FCC PART 15.247

TEST REPORT

For

Shenzhen Rapoo Technology Co., Ltd.

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

FCC ID: PP2UI2600

Report Type:	**Product Type:**
Original Report	Range Extender

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TABLE OF CONTENTS

GENERAL INFORMATION **4**
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) 4
OBJECTIVE 4
RELATED SUBMITTAL(S)/GRANT(S) 4
TEST METHODOLOGY 4
TEST FACILITY 4
SYSTEM TEST CONFIGURATION **5**
DESCRIPTION OF TEST CONFIGURATION 5
EQUIPMENT MODIFICATIONS 5
EUT EXERCISE SOFTWARE 5
SUPPORT EQUIPMENT LIST AND DETAILS 6
BLOCK DIAGRAM OF TEST SETUP 6
SUMMARY OF TEST RESULTS **7**
FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE **8**
APPLICABLE STANDARD 8
FCC §15.203 - ANTENNA REQUIREMENT **10**
APPLICABLE STANDARD 10
ANTENNA CONNECTOR CONSTRUCTION 10
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS **11**
APPLICABLE STANDARD 11
MEASUREMENT UNCERTAINTY 11
EUT SETUP 11
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP 12
TEST PROCEDURE 12
CORRECTED AMPLITUDE & MARGIN CALCULATION 13
TEST EQUIPMENT LIST AND DETAILS 13
TEST RESULTS SUMMARY 13
TEST DATA 13
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH **22**
APPLICABLE STANDARD 22
TEST PROCEDURE 22
TEST EQUIPMENT LIST AND DETAILS 22
TEST DATA 22
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER **30**
APPLICABLE STANDARD 30
TEST PROCEDURE 30
TEST EQUIPMENT LIST AND DETAILS 30
TEST DATA 30
FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE **32**
APPLICABLE STANDARD 32
TEST PROCEDURE 32
TEST EQUIPMENT LIST AND DETAILS 32
TEST DATA 32

FINAL

FCC §15.247(e) - POWER SPECTRAL DENSITY 37
APPLICABLE STANDARD 37
TEST PROCEDURE 37
TEST EQUIPMENT LIST AND DETAILS.....37
TEST DATA 37

FINAL

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Shenzhen Rapoo Technology Co., Ltd.*'s product, model number: *UI2600(FCC ID: PP2UI2600)* (or the "EUT") in this report was a *Range Extender,* which was measured approximately: 8.3 cm (L) x 7.5 cm (W) x 3.3 cm (H), rated input voltage: DC 4.2 V from Remote Control sytem.

** All measurement and test data in this report was gathered from production sample serial number: 150331009 (Assigned by applicant). The EUT was received on 2015-04-03.*

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.

Related Submittal(s)/Grant(s)

N/A

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.

FINAL

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in testing mode, which was provided by manufacturer. For the test mode, the device test with remote controller.

For 802.11b and 802.11g modes, the device supports MIMO function, and 11 channels employed by the system:

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 modes were tested with Channel 1, 6 and 11.

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

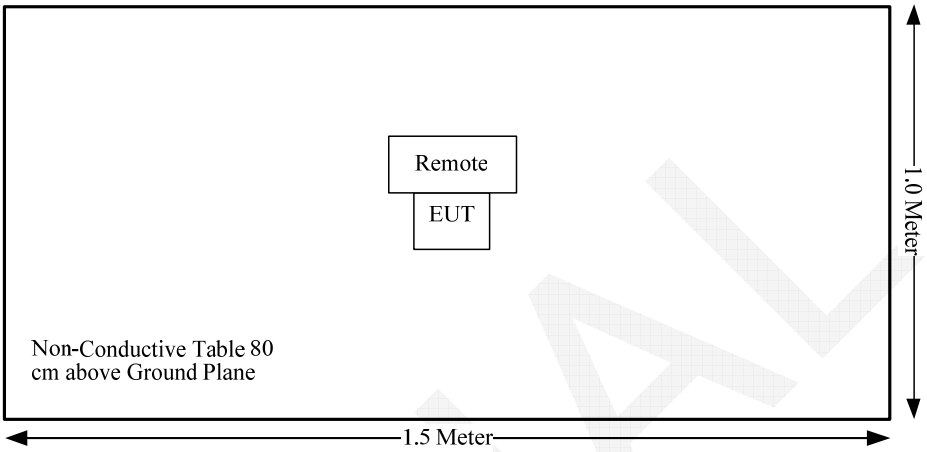
The worst condition (maximum power with 100% duty cycle) was setting by the software as following table:

Software and version			SmartTools 20110519		
Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Power Level	
				Chain 0	Chain 1
802.11 b	Low	2412	1	27	27
	Middle	2437	1	27	27
	High	2462	1	27	27
802.11 g	Low	2412	6	33	33
	Middle	2437	6	33	33
	High	2462	6	33	33

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
Rapoo	Remote Controller	UR5800	150331005	PP2UR5800

Block Diagram of Test Setup



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SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247 (i) & §1.1310 & §2.1093	RF 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 remoter system in the operation mode.

FINAL

FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE

Applicable Standard

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

According to KDB447498 D01 General RF Exposure Guidance v05r02§4.3.1:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:

[(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] · [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR,[25] where

- $f_{(GHz)}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation[26]
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum *test separation distance* is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum *test separation distance* is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

According to KDB447498 D01 General RF Exposure Guidance v05r02§4.3.2:

When the standalone SAR test exclusion of section 4.3.1 is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following to determine simultaneous transmission SAR test exclusion:[30]

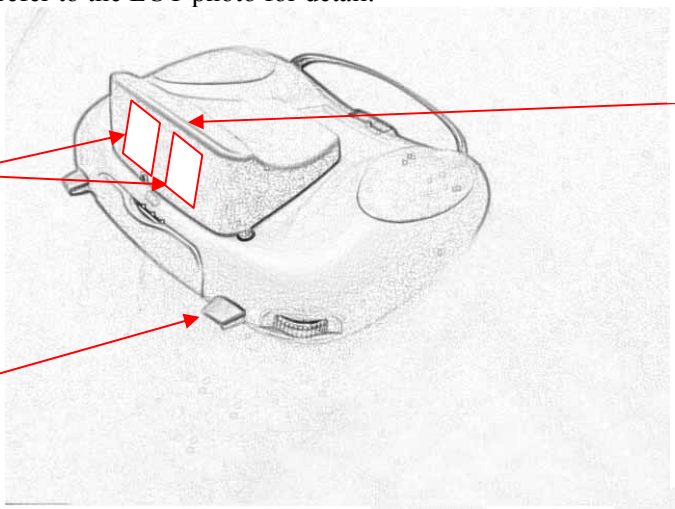
- (*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)]·[$\sqrt{f_{(GHz)}}/x$] W/kg for *test separation distances* ≤ 50 mm;
  where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.
- 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the *test separation distances* is > 50 mm.[31]

This SAR estimation formula has been considered, in conjunction with the *SAR Test Exclusion Thresholds*, to result in substantially conservative SAR values of ≤ 0.4 W/kg. When SAR is estimated, the peak SAR location is assumed to be at the feed-point or geometric center of the antenna, whichever provides a smaller antenna separation distance, and must be clearly identified in test reports. The estimated SAR is only used to determine simultaneous transmission SAR test exclusion; it should not be reported as the standalone SAR. When SAR is estimated, it must be applied to determine the sum of 1-g SAR test exclusion. When SAR to peak location separation ratio test exclusion is applied, the highest reported SAR for simultaneous transmission can be an estimated standalone SAR if the estimated SAR is the highest among the simultaneously transmitting antennas (see KDB 690783). For conditions where the estimated SAR is overly conservative for certain conditions, the test lab may choose to perform standalone SAR measurements and use the measured SAR to determine simultaneous transmission SAR test exclusion. The estimated SAR values at selected frequencies, distances and power levels are illustrated in Appendix D.

Measurement Results

The maximum conducted output power including tune-up tolerance is 13dBm (20 mW) per chain. For both antenna, the minimum distance between the antenna and the EUT position that human is able to touch is less than 5mm, please refer to the EUT photo for detail.

EUT antenna in side the enclosure
The worst distance to hands is less than 5mm for hands in the bottom of EUT



Bottom Side

Remote Antenna@ 5.8G
Worst distance to hands is less than 5mm

For extremity SAR(Hands Use)
[(max. power of channel, mW)/(min. test separation distance, mm)] · [√f(GHz)]< 7.5

[(max. power of channel, mW)/(min. test separation distance, mm)] · [√f(GHz)]= 20/5*(√2.462)=6.28 <7.5

So the SAR evaluation for each chain is not necessary.

For Simultaneous transmission:

Estimated SAR(10-g SAR) per chain:

(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)]·[$\sqrt{f_{(GHz)}}/x$]

= 20/5* (√2.462/18.75)
=0.33 W/kg

The remote controller maximum average field strength is 87.18dBμV/m@ 3m (0.0229V/m@ 3m),

According to KDB412712: **eirp= (E x d)^2/30**
⇨ Remote controller Average output power is (E x d)^2/30 =(0.0229 * 3)^2/30 = 0.157 mW

Estimated SAR(10-g SAR) for the remote controller:

(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)]·[$\sqrt{f_{(GHz)}}/x$]

= 0.157/5* (√5.794/18.75)
=0.004 W/kg

Summation SAR= 0.33*2+ 0.004= 0.664 < 4.0W/kg

So the Simultaneous transmission SAR evaluation is not necessary.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

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

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

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

Antenna Connector Construction

The EUT has two internal antennas arrangement and the antenna gains are 3.4 dBi, which fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

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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.

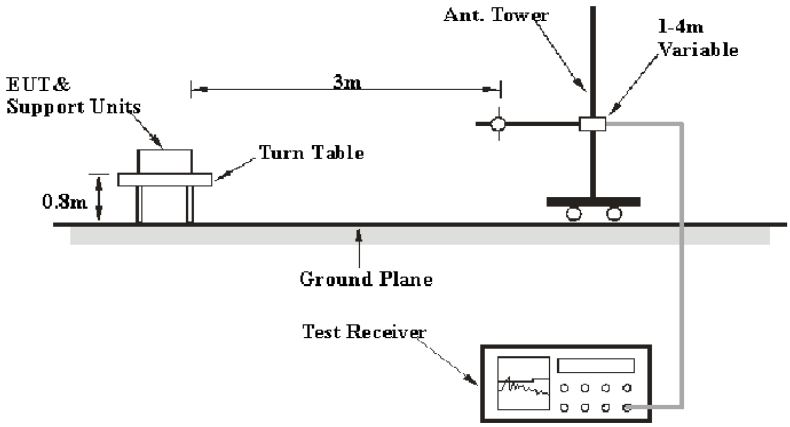
Based on CISPR 16-4-2-2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Dongguan) is:
30M~200MHz: 5.0 dB
200M~1GHz: 6.2 dB
1G~6GHz: 4.45 dB
6G~18GHz: 5.23 dB

Table 2 – Values of U_{cispr}

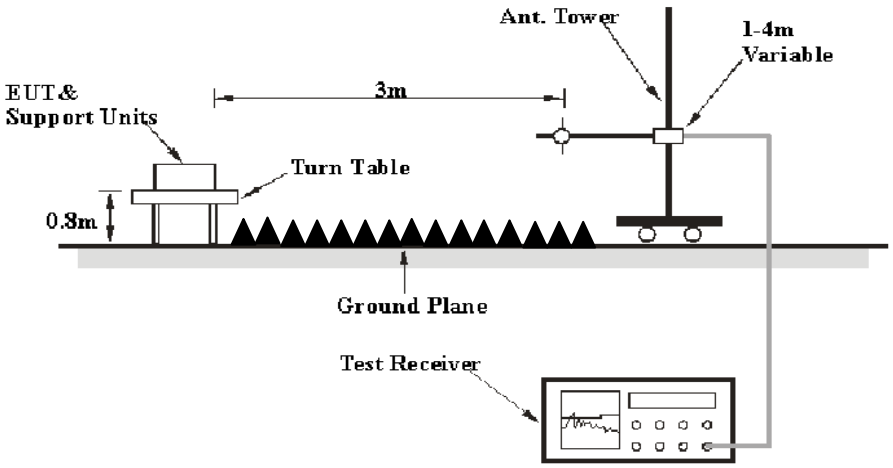
Measurement	U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

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:

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

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

Margin = Limit –Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2014-05-09	2015-05-09
Sunol Sciences	Antenna	JB3	A060611-3	2014-11-06	2017-11-05
HP	Amplifier	8447E	2434A02181	2014-09-01	2015-09-01
Agilent	Spectrum Analyzer	E4440A	SG43360054	2014-12-04	2015-12-04
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	2014-05-09	2015-05-09
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:

4.70 dB at **2483.5MHz** in the **Horizontal** polarization for 802.11 b Mode

Test Data

Environmental Conditions

Temperature:	21.6°C
Relative Humidity:	58 %
ATM Pressure:	101.4 kPa

** The testing was performed by Allen Qiao on 2015-04-11.*

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	77.05	PK	H	25.67	3.68	0.00	106.40	N/A	N/A
2412	71.21	AV	H	25.67	3.68	0.00	100.56	N/A	N/A
2412	72.15	PK	V	25.67	3.68	0.00	101.50	N/A	N/A
2412	66.34	AV	V	25.67	3.68	0.00	95.69	N/A	N/A
2390	39.14	PK	H	25.61	3.63	0.00	68.38	74.00	5.62
2390	13.36	AV	H	25.61	3.63	0.00	42.60	54.00	11.40
4824	35.93	PK	H	30.64	5.03	27.41	44.19	74.00	29.81
4824	19.73	AV	H	30.64	5.03	27.41	27.99	54.00	26.01
7236	30.91	PK	H	34.17	6.65	25.90	45.83	74.00	28.17
7236	19.02	AV	H	34.17	6.65	25.90	33.94	54.00	20.06
9648	29.81	PK	H	36.06	8.55	27.46	46.96	74.00	27.04
9648	17.34	AV	H	36.06	8.55	27.46	34.49	54.00	19.51
3131	35	PK	H	27.62	6.93	27.43	42.12	74.00	31.88
3131	21.96	AV	H	27.62	6.93	27.43	29.08	54.00	24.92
216	46.6	QP	V	11.41	1.78	21.47	38.32	43.50	5.18 *
Middle Channel: 2437 MHz									
2437	77.12	PK	H	25.74	3.75	0.00	106.61	N/A	N/A
2437	72.05	AV	H	25.74	3.75	0.00	101.54	N/A	N/A
2437	72.44	PK	V	25.74	3.75	0.00	101.93	N/A	N/A
2437	66.75	AV	V	25.74	3.75	0.00	96.24	N/A	N/A
4874	35.5	PK	H	30.77	5.14	27.42	43.99	74.00	30.01
4874	19.36	AV	H	30.77	5.14	27.42	27.85	54.00	26.15
7311	30.62	PK	H	34.35	6.74	25.88	45.83	74.00	28.17
7311	18.68	AV	H	34.35	6.74	25.88	33.89	54.00	20.11
9748	29.37	PK	H	36.30	8.61	27.24	47.04	74.00	26.96
9748	16.86	AV	H	36.30	8.61	27.24	34.53	54.00	19.47
3131	34.73	PK	H	27.62	6.93	27.43	41.85	74.00	32.15
3131	21.47	AV	H	27.62	6.93	27.43	28.59	54.00	25.41
3190	33.96	PK	H	27.81	6.26	27.38	40.65	74.00	33.35
3190	20.74	AV	H	27.81	6.26	27.38	27.43	54.00	26.57
216	46.3	QP	V	11.41	1.78	21.47	38.02	43.50	5.48 *
High Channel: 2462 MHz									
2462	78.35	PK	H	25.80	3.75	0.00	107.90	N/A	N/A
2462	72.65	AV	H	25.80	3.75	0.00	102.20	N/A	N/A
2462	73.42	PK	V	25.80	3.75	0.00	102.97	N/A	N/A
2462	67.02	AV	V	25.80	3.75	0.00	96.57	N/A	N/A
2483.5	39.77	PK	H	25.86	3.67	0.00	69.30	74.00	4.70
2483.5	15.29	AV	H	25.86	3.67	0.00	44.82	54.00	9.18
4924	35.91	PK	H	30.90	5.34	27.43	44.72	74.00	29.28
4924	19.64	AV	H	30.90	5.34	27.43	28.45	54.00	25.55
7386	30.9	PK	H	34.53	6.83	25.86	46.40	74.00	27.60
7386	18.94	AV	H	34.53	6.83	25.86	34.44	54.00	19.56
9848	29.86	PK	H	36.54	8.66	26.94	48.12	74.00	25.88
9848	17.5	AV	H	36.54	8.66	26.94	35.76	54.00	18.24
3131	35.11	PK	H	27.62	6.93	27.43	42.23	74.00	31.77
3131	22.12	AV	H	27.62	6.93	27.43	29.24	54.00	24.76
216	45.8	QP	V	11.41	1.78	21.47	37.52	43.50	5.98 *

*Within measurement uncertainty!

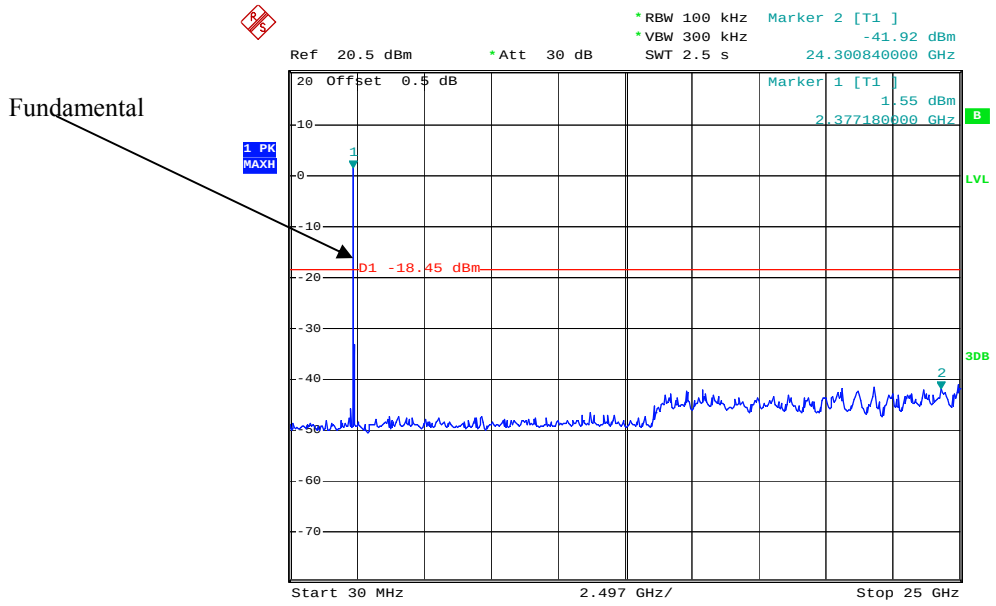
802.11g Mode

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	76.64	PK	H	25.67	3.68	0.00	105.99	N/A	N/A
2412	65.36	AV	H	25.67	3.68	0.00	94.71	N/A	N/A
2412	69.6	PK	V	25.67	3.68	0.00	98.95	N/A	N/A
2412	58.83	AV	V	25.67	3.68	0.00	88.18	N/A	N/A
2390	37.33	PK	H	25.61	3.63	0.00	66.57	74.00	7.43
2390	14.8	AV	H	25.61	3.63	0.00	44.04	54.00	9.96
4824	35.93	PK	H	30.64	5.03	27.41	44.19	74.00	29.81
4824	19.73	AV	H	30.64	5.03	27.41	27.99	54.00	26.01
7236	30.91	PK	H	34.17	6.65	25.90	45.83	74.00	28.17
7236	19.02	AV	H	34.17	6.65	25.90	33.94	54.00	20.06
9648	29.81	PK	H	36.06	8.55	27.46	46.96	74.00	27.04
9648	17.34	AV	H	36.06	8.55	27.46	34.49	54.00	19.51
3323	34.36	PK	H	28.23	4.98	27.27	40.30	74.00	33.70
3323	21.96	AV	H	28.23	4.98	27.27	27.90	54.00	26.10
216	46.5	QP	V	11.41	1.78	21.47	38.22	43.50	5.28 *
Middle Channel: 2437 MHz									
2437	78.12	PK	H	25.74	3.75	0.00	107.61	N/A	N/A
2437	67.67	AV	H	25.74	3.75	0.00	97.16	N/A	N/A
2437	70.32	PK	V	25.74	3.75	0.00	99.81	N/A	N/A
2437	59.36	AV	V	25.74	3.75	0.00	88.85	N/A	N/A
4874	35.93	PK	H	30.77	5.14	27.42	44.42	74.00	29.58
4874	19.73	AV	H	30.77	5.14	27.42	28.22	54.00	25.78
7311	30.91	PK	H	34.35	6.74	25.88	46.12	74.00	27.88
7311	19.02	AV	H	34.35	6.74	25.88	34.23	54.00	19.77
9748	29.81	PK	H	36.30	8.61	27.24	47.48	74.00	26.52
9748	17.34	AV	H	36.30	8.61	27.24	35.01	54.00	18.99
3323	35	PK	H	28.23	4.98	27.27	40.94	74.00	33.06
3323	21.96	AV	H	28.23	4.98	27.27	27.90	54.00	26.10
2538	34.25	PK	H	26.00	4.14	27.39	37.00	74.00	37.00
2538	21.23	AV	H	26.00	4.14	27.39	23.98	54.00	30.02
216	46.2	QP	V	11.41	1.78	21.47	37.92	43.50	5.58 *
High Channel: 2462 MHz									
2462	80.42	PK	H	25.80	3.75	0.00	109.97	N/A	N/A
2462	69.83	AV	H	25.80	3.75	0.00	99.38	N/A	N/A
2462	70.32	PK	V	25.80	3.75	0.00	99.87	N/A	N/A
2462	60.35	AV	V	25.80	3.75	0.00	89.90	N/A	N/A
2483.5	37.59	PK	H	25.86	3.67	0.00	67.12	74.00	6.88
2483.5	17.96	AV	H	25.86	3.67	0.00	47.49	54.00	6.51
4924	36.3	PK	H	30.90	5.34	27.43	45.11	74.00	28.89
4924	20.14	AV	H	30.90	5.34	27.43	28.95	54.00	25.05
7386	31.25	PK	H	34.53	6.83	25.86	46.75	74.00	27.25
7386	19.25	AV	H	34.53	6.83	25.86	34.75	54.00	19.25
9848	30.28	PK	H	36.54	8.66	26.94	48.54	74.00	25.46
9848	17.83	AV	H	36.54	8.66	26.94	36.09	54.00	17.91
3323	35.41	PK	H	28.23	4.98	27.27	41.35	74.00	32.65
3323	22.36	AV	H	28.23	4.98	27.27	28.30	54.00	25.70
216	46.1	QP	V	11.41	1.78	21.47	37.82	43.50	5.68 *

*Within measurement uncertainty!

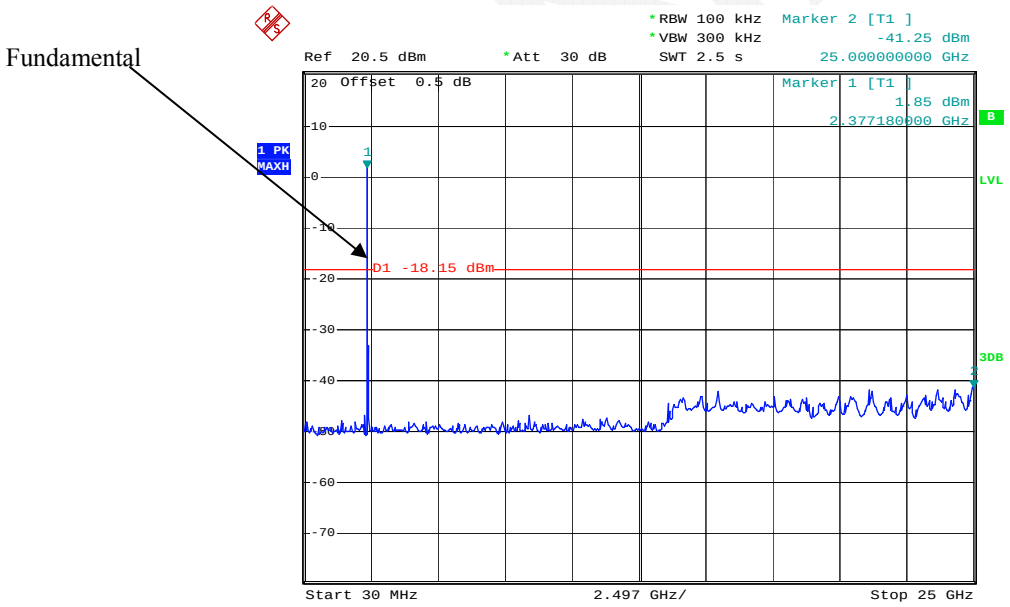
Conducted Spurious Emissions at Antenna Port

Chain 0 802.11b Low Channel



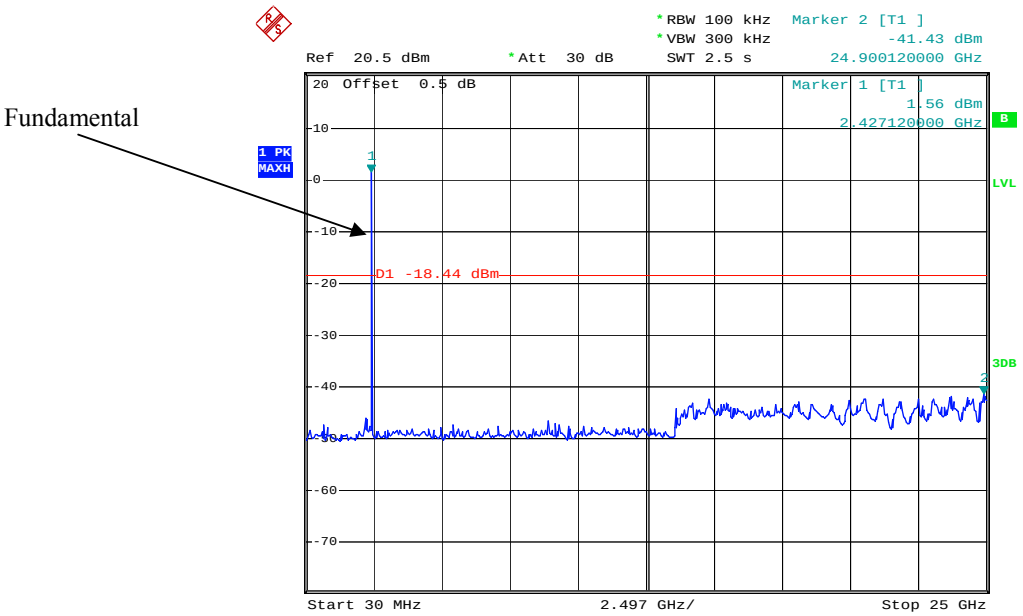
Date: 11.APR.2015 09:42:19

Chain 0 802.11b Middle Channel



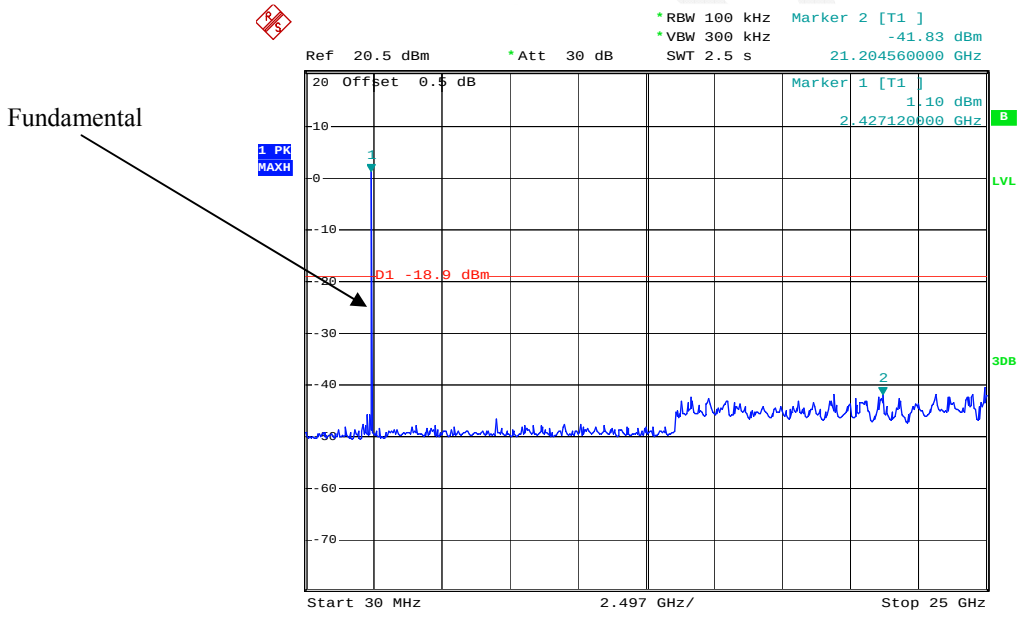
Date: 11.APR.2015 09:42:45

Chain 0 802.11b High Channel



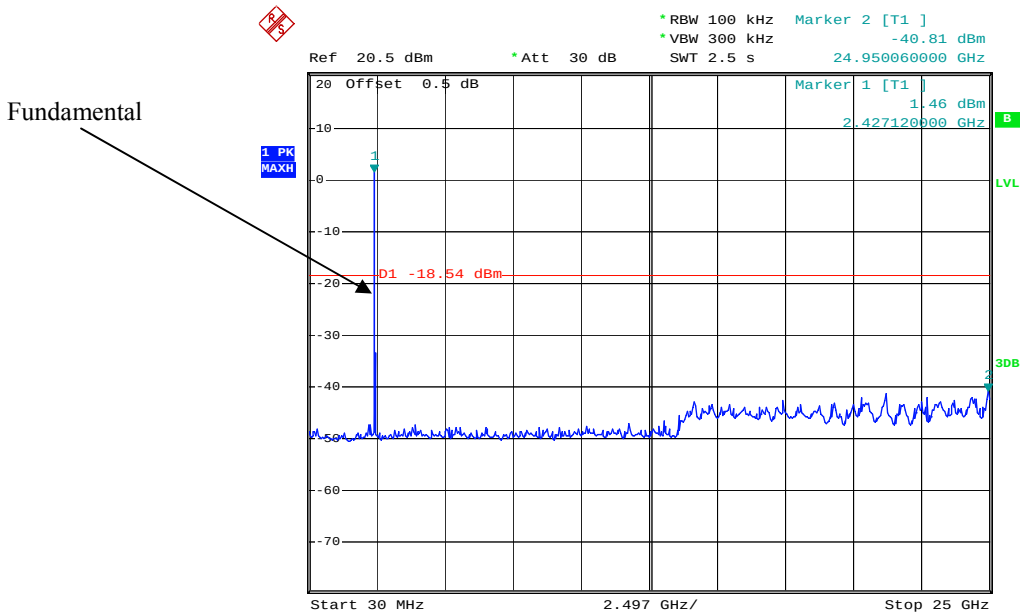
Date: 11.APR.2015 09:43:43

Chain 0 802.11g Low Channel



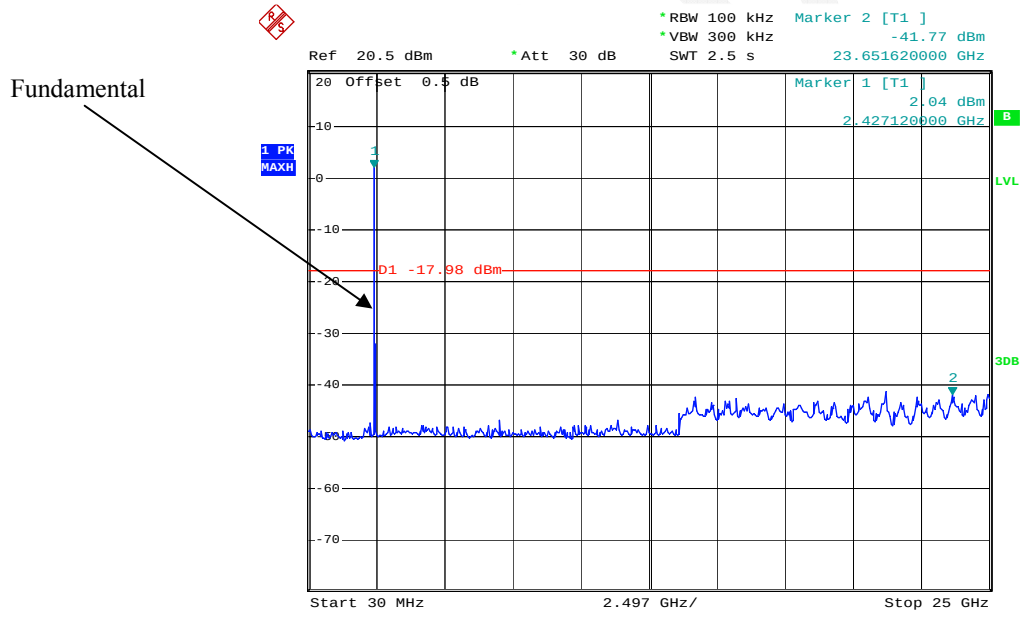
Date: 11.APR.2015 09:44:10

Chain 0 802.11g Middle Channel



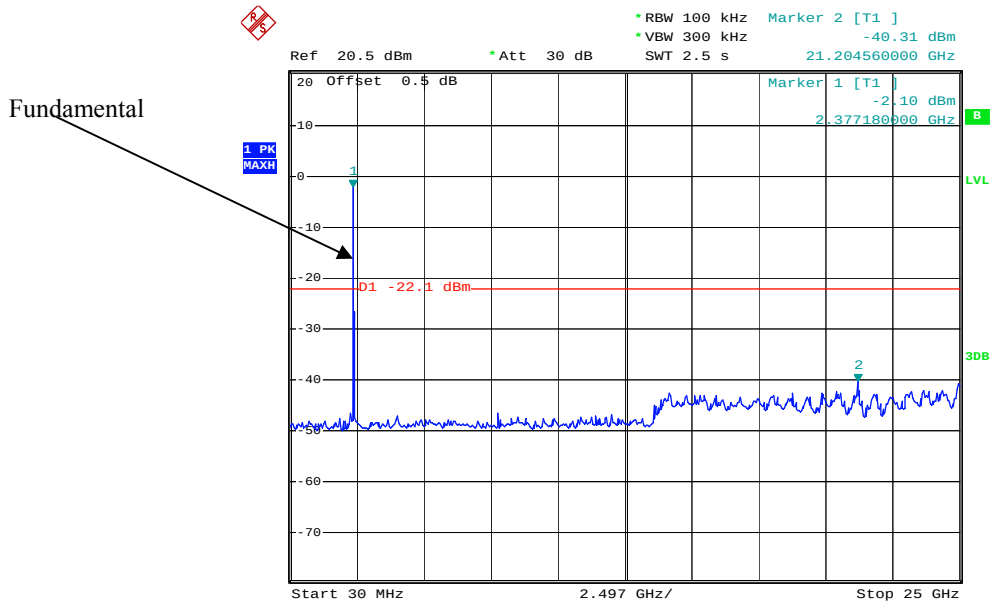
Date: 11.APR.2015 09:44:57

Chain 0 802.11g High Channel



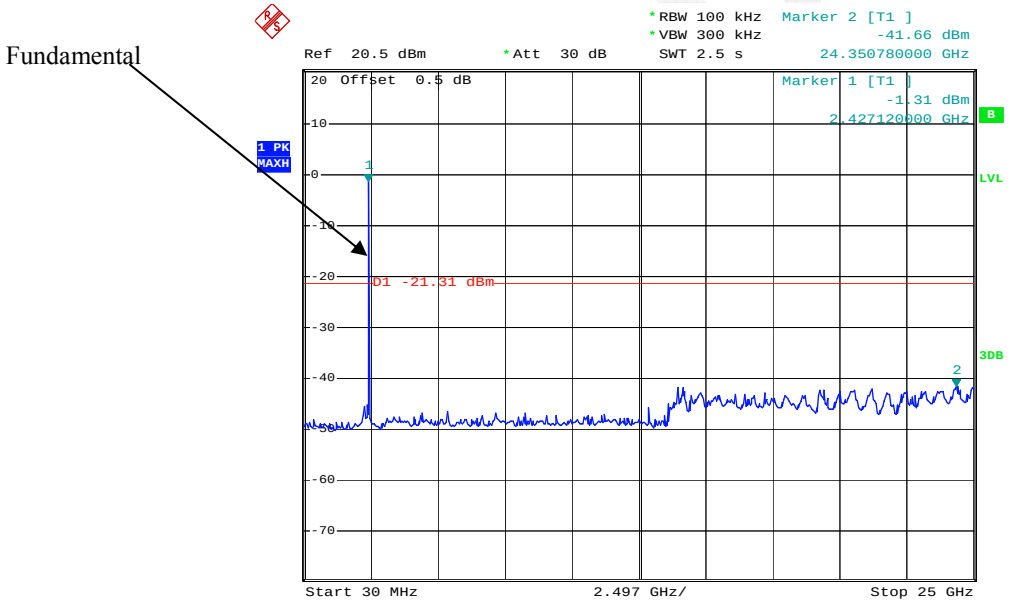
Date: 11.APR.2015 09:45:19

Chain 1 802.11b Low Channel



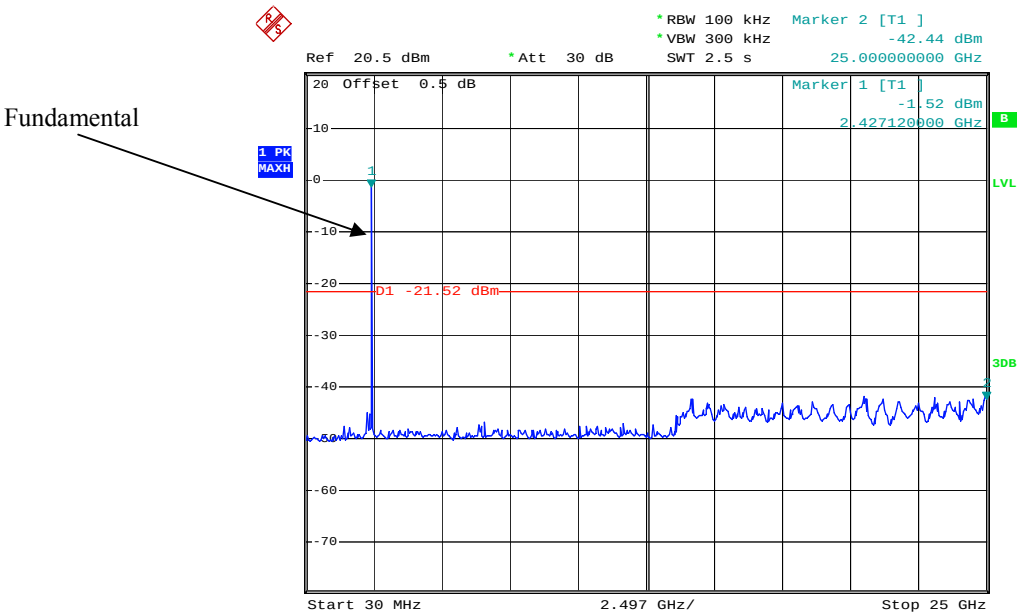
Date: 11.APR.2015 09:46:57

Chain 1 802.11b Middle Channel



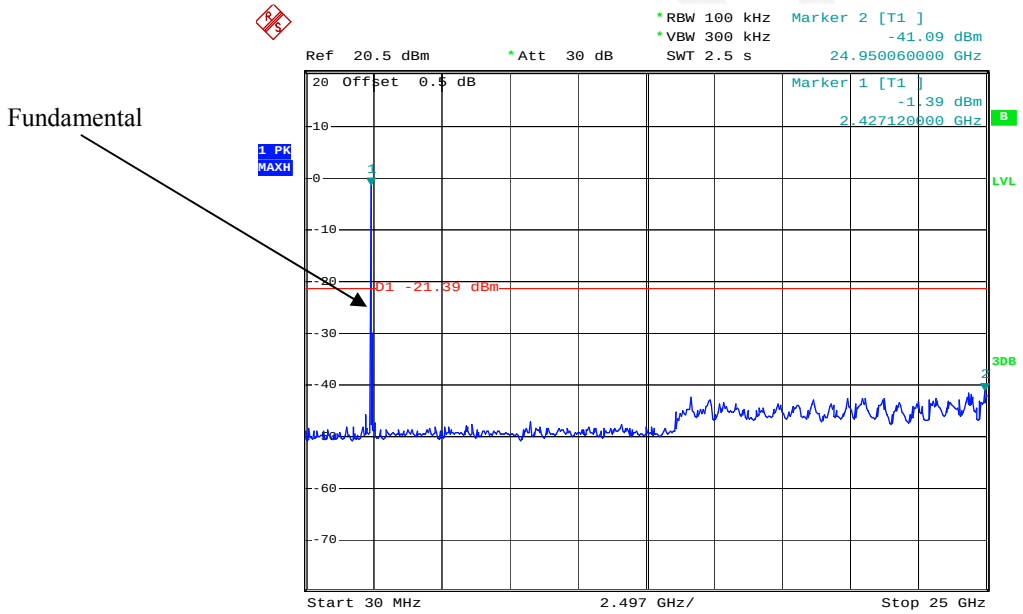
Date: 11.APR.2015 09:48:52

Chain 1 802.11b High Channel



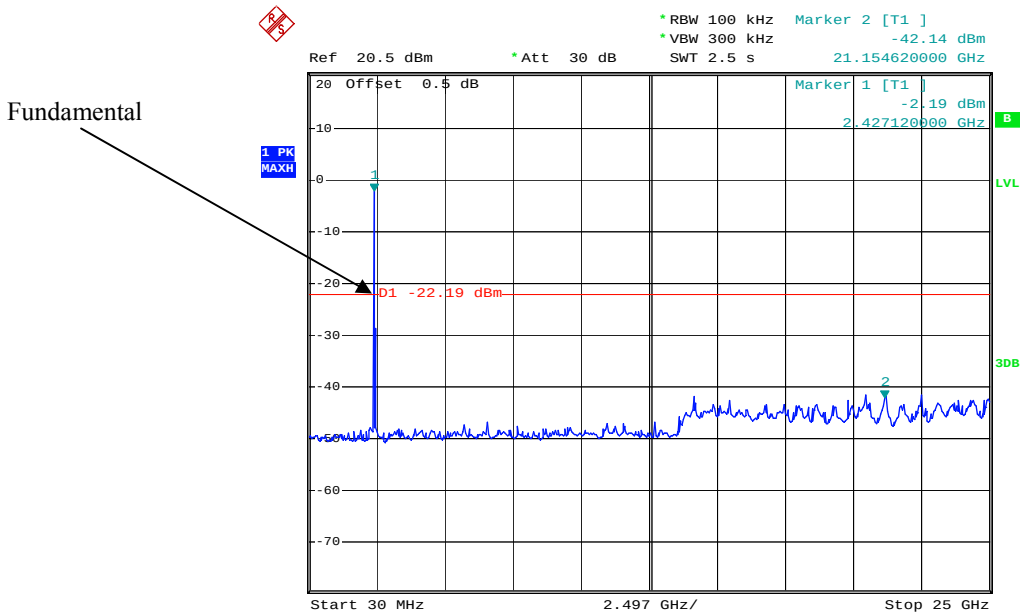
Date: 11.APR.2015 09:49:23

Chain 1 802.11g Low Channel



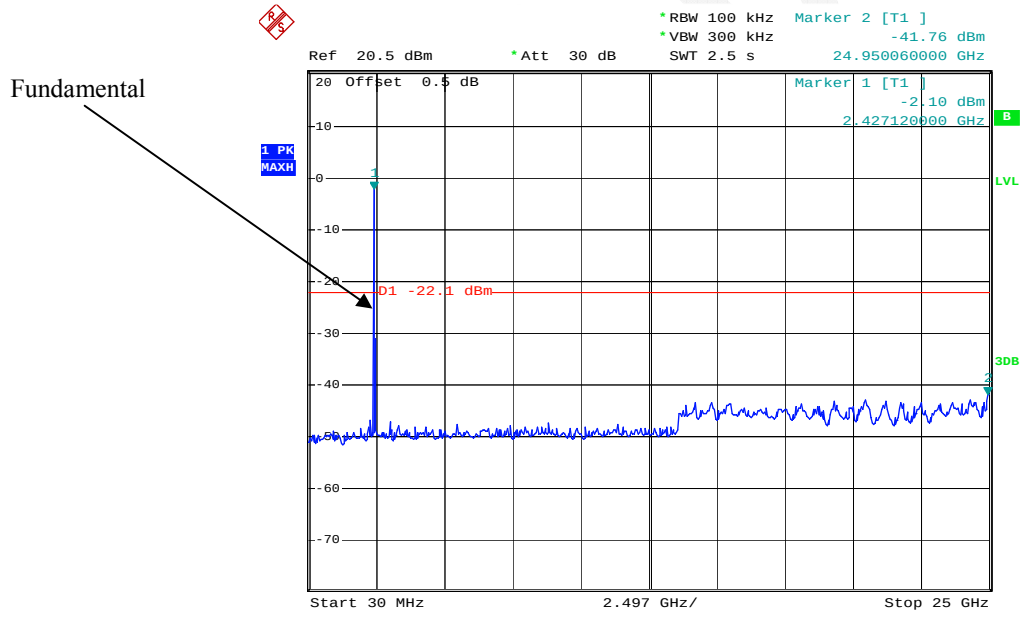
Date: 11.APR.2015 09:50:10

Chain 1 802.11g Middle Channel



Date: 11.APR.2015 09:51:40

Chain 1 802.11g High Channel



Date: 11.APR.2015 09:52:19

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	2014-05-09	2015-05-09

*** 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:	23.8 °C
Relative Humidity:	56 %
ATM Pressure:	101.4 kPa

The testing was performed by Allen Qiao on 2015-04-08.

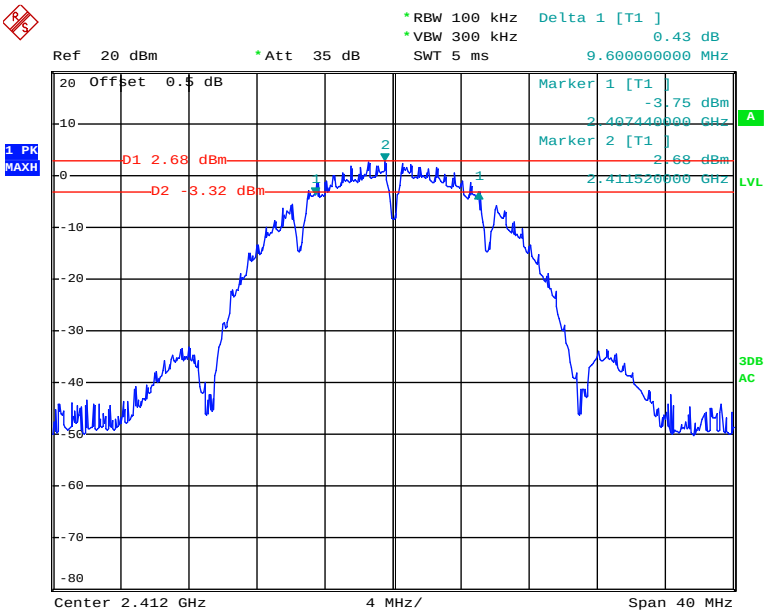
Test Mode: Transmitting

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

Mode	Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Limit (MHz)
			Chain 0	Chain 1	
802.11 b	Low	2412	9.6	9.76	0.5
	Middle	2437	10.08	9.68	0.5
	High	2462	10.08	9.68	0.5
802.11 g	Low	2412	16.4	16.48	0.5
	Middle	2437	16.4	16.4	0.5
	High	2462	16.4	16.48	0.5

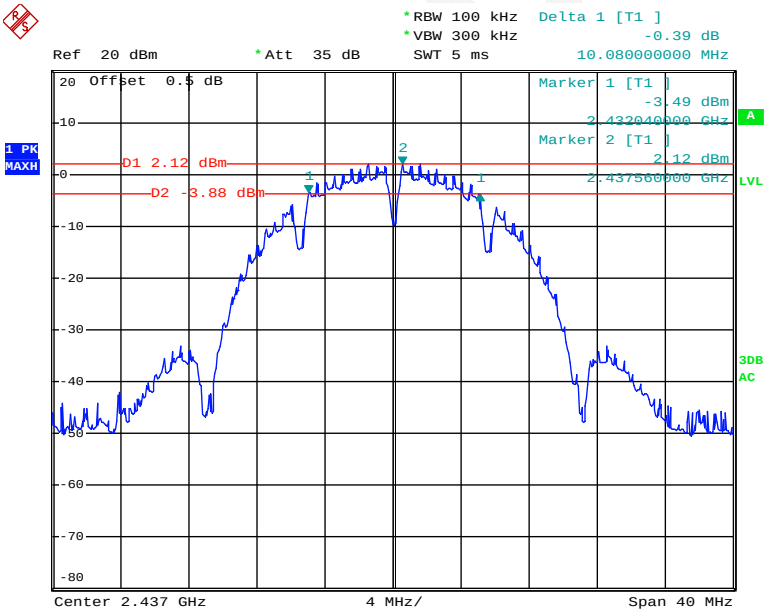
FINAL

Chain 0 802.11b Low Channel



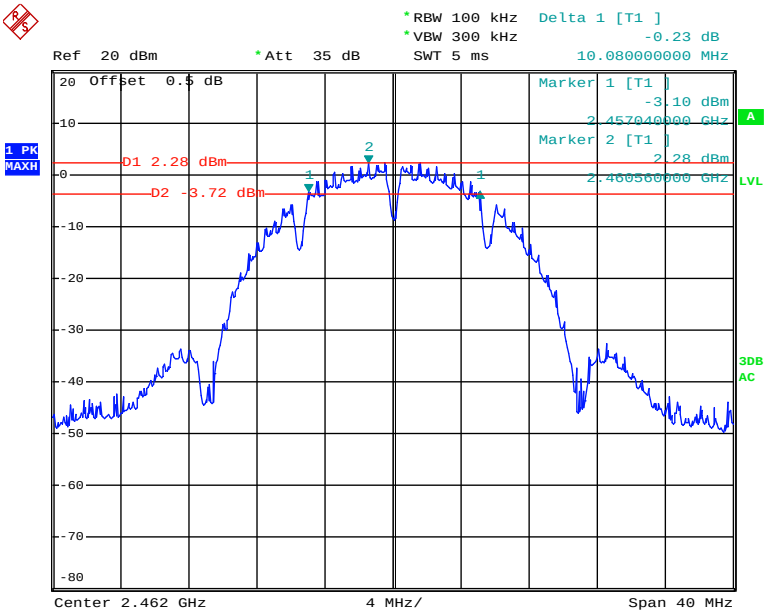
Date: 8.APR.2015 22:25:07

Chain 0 802.11b Middle Channel



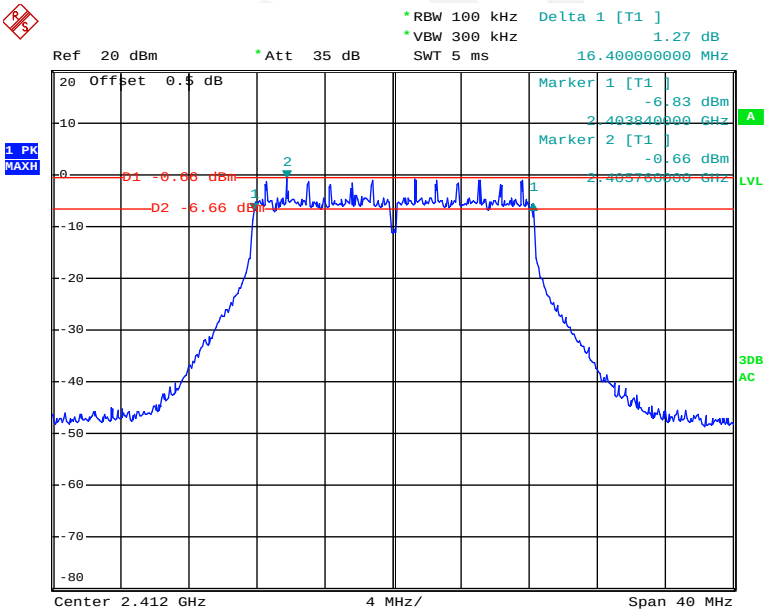
Date: 8.APR.2015 22:23:26

Chain 0 802.11b High Channel



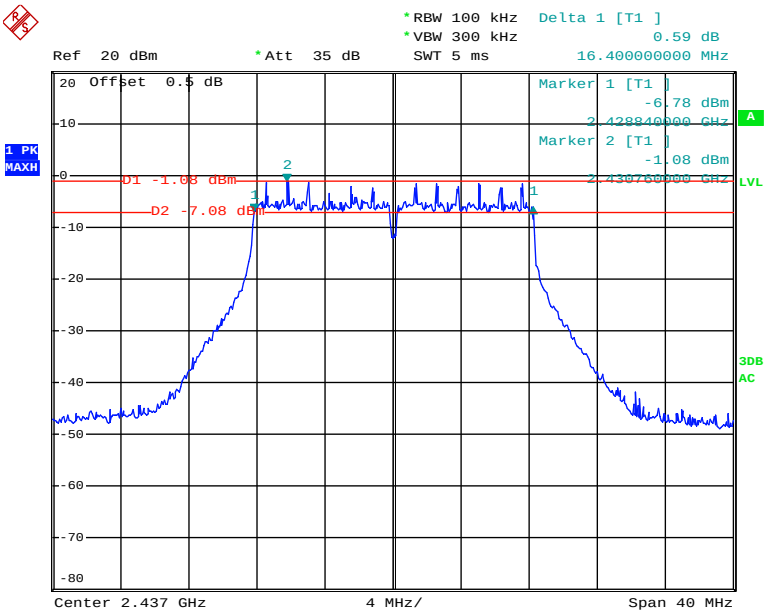
Date: 8.APR.2015 22:20:07

Chain 0 802.11g Low Channel



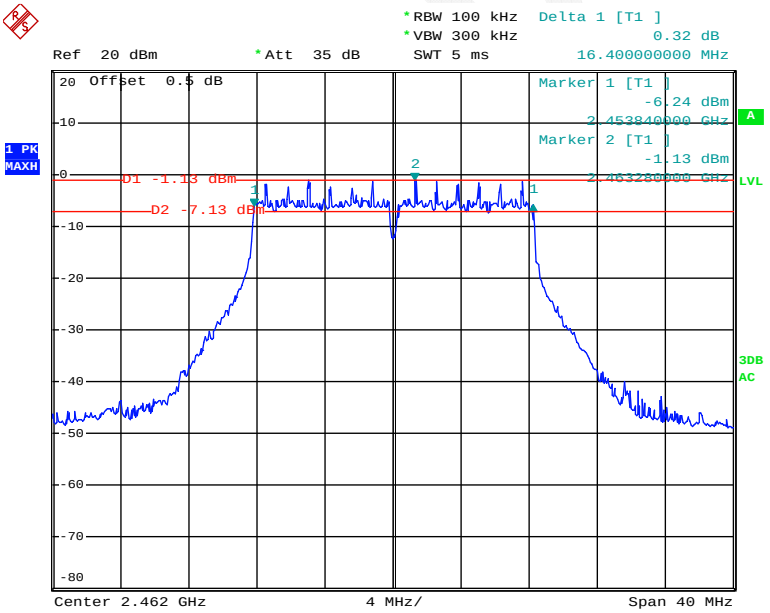
Date: 8.APR.2015 22:09:32

Chain 0 802.11g Middle Channel



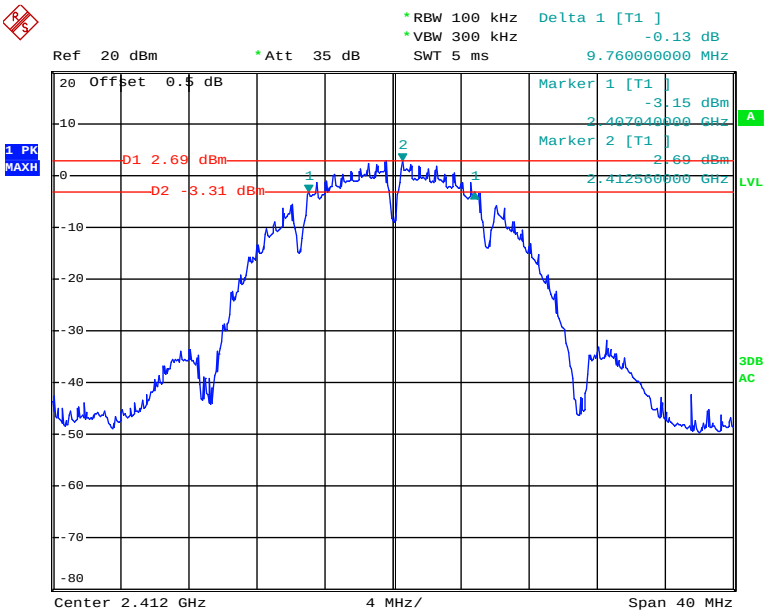
Date: 8.APR.2015 22:13:11

Chain 0 802.11g High Channel



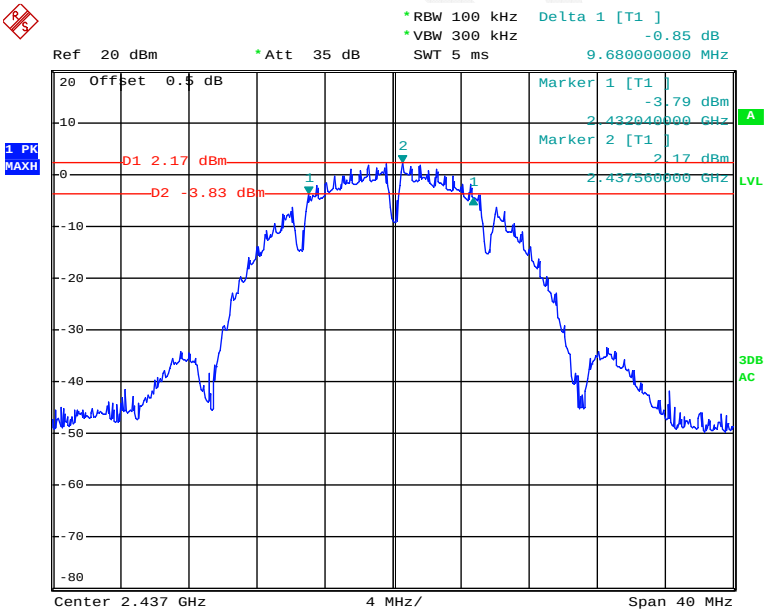
Date: 8.APR.2015 22:16:21

Chain 1 802.11b Low Channel



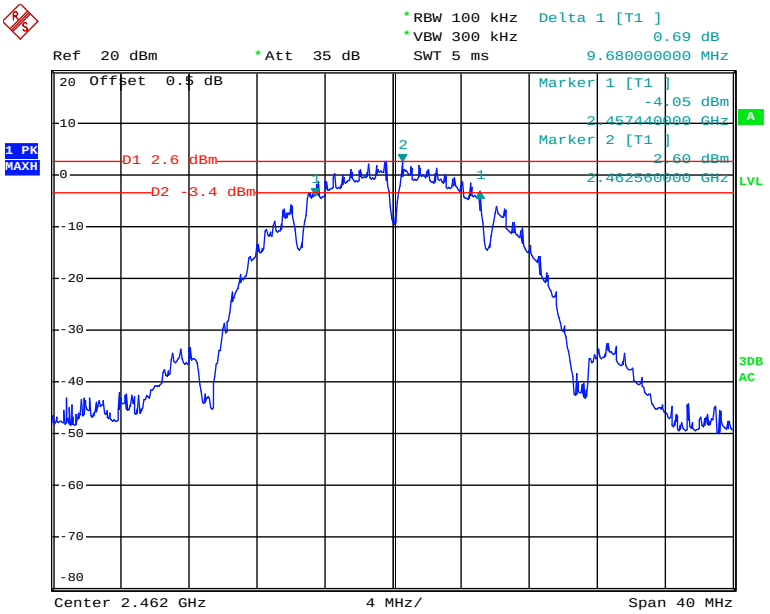
Date: 8.APR.2015 21:46:24

Chain 1 802.11b Middle Channel



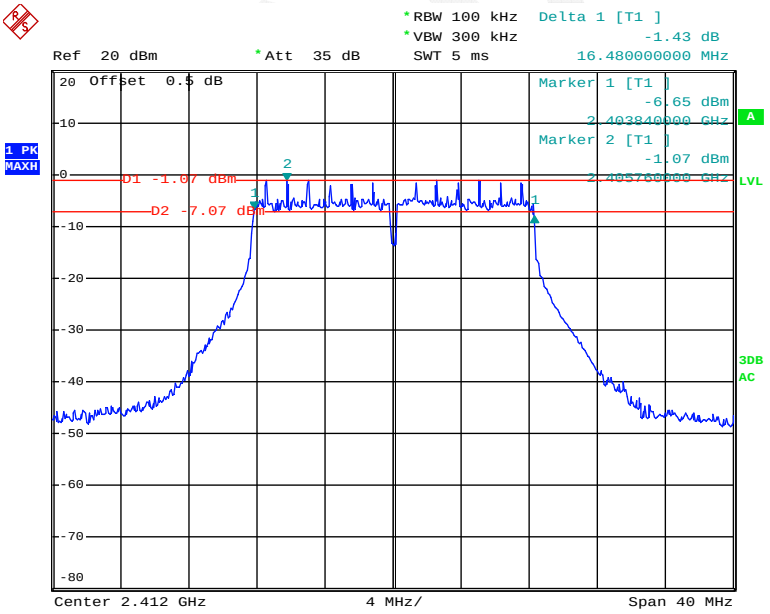
Date: 8.APR.2015 21:49:33

Chain 1 802.11b High Channel



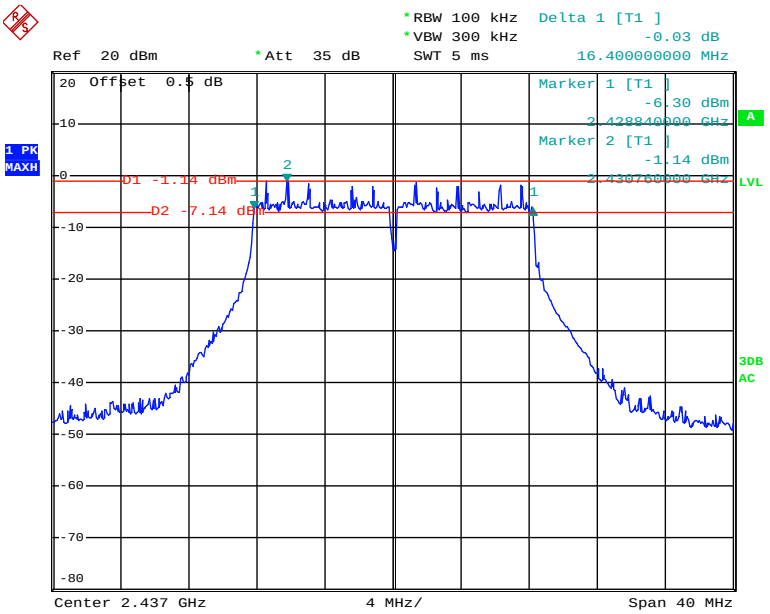
Date: 8.APR.2015 21:55:50

Chain 1 802.11g Low Channel



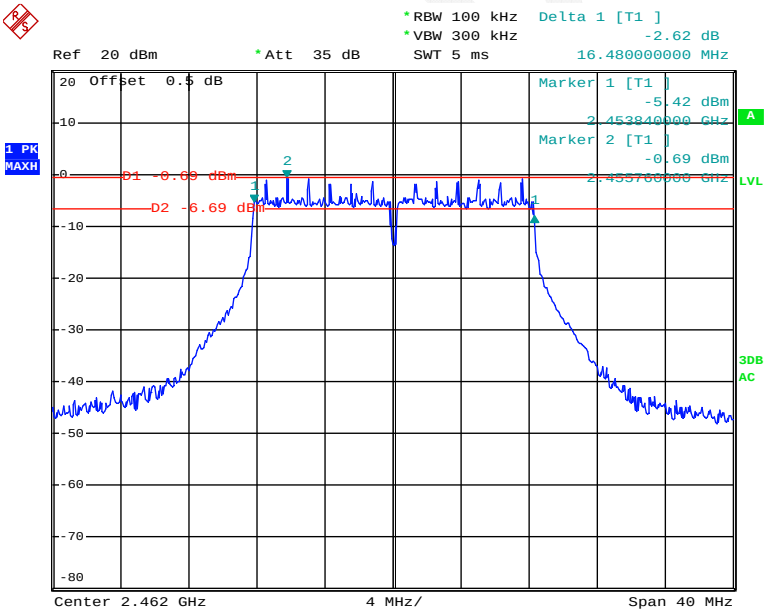
Date: 8.APR.2015 22:03:51

Chain 1 802.11g Middle Channel



Date: 8.APR.2015 22:01:22

Chain 1 802.11g High Channel



Date: 8.APR.2015 21:58:38

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
R&S	Spectrum Analyzer	FSEM	DE31388	2014-05-09	2015-05-09

*** 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:	21.3 °C
Relative Humidity:	56 %
ATM Pressure:	101.6 kPa

The testing was performed by Allen Qiao on 2015-04-09

Test Mode: Transmitting

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

Mode	Channel	Frequency (MHz)	Maximum Conducted Peak Output Power (dBm)			Limit (dBm)
			Chain 0	Chain 1	Total	
802.11 b	Low	2412	14.39	14.06	17.24	30
	Middle	2437	13.88	13.68	16.79	30
	High	2462	14.03	14.13	17.09	30
802.11 g	Low	2412	16.94	16.72	19.84	30
	Middle	2437	16.4	16.5	19.46	30
	High	2462	16.56	16.64	19.61	30

Mode	Channel	Frequency (MHz)	Maximum Conducted Average Output Power (dBm)			Limit (dBm)
			Chain 0	Chain 1	Total	
802.11 b	Low	2412	12.94	12.69	15.83	30
	Middle	2437	12.86	12.91	15.90	30
	High	2462	12.64	12.71	15.69	30
802.11 g	Low	2412	12.53	12.41	15.48	30
	Middle	2437	12.08	12.07	15.09	30
	High	2462	12.25	12.29	15.28	30

FINAL

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	FSEM	DE31388	2014-05-09	2015-05-09

*** 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

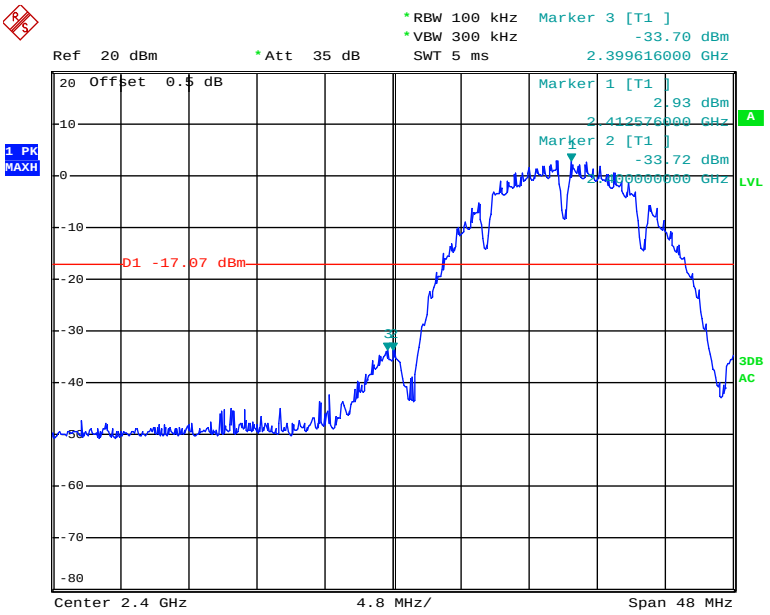
Temperature:	22 °C
Relative Humidity:	59 %
ATM Pressure:	101.4 kPa

The testing was performed by Allen Qiao on 2015-04-08

Test mode: Transmitting

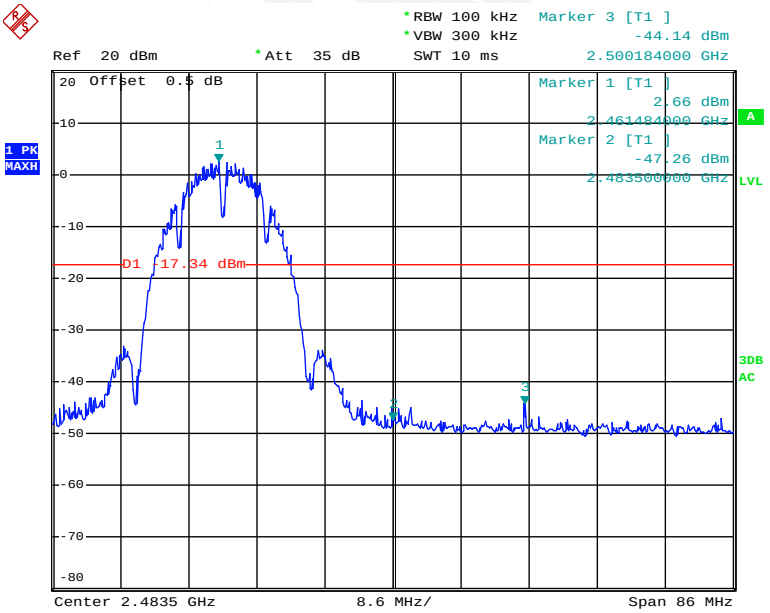
Test Result: Compliant. Please refer to following plots.

Chain 0 802.11b: Band Edge, Left Side



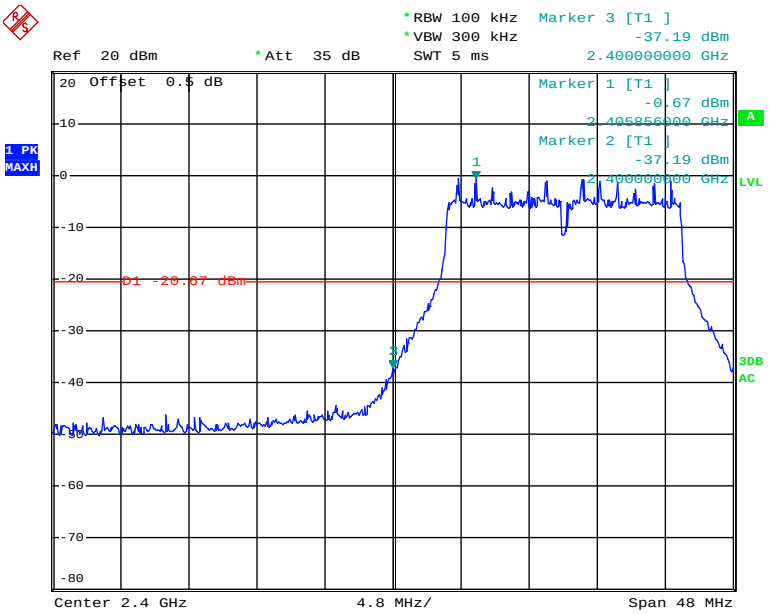
Date: 8.APR.2015 22:26:43

Chain 0 802.11b: Band Edge, Right Side



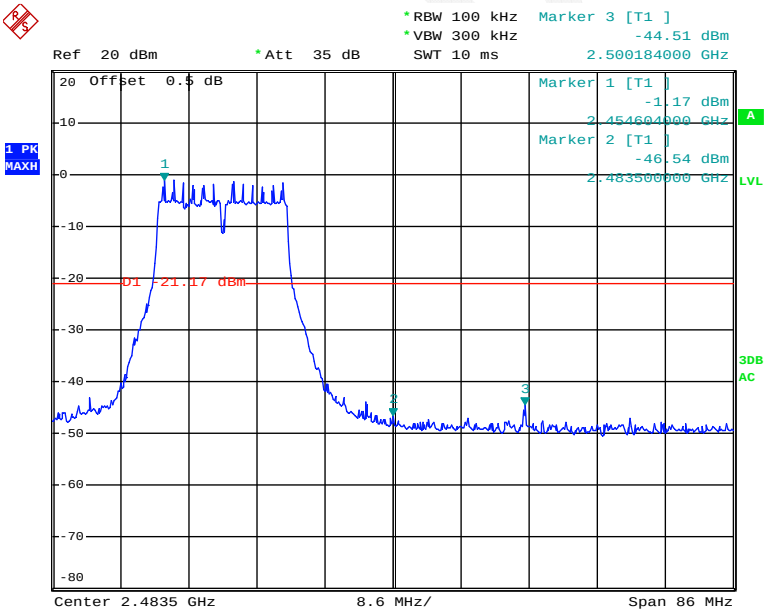
Date: 8.APR.2015 22:21:49

Chain 0 802.11g: Band Edge, Left Side



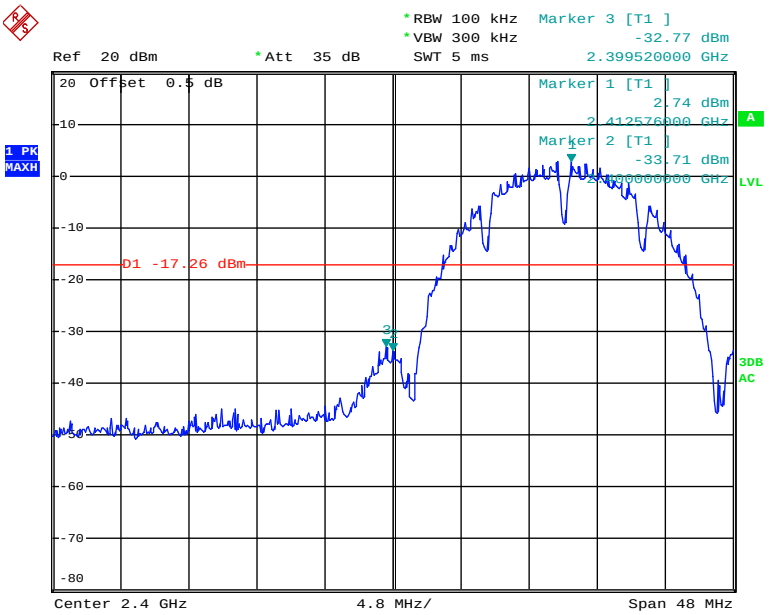
Date: 8.APR.2015 22:11:13

Chain 0 802.11g: Band Edge, Right Side



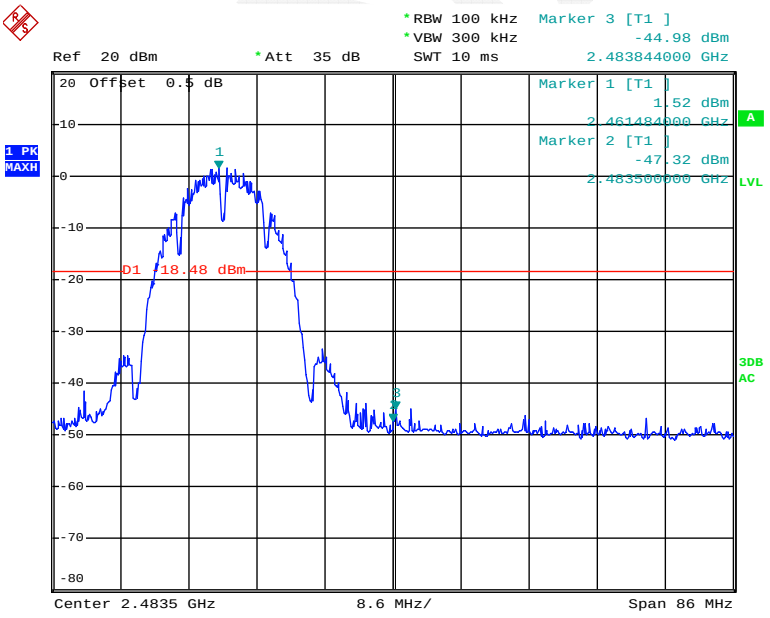
Date: 8.APR.2015 22:18:20

Chain 1 802.11b: Band Edge, Left Side



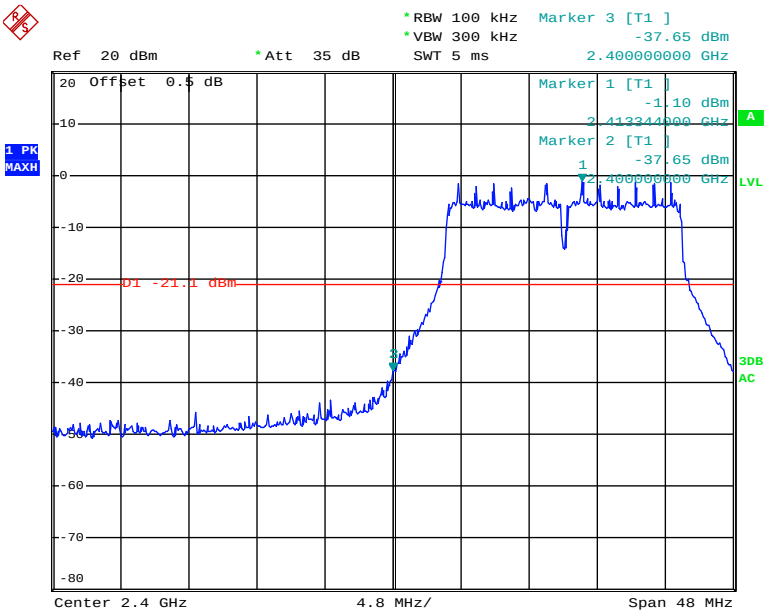
Date: 8.APR.2015 21:47:57

Chain 1 802.11b: Band Edge, Right Side



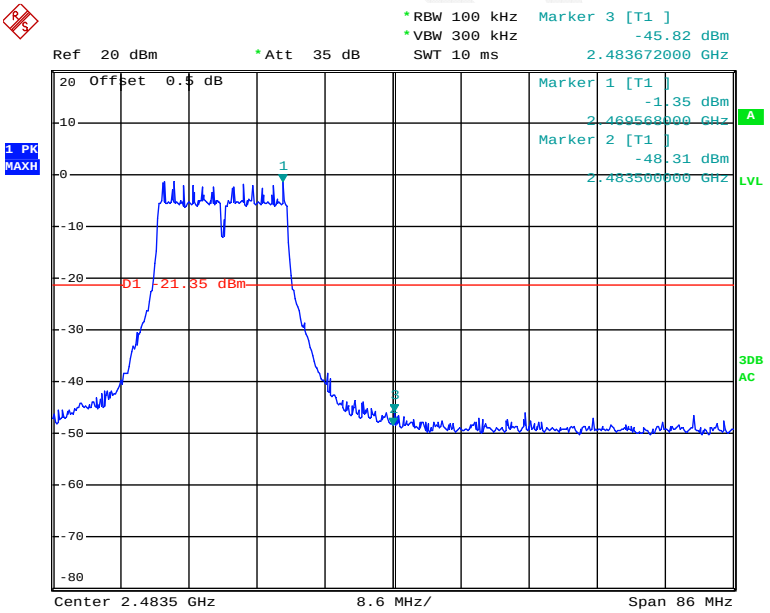
Date: 8.APR.2015 21:54:27

Chain 1 802.11g: Band Edge, Left Side



Date: 8.APR.2015 22:05:29

Chain 1 802.11g: Band Edge, Right Side



Date: 8.APR.2015 22:00:34

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 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	FSEM	DE31388	2014-05-09	2015-05-09

*** 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:	22 °C
Relative Humidity:	59 %
ATM Pressure:	101.4 kPa

The testing was performed by Allen Qiao on 2015-04-08

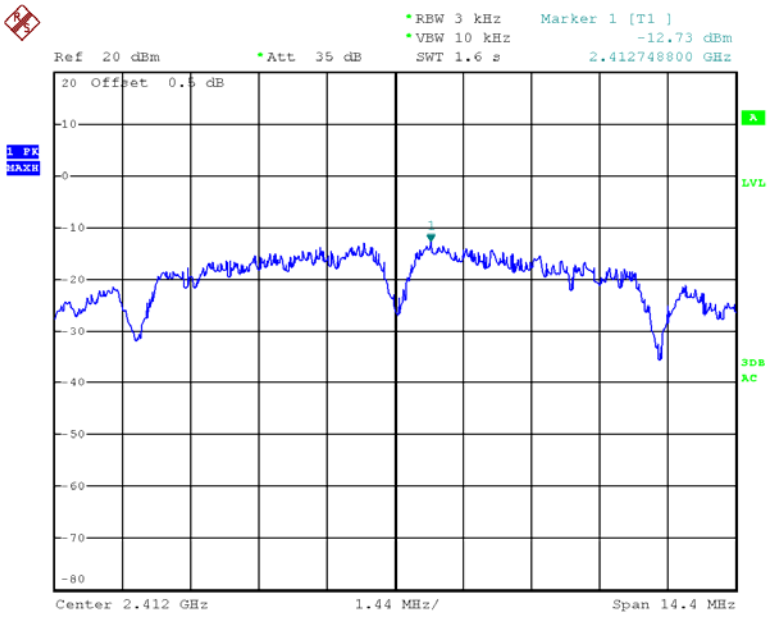
Test Mode: Transmitting

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

Mode	Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)			Limit (dBm/3kHz)
			Chain 0	Chain 1	Total	
802.11 b	Low	2412	-12.73	-13.69	-10.17	8
	Middle	2437	-13.86	-13.55	-10.69	8
	High	2462	-13.12	-13.72	-10.40	8
802.11 g	Low	2412	-16.86	-16.83	-13.83	8
	Middle	2437	-17.95	-17.27	-14.59	8
	High	2462	-17.09	-17.23	-14.15	8

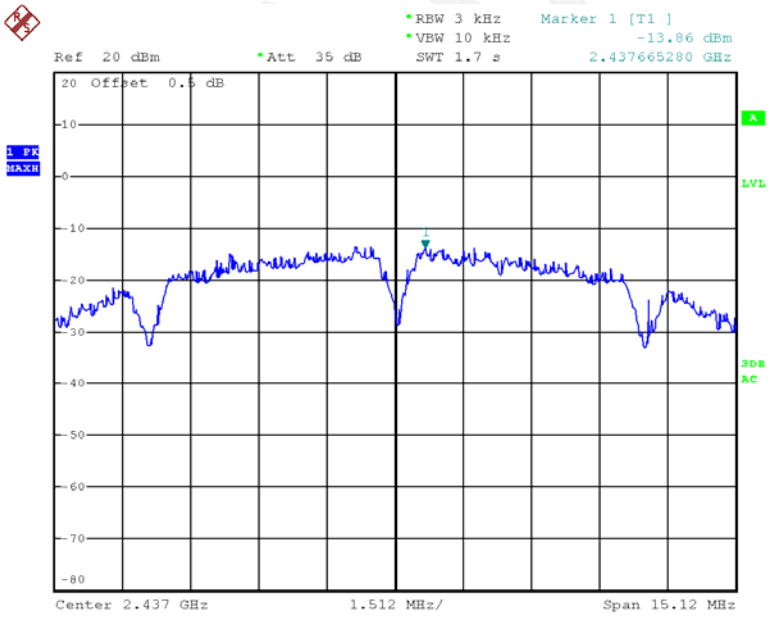
FINAL

Chain 0 Power Spectral Density, 802.11b Low Channel



Date: 8.APR.2015 22:27:58

Chain 0 Power Spectral Density, 802.11b Middle Channel



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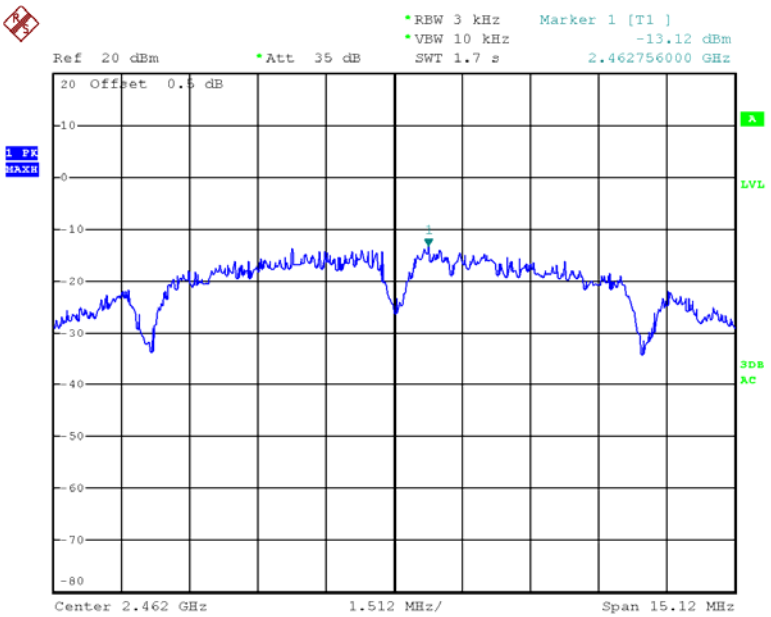
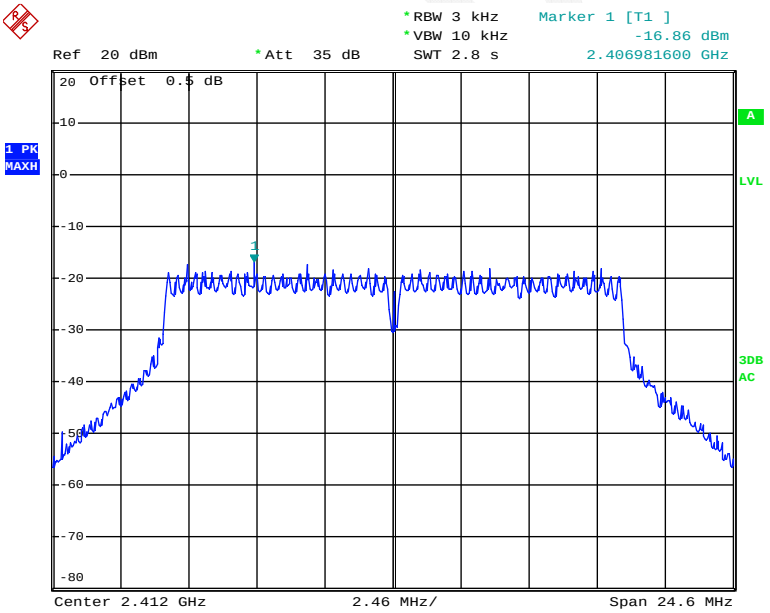
Chain 0 Power Spectral Density, 802.11b High Channel



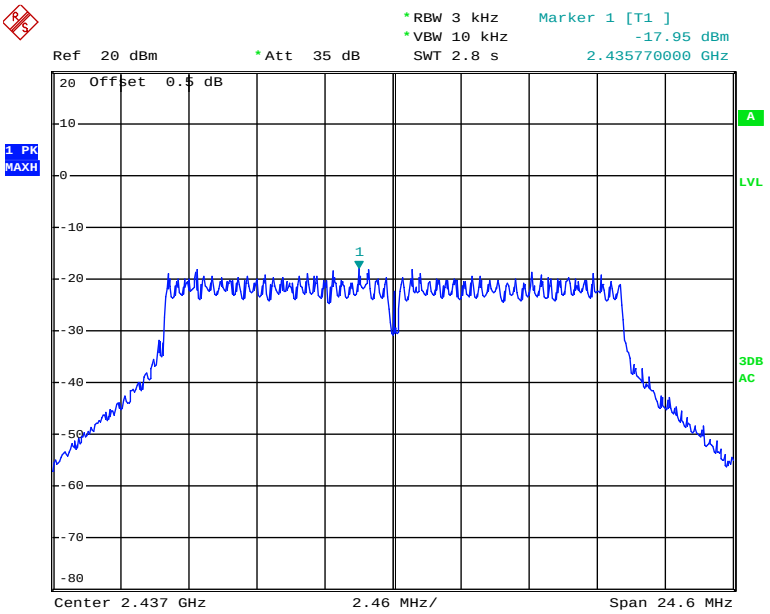
Date: 8.APR.2015 22:29:31

Chain 0 Power Spectral Density, 802.11g Low Channel



Date: 8.APR.2015 22:10:51

Chain 0 Power Spectral Density, 802.11g Middle Channel



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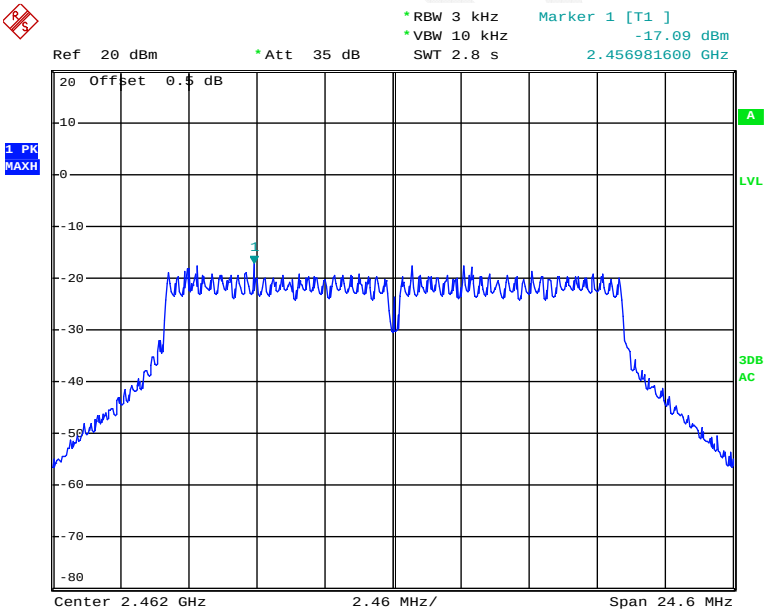
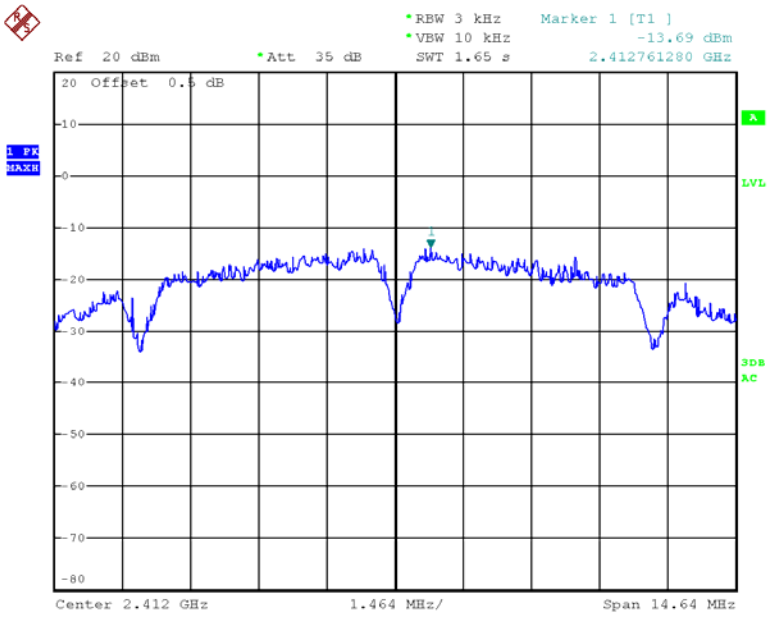
Chain 0 Power Spectral Density, 802.11g High Channel



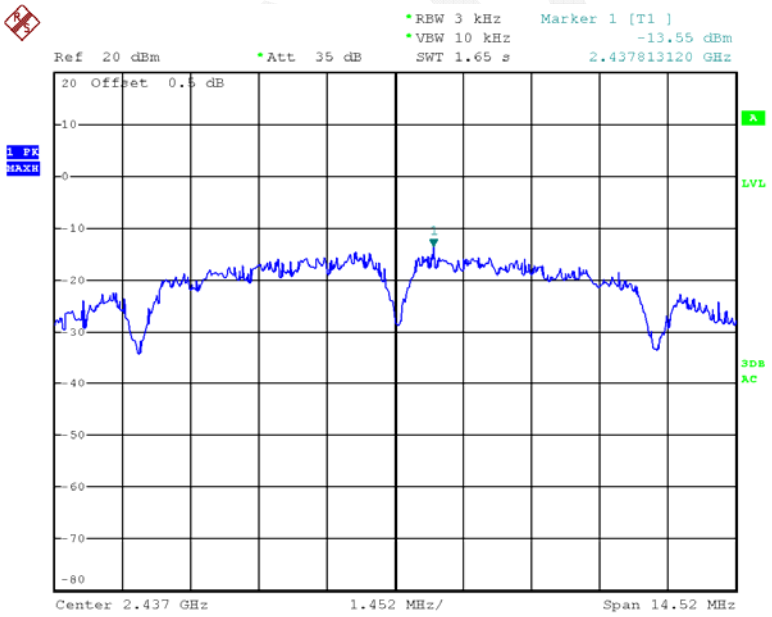
Date: 8.APR.2015 22:17:43

Chain 1 Power Spectral Density, 802.11b Low Channel



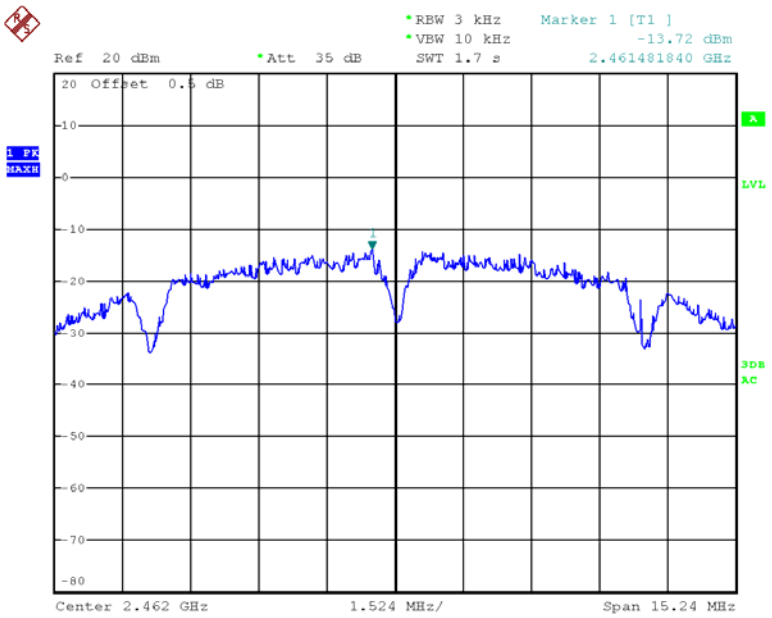
Date: 8.APR.2015 22:35:54

Chain 1 Power Spectral Density, 802.11b Middle Channel



Date: 8.APR.2015 22:35:21

Chain 1 Power Spectral Density, 802.11b High Channel



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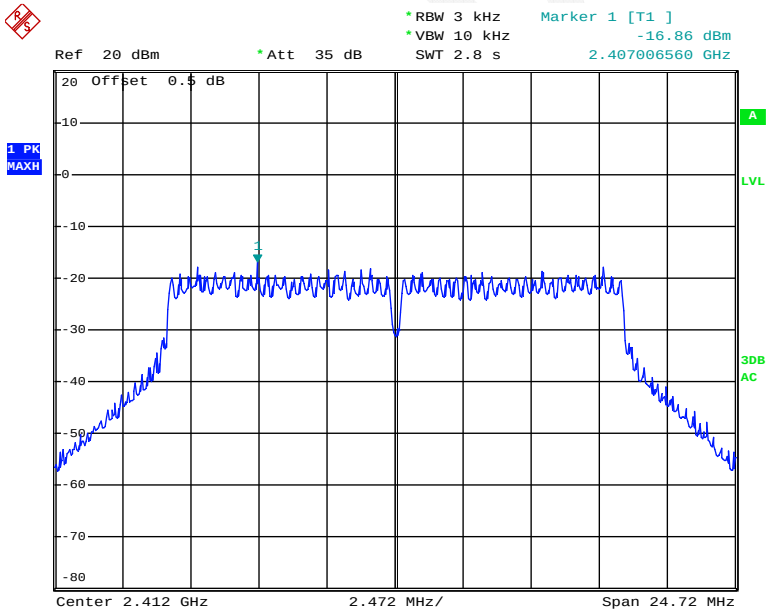
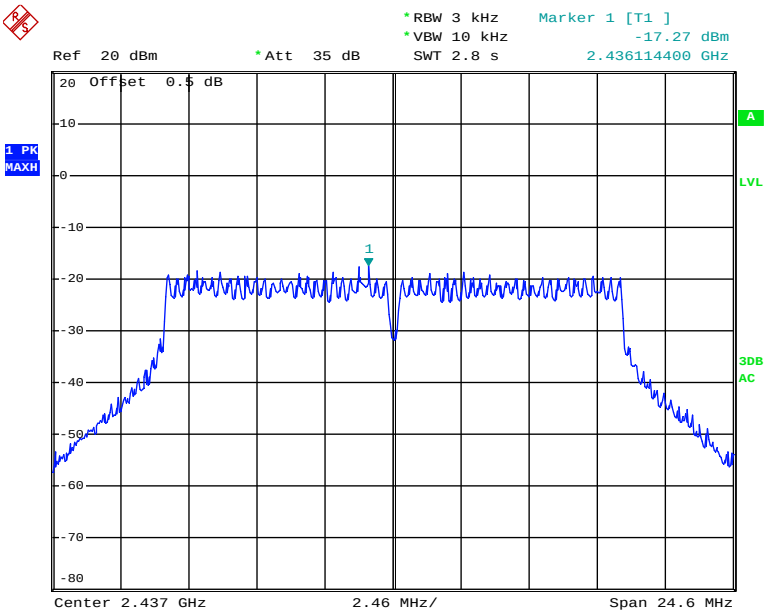
Chain 1 Power Spectral Density, 802.11g Low Channel



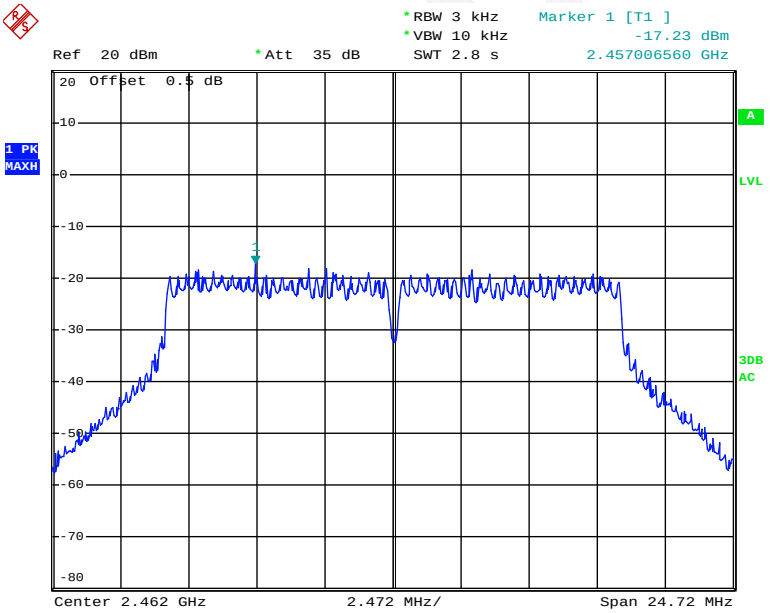
Date: 8.APR.2015 22:05:09

Chain 1 Power Spectral Density, 802.11g Middle Channel



Date: 8.APR.2015 22:02:46

Chain 1 Power Spectral Density, 802.11g High Channel



Date: 8.APR.2015 21:59:58

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