



FCC Test Report

FOR:

**Model Name:A1332
Smart Cellular Telephone with Quad band GSM, UMTS I/II/V/VI/VIII,
Bluetooth and WiFi 802.11 b,g,n**

**FCC ID:BCG-E2380A
47 CFR Part 15.247 for DSSS Systems**

**TEST REPORT #: EMC_057_09001_FCC15.247DSSS_BCG-E2380A_Rev3
DATE: 2010-06-07**



**FCC listed
A2LA Accredited**

**IC recognized #
3462B**

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1 Assessment

The following is in compliance with the applicable criteria specified in FCC rules Parts 15.247 of Title 47 of the Code of Federal Regulations.

Company	Description	Model #
Apple Inc.	Smart Cellular Telephone with Quad band GSM, UMTS I/II/V/VI/VIII, Bluetooth and WiFi 802.11 b,g,n	A1332

Responsible for Testing Laboratory:

2010-06-07	Compliance	Heiko Strehlow (Director)	
Date	Section	Name	Signature

Responsible for the Report:

2010-06-07	Compliance	Sajay Jose (EMC Engineer)	
Date	Section	Name	Signature

The test results of this test report relate exclusively to the test item specified in Section 3. 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:	Sajay Jose

2.2 Identification of the Client

Applicant's Name:	Apple Inc.
Street Address:	1 Infinite Loop
City/Zip Code	Cupertino, CA 95014
Country	USA
Contact Person:	Bob Steinfeld
Phone No.	408-974-2618
e-mail:	steinfel@apple.com

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as above
Manufacturers Address:	
City/Zip Code	
Country	

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name:	A1332
Model No:	A1332
Product Type:	Smart Cellular Telephone with Quad band GSM, UMTS I/II/V/VI/VIII, Bluetooth and WiFi 802.11 b/g/n. Includes Ipod music, photo, GPS and application functions.
FCC-ID:	BCG-E2380A
Frequency:	ISM Band 2400-2483.5 MHz
Type(s) of Modulation:	DSSS & OFDM with BPSK, QPSK, 16QAM, 64QAM
Number of channels:	11
Antenna Type:	Internal PIFA
Operating Voltage:	3.4V (Low)/4.2V (Nominal)/4.2V (High)
Temperature Range:	0 (Low)/22 (Nominal)/35 (High)

3.2 Identification of the Equipment Under Test (EUT)

EUT #	Serial Number/IMEI	HW Version	SW Version	Notes
1	880130HMFRZ/ 00107200 292788 5	Rev C	01.48.03/ 8A224	Conducted testing sample.
2	8801202QFRZ/ 00107200 288926 7	Rev C	01.50.01/ 8A224	Radiated testing sample.
3	880203FCA4S/ 01233600-436199-8	Rev 1	01.59.00/ 8A2746	Radiated testing sample.

3.3 Identification of Accessory equipment

AE #	Type	Manufacturer	Model	Serial Number
1	110V AC Adapter	Flextronics	A1265	N/A
2	Dummy Battery	Apple Inc.	N/A	N/A
3	External Antenna connector	Apple Inc.	N/A	N/A



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	BPSK
802.11g	6.0	BPSK
HT20	MCS0: 6.5	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.

This test report is to support a request for new equipment authorization under the **FCC ID BCG-E2380A**.

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 FCC15.247.

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 polarization measurements.

This test report replaces all previously issued reports:

“EMC_APPLE_057_09001_FCC15.247DSSS_BCG-E2380A” issued by Cetecom Inc.

5 Measurements

5.1 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

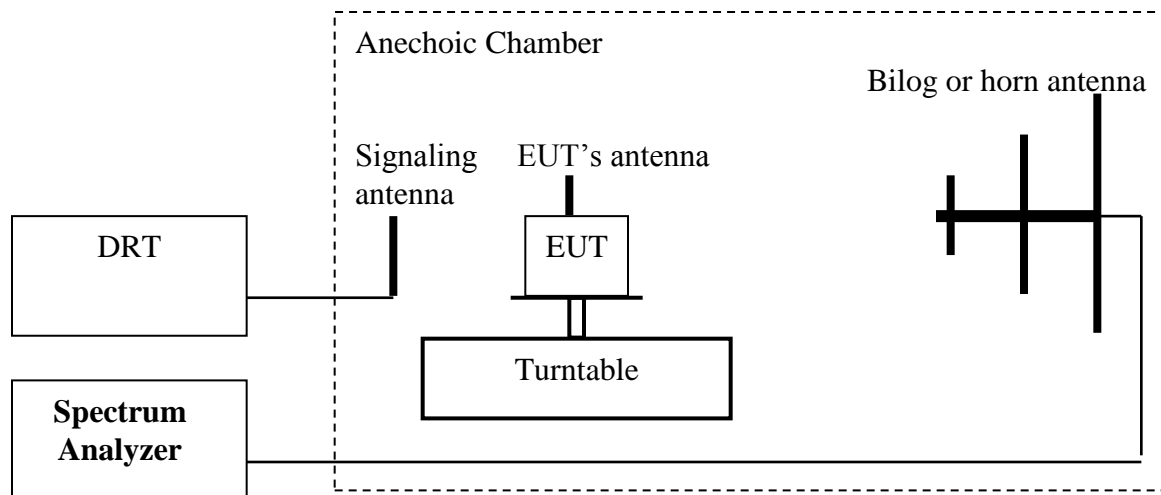
Based on the measurement results in 8.3.1.1, the one EUT, cable and wire arrangement, and mode of operation that produces the emission that has the highest amplitude relative to the limit is selected for the final measurement. The final measurement is then performed on a site meeting the requirements 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.

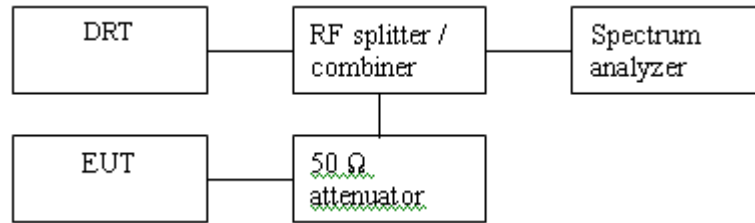


1. Connect the equipment as shown in the above diagram with the EUT's antenna in a vertical orientation.
2. Adjust the settings of the Digital RadioCommunication Tester (DRT) to set the EUT to its maximum power at the required channel.
3. Set the spectrum analyzer to the channel frequency. Set the analyzer to measure peak hold with the required settings.
4. Rotate the EUT 360°. Record the peak level in dBm (**LVL**).
5. Replace the EUT with a vertically polarized half wave dipole or known gain antenna. The center of the antenna should be at the same location as the center of the EUT's antenna.
6. Connect the antenna to a signal generator with known output power and record the path loss in dB (**LOSS**). **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).
7. Determine the ERP using the following equation:

$$\mathbf{ERP\ (dBm) = LVL\ (dBm) + LOSS\ (dB)}$$
8. Determine the EIRP using the following equation:

$$\mathbf{EIRP\ (dBm) = ERP\ (dBm) + 2.14\ (dB)}$$
9. Measurements are to be performed with the EUT set to the low, middle and high channels.

5.2 Conducted Measurement Procedure



1. Connect the equipment as shown in the above diagram.
2. Adjust the settings of the Digital RadioCommunication Tester (DRT) to set the EUT to its maximum power at the required channel.
3. Measurements are to be performed with the EUT set to the low, middle and high channels.

Spectrum analyzer settings:

RBW=20MHz

VBW=30MHz

Span=40MHz

Sweep Time: Auto

Detector: Peak; Max Hold



5.3 Maximum Peak Output Power §15.247 (b)(3)

5.3.1 Limits:

§15.247 (b)(1)

Nominal Peak Output Power < 30 dBm (1W)

EIRP < 36dBm

5.3.2 Test Conditions:

Tnom: 22°C; Vnom: 4.2 V

Antenna Gain (dBi):

Low Channel: -1.89

Mid Channel: -1.63

High Channel: -2.58

5.3.3 Test Result:

EIRP= Conducted Output Power + Antenna Gain

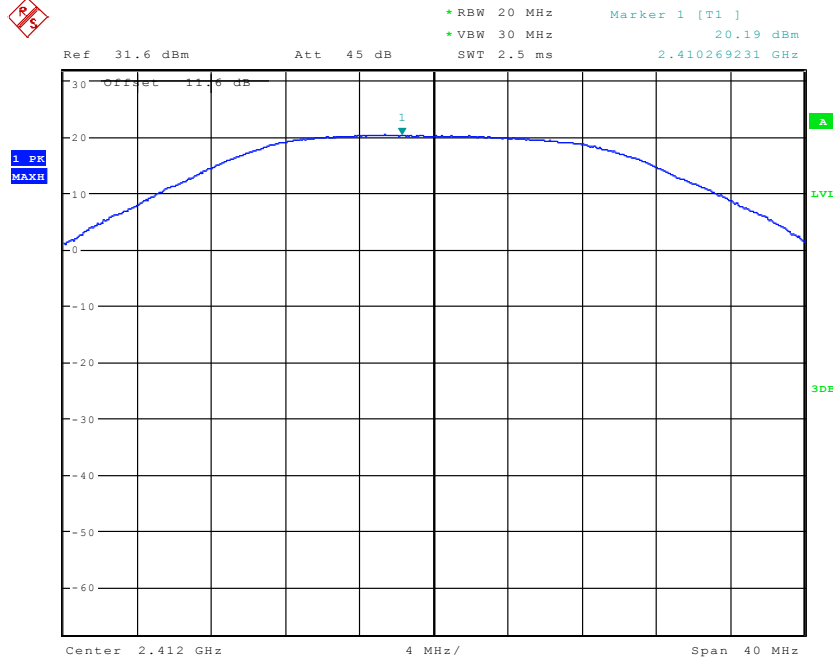
Max Peak Output Power- Radiated (dBm)			
Mode	Frequency (MHz)		
	2412 Channel 1	2437 Channel 6	2462 Channel 11
802.11b	18.3	19.15	18.67
802.11g	22.00	23.96	21.86
HT20	21.97	23.75	21.89
Measurement Uncertainty: ±3dB			

Output Power- Conducted (dBm)						
Mode	Frequency (MHz)					
	2412 Channel 1		2437 Channel 6		2462 Channel 11	
	Peak	Average	Peak	Average	Peak	Average
802.11b	20.19	16.5	20.78	16.5	21.25	16.5
802.11g	23.89	13.0	25.59	16.5	24.44	14.0
HT20	23.86	13.0	25.38	16.5	24.47	14.0
Measurement Uncertainty: ±0.5dB						



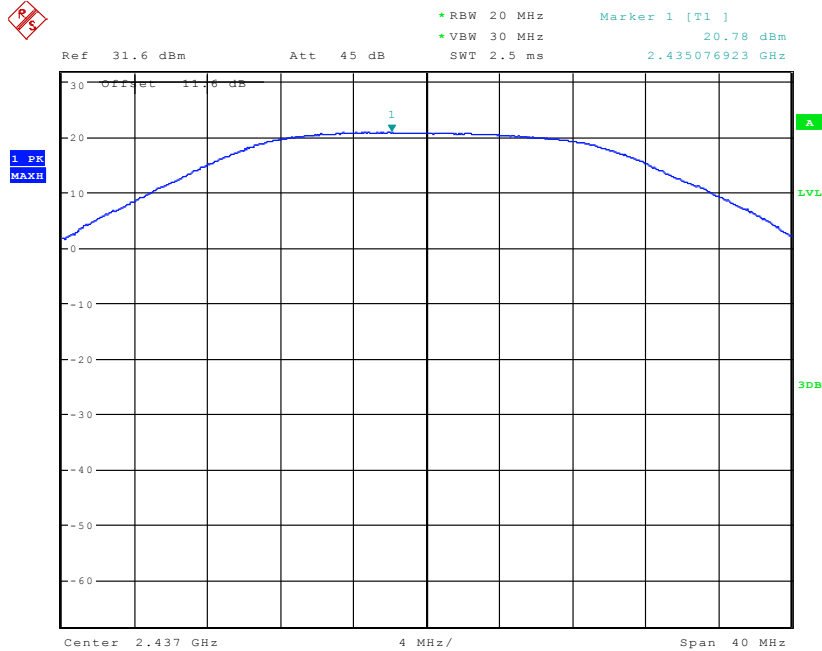
5.3.4 Test Data/plots:

Conducted Peak Power 802.11b 2412 MHz



Date: 16.APR.2010 11:08:39

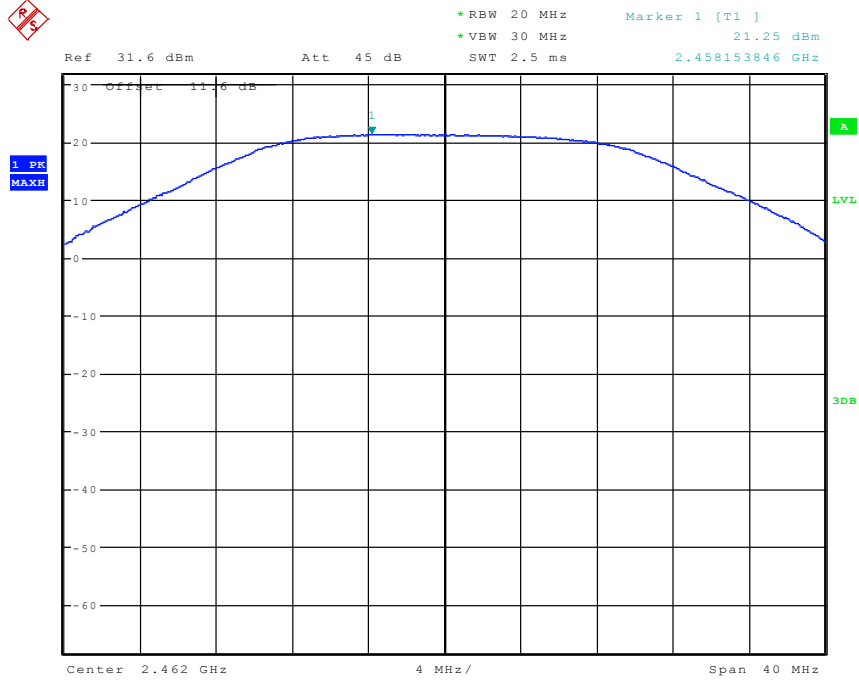
Conducted Peak Power 802.11b 2437 MHz



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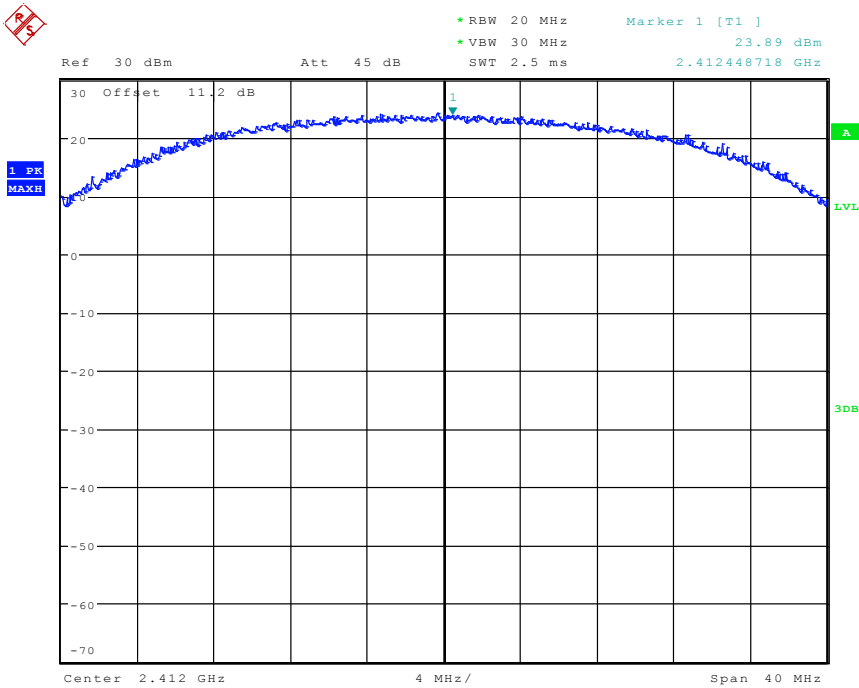


Conducted Peak Power 802.11b 2462 MHz



Date: 16.APR.2010 11:16:44

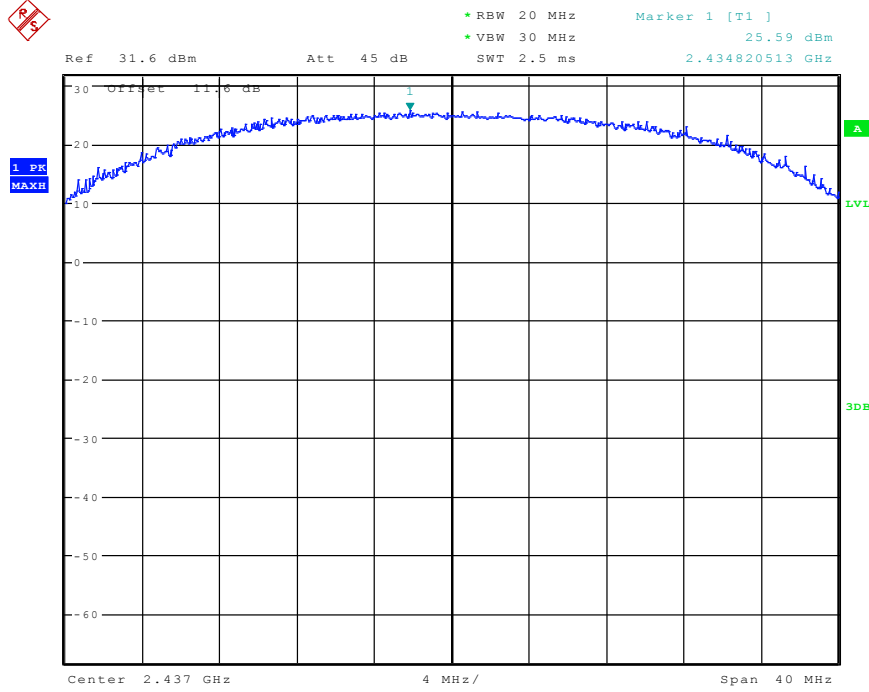
Conducted Peak Power 802.11g 2412 MHz



Date: 27.APR.2010 11:12:35

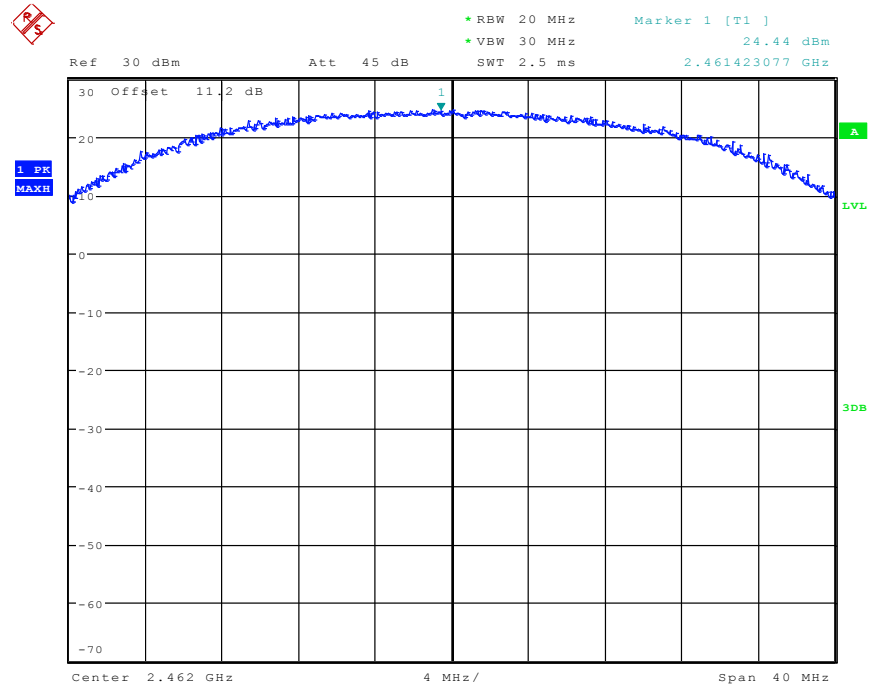


Conducted Peak Power 802.11g 2437 MHz



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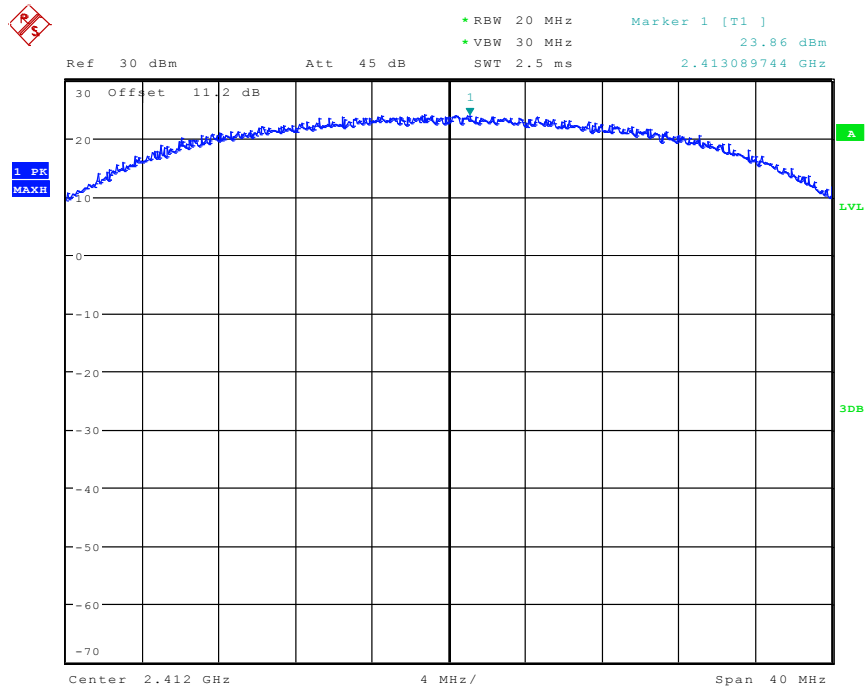
Conducted Peak Power 802.11g 2462 MHz



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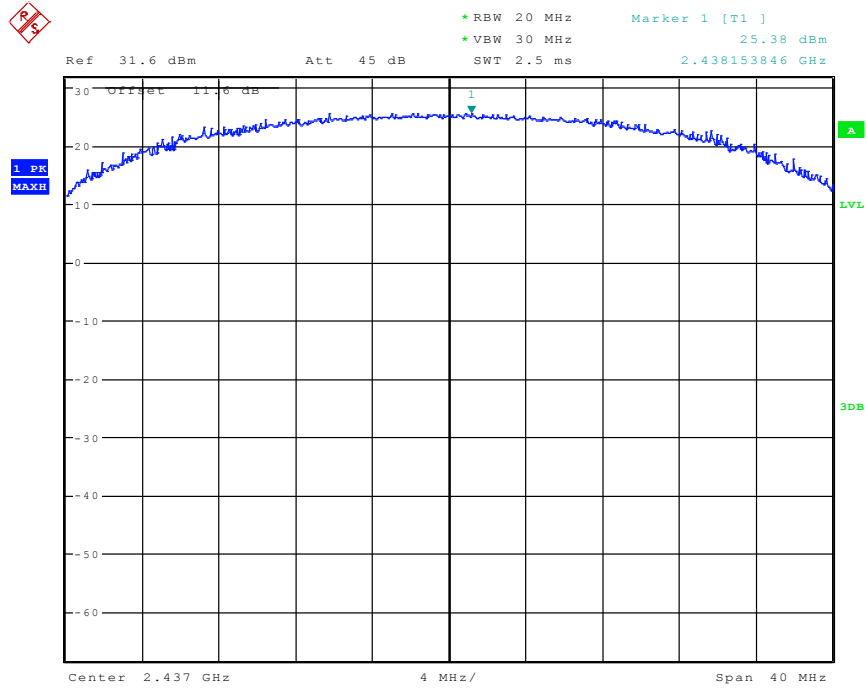


Conducted Peak Power HT20 2412 MHz



Date: 27.APR.2010 11:20:54

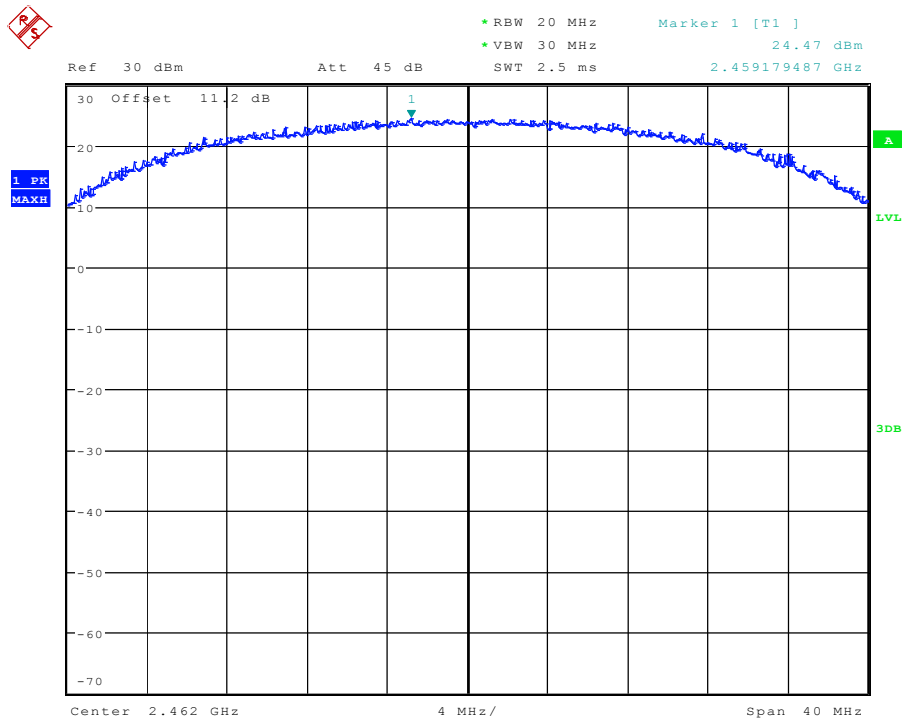
Conducted Peak Power HT20 2437 MHz



Date: 16.APR.2010 11:33:47



Conducted Peak Power HT20 2462 MHz



Date: 27.APR.2010 11:20:07



5.4 Restricted Band Edge Compliance

5.4.1 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
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. 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)).

5.4.2 Measurement Procedure:

Peak measurements are made using a peak detector and RBW=1MHz.

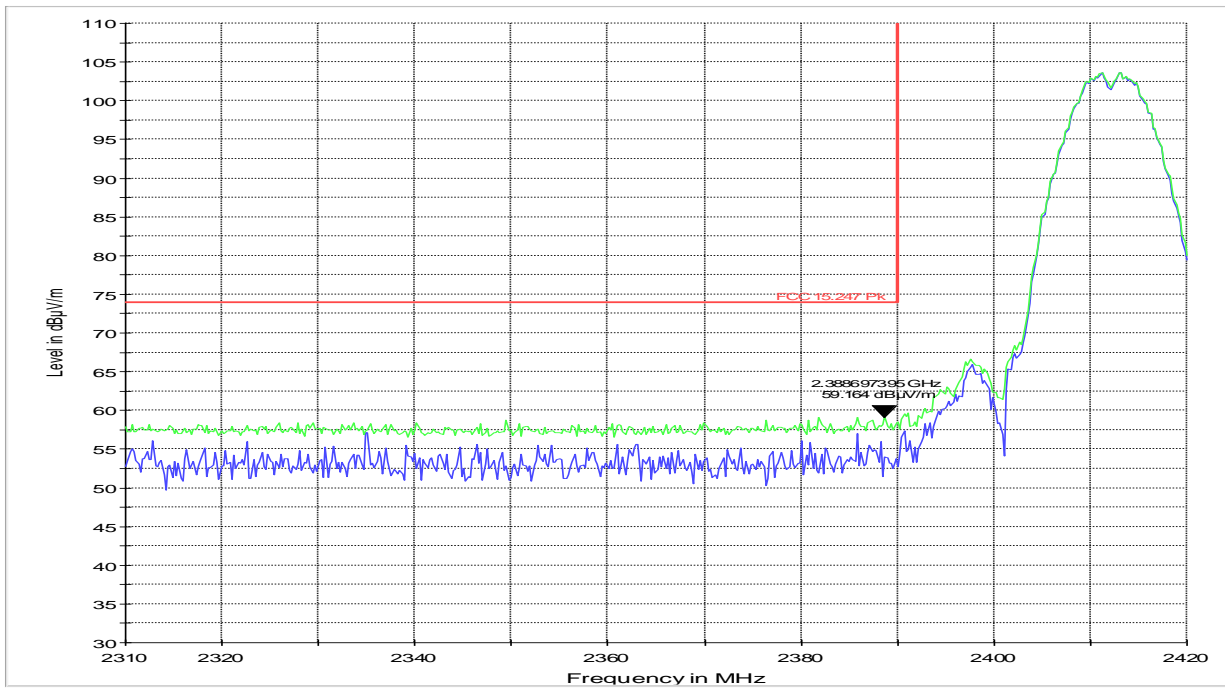
Average measurements performed using a peak detector and according to video averaging procedure with RBW=1MHz and VBW=10Hz.

*PEAK LIMIT= 74dBµV/m

*AVG. LIMIT= 54dBµV/m

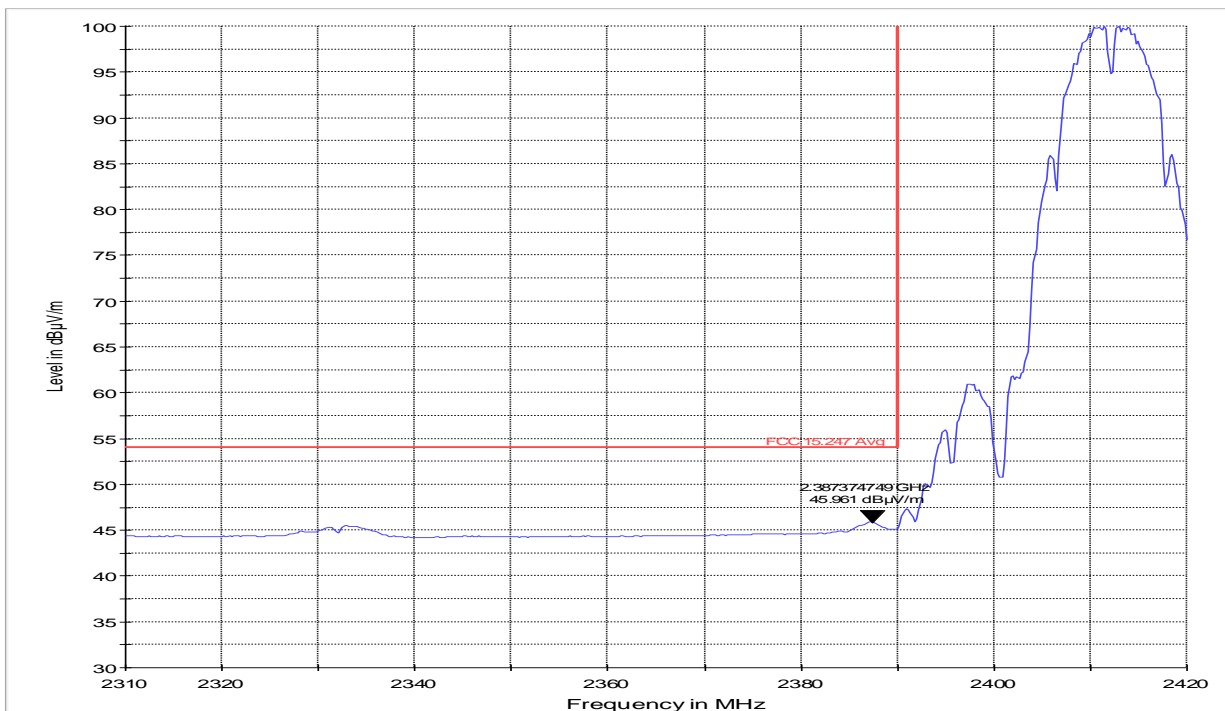


5.4.3 Test Data/plots: Lower band edge peak -802.11b mode



MixPeak-ClearView MixPeak-MixHold FCC15.247Pk

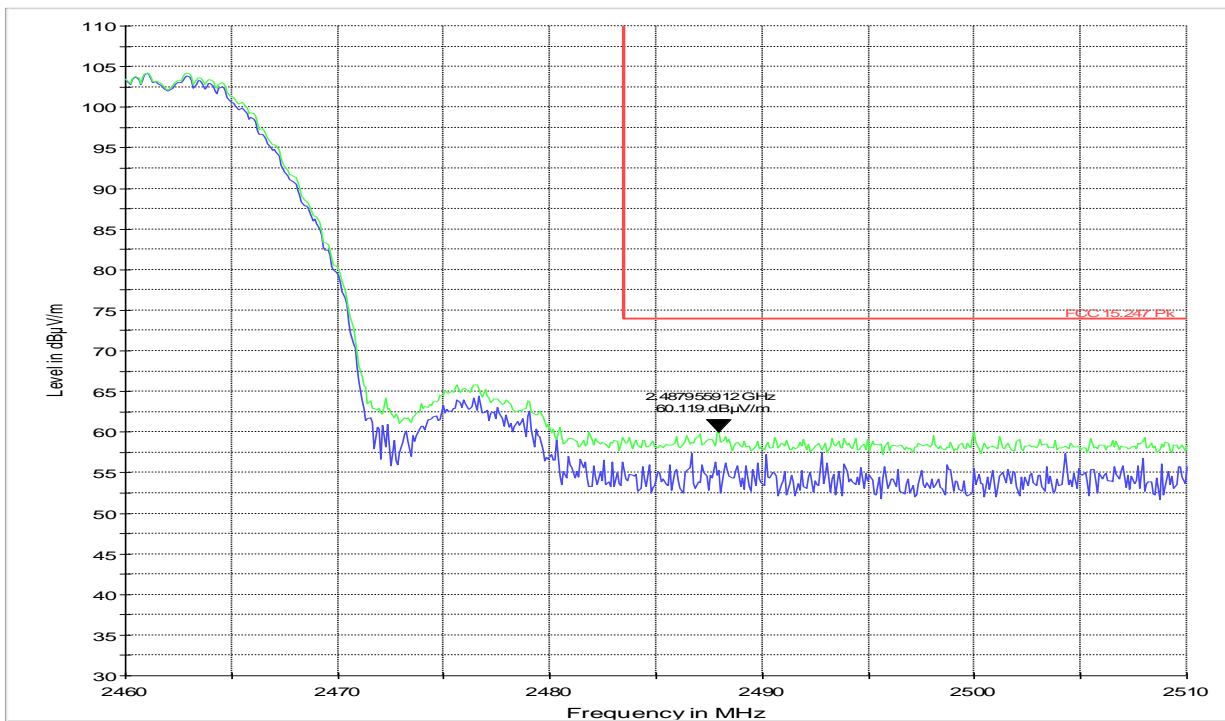
Lower band edge average -802.11b mode



MixPeak-MixHold Average-MixHold FCC 15.247 Avg

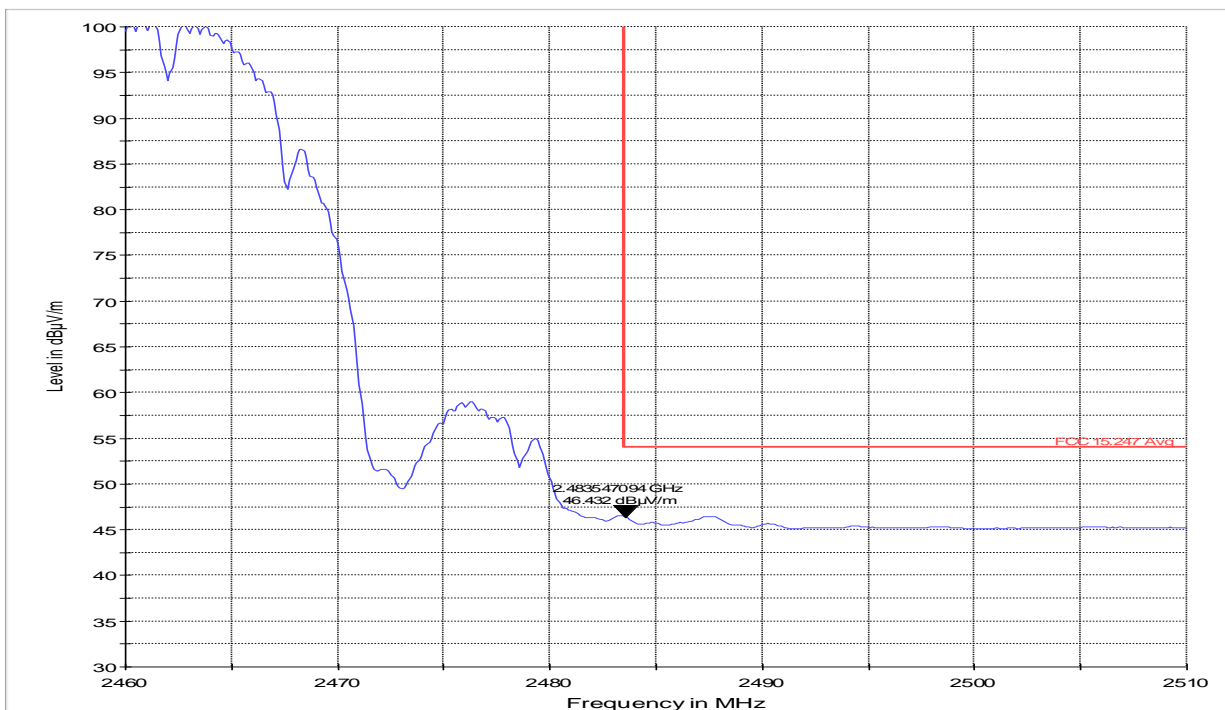


Higher band edge peak -802.11b mode



MixPeak-ClearWfcs MixPeak-MixHeld FCC 15.247 Pk

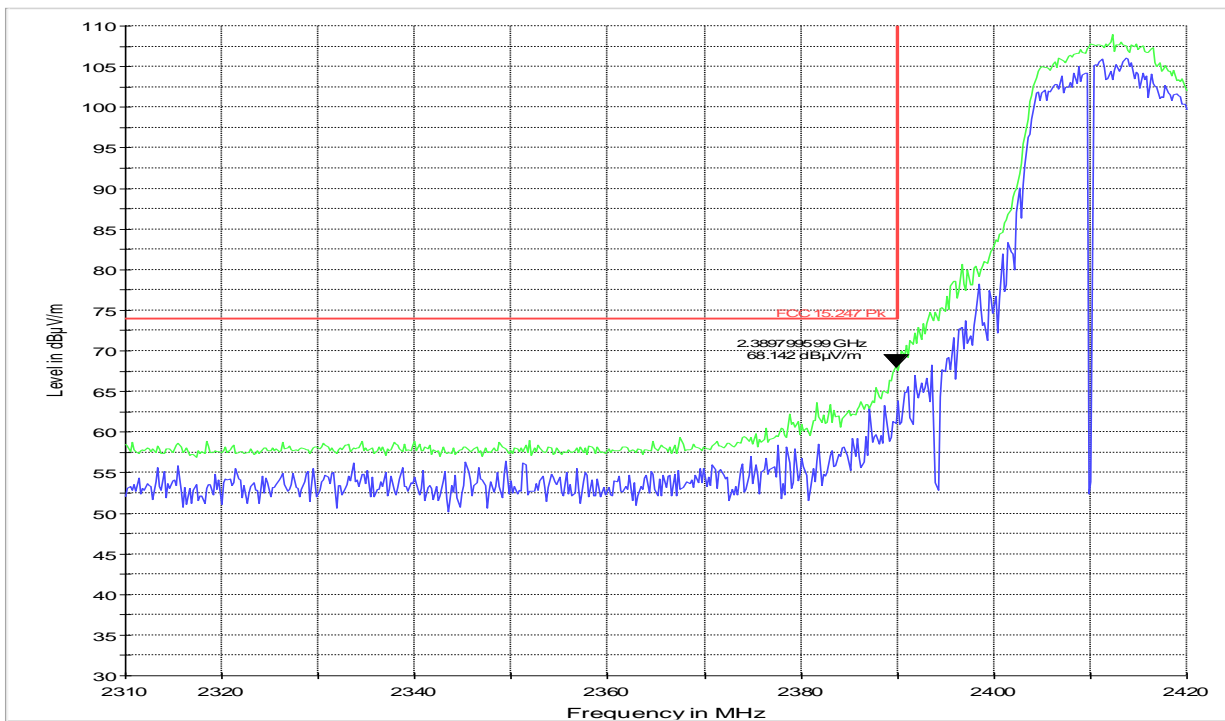
Higher band edge average -802.11b mode



MixPeak-MixHeld Average-MixHeld FCC 15.247 Avg

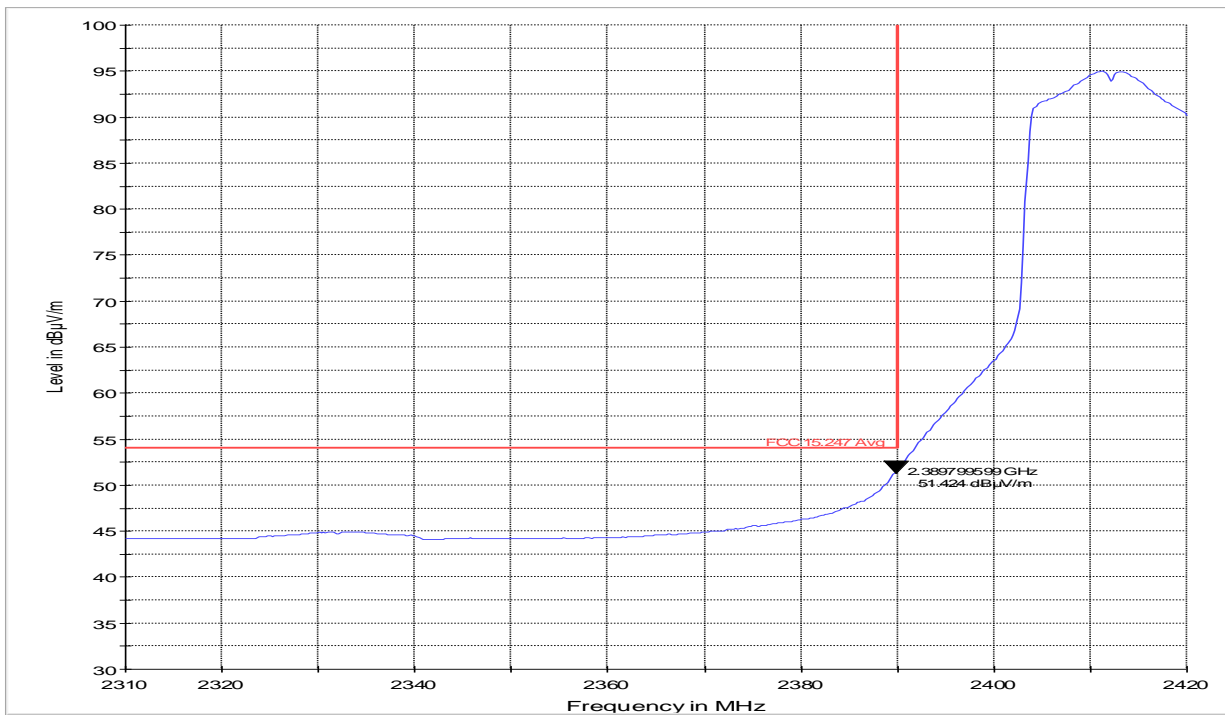


Lower band edge peak - 802.11g mode



MixPeak-ClearWhite MixPeak-MixHold FCC 15.247Pk

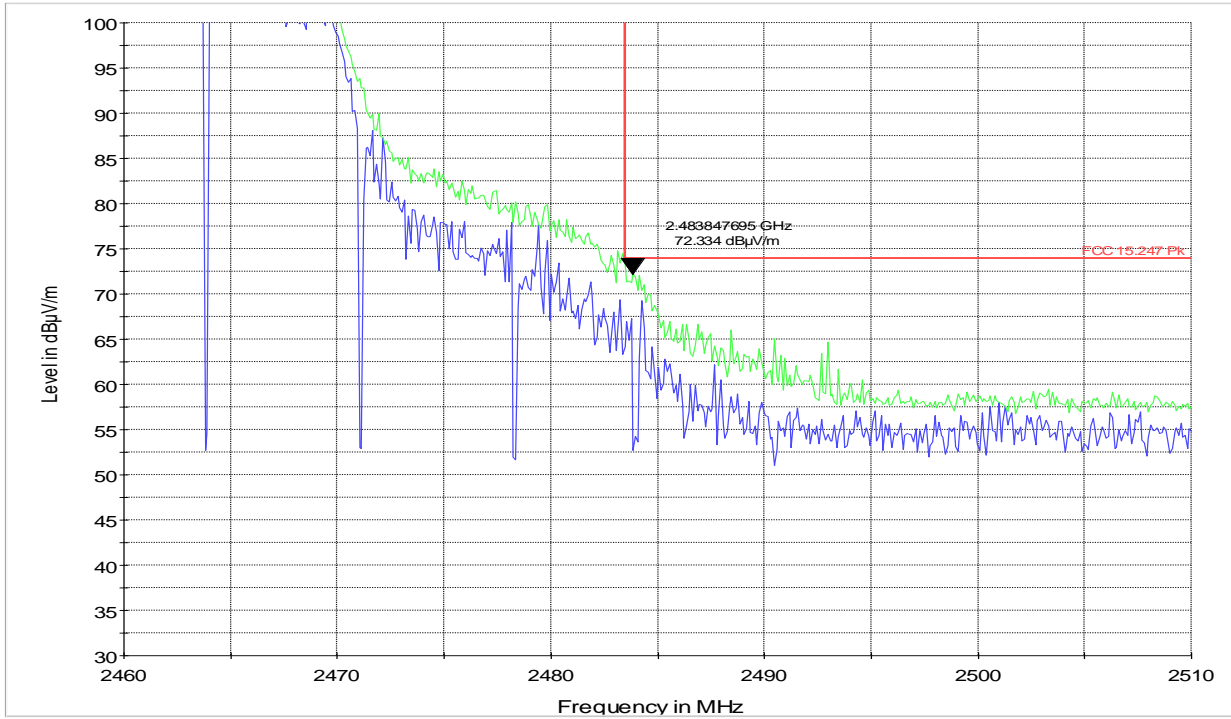
Lower band edge average -802.11g mode



MixPeak-MixHold Average-MixHold FCC 15.247Avg

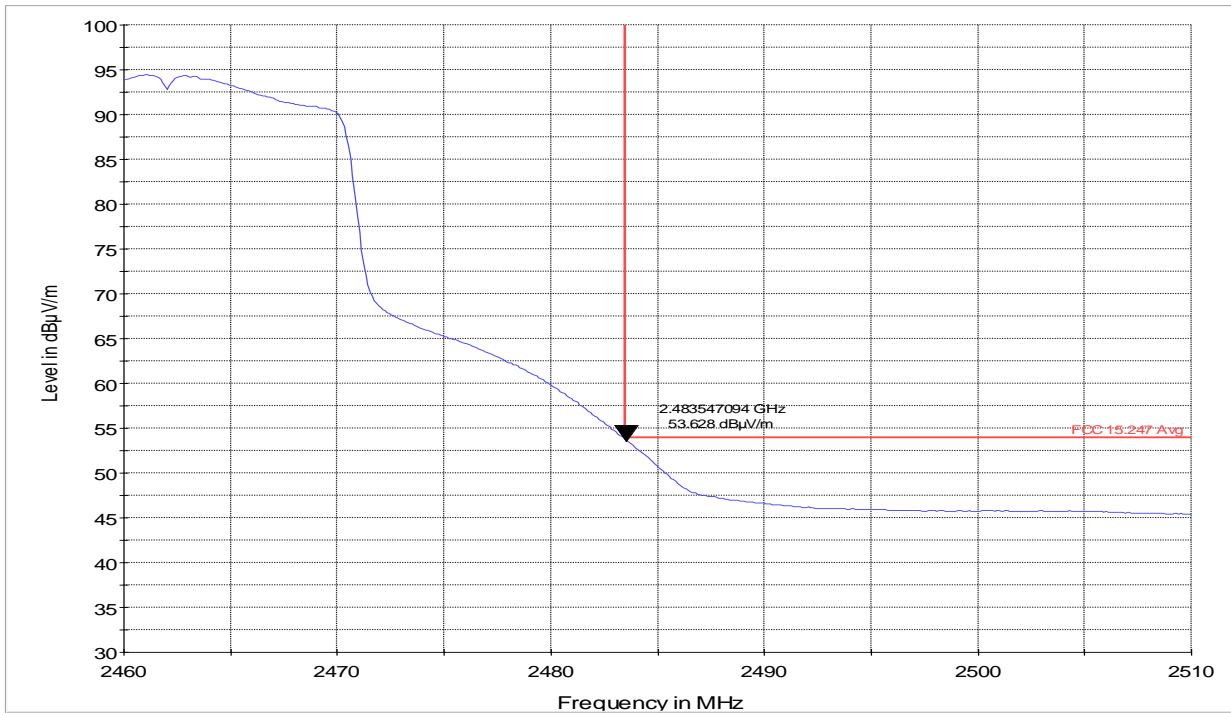


Higher band edge peak -802.11g mode (Peak measurement= 72.33 dB μ V/m)



MixPeak-ClearWhite MixPeak-MixHold FCC 15.247 Pk

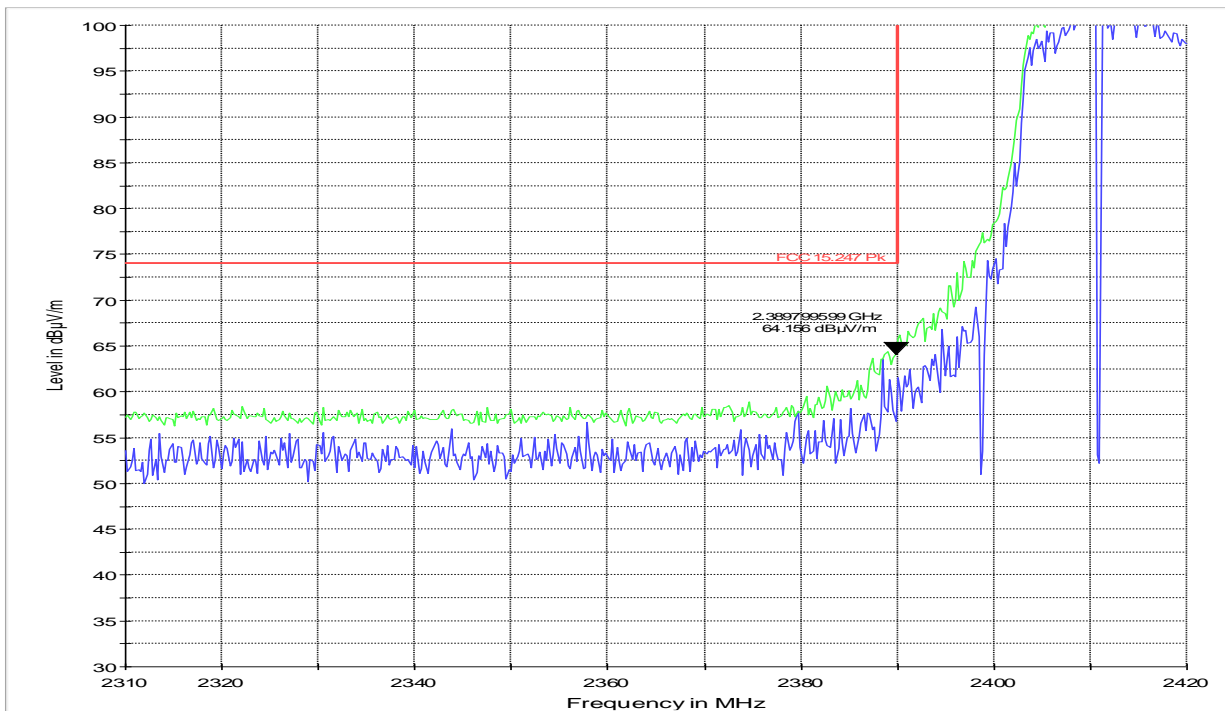
Higher band edge average- 802.11g mode (Peak measurement= 53.63 dB μ V/m)



MixPeak-MixHold Average-MixHold FCC 15.247 Avg

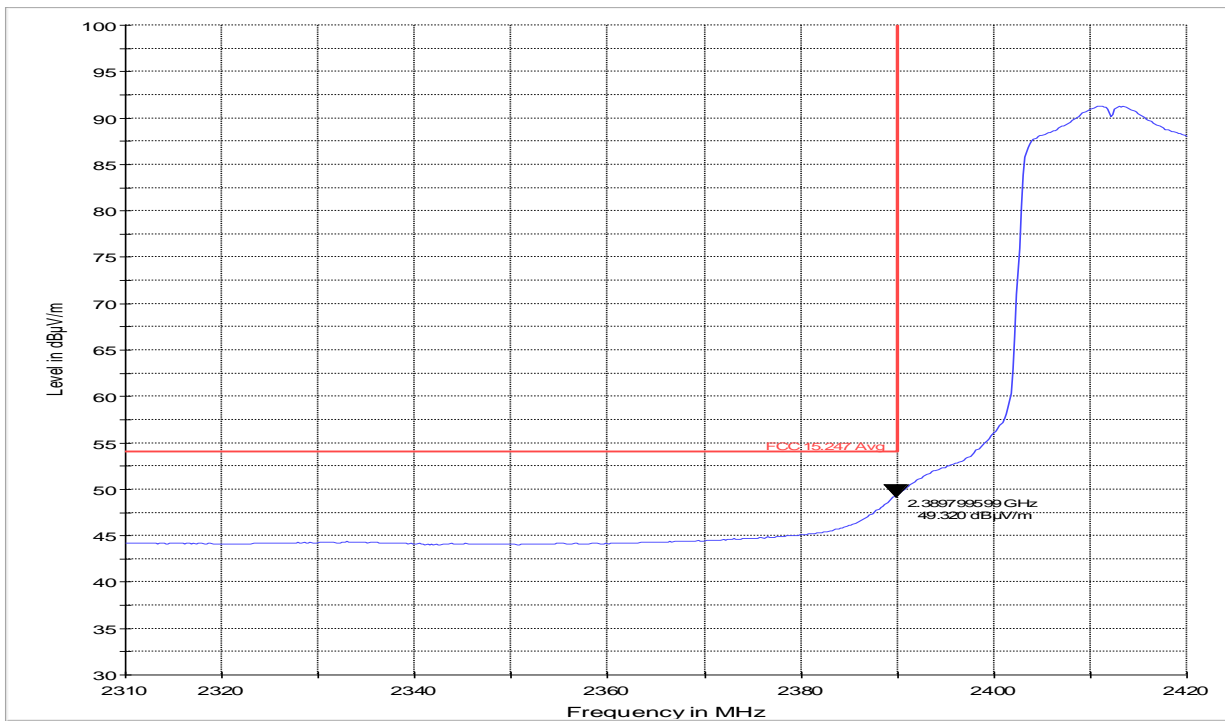


Lower band edge peak – HT20 mode



MixPeak-ClearWtd MixPeak-MixHeld FCC 15.247 Pk

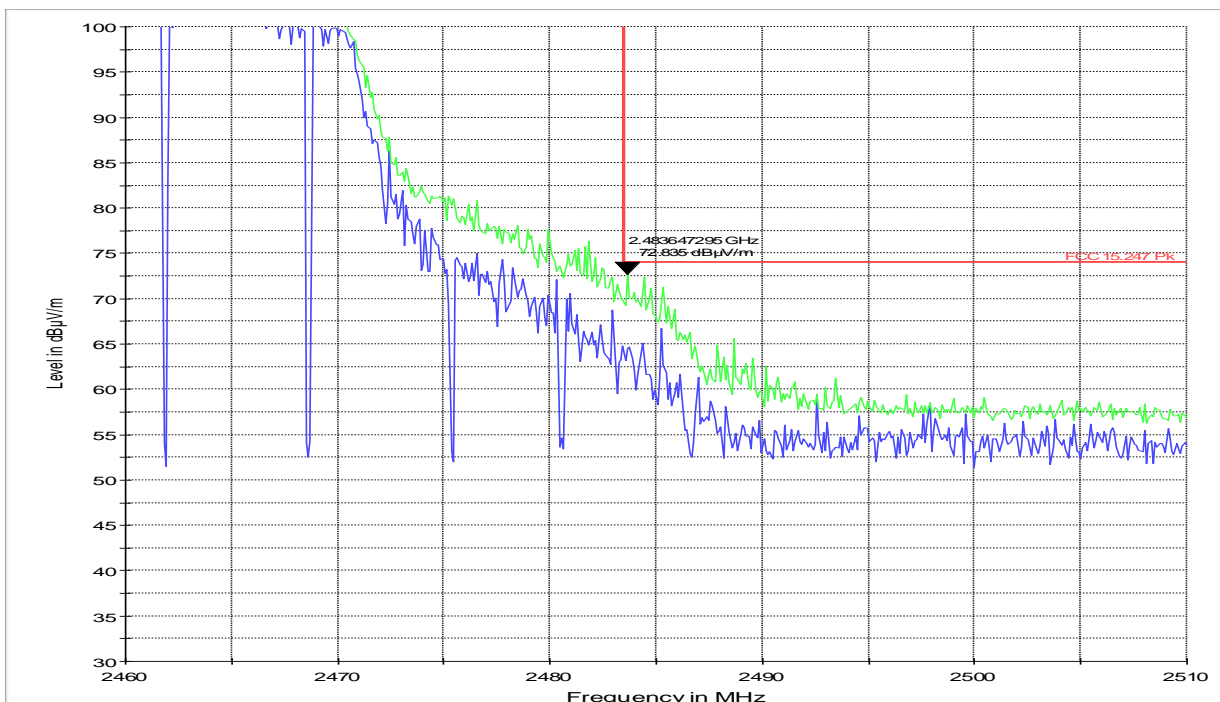
Lower band edge average -HT20 mode



MixPeak-MixHeld Average-MixHeld FCC 15.247 Avg

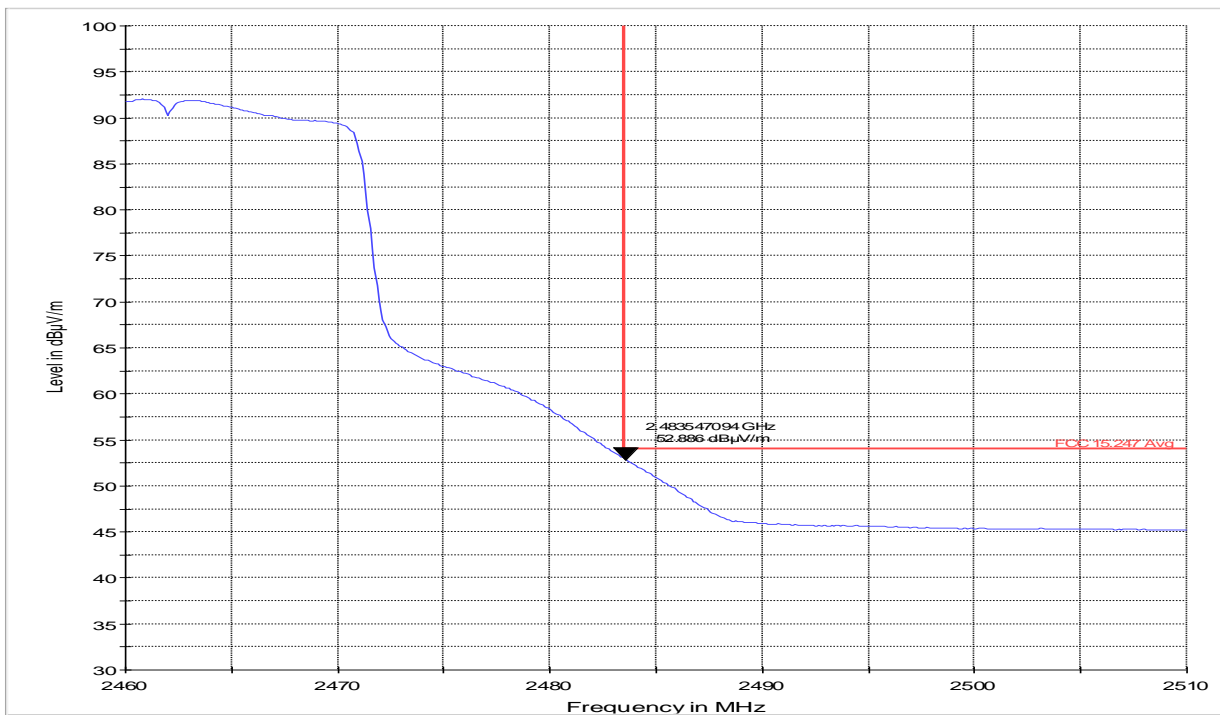


Higher band edge peak - HT20 mode (Peak measurement= 72.83 dB μ V/m)



— MixPeak-ClearWid — MixPeak-MixHeld — FCC 15.247 Pk

Higher band edge average- HT20 mode (Peak measurement= 52.89 dB μ V/m)



— MixPeak-MixHeld — Average-MixHeld — FCC 15.247 Avg



5.5 Spectrum Bandwidth/ 20dB Bandwidth § 15.247 (a)(2)

5.5.1 Limits:

§ 15.247 (a)(1)

Spectrum Bandwidth > 500 kHz

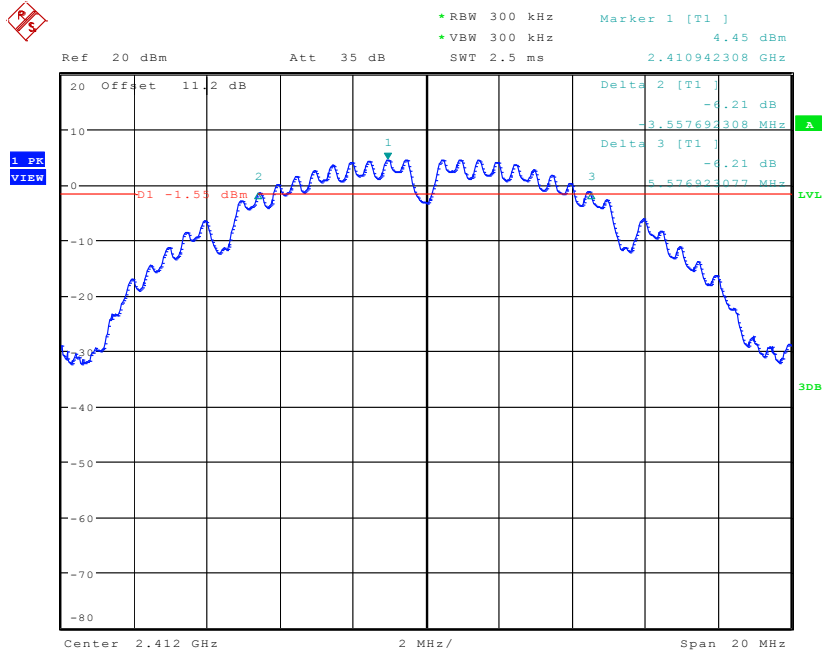
5.5.2 Test Result:

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	9.14	13.03	9.21	13.07	9.16	13.07
802.11g	16.06	16.44	16.02	16.44	16.05	16.49
HT20	17.24	17.64	17.43	17.64	17.33	17.64
Measurement Uncertainty: ±100 kHz						

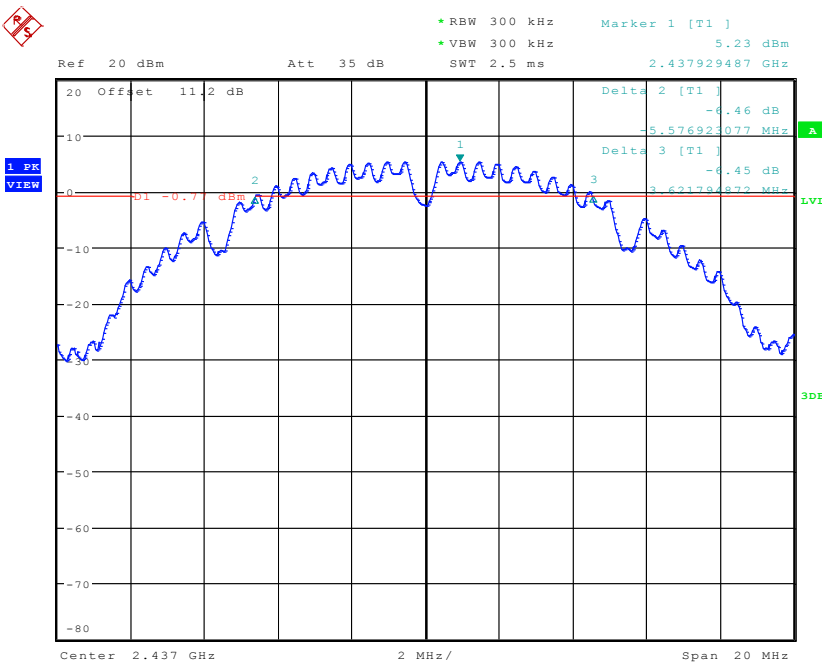


5.5.3 Test Data/plots:

6dB Bandwidth 802.11b 2412 MHz

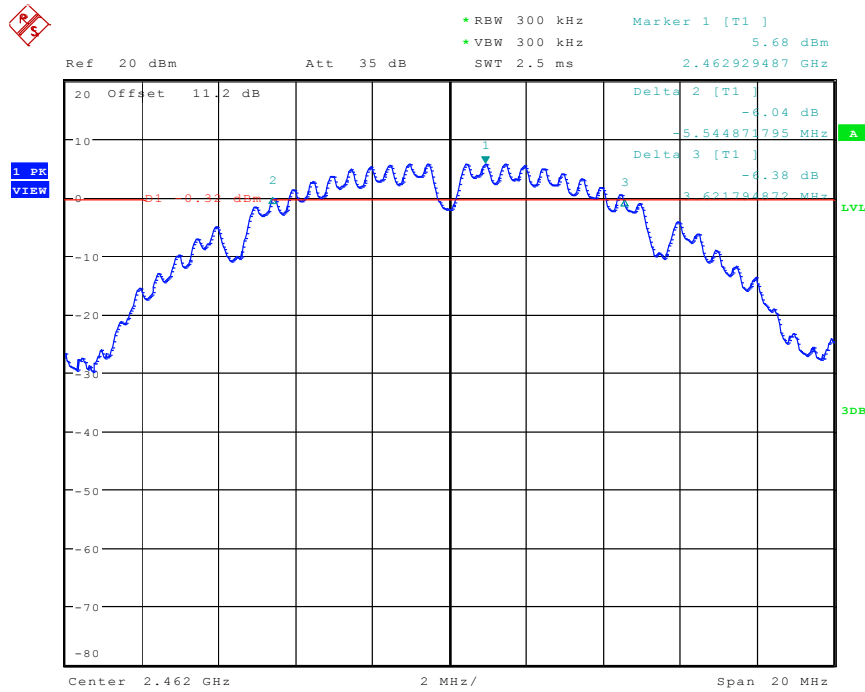


Date: 4.MAY.2010 10:21:25
 6dB Bandwidth 802.11b 2437 MHz

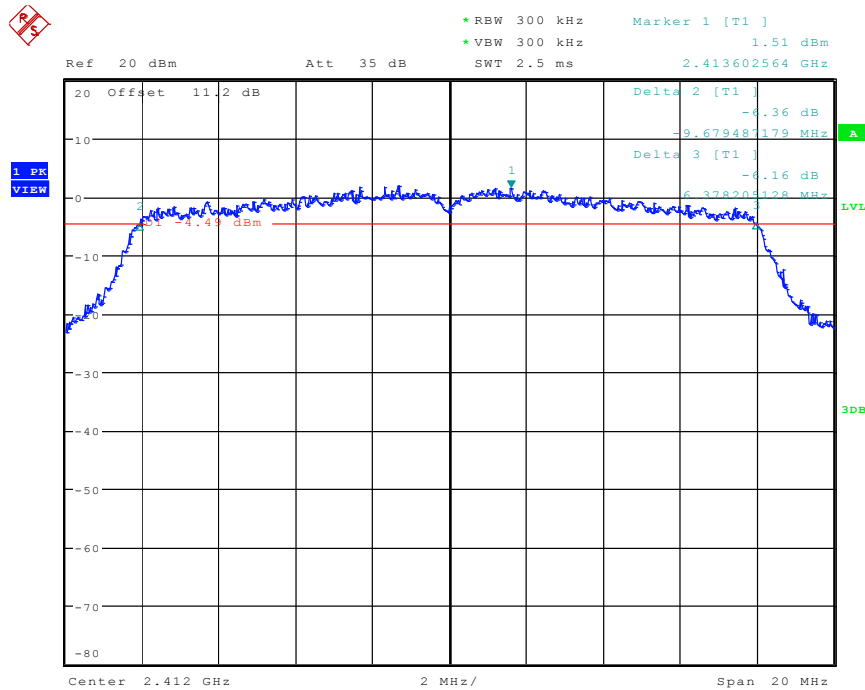




6dB Bandwidth 802.11b 2462 MHz

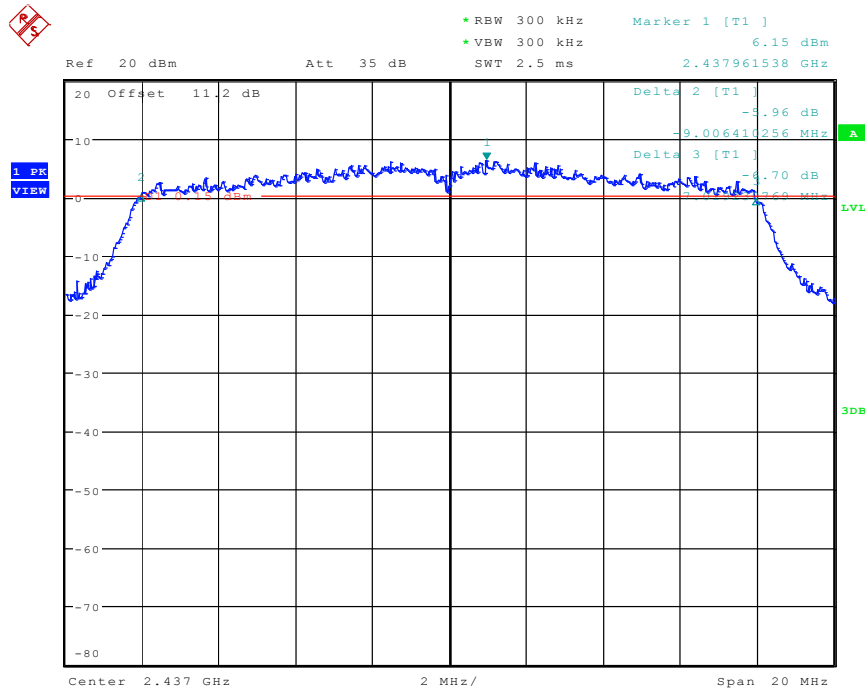


Date: 4.MAY.2010 10:23:23
6dB Bandwidth 802.11g 2412 MHz

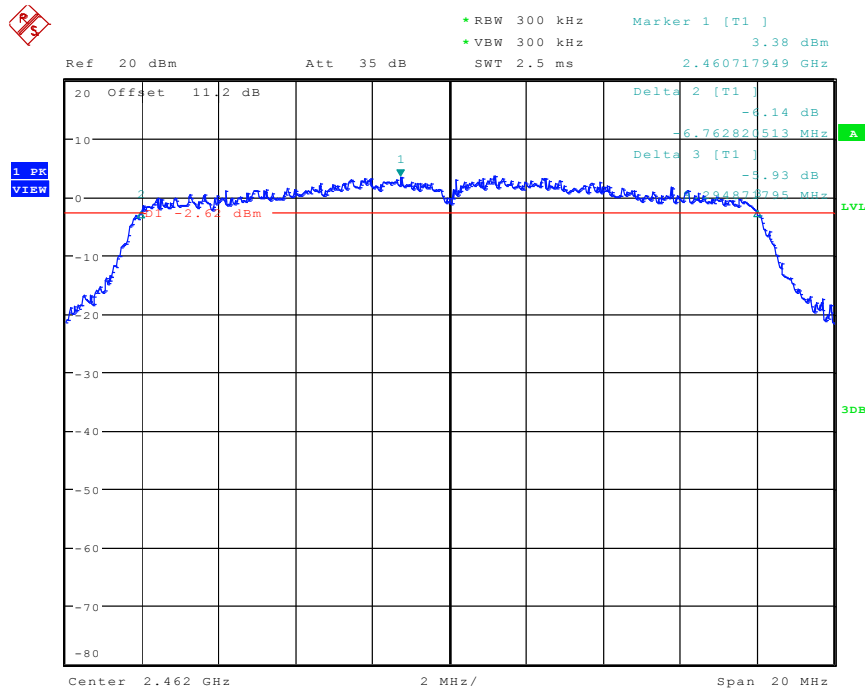




6dB Bandwidth 802.11g 2437 MHz

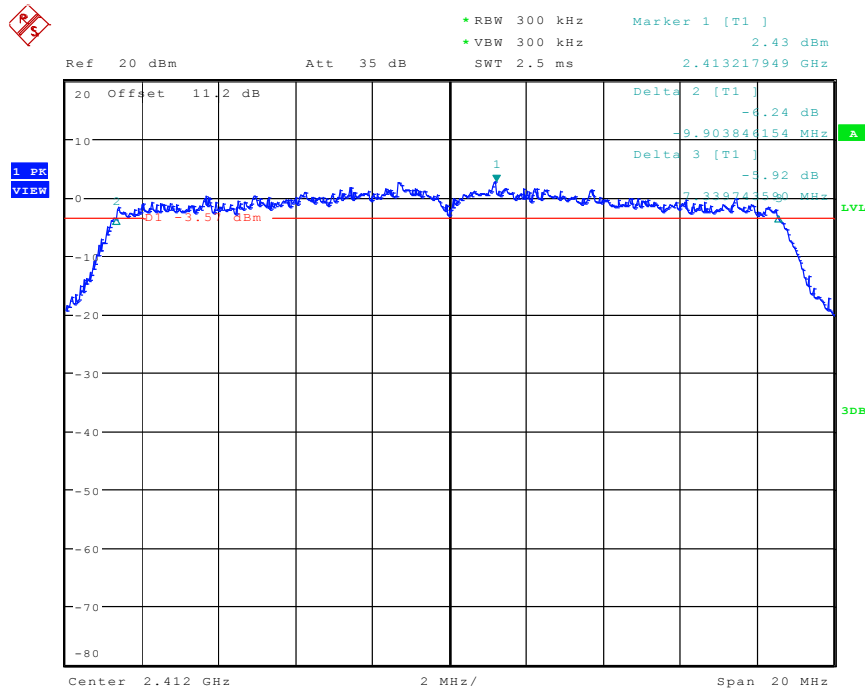


Date: 4.MAY.2010 10:25:45
6dB Bandwidth 802.11g 2462 MHz



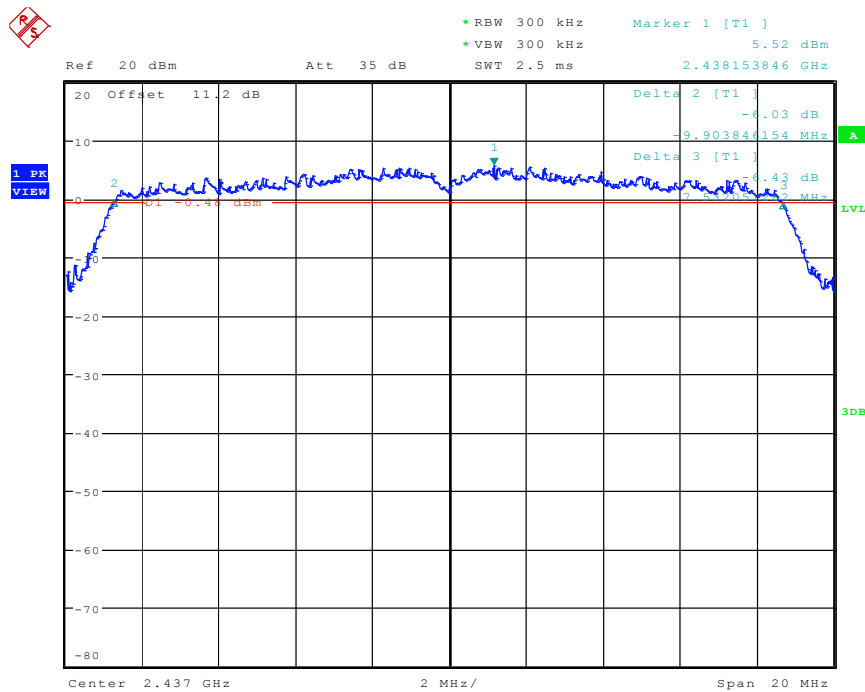


6dB Bandwidth HT20 2412 MHz



Date: 4.MAY.2010 10:27:56

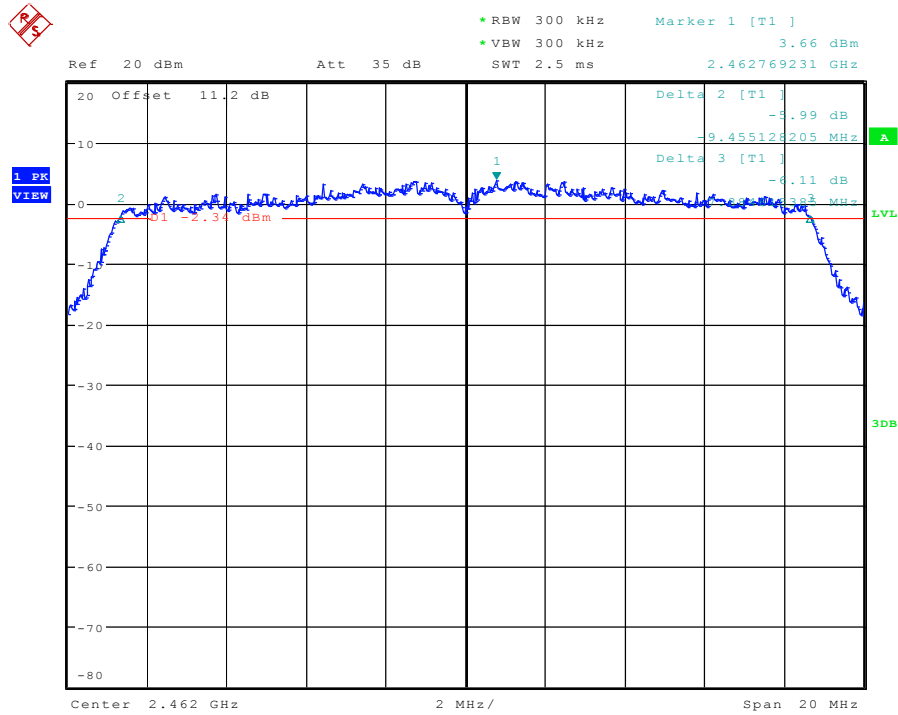
6dB Bandwidth HT20 2437 MHz



Date: 4.MAY.2010 10:29:17



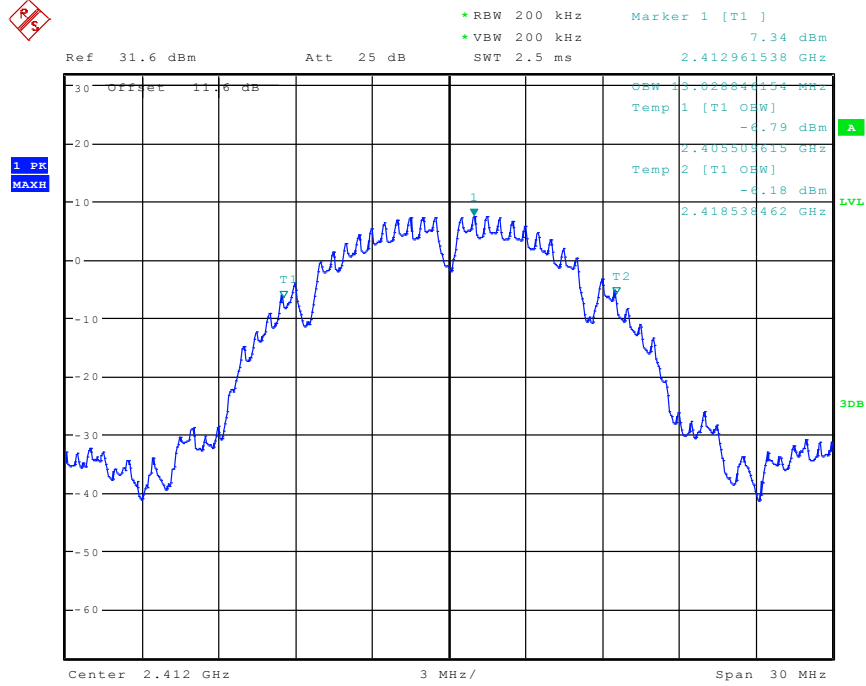
6dB Bandwidth HT20 2462 MHz



Date: 4.MAY.2010 10:30:15

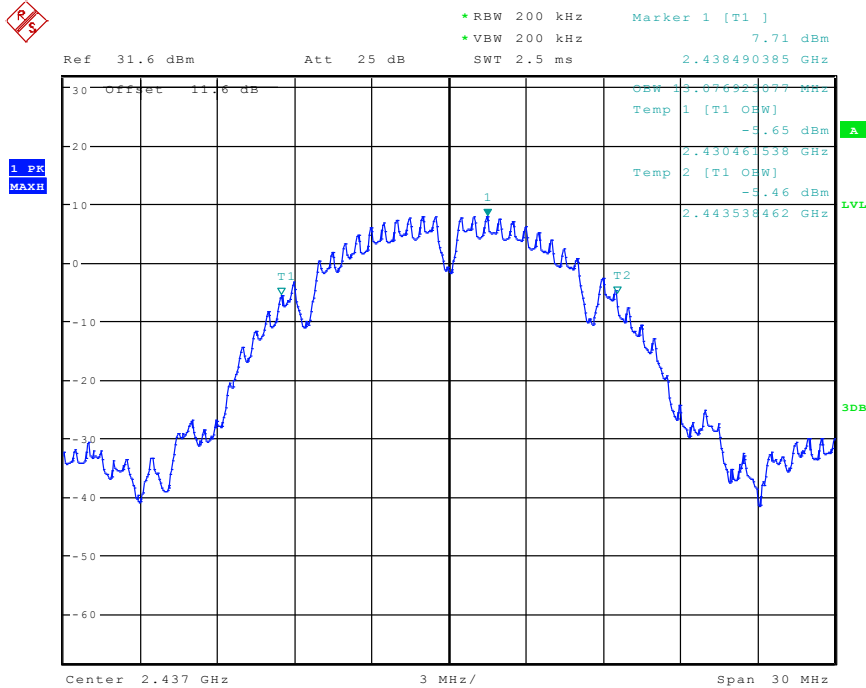


20dB Bandwidth 802.11b 2412 MHz



Date: 16.APR.2010 11:49:22

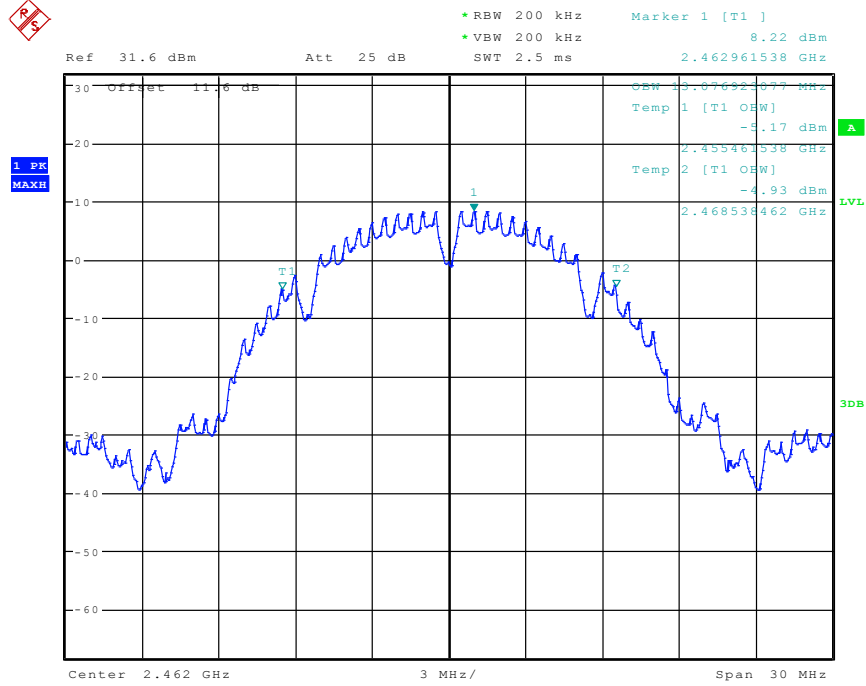
20dB Bandwidth 802.11b 2437 MHz



Date: 16.APR.2010 12:04:58

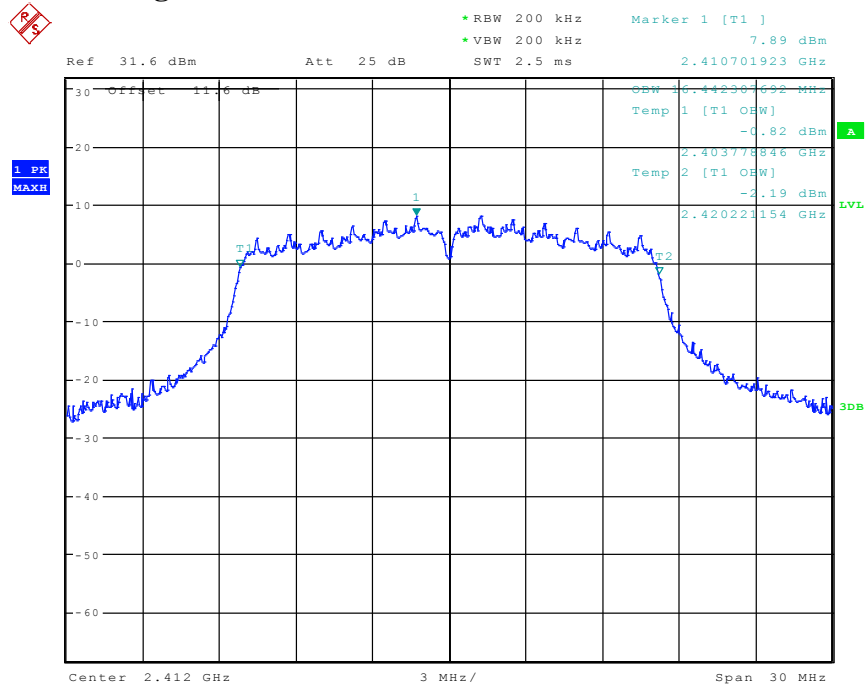


20dB Bandwidth 802.11b 2462 MHz



Date: 16.APR.2010 12:05:31

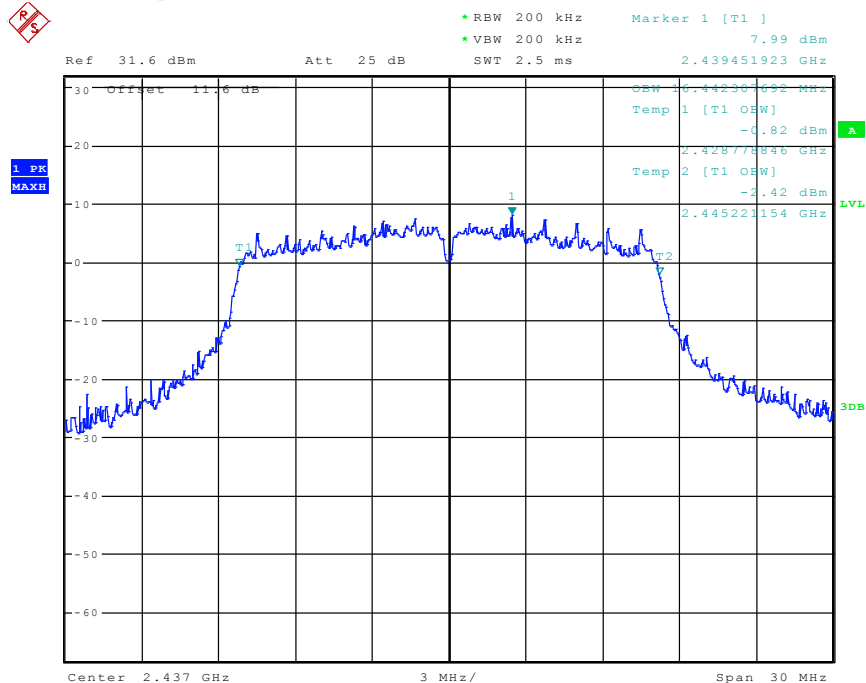
20dB Bandwidth 802.11g 2412 MHz



Date: 16.APR.2010 12:14:02

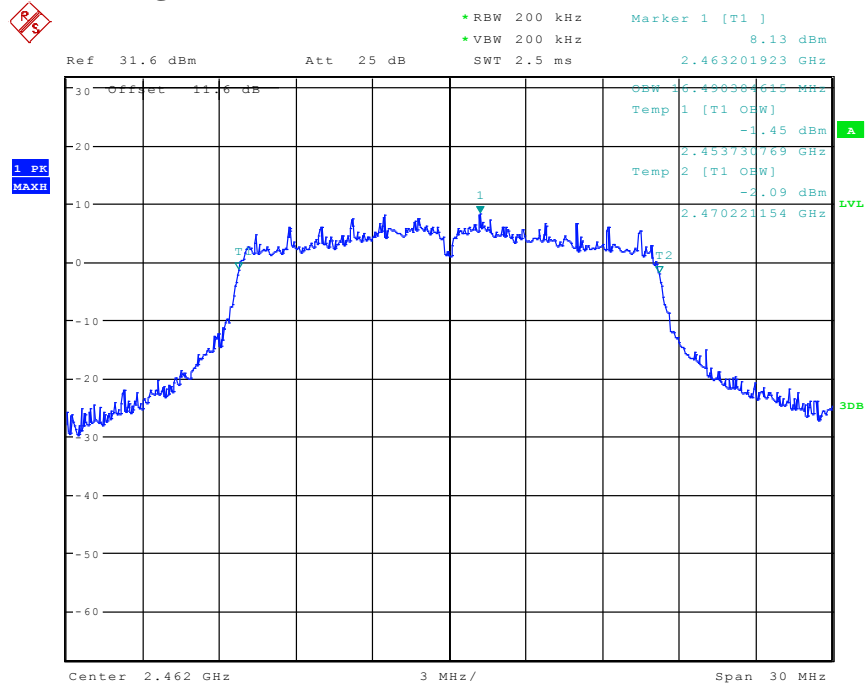


20dB Bandwidth 802.11g 2437 MHz



Date: 16.APR.2010 12:17:05

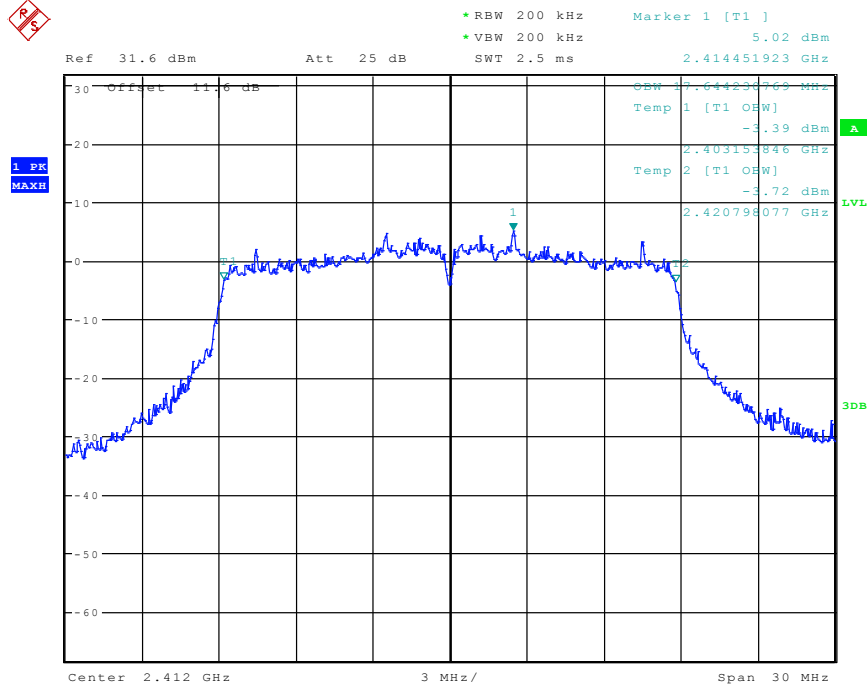
20dB Bandwidth 802.11g 2462 MHz



Date: 16.APR.2010 12:18:36

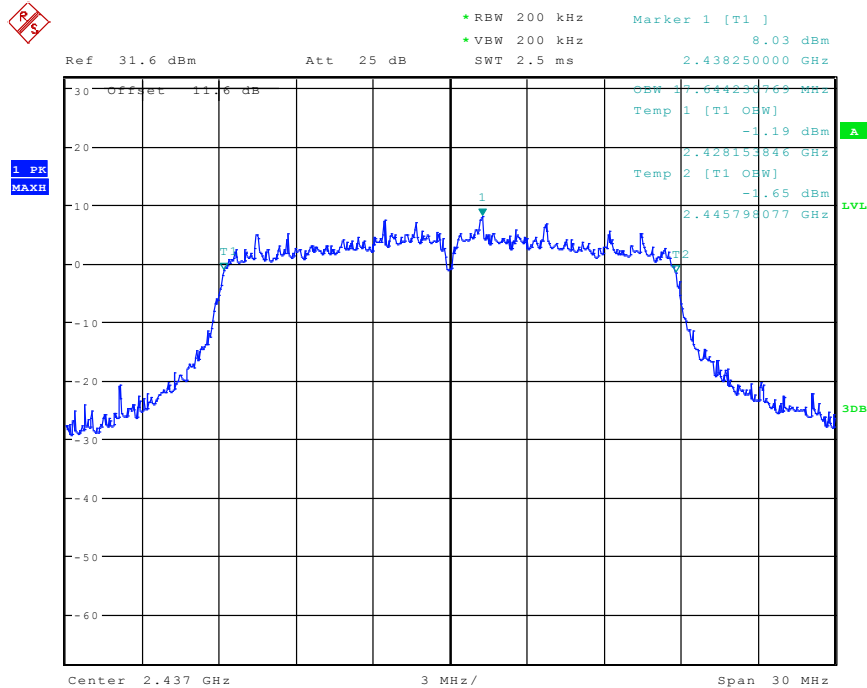


20dB Bandwidth HT20 2412 MHz



Date: 16.APR.2010 12:20:51

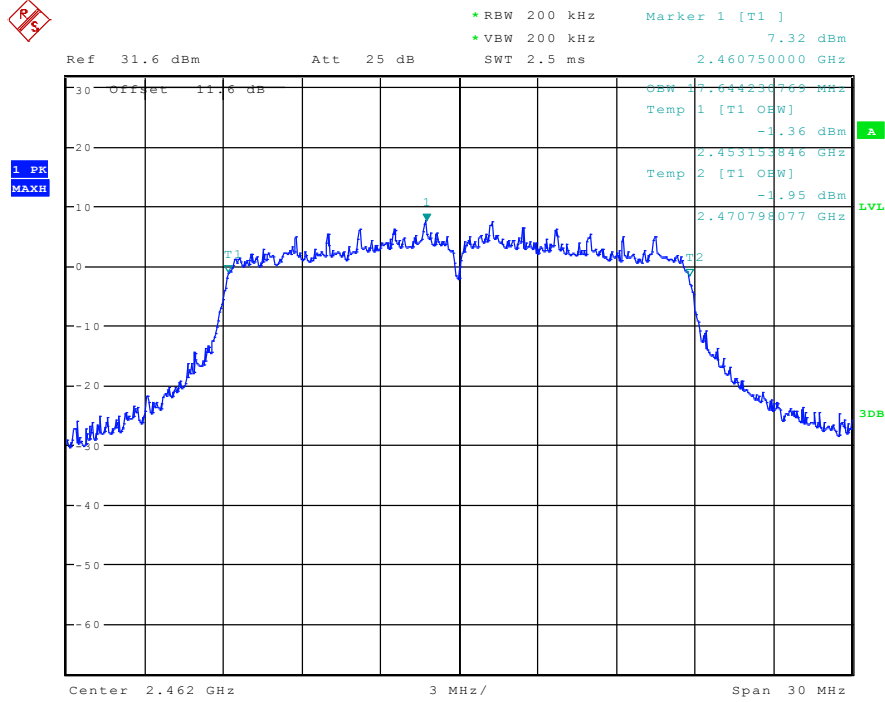
20dB Bandwidth HT20 2437 MHz



Date: 16.APR.2010 12:22:40



20dB Bandwidth HT20 2462 MHz



Date: 16.APR.2010 12:52:17



5.6 Power Spectral Density

5.6.1 Limits:

§ 15.247 (e)

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.

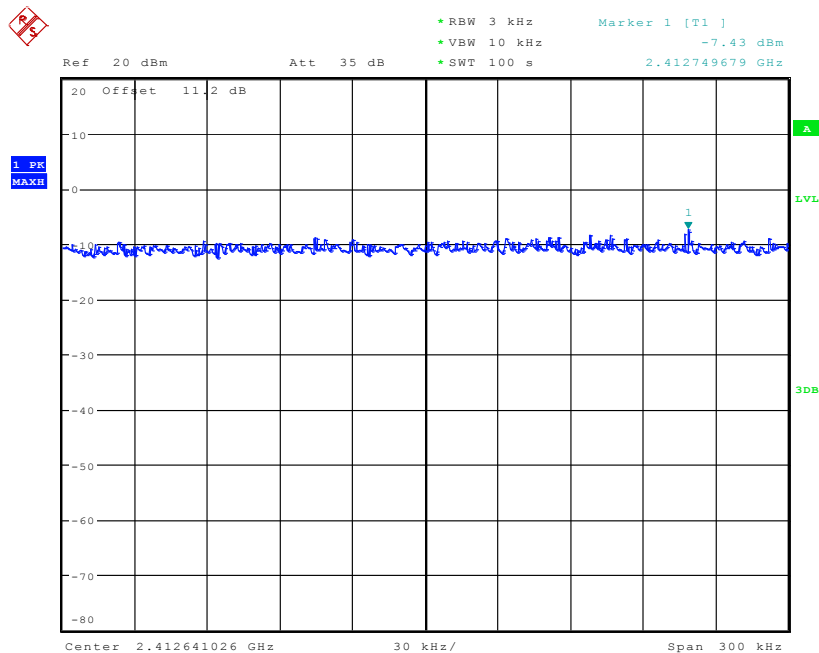
5.6.2 Test results:

Power Spectral Density (dBm/MHz)			
Mode	Frequency (MHz)		
	2412 Channel 1	2437 Channel 6	2462 Channel 11
802.11b	-7.43	-7.23	-6.34
802.11g	-13.64	-9.36	-11.85
HT20	-13.47	-9.91	-11.85
Measurement Uncertainty: ±0.5dB			



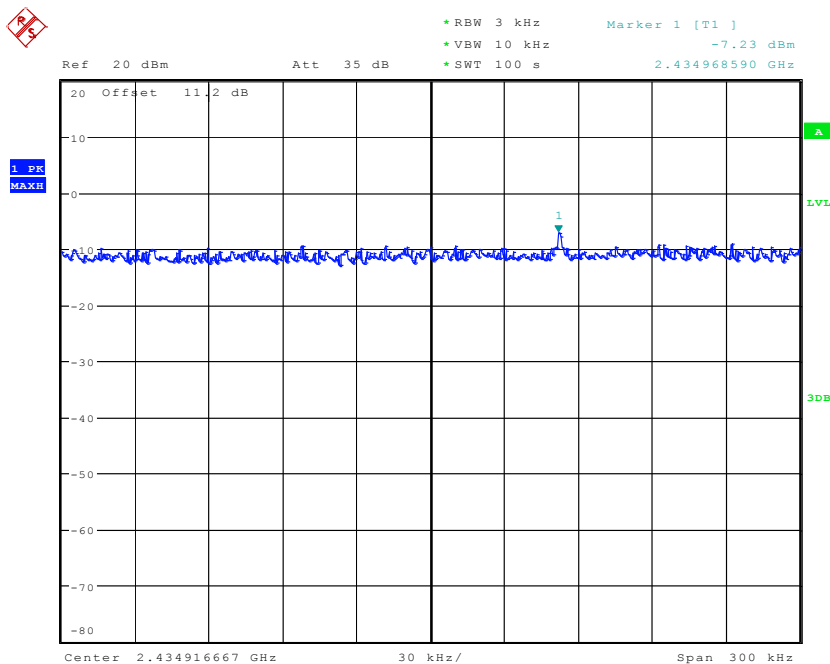
5.6.3 Test Data/plots:

Power Spectral Density 802.11b 2412 MHz



Date: 4.MAY.2010 09:51:58

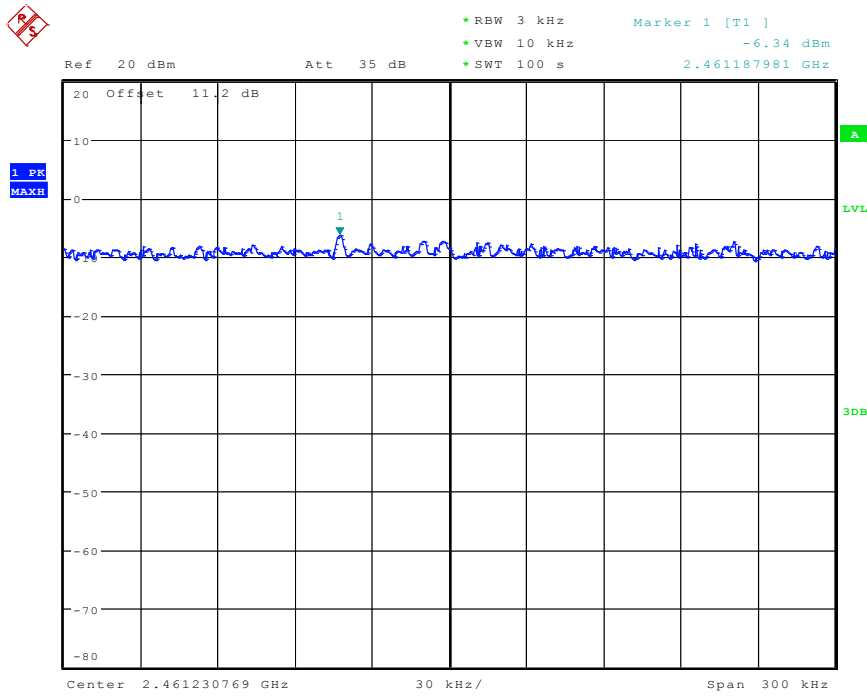
Power Spectral Density 802.11b 2437 MHz



Date: 4.MAY.2010 09:54:21

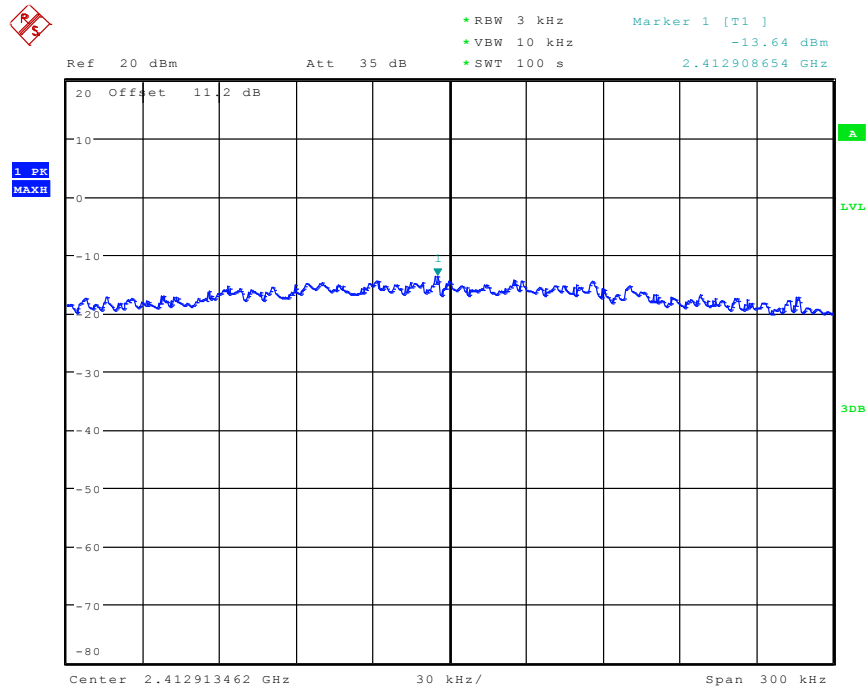


Power Spectral Density 802.11b 2462 MHz



Date: 4.MAY.2010 09:59:13

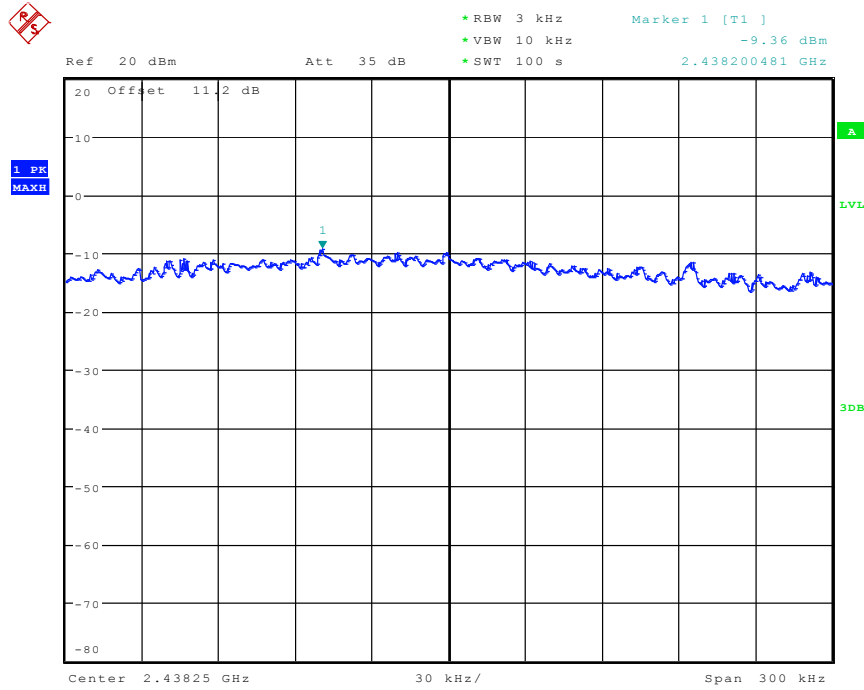
Power Spectral Density 802.11g 2412 MHz



Date: 4.MAY.2010 09:37:20

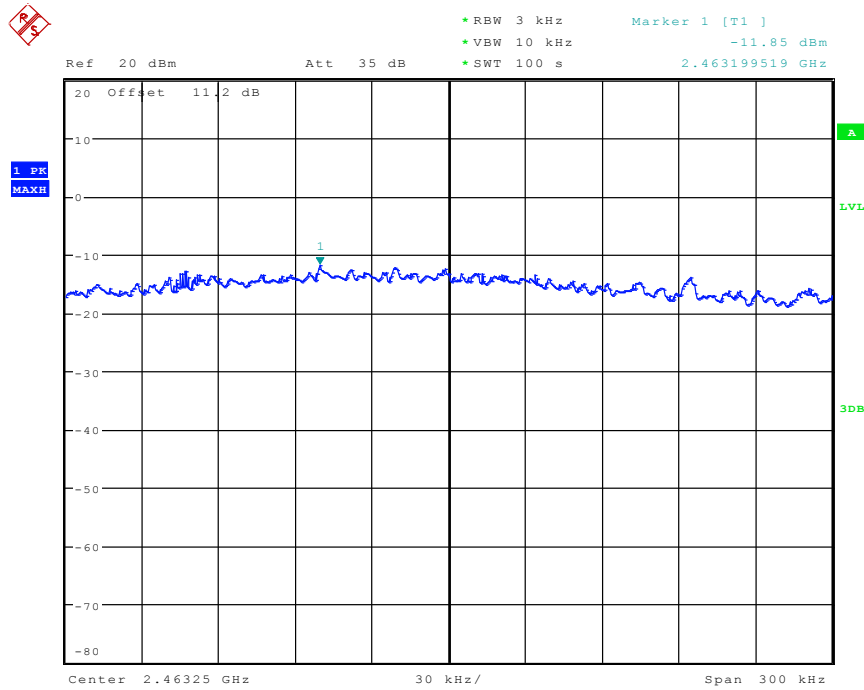


Power Spectral Density 802.11g 2437 MHz



Date: 4.MAY.2010 09:39:43

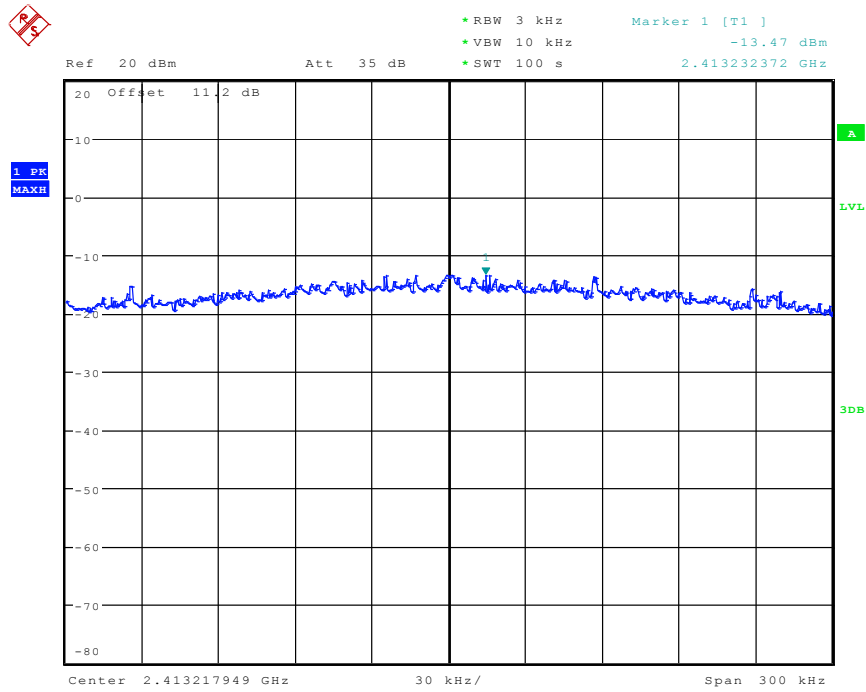
Power Spectral Density 802.11g 2462 MHz



Date: 4.MAY.2010 09:42:05

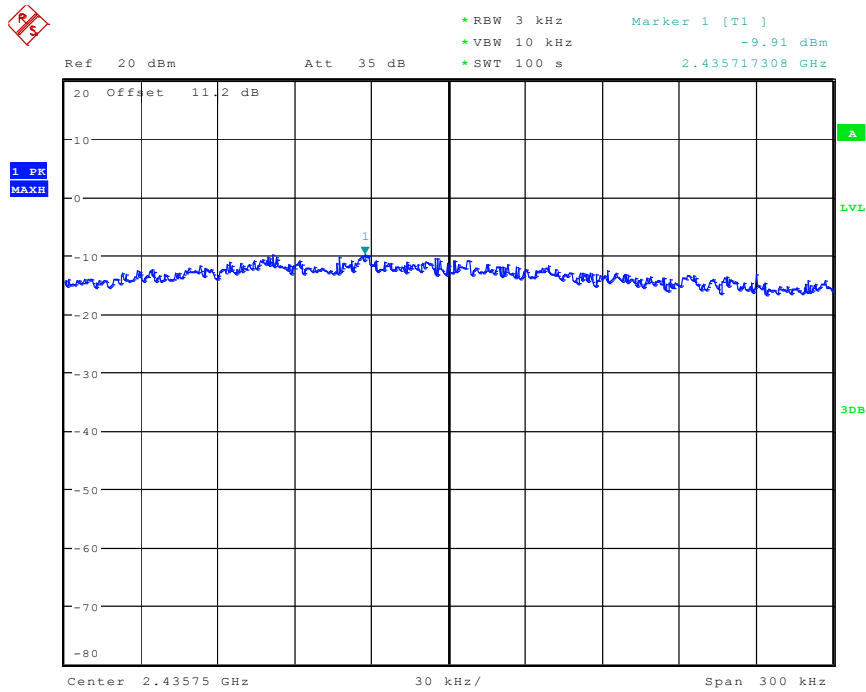


Power Spectral Density HT20 2412 MHz



Date: 4.MAY.2010 09:44:31

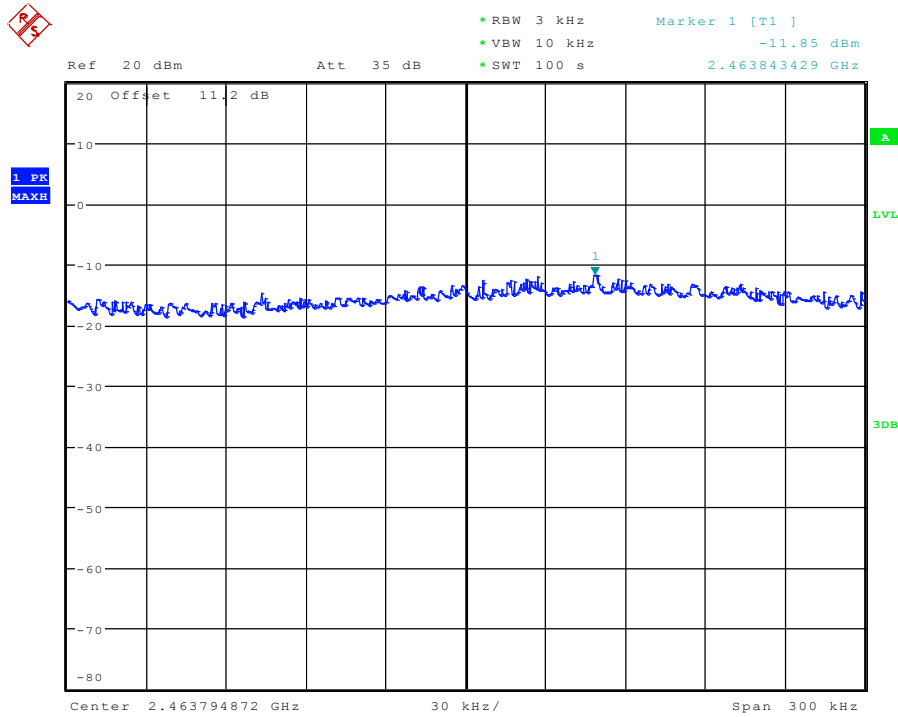
Power Spectral Density HT20 2437 MHz



Date: 4.MAY.2010 09:47:16



Power Spectral Density HT20 2462 MHz



Date: 4.MAY.2010 09:49:37



5.7 Transmitter Spurious Emissions- Conducted § 15.247 (c)

5.7.1 Limits:

§ 15.247 (d)

30dBm for the transmitter.

-20dBc in the frequency range 30MHz- 25GHz.

5.7.2 Test Conditions:

Mode: All modes.

Analyzer settings: RBW=VBW=100 kHz

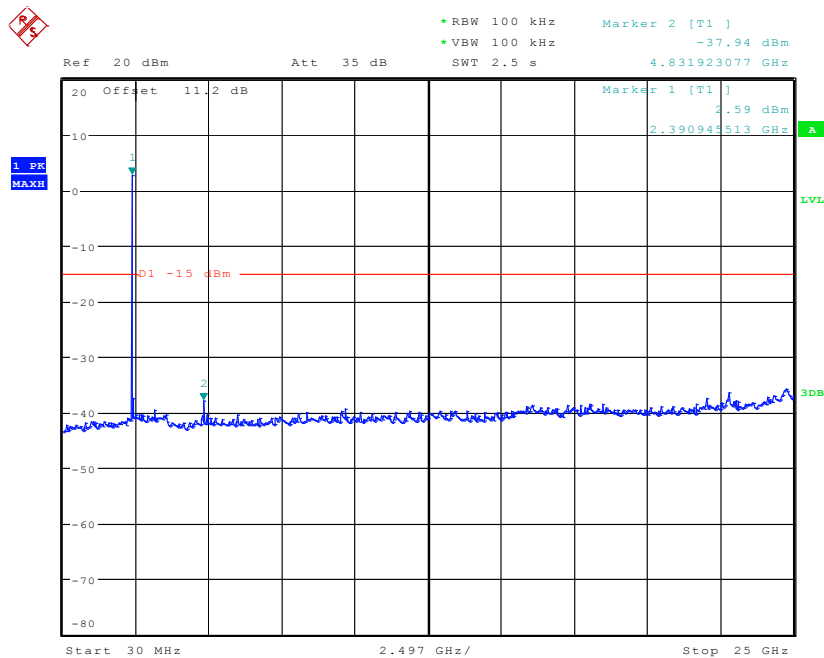
5.7.3 Test data/ plots:

Conducted Spurious Emissions					
Channel	Frequency (MHz)	Amplitude (dBm)			Limits
		802.11b	802.11g	HT20	
Low	2412	2.59	4.13	3.83	30dBm
	Spurious	All other peaks >20dB below limit.			-20dBc
Mid	2437	-3.62	2.62	-1.83	30 dBm
	Spurious	All other peaks >20dB below limit.			-20dBc
High	2462	-3.72	-0.75	0.21	30 dBm
	Spurious	All other peaks >20dB below limit.			-20dBc
Measurement Uncertainty: ±0.5 dB					



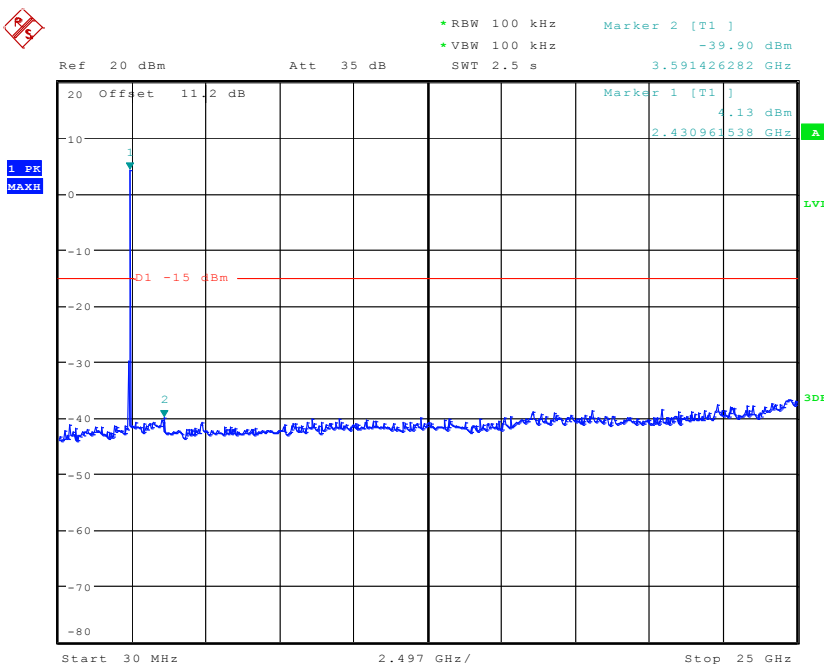
5.7.4 Test data/ plots:

Conducted Spurious Emission 802.11b 2412 MHz



Date: 4.MAY.2010 09:13:29

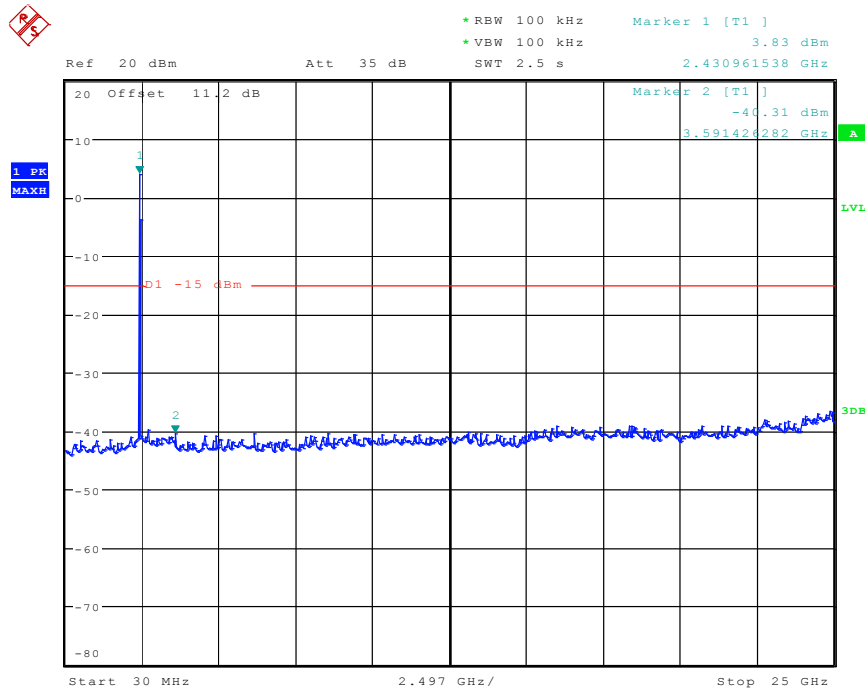
Conducted Spurious Emission 802.11b 2437 MHz



Date: 4.MAY.2010 09:15:10

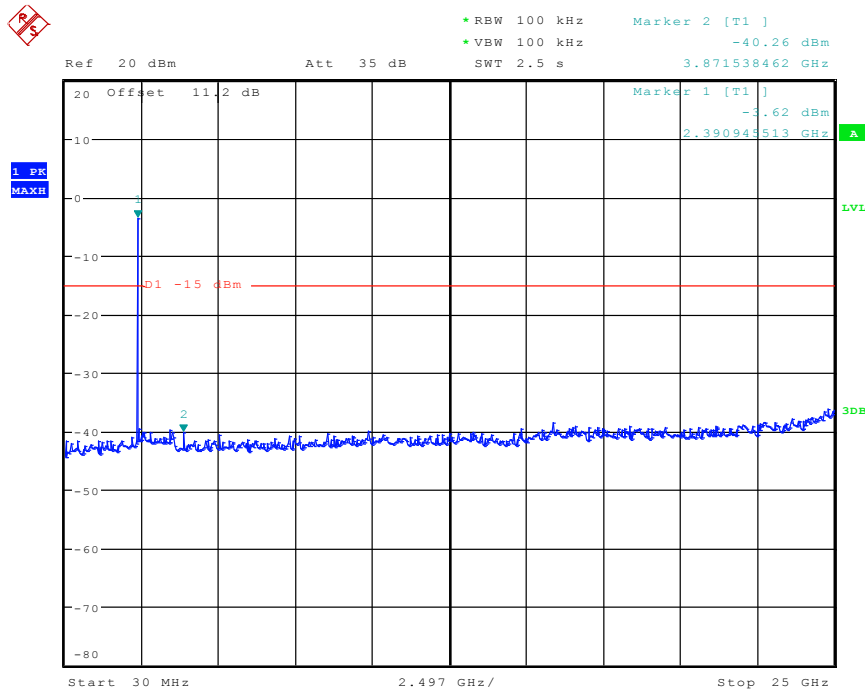


Conducted Spurious Emission 802.11b 2462 MHz



Date: 4.MAY.2010 09:17:00

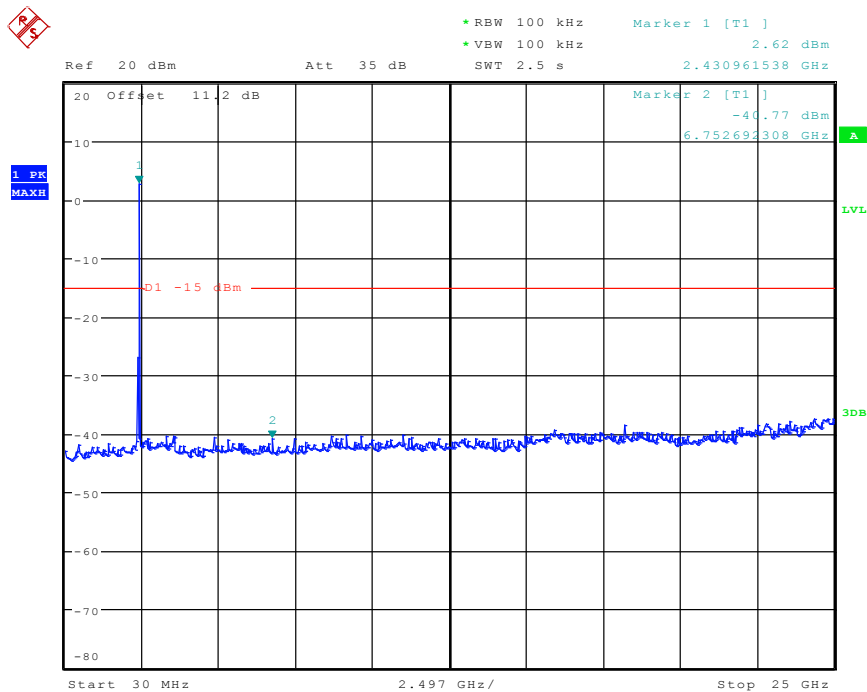
Conducted Spurious Emission 802.11g 2412 MHz



Date: 4.MAY.2010 09:18:11

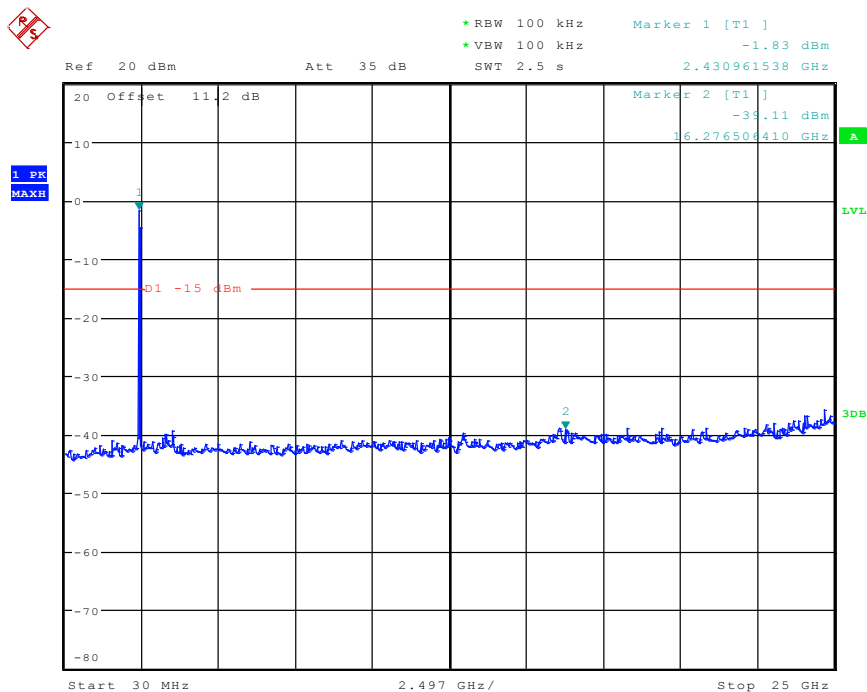


Conducted Spurious Emission 802.11g 2437 MHz



Date: 4.MAY.2010 09:18:47

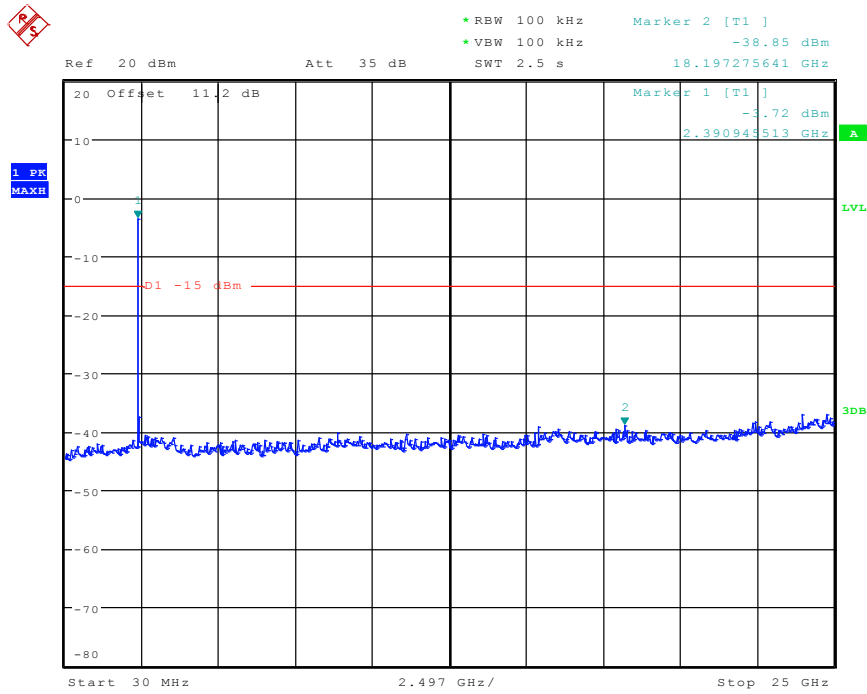
Conducted Spurious Emission 802.11g 2462 MHz



Date: 4.MAY.2010 09:20:08

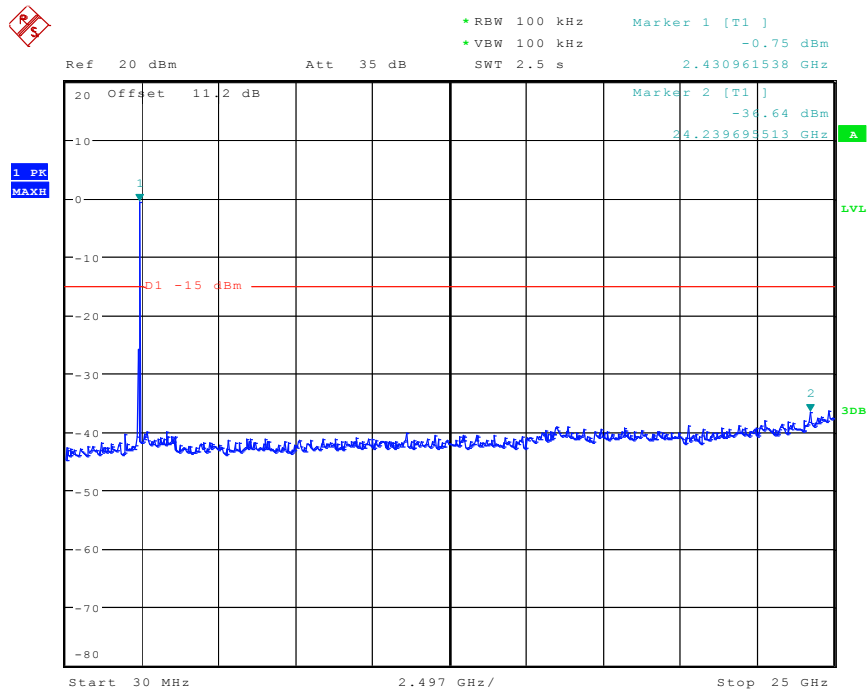


Conducted Spurious Emission HT20 2412 MHz



Date: 4.MAY.2010 09:20:54

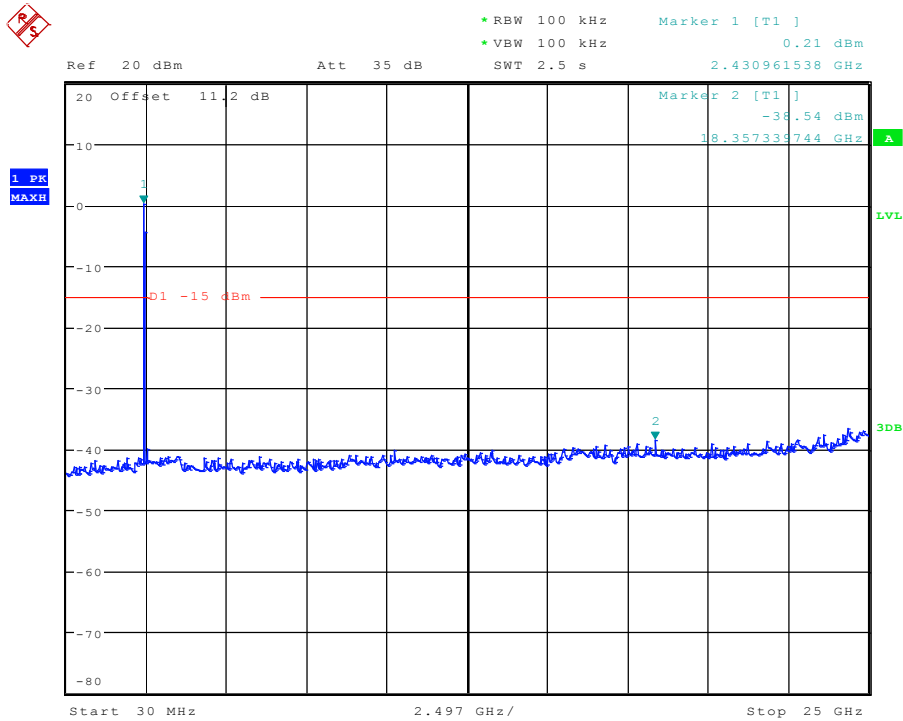
Conducted Spurious Emission HT20 2437 MHz



Date: 4.MAY.2010 09:21:33



Conducted Spurious Emission HT20 2462 MHz



Date: 4.MAY.2010 09:22:25



5.8 Transmitter Spurious Emissions- Radiated

5.8.1 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. 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)).

*PEAK LIMIT= 74dBµV/m

*AVG. LIMIT= 54dBµV/m

5.8.2 Limits: §15.209

(For measurement distance of 3m)

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)



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 within the plots.

5.8.3 Limits: §15.209

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

5.8.4 Test Result:

Test mode: 802.11b (Worst case)

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.

No spurious emissions reported below 30MHz.

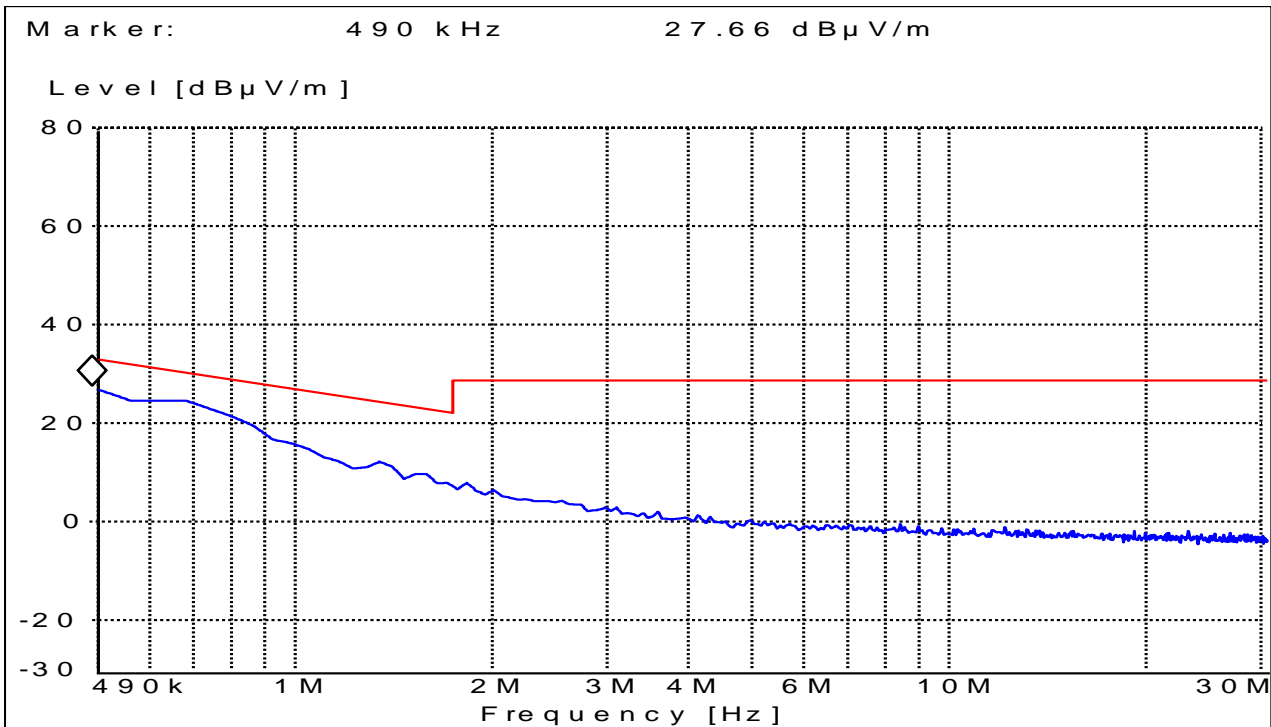
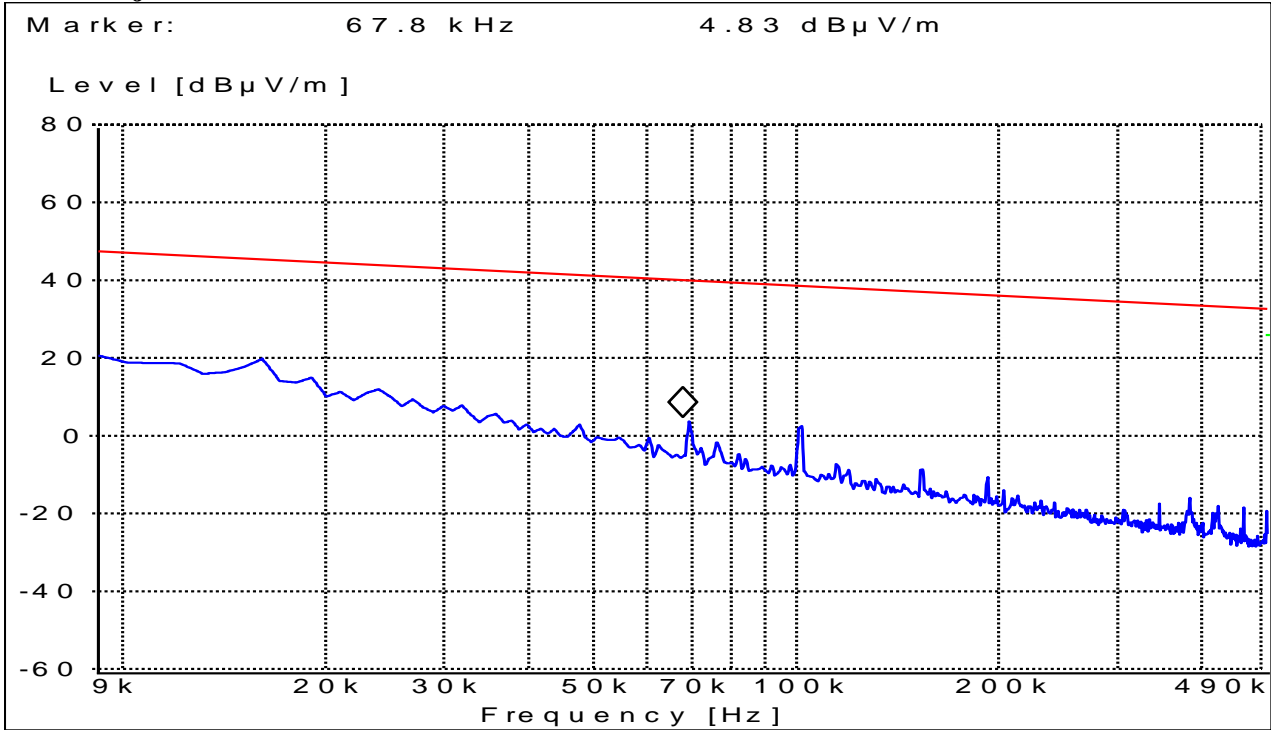


5.8.5 Test data/ plots:

Transmitter Radiated Spurious Emission:<30MHz

Note: Worst case representation for all modes of operation in this frequency range-

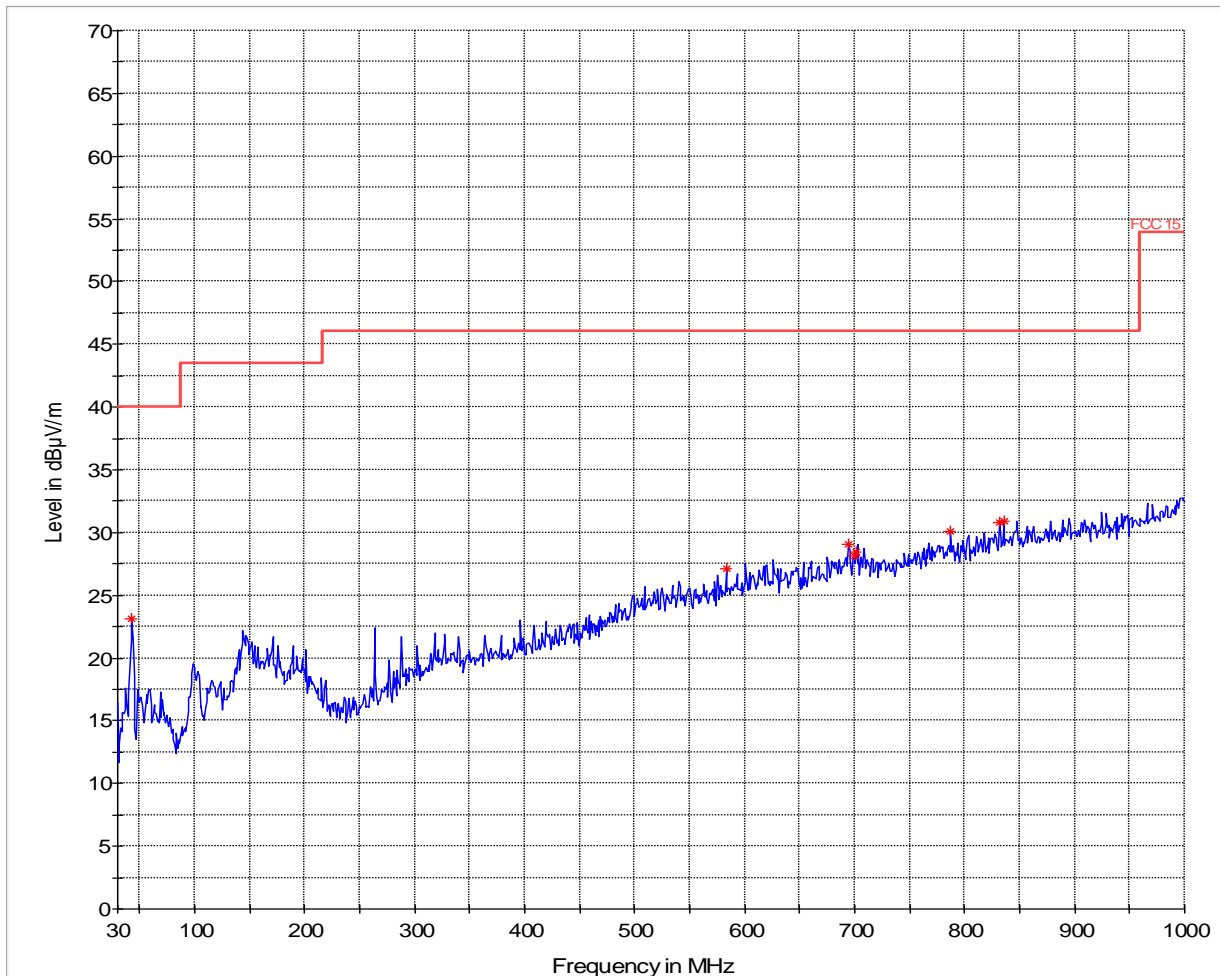
Limits adjusted for 3m measurement.





Transmitter Radiated Spurious Emission- Ch11 (2462 MHz)- 30M-1GHz

Note: Worst case representation for all modes of operation in this frequency range-

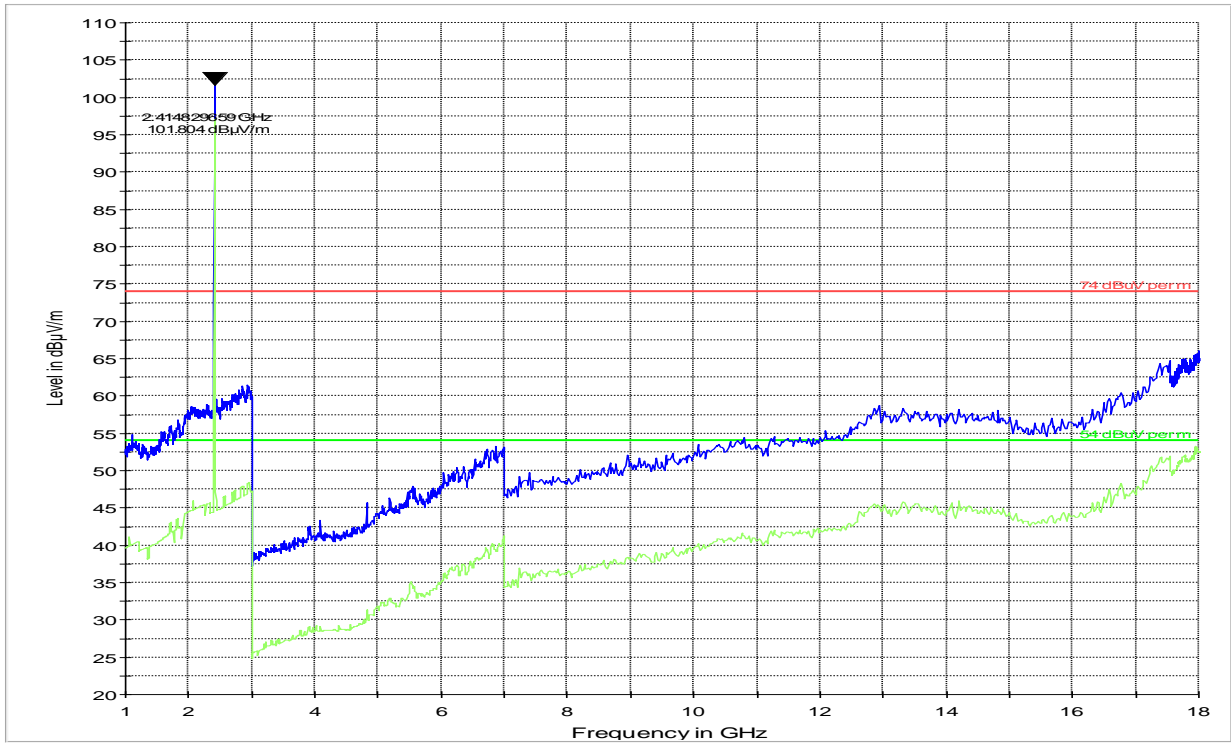


— FCC15.LimitLine — Preview Result 1

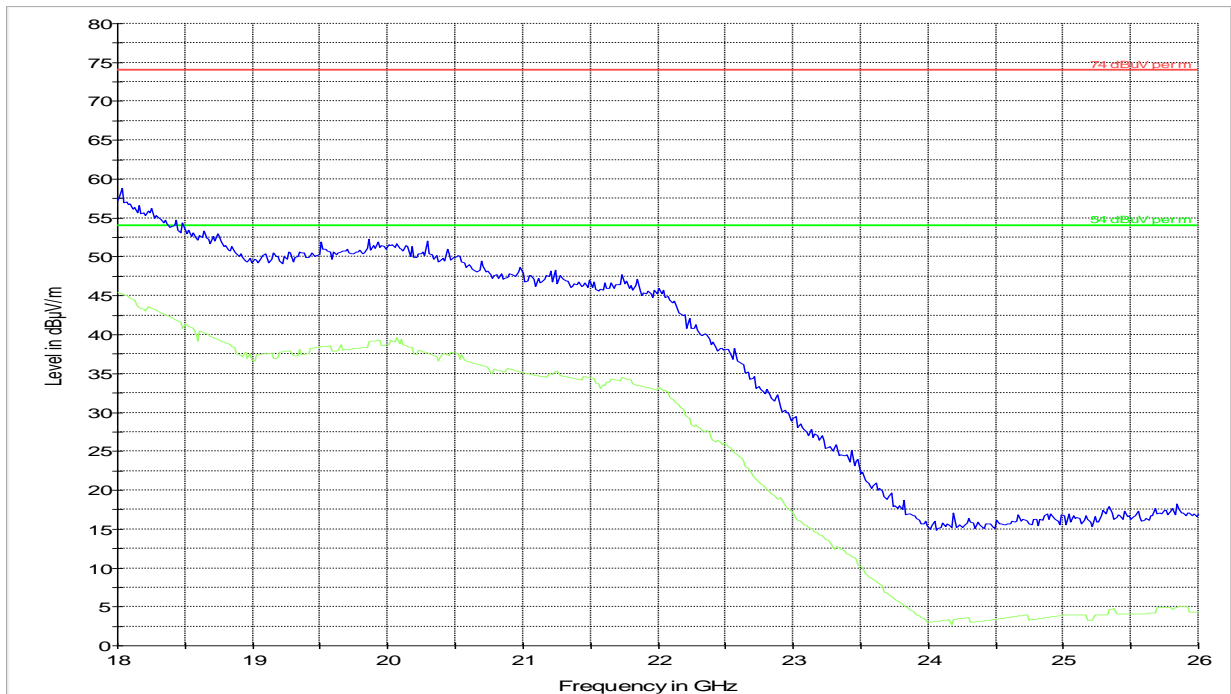
Frequency MHz	MaxPeak- ClearWrite dBµV/m	Height cm	Polarization	Azimuth deg
43.19	23.08	121.00	V	0.00
583.17	27.10	121.00	V	90.00
694.39	29.11	121.00	H	270.00
699.40	28.17	121.00	H	90.00
701.40	28.43	121.00	H	90.00
787.58	30.10	121.00	H	270.00
831.66	30.77	121.00	H	0.00
835.67	30.90	121.00	H	180.00



Transmitter Radiated Spurious Emission- Ch1 (2412 MHz)- 1G-18GHz



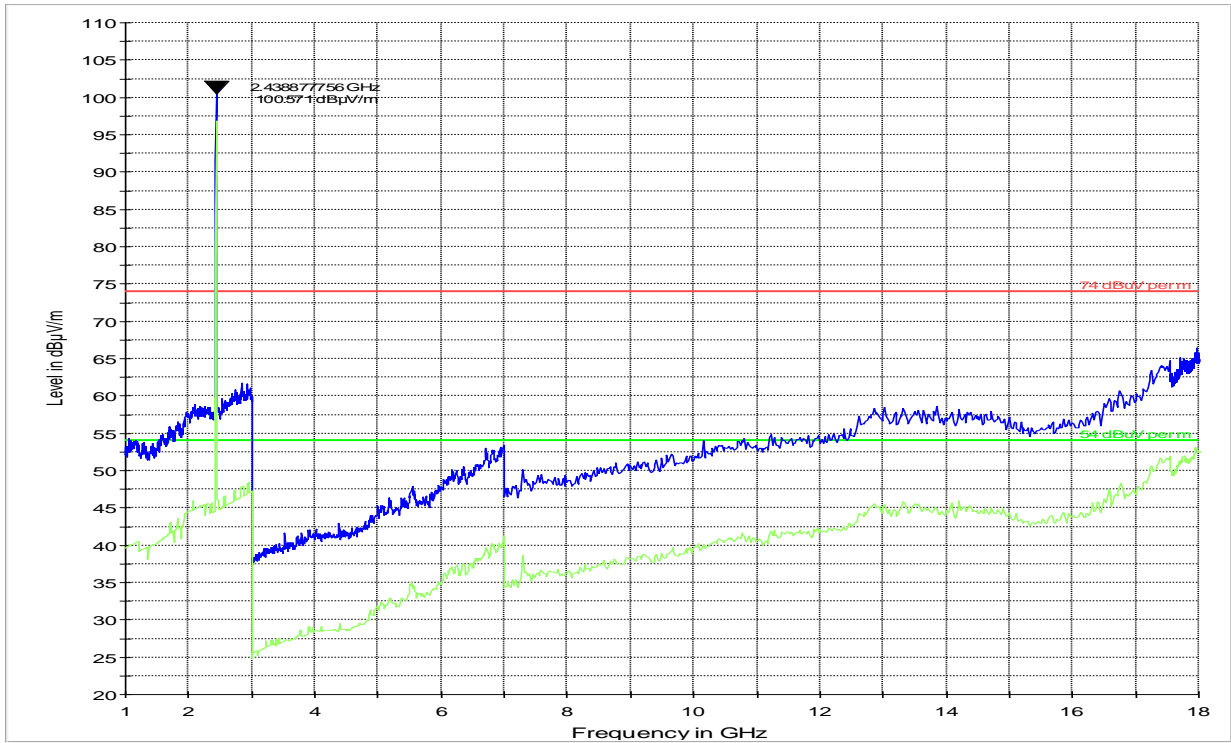
Transmitter Radiated Spurious Emission- Ch1 (2412 MHz)- 18G-26GHz



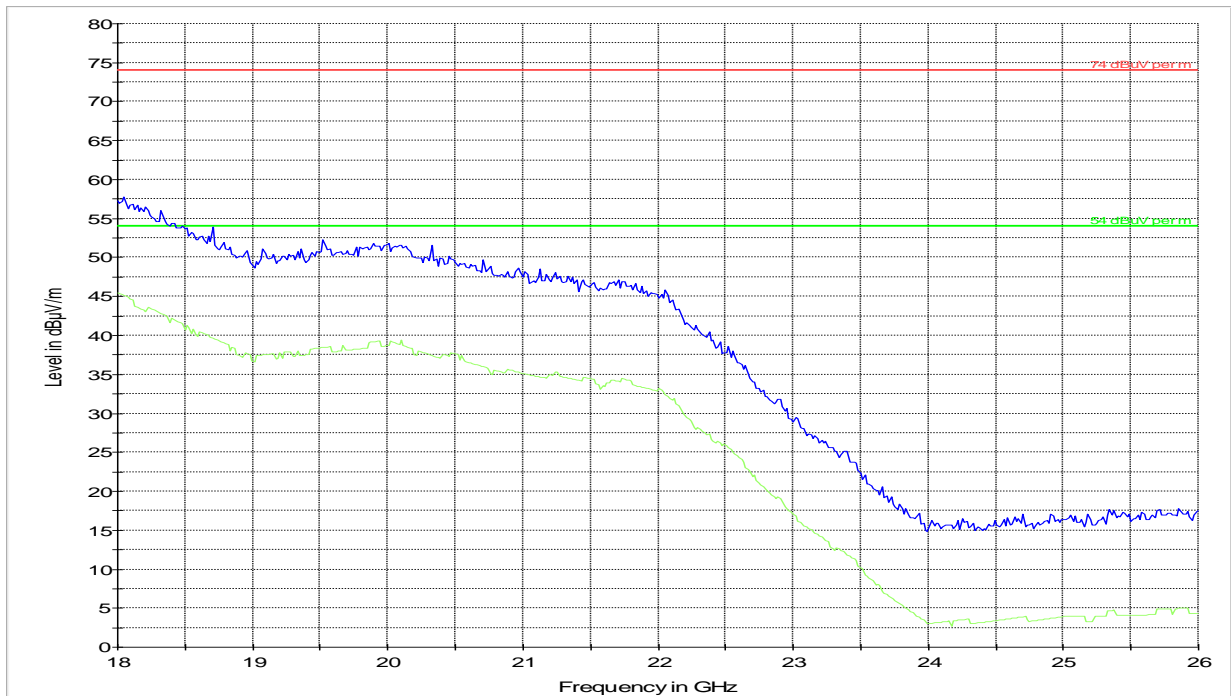
- 74 dBµV per m LimitLine
- 54 dBµV per m LimitLine
- Preview Result 1
- Preview Result 2



Transmitter Radiated Spurious Emission- Ch6 (2437 MHz)- 1G-18GHz



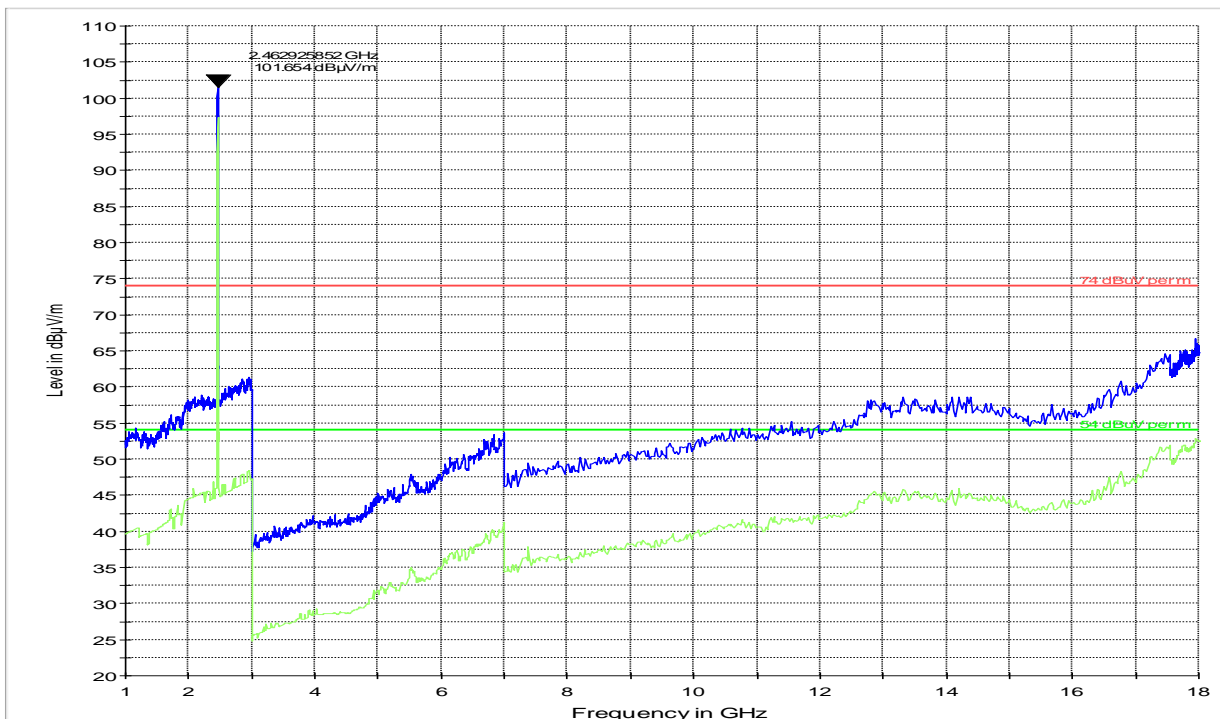
Transmitter Radiated Spurious Emission- Ch6 (2437 MHz)- 18G-26GHz



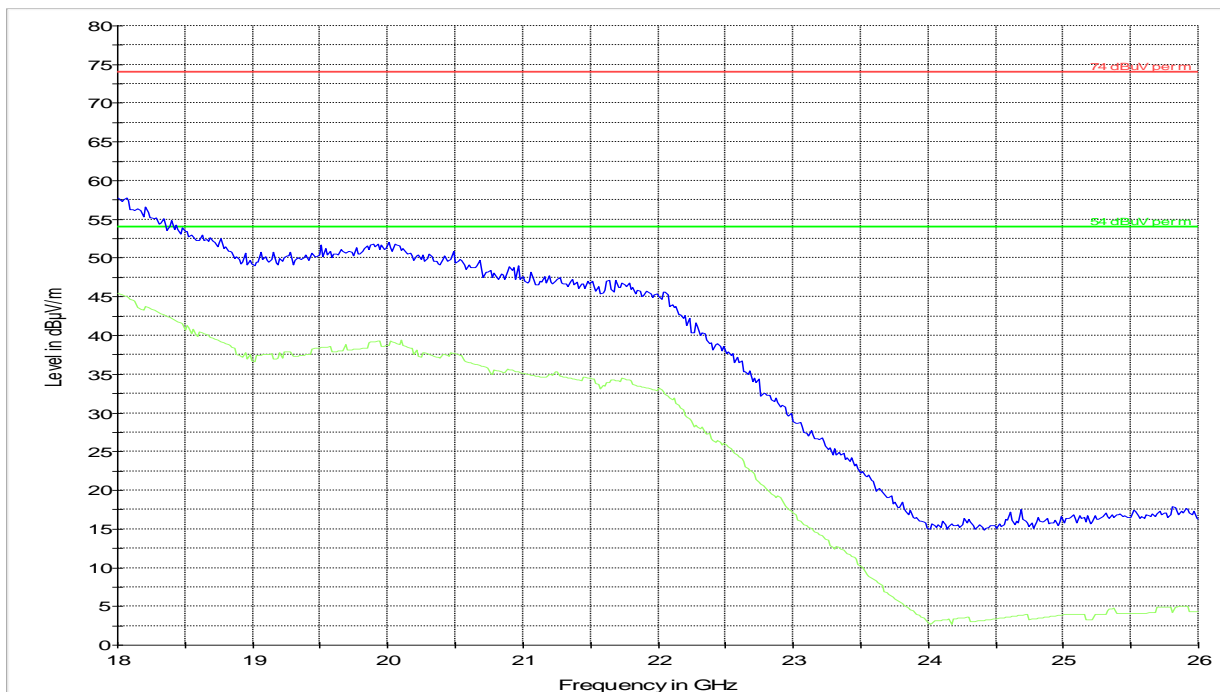
- 74 dBµV per m LimitLine
- 54 dBµV per m LimitLine
- Preview Result 1
- Preview Result 2



Transmitter Radiated Spurious Emission- Ch11 (2462 MHz)- 1G-18GHz



Transmitter Radiated Spurious Emission- Ch11 (2462 MHz)- 18G-26GHz



- 74 dBµV per m LimitLine
- 54 dBµV per m LimitLine
- PreviewResult 1
- PreviewResult 2



5.9 Receiver Spurious Emissions- Radiated

5.9.1 Limits: §15.109

Frequency of emission (MHz)	Field strength ($\mu\text{V/m}$)	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 (40dB $\mu\text{V/m}$)	3
88–216	150 (43.5 dB $\mu\text{V/m}$)	3
216–960	200 (46 dB $\mu\text{V/m}$)	3
Above 960	500 (54 dB $\mu\text{V/m}$)	3

5.9.2 Test Conditions:

Mode: Receive mode

5.9.3 Test Result:

No significant emissions measured below 30 MHz.

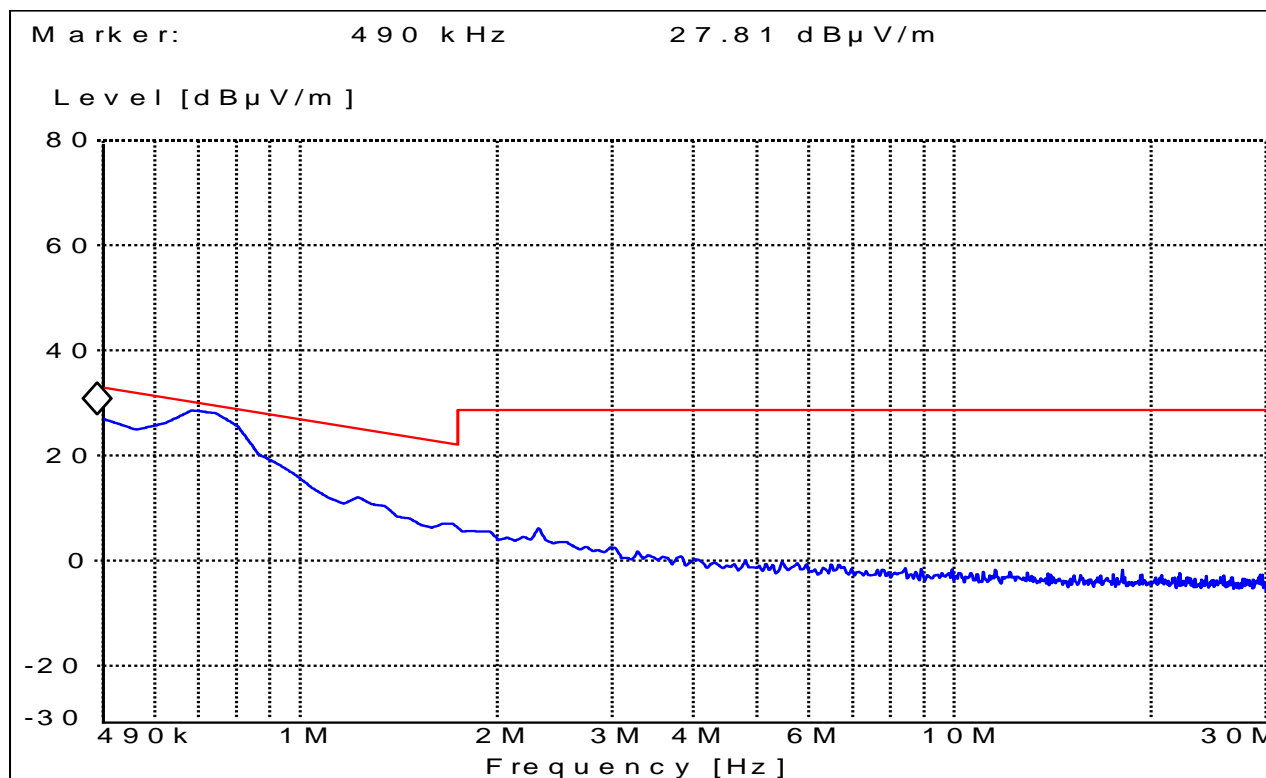
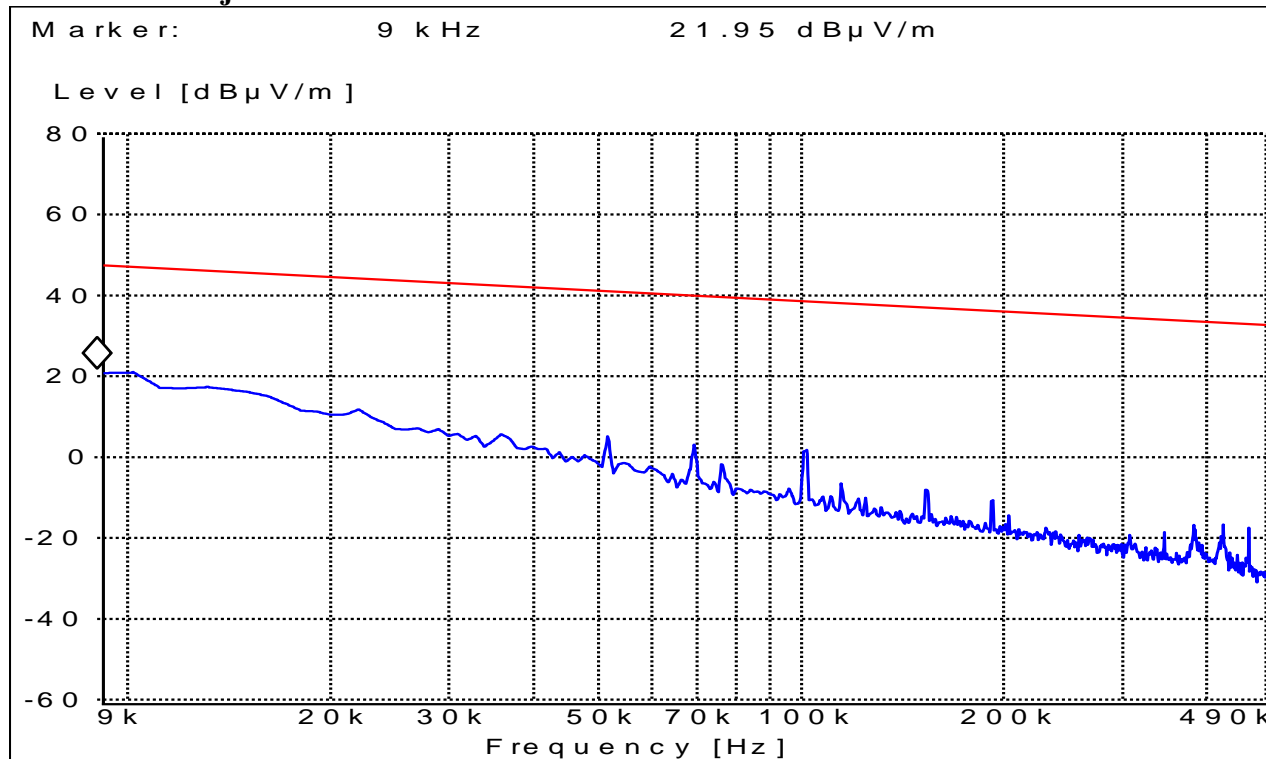
Plots reported here represent the worse case emissions.



5.9.4 Test data/ plots:

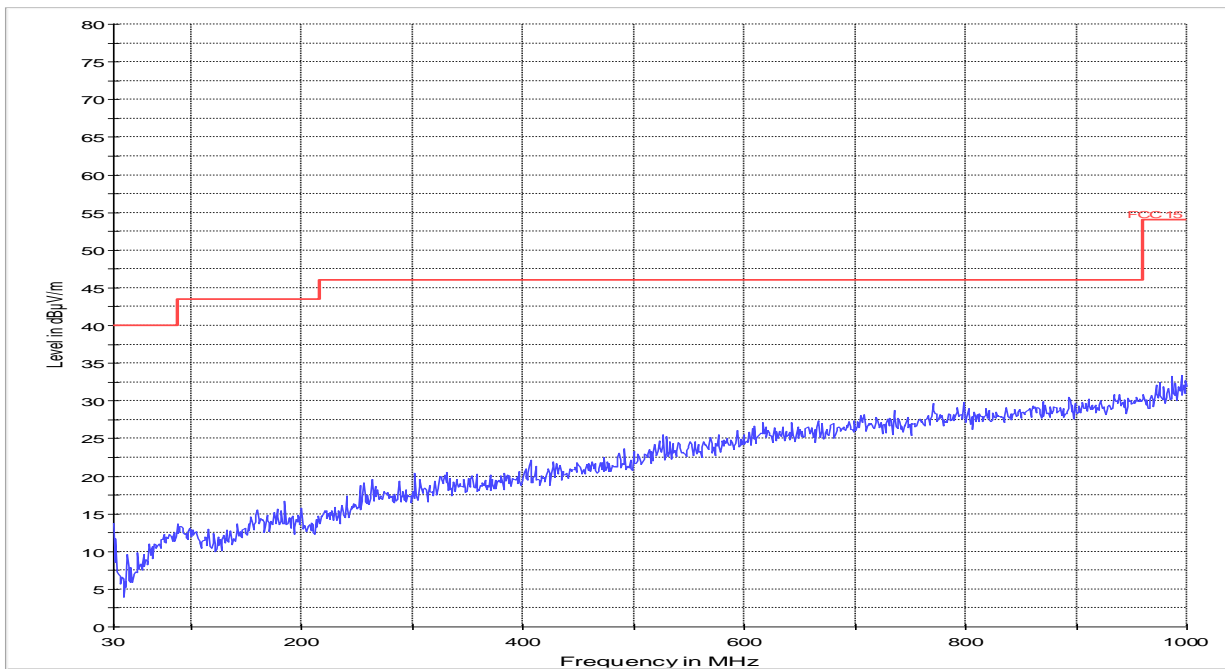
Receive Mode: <30MHz

Note: Limits adjusted for 3m measurement.



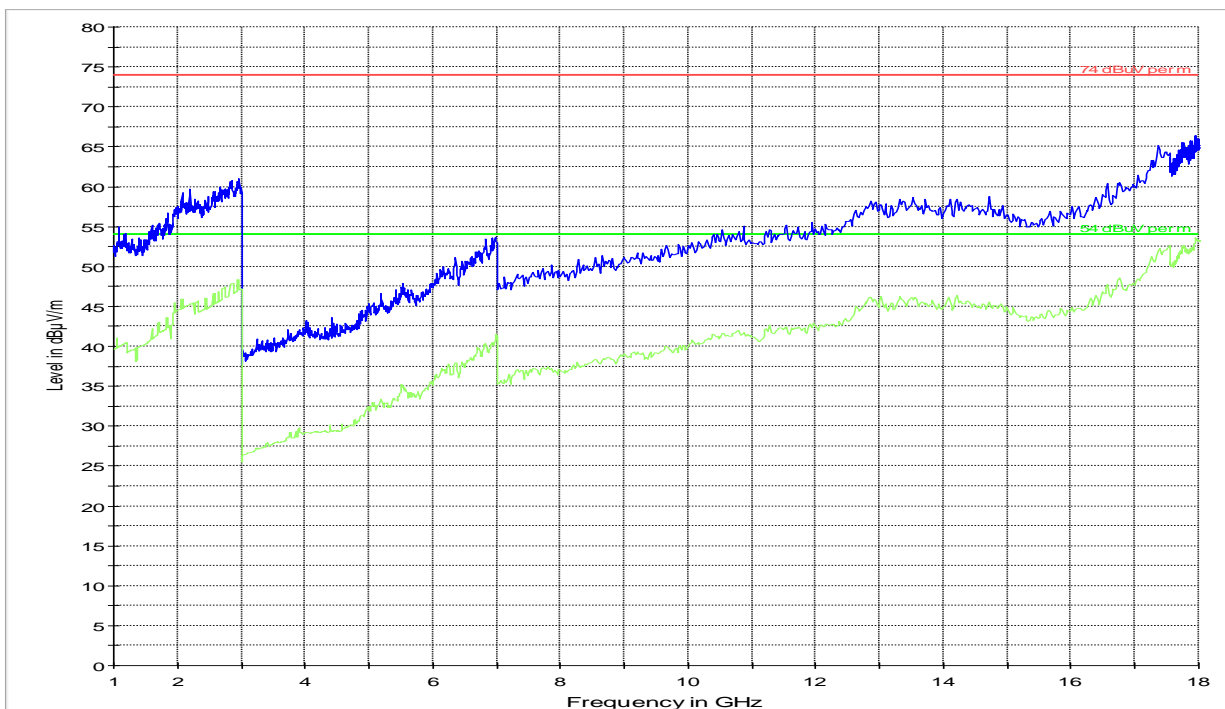


Receive Mode: 30MHz-1GHz



— FCC 15 Limit Line — Preview Result 1

Receive Mode: 1GHz-18GHz



— 74 dBuV per m Limit Line — 54 dBuV per m Limit Line
— Preview Result 1 — Preview Result 2



5.10 AC Power Line Conducted Emissions

5.10.1 Limits: §15.107/15.207

(a) Except as shown in paragraphs (b) and (c) of this section, 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, 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.

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: RBW = 10KHz; VBW = 10KHz

5.10.2 Test Conditions:

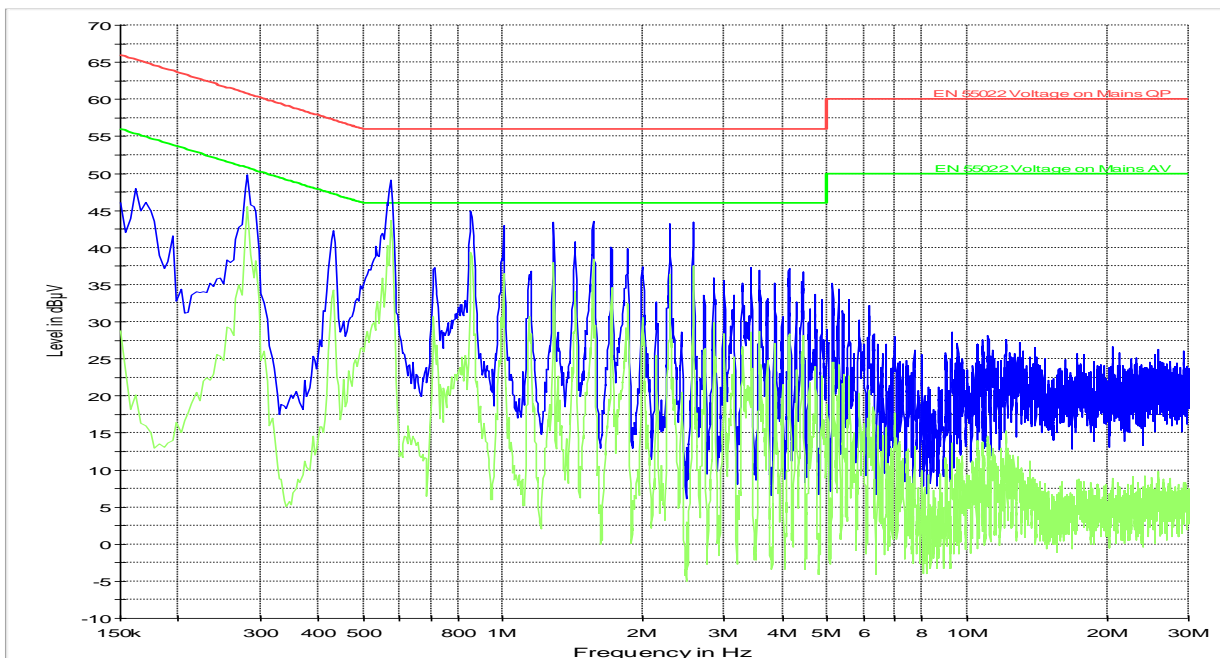
Mode: 802.11b (Worst case)

5.10.3 Test Result:

Plots reported here represent the combined worse case emissions for both Line and Neutral.

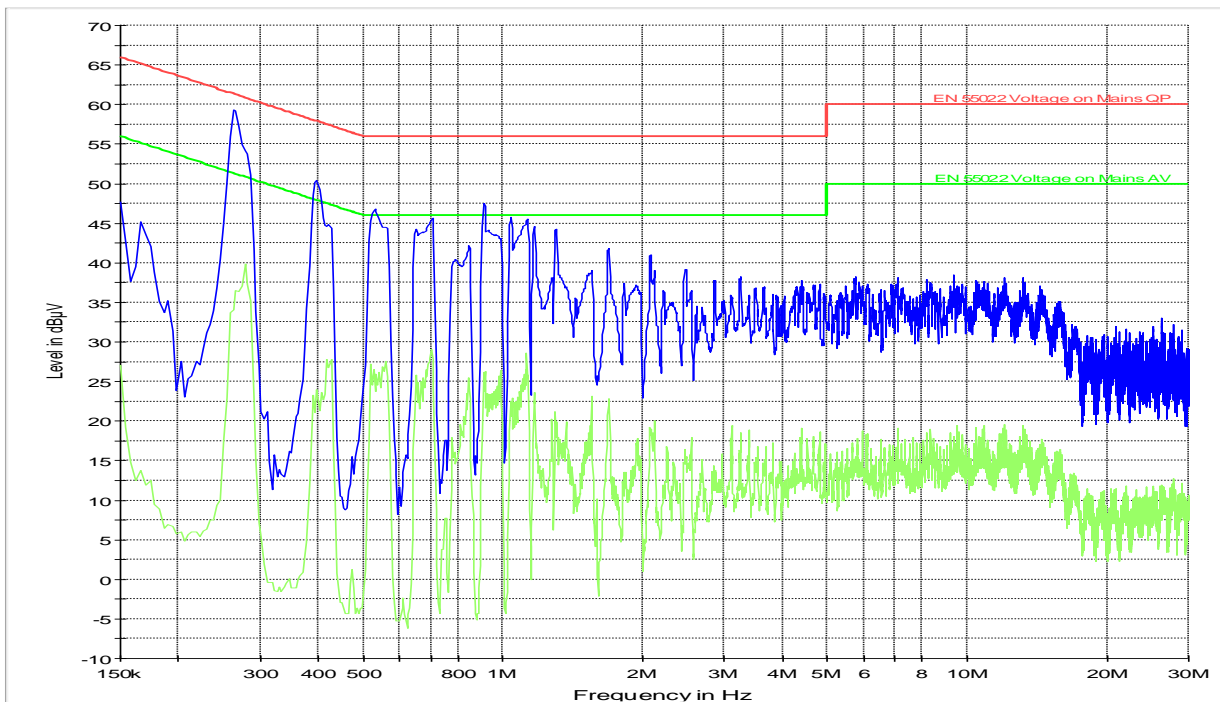


5.10.4 Test data/ plots: WLAN TX Mode: Line and Neutral



EN 55022 Voltage on Mains CPL/Line/Line EN 55022 Voltage on Mains A/V/Line/Line
Preview Result 1 Preview Result 2

WLAN RX Mode: Line and Neutral



EN 55022 Voltage on Mains CPL/Line/Line EN 55022 Voltage on Mains A/V/Line/Line
Preview Result 1 Preview Result 2

6 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	May 2009	1 year
Radio Communication Tester	CMU 200	Rohde & Schwarz	109879	May 2009	1 year
Radio Communication Tester	CMU 200	Rohde & Schwarz	110759	May 2009	1 year
Bluetooth Tester	CBT	Rohde & Schwarz	100212	May 2009	1 year
EMI Receiver/Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2009	1 year
Spectrum Analyzer	FSU	Rohde & Schwarz	200302	Dec 2009	1 year
Loop Antenna	6512	EMCO	00049838	July 2008	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	n/a	n/a
High Pass Filter	4HC1600	Trilithic Inc.	9922307	n/a	n/a
6GHz High Pass Filter	HPM50106	Microtronics	001	n/a	n/a
Pre-Amplifier	JS4-00102600	Miteq	00616	May 2009	1 year
LISN	50-25-2-08	FCC	08014	Apr 2009	1 year
Power Smart Sensor	R&S	NRP-Z81	100161	May 2009	1 Year
Power Smart Sensor	R&S	NRP-Z22	100223	May 2009	1 Year
Upconverter	PXI-5610	NI	E93740	Aug 2008	2 years
Waveform Generator	PXI-5421	NI	E965F1	Aug 2008	2 years
10dB attenuator	ATT-0298-10	MidwestMicrowav	n/a	n/a	n/a
Power Splitter	11667B	Hewlett Packard	645348	n/a	n/a
DC Power Supply	E3610A	Hewlett Packard	KR83021224	n/a	n/a
DC Power Supply	E3610A	Hewlett Packard	KR83023316	n/a	n/a
DC Power Supply	6632A	Hewlett Packard	3524A-12822	n/a	n/a
DC Power Supply	6655A	Hewlett Packard	3403A-00487	n/a	n/a
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
Climatic Chamber	VT4004	Votsch	G1115	May 2009	1 year

Note:

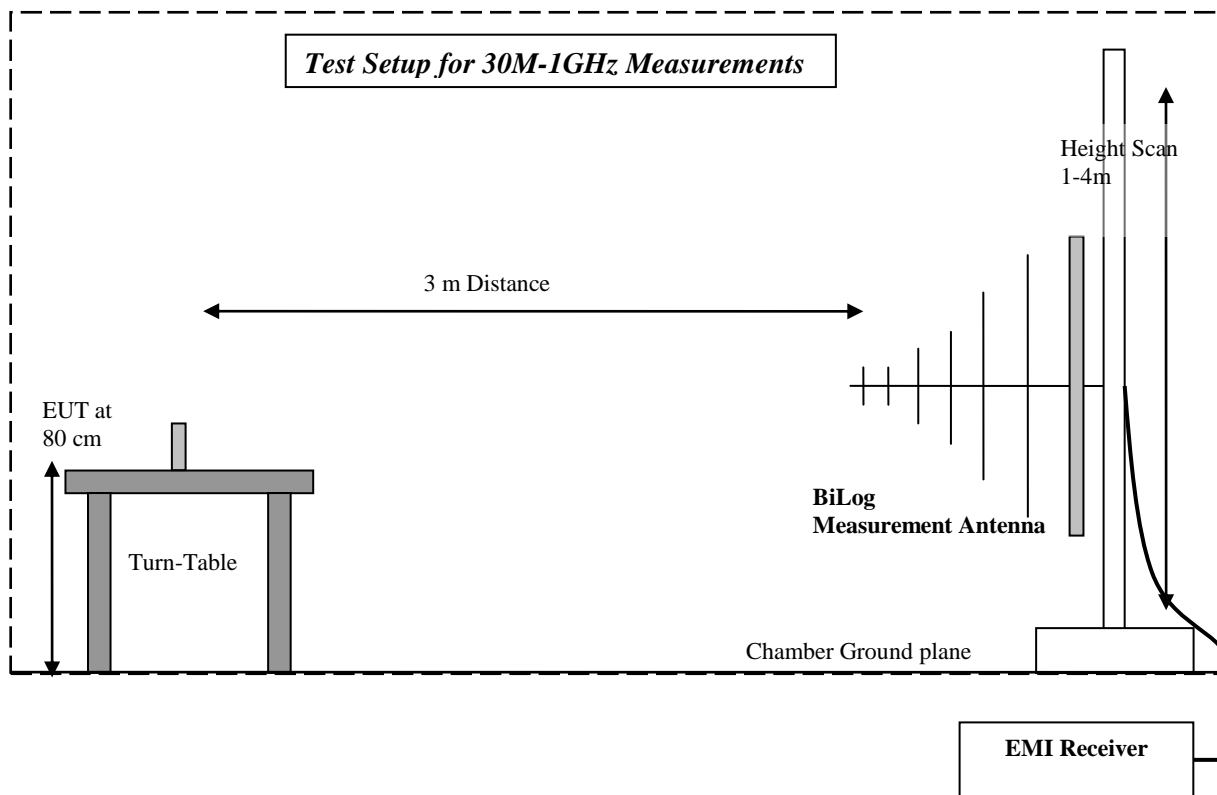
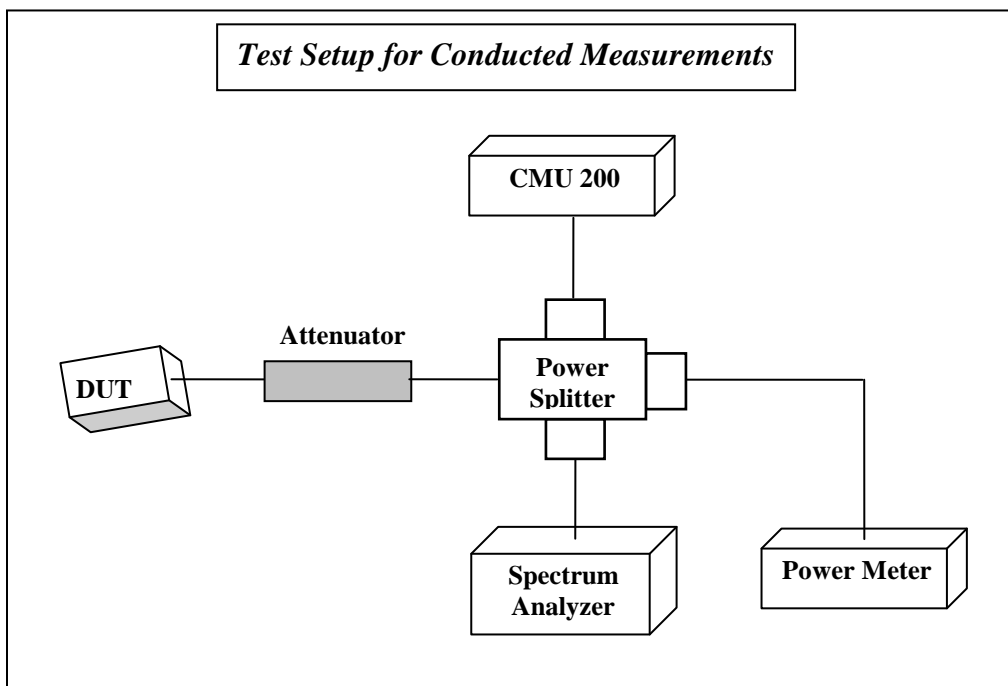
Testing on this EUT performed when the equipment calibration was valid.

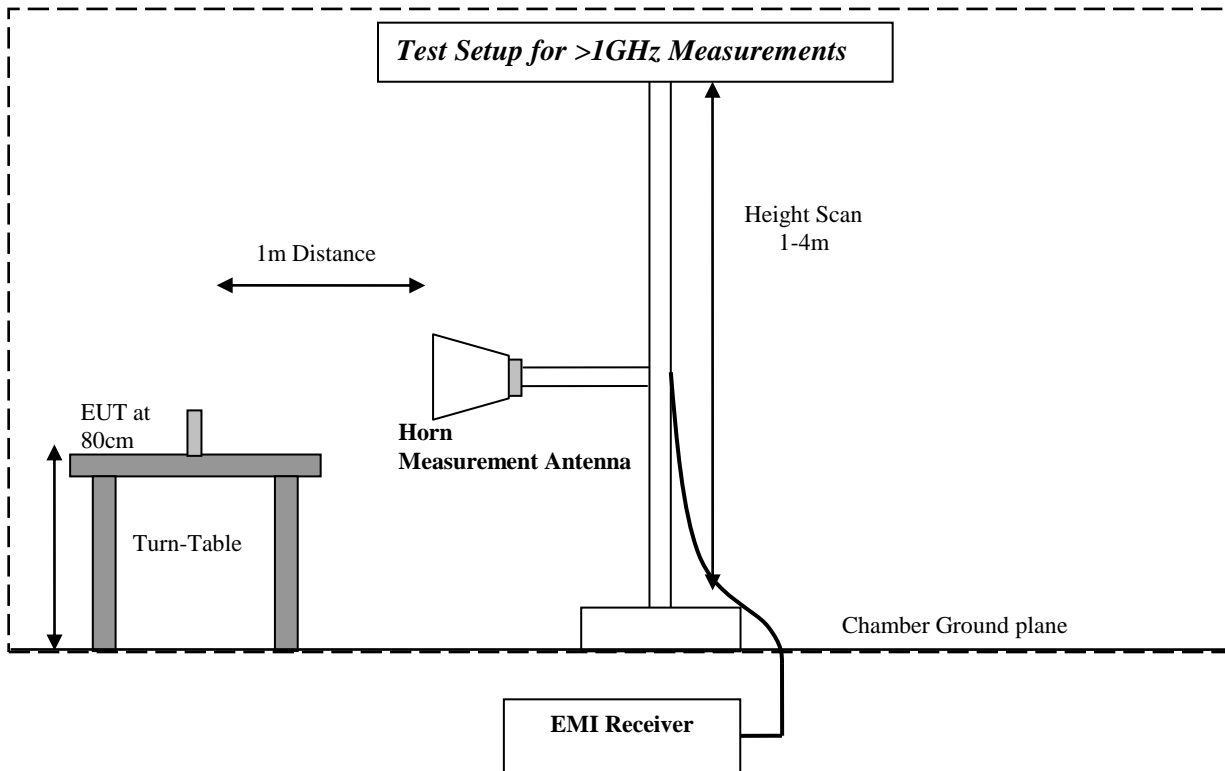
Equipment calibration is performed by an accredited calibration lab according to ISO 17025 requirements.

Calibration intervals are determined from manufacturer recommendation and/or lab discretion.

Cetecom Inc takes all measures to calibrate equipment before the due date; for instances when the equipment has to be used beyond the calibration due date, necessary steps are taken for calibration verification and documented until accredited calibration can be performed- to meet the Quality System requirements

7 BLOCK DIAGRAMS





Test Report #: EMC_057_09001_FCC15.247DSSS_BCG-E2380A_Rev3

Date of Report : 2010-06-07

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8 Revision History

Date	Report Name	Changes to report	Report prepared by
2010-05-30	EMC_APPLE_057_09001_FCC15.247DSSS_BCG-E2380A	First Version	S Jose
2010-06-01	EMC_057_09001_FCC15.247DSSS_BCG-E2380A_Rev1	Updated antenna gain and EIRP.	S Jose
2010-06-05	EMC_057_09001_FCC15.247DSSS_BCG-E2380A_Rev2	Added Sec 3.4. Updated Radiated emissions results.	S Jose
2010-06-07	EMC_057_09001_FCC15.247DSSS_BCG-E2380A_Rev3	Added Plots for radiated emissions below 30MHz.	S Jose