66	≤8
High	2452	-17.17	-16.80	-13.97	≤8

Chain 0 Power Spectral Density, 802.11b Low Channel



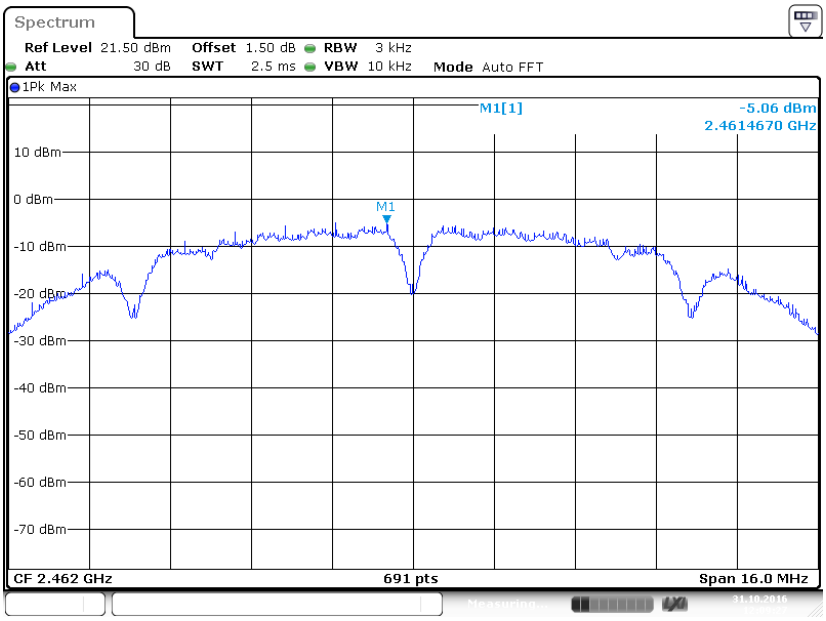
Date: 31.OCT.2016 12:07:19

Chain 0 Power Spectral Density, 802.11b Middle Channel



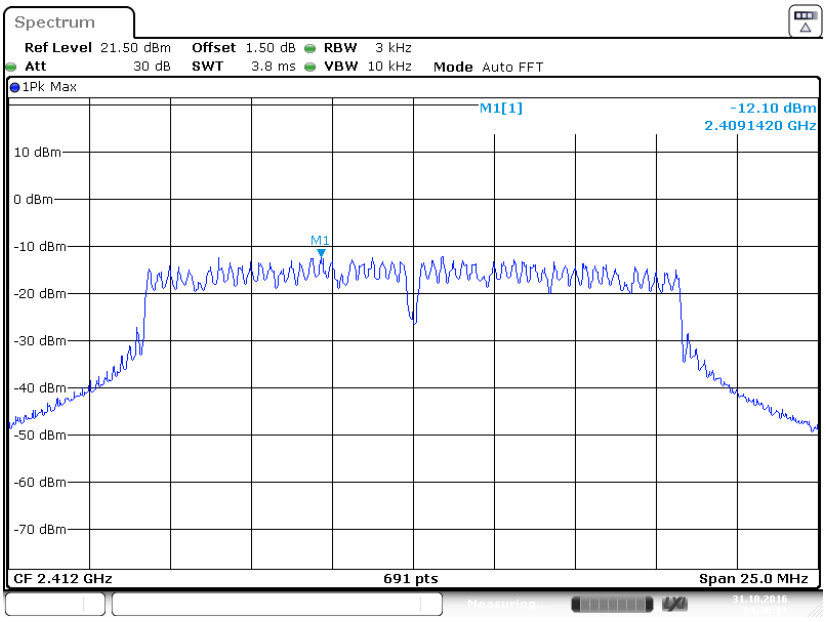
Date: 31.OCT.2016 12:08:47

Chain 0 Power Spectral Density, 802.11b High Channel



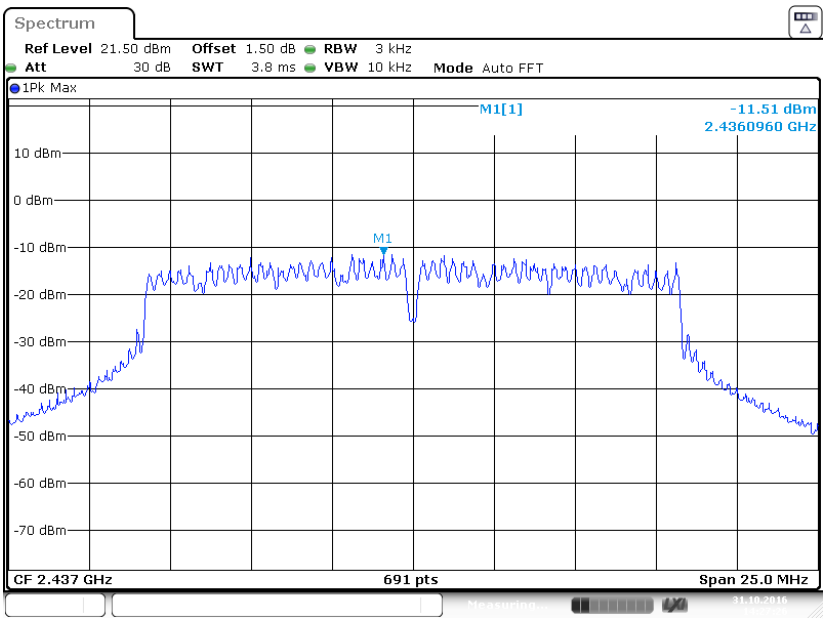
Date: 31.OCT.2016 12:09:27

Chain 0 Power Spectral Density, 802.11g Low Channel



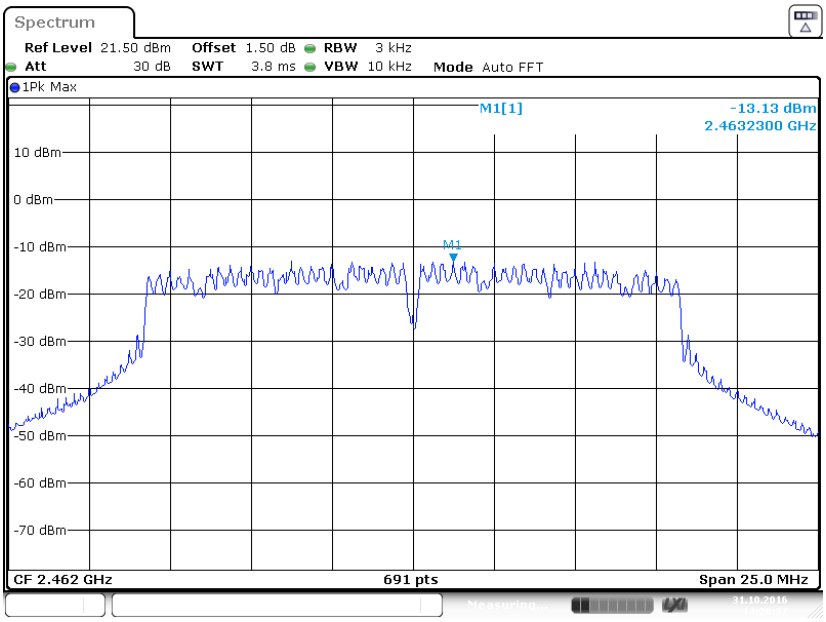
Date: 31.OCT.2016 14:26:11

Chain 0 Power Spectral Density, 802.11g Middle Channel



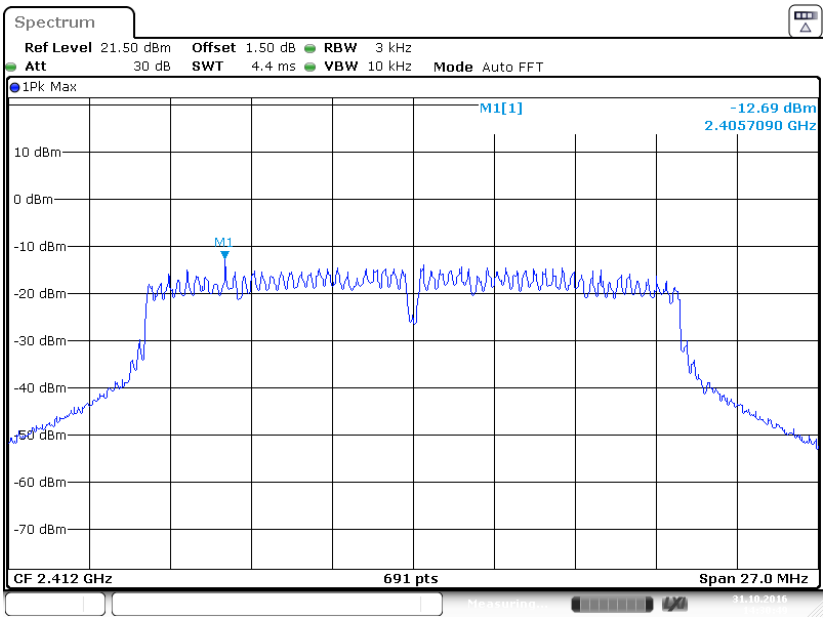
Date: 31.OCT.2016 14:27:26

Chain 0 Power Spectral Density, 802.11g High Channel



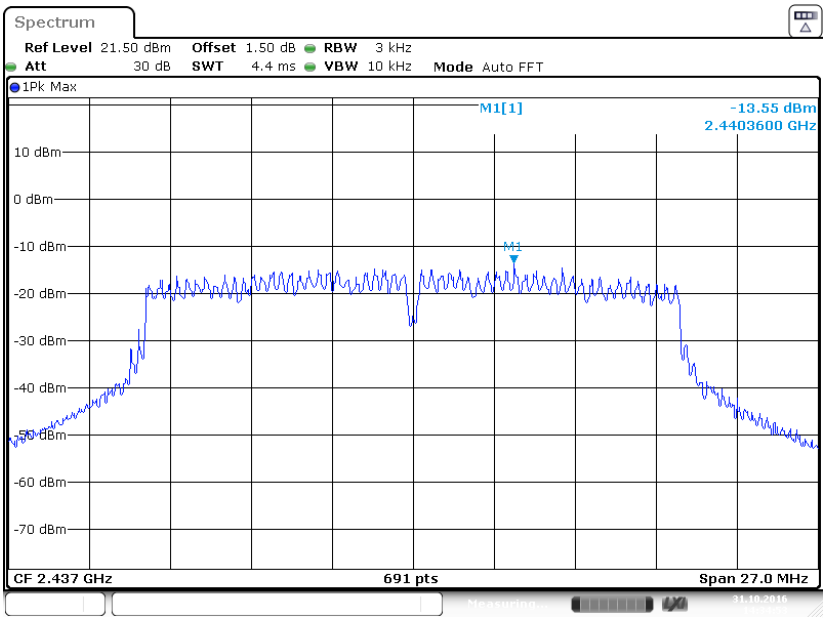
Date: 31.OCT.2016 14:28:37

Chain 0 Power Spectral Density, 802.11n-HT20 Low Channel



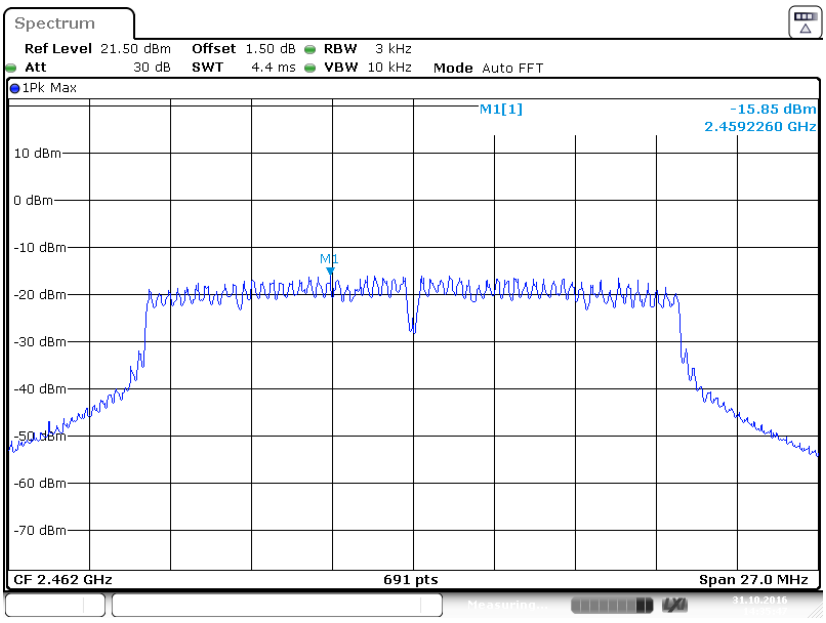
Date: 31.OCT.2016 14:30:49

Chain 0 Power Spectral Density, 802.11n-HT20 Middle Channel



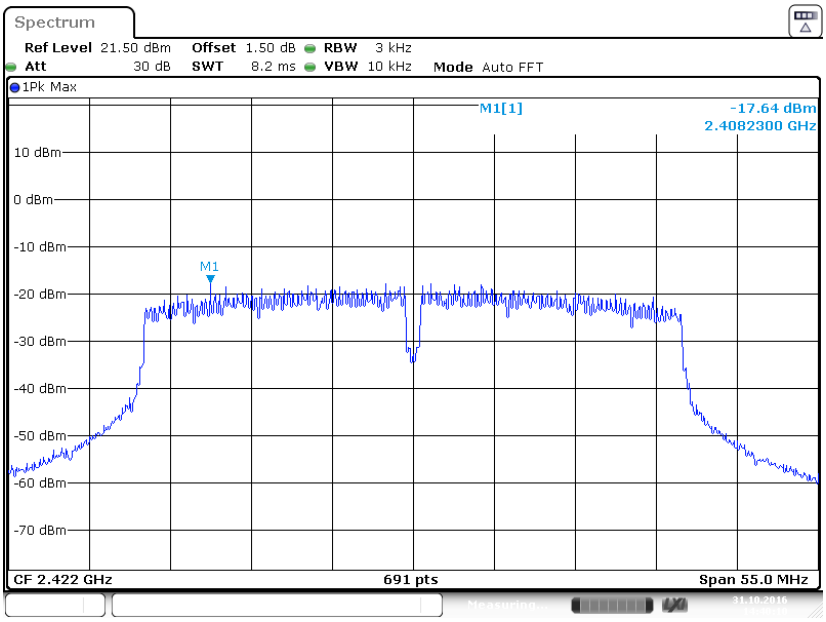
Date: 31.OCT.2016 14:34:53

Chain 0 Power Spectral Density, 802.11n-HT20 High Channel



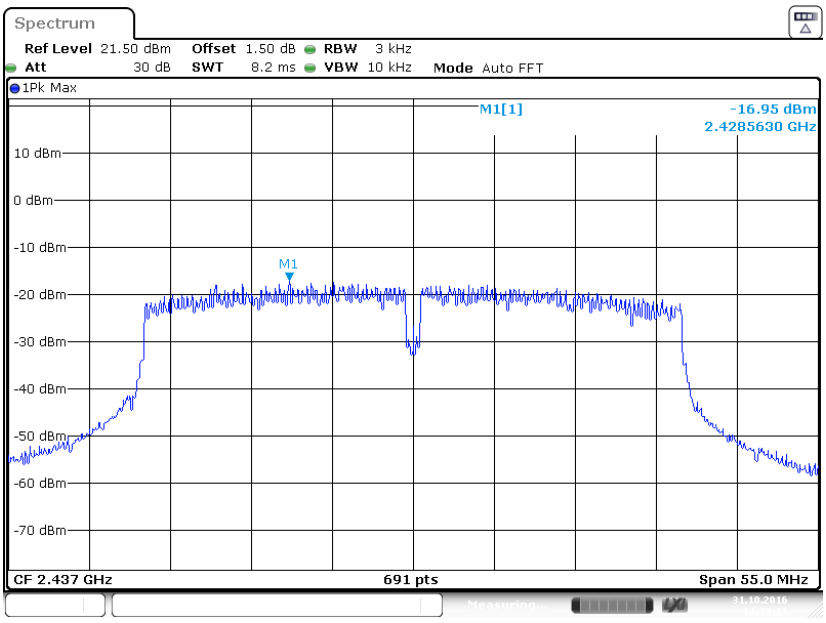
Date: 31.OCT.2016 14:35:47

Chain 0 Power Spectral Density, 802.11n-HT40 Low Channel



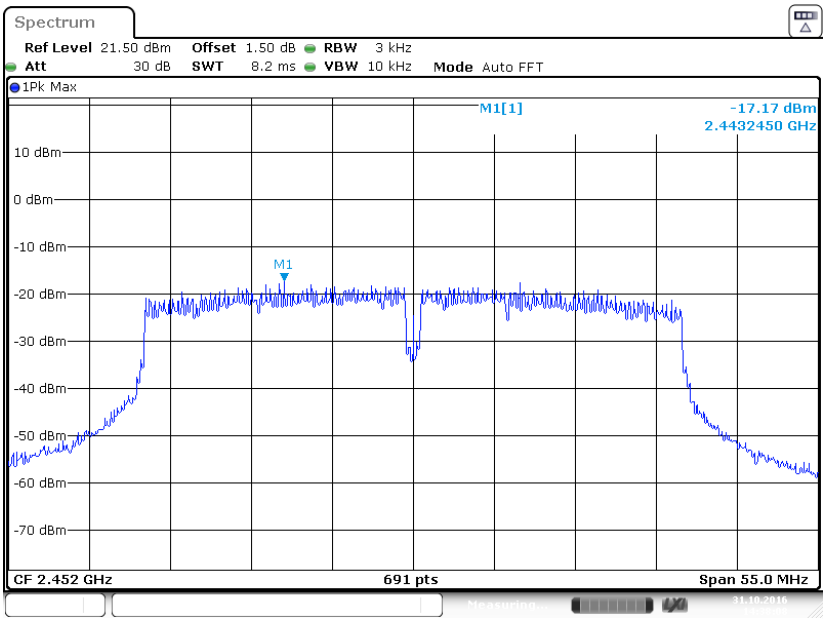
Date: 31.OCT.2016 14:40:11

Chain 0 Power Spectral Density, 802.11n-HT40 Middle Channel



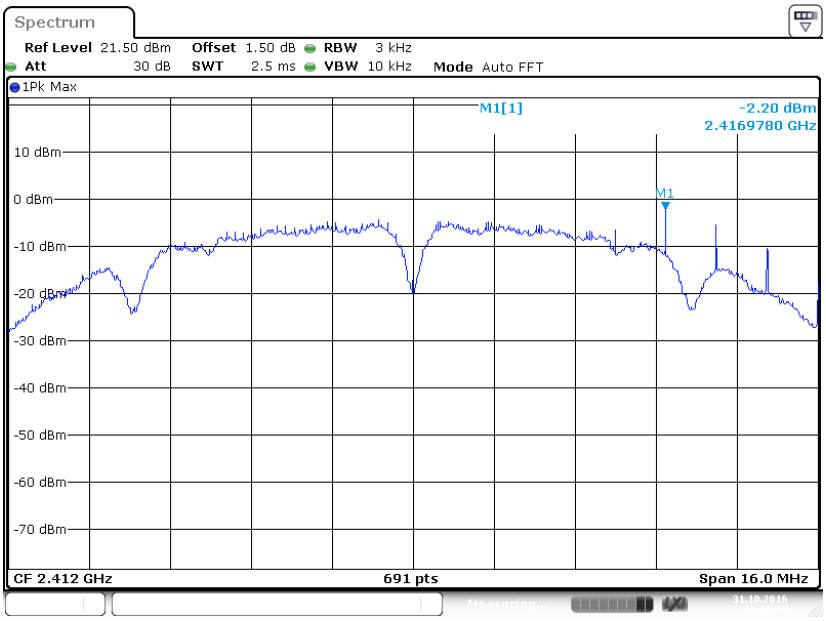
Date: 31.OCT.2016 14:39:11

Chain 0 Power Spectral Density, 802.11n-HT40 High Channel

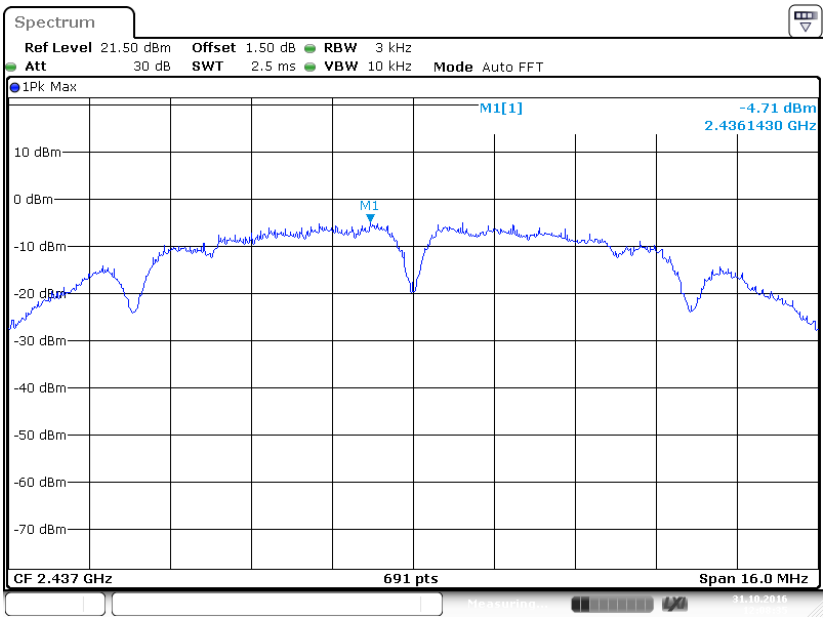


Date: 31.OCT.2016 14:38:08

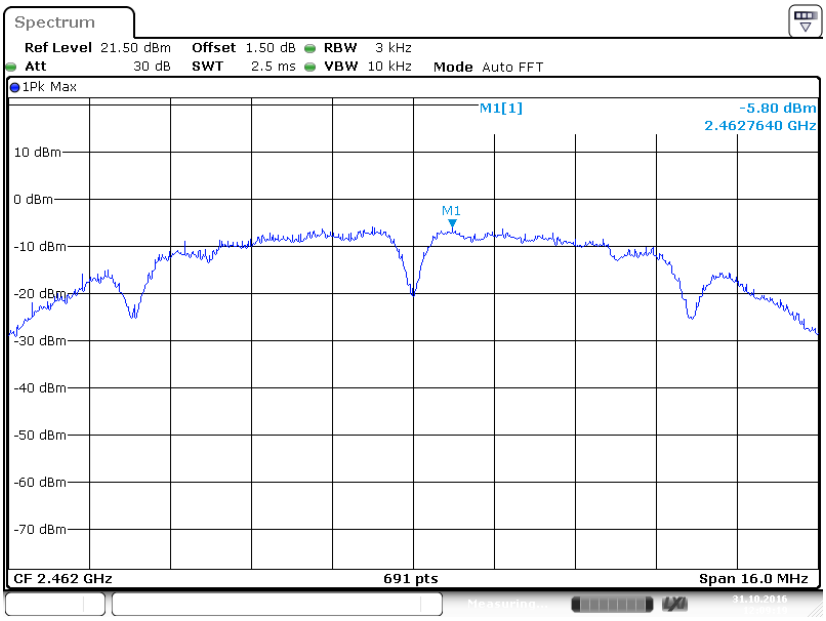
Chain 1 Power Spectral Density, 802.11b Low Channel



Chain 1 Power Spectral Density, 802.11b Middle Channel

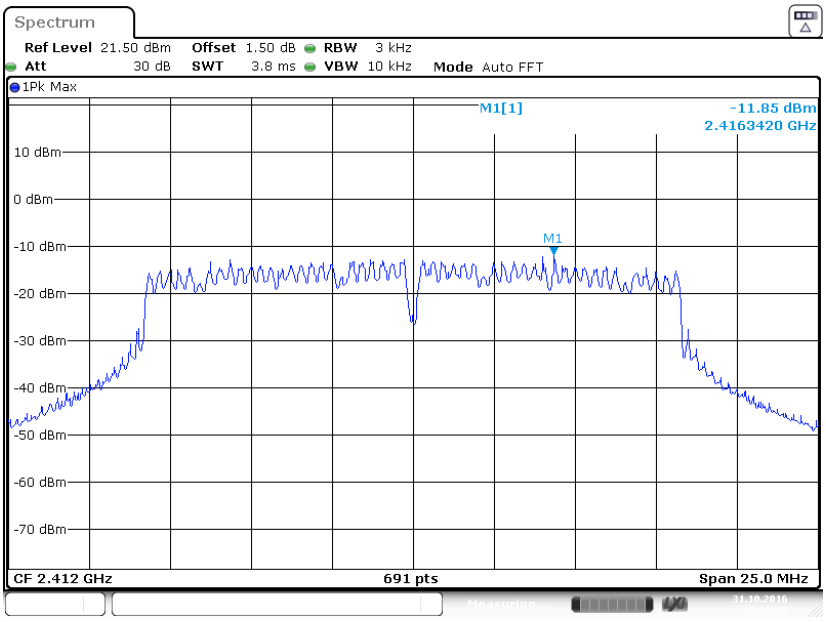


Chain 1 Power Spectral Density, 802.11b High Channel



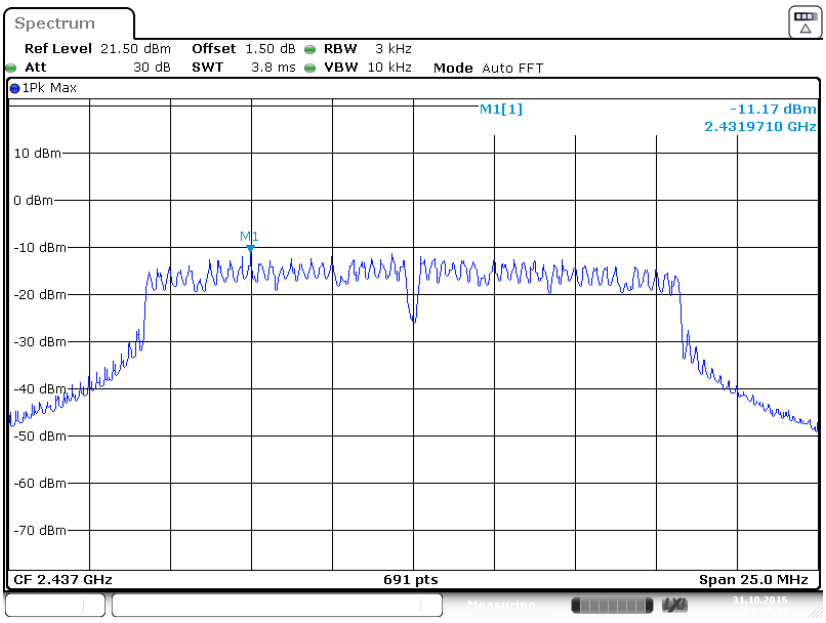
Date: 31.OCT.2016 12:09:19

Chain 1 Power Spectral Density, 802.11g Low Channel



Date: 31.OCT.2016 14:26:36

Chain 1 Power Spectral Density, 802.11g Middle Channel



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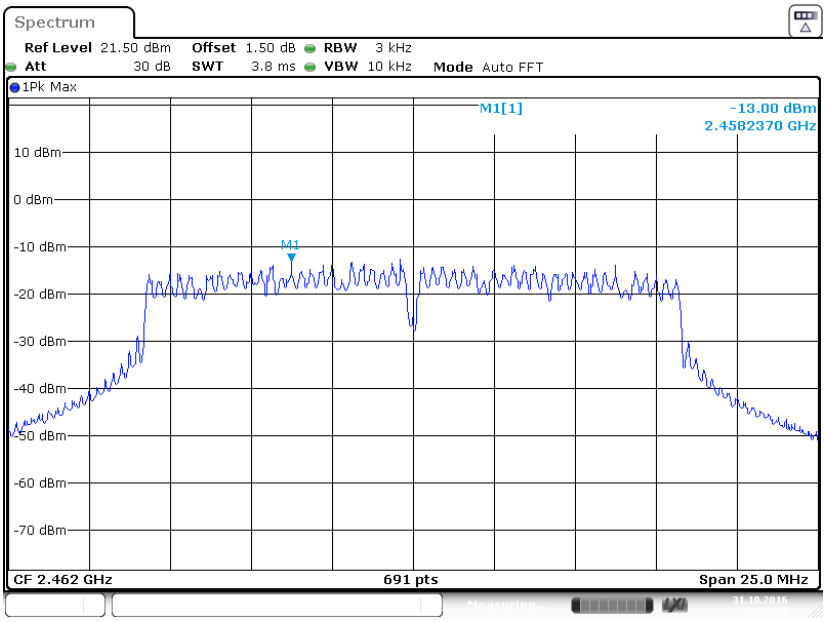
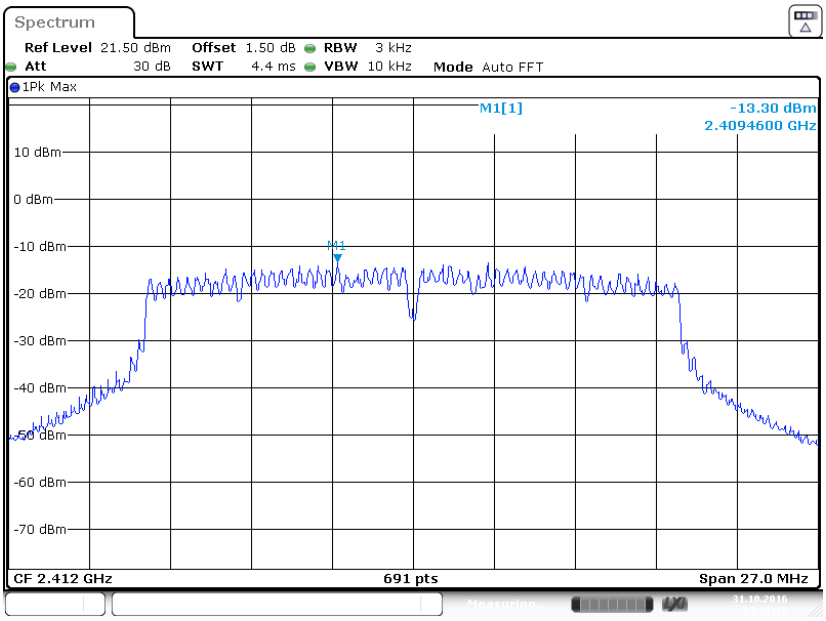
Chain 1 Power Spectral Density, 802.11g High Channel



Date: 31.OCT.2016 14:28:52

Chain 1 Power Spectral Density, 802.11n-HT20 Low Channel



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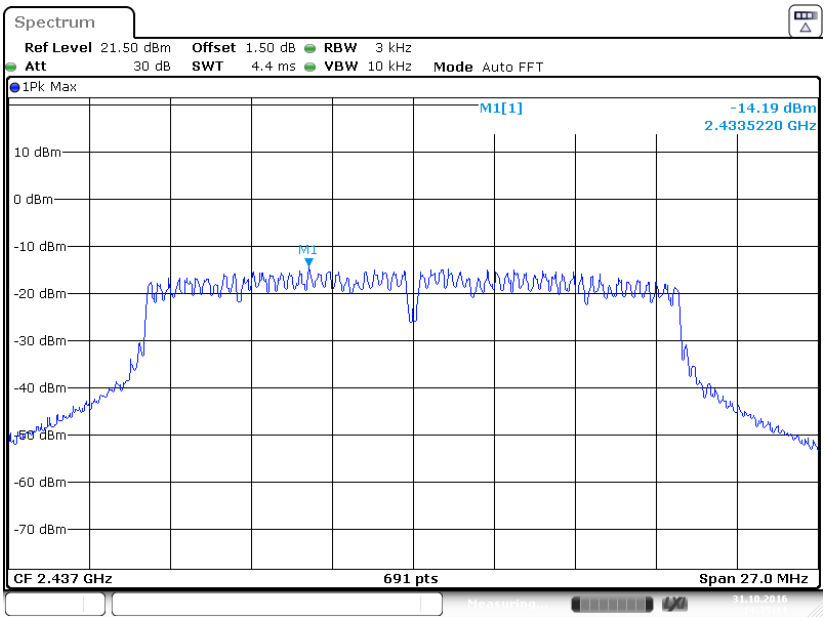
Chain 1 Power Spectral Density, 802.11n-HT20 Middle Channel



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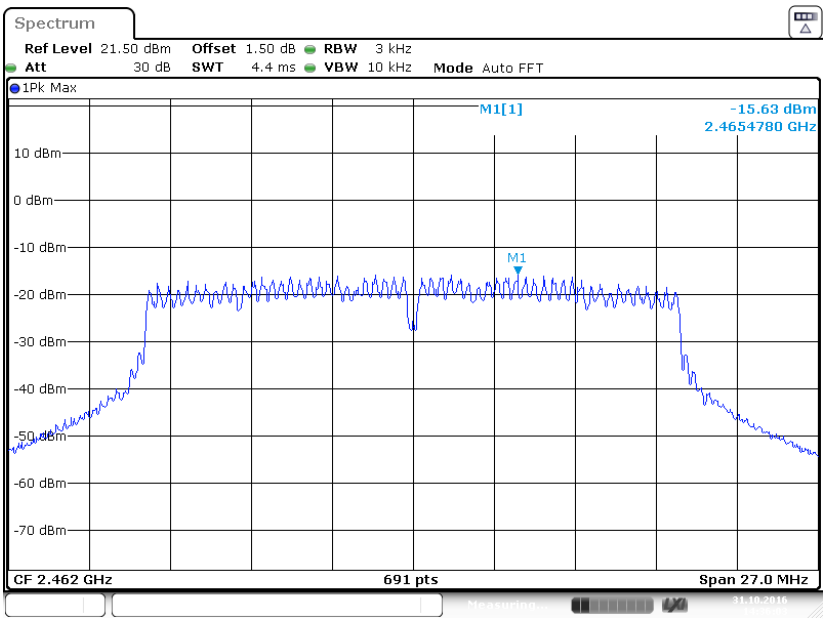
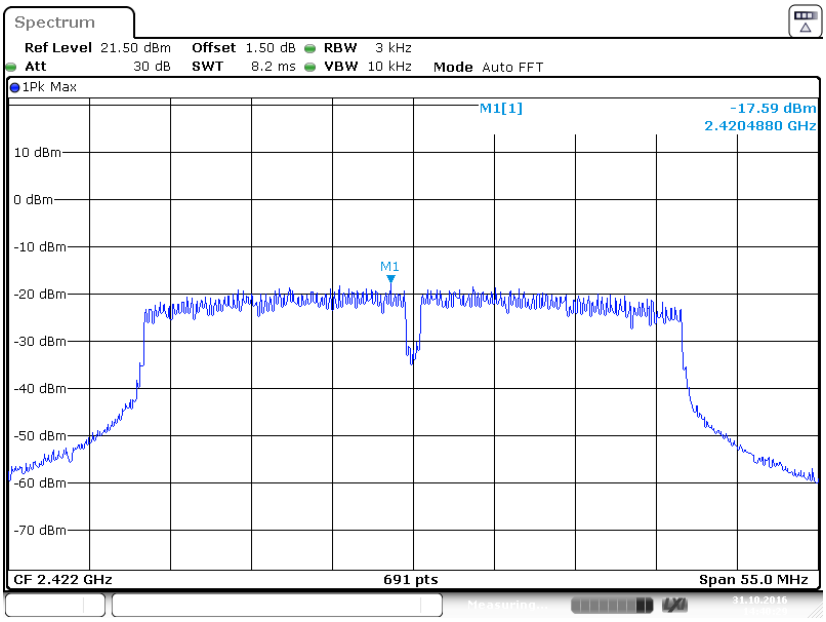
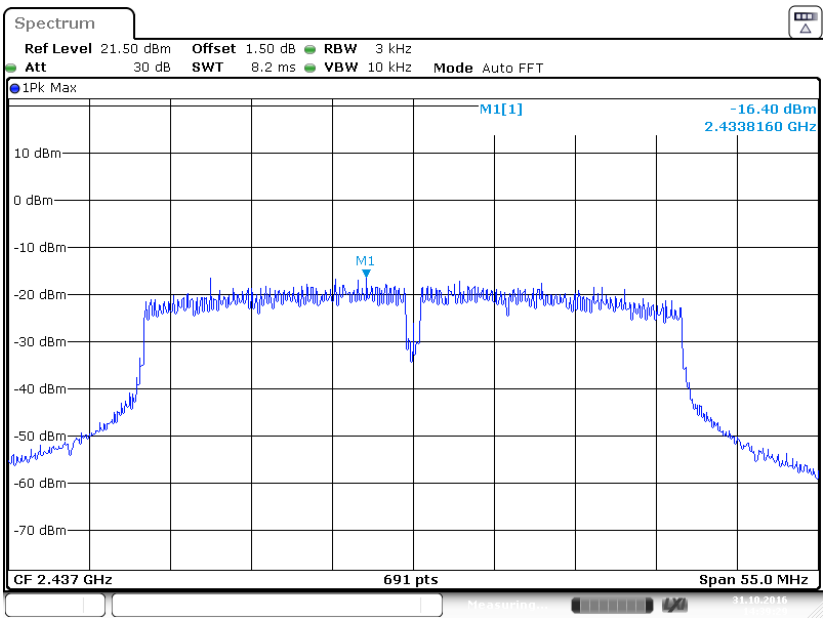
Chain 1 Power Spectral Density, 802.11n-HT20 High Channel



Chain 1 Power Spectral Density, 802.11n-HT40 Low Channel



Chain 1 Power Spectral Density, 802.11n-HT40 Middle Channel



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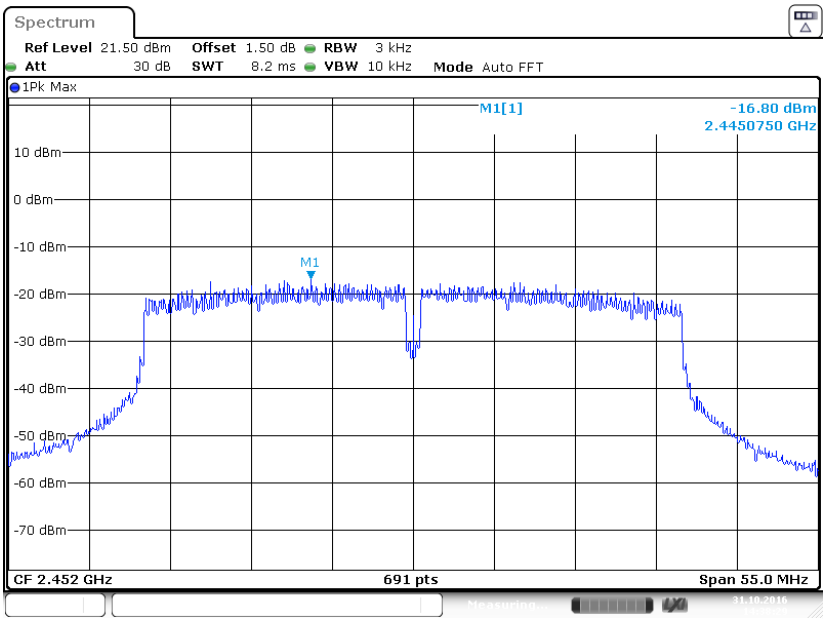
Chain 1 Power Spectral Density, 802.11n-HT40 High Channel



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