FCC PART 15.247

TEST REPORT

For

ZIONCOM ELECTRONICS (SHENZHEN) LTD.

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FCC ID: X7DWX009

Report Type:	**Product Name:**
Original Report	AC1200 Dual Band Wi-Fi Range Extender

Report Number:	RDG170930001-00B
Report Date:	2017-11-06
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The ***ZIONCOM ELECTRONICS (SHENZHEN) LTD.***'s product, model number: ***EX1200M (FCC ID: X7DWX009)*** (the "EUT") in this report was an ***AC1200 Dual Band Wi-Fi Range Extender,*** which was measured approximately: 11.7cm(L)*6.6cm(W)*4.8cm(H) without antenna, 11.7cm(L)*6.6cm(W)*22.1cm(H) with antenna, rated power: AC 100V~240V / 50~60Hz 0.1A.

Note:The EUT have two type of antenna, the two type of antenna is only appearance difference. The series product, model EX1200M , WX009 are electrically identical, the difference between them is model name, we selected EX1200M for testing, the detail was explained in the attached declaration letter.

**All measurement and test data in this report was gathered from production sample serial number: 170930001 (Assigned by BACL,Dongguan). The EUT was received on 2017-10-09.*

Objective

This report is prepared on behalf of ***ZIONCOM ELECTRONICS (SHENZHEN) LTD.*** in accordance with Part 2, Subpart J, Part 15, Subparts A, and C of the Federal Communications Commission's rules.

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

Related Submittal(s)/Grant(s)

FCC Part 15E NII submissions with FCC ID: X7DWX009.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and KDB 558074 D01 DTS Meas Guidance v04.

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

Measurement Uncertainty

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

Test Facility

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

Bay Area Compliance Laboratories Corp. (Dongguan) has been accredited to ISO/IEC 17025 by CNAS(Lab code: L5662). And accredited to ISO/IEC 17025 by NVLAP(Test Laboratory Accreditation Certificate Number 500069-0), the FCC Designation No. CN5002 under the KDB 974614 D01.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Bay Area Compliance Laboratories Corp. (Dongguan) was registered with ISED Canada under ISED Canada Registration Number 3062D.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

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

The device has 2 external antennas for 2.4GHz and 5GHz. For 2.4GHz band, 11 channels are provided:

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

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

The device supports SISO and MIMO mode at 802.11n ht20 and 802.11n ht40 mode, per pre-test, MIMO mode was the worst and reported.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

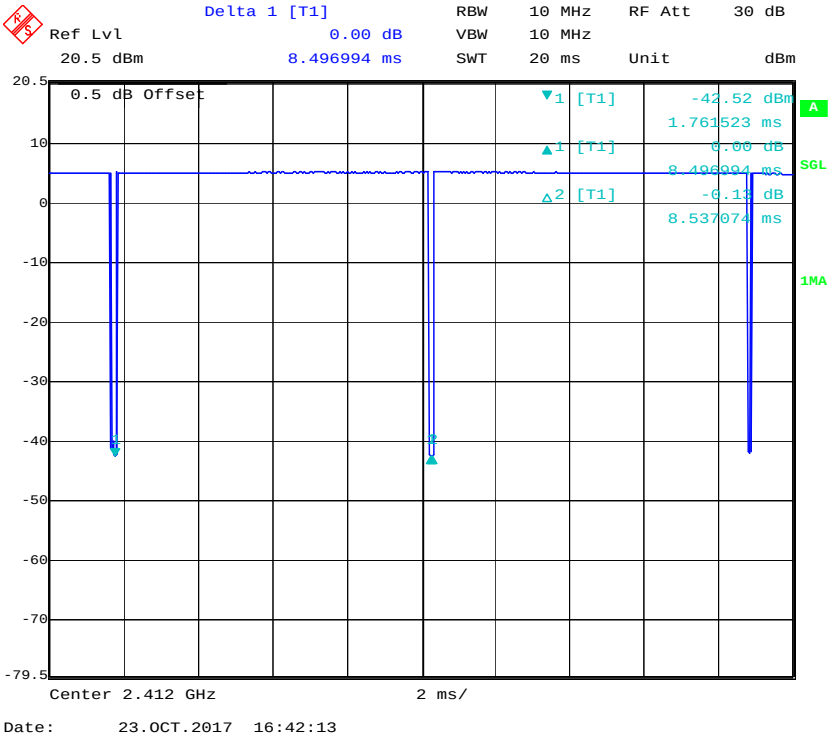
The software "QATool_Dbg" was used for testing, which was provided by manufacturer. The worst-case data rates are determined to be as follows for each mode based upon investigations by measuring the average power and PSD across all date rates bandwidths, and modulations. The maximum power was configured as below table, that provided by the manufacturer:

Test Mode	Test Software Version	QATool_Dbg		
802.11b	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	1Mbps	1Mbps	1Mbps
	Power Level Setting Chain 0&1	20	20	20
802.11g	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	6Mbps	6Mbps	6Mbps
	Power Level Setting Chain 0&1	1A	1A	1A
802.11n ht20	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	MCS8	MCS8	MCS8
	Power Level Setting Chain 0&1	1B	1B	1B
802.11n ht40	Test Frequency	2422MHz	2437MHz	2452MHz
	Data Rate	MCS8	MCS8	MCS8
	Power Level Setting Chain 0&1	1A	1A	1A

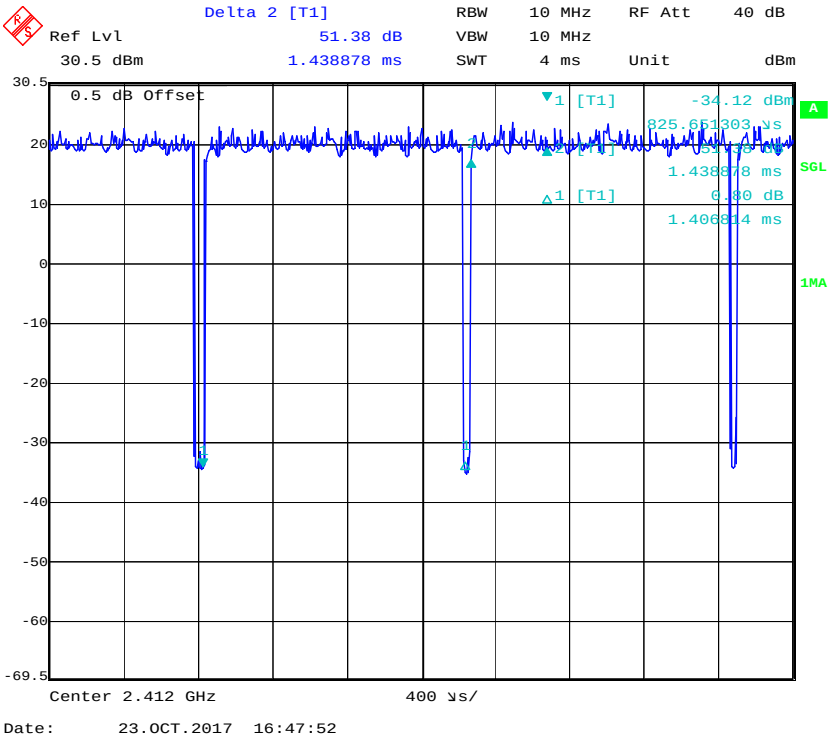
The duty cycle as below:

Mode	T_{on} (ms)	T_{on+off} (ms)	Duty Cycle (%)
802.11b	8.497	8.537	99.5
802.11g	1.407	1.439	97.8
802.11n ht20	1.323	1.469	90.1
802.11n ht40	0.657	0.810	81.1

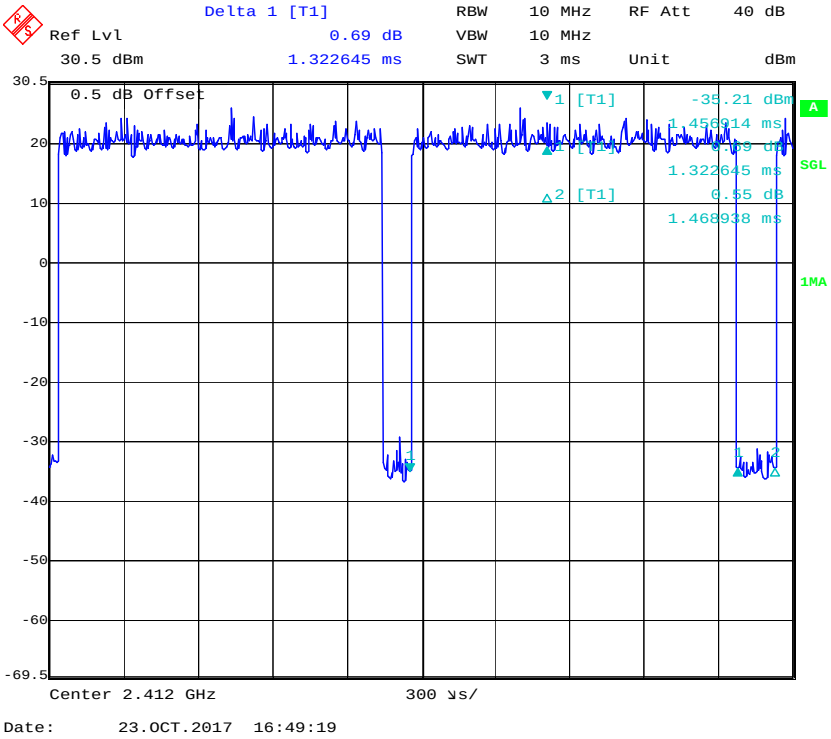
802.11b



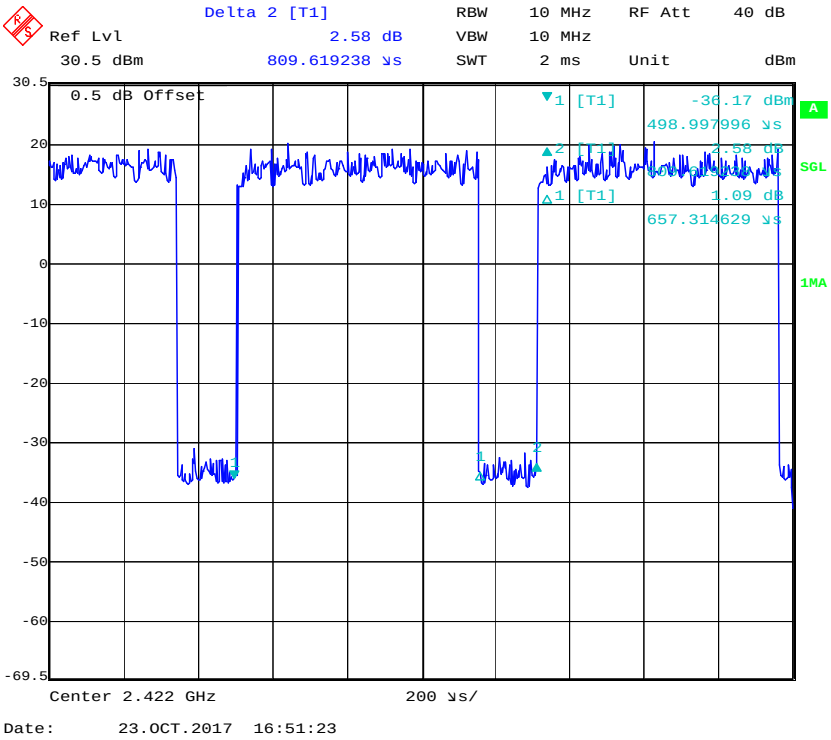
802.11g



802.11n ht20



802.11n ht40



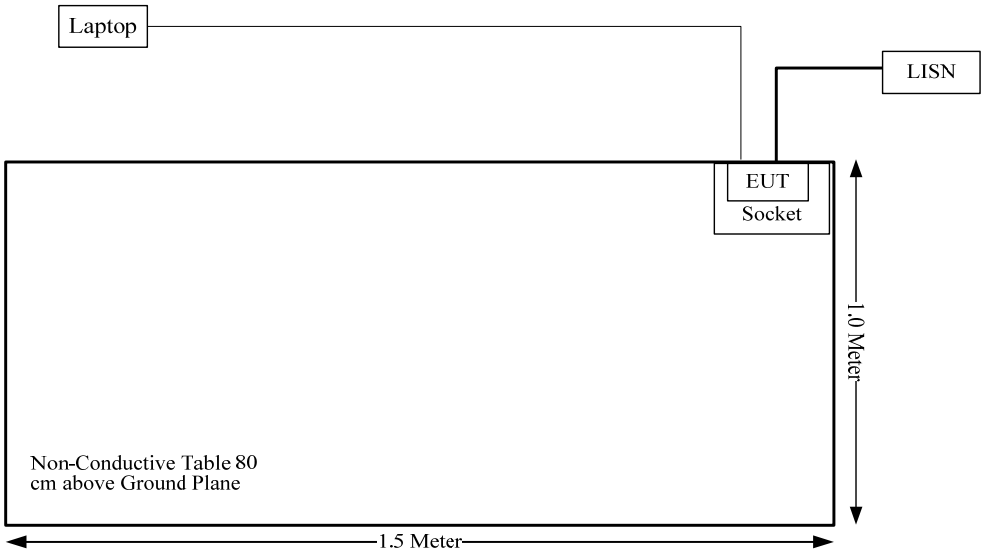
Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
DELL	Laptop	PP11L	QDS-BRCM1017

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
RJ45 Cable	yes	No	10.0	RJ45 Port of Laptop	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 Permissable 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.

Calculation formula:

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

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

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

Calculated Data:

Frequency (MHz)	Antenna Gain		Conducted output power including Tune-up Tolerance		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
	(dBi)	(numeric)	(dBm)	(mW)			
2412-2462	5	3.16	27	501.19	20.00	0.3155	1.0
5150-5250 & 5725-5850	5	3.16	16	39.81	20.00	0.0251	1.0

The 2.4GHz band and 5GHz band can transmit simultaneously:

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

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

=0.3155/1+0.0251/1

=0.3405

< 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.

Antenna Connector Construction

The EUT have 2 external antennas for 2.4G and 5GHz band, which was permanently attached to the Unit, both antenna gains are 5dBi in 2.4G and 5GHz range. Please refer to the EUT photo.

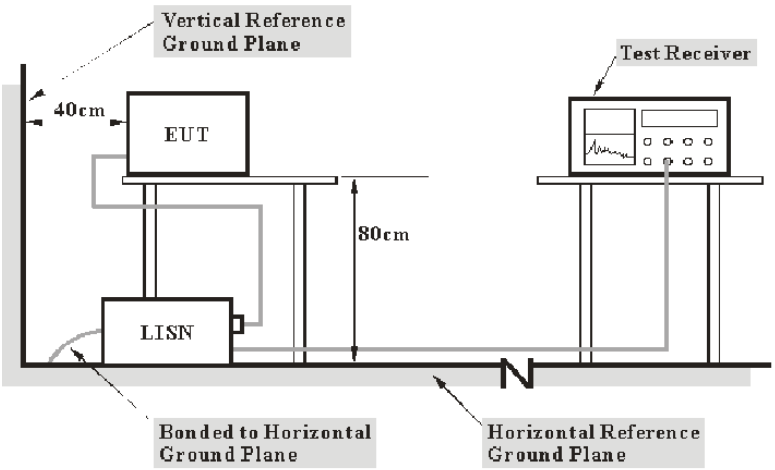
Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207(a)

EUT Setup



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

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

The spacing between the peripherals was 10 cm.

The EUT was connected to the main lisn with 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 EUT was connected to the first LISN.

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

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

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

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

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

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

Margin = Limit – Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCS 30	830245/006	2016-12-08	2017-12-08
R&S	L.I.S.N	ESH2-Z5	892107/021	2017-09-01	2018-09-01
R&S	Two-line V-network	ENV 216	3560.6550.12	2016-12-08	2017-12-08
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A
N/A	Coaxial Cable	2m	C0200/01	2017-09-05	2018-09-05

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

Test Data

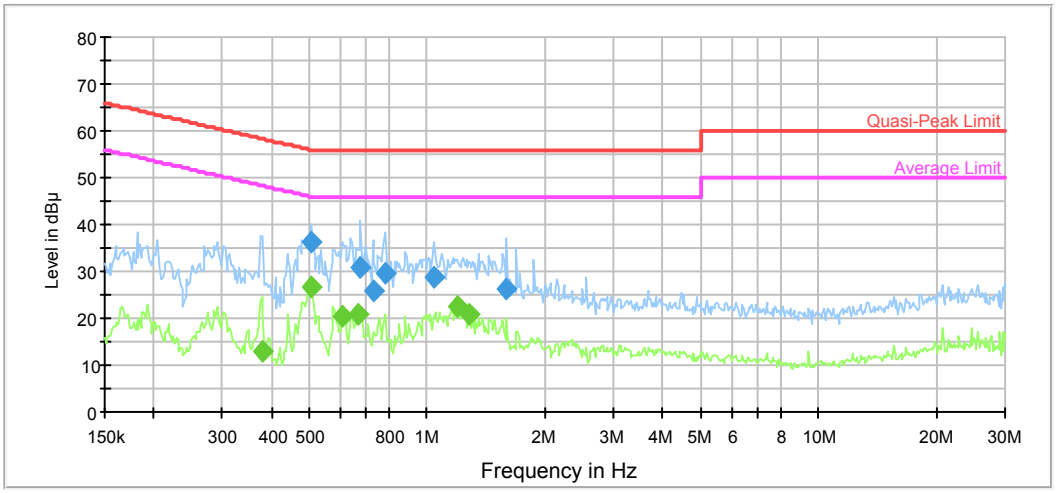
Environmental Conditions

Temperature:	27.6 °C
Relative Humidity:	50 %
ATM Pressure:	100.6kPa

The testing was performed by Alex You on 2017-10-12.

Test Mode: Transmitting

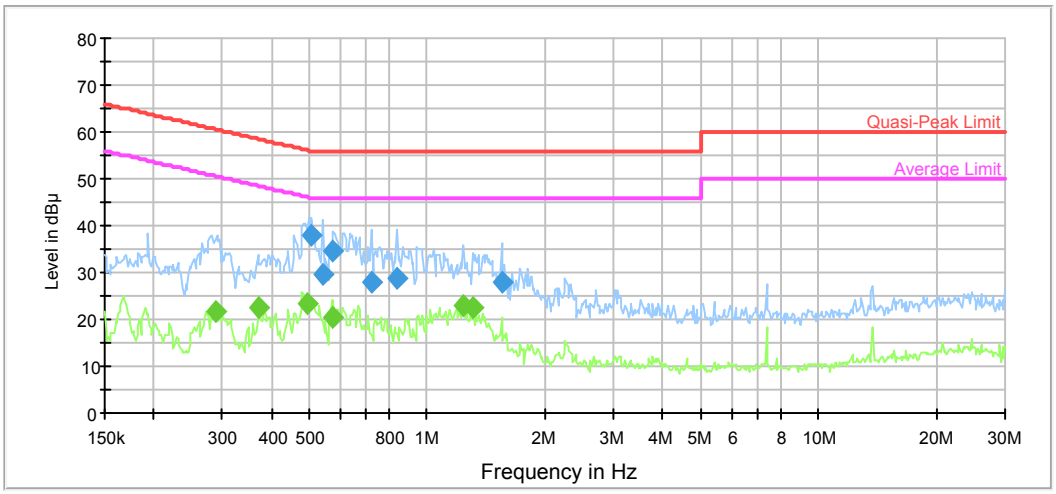
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.507637	36.3	9.000	L1	9.9	19.7	56.0	Compliance
0.676289	31.0	9.000	L1	9.8	25.0	56.0	Compliance
0.726569	25.7	9.000	L1	9.8	30.3	56.0	Compliance
0.780588	29.4	9.000	L1	9.8	26.6	56.0	Compliance
1.039922	28.7	9.000	L1	9.8	27.3	56.0	Compliance
1.599078	26.1	9.000	L1	9.7	29.9	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.378019	12.8	9.000	L1	10.0	35.5	48.3	Compliance
0.503608	26.7	9.000	L1	9.9	19.3	46.0	Compliance
0.609741	20.5	9.000	L1	9.8	25.5	46.0	Compliance
0.665597	20.8	9.000	L1	9.8	25.2	46.0	Compliance
1.190776	22.5	9.000	L1	9.8	23.5	46.0	Compliance
1.279307	20.8	9.000	L1	9.8	25.2	46.0	Compliance

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.507637	38.0	9.000	N	9.9	18.0	56.0	Compliance
0.541050	29.7	9.000	N	9.9	26.3	56.0	Compliance
0.576662	34.8	9.000	N	9.8	21.2	56.0	Compliance
0.720803	27.9	9.000	N	9.8	28.1	56.0	Compliance
0.838622	28.8	9.000	N	9.8	27.2	56.0	Compliance
1.548915	27.8	9.000	N	9.7	28.2	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.288307	21.7	9.000	N	10.2	28.9	50.6	Compliance
0.372042	22.5	9.000	N	10.0	26.0	48.5	Compliance
0.495646	23.3	9.000	N	9.9	22.8	46.1	Compliance
0.572086	20.5	9.000	N	9.8	25.5	46.0	Compliance
1.239175	23.1	9.000	N	9.8	22.9	46.0	Compliance
1.310256	22.5	9.000	N	9.8	23.5	46.0	Compliance

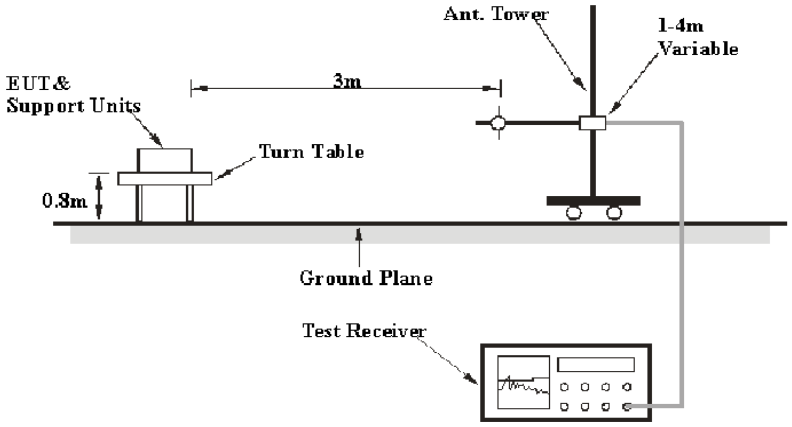
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

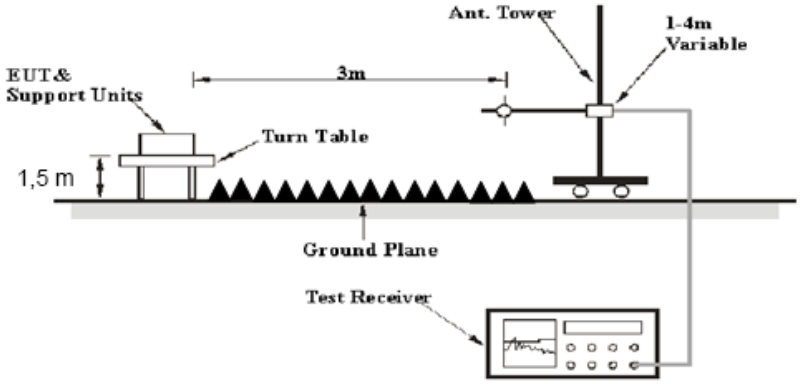
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission 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:

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

1GHz- 25GHz:

Measurement	Duty cycle	RBW	Video B/W
PK	Any	1MHz	3 MHz
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 Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

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

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

Margin = Limit –Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2017-09-01	2018-09-01
Sunol Sciences	Antenna	JB3	A060611-1	2014-11-06	2017-11-06
HP	Amplifier	8447D	2727A05902	2017-09-05	2018-09-05
Agilent	Signal Generator	E8247C	MY43321350	2016-09-23	2018-09-23
MITEQ	Amplifier	AFS42-00101800-25-S-42	2001271	2017-09-05	2018-09-05
TDK RF	Horn Antenna	HRN-0118	130 084	2016-01-05	2019-01-05
ETS-Lindgren	Horn Antenna	3115	000 527 35	2016-01-05	2019-01-05
Agilent	Spectrum Analyzer	E4440A	SG43360054	2016-12-08	2017-12-08
HP	Signal Generator	1026	320408	2016-12-08	2017-12-08
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-02 1304	2016-11-18	2019-11-18
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2017-06-27	2018-06-27
R&S	Spectrum Analyzer	FSP 38	100478	2016-12-08	2017-12-08
Unknown	Coaxial Cable	Chamber A-1	4m	2017-09-05	2018-09-05
Unknown	Coaxial Cable	Chamber B-1	0.75m	2017-09-05	2018-09-05
Unknown	Coaxial Cable	Chamber A-2	10m	2017-09-05	2018-09-05
Unknown	Coaxial Cable	Chamber B-2	8m	2017-09-05	2018-09-05
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A

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

Test Data

Environmental Conditions

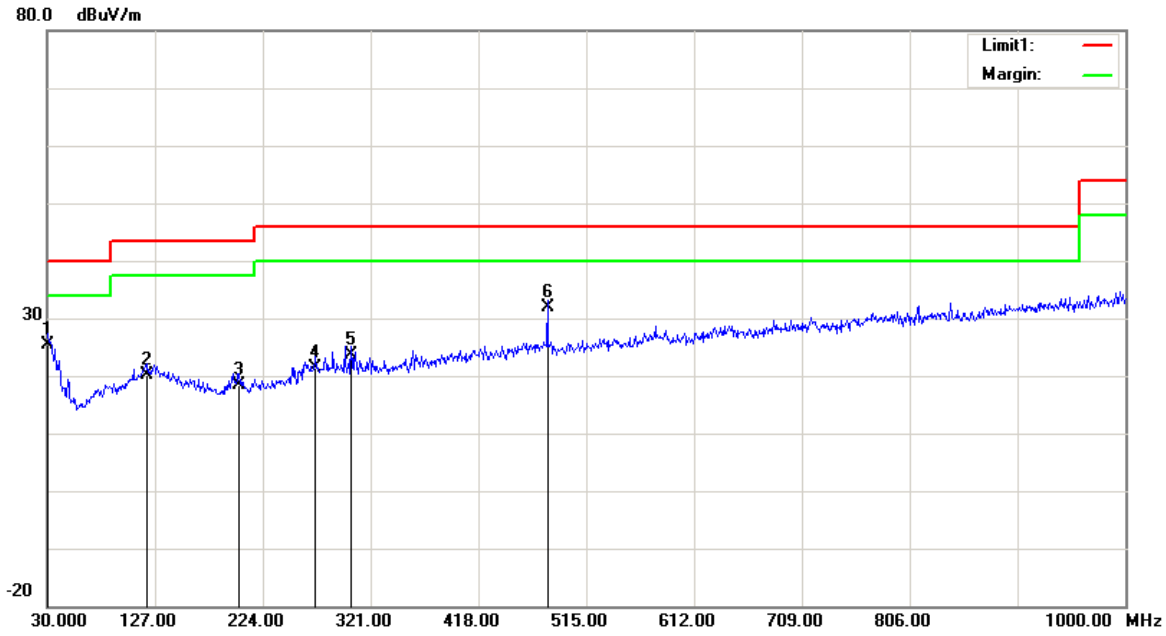
Temperature:	25.1~25.3 °C
Relative Humidity:	27~38 %
ATM Pressure:	101~101.4 kPa

** The testing was performed by Sunny Cen from 2017-10-23 to 2017-10-27.*

Test Mode: Transmitting

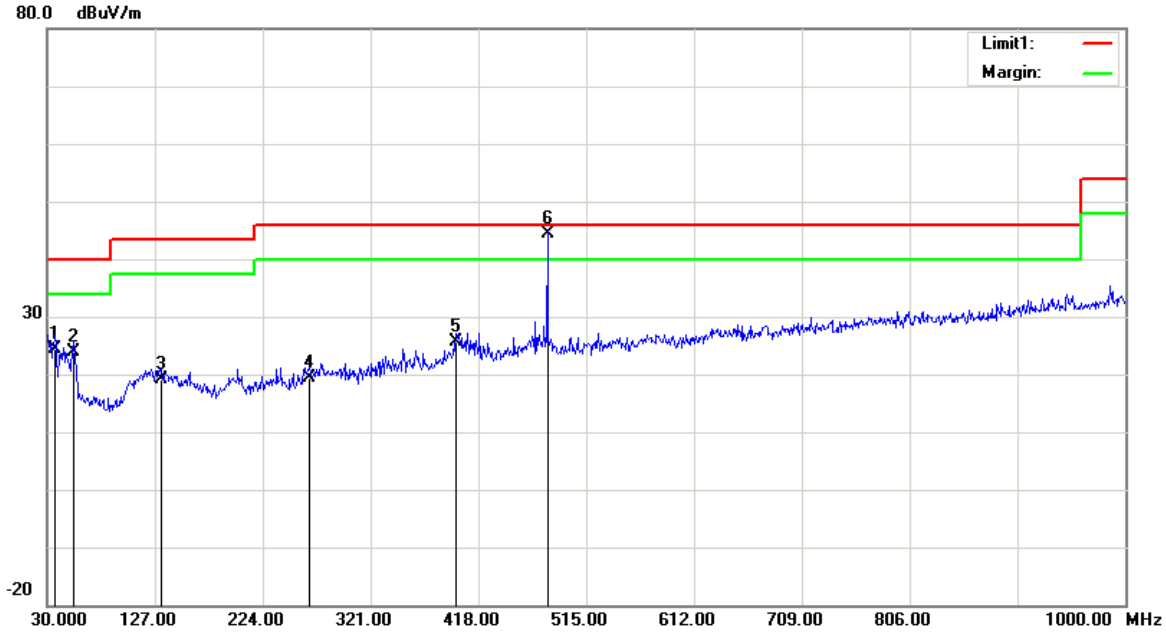
1) Below 1GHz(802.11n ht20 mode middle channel was the worst):

Horizontal



Frequency (MHz)	Receiver Reading (dBµV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30.0000	24.22	QP	1.08	25.30	40.00	14.70
120.2100	25.04	QP	-4.94	20.10	43.50	23.40
202.6600	24.58	QP	-6.28	18.30	43.50	25.20
271.5300	25.28	QP	-3.88	21.40	46.00	24.60
303.5400	28.03	QP	-4.43	23.60	46.00	22.40
480.0800	32.91	QP	-1.01	31.90	46.00	14.10

Vertical

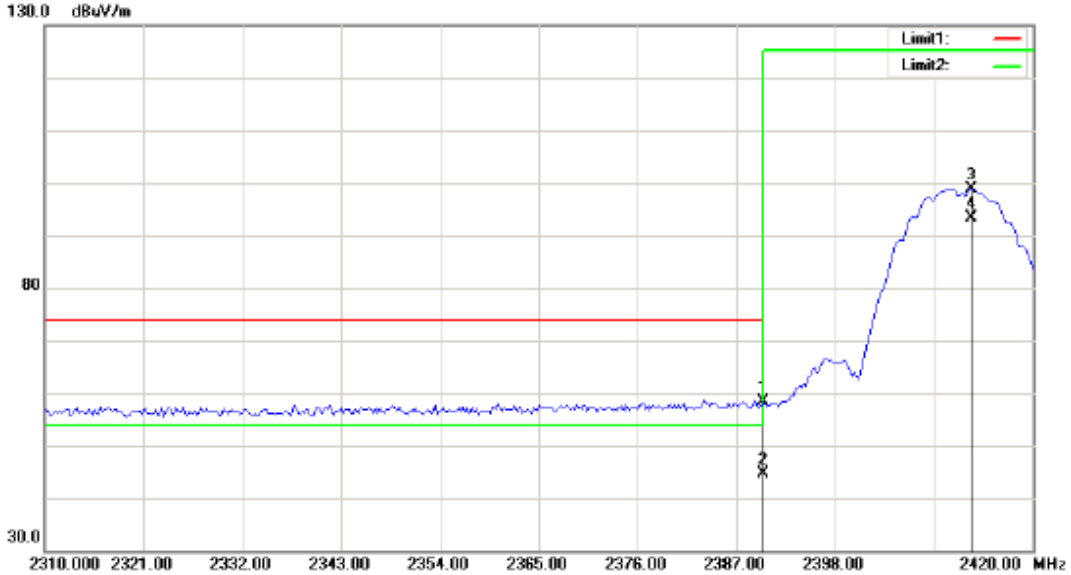


Frequency (MHz)	Receiver Reading (dBµV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
36.7900	28.13	QP	-3.83	24.30	40.00	15.70
54.2500	36.17	QP	-12.37	23.80	40.00	16.20
132.8200	24.53	QP	-5.33	19.20	43.50	24.30
265.7100	23.76	QP	-4.36	19.40	46.00	26.60
397.6300	27.84	QP	-2.24	25.60	46.00	20.40
480.0800	45.31	QP	-1.01	44.30	46.00	1.70

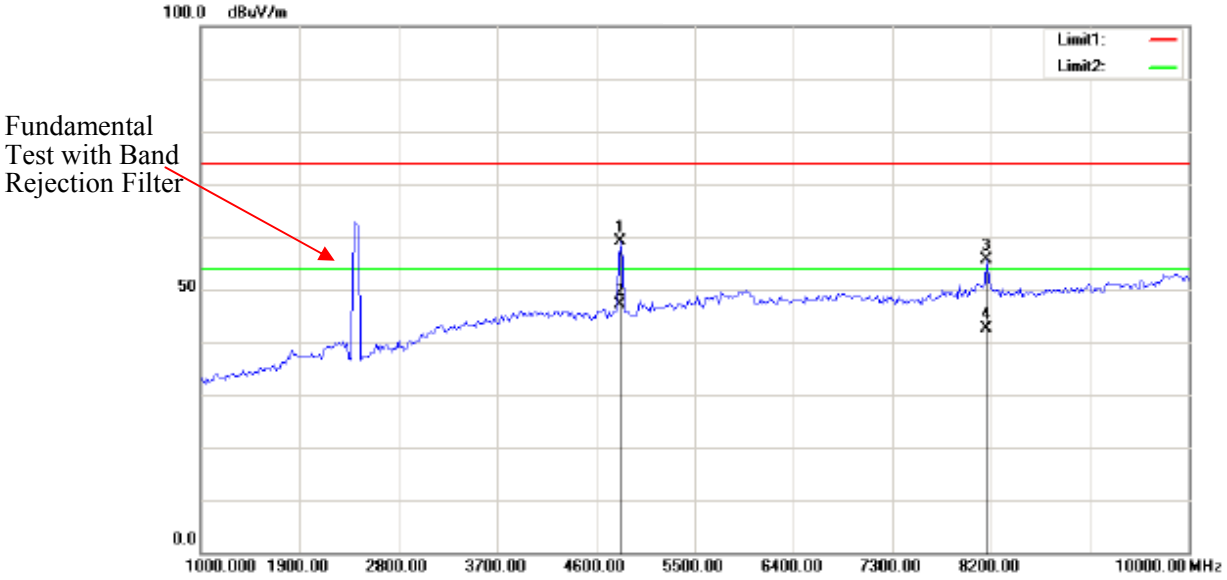
802.11b(Chain 0 was the worst)

Low Channel

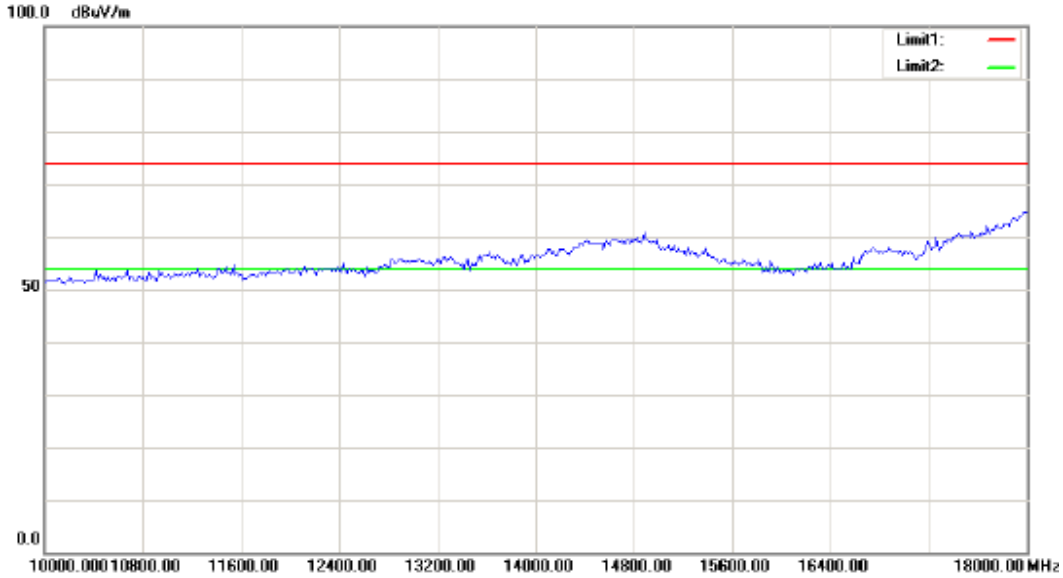
Horizontal



Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	2390.000	28.62	peak	29.87	58.49	74.00	152	224	15.51	
*	2	2390.000	14.67	AVG	29.87	44.54	54.00	152	224	9.46	
	3	2413.166	69.00	peak	29.94	98.94	125.20	152	224	26.26	Fundamental
	4	2413.166	63.52	AVG	29.94	93.46	125.20	152	224	31.74	Fundamental



Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4823.647	60.28	peak	-1.06	59.22	74.00	153	226	14.78	
*	2	4823.647	48.25	AVG	-1.06	47.19	54.00	153	226	6.81	
	3	8160.321	50.49	peak	5.03	55.52	74.00	153	226	18.48	
	4	8160.321	37.64	AVG	5.03	42.67	54.00	153	226	11.33	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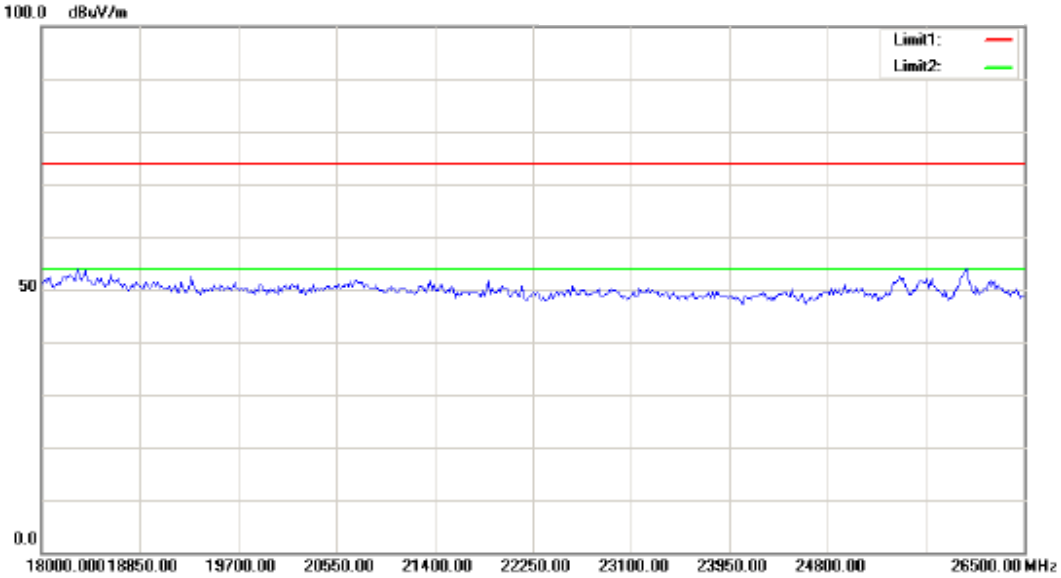
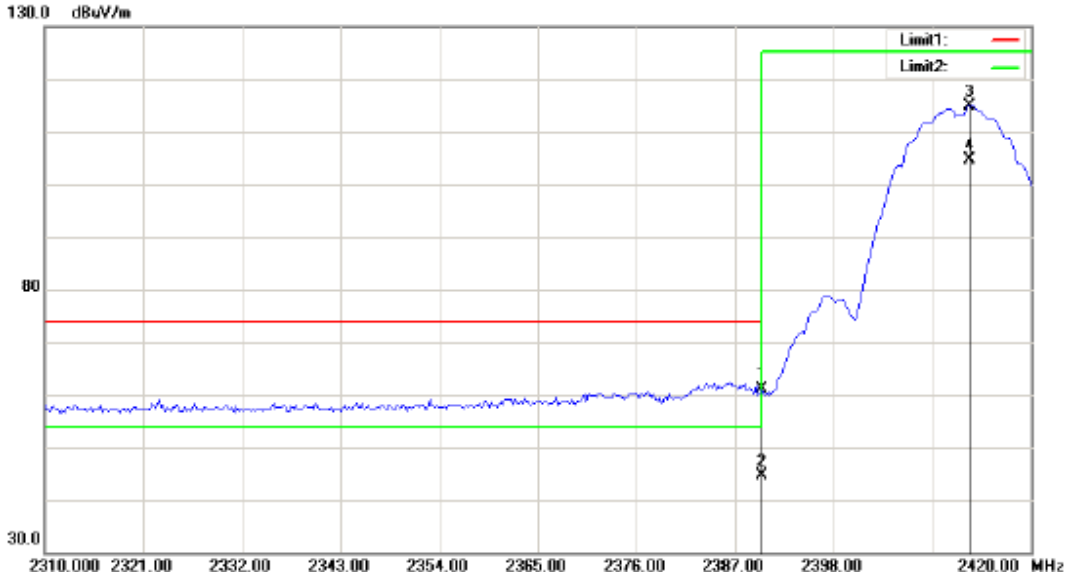
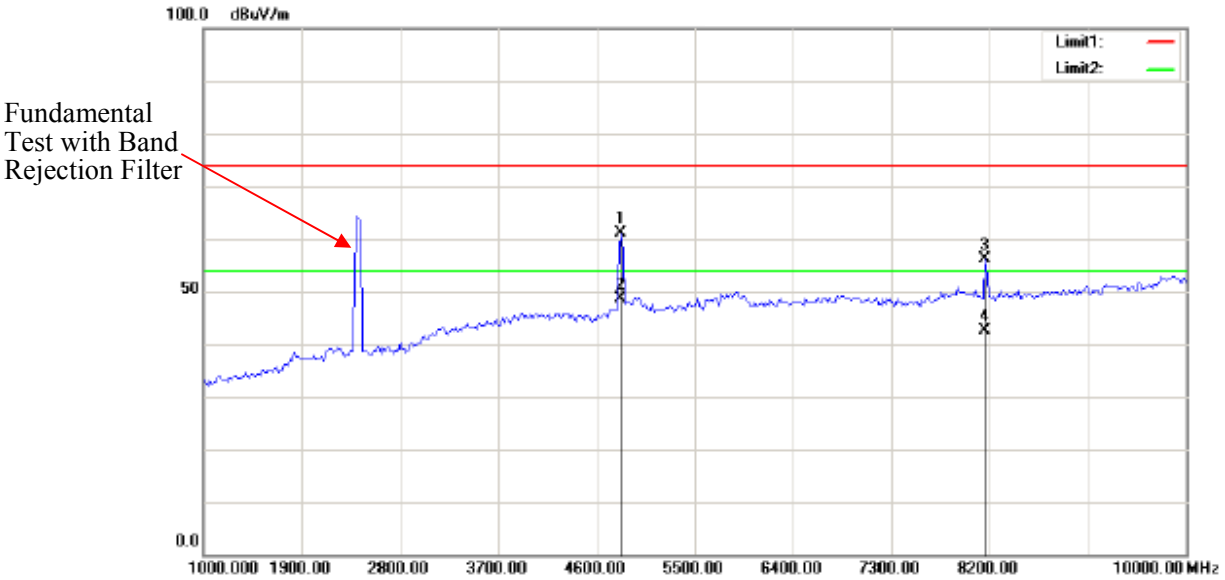
Limit1:
Limit2:
50
0.0
10000.000 10800.00 11600.00 12400.00 13200.00 14000.00 14800.00 15600.00 16400.00 18000.00 MHz


100.0 dBuV/m
Limit1:
Limit2:
50
0.0
18000.000 18850.00 19700.00 20550.00 21400.00 22250.00 23100.00 23950.00 24800.00 26500.00 MHz

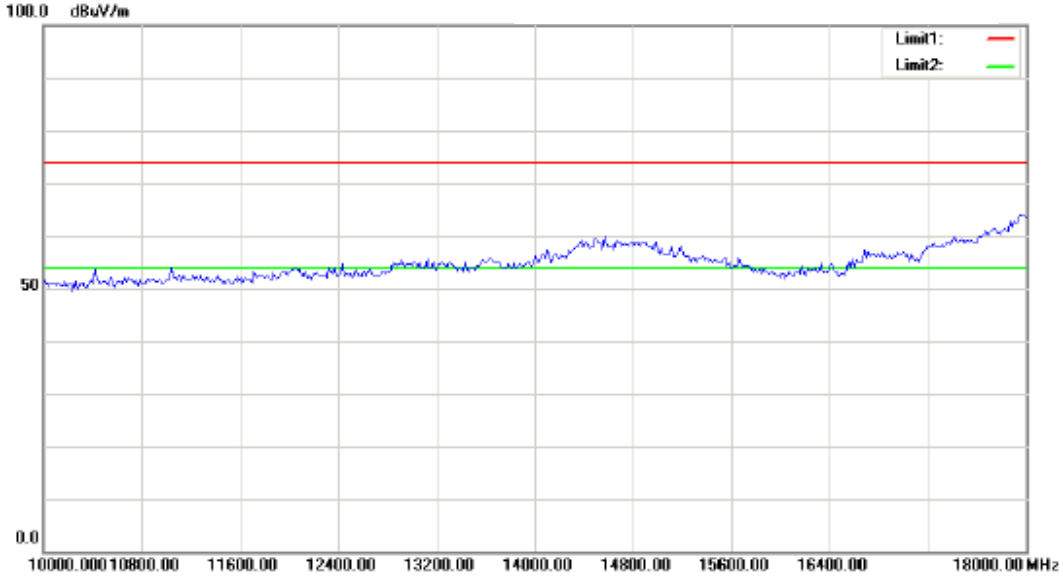
Vertical



Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	2390.000	31.18	peak	29.88	61.06	74.00	147	224	12.94	
*	2	2390.000	14.84	AVG	29.88	44.72	54.00	147	224	9.28	
	3	2413.166	84.87	peak	29.94	114.81	125.20	147	224	10.39	Fundamental
	4	2413.166	74.62	AVG	29.94	104.56	125.20	147	224	20.64	Fundamental



Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4823.647	62.28	peak	-1.06	61.22	74.00	145	166	12.78	
*	2	4823.647	49.63	AVG	-1.06	48.57	54.00	145	166	5.43	
	3	8160.321	50.99	peak	5.03	56.02	74.00	145	166	17.98	
	4	8160.321	37.52	AVG	5.03	42.55	54.00	145	166	11.45	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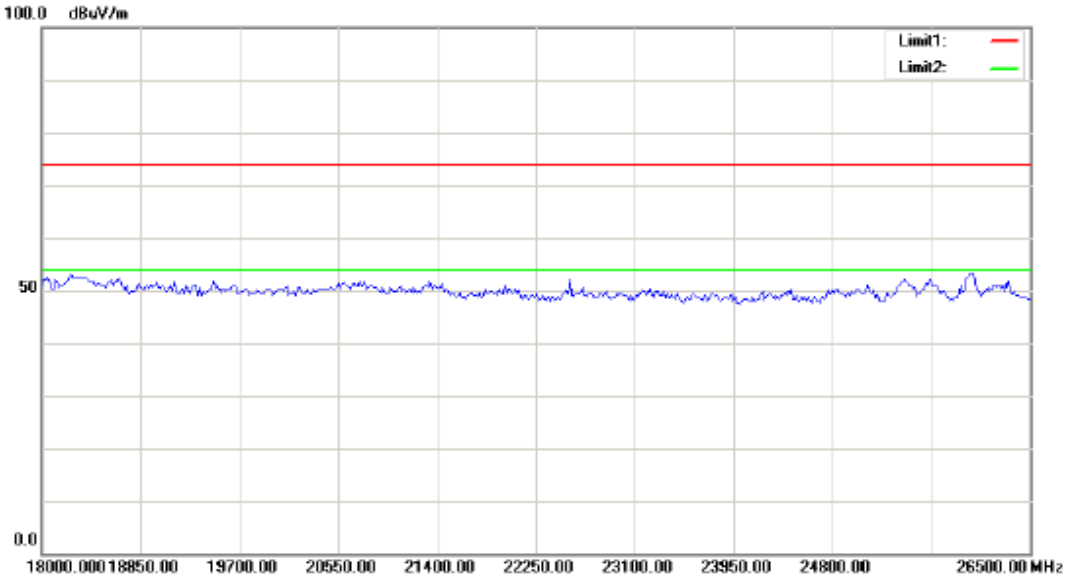
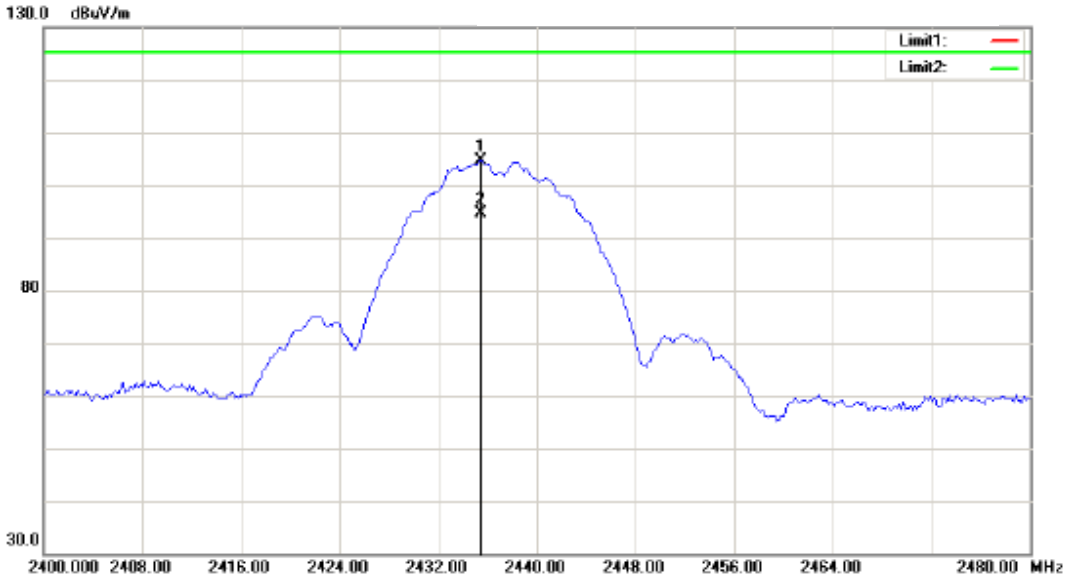
Limit1:
Limit2:
50
0.0
10000.000 10800.00 11600.00 12400.00 13200.00 14000.00 14800.00 15600.00 16400.00 18000.00 MHz

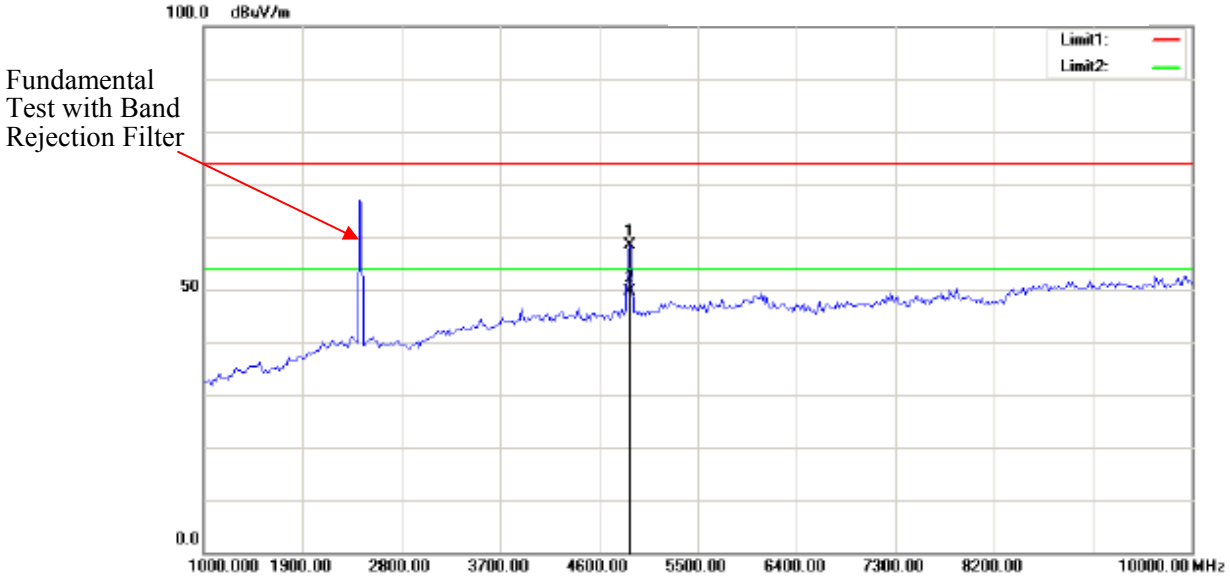

100.0 dBuV/m
Limit1:
Limit2:
50
0.0
18000.000 18850.00 19700.00 20550.00 21400.00 22250.00 23100.00 23950.00 24800.00 26500.00 MHz

Middle Channel

Horizontal



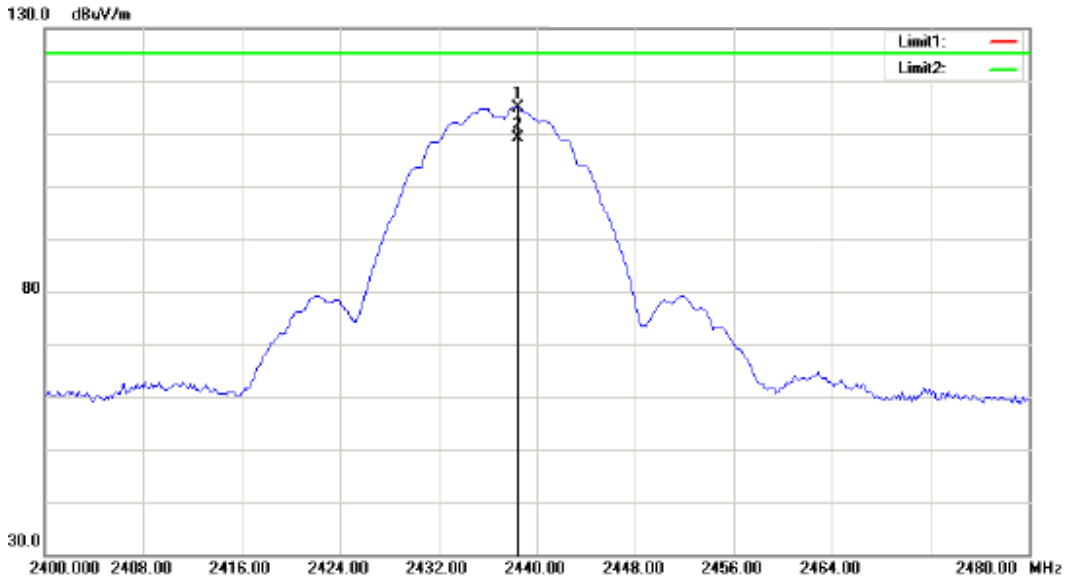
Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
*	1	2435.431	74.69	peak	29.99	104.68	125.20	148	155	20.52	Fundamental
	2	2435.431	64.58	AVG	29.99	94.57	125.20	148	155	30.63	Fundamental



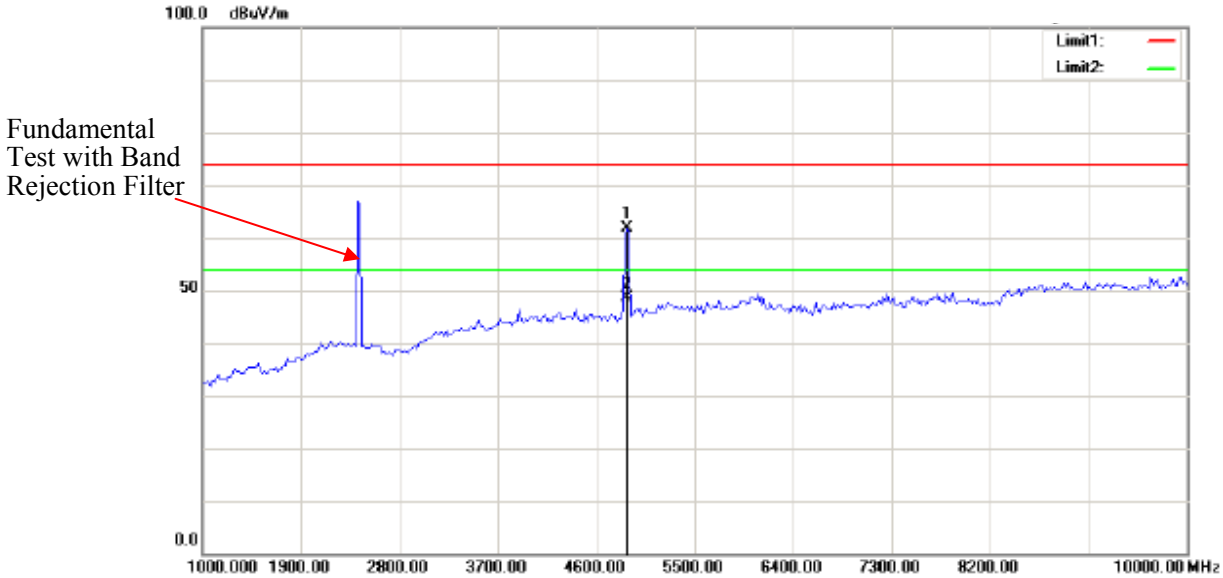
Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4877.756	59.17	peak	-0.88	58.29	74.00	152	227	15.71	
*	2	4877.756	50.43	AVG	-0.88	49.55	54.00	152	227	4.45	

Note: No emission was detected in the range 10-25GHz.

Vertical



Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
*	1	2438.477	84.83	peak	30.00	114.83	125.20	168	95	10.37	Fundamental
	2	2438.477	79.25	AVG	30.00	109.25	125.20	168	95	15.95	Fundamental

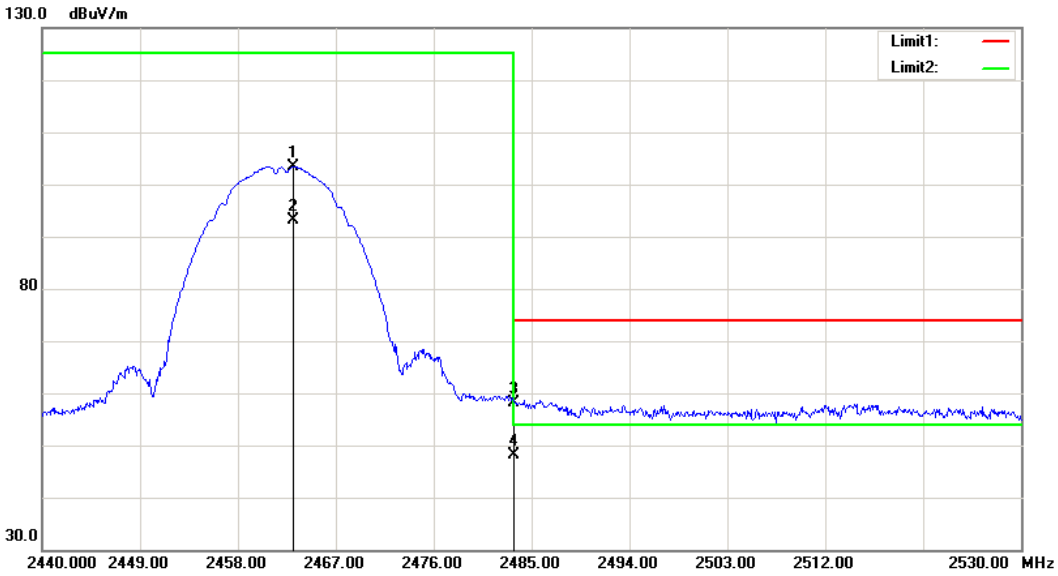


Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4877.756	62.67	peak	-0.88	61.79	74.00	158	37	12.21	
*	2	4877.756	49.62	AVG	-0.88	48.74	54.00	158	37	5.26	

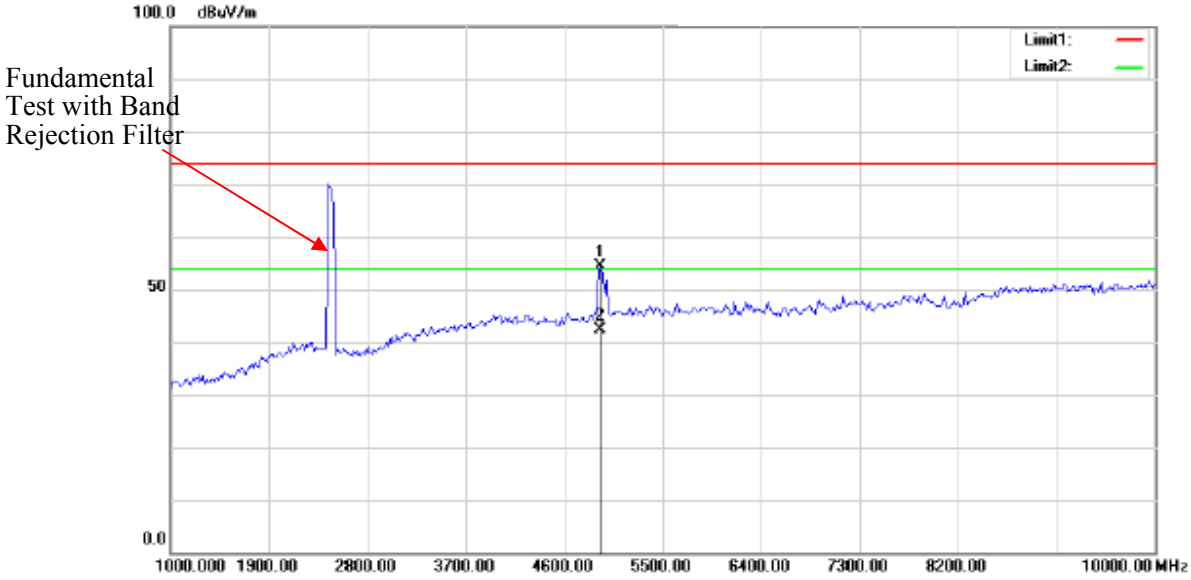
Note: No emission was detected in the range 10-25GHz.

High Channel

Horizontal



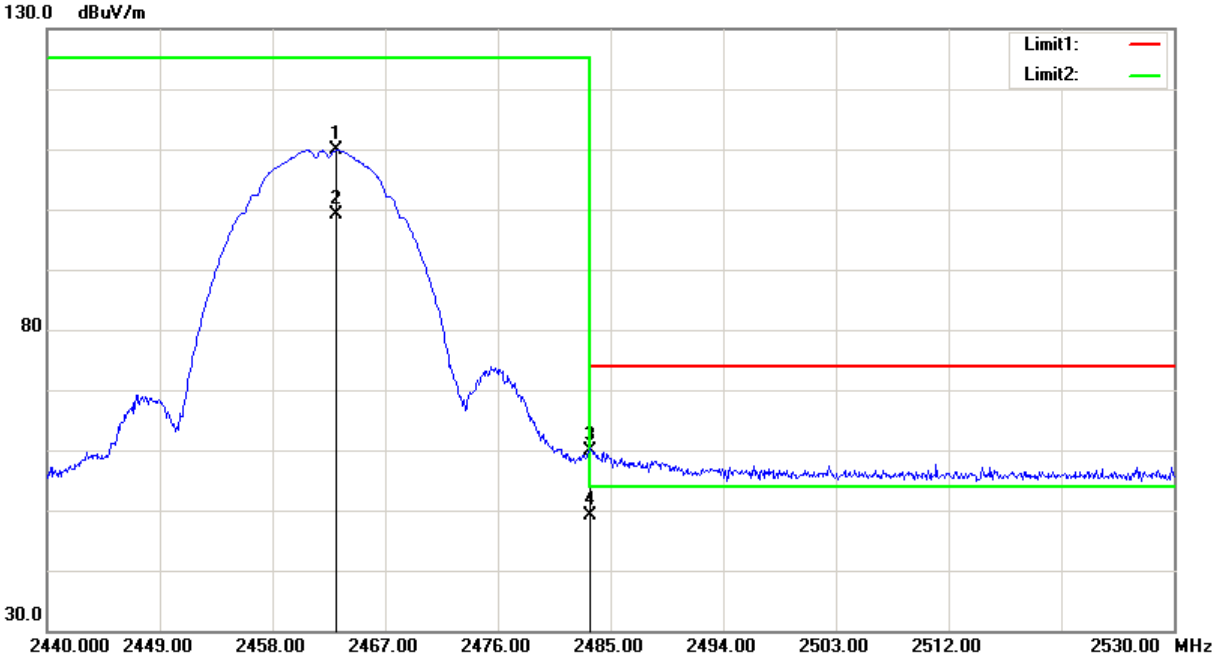
Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	2463.130	73.34	peak	30.06	103.40	125.20	159	88	21.80	Fundamental
	2	2463.130	63.19	AVG	30.06	93.25	125.20	159	88	31.95	Fundamental
	3	2483.500	27.98	peak	30.11	58.09	74.00	159	88	15.91	
*	4	2483.500	17.95	AVG	30.11	48.06	54.00	159	88	5.94	



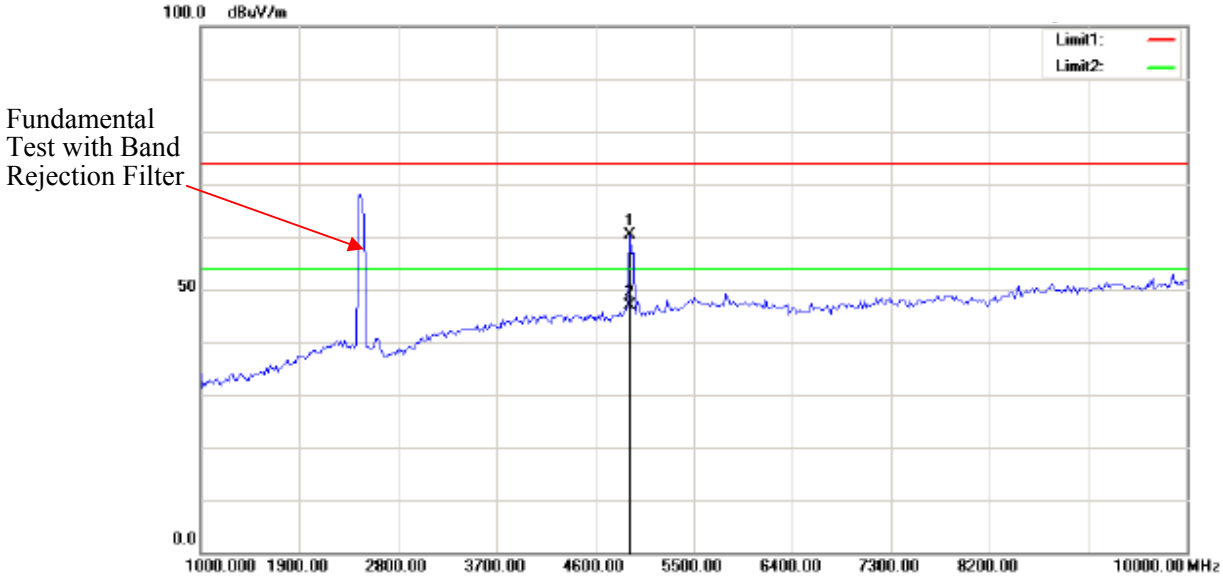
Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4931.864	55.12	peak	-0.81	54.31	74.00	158	79	19.69	
*	2	4931.864	43.26	AVG	-0.81	42.45	54.00	158	79	11.55	

Note: No emission was detected in the range 10-25GHz.

Vertical



Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	2463.130	79.74	peak	30.06	109.80	125.20	148	88	15.40	Fundamental
	2	2463.130	69.10	AVG	30.06	99.16	125.20	148	88	26.04	Fundamental
	3	2483.500	29.67	peak	30.11	59.78	74.00	148	88	14.22	
*	4	2483.500	19.14	AVG	30.11	49.25	54.00	148	88	4.75	



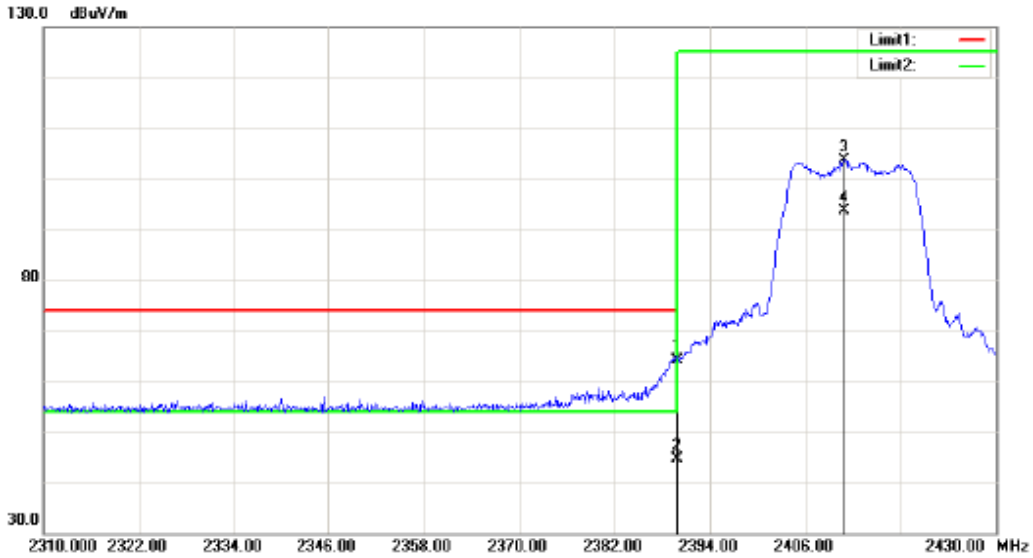
Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4913.828	61.29	peak	-0.81	60.48	74.00	185	334	13.52	
*	2	4913.828	47.65	AVG	-0.81	46.84	54.00	185	334	7.16	

Note: No emission was detected in the range 10-25GHz.

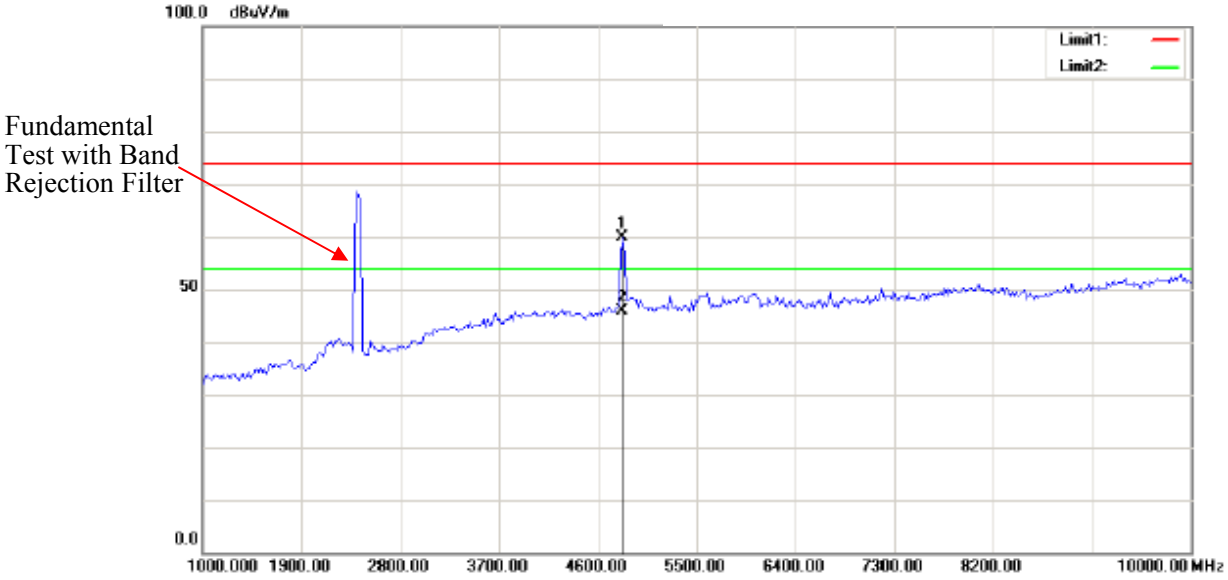
802.11g(Chain 0 was the worst)

Low Channel

Horizontal



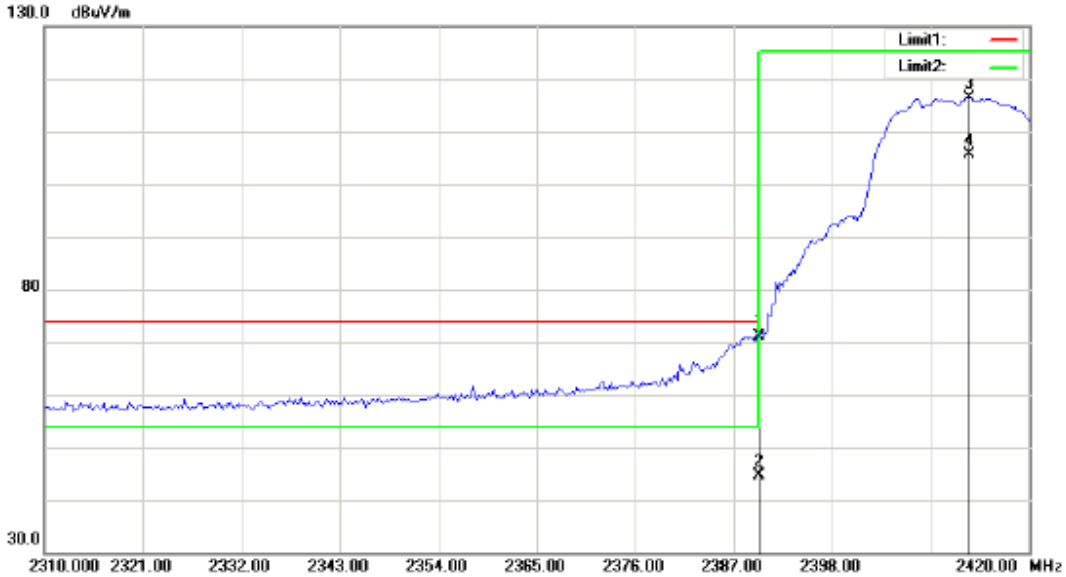
Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	2390.000	34.23	peak	29.87	64.10	74.00	156	153	9.90	
*	2	2390.000	14.75	AVG	29.87	44.62	54.00	156	153	9.38	
	3	2410.920	73.73	peak	29.93	103.66	125.20	156	153	21.54	Fundamental
	4	2410.920	63.58	AVG	29.93	93.51	125.20	156	153	31.69	Fundamental



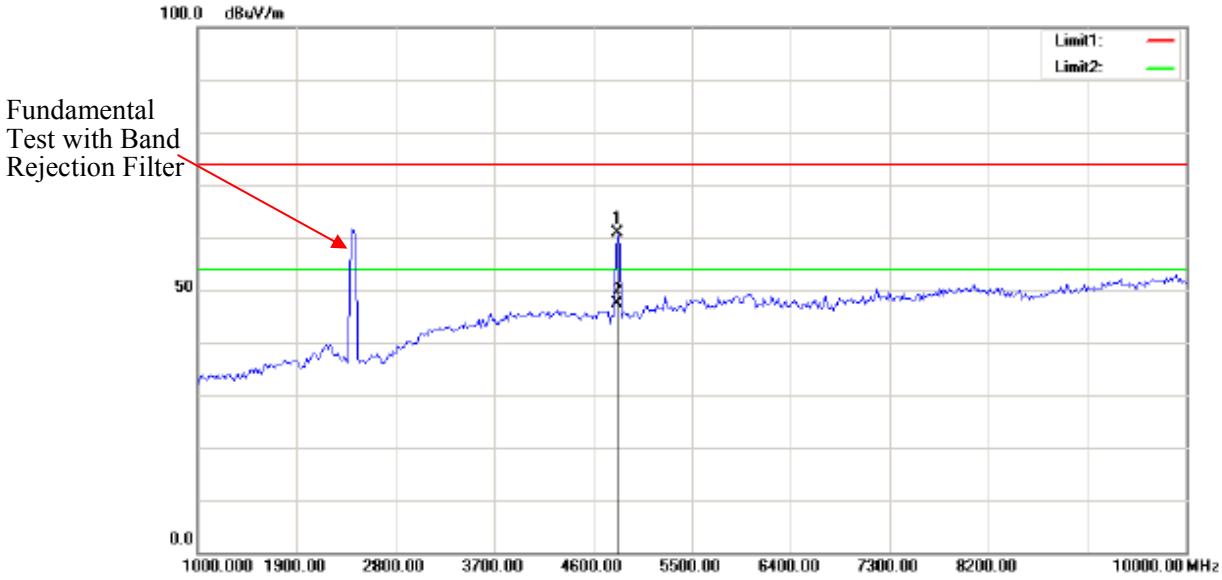
Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4823.647	60.87	peak	-1.06	59.81	74.00	144	25	14.19	
*	2	4823.647	46.93	AVG	-1.06	45.87	54.00	144	25	8.13	

Note: No emission was detected in the range 10-25GHz.

Vertical



Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
*	1	2390.000	41.32	peak	29.88	71.20	74.00	153	22	2.80	
	2	2390.000	14.68	AVG	29.88	44.56	54.00	153	22	9.44	
	3	2413.387	86.41	peak	29.94	116.35	125.20	153	22	8.85	Fundamental
	4	2413.387	75.68	AVG	29.94	105.62	125.20	153	22	19.58	Fundamental

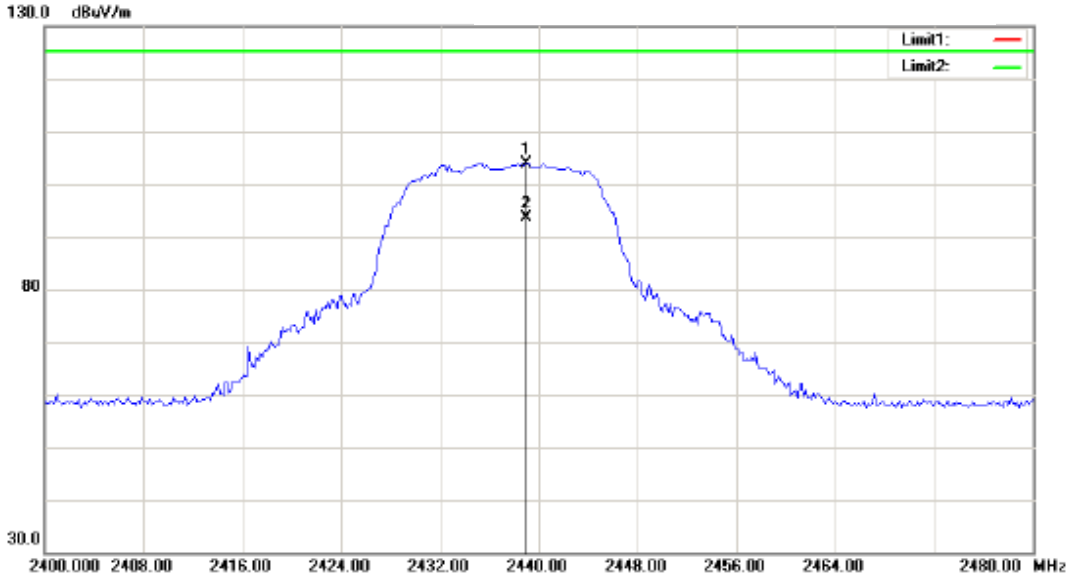


Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4823.647	61.87	peak	-1.06	60.81	74.00	166	223	13.19	
*	2	4823.647	48.35	AVG	-1.06	47.29	54.00	166	223	6.71	

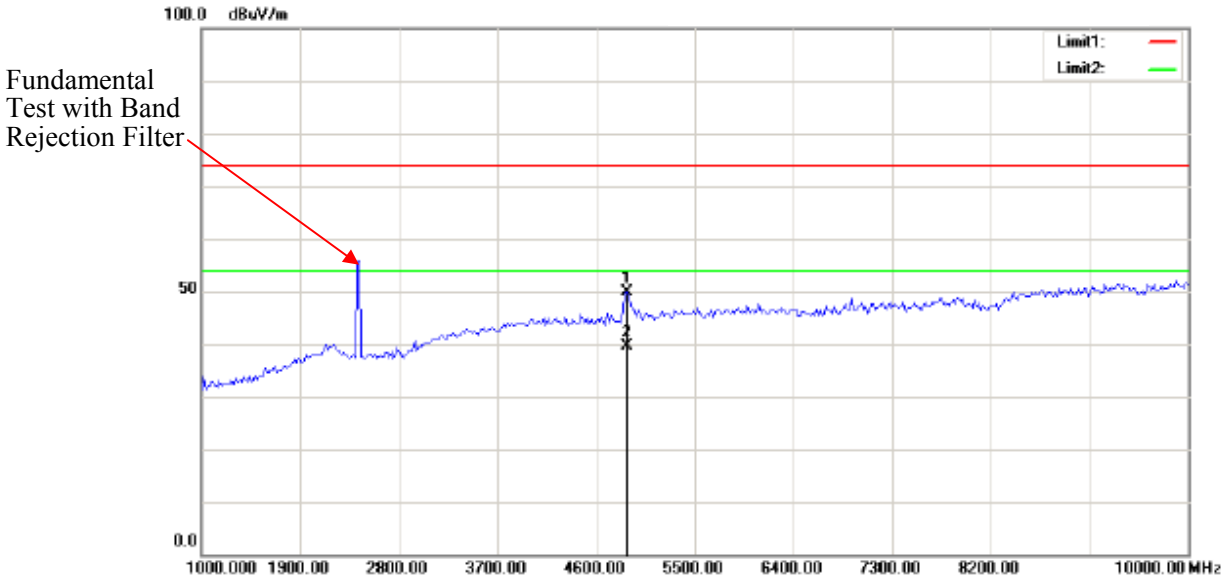
Note: No emission was detected in the range 10-25GHz.

Middle Channel

Horizontal



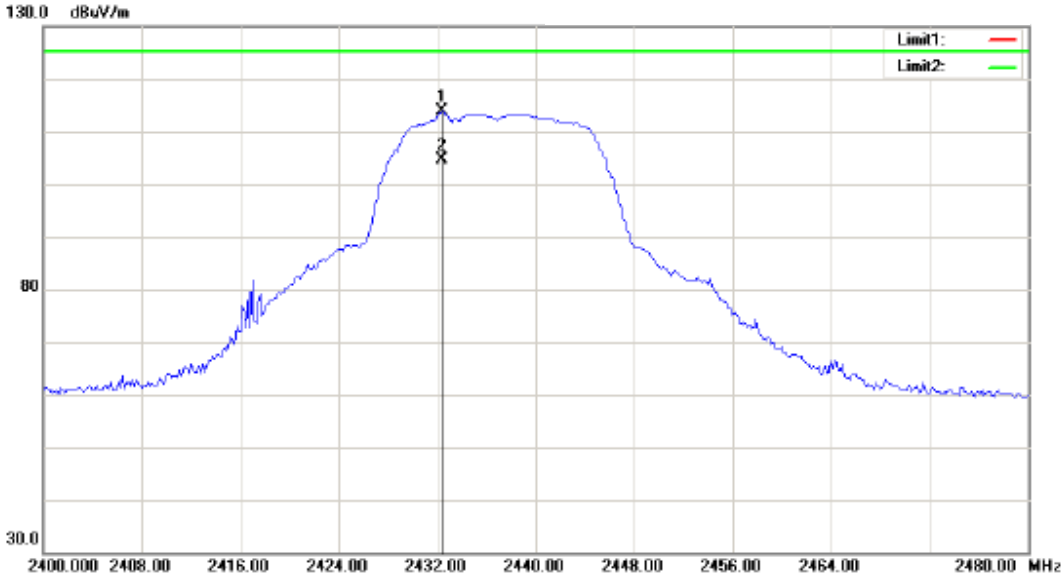
Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
*	1	2438.958	73.89	peak	30.00	103.89	125.20	157	46	21.31	Fundamental
	2	2438.958	63.57	AVG	30.00	93.57	125.20	157	46	31.63	Fundamental



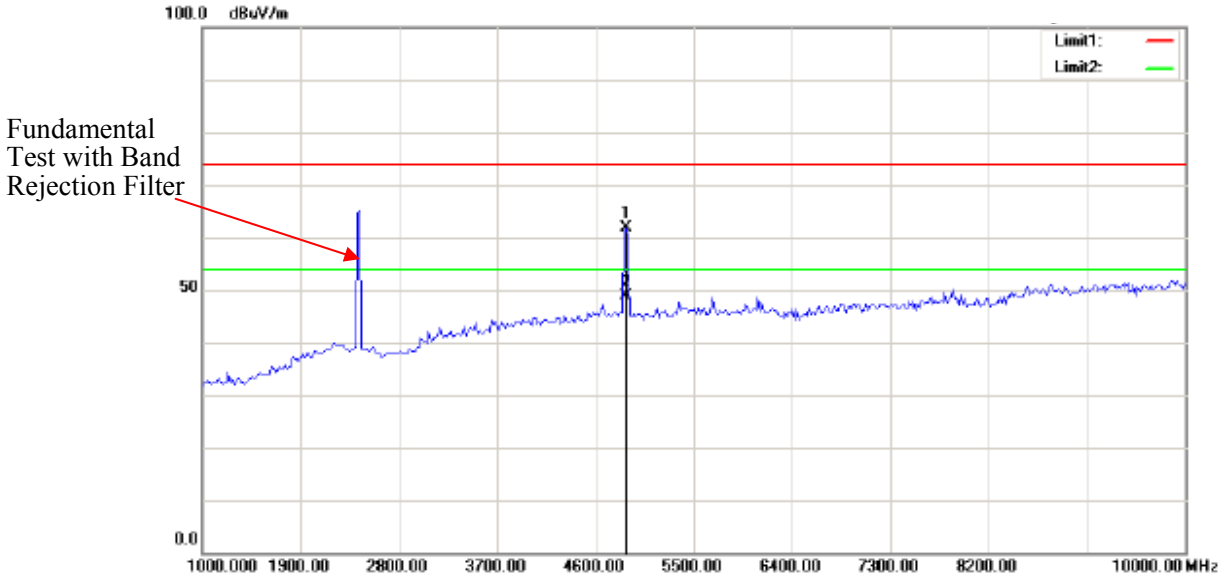
Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4877.756	50.75	peak	-0.88	49.87	74.00	169	34	24.13	
*	2	4877.756	40.62	AVG	-0.88	39.74	54.00	169	34	14.26	

Note: No emission was detected in the range 10-25GHz.

Vertical



Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
*	1	2432.385	83.82	peak	29.98	113.80	125.20	152	336	11.40	Fundamental
	2	2432.385	74.53	AVG	29.98	104.51	125.20	152	336	20.69	Fundamental

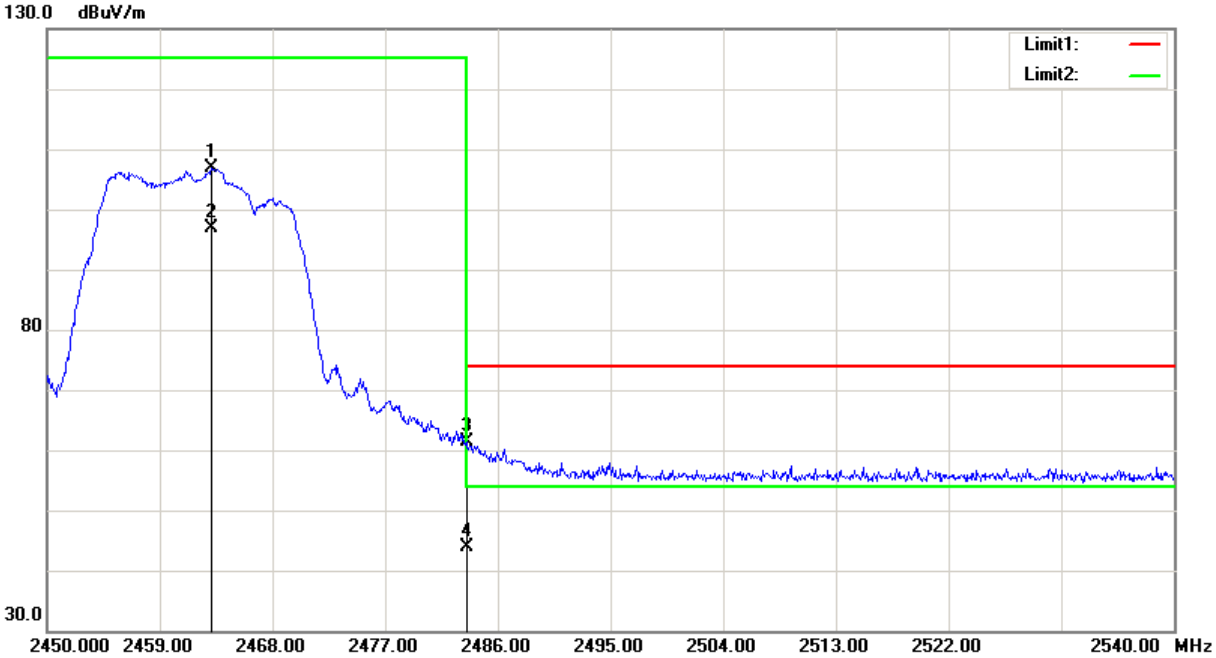


Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4877.756	62.87	peak	-0.88	61.99	74.00	148	76	12.01	
*	2	4877.756	49.86	AVG	-0.88	48.98	54.00	148	76	5.02	

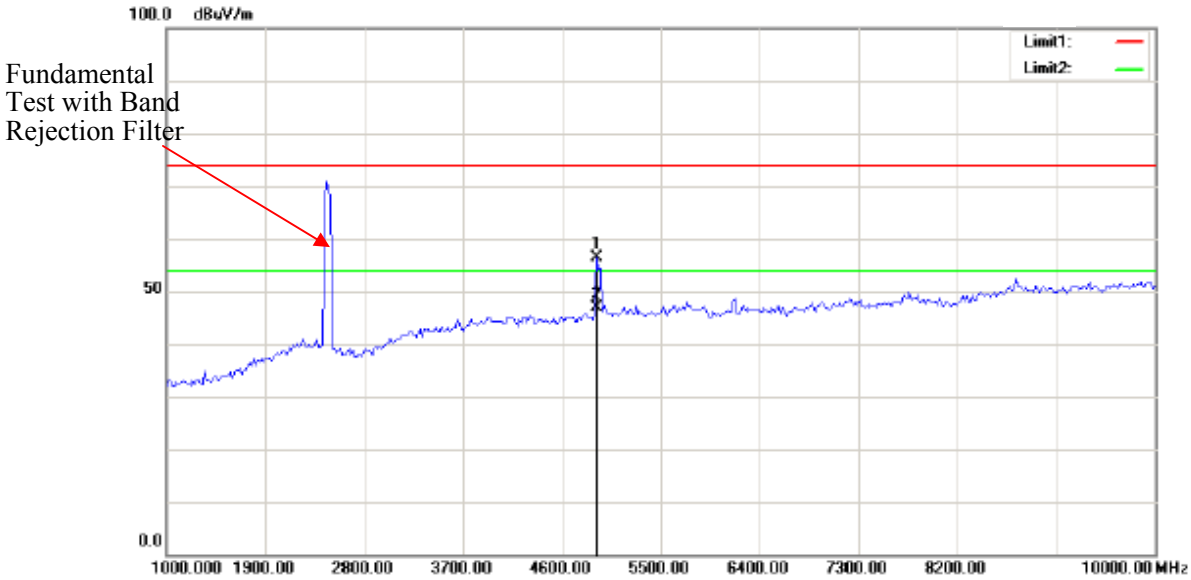
Note: No emission was detected in the range 10-25GHz.

High Channel

Horizontal



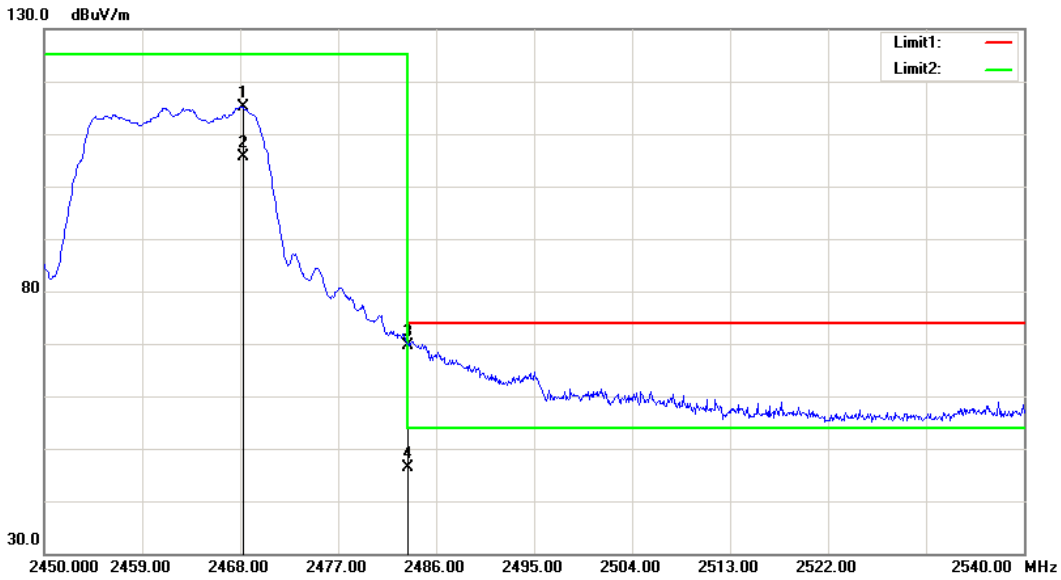
Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	2463.185	76.72	peak	30.06	106.78	125.20	156	87	18.42	Fundamental
	2	2463.185	66.84	AVG	30.06	96.90	125.20	156	87	28.30	Fundamental
	3	2483.500	31.33	peak	30.11	61.44	74.00	156	87	12.56	
*	4	2483.500	13.86	AVG	30.11	43.97	54.00	156	87	10.03	



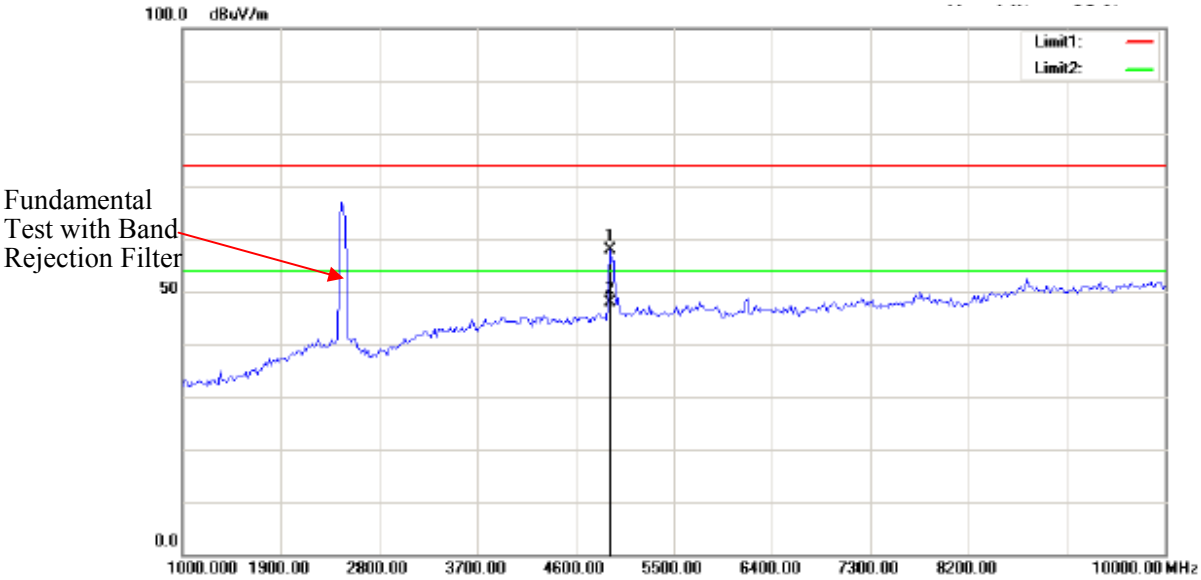
Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4913.828	57.28	peak	-0.81	56.47	74.00	138	45	17.53	
*	2	4913.828	47.68	AVG	-0.81	46.87	54.00	138	45	7.13	

Note: No emission was detected in the range 10-25GHz.

Vertical



Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	2468.270	85.18	peak	30.07	115.25	125.20	149	153	9.95	Fundamental
	2	2468.270	75.49	AVG	30.07	105.56	125.20	149	153	19.64	Fundamental
*	3	2483.500	39.61	peak	30.11	69.72	74.00	149	153	4.28	
	4	2483.500	16.38	AVG	30.11	46.49	54.00	149	153	7.51	



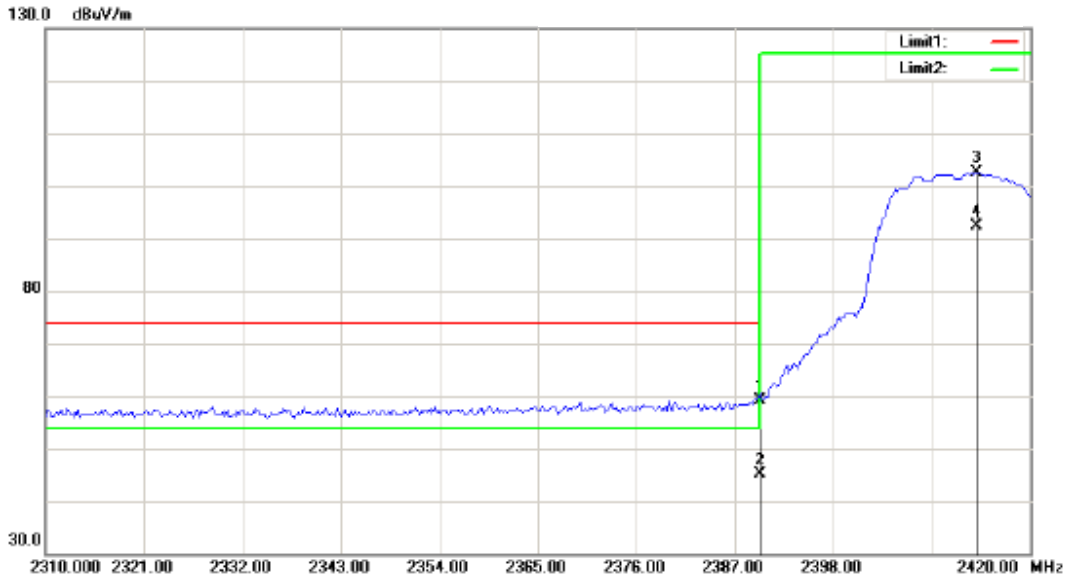
Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4913.828	58.78	peak	-0.81	57.97	74.00	147	55	16.03	
*	2	4913.828	48.59	AVG	-0.81	47.78	54.00	147	55	6.22	

Note: No emission was detected in the range 10-25GHz.

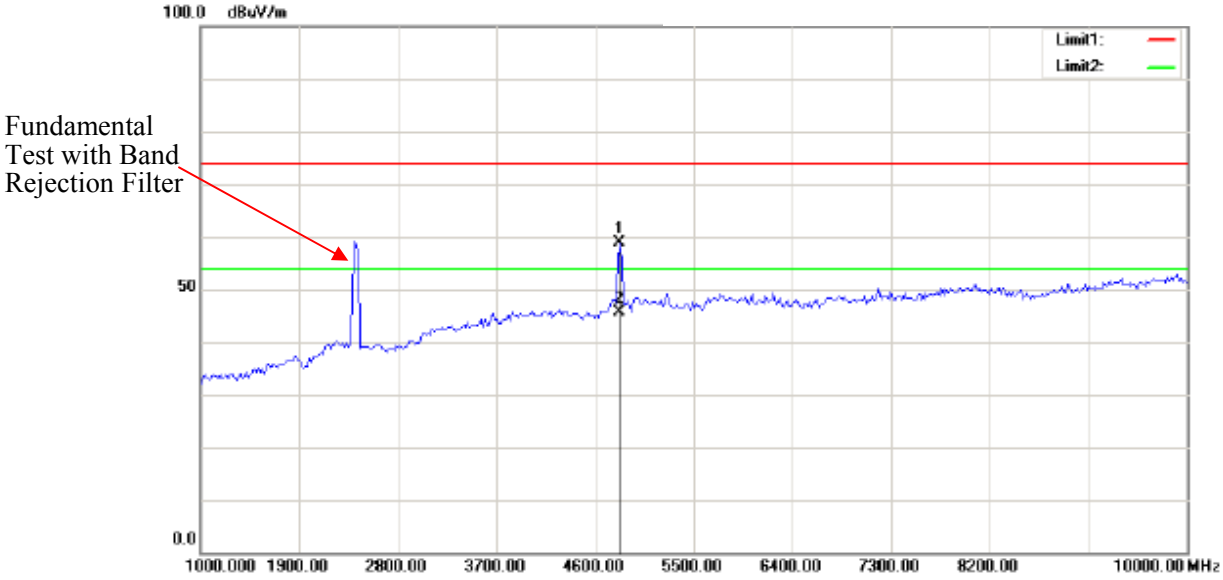
802.11n ht20(2TX was the worst)

Low Channel

Horizontal



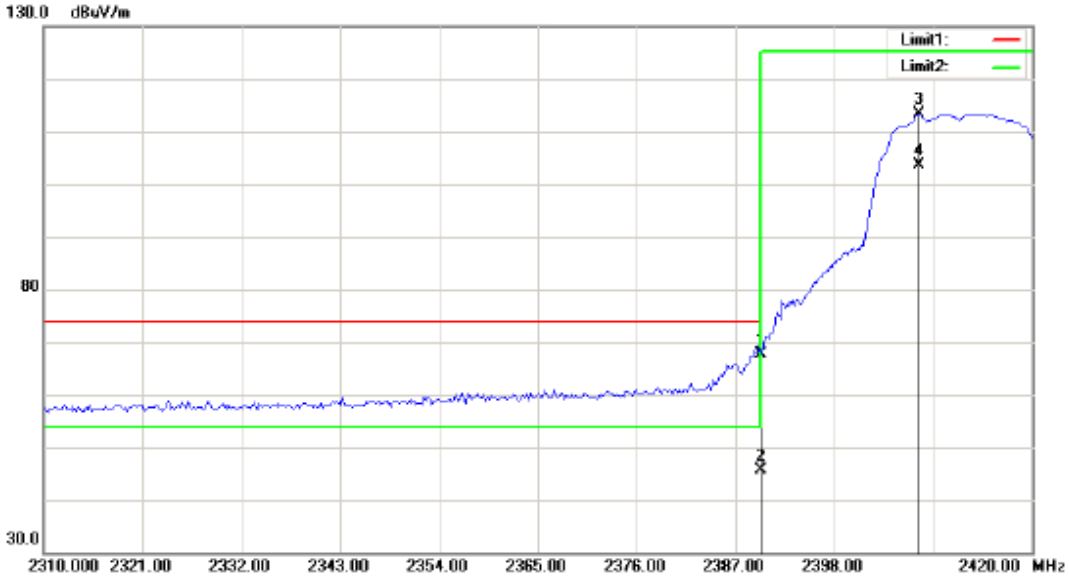
Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	2390.000	29.16	peak	29.88	59.04	74.00	153	45	14.96	
*	2	2390.000	15.25	AVG	29.88	45.13	54.00	153	45	8.87	
	3	2414.048	72.73	peak	29.94	102.67	125.20	153	45	22.53	Fundamental
	4	2414.048	62.37	AVG	29.94	92.31	125.20	153	45	32.89	Fundamental



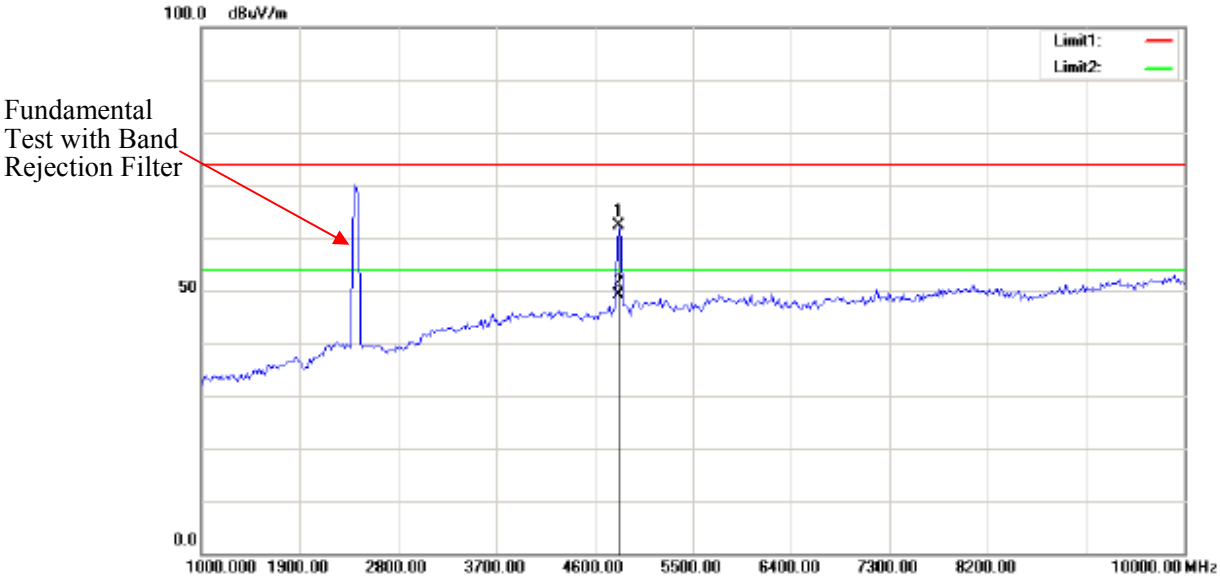
Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4823.647	59.87	peak	-1.06	58.81	74.00	151	163	15.19	
*	2	4823.647	46.59	AVG	-1.06	45.53	54.00	151	163	8.47	

Note: No emission was detected in the range 10-25GHz.

Vertical



Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
*	1	2390.000	37.77	peak	29.88	67.65	74.00	165	223	6.35	
	2	2390.000	15.66	AVG	29.88	45.54	54.00	165	223	8.46	
	3	2407.435	83.58	peak	29.91	113.49	125.20	165	223	11.71	Fundamental
	4	2407.435	73.62	AVG	29.91	103.53	125.20	165	223	21.67	Fundamental

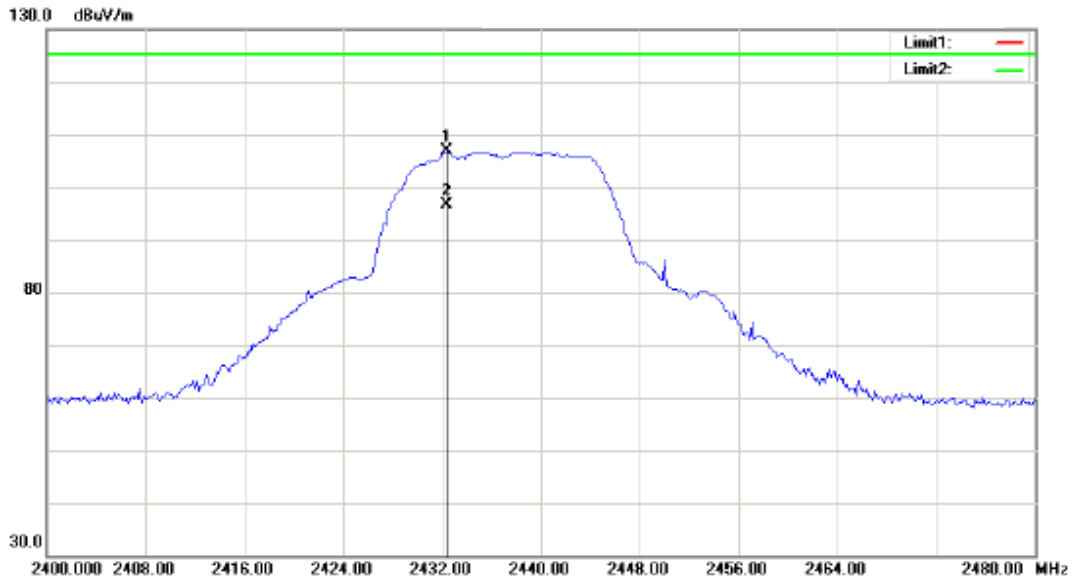


Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4823.647	63.37	peak	-1.06	62.31	74.00	133	166	11.69	
*	2	4823.647	50.24	AVG	-1.06	49.18	54.00	133	166	4.82	

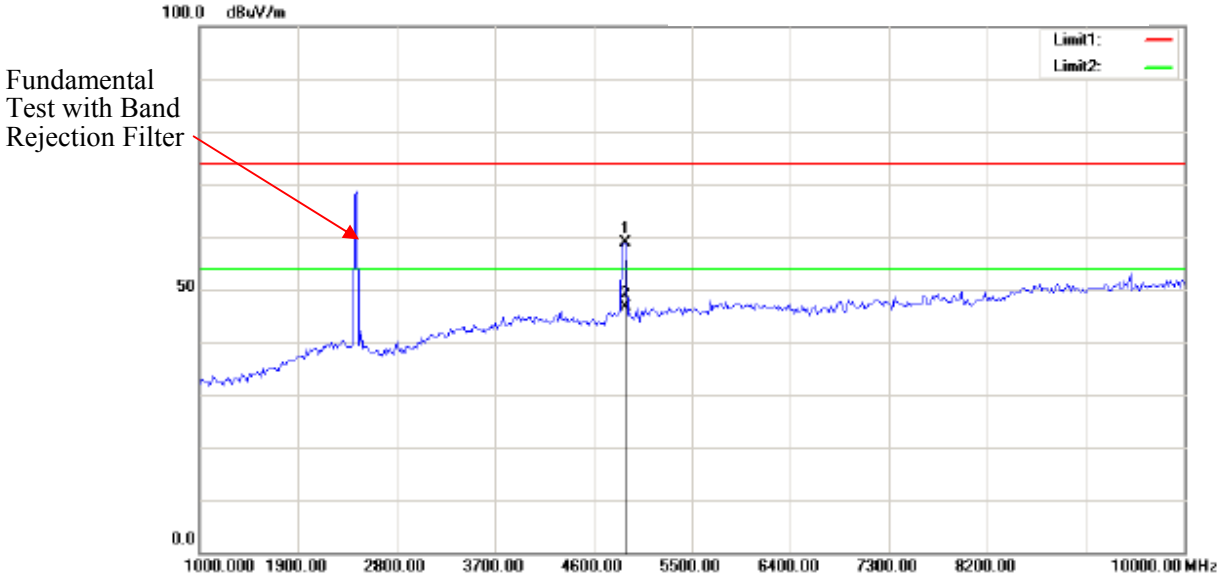
Note: No emission was detected in the range 10-25GHz.

Middle Channel

Horizontal



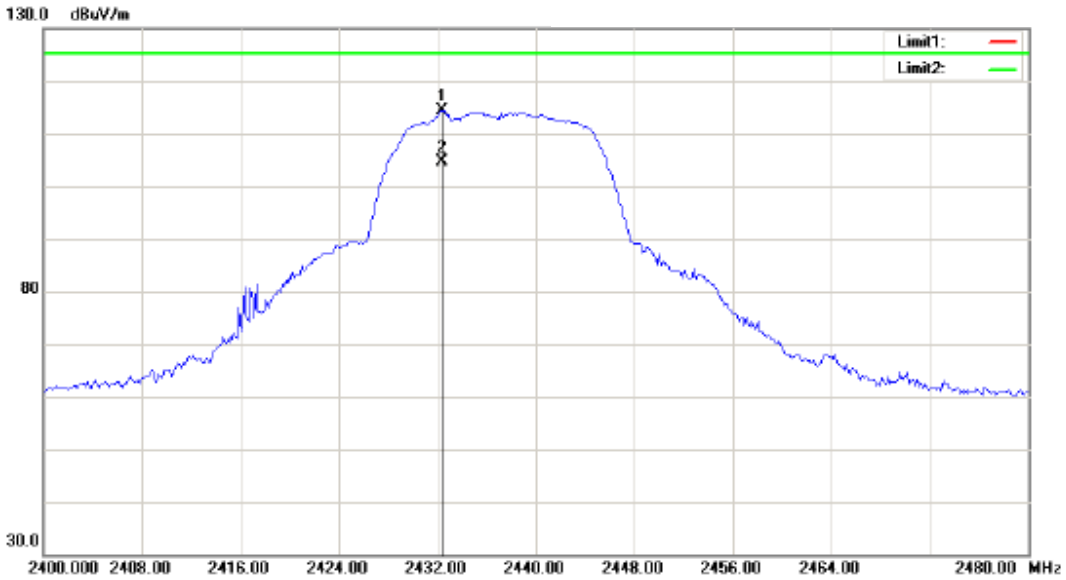
Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
*	1	2432.385	76.80	peak	29.98	106.78	125.20	145	55	18.42	Fundamental
	2	2432.385	66.59	AVG	29.98	96.57	125.20	145	55	28.63	Fundamental



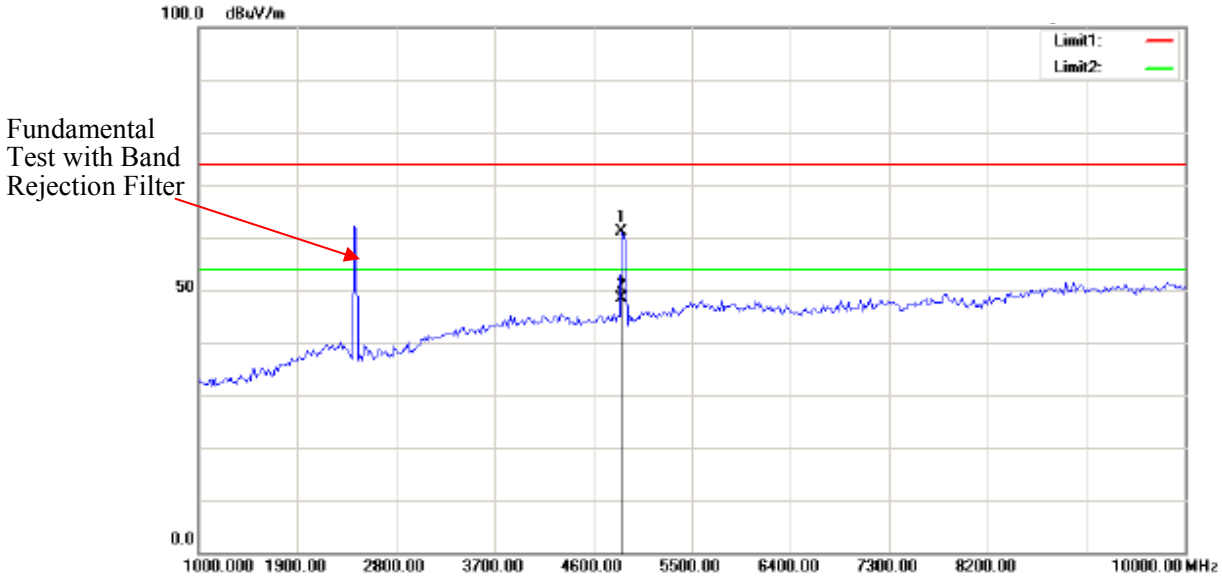
Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4895.792	59.80	peak	-0.83	58.97	74.00	153	266	15.03	
*	2	4895.792	47.52	AVG	-0.83	46.69	54.00	153	266	7.31	

Note: No emission was detected in the range 10-25GHz.

Vertical



Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
*	1	2432.385	84.39	peak	29.98	114.37	125.20	135	224	10.83	Fundamental
	2	2432.385	74.65	AVG	29.98	104.63	125.20	135	224	20.57	Fundamental

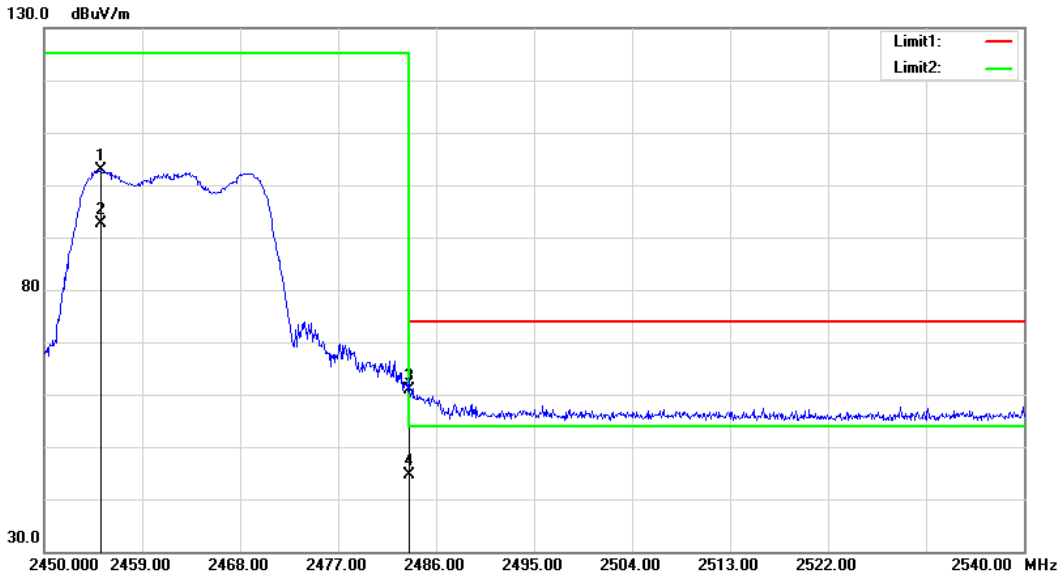


Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4859.719	62.05	peak	-0.95	61.10	74.00	154	28	12.90	
*	2	4859.719	49.34	AVG	-0.95	48.39	54.00	154	28	5.61	

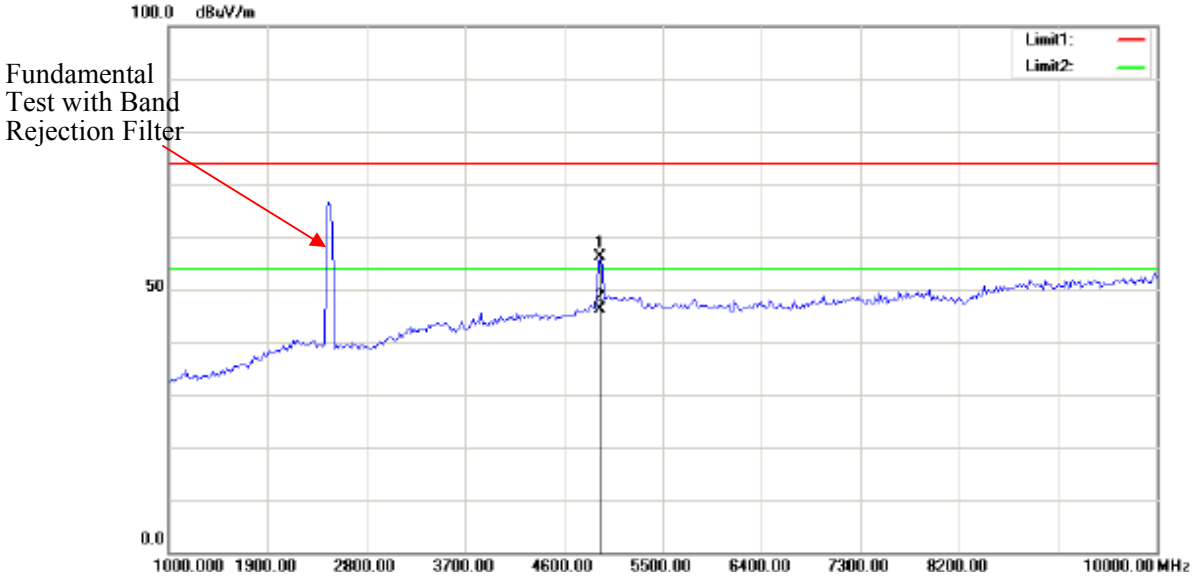
Note: No emission was detected in the range 10-25GHz.

High Channel

Horizontal



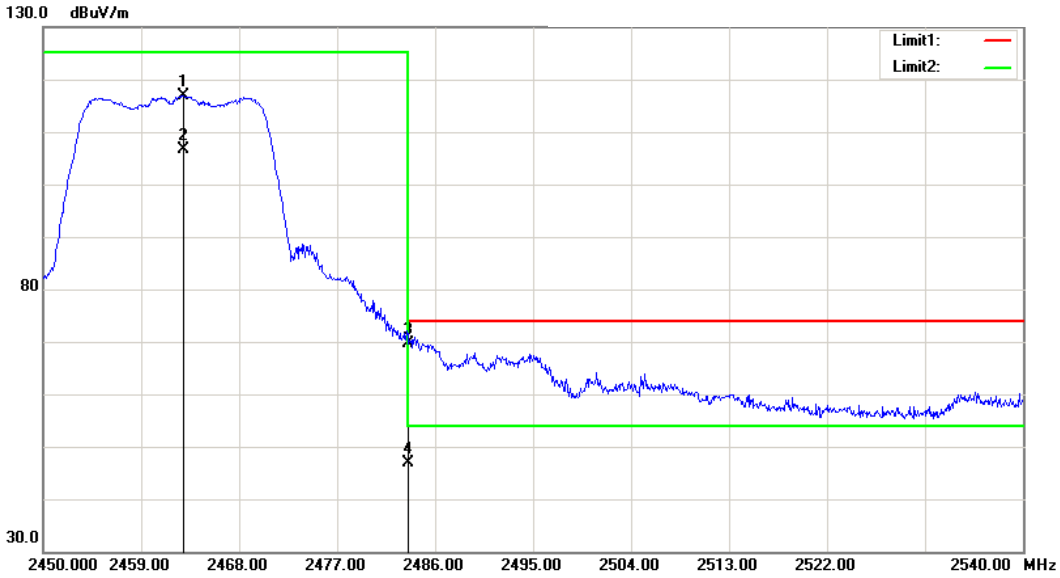
Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	2455.265	72.74	peak	30.04	102.78	125.20	145	223	22.42	Fundamental
	2	2455.265	62.53	AVG	30.04	92.57	125.20	145	223	32.63	Fundamental
	3	2483.500	30.79	peak	30.11	60.90	74.00	145	223	13.10	
*	4	2483.500	14.56	AVG	30.11	44.67	54.00	145	223	9.33	



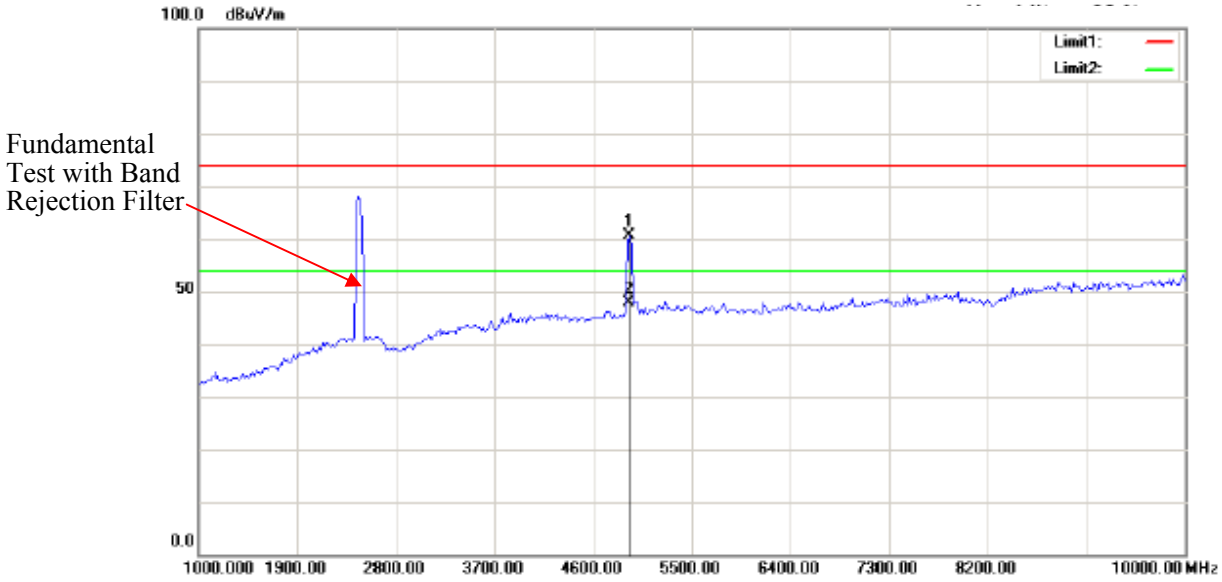
Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4931.864	56.86	peak	-0.81	56.05	74.00	158	64	17.95	
*	2	4931.864	46.87	AVG	-0.81	46.06	54.00	158	64	7.94	

Note: No emission was detected in the range 10-25GHz.

Vertical



Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	2462.870	86.89	peak	30.06	116.95	125.20	148	153	8.25	Fundamental
	2	2462.870	76.58	AVG	30.06	106.64	125.20	148	153	18.56	Fundamental
*	3	2483.500	39.50	peak	30.11	69.61	74.00	148	153	4.39	
	4	2483.500	16.84	AVG	30.11	46.95	54.00	148	153	7.05	



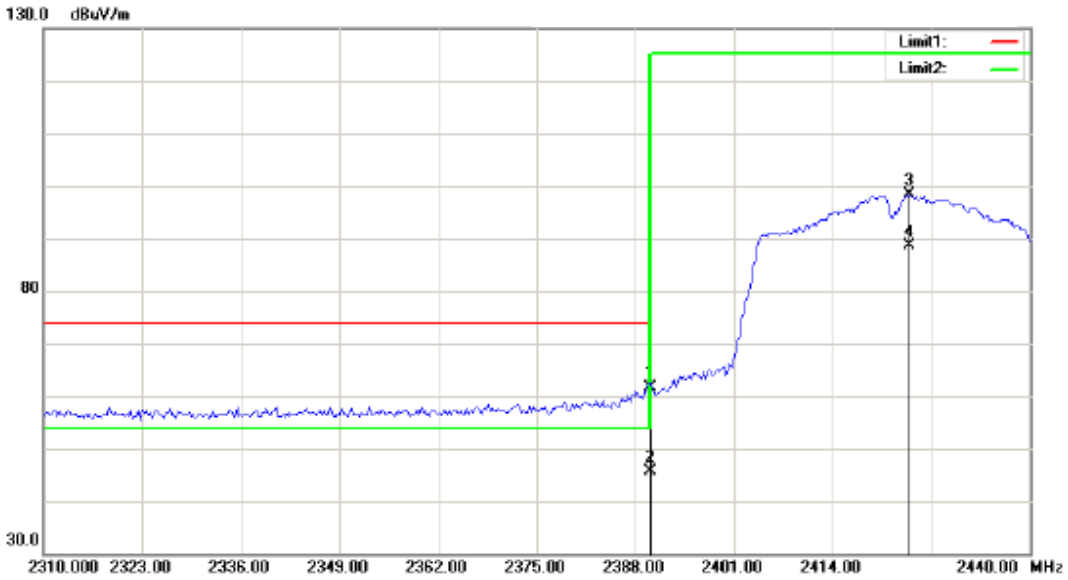
Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4931.864	61.36	peak	-0.81	60.55	74.00	157	48	13.45	
*	2	4931.864	48.62	AVG	-0.81	47.81	54.00	157	48	6.19	

Note: No emission was detected in the range 10-25GHz.

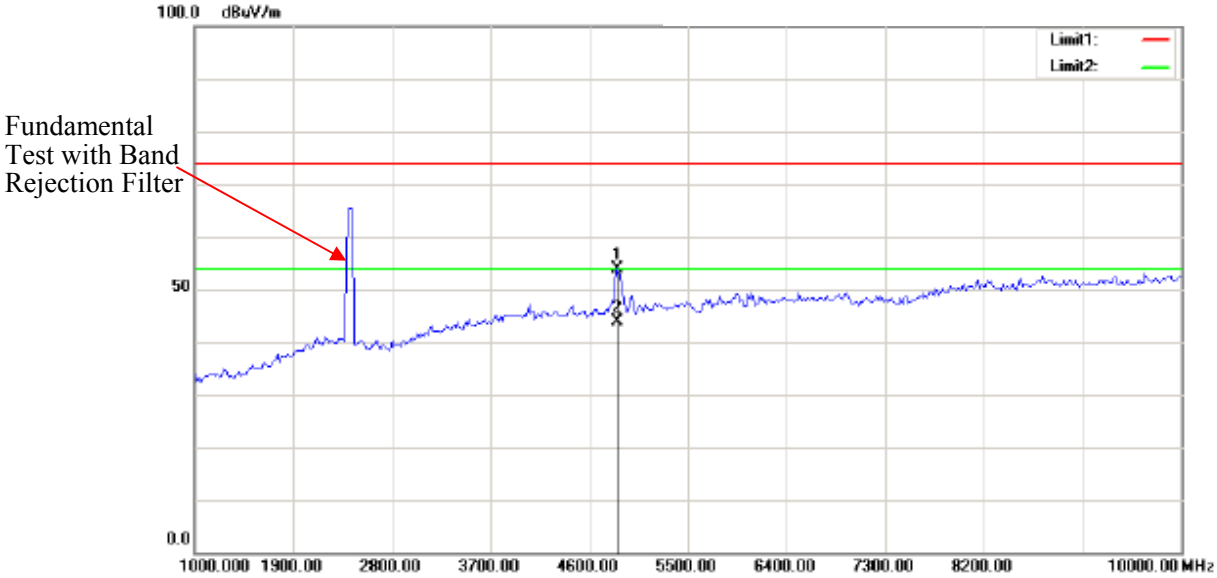
802.11n ht40(2TX was the worst)

Low Channel

Horizontal



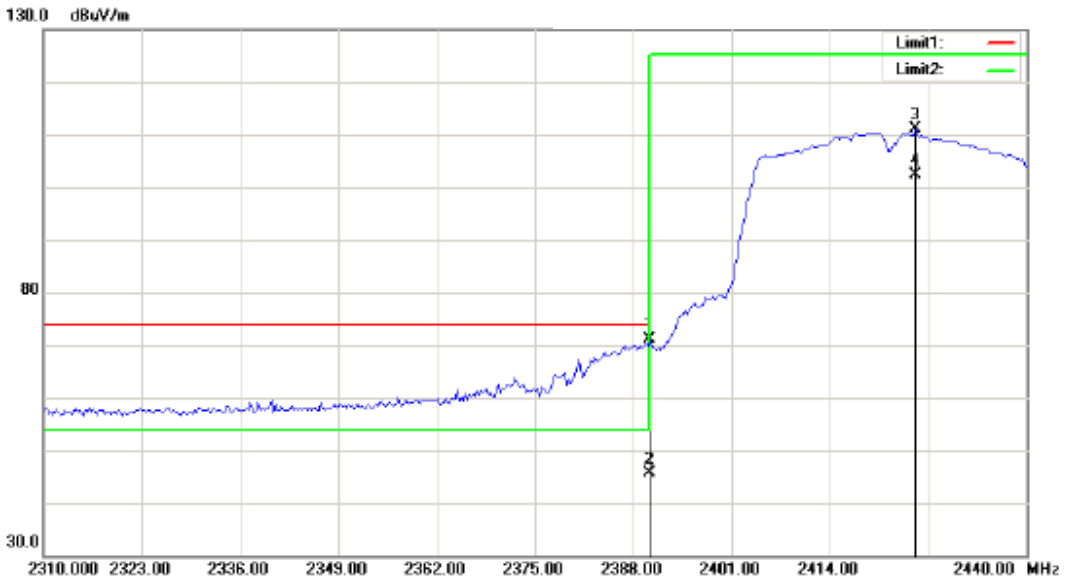
Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	2390.000	31.84	peak	29.88	61.72	74.00	158	26	12.28	
*	2	2390.000	15.66	AVG	29.88	45.54	54.00	158	26	8.46	
	3	2424.108	68.38	peak	29.96	98.34	125.20	158	26	26.86	Fundamental
	4	2424.108	58.69	AVG	29.96	88.65	125.20	158	26	36.55	Fundamental



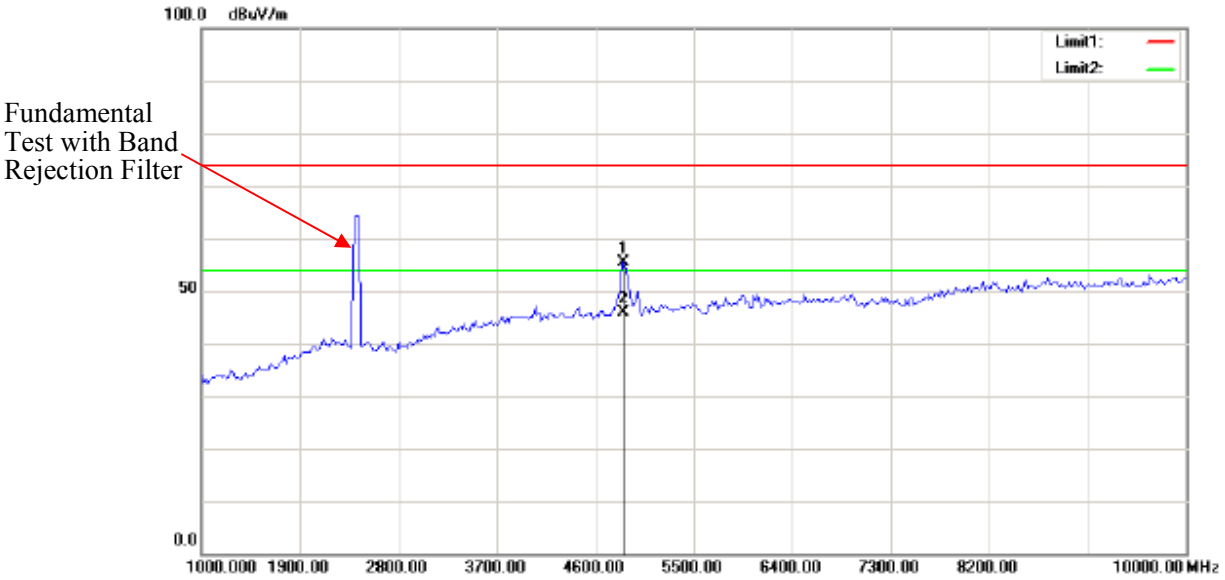
Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4859.719	54.95	peak	-0.95	54.00	74.00	152	334	20.00	
*	2	4859.719	44.86	AVG	-0.95	43.91	54.00	152	334	10.09	

Note: No emission was detected in the range 10-25GHz.

Vertical



Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
*	1	2390.000	41.20	peak	29.88	71.08	74.00	154	228	2.92	
	2	2390.000	15.82	AVG	29.88	45.70	54.00	154	228	8.30	
	3	2425.411	81.11	peak	29.96	111.07	125.20	154	228	14.13	Fundamental
	4	2425.411	72.49	AVG	29.96	102.45	125.20	154	228	22.75	Fundamental

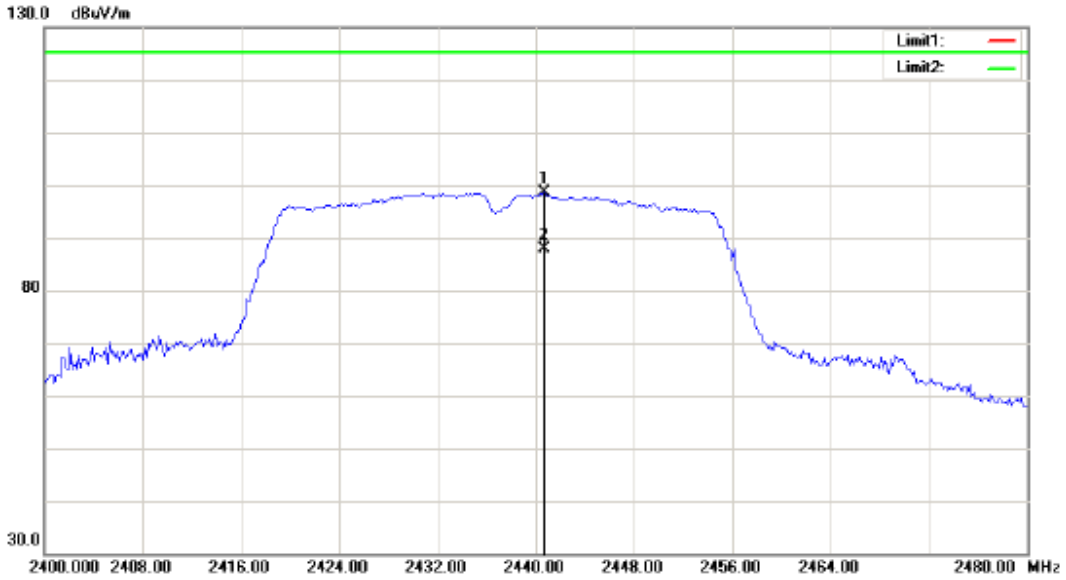


Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4859.719	56.45	peak	-0.95	55.50	74.00	153	154	18.50	
*	2	4859.719	46.83	AVG	-0.95	45.88	54.00	153	154	8.12	

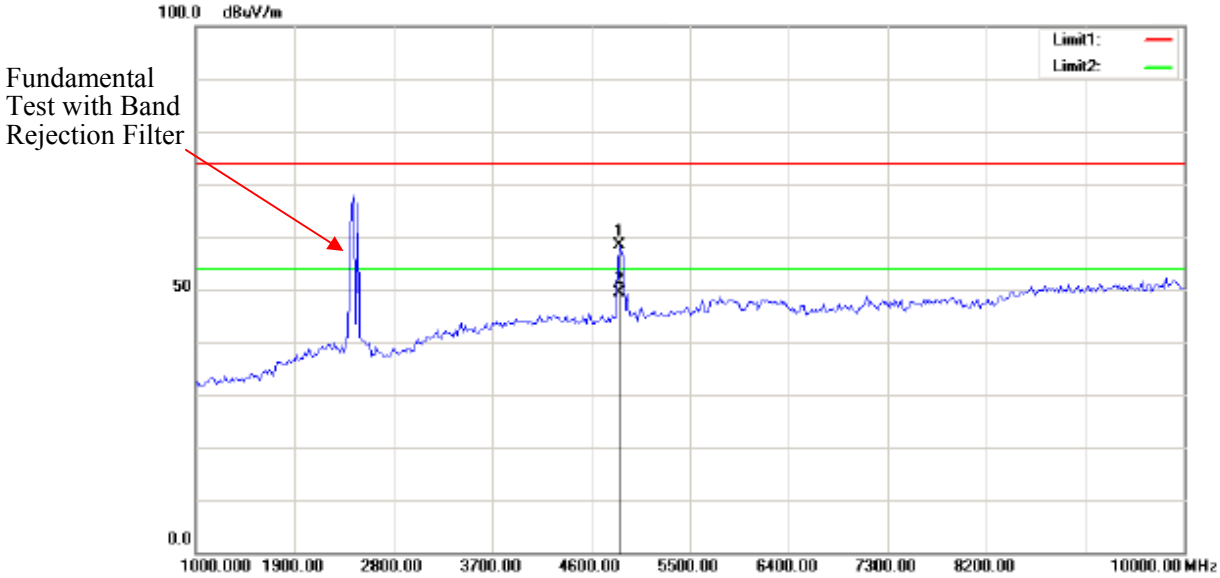
Note: No emission was detected in the range 10-25GHz.

Middle Channel

Horizontal



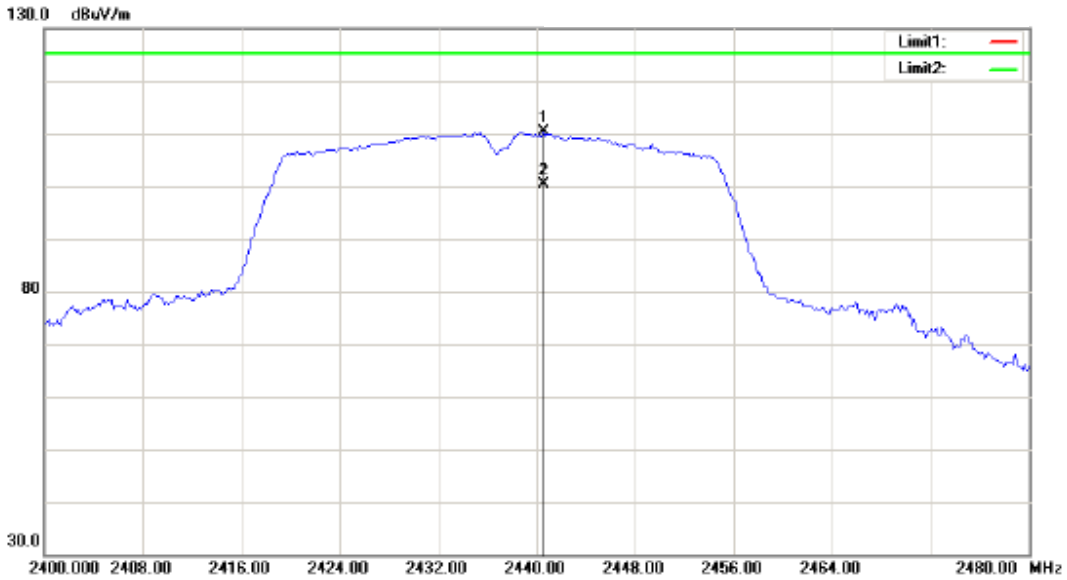
Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
*	1	2440.721	68.59	peak	30.00	98.59	125.20	153	149	26.61	Fundamental
	2	2440.721	57.94	AVG	30.00	87.94	125.20	153	149	37.26	Fundamental



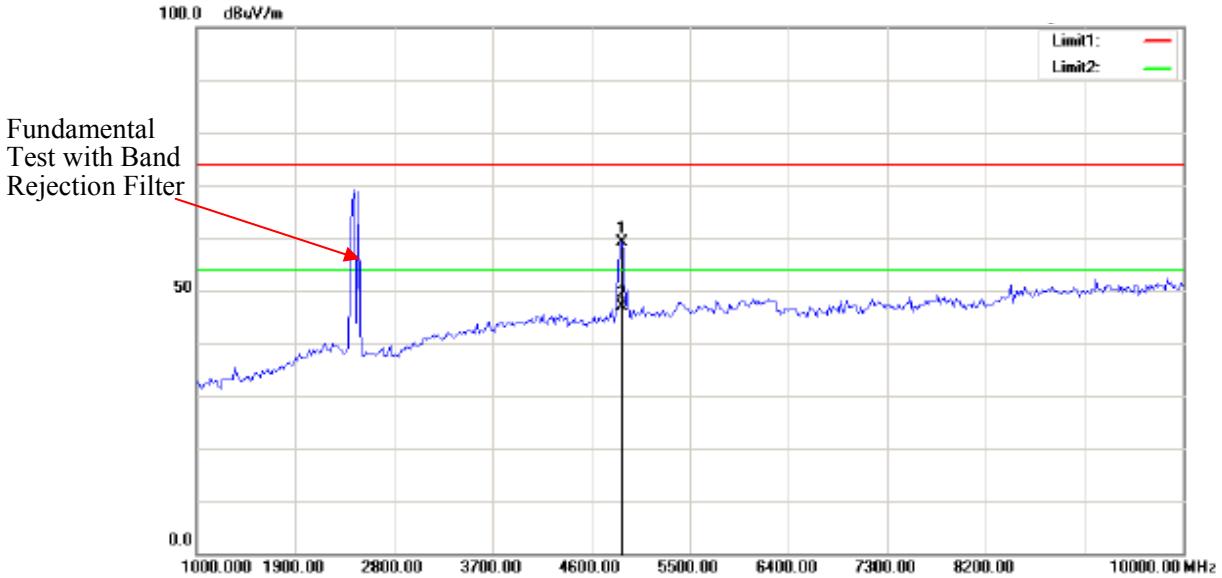
Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4859.719	59.39	peak	-0.95	58.44	74.00	146	25	15.56	
*	2	4859.719	50.34	AVG	-0.95	49.39	54.00	146	25	4.61	

Note: No emission was detected in the range 10-25GHz.

Vertical



Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
*	1	2440.561	80.35	peak	30.00	110.35	125.20	152	334	14.85	Fundamental
	2	2440.561	70.38	AVG	30.00	100.38	125.20	152	334	24.82	Fundamental

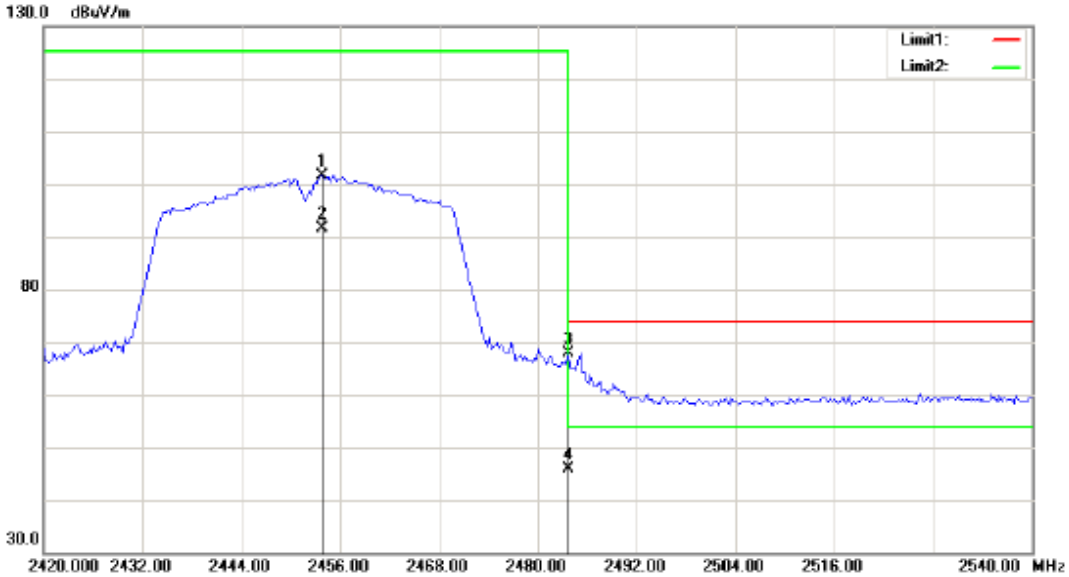


Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4877.756	60.10	peak	-0.88	59.22	74.00	156	58	14.78	
*	2	4877.756	47.68	AVG	-0.88	46.80	54.00	156	58	7.20	

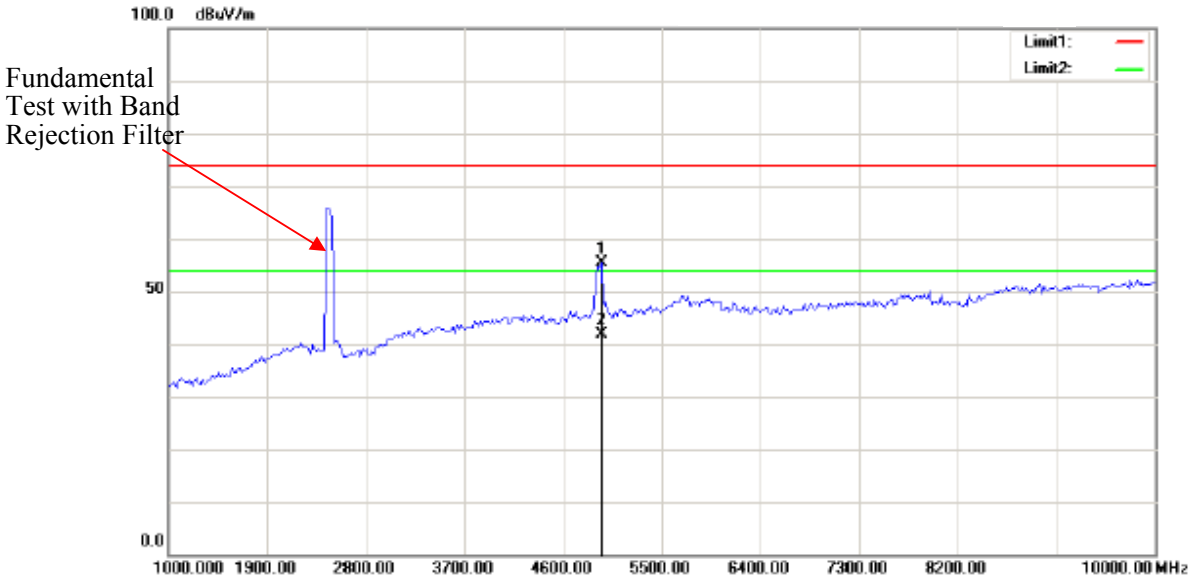
Note: No emission was detected in the range 10-25GHz.

High Channel

Horizontal



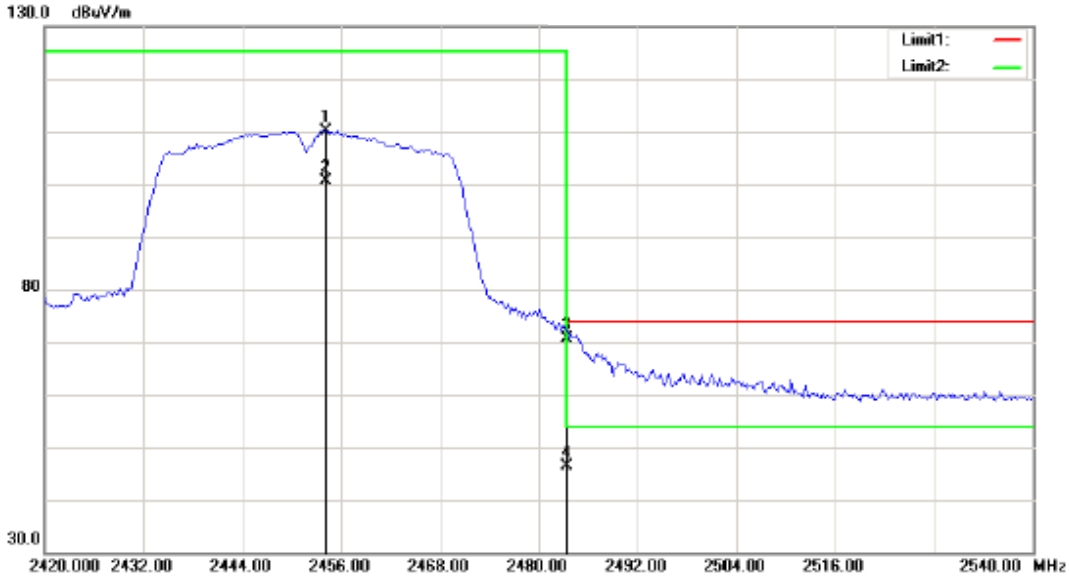
Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	2453.908	71.61	peak	30.04	101.65	125.20	158	46	23.55	
	2	2453.908	61.59	AVG	30.04	91.63	125.20	158	46	33.57	
*	3	2483.500	37.67	peak	30.11	67.78	74.00	158	46	6.22	Fundamental
	4	2483.500	15.84	AVG	30.11	45.95	54.00	158	46	8.05	Fundamental



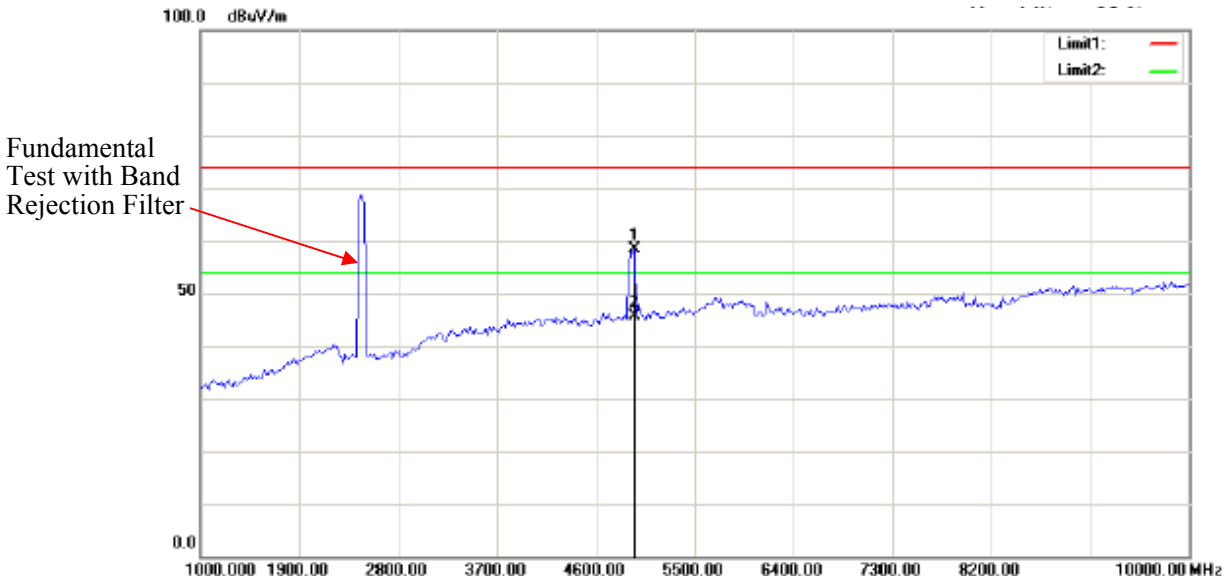
Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4949.900	56.24	peak	-0.80	55.44	74.00	157	64	18.56	
*	2	4949.900	42.58	AVG	-0.80	41.78	54.00	157	64	12.22	

Note: No emission was detected in the range 10-25GHz.

Vertical



Mk.	No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	2454.148	80.18	peak	30.04	110.22	125.20	151	112	14.98	Fundamental
	2	2454.148	70.54	AVG	30.04	100.58	125.20	151	112	24.62	Fundamental
*	3	2483.500	40.61	peak	30.11	70.72	74.00	151	112	3.28	
	4	2483.500	16.24	AVG	30.11	46.35	54.00	151	112	7.65	



Mk.	No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Ant.Pos (cm)	Tab.Pos (deg.)	Margin (dB)	Comment
	1	4949.900	59.24	peak	-0.80	58.44	74.00	165	46	15.56	
*	2	4949.900	46.52	AVG	-0.80	45.72	54.00	165	46	8.28	

Note: No emission was detected in the range 10-25GHz.

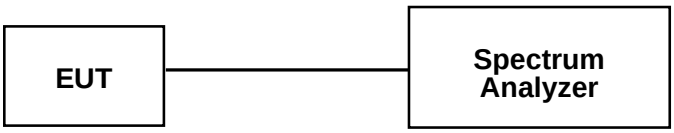
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

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
R&S	Spectrum Analyzer	FSIQ	831929/005	2017-08-31	2018-08-31
Unknown	RF Cable	Unknown	C-4	Each Time	/

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

Test Data

Environmental Conditions

Temperature:	26.6 °C
Relative Humidity:	47 %
ATM Pressure:	101 kPa

** The testing was performed by Kami Zhou on 2017-10-23.*

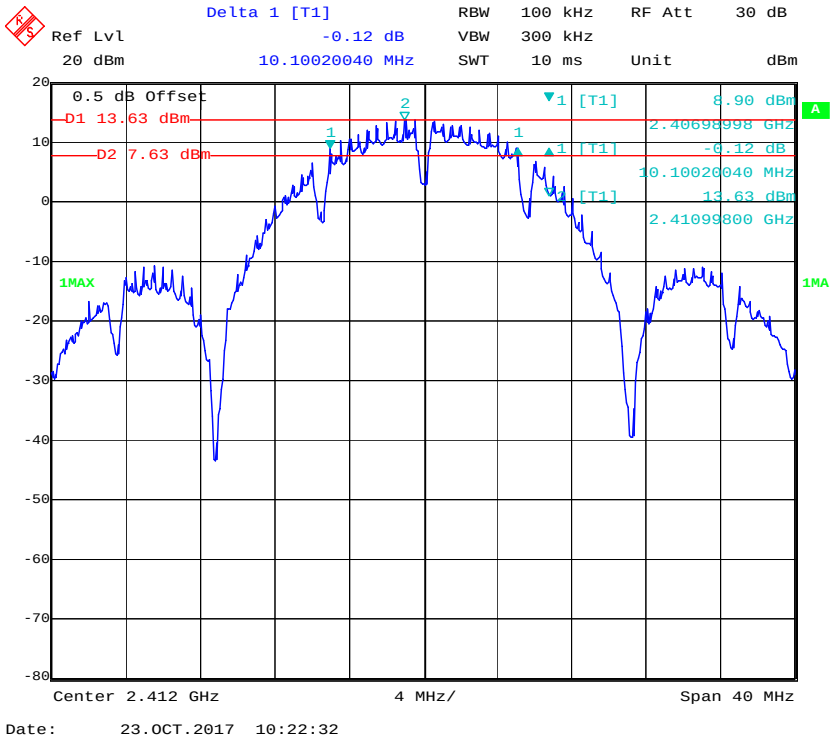
Test Mode: Transmitting

Test Result: Compliant

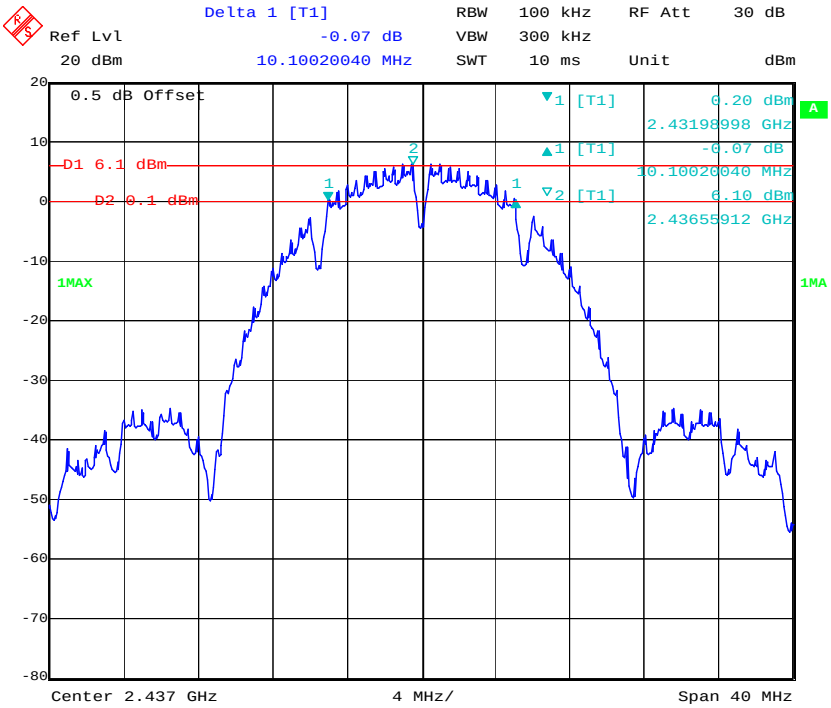
Test performed at chain 0, please refer to the following table and plots.

Test mode	Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (MHz)
802.11b	Low	2412	10.1	≥0.5
	Middle	2437	10.1	≥0.5
	High	2462	10.1	≥0.5
802.11g	Low	2412	15.23	≥0.5
	Middle	2437	15.23	≥0.5
	High	2462	15.15	≥0.5
802.11n ht20	Low	2412	15.23	≥0.5
	Middle	2437	15.23	≥0.5
	High	2462	15.15	≥0.5
802.11n ht40	Low	2422	35.11	≥0.5
	Middle	2437	33.83	≥0.5
	High	2452	35.27	≥0.5

802.11b Low Channel

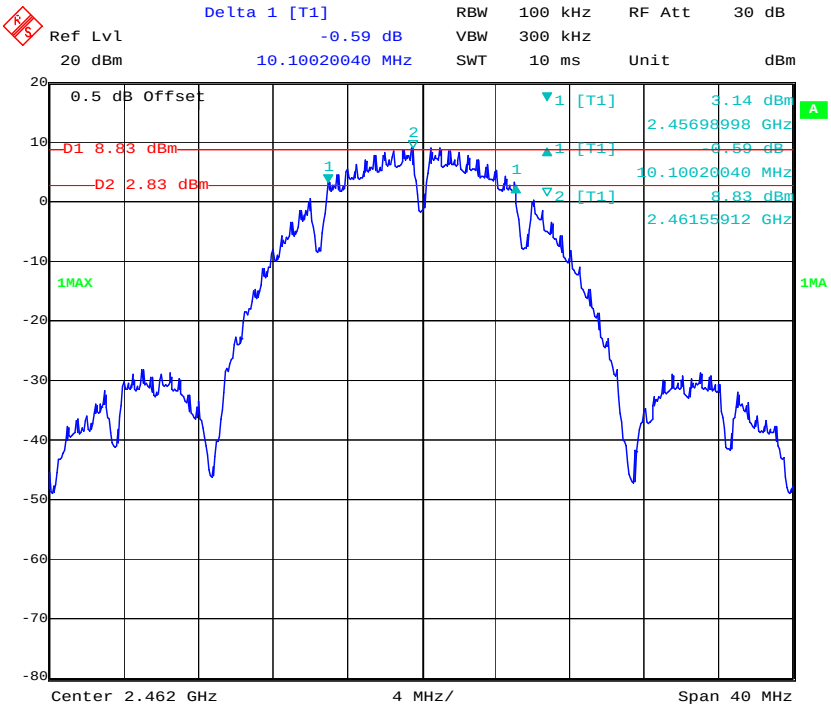


802.11b Middle Channel



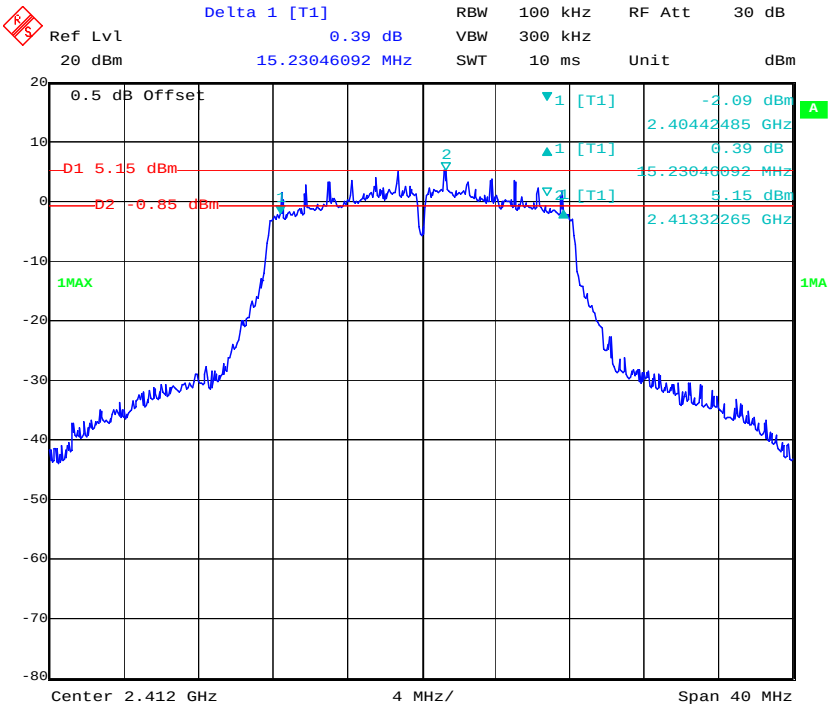
Date: 23.OCT.2017 08:39:00

802.11b High Channel



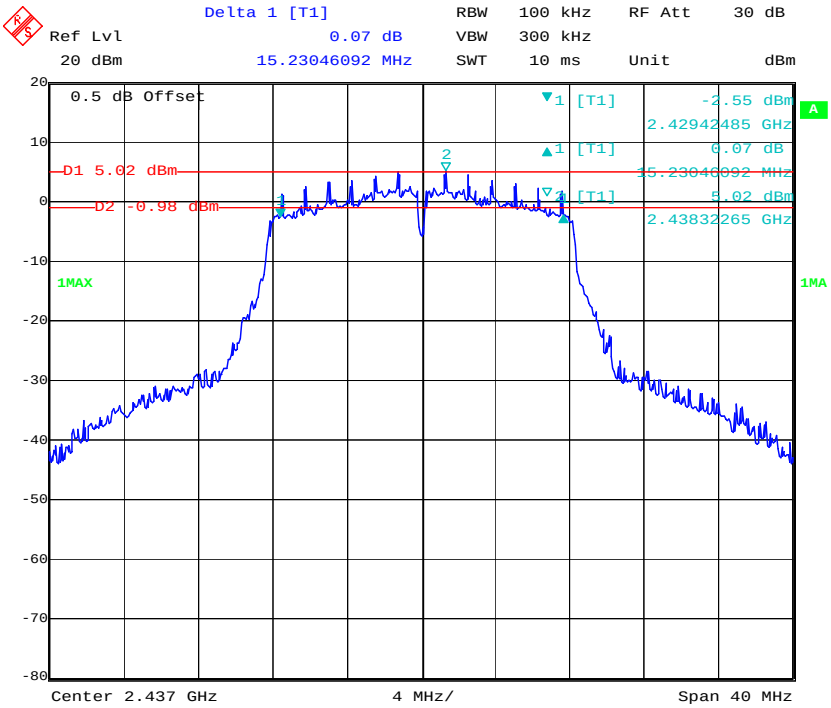
Date: 23.OCT.2017 08:42:12

802.11g Low Channel



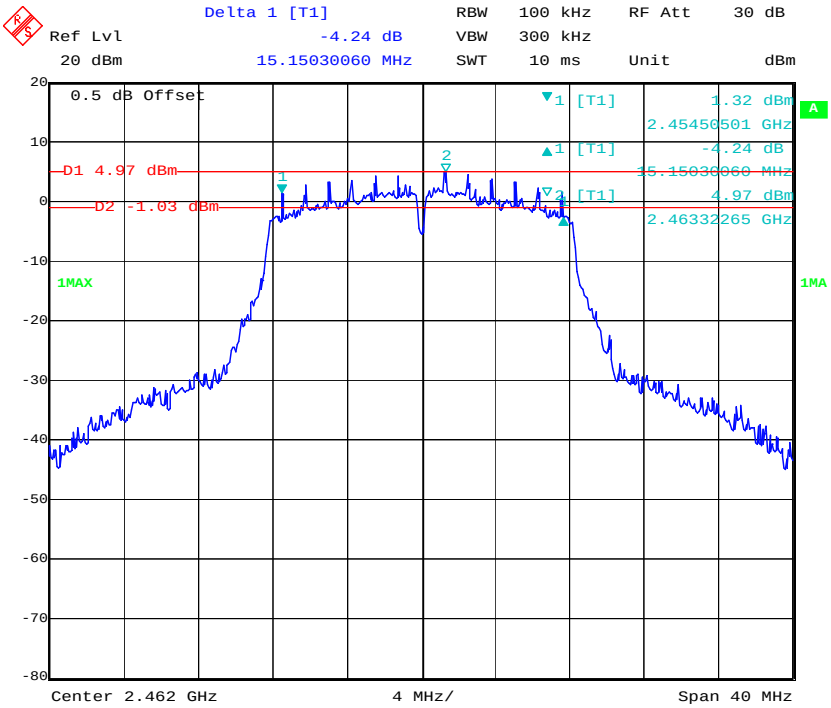
Date: 23.OCT.2017 10:30:40

802.11g Middle Channel



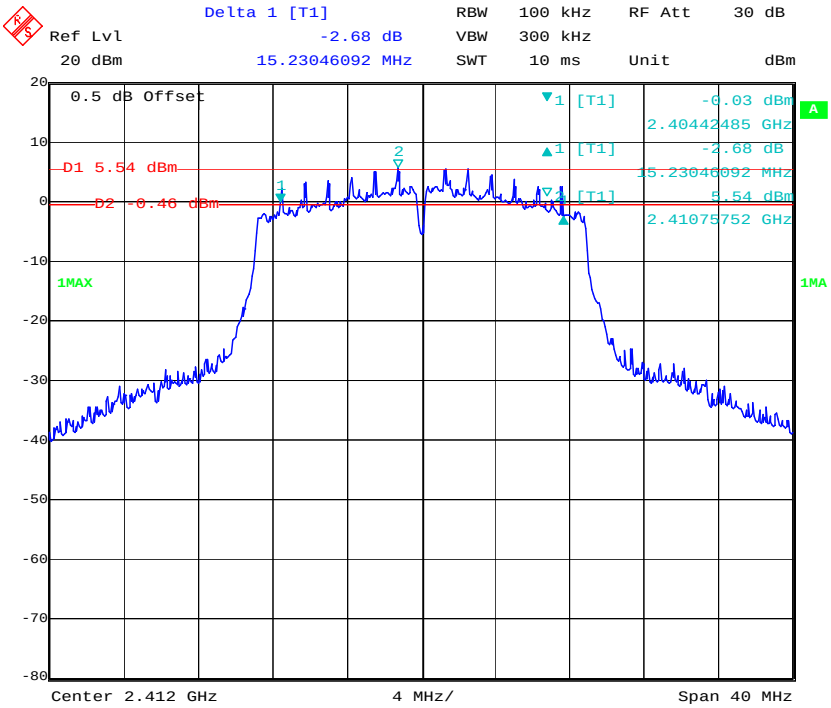
Date: 23.OCT.2017 10:33:08

802.11g High Channel



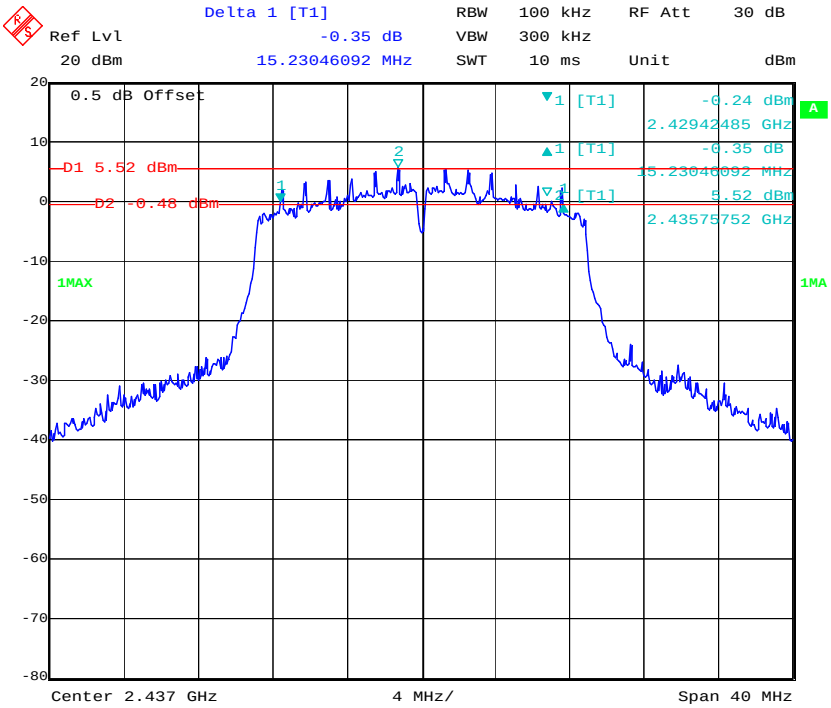
Date: 23.OCT.2017 10:37:24

802.11n ht20 Low Channel



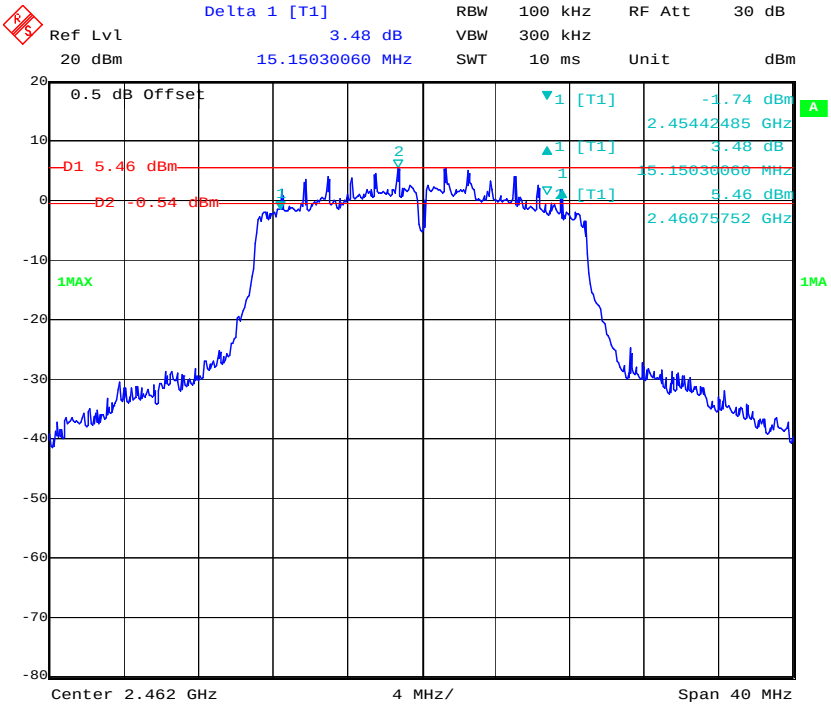
Date: 23.OCT.2017 10:40:36

802.11n ht20 Middle Channel



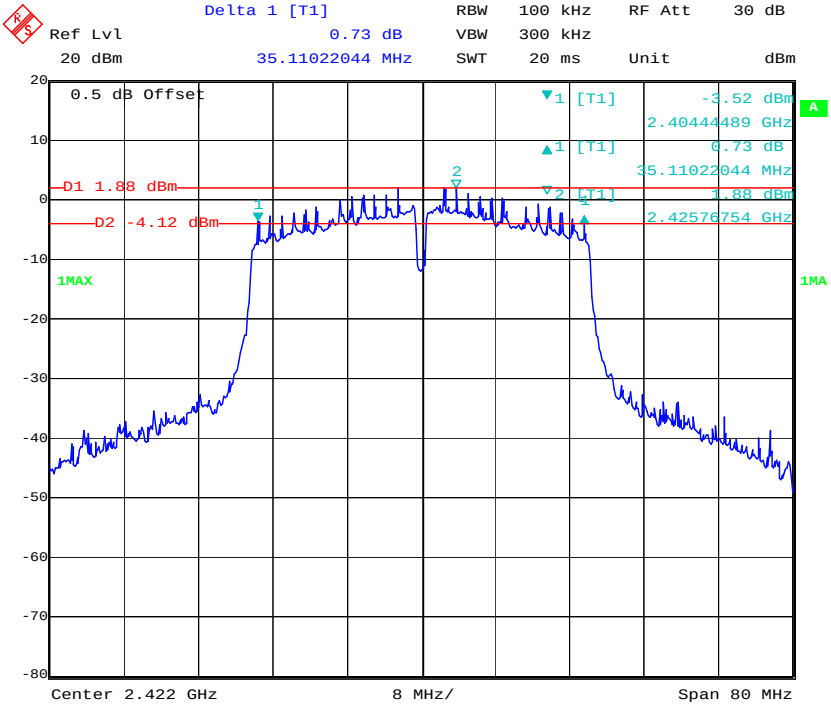
Date: 23.OCT.2017 10:44:39

802.11n ht20 High Channel



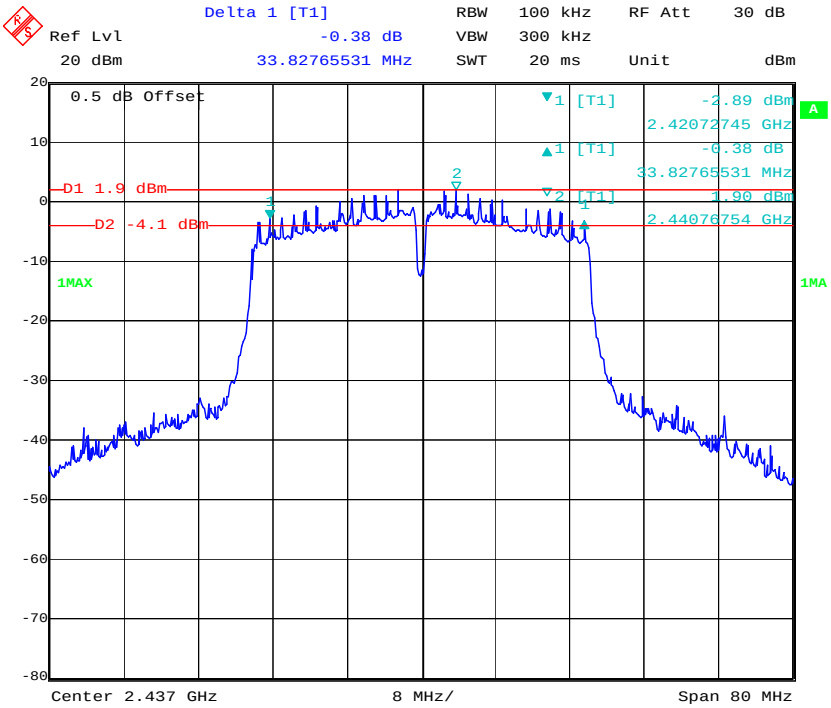
Date: 23.OCT.2017 10:48:06

802.11n ht40 Low Channel



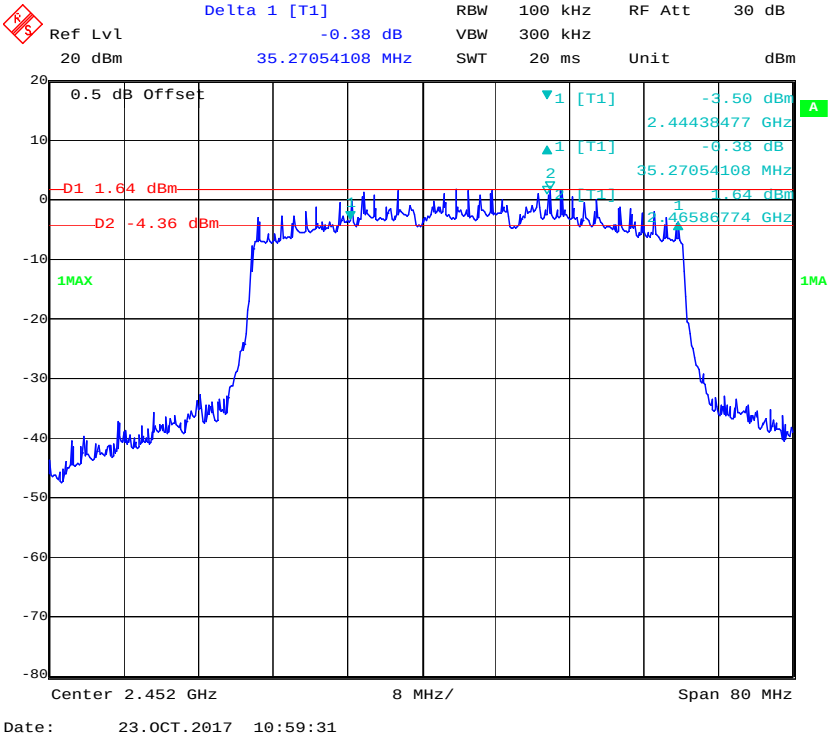
Date: 23.OCT.2017 10:51:38

802.11n ht40 Middle Channel



Date: 23.OCT.2017 10:55:35

802.11n ht40 High Channel



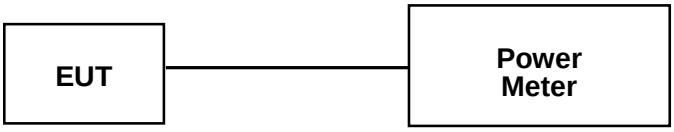
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

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.
4. Set the power Meter to test Peak output power, record the result as peak power.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Wideband Power Sensor	N1921A	MY54210016	2016-11-03	2017-11-03
Agilent	P-Series Power Meter	N1912A	MY5000448	2016-11-03	2017-11-03
Unknown	RF Cable	Unknown	C-4	Each Time	/

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

Test Data

Environmental Conditions

Temperature:	26.6 °C
Relative Humidity:	47 %
ATM Pressure:	101 kPa

** The testing was performed by Kami Zhou on 2017-10-23.*

Test Mode: Transmitting

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

Test mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)			Limit (dBm)
			Chain 0	Chain 1	Total	
802.11b	Low	2412	21.89	21.72	/	30
	Middle	2437	18.67	21.71	/	30
	High	2462	21.4	21.46	/	30
802.11g	Low	2412	23.12	23.1	/	30
	Middle	2437	22.99	23.03	/	30
	High	2462	22.96	22.78	/	30
802.11n ht20	Low	2412	23.28	23.62	26.46	30
	Middle	2437	23.31	23.69	26.51	30
	High	2462	23.18	23.54	26.37	30
802.11n ht40	Low	2422	22.47	22.84	25.67	30
	Middle	2437	22.43	22.76	25.61	30
	High	2452	22.53	22.6	25.58	30

Note: the maximum antenna gain is 5 dBi, the device 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 = G_{ANT} + Array Gain = 5dBi < 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
R&S	Spectrum Analyzer	FSIQ	831929/005	2017-08-31	2018-08-31
Unknown	RF Cable	Unknown	C-4	Each Time	/

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

Test Data

Environmental Conditions

Temperature:	26.6 °C
Relative Humidity:	47 %
ATM Pressure:	101 kPa

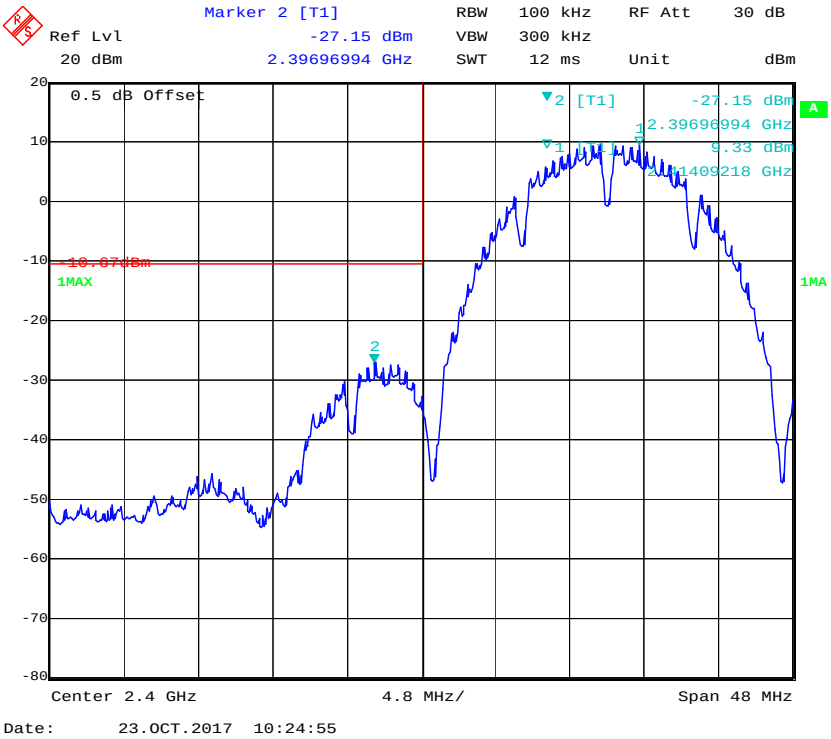
** The testing was performed by Kami Zhou on 2017-10-23.*

Test mode: Transmitting

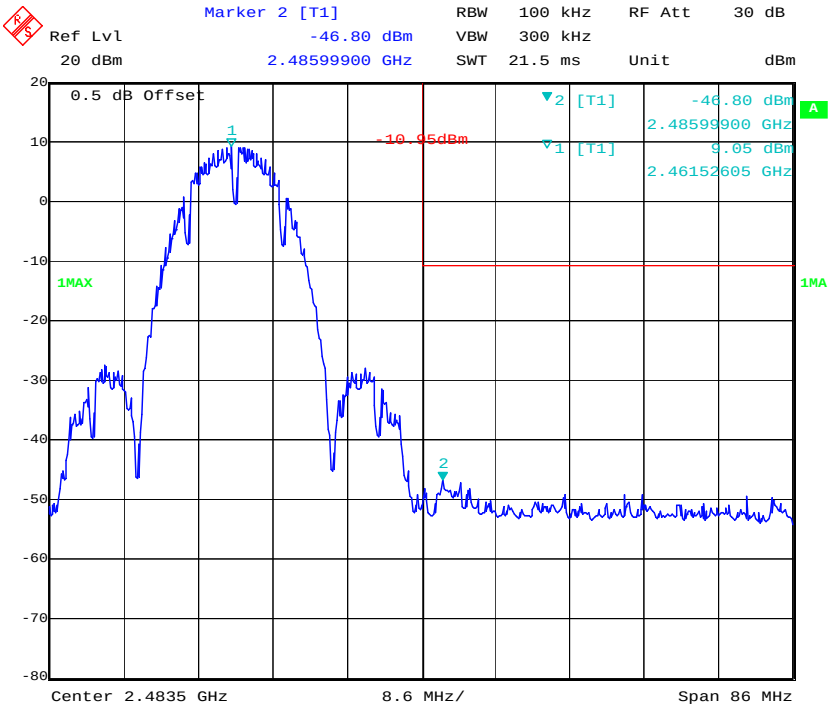
Test Result: Compliant. Please refer to following plots.

Chain 0:

802.11b: Band Edge, Left Side

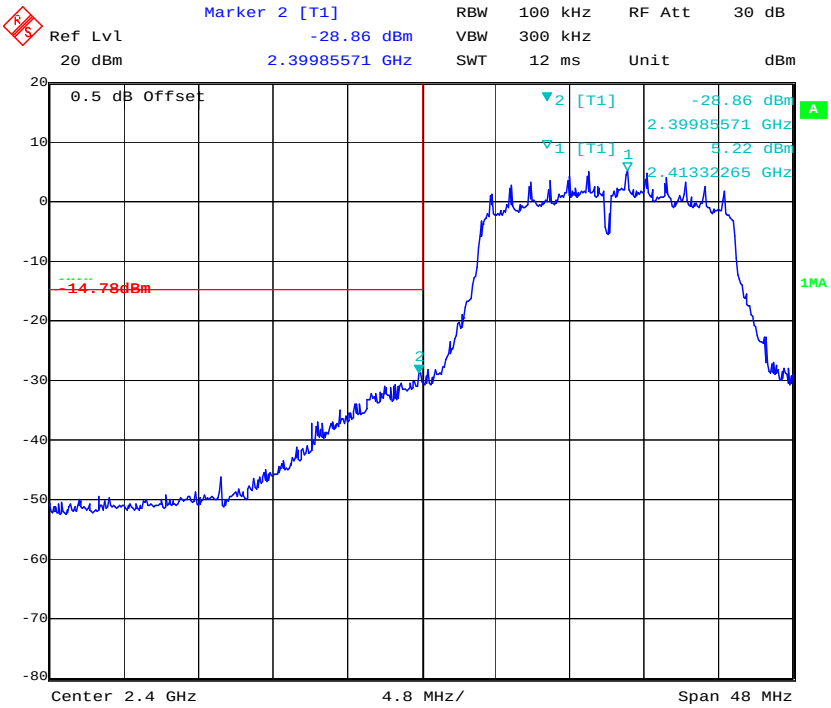


802.11b: Band Edge, Right Side



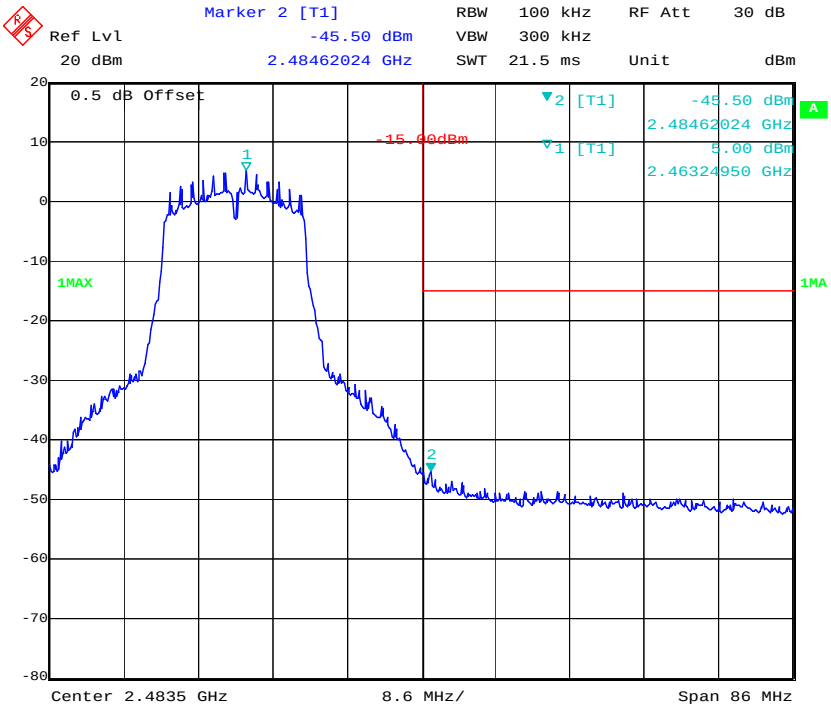
Date: 23.OCT.2017 10:27:12

802.11g: Band Edge, Left Side



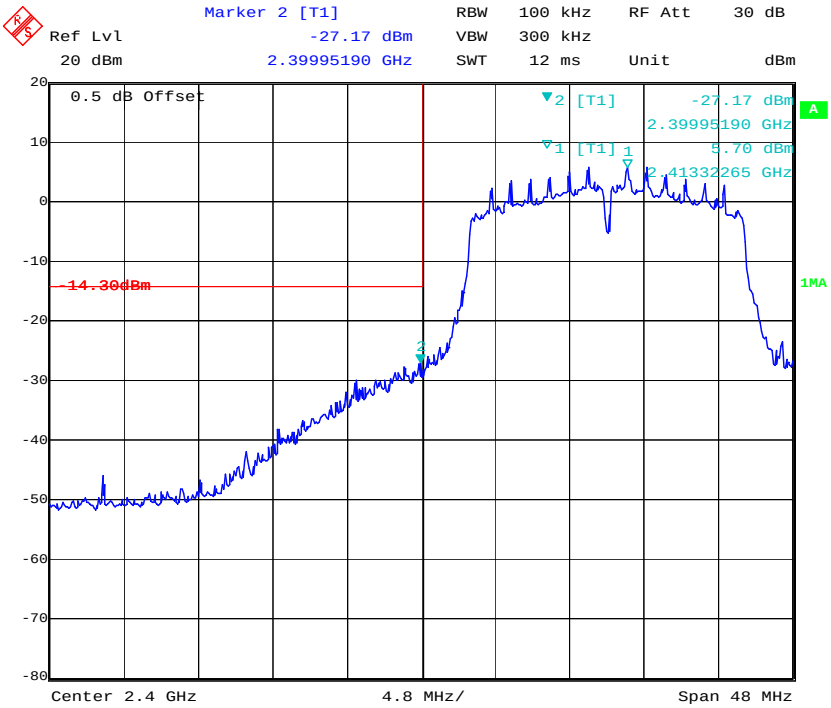
Date: 23.OCT.2017 10:29:59

802.11g: Band Edge, Right Side



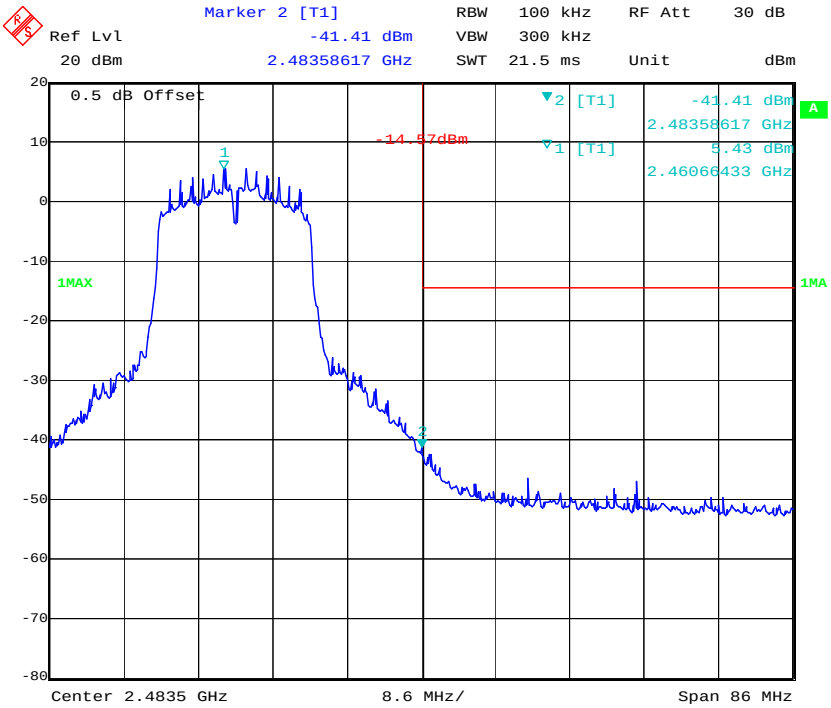
Date: 23.OCT.2017 10:39:50

802.11n ht20 Band Edge, Left Side



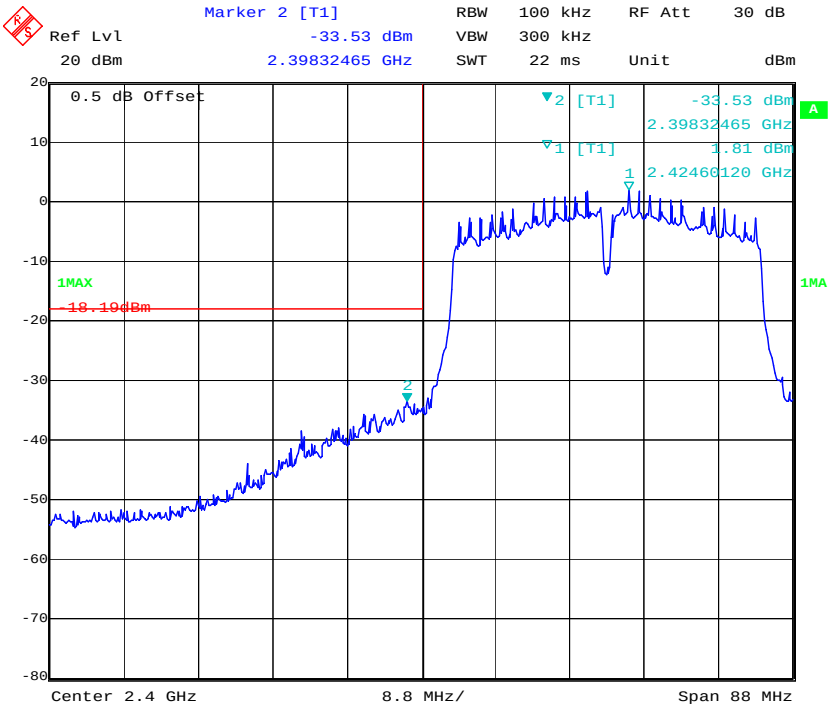
Date: 23.OCT.2017 10:43:59

802.11n ht20 Band Edge, Right Side



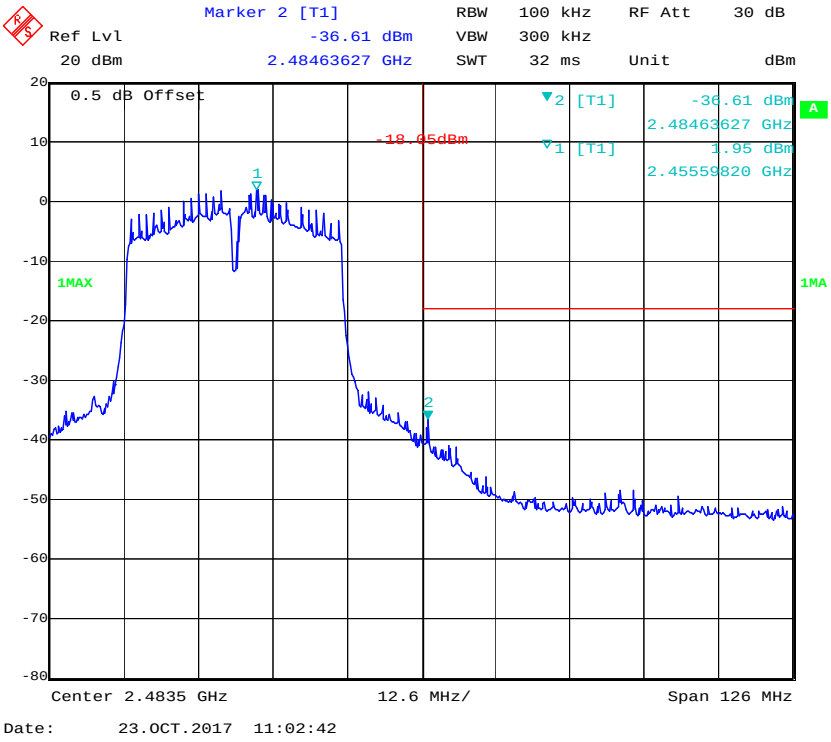
Date: 23.OCT.2017 10:50:41

802.11n ht40 Band Edge, Left Side



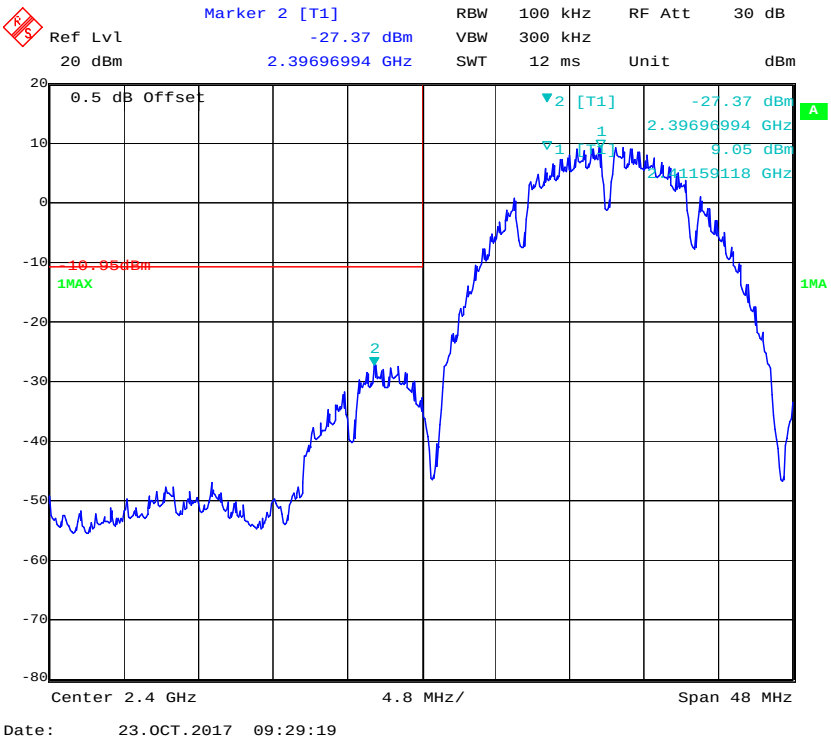
Date: 23.OCT.2017 10:54:48

802.11n ht40 Band Edge, Right Side

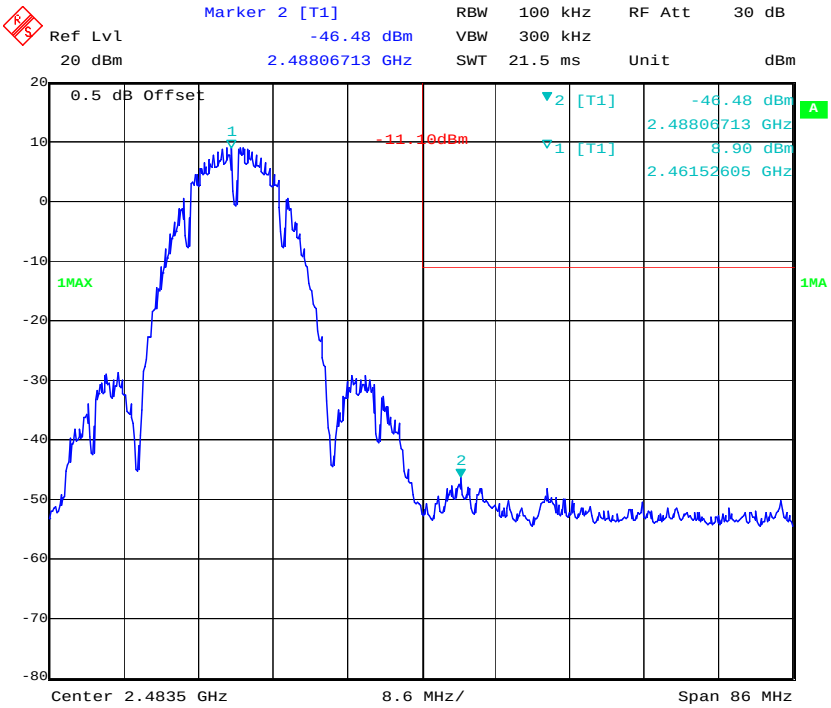


Chain 1:

802.11b: Band Edge, Left Side

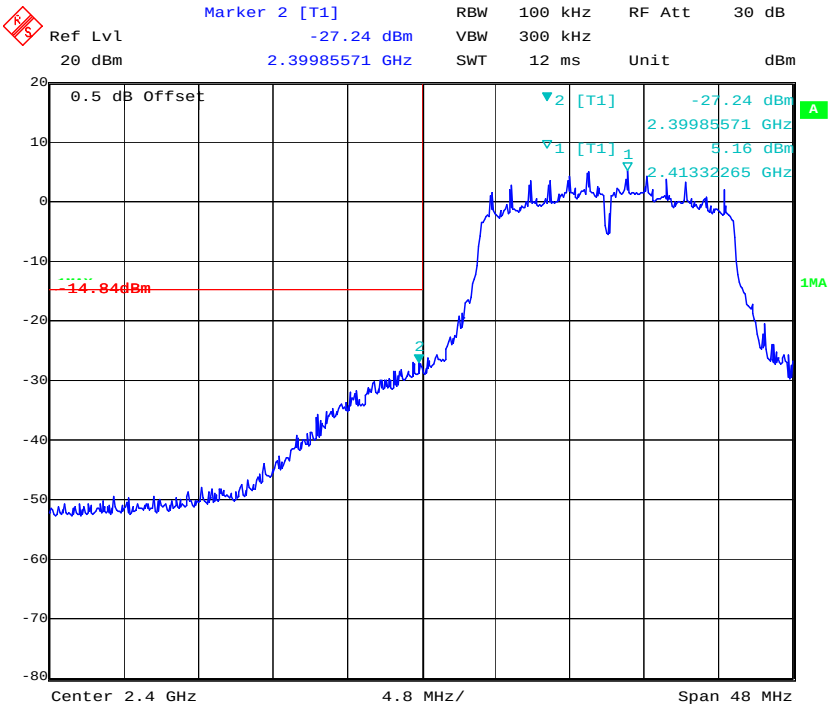


802.11b: Band Edge, Right Side



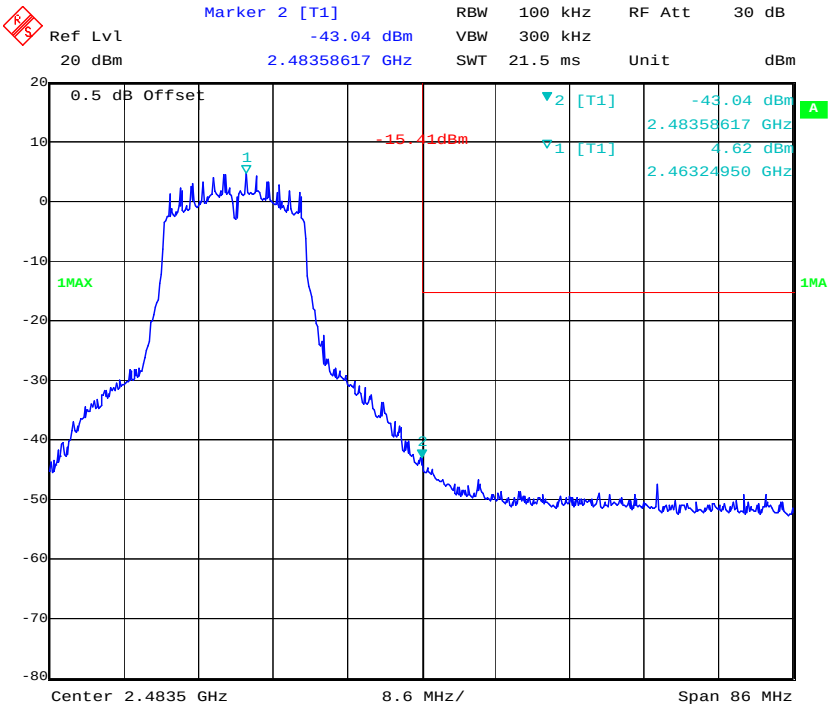
Date: 23.OCT.2017 09:39:32

802.11g: Band Edge, Left Side



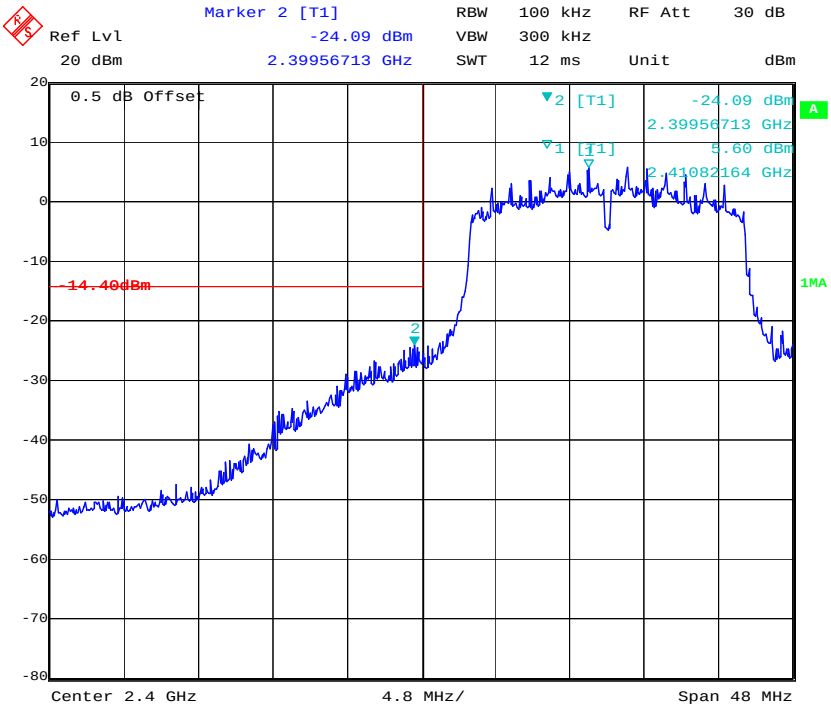
Date: 23.OCT.2017 09:44:02

802.11g: Band Edge, Right Side



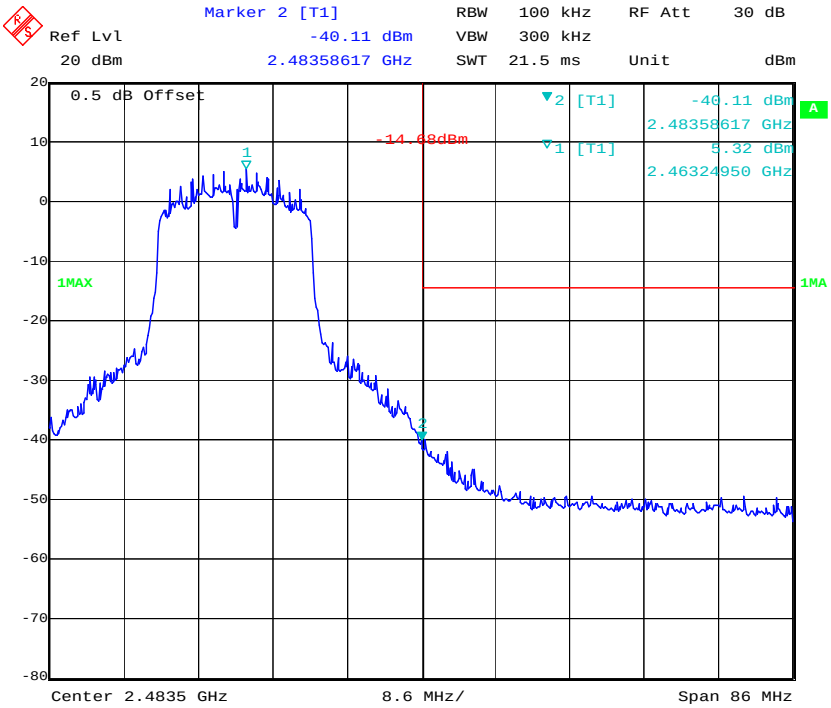
Date: 23.OCT.2017 09:49:52

802.11n ht20 Band Edge, Left Side



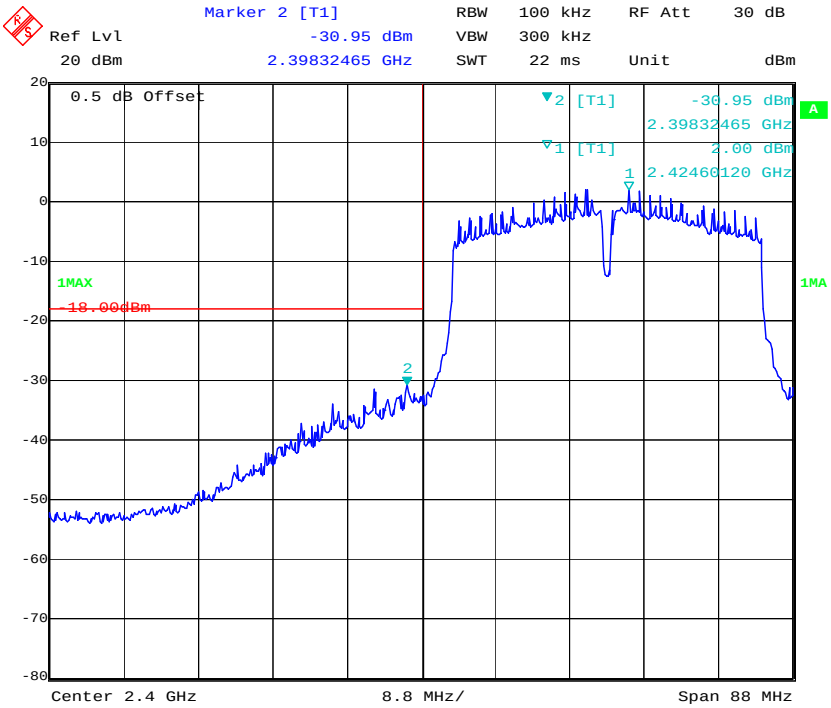
Date: 23.OCT.2017 09:53:32

802.11n ht20 Band Edge, Right Side



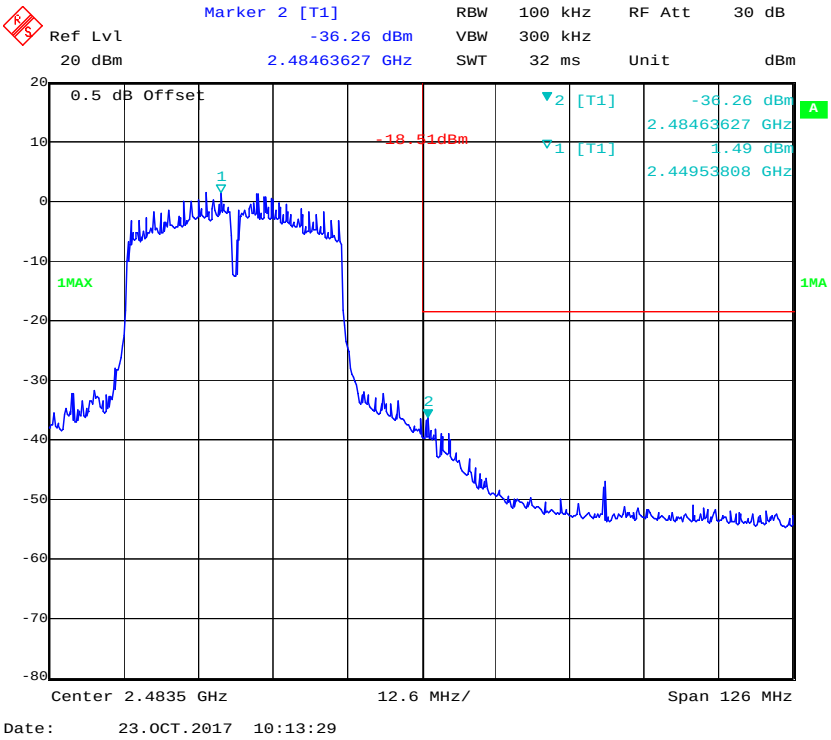
Date: 23.OCT.2017 10:01:17

802.11n ht40 Band Edge, Left Side



Date: 23.OCT.2017 10:05:55

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
R&S	Spectrum Analyzer	FSIQ	831929/005	2017-08-31	2018-08-31
Unknown	RF Cable	Unknown	C-4	Each Time	/

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

Test Data

Environmental Conditions

Temperature:	26.6~27.5 °C
Relative Humidity:	42~47 %
ATM Pressure:	101~101.9 kPa

** The testing was performed by Kami Zhou on 2017-10-23.*

Test Mode: Transmitting

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

Test mode	Channel	Frequency (MHz)	PSD (dBm/3kHz)		Total (dBm/3kHz)	Limit (dBm/3kHz)
			Chain 0	Chain 1		
802.11b	Low	2412	-6.7	-6.59	/	≤8
	Middle	2437	-6.81	-6.88	/	≤8
	High	2462	-6.43	-6.62	/	≤8
802.11g	Low	2412	-11.08	-11.22	/	≤8
	Middle	2437	-10.74	-10.1	/	≤8
	High	2462	-11.97	-10.74	/	≤8
802.11n ht20	Low	2412	-10.26	-10.05	-7.14	≤6
	Middle	2437	-9.54	-10.4	-6.94	≤6
	High	2462	-10.6	-10	-7.28	≤6
802.11n ht40	Low	2422	-14.03	-13.95	-10.98	≤6
	Middle	2437	-13.76	-14.54	-11.12	≤6
	High	2452	-13.35	-14.26	-10.77	≤6

Note: the maximum antenna gain is 5 dBi, the device employed Cyclic Delay Diversity (CDD) for 802.11 MIMO transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01,for power spectral density (PSD) measurements on the devices:

Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

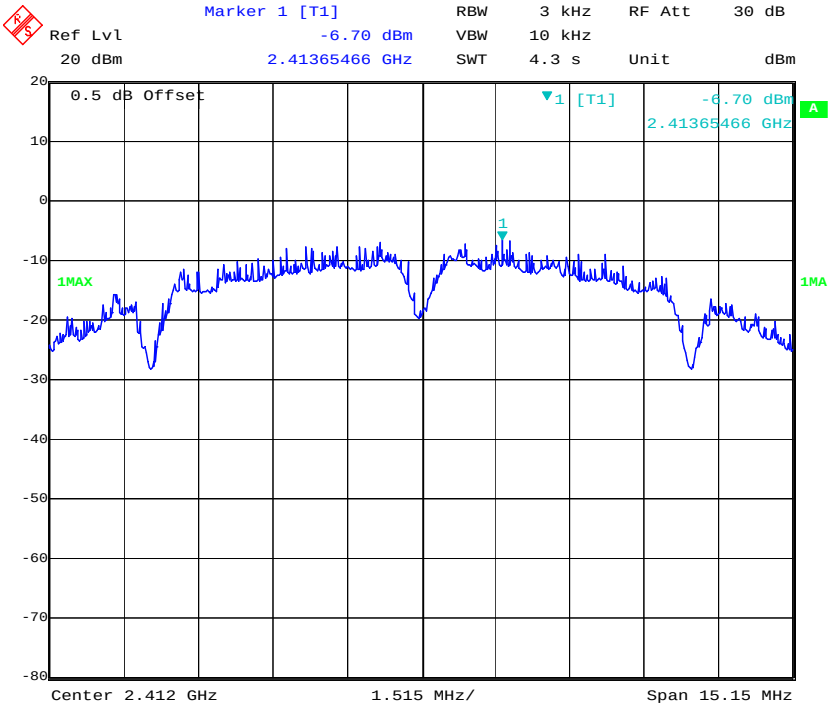
So:

Directional gain = GANT + Array Gain = 5+10*log(2) =8 dBi

The limit should be reduced by 2dB.

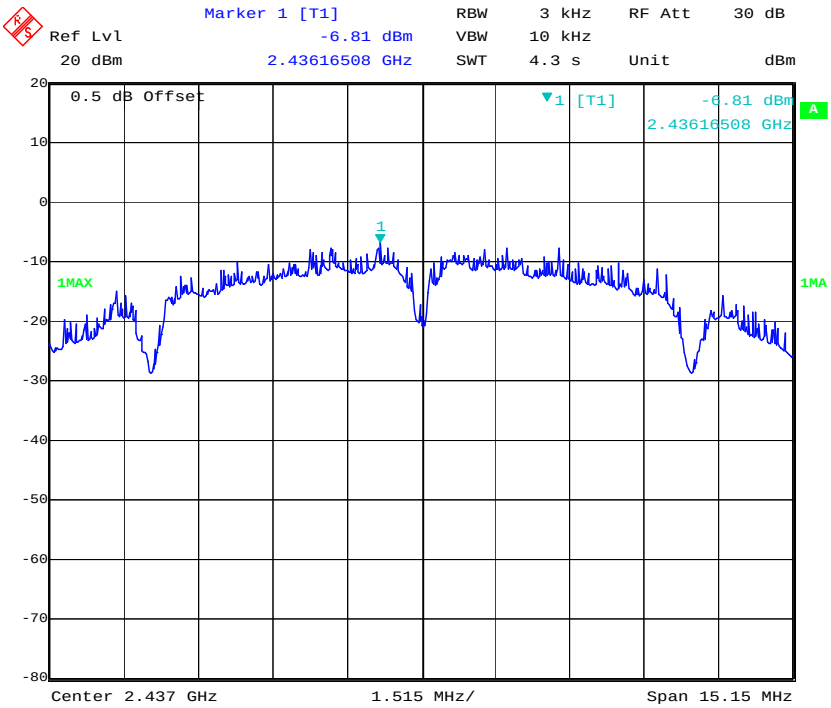
Chain 0:

Power Spectral Density, 802.11b, Low Channel



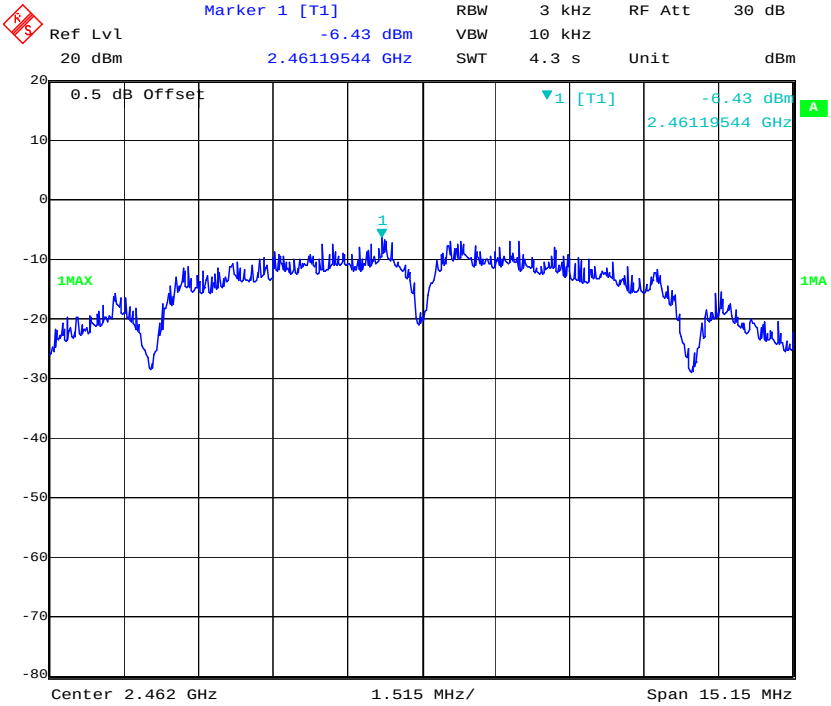
Date: 23.OCT.2017 10:24:02

Power Spectral Density, 802.11b, Middle Channel



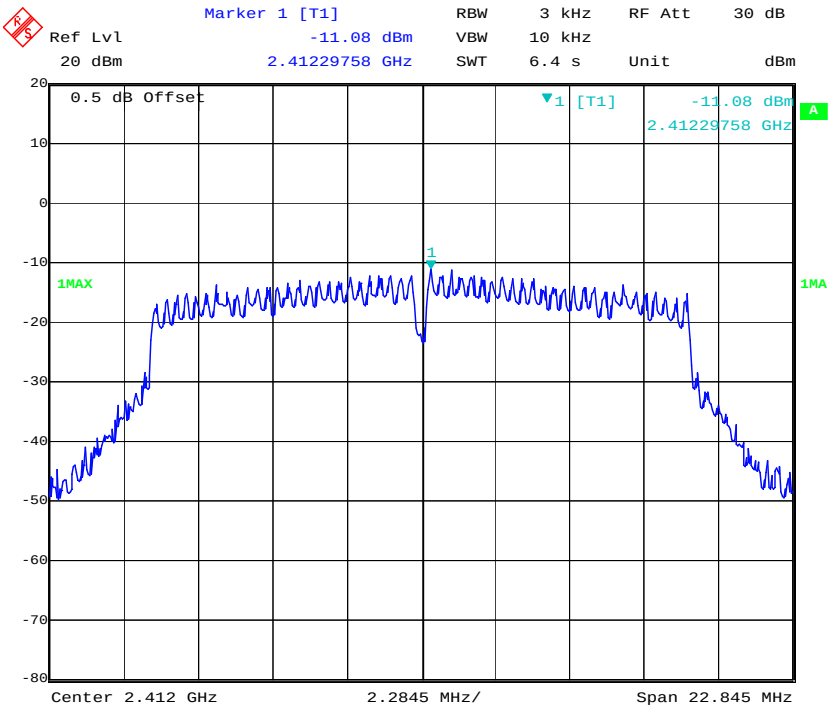
Date: 23.OCT.2017 08:48:45

Power Spectral Density, 802.11b, High Channel



Date: 23.OCT.2017 09:40:12

Power Spectral Density, 802.11g, Low Channel



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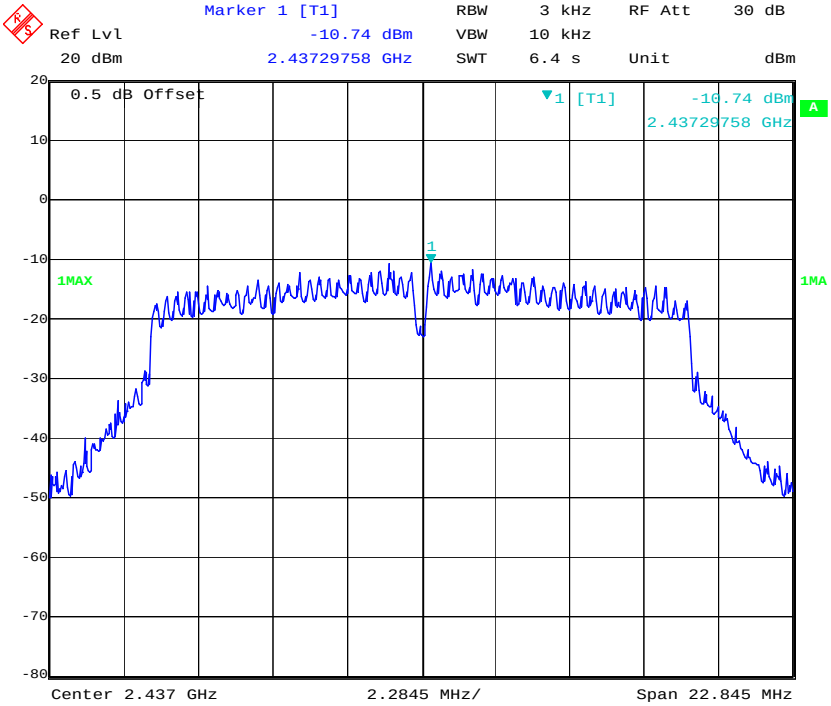
Power Spectral Density, 802.11g, Middle Channel



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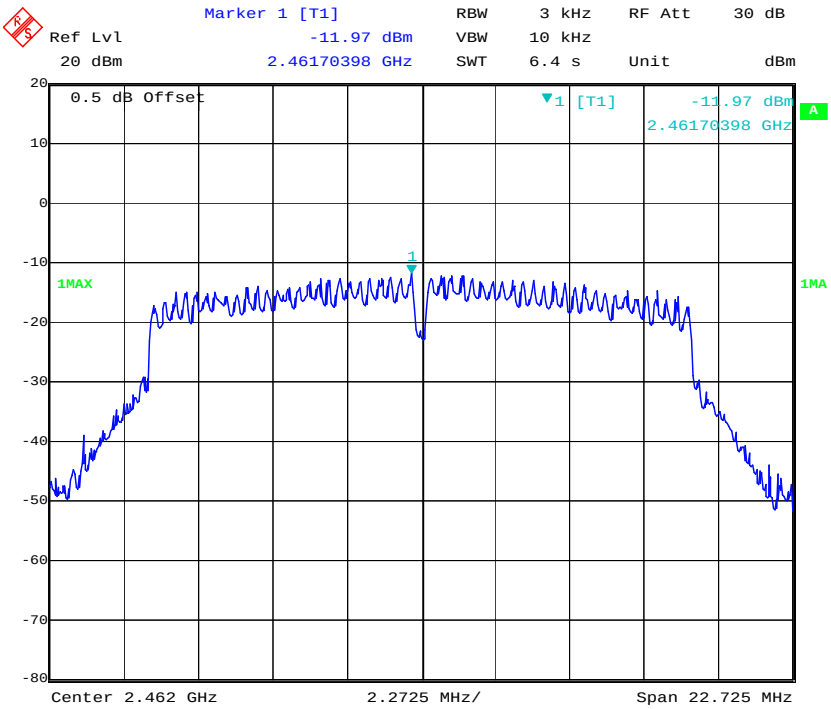
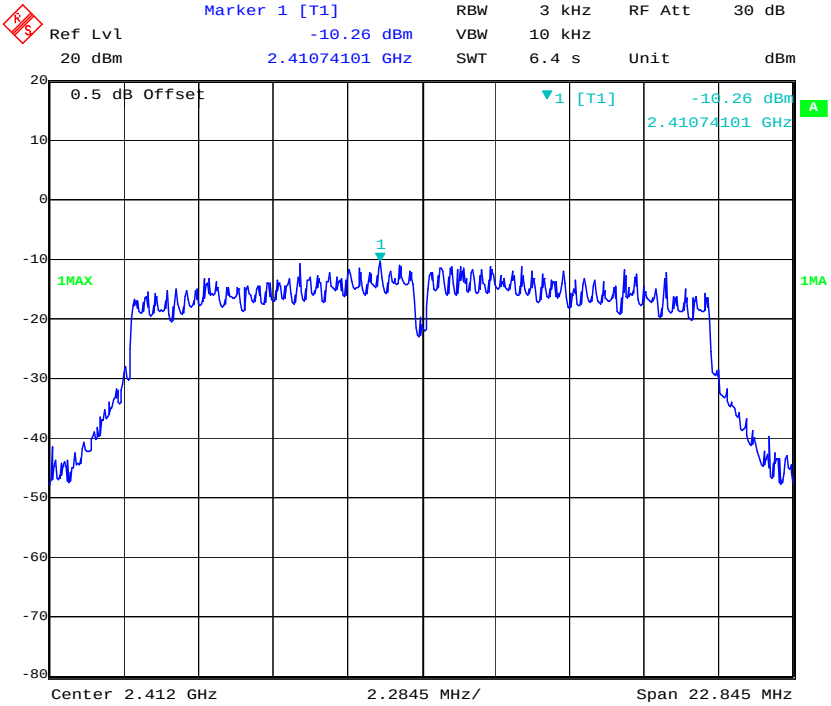
Power Spectral Density, 802.11g, High Channel



Date: 23.OCT.2017 10:38:45

Power Spectral Density, 802.11n ht20, Low Channel



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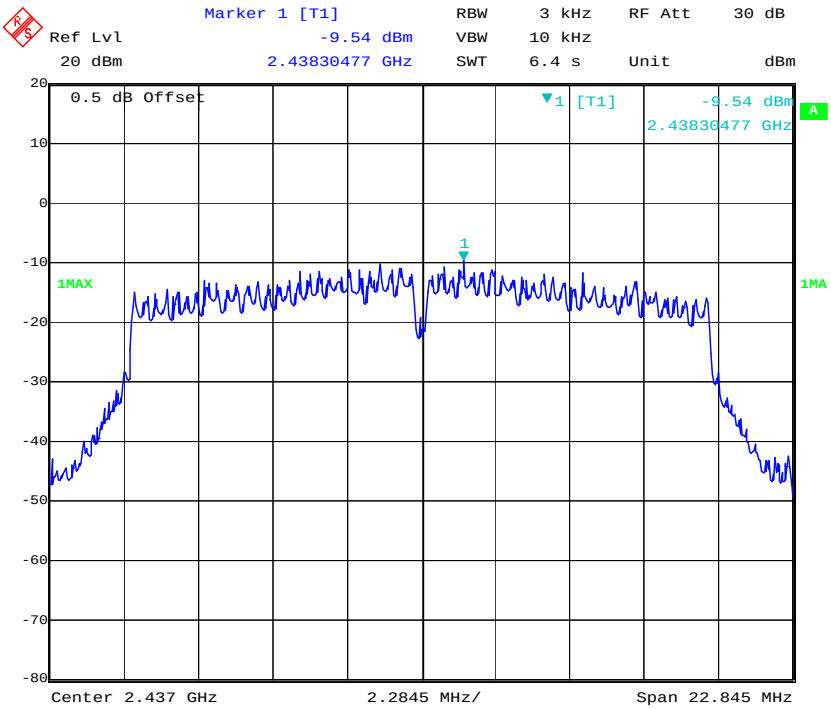
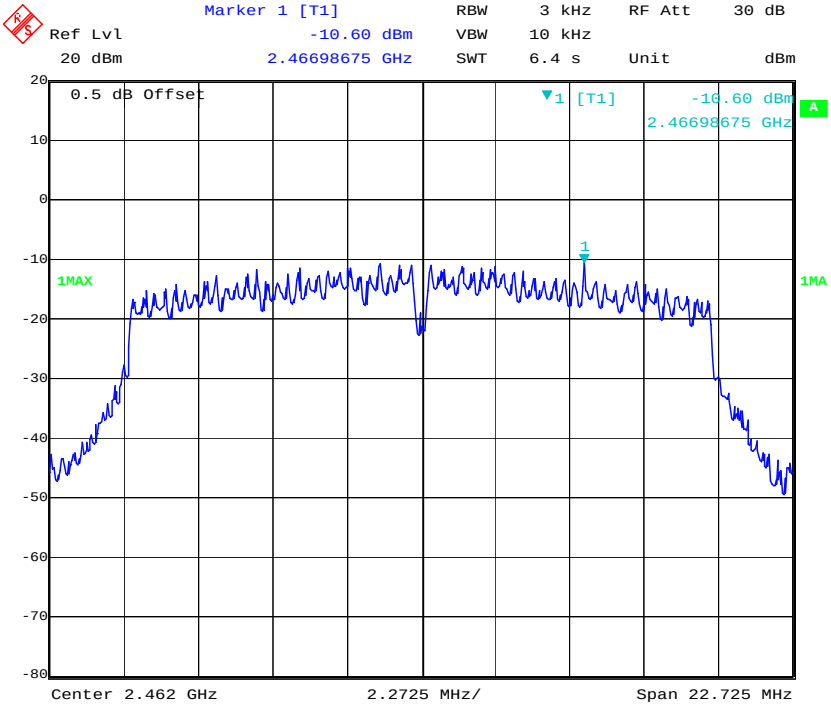
Power Spectral Density, 802.11n ht20, Middle Channel



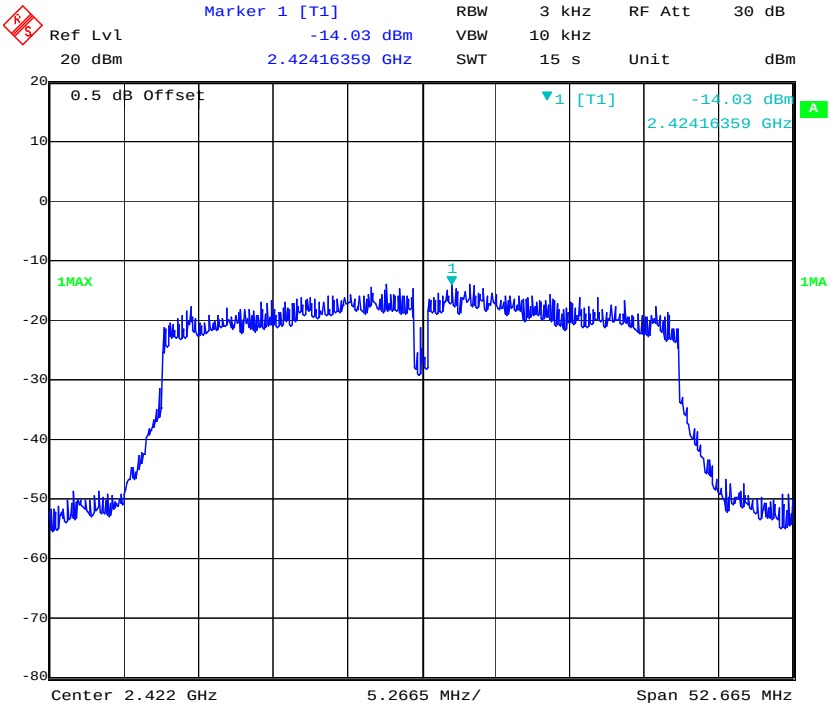
Date: 23.OCT.2017 10:46:40

Power Spectral Density, 802.11n ht20, High Channel



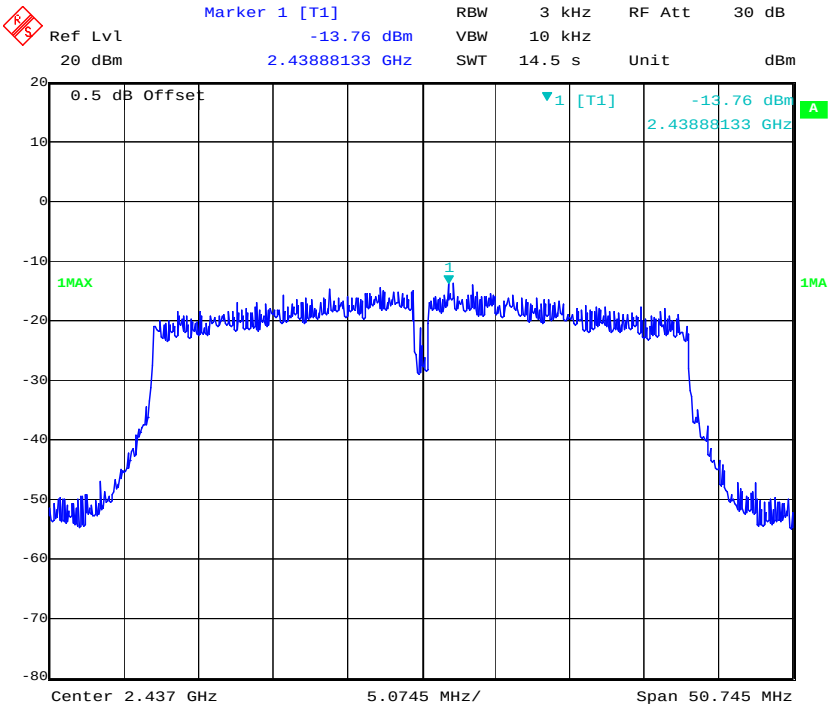
Date: 23.OCT.2017 10:49:41

Power Spectral Density, 802.11n ht40 Low Channel



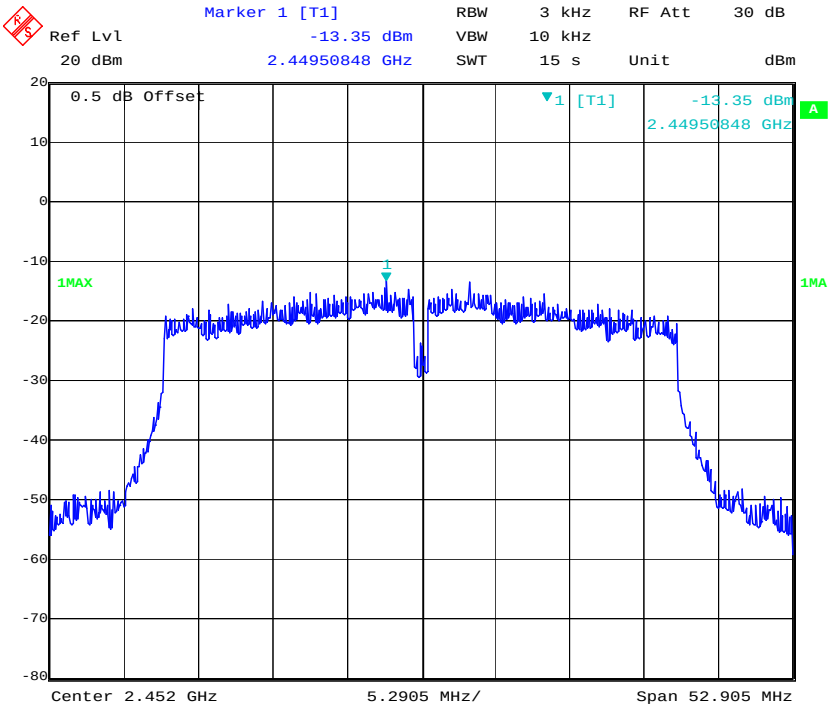
Date: 23.OCT.2017 10:53:49

Power Spectral Density, 802.11n ht40 Middle Channel



Date: 23.OCT.2017 10:57:43

Power Spectral Density, 802.11n ht40 High Channel



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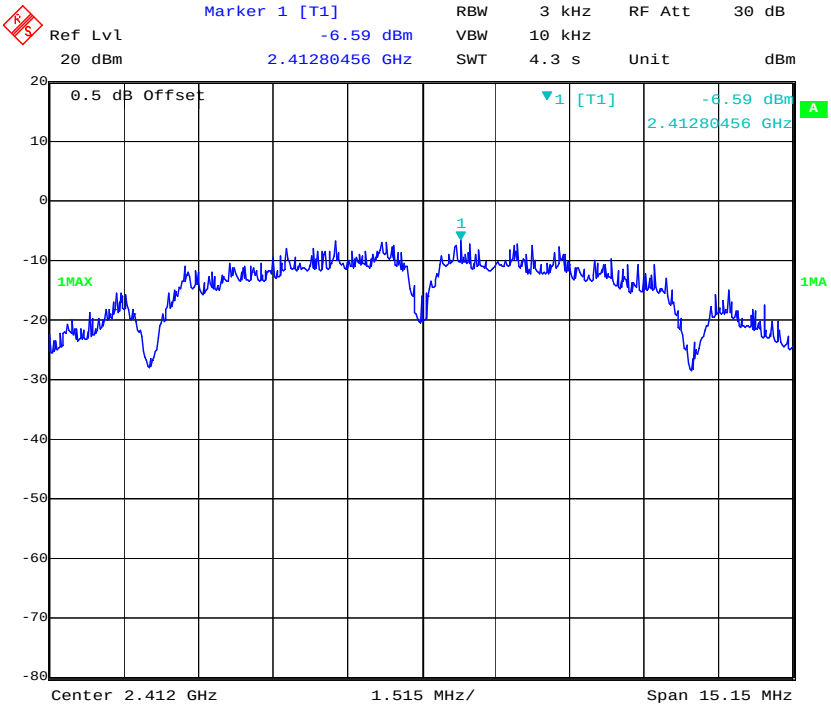
Chain 1:

Power Spectral Density, 802.11b, Low Channel



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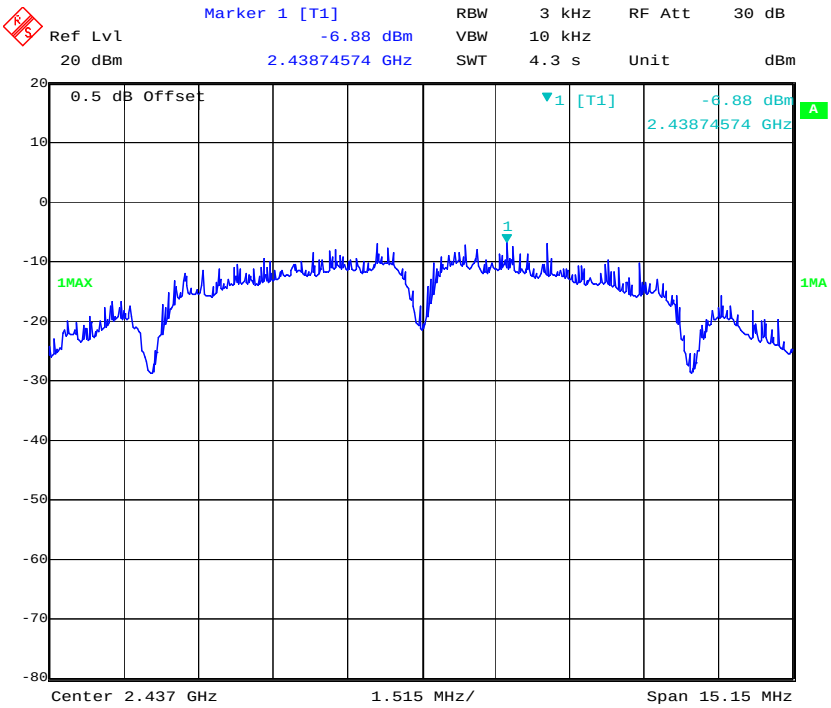
Power Spectral Density, 802.11b, Middle Channel



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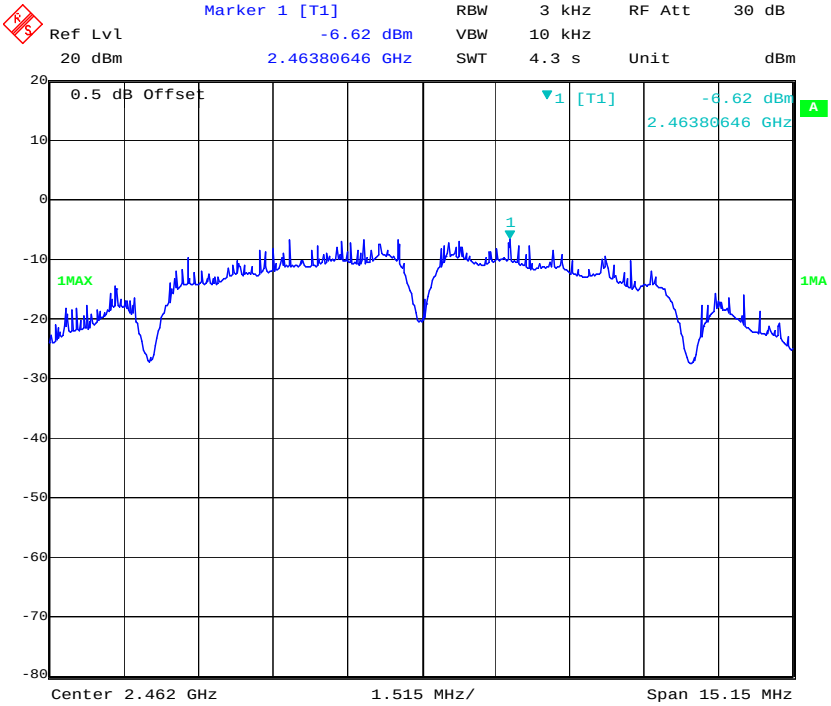
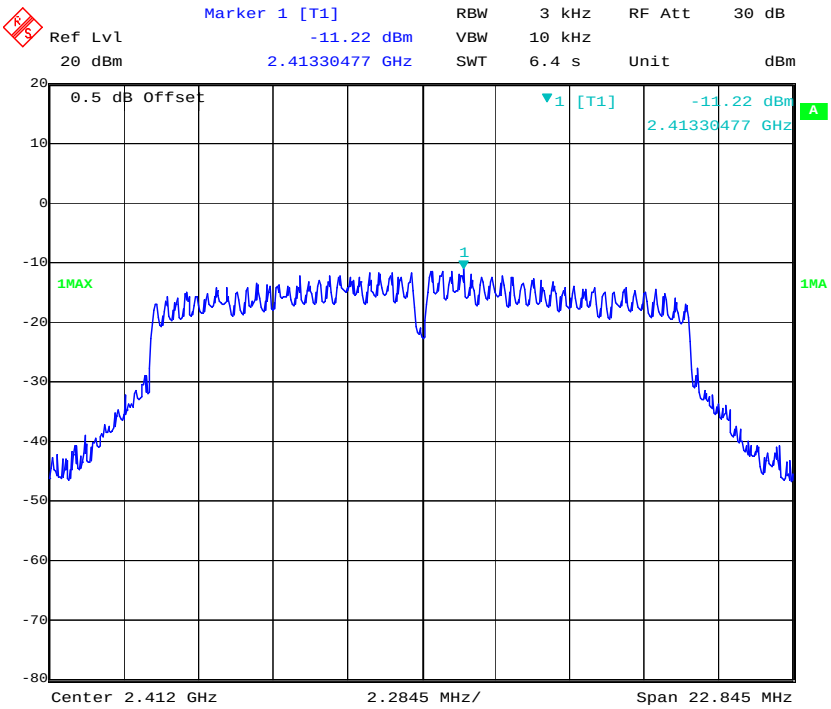
Power Spectral Density, 802.11b, High Channel



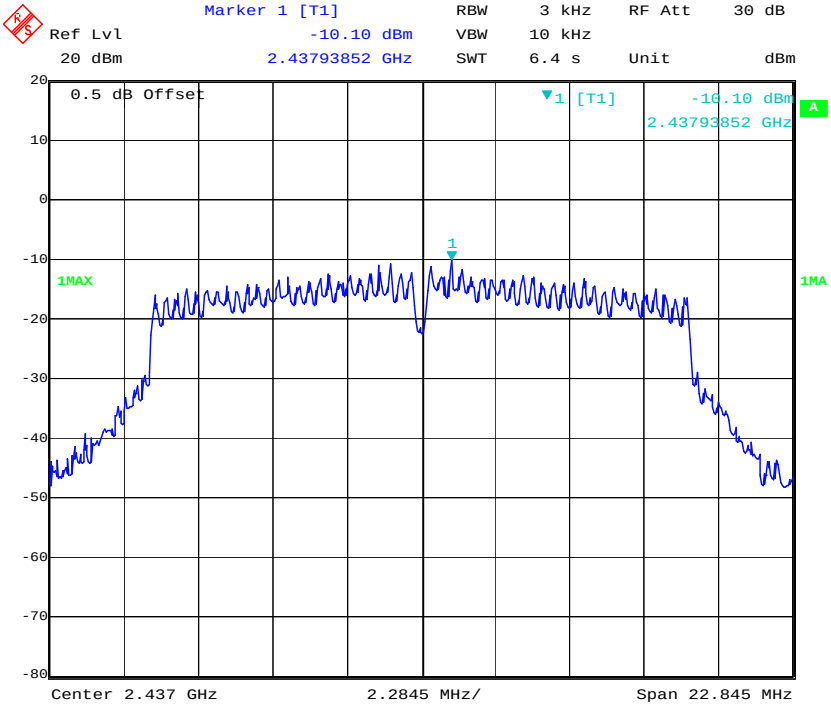
Date: 31.OCT.2017 22:22:00

Power Spectral Density, 802.11g, Low Channel



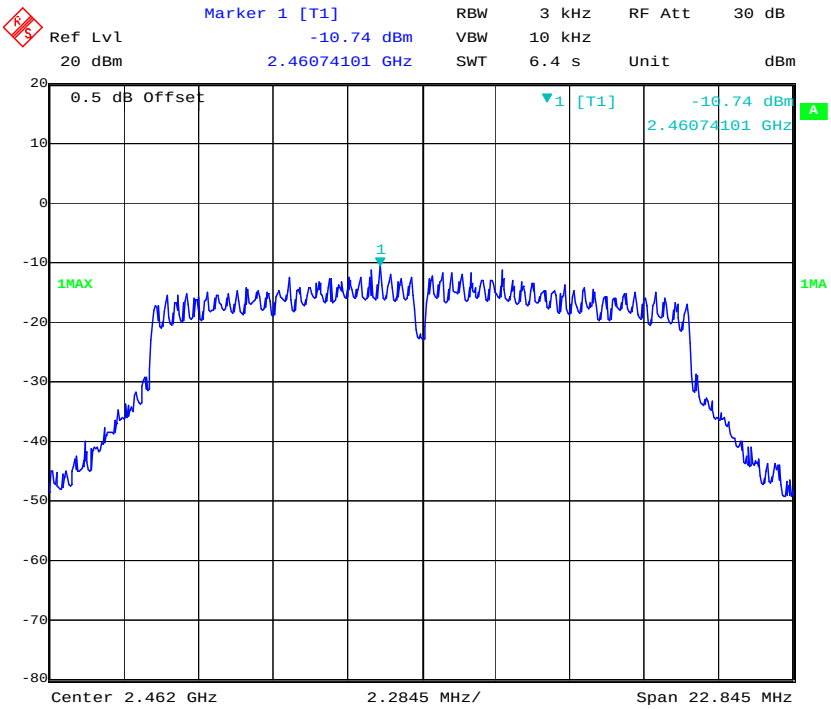
Date: 23.OCT.2017 09:43:05

Power Spectral Density, 802.11g, Middle Channel



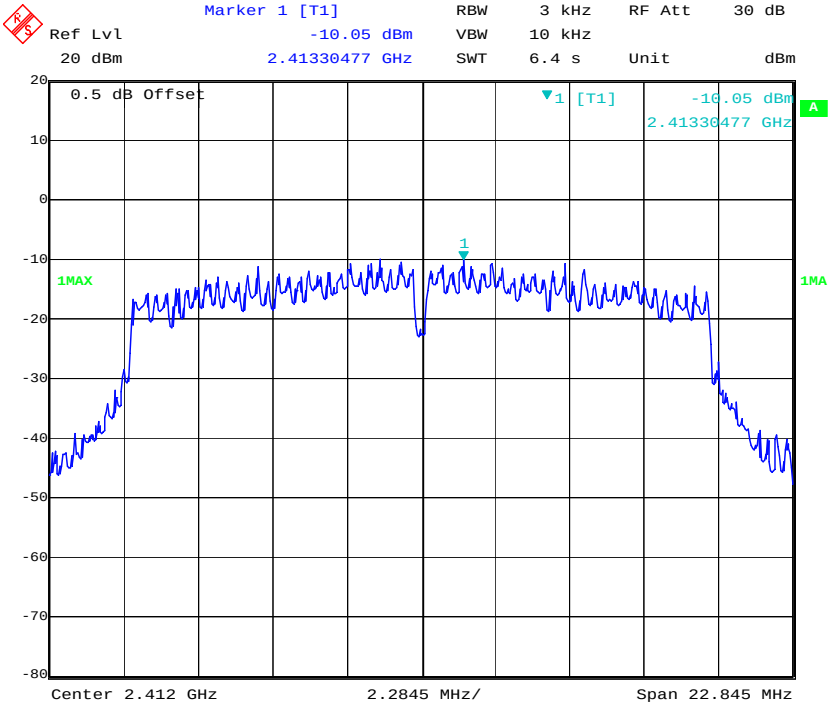
Date: 23.OCT.2017 09:45:59

Power Spectral Density, 802.11g, High Channel



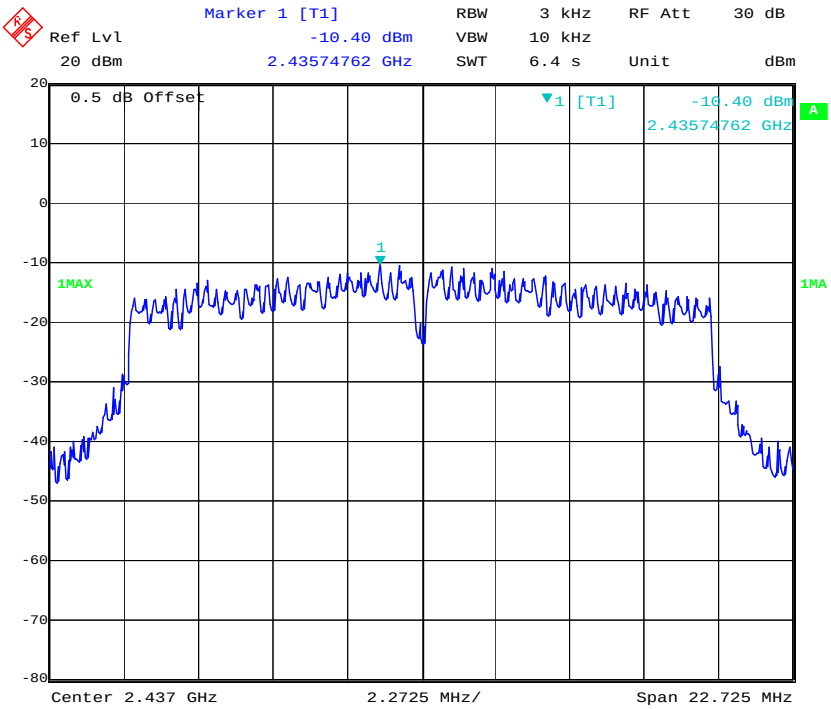
Date: 23.OCT.2017 09:48:53

Power Spectral Density, 802.11n ht20, Low Channel



Date: 23.OCT.2017 09:52:28

Power Spectral Density, 802.11n ht20, Middle Channel



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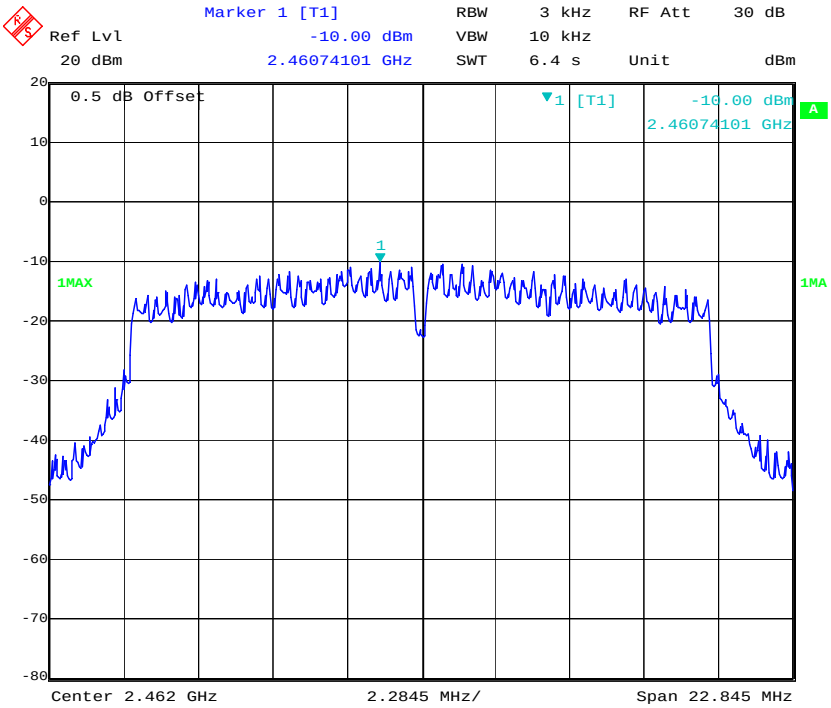
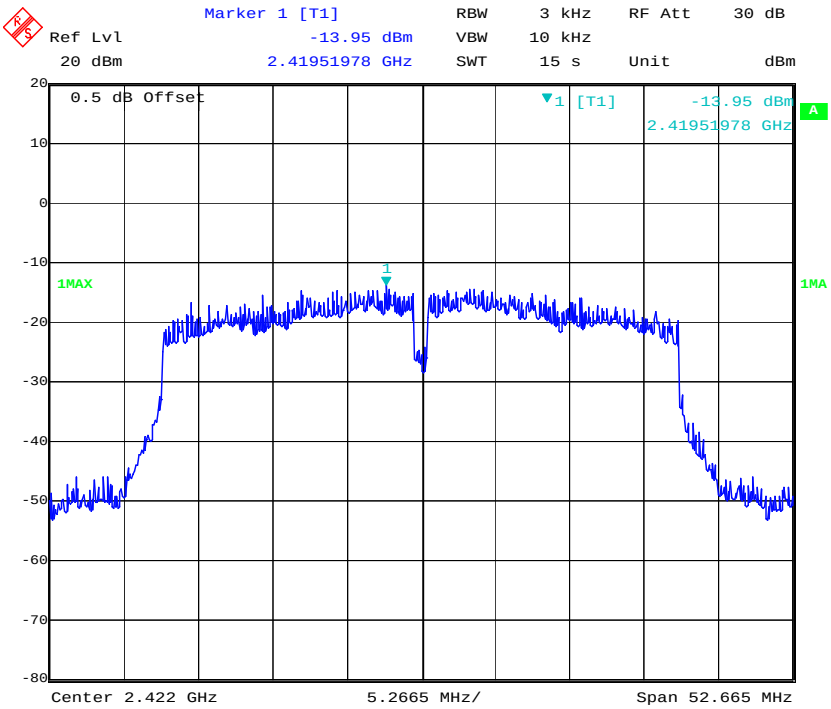
Power Spectral Density, 802.11n ht20, High Channel



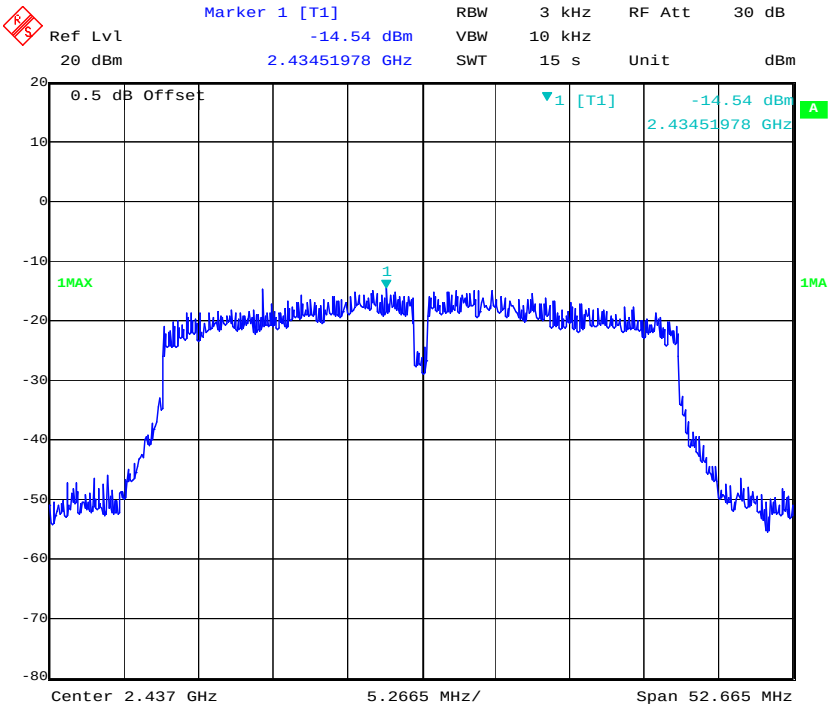
Date: 23.OCT.2017 10:00:13

Power Spectral Density, 802.11n ht40 Low Channel



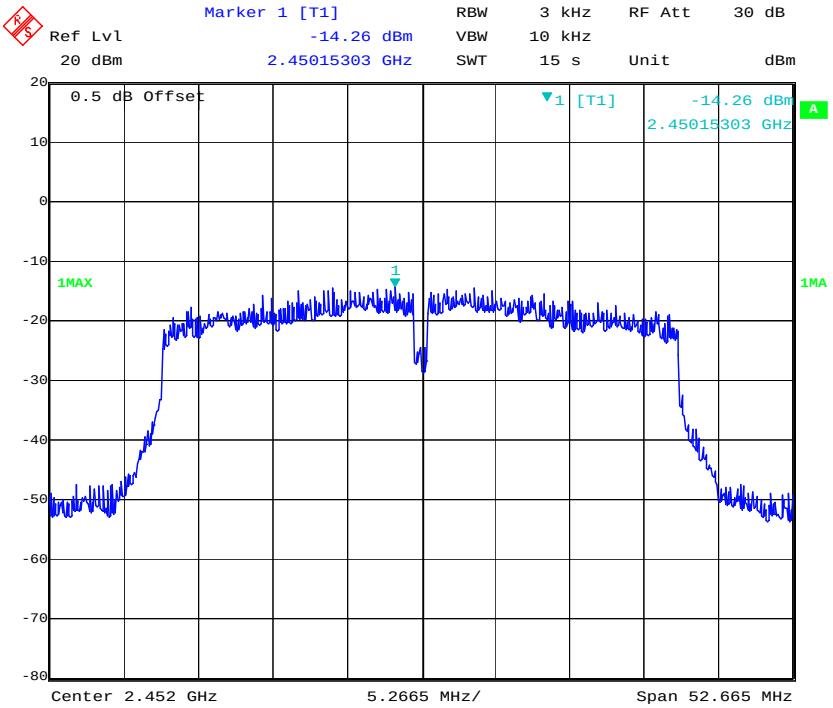
Date: 23.OCT.2017 10:04:52

Power Spectral Density, 802.11n ht40 Middle Channel



Date: 23.OCT.2017 10:08:23

Power Spectral Density, 802.11n ht40 High Channel



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