FCC/IC Test Report

FOR:

Company: Trimble Navigation Limited

Model Name: 88951

FCC ID: JUP616

IC ID: 1756A-616

47 CFR Part 15.247 for DSSS Systems

IC RSS-210 Issue 8

TEST REPORT #: EMC_ TRIM2_001_09001_15.247WLAN_616_rev1
DATE: 2011-03-03

ACCREDITED TESTING LABORATORY Certificate #2135.01

Bluetooth Qualification Test Facility (BQTF)

CTIA Authorized Test Lab LAB CODE 20020328-00

FCC listed
A2LA Accredited

IC recognized # 3462B

***CETECOM* Inc.**

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Board of Directors: Dr. Harald Ansorge, Hans Peter May.

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1 Assessment

The following device was tested against the applicable criteria specified in FCC rules Parts 15.247 of Title 47 of the Code of Federal Regulations and Industry Canada Standards RSS 210 Issue 7 and no deviations were ascertained during the course of the tests performed.

Company	Description	Model #
Trimble Navigation Limited	GeoExplorer 6000 Series: GeoXH / GeoXT Handheld	88951

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2011-03-03	Compliance	Heiko Strehlow (Director of Compliance)	H. Strehlow Digitally signed by Heiko Strehlow Date: 2011.03.05 22:55:47 -08'00'

Responsible for the Report:

Date	Section	Name	Signature
2011-03-03	Compliance	Josie Sabado (Project Engineer)	Josie Sabado I am the author of this document

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
Test Lab Director:	Heiko Strehlow
Responsible Project Leader:	Josie Sabado

2.2 Identification of the Client

Applicant's Name:	Trimble Navigation Limited
Street Address:	935 Stewart Drive
City/Zip Code	Sunnyvale, CA 94088-3642
Country	United States
Contact Person:	Roy Cann
Phone No.	+1-408-481-8284
e-mail:	Roy.Cann@Trimble.com

2.3 Identification of the Manufacturer

Manufacturer's Name:	Trimble Navigation New Zealand Ltd
Manufacturers Address:	11 Birmingham Drive, Riccarton
City/Zip Code	Christchurch, Canterbury 8024
Country	New Zealand

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name:	GeoExplorer 6000 Series
Model No:	88951
Product Type:	Portable
Product Description:	GeoExplorer 6000 Series: GeoXH / GeoXT Handheld
Modes of Operation:	GSM/(E)GPRS/WCDMA 802.11 b/g Bluetooth + 2.1 EDR GPS (Receive only)
Hardware Revision :	1
Software Revision :	OS 6.5.1 (Build 20192) Nov 8 2010
FCC-ID:	JUP616
IC-ID :	1756A-616
Frequency:	GSM 850: 824.2-848.8MHz PCS 1900: 1850.2-1909.8MHz FDD V: 826.4-846.6MHz FDD II: 1852.4-1907.6MHz 802.11 b/g: 2400-2483.5MHz Bluetooth: 2400-2483.5MHz GPS: 1575.42MHz, 1227.60MHz
Type(s) of Modulation:	802.11b/g: CCK, BPSK, QPSK, 16QAM, 64QAM Bluetooth: GFSK, DQPSK, 8DPSK WWAN 2G: GMSK, 8PSK WWAN 3G: QPSK, 16QAM
Number of channels:	GSM850: 125 PCS 1900: 300 FDD II: 278 FDD V: 103 802.11 b/g: 11 Bluetooth: 79
Antenna Type:	Cellular: Cirocom PiFA Foil Antenna 802.11 b/g, Bluetooth: Pulse Antenna W3008 Omnidirectional, 1.7dBi
Power Supply:	11.1 VDC Li Ion Batt, AC Adapter
Prototype /Production Unit:	Production

3.2 Identification of the Equipment under Test (EUT)

EUT #	Serial Number	HW Version	SW Version
1	5043452638	1	OS 6.5.7 (Build 20192) Dec 20 2010

3.3 Identification of Accessory equipment

No accessory equipment.

3.4 Test modes of operation:

Worst case operation was determined for these data rates and modulations.

Mode	Data rate (Mbps)	Modulation scheme
802.11b	1.0	CCK
802.11g	6.0	BPSK

4 Subject Of Investigation

The objective of the measurements done by Cetecom Inc. was to measure the performance of the EUT as specified by requirements listed in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations and Industry Canada rules RSS-210 Issue 7.

This test report is to support a request for new equipment authorization under the FCC ID **JUP616** and IC ID **1756A-616.**
All testing was performed on the product referred to in Section 3 as EUT.
This test report contains full radiated and conducted testing results as per

- 47 CFR Part 15: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission subchapter A- General, Part 15- Radio Frequency Devices.
- RSS-210 Issue 7: Spectrum Management and Telecommunications- Radio Standards Specification. Low-power Licence-exempt radio communication devices (All frequency bands): Category 1 equipment.

During the testing process the EUT was tested on low, mid and high channels for all the supported modes of operation. For radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT.

5 Summary of Measurement Results

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§15.247(b)(4) RSS210 A8.4(2)	Antenna Gain	Nominal	802.11b 802.11g	■	☐	☐	☐	Complies
§15.247(e) RSS210 A8.2(b)	Power Spectral Density	Nominal	802.11b 802.11g	■	☐	☐	☐	Complies
§15.247(a)(1) RSS210 A8.1(b)	Carrier Frequency Separation	Nominal	802.11b 802.11g	■	☐	☐	☐	Complies
§15.247(a)(1) RSS210 A8.1(d)	Number of Hopping Channels	Nominal	802.11b 802.11g	■	☐	☐	☐	Complies
§15.247(a)(1)(iii) RSS210 A8.3(1)	Time of occupancy	Nominal	802.11b 802.11g	■	☐	☐	☐	Complies
§15.247(a)(1) RSS210 A8.2(a)	Spectrum Bandwidth	Nominal	802.11b 802.11g	■	☐	☐	☐	Complies
§15.247(b)(1) RSS210 A8.4(2)	Maximum Output Power	Nominal	802.11b 802.11g	■	☐	☐	☐	Complies
§15.247(d) RSS210 A8.5	Band edge compliance-Conducted	Nominal	802.11b 802.11g	☐	☐	☐	■	-
§15.247(d) RSS210 A8.5	Band edge compliance-Radiated	Nominal	802.11b 802.11g	■	☐	☐	☐	Complies
§15.247(d) RSS210 A8.5	TX Spurious emissions-Conducted	Nominal	802.11b 802.11g	■	☐	☐	☐	Complies
§15.247(d) RSS210 A8.5	TX Spurious emissions-Radiated	Nominal	802.11b 802.11g	■	☐	☐	☐	Complies
§15.209(a) RSS Gen	TX Spurious Emissions Radiated<30MHz	Nominal	802.11b 802.11g	■	☐	☐	☐	Complies
§15.109 RSS Gen	RX Spurious Emissions Radiated	Nominal	802.11b 802.11g	■	☐	☐	☐	Complies
§15.107(a)	Conducted Emissions <30MHz	Nominal	802.11b 802.11g	■	☐	☐	☐	Complies

Note: NA= Not Applicable; NP= Not Performed.

1. Band Edge compliance-conducted is NOT PERFORMED as the device passes radiated measurement.

6 Measurements

6.1 Radiated Measurement Procedure

ANSI C63.4 Section 8.3.1.1: Exploratory radiated emission measurements

Exploratory radiated measurements shall be performed at the measurement distance or at a closer distance than that specified for compliance to determine the emission characteristics of the EUT. At near distances, for EUTs of comparably small size, it is relatively easy to determine the spectrum signature of the EUT and, if applicable, the EUT configuration that produces the maximum level of emissions. A shielded room may be used for exploratory testing, but may have anomalies that can lead to significant errors in amplitude measurements.

Broadband antennas and a spectrum analyzer or a radio-noise meter with a panoramic display are often useful in this type of testing. It is recommended that either a headset or loudspeaker be connected as an aid in detecting ambient signals and finding frequencies of significant emission from the EUT when the exploratory and final testing is performed in an OATS with strong ambient signals. Caution should be taken if either antenna height between 1 and 4 meters or EUT azimuth is not fully explored. Not fully exploring these parameters during exploratory testing may require complete testing at the OATS or semi-anechoic chamber when the final full spectrum testing is conducted.

The EUT should be set up in its typical configuration and arrangement, and operated in its various modes. For tabletop systems, cables or wires should be manipulated within the range of likely arrangements. For floor-standing equipment, the cables or wires should be located in the same manner as the user would install them and no further manipulation is made. For combination EUTs, the tabletop and floor-standing portions of the EUT shall follow the procedures for their respective setups and cable manipulation. If the manner of cable installation is not known, or if it changes with each installation, cables or wires for floor-standing equipment shall be manipulated to the extent possible to produce the maximum level of emissions.

For each mode of operation required to be tested, the frequency spectrum shall be monitored. Variations in antenna height between 1 and 4 m, antenna polarization, EUT azimuth, and cable or wire placement (each variable within bounds specified elsewhere) shall be explored to produce the emission that has the highest amplitude relative to the limit. A step-by-step technique for determining this emission can be found in Annex C.

When measuring emissions above 1 GHz, the frequencies of maximum emission shall be determined by manually positioning the antenna close to the EUT and by moving the antenna over all sides of the EUT while observing a spectral display. It will be advantageous to have prior knowledge of the frequencies of emissions above 1 GHz. If the EUT is a device with dimensions approximately equal to that of the measurement antenna beamwidth, the measurement antenna shall be aligned with the EUT.

ANSI C63.4 Section 8.3.1.2: Final radiated emission measurements

Based on the measurement results in 8.3.1.1, the one EUT, cable and wire arrangement, and mode of operation that produces the emission that has the highest amplitude relative to the limit is selected for the final measurement. The final measurement is then performed on a site meeting the requirements of 5.3, 5.4, or 5.5 as appropriate without variation of the EUT arrangement or EUT mode of operation. If the EUT is relocated from an exploratory test site to a final test site, the highest emission shall be remaximized at the final test location before final radiated emissions measurements are performed. However, antenna height and polarity and EUT azimuth are to be varied. In addition, the full frequency spectrum (for the range to be checked for meeting compliance) shall be investigated.

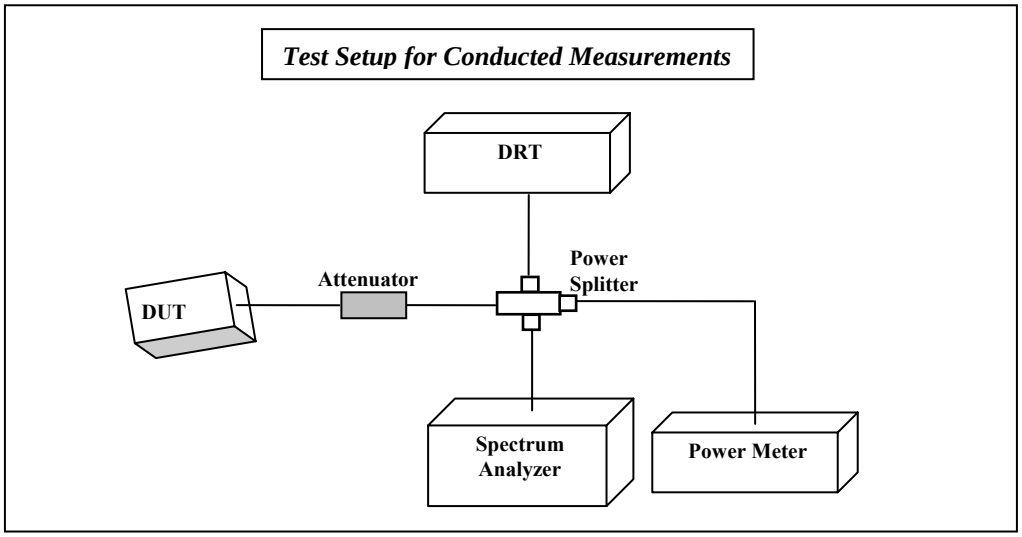
This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. During the full frequency spectrum investigation, particular focus should be made on those frequencies found in exploratory testing that were used to find the final test configuration, mode of operation, and arrangement (associated with achieving the least margin with respect to the limit). This full spectrum test constitutes the compliance measurement.

For measurements above 1 GHz, use the cable, EUT arrangement, and mode of operation determined in the exploratory testing to produce the emission that has the highest amplitude relative to the limit. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the antenna in the “cone of radiation” from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response. The antenna may have to be higher or lower than the EUT, depending on the EUT’s size and mounting height, but the antenna should be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. If the transmission line for the measurement antenna restricts its range of height and polarization, the steps needed to ensure the correct measurement of the maximum emissions, shall be described in detail in the report of measurements. Data collected shall satisfy the report requirements of Clause 10.

NOTES

1— Where limits are specified by agencies for both average and peak (or quasi-peak) detection, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.
2—Use of waveguide and flexible waveguide may be necessary at frequencies above 10 GHz to achieve usable signal-to noise ratios at required measurement distances. If so, it may be necessary to restrict the height search of the antenna, and special care should be taken to ensure that maximum emissions are correctly measured.
3—All presently known devices causing emissions above 10 GHz are physically small compared with the beam-widths of typical horn antennas used for EMC measurements. For such EUTs and frequencies, it may be preferable to vary the height and polarization of the EUT instead of the receiving antenna to maximize the measured emissions.

6.2 Conducted Measurement Procedure



1. Connect the equipment as shown in the above diagram.
2. Adjust the settings of the Digital Radio Communication Tester (DRT) to connect the EUT at the required channel (OR) alternatively use the EUT to set to transmit at a specific mode.
3. Measurements are to be performed with the EUT set to the low, middle and high channels.

6.3 Maximum Peak Output Power

6.3.1 References:

FCC CFR §2.1046
RSS-Gen 4.8

6.3.2 Measurement requirements:

6.3.2.1 FCC 2.1046: RF power output.

Power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on circuit elements as specified. The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

6.3.2.2 RSS-Gen 4.8: RF power output.

Transmitter output power measurements shall be carried out before the unwanted emissions test. The transmitter output power value, obtained from this test, serves as the reference level used to determine the unwanted emissions.

6.3.3 Limits:

6.3.3.1 §15.247 (b)(1)

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

6.3.3.2 RSS 210- A8.4(2)

Nominal Peak Output Power < 30 dBm (1W)
EIRP < 36dBm

6.3.4 Test Conditions:

Tnom: 25°C; Vnom: AC
Spectrum Analyzer settings:
RBW=20MHz, VBW=30MHz, Detector: Peak- Max Hold.
Sweep Time: Auto
Span=40MHz
Antenna Gain (dBi): 1.7 dBi

6.3.5 Test Result:

Output Power- Conducted (dBm)			
Mode	**Frequency (MHz)**		
	2412 Channel 1	**2437 Channel 6**	**2462 Channel 11**
	Peak	Peak	Peak
802.11b	20.78	20.81	20.72
802.11g	25.01	25.07	25.00
Measurement Uncertainty: ±0.5dB			

Max Peak Output Power- Radiated (dBm)			
Mode	**Frequency (MHz)**		
	2412 Channel 1	**2437 Channel 6**	**2462 Channel 11**
802.11b	22.48	22.51	22.42
802.11g	26.71	26.77	26.70
Measurement Uncertainty: ±3dB			

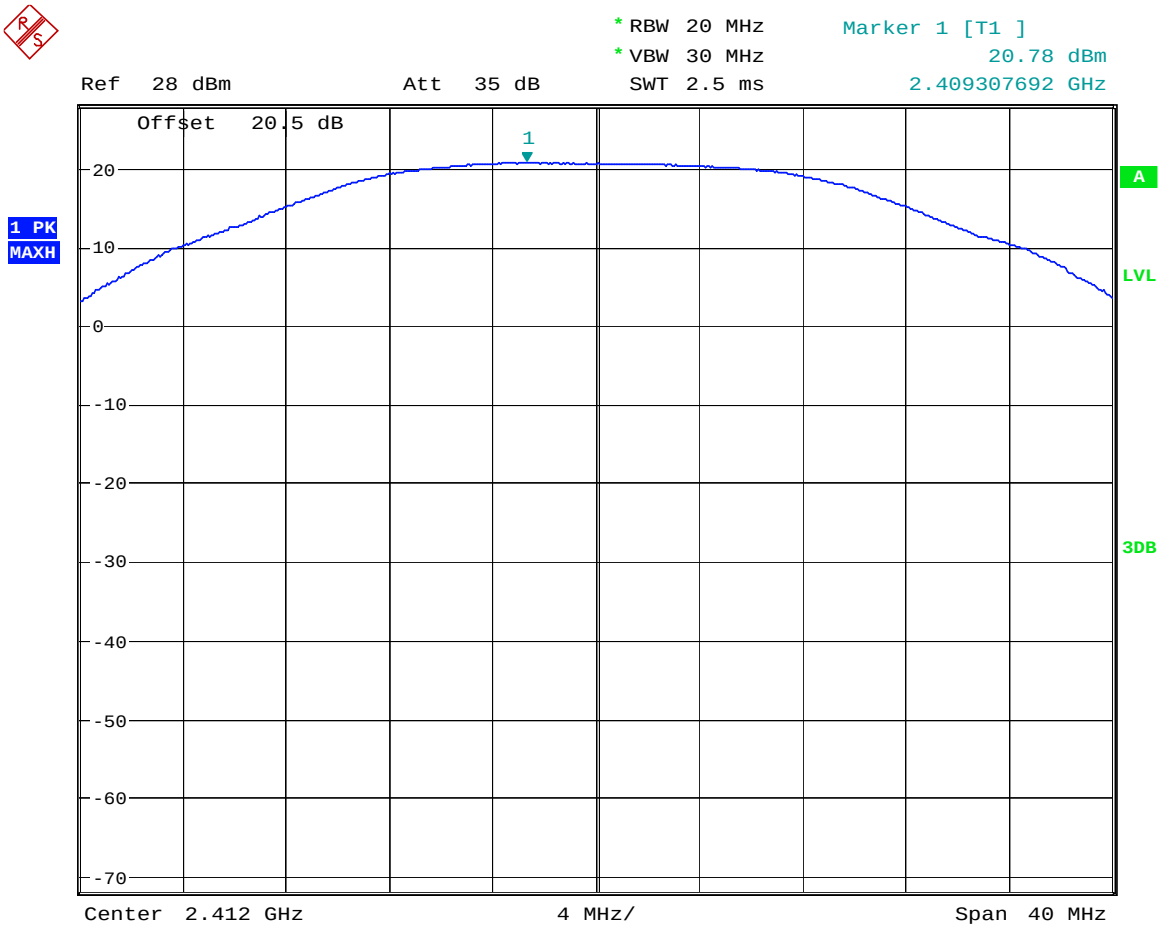
Note: Radiated EIRP is calculated as
Conducted Measurement + Antenna Gain

6.3.5.1 Measurement Result

Pass.

6.3.6 Test Data/plots:

Conducted Peak Power 802.11b 2412 MHz



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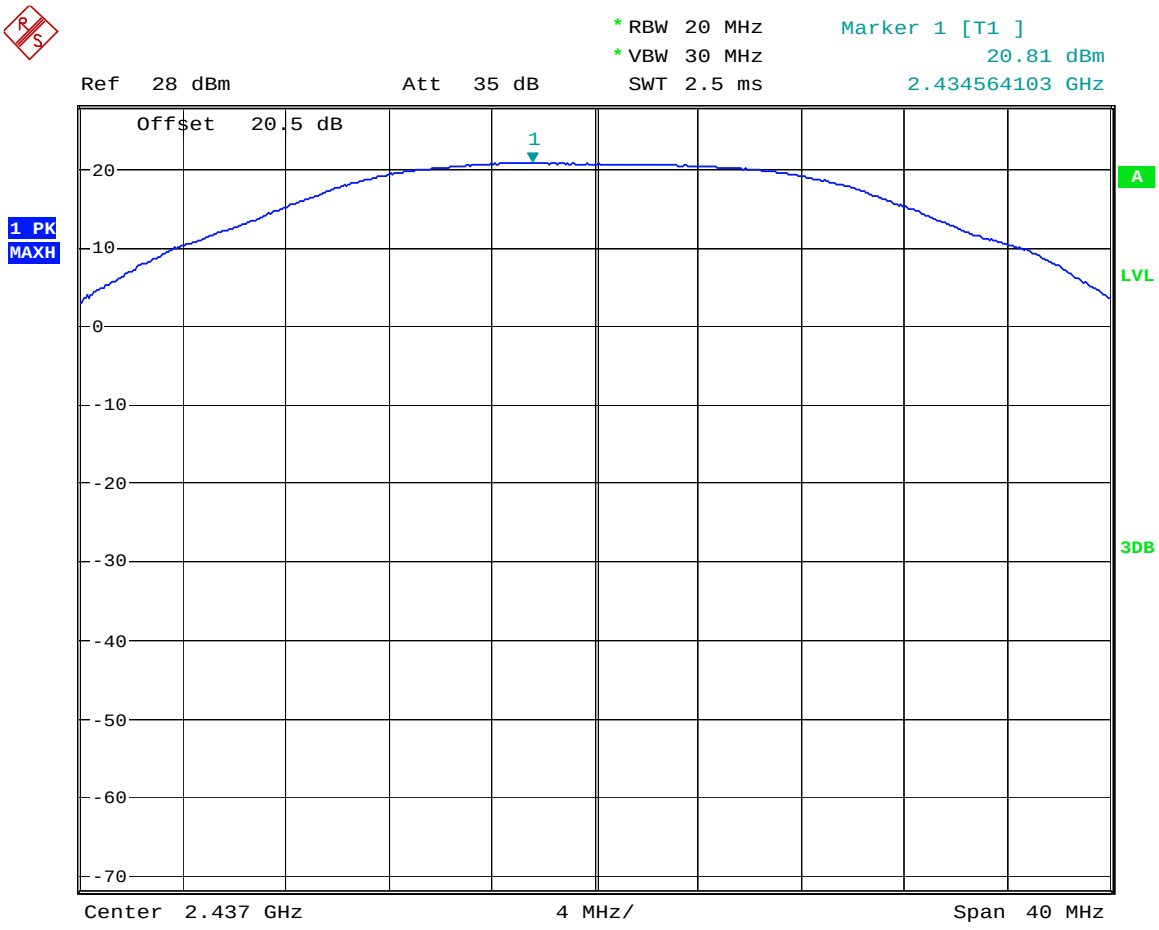
Conducted Peak Power 802.11b 2437 MHz



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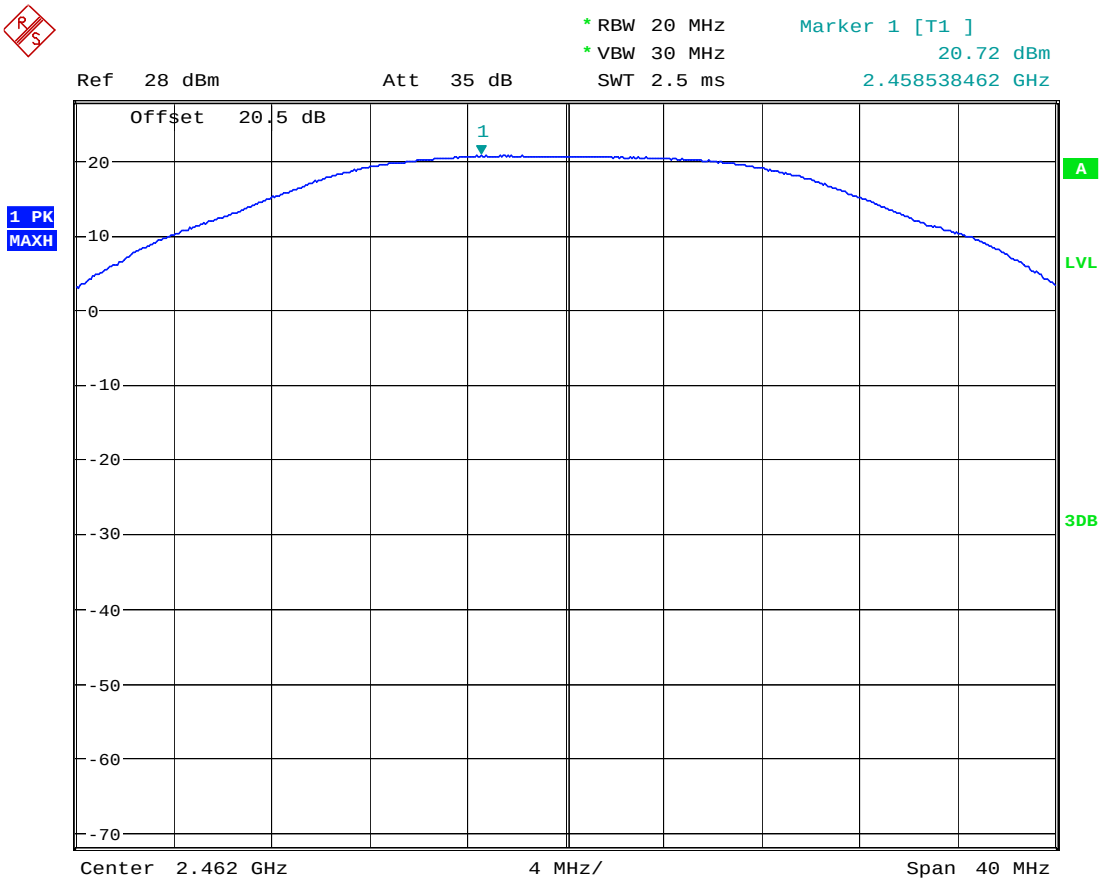
Conducted Peak Power 802.11b 2462 MHz



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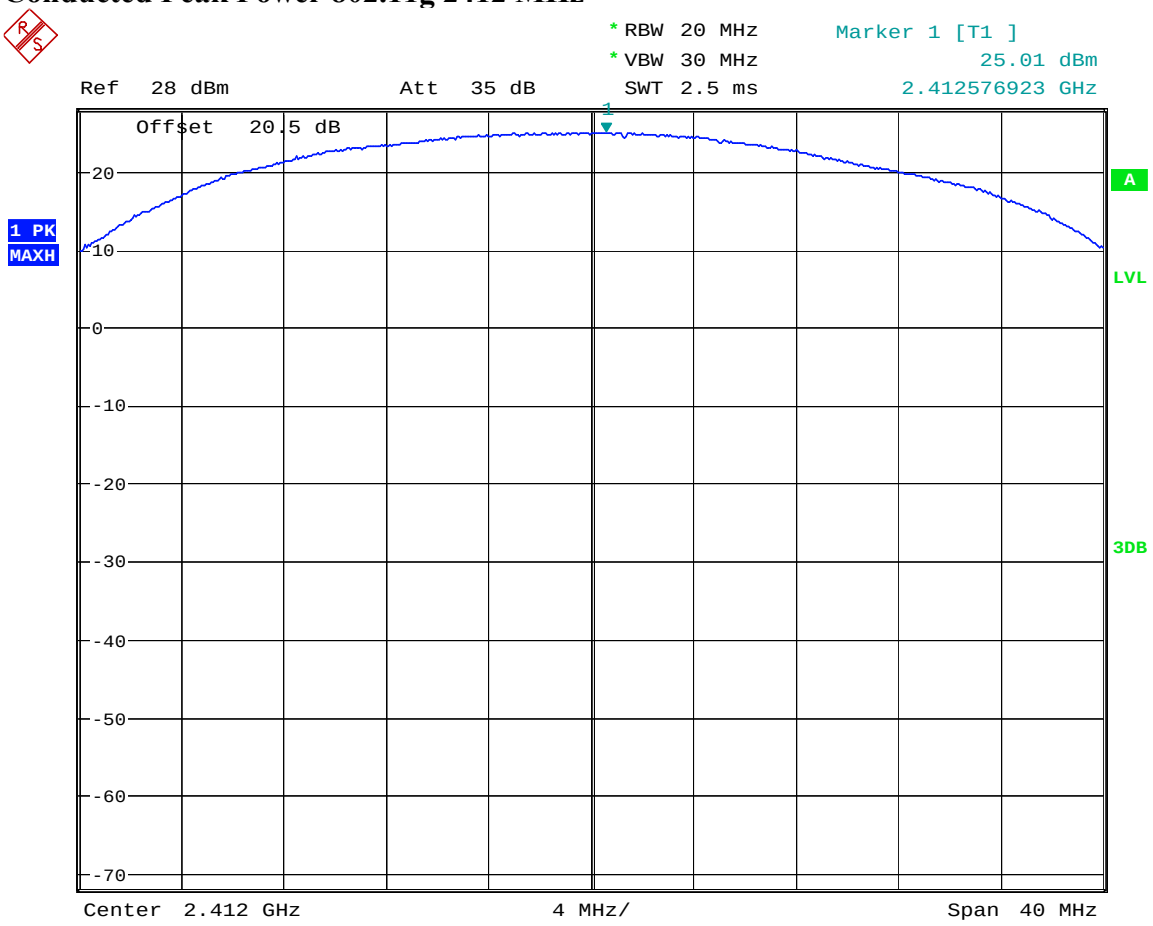
Conducted Peak Power 802.11g 2412 MHz



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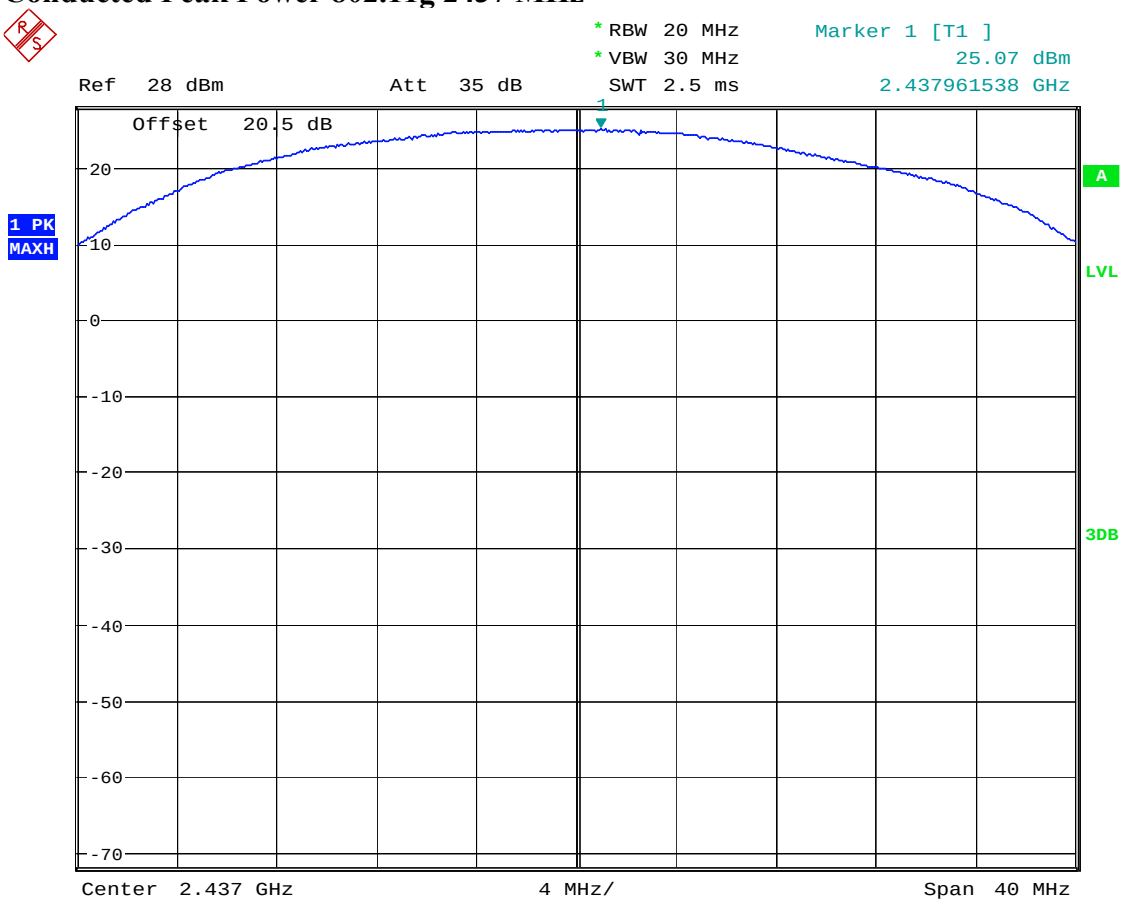
Conducted Peak Power 802.11g 2437 MHz



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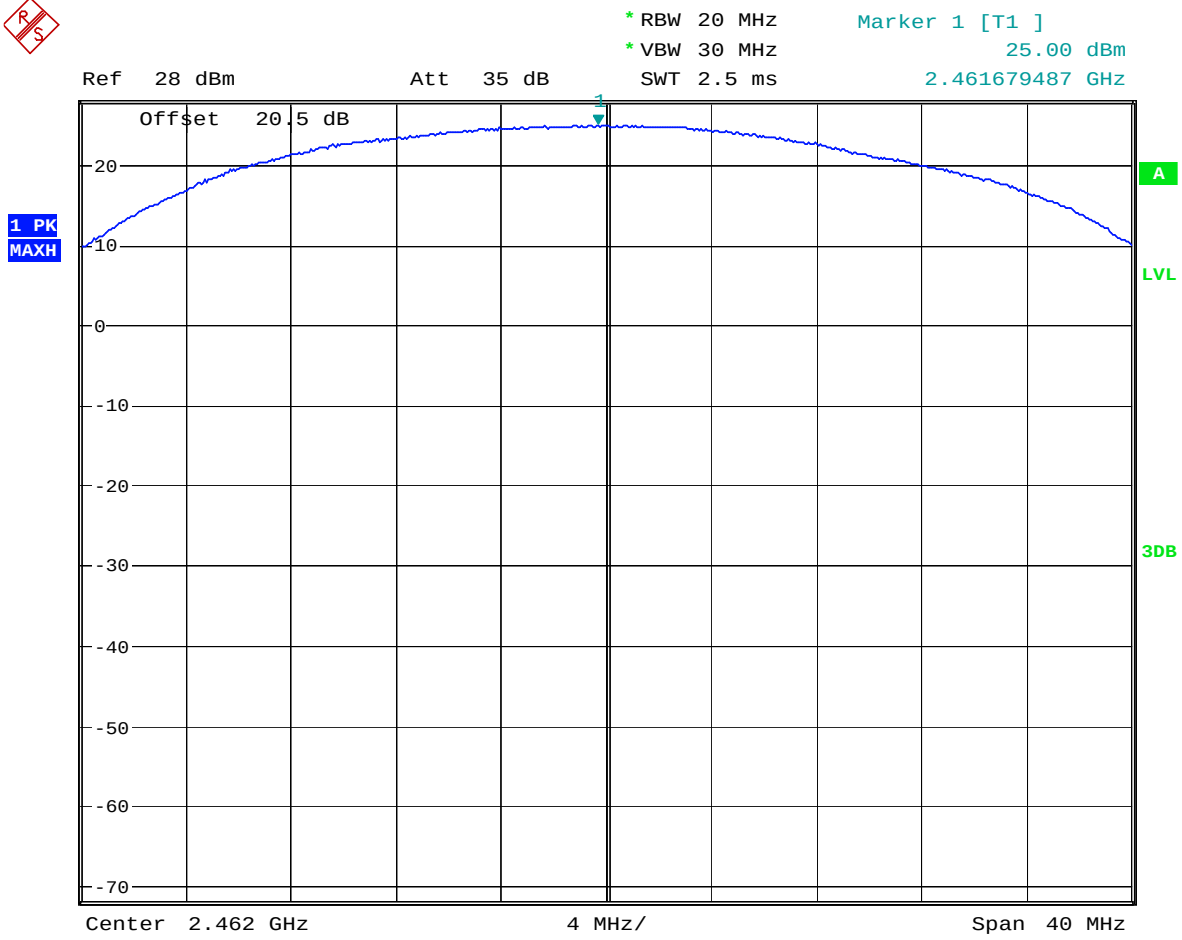
Conducted Peak Power 802.11g 2462 MHz



Date: 16.DEC.2010 17:10:59

6.4 Restricted Band Edge Compliance

6.4.1 References:

FCC CFR §2.1053
RSS-210 A8.5

6.4.2 Limits: §15.247/15.205

(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			

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.

6.4.3 Measurement Procedure:

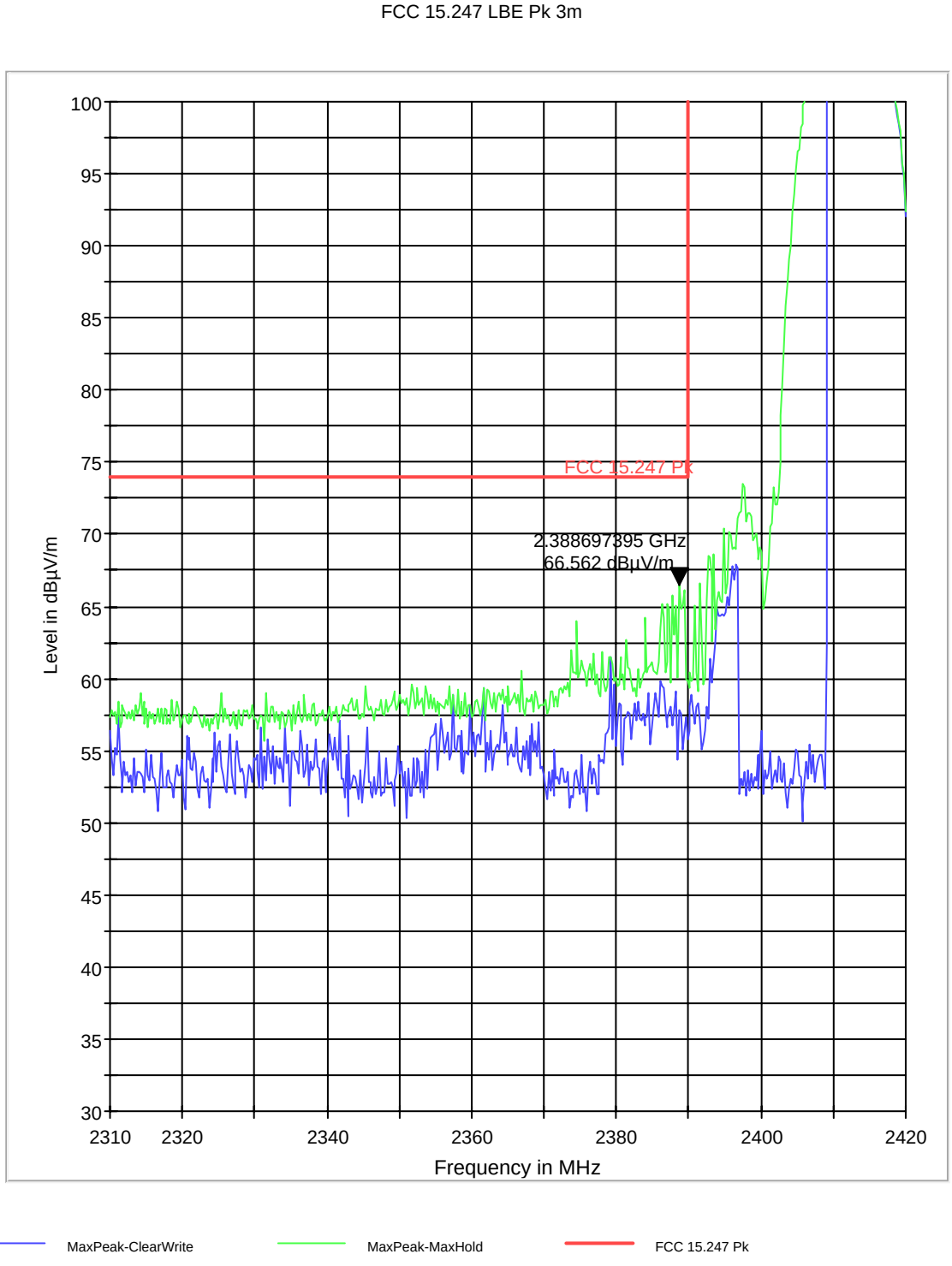
Peak measurements are made using a peak detector and RBW=1MHz.
Average measurements performed using a peak detector and according to video averaging procedure with RBW=1MHz and VBW=10Hz.
*PEAK LIMIT= 74dBµV/m
*AVG. LIMIT= 54dBµV/m
Measurement Uncertainty: ±3.0dB

6.4.3.1 Measurement Result

Pass.

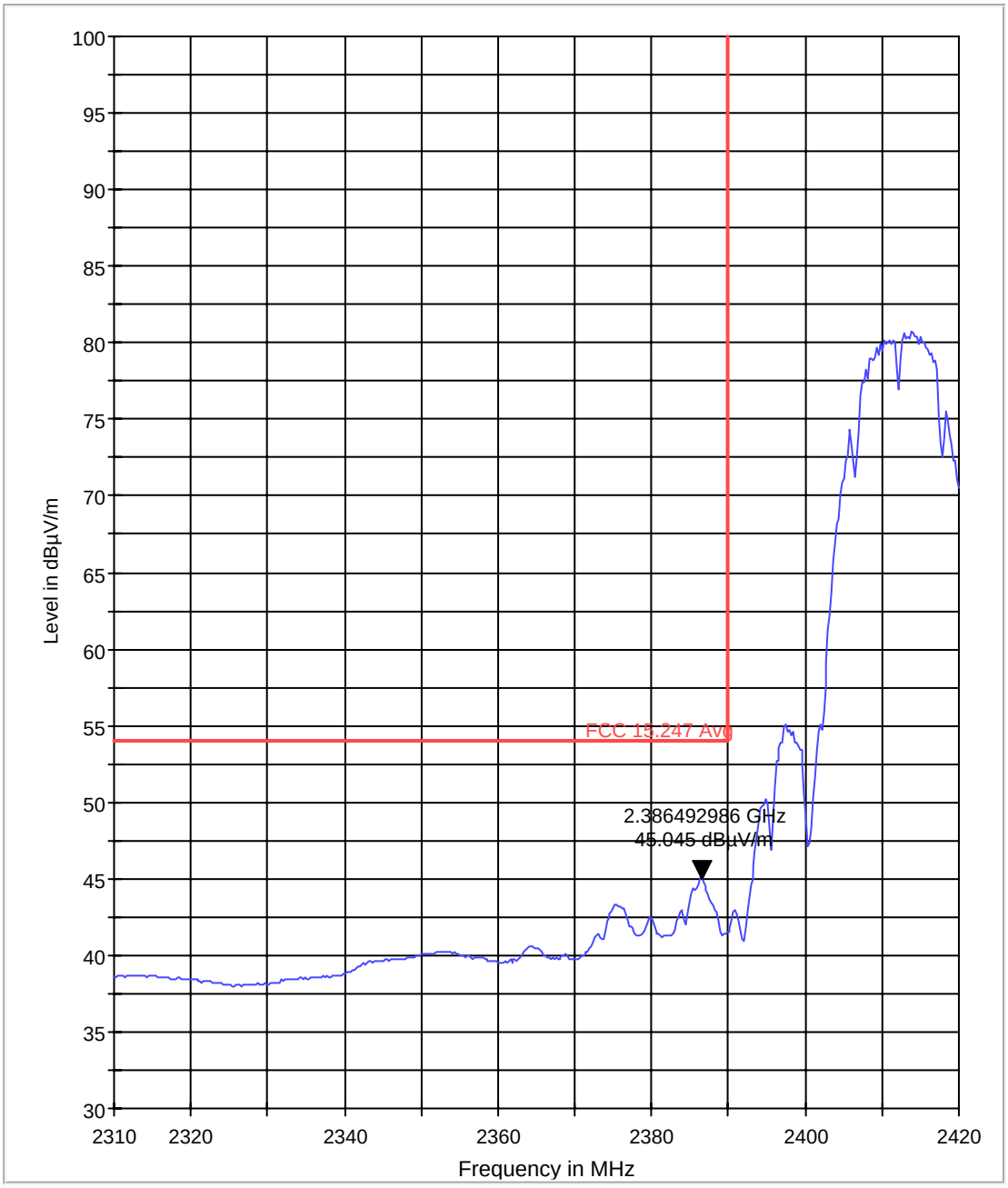
6.4.4 Test Data/plots:

Lower band edge peak -802.11b mode



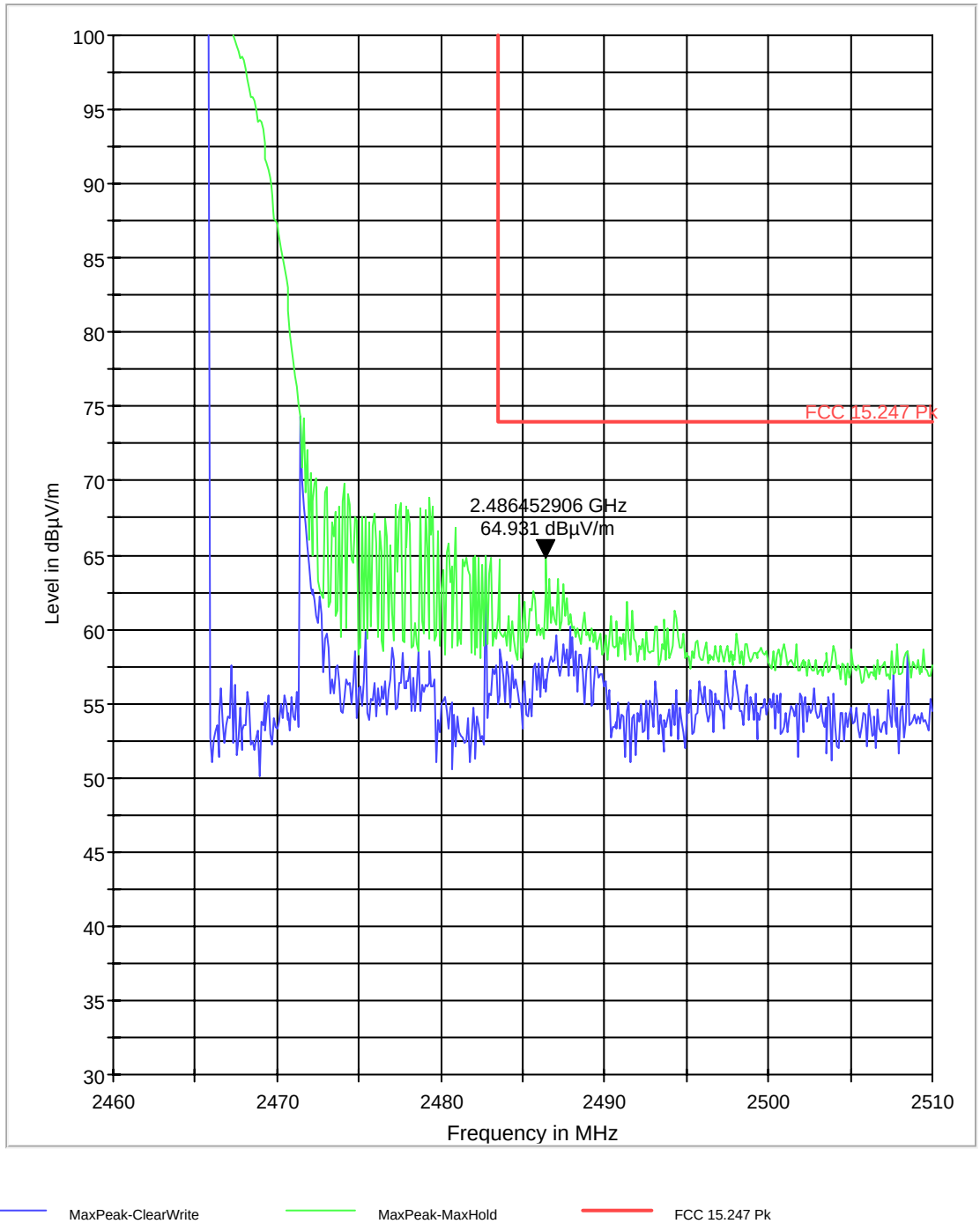
Lower band edge average -802.11b mode

FCC 15.247 LBE Avg 3m

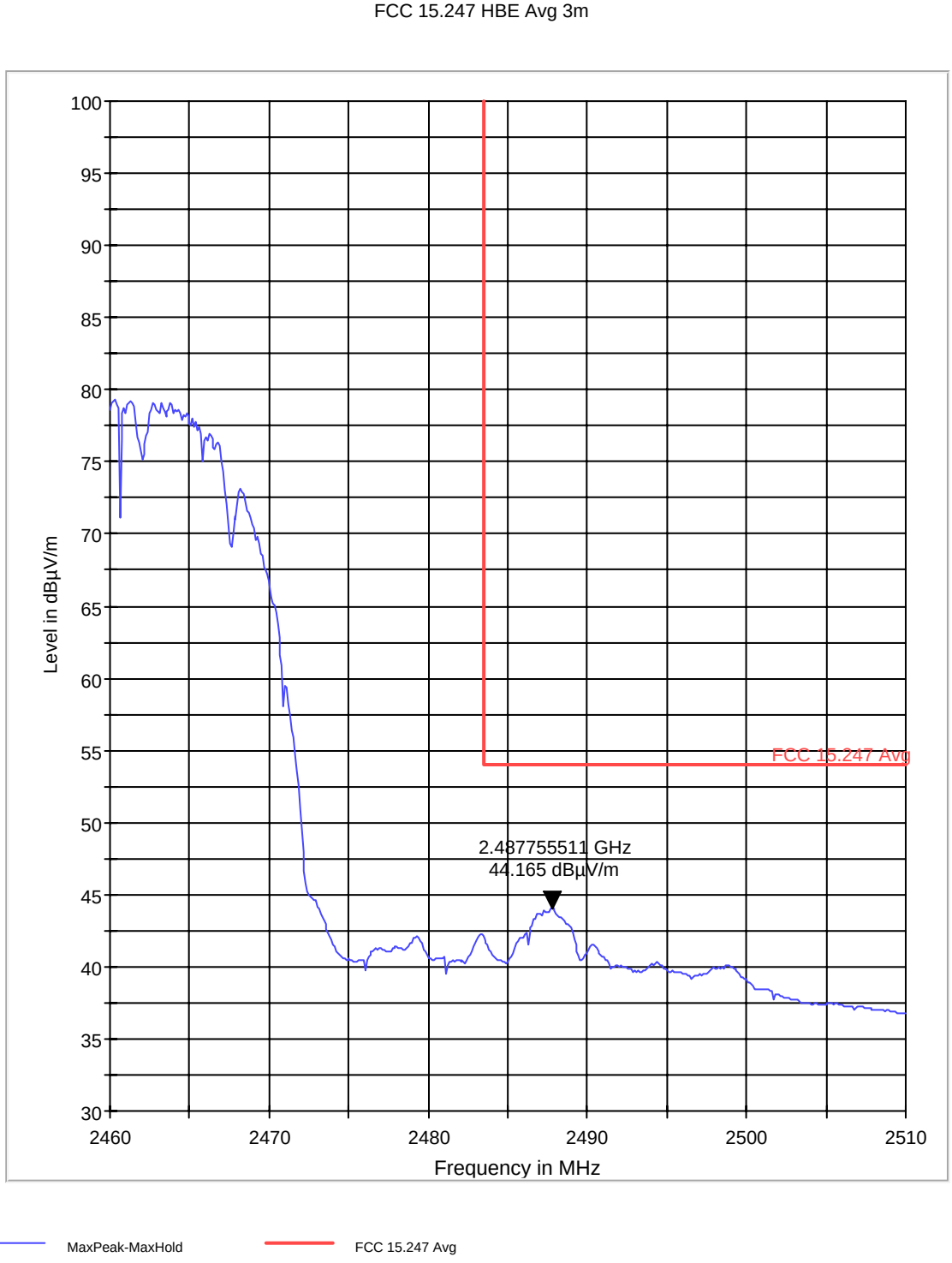


Higher band edge peak -802.11b mode

FCC 15.247 HBE Pk 3m

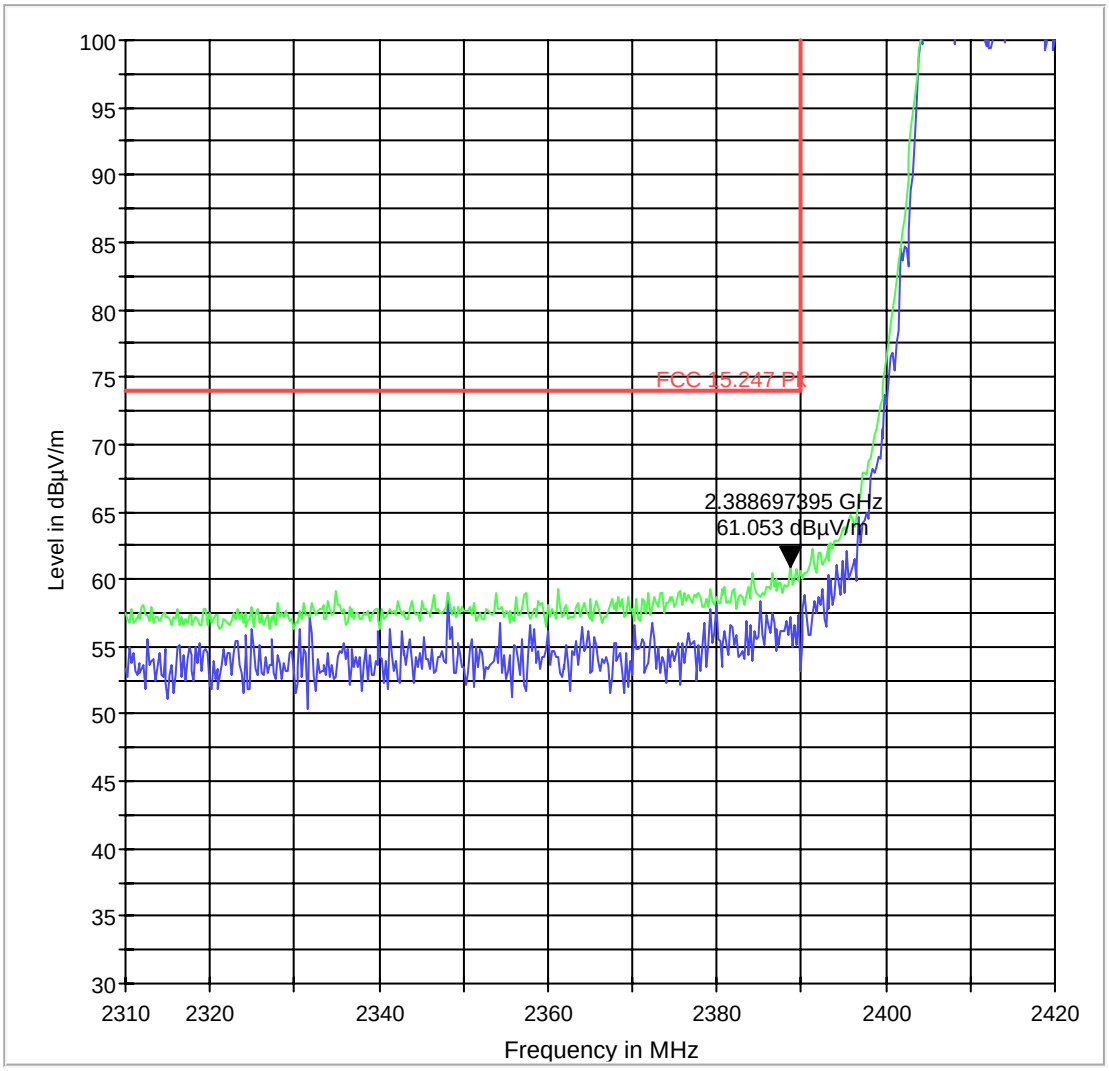


Higher band edge average-802.11b mode

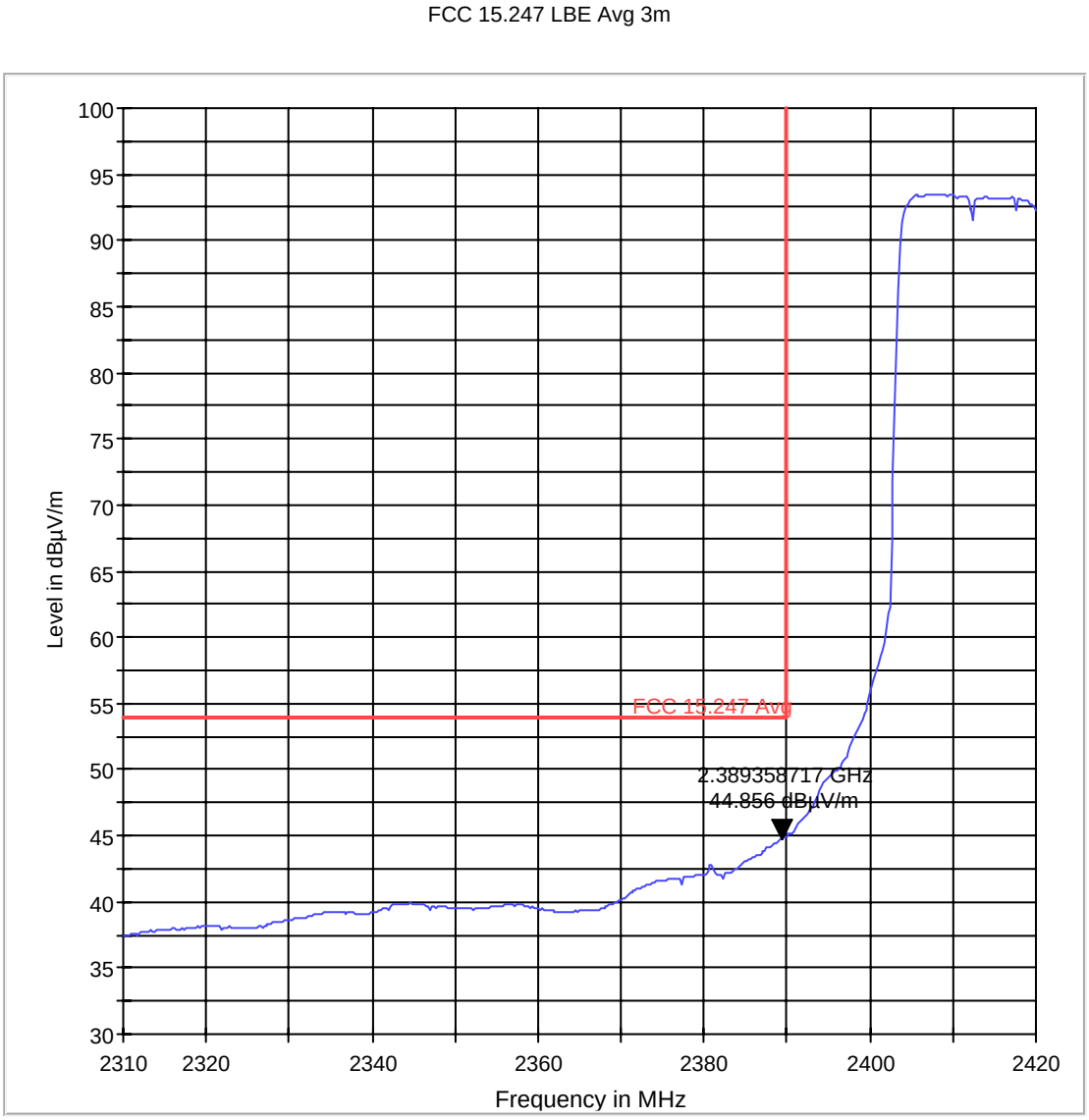


Lower band edge peak – 802.11g mode

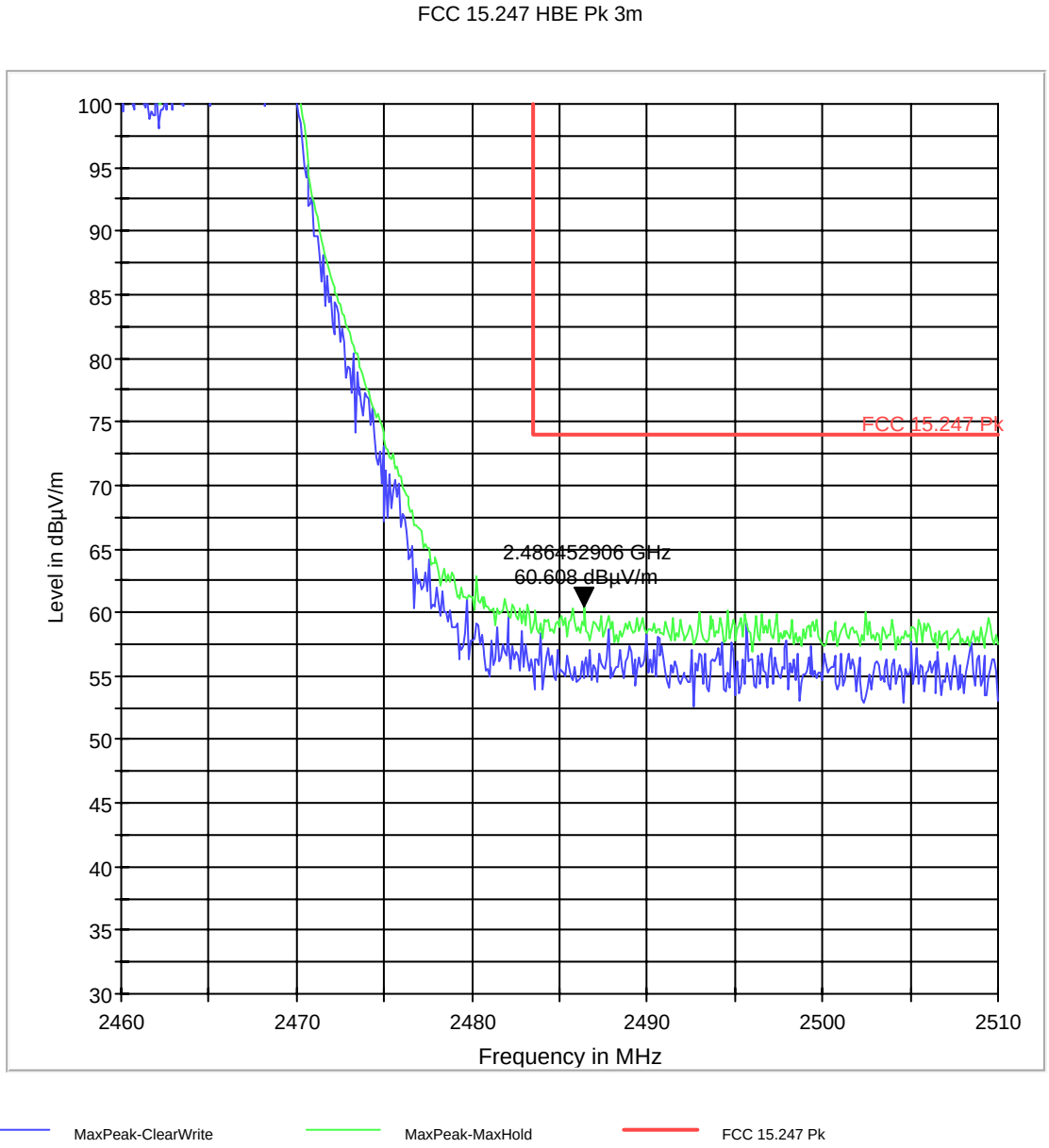
FCC 15.247 LBE Pk 3m



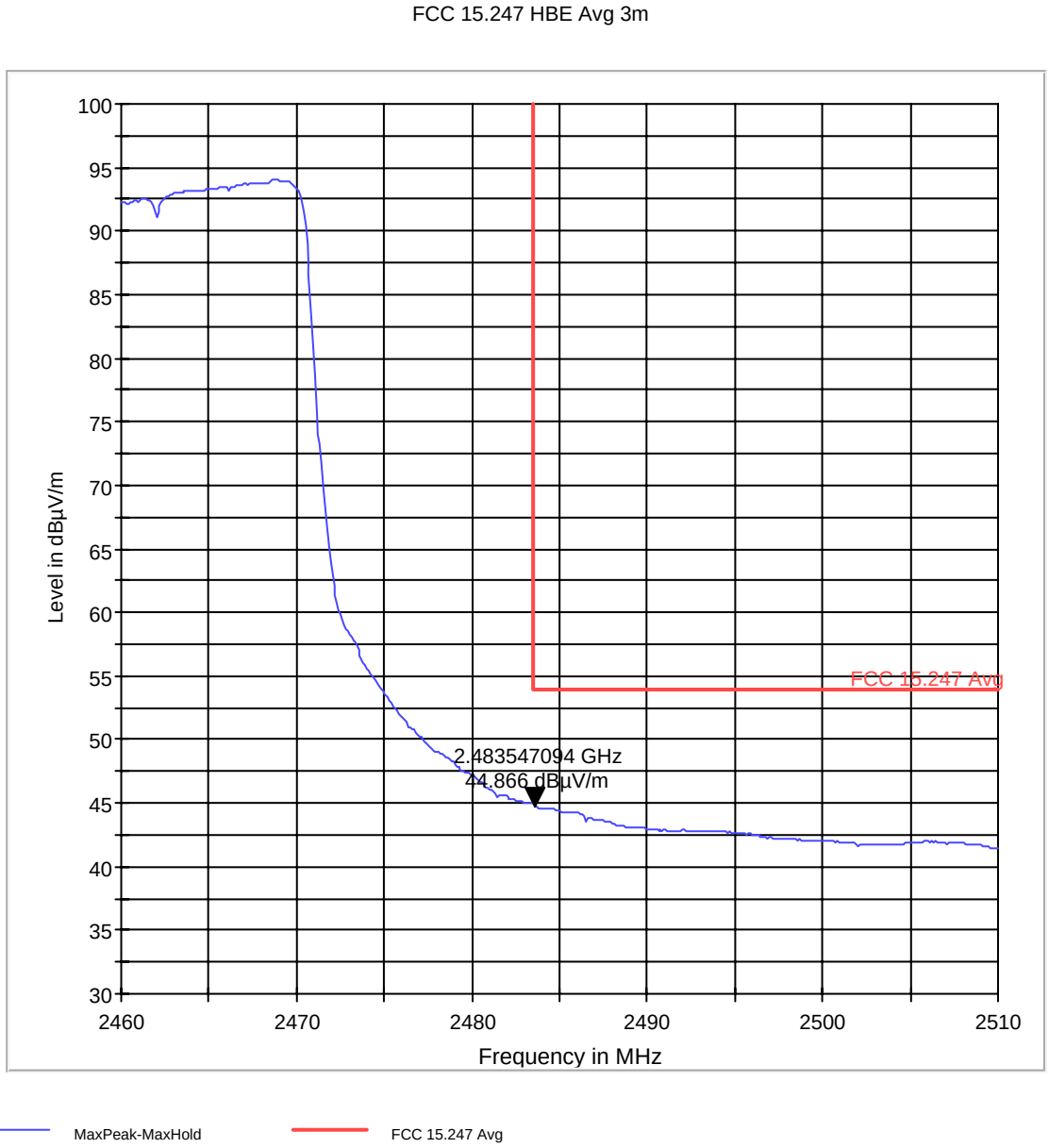
Lower band edge average -802.11g mode



Higher band edge peak -802.11g mode



Higher band edge average- 802.11g mode



6.5 Occupied Bandwidth/ 20dB Bandwidth

6.5.1 References:

FCC CFR §2.1049
RSS-Gen Section 4.6.2

6.5.2 Measurement requirements:

6.5.2.1 FCC 2.1049: Occupied bandwidth

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable.
(h) Transmitters employing digital modulation techniques-when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated.

6.5.2.2 RSS-Gen 4.6.2: Occupied bandwidth

Where indicated, the 6 dB bandwidth is measured at the points when the spectral density of the signal is 6 dB down from the in-band spectral density of the modulated signal, with the transmitter modulated by a representative signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0 percent of the emission bandwidth.

6.5.3 Limits:

6.5.3.1 §15.247 (a)(1)
6.5.3.2 RSS 210- A8.2(a)
Spectrum Bandwidth > 500 kHz

6.5.4 Test Conditions:

Tnom: 25°C; Vnom: AC
Spectrum Analyzer settings:
RBW=300kHz, VBW=300kHz, Detector: Peak- Max hold;
Sweep Time: Auto
Span=20MHz

6.5.5 Test Result:

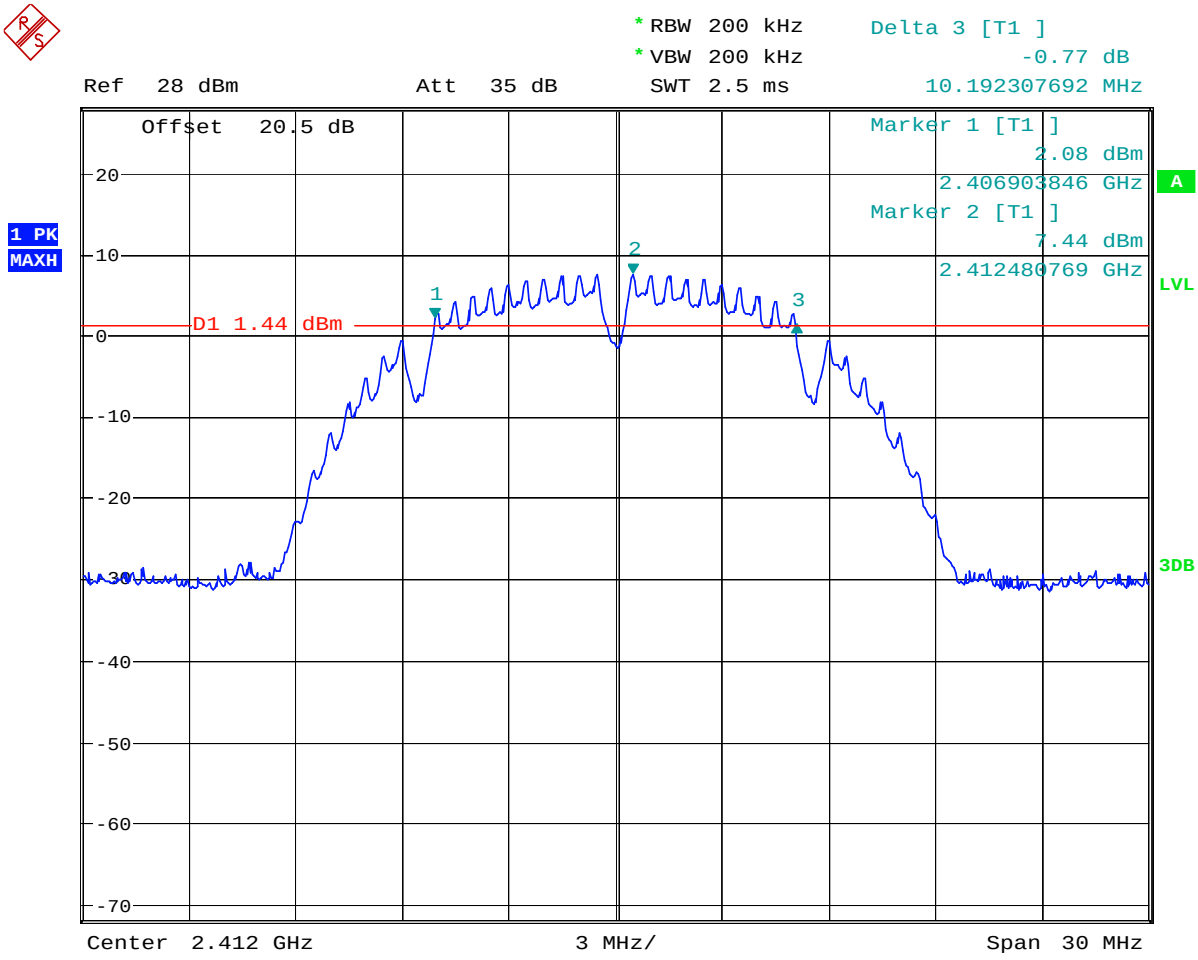
Occupied Bandwidth (MHz)						
Mode	**Frequency (MHz)**					
	2412 Channel 1		**2437 Channel 6**		**2462 Channel 11**	
	6dB	**20dB/ 99%**	**6dB**	**20dB/ 99%**	**6dB**	**20dB/ 99%**
802.11b	10.19	13.85	10.24	13.80	10.14	13.85
802.11g	16.5	16.6	16.5	16.5	16.5	16.6
Measurement Uncertainty: ±100 kHz						

6.5.5.1 Measurement Result

Pass.

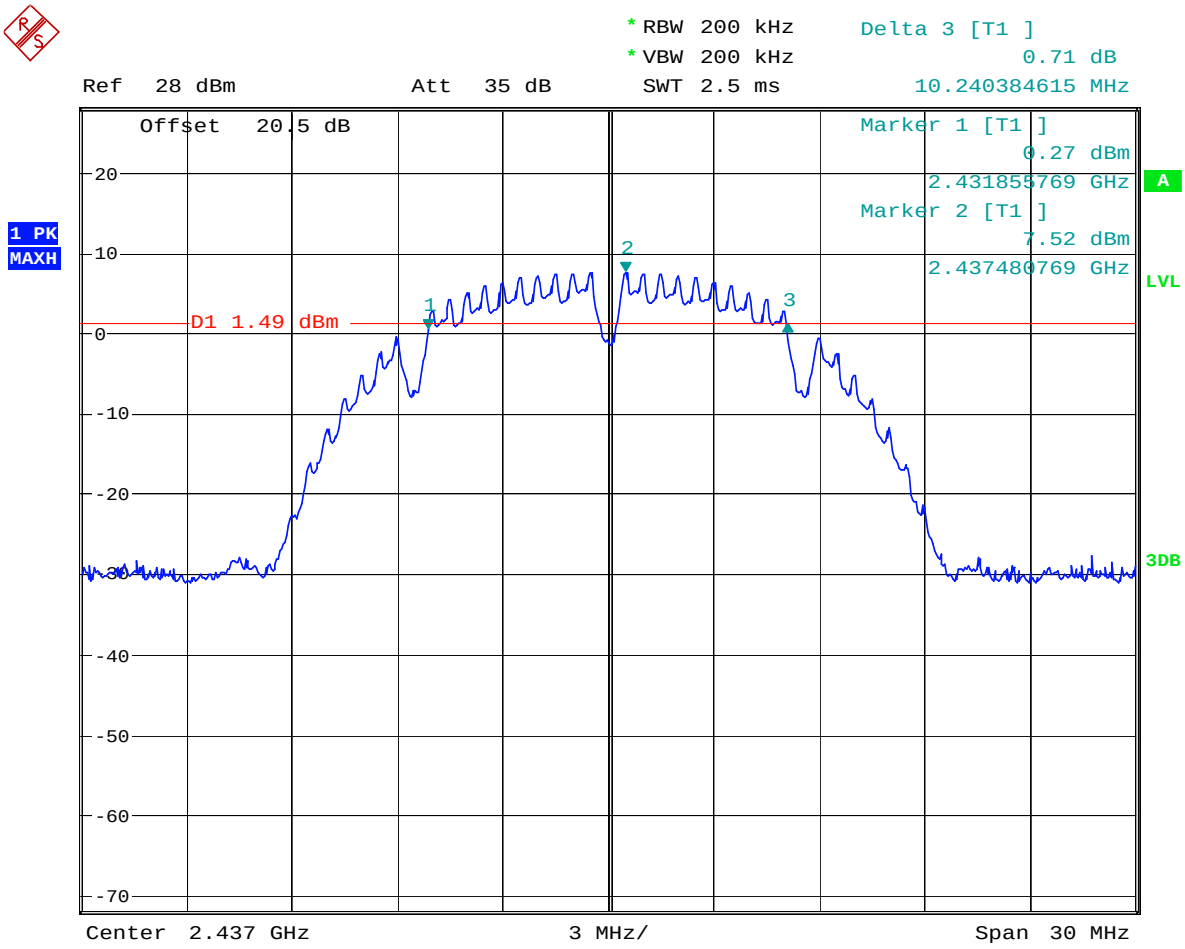
6.5.6 Test Data/plots:

6dB Bandwidth 802.11b 2412 MHz



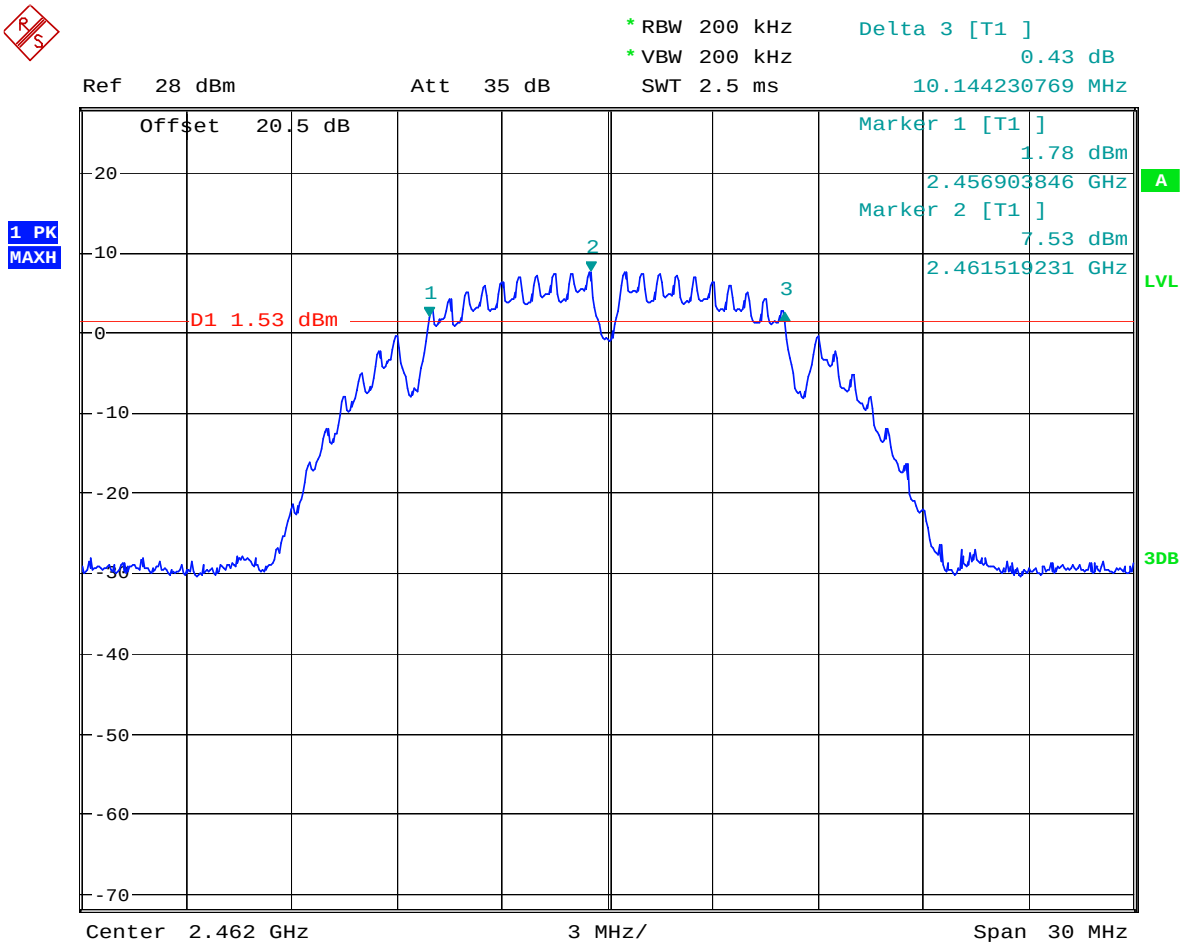
Date: 16.DEC.2010 13:21:49

6dB Bandwidth 802.11b 2437 MHz



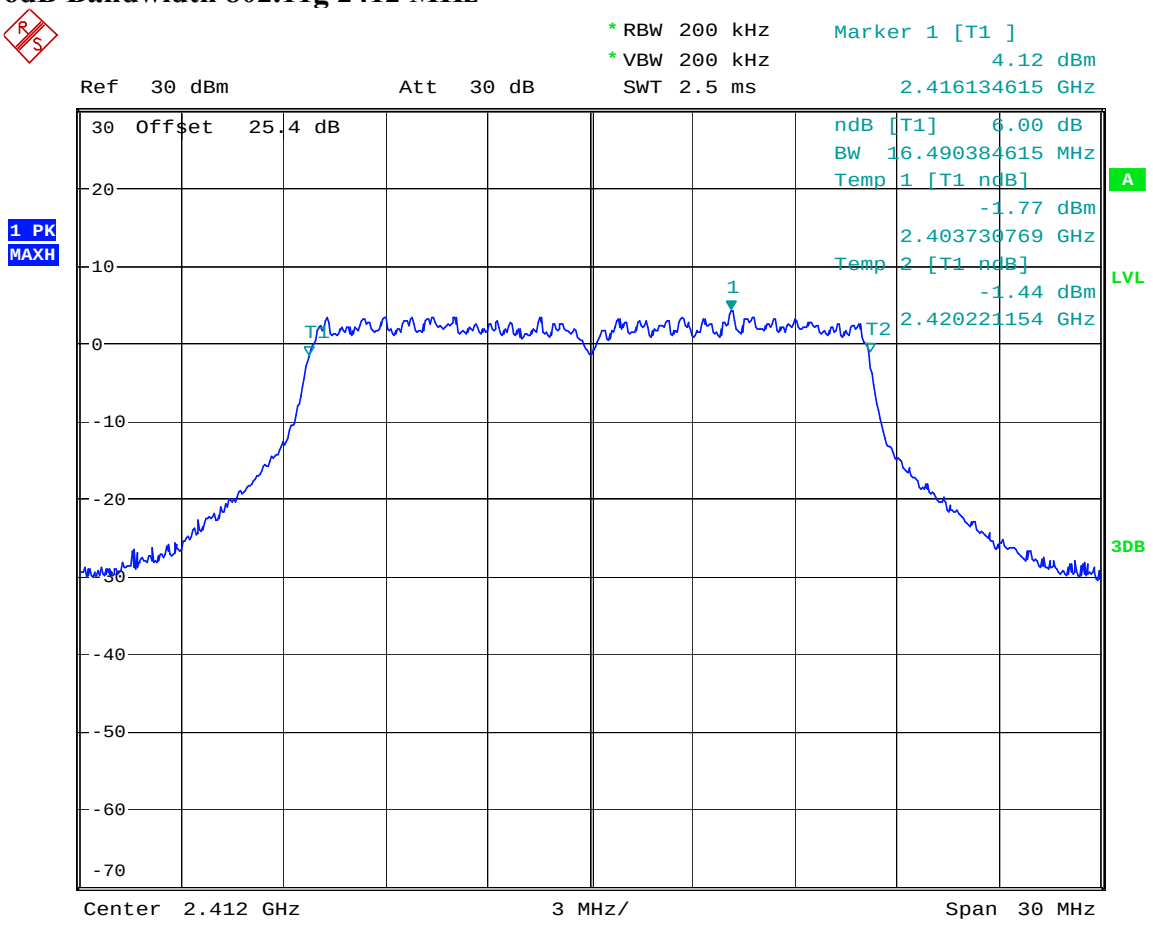
Date: 16.DEC.2010 13:20:17

6dB Bandwidth 802.11b 2462 MHz



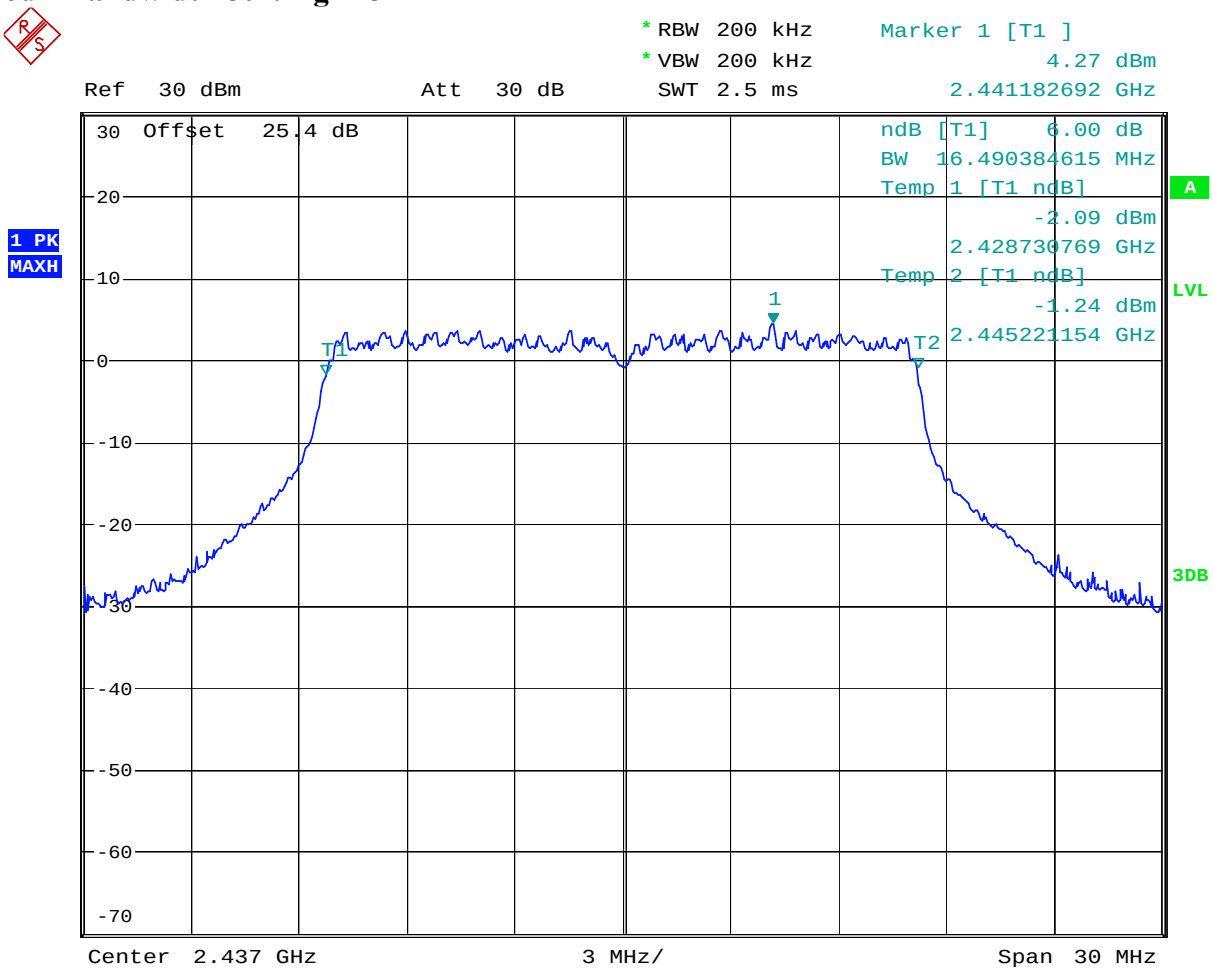
Date: 16.DEC.2010 13:15:46

6dB Bandwidth 802.11g 2412 MHz



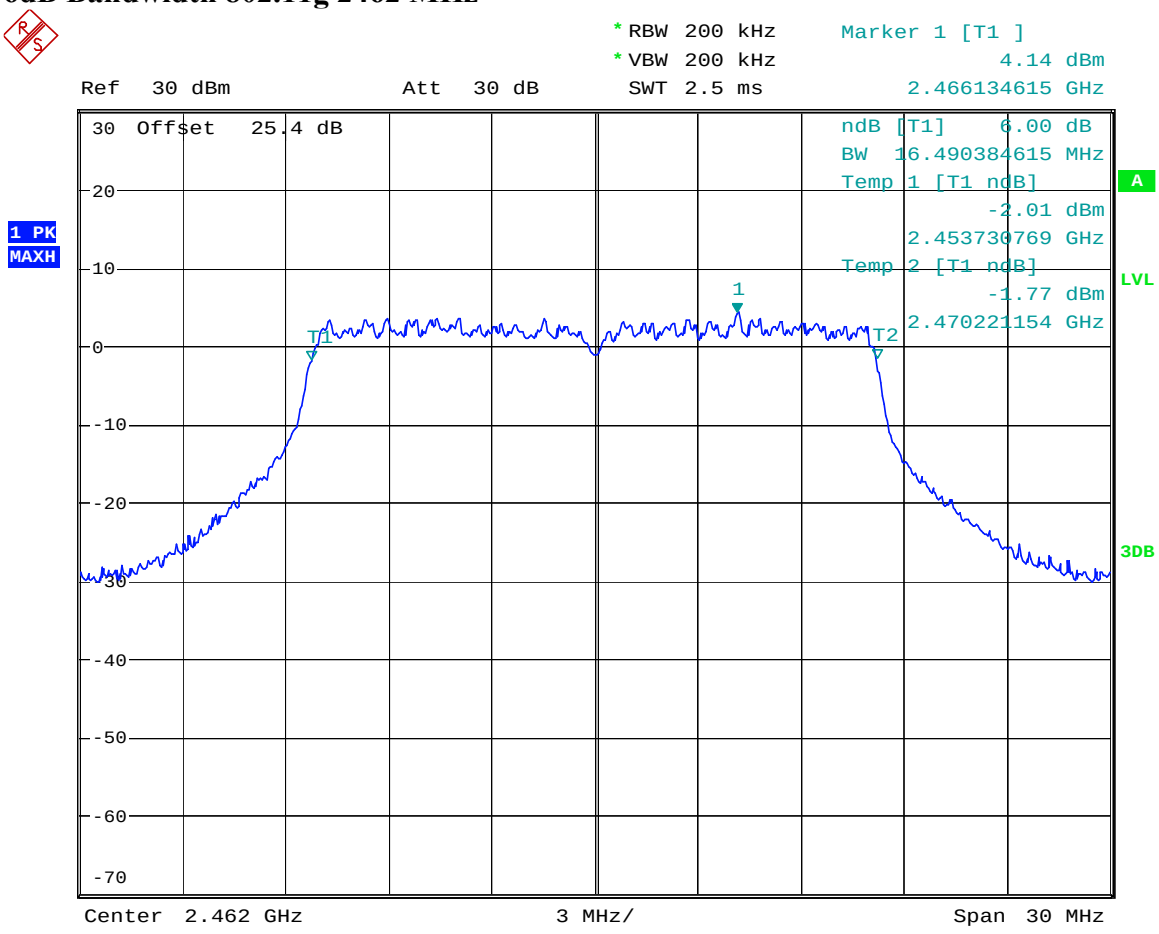
Date: 15.JAN.2011 11:22:12

6dB Bandwidth 802.11g 2437 MHz



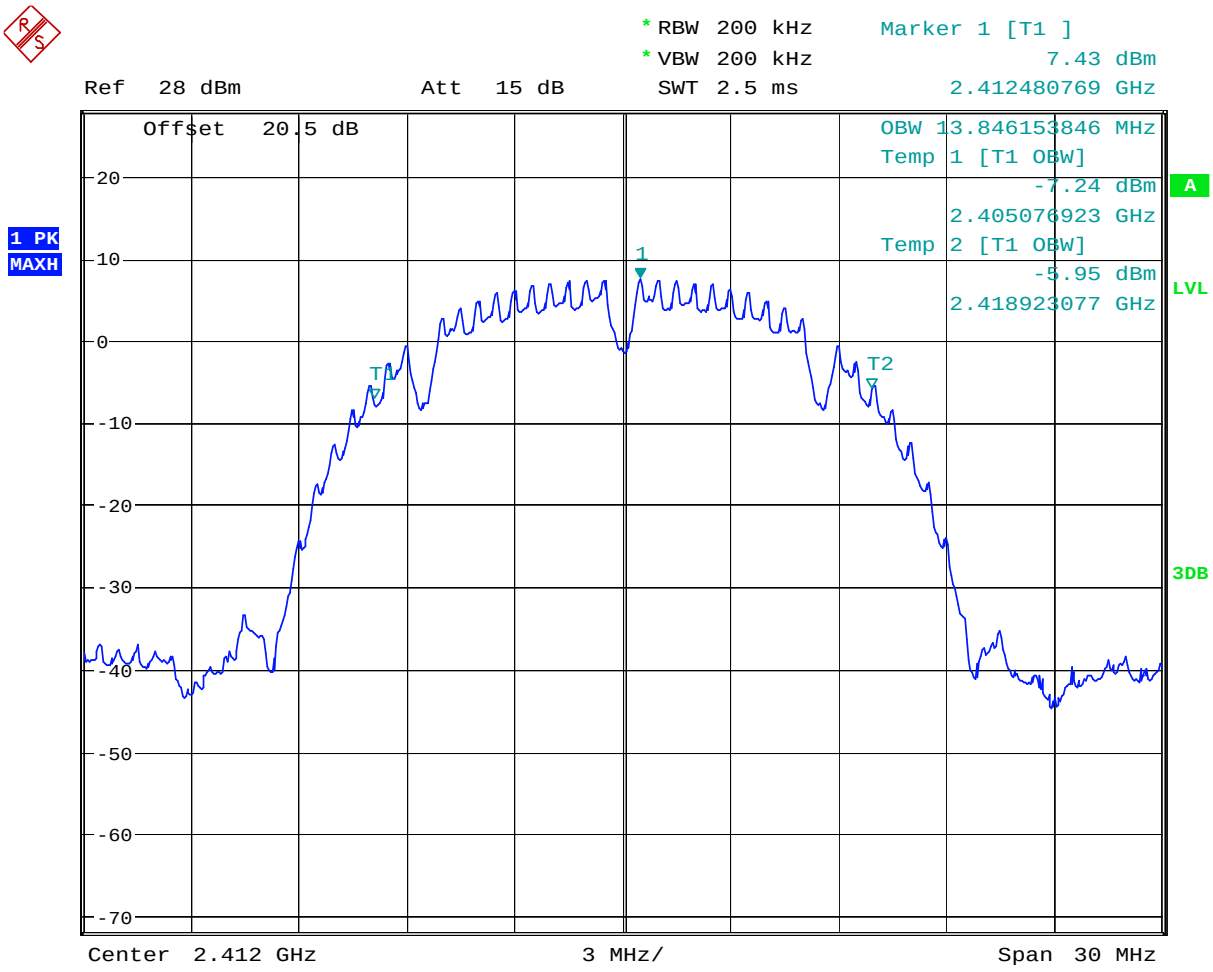
Date: 15.JAN.2011 11:19:49

6dB Bandwidth 802.11g 2462 MHz



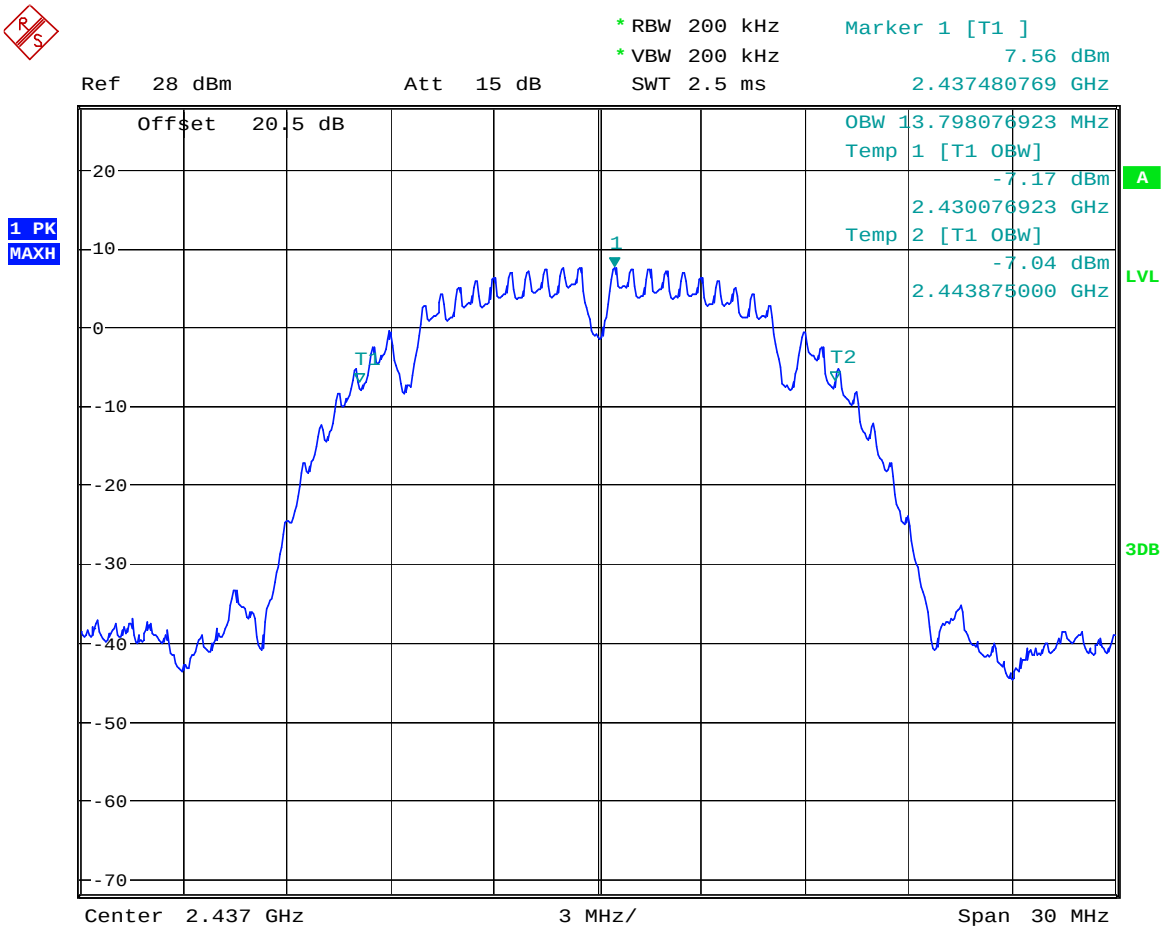
Date: 15.JAN.2011 11:18:45

20dB Bandwidth 802.11b 2412 MHz



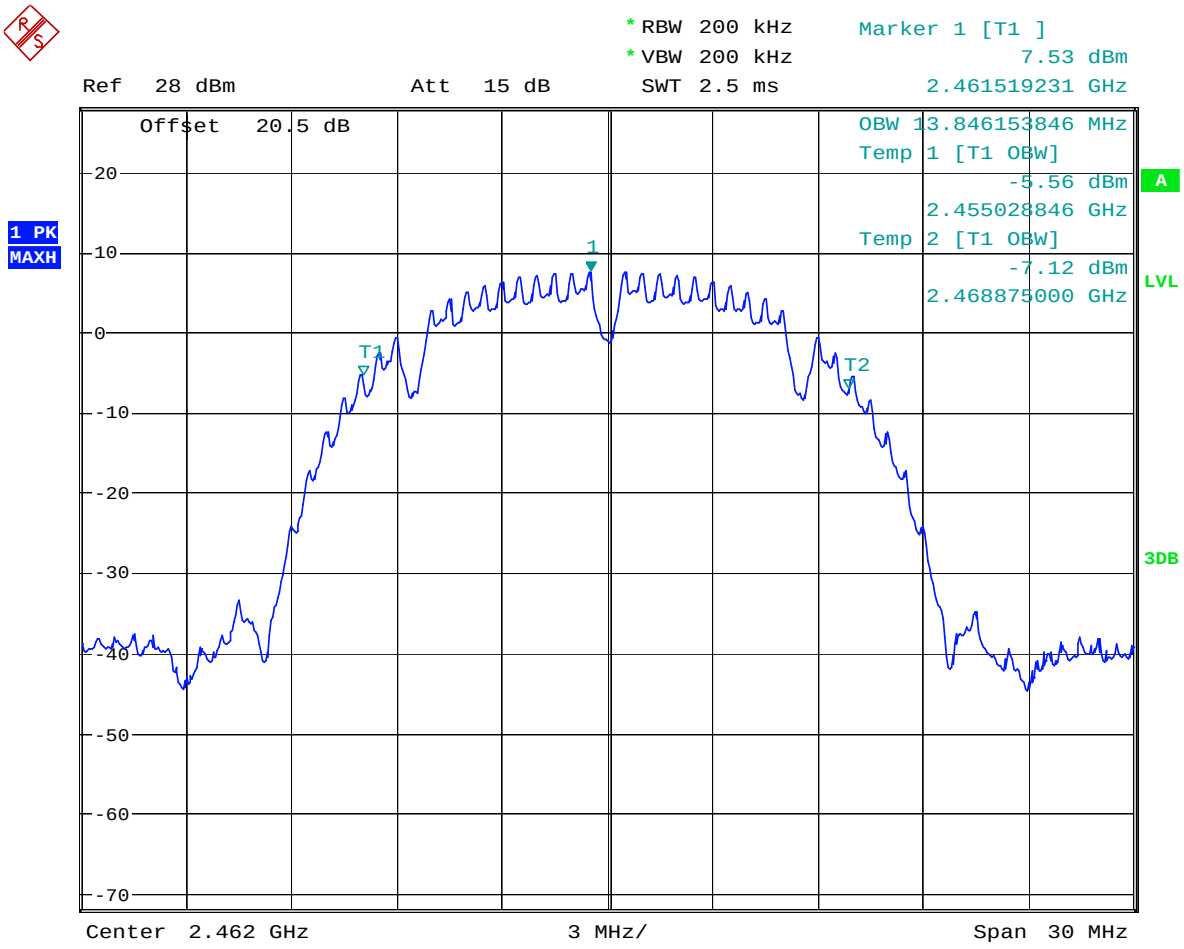
Date: 16.DEC.2010 13:22:37

20dB Bandwidth 802.11b 2437 MHz



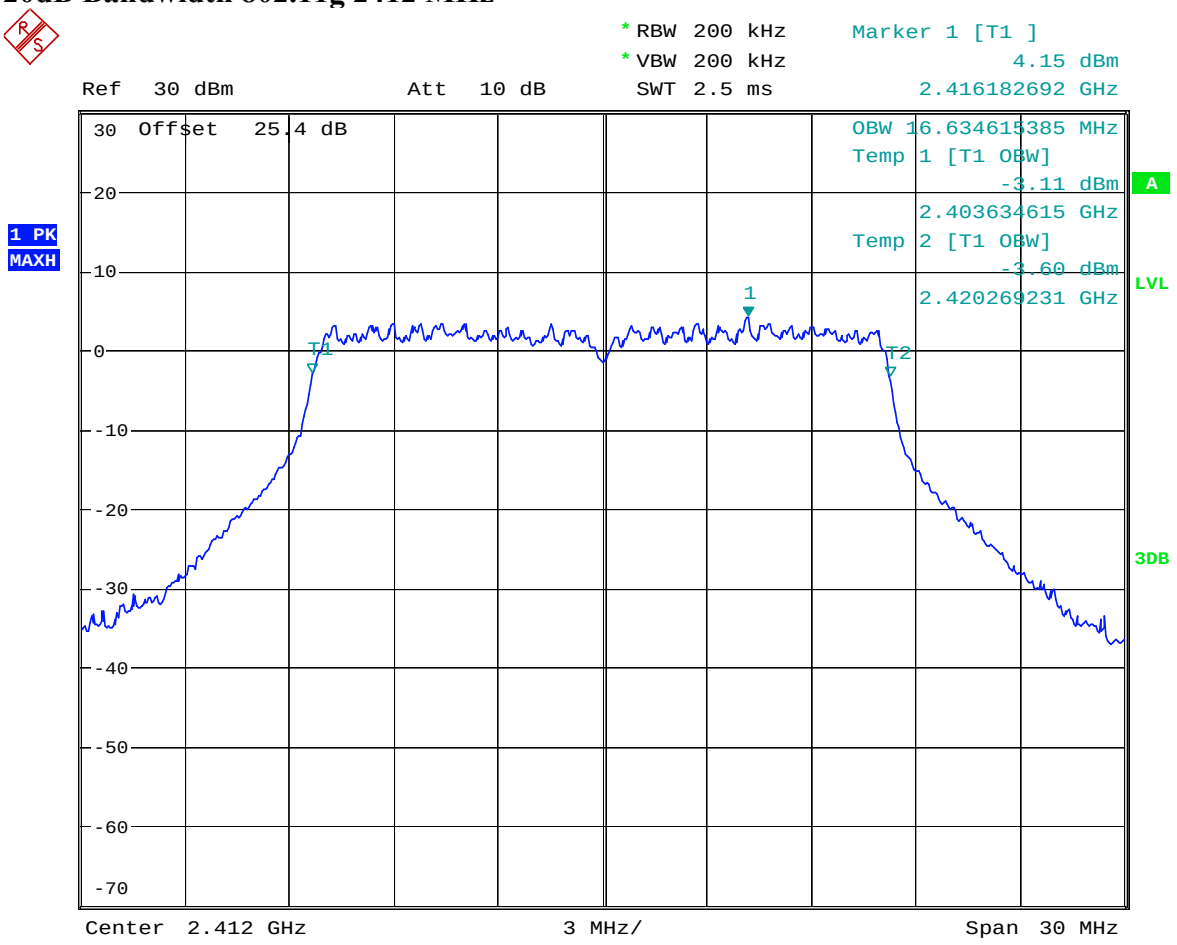
Date: 16.DEC.2010 13:18:46

20dB Bandwidth 802.11b 2462 MHz



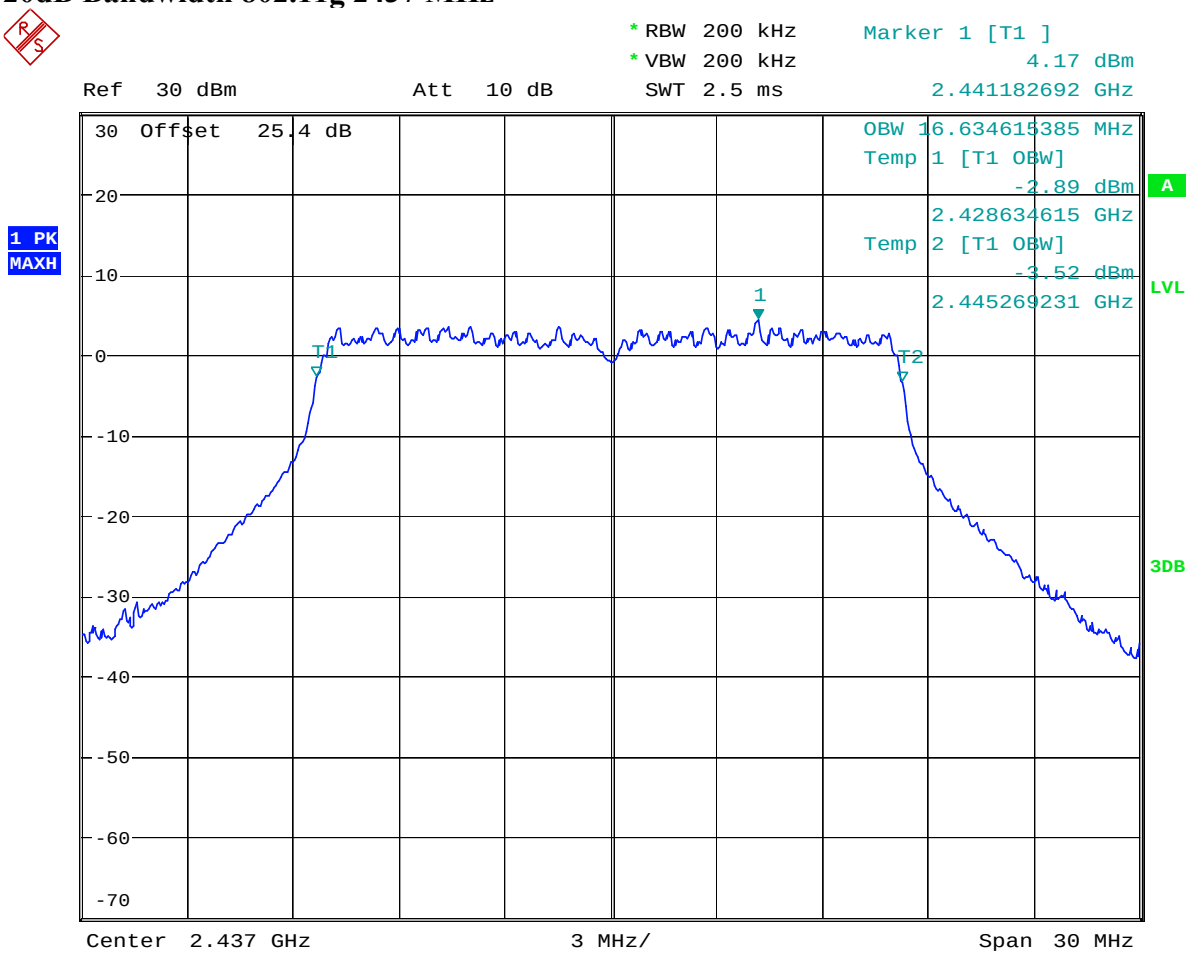
Date: 16.DEC.2010 13:17:39

20dB Bandwidth 802.11g 2412 MHz



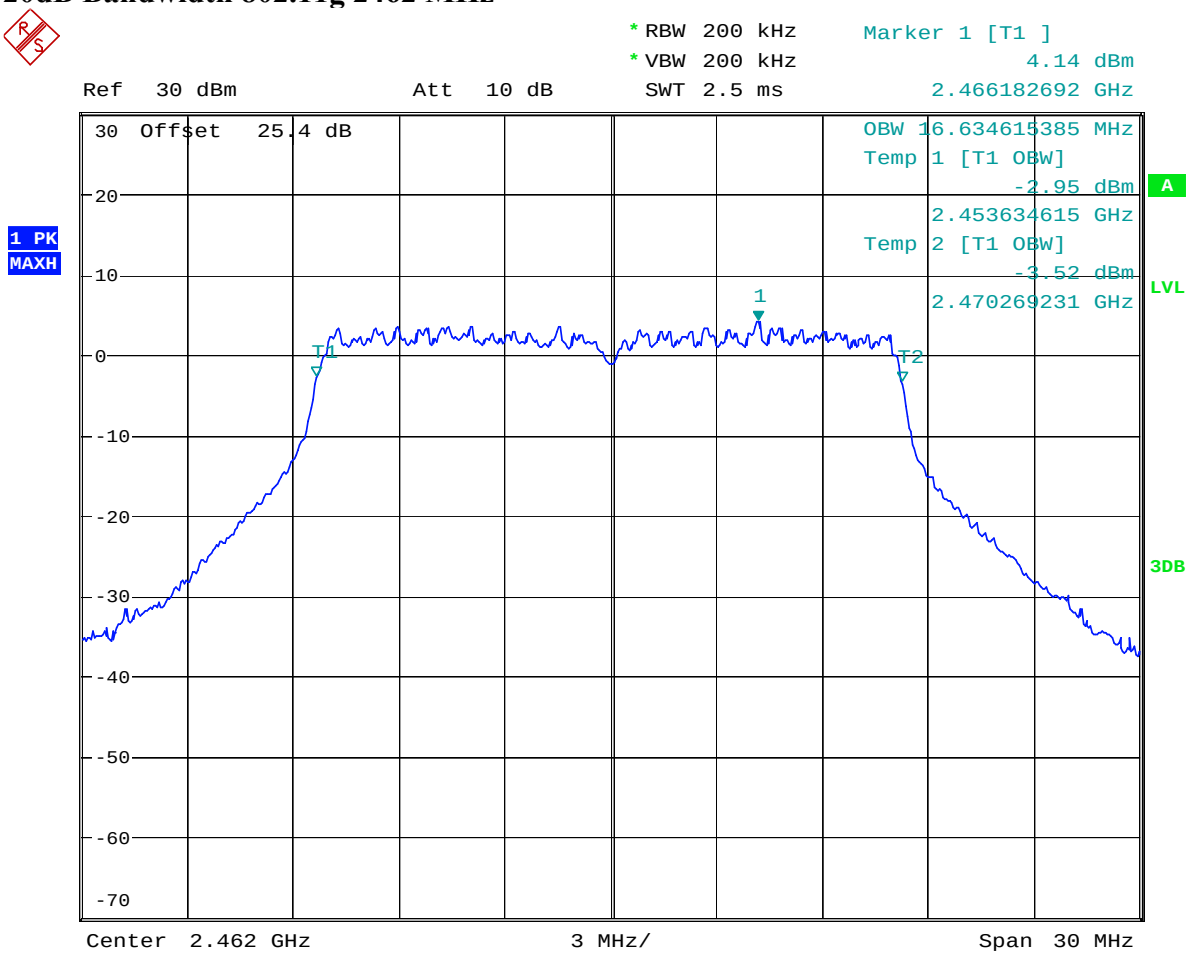
Date: 15.JAN.2011 11:21:30

20dB Bandwidth 802.11g 2437 MHz



Date: 15.JAN.2011 11:20:41

20dB Bandwidth 802.11g 2462 MHz



Date: 15.JAN.2011 11:17:43

6.6 Power Spectral Density

6.6.1 Limits:

6.6.1.1 § 15.247 (e)

6.6.1.2 RSS 210- A8.2(b)

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

6.6.2 Measurement procedure:

1. Determine the highest peak level for a sweep with RBW=VBW=100kHz and span =10MHz.
2. Set the peak level at the center of the screen and sweep again for a span of 5MHz.
3. Repeat step 2 with a span of 1MHz.
4. Set the peak level at the center of the screen and sweep with RBW=3kHz, VBW=10kHz, Span=300kHz and sweep time of 100sec.
5. Allow two sweeps to complete to determine the highest level as the PSD.

6.6.3 Test results:

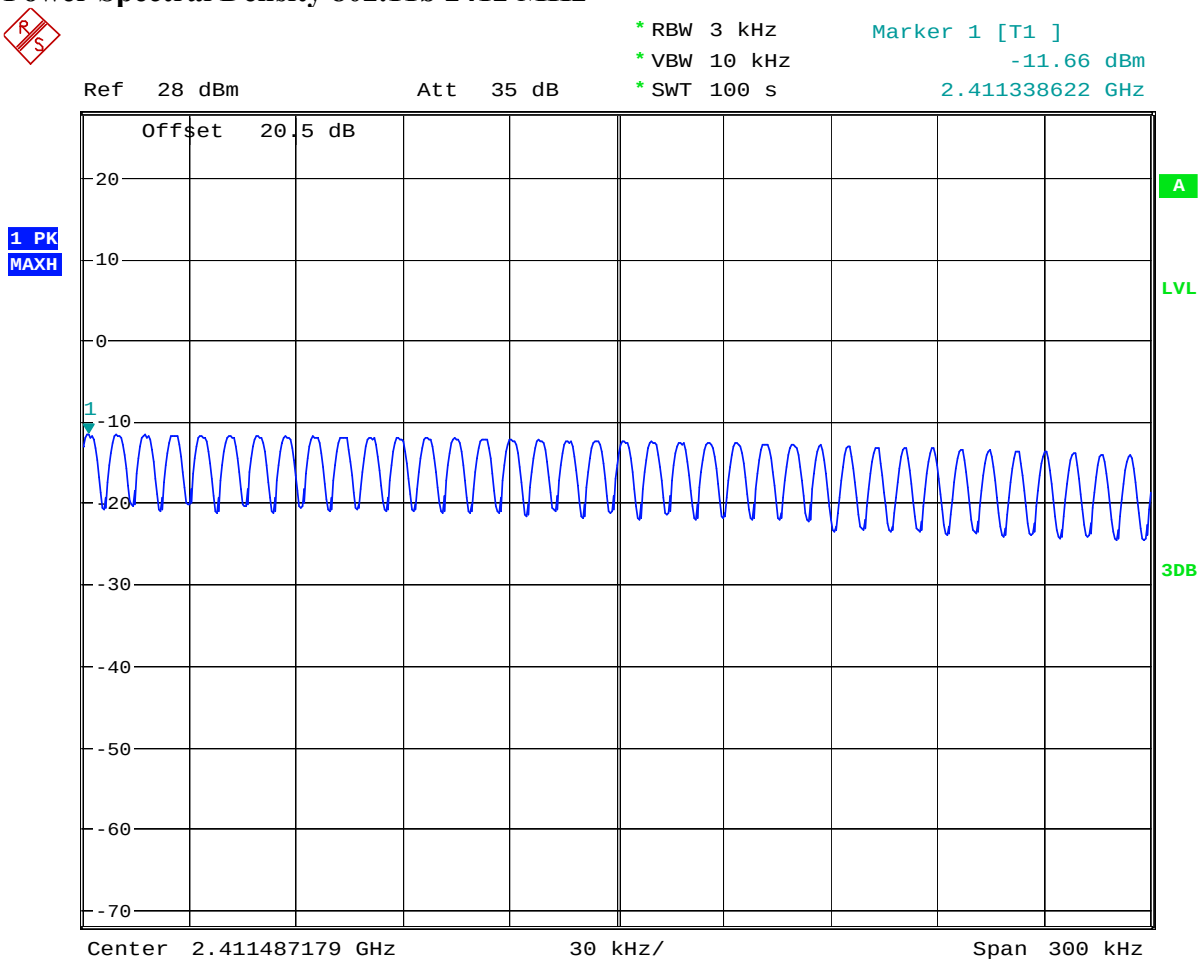
Power Spectral Density (dBm)			
Mode	**Frequency (MHz)**		
	2412 Channel 1	**2437 Channel 6**	**2462 Channel 11**
802.11b	-11.66	-11.91	-12.15
802.11g	-14.10	-14.17	-14.33
Measurement Uncertainty: ±0.5dB			

6.6.3.1 Measurement Result

Pass.

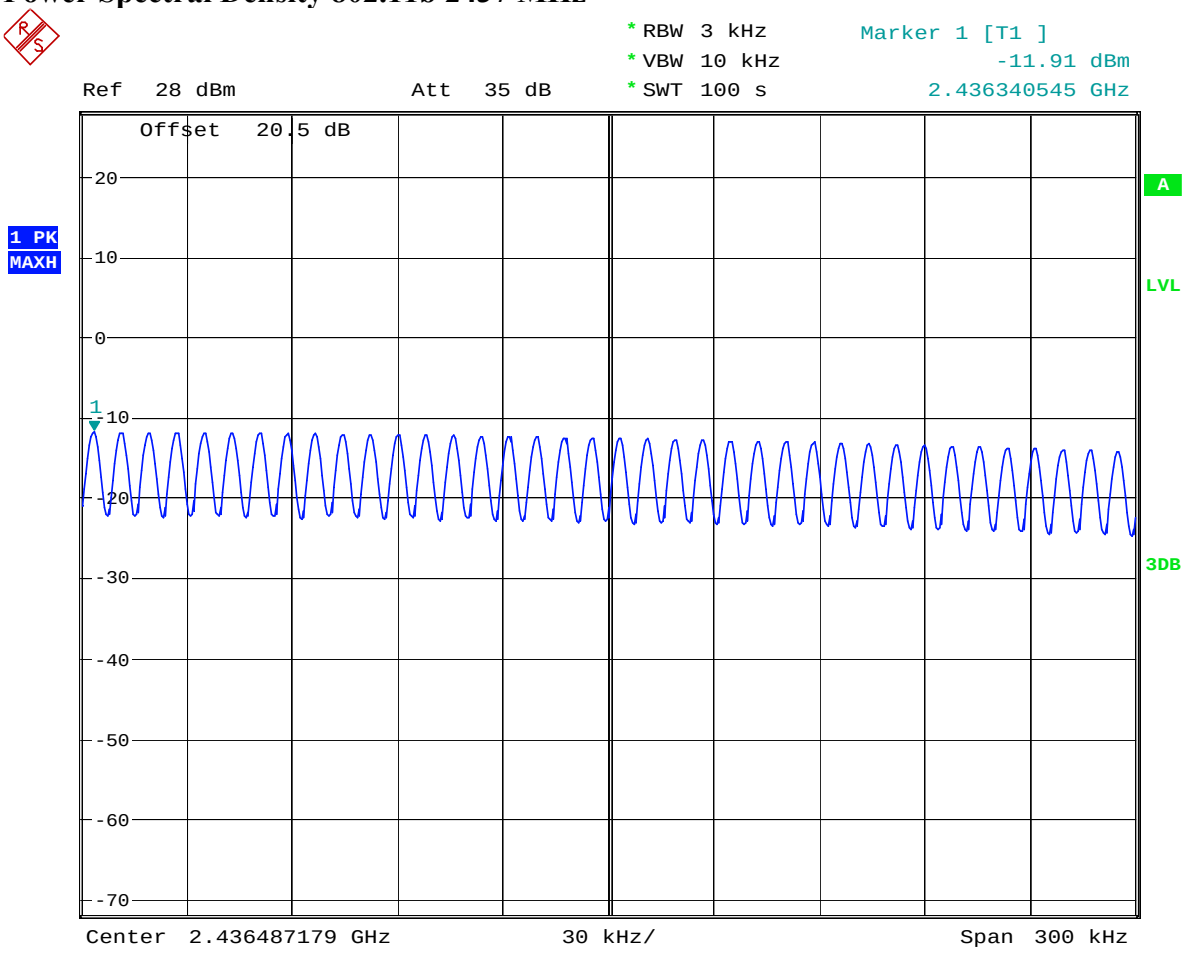
6.6.4 Test Data/plots:

Power Spectral Density 802.11b 2412 MHz



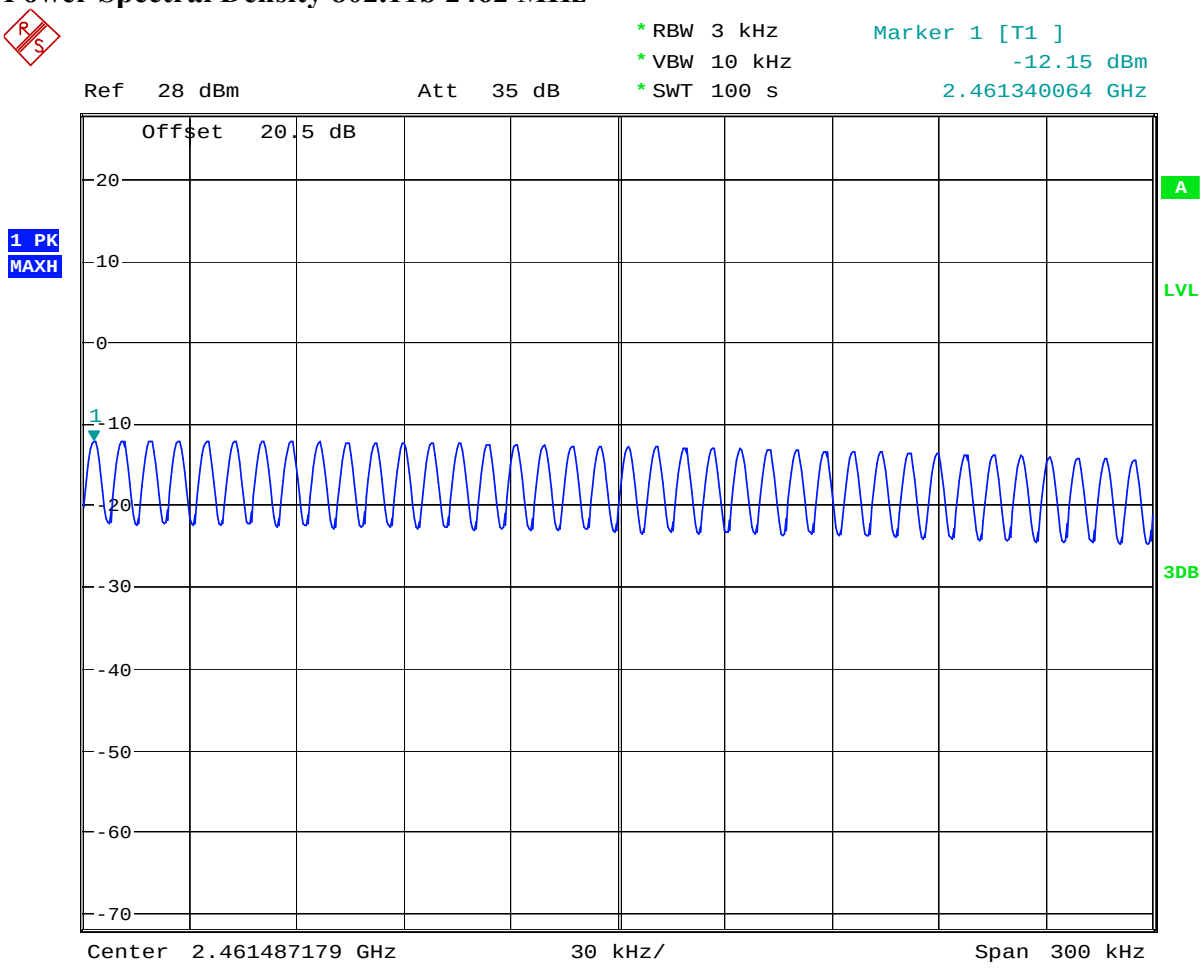
Date: 16.DEC.2010 16:46:03

Power Spectral Density 802.11b 2437 MHz



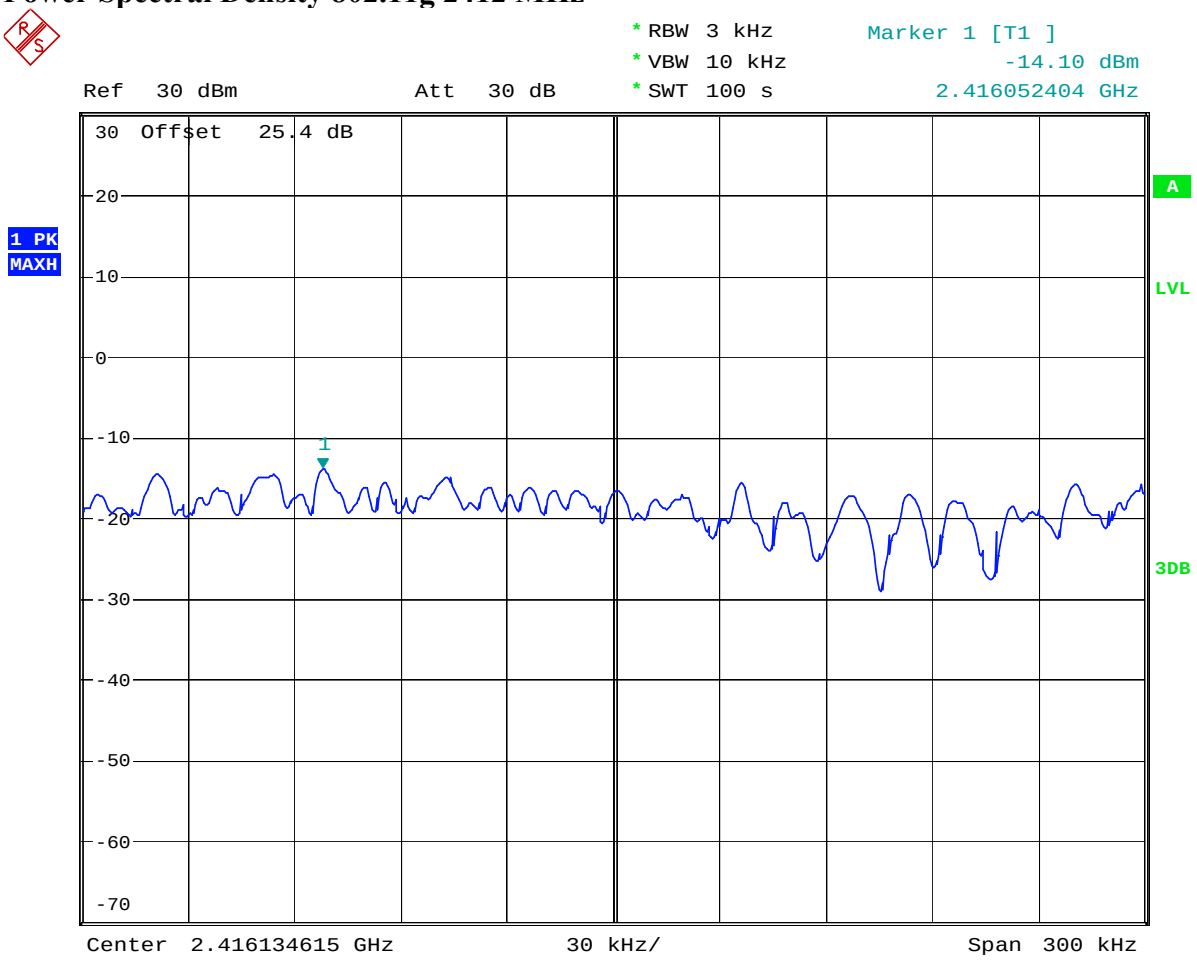
Date: 16.DEC.2010 16:49:47

Power Spectral Density 802.11b 2462 MHz



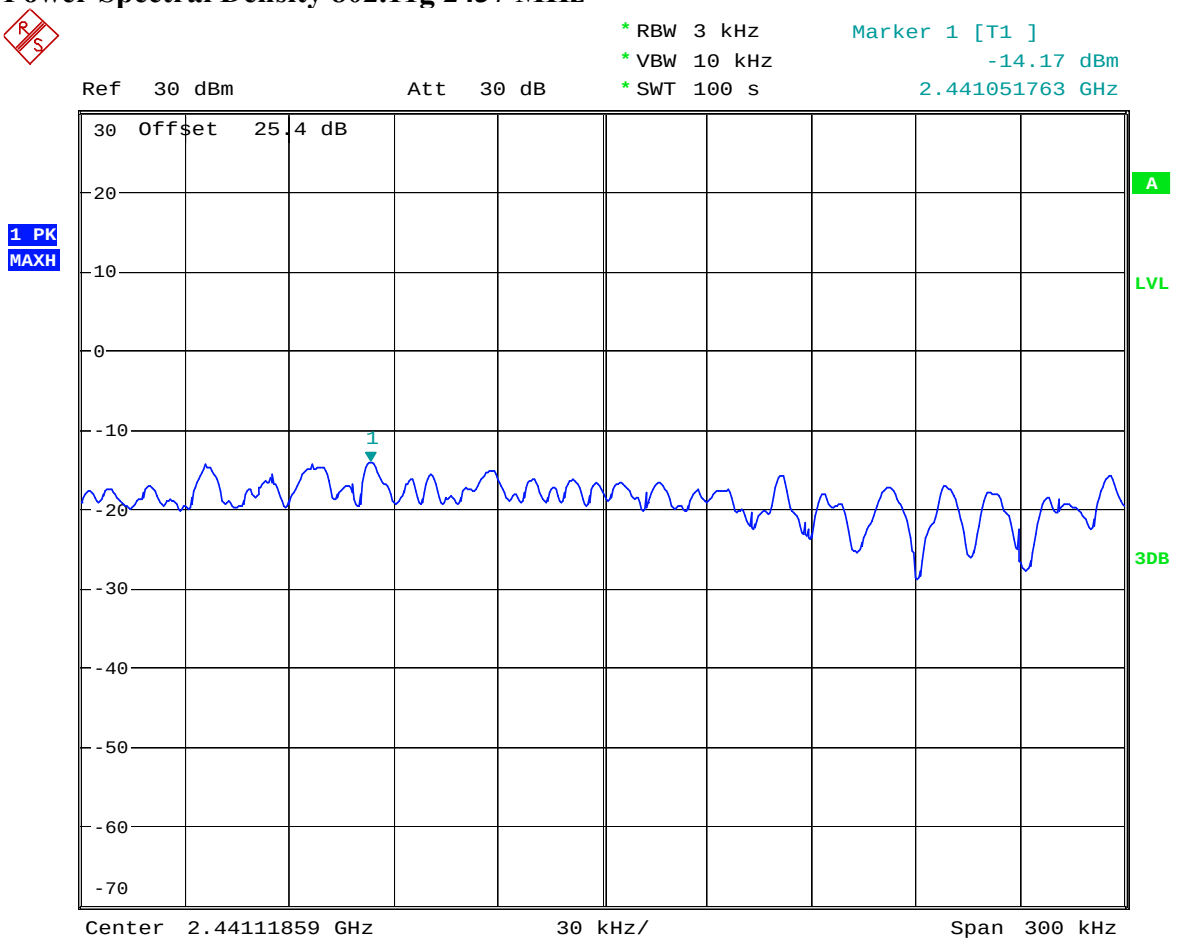
Date: 16.DEC.2010 16:53:21

Power Spectral Density 802.11g 2412 MHz



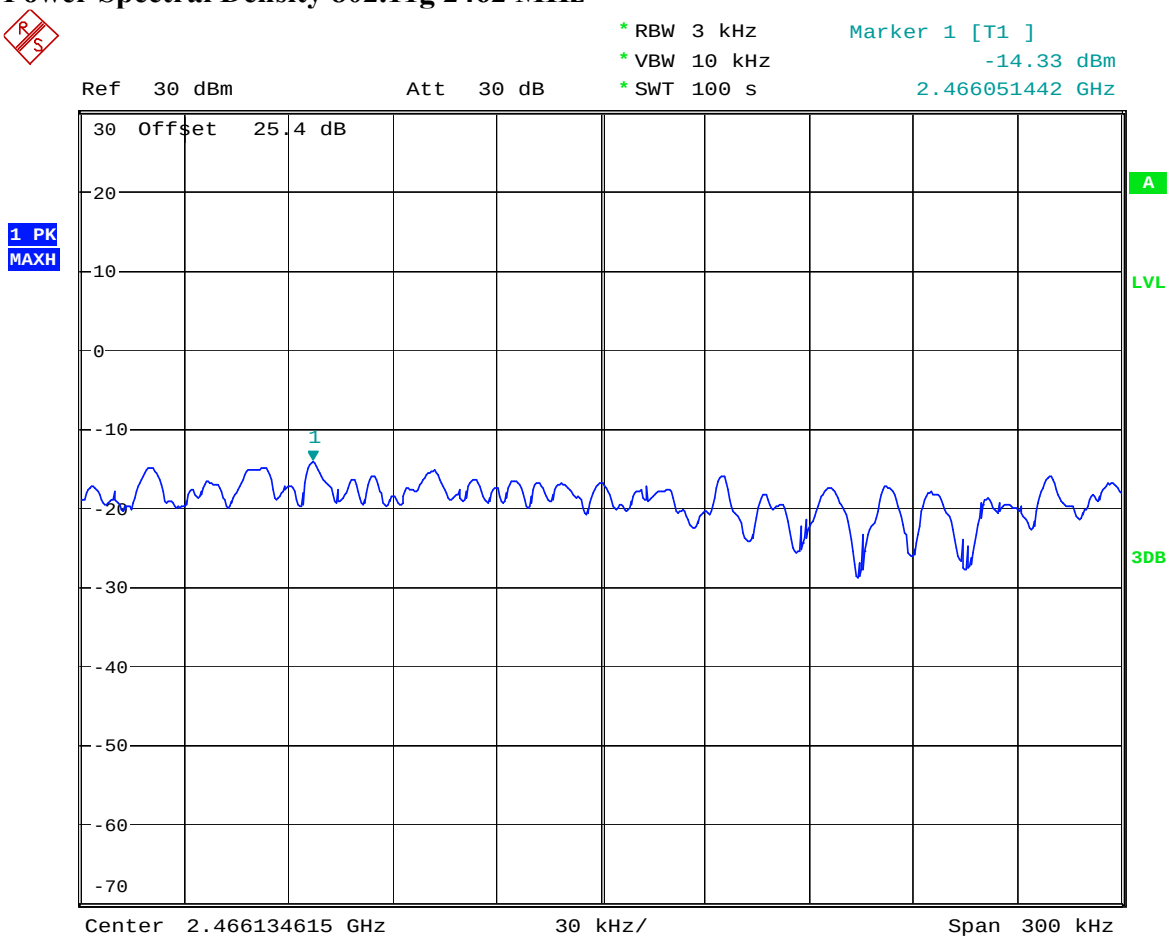
Date: 15.JAN.2011 11:27:16

Power Spectral Density 802.11g 2437 MHz



Date: 15.JAN.2011 11:32:30

Power Spectral Density 802.11g 2462 MHz



Date: 15.JAN.2011 11:39:30

6.7 Transmitter Spurious Emissions- Conducted § 15.247 (c)

6.7.1 Reference and Limits:

6.7.1.1 § 15.247 (d)
6.7.1.2 RSS 210-A8.5
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced 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.
30dBm for the transmitter.
-20dBc in the frequency range 30MHz- 25GHz.

6.7.2 Test Conditions:

Operating Mode: 802.11g
Spectrum Analyzer settings:
RBW=100kHz, VBW=100kHz, Detector: Peak- Max hold;
Sweep Time: Auto
Span=Full range

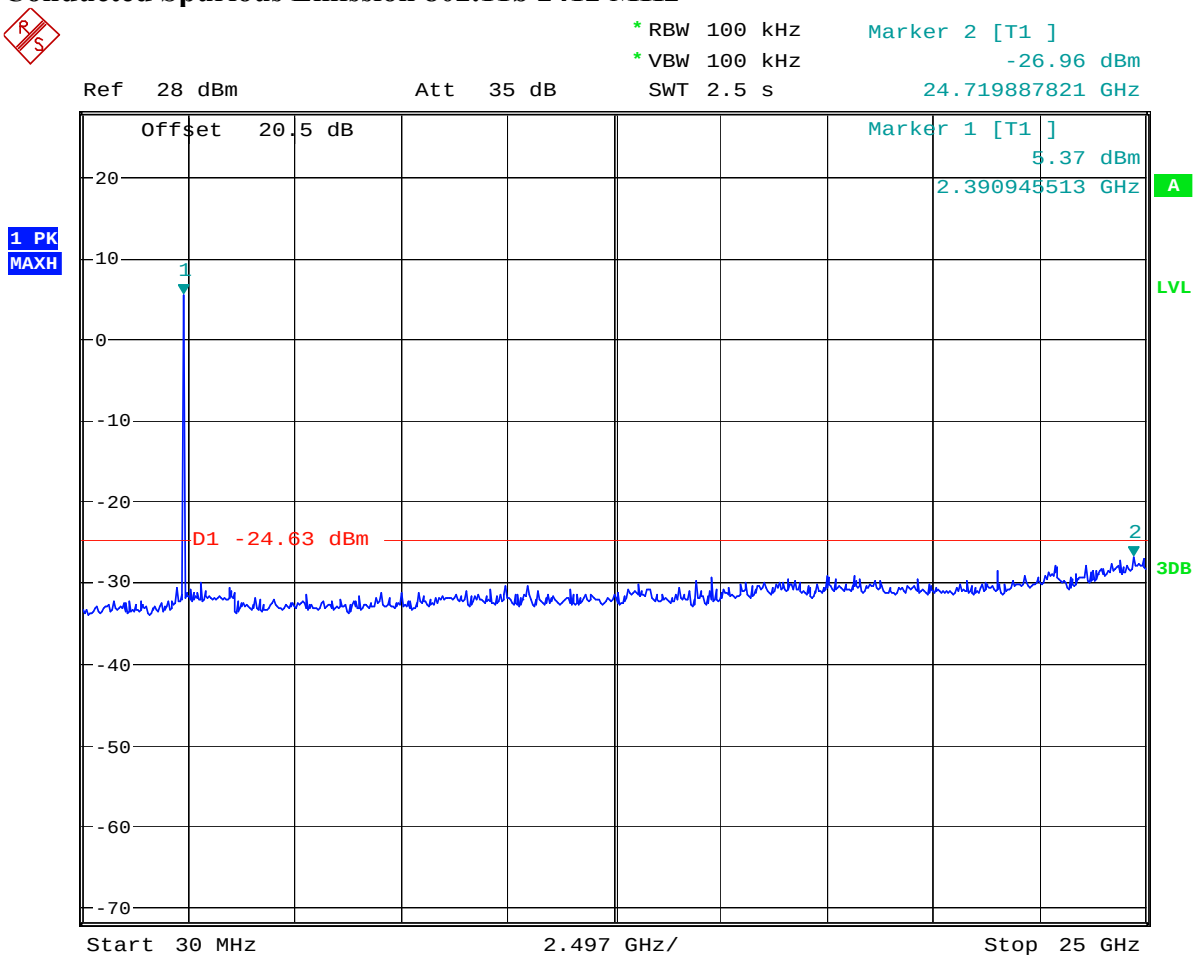
6.7.3 Test data/ plots:

Conducted Spurious Emissions				
Channel	**Frequency (MHz)**	**Amplitude (dBm)**		**Limits**
		802.11b	**802.11g**	
Low	**2412**	5.37	-0.25	30dBm
	Spurious	All other peaks >20dB below limit		-20dBc
Mid	**2437**	5.59	-0.74	30 dBm
	Spurious	All other peaks >20dB below limit		-20dBc
High	**2462**	5.92	-0.65	30 dBm
	Spurious	All other peaks >20dB below limit		-20dBc
Measurement Uncertainty: ±1.0 dB				

6.7.3.1 Measurement Result
Pass.

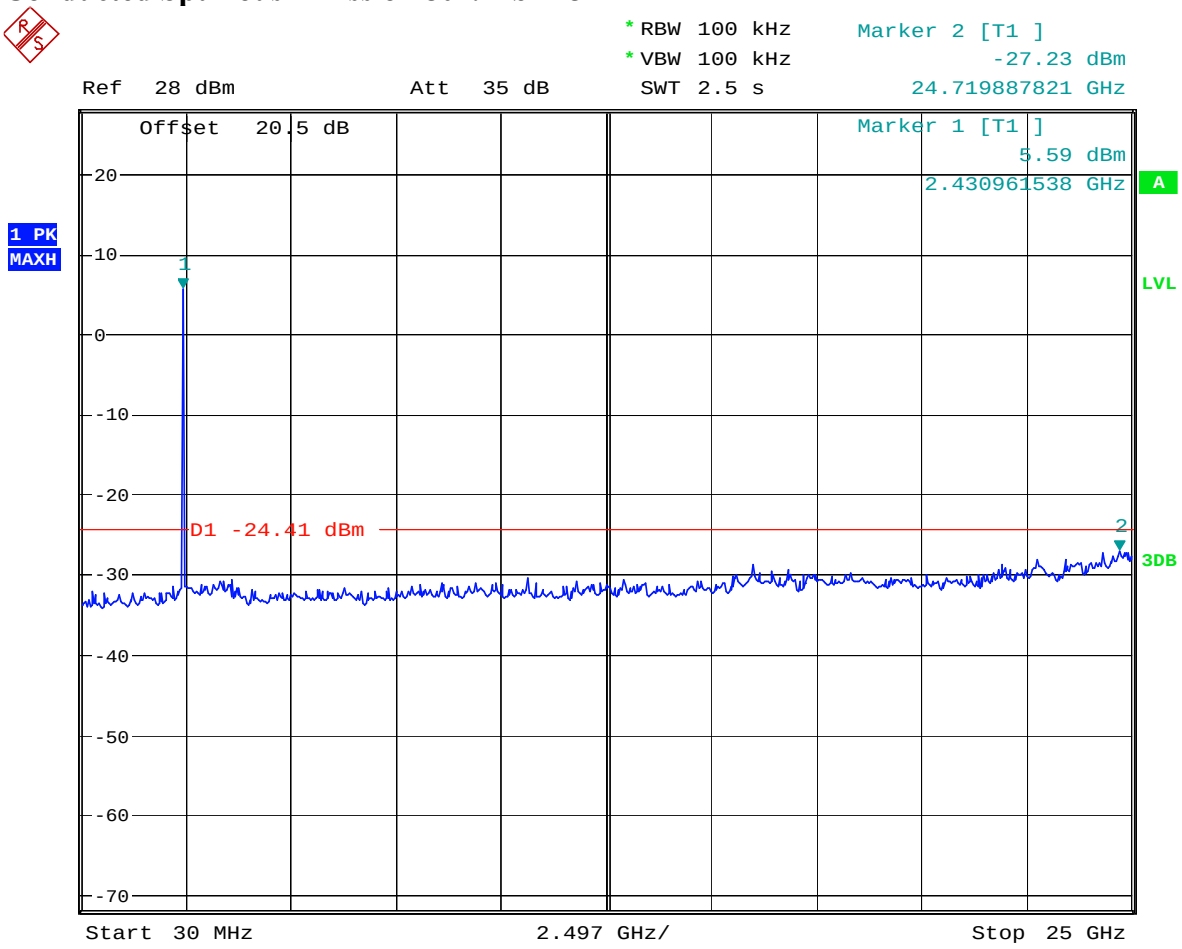
6.7.4 Test data/ plots:

Conducted Spurious Emission 802.11b 2412 MHz



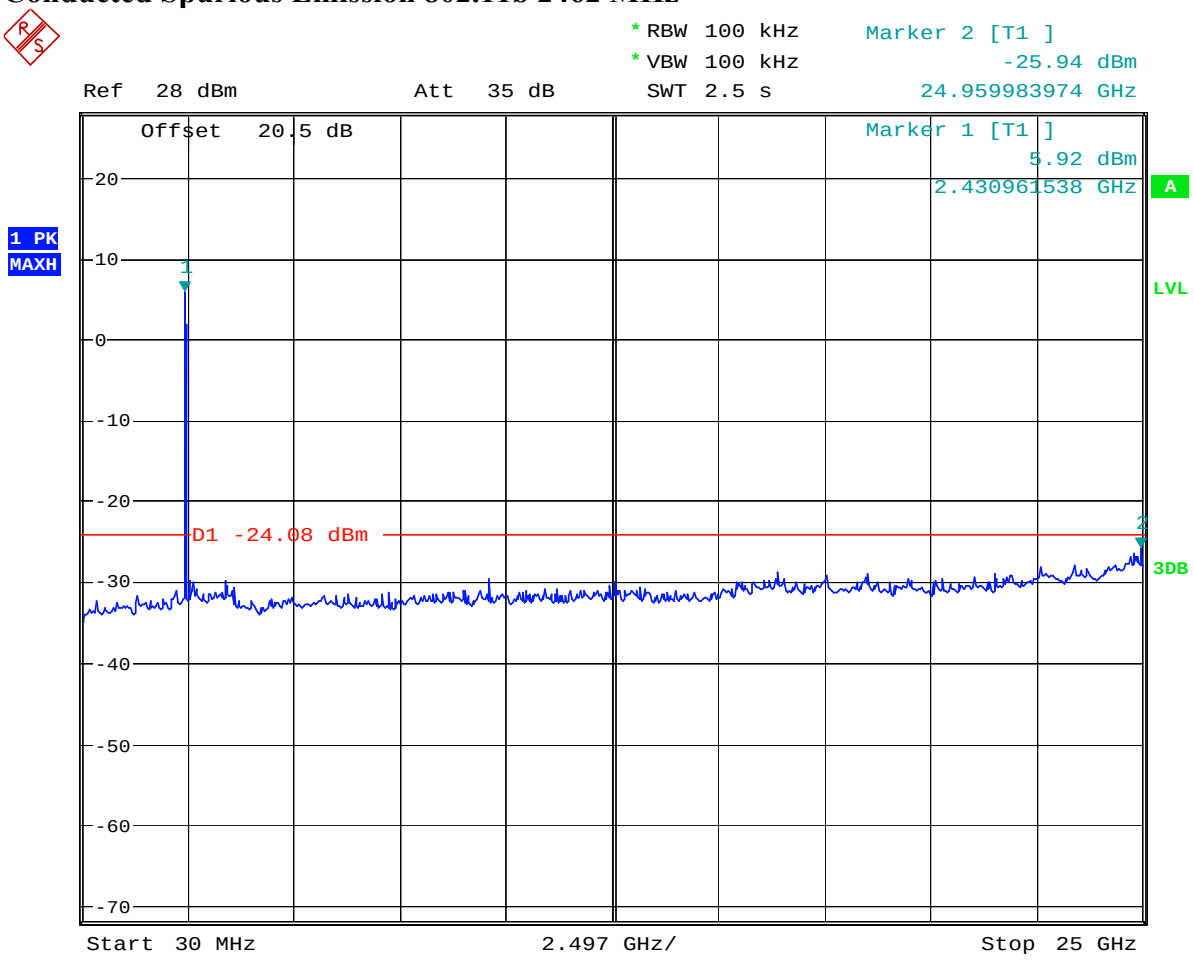
Date: 16.DEC.2010 16:59:46

Conducted Spurious Emission 802.11b 2437 MHz



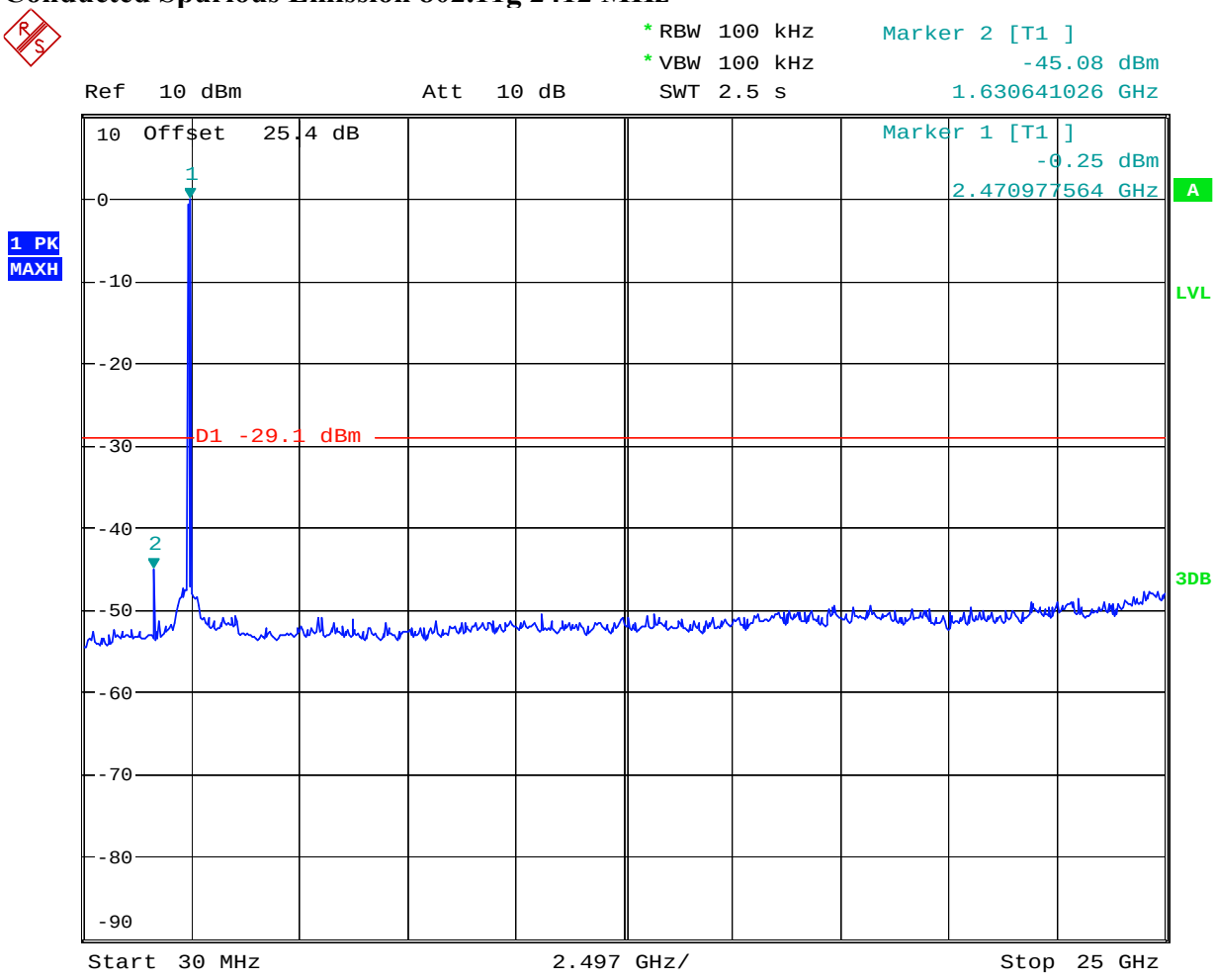
Date: 16.DEC.2010 16:58:19

Conducted Spurious Emission 802.11b 2462 MHz



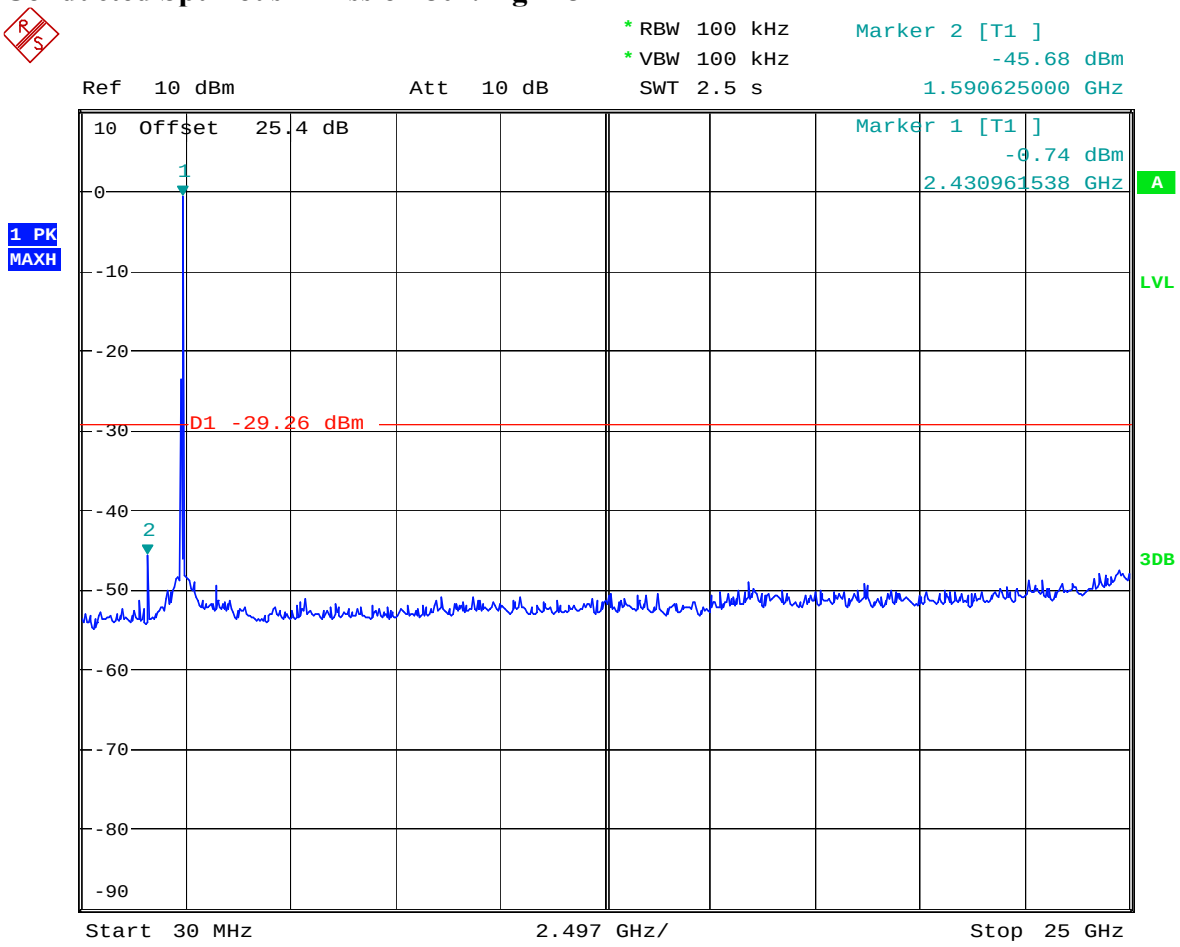
Date: 16.DEC.2010 16:56:55

Conducted Spurious Emission 802.11g 2412 MHz



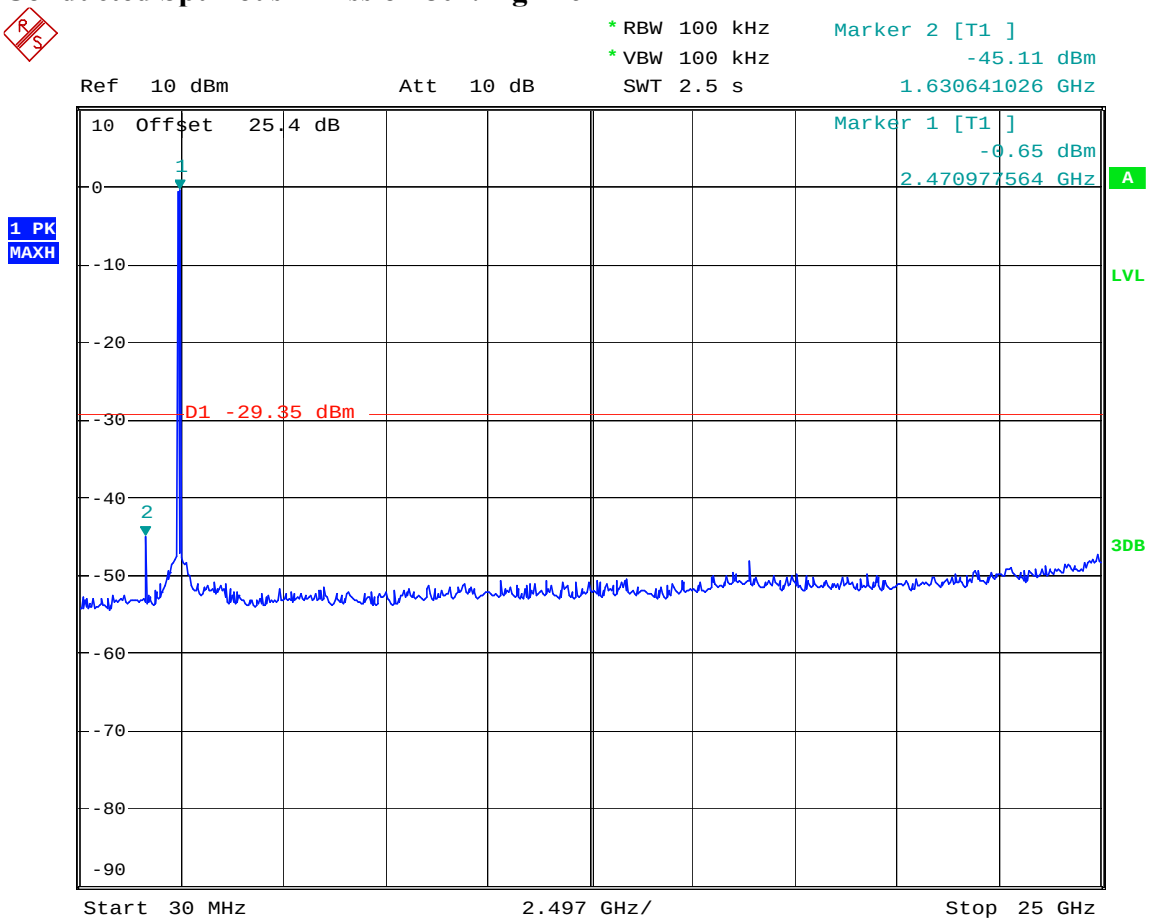
Date: 15.JAN.2011 11:47:26

Conducted Spurious Emission 802.11g 2437 MHz



Date: 15.JAN.2011 11:48:40

Conducted Spurious Emission 802.11g 2462 MHz



Date: 15.JAN.2011 11:49:58

6.8 Transmitter Spurious Emissions- Radiated

6.8.1 References:

FCC CFR 2.1053
RSS-Gen Section 4.9; RSS 210-A8.5

6.8.2 Measurement requirements:

6.8.2.1 FCC 2.1053: Field strength of spurious radiation.

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission.

6.8.2.2 RSS-Gen 4.9: Transmitter unwanted spurious emissions

The same parameter, peak power or average power, used for the transmitter output power measurement shall be used for unwanted emission measurements.
The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency), or from 30 MHz, whichever is the lower, to the 5th harmonic of the highest frequency generated without exceeding 40 GHz.

6.8.3 Limits:

§15.247/15.205
RSS 210-A8.5

(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			

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 Section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB.
*PEAK LIMIT= 74dBµV/m
*AVG. LIMIT= 54dBµV/m

Table 1:

Frequency of emission (MHz)	Field strength (µV/m)
30–88	100 (40dBµV/m)
88–216	150 (43.5 dBµV/m)
216–960	200 (46 dBµV/m)
Above 960	500 (54 dBµV/m)

Table 2:

Frequency of emission (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

6.8.4 Test Result:

Test mode: *Modulation:* 802.11g- since highest conducted power
Unless mentioned otherwise, the emissions outside the limit lines in the plots are from the transmit signal.
Plots reported here represent the worse case emissions for horizontal and vertical antenna polarizations and for three orientations of the EUT.
Measurement Uncertainty: ±3.0dB

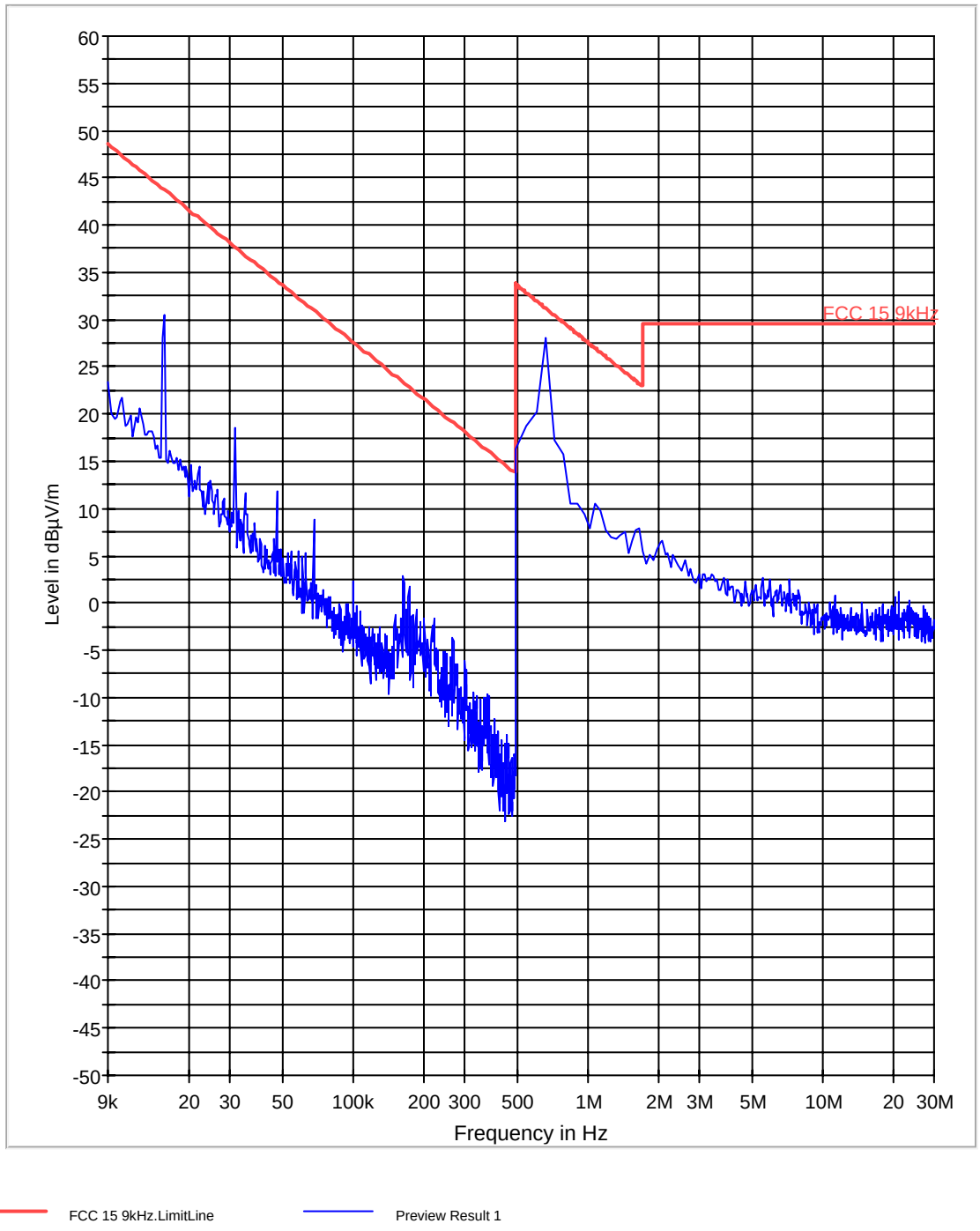
6.8.4.1 Measurement Result

Pass.

6.8.5 Test data/ plots:

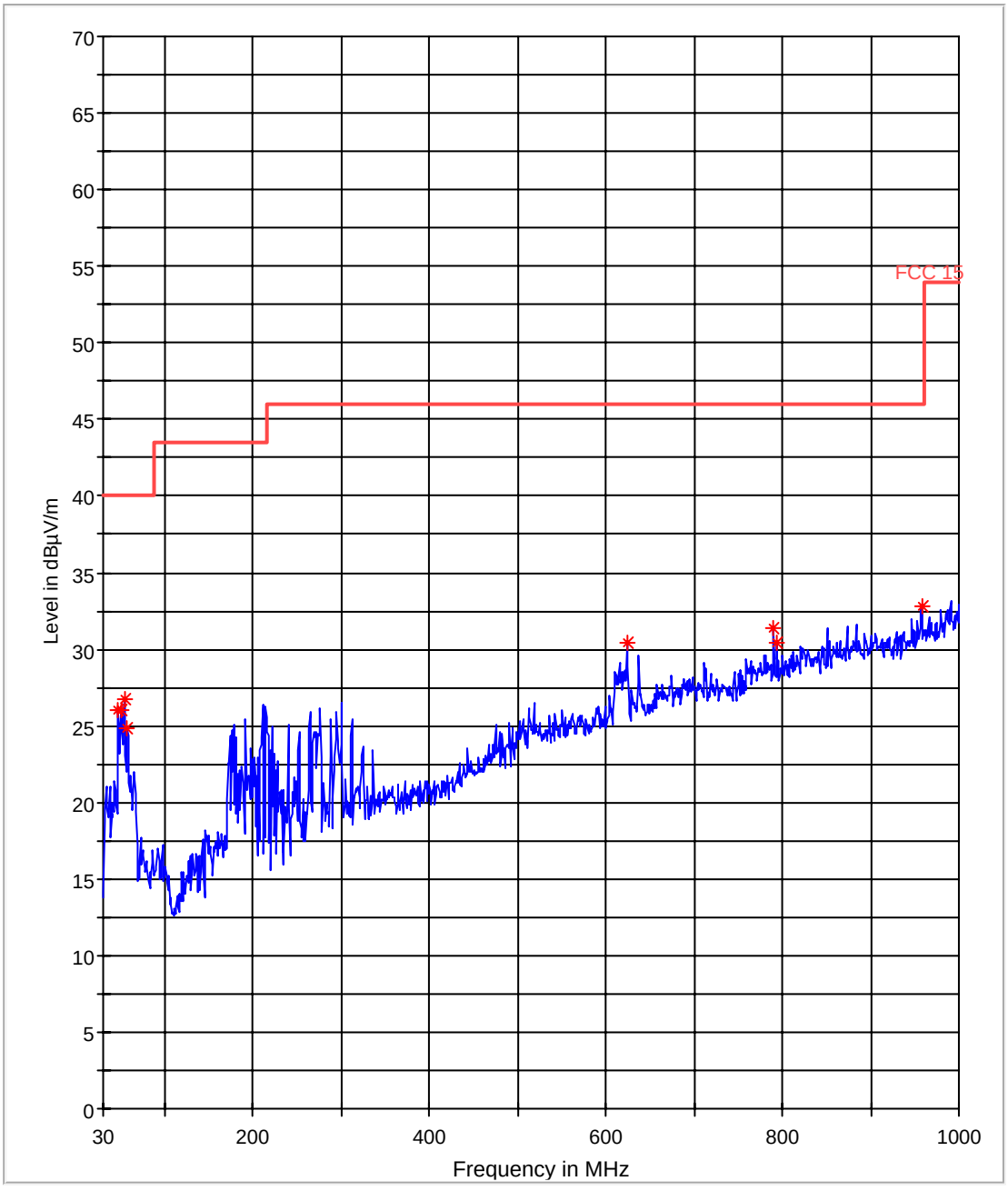
Transmitter Radiated Spurious Emission- 9kHz-30MHz

Note: Represents worst case channel



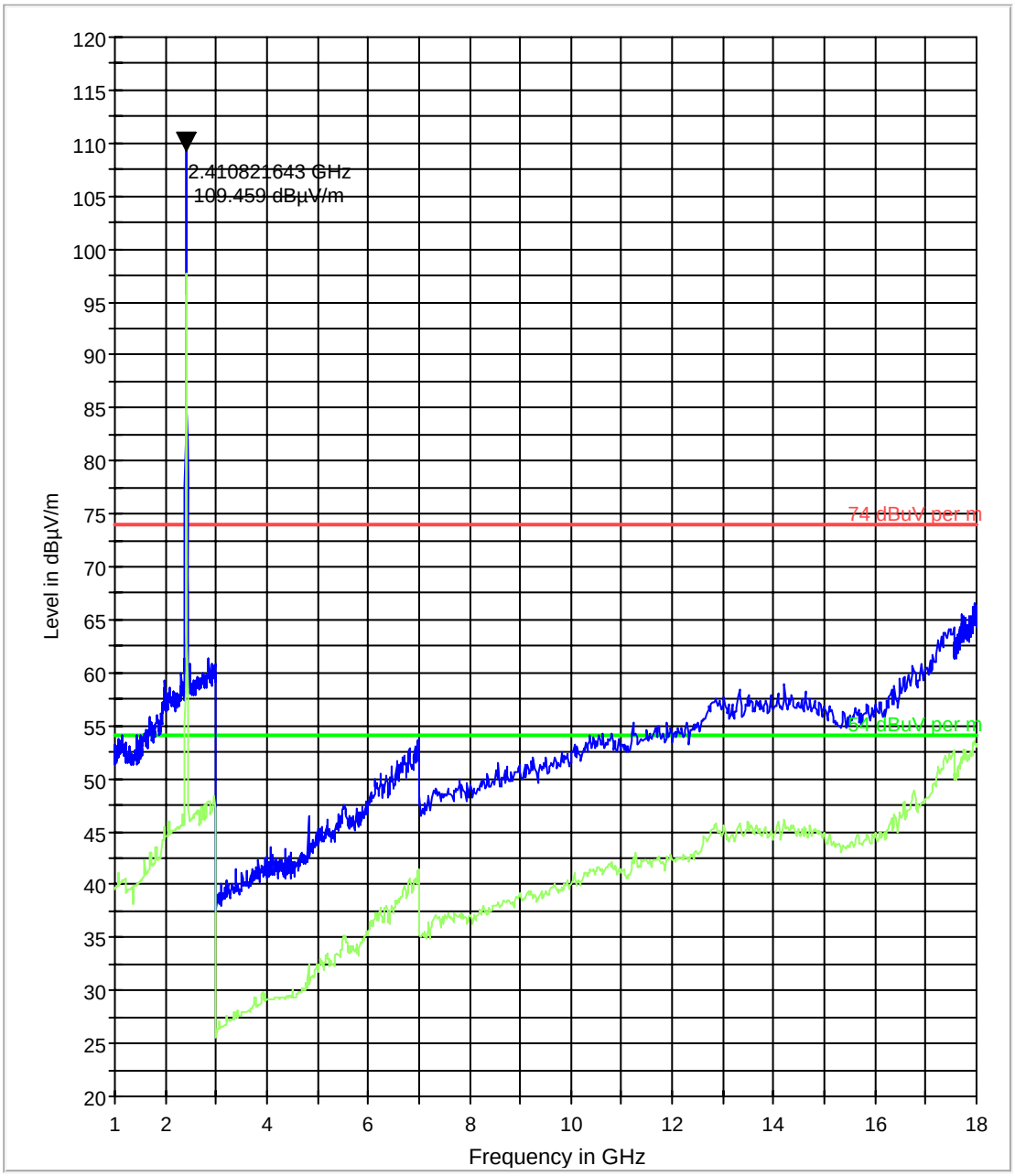
Transmitter Radiated Spurious Emission- Ch1- 30M-1GHz

FCC 15 30-1000MHz



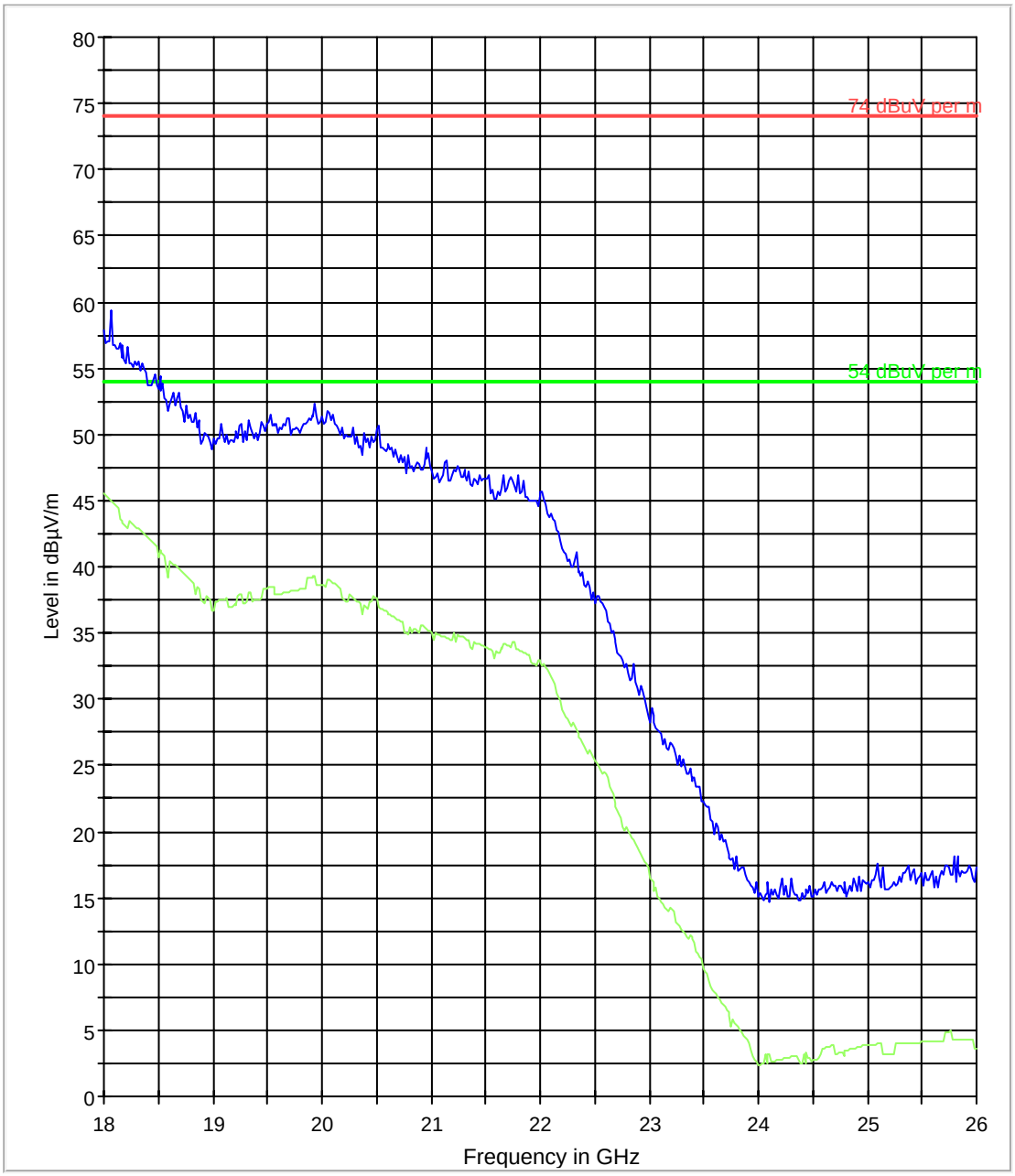
Transmitter Radiated Spurious Emission- Ch1- 1G-18GHz

FCC 15 1-18GHz



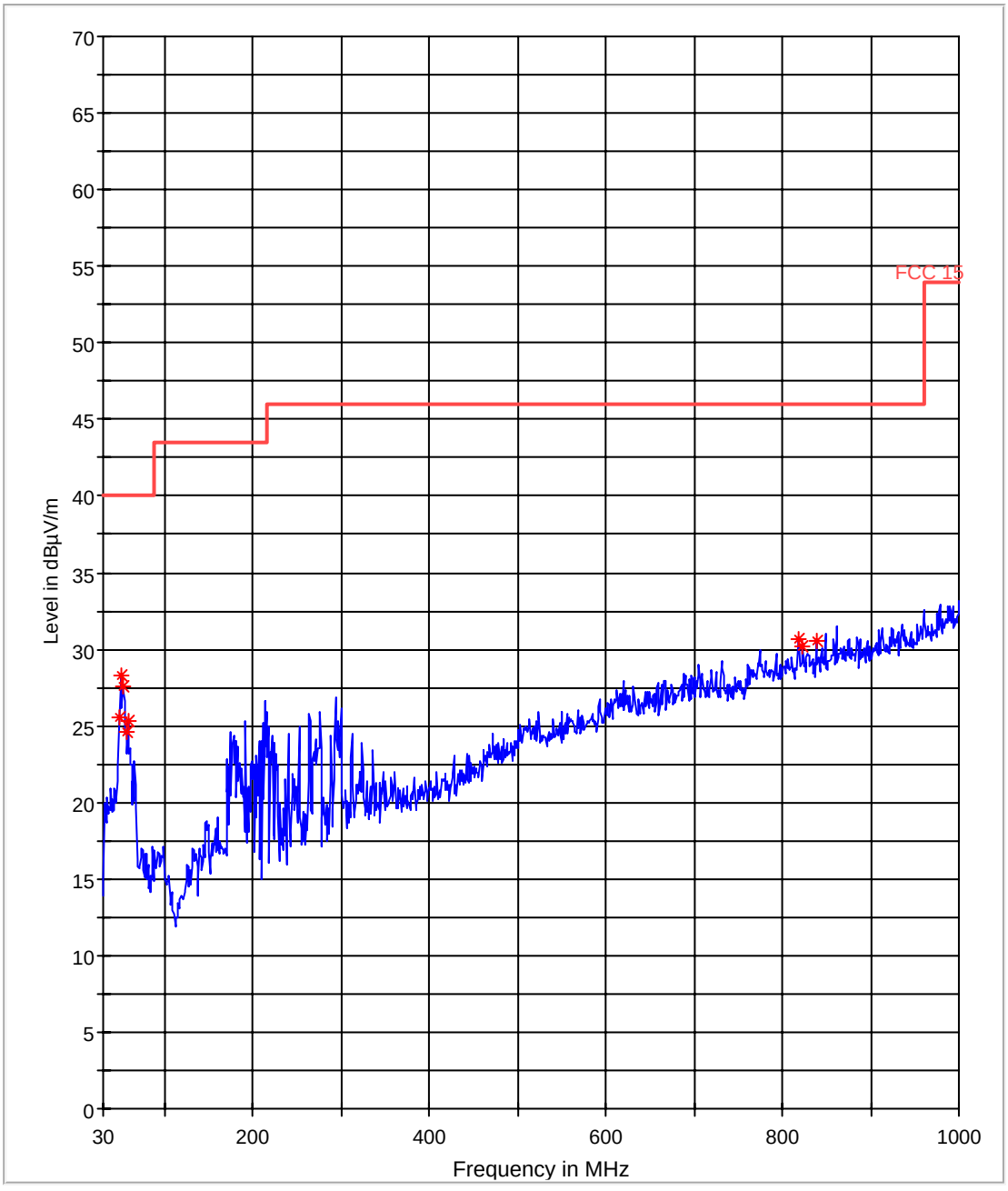
Transmitter Radiated Spurious Emission- Ch1- 18G-26GHz

FCC 15 18-26GHz



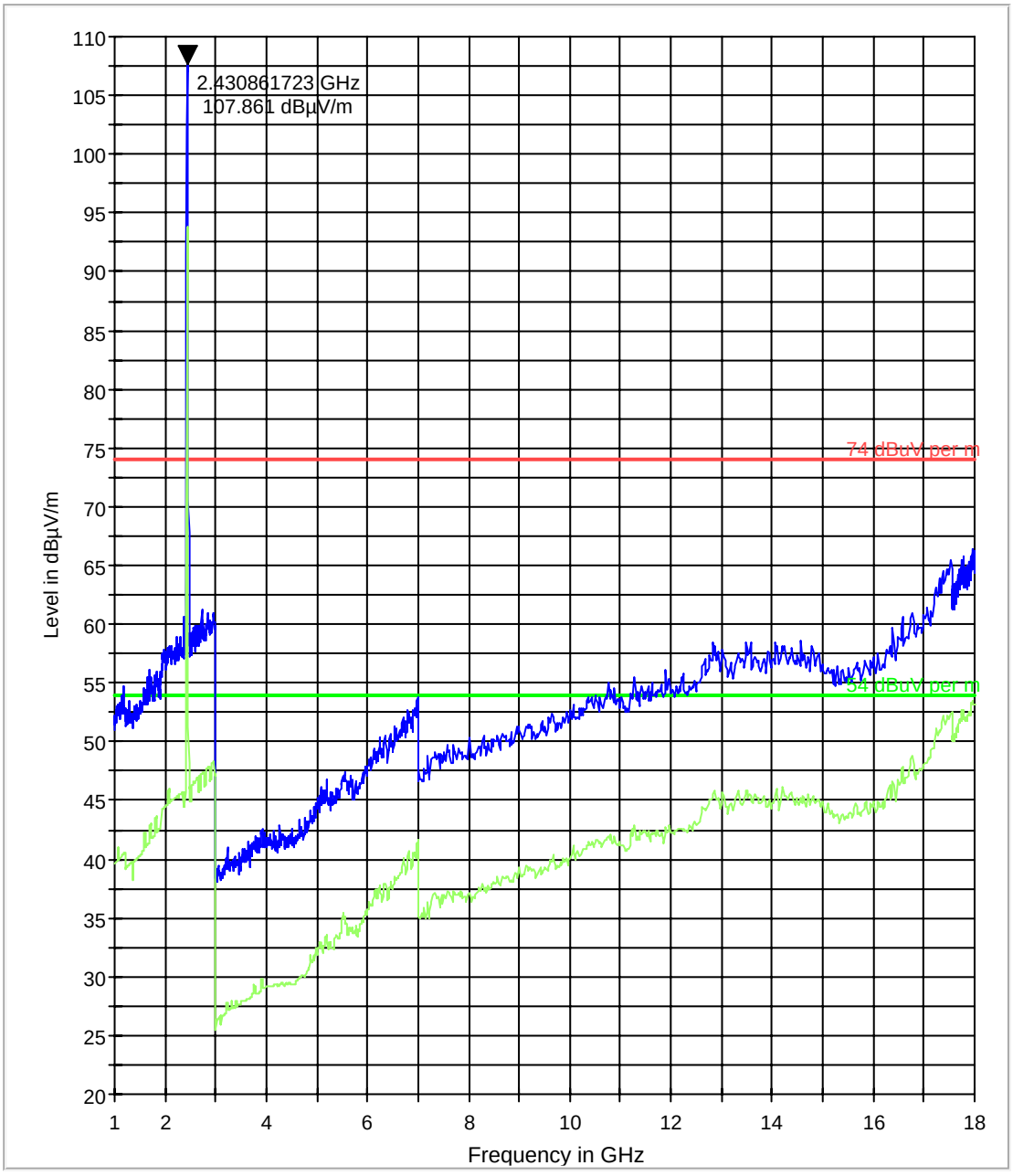
Transmitter Radiated Spurious Emission- Ch6- 30M-1GHz

FCC 15 30-1000MHz



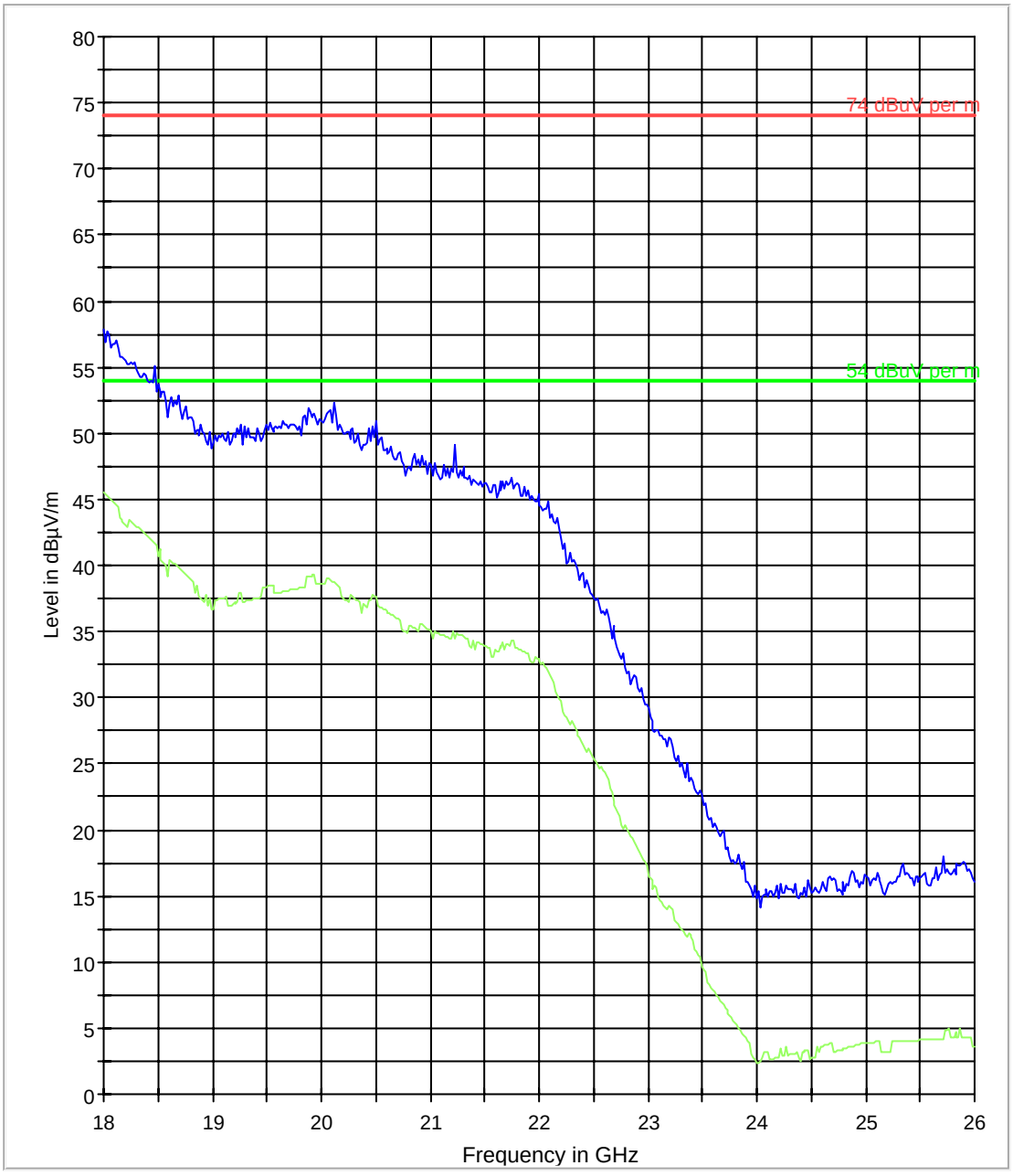
Transmitter Radiated Spurious Emission- Ch6- 1G-18GHz

FCC 15 1-18GHz



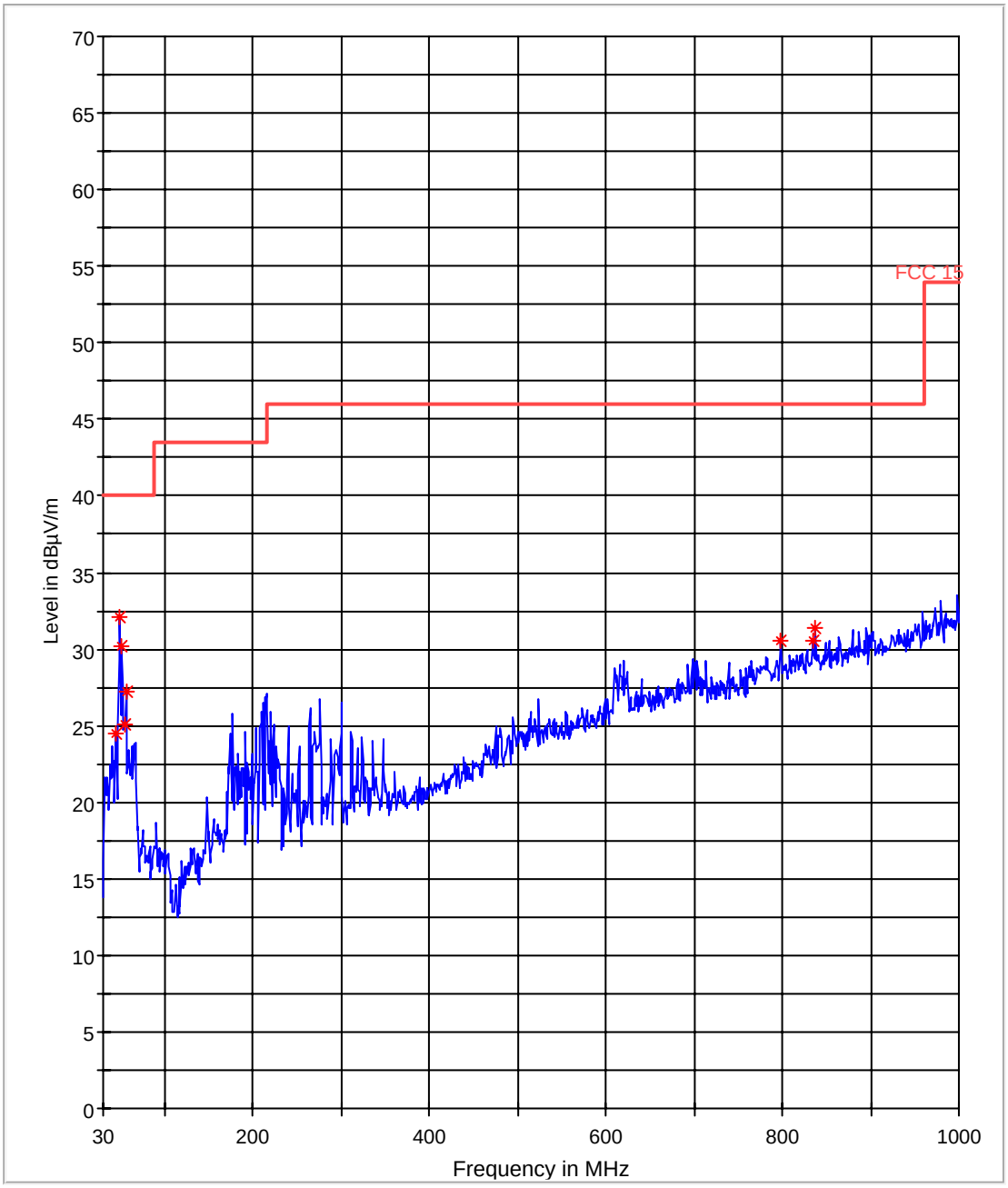
Transmitter Radiated Spurious Emission- Ch6- 18G-26GHz

FCC 15 18-26GHz



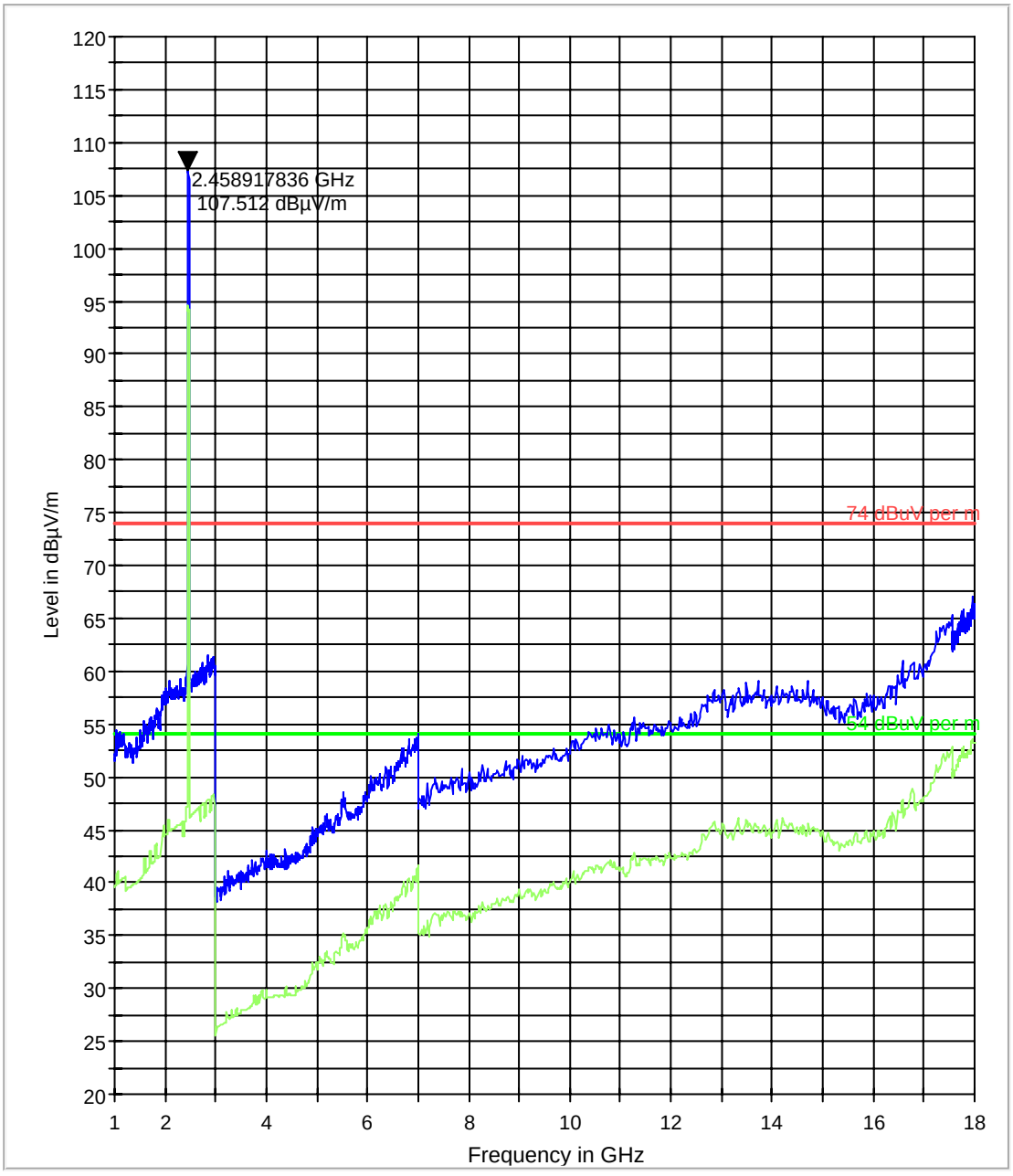
Transmitter Radiated Spurious Emission- Ch11- 30M-1GHz

FCC 15 30-1000MHz



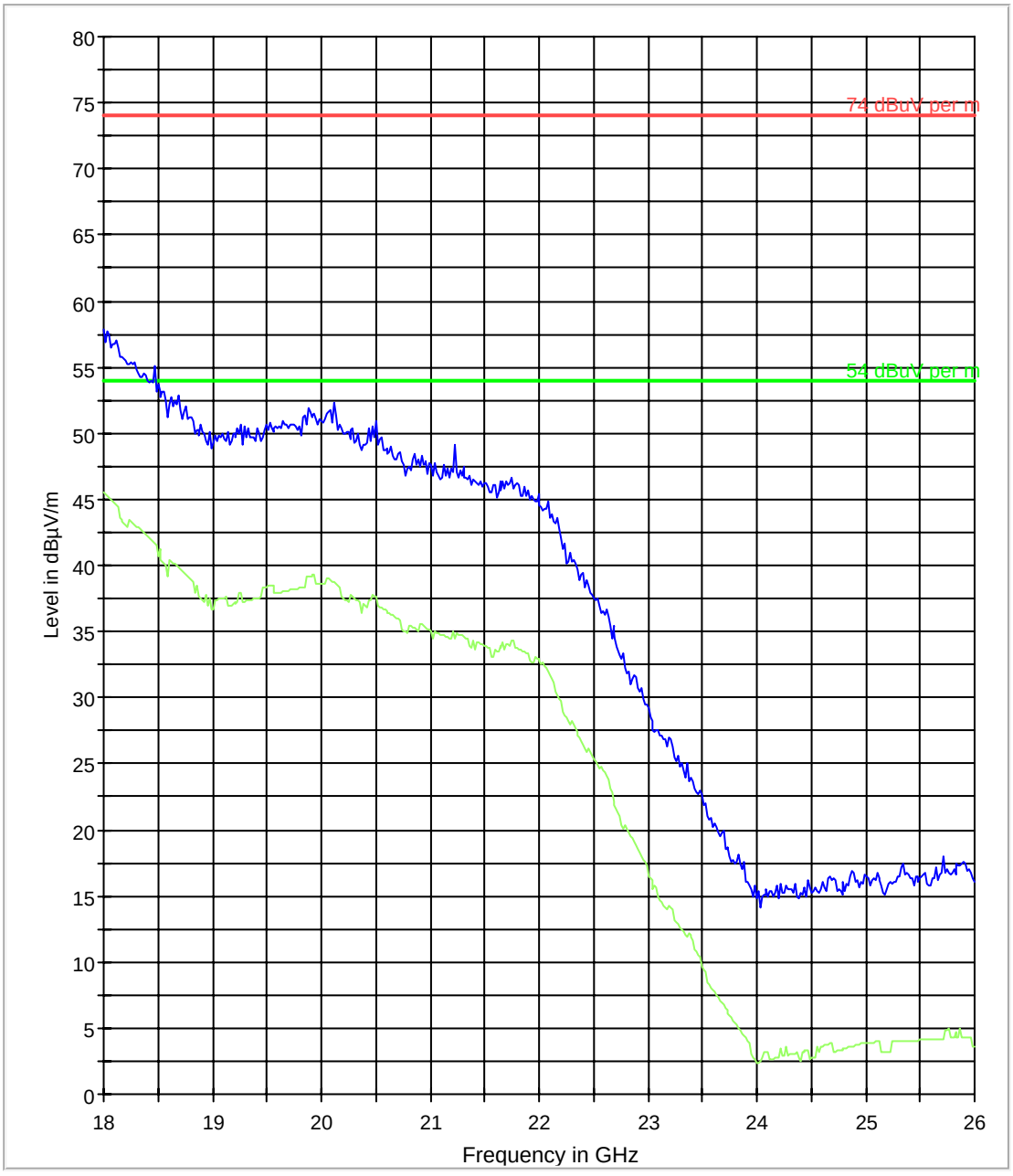
Transmitter Radiated Spurious Emission- Ch11- 1G-18GHz

FCC 15 1-18GHz



Transmitter Radiated Spurious Emission- Ch11- 18G-26GHz

FCC 15 18-26GHz



6.9 Receiver Spurious Emissions- Radiated

6.9.1 Limits:

6.9.1.1 FCC CFR §15.109
6.9.1.2 RSS-210

Frequency of emission (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 (40dBµV/m)	3
88–216	150 (43.5 dBµV/m)	3
216–960	200 (46 dBµV/m)	3
Above 960	500 (54 dBµV/m)	3

6.9.2 Test Conditions:

Mode: Receive mode
Measurement Uncertainty: ±3.0dB

6.9.3 Test Result:

No significant emissions measurable. Plots reported here represent the worse case emissions for horizontal and vertical antenna polarizations and for three orientations of the EUT.

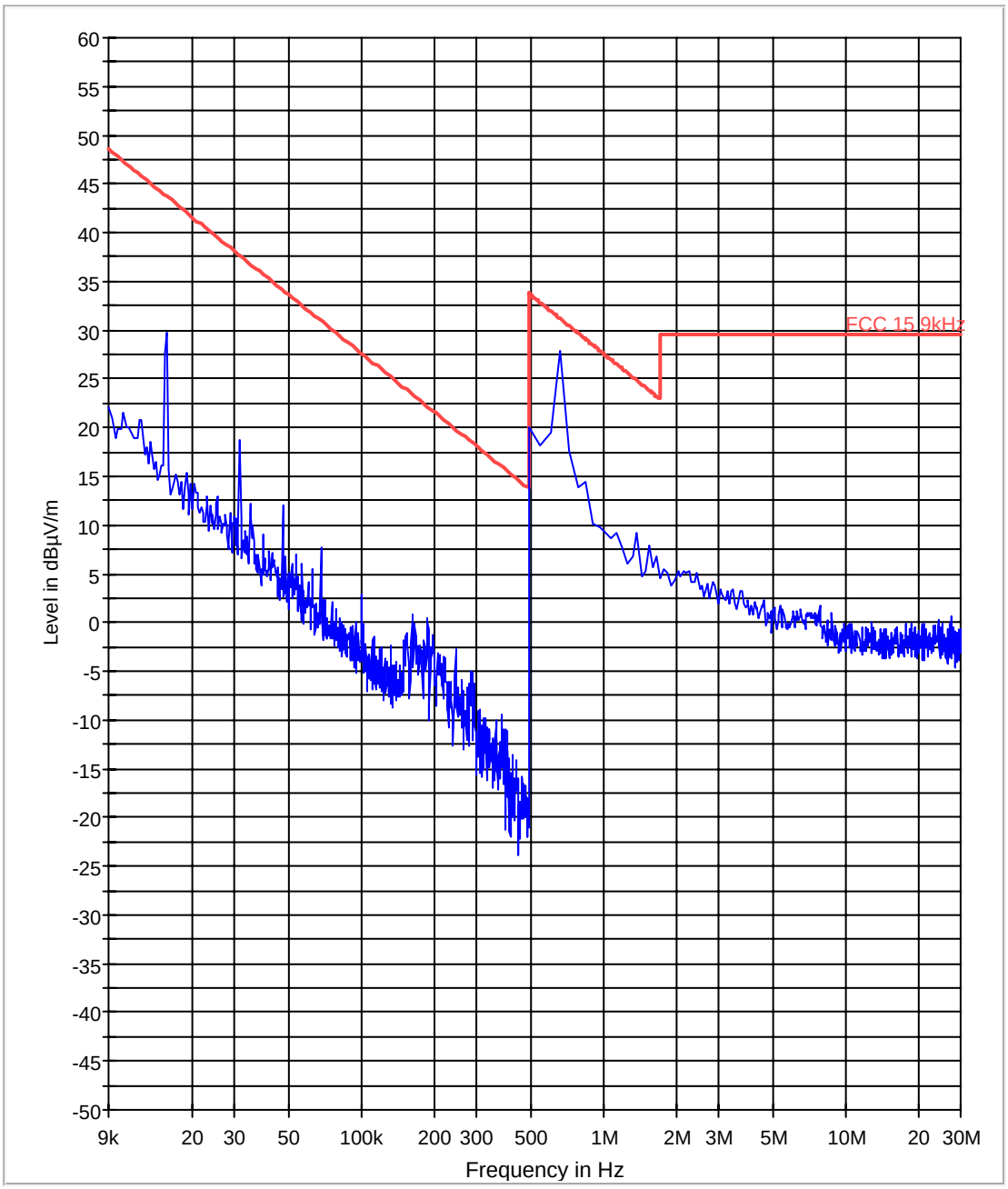
6.9.3.1 Measurement Result

Pass.

6.9.4 Test data/ plots:

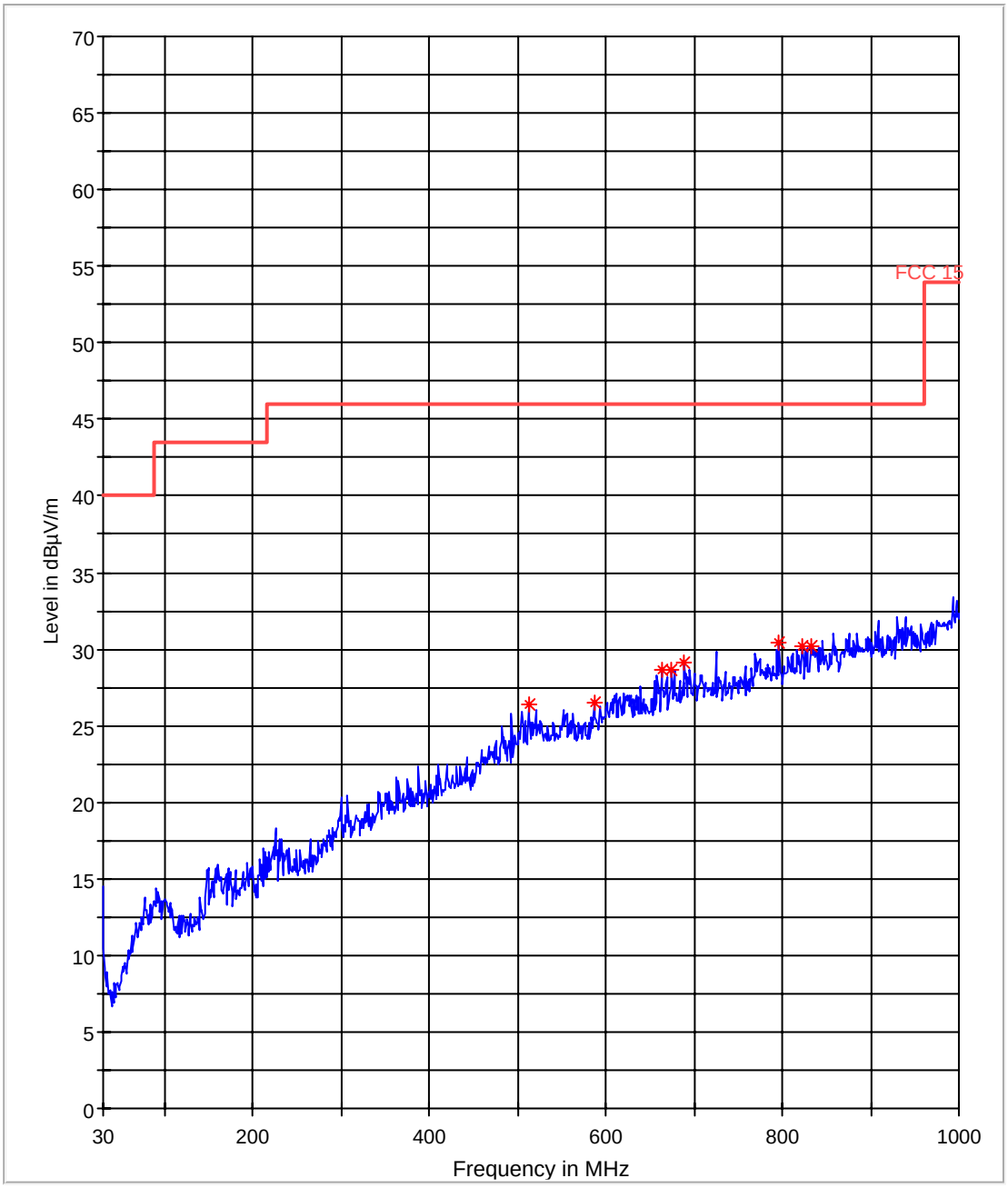
Receive Mode: 30MHz-1GHz

FCC 15 9kHz - 30 MHz



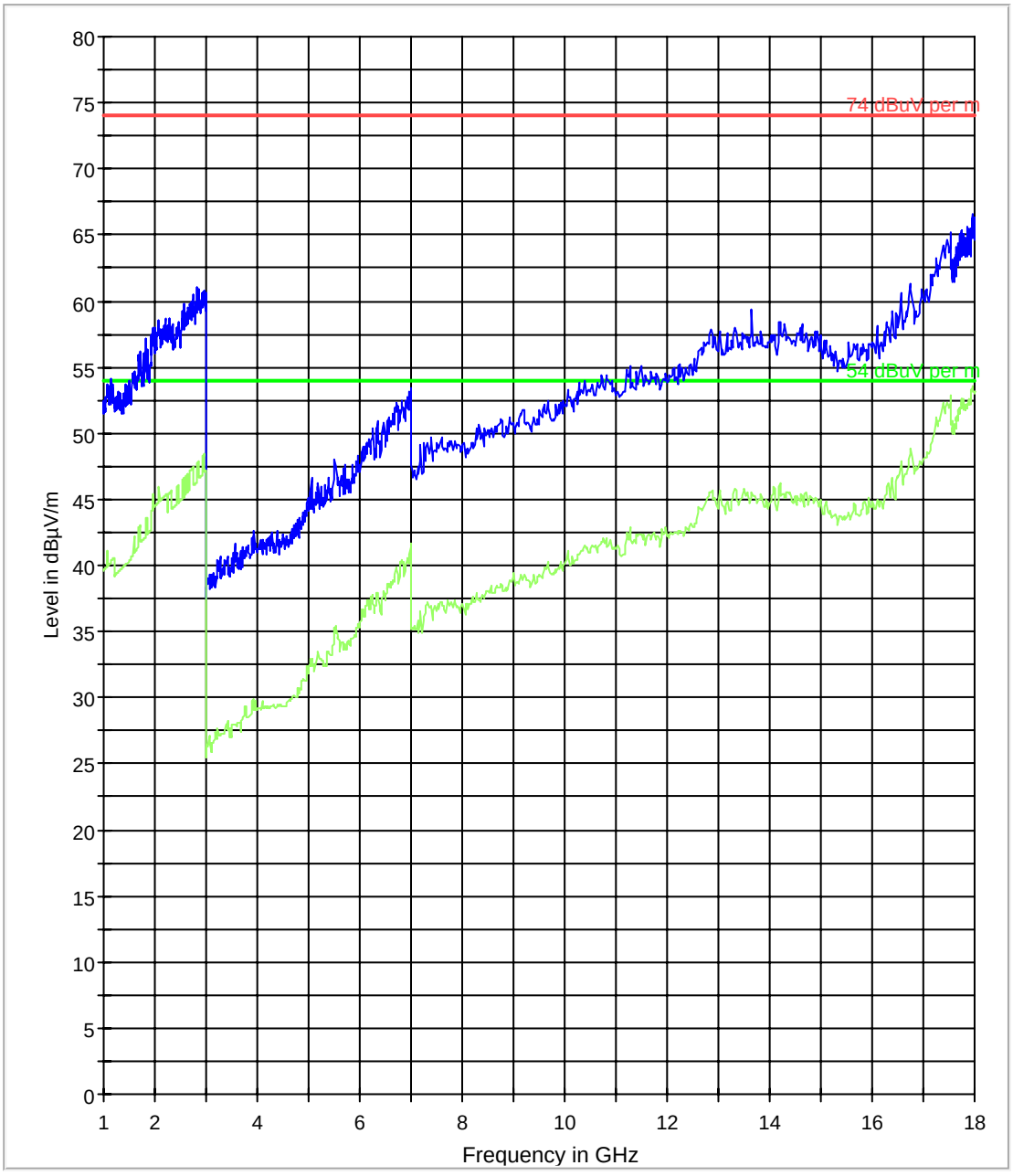
Receive Mode: 30MHz-1GHz

FCC 15 30-1000MHz



Receive Mode: 1GHz-18GHz

FCC 15 1-18GHz



6.10 AC Power Line Conducted Emissions

6.10.1 References:

FCC: CFR Part 15.207
IC: RSS-Gen Section 7.2.2
The purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network.

6.10.2 Limits:

6.10.2.1 §15.207 Conducted limits- Intentional Radiators:

(a) Except as shown in paragraphs (b) and (c) of this section of the CFR, for an intentional radiator 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 (1), 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.

6.10.2.2 RSS-Gen 7.2.2

Except when the requirements applicable to a given device state otherwise, for any licence-exempt radiocommunication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown below. The tighter limit applies at the frequency range boundaries.

Table 1:

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 the logarithm of the frequency.

Analyzer Settings: CISPR Bandwidth- 9KHz.

6.10.3 Test Conditions:

Modulation: 802.11g- Transmit and Receive modes of operation
Measurement Uncertainty: ±3.0dB

6.10.4 Results

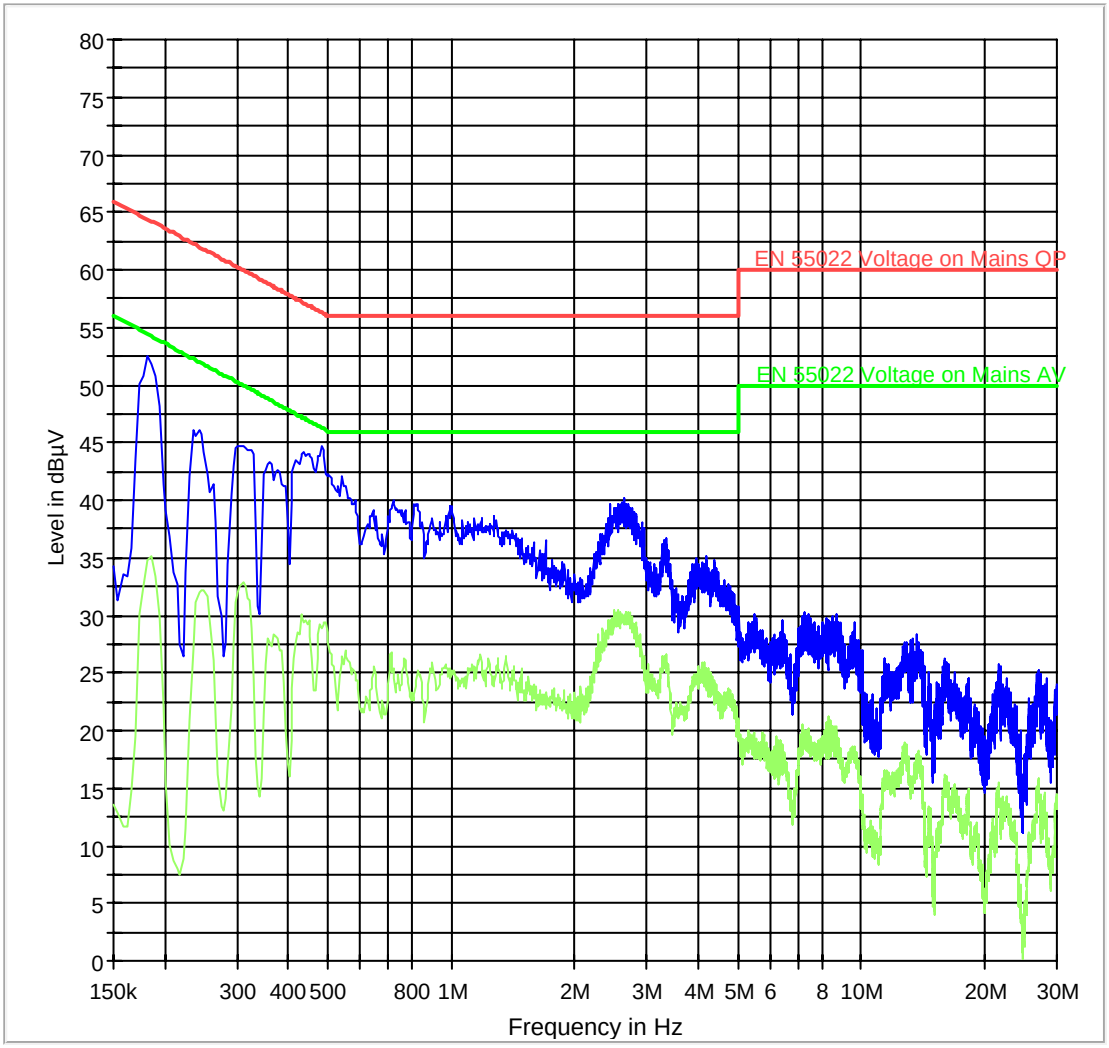
Plots shown here represent the combined worse case emissions for power lines, phases and neutral line.

6.10.4.1 Measurement Result

Pass.

6.10.5 Test Results:
WLAN TX Mode:

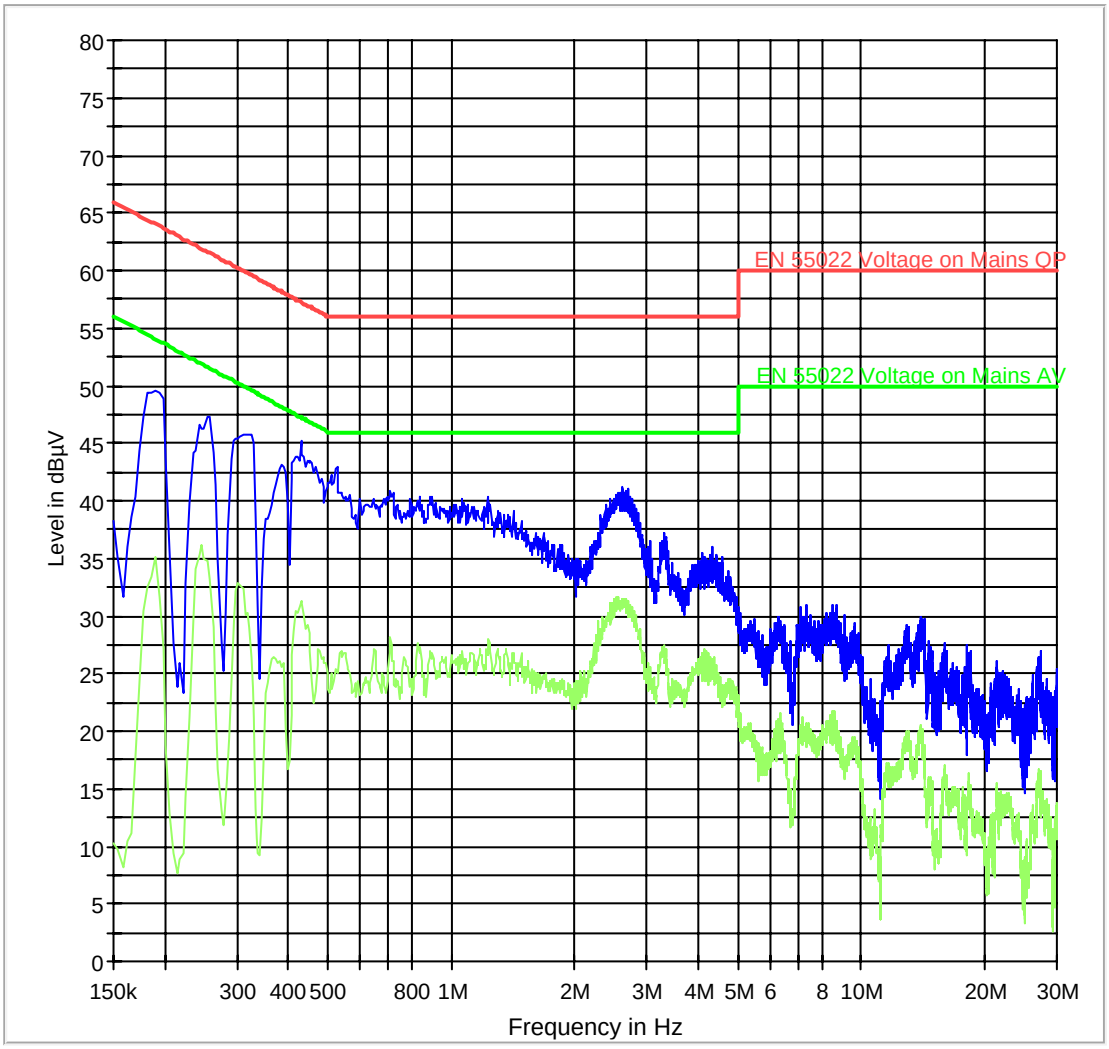
CISPR 22 Mains Conducted



EN 55022 Voltage on Mains QP.LimitLine
Preview Result 1
EN 55022 Voltage on Mains AV.LimitLine
Preview Result 2

WLAN RX Mode:

CISPR 22 Mains Conducted

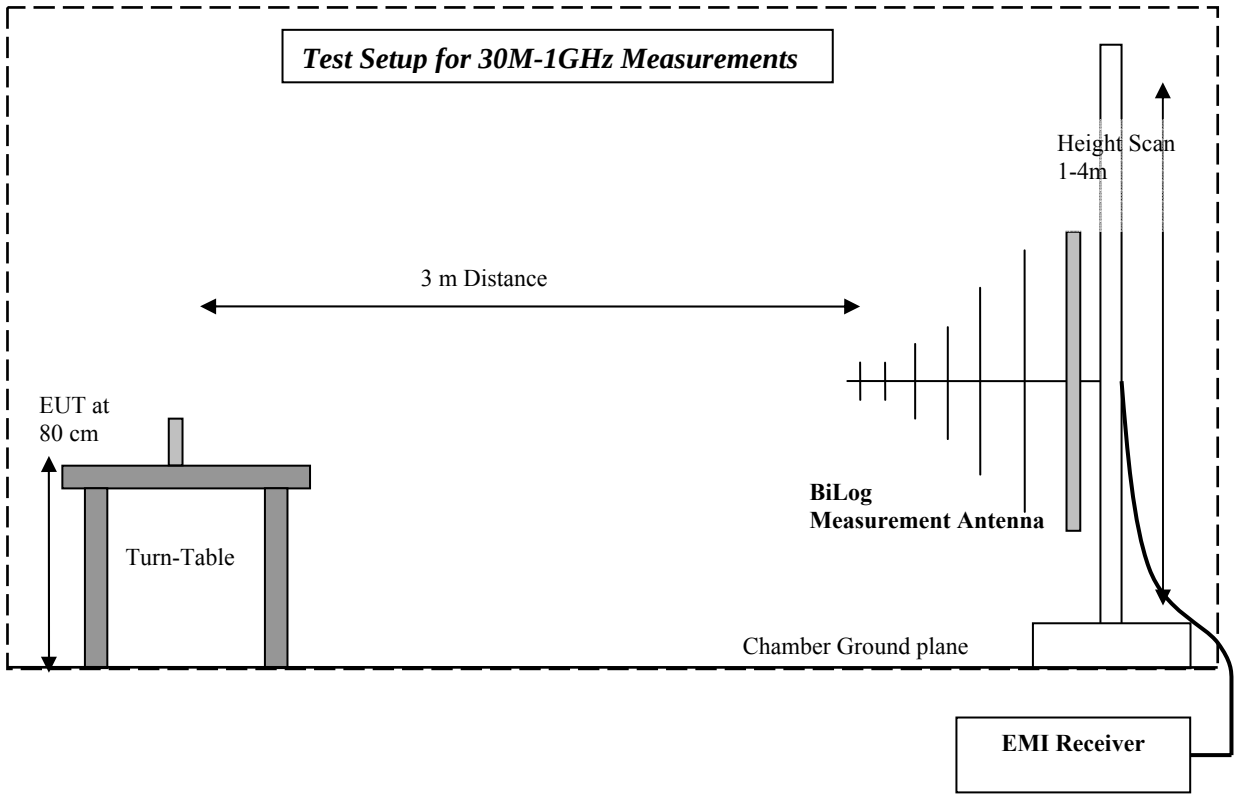


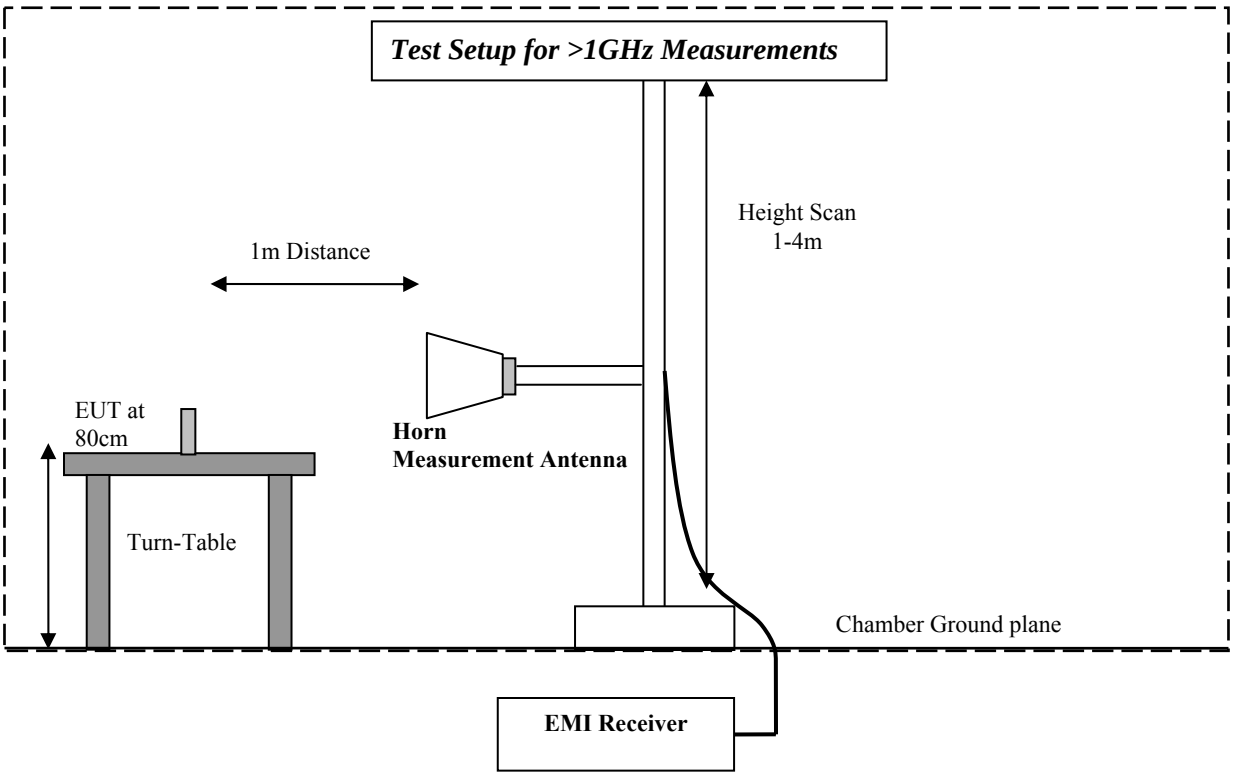
EN 55022 Voltage on Mains QP.LimitLine
Preview Result 1
EN 55022 Voltage on Mains AV.LimitLine
Preview Result 2

7 Test Equipment and Ancillaries used for tests

Instrument/Ancillary	Model	Manufacturer	Serial No.	Cal Date	Cal Interval
Radio Communication Tester	CMU 200	Rohde & Schwarz	101821	June 2010	1 year
EMI Receiver/Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2010	1 year
Spectrum Analyzer	FSU	Rohde & Schwarz	200302	Jul 2010	1 year
Loop Antenna	6512	EMCO	00049838	April 2009	2 years
Biconilog Antenna	3141	EMCO	0005-1186	June 2009	2 years
Horn Antenna (1-18GHz)	3115	ETS	00035111	Jan 2009	3 years
Horn Antenna (18-40GHz)	3116	ETS	00070497	Jan 2009	3 years
Communication Antenna	IBP5-900/1940	Kathrein	n/a	n/a	n/a
High Pass Filter	5HC2700	Trilithic Inc.	9926013	Part of system calibration	
High Pass Filter	4HC1600	Trilithic Inc.	9922307	Part of system calibration	
6GHz High Pass Filter	HPM50106	Microtronics	001	Part of system calibration	
Pre-Amplifier	JS4-00102600	Miteq	00616	Part of system calibration	
LISN	50-25-2-08	FCC	08014	June 2010	1 year
Power Smart Sensor	R&S	NRP-Z81	100161	June 2010	1 Year
Multimeter	179	Fluke	N/A	Feb 2010	1 Year
Temp Hum Logger	TM320	Dickson	03280063	Feb 2010	1 Year
Temp Hum Logger	TM325	Dickson	5285354	Feb 2010	1 Year

8 Block Diagrams





9 Revision History

Date	Report Name	Changes to report	Report prepared by
2011-01-27	**EMC_ TRIM2_001_09001_15.247WLAN_616**	**First Version**	**Josie Sabado**
2011-03-03	**EMC_ TRIM2_001_09001_15.247WLAN_616_rev1**	**Updated EUT information. Added measurements for radiated spurious emissions 9kHz to 30MHz. Replaces previous report number.**	**Josie Sabado**