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Emissions Test Report

EUT Name: USNAP WiFi Module

Model No.: WiFi USNAP

CFR 47 Part 15.247 2008 and RSS 210: 2007

Prepared for:

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Report/Issue Date: April 8, 2010
Report Number: 31050899.001

Statement of Compliance

Manufacturer:	Golden Power Manufacturing Ltd. 6 Tonnochy Road, Room1-3, 10/F Wanchai, 852 HK (415) 203-0074
Requester / Applicant:	Pete Peterson
Name of Equipment:	USNAP WiFi Module
Model No.	WiFi USNAP
Type of Equipment:	Intentional Radiator
Application of Regulations:	CFR 47 Part 15.247 2008 and RSS 210: 2007
Test Dates:	6 April 2010 to 8 April 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	8 April 2010	Conan Boyle	8 April 2010
Test Engineer	Date	NVLAP Signatory	Date

NVLAP CODE 500011-0 **US5251** **2932D-1**

Industry Canada

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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 2008 and RSS 210: 2007 based on the results of testing performed on 6 April 2010 through 8 April 2010 on the USNAP WiFi Module Model WiFi USNAP manufactured by Golden Power Manufacturing Ltd.. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

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

1.3 Summary of Test Results

Table 1: Summary of Test Results

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

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 #US5251). The laboratory scope of accreditation includes: Title 47 CFR Parts 15, 18, and 90. The accreditation is updated every 3 years.

2.1.2 NIST / NVLAP

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

2.1.3 Canada – Industry Canada

Industry Canada

TUV Rheinland of North America at the 1279 Quarry Ln, Pleasanton, CA 94566 address is accredited by Industry Canada for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by Industry Canada (File Number 2932D-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 No. R-2366, C-2585, C-2586).

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 Ln, Pleasanton, CA 94566 test results and test reports within the scope of the laboratory NIST / NVLAP accreditation will be accepted by each member country.

2.2 Test Facilities

All of the test facilities are located at 1279 Quarry Lane, 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 a test distance of 3 and 5 meters. This site has been described in reports dated May 12, 1997, submitted to the FCC, and accepted by letter dated June 25, 1997 (31040/SIT 1300F2). The site is listed with the FCC and accredited by NVLAP (Lab Code 500011-0). The 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 a test distance of 3 meter 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.

2.3 Measurement Uncertainty

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

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

2.3.1 Sample Calculation – radiated & conducted emissions

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

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

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

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

Sample radiated emissions calculation @ 30 MHz

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

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

2.3.2 Measurement Uncertainty

	U_{lab}	U_{cispr}
Radiated Disturbance @ 10m		
30 MHz – 1,000 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

Measurement Uncertainty Immunity

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

Schaffner Modula 6000

The estimated combined standard uncertainty for EFT fast transient immunity measurements is ± 3.49%.
The estimated combined standard uncertainty for surge immunity measurements is ± 5.79%.
The estimated combined standard uncertainty for voltage variation and interruption measurements is ± 3.02%.

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 Standard 17025:2005. Equipment calibration records are kept on file at the test facility.

3 Product Information

3.1 Product Description

The USNAP WiFi Module is intended for the Smart Thermostats application.

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 WiFi USNAP Module uses an integrated on-board PCB antenna for measurement purposes manufacturer added an SMA connector.

4 Emissions

Testing was performed in accordance with CFR 47 Part 15.247: 2008 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 peak output power requirement is the maximum equivalent isotropic radiated power delivering at the transmitting antenna under specified conditions of measurements in the presence of modulation.

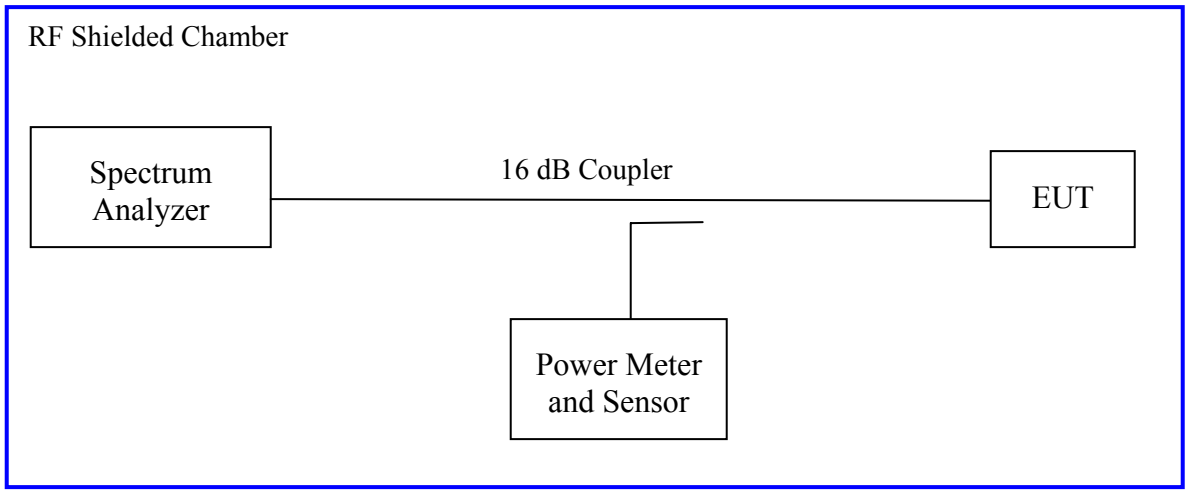
The maximum output power and harmonics shall not exceed CFR47 Part 15.247 (b3):2008 and RSS 210 A.8.4

The maximum transmitted power is +30 dBm or1 Watt.

4.1.1 Test Method

The conducted method was used to measure the channel power output according to ANSI C63.10:2009 Section 6.10.3.1. The measurement was performed with modulation per CFR47 Part15.247 (b3):2008 and RSS 210 A.8.4. This test was conducted on 3 channels of Sample, MAC 001DC9050067. The worst mode result indicated below.

Test Setup:



4.1.2 Results

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

Table 2: RF Power Output at Antenna Port – Test Results

Test Conditions: Conducted Measurement, Normal Temperature			
Antenna Type: Integrated		**Power Setting:** 10	
Max. Antenna Gain: 1.0 dBi		**Signal State:** Modulated	
Ambient Temp.: 23° C		**Relative Humidity:**37%	
Test Results			
Operating Channel	**Limit [dBm]**	**11 Mbps Output Level [dBm]**	**11 Mbps Margin [dB]**
2412 MHz	+30.00	10.86	-19.14
2437 MHz	+30.00	11.01	-18.99
2462 MHz	+30.00	11.21	-18.79

Note: The highest peak power outputs were measured at 11 Mbit/s.

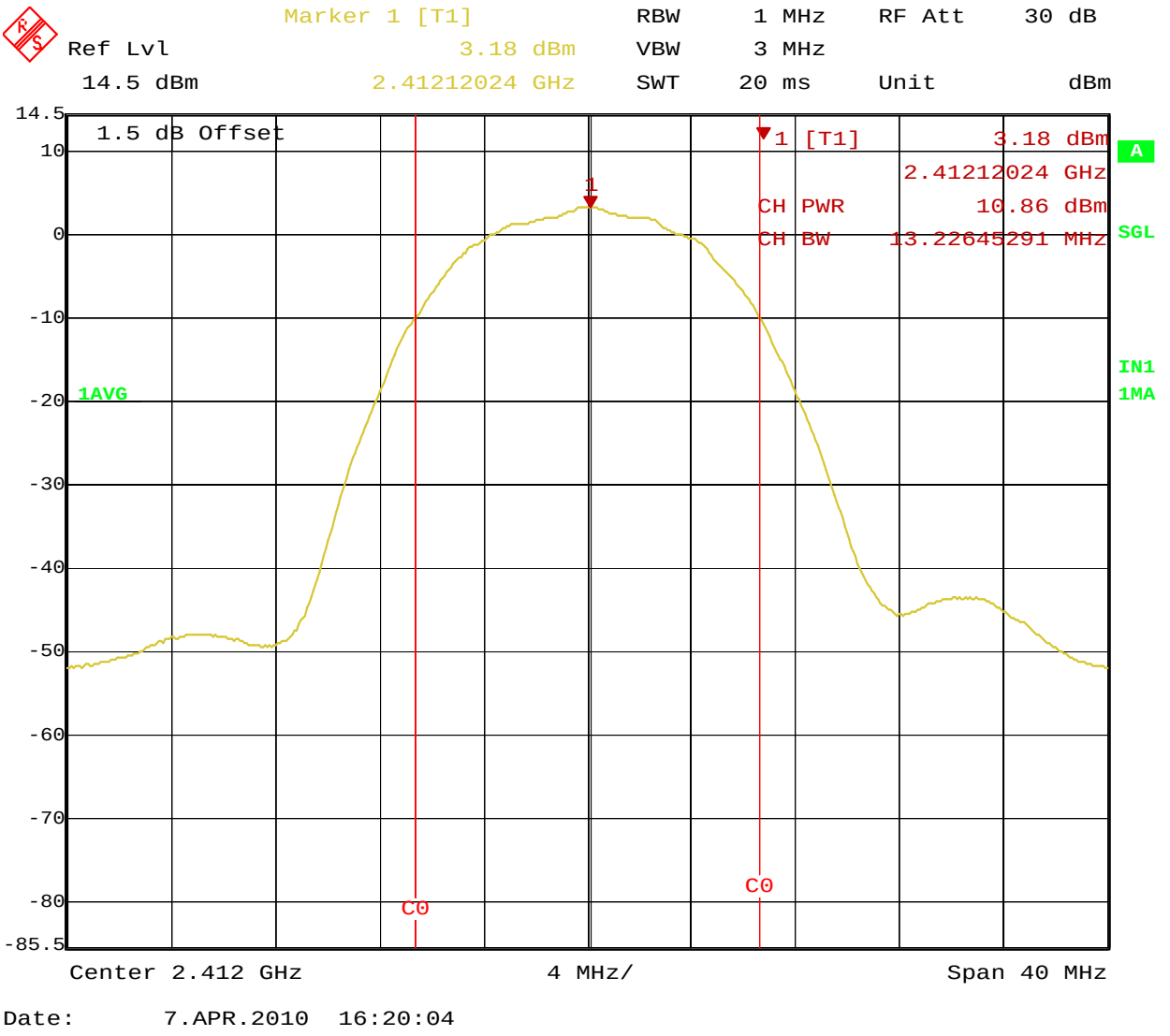


Figure 1: Maximum Transmitted Power at Lowest Channel 2412 MHz – 11 Mbps

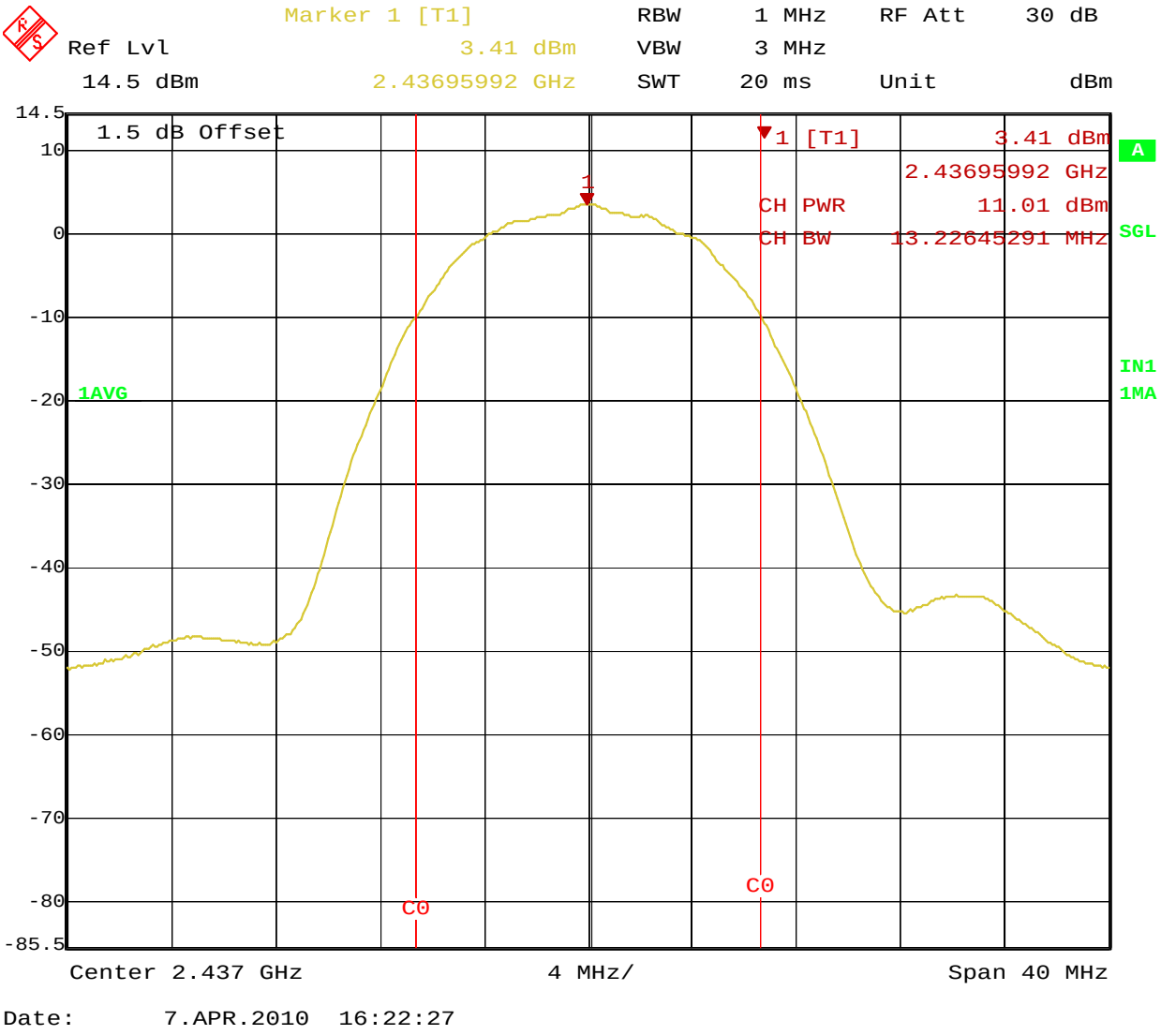


Figure 2: Maximum Transmitted Power at Middle Channel 2437 MHz – 11 Mbps

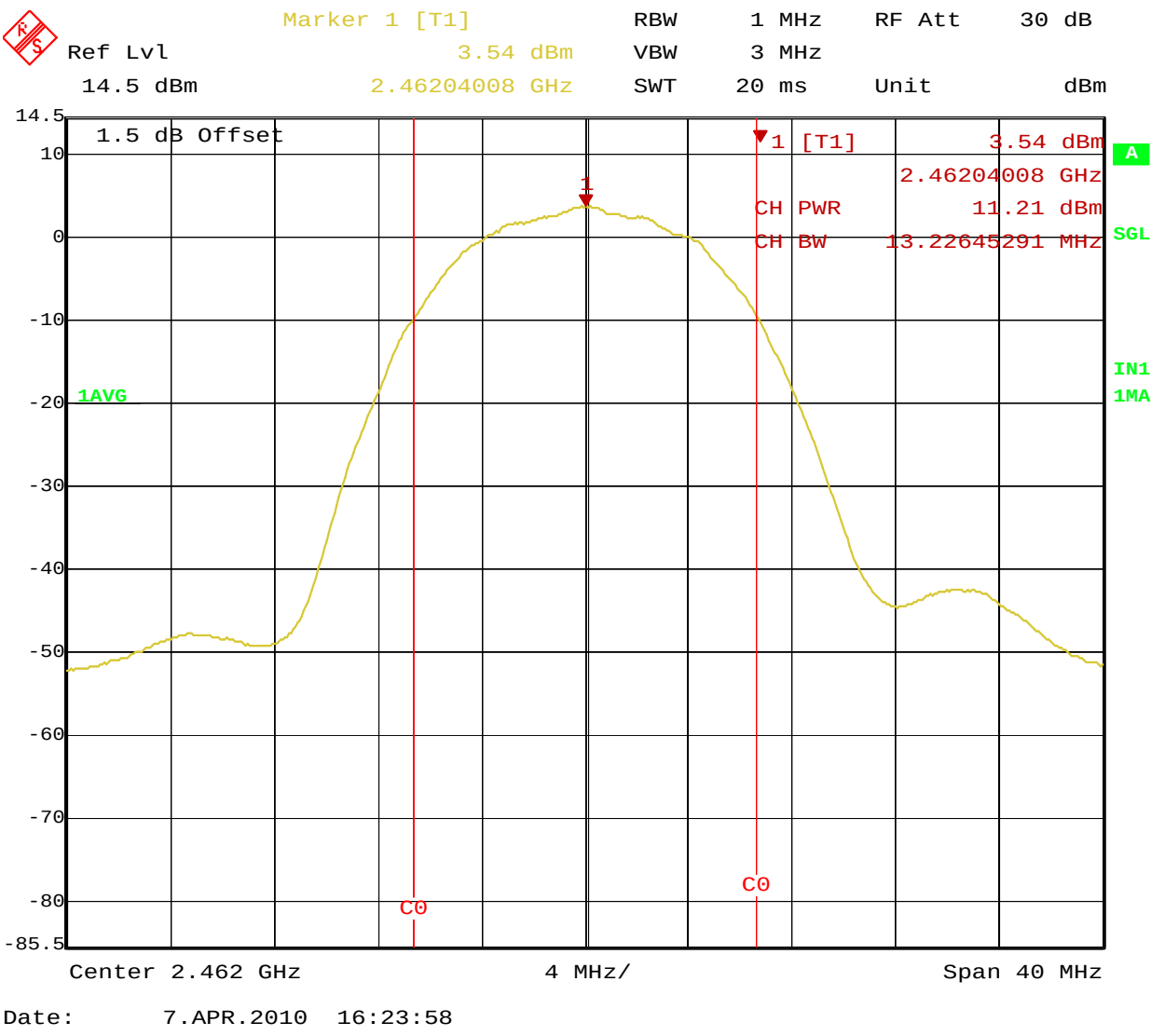


Figure 3: Maximum Transmitted Power at Highest Channel 2462 MHz – 11 Mbps

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.

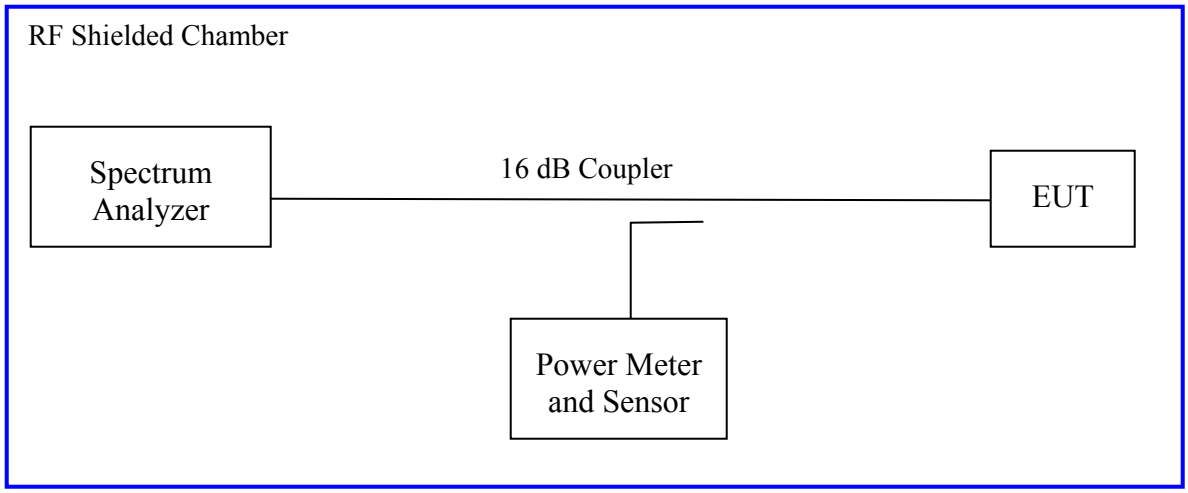
The 6 dB bandwidth is defined the bandwidth of 6 dBr from highest transmitted level of the fundamental frequency.

The bandwidth shall be at least 500 kHz per Section CFR47 15.247(a2) 2008 and RSS Gen Sect. 4.4.1.

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) 2008 and RSS Gen Sect. 4.4.1. This test was conducted on 3 channels of Sample, MAC 001DC9050067. The worst sample result indicated below.

Test Setup:



4.2.2 Results

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

Table 3: Occupied Bandwidth – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only			
Antenna Type: Integrated		**Power Setting:** 10	
Max. Antenna Gain: 1.0 dBi		**Signal State:** Modulated	
Ambient Temp.: 23° C		**Relative Humidity:**37%	
99% Bandwidth (MHz)			
Operating Channel	**Minimum Bandwidth**	**802.11g @ 5.5Mbps**	**Results**
2412 MHz	NA	12.9058 MHz	NA
2437 MHz	NA	12.9058 MHz	NA
2462 MHz	NA	12.9458 MHz	NA
Note: the narrowest 99% bandwidth was observed at 5.5 Mbps.			
6 dB Bandwidth (MHz)			
Operating Channel	**Minimum Bandwidth**	**802.11b @ 2Mbps**	**Results**
2412 MHz	500 kHz	9.8597 MHz	Pass
2437 MHz	500 kHz	9.8196 MHz	Pass
2462 MHz	500 kHz	9.7795 MHz	Pass
Note: the narrowest 6 dB bandwidth was observed at 2 Mbps.			

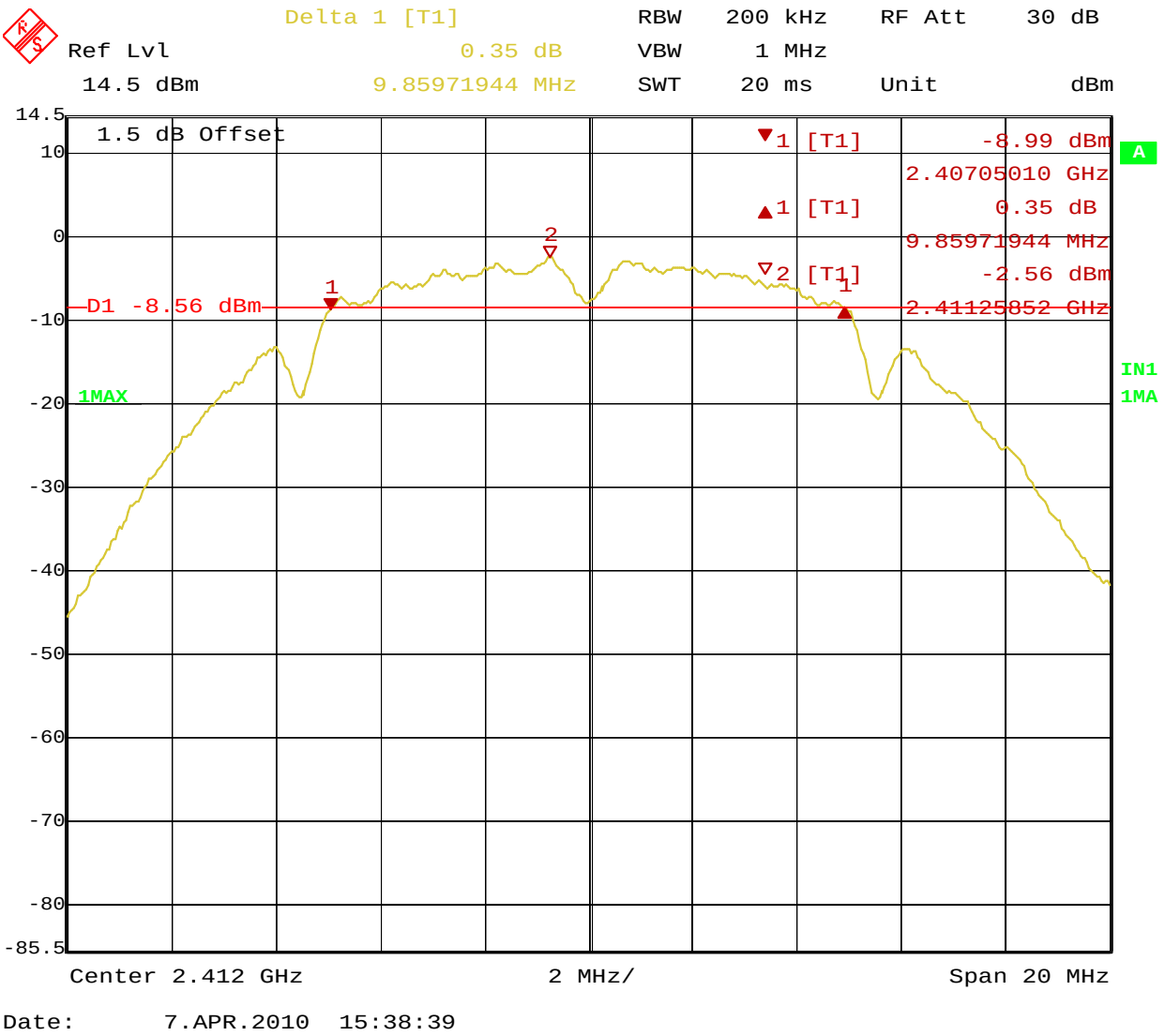


Figure 4: 6 dB Bandwidth at 2 Mbit/s – Operating Channel 2412 MHz

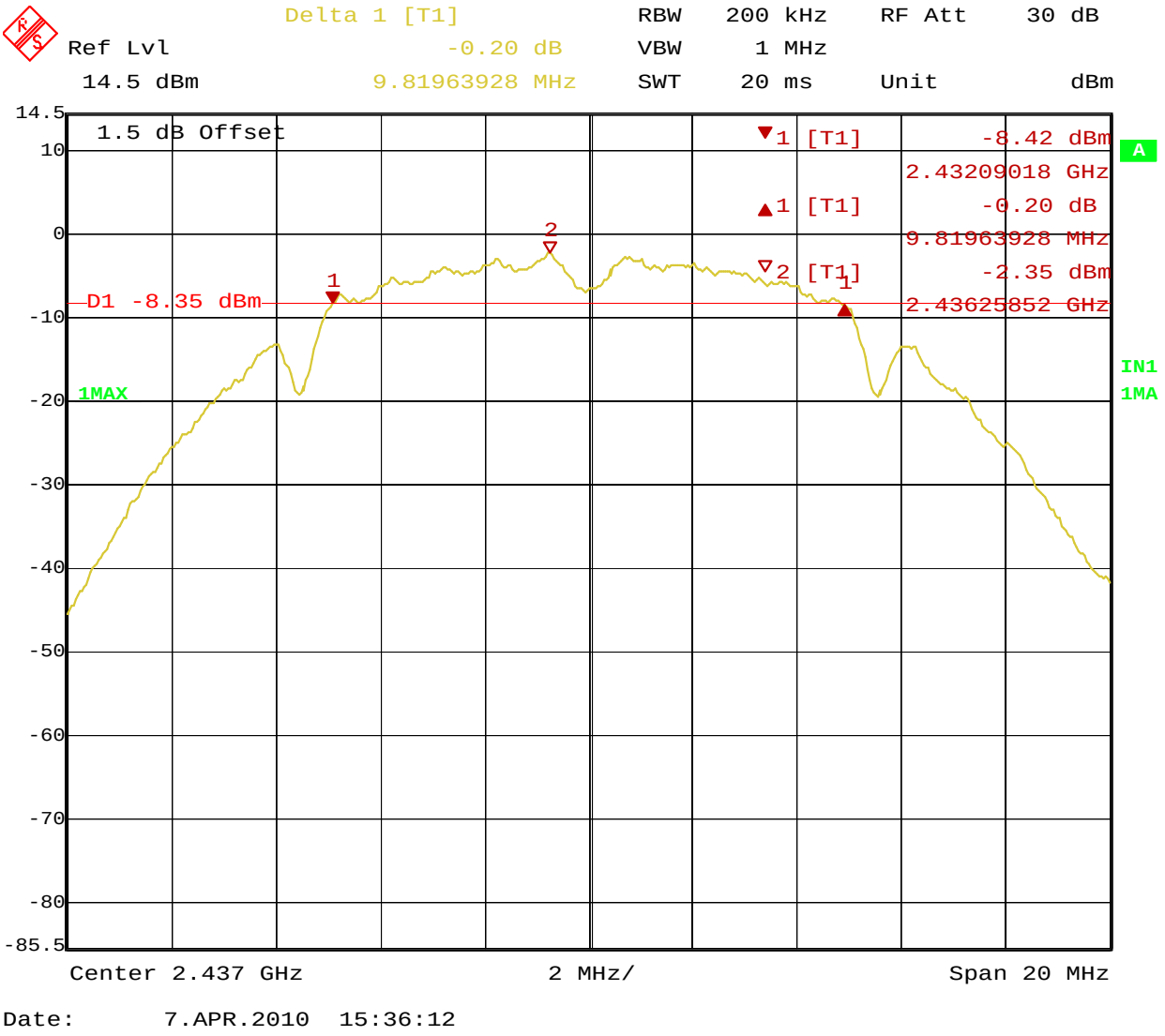


Figure 5: 6 dB Bandwidth at 2 Mbit/s – Operating Channel 2437 MHz

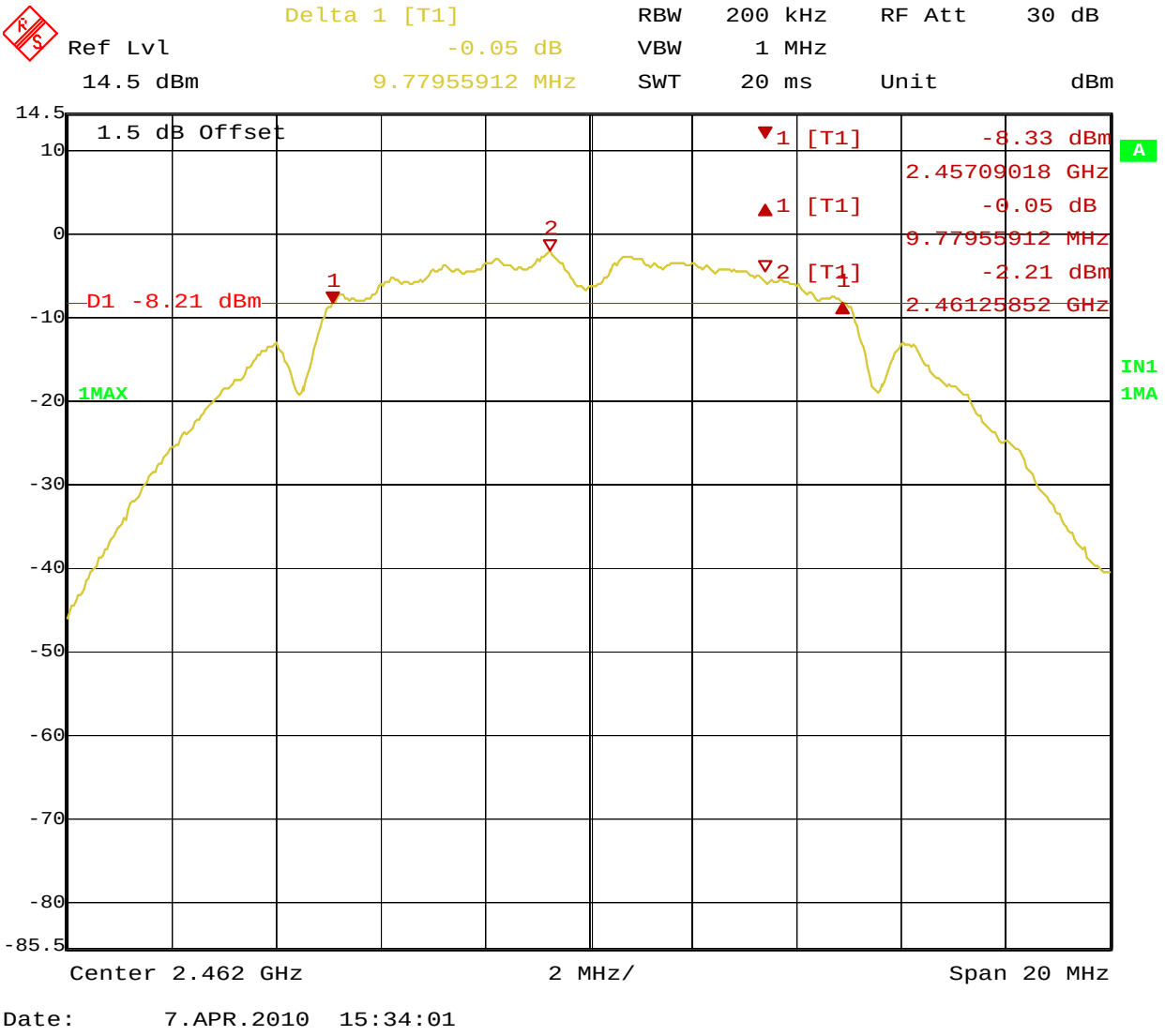


Figure 6: 6 dB Bandwidth at 2 Mbit/s – Operating Channel 2462 MHz

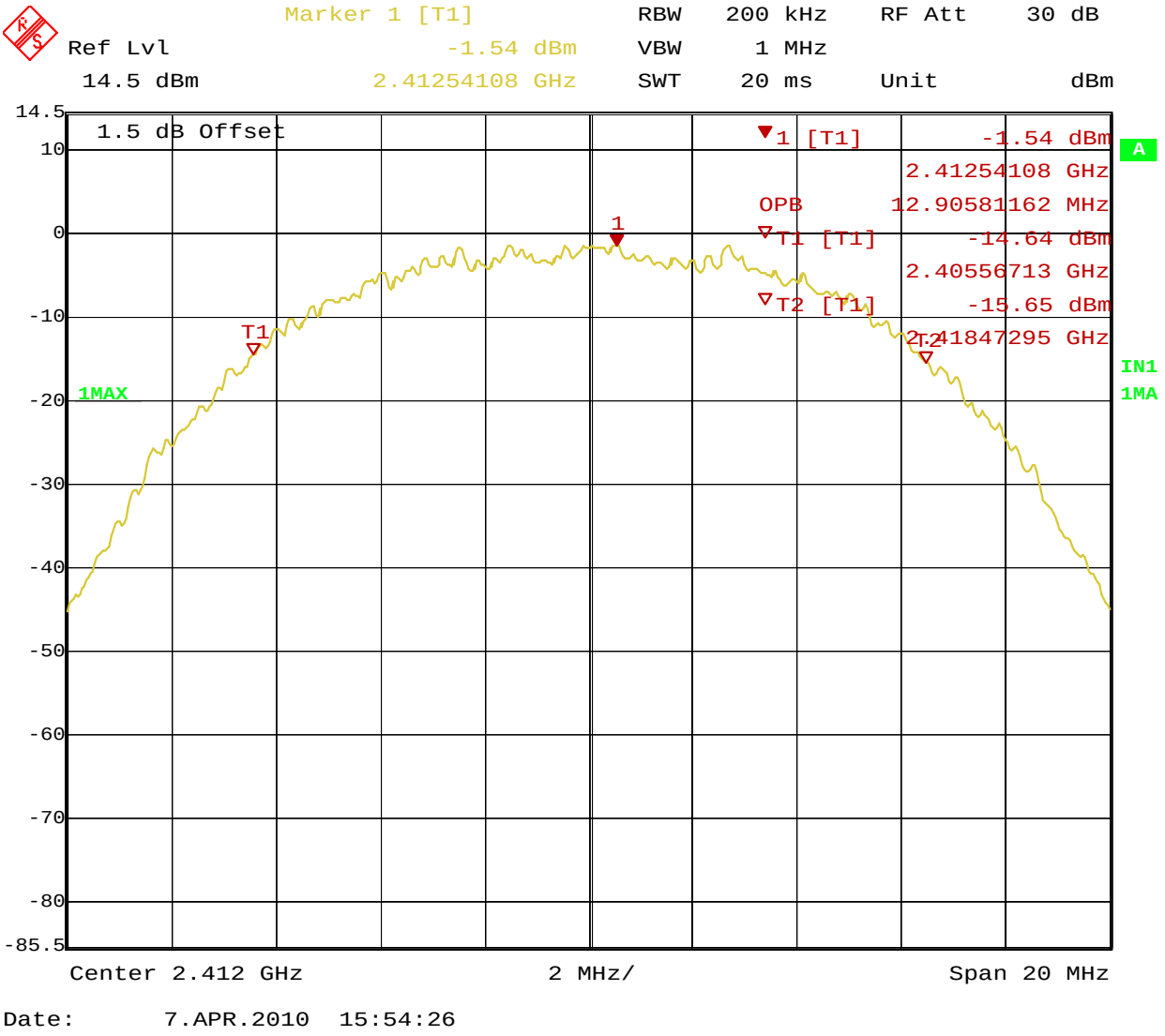


Figure 7: 99% Bandwidth at 5.5 Mbit/s – Operating Channel 2412 MHz

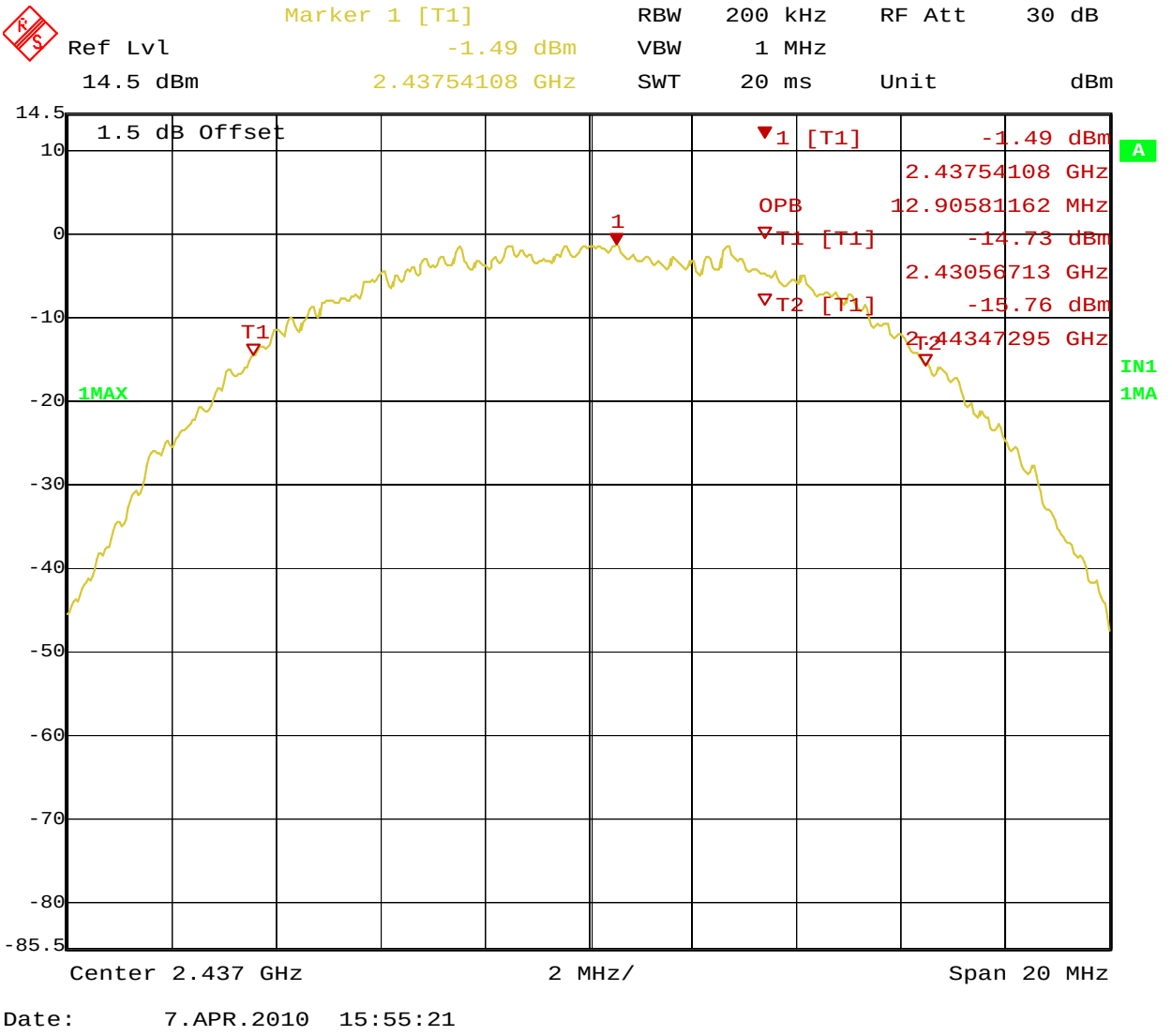


Figure 8: 99% Bandwidth at 5.5 Mbit/s – Operating Channel 2437 MHz

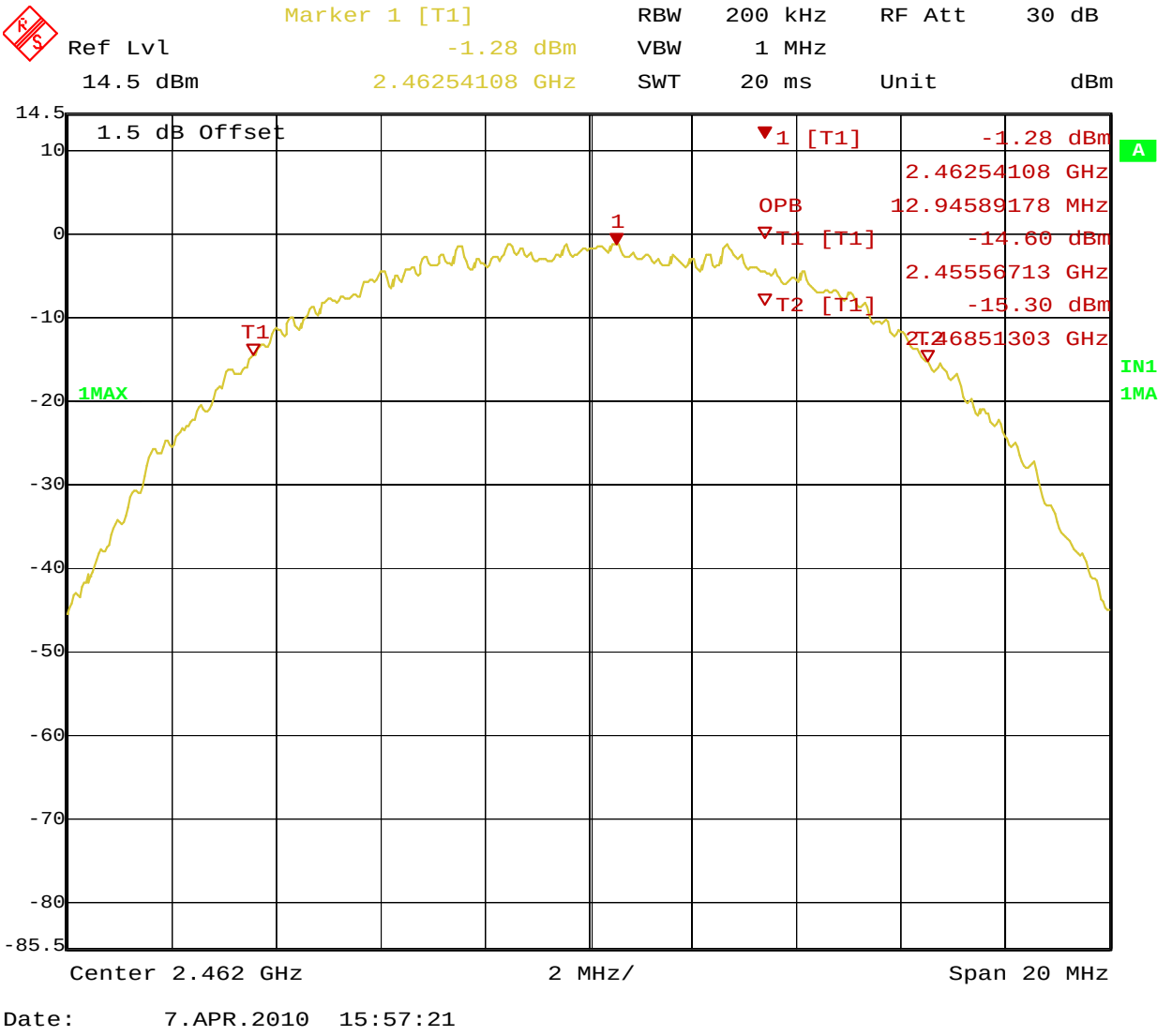


Figure 9: 99% Bandwidth at 5.5 Mbit/s – Operating Channel 2462 MHz

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.

Any frequency outside the band of 2400 MHz to 2483.5 MHz, the power output level must be below 20 db 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 4: Band-Edge Requirements – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only				
Antenna Type: Integrated		**Power Setting:** 10		
Signal State: Modulated		**Data Rate:** 11 Mbps		
Ambient Temp.: 23° C		**Relative Humidity:**37%		
Band-Edge Results				
Operating Channel	**Mode**	**Band-edge Level (dBm)**	**20 dB Level (dBm)**	**Margin (dB)**
2412 MHz	11 Mbps	-53.54	-22.90	-30.64
2437 MHz	11 Mbps	-54.29	-22.76	-31.53
2462 MHz	11 Mbps	-55.46	-22.43	-33.03

Table 5: Out of band Conducted Emission – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only					
Antenna Type: Integrated			**Power Setting:** 10		
Signal State: Modulated			**Data Rate:** 11 Mbit/s		
Ambient Temp.: 23 °C			**Relative Humidity:**33 %		
Output of Band Results					
Operating Channel	**Mode**	**Band 1 30MHz-2.4835GHz**	**Band 2 2.4835GHz-10GHz**	**Band 3 10GHz-25GHz**	**Result**
2412 MHz	11 Mbps	Figure 13	Figure 14	Figure 15	Pass
2437 MHz	11 Mbps	Figure 16	Figure 17	Figure 18	Pass
2462 MHz	11 Mbps	Figure 19	Figure 20	Figure 21	Pass

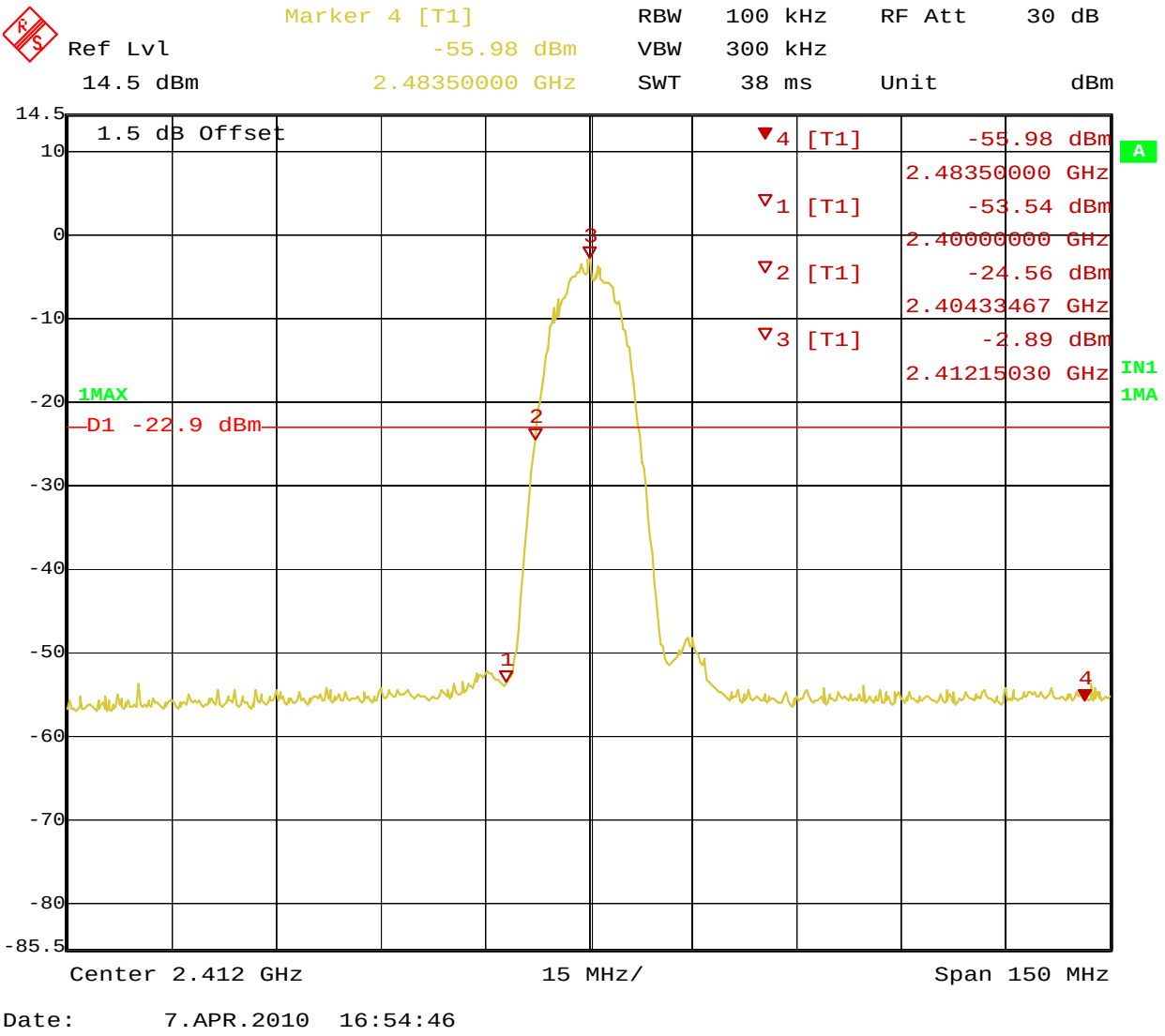


Figure 10: Band-edge Requirement for Operating Channel 2412 MHz at 11 Mbit/s

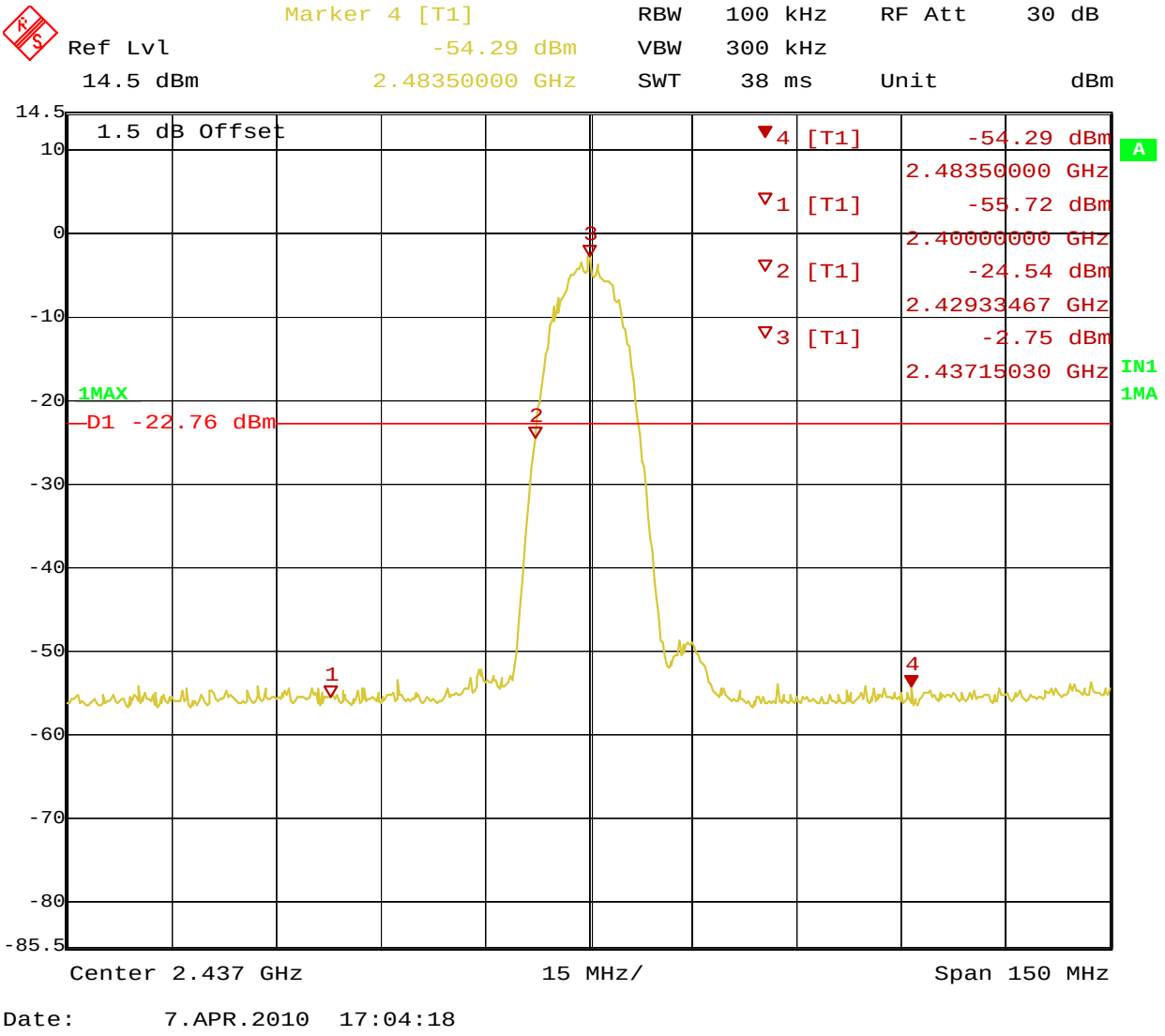


Figure 11: Band-edge Requirement for Operating Channel 2437 MHz at 11 Mbit/s

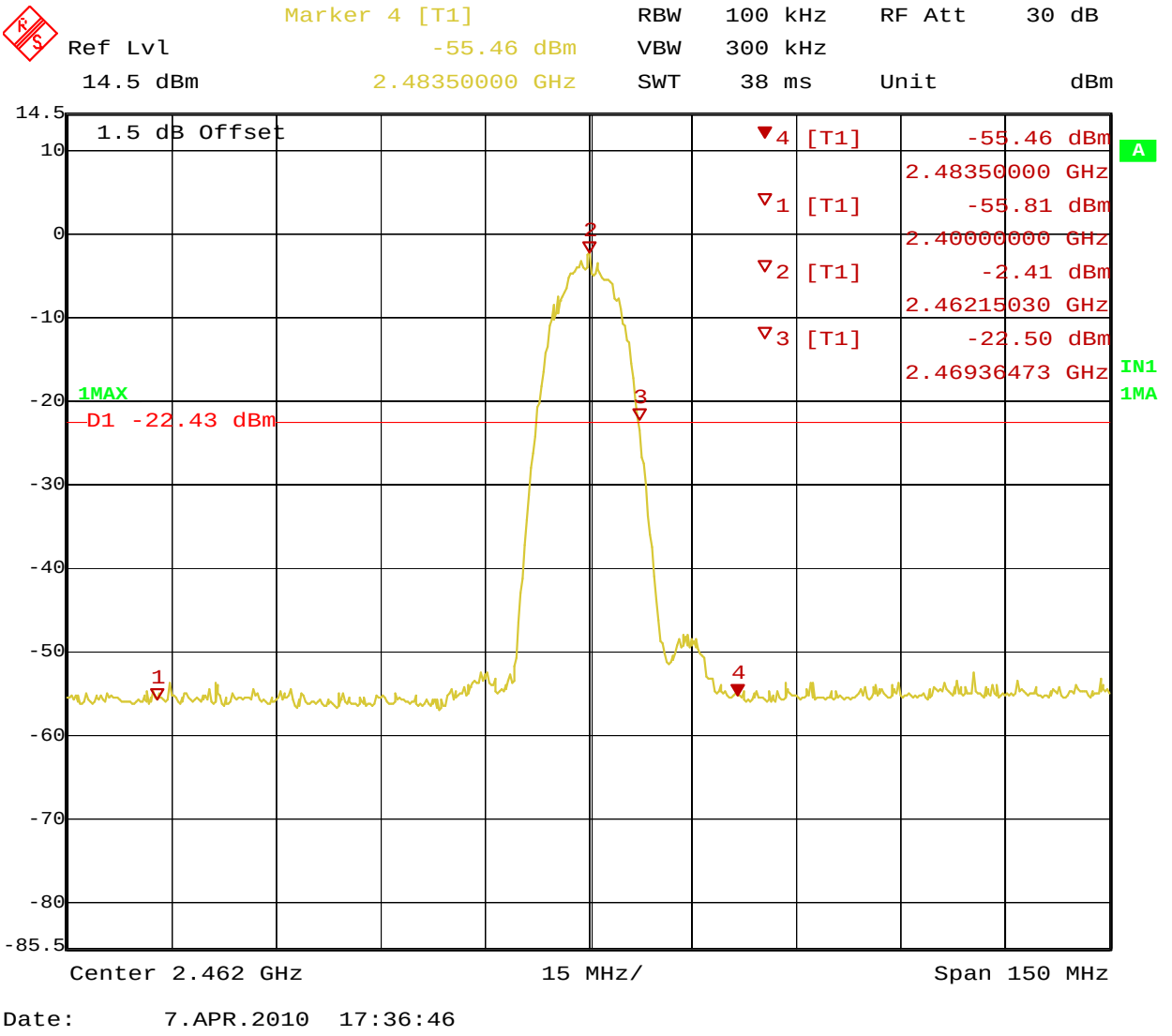


Figure 12: Band-edge Requirement for Operating Channel 2462 MHz at 11 Mbit/s

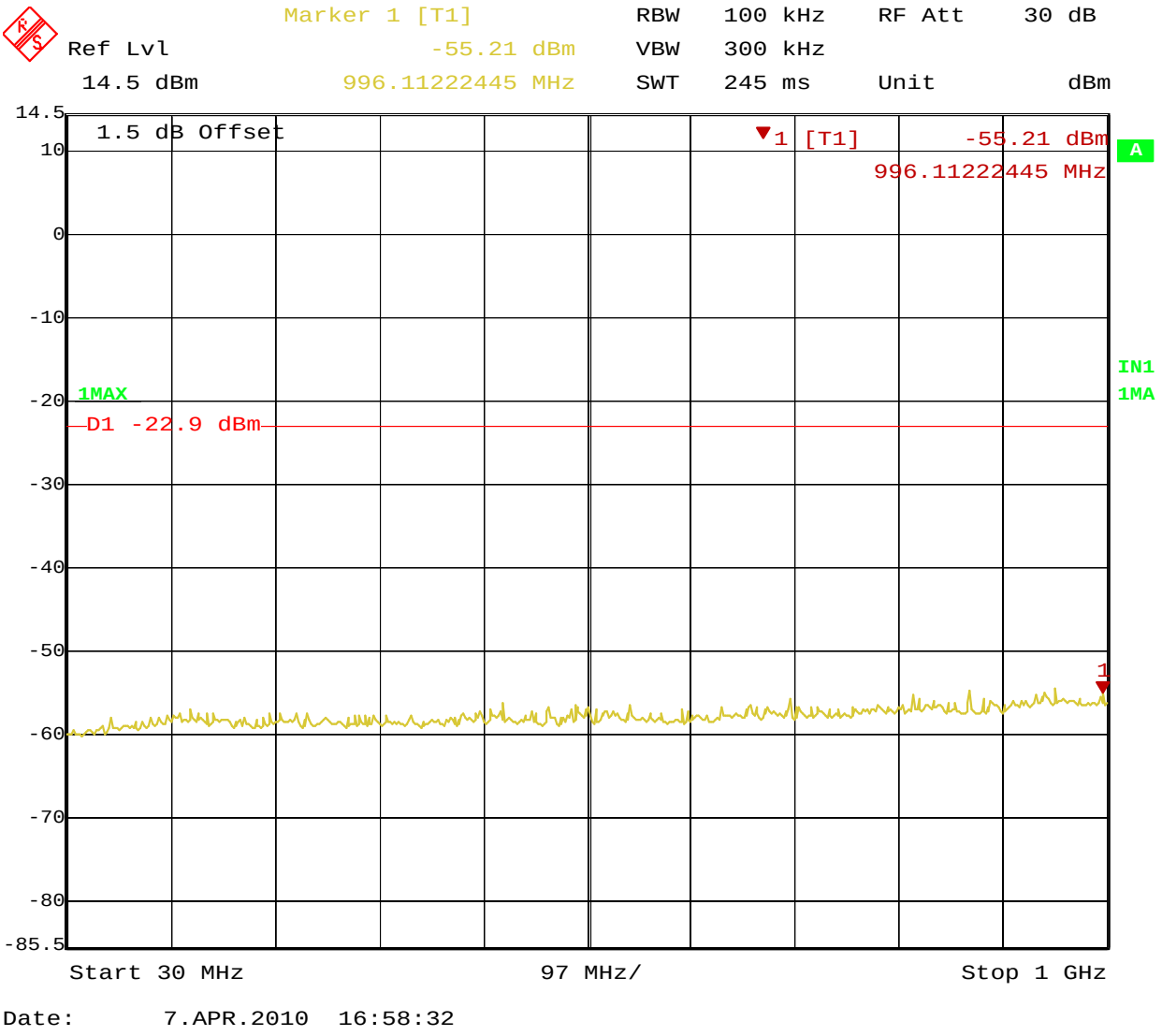


Figure 13: Out of Band Emission for Channel 2412 MHz at 11 Mbit/s – Band 1

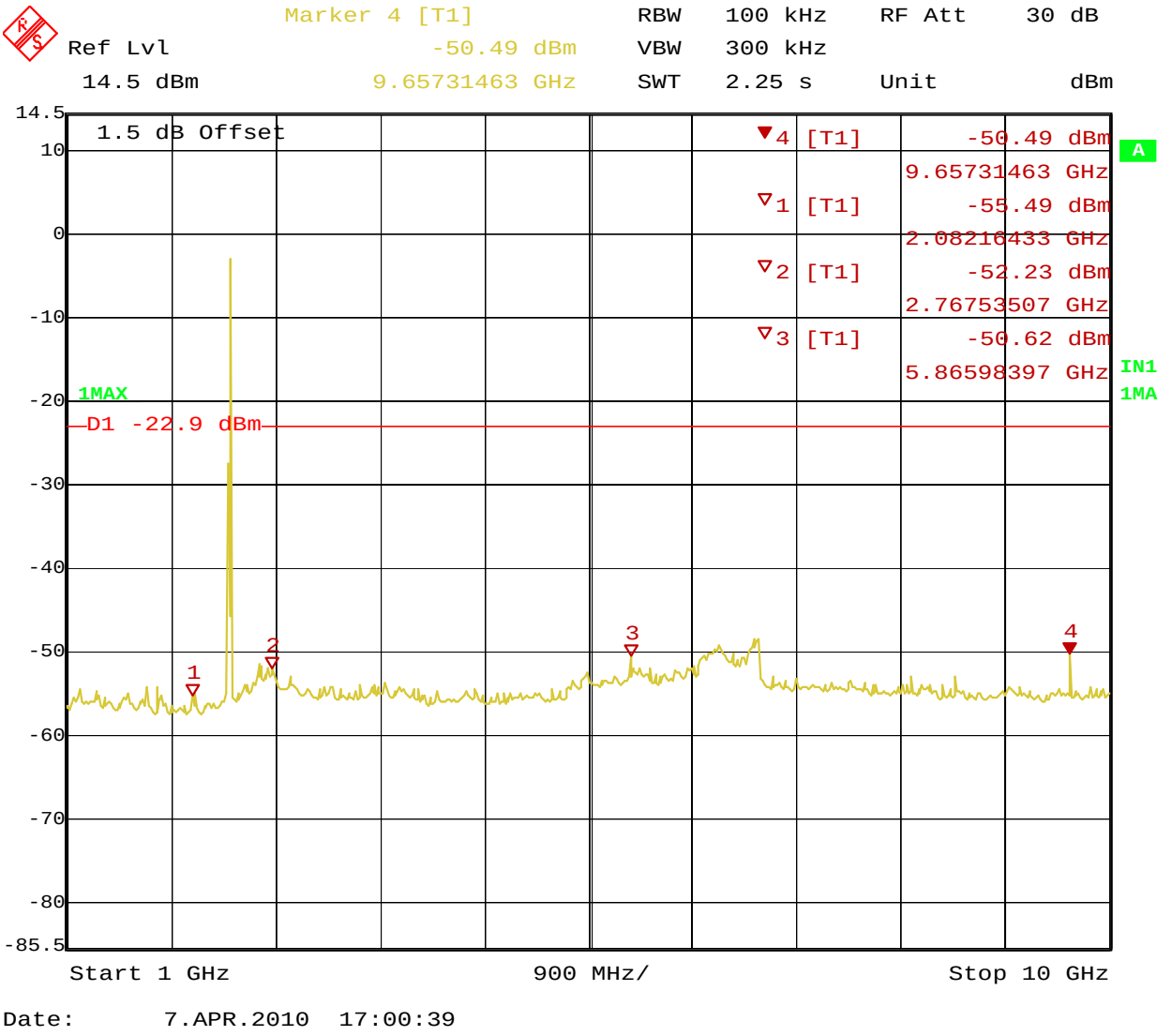


Figure 14: Out of Band Emission for Channel 2412 MHz at 11 Mbit/s – Band 2

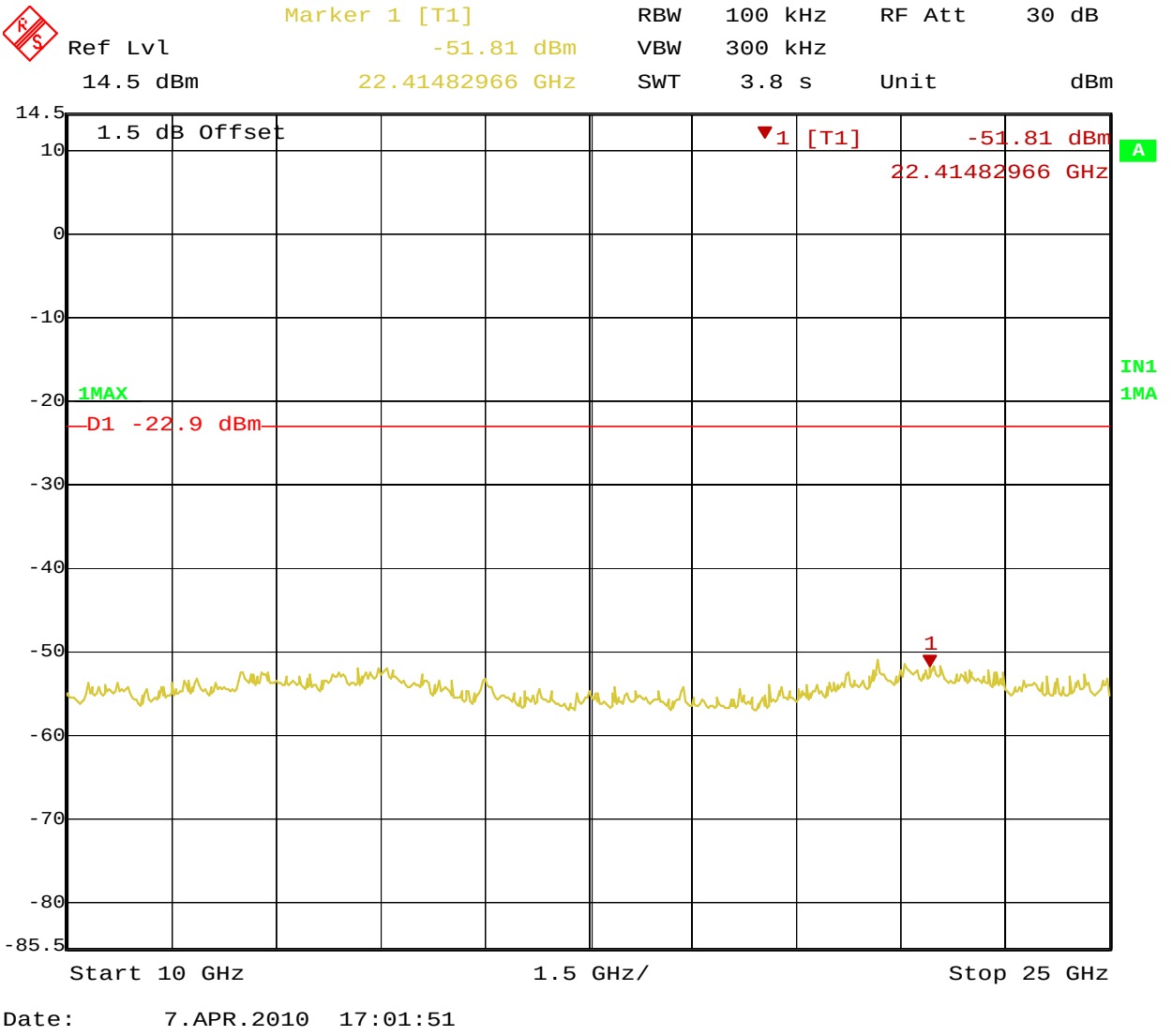


Figure 15: Out of Band Emission for Channel 2412 MHz at 11 Mbit/s – Band 3

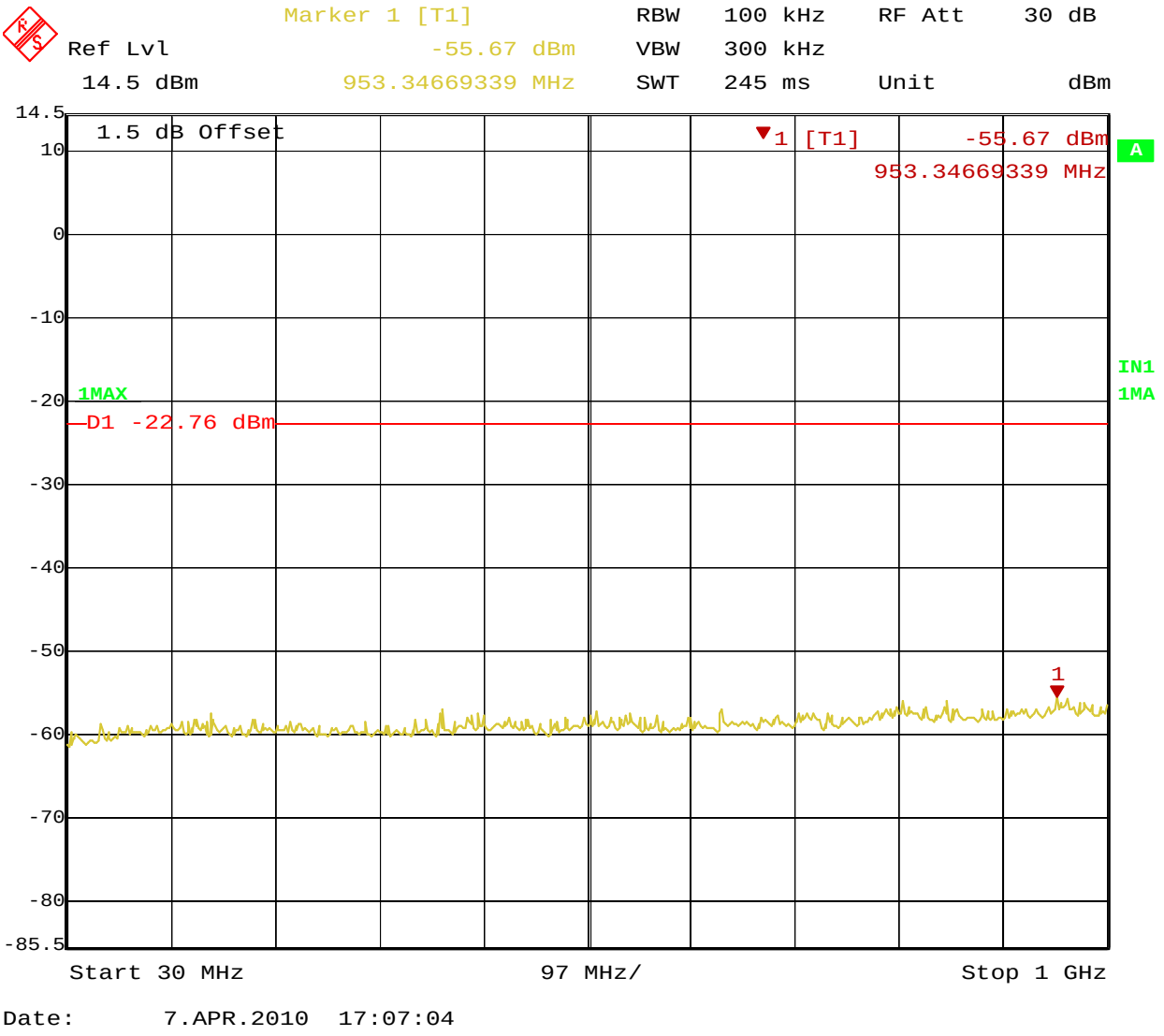


Figure 16: Out of Band Emission for Channel 2437 MHz at 11 Mbit/s – Band 1

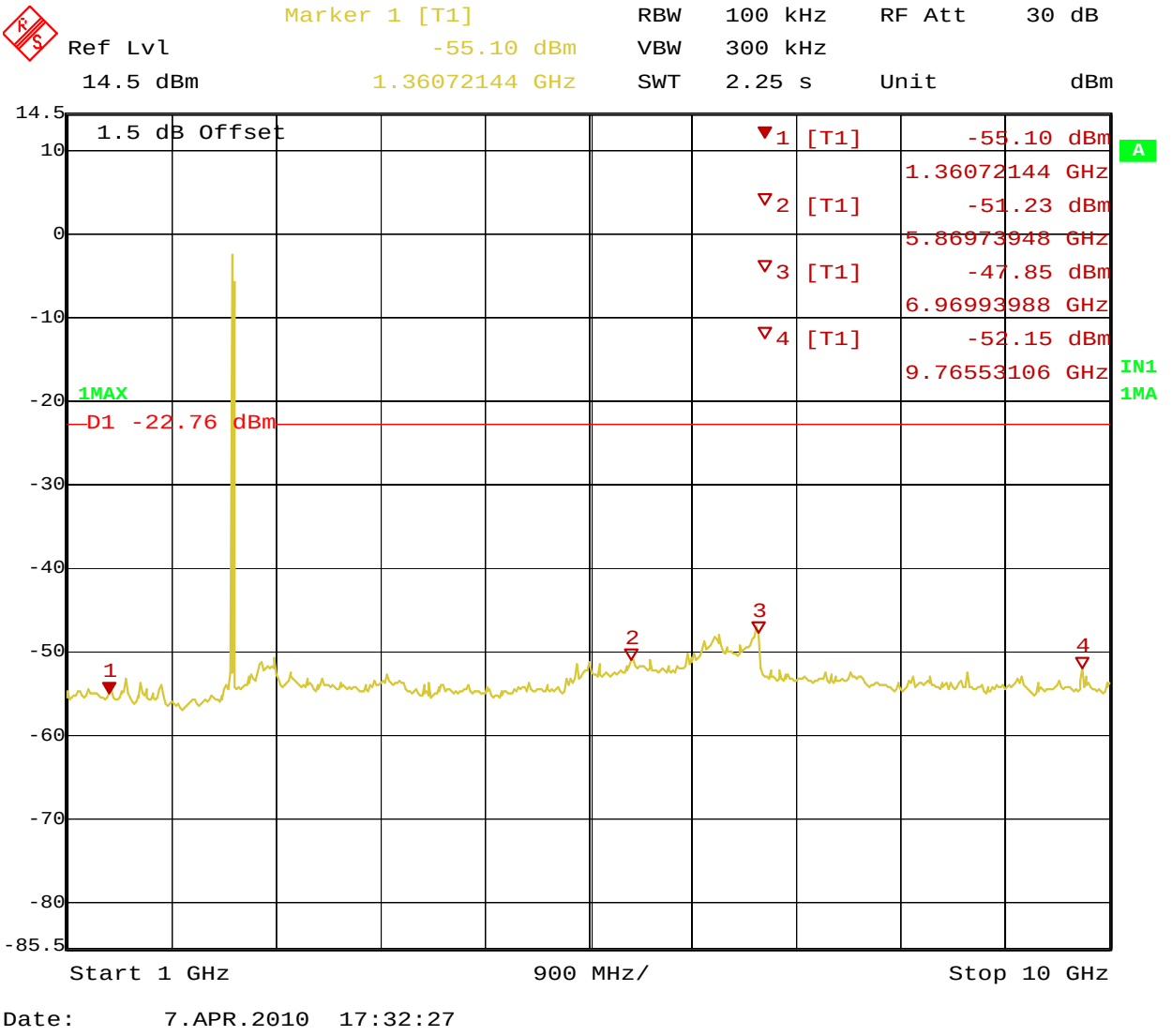


Figure 17: Out of Band Emission for Channel 2437 MHz at 11 Mbit/s – Band 2

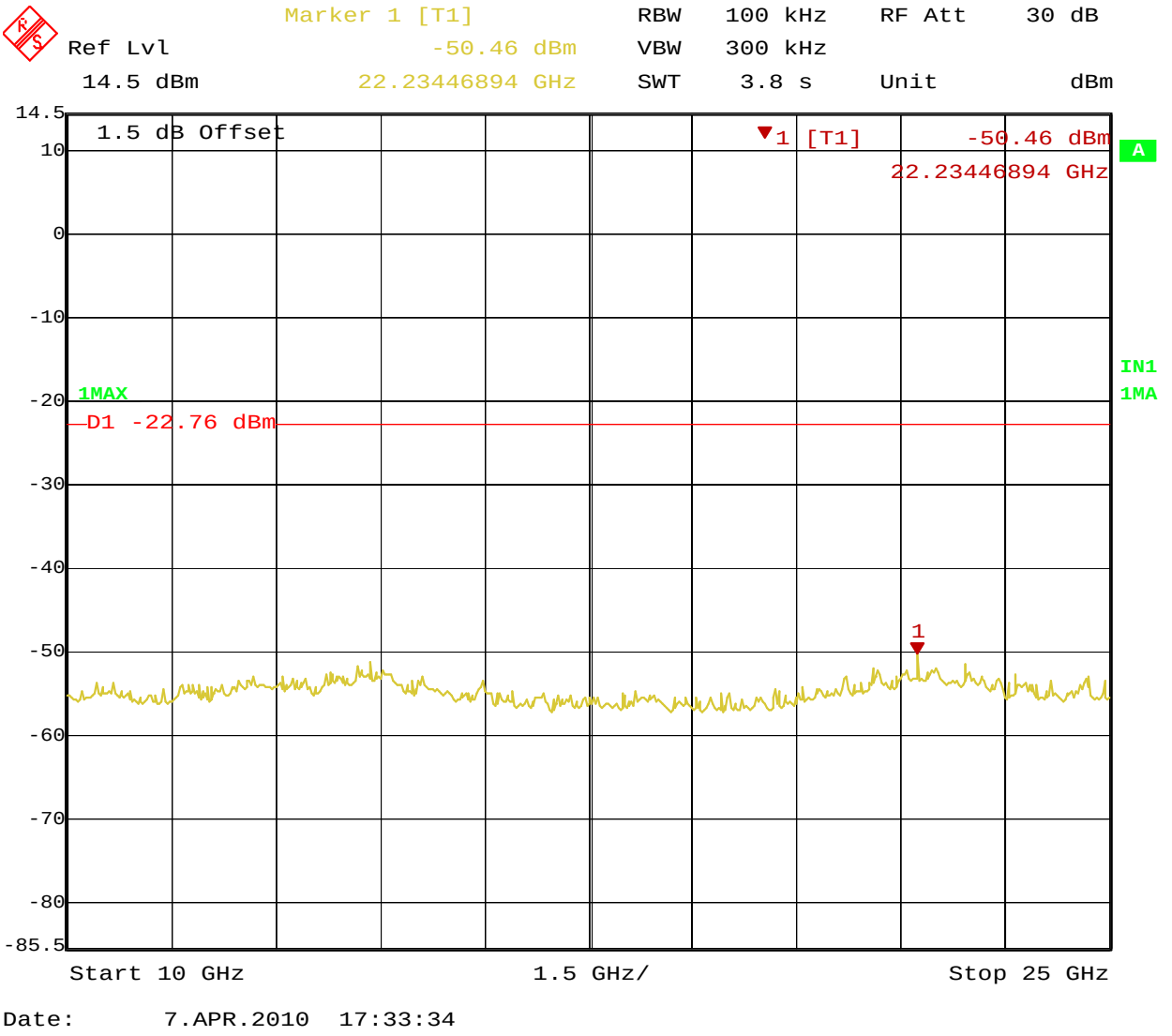


Figure 18: Out of Band Emission for Channel 2437 MHz at 11 Mbit/s – Band 3

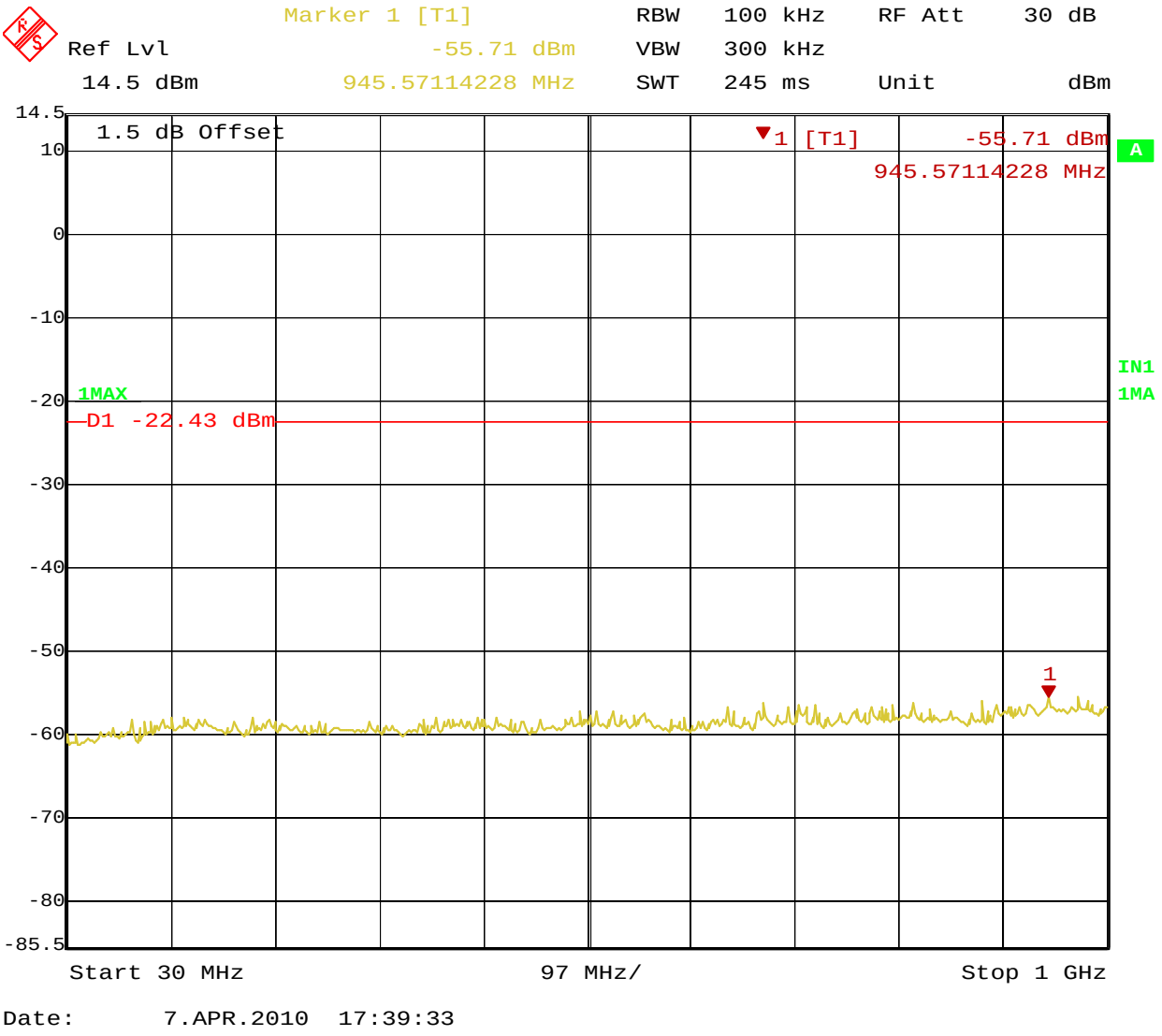


Figure 19: Out of Band Emission for Channel 2462 MHz at 11 Mbit/s – Band 1

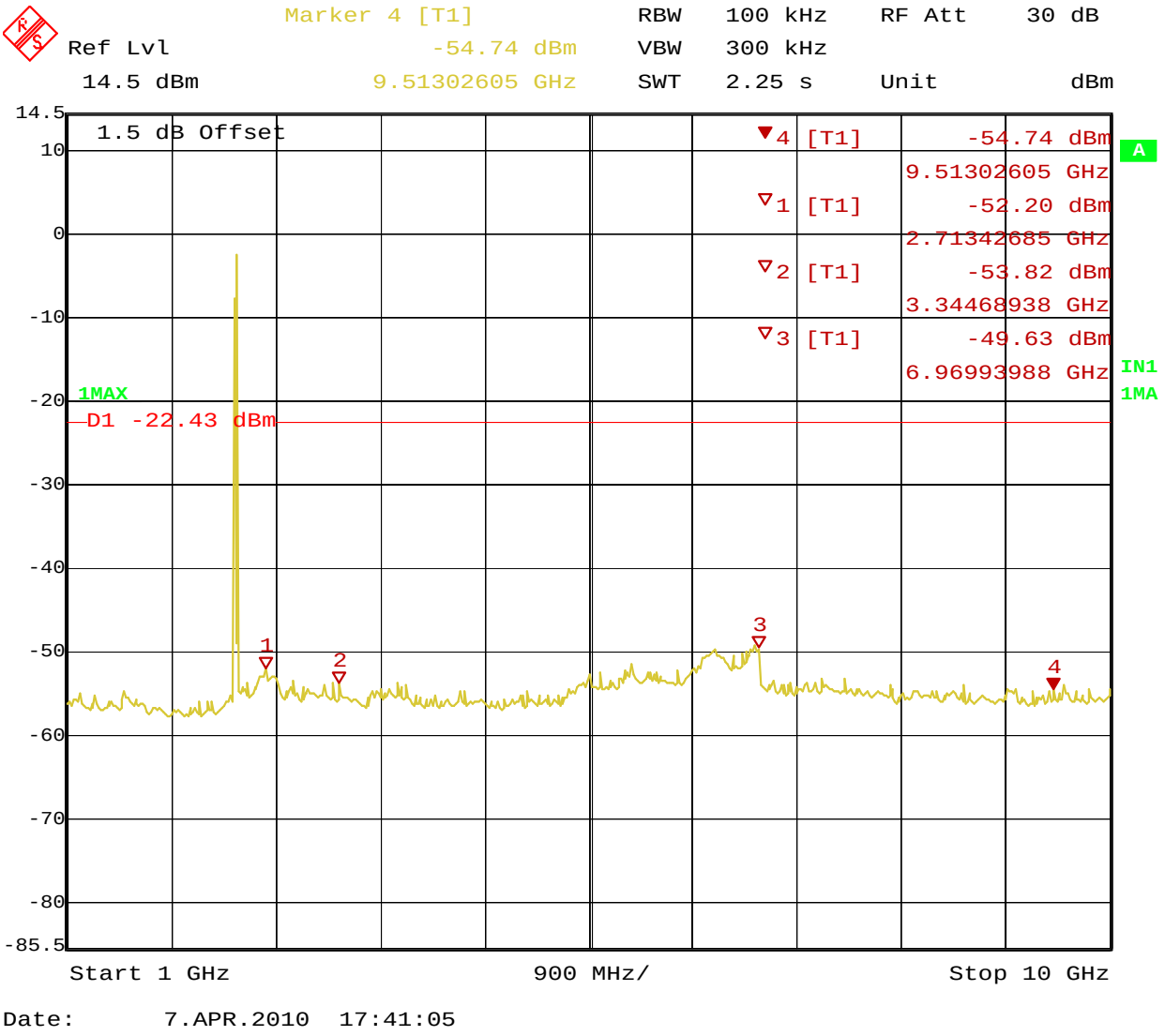


Figure 20: Out of Band Emission for Channel 2462 MHz at 11 Mbit/s – Band 2

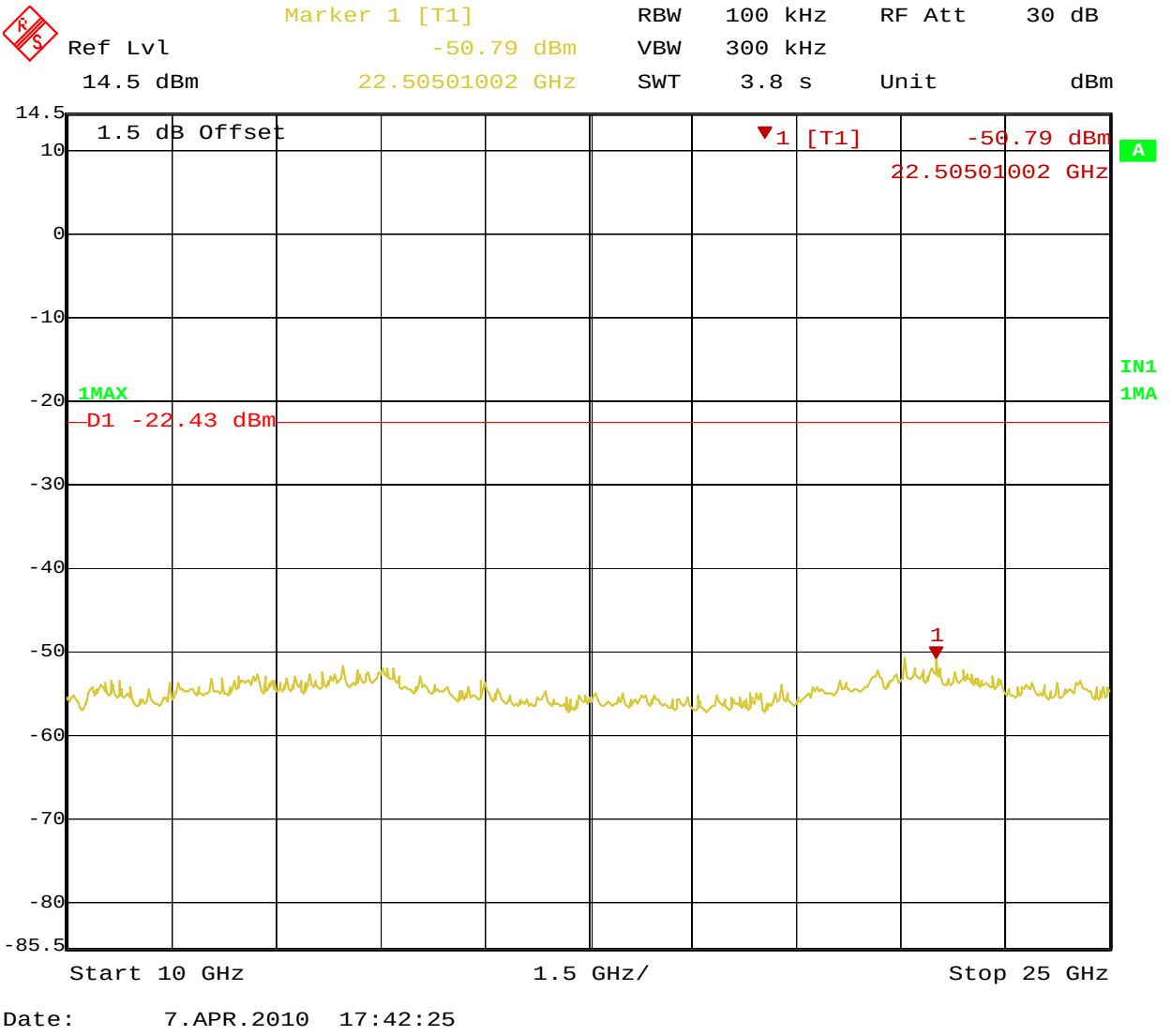


Figure 21: Out of Band Emission for Channel 2462 MHz at 11 Mbit/s – Band 3

4.4 Peak Power Spectral Density

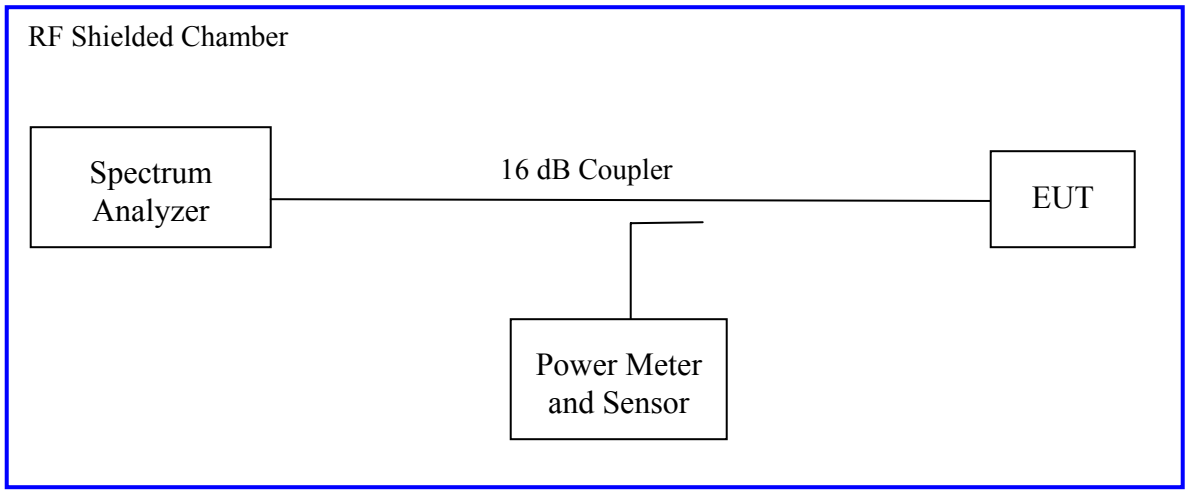
According to the CFR47 Part 15.247 (e) and RSS 210 (A8.2), the spectral power density output of the antenna port shall be less than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

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, MAC 001DC9050067. The worst sample result indicated below.

Test Setup:



4.4.2 Results

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

Table 6: Peak Power Spectral Density – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only				
Antenna Type: Integrated		**Power Setting:** 10		
Signal State: Modulated		**Data Rate:** 11 Mbps		
Ambient Temp: 23° C		**Relative Humidity:**37 %		
Peak Power Spectral Density Test Results				
Operating Channel	**Mode**	**PPSD [dBm]**	**Limit [dBm]**	**Margin [dB]**
2412 MHz	11 Mbps	-11.58	8.0	-19.58
2437 MHz	11 Mbps	-13.26	8.0	-21.26
2462 MHz	11 Mbps	-11.09	8.0	-19.09
Note: the highest PPSD was observed at 11 Mbps				

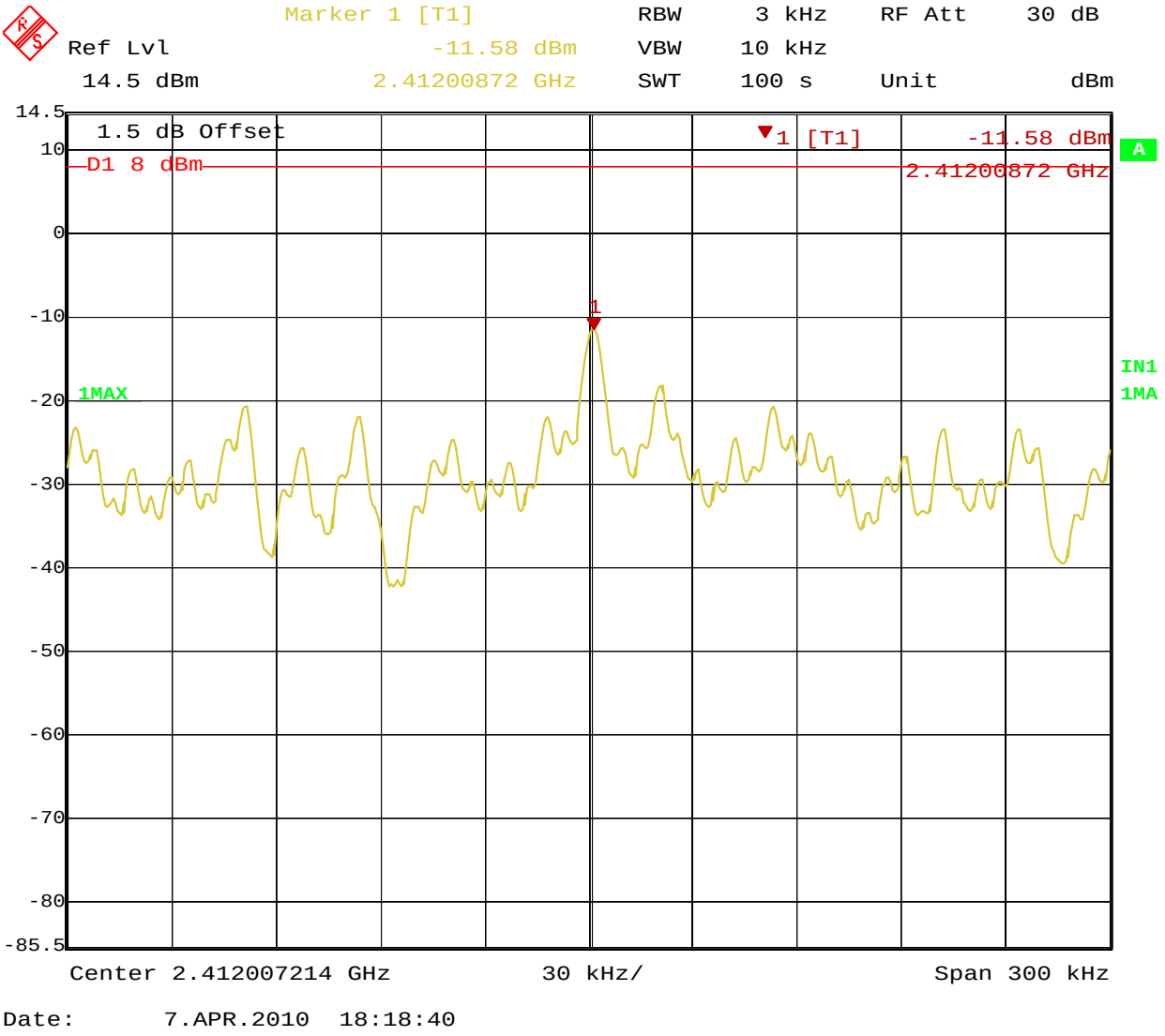


Figure 22: Peak Power Spectral Density for Operating Channel 2412 MHz – 11 Mbit/s

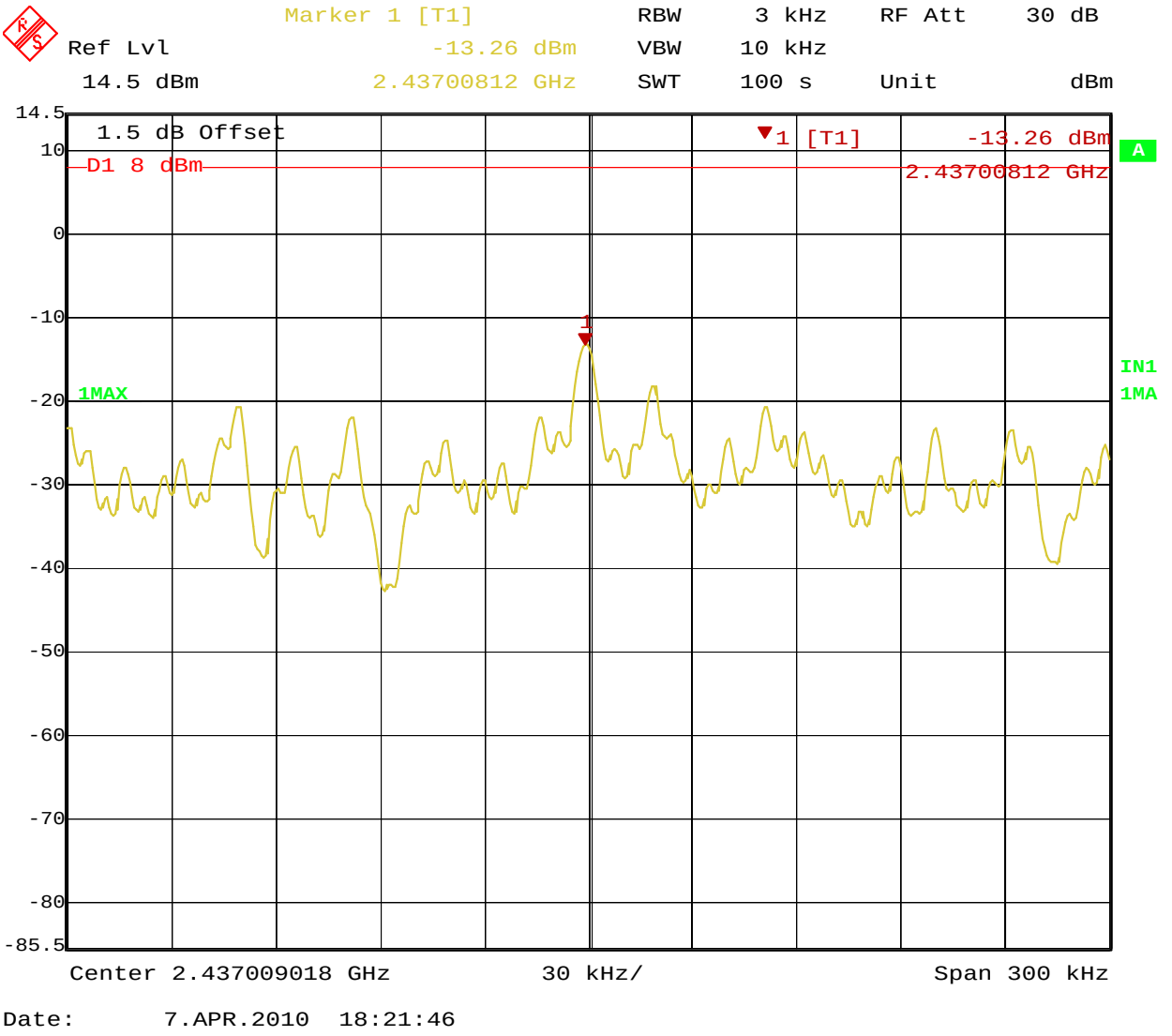


Figure 23: Peak Power Spectral Density for Operating Channel 2437 MHz – 11 Mbit/s

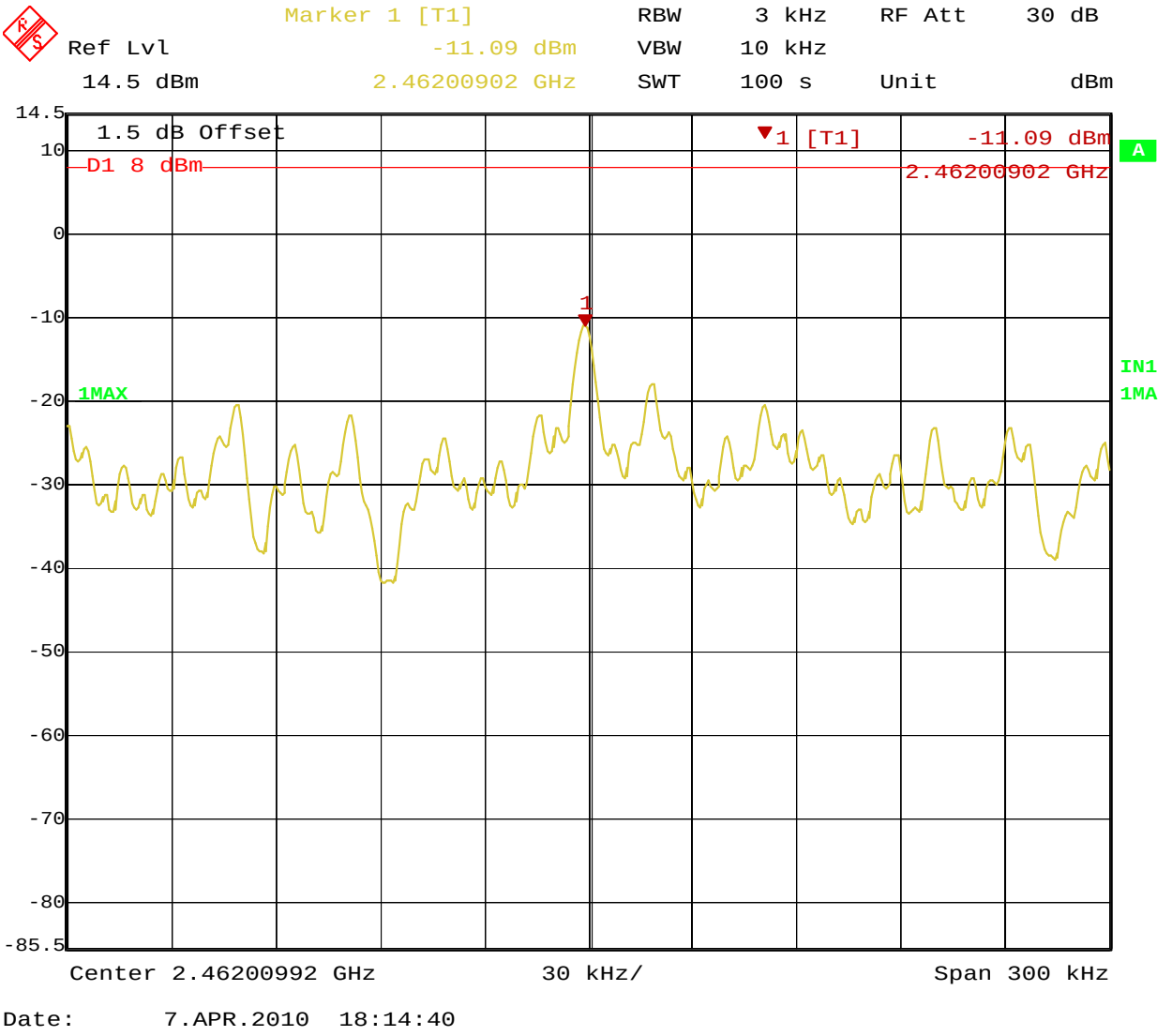


Figure 24: Peak Power Spectral Density for Operating Channel 2462 MHz – 11 Mbit/s

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				
300-1,500	…	…	F/300	6
1,500-100,000	…	…	5	6
(B)Limits For General Population / Uncontrolled Exposure				
300-1500	…	…	F/1500	6
1,500-100,000	…	…	1.0	30

F = Frequency in MHz

4.5.3 EUT Operating Condition

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

4.5.4 Classification

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

4.5.5 Test Results

4.5.5.1 Antenna Gain

The transmitting antenna was integrated. The antenna gain was +1.0 dBi or 1.26 (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 +11.21 dBm or 13.21 mW

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

Pd = (13.21*1.26) / (1600π) = 0.003313mW/cm2, which is 0.9966 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).

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.

The preliminary tests performed for 802.11b modes at different data rate and positions. The worst mode was 802.11b at 1 Mbps on Z-Axis.

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 for three operating channels; 2412 MHz, 2437 MHz, and 2462 MHz at 1 Mbps on Z-Axis.

The plots were captured to show the band-edge of the fundamental signal meeting the spurious emission limit at the restricted bands.

4.6.1.3 Deviations

None.

4.6.2 Transmitter Spurious Emission Limit

The spurious emissions of the transmitter shall not exceed the values in CFR47 Part 15.205, 15.209: 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 20 dB below the in-band emission.

4.6.3 Test Results

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

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

Table 7: Transmit Spurious Emission at Band-Edge Requirements – Test Results

Test Conditions: Radiated Measurement, Normal Temperature and Voltage only							
Antenna Type: Integrated			**Power Setting:** 10				
Signal State: Modulated			**Data Rate:** 1 Mbps				
Ambient Temp.: 23° C			**Relative Humidity:**33%				
Band-Edge Results							
Operating Channel	**EUT Position**	**Polarity**	**Pk Plots**	**Peak Limit**	**Ave. Plots**	**Ave. Limit**	**Result**
2412 MHz	Horizontal	Horizontal	#25	74.00	#26	54.00	Pass
2412 MHz	Horizontal	Vertical	#27	74.00	#28	54.00	Pass
2437 MHz	Horizontal	Horizontal	#29	74.00	#30	54.00	Pass
2437 MHz	Horizontal	Vertical	#31	74.00	#32	54.00	Pass
2462 MHz	Horizontal	Horizontal	#33	74.00	#34	54.00	Pass
2462 MHz	Horizontal	Vertical	#36	74.00	#36	54.00	Pass

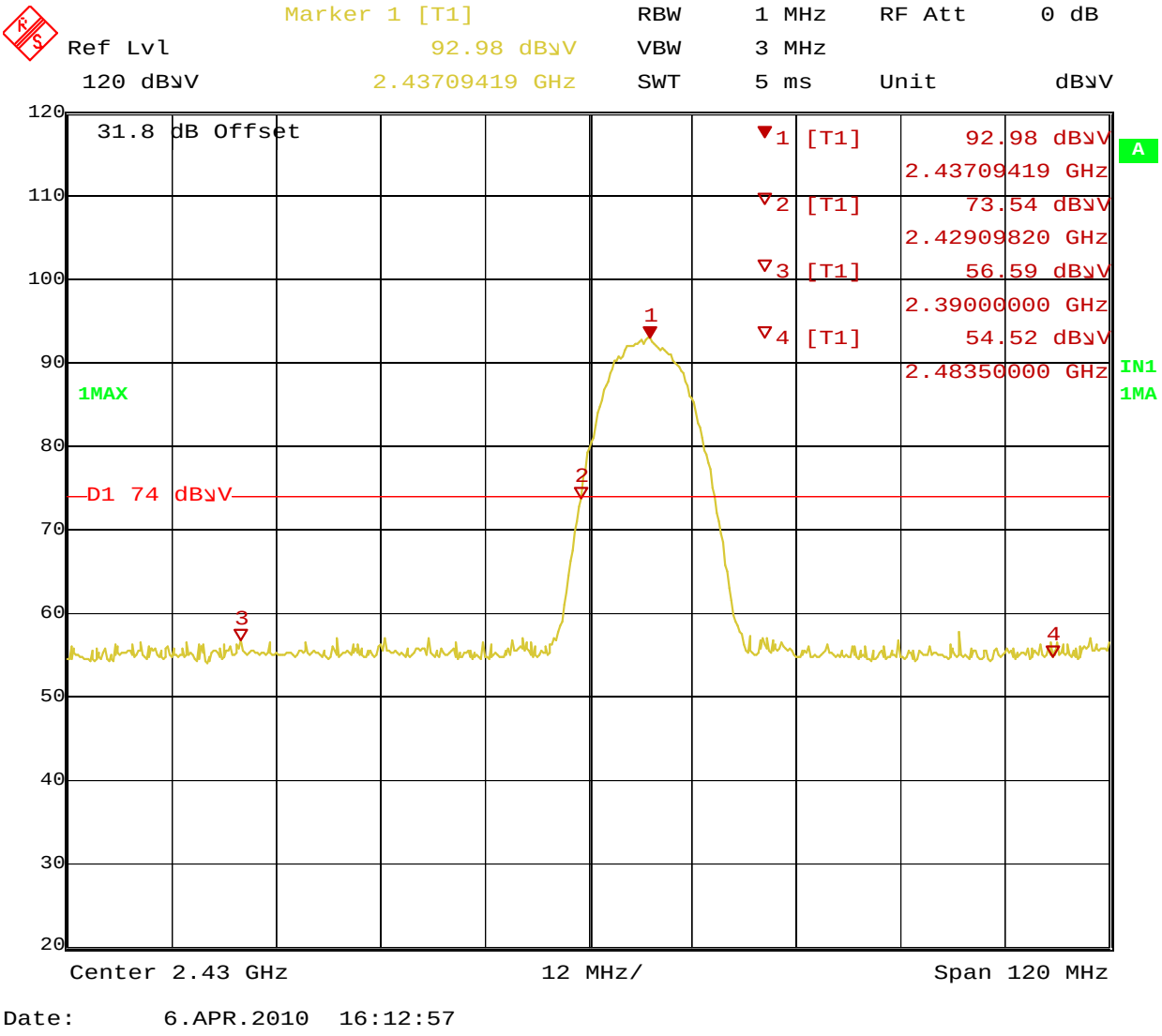


Figure 25: Spurious Emission at the Band-Edge for Channel 2412 MHz at 1 Mbps – Horizontal (Peak)

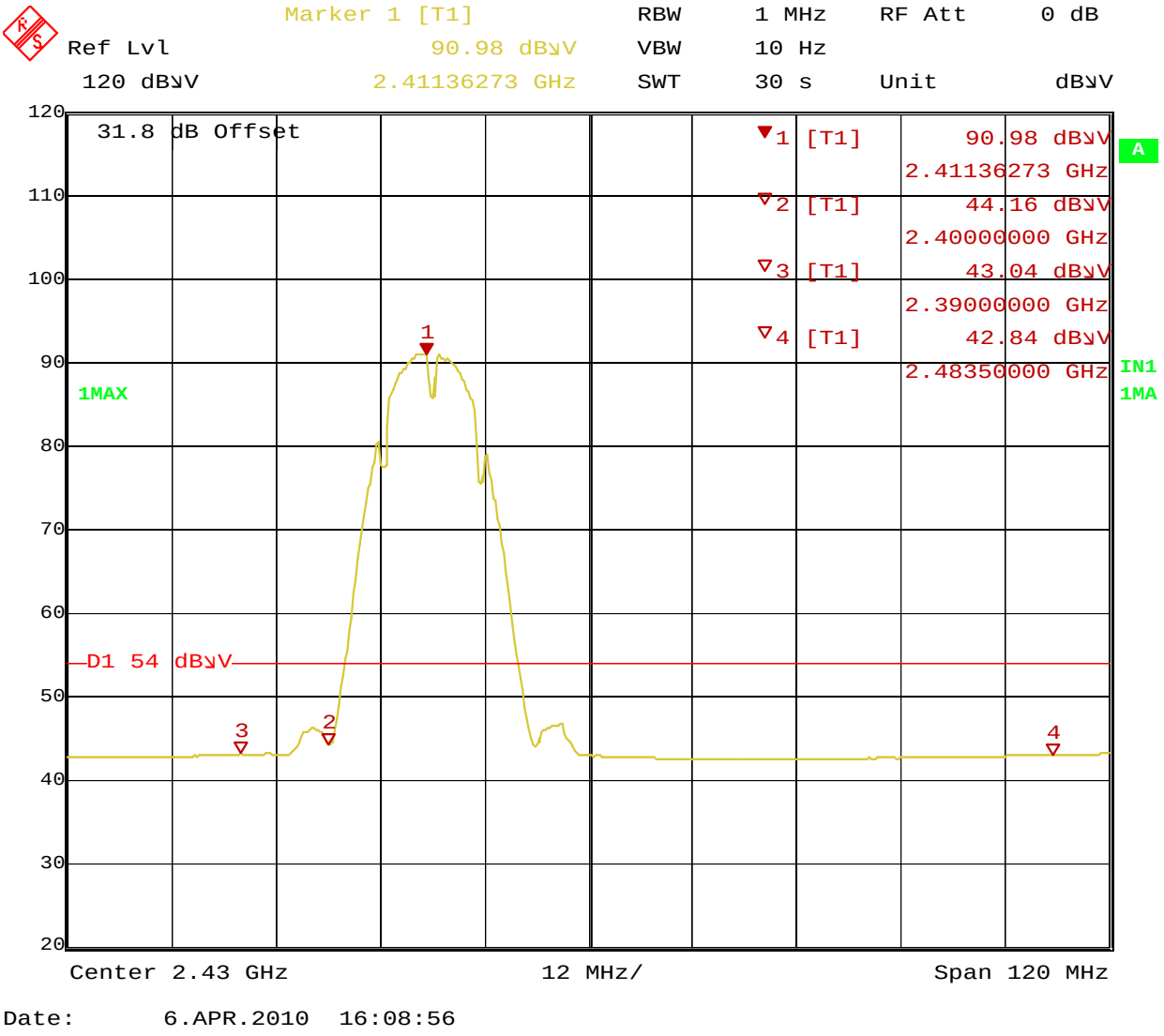


Figure 26: Spurious Emission at the Band-Edge for Channel 2412 MHz at 1 Mbps – Horizontal (Ave.)

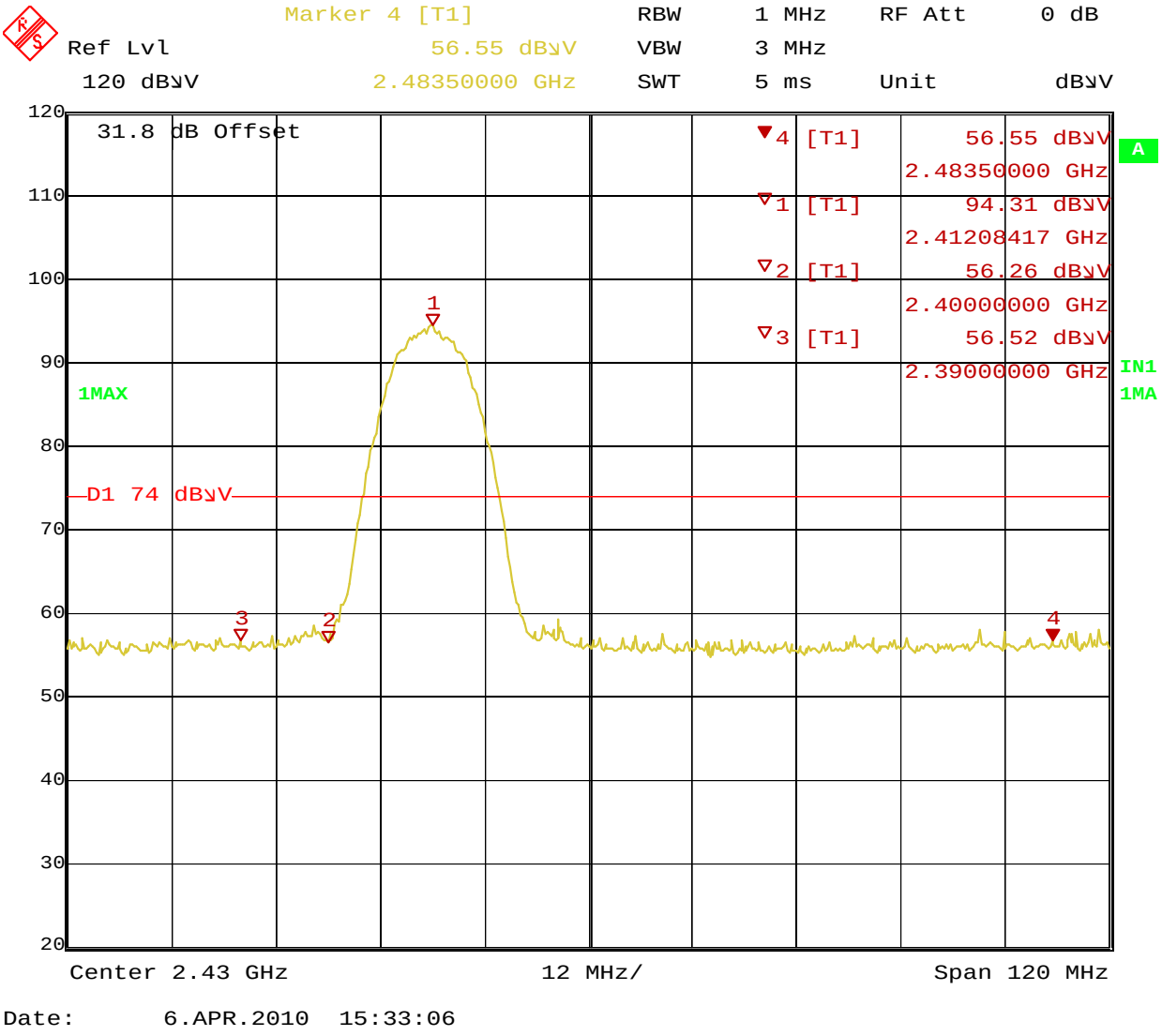


Figure 27: Spurious Emission at the Band-Edge for Channel 2412 MHz at 1 Mbps – Vertical (Peak)

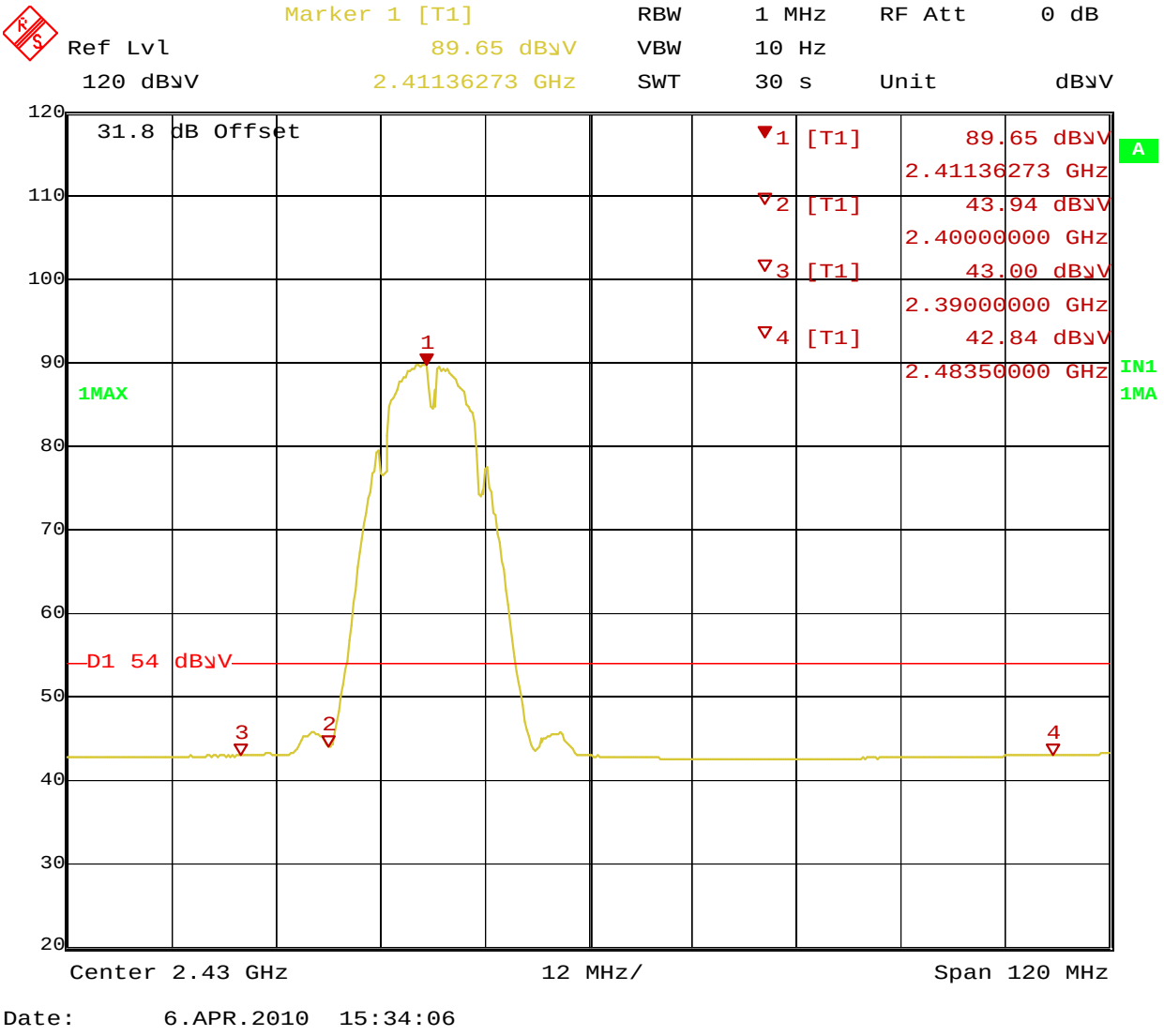


Figure 28: Spurious Emission at the Band-Edge for Channel 2412 MHz at 1 Mbps – Vertical (Ave.)

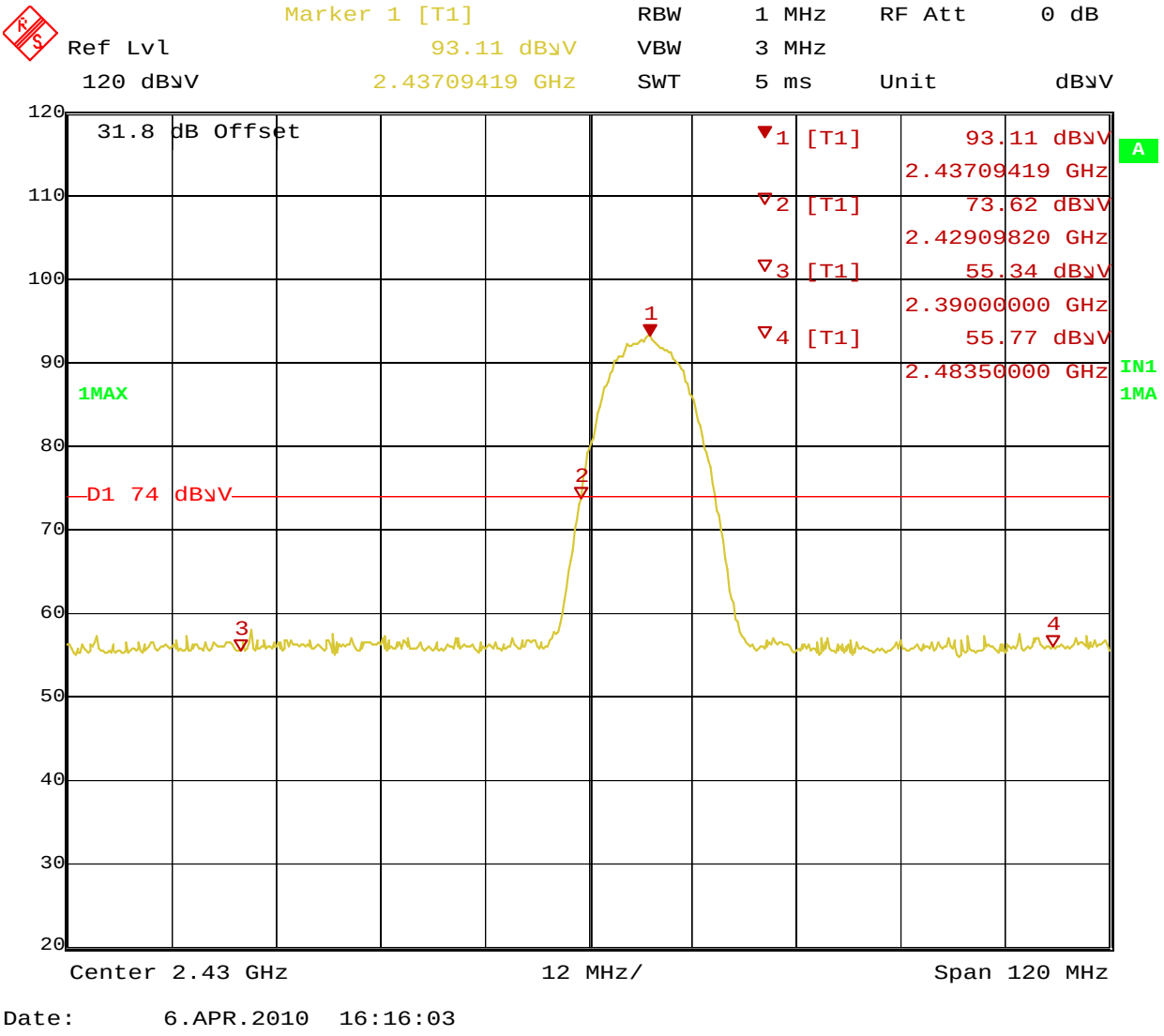


Figure 29: Spurious Emission at the Band-Edge for Channel 2437 MHz at 1 Mbps – Horizontal (Peak)

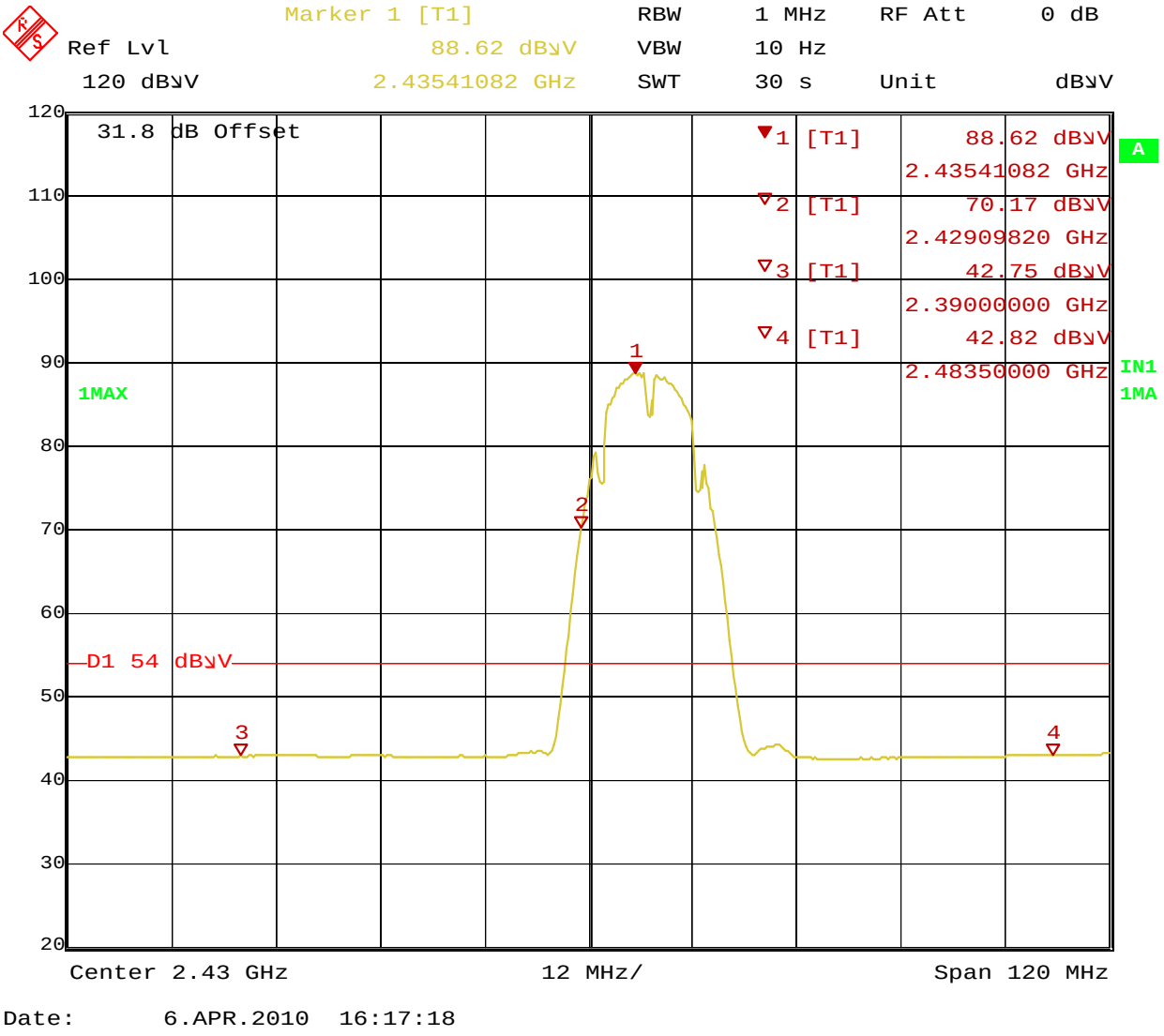


Figure 30: Spurious Emission at the Band-Edge for Channel 2437 MHz at 1 Mbps – Horizontal (Ave.)

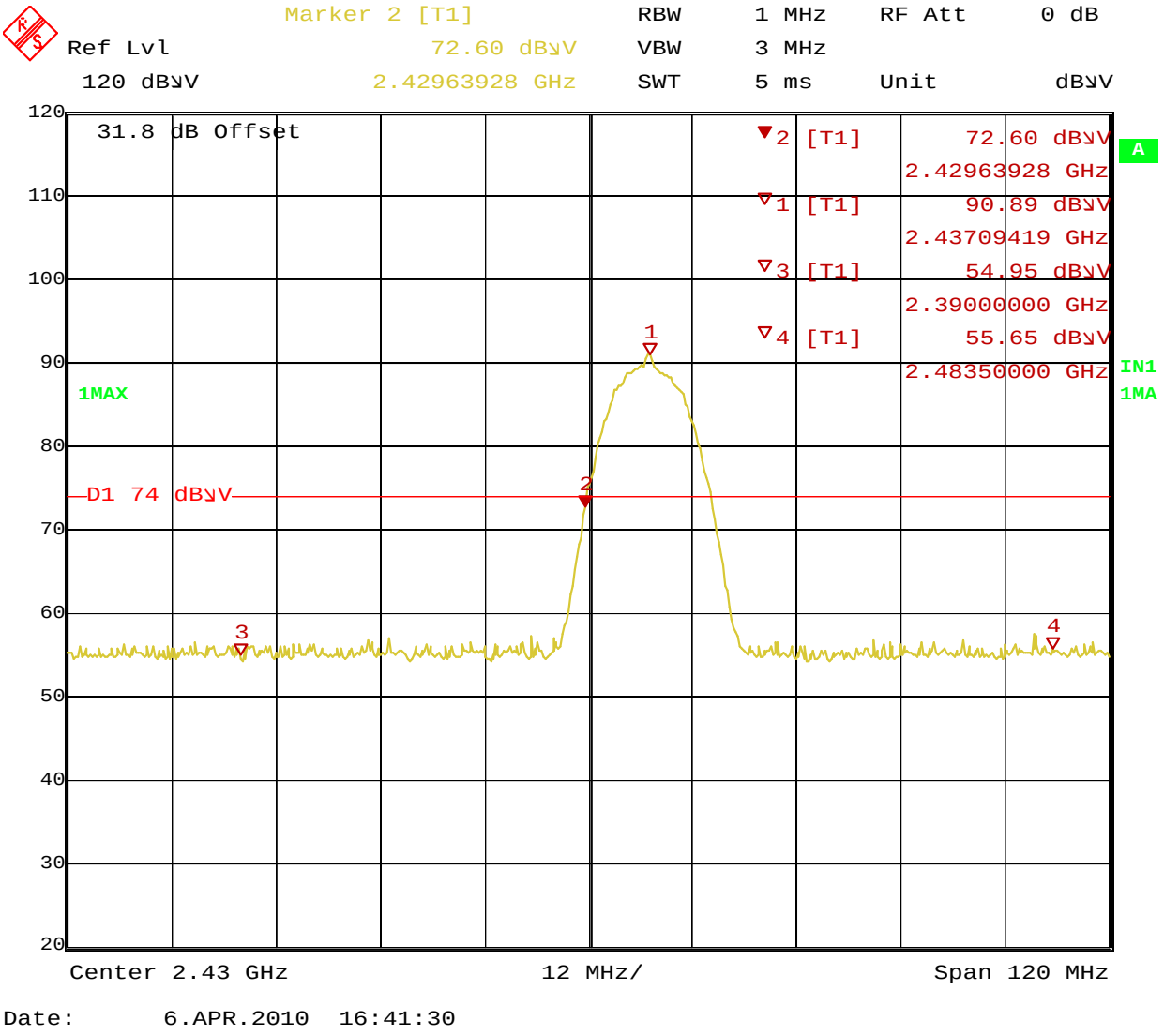


Figure 31: Spurious Emission at the Band-Edge for Channel 2437 MHz at 1 Mbps – Vertical (Peak)

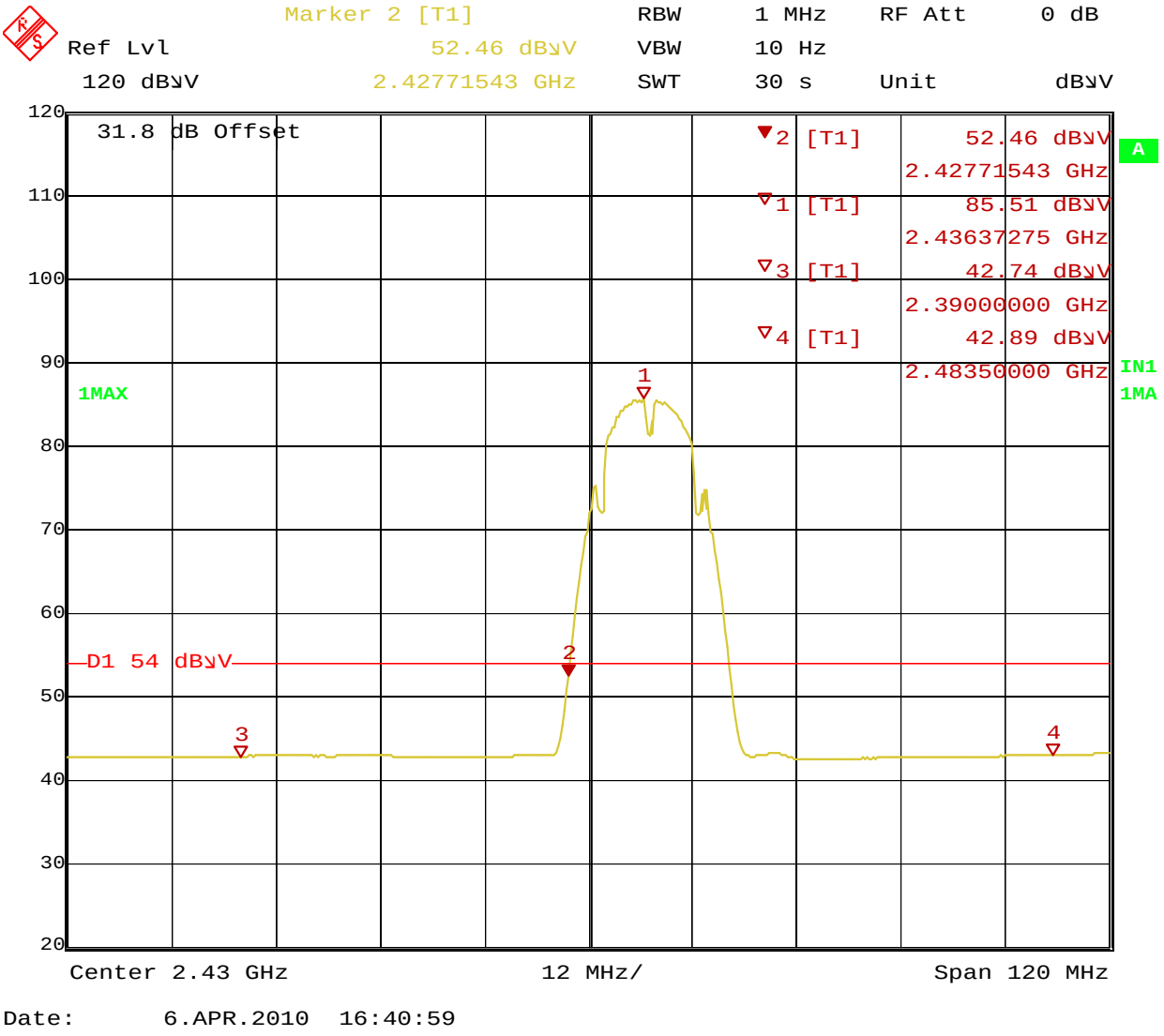


Figure 32: Spurious Emission at the Band-Edge for Channel 2437 MHz at 1 Mbps – Vertical (Ave.)

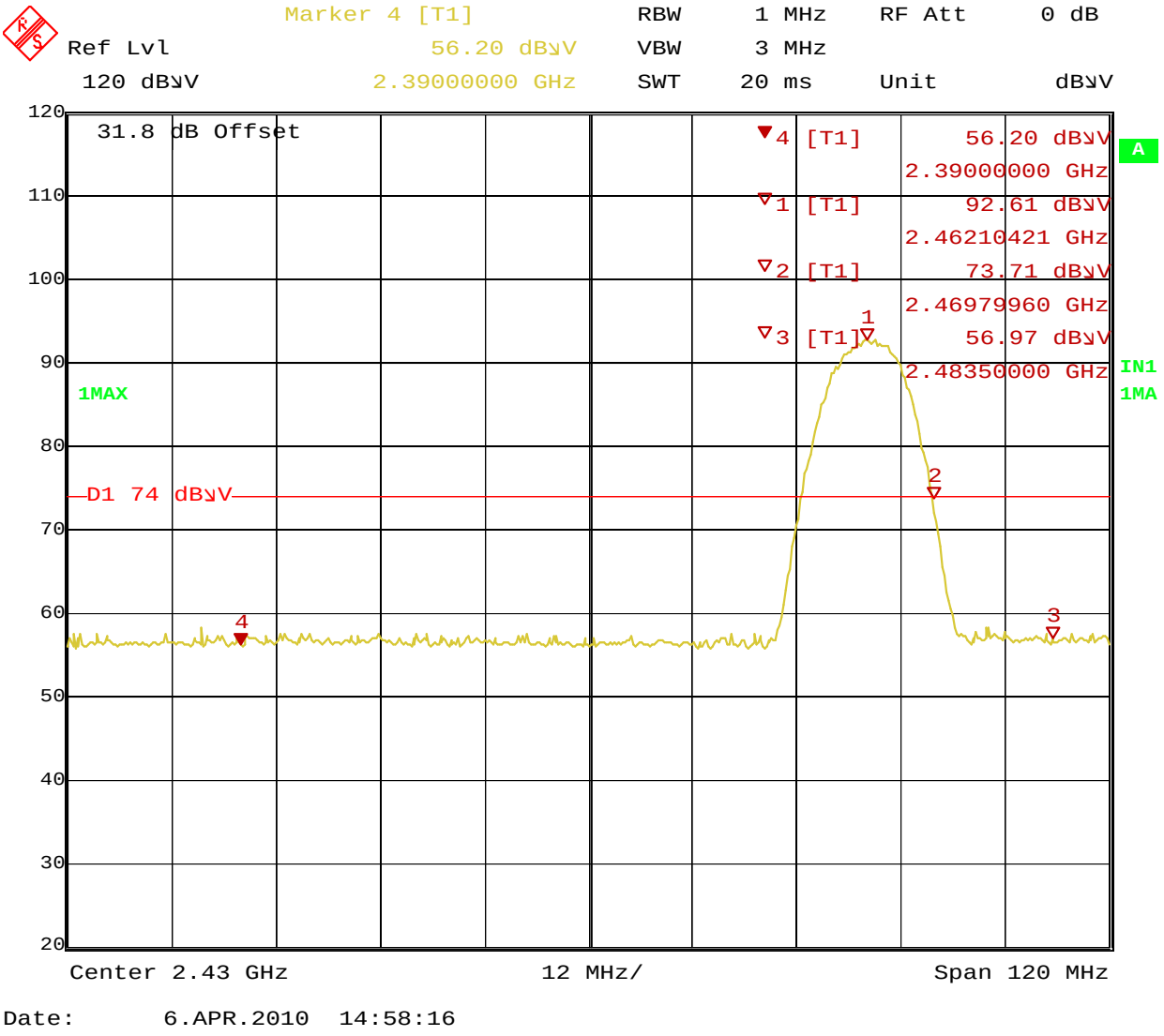


Figure 33: Spurious Emission at the Band-Edge for Channel 2462 MHz at 1 Mbps – Horizontal (Peak)

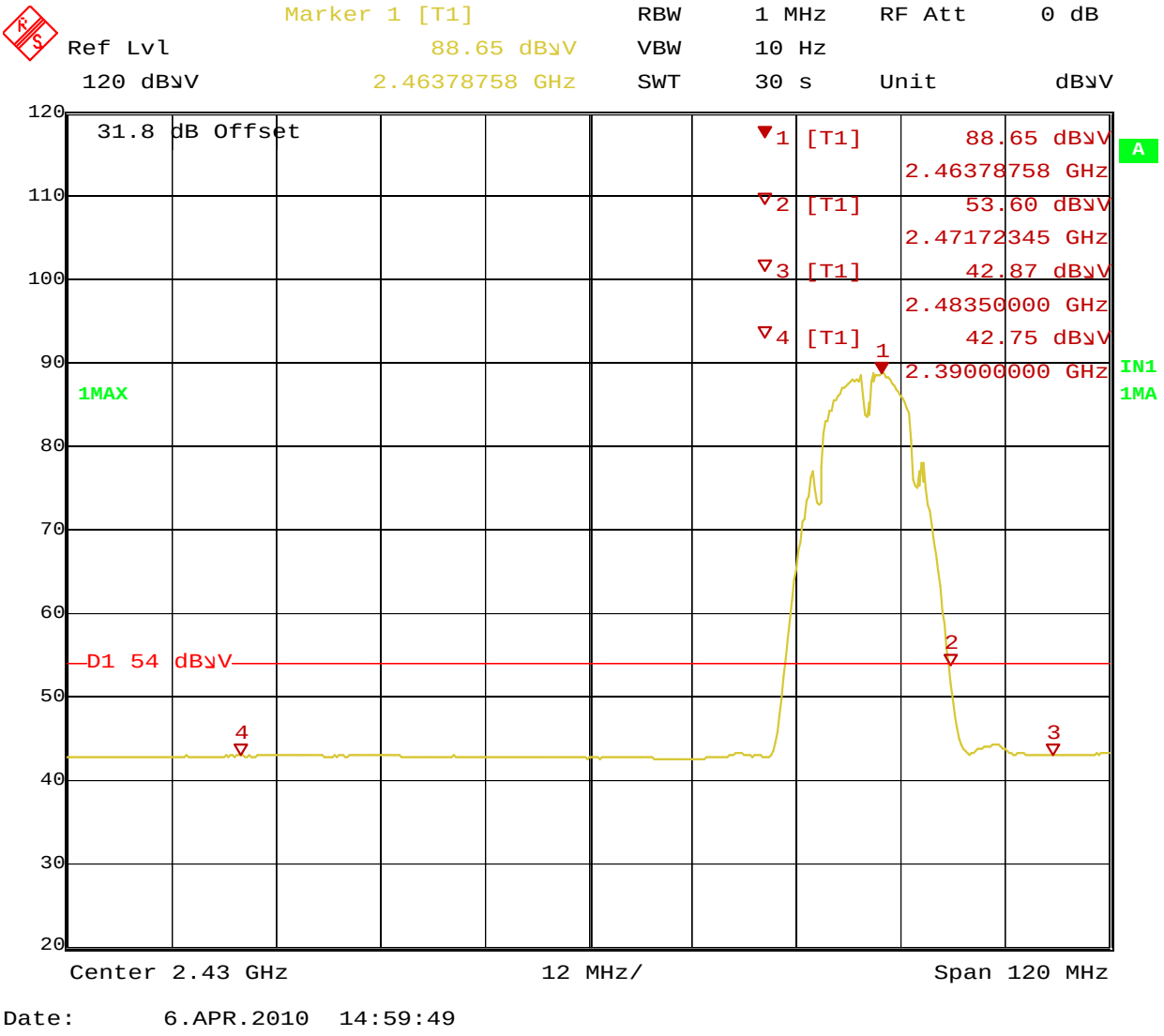


Figure 34: Spurious Emission at the Band-Edge for Channel 2462 MHz at 1 Mbps – Horizontal (Ave.)

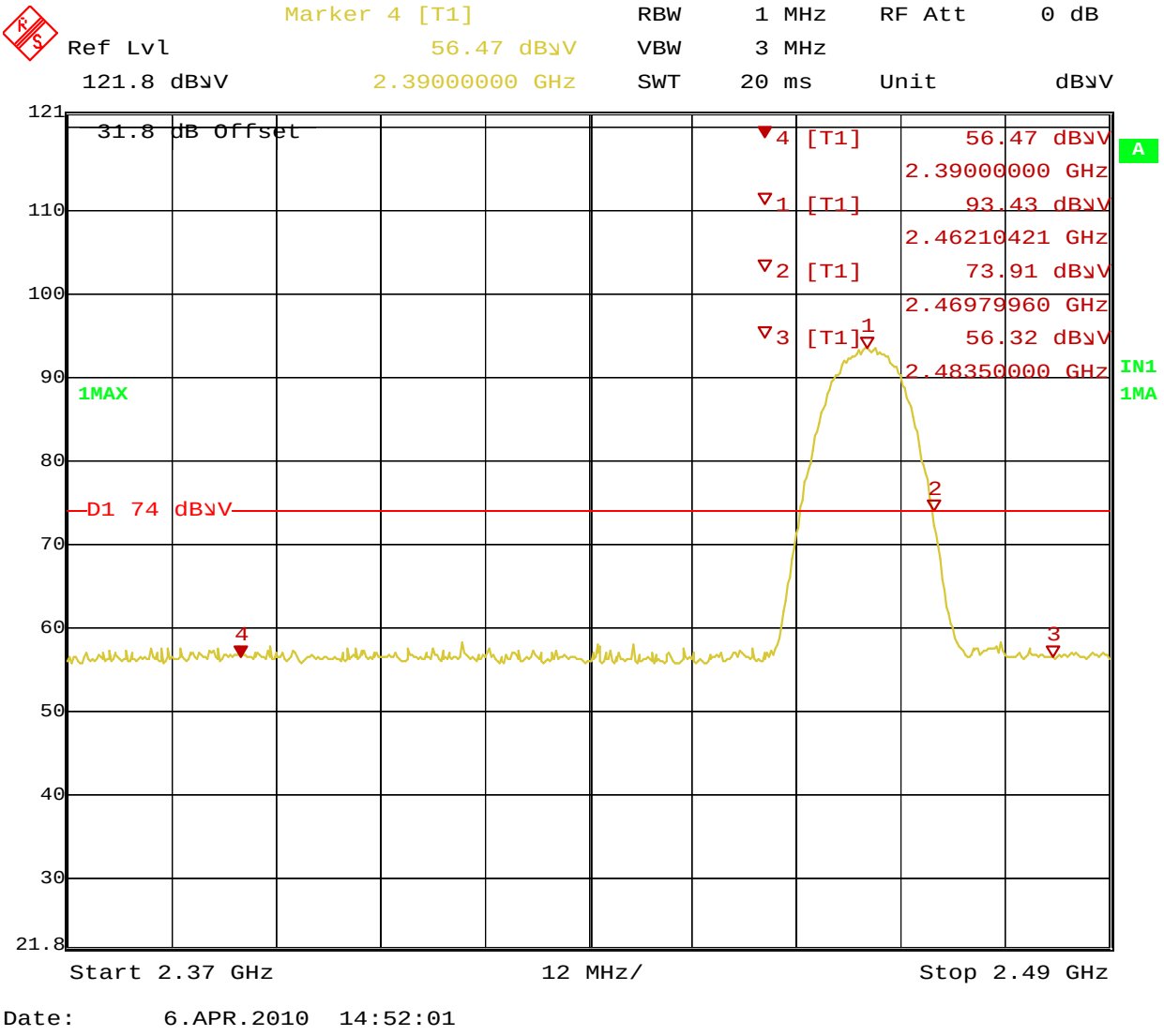


Figure 35: Spurious Emission at the Band-Edge for Channel 2462 MHz at 1 Mbps – Vertical (Peak)

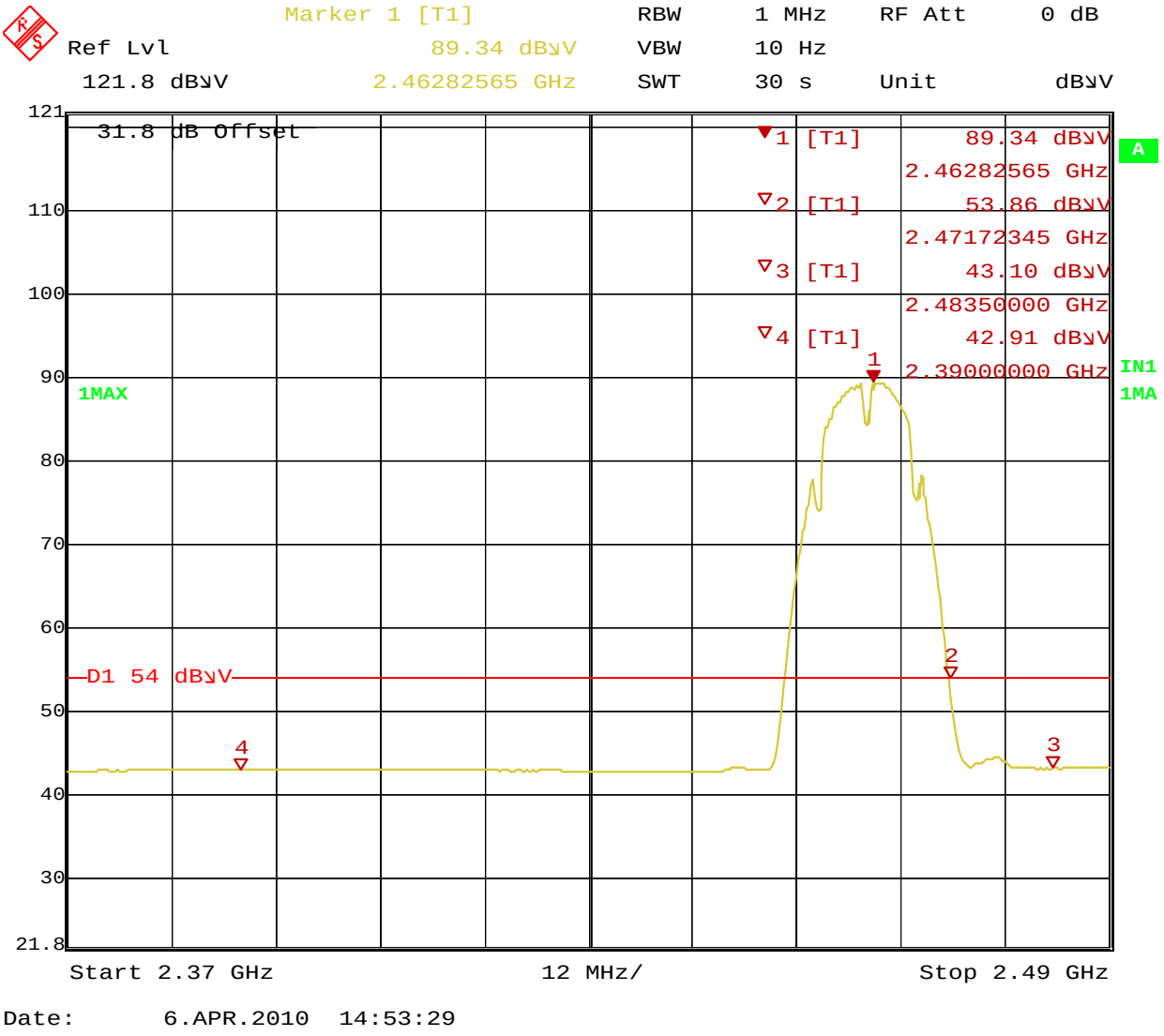


Figure 36: Spurious Emission at the Band-Edge for Channel 2462 MHz at 1 Mbps – Vertical (Ave.)

SOP 1 Radiated Emissions — Tracking # 31050899.001 Page 1 of 8

EUT Name	USNAP WiFi Module	**Date**	April 7, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	22°C / 32%rh
EUT Serial	MAC 001DC9050067	**Temp / Hum out**	N/A
EUT Config.	Integrated Antenna, Tabletop	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	Table Pos (deg)	ANT Pos (cm)	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										
156.398	H	231	185	42.37	36.96	-10.67	26.29	43.52	-17.23	Spurious
168.874	H	25	208	45.13	44.14	-11.05	33.09	43.52	-10.43	Spurious
183.426	H	33	129	32.64	27.92	-11.86	16.06	43.52	-27.46	Spurious
210.224	H	203	135	45.30	43.34	-12.10	31.24	43.52	-12.28	Spurious
63.781	V	92	108	41.85	40.21	-16.56	23.65	40.00	-16.35	Spurious
170.705	V	278	108	43.67	38.03	-11.22	26.81	43.52	-16.71	Spurious
Transmitted Data at 2437 MHz										
155.820	H	189	174	44.70	40.39	-10.66	29.73	43.52	-13.79	Spurious
171.031	H	348	201	44.39	42.55	-11.25	31.30	43.52	-12.22	Spurious
183.885	H	172	107	34.72	37.41	-11.85	25.56	43.52	-17.96	Spurious
212.151	H	167	117	41.85	39.44	-12.08	27.36	43.52	-16.16	Spurious
382.628	H	170	112	25.99	22.17	-7.27	14.90	46.02	-31.12	Spurious
169.344	V	279	119	40.17	38.89	-11.09	27.80	43.52	-15.72	Spurious
180.151	V	215	107	35.62	36.82	-11.84	24.98	43.52	-18.54	Spurious
199.679	V	235	108	34.38	33.87	-10.62	23.25	43.52	-20.27	Spurious
210.585	V	100	216	30.79	28.06	-12.11	15.95	43.52	-27.57	Spurious
Transmitted Data at 2462 MHz										
115.824	H	192	245	32.45	30.31	-10.69	19.62	43.52	-23.90	Spurious
142.798	H	45	182	38.58	39.07	-10.27	28.80	43.52	-14.72	Spurious
160.932	H	348	257	35.61	35.41	-10.72	24.69	43.52	-18.83	Spurious
176.359	H	29	149	47.70	44.78	-11.66	33.12	43.52	-10.40	Spurious
180.906	H	356	212	43.41	41.72	-11.87	29.85	43.52	-13.67	Spurious
115.294	V	275	272	31.37	27.54	-10.75	16.79	43.52	-26.73	Spurious
141.418	V	123	253	25.51	24.83	-10.15	14.68	43.52	-28.84	Spurious
182.751	V	304	116	36.89	34.39	-11.86	22.53	43.52	-20.99	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 at worst case at 1MBit/s.

SOP 1 Radiated Emissions

Tracking # 31050899.001 Page 2 of 8

EUT Name	USNAP WiFi Module	**Date**	April 6, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	23°C / 31%rh
EUT Serial	MAC 001DC9050067	**Temp / Hum out**	N/A
EUT Config.	Integrated Antenna, Tabletop Position	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	Table Pos (deg)	ANT Pos (cm)	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										
4824.02	H	38	109	48.66	46.25	5.08	51.33	53.98	-2.65	Harmonic
9648.04	H	18	106	39.88	36.12	12.73	52.61*	74.31	-21.70	Harmonic**
4824.06	V	70	137	45.62	43.38	5.08	48.46	53.98	-5.52	Harmonic
9647.99	V	350	105	43.04	40.83	12.73	55.77*	74.31	-18.54	Harmonic**
Transmitted Data at 2437 MHz										
4874.09	H	32	144	48.39	45.41	5.25	50.66	53.98	-3.33	Harmonic
9748.05	H	19	101	38.60	33.92	12.84	50.90*	74.31	-23.41	Harmonic**
1067.2	V	339	171	41.99	26.00	-5.79	20.21	53.98	-33.77	Spurious
4874.01	V	38	154	46.97	44.19	5.25	49.43	53.98	-4.55	Harmonic
9748.05	V	2	175	45.8	40.30	12.84	58.64*	74.31	-15.67	Harmonic**
Transmitted Data at 2462 MHz										
4923.98	H	32	146	45.47	42.43	5.38	47.81	53.98	-6.17	Harmonic
9848.06	H	352	99	37.89	34.06	12.94	50.83*	74.31	-23.48	Harmonic**
4924.03	V	9	173	42.28	39.91	5.38	45.28	53.98	-8.70	Harmonic
9848.02	V	8	103	45.10	40.96	12.94	58.04*	74.31	-16.27	Harmonic**

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

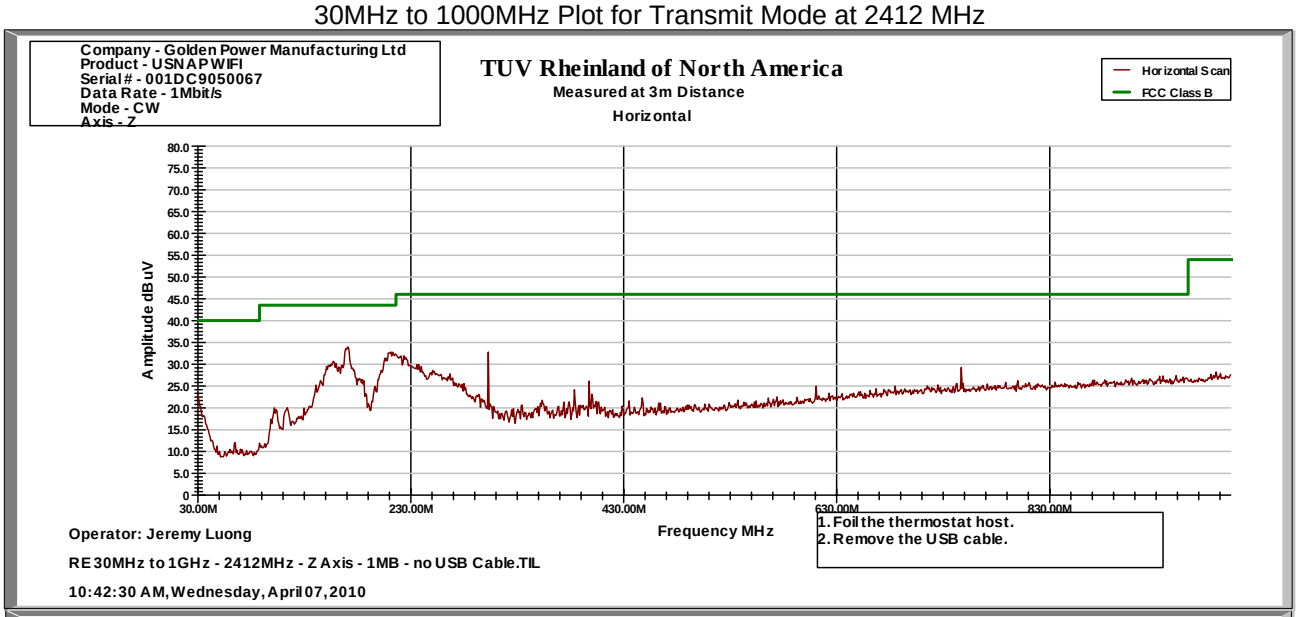
Combined Standard Uncertainty $u_c(y)$ = ± 1.6 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

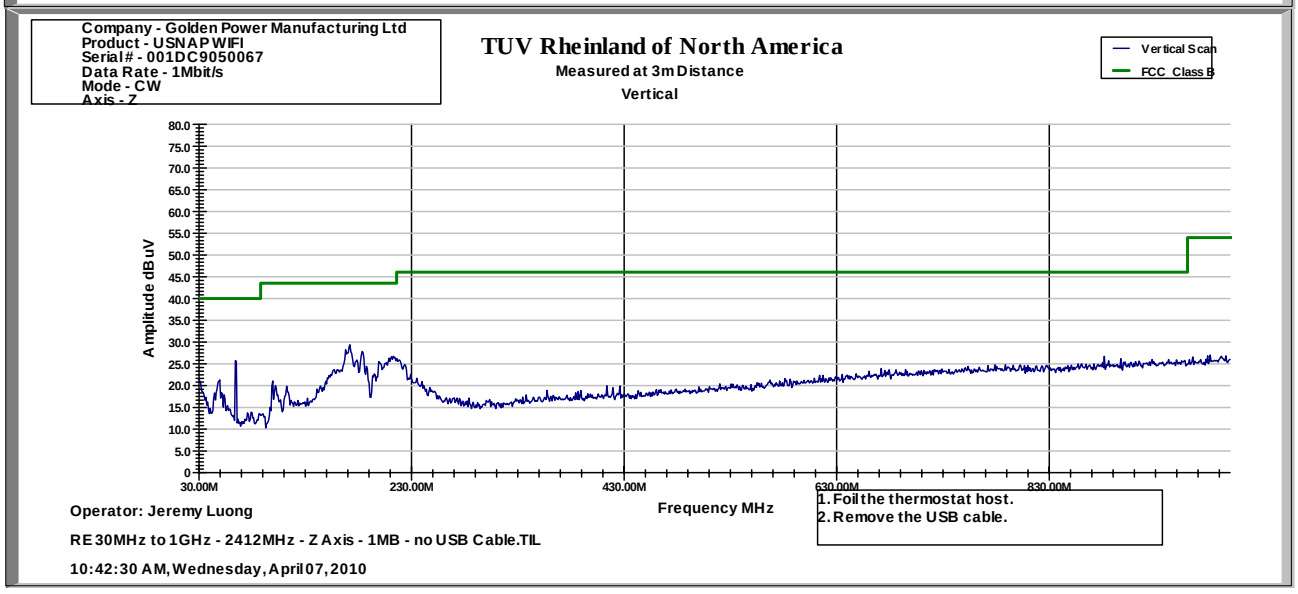
Notes: Tested at worst case; 1MBit/s.
(*) Corrected Peak Measurement.
(**) Emission is outside the restricted band, CFR47 Part 15.205. Apply the -20 dBr limit from the highest level of in-band signal. The highest was observed at Channel 1 (2412 MHz) on vertical polarization. See Figure 27.

SOP 1 Radiated Emissions

EUT Name	USNAP WiFi Module	**Date**	April 7, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	22°C / 33%rh
EUT Serial	MAC 001DC9050067	**Temp / Hum out**	N/A
EUT Config.	Integrated Antenna, Tabletop Position	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

30MHz to 1000MHz Plot for Transmit Mode at 2412 MHz



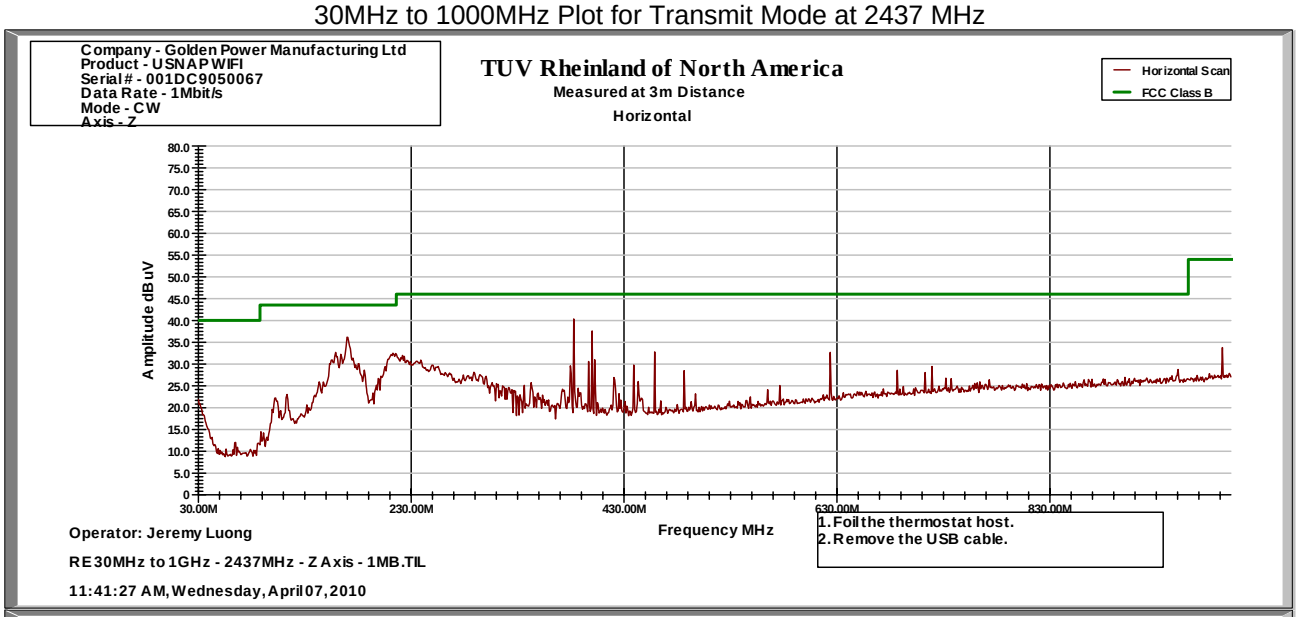


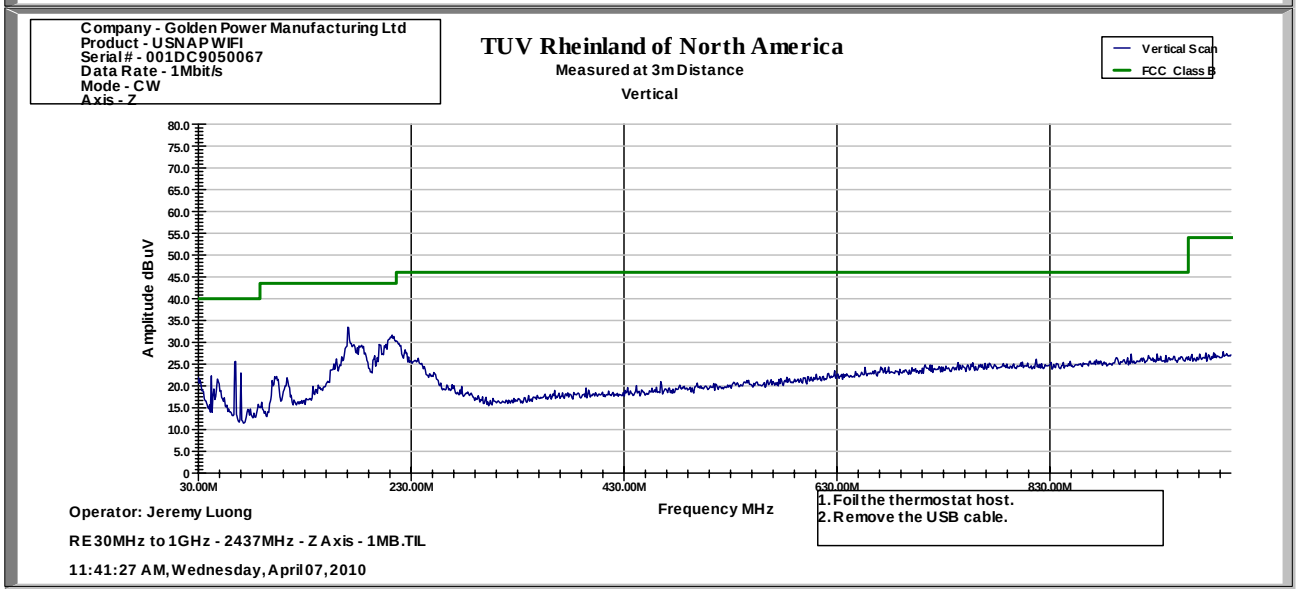
Notes: None.

SOP 1 Radiated Emissions

EUT Name	USNAP WiFi Module	**Date**	April 7, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	23°C / 33%rh
EUT Serial	MAC 001DC9050067	**Temp / Hum out**	N/A
EUT Config.	Integrated Antenna, Tabletop Position	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

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



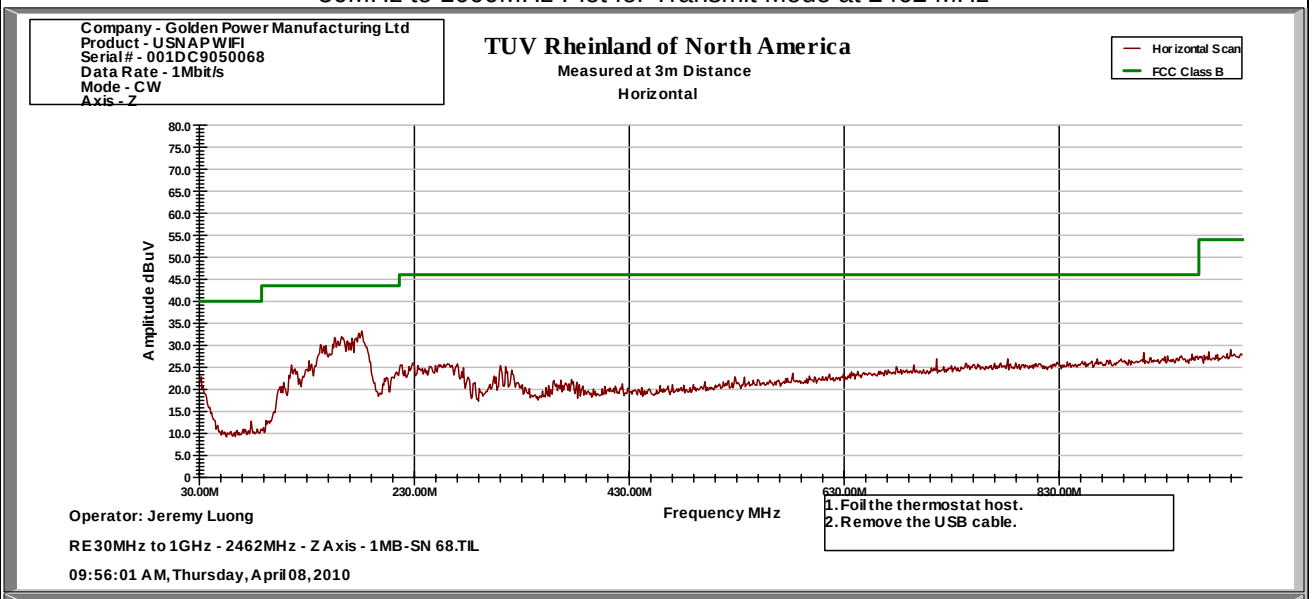


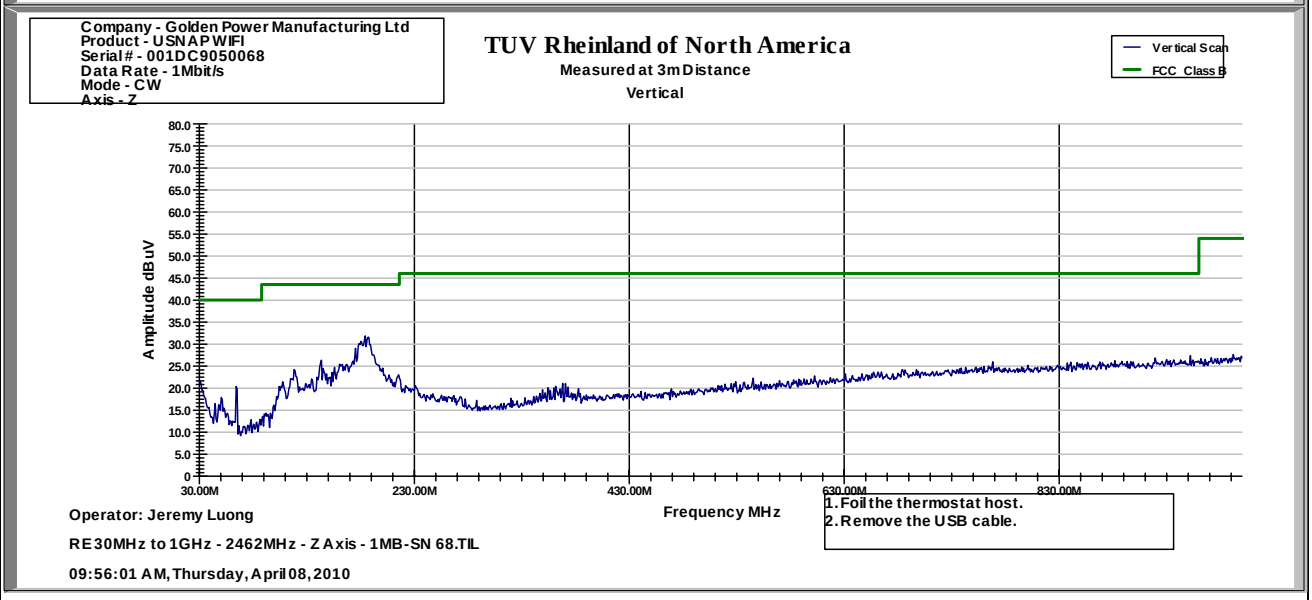
Notes: None.

SOP 1 Radiated Emissions

EUT Name	USNAP WiFi Module	**Date**	April 8, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	22°C / 32%rh
EUT Serial	MAC 001DC9050068	**Temp / Hum out**	N/A
EUT Config.	Integrated Antenna, Tabletop Position	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

30MHz to 1000MHz Plot for Transmit Mode at 2462 MHz





Notes: None.

SOP 1 Radiated Emissions

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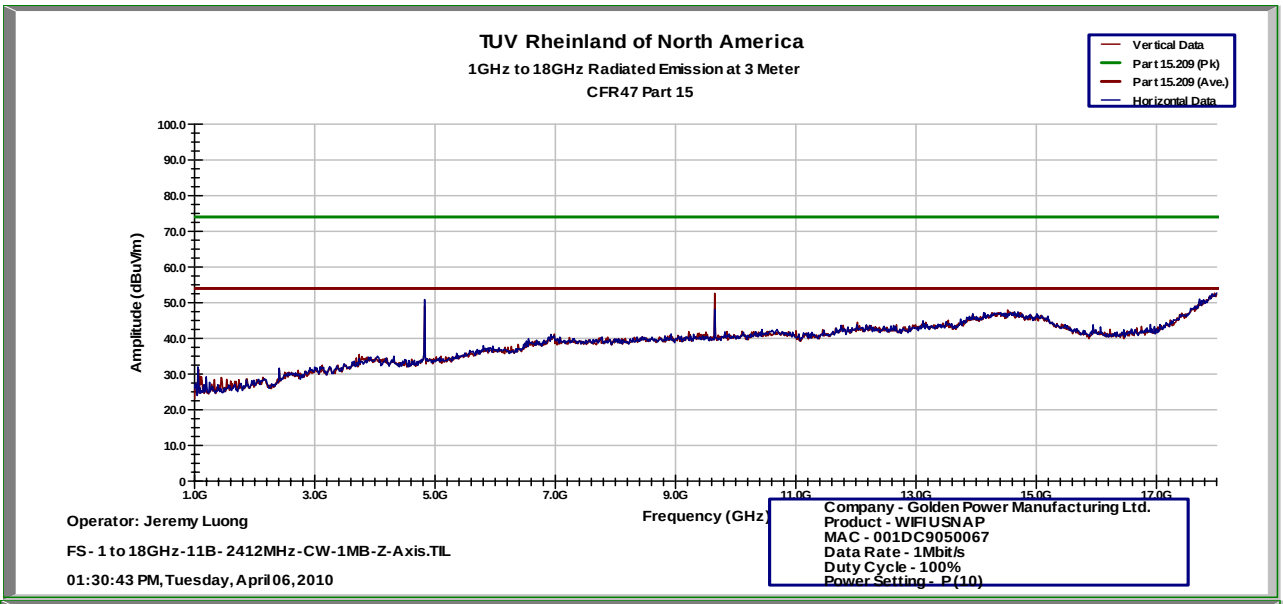
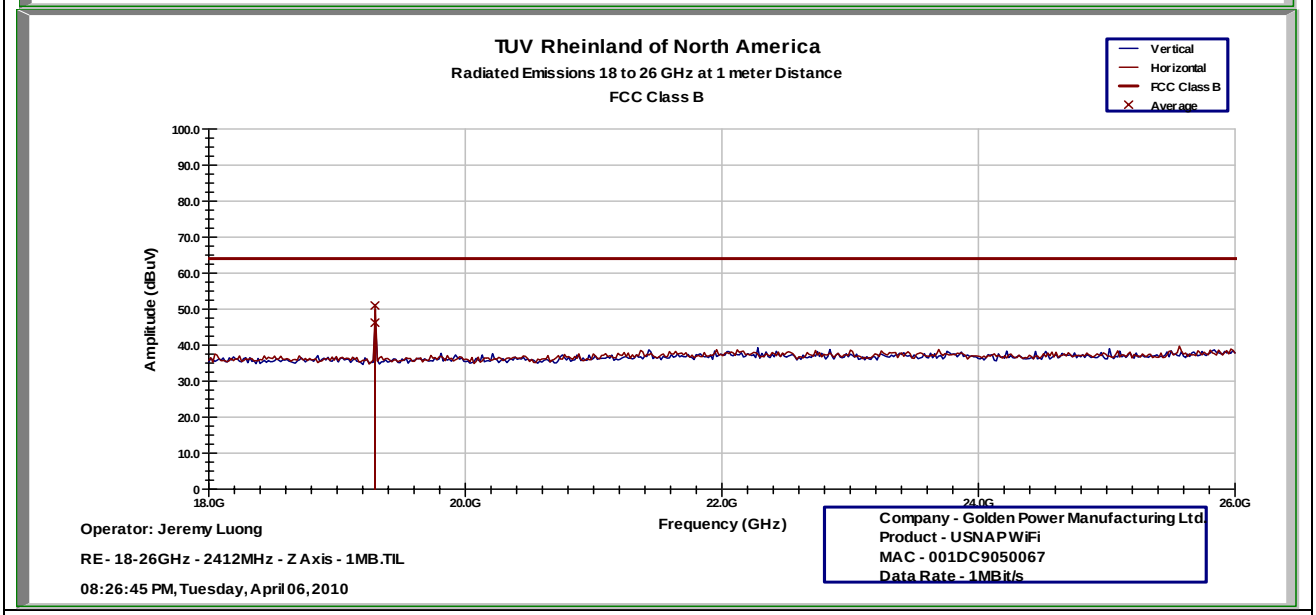
EUT Name	USNAP WiFi Module	**Date**	April 6, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	22°C / 32%rh
EUT Serial	MAC 001DC9050067	**Temp / Hum out**	N/A
EUT Config.	Integrated Antenna, Tabletop Position	**Line AC**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	1m and 3m / EMCO3115 & RA42-K-F-4B-C	**Performed by**	Jeremy Luong

1GHz to 25GHz Plots for Transmit Mode at 2412 MHz



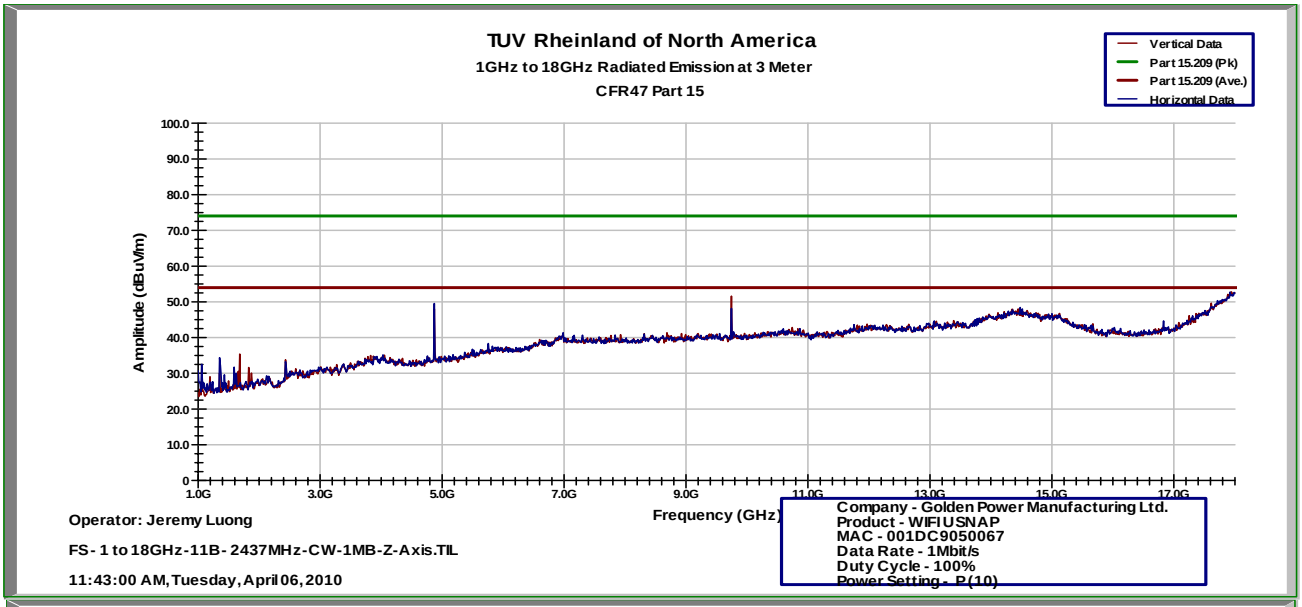


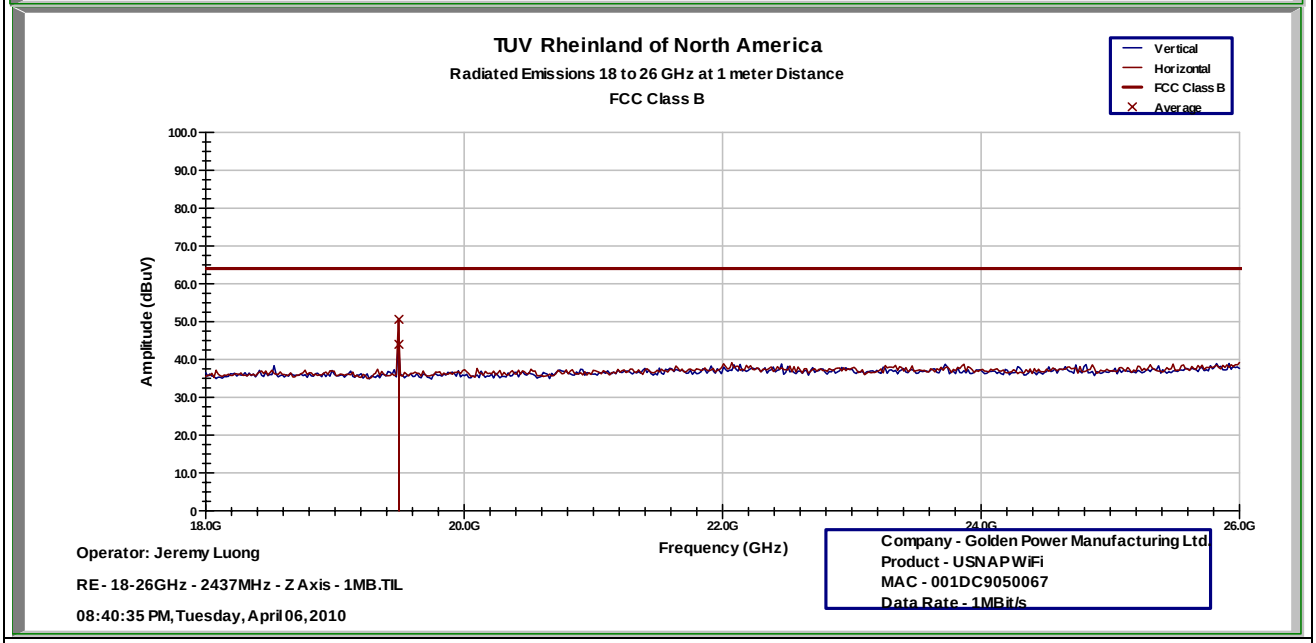
Notes: None.

SOP 1 Radiated Emissions

EUT Name	USNAP WiFi Module	**Date**	April 6, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	23°C / 32%rh
EUT Serial	MAC 001DC9050067	**Temp / Hum out**	N/A
EUT Config.	Integrated Antenna, Tabletop Position	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	1m and 3m / EMCO3115 & RA42-K-F-4B-C	**Performed by**	Jeremy Luong

1GHz to 25GHz Plots for Transmit Mode at 2437 MHz



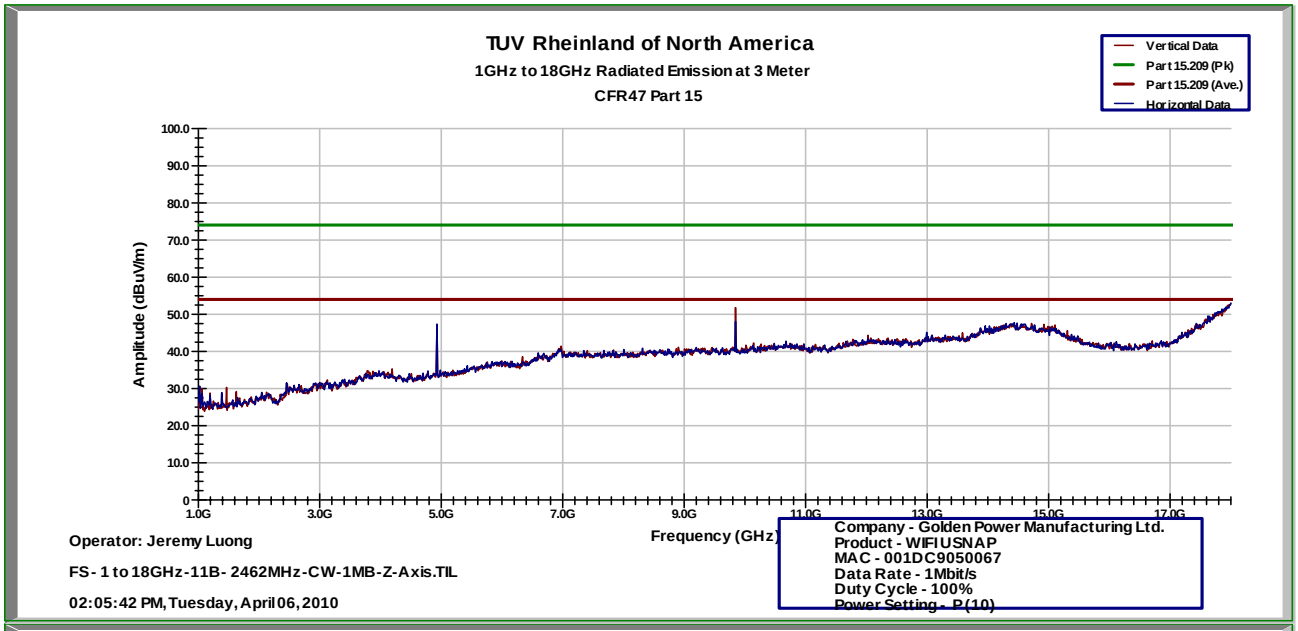


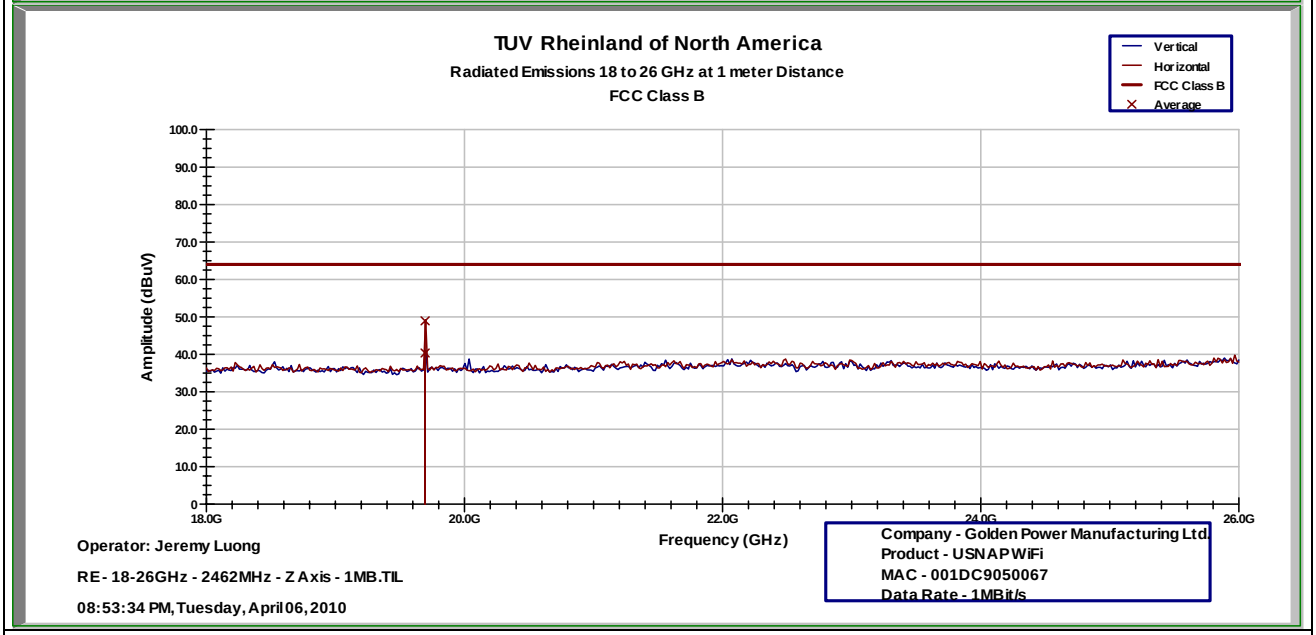
Notes: None.

SOP 1 Radiated Emissions

EUT Name	USNAP WiFi Module	**Date**	April 6, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	23°C / 32%rh
EUT Serial	MAC 001DC9050067	**Temp / Hum out**	N/A
EUT Config.	Integrated Antenna, Tabletop Position	**Line AC**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	1m and 3m / EMCO3115 & RA42-K-F-4B-C	**Performed by**	Jeremy Luong

1GHz to 25GHz Plots for Transmit Mode at 2462 MHz





Notes: None.

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)

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

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 15.109, RSS-GEN Sect.7.2.3

4.7.1 Test Methodology

4.7.1.1 Preliminary Test

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

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

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

4.7.1.2 Final Test

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

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

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

4.7.1.3 Deviations

None.

4.7.2 Receiver Spurious Emission Limit

The spurious emissions of the receiver shall not exceed the values in CFR47 15.109: 2008 and RSS 210:2007 Section 2.6.

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	USNAP WiFi Module	**Date**	April 8, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	22°C / 33%rh
EUT Serial	MAC 001DC9050068	**Temp / Hum out**	N/A
EUT Config.	Integrated Antenna, Tabletop	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	Table Pos (deg)	ANT Pos (cm)	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
Received Mode at 2412 MHz										
141.152	H	27	157	30.27	26.32	-10.13	16.19	43.52	-27.33	Spurious
162.839	H	39	147	29.69	26.61	-10.80	15.81	43.52	-27.71	Spurious
180.010	H	49	192	29.99	29.06	-11.83	17.23	43.52	-26.29	Spurious
63.738	V	34	113	35.67	34.63	-16.57	18.06	40.00	-21.94	Spurious
178.868	V	321	106	27.18	23.27	-11.78	11.49	43.52	-32.03	Spurious
181.682	V	232	123	31.06	27.45	-11.87	15.58	43.52	-27.94	Spurious
Received Data at 2437 MHz										
161.435	H	19	155	37.44	38.68	-10.74	27.94	43.52	-15.58	Spurious
177.929	H	197	131	41.19	39.55	-11.74	27.81	43.52	-15.71	Spurious
181.295	H	51	143	43.87	41.70	-11.87	29.83	43.52	-13.69	Spurious
227.848	H	11	109	35.04	31.87	-11.44	20.43	46.02	-25.59	Spurious
313.604	H	57	117	29.54	28.53	-8.42	20.11	46.02	-25.91	Spurious
394.964	H	27	210	23.79	19.47	-7.12	12.35	46.02	-33.67	Spurious
179.641	V	282	115	37.71	36.84	-11.82	25.02	43.52	-18.50	Spurious
185.832	V	261	115	32.10	32.24	-11.84	20.40	43.52	-23.12	Spurious
Received Mode Data at 2462 MHz										
160.857	H	27	182	31.00	28.96	-10.72	18.24	43.52	-25.28	Spurious
181.056	H	52	153	33.52	33.05	-11.87	21.18	43.52	-22.34	Spurious
184.429	H	70	108	30.25	27.28	-11.85	15.43	43.52	-28.09	Spurious
228.201	H	211	120	28.16	26.84	-11.44	15.40	46.02	-30.62	Spurious
63.720	V	129	105	36.62	33.87	-16.57	17.30	40.00	-22.70	Spurious
182.156	V	274	106	29.84	26.33	-11.87	14.46	43.52	-29.06	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: 1.Tested at worst case on Z Axis.
2. Removed the USB connection for testing since it is a maintenance port.
3.The testing performed on Sample MAC 001DC9050068.

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EUT Name	USNAP WiFi Module	**Date**	April 6, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	23°C / 31%rh
EUT Serial	MAC 001DC9050067	**Temp / Hum out**	N/A
EUT Config.	Integrated Antenna, Tabletop Position	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	1m & 3m / EMCO3115 & RA42-K-F-4B-C	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	Table Pos (deg)	ANT Pos (cm)	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
Received Mode at 2412 MHz										
4824.05	H	32	175	43.96	40.92	5.08	46.00	53.98	-7.98	Spurious
9647.98	H	61	168	39.75	36.23	12.73	48.96	53.98	-5.02	Spurious
19296.1	H	355	118	43.48	40.26	11.36	51.62	63.98	-12.36	Spurious
4824.02	V	336	154	44.83	43.14	5.08	48.22	53.98	-5.76	Spurious
9648.02	V	348	189	43.59	40.98	12.73	53.71	53.98	-0.27	Spurious
19296.1	V	52	100	38.61	36.12	11.36	47.48	63.98	-16.5	Spurious
Received Mode at 2437 MHz										
4873.98	H	21	149	44.25	40.43	5.24	45.67	53.98	-8.31	Spurious
9748.07	H	12	125	38.08	33.75	12.84	46.59	53.98	-7.39	Spurious
19496.1	H	1	109	43.26	39.60	11.55	51.15	63.98	-12.83	Spurious
4874.01	V	340	218	42.50	40.28	5.25	45.52	53.98	-8.46	Spurious
9747.98	V	351	131	41.49	38.63	12.84	51.47	53.98	-2.51	Spurious
19496.1	V	314	114	37.47	31.45	11.55	43.00	63.98	-20.98	Spurious
Received Mode at 2462 MHz										
4923.98	H	1	154	42.00	38.82	5.38	44.20	53.98	-9.78	Spurious
9848.08	H	353	153	39.14	34.01	12.94	46.95	53.98	-7.03	Spurious
19696.1	H	0	107	42.28	38.65	11.71	50.36	63.98	-13.62	Spurious
4924.03	V	18	172	42.47	39.72	5.38	45.09	53.98	-8.89	Spurious
9848.08	V	22	100	41.42	37.46	12.94	50.40	53.98	-3.58	Spurious
19696.1	V	331	102	37.33	30.12	11.71	41.83	63.98	-22.15	Spurious

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

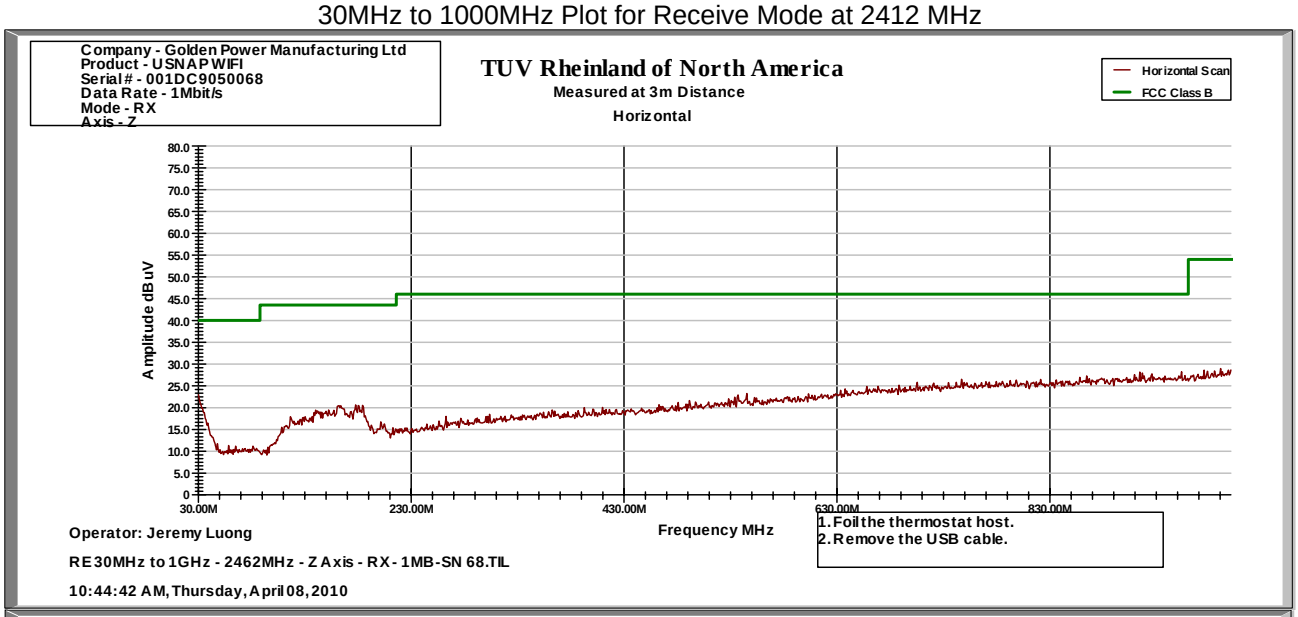
Combined Standard Uncertainty $u_c(y)$ = ± 1.6 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

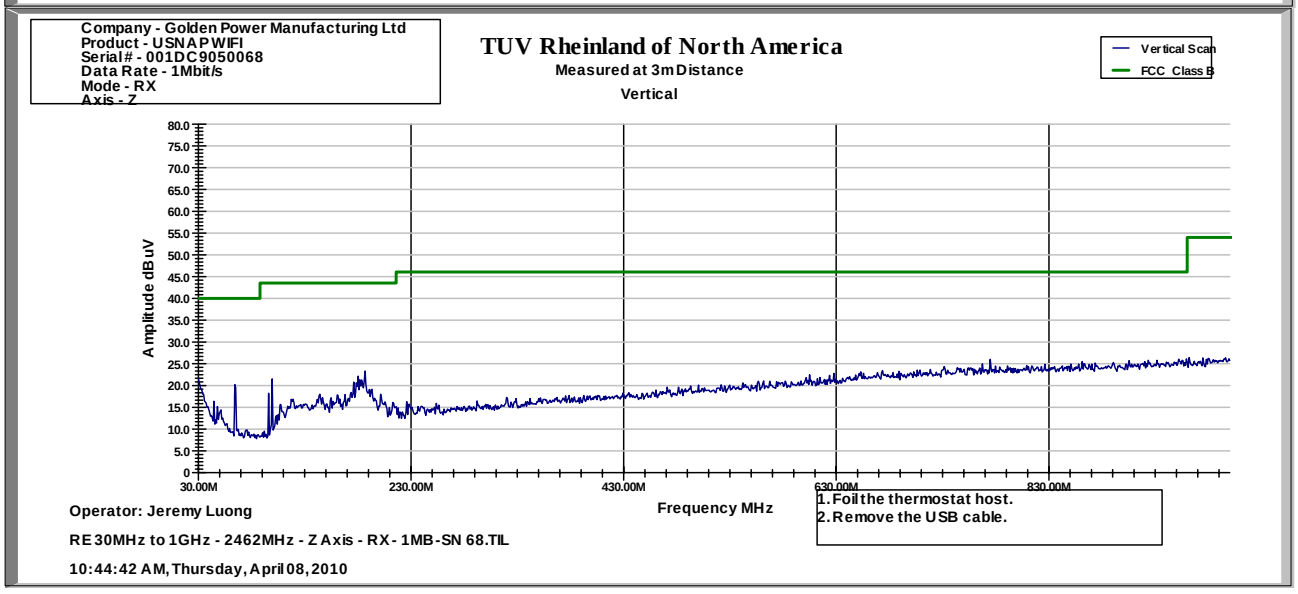
Notes: 1. Tested at worst case on Z-Axis.
2. All emission above 18GHz performed at 1 meter distance with the extrapolated limit.

SOP 1 Radiated Emissions

EUT Name	USNAP WiFi Module	**Date**	April 8, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	23°C / 33%rh
EUT Serial	MAC 001DC9050068	**Temp / Hum out**	N/A
EUT Config.	Integrated Antenna, Tabletop Position	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

30MHz to 1000MHz Plot for Receive Mode at 2412 MHz



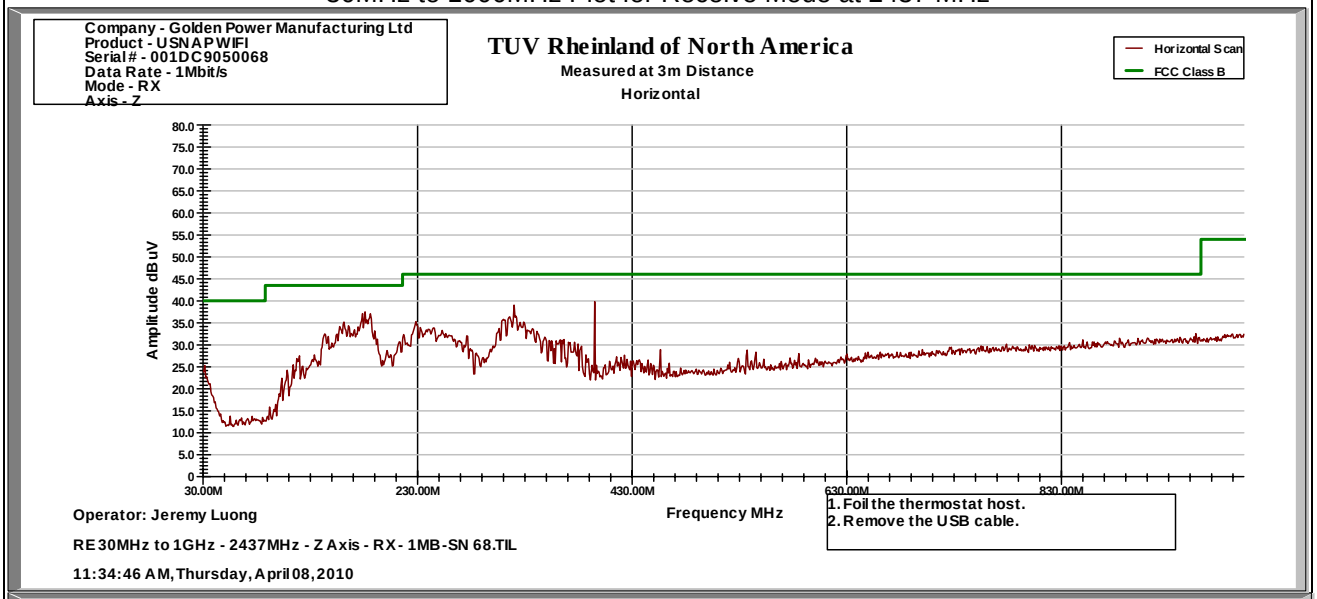


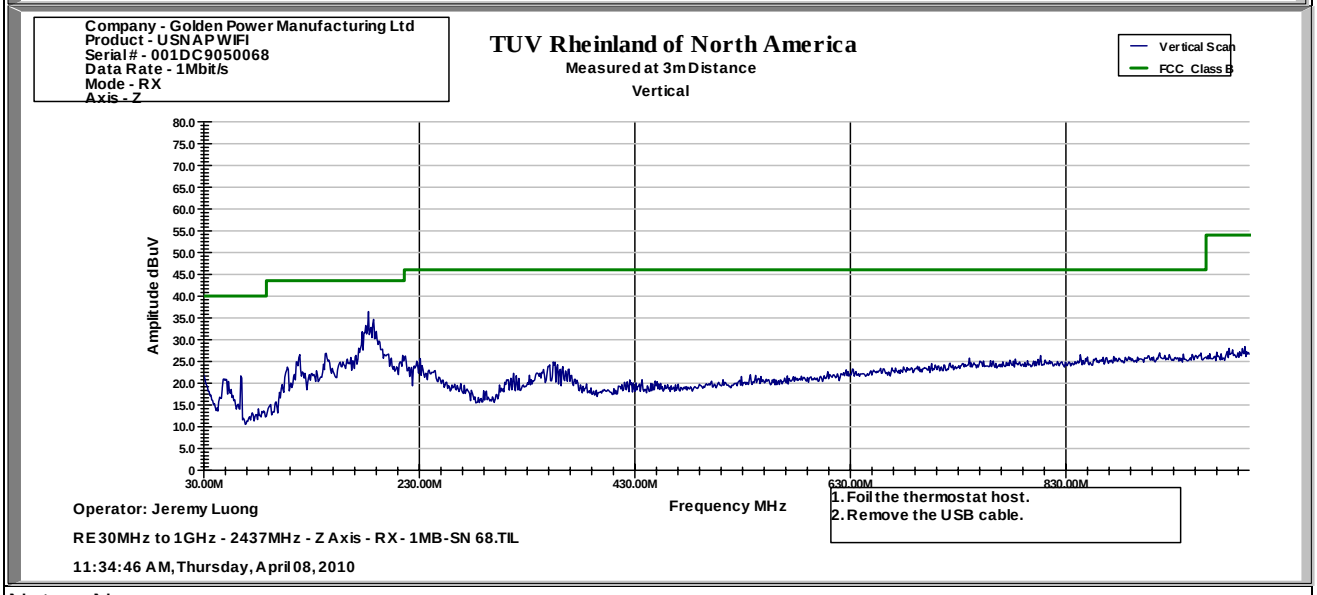
Notes: None.

SOP 1 Radiated Emissions

EUT Name	USNAP WiFi Module	**Date**	April 8, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	23°C / 33%rh
EUT Serial	MAC 001DC9050068	**Temp / Hum out**	N/A
EUT Config.	Integrated Antenna, Tabletop Position	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

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





Notes: None.

SOP 1 Radiated Emissions

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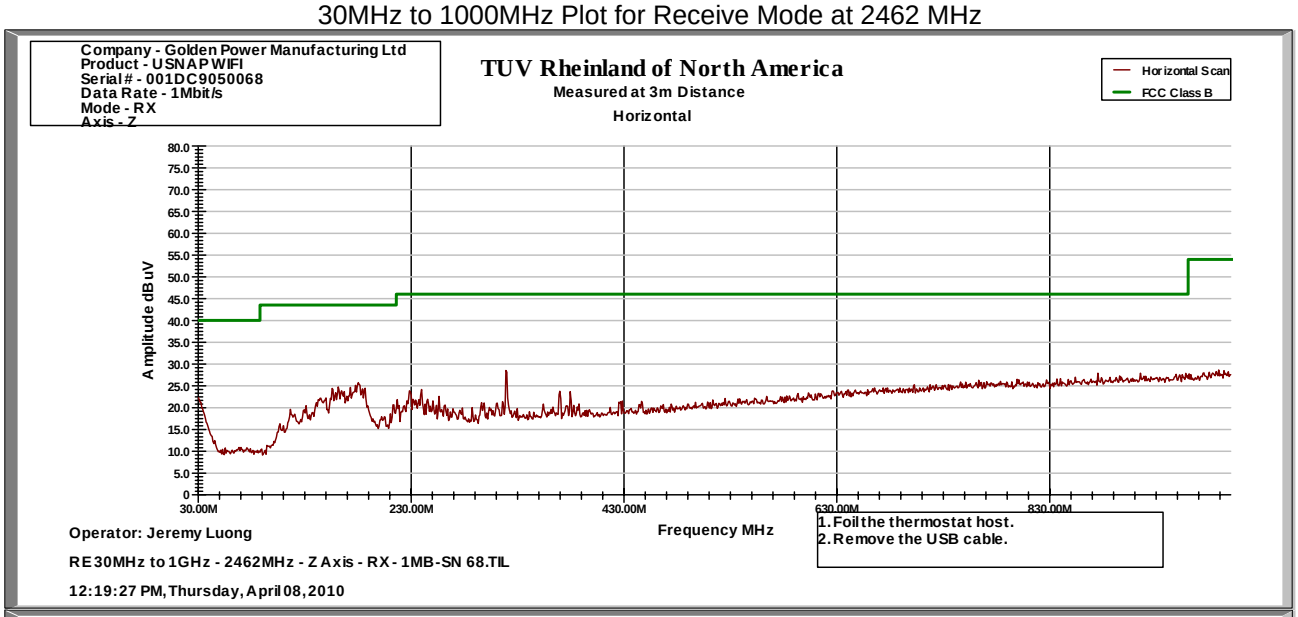
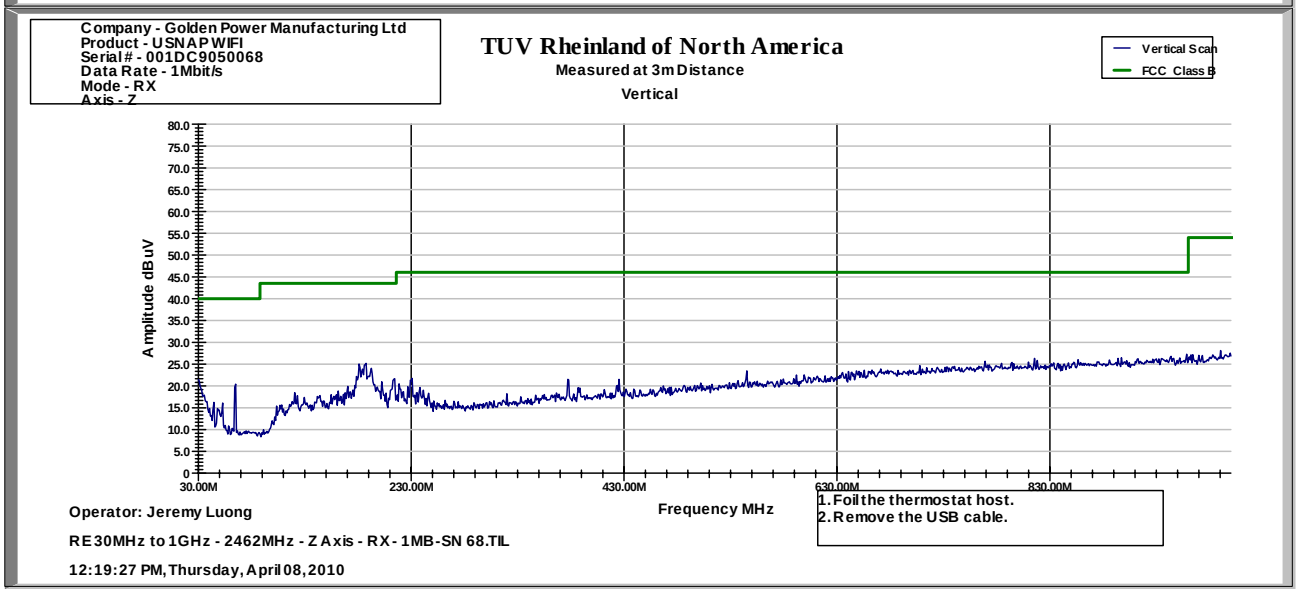
EUT Name	USNAP WiFi Module	**Date**	April 8, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	23°C / 33%rh
EUT Serial	MAC 001DC9050068	**Temp / Hum out**	N/A
EUT Config.	Integrated Antenna, Tabletop Position	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / JB3	**Performed by**	Jeremy Luong

30MHz to 1000MHz Plot for Receive Mode at 2462 MHz





Notes: None.

SOP 1 Radiated Emissions

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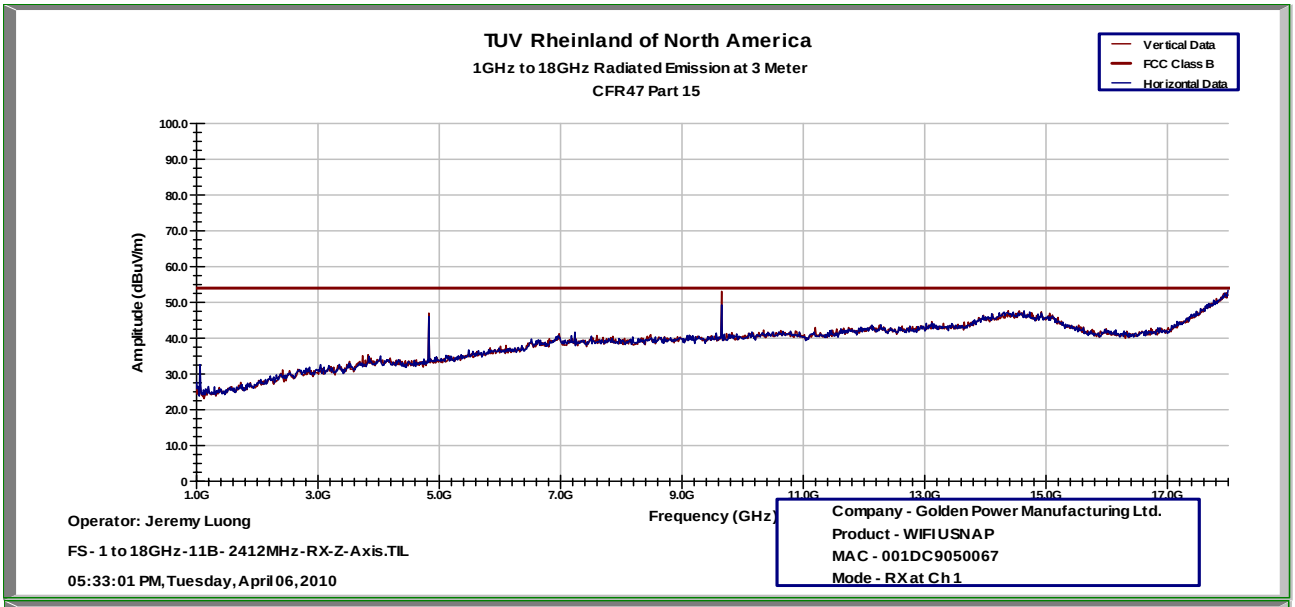
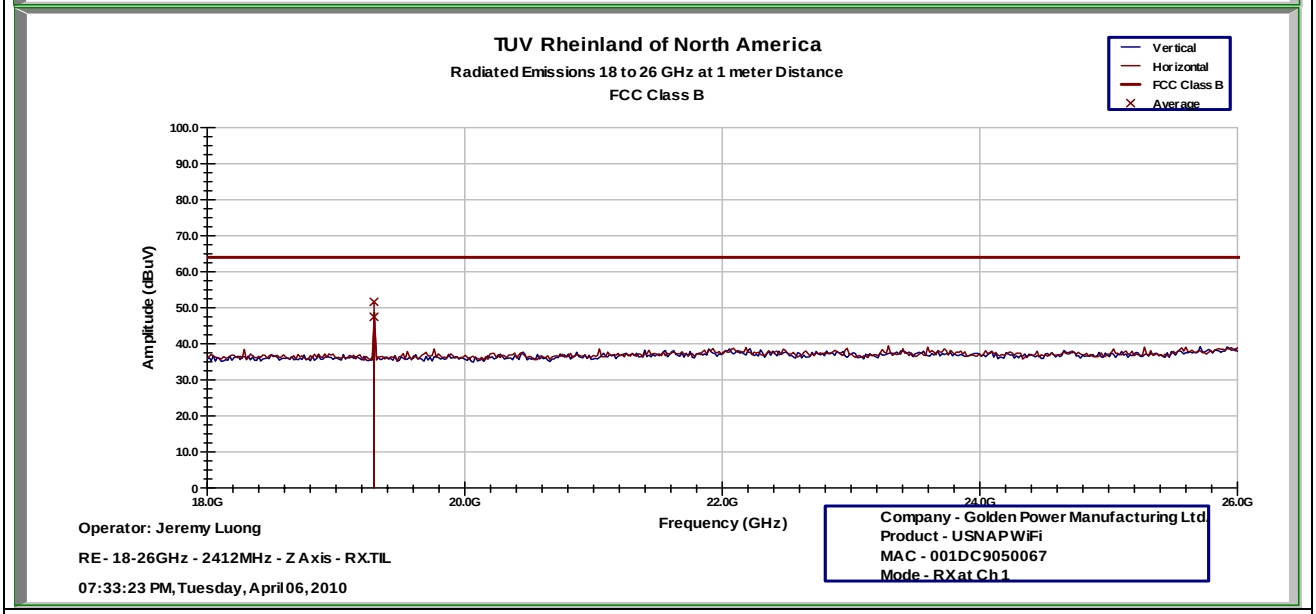
EUT Name	USNAP WiFi Module	**Date**	April 6, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	23°C / 31%rh
EUT Serial	MAC 001DC9050067	**Temp / Hum out**	N/A
EUT Config.	Integrated Antenna, Tabletop Position	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	1m & 3m / EMCO3115 & RA42-K-F-4B-C	**Performed by**	Jeremy Luong

1GHz to 26GHz Plot for Receive Mode at 2412 MHz



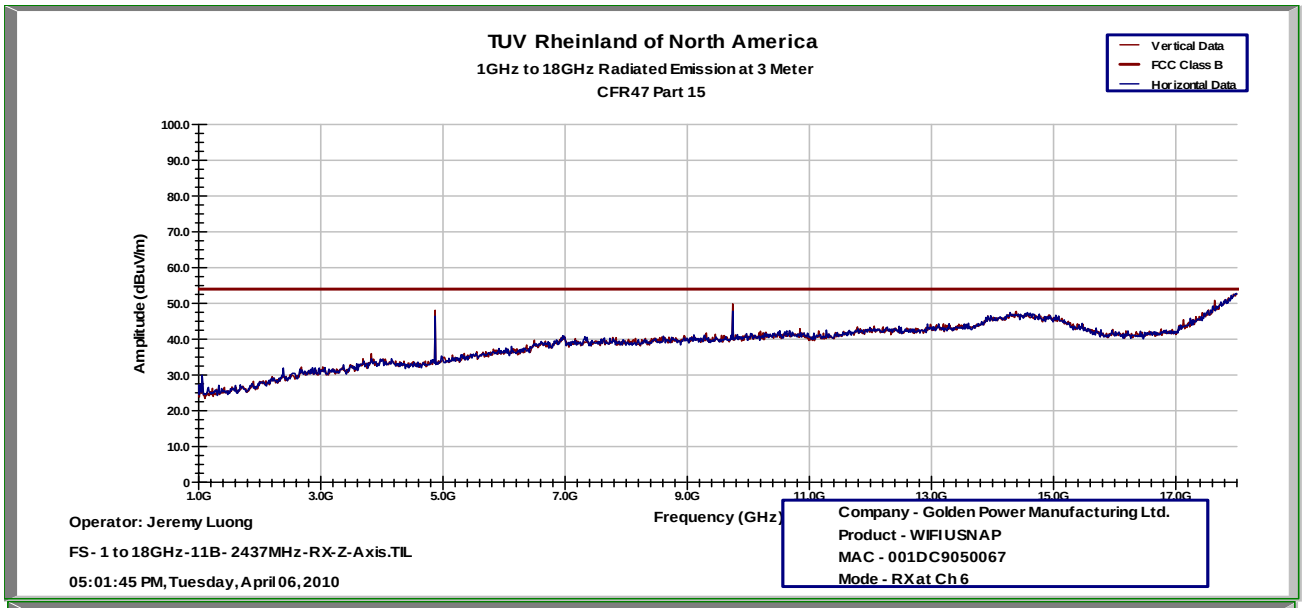


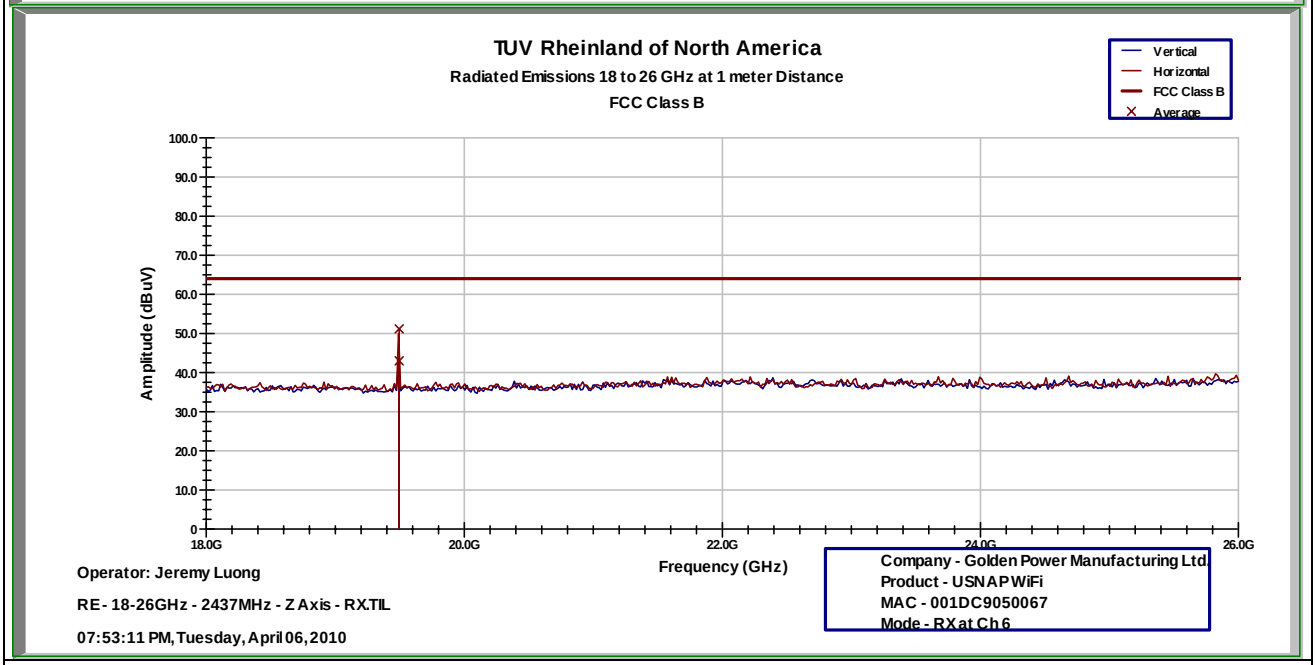
Notes: None.

SOP 1 Radiated Emissions

EUT Name	USNAP WiFi Module	**Date**	April 6, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	23°C / 31%rh
EUT Serial	MAC 001DC9050067	**Temp / Hum out**	N/A
EUT Config.	Integrated Antenna, Tabletop Position	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	1m & 3m / EMCO3115 & RA42-K-F-4B-C	**Performed by**	Jeremy Luong

1GHz to 26GHz Plot for Receive Mode at 2437 MHz



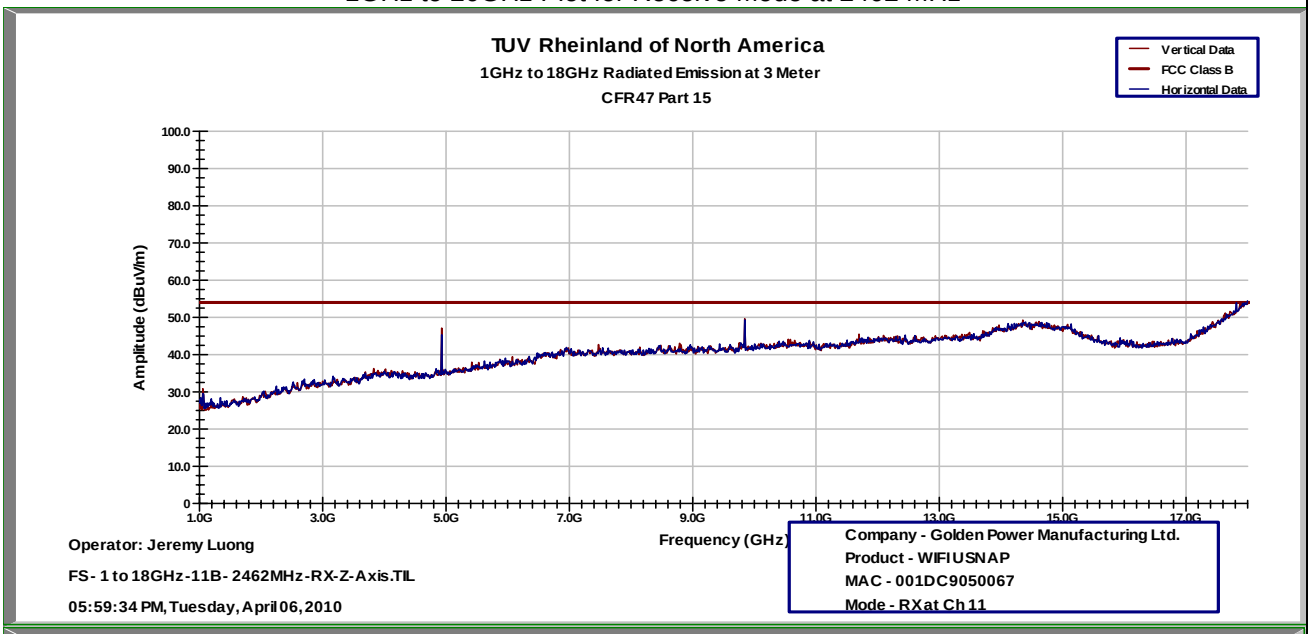


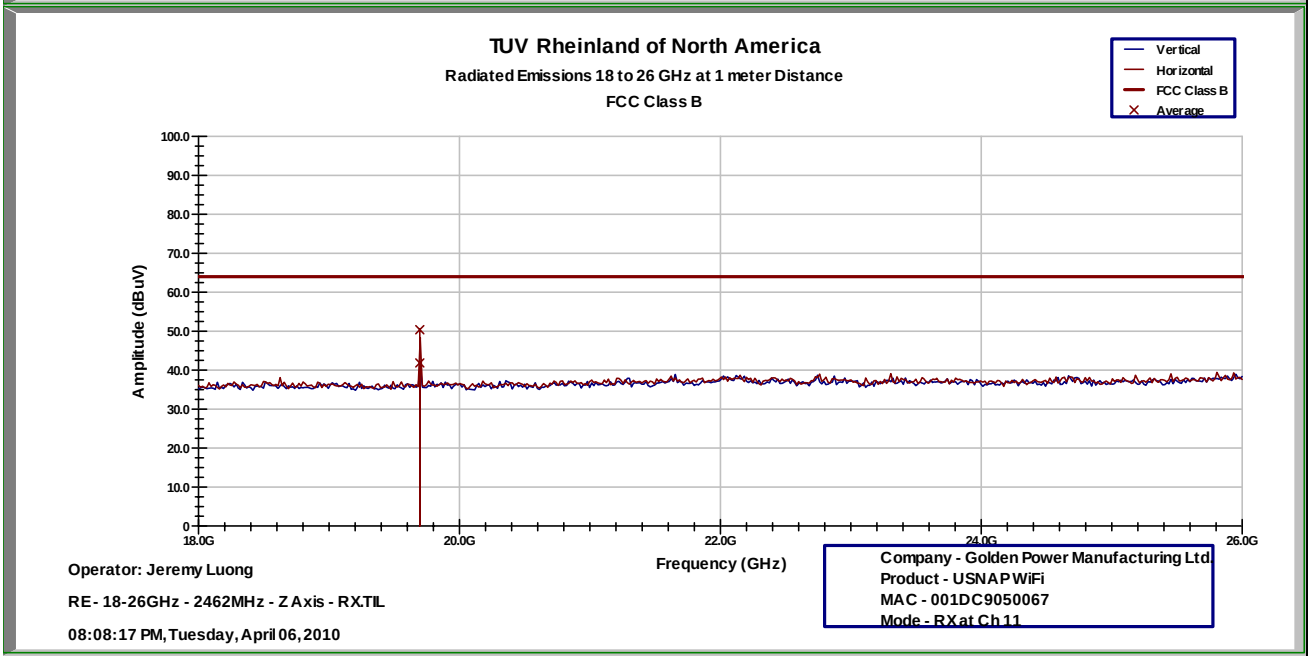
Notes: None.

SOP 1 Radiated Emissions

EUT Name	USNAP WiFi Module	**Date**	April 6, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	23°C / 31%rh
EUT Serial	MAC 001DC9050067	**Temp / Hum out**	N/A
EUT Config.	Integrated Antenna, Tabletop Position	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	1m & 3m / EMCO3115 & RA42-K-F-4B-C	**Performed by**	Jeremy Luong

1GHz to 26GHz Plot for Receive Mode at 2462 MHz





Notes: None.

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 50 μH / 50 Ω LISNs.

Testing is either 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).

Table 8: AC Conducted Emissions – Test Results

Test Conditions: Conducted Measurement at host's AC Main, Normal Conditions only		
Antenna Type: Attached	**Power Level:** 10	
AC Power: 120Vac/60Hz	**Configuration:** Tabletop	
Ambient Temperature: 22° C	**Relative Humidity:** 33% RH	
Configuration	**Frequency Range**	**Test Result**
Line 1 (Hot)	0.15 to 30 MHz	Pass

Line 2 (Neutral)	0.15 to 30 MHz	Pass

SOP 2 Conducted Emissions — Tracking # 31050899.001 Page 1 of 4

EUT Name	USNAP WiFi Module	**Date**	April 7, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	23°C / 33%rh
EUT Serial	MAC 001DC9050067	**Temp / Hum out**	N/A
EUT Config.	Attached Antenna	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15.207	**RBW / VBW**	9kHz / 30kHz
Lab/LISN	Lab 5 / Solar 9348-50-R-24-BNC, Line 1	**Performed by**	Jeremy Luong

Frequency MHz	Quasi-Peak dBuV	QP Limit dBuV	QP Margin dB	Average dBuV	Ave Limit dBuV	Ave Margin dB
0.1502	30.92	66.00	-47.84	0.20	56.00	-65.57
0.1502	30.91	66.00	-47.85	0.23	56.00	-65.54
0.1549	29.57	65.86	-49.19	-2.23	55.86	-67.99
0.1620	28.43	65.66	-50.33	-3.66	55.66	-69.42
0.2652	15.52	62.71	-63.26	5.36	52.71	-60.42
3.4696	-1.12	56.00	-74.00	-7.80	46.00	-67.68
6.0975	22.17	60.00	-50.68	14.02	50.00	-45.83
6.3624	23.31	60.00	-49.54	14.45	50.00	-45.40
6.3626	23.33	60.00	-49.52	14.63	50.00	-45.21
6.6279	21.23	60.00	-51.62	8.81	50.00	-51.04
12.9899	34.77	60.00	-38.00	27.89	50.00	-31.89
13.2550	37.11	60.00	-35.66	29.03	50.00	-30.75
13.5185	38.41	60.00	-34.36	29.16	50.00	-30.60
22.7999	27.59	60.00	-45.07	22.56	50.00	-37.10

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

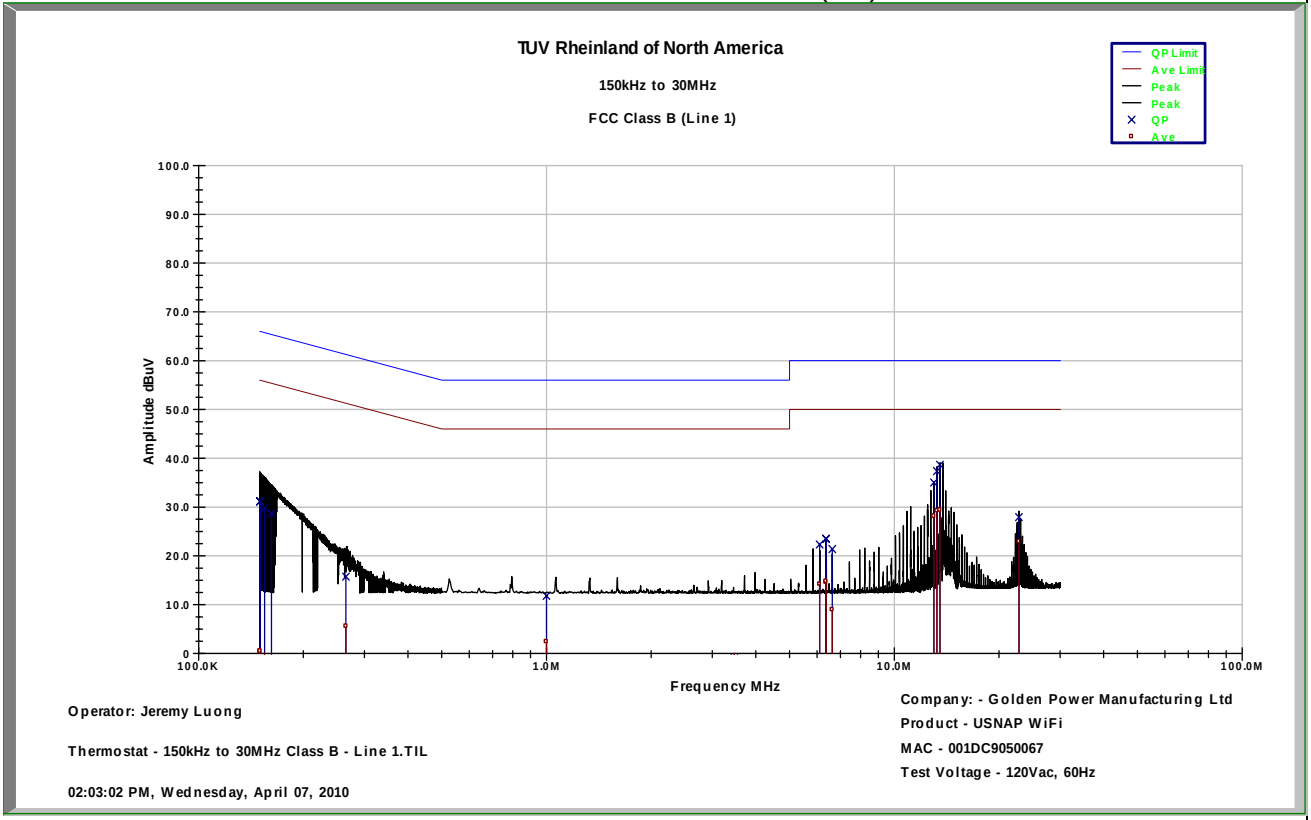
Combined Standard Uncertainty $u_c(y)$ = ± 1.2dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: EUT was setup as table top equipment.

SOP 2 Conducted Emissions

EUT Name	USNAP WiFi Module	**Date**	April 7, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	23°C / 33%rh
EUT Serial	MAC 001DC9050067	**Temp / Hum out**	N/A
EUT Config.	Attached Antenna	**Line AC**	120Vac/60Hz
Standard	CFR47 Part 15.207	**RBW / VBW**	9kHz / 30kHz
Lab/LISN	Lab 5/ Solar 9348-50-R-24-BNC, Line 1	**Performed by**	Jeremy Luong

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



Notes: Using CISPR Class B Limit.

SOP 2 Conducted Emissions

Tracking # 31050899.001 Page 3 of 4

EUT Name	USNAP WiFi Module	**Date**	April 7, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	23°C / 33%rh
EUT Serial	MAC 001DC9050067	**Temp / Hum out**	N/A
EUT Config.	Attached Antenna	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15.207	**RBW / VBW**	9kHz / 30kHz
Lab/LISN	5m Chamber/ Solar 9348-50-R-24-BNC, Line 2	**Performed by**	Jeremy Luong

Frequency	Quasi-Peak	QP Limit	QP Margin	Average	Ave Limit	Ave Margin
MHz	dBuV	dBuV	dB	dBuV	dBuV	dB
0.1502	29.17	65.99	-49.59	-0.33	55.99	-66.09
0.1503	28.97	65.99	-49.79	-0.19	55.99	-65.95
0.1604	27.28	65.70	-51.48	-4.39	55.70	-70.15
0.1817	23.30	65.09	-55.47	-5.11	55.09	-70.87
0.2647	15.25	62.72	-63.53	5.45	52.72	-60.33
3.9761	17.98	56.00	-54.90	9.01	46.00	-50.87
12.9915	32.48	60.00	-40.29	26.24	50.00	-33.54
13.2566	34.69	60.00	-38.08	27.11	50.00	-32.66
13.5209	36.32	60.00	-36.45	27.32	50.00	-32.45
13.7862	35.08	60.00	-37.68	25.54	50.00	-34.22
22.5376	25.29	60.00	-47.37	18.81	50.00	-40.85
22.8032	25.41	60.00	-47.25	19.91	50.00	-39.75

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

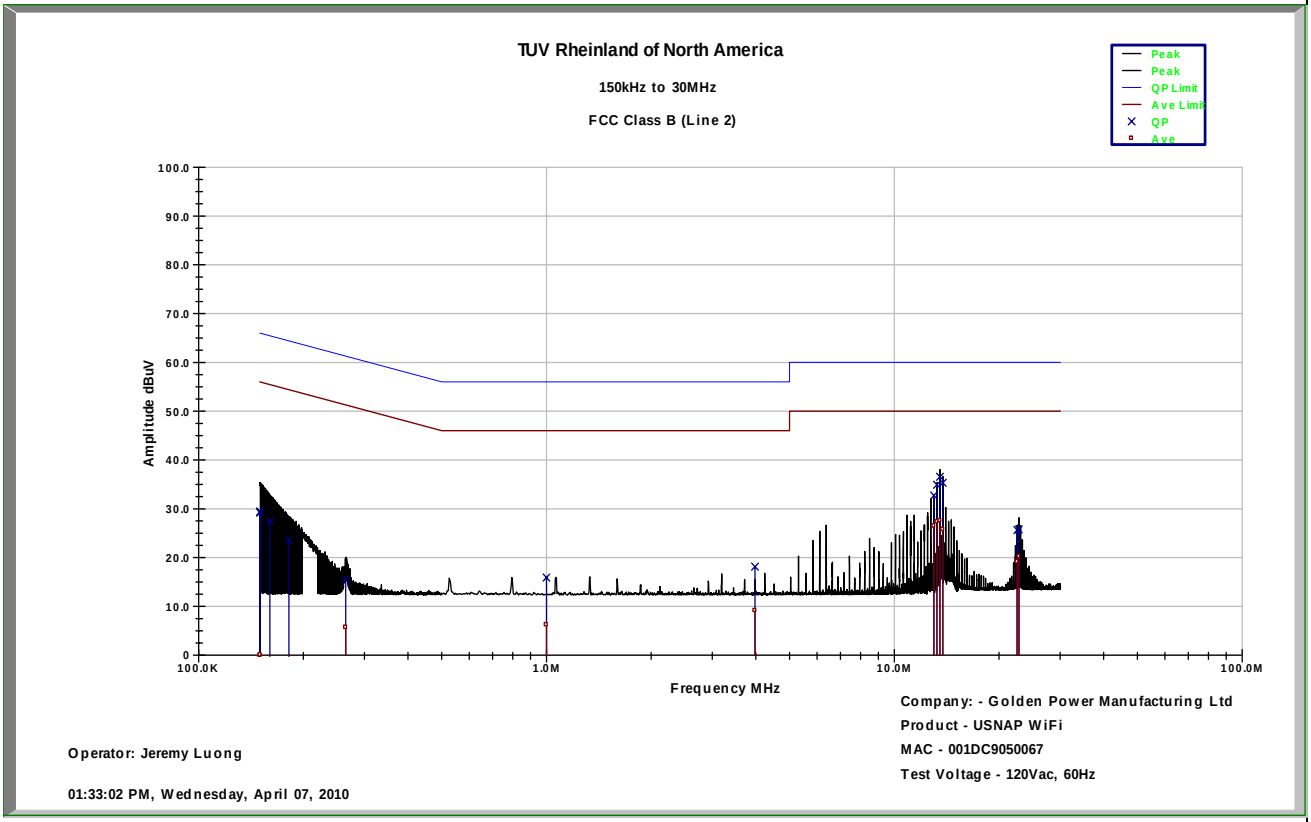
Notes: EUT was setup as table top equipment.

SOP 2 Conducted Emissions

Tracking # 31050899.001 Page 4 of 4

EUT Name	USNAP WiFi Module	**Date**	April 7, 2010
EUT Model	WiFi USNAP	**Temp / Hum in**	23°C / 33%rh
EUT Serial	MAC 001DC9050067	**Temp / Hum out**	N/A
EUT Config.	Attached Antenna	**Line AC**	120Vac/60Hz
Standard	CFR47 Part 15.207	**RBW / VBW**	9kHz / 30kHz
Lab/LISN	Lab 5/ Solar 9348-50-R-24-BNC, Line 2	**Performed by**	Jeremy Luong

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



Notes: Using CISPR Class B Limit.

5 Test Equipment Use List

5.1 Equipment List

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
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
Bilog Antenna	Sunol Science	JB3	A102606	02/18/10	02/18/11
Antenna Horn (1-18GHz)	EMCO	3115	9602-4676	07/03/08	07/03/10
Antenna Horn (18-26GHz)	CMT	RA42-K-F-4B-C	020131-004	08/14/08	08/14/10
Antenna Horn (18-26GHz)	CMT	RA42-K-F-4B-C	961178-001	08/14/08	08/14/10
EMI Receiver	Hewlett Packard	8546A	3942A00514	02/23/10	02/23/11
Preselector	Hewlett Packard	85460A	3704A00485	02/23/10	02/23/11
LISN	Solar Electronics	Type 9348-50-R-24-BNC	068506	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
Notch Filter	Micro-Tronics	BRM50702	037	01/22/10	01/22/11

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

6 EMC Test Plan

6.1 Introduction

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

6.2 Customer

Table 9: Customer Information

Company Name	Golden Power Manufacturing Ltd.
Address	6 Tonnochy Road, Room1-3, 10/F
City, State, Zip	Wanchai, 852 HK
Country	USA
Phone	(415) 203-0074
Fax	(415) 203-0074

Table 10: Technical Contact Information

Name	Pete Peterson
E-mail	p_peterson@ourhomespaces.com
Phone	(415) 203-0074
Fax	(415) 203-0074

6.3 Equipment Under Test (EUT)

Table 11: EUT Specifications

USNAP WiFi Module P/N	GS1011
USNAP WiFi Module Dimensions	47 mm x 41 mm x 4.75mm
Supply Information	Voltage: 3.3 Vdc Current: 500 mA
Environment	Indoor
Operating Temperature Range:	0 to 50 degrees C
Multiple Feeds:	☐ Yes and how many ☒ No
Hardware Version	USNAP1 Rev. 2.1
WLAN Firmware	V2.0.13
Operating Mode	802.11b
Transmitter Frequency Band	2.412 GHz to 2.462 MHz (DSSS)
Rated Power Output	0.0132 W (+11.21 dBm)
Operating Channel	2412 MHz, 2417MHz, 2422 MHz, 2427 MHz, 2432MHz, 2437 MHz, 2442 MHz, 2447 MHz, 2452 MHz, 2457 MHz, 2462 MHz.
Modulation Type	☐ AM ☐ FM ☐ Phase ☒ Other describe: DSSS
Date Rate	802.11b – 1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s, 11 Mbit/s.
Antenna Type	Attached on board (Fractus)
Antenna Gain	+1 dBi
Type of Equipment	☐ Table Top ☐ Wall-mount ☐ Floor standing cabinet ☒ Other *describe: WiFi Module*

Table 12: 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?
12-Pin 2mm pin header	Ribbon	☒ Yes	☒ 10cm	☒ M
Mini-USB	USB	☒ Yes	☒ 5m	☒ M
Note: 12-pin ribbon cable was used to connect to the thermostat host, and USB connection was used to set the operation mode.				

Table 13: Supported Equipment

Equipment	Manufacturer	Model	Serial	Used for
Laptop	IBM Computer		3894765713	Setting up test mode
Thermostat	Golden Power Manufacturing Ltd.	None	None	Host.

Table 14: Description of Sample used for Testing

Device	MAC	Configuration	Used For
USNAP WiFi Module	001DC9050067	With on-board antenna	Radiated Emission (TX Mode) Conducted Emission
USNAP WiFi Module	001DC9050068	With on-board antenna	Radiated Emission (RX Mode)
USNAP WiFi Module	001DC9050067	Remove on-board antenna. Connect to the RF Port via Apex Connector	Output Power, Bandwidth, Conducted Spurious Emission, Peak Power Spectral Density,
Note: None			

Table 15: Description of Test Configuration used for Radiated Measurement.

Device	Antenna	Mode	Setup Description
USNAP WiFi Module	Attached	Transmit & Receive	X-Axis: Module connects to host, and it faces upward.
USNAP WiFi Module	Attached	Transmit & Receive	Y-Axis: Module connects to host. It is facing sideways, and the width is positioned horizontally.
USNAP WiFi Module	Attached	Transmit & Receive	Z-Axis: Module connects to host. It is facing sideways, and the length is positioned horizontally.
Note: Test configuration was used in the preliminary testing.			

6.4 Test Specifications

Testing requirements

Table 16: EUT Designation

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