

# FCC PART 15.247

## TEST REPORT

For

### Shenzhen Rapoo Technology Co., Ltd.

22,Jinxiu Road East,Pingshan District,Shenzhen,China

**FCC ID: PP2UG3310**

<b>Report Type:</b> Original Report	<b>Product Type:</b> Gopro Gimbal
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## TABLE OF CONTENTS

<b>GENERAL INFORMATION.....</b>	<b>4</b>
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	4
OBJECTIVE .....	4
TEST METHODOLOGY .....	4
TEST FACILITY .....	4
<b>SYSTEM TEST CONFIGURATION.....</b>	<b>5</b>
DESCRIPTION OF TEST CONFIGURATION .....	5
EQUIPMENT MODIFICATIONS .....	5
EUT EXERCISE SOFTWARE .....	5
SUPPORT EQUIPMENT LIST AND DETAILS .....	6
BLOCK DIAGRAM OF TEST SETUP .....	6
<b>SUMMARY OF TEST RESULTS .....</b>	<b>7</b>
<b>FCC §15.247 (i) &amp; §1.1307 &amp; §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE).....</b>	<b>8</b>
APPLICABLE STANDARD .....	8
<b>FCC §15.203 - ANTENNA REQUIREMENT.....</b>	<b>9</b>
APPLICABLE STANDARD .....	9
ANTENNA CONNECTOR CONSTRUCTION .....	9
<b>FCC §15.209, §15.205 &amp; §15.247(d) - SPURIOUS EMISSIONS.....</b>	<b>10</b>
APPLICABLE STANDARD .....	10
MEASUREMENT UNCERTAINTY .....	10
EUT SETUP .....	10
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP .....	11
TEST PROCEDURE .....	11
CORRECTED AMPLITUDE & MARGIN CALCULATION .....	12
TEST EQUIPMENT LIST AND DETAILS.....	12
TEST RESULTS SUMMARY .....	12
TEST DATA .....	12
<b>FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH.....</b>	<b>29</b>
APPLICABLE STANDARD .....	29
TEST PROCEDURE .....	29
TEST EQUIPMENT LIST AND DETAILS.....	29
TEST DATA .....	29
<b>FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER.....</b>	<b>43</b>
APPLICABLE STANDARD .....	43
TEST PROCEDURE .....	43
TEST EQUIPMENT LIST AND DETAILS.....	43
TEST DATA .....	43
<b>FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE.....</b>	<b>45</b>
APPLICABLE STANDARD .....	45
TEST PROCEDURE .....	45
TEST EQUIPMENT LIST AND DETAILS.....	45
TEST DATA .....	45
<b>FCC §15.247(e) - POWER SPECTRAL DENSITY .....</b>	<b>54</b>

APPLICABLE STANDARD .....54  
TEST PROCEDURE .....54  
TEST EQUIPMENT LIST AND DETAILS.....54  
TEST DATA .....54

FEMVAL

## GENERAL INFORMATION

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### Product Description for Equipment under Test (EUT)

The *Shenzhen Rapoo Technology Co., Ltd.*'s product, model number: *UG3310 (FCC ID: PP2UG3310)* (the "EUT") in this report was a *Gopro Gimbal*, which was measured approximately: 11.5 mm (L) x 7.5 mm (W) x 8 mm (H), rated input voltage: *DC12V* from Aircraft System.

*All measurement and test data in this report was gathered from production sample serial number: 150513003 (Assigned by BACL, Dongguan). The EUT was received on 2015-05-15.*

### Objective

This report is prepared on behalf of *Shenzhen Rapoo Technology 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.

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

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

### 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 Industrial Zone, Tangxia, Dongguan, Guangdong, China

Test site at Bay Area Compliance Laboratories Corp. (Dongguan) has been fully described in reports submitted to the Federal Communications 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 February 06, 2015. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2009.

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.

## 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, 802.11b,g, n ht20, ht40 was support MIMO mode, and 11 channels are provided to testing:

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

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.

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.

### Equipment Modifications

No modification was made to the EUT tested.

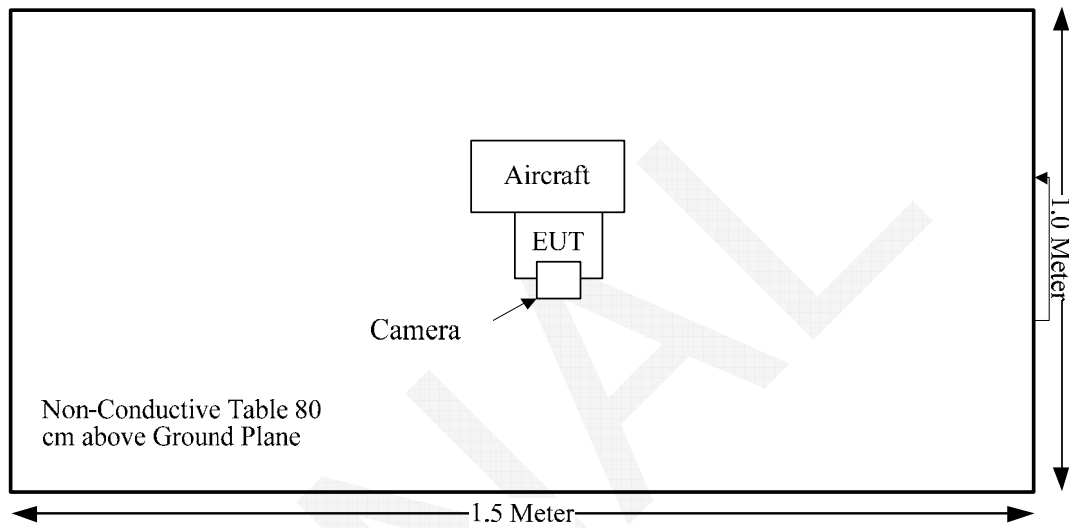
### EUT Exercise Software

Test Mode	Test Software Version	SmartTools20110519					
802.11b	Test Frequency	2412MHz		2437MHz		2462MHz	
	Data Rate	1Mbps		1Mbps		1Mbps	
	Power Level Setting	Ant A	Ant B	Ant A	Ant B	Ant A	Ant B
		48	48	48	48	52	52
802.11g	Test Frequency	2412MHz		2437MHz		2462MHz	
	Data Rate	6Mbps		6Mbps		6Mbps	
	Power Level Setting	Ant A	Ant B	Ant A	Ant B	Ant A	Ant B
		54	54	54	54	54	54
802.11n ht20	Test Frequency	2412MHz		2437MHz		2462MHz	
	Data Rate	MCS0		MCS0		MCS0	
	Power Level Setting	Ant A	Ant B	Ant A	Ant B	Ant A	Ant B
		54	55	56	56	59	59
802.11n ht40	Test Frequency	2422MHz		2437MHz		2452MHz	
	Data Rate	MCS0		MCS0		MCS0	
	Power Level Setting	Ant A	Ant B	Ant A	Ant B	Ant A	Ant B
		57	56	59	59	60	59

**Support Equipment List and Details**

Manufacturer	Description	Model	Serial Number
Rapoo	Aircraft	UA3500	150331003
Gopro	Camera	Hero 4	N/A

**Block Diagram of Test Setup**



**SUMMARY OF TEST RESULTS**

FCC Rules	Description of Test	Result
FCC §15.247 (i) & §1.1307 & §2.1091	Maximum Permissible Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Not Applicable
§15.247(d)	Spurious Emissions at Antenna Port	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliance
§15.247(b)(3)	Maximum conducted output power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

Not Applicable\*: the device was powered by DC from system in the operation mode.

**FCC §15.247 (i) & §1.1307 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

**Applicable Standard**

According to subpart 15.247(i) and subpart §1.1307, 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>(B) Limits for General Population/Uncontrolled Exposure</b>				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minutes)
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f <sup>2</sup> )	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<sup>2</sup>);

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		Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
	(dBi)	(numeric)	(dBm)	(mW)			
2452	3.40	2.19	18.89	77.45	20.00	0.03	1.0

**Result:** The device meet FCC MPE at 20 cm distance.



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## **FCC §15.203 - ANTENNA REQUIREMENT**

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### **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 two internal antenna arrangement, and the antenna gain is 3.4 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

**Result:** 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. (Dongguan) is:

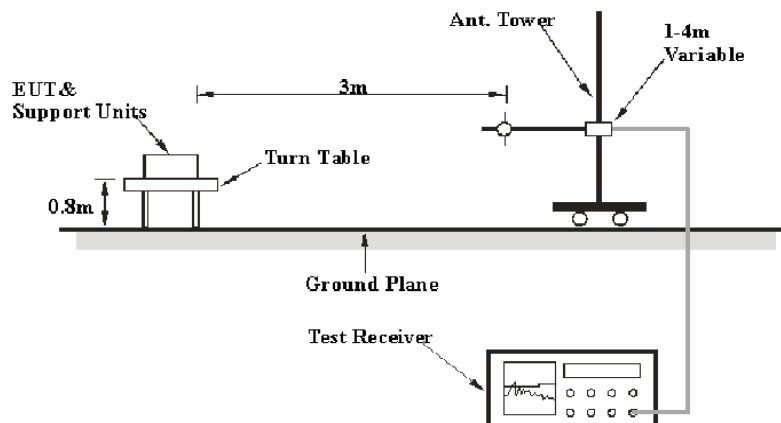
- 30M~200MHz: 5.0 dB
- 200M~1GHz: 6.2 dB
- 1G~6GHz: 4.45 dB
- 6G~18GHz: 5.23 dB

Table 2 – Values of  $U_{cispr}$

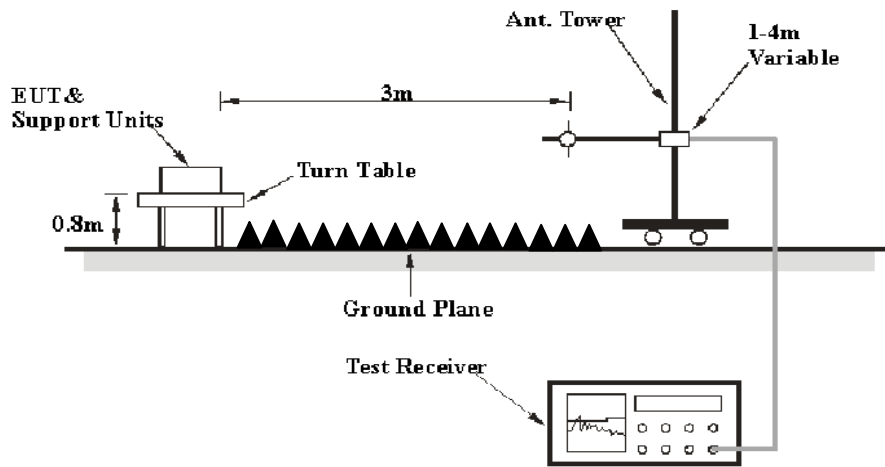
Measurement	$U_{cispr}$
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

**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 C63.4-2009. 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.

**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:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	Ave.

**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:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Loss} + \text{Cable Loss} - \text{Amplifier Gain}$$

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:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2015-05-09	2016-05-09
Sunol Sciences	Antenna	JB3	A060611-3	2014-07-28	2017-07-27
HP	Amplifier	8447E	2434A02181	2014-09-01	2015-09-01
R&S	Spectrum Analyzer	FSEM	DE31388	2015-05-09	2016-05-09
ETS LINDGREN	Horn Antenna	3115	000 527 35	2012-09-06	2015-09-06
Mini-Circuit	Amplifier	ZVA-213-S+	054201245	2015-02-19	2016-02-19
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-01 1304	2014-06-16	2017-06-15
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2014-09-06	2015-09-06

\* **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 Results Summary**

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Section 15.205, 15.209 and 15.247, with the worst margin reading of:

**1.08 dB at 167.74 MHz in the Vertical polarization for 802.11b Mode**

**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	26.8 °C
<b>Relative Humidity:</b>	57 %
<b>ATM Pressure:</b>	100.1 kPa

*The testing was performed by Allen Qiao on 2015-06-03.*

*Test Mode: Transmitting*

802.11b Mode

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	72.84	PK	H	25.67	3.68	0.00	102.19	N/A	N/A
2412	67.44	AV	H	25.67	3.68	0.00	96.79	N/A	N/A
2412	75.14	PK	V	25.67	3.68	0.00	104.49	N/A	N/A
2412	70.34	AV	V	25.67	3.68	0.00	99.69	N/A	N/A
2390	30.14	PK	V	25.61	3.63	0.00	59.38	74.00	14.62
2390	17.64	AV	V	25.61	3.63	0.00	46.88	54.00	7.12
4824	32.83	PK	V	30.64	5.03	27.41	41.09	74.00	32.91
4824	21.89	AV	V	30.64	5.03	27.41	30.15	54.00	23.85
7236	31.77	PK	V	34.17	6.65	25.90	46.69	74.00	27.31
7236	20.14	AV	V	34.17	6.65	25.90	35.06	54.00	18.94
9648	31.02	PK	V	36.06	8.55	27.46	48.17	74.00	25.83
9648	19.04	AV	V	36.06	8.55	27.46	36.19	54.00	17.81
2925	40.71	PK	V	27.01	6.26	27.54	46.44	74.00	27.56
2925	24.56	AV	V	27.01	6.26	27.54	30.29	54.00	23.71
167.74	50.16	QP	V	12.14	1.56	21.44	42.42	43.50	1.08 *
Middle Channel: 2437 MHz									
2437	72.35	PK	H	25.74	3.75	0.00	101.84	N/A	N/A
2437	67.04	AV	H	25.74	3.75	0.00	96.53	N/A	N/A
2437	76.75	PK	V	25.74	3.75	0.00	106.24	N/A	N/A
2437	71.89	AV	V	25.74	3.75	0.00	101.38	N/A	N/A
4874	31.3	PK	V	30.77	5.14	27.42	39.79	74.00	34.21
4874	18.34	AV	V	30.77	5.14	27.42	26.83	54.00	27.17
7311	31.16	PK	V	34.35	6.74	25.88	46.37	74.00	27.63
7311	20.48	AV	V	34.35	6.74	25.88	35.69	54.00	18.31
9748	32.42	PK	V	36.30	8.61	27.24	50.09	74.00	23.91
9748	19.4	AV	V	36.30	8.61	27.24	37.07	54.00	16.93
3131	35.12	PK	V	27.62	6.93	27.43	42.24	74.00	31.76
3131	20.06	AV	V	27.62	6.93	27.43	27.18	54.00	26.82
3190	37.53	PK	V	27.81	6.26	27.38	44.22	74.00	29.78
3190	23.5	AV	V	27.81	6.26	27.38	30.19	54.00	23.81
167.74	48.62	QP	V	12.14	1.56	21.44	40.88	43.50	2.62*
High Channel: 2462 MHz									
2462	70.19	PK	H	25.80	3.75	0.00	99.74	N/A	N/A
2462	64.9	AV	H	25.80	3.75	0.00	94.45	N/A	N/A
2462	75.48	PK	V	25.80	3.75	0.00	105.03	N/A	N/A
2462	69.12	AV	V	25.80	3.75	0.00	98.67	N/A	N/A
2483.5	31.25	PK	V	25.86	3.67	0.00	60.78	74.00	13.22
2483.5	17.69	AV	V	25.86	3.67	0.00	47.22	54.00	6.78
4924	31.35	PK	V	30.90	5.34	27.43	40.16	74.00	33.84
4924	22.39	AV	V	30.90	5.34	27.43	31.20	54.00	22.80
7386	31.41	PK	V	34.53	6.83	25.86	46.91	74.00	27.09
7386	22.46	AV	V	34.53	6.83	25.86	37.96	54.00	16.04
9848	30.04	PK	V	36.54	8.66	26.94	48.30	74.00	25.70
9848	21.27	AV	V	36.54	8.66	26.94	39.53	54.00	14.47
3131	36.55	PK	V	27.62	6.93	27.43	43.67	74.00	30.33
3131	21.26	AV	V	27.62	6.93	27.43	28.38	54.00	25.62
167.74	47.62	QP	V	12.14	1.56	21.44	39.88	43.50	3.62*

\*within measurement uncertainty!

802.11g Mode

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	72.69	PK	H	25.67	3.68	0.00	102.04	N/A	N/A
2412	60.25	AV	H	25.67	3.68	0.00	89.60	N/A	N/A
2412	74.9	PK	V	25.67	3.68	0.00	104.25	N/A	N/A
2412	62.2	AV	V	25.67	3.68	0.00	91.55	N/A	N/A
2390	31.59	PK	V	25.61	3.63	0.00	60.83	74.00	13.17
2390	18.98	AV	V	25.61	3.63	0.00	48.22	54.00	5.78
4824	32.54	PK	H	30.64	5.03	27.41	40.80	74.00	33.20
4824	18.21	AV	H	30.64	5.03	27.41	26.47	54.00	27.53
7236	30.32	PK	H	34.17	6.65	25.90	45.24	74.00	28.76
7236	18.11	AV	H	34.17	6.65	25.90	33.03	54.00	20.97
9648	30.88	PK	H	36.06	8.55	27.46	48.03	74.00	25.97
9648	18.35	AV	H	36.06	8.55	27.46	35.50	54.00	18.50
2925	40.07	PK	H	27.01	6.26	27.54	45.80	74.00	28.20
2925	23.25	AV	H	27.01	6.26	27.54	28.98	54.00	25.02
167.74	49.68	QP	V	12.14	1.56	21.44	41.94	43.50	1.56*
Middle Channel: 2437 MHz									
2437	72.37	PK	H	25.74	3.75	0.00	101.86	N/A	N/A
2437	60.88	AV	H	25.74	3.75	0.00	90.37	N/A	N/A
2437	74.52	PK	V	25.74	3.75	0.00	104.01	N/A	N/A
2437	62.96	AV	V	25.74	3.75	0.00	92.45	N/A	N/A
4874	31.39	PK	H	30.77	5.14	27.42	39.88	74.00	34.12
4874	17.89	AV	H	30.77	5.14	27.42	26.38	54.00	27.62
7311	30.71	PK	H	34.35	6.74	25.88	45.92	74.00	28.08
7311	17.94	AV	H	34.35	6.74	25.88	33.15	54.00	20.85
9748	31.24	PK	H	36.30	8.61	27.24	48.91	74.00	25.09
9748	19.79	AV	H	36.30	8.61	27.24	37.46	54.00	16.54
2950	32.96	PK	H	27.07	6.61	27.54	39.10	74.00	34.90
2950	19.05	AV	H	27.07	6.61	27.54	25.19	54.00	28.81
3610	37.61	PK	H	29.04	4.61	27.28	43.98	74.00	30.02
3610	12.34	AV	H	29.04	4.61	27.28	18.71	54.00	35.29
167.74	48.96	QP	V	12.14	1.56	21.44	41.22	43.50	2.28*
High Channel: 2462 MHz									
2462	72.47	PK	H	25.80	3.75	0.00	102.02	N/A	N/A
2462	60.1	AV	H	25.80	3.75	0.00	89.65	N/A	N/A
2462	74.67	PK	V	25.80	3.75	0.00	104.22	N/A	N/A
2462	62.05	AV	V	25.80	3.75	0.00	91.60	N/A	N/A
2483.5	30.4	PK	H	25.86	3.67	0.00	59.93	74.00	14.07
2483.5	16.82	AV	H	25.86	3.67	0.00	46.35	54.00	7.65
4924	31.8	PK	H	30.90	5.34	27.43	40.61	74.00	33.39
4924	18.34	AV	H	30.90	5.34	27.43	27.15	54.00	26.85
7386	30.21	PK	H	34.53	6.83	25.86	45.71	74.00	28.29
7386	19.41	AV	H	34.53	6.83	25.86	34.91	54.00	19.09
9848	30.1	PK	H	36.54	8.66	26.94	48.36	74.00	25.64
9848	18.48	AV	H	36.54	8.66	26.94	36.74	54.00	17.26
2950	38.26	PK	H	27.07	6.61	27.54	44.40	74.00	29.60
2950	22.5	AV	H	27.07	6.61	27.54	28.64	54.00	25.36
167.74	47.08	QP	H	12.14	1.56	21.44	39.34	43.50	4.16 *

\*within measurement uncertainty!

802.11 n ht20 Mode

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	71.69	PK	H	25.67	3.68	0.00	101.04	N/A	N/A
2412	60.73	AV	H	25.67	3.68	0.00	90.08	N/A	N/A
2412	73.96	PK	V	25.67	3.68	0.00	103.31	N/A	N/A
2412	62.39	AV	V	25.67	3.68	0.00	91.74	N/A	N/A
2390	31.55	PK	V	25.61	3.63	0.00	60.79	74.00	13.21
2390	19.08	AV	V	25.61	3.63	0.00	48.32	54.00	5.68
4824	32.24	PK	V	30.64	5.03	27.41	40.50	74.00	33.50
4824	19.04	AV	V	30.64	5.03	27.41	27.30	54.00	26.70
7236	30.35	PK	V	34.17	6.65	25.90	45.27	74.00	28.73
7236	17.56	AV	V	34.17	6.65	25.90	32.48	54.00	21.52
9648	31.52	PK	V	36.06	8.55	27.46	48.67	74.00	25.33
9648	18.38	AV	V	36.06	8.55	27.46	35.53	54.00	18.47
2925	39.18	PK	V	27.01	6.26	27.54	44.91	74.00	29.09
2925	23.08	AV	V	27.01	6.26	27.54	28.81	54.00	25.19
167.74	48.45	QP	V	12.14	1.56	21.44	40.71	43.50	2.79*
Middle Channel: 2437 MHz									
2437	71.48	PK	H	25.74	3.75	0.00	100.97	N/A	N/A
2437	60.42	AV	H	25.74	3.75	0.00	89.91	N/A	N/A
2437	73.57	PK	V	25.74	3.75	0.00	103.06	N/A	N/A
2437	62.16	AV	V	25.74	3.75	0.00	91.65	N/A	N/A
4874	30.21	PK	V	30.77	5.14	27.42	38.70	74.00	35.30
4874	19.33	AV	V	30.77	5.14	27.42	27.82	54.00	26.18
7311	30.16	PK	V	34.35	6.74	25.88	45.37	74.00	28.63
7311	18.65	AV	V	34.35	6.74	25.88	33.86	54.00	20.14
9748	30.65	PK	V	36.30	8.61	27.24	48.32	74.00	25.68
9748	19.6	AV	V	36.30	8.61	27.24	37.27	54.00	16.73
2950	30.09	PK	V	27.07	6.61	27.54	36.23	74.00	37.77
2950	18.99	AV	V	27.07	6.61	27.54	25.13	54.00	28.87
3610	35.96	PK	V	29.04	4.61	27.28	42.33	74.00	31.67
3610	21.82	AV	V	29.04	4.61	27.28	28.19	54.00	25.81
167.74	47.87	QP	V	12.14	1.56	21.44	40.13	43.50	3.37*
High Channel: 2462 MHz									
2462	71.46	PK	H	25.80	3.75	0.00	101.01	N/A	N/A
2462	60.55	AV	H	25.80	3.75	0.00	90.10	N/A	N/A
2462	73.79	PK	V	25.80	3.75	0.00	103.34	N/A	N/A
2462	62.2	AV	V	25.80	3.75	0.00	91.75	N/A	N/A
2483.5	31.79	PK	V	25.86	3.67	0.00	61.32	74.00	12.68
2483.5	19.26	AV	V	25.86	3.67	0.00	48.79	54.00	5.21
4924	33.48	PK	V	30.90	5.34	27.43	42.29	74.00	31.71
4924	21.5	AV	V	30.90	5.34	27.43	30.31	54.00	23.69
7386	31.45	PK	V	34.53	6.83	25.86	46.95	74.00	27.05
7386	18.89	AV	V	34.53	6.83	25.86	34.39	54.00	19.61
9848	30.78	PK	V	36.54	8.66	26.94	49.04	74.00	24.96
9848	17.81	AV	V	36.54	8.66	26.94	36.07	54.00	17.93
2950	36.38	PK	V	27.07	6.61	27.54	42.52	74.00	31.48
2950	22.21	AV	V	27.07	6.61	27.54	28.35	54.00	25.65
167.74	46.63	QP	V	12.14	1.56	21.44	38.89	43.50	4.61*

\*within measurement uncertainty!

802.11 n ht40 Mode

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	74.46	PK	H	25.70	3.71	0.00	103.87	N/A	N/A
2422	55.3	AV	H	25.70	3.71	0.00	84.71	N/A	N/A
2422	70.22	PK	V	25.70	3.71	0.00	99.63	N/A	N/A
2422	58.65	AV	V	25.70	3.71	0.00	88.06	N/A	N/A
2390	29.91	PK	V	25.61	3.63	0.00	59.15	74.00	14.85
2390	17.38	AV	V	25.61	3.63	0.00	46.62	54.00	7.38
4844	30.44	PK	V	30.69	4.99	27.42	38.70	74.00	35.30
4844	17.66	AV	V	30.69	4.99	27.42	36.79	54.00	17.21
7266	28.53	PK	V	34.24	6.68	25.89	27.87	74.00	46.13
7266	12.84	AV	V	34.24	6.68	25.89	27.87	54.00	26.13
9688	27.65	PK	V	36.15	8.58	27.37	45.01	74.00	28.99
9688	14.82	AV	V	36.15	8.58	27.37	32.18	54.00	21.82
2925	38.39	PK	V	27.01	6.26	27.54	44.12	74.00	29.88
2925	22.19	AV	V	27.01	6.26	27.54	27.92	54.00	26.08
167.74	47.75	QP	V	12.14	1.56	21.44	40.01	43.50	3.49*
Middle Channel: 2437 MHz									
2437	75.08	PK	H	25.74	3.75	0.00	104.57	N/A	N/A
2437	54.98	AV	H	25.74	3.75	0.00	84.47	N/A	N/A
2437	77.88	PK	V	25.74	3.75	0.00	107.37	N/A	N/A
2437	58.42	AV	V	25.74	3.75	0.00	87.91	N/A	N/A
4874	33.16	PK	V	30.77	5.14	27.42	41.65	74.00	32.35
4874	19.15	AV	V	30.77	5.14	27.42	27.64	54.00	26.36
7311	31.23	PK	V	34.35	6.74	25.88	46.44	74.00	27.56
7311	19.63	AV	V	34.35	6.74	25.88	34.84	54.00	19.16
9748	30.55	PK	V	36.30	8.61	27.24	48.22	74.00	25.78
9748	18.54	AV	V	36.30	8.61	27.24	36.21	54.00	17.79
2950	31.09	PK	V	27.07	6.61	27.54	37.23	74.00	36.77
2950	18.95	AV	V	27.07	6.61	27.54	25.09	54.00	28.91
3610	37.06	PK	V	29.04	4.61	27.28	43.43	74.00	30.57
3610	22.08	AV	V	29.04	4.61	27.28	28.45	54.00	25.55
167.74	46.86	QP	V	12.14	1.56	21.44	39.12	43.50	4.38 *
High Channel: 2452 MHz									
2452	74.23	PK	H	25.78	3.78	0.00	103.79	N/A	N/A
2452	56.92	AV	H	25.78	3.78	0.00	86.48	N/A	N/A
2452	70.75	PK	V	25.78	3.78	0.00	100.31	N/A	N/A
2452	59.08	AV	V	25.78	3.78	0.00	88.64	N/A	N/A
2483.5	31.8	PK	V	25.86	3.67	0.00	61.33	74.00	12.67
2483.5	19.22	AV	V	25.86	3.67	0.00	48.75	54.00	5.25
4904	30.48	PK	V	30.85	5.31	27.43	39.21	74.00	34.79
4904	17.49	AV	V	30.85	5.31	27.43	26.22	54.00	27.78
7356	30.27	PK	V	34.45	6.79	25.87	45.64	74.00	28.36
7356	17.74	AV	V	34.45	6.79	25.87	33.11	54.00	20.89
9808	30.59	PK	V	36.44	8.64	27.09	48.58	74.00	25.42
9808	17.57	AV	V	36.44	8.64	27.09	35.56	54.00	18.44
2950	36.34	PK	V	27.07	6.61	27.54	42.48	74.00	31.52
2950	21.12	AV	V	27.07	6.61	27.54	27.26	54.00	26.74
167.74	47.63	QP	V	12.14	1.56	21.44	39.89	43.50	3.61*

\*within measurement uncertainty!

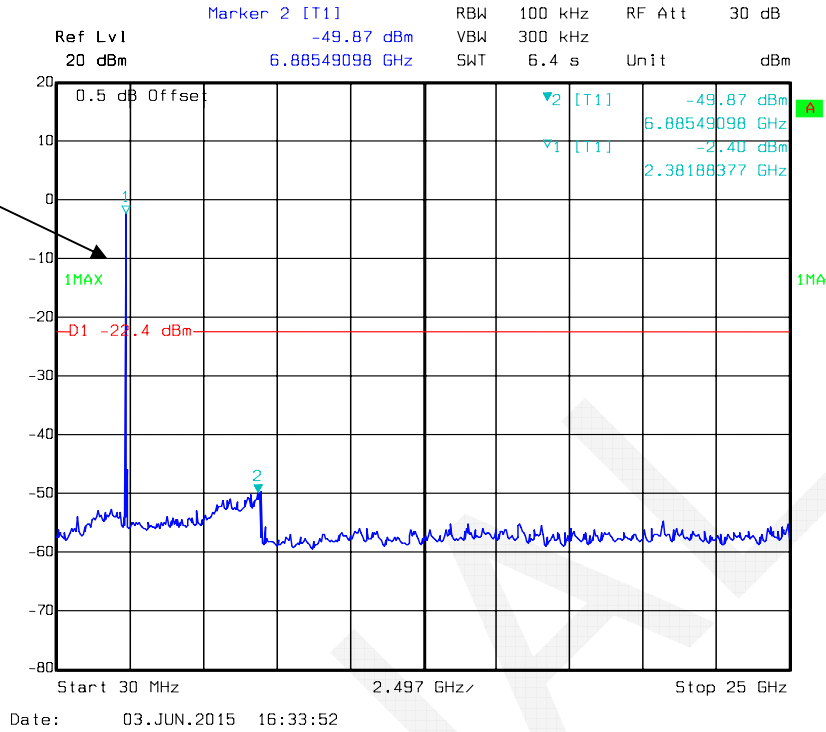


**Conducted Spurious Emissions at Antenna Port**

**Antenna A**

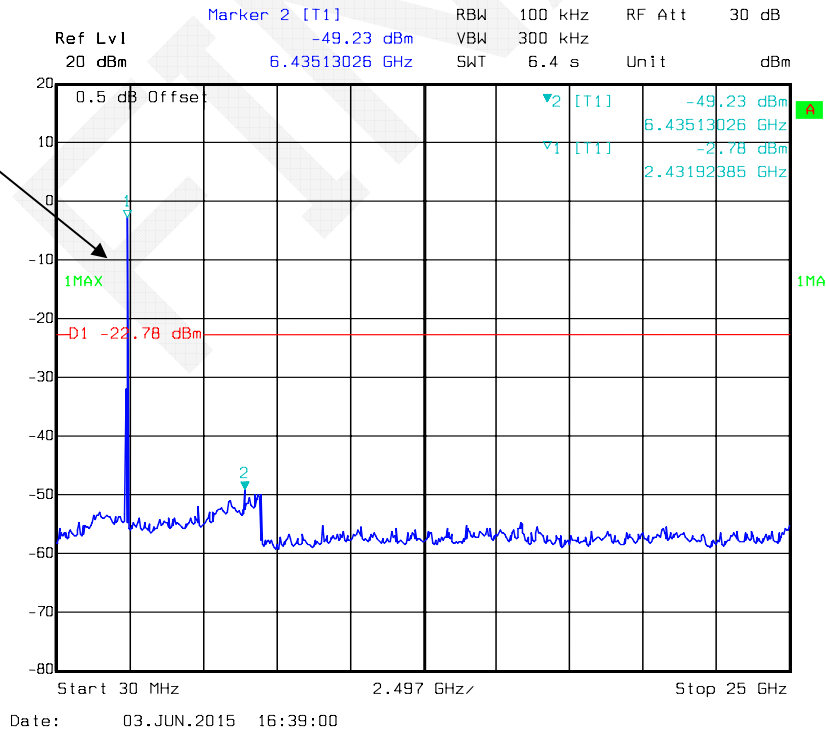
**802.11b Low Channel**

Fundamental

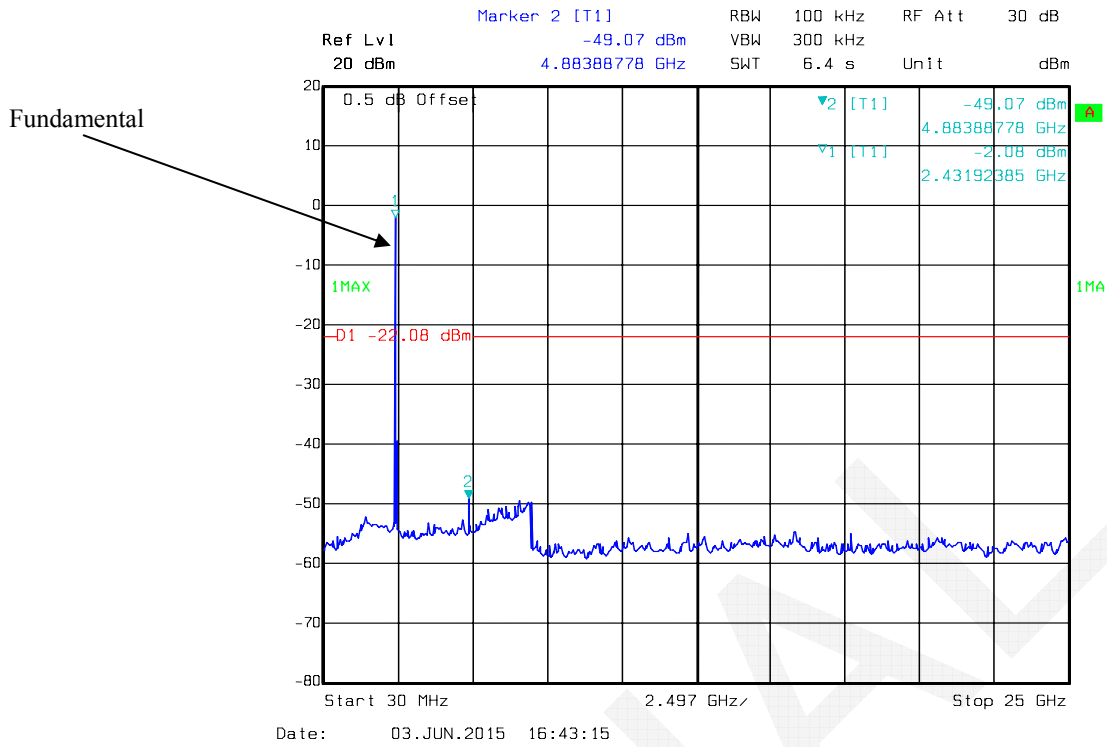


**802.11b Middle Channel**

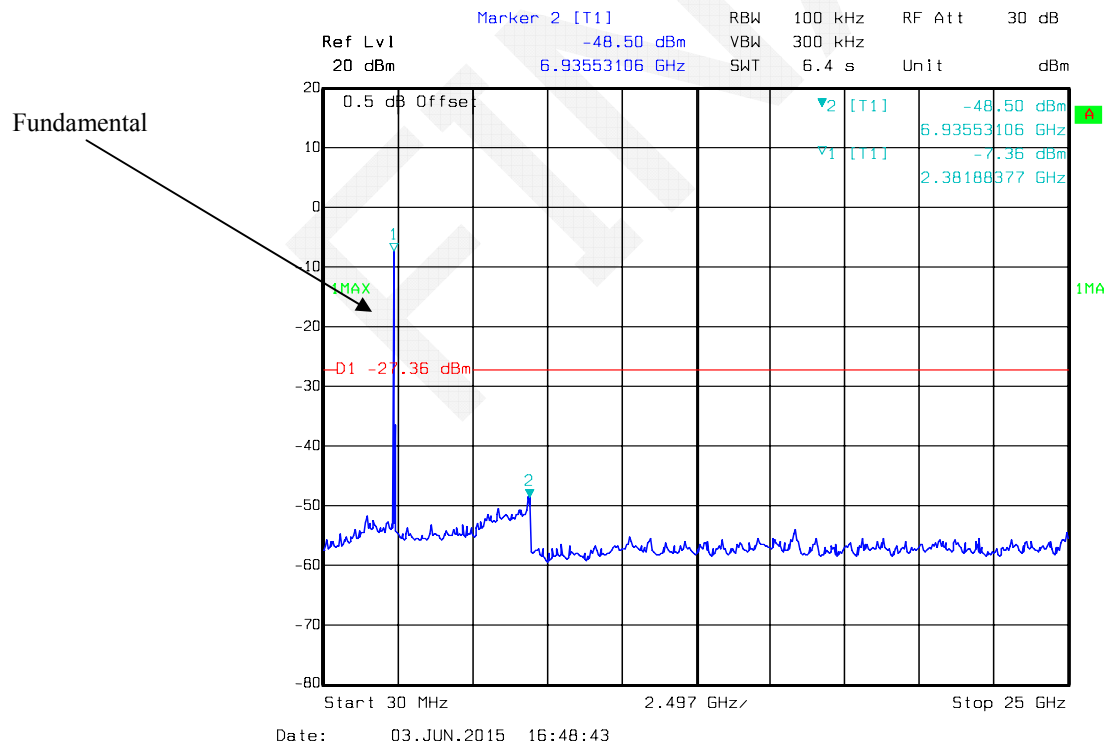
Fundamental



### 802.11b High Channel

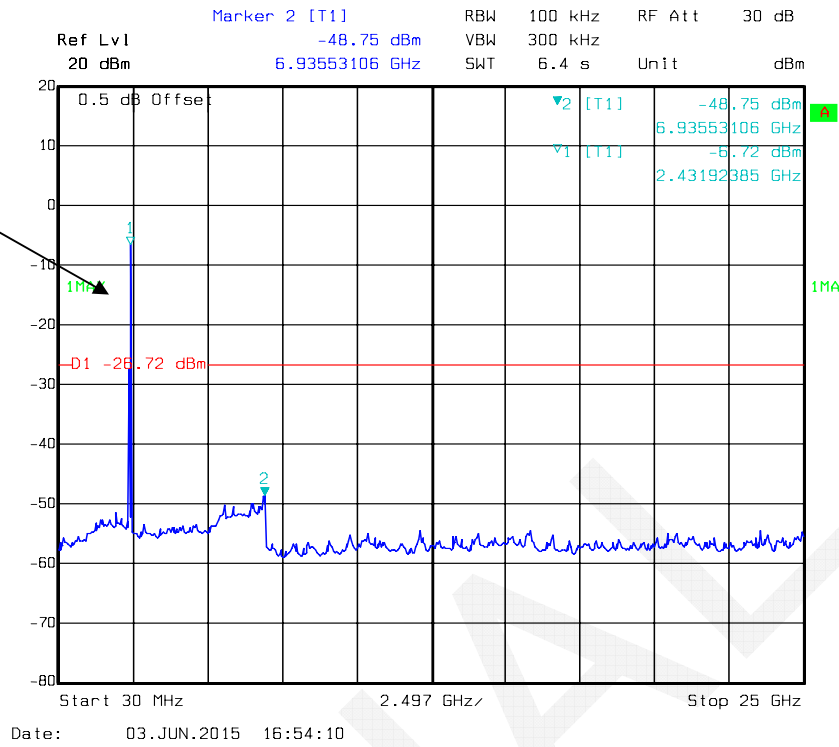


### 802.11g Low Channel



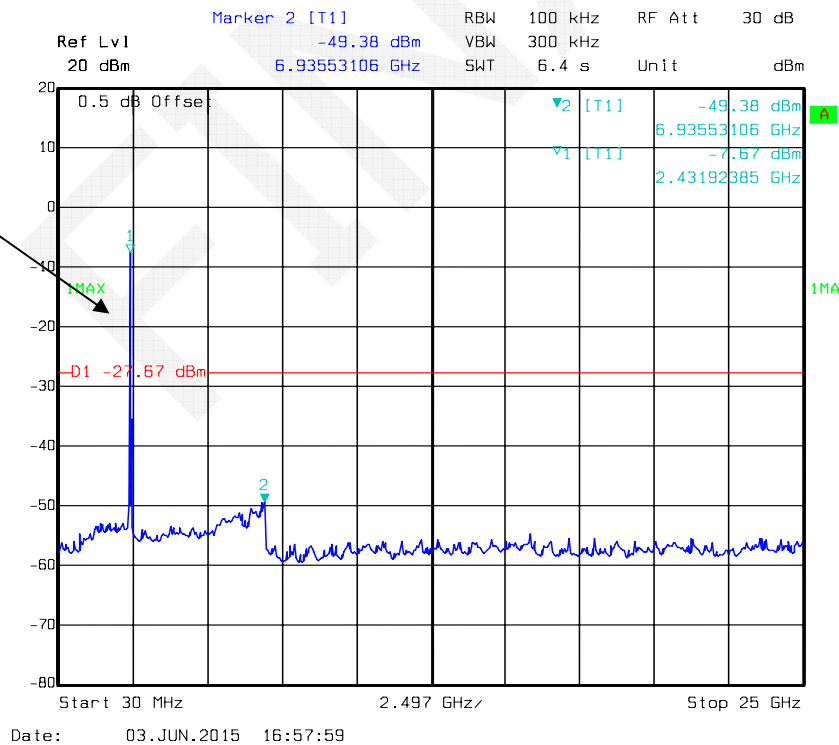
### 802.11g Middle Channel

Fundamental



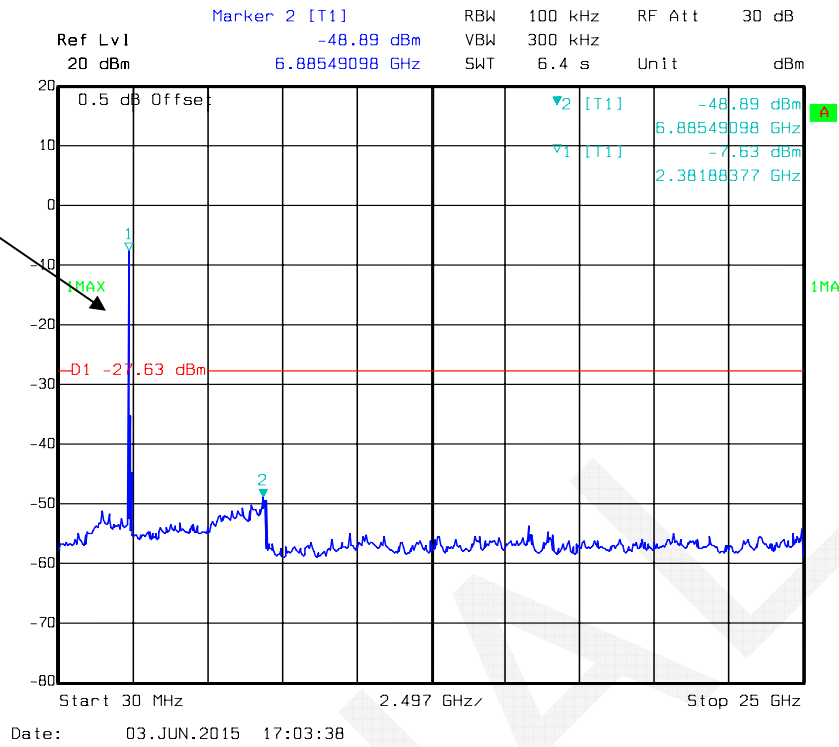
### 802.11g High Channel

Fundamental



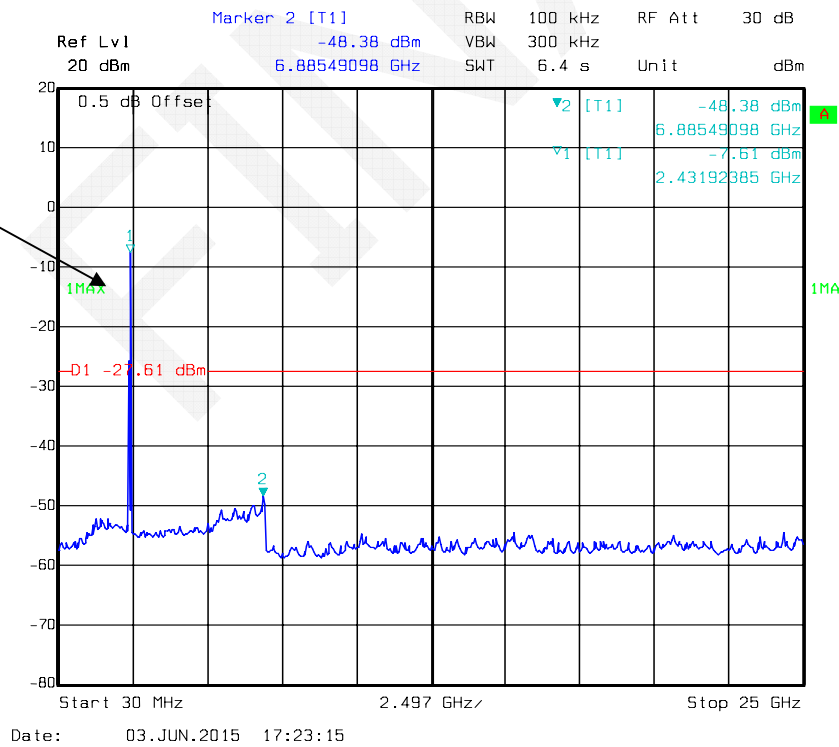
**802.11n ht20 Low Channel**

Fundamental



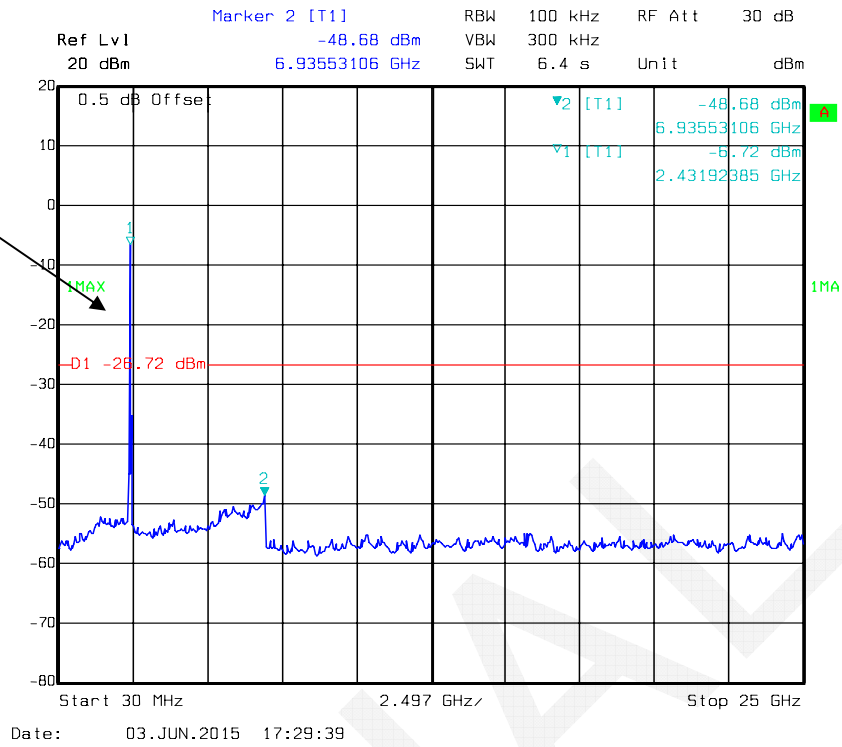
**802.11n ht20 Middle Channel**

Fundamental



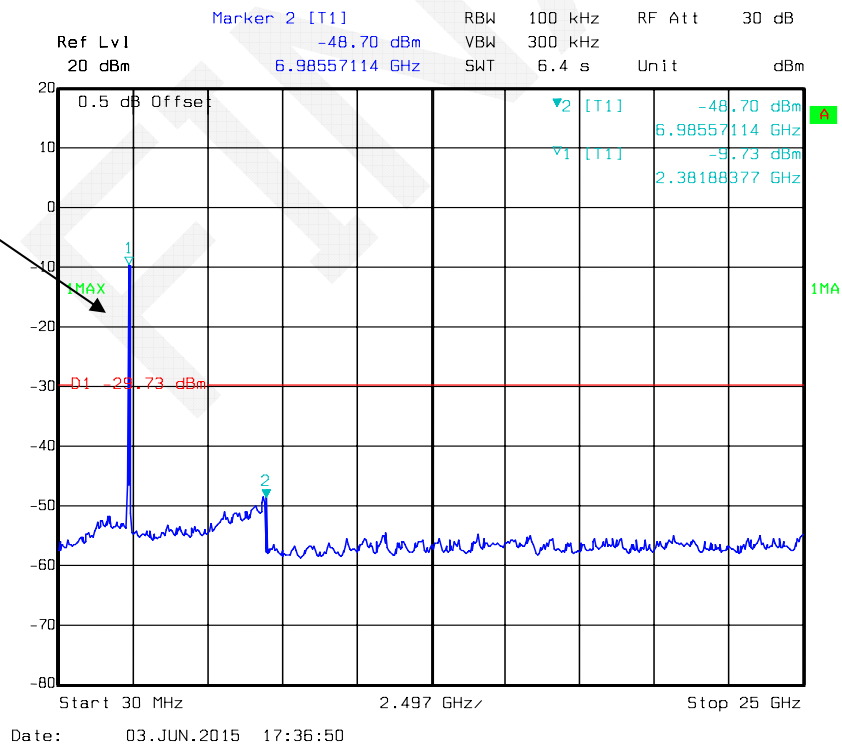
### 802.11n ht20 High Channel

Fundamental

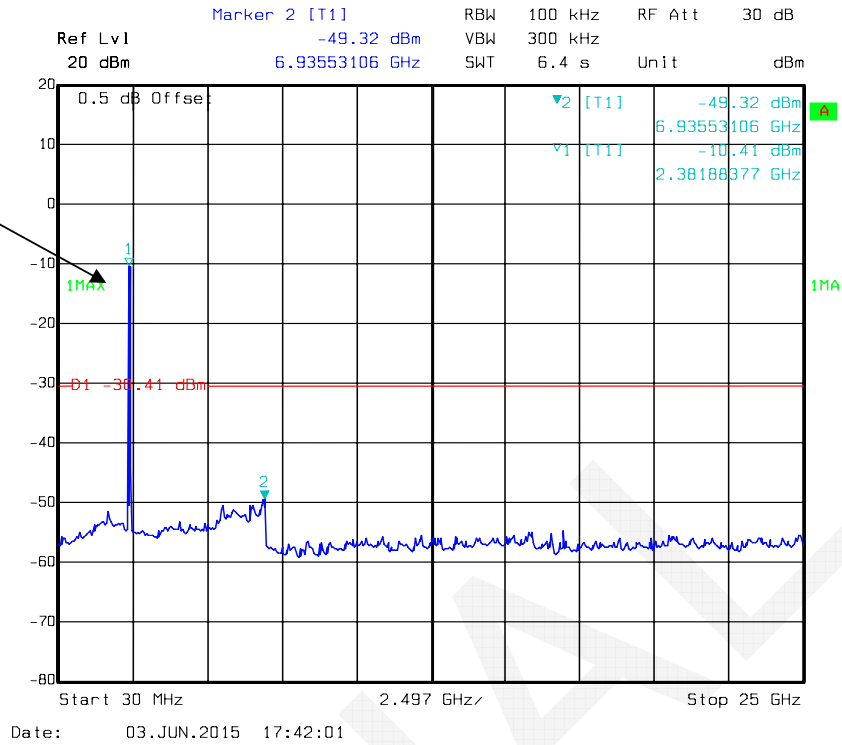


### 802.11n ht40 Low Channel

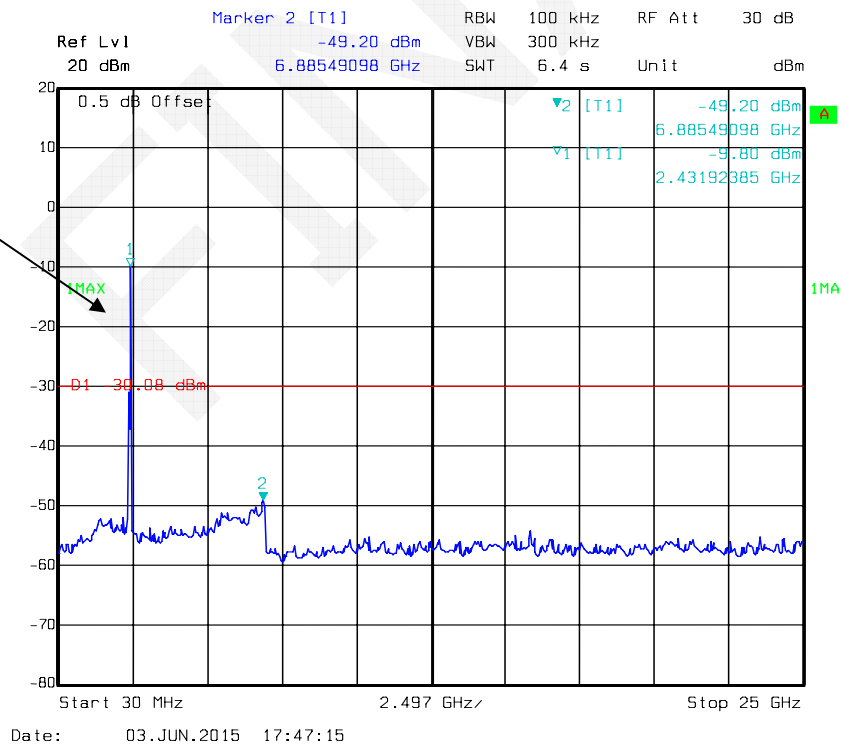
Fundamental



### 802.11n ht40 Middle Channel



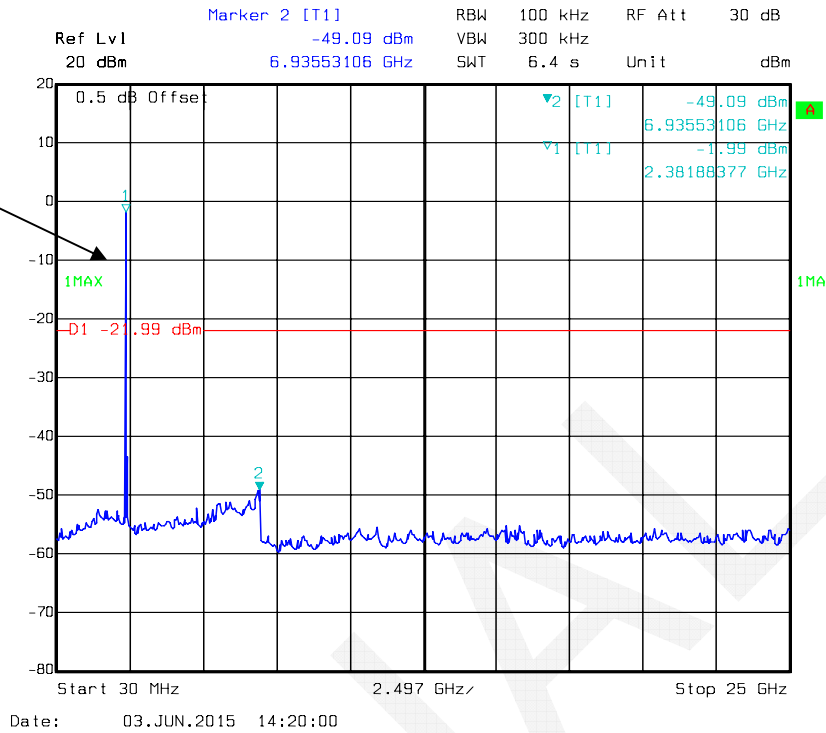
### 802.11n ht40 High Channel



Antenna B

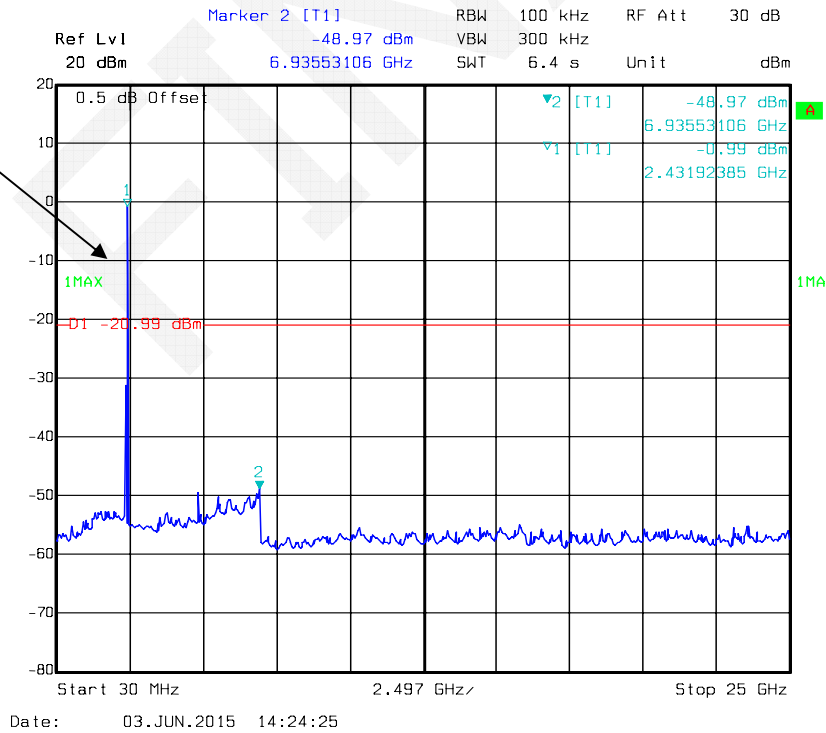
802.11b Low Channel

Fundamental

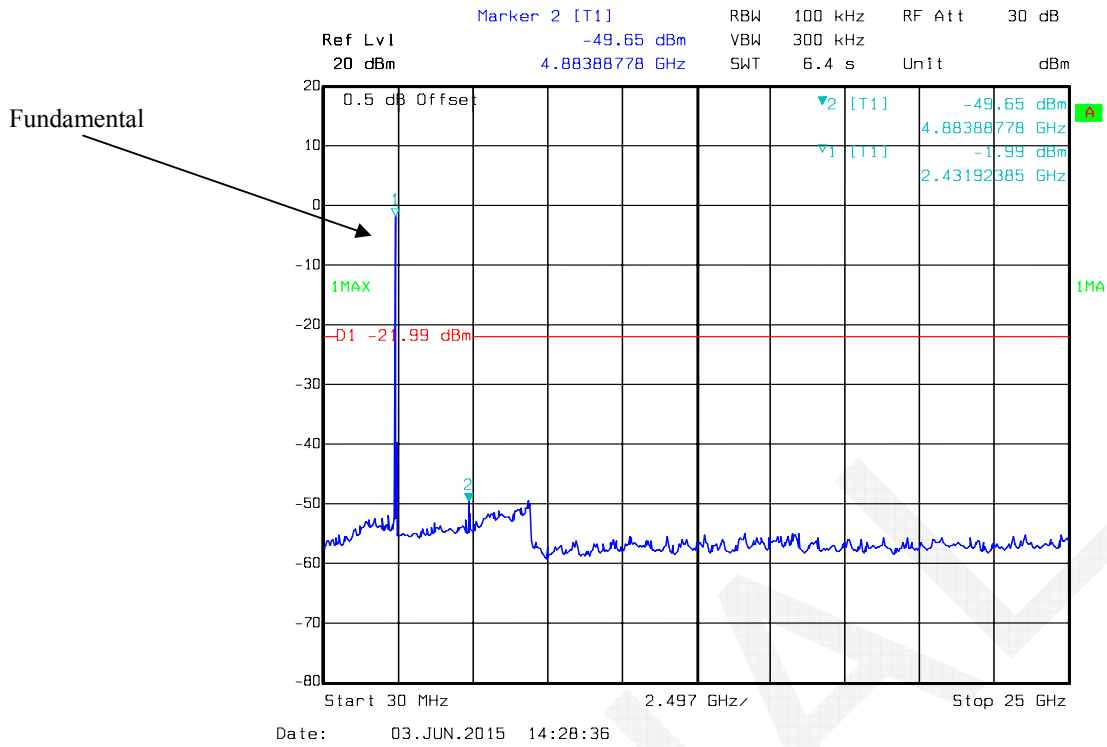


802.11b Middle Channel

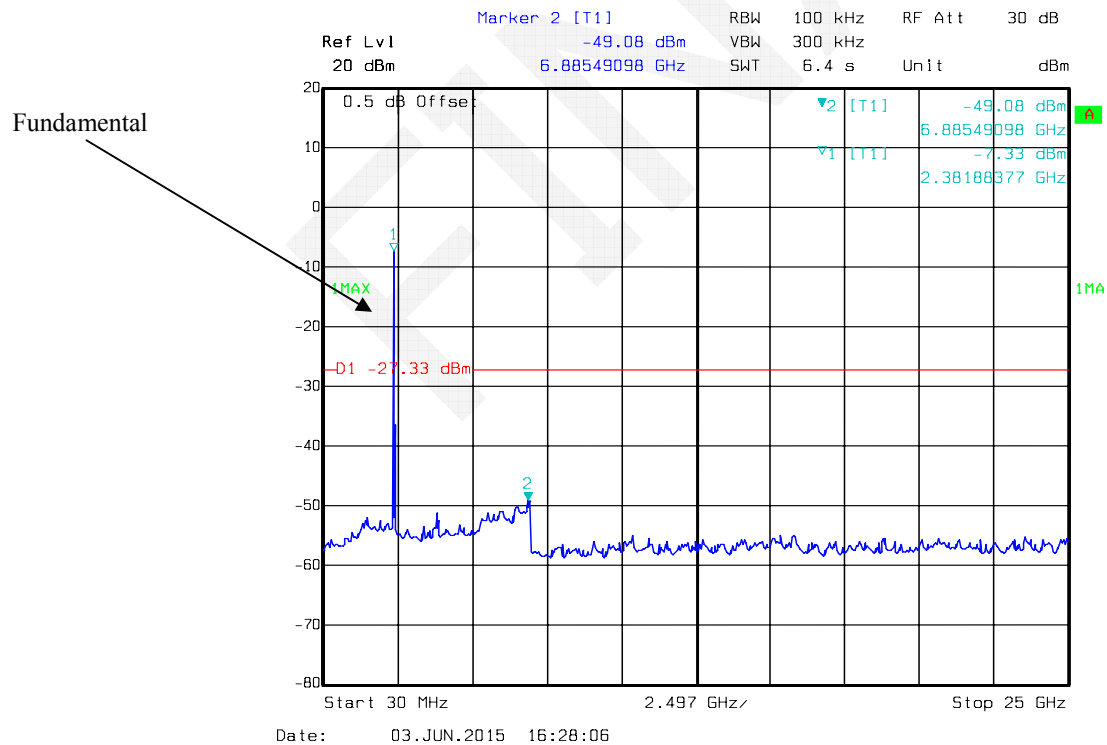
Fundamental



### 802.11b High Channel

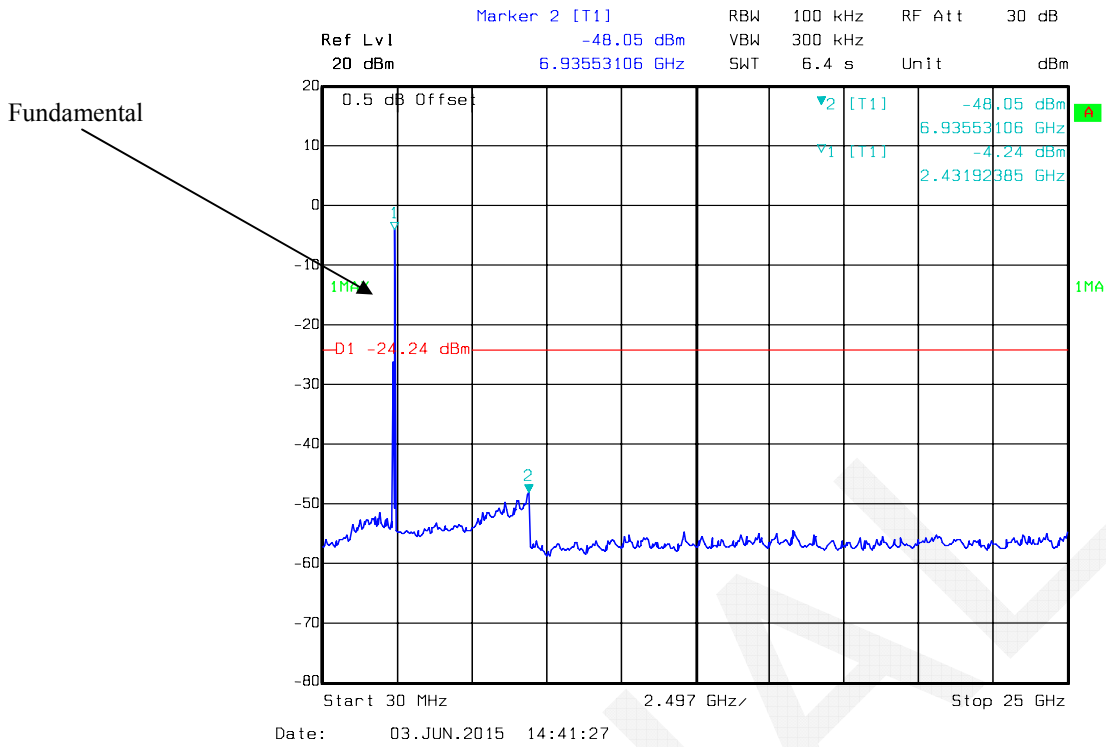


### 802.11g Low Channel

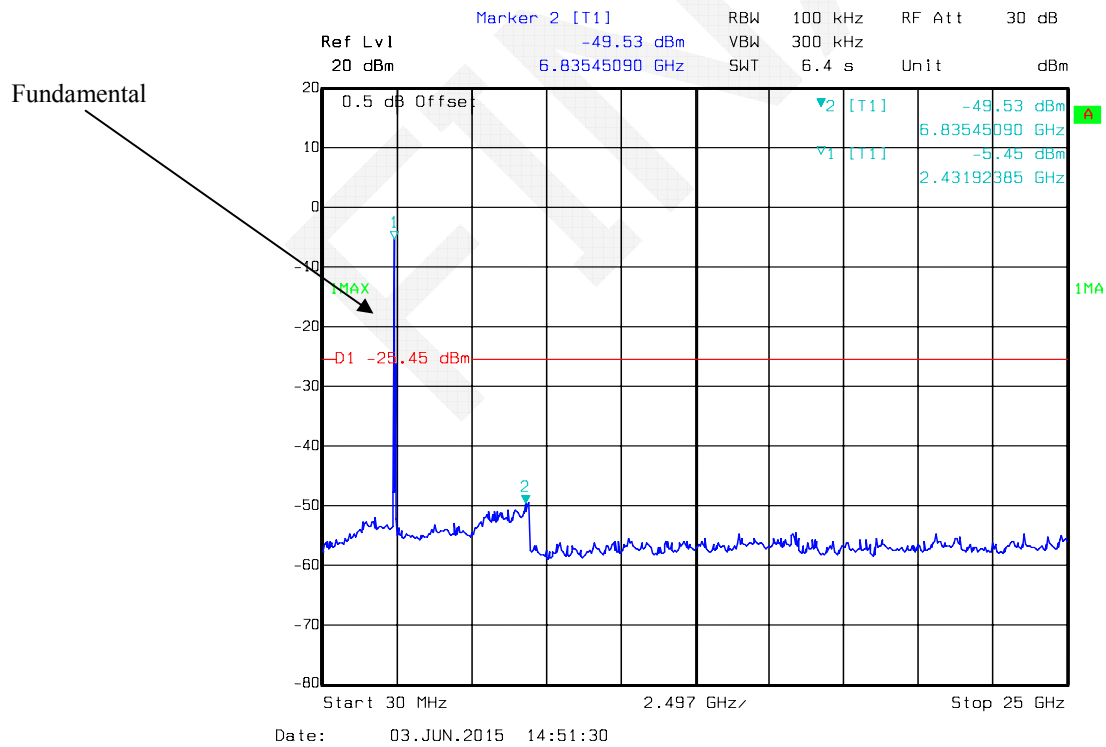




### 802.11g Middle Channel

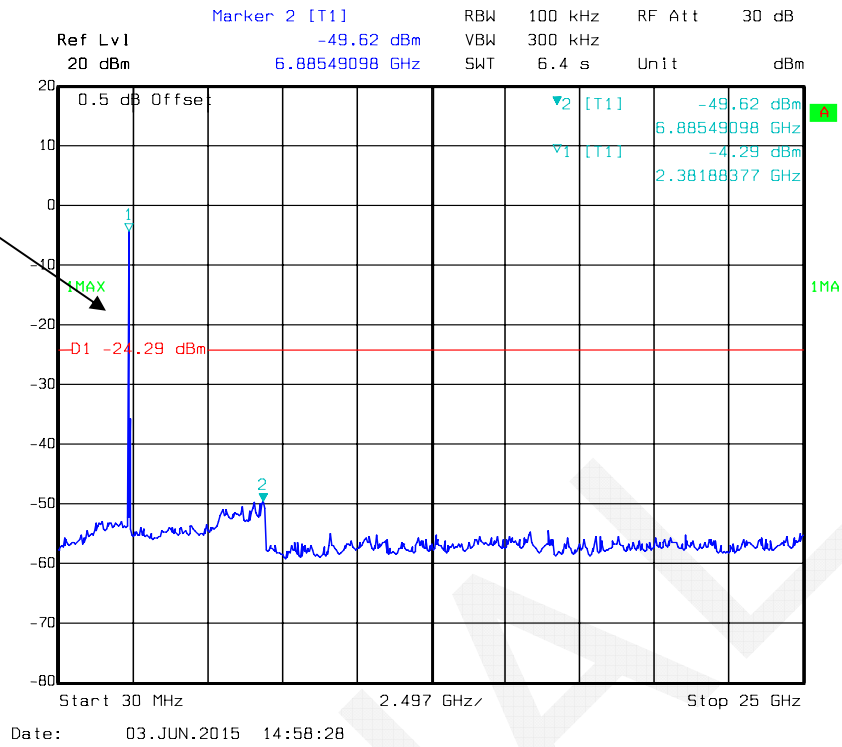


### 802.11g High Channel



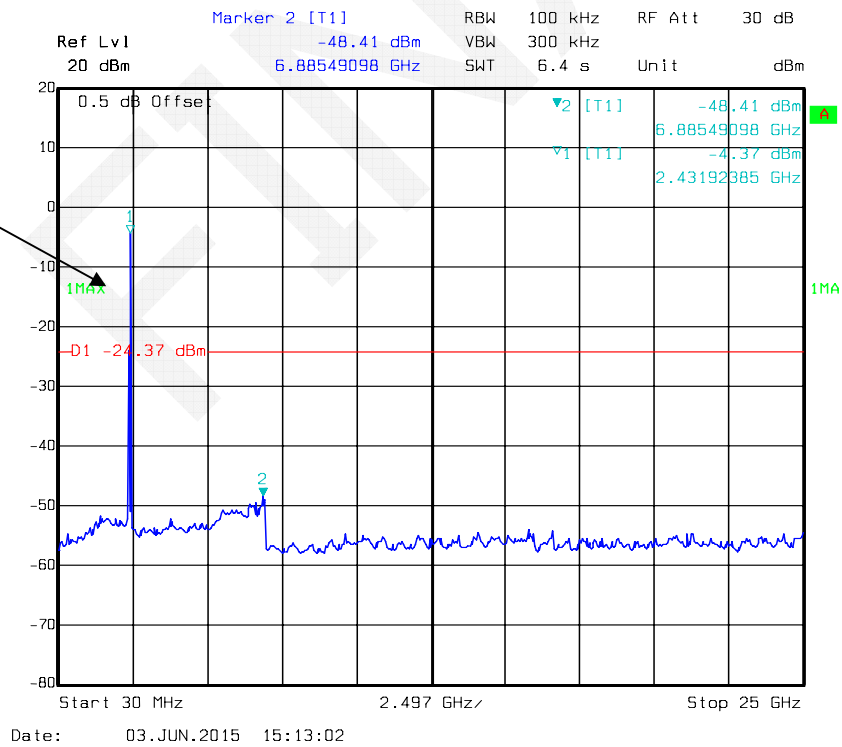
**802.11n ht20 Low Channel**

Fundamental



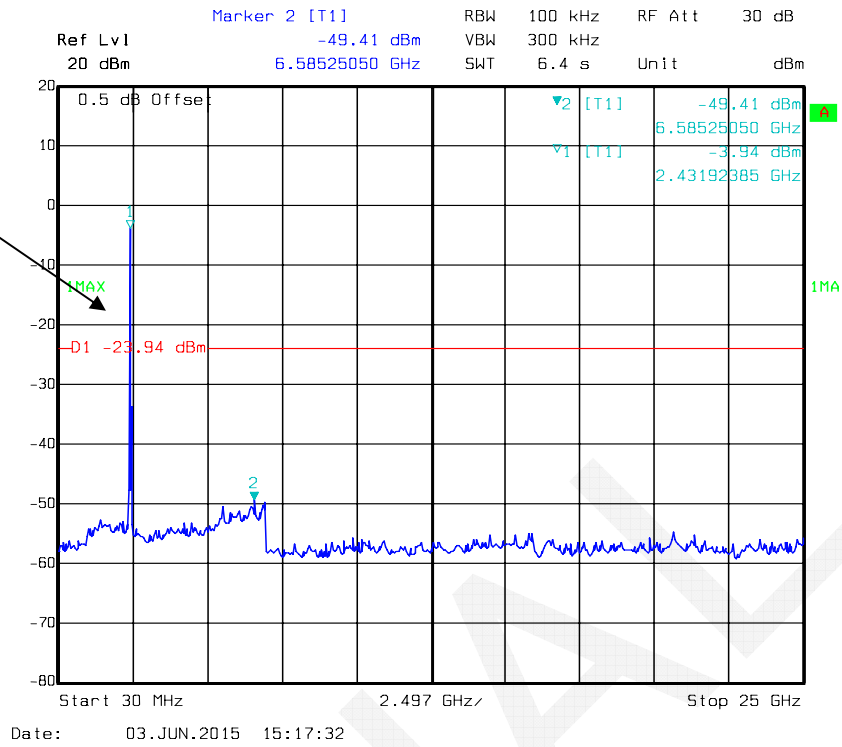
**802.11n ht20 Middle Channel**

Fundamental



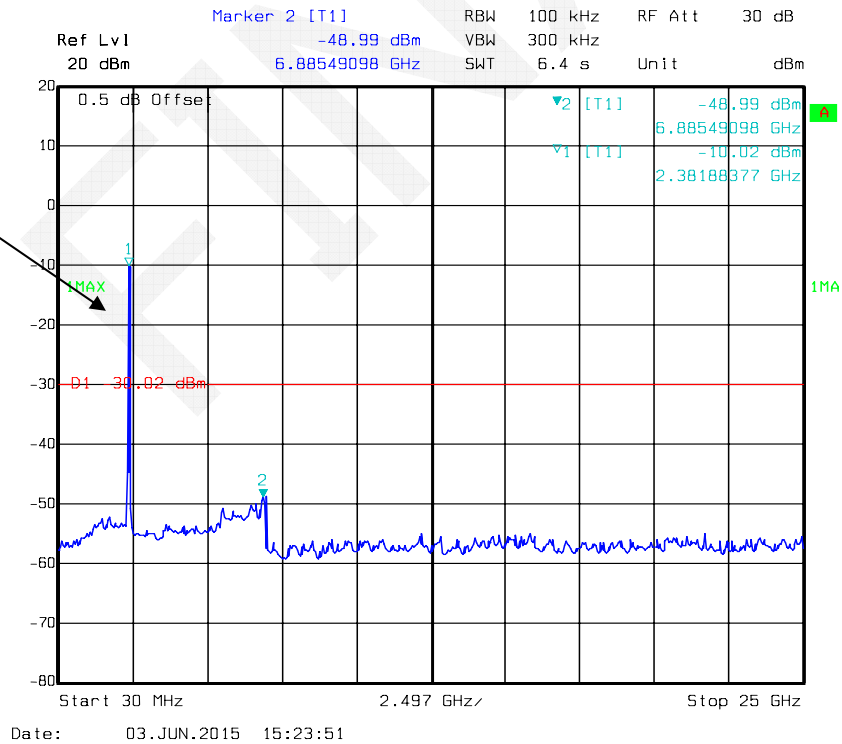
### 802.11n ht20 High Channel

Fundamental

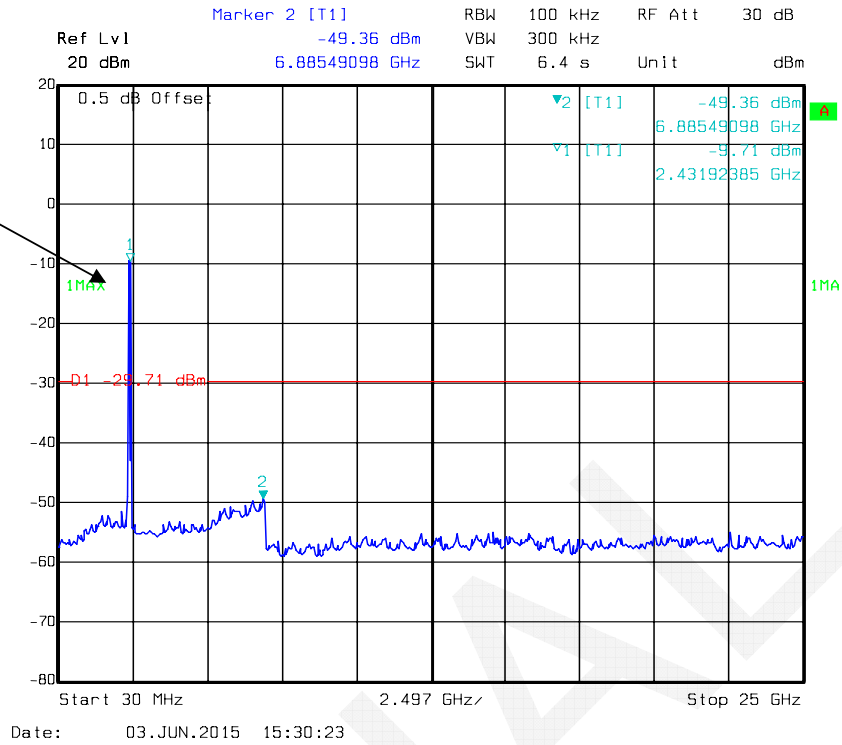


### 802.11n ht40 Low Channel

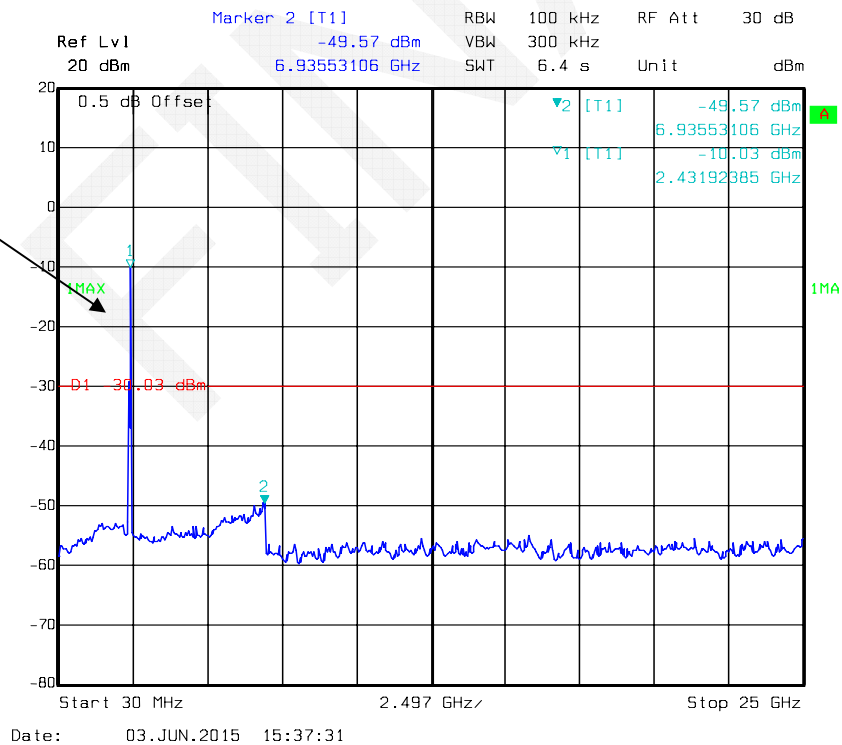
Fundamental



### 802.11n ht40 Middle Channel



### 802.11n ht40 High Channel



**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**

According to KDB 558074 D01 DTS Meas Guidance v03r02 clause8.1 Option 1:

- 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	FSEM	DE31388	2015-05-09	2016-05-09

\* **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:	25.4 °C
Relative Humidity:	51 %
ATM Pressure:	100.1 kPa

*The testing was performed by Allen Qiao on 2015-06-03.*

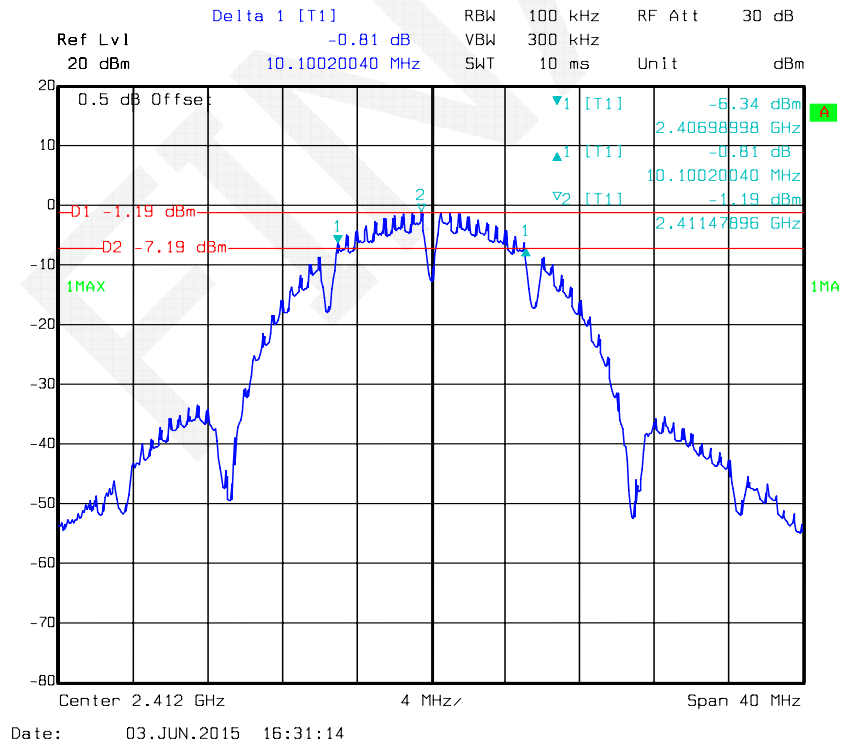
Test Mode: Transmitting

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

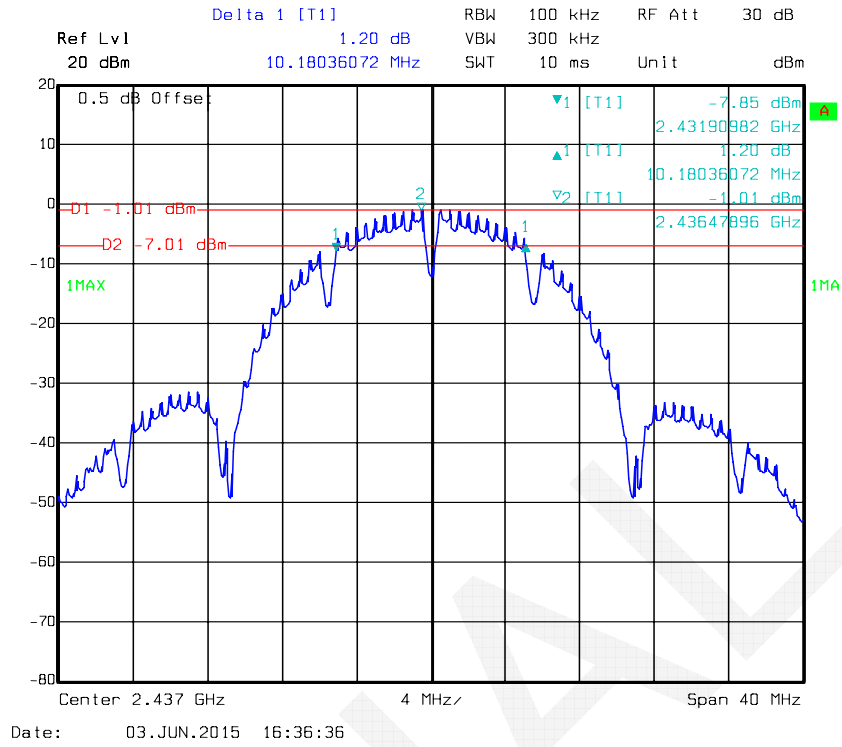
Test mode	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Limit (MHz)
			Antenna A	Antenna B	
802.11b	Low	2412	10.1	10.1	≥0.5
	Middle	2437	10.18	10.1	≥0.5
	High	2462	10.1	10.1	≥0.5
802.11g	Low	2412	16.67	16.67	≥0.5
	Middle	2437	16.59	16.43	≥0.5
	High	2462	16.59	16.43	≥0.5
802.11n20	Low	2412	17.88	17.64	≥0.5
	Middle	2437	17.88	17.72	≥0.5
	High	2462	17.88	17.64	≥0.5
802.11n40	Low	2422	36.71	36.71	≥0.5
	Middle	2437	36.71	36.71	≥0.5
	High	2452	36.71	36.71	≥0.5

Antenna A:

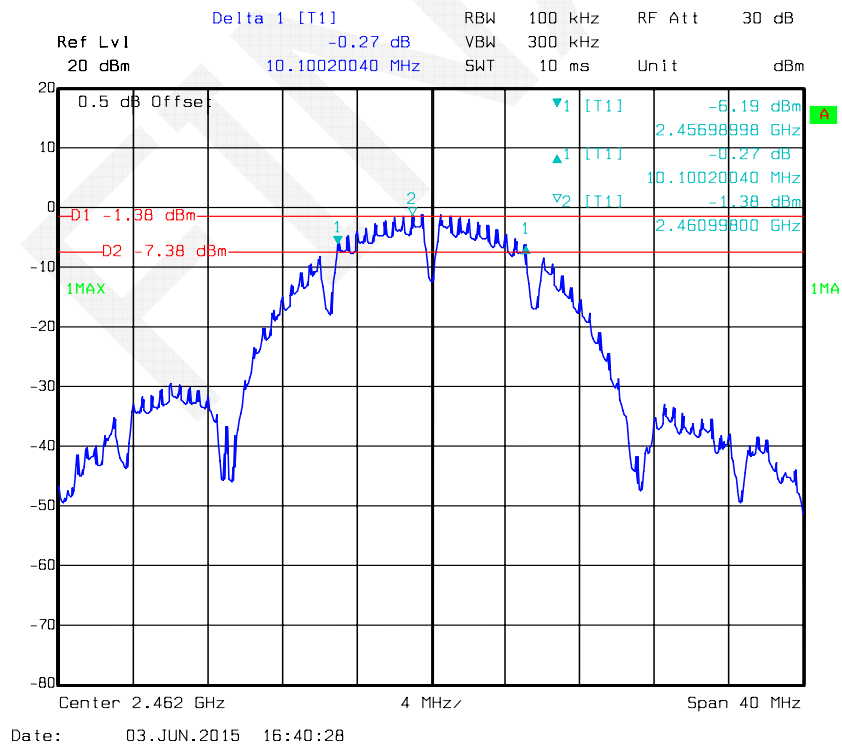
802.11b Low Channel



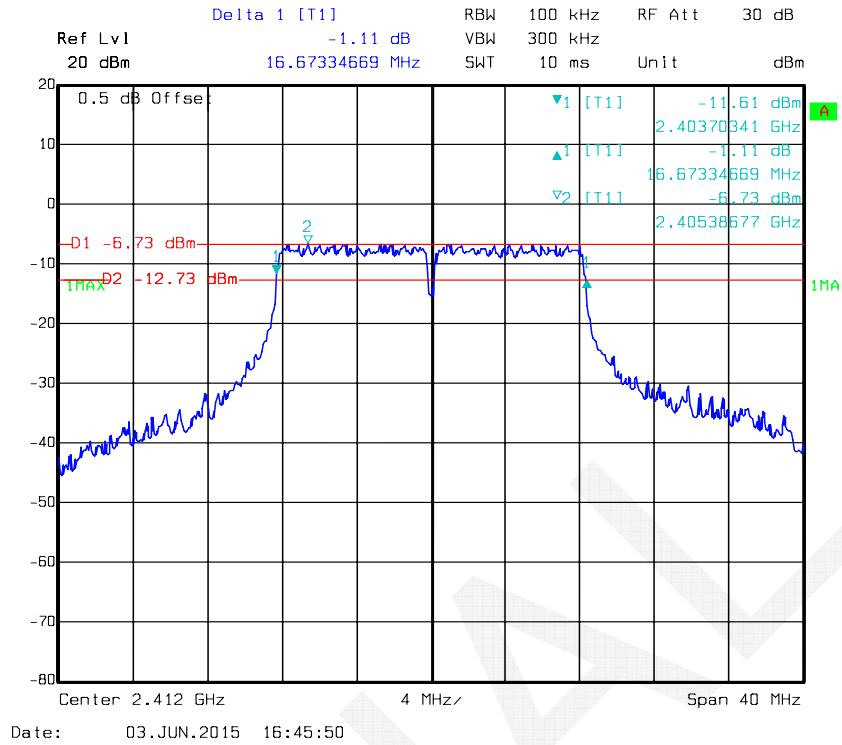
### 802.11b Middle Channel



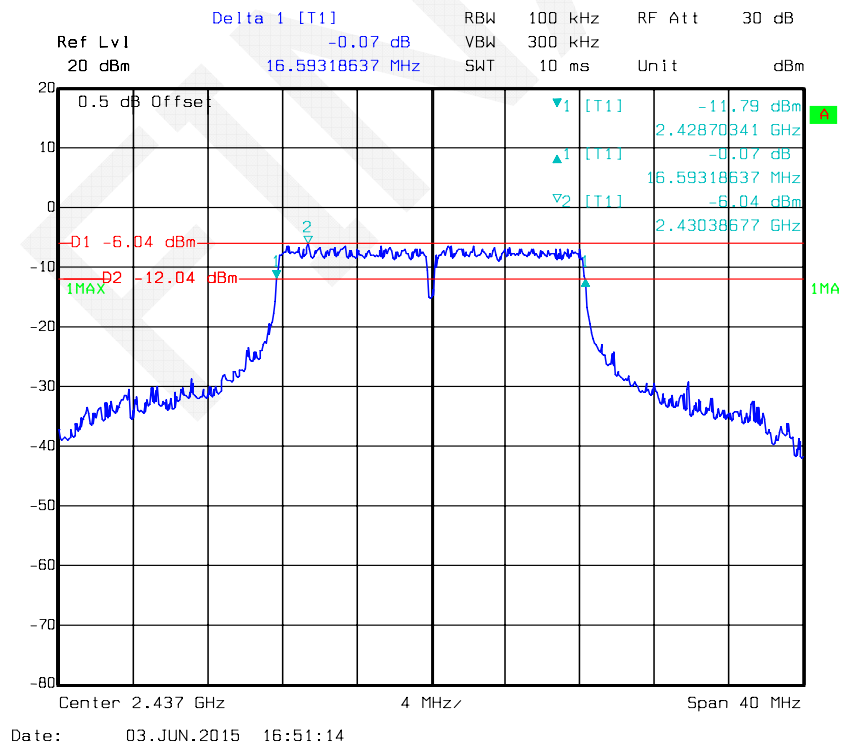
### 802.11b High Channel



### 802.11g Low Channel

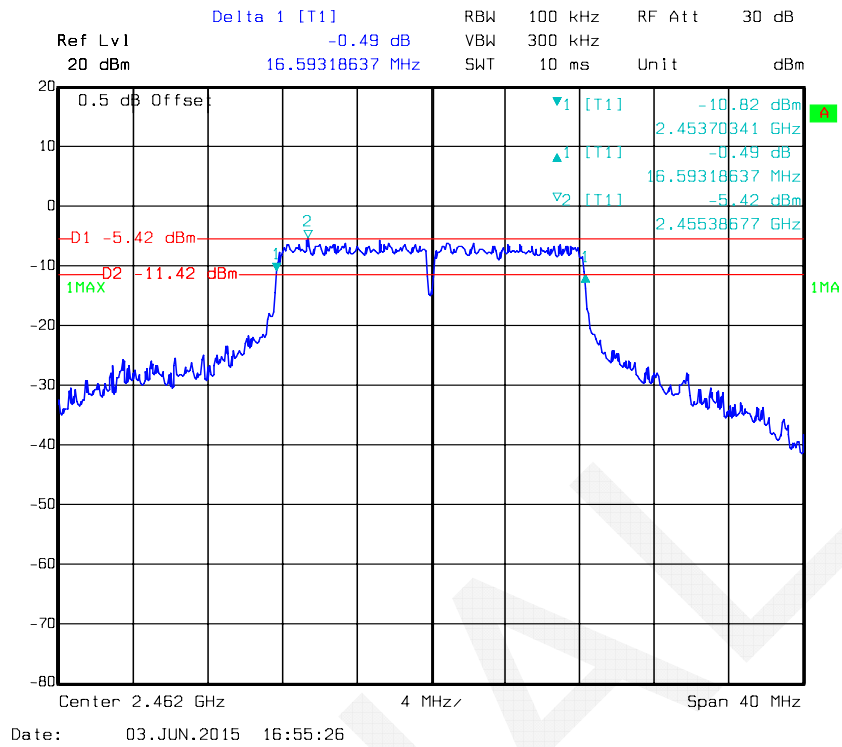


### 802.11g Middle Channel

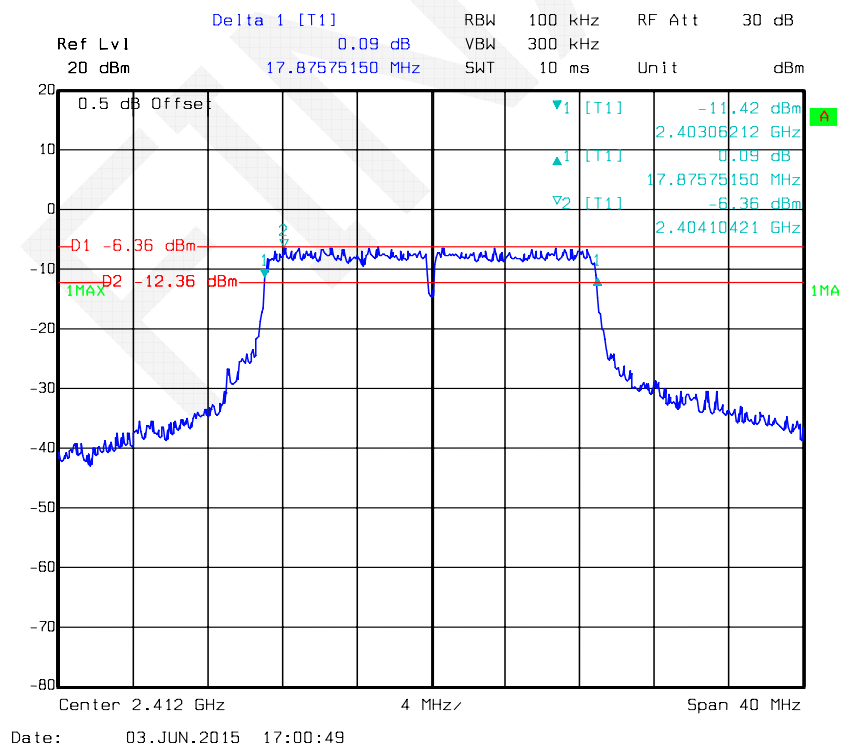




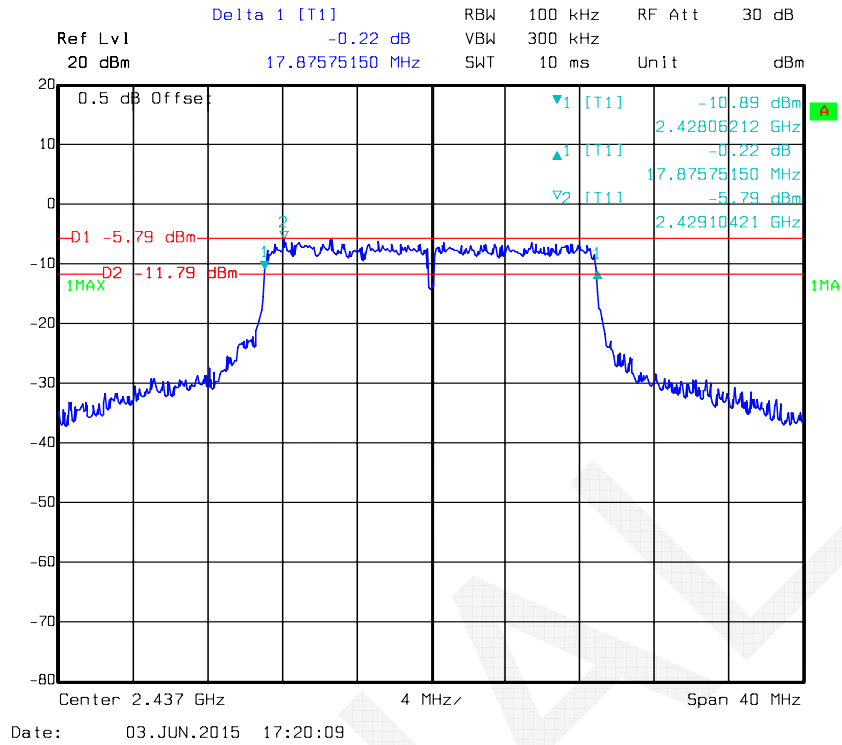
### 802.11g High Channel



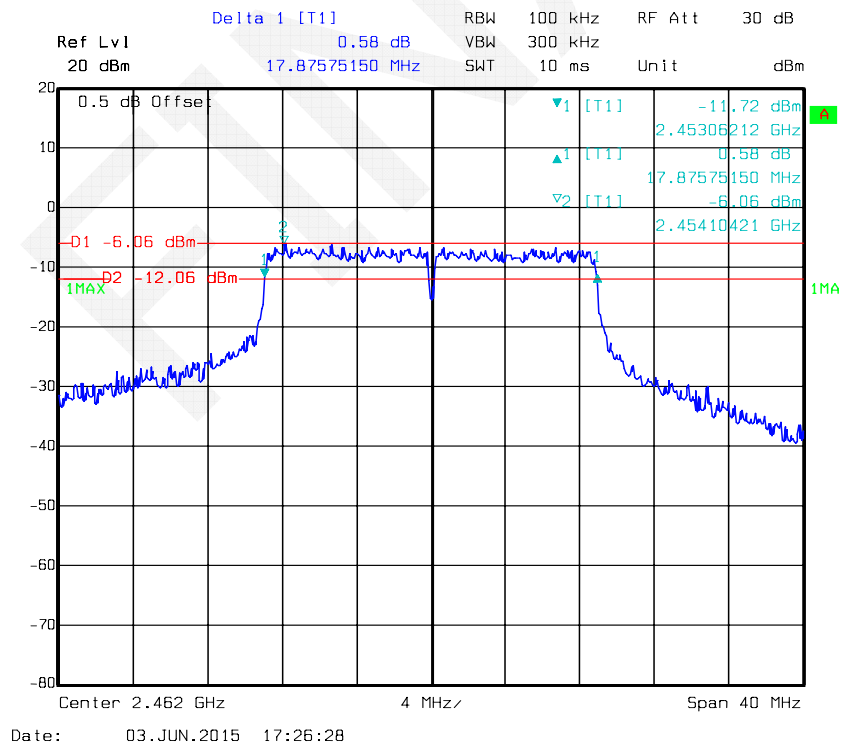
### 802.11n ht20 Low Channel



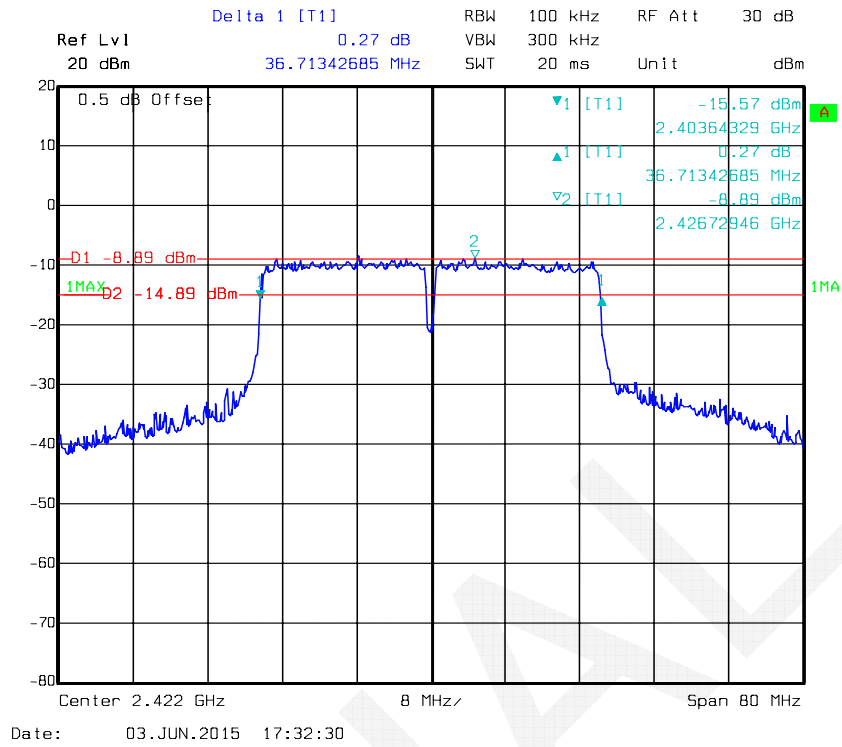
### 802.11n ht20 Middle Channel



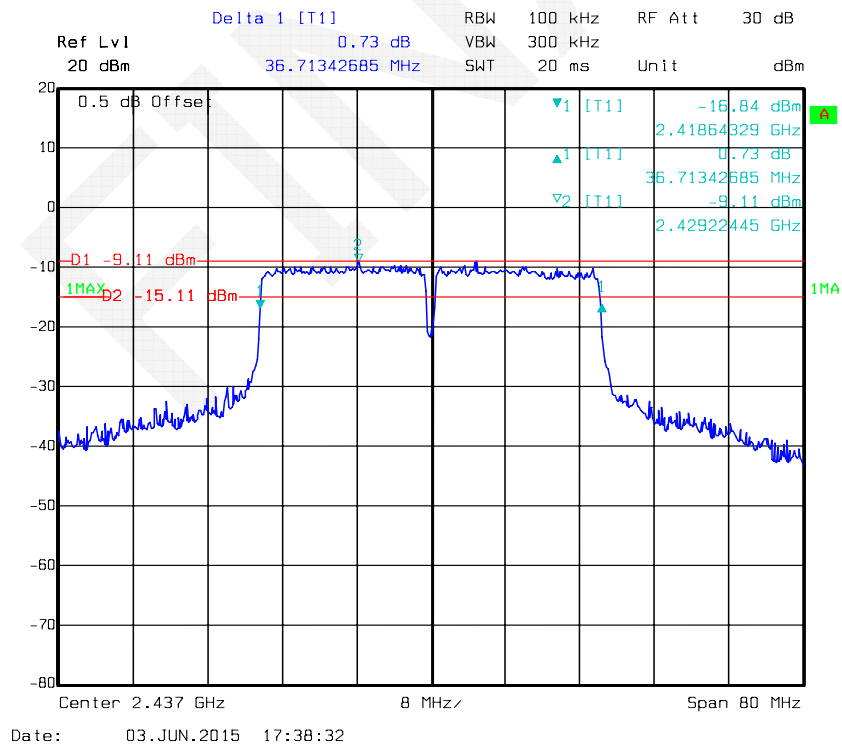
### 802.11n ht20 High Channel



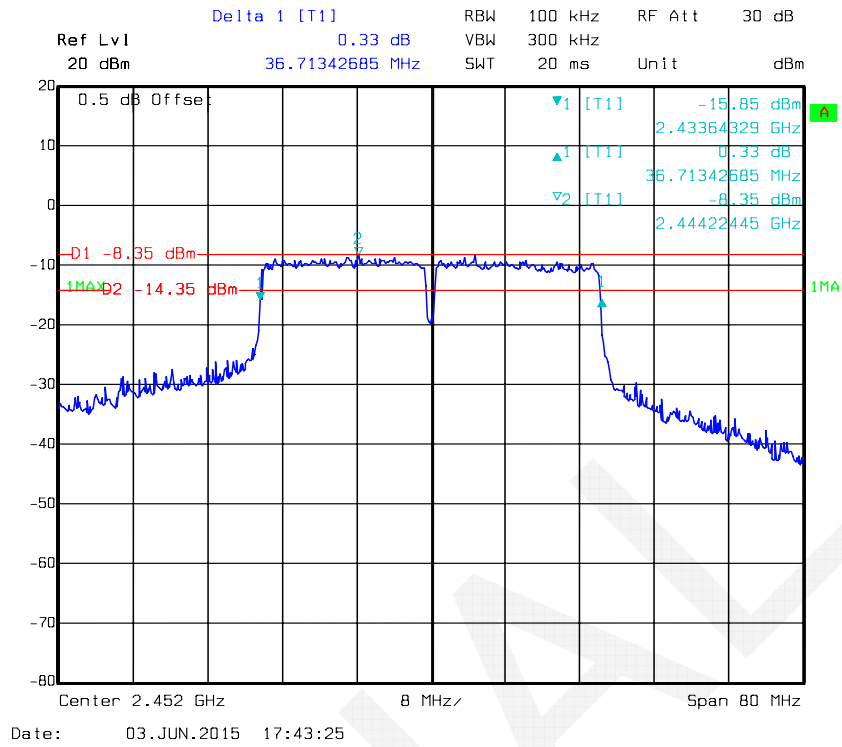
### 802.11n ht40 Low Channel



### 802.11n ht40 Middle Channel

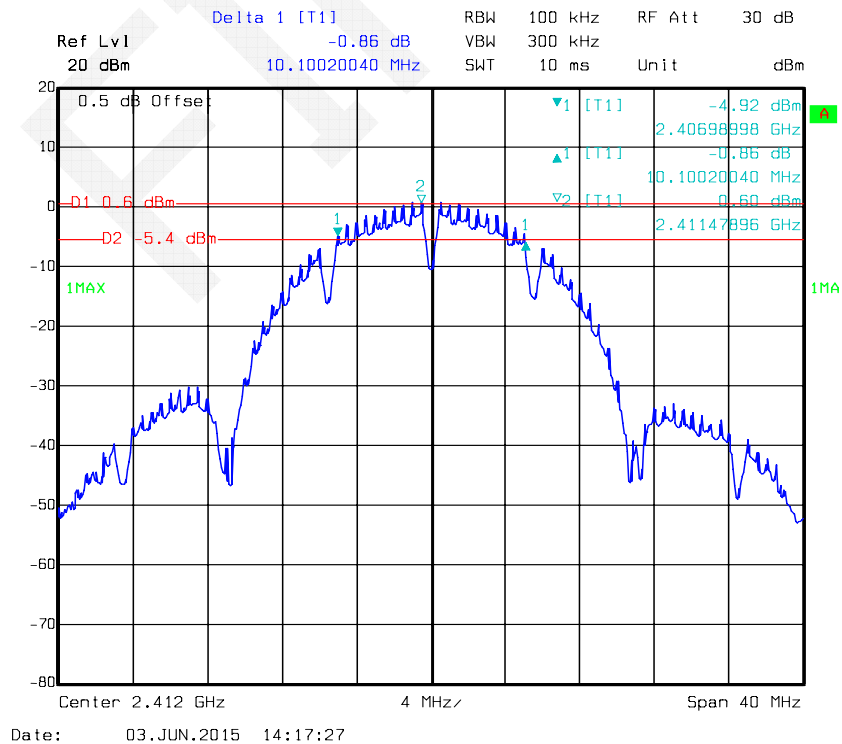


### 802.11n ht40 High Channel

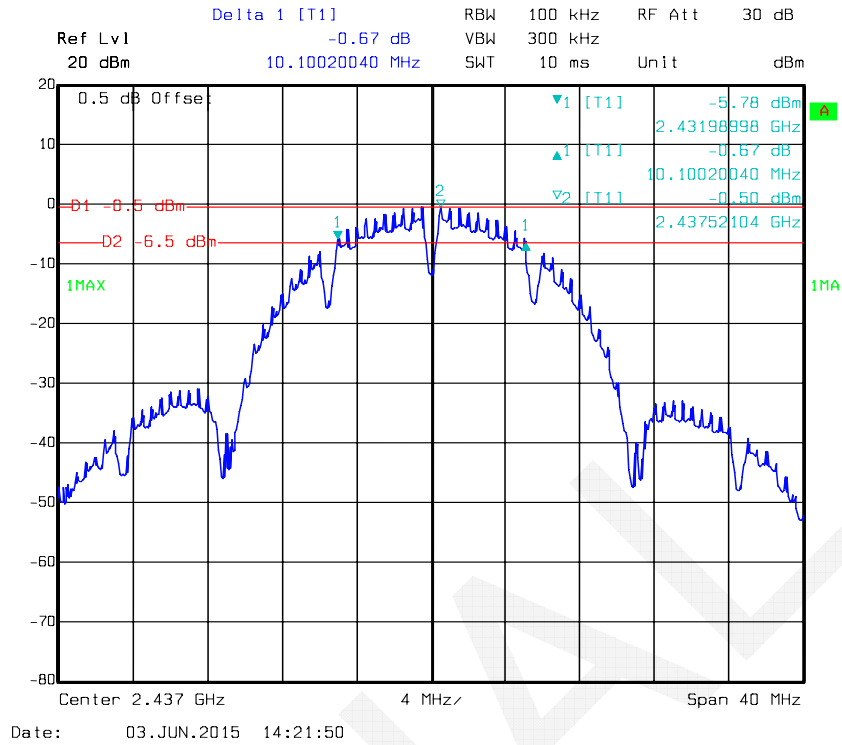


### Antenna B:

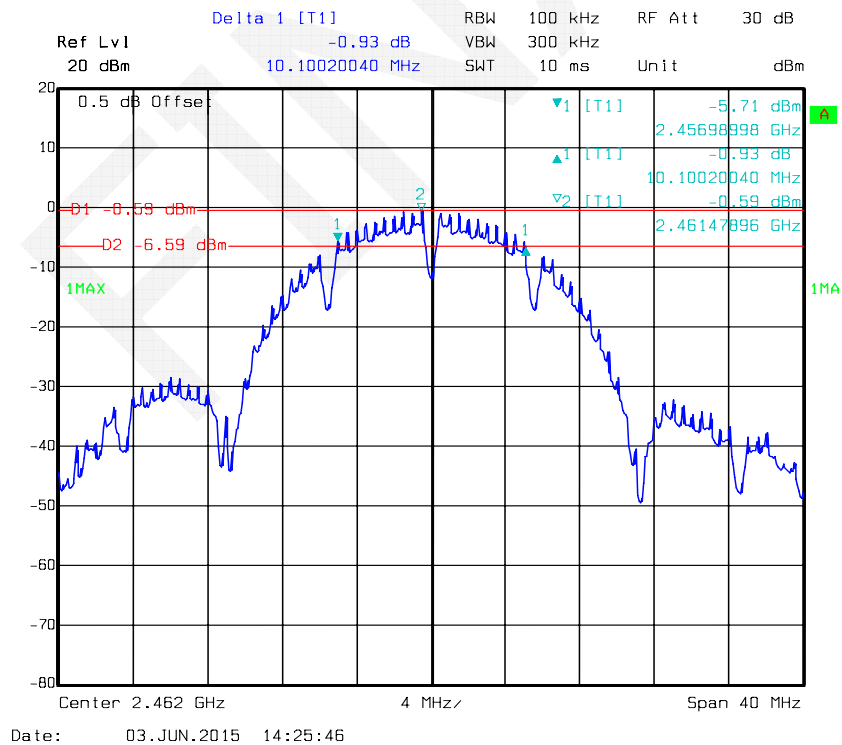
### 802.11b Low Channel



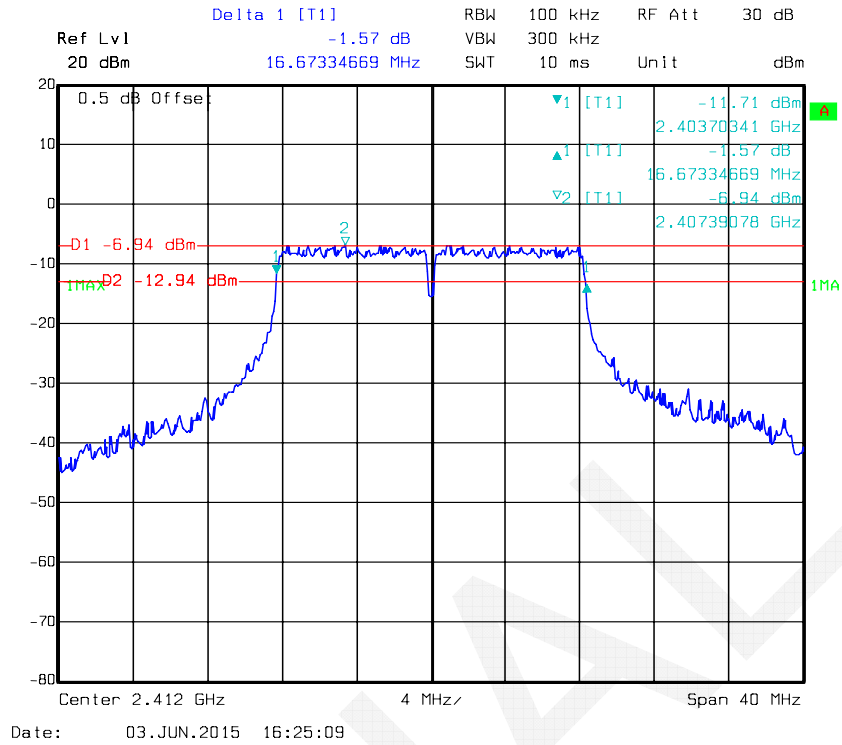
### 802.11b Middle Channel



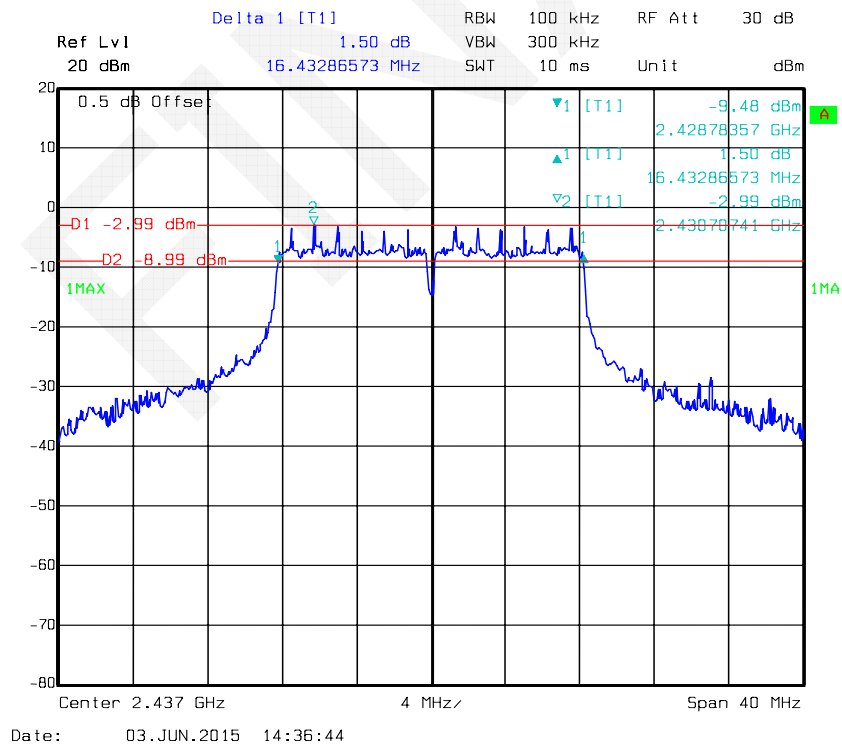
### 802.11b High Channel



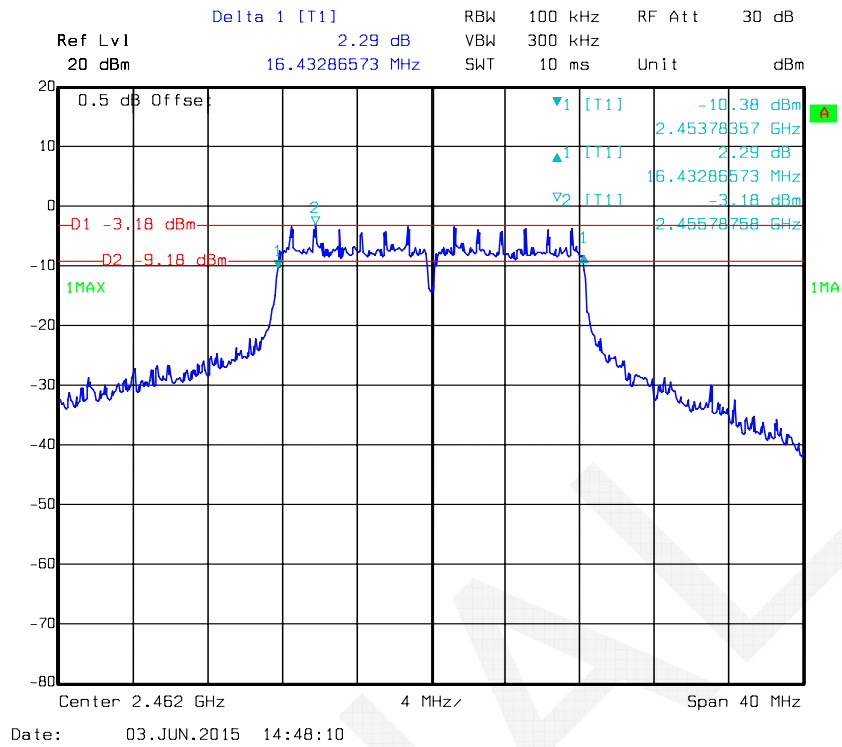
### 802.11g Low Channel



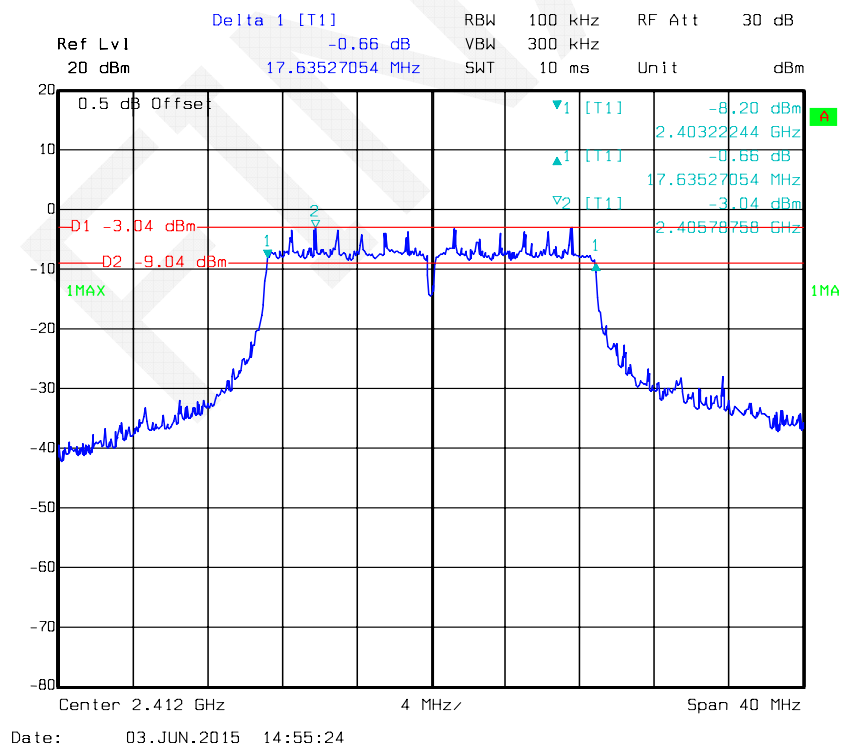
### 802.11g Middle Channel



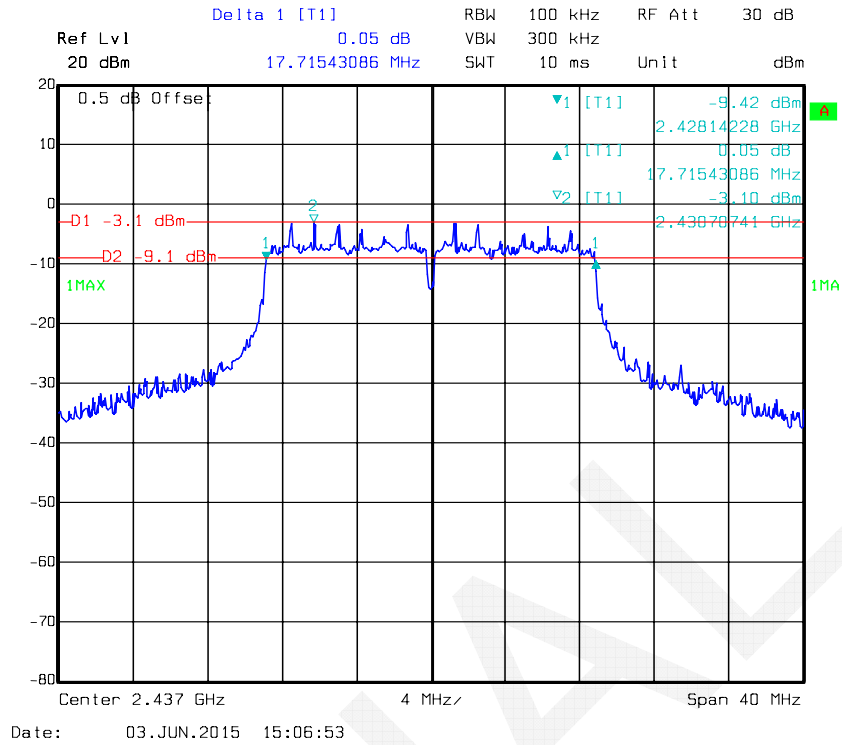
### 802.11g High Channel



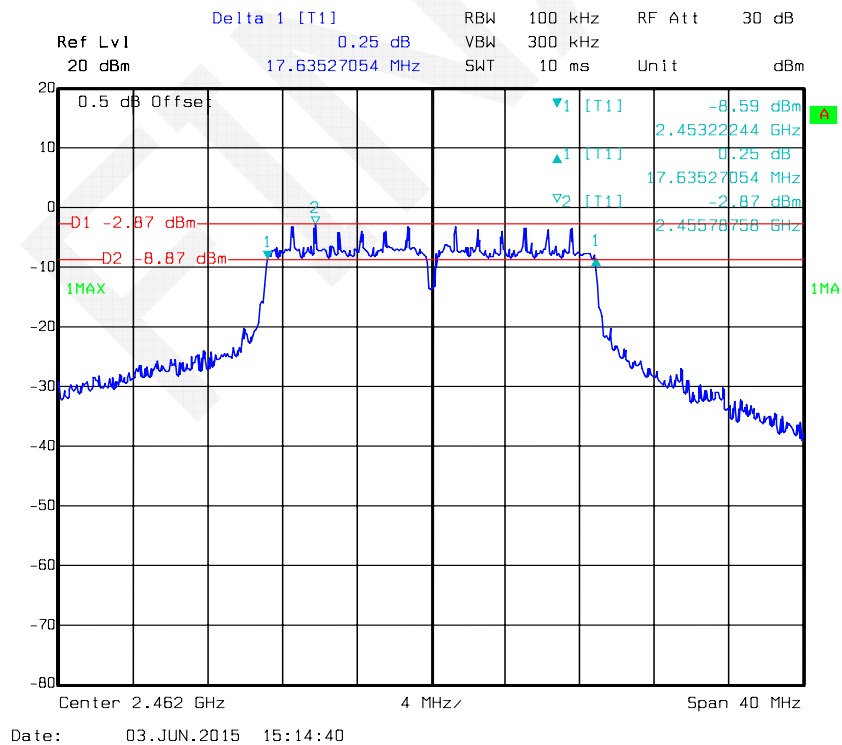
### 802.11n ht20 Low Channel



### 802.11n ht20 Middle Channel

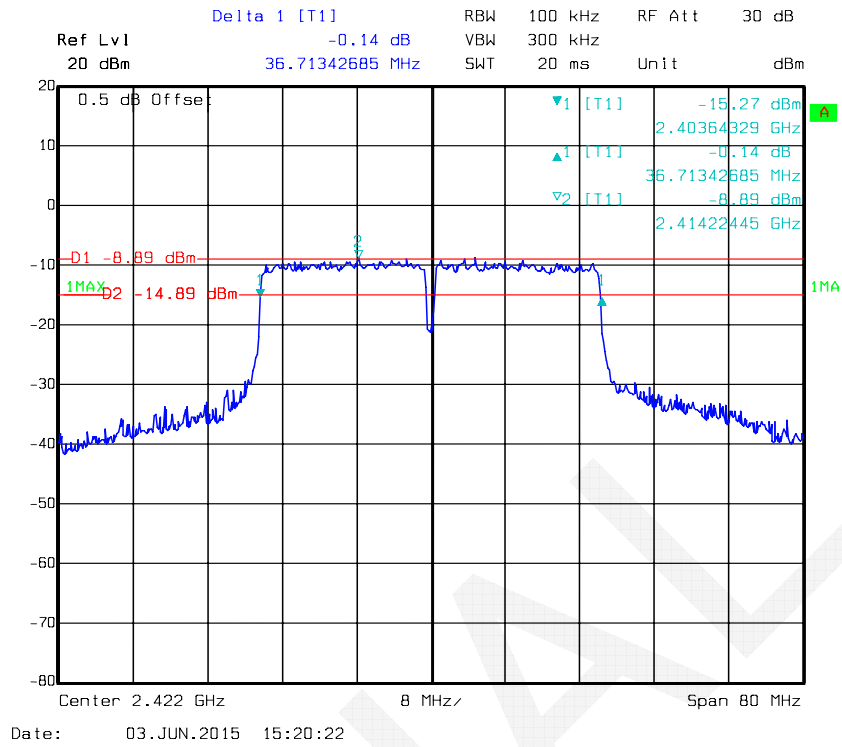


### 802.11n ht20 High Channel

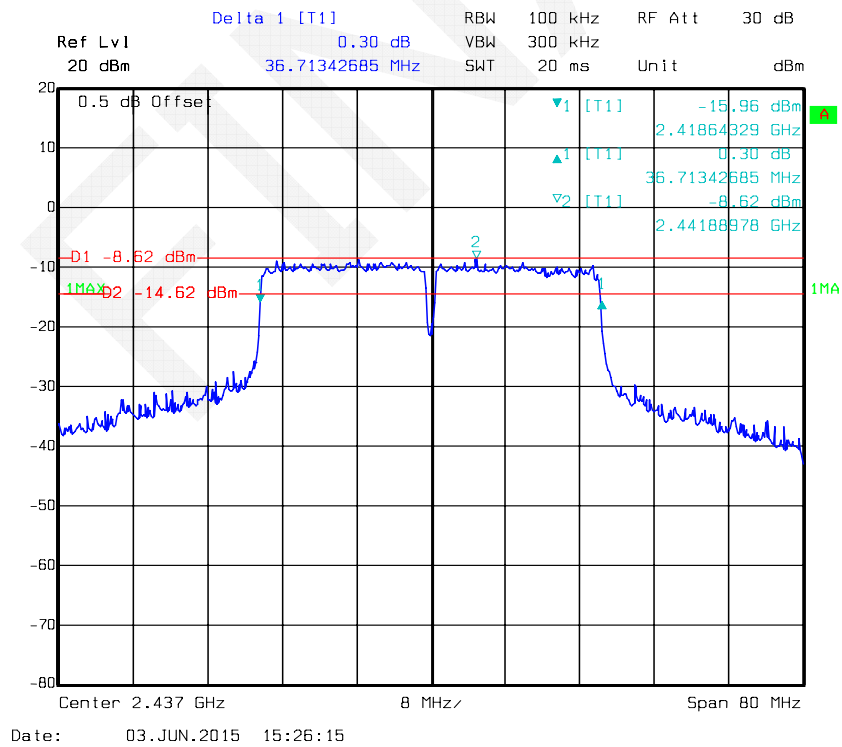




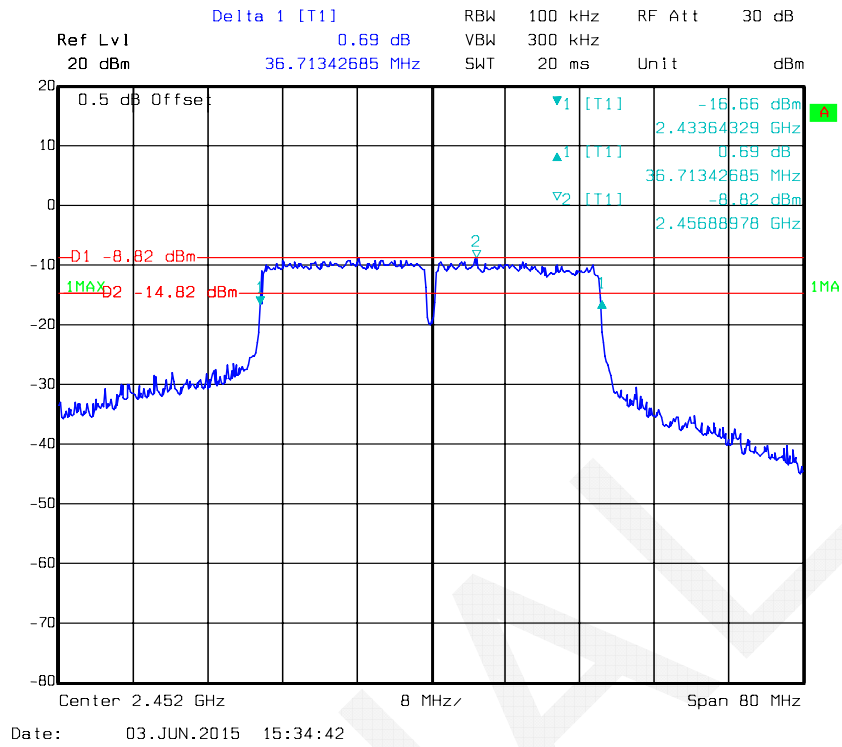
### 802.11n ht40 Low Channel



### 802.11n ht40 Middle Channel



**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

According to KDB 558074 D01 DTS Meas Guidance v03r02

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	MY54210016	2014-11-03	2015-11-03
Agilent	Wideband Power Sensor	N1921A	MY54170013	2014-11-03	2015-11-03
Agilent	P-Series Power Meter	N1912A	MY5000448	2014-11-03	2015-11-03

\* **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:	25.4 °C
Relative Humidity:	51 %
ATM Pressure:	100.1 kPa

*The testing was performed by Allen Qiao on 2015-06-03.*

*Test Mode: Transmitting*

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

Test mode	Channel	Frequency (MHz)	Max. Conducted Peak Output Power (dBm)				Result
			Antenna A	Antenna B	Total	Limit	
802.11b	Low	2412	12.10	12.76	15.45	30	PASS
	Middle	2437	12.38	12.48	15.44	30	PASS
	High	2462	12.22	12.40	15.32	30	PASS
802.11g	Low	2412	13.99	13.99	17.00	30	PASS
	Middle	2437	14.10	14.21	17.17	30	PASS
	High	2462	14.12	14.11	17.13	30	PASS
802.11n20	Low	2412	14.02	14.23	17.14	30	PASS
	Middle	2437	14.18	14.42	17.31	30	PASS
	High	2462	14.17	14.51	17.35	30	PASS
802.11n40	Low	2422	15.84	15.89	18.88	30	PASS
	Middle	2437	15.30	16.01	18.68	30	PASS
	High	2452	15.97	15.78	18.89	30	PASS

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

### **Applicable Standard**

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

### **Test Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

### **Test Equipment List and Details**

<b>Manufacturer</b>	<b>Description</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration Date</b>	<b>Calibration Due Date</b>
R&S	Spectrum Analyzer	FSEM	DE31388	2015-05-09	2016-05-09

\* **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**

<b>Temperature:</b>	25.4°C
<b>Relative Humidity:</b>	51 %
<b>ATM Pressure:</b>	100.1 kPa

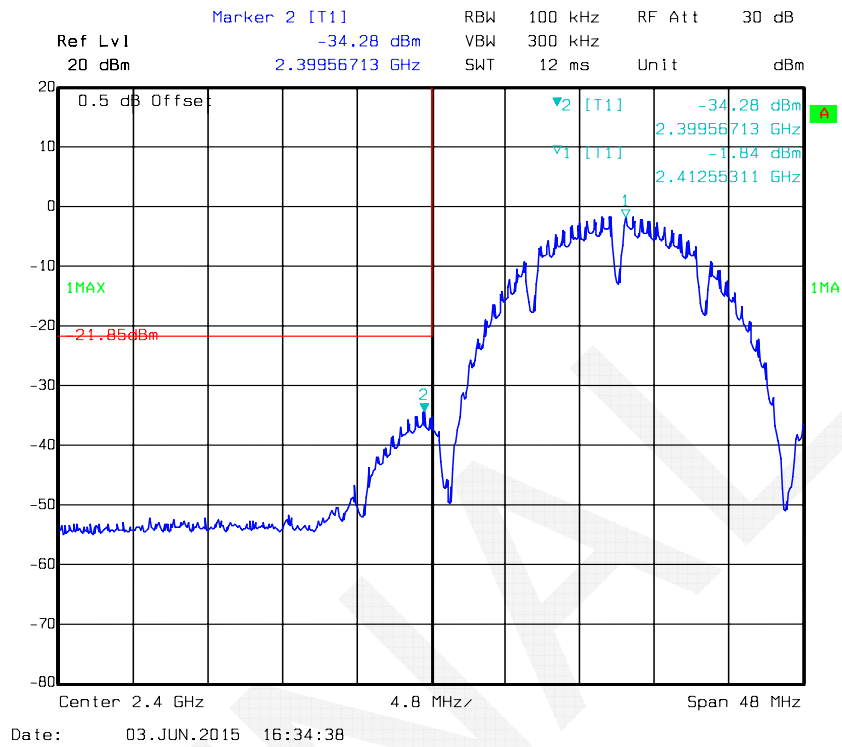
\* The testing was performed by Allen Qiao on 2015-06-03.

*Test mode: Transmitting*

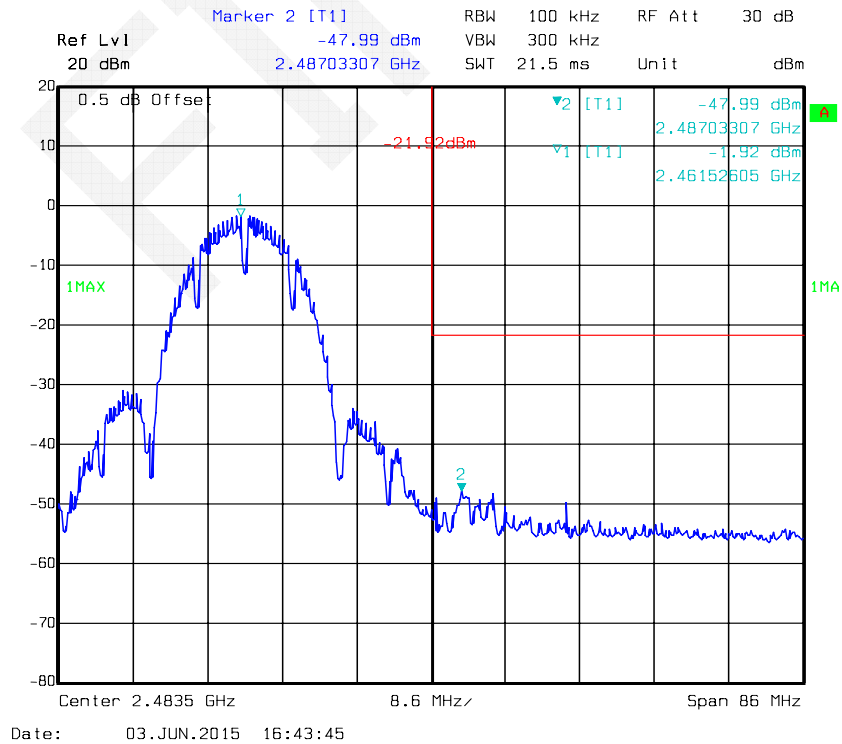
Test Result: Compliant. Please refer to following plots.

Antenna A:

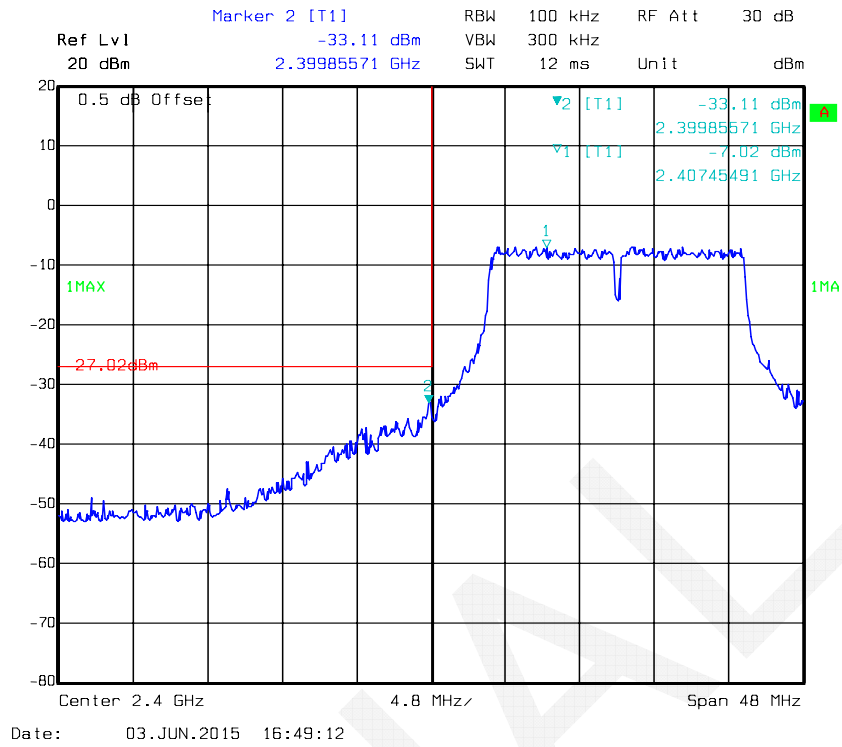
802.11b: Band Edge, Left Side



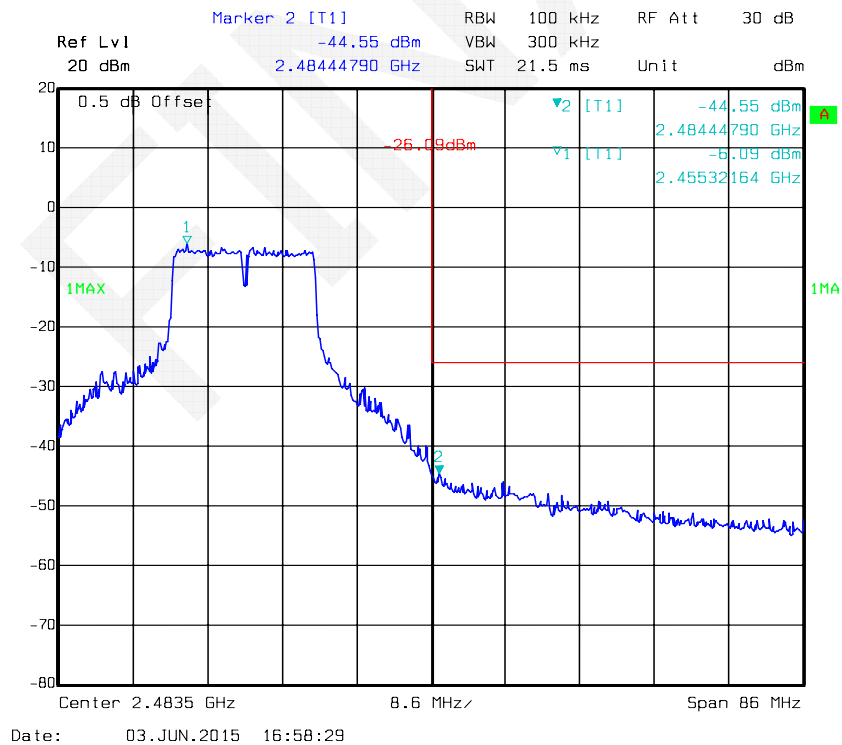
802.11b: Band Edge, Right Side



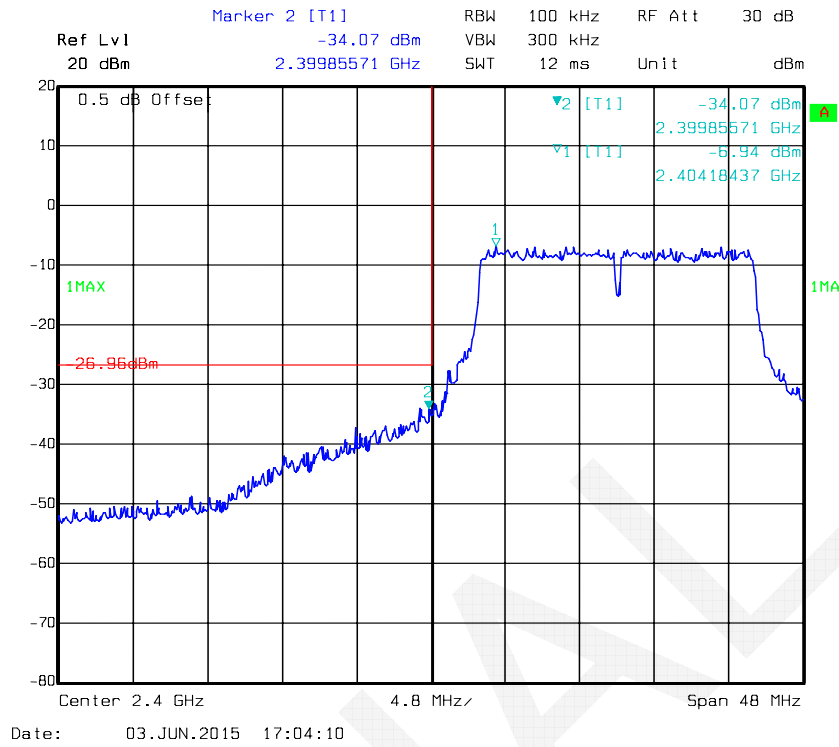
### 802.11g: Band Edge, Left Side



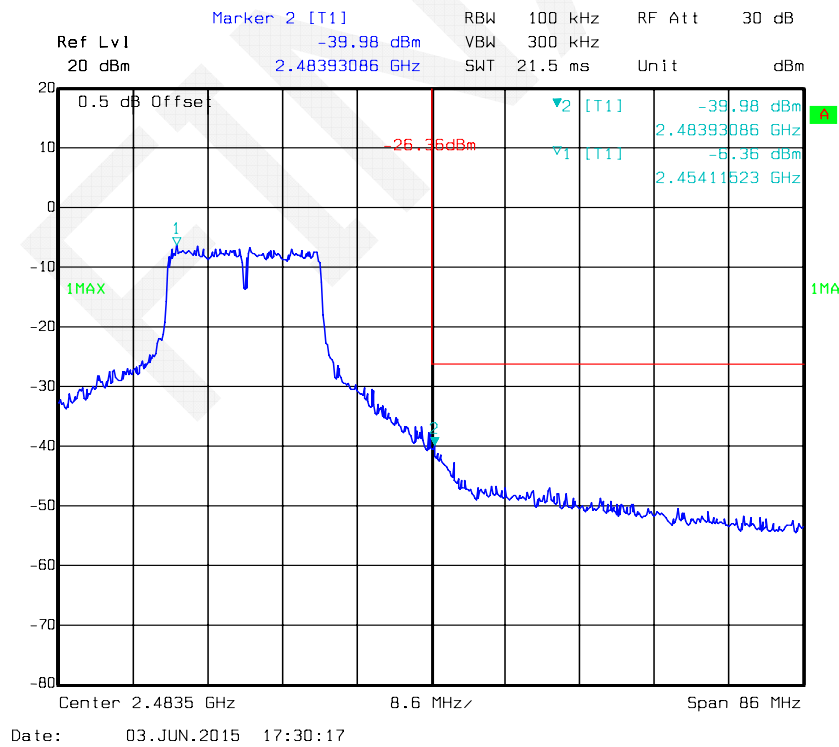
### 802.11g: Band Edge, Right Side



### 802.11n ht20 Band Edge, Left Side

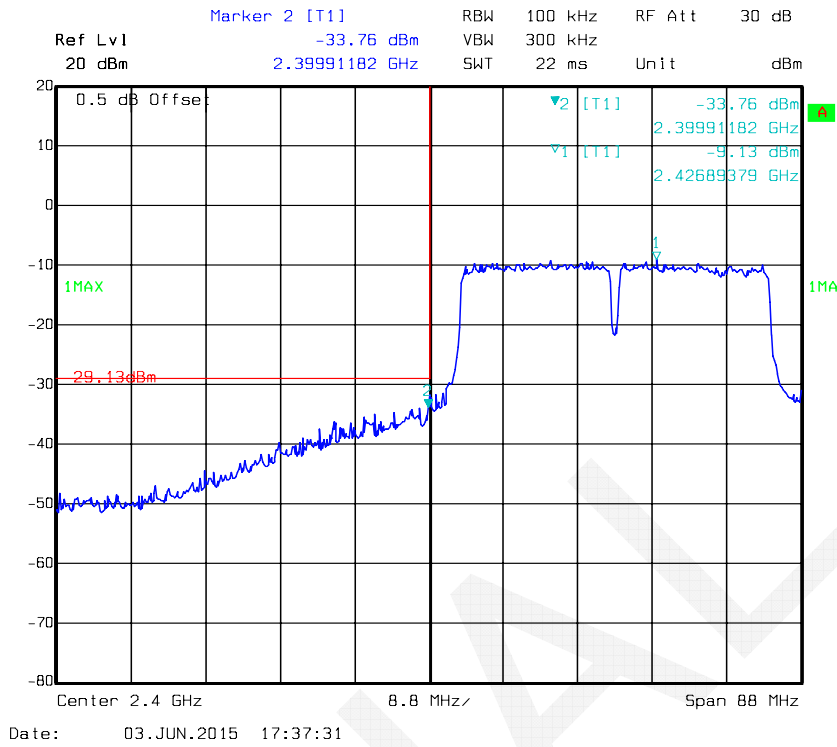


### 802.11n ht20 Band Edge, Right Side

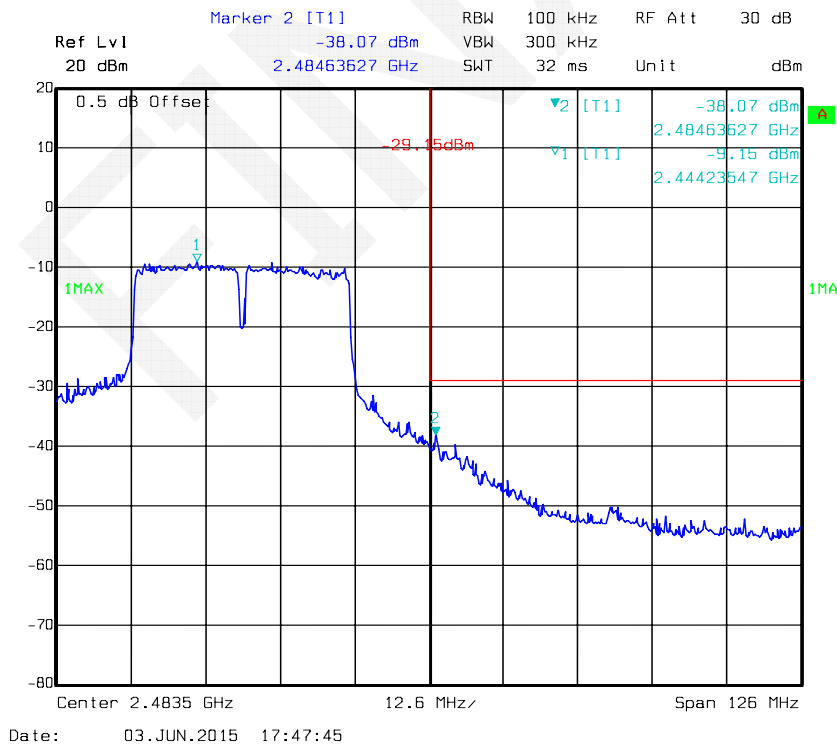




### 802.11n ht40 Band Edge, Left Side

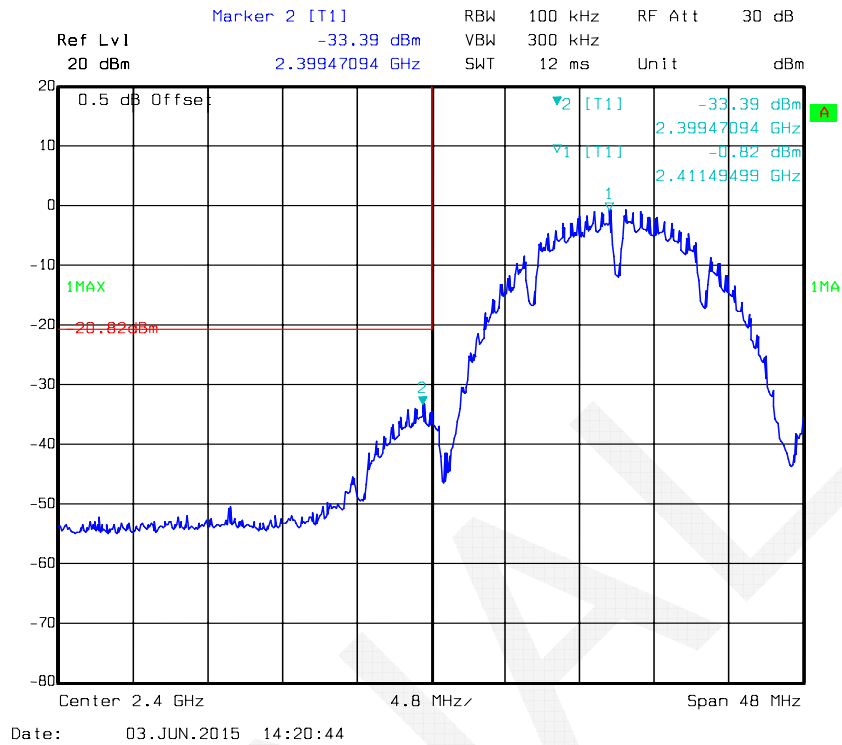


### 802.11n ht40 Band Edge, Right Side

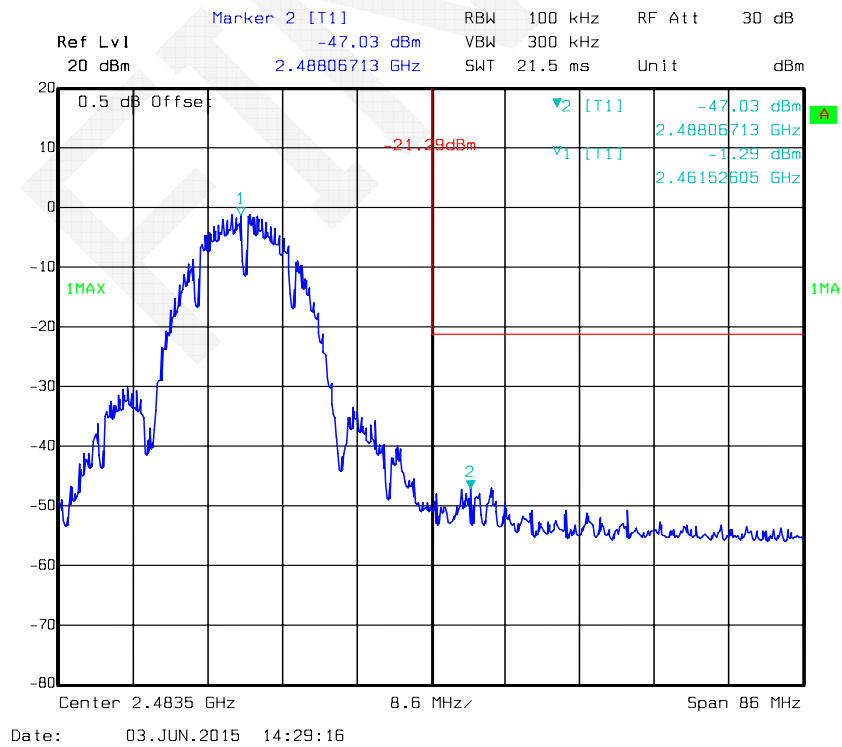


**Antenna B:**

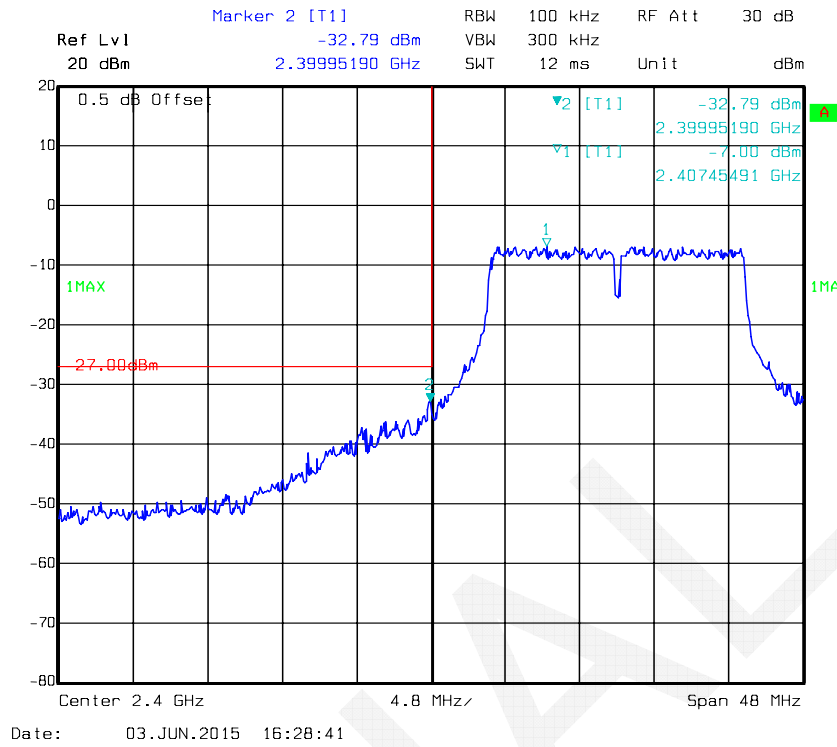
**802.11b: Band Edge, Left Side**



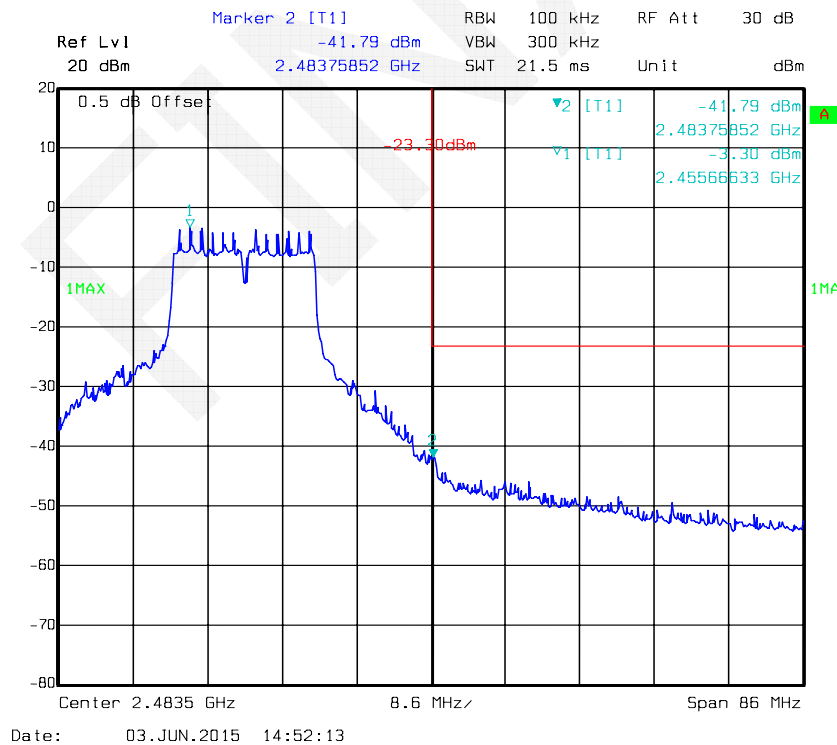
**802.11b: Band Edge, Right Side**



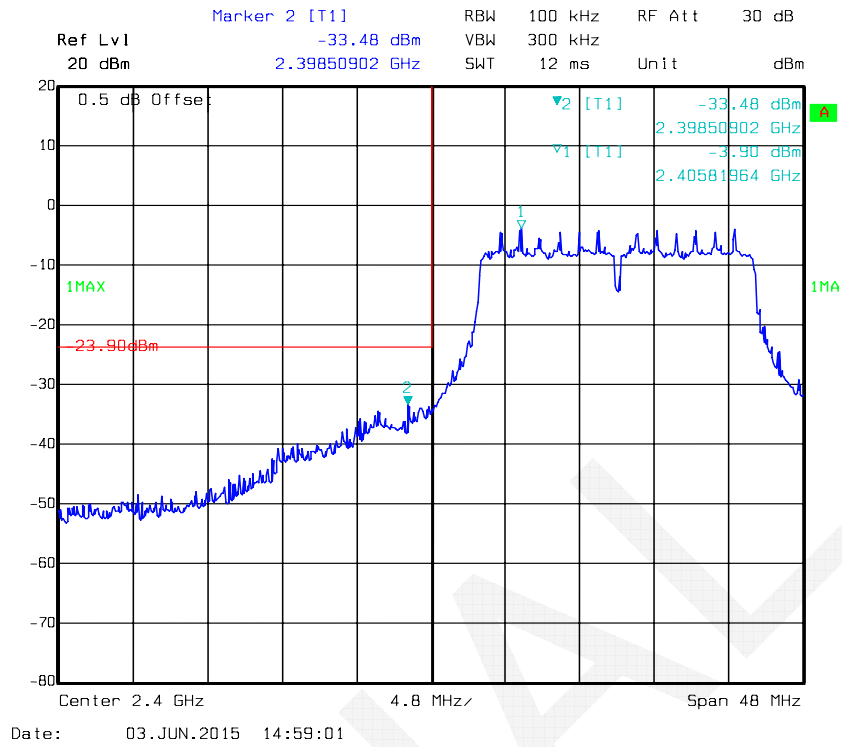
**802.11g: Band Edge, Left Side**



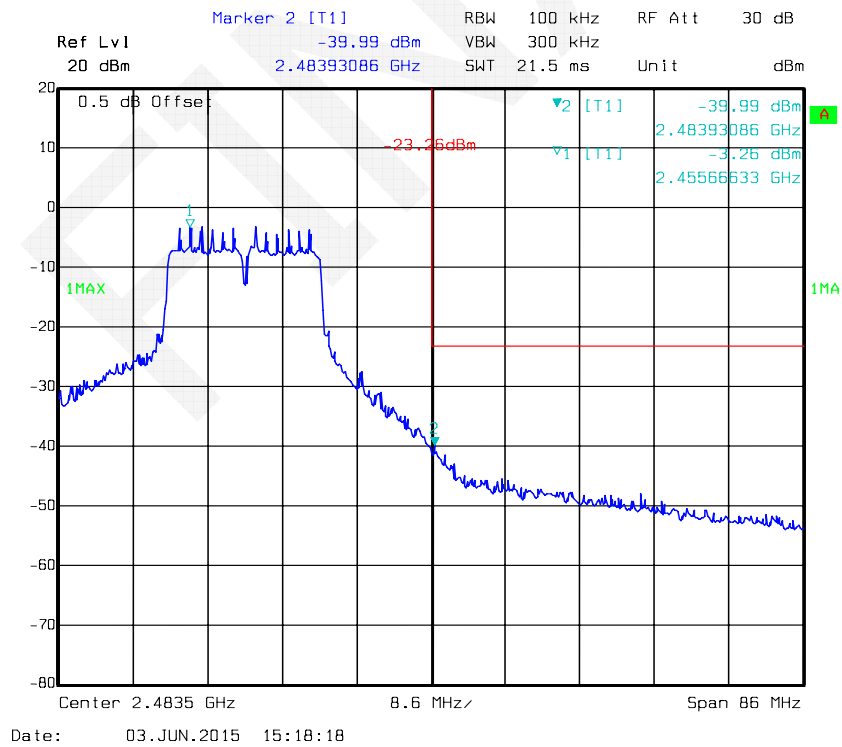
**802.11g: Band Edge, Right Side**



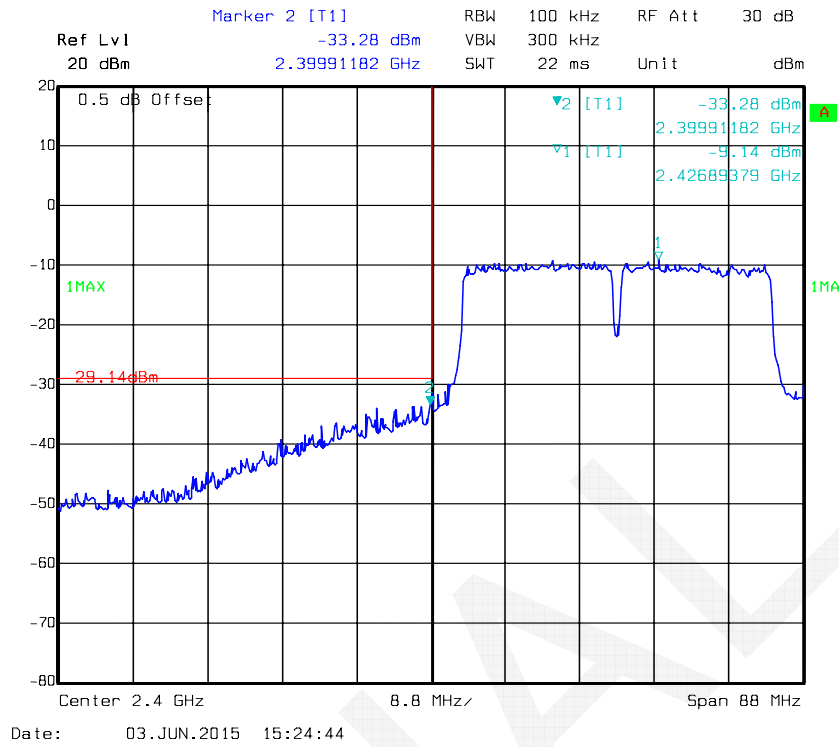
### 802.11n ht20 Band Edge, Left Side



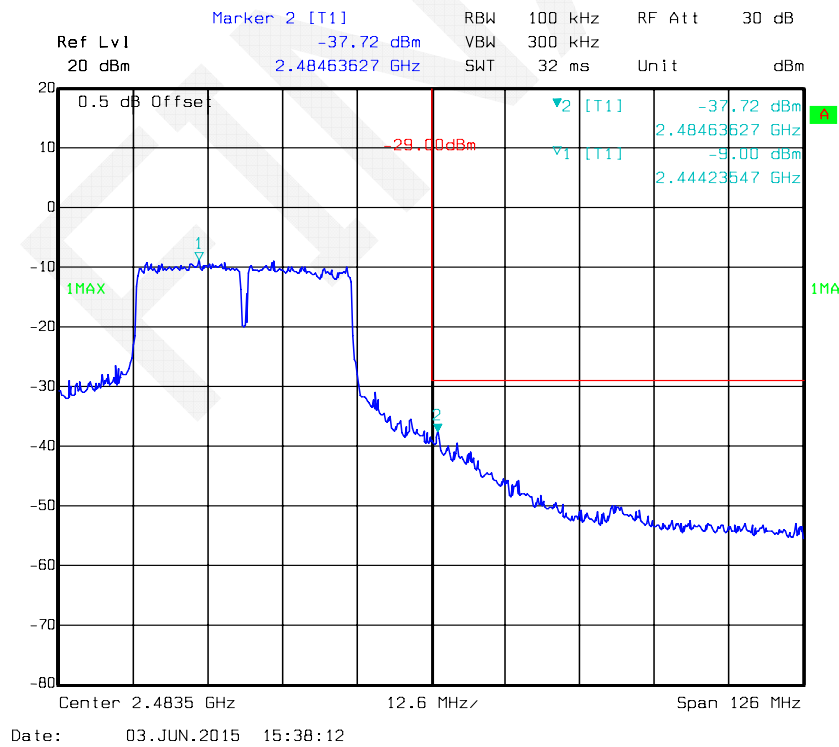
### 802.11n ht20 Band Edge, Right Side



**802.11n ht40 Band Edge, Left Side**



**802.11n ht40 Band Edge, Right Side**



## FCC §15.247(e) - POWER SPECTRAL DENSITY

### Applicable Standard

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

### Test Procedure

According to KDB 558074 D01 DTS Meas Guidance v03r02 clause10.2:

- 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:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- d) Set the VBW  $\geq 3 \times \text{RBW}$ .
- 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	FSEM	DE31388	2015-05-09	2016-05-09

\* **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:	25.3 °C
Relative Humidity:	56 %
ATM Pressure:	100.4kPa

\* The testing was performed by Allen Qiao from 2015-06-03 to 2015-06-12.

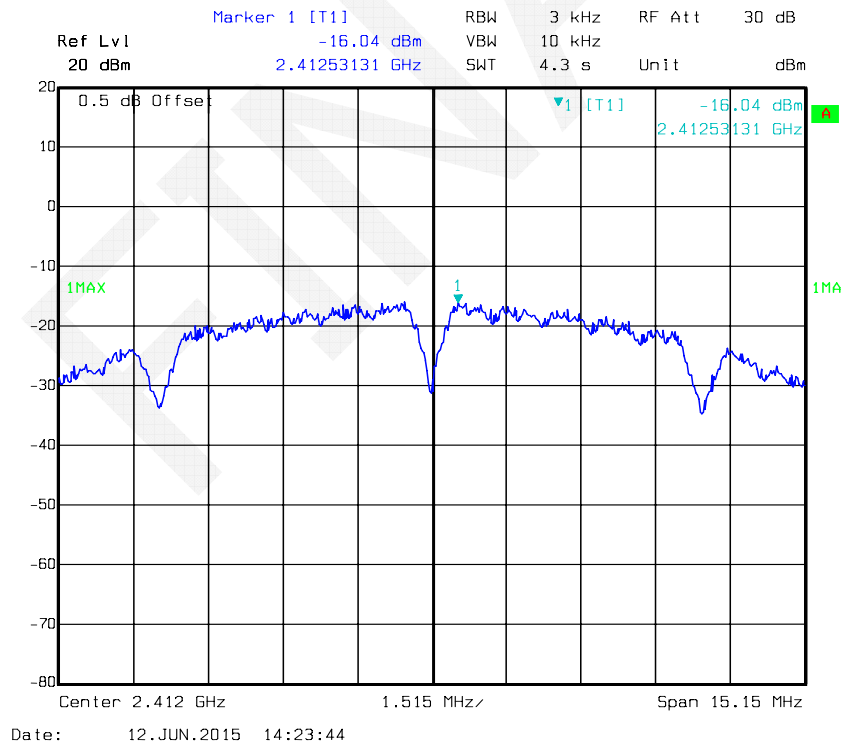
Test Mode: Transmitting

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

Test mode	Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)			
			Antenna A	Antenna B	Total	Limits
802.11b	Low	2412	-16.04	-16.45	-13.23	≤8
	Middle	2437	-16.17	-16.58	-13.36	≤8
	High	2462	-16.08	-15.44	-12.74	≤8
802.11g	Low	2412	-21.61	-21.7	-18.64	≤8
	Middle	2437	-21.56	-21.13	-18.33	≤8
	High	2462	-21.29	-21.61	-18.44	≤8
802.11n20	Low	2412	-20.81	-20.06	-17.41	≤8
	Middle	2437	-20.19	-20.27	-17.22	≤8
	High	2462	-20.19	-20.95	-17.54	≤8
802.11n40	Low	2422	-20.71	-21.18	-17.93	≤8
	Middle	2437	-21.2	-20.69	-17.93	≤8
	High	2452	-21.03	-20.47	-17.73	≤8

Antenna A:

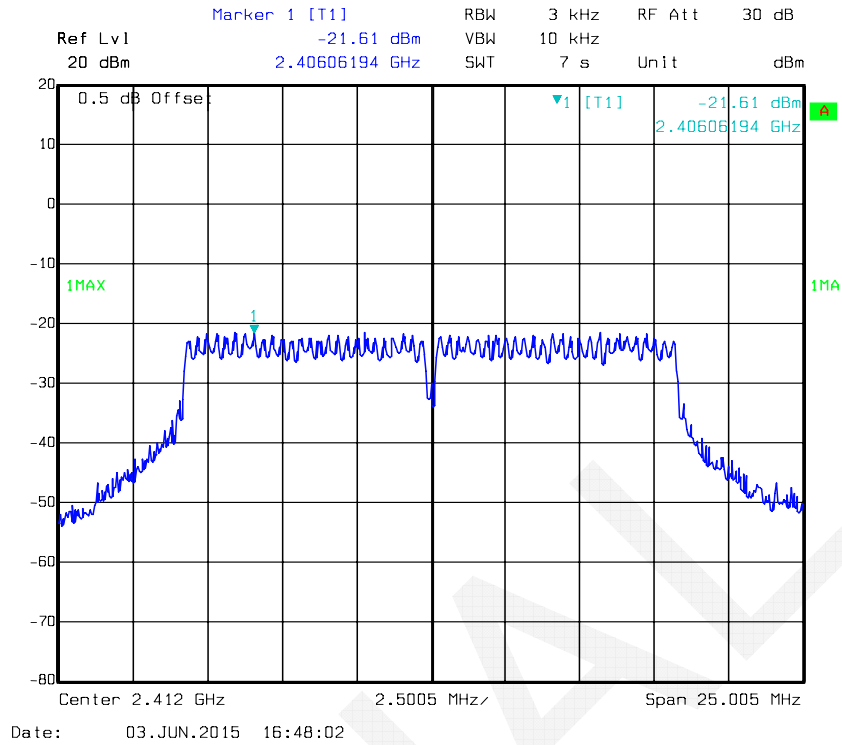
Power Spectral Density, 802.11b Low Channel



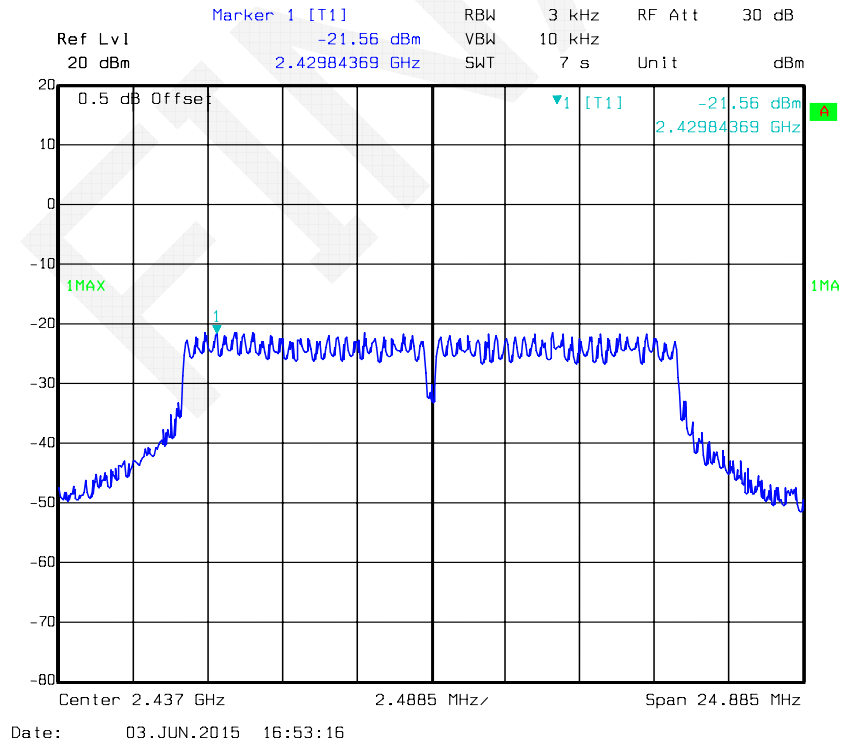




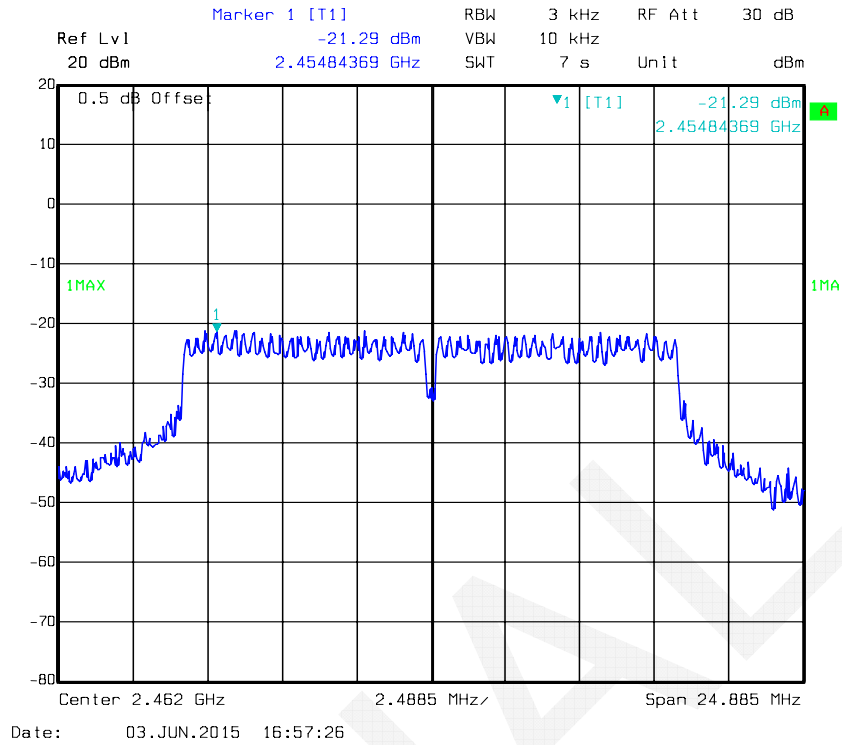
**Power Spectral Density, 802.11g Low Channel**



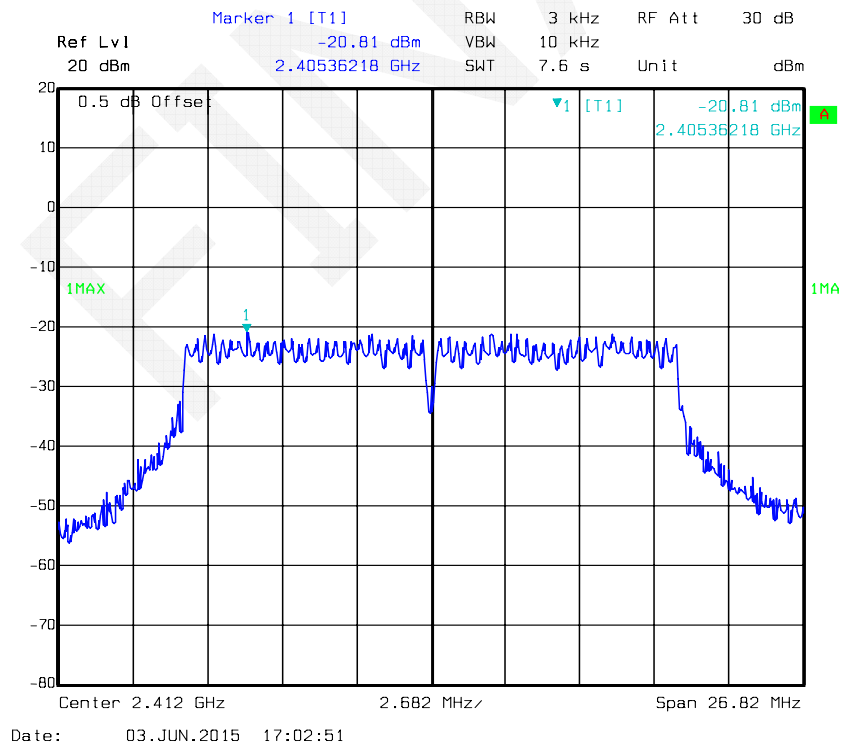
**Power Spectral Density, 802.11g Middle Channel**



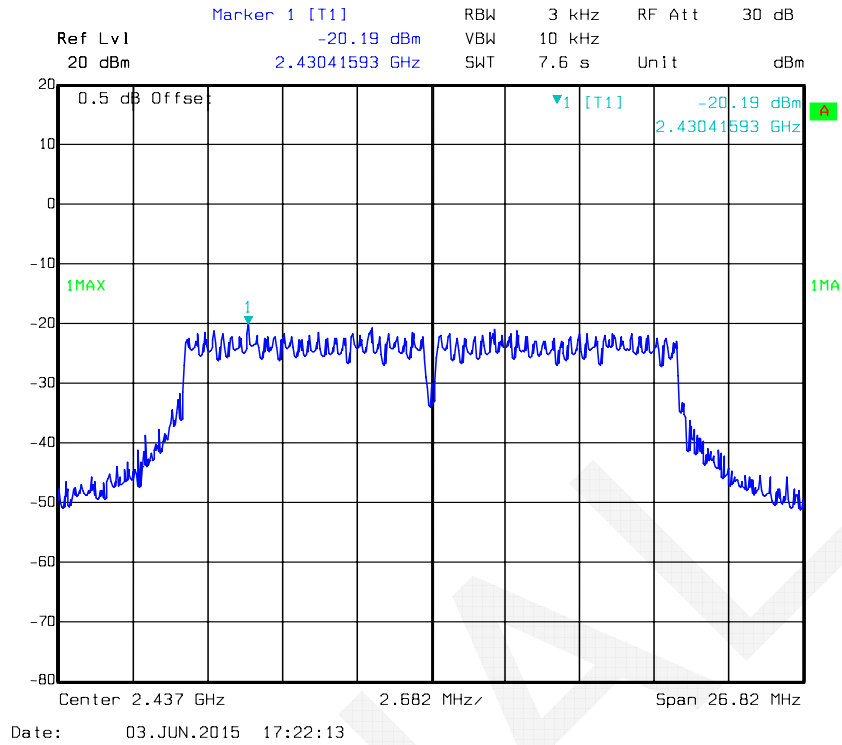
**Power Spectral Density, 802.11g High Channel**



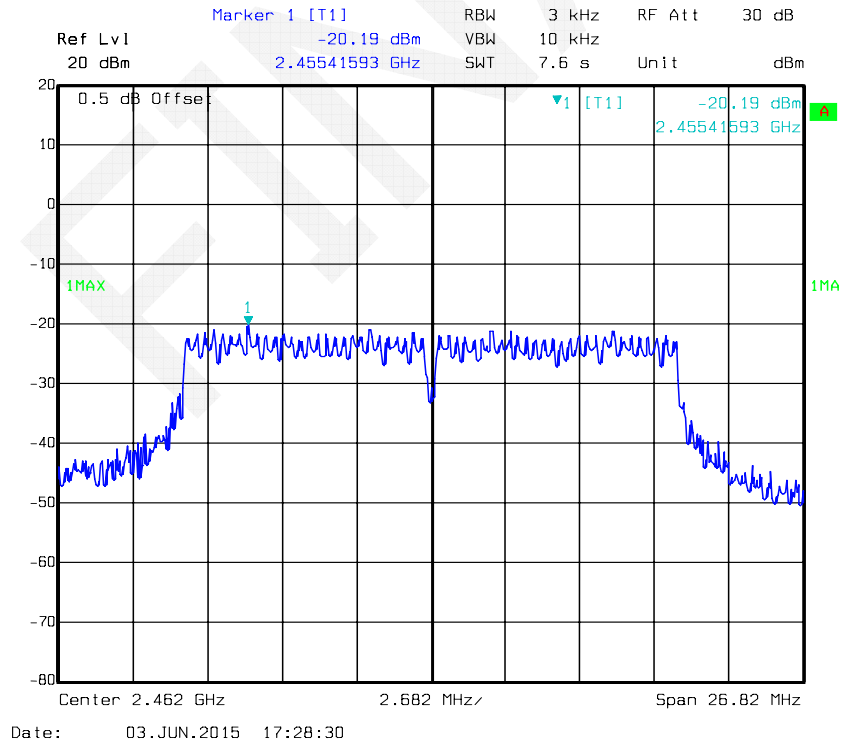
**Power Spectral Density, 802.11n ht20 Low Channel**



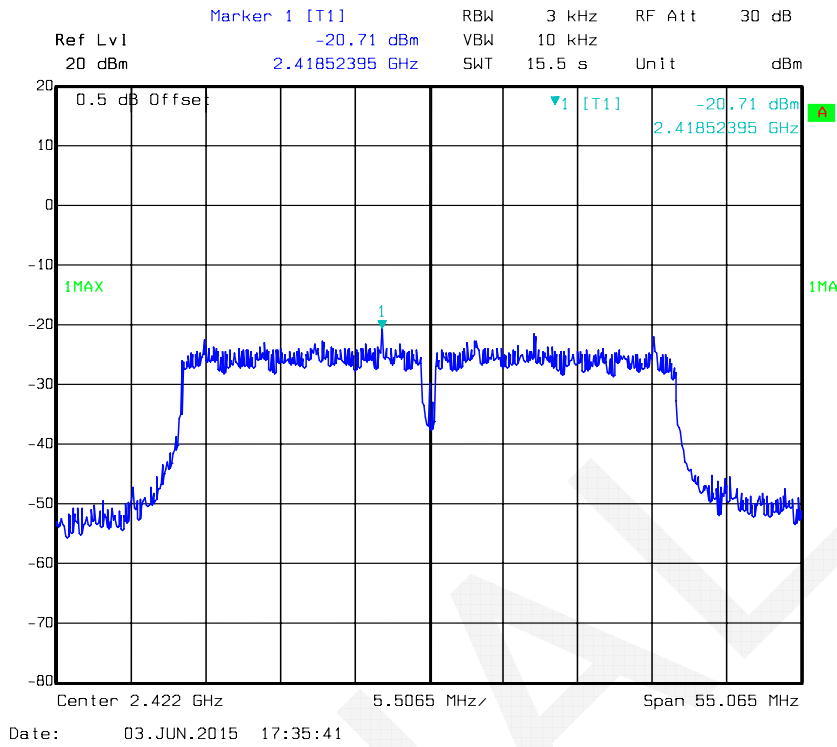
**Power Spectral Density, 802.11n ht20 Middle Channel**



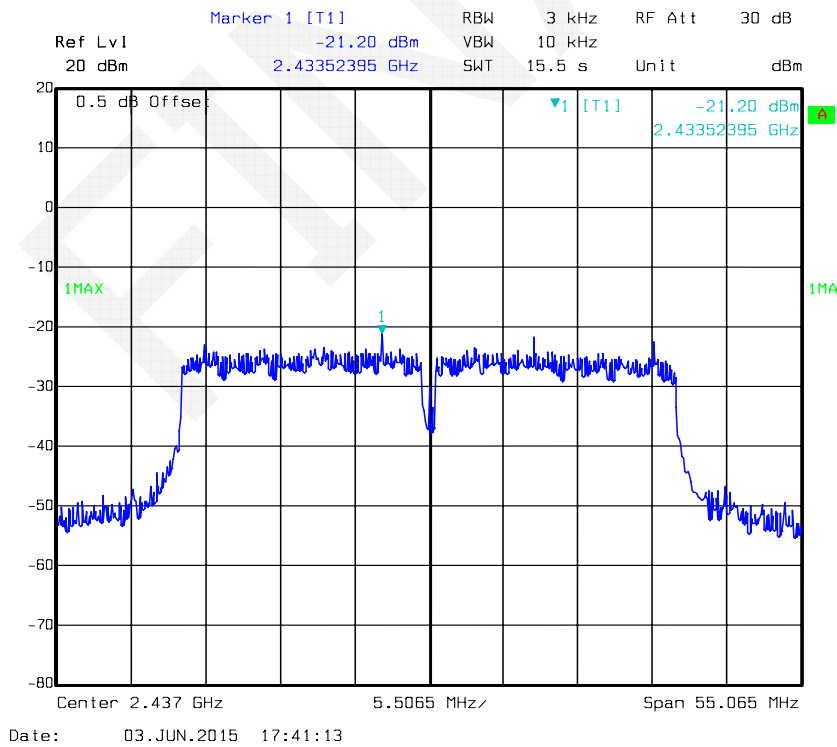
**Power Spectral Density, 802.11n ht20 High Channel**



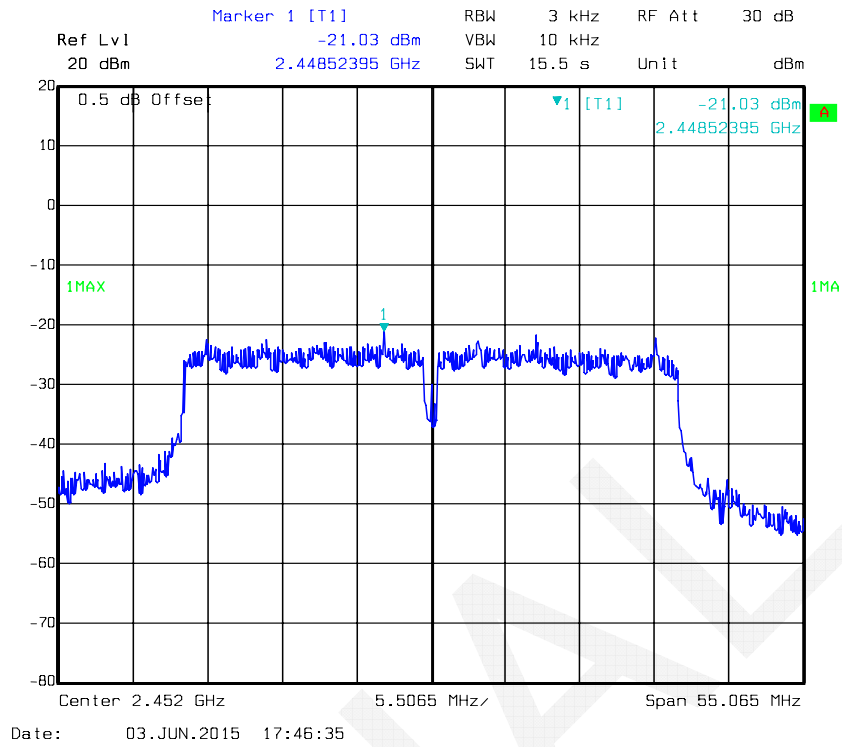
### Power Spectral Density, 802.11n ht40 Low Channel



### Power Spectral Density, 802.11n ht40 Middle Channel

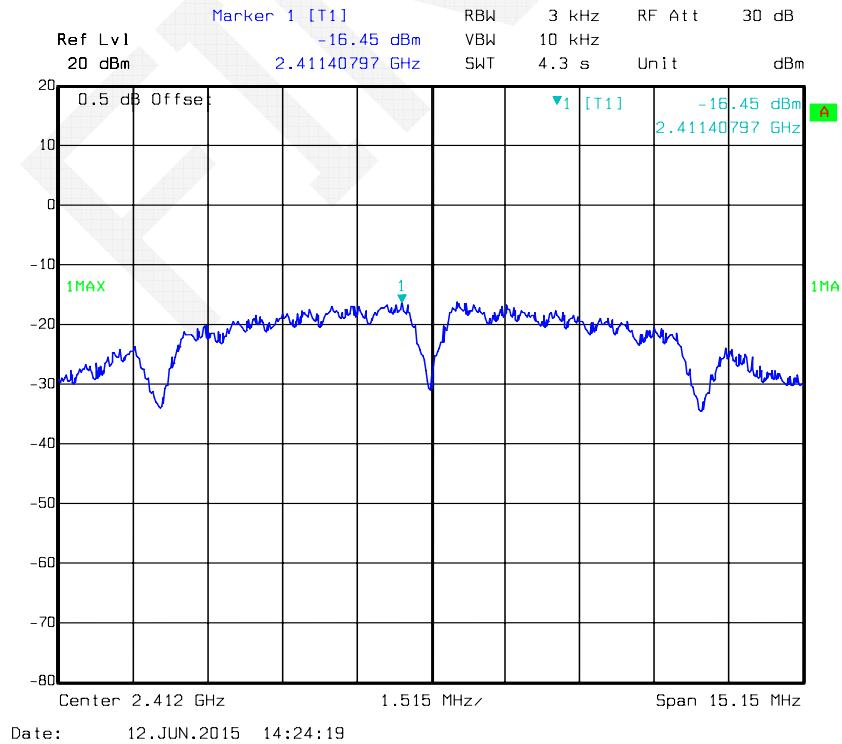


**Power Spectral Density, 802.11n ht40 High Channel**



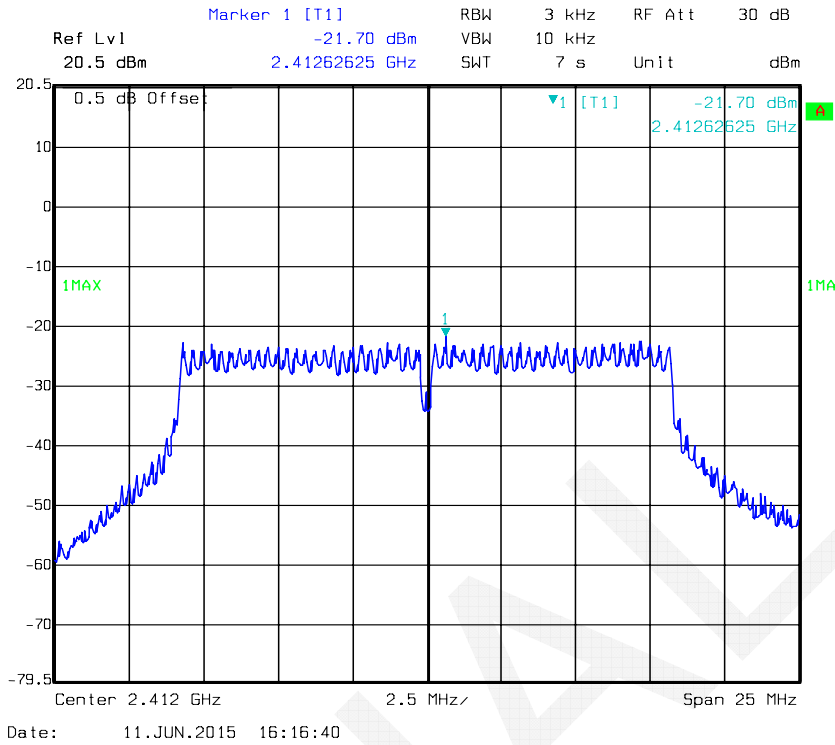
**Antenna B:**

**Power Spectral Density, 802.11b Low Channel**

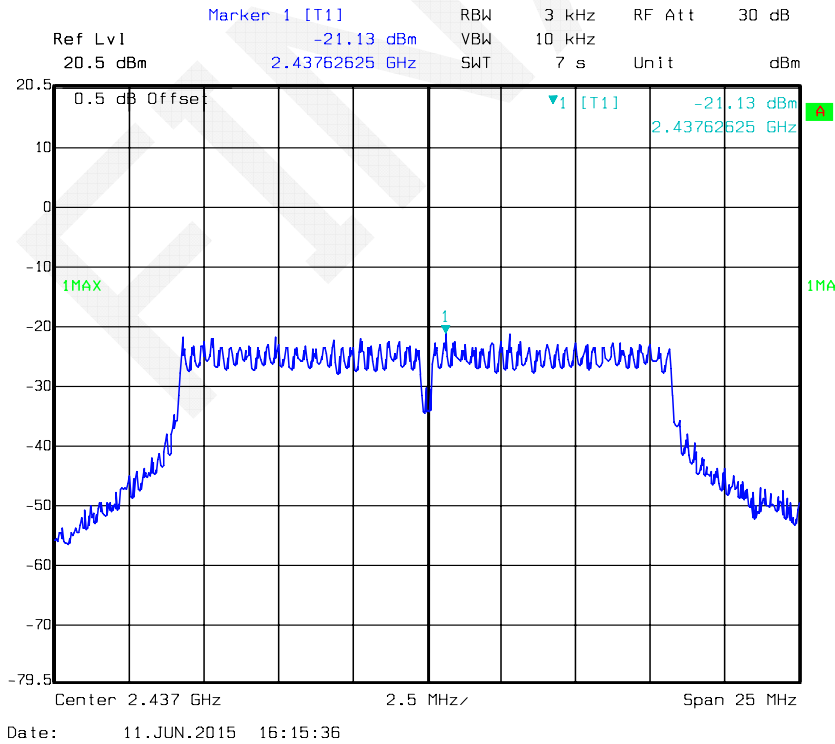




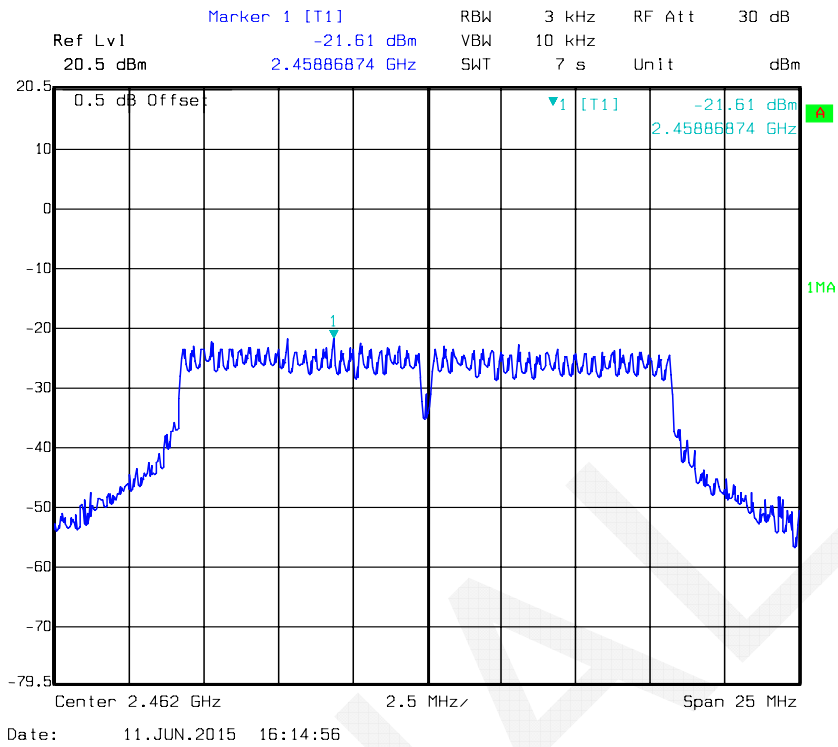
**Power Spectral Density, 802.11g Low Channel**



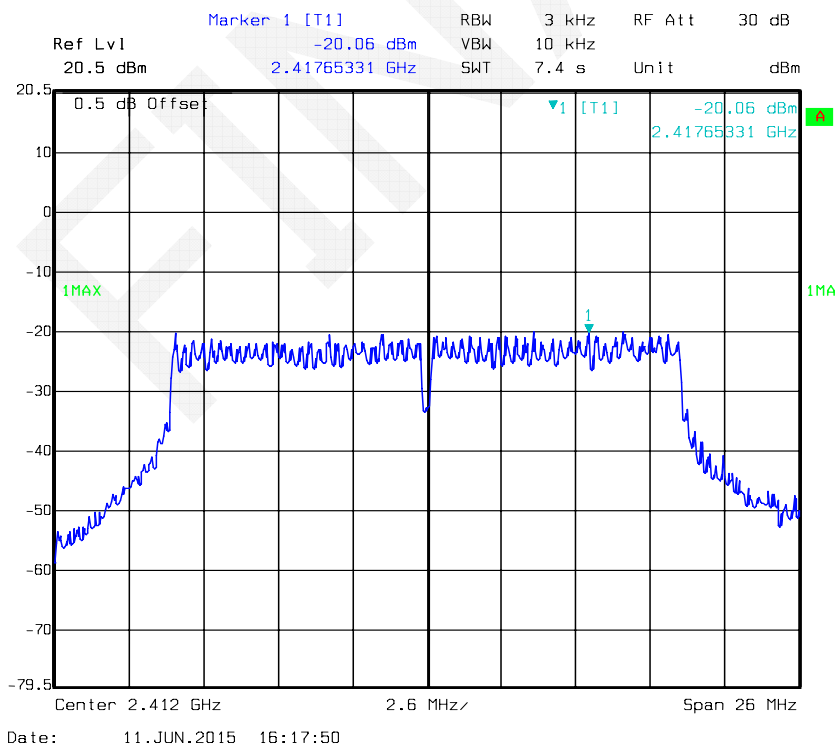
**Power Spectral Density, 802.11g Middle Channel**



### Power Spectral Density, 802.11g High Channel

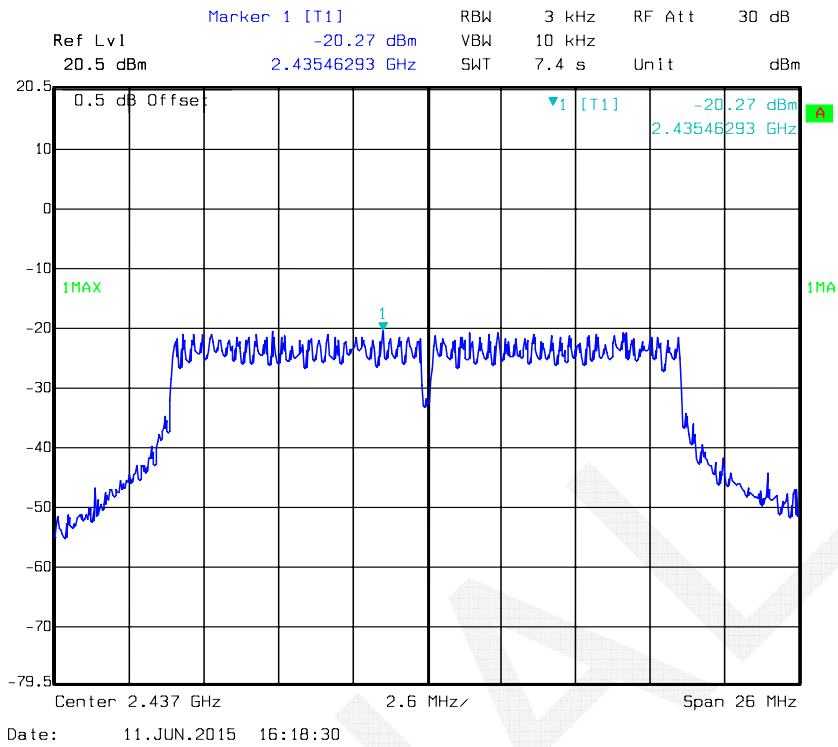


### Power Spectral Density, 802.11n ht20 Low Channel

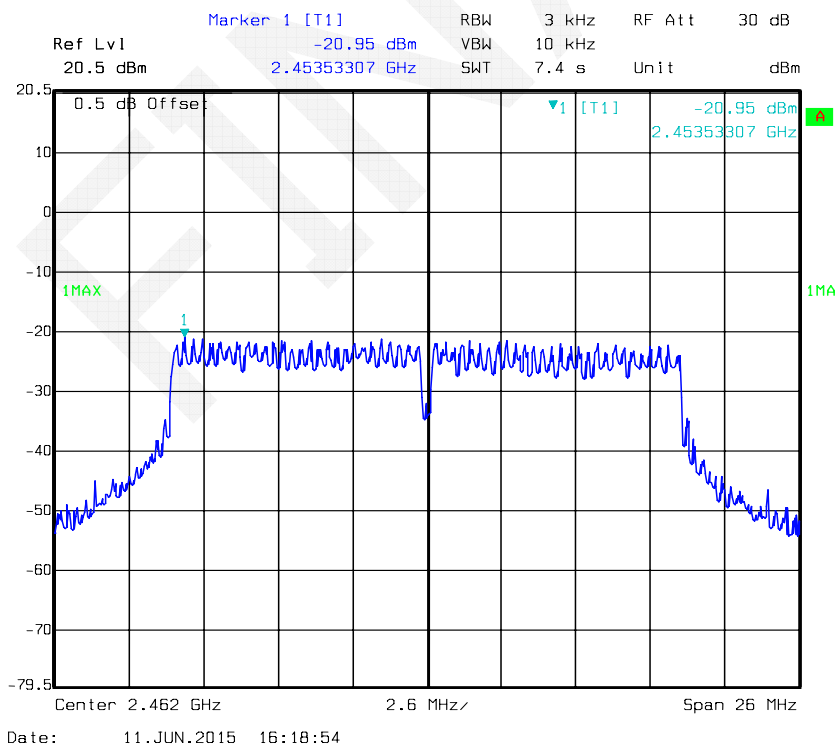




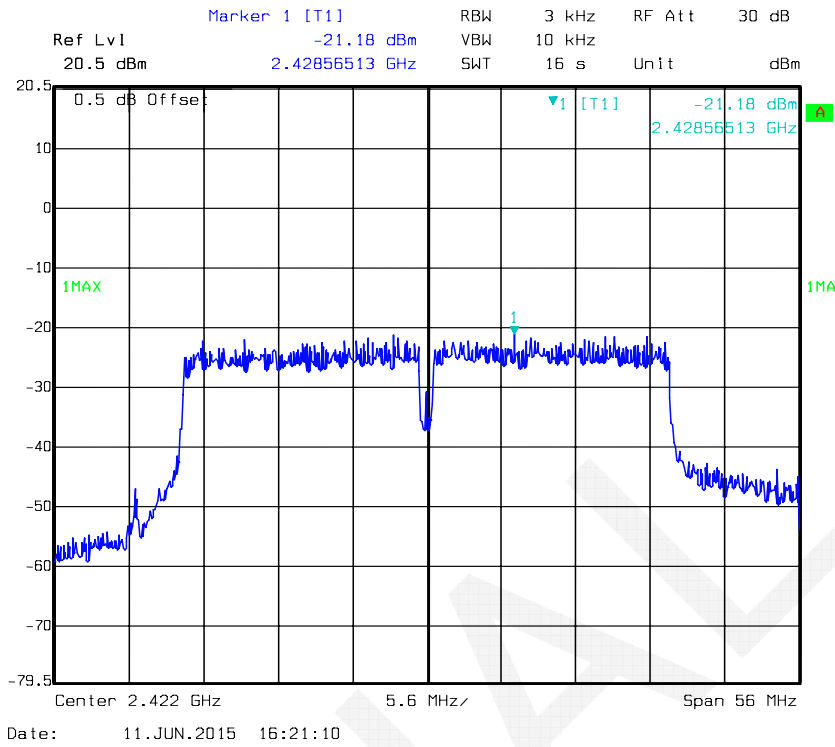
### Power Spectral Density, 802.11n ht20 Middle Channel



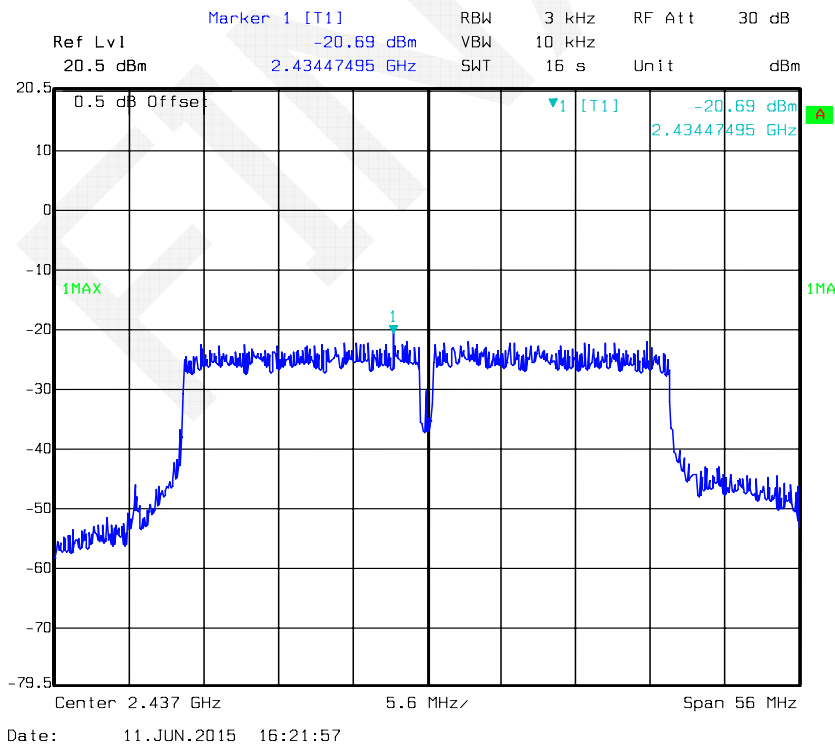
### Power Spectral Density, 802.11n ht20 High Channel



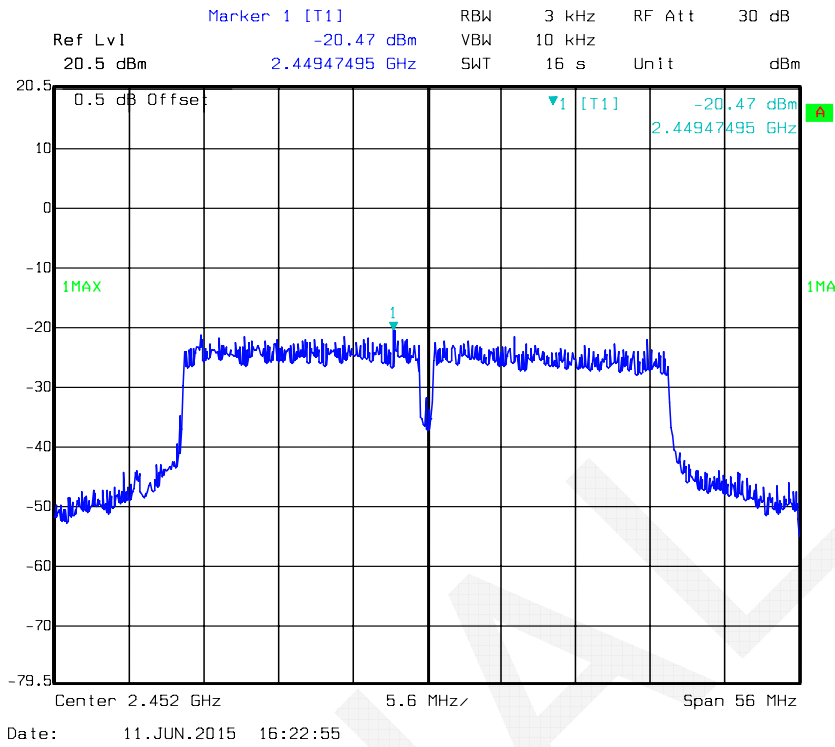
### Power Spectral Density, 802.11n ht40 Low Channel



### Power Spectral Density, 802.11n ht40 Middle Channel



### Power Spectral Density, 802.11n ht40 High Channel



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