FCC PART 15.247

TEST REPORT

For

Humax Co., Ltd.

HUMAX Village, 11-4, Sunae-dong, Bundang-gu, Seongnam city, Gyeonggi-do, 463-825, South Korea

FCC ID: O6ZT2

Report Type:	Product Name:
Original Report	11n Wireless Roaming Router

Test Engineer:	*Lorin Bian*
Report Number:	RDG170303001
Report Date:	2017-03-21
Reviewed By:	Henry Ding EMC Leader
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Chengdu) No.5040, Huilongwan Plaza, No.1, Shawan Road, Jinniu District, Chengdu, Sichuan, China Tel: 028-65523123, Fax: 028-65525125 www.baclcorp.com

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The ***Humax Co., Ltd.***'s product, model number: ***QUANTUM T2 (FCC ID: O6ZT2)*** (the "EUT") in this report was an ***11n Wireless Roaming Router***, which was measured approximately: 14.5 cm (L) x 11.5 cm (W) x 2.7 cm (H), rated input voltage: DC12V from adapter.

Adpater Information:
Model: MSA-C1000IC12.0-12W-US
Input: AC100-240V, 50/60Hz, 0.5A
Output: DC12V, 1A

**All measurement and test data in this report was gathered from final production sample, serial number: 170303001 (assigned by the BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2017-03-03, and EUT conformed to test requirement.*

Objective

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

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

Related Submittal(s)/Grant(s)

N/A

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.

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

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.62dB
Power Spectral Density, conducted	±0.62 dB
Unwanted Emissions, radiated	30M~200MHz: 4.7 dB for Horizontal, 4.7 dB for Vertical 200M~1GHz:6.0 dB for Horizontal, 6.0 for Vertical 1G~6GHz: 5.13 dB, 6G~18GHz: 5.47 dB
Temperature	±1℃
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.17 dB (150 kHz to 30 MHz)

Test Facility

The test site used by BACL to collect test data is located in the No.5040, Huilongwan Plaza, No.1, Shawan Road, Jinniu District, Chengdu, Sichuan, China

Test site at BACL 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 April 24, 2015. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 560332. 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.
For 2.4GHz band, 11 channels are provided:

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

For 802.11b, 802.11g, and 802.11n ht20 modes were tested with channel 1, 6 and 11.
For 802.11n ht40 mode were tested with Channel 3, 6 and 9.

For 802.11n mode, the devices support SISO, and 2TX, 3TX MIMO modes at antenna chain 0,1 and 2, chain 3 only transmit in SISO mode.

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

EUT Exercise Software

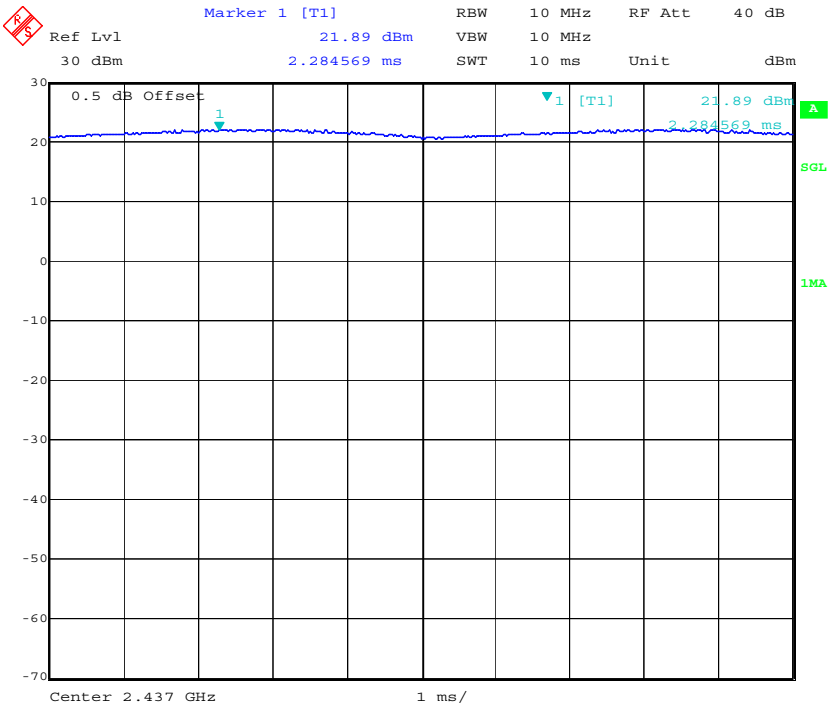
The software "MP_TEST" was used for testing, which was provided by manufacturer.The worst condition was setting by the software as following table:

Test Mode	Test Software Version	MP_TEST		
802.11b	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	1Mbps	1Mbps	1Mbps
	Power Level Setting Chain0	40	39	39
	Power Level Setting Chain1	43	43	42
	Power Level Setting Chain2	41	41	40
	Power Level Setting Chain3	41	41	41
802.11g	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	6Mbps	6Mbps	6Mbps
	Power Level Setting Chain0	40	40	39
	Power Level Setting Chain1	43	42	42
	Power Level Setting Chain2	42	41	40
	Power Level Setting Chain3	42	41	41
802.11n ht20	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	MCS0	MCS0	MCS0
	Power Level Setting Chain0	38	38	37
	Power Level Setting Chain1	41	40	40
	Power Level Setting Chain2	41	41	41
	Power Level Setting Chain3	42	42	41
802.11n ht40	Test Frequency	2422MHz	2437MHz	2452MHz
	Data Rate	MCS0	MCS0	MCS0
	Power Level Setting Chain0	35	35	34
	Power Level Setting Chain1	39	39	38
	Power Level Setting Chain2	39	39	39
	Power Level Setting Chain3	39	39	39

The duty cycle as below:

Test 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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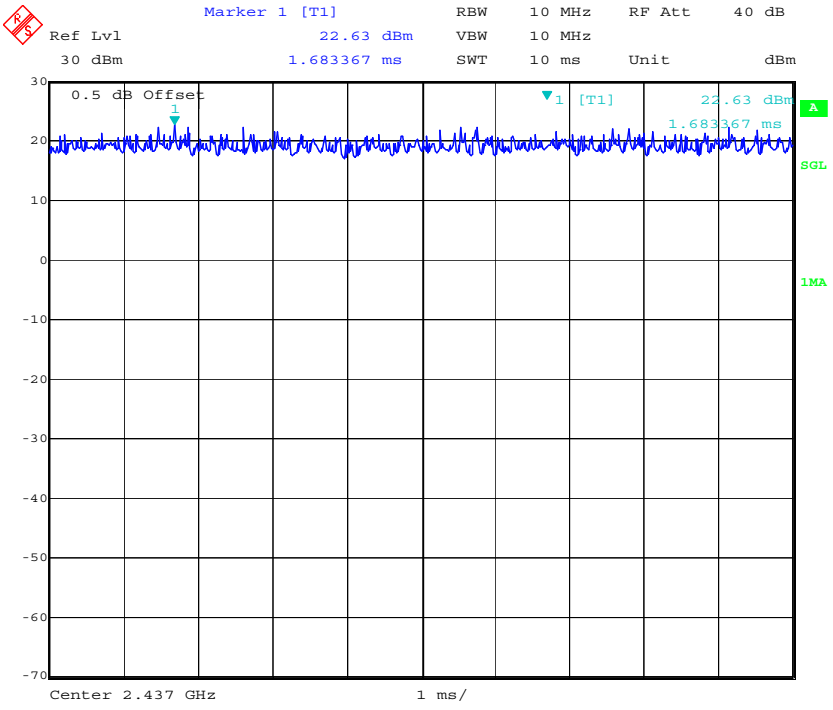
802.11g



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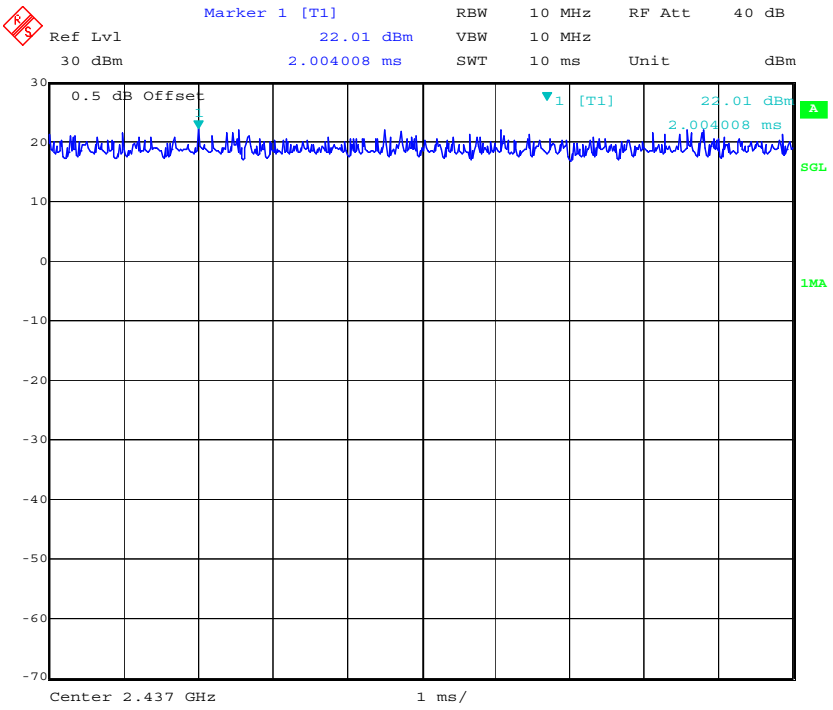
802.11n ht20



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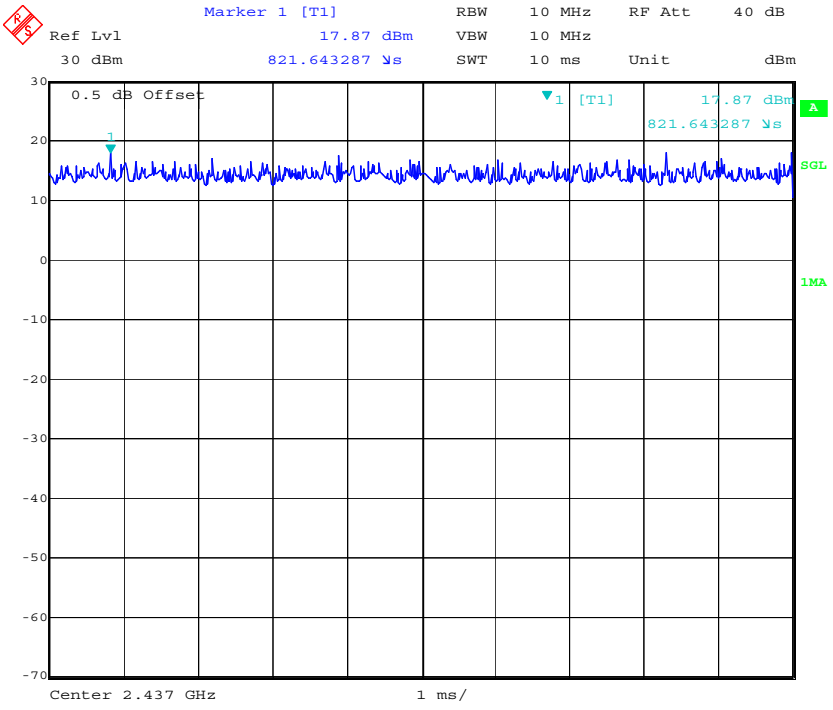
802.11n ht40



Date: 10.MAR.2017 21:05:16

Equipment Modifications

No modification was made to the EUT tested.

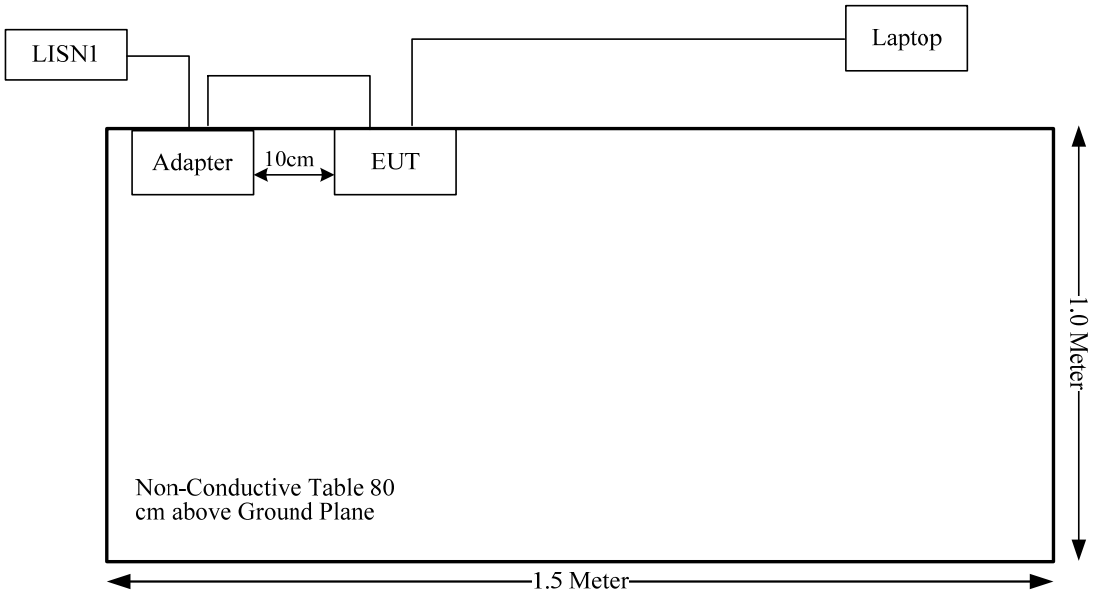
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
lenovo	laptop	TP00067A	PF-0MRADG 16/08

External Cable

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Apdater Cable	No	No	1.59	Adapter	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

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

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

Applicable Standard

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

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

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

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

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

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);

Calculated Data:

Frequency (MHz)	**Antenna Gain**		**Tune-up Power**		**Evaluation Distance (cm)**	**Power Density (mW/cm^2)**	**MPE Limit (mW/cm^2)**
	(dBi)	**(numeric)**	**(dBm)**	**(mW)**			
2412-2462	4	2.51	25	316.23	20.00	0.1581	1.0

Note: The maximum tune-up power including tolerance is 25dBm, that declared by manufacturer.

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.

Antenna Connector Construction

The EUT has 4 internal antennas, and all antenna gains are 4.0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

Measurement Uncertainty

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

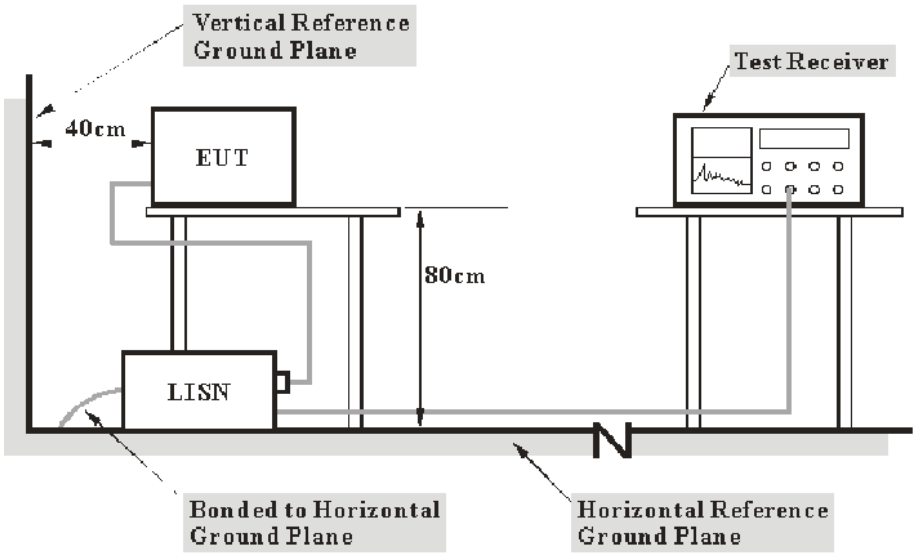
If U_{lab} is less than or equal to U_{cispr} of Table 1, then:
–compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
–non - compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.
If U_{lab} is greater than U_{cispr} of 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. (Chengdu) is ±3.17 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 an AC 120 V/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 first LISN.

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

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

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

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

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

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the 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	ESCS 30	836858/0016	2016-12-02	2017-12-01
Rohde & Schwarz	L.I.S.N.	ENV216	3560.6550.06	2016-12-02	2017-12-01
Rohde & Schwarz	PULSE LIMITER	ESH3Z2	357.8810.52	2016-10-31	2017-10-30
N/A	Conducted Cable	NO.5	N/A	2016-11-10	2017-11-09
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A

*** Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

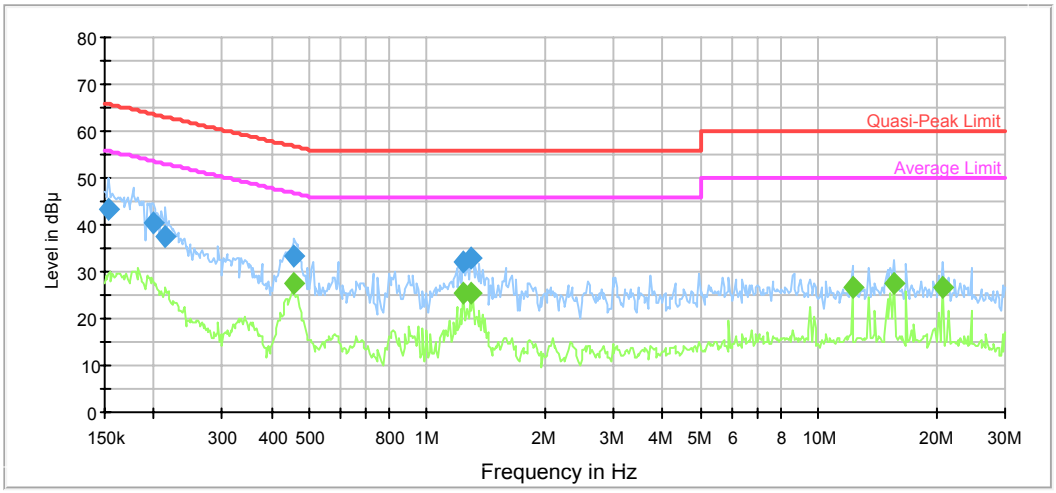
Environmental Conditions

Temperature:	25.6 °C
Relative Humidity:	50%
ATM Pressure:	97.6kPa

The testing was performed by Lorin Bian on 2017-03-06.

Test Mode: Operating

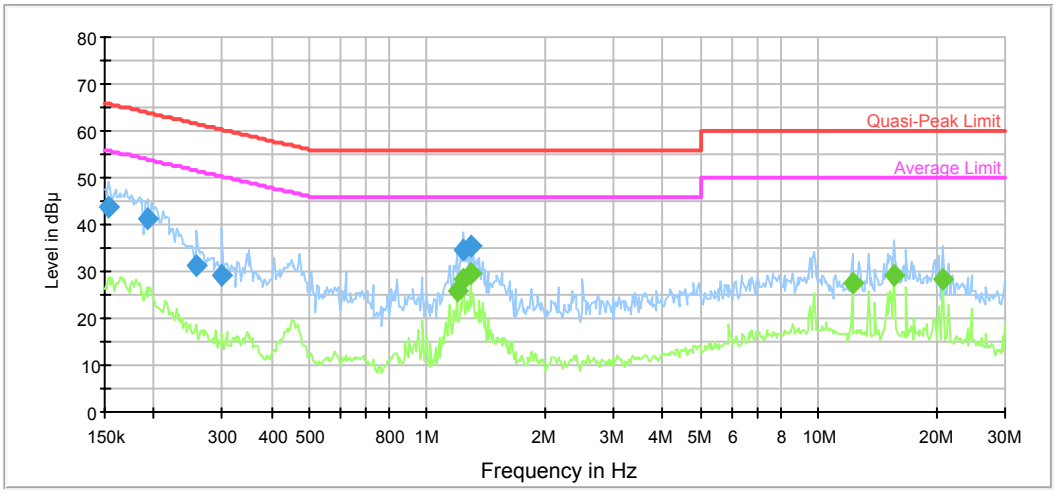
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.153629	43.2	9.000	L1	19.7	22.6	65.8	Compliance
0.199835	40.3	9.000	L1	19.7	23.3	63.6	Compliance
0.214692	37.5	9.000	L1	19.7	25.5	63.0	Compliance
0.457684	33.3	9.000	L1	19.7	23.4	56.7	Compliance
1.239175	32.1	9.000	L1	19.7	23.9	56.0	Compliance
1.289541	32.9	9.000	L1	19.7	23.1	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.454052	27.4	9.000	L1	19.7	19.4	46.8	Compliance
1.239175	25.3	9.000	L1	19.7	20.7	46.0	Compliance
1.289541	25.4	9.000	L1	19.7	20.6	46.0	Compliance
12.198467	26.7	9.000	L1	20.0	23.3	50.0	Compliance
15.616430	27.5	9.000	L1	20.1	22.5	50.0	Compliance
20.804674	26.5	9.000	L1	20.1	23.5	50.0	Compliance

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.153629	43.7	9.000	N	19.7	22.1	65.8	Compliance
0.193566	41.3	9.000	N	19.6	22.6	63.9	Compliance
0.257874	31.4	9.000	N	19.6	30.1	61.5	Compliance
0.300025	29.0	9.000	N	19.6	31.2	60.2	Compliance
1.239175	34.7	9.000	N	19.6	21.3	56.0	Compliance
1.289541	35.4	9.000	N	19.6	20.6	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
1.190776	25.9	9.000	N	19.6	20.1	46.0	Compliance
1.239175	28.4	9.000	N	19.6	17.6	46.0	Compliance
1.289541	29.8	9.000	N	19.6	16.2	46.0	Compliance
12.198467	27.7	9.000	N	19.9	22.3	50.0	Compliance
15.616430	29.2	9.000	N	19.9	20.8	50.0	Compliance
20.804674	28.5	9.000	N	20.0	21.5	50.0	Compliance

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

Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

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 2, 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 2, 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.

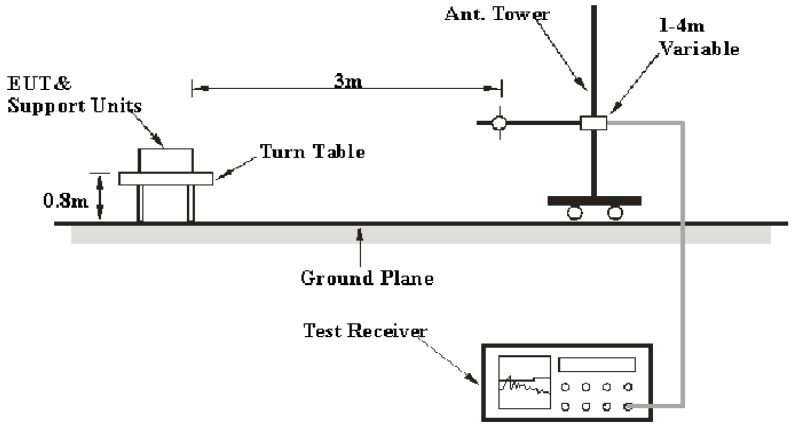
Based on CISPR 16-4-2-2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Chengdu) is:
30M~200MHz: ±4.7 dB;
200M~1GHz: ±6.0 dB;
1G~6GHz: ±5.13dB;
6G~25GHz: ±5.47 dB;

Table 2 – Values of U_{cispr}

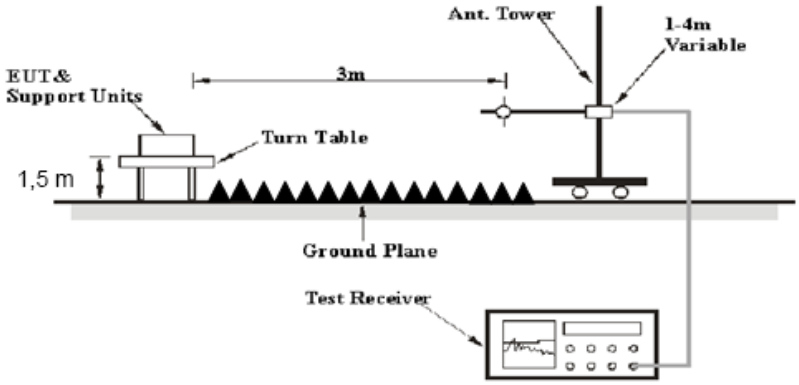
Measurement		U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC)	(30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR)	(1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR)	(6 GHz to 18 GHz)	5.5 dB

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters chamber 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 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.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

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

30MHz-1000MHz:

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

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.

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 –Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Amplifier	8447D	2944A10442	2016-12-02	2017-12-01
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
Sunol Sciences	Broadband Antenna	JB3	A101808	2016-04-10	2019-04-09
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2016-12-02	2017-12-01
ETS	Horn Antenna	3115	003-6076	2016-12-02	2017-12-01
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-0113024	2014-06-16	2017-06-15
Mini-circuits	Amplifier	ZVA-183-S+	771001215	2016-05-20	2017-05-19
HP	Amplifier	8449B	3008A00277	2016-12-02	2017-12-01
EMCT	Semi-Anechoic Chamber	966	N/A	2015-04-24	2018-04-23
N/A	RF Cable (below 1GHz)	NO.1	N/A	2016-11-10	2017-11-09
N/A	RF Cable (below 1GHz)	NO.4	N/A	2016-11-10	2017-11-09
N/A	RF Cable (above 1GHz)	NO.2	N/A	2016-11-10	2017-11-09
WEINSCHEL ENGINEERING	Attenuator	1A10dB	AA4135	2016-11-10	2017-11-09

*** Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	26.4 °C
Relative Humidity:	55 %
ATM Pressure:	98.2 kPa

** The testing was performed by Lorin Bian on 2017-03-14.*

Test Mode: Transmitting

30MHz-25GHz:

802.11b Mode(Chain 3 was the worst)

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)					
Low Channel: 2412 MHz									
2412	74.34	PK	H	23.50	3.00	0.00	100.84	N/A	N/A
2412	71.03	AV	H	23.50	3.00	0.00	97.53	N/A	N/A
2412	85.81	PK	V	23.50	3.00	0.00	112.31	N/A	N/A
2412	81.94	AV	V	23.50	3.00	0.00	108.44	N/A	N/A
2390	35.87	PK	V	23.57	3.00	0.00	62.44	74	11.56
2390	23.11	AV	V	23.57	3.00	0.00	49.68	54	4.32
4824	31.67	PK	V	30.84	5.11	26.87	40.75	74	33.25
4824	22.48	AV	V	30.84	5.11	26.87	31.56	54	22.44
7236	24.33	PK	V	34.77	6.18	26.36	38.92	74	35.08
7236	15.55	AV	V	34.77	6.18	26.36	30.14	54	23.86
1405	40.40	PK	V	23.85	2.54	26.42	40.37	74	33.63
1405	31.17	AV	V	23.85	2.54	26.42	31.14	54	22.86
266.68	37.23	QP	H	13.40	1.25	27.49	24.39	46.00	21.61
391.81	37.49	QP	H	15.94	1.51	28.15	26.79	46.00	19.21
Middle Channel: 2437 MHz									
2437	75.90	PK	H	23.41	3.00	0.00	102.31	N/A	N/A
2437	72.51	AV	H	23.41	3.00	0.00	98.92	N/A	N/A
2437	86.34	PK	V	23.41	3.00	0.00	112.75	N/A	N/A
2437	82.06	AV	V	23.41	3.00	0.00	108.47	N/A	N/A
4874	31.08	PK	V	31.00	5.09	26.87	40.3	74	33.7
4874	22.27	AV	V	31.00	5.09	26.87	31.49	54	22.51
7311	24.29	PK	V	34.92	6.21	26.40	39.02	74	34.98
7311	15.97	AV	V	34.92	6.21	26.40	30.7	54	23.3
2118	39.96	PK	V	24.50	3.04	26.84	40.66	74	33.34
2118	30.21	AV	V	24.50	3.04	26.84	30.91	54	23.09
1447	38.79	PK	V	23.96	2.60	26.38	38.97	74	35.03
1447	29.54	AV	V	23.96	2.60	26.38	29.72	54	24.28
266.68	37.5	QP	H	13.40	1.25	27.49	24.66	46.00	21.34
391.81	37.63	QP	H	15.94	1.51	28.15	26.93	46.00	19.07
High Channel: 2462 MHz									
2462	74.02	PK	H	23.33	2.99	0.00	100.34	N/A	N/A
2462	70.04	AV	H	23.33	2.99	0.00	96.36	N/A	N/A
2462	85.89	PK	V	23.33	2.99	0.00	112.21	N/A	N/A
2462	82.33	AV	V	23.33	2.99	0.00	108.65	N/A	N/A
2483.5	33.65	PK	V	23.26	2.99	0.00	59.9	74	14.1
2483.5	23.55	AV	V	23.26	2.99	0.00	49.8	54	4.2
4924	30.59	PK	V	31.16	5.07	26.88	39.94	74	34.06
4924	21.87	AV	V	31.16	5.07	26.88	31.22	54	22.78
7386	23.73	PK	V	35.07	6.25	26.43	38.62	74	35.38
7386	15.06	AV	V	35.07	6.25	26.43	29.95	54	24.05
1494	38.95	PK	V	24.08	2.66	26.34	39.35	74	34.65
1494	30.17	AV	V	24.08	2.66	26.34	30.57	54	23.43
266.68	38.34	QP	H	13.40	1.25	27.49	25.50	46.00	20.50
391.81	38.05	QP	H	15.94	1.51	28.15	27.35	46.00	18.65

802.11g Mode(Chain 3 was the worst)

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)					
Low Channel: 2412 MHz									
2412	73.89	PK	H	23.50	3.00	0.00	100.39	N/A	N/A
2412	63.05	AV	H	23.50	3.00	0.00	89.55	N/A	N/A
2412	84.40	PK	V	23.50	3.00	0.00	110.9	N/A	N/A
2412	74.63	AV	V	23.50	3.00	0.00	101.13	N/A	N/A
2390	33.53	PK	V	23.57	3.00	0.00	60.1	74	13.9
2390	21.87	AV	V	23.57	3.00	0.00	48.44	54	5.56
4824	35.18	PK	V	30.84	5.11	26.87	44.26	74	29.74
4824	25.79	AV	V	30.84	5.11	26.87	34.87	54	19.13
7236	26.13	PK	V	34.77	6.18	26.36	40.72	74	33.28
7236	16.29	AV	V	34.77	6.18	26.36	30.88	54	23.12
9648	22.25	PK	V	37.09	7.79	26.20	40.93	74	33.07
9648	12.96	AV	V	37.09	7.79	26.20	31.64	54	22.36
266.68	37.87	QP	H	13.40	1.25	27.49	25.03	46.00	20.97
391.81	38.49	QP	H	15.94	1.51	28.15	27.79	46.00	18.21
Middle Channel: 2437 MHz									
2437	73.58	PK	H	23.41	3.00	0.00	99.99	N/A	N/A
2437	63.13	AV	H	23.41	3.00	0.00	89.54	N/A	N/A
2437	84.22	PK	V	23.41	3.00	0.00	110.63	N/A	N/A
2437	74.96	AV	V	23.41	3.00	0.00	101.37	N/A	N/A
4874	35.69	PK	V	31.00	5.09	26.87	44.91	74	29.09
4874	25.53	AV	V	31.00	5.09	26.87	34.75	54	19.25
7311	25.82	PK	V	34.92	6.21	26.40	40.55	74	33.45
7311	16.27	AV	V	34.92	6.21	26.40	31	54	23
9748	22.03	PK	V	37.15	7.72	26.26	40.64	74	33.36
9748	13.29	AV	V	37.15	7.72	26.26	31.9	54	22.1
1396	40.65	PK	V	23.83	2.53	26.43	40.58	74	33.42
1396	32.01	AV	V	23.83	2.53	26.43	31.94	54	22.06
1608	37.27	PK	V	24.27	2.75	26.44	37.85	74	36.15
1608	28.13	AV	V	24.27	2.75	26.44	28.71	54	25.29
266.68	38.14	QP	H	13.40	1.25	27.49	25.30	46.00	20.70
391.81	38.69	QP	H	15.94	1.51	28.15	27.99	46.00	18.01
High Channel: 2462 MHz									
2462	73.62	PK	H	23.33	2.99	0.00	99.94	N/A	N/A
2462	63.20	AV	H	23.33	2.99	0.00	89.52	N/A	N/A
2462	83.84	PK	V	23.33	2.99	0.00	110.16	N/A	N/A
2462	74.43	AV	V	23.33	2.99	0.00	100.75	N/A	N/A
2483.5	34.38	PK	V	23.26	2.99	0.00	60.63	74	13.37
2483.5	23.11	AV	V	23.26	2.99	0.00	49.36	54	4.64
4924	35.09	PK	V	31.16	5.07	26.88	44.44	74	29.56
4924	25.58	AV	V	31.16	5.07	26.88	34.93	54	19.07
7386	25.53	PK	V	35.07	6.25	26.43	40.42	74	33.58
7386	16.26	AV	V	35.07	6.25	26.43	31.15	54	22.85
9848	22.31	PK	V	37.21	7.65	26.33	40.84	74	33.16
9848	13.37	AV	V	37.21	7.65	26.33	31.9	54	22.1
1434	40.27	PK	V	23.93	2.58	26.39	40.39	74	33.61
1434	31.41	AV	V	23.93	2.58	26.39	31.53	54	22.47
266.68	38.41	QP	H	13.40	1.25	27.49	25.57	46.00	20.43
391.81	38.83	QP	H	15.94	1.51	28.15	28.13	46.00	17.87

802.11 n ht20 Mode(MIMO 3TX was the worst)

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)					
Low Channel: 2412 MHz									
2412	76.89	PK	H	23.50	3.00	0.00	103.39	N/A	N/A
2412	68.32	AV	H	23.50	3.00	0.00	94.82	N/A	N/A
2412	88.37	PK	V	23.50	3.00	0.00	114.87	N/A	N/A
2412	79.03	AV	V	23.50	3.00	0.00	105.53	N/A	N/A
2390	42.07	PK	V	23.57	3.00	0.00	68.64	74	5.36
2390	24.86	AV	V	23.57	3.00	0.00	51.43	54	2.57
4824	35.48	PK	V	30.84	5.11	26.87	44.56	74	29.44
4824	26.11	AV	V	30.84	5.11	26.87	35.19	54	18.81
7236	25.57	PK	V	34.77	6.18	26.36	40.16	74	33.84
7236	15.94	AV	V	34.77	6.18	26.36	30.53	54	23.47
9648	21.83	PK	V	37.09	7.79	26.20	40.51	74	33.49
9648	12.60	AV	V	37.09	7.79	26.20	31.28	54	22.72
266.68	39.25	QP	H	13.40	1.25	27.49	26.41	46.00	19.59
391.81	39.25	QP	H	15.94	1.51	28.15	28.55	46.00	17.45
Middle Channel: 2437 MHz									
2437	76.14	PK	H	23.41	3.00	0.00	102.55	N/A	N/A
2437	67.68	AV	H	23.41	3.00	0.00	94.09	N/A	N/A
2437	86.59	PK	V	23.41	3.00	0.00	113	N/A	N/A
2437	78.42	AV	V	23.41	3.00	0.00	104.83	N/A	N/A
4874	34.88	PK	V	31.00	5.09	26.87	44.1	74	29.9
4874	26.06	AV	V	31.00	5.09	26.87	35.28	54	18.72
7311	25.42	PK	V	34.92	6.21	26.40	40.15	74	33.85
7311	15.85	AV	V	34.92	6.21	26.40	30.58	54	23.42
9748	21.73	PK	V	37.15	7.72	26.26	40.34	74	33.66
9748	13.21	AV	V	37.15	7.72	26.26	31.82	54	22.18
1396	40.51	PK	V	23.83	2.53	26.43	40.44	74	33.56
1396	32.59	AV	V	23.83	2.53	26.43	32.52	54	21.48
1608	37.24	PK	V	24.27	2.75	26.44	37.82	74	36.18
1608	28.00	AV	V	24.27	2.75	26.44	28.58	54	25.42
266.68	38.78	QP	H	13.40	1.25	27.49	25.94	46.00	20.06
391.81	39.69	QP	H	15.94	1.51	28.15	28.99	46.00	17.01
High Channel: 2462 MHz									
2462	76.43	PK	H	23.33	2.99	0.00	102.75	N/A	N/A
2462	67.09	AV	H	23.33	2.99	0.00	93.41	N/A	N/A
2462	86.83	PK	V	23.33	2.99	0.00	113.15	N/A	N/A
2462	78.15	AV	V	23.33	2.99	0.00	104.47	N/A	N/A
2483.5	44.43	PK	V	23.26	2.99	0.00	70.68	74	3.32
2483.5	26.07	AV	V	23.26	2.99	0.00	52.32	54	1.68
4924	35.50	PK	V	31.16	5.07	26.88	44.85	74	29.15
4924	25.83	AV	V	31.16	5.07	26.88	35.18	54	18.82
7386	25.00	PK	V	35.07	6.25	26.43	39.89	74	34.11
7386	15.97	AV	V	35.07	6.25	26.43	30.86	54	23.14
9848	22.36	PK	V	37.21	7.65	26.33	40.89	74	33.11
9848	13.01	AV	V	37.21	7.65	26.33	31.54	54	22.46
1434	40.41	PK	V	23.93	2.58	26.39	40.53	74	33.47
1434	32.10	AV	V	23.93	2.58	26.39	32.22	54	21.78
266.68	38.31	QP	H	13.40	1.25	27.49	25.47	46.00	20.53
391.81	40.13	QP	H	15.94	1.51	28.15	29.43	46.00	16.57

802.11 n ht40 Mode(MIMO 3TX was the worst)

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)					
Low Channel: 2422 MHz									
2422	73.05	PK	H	23.47	3.00	0.00	99.52	N/A	N/A
2422	74.76	AV	H	23.47	3.00	0.00	101.23	N/A	N/A
2422	83.43	PK	V	23.47	3.00	0.00	109.9	N/A	N/A
2422	73.92	AV	V	23.47	3.00	0.00	100.39	N/A	N/A
2390	36.61	PK	V	23.57	3.00	0.00	63.18	74	10.82
2390	22.86	AV	V	23.57	3.00	0.00	49.43	54	4.57
4844	32.79	PK	V	30.90	5.10	26.87	41.92	74	32.08
4844	23.17	AV	V	30.90	5.10	26.87	32.3	54	21.7
7266	23.47	PK	V	34.83	6.19	26.38	38.11	74	35.89
7266	12.85	AV	V	34.83	6.19	26.38	27.49	54	26.51
9688	19.87	PK	V	37.11	7.76	26.23	38.51	74	35.49
9688	10.34	AV	V	37.11	7.76	26.23	28.98	54	25.02
1352	40.69	PK	V	23.72	2.47	26.47	40.41	74	33.59
1352	30.96	AV	V	23.72	2.47	26.47	30.68	54	23.32
266.68	38.71	QP	H	13.40	1.25	27.49	25.87	46.00	20.13
391.81	37.92	QP	H	15.94	1.51	28.15	27.22	46.00	18.78
Middle Channel: 2437 MHz									
2437	73.38	PK	H	23.41	3.00	0.00	99.79	N/A	N/A
2437	74.16	AV	H	23.41	3.00	0.00	100.57	N/A	N/A
2437	82.95	PK	V	23.41	3.00	0.00	109.36	N/A	N/A
2437	74.31	AV	V	23.41	3.00	0.00	100.72	N/A	N/A
4874	32.87	PK	V	31.00	5.09	26.87	42.09	74	31.91
4874	22.93	AV	V	31.00	5.09	26.87	32.15	54	21.85
7311	23.31	PK	V	34.92	6.21	26.40	38.04	74	35.96
7311	13.47	AV	V	34.92	6.21	26.40	28.2	54	25.8
9748	20.13	PK	V	37.15	7.72	26.26	38.74	74	35.26
9748	11.02	AV	V	37.15	7.72	26.26	29.63	54	24.37
1396	38.94	PK	V	23.83	2.53	26.43	38.87	74	35.13
1396	30.43	AV	V	23.83	2.53	26.43	30.36	54	23.64
266.68	38.98	QP	H	13.40	1.25	27.49	26.14	46.00	19.86
391.81	38.06	QP	H	15.94	1.51	28.15	27.36	46.00	18.64
High Channel: 2452 MHz									
2452	73.30	PK	H	23.36	3.00	0.00	99.66	N/A	N/A
2452	74.46	AV	H	23.36	3.00	0.00	100.82	N/A	N/A
2452	83.02	PK	V	23.36	3.00	0.00	109.38	N/A	N/A
2452	74.25	AV	V	23.36	3.00	0.00	100.61	N/A	N/A
2483.5	39.31	PK	V	23.26	2.99	0.00	65.56	74	8.44
2483.5	23.85	AV	V	23.26	2.99	0.00	50.1	54	3.9
4904	33.05	PK	V	31.09	5.08	26.87	42.35	74	31.65
4904	22.79	AV	V	31.09	5.08	26.87	32.09	54	21.91
7356	22.94	PK	V	35.01	6.23	26.42	37.76	74	36.24
7356	12.26	AV	V	35.01	6.23	26.42	27.08	54	26.92
9808	19.87	PK	V	37.18	7.68	26.30	38.43	74	35.57
9808	10.75	AV	V	37.18	7.68	26.30	29.31	54	24.69
1434	39.57	PK	V	23.93	2.58	26.39	39.69	74	34.31
1434	29.44	AV	V	23.93	2.58	26.39	29.56	54	24.44
266.68	39.82	QP	H	13.40	1.25	27.49	26.98	46.00	19.02
391.81	38.48	QP	H	15.94	1.51	28.15	27.78	46.00	18.22

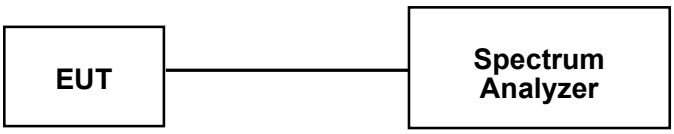
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

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

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



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
N/A	RF Cable	N/A	N/A	Each Time	/

*** Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	25.6 °C
Relative Humidity:	48 %
ATM Pressure:	99.7 kPa

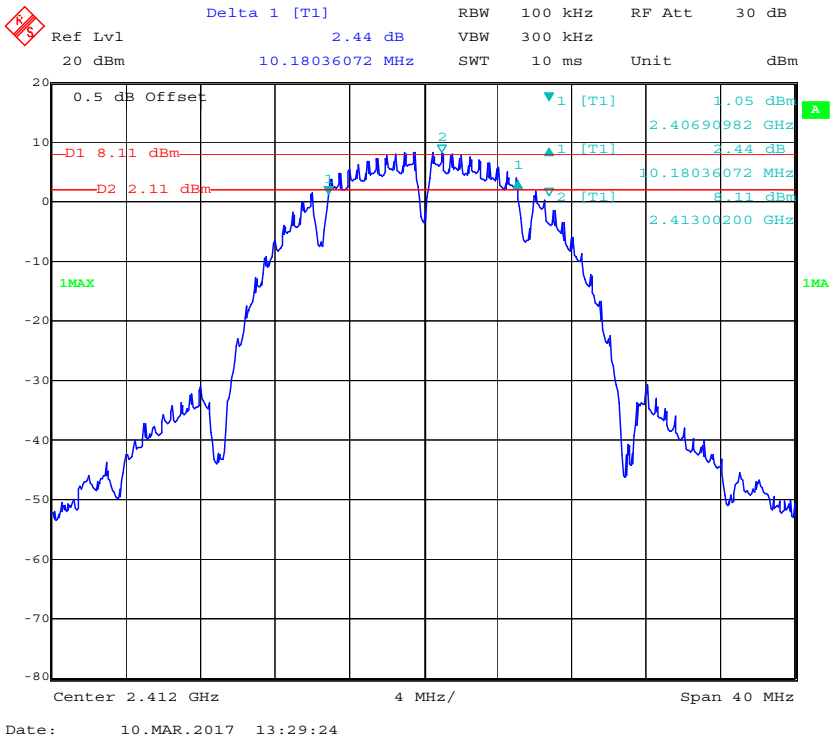
** The testing was performed by Lorin Bian on 2017-03-10.*

Test Mode: Transmitting (Test performed at Chain 0 only)

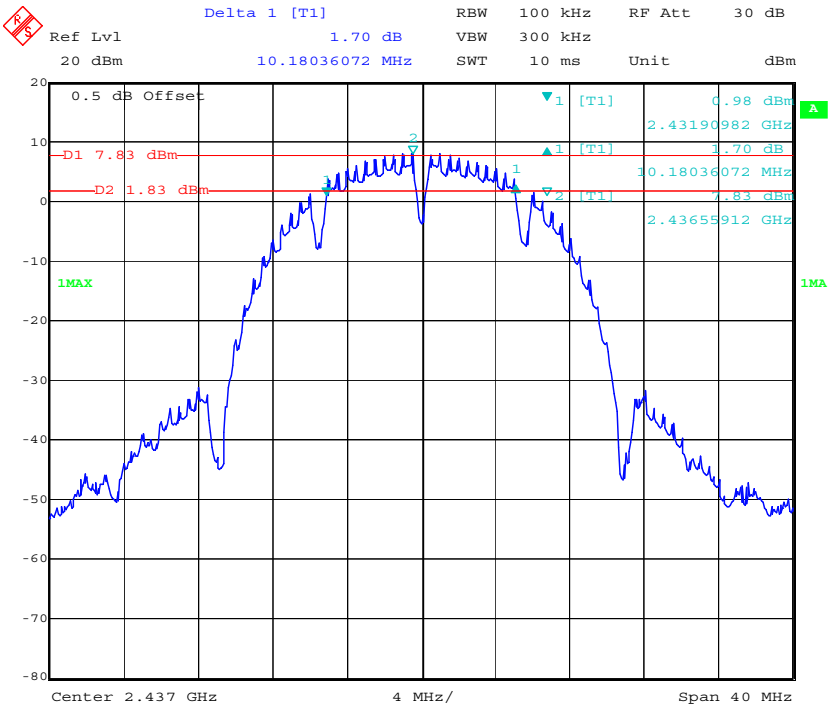
Test Result: Compliant. Please refer to the following table and plots.

Test mode	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)
802.11b	Low	2412	10.18	≥0.5
	Middle	2437	10.18	≥0.5
	High	2462	10.18	≥0.5
802.11g	Low	2412	16.59	≥0.5
	Middle	2437	16.59	≥0.5
	High	2462	16.59	≥0.5
802.11n20	Low	2412	17.8	≥0.5
	Middle	2437	17.8	≥0.5
	High	2462	17.8	≥0.5
802.11 n40	Low	2422	36.71	≥0.5
	Middle	2437	36.71	≥0.5
	High	2452	36.71	≥0.5

802.11b Low Channel

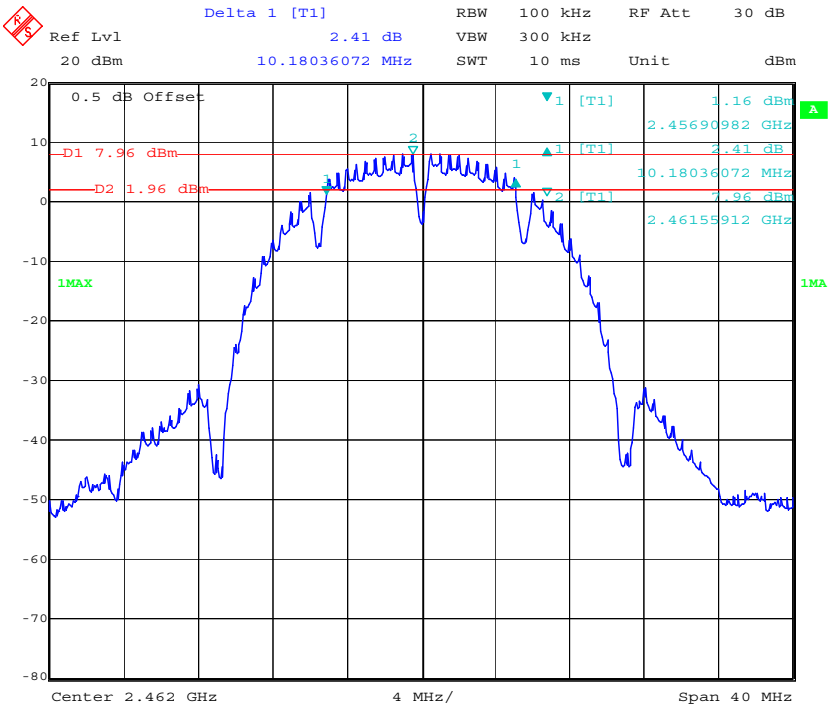


802.11b Middle Channel



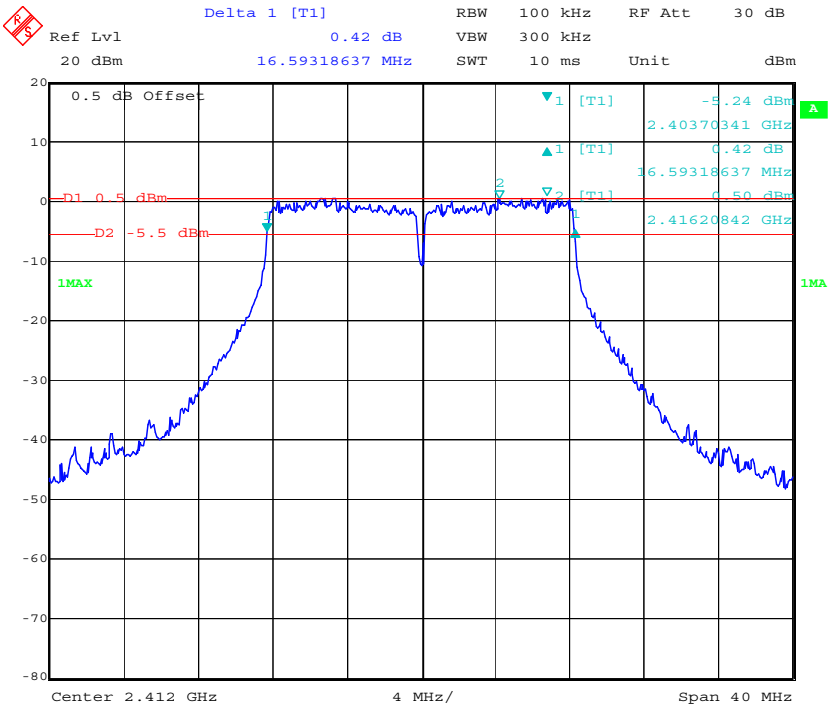
Date: 10.MAR.2017 13:33:17

802.11b High Channel

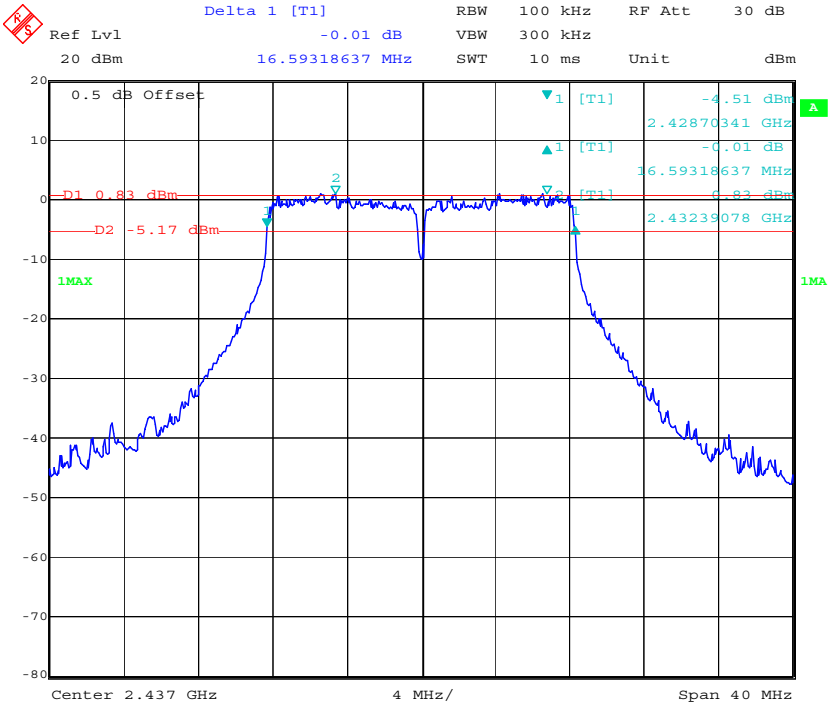


Date: 10.MAR.2017 13:36:46

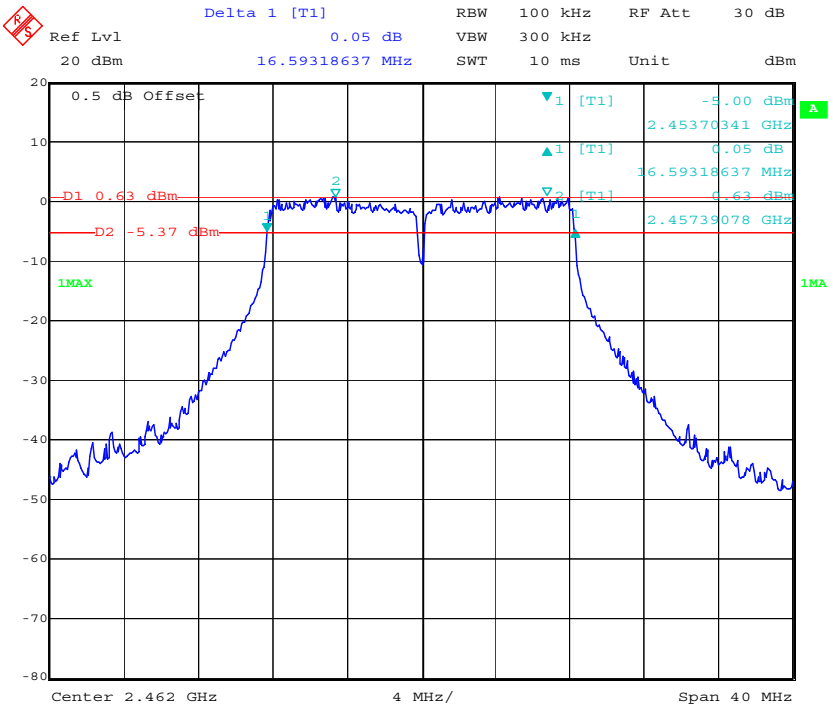
802.11g Low Channel



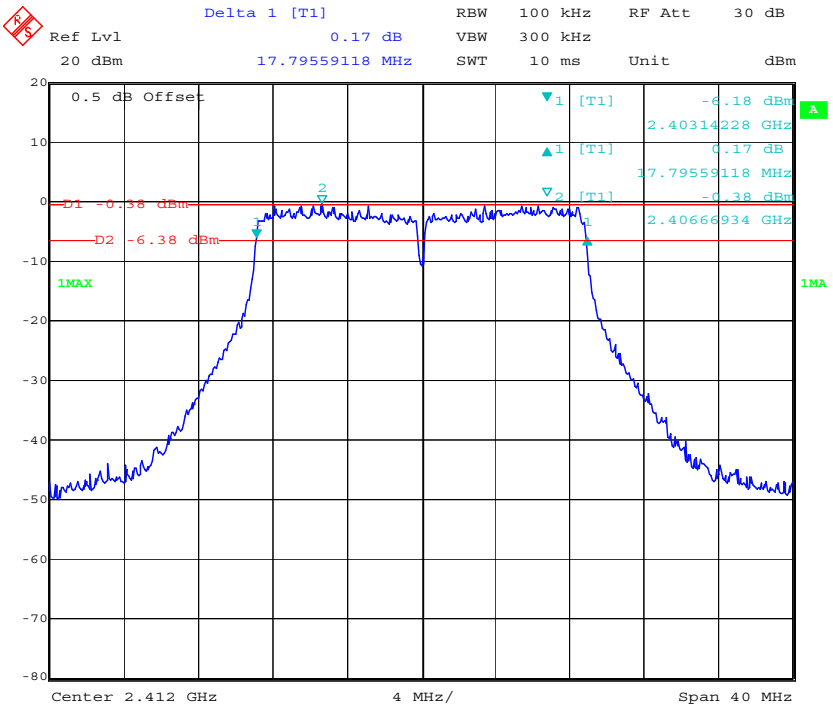
802.11g Middle Channel



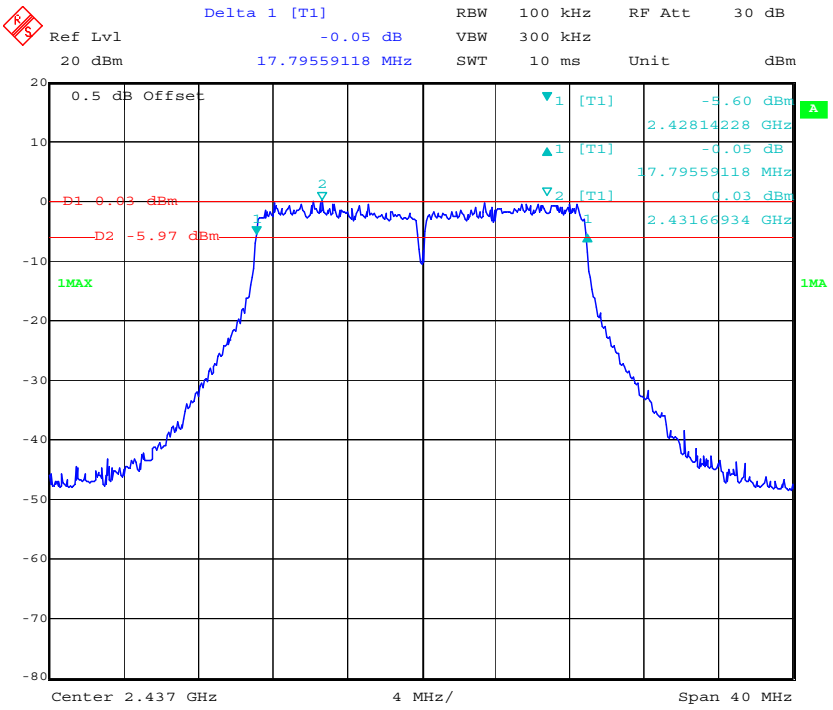
802.11g High Channel



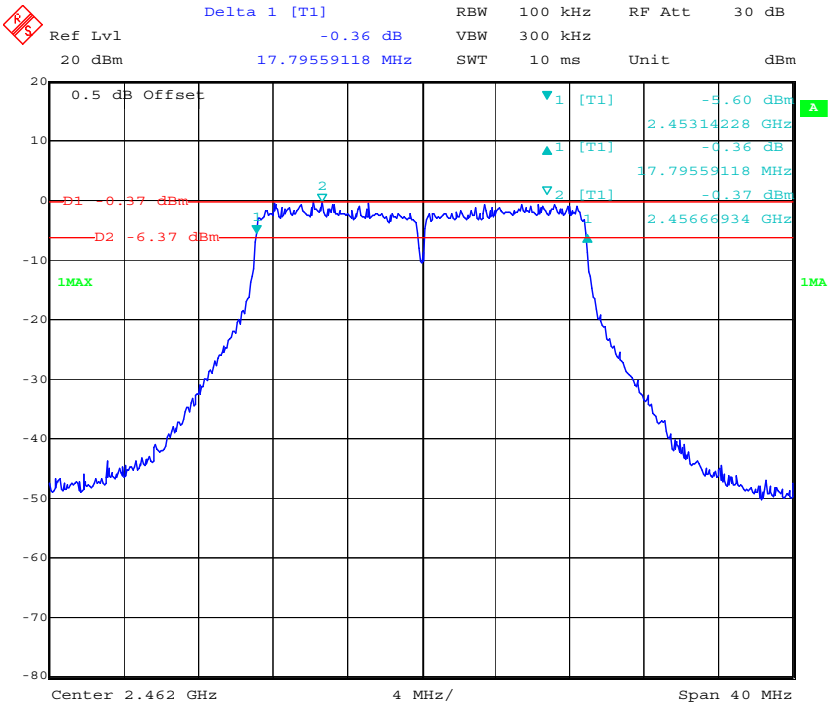
802.11n ht20 Low Channel



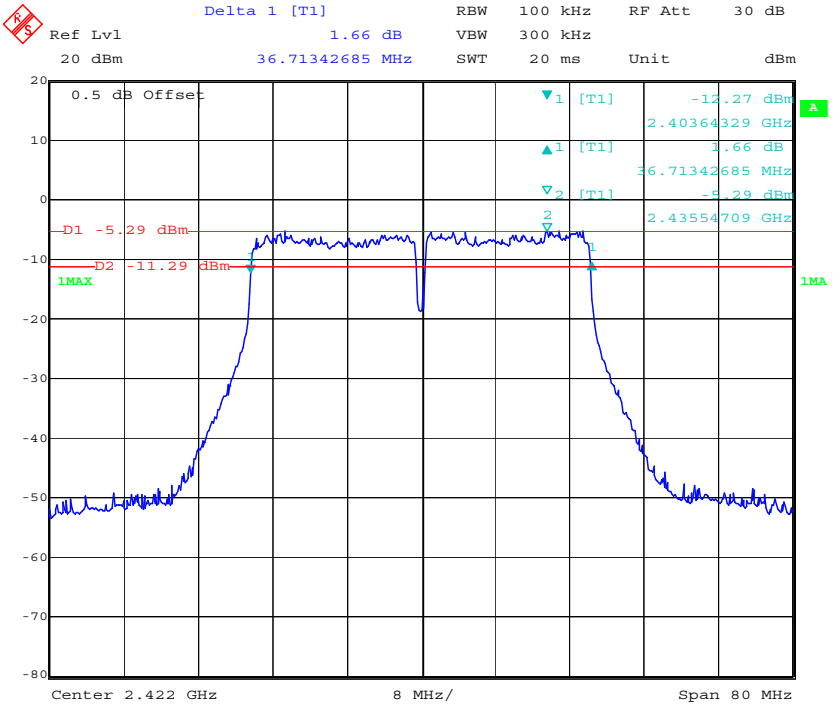
802.11n ht20 Middle Channel



802.11n ht20 High Channel

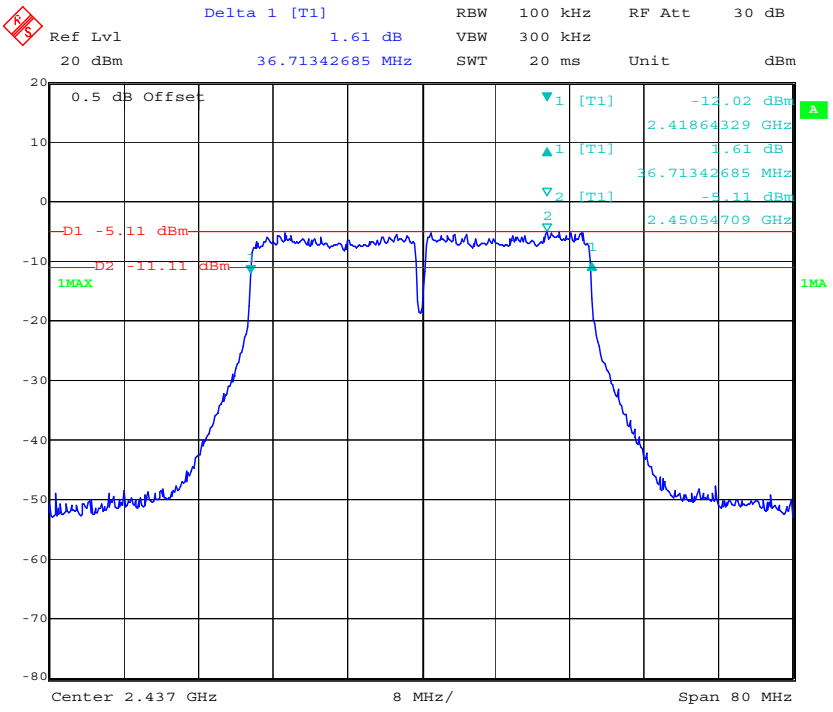


802.11n ht40 Low Channel



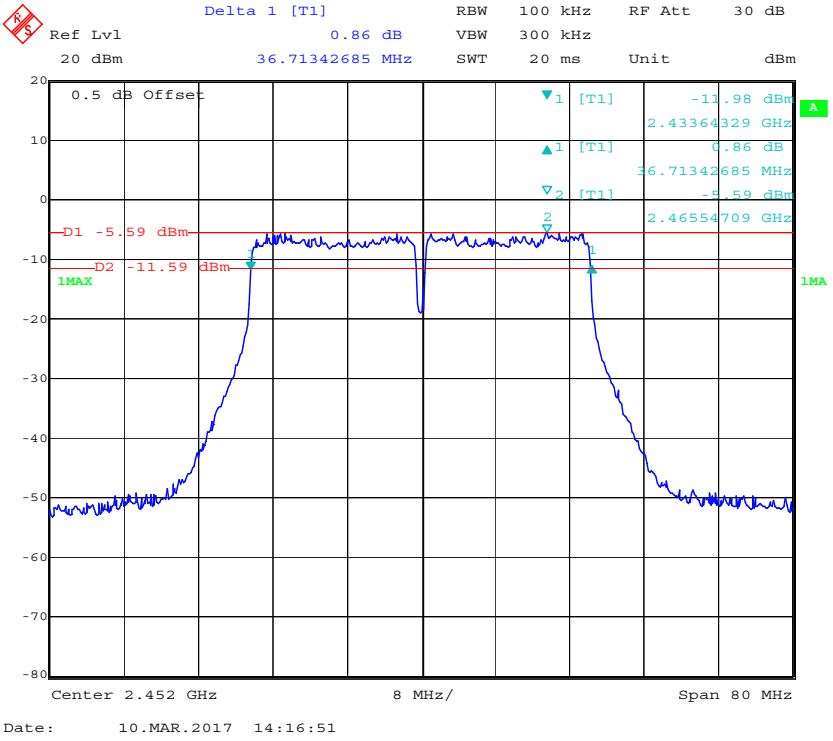
Date: 10.MAR.2017 14:07:57

802.11n ht40 Middle Channel



Date: 10.MAR.2017 14:12:49

802.11n ht40 High Channel



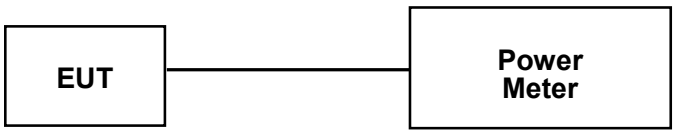
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

Applicable Standard

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

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to test equipment.
3. Add a correction factor to the display.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Wideband Power Sensor	N1921A	MY54170074	2017-01-03	2018-01-03
Agilent	P-Series Power Meter	N1912A	MY5000798	2017-01-03	2018-01-03
N/A	RF Cable	N/A	N/A	Each Time	/

*** Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	25.6 °C
Relative Humidity:	48 %
ATM Pressure:	99.7 kPa

** The testing was performed by Lorin Bian on 2017-03-10.*

Test Mode: Transmitting

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

SISO mode:

Test mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)				Limit (dBm)
			Chain 0	Chain 1	Chain 2	Chain 3	
802.11b	Low	2412	22.07	20.47	20.43	20.38	30
	Middle	2437	21.87	21.6	21.27	21.10	30
	High	2462	22.01	21.54	21.32	21.44	30
802.11g	Low	2412	20.9	20.20	20.17	20.35	30
	Middle	2437	21.33	20.41	20.44	20.52	30
	High	2462	21.06	20.72	20.57	20.92	30
802.11n20	Low	2412	19.87	18.92	19.87	19.78	30
	Middle	2437	20.21	18.98	19.78	19.59	30
	High	2462	20.45	18.99	19.98	20.42	30
802.11n40	Low	2422	20.23	19.46	20.75	18.87	30
	Middle	2437	19.87	19.53	19.65	19.42	30
	High	2452	19.98	19.26	19.74	19.43	30

MIMO mode:

Test mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)				Limit (dBm)
			Chain 0	Chain 1	Chain 2	Total	
802.11n20	Low	2412	20.00	18.88	19.58	24.28	30
	Middle	2437	20.37	18.97	19.89	24.55	30
	High	2462	20.14	19.32	20.33	24.72	30
802.11n40	Low	2422	19.59	19.03	19.12	24.02	30
	Middle	2437	19.77	19.13	19.62	24.29	30
	High	2452	19.39	19.02	19.95	24.24	30

Note: For 802.11n, MIMO 3TX mode was the worst,

The 3 antenna maximum atenna gains are 4.0 dBi, and employed Cyclic Delay Diversity (CDD) for 802.11 MIMO transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01, for power measurements on IEEE 802.11 devices:

Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4;

So:

Directional gain = GANT + Array Gain = 4 dBi < 6dBi

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	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
N/A	RF Cable	N/A	N/A	Each Time	/

*** Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	25.6 °C
Relative Humidity:	48 %
ATM Pressure:	99.7 kPa

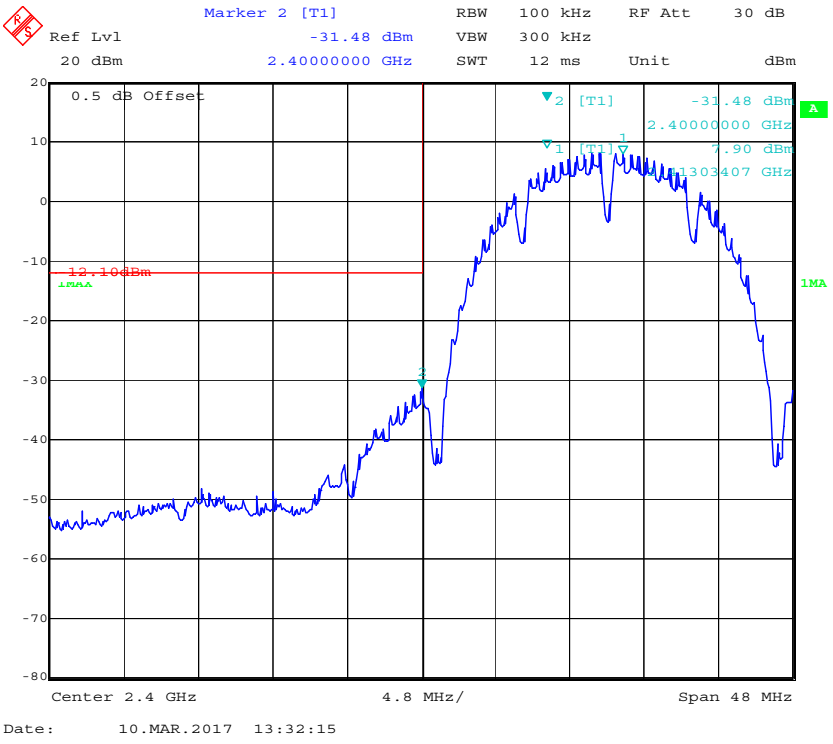
** The testing was performed by Lorin Bian on 2017-03-10.*

Test mode: Transmitting

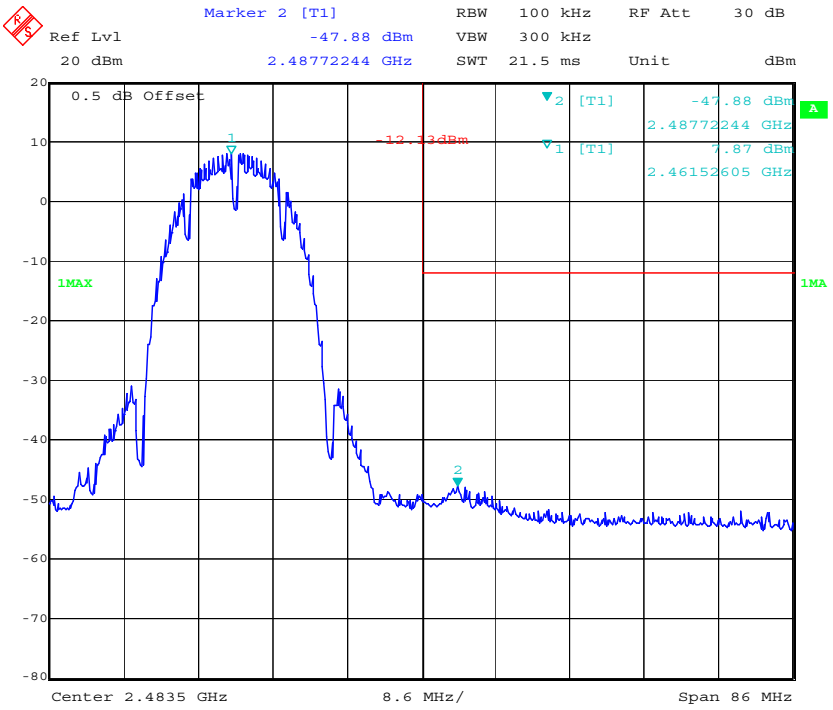
Test Result: Compliant. Please refer to following plots.

Chain 0:

802.11b: Band Edge, Left Side

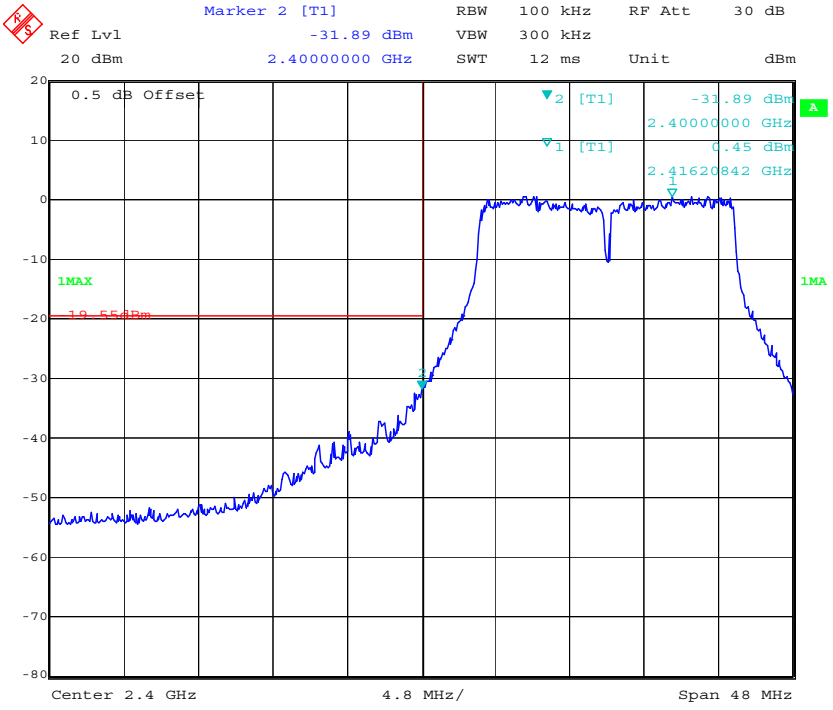


802.11b: Band Edge, Right Side



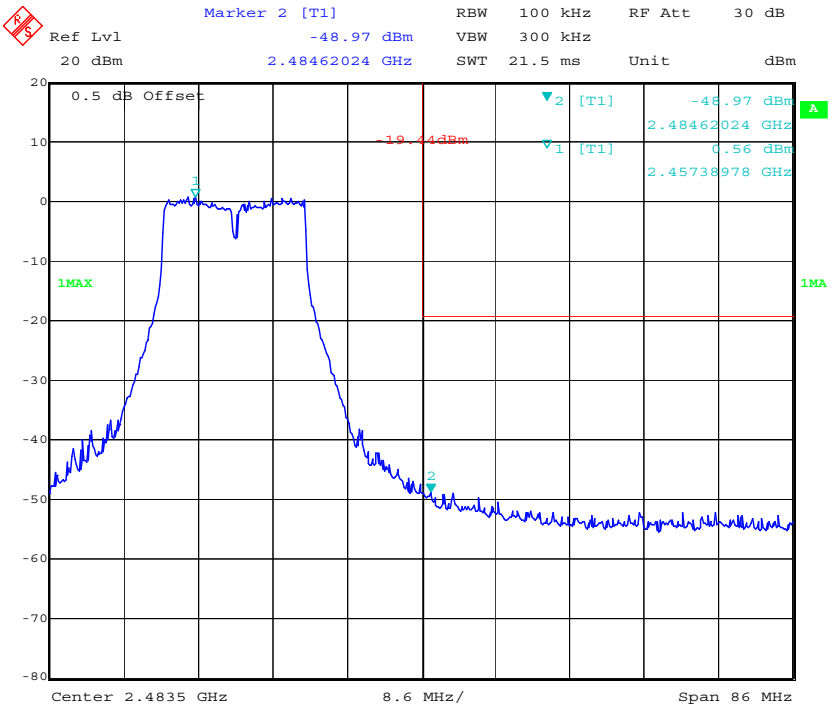
Date: 10.MAR.2017 13:39:36

802.11g: Band Edge, Left Side



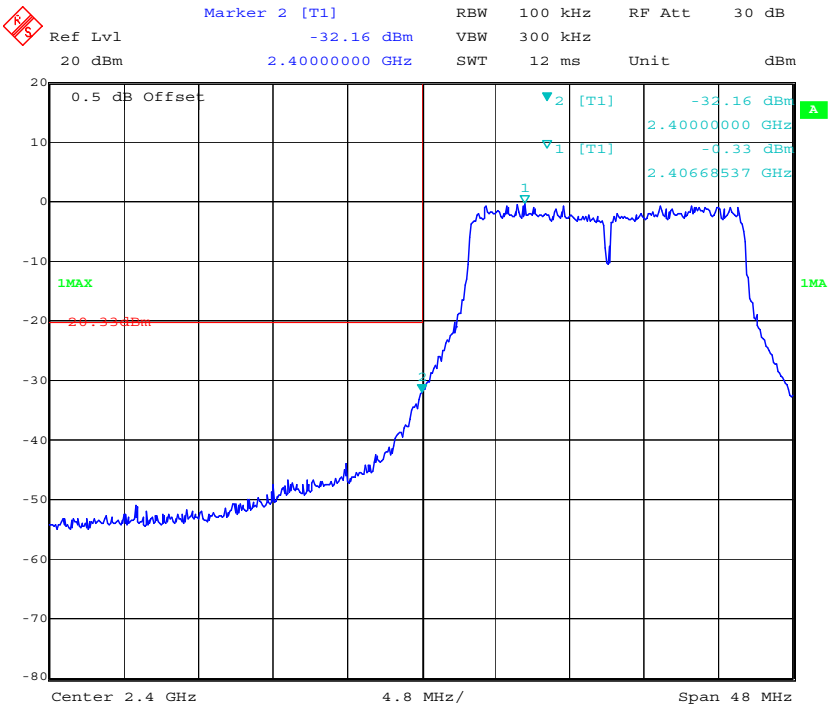
Date: 10.MAR.2017 13:44:21

802.11g: Band Edge, Right Side



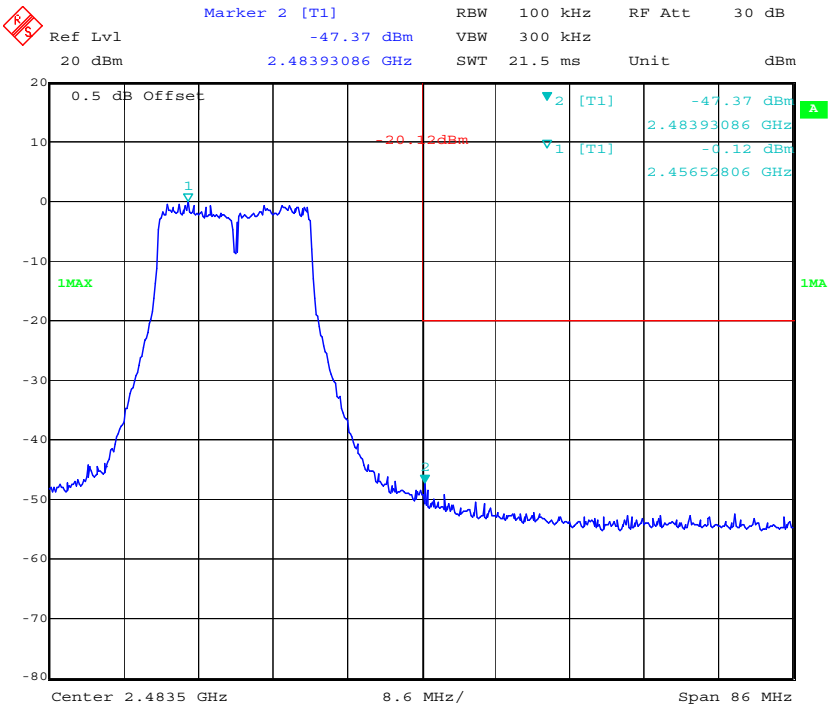
Date: 10.MAR.2017 13:51:41

802.11n ht20 Band Edge, Left Side



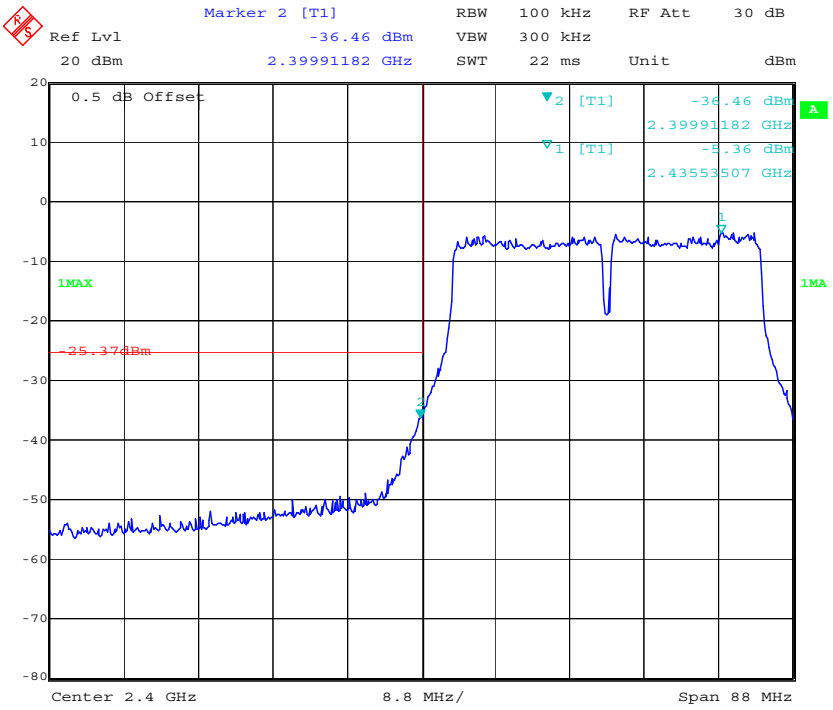
Date: 10.MAR.2017 13:56:44

802.11n ht20 Band Edge, Right Side



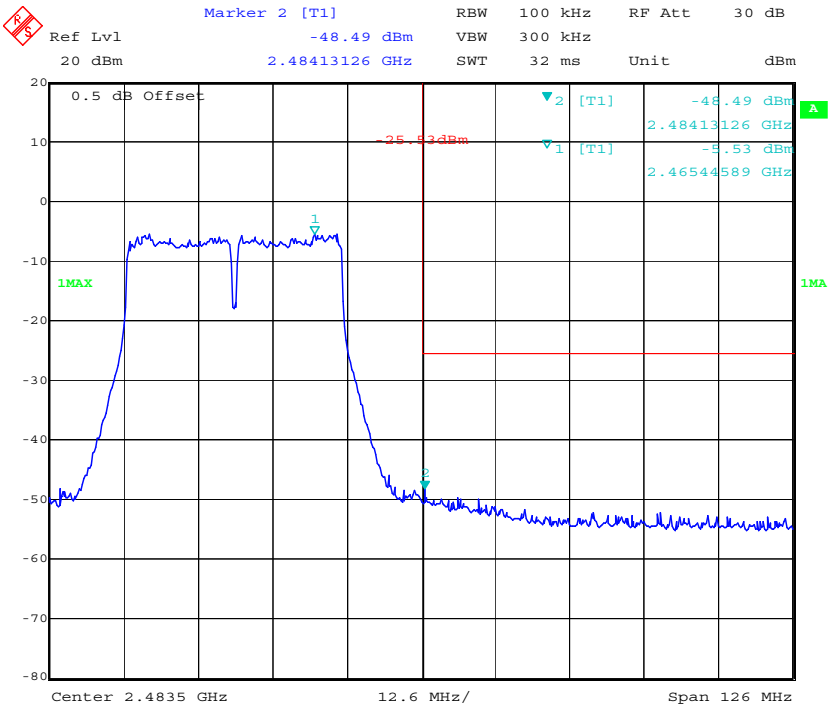
Date: 10.MAR.2017 14:04:16

802.11n ht40 Band Edge, Left Side



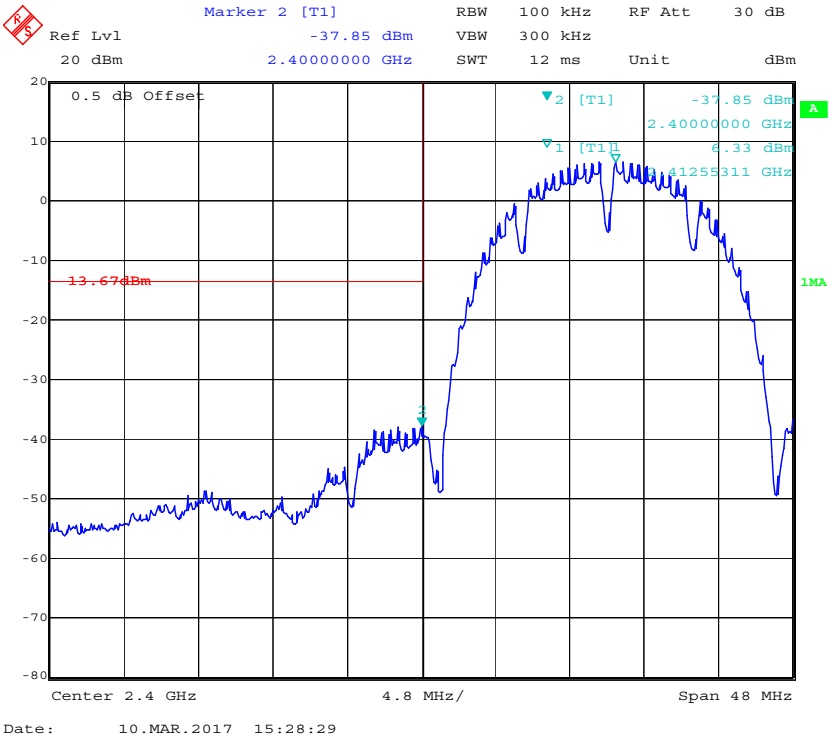
Date: 10.MAR.2017 14:11:57

802.11n ht40 Band Edge, Right Side

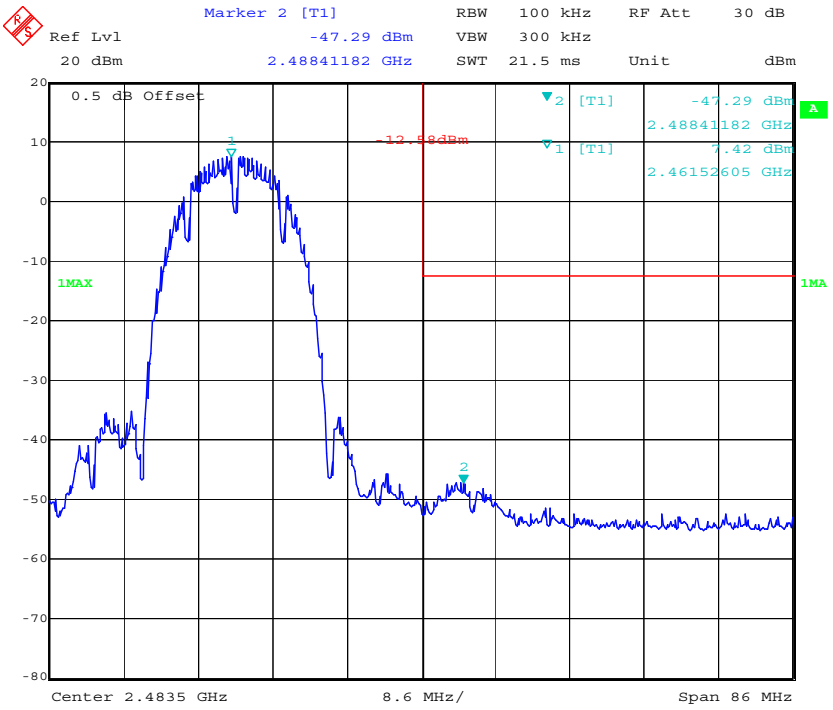


Chain 1:

802.11b: Band Edge, Left Side

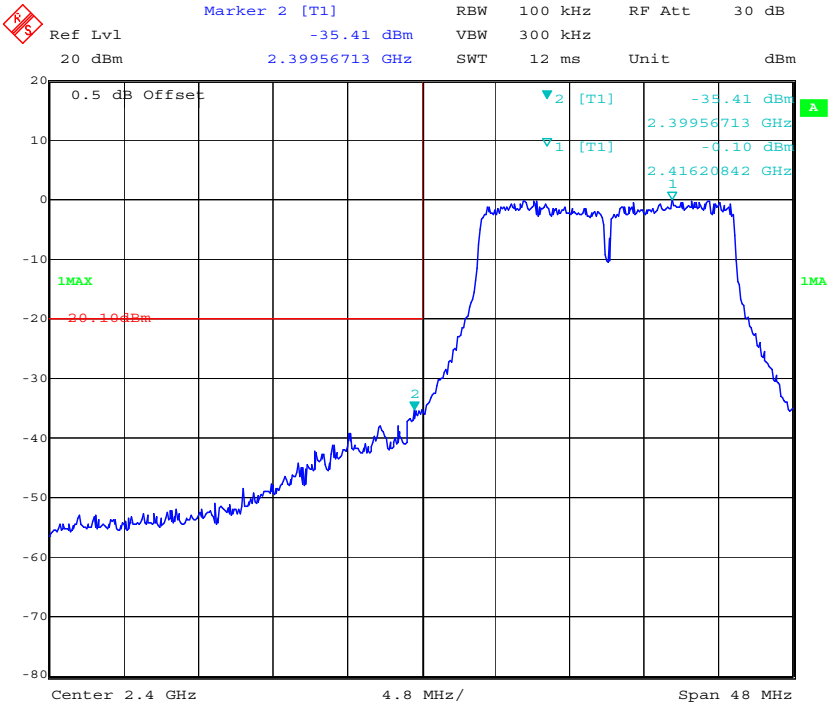


802.11b: Band Edge, Right Side



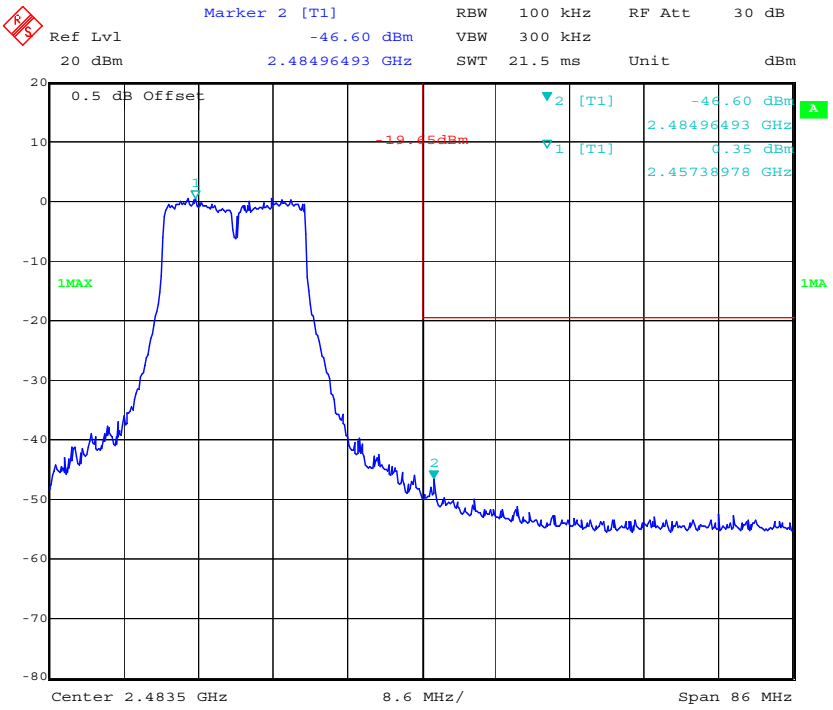
Date: 10.MAR.2017 15:52:02

802.11g: Band Edge, Left Side



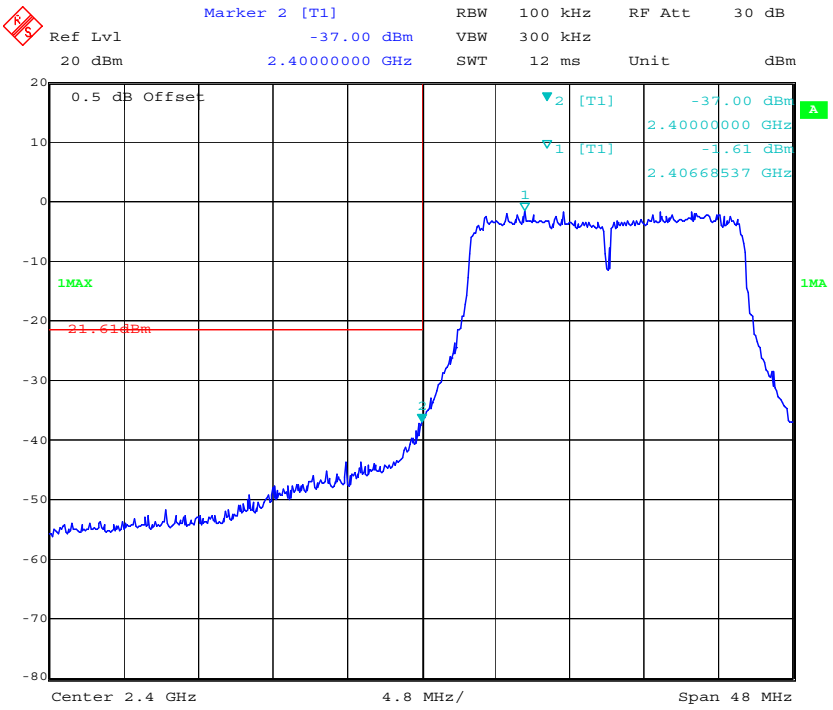
Date: 10.MAR.2017 16:01:36

802.11g: Band Edge, Right Side



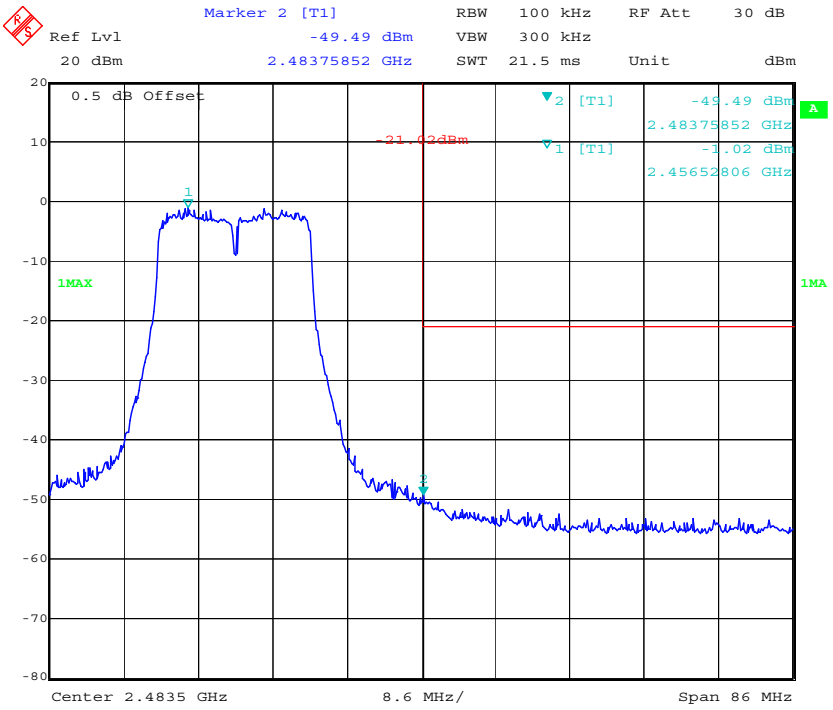
Date: 10.MAR.2017 16:08:02

802.11n ht20 Band Edge, Left Side



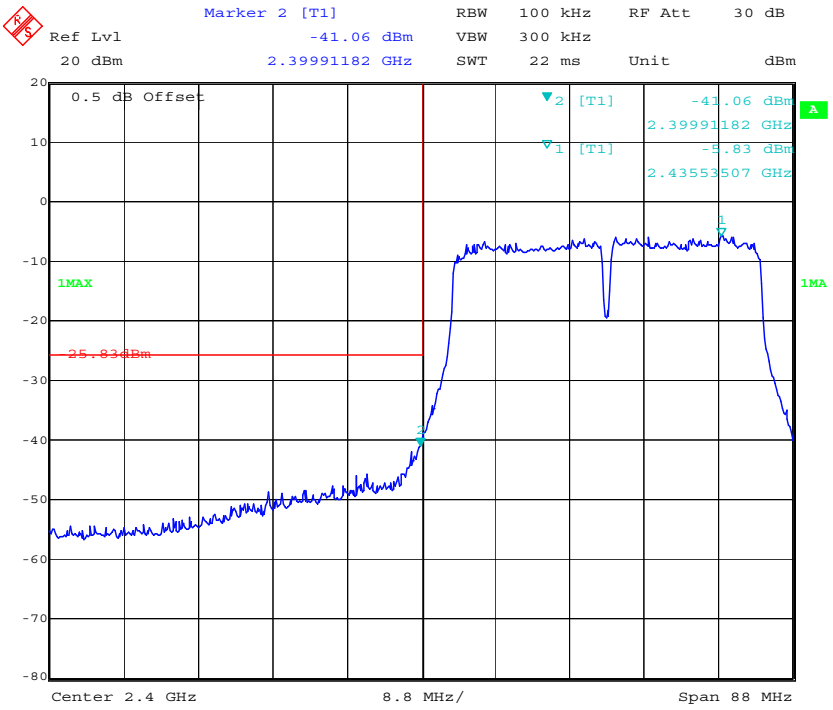
Date: 10.MAR.2017 16:13:04

802.11n ht20 Band Edge, Right Side



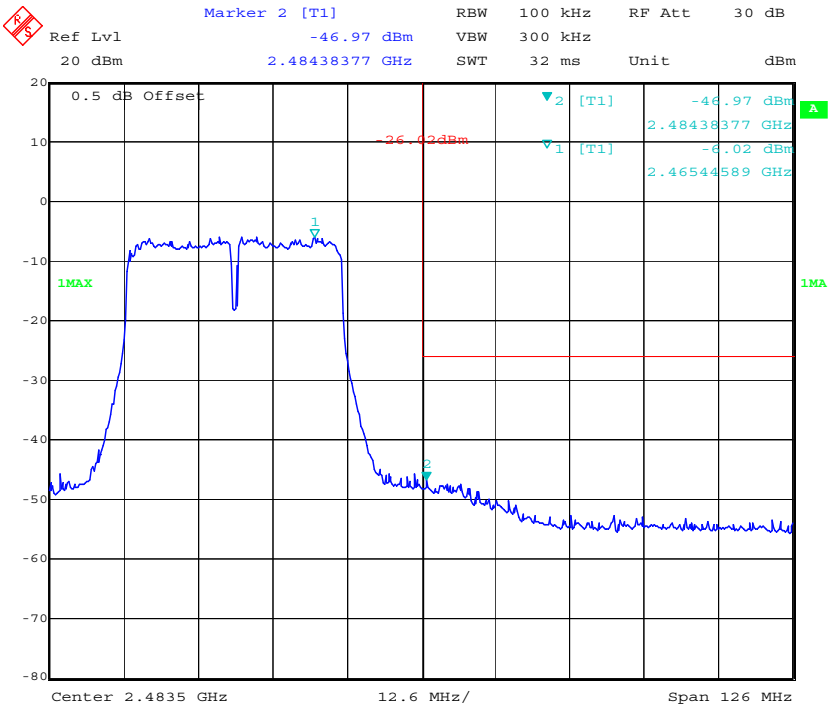
Date: 10.MAR.2017 16:19:24

802.11n ht40 Band Edge, Left Side



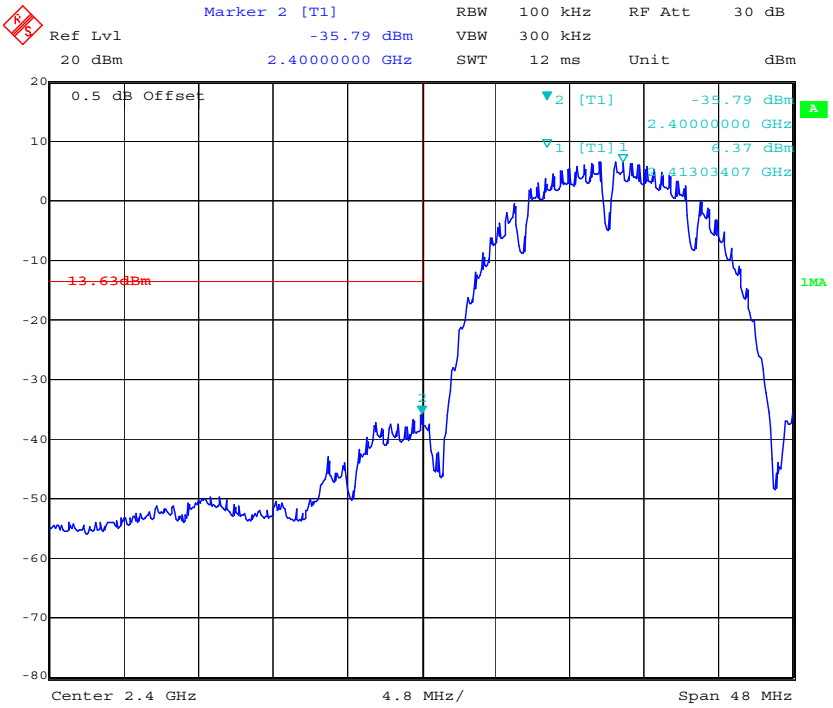
Date: 10.MAR.2017 16:33:15

802.11n ht40 Band Edge, Right Side

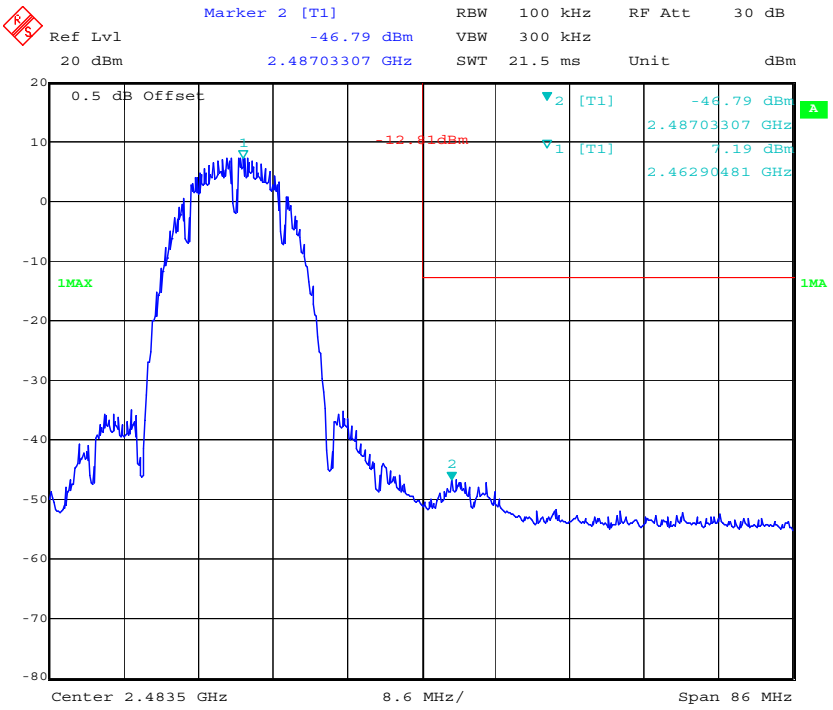


Chain 2:

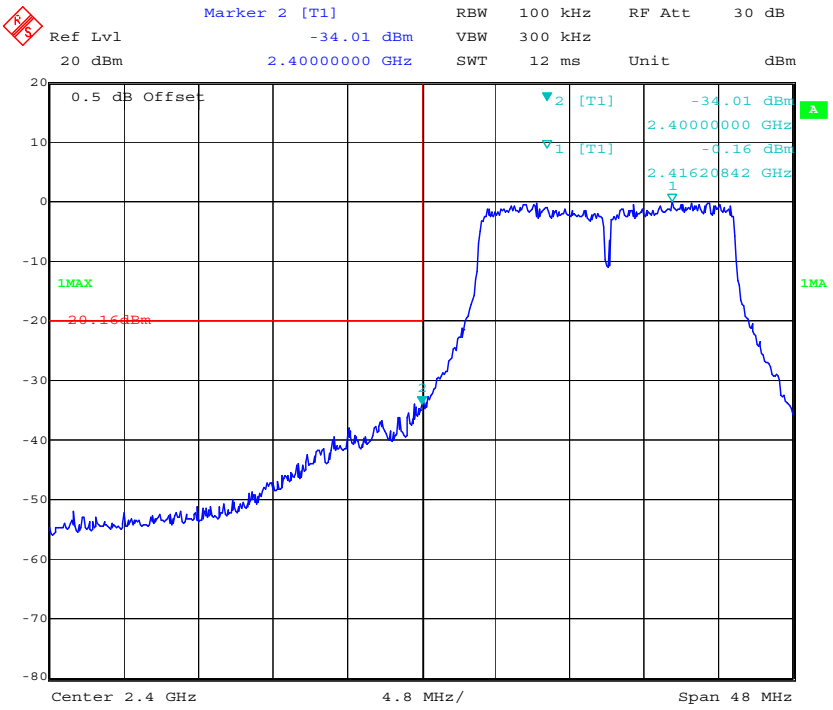
802.11b: Band Edge, Left Side



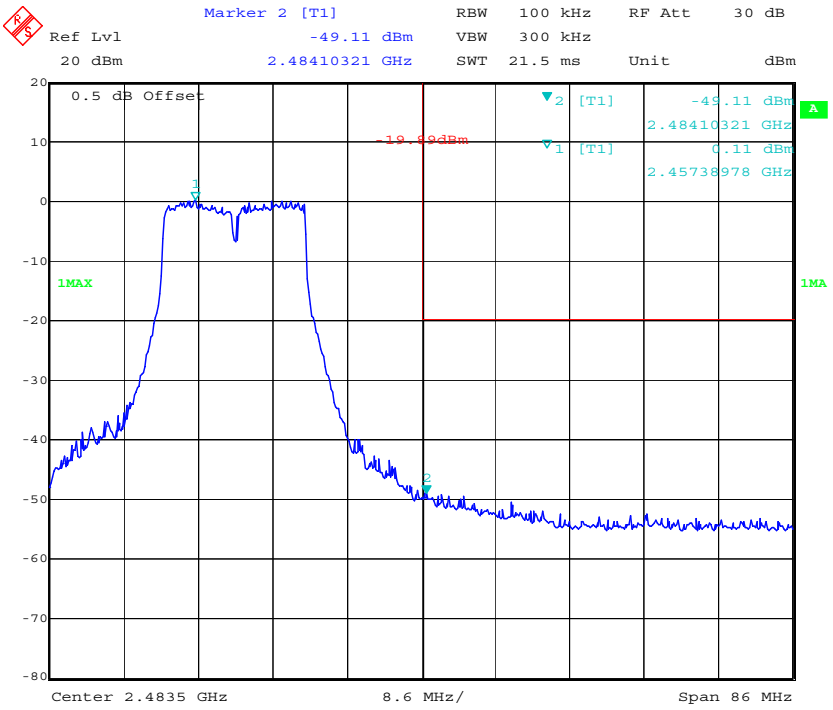
802.11b: Band Edge, Right Side



802.11g: Band Edge, Left Side

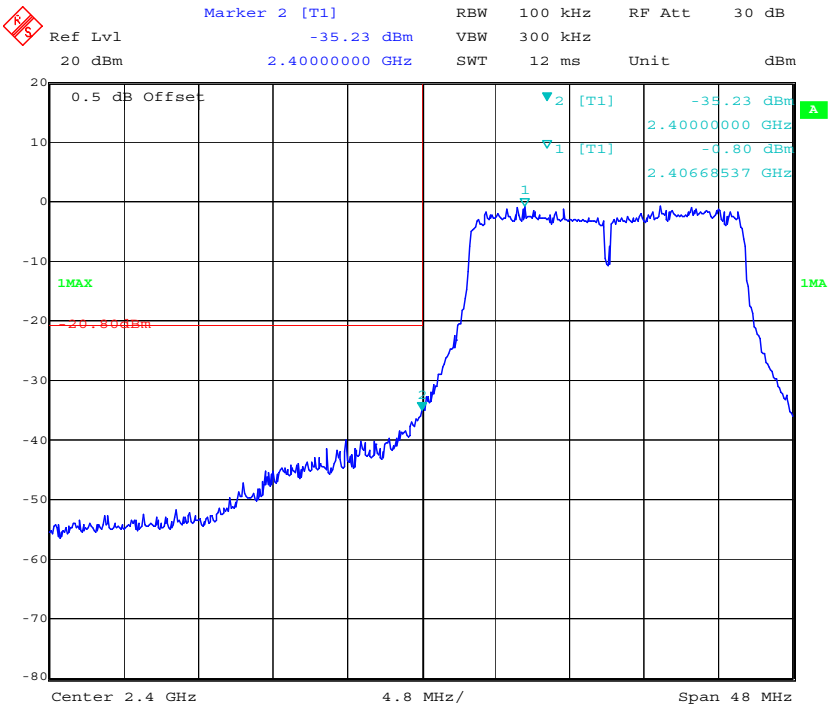


802.11g: Band Edge, Right Side



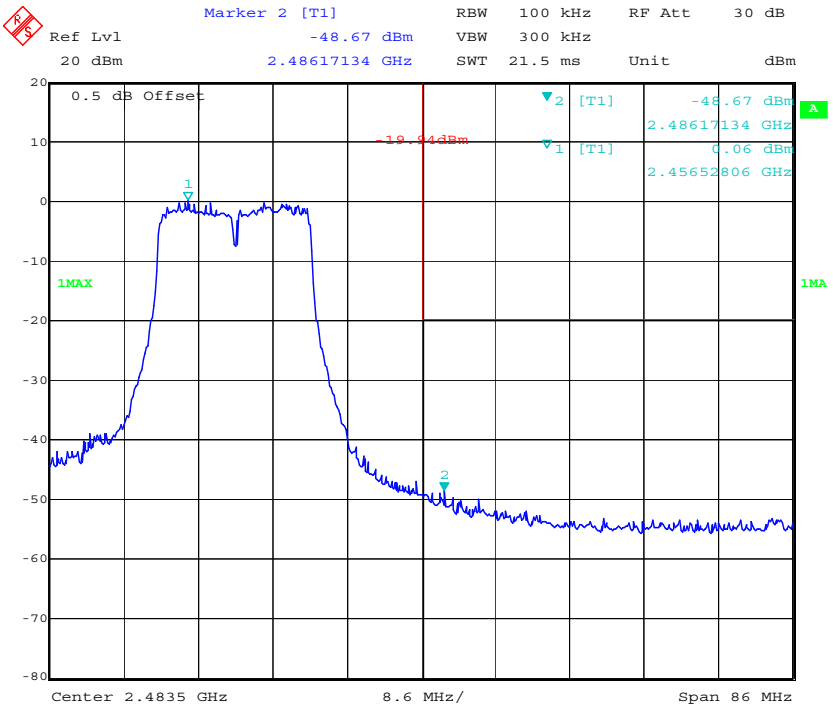
Date: 10.MAR.2017 18:09:03

802.11n ht20 Band Edge, Left Side



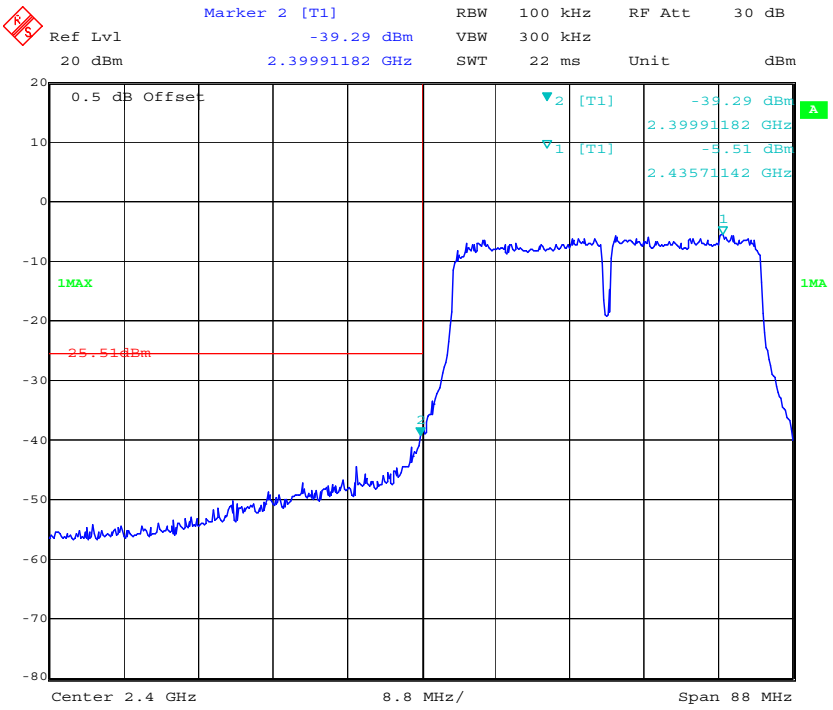
Date: 10.MAR.2017 18:17:30

802.11n ht20 Band Edge, Right Side



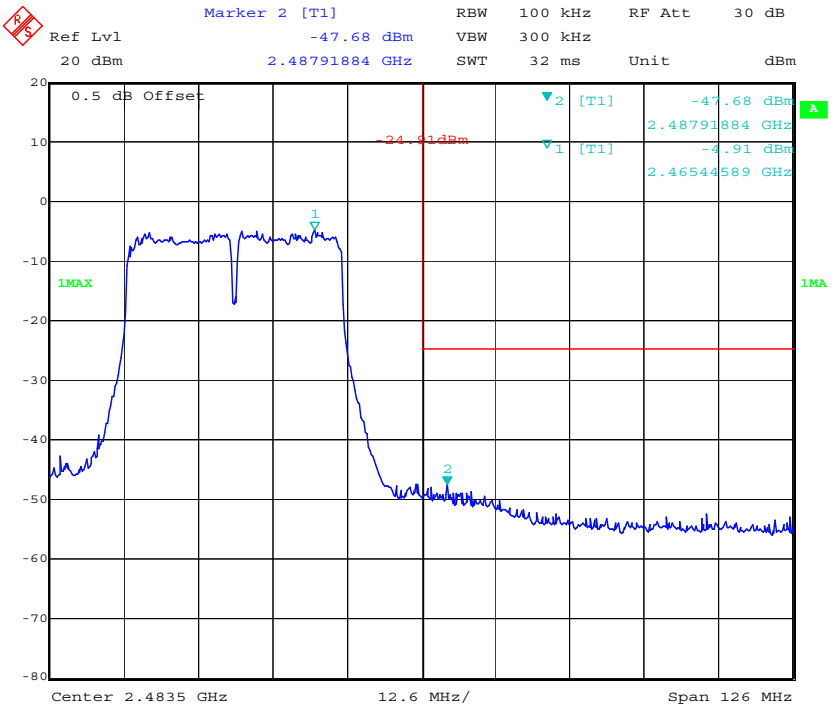
Date: 10.MAR.2017 18:29:36

802.11n ht40 Band Edge, Left Side



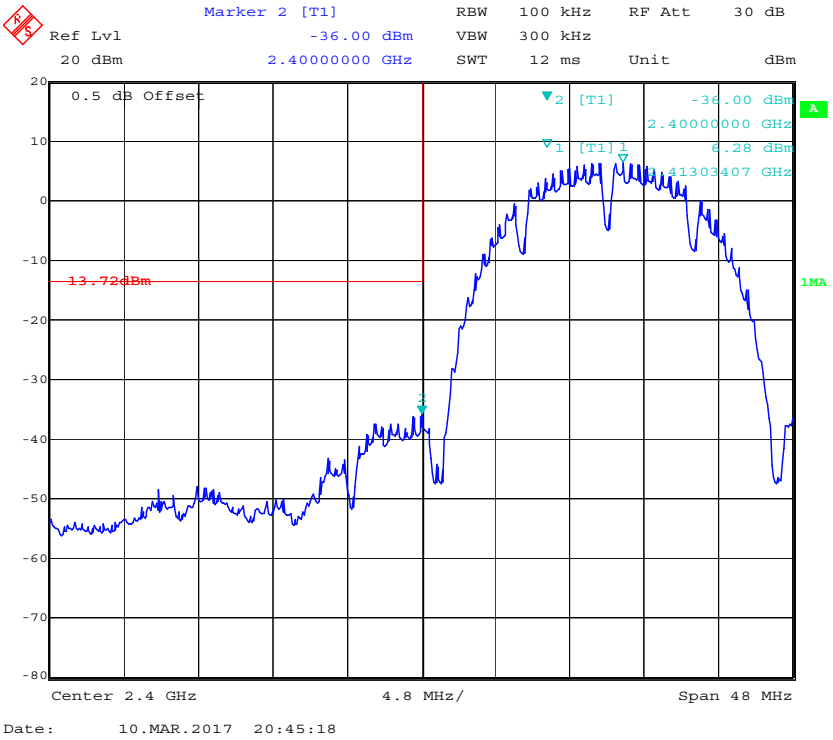
Date: 10.MAR.2017 18:39:04

802.11n ht40 Band Edge, Right Side

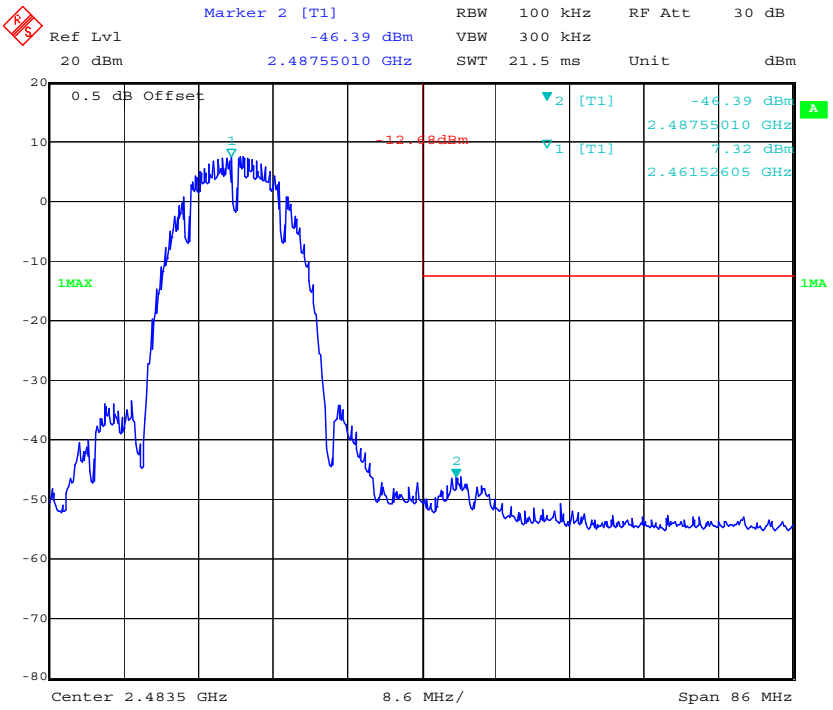


Chain 3:

802.11b: Band Edge, Left Side

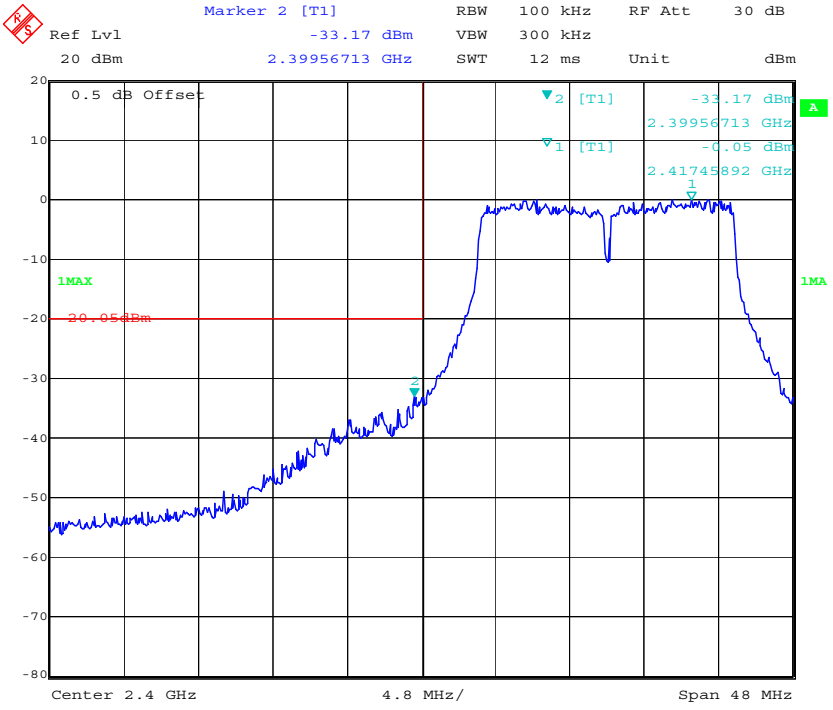


802.11b: Band Edge, Right Side



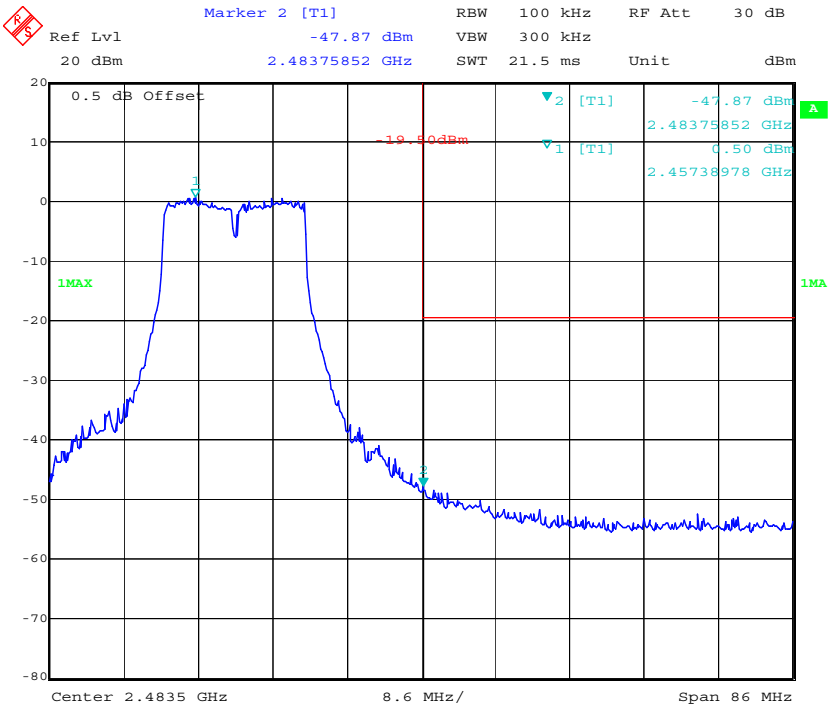
Date: 10.MAR.2017 20:52:07

802.11g: Band Edge, Left Side

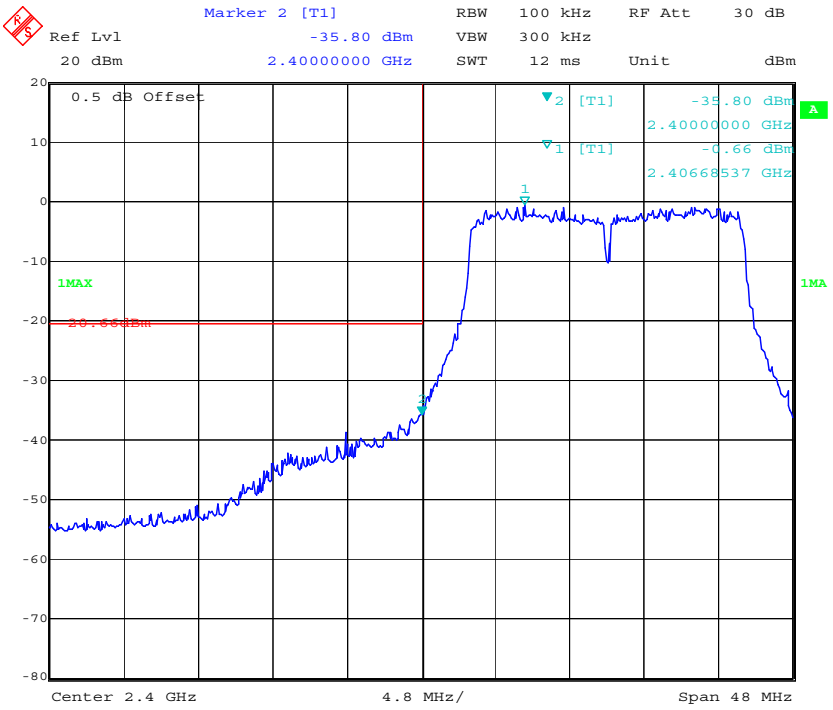


Date: 10.MAR.2017 19:47:44

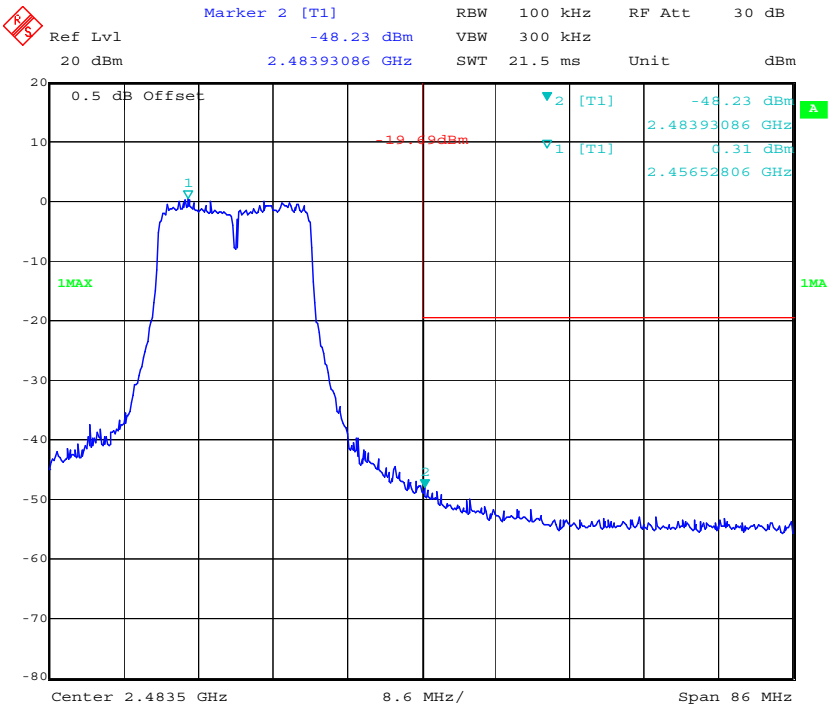
802.11g: Band Edge, Right Side



802.11n ht20 Band Edge, Left Side

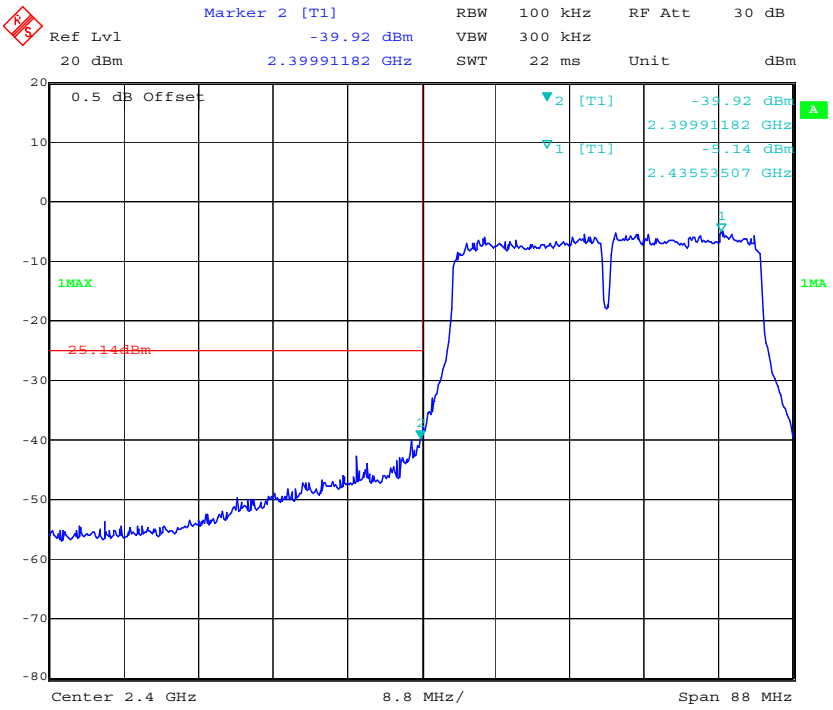


802.11n ht20 Band Edge, Right Side



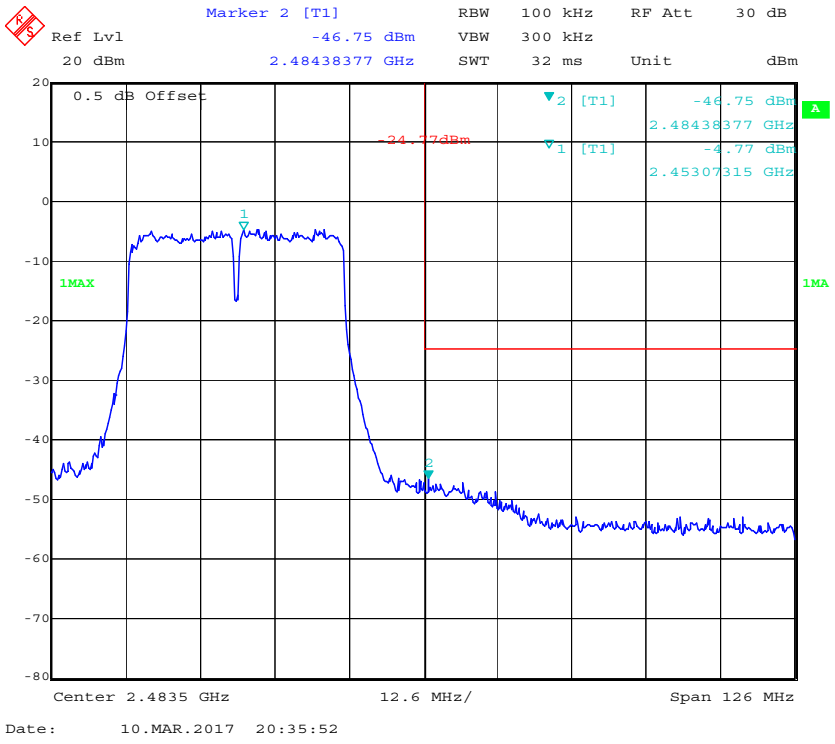
Date: 10.MAR.2017 20:22:38

802.11n ht40 Band Edge, Left Side



Date: 10.MAR.2017 20:27:27

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

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3×RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) 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	Signal Analyzer	FSIQ26	831929/005	2016-09-21	2017-09-20
N/A	RF Cable	N/A	N/A	Each Time	/

*** Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	25.6 °C
Relative Humidity:	48 %
ATM Pressure:	99.7 kPa

** The testing was performed by Lorin Bian on 2017-03-10.*

Test Mode: Transmitting

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

Test mode	Channel	Frequency (MHz)	PSD (dBm/3kHz)				Limit (dBm/3kHz)
			Chain 0	Chain 1	Chain 2	Chain 3	
802.11b	Low	2412	-11.57	-13.14	-13.11	-13.19	≤8
	Middle	2437	-11.8	-12.05	-12.29	-12.52	≤8
	High	2462	-11.63	-12.15	-12.35	-12.22	≤8
802.11g	Low	2412	-14.04	-14.72	-14.72	-14.48	≤8
	Middle	2437	-13.58	-14.67	-14.54	-14.55	≤8
	High	2462	-13.75	-14.1	-14.48	-13.99	≤8

Note: For 802.11b and 802.11g, only support SISO mode.

Test mode	Channel	Frequency (MHz)	PSD (dBm/3kHz)					Limit (dBm/3kHz)
			Chain 0	Chain 1	Chain 2	Chain 3	Total (Chain 0+1+2)	
802.11n20	Low	2412	-13.82	-15.05	-14.3	-14.18	-9.59	≤5.23
	Middle	2437	-13.74	-15	-14.09	-13.33	-9.47	≤5.23
	High	2462	-13.73	-14.77	-13.59	-13.49	-9.23	≤5.23
802.11n40	Low	2422	-17.15	-17.89	-17.69	-17.32	-12.79	≤5.23
	Middle	2437	-17.24	-17.74	-17.3	-17.55	-12.65	≤5.23
	High	2452	-17.74	-18.12	-17.2	-16.76	-12.90	≤5.23

Note: For 802.11n, SISO mode power is more than MIMO mode,so test with SISO mode and combine 3 chains more strict than MIMO mode.

The 3 antenna maximum atenna gains are 4.0 dBi, and employed Cyclic Delay Diversity (CDD) for 802.11 MIMO transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01, for power density measurements on IEEE 802.11 devices,

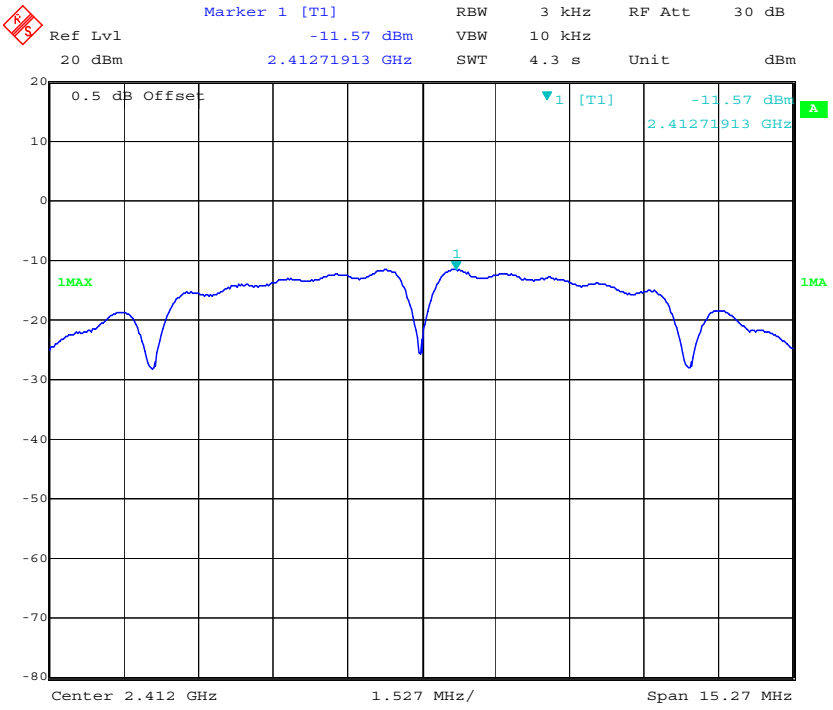
Array Gain = 10 log(NANT/NSS) dB.

So:

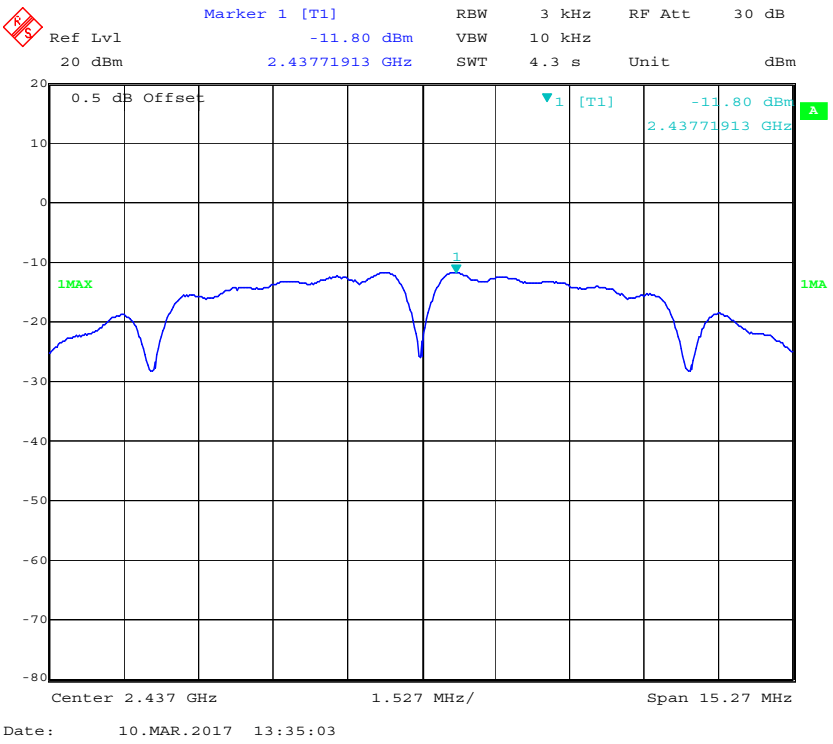
Directional gain = GANT + Array Gain = 4+10*log(3) =8.77 dBi

802.11b, Chain 0

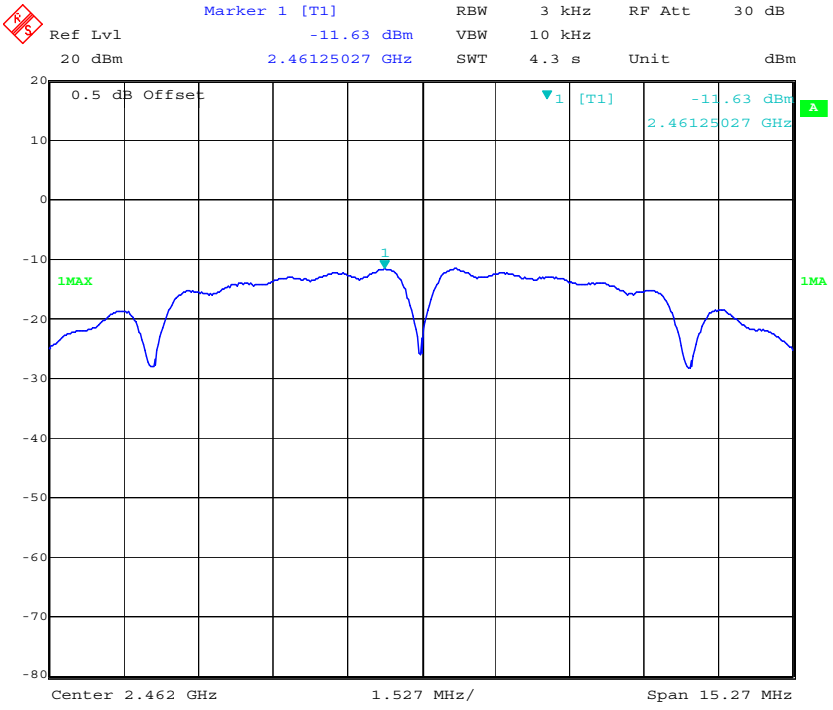
Power Spectral Density, 802.11b Low Channel



Power Spectral Density, 802.11b Middle Channel

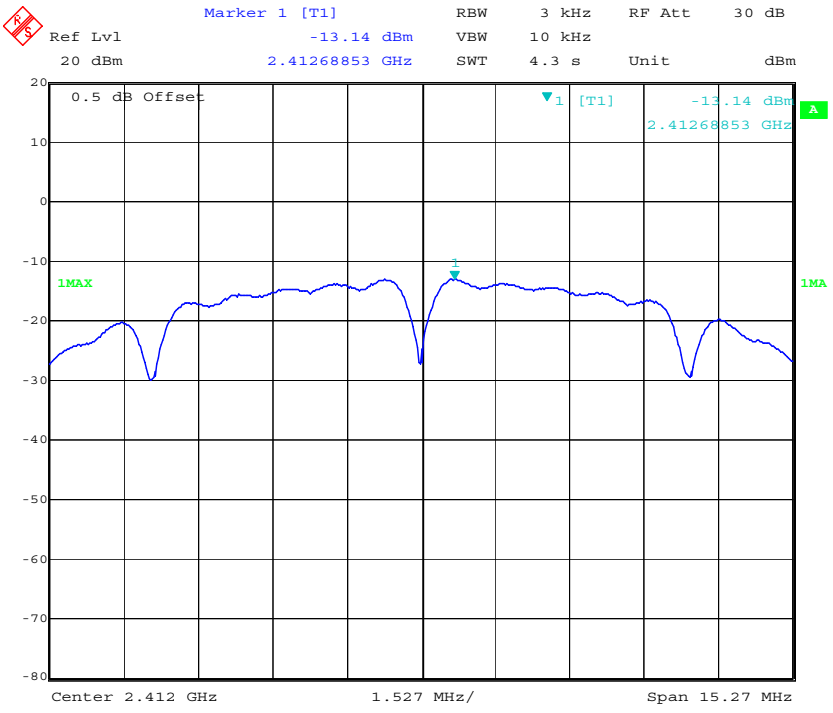


Power Spectral Density, 802.11b High Channel

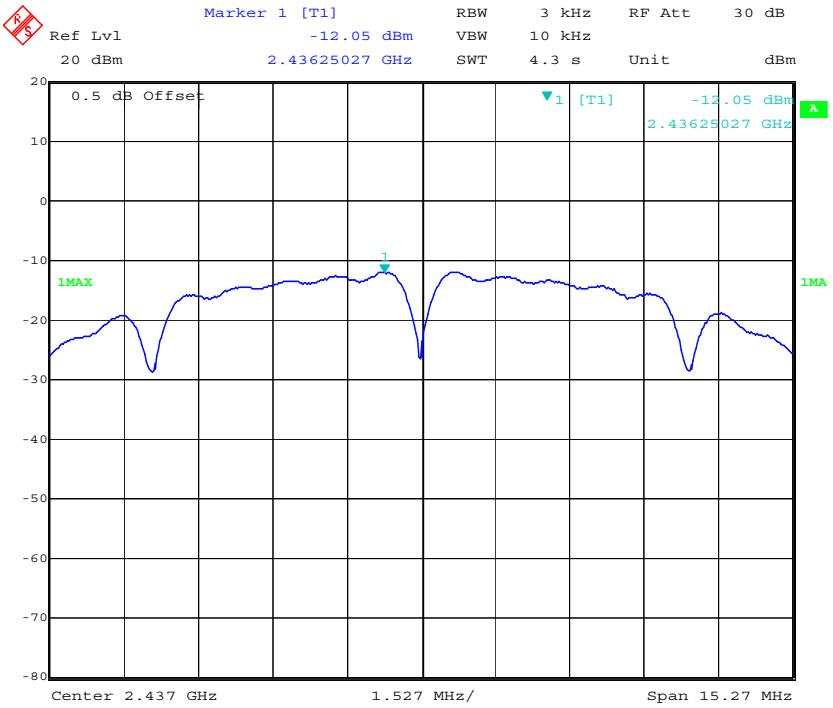


802.11b, Chain 1

Power Spectral Density, 802.11b Low Channel

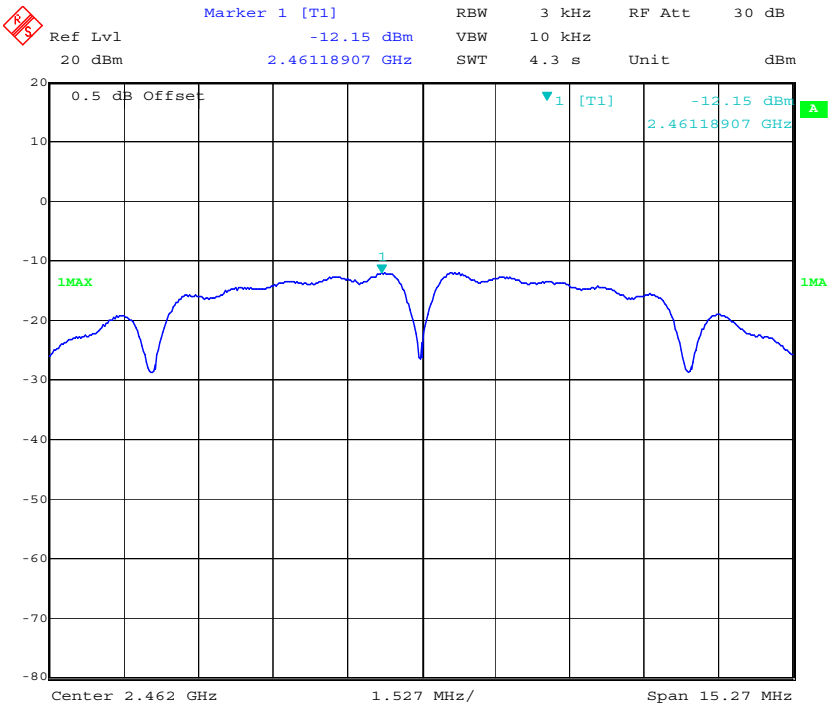


Power Spectral Density, 802.11b Middle Channel



Date: 10.MAR.2017 15:34:01

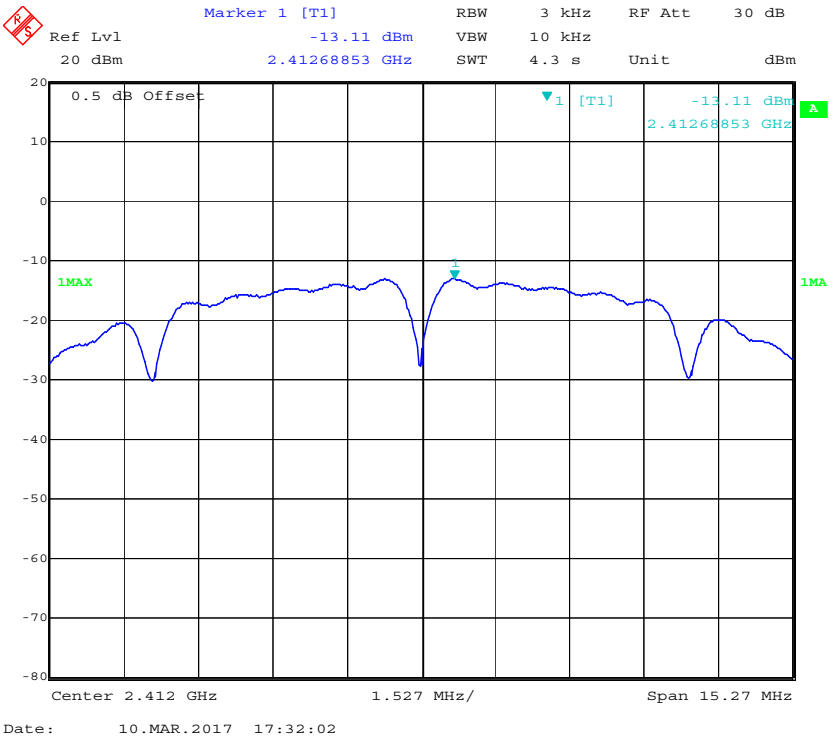
Power Spectral Density, 802.11b High Channel



Date: 10.MAR.2017 15:51:41

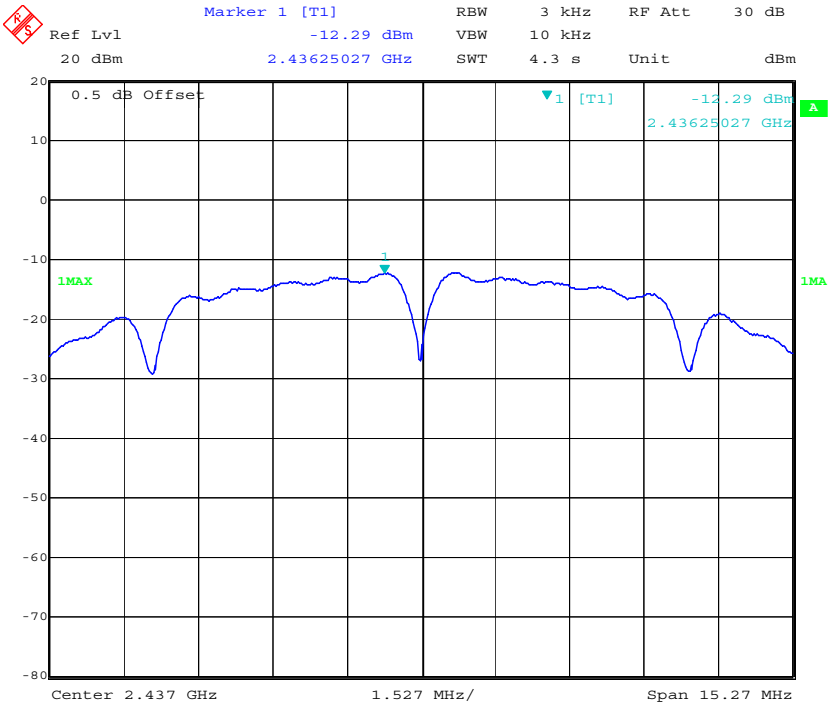
802.11b, Chain 2

Power Spectral Density, 802.11b Low Channel



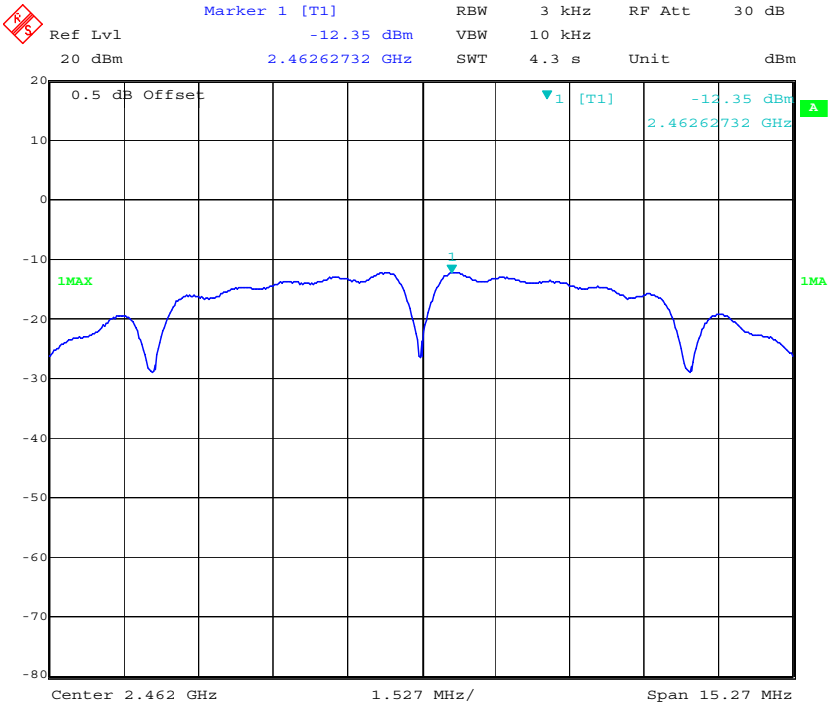
Date: 10.MAR.2017 17:32:02

Power Spectral Density, 802.11b Middle Channel



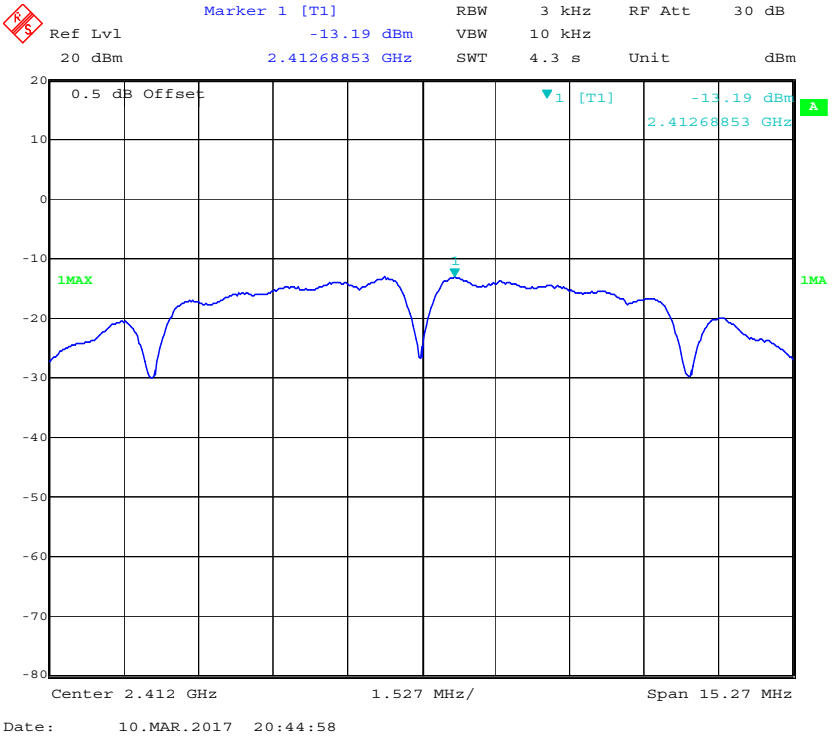
Date: 10.MAR.2017 17:35:21

Power Spectral Density, 802.11b High Channel

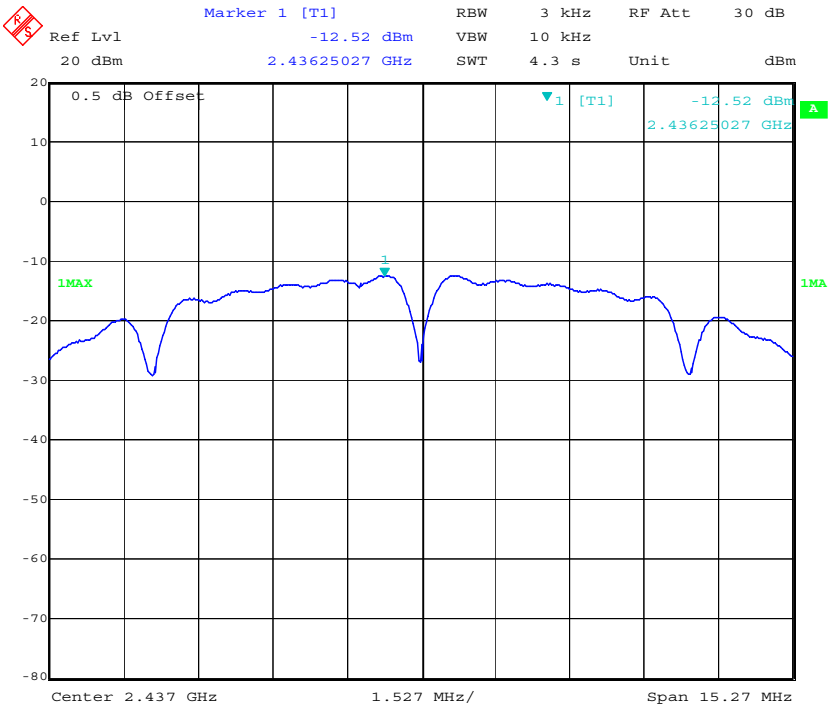


802.11b, Chain 3

Power Spectral Density, 802.11b Low Channel

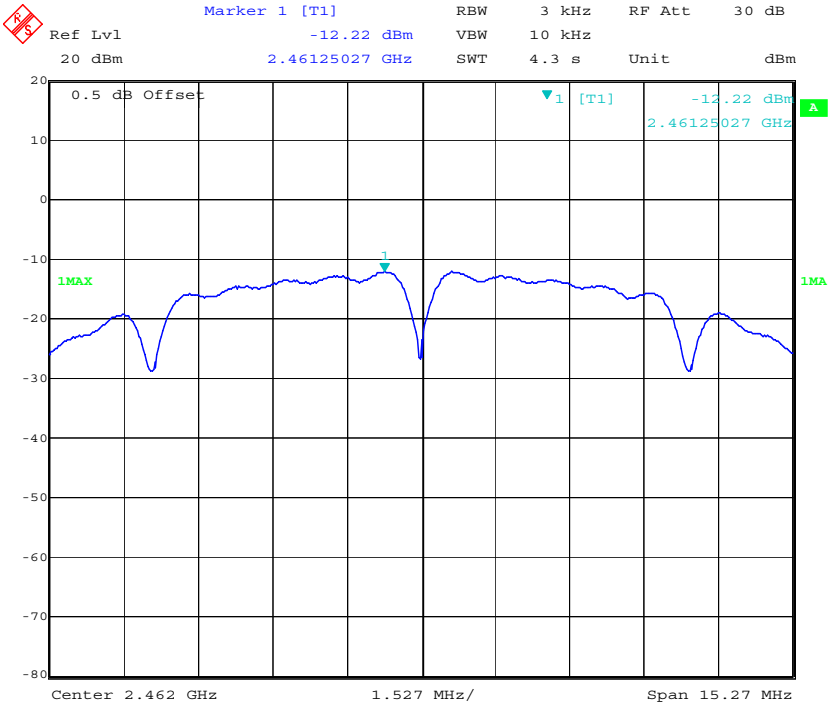


Power Spectral Density, 802.11b Middle Channel



Date: 10.MAR.2017 20:47:56

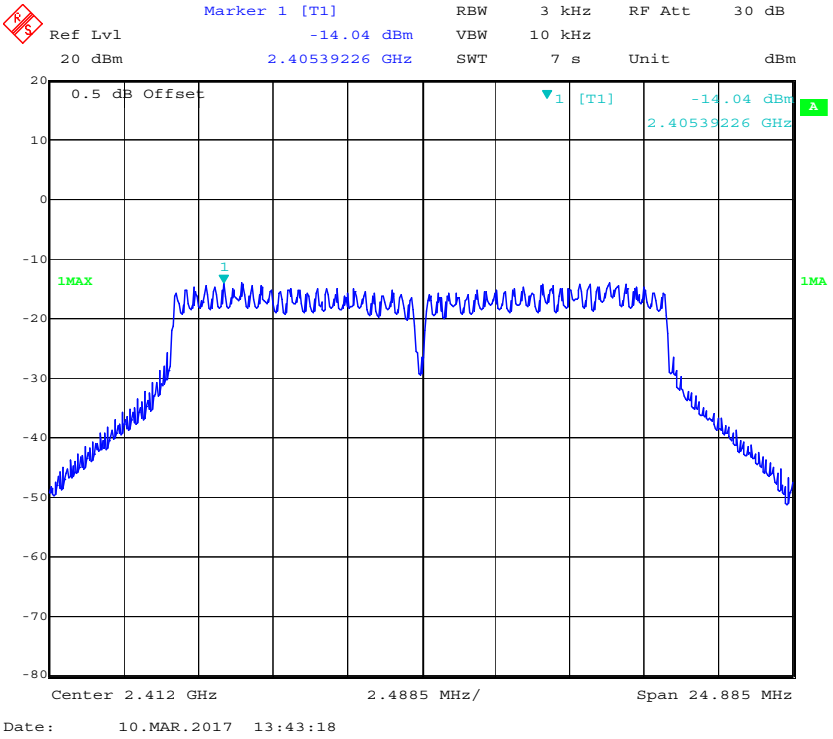
Power Spectral Density, 802.11b High Channel



Date: 10.MAR.2017 20:51:40

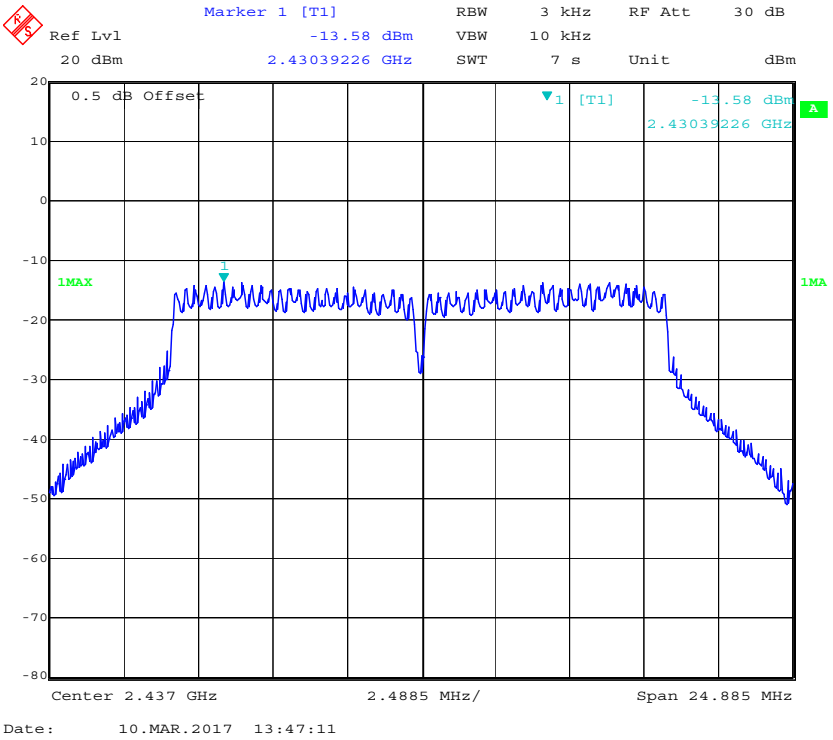
802.11g, Chain 0:

Power Spectral Density, 802.11g Low Channel



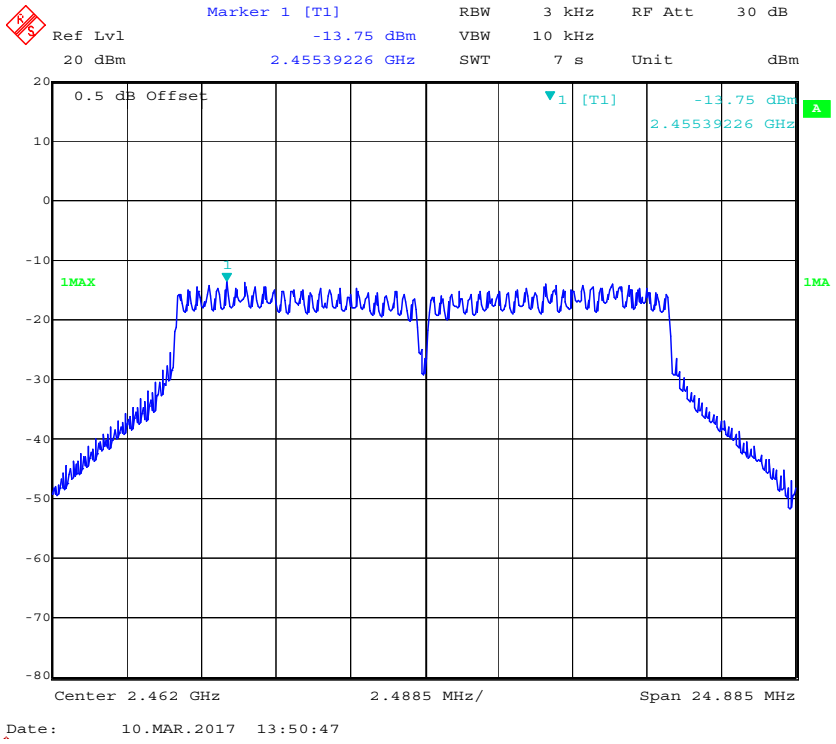
Date: 10.MAR.2017 13:43:18

Power Spectral Density, 802.11g Middle Channel



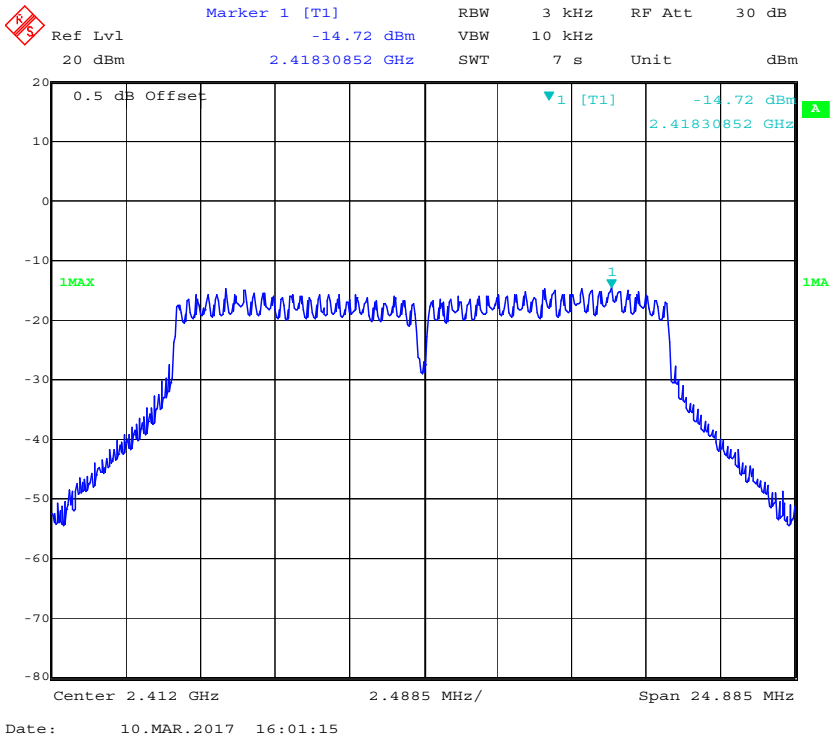
Date: 10.MAR.2017 13:47:11

Power Spectral Density, 802.11g High Channel

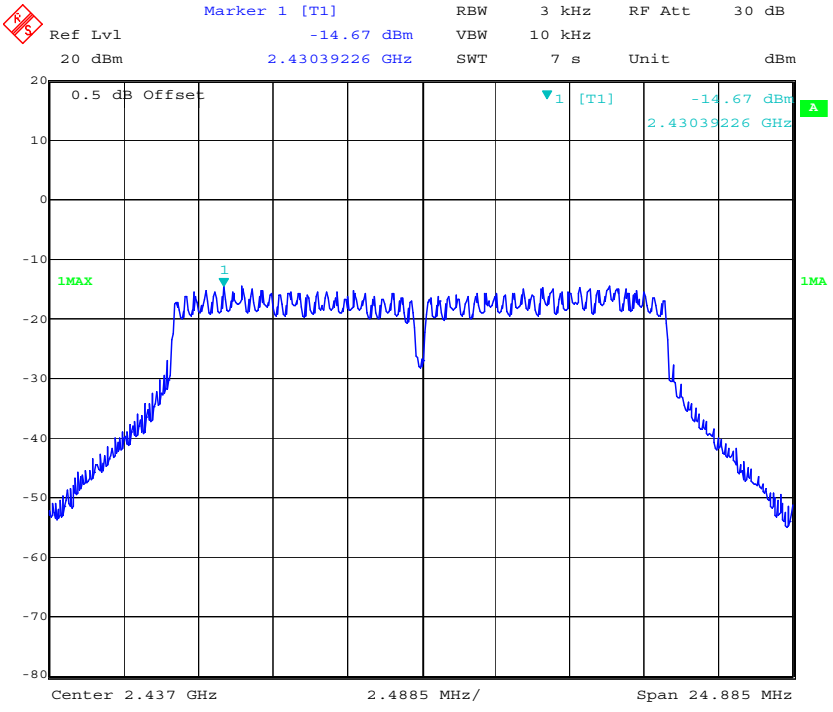


802.11g, Chain 1:

Power Spectral Density, 802.11g Low Channel

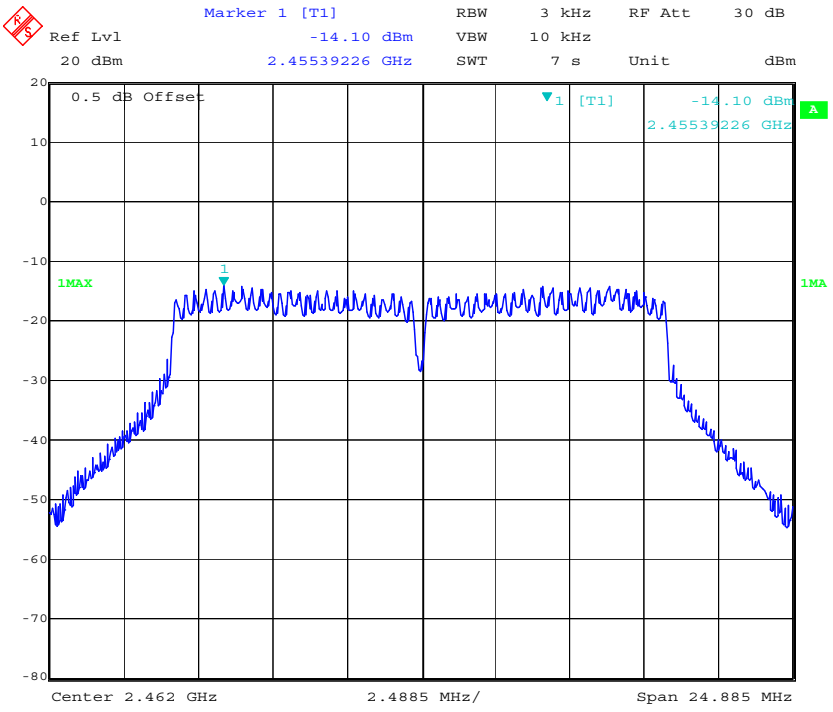


Power Spectral Density, 802.11g Middle Channel



Date: 10.MAR.2017 16:04:38

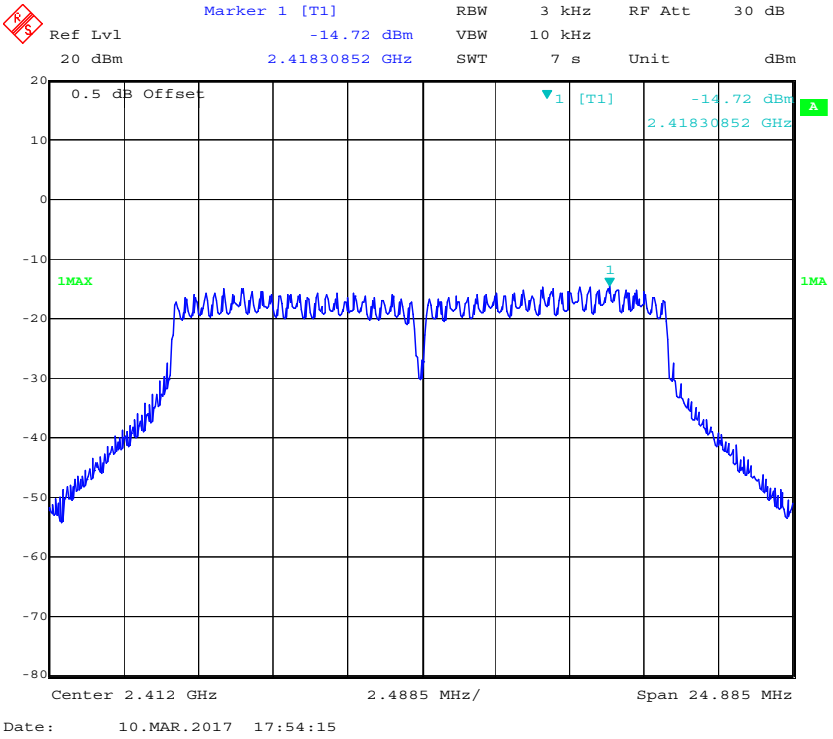
Power Spectral Density, 802.11g High Channel



Date: 10.MAR.2017 16:07:35

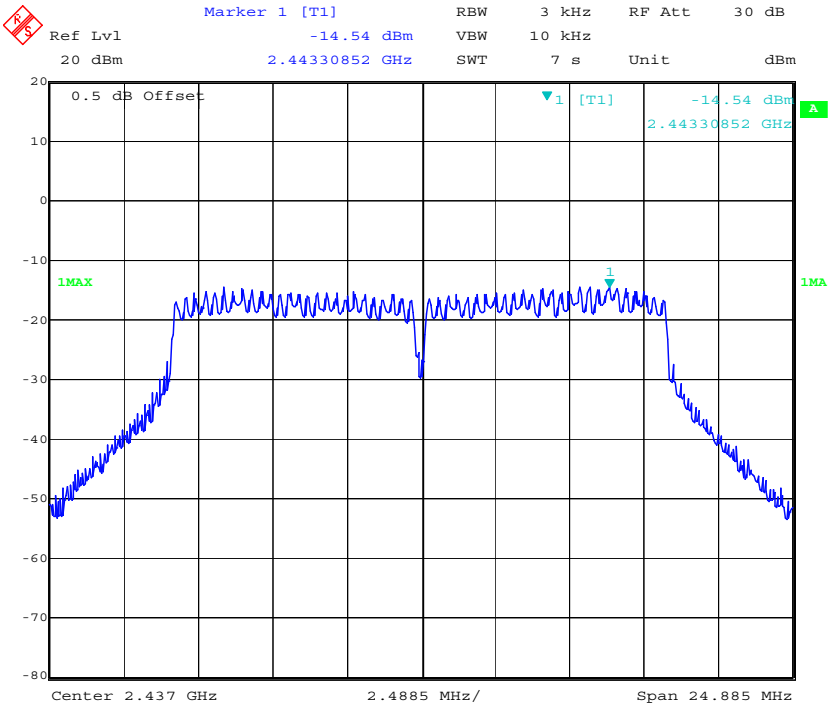
802.11g, Chain 2:

Power Spectral Density, 802.11g Low Channel

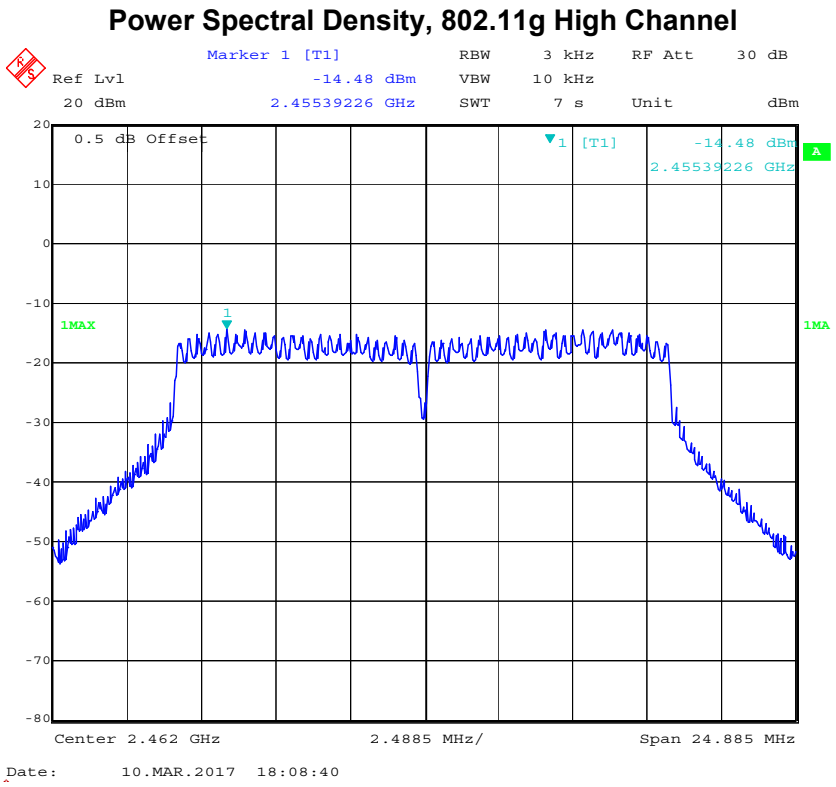


Date: 10.MAR.2017 17:54:15

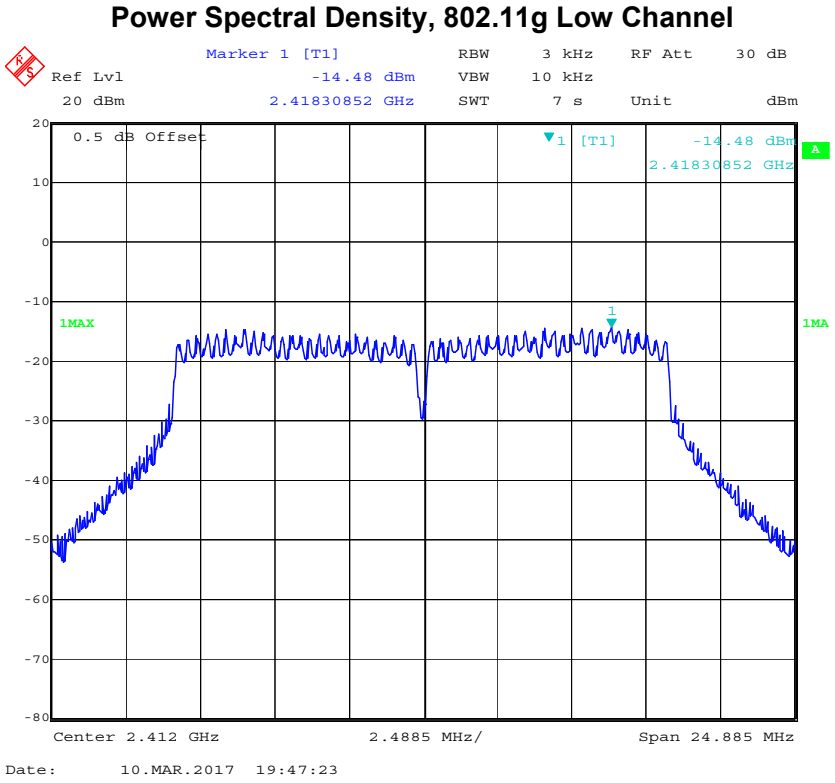
Power Spectral Density, 802.11g Middle Channel



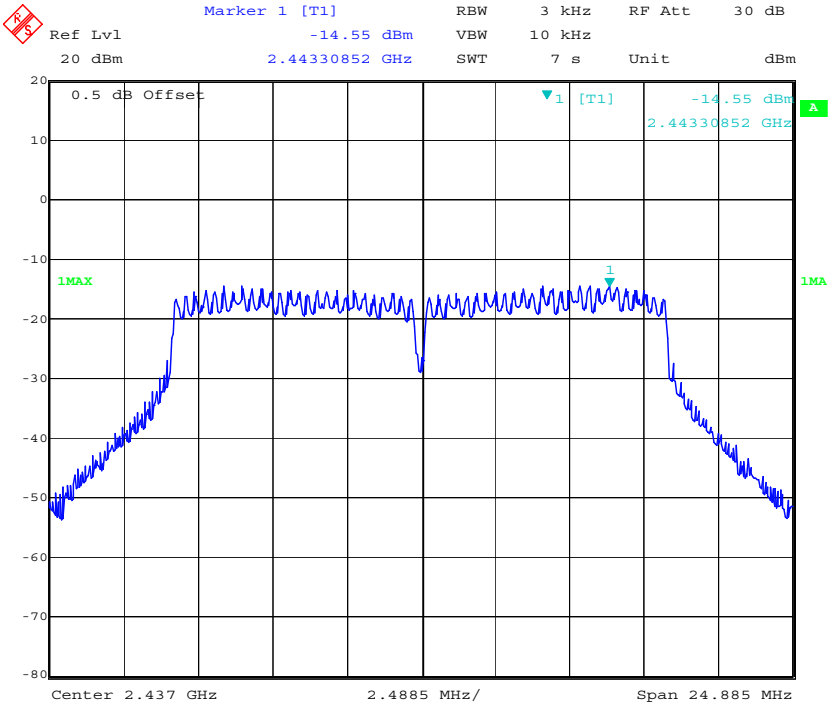
Date: 10.MAR.2017 18:01:31



802.11g, Chain 3:

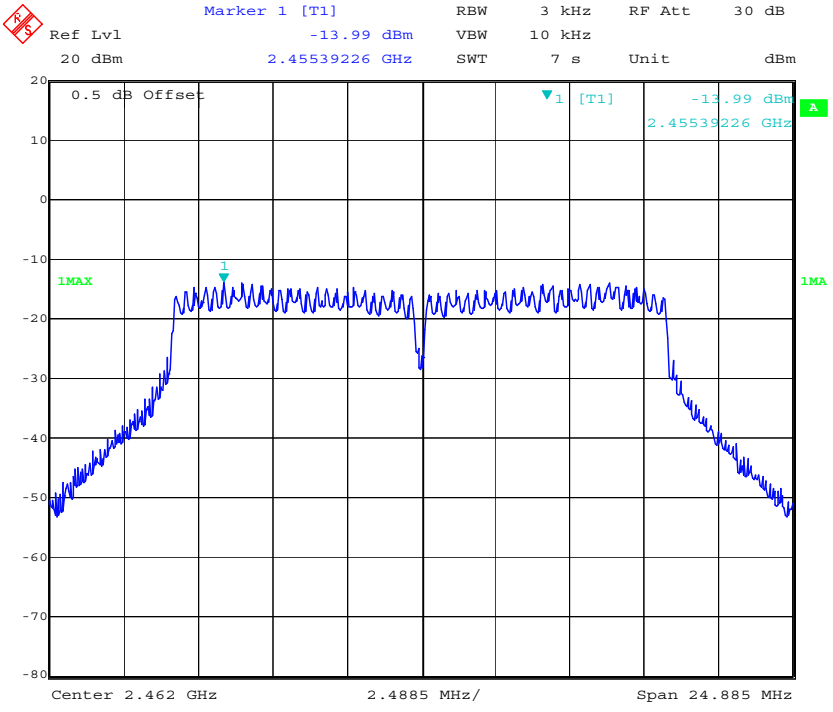


Power Spectral Density, 802.11g Middle Channel



Date: 10.MAR.2017 19:54:07

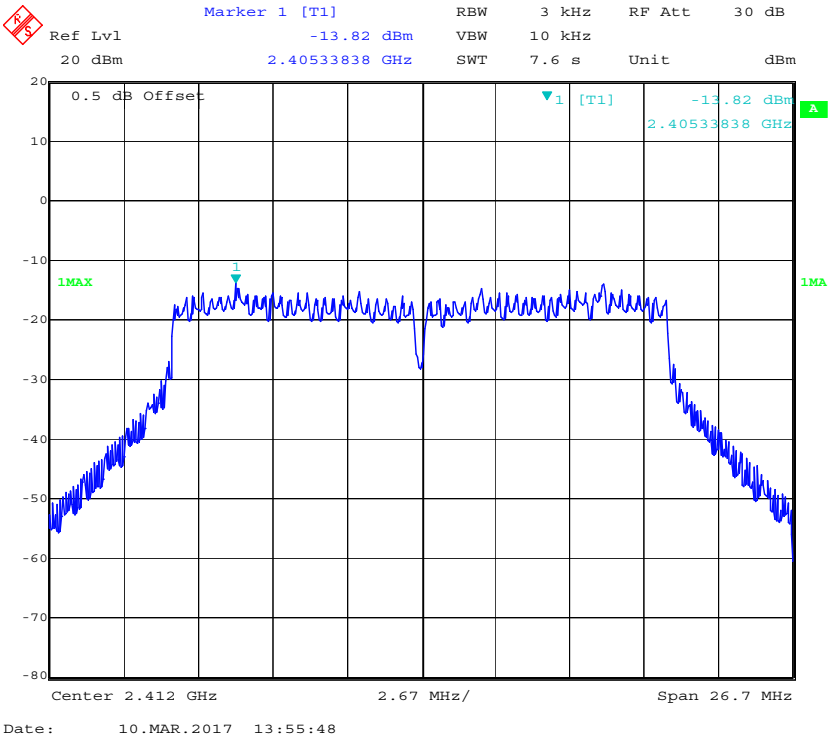
Power Spectral Density, 802.11g High Channel



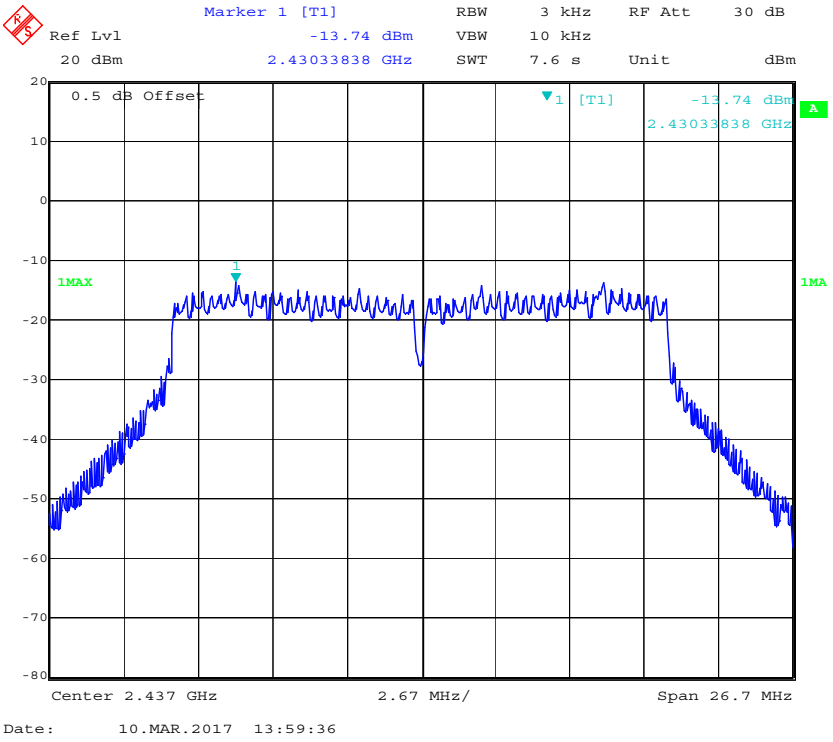
Date: 10.MAR.2017 19:59:10

802.11n ht20, Chain 0:

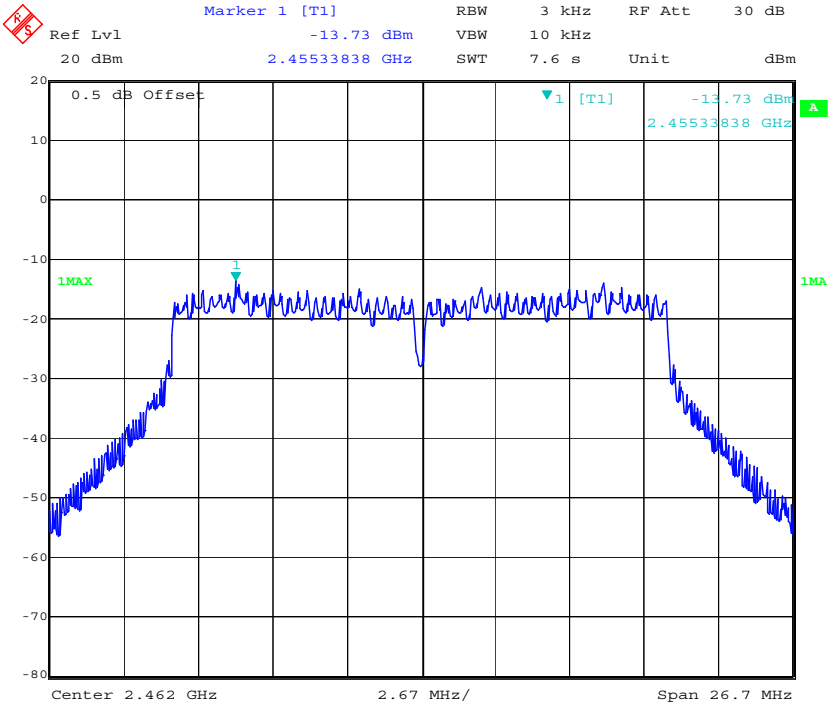
Power Spectral Density, 802.11n ht20 Low Channel



Power Spectral Density, 802.11n ht20 Middle Channel

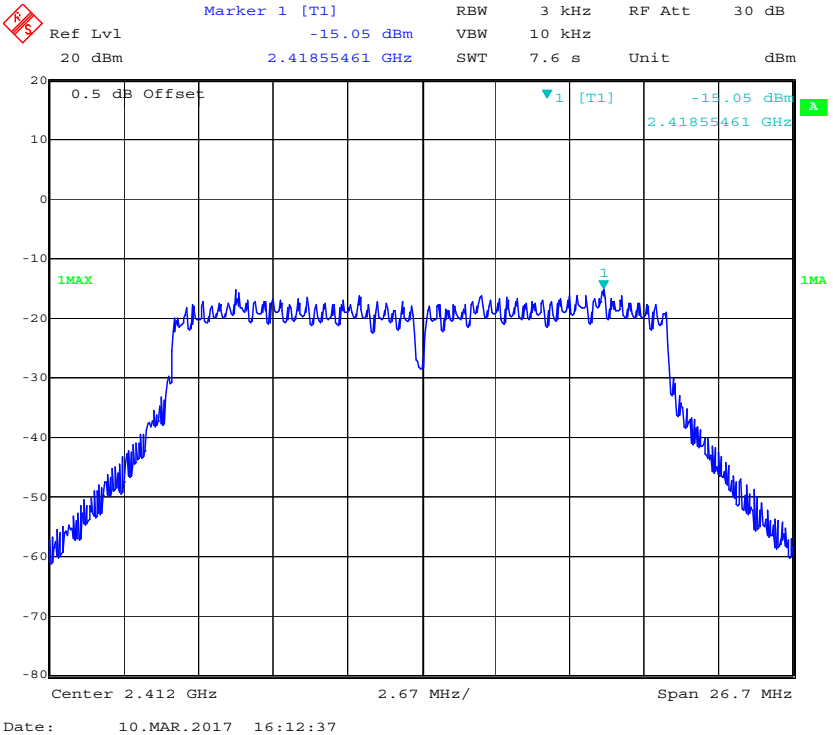


Power Spectral Density, 802.11n ht20 High Channel

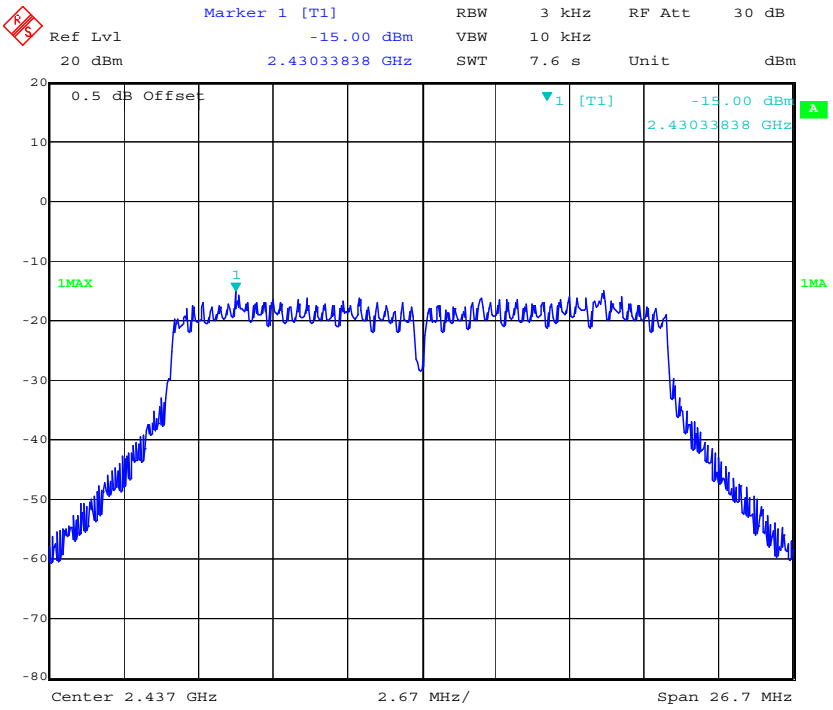


802.11n ht20, Chain 1:

Power Spectral Density, 802.11n ht20 Low Channel

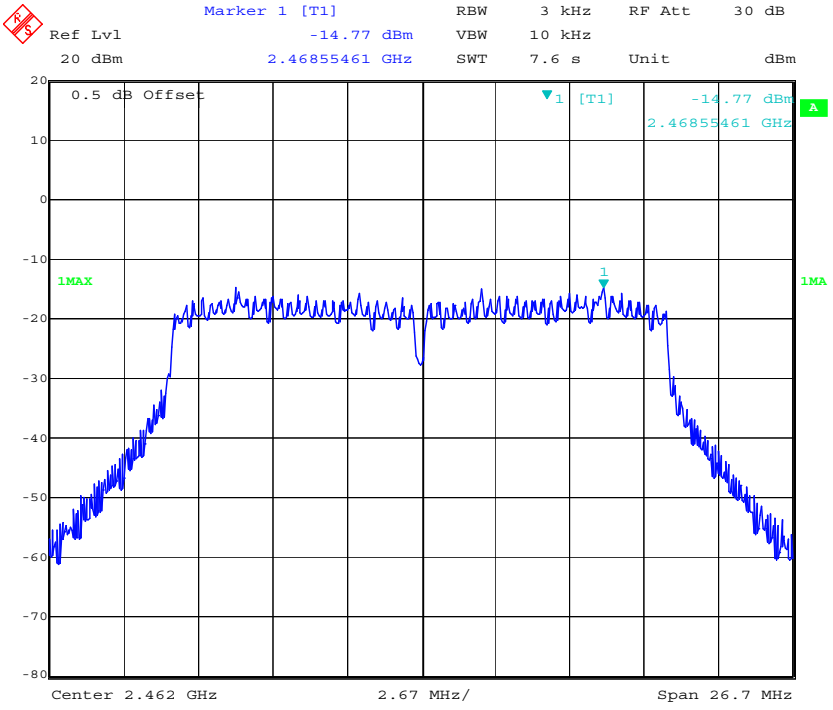


Power Spectral Density, 802.11n ht20 Middle Channel



Date: 10.MAR.2017 16:16:04

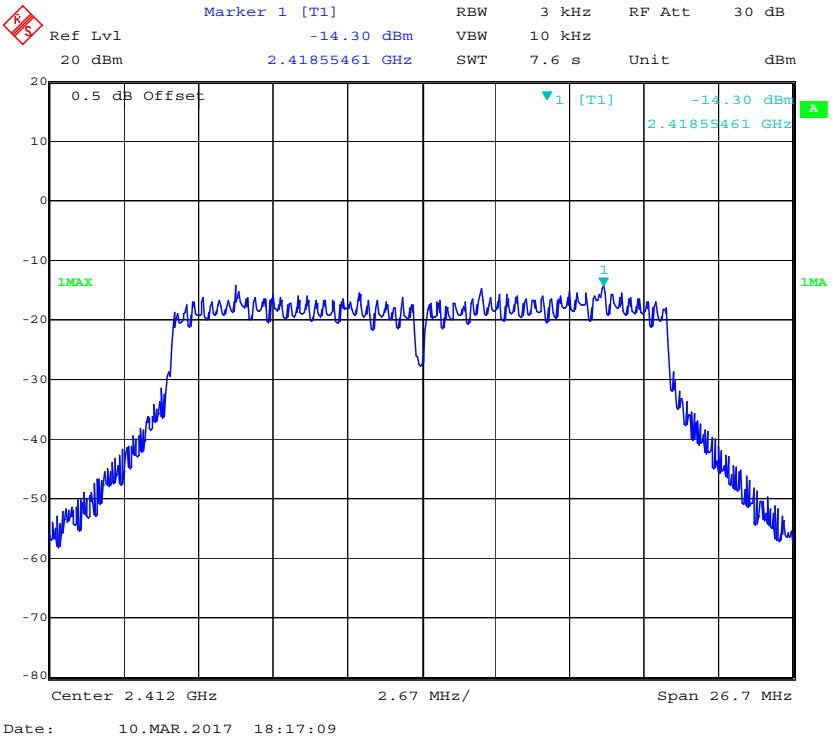
Power Spectral Density, 802.11n ht20 High Channel



Date: 10.MAR.2017 16:19:03

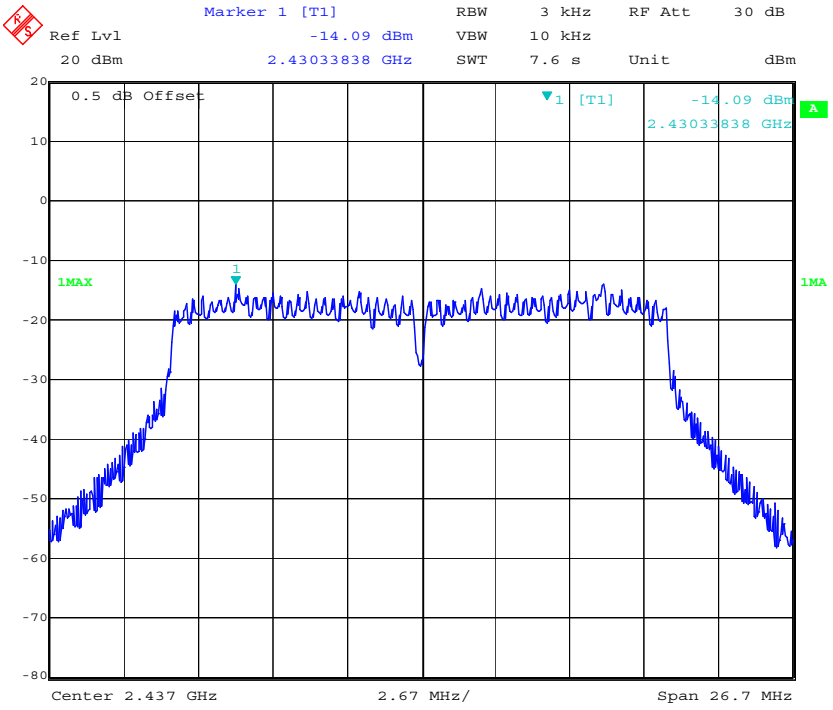
802.11n ht20, Chain 2:

Power Spectral Density, 802.11n ht20 Low Channel



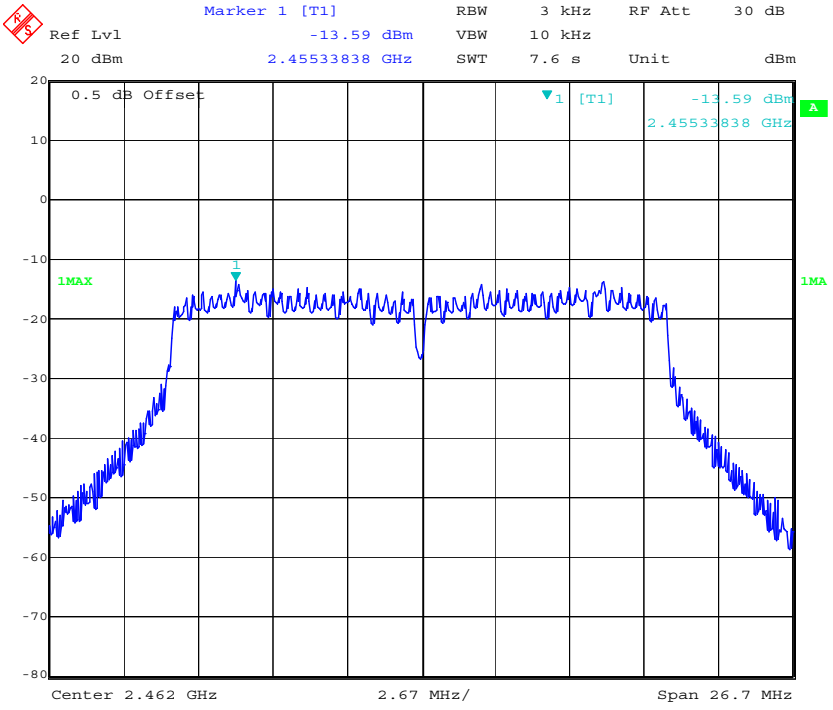
Date: 10.MAR.2017 18:17:09

Power Spectral Density, 802.11n ht20 Middle Channel



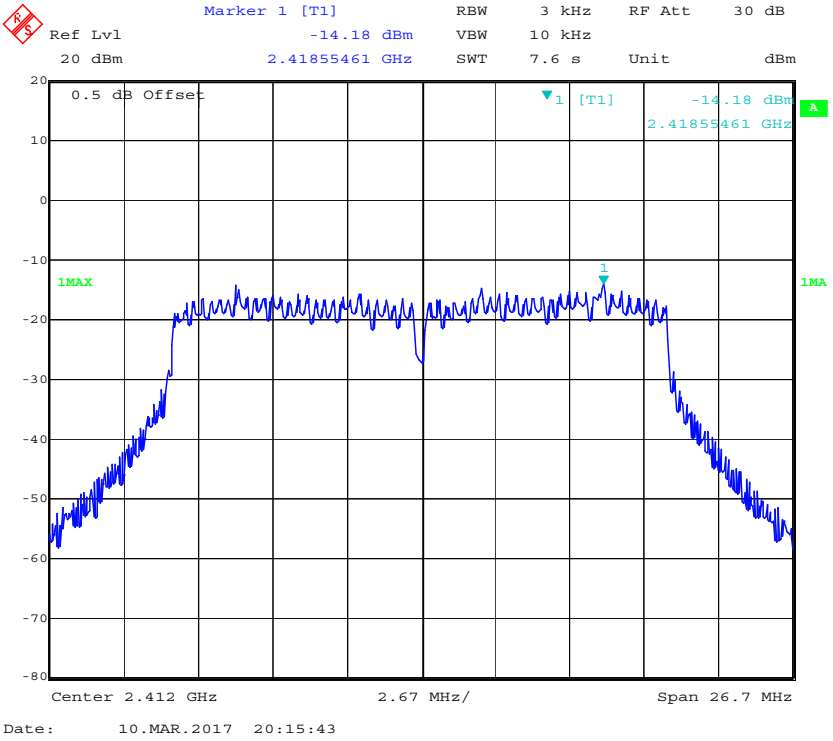
Date: 10.MAR.2017 18:24:28

Power Spectral Density, 802.11n ht20 High Channel

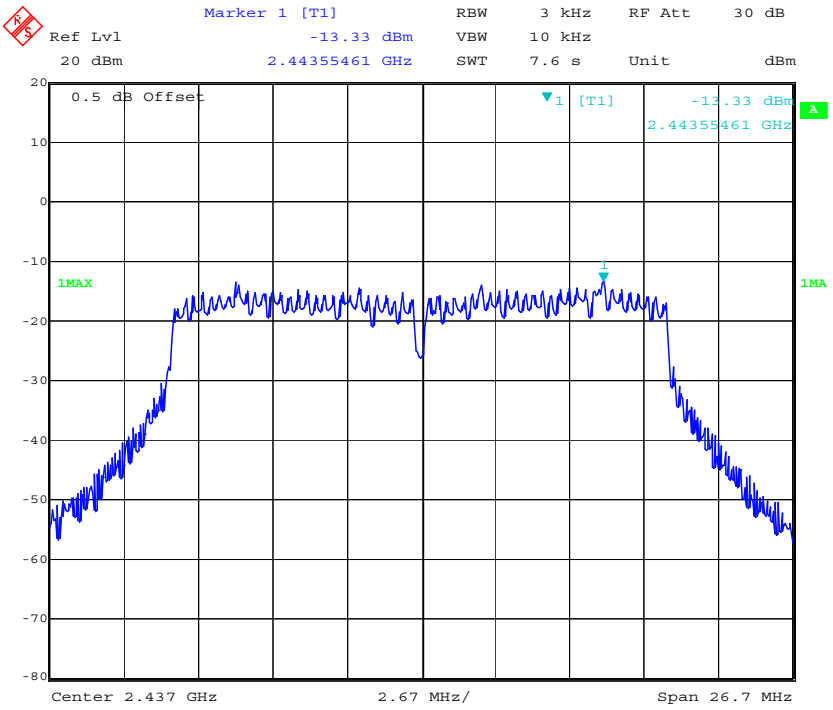


802.11n ht20, Chain 3:

Power Spectral Density, 802.11n ht20 Low Channel

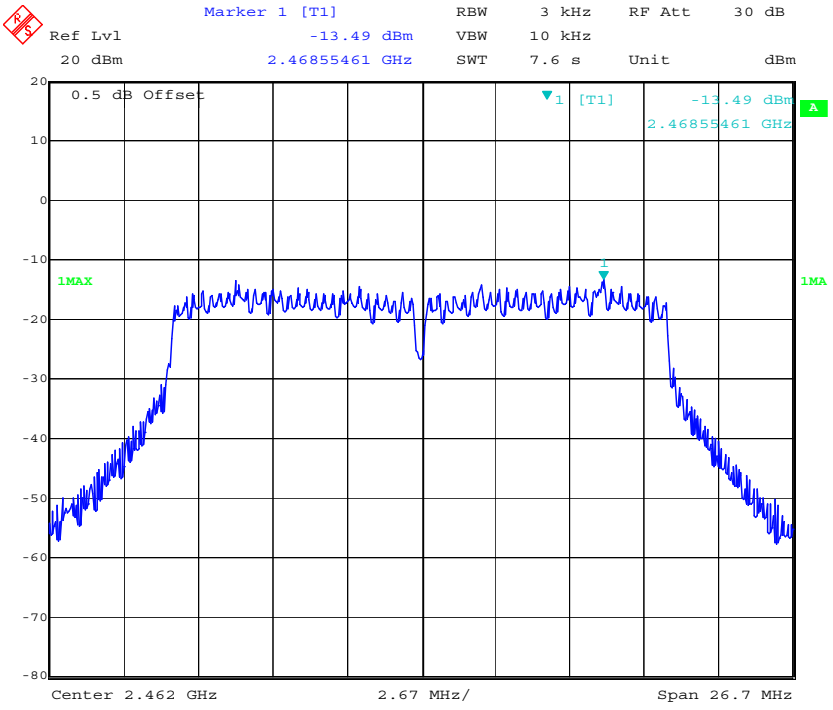


Power Spectral Density, 802.11n ht20 Middle Channel



Date: 10.MAR.2017 20:19:15

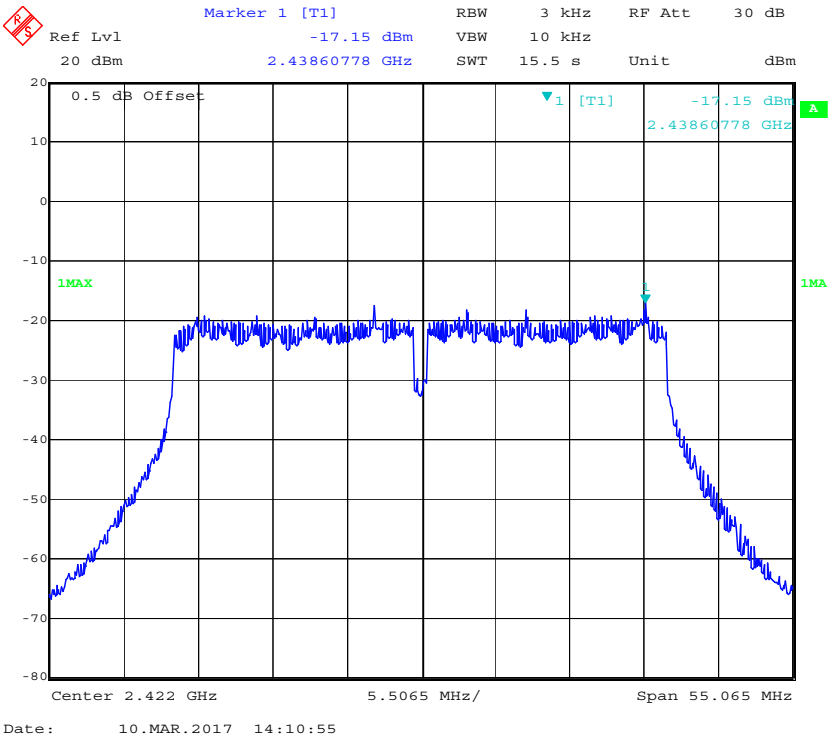
Power Spectral Density, 802.11n ht20 High Channel



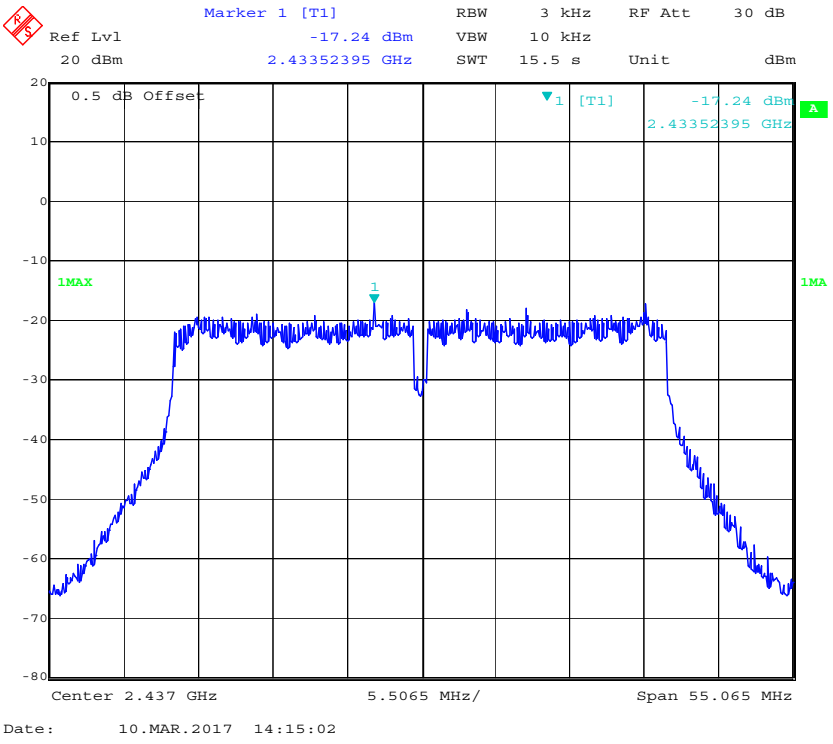
Date: 10.MAR.2017 20:22:10

802.11n ht40, Chain 0:

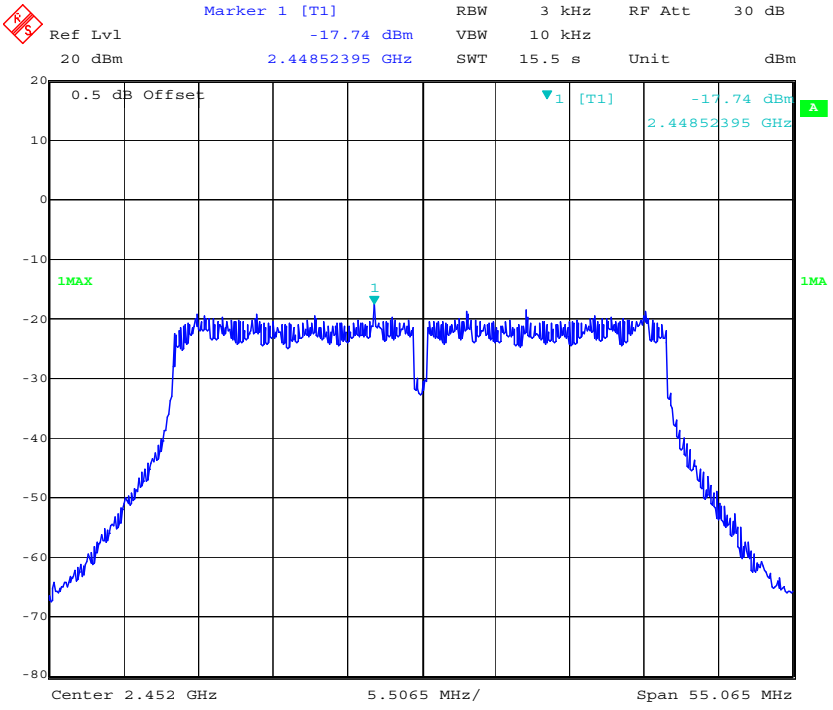
Power Spectral Density, 802.11n ht40 Low Channel



Power Spectral Density, 802.11n ht40 Middle Channel

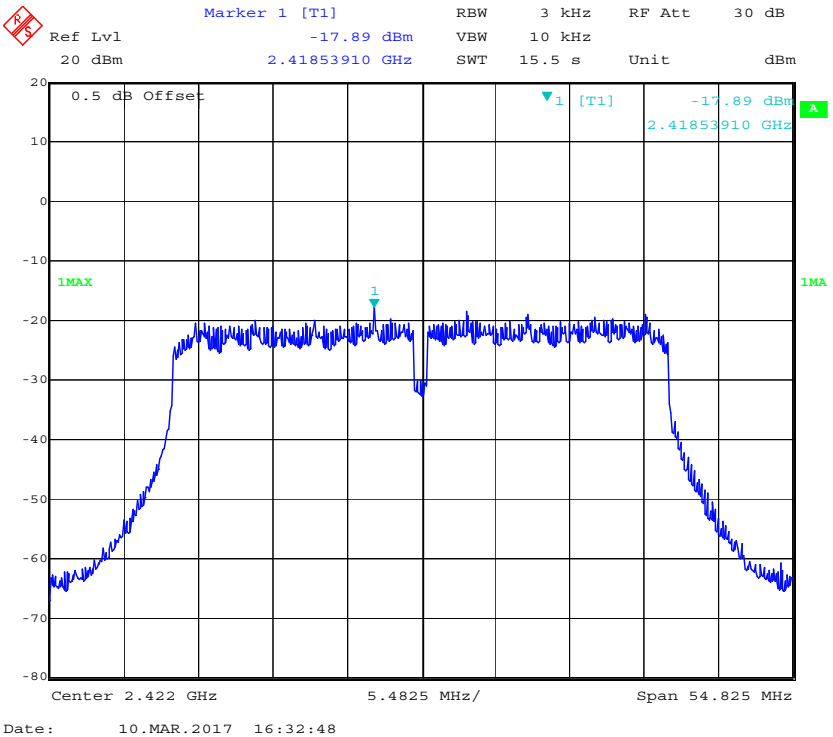


Power Spectral Density, 802.11n ht40 High Channel

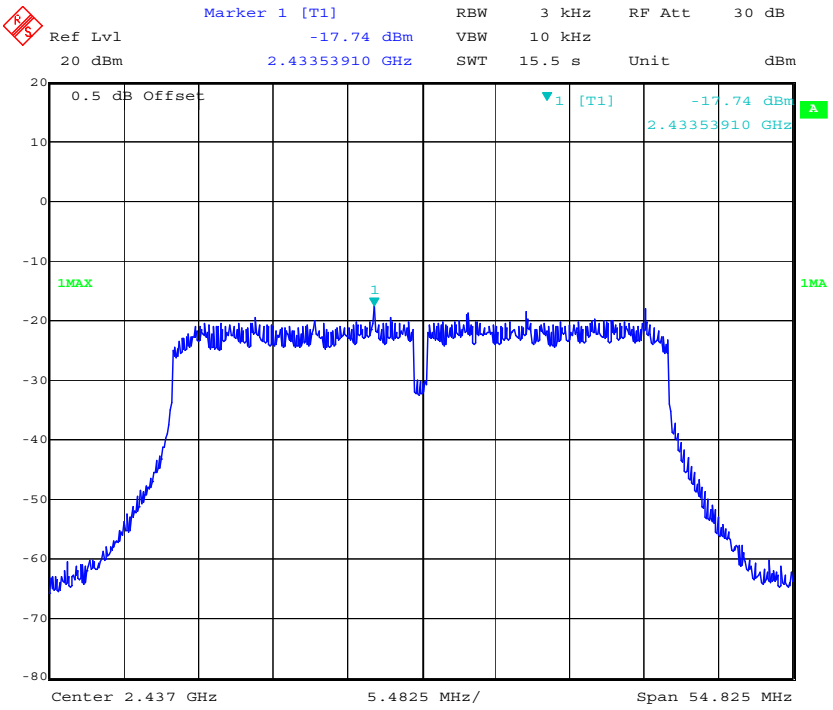


802.11n ht40,Chain 1:

Power Spectral Density, 802.11n ht40 Low Channel

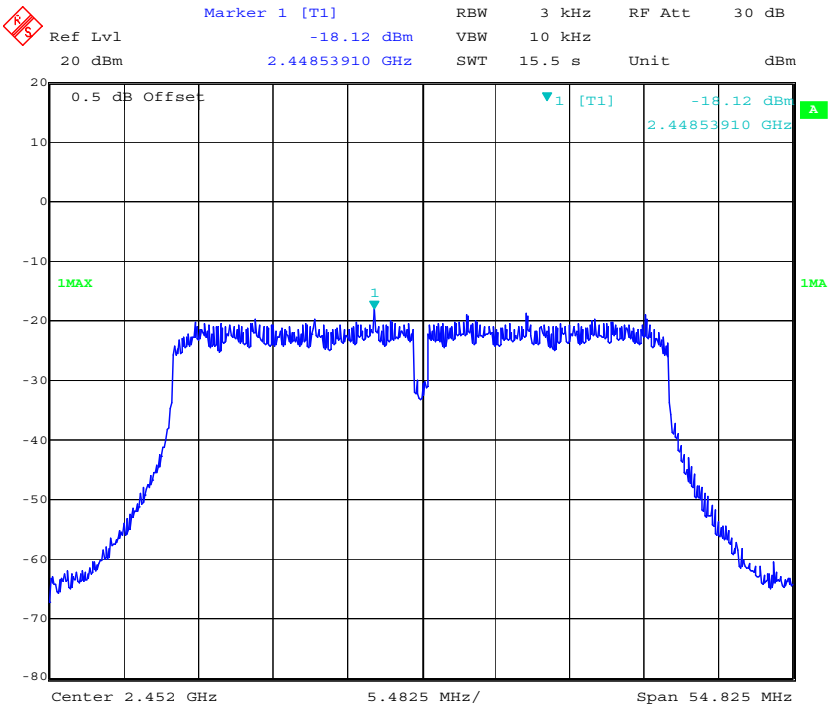


Power Spectral Density, 802.11n ht40 Middle Channel



Date: 10.MAR.2017 16:37:10

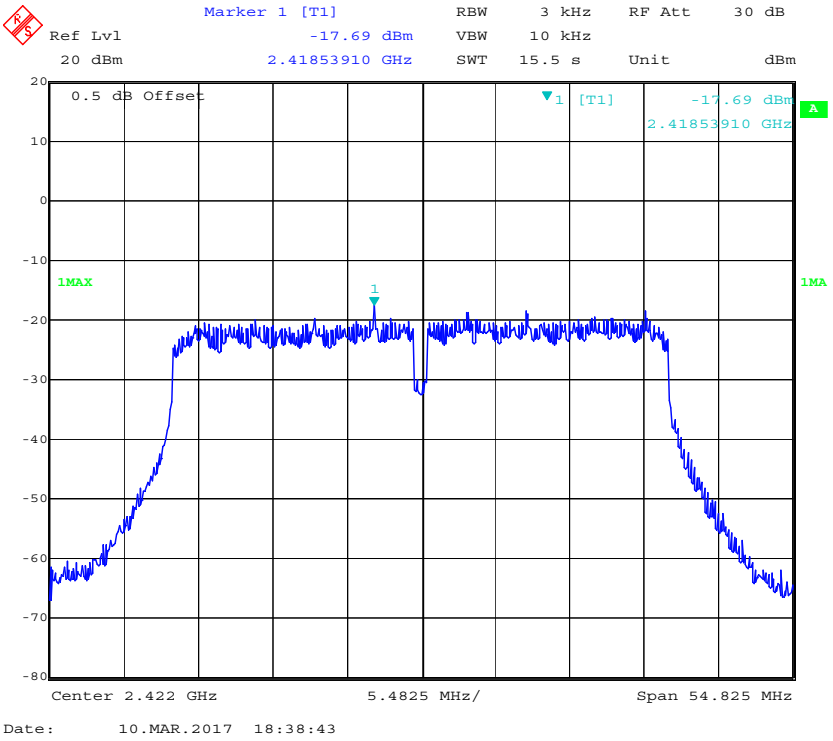
Power Spectral Density, 802.11n ht40 High Channel



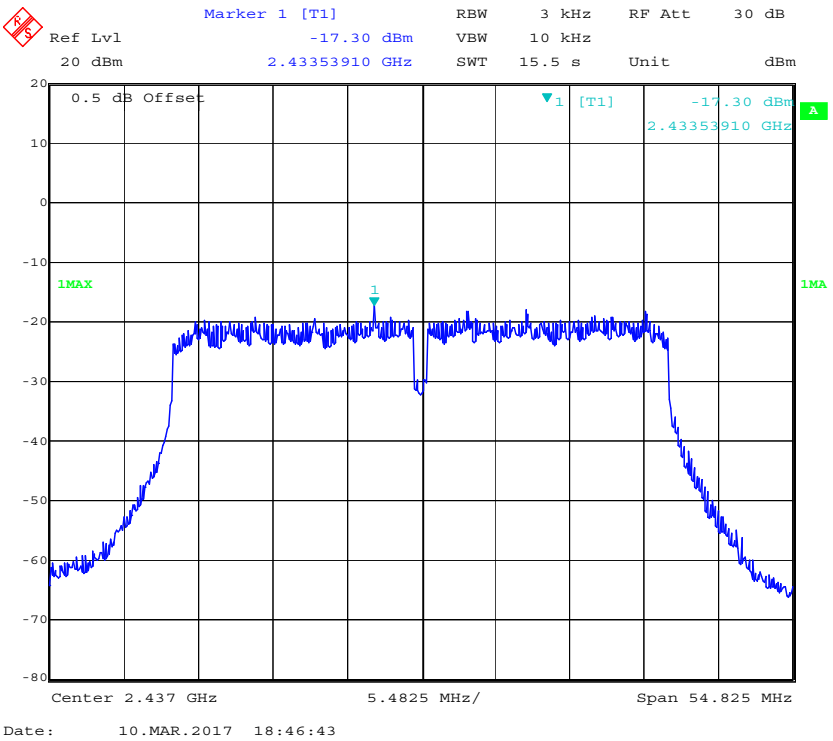
Date: 10.MAR.2017 17:03:11

802.11n ht40,Chain 2:

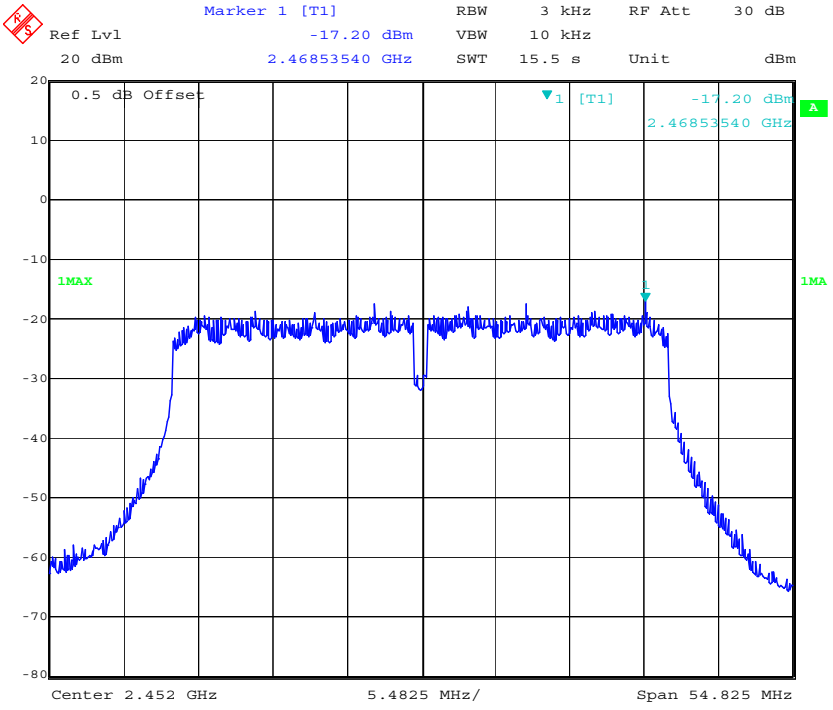
Power Spectral Density, 802.11n ht40 Low Channel



Power Spectral Density, 802.11n ht40 Middle Channel

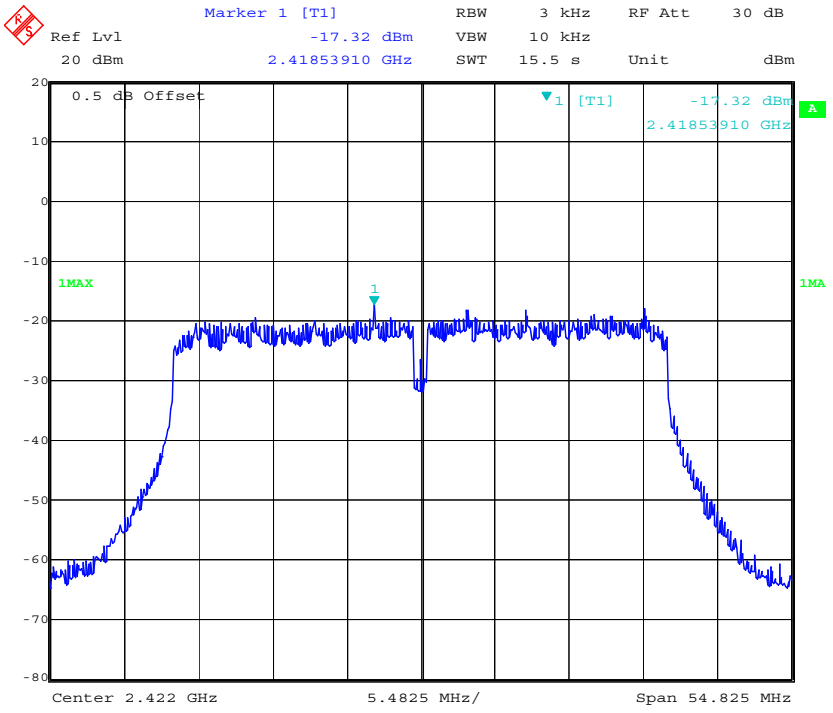


Power Spectral Density, 802.11n ht40 High Channel

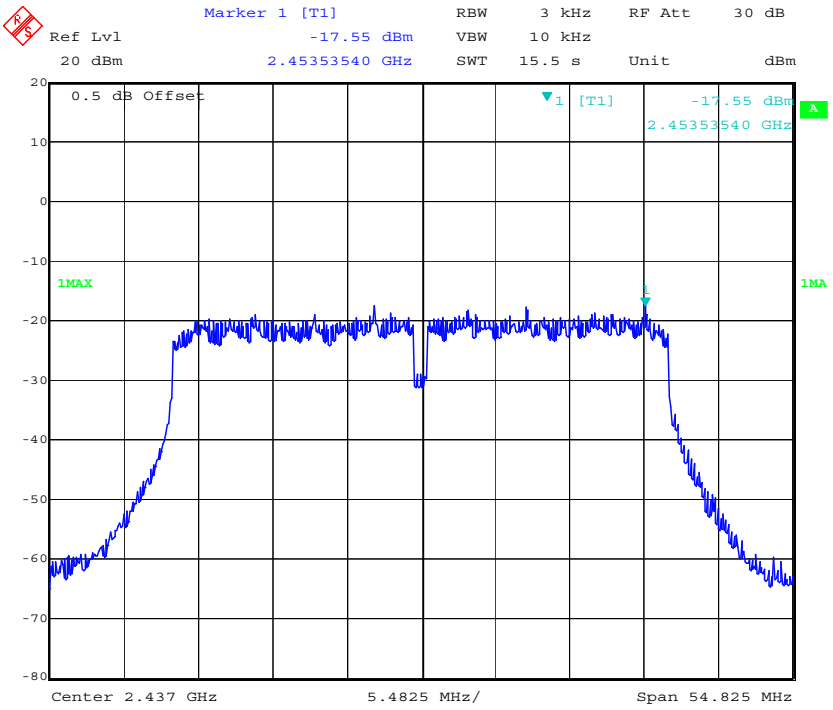


802.11n ht40,Chain 3:

Power Spectral Density, 802.11n ht40 Low Channel



Power Spectral Density, 802.11n ht40 Middle Channel



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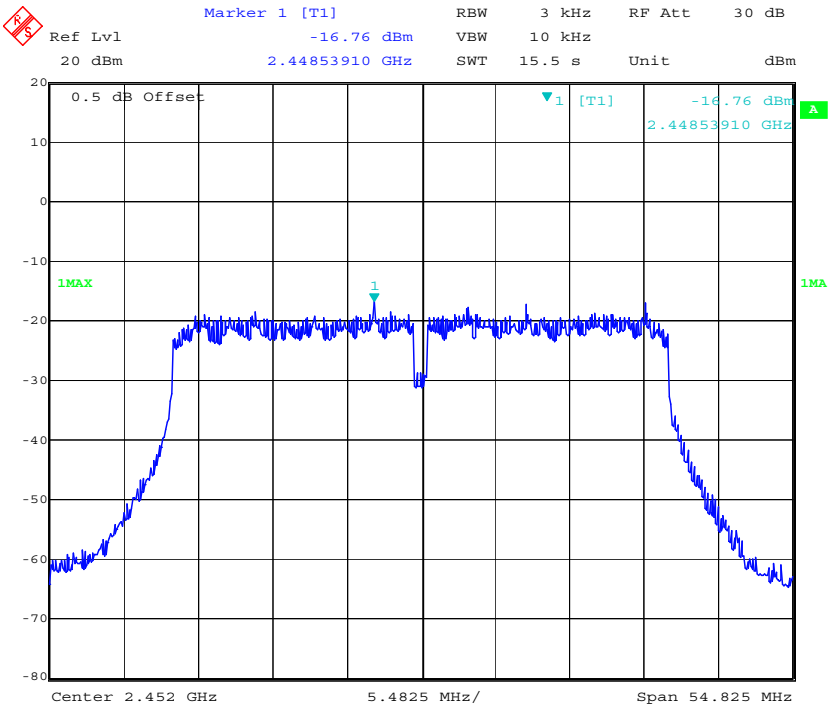
Power Spectral Density, 802.11n ht40 High Channel



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