Test Report

FCC Part 15.247

DTS Devices operating in range 2400-2483.5MHz

FOR:

Dell Inc.
Model Name: V01B
FCC ID: E2KV01B001

TEST REPORT #: EMC_001_09003_15.247_WLAN
DATE: 2010-04-07

Bluetooth Qualification Test Facility (BQTF)

FCC listed: A2LA accredited

IC recognized # 3462B

***CETECOM* Inc.**
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CETECOM Inc. is a Delaware Corporation with Corporation number: 2113686
Board of Directors: Dr. Harald Ansorge, Dr. Klaus Matkey, Hans Peter May

1 Assessment

The following is in compliance with the applicable criteria specified in FCC rules Part 15.247 of the Code of Federal Regulations.

Company	Description	Model #
Dell Inc.	**GSM/UMTS Mobile Phone**	**V01B**

This report is reviewed by:

Date	Section	Name	Signature
2010-04-07	**EMC & Radio**	**Marc Douat (Test Lab Manager)**	

This report is prepared by:

Date	Section	Name	Signature
2010-04-07	**EMC & Radio**	**Satya Radhakrishna (EMC Project Engineer)**	Satya Radhakrishna I am the author of this document

The test results of this test report relate exclusively to the test item specified in Identification of the Equipment under Test. The CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM Inc USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Address:	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Responsible Test Lab Manager:	Heiko Strehlow
Responsible Project Leader:	Satya Radhakrishna

2.2 Identification of the Client

Applicant's Name:	Dell Inc.
Street Address:	One Dell Way Round Rock, TX 78682 Mail stop PS4-30
City/Zip Code	Round Rock, TX 78682
Country	USA
Contact Person:	Richard Worley
Phone No.	+1-512-728-1081
Fax:	+1-512-728-5278
e-mail:	Richard_Worley@dell.com

2.3 Identification of the Manufacturer

Same as above

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name:	Aero
Model No:	V01B
Product Type:	Portable
Hardware Revision :	EPR2
Software Revision :	1001210212ZEN_FBW1.4BENZ_WBD_512rabbit_318953310623 1764066729122
FCC-ID:	E2KV01B001
Frequency:	2400-2483.5 MHz
Type(s) of Modulation:	CCK, OFDM
Number of channels:	11
Antenna Type/Gain:	Integral/-3.7 dBi
Equipment Classification:	☐Fixed ☐Vehicular ■Portable ☐Module

3.2 Identification of the Equipment under Test (EUT)

EUT #	Serial Number	HW Version	SW Version	Comments
1	BZ3EA000002597	EPR2	1001210212ZEN_FBW1.4BENZ_WBD_512rabbit _3189533106231764066729122	Conducted Sample
2	BZ3EA000002597	EPR2	1001210212ZEN_FBW1.4BENZ_WBD_512rabbit _3189533106231764066729122	Radiated Sample

3.3 Identification of Accessory equipment

AE #	Type	Manufacturer	Model	Serial Number
1	USB Cable	N/A	N/A	N/A
2	AC Adapter	N/A	N/A	N/A

4 Subject Of Investigation

All testing was performed on the product referred to in Section 3 as EUT. EUT operates in the band 2400-2483.5MHz in 802.11b/g mode. All measurements were made with transmit power set to 13.

The objective of the measurements done by Cetecom Inc. was to measure the performance of the EUT operating under all operating modes as per requirements listed in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations. The maximization of portable equipment is conducted in accordance with ANSI C63.4

5 Conducted Measurements

5.1 6dB bandwidth and 99% bandwidth

5.1.1 Limit

FCC15.247(a)(2) 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.

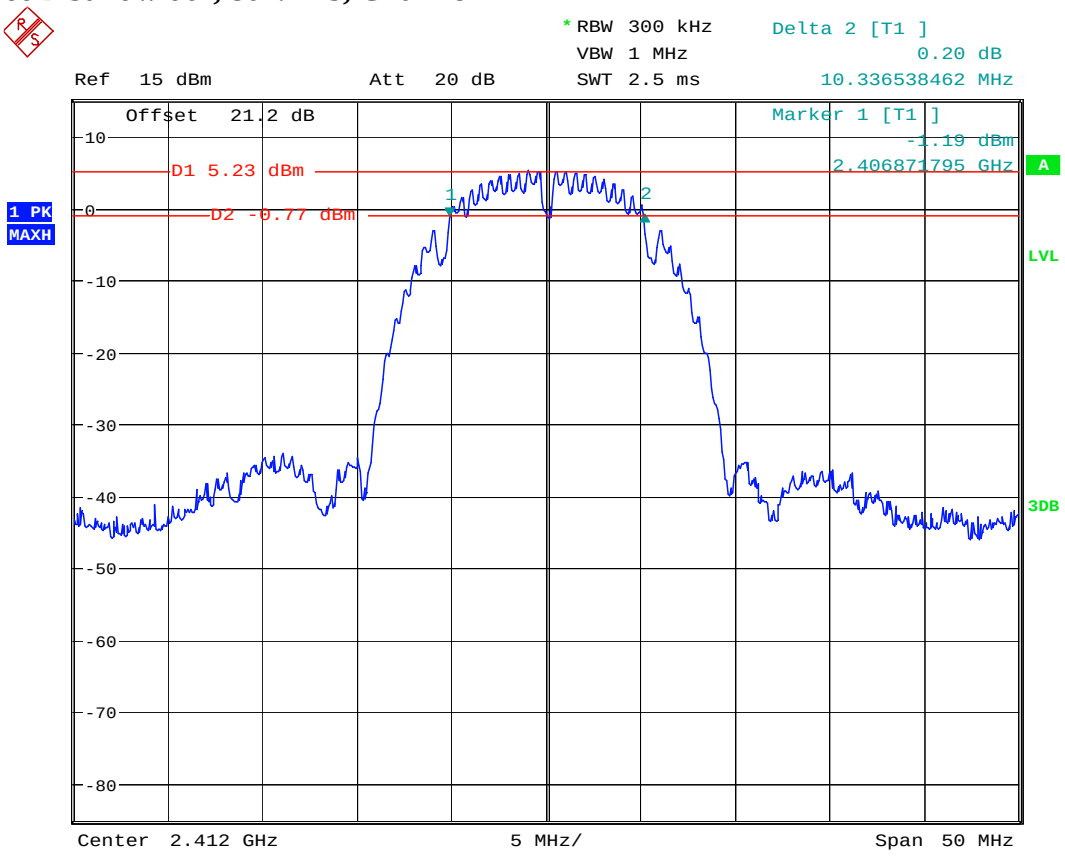
RSS210 A8.2 (a): The minimum 6 dB bandwidth shall be at least 500 kHz.

5.1.2 Measurement Result:

	Channel Frequency (MHz)	6dB Bandwidth (MHz)	20dB/99% Bandwidth (MHz)
2400-2483.5 MHz (802.11 b)	2412	10.337	15.465
	2437	10.337	15.465
	2462	10.337	15.545
2400-2483.5 MHz (802.11 g)	2412	16.506	19.391
	2437	16.506	19.551
	2462	16.587	19.551

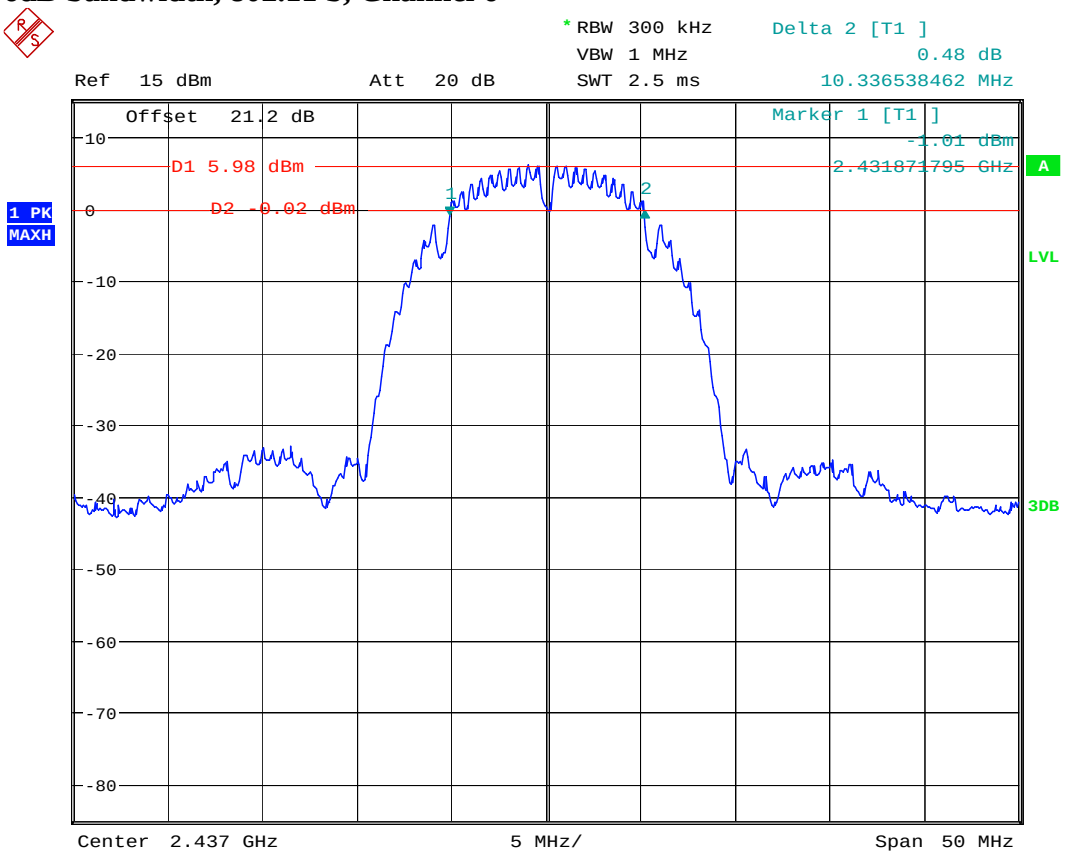
5.1.3 Plots:

6dB bandwidth, 802.11 b, Channel 1



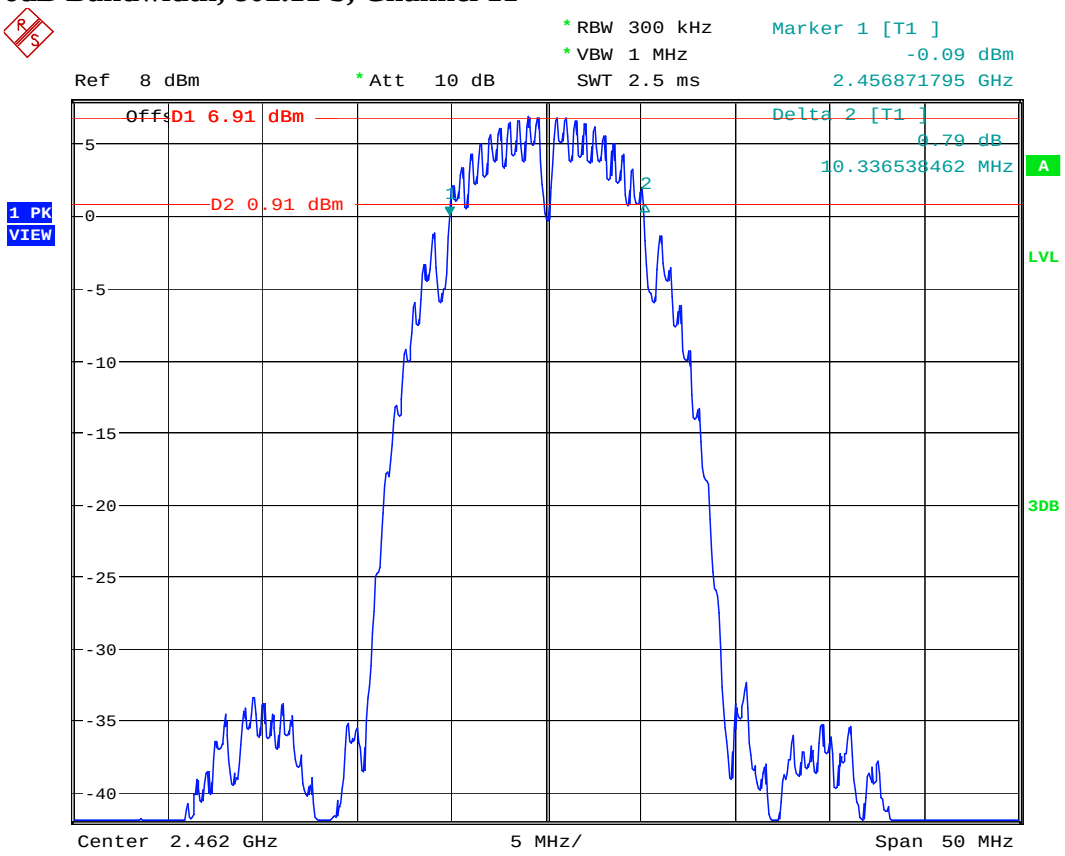
Date: 11.FEB.2010 10:03:51

6dB bandwidth, 802.11 b, Channel 6



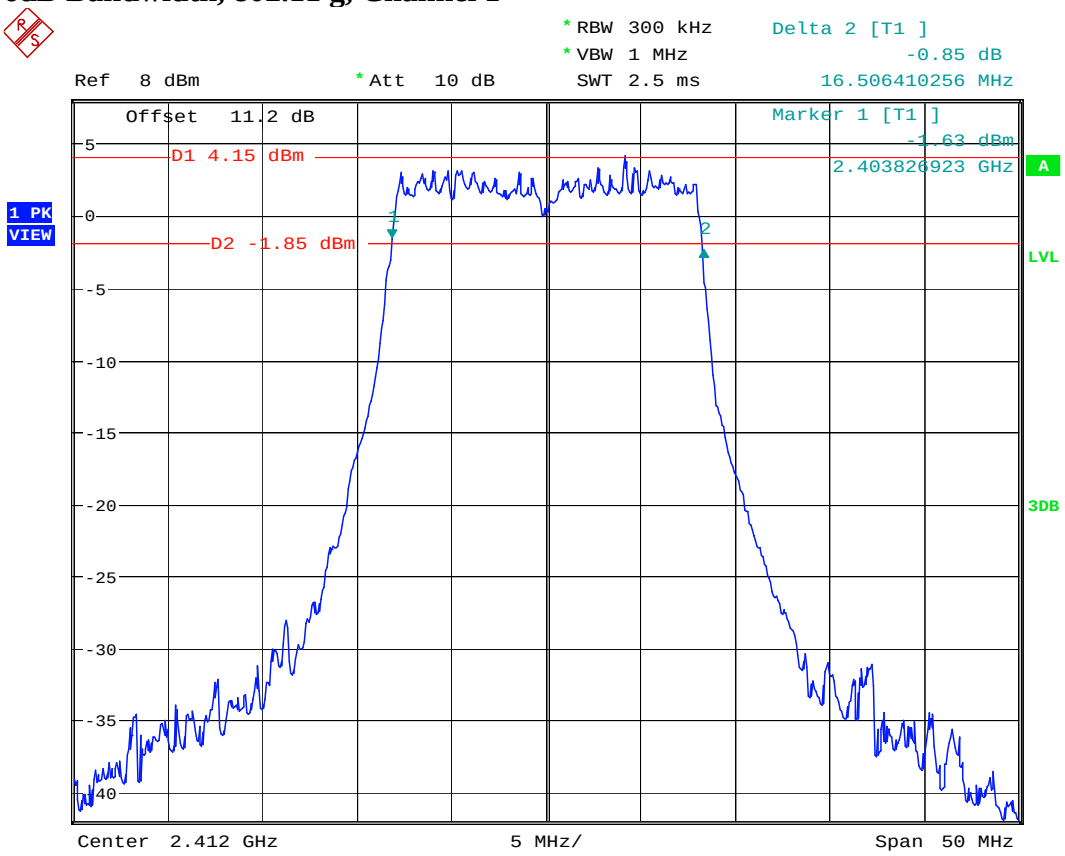
Date: 11.FEB.2010 10:07:04

6dB Bandwidth, 802.11 b, Channel 11



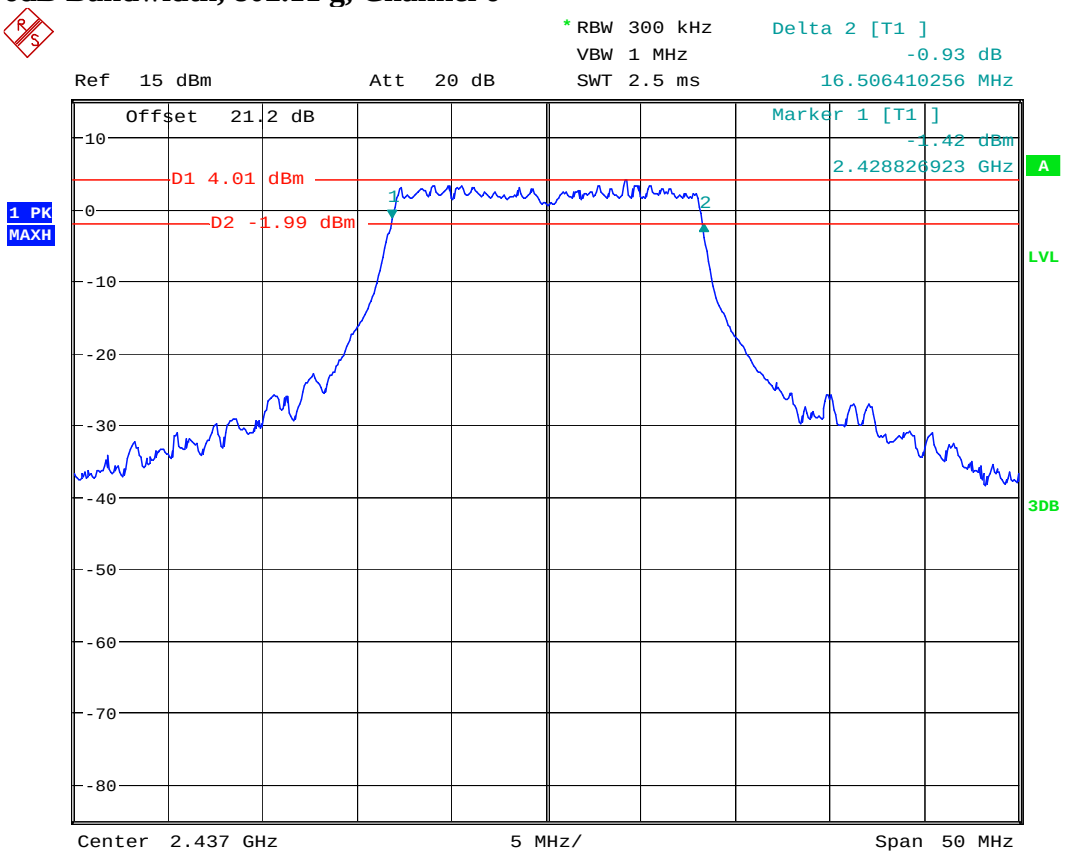
Date: 20.JAN.2010 14:35:54

6dB Bandwidth, 802.11 g, Channel 1



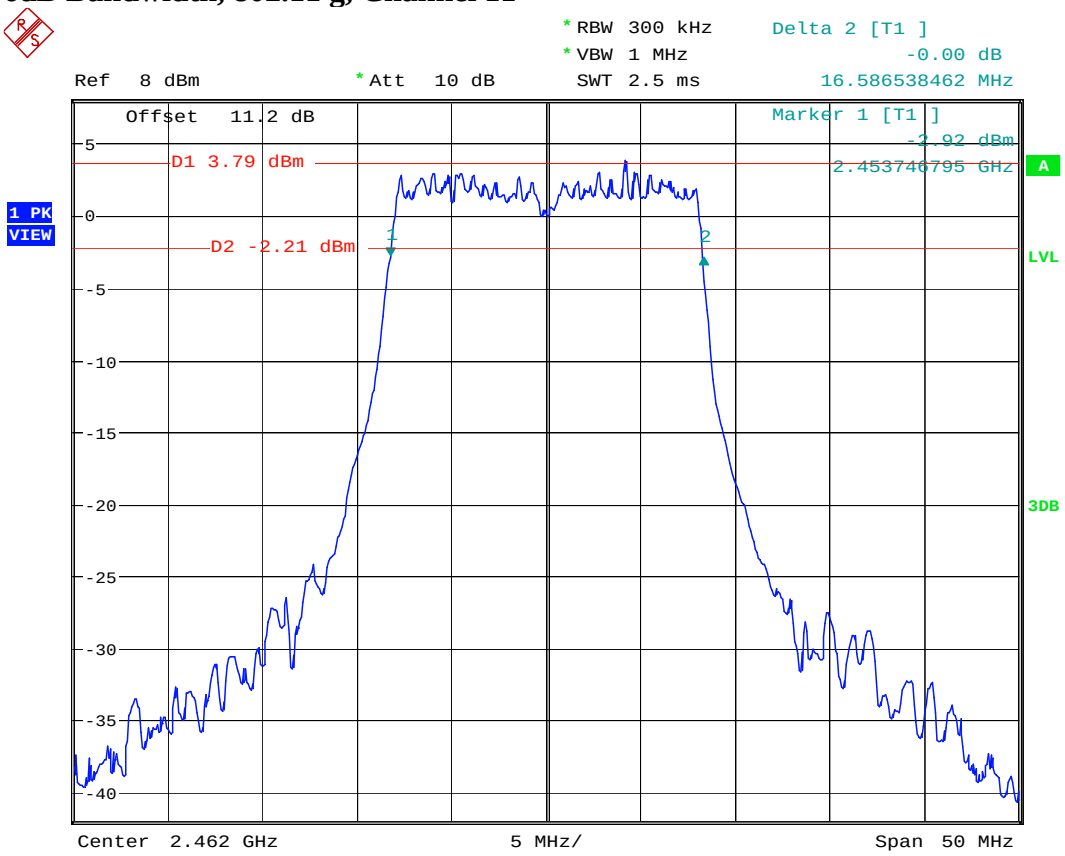
Date: 20.JAN.2010 15:03:16

6dB Bandwidth, 802.11 g, Channel 6



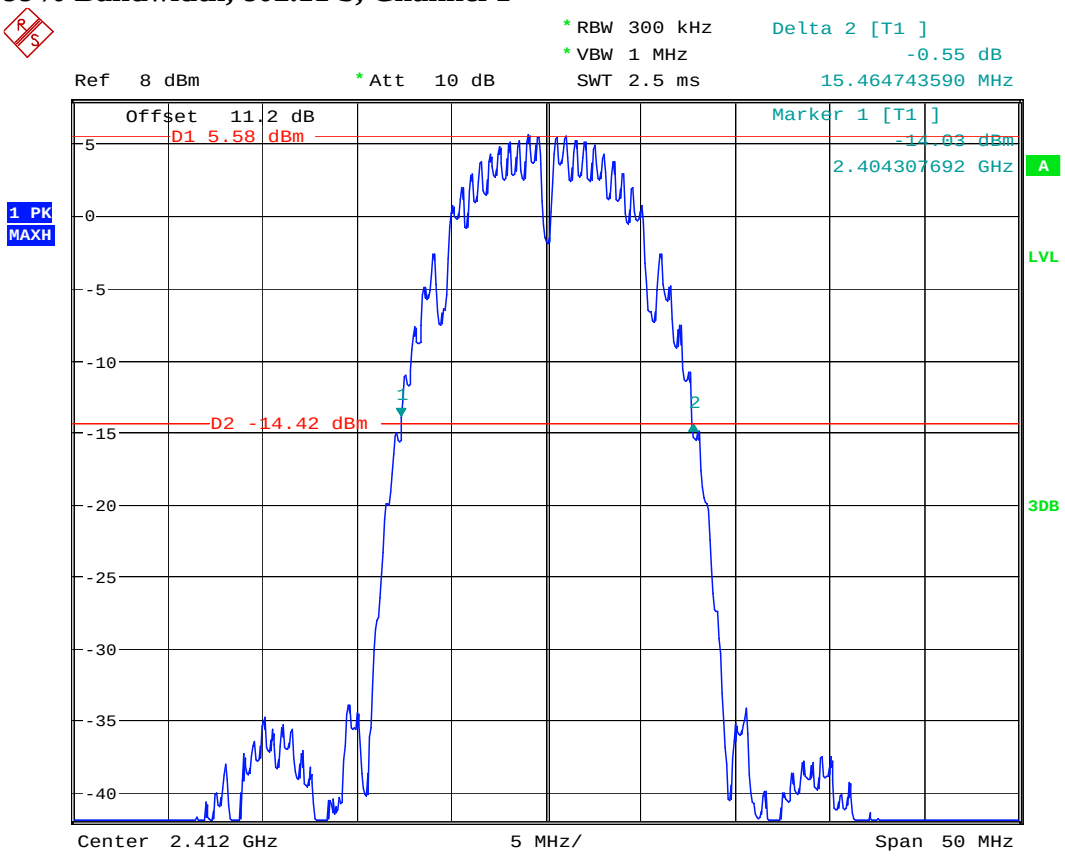
Date: 11.FEB.2010 10:09:40

6dB Bandwidth, 802.11 g, Channel 11



Date: 20.JAN.2010 15:13:50

99% Bandwidth, 802.11 b, Channel 1



Date: 20.JAN.2010 14:52:33

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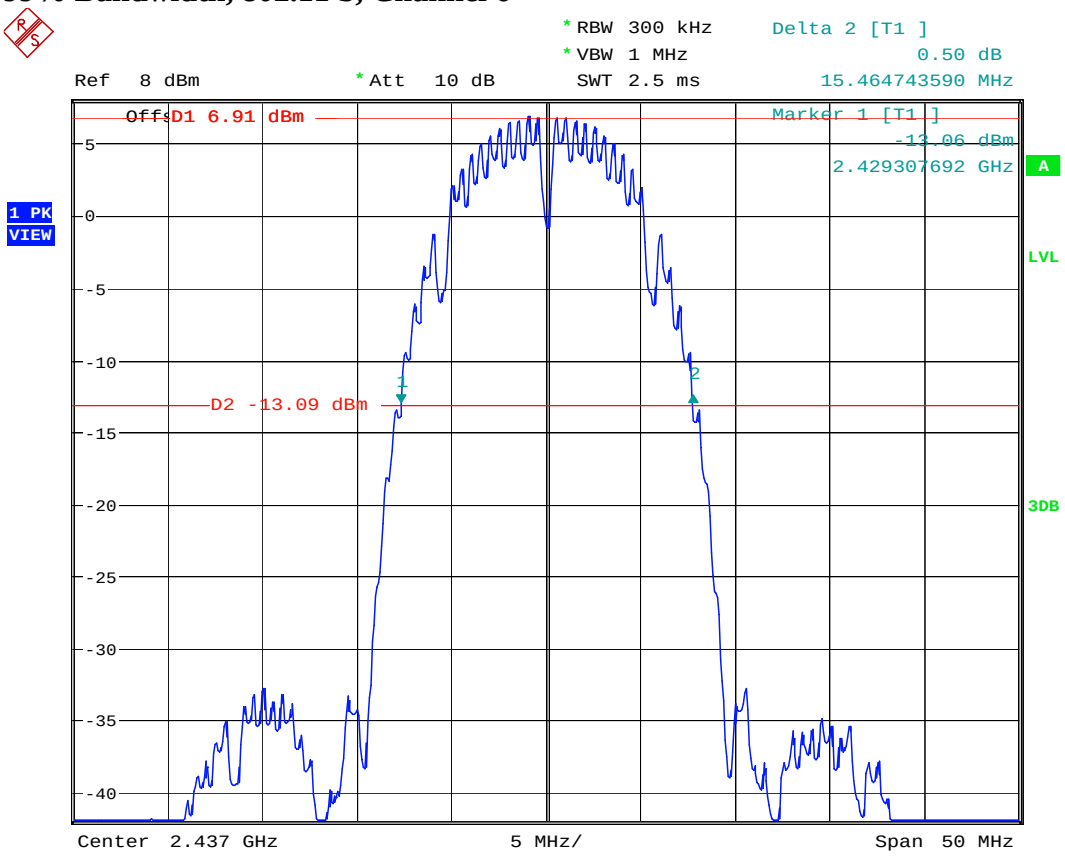
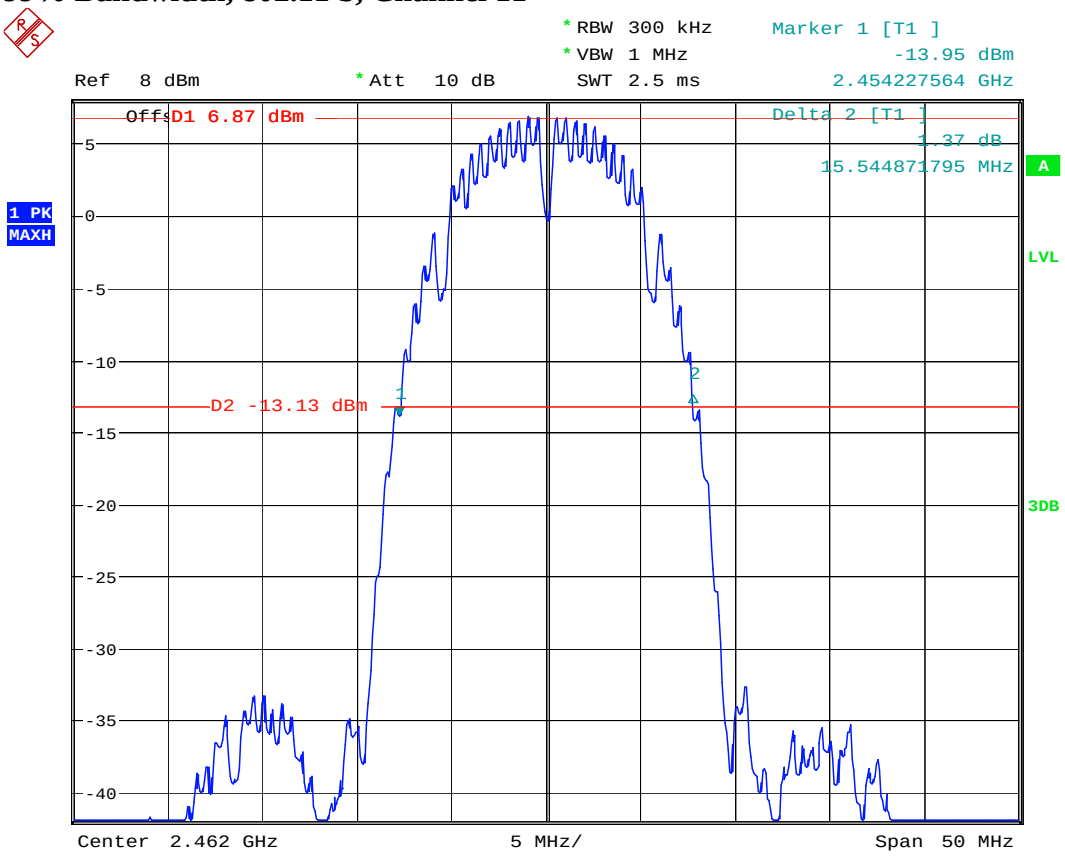


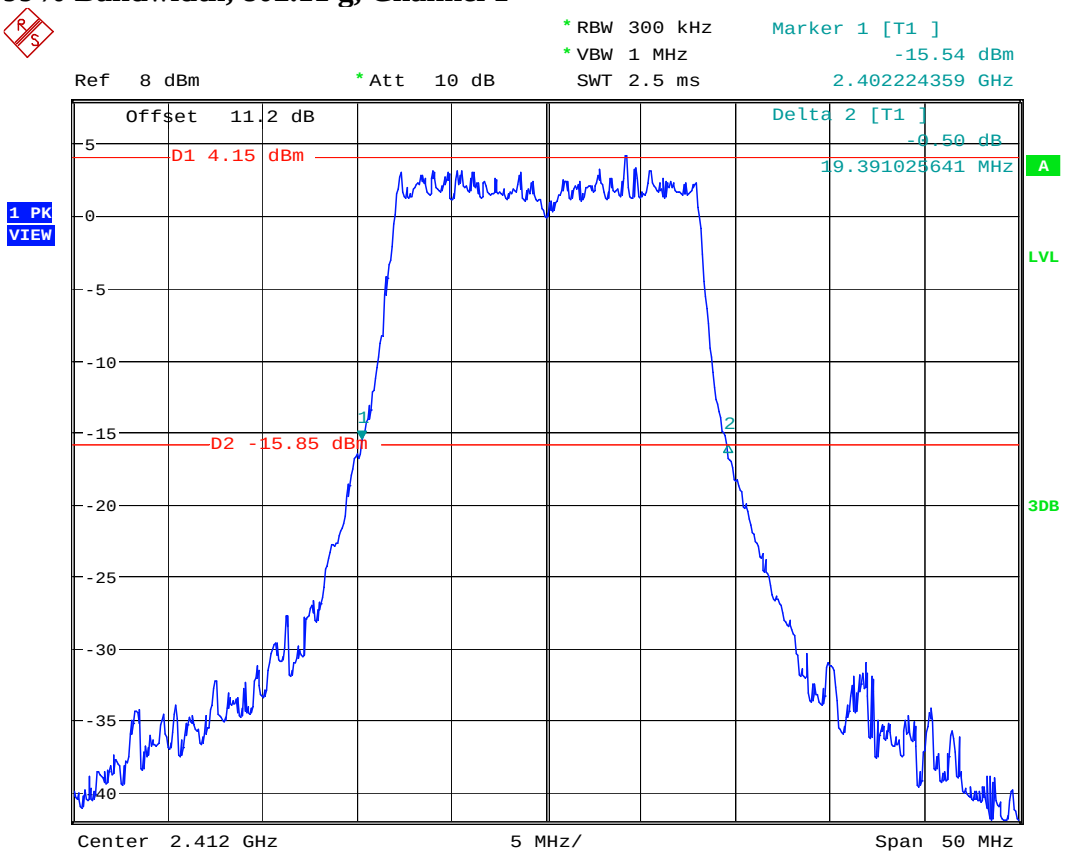
Date: 20.JAN.2010 14:50:34

99% Bandwidth, 802.11 b, Channel 11



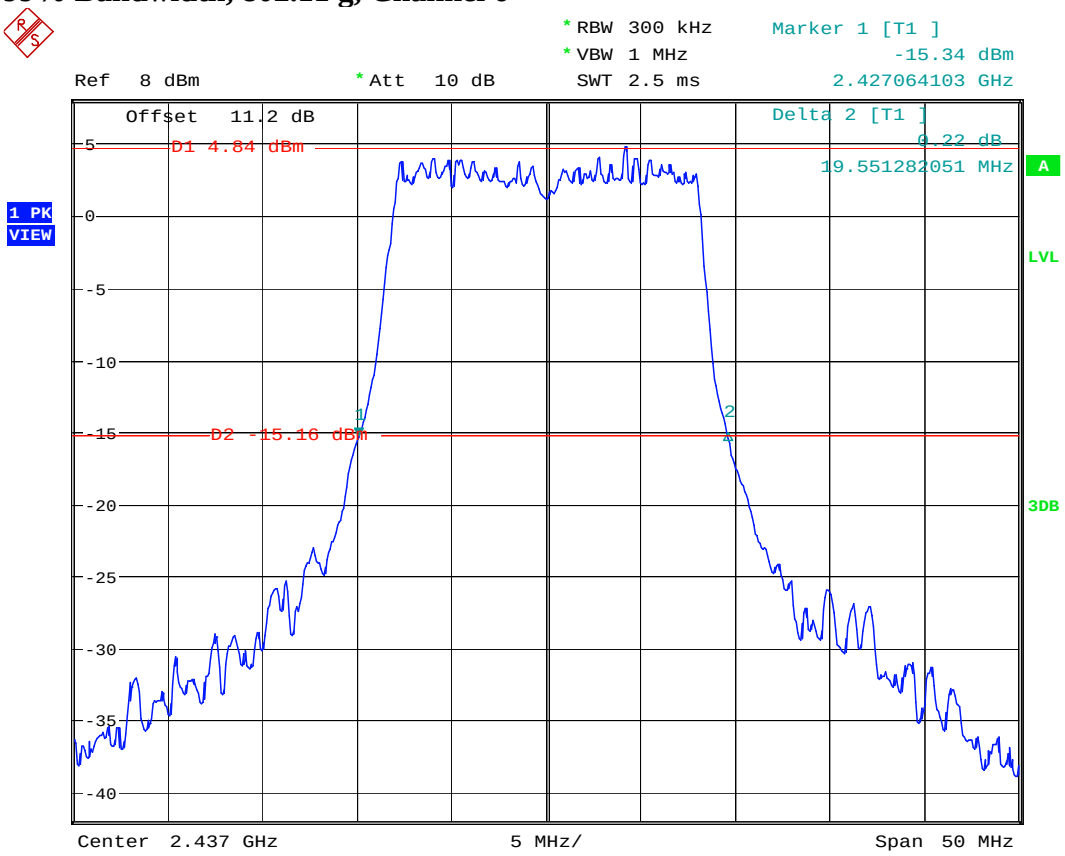
Date: 20.JAN.2010 14:54:34

99% Bandwidth, 802.11 g, Channel 1



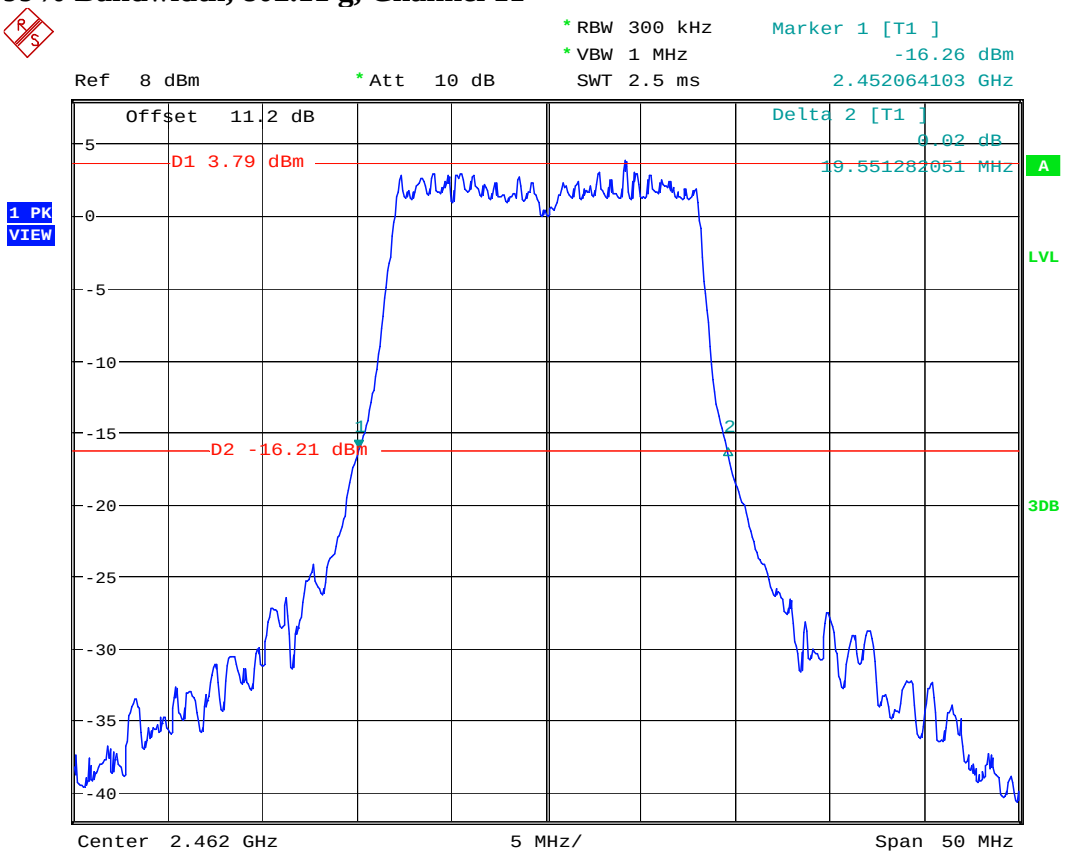
Date: 20.JAN.2010 15:06:14

99% Bandwidth, 802.11 g, Channel 6



Date: 20.JAN.2010 15:09:15

99% Bandwidth, 802.11 g, Channel 11



Date: 20.JAN.2010 15:11:55

5.2 Conducted Power Measurement

5.2.1 Limit

FCC15.247 (b)(3): For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt

RSS210 A8.4(4): For systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz, the maximum peak conducted output power shall not exceed 1 W. Except as provided in Section A8.4(5), the e.i.r.p. shall not exceed 4 W.

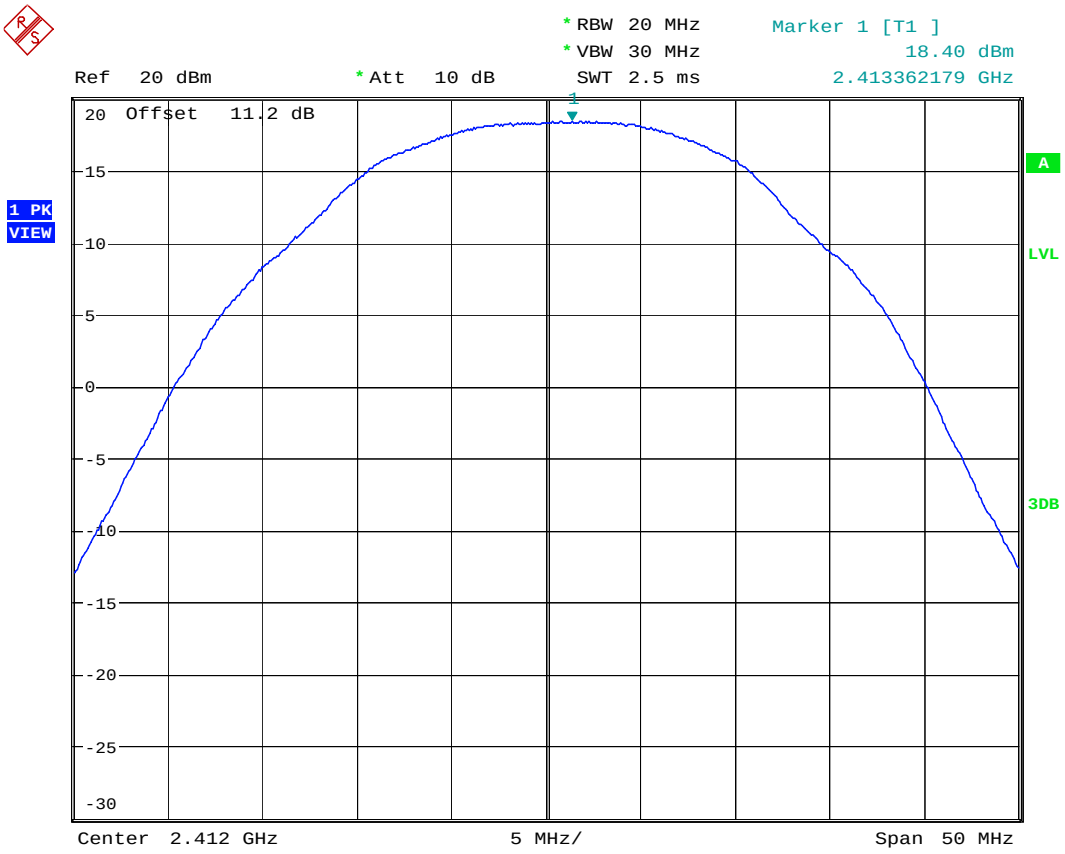
5.2.2 Results

Conducted power measurements were made using a spectrum analyzer.

TEST CONDITIONS T_{nom}(23)°C, V_{nom}VDC	Channel Frequency	Peak (dBm)	Peak (mW)	Verdict
Sub-band 1: 2400-2483.5MHz (802.11b)	2412	**18.40**	**69.18**	PASS
	2437	**19.59**	**90.99**	PASS
	2462	**19.57**	**90.57**	PASS
Sub-band 1: 2400-2483.5MHz (802.11g)	2412	**22.66**	**184.50**	PASS
	2437	**22.89**	**194.54**	PASS
	2462	**22.05**	**160.32**	PASS

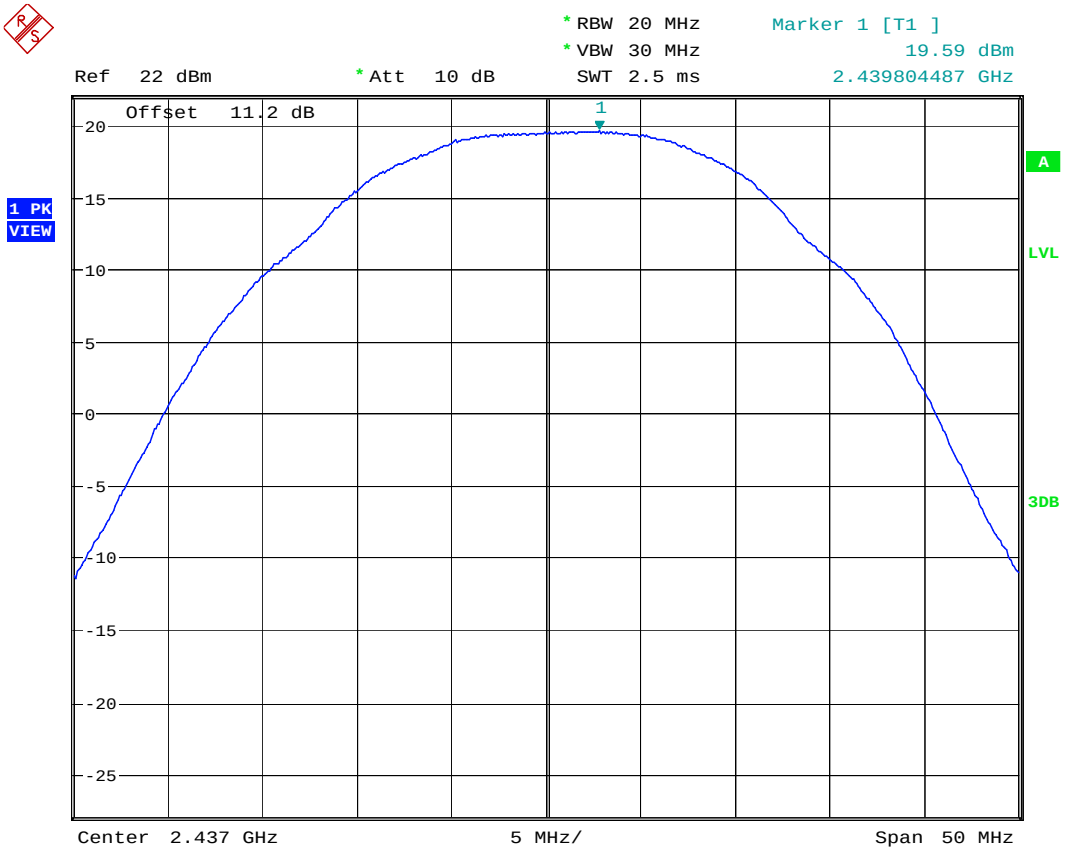
5.3 Test Data/Plots

802.11b 2412MHz



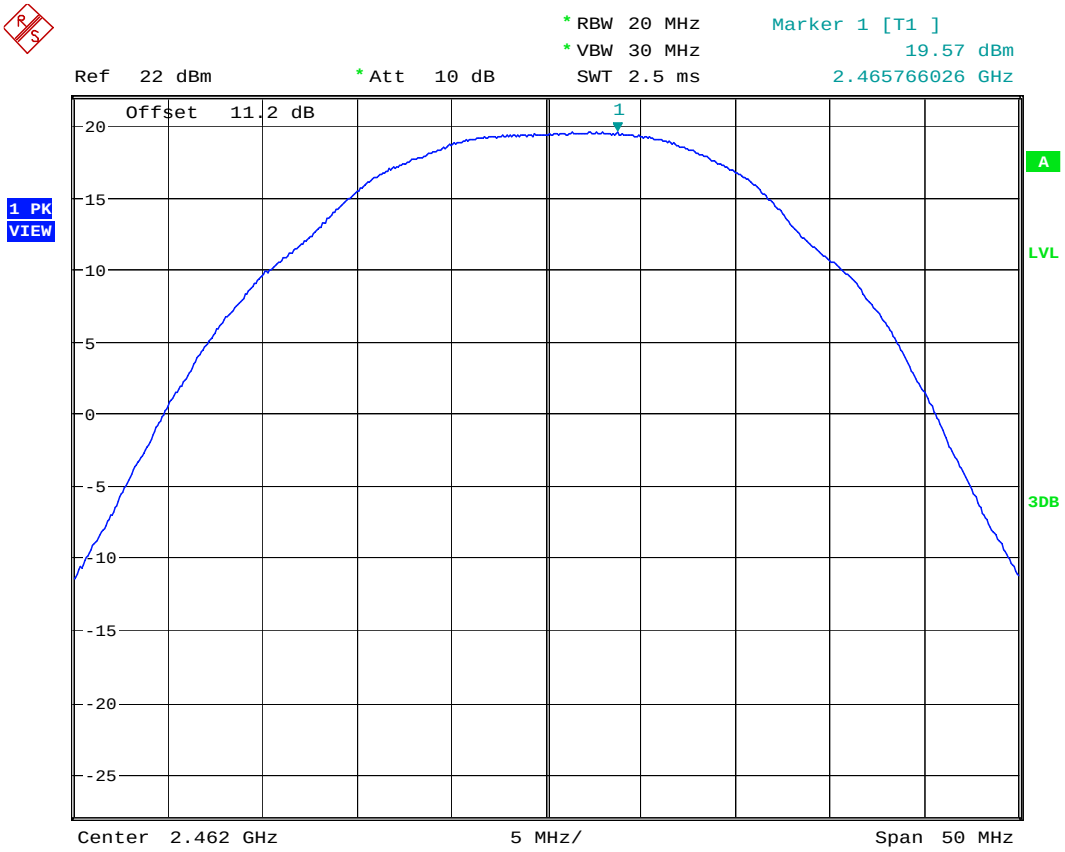
Date: 20.JAN.2010 15:47:06

802.11b 2437MHz



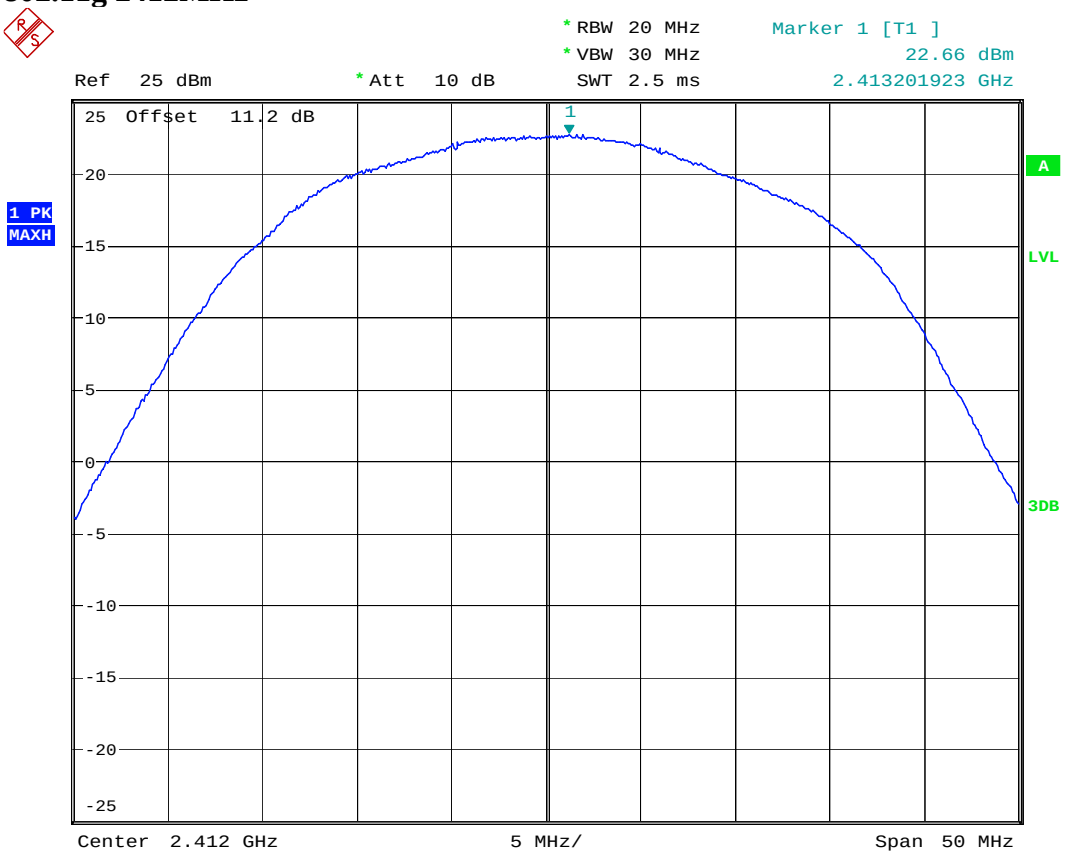
Date: 20.JAN.2010 15:48:18

802.11b 2462MHz



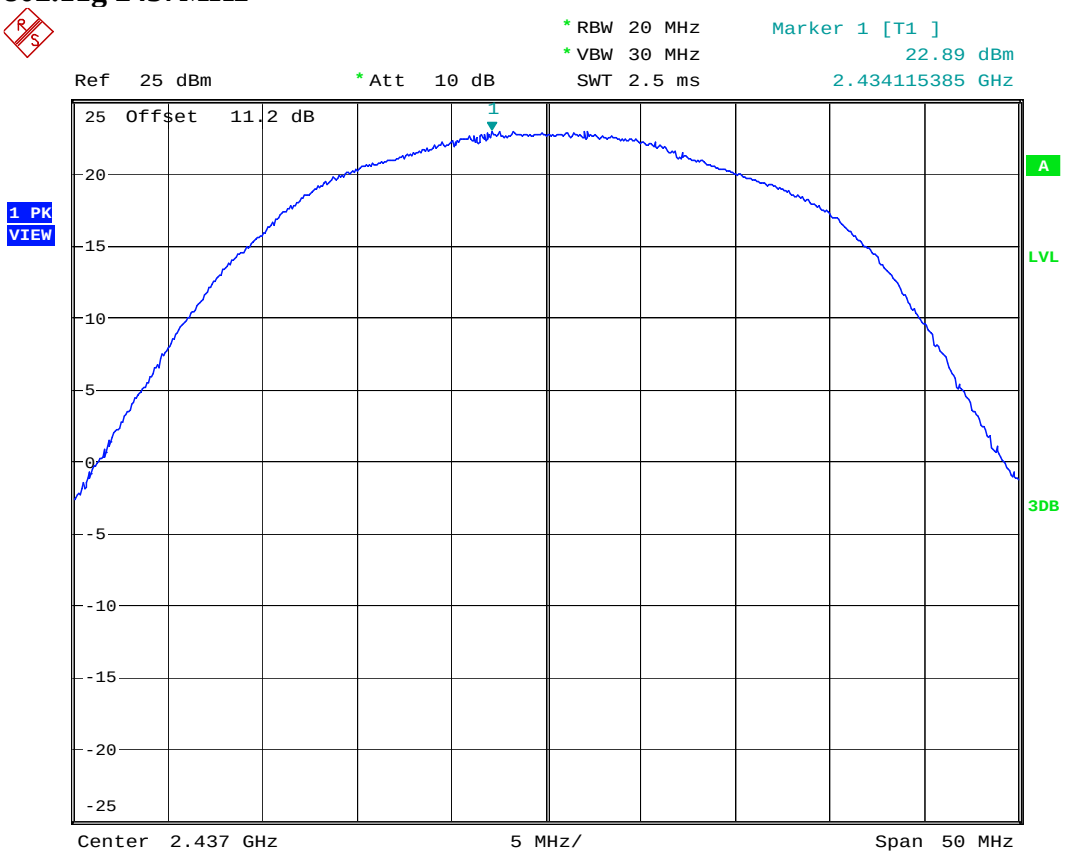
Date: 20.JAN.2010 15:49:38

802.11g 2412MHz



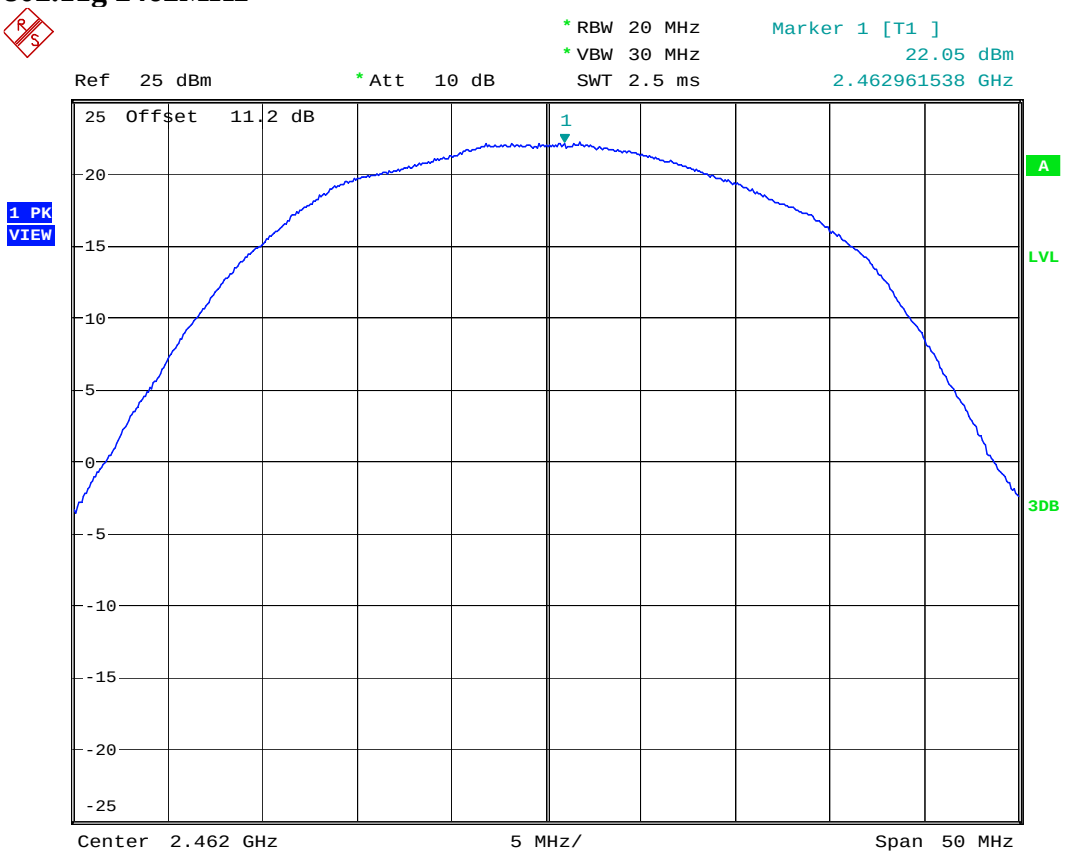
Date: 20.JAN.2010 15:40:45

802.11g 2437MHz



Date: 20.JAN.2010 15:41:50

802.11g 2462MHz



Date: 20.JAN.2010 15:44:10

5.4 Power Spectral Density

5.4.1 Limit

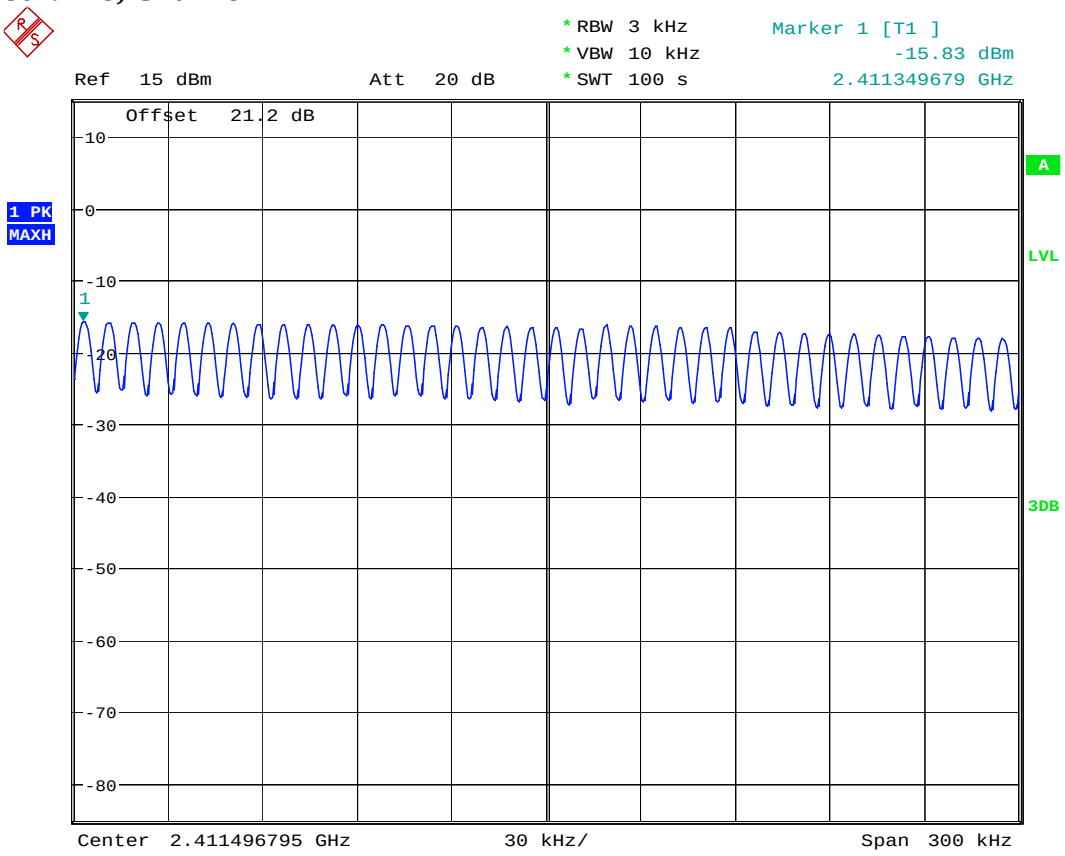
FCC 15.247 (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

5.4.2 Results

TEST CONDITIONS T_{nom}(23)°C, V_{nom}VDC	Channel Frequency	PSD (dBm)	Verdict
Sub-band 1: 2400-2483.5MHz (802.11b)	2412	**-15.83**	PASS
	2442	**-11.23**	PASS
	2472	**-11.74**	PASS
Sub-band 1: 2400-2483.5MHz (802.11g)	2412	**-10.26**	PASS
	2442	**-9.13**	PASS
	2472	**-9.75**	PASS

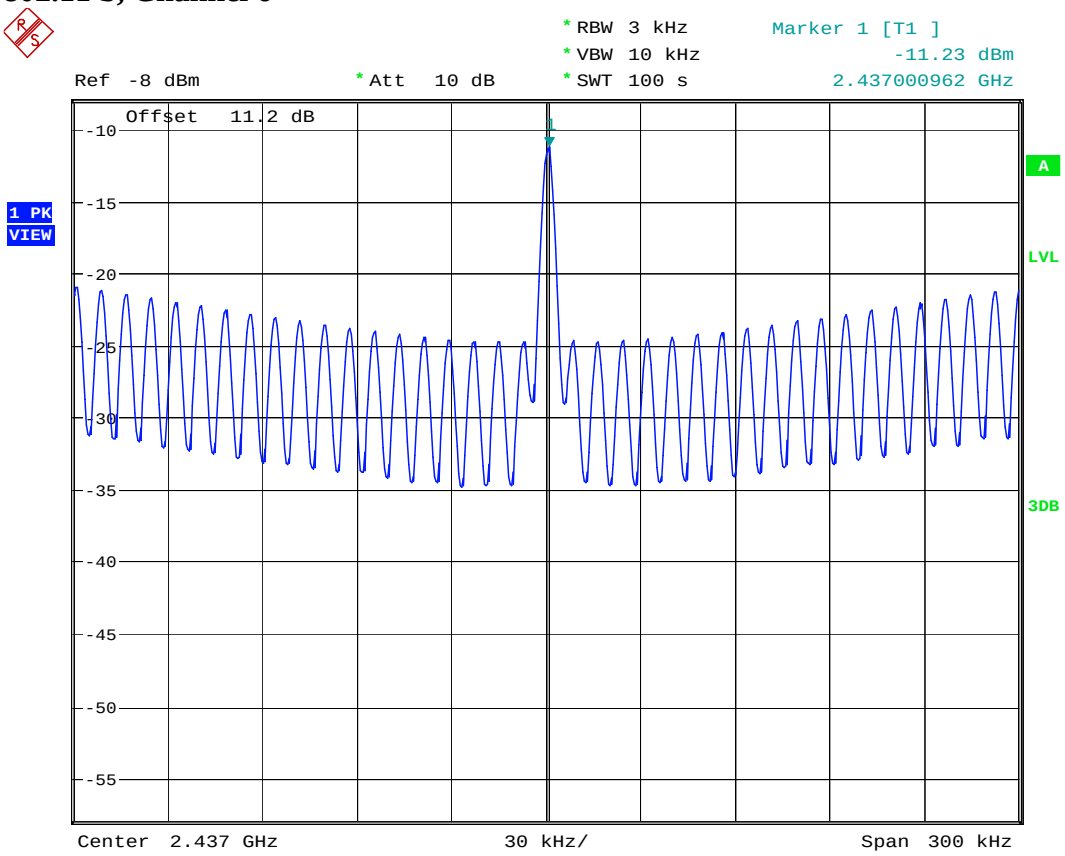
5.4.3 Plots

802.11 b, Channel 1



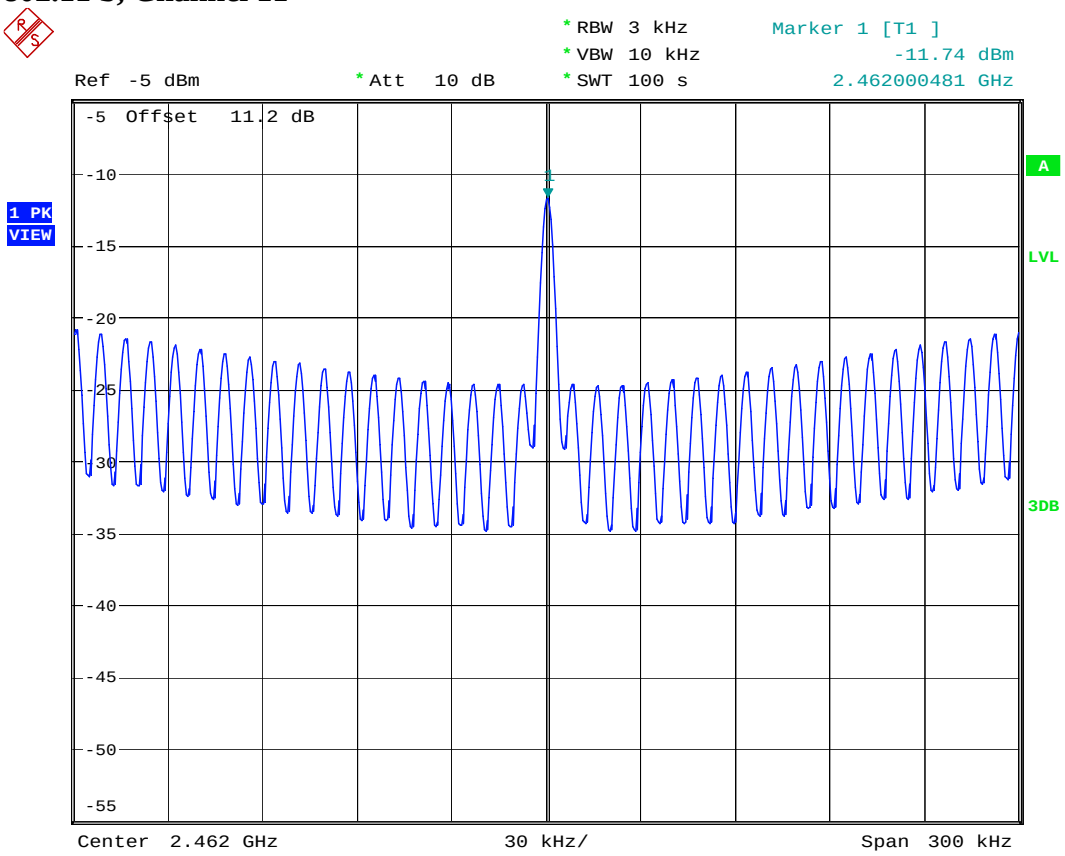
Date: 11.FEB.2010 10:20:06

802.11 b, Channel 6



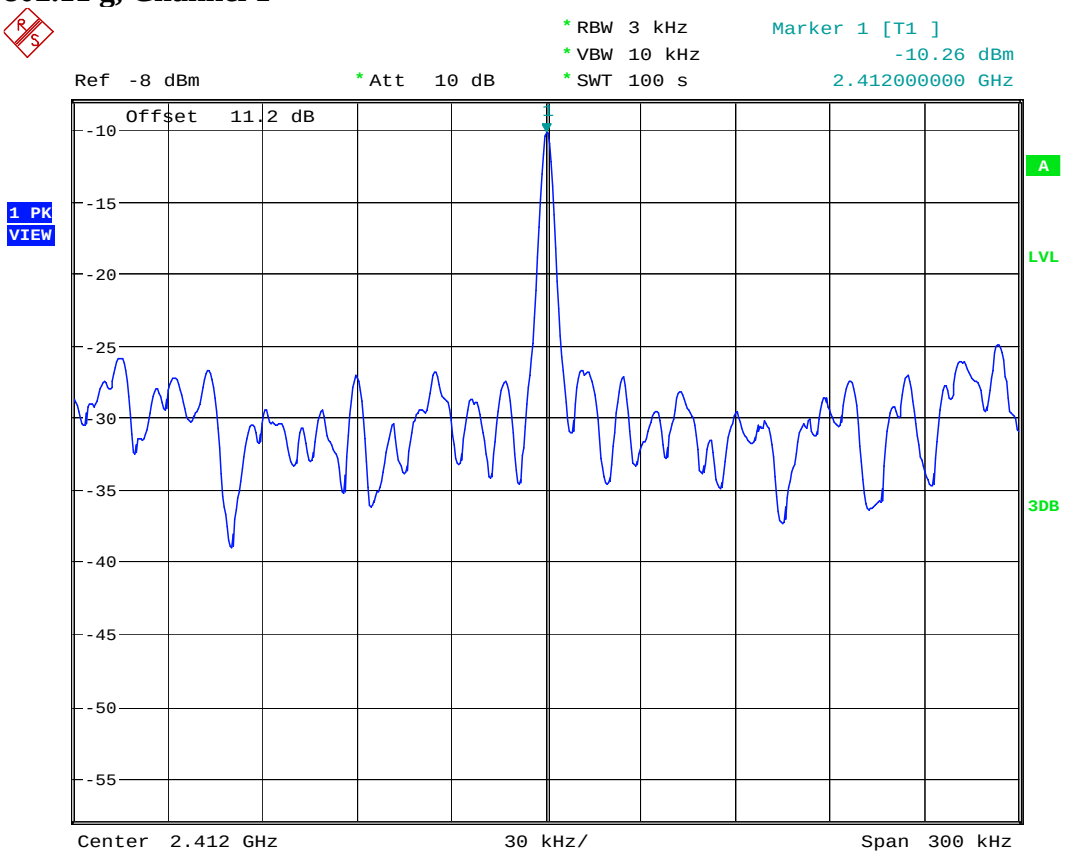
Date: 20.JAN.2010 16:15:43

802.11 b, Channel 11



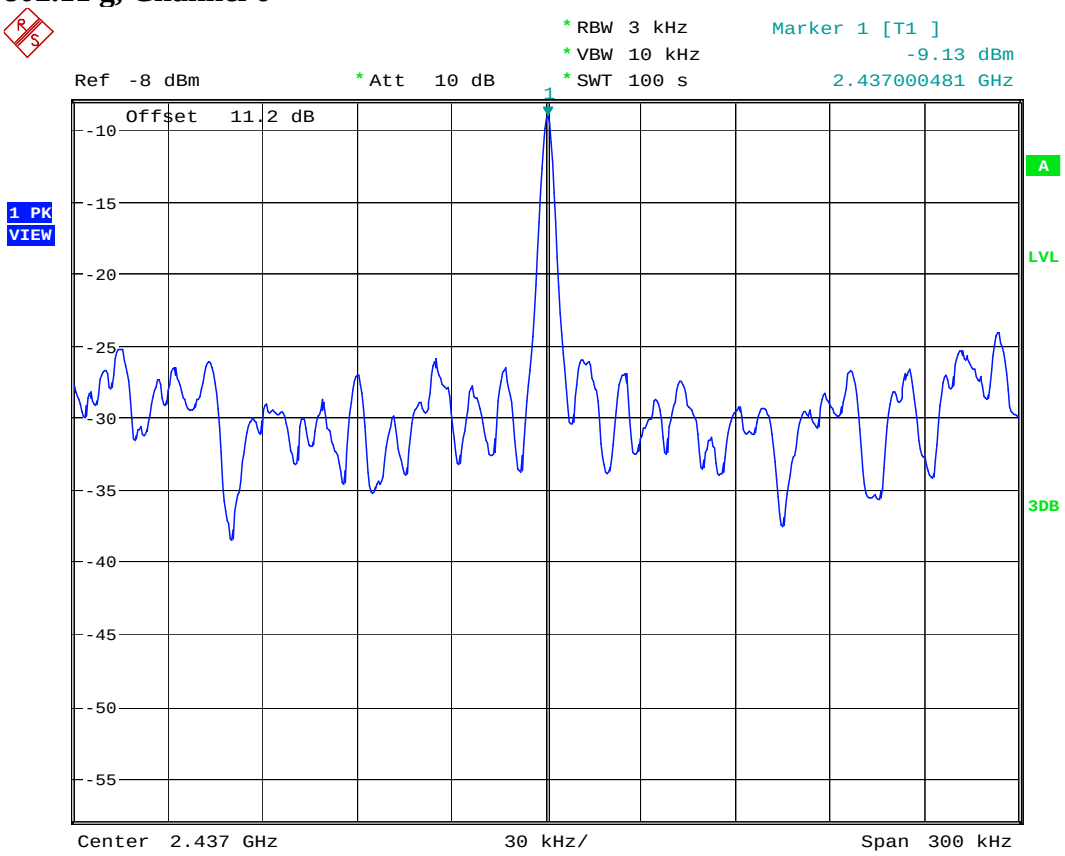
Date: 20.JAN.2010 16:06:26

802.11 g, Channel 1



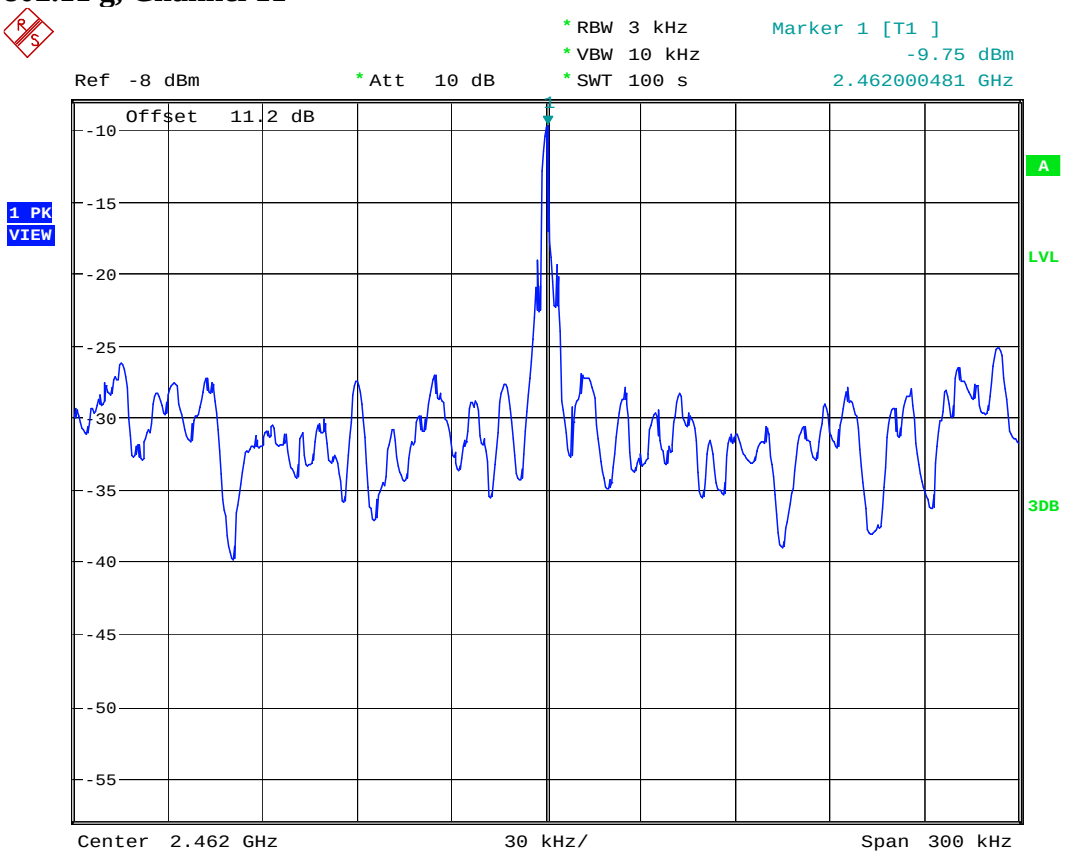
Date: 20.JAN.2010 16:28:53

802.11 g, Channel 6



Date: 20.JAN.2010 16:33:35

802.11 g, Channel 11



Date: 20.JAN.2010 16:36:57

5.5 Conducted Spurious Emission

5.5.1 Limit

§15.247(d) & RSS-210 (A8.5): -30dBc

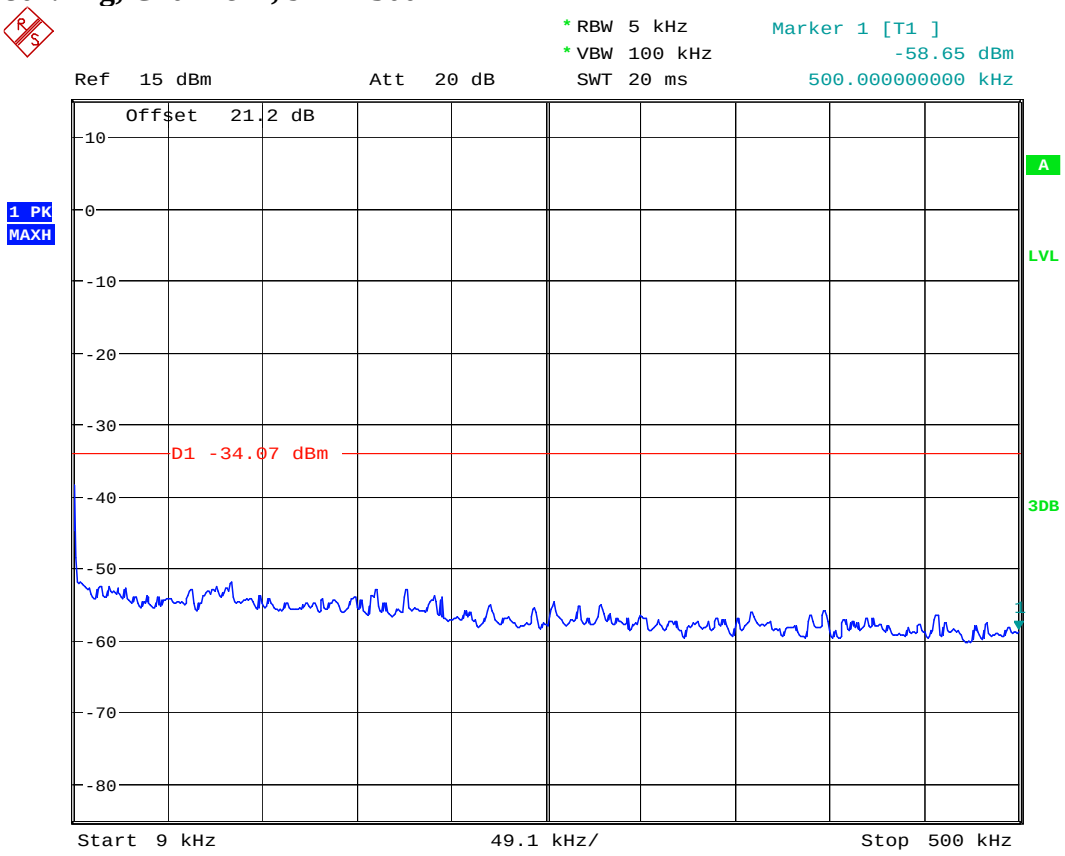
5.5.2 Results:

TEST CONDITIONS T_{nom}(23)°C, V_{nom}VDC	Channel Frequency	Verdict
Sub-band 1: 2400-2483.5MHz (802.11g)	2412	PASS
	2442	PASS
	2472	PASS

Plots represent worst case of all modes.

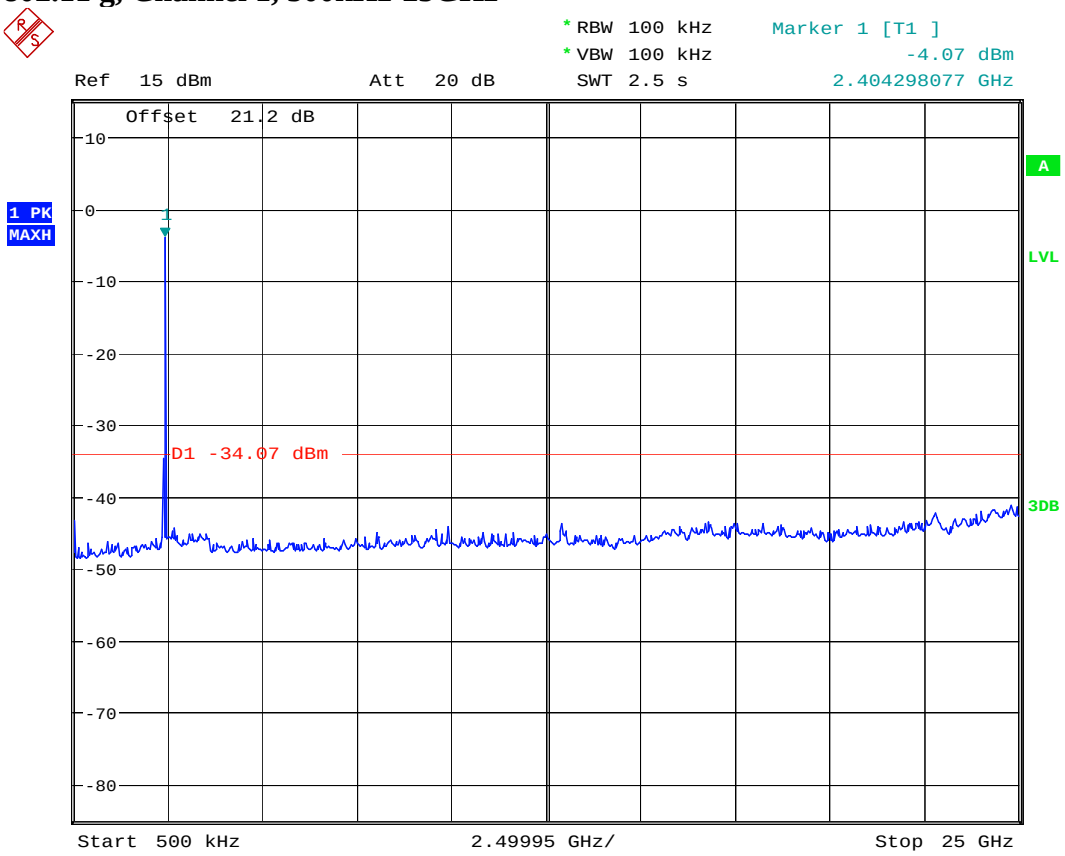
5.5.3 Plots

802.11 g, Channel 1, 9kHz-500kHz



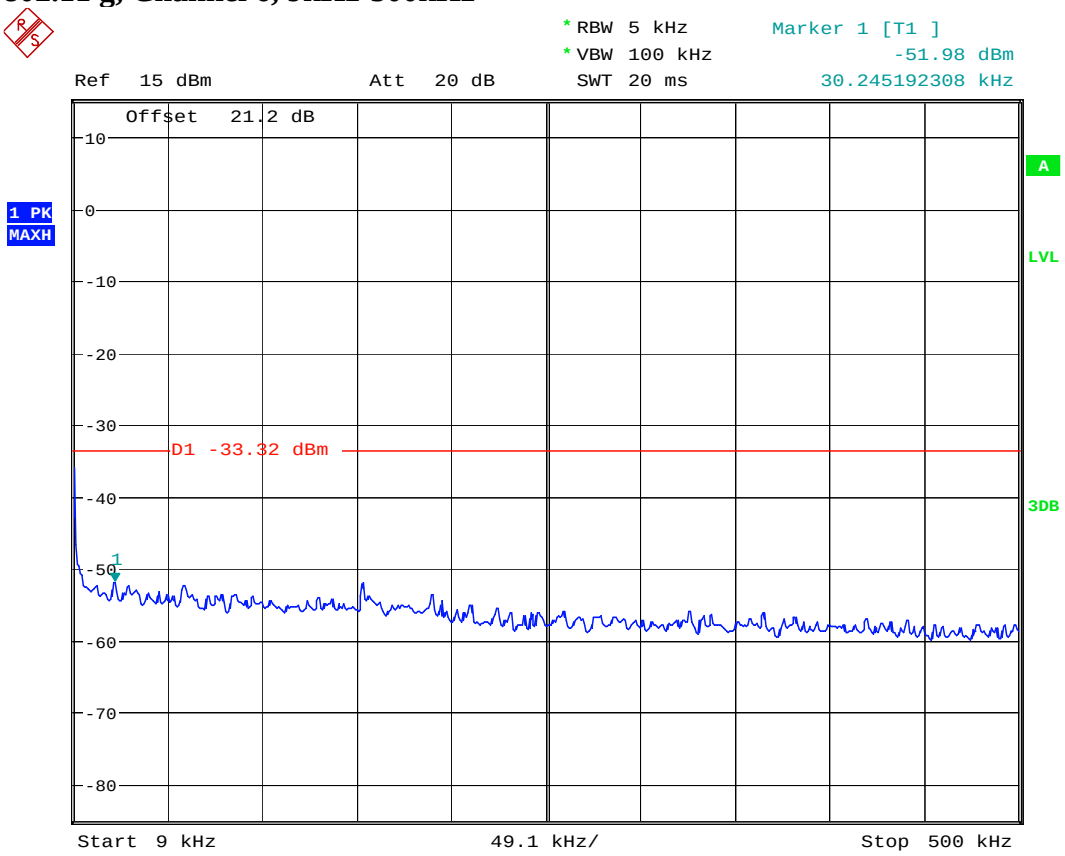
Date: 11.FEB.2010 10:27:41

802.11 g, Channel 1, 500kHz-25GHz



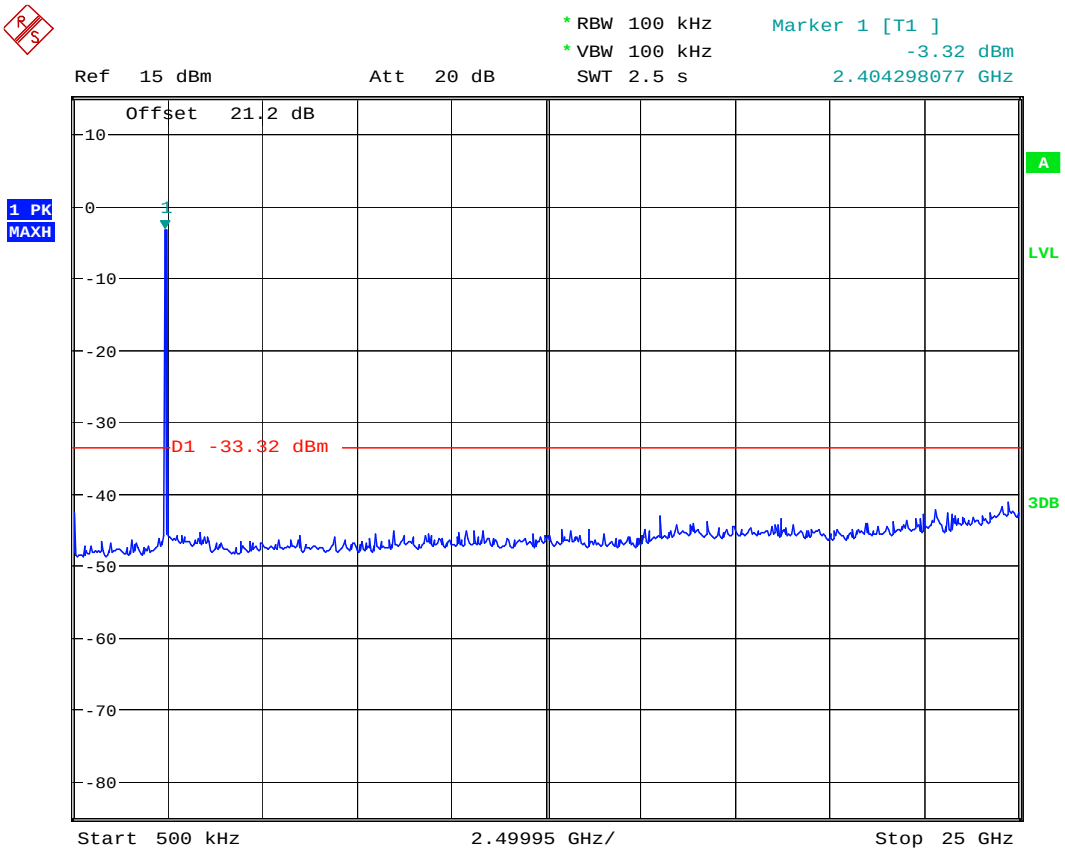
Date: 11.FEB.2010 10:26:19

802.11 g, Channel 6, 9kHz-500kHz



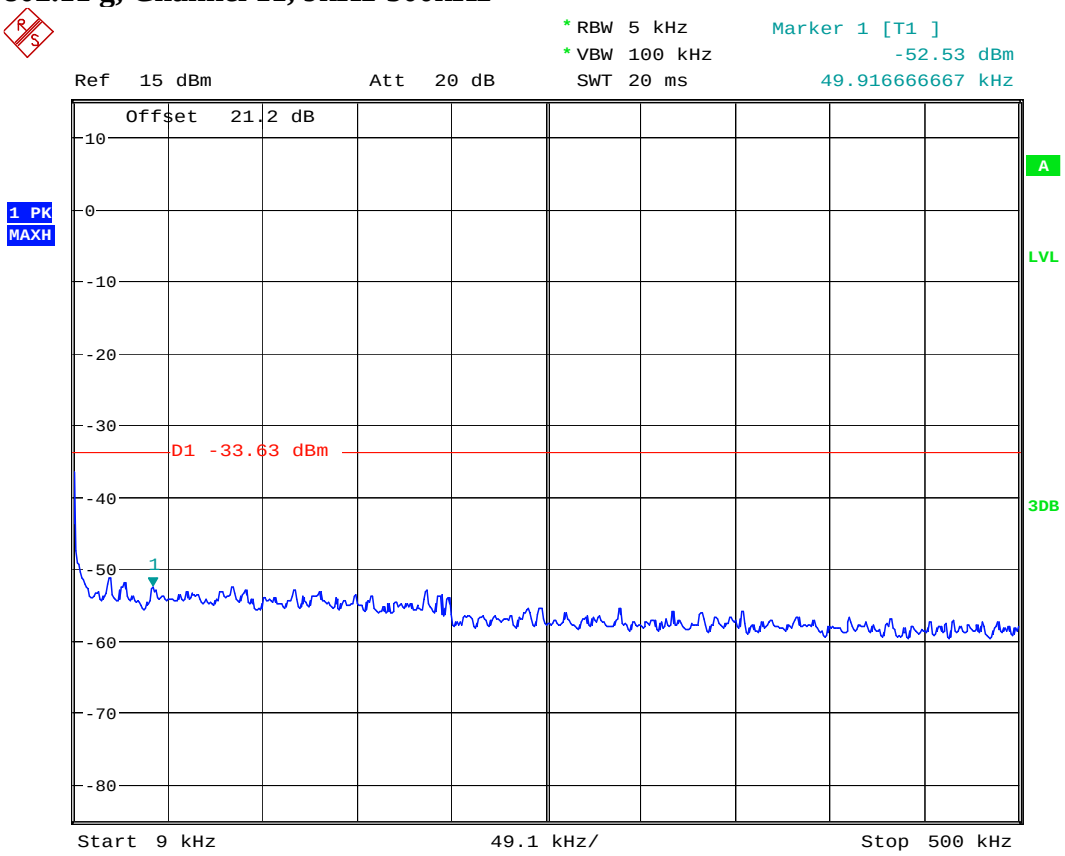
Date: 11.FEB.2010 10:30:39

802.11 g, Channel 6, 500kHz-25GHz



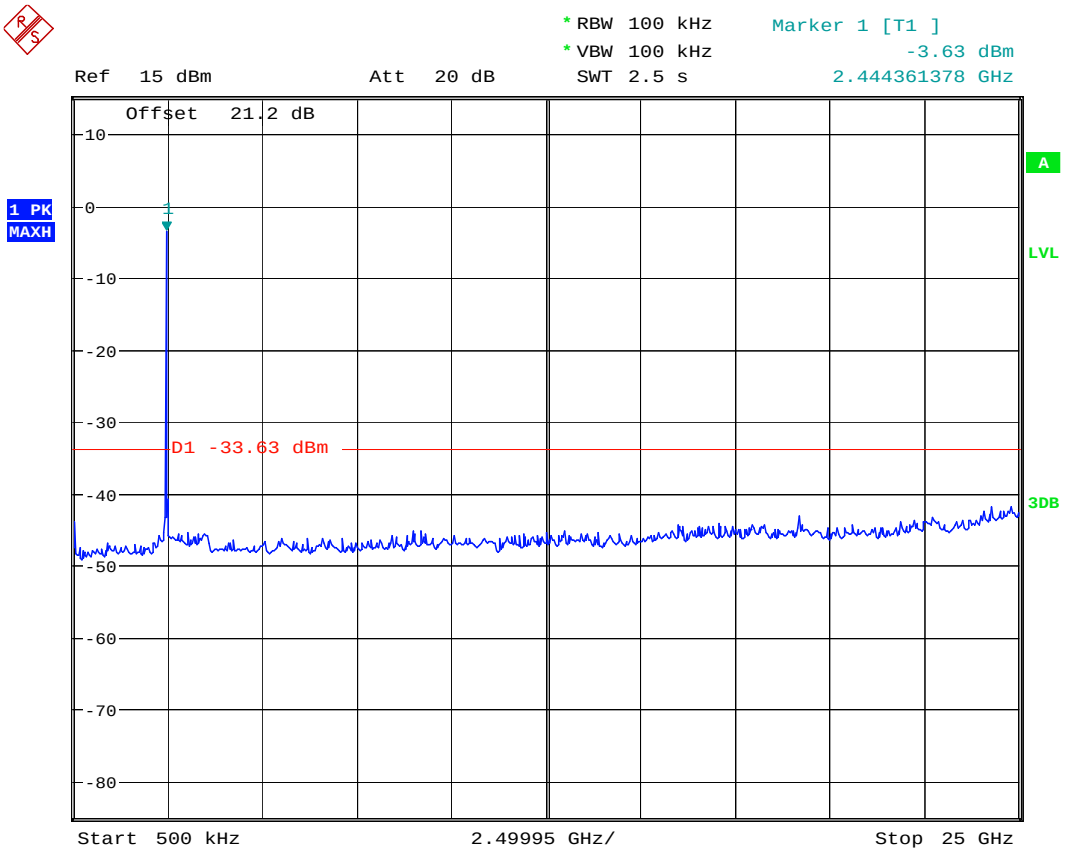
Date: 11.FEB.2010 10:29:38

802.11 g, Channel 11, 9kHz-500kHz



Date: 11.FEB.2010 10:32:55

802.11 g, Channel 11, 500kHz-25GHz



Date: 11.FEB.2010 10:32:05

5.6 AC POWER LINE CONDUCTED EMISSIONS § 15.107/207

5.6.1 LIMITS

Technical specification: 15.107 / 15.207 (Revised as of August 20, 2002)

§15.107 (a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Limit

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50
* Decreases with logarithm of the frequency		

ANALYZER SETTINGS: RBW = 10KHz VBW = 10KHz

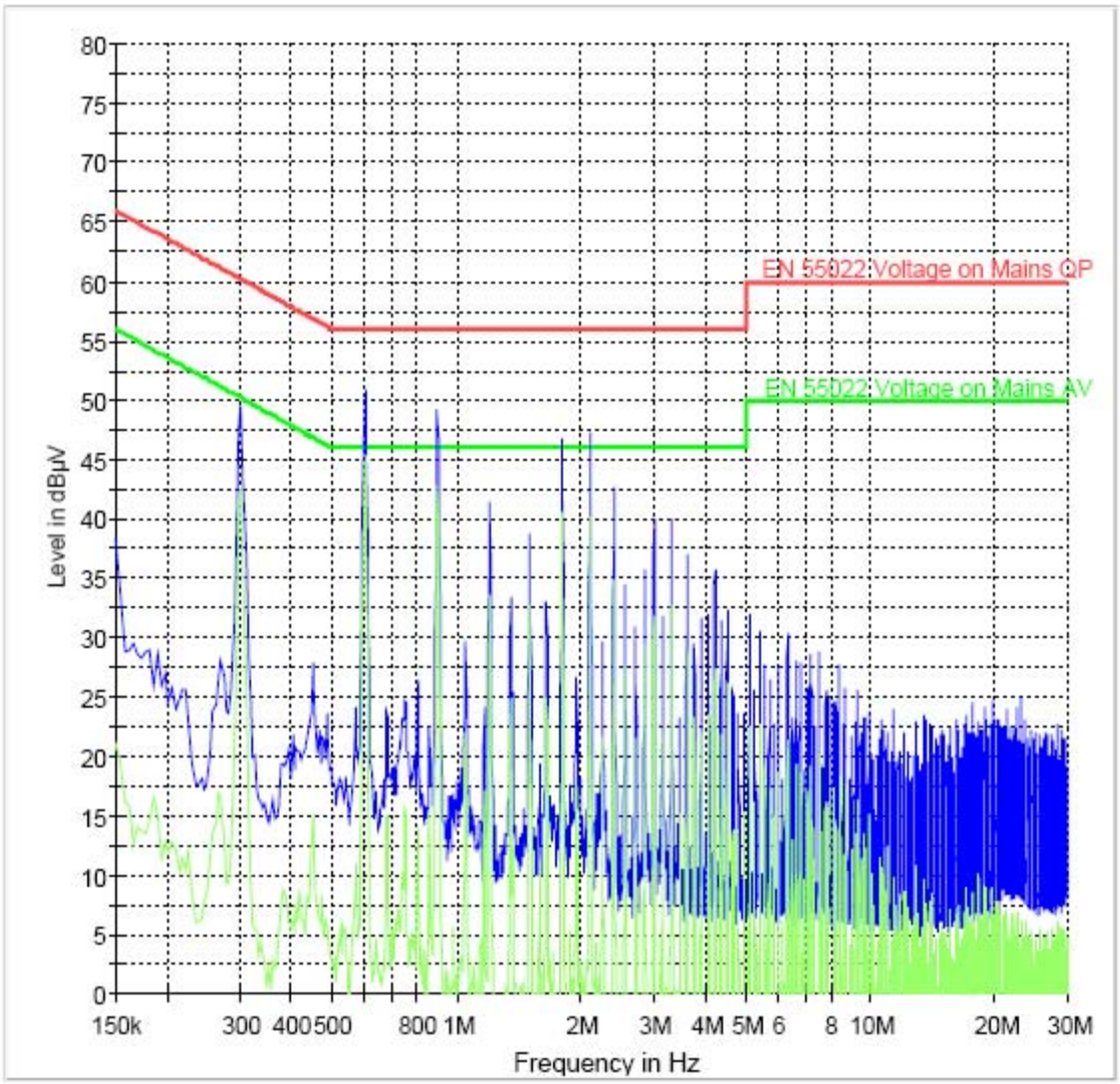
Note: AC Line Conducted Emission reported here are the worse cases among all operating modes.

5.6.2 RESULT:

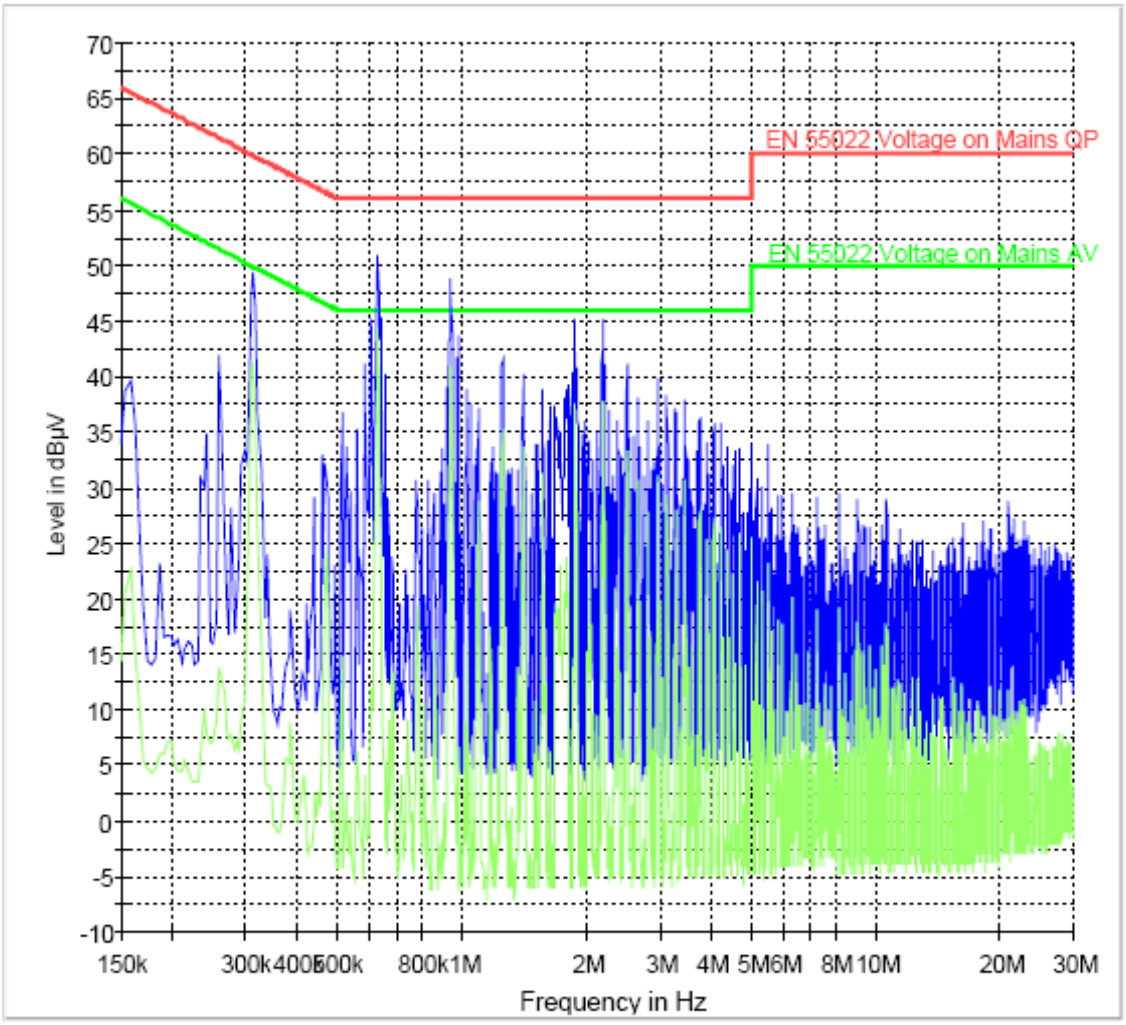
No significant emissions measurable. Plots reported here represent the worse case emissions for all modes.

5.6.3 PLOTS

Transmit



Receive


EN 55022 Voltage on Mains QP
EN 55022 Voltage on Mains AV
Level in dBµV
Frequency in Hz
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
150k
300k
400k
500k
800k
1M
2M
3M
4M
5M
6M
8M
10M
20M
30M
EN 55022 Voltage on Mains QP.LimitLine
Preview Result 1
EN 55022 Voltage on Mains AV.LimitLine
Preview Result 2

6 Radiated Measurements

6.1 Maximum Peak Output Power § 15.247 (b)(1) (Radiated)

6.1.1 Limits

FCC15.247 (b) (1): 4W (36dBm), with antenna gain < 6dBi.
RSS-210 A8.4 (4): 4W (36dBm)

6.1.2 Results:

EIRP is calculated from peak conducted power and antenna gain.

EIRP=Conducted Peak power +Antenna Gain: Antenna gain=-3.7 dBi

EIRP 802.11 b/g Mode:

TEST CONDITIONS T_{nom}(23)°C, V_{nom}VDC	Channel Frequency	EIRP (dBm)	EIRP (mW)	Verdict
Sub-band 1: 2400-2483.5MHz (802.11b)	2412	**14.70**	**29.51**	PASS
	2437	**15.89**	**38.82**	PASS
	2462	**15.87**	**38.63**	PASS
Sub-band 1: 2400-2483.5MHz (802.11g)	2412	**18.96**	**78.70**	PASS
	2437	**19.19**	**82.99**	PASS
	2462	**18.35**	**68.39**	PASS

6.2 Restricted Band Edge Compliance §15.247/15.205

6.2.1 Limits

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

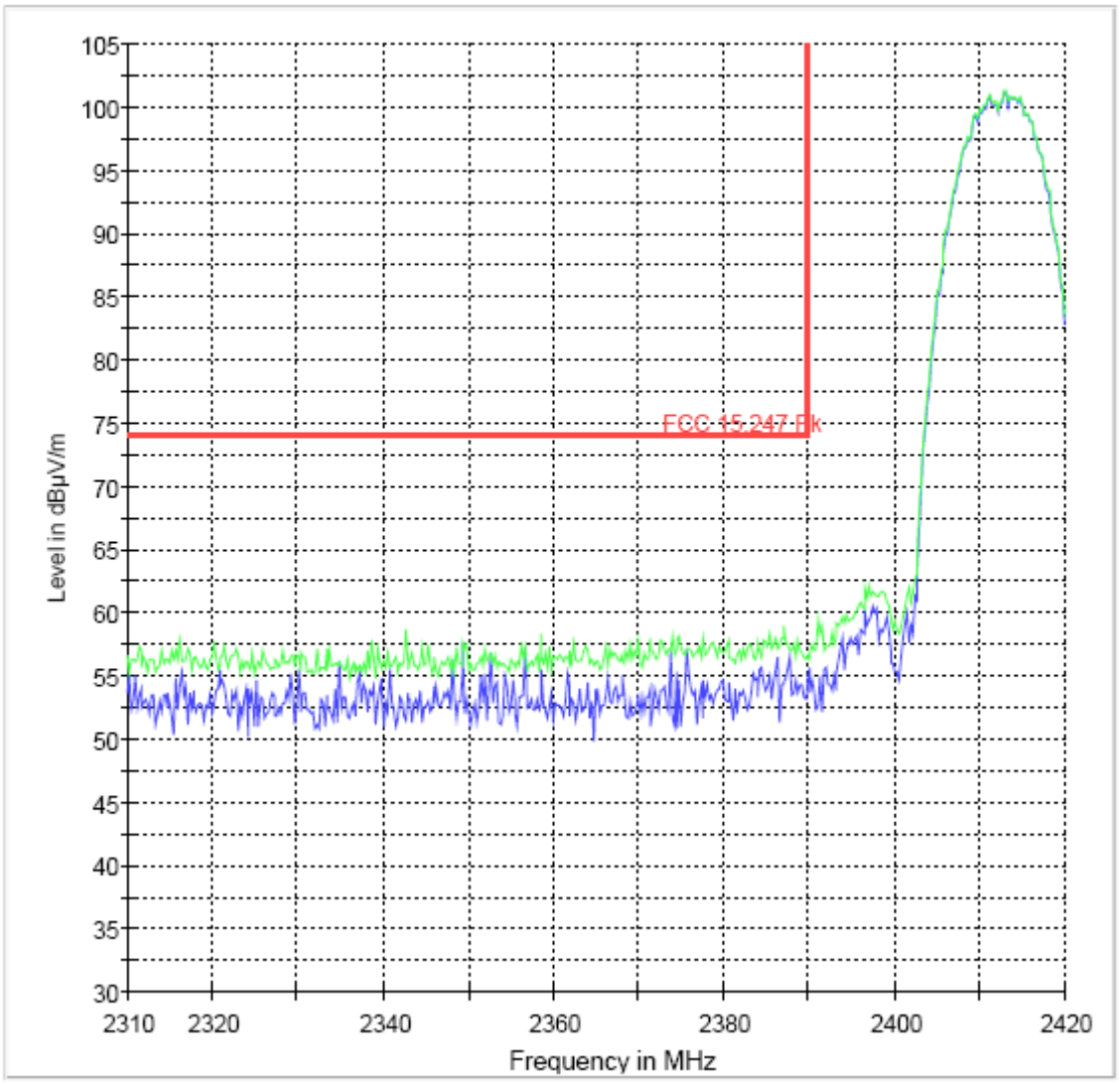
MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

***PEAK LIMIT= 74dBuV/m**
***AVG. LIMIT= 54dBuV/m**

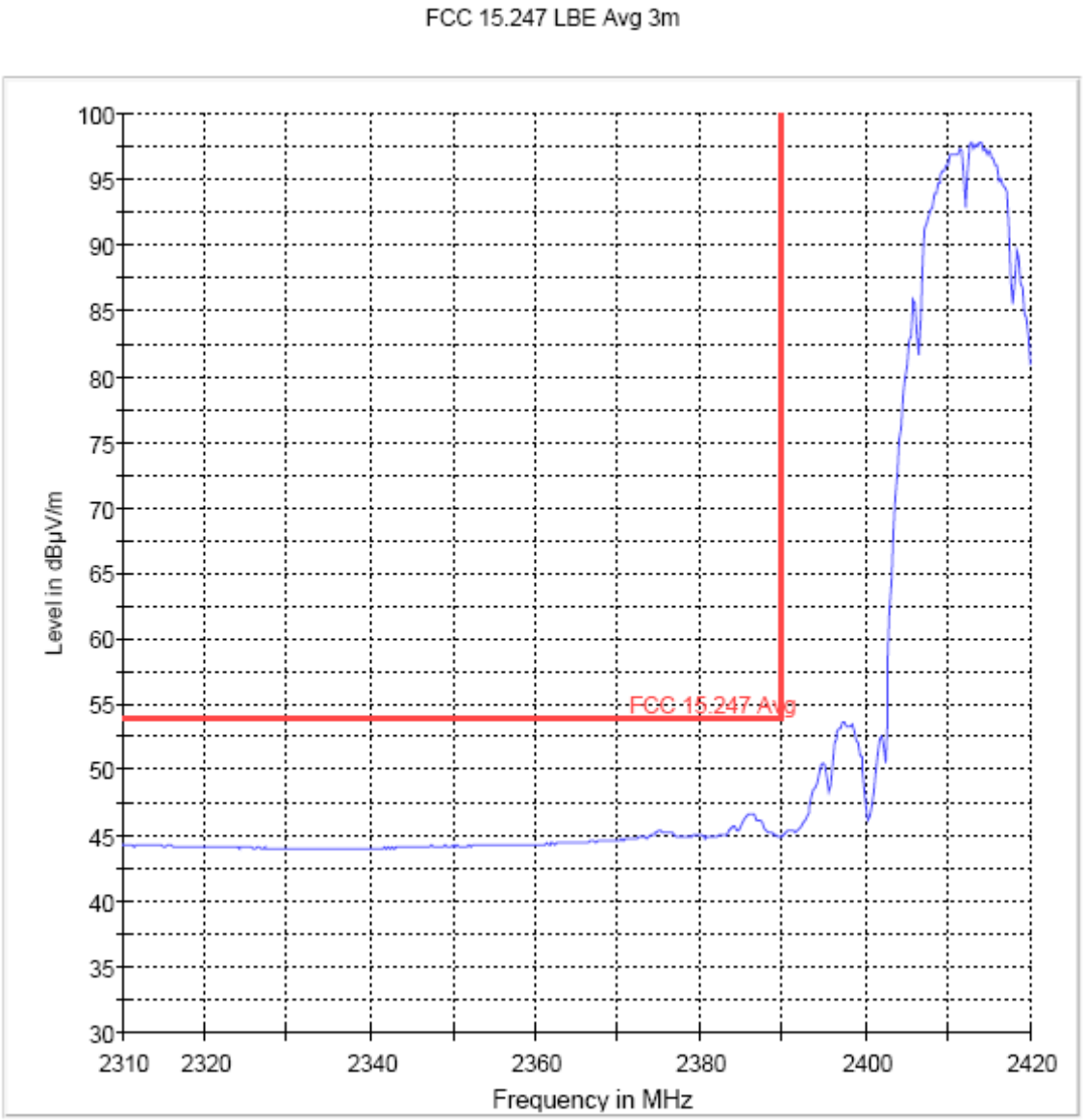
Notes:

1. Radiated emissions are maximized by rotating the EUT 360° at 0.5 meter height increments between 1 and 4 meters.
2. Measurements were performed with the EUT in X, Y and Z orientations with the measurement antenna in both horizontal and vertical polarity. The plots below show the results of the worst case orientation and polarity.

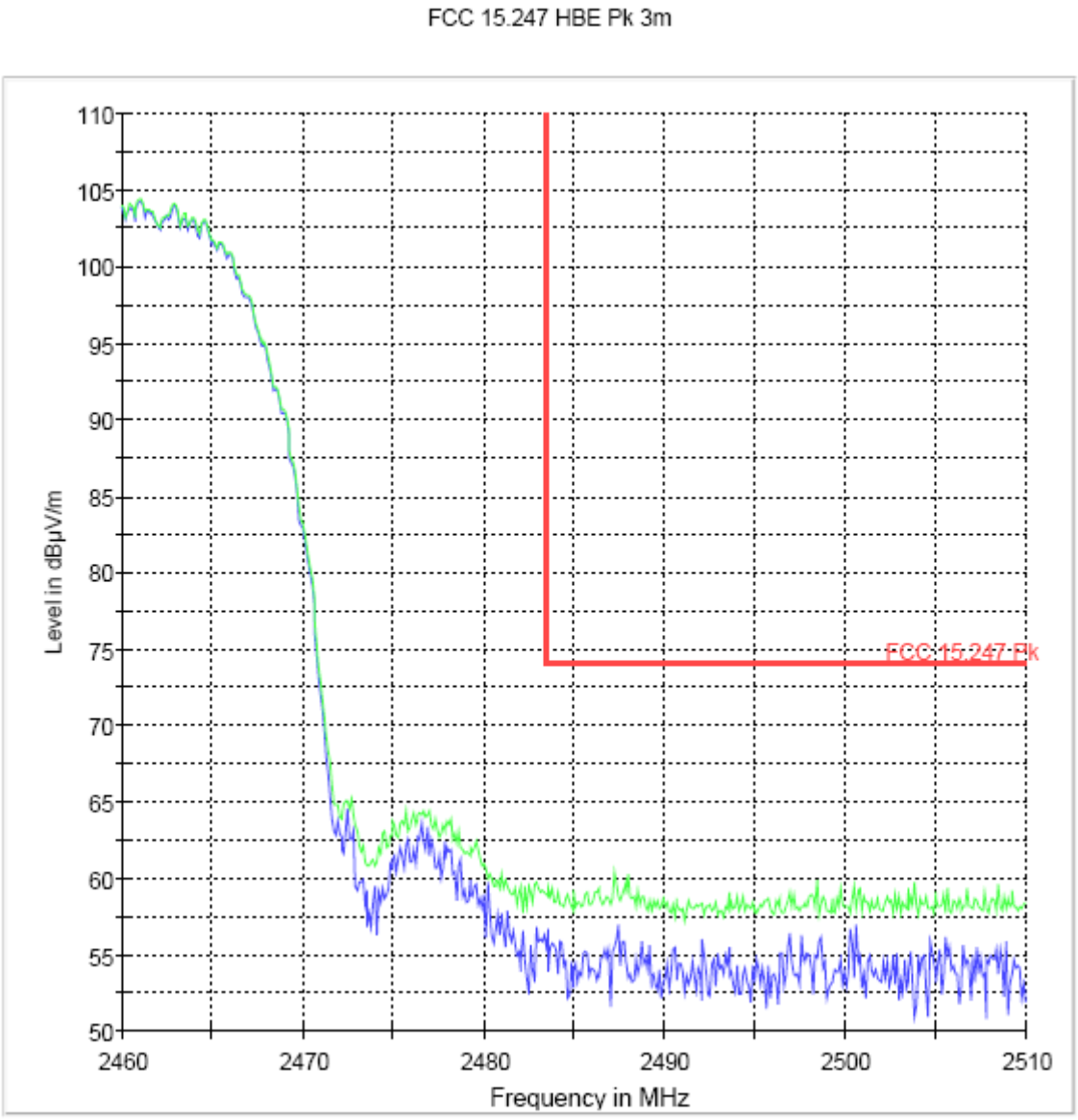
6.2.2 Sub-band 1 802.11b
Lower band edge PEAK



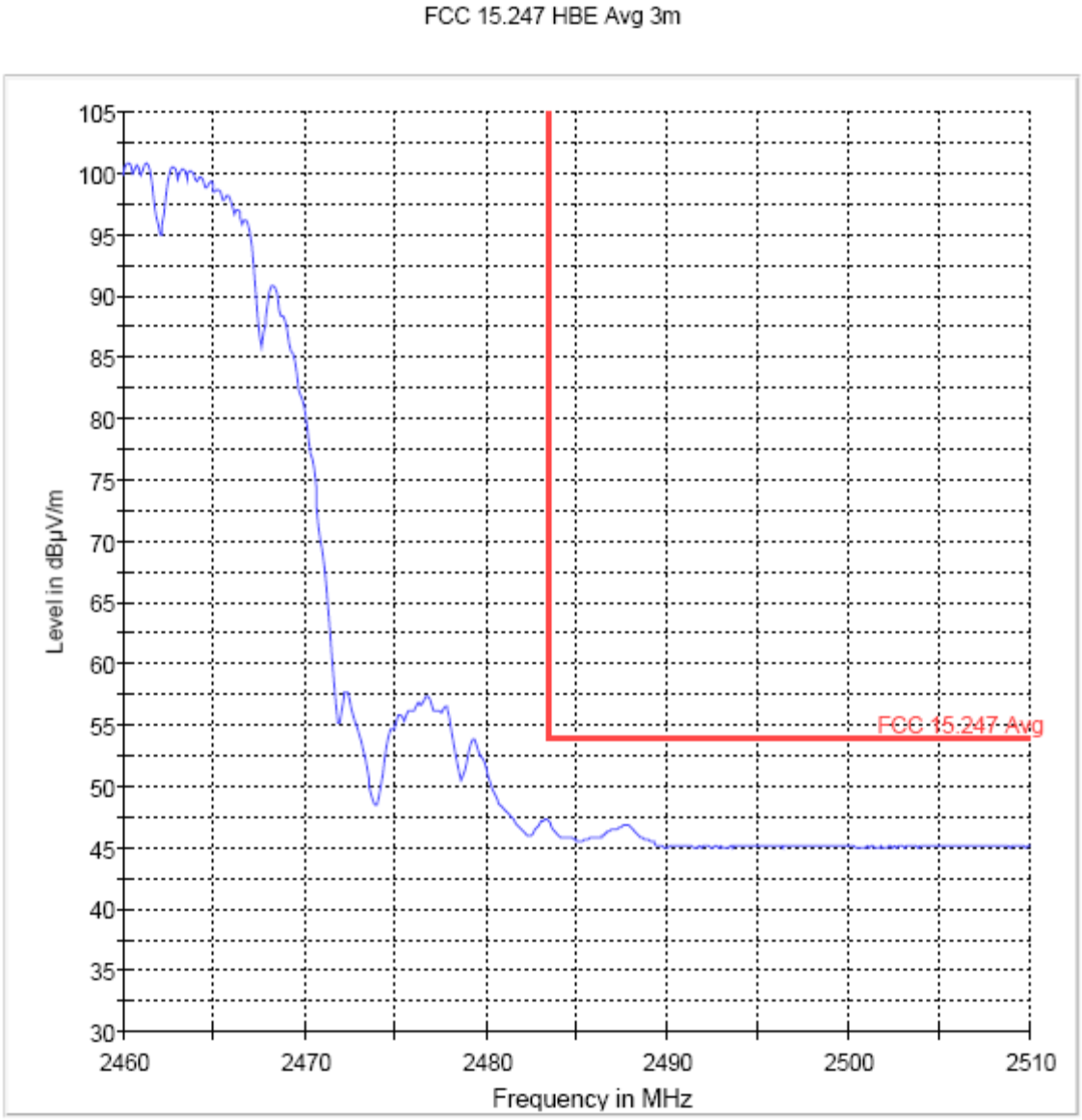
Lower band edge Average



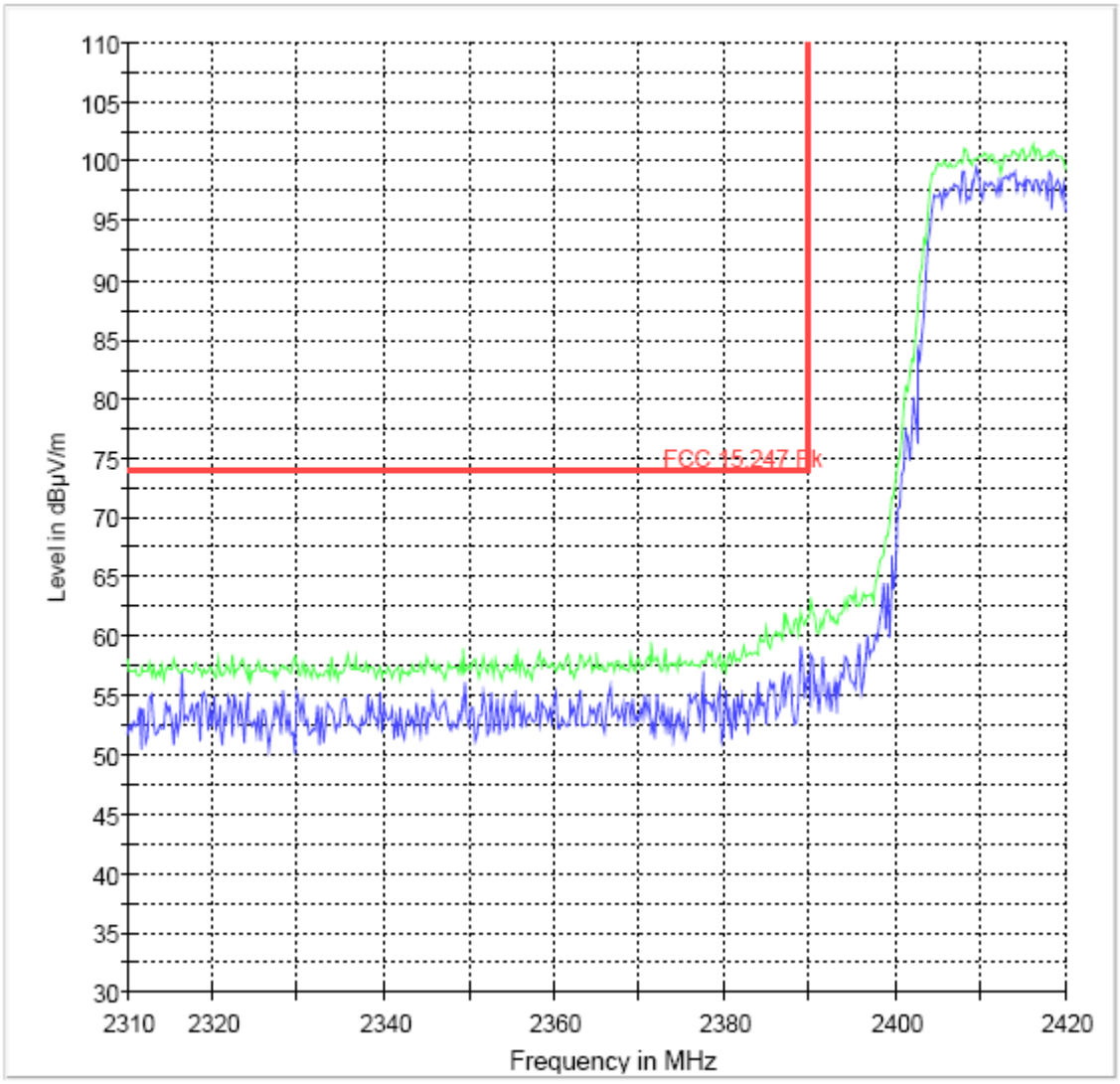
High band edge PEAK



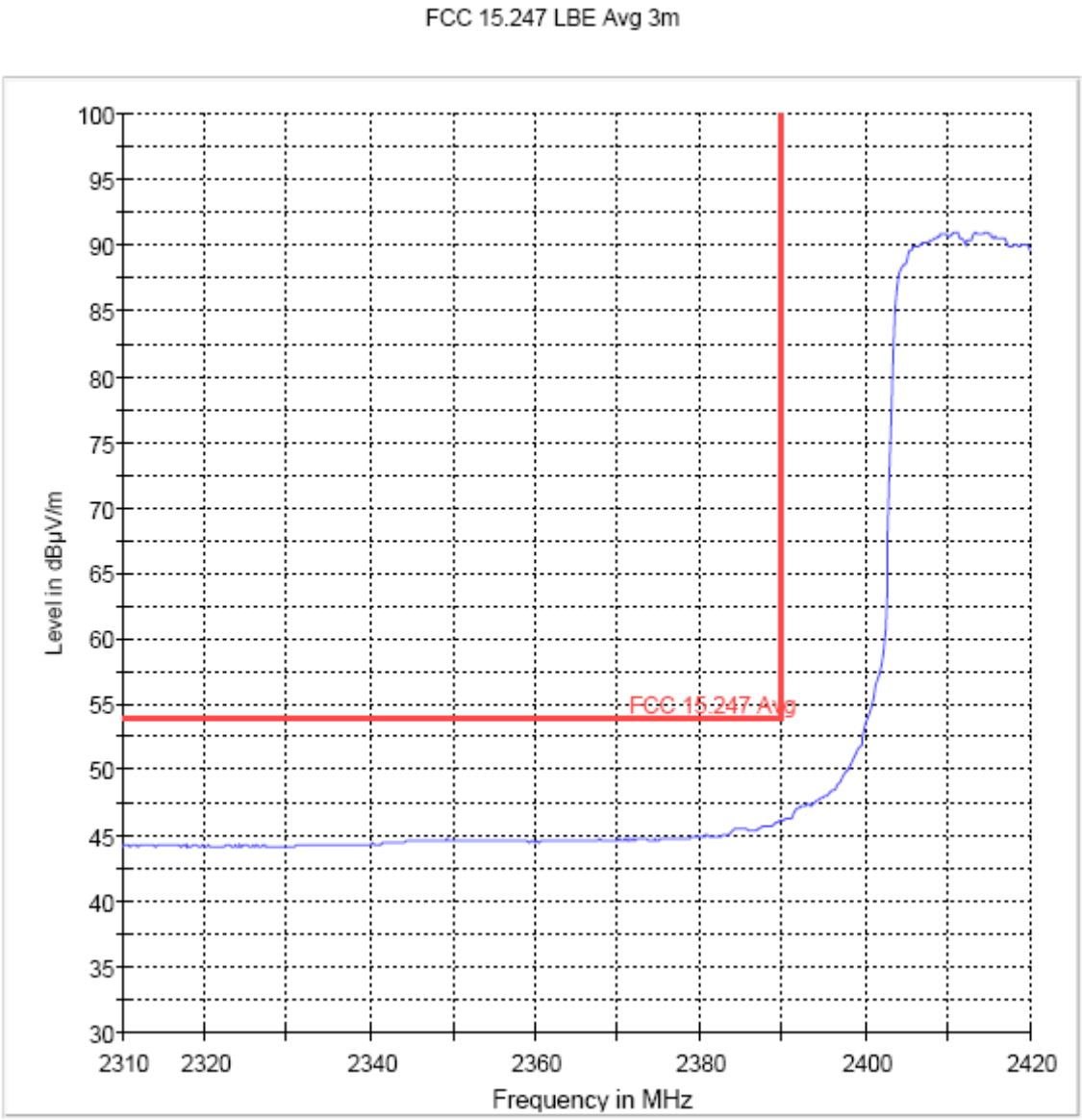
High band edge Average



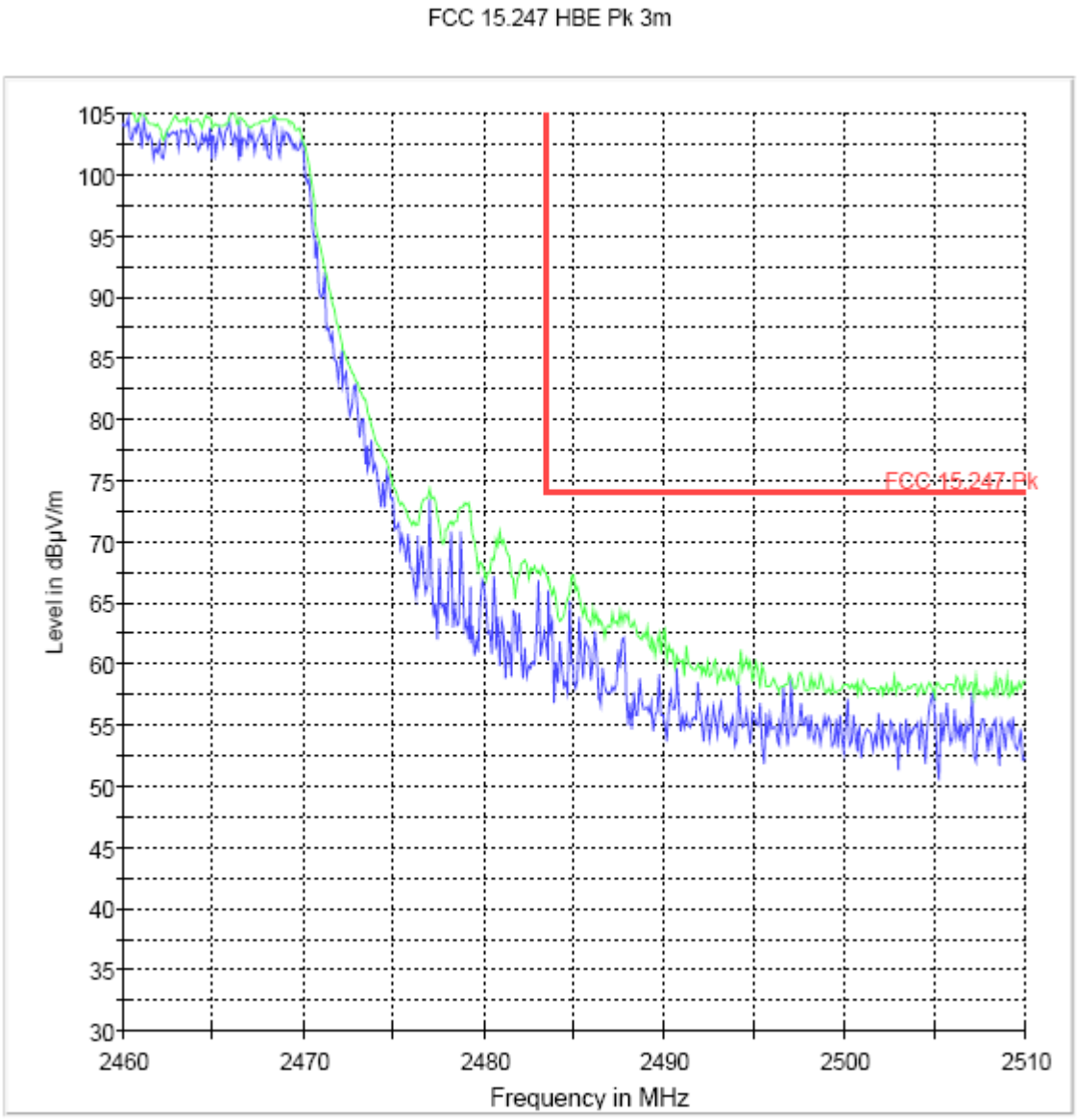
6.2.3 Sub-band 1 802.11g
Lower band edge PEAK



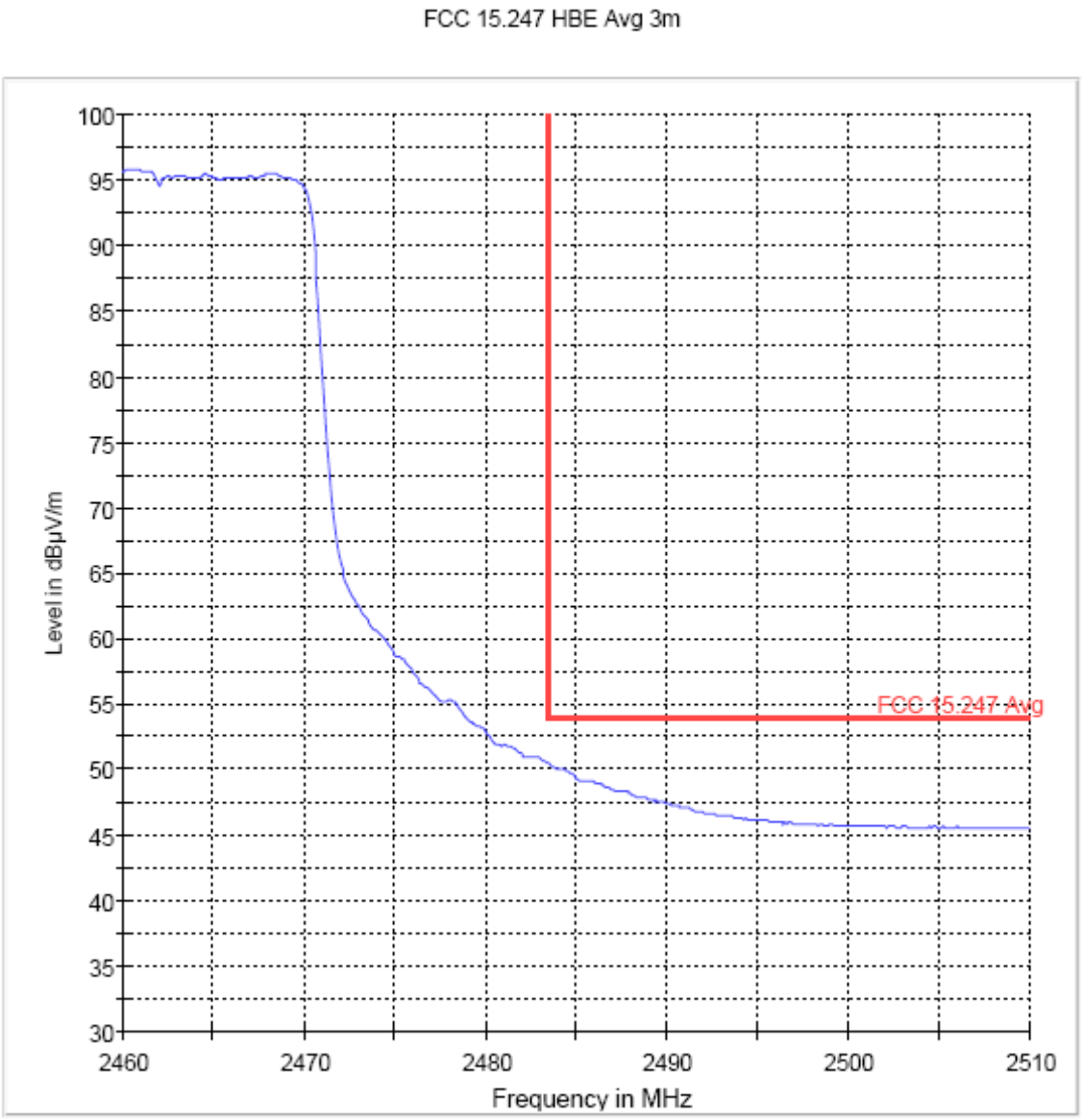
Lower band edge Average



High band edge PEAK



High band edge Average



6.3 Transmitter Spurious Emission § 15.247/15.205/15.209

6.3.1 Limits

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

***PEAK LIMIT= 74dBµV/m**
***AVG. LIMIT= 54dBµV/m**

Notes:

1. The radiated emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels. In the range between 3 and 25 GHz very short cable connections to the antenna was used to minimize the noise level.
2. All measurements are done in peak mode using an average limit , unless specified with the plots.
3. Radiated emissions are maximized by rotating the EUT 360° at 0.5 meter height increments between 1 and 4 meters.
4. Measurements were performed with the EUT in X, Y and Z orientations with the measurement antenna in both horizontal and vertical polarity. The plots below show the results of the worst case orientation and polarity

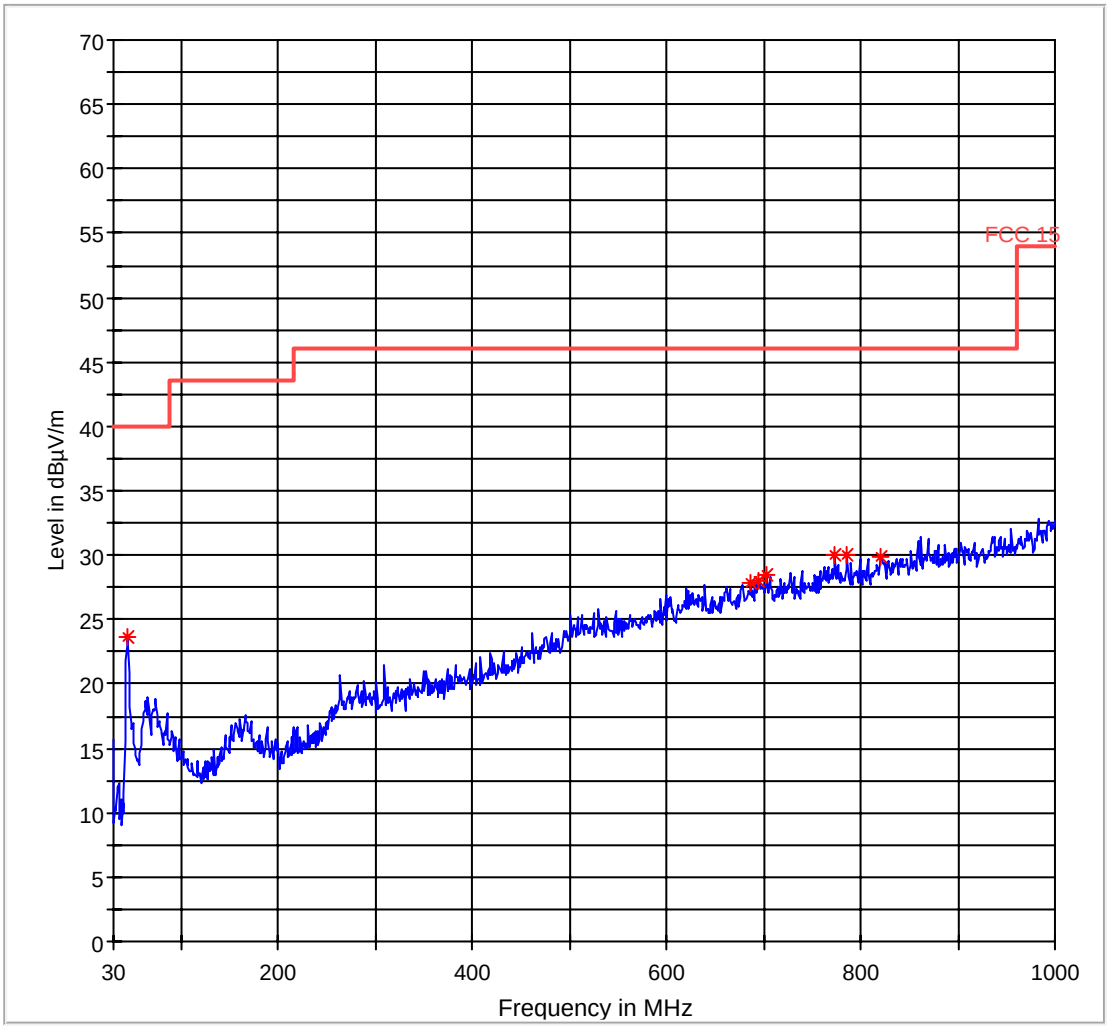
Results for the radiated measurements below 30MHz according § 15.33

Frequency	Measured values	Remarks
9KHz – 30MHz	No emissions found, caused by the EUT	This is valid for all the tested channels

6.3.2 RESULTS Sub-band 1 802.11b/g MODE:

Emissions reported here are worse cases emissions for all operation modes.
30MHz – 1GHz, Worst case for all channels

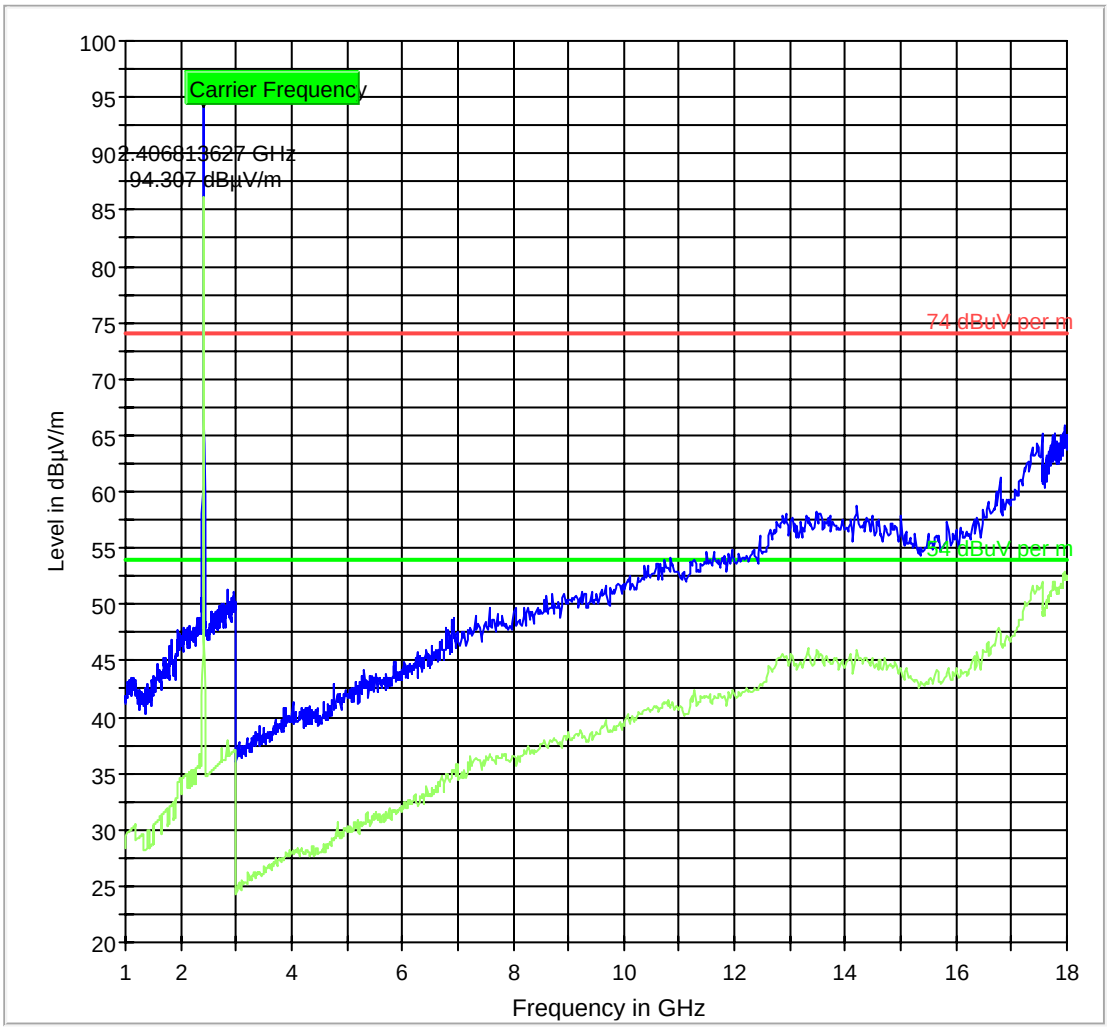
FCC 15 30-1000MHz



1-18GHz Channel 1

Note: The peak above the limit line is the carrier freq.

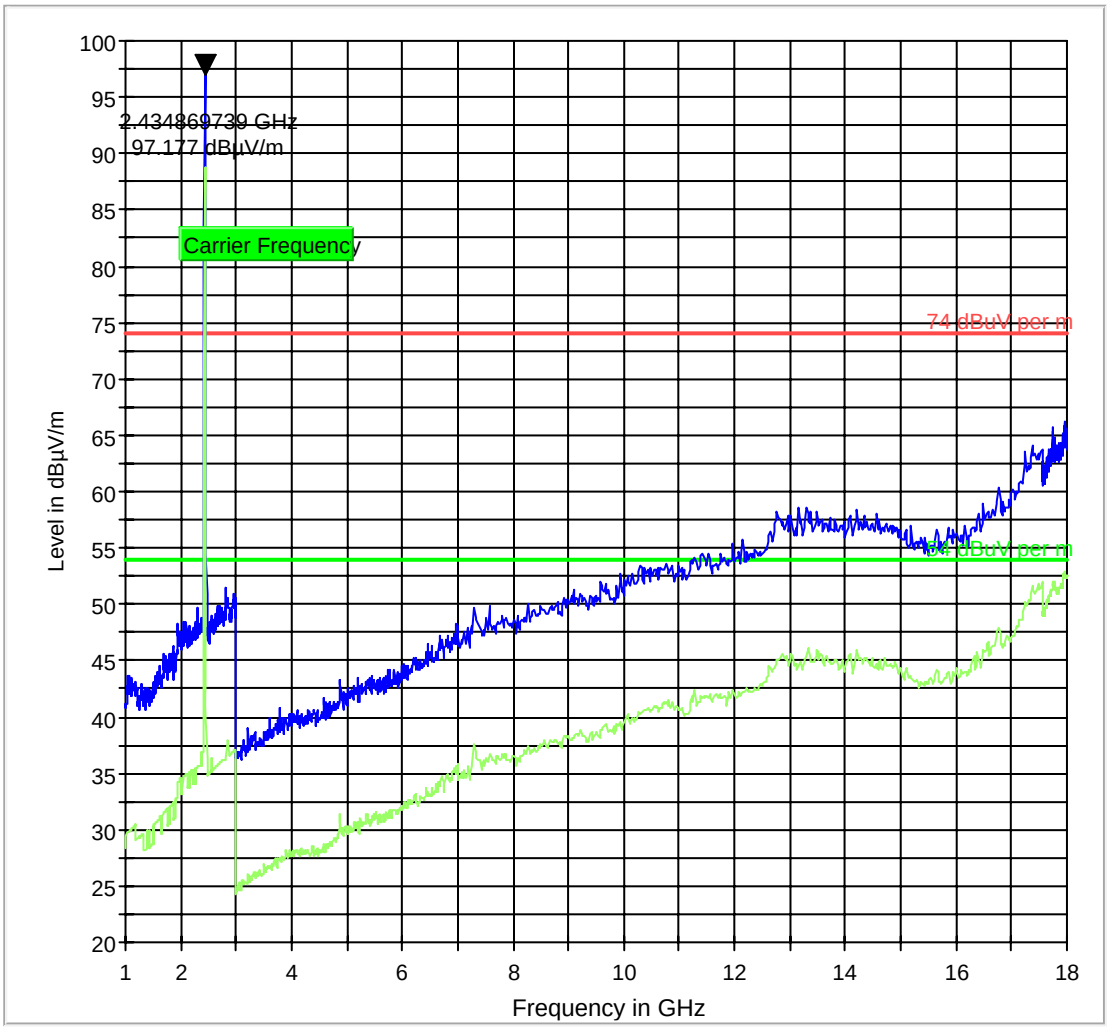
FCC 15 1-18GHz



1-18GHz Channel 6

Note: The peak above the limit line is the carrier freq.

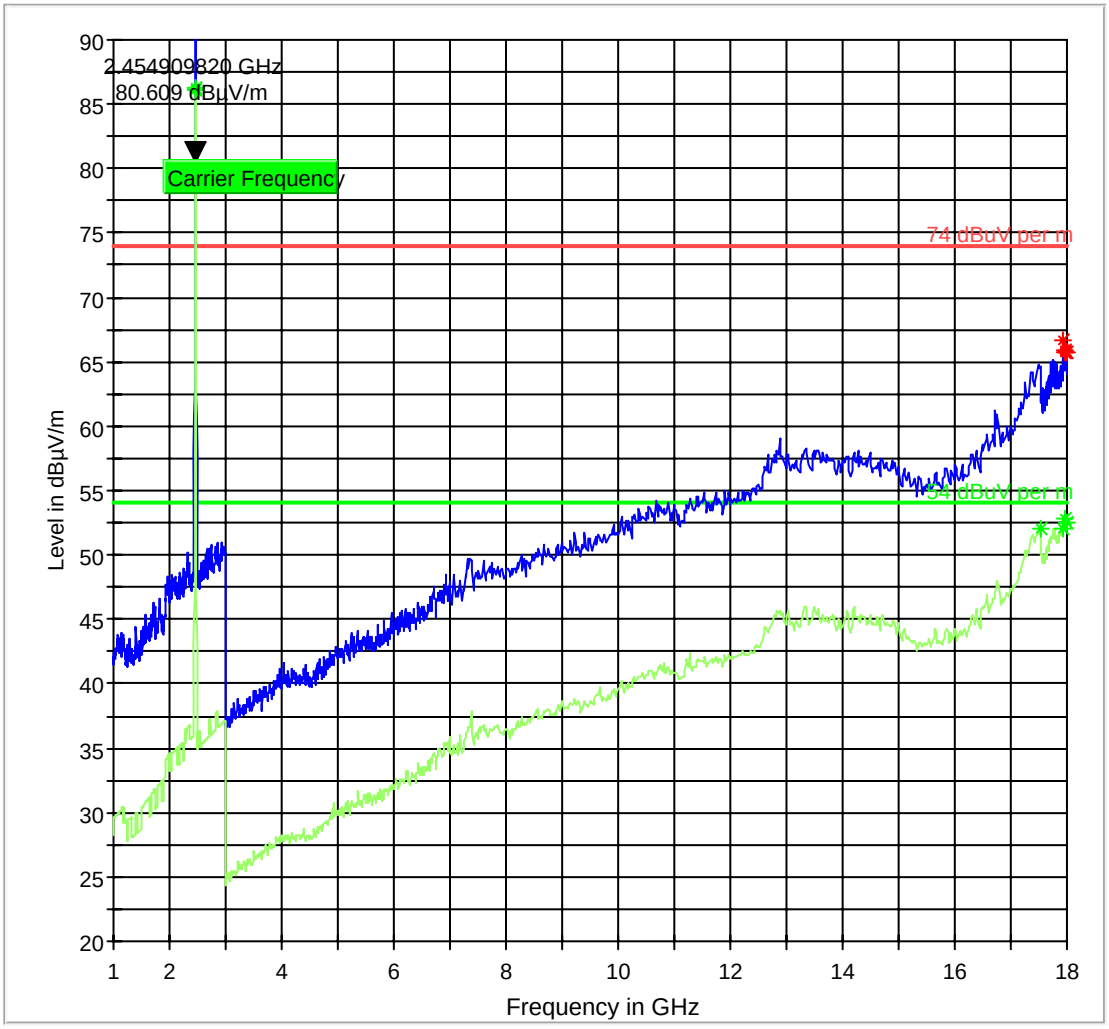
FCC 15 1-18GHz



1-18GHz Channel 11

Note: The peak above the limit line is the carrier freq.

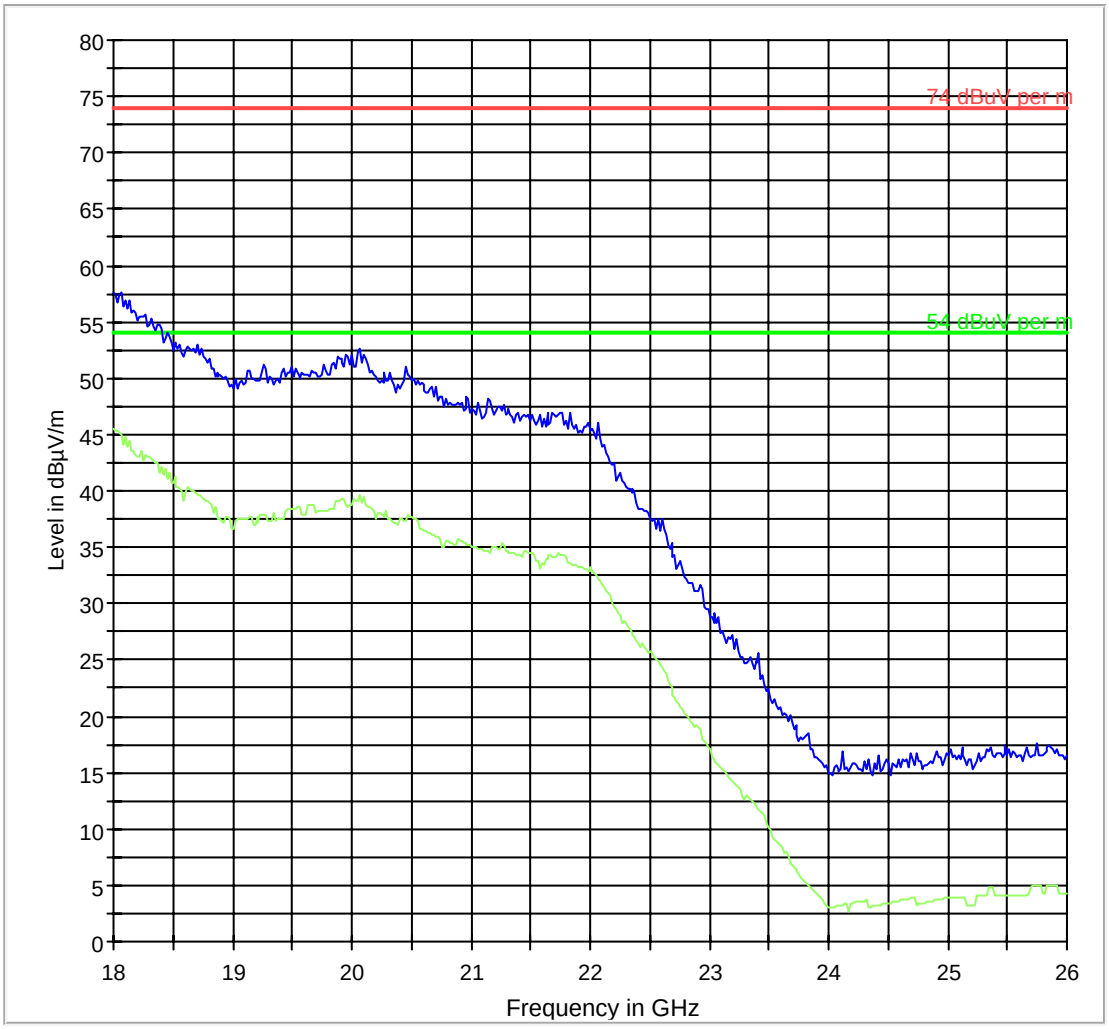
FCC 15 1-18GHz



18-26.5GHz

Note: This plot is valid for low, mid, high channels (worst-case plot).

FCC 15 18-26GHz



6.4 Receiver Spurious Emission § 15.209/RSS210

6.4.1 Limits

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

NOTE:

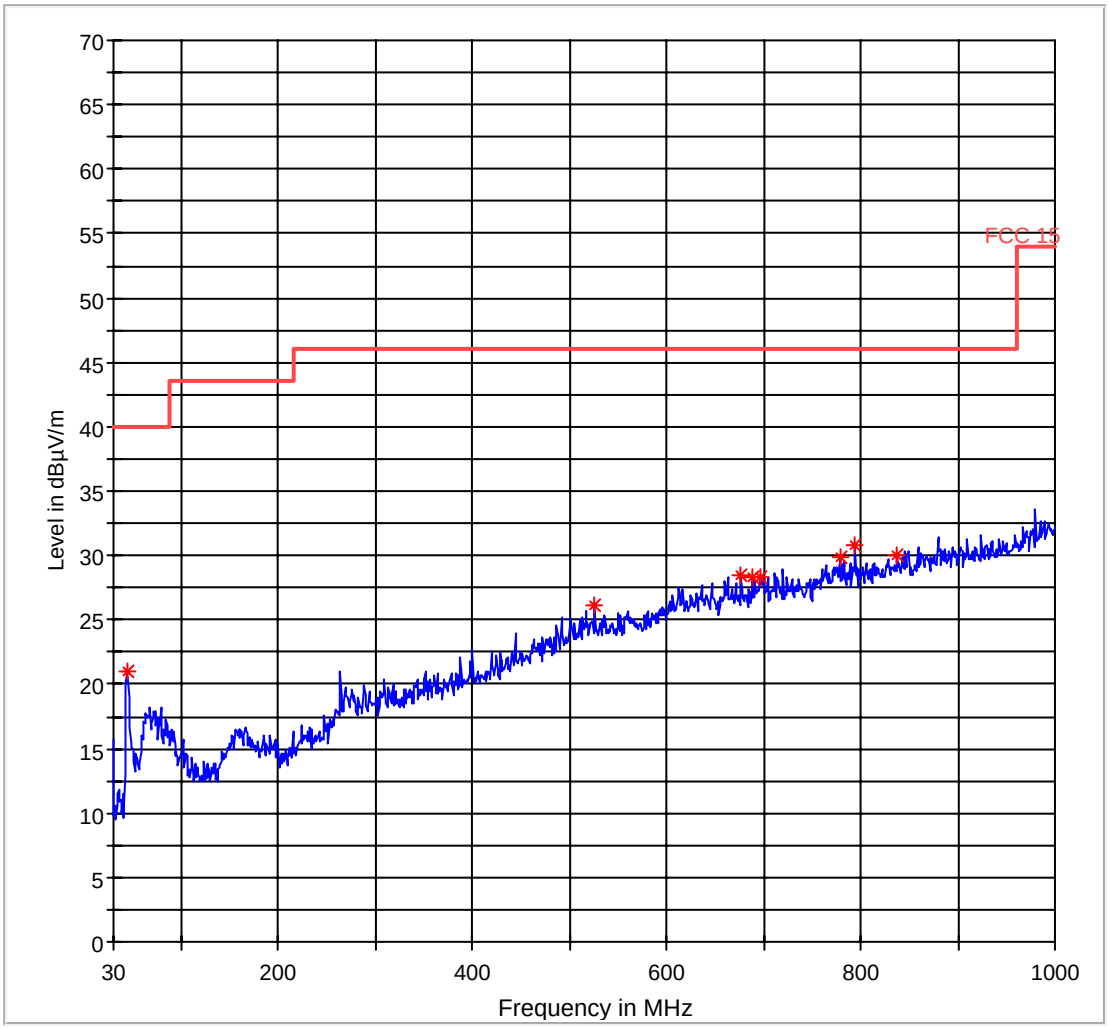
1. The radiated emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels. In the range between 3 and 25 GHz very short cable connections to the antenna was used to minimize the noise level.
2. All measurements are done in peak mode using an average limit unless specified with the plots.
3. There are no measurable emissions up to 18GHz in Rx mode.
4. Receiver spurious emissions reported here are the worse case emissions for all receiver modes and between two receiving chains.

6.4.2 RESULTS

30MHz – 1GHz

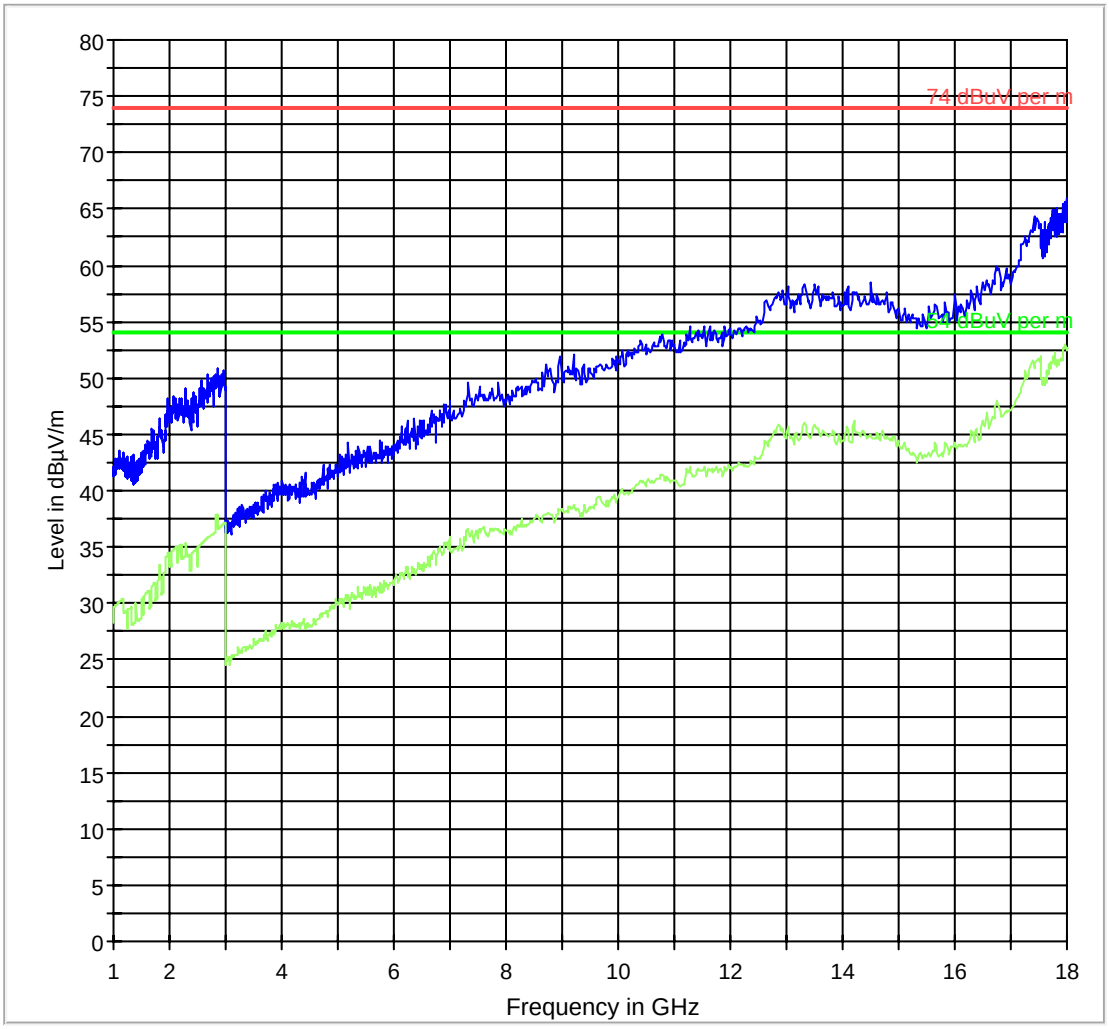
Note: This plot is valid for low, mid, high channels (worst-case plot).

FCC 15 30-1000MHz



1-18GHz

FCC 15 1-18GHz

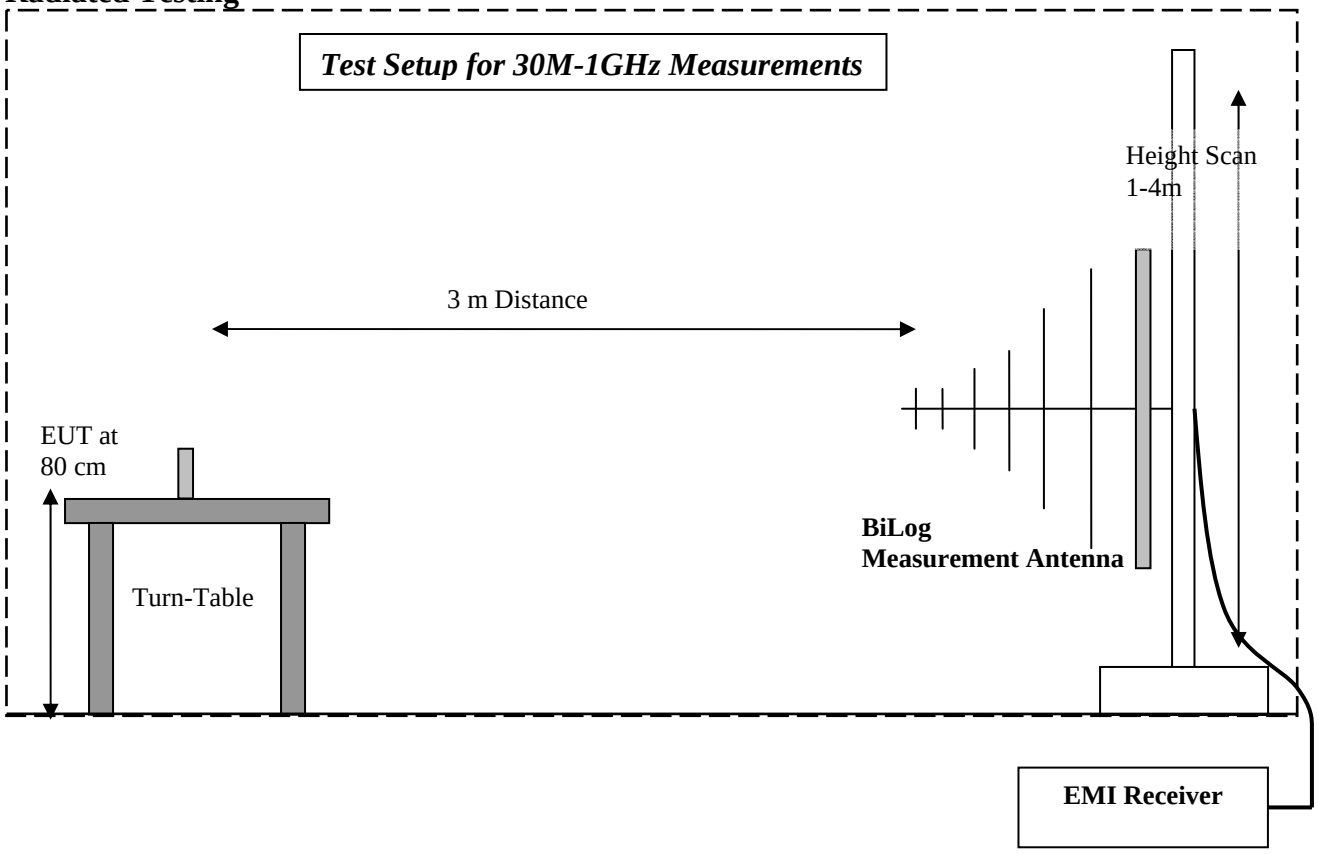


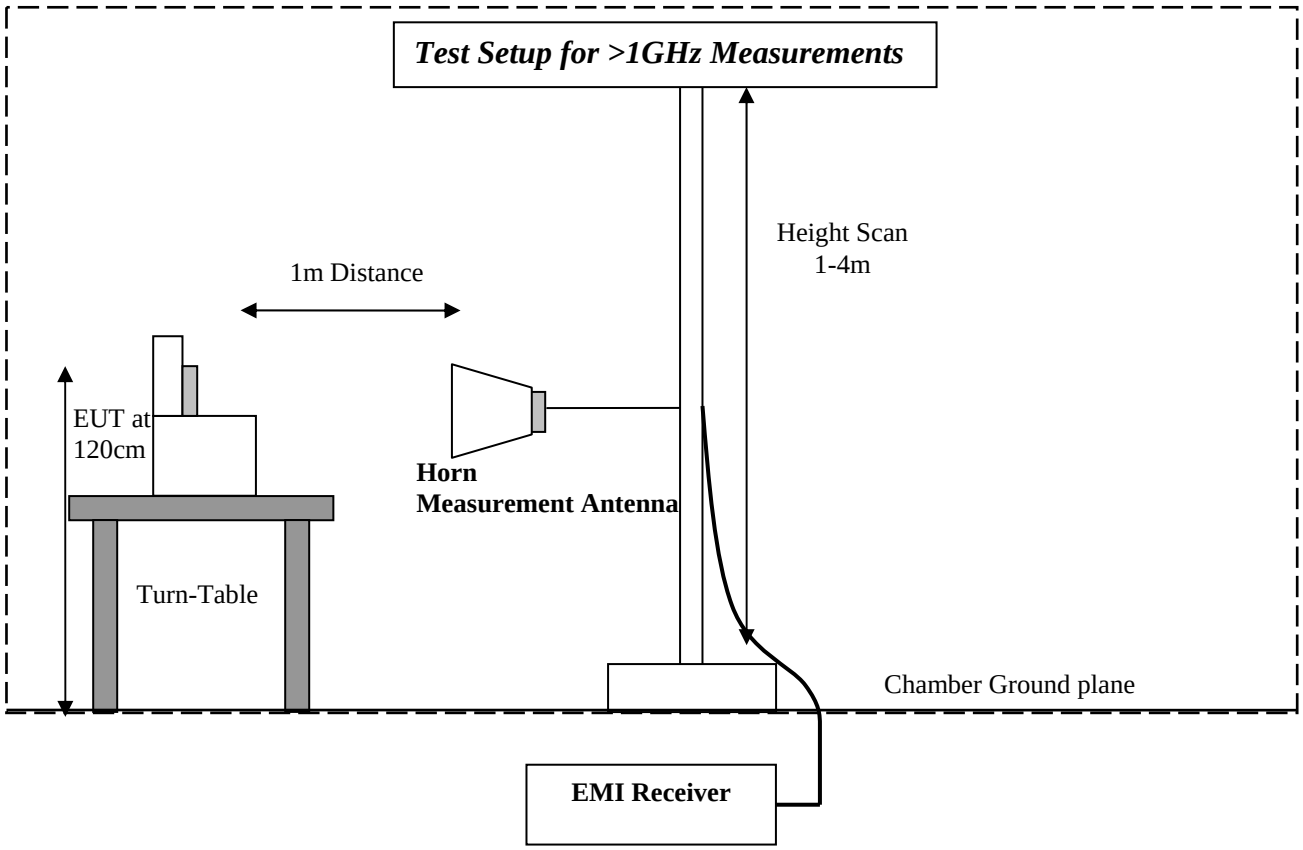
7 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

No	Instrument/Ancillary	Type	Manufacturer	Serial No.	Cal Due	Interval
01	Spectrum Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2010	1 year
02	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	100017	August 2010	1 year
03	Signal Generator	SMY02	Rohde & Schwarz	836878/011	May 2010	1 year
04	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02	May 2010	1 year
05	Biconilog Antenna	3141	EMCO	0005-1186	June 2010	1 year
06	Horn Antenna (1-18GHz)	SAS-200/571	AH Systems	325	June 2010	1 year
07	Horn Antenna (18-26.5GHz)	3160-09	EMCO	1240	June 2010	1 year
08	Power Splitter	11667B	Hewlett Packard	645348	n/a	n/a
09	Climatic Chamber	VT4004	Voltsch	G1115	May 2010	1 year
10	High Pass Filter	5HC2700	Trilithic Inc.	9926013	n/a	n/a
11	High Pass Filter	4HC1600	Trilithic Inc.	9922307	n/a	n/a
12	Pre-Amplifier	JS4-00102600	Miteq	00616	May 2010	1 year
13	Power Sensor	URV5-Z2	Rohde & Schwarz	DE30807	May 2010	1 year
14	Digital Radio Comm. Tester	CMD-55	Rohde & Schwarz	847958/008	May 2010	1 year
15	Universal Radio Comm. Tester	CMU 200	Rohde & Schwarz	832221/06	May 2010	1 year
16	LISN	ESH3-Z5	Rohde & Schwarz	836679/003	May 2010	1 year
17	Loop Antenna	6512	EMCO	00049838	July 2011	2 years

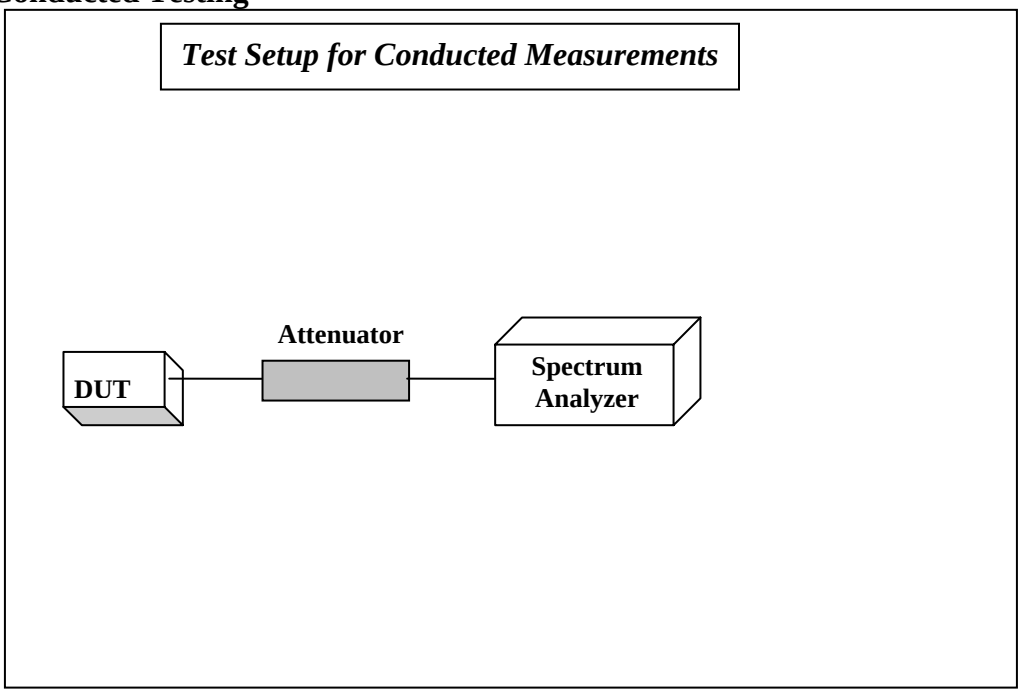
8 BLOCK DIAGRAMS

Radiated Testing




Test Setup for >1GHz Measurements
Height Scan
1-4m
1m Distance
EUT at
120cm
Horn
Measurement Antenna
Turn-Table
Chamber Ground plane
EMI Receiver

Conducted Testing



9 Revision History

2010-04-07: First Issue