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Emissions
Test Report

EUT Name: Wi-Fi Module

Model No.: GS1011MIE

CFR 47 Part 15.247:2009 and RSS 210:2007

Prepared for:

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Statement of Compliance

Manufacturer:	Gainspan Corporation 125 S. Market St. Suite 400 San Jose, CA 95113-2292 (408) 673-2900
Requester / Applicant:	Ron Green
Name of Equipment:	Wi-Fi Module
Model No.	GS1011MIE
Type of Equipment:	Intentional Radiator
Application of Regulations:	CFR 47 Part 15.247:2009 and RSS 210:2007
Test Dates:	June 30 to July 12, 2010

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	Conan Boyle
Test Engineer Date	NVLAP Signatory Date

NVLAP LAB CODE 500011-0

US5254

2932M-1

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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 15.247:2009 and RSS 210:2007 based on the results of testing performed on June 30 to July 12, 2010 on the Wi-Fi Module Model GS1011MIE manufactured by Gainspan Corporation 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 addendum 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	**Complied**
Maximum Transmitted Power	CFR47 15.247 (b3), RSS 210 Sect. A.8.4	30 dBm	**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	20 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

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2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America at 1279 Quarry Ln, Pleasanton, CA 94566 is accredited 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 # 0014391684). 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 Standard 17025:2005 (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

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 Ln, 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.

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2.2 Test Facilities

All of the test facilities are located at 1279 Quarry Lane, 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 C63.4:2003, at test distances of 3 and 5 meters. The site is listed with the FCC and accredited by NVLAP (Lab Code 500011-0). The 3/5-meter semi-anechoic chamber used to collect the radiated data has been verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4:2003, at test distances of 3 meters and 5 meters. 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.

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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, equal to the positive square root of a sum of terms, the terms being 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

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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 ± 2.7dB.
The estimated combined standard uncertainty for conducted immunity measurements is ± 1.4dB.
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%.

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.

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3 Product Information

3.1 Product Description

The WiFi Module, model GS1011MIE, is an 802.11B WiFi module. It is intended to deploy in a low system resource device such as a sensor.

3.2 Equipment Configuration

A description of the equipment configuration is given in the 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.

3.3 Operating Mode

A description of the operation mode is given in the 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 GS1011MIE WiFi Module is specified to be use with two different types of antenna;

- External 2 dBi PCB Antenna with UFL Connector (example: RFA-02-P05-70B-150)
- External 5 dBi Dipole Antenna with UFL Connector (example: RFA-02-5-F7H1)

Note: Similar antenna types with equal or lower gain can be used with GS1011MIE

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4 Emissions

Testing was performed in accordance with CFR 47 Part 15.247: 2007 and RSS 210 Annex 8: 2007. 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 Section 8 of the standard were used.

4.1 Output Power Requirements

The maximum 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.

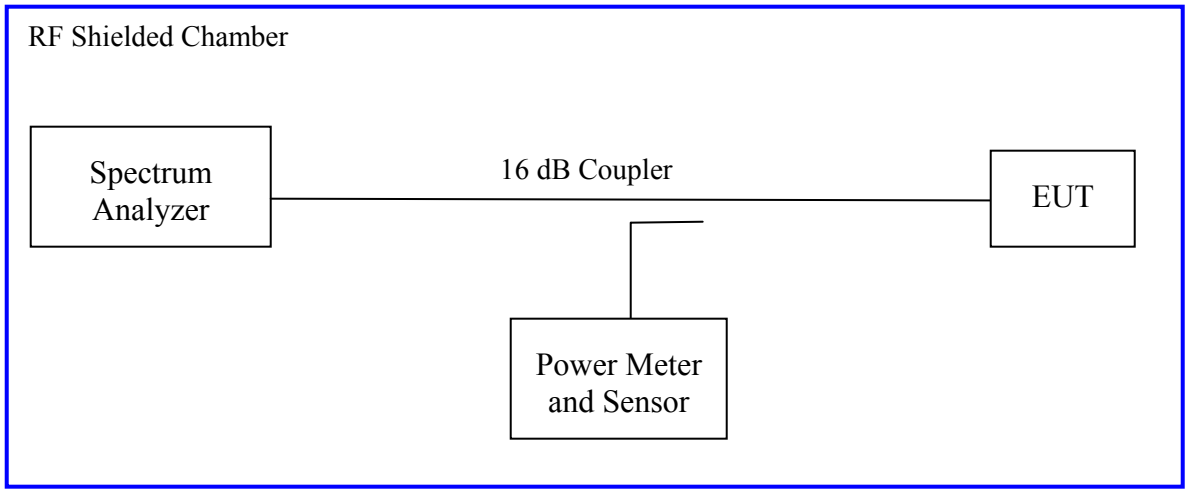
The maximum output power and harmonics shall not exceed CFR47 Part 15.247 (b3):2010 and RSS 210 A.8.4: 2007

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

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):2008 and RSS 210 A.8.4. This test was conducted on 3 channels of Sample, S/N 001DC90009F5. The worst mode result indicated below.

Test Setup:



Method #1 of "Measurement of Digital Transmission Systems Operating under Section 15.247" applies since the GS1011MIE *continuously transmit; where T, Transmission Duration Pulse, is greater than analyzer sweep time.*

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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: PCB and Dipole		**Power Setting:** +9 dBm	
Max. Antenna Gain: +5 dBi		**Signal State:** Modulated	
Ambient Temp.: 22° C		**Relative Humidity:**36%	
Test Results			
Operating Channel	**Limit [dBm]**	**802.11b (11 Mbit/s) Output Level [dBm]**	**802.11b Margin [dB]**
2412 MHz	+30.00	14.00	-16.00
2437 MHz	+30.00	14.34	-15.66
2462 MHz	+30.00	14.39	-15.61
Note: The highest peak output power was observed at 11Mbps.			

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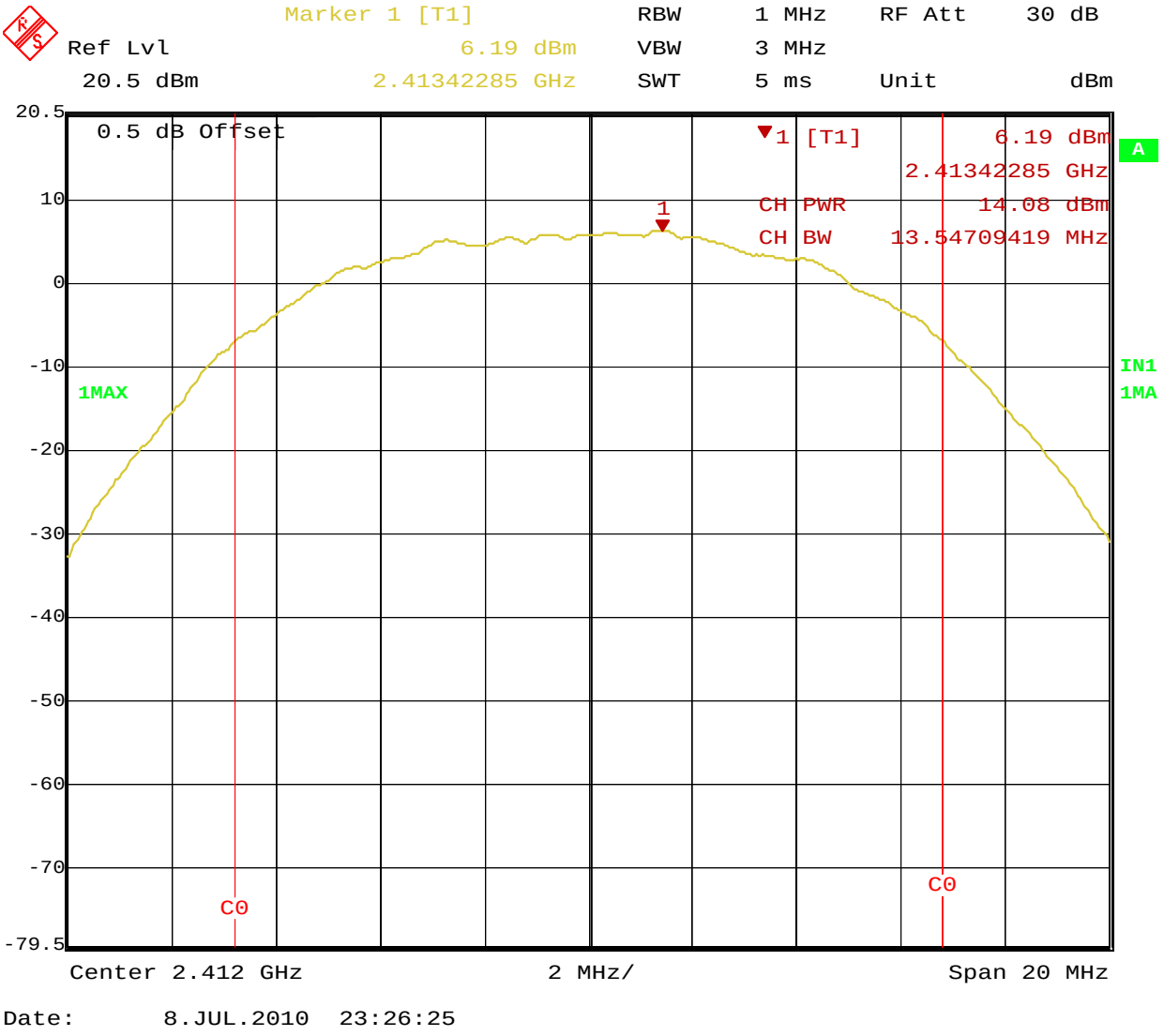

Figure 1: Maximum Transmitted Power – Lowest Channel 2412 MHz of 802.11b (11 Mbit/s)

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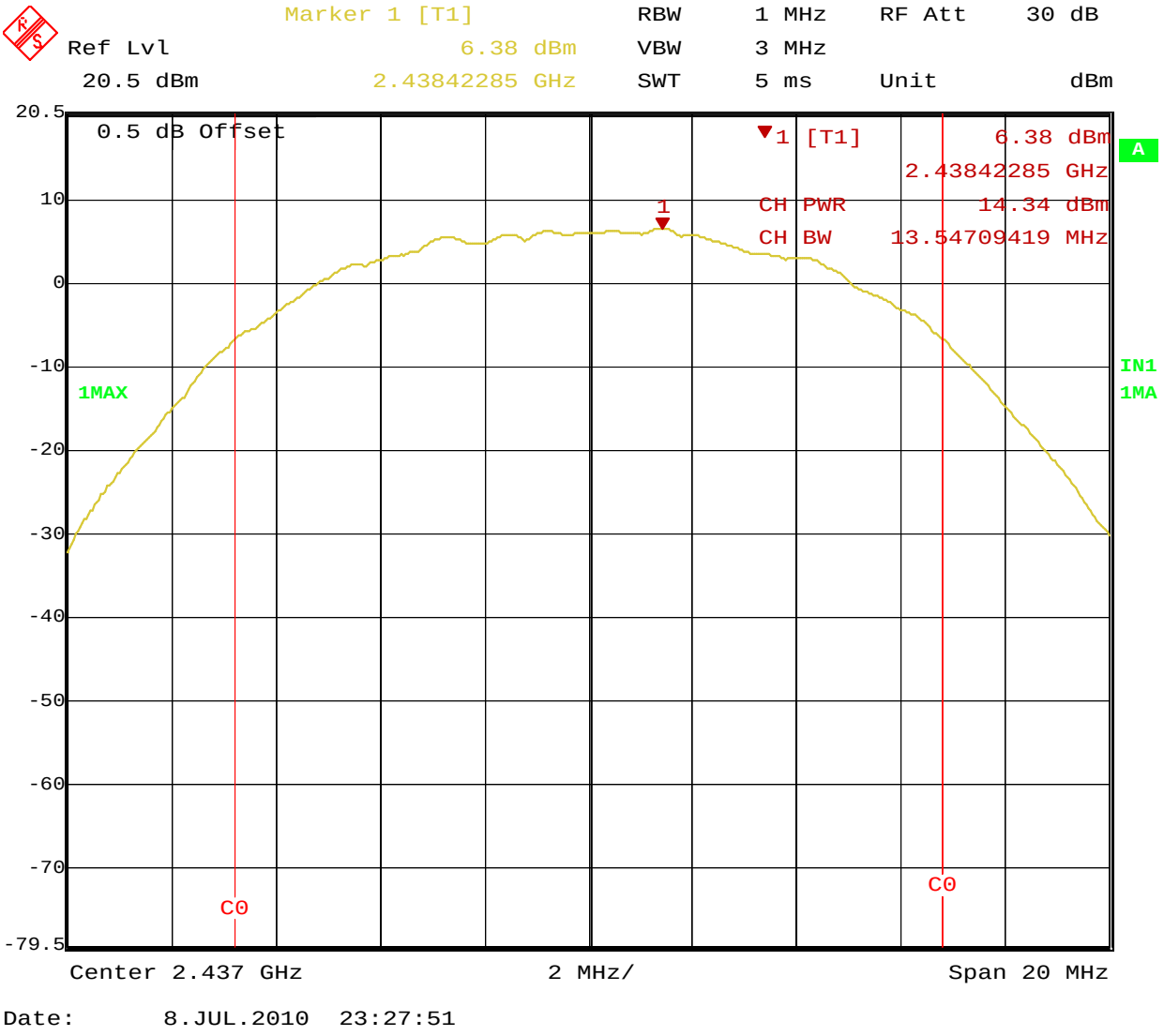

Figure 2: Maximum Transmitted Power – Middle Channel 2437 MHz of 802.11b (11 Mbit/s)

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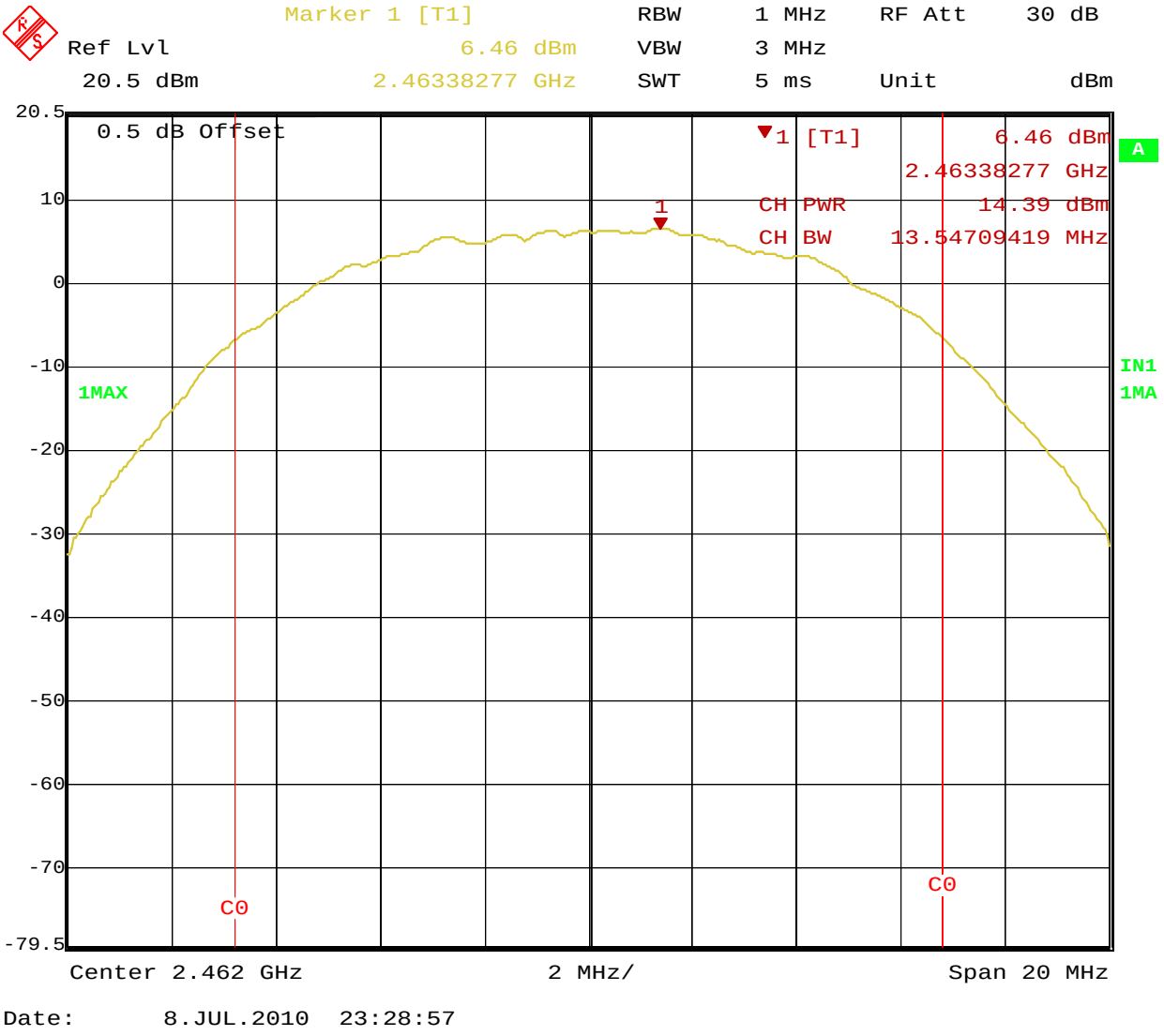

Figure 3: Maximum Transmitted Power – Highest Channel 2462 MHz of 802.11b (11 Mbit/s)

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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.

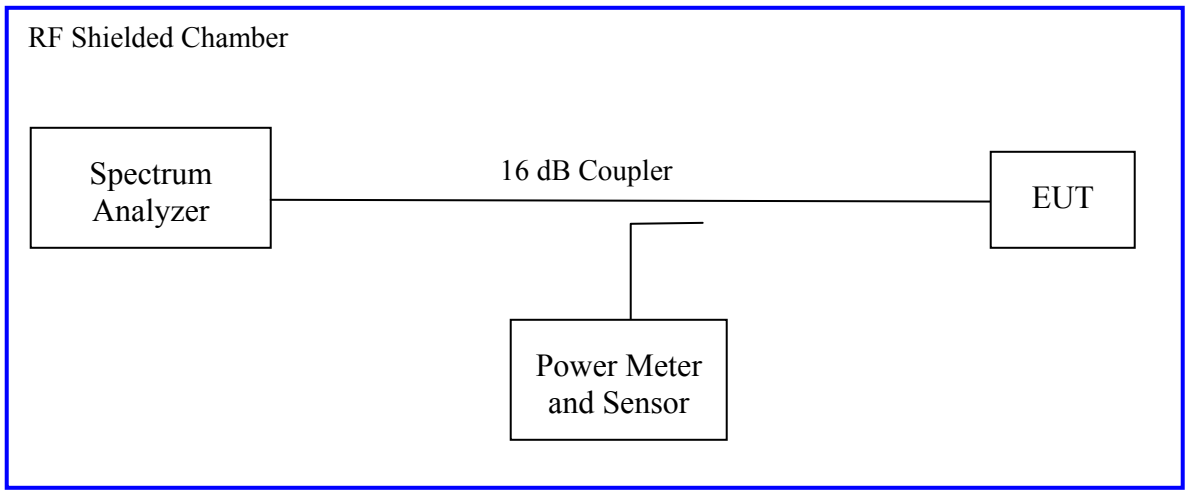
The 6 dB bandwidth is defined the bandwidth of 6 dBr from highest transmitted level of the fundamental frequency.

The bandwidth shall be at least 500 kHz per Section CFR47 15.247(a2):2010 and RSS Gen Sect. 4.4.1: 2007.

4.2.1 Test Method

The conducted method was used to measure the channel power output. The measurement was performed with modulation per CFR47 15.247(a2) 2010 and RSS Gen Sect. 4.4.1.:2007. This test was conducted on 3 channels of Sample, S/N: 001DC90009F5. The worst sample result indicated below.

Test Setup:



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4.2.2 Results

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

Table 4: Occupied Bandwidth – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only			
Antenna Type: PCB or Dipole		**Power Setting:** +9 dBm	
Max. Antenna Gain: 5 dBi		**Signal State:** Modulated	
Ambient Temp.: 23° C		**Relative Humidity:**36%	
99% Bandwidth (MHz)			
Operating Channel	**Limit**	**802.11g @ 2 Mbps**	**Results**
2412 MHz	Na	13.22645291	Na
2437 MHz	Na	13.26653307	Na
2462 MHz	Na	13.22645291	Na
Note: The 99% bandwidth was observed at 2 Mbps.			
6 dB Bandwidth (MHz)			
Operating Channel	**Limit**	**802.11b @ 5.5 Mbps**	**Results**
2412 MHz	500 kHz	9.57915832	Pass
2437 MHz	500 kHz	9.61923848	Pass
2462 MHz	500 kHz	9.53907816	Pass
Note: the narrowest 6 dB bandwidth was observed at 5.5 Mbps.			

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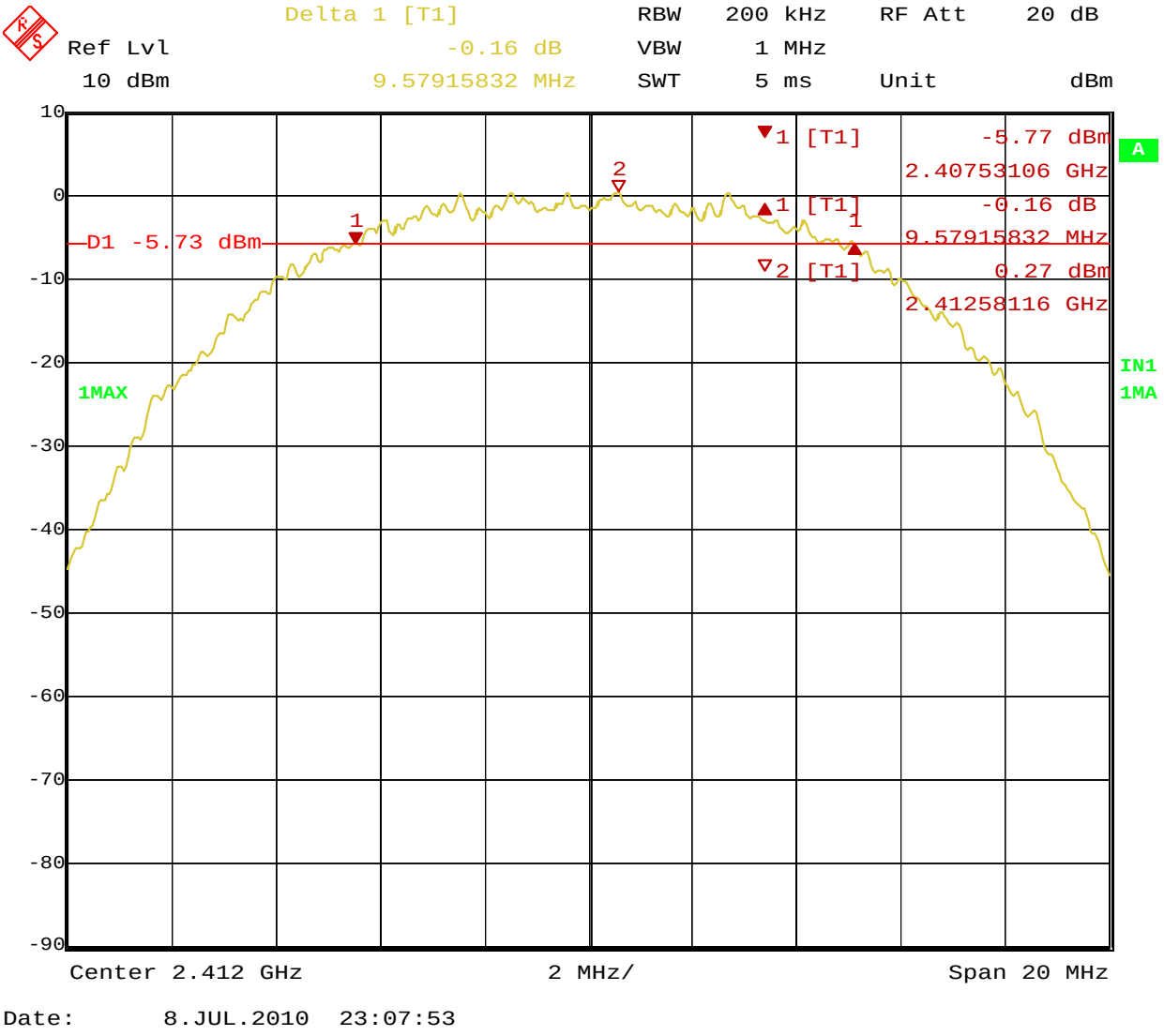

Figure 4: 6 dB Bandwidth at 5.5 Mbit/s – Operating Channel 2412 MHz

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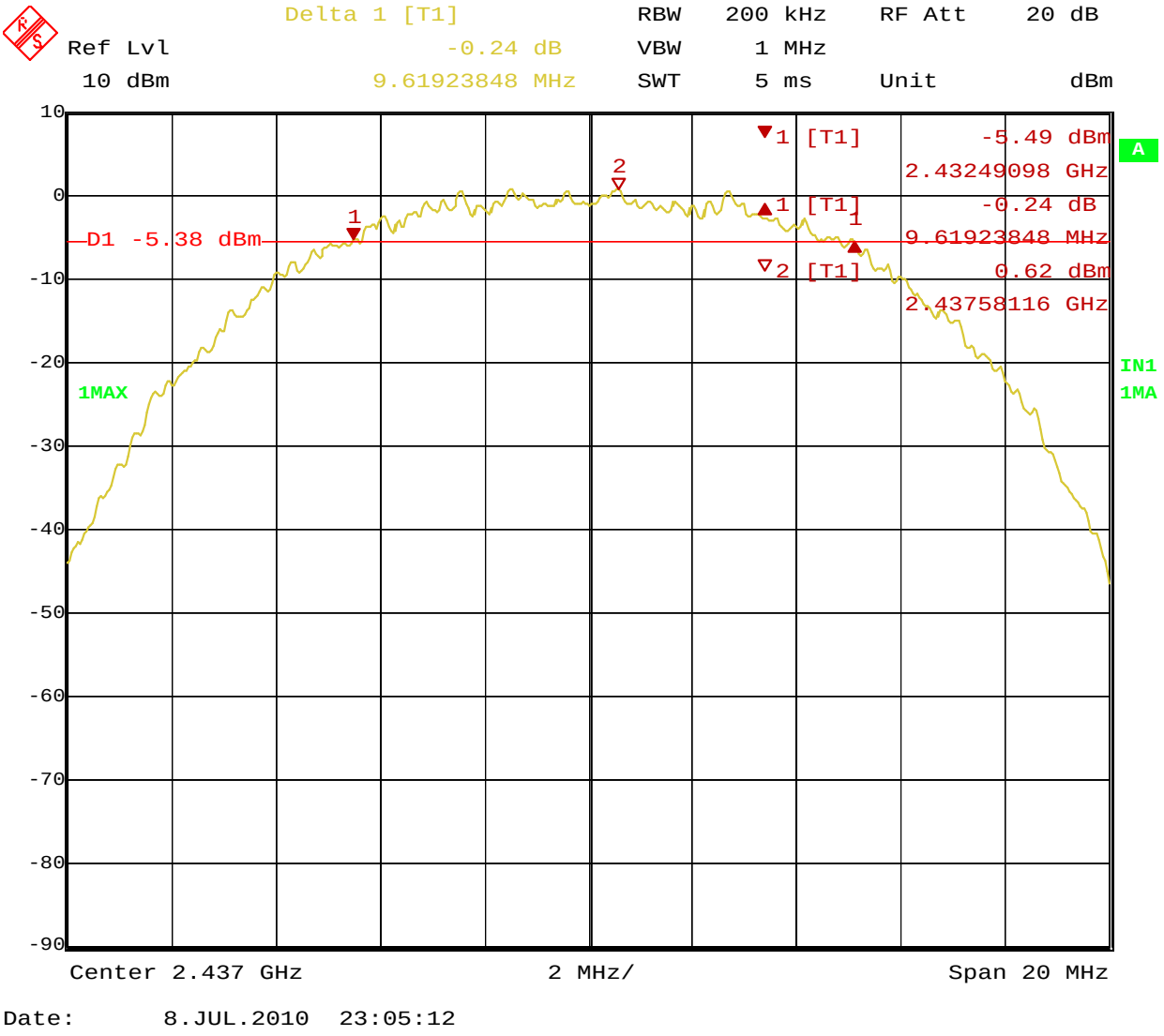

Figure 5: 6 dB Bandwidth at 5.5 Mbit/s – Operating Channel 2437 MHz

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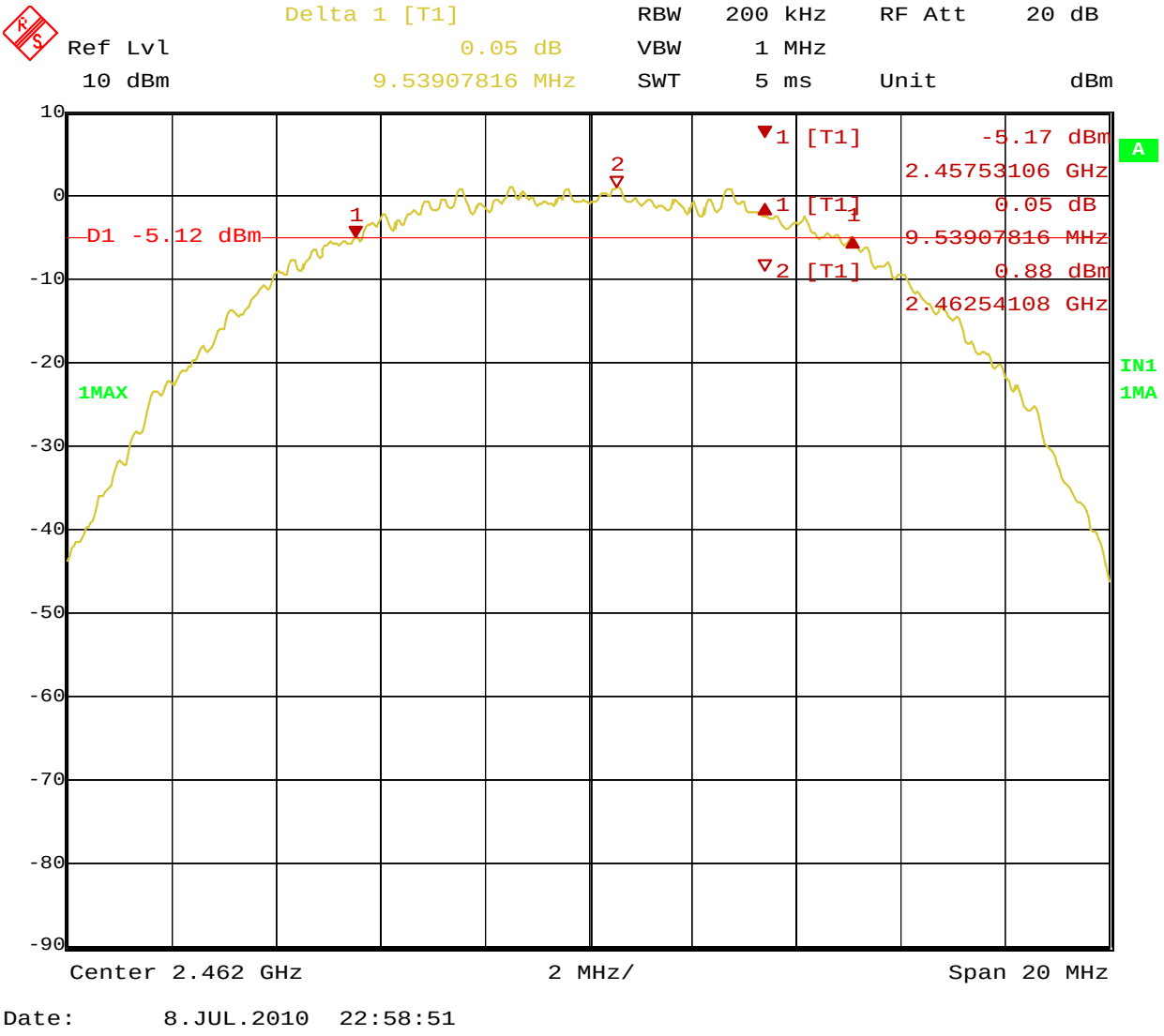

Figure 6: 6 dB Bandwidth at 5.5 Mbit/s – Operating Channel 2462 MHz

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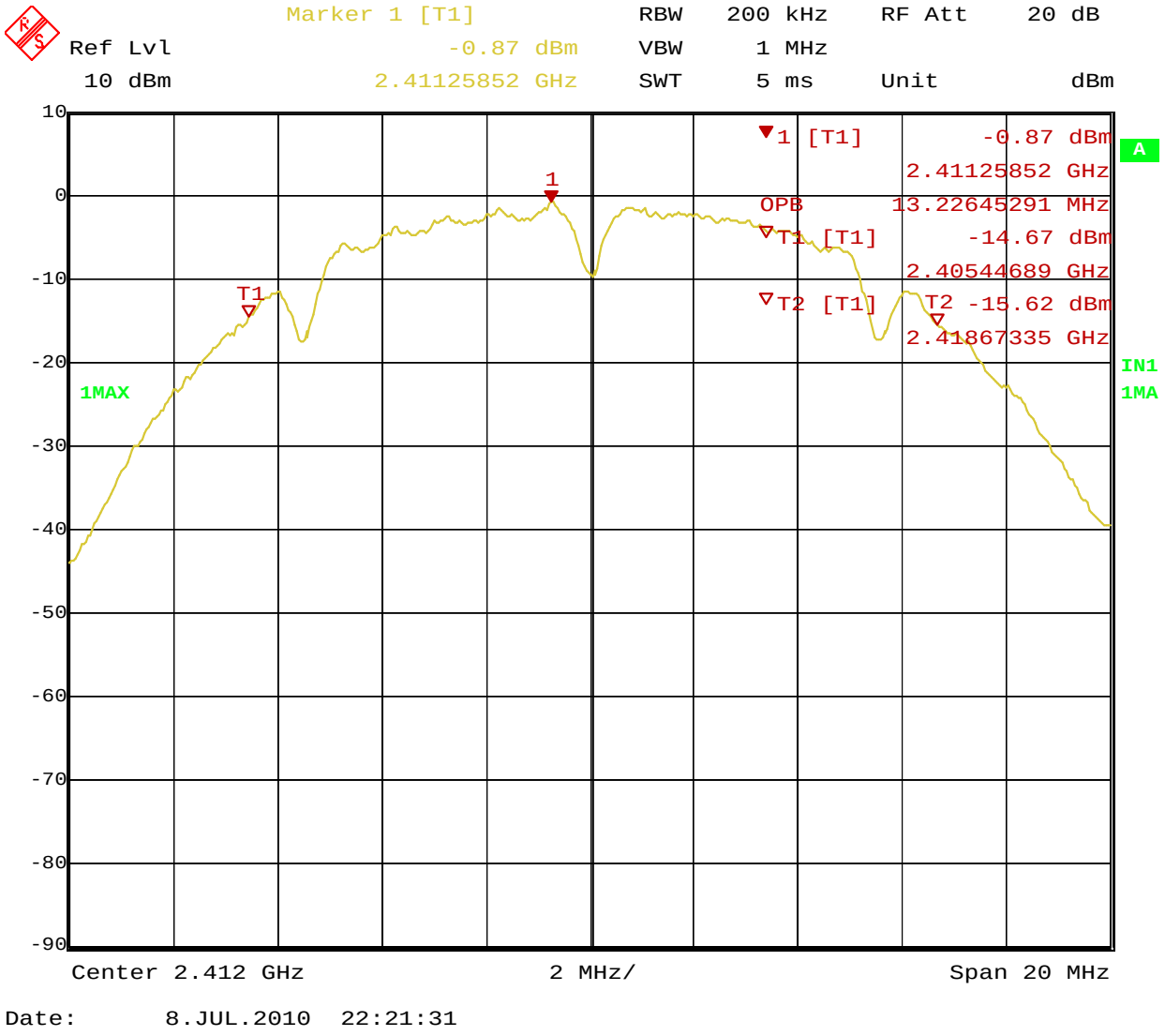

Figure 7: 99% Bandwidth at 2 Mbit/s – Operating Channel 2412 MHz

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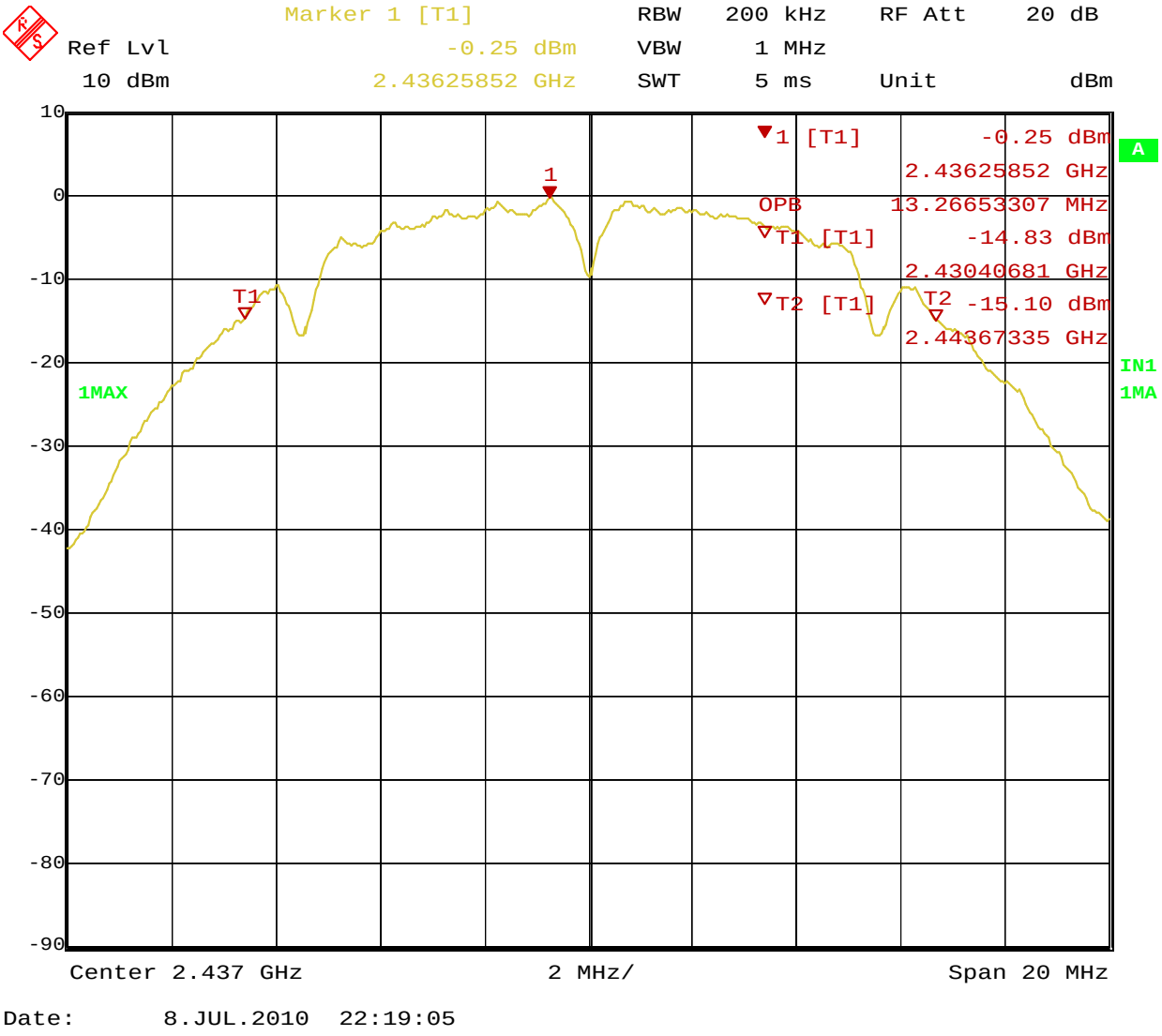

Figure 8: 99% Bandwidth at 2 Mbit/s – Operating Channel 2437 MHz

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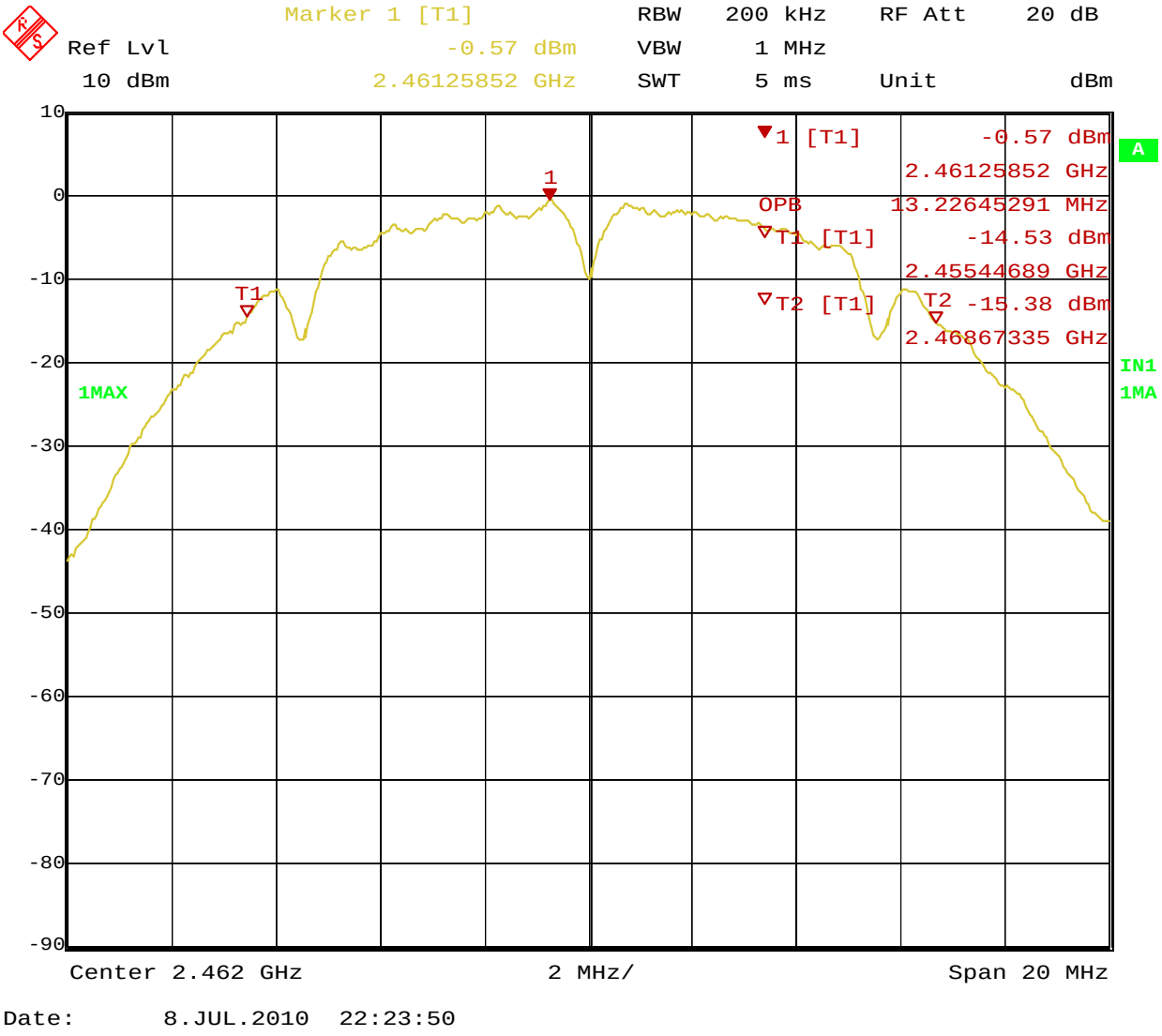

Figure 9: 99% Bandwidth at 2 Mbit/s – Operating Channel 2462 MHz

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4.3 Band Edge Requirements

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 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.

The test setup is same as the output power measurement.

Any frequency outside the band of 2400MHz to 2483.5MHz, the power output level must be below 20db from the in-band transmitting signal; CFR 47 Part 15.215, 15.247(d) and RSS 210 A8.5

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

Table 5: Band Edge Requirements – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only				
Antenna Type: PCB or Dipole		**Power Setting:** +9 dBm		
Max. Antenna Gain: +5 dBi		**Signal State:** Modulated		
Ambient Temp.: 23° C		**Relative Humidity:**36%		
Band Edge Results				
Operating Channel	**Mode**	**Band Edge Level (dBm)**	**20 dB Level (dBm)**	**Margin (dB)**
2412 MHz	11Mbps	-52.70	-20.34	-32.36
2437 MHz	11Mbps	-53.87	-20.42	-33.45
2462 MHz	11Mbps	-55.05	-20.47	-34.58

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Table 6: Out of band Conducted Emission – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only					
Antenna Type: PCB or Dipole		**Power Setting:** +9 dBm			
Max. Antenna Gain: 5 dBi		**Signal State:** Modulated			
Ambient Temp.: 23° C		**Relative Humidity:**36%			
Output of Band Results					
Operating Channel	**Mode**	**Band 1 30MHz-2.4835GHz**	**Band 2 2.4835GHz-10GHz**	**Band 3 10GHz-25GHz**	**Result**
2412 MHz	11Mbps	Figure 13	Figure 14	Figure 15	Pass
2437 MHz	11Mbps	Figure 16	Figure 17	Figure 18	Pass
2462 MHz	11Mbps	Figure 19	Figure 20	Figure 21	Pass

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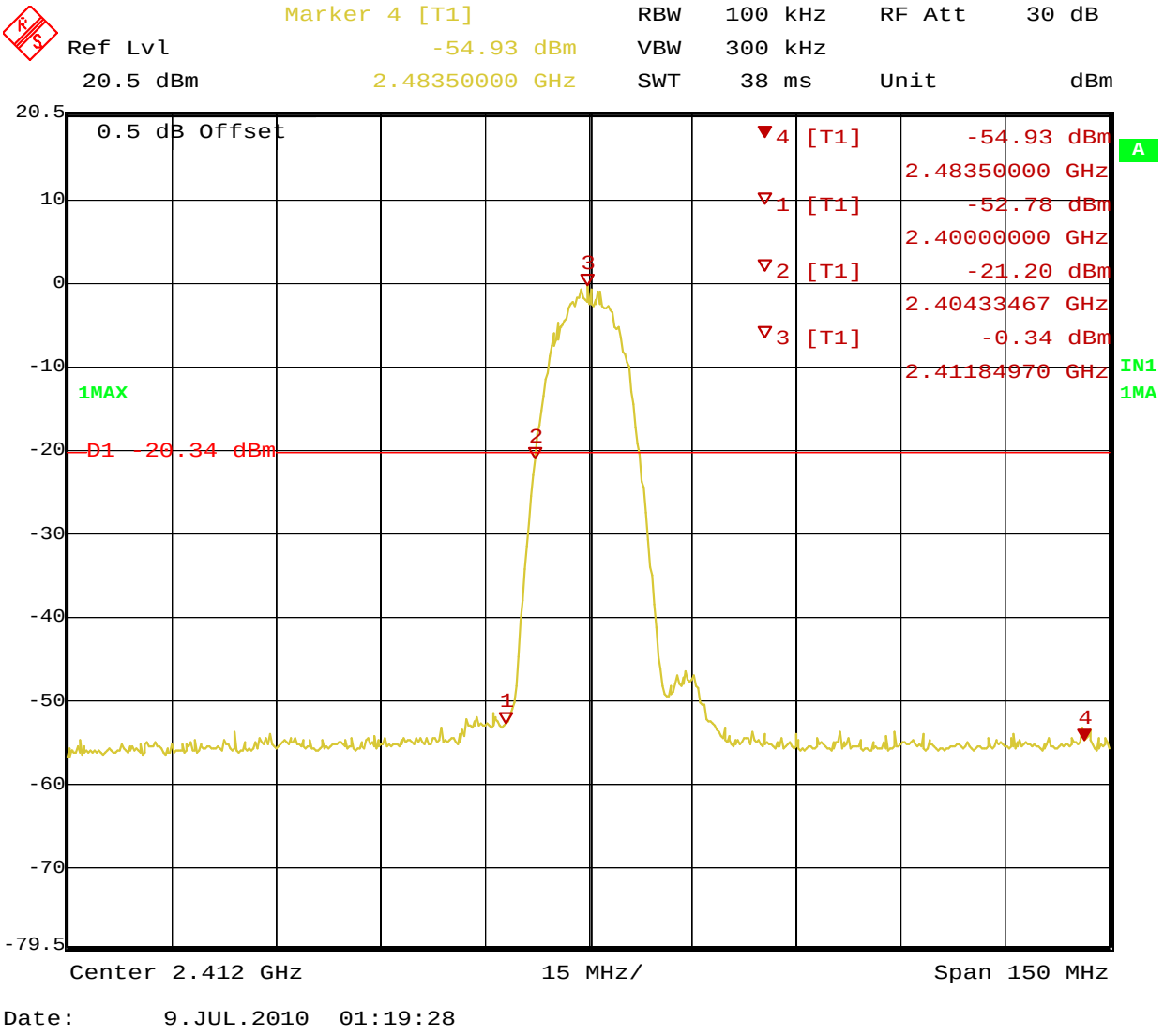

Figure 10: Band Edge Requirement for Operating Channel 2412 MHz at 11 Mbit/s

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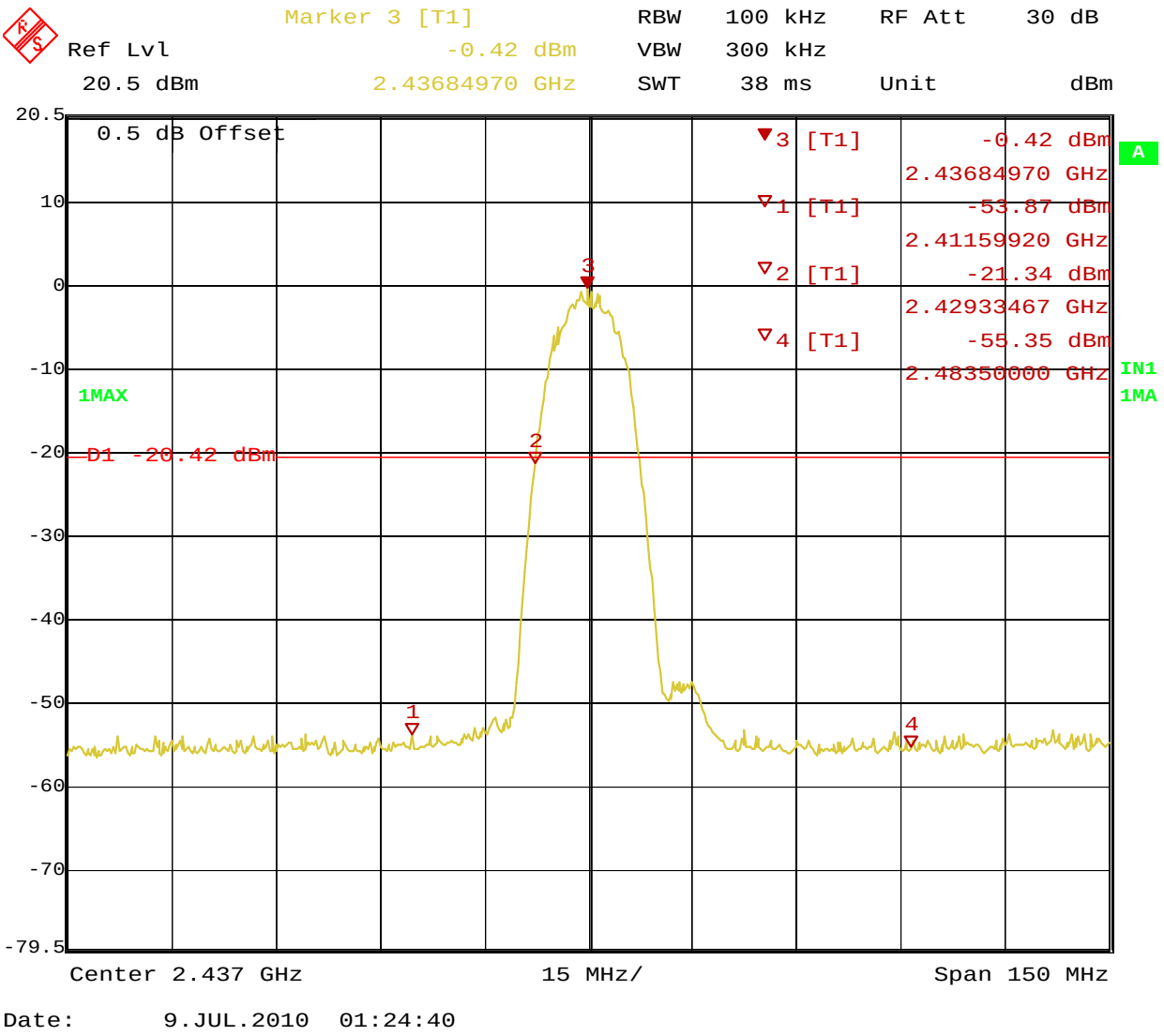

Figure 11: Band Edge Requirement for Operating Channel 2437 MHz at 11 Mbit/s

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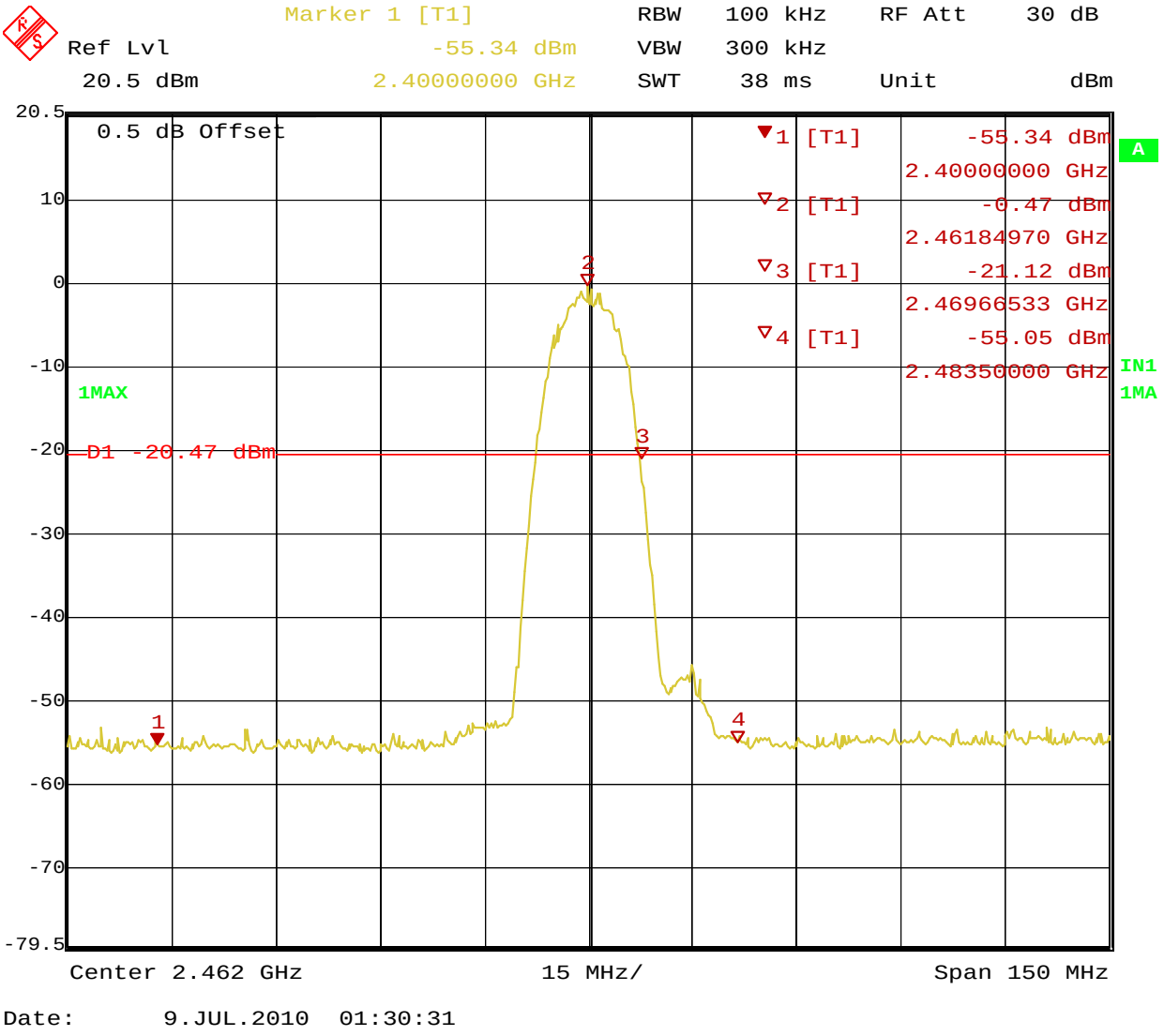

Figure 12: Band Edge Requirement for Operating Channel 2462 MHz at 11 Mbit/s

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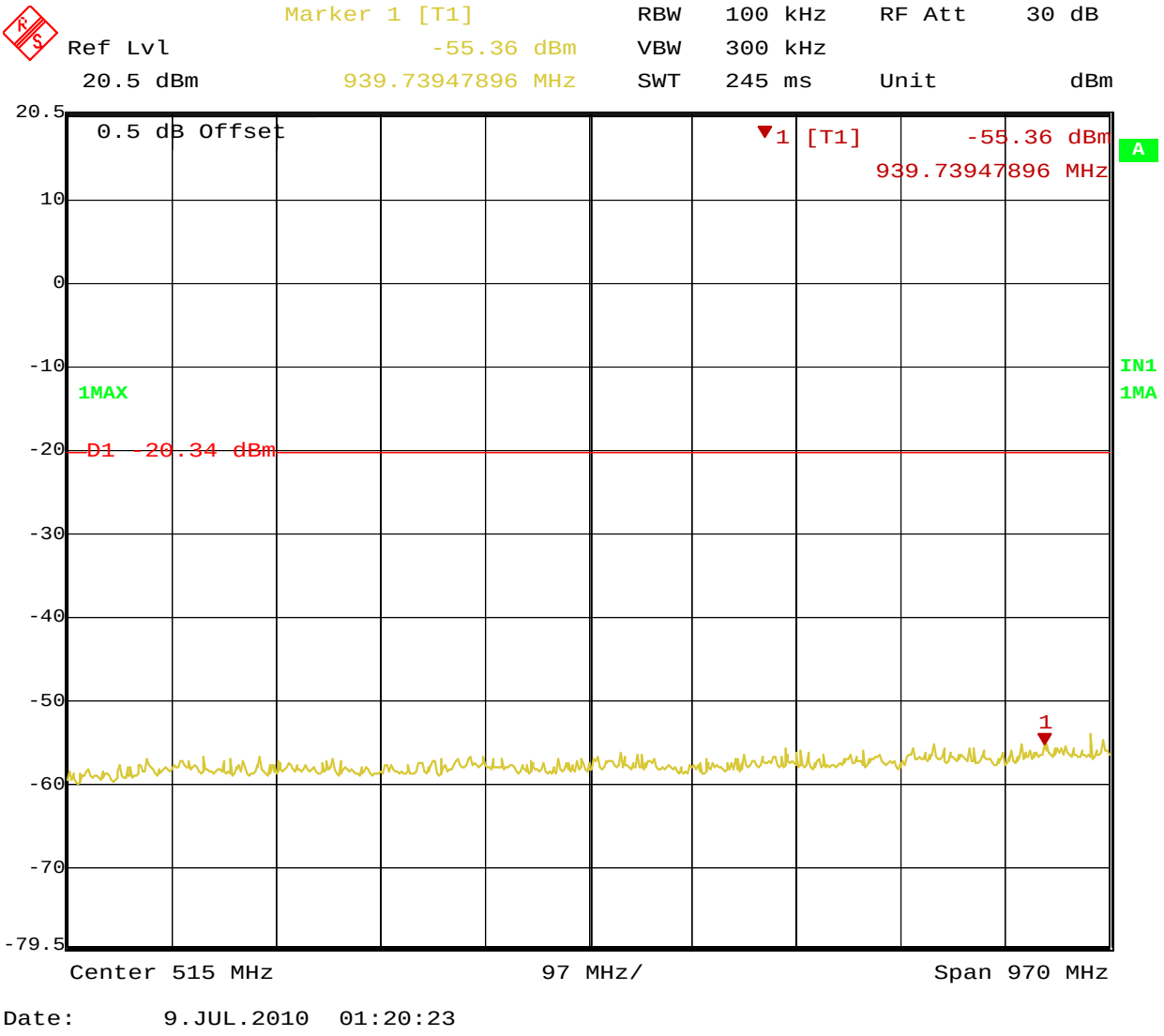

Figure 13: Out of Band Emission for Channel 2412 MHz at 11 Mbit/s – Band 1

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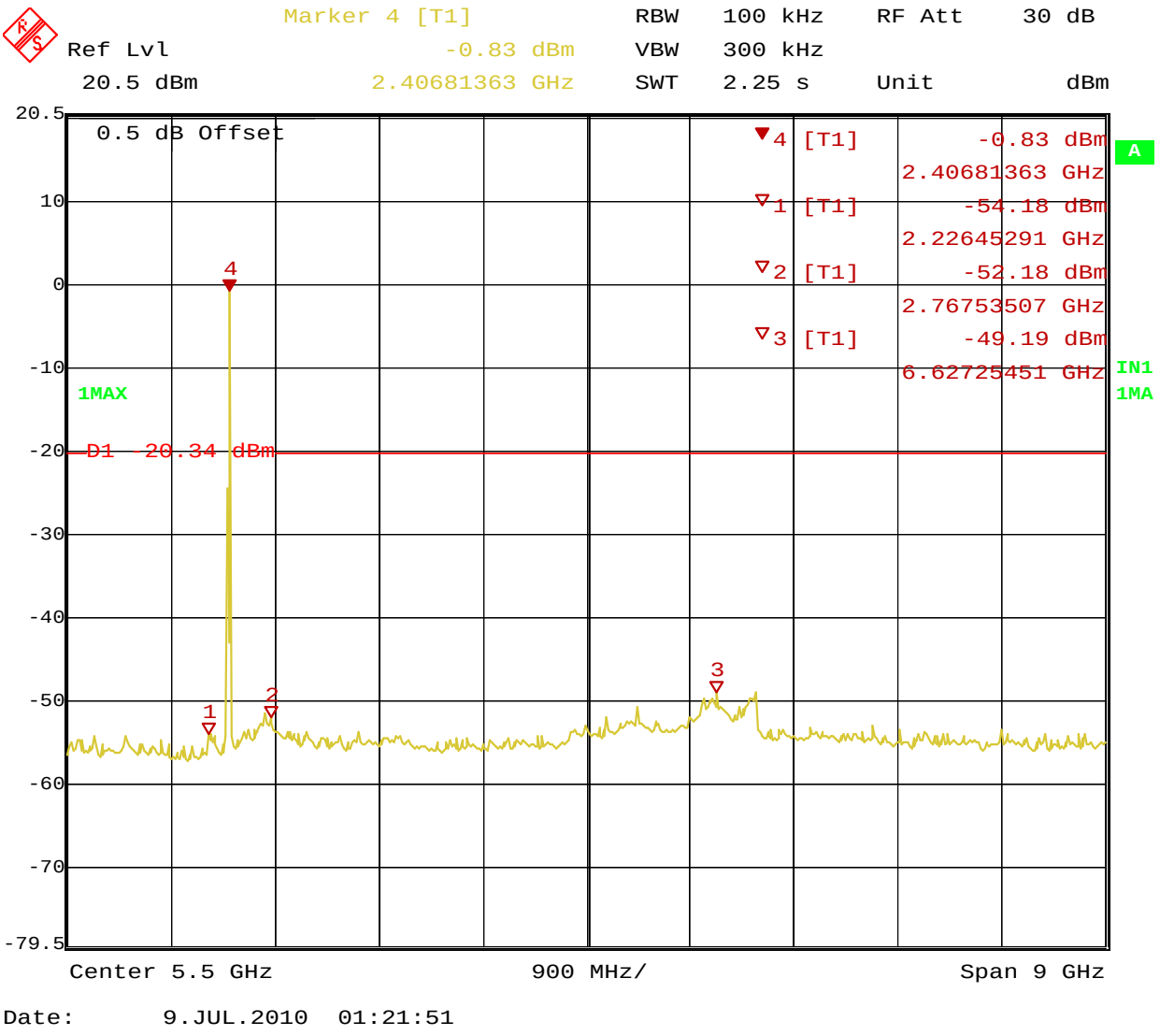

Figure 14: Out of Band Emission for Channel 2412 MHz at 11 Mbit/s – Band 2

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. This report must not be used by the applicant to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

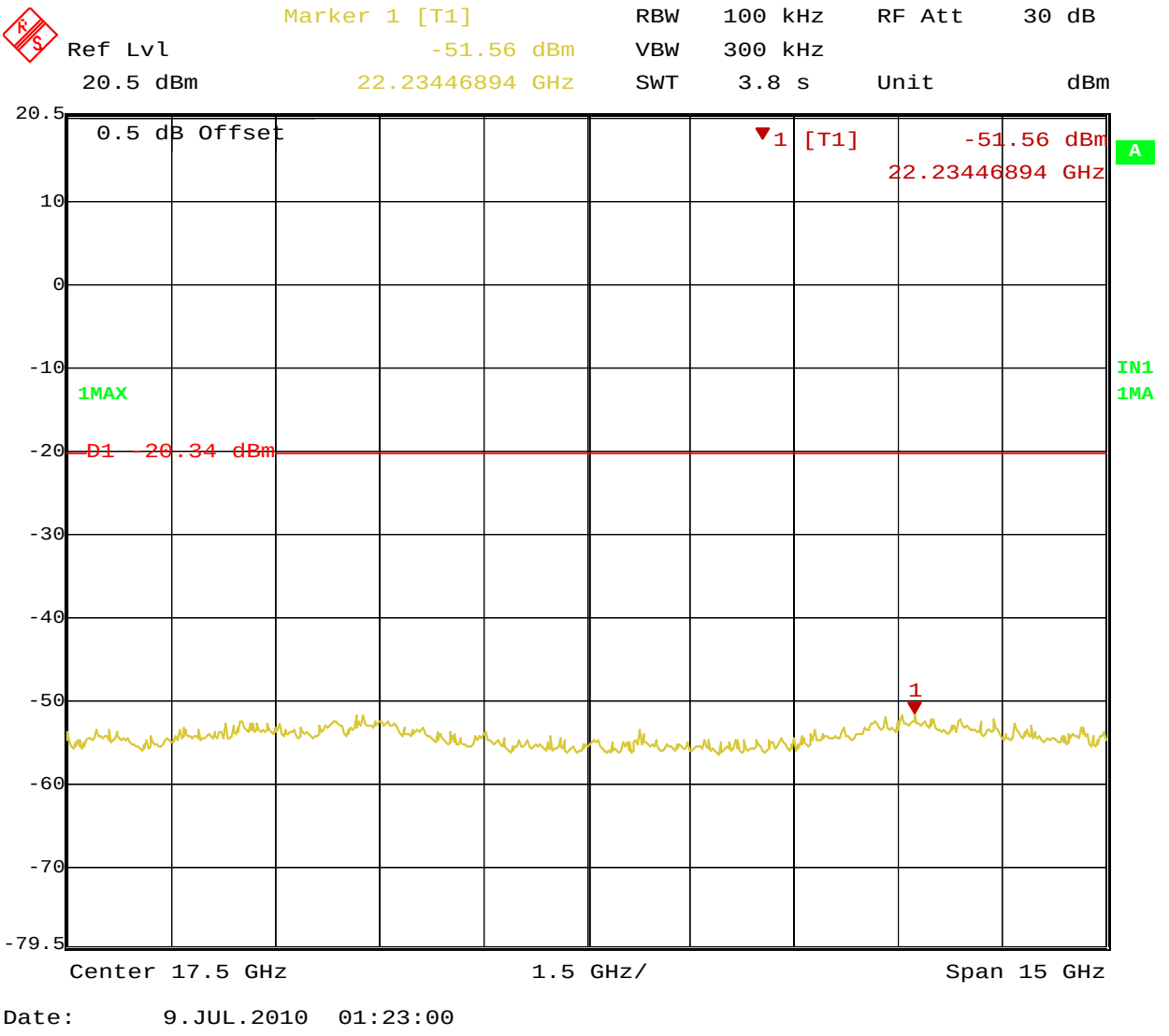

Figure 15: Out of Band Emission for Channel 2412 MHz at 11 Mbit/s – Band 3

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. This report must not be used by the applicant to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

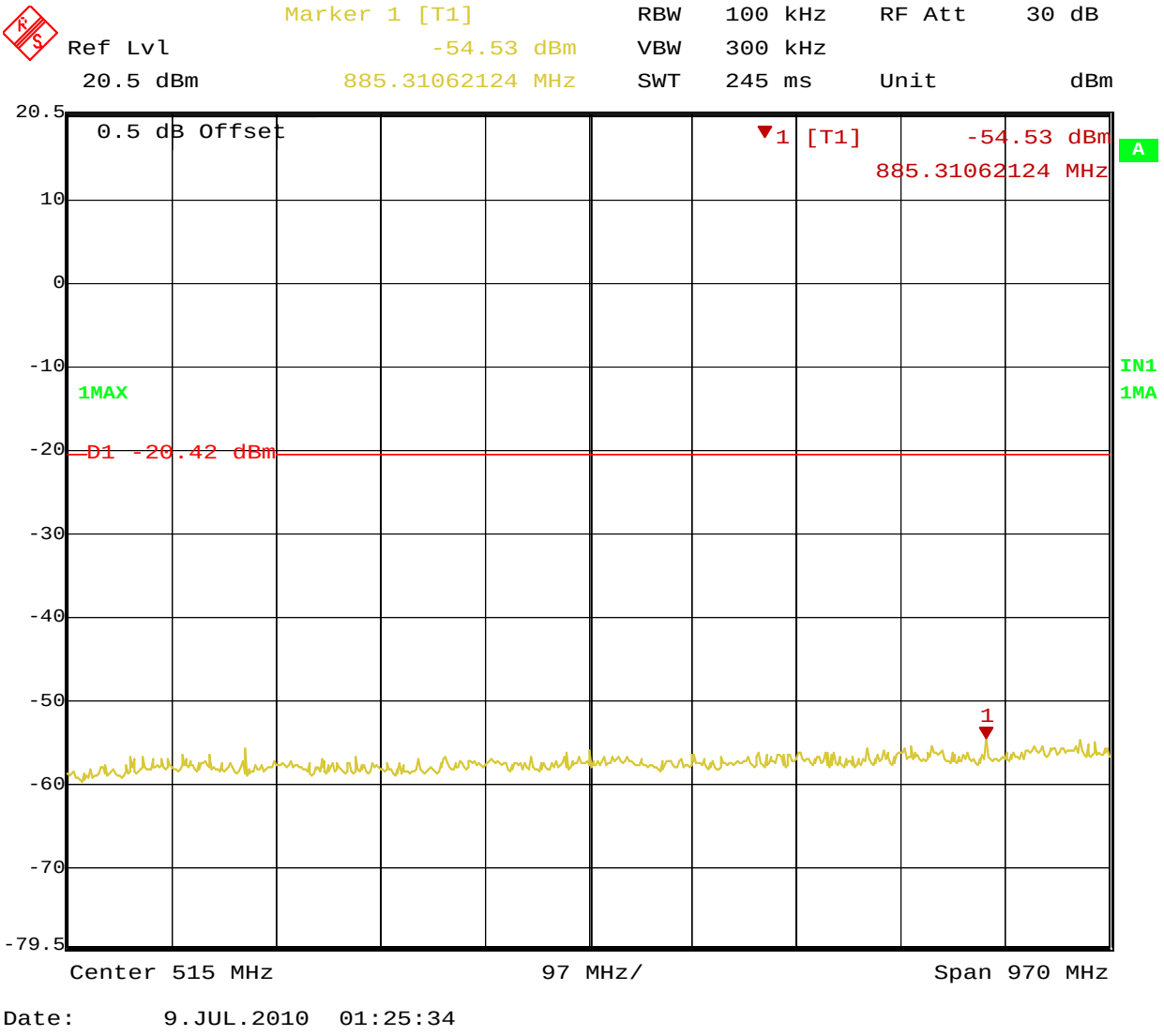

Figure 16: Out of Band Emission for Channel 2437 MHz at 11 Mbit/s – Band 1

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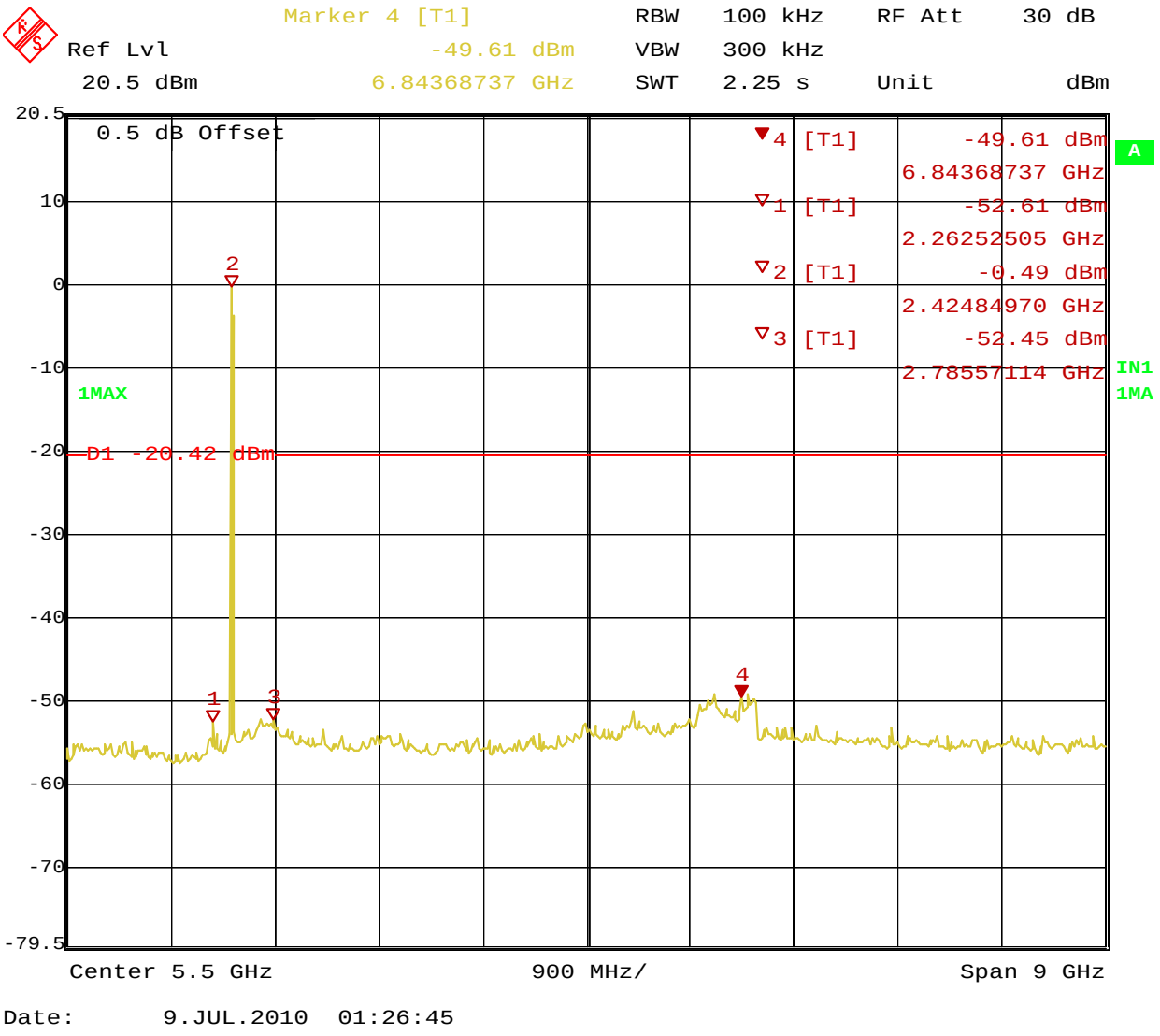

Figure 17: Out of Band Emission for Channel 2437 MHz at 11 Mbit/s – Band 2

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. This report must not be used by the applicant to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

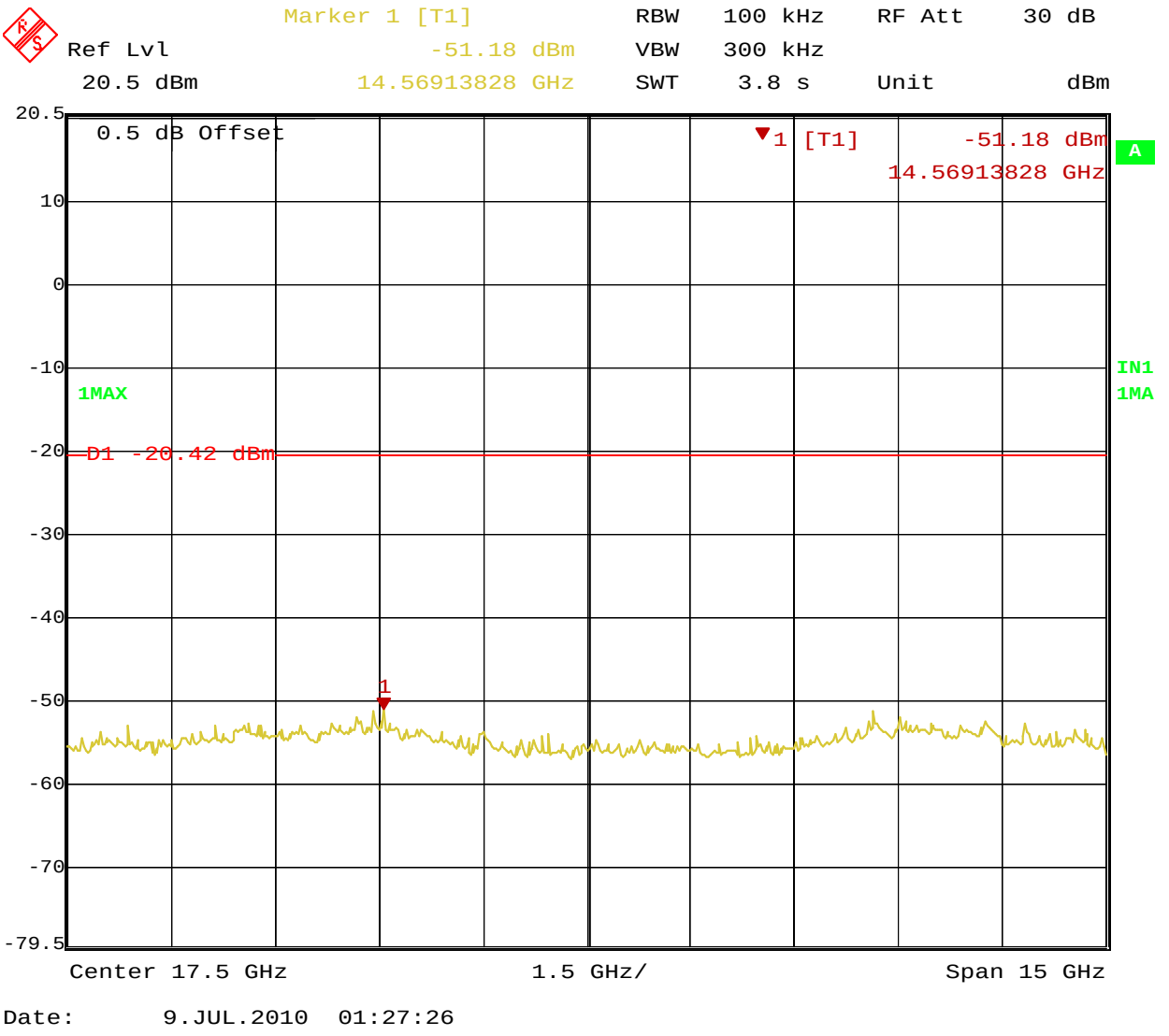

Figure 18: Out of Band Emission for Channel 2437 MHz at 11 Mbit/s – Band 3

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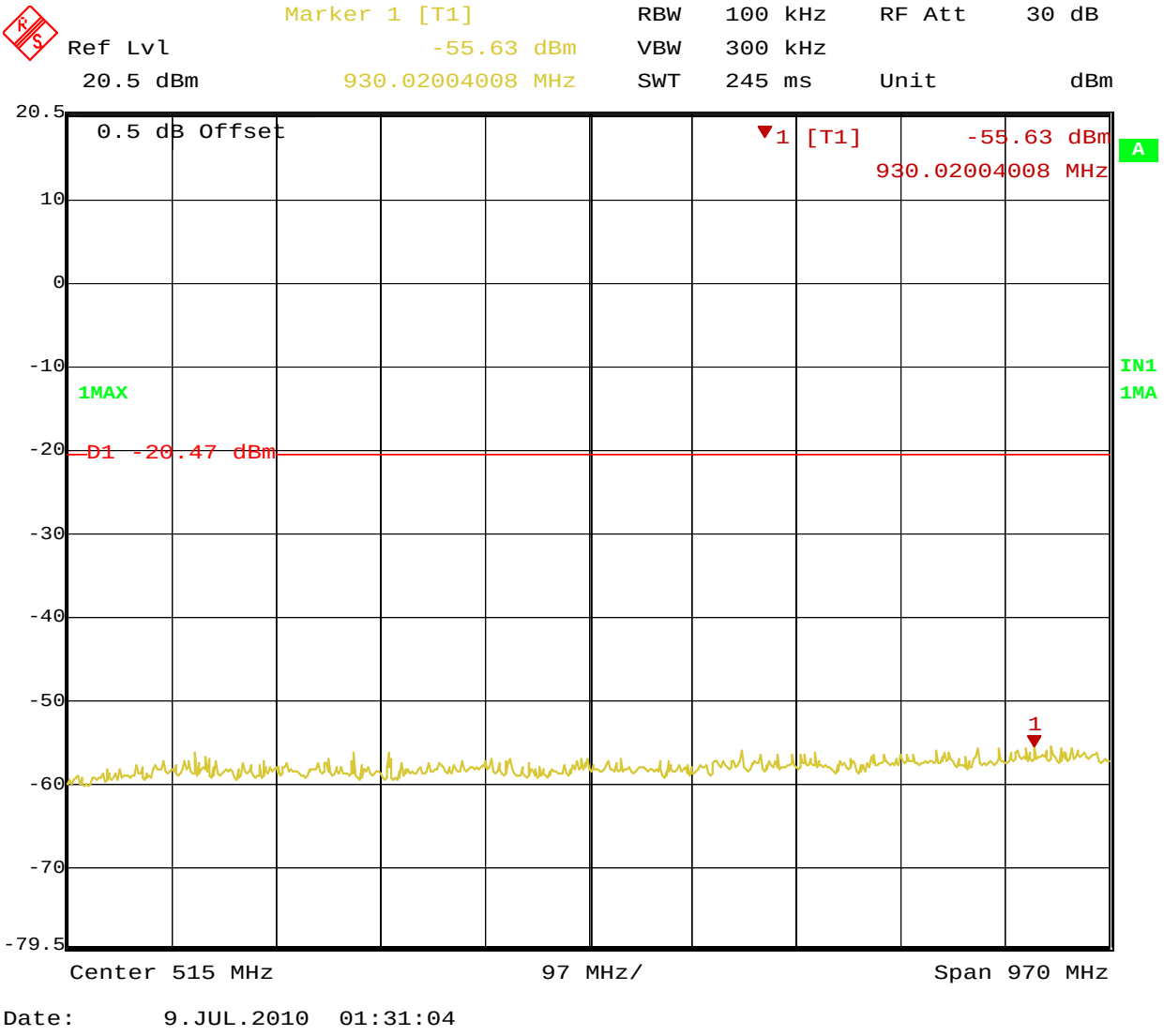

Figure 19: Out of Band Emission for Channel 2462 MHz at 11 Mbit/s – Band 1

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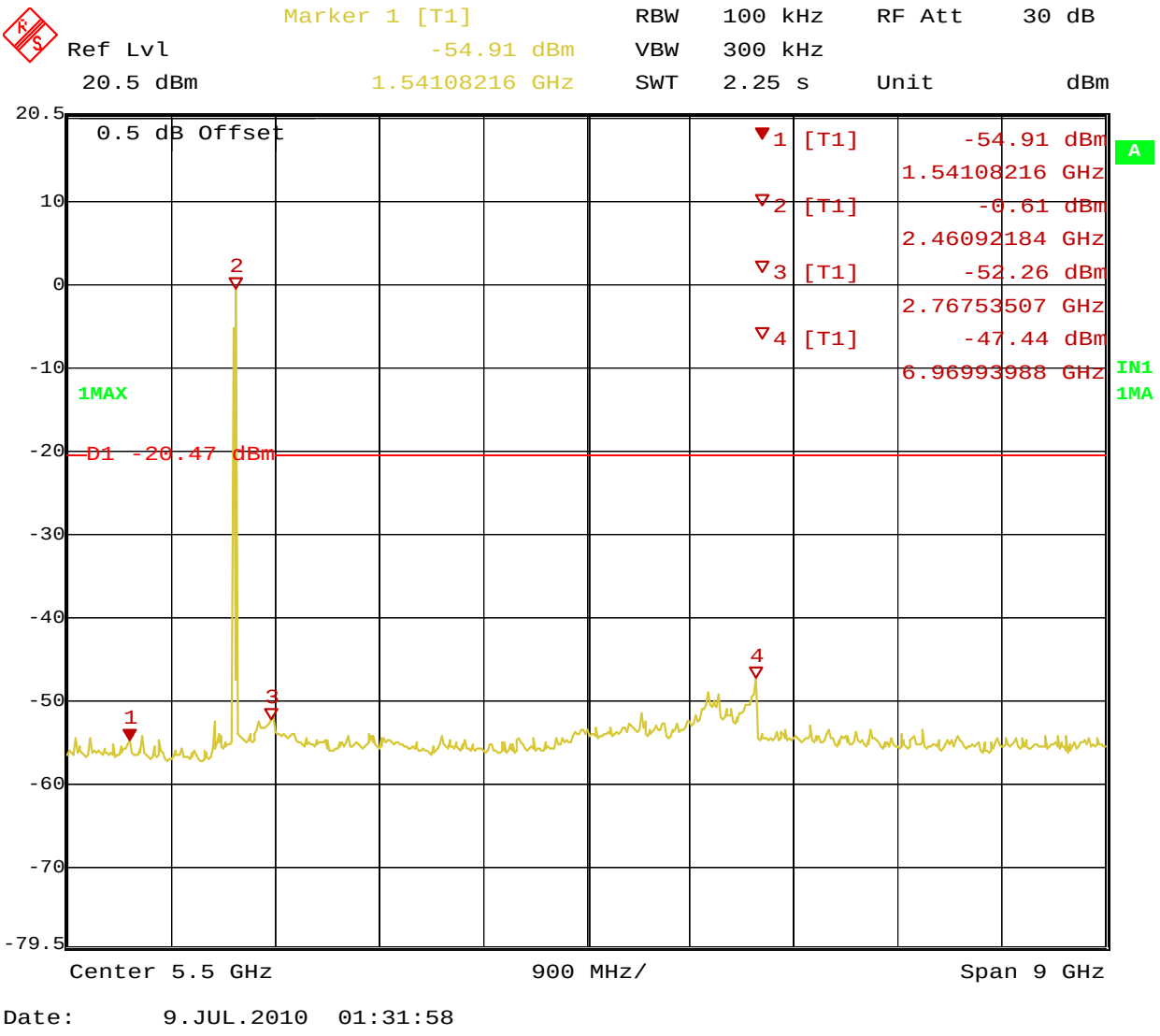

Figure 20: Out of Band Emission for Channel 2462 MHz at 11 Mbit/s – Band 2

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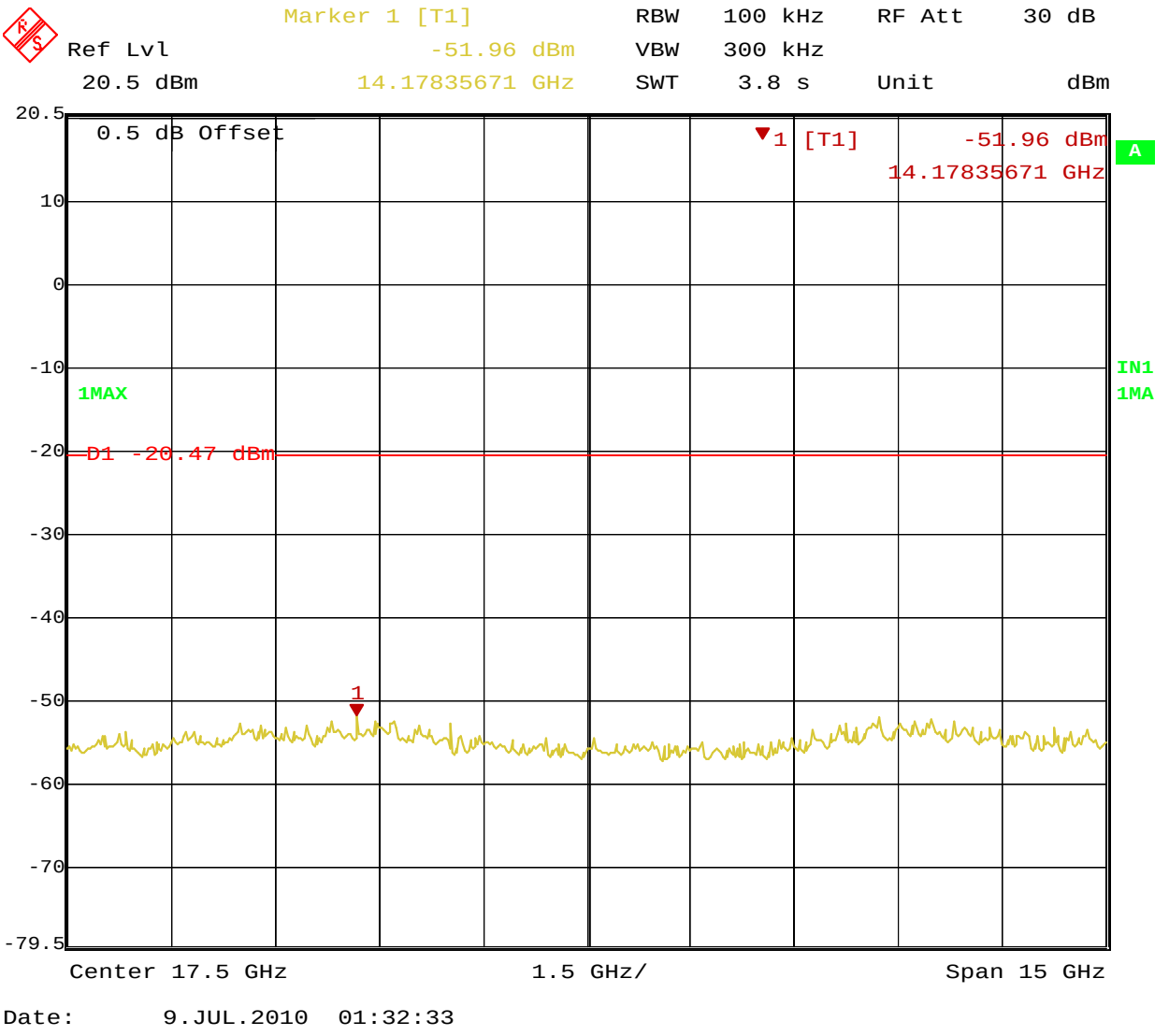

Figure 21: Out of Band Emission for Channel 2462 MHz at 11 Mbit/s – Band 3

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4.4 Peak Power Spectral Density

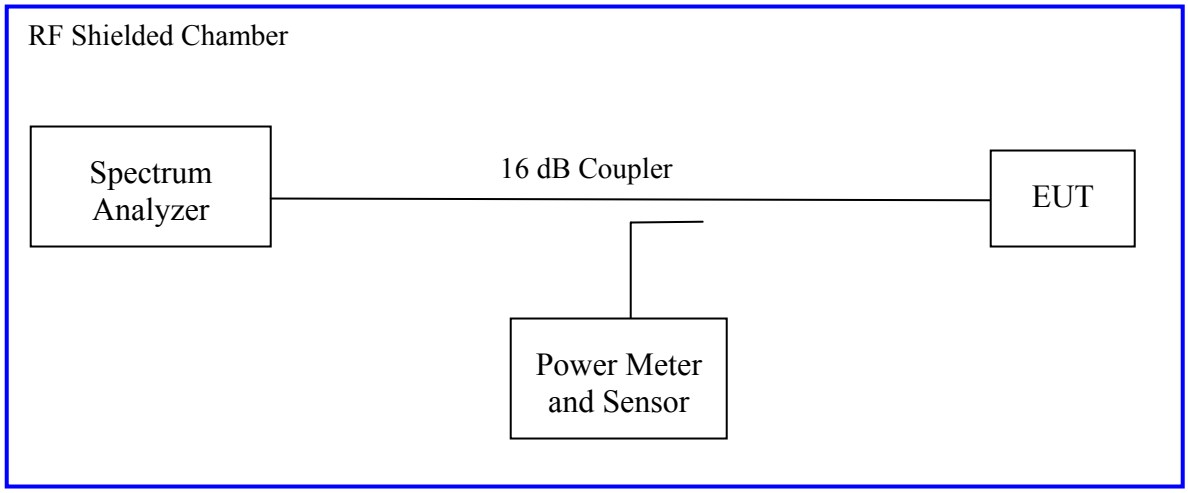
According to the CFR47 Part 15.247 (e) and RSS 210 (A8.2), the spectral power density output of the antenna port shall be less than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

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, S/N: 001DC90009F5. The worst sample result indicated below.

Test Setup:



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4.4.2 Results

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

Table 7: Peak Power Spectral Density – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only				
Antenna Type: PCB or Dipole		**Power Setting:** +9 dBm		
Max. Antenna Gain: 5 dBi		**Signal State:** Modulated		
Ambient Temp.: 23° C		**Relative Humidity:**36%		
Peak Power Spectral Density Test Results				
Operating Channel	**Mode**	**PPSD [dBm]**	**Limit [dBm]**	**Margin [dB]**
2412 MHz	11Mbps	-15.09	8.0	23.09
2437 MHz	11Mbps	-14.80	8.0	22.8
2462 MHz	11Mbps	-14.86	8.0	22.86
Note: the highest PPSD was observed at 11 Mbps				

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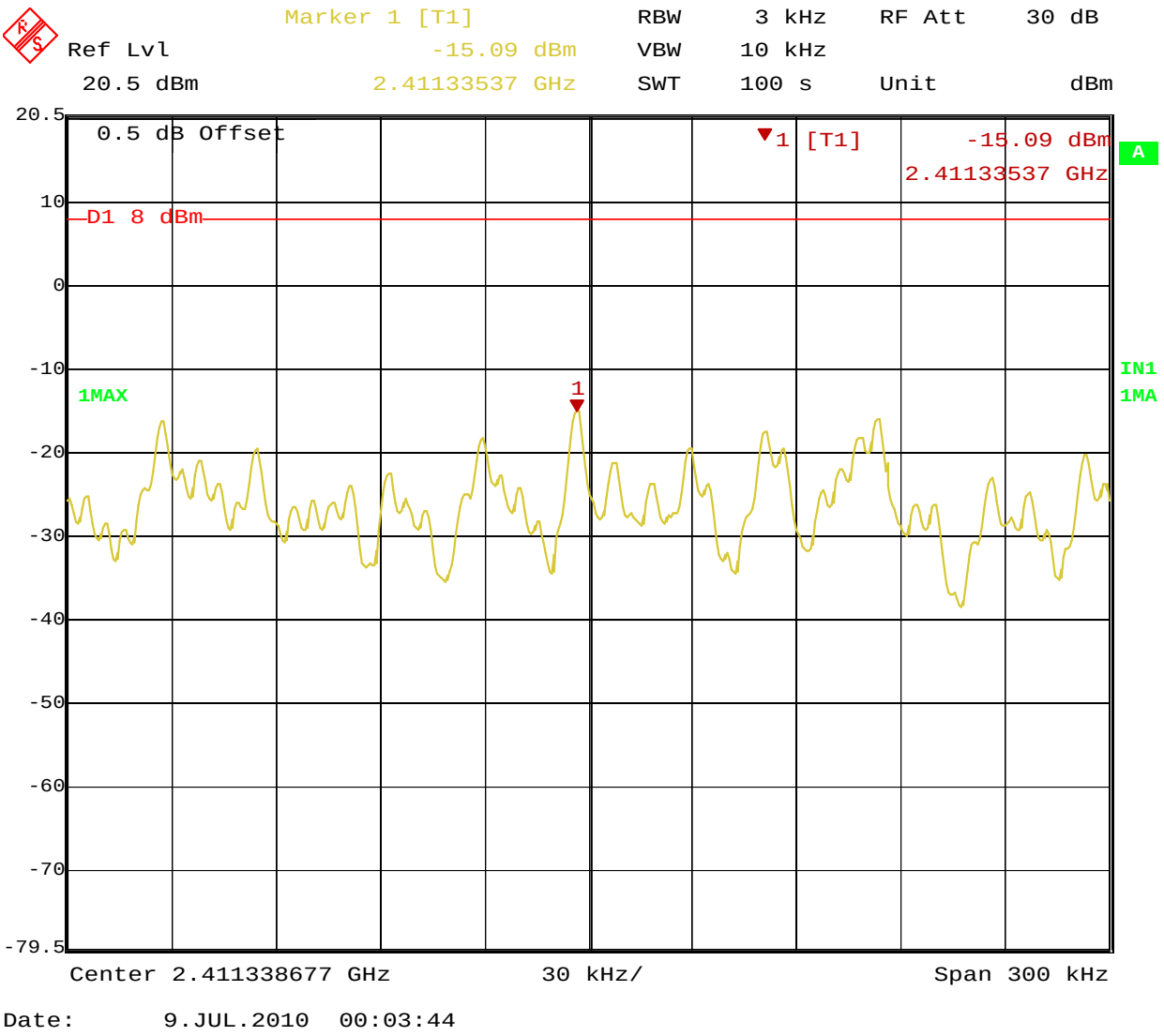

Figure 22: Peak Power Spectral Density for Operating Channel 2412 MHz – 11 Mbit/s

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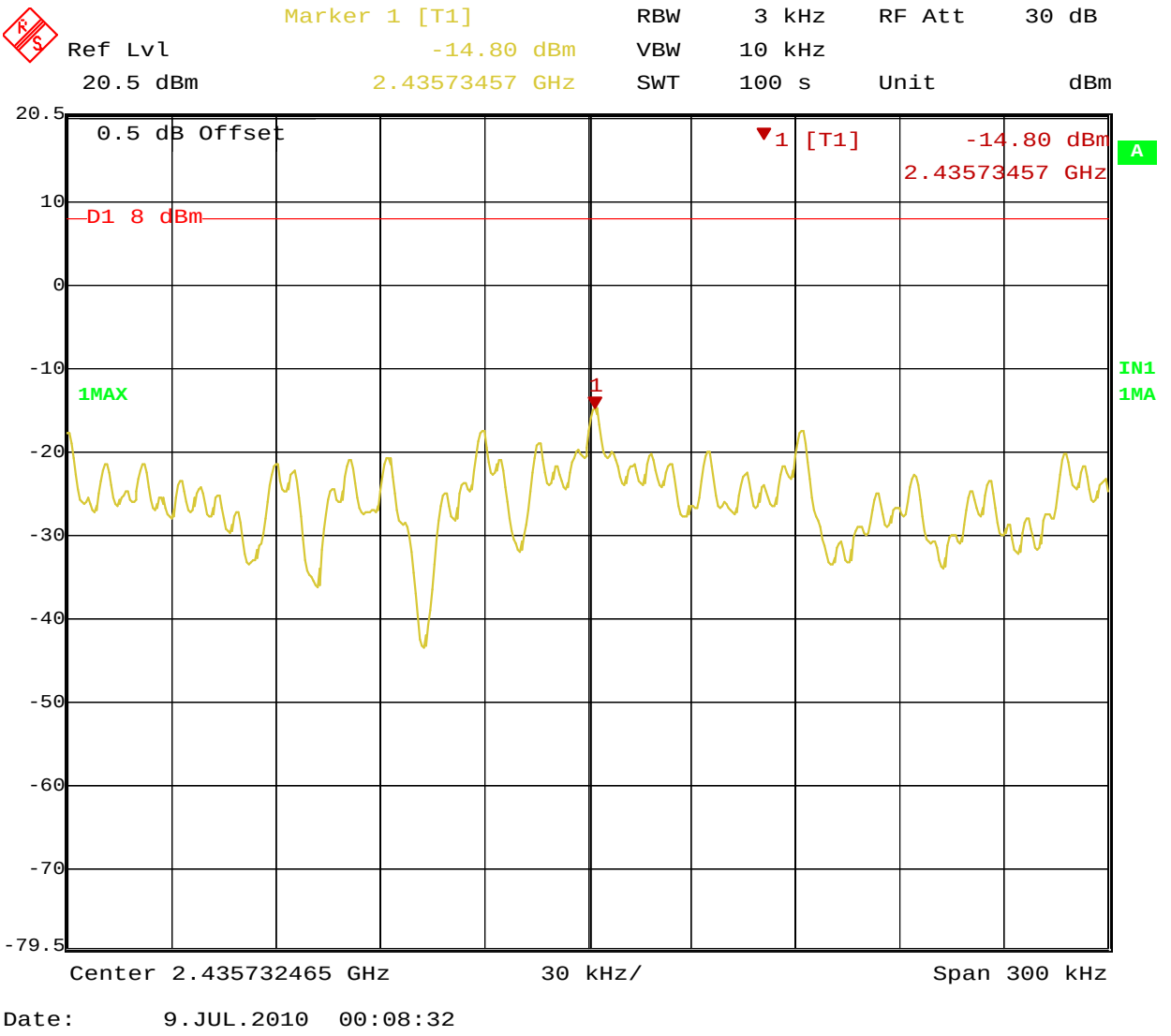

Figure 23: Peak Power Spectral Density for Operating Channel 2437 MHz – 11 Mbit/s

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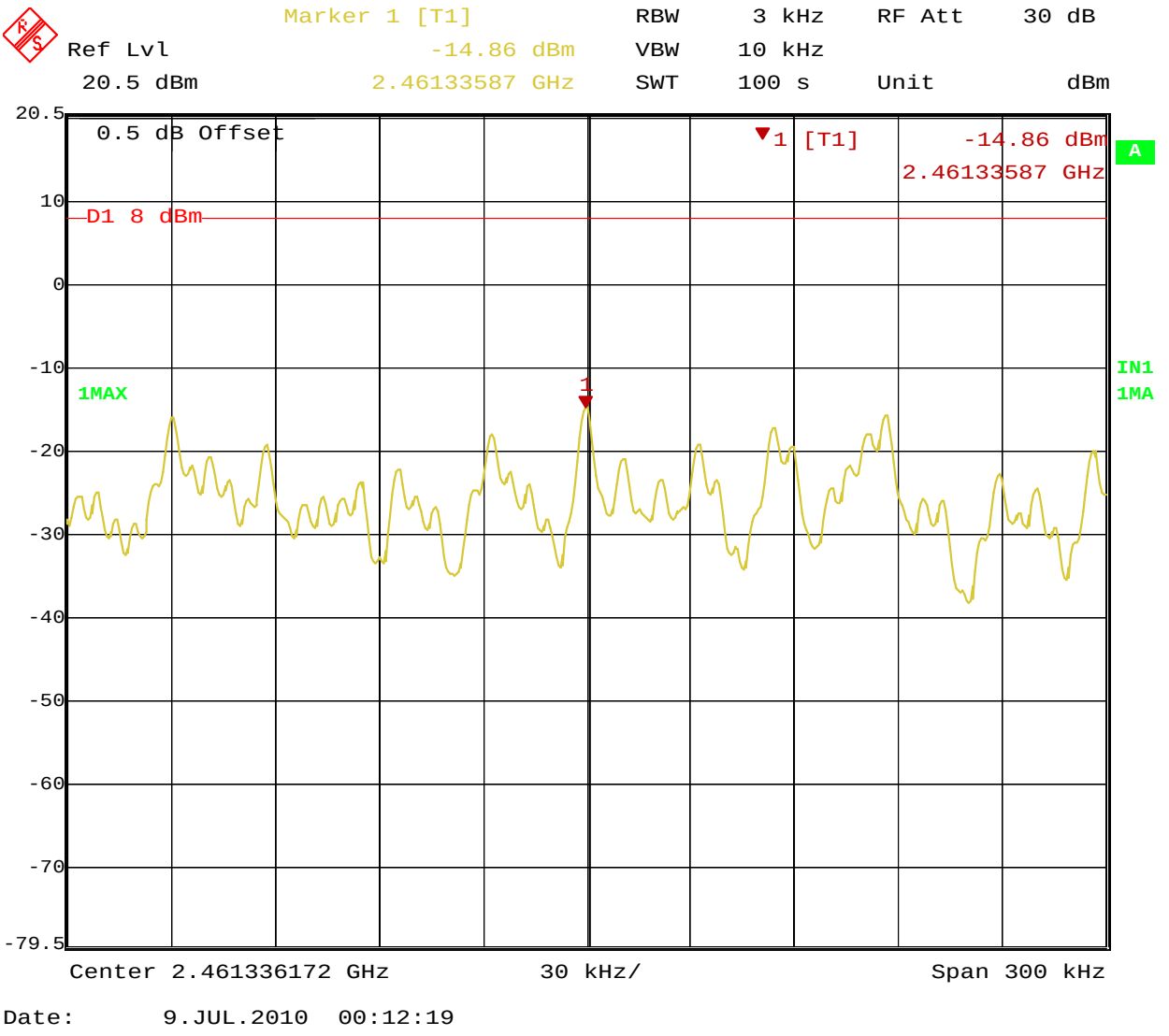

Figure 24: Peak Power Spectral Density for Operating Channel 2462 MHz – 11 Mbit/s

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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.

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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 users manual. Therefore, 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 +5 dBi or 3.16 (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 channel output power is +14.39 dBm or 27.48 mW

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

Pd = (27.48*3.16) / (1600π) = 0.01728mW/cm2, which is 0.9827 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 Friis transmission formula: $Pd = (Pout*G) / (4*\pi*R^2)$

Where;

Pd = power density in $mW/cm2$
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).

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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 for three operating channels: 2412 MHz, 2437 MHz, and 2462 MHz at 1 Mbit/s for 802.11b mode.

4.6.1.3 Deviations

None.

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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: 2008 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 20dB 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 1.5.

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

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Table 8: Transmit Spurious Emission at Band Edge Requirements – Dipole Antenna

Test Conditions: Radiated Measurement, Normal Temperature and Voltage only							
Antenna Type: Dipole			**Power Setting:** +9 dBm				
Max. Antenna Gain: +5 dBi			**Signal State:** Modulated				
Ambient Temp.: 22° C			**Relative Humidity:**34%				
Band Edge Results for Dipole Antenna							
Operating Channel	**EUT Position**	**Polarity**	**Pk Plots**	**Peak Limit**	**Ave. Plots**	**Ave. Limit**	**Result**
2412 MHz	Y-Axis	Horizontal	#25	74.00	#26	54.00	Pass
2412 MHz	Y-Axis	Vertical	#27	74.00	#28	54.00	Pass
2437 MHz	Y-Axis	Horizontal	#29	74.00	#30	54.00	Pass
2437 MHz	Y-Axis	Vertical	#31	74.00	#32	54.00	Pass
2462 MHz	Y-Axis	Horizontal	#33	74.00	#34	54.00	Pass
2462 MHz	Y-Axis	Vertical	#35	74.00	#36	54.00	Pass

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Table 9: Transmit Spurious Emission at Band Edge Requirements –PCB Antenna

Test Conditions: Radiated Measurement, Normal Temperature and Voltage only							
Antenna Type: Ext. PCB			**Power Setting:** +9 dBm				
Max. Antenna Gain: +2 dBi			**Signal State:** Modulated				
Ambient Temp.: 22°C			**Relative Humidity:**34%				
Band Edge Results for Dipole Antenna							
Operating Channel	**EUT Position**	**Polarity**	**Pk Plots**	**Peak Limit**	**Ave. Plots**	**Ave. Limit**	**Result**
2412 MHz	Z-Axis	Horizontal	#37	74.00	#38	54.00	Pass
2412 MHz	Z-Axis	Vertical	#39	74.00	#40	54.00	Pass
2437 MHz	Z-Axis	Horizontal	#41	74.00	#42	54.00	Pass
2437 MHz	Z-Axis	Vertical	#43	74.00	#44	54.00	Pass
2462 MHz	Z-Axis	Horizontal	#45	74.00	#46	54.00	Pass
2462 MHz	Z-Axis	Vertical	#47	74.00	#48	54.00	Pass

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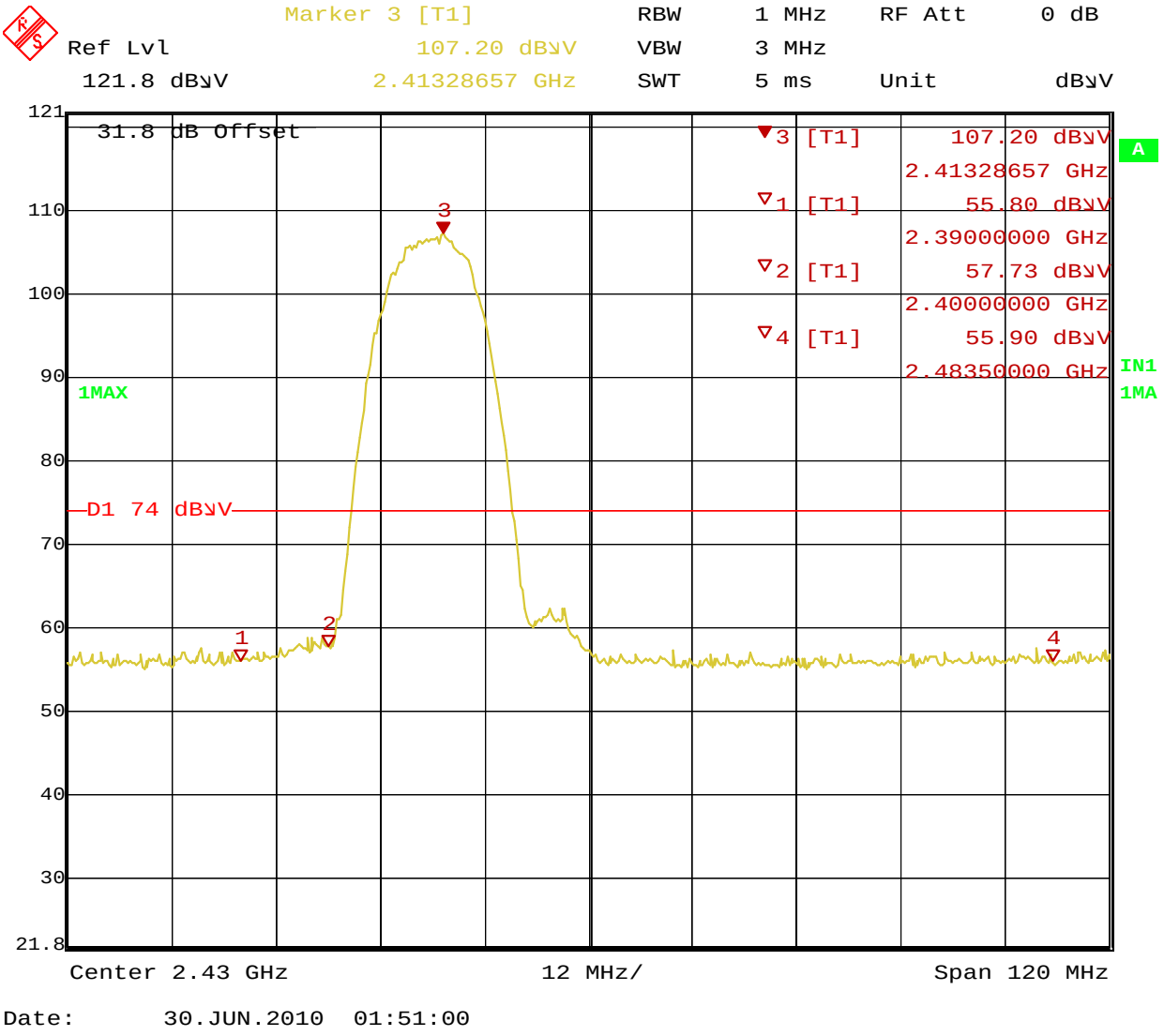

Figure 25: Dipole Antenna Emission at the Edge for Channel 2412 MHz at 11 Mbps – Horizontal (Peak)

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. This report must not be used by the applicant to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

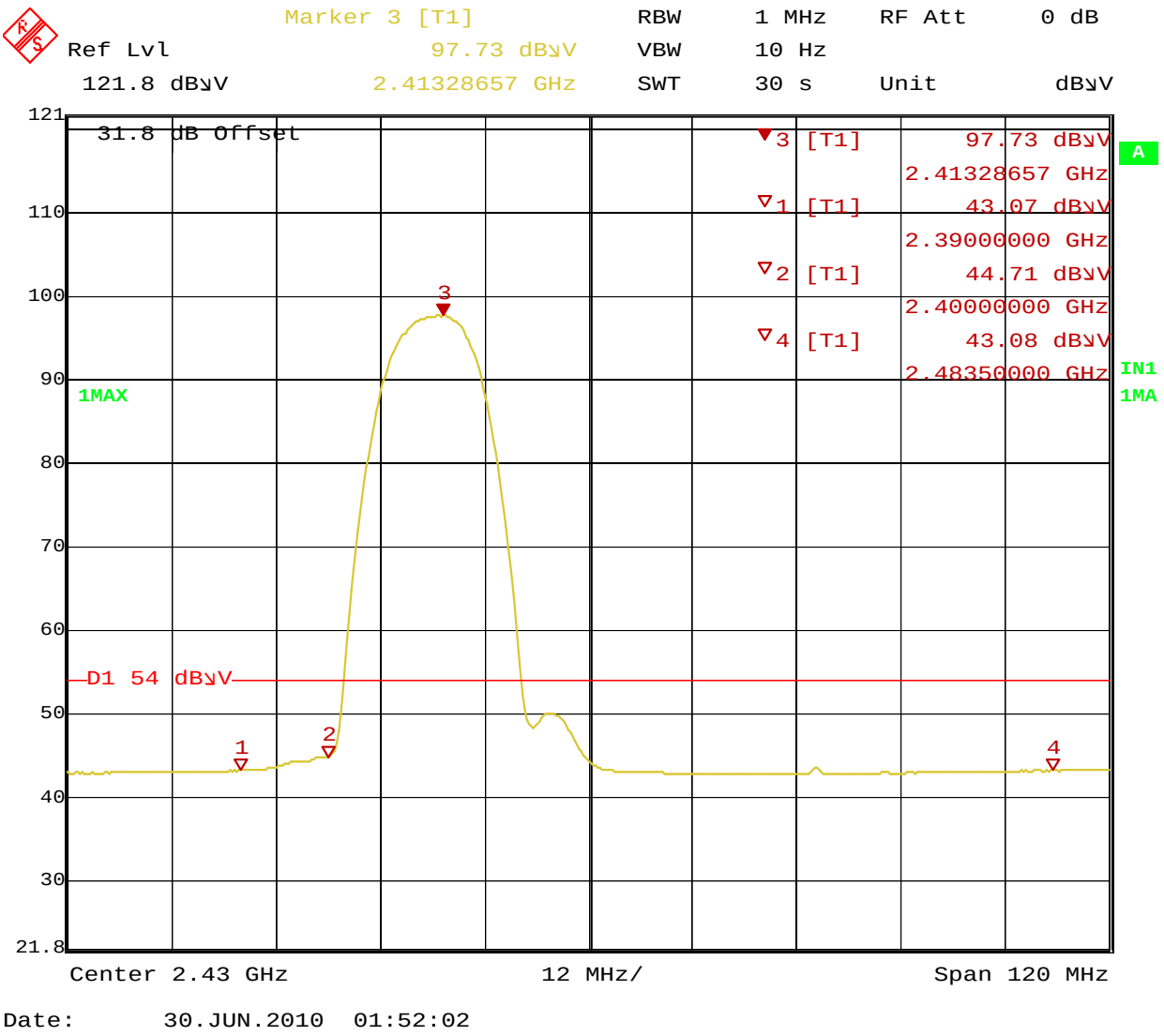

Figure 26: Dipole Antenna Emission at the Edge for Channel 2412 MHz at 11 Mbps – Horizontal (Ave.)

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. This report must not be used by the applicant to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

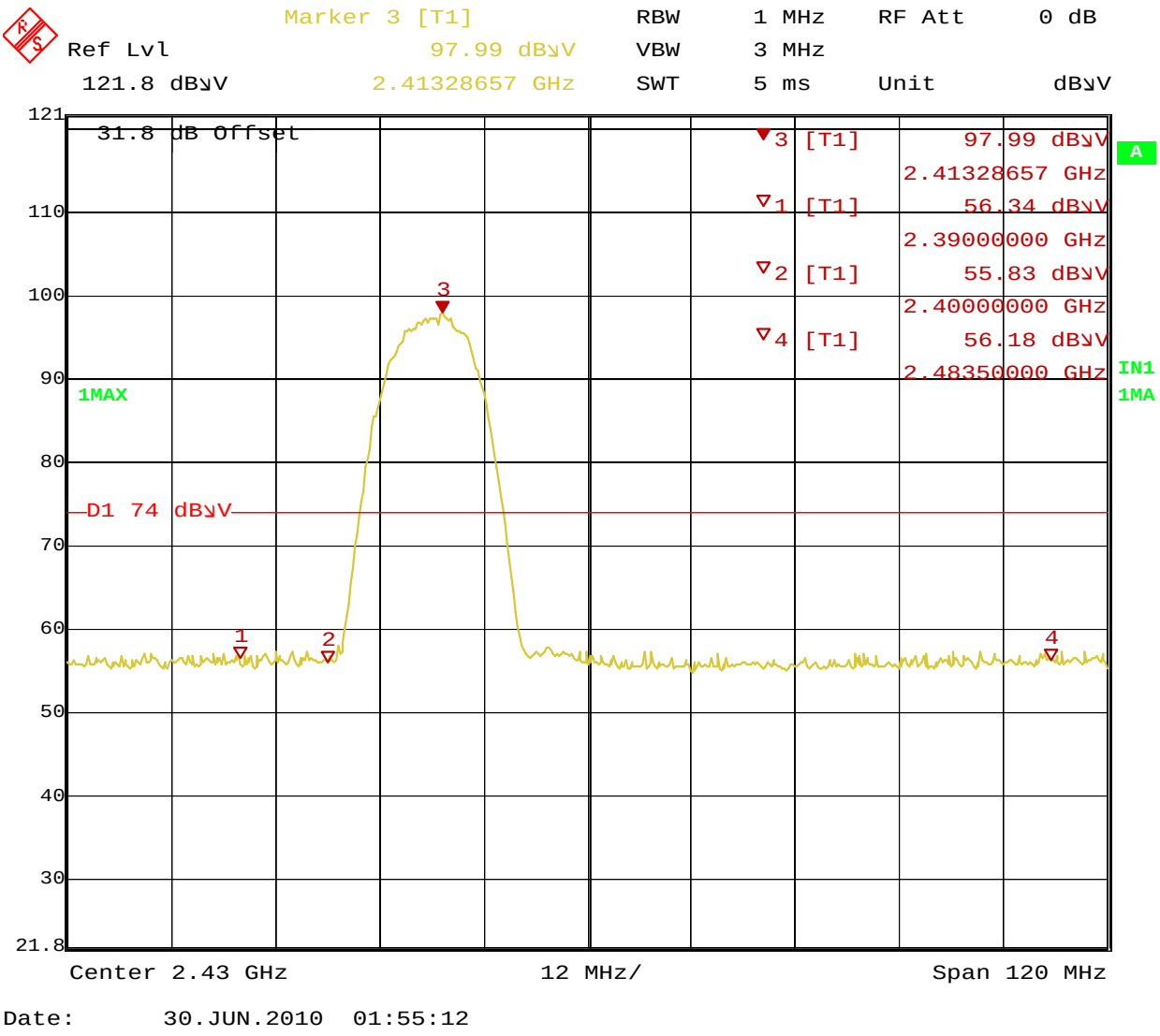

Figure 27: Dipole Antenna Emission at the Edge for Channel 2412 MHz at 11 Mbps – Vertical (Peak)

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. This report must not be used by the applicant to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

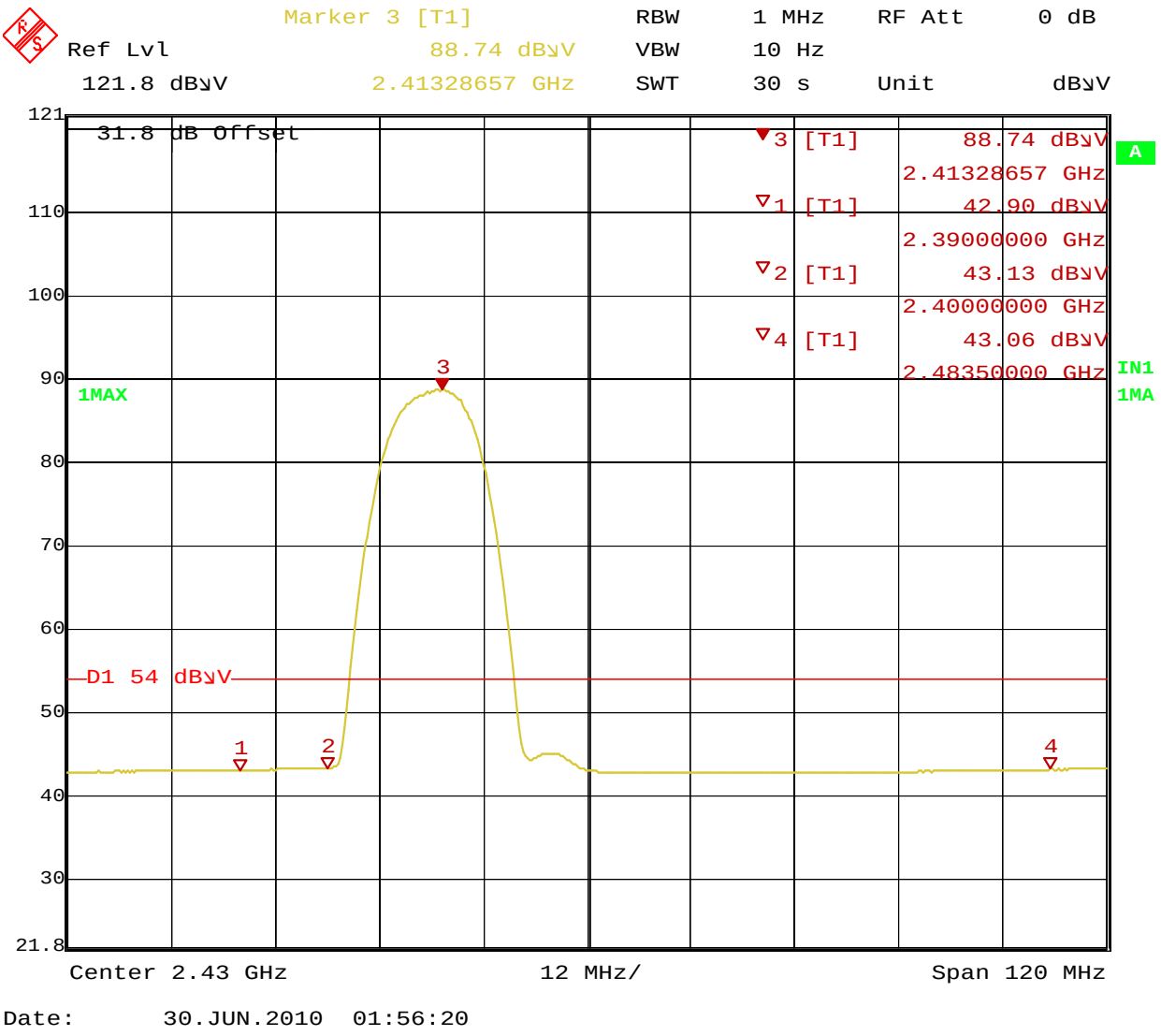

Figure 28: Dipole Antenna Emission at the Edge for Channel 2412 MHz at 11 Mbps – Vertical (Ave.)

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. This report must not be used by the applicant to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

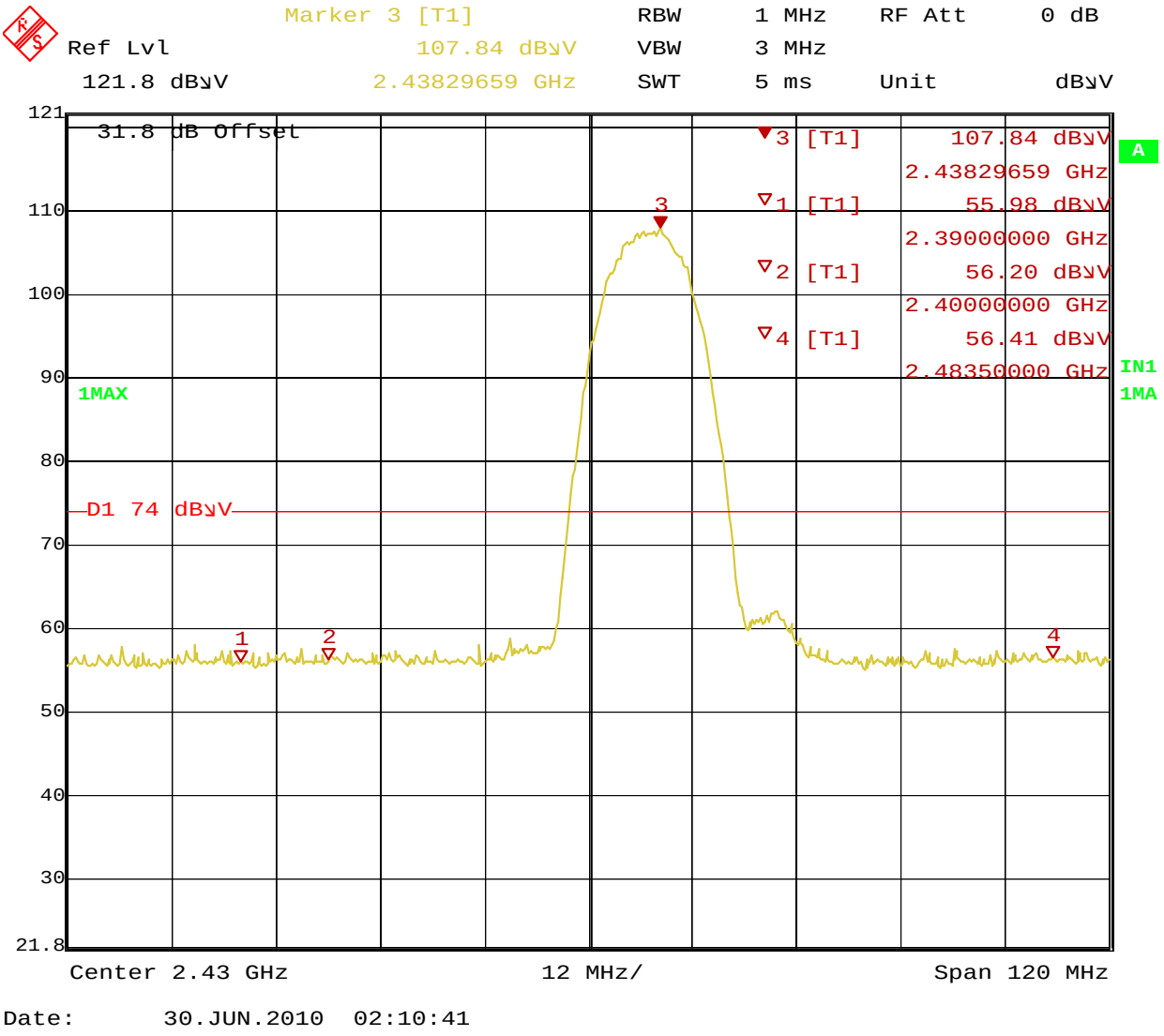

Figure 29: Dipole Antenna Emission at the Edge for Channel 2437 MHz at 11 Mbps – Horizontal (Peak)

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. This report must not be used by the applicant to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

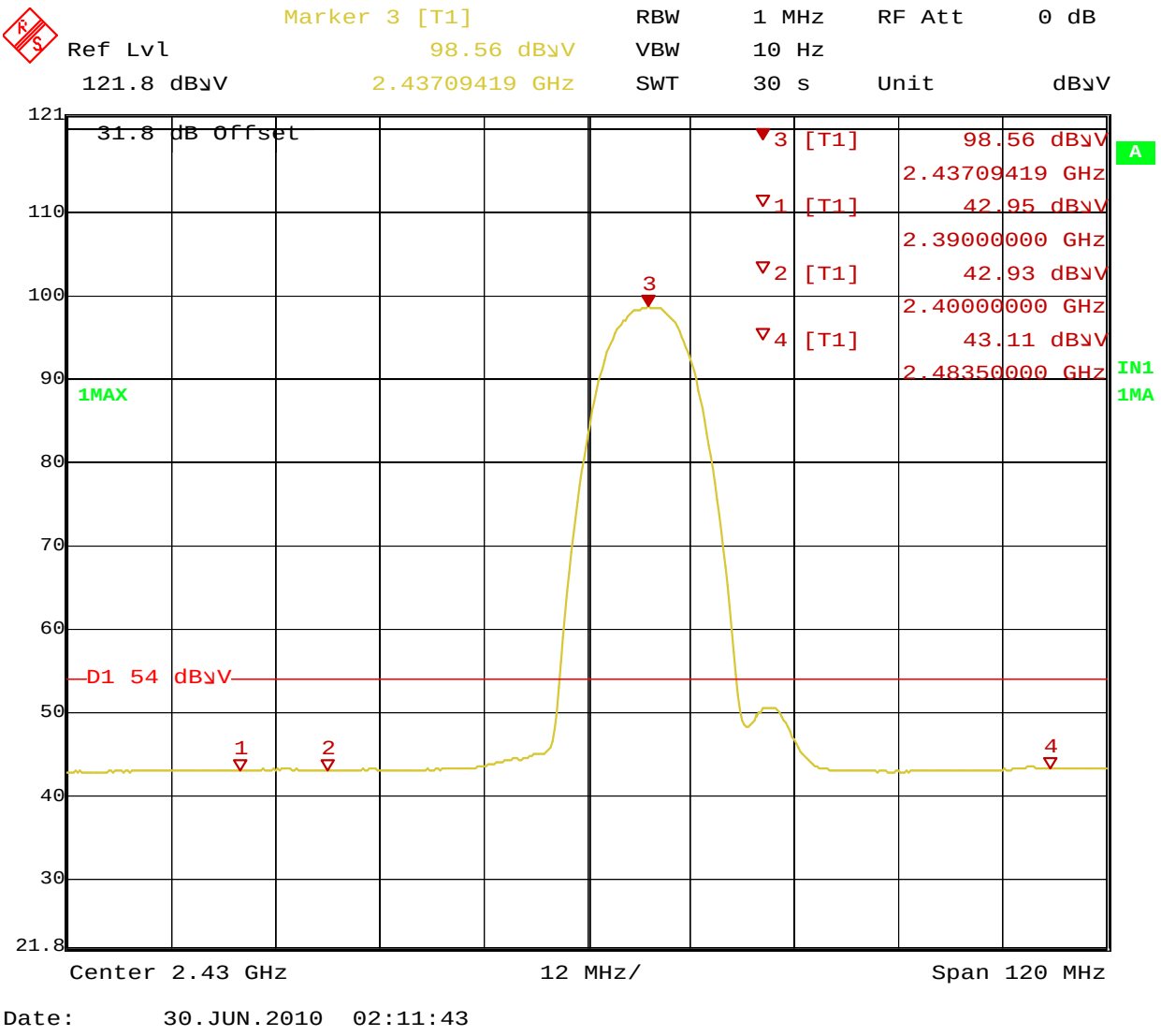

Figure 30: Dipole Antenna Emission at the Edge for Channel 2437 MHz at 11 Mbps – Horizontal (Ave.)

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. This report must not be used by the applicant to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

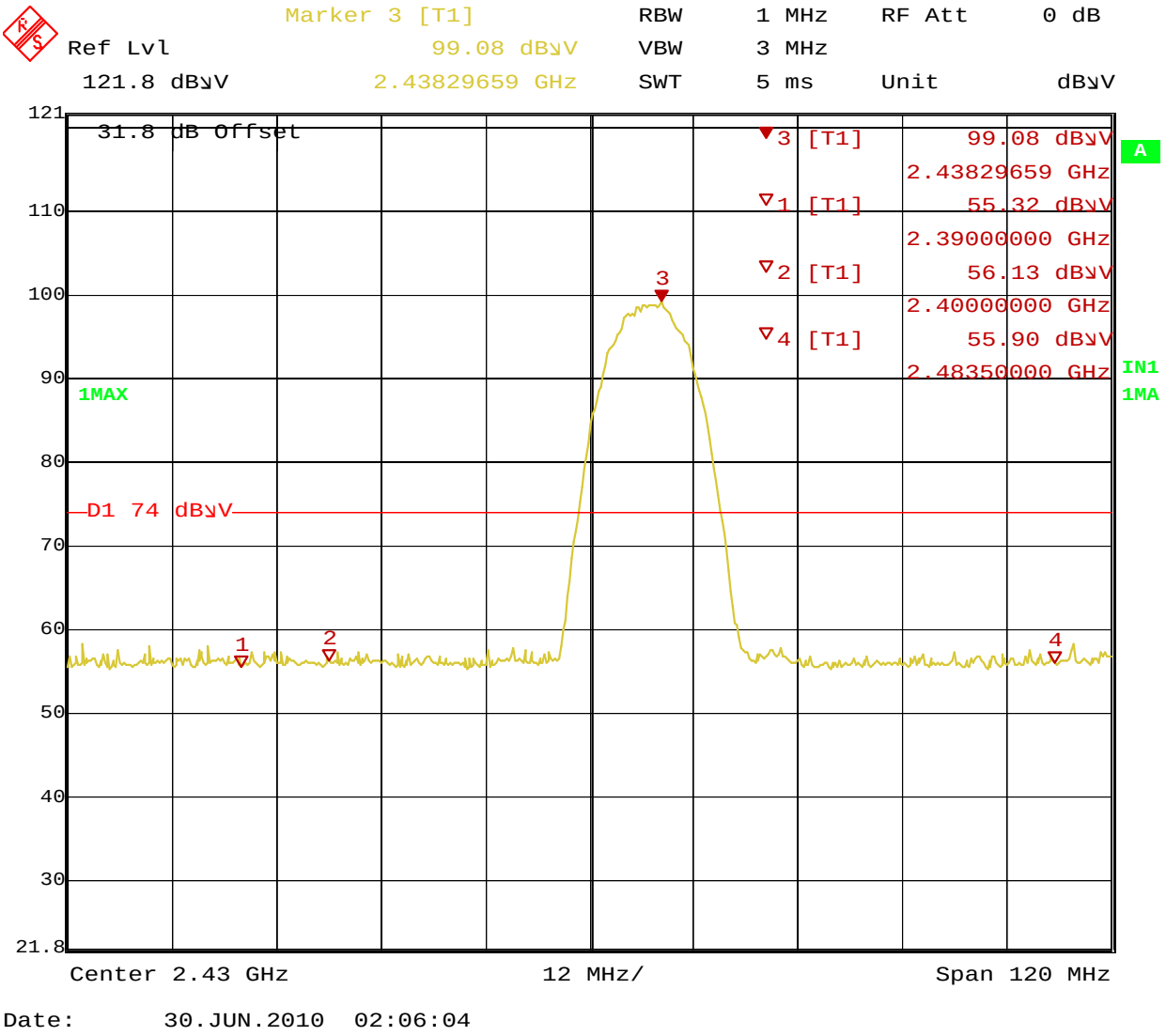

Figure 31: Dipole Antenna Emission at the Edge for Channel 2437 MHz at 11 Mbps – Vertical (Peak)

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. This report must not be used by the applicant to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

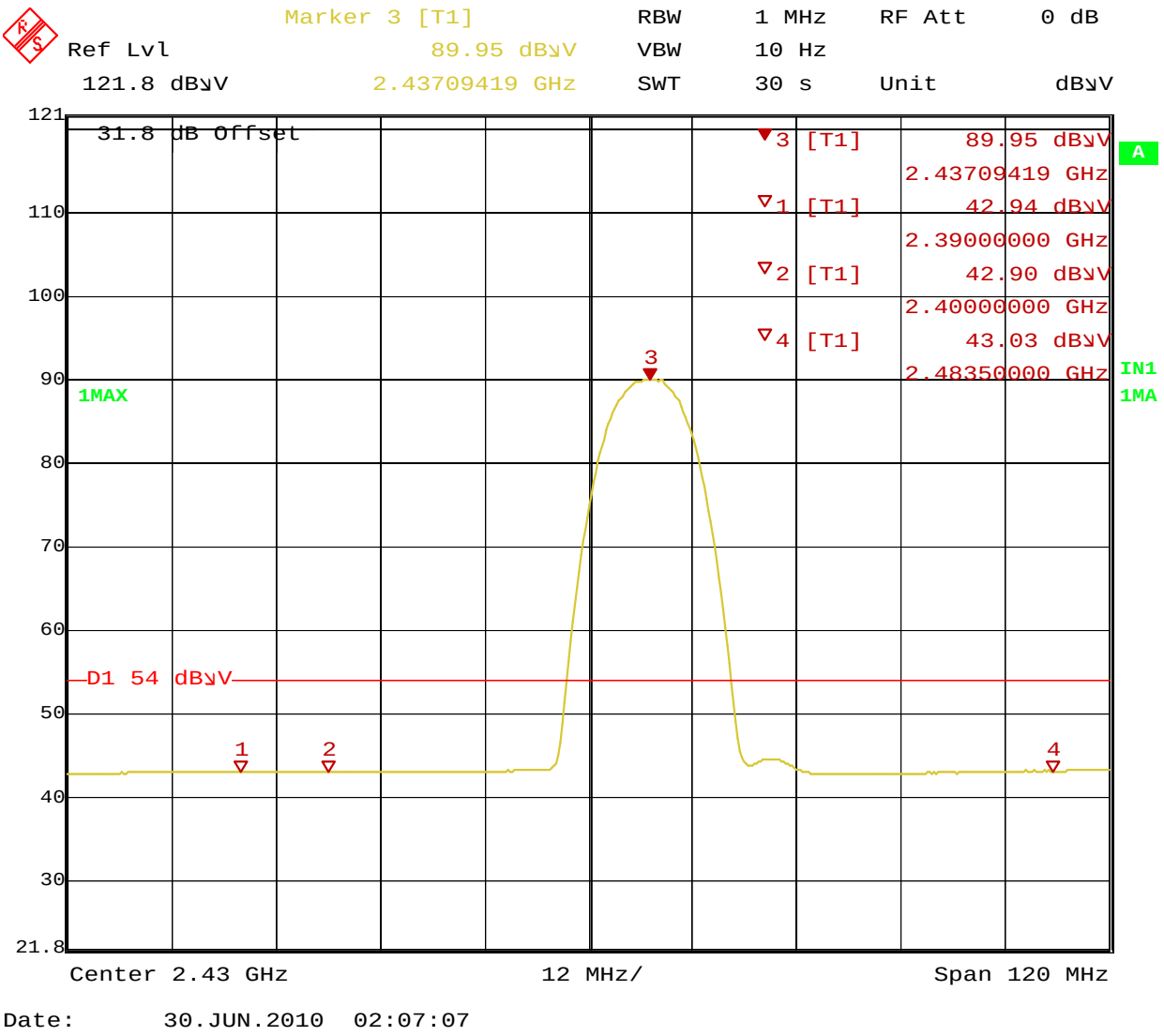

Figure 32: Dipole Antenna Emission at the Edge for Channel 2437 MHz at 11 Mbps – Vertical (Ave.)

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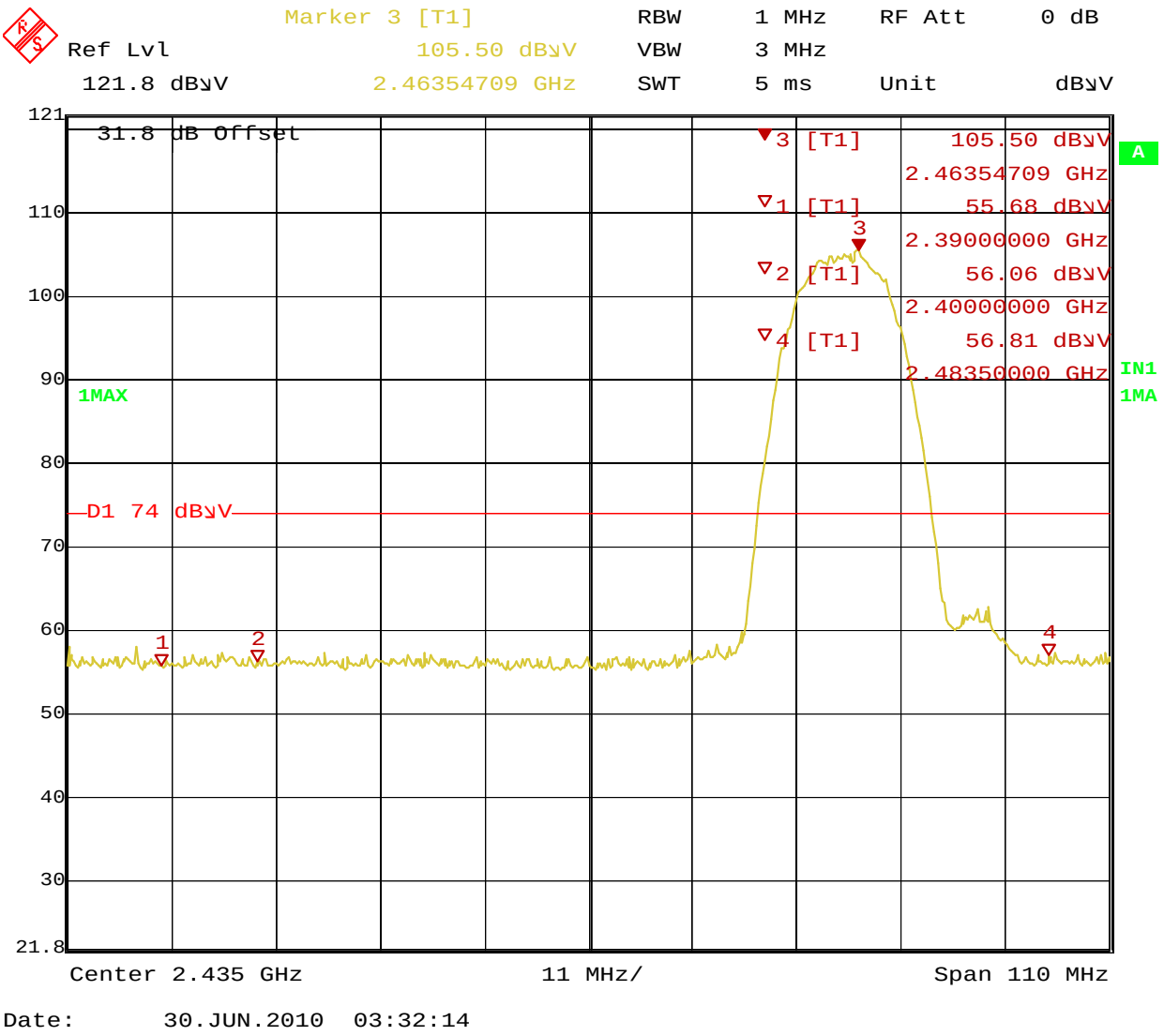

Figure 33: Dipole Antenna Emission at the Edge for Channel 2462 MHz at 11 Mbps – Horizontal (Peak)

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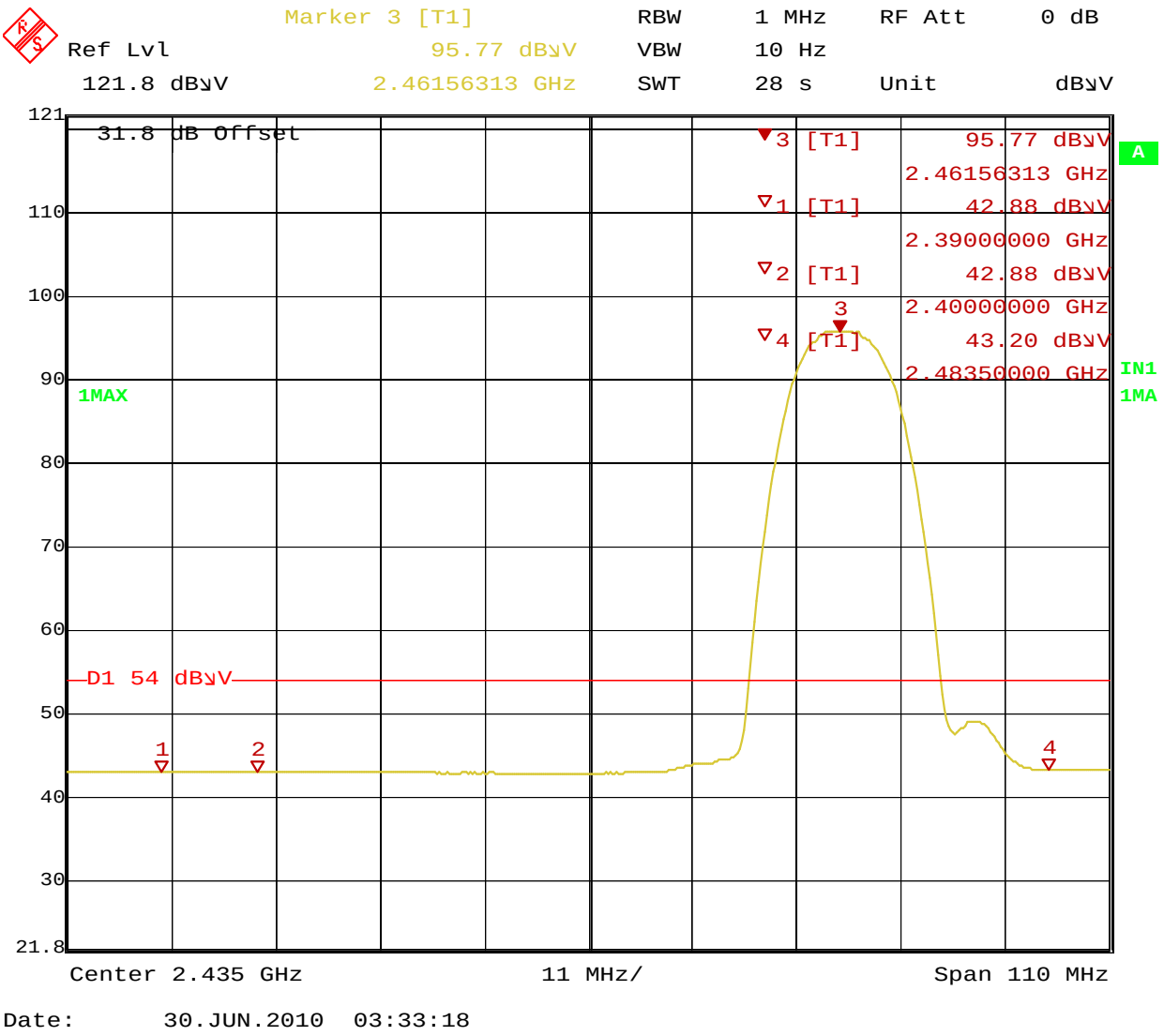

Figure 34: Dipole Antenna Emission at the Edge for Channel 2462 MHz at 11 Mbps – Horizontal (Ave.)

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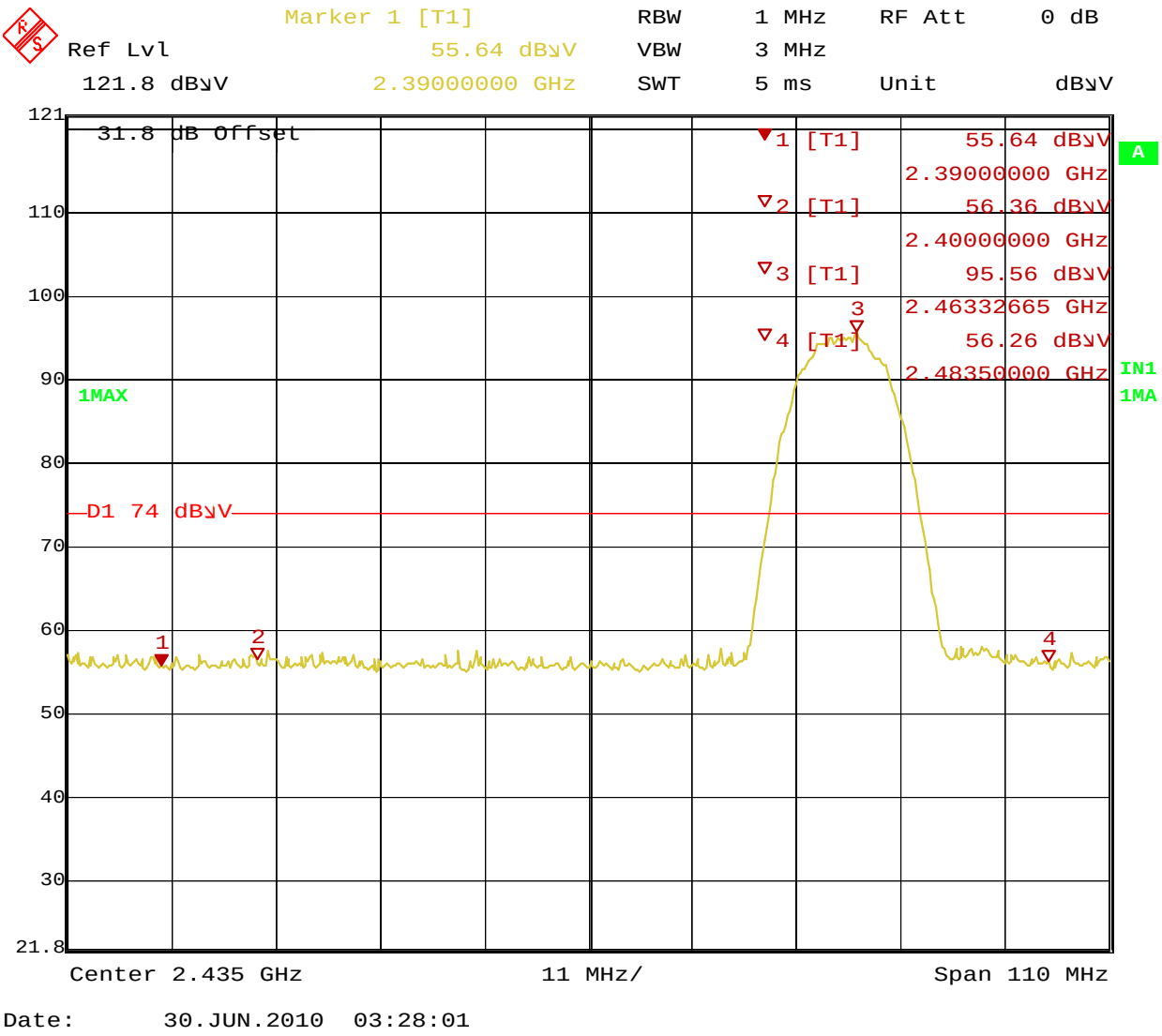

Figure 35: Dipole Antenna Emission at the Edge for Channel 2462 MHz at 11 Mbps – Vertical (Peak)

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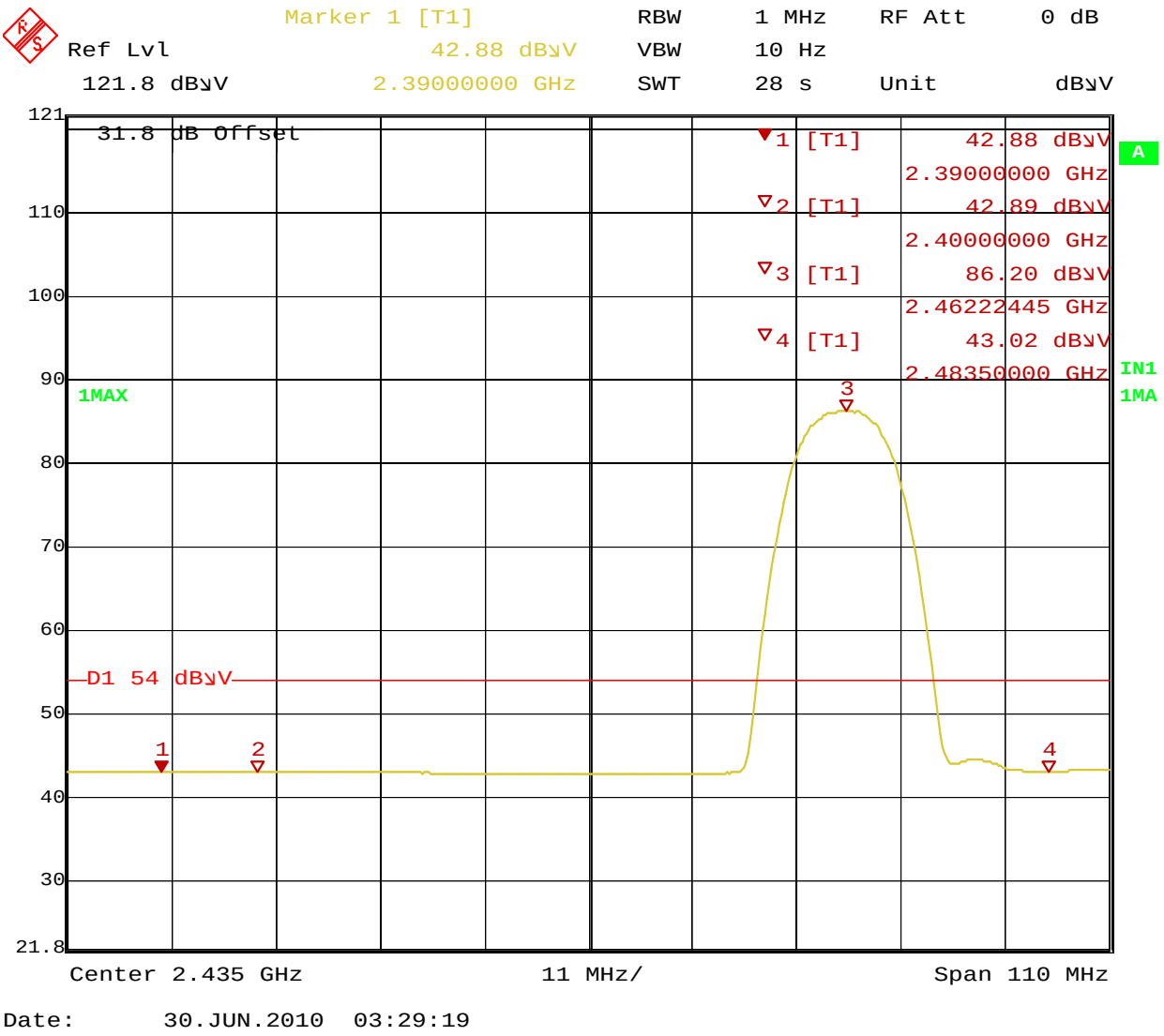

Figure 36: Dipole Antenna Emission at the Edge for Channel 2462 MHz at 11 Mbps – Vertical (Ave.)

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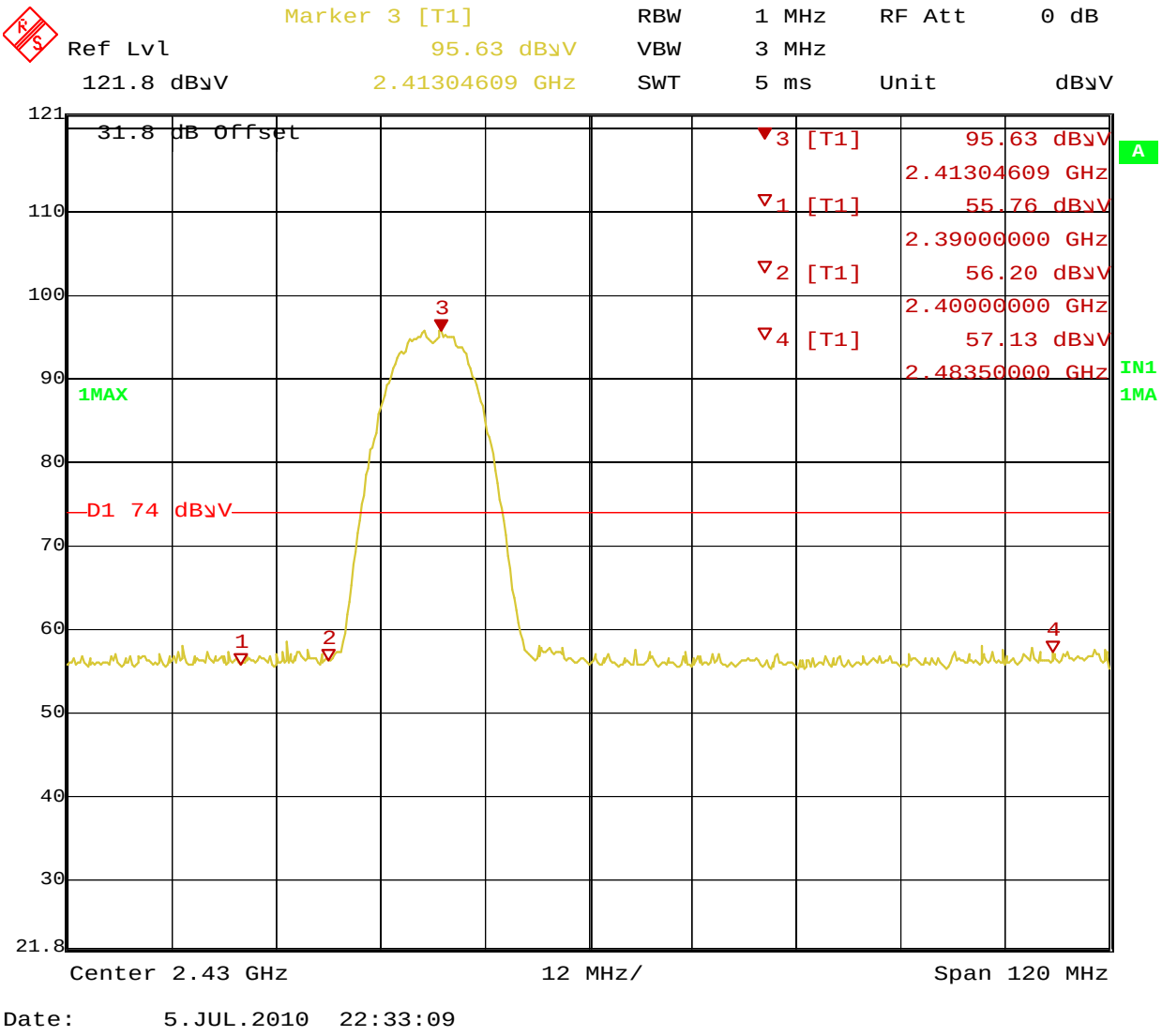

Figure 37: PCB Antenna Emission at the Edge for Channel 2412 MHz at 1 Mbps – Horizontal (Peak)

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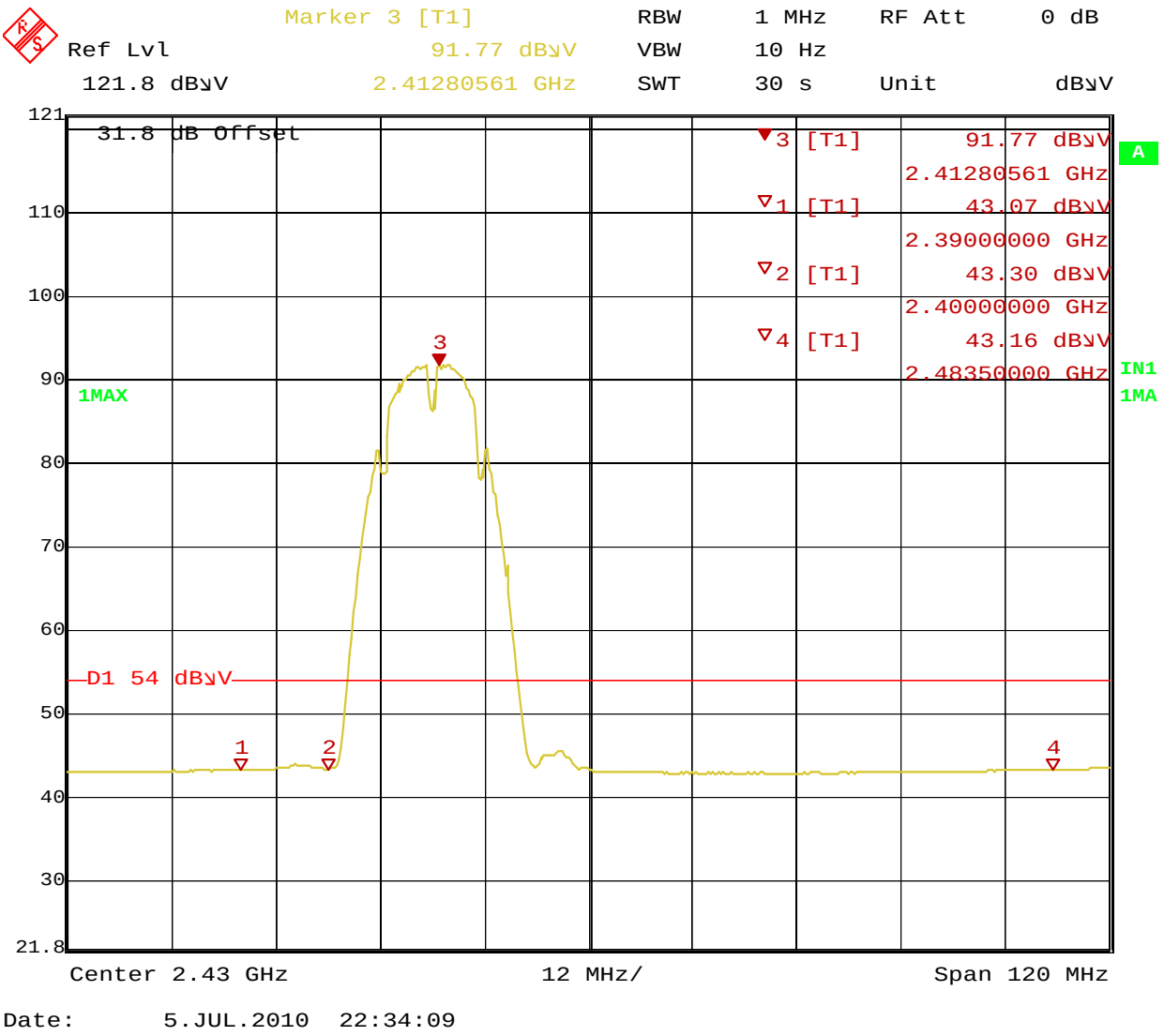

Figure 38: PCB Antenna Emission at the Edge for Channel 2412 MHz at 1 Mbps – Horizontal (Ave.)

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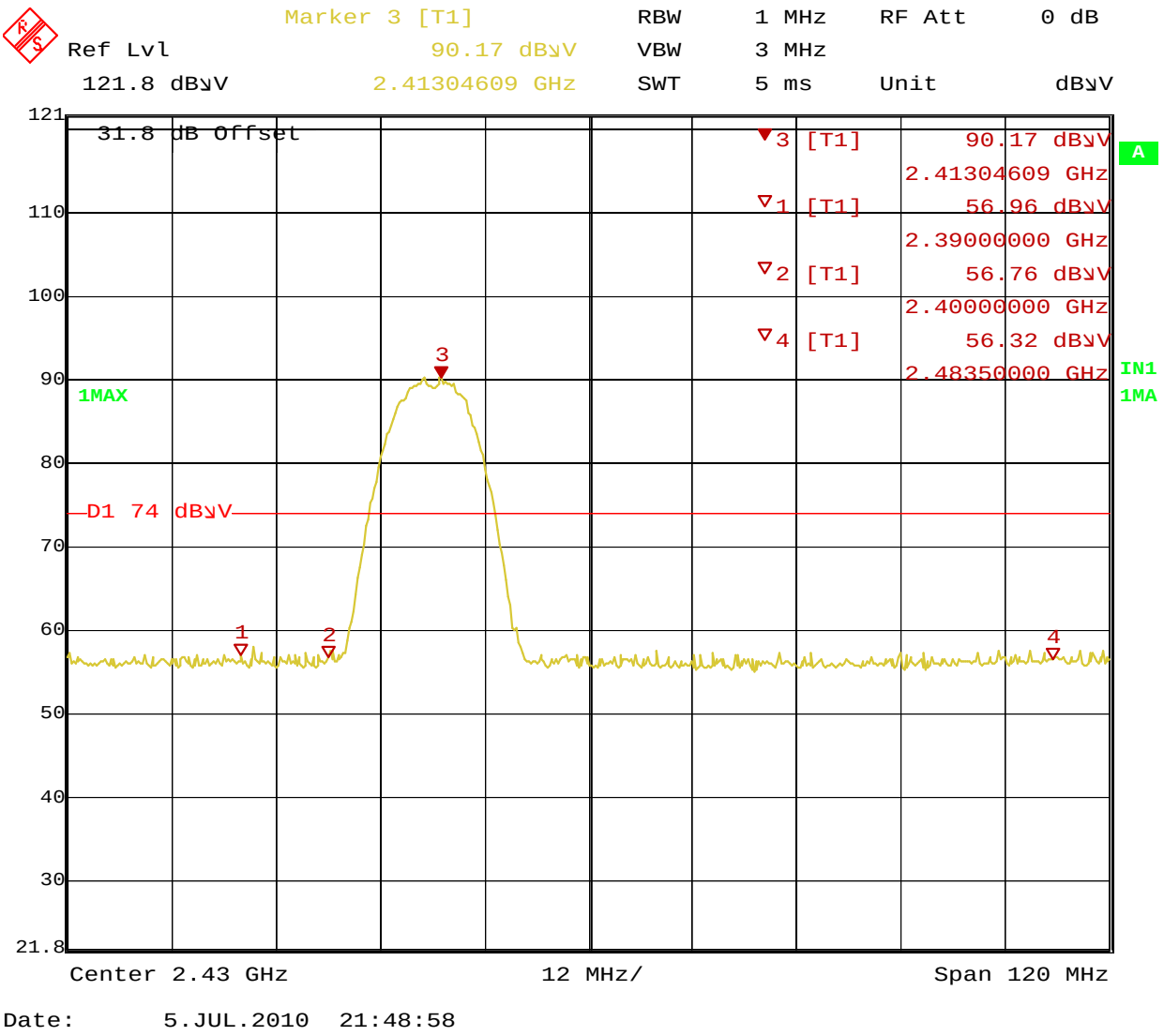

Figure 39: PCB Antenna Emission at the Edge for Channel 2412 MHz at 1 Mbps – Vertical (Peak)

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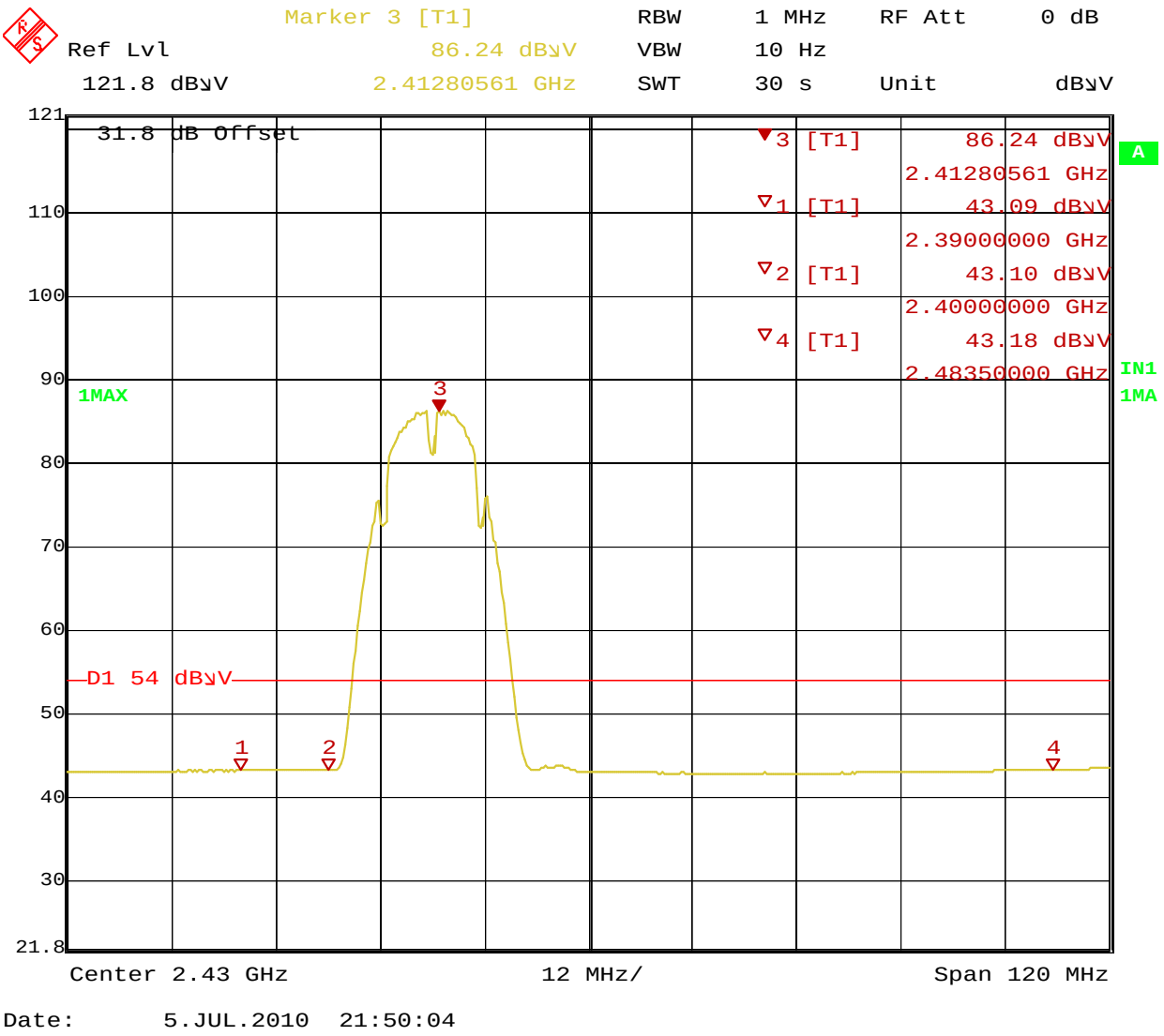

Figure 40: PCB Antenna Emission at the Edge for Channel 2412 MHz at 1 Mbps – Vertical (Ave.)

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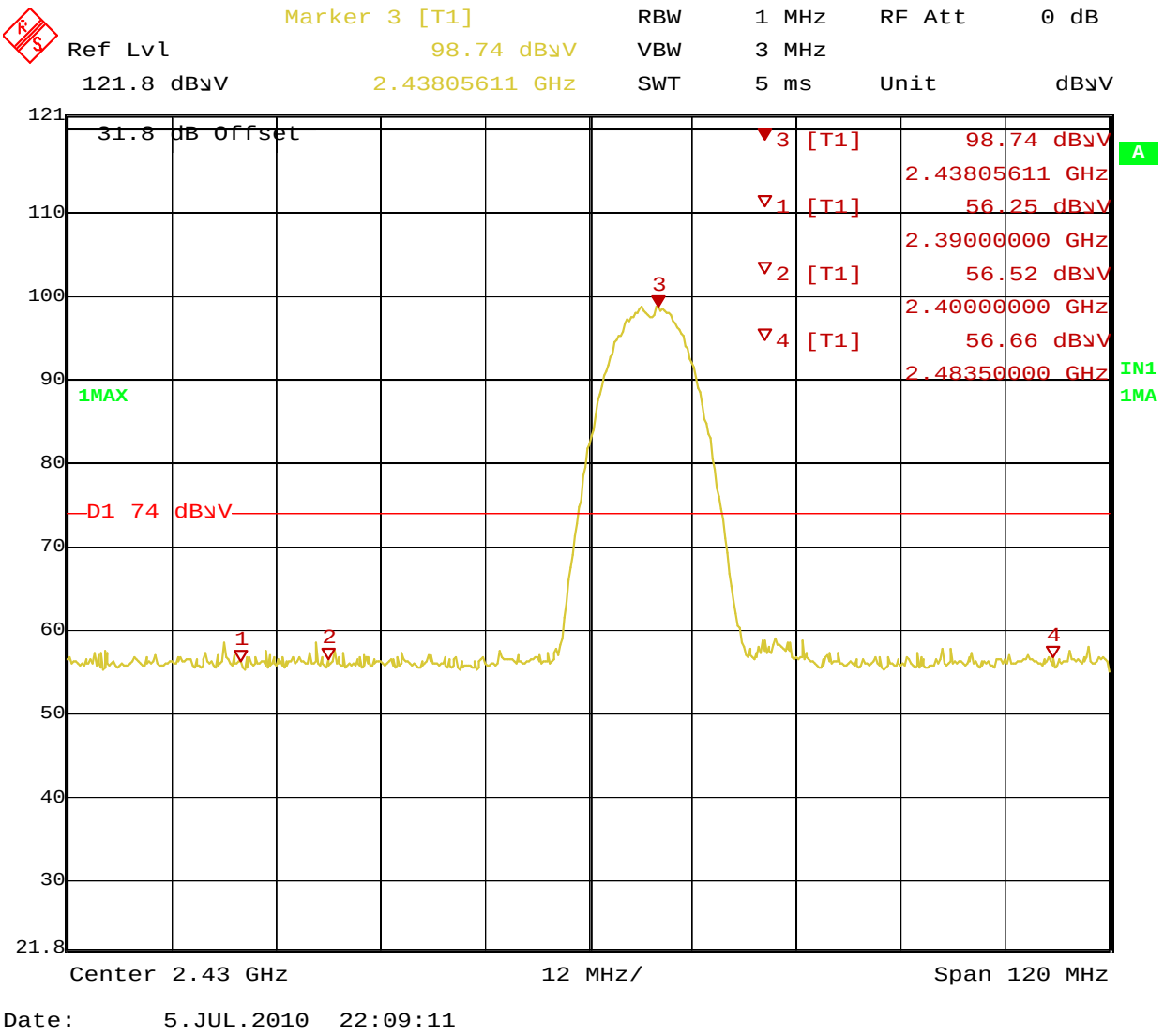

Figure 41: PCB Antenna Emission at the Edge for Channel 2437 MHz at 1 Mbps – Horizontal (Peak)

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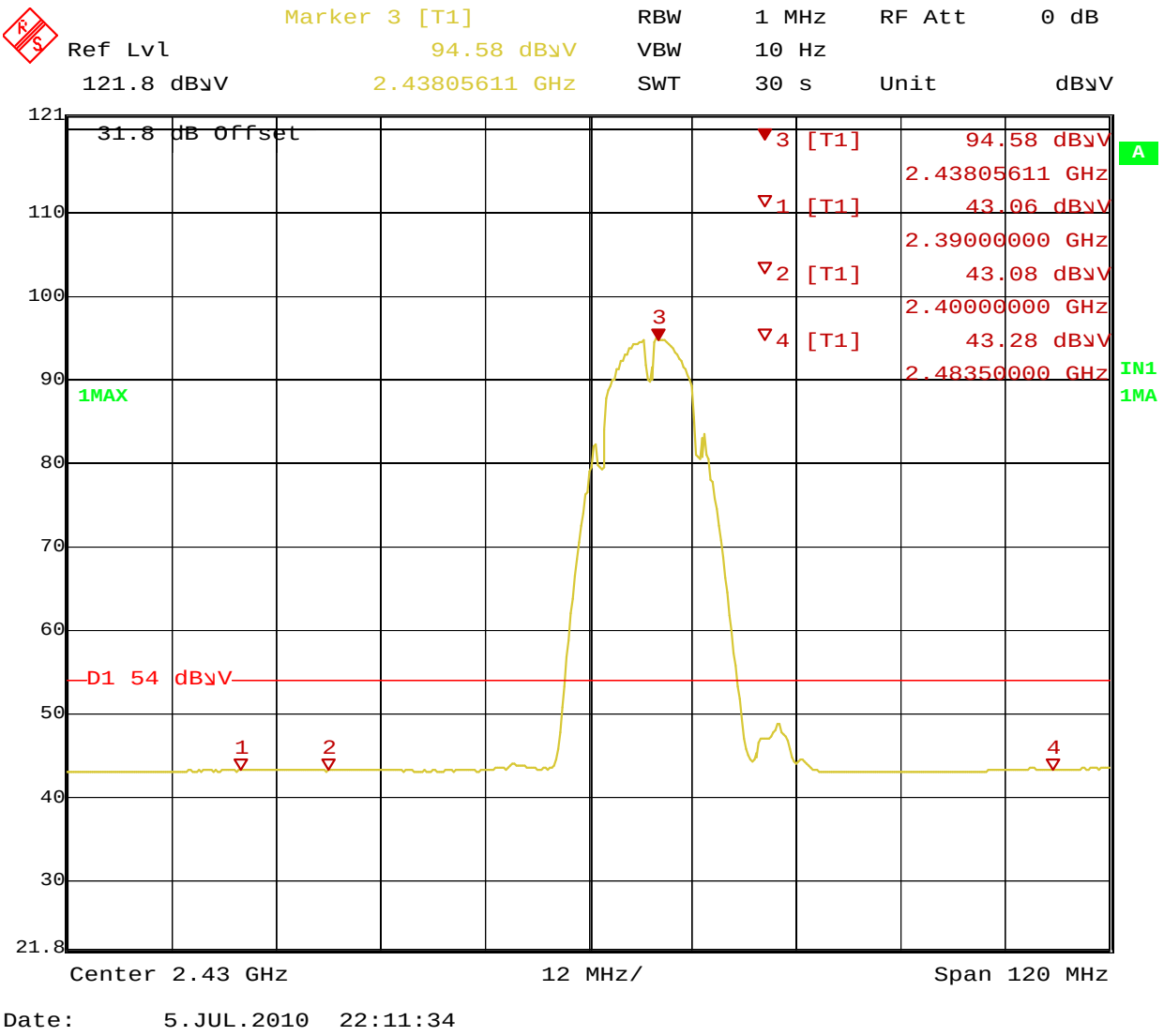

Figure 42: PCB Antenna Emission at the Edge for Channel 2437 MHz at 1 Mbps – Horizontal (Ave.)

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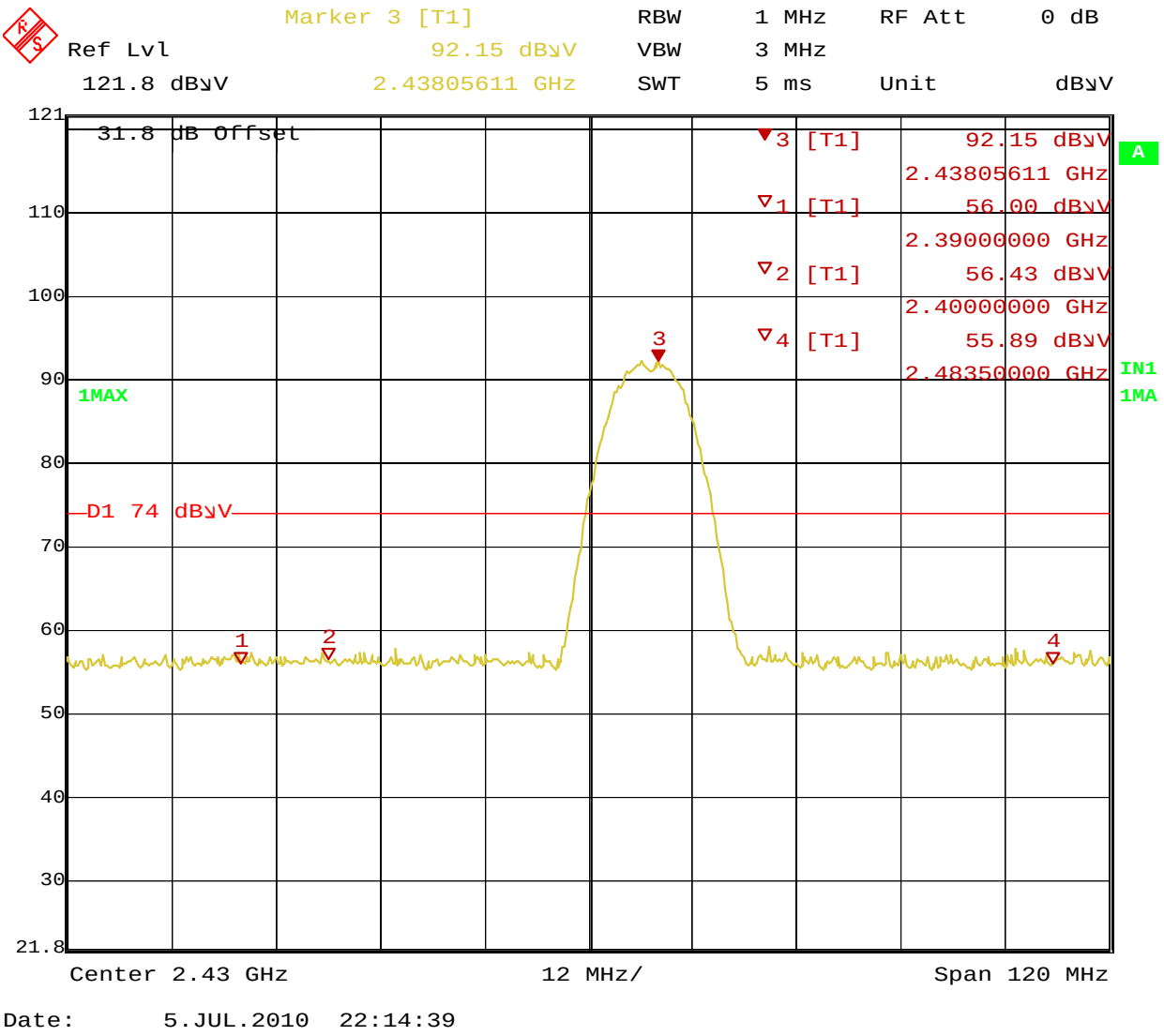

Figure 43: PCB Antenna Emission at the Edge for Channel 2437 MHz at 1 Mbps – Vertical (Peak)

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. This report must not be used by the applicant to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

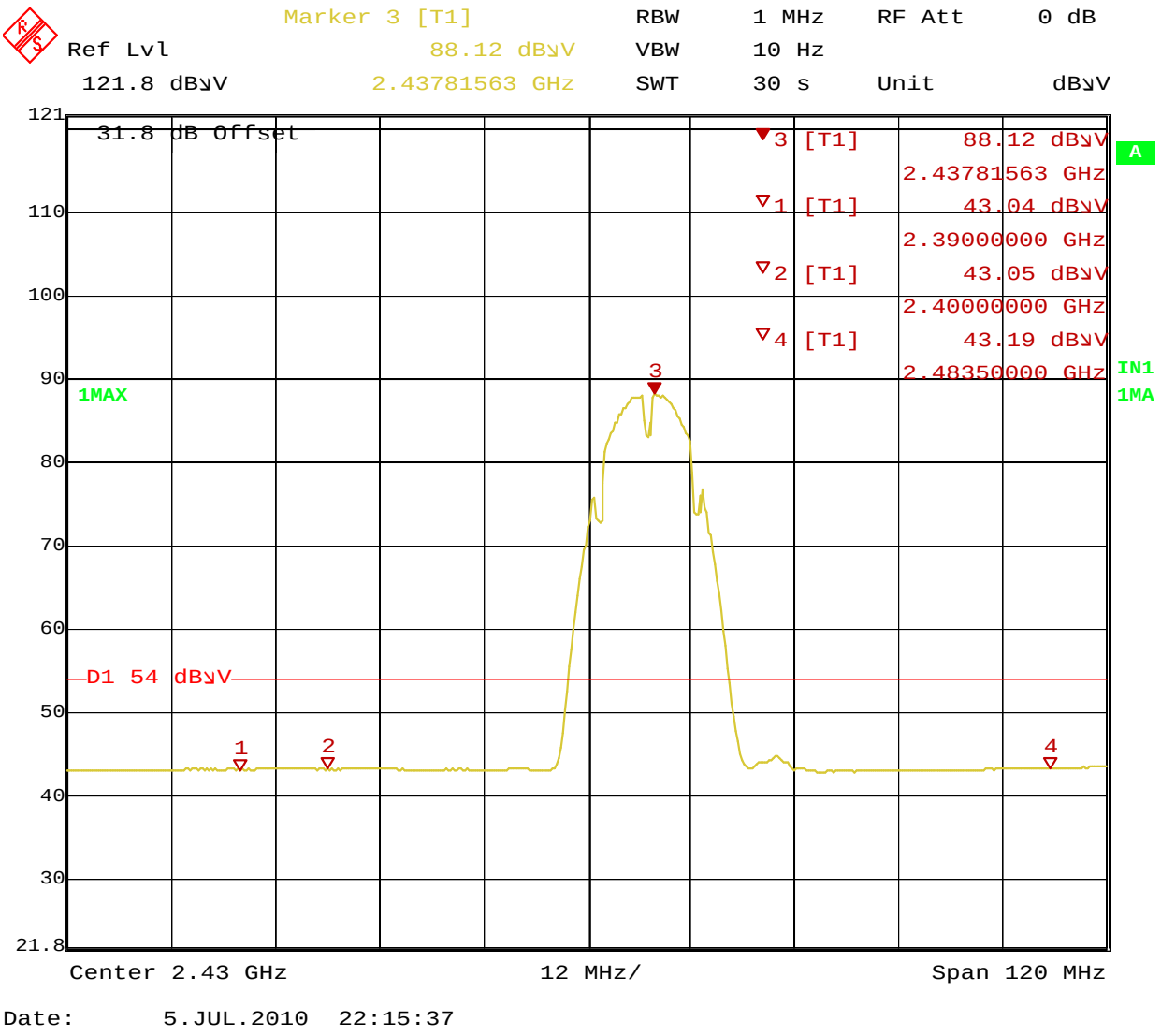

Figure 44: PCB Antenna Emission at the Edge for Channel 2437 MHz at 1 Mbps – Vertical (Ave.)

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. This report must not be used by the applicant to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

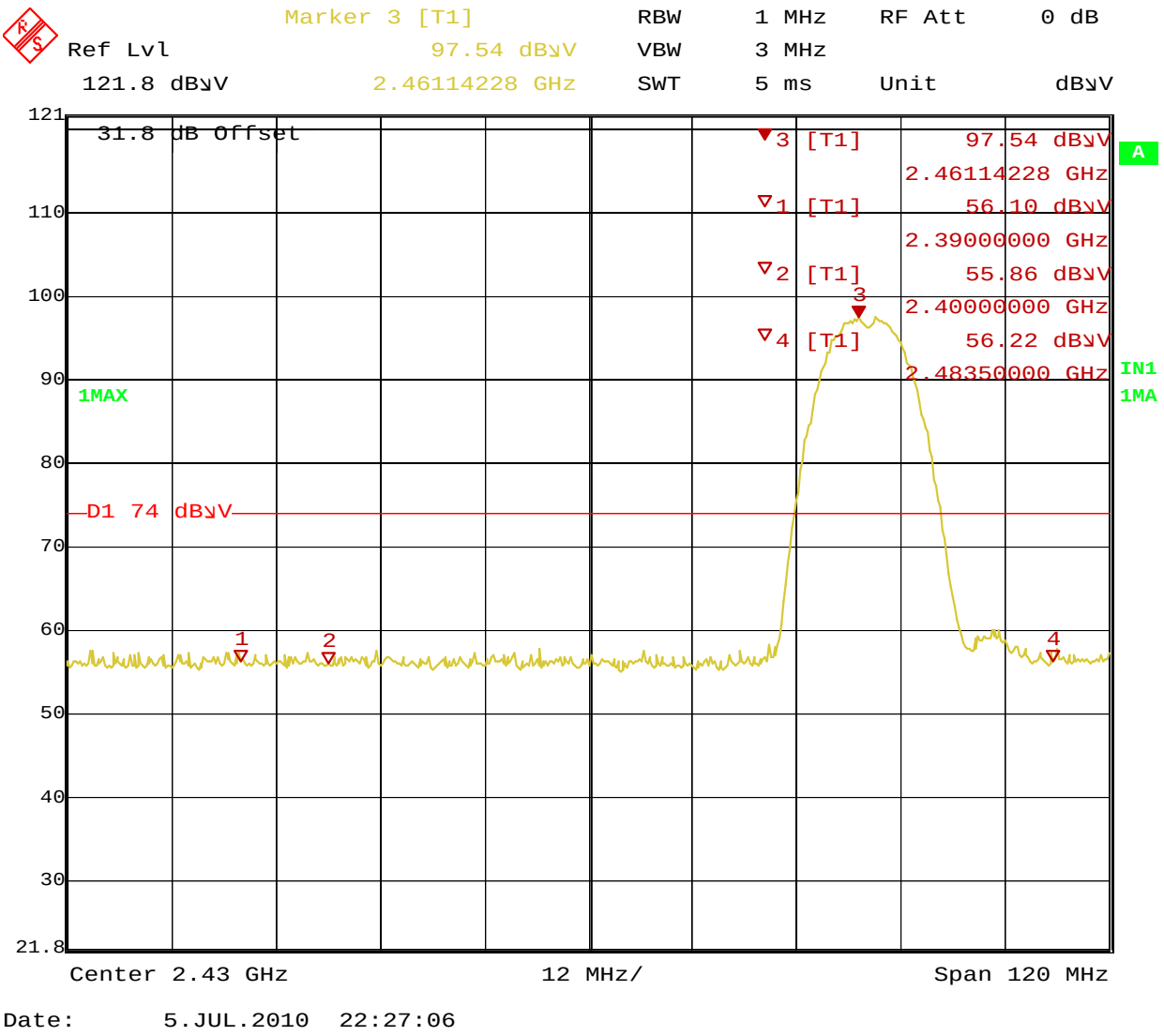

Figure 45: PCB Antenna Emission at the Edge for Channel 2462 MHz at 1 Mbps – Horizontal (Peak)

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. This report must not be used by the applicant to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

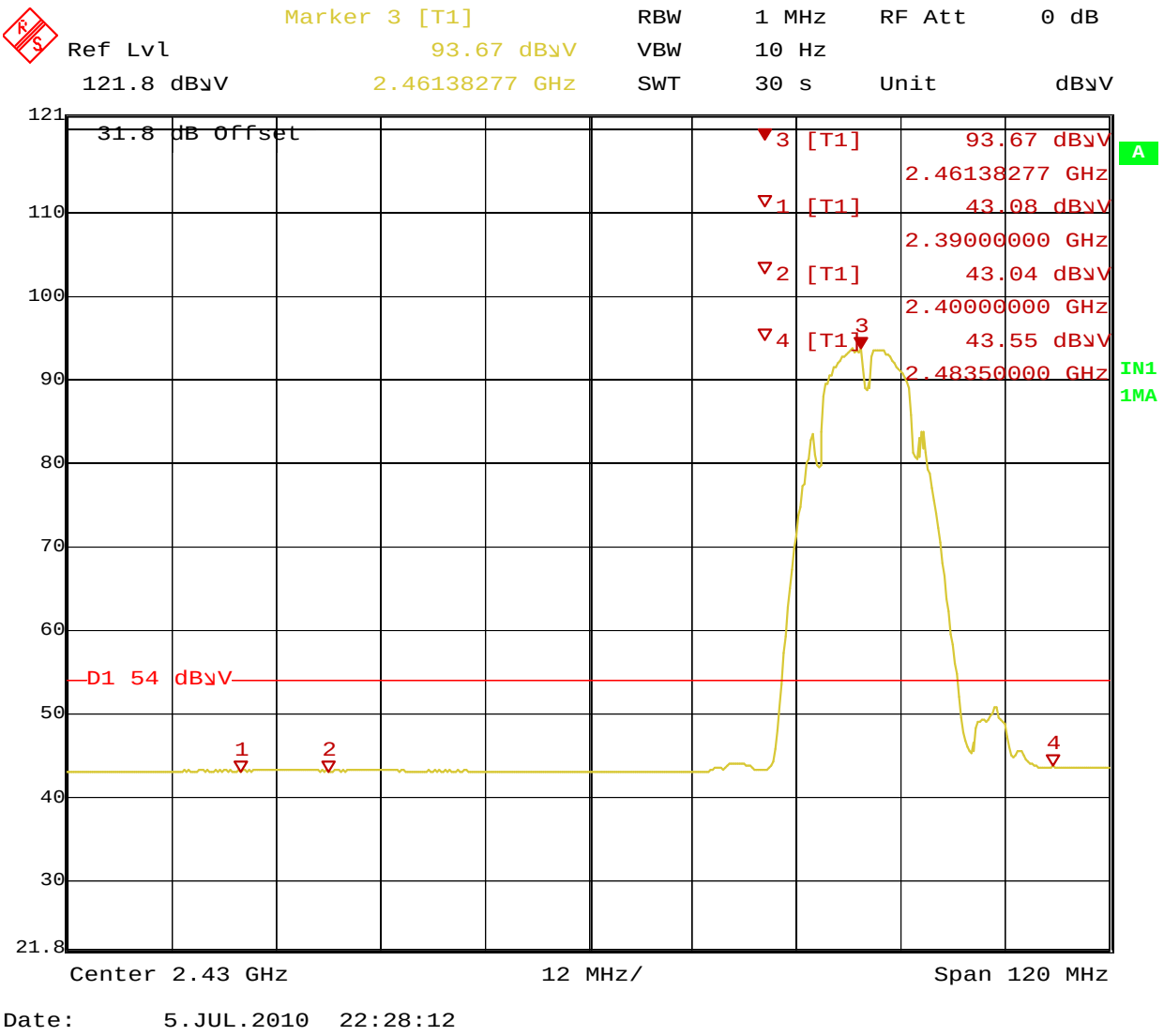

Figure 46: PCB Antenna Emission at the Edge for Channel 2462 MHz at 1 Mbps – Horizontal (Ave.)

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. This report must not be used by the applicant to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

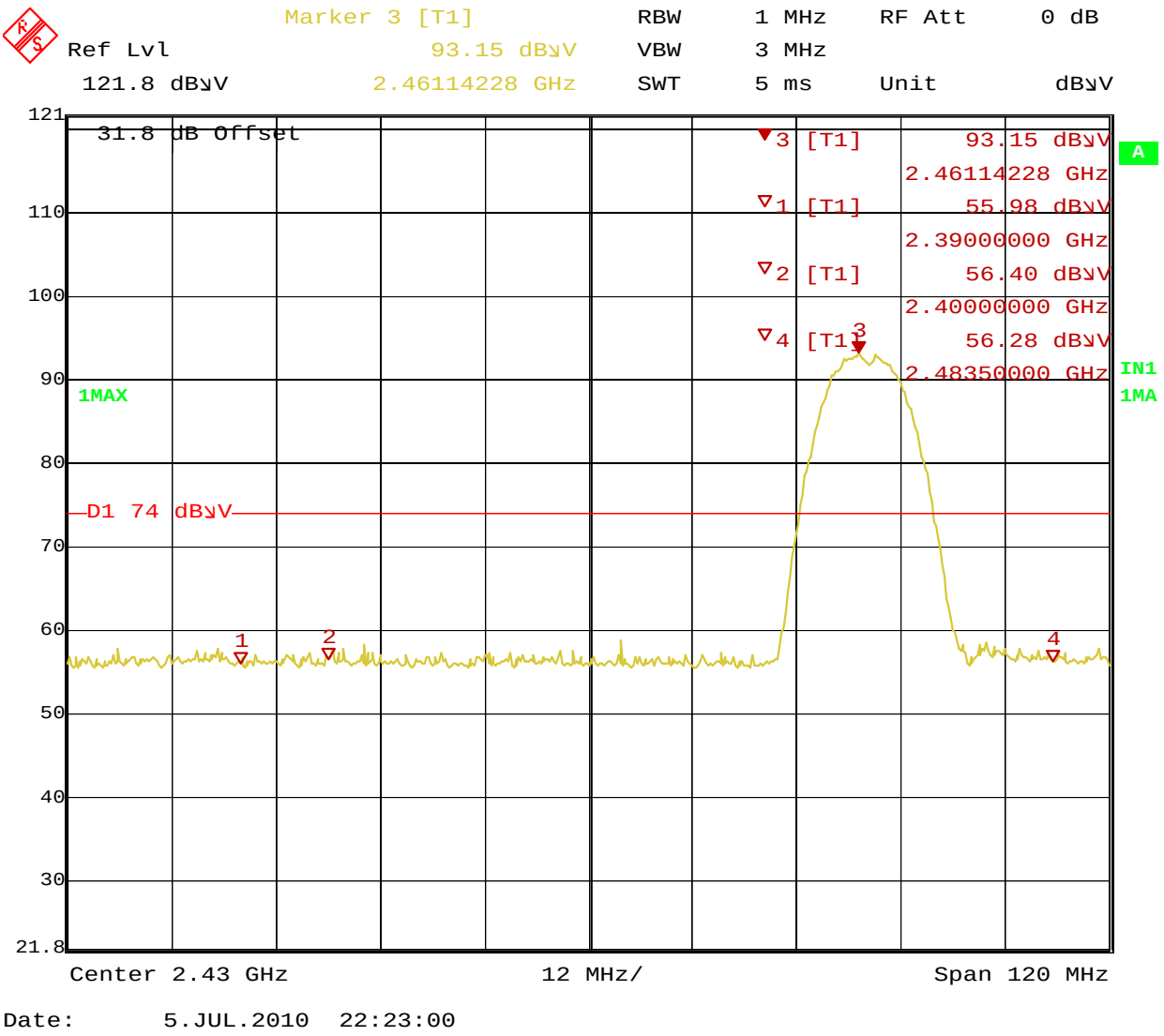

Figure 47: PCB Antenna Emission at the Edge for Channel 2462 MHz at 1 Mbps – Vertical (Peak)

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. This report must not be used by the applicant to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

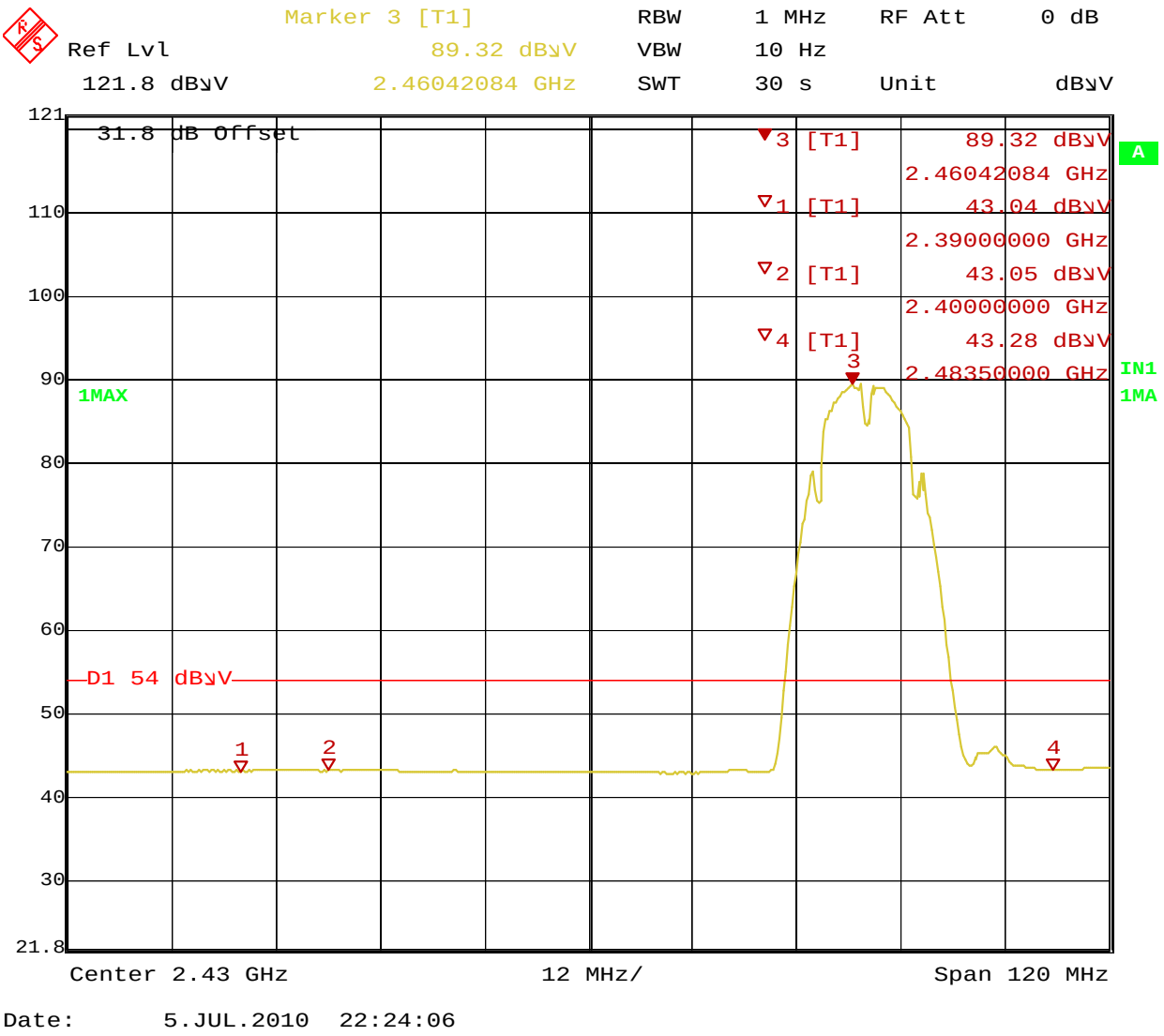

Figure 48: PCB Antenna Emission at the Edge for Channel 2462 MHz at 1 Mbps – Vertical (Ave.)

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EUT Name	Wi-Fi Module	**Date**	July 7, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	23°C / 36% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna laid horizontally	**Line AC / Freq**	120 Vac, 60 Hz
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 (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 2412 MHz										
161.63	H	185	278	37.30	34.28	-10.74	23.54	43.52	-19.98	Spurious
164.59	H	189	317	38.46	34.06	-10.87	23.19	43.52	-20.33	Spurious
260.43	H	110	270	37.32	35.09	-10.35	24.74	46.02	-21.28	Spurious
53.03	V	108	274	51.54	48.52	-16.96	31.56	40.00	-8.44	Spurious
56.78	V	130	350	49.69	47.56	-16.95	30.61	40.00	-9.39	Spurious
86.76	V	125	353	42.19	39.44	-16.58	22.86	40.00	-17.14	Spurious
92.72	V	115	21	44.67	41.72	-16.57	25.15	43.52	-18.37	Spurious
Transmitted Data at 2437 MHz										
52.42	V	133	199	50.71	47.41	-16.90	30.51	40.00	-9.49	Spurious
56.88	V	129	136	49.42	46.31	-16.94	29.37	40.00	-10.63	Spurious
91.01	V	135	288	43.83	41.03	-16.72	24.31	43.52	-19.21	Spurious
92.78	V	106	331	45.10	40.30	-16.56	23.74	43.52	-19.78	Spurious
164.60	H	197	108	38.78	35.17	-10.87	24.30	43.52	-19.22	Spurious
167.51	H	209	302	39.10	36.45	-10.95	25.50	43.52	-18.02	Spurious
257.40	H	119	126	36.89	33.71	-10.54	23.17	46.02	-22.85	Spurious
Transmitted Data at 2462 MHz										
167.55	H	189	110	38.98	35.76	-10.96	24.80	43.52	-18.72	Spurious
257.40	H	134	114	36.89	33.71	-10.54	23.17	46.02	-22.85	Spurious
260.20	H	132	114	37.36	35.48	-10.39	25.09	46.02	-20.93	Spurious
52.75	V	108	146	51.35	48.66	-16.93	31.73	40.00	-8.27	Spurious
56.91	V	135	127	49.37	47.18	-16.94	30.24	40.00	-9.76	Spurious
89.78	V	122	126	44.17	40.90	-16.74	24.16	43.52	-19.36	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 $u_c(y)$ = ± 1.6 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Worst case was observed on the Y-axis, 1Mbps, dipole on horizontal position.

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SOP 1 Radiated Emissions — Tracking # 31051810.001 Page 2 of 16

EUT Name	Wi-Fi Module	**Date**	July 1, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 33% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna laid horizontally	**Line AC / Freq**	120 Vac, 60 Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
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										
4824.05	V	292	112	47.72	45.86	5.08	50.94	53.98	-3.04	Restricted
4824.09	H	231	106	41.10	37.32	5.08	42.40	53.98	-11.58	Restricted
9648.05	V	342	84	43.87		12.73	56.60	87.20	-30.60	Unrestricted
9648.06	H	98	91	42.12		12.73	54.85	87.20	-32.35	Unrestricted
19296.00	V	121	310	32.92	28.10	11.36	39.46	63.98	-24.52	Restricted
19296.10	H	120	139	31.54	26.52	11.36	37.88	63.98	-26.10	Restricted
Transmitted Data at 2437 MHz at 802.11b, 1Mbit/s										
4874.04	H	289	104	42.99	36.94	5.25	42.19	53.98	-11.79	Restricted
4874.05	V	287	114	48.37	46.26	5.25	51.50	53.98	-2.48	Restricted
9748.05	H	246	73	41.63		12.84	51.19	87.84	-36.65	Unrestricted
9748.06	V	279	272	41.55		12.84	51.17	87.84	-36.67	Unrestricted
19496.00	H	110	278	33.39	29.84	11.55	41.39	63.98	-22.59	Restricted
19496.00	V	115	1	33.72	27.60	11.55	39.15	63.98	-24.83	Restricted
Transmitted Data at 2462 MHz at 802.11b, 1Mbit/s										
4924.06	V	313	119	45.53	41.98	5.38	41.98	53.98	-6.63	Restricted
4924.06	H	136	101	41.05	37.20	5.38	37.20	53.98	-11.40	Restricted
9848.07	H	156	67	39.75		12.94	52.69	85.50	-32.81	Unrestricted
9848.07	V	213	71	38.12		12.94	51.06	85.50	-34.44	Unrestricted
19696.00	V	128	0	33.92	29.26	11.71	40.97	63.98	-23.01	Restricted
19696.00	H	120	4	32.29	27.25	11.71	38.96	63.98	-25.02	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 $u_c(y)$ = ± 1.6 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Worst case was observed on the Y-axis, 1Mbps, dipole on horizontal position.
1 GHz – 25 GHz Setting: RBW = 1 MHz/ VBW = 3 MHz
20 dBr, from the fundamental emission, limit applied to the unrestricted band emission.

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EUT Name	Wi-Fi Module	**Date**	July 7, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 37% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	2dBi ext. PCB Antenna laid horizontally	**Line AC / Freq**	120 Vac, 60 Hz
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 2412 MHz										
53.83	V	119	103	51.79	48.88	-17.02	31.86	40.00	-8.14	Spurious
56.82	V	116	355	51.47	49.16	-16.95	32.21	40.00	-7.79	Spurious
92.02	V	137	43	44.41	42.17	-16.64	25.53	43.52	-17.99	Spurious
120.35	V	110	64	34.90	32.17	-9.90	22.27	43.52	-21.25	Spurious
182.56	V	112	90	32.82	30.84	-11.86	18.98	43.52	-24.54	Spurious
179.50	H	132	142	37.36	32.74	-11.81	20.93	43.52	-22.59	Spurious
290.07	H	107	317	36.44	33.73	-8.87	24.86	46.02	-21.16	Spurious
Transmitted Data at 2437 MHz										
179.50	H	124	115	36.41	32.22	-11.81	20.41	43.52	-23.11	Spurious
290.21	H	117	308	36.01	33.09	-8.86	24.23	46.02	-21.79	Spurious
53.98	V	106	54	52.42	49.57	-17.04	32.53	40.00	-7.47	Spurious
56.86	V	112	340	52.54	49.75	-16.95	32.80	40.00	-7.20	Spurious
92.80	V	106	94	44.63	41.89	-16.56	25.33	43.52	-18.19	Spurious
119.55	V	127	215	34.44	31.44	-10.03	21.41	43.52	-22.11	Spurious
179.38	V	111	160	30.47	27.04	-11.80	15.24	43.52	-28.28	Spurious
290.16	V	119	103	32.76	29.62	-8.86	20.76	46.02	-25.26	Spurious
Transmitted Data at 2462 MHz										
53.91	V	125	247	51.86	48.69	-17.03	31.66	40.00	-8.34	Spurious
56.87	V	141	143	51.89	48.81	-16.94	31.87	40.00	-8.13	Spurious
92.78	V	109	55	45.72	41.34	-16.56	24.78	43.52	-18.74	Spurious
179.57	H	130	339	36.48	33.22	-11.81	21.41	43.52	-22.11	Spurious
290.29	H	102	128	35.42	29.17	-8.85	20.32	46.02	-25.70	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 $u_c(y)$ = ± 1.6 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Worst case was observed on the Y-axis, 1Mbps, PCB on horizontal position.

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SOP 1 Radiated Emissions — Tracking # 31051810.001 Page 4 of 16

EUT Name	Wi-Fi Module	**Date**	July 1, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 33% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	2dBi external PCB antenna laid horizontally	**Line AC / Freq**	120 Vac, 60 Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
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										
4824.05	V	185	83	45.29	43.47	5.08	48.55	53.98	-5.43	Restricted
4824.07	H	238	89	43.85	39.33	5.08	44.41	53.98	-9.57	Restricted
9648.05	H	251	71	44.51		12.77	57.28	75.63	-18.35	Unrestricted
9648.06	V	221	132	47.85		12.77	60.62	75.63	-15.01	Unrestricted
19296	V	115	129	29.83	24.81	11.36	36.17	63.98	-27.81	Restricted
19296	H	116	298	33.44	28.56	11.36	39.92	63.98	-24.06	Restricted
Transmitted Data at 2437 MHz at 802.11b, 1Mbit/s										
4874.03	H	288	88	44.92	40.89	5.25	46.14	53.98	-7.84	Restricted
4874.03	V	205	77	48.64	46.02	5.25	51.27	53.98	-2.71	Restricted
9748.05	H	247	67	44.59		12.84	57.43	78.74	-21.31	Unrestricted
9748.07	V	249	129	43.82		12.84	56.66	78.74	-22.08	Unrestricted
19496	V	109	301	32.79	27.89	11.55	39.44	63.98	-24.54	Restricted
19496	H	119	300	36.82	29.16	11.55	40.71	63.98	-23.27	Restricted
Transmitted Data at 2462 MHz at 802.11b, 1Mbit/s										
4924.05	H	205	434	44.05	39.06	5.38	44.44	53.98	-9.54	Restricted
4924.07	V	260	114	46.5	44.93	5.38	50.31	53.98	-3.67	Restricted
9848.05	H	169	81	39.95		12.9	52.85	77.54	-24.69	Unrestricted
9848.05	V	272	476	44.56		12.9	57.46	77.54	-20.08	Unrestricted
19696	H	100	302	32.29	28.24	11.71	39.95	63.98	-24.03	Restricted
19696	V	103	-64	31.21	25.78	11.71	37.49	63.98	-26.49	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 $u_c(y)$ = ± 1.6 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Worst case was observed on the Y-axis, 1Mbps, PCB Antenna laid on horizontal position.
1 GHz – 25 GHz Setting: RBW = 1 MHz/ VBW = 3 MHz
20 dBr, from the fundamental emission, limit applied to the unrestricted band emission.

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SOP 1 Radiated Emissions

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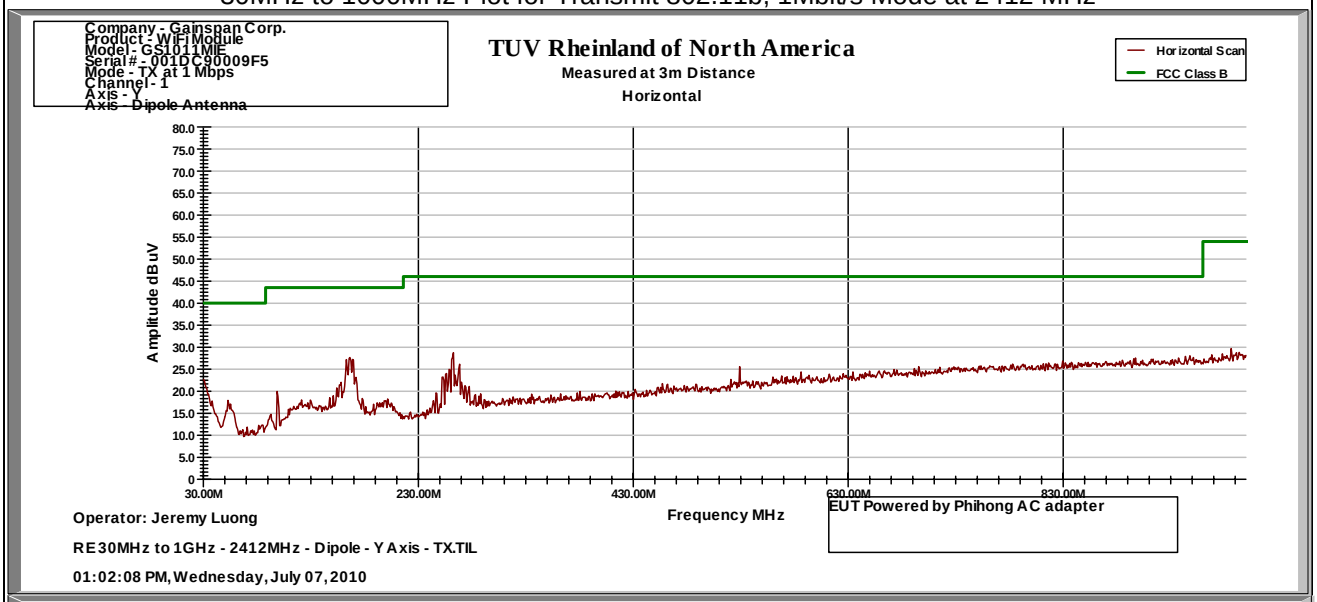
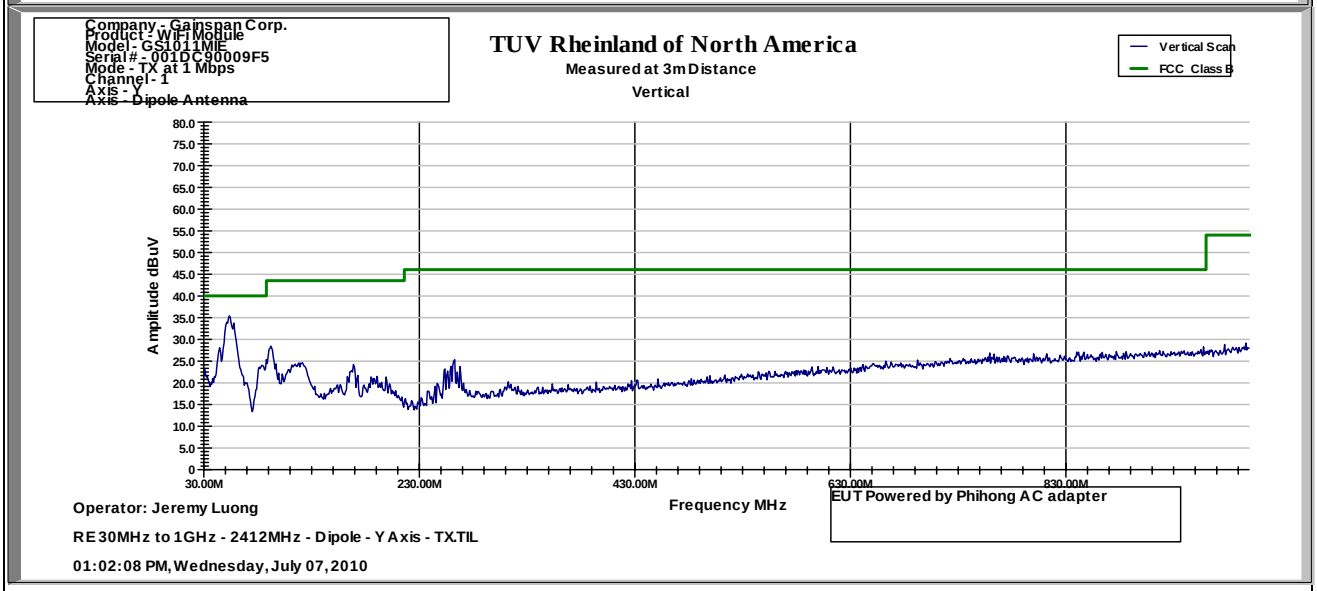
EUT Name	Wi-Fi Module	**Date**	July 7, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 33% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna laid horizontally	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz / 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

30MHz to 1000MHz Plot for Transmit 802.11b, 1Mbit/s Mode at 2412 MHz





Notes: None.

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SOP 1 Radiated Emissions

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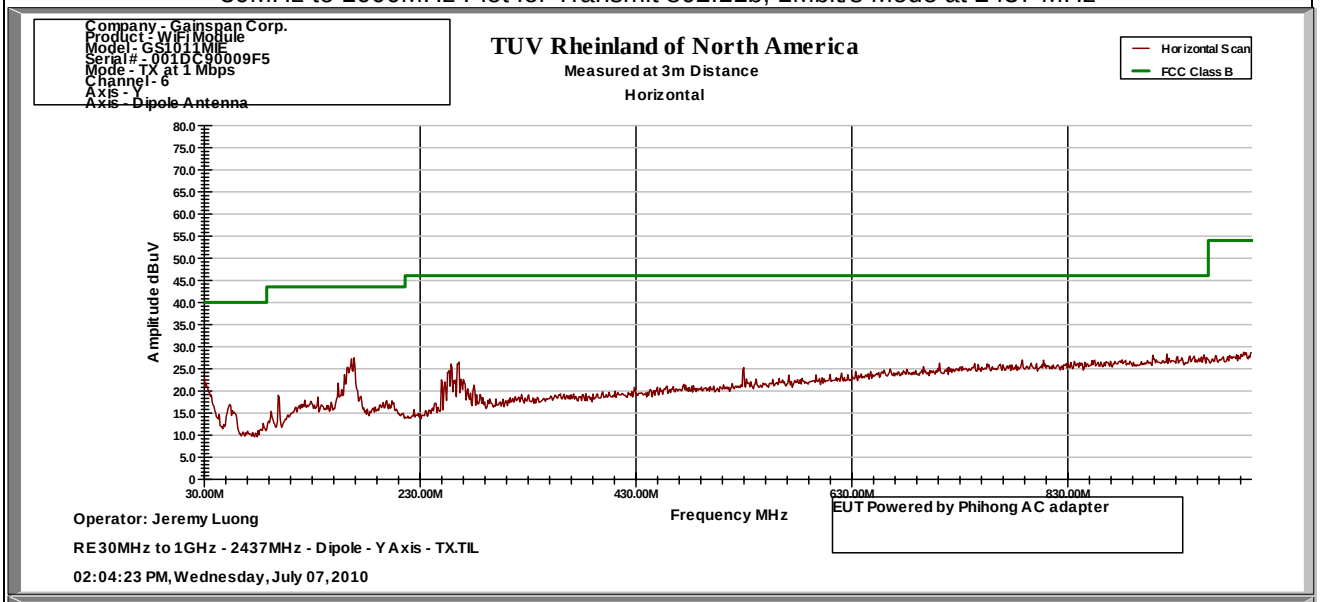
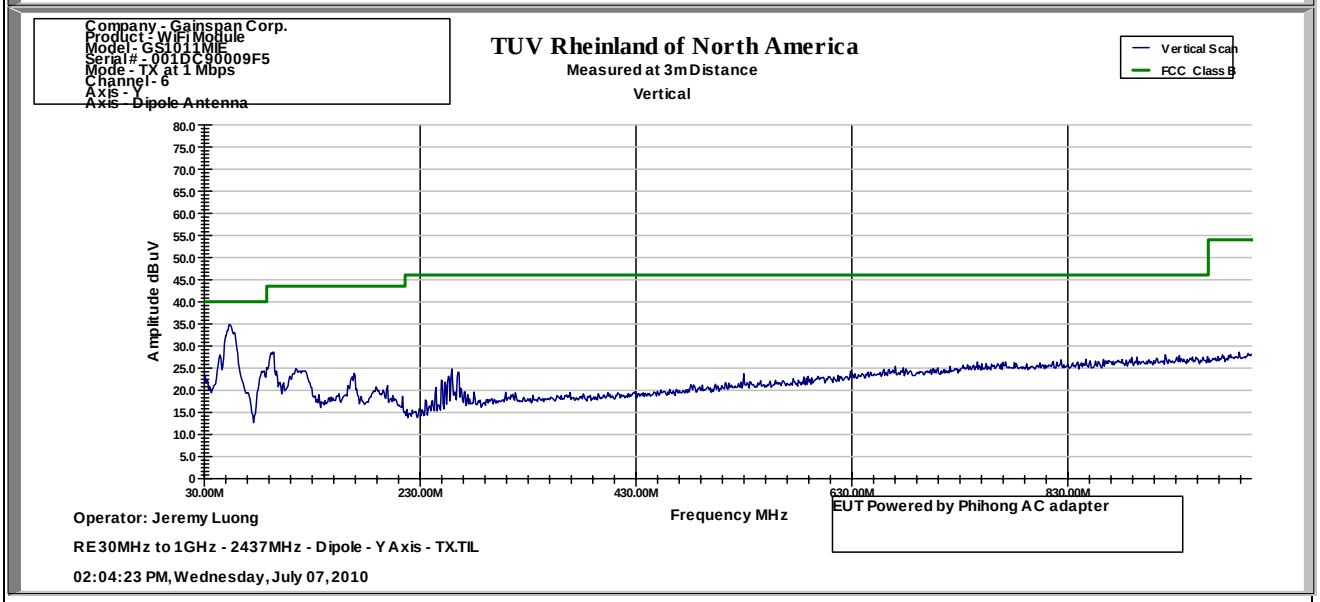
EUT Name	Wi-Fi Module	**Date**	July 7, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 33% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna laid horizontally	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz / 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

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





Notes: None.

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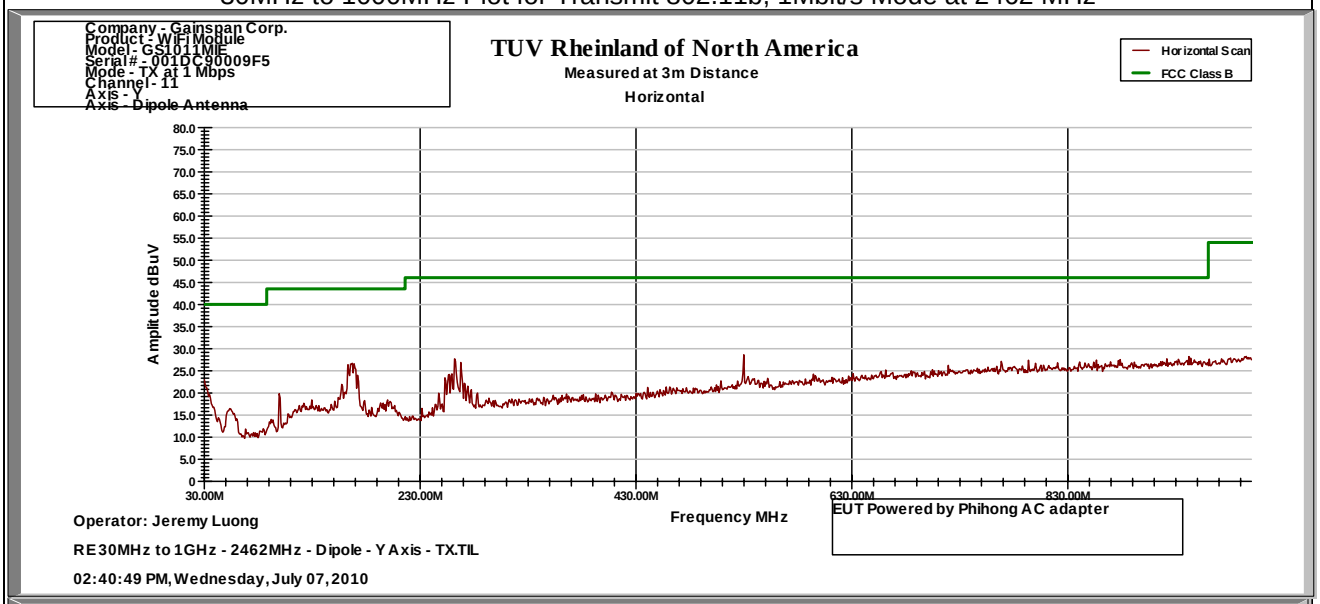
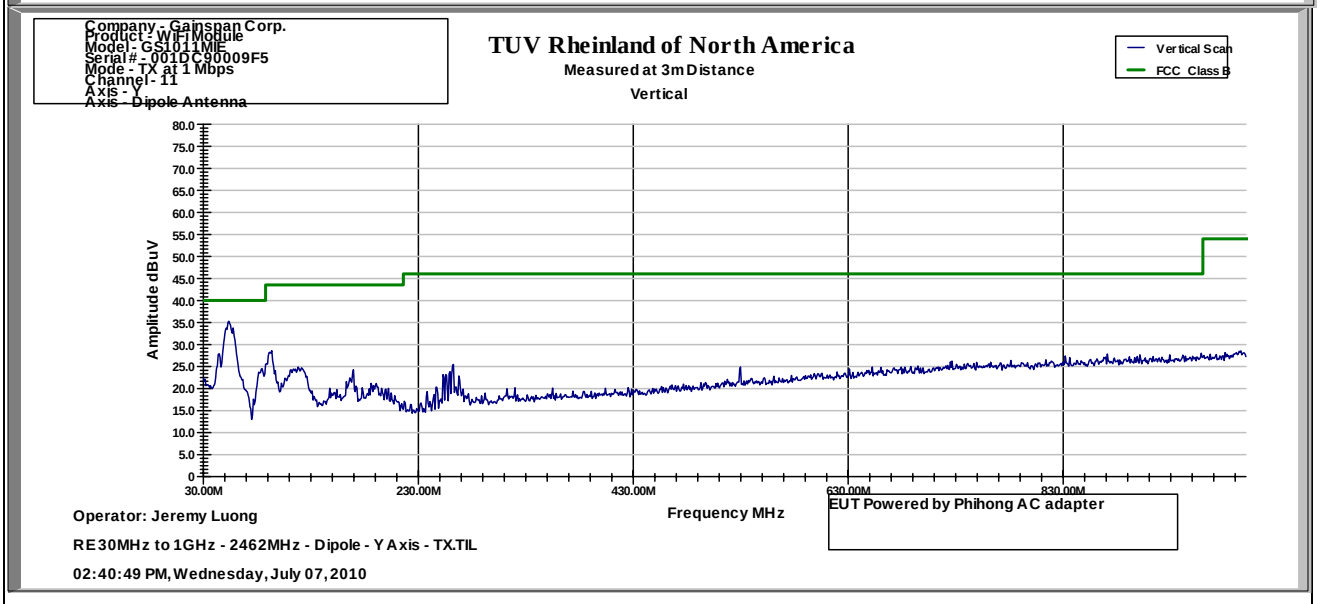
SOP 1 Radiated Emissions

Tracking # 31051810.001 Page 7 of 16

EUT Name	Wi-Fi Module	**Date**	July 7, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 33% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna laid horizontally	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz / 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

30MHz to 1000MHz Plot for Transmit 802.11b, 1Mbit/s Mode at 2462 MHz





Notes: None.

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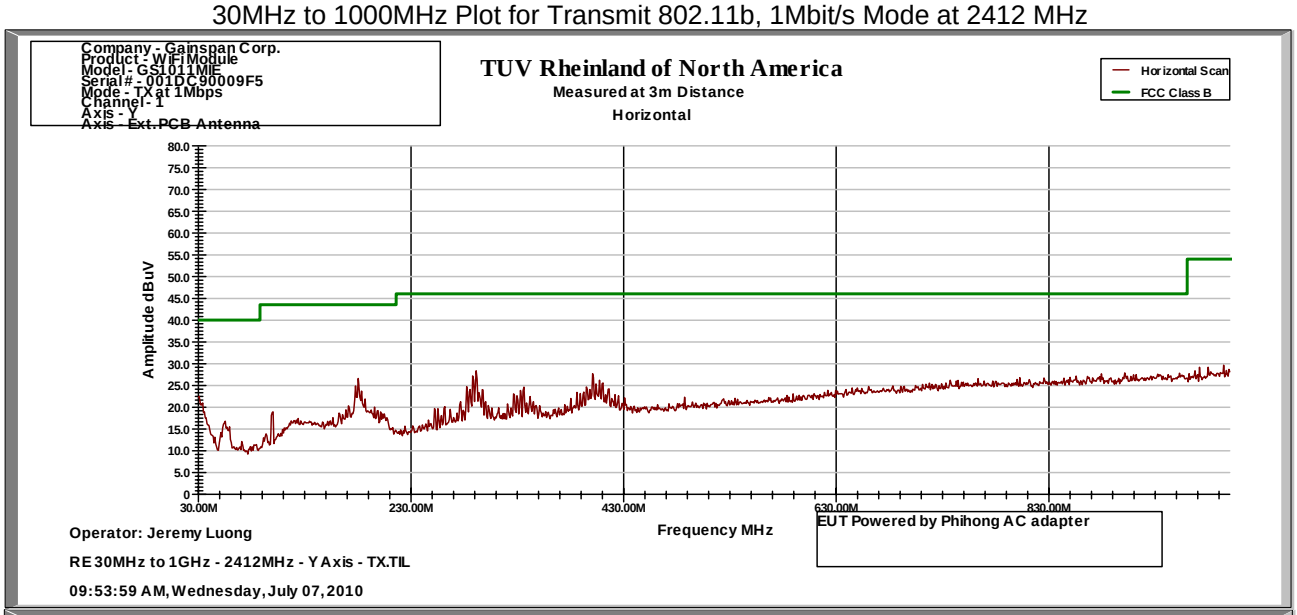
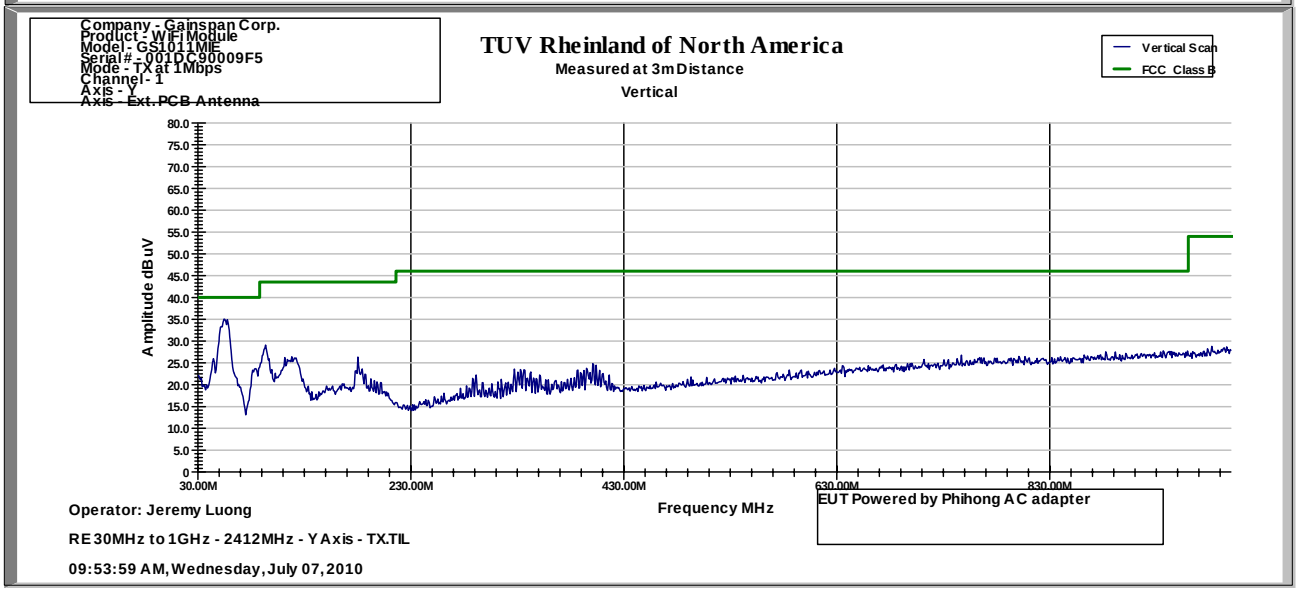
SOP 1 Radiated Emissions

Tracking # 31051810.001 Page 8 of 16

EUT Name	Wi-Fi Module	**Date**	July 7, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 33% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	2 dBi PCB Antenna laid horizontally	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz / 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

30MHz to 1000MHz Plot for Transmit 802.11b, 1Mbit/s Mode at 2412 MHz





Notes: None.

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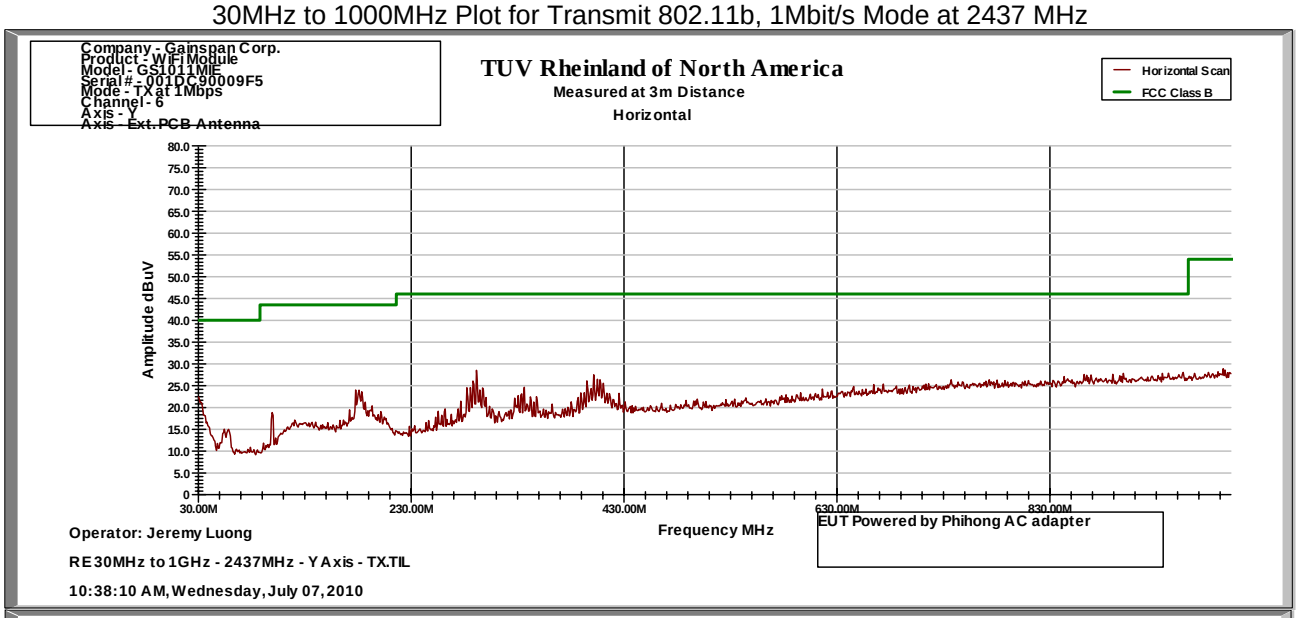
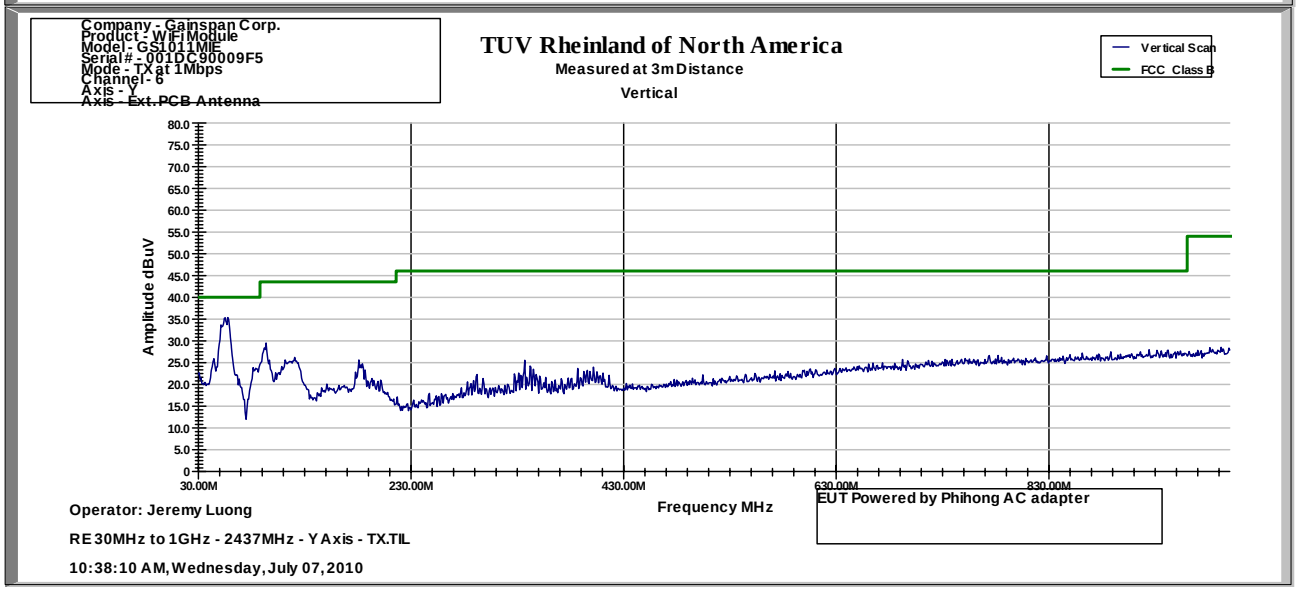
EUT Name	Wi-Fi Module	**Date**	July 7, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 33% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	2dBi PCB Antenna laid horizontally	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz / 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

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





Notes: None.

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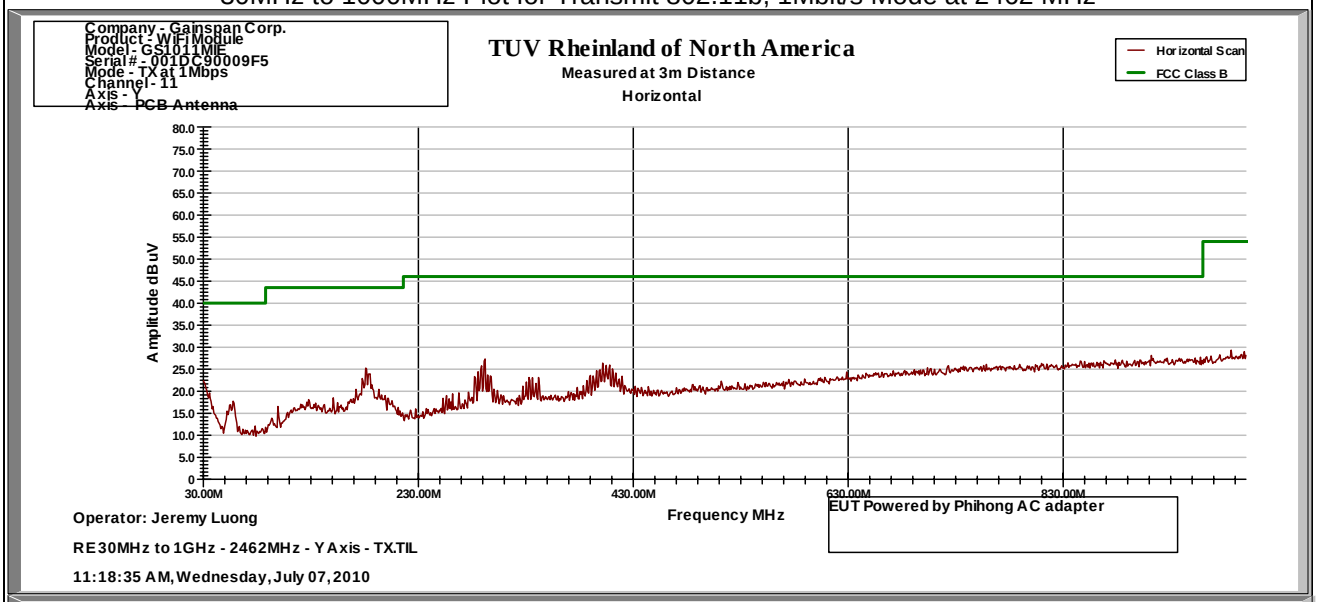
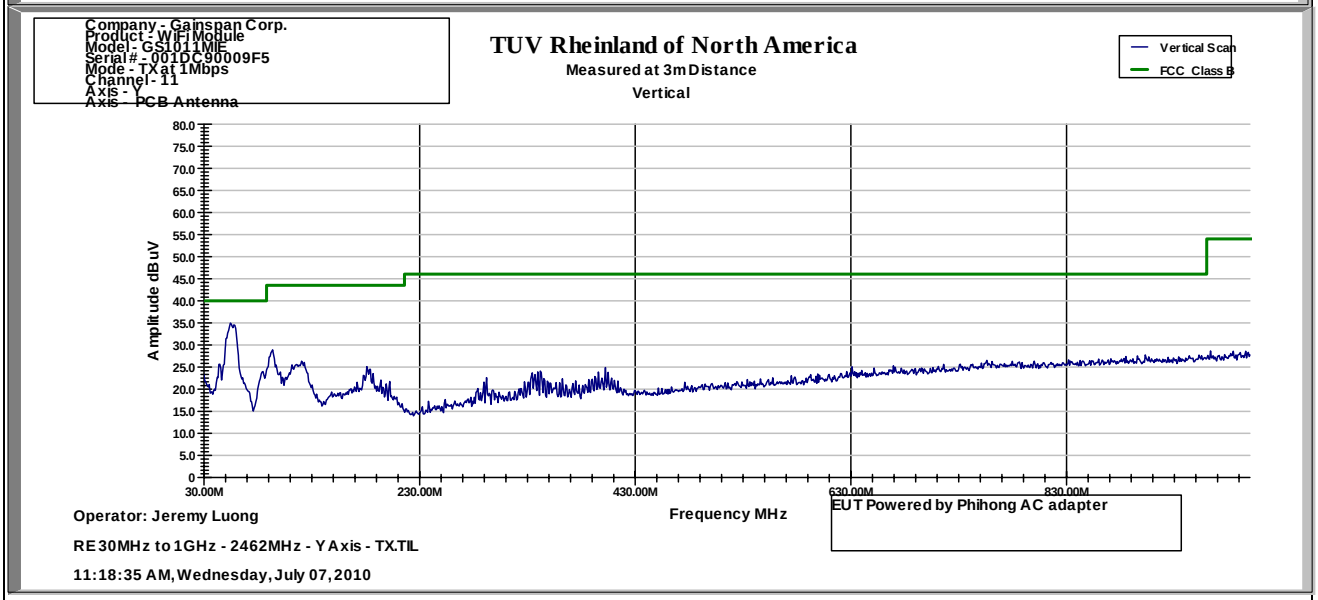
EUT Name	Wi-Fi Module	**Date**	July 7, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 33% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	2dBi PCB Antenna laid horizontally	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz / 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

30MHz to 1000MHz Plot for Transmit 802.11b, 1Mbit/s Mode at 2462 MHz





Notes: None.

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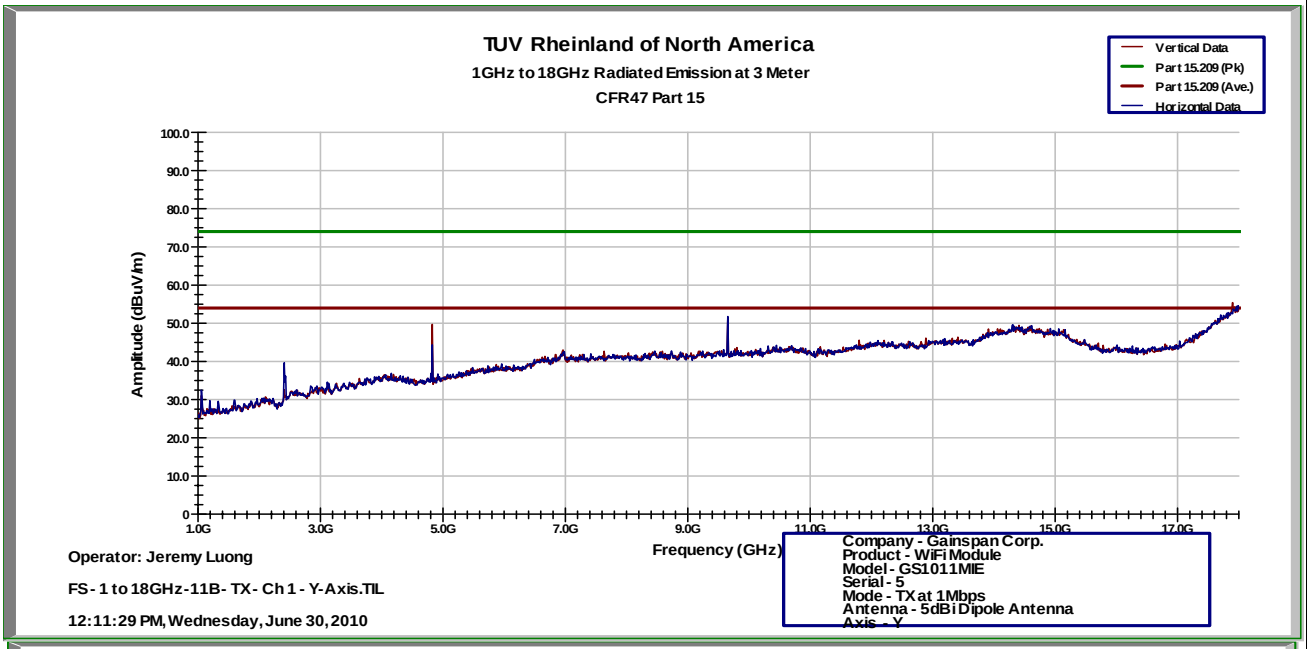
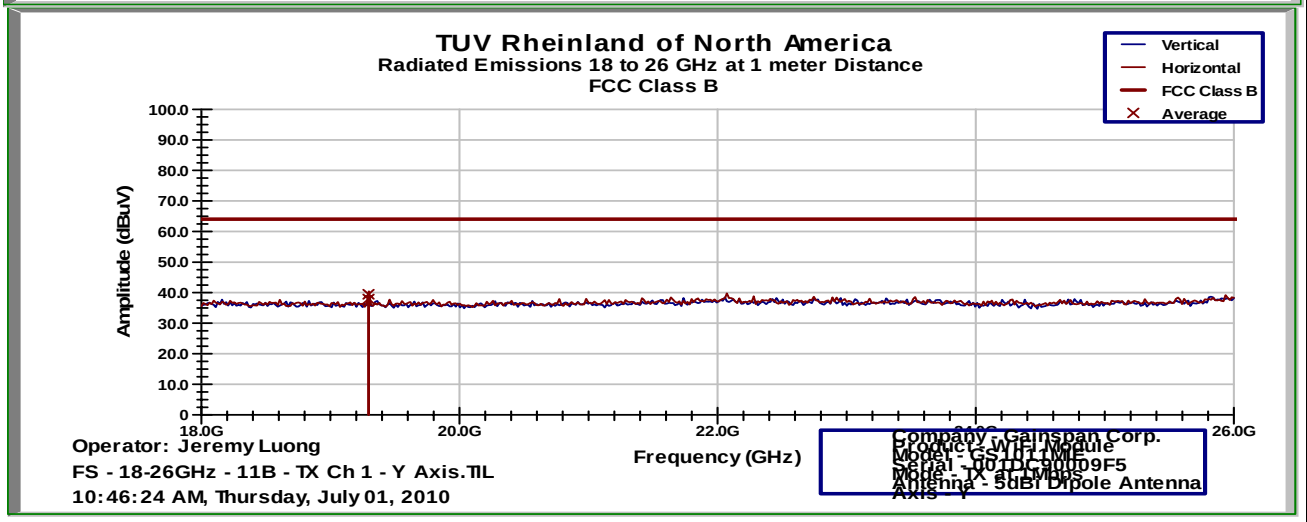
EUT Name	Wi-Fi Module	**Date**	July 1, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 33% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna laid horizontally	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m – EMCO3115 / 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.
30 MHz – 1000 MHz Setting: RBW = 120 kHz / VBW = 300 kHz
1 GHz – 25 GHz Setting: RBW = 1 MHz/ VBW = 3 MHz

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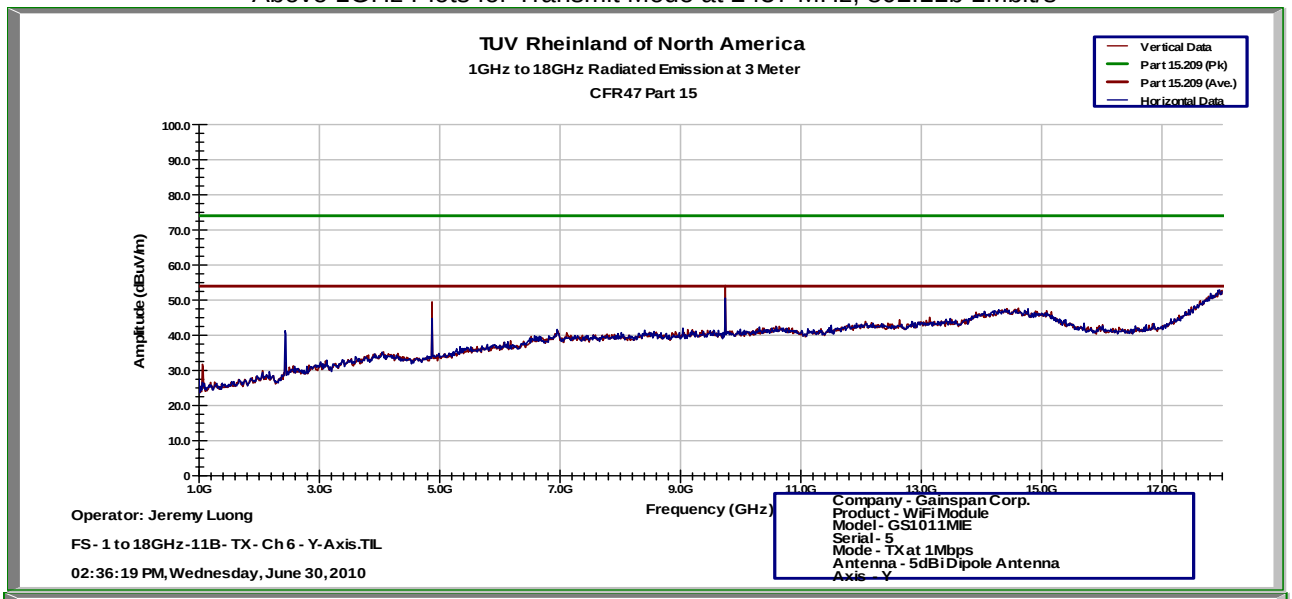
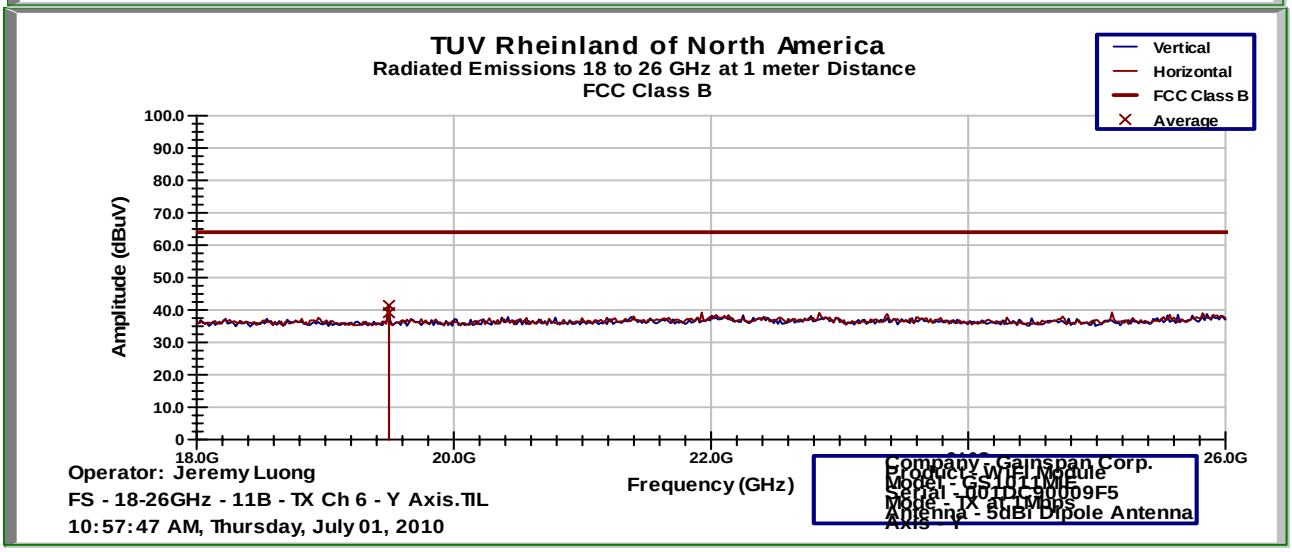
EUT Name	Wi-Fi Module	**Date**	July 1, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 33% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna laid horizontally	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m – EMCO3115 / 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.
30 MHz – 1000 MHz Setting: RBW = 120 kHz / VBW = 300 kHz
1 GHz – 25 GHz Setting: RBW = 1 MHz/ VBW = 3 MHz

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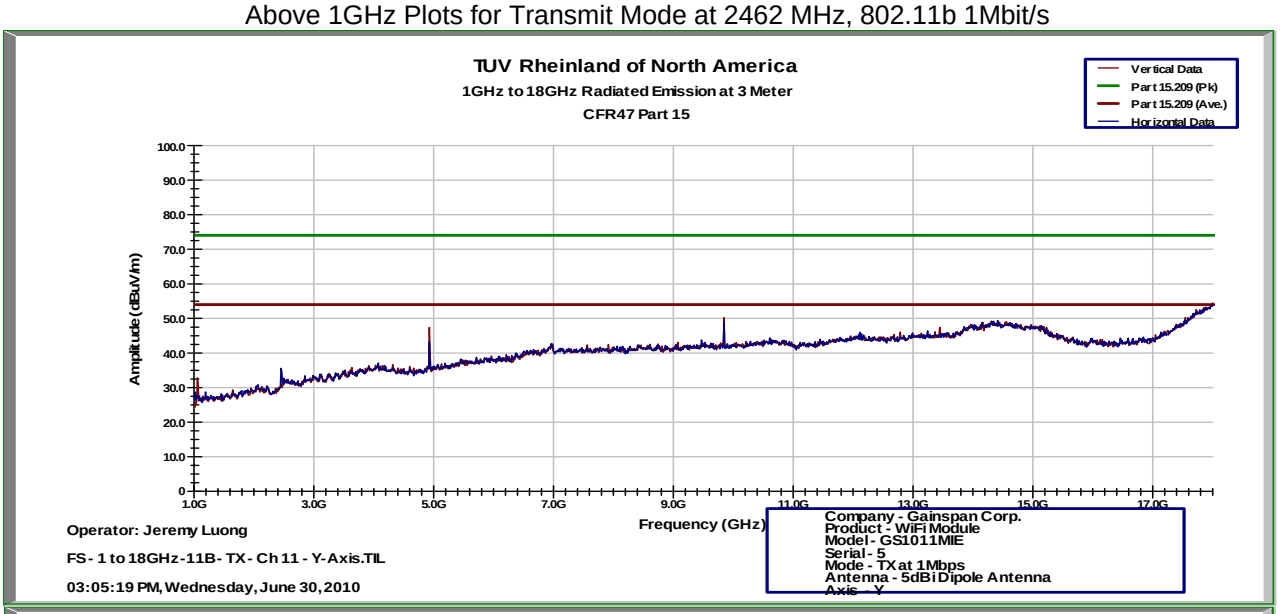
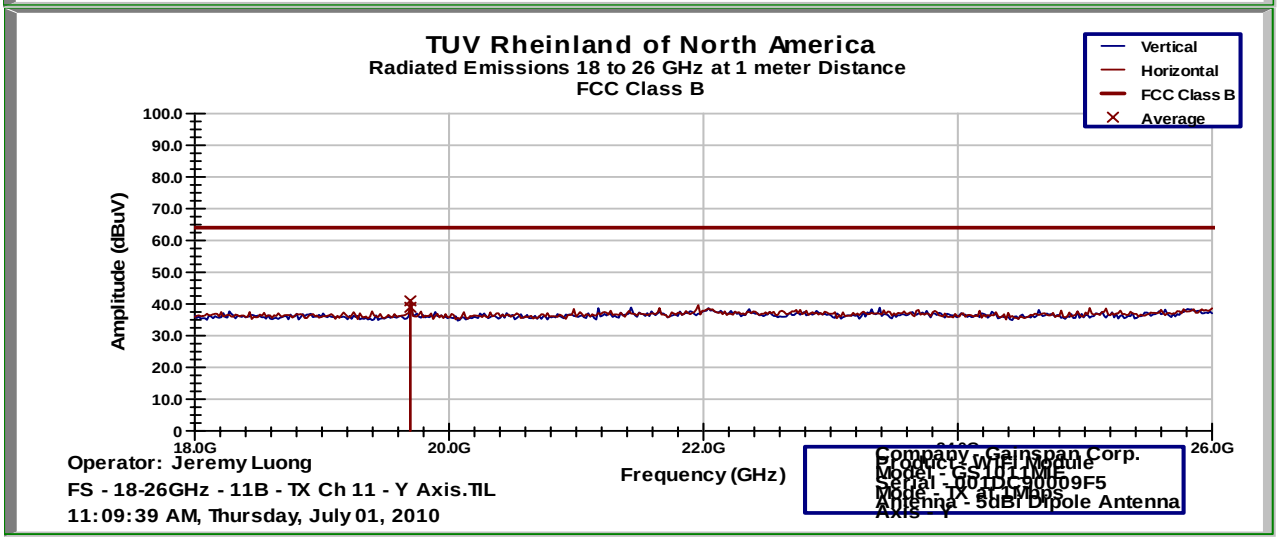
EUT Name	Wi-Fi Module	**Date**	July 1, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 33% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna laid horizontally	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m – EMCO3115 / 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.
30 MHz – 1000 MHz Setting: RBW = 120 kHz / VBW = 300 kHz
1 GHz – 25 GHz Setting: RBW = 1 MHz/ VBW = 3 MHz

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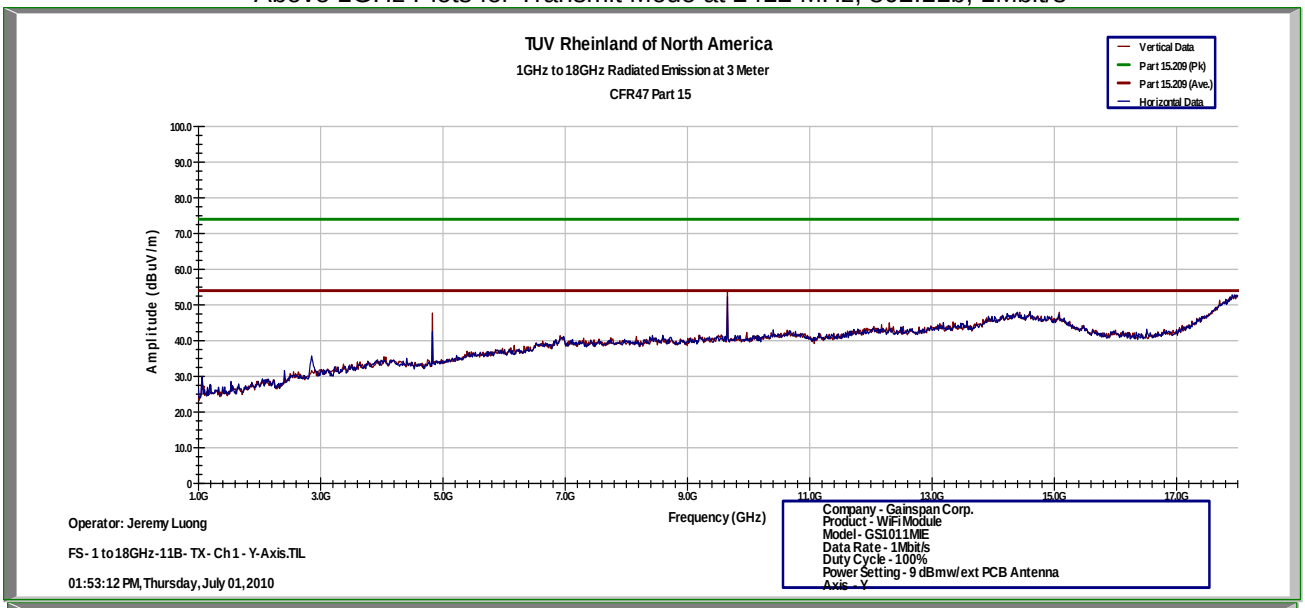
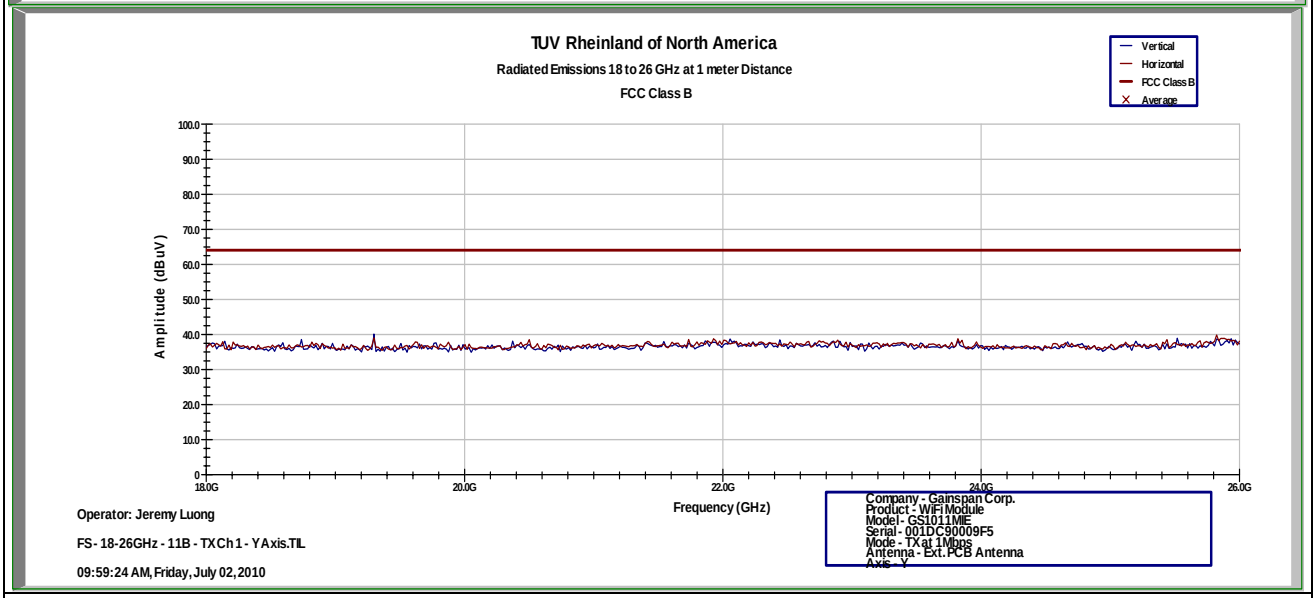
EUT Name	Wi-Fi Module	**Date**	July 2, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 31% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	2dBi Ext. PCB Antenna laid horizontally	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m – EMCO3115 / 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.
1 GHz – 25 GHz Setting: RBW = 1 MHz/ VBW = 3 MHz

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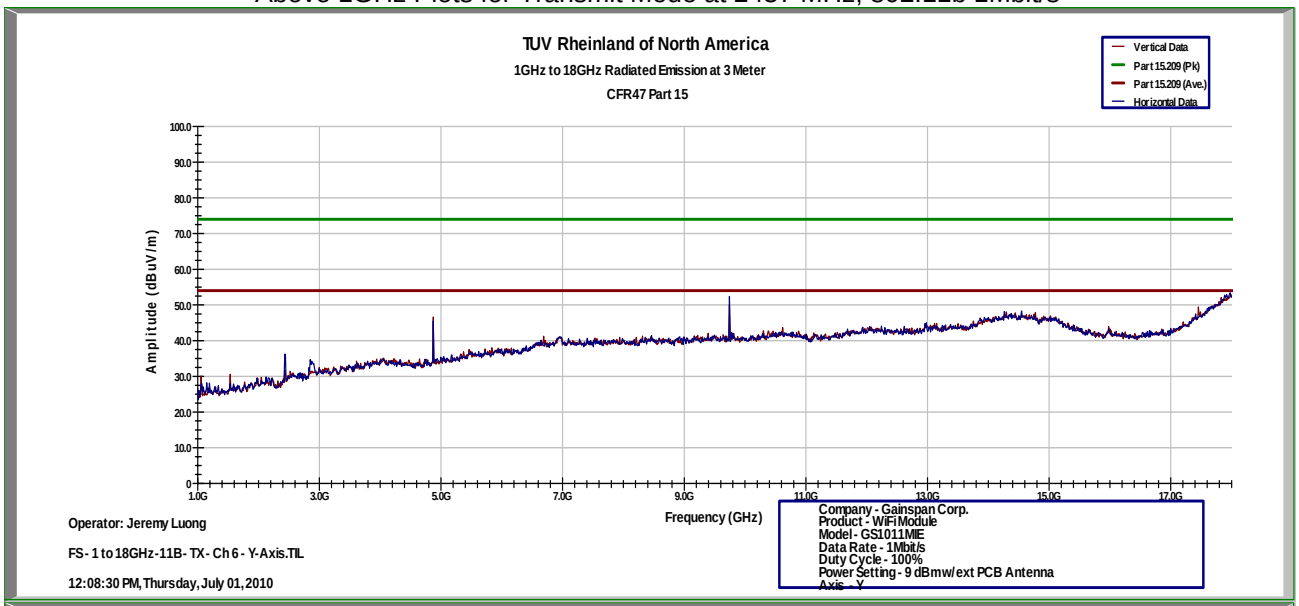
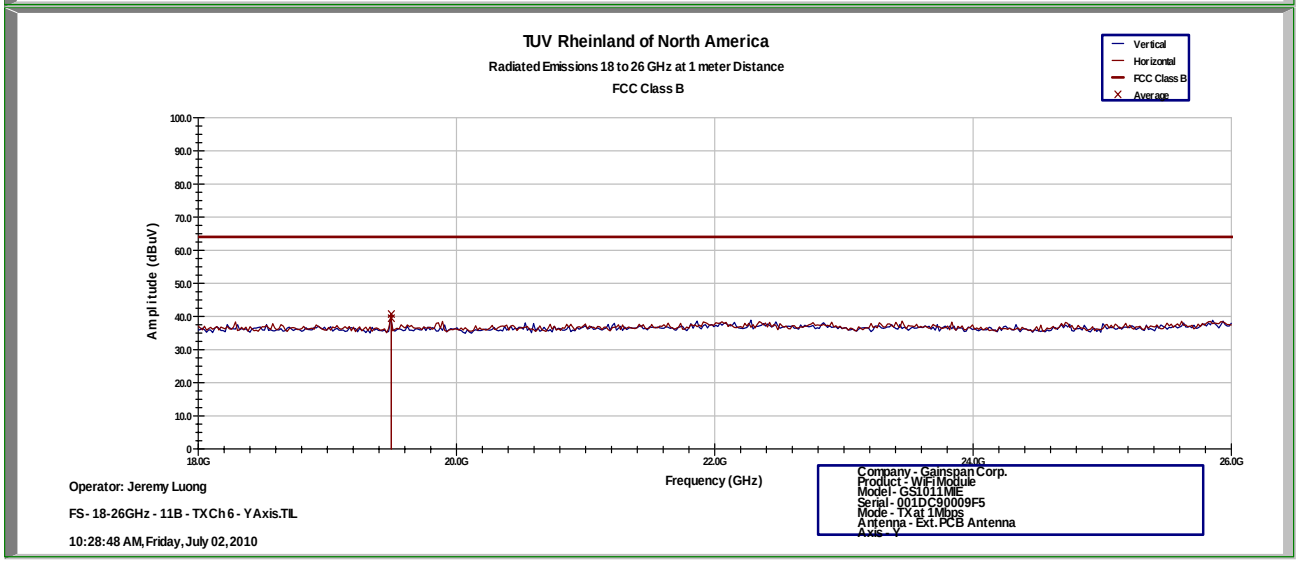
EUT Name	Wi-Fi Module	**Date**	July 2, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 31% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	2dBi Ext. PCB Antenna laid horizontally	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m – EMCO3115 / 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.
1 GHz – 25 GHz Setting: RBW = 1 MHz/ VBW = 3 MHz

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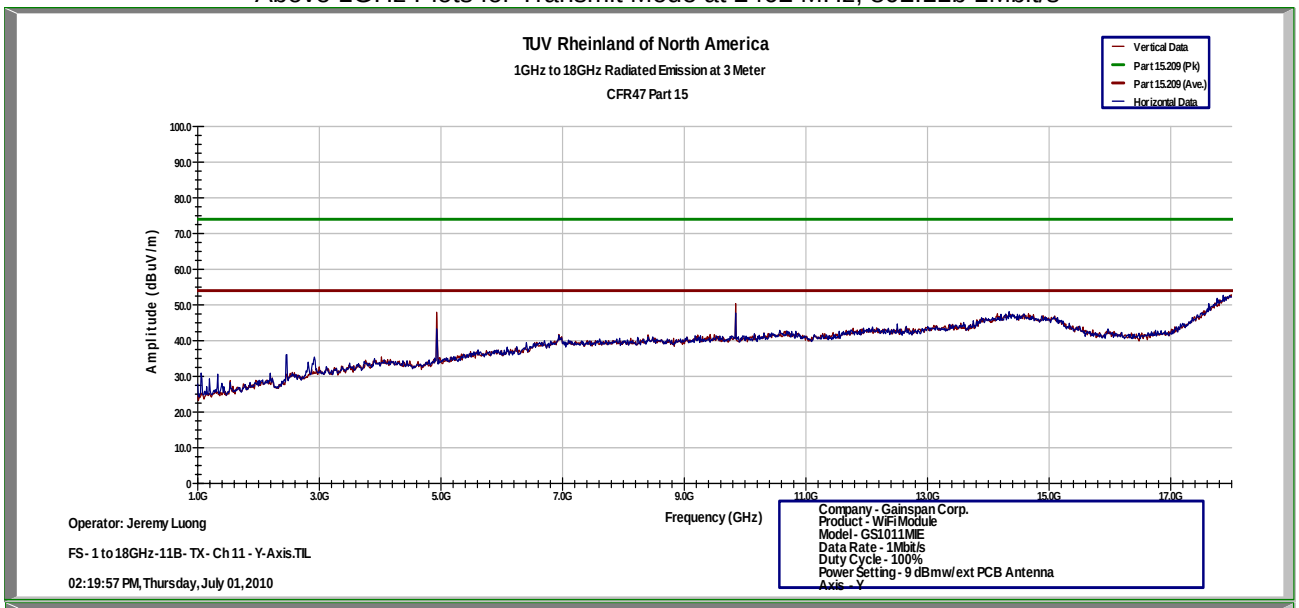
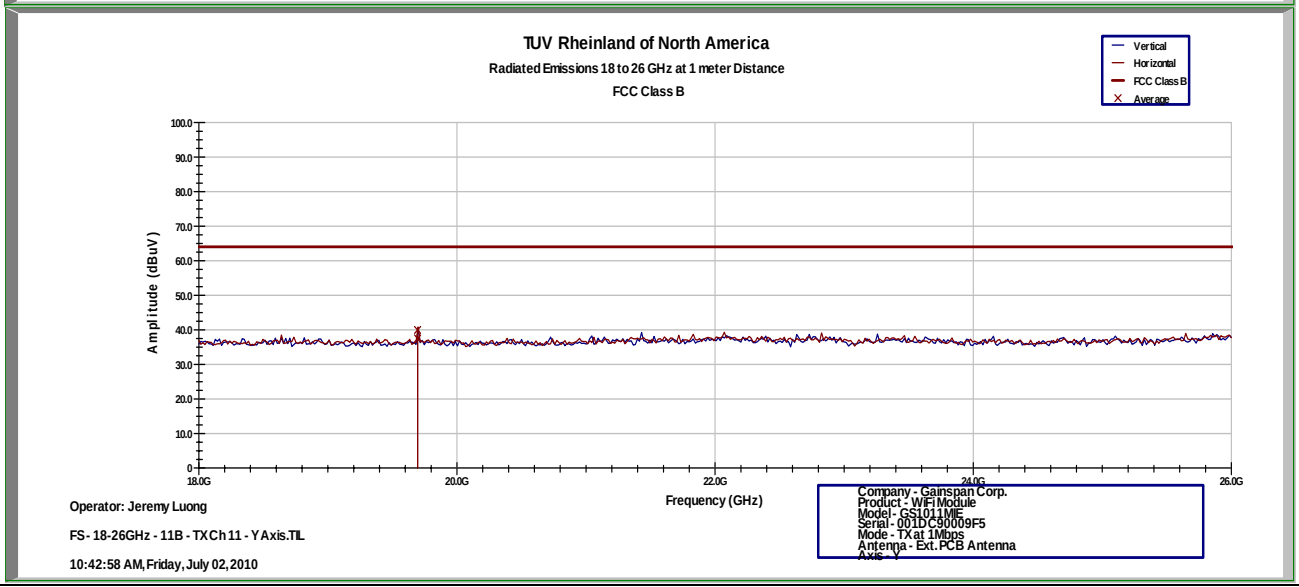
EUT Name	Wi-Fi Module	**Date**	July 2, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 31% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	2dBi Ext. PCB Antenna laid horizontally	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m – EMCO3115 / 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.
1 GHz – 25 GHz Setting: RBW = 1 MHz/ VBW = 3 MHz

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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:

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

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

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

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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.

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.

4.7.1.3 Deviations

None.

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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: 2008 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

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.

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EUT Name	Wi-Fi Module	**Date**	July 1, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 33% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna laid horizontally	**Line AC / Freq**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	See below
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (cm)	Table Pos (deg)	FIM Pk (dBuV/m)	FIM QP/Ave (dBuV/m)	Total CF dBuV	E-Field QP/Ave (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)	Type
Receive Mode at Channel 6, 2437 MHz										
52.81	V	106	5	51.40	48.17	-16.94	31.23	40.00	-8.77	Spurious
56.85	V	121	180	49.03	46.47	-16.95	29.52	40.00	-10.48	Spurious
92.77	V	136	8	44.98	41.64	-16.56	25.08	43.52	-18.44	Spurious
164.71	H	191	281	39.70	36.37	-10.88	25.49	43.52	-18.03	Spurious
260.55	H	102	273	36.90	33.94	-10.33	23.61	46.02	-22.41	Spurious
4874.03	H	282	120	40.48	35.38	5.25	40.63	53.98	-13.35	Spurious
4874.05	V	286	92	47.67	44.45	5.25	49.69	53.98	-4.29	Spurious
9748.05	H	284	334	38.63	33.34	12.84	46.18	53.98	-7.80	Spurious
9748.06	V	284	105	39.02	33.19	12.84	46.03	53.98	-7.95	Spurious
19496.00	H	115	5	33.97	29.83	11.55	41.38	63.98	-22.60	Spurious
19496.10	V	109	79	37.08	27.70	11.55	39.25	63.98	-24.73	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 $u_c(y)$ = ± 1.6 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Tested on the Y-Axis.
30-1000 MHz Setting: RBW (120 kHz) / VBW (300 kHz)
1-25 GHz Setting: RBW (1 MHz) / VBW (3 MHz)
Average detector was used for above 1GHz.

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SOP 1 Radiated Emissions

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EUT Name	Wi-Fi Module	**Date**	July 2, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	23°C / 36% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	2dBi ext. PCB Antenna laid horizontally	**Line AC / Freq**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	See below
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (cm)	Table Pos (deg)	FIM Pk (dBuV/m)	FIM QP/Ave (dBuV/m)	Total CF dBuV	E-Field QP/Ave (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)	Type
Receive Mode at Channel 6, 2437 MHz										
179.62	H	171	307	38.00	34.63	-11.81	22.82	43.52	-20.70	Spurious
290.27	H	136	146	34.72	30.99	-8.86	22.13	46.02	-23.89	Spurious
53.95	V	117	66	51.15	48.61	-17.03	31.58	40.00	-8.42	Spurious
56.91	V	106	108	51.72	49.27	-16.94	32.33	40.00	-7.67	Spurious
92.86	V	144	22	45.42	42.19	-16.55	25.64	43.52	-17.88	Spurious
4874.04	V	232	80	45.92	44.06	5.25	49.31	53.98	-4.67	Spurious
4874.04	H	232	431	44.77	40.75	5.25	46	53.98	-7.98	Spurious
9748.06	H	230	26	37.69	31.96	12.84	44.8	53.98	-9.18	Spurious
9748.06	V	259	447	37.45	31.89	12.84	44.73	53.98	-9.25	Spurious
19496	V	104	14	32.67	26.71	11.55	38.26	63.98	-25.72	Spurious
19496	H	103	312	34.46	29.9	11.55	41.45	63.98	-22.53	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 $u_c(y)$ = ± 1.6 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Tested on the Y-Axis.
30-1000 MHz Setting: RBW (120 kHz) / VBW (300 kHz)
1-25 GHz Setting: RBW (1 MHz) / VBW (3 MHz)
Average detector was used for above 1GHz.

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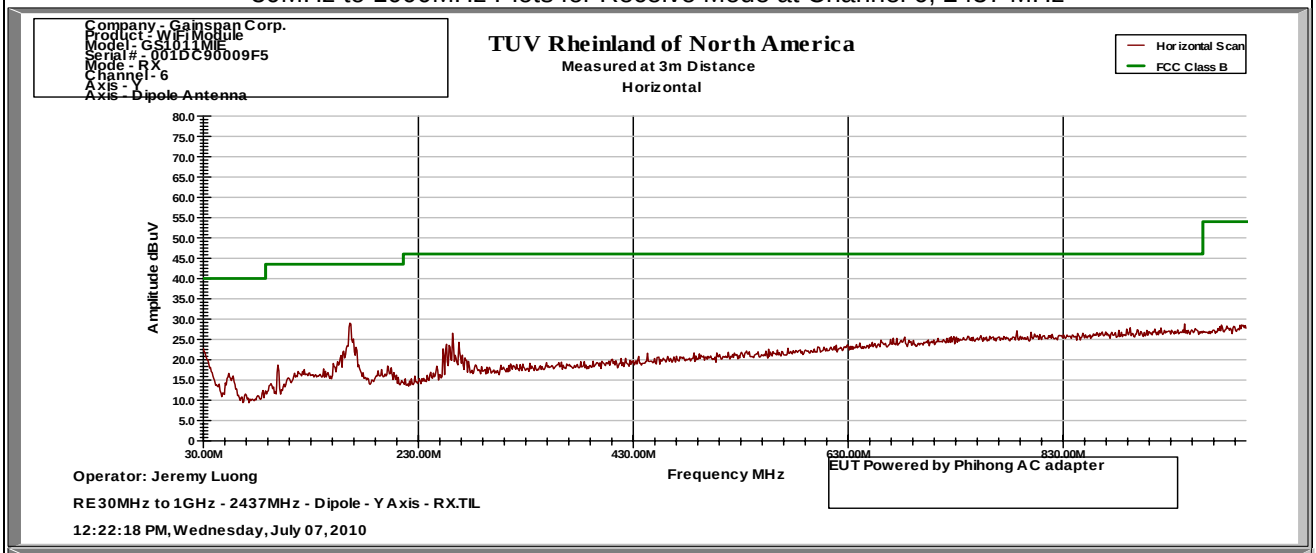
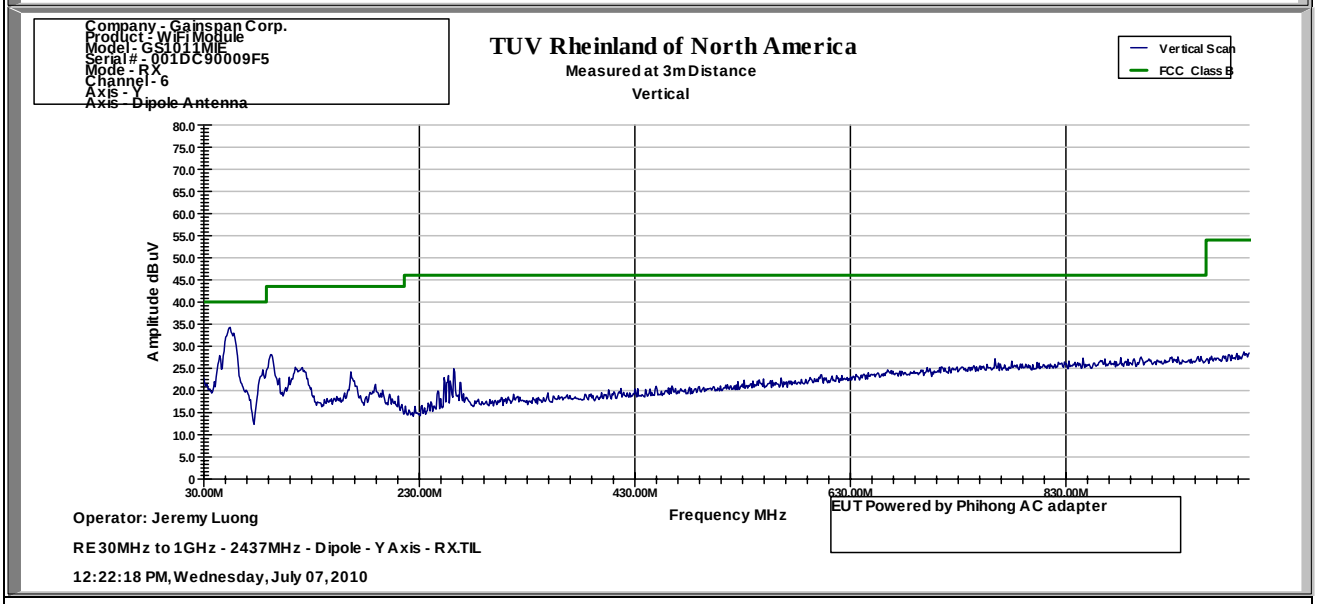
EUT Name	Wi-Fi Module	**Date**	July 7, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	23°C / 37% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna laid horizontally	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz / 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

30MHz to 1000MHz Plots for Receive Mode at Channel 6, 2437 MHz





Notes: None.

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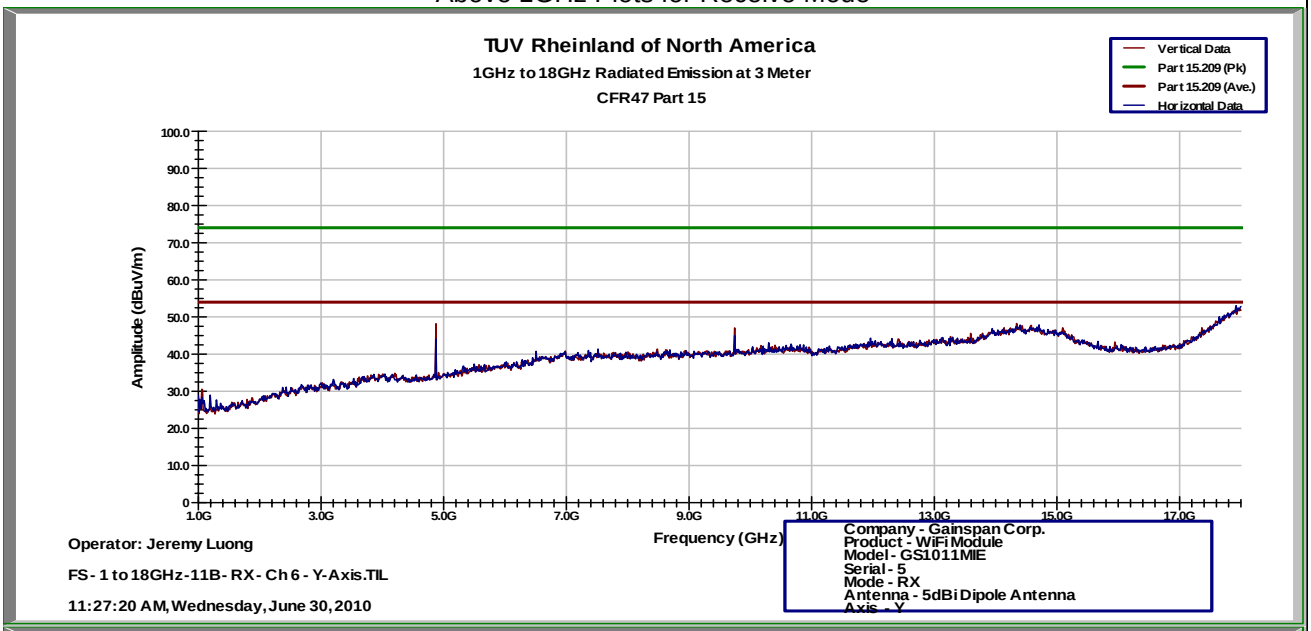
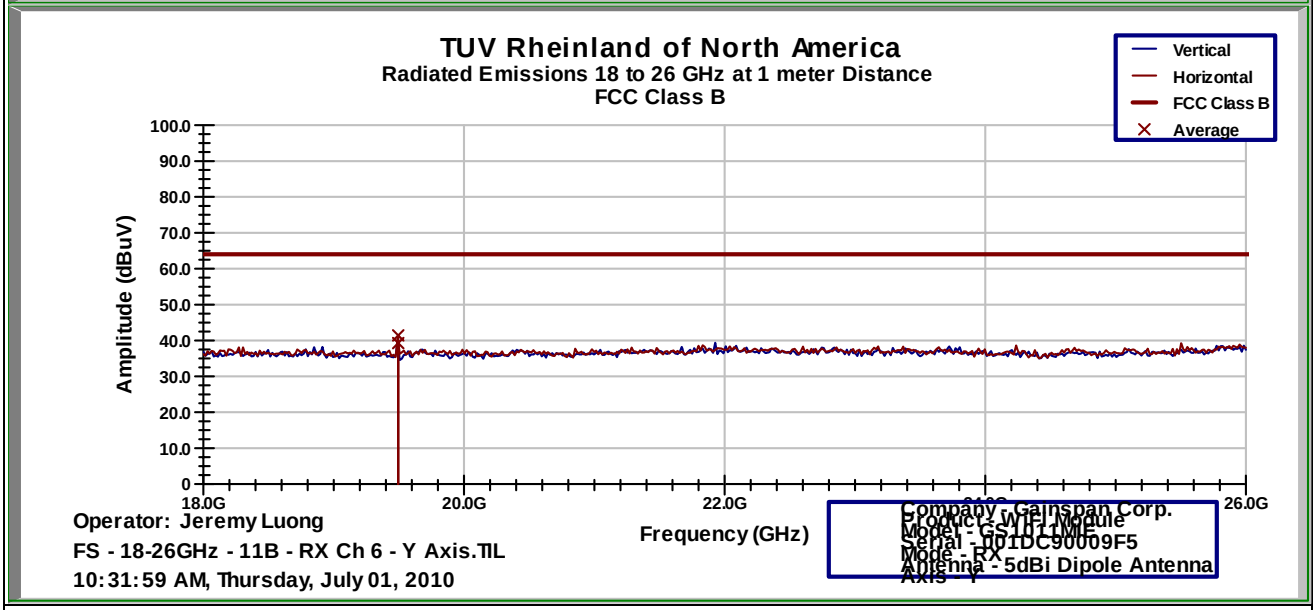
SOP 1 Radiated Emissions

Tracking # 31051810.001 Page 4 of 6

EUT Name	Wi-Fi Module	**Date**	July 1, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	21°C / 33% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna laid horizontally	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

Above 1GHz Plots for Receive Mode





Notes: : Limit was extrapolated to 1m distance.
30 MHz – 1000 MHz Setting: RBW = 120 kHz / VBW = 300 kHz
1 GHz – 25 GHz Setting: RBW = 1 MHz/ VBW = 3 MHz

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SOP 1 Radiated Emissions

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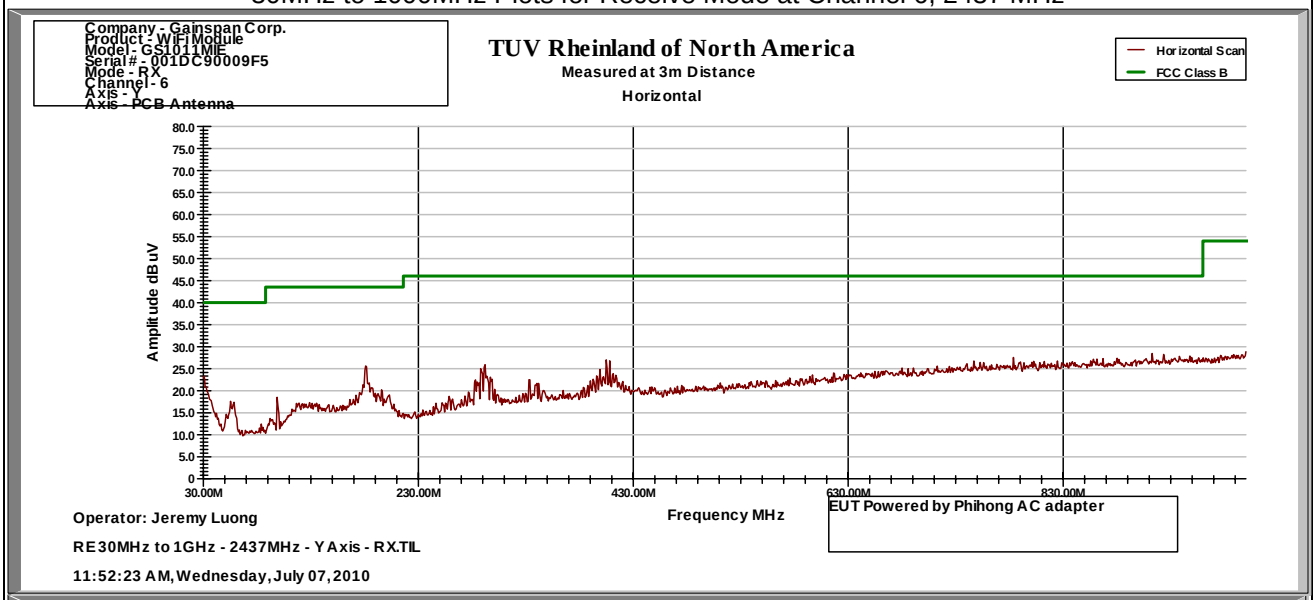
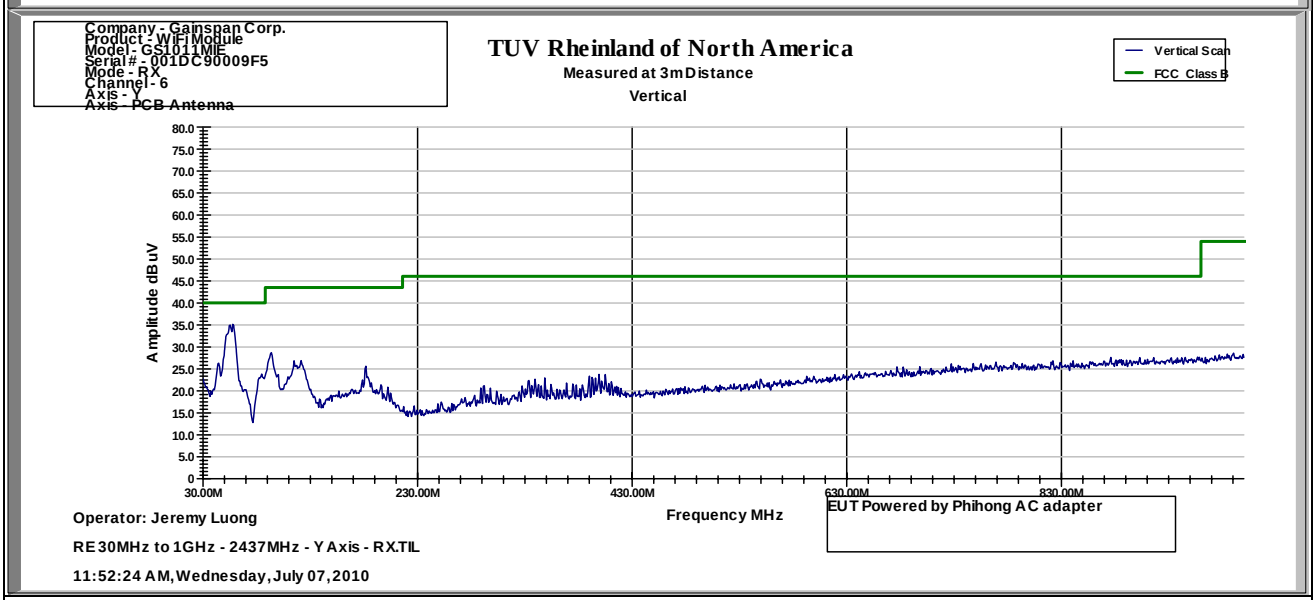
EUT Name	Wi-Fi Module	**Date**	July 7, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	23°C / 37% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	2dBi Ext. PCB Antenna laid horizontally	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz / 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

30MHz to 1000MHz Plots for Receive Mode at Channel 6, 2437 MHz





Notes: None.

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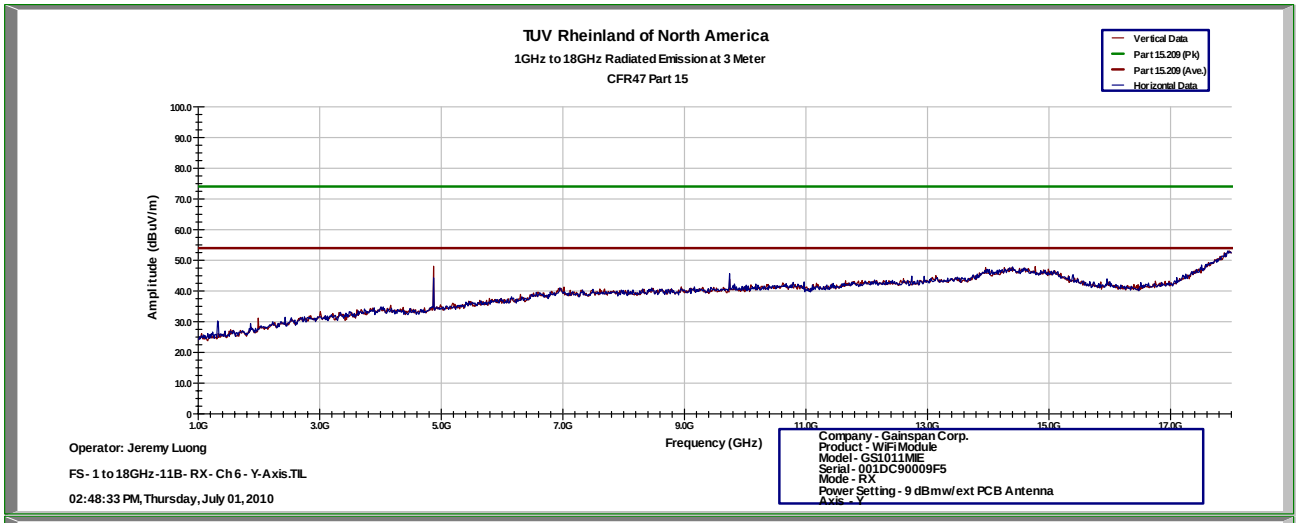
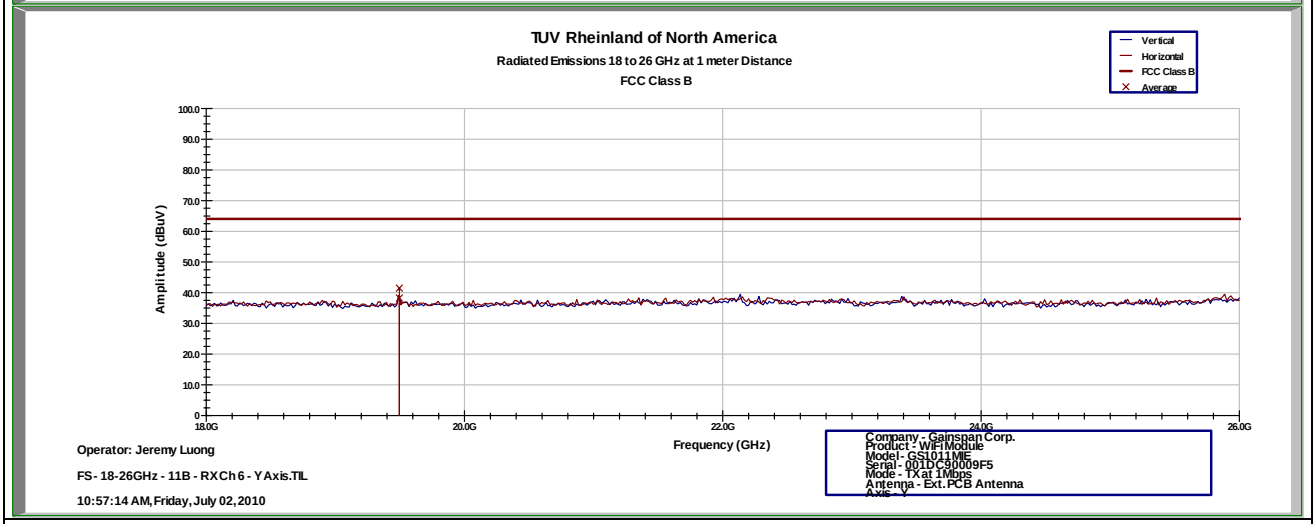
SOP 1 Radiated Emissions

Tracking # 31051810.001 Page 6 of 6

EUT Name	Wi-Fi Module	**Date**	July 1, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	21°C / 33% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	2dBi Ext. PCB Antenna laid horizontally	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

Above 1GHz Plots for Receive Mode





Notes: : Limit was extrapolated to 1m distance.
30 MHz – 1000 MHz Setting: RBW = 120 kHz / VBW = 300 kHz
1 GHz – 25 GHz Setting: RBW = 1 MHz/ VBW = 3 MHz

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4.7.4 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:

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

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

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

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4.8 AC Conducted Emissions

Testing was performed in accordance with ANSI C63.4:2003, RSS-210. These test methods are listed under the laboratory's NVLAP Scope of Accreditation.

This test measures the levels emanating from the EUT' 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 15.207, RSS-GEN Sect.7.2.2

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 performed in 5m semi anechoic chamber. 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).

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Table 10: AC Conducted Emissions – Test Results

Test Conditions: Conducted Measurement at the host Interface Card's AC Main, Normal Conditions			
Antenna Type: Dipole / PCB		**Power Level:** 9 dBm	
AC Power: 120 Vac, 60 Hz		**Configuration:** Tabletop	
Ambient Temperature: 22° C		**Relative Humidity:** 33% rh	
Antenna	**Configuration**	**Frequency Range**	**Test Result**
5 dBi Dipole	Line 1(Hot)	0.15 to 30 MHz	Pass
5 dBi Dipole	Line 2 (Neutral)	0.15 to 30 MHz	Pass
2 dBi PCB	Line 1(Hot)	0.15 to 30 MHz	Pass
2 dBi PCB	Line 2 (Neutral)	0.15 to 30 MHz	Pass

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SOP 2 Conducted Emissions

Tracking # 31051810.001 Page 1 of 4

EUT Name	Wi-Fi Module	**Date**	July 12, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 37% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	5 dBi Dipole Antenna	**Line AC / Freq**	120 Vac, 60 Hz
Standard	CFR47 Part 15.207	**RBW / VBW**	9 kHz / 30 kHz
Lab/LISN	Lab 5 / Solar 9348-50-R-24-BNC	**Performed by**	Jeremy Luong

Frequency MHz	Quasi-Peak dBuV	QP Limit dBuV	QP Margin dB	Average dBuV	Ave Limit dBuV	Ave Margin dB	Line
0.154	40.47	65.88	-38.29	16.96	55.88	-48.80	2
0.173	38.03	65.35	-40.73	16.48	55.35	-49.29	2
0.210	34.63	64.29	-44.14	13.46	54.29	-52.31	2
0.275	28.81	62.44	-49.97	7.23	52.44	-58.55	2
0.660	28.84	56.00	-44.01	23.09	46.00	-36.76	2
0.671	26.75	56.00	-46.10	20.57	46.00	-39.28	2
2.359	13.01	56.00	-59.88	0.46	46.00	-59.44	2
0.156	40.99	65.84	-37.77	14.90	55.84	-50.86	1
0.173	38.63	65.35	-40.13	12.93	55.35	-52.83	1
0.218	33.44	64.07	-45.33	8.09	54.07	-57.68	1
0.656	27.87	56.00	-44.98	20.26	46.00	-39.59	1
0.664	26.96	56.00	-45.89	18.93	46.00	-40.92	1
0.674	24.66	56.00	-48.19	16.03	46.00	-43.82	1

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

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

Notes: EUT was setup as table top equipment.

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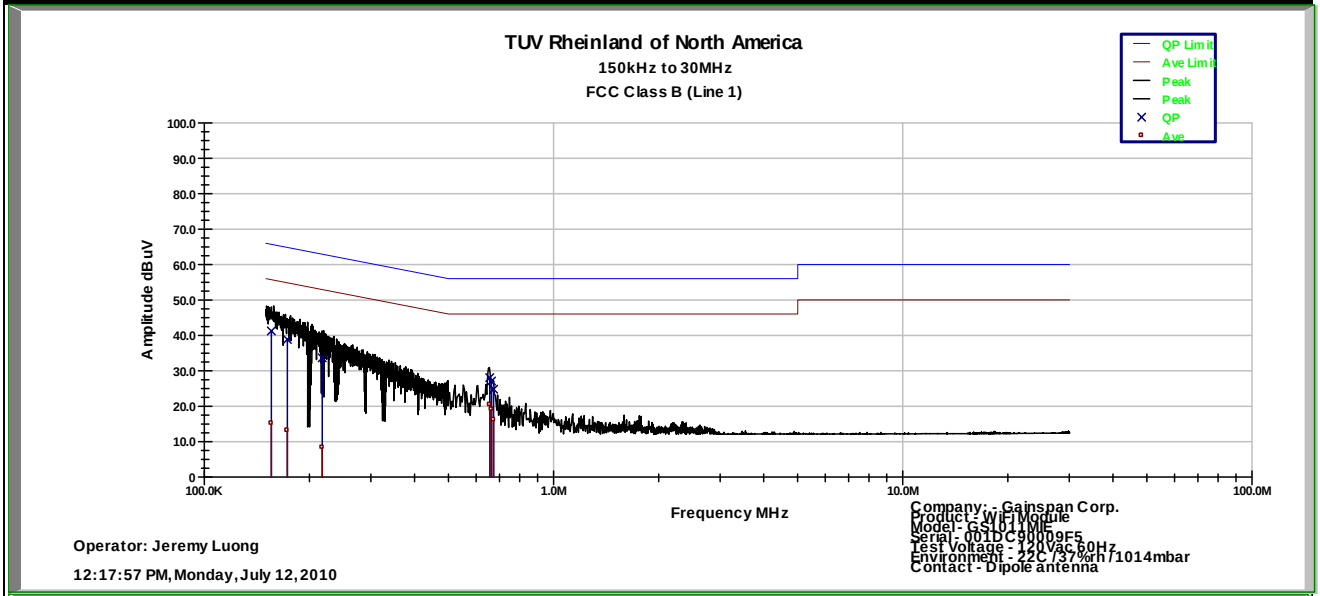
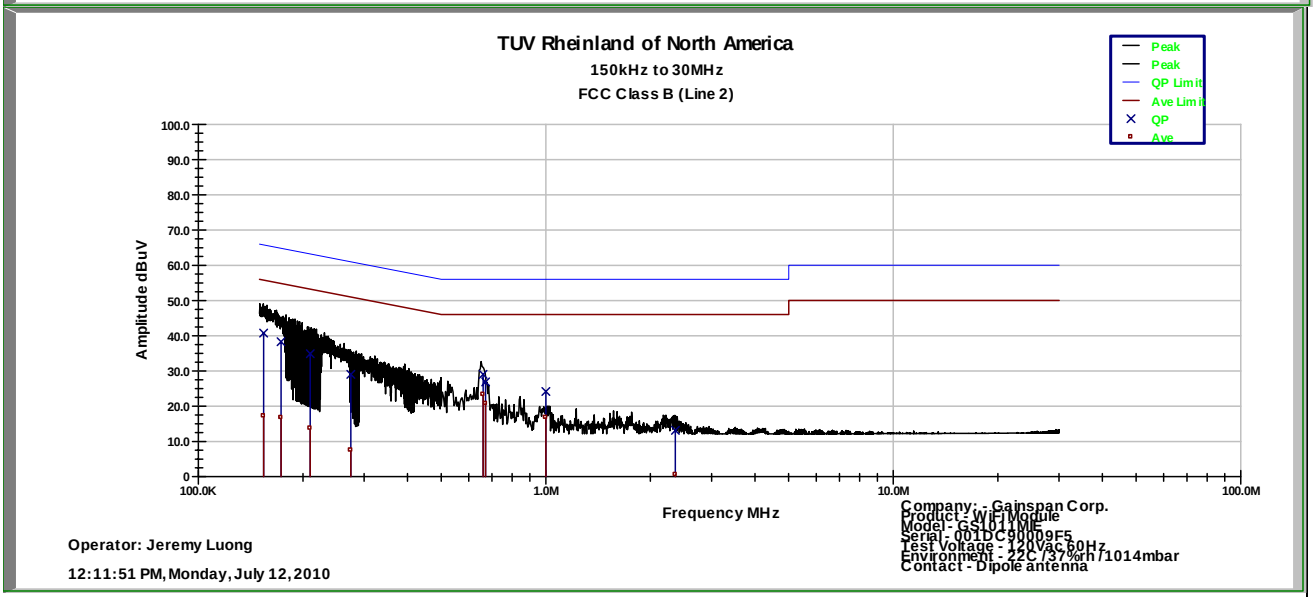
SOP 2 Conducted Emissions

Tracking # 31051810.001 Page 2 of 4

EUT Name	Wi-Fi Module	**Date**	July 12, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 37% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	5 dBi Dipole Antenna	**Line AC**	120 Vac, 60 Hz
Standard	CFR47 Part 15.207	**RBW / VBW**	9 kHz / 30 kHz
Lab/LISN	Lab 5/ Solar 9348-50-R-24-BNC	**Performed by**	Jeremy Luong





Notes: Using CISRP Class B Limit.

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SOP 2 Conducted Emissions

Tracking # 31051810.001 Page 3 of 4

EUT Name	Wi-Fi Module	**Date**	July 12, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 37% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	2 dBi PCB Antenna	**Line AC / Freq**	120 Vac, 60 Hz
Standard	CFR47 Part 15.207	**RBW / VBW**	9 kHz / 30 kHz
Lab/LISN	Lab 5 / Solar 9348-50-R-24-BNC	**Performed by**	Jeremy Luong

Frequency MHz	Quasi-Peak dBuV	QP Limit dBuV	QP Margin dB	Average dBuV	Ave Limit dBuV	Ave Margin dB	Line
0.151	41.56	65.98	-37.20	17.36	55.98	-48.40	2
0.180	37.23	65.15	-41.54	15.74	55.15	-50.03	2
0.224	32.02	63.90	-46.75	11.99	53.90	-53.78	2
0.313	23.88	61.35	-54.91	7.58	51.35	-58.21	2
0.657	29.11	56.00	-43.74	22.92	46.00	-36.92	2
0.672	26.13	56.00	-46.72	19.65	46.00	-40.20	2
1.717	10.96	56.00	-61.94	1.63	46.00	-58.27	2
0.150	41.03	66.00	-37.73	15.40	56.00	-50.36	1
0.182	37.98	65.08	-40.79	11.02	55.08	-54.75	1
0.299	25.77	61.74	-53.02	4.91	51.74	-60.88	1
0.655	28.30	56.00	-44.55	20.26	46.00	-39.59	1
0.672	25.28	56.00	-47.57	16.52	46.00	-43.33	1
1.722	8.46	56.00	-64.44	-0.07	46.00	-59.97	1

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

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

Notes: EUT was setup as table top equipment.

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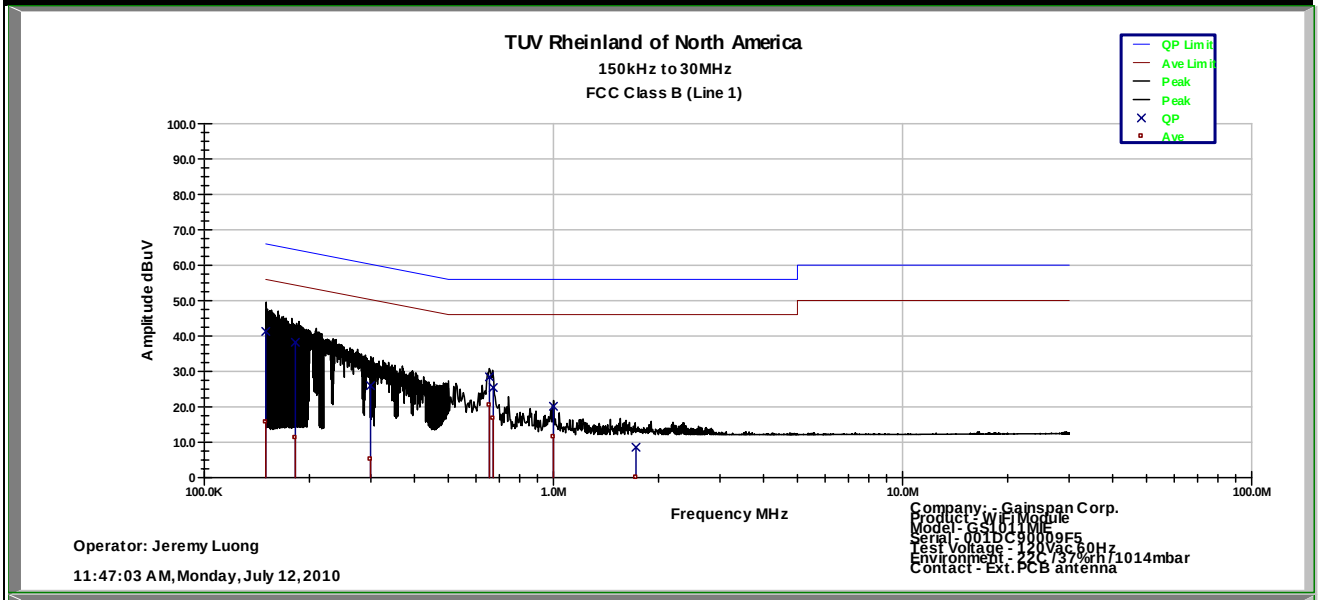
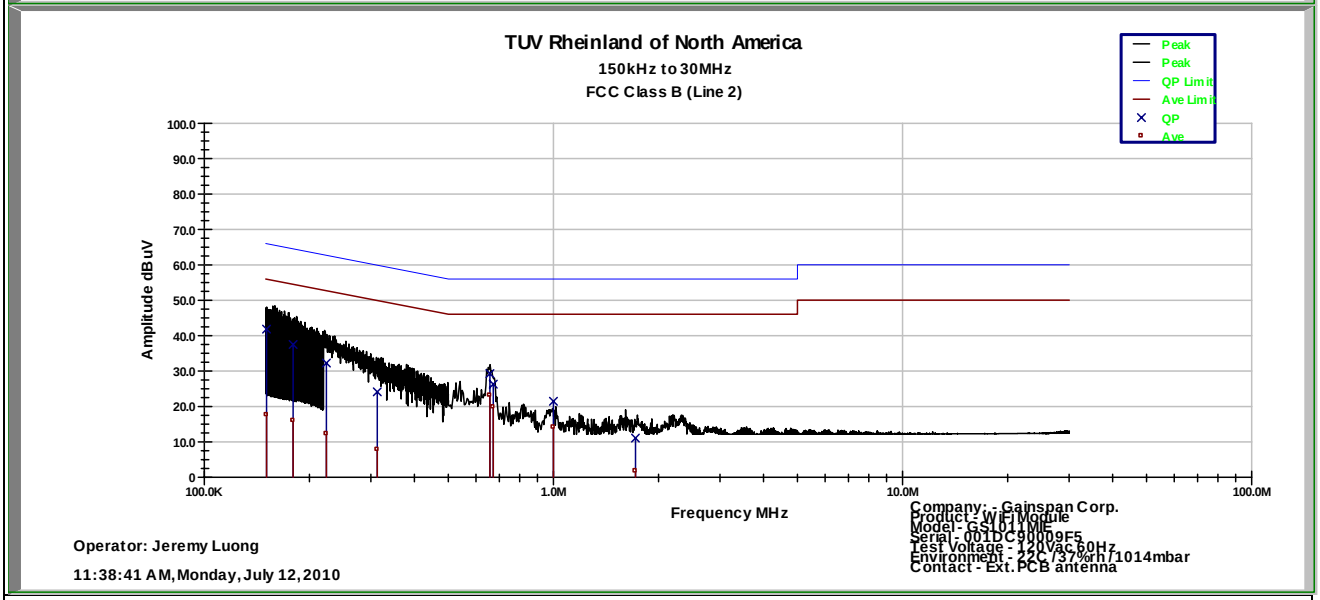
SOP 2 Conducted Emissions

Tracking # 31051810.001 Page 4 of 4

EUT Name	Wi-Fi Module	**Date**	July 12, 2010
EUT Model	GS1011MIE	**Temp / Hum in**	22°C / 37% rh
EUT Serial	001DC90009F5	**Temp / Hum out**	N/A
EUT Config.	2 dBi PCB Antenna	**Line AC / Freq**	120 Vac, 60 Hz
Standard	CFR47 Part 15.207	**RBW / VBW**	9 kHz / 30 kHz
Lab/LISN	Lab 5/ Solar 9348-50-R-24-BNC	**Performed by**	Jeremy Luong





Notes: Using CISRP Class B Limit.

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5 Test Equipment Use 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	02/18/10	02/18/12
Antenna Bilog	Sunol Science	JB3	A061907	05/14/10	05/14/12
TuneD Dipole Antenna	A.H Systems, Inc.	TDS-200/535-1	154	01/09/09	01/09/11
TuneD Dipole Antenna	A.H Systems, Inc.	TDS-200/535-2	154	01/09/09	01/09/11
TuneD Dipole Antenna	A.H Systems, Inc.	TDS-200/535-3	154	01/09/09	01/09/11
TuneD Dipole Antenna	A.H Systems, Inc.	TDS-200/535-4	154	01/09/09	01/09/11
Antenna Horn (1-18GHz)	EMCO	3115	9211-3969	04/15/09	04/15/11
Antenna Horn (1-18GHz)	AHS	3115	9710-5301	06/30/10	06/30/11
EMI Receiver	Hewlett Packard	8546A	3325A00168	10/29/09	10/29/10
Preselector	Hewlett Packard	85460A	3330A00174	10/29/09	10/29/10
Amplifier	Hewlett Packard	8447D	2944A07996	01/21/10	01/21/11
Spectrum Analyzer	Rhode&Schwarz	ESIB	100180	08/19/09	08/19/10
Amplifier	Rhode&Schwarz	TS-PR18	100019	08/14/08	08/14/10
Amplifier	Rhode&Schwarz	TS-PR26	100011	08/14/08	08/14/10
Signal Generator	Anritsu	MG3694A	42803	09/19/09	09/19/10
Thermo Chamber	Associated Environmental	SK-3102	5999	01/22/10	01/22/11
Notch Filter	Micro-Tronics	BRM50702	037	01/22/10	01/22/11
Power Supplier	Kikosui	PCR8000W	CM000912	01/18/10	01/18/11
Digital Multimeter	Fluke	83 III	84590116	01/21/10	01/21/11
Thermometer	Fluke	52II	88650033	10/16/09	10/16/10

22 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.

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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	Gainspan Corporation
Address	125 S. Market St. Suite 400
City, State, Zip	San Jose, CA 95113-2292
Country	USA
Phone	(408) 673-2900
Fax	(408) 673-2901

Table 12: Technical Contact Information

Name	Ron Green
E-mail	Ron.Green@gainspan.com
Phone	(408) 673-2900
Fax	(408) 673-2901

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6.3 Equipment Under Test (EUT)

Table 13: EUT Specifications

GS1011MIE Dimensions	1.28” x 0.9” x 0.143”
Power Supply	Input Voltage: 3.3 Vdc Input Current: 300mA Cutoff Voltage: 2.4 Vdc
Environment	Indoor and Outdoor
Operating Temperature Range:	-40 to 85 degrees C
Multiple Feeds:	☐ Yes and how many ☒ No
Operating Mode	802.11b
Transmitter Frequency Band	2.412 GHz to 2.462 MHz (DSSS)
Rated Power Output	9 dBm (Fixed)
Operating Channel	2412 MHz, 2417 MHz, 2422 MHz, 2427MHz, 2432 MHz, 2437 MHz, 2442 MHz, 2447 MHz, 2452 MHz, 2457 MHz, 2462 MHz.
Antenna Type	2 dBi external PCB 2 dBi, 3 dBi, 5 dBi Dipole.
Modulation Type	☐ AM ☐ FM ☐ Phase ☒ Other describe: DSSS
Bandwidth	22 MHz
Type of Equipment	☐ Table Top ☐ Wall-mount ☐ Floor standing cabinet ☒ Other *describe: Portable in any orientation.*
Note	PCB antenna maximum gain is 2dBi, and its average gain is 1dBi. Dipole antenna maximum gain is 5dBi, and its average gain is 4dBi.

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Table 14: 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?
RS232	Serial (Null Cable)	☒ Yes	☒ Metric: 1.5m	☒ M

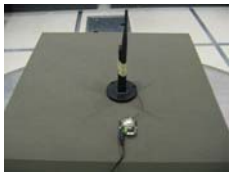
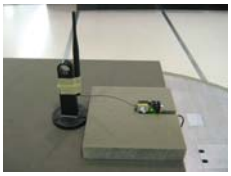
Table 15: Supported Equipment

Equipment	Manufacturer	Model	Serial	Used for
Laptop	Lenovo	Type 2808	R8-CAHRZ	Set test mode

Table 16: Description of Sample used for Testing

Device	Serial	Antenna	Test
GS1011MIE	001DC90009F5	2 dBi PCB	TX Emission, RX Emission, RF Power Output, Peak Power Spectral Density, Out of Band Emission, Bandwidth
		5 dBi Dipole	

Table 17: Description of Test Configuration used for Radiated Measurement.

Device	Antenna	Mode	Setup Photo (X-Axis)	Setup Photo (Y-Axis)	Setup Photo (Z-Axis)
GS1011MIE	2 dBi PCB	* Transmit in Mode b (1Mbit/s) * Transmit in Mode g (11 Mbit/s) * Receive			
GS1011MIE	5 dBi Dipole	* Transmit in Mode b (1Mbit/s) * Transmit in Mode g (11 Mbit/s) * Receive			

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6.4 Test Specifications

Testing requirements

Table 18: Test Requirements

Emissions and Immunity	
Standard	Requirement
CFR 47 Part 15.247	All
RSS 210	All

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