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Emissions
Test Report

EUT Name: Wireless ADSL Residential Gateway

Model No.: 5111N, 5111NV

CFR 47 Part 15.247:2010 and RSS 210:2010

Prepared for:

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Statement of Compliance

Manufacturer:	Pace Americas 310 Providence Mine Road Nevada City, CA 95959 (530) 274-5440
Requester / Applicant:	Mark Rieger
Name of Equipment:	Wireless ADSL Residential Gateway
Model No.	5111N, 5111NV
Type of Equipment:	Intentional Radiator
Application of Regulations:	CFR 47 Part 15.247:2010 and RSS 210:2010
Test Dates:	13 May 2011 to 8 June 2011

Guidance Documents:

Emissions: ANSI C63.10: 2009

Test Methods:

Emissions: ANSI C63.10: 2009

The electromagnetic compatibility test and documented data described in this report has been performed and recorded by TUV Rheinland, in accordance with the standards and procedures listed herein. As the responsible authorized agent of the EMC laboratory, I hereby declare that the equipment described above has been shown to be compliant with the EMC requirements of the stated regulations and standards based on these results. If any special accessories and/or modifications were required for compliance, they are listed in the Executive Summary of this report.

This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. This report contains data that are not covered by NVLAP accreditation. This report shall not be reproduced except in full, without the written authorization of TUV Rheinland of North America.

Jeremy Luong	June 27, 2011	Conan Boyle	June 28, 2011
Test Engineer	Date	NVLAP Signatory	Date

Industry Canada

NVLAPCODE 500011-0 **US5254** **2932M**

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1 Executive Summary

1.1 Scope

This report is intended to document the status of conformance with the requirements of the CFR 47 Part 15.247:2010 and RSS 210:2010 based on the results of testing performed on 13 May 2011 through 8 June 2011 on the Wireless ADSL Residential Gateway Model 5111N, 5111NV manufactured by Pace Americas. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

1.3 Summary of Test Results

Table 1: Summary of Test Results

Test	Test Method ANSI C63.4	Test Parameters (from Standard)	Result
Spurious Emission in Received Mode	CFR47 15.109, RSS-GEN Sect.7.2.3	Class B	**Complied**
Spurious Emission in Transmitted Mode	CFR47 15.209, RSS-GEN Sect.7.2.3	Class B	**Complied**
Restricted Bands of Operation	CFR47 15.205, RSS 210 Sect.2.6	Class B	**Complied**
AC Power Conducted Emission	CFR47 15.207, RSS-GEN Sect.7.2.2	Class B	**Complied**
Occupied Bandwidth	CFR47 15.247 (a2), RSS GEN Sect.4.4.1	500 kHz Minimum	**Complied**
Maximum Transmitted Power	CFR47 15.247 (b3), RSS 210 Sect. A.8.4	30 dBm w/ 6 dBi antenna	**Complied**
Peak Power Spectral Density	CFR47 15.247 (e), RSS 210 Sect. A.8.2	8 dBm/ 3 kHz.	**Complied**
Band Edge Measurement	CFR47 15.247 (d), RSS 210 Sect. A.8.5	30 dBr	**Complied**
RF Exposure	CFR47 15.247 (i), 2.1091	General Population	**Complied**

1.4 Special Accessories

No special accessories were necessary in order to achieve compliance.

1.5 Equipment Modifications

None.

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America at 1279 Quarry Lane, Ste. A., Pleasanton, CA 94566, is recognized by the commission for performing testing services for the general public on a fee basis. These laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (FRN # US5254). The laboratory scope of accreditation includes: Title 47 CFR Parts 15, 18, and 90. The accreditation is updated every 3 years.

2.1.2 NIST / NVLAP

TUV Rheinland of North America is accredited by the National Voluntary Laboratory Accreditation Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Guide 17025:2005 and ISO 9002 (Lab Code 500011-0). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Canada – Industry Canada

Industry Canada

TUV Rheinland of North America at the 1279 Quarry Ln, Pleasanton, CA 94566 address is accredited by Industry Canada for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by Industry Canada (File Number 2932M-1). This reference number is the indication to the Industry Canada Certification Officers that the site meets the requirements of RSS 212, Issue 1 (Provisional). The accreditation is updated every 3 years.

2.1.4 Japan – VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland of North America at 1279 Quarry Lane, Pleasanton, CA 94566 has been assessed and approved in accordance with the Regulations for Voluntary Control Measures. (Registration Nos. R-3269, C-3637, C-3638, T-1752, T-1753).

2.1.5 Acceptance by Mutual Recognition Arrangement

The United States has an established agreement with specific countries under the Asia Pacific Laboratory Accreditation Corporation (APLAC) Mutual Recognition Arrangement. Under this agreement, all TUV Rheinland at 1279 Quarry Lane, Pleasanton, CA 94566 test results and test reports within the scope of the laboratory NIST / NVLAP accreditation will be accepted by each member country.

2.2 Test Facilities

All of the test facilities are located at 1279 Quarry Lane, Ste. A, Pleasanton, California 94566, USA. The 2305 Mission College, Santa Clara, 95054, USA location is considered a Pleasanton annex.

2.2.1 Emission Test Facility

The Semi-Anechoic chamber and AC Line Conducted measurement facility used to collect the radiated and conducted data has been constructed in accordance with ANSI C63.7:1992. The site has been measured in accordance with and verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4-2009, at test distances of 3 and 5 meters. The site is listed with the FCC and accredited by NVLAP (Lab Code 500011-0). A report detailing this site can be obtained from TUV Rheinland of North America.

2.2.2 Immunity Test Facility

ESD, EFT, Surge, PQF: These tests are performed in an environmentally controlled room with a 3.7 m x 4.8 m x 3.175 mm thick aluminum floor connected to PE ground.

For ESD testing, tabletop equipment is placed on an insulated mat with a surface resistivity of 10^9 Ohms/square on a 1.6 m x 0.8 m x 0.8 m high non-conductive table with a 3.175 mm aluminum top (Horizontal Coupling Plane). The HCP is connected to the main ground plane via a low impedance ground strap through two 470-kΩ resistors. The Vertical Coupling Plane consists of an aluminum plate 50 cm x 50 cm x 3.175 mm thick. The VCP is connected to the main ground plane via a low impedance ground strap through two 470-kΩ resistors.

For EFT, Surge, PQF, the HCP and VCP are removed.

RF Field Immunity testing is performed in a 7.3m x 4.3m x 4.1m anechoic chamber.

RF Conducted and Magnetic Field Immunity testing is performed on a 4.8m x 3.7m x 3.175mm thick aluminum ground plane.

All test areas allow a minimum distance of 1 meter from the EUT to walls or conducting objects.

2.3 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1st Edition, 1995.

The Combined Standard Uncertainty is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities; it is equal to the positive square root of the sum of the variances or co-variances of these other quantities, weighted according to how the measurement result varies with changes in these quantities. The term *standard uncertainty* is the result of a measurement expressed as a standard deviation.

The Expanded Uncertainty defines an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand. The fraction may be viewed as the coverage probability or level of confidence of the interval.

2.3.1 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

2.3.2 Measurement Uncertainties

Table 2: Summary of Uncertainties

	U_{lab}	U_{cispr}
Radiated Disturbance		
30 MHz – 25,000 MHz	3.2 dB	5.2 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	2.4 dB	3.6 dB
Disturbance Power		
30 MHz – 300 MHz	3.92 dB	4.5 dB

Note: U_{lab} is the calculated Combined Standard Uncertainty
U_{cispr} is the measurement uncertainty requirement per CISPR 16.

Measurement Uncertainty Immunity

The estimated combined standard uncertainty for ESD immunity measurements is ± 4.1%.
The estimated combined standard uncertainty for radiated immunity measurements is ± 2.7 dB.
The estimated combined standard uncertainty for conducted immunity measurements is ± 1.4 dB.
The estimated combined standard uncertainty for damped oscillatory wave immunity measurements is ± 8.8%.
The estimated combined standard uncertainty for harmonic current and flicker measurements is ± 0.45%.

Measurement Uncertainty – Radio Testing

The estimated combined standard uncertainty for frequency error measurements is ± 3.88 Hz
The estimated combined standard uncertainty for carrier power measurements is ± 1.59 dB.
The estimated combined standard uncertainty for adjacent channel power measurements is ± 1.47 dB.
The estimated combined standard uncertainty for modulation frequency response measurements is ± 0.46 dB.
The estimated combined standard uncertainty for transmitter conducted emission measurements is ± 4.01 dB

The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria are not based on measurement uncertainty.

2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Guide 17025:2005.

3 Product Information

3.1 Product Description

Pace Americas 5111 is a residential gateway that provides an 802.11b/g/n Wi-Fi access point and Ethernet switch function for connecting personal computers and other in-home networked devices to the service provider's network. The 5111NV features:

• 1-DSL (RJ-11) Broadband Modem Port
• 4-Ethernet Ports/
• 1 Ethernet/ Broadband Port
• 802.11b/g/n Wireless Access Point
• 1-2line RJ14 FXS (VoIP) port
• 1 USB Home Network

Note: Model 5111N does not have 1-2line RJ14 FXS (VoIP) port populated.

3.2 Equipment Configuration

A description of the equipment configuration is given in Test Plan Section. The EUT was tested as called for in the test standard and was configured and operated in a manner consistent with its intended use. The EUT was connected to rated power and allowed to reach intended operating conditions. The placement of the EUT system components was guided by the test standard and selected to represent typical installation conditions.

In the case of an EUT that can operate in more than one configuration, preliminary testing was performed to determine the configuration that produced maximum radiation.

The final configuration was selected to produce the worst case radiation for emissions testing and to place the EUT in the most susceptible state for immunity testing.

Model 5111NV selected for testing.

3.3 Operating Mode

A description of the operation mode is given in Test Plan Section. In the case of an EUT that can operate in more than one state, preliminary testing was performed to determine the operating mode that produced maximum radiation.

The final operating mode was selected to produce the worst case radiation for emissions testing and to place the EUT in the most susceptible state for immunity testing.

3.4 Unique Antenna Connector

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of CFR47 Parts 15.211, 15.213, 15.217, 15.219, or 15.221.

3.4.1 Results

The 5111N, 5111NV uses the permanently attached antennas inside the device.

4 Emissions

Testing was performed in accordance with CFR 47 Part 15.247:2010 and RSS 210 Annex 8:2010. These test methods are listed under the laboratory's NVLAP Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices. Procedures described in ANSI C63.10: 2009 were used.

4.1 Output Power Requirements

The maximum peak output power requirement is the maximum equivalent isotropic radiated power delivering at the transmitting antenna under specified conditions of measurements in the presence of modulation.

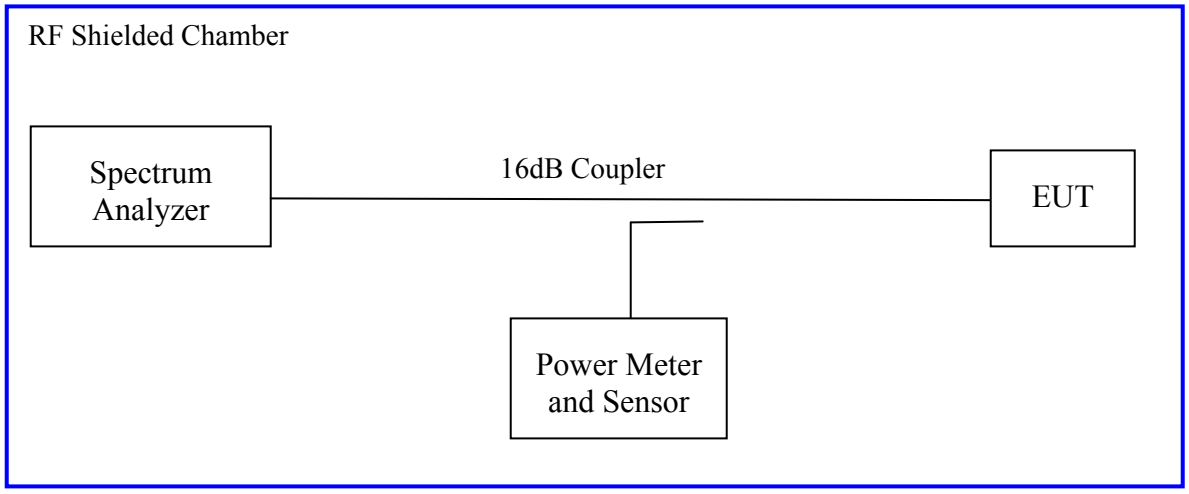
The maximum output power and harmonics shall not exceed CFR47 Part 15.247 (b3):2010 and RSS 210 A.8.4: 2010

The maximum transmitted power is +30 dBm or 1 Watt.

4.1.1 Test Method

The conducted method was used to measure the channel power output according to ANSI C63.10:2009 Section 6.10.3.1. The measurement was performed with modulation per CFR47 Part15.247 (b3):2010 and RSS 210 A.8.4: 2010. This test was conducted on 3 channels of Sample, S/N 131104000001. The worst mode result indicated below.

Test Setup:



Method #1 of "Measurement of Digital Transmission Systems Operating under Section 15.247" applies since the 5111N, 5111NV *continuously transmit; where T, Transmission Duration Pulse, is greater than analyzer sweep time. Sample detector was used.*

4.1.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 3: RF Output Power at the Antenna Port – Test Results

Test Conditions: Conducted Measurement, Normal Temperature					
Antenna Type: Integrated			**Power Setting:** See test plan		
Max. Antenna Gain: +3.0 dBi			**Signal State:** Modulated		
Ambient Temp.: 21° C			**Relative Humidity:**41%		
802.11b Mode					
Frequency	**Limit [dBm]**	**Chain 0 [dBm]**	**Chain 1 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
2412 MHz	+30.00	22.79			-8.12
2437 MHz	+30.00	24.11			-5.44
2462 MHz	+30.00	21.89			-8.74
Note: The highest output power was observed at 1Mbps. Only one chain would be active in this mode.					
802.11g Mode					
Frequency	**Limit [dBm]**	**Chain 0 [dBm]**	**Chain 1 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
2412 MHz	+30.00	17.97			-11.28
2437 MHz	+30.00	22.34			-4.88
2462 MHz	+30.00	17.19			-11.79
Note: The highest output power was observed at 6 Mbps. Only one chain would be active in this mode.					
802.11n (HT20) Mode, 1x2					
Frequency	**Limit [dBm]**	**Chain 0 [dBm]**	**Chain 1 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
2412 MHz	+30.00	17.60			-11.13
2437 MHz	+30.00	20.81			-7.14
2462 MHz	+30.00	17.61			-11.52
Note: The highest output power was observed at HT20 6.5 Mbps, 1 Data Stream. Only one chain would be active in this mode.					

802.11n (HT20) Mode, 2x2					
Frequency	**Limit [dBm]**	**Chain 0 [dBm]**	**Chain 1 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
2412 MHz	+30.00	15.56	15.94	18.76	-11.24
2437 MHz	+30.00	22.27	21.43	24.88	-5.12
2462 MHz	+30.00	15.15	15.00	18.09	-11.91
Note: The highest output power was observed at HT20 13 Mbps, 2 Data Stream.					
802.11n (HT40) Mode, 1x2					
Frequency	**Limit [dBm]**	**Chain 0 [dBm]**	**Chain 1 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
2437 MHz	+30.00	18.10			-11.90
Note: The highest output power was observed at HT40 13.5 Mbps, 1 Data Stream.					
802.11n (HT40) Mode, 2x2					
Frequency	**Limit [dBm]**	**Chain 0 [dBm]**	**Chain 1 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
2437 MHz	+30.00	17.70	18.49	21.11	-8.89
Note: The highest output power was observed at HT40 27 Mbps, 2 Data Stream.					

Table 4: Average Output Power at the Antenna Port – Test Results

Test Conditions: Conducted Measurement, Normal Temperature					
Antenna Type: Integrated			**Power Setting:** See test plan		
Max. Antenna Gain: +3.0 dBi			**Signal State:** Modulated		
Ambient Temp.: 21 °C			**Relative Humidity:**41%		
802.11b Mode					
Frequency	**Limit [dBm]**	**Chain 0 [dBm]**	**Chain 1 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
2412 MHz	Na	24.82			
2437 MHz	Na	26.34			
2462 MHz	Na	24.03			
Note: The highest output power was observed at 1Mbps. Only one chain would be active in this mode.					
802.11g Mode					
Frequency	**Limit [dBm]**	**Chain 0 [dBm]**	**Chain 1 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
2412 MHz	Na	19.80			
2437 MHz	Na	24.35			
2462 MHz	Na	19.18			
Note: The highest output power was observed at 6 Mbps. Only one chain would be active in this mode.					
802.11n (HT20) Mode, 1x2					
Frequency	**Limit [dBm]**	**Chain 0 [dBm]**	**Chain 1 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
2412 MHz	Na	19.65			
2437 MHz	Na	22.84			
2462 MHz	Na	19.57			
Note: The highest output power was observed at HT20 6.5 Mbps, 1 Data Stream. Only one chain would be active in this mode.					
802.11n (HT20) Mode, 2x2					
Frequency	**Limit [dBm]**	**Chain 0 [dBm]**	**Chain 1 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
2412 MHz	Na	14.73	14.26	17.51	
2437 MHz	Na	21.51	20.55	24.07	

2462 MHz	Na	14.36	14.22	17.03	
Note: The highest output power was observed at HT20 13 Mbps, 2 Data Stream.					
802.11n (HT40) Mode, 1x2					
Frequency	**Limit [dBm]**	**Chain 0 [dBm]**	**Chain 1 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
2437 MHz	Na	17.12			
Note: The highest output power was observed at HT40 13.5 Mbps, 1 Data Stream.					
802.11n (HT40) Mode, 2x2					
Frequency	**Limit [dBm]**	**Chain 0 [dBm]**	**Chain 1 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
2437 MHz	Na	16.89	17.37	20.15	
Note: The highest output power was observed at HT40 27 Mbps, 2 Data Stream.					

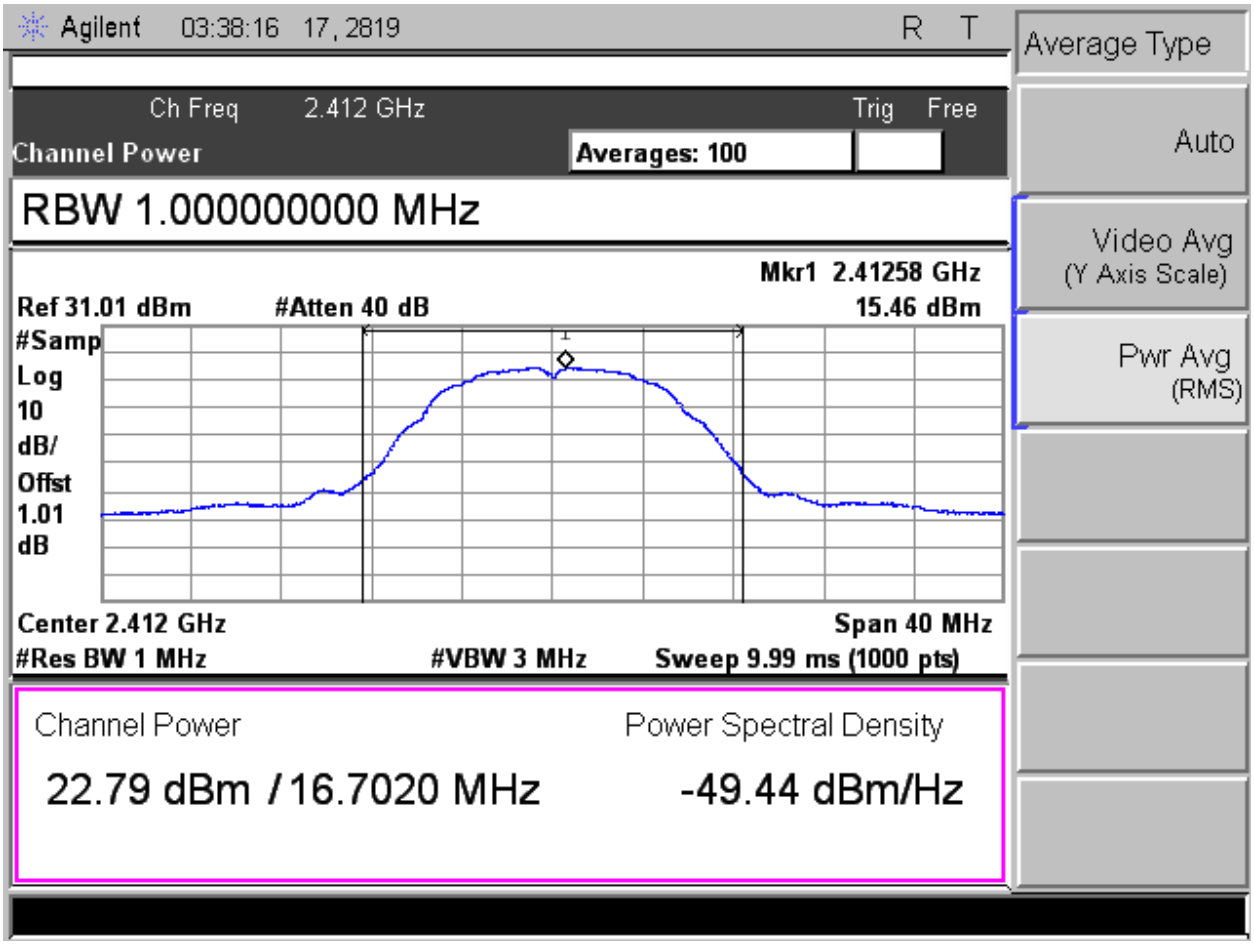


Figure 1: Maximum Transmitted Power, 2412 MHz of 802.11b 1Mbps

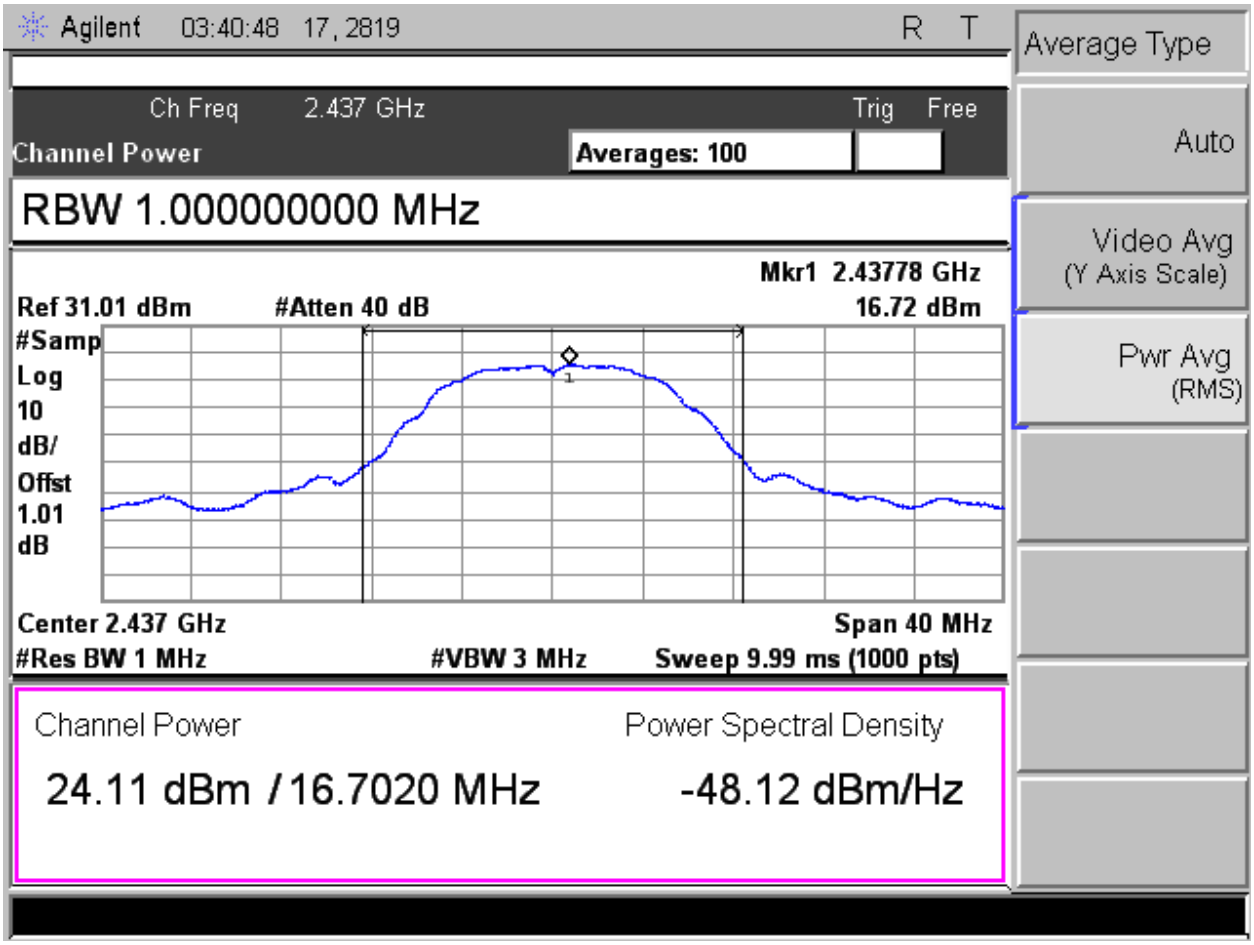


Figure 2: Maximum Transmitted Power, 2437 MHz of 802.11b 1Mbps

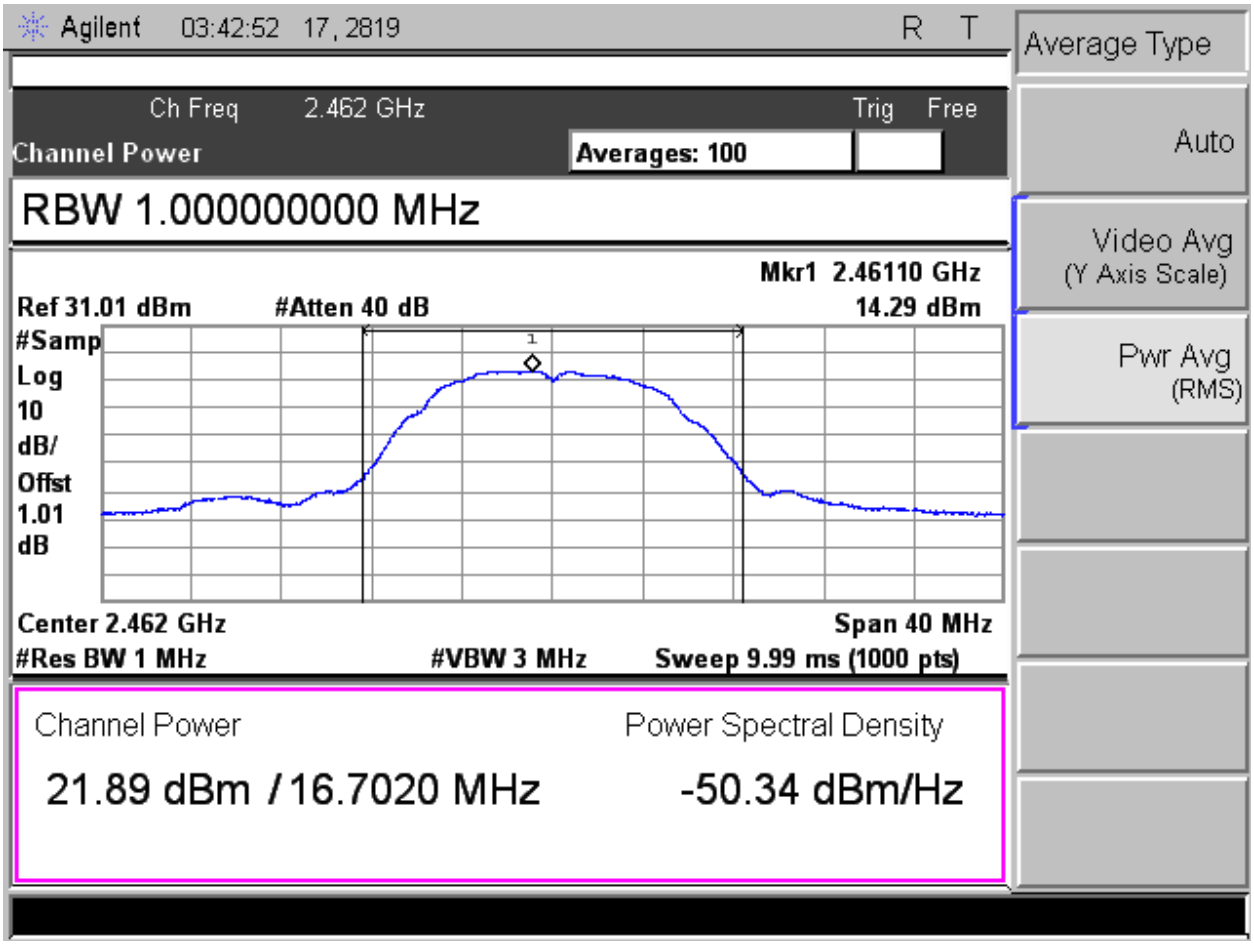


Figure 3: Maximum Transmitted Power, 2462 MHz of 802.11b 1Mbps

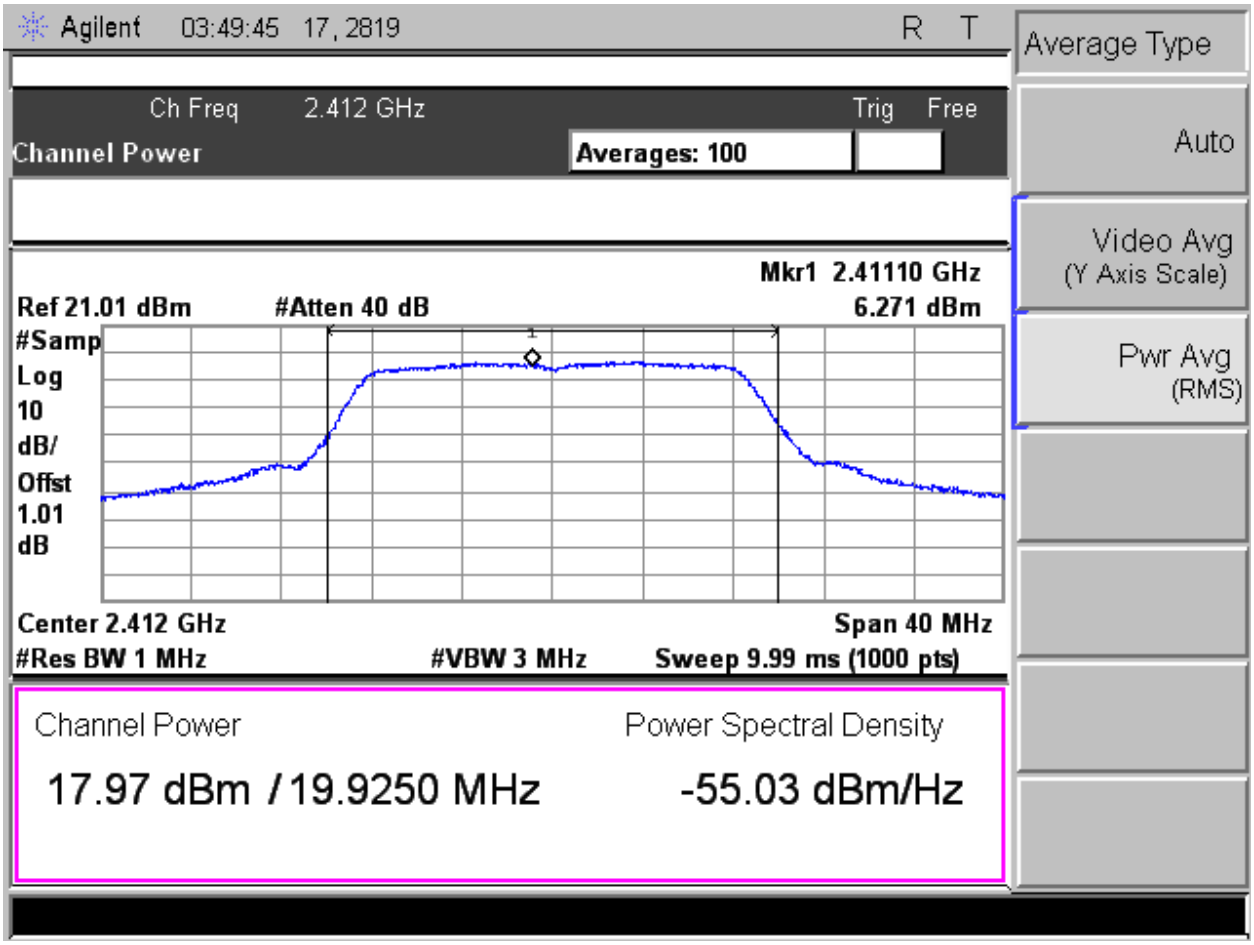


Figure 4: Maximum Transmitted Power, 2412 MHz of 802.11g 6Mbps

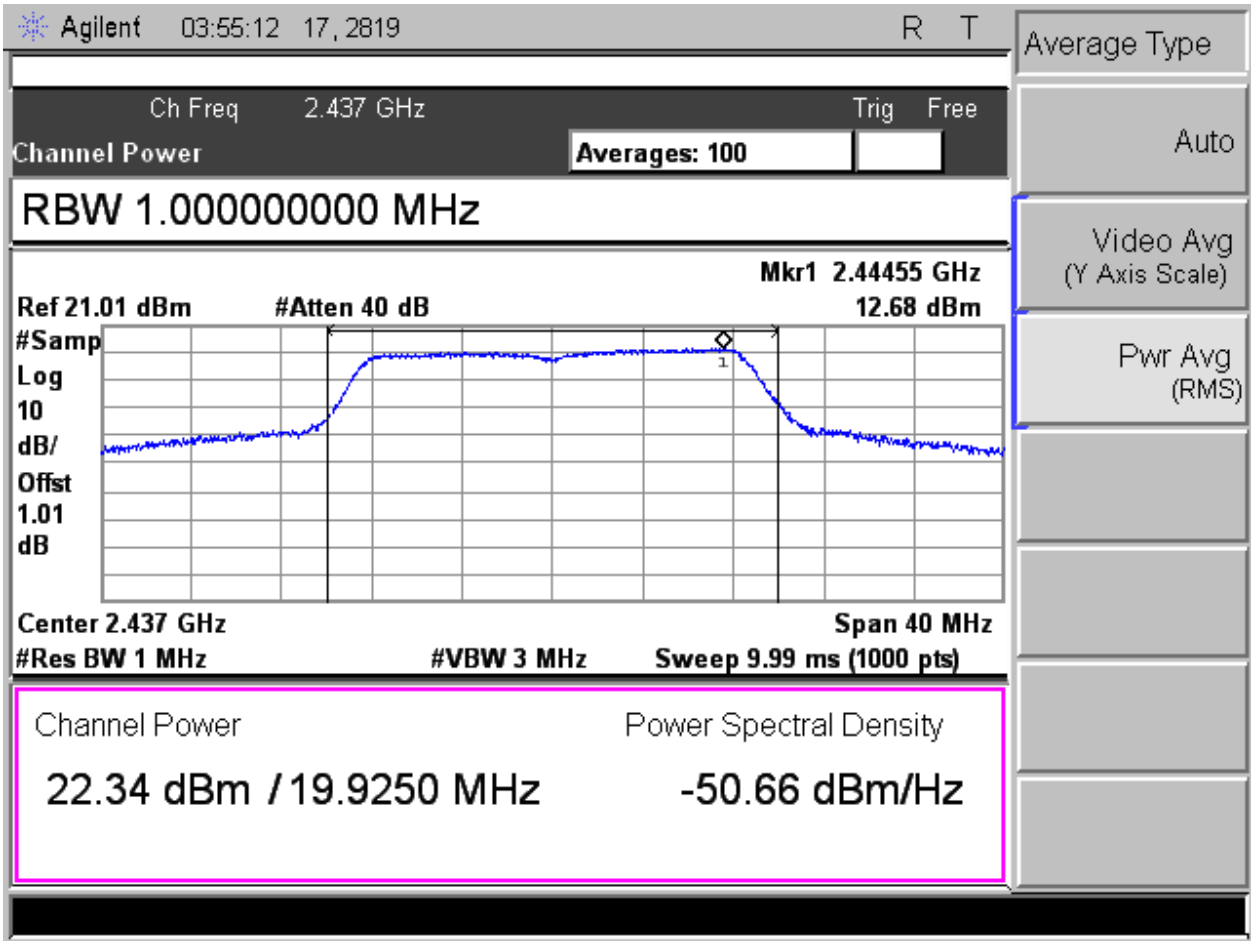


Figure 5: Maximum Transmitted Power, 2437 MHz of 802.11g 6Mbps

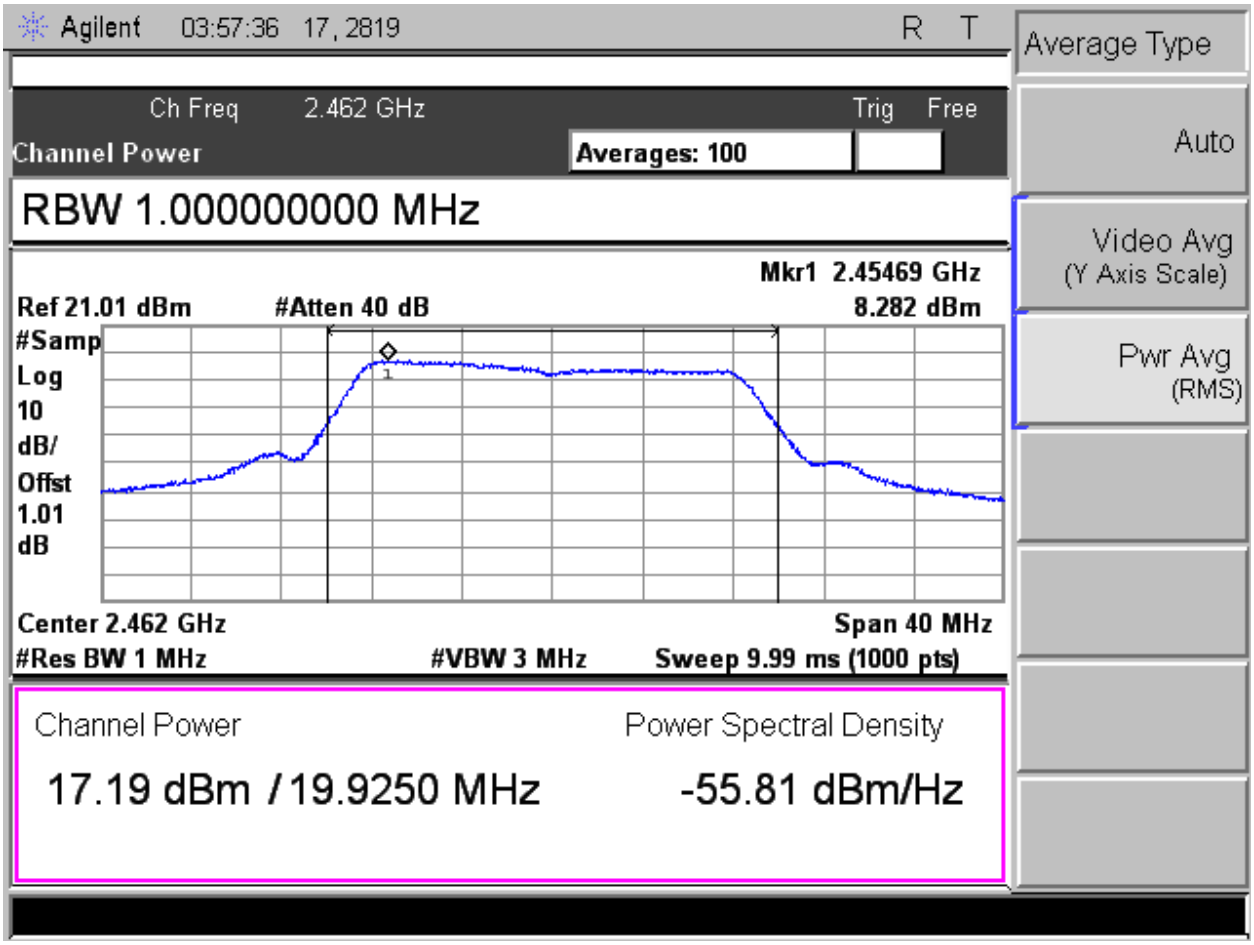


Figure 6: Maximum Transmitted Power, 2462 MHz of 802.11g 6Mbps

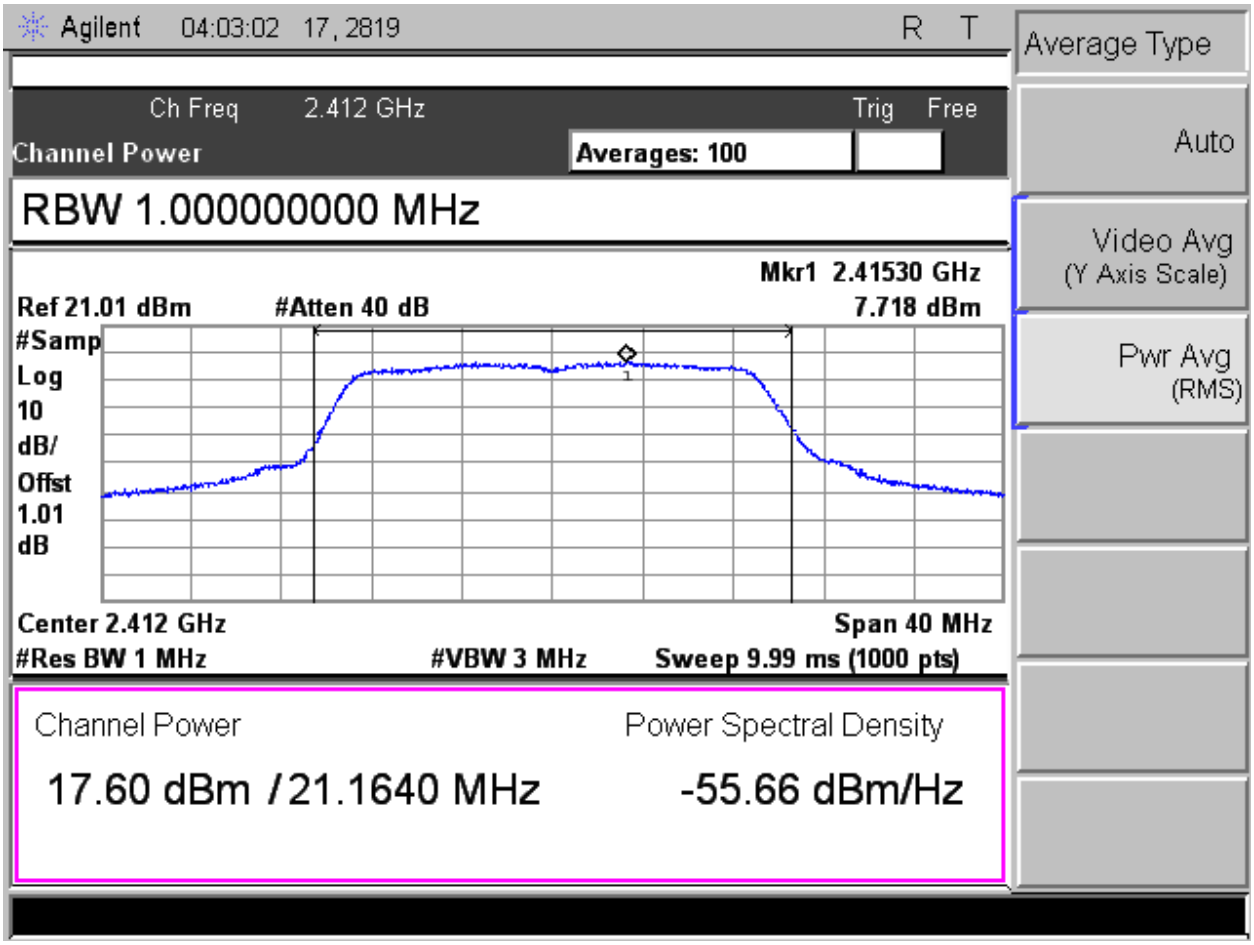


Figure 7: Maximum Transmitted Power, 2412 MHz at HT20 1x2 6.5Mbps

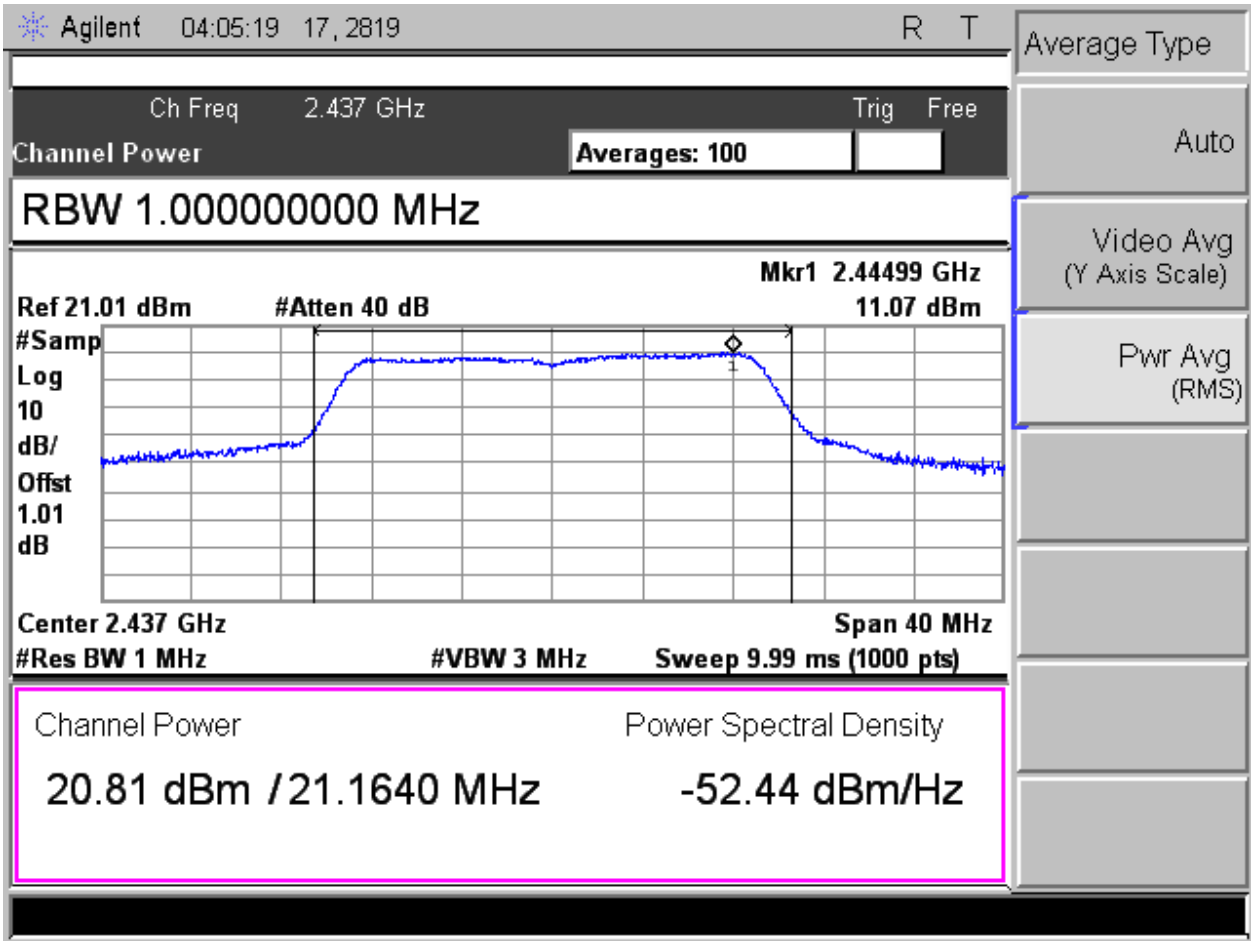


Figure 8: Maximum Transmitted Power, 2437 MHz at HT20 1x2 6.5Mbps

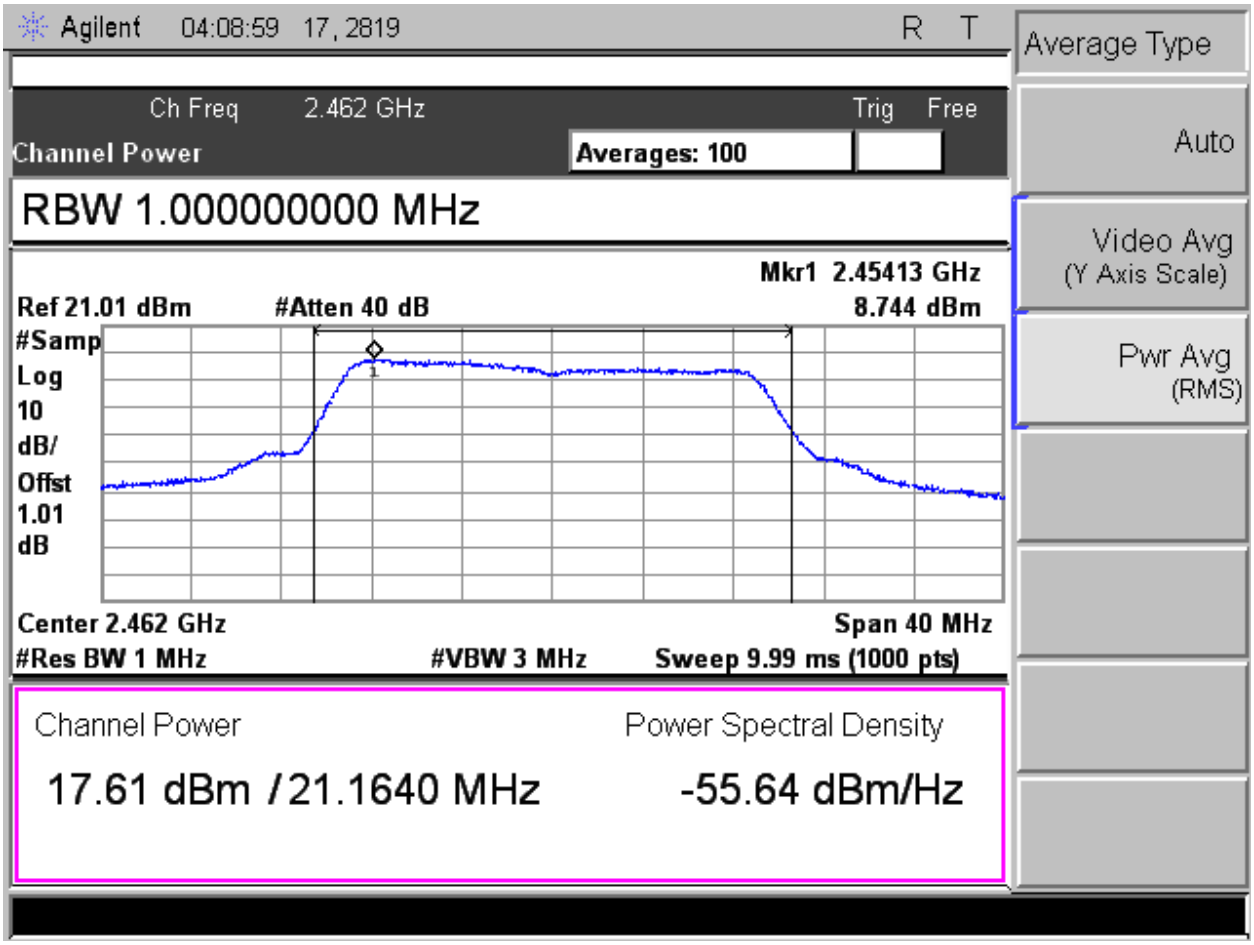


Figure 9: Maximum Transmitted Power, 2462 MHz at HT20 1x2 6.5Mbps

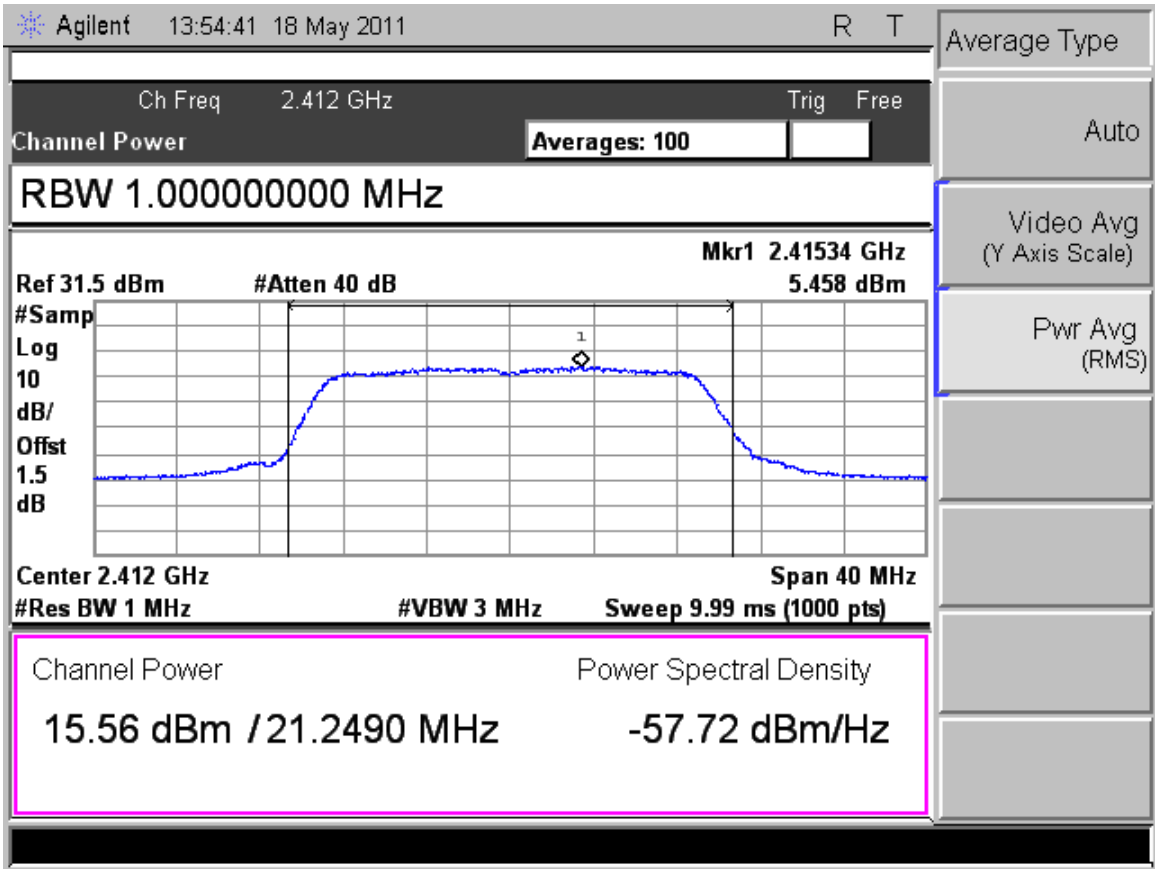


Figure 10: Maximum Transmitted Power, 2412 MHz at HT20 2x2 ch0 13Mbps

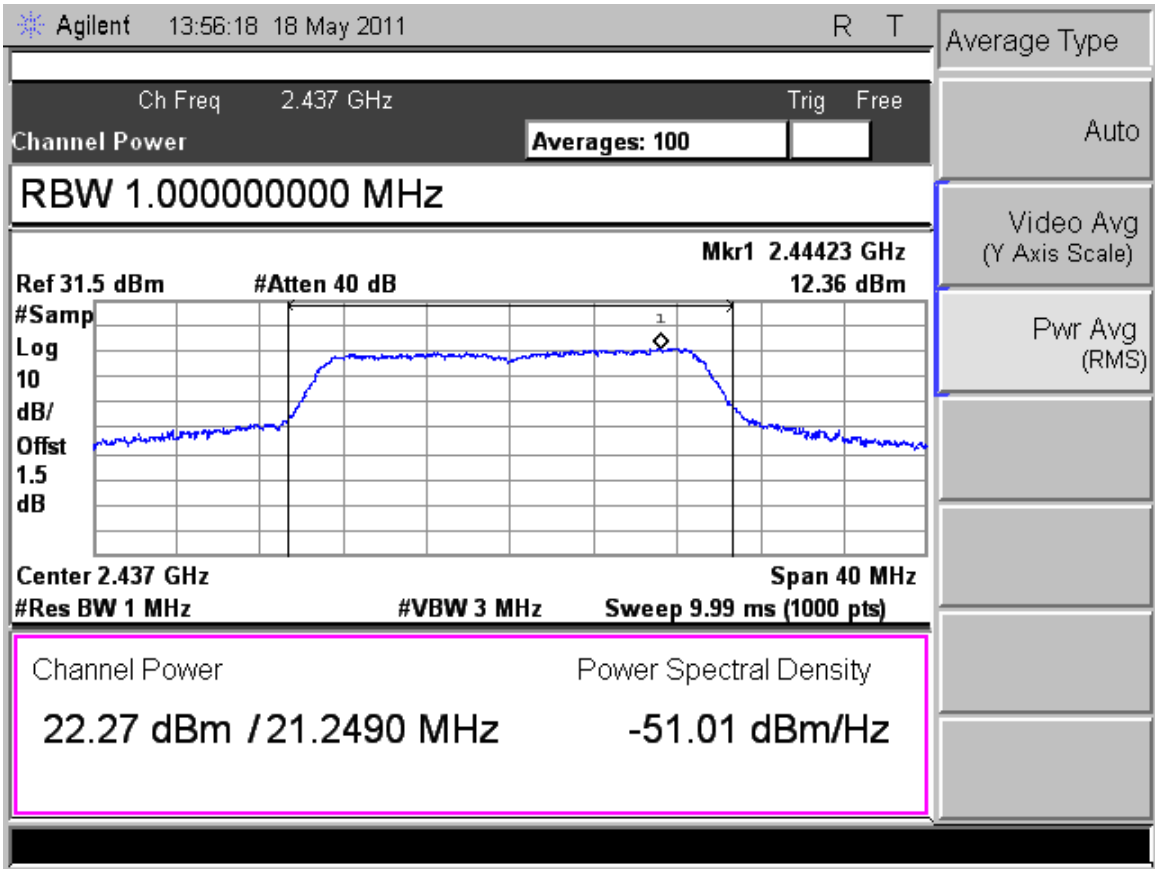


Figure 11: Maximum Transmitted Power, 2437 MHz at HT20 2x2 ch0 13Mbps

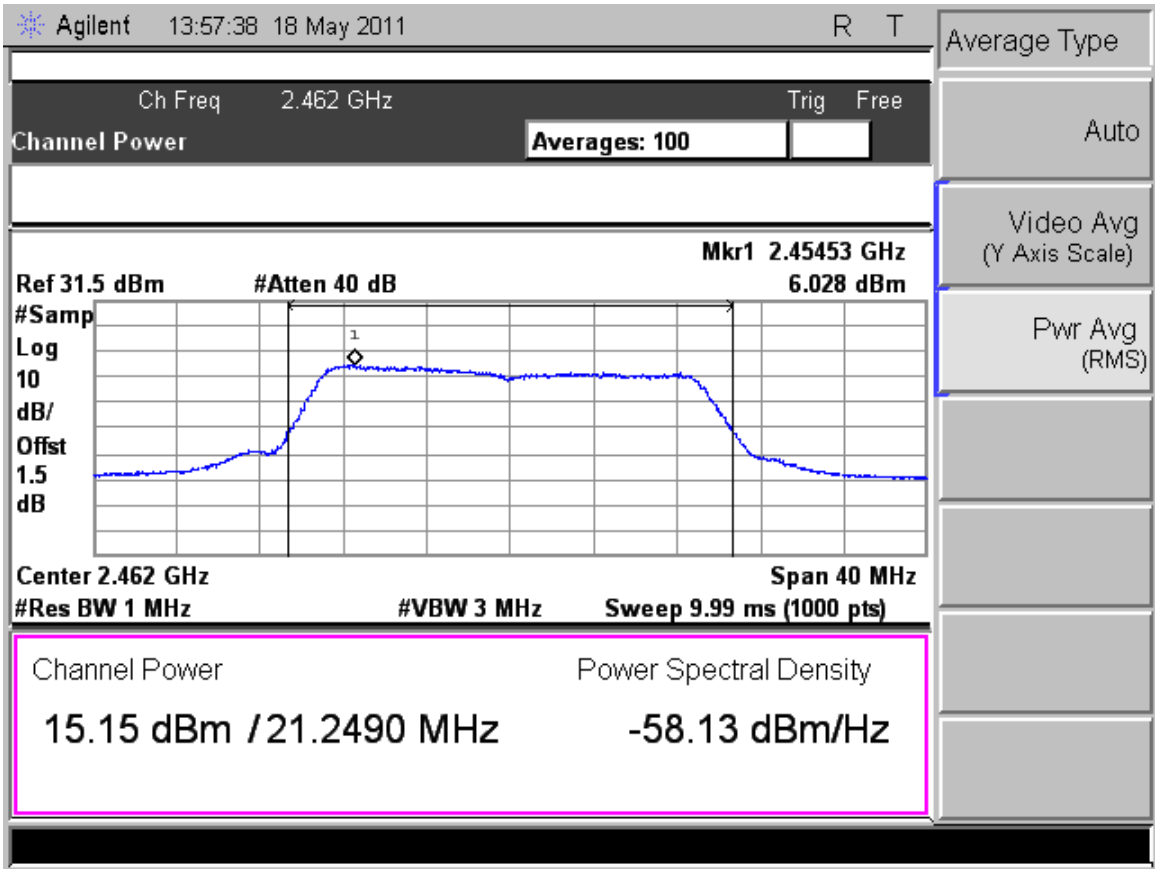


Figure 12: Maximum Transmitted Power, 2462 MHz at HT20 2x2 ch0 13Mbps

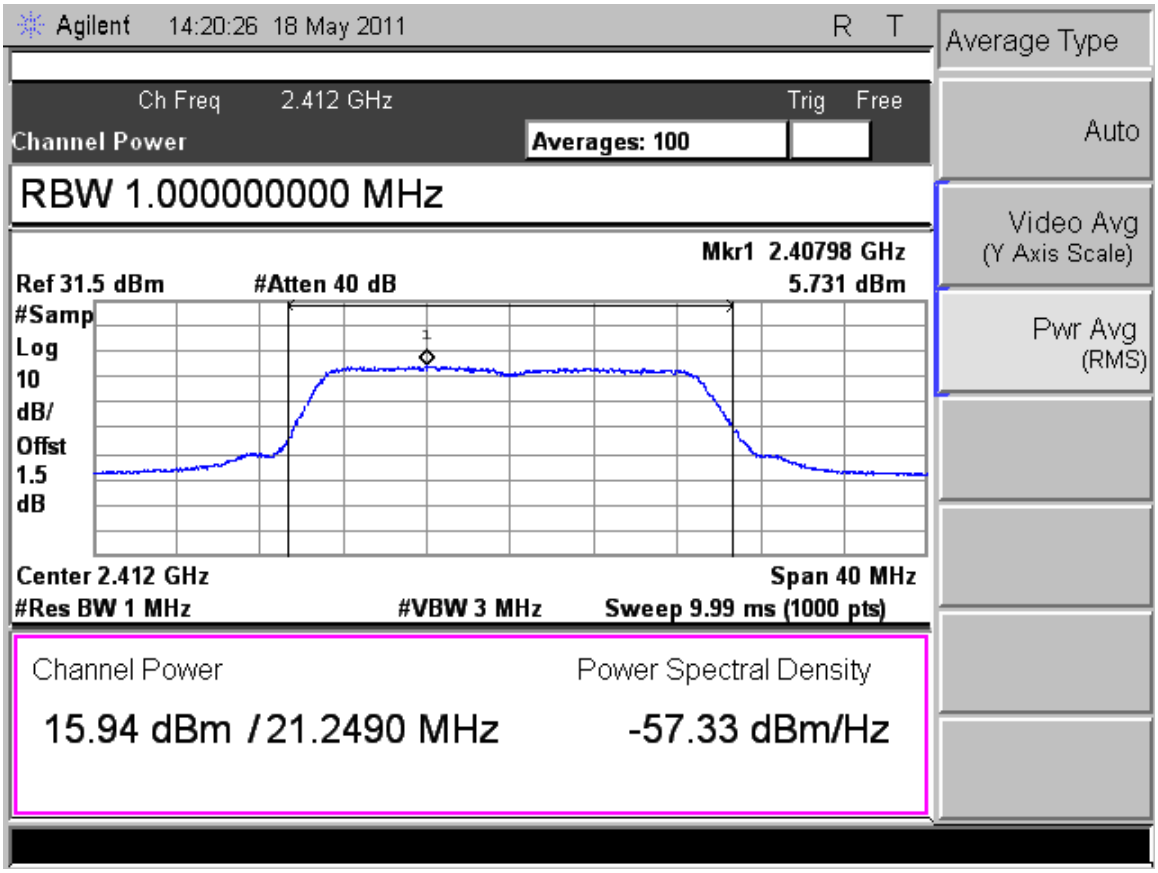


Figure 13: Maximum Transmitted Power, 2412 MHz at HT20 2x2 ch1 13Mbps

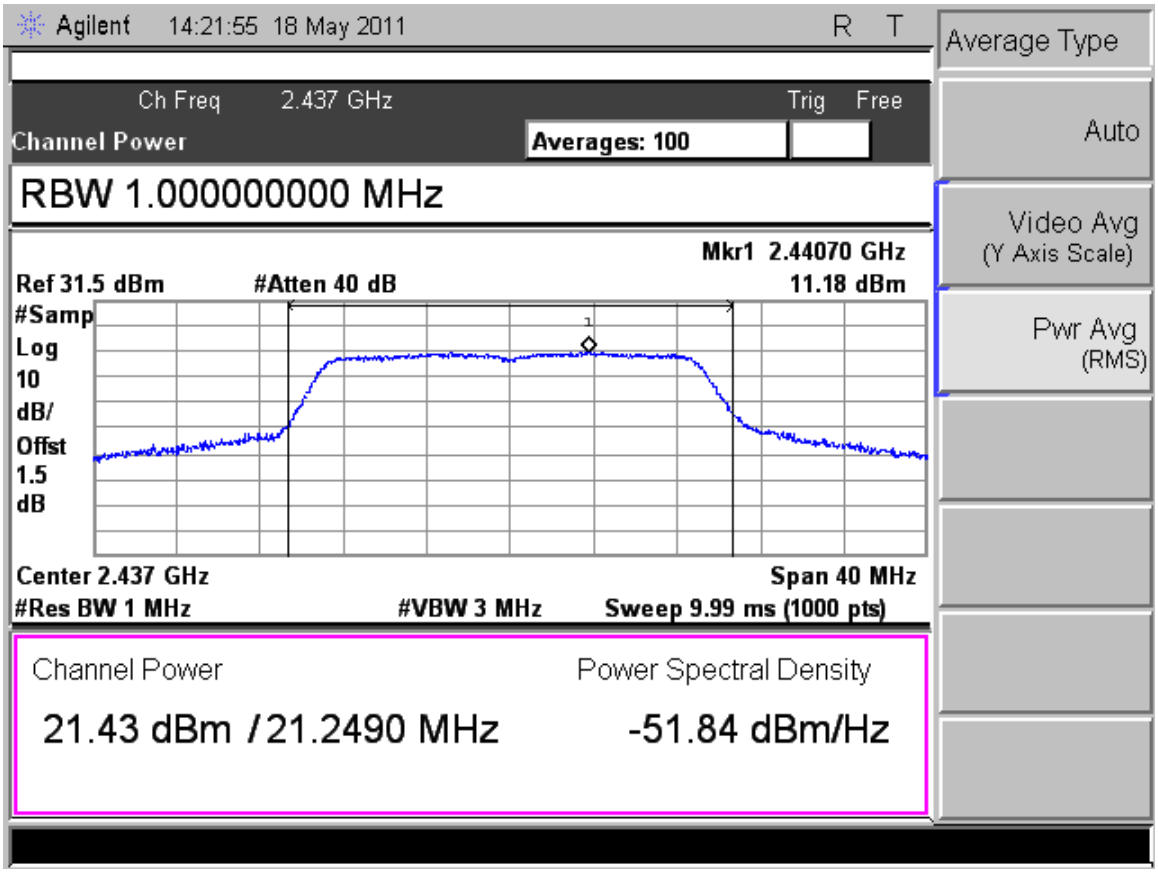


Figure 14: Maximum Transmitted Power, 2437 MHz at HT20 2x3 ch1 13Mbps

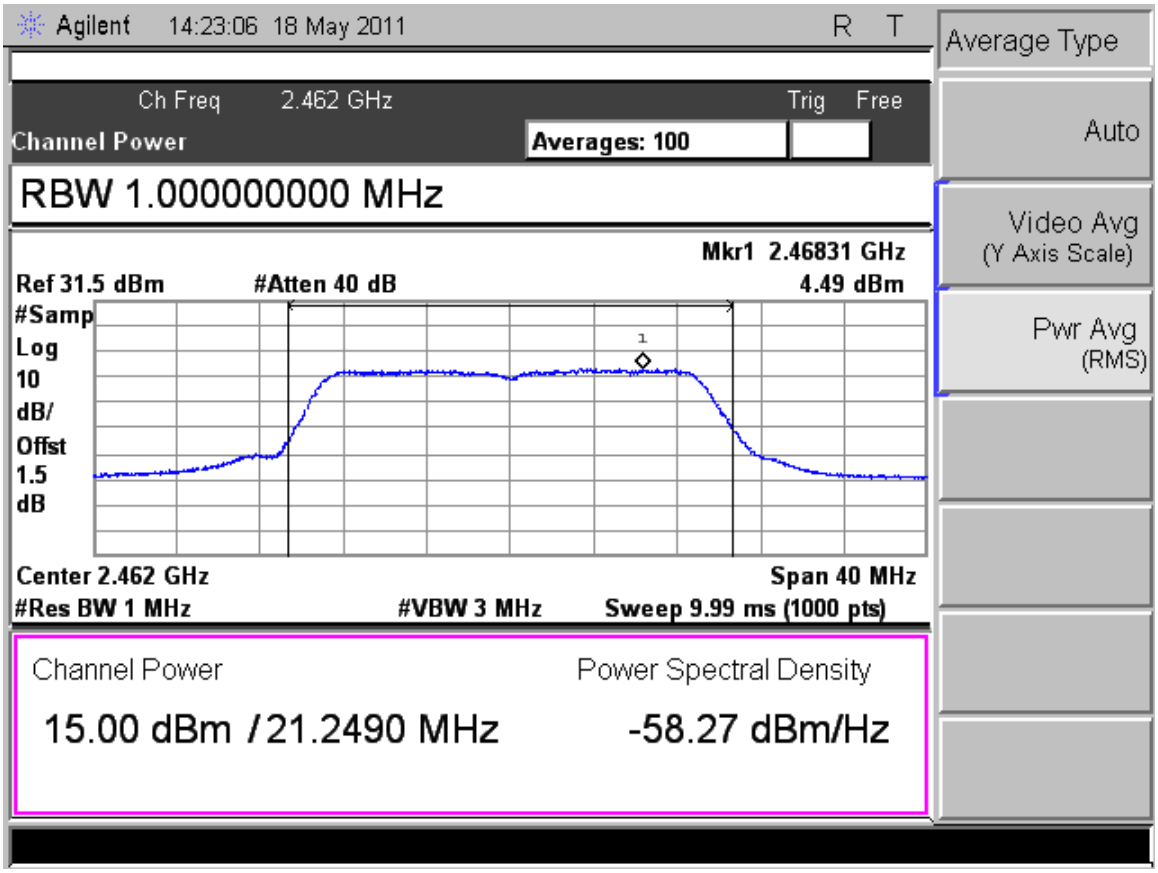


Figure 15: Maximum Transmitted Power, 2462 MHz at HT20 2x3 ch1 13Mbps

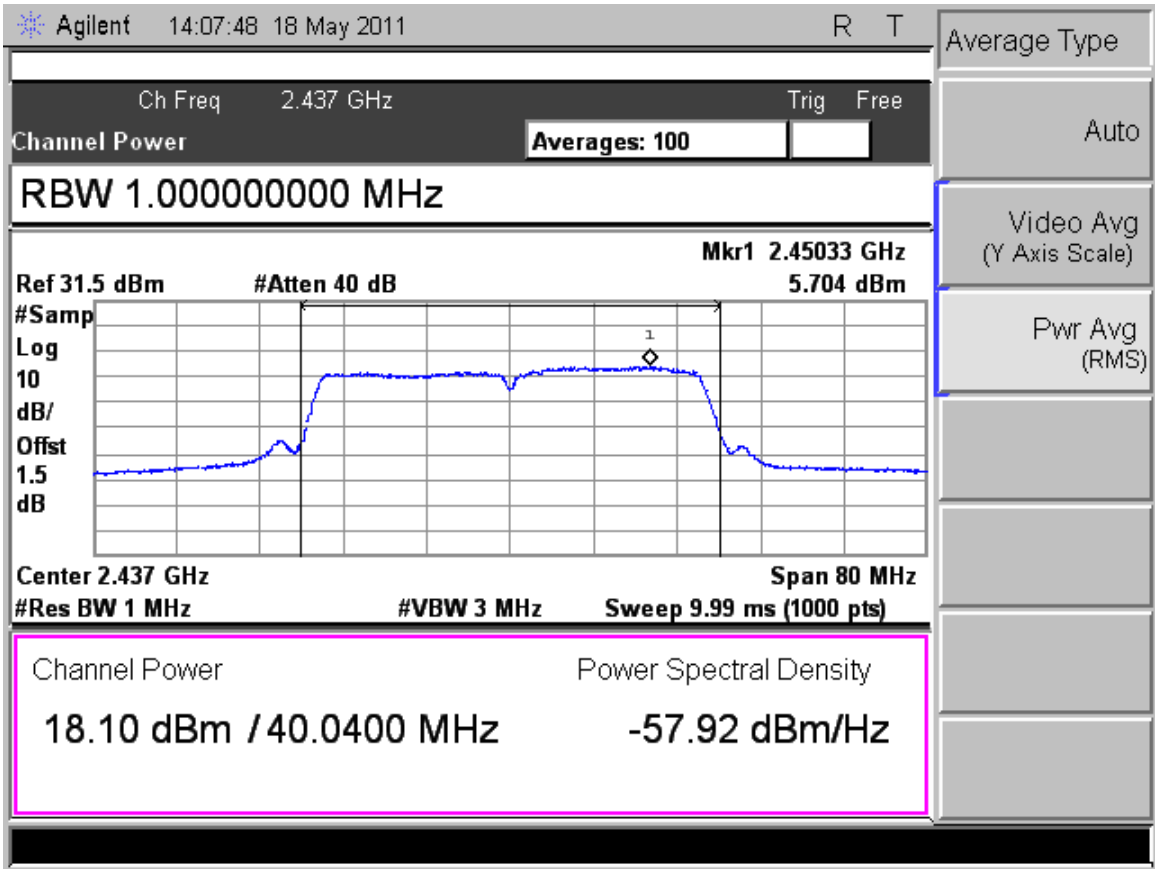


Figure 16: Maximum Transmitted Power, 2437 MHz at HT40 1x2 ch0 13.5Mbps

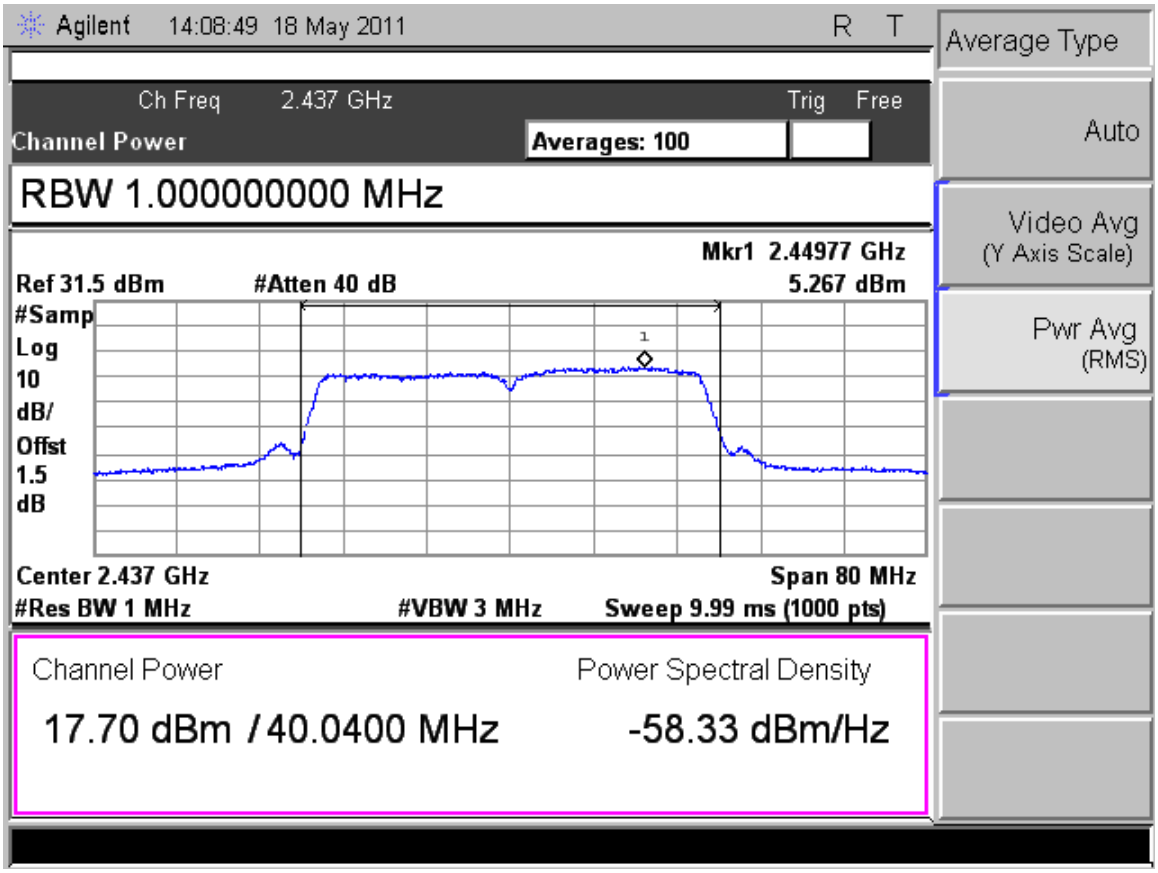


Figure 17: Maximum Transmitted Power, 2437 MHz at HT40 2x2 ch0 27Mbps

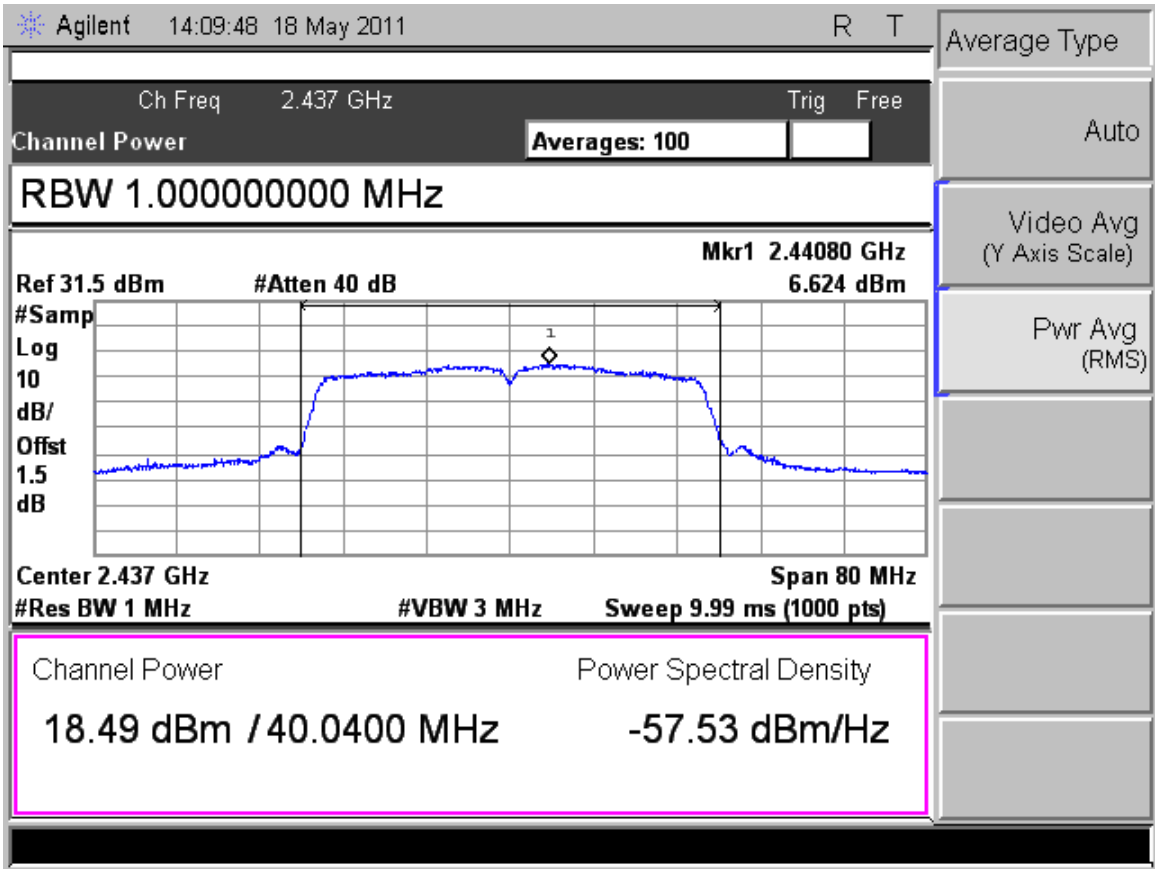


Figure 18: Maximum Transmitted Power, 2437 MHz at HT40 2x2 ch1 27Mbps

4.2 Occupied Bandwidth

The occupied bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency.

The 99% bandwidth is the bandwidth in which 99% of the transmitted power occupied.

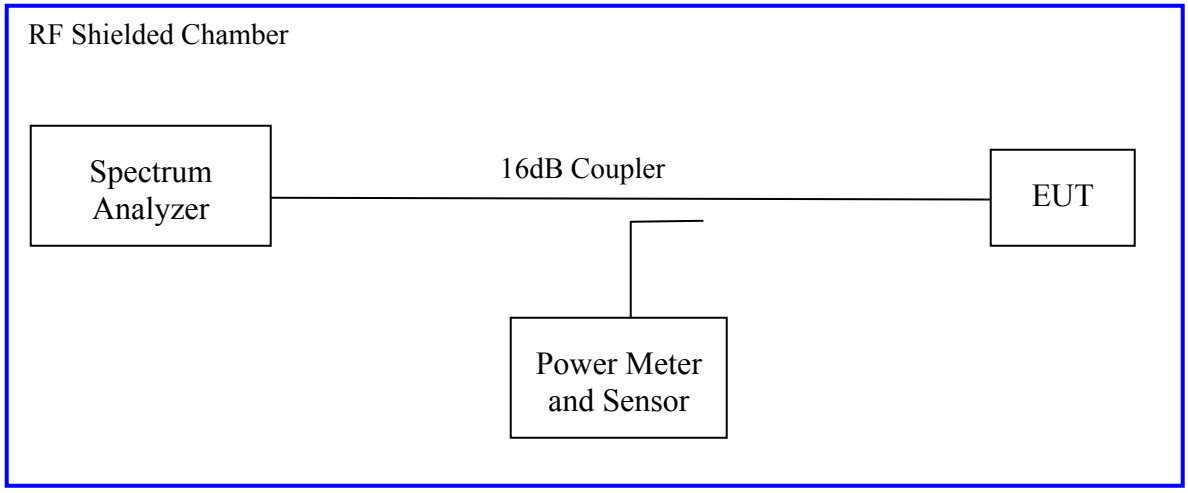
The 6 dB bandwidth is defined the bandwidth of 6 dBr from highest transmitted level of the fundamental frequency.

The bandwidth shall be at least 500 kHz per Section CFR47 15.247(a2) 2010 and RSS Gen Sect. 4.4.1: 2010.

4.2.1 Test Method

The conducted method was used to measure the occupied bandwidth according to ANSI C63.10:2009 Section 6.9.1. The measurement was performed with modulation per CFR47 15.247(a2) 2010 and RSS Gen Sect. 4.4.1:2010. This test was conducted on 3 channels of Sample SN 131104000001. The worst sample result indicated below.

Test Setup:



4.2.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 5: Occupied Bandwidth – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only				
Antenna Type: Integrated		**Power Setting:** See test plan		
Max. Antenna Gain: +3.0 dBi		**Signal State:** Modulated		
Ambient Temp.: 21 °C		**Relative Humidity:**38%		
Bandwidth (MHz) for 802.11b				
Frequency (MHz)	**Limit (kHz)**	**Ch 0 99% BW**	**Ch 0 6 dB BW**	**Results**
2412	500	10.3622	8.214	Pass
2437	500	11.4632	8.696	Pass
2462	500	10.9903	8.685	Pass
Note: The bandwidth was measured at 1Mbps for 802.11b mode.				
Bandwidth (MHz) for 802.11g				
Frequency (MHz)	**Limit (kHz)**	**Ch 0 99% BW**	**Ch 0 6 dB BW**	**Results**
2412	500	16.9408	16.369	Pass
2437	500	18.1265	16.695	Pass
2462	500	17.4017	16.830	Pass
Note: The bandwidth was measured at 6Mbps for 802.11g mode.				
Bandwidth (MHz) for 802.11n HT20				
Frequency (MHz)	**Limit (kHz)**	**Ch 0 99% BW**	**Ch 0 6 dB BW**	**Results**
2412	500	17.6836	17.358	Pass
2437	500	18.1739	17.648	Pass
2462	500	18.0067	17.611	Pass
Note: The bandwidth was measured at 6.5Mbps at 1 data stream				

Bandwidth (MHz) for 802.11n HT40				
Frequency (MHz)	**Limit (kHz)**	**Ch 0 99% BW**	**Ch 0 6 dB BW**	**Results**
2437	500	36.5217	35.960	Pass
Note: The bandwidth was observed at 13.5Mbps at 1 data stream				

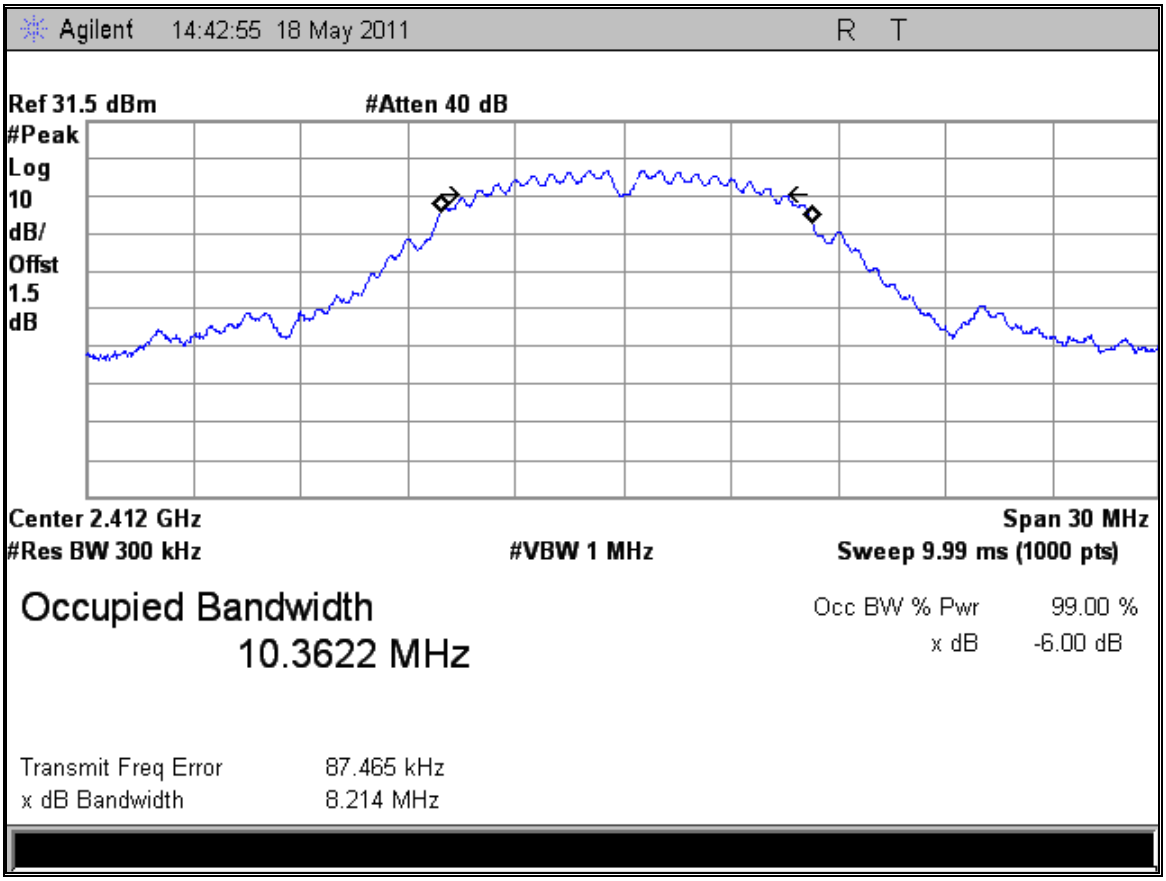


Figure 19: Occupied Bandwidth, 2412 MHz at 802.11b, 1x2 ch0, 1Mbps

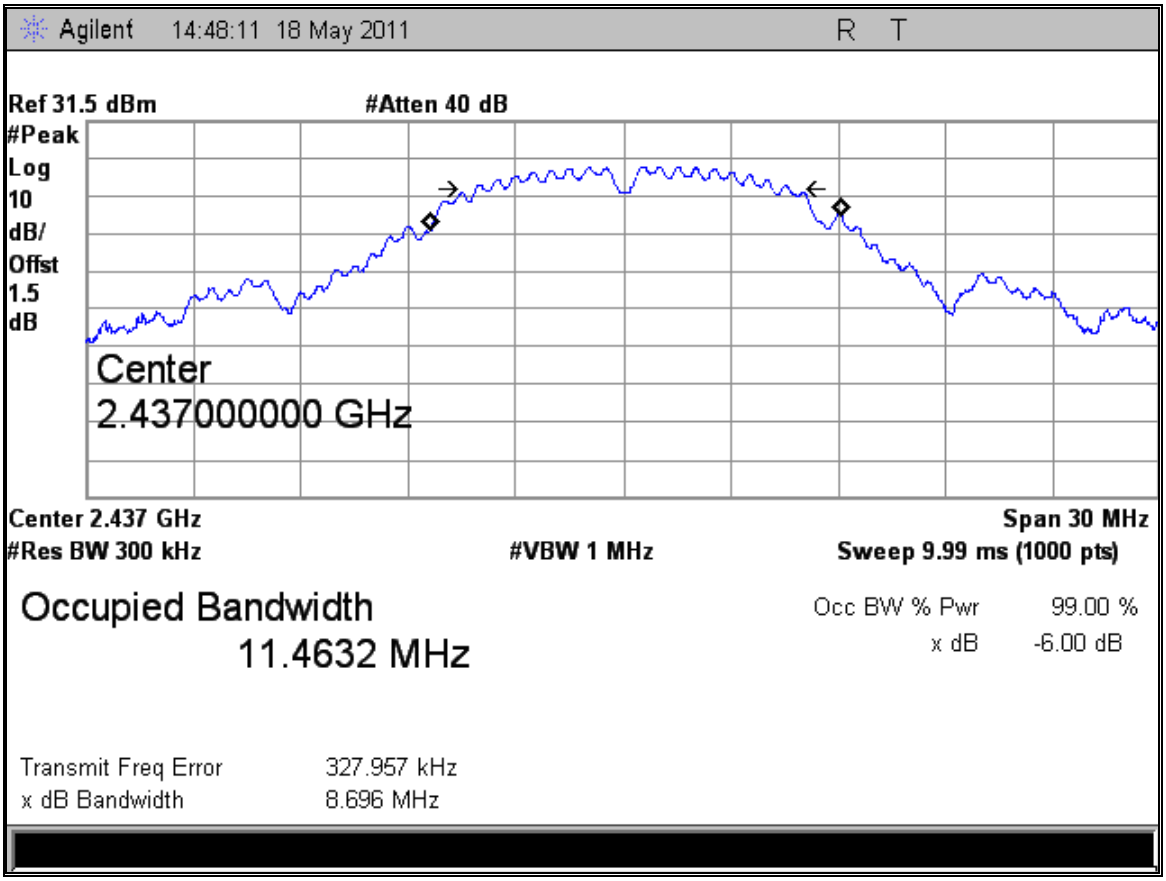


Figure 20: Occupied Bandwidth, 2437 MHz at 802.11b, 1x2 ch0, 1Mbps

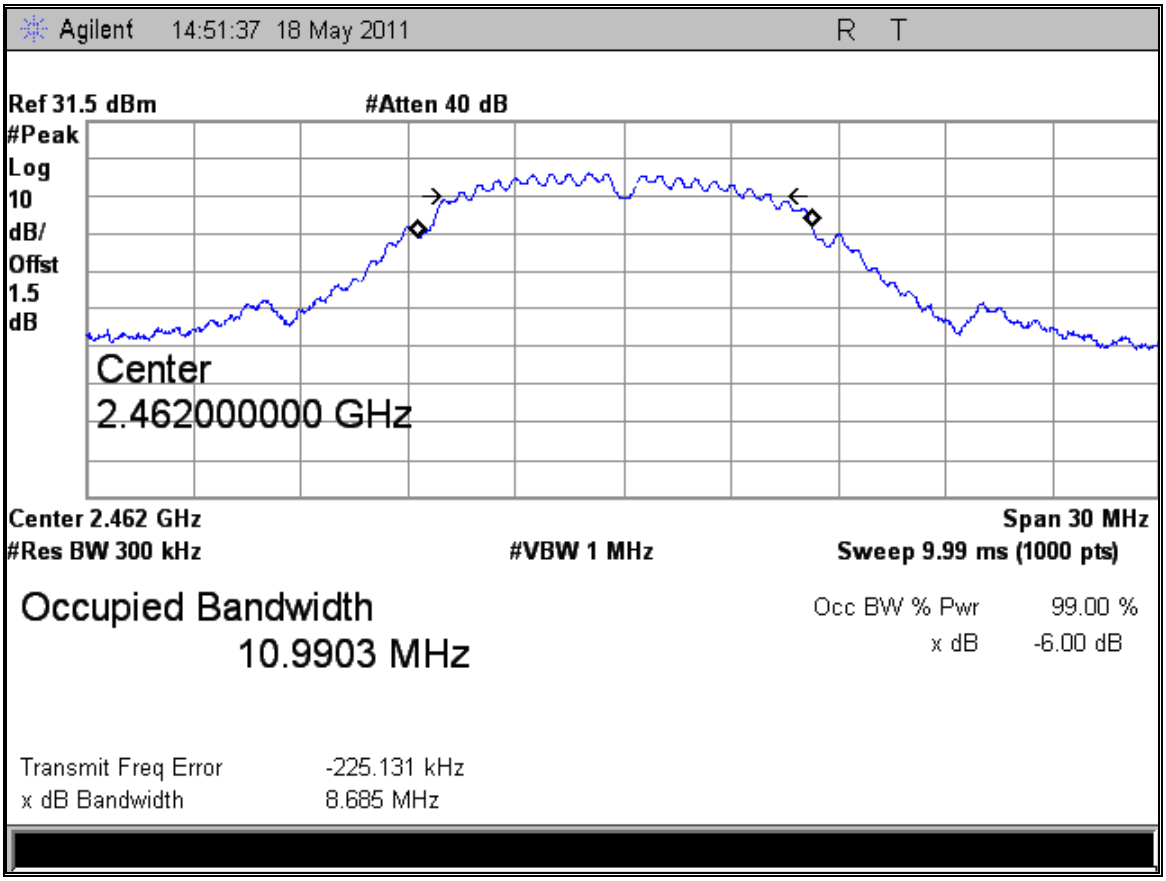


Figure 21: Occupied Bandwidth, 2462 MHz at 802.11b, 1x2 ch0, 1Mbps

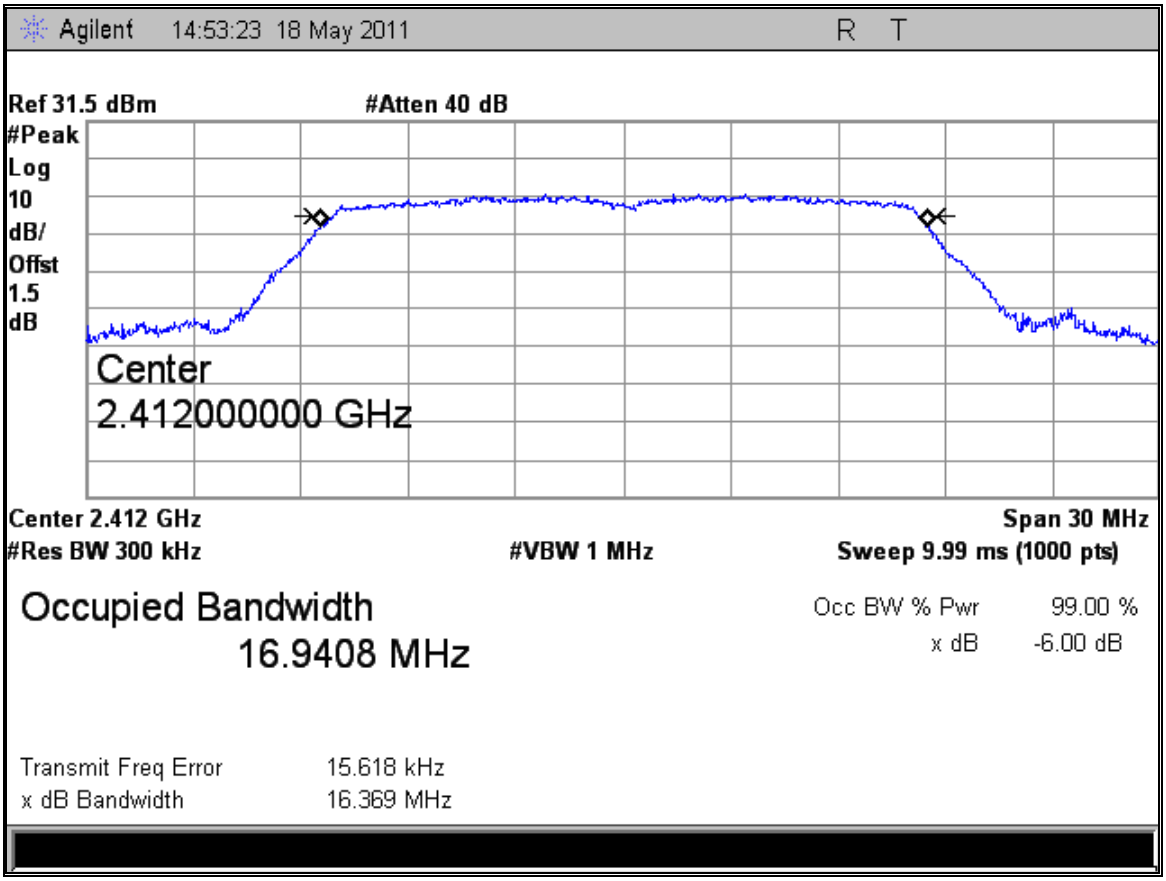


Figure 22: Occupied Bandwidth, 2412 MHz at 802.11g, 1x2 ch0, 6Mbps

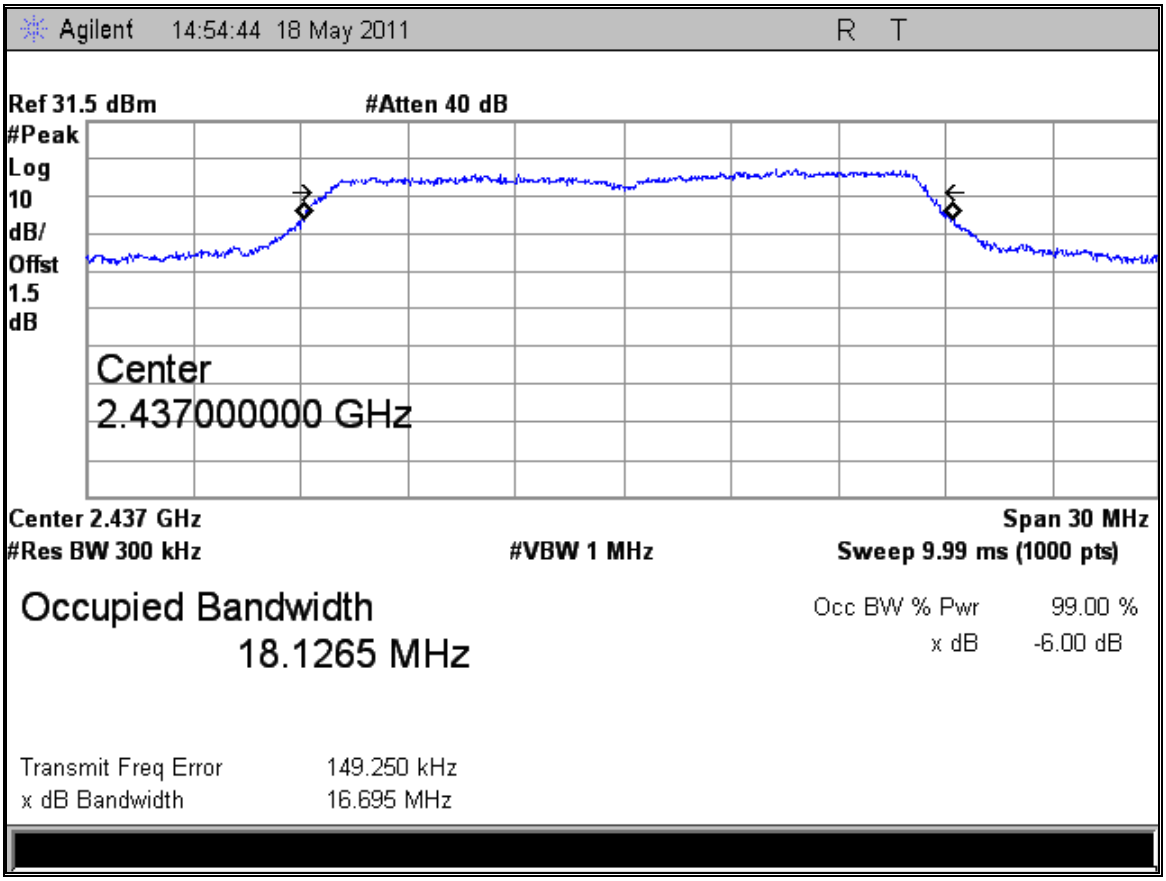


Figure 23: Occupied Bandwidth, 2437 MHz at 802.11g, 1x2 ch0, 6Mbps

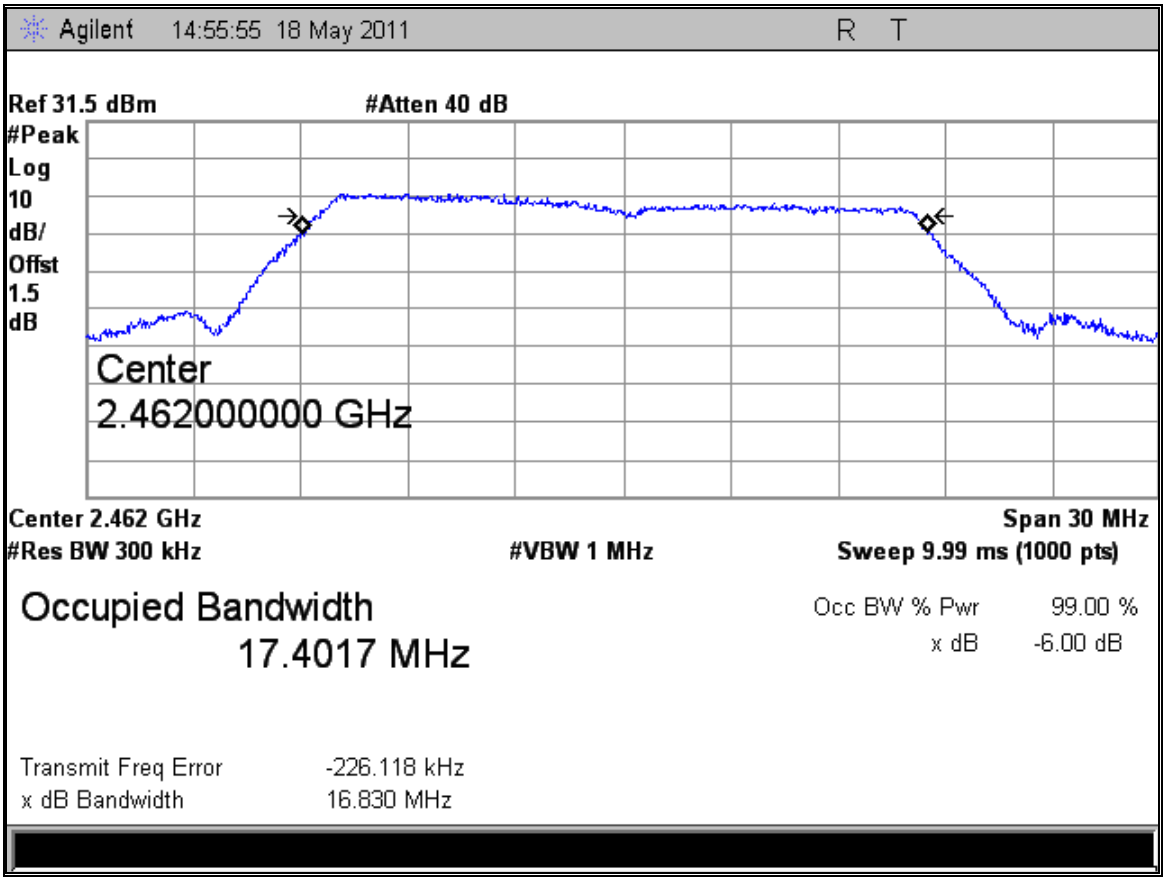


Figure 24: Occupied Bandwidth, 2462 MHz at 802.11g, 1x2 ch0, 6Mbps

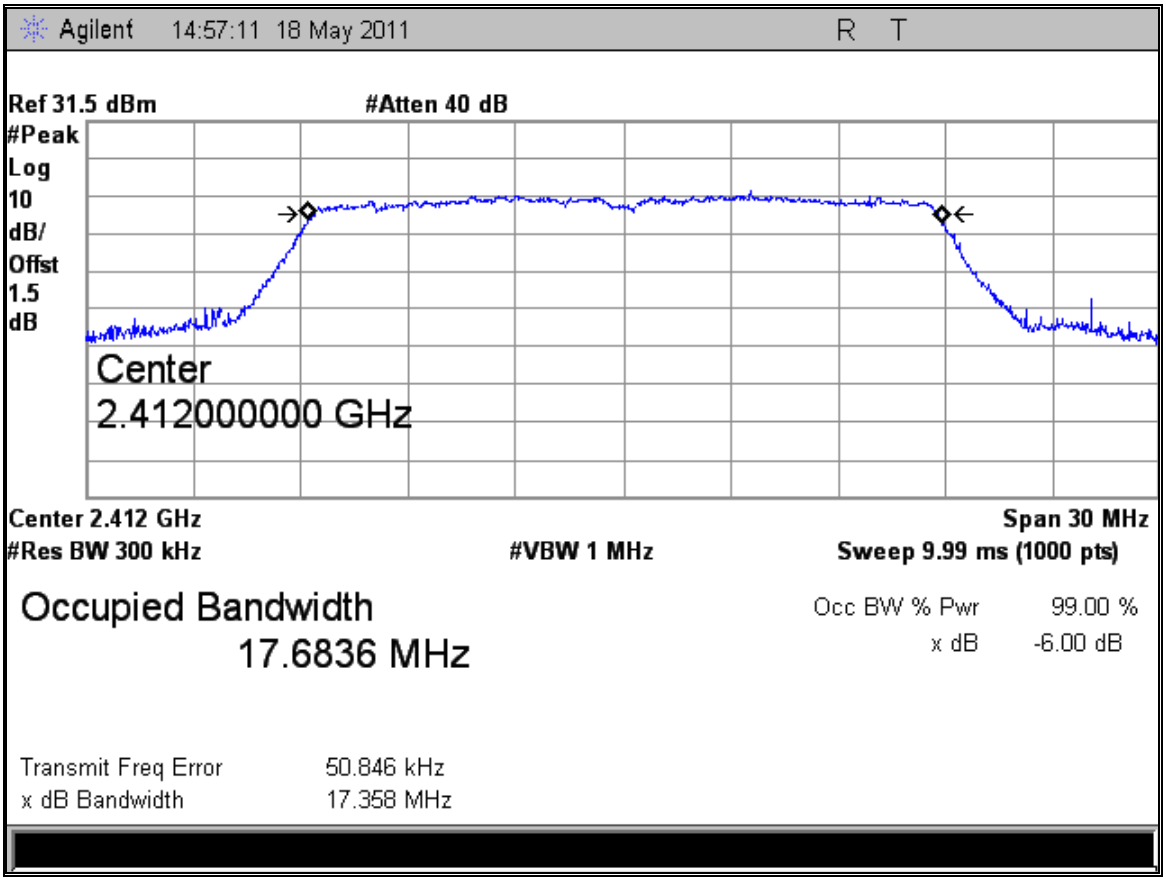


Figure 25: Occupied Bandwidth, 2412 MHz at HT20, 1x2 ch0, 6.5Mbps

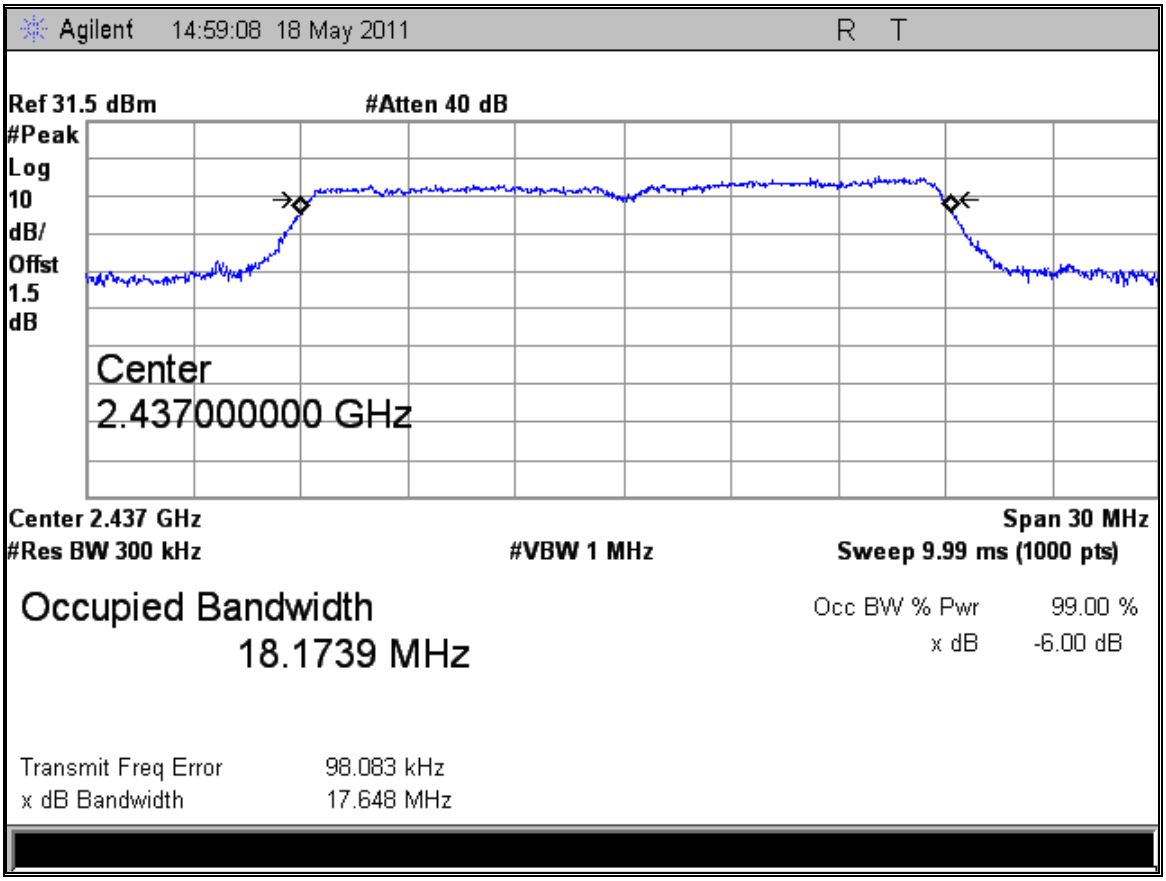


Figure 26: Occupied Bandwidth, 2437 MHz at HT20, 1x2 ch0, 6.5Mbps

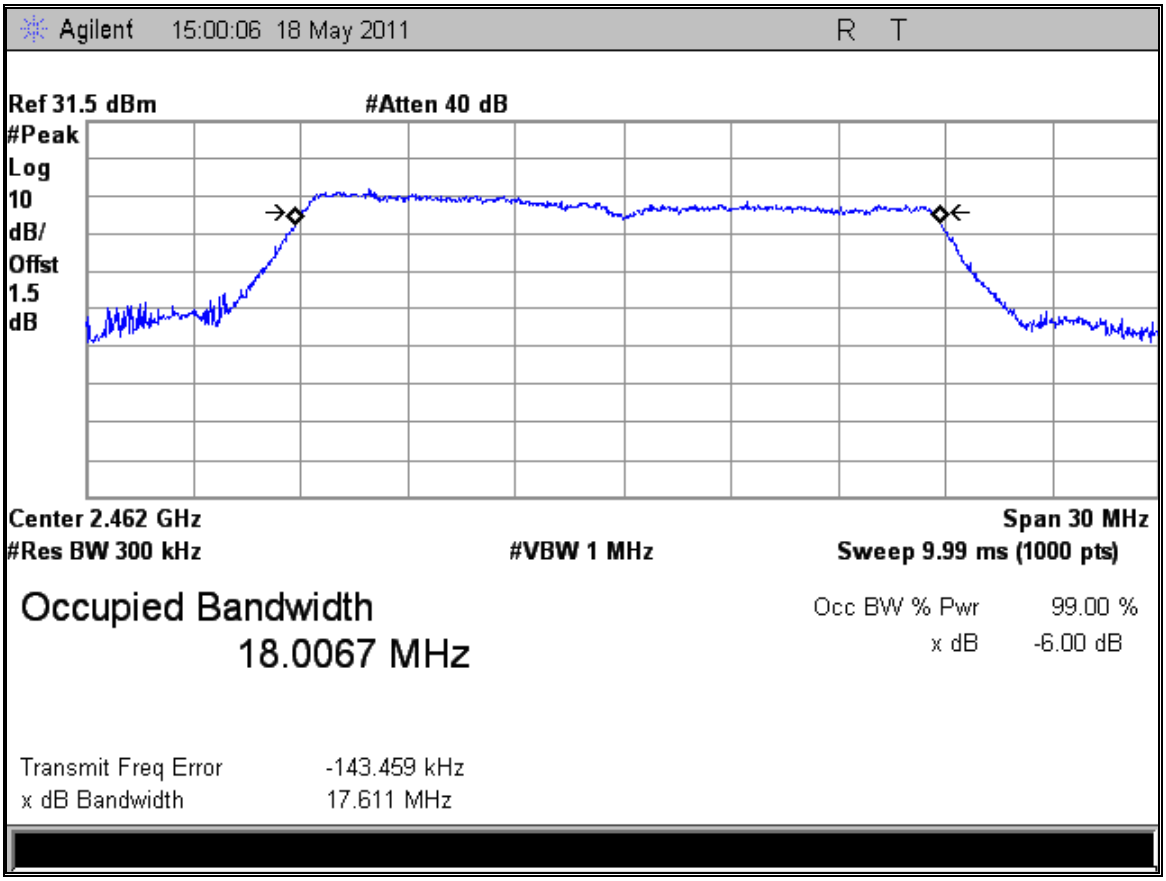


Figure 27: Occupied Bandwidth, 2462 MHz at HT20, 1x2 ch0, 6.5Mbps

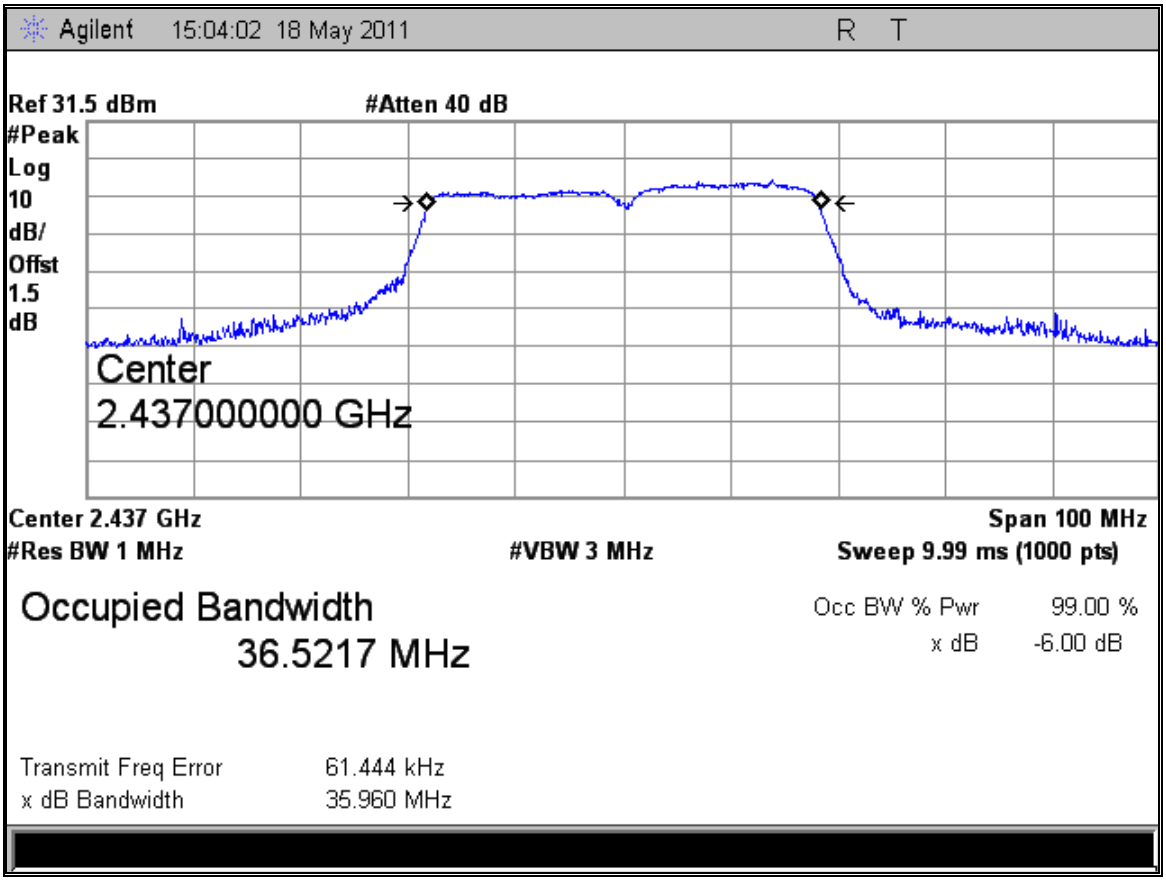


Figure 28: Occupied Bandwidth, 2437 MHz at HT40, 1x2 ch0, 13.5Mbps

4.3 Out-of-Band Emissions

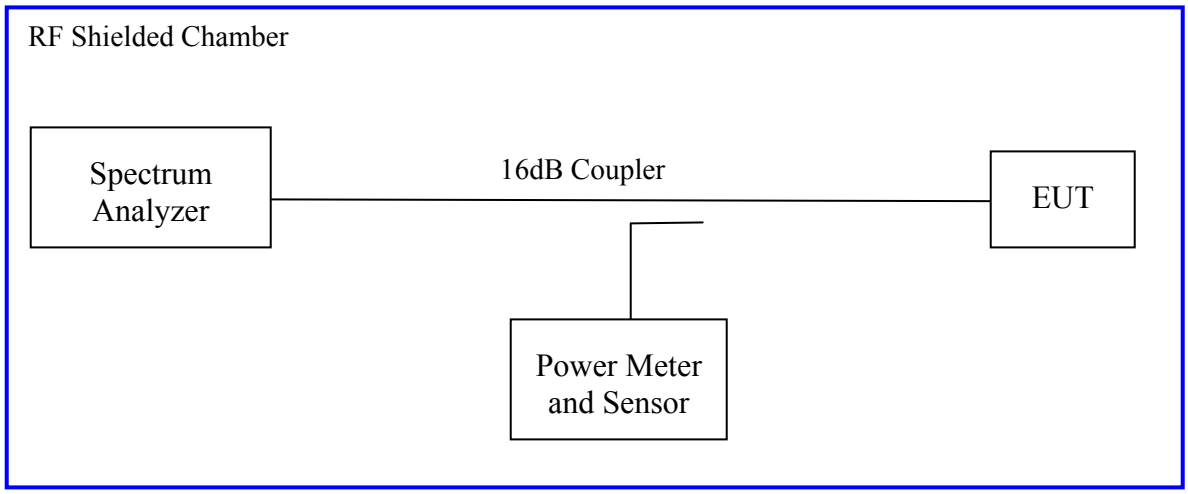
The setup was identical to RF output power measurement. Intentional radiators operating under the alternative provisions to the general emission limits, must be designed to ensure that the 20 dB or 30 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If the frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Since the transmitter complies with the conducted power limits base on the use of RMS averaging per CFR47 Part 15.247(b)(3), any frequency outside the band of 2400 MHz to 2483.5 MHz, the power output level must be below 30 dB from the in-band transmitting signal; CFR 47 Part 15.215, 15.247(d) and RSS 210 A8.5

4.3.1 Test Method

The conducted method was used to measure the out-of-band emission requirement. The measurement was performed with modulation per CFR47 15.247(4)(d) 2010 and *RSS 210 A8.5: 2010*. This test was conducted on 3 channels of Sample SN 131104000001. The worst sample result indicated below.

Test Setup:



4.3.2 Test Result

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 6: Emissions at the Band-Edge – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only				
Antenna Type: Integrated		**Power Setting:** See test plan		
Max. Antenna Gain: +3.0 dBi		**Signal State:** Modulated		
Ambient Temp.: 21 °C		**Relative Humidity:**34%		
Band-Edge Results				
Operating Channel	**Mode**	**Band-edge Level (dBm)**	**30 dB Level (dBm)**	**Margin (dB)**
2412 MHz	1Mbps	-29.73	-12.22	-17.51
2437 MHz	1Mbps	-41.98	-11.56	-30.42
2462 MHz	1Mbps	-40.32	-13.27	-27.05
2412 MHz	6 Mbps	-27.69	-20.82	-6.87
2437 MHz	6 Mbps	-30.50	-13.78	-16.72
2462 MHz	6 Mbps	-41.50	-20.76	-20.74
2412 MHz	6.5 Mbps	-27.75	-20.90	-6.85
2437 MHz	6.5 Mbps	-35.33	-16.46	-18.87
2462 MHz	6.5 Mbps	-39.24	-20.36	-18.88
2437 MHz	13.5 Mbps	-37.80	-23.61	-14.19
Note: The band-edge level must lower than the 30 dBr level. The maximum out of band emission on each individual output put is at least 30 dB below the maximum in-band PSD on that output.				

Table 7: Out of band Conducted Emission – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only			
Antenna Type: Integrated		**Power Setting:** See test plan	
Max. Antenna Gain: +3.0 dBi		**Signal State:** Modulated	
Ambient Temp.: 21 °C		**Relative Humidity:**34%	
Output of Band Results			
Operating Channel	**Mode**	**Band 30 MHz- 26GHz**	**Result**
2412 MHz	1Mbps	Figure 30	Pass
2437 MHz	1Mbps	Figure 32	Pass
2462 MHz	1Mbps	Figure 34	Pass
2412 MHz	6 Mbps	Figure 36	Pass
2437 MHz	6 Mbps	Figure 38	Pass
2462 MHz	6 Mbps	Figure 40	Pass
2412 MHz	6.5 Mbps	Figure 42	Pass
2437 MHz	6.5 Mbps	Figure 44	Pass
2462 MHz	6.5 Mbps	Figure 46	Pass
2437 MHz	13.5 Mbps	Figure 48	Pass

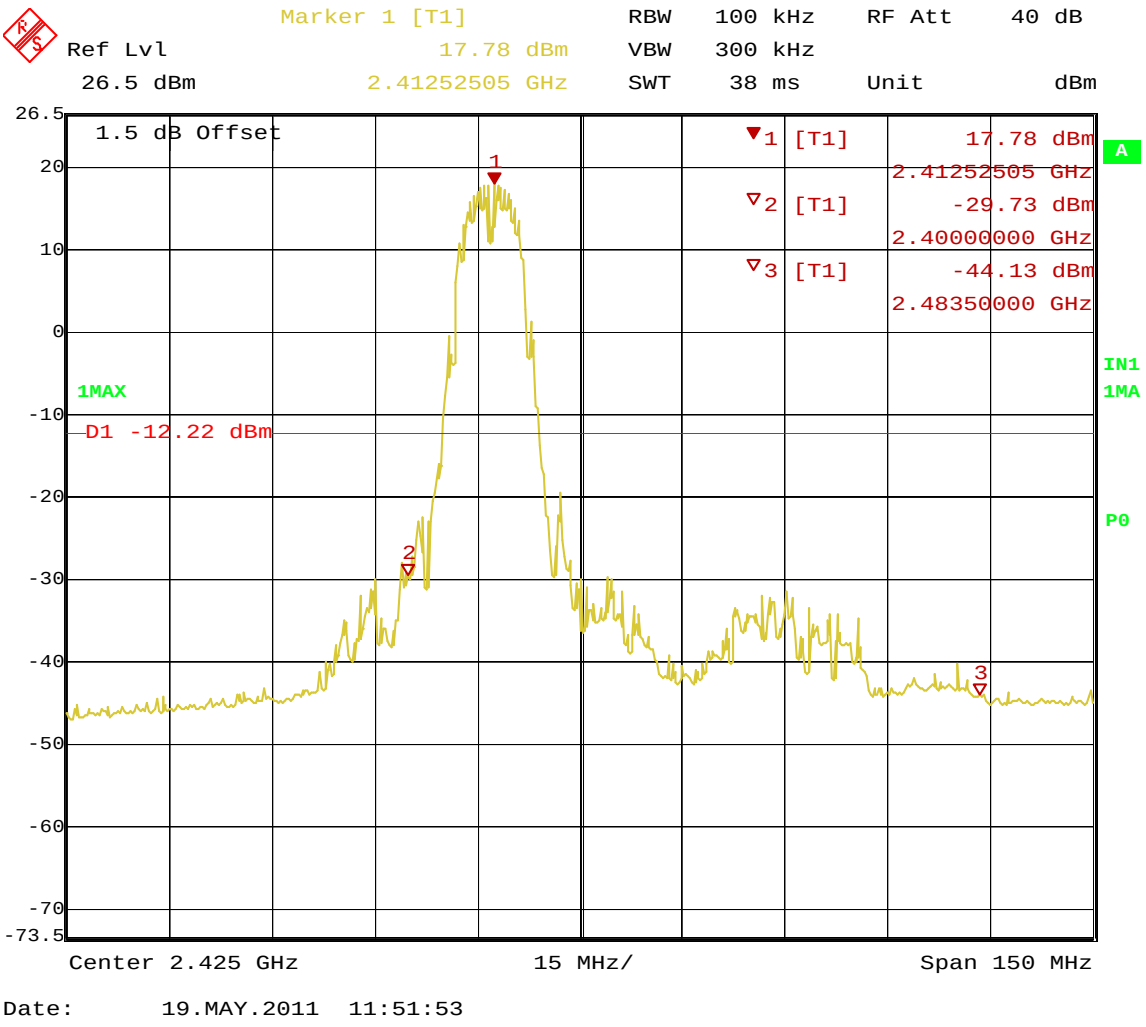


Figure 29: Band-edge Requirement at Operating Channel 2412 MHz, 1MBit/s

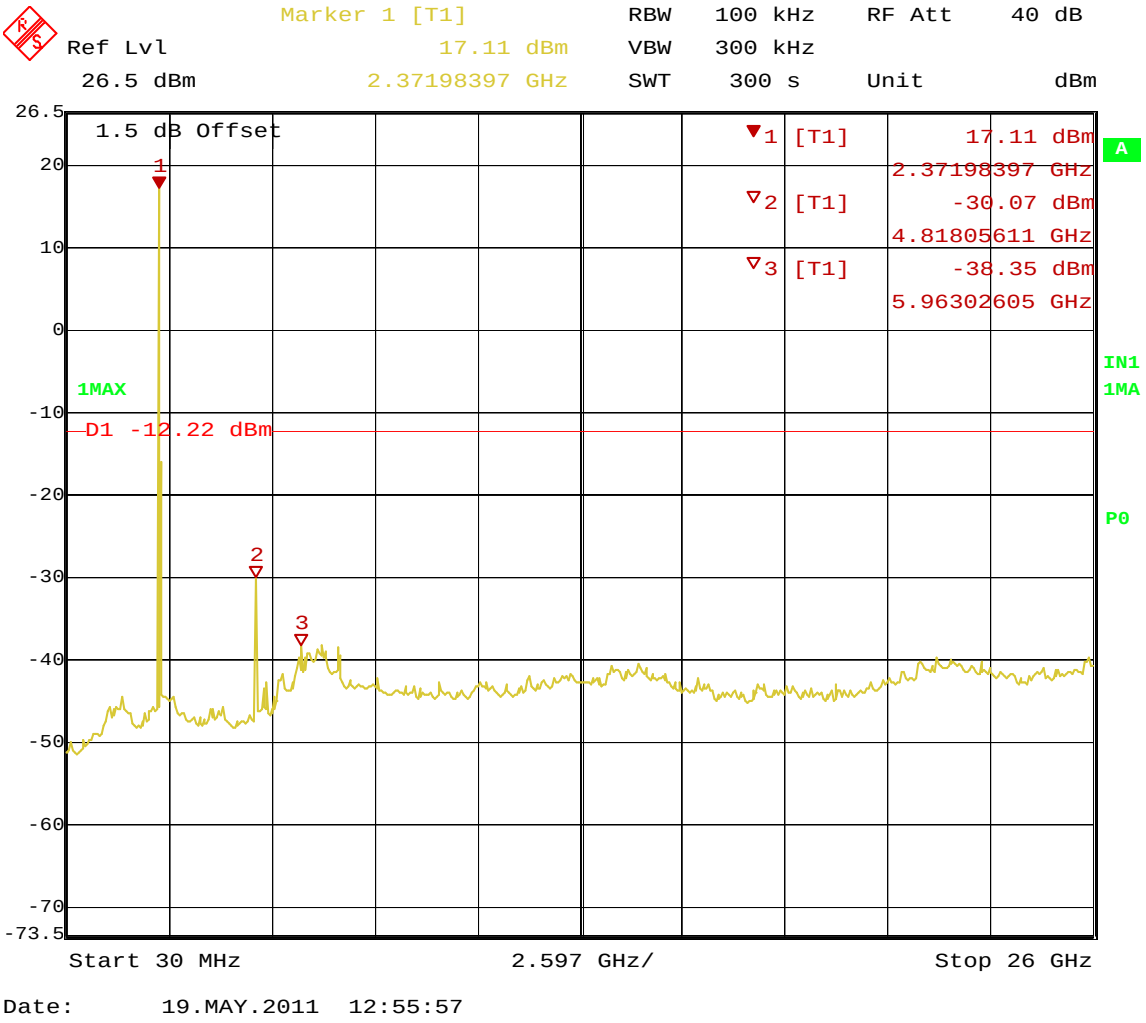


Figure 30: Out of Band Emission for Channel 2412 MHz at 1Mbit/s

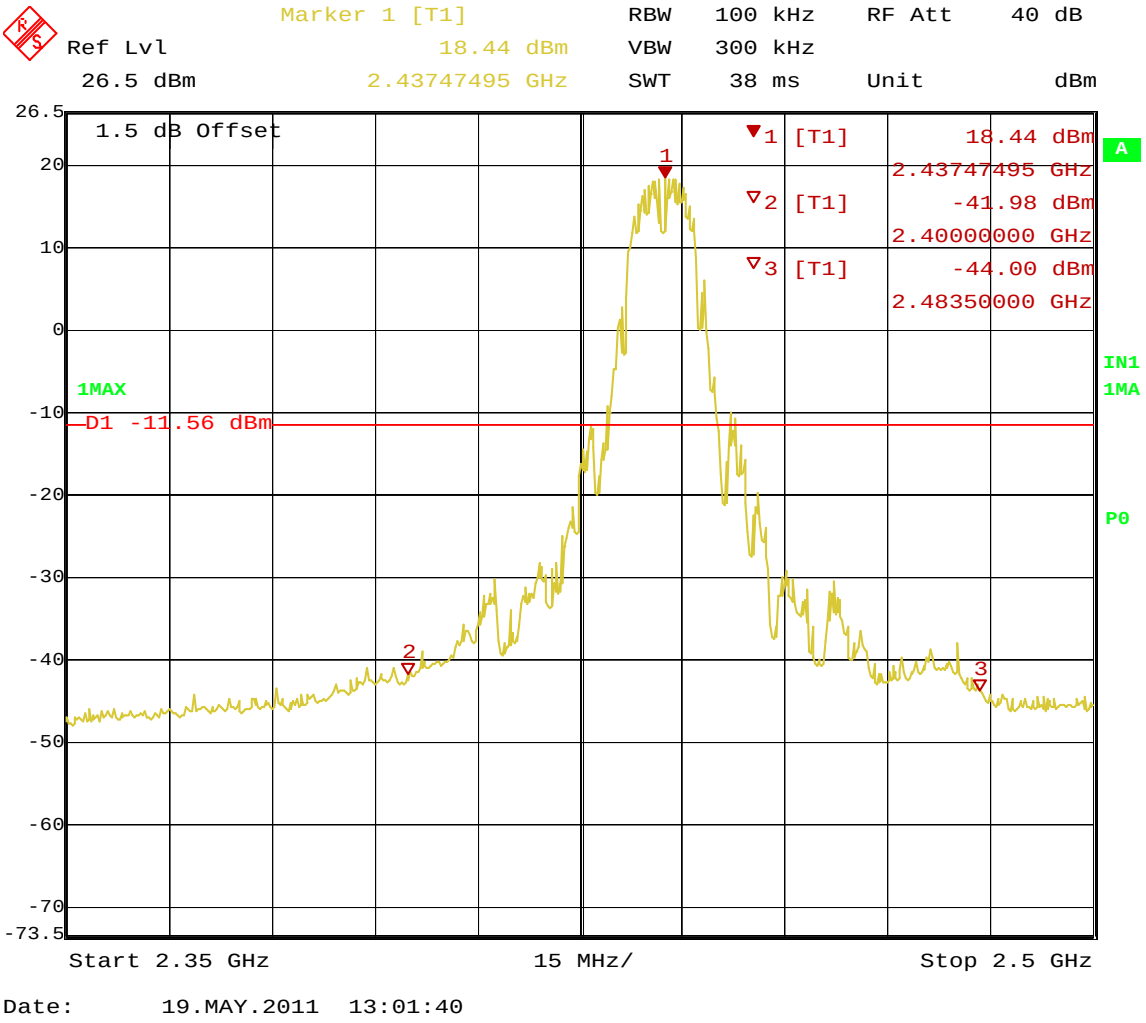


Figure 31: Band-edge Requirement at Operating Channel 2437 MHz, 1MBit/s

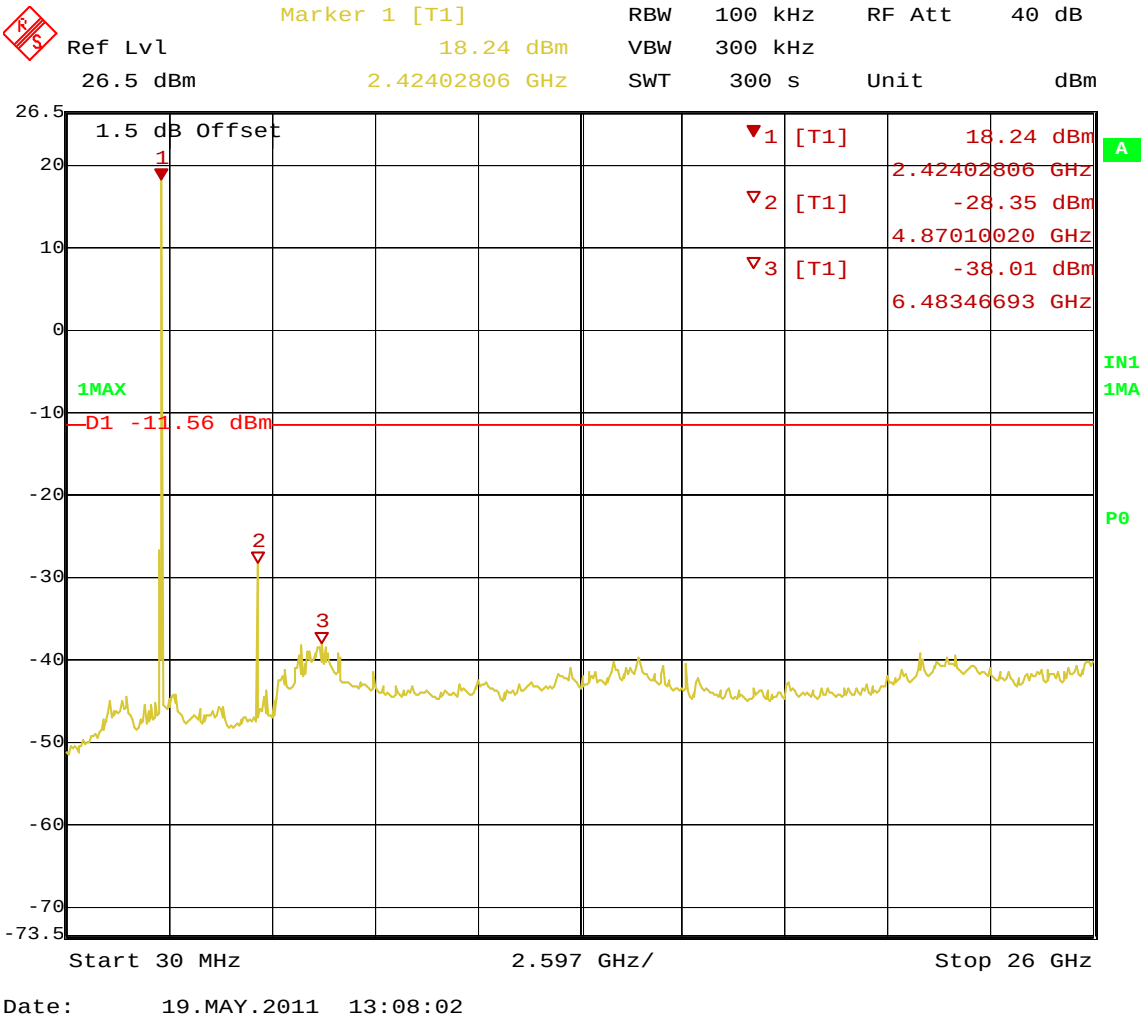


Figure 32: Out of Band Emission for Channel 2437 MHz at 1Mbit/s

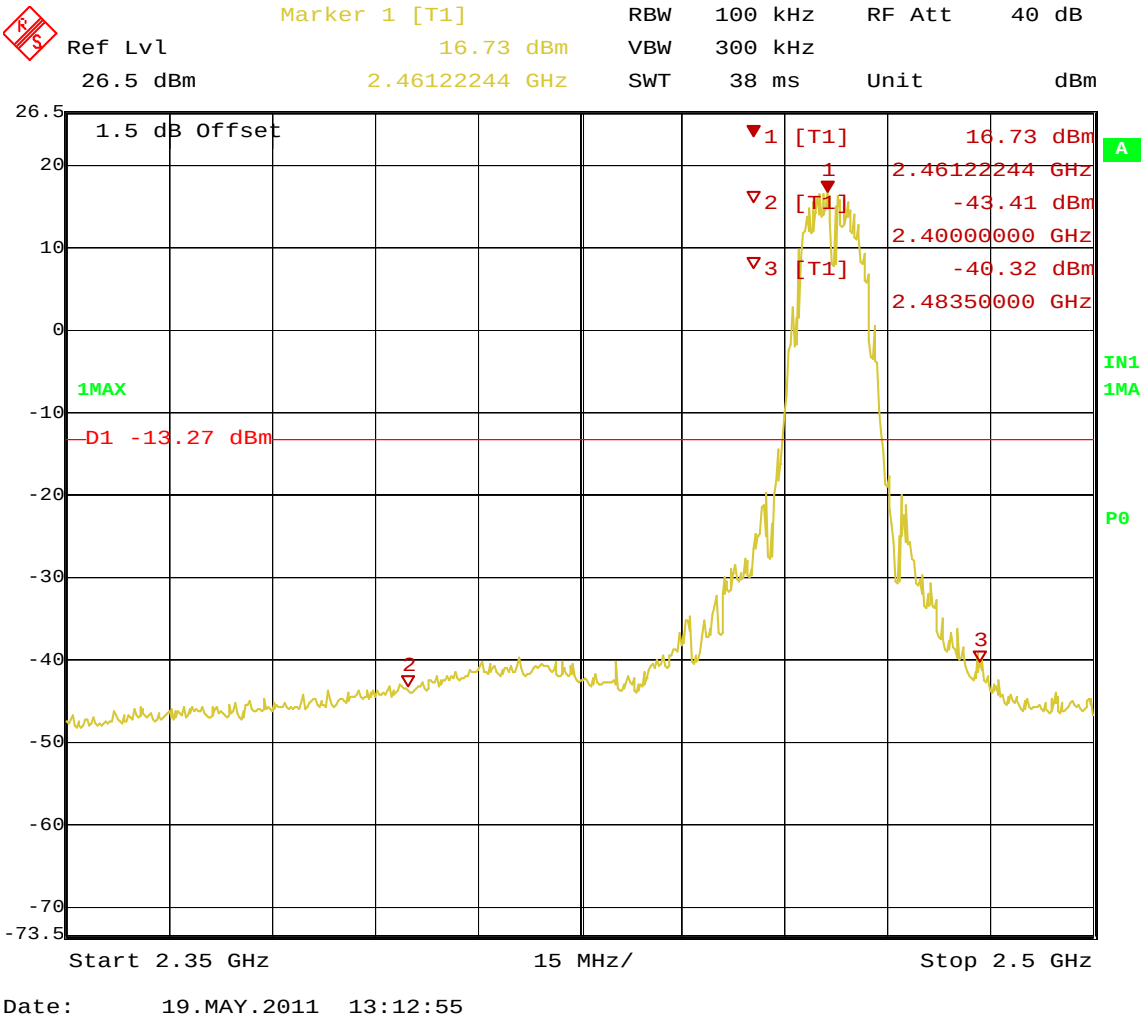


Figure 33: Band-edge Requirement at Operating Channel 2462 MHz, 1MBit/s

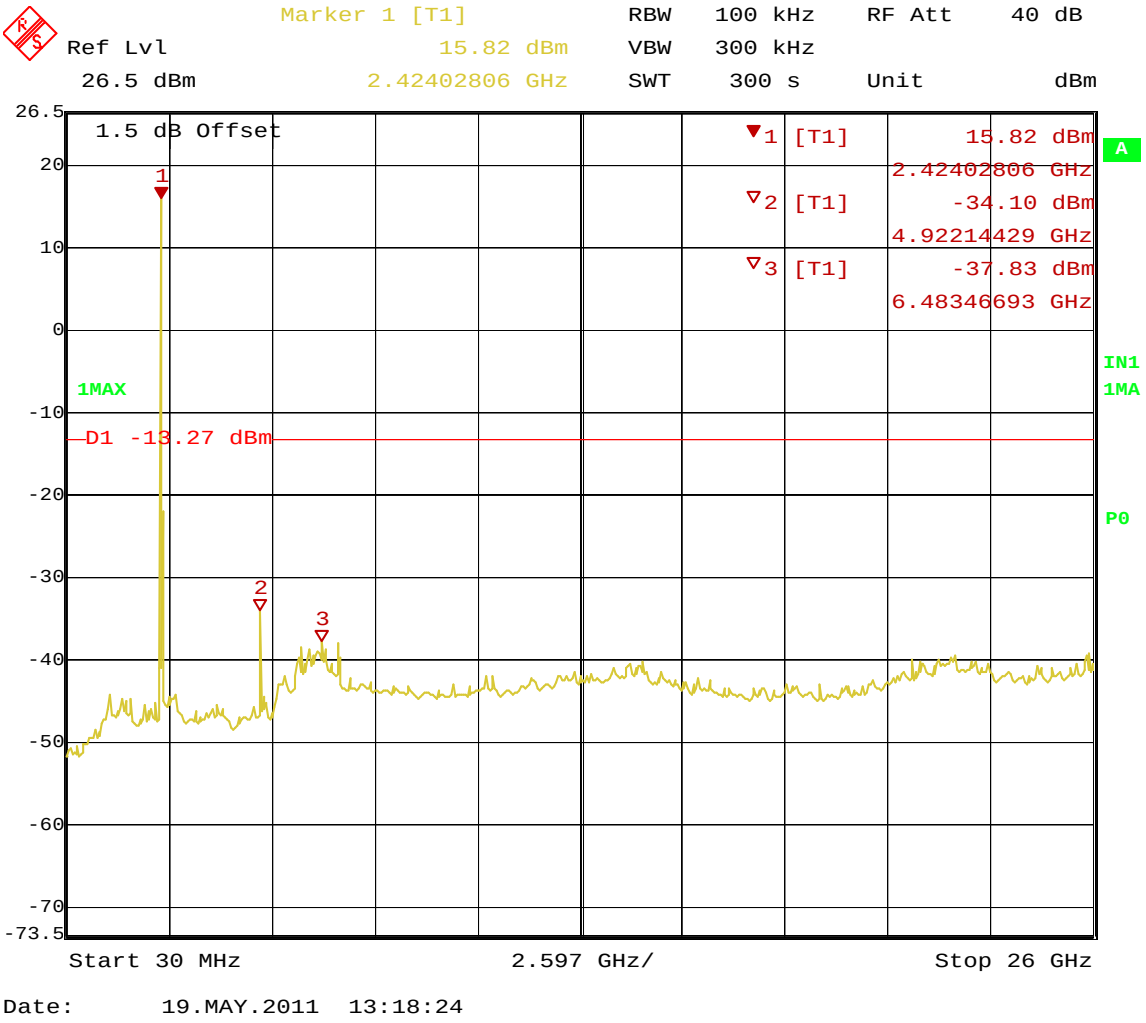


Figure 34: Out of Band Emission for Channel 2462 MHz at 1Mbit/s

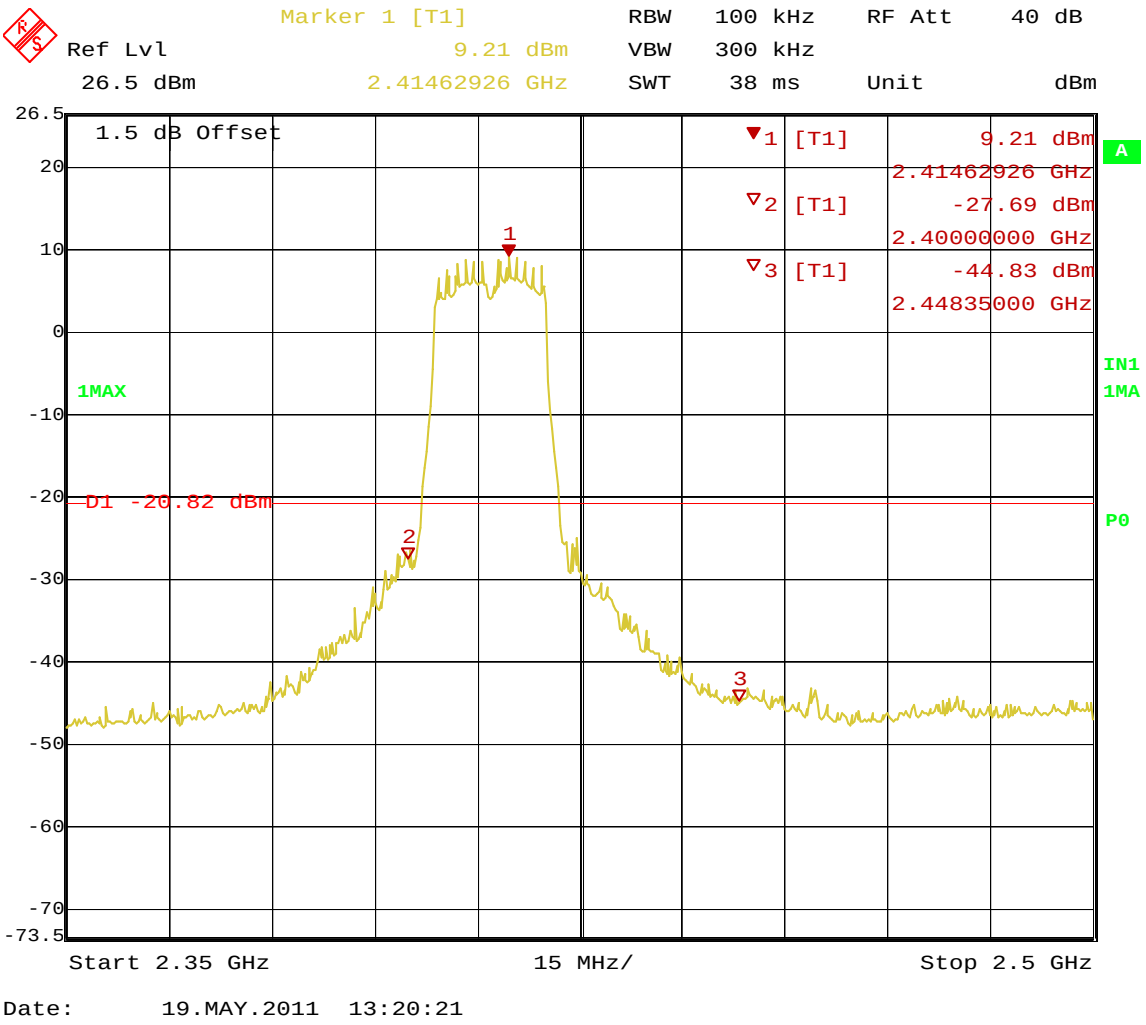


Figure 35: Band-edge Requirement at Operating Channel 2412 MHz, 6MBit/s

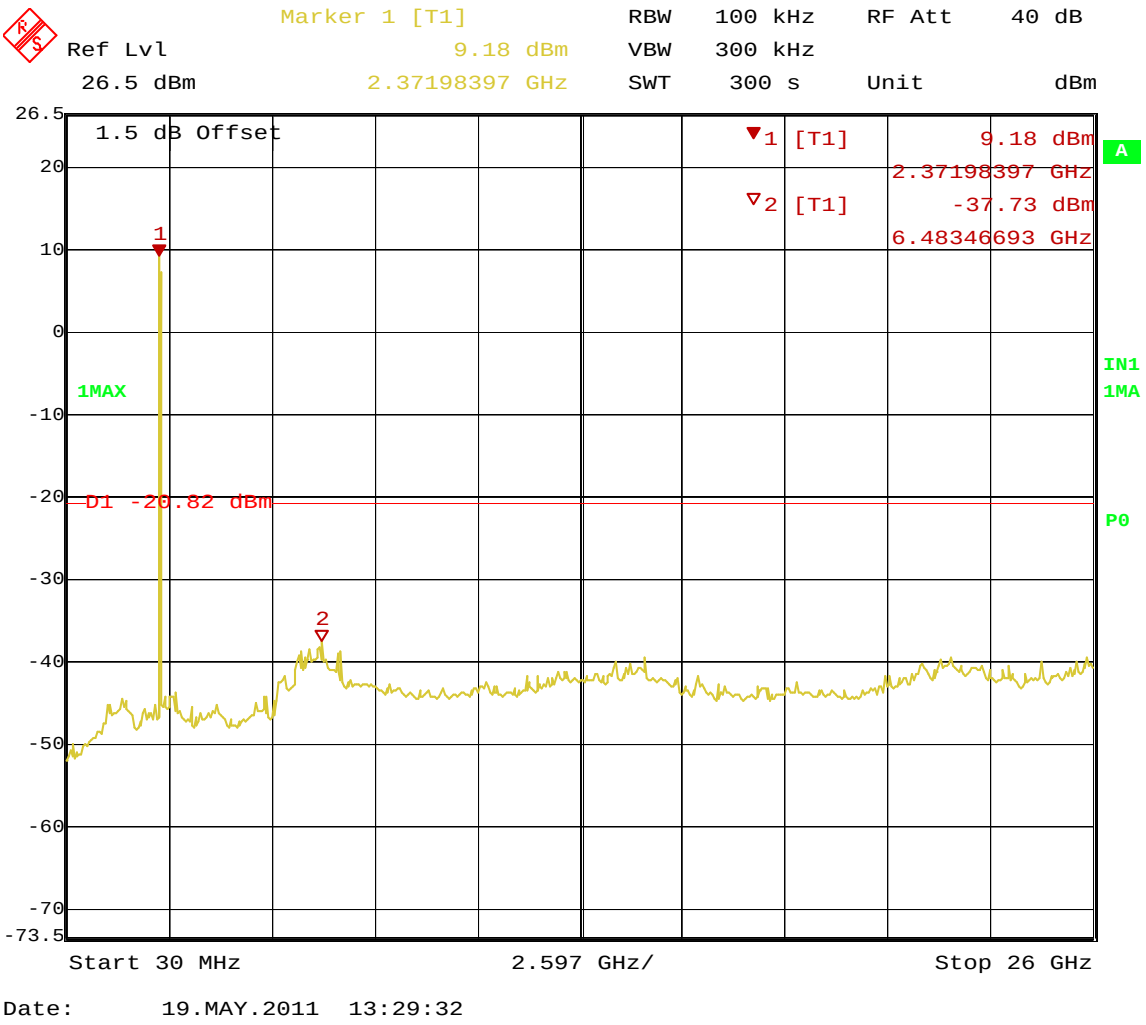


Figure 36: Out of Band Emission for Channel 2412 MHz at 6Mbit/s

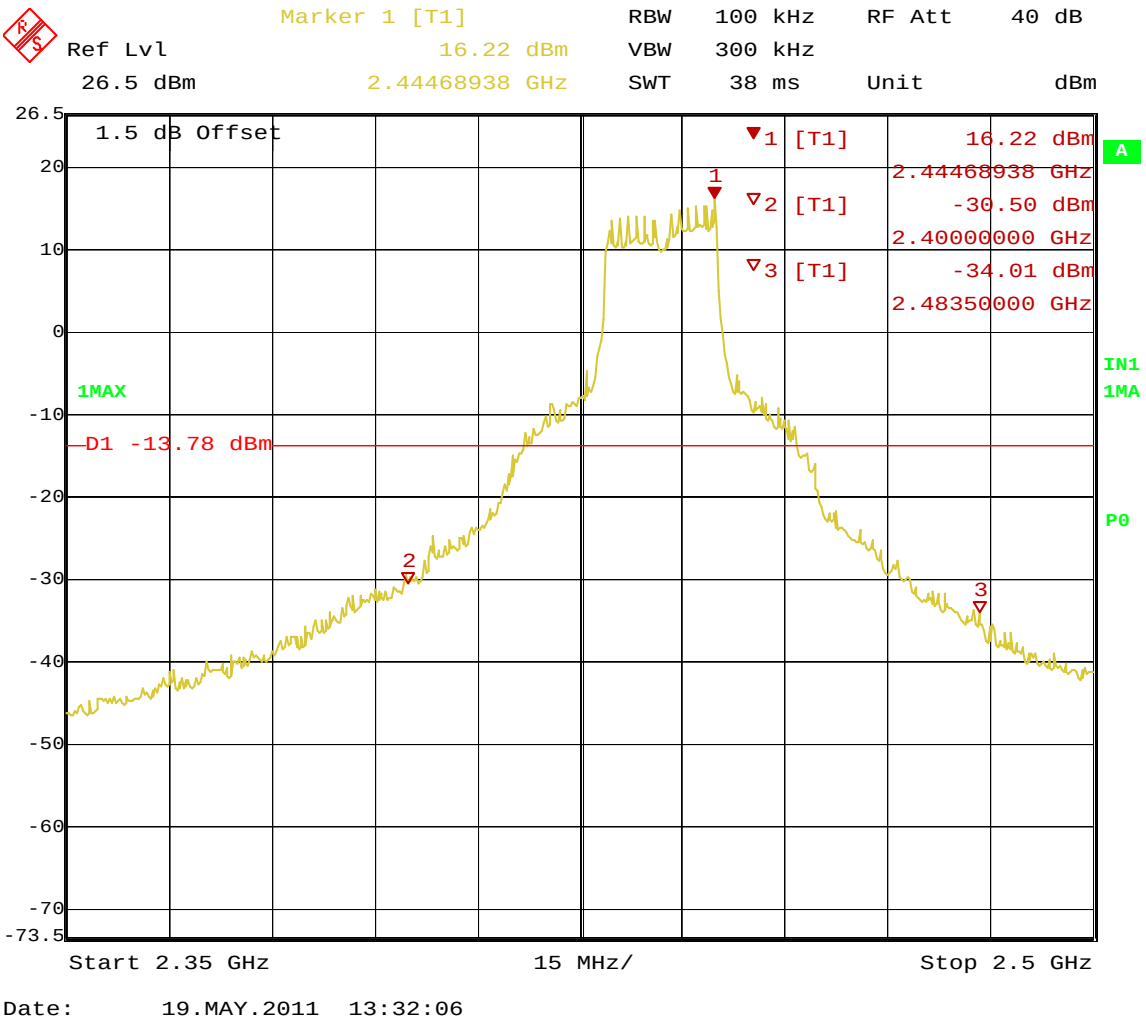


Figure 37: Band-edge Requirement at Operating Channel 2437 MHz, 6MBit/s

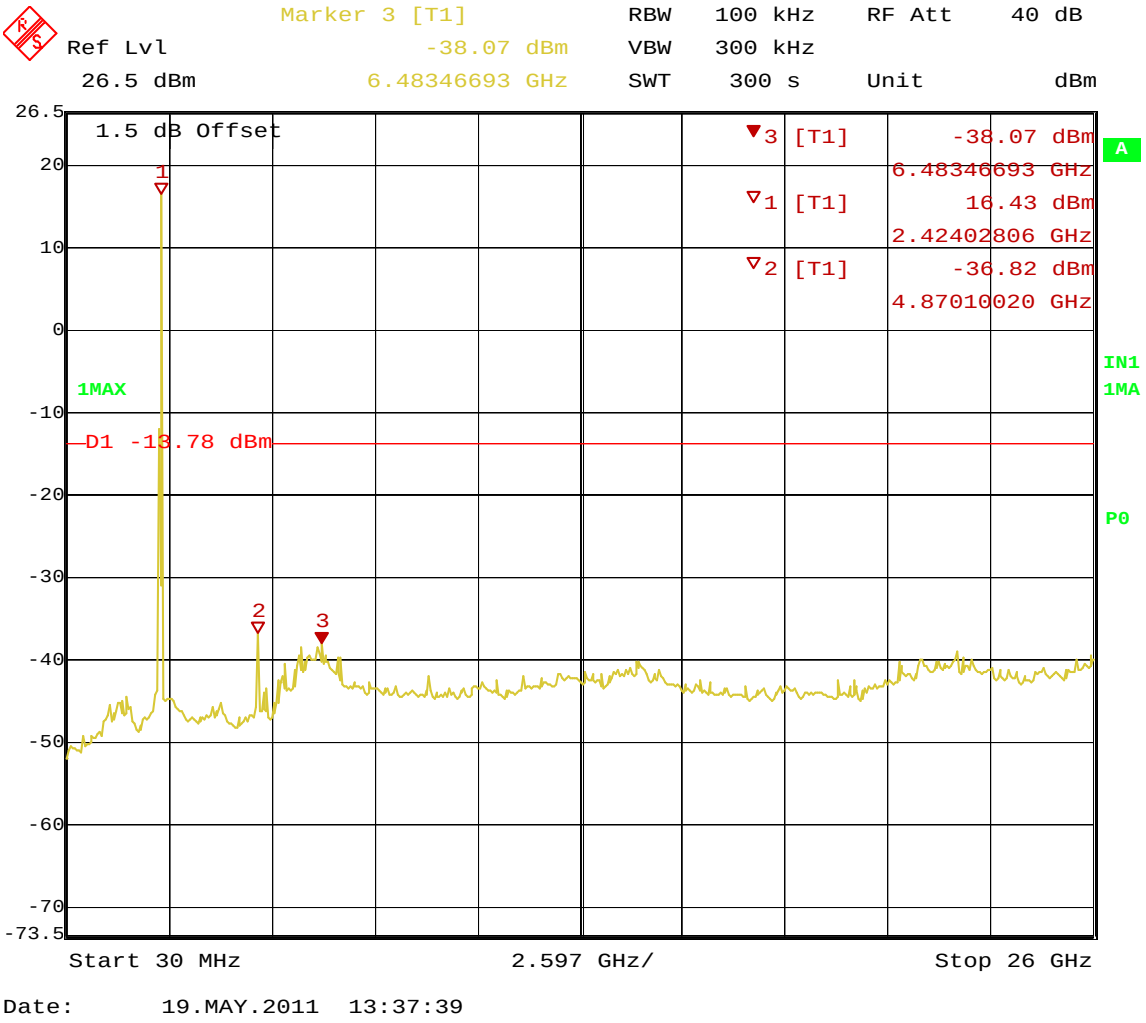


Figure 38: Out of Band Emission for Channel 2437 MHz at 6Mbit/s

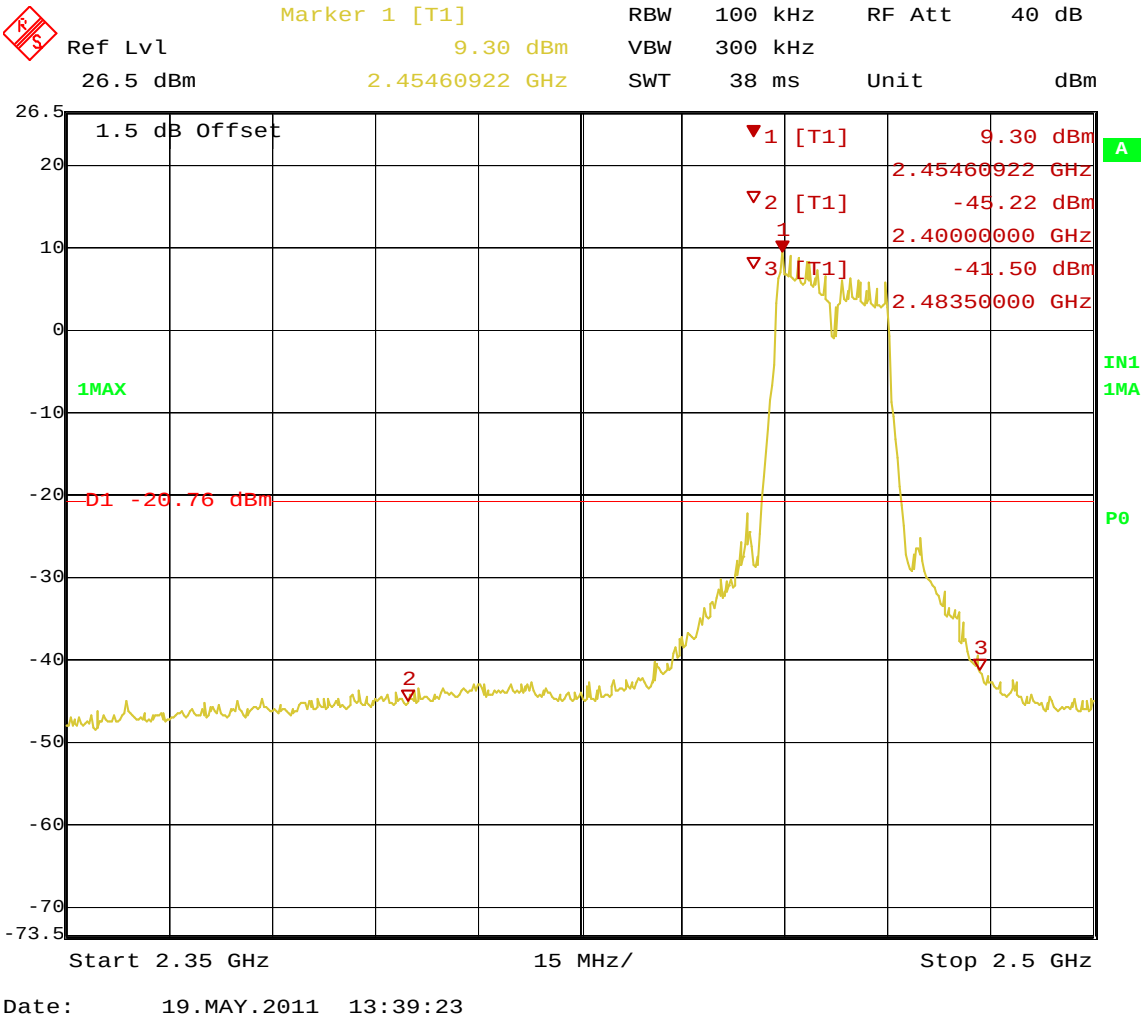


Figure 39: Band-edge Requirement at Operating Channel 2462 MHz, 6MBit/s

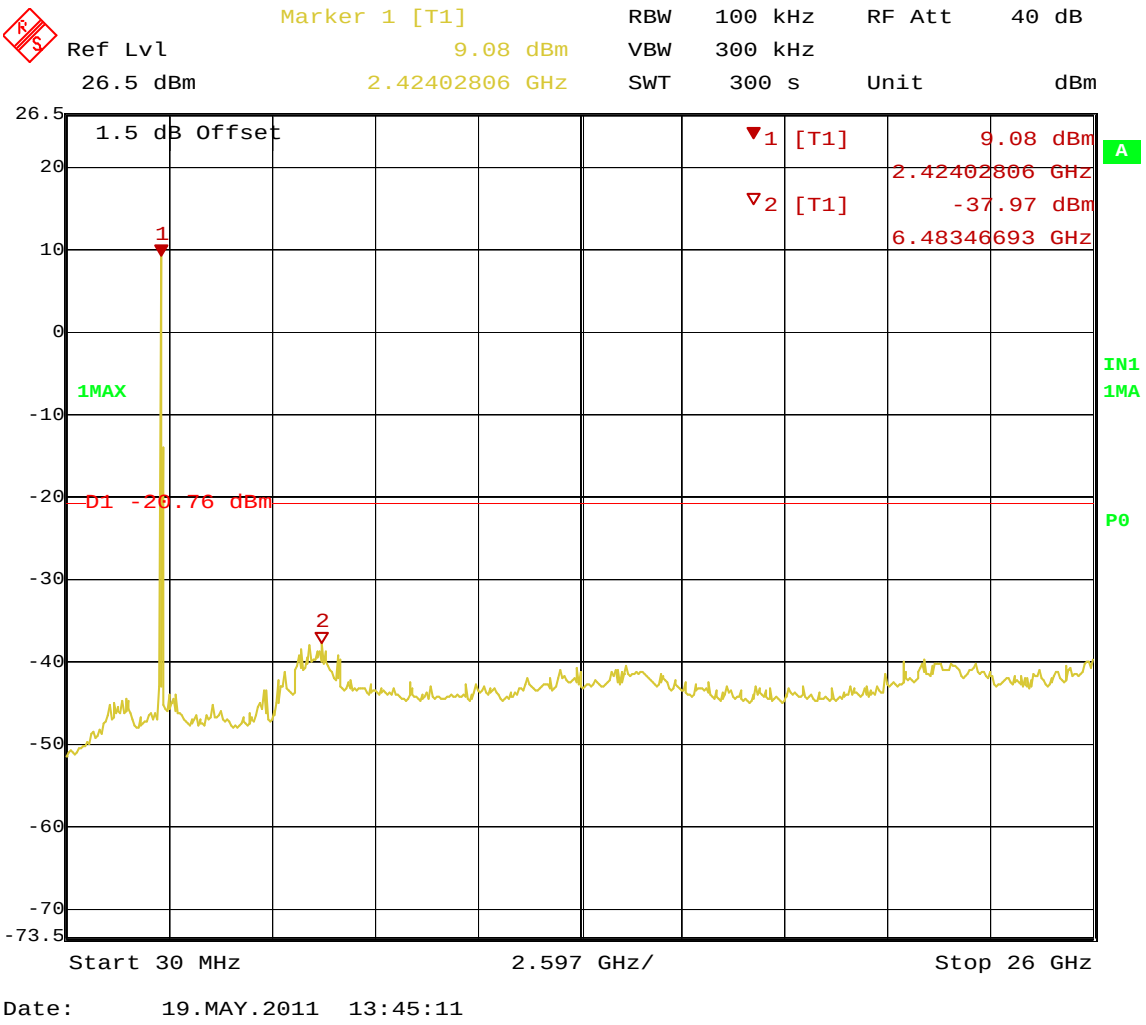


Figure 40: Out of Band Emission for Channel 2462 MHz at 6Mbit/s

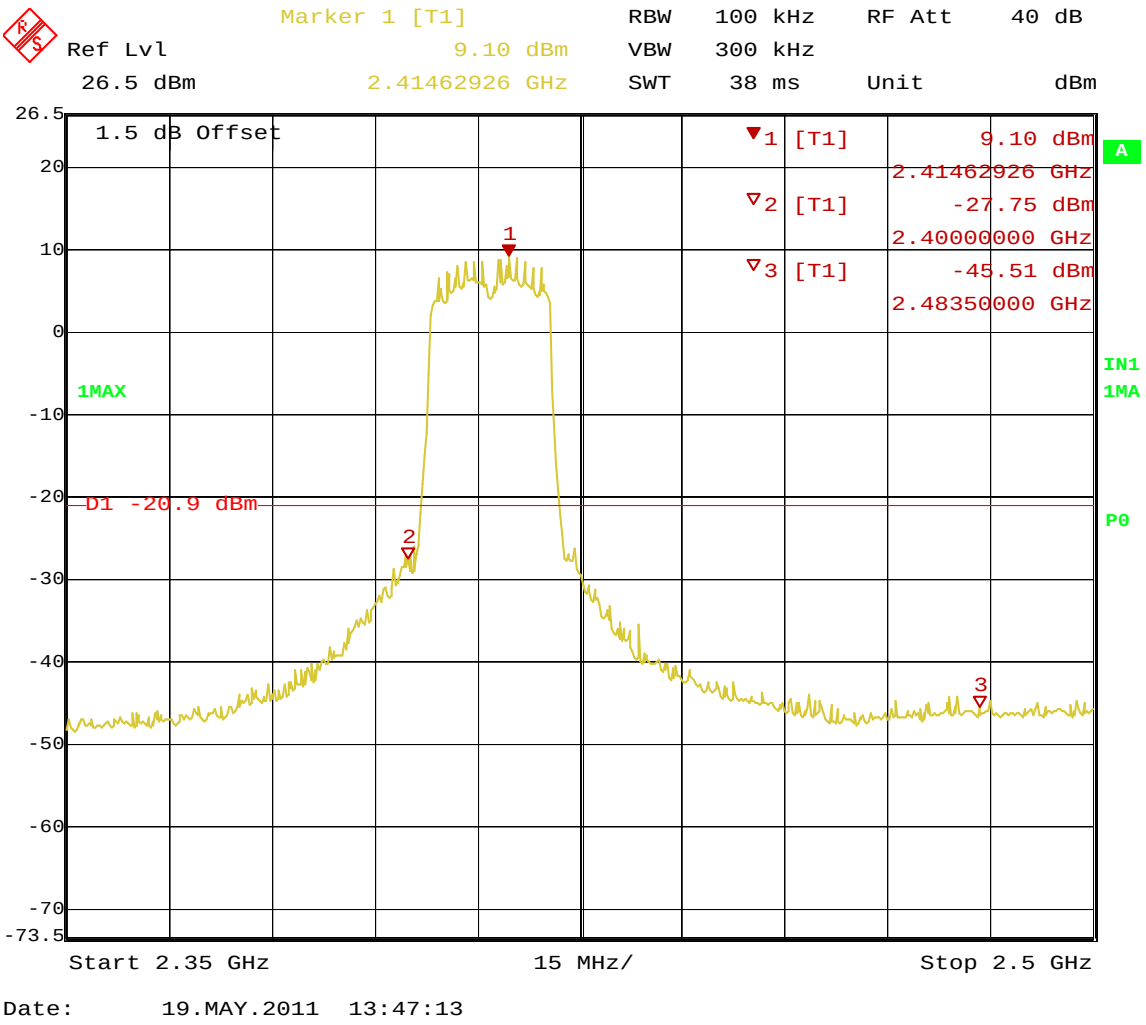


Figure 41: Band-edge Requirement at Operating Channel 2412 MHz, 6.5MBit/s

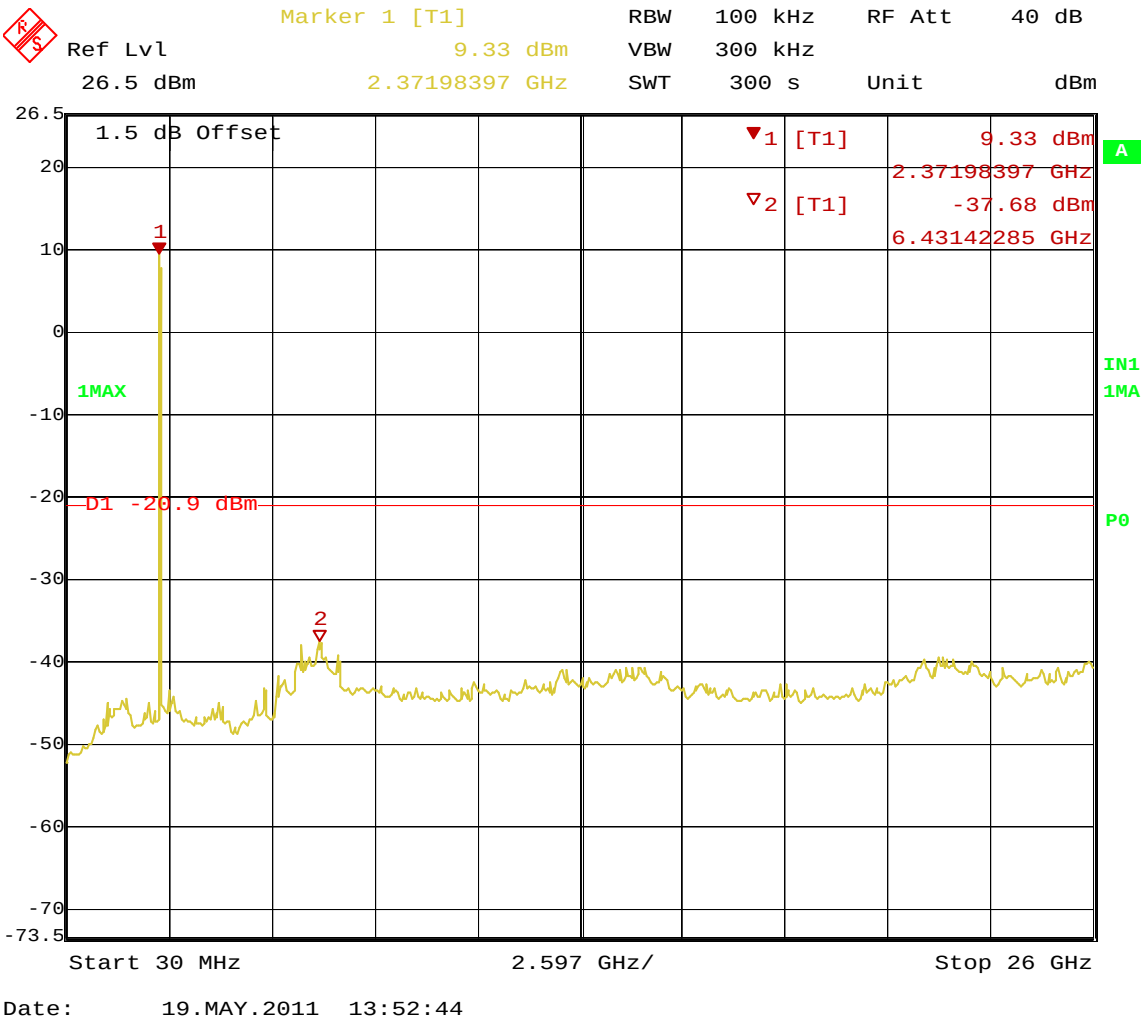


Figure 42: Out of Band Emission for Channel 2412 MHz at 6.5Mbit/s

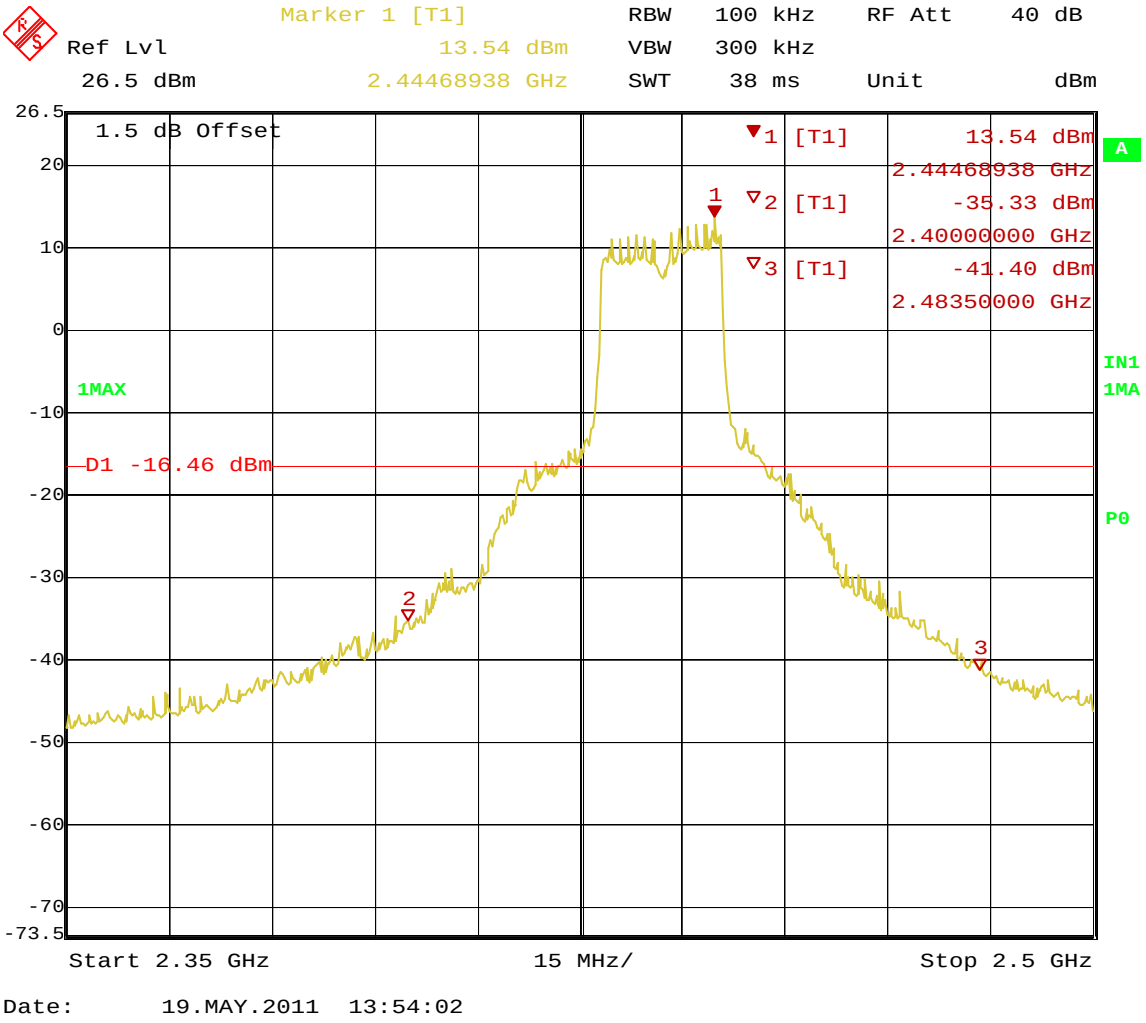


Figure 43: Band-edge Requirement at Operating Channel 2437 MHz, 6.5MBit/s

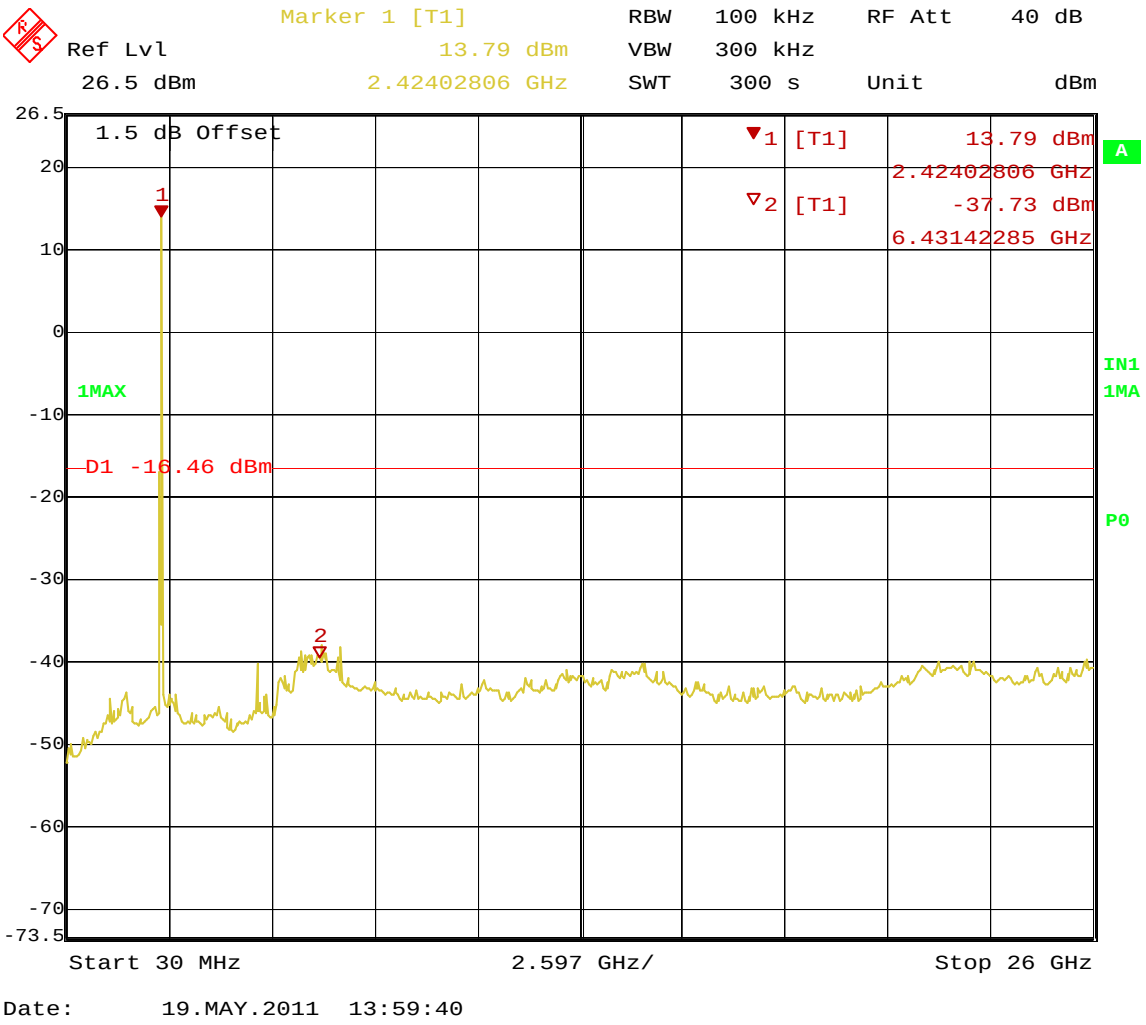


Figure 44: Out of Band Emission for Channel 2437 MHz at 6.5Mbit/s

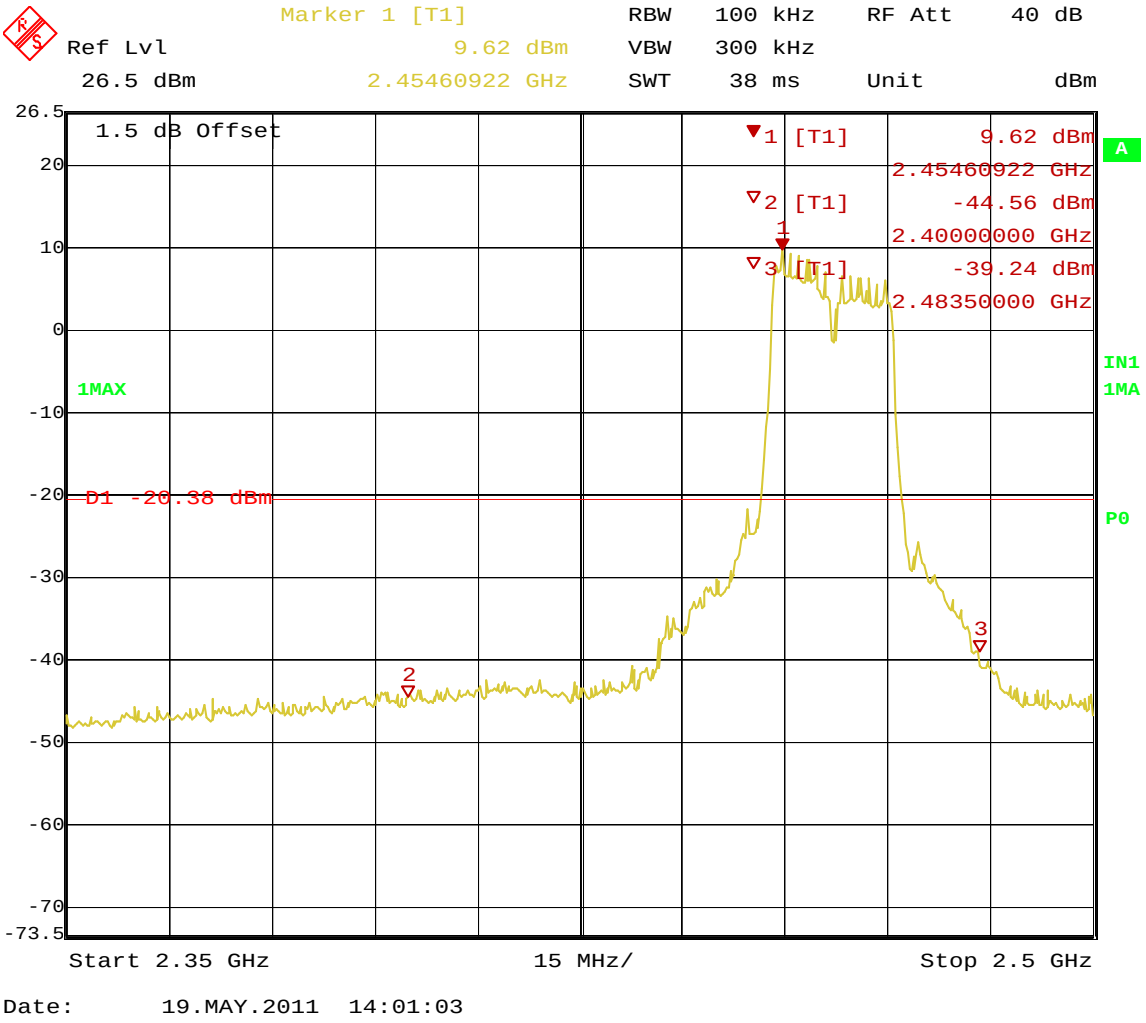


Figure 45: Band-edge Requirement at Operating Channel 2462 MHz, 6.5MBit/s

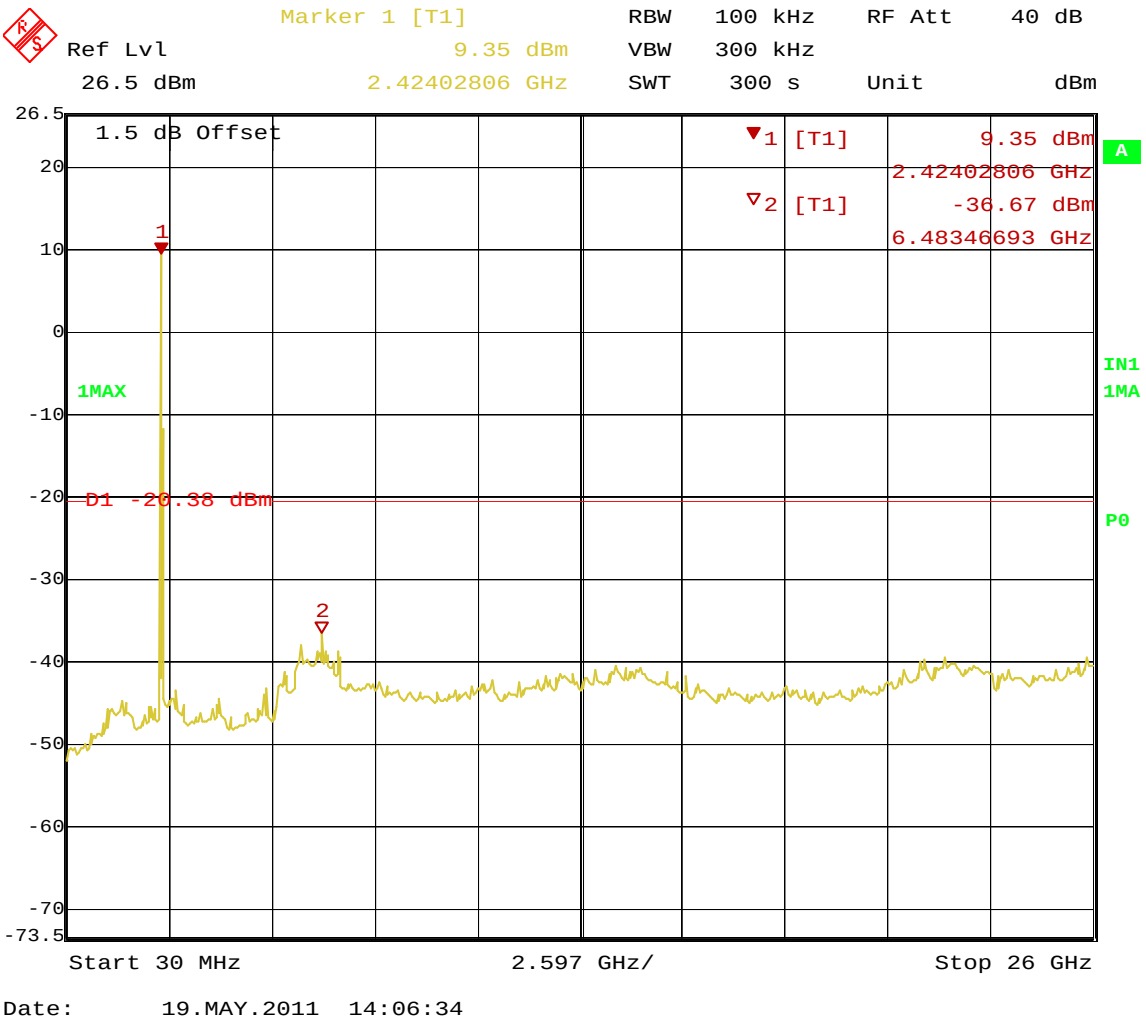


Figure 46: Out of Band Emission for Channel 2462 MHz at 6.5Mbit/s

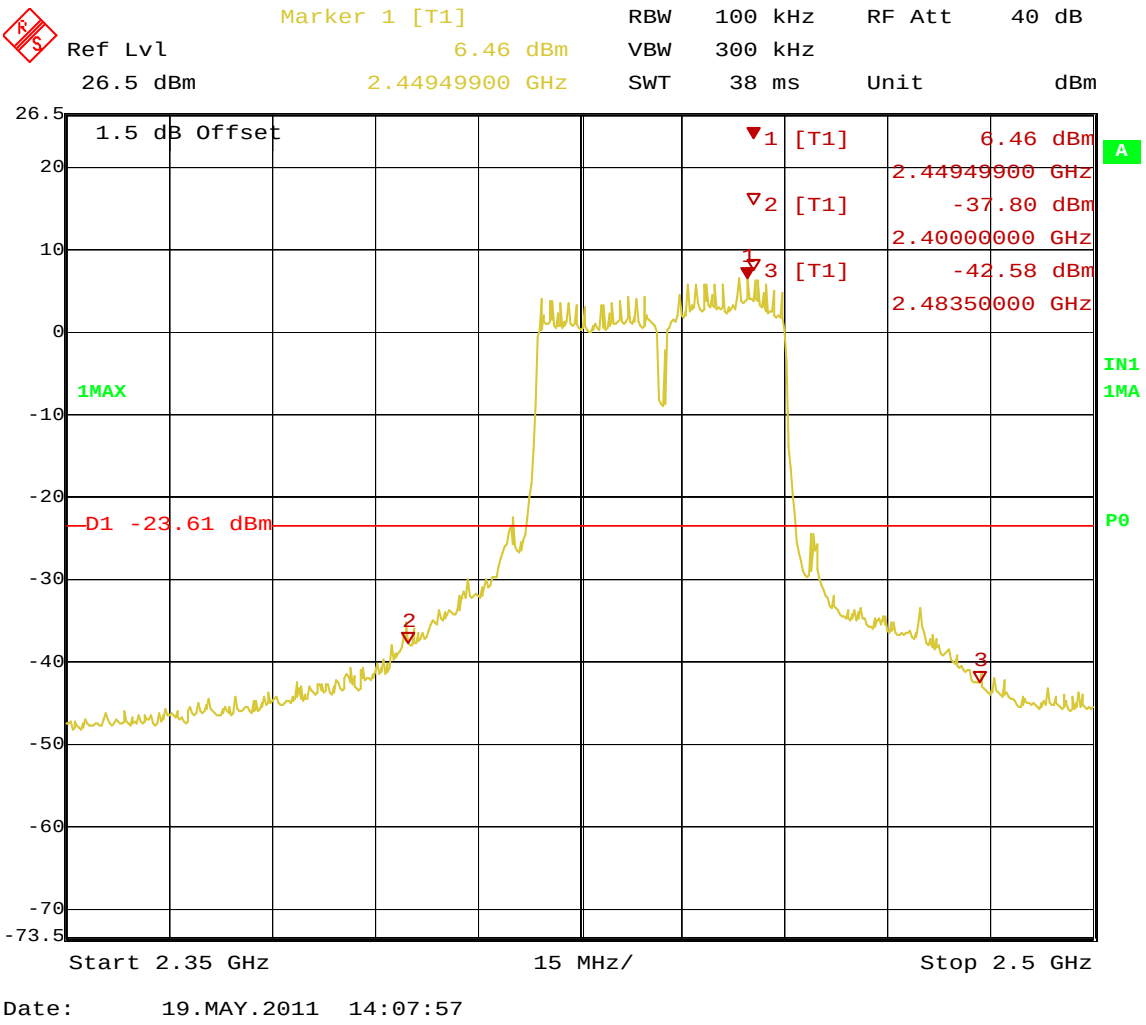


Figure 47: Band-edge Requirement at Operating Channel 2437 MHz, 13.5MBit/s

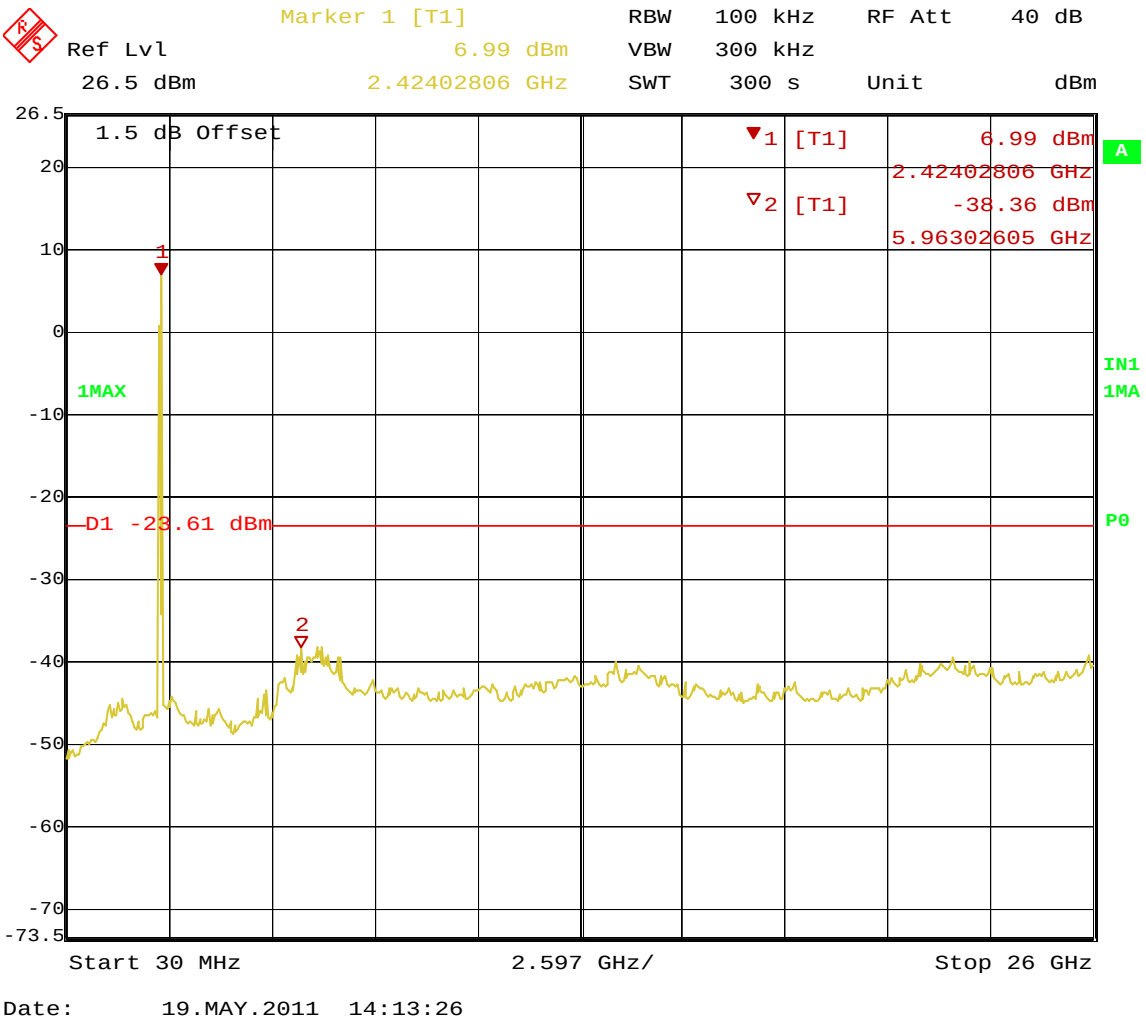


Figure 48: Out of Band Emission for Channel 2437 MHz at 13.5Mbit/s

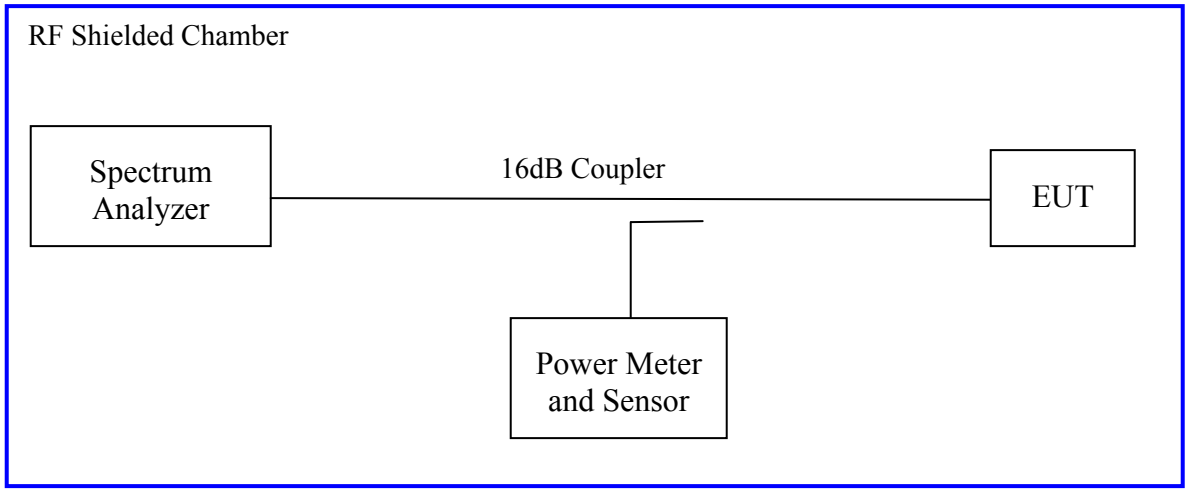
4.4 Peak Power Spectral Density

According to the CFR47 Part 15.247 (e) and RSS 210 (A8.2), the spectral power density output of the antenna port shall be less than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

4.4.1 Test Method

The conducted method was used to measure the channel power output per ANSI C63.10:2009 Section 6.11.2. The measurement was performed with modulation per CFR47 Part 15.247 (e) and RSS 210 (A8.2). This test was conducted on 3 channels of Sample SN 131104000001. The worst sample result indicated below.

Test Setup:



4.4.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 8: Peak Power Spectral Density – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only							
Antenna Type: Integrated			**Power Setting:** See test plan				
Max. Antenna Gain: + 3.0 dBi			**Signal State:** Modulated				
Ambient Temp.: 21 °C			**Relative Humidity:**39%				
Peak Power Spectral Density							
Freq. (MHz)	**Mode**	**Chain 0 [dBm]**	**Chain 1 [dBm]**	**CF [dB]**	**Max. PPSD [dBm]**	**Limit [dBm]**	**Margin [dB]**
2412	1Mbps	0.757			0.757	8.00	-7.24
2437	1Mbps	3.292			3.292	8.00	-4.71
2462	1Mbps	-0.470			-0.470	8.00	-8.47
2412	6 Mbps	-4.945			-4.945	8.00	-12.95
2437	6 Mbps	0.788			0.788	8.00	-7.21
2462	6 Mbps	-3.914			-3.914	8.00	-11.91
2412	HT20 6.5 Mbps	-3.900			-3.900	8.00	-11.90
2437	HT20 6.5 Mbps	0.778			0.778	8.00	-7.22
2462	HT20 6.5 Mbps	-2.946			-2.946	8.00	-10.95
2412	HT20 13 Mbps	-7.198	-7.290	3.01	-4.280	8.00	-12.28
2437	HT20 13 Mbps	0.426	-2.611	3.01	3.436	8.00	-4.56

2462	HT20 13 Mbps	-6.381	-8.218	3.01	-3.371	8.00	-11.37
2437	HT40 13.5 Mbps	-6.181			-6.181	8.00	-14.18
2437	HT40 27 Mbps	-6.571	-5.197	3.01	-2.187	8.00	-10.19
Note: CF was accounted for the number of data streams being used, 10*Log(N) per KDB 662911; where N is number of outputs.							

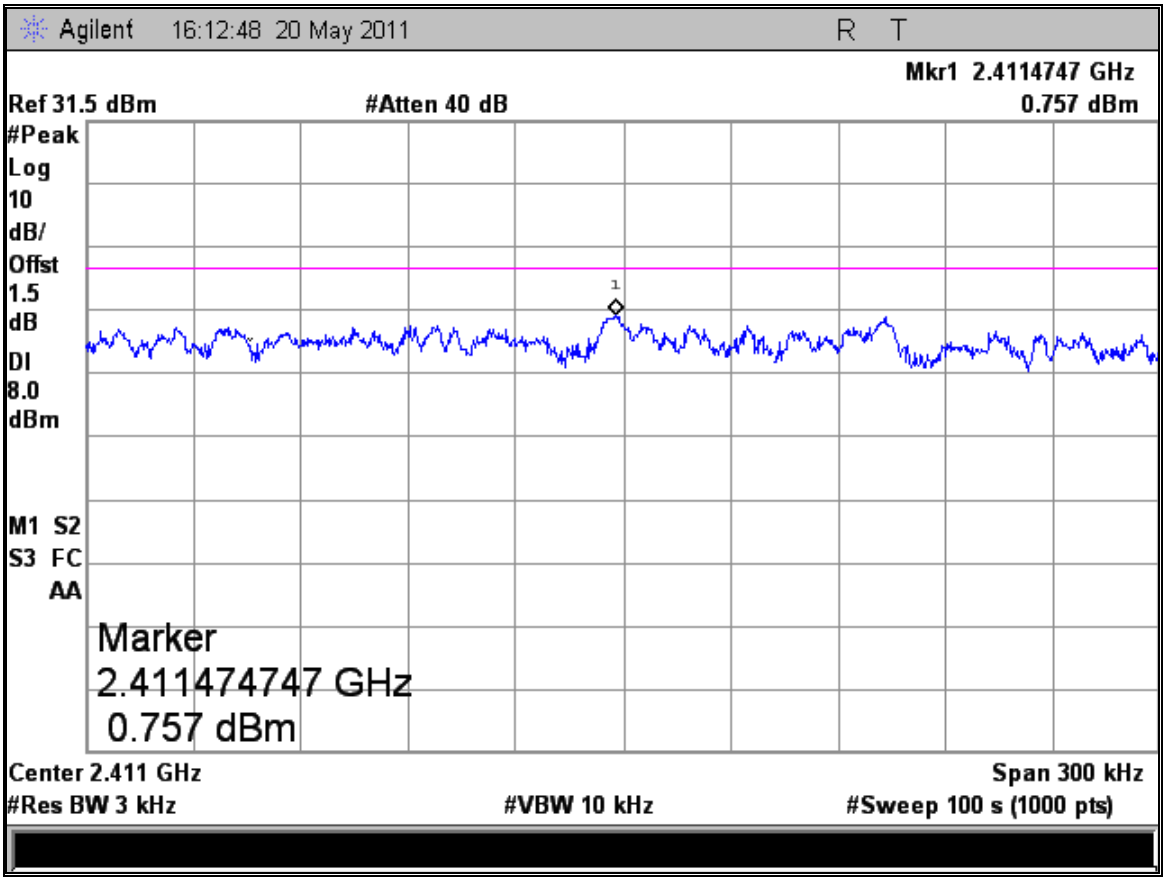


Figure 49: Peak Power Spectral Density for Operating Channel 2412 MHz, Ch 0 – 1Mbps

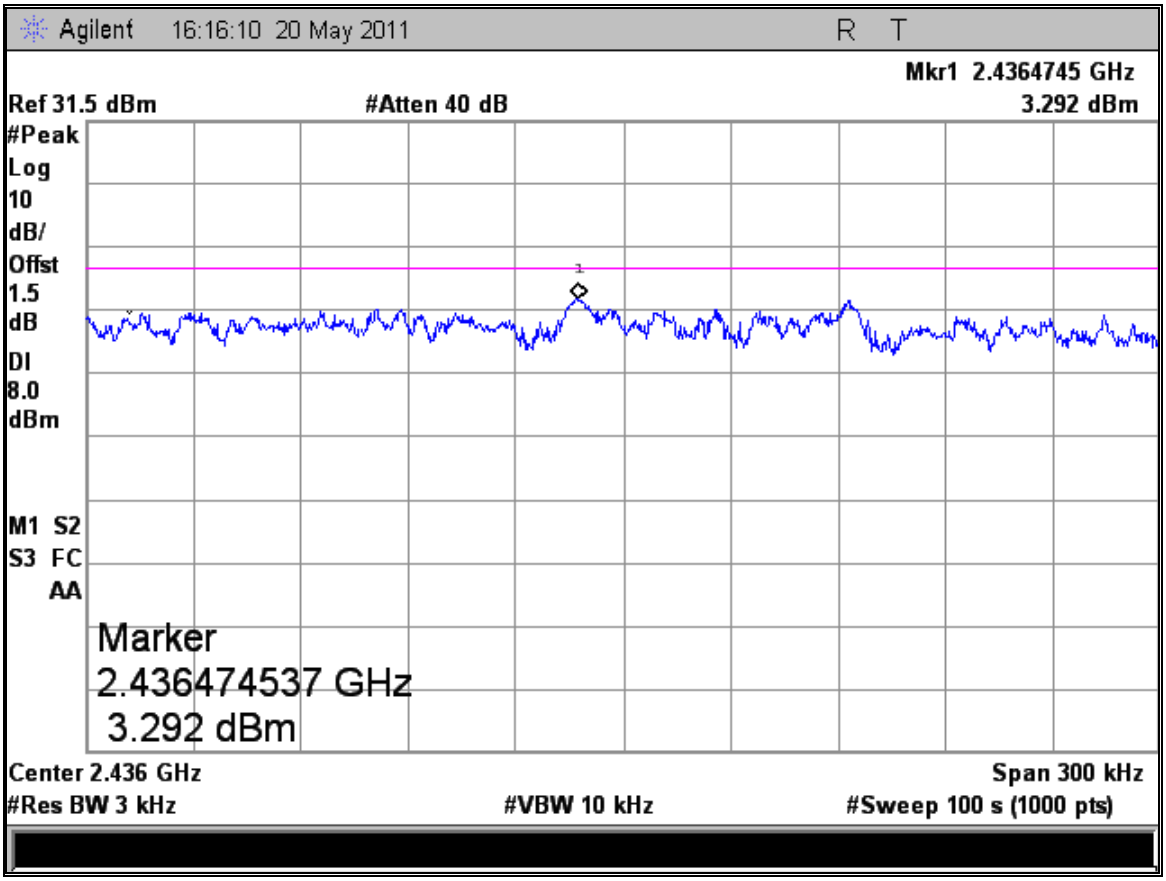


Figure 50: Peak Power Spectral Density for Operating Channel 2437 MHz, Ch 0 – 1Mbps

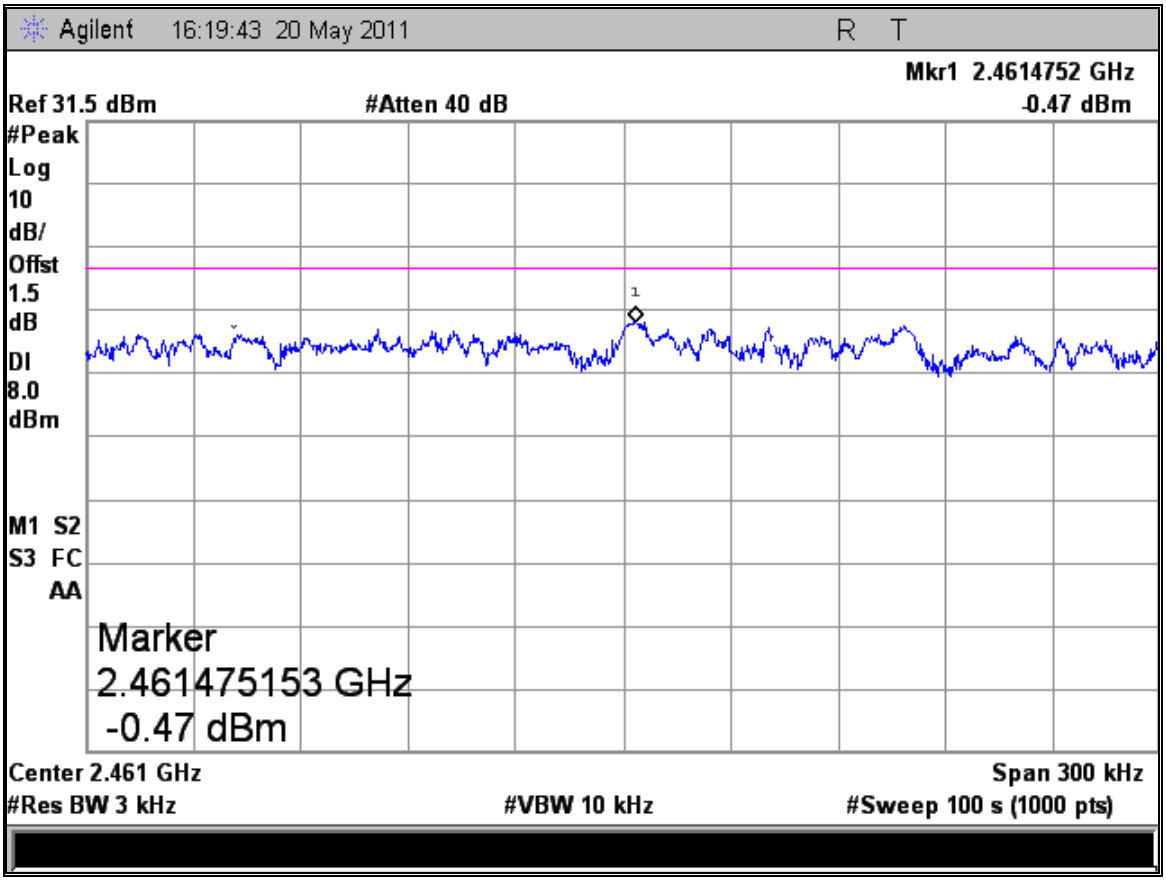


Figure 51: Peak Power Spectral Density for Operating Channel 2462 MHz, Ch 0 – 1Mbps

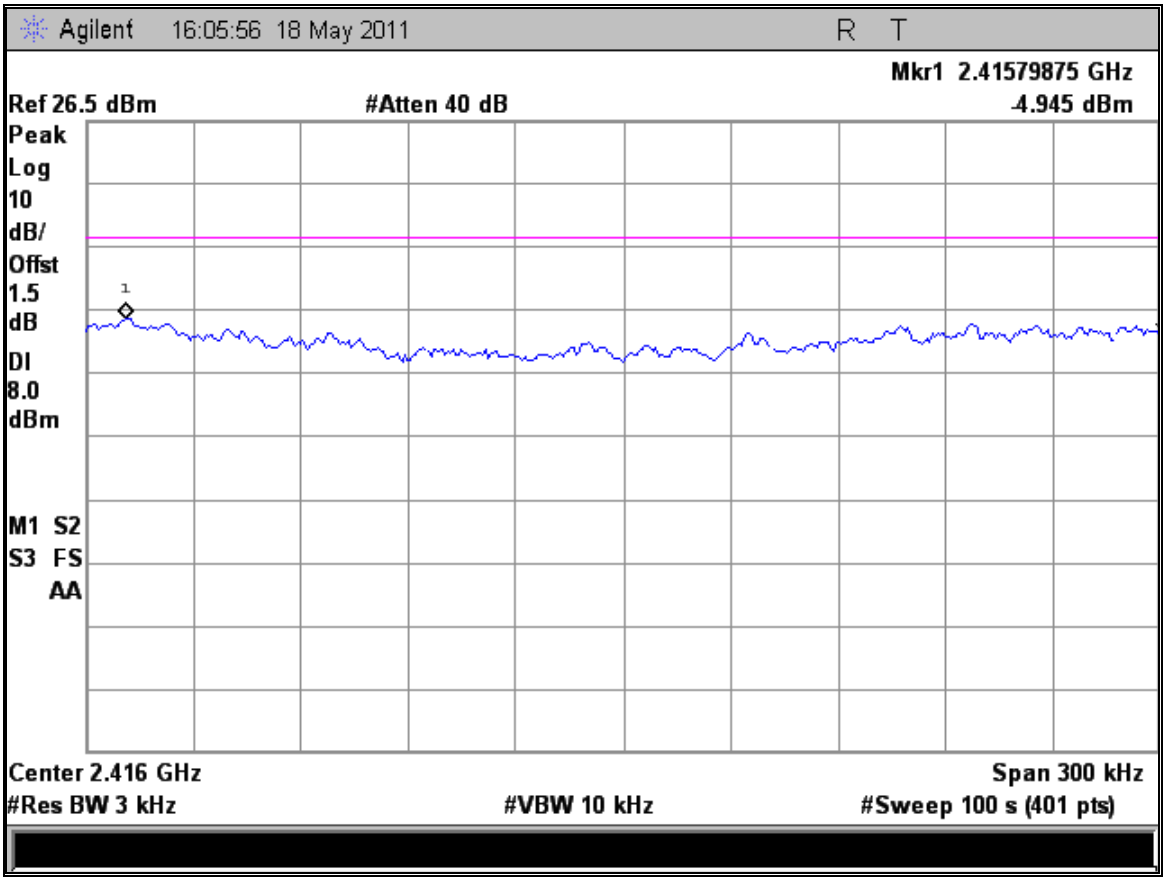


Figure 52: Peak Power Spectral Density for Operating Channel 2412 MHz, Ch 0 – 6Mbps

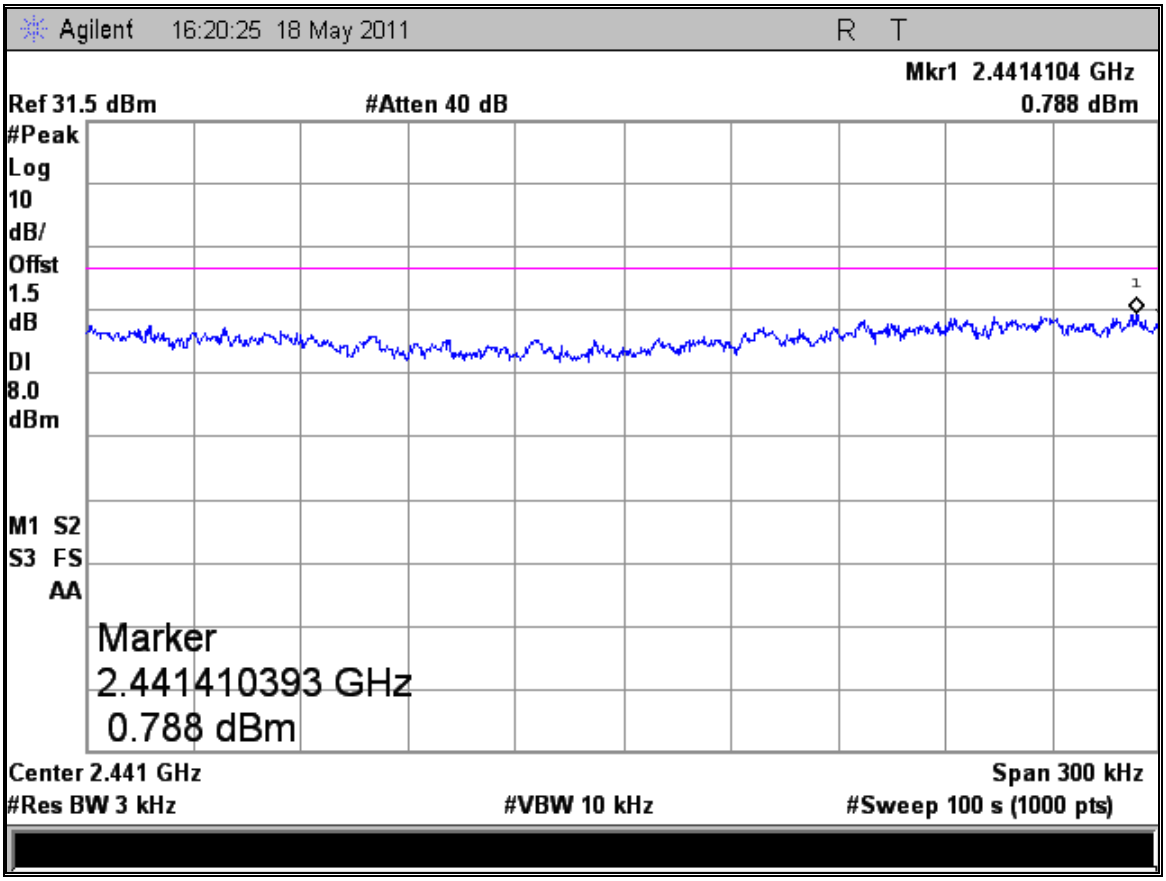


Figure 53: Peak Power Spectral Density for Operating Channel 2437 MHz, Ch 0 – 6Mbps

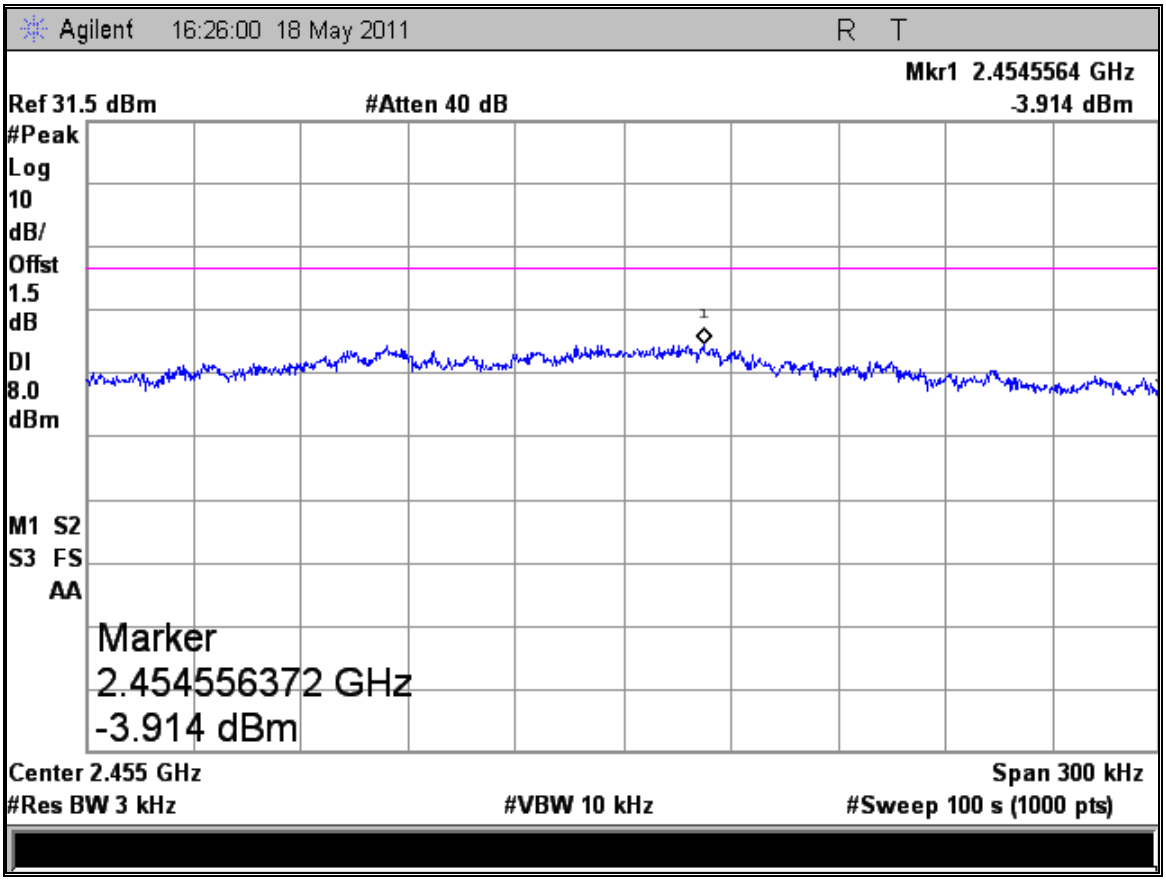


Figure 54: Peak Power Spectral Density for Operating Channel 2462 MHz, Ch 0 – 6Mbps

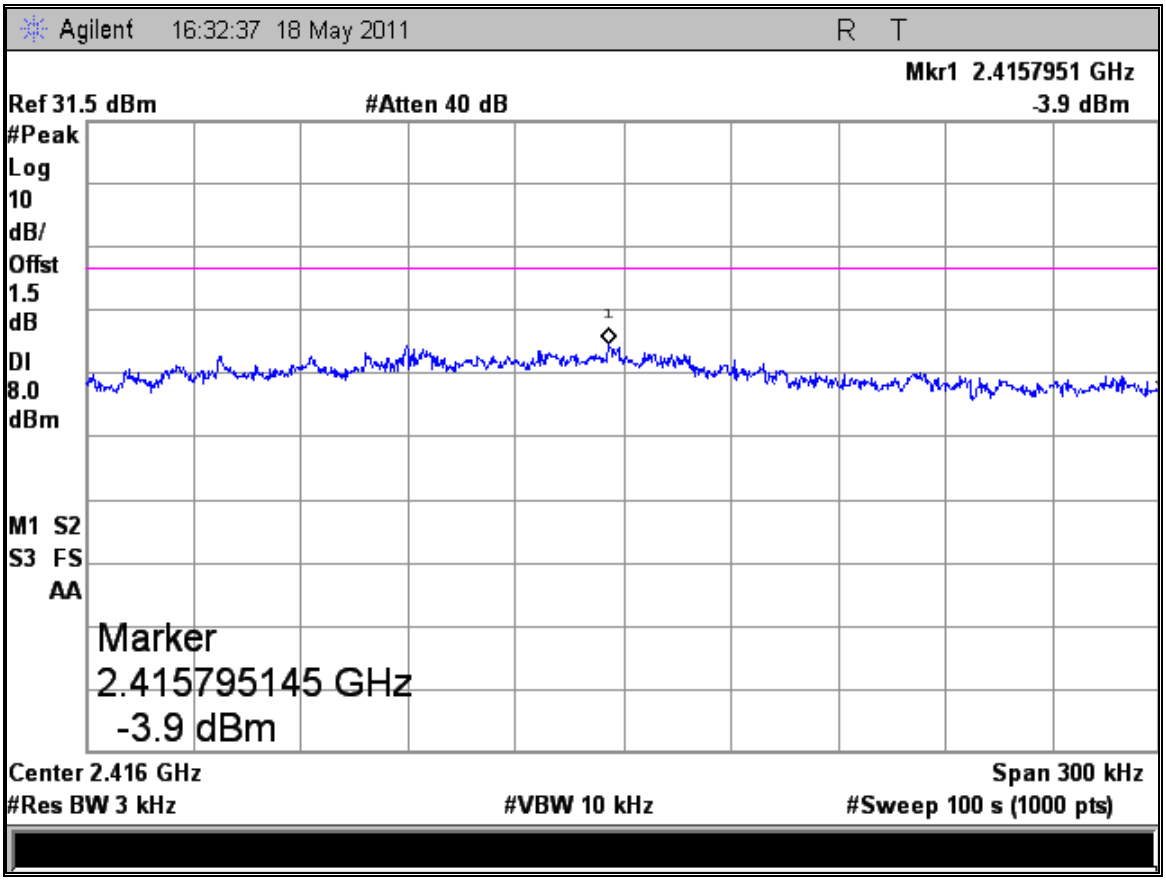


Figure 55: Peak Power Spectral Density for Operating Channel 2412 MHz, Ch 0 – 6.5Mbps

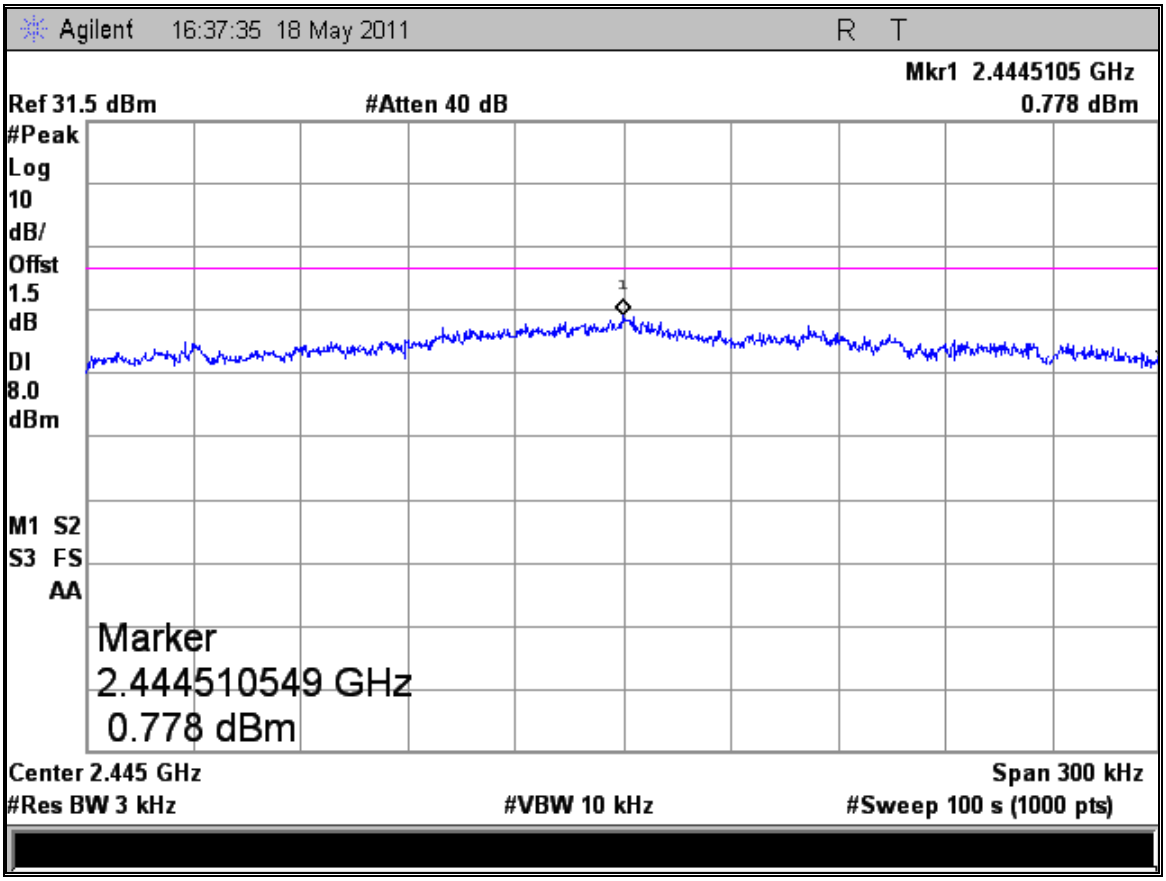


Figure 56: Peak Power Spectral Density for Operating Channel 2437 MHz, Ch 0 – 6.5Mbps

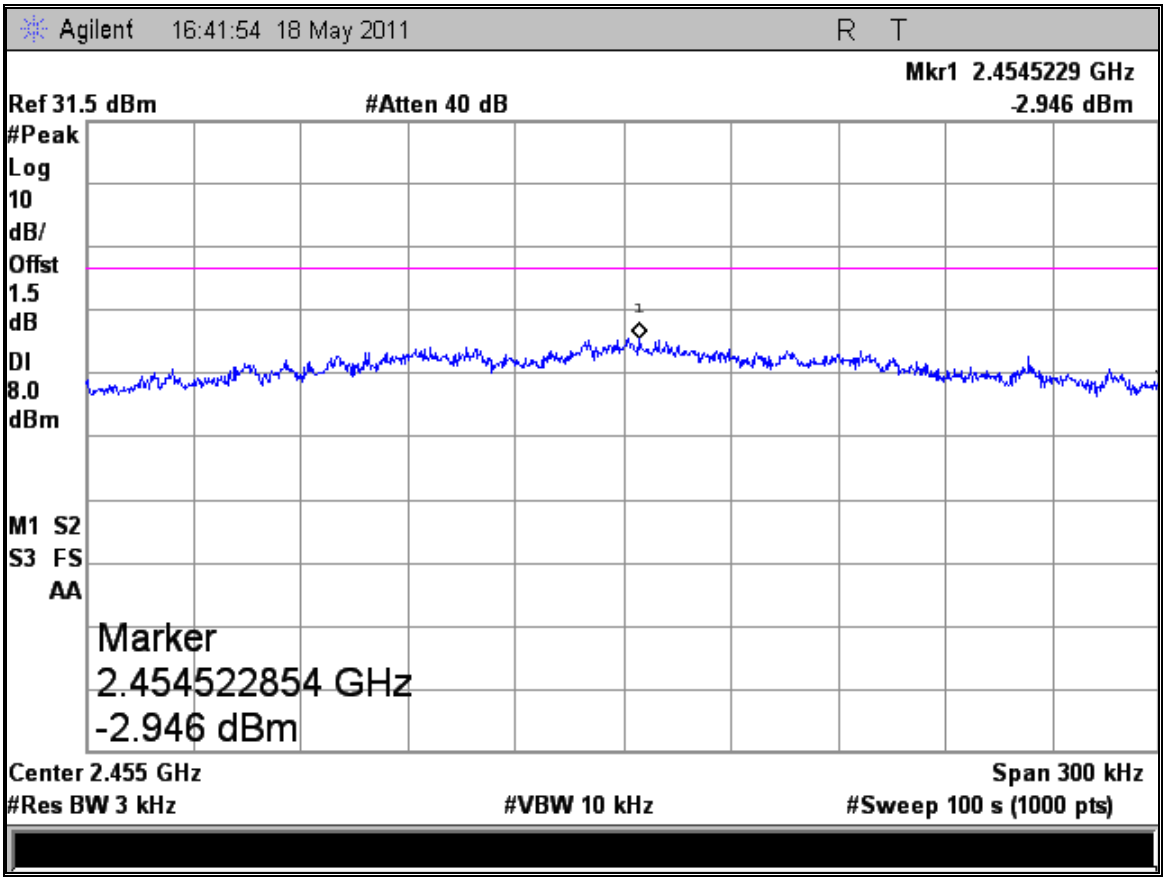


Figure 57: Peak Power Spectral Density for Operating Channel 2462 MHz, Ch 0 – 6.5Mbps

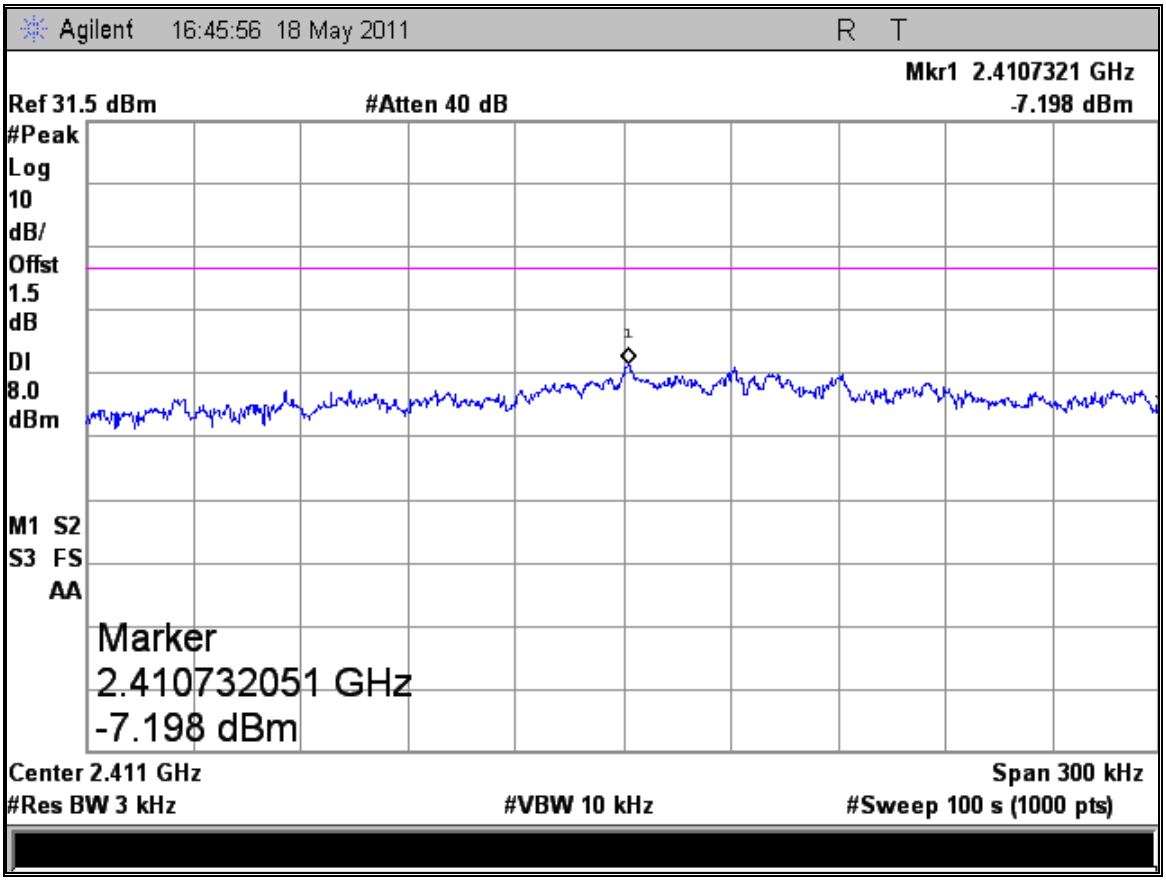


Figure 58: Peak Power Spectral Density for Operating Channel 2412 MHz, Ch 0 – 13Mbps

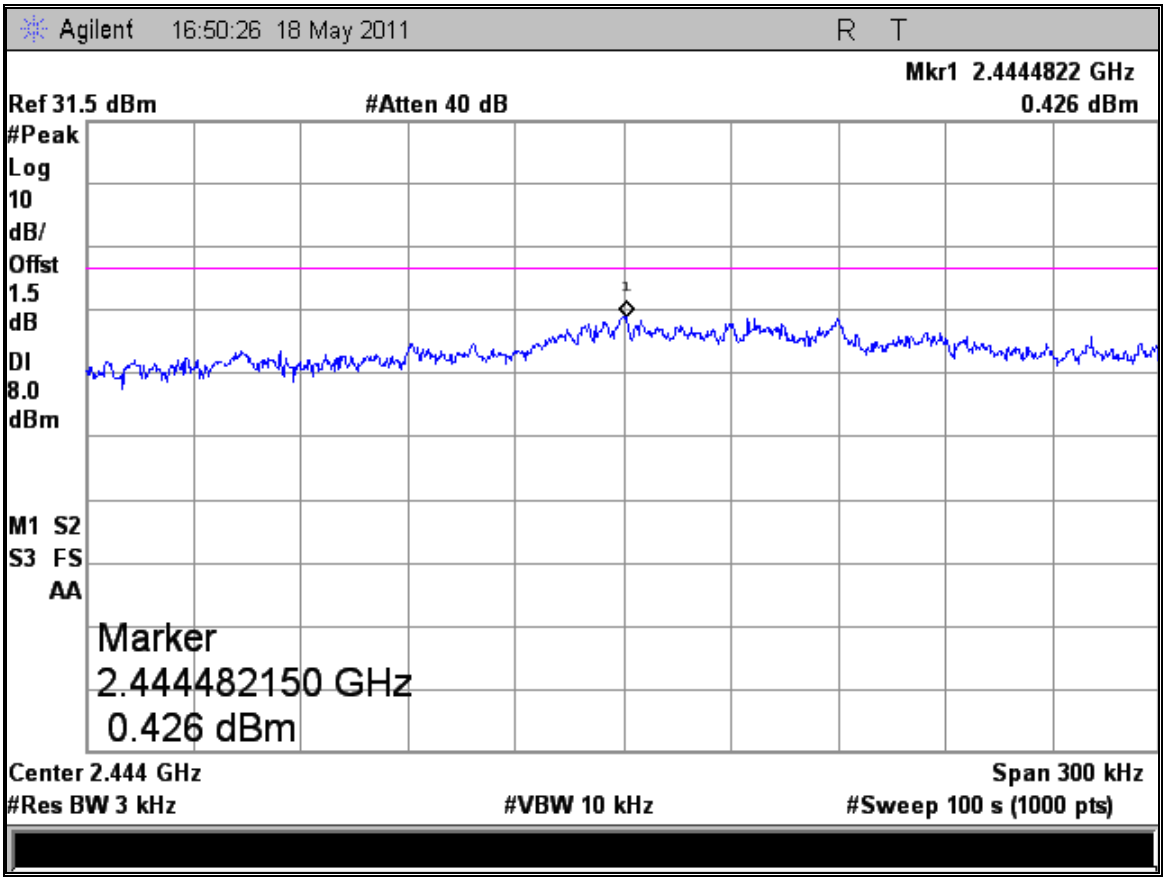


Figure 59: Peak Power Spectral Density for Operating Channel 2437 MHz, Ch 0 – 13Mbps

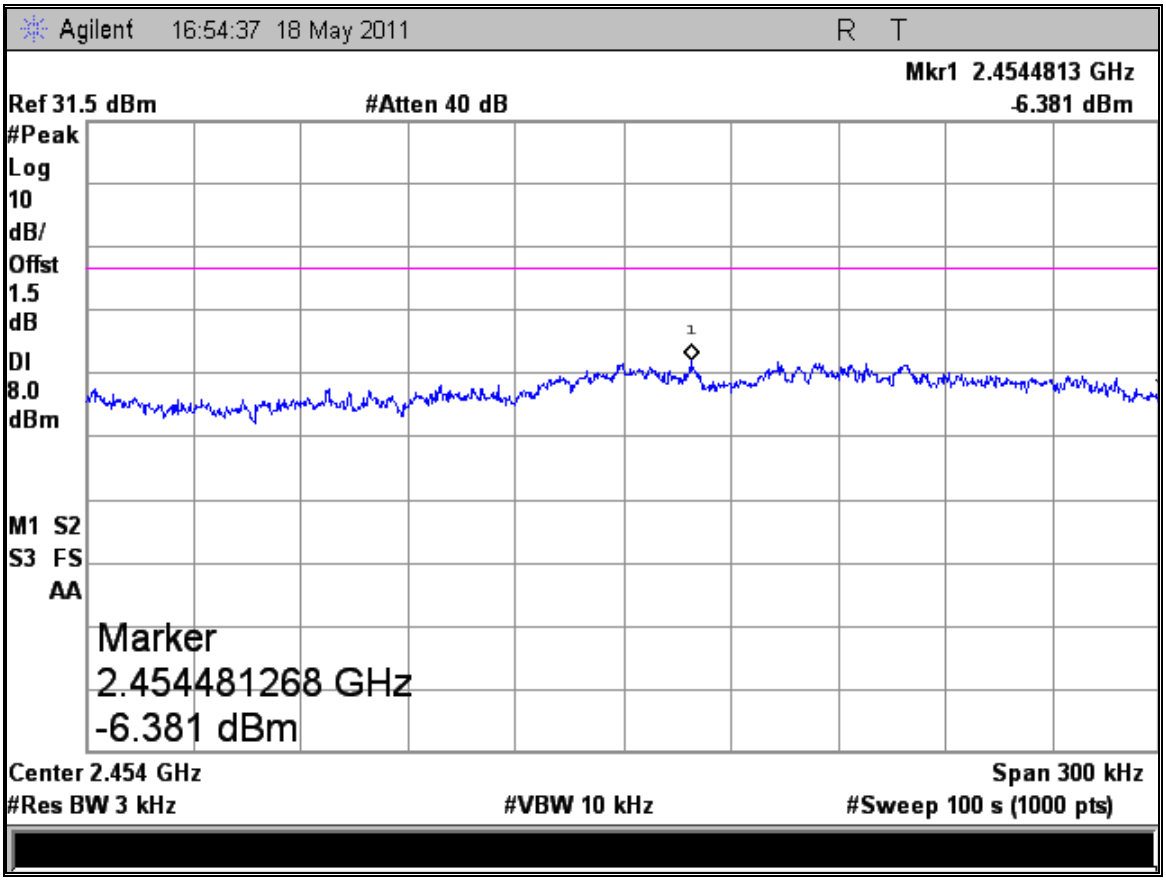


Figure 60: Peak Power Spectral Density for Operating Channel 2462 MHz, Ch 0 – 13Mbps

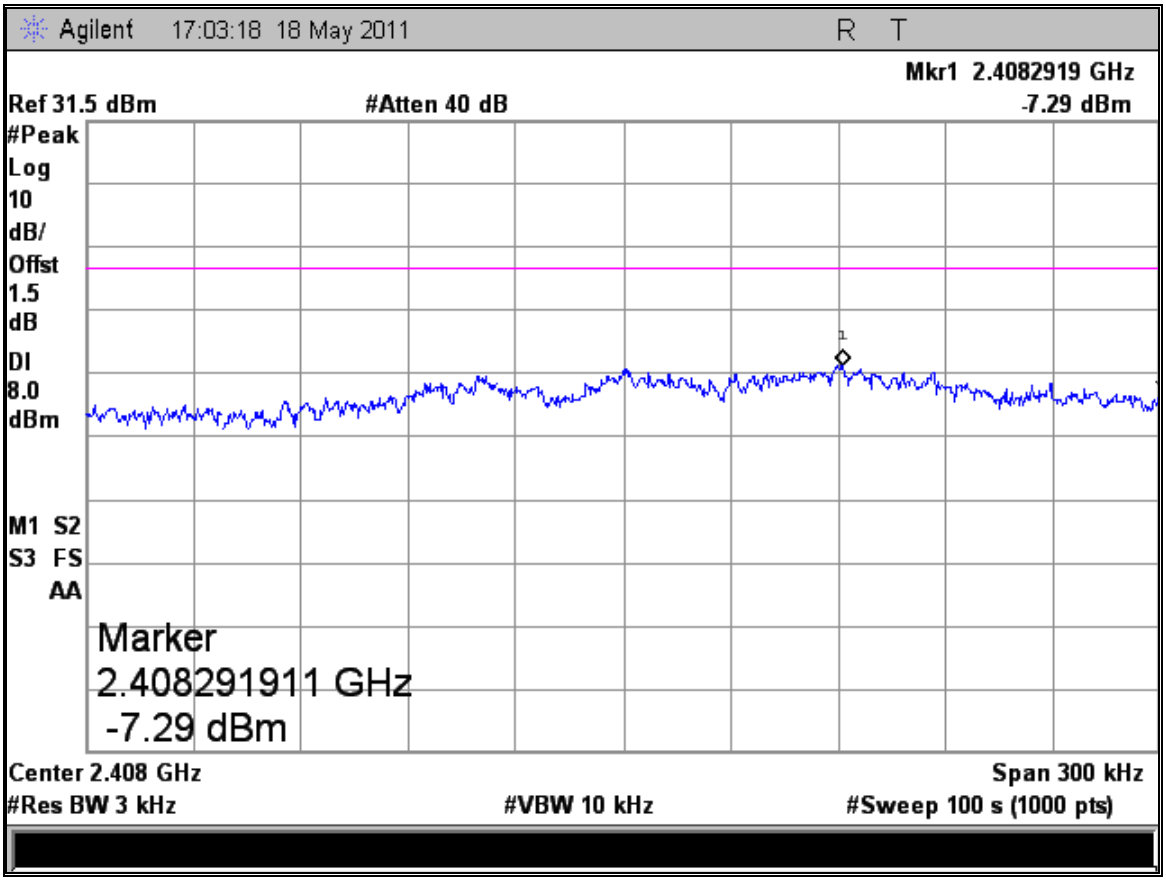


Figure 61: Peak Power Spectral Density for Operating Channel 2412 MHz, Ch 1 – 13Mbps

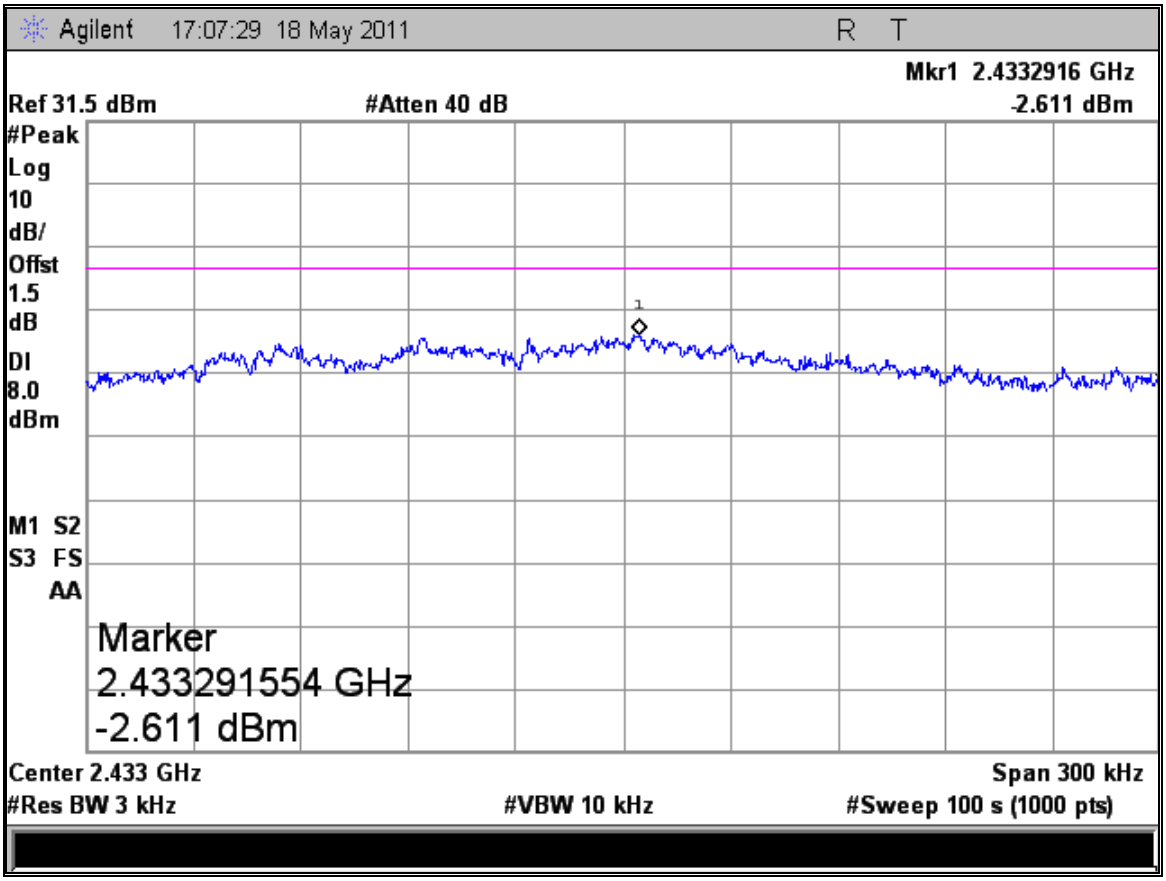


Figure 62: Peak Power Spectral Density for Operating Channel 2437 MHz, Ch 1 – 13Mbps

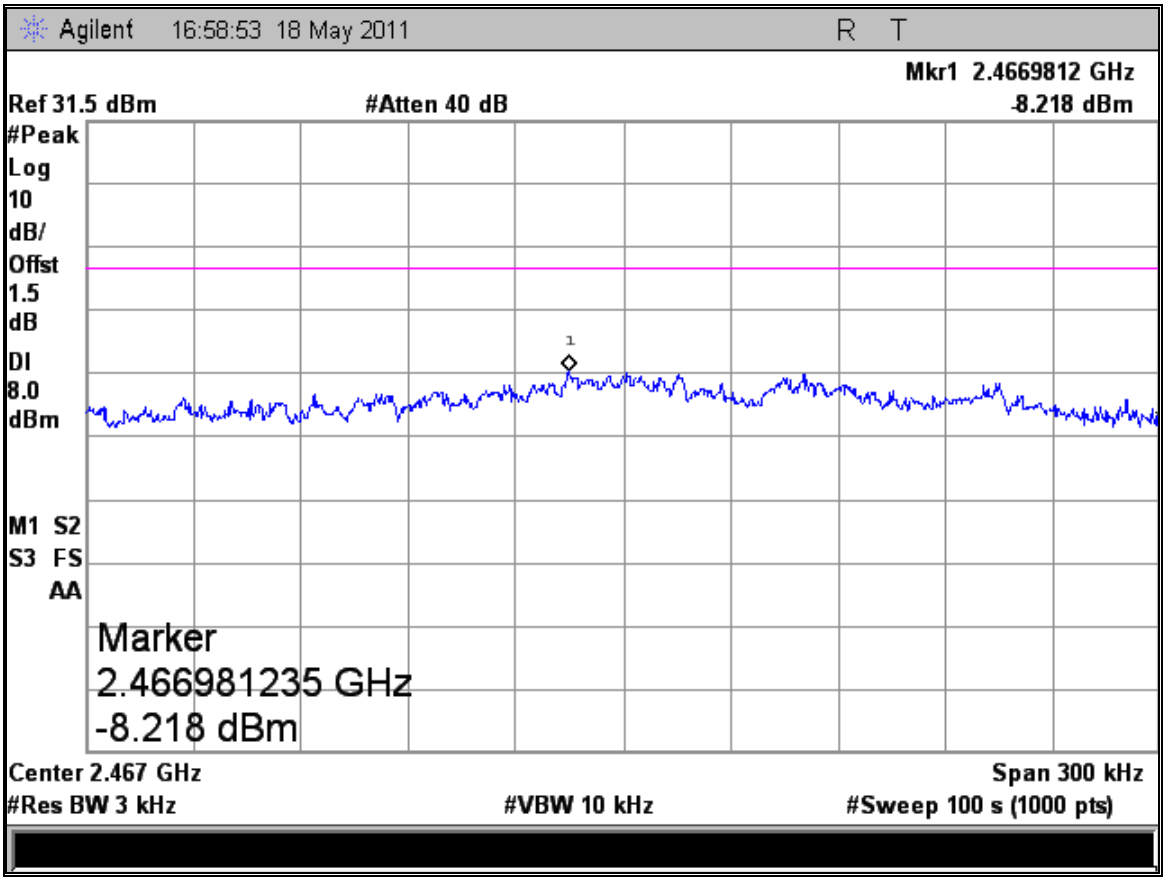


Figure 63: Peak Power Spectral Density for Operating Channel 2462 MHz, Ch 1 – 13Mbps

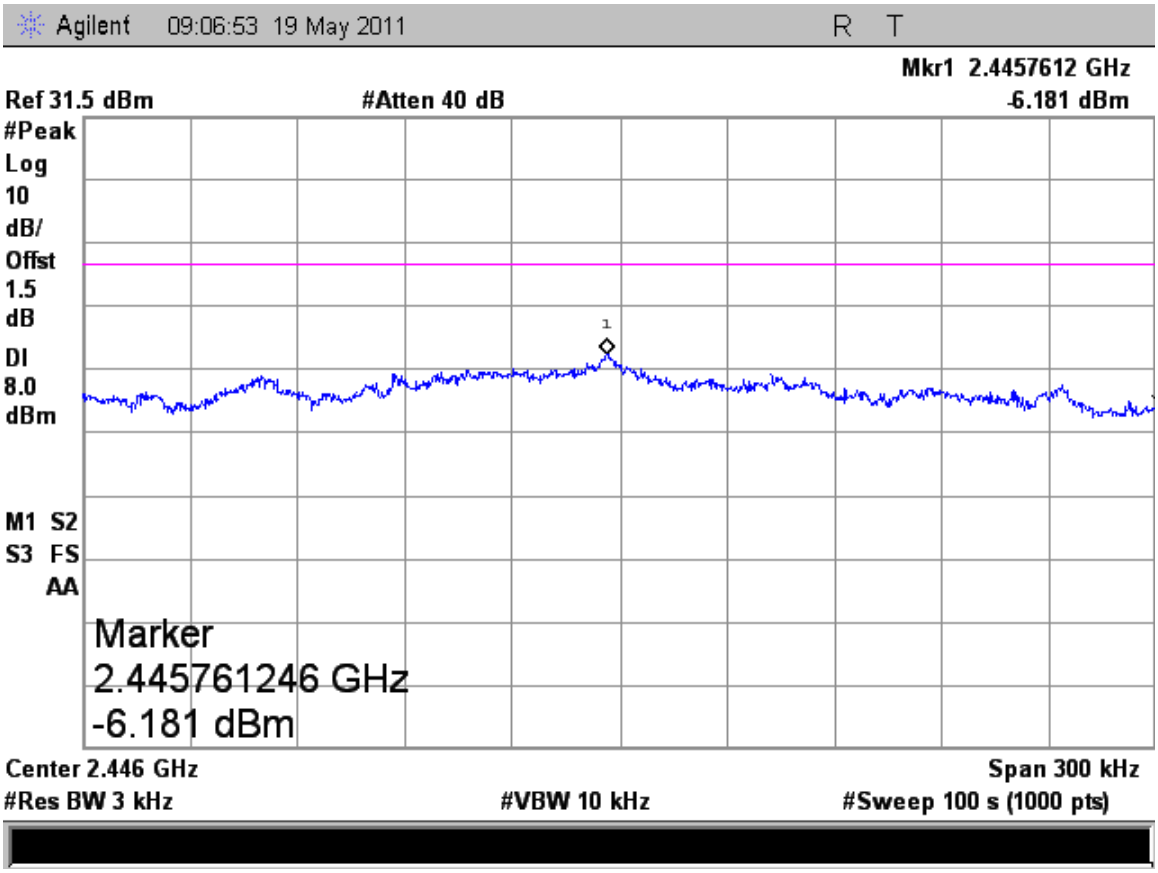


Figure 64: Peak Power Spectral Density for Operating Channel 2437 MHz, Ch 0 – 13.5Mbps

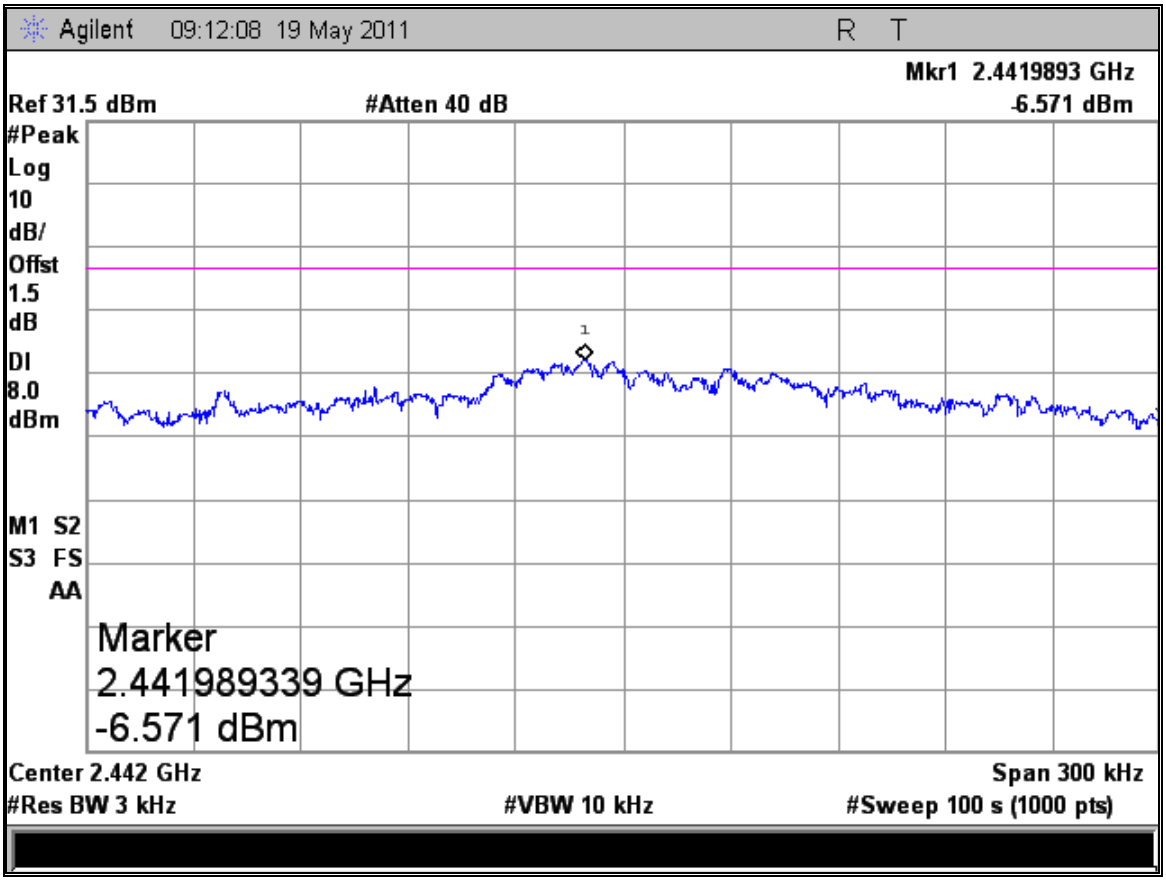


Figure 65: Peak Power Spectral Density for Operating Channel 2437 MHz, Ch 0 – 27Mbps

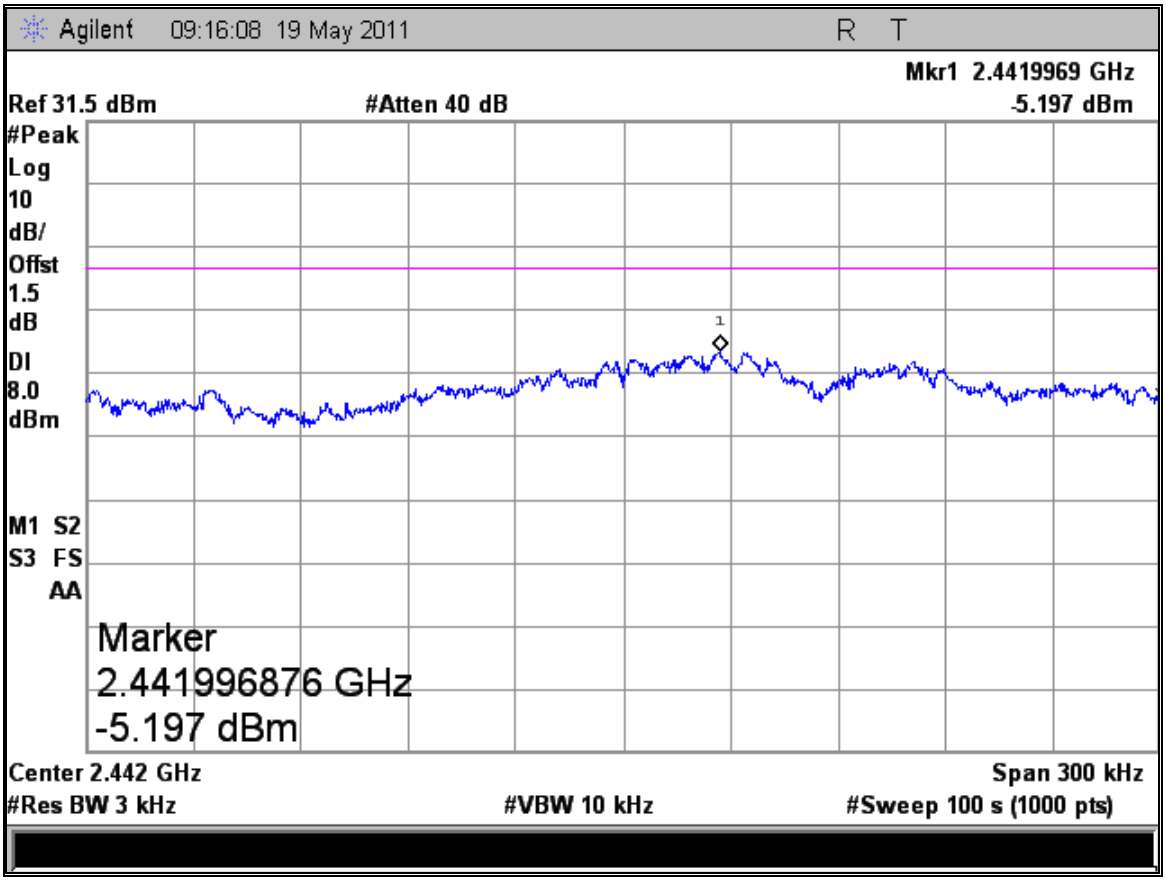


Figure 66: Peak Power Spectral Density for Operating Channel 2437 MHz, Ch 1 – 27Mbps

4.5 Maximum Permissible Exposure

4.5.1 Test Methodology

In this document, we try to prove the safety of radiation harmfulness to the human body for our product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The Gain of the antenna used in this product is measured in a Semi-Anechoic Chamber, and also the maximum total power input to the antenna is measured. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis transmission formula is a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

4.5.2 RF Exposure Limit

According to FCC 1.1310 table 1: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (minutes)
(A)Limits For Occupational / Control Exposures				
300 - 1500	…	…	F/300	6
1500 - 100,000	…	…	5	6
(B)Limits For General Population / Uncontrolled Exposure				
300 - 1500	…	…	F/1500	6
1500 - 100,000	…	…	1.0	30

F = Frequency in MHz

4.5.3 EUT Operating Condition

The software provided by Manufacturer enabled the EUT to transmit data at lowest, middle and highest channel individually.

4.5.4 Classification

The antenna of the product, under normal use condition, is at least 20cm away from the body of the user. Warning statement to the user for keeping at least 20cm or more separation distance with the antenna should be included in user's manual. So, this device is classified as a **Mobile Device**.

4.5.5 Test Results

4.5.5.1 Antenna Gain

The transmitting antenna was integrated. The antenna gain was +3.0 dBi or 2.0 (numeric).

4.5.5.2 Output Power into Antenna & RF Exposure value at distance 20cm:

Calculations for this report are based on highest power measurement.

Limit for MPE (from FCC part 1.1310 table1) is 1.0 mW/cm^2

The highest measured power is +26.34 dBm or 430.53mW

Using the Friss transmission formula, the EIRP is Pout*G, and R is 20cm.

Pd = (430.53*2.0) / (1600π) = 0.1713 mW/cm2, which is 0.8287 mW/cm2 below to the limit.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

4.5.6 Sample Calculation

The Friss transmission formula: $Pd = (Pout*G) / (4*\pi*R^2)$

Where;

Pd = power density in mW/cm_2
Pout = output power to antenna in mW
G = gain of antenna in linear scale
$\pi \approx 3.1416$
R = distance between observation point and center of the radiator in cm

Ref. : David K. Cheng, *Field and Wave Electromagnetics*, Second Edition, Page 640, Eq. (11-133).

4.6 Transmitter Spurious Emissions

Transmitter spurious emissions are emissions outside the frequency range of the equipment when the equipment is in transmit mode; per requirement of CFR47 15.205, 15.209, 15.247(d), RSS 210 Sect. A.8.5

4.6.1 Test Methodology

4.6.1.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. The frequency range of interest was divided into sub-ranges to yield a frequency resolution of approximately 120 kHz and provide a reading at each frequency for no more than 12° of turntable rotation. For each frequency sub-range the turntable was rotated 360° while peak emission data was recorded and plotted over the frequency range of interest in horizontal and vertical antenna polarization's.

Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m at a fixed height of 1m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT.

4.6.1.2 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, than the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked.

Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

The final scans performed on the worst axis, Y-Axis, for three operating channels;

2412 MHz, 2437 MHz, and 2462 MHz at 1Mbit/s for 802.11b mode,

2412 MHz, 2437 MHz, and 2462 MHz at 6Mbit/s for 802.11g mode,

2412 MHz, 2437 MHz, and 2462 MHz at 6.5Mbit/s for 802.11n HT20 mode, and

2437 MHz at 13.5Mbit/s for 802.11n HT40 mode.

4.6.1.3 Deviations

None.

4.6.2 Transmitter Spurious Emission Limit

The spurious emissions of the transmitter shall not exceed the values in CFR47 Part 15.205, 15.209: 2009 and RSS 210 A1.1.2 2007.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100 **	3
88-216	150 **	3
216-960	200 **	3
Above 960	500	3

All harmonics and spurious emission which are outside of the restricted band shall be 20 dB below the in-band emission.

4.6.3 Test Results

The final measurement data was taken under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and Test Plan.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 9: Transmit Spurious Emission at Band-Edge Requirements

Test Conditions: Radiated Measurement, Normal Temperature and Voltage only							
Antenna Type: Integrated			**Power Setting:** See Test Plan				
Max. Antenna Gain: + 3.0 dBi			**Signal State:** Modulated				
Ambient Temp.: 22 °C			**Relative Humidity:**34%				
Band-Edge Results							
Operating Channel	**Mode**	**Polarity**	**Pk Plot #**	**Peak Limit**	**Ave. Plot #**	**Ave. Limit**	**Result**
2412 MHz	802.11b, 1Mbps	Horz.	67	74.00	68	54.00	Pass
2412 MHz	802.11b, 1Mbps	Vert.	69	74.00	70	54.00	Pass
2417 MHz	802.11b, 1Mbps	Horz.	71	74.00	72	54.00	Pass
2417 MHz	802.11b, 1Mbps	Vert.	73	74.00	74	54.00	Pass
2437 MHz	802.11b, 1Mbps	Horz.	75	74.00	76	54.00	Pass
2437 MHz	802.11b, 1Mbps	Vert.	77	74.00	78	54.00	Pass
2457 MHz	802.11b, 1Mbps	Horz.	79	74.00	80	54.00	Pass
2457 MHz	802.11b, 1Mbps	Vert.	81	74.00	82	54.00	Pass
2462 MHz	802.11b, 1Mbps	Horz.	83	74.00	84	54.00	Pass
2462 MHz	802.11b, 1Mbps	Vert.	85	74.00	86	54.00	Pass
2412 MHz	802.11g, 6Mbps	Horz.	87	74.00	88	54.00	Pass
2412 MHz	802.11g, 6Mbps	Vert.	89	74.00	90	54.00	Pass
2417 MHz	802.11g, 6Mbps	Horz.	91	74.00	92	54.00	Pass
2417 MHz	802.11g, 6Mbps	Vert.	93	74.00	94	54.00	Pass
2437 MHz	802.11g, 6Mbps	Horz.	95	74.00	96	54.00	Pass
2437 MHz	802.11g, 6Mbps	Vert.	97	74.00	98	54.00	Pass
2457 MHz	802.11g, 6Mbps	Horz.	99	74.00	100	54.00	Pass
2457 MHz	802.11g, 6Mbps	Vert.	101	74.00	102	54.00	Pass
2462 MHz	802.11g, 6Mbps	Horz.	103	74.00	104	54.00	Pass

2462 MHz	802.11g, 6Mbps	Vert.	105	74.00	106	54.00	Pass
2412 MHz	HT20, 6.5Mbps	Horz.	107	74.00	108	54.00	Pass
2412 MHz	HT20, 6.5Mbps	Vert.	109	74.00	110	54.00	Pass
2417 MHz	HT20, 6.5Mbps	Horz.	111	74.00	112	54.00	Pass
2417 MHz	HT20, 6.5Mbps	Vert.	113	74.00	114	54.00	Pass
2437 MHz	HT20, 6.5Mbps	Horz.	115	74.00	116	54.00	Pass
2437 MHz	HT20, 6.5Mbps	Vert.	117	74.00	118	54.00	Pass
2457 MHz	HT20, 6.5Mbps	Horz.	119	74.00	120	54.00	Pass
2457 MHz	HT20, 6.5Mbps	Vert.	121	74.00	122	54.00	Pass
2462 MHz	HT20, 6.5Mbps	Horz.	123	74.00	124	54.00	Pass
2462 MHz	HT20, 6.5Mbps	Vert.	125	74.00	126	54.00	Pass
2412 MHz	HT20, 13Mbps	Horz.	127	74.00	128	54.00	Pass
2412 MHz	HT20, 13Mbps	Vert.	129	74.00	130	54.00	Pass
2437 MHz	HT20, 13Mbps	Horz.	131	74.00	132	54.00	Pass
2437 MHz	HT20, 13Mbps	Vert.	133	74.00	134	54.00	Pass
2462 MHz	HT20, 13Mbps	Horz.	135	74.00	136	54.00	Pass
2462 MHz	HT20, 13Mbps	Vert.	137	74.00	138	54.00	Pass
2437 MHz	HT40, 13.5Mbps	Horz.	139	74.00	140	54.00	Pass
2437 MHz	HT40, 13.5Mbps	Vert.	141	74.00	142	54.00	Pass
2437 MHz	HT40, 27Mbps	Horz.	143	74.00	144	54.00	Pass
2437 MHz	HT40, 27Mbps	Vert.	145	74.00	146	54.00	Pass

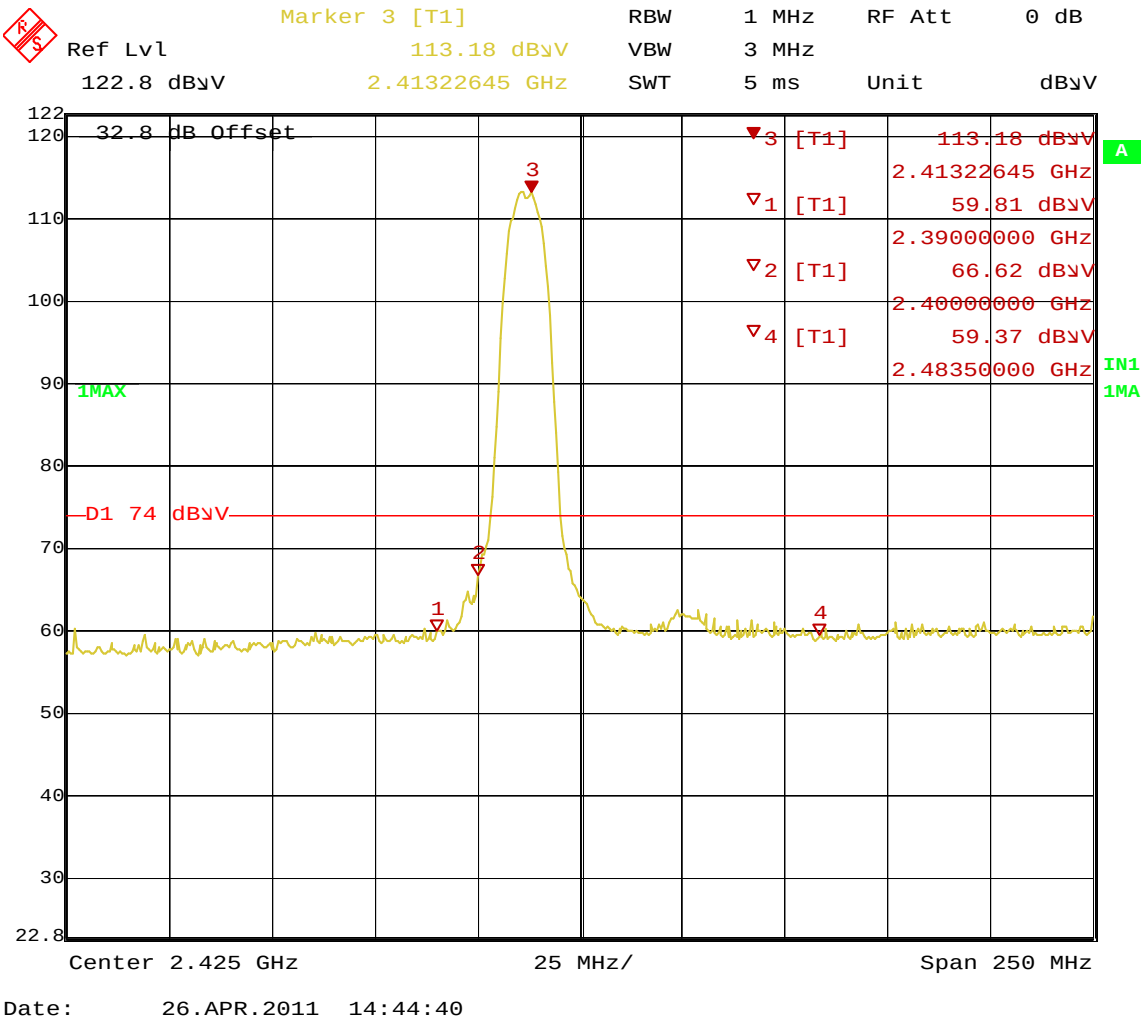


Figure 67: Radiated Emission at the Edge for 2412 MHz at 1Mbps Y-Axis – Horizontal (Peak)

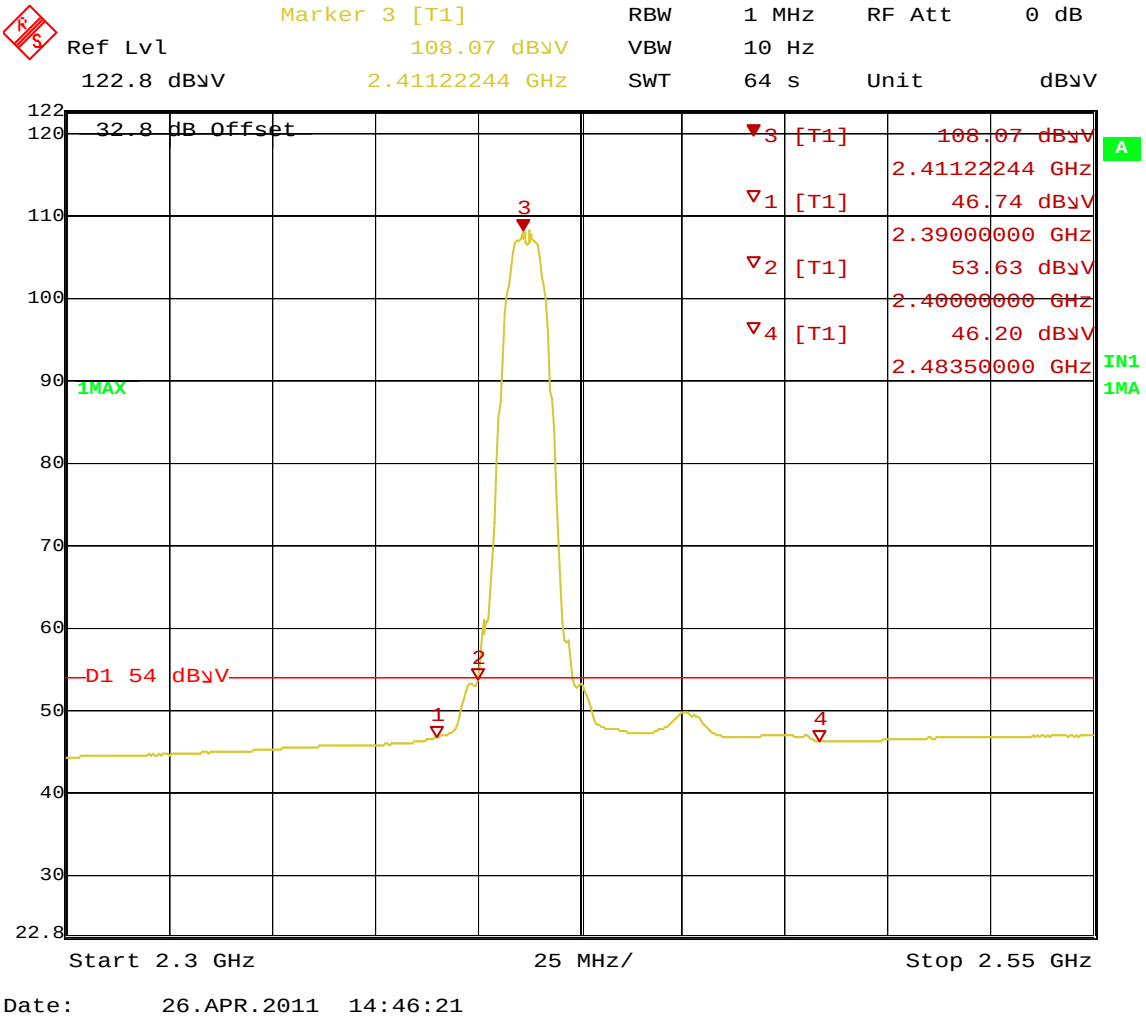


Figure 68: Radiated Emission at the Edge for 2412 MHz at 1Mbps Y-Axis – Horizontal (Ave)

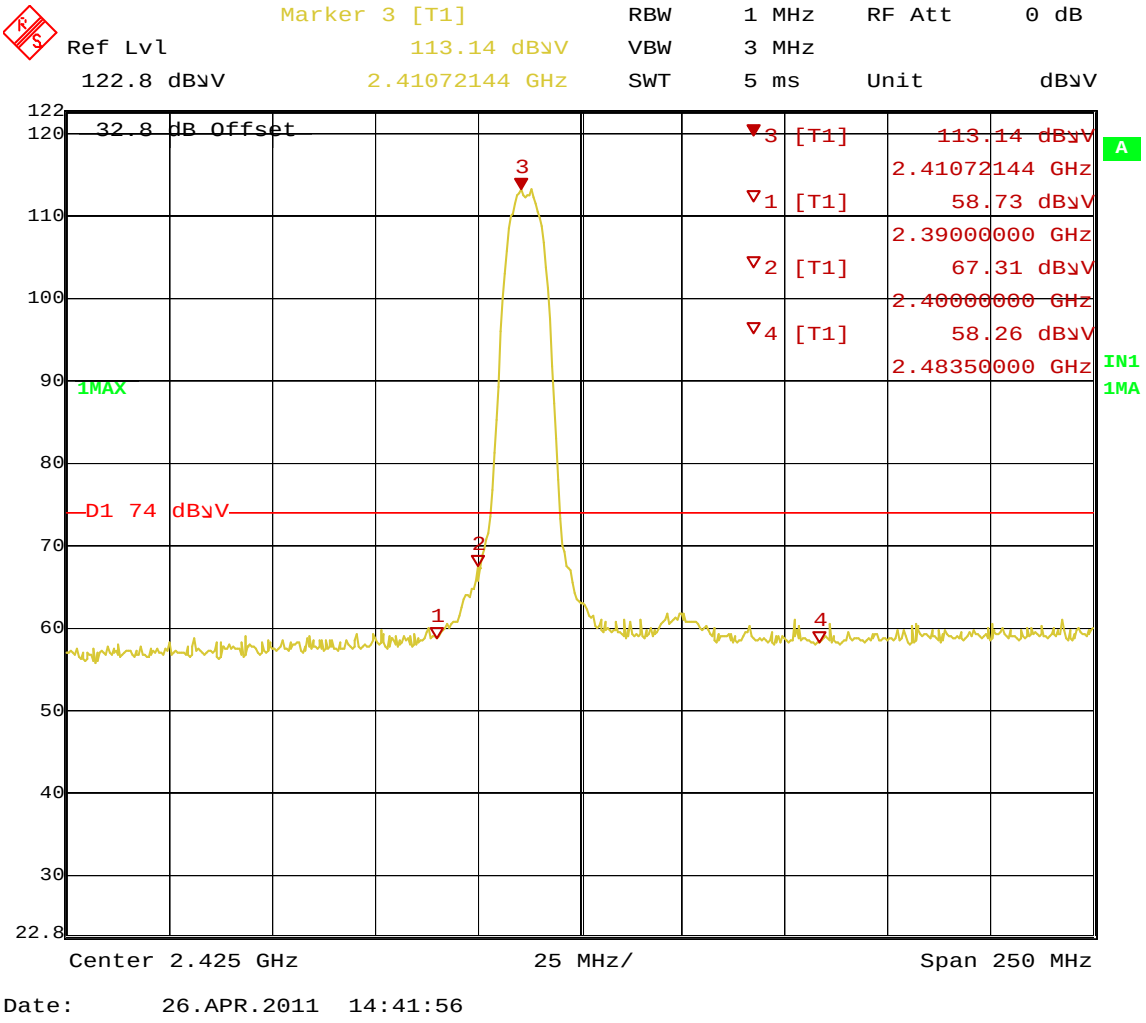


Figure 69: Radiated Emission at the Edge for 2412 MHz at 1Mbps Y-Axis – Vertical (Peak)

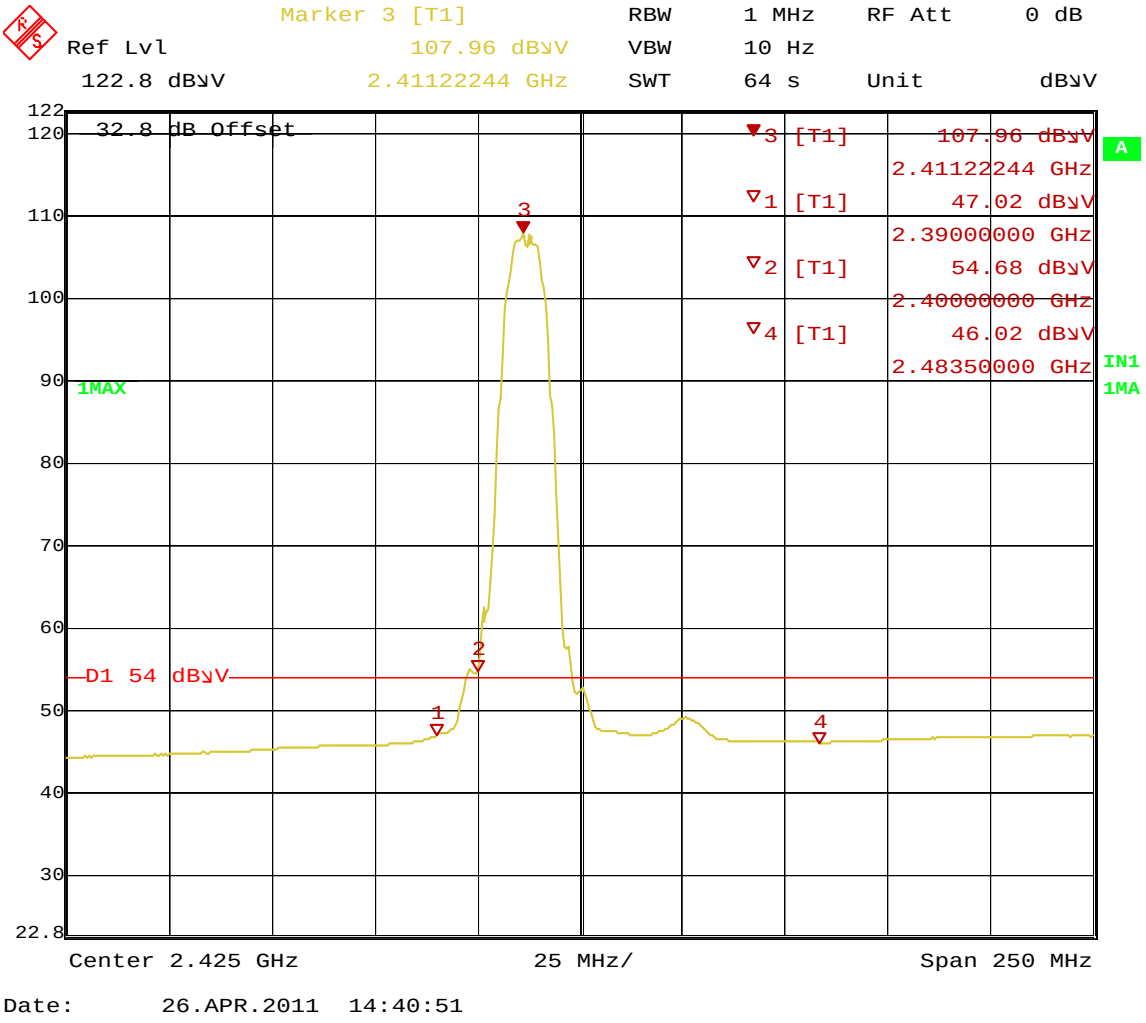


Figure 70: Radiated Emission at the Edge for 2412 MHz at 1Mbps Y-Axis – Vertical (Ave)

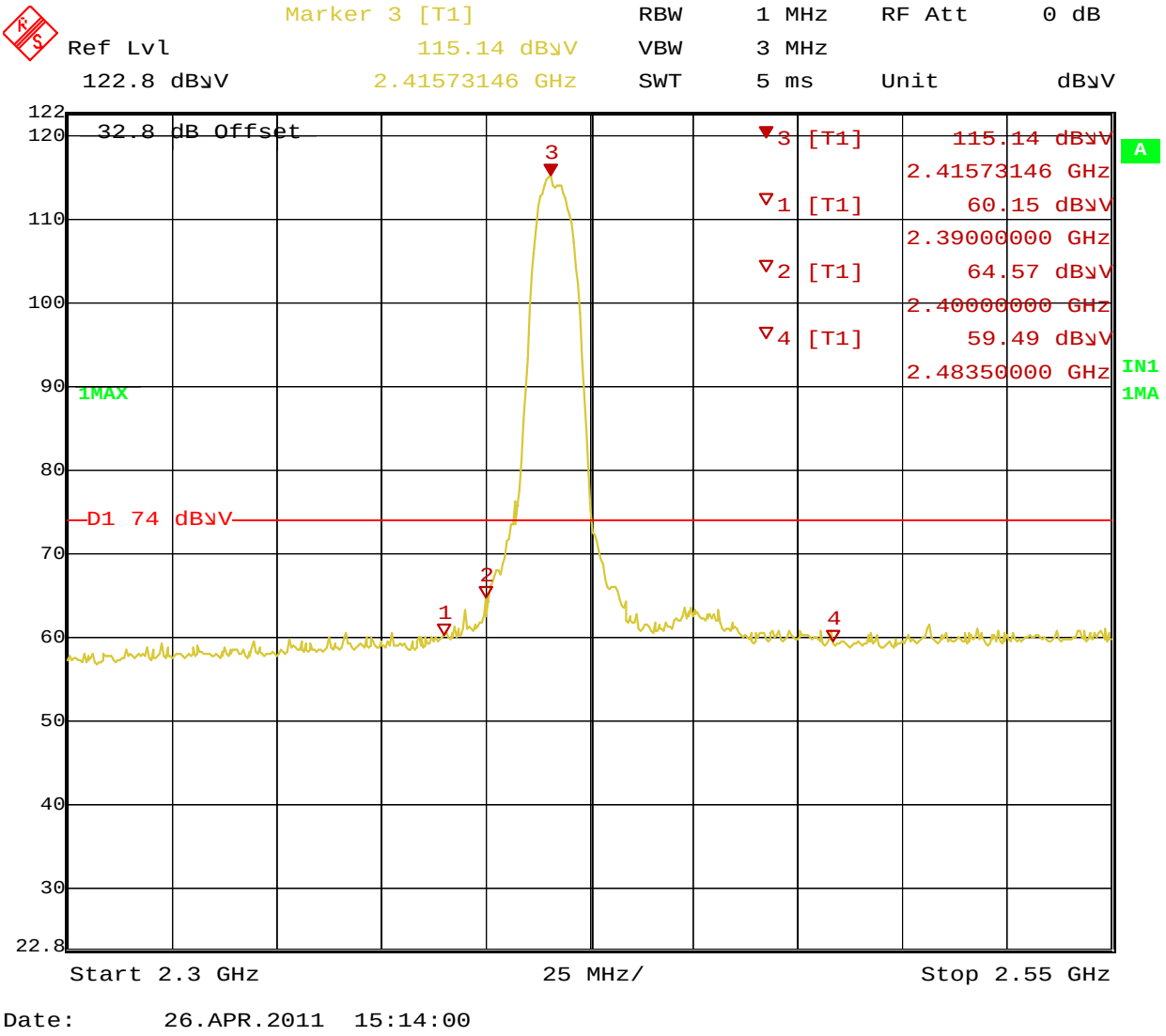


Figure 71: Radiated Emission at the Edge for 2417 MHz at 1Mbps Y-Axis –Horizontal (Pk)

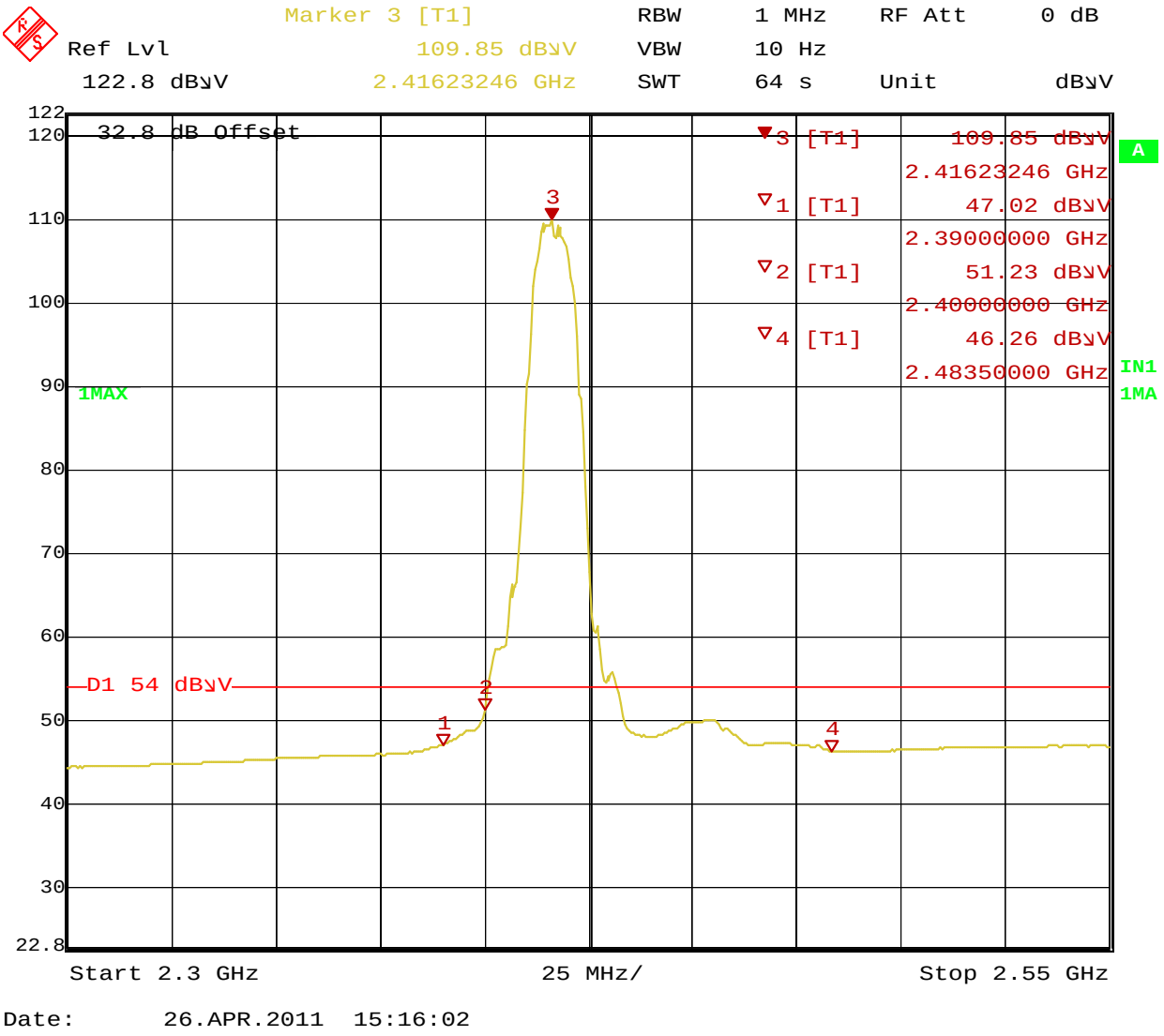


Figure 72: Radiated Emission at the Edge for 2417 MHz at 1Mbps Y-Axis –Horizontal (Ave)

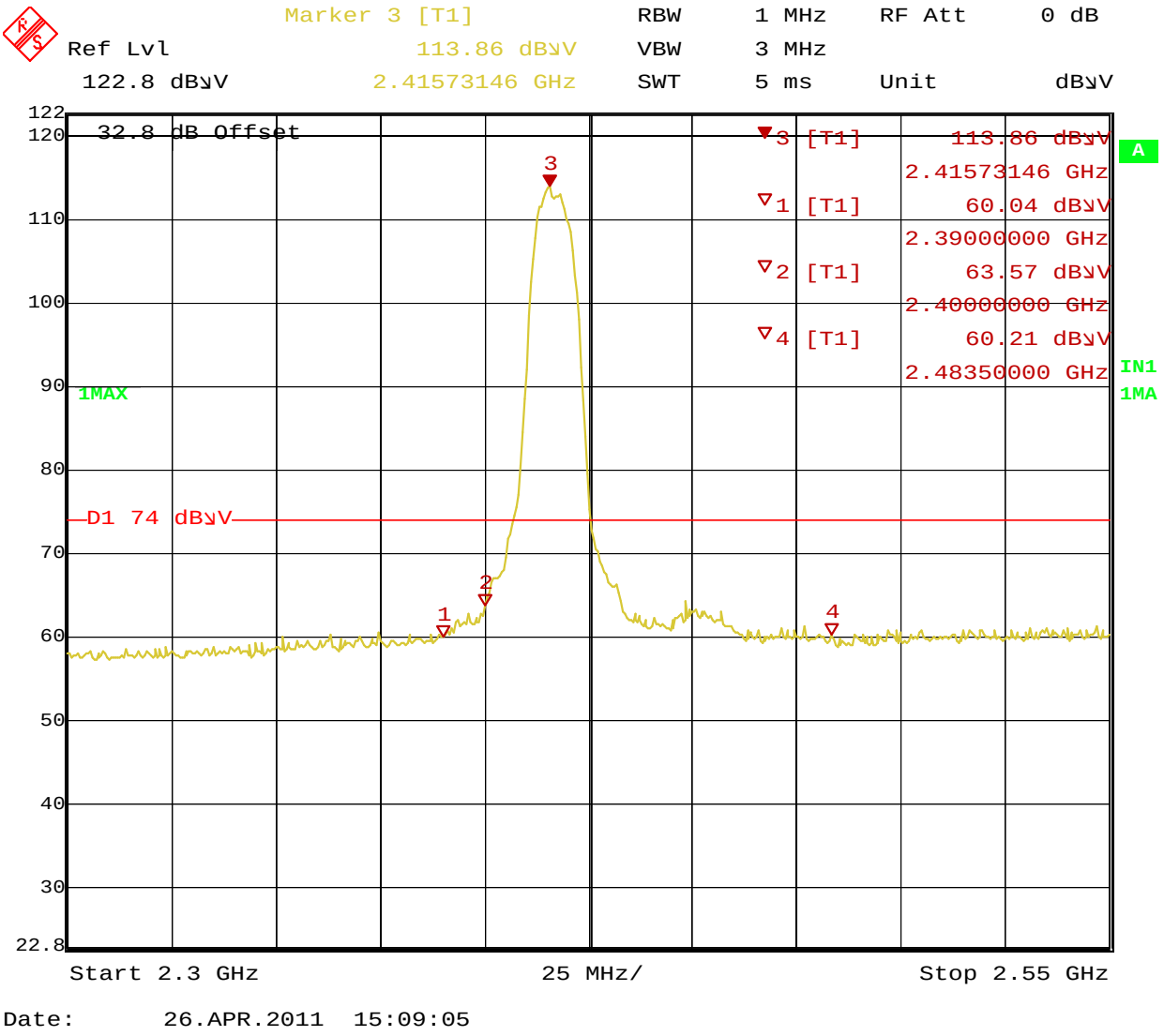


Figure 73: Radiated Emission at the Edge for 2417 MHz at 1Mbps Y-Axis – Vertical (Peak)

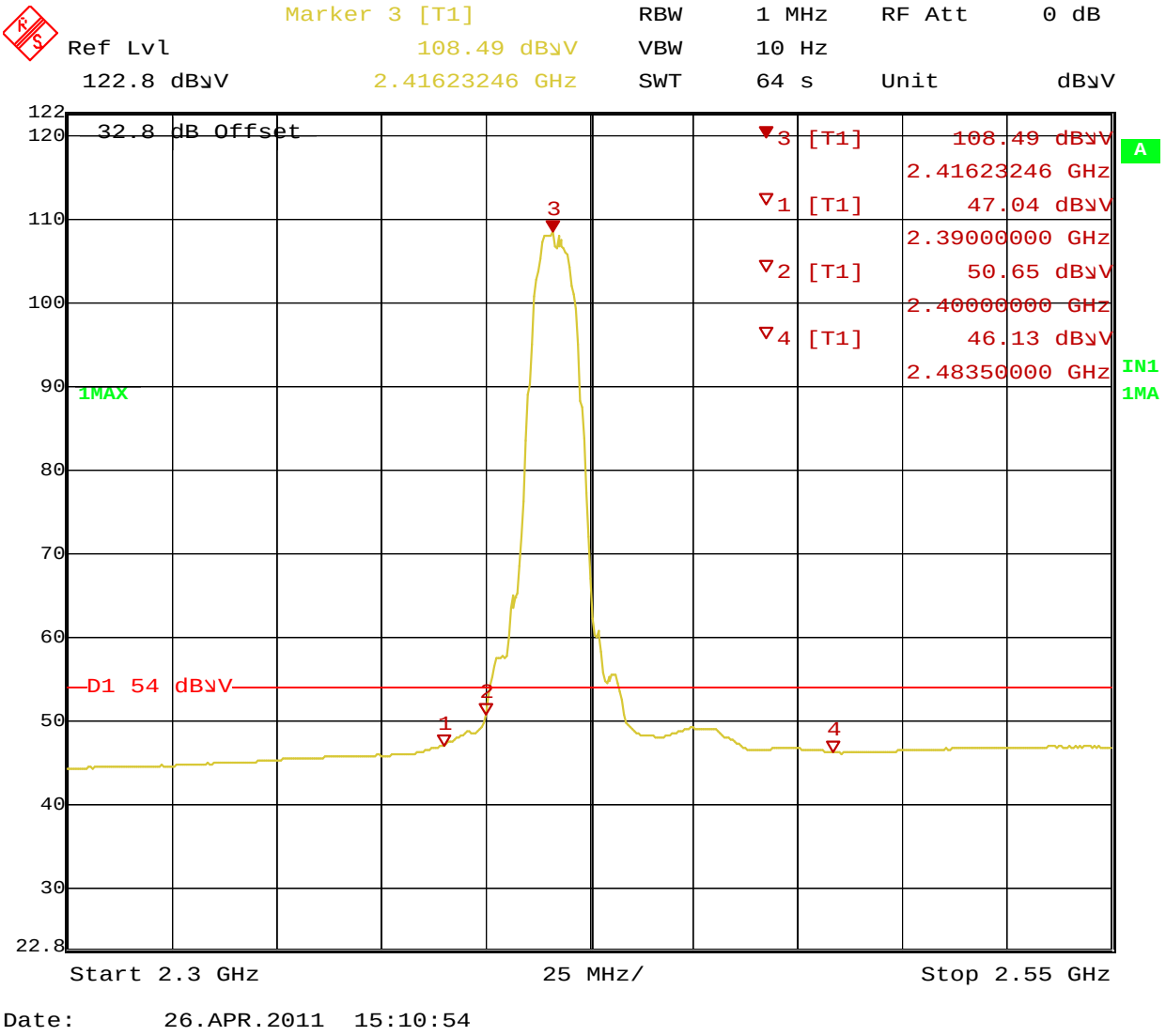


Figure 74: Radiated Emission at the Edge for 2417 MHz at 1Mbps Y-Axis –Vertical (Ave)

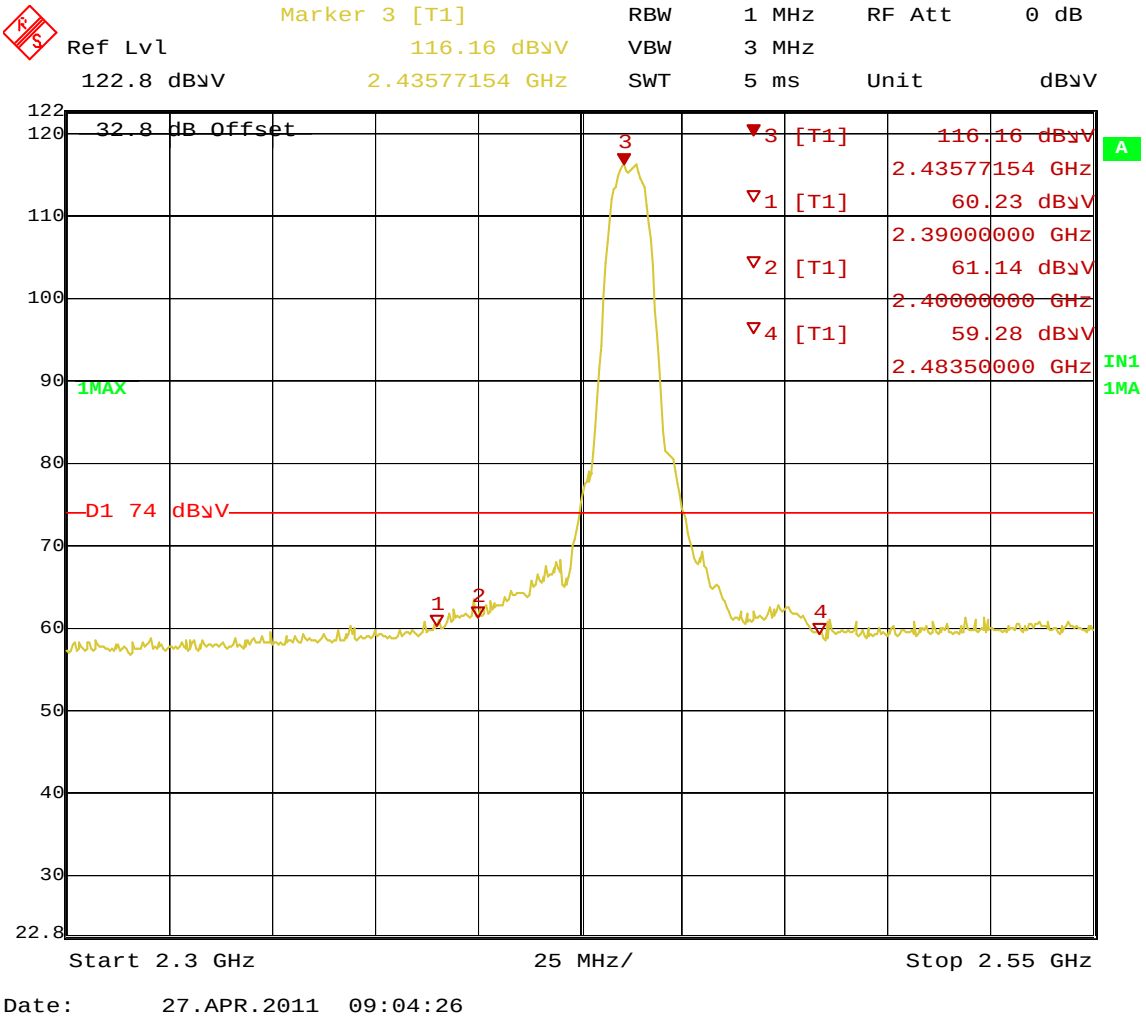


Figure 75: Radiated Emission at the Edge for 2437 MHz at 1Mbps Y-Axis – Horizontal (Peak)

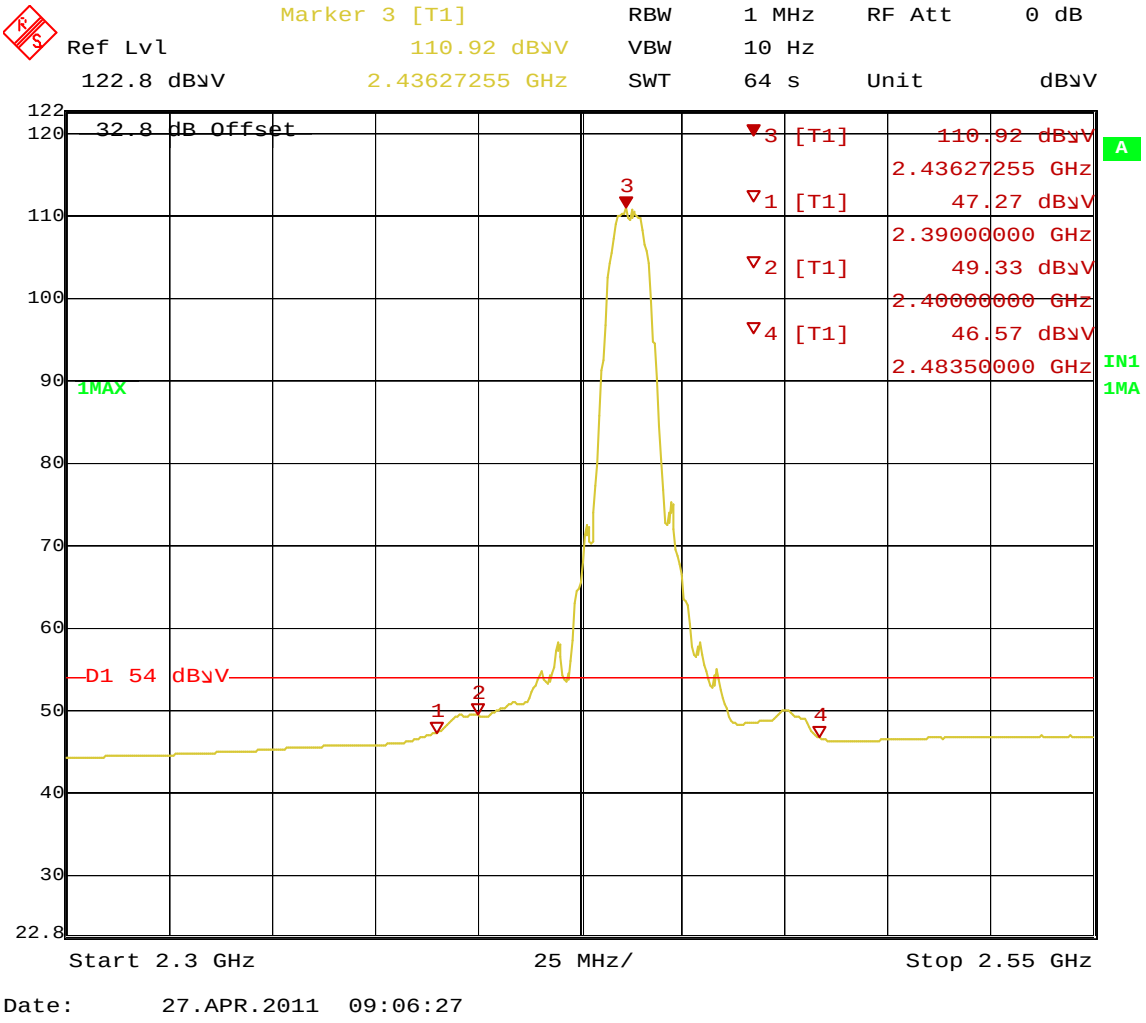


Figure 76: Radiated Emission at the Edge for 2437 MHz at 1Mbps Y-Axis – Horizontal (Ave)

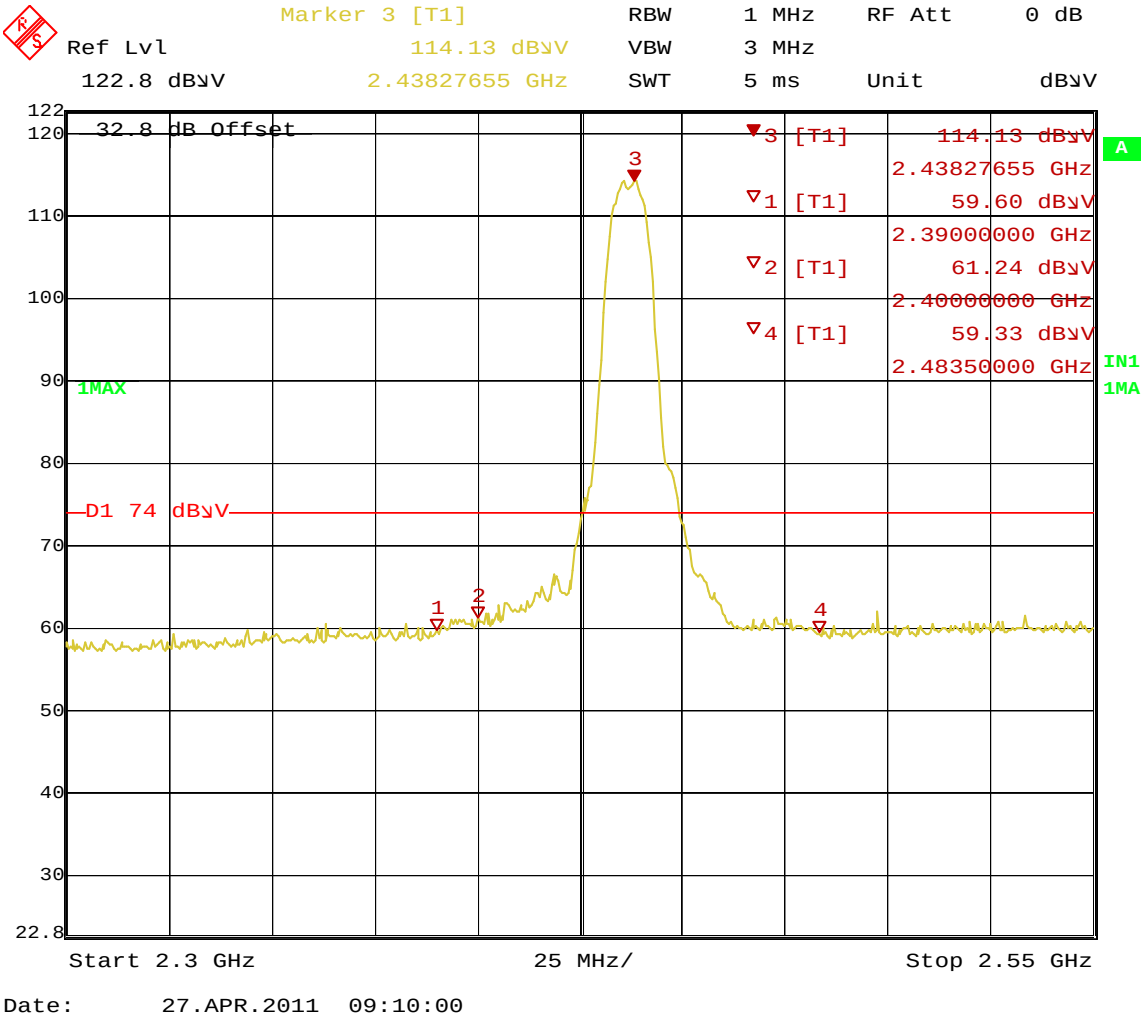


Figure 77: Radiated Emission at the Edge for 2437 MHz at 1Mbps Y-Axis – Vertical (Peak)

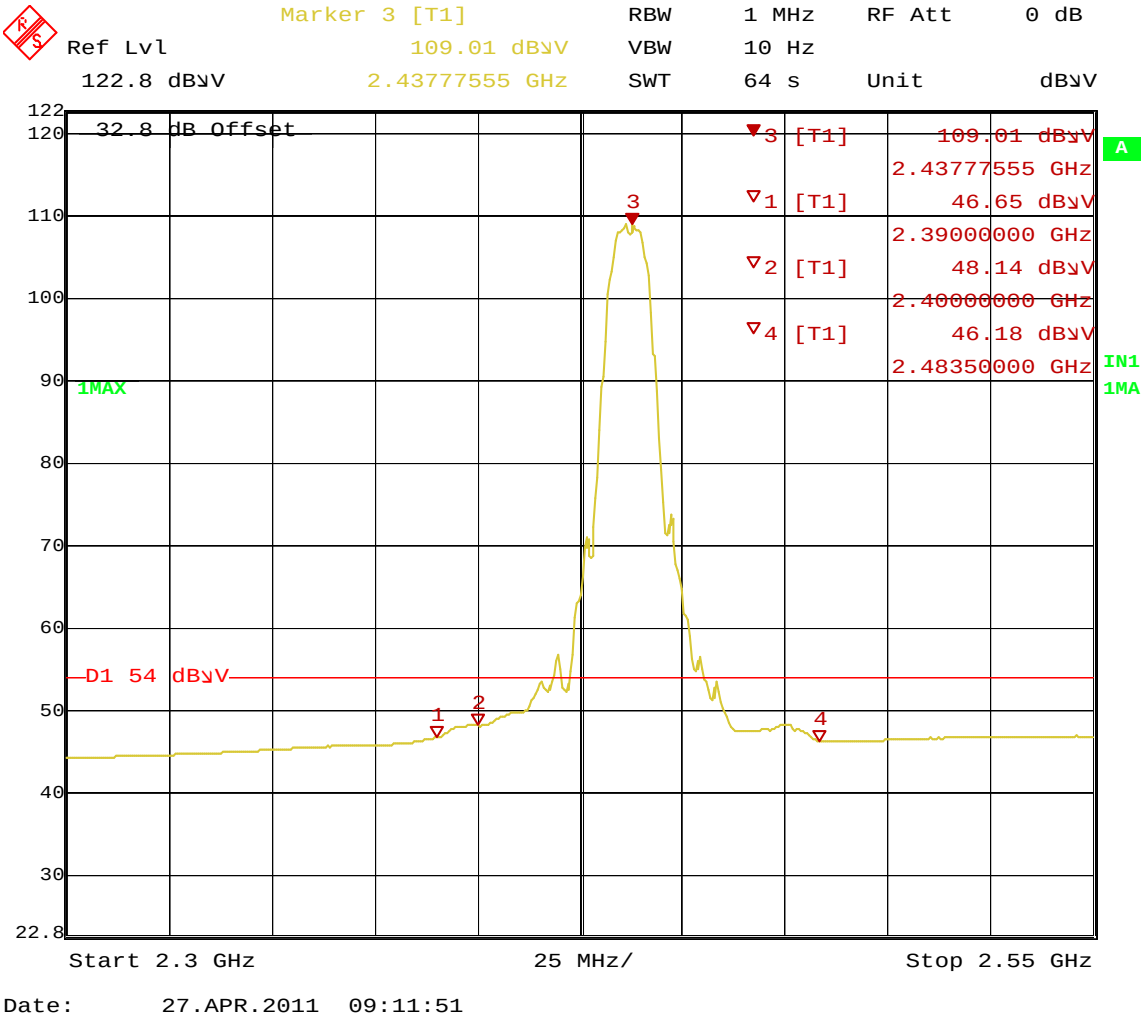


Figure 78: Radiated Emission at the Edge for 2437 MHz at 1Mbps Y-Axis – Vertical (Ave)

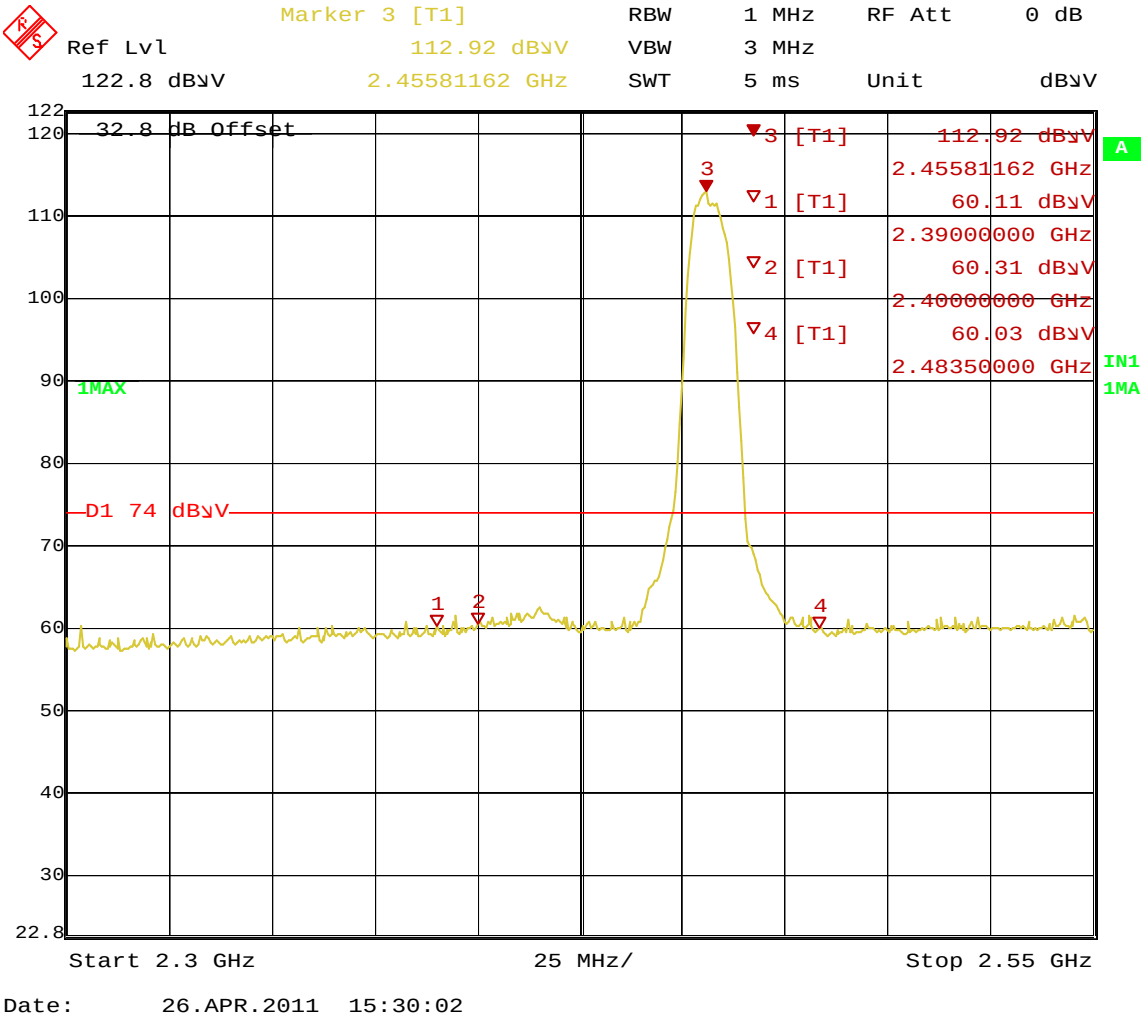


Figure 79: Radiated Emission at the Edge for 2457 MHz at 1Mbps Y-Axis – Horizontal (Peak)

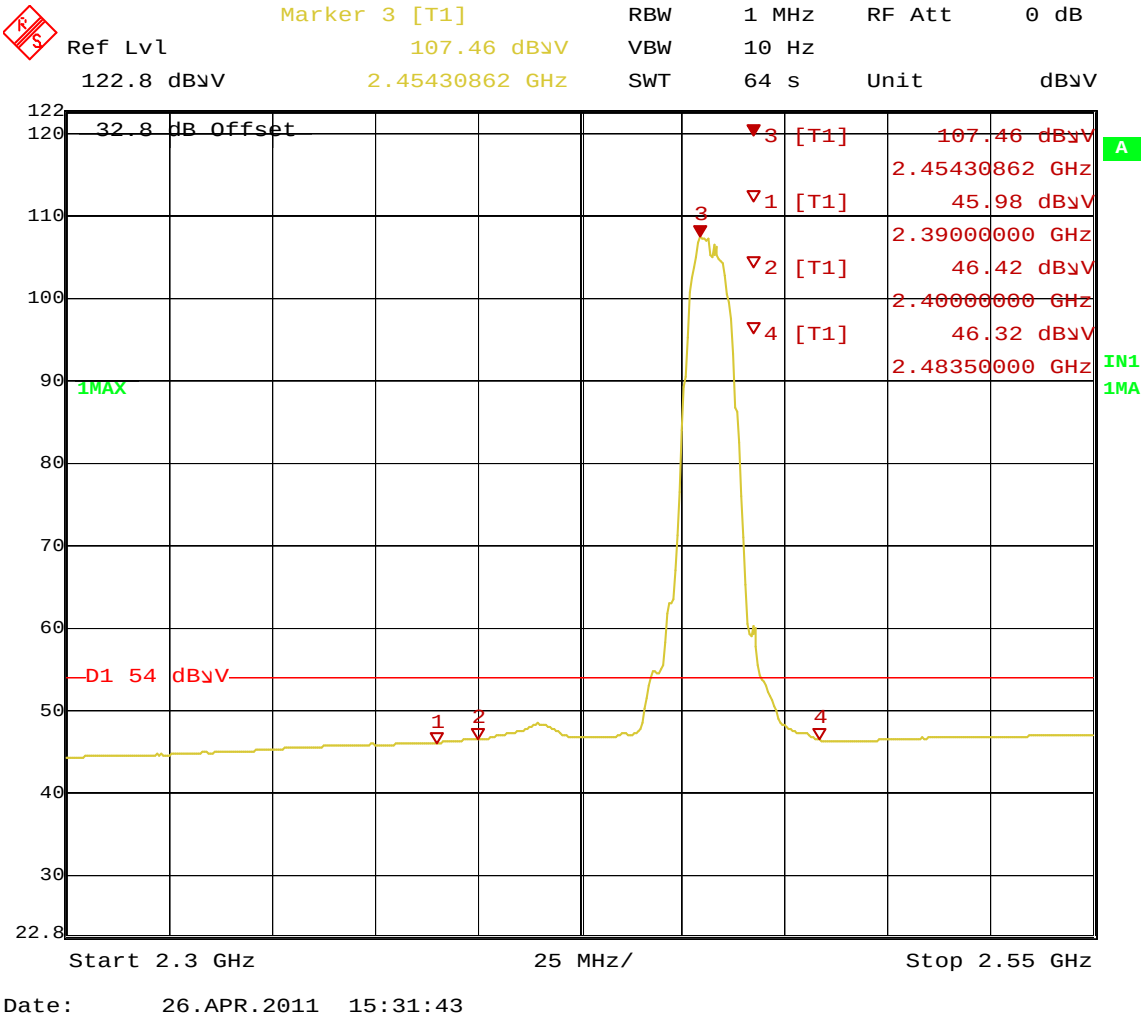


Figure 80: Radiated Emission at the Edge for 2457 MHz at 1Mbps Y-Axis – Horizontal (Ave)

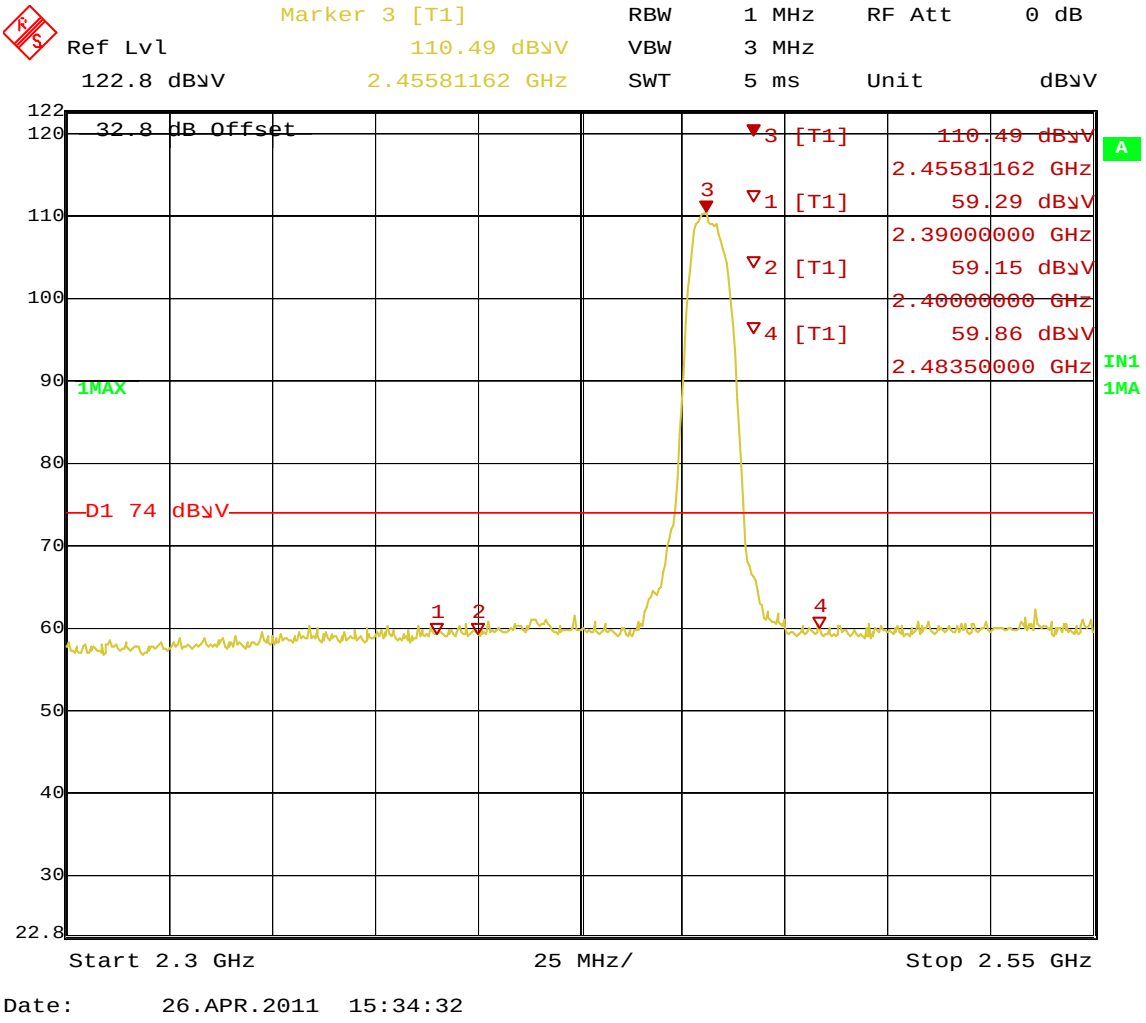


Figure 81: Radiated Emission at the Edge for 2457 MHz at 1Mbps Y-Axis – Vertical (Peak)

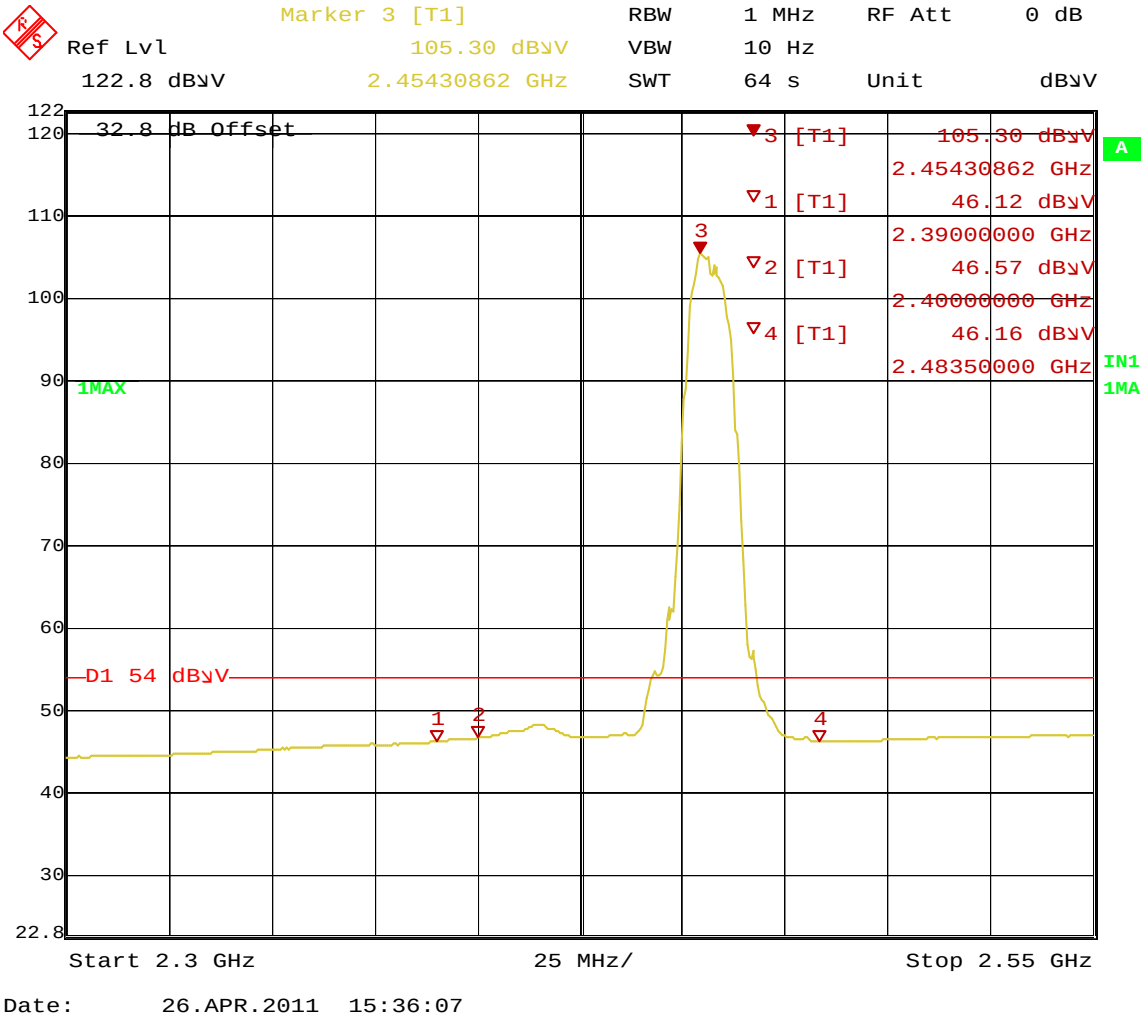


Figure 82: Radiated Emission at the Edge for 2457 MHz at 1Mbps Y-Axis – Vertical (Ave)

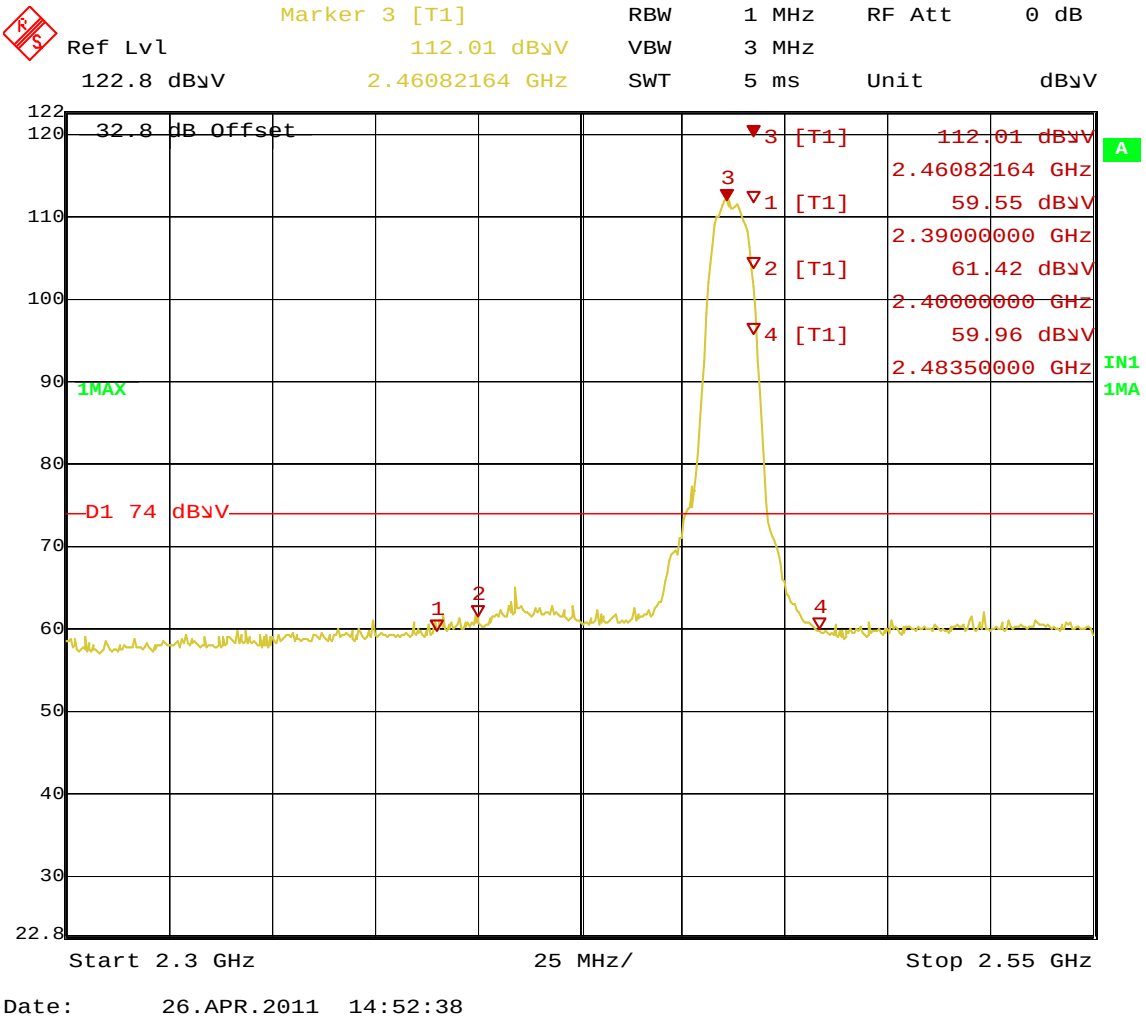


Figure 83: Radiated Emission at the Edge for 2462 MHz at 1Mbps Y-Axis – Horizontal (Peak)

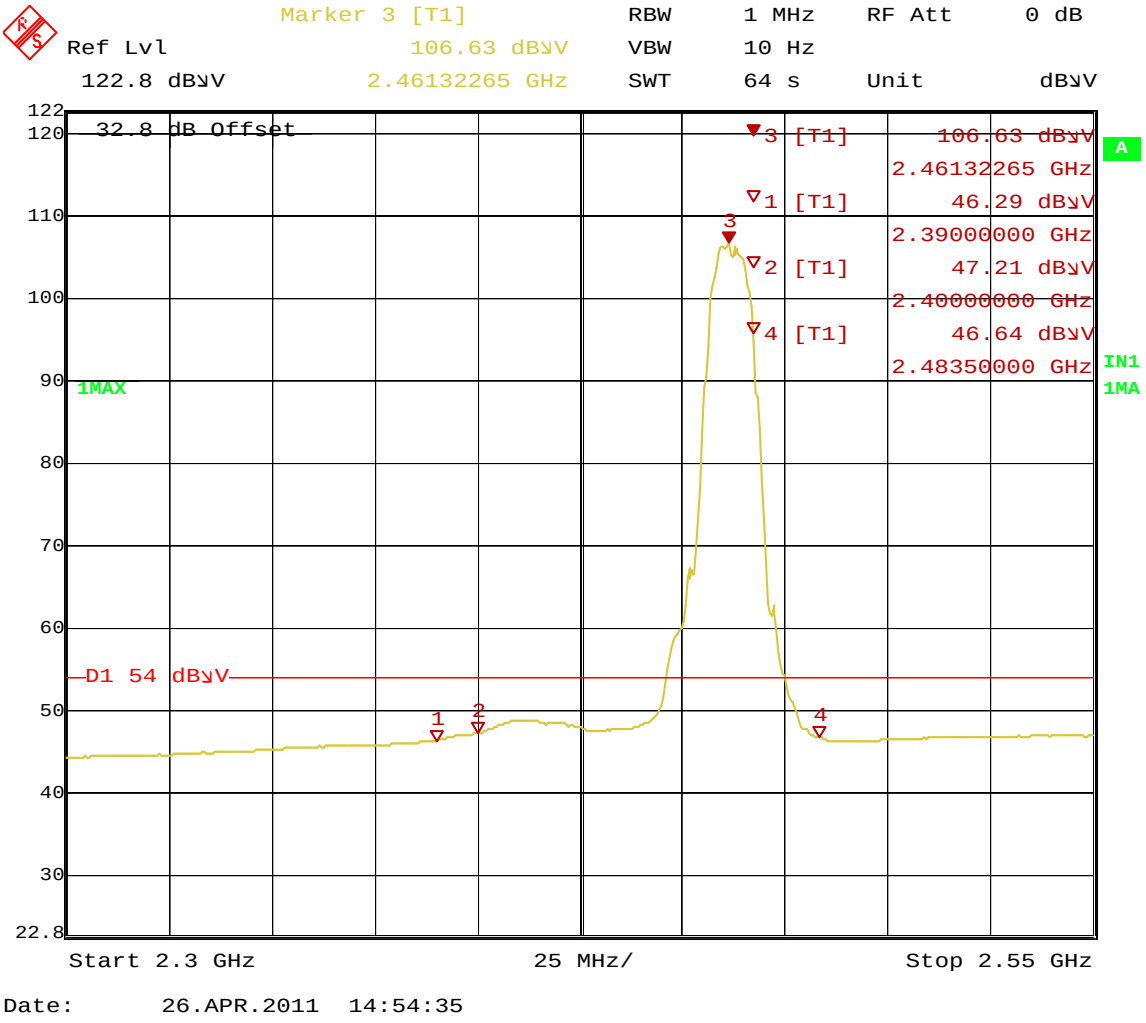


Figure 84: Radiated Emission at the Edge for 2462 MHz at 1Mbps Y-Axis – Horizontal (Ave)

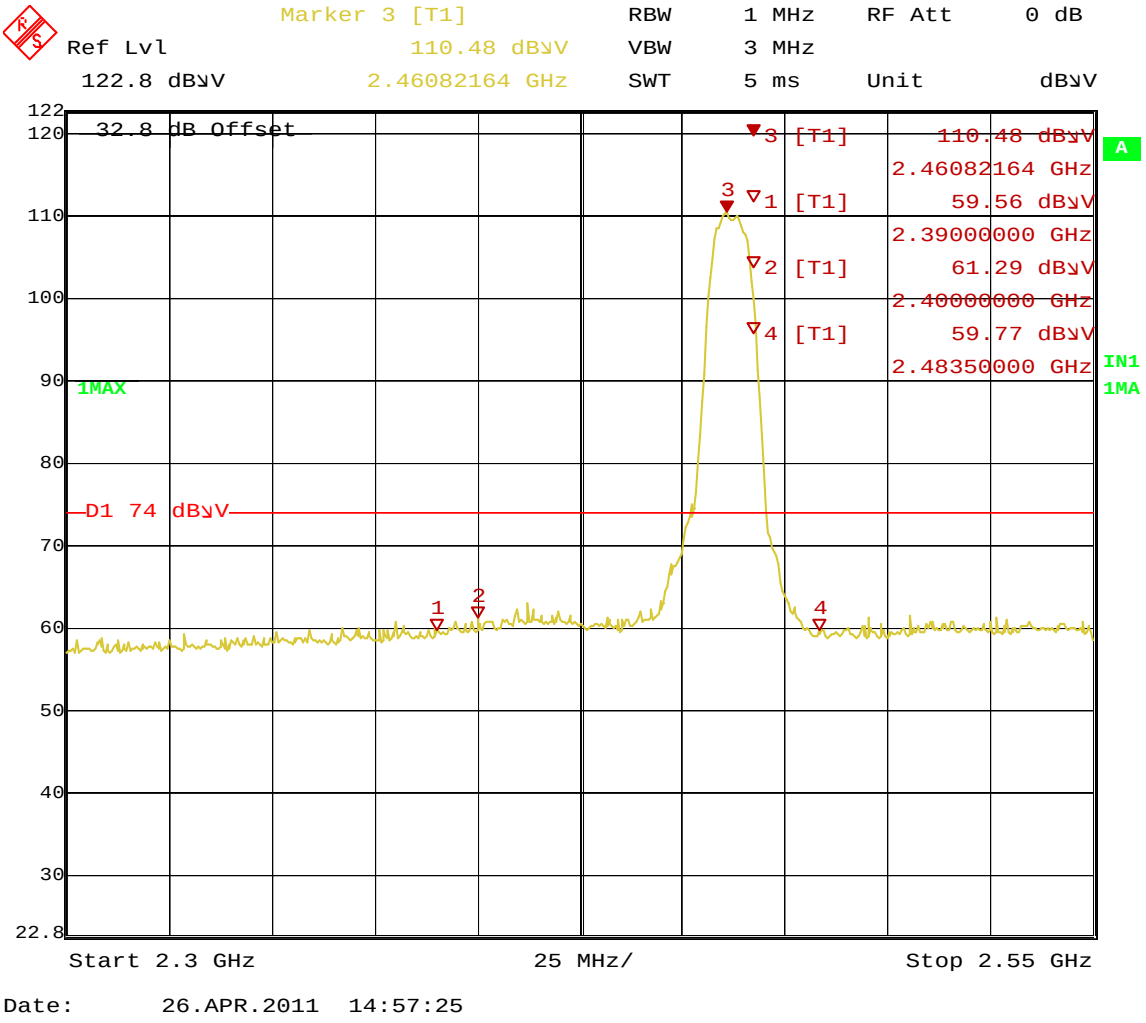


Figure 85: Radiated Emission at the Edge for 2462 MHz at 1Mbps Y-Axis – Vertical (Peak)

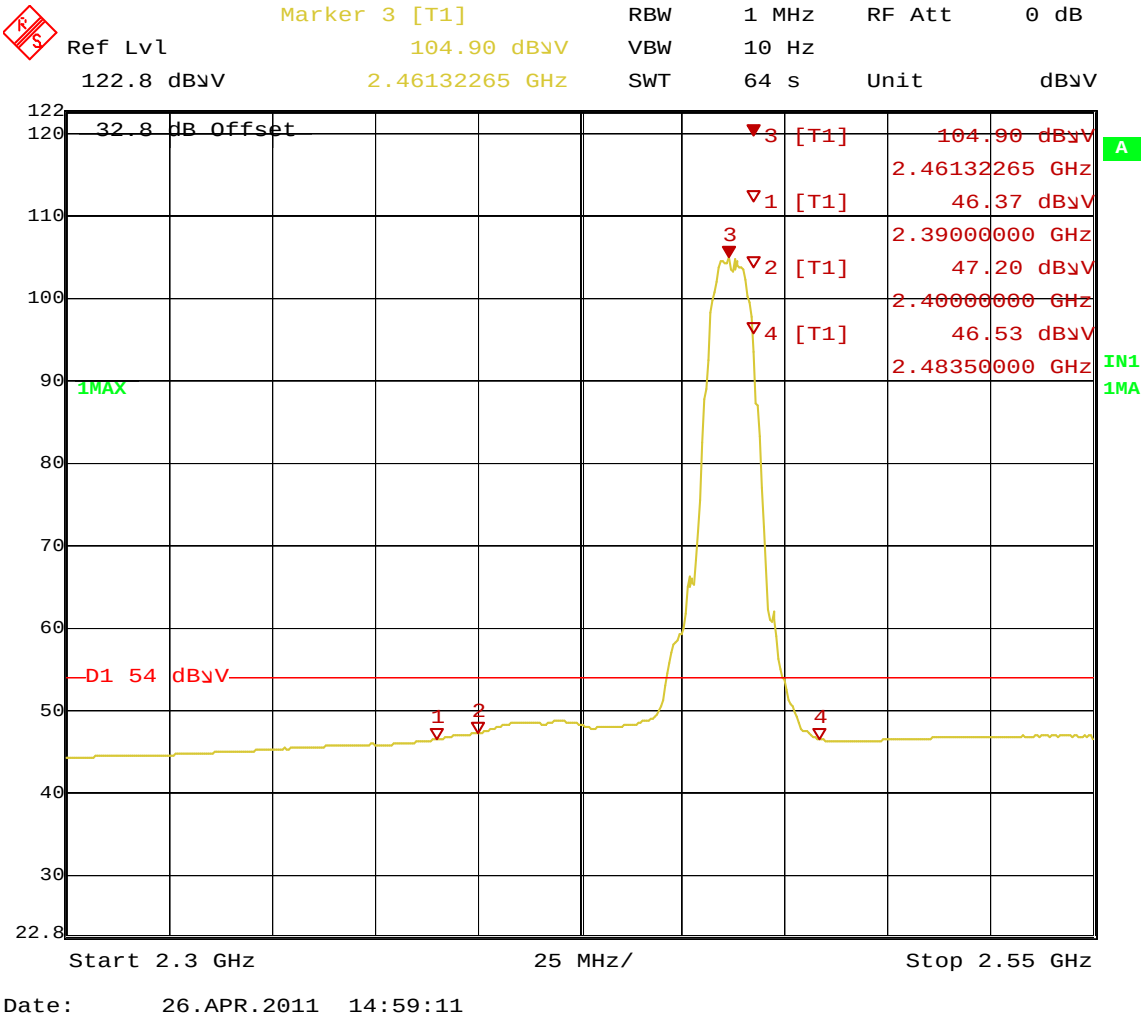


Figure 86: Radiated Emission at the Edge for 2462 MHz at 1Mbps Y-Axis – Vertical (Ave)

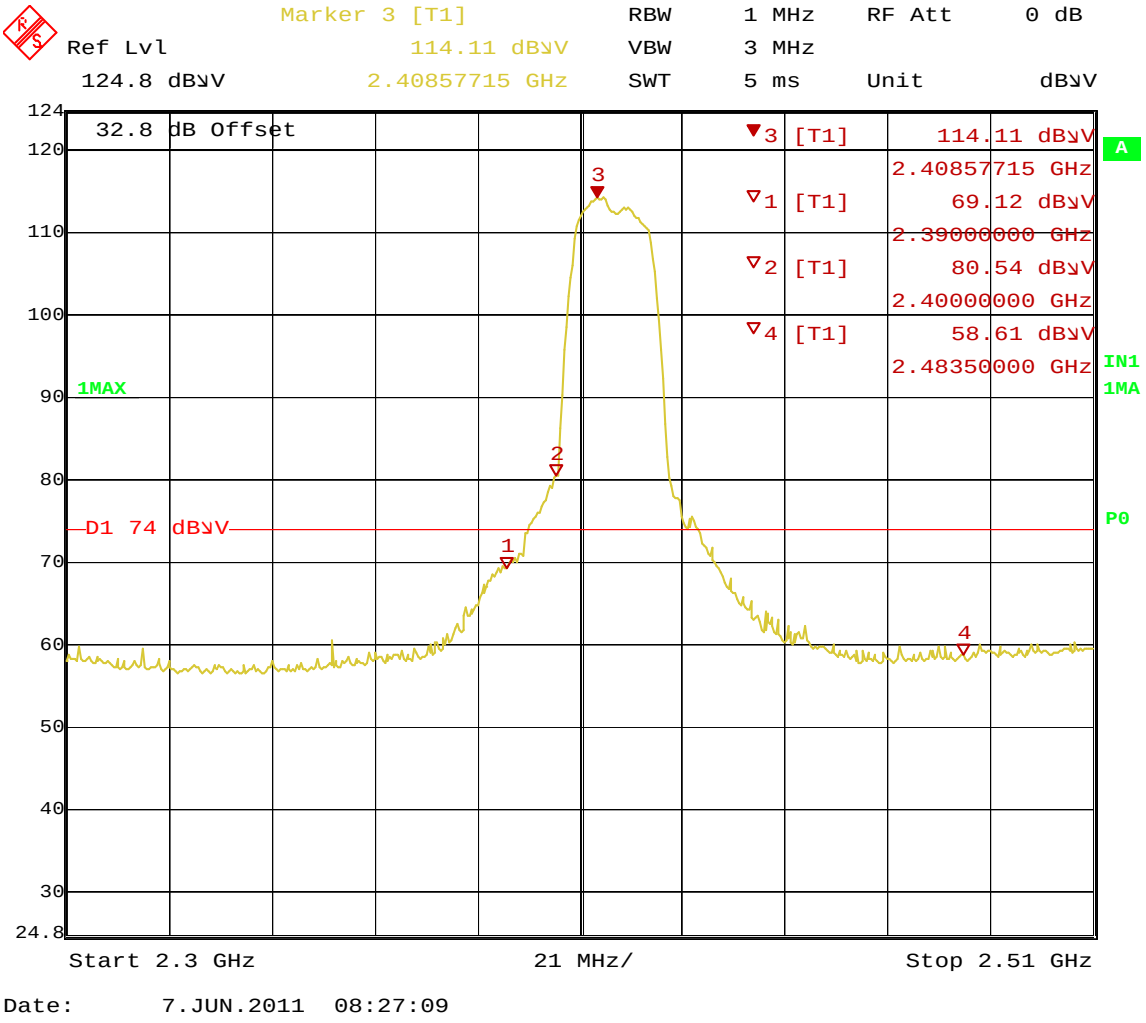


Figure 87: Radiated Emission at the Edge for 2412 MHz at 6 Mbps Y-Axis – Horizontal (Peak)

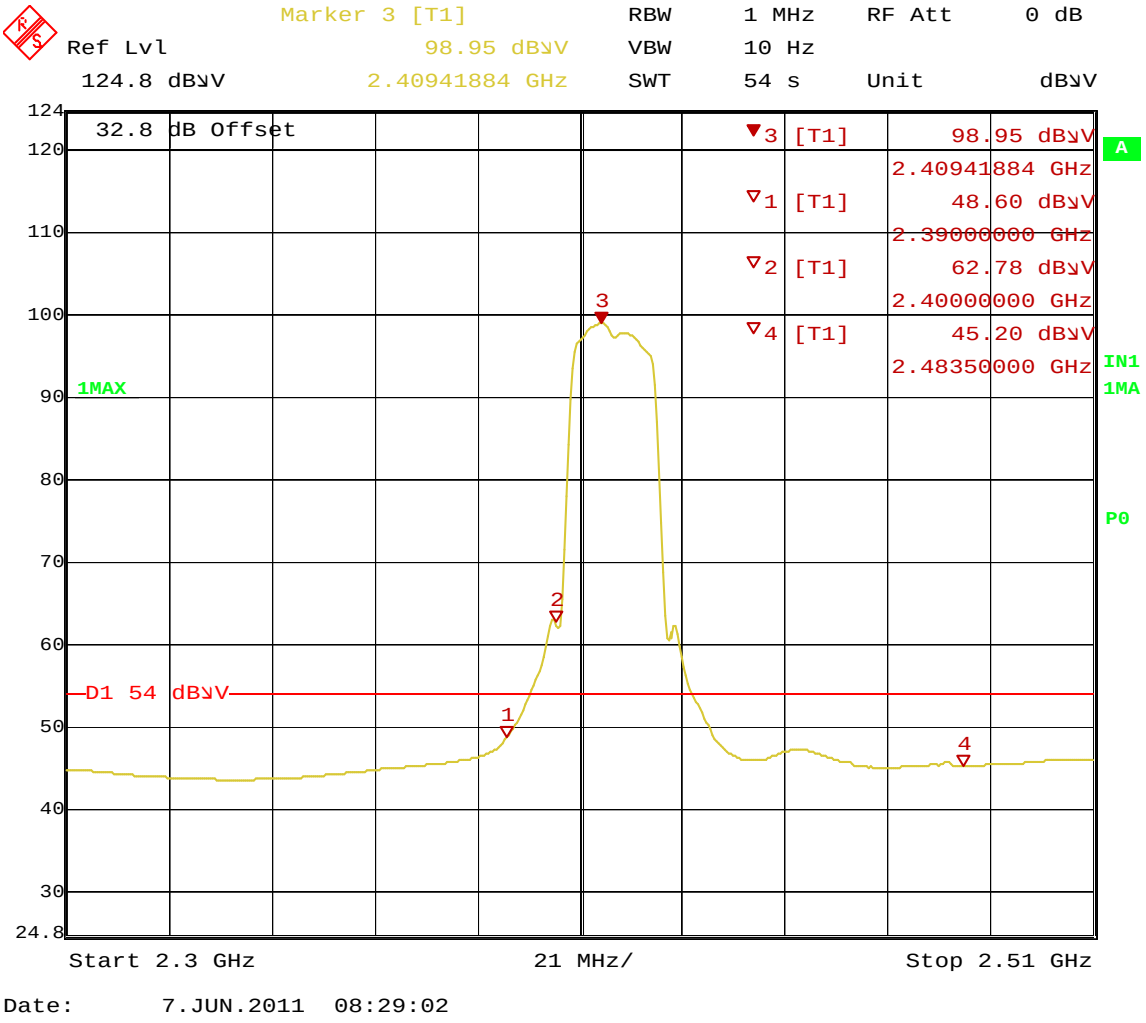


Figure 88: Radiated Emission at the Edge for 2412 MHz at 6 Mbps Y-Axis – Horizontal (Ave)

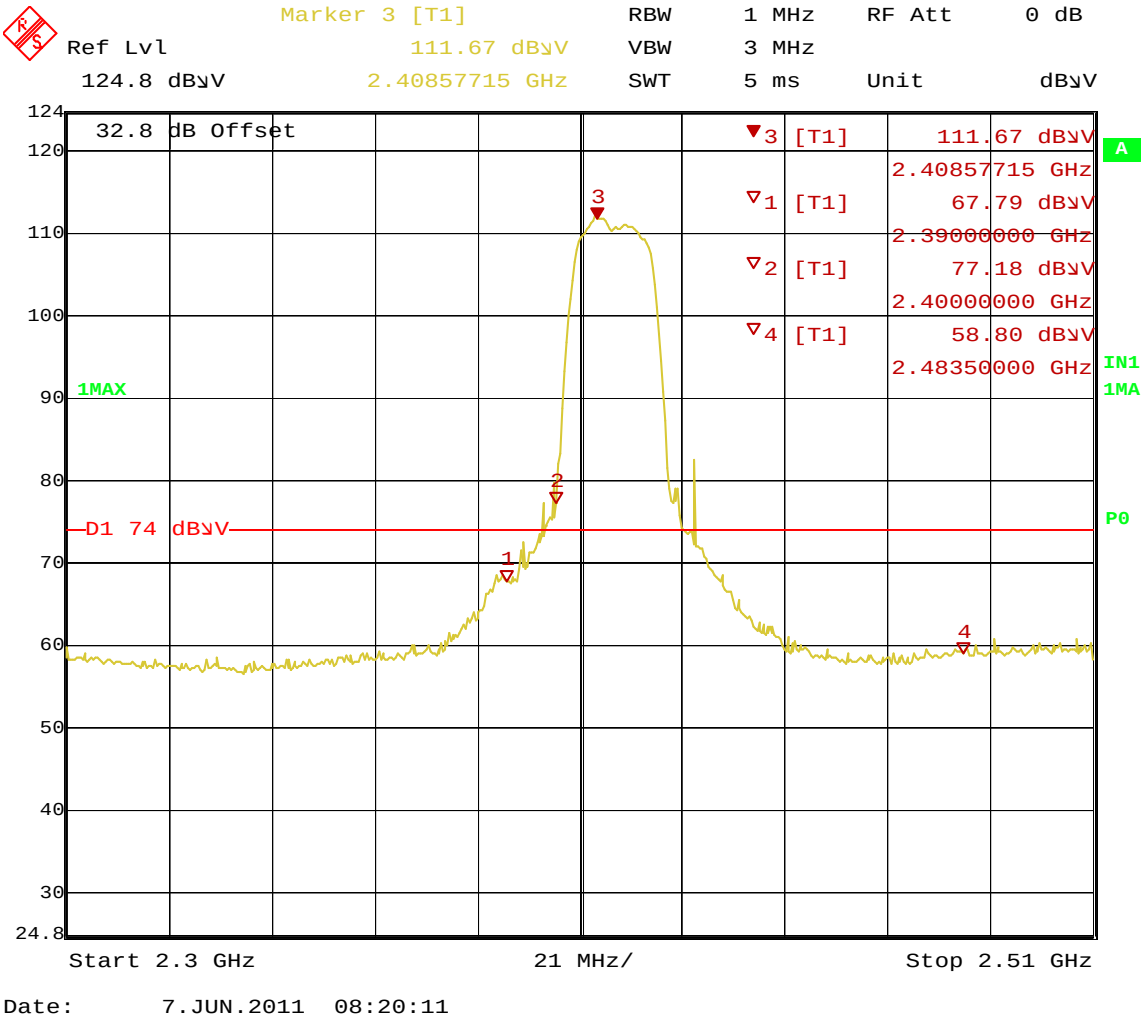


Figure 89: Radiated Emission at the Edge for 2412 MHz at 6 Mbps Y-Axis – Vertical (Peak)

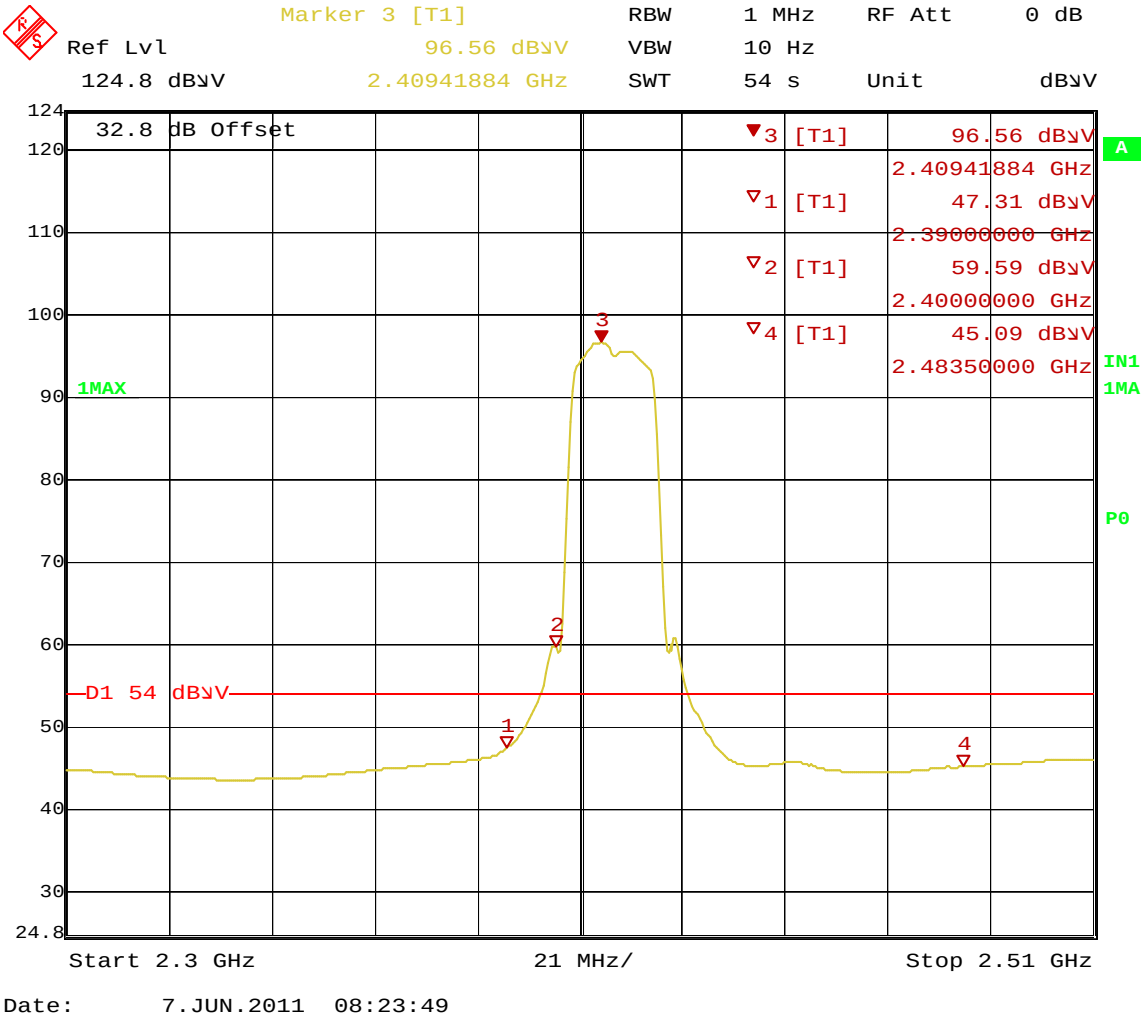


Figure 90: Radiated Emission at the Edge for 2412 MHz at 6 Mbps Y-Axis – Vertical (Ave)

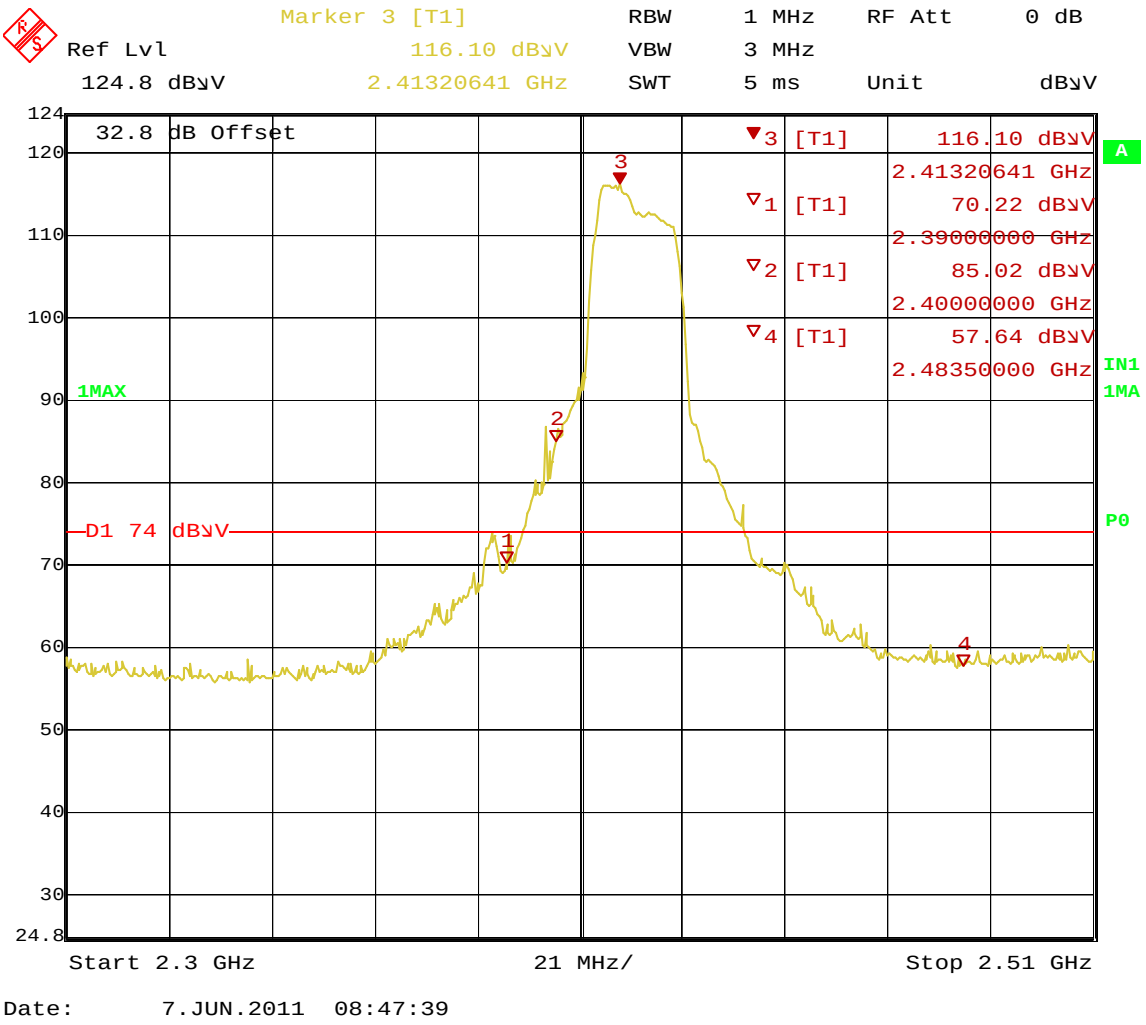


Figure 91: Radiated Emission at the Edge for 2417 MHz at 6 Mbps Y-Axis – Horizontal (Peak)

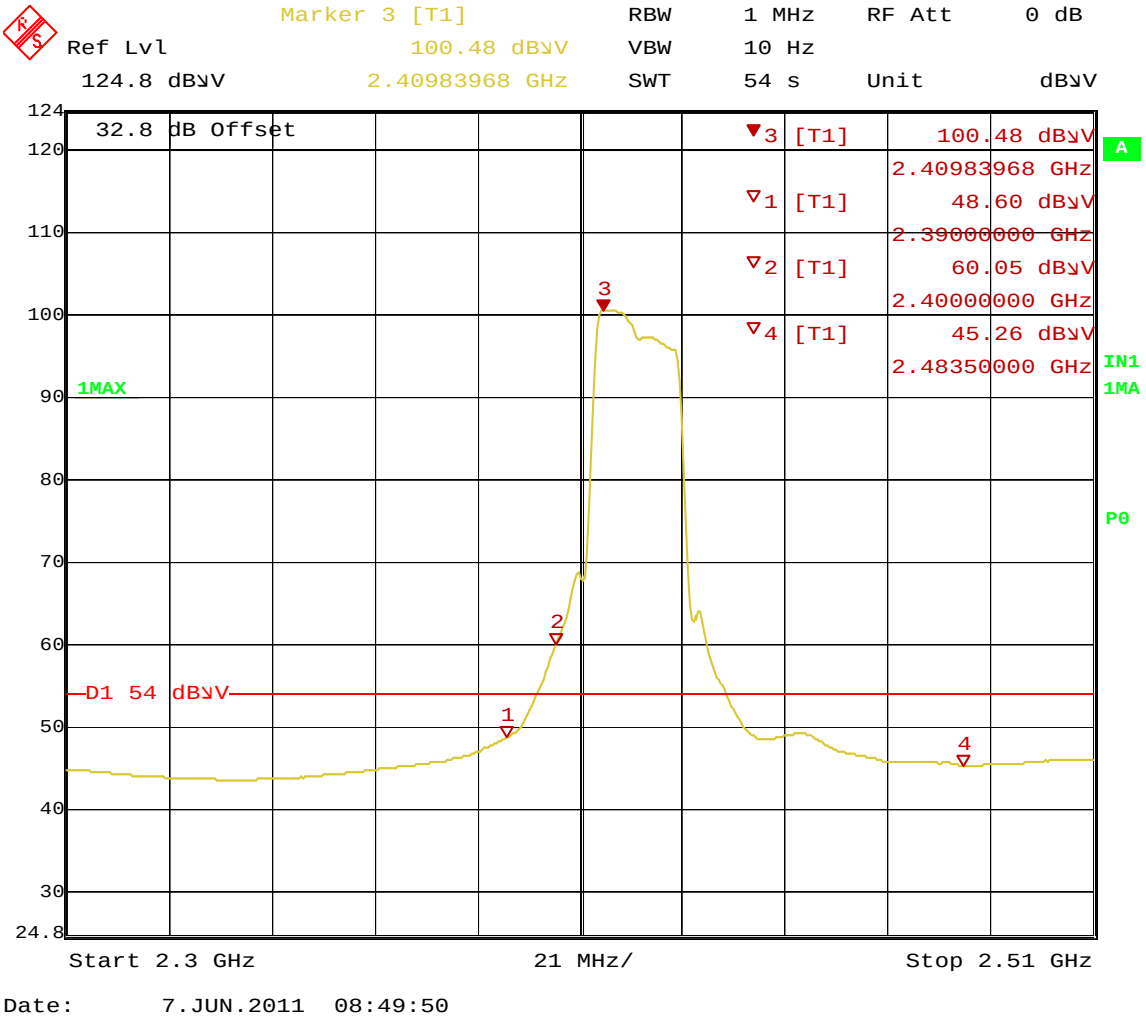


Figure 92: Radiated Emission at the Edge for 2417 MHz at 6 Mbps Y-Axis – Horizontal (Ave)

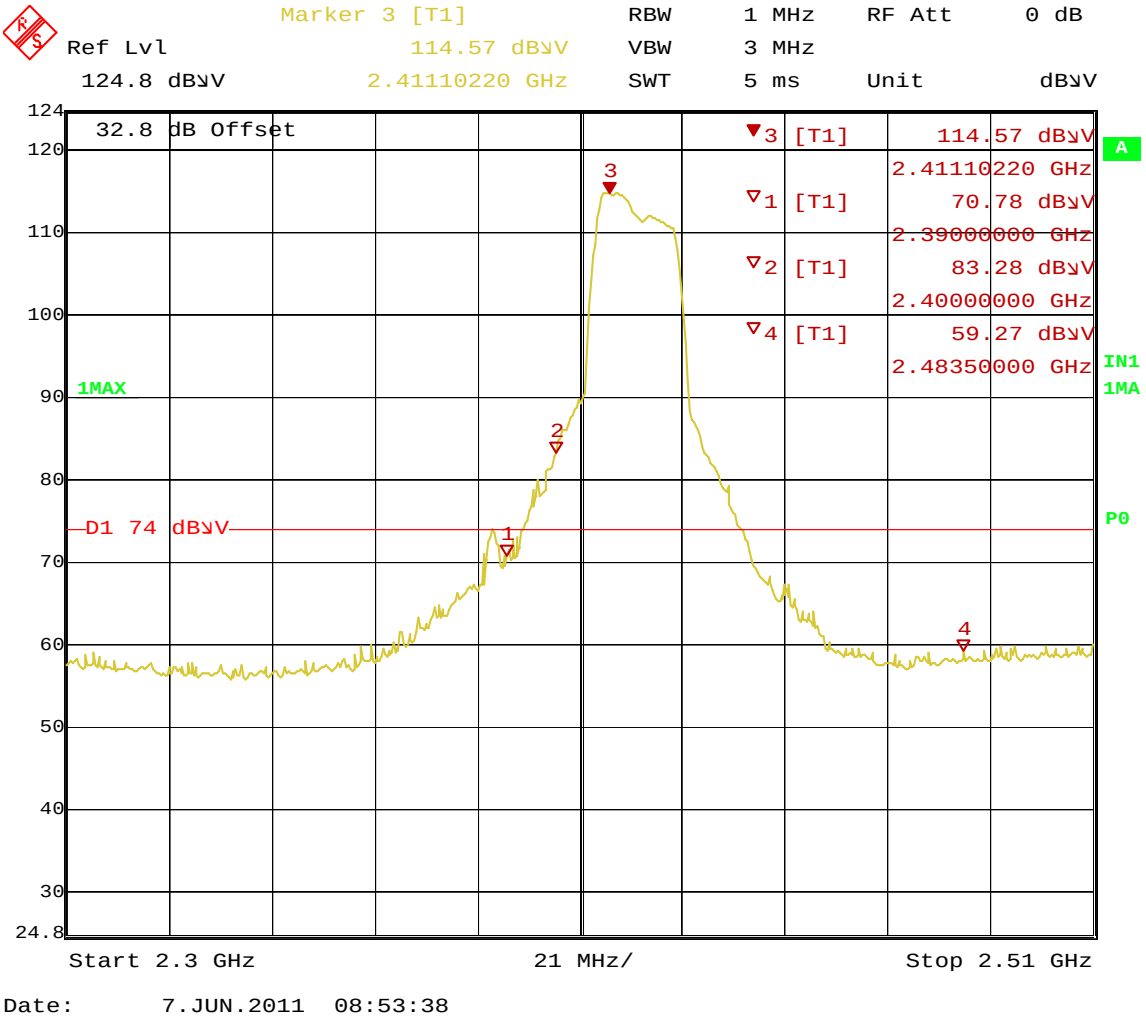


Figure 93: Radiated Emission at the Edge for 2417 MHz at 6 Mbps Y-Axis – Vertical (Peak)

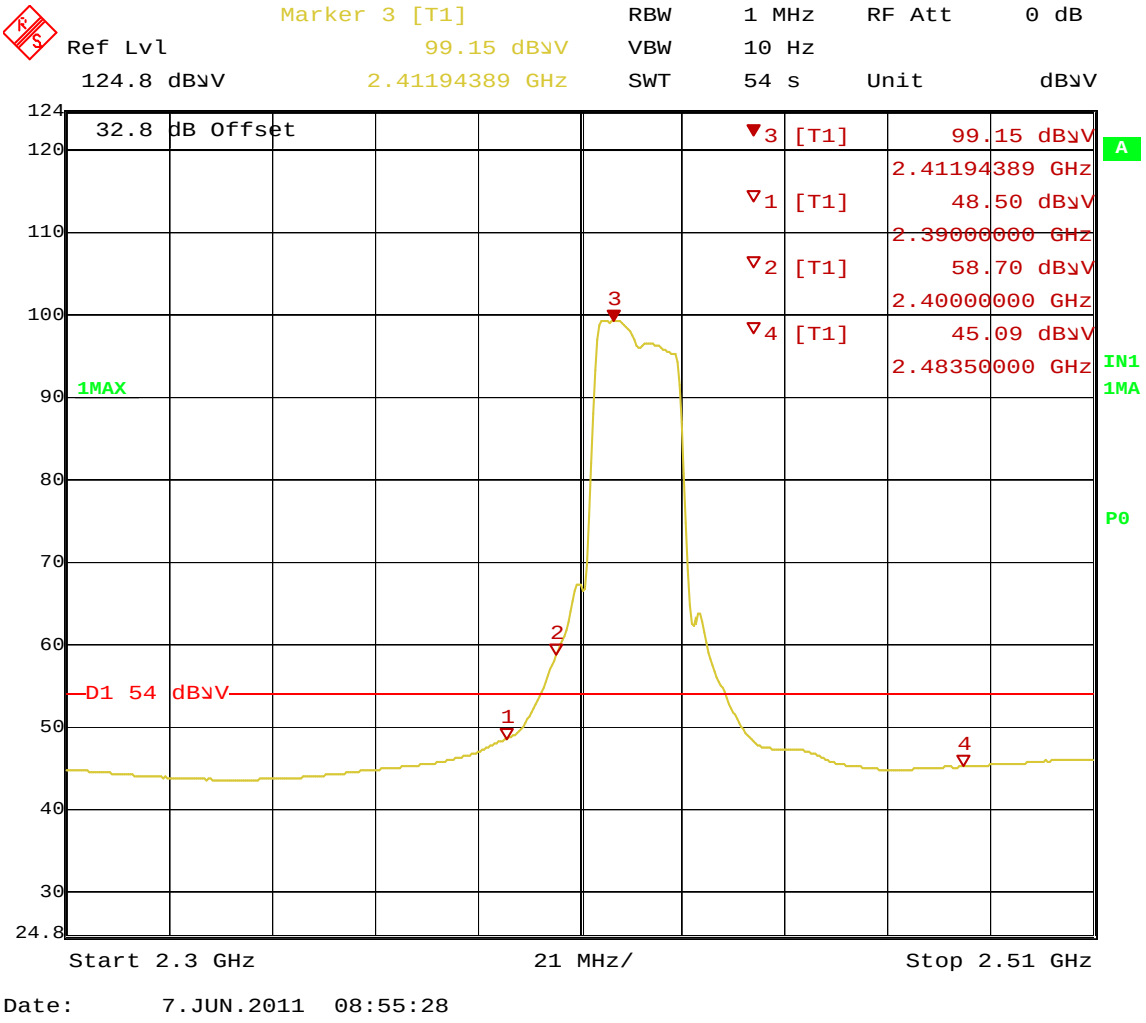


Figure 94: Radiated Emission at the Edge for 2417 MHz at 6 Mbps Y-Axis – Vertical (Ave)

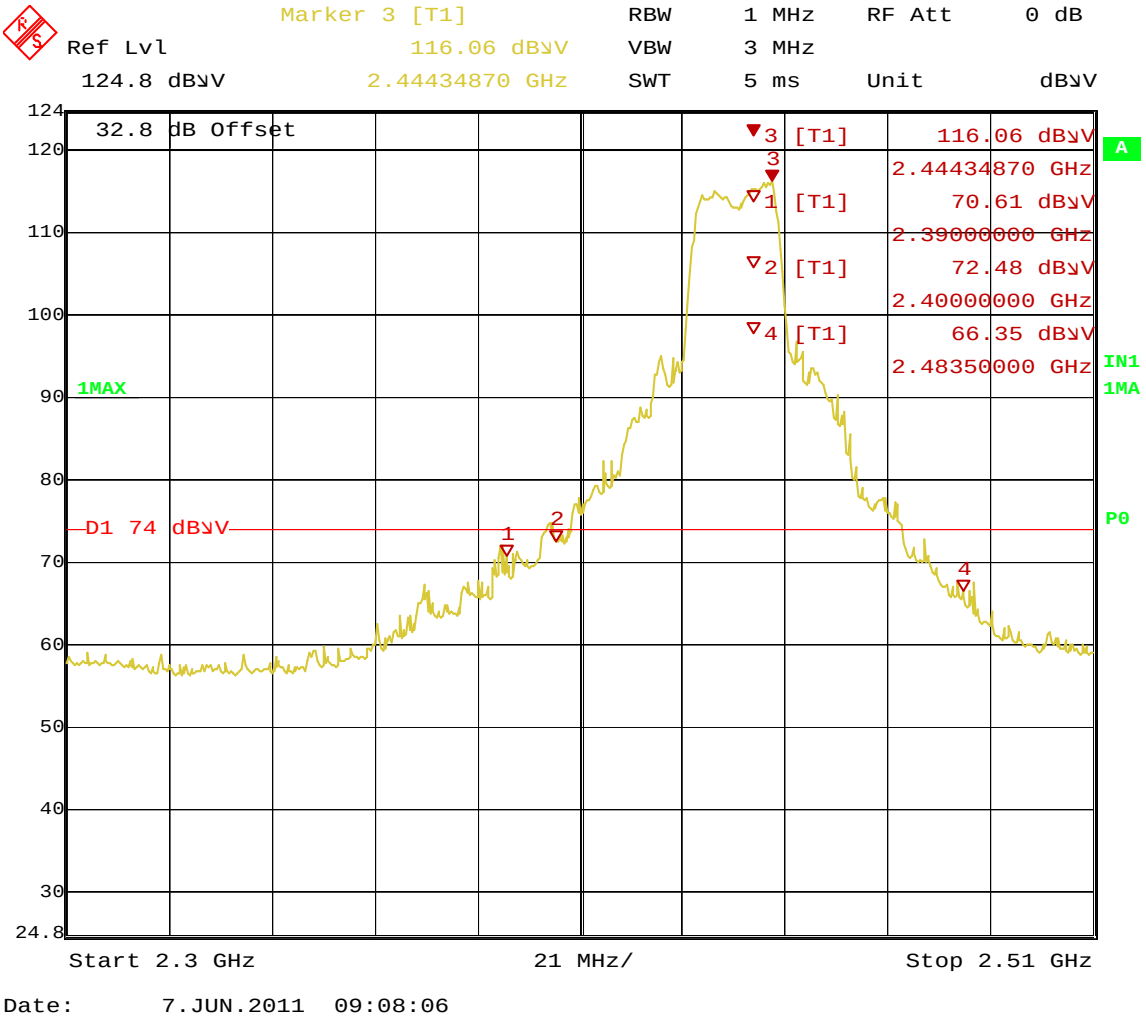


Figure 95: Radiated Emission at the Edge for 2437 MHz at 6 Mbps Y-Axis – Horizontal (Peak)

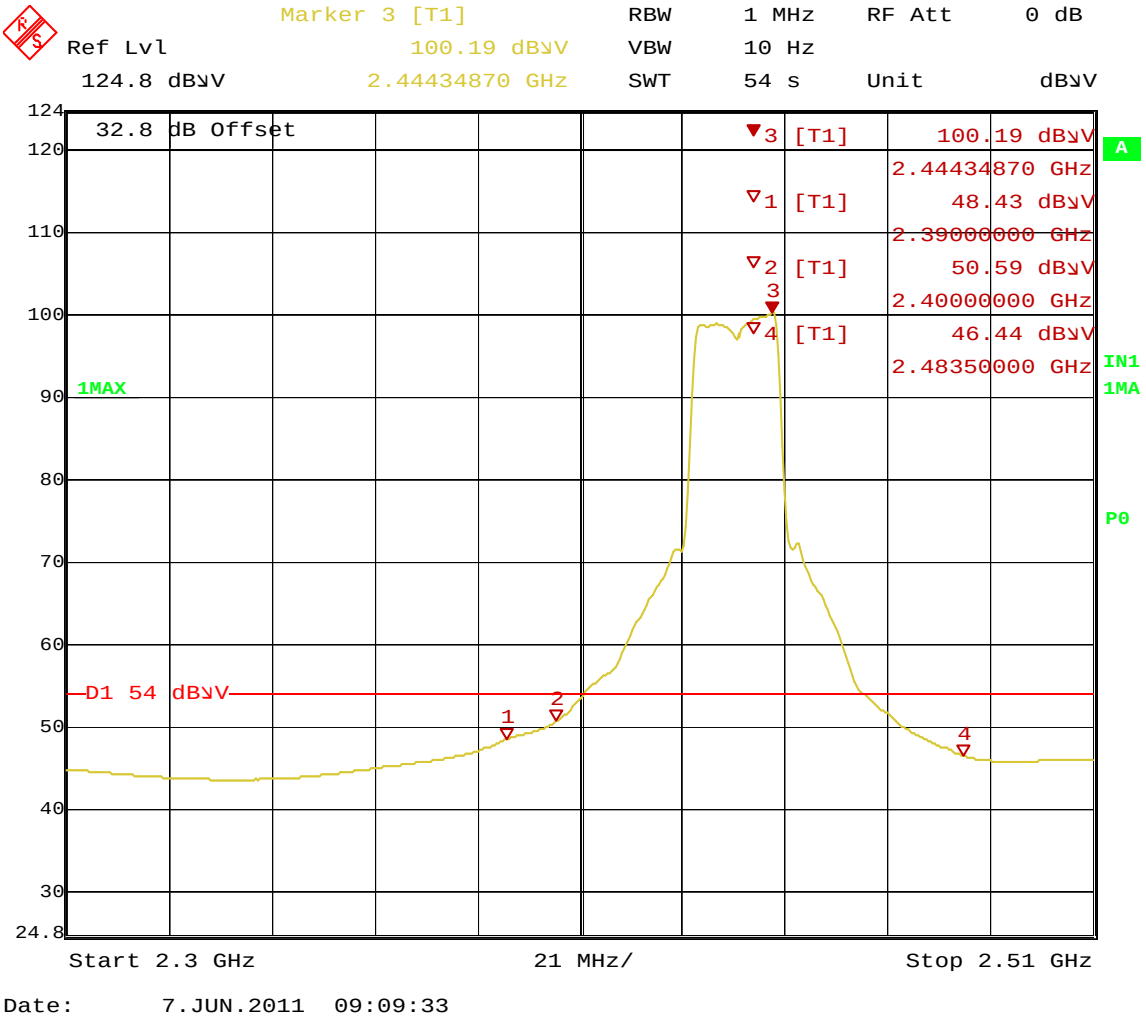


Figure 96: Radiated Emission at the Edge for 2437 MHz at 6 Mbps Y-Axis – Horizontal (Ave)

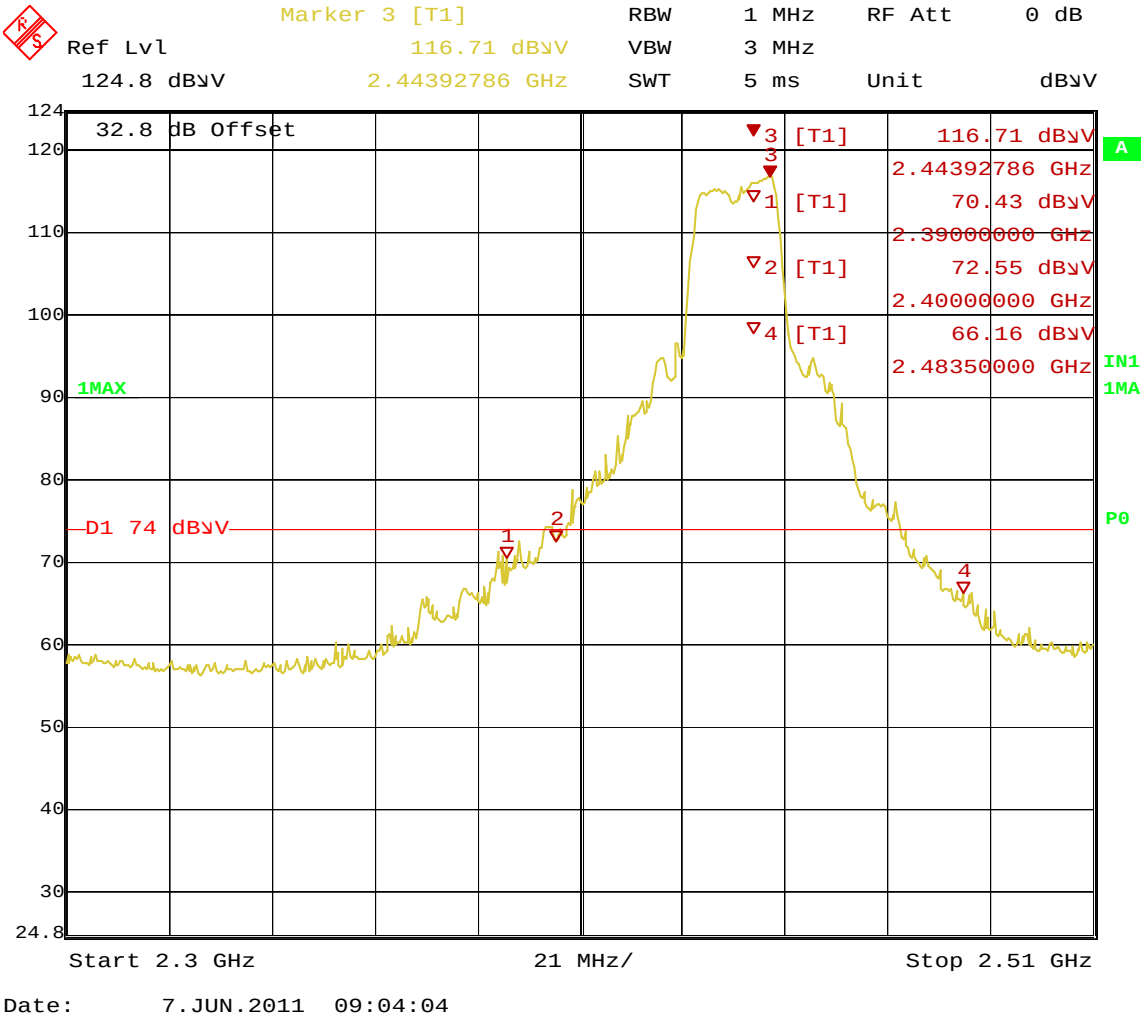


Figure 97: Radiated Emission at the Edge for 2437 MHz at 6 Mbps Y-Axis – Vertical (Peak)

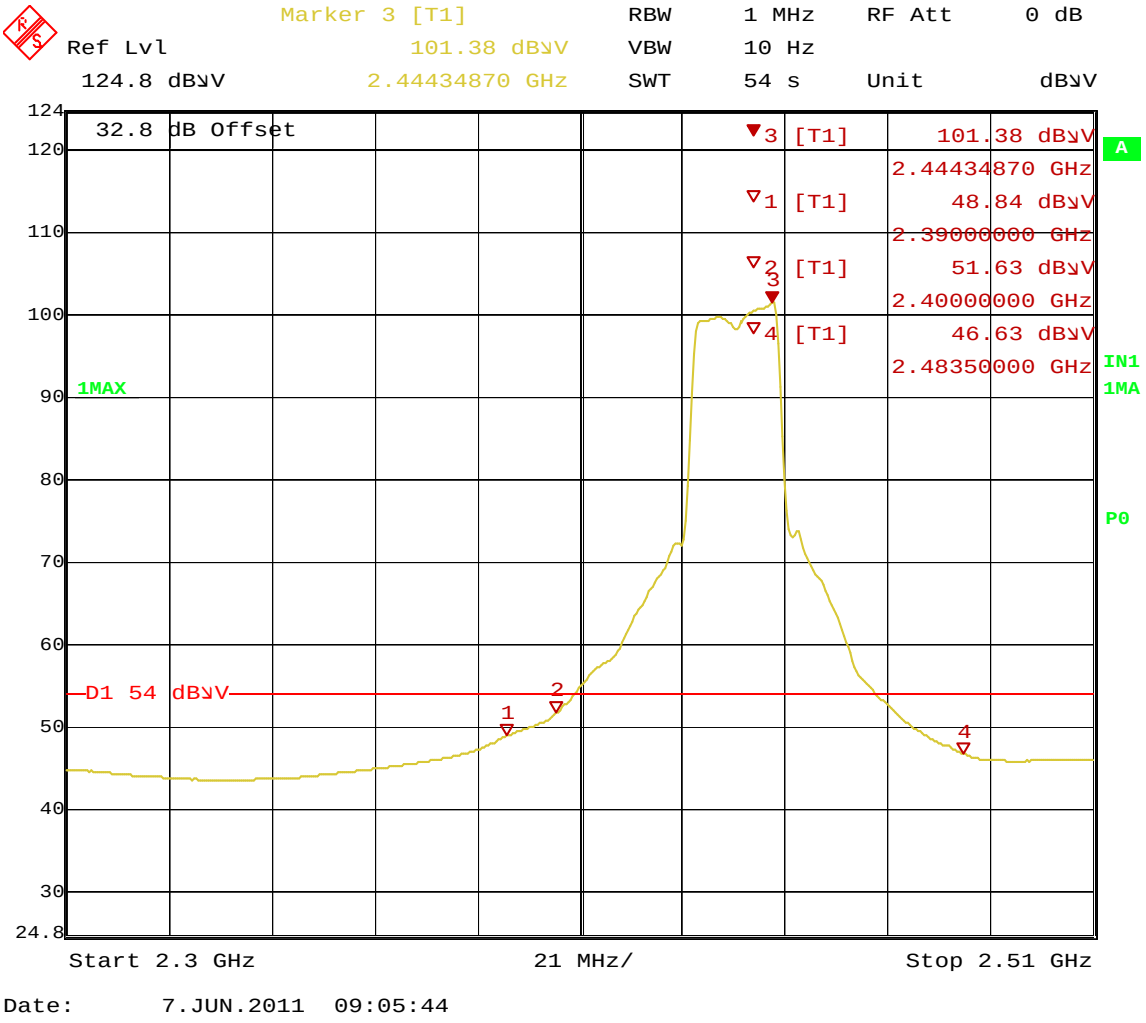


Figure 98: Radiated Emission at the Edge for 2437 MHz at 6 Mbps Y-Axis – Vertical (Ave)

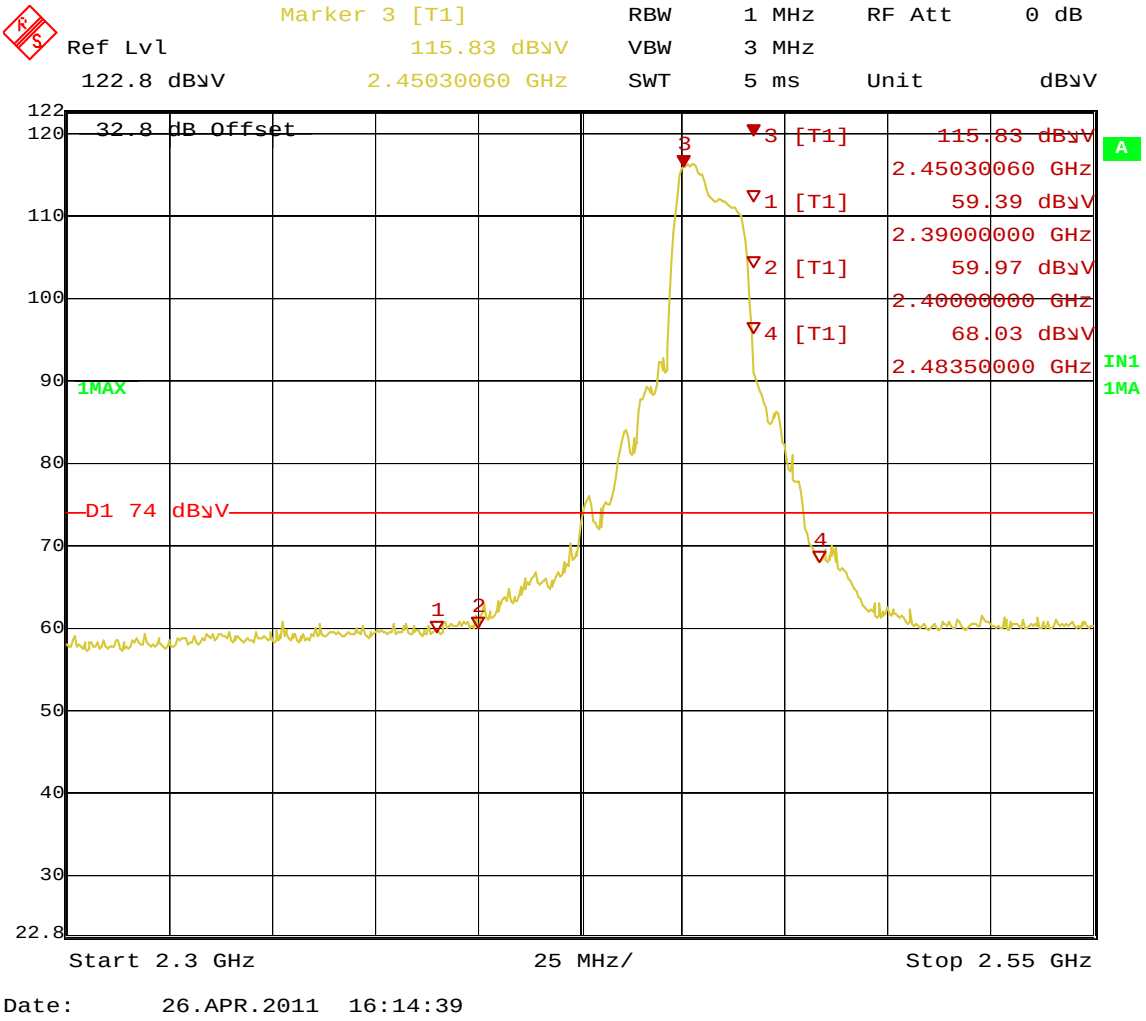


Figure 99: Radiated Emission at the Edge for 2457 MHz at 6 Mbps Y-Axis – Horizontal (Peak)

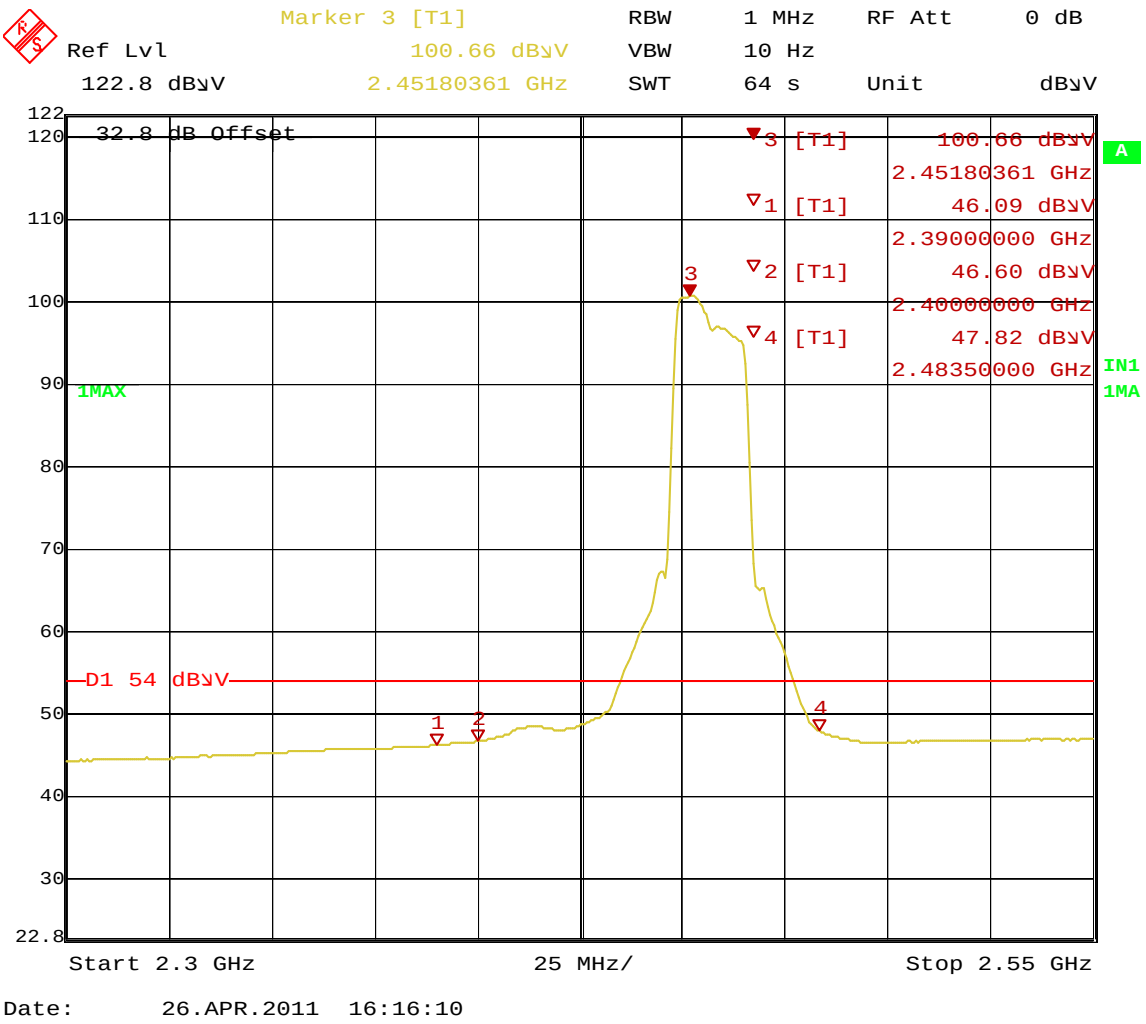


Figure 100: Radiated Emission at the Edge for 2457 MHz at 6 Mbps Y-Axis – Horizontal (Ave.)

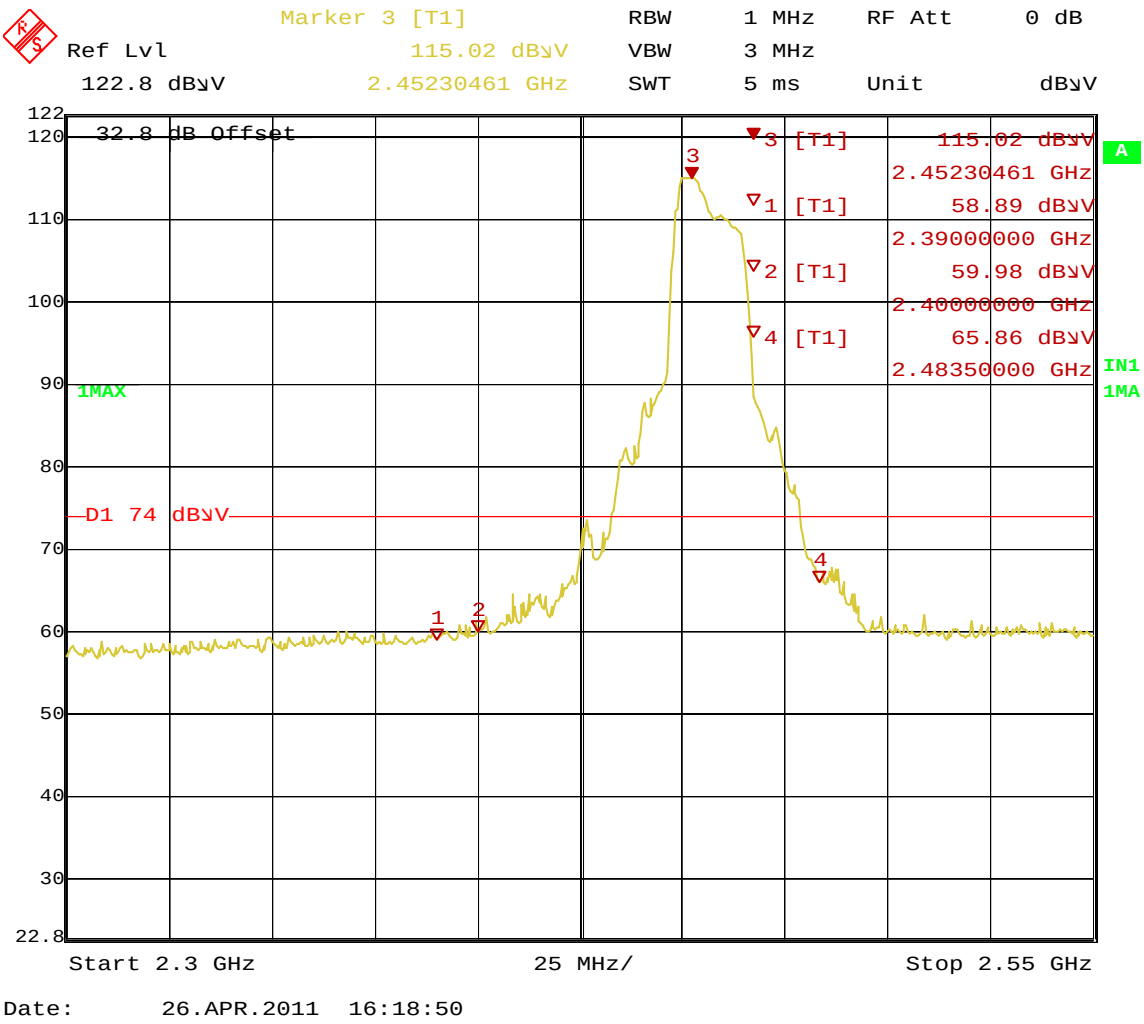


Figure 101: Radiated Emission at the Edge for 2457 MHz at 6 Mbps Y-Axis – Vertical (Peak)

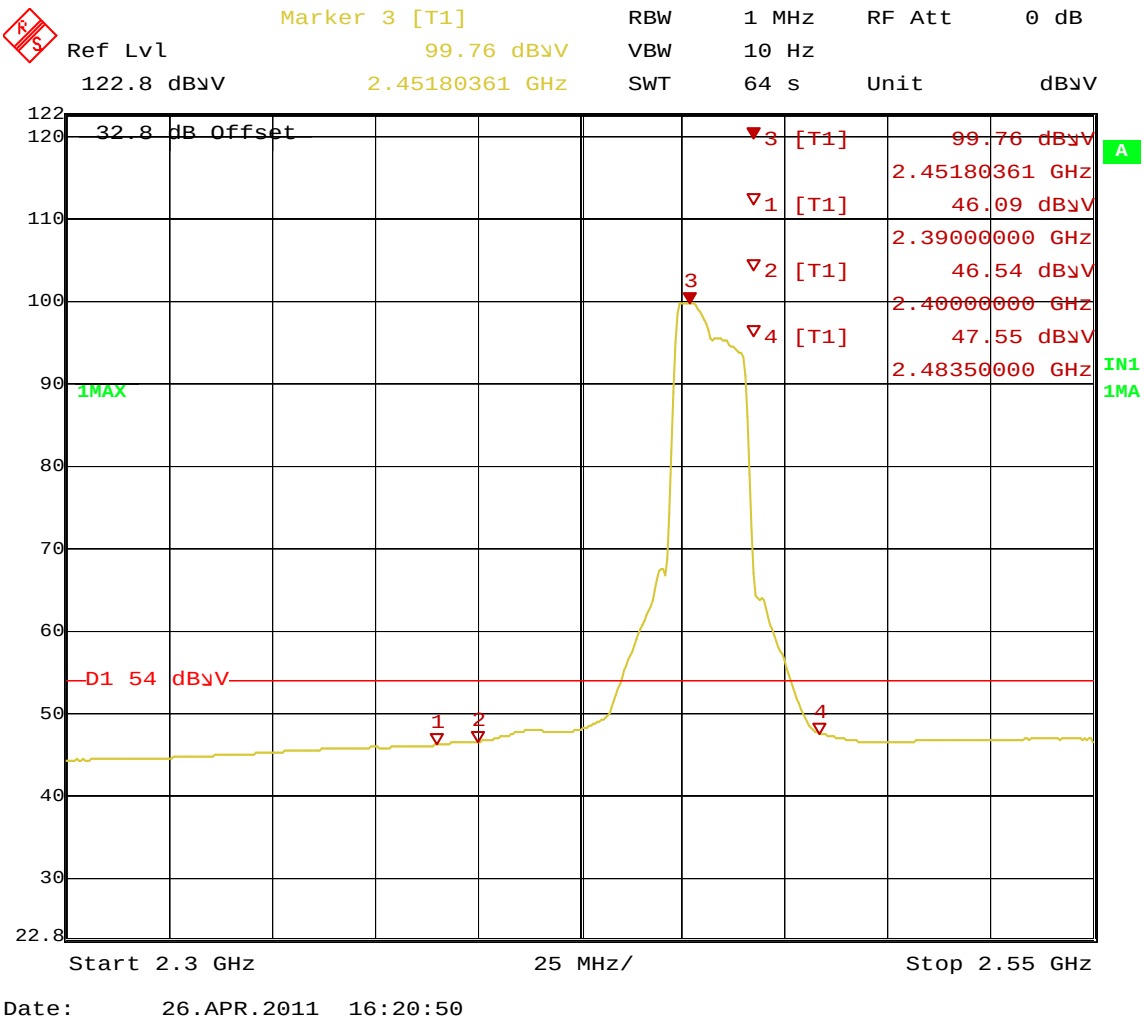


Figure 102: Radiated Emission at the Edge for 2457 MHz at 6 Mbps Y-Axis – Vertical (Ave.)

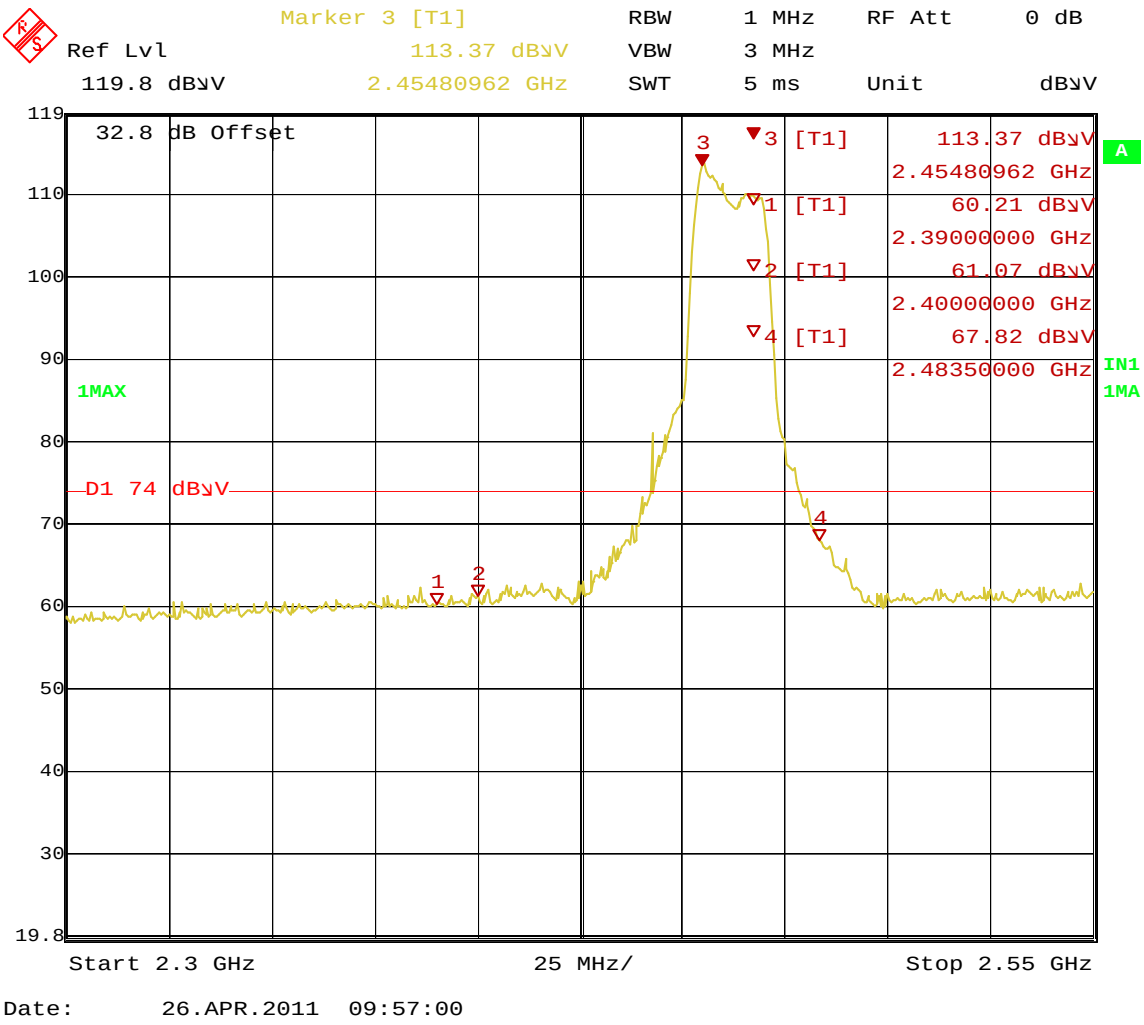


Figure 103: Radiated Emission at the Edge for 2462 MHz at 6 Mbps Y-Axis – Horizontal (Peak)

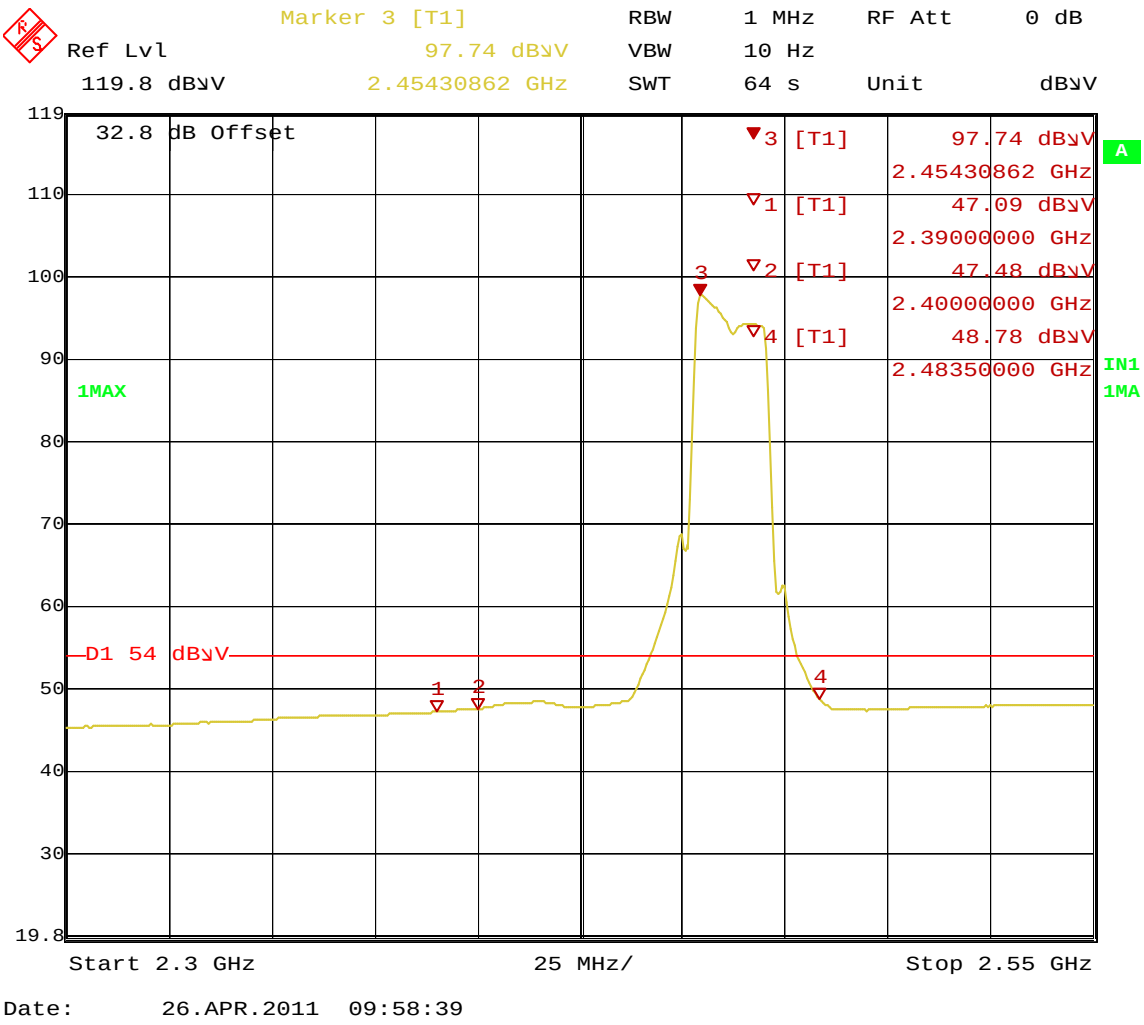


Figure 104: Radiated Emission at the Edge for 2462 MHz at 6 Mbps Y-Axis – Horizontal (Ave.)

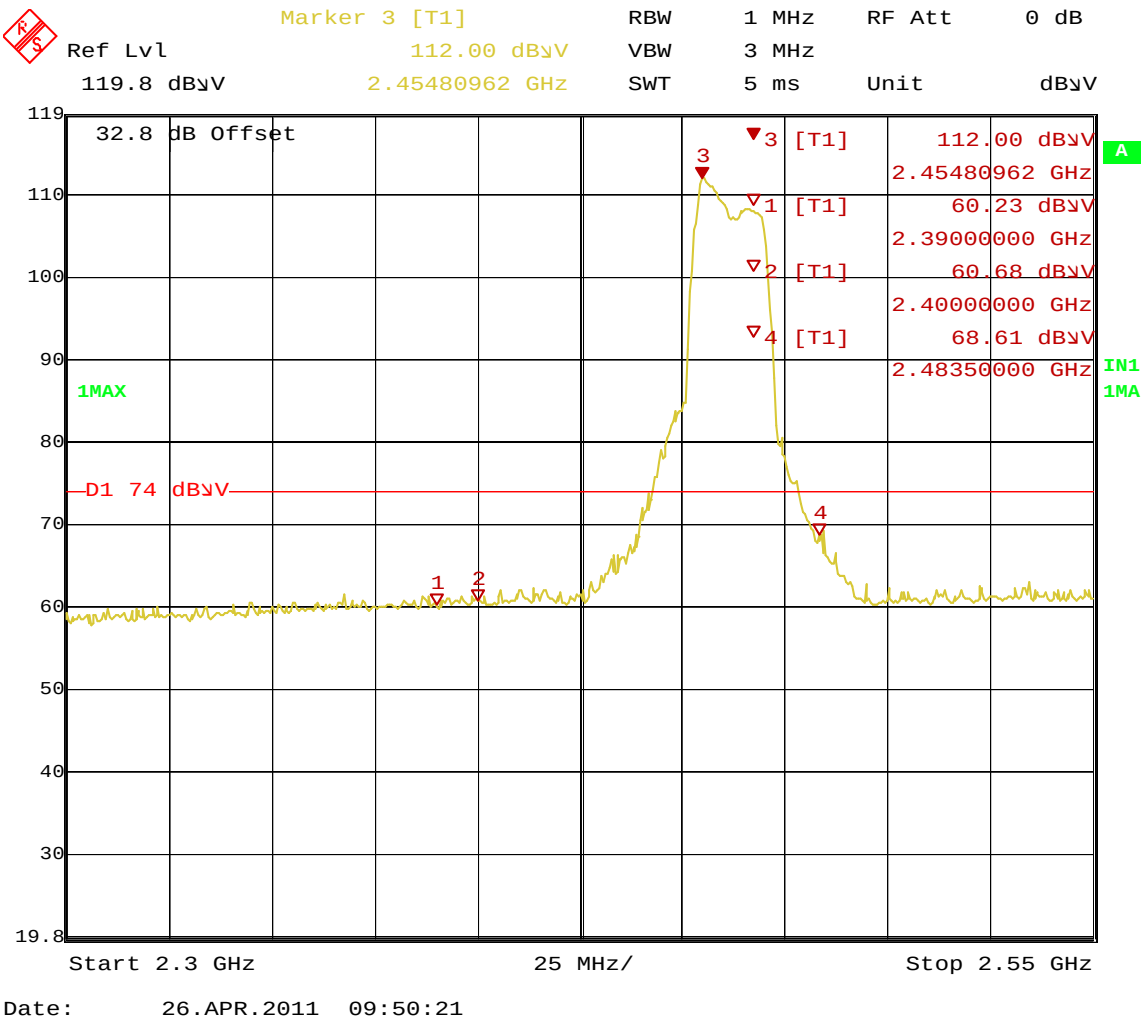


Figure 105: Radiated Emission at the Edge for 2462 MHz at 6 Mbps Y-Axis – Vertical (Peak)

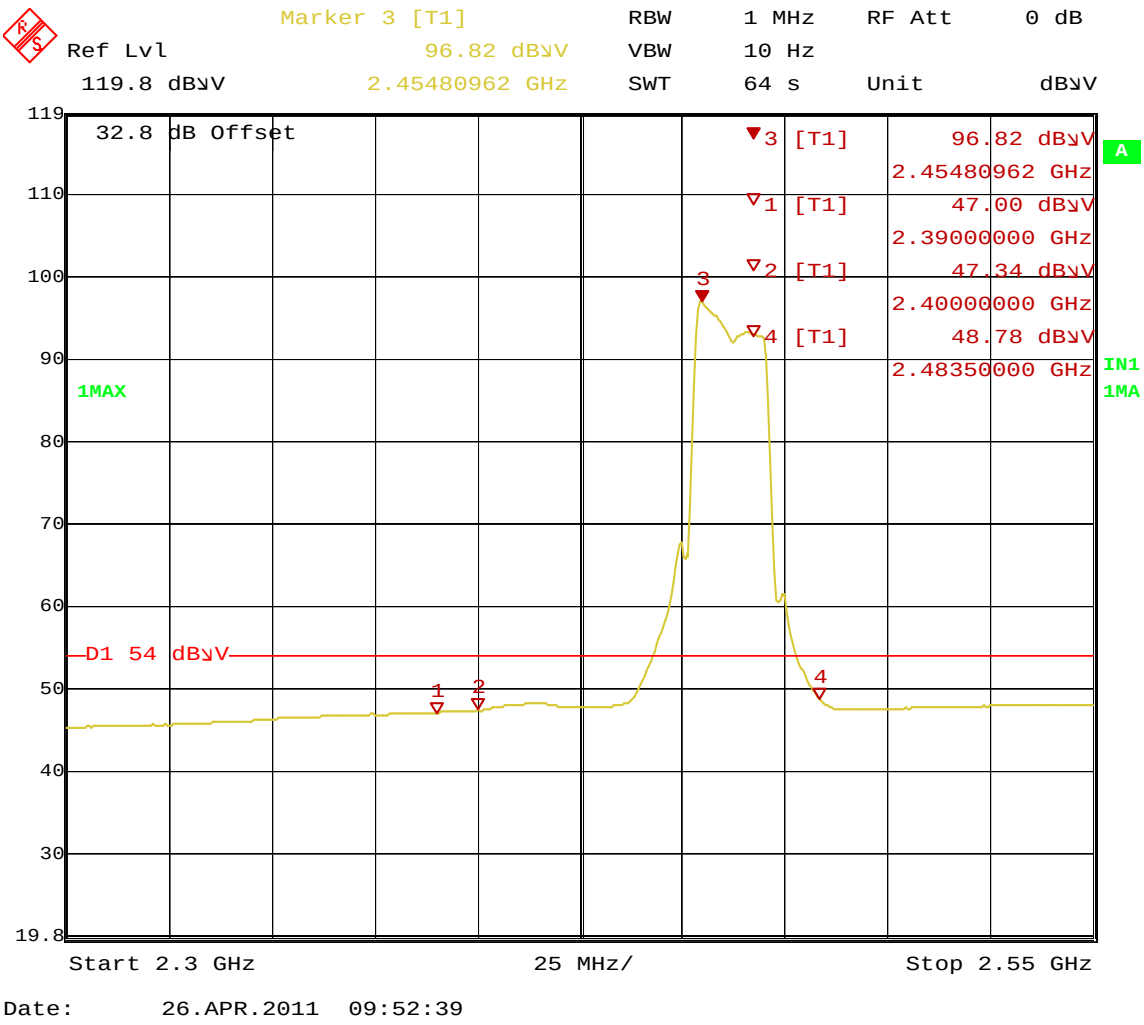


Figure 106: Radiated Emission at the Edge for 2462 MHz at 6 Mbps Y-Axis – Vertical (Ave.)

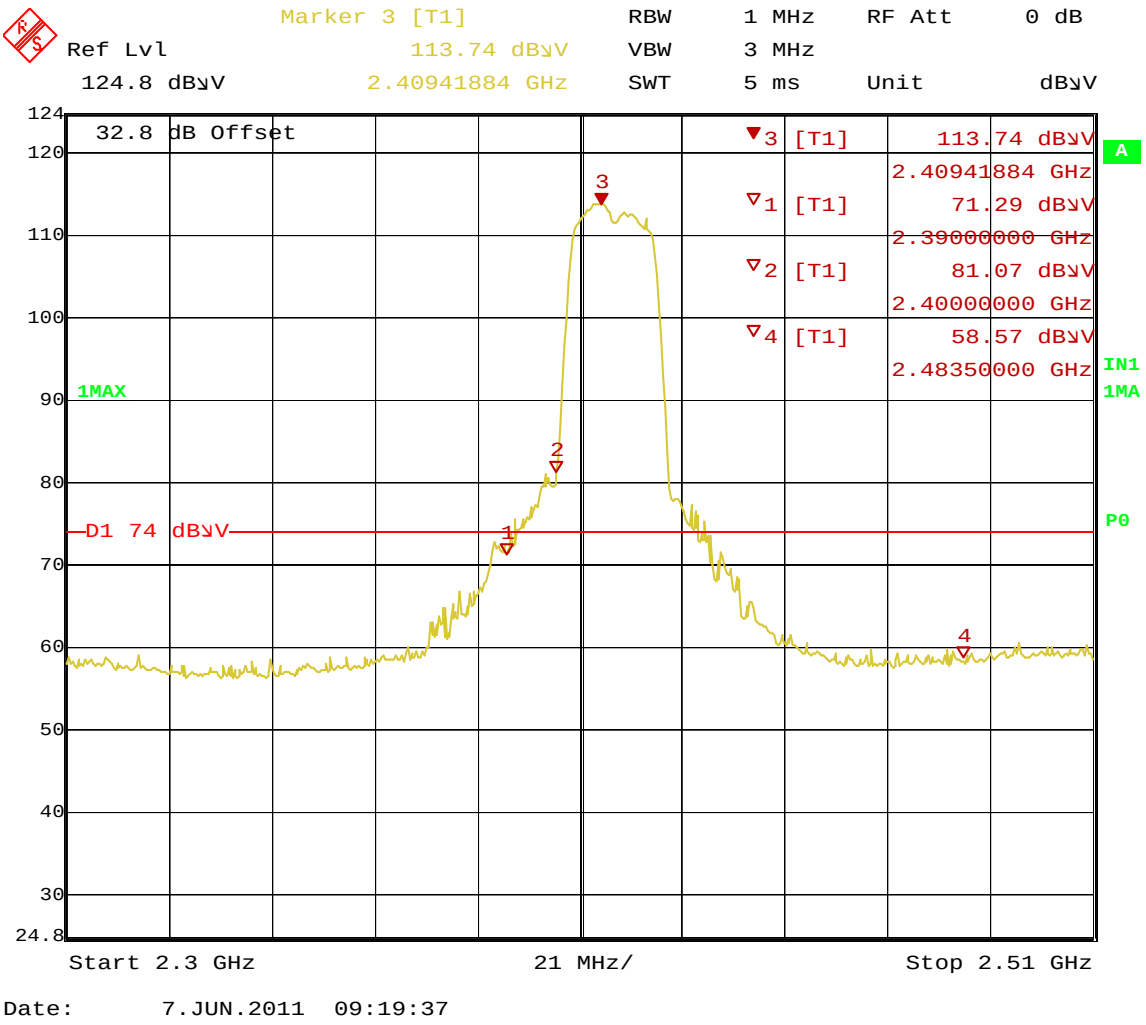


Figure 107: Radiated Emission at the Edge for 2412 MHz at Chain 0 HT20 6.5 Mbps – Horizontal (Peak)

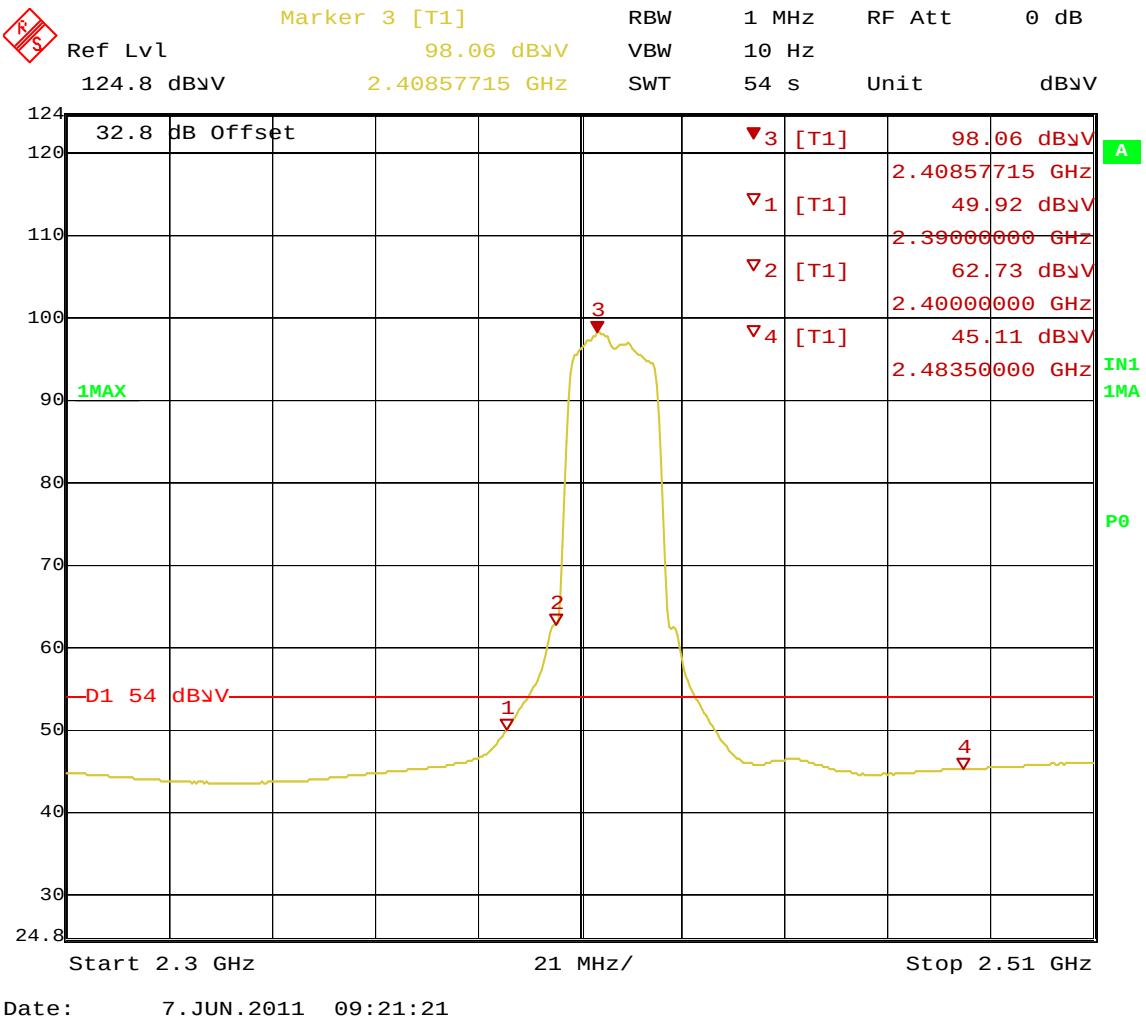


Figure 108: Radiated Emission at the Edge for 2412 MHz at Chain 0 HT20 6.5 Mbps – Horizontal (Ave.)

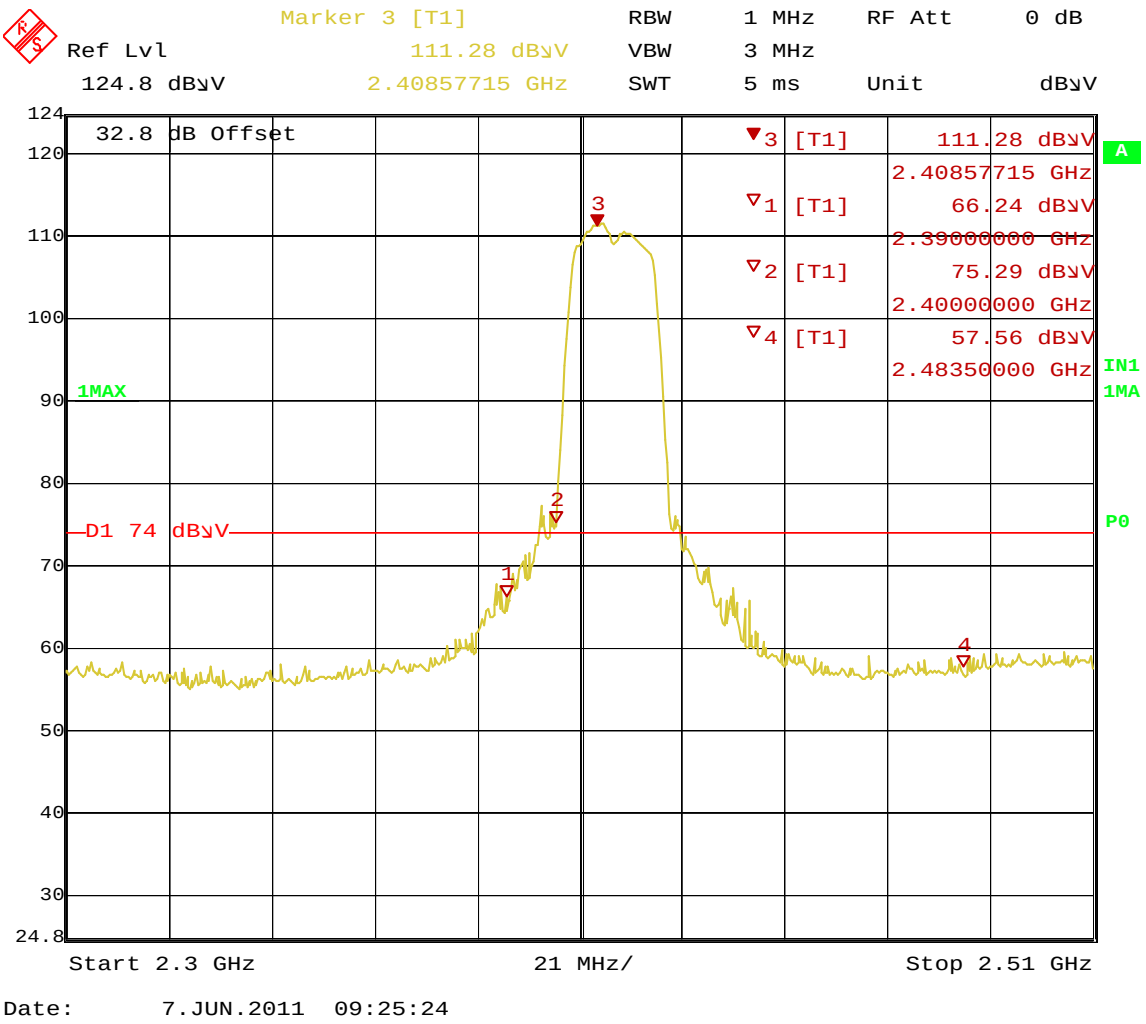


Figure 109: Radiated Emission at the Edge for Channel 2412 MHz at Chain 0 HT20 6.5 Mbps – Vertical (Peak)

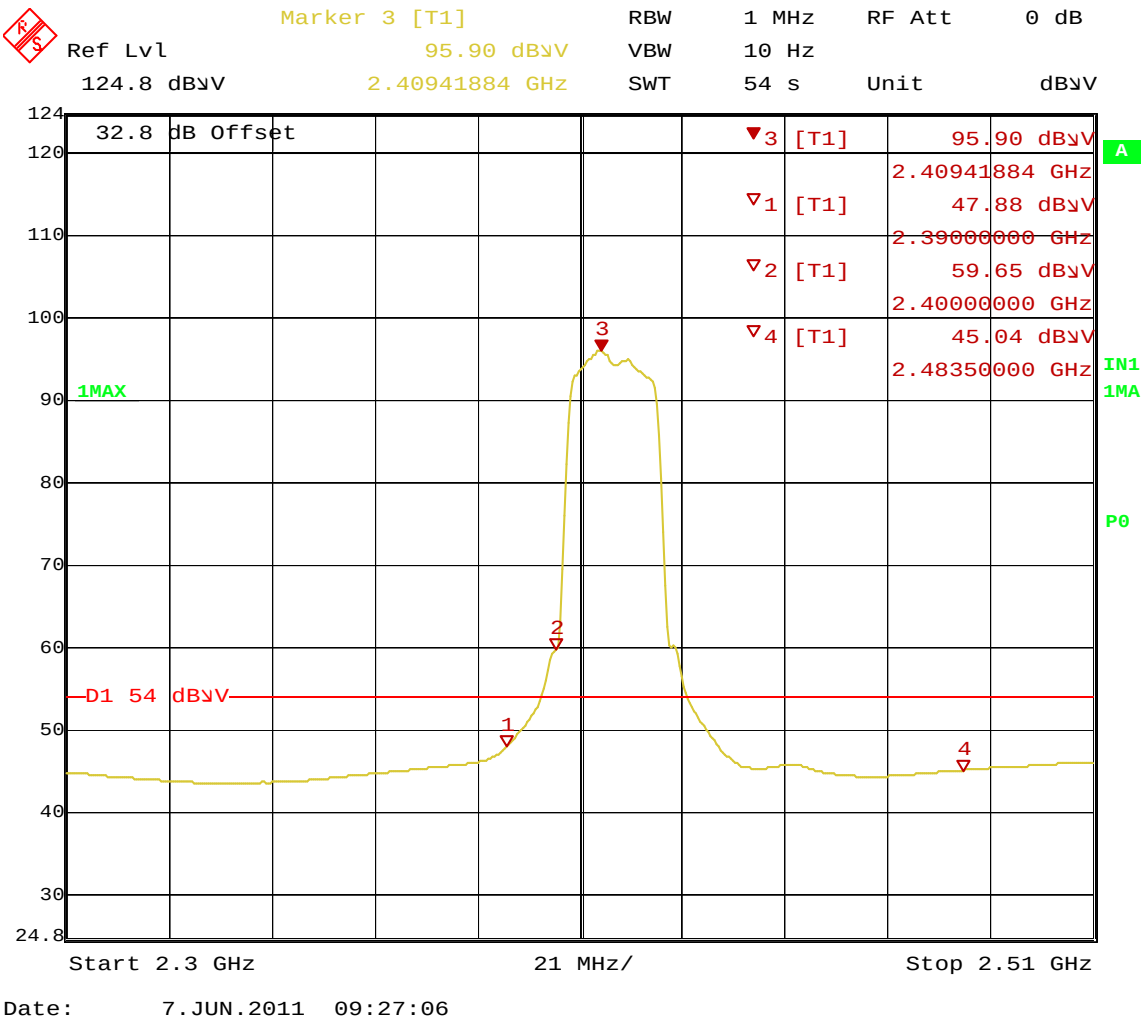


Figure 110: Radiated Emission at the Edge for 2412 MHz at Chain 0 HT20 6.5 Mbps – Vertical (Ave.)

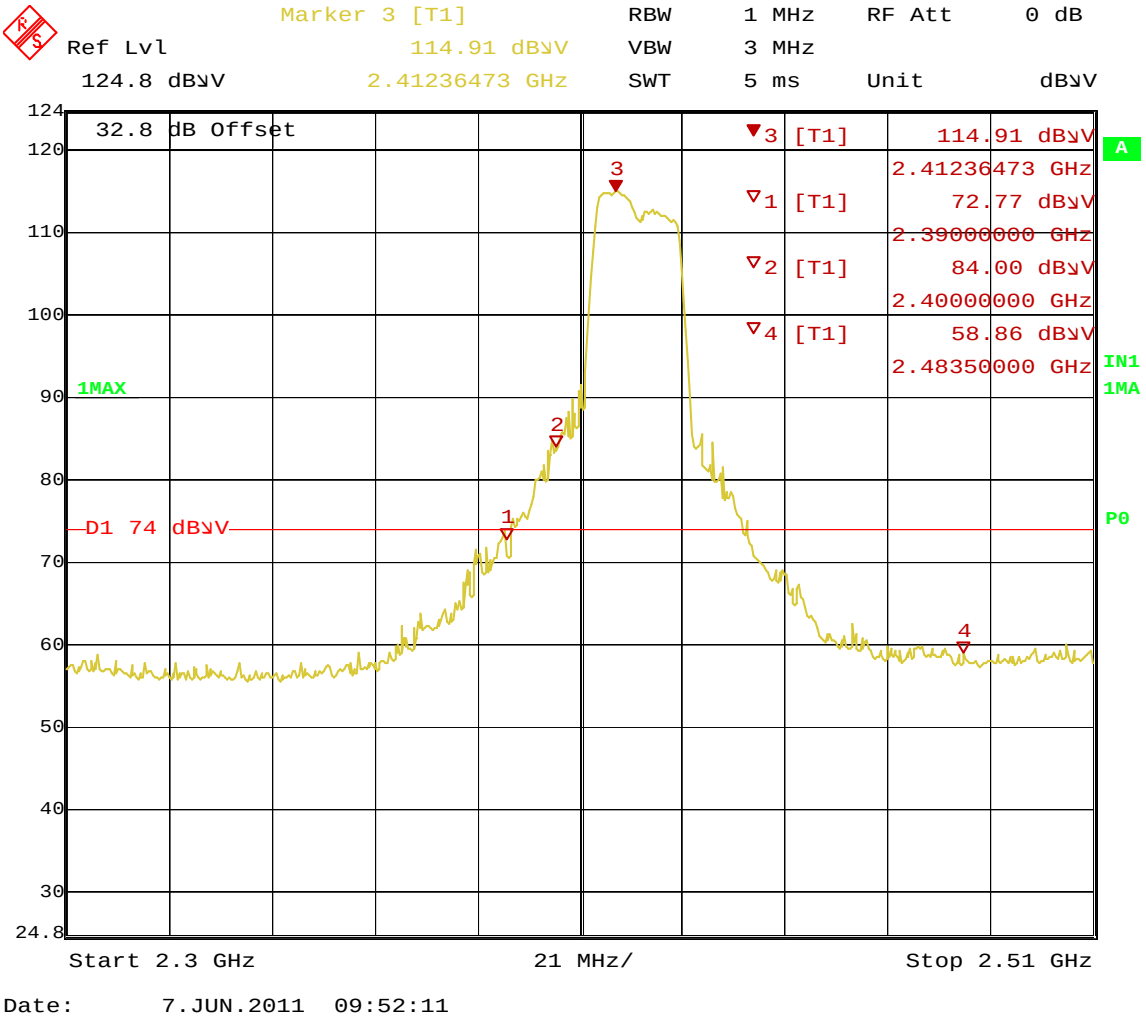


Figure 111: Radiated Emission at the Edge for 2417 MHz at Chain 0 HT20 6.5 Mbps – Horizontal (Peak)

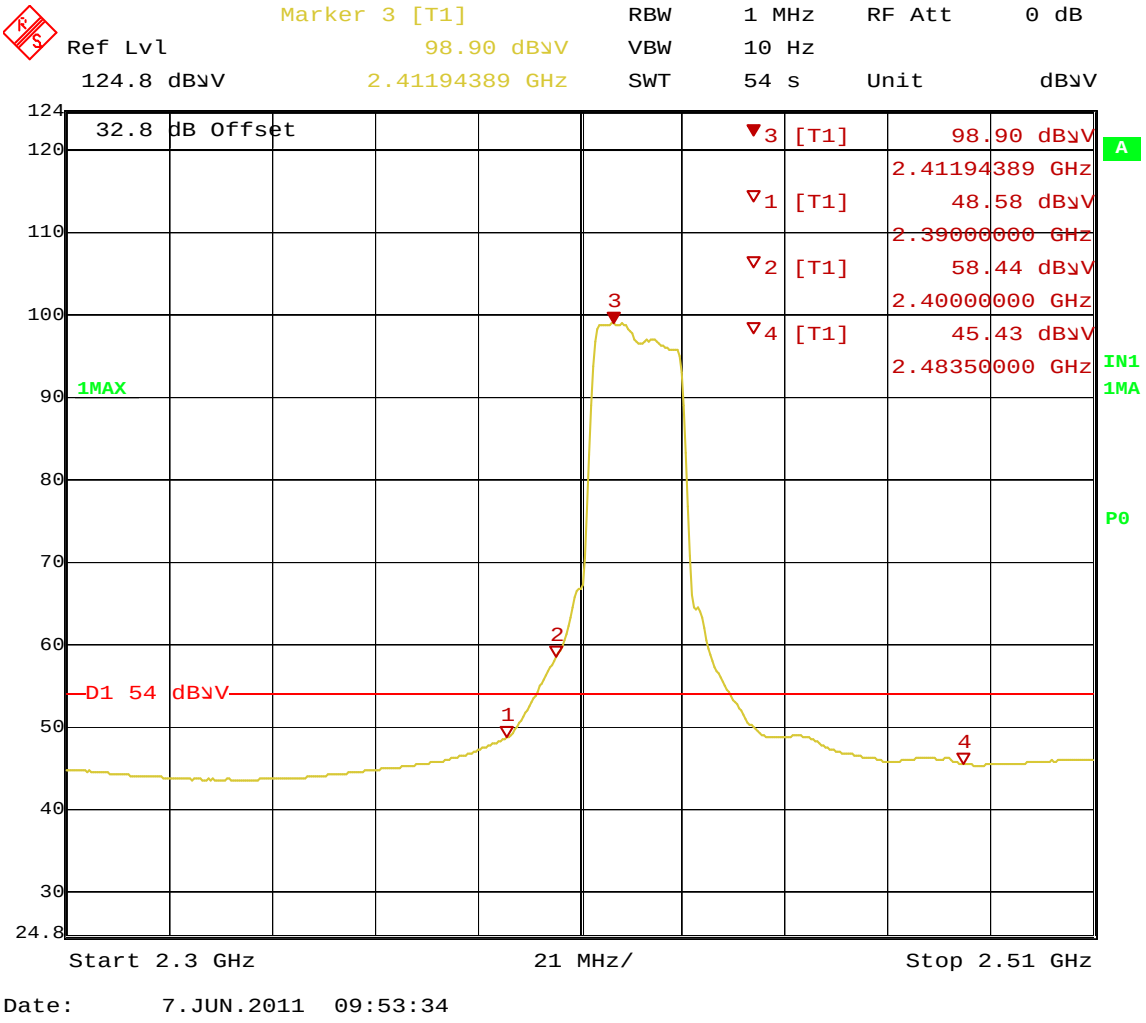


Figure 112: Radiated Emission at the Edge for 2417 MHz at Chain 0 HT20 6.5 Mbps – Horizontal (Ave)

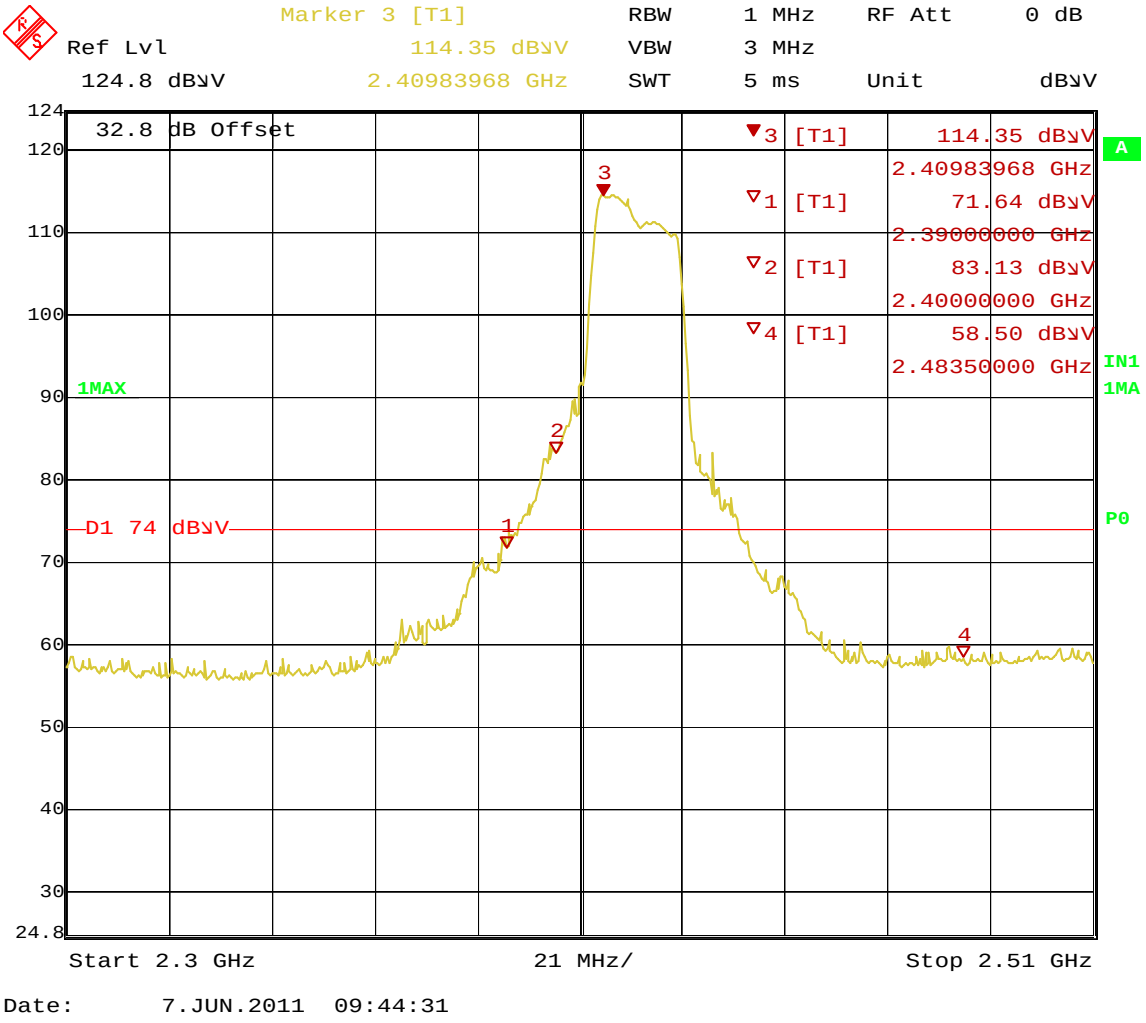


Figure 113: Radiated Emission at the Edge for 2417 MHz at Chain 0 HT20 6.5 Mbps – Vertical (Peak)

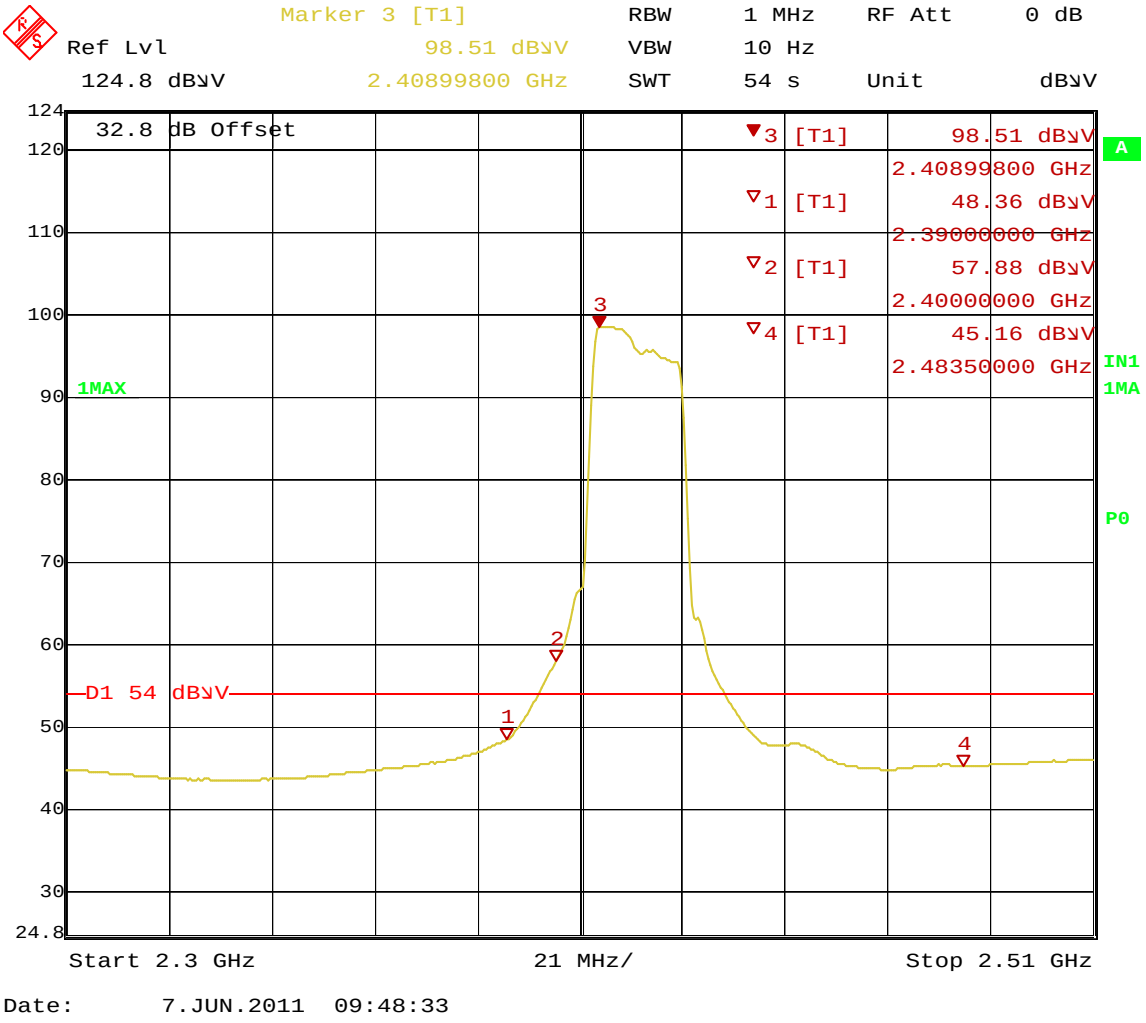


Figure 114: Radiated Emission at the Edge for 2417 MHz at Chain 0 HT20 6.5 Mbps – Vertical (Ave)

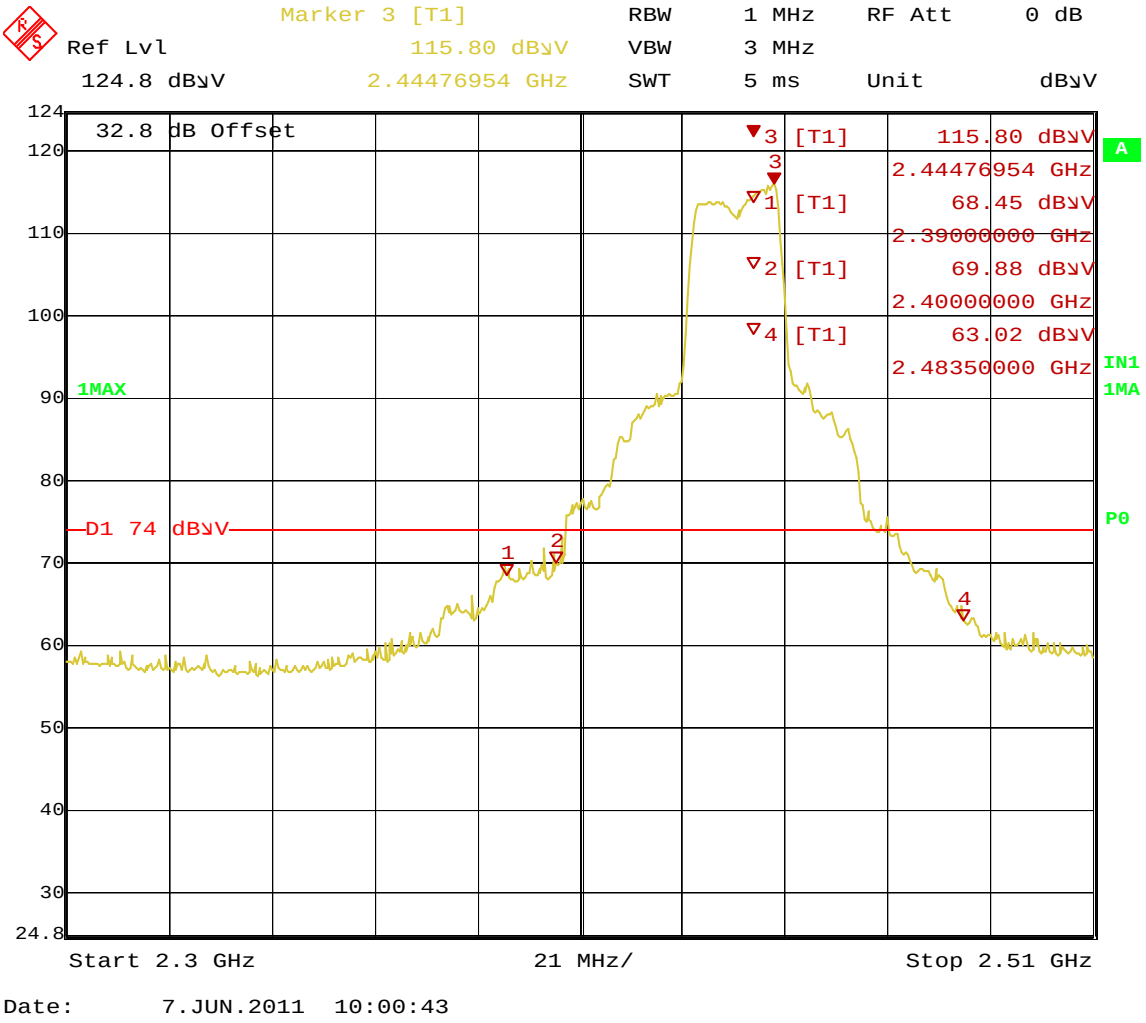


Figure 115: Radiated Emission at the Edge for 2437 MHz at Chain 0 HT20 6.5 Mbps –Horizontal (Peak)

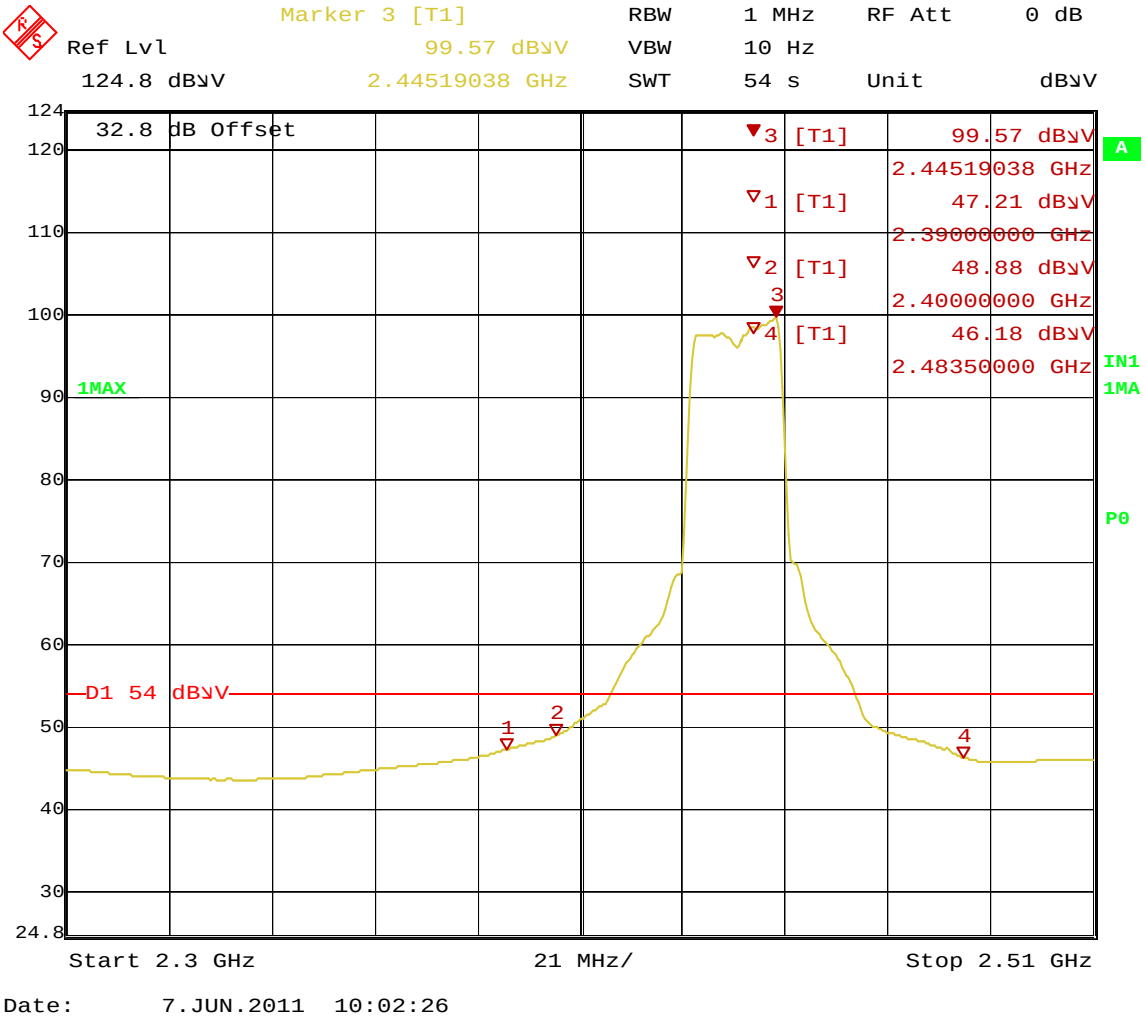


Figure 116: Radiated Emission at the Edge for 2437 MHz at Chain 0 HT20 6.5 Mbps –Horizontal (Ave)

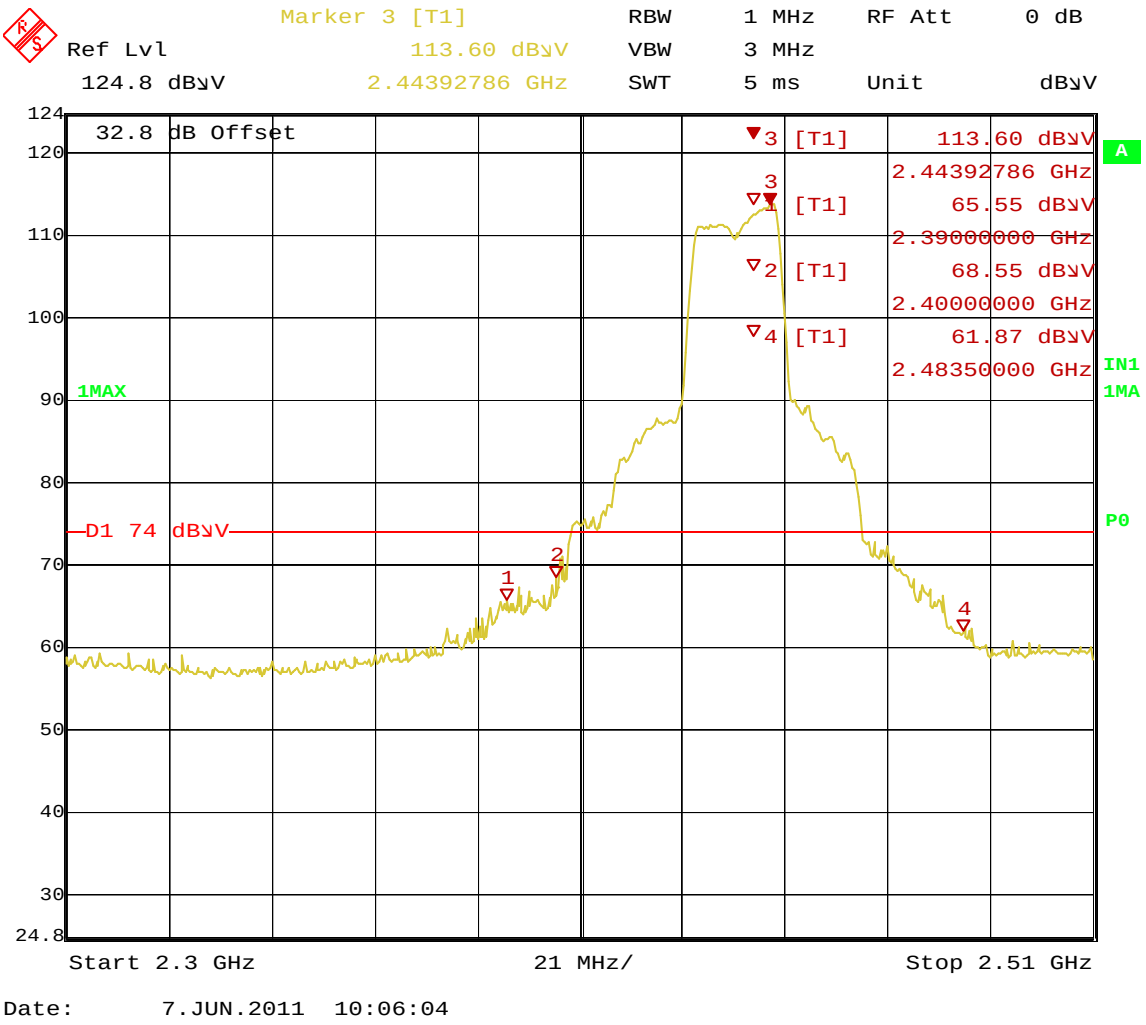


Figure 117: Radiated Emission at the Edge for 2437 MHz at Chain 0 HT20 6.5 Mbps –Vertical (Peak)

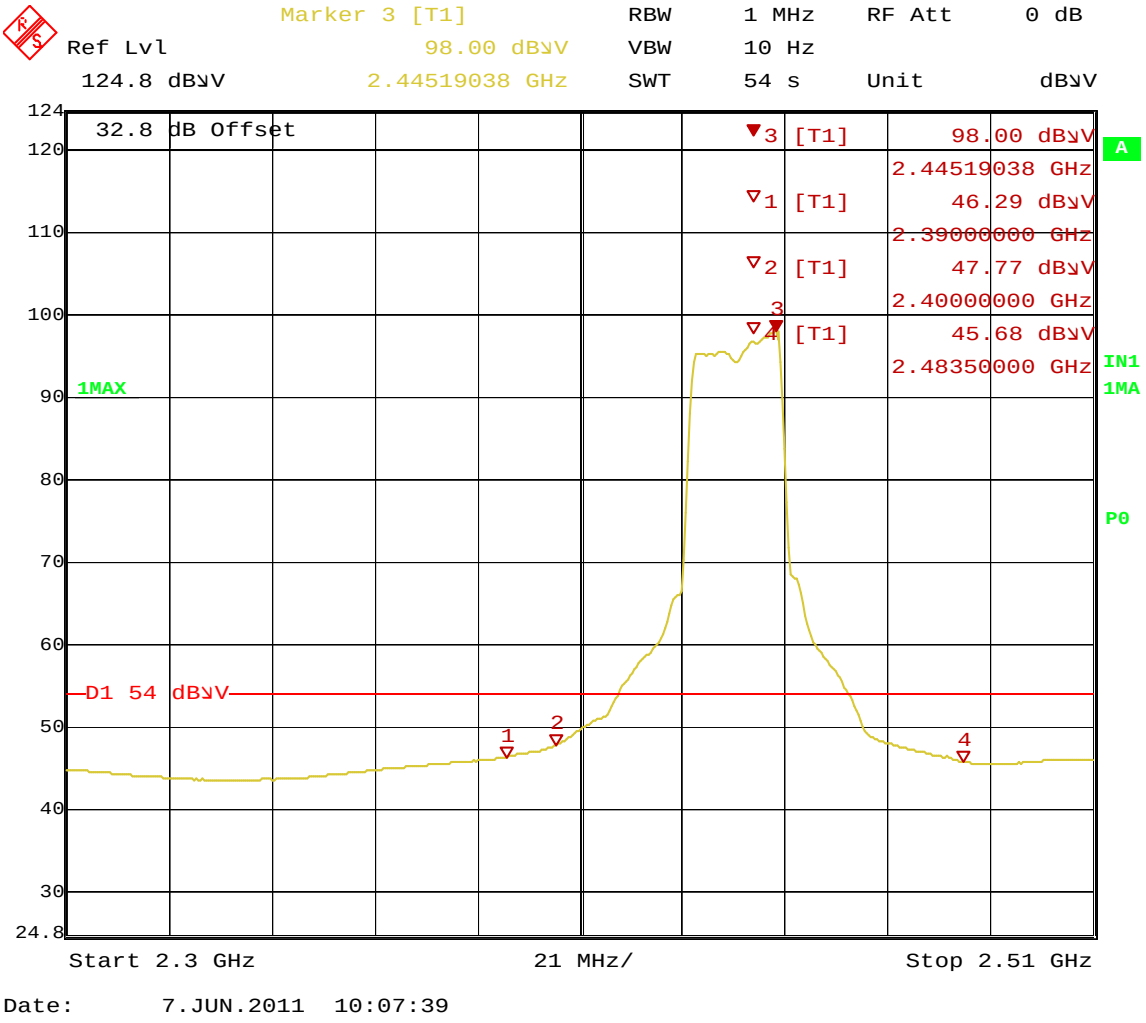


Figure 118: Radiated Emission at the Edge for 2437 MHz at Chain 0 HT20 6.5 Mbps –Vertical (Ave)

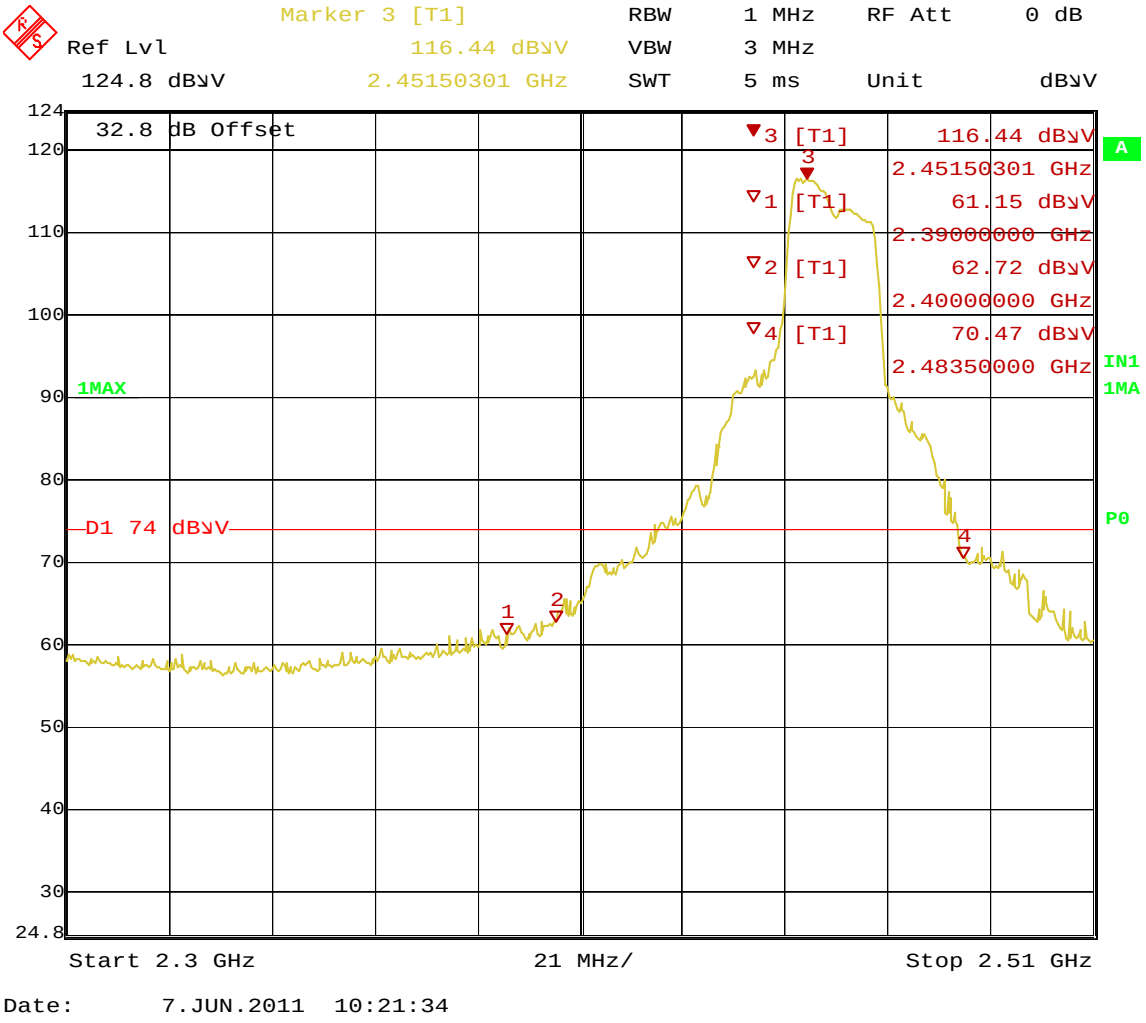


Figure 119: Radiated Emission at the Edge for 2457 MHz at Chain 0 HT20 6.5 Mbps – Horizontal (Peak)

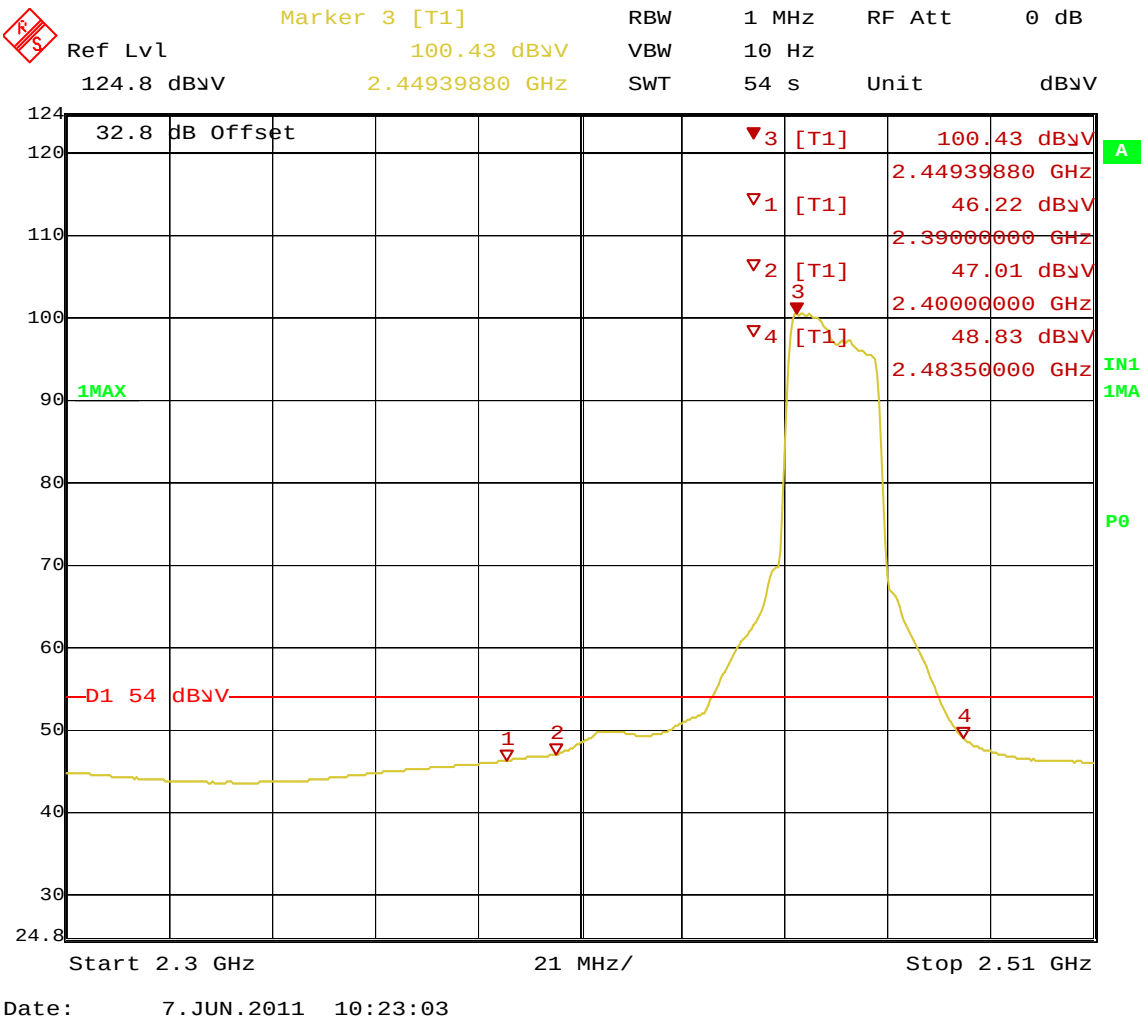


Figure 120: Radiated Emission at the Edge for 2457 MHz at Chain 0 HT20 6.5 Mbps – Horizontal (Ave.)

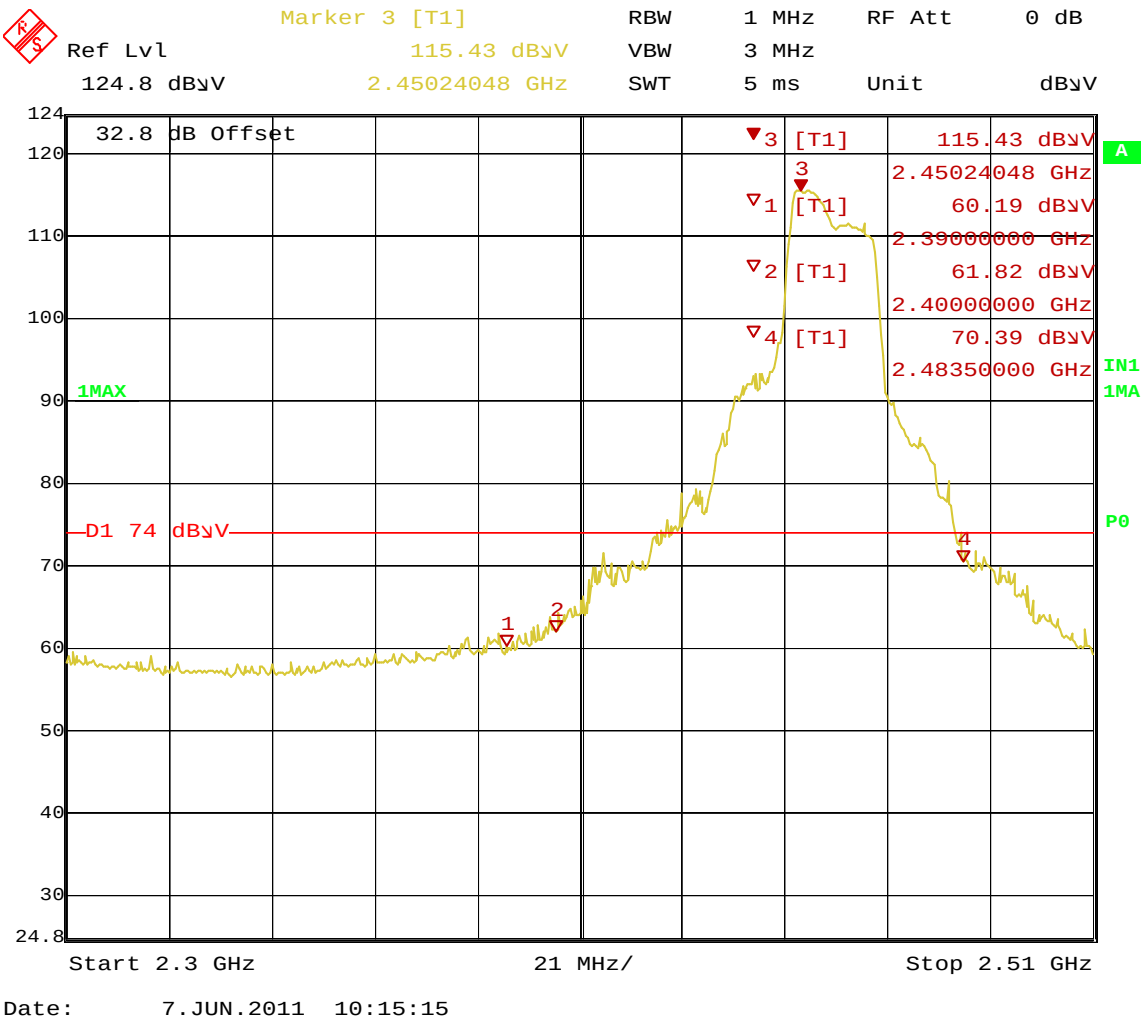


Figure 121: Radiated Emission at the Edge for Channel 2457 MHz at Chain 0 HT20 6.5 Mbps – Vertical (Peak)

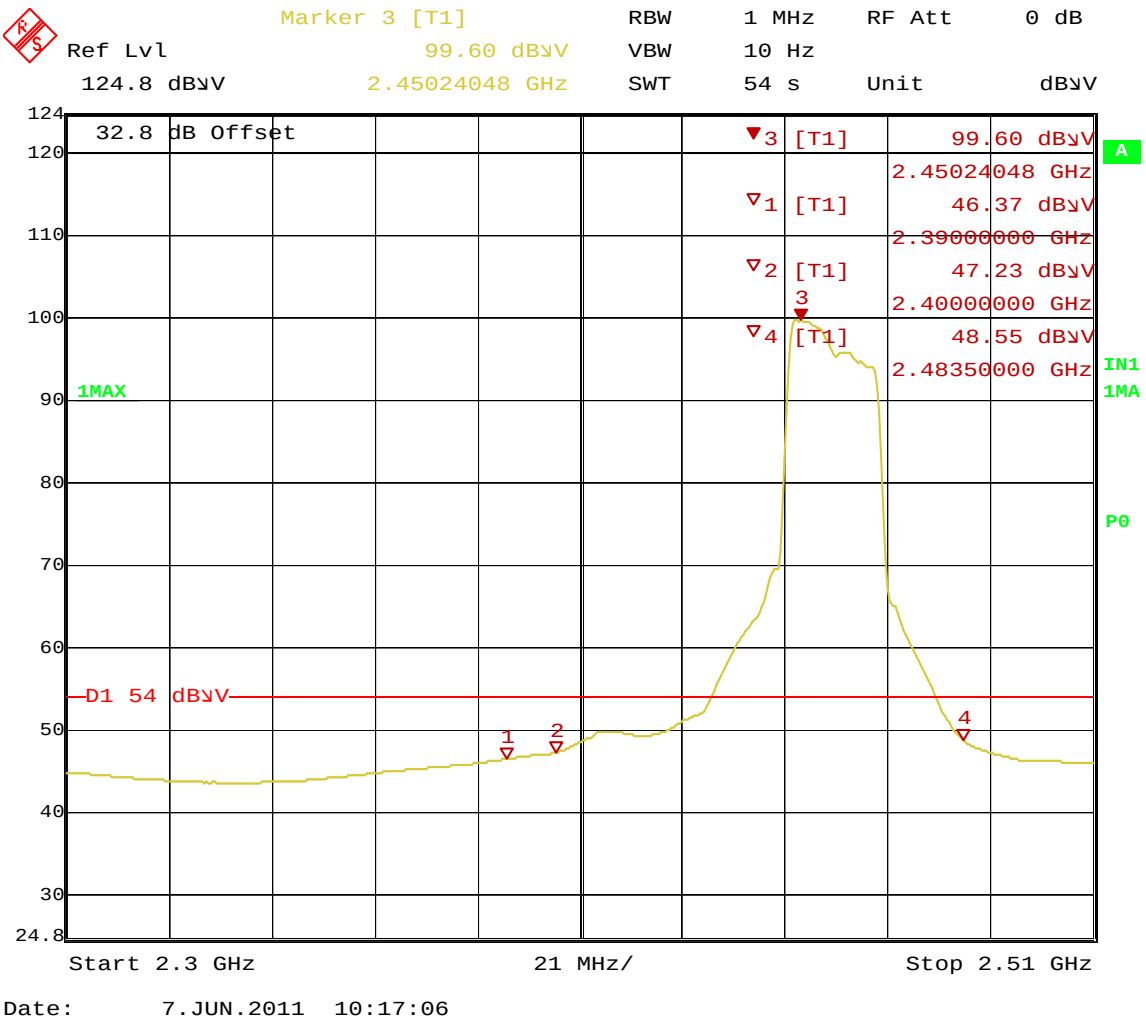


Figure 122: Radiated Emission at the Edge for 2457 MHz at Chain 0 HT20 6.5 Mbps – Vertical (Ave.)

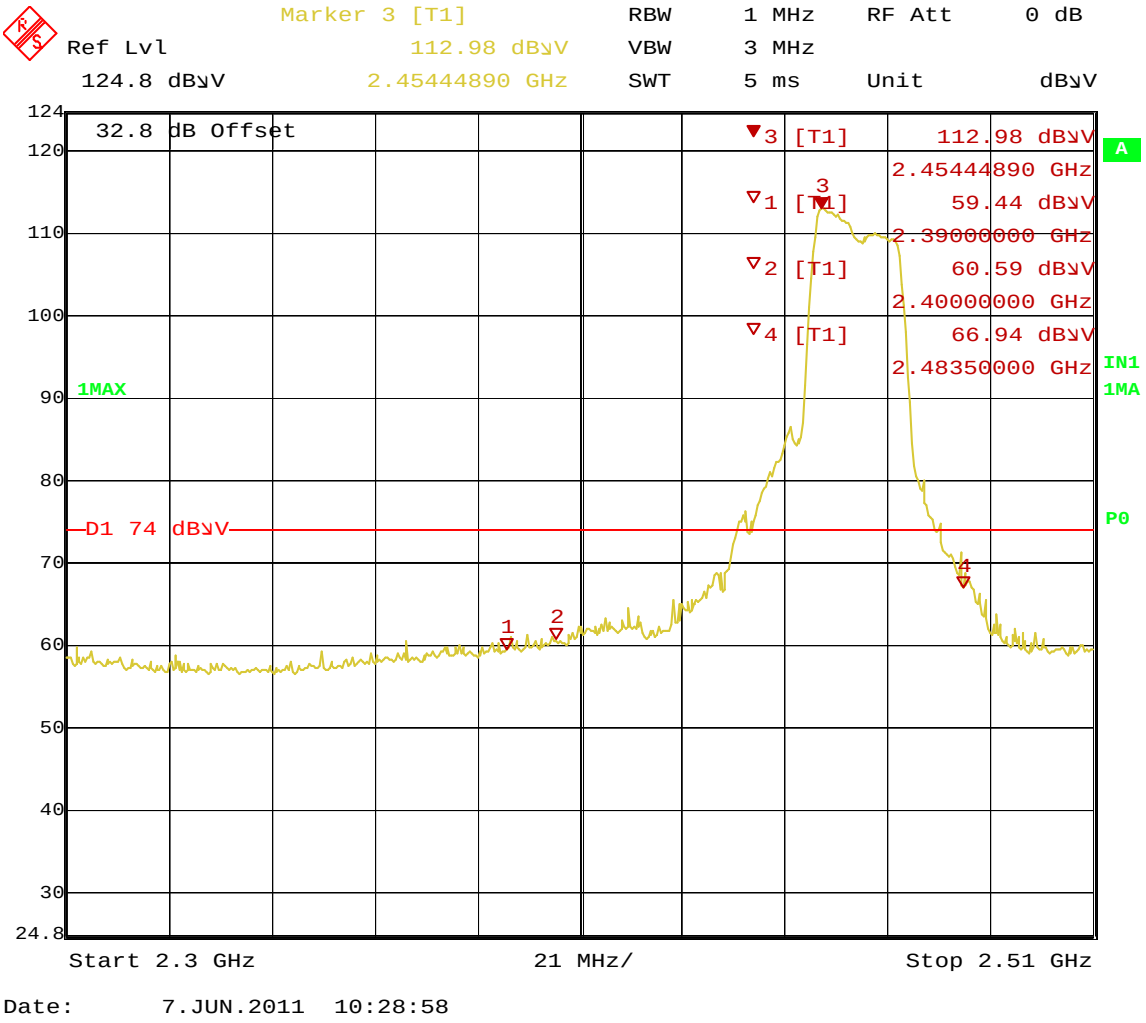


Figure 123: Radiated Emission at the Edge for 2462 MHz at Chain 0 HT20 6.5 Mbps – Horizontal (Peak)

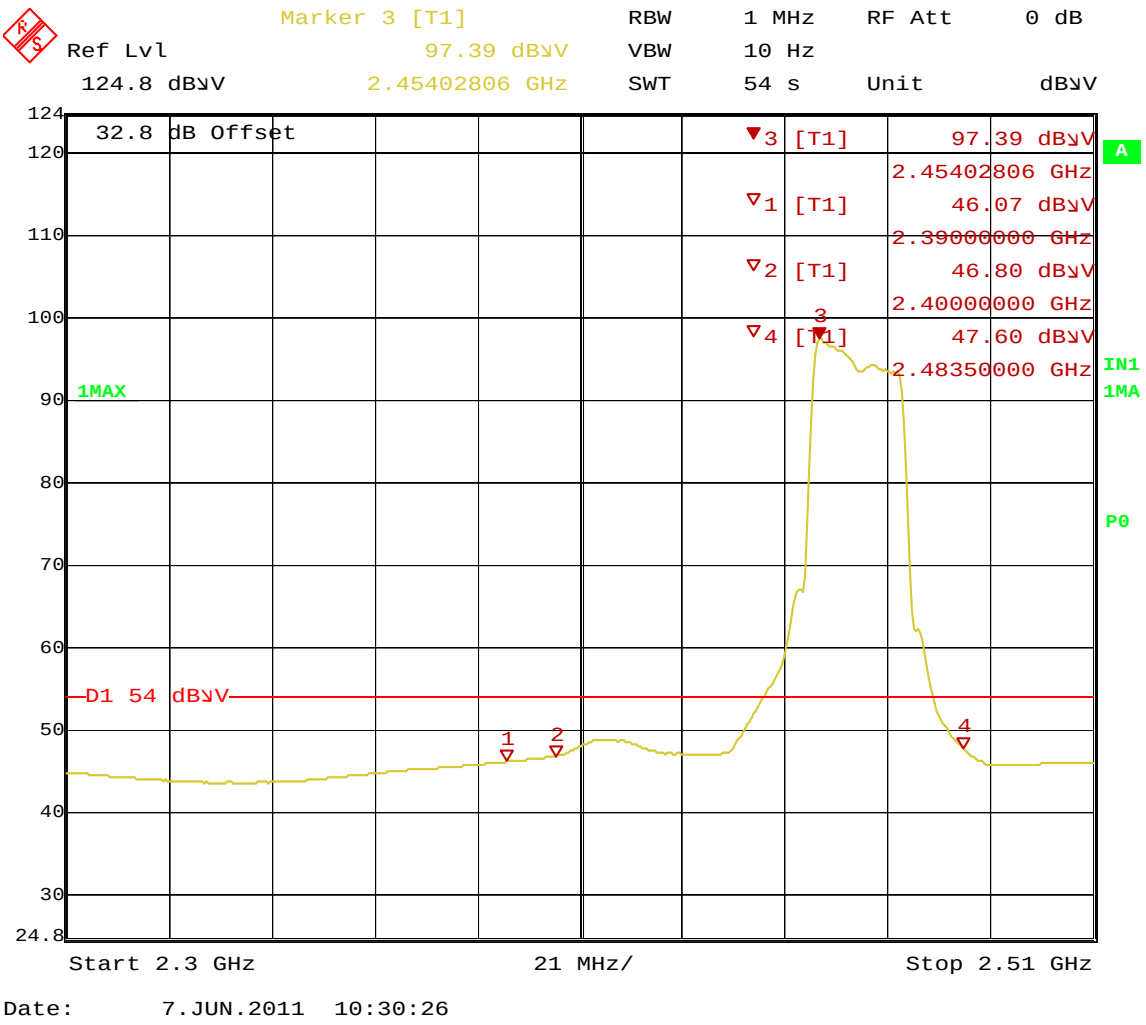


Figure 124: Radiated Emission at the Edge for 2462 MHz at Chain 0 HT20 6.5 Mbps – Horizontal (Ave.)

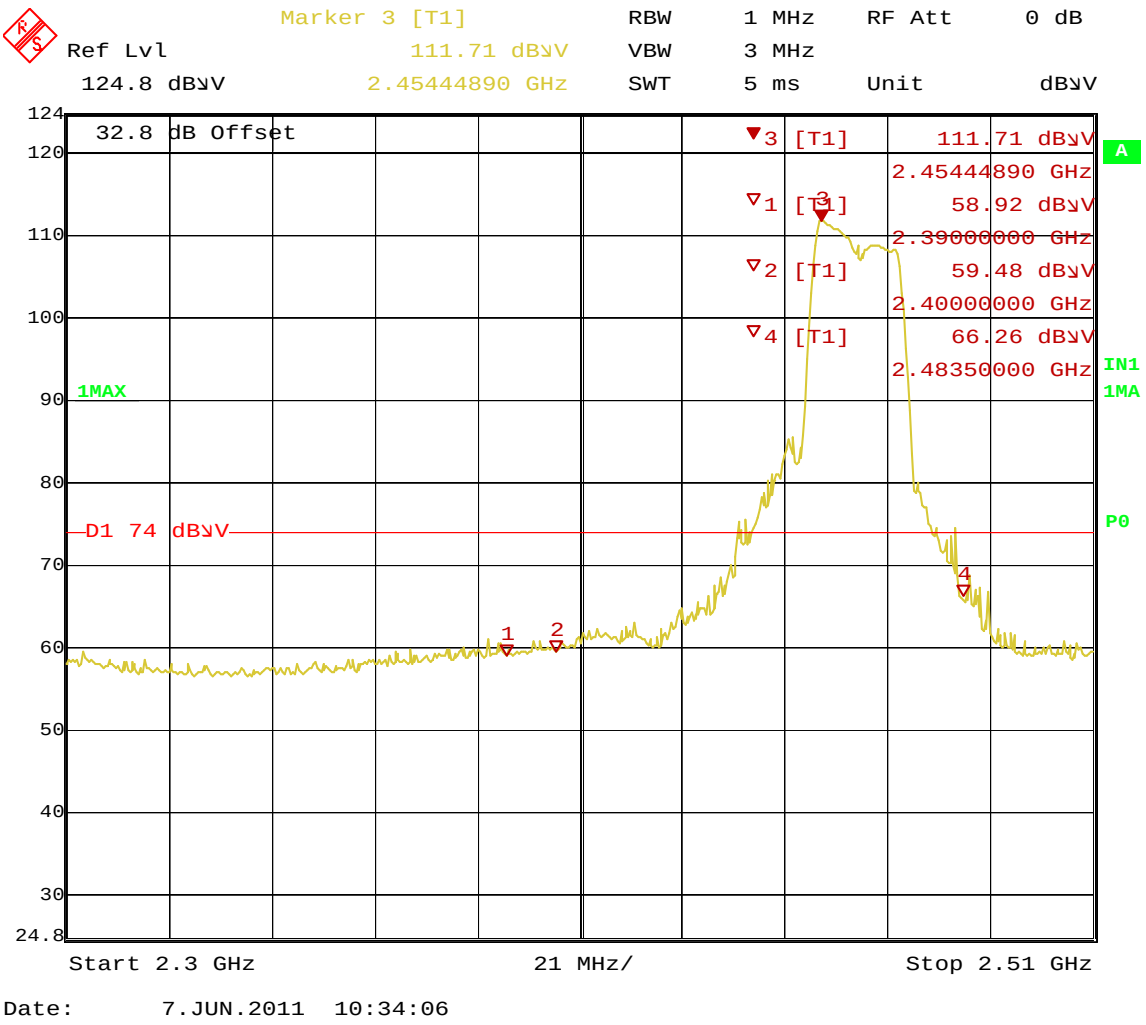


Figure 125: Radiated Emission at the Edge for 2462 MHz at Chain 0 HT20 6.5 Mbps – Vertical (Peak)

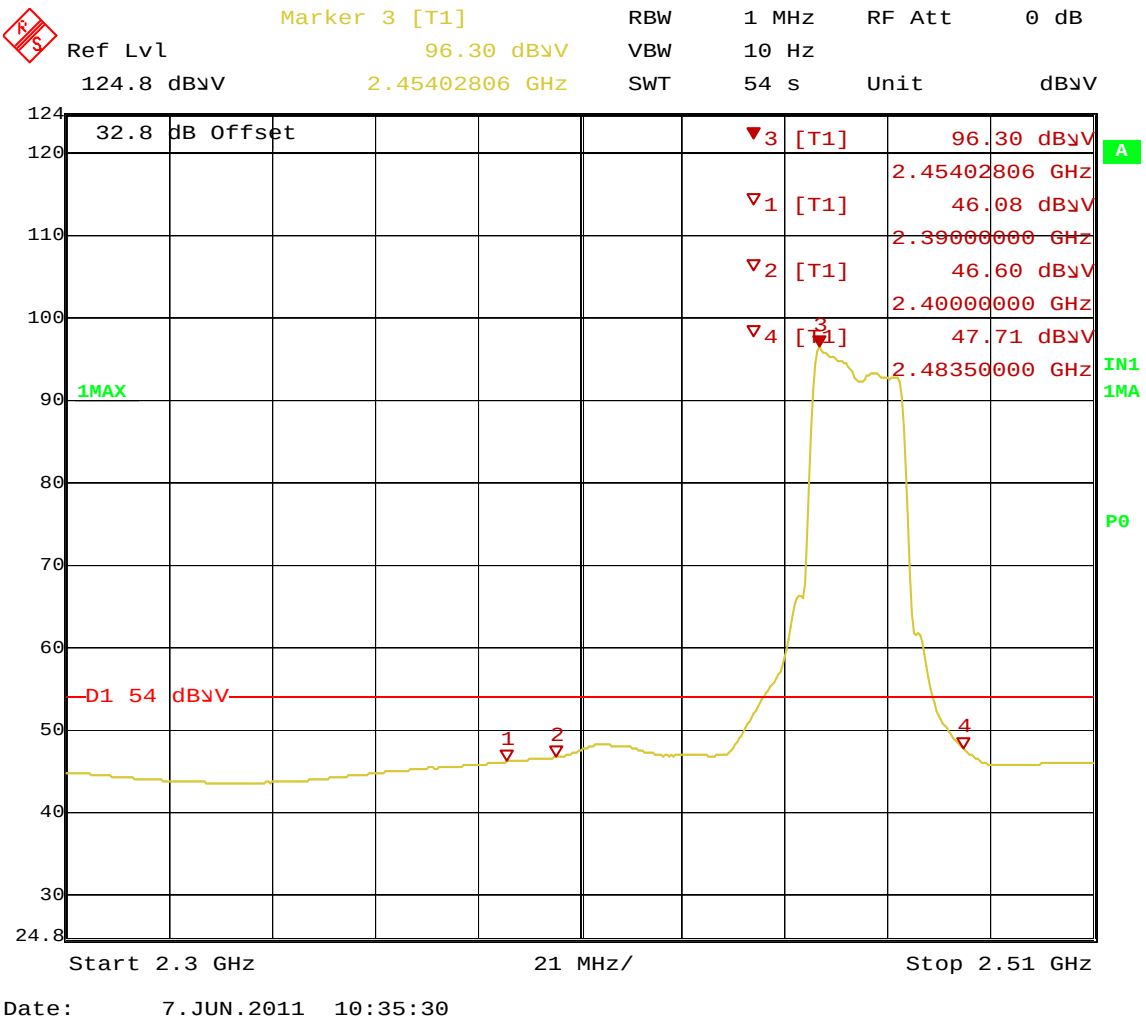


Figure 126: Radiated Emission at the Edge for Channel 2462 MHz at Chain 0 HT20 6.5 Mbps – Vertical (Ave.)

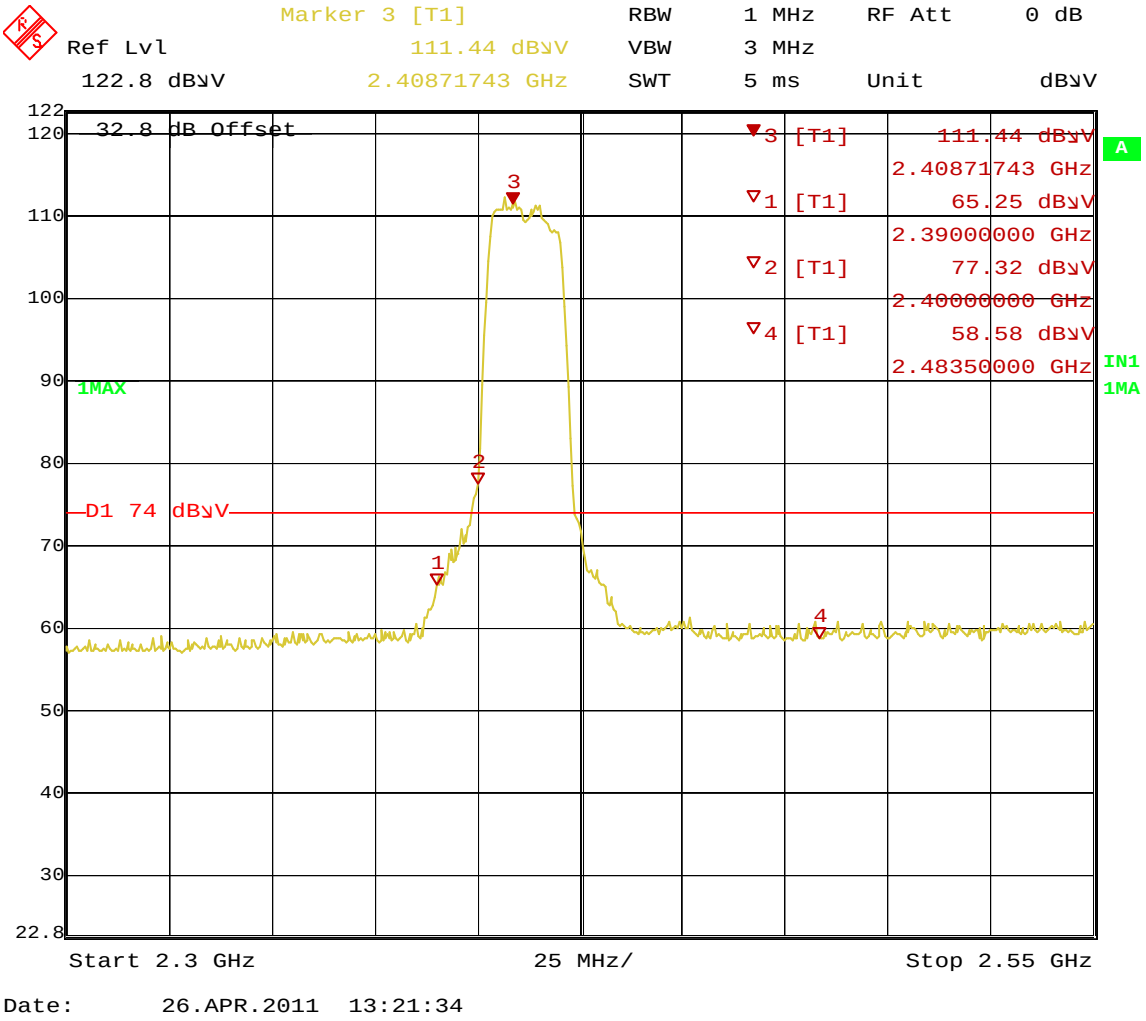


Figure 127: Radiated Emission at the Edge for 2412 MHz at Chain 0 + 1 HT20 13 Mbps Y-Axis – Horizontal (Peak)

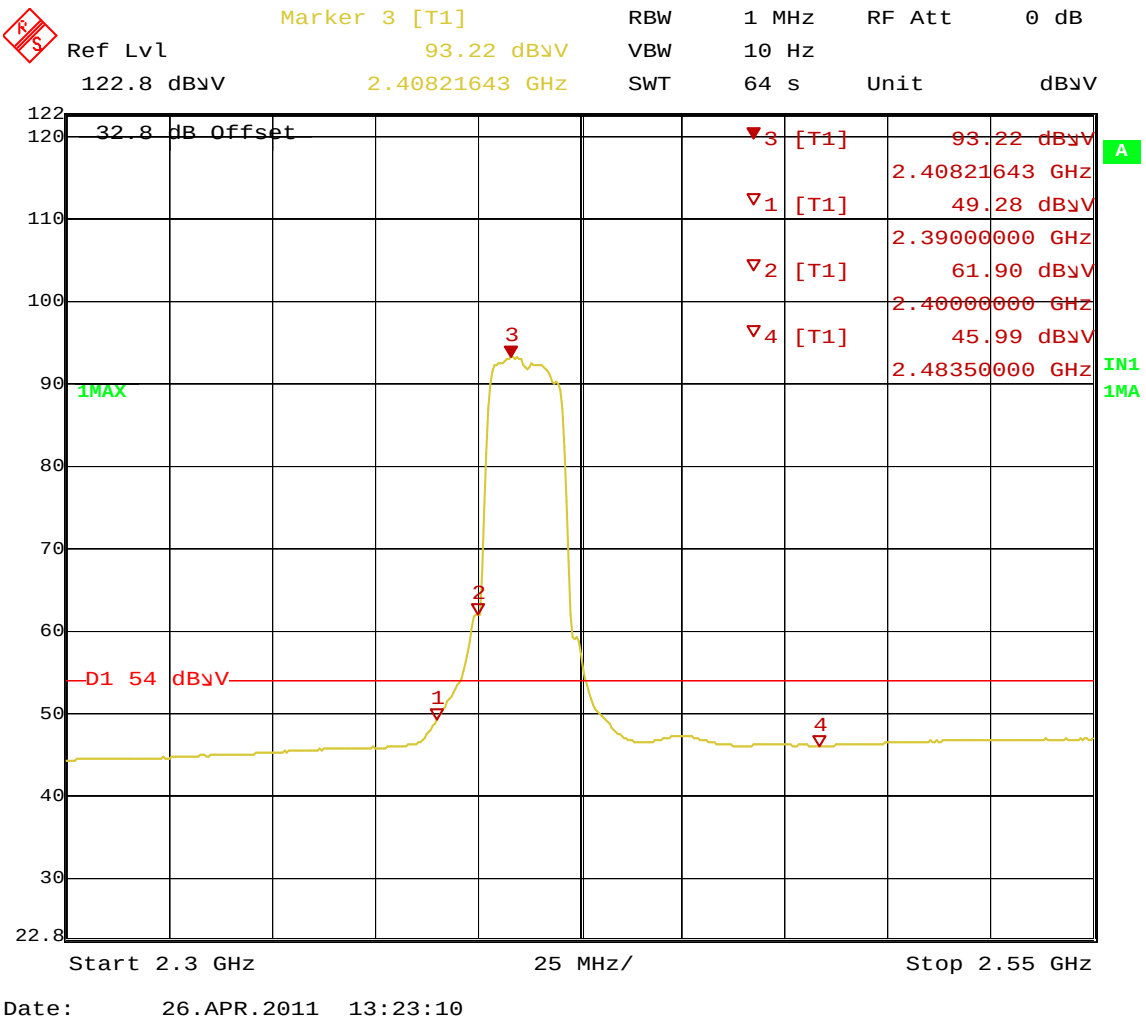


Figure 128: Radiated Emission at the Edge for 2412 MHz at Chain 0 + 1 HT20 13 Mbps Y-Axis – Horizontal (Ave.)

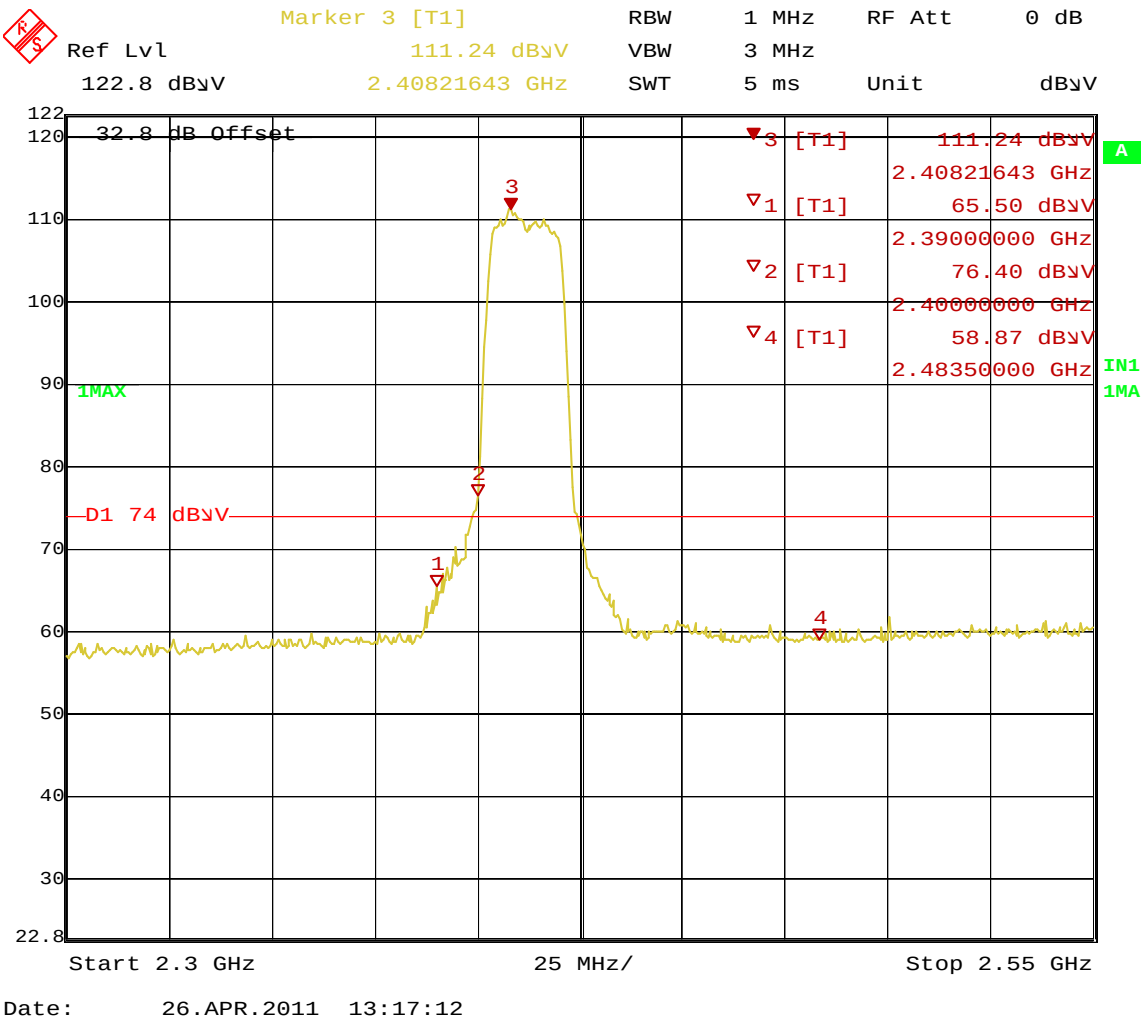


Figure 129: Radiated Emission at the Edge for 2412 MHz at Chain 0 + 1 HT20 13 Mbps Y-Axis – Vertical (Peak)

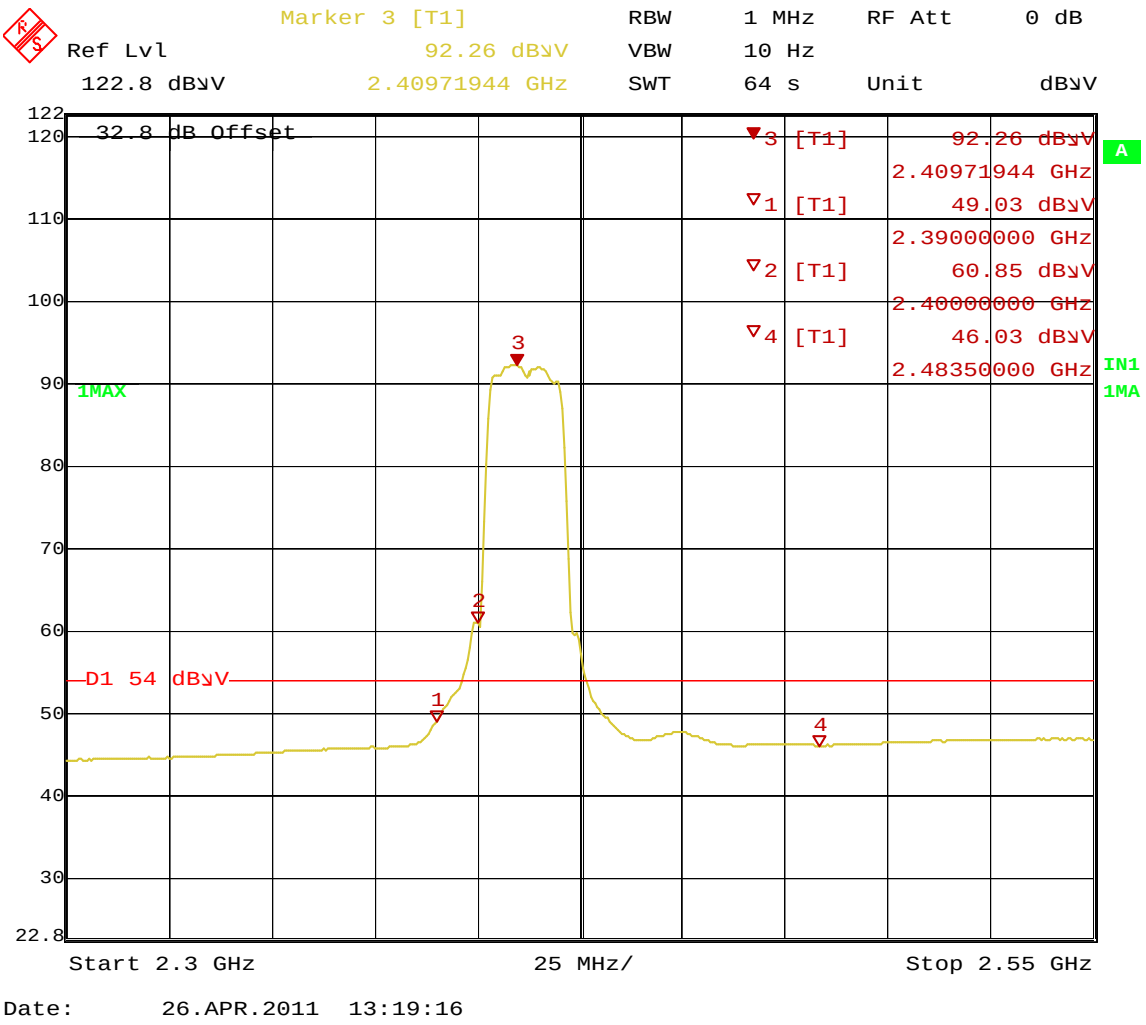


Figure 130: Radiated Emission at the Edge for 2412 MHz at Chain 0 + 1 HT20 13 Mbps Y-Axis – Vertical (Ave.)

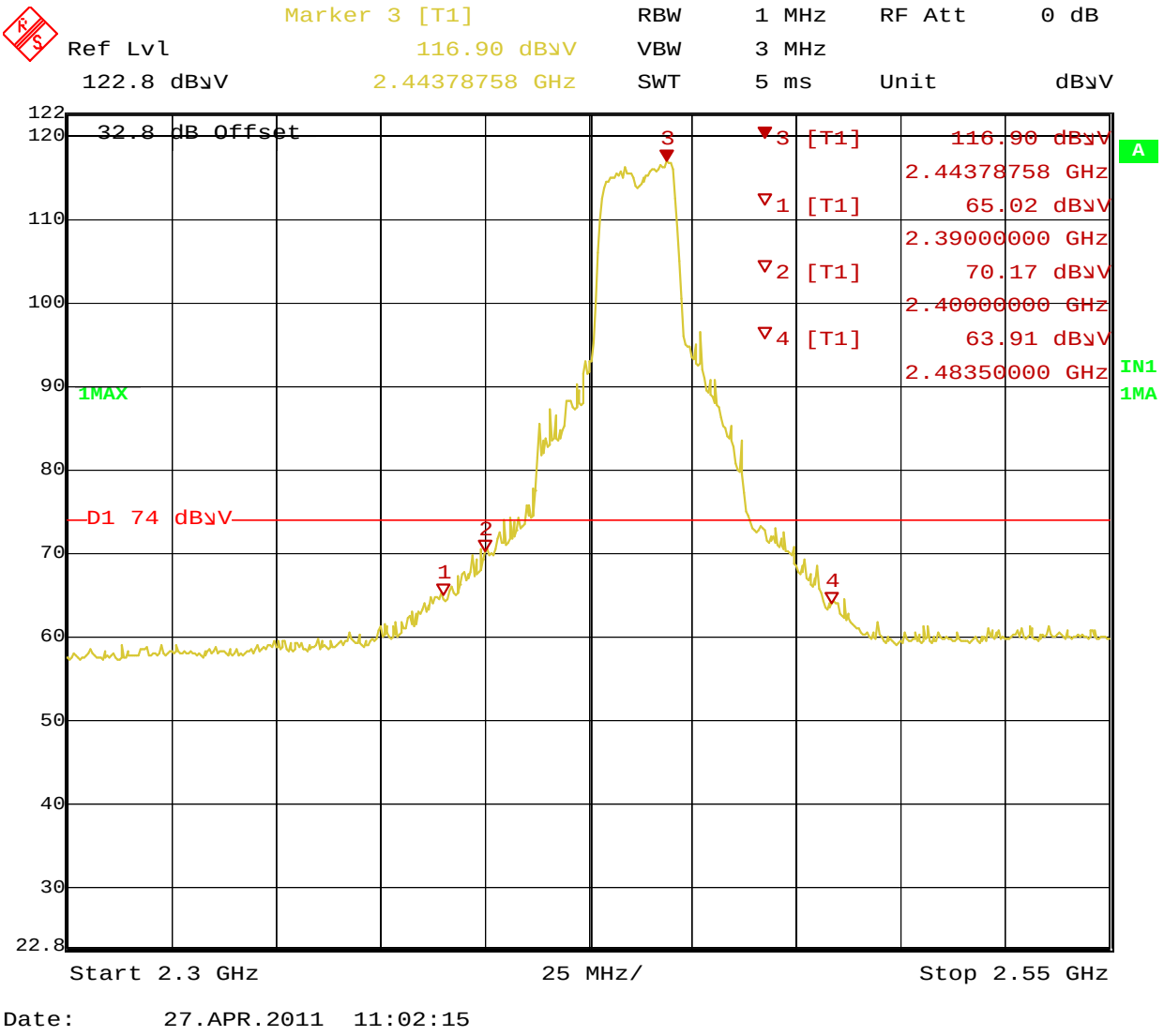


Figure 131: Radiated Emission at the Edge for 2437 MHz at Chain 0 + 1 HT20 13 Mbps Y-Axis – Horizontal (Peak.)

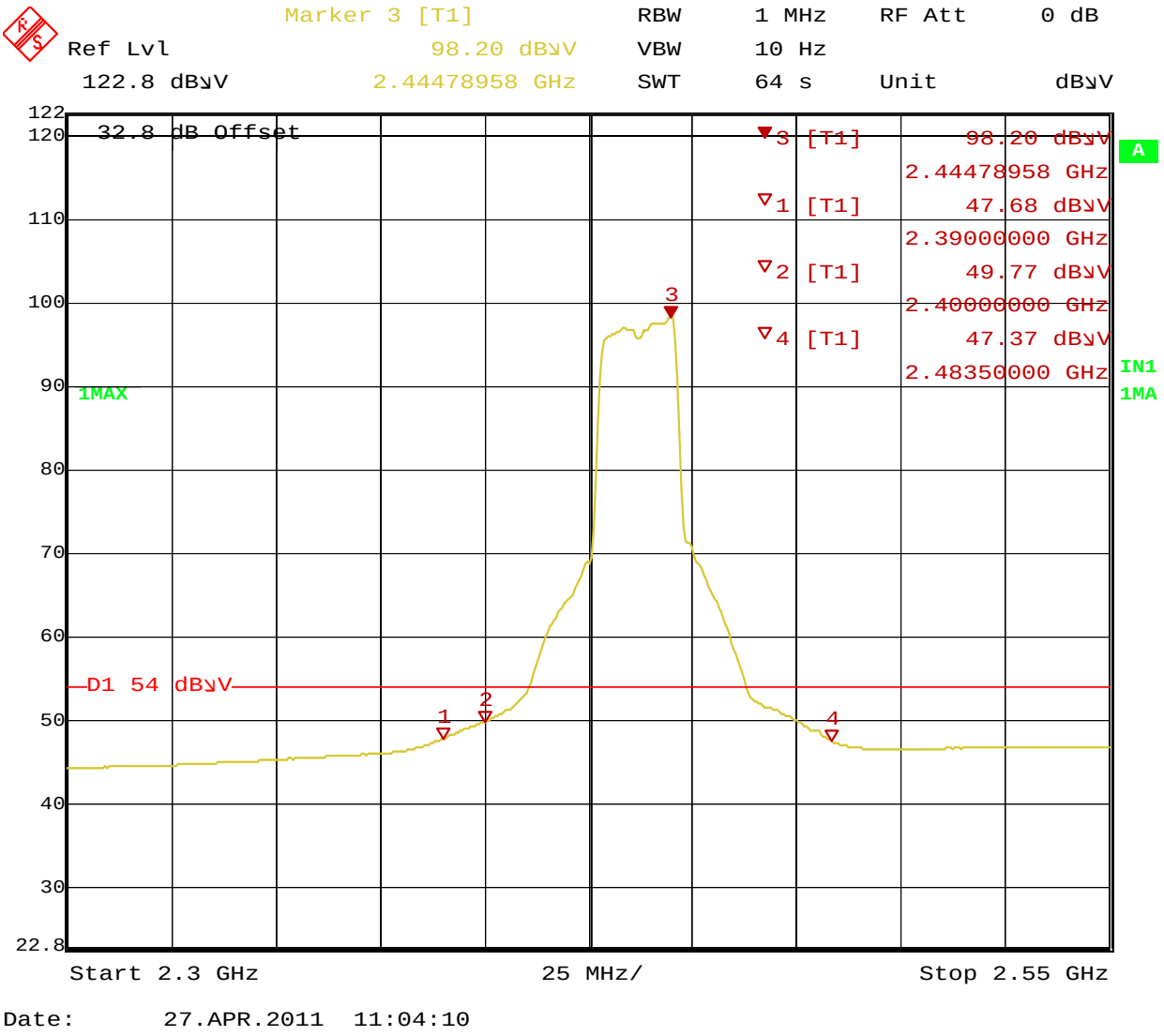


Figure 132: Radiated Emission at the Edge for 2437 MHz at Chain 0 + 1 HT20 13 Mbps Y-Axis – Horizontal (Ave.)

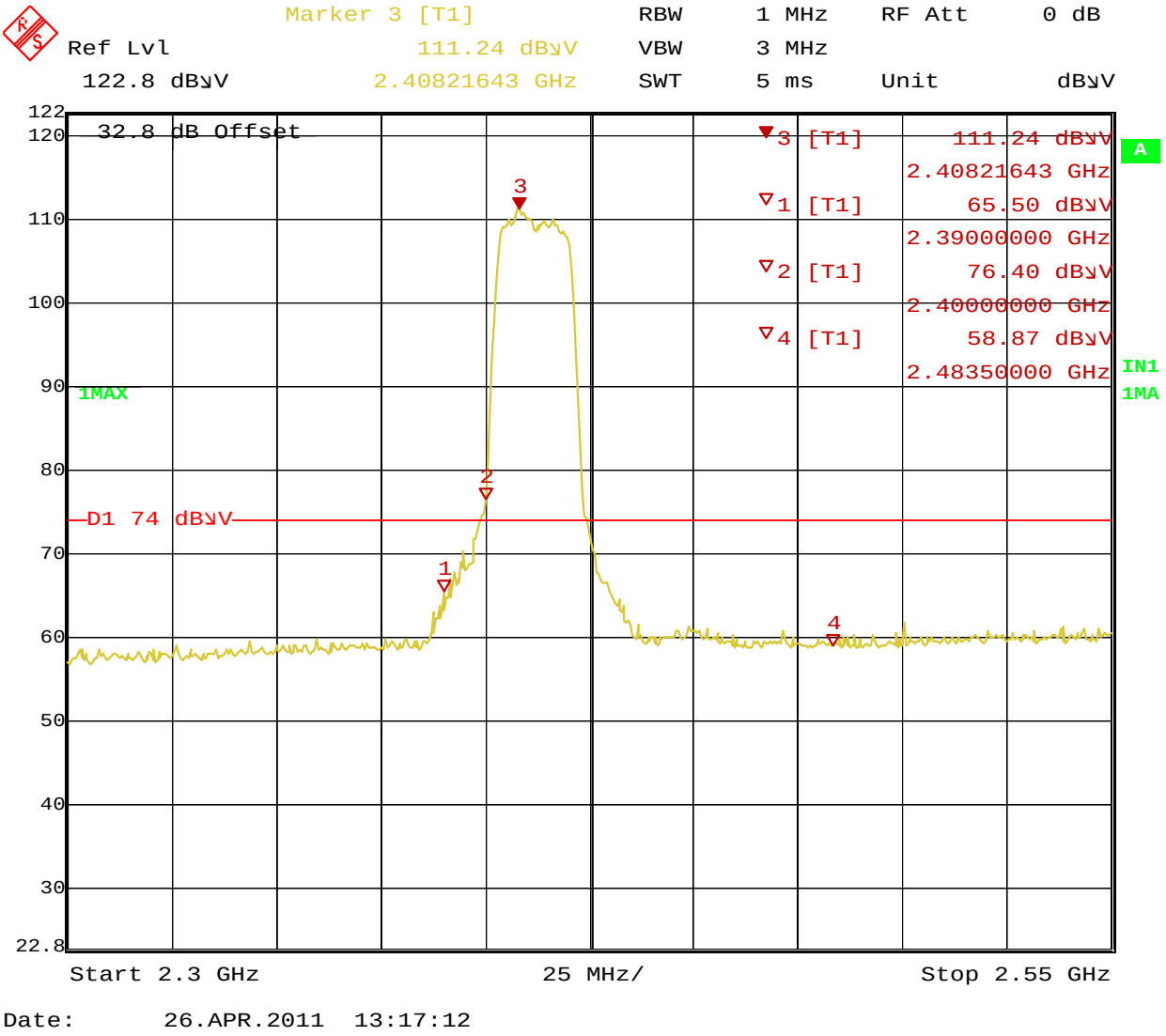


Figure 133: Radiated Emission at the Edge for 2437 MHz at Chain 0 + 1 HT20 13 Mbps Y-Axis – Vertical (Peak.)

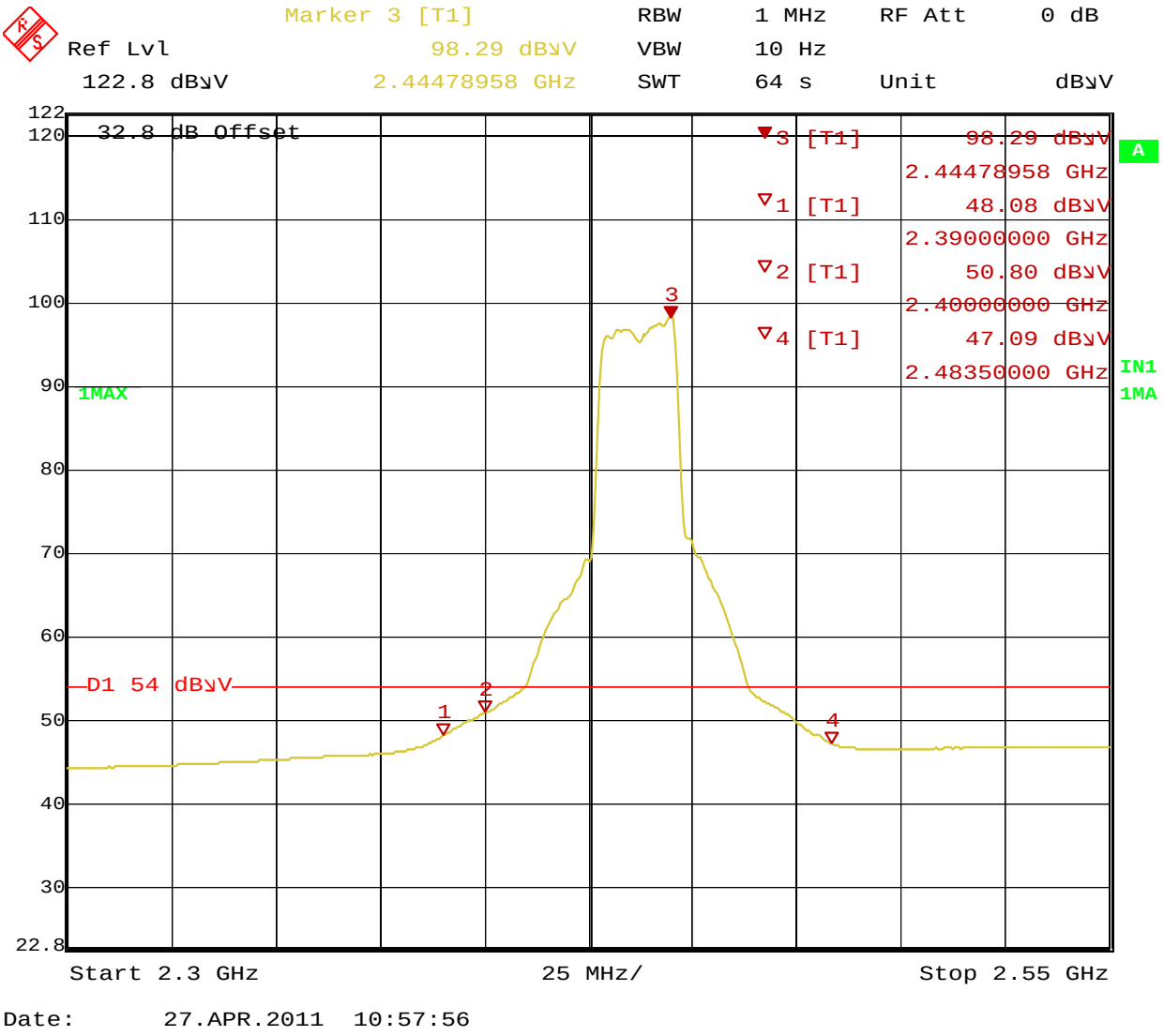


Figure 134: Radiated Emission at the Edge for 2437 MHz at Chain 0 + 1 HT20 13 Mbps Y-Axis – Vertical (Ave.)

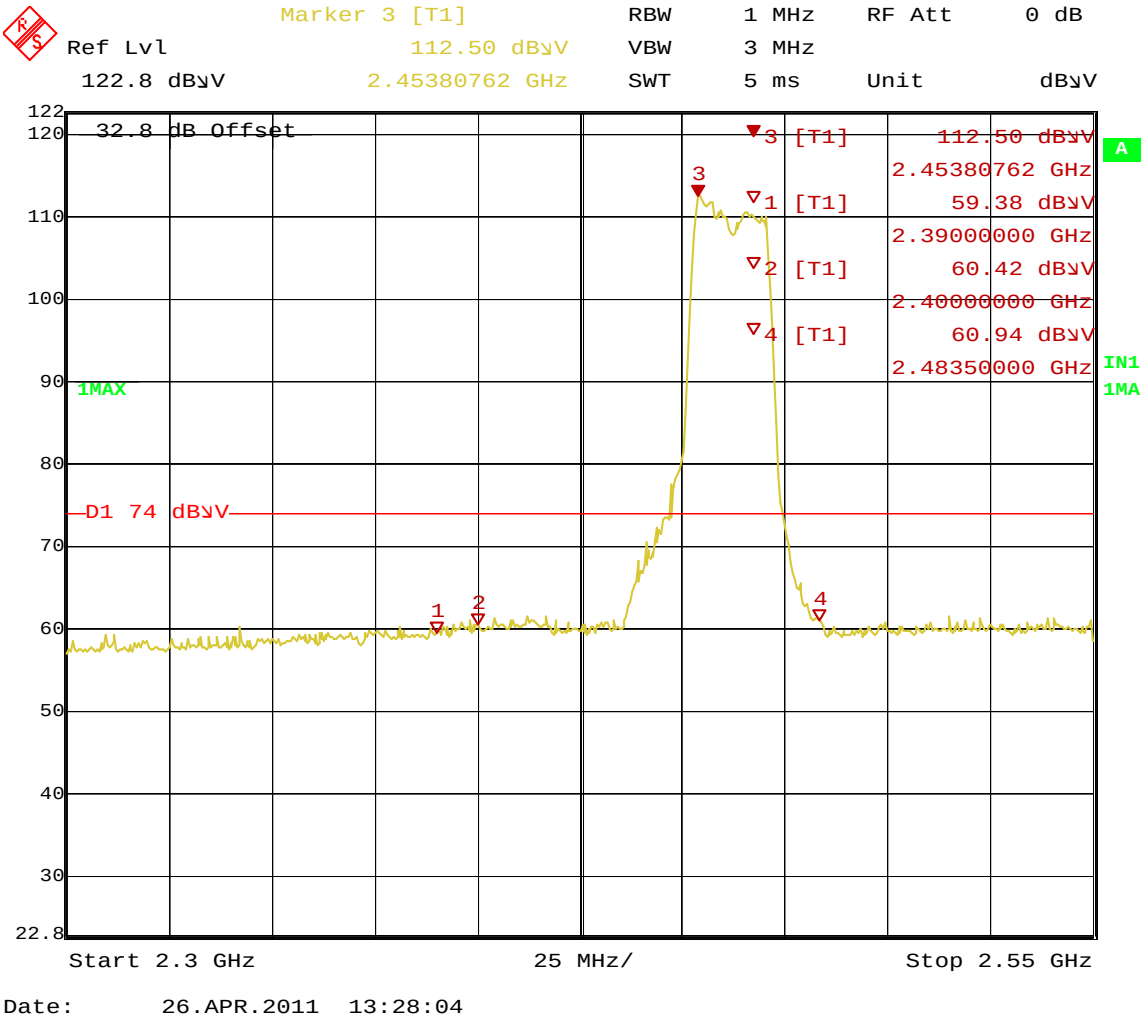


Figure 135: Radiated Emission at the Edge for 2462 MHz at Chain 0 + 1 HT20 13 Mbps Y-Axis – Horizontal (Peak)

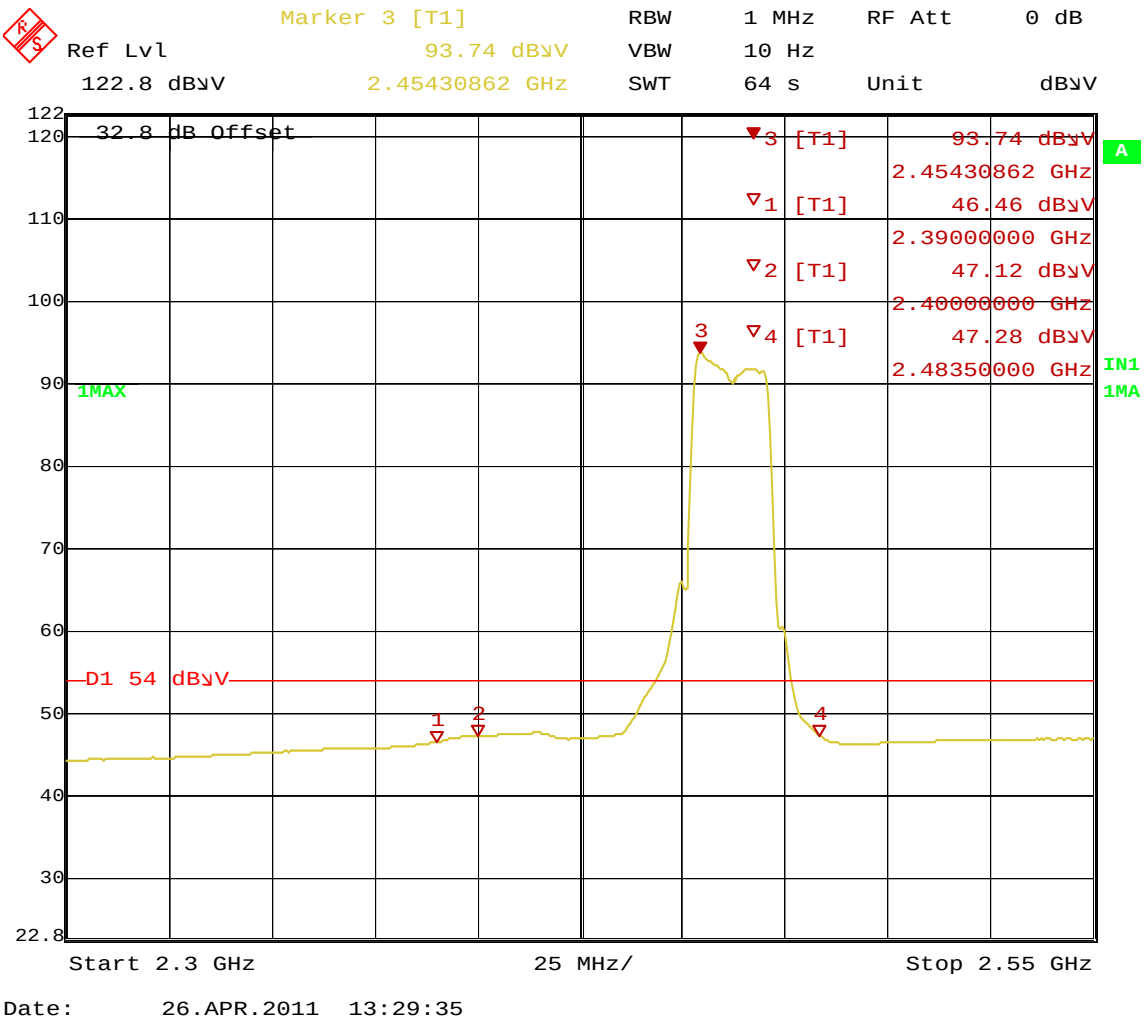


Figure 136: Radiated Emission at the Edge for 2462 MHz at Chain 0 + 1 HT20 13 Mbps Y-Axis – Horizontal (Ave.)

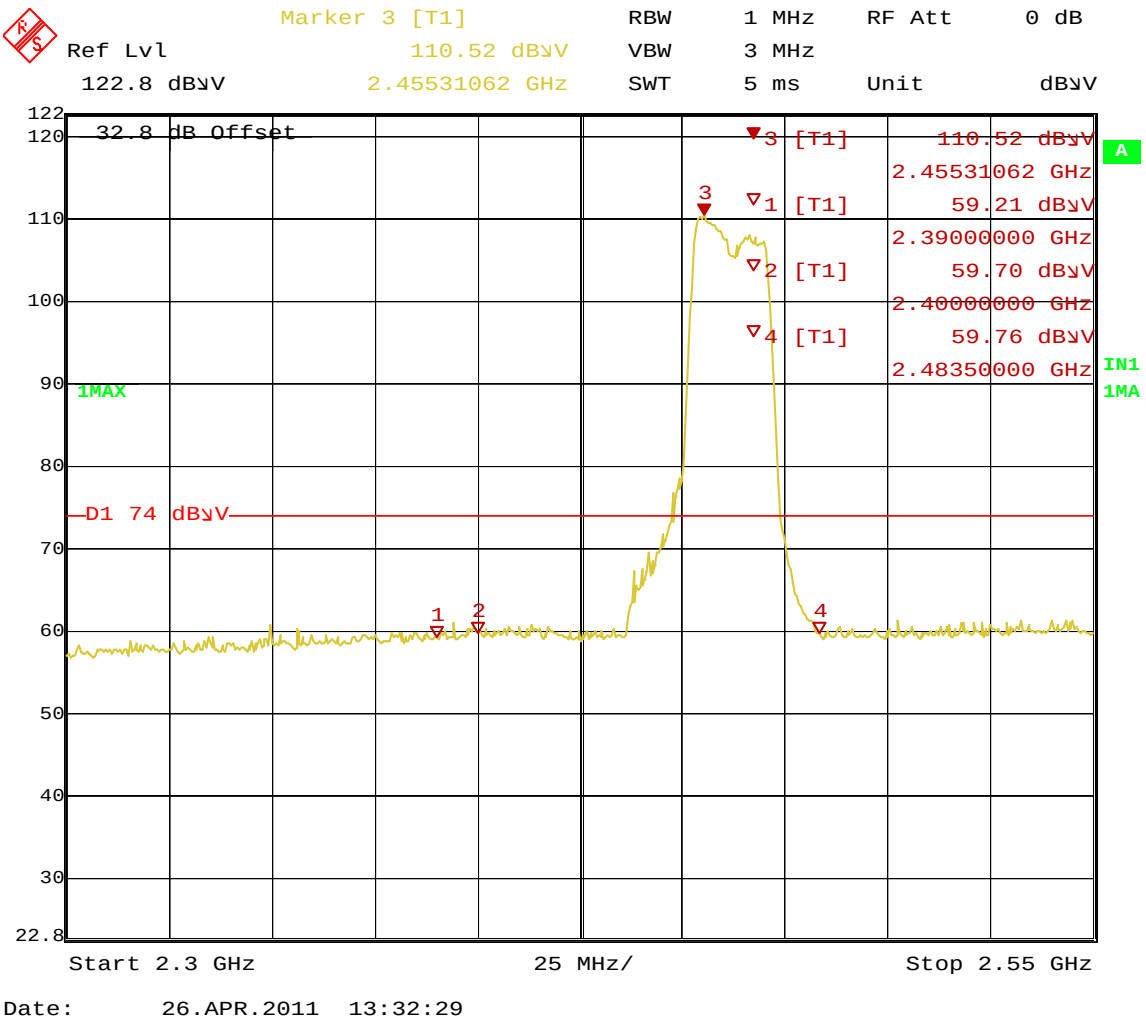


Figure 137: Radiated Emission at the Edge for 2462 MHz at Chain 0 + 1 HT20 13 Mbps Y-Axis – Vertical (Peak)

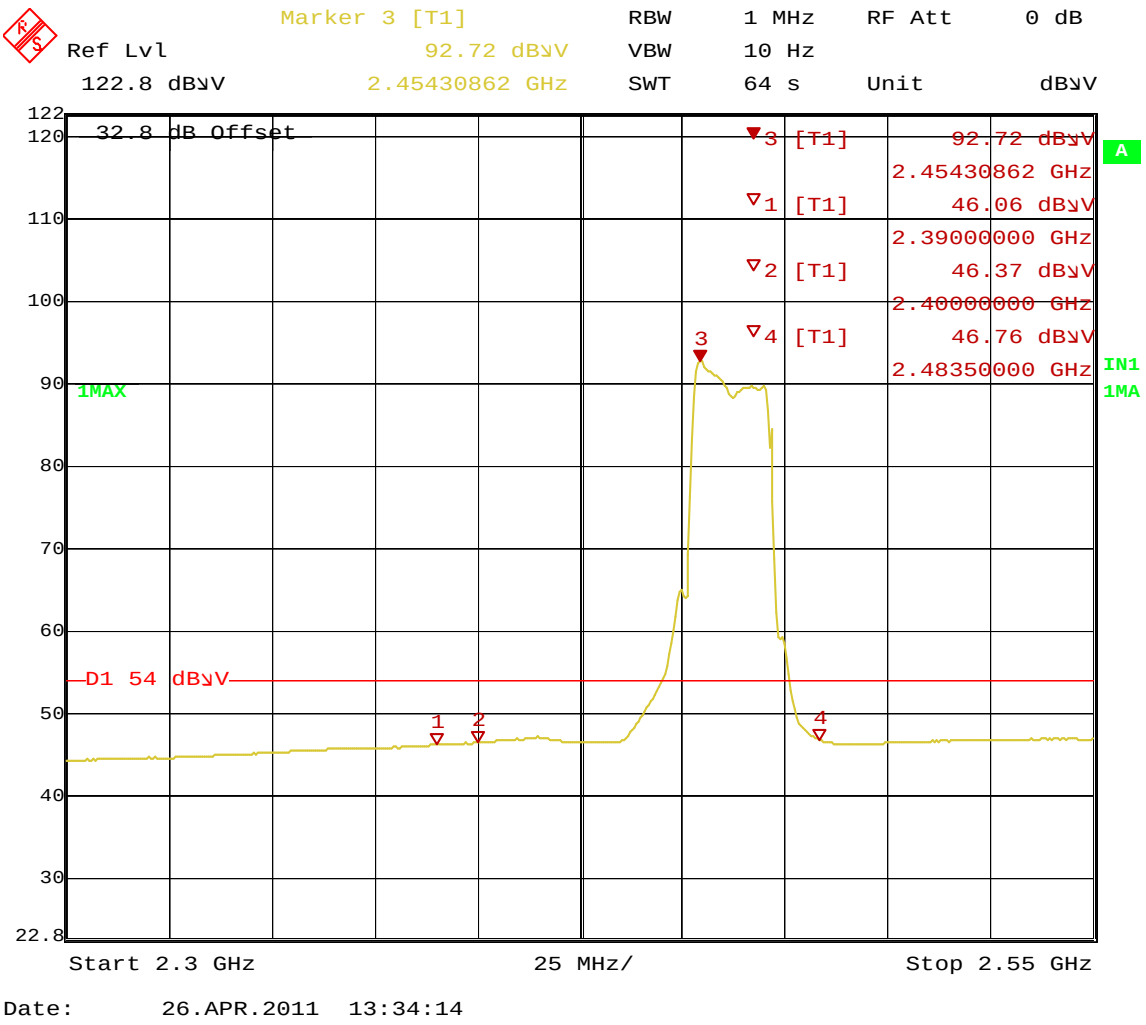


Figure 138: Radiated Emission at the Edge for 2462 MHz at Chain 0 + 1 HT20 13 Mbps Y-Axis – Vertical (Ave.)

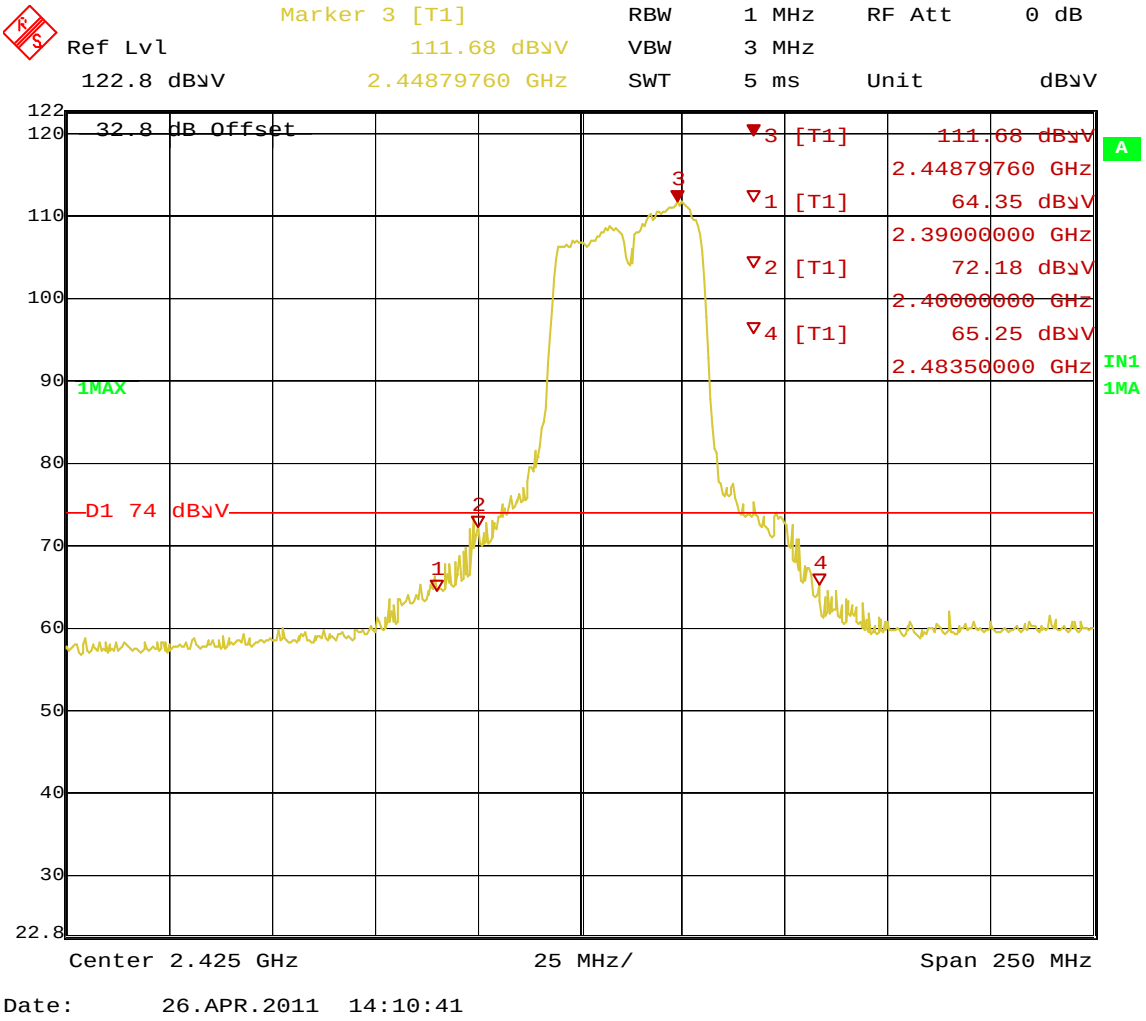


Figure 139: Radiated Emission at the Edge for 2437 MHz at Chain 0 HT40 13.5 Mbps – Horizontal (Peak)

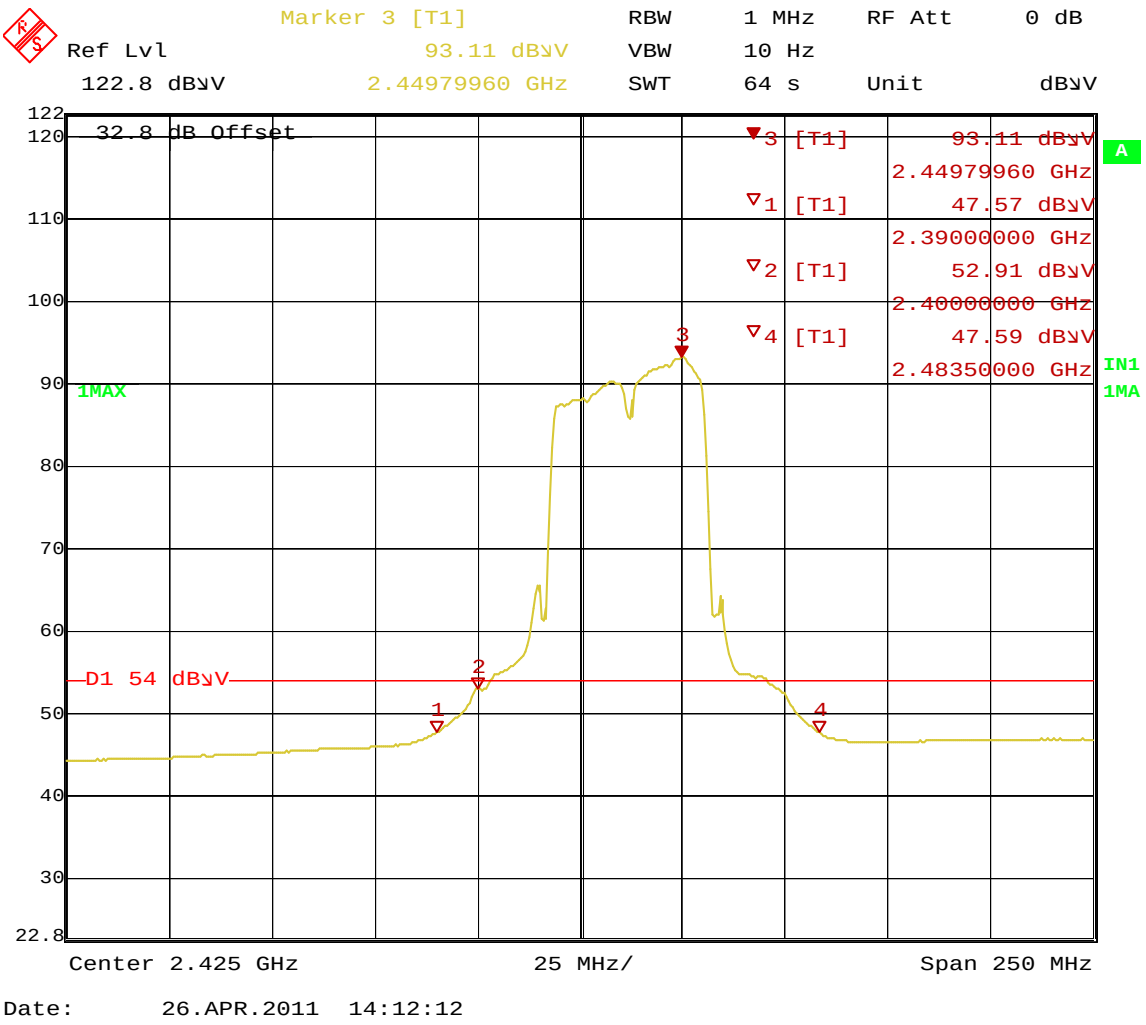


Figure 140: Radiated Emission at the Edge for 2437 MHz at Chain 0 HT40 13.5 Mbps – Horizontal (Ave.)

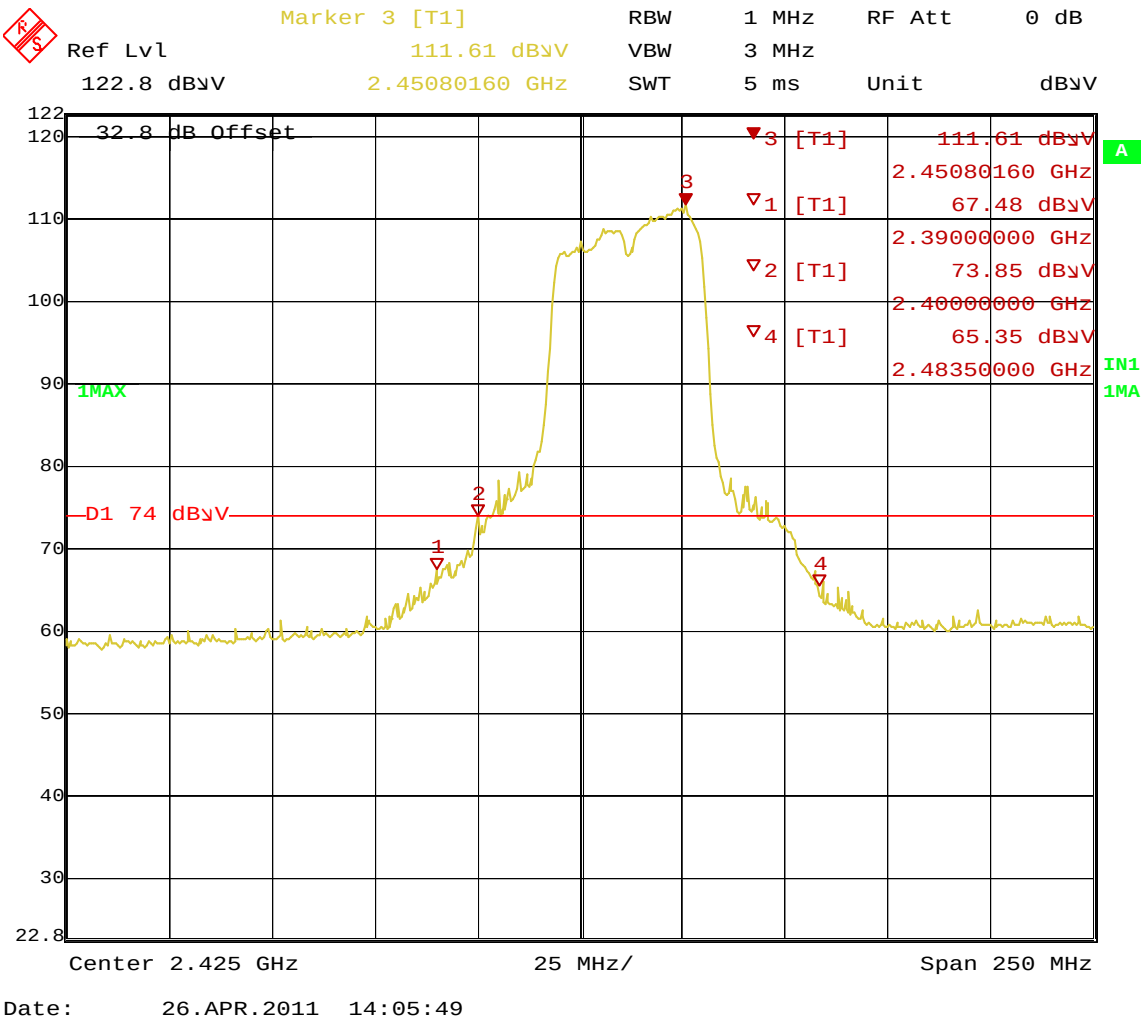


Figure 141: Radiated Emission at the Edge for 2437 MHz at Chain 0 HT40 13.5 Mbps – Vertical (Peak)

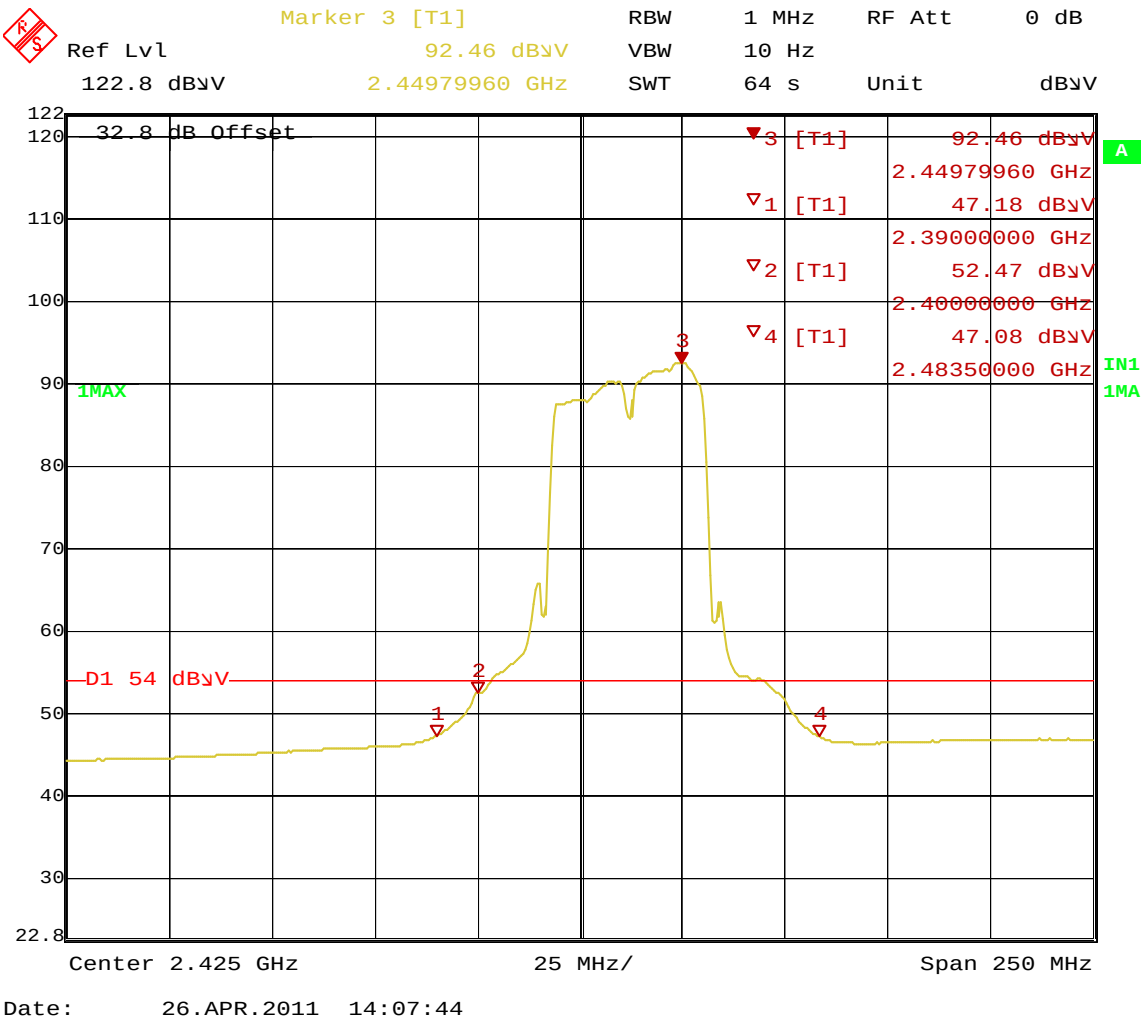


Figure 142: Radiated Emission at the Edge for 2437 MHz at Chain 0 HT40 13.5 Mbps – Vertical (Ave.)

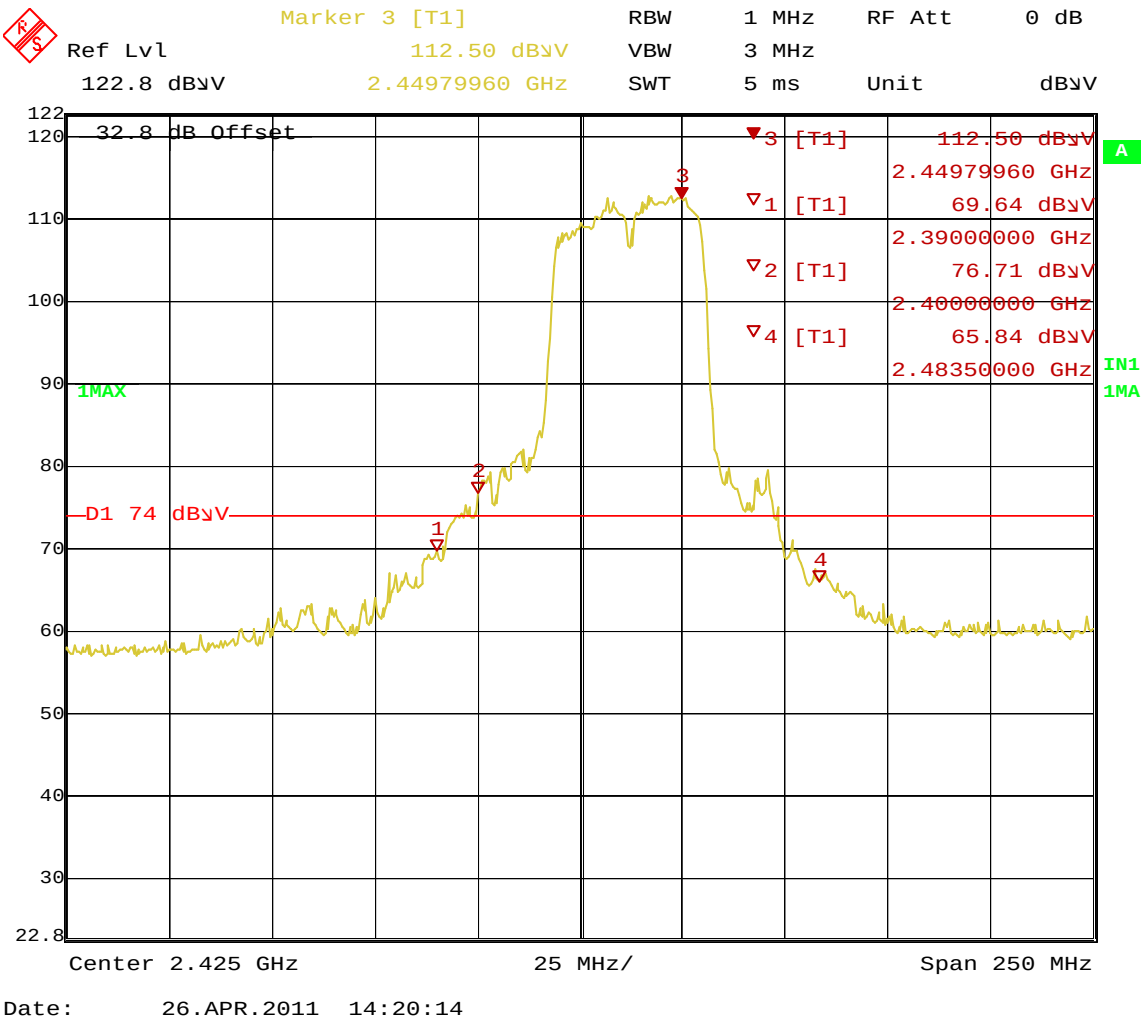


Figure 143: Radiated Emission at the Edge for 2437 MHz at Chain 0 +1 HT40 27 Mbps – Horizontal (Peak)

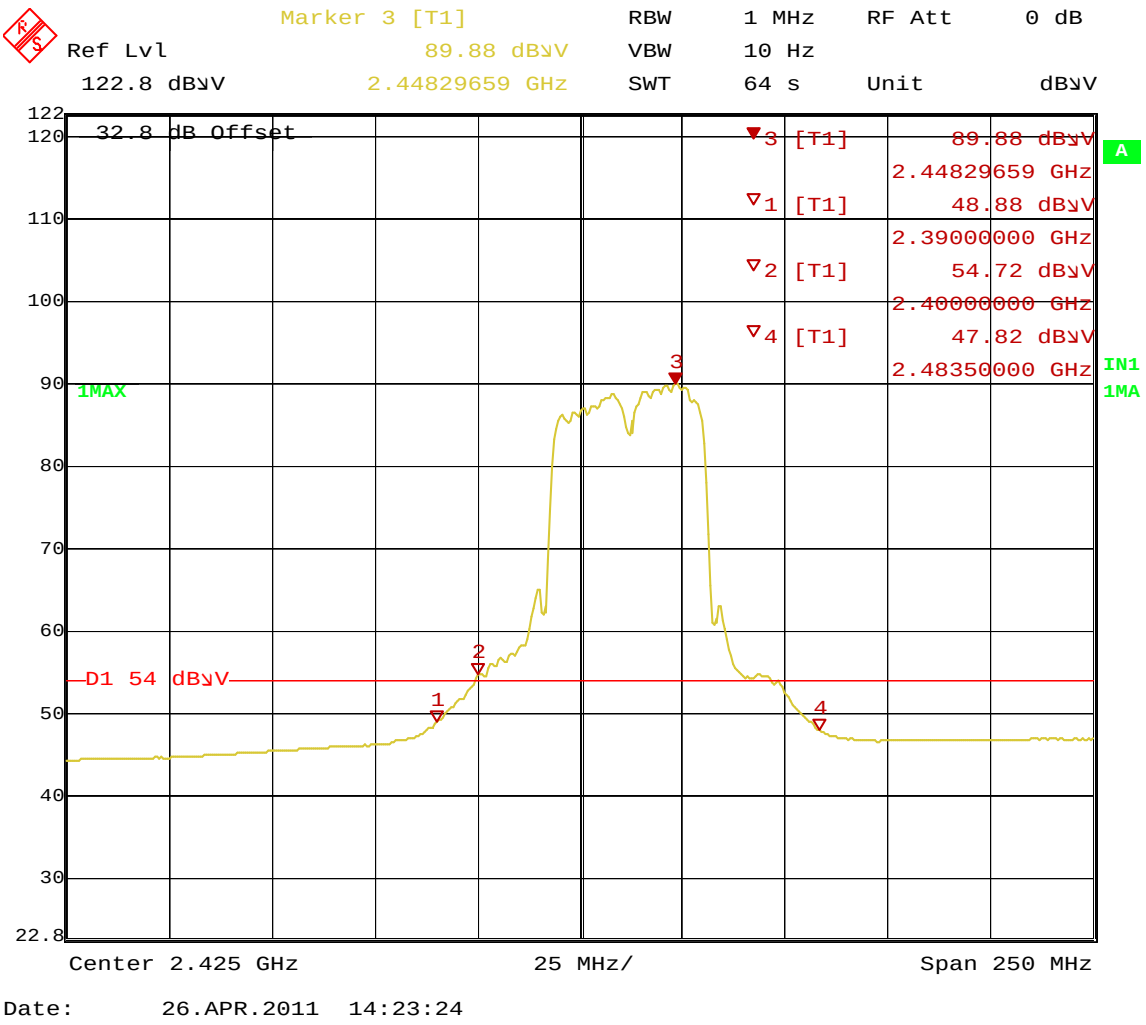


Figure 144: Radiated Emission at the Edge for 2437 MHz at Chain 0 +1 HT40 27 Mbps – Horizontal (Ave.)

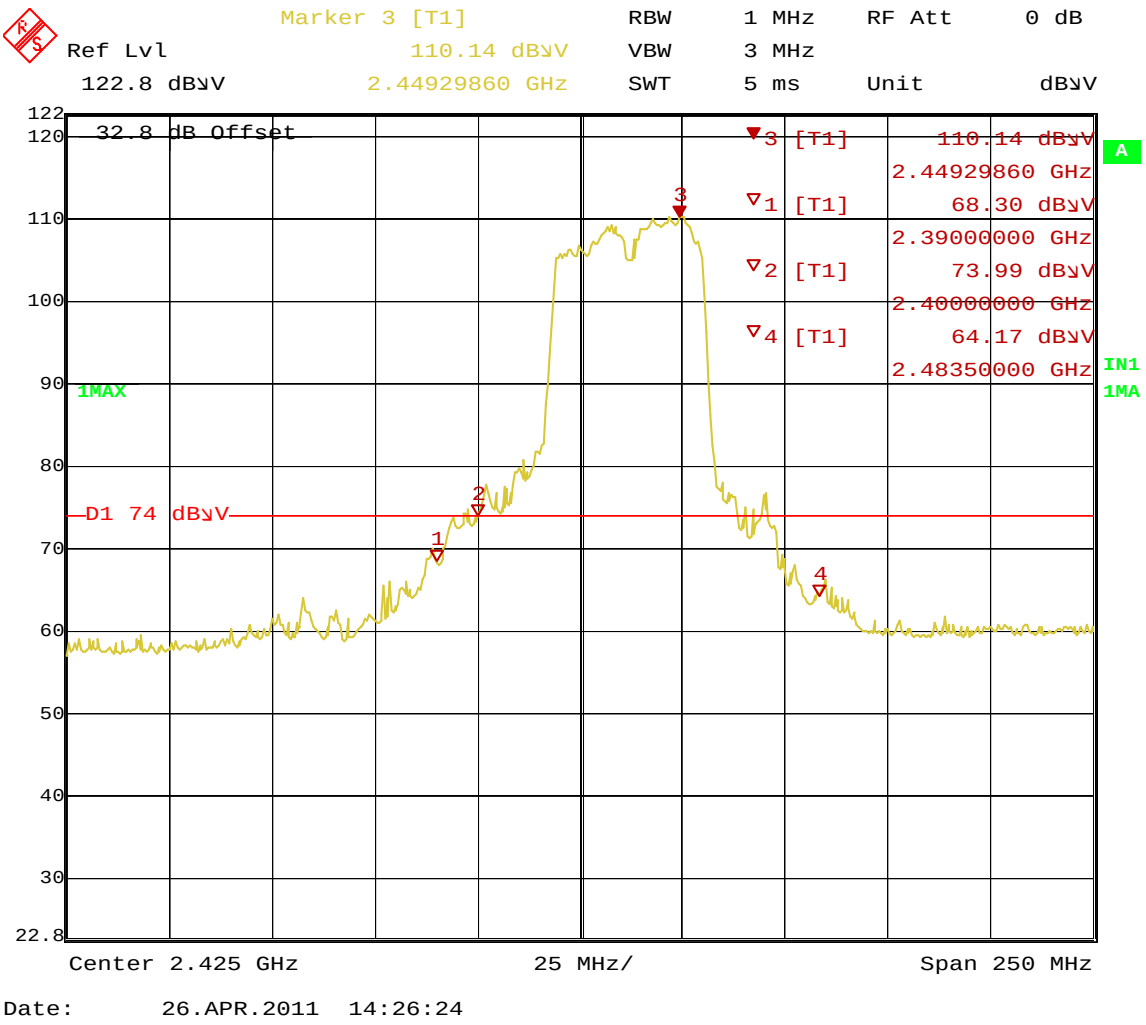


Figure 145: Radiated Emission at the Edge for 2437 MHz at Chain 0 +1 HT40 27 Mbps – Vertical (Peak)

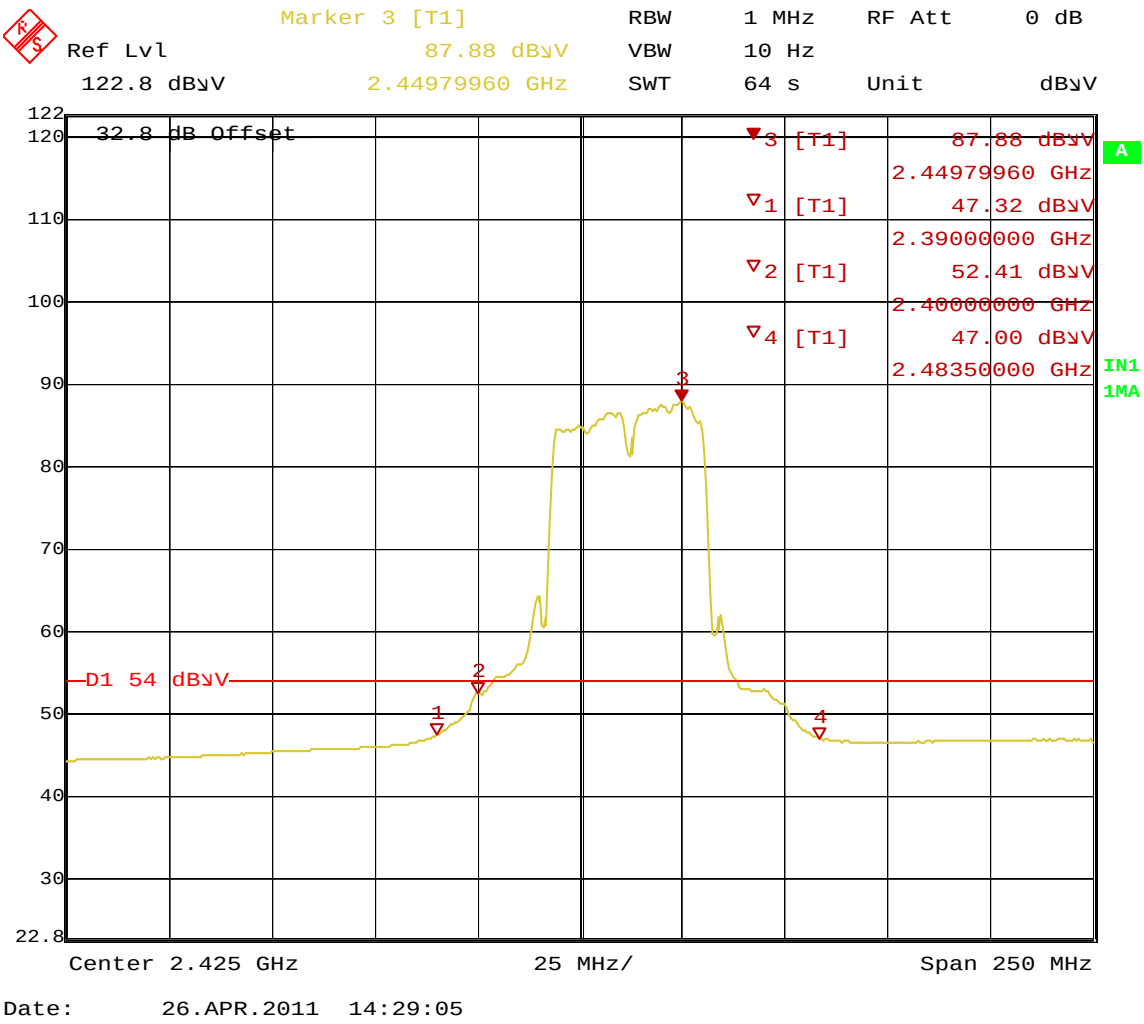


Figure 146: Radiated Emission at the Edge for 2437 MHz at Chain 0 +1 HT40 27 Mbps – Vertical (Ave.)

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EUT Name	Wireless ADSL Residential Gateway	**Date**	May 17, 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	22°C / 38%rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	802.11b, 1Mbps at Y-Axis (30 MHz-1GHz)	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz/ 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (cm)	Table Pos (deg)	FIM (Pk) Pk (dBuV/m)	FIM QP (dBuV/m)	Total CF dBuV	E-Field QP (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)	Type
Transmitted Data at 2437 MHz										
218.74	H	120	288	35.56	34.36	-13.64	20.72	46.02	-25.30	Spurious
220.07	H	121	287	27.19	22.86	-13.70	9.16	46.02	-36.86	Spurious
281.25	H	102	301	37.00	35.33	-11.06	24.27	46.02	-21.75	Spurious
666.66	H	108	39	33.06	31.82	-4.79	27.03	46.02	-18.99	Spurious
799.99	H	104	66	29.01	27.81	-2.42	25.39	46.02	-20.63	Spurious
55.31	V	147	275	44.75	43.15	-19.08	24.07	40.00	-15.93	Spurious
56.00	V	121	31	48.49	46.08	-18.94	27.14	40.00	-12.86	Spurious
56.77	V	115	23	48.54	46.33	-18.77	27.56	40.00	-12.44	Spurious
124.99	V	110	205	34.67	33.39	-11.53	21.86	43.52	-21.66	Spurious
249.99	V	146	243	35.10	33.76	-12.60	21.16	46.02	-24.86	Spurious

Spec Margin = E-Field QP - Limit, E-Field QP = FIM QP+ Total CF ± Uncertainty
Total CF= Amp Gain + Cable Loss + ANT Factor

Combined Standard Uncertainty $u_c(y)$ = ± 3.2 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Note: The worst case was observed at 802.11b, 1Mbps at Channel 2437 MHz.

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EUT Name	Wireless ADSL Residential Gateway	**Date**	June 07, 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	22°C / 34%rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	802.11b, 1Mbps at Y-Axis (above 1GHz)	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (cm)	Table Pos (deg)	FIM (Pk) Pk (dBuV/m)	FIM Ave. (dBuV/m)	Total CF dBuV	E-Field Pk/Ave. (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)	Type
Transmitted Data at 2412 MHz at 802.11b, 1Mbit/s										
3216.06	H	162	51	45.18	41.73	0.03	41.76	53.98	-12.22	Unrestricted
3216.10	V	293	261	44.56	40.49	0.03	40.52	53.98	-13.46	Unrestricted
3333.36	V	249	242	42.61	38.09	0.35	38.44	53.98	-15.54	Restricted
3666.77	H	156	39	43.30	38.85	0.47	39.32	53.98	-14.66	Restricted
4824.06	V	160	-61	39.63	32.25	2.42	34.67	53.98	-19.31	Restricted
4824.06	H	157	167	43.58	38.91	2.42	41.33	53.98	-12.65	Restricted
9648.18	H	150	394	38.15	28.64	10.60	39.24	53.98	-14.74	Unrestricted
12049.30	H	222	104	33.90	19.29	13.96	33.25	53.98	-20.73	Unrestricted
19296.20	H	92	86	39.86	32.52	11.36	43.88	63.98	-20.10	Restricted
19296.20	V	98	164	36.44	31.99	11.36	43.35	63.98	-20.63	Restricted
Transmitted Data at 2437 MHz at 802.11b, 1Mbit/s										
3249.43	V	221	256	45.49	41.93	0.11	42.04	53.98	-11.94	Unrestricted
3666.75	H	170	87	42.78	35.98	0.47	36.45	53.98	-17.53	Restricted
4873.89	V	166	292	48.45	43.99	2.52	46.51	53.98	-7.47	Restricted
4874.07	H	166	177	48.77	44.94	2.52	47.46	53.98	-6.52	Restricted
7310.37	H	182	450	43.98	36.38	8.29	44.67	53.98	-9.31	Restricted
7311.69	V	167	127	41.88	33.05	8.29	41.34	53.98	-12.64	Restricted
9748.09	V	160	445	41.25	35.56	10.66	46.22	53.98	-7.76	Unrestricted
9748.09	H	170	104	42.56	37.44	10.66	48.10	53.98	-5.88	Unrestricted
19496.10	V	96	47	37.24	33.41	11.55	44.96	63.98	-19.02	Restricted
19496.20	H	145	102	38.02	29.39	11.55	40.94	63.98	-23.04	Restricted
Transmitted Data at 2462 MHz at 802.11b, 1Mbit/s										
3282.73	V	278	258	45.92	42.67	0.23	42.90	53.98	-11.08	Unrestricted
3333.41	V	238	-69	44.62	40.71	0.35	41.06	53.98	-12.92	Unrestricted
4924.06	H	245	126	42.78	37.21	2.60	39.81	53.98	-14.17	Restricted
4924.12	V	195	283	43.16	36.93	2.60	39.53	53.98	-14.45	Restricted
6565.44	H	250	165	41.00	34.25	6.38	40.63	53.98	-13.35	Unrestricted
19696.10	V	101	335	35.87	30.07	11.71	41.78	63.98	-22.20	Restricted
19696.20	H	107	326	40.81	32.85	11.71	44.56	63.98	-19.42	Restricted

Spec Margin = E-Field Ave. - Limit, E-Field Ave. = FIM Ave. + Total CF ± Uncertainty
Total CF= Amp Gain + Cable Loss + ANT Factor

Combined Standard Uncertainty $u_c(y)$ = ± 3.2dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: All emissions passed the spurious emission limit.

SOP 1 Radiated Emissions

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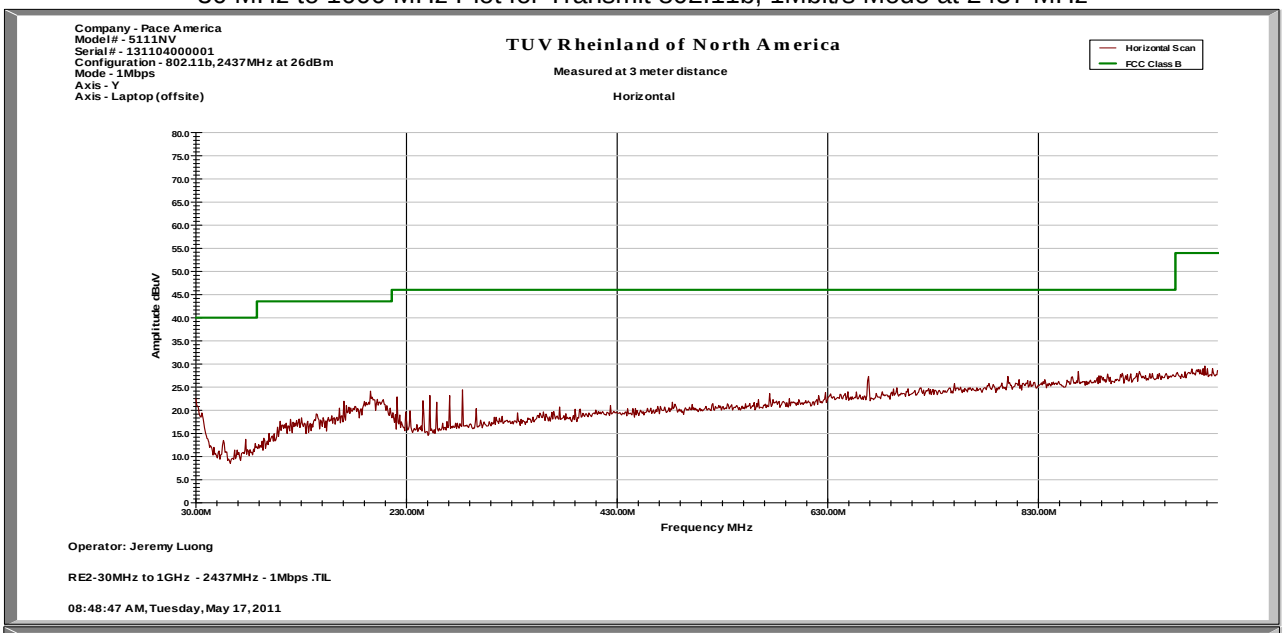
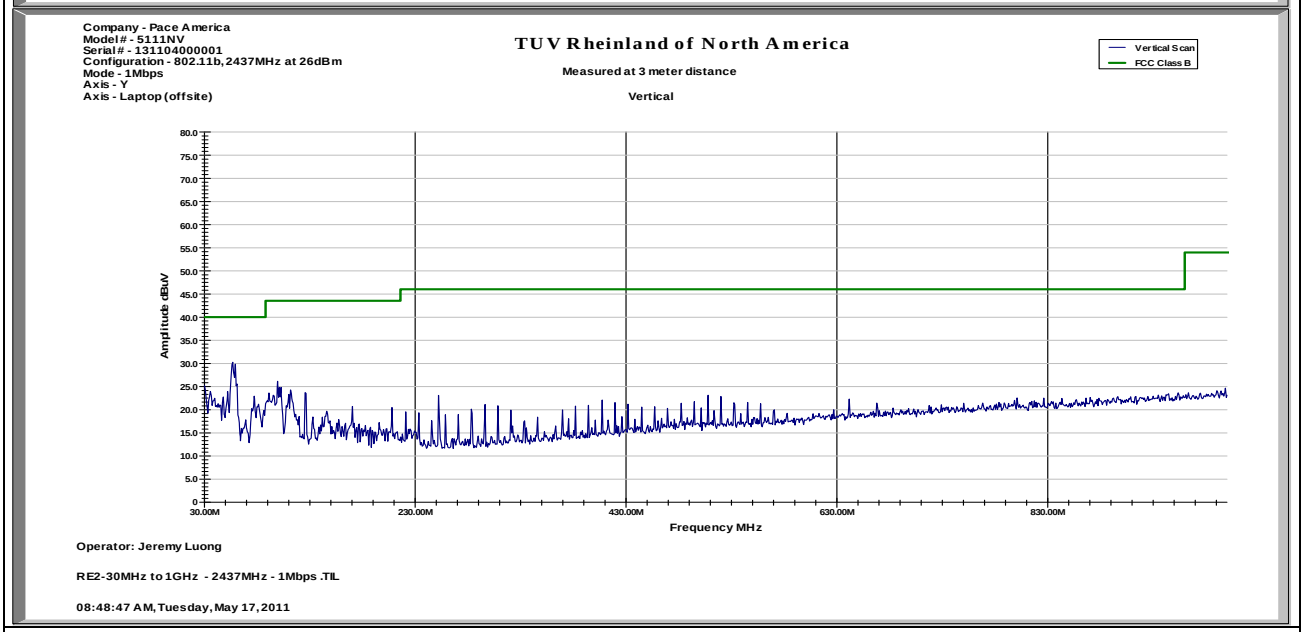
EUT Name	Wireless ADSL Residential Gateway	**Date**	May 17, 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	21°C / 33%rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	802.11b, 1Mbps at Y-Axis	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

30 MHz to 1000 MHz Plot for Transmit 802.11b, 1Mbit/s Mode at 2437 MHz





Notes: None.

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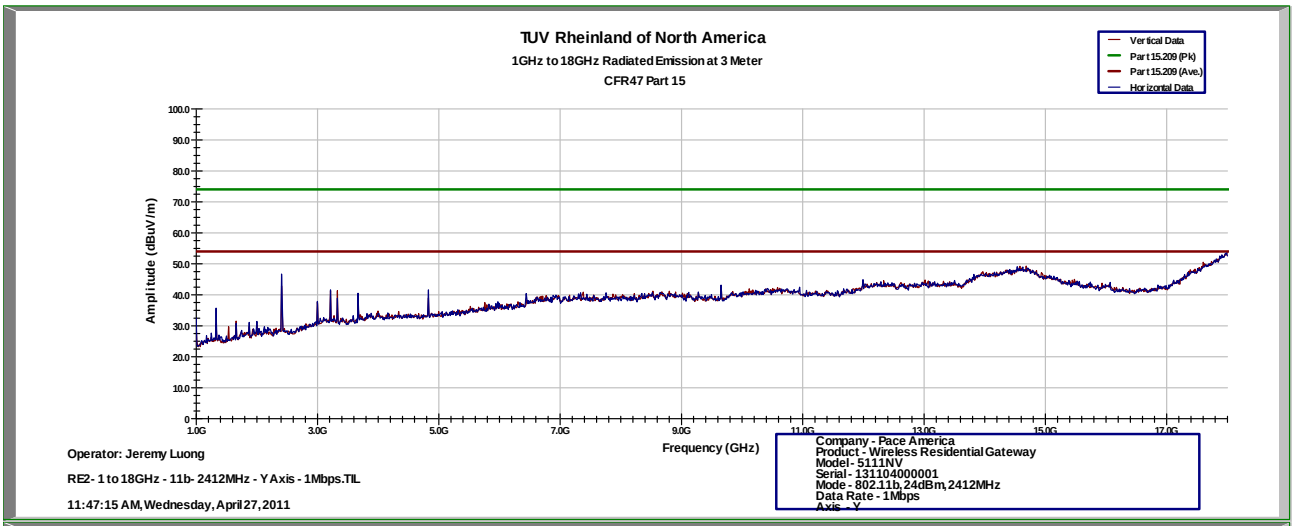
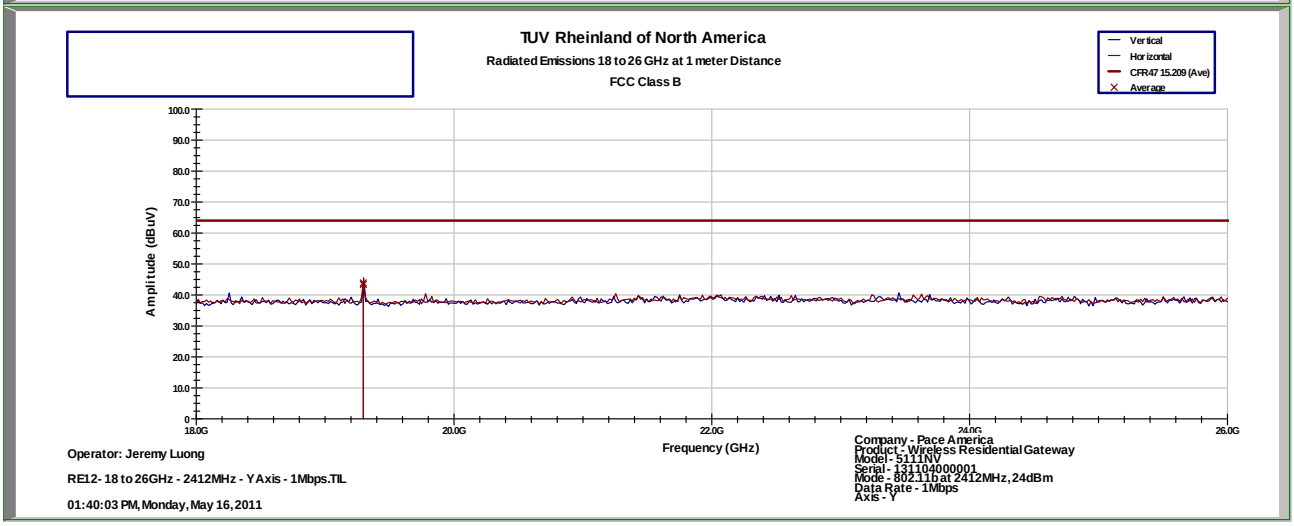
EUT Name	Wireless ADSL Residential Gateway	**Date**	April 27 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	21°C / 35%rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	802.11b, 1Mbps at Y-Axis	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Jeremy Luong

Above 1GHz Plots for Transmit Mode at 2412 MHz, 802.11b 1Mbit/s





Notes: Limit was extrapolated to 1m distance for 18GHz – 25GHz range.
1GHz – 25GHz Setting: RBW = 1MHz/ VBW = 3MHz

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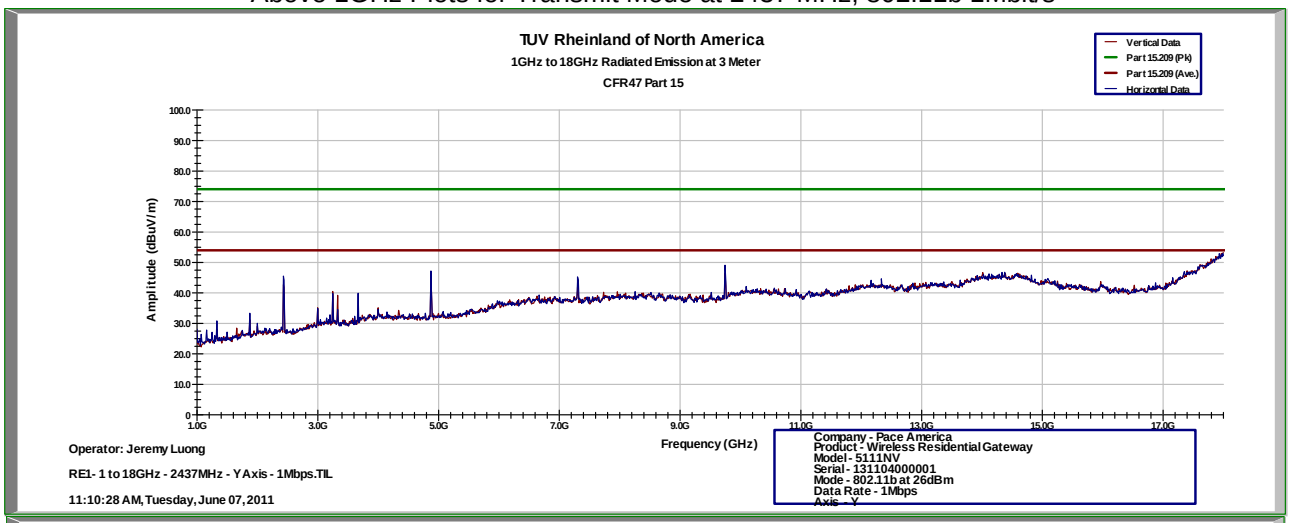
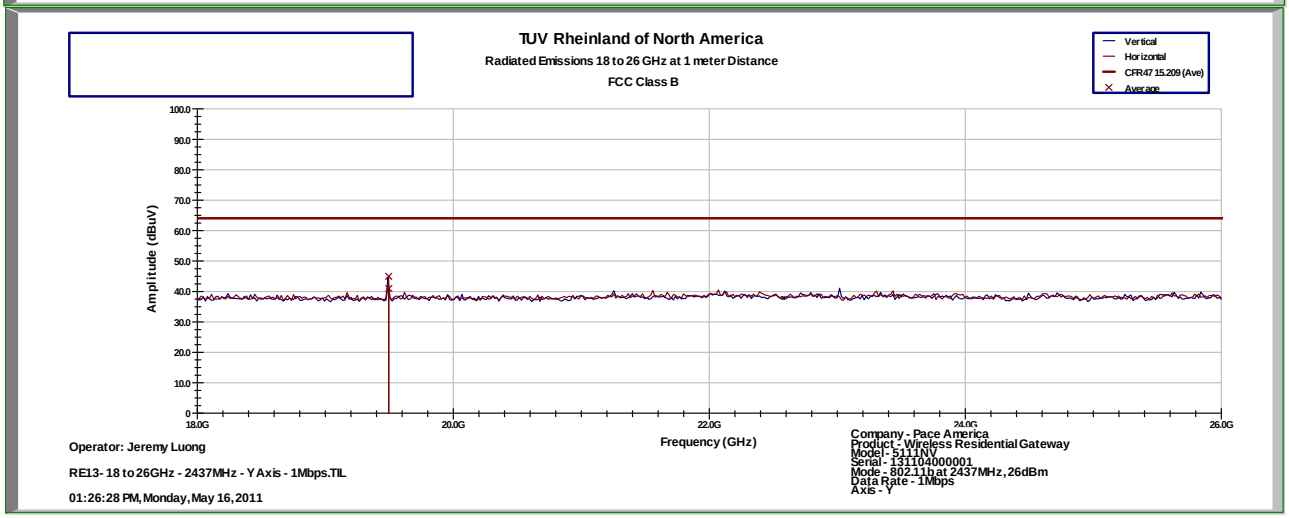
EUT Name	Wireless ADSL Residential Gateway	**Date**	April 28 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	21°C / 39%rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	802.11b, 1Mbps at Y-Axis	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Jeremy Luong

Above 1GHz Plots for Transmit Mode at 2437 MHz, 802.11b 1Mbit/s





Notes: Limit was extrapolated to 1m distance for 18GHz – 25GHz range.
1GHz – 25GHz Setting: RBW = 1MHz/ VBW = 3MHz.

SOP 1 Radiated Emissions

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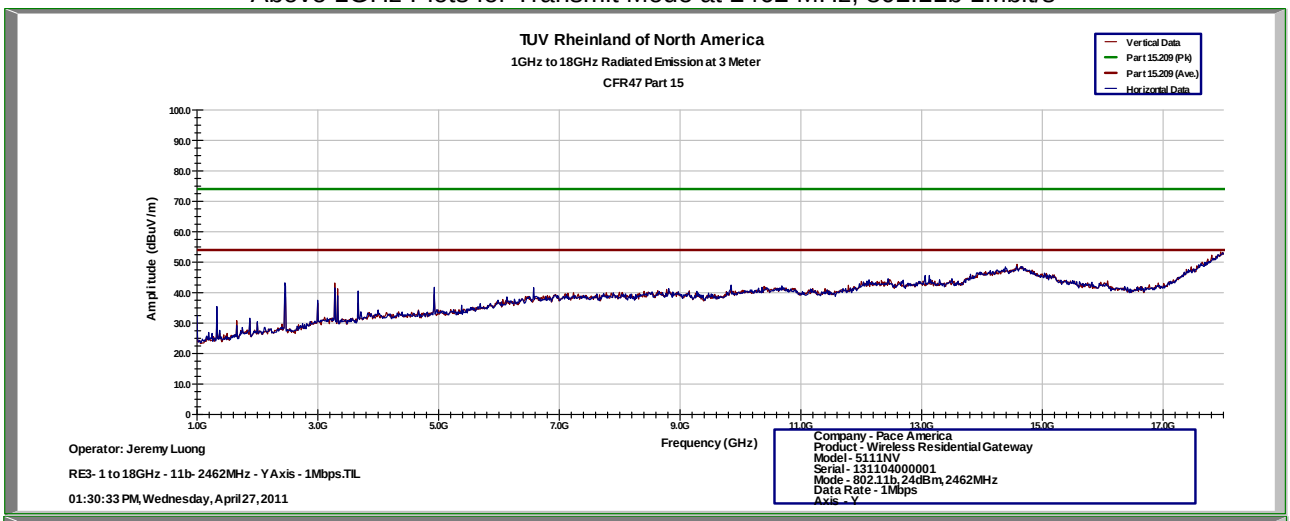
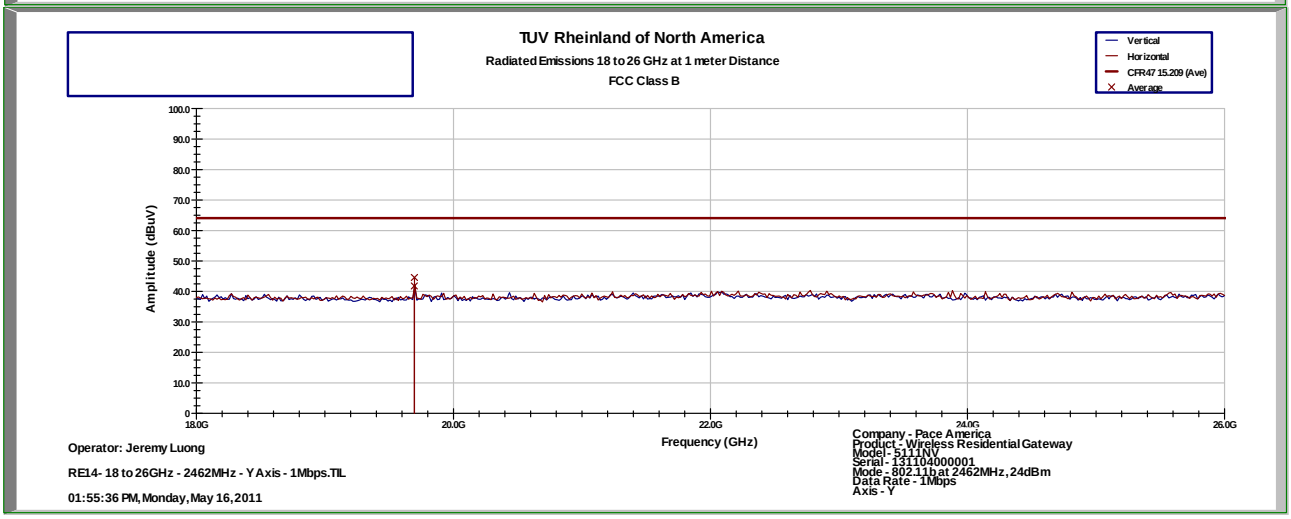
EUT Name	Wireless ADSL Residential Gateway	**Date**	April 27 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	21°C / 35%rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	802.11b, 1Mbps at Y-Axis	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Jeremy Luong

Above 1GHz Plots for Transmit Mode at 2462 MHz, 802.11b 1Mbit/s





Notes: Limit was extrapolated to 1m distance for 18GHz – 25GHz range.
1GHz – 25GHz Setting: RBW = 1MHz/ VBW = 3MHz

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EUT Name	Wireless ADSL Residential Gateway	**Date**	April 26, 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	21°C / 36%rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	802.11g, 6Mbit/s at Y-Axis (above 1GHz)	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (cm)	Table Pos (deg)	FIM (Pk) Pk (dBuV/m)	FIM Ave. (dBuV/m)	Total CF dBuV	E-Field Pk/Ave. (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)	Type
Transmitted Data at 2412 MHz at 802.11g, 6Mbit/s										
1333.42	H	101	494	46.60	42.90	-7.61	35.29	53.98	-18.69	Restricted
3216.06	H	133	46	45.17	41.79	0.03	41.82	53.98	-12.16	Unrestricted
3333.35	V	171	331	42.53	37.72	0.35	38.07	53.98	-15.91	Restricted
4824.06	H	106	163	42.14	25.52	2.42	27.94	53.98	-26.04	Restricted
Transmitted Data at 2437 MHz at 802.11g, 6Mbit/s										
3249.39	V	246	256	46.21	42.74	0.11	42.85	53.98	-11.13	Unrestricted
3333.46	V	328	267	44.74	41.14	0.35	41.49	53.98	-12.49	Restricted
3666.71	H	118	262	43.97	40.14	0.47	40.61	53.98	-13.37	Restricted
4874.16	V	177	272	48.30	34.42	2.52	36.94	53.98	-17.04	Restricted
4874.25	H	178	169	50.45	37.38	2.52	39.9	53.98	-14.08	Restricted
7313.74	V	208	106	47.89	31.42	8.29	39.71	53.98	-14.27	Restricted
7314.85	H	146	402	47.12	32.25	8.29	40.54	53.98	-13.44	Restricted
9753.36	H	105	31	49.48	30.43	10.66	41.09	53.98	-12.89	Unrestricted
9758.17	V	229	492	46.84	28.94	10.67	39.61	53.98	-14.37	Unrestricted
19496.10	V	100	49	33.25	29.10	11.55	40.65	63.98	-23.33	Restricted
19496.10	H	93	320	38.97	30.65	11.55	42.20	63.98	-21.78	Restricted
Transmitted Data at 2462 MHz at 802.11g, 6Mbit/s										
1333.39	H	102	494	46.20	42.68	-7.61	35.07	53.98	-18.91	Restricted
3282.76	H	129	55	45.96	42.64	0.23	42.87	53.98	-11.11	Unrestricted
3333.42	V	210	478	42.23	37.39	0.35	37.74	53.98	-16.24	Restricted
3666.76	H	122	219	45.21	40.95	0.47	41.42	53.98	-12.56	Restricted
4924.06	H	223	133	41.91	27.17	2.6	29.77	53.98	-24.21	Restricted

Spec Margin = E-Field Ave. - Limit, E-Field Ave. = FIM Ave. + Total CF ± Uncertainty
Total CF= Amp Gain + Cable Loss + ANT Factor

Combined Standard Uncertainty $u_c(y)$ = ± 3.2dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: All emissions passed the spurious emission limit.

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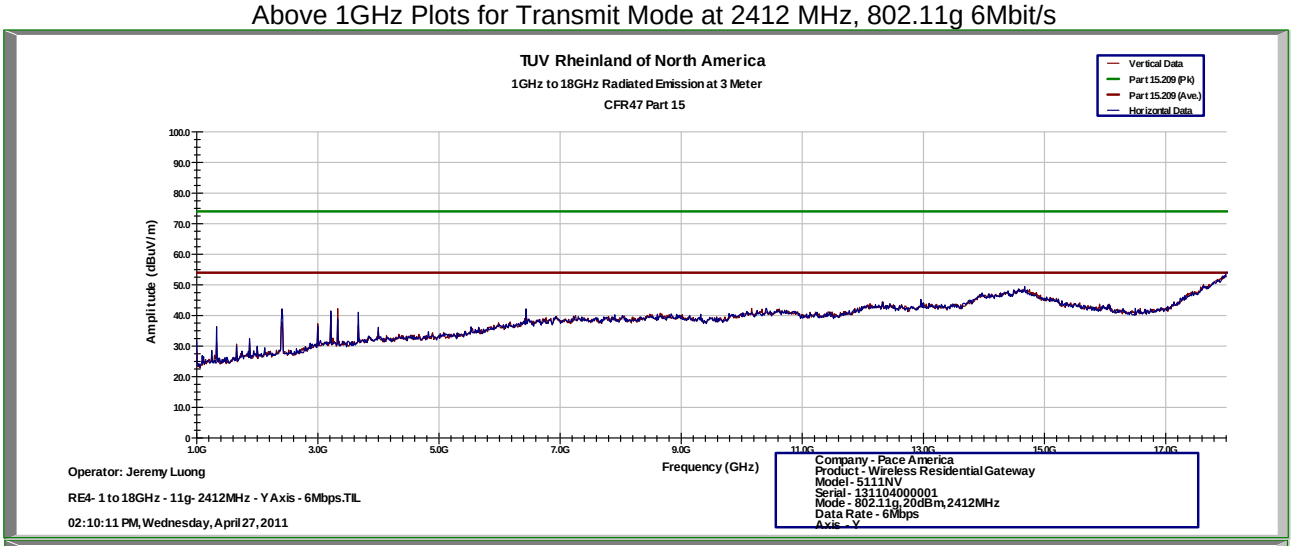
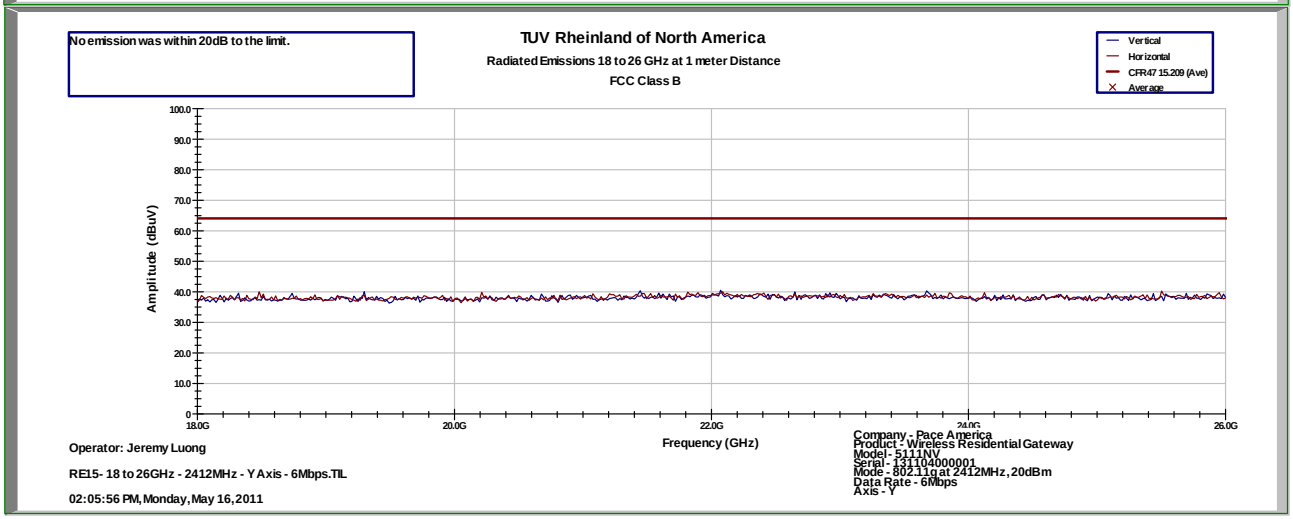
EUT Name	Wireless ADSL Residential Gateway	**Date**	April 27 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	21°C / 35%rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	802.11g, 6Mbps at Y-Axis	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Jeremy Luong

Above 1GHz Plots for Transmit Mode at 2412 MHz, 802.11g 6Mbit/s





Notes: Limit was extrapolated to 1m distance for 18GHz – 25GHz range.
1GHz – 25GHz Setting: RBW = 1MHz/ VBW = 3MHz

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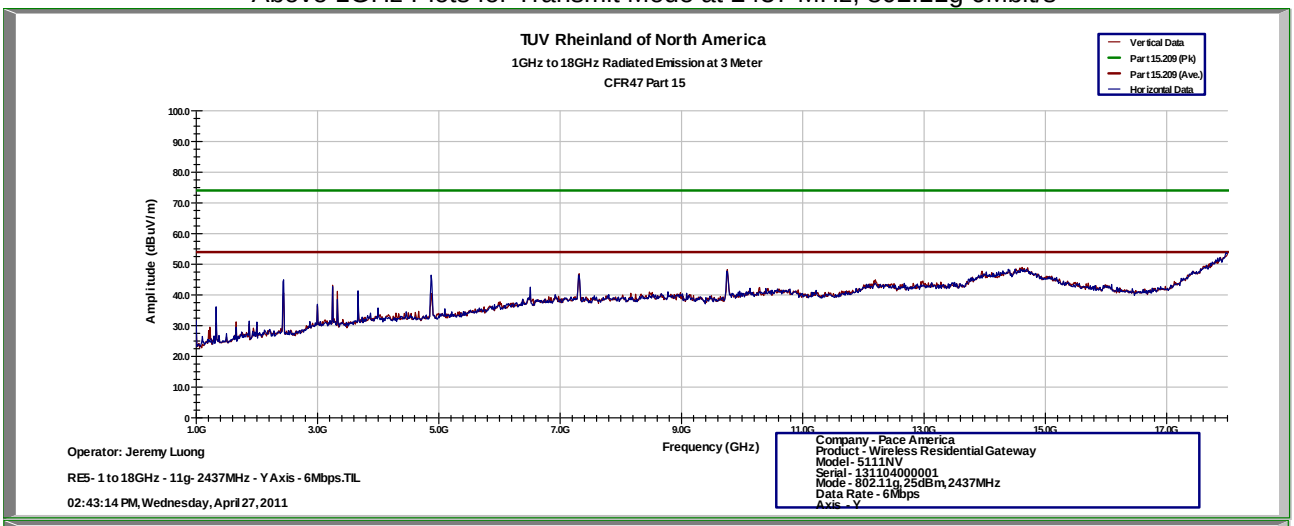
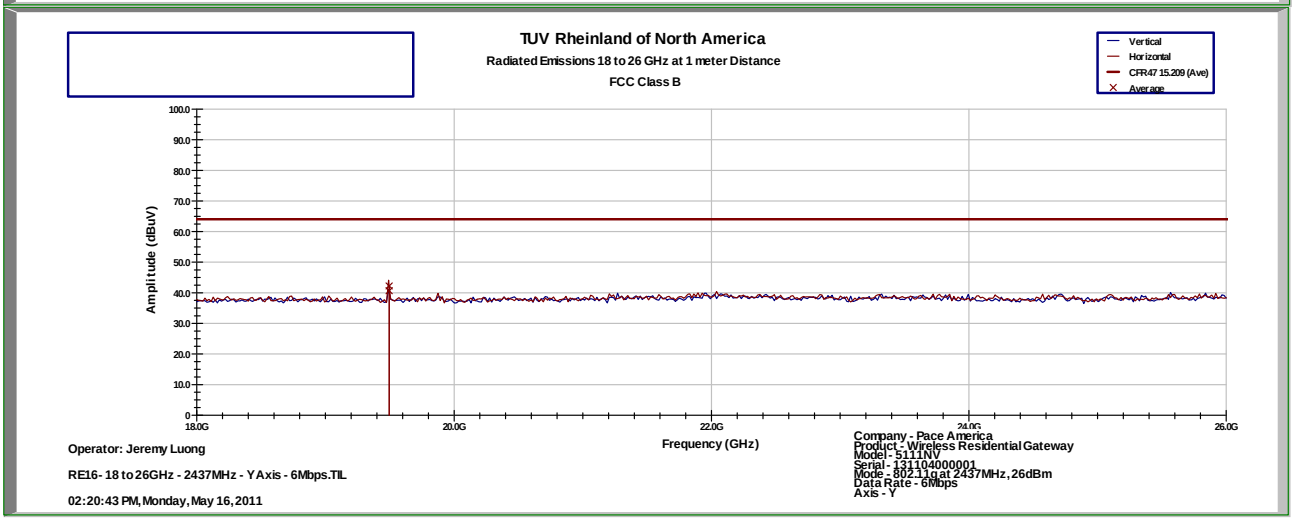
EUT Name	Wireless ADSL Residential Gateway	**Date**	April 27 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	21°C / 36%rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	802.11g, 6Mbps at Y-Axis	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Jeremy Luong

Above 1GHz Plots for Transmit Mode at 2437 MHz, 802.11g 6Mbit/s





Notes: Limit was extrapolated to 1m distance for 18GHz – 25GHz range.
1GHz – 25GHz Setting: RBW = 1MHz/ VBW = 3MHz

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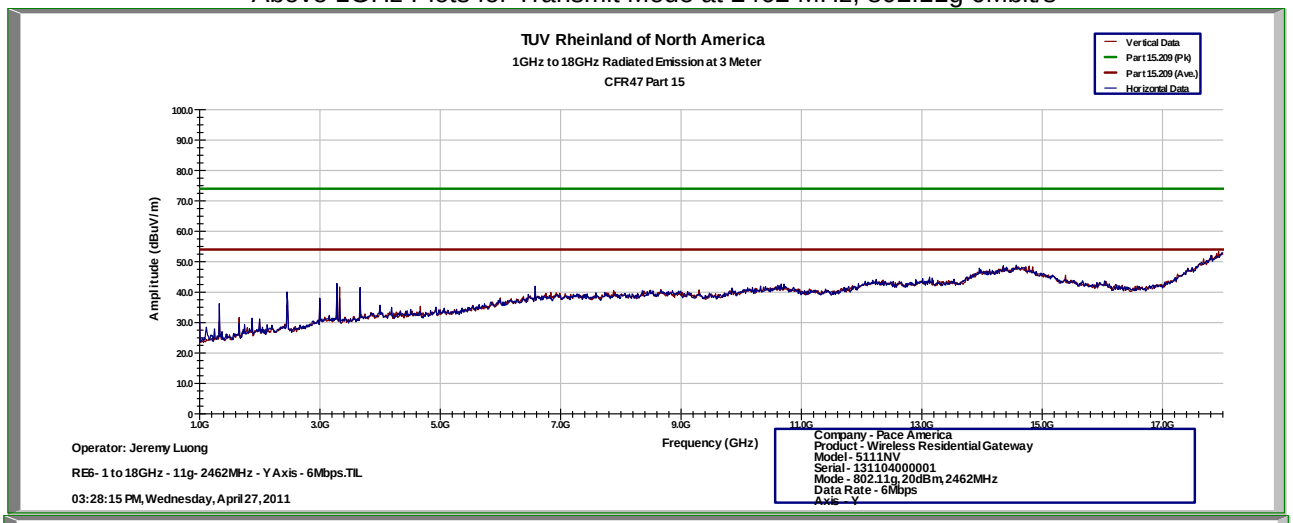
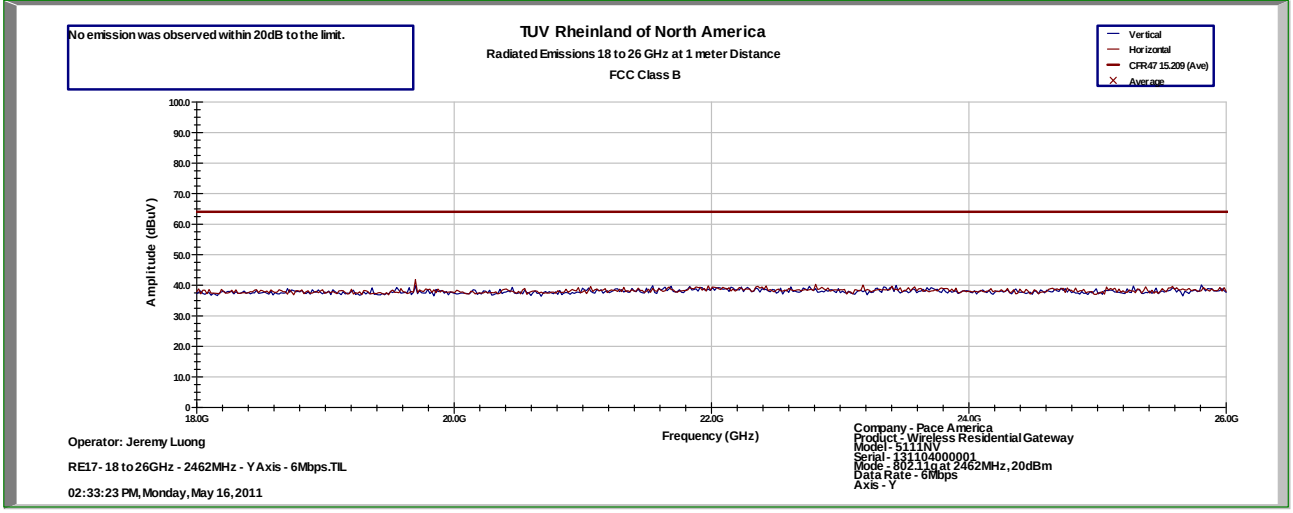
EUT Name	Wireless ADSL Residential Gateway	**Date**	April 27 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	21°C / 36%rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	802.11g, 6Mbps at Y-Axis	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Jeremy Luong

Above 1GHz Plots for Transmit Mode at 2462 MHz, 802.11g 6Mbit/s





Notes: Limit was extrapolated to 1m distance for 18GHz – 25GHz range.
1GHz – 25GHz Setting: RBW = 1MHz/ VBW = 3MHz

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EUT Name	Wireless ADSL Residential Gateway	**Date**	April 26, 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	21°C / 36%rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	802.11n HT20, 6.5Mbit/s at Y-Axis (above 1GHz)	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (cm)	Table Pos (deg)	FIM (Pk) Pk (dBuV/m)	FIM Ave. (dBuV/m)	Total CF dBuV	E-Field Pk/Ave. (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)	Type
Transmitted Data at 2412 MHz at 802.11n HT20, 6.5Mbit/s										
3216.28	V	256	257	44.73	40.29	0.03	40.32	53.98	-13.66	Unrestricted
3333.45	V	295	265	44.11	40.54	0.35	40.89	53.98	-13.09	Restricted
3666.75	H	167	283	42.70	36.85	0.47	37.32	53.98	-16.66	Restricted
4824.03	H	111	157	41.41	24.76	2.42	27.18	53.98	-26.80	Restricted
4824.06	V	114	294	36.75	23.41	2.42	25.83	53.98	-28.15	Restricted
Transmitted Data at 2437 MHz at 802.11n HT20, 6.5Mbit/s										
3249.45	H	160	49	46.25	42.55	0.11	42.66	53.98	-11.32	Unrestricted
3333.44	V	252	247	43.02	38.63	0.35	38.98	53.98	-15.00	Restricted
3666.71	H	140	273	43.44	38.91	0.47	39.38	53.98	-14.60	Restricted
4874.06	H	180	144	48.32	31.91	2.52	34.43	53.98	-19.55	Restricted
4874.12	V	176	270	47.11	30.14	2.52	32.66	53.98	-21.32	Restricted
6498.74	H	188	63	42.55	34.74	6.04	40.78	53.98	-13.2	Unrestricted
7317.43	H	190	386	43.93	27.14	8.3	35.44	53.98	-18.54	Restricted
19496.1	V	102	318	32.38	26.42	11.55	37.97	63.98	-26.01	Restricted
19496.2	H	92	332	38.27	28.18	11.55	39.73	63.98	-24.25	Restricted
Transmitted Data at 2462 MHz at 802.11n HT20, 6.5Mbit/s										
1333.41	H	105	131	47.08	43.43	-7.61	35.82	53.98	-18.16	Restricted
3282.79	H	103	418	46.49	43.32	0.23	43.55	53.98	-10.43	Unrestricted
3666.78	H	157	259	40.13	32.01	0.47	32.49	53.98	-21.49	Restricted
3666.78	H	157	259	40.13	32.01	0.47	32.49	53.98	-21.49	Restricted
4924.09	V	289	-62	40.06	24.37	2.6	26.97	53.98	-27.01	Restricted
4924.15	H	235	134	39.65	25.84	2.6	28.44	53.98	-25.54	Restricted
6565.41	H	171	409	40.73	34.57	6.38	40.95	53.98	-13.03	Unrestricted
19696.1	V	102	307	32.53	26.72	11.71	38.43	63.98	-25.55	Restricted
19696.2	H	97	-37	40.09	31.03	11.71	42.74	63.98	-21.24	Restricted

Spec Margin = E-Field Ave. - Limit, E-Field Ave. = FIM Ave. + Total CF ± Uncertainty
Total CF= Amp Gain + Cable Loss + ANT Factor

Combined Standard Uncertainty $u_c(y)$ = ± 3.2dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: All emissions passed the spurious emission limit.

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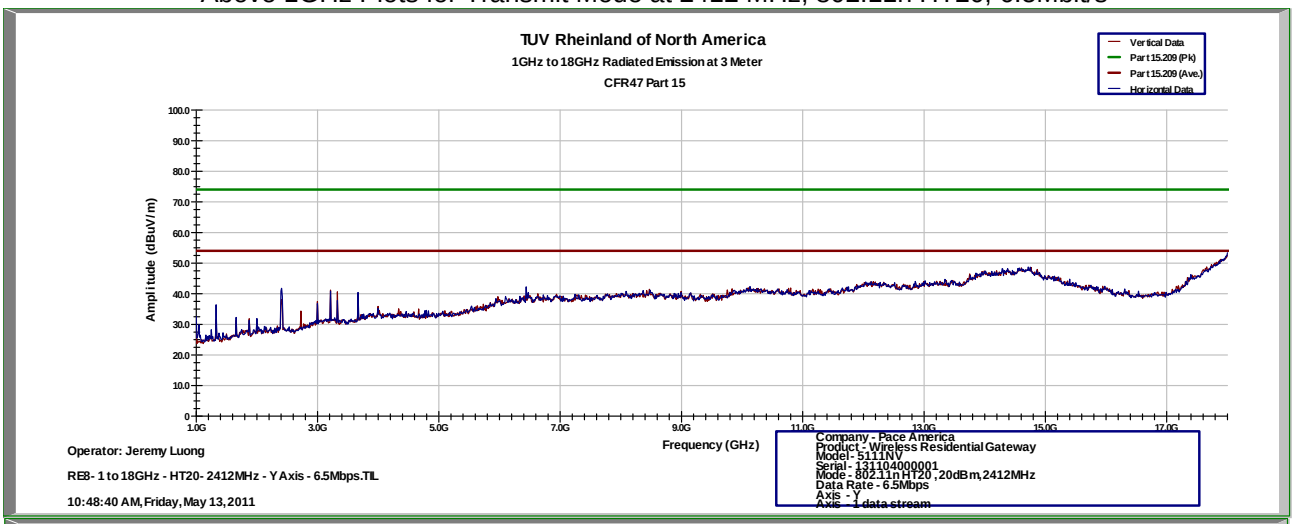
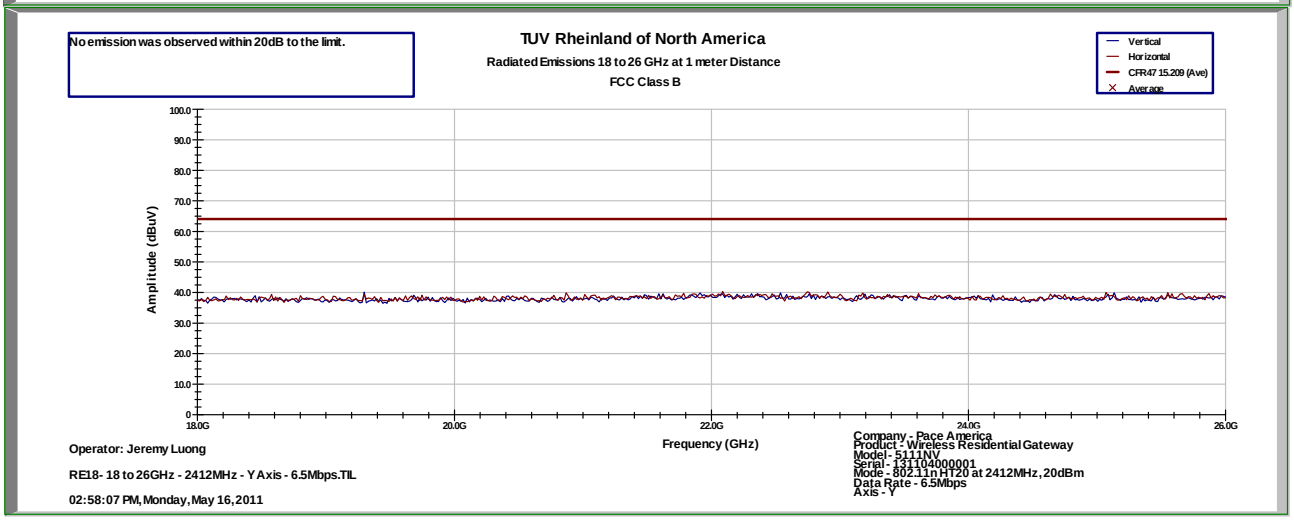
EUT Name	Wireless ADSL Residential Gateway	**Date**	April 27 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	21°C / 35%rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	802.11n HT20, 6.5Mbit/s at Y-Axis	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Jeremy Luong

Above 1GHz Plots for Transmit Mode at 2412 MHz, 802.11n HT20, 6.5Mbit/s





Notes: Limit was extrapolated to 1m distance for 18GHz – 25GHz range.
1GHz – 25GHz Setting: RBW = 1MHz/ VBW = 3MHz

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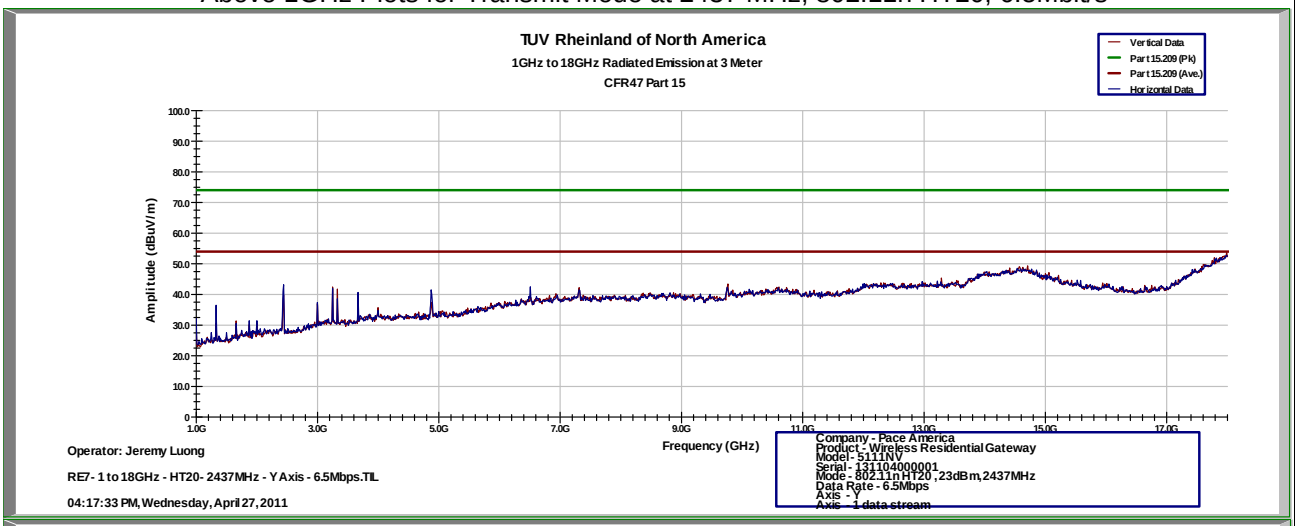
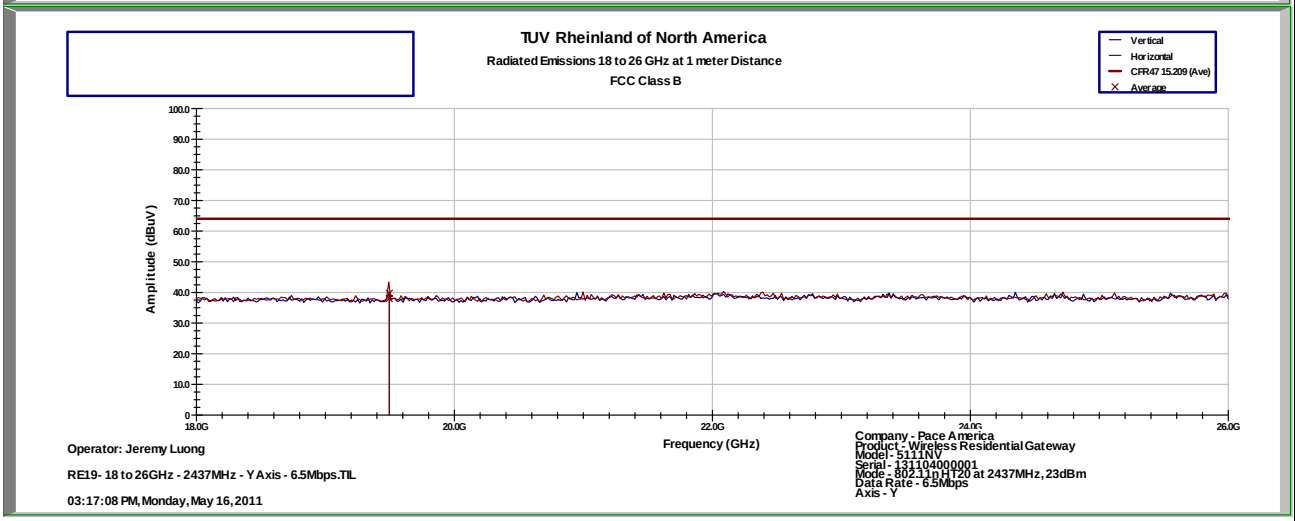
EUT Name	Wireless ADSL Residential Gateway	**Date**	April 27 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	21°C / 36%rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	802.11n HT20, 6.5Mbit/s at Y-Axis	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Jeremy Luong

Above 1GHz Plots for Transmit Mode at 2437 MHz, 802.11n HT20, 6.5Mbit/s





Notes: Limit was extrapolated to 1m distance for 18GHz – 25GHz range.
1GHz – 25GHz Setting: RBW = 1MHz/ VBW = 3MHz

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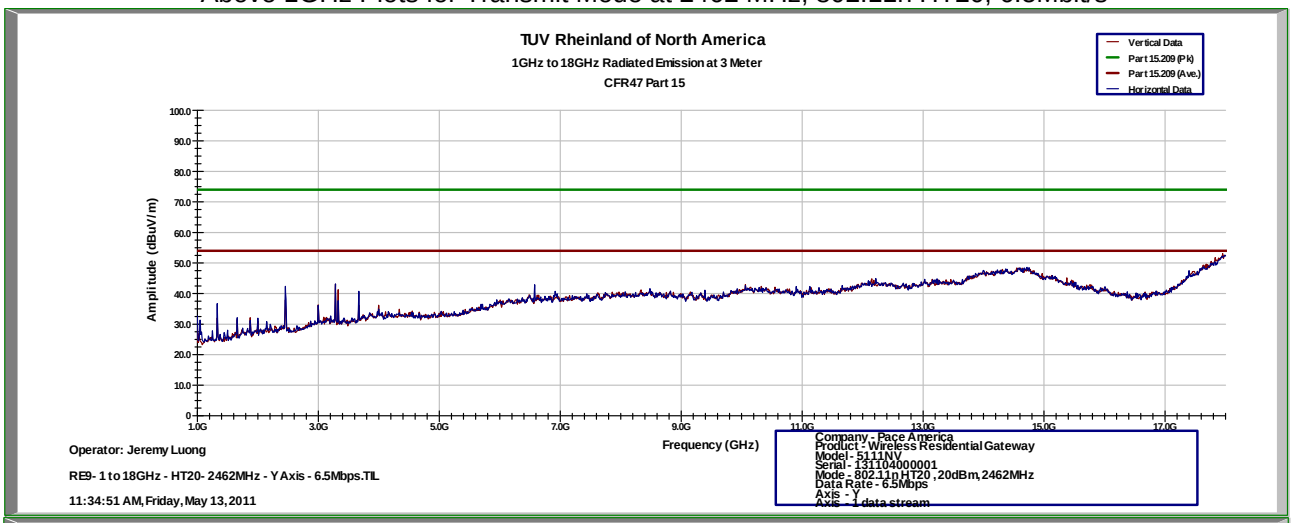
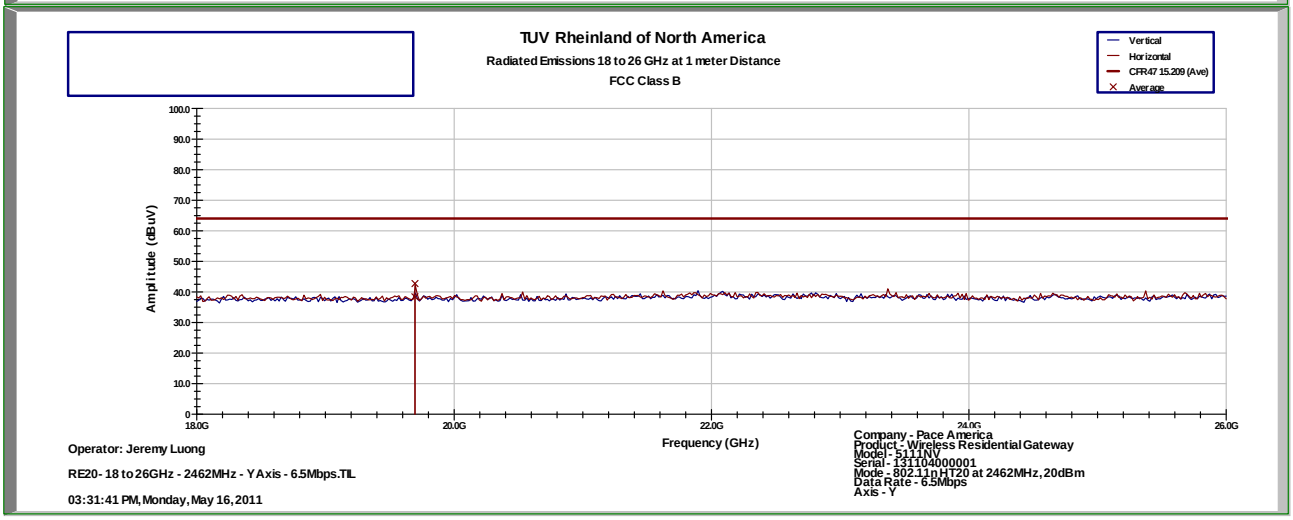
EUT Name	Wireless ADSL Residential Gateway	**Date**	May 18 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	21°C / 36%rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	802.11n HT20, 6.5Mbit/s at Y-Axis	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Jeremy Luong

Above 1GHz Plots for Transmit Mode at 2462 MHz, 802.11n HT20, 6.5Mbit/s





Notes: Limit was extrapolated to 1m distance for 18GHz – 25GHz range.
1GHz – 25GHz Setting: RBW = 1MHz/ VBW = 3MHz

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EUT Name	Wireless ADSL Residential Gateway	**Date**	May 13, 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	21°C / 35%rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	802.11n HT40, 27Mbit/s at Y-Axis	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (cm)	Table Pos (deg)	FIM (Pk) Pk (dBuV/m)	FIM Ave. (dBuV/m)	Total CF dBuV	E-Field Pk/Ave. (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)	Type
Transmitted Data at 2437 MHz at 802.11n HT40, 27Mbit/s , 2 Streams										
1333.38	H	103	129	47.07	43.44	-7.61	35.83	53.98	-18.15	Restricted
3249.44	H	104	408	46.51	43.26	0.11	43.37	53.98	-10.61	Unrestricted
3333.45	V	209	285	44.29	41.16	0.35	41.51	53.98	-12.47	Restricted
3666.78	H	153	218	42.21	40.52	0.47	40.99	53.98	-12.99	Restricted
4867.31	V	206	276	41.5	25.83	2.53	28.37	53.98	-25.61	Restricted
4874.09	H	111	153	42.81	25.86	2.52	28.38	53.98	-25.6	Restricted
6498.78	H	120	66	41.56	34	6.04	40.04	53.98	-13.94	Unrestricted

Spec Margin = E-Field Ave. - Limit, E-Field Ave. = FIM Ave. + Total CF ± Uncertainty
Total CF= Amp Gain + Cable Loss + ANT Factor

Combined Standard Uncertainty $u_c(y)$ = ± 3.2dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: All emissions passed the spurious emission limit.

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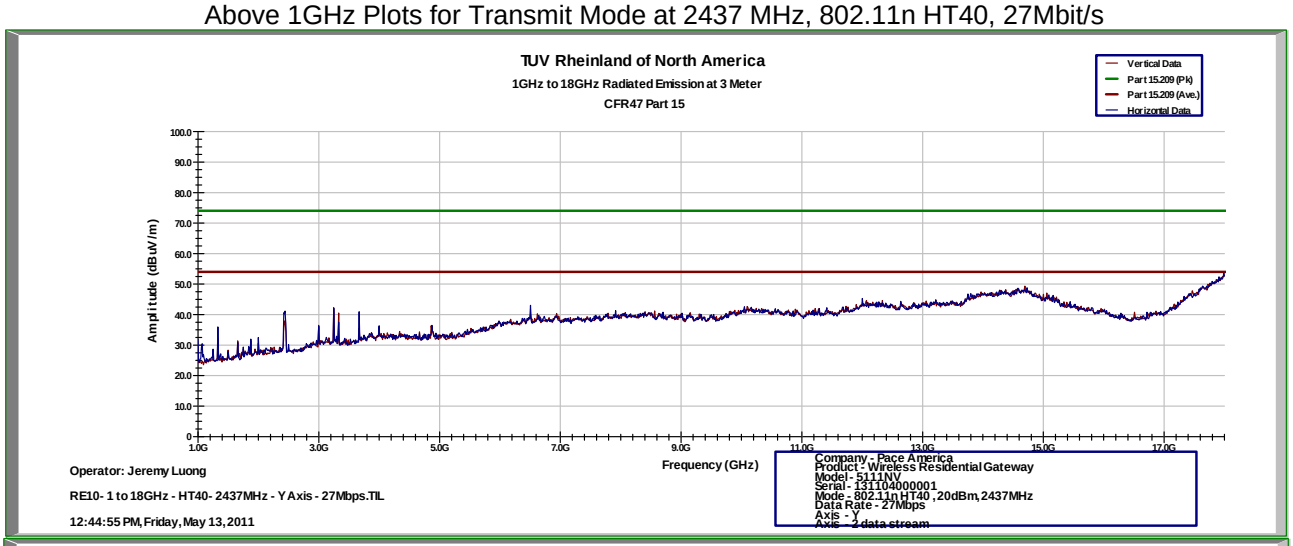
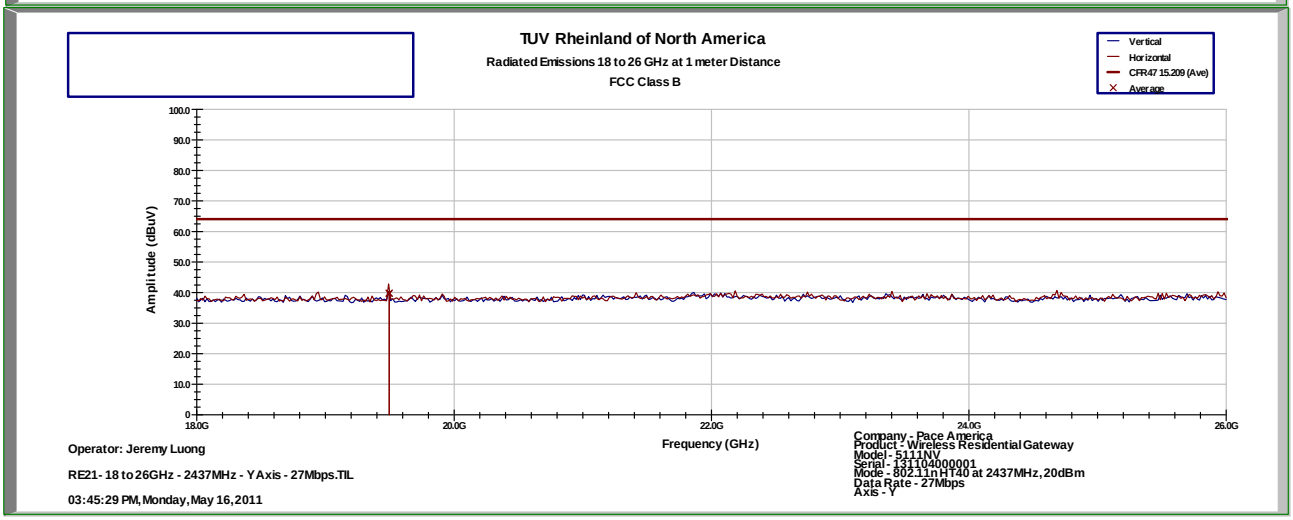
EUT Name	Wireless ADSL Residential Gateway	**Date**	May 13, 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	21°C / 35%rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	802.11n HT40, 27Mbit/s at Y-Axis	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Jeremy Luong

Above 1GHz Plots for Transmit Mode at 2437 MHz, 802.11n HT40, 27Mbit/s





Notes: Limit was extrapolated to 1m distance for 18GHz – 25GHz range.
1GHz – 25GHz Setting: RBW = 1MHz/ VBW = 3MHz

4.6.4 Sample Calculation

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

$$\text{Field Strength (dB}\mu\text{V/m)} = \text{FIM - AMP + CBL + ACF}$$

Where: FIM = Field Intensity Meter (dBμV)
AMP = Amplifier Gain (dB)
CBL = Cable Loss (dB)
ACF = Antenna Correction Factor (dB/m)

$$\mu\text{V/m} = 10^{\frac{dB\mu V/m}{20}}$$

4.7 Receiver Spurious Emissions

Receiver spurious emissions are emissions at any frequency when the equipment is in receive mode.

The spurious emissions of the receiver shall not exceed the values in CFR47 Part 15.109 and RSS 210 Sect 2.7.

4.7.1 Test Methodology

4.7.1.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. The frequency range of interest was divided into sub-ranges to yield a frequency resolution of approximately 120 kHz and provide a reading at each frequency for no more than 12° of turntable rotation. For each frequency sub-range the turntable was rotated 360° while peak emission data was recorded and plotted over the frequency range of interest in horizontal and vertical antenna polarization's.

Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m at a fixed height of 1m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT.

Preliminary scans performed with EUT positioned horizontal and vertically. Horizontal position was worse.

4.7.1.2 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, than the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked.

Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

The final scans performed on Channel 6; 2437 MHz with EUT positioned Vertically.

4.7.1.3 Deviations

None.

4.7.2 Receiver Spurious Emission Limit

The spurious emissions of the receiver shall not exceed the values in CFR47 Part 15.205, 15.209: 2010 and RSS 210 A1.1.2 2010.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490.....	2400/F(kHz)	300
0.490-1.705.....	24000/F(kHz)	30
1.705-30.0.....	30	30
30-88.....	100 **	3
88-216.....	150 **	3
216-960.....	200 **	3
Above 960.....	500	3

4.7.3 Test Results

The final measurement data indicates the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and 1.5.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

4.7.3.1 Final Data

The data recorded in this section contains the final results under the worst-case conditions and without any modifications or special accessories implemented as the manufacturer intends.

SOP 1 Radiated Emissions

Tracking # 31151325.001 Page 1 of 4

EUT Name	Wireless ADSL Residential Gateway	**Date**	June 7, 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	22° C / 34% rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	RX on Y-Axis	**Line AC / Freq**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (cm)	Table Pos (Deg)	FIM (Pk) Pk (dBuV/m)	FIM QP (dBuV/m)	Total CF dBuV	E-Field QP (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)	Type
Receive Mode at 2437 MHz										
58.73	H	131	344	50.11	48.58	-18.18	30.40	40.00	-9.60	Spurious
60.22	H	115	129	46.06	44.10	-18.22	25.88	40.00	-14.12	Spurious
124.99	H	109	159	42.81	41.71	-11.53	30.18	43.52	-13.34	Spurious
206.23	H	108	292	35.31	33.09	-13.38	19.71	43.52	-23.81	Spurious
250.00	H	232	213	33.54	32.33	-12.60	19.73	46.02	-26.29	Spurious
406.24	H	142	267	31.74	30.74	-9.03	21.71	46.02	-24.31	Spurious
206.24	V	126	292	37.71	35.42	-13.50	21.92	43.52	-21.60	Spurious
268.75	V	114	282	37.56	36.14	-11.20	24.94	46.02	-21.08	Spurious
281.25	V	108	245	33.51	32.29	-11.06	21.23	46.02	-24.79	Spurious

Spec Margin = E-Field QP - Limit, E-Field QP = FIM QP+ Total CF ± Uncertainty
Total CF= Amp Gain + Cable Loss + ANT Factor

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: RX mode at 2437 MHz

SOP 1 Radiated Emissions

Tracking # 31151325.001 Page 2 of 4

EUT Name	Wireless ADSL Residential Gateway	**Date**	June 07, 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	22° C / 34% rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	RX on Y-Axis	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (cm)	Table Pos (Deg)	FIM (Pk) Pk (dBuV/m)	FIM Ave (dBuV/m)	Total CF dBuV	E-Field Ave (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)	Type
Transmitted Data at 2437 MHz										
3249.36	V	252	260	45.61	42.24	0.11	42.35	53.98	-11.63	Spurious
3249.39	H	116	282	44.02	40.10	0.11	40.21	53.98	-13.77	Spurious
3333.42	V	213	-34	44.76	38.38	0.35	38.73	53.98	-15.25	Spurious
3666.72	H	152	259	45.89	41.64	0.47	42.11	53.98	-11.87	Spurious
19496.1	V	118	167	33.9	28.06	11.55	39.61	63.98	-24.37	Spurious
19496.2	H	83	324	40	31.01	11.55	42.56	63.98	-21.42	Spurious

Spec Margin = E-Field Ave - Limit, E-Field Ave = FIM Ave+ Total CF ± Uncertainty
Total CF= Amp Gain + Cable Loss + ANT Factor

Combined Standard Uncertainty $u_c(y)$ = ± 1.6 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

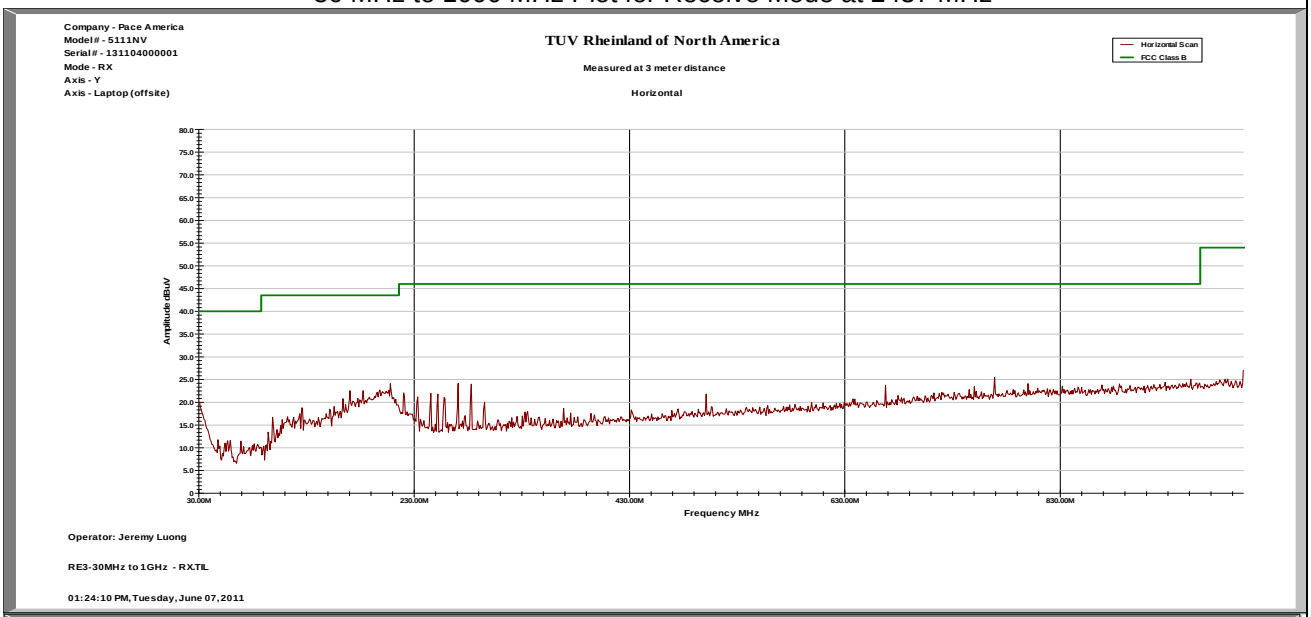
Notes RX mode at 2437 MHz

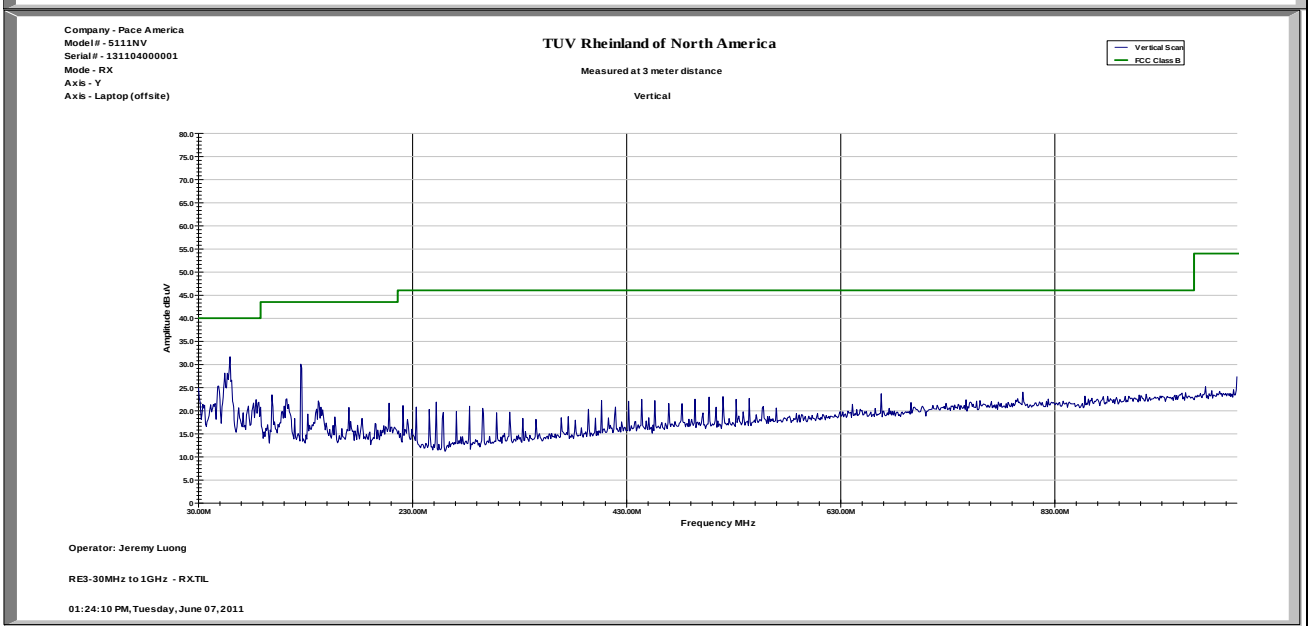
SOP 1 Radiated Emissions

Tracking # 31151325.001 Page 3 of 4

EUT Name	Wireless ADSL Residential Gateway	**Date**	June 7, 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	22° C / 34% rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	RX on Y-Axis	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

30 MHz to 1000 MHz Plot for Receive Mode at 2437 MHz





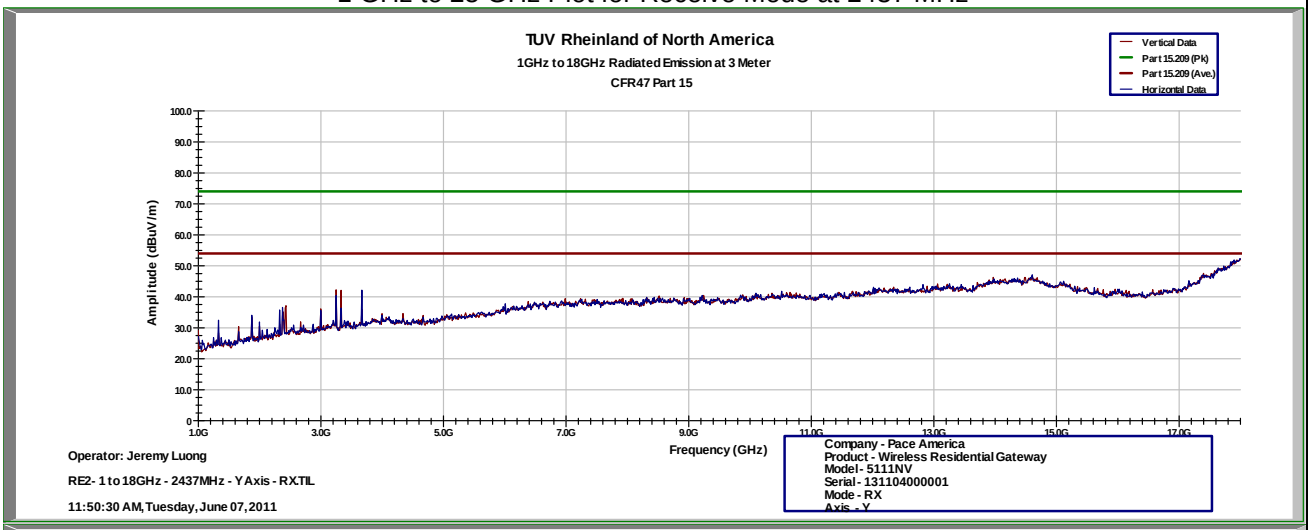
Notes: None.

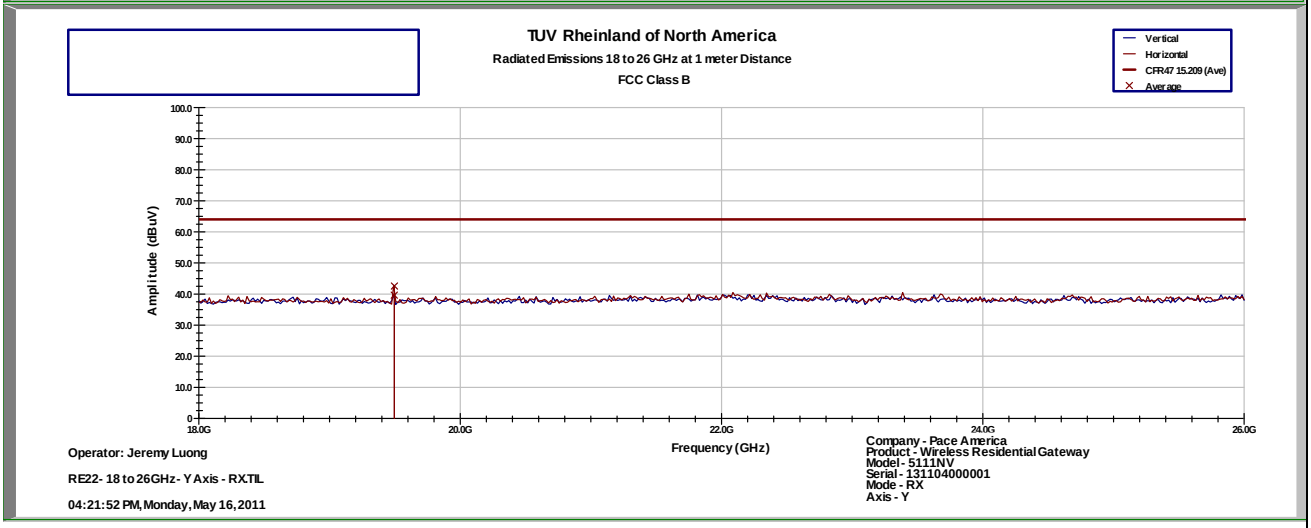
SOP 1 Radiated Emissions

Tracking # 31151325.001 Page 4 of 4

EUT Name	Wireless ADSL Residential Gateway	**Date**	June 07, 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	22° C / 34% rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	RX on Y-Axis	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

1 GHz to 25 GHz Plot for Receive Mode at 2437 MHz





Notes: None

4.8 AC Conducted Emissions

Testing was performed in accordance with ANSI C63.4-2009. These test methods are listed under the laboratory's NVLAP Scope of Accreditation.

This test measures the levels emanating from the EUT's AC input port, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

The AC conducted emissions of equipment under test shall not exceed the values in CFR47 Part 15.207: 2010 and RSS 210: 2010.

4.8.1 Test Methodology

A test program that controls instrumentation and data logging was used to automate the AC Power Line Conducted emission test procedure. The frequency range of interest was divided into sub-ranges such as to yield a frequency resolution of 9 kHz. Each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a set of 50µH / 50Ω LISNs.

Testing is either performed in Lab 2. The setup photographs clearly identify which site was used. The vertical ground plane used in the semi-anechoic chamber is a 2m x 2m solid aluminum frame and panel, and it is bonded to the horizontal ground plane.

In the case of tabletop equipment, the EUT is placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane and 40cm from a vertical ground reference plane. The rear of the EUT was positioned flush with the backside of the table and directly over the LISNs. The power and I/O cables were routed over the edge of the table and bundled approximately 40cm from the ground plane. Support equipment was powered from a separate LISN.

4.8.1.1 Deviations

There were no deviations from this test methodology.

4.8.2 Test Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 10: AC Conducted Emissions – Test Results

Test Conditions: Conducted Measurement at Normal Conditions only		
Antenna Type: Attached	**Power Level:** +26dBm at 2437 MHz	
AC Power: 120 Vac/60 Hz	**Configuration:** Tabletop	
Ambient Temperature: 22° C	**Relative Humidity:** 36% RH	
Configuration	**Frequency Range**	**Test Result**
Line 1 (Hot)	0.15 to 30 MHz	Pass
Line 2 (Neutral)	0.15 to 30 MHz	Pass

SOP 2 Conducted Emissions

Tracking # 31151325.001 Page 1 of 4

EUT Name	Wireless ADSL Residential Gateway	**Date**	May 13, 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	22° C / 38% rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	Attached Antenna	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15.207	**RBW / VBW**	9kHz / 30kHz
Lab/LISN	Lab #5 / Solar 9348-50-R-24-BNC, Line 1	**Performed by**	Jeremy Luong

Frequency	Quasi-Peak	QP Limit	QP Margin	Average	Ave Limit	Ave Margin
MHz	dBuV	dBuV	dB	dBuV	dBuV	dB
0.156	52.12	65.83	-13.47	33.35	55.83	-22.24
0.157	52.04	65.81	-13.53	33.82	55.81	-21.74
0.181	44.70	65.12	-20.18	25.89	55.12	-29.00
0.209	41.76	64.31	-22.33	23.26	54.31	-30.83
0.213	41.25	64.19	-22.71	24.42	54.19	-29.54
0.259	32.50	62.90	-30.18	14.74	52.90	-37.94
0.434	28.59	57.89	-29.11	21.96	47.89	-25.74
0.621	20.87	56.00	-34.97	14.19	46.00	-31.65
0.859	20.31	56.00	-35.58	13.85	46.00	-32.04
8.135	21.78	60.00	-38.05	15.92	50.00	-33.91
16.249	16.94	60.00	-42.80	11.35	50.00	-38.39
29.318	17.18	60.00	-42.41	11.64	50.00	-37.95

Spec Margin = QP./Ave. - Limit, ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.2 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

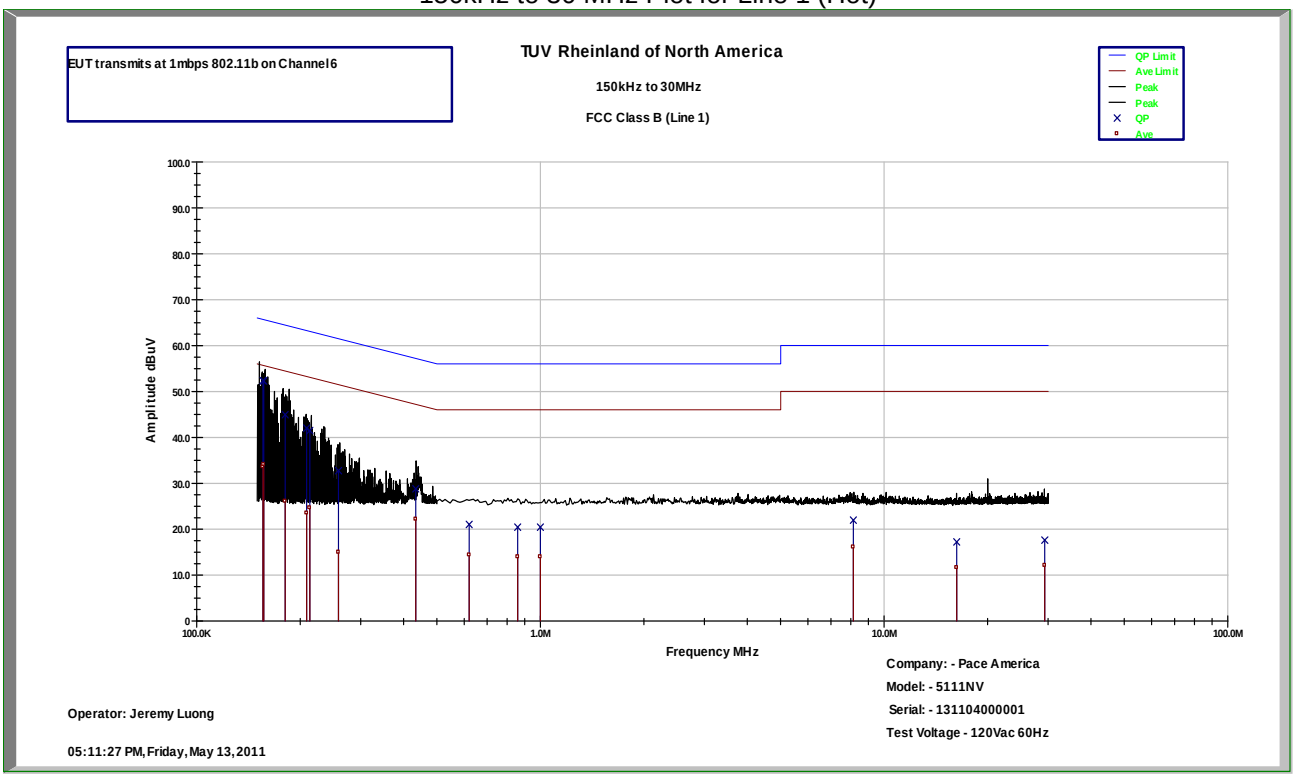
Notes: EUT was setup as table top equipment.

SOP 2 Conducted Emissions

Tracking # 31151325.001 Page 2 of 4

EUT Name	Wireless ADSL Residential Gateway	**Date**	May 13, 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	22° C / 38% rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	Attached Antenna	**Line AC**	120Vac/60Hz
Standard	CFR47 Part 15.207	**RBW / VBW**	9kHz / 30kHz
Lab/LISN	Lab #5 / Solar 9348-50-R-24-BNC, Line 1	**Performed by**	Jeremy Luong

150kHz to 30 MHz Plot for Line 1 (Hot)



Notes: Meet FCC Class B limit.

SOP 2 Conducted Emissions

Tracking # 31151325.001 Page 3 of 4

EUT Name	Wireless ADSL Residential Gateway	**Date**	May 13, 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	22° C / 38% rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	Attached Antenna	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15.107	**RBW / VBW**	9kHz / 30kHz
Lab/LISN	Lab #5 / Solar 9348-50-R-24-BNC, Line 2	**Performed by**	Jeremy Luong

Frequency	Quasi-Peak	QP Limit	QP Margin	Average	Ave Limit	Ave Margin
MHz	dBuV	dBuV	dB	dBuV	dBuV	dB
0.155	53.09	65.86	-12.53	34.23	55.86	-21.39
0.158	52.85	65.78	-12.69	35.91	55.78	-19.63
0.180	47.45	65.13	-17.45	28.68	55.13	-26.21
0.206	41.59	64.39	-22.57	23.39	54.39	-30.77
0.213	42.06	64.21	-21.92	24.74	54.21	-29.23
0.259	31.69	62.90	-30.98	17.42	52.90	-35.25
0.430	29.65	57.99	-28.15	22.02	47.99	-25.78
0.619	24.18	56.00	-31.66	17.09	46.00	-28.75
0.860	24.01	56.00	-31.88	17.74	46.00	-28.15
8.131	22.56	60.00	-37.27	16.29	50.00	-33.54
16.248	17.11	60.00	-42.63	11.71	50.00	-38.03
29.320	17.14	60.00	-42.45	11.73	50.00	-37.86

Spec Margin = QP./Ave. - Limit, ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.2 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

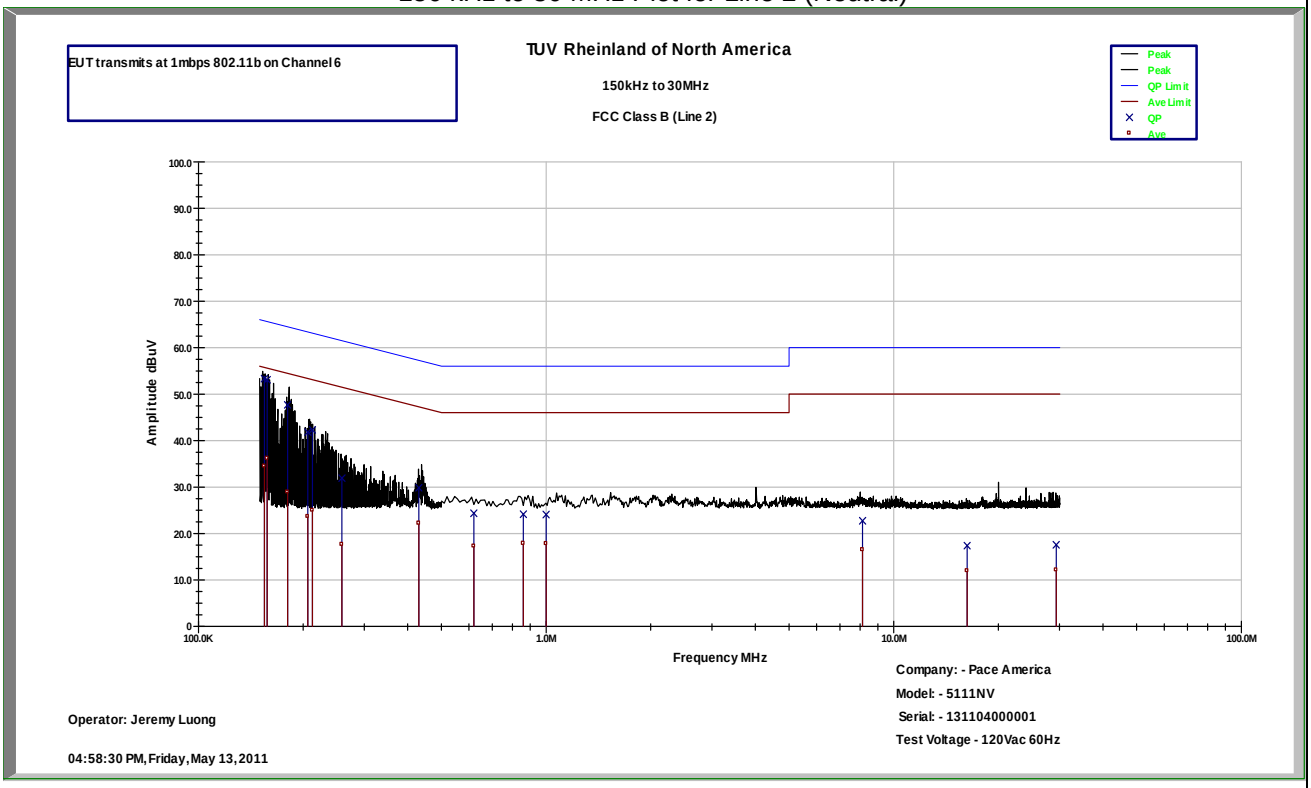
Notes: EUT was setup as table top equipment.

SOP 2 Conducted Emissions

Tracking # 31151325.001 Page 4 of 4

EUT Name	Wireless ADSL Residential Gateway	**Date**	May 13, 2011
EUT Model	5111N, 5111NV	**Temp / Hum in**	22° C / 38% rh
EUT Serial	131104000001	**Temp / Hum out**	N/A
EUT Config.	Attached Antenna	**Line AC**	120Vac/60Hz
Standard	CFR47 Part 15.107	**RBW / VBW**	9kHz / 30kHz
Lab/LISN	Lab #5/ Solar 9348-50-R-24-BNC, Line 2	**Performed by**	Jeremy Luong

150 kHz to 30 MHz Plot for Line 2 (Neutral)



Note: Meet FCC Class B Limit.

5 Test Equipment List

5.1 Equipment List

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
Bilog Antenna	Sunol Science	JB3	A102606	2/18/2010	2/18/2012
Tuned Dipole Antenna	A.H Systems, Inc.	TDS-200/535-1	154	11/10/2010	11/10/2011
Tuned Dipole Antenna	A.H Systems, Inc.	TDS-200/535-2	154	11/10/2010	11/10/2011
Tuned Dipole Antenna	A.H Systems, Inc.	TDS-200/535-3	154	11/10/2010	11/10/2011
Tuned Dipole Antenna	A.H Systems, Inc.	TDS-200/535-4	154	11/10/2010	11/10/2011
Horn Antenna	Sunol Scienece	DRH-118	A040806	9/29/2010	9/29/2012
Antenna (18-26GHz)	CMT	RA42-K-F-4B-C	020131-004	10/15/2010	10/15/2011
EMI Receiver	Hewlett Packard	8546A	3807A00445	2/5/2011	2/5/2012
Preselector	Hewlett Packard	85460A	3704A00407	2/5/2011	2/5/2012
Amplifier	Hewlett Packard	8447D	2944A07996	1/17/2011	1/17/2012
Spectrum Analyzer	Rhode&Schwarz	ESIB	832427/002	1/18/2011	1/18/2012
Amplifier	Rhode&Schwarz	TS-PR18	3545.7008.03	9/29/2010	9/29/2012
Amplifier	Rhode&Schwarz	TS-PR26	100011	10/15/2010	10/15/2011
Signal Generator	Anritsu	MG3694A	42803	1/26/2011	1/26/2012
Notch Filter	Micro-Tronics	BRM50702	37	1/19/2011	1/19/2012
High Pass Filter (3.5 GHz)	Hewlett Packard	84300-80038	820004	1/19/2011	1/19/2012
High Pass Filter (8.5 GHz)	Micro-Tronics	HPM50107	4	1/19/2011	1/19/2012
Power Supplier	Kikosui	PCR8000W	CM000912	1/19/2011	1/19/2012
Digital Multimeter	Fluke	177	92780314	1/18/2011	1/18/2012
Power Meter	Agilent	E4418B	MY45103902	1/18/2011	1/18/2012
Power Sensor	Hewlett Packard	8482A	55-5131	10/27/2010	10/27/2011
EMI Receiver	Hewlett Packard	8546A	3942A00514	11/22/2010	11/22/2011
Preselector	Hewlett Packard	85460A	3704A00485	11/22/2010	11/22/2011
LISN	Solar Electronics	Type 9348-50-R-24-BNC	68509	1/17/2011	1/17/2012

* Calibration of equipment past due for re-calibration will be performed expeditiously. If any equipment is found to be out of tolerance at that time, affected customers will be notified accordingly.

6 EMC Test Plan

6.1 Introduction

This section provides a description of the Equipment Under Test (EUT), configurations, operating conditions, and performance acceptance criteria. It is an overview of information provided by the manufacturer so that the test laboratory may perform the requested testing.

6.2 Customer

Table 11: Customer Information

Company Name	Pace Americas
Address	310 Providence Mine Road
City, State, Zip	Nevada City, CA 95959
Country	USA
Phone	(530) 274-5440
Fax	(530) 273-6340

Table 12: Technical Contact Information

Name	Mark Rieger
E-mail	mark.rieger@pace.com
Phone	(530) 274-5440
Fax	(530) 273-6340

6.3 Equipment Under Test (EUT)

Table 13: EUT Specifications

EUT Specification	
Dimensions	3.1" x 9.6" x 9.7" (7.8 cm x 24.3 cm x 24.5 cm)
AC Adapter (M/N:EADP-36FB A)	Input Voltage: 100 – 240 Vac Input Current: 800 mA Output Voltage: 12 Vdc Output Current: 3.0 A
Environment	Indoor
Operating Temperature Range:	0 to 40 degrees C
Multiple Feeds:	☐ Yes and how many ☒ No
Hardware Version	Rev. 29, X-Patch: 20
Part Number	3201-000846-001
RF Software Version	8.99.8.73
Operating Mode	802.11b, g, HT20, and HT40
Transmitter Frequency Band	2.412 GHz to 2.462 GHz (DSSS)
Max. Rated Power Output	See Channel Planning Table.
Power Setting @ Operating Channel	See Channel Planning Table.
Antenna Type	Attached on board
Modulation Type	☐ AM ☐ FM ☒ DSSS ☒ OFDM ☐ Other describe:
Date Rate	802.11b: 1, 2, 5.5, 11 Mbps at 1 Spatial Stream 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps at 1 Spatial Stream 802.11n HT20: 1 Spatial Stream: 6.5, 13, 19.5, 26, 39, 52, 58.5, 65 Mbps 2 Spatial Streams: 13, 26, 39, 58, 78, 104, 117, 130 Mbps 802.11n HT40: 1 Spatial Stream: 13.5, 27, 40.5, 54, 81, 108, 121.5, 135 Mbps 2 Spatial Streams: 27, 54, 81, 108, 162, 216, 243, 270 Mbps
TX/RX Chain (s)	MIMO (2x2)
Directional Gain Type	☒ Uncorrelated ☒ No Beam-Forming ☐ Other describe:
Type of Equipment	☒ Table Top ☐ Wall-mount ☐ Floor standing cabinet ☐ Other *describe*

Table 14: EUT Channel Power Specifications

No.	Frequency (MHz)	Target Power Value (dBm)					
		802.11b	802.11g	802.11n HT20		802.11n HT40	
				1 Stream	2 Stream	1 Stream	2 Stream
1	2412	24	20	20	17		
2	2417	26	22	21.5	17		
3	2422	26	25	23	23		
4	2427	26	25	23	23		
5	2432	26	25	23	23		
6	2437	26	25	23	23	20	23
7	2442	26	25	23	23		
8	2447	26	25	23	23		
9	2452	26	25	23	23		
10	2457	26	22	23	17		
11	2462	24	20	20	17		

Table 15: Interface Specifications

Interface Type	Cabled with what type of cable?	Is the cable shielded?	Maximum potential length of the cable?	Metallic (M), Coax (C), Fiber (F), or Not Applicable?
Ethernet	Terminated	☒ No	☐ Metric: 30m	☒ M
Ethernet (x3)	Unterminated	☒ No	☐ Metric: 30m	☒ M
DSL	Unterminated	☒ No	☐ Metric: 30 m	☒ M
Broadband	Unterminated	☒ No	☐ Metric: 30 m	☒ M
Telephone	Unterminated	☒ No	☐ Metric: 30m	☒ M
USB	Unterminated	☒ No	☐ Metric: 2.8 m	☒ M

Table 16: Supported Equipment

Equipment	Manufacturer	Model	Serial	Used for
Laptop	Dell Computer	PP23LB	32894765713	Set test mode

Table 17: Description of Sample used for Testing

Device	Serial Number	Configuration	Used For
5111NV	131104000001	Radiated Sample	Radiated Emission. AC Conducted Emission
5111NV	131104000001	Conducted Sample	Output Power, Occupied Bandwidth, Conducted Spurious Emission, Peak Power Spectral Density
Note: None			

Table 18: Description of Test Configuration used for Radiated Measurement.

Device	Antenna	Mode	Setup Description
5111NV	Attached	Transmit & Receive	Tabletop. 5111N, 5111NV positioned horizontally.
5111NV	Attached	Transmit & Receive	Tabletop. 5111N, 5111NV positioned vertically.
Note: Test configuration was used in the preliminary testing.			

Table 19: Final Test Mode for 2400 MHz to 2483.5 MHz Band

Test	802.11b	802.11g	802.11n HT20	802.11n HT40
Occupied Bandwidth	2412, 2437, 2462 MHz @ 1Mbps	2412, 2437, 2462 MHz @ 6Mbps	2412, 2437, 2462 MHz @ 1 Stream – 6.5Mbps	2437 MHz @ 1 Stream – 13.5Mbps
Output Power	2412, 2437, 2462 MHz @ 1Mbps	2412, 2437, 2462 MHz @ 6Mbps	2412, 2437, 2462 MHz @ 1 Stream – 6.5Mbps 2 Streams – 13Mbps	2437 MHz @ 1 Stream – 13.5Mbps 2 Streams – 27Mbps
Peak Power Spectral Density	2412, 2437, 2462 MHz @ 1Mbps	2412, 2437, 2462 MHz @ 6Mbps	2412, 2437, 2462 MHz @ 1 Stream – 6.5Mbps 2 Streams – 13Mbps	2437 MHz @ 1 Stream – 13.5Mbps 2 Streams – 27Mbps
Out-of-Band (-30 dBr)	2412, 2437, 2462 MHz @ 1Mbps	2412, 2437, 2462 MHz @ 6Mbps	2412, 2437, 2462 MHz @ 1 Stream – 6.5Mbps	2437 MHz @ 1 Stream – 13.5Mbps
Band-Edge (Radiated)	2412, 2417, 2437, 2457, 2462 MHz @ 1Mbps	2412, 2417, 2437, 2457, 2462 MHz @ 6Mbps	2412, 2417, 2437, 2457, 2462 MHz @ 1 Stream – 6.5Mbps 2412, 2437, 2462 MHz @ 2 Streams – 13Mbps	2437 MHz @ 1 Stream – 13.5Mbps 2 Streams – 27Mbps
Transmitted Spurious Emission	2412, 2437, 2462 MHz @ 1Mbps	2412, 2437, 2462 MHz @ 6Mbps	2412, 2437, 2462 MHz @ 1 Stream – 6.5Mbps	2437 MHz @ 2 Stream – 27Mbps
Received Spurious Emission	2437 MHz			
AC Conducted Emission	2437 MHz @ 1Mbps			

Note:
1. All tests were pre-scanned for worst case before final testing.
2. All radiated emission performed on Y-Axis.
3. Receive Mode was tested with "wl out" command.
4. In 802.11b mode, the power command was lower by 2dB due to the 5111NV calibration.
5. The peak power spectral density tested with command line; "tx 30 0 0"

6.4 Test Specifications

Testing requirements

Table 20: Test Specifications

Emissions and Immunity	
Standard	Requirement
CFR 47 Part 15.247: 2010	All
RSS 210 Iss. 8 2010	All

Pace Americas
310 Providence Mine Road
Nevada City, CA 95959
Tel: 530 274 5400
Fax: 530 273 6340

June 14, 2011

Declaration of Similarity (DoS)
for
Product Families

To Whom it May Concern:

We, the undersigned manufacturer, confirm hereby that the following models are identical in all electrical safety, telecom and electromagnetic aspects from a regulatory perspective. The system tested was the 5111NV ADSL Wireless Residential Gateway and represents a typical worst-case installation. The following table describes the model number differences.

Model Differences:

5111N:
- 1 ADSL Broadband port
- 1 Ethernet 10/100 Broadband port (Optional)
- 4 Ethernet 10/100 LAN ports
- 1 USB Host port
- 802.11n 2x2 2.4GHz Wireless Access Point

5111NV:
- 1 ADSL Broadband port
- 1 Ethernet 10/100 Broadband port (Optional)
- **1 Voice (VoIP) port (2 Lines)**
- 4 Ethernet 10/100 LAN ports
- 1 USB Host port
- 802.11n 2x2 2.4GHz Wireless Access Point

Sincerely,

Mark A. Rieger
Senior Hardware Approvals Engineer
Pace Americas
310 Providence Mine Road
Nevada City, CA 95959

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Tel: 530.274.5440
Fax: 530.273.6340
mark.rieger@pace.com

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310 Providence Mine Road
Nevada City, CA 95959
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June 14, 2011

Federal Communications Commission
7435 Oakland Mills Road
Columbia, MD 21046

Re: Agent Authorization Letter for FCC ID: PGR2W5111

To Whom it May Concern:

Please be advised that Pace Americas authorizes Jeremy Luong of TUV Rheinland of North America, EMC/Telecom Division, 1279 Quarry Lane, Ste. A, Pleasanton, CA 94566, USA to act on our behalf on all matters relating to applications for equipment authorization before the Federal Communications Commission, including signing of documents related to these matters.

Pace Americas certifies that neither the applicant nor any party to this application, as defined in 47 CFR Ch. 1.2002(b), is subject to a denial to Federal benefits, that include FCC benefits, pursuant to section 5301 of the Anti-Drug Abuse Act of 1998, 21 U.S.C. 835(a).

This authorization is valid until further written notice from Pace Americas

Sincerely,

Mark A. Rieger
Senior Hardware Approvals Engineer
Pace Americas
310 Providence Mine Road
Nevada City, CA 95959

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