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Emissions
Test Report

EUT Name: Low Power Transceiver Module

Model No.: ZG2100 and ZG2101

CFR 47 Part 15.247 2008 and RSS 210: 2007

Prepared for:

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Report/Issue Date: 06 March 2009
Report Number: 30853571.001

Statement of Compliance

Manufacturer:	Zerog Wireless 255 San Geronimo Way Sunnyvale, CA 94085 (408) 594-9334
Requester / Applicant:	Hamid Movahedi
Name of Equipment:	Low Power Transceiver Module
Model No.	ZG2100 and ZG2101
Type of Equipment:	Intentional Radiator
Application of Regulations:	CFR 47 Part 15.247 2008 and RSS 210: 2007
Test Dates:	19 February 2009 to 05 March 2009

Guidance Documents:

Emissions: AN C63.4: 2003

Test Methods:

Emissions: AN C63.4: 2003

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	05 March 2009
Test Engineer	Date

Sarb Shelopal	05 March 2009
NVLAP Signatory	Date

100411-0 **0014391684** **IC4453-1**

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 19 February 2009 through 05 March 2009 on the Low Power Transceiver Module Model ZG2100 and ZG2101 manufactured by Zerog Wireless. 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	500kHz mininum	**Complied**
Maximum Transmitted Power	CFR47 15.247 (b3), RSS 210 Sect. A.8.1	30dBm w/ 6dBi antenna	**Complied**
Peak Power Spectral Density	CFR47 15.247 (e), RSS 210 Sect. A.8.1	8dBm/ 3kHz.	**Complied**
Bandedge Measurement	CFR47 15.247 (d), RSS 210 Sect. A.8.5	20dBr	**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 2305 Mission College, Santa Clara, CA, 95054 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 Guide 17025:1999 and ISO 9002 (Lab code 100411-0). 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 2305 Mission College, Santa Clara, CA, 95054 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 IC 4453-1). 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 2305 Mission College, Santa Clara, CA, 95054 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 2305 Mission College, Santa Clara, CA, 95054 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-Anachoic 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 10 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 (code 100411-0). The 10-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 10 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 addition, 1995.

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

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

Table 2: Summary of Uncertainties

Test	System	Combined Standard Uncertainty
Conducted Emissions	LISN, spectrum analyzer, coaxial cables, and pads	± 1.2 dB
Radiated Emissions	antenna, spectrum analyzer, pre-amplifier, coaxial cables, and pads	± 1.6 dB
Radiated Immunity	antenna, amplifier, cables, signal generator field probe, and spectrum analyzer	± 2.7 dB
Conducted Immunity	coupling/decoupling device, amplifier, cables, signal generator, and spectrum analyzer	± 1.5 dB
Voltage Dips, Drops, and Interruptions	AC power source and interruptions generator	± 4.3 dB
Electrical Fast Transient Immunity	AC power output source and fast transient generator	± 5.8 dB
Lightning Surge Immunity	AC power output source and lightning surge generator	± 8.0 dB
Electrostatic Discharge Immunity	air and contact discharge generators	± 4.1 dB
Power Frequency Magnetic Field Immunity	AC voltage source	± 0.58 dB
Damped Oscillatory Wave Immunity	AC power output source and oscillatory wave generator	± 8.7 dB
Harmonic Current and Voltage Flicker	AC power source and detection devices	± 11.6 dB

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

2.4 Calibration Traceability

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

3 Product Information

3.1 Product Description

ZG2100CxAxQ wireless chipset provides an easy to use, low power implementation of 802.11b. All RF components, the baseband, and the entire 802.11 MAC reside on-chip, enabling simple and cost-effective Wi-Fi connectivity for embedded devices. An on-chip processor hosts an API, simplifying design-in and allowing the ZG2100M or ZG2101M to be hosted by 8- and 16-bit host microcontrollers. Hardware accelerators support Wi-Fi security standards.

The ZG2100 and ZG2101 have SKU# of CC2 and CC3. The CC2 is the standard module, and CC3 is enhanced battery life extender version via software.

There are two antenna configurations for the ZG2100CxAxQ wireless chipset; ZG2100 (Version using onboard PCB antenna) and ZG2101 (Version using external antenna).

The ZG2101 was configured and tested for multiple antenna families.

3.2 Equipment Configuration

A description of the equipment configuration is given in Table 16 and Table 17. 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 Table 16 and Table 17. 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 ZG2100 configuration has an On-board PCB antenna (Meander). It is permanently attached.

The tested antenna families for ZG2101 module use the non-standard antenna jack.

Table 3: Antenna Characteristics

Transceiver Module	Antenna Name	Antenna Description	Connector Type	Antenna Gain
ZG2100	Meander	On-board PCB Antenna	Na.	-2dBi
ZG2101	RFA-02-P05	PCB Antenna #3	IPEX	2dBi
ZG2101	Inverter F	PCB Antenna	Reversed SMA	2dBi
ZG2101	RFA-02-D3-70-100	Dipole Antenna	IPEX	2dBi
ZG2101	BTC013-1-70B-150	Helical Antenna	RP-SMA	2dBi
ZG2101	WF2400-15001A	Dipole Antenna	IPEX	5dBi
ZG2101	AN2400-5901RS	Monopole Antenna	Reversed SMA	10dBi

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 peak output power requirement is the maximum conducted power delivering to the transmitting antenna under specified conditions of measurements in the presence of modulation.

Per CFR47 Part 15.31(e), the conducted output power shall measure at ±15% of the rated DC input.

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 +30dBm with 6dBi antenna.

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

Table 4: RF Conducted Output Power – Test Results

Test Conditions: Conducted Measurement, Normal Temperature, Normal and ±15% Voltage					
Antenna Type: Integrated and detachable			**Power Setting:** +10 dBm		
Max. Antenna Gain: +10dBi			**Signal State:** Modulated		
Duty Cycle: 84.61 %			**Data Rate:** 2Mbit/s		
Ambient Temp.: 23 °C			**Relative Humidity:**45 %		
Test Results					
Operating Channel	**Level @ 3.3VDC [dBm]**	**Level @ 2.8VDC [dBm]**	**Level @ 3.8VDC [dBm]**	**Limit [dBm]**	**Margin [dB]**
ZG2101 @ 2412MHz	+14.30	+14.45	+14.35	+26	-11.55
ZG2101 @ 2437MHz	+14.83	+15.32	+14.57	+26	-10.68
ZG2101 @ 2462MHz	+16.04	+16.71	+15.68	+26	-9.29

Note: The above limit is adjusted for the highest antenna gain of 10dBi.

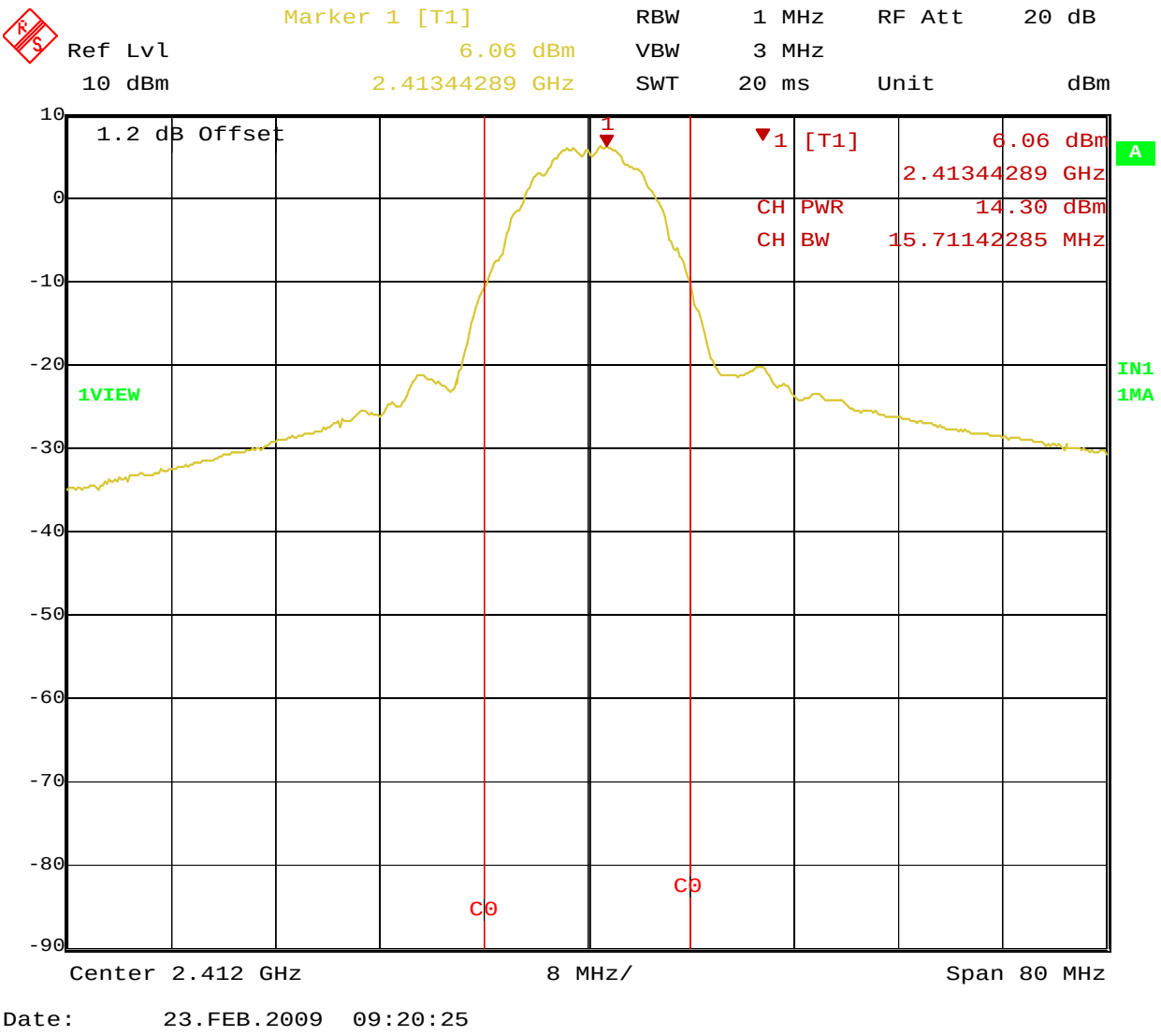

Figure 1: Maximum Transmitted Power at 3.3VDC– Lowest Channel 2412MHz

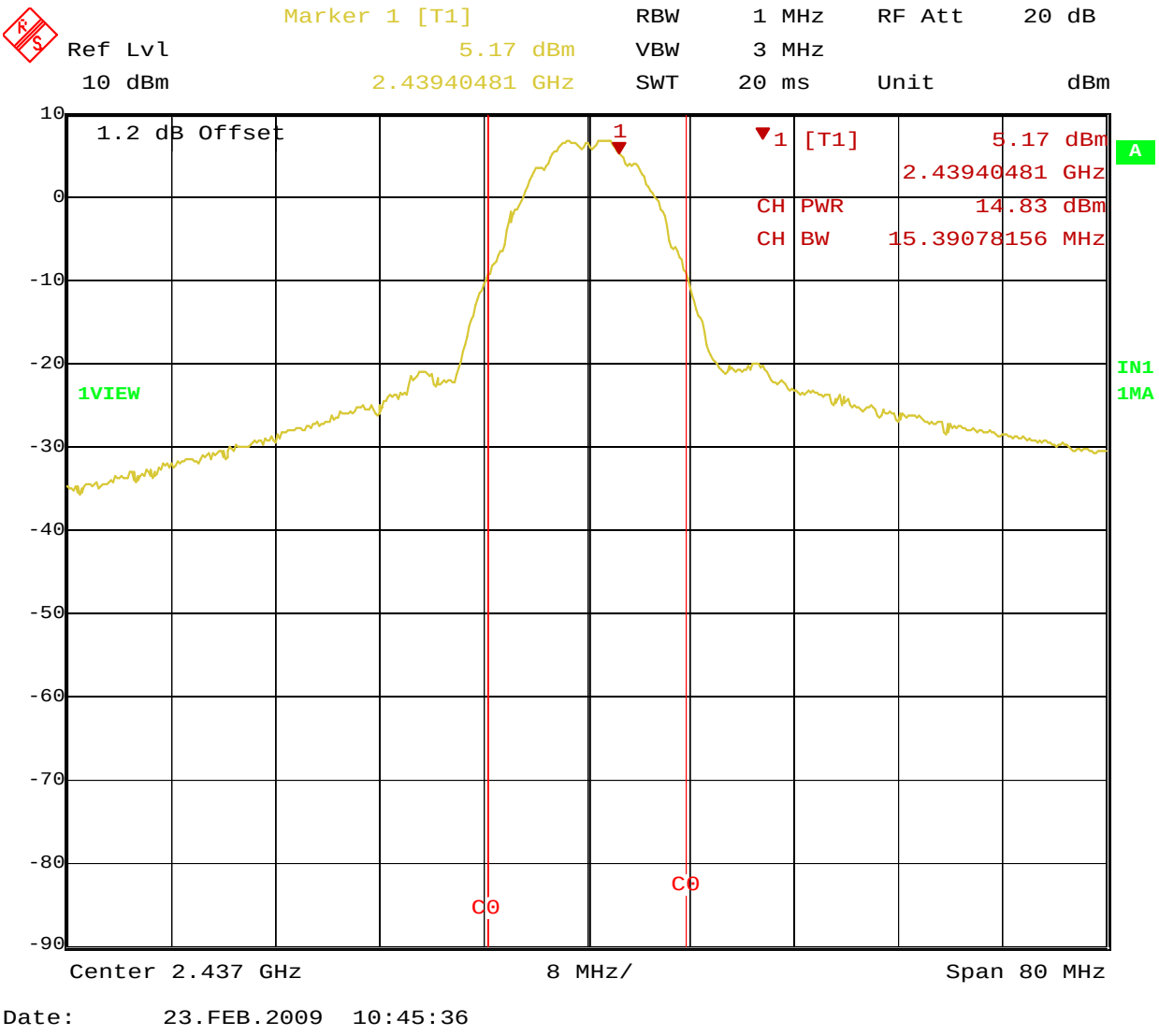

Figure 2: Maximum Transmitted Power at 3.3VDC – Middle Channel 2437 MHz

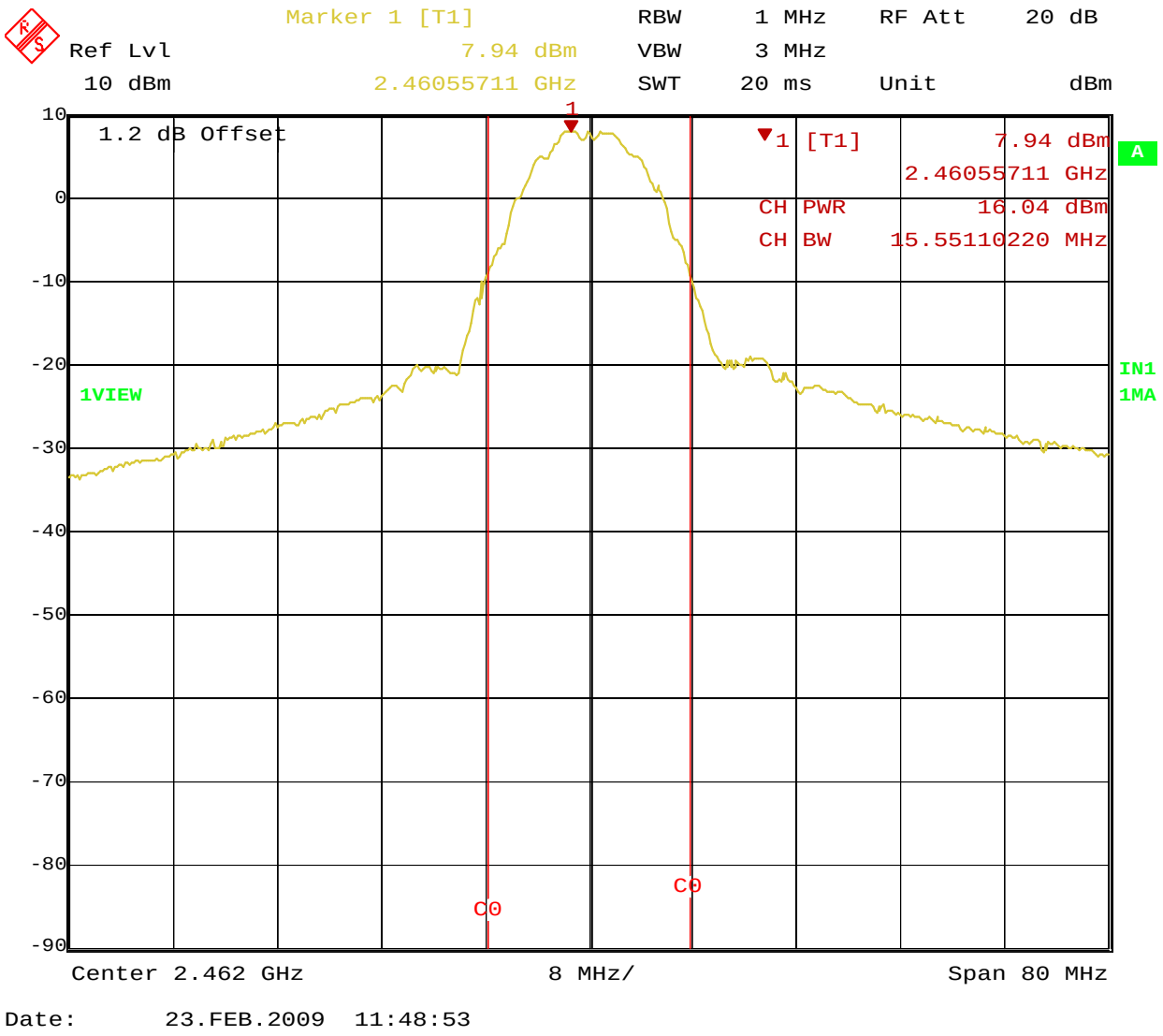

Figure 3: Maximum Transmitted Power at 3.3VDC – Highest Channel 2462 MHz

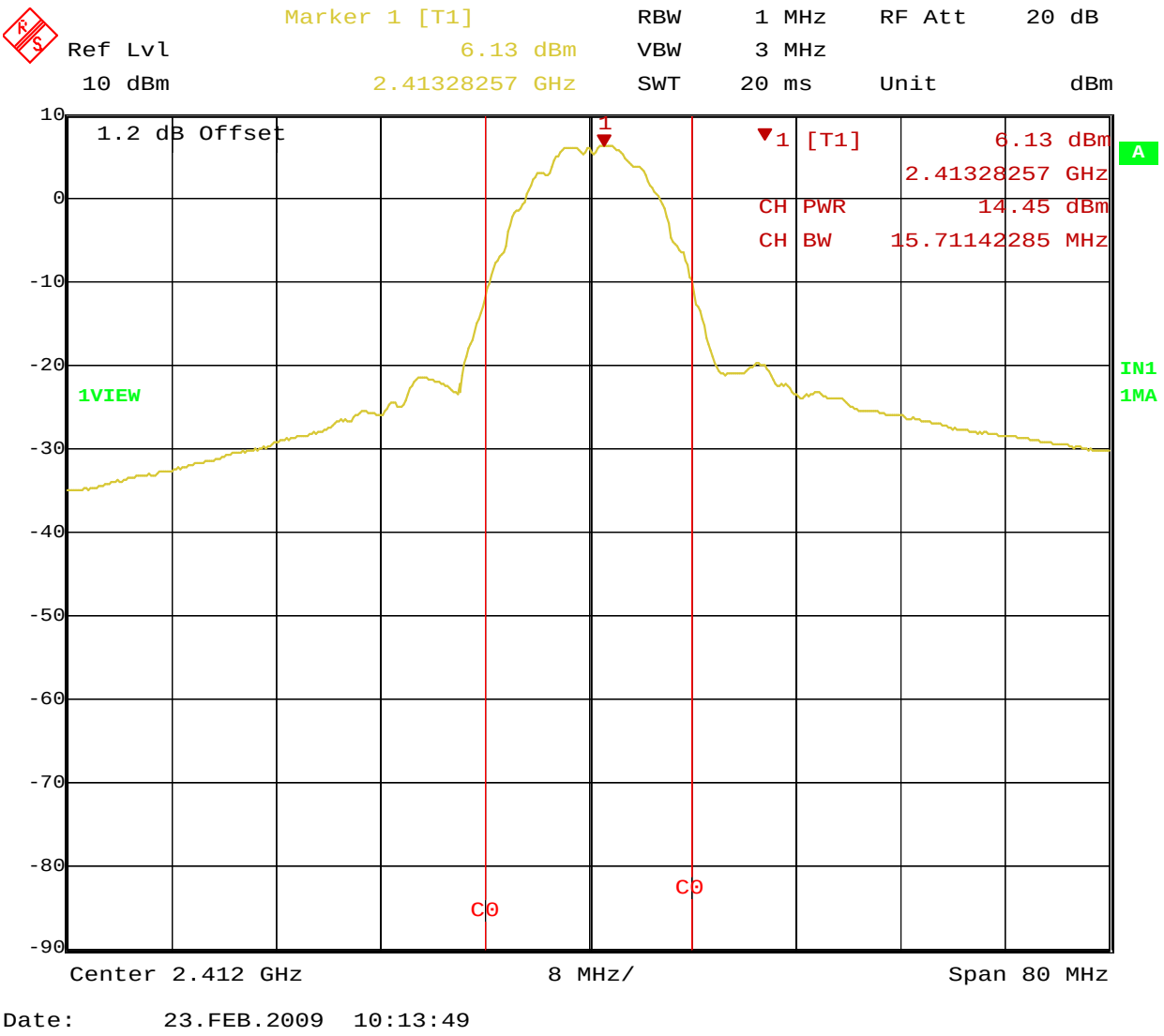

Figure 4: Maximum Transmitted Power at 2.8VDC – Lowest Channel 2412 MHz

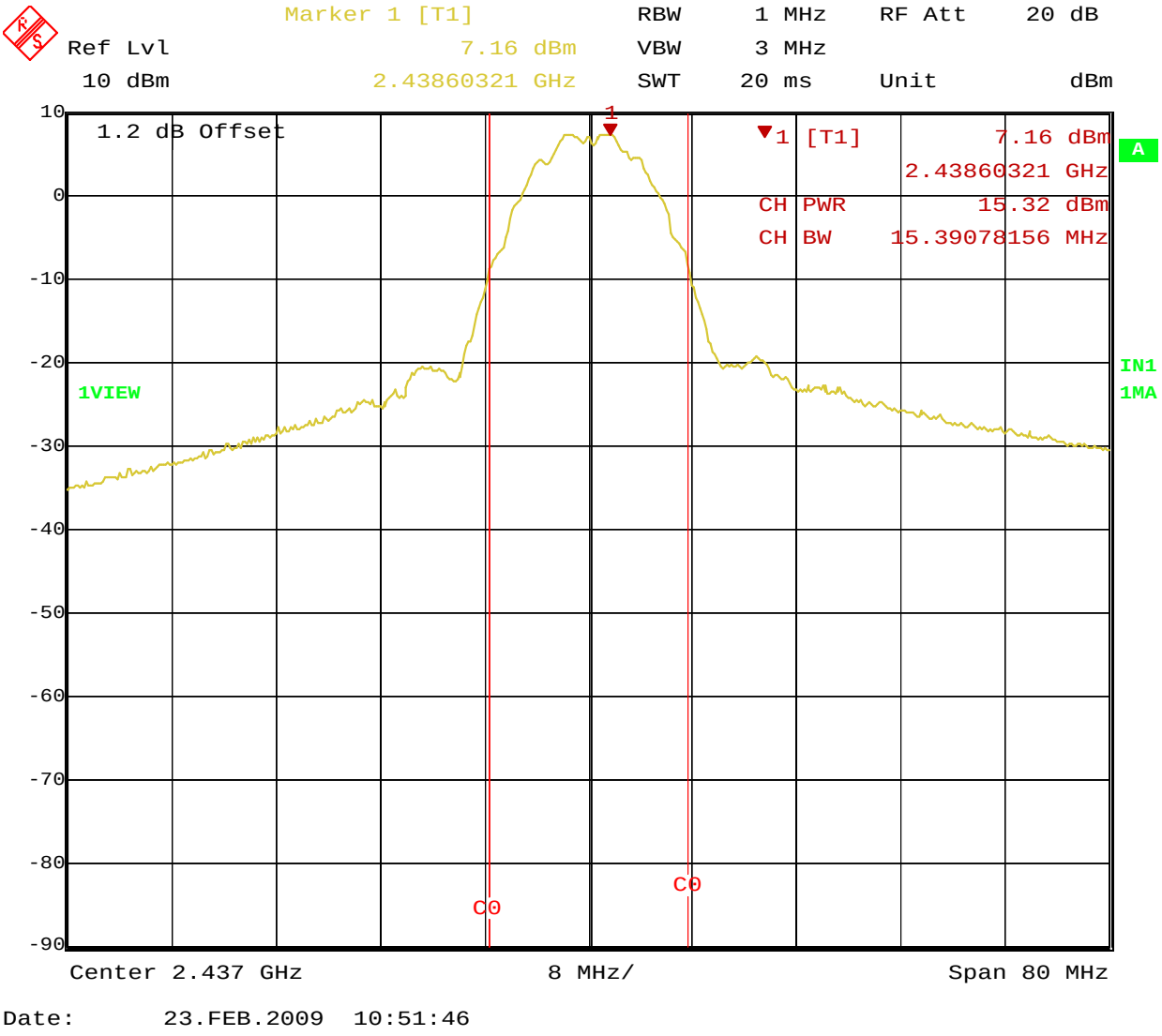

Figure 5: Maximum Transmitted Power at 2.8VDC – Middle Channel 2437 MHz

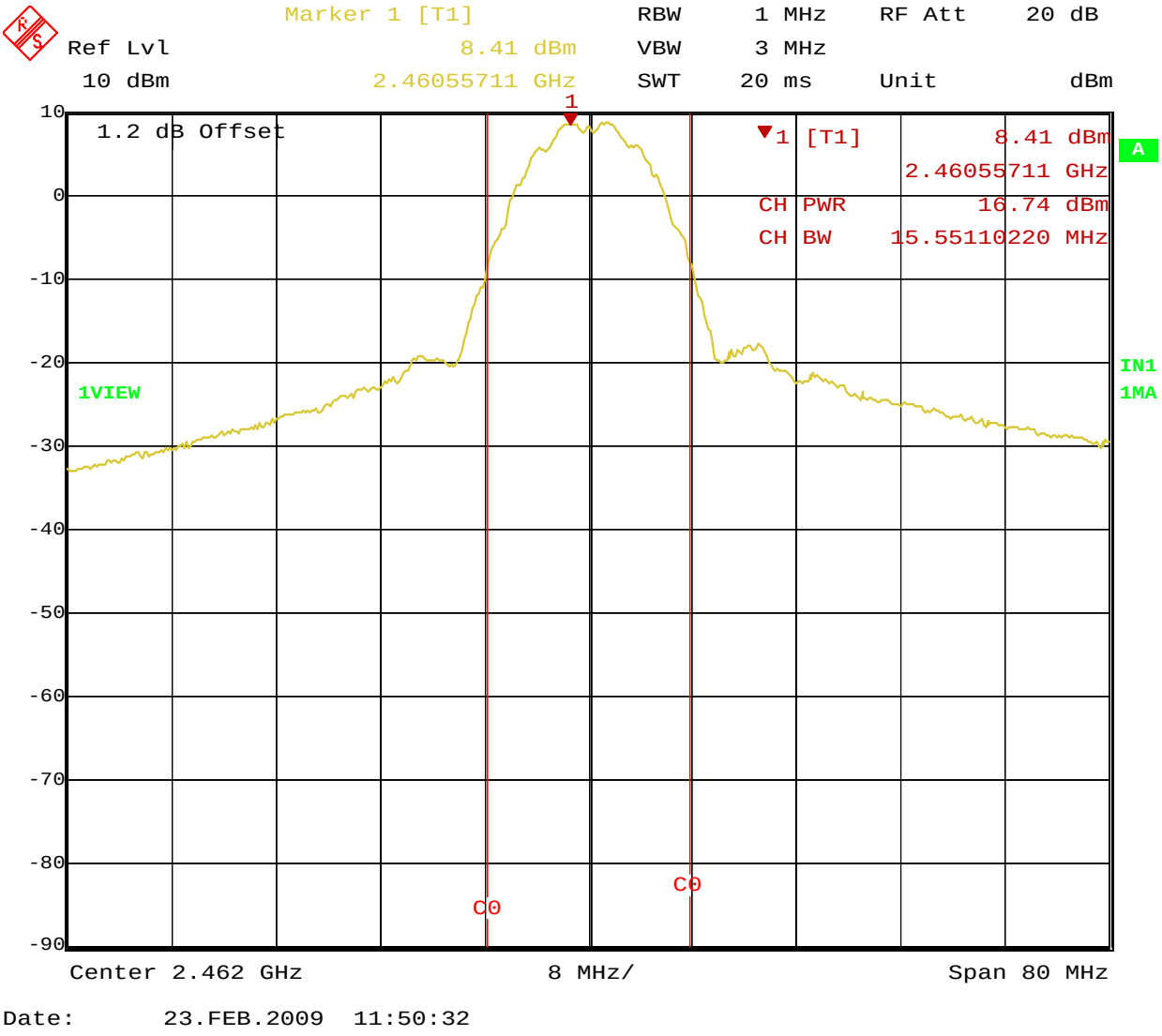

Figure 6: Maximum Transmitted Power at 2.8VDC – Highest Channel 2462 MHz

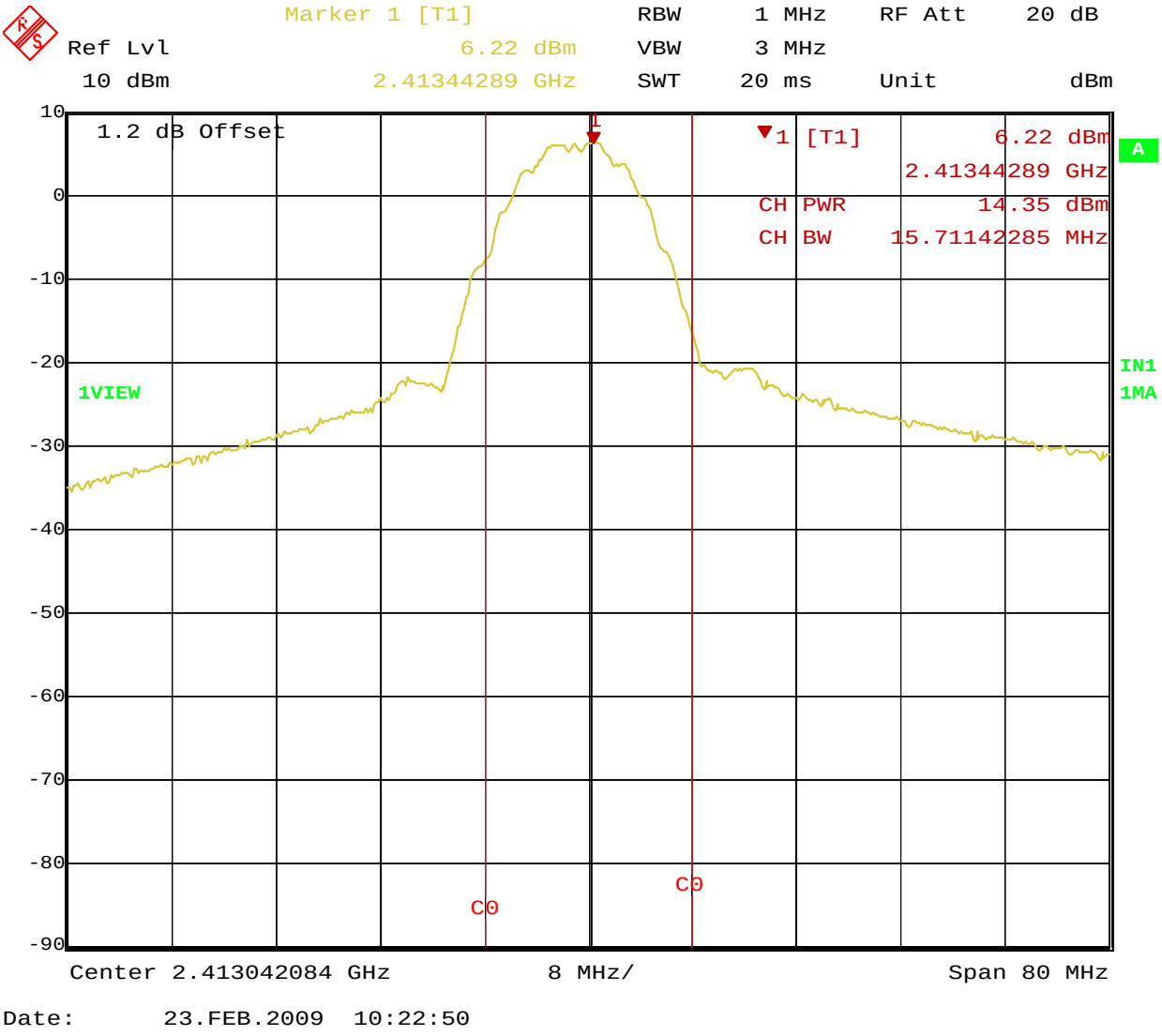

Figure 7: Maximum Transmitted Power at 3.8VDC – Lowest Channel 2412 MHz

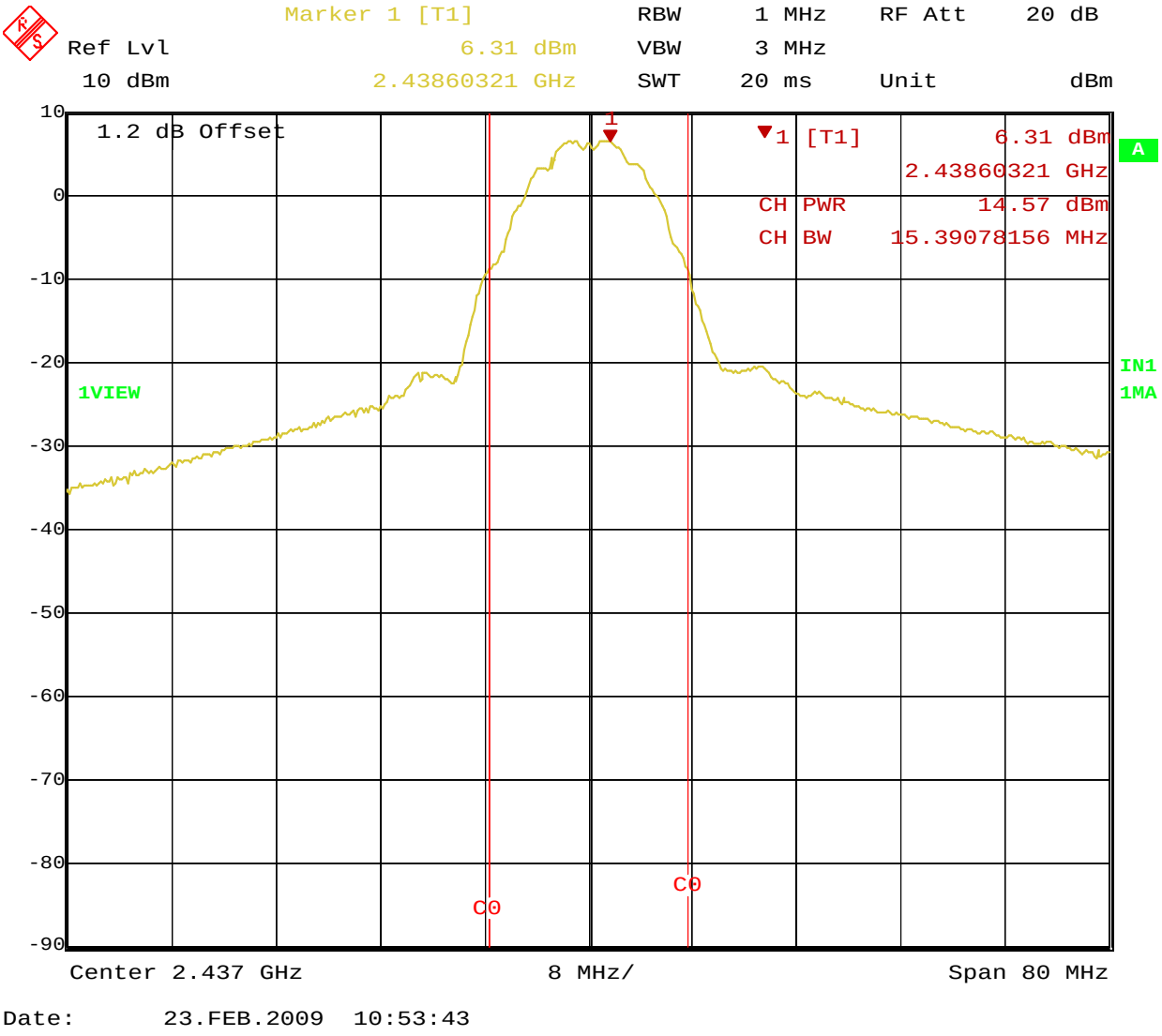

Figure 8: Maximum Transmitted Power at 3.8VDC – Middle Channel 2437 MHz

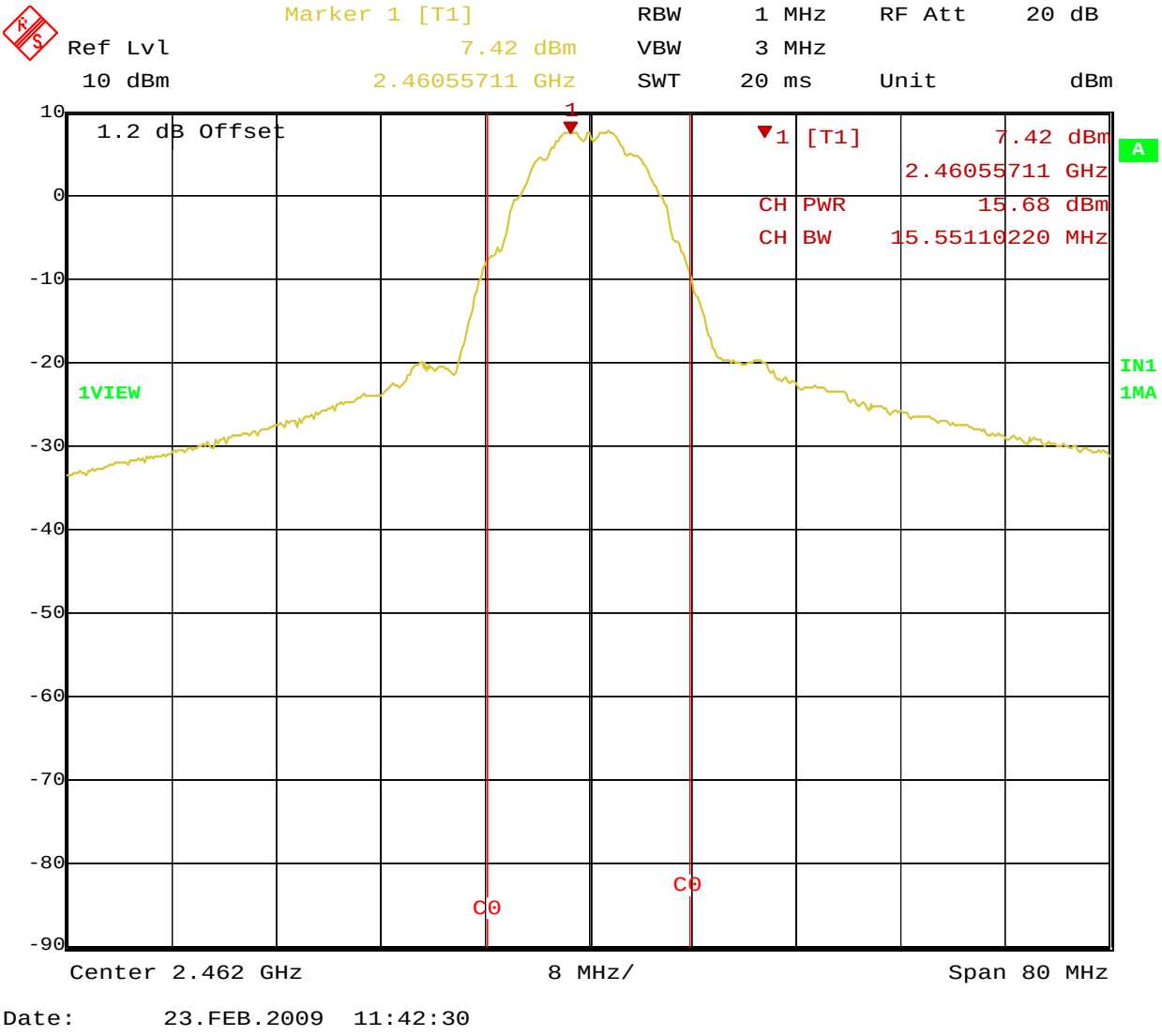

Figure 9: Maximum Transmitted Power at 3.8VDC – Highest Channel 2462 MHz

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

The bandwidth shall be at least 500 kHz per Section CFR47 15.2 (a2) 2008 and RSS GEN Sect.4.4.1 2007.

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

Table 5: Occupied Bandwidth Requirements – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only				
Antenna Type: Integrated and detachable		**Power Setting:** +10 dBm		
Max. Antenna Gain: +10dBi		**Signal State:** Modulated		
Duty Cycle: 84.61 %		**Data Rate:** 2Mbit/s		
Ambient. Temperature: 23°C		**Relative Humidity:** 45 %		
Bandwidth Test Results				
Operating Channel	**99% Bandwidth (MHz)**	**6dB Bandwidth (MHz)**	**Limit [kHz]**	**Result**
2412 MHz	15.71142285	9.61923848	500	Complied
2437 MHz	15.39078156	8.97795591	500	Complied
2462 MHz	15.55110220	9.13827655	500	Complied

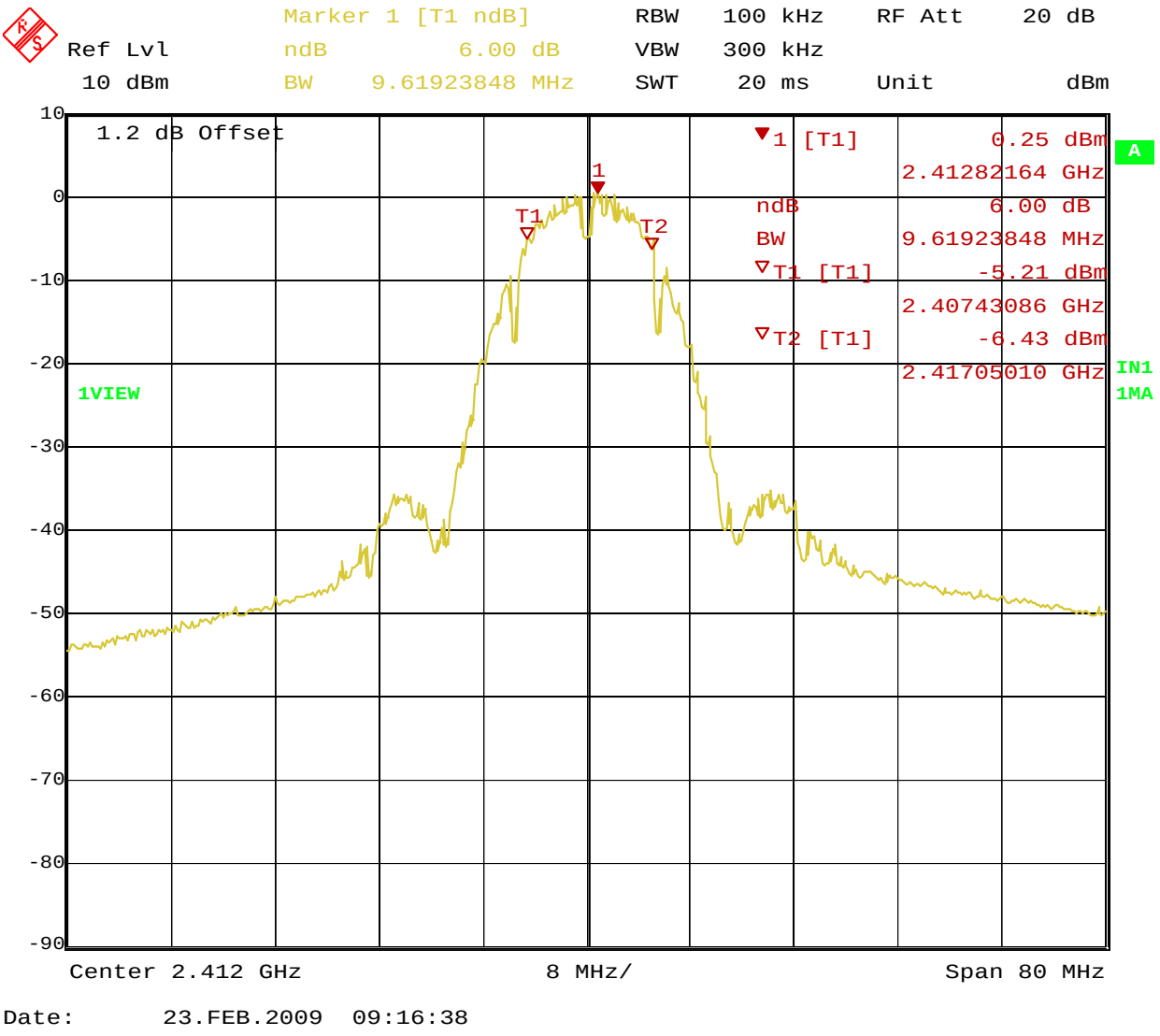

Figure 10: 6dB Bandwidth – Operating Channel 2412MHz

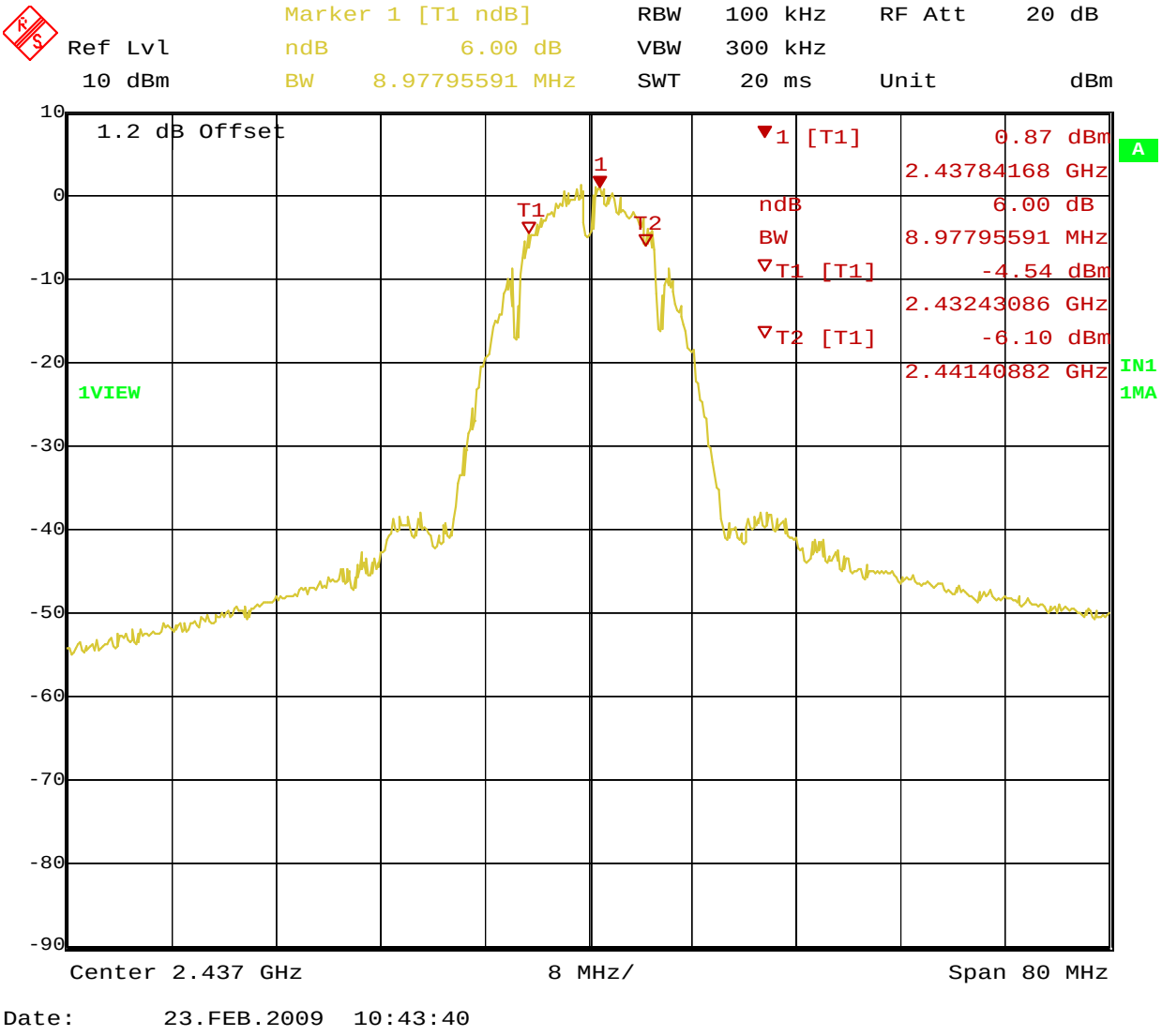

Figure 11: 6dB Bandwidth – Operating Channel 2437MHz

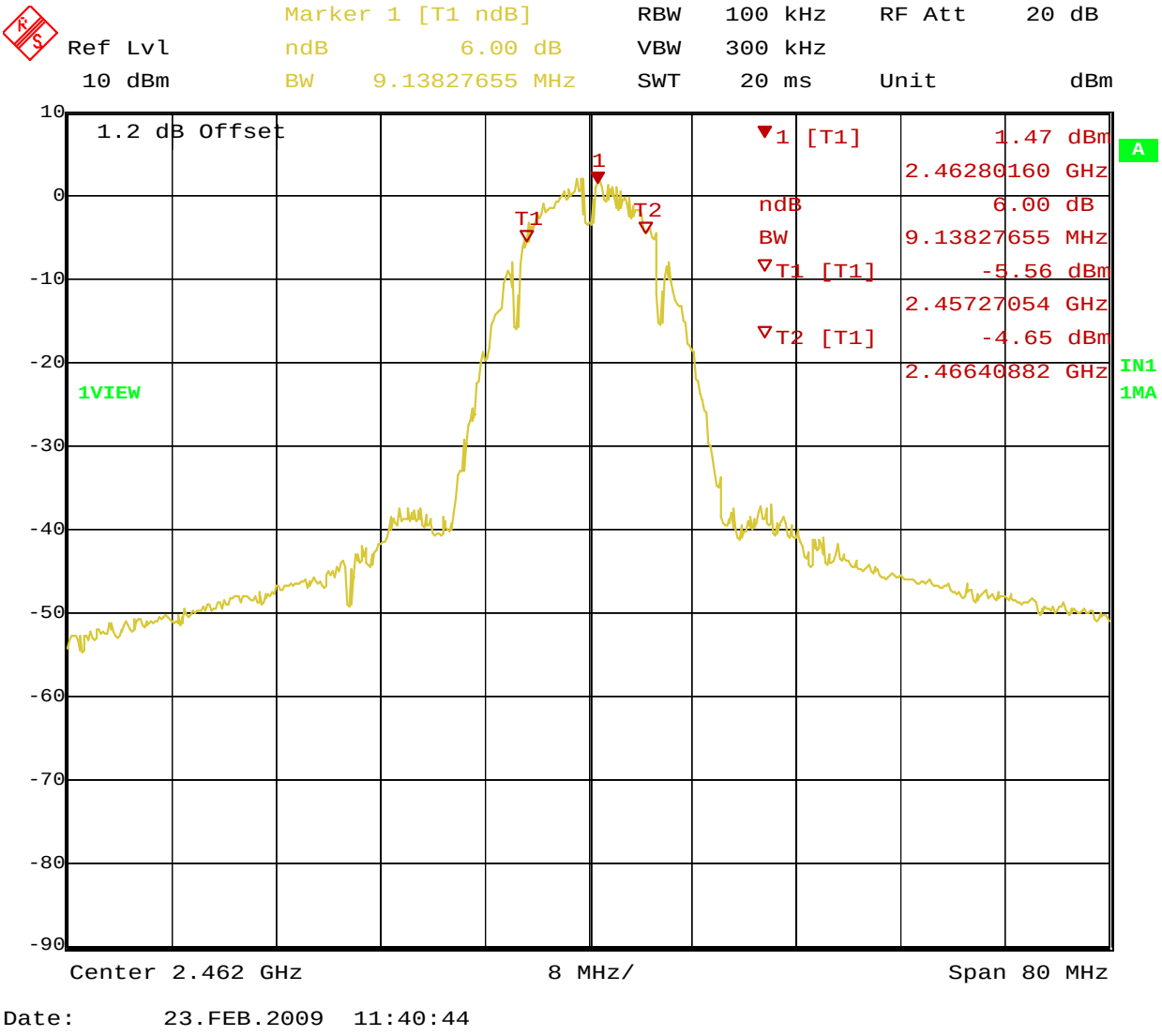

Figure 12: 6dB Bandwidth – Operating Channel 2462MHz

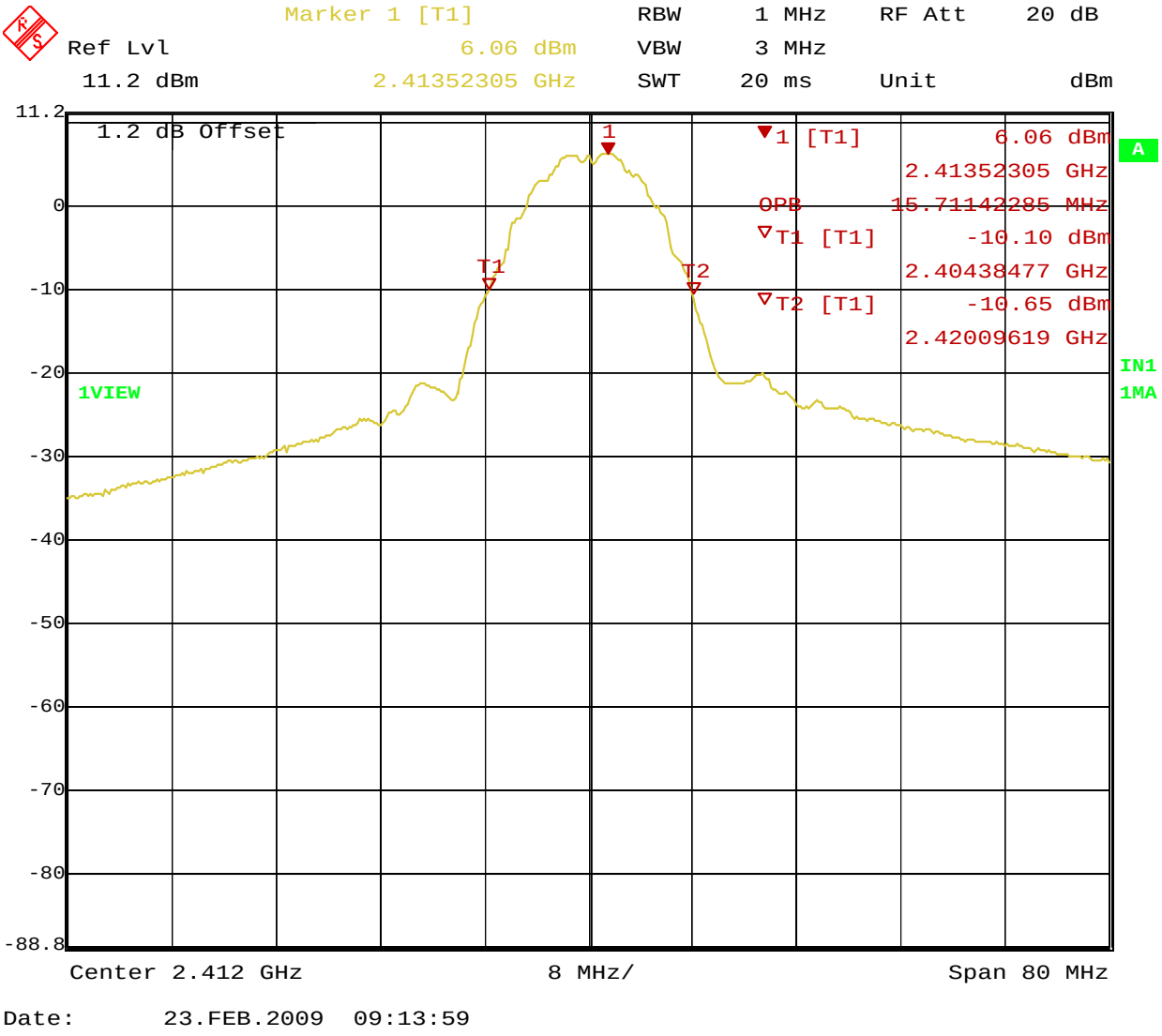

Figure 13: 99% Bandwidth – Operating Channel 2412MHz

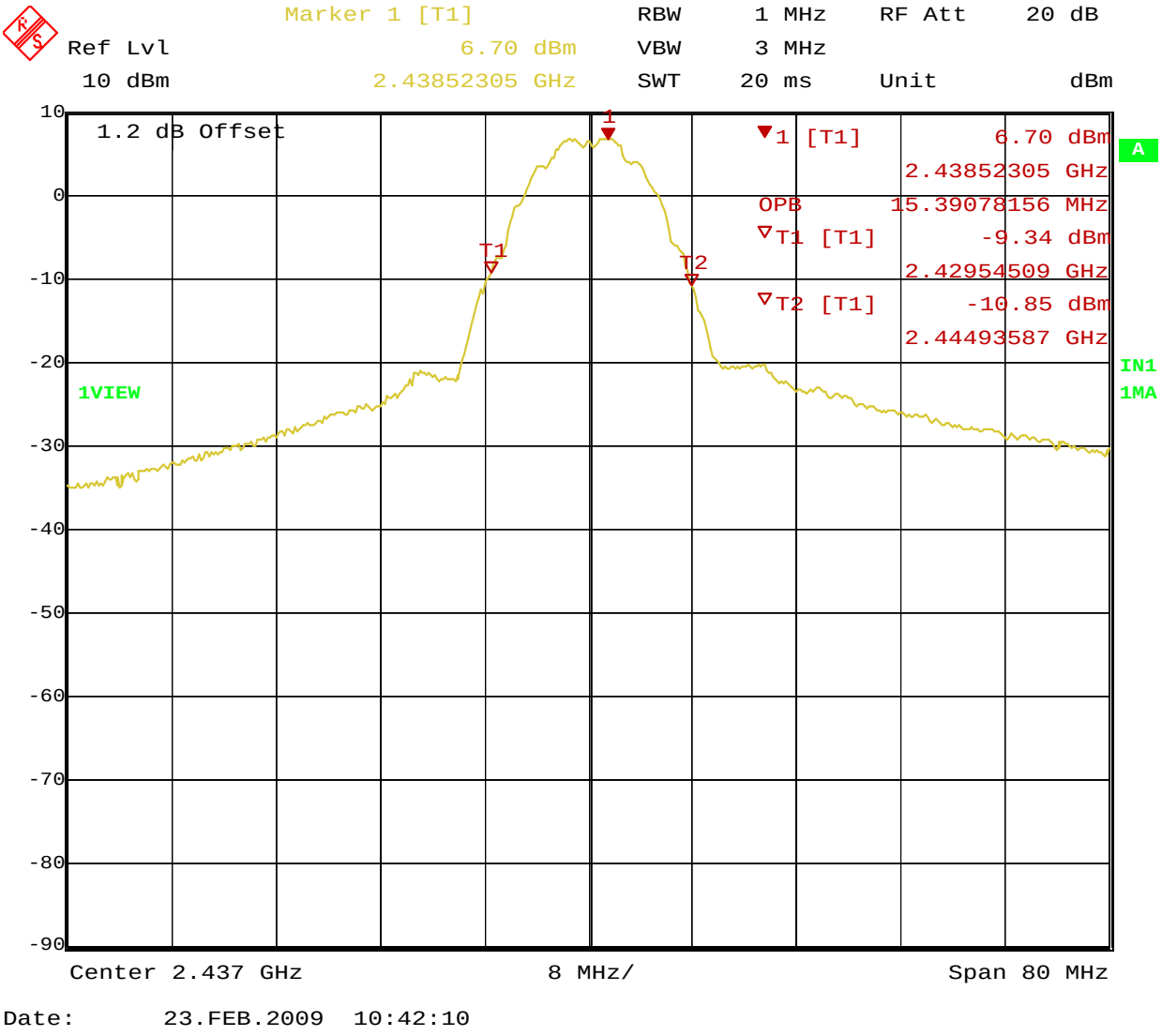

Figure 14: 99% Bandwidth – Operating Channel 2437MHz

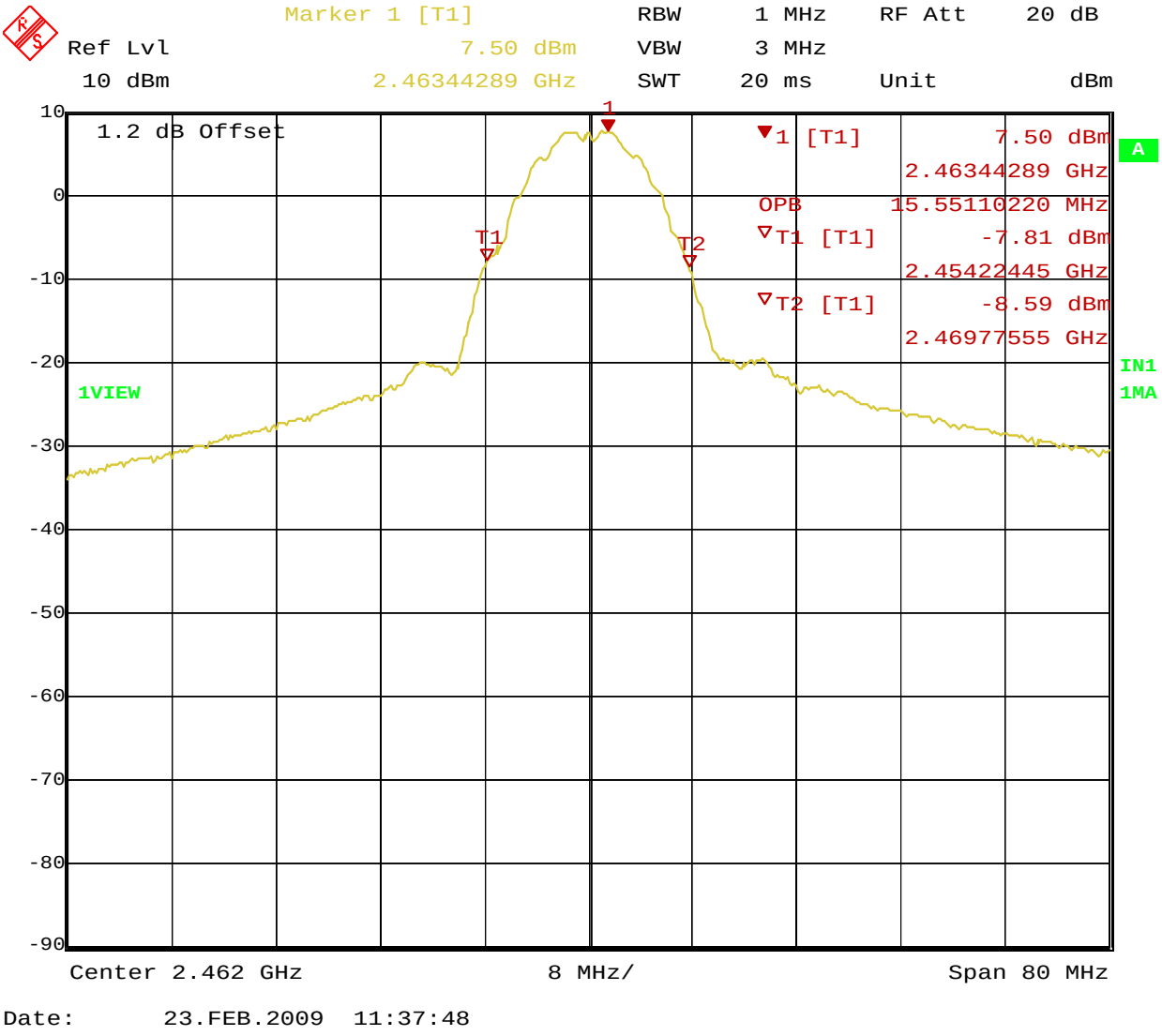

Figure 15: 99% Bandwidth – Operating Channel 2462MHz

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 2400MHz to 2483.5MHz, the conducted 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 6: Band-Edge/ Outband Emission – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only			
Antenna Type: Integrated and detachable		**Power Setting:** +10 dBm	
Max. Antenna Gain: +10dBi		**Signal State:** Modulated	
Duty Cycle: 84.61 %		**Data Rate:** 2Mbit/s	
Ambient. Temperature: 23°C		**Relative Humidity:** 45 %	
Band-Edge Results			
Operating Channel	**Range 1 (30MHz – 1000MHz)**	**Range 2 (1GHz – 10GHz)**	**Range 3 (10GHz – 25GHz)**
2412 MHz	Complied	Complied	Complied
2442 MHz	Complied	Complied	Complied
2462 MHz	Complied	Complied	Complied

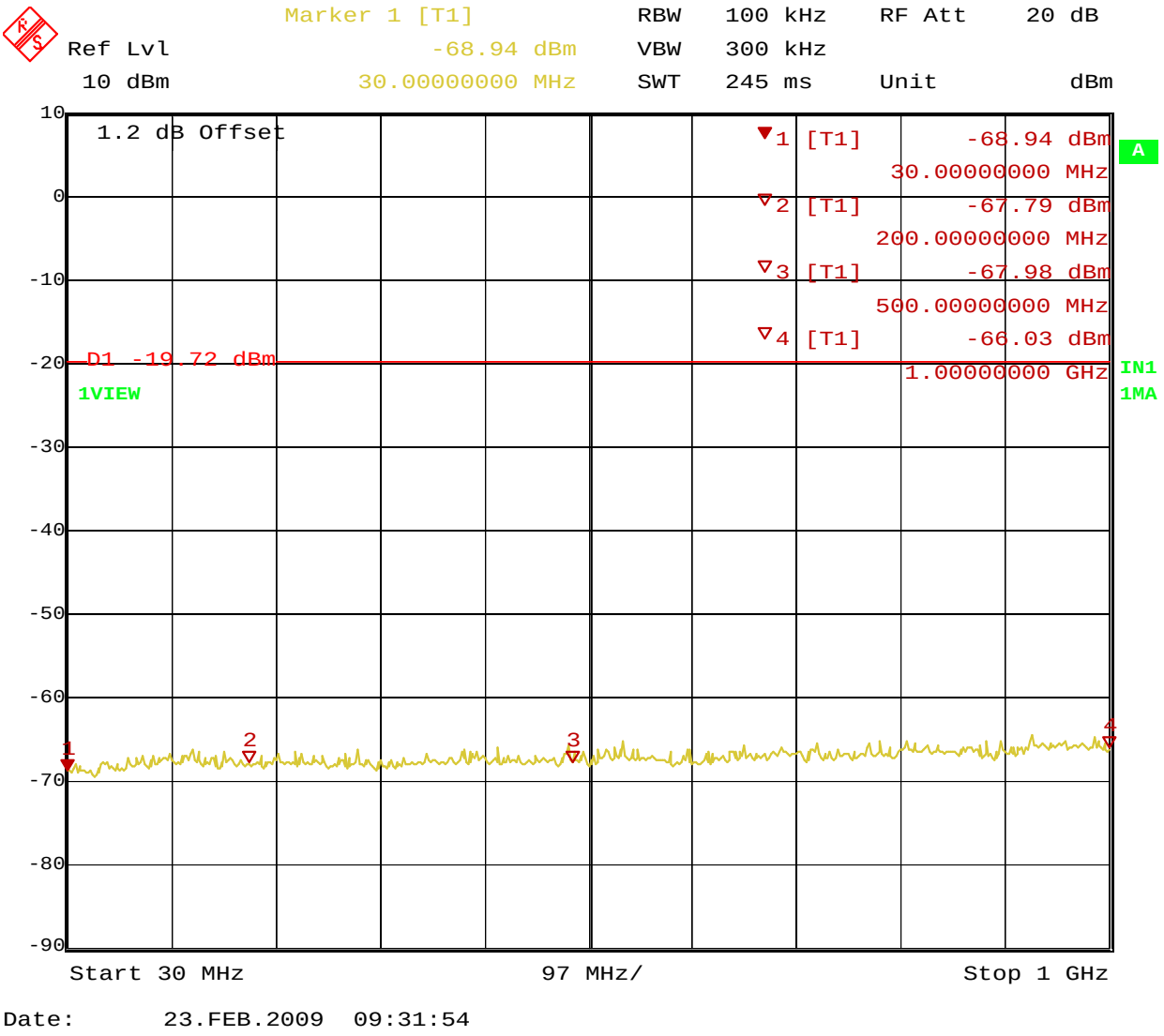

Figure 16: Band-edge Requirement for Operating Channel 2412MHz (30MHz to 1GHz)

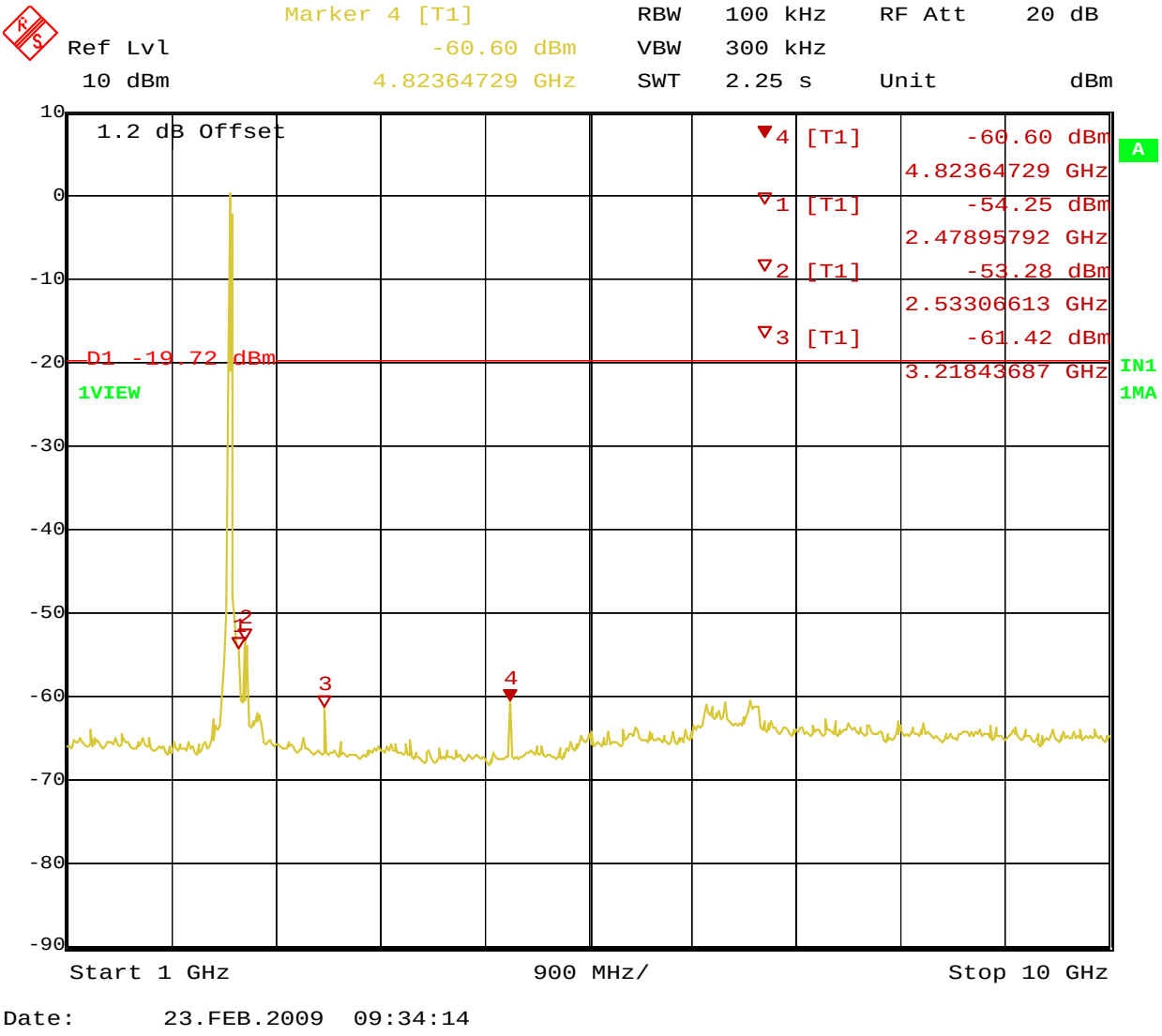

Figure 17: Band-edge Requirement for Operating Channel 2412MHz (1GHz to 10GHz)

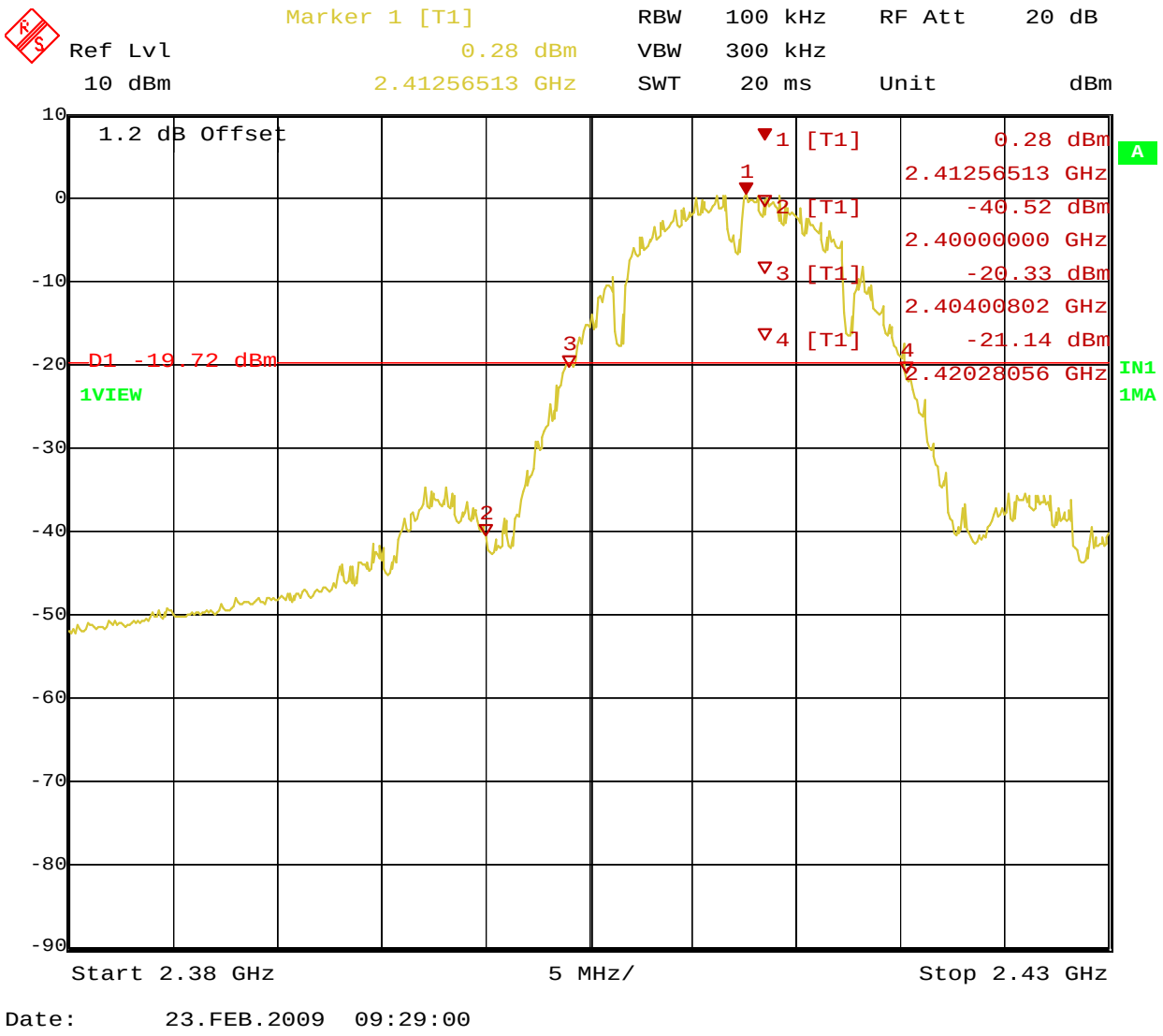

Figure 18: Band-edge Requirement for Operating Channel 2412MHz

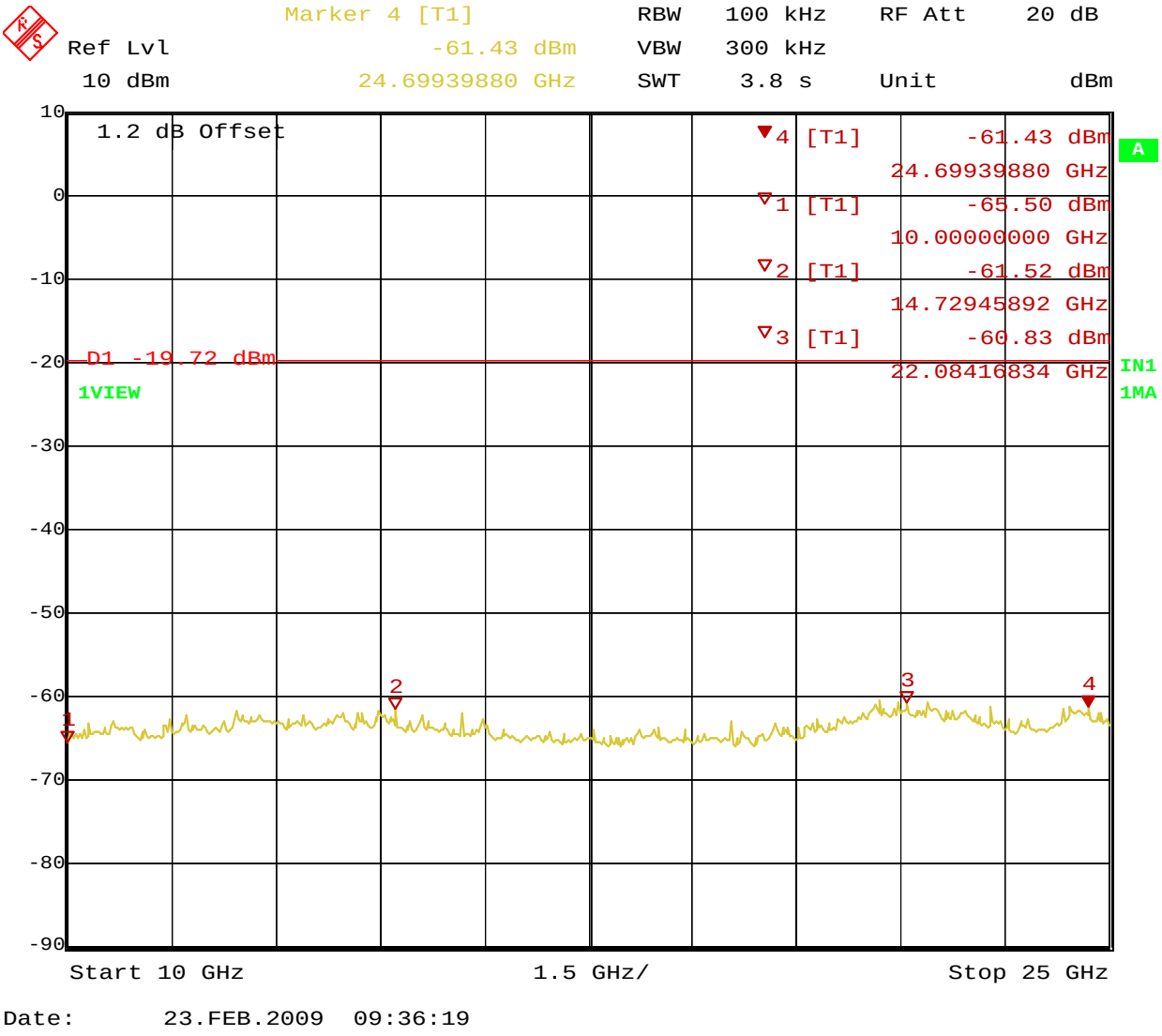

Figure 19: Band-edge Requirement for Operating Channel 2412MHz (10GHz to 25GHz)

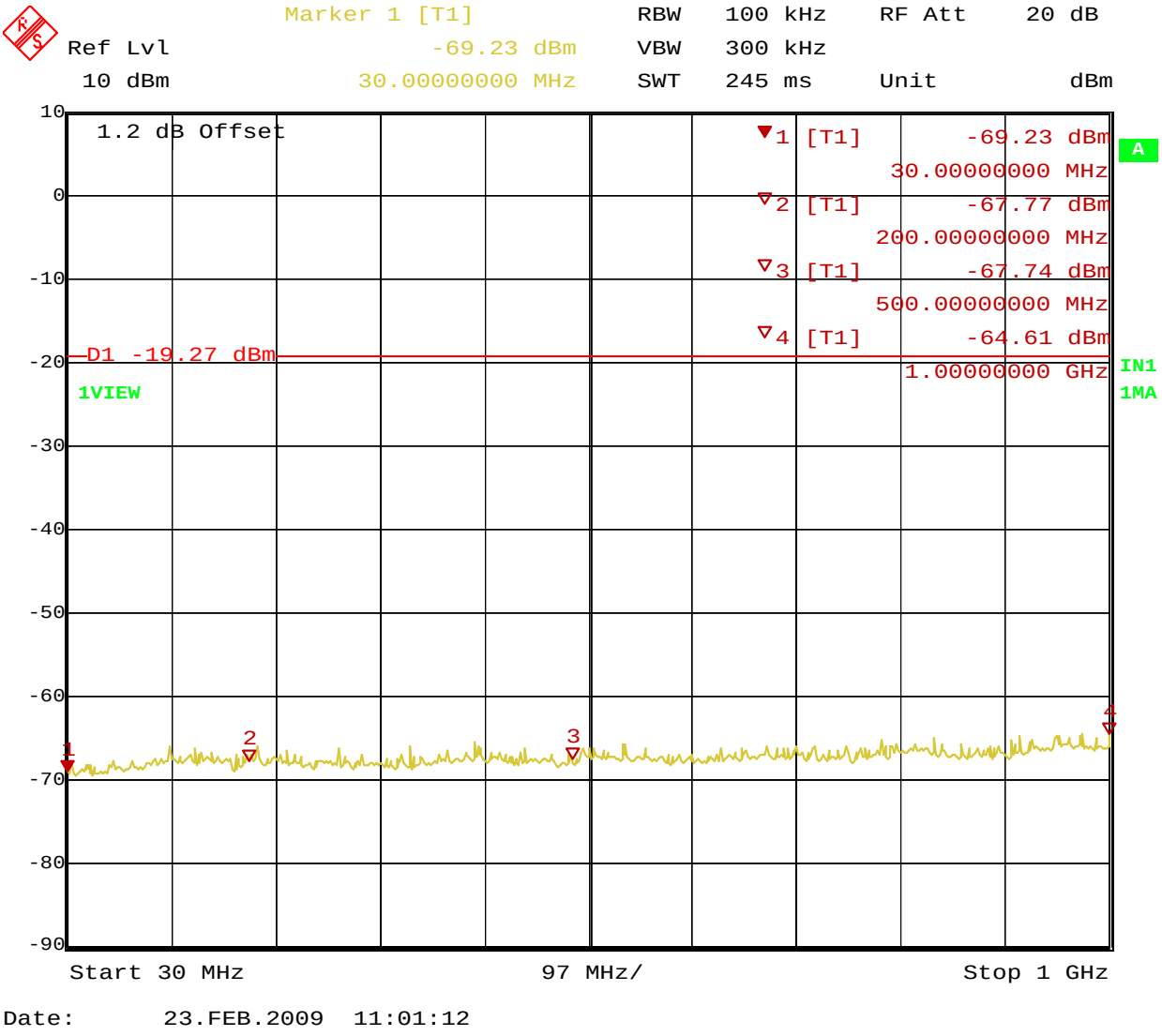

Figure 20: Band-edge Requirement for Operating Channel 2437MHz (30MHz to 1GHz)

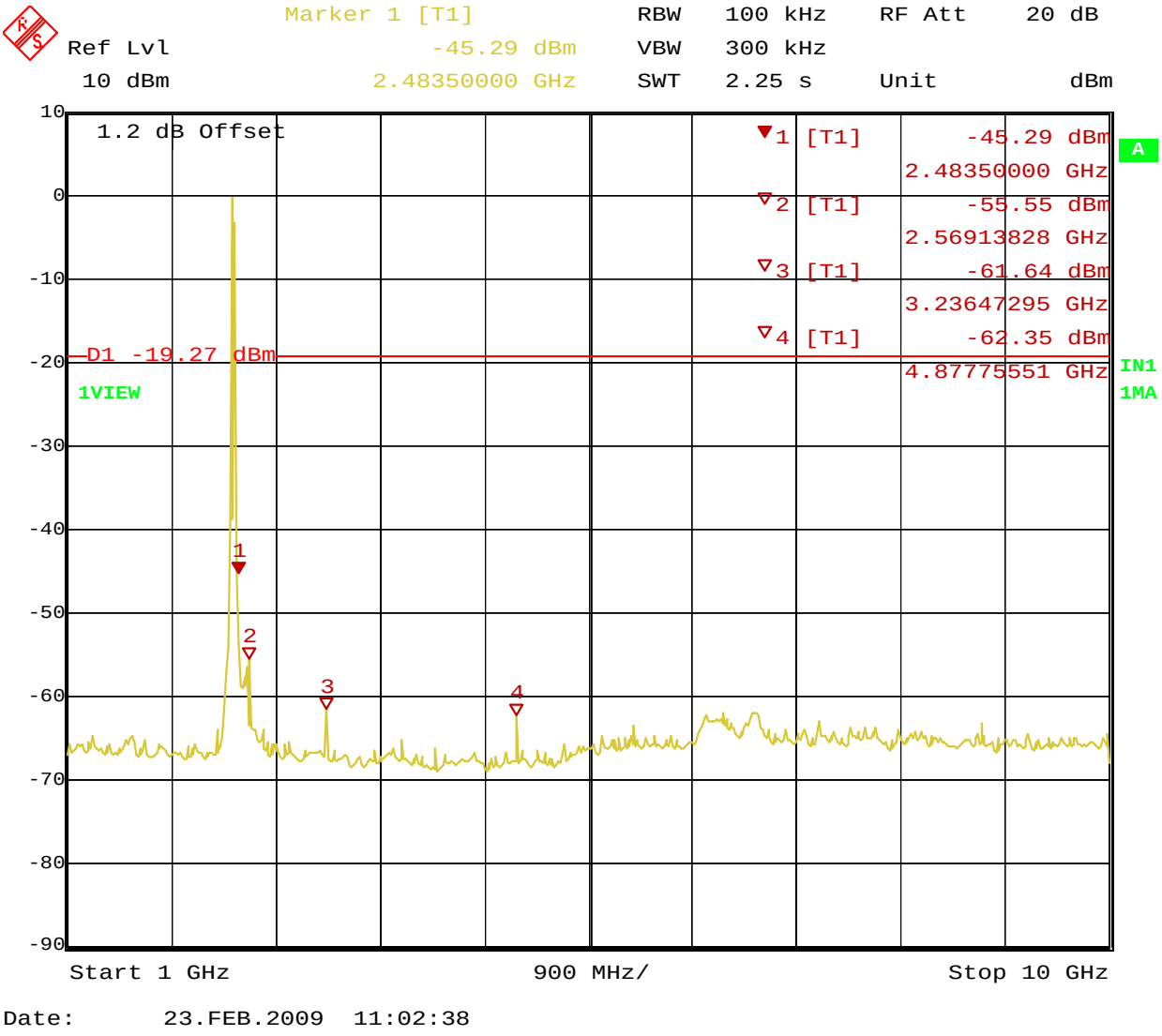

Figure 21: Band-edge Requirement for Operating Channel 2437MHz (1GHz to 10GHz)

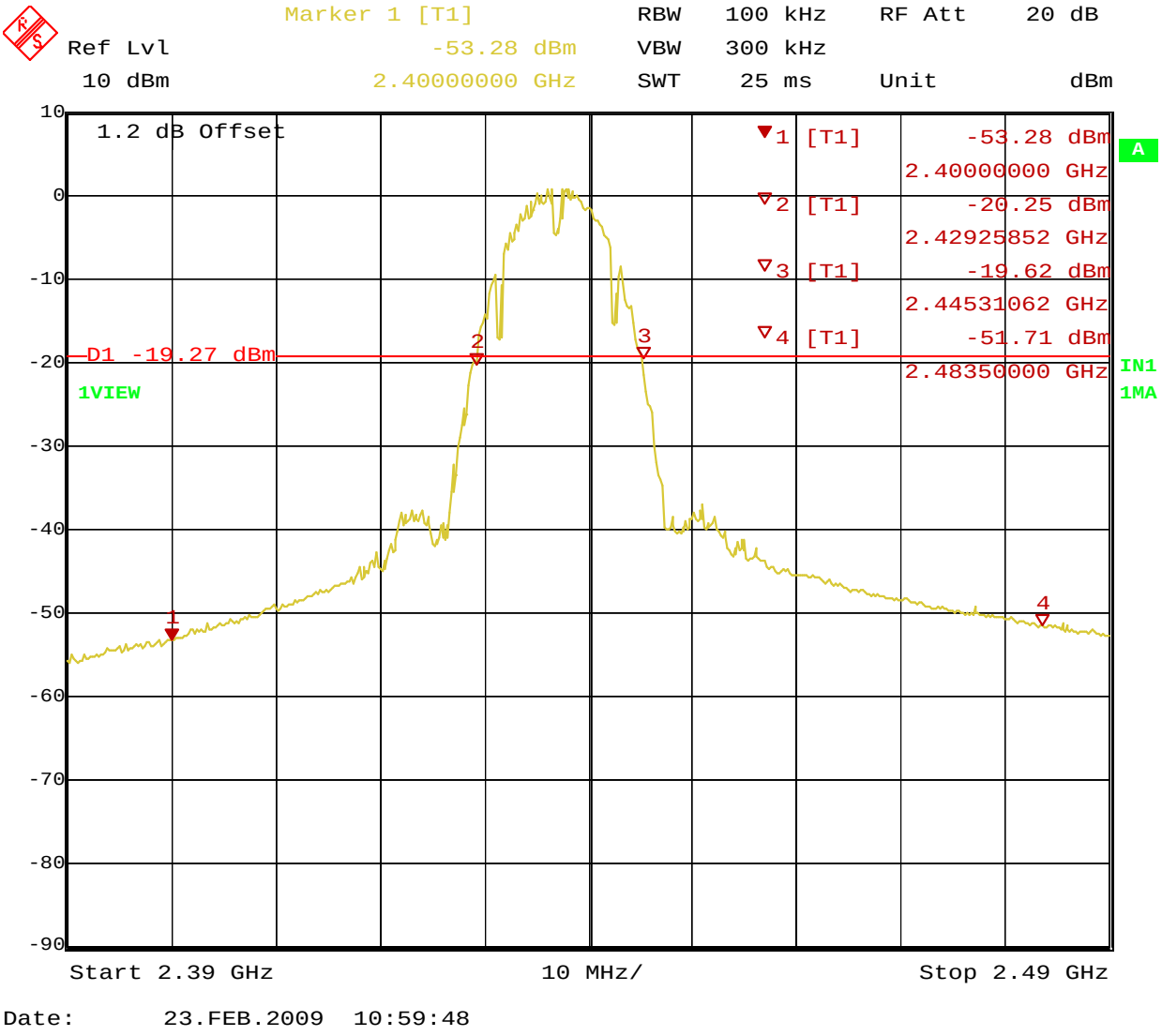

Figure 22: Band-edge Requirement for Operating Channel 2437MHz

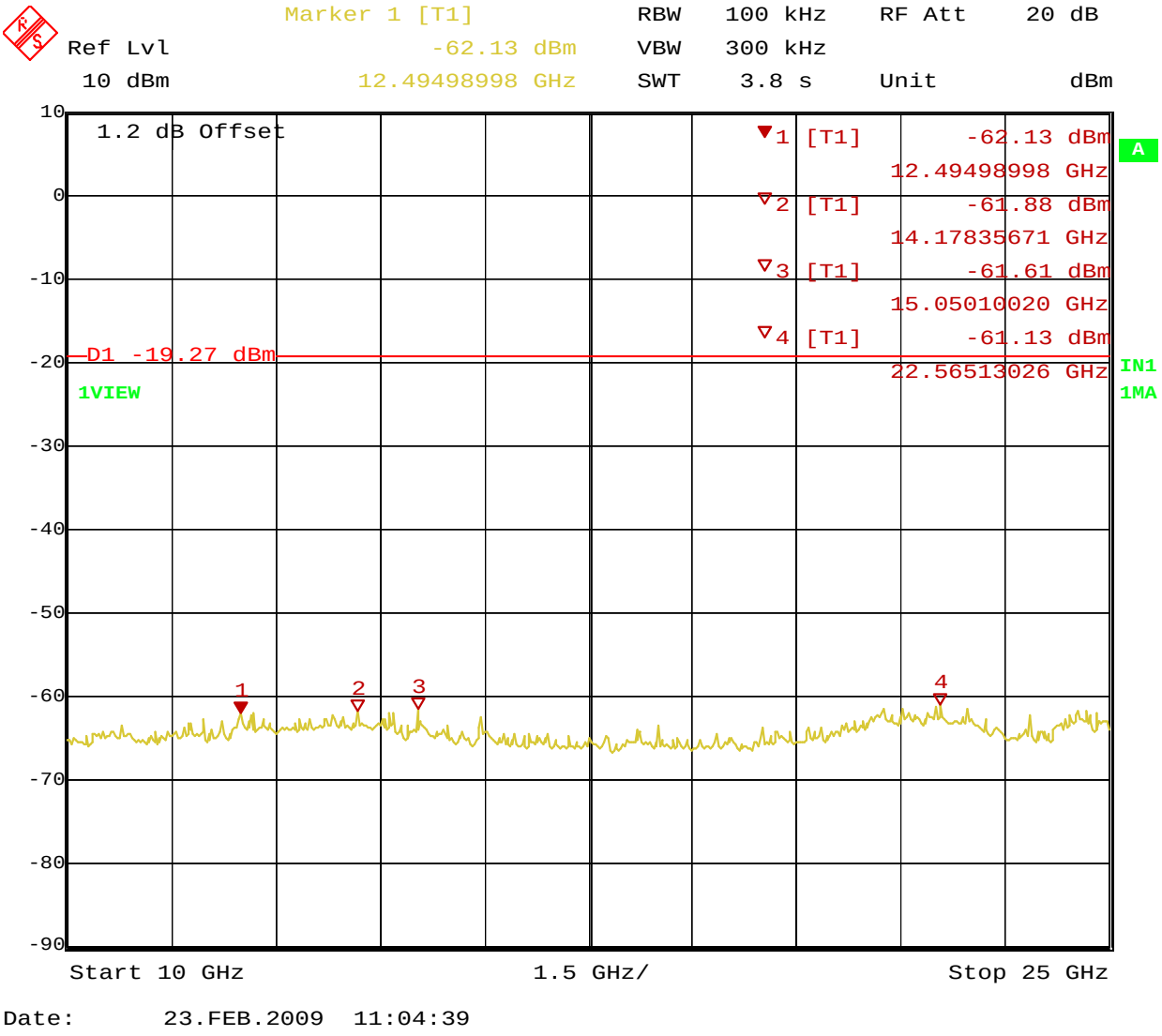

Figure 23: Band-edge Requirement for Operating Channel 2437MHz (10GHz to 25GHz)

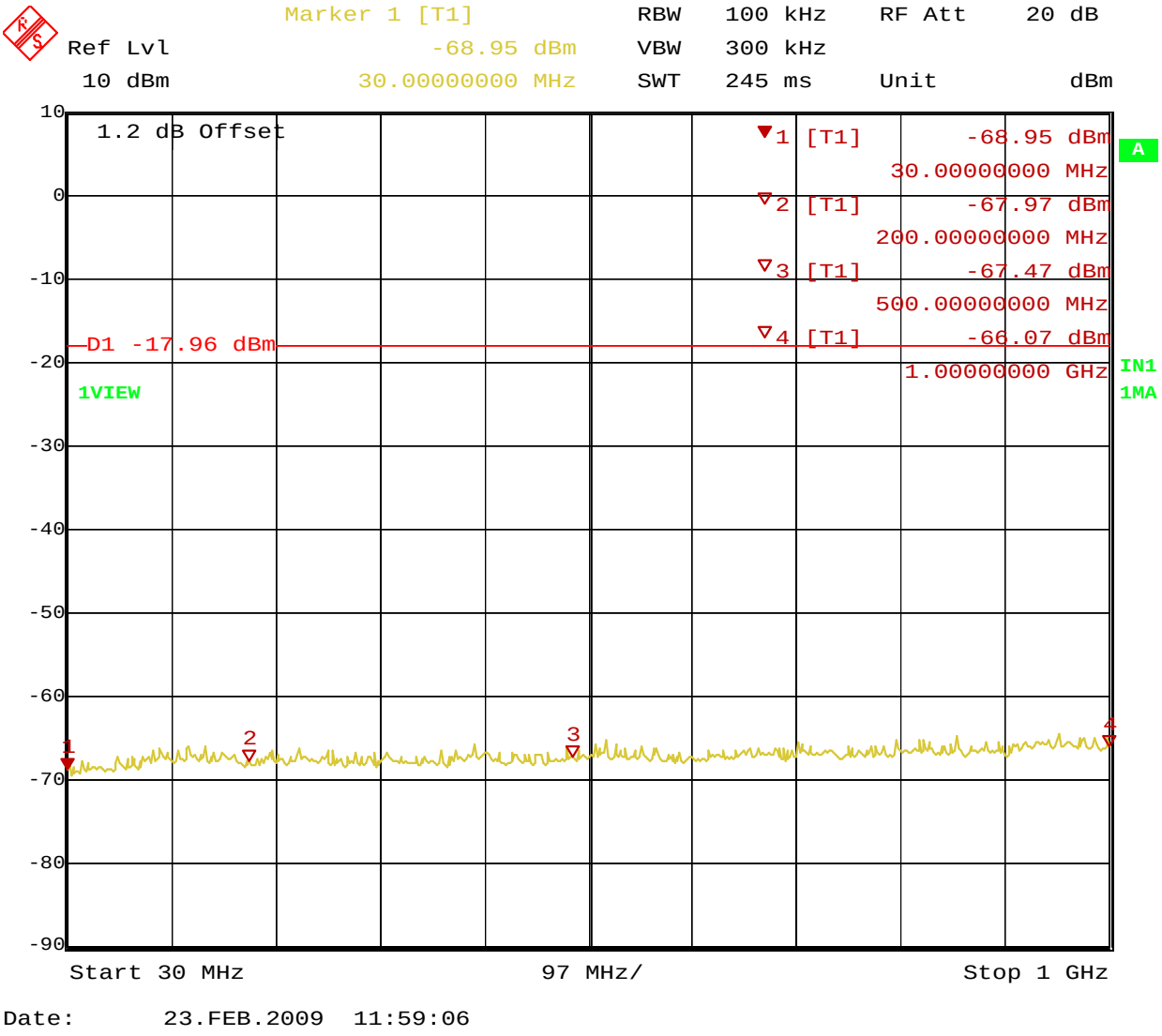

Figure 24: Band-edge Requirement for Operating Channel 2462MHz (30MHz to 1GHz)

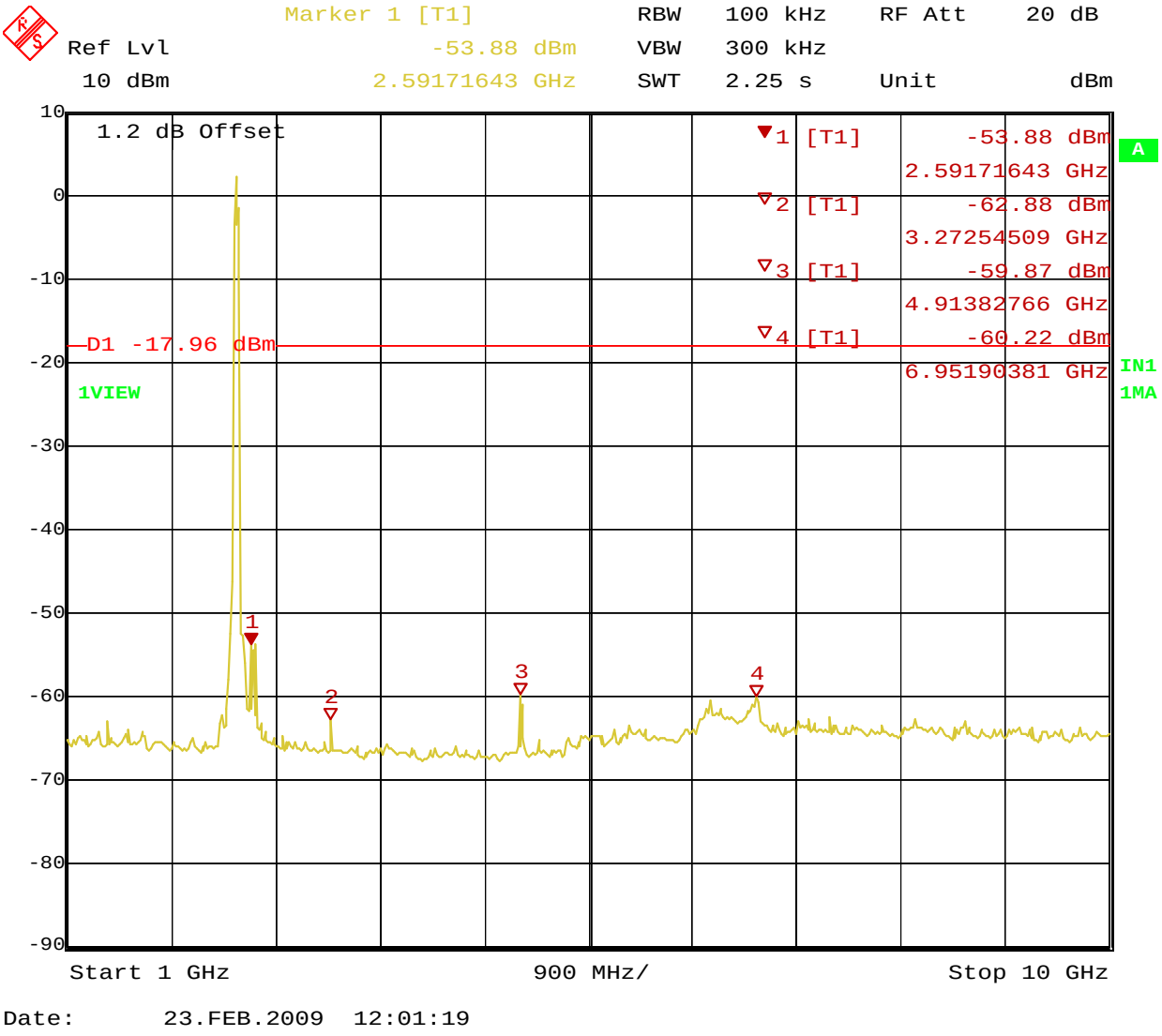

Figure 25: Band-edge Requirement for Operating Channel 2462MHz (1GHz to 10GHz)

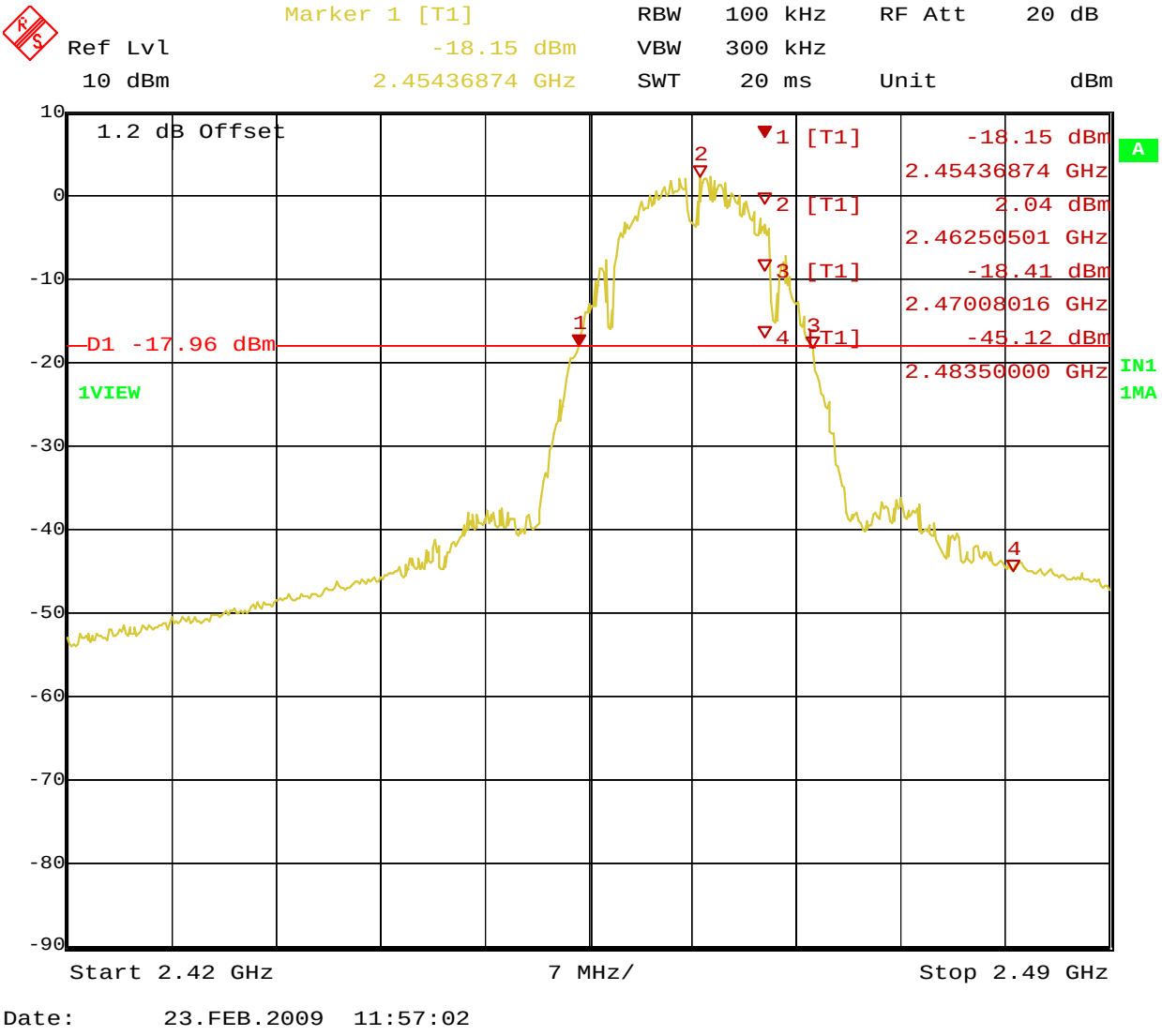

Figure 26: Band-edge Requirement for Operating Channel 2462MHz

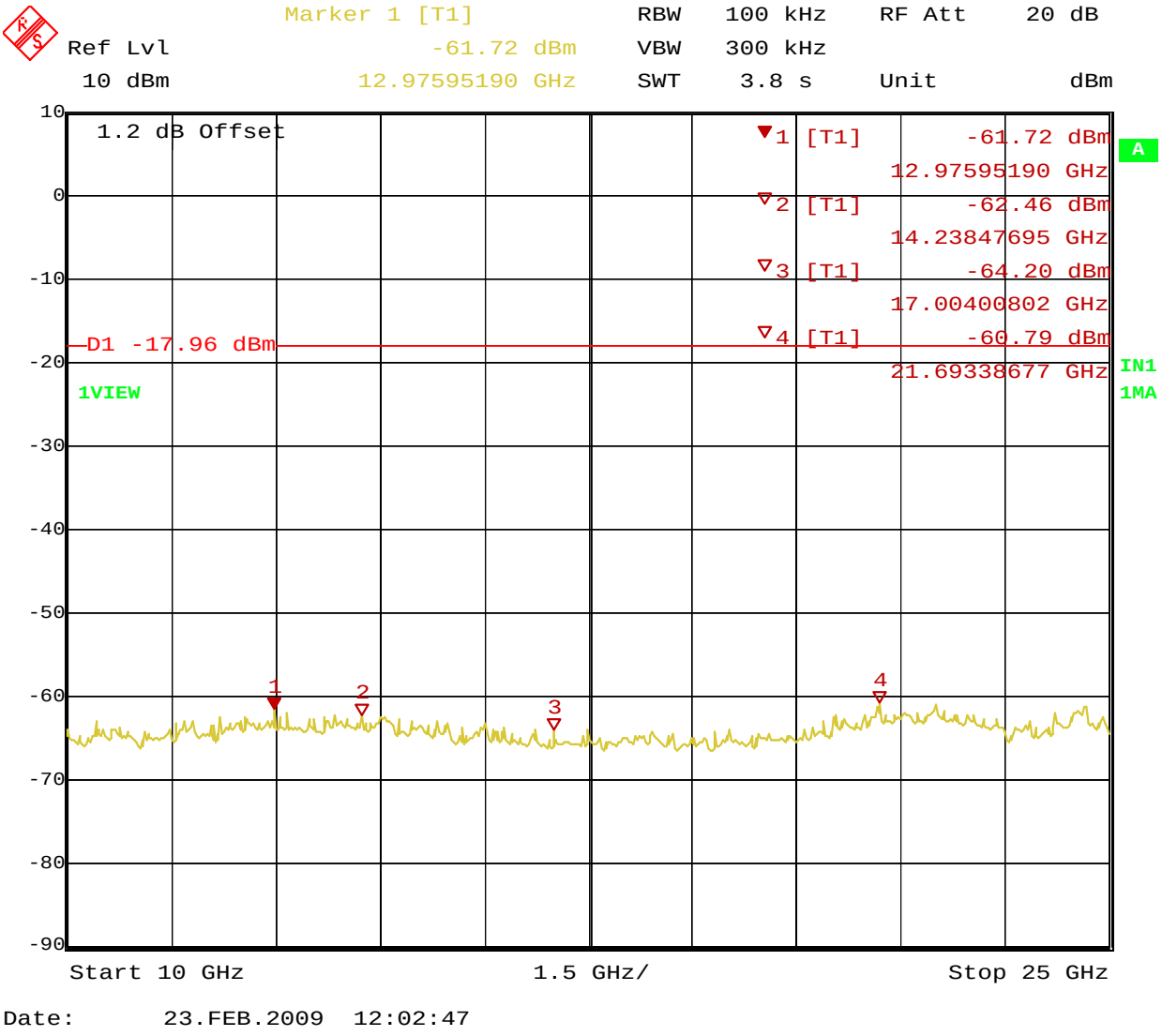

Figure 27: Band-edge Requirement for Operating Channel 2462MHz (10GHz to 25GHz)

4.4 Peak Power Spectral Density

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

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: Integrated and detachable		**Power Setting:** +10 dBm	
Max. Antenna Gain: +10dBi		**Signal State:** Modulated	
Duty Cycle: 84.61 %		**Data Rate:** 2Mbit/s	
Ambient. Temperature: 23°C		**Relative Humidity:** 45 %	
Peak Power Spectral Density Test Results			
Operating Channel	**PPSD (dBm)**	**Limit [dBm]**	**Margin [dB]**
2412 MHz	-9.84	8.0	-17.84
2437 MHz	-9.53	8.0	-17.53
2462 MHz	-10.64	8.0	-18.64

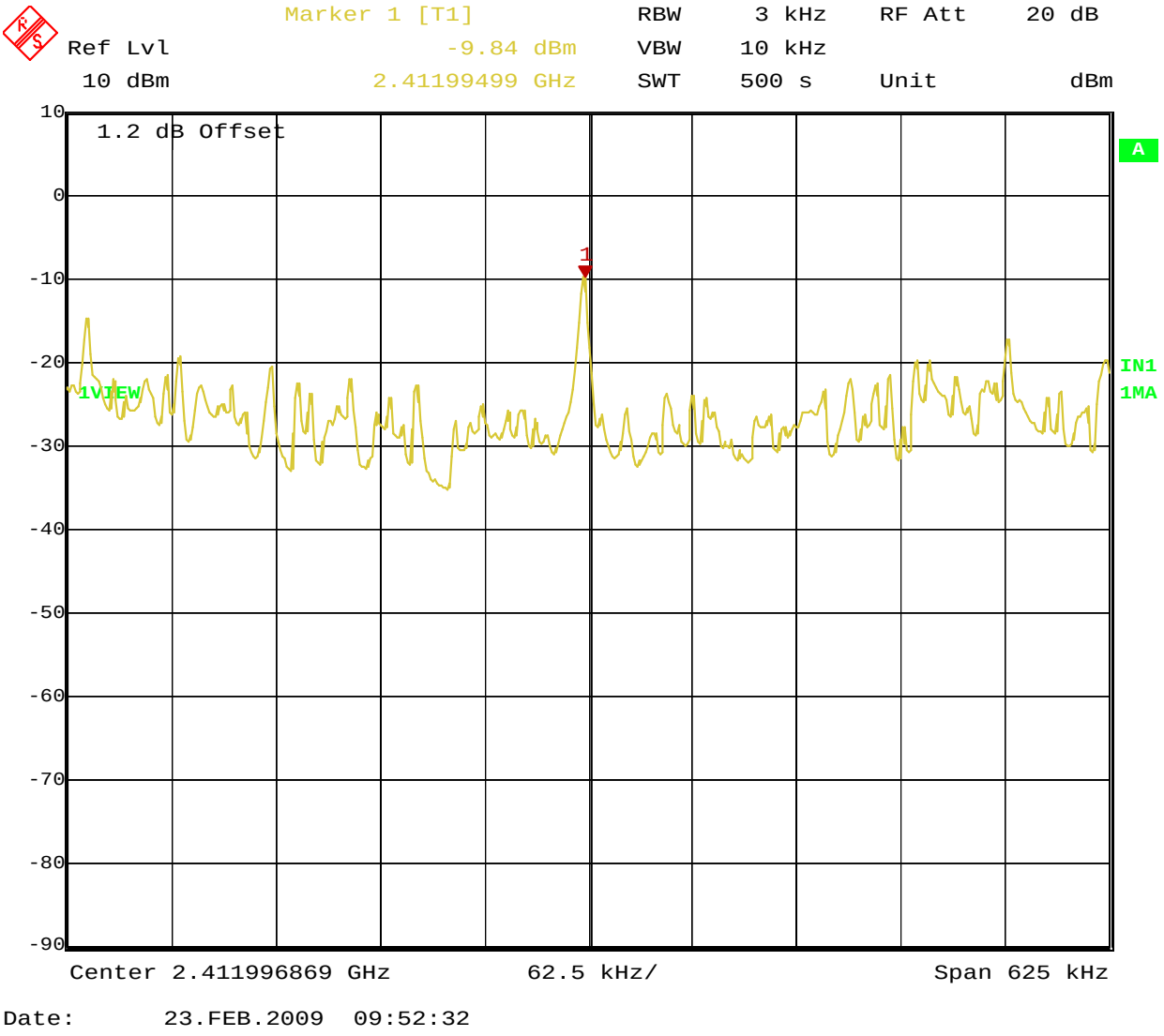

Figure 28: Peak Power Spectral Density for Operating Channel 2412MHz

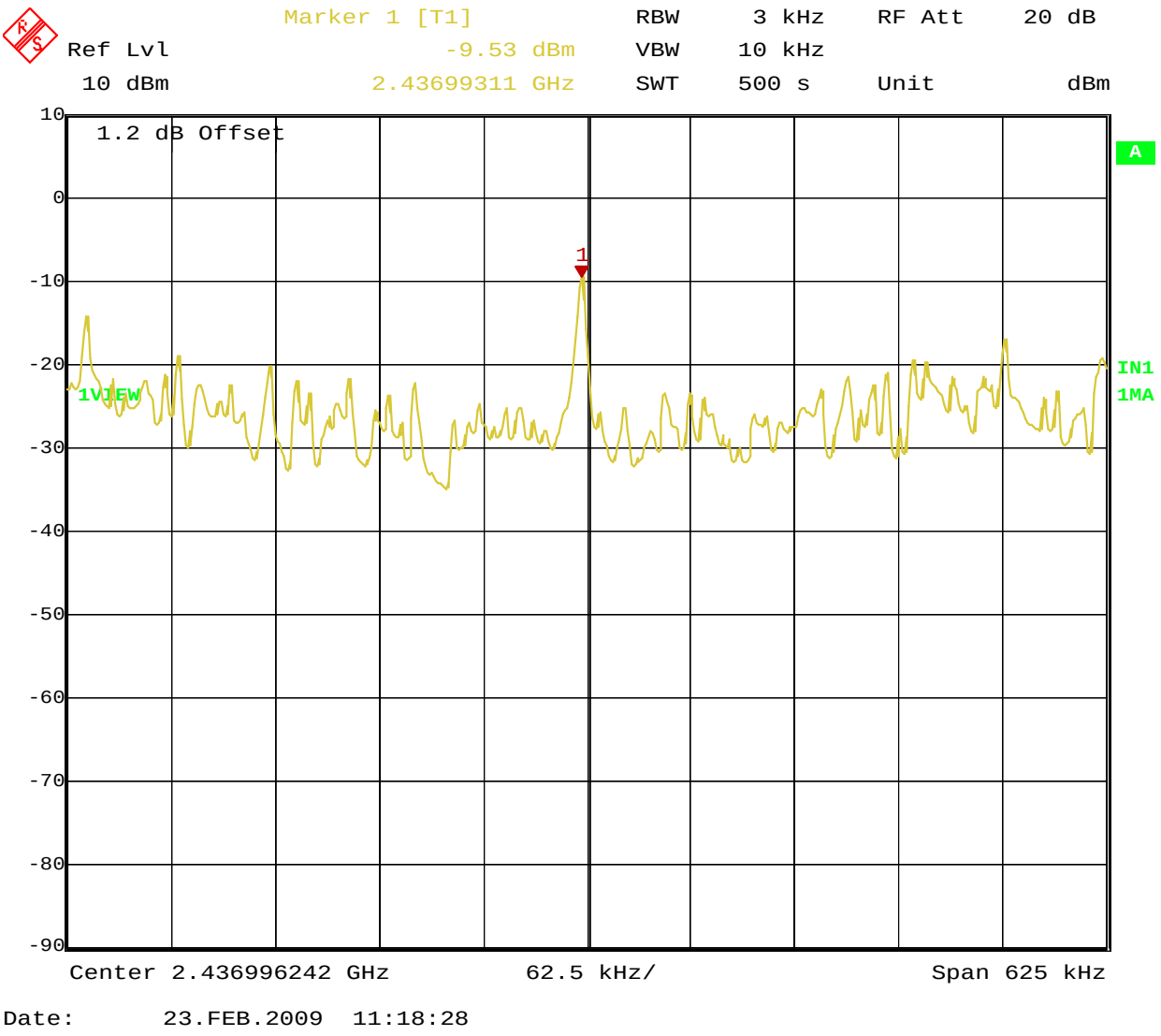

Figure 29: Peak Power Spectral Density for Operating Channel 2437MHz

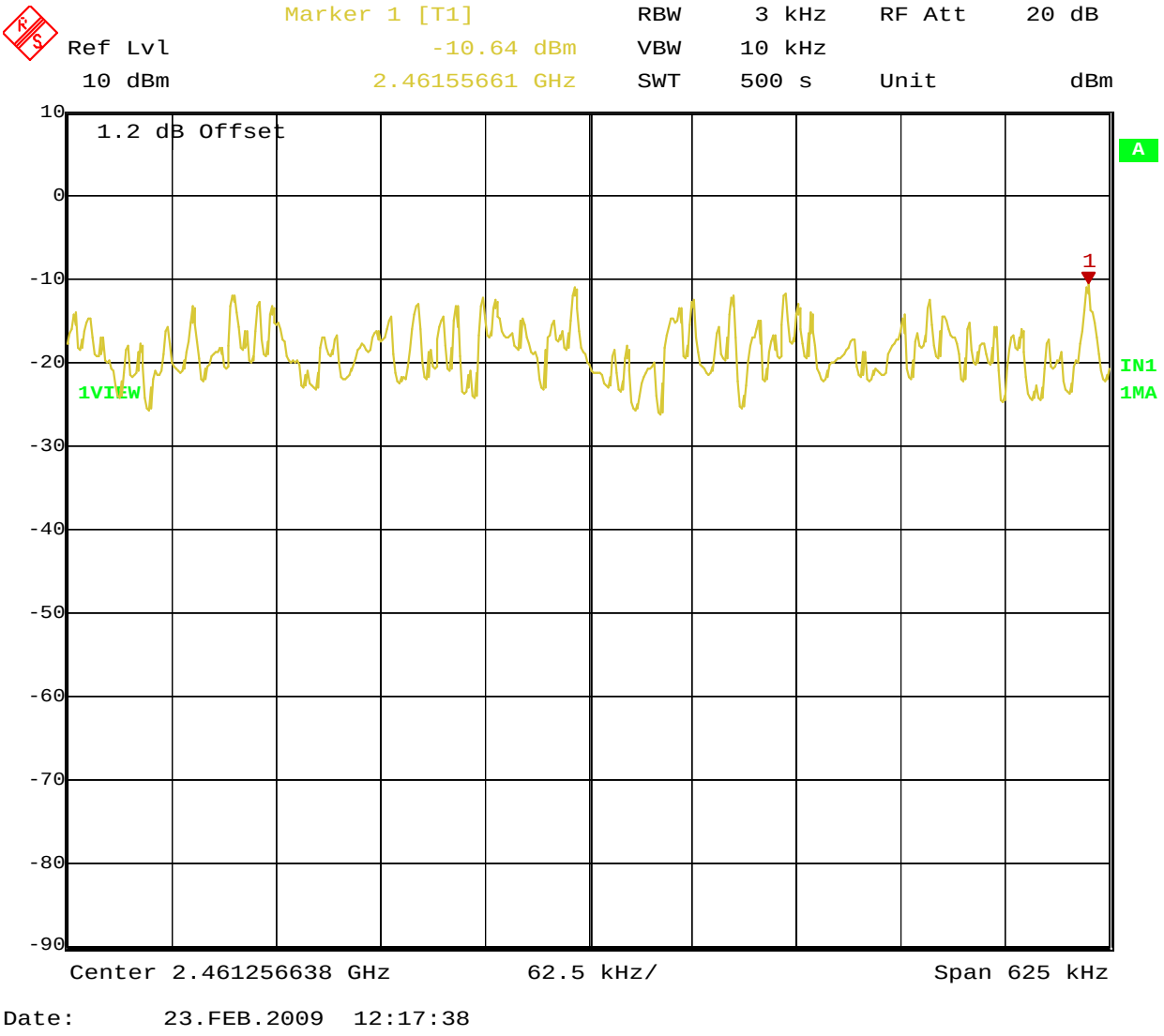

Figure 30: Peak Power Spectral Density for Operating Channel 2462MHz

4.5 Maximum Permissible Exposure

4.5.1 Test Methodology

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

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

4.5.2 RF Exposure Limit

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

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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

F = Frequency in MHz

4.5.3 EUT Operating Condition

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

4.5.4 Classification

The antenna of the product, under normal use condition, is at least 20cm away from the body of the user. Warning statement to the user for keeping at least 20cm or more separation distance with the antenna should be included in 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 maximum gain is 10dBi or 10 (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 and the highest gain of the antenna. Limit for MPE (from FCC part 1.1310 table1) is 1.0 mW/cm^2

The highest measured output power is +16.74dBm or 47.2063mw

Using the equation $E=(\sqrt{30}*Pt)/D$, highest Pout is 47.2063mW, antenna gain (in linear scale) is 10, and R is 20cm.

$Pd = (47.2063*10) / (1600\pi) =$ **0.093961 mW/cm^2**, which is 0.90603mW/cm^2 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.

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.

To determine the worst axis, the pre-scans performed on X-Axis, Y-Axis, and Z-Axis for each transmitting antenna family.

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; 2412MHz, 2437MHz, and 2462MHz.

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

4.6.3 Test Results

Section 4.6.3.1.2 lists the final measurement data 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).

4.6.3.1 Pre-scan Data

The data recorded in this section is used toward the final scan.

To determine the worst axis, ZG2100 and ZG2101 were scanned from 30MHz to 25GHz.

Table 8: Transmitter Spurious Emissions – Pre-scan Test Results

Test Conditions: Radiated Measurement at Normal Conditions only			
Antenna Type: Integrated and detachable		**Power Setting:** +10 dBm	
Operating Frequency: 2442 MHz		**Duty Cycle:** 84.61 %	
Ambient Temperature: 23°C		**Relative Humidity:** 45 %	
Configuration	**Frequency Range**	**Measuring Distance**	**Worst Axis**
On-board PCB Antenna (Meander)	30MHz to 25GHz	3 m	Y- Axis
2dBi Dipole Antenna (RFA-02-D3-70-100)	30MHz to 25GHz	3 m	X-Axis
Helical Antenna	30MHz to 25GHz	3 m	Z-Axis
Inverter F Antenna	30MHz to 25GHz	3 m	Z-Axis
2dBi PCB Antenna (#3)	30MHz to 25GHz	3 m	Z-Axis
5dBi Dipole Antenna	30MHz to 25GHz	3 m	X-Axis
10dBi Monopole Antenna	30MHz to 25GHz	3 m	Z-Axis

Note: One of the middle channels was chose for pre-scan. There was no emission observed from 18GHz to 25GHz.

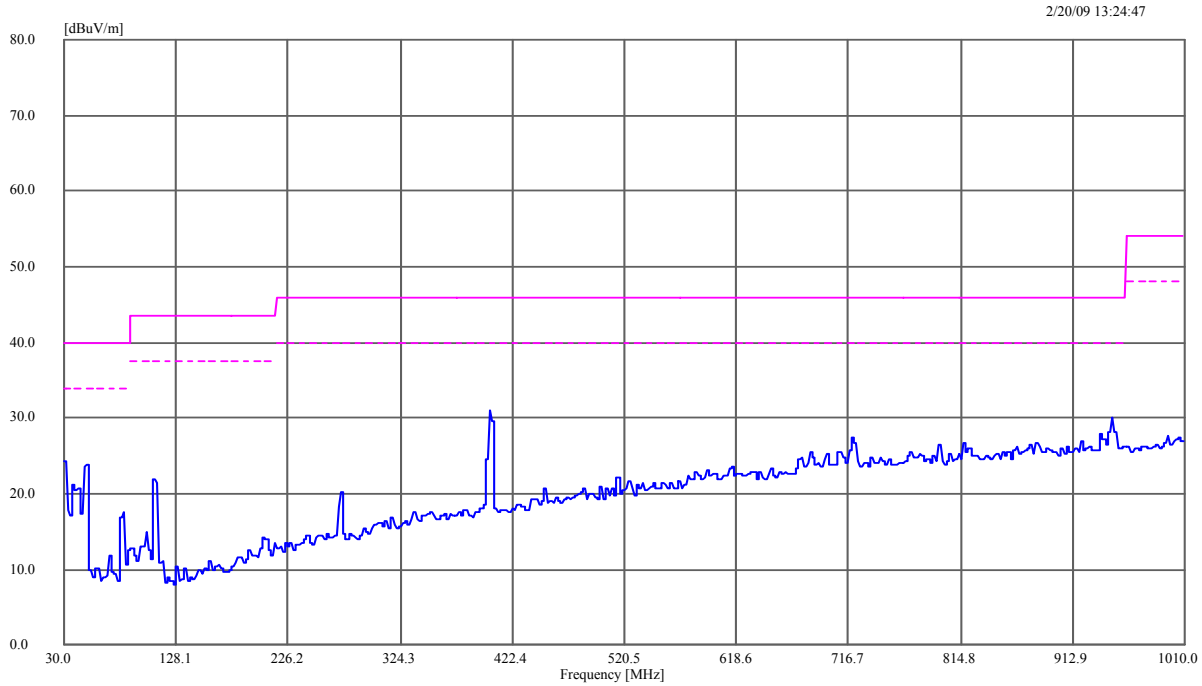

Figure 31: Emissions Pres-can, Onboard Antenna (Meander), 30 to 1000 MHz, X-Axis

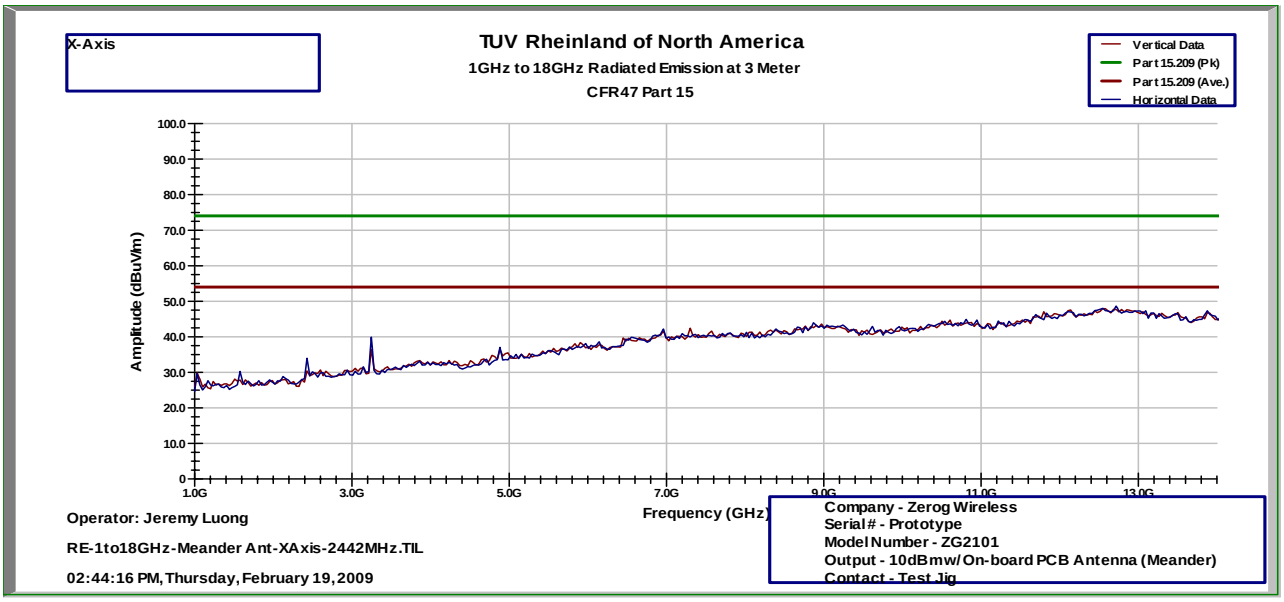

Figure 32: Emissions Pres-can, Onboard Antenna (Meander), 1GHz-18GHz, X-Axis

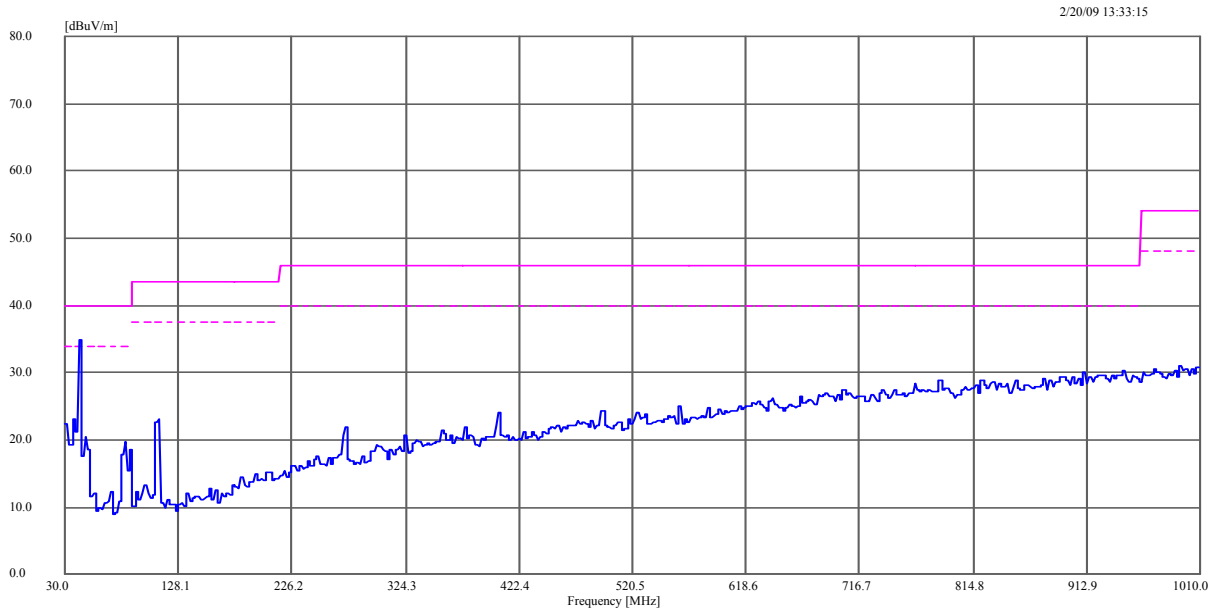

Figure 33: Emissions Pres-can, Onboard Antenna (Meander), 30 to 1000 MHz, Y-Axis

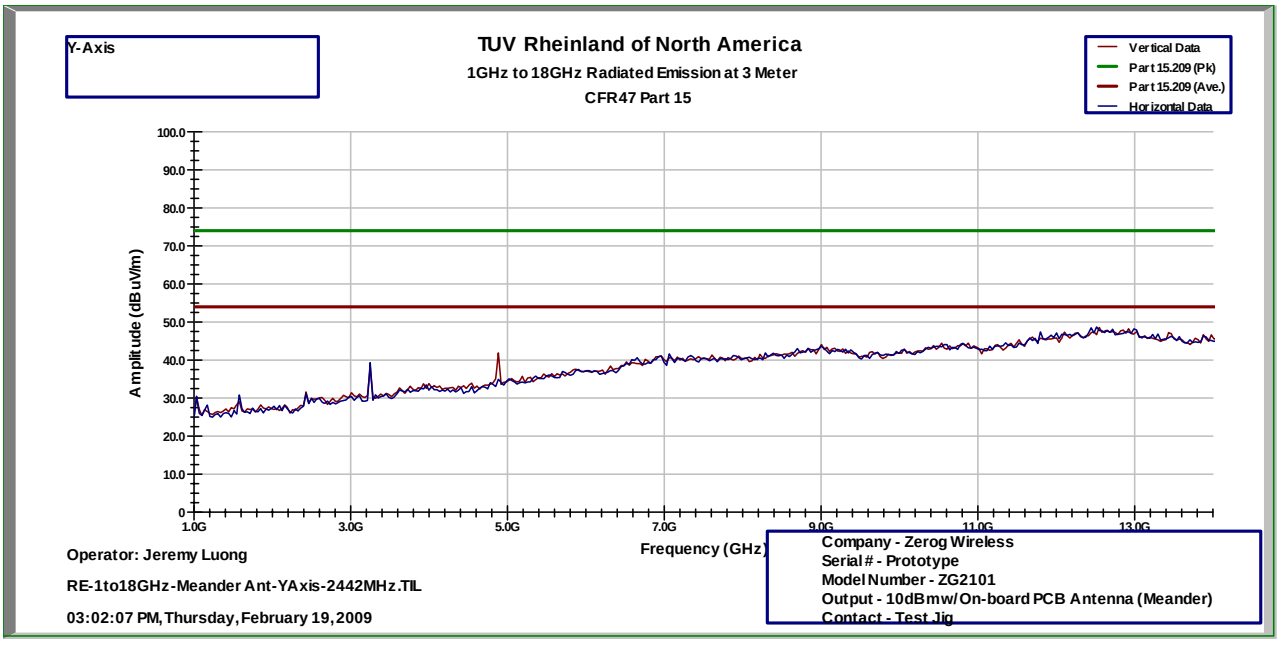

Figure 34: Emissions Pres-can, Onboard Antenna (Meander), 1GHz-18GHz, Y-Axis

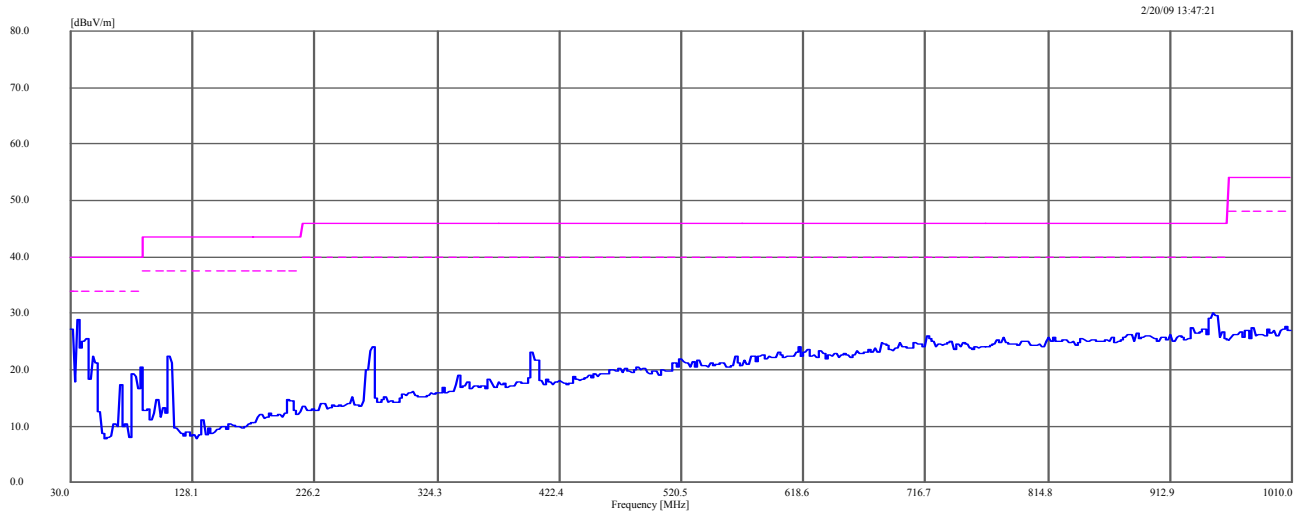

Figure 35: Emissions Pres-can, Onboard Antenna (Meander), 30 to 1000 MHz, Z-Axis

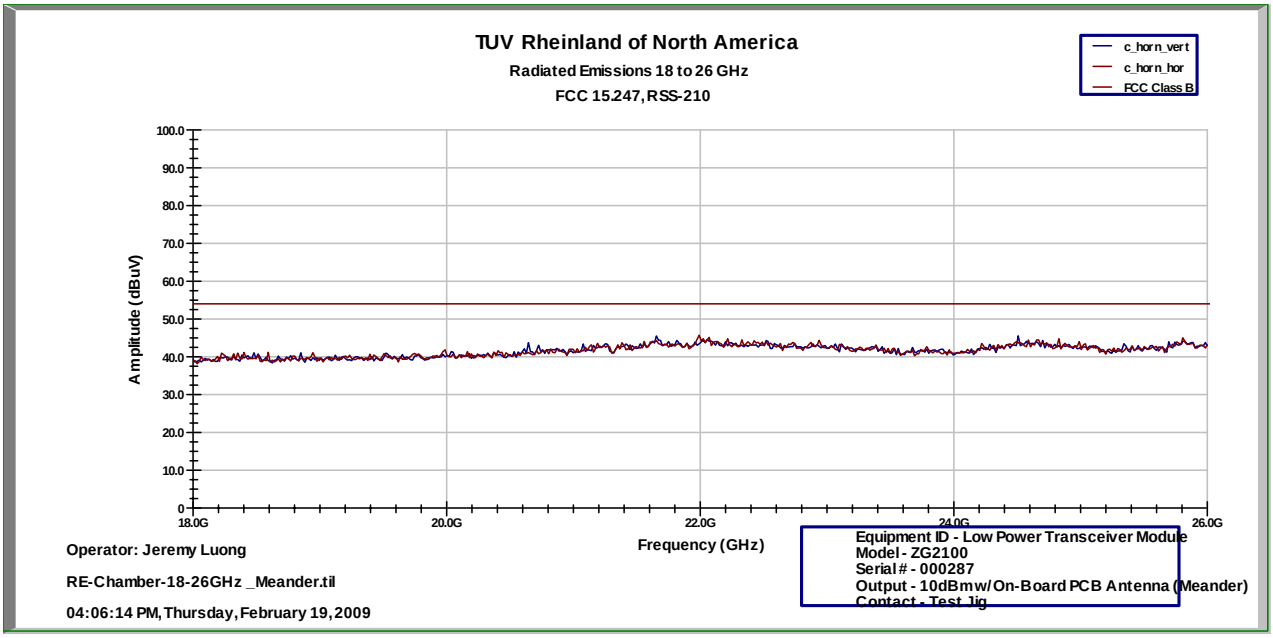

Figure 36: Emissions Pres-can, Onboard Antenna (Meander), 1GHz-18GHz, Z-Axis

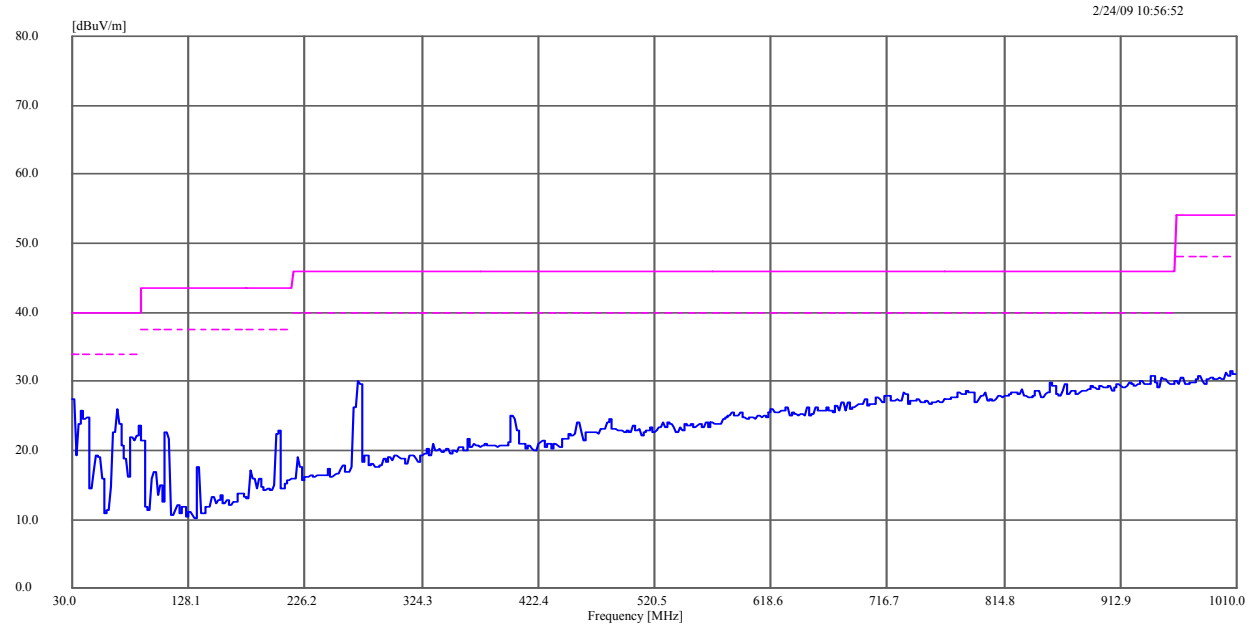

Figure 37: Emissions Pres-can, 2dBi Dipole Antenna (RFA-02-D3-70-100), 30 to 1000 MHz, X-Axis

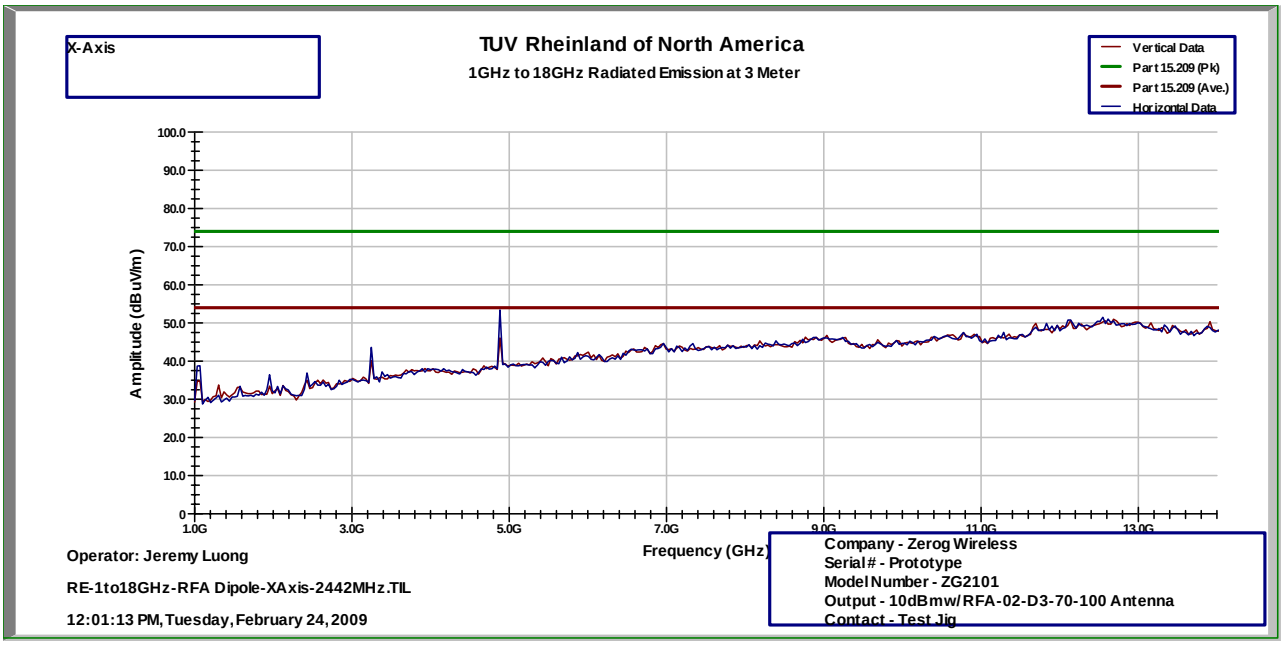

Figure 38: Emissions Pres-can, 2dBi Dipole Antenna (RFA-02-D3-70-100), 1GHz-18GHz, X-Axis

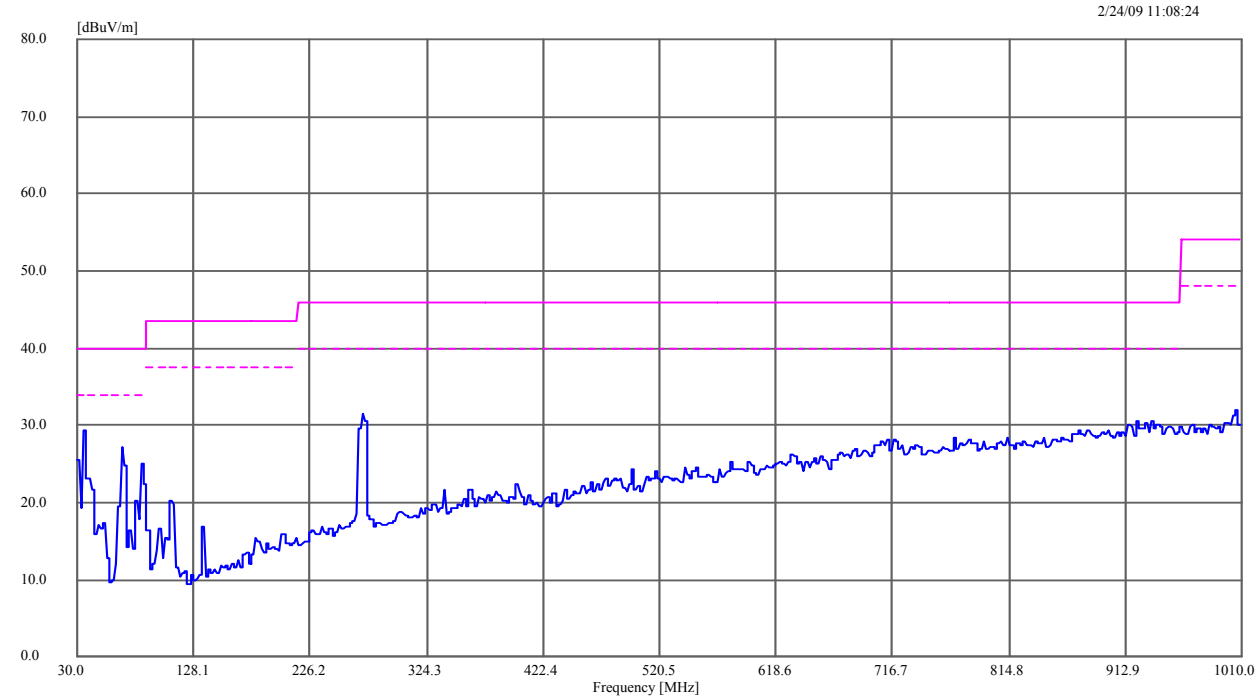

Figure 39: Emissions Pres-can, 2dBi Dipole Antenna (RFA-02-D3-70-100), 30 to 1000 MHz, Y-Axis

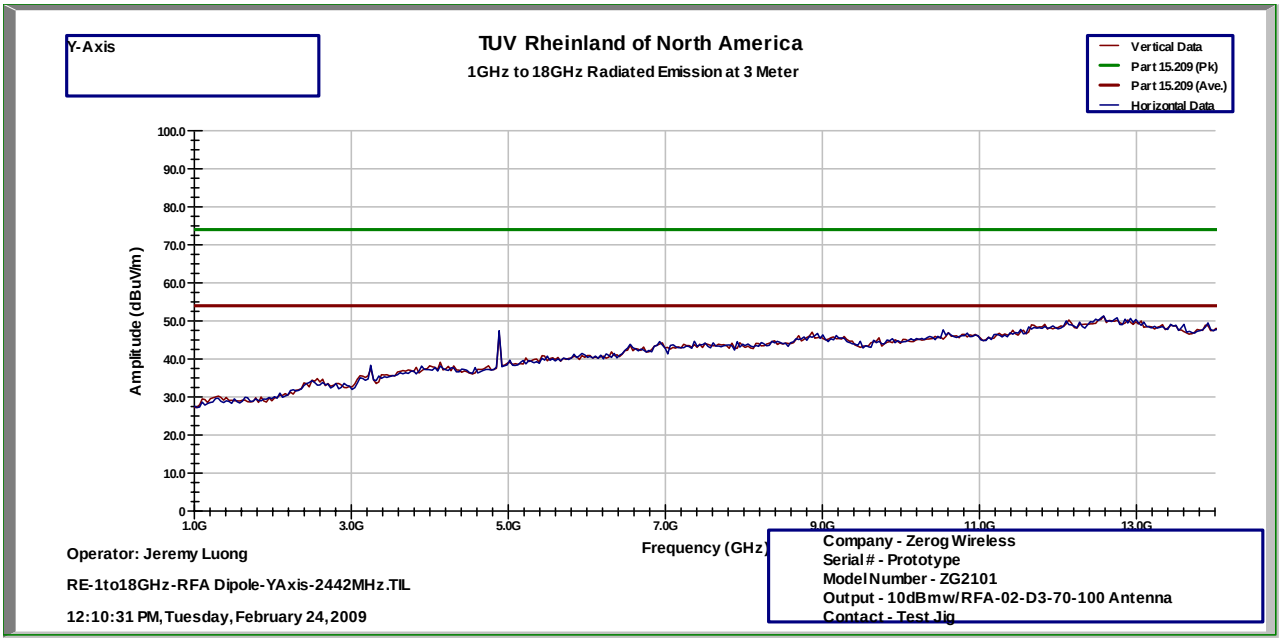

Figure 40: Emissions Pres-can, 2dBi Dipole Antenna (RFA-02-D3-70-100), 1GHz-18GHz, Y-Axis

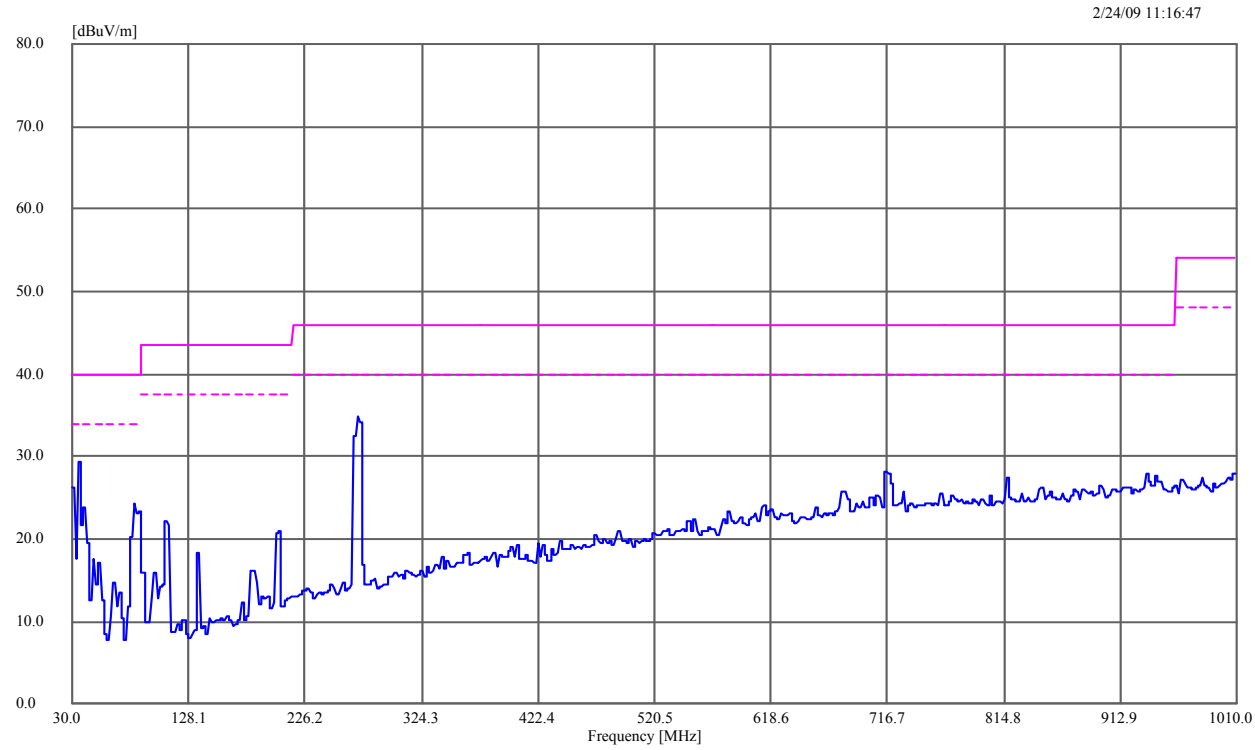

Figure 41: Emissions Pres-can, 2dBi Dipole Antenna (RFA-02-D3-70-100), 30 to 1000 MHz, Z-Axis

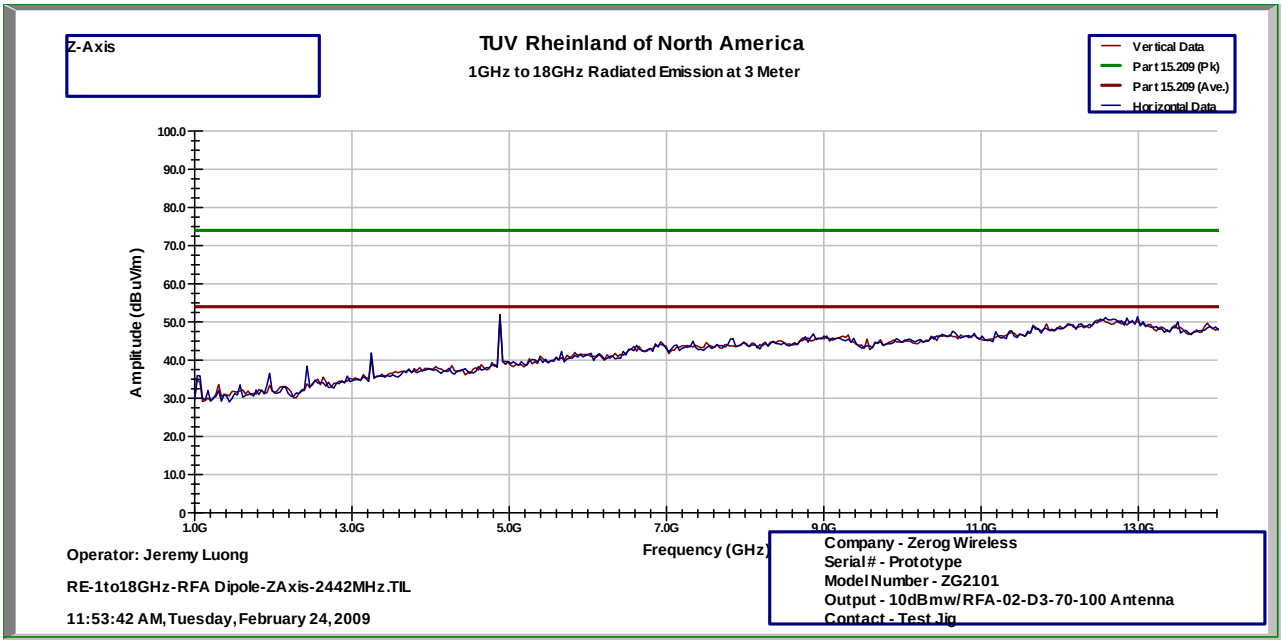

Figure 42: Emissions Pres-can, 2dBi Dipole Antenna (RFA-02-D3-70-100), 1GHz-18GHz, Z-Axis

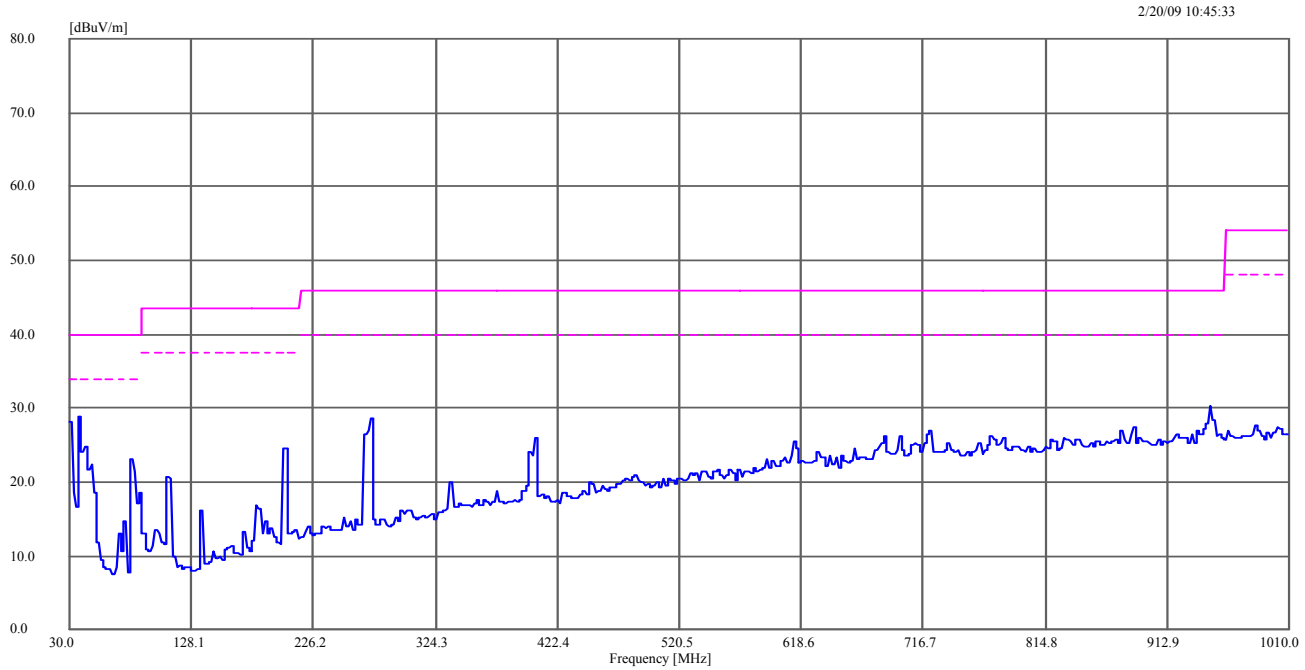

Figure 43: Emissions Pres-can, Helical Antenna, 30 to 1000 MHz, X-Axis

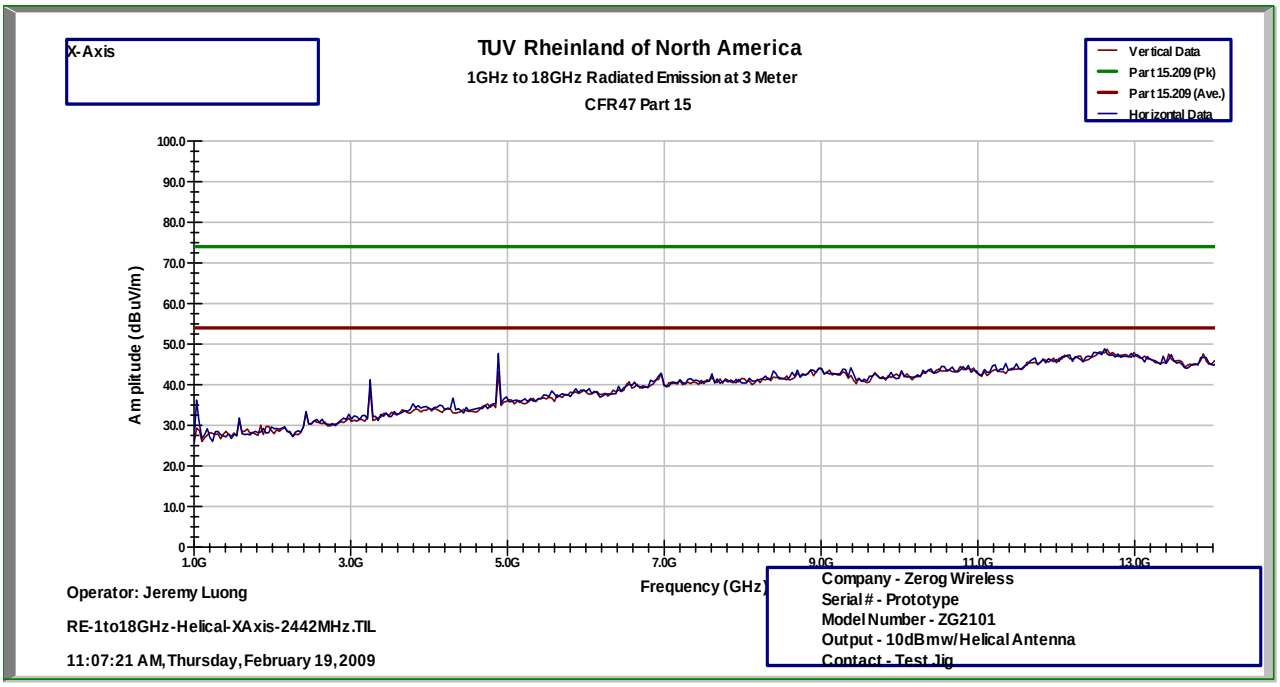

Figure 44: Emissions Pres-can, Helical Antenna, 1GHz-18GHz, X-Axis

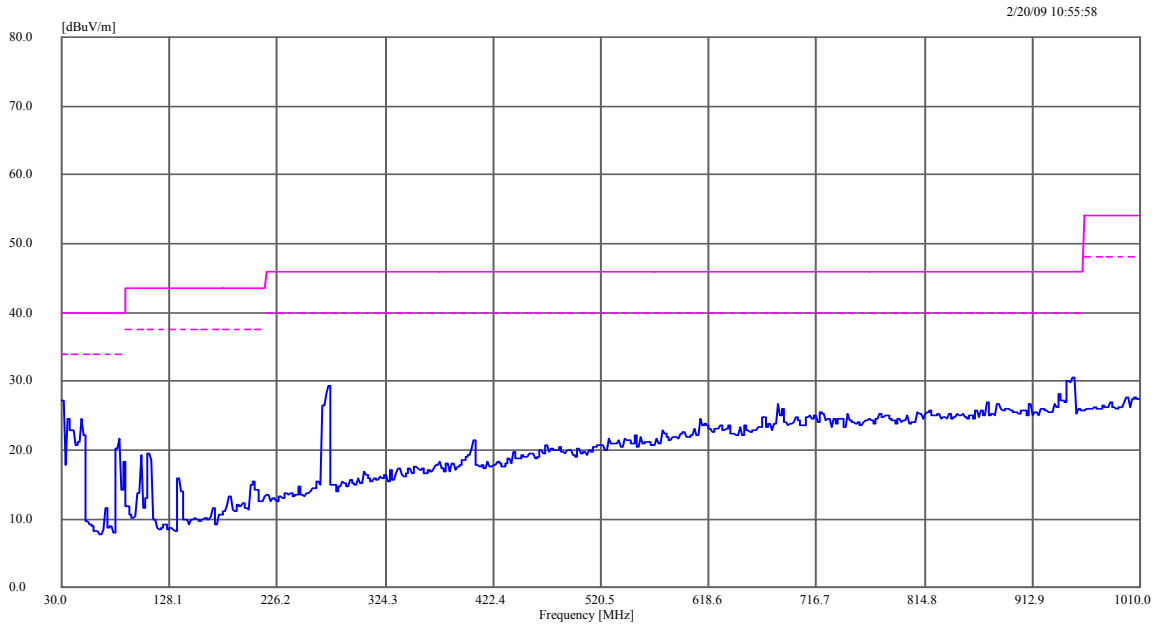

Figure 45: Emissions Pres-can, Helical Antenna, 30 to 1000 MHz, Y-Axis

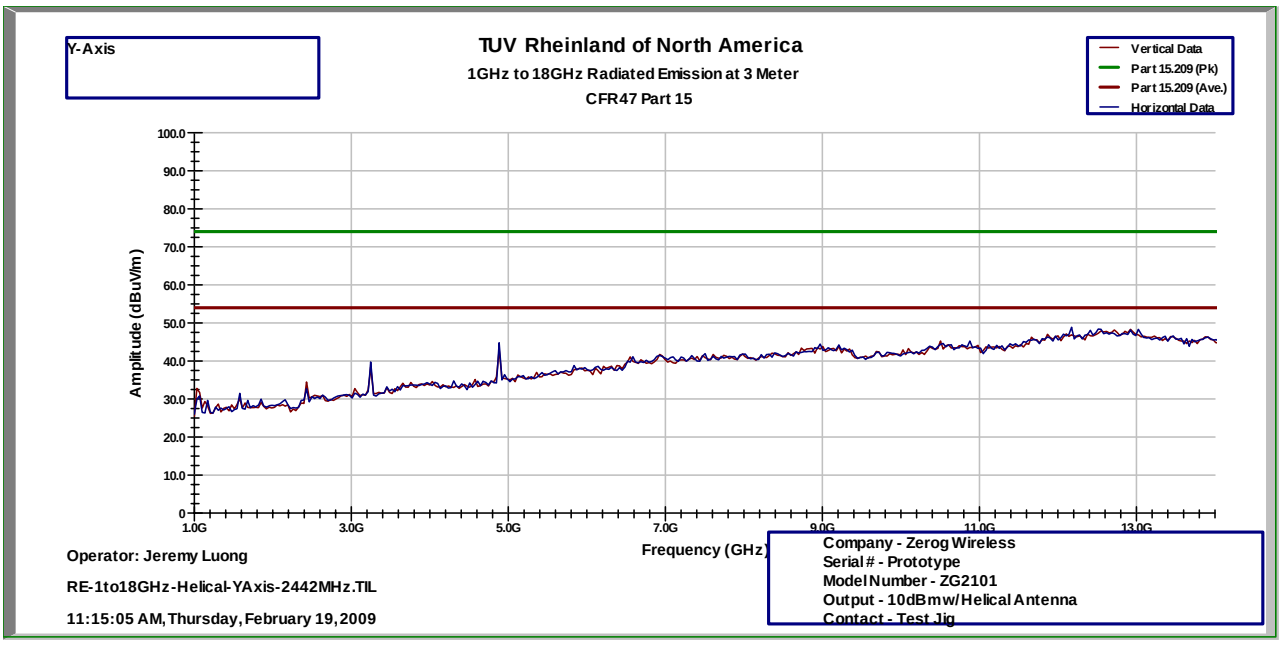

Figure 46: Emissions Pres-can, Helical Antenna, 1GHz-18GHz, Y-Axis

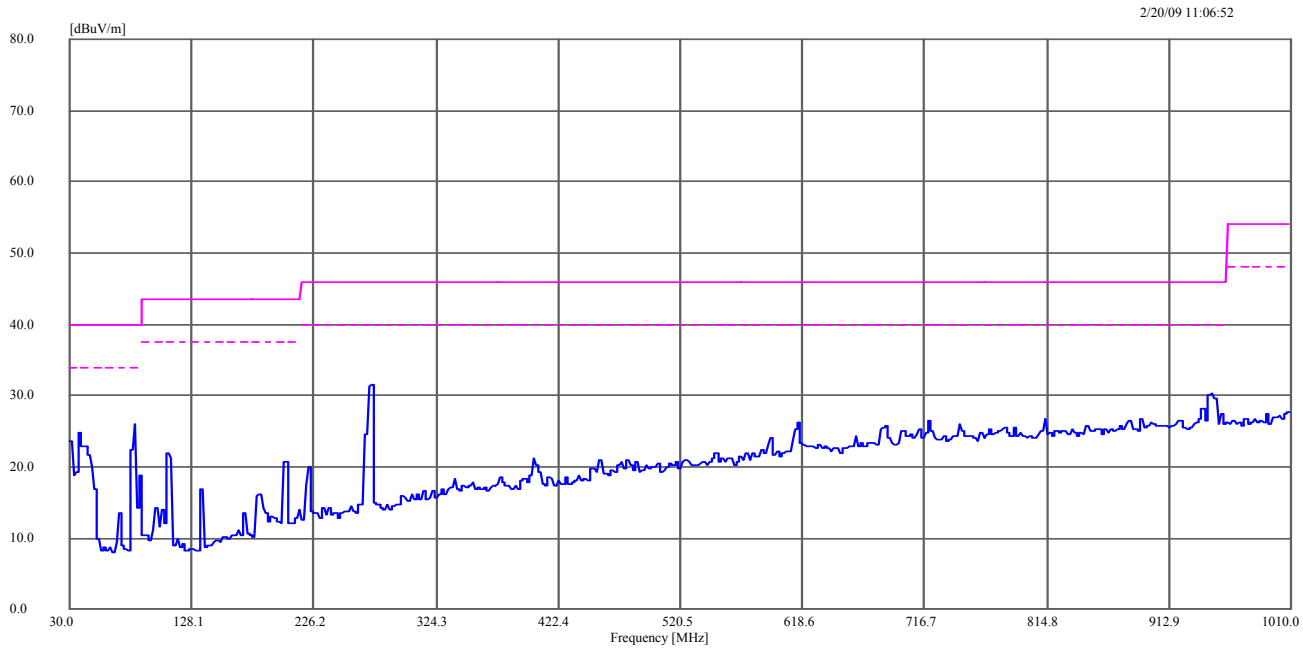

Figure 47: Emissions Pres-can, Helical Antenna, 30 to 1000 MHz, Z-Axis

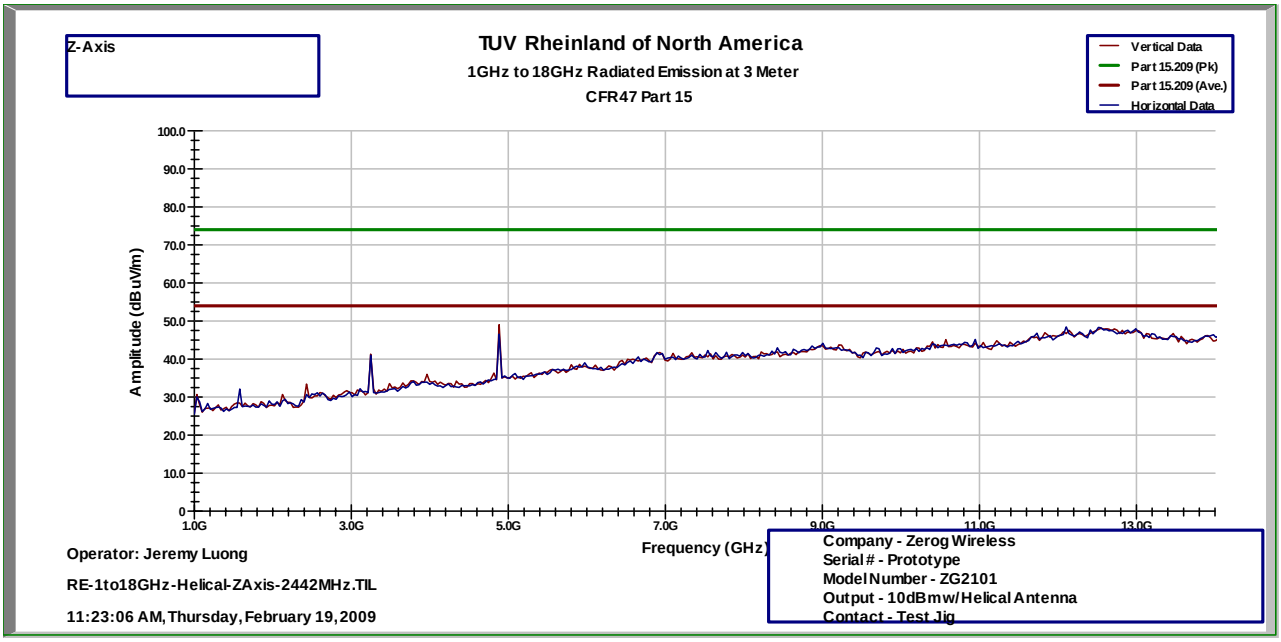

Figure 48: Emissions Pres-can, Helical Antenna, 1GHz-18GHz, Z-Axis

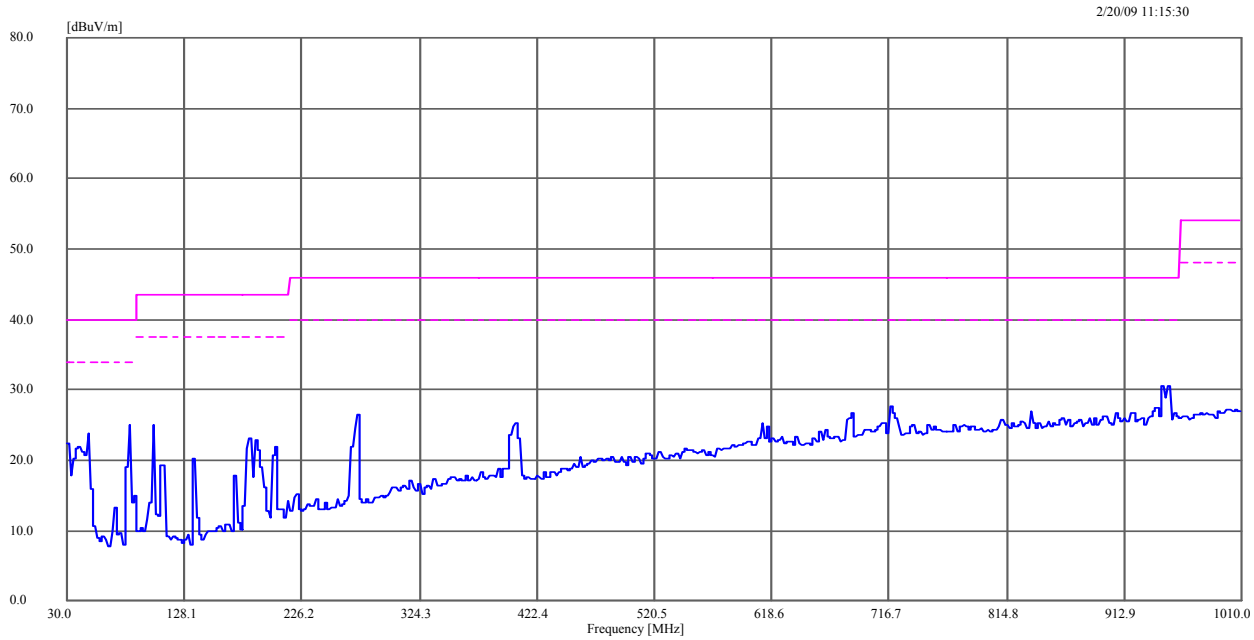

Figure 49: Emissions Pres-can, Inverter F Antenna, 30 to 1000 MHz, X-Axis

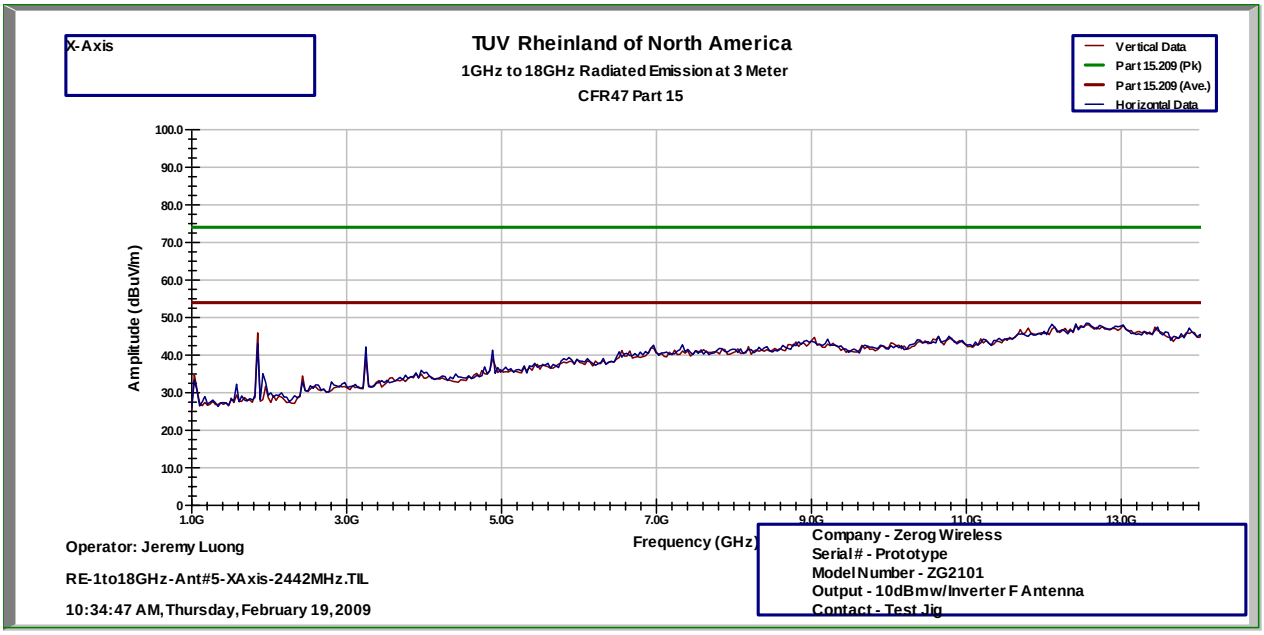

Figure 50: Emissions Pres-can, Inverter F Antenna, 1GHz-18GHz, X-Axis

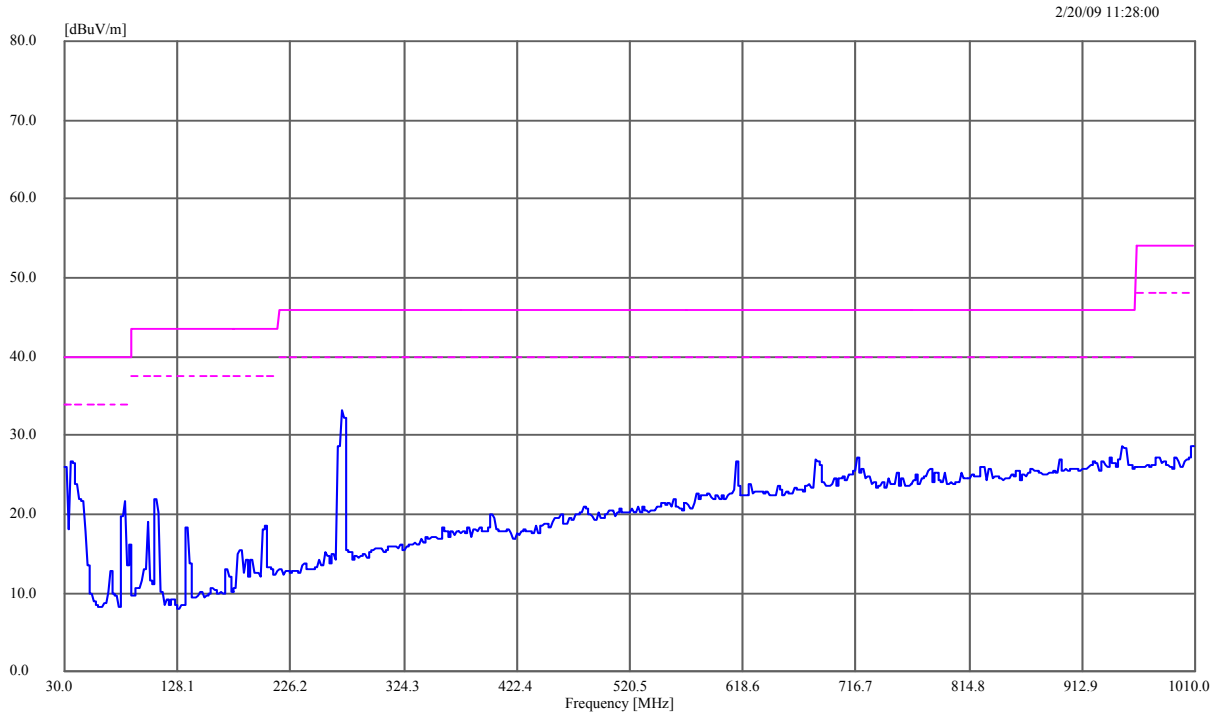

Figure 51: Emissions Pres-can, Inverter F Antenna, 30 to 1000 MHz, Y-Axis

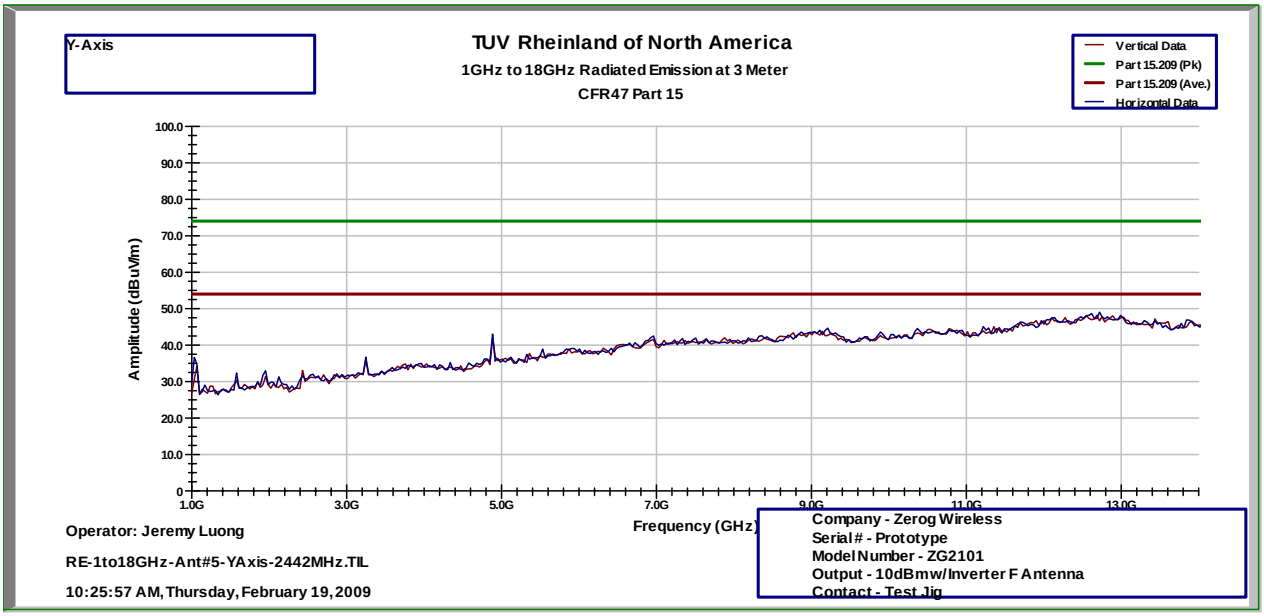

Figure 52: Emissions Pres-can, Inverter F Antenna, 1GHz-18GHz, Y-Axis

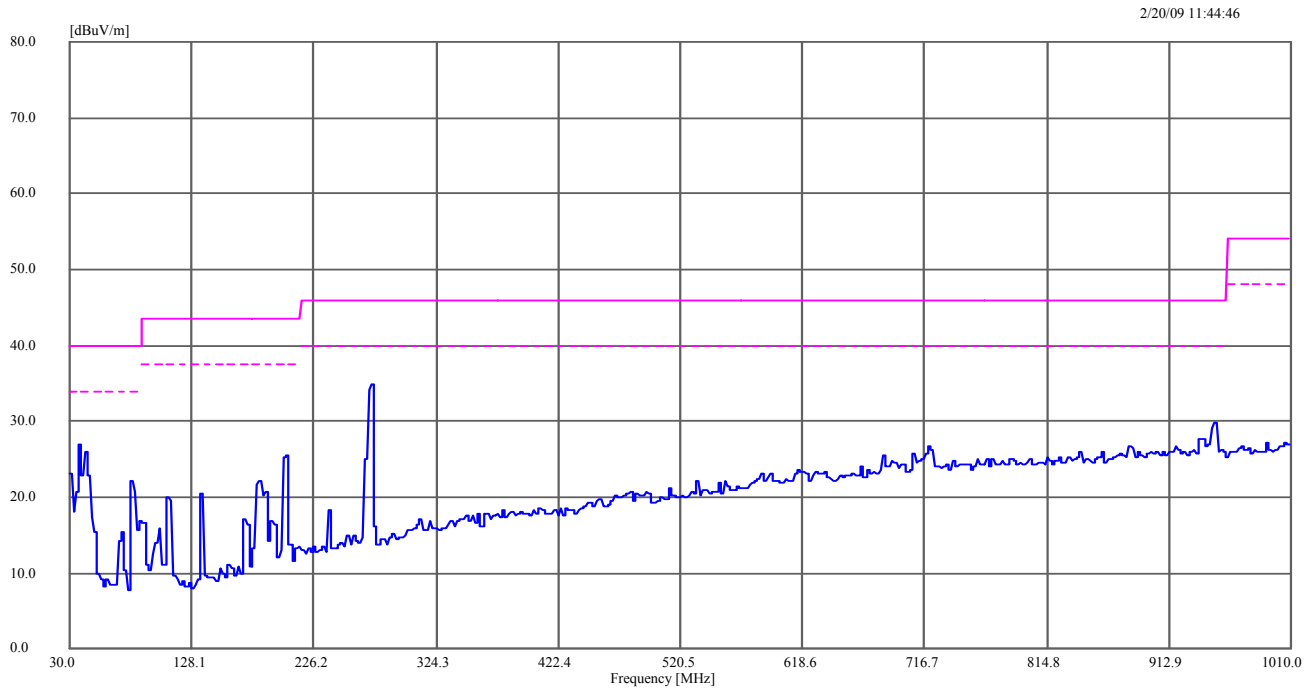

Figure 53: Emissions Pres-can, Inverter F Antenna, 30 to 1000 MHz, Z-Axis

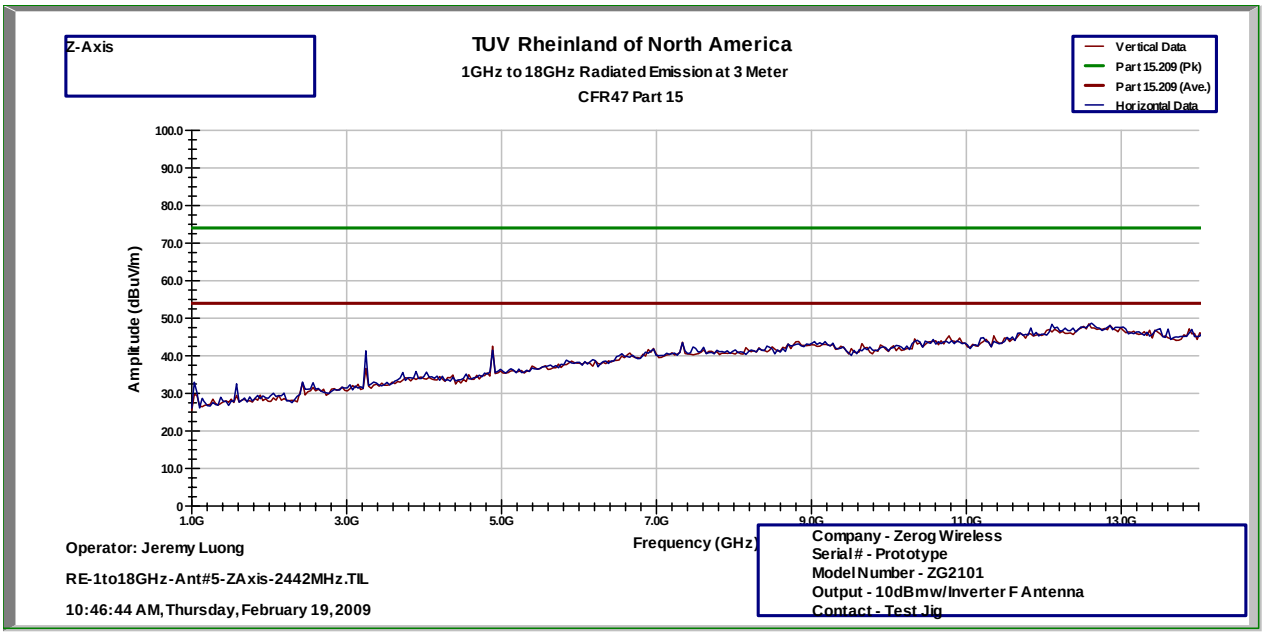

Figure 54: Emissions Pres-can, Inverter F Antenna, 1GHz-18GHz, Z-Axis

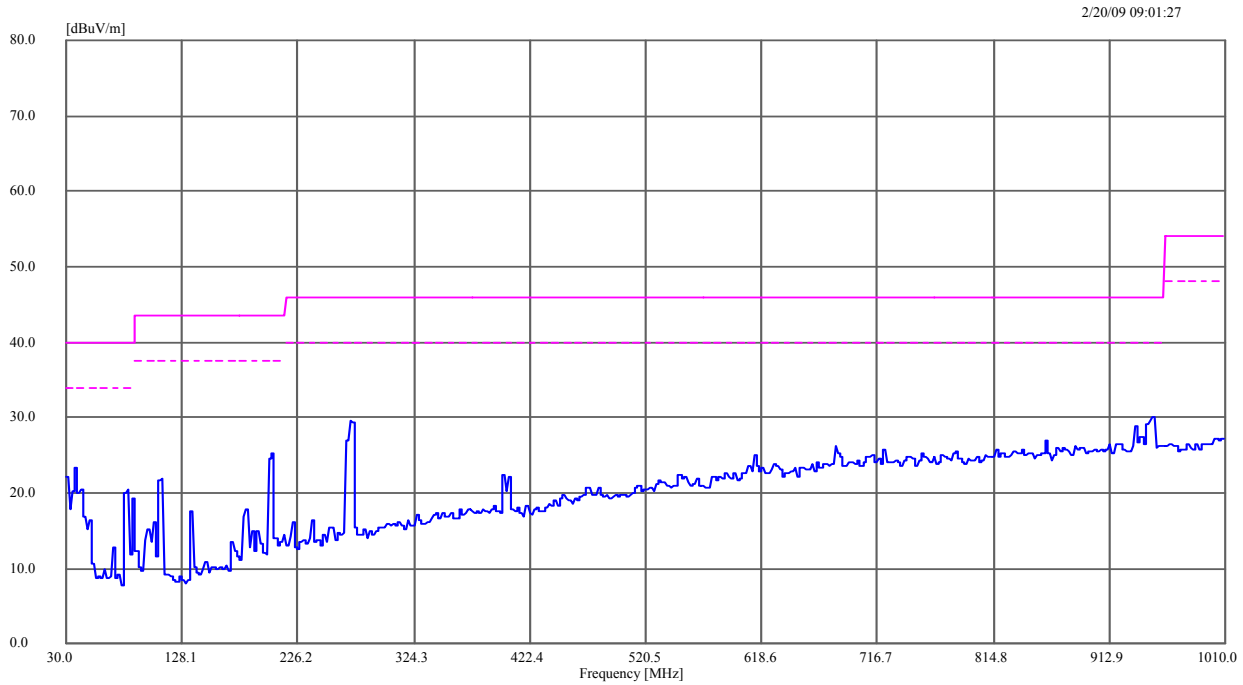

Figure 55: Emissions Pres-can, 2dBi PCB Antenna #3, 30 to 1000 MHz, X-Axis

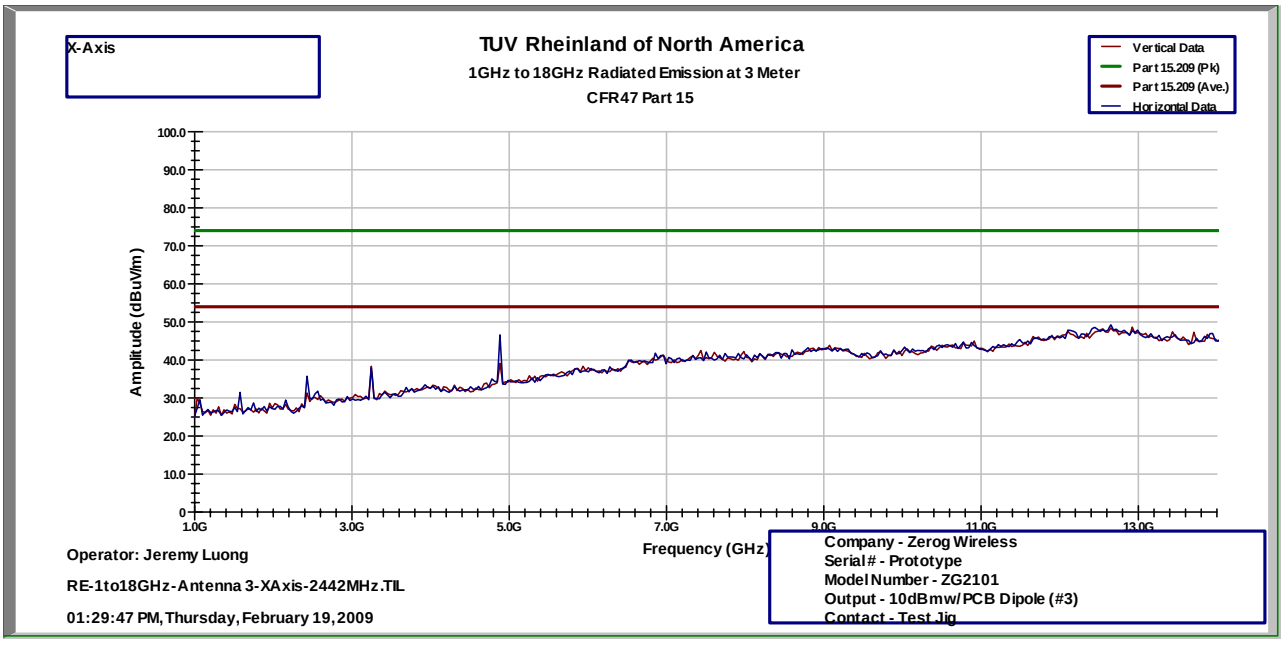

Figure 56: Emissions Pres-can, 2dBi PCB Antenna #3, 1GHz-18GHz, X-Axis

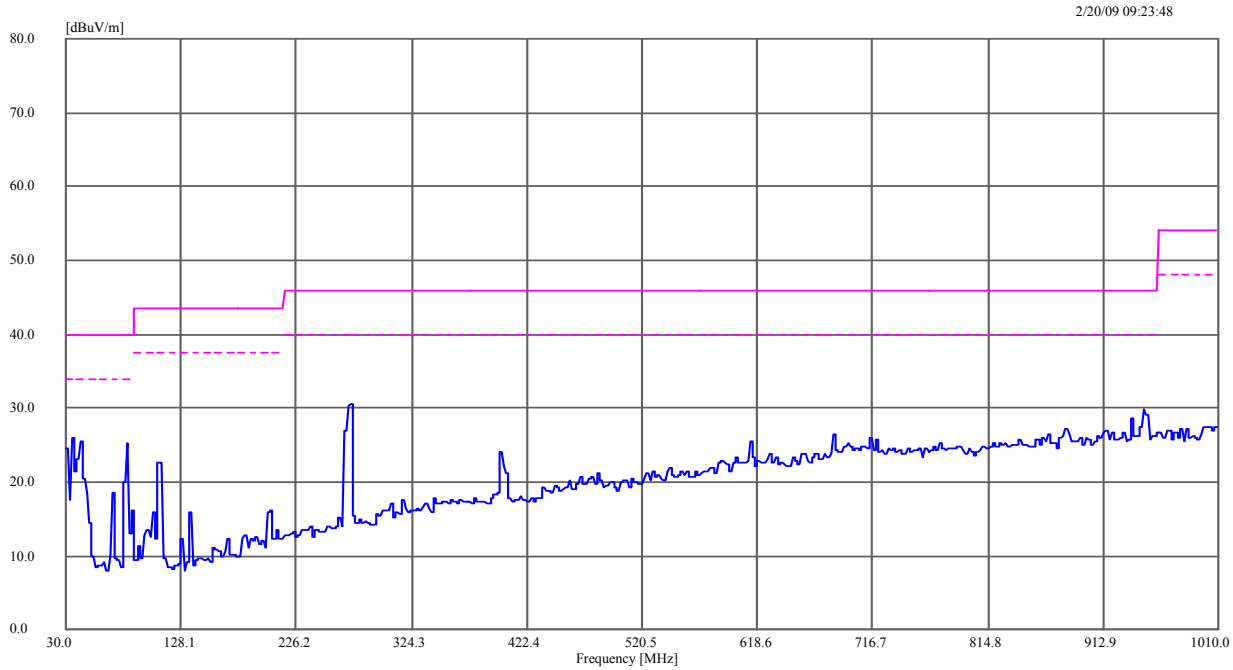

Figure 57: Emissions Pres-can, 2dBi PCB Antenna #3, 30 to 1000 MHz, Y-Axis

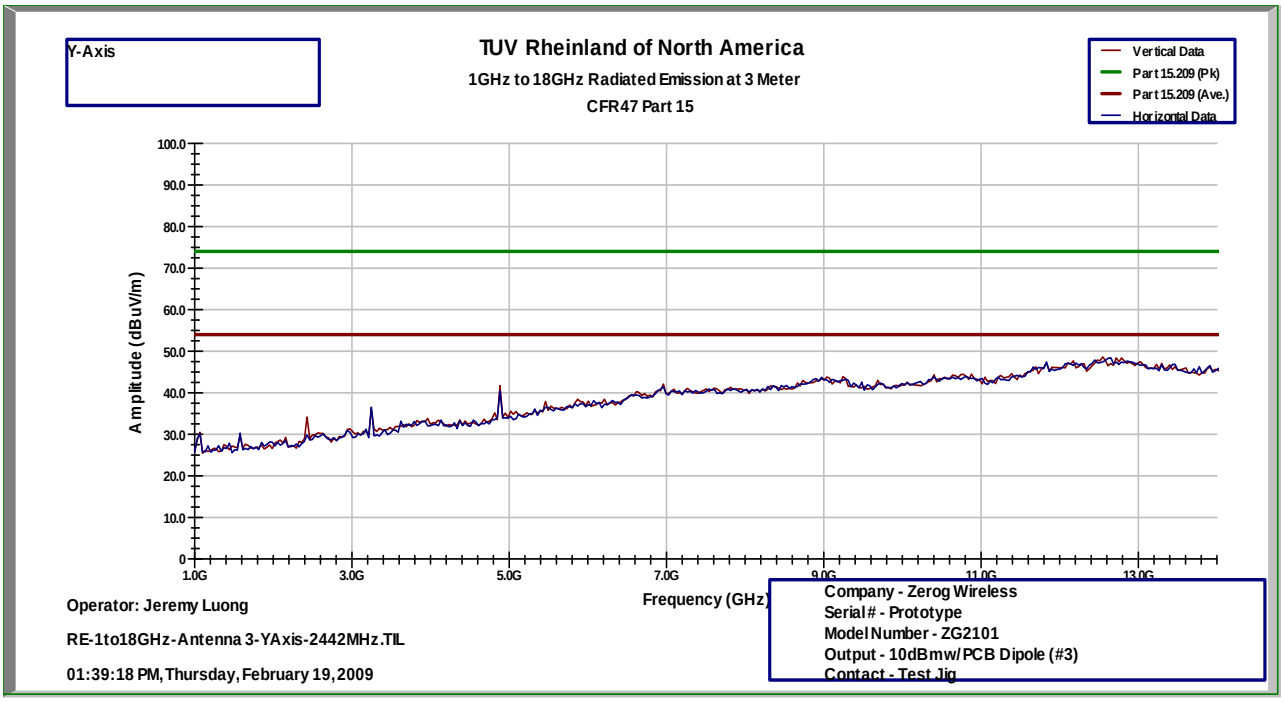

Figure 58: Emissions Pres-can, 2dBi PCB Antenna #3, 1GHz-18GHz, Y-Axis

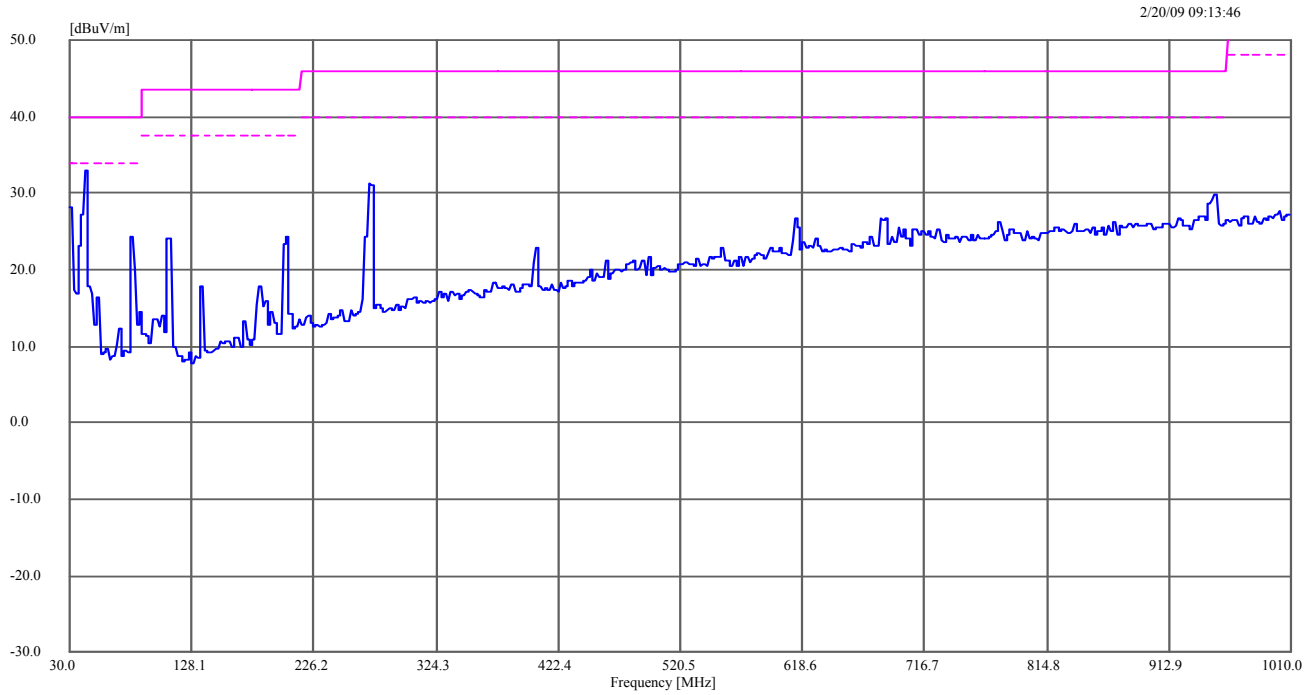

Figure 59: Emissions Pres-can, 2dBi PCB Antenna #3, 30 to 1000 MHz, Z-Axis

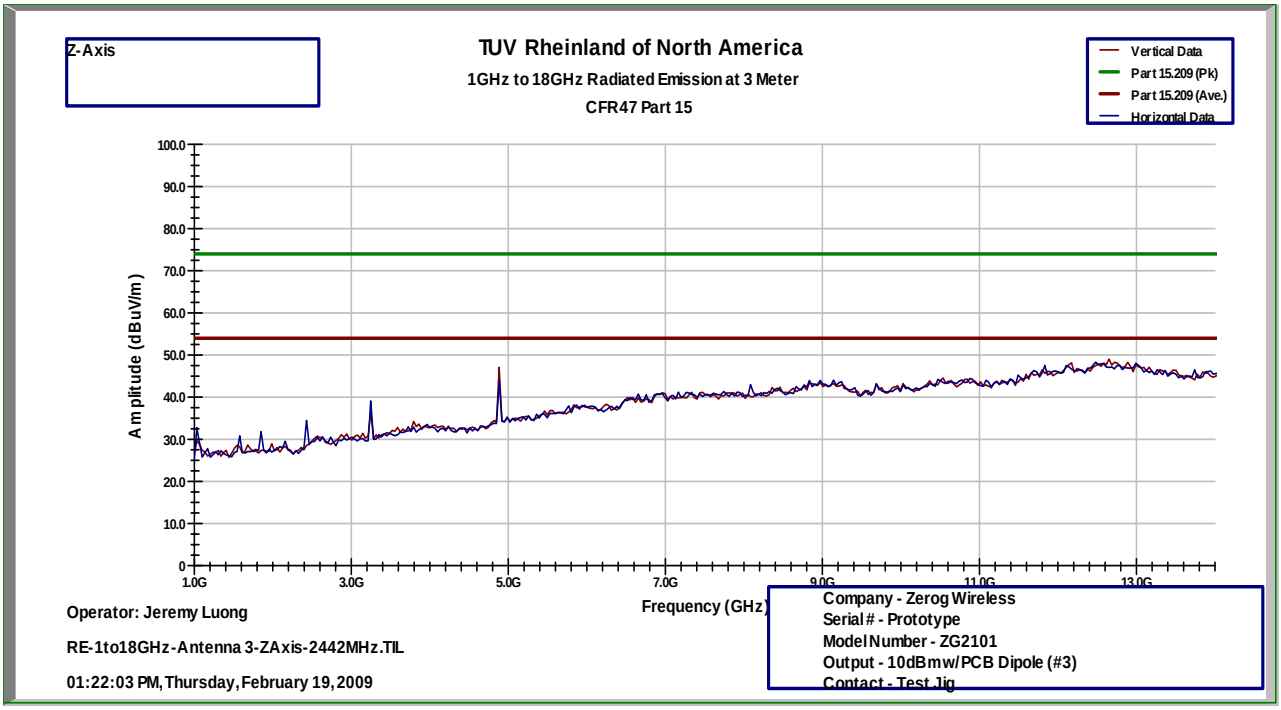

Figure 60: Emissions Pres-can, 2dBi PCB Antenna #3, 1GHz-18GHz, Z-Axis

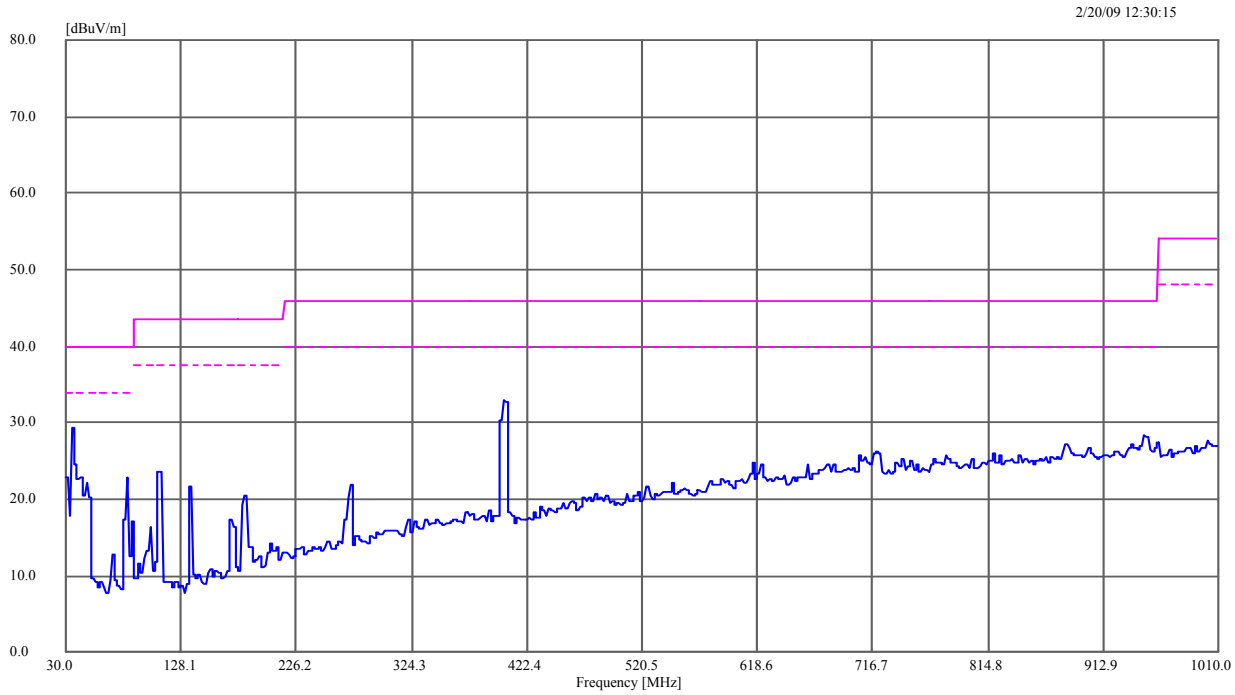

Figure 61: Emissions Pres-can, 5dBi Dipole Antenna, 30 to 1000 MHz, X-Axis

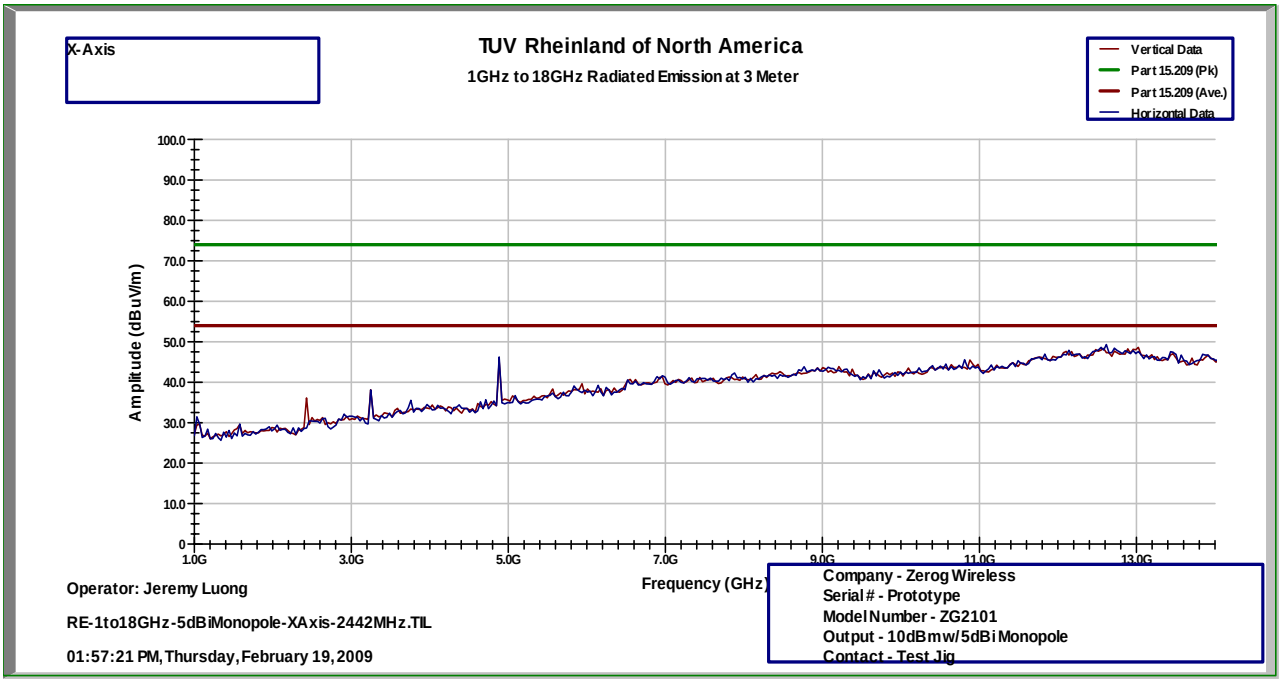

Figure 62: Emissions Pres-can, 5dBi Dipole Antenna, 1GHz-18GHz, X-Axis

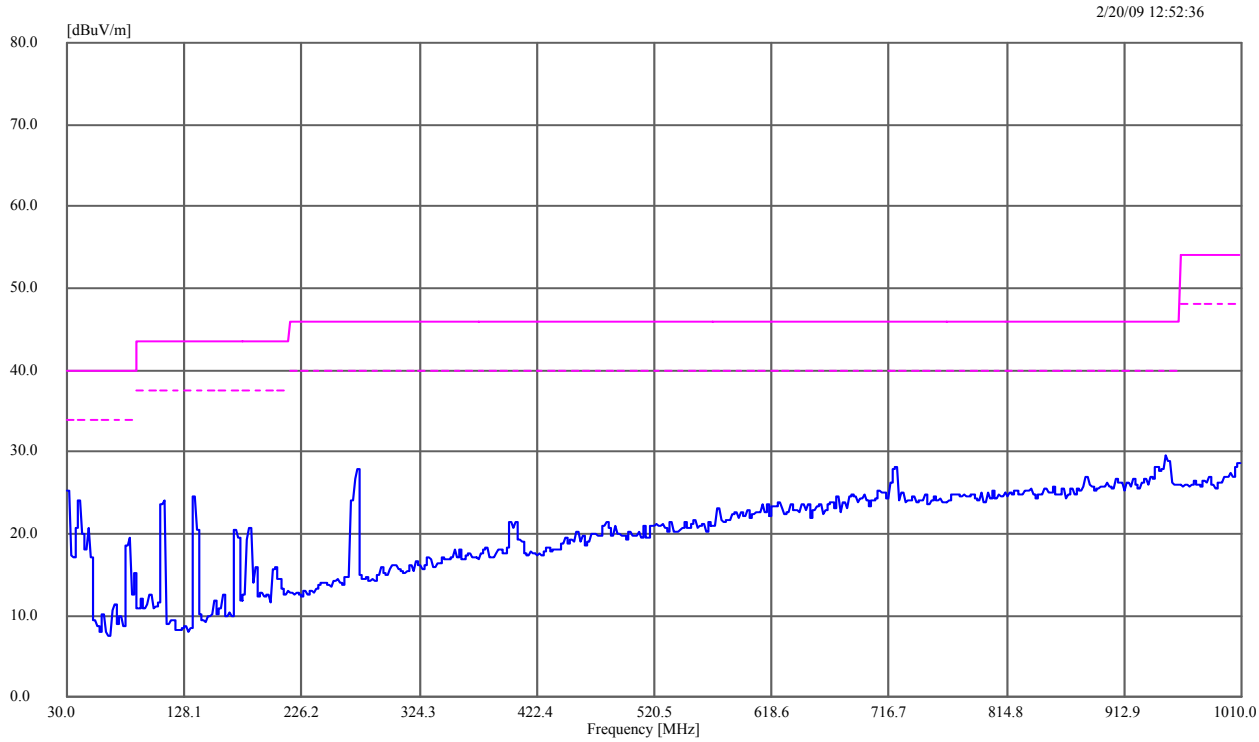

Figure 63: Emissions Pres-can, 5dBi Dipole Antenna, 30 to 1000 MHz, Y-Axis

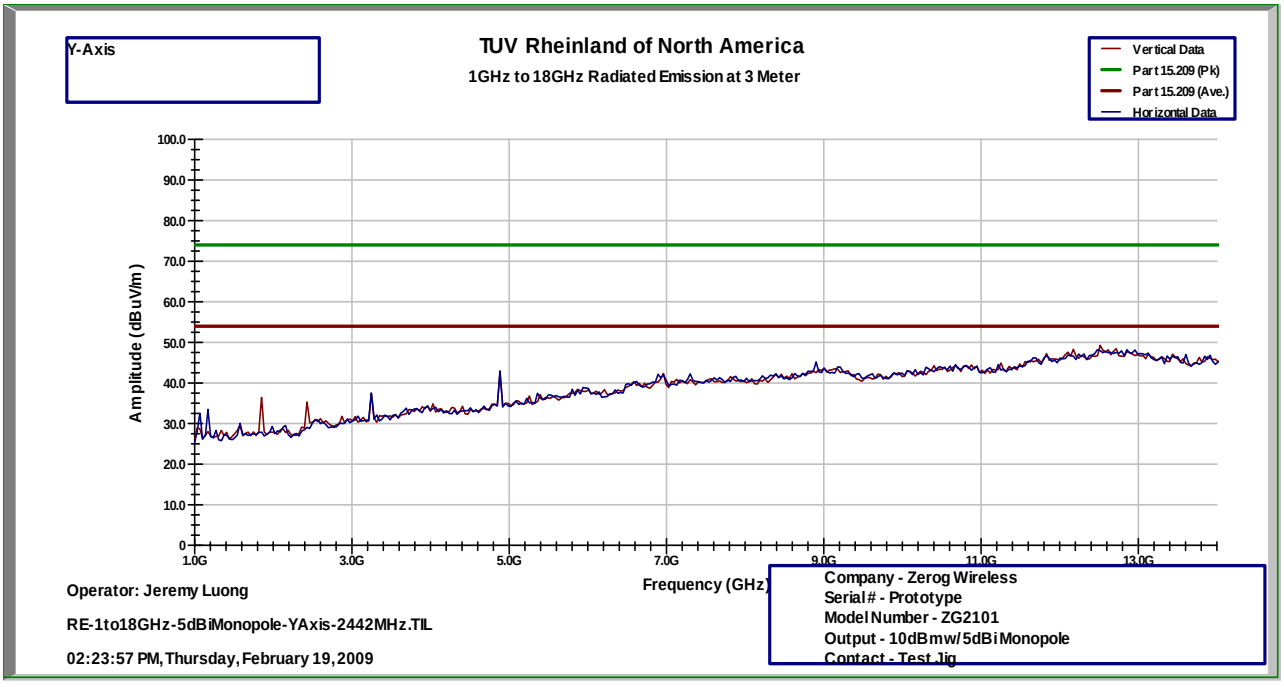

Figure 64: Emissions Pres-can, 5dBi Dipole Antenna, 1GHz-18GHz, Y-Axis

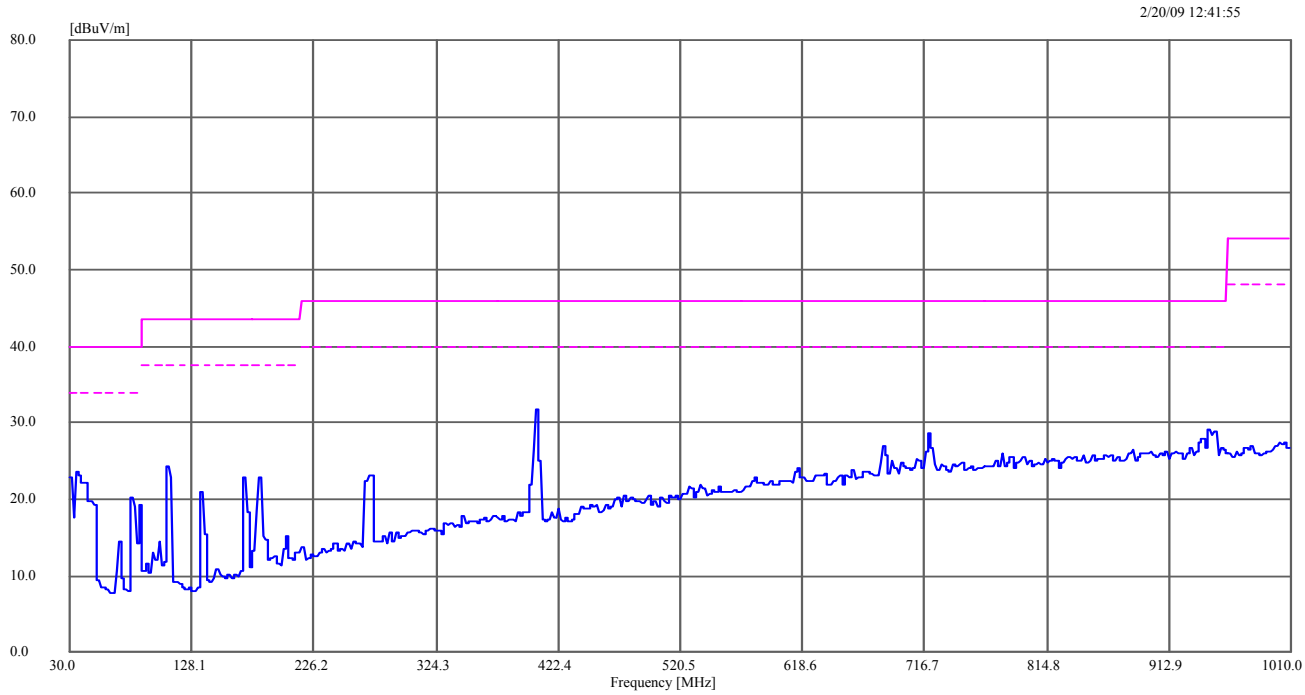

Figure 65: Emissions Pres-can, 5dBi Dipole Antenna, 30 to 1000 MHz, Z-Axis

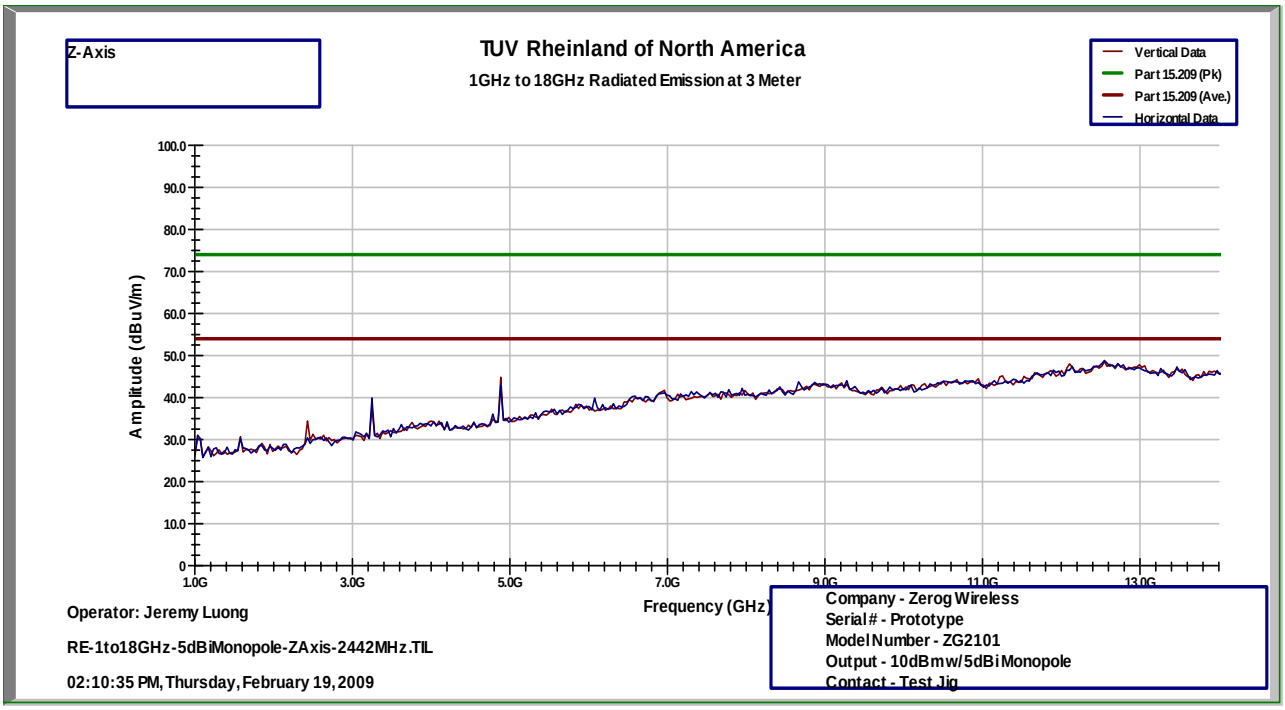

Figure 66: Emissions Pres-can, 5dBi Dipole Antenna, 1GHz-18GHz, Z-Axis

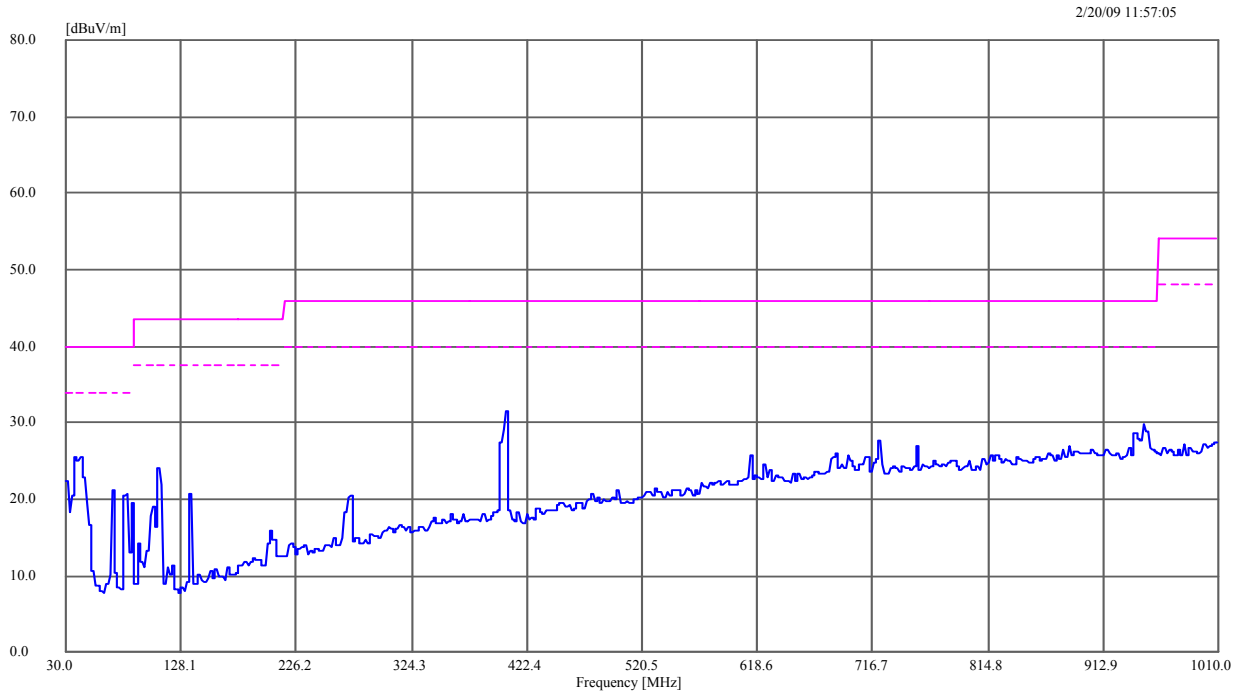

Figure 67: Emissions Pres-can, 10dBi Monopole Antenna, 30 to 1000 MHz, X-Axis

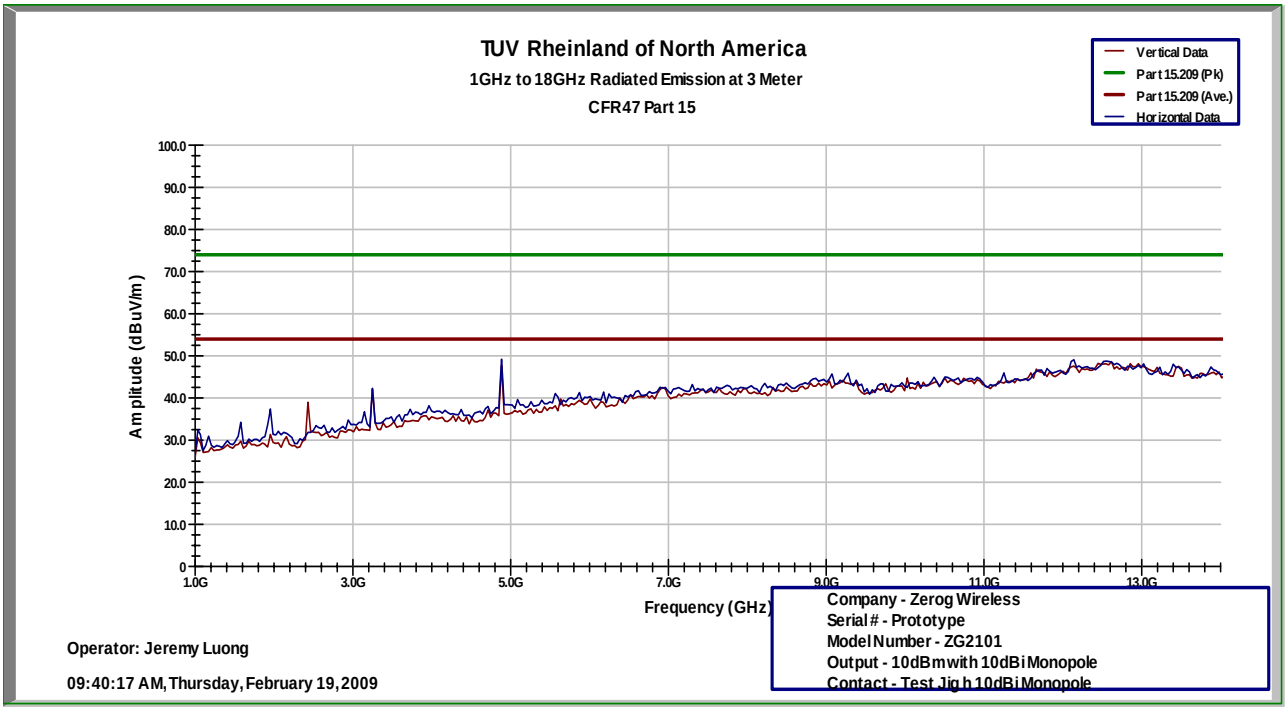

Figure 68: Emissions Pres-can, 10dBi Monopole Antenna, 1GHz-18GHz, X-Axis

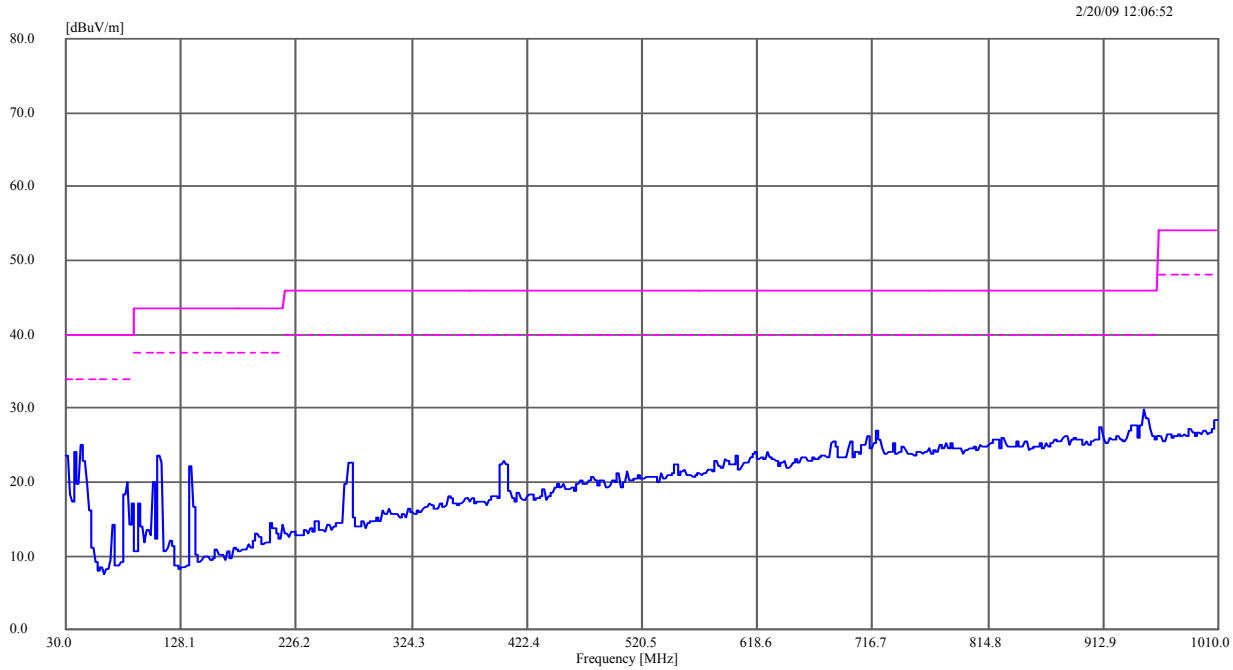

Figure 69: Emissions Pres-can, 10dBi Monopole Antenna, 30 to 1000 MHz, Y-Axis

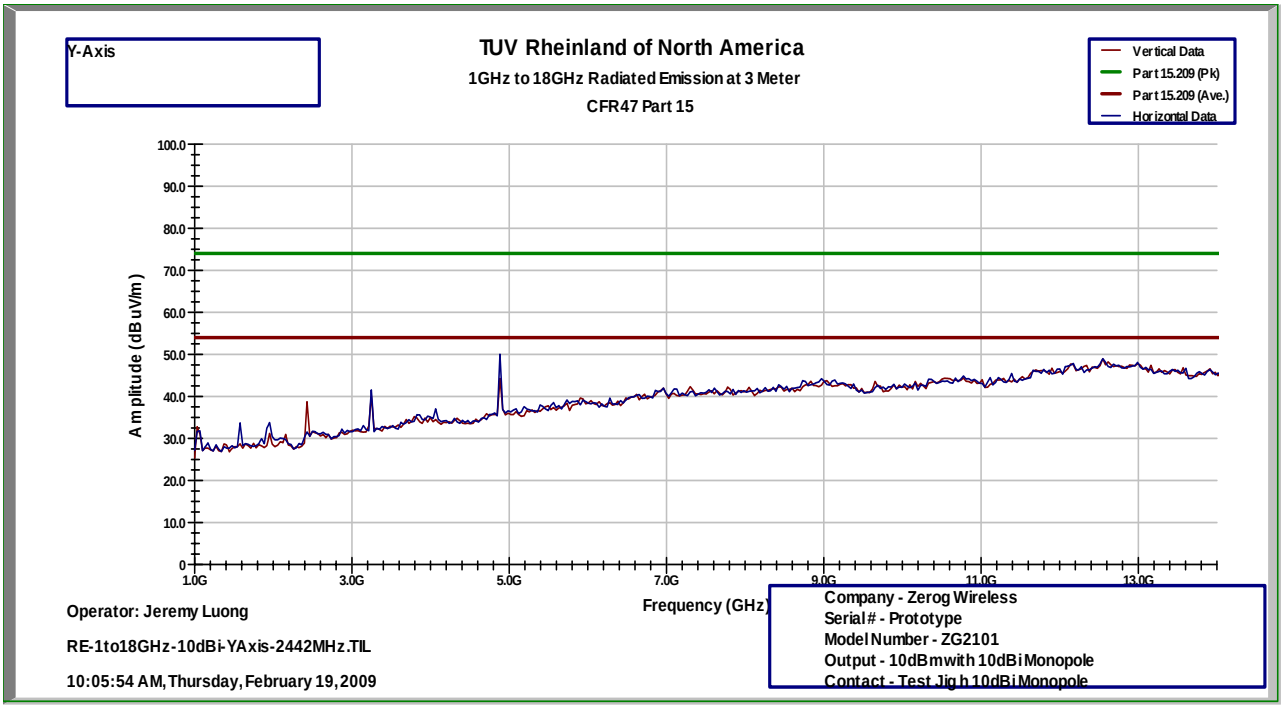

Figure 70: Emissions Pres-can, 10dBi Monopole Antenna, 1GHz-18GHz, Y-Axis

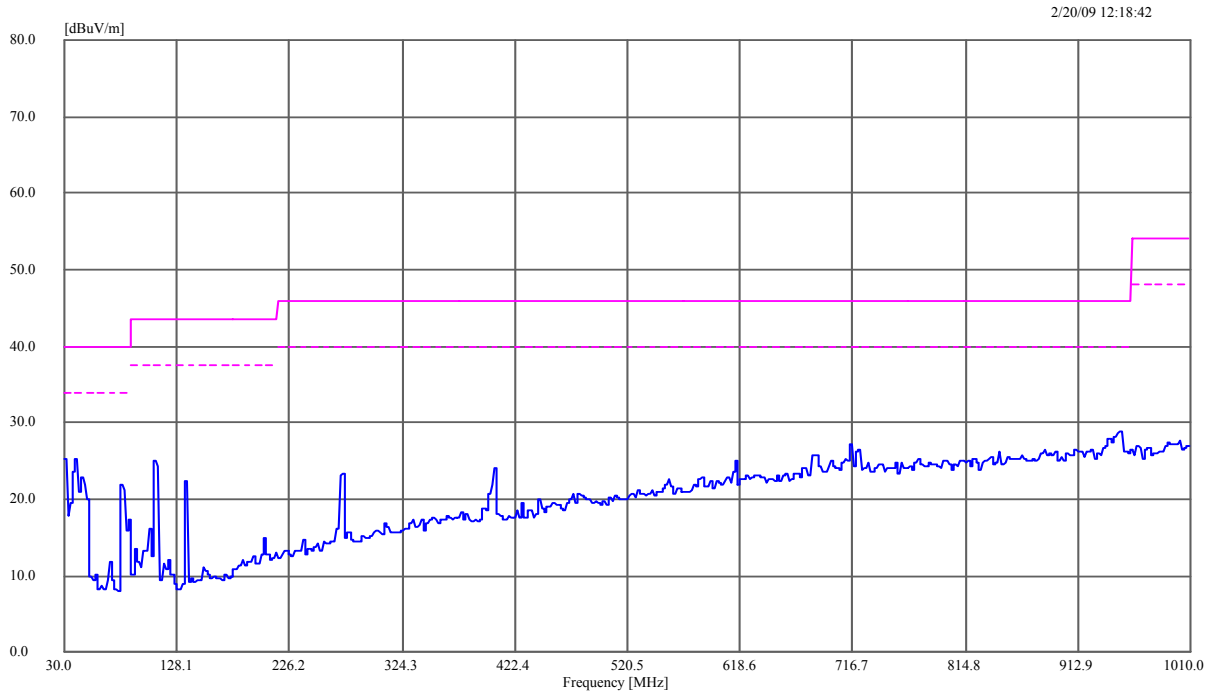

Figure 71: Emissions Pres-can, 10dBi Monopole Antenna, 30 to 1000 MHz, Z-Axis

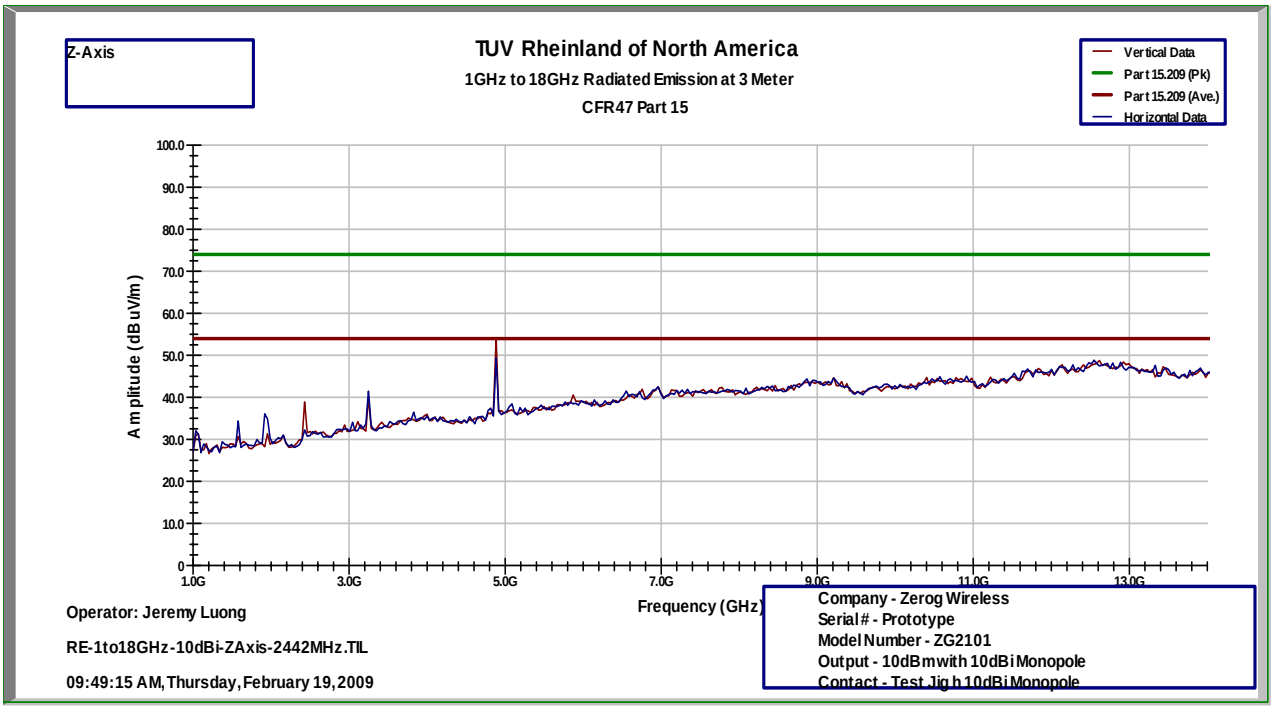

Figure 72: Emissions Pres-can, 10dBi Monopole Antenna, 1GHz-18GHz, Z-Axis

4.6.3.2 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	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 48%rh
EUT Serial	00000287	**Temp / Hum out**	N/A
EUT Config.	On-board Ant. (Meander) on Y-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	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 2412MHz										
32.669700	V	3.13	193	36.38	25.05	-7.68	17.37	40.00	-22.63	Spurious
79.997682	V	2.95	312	39.76	38.54	-17.86	20.68	40.00	-19.32	Spurious
395.959097	V	1.06	140	34.74	31.35	-6.41	24.94	46.00	-21.06	Spurious
675.226230	V	2.95	107	27.64	24.06	-1.26	22.80	46.00	-23.20	Spurious
Transmitted Data at 2437MHz										
33.873827	V	2.6	226	29.85	24.09	-8.45	15.64	40.00	-24.36	Spurious
105.681791	V	1.1	80	39.15	37.74	-15.59	22.15	43.50	-21.35	Spurious
263.922880	V	1.7	143	31.45	27.31	-9.77	17.54	46.00	-28.46	Spurious
396.034194	V	1.2	148	34.97	31.42	-6.41	25.01	46.00	-20.99	Spurious
Transmitted Data at 2462MHz										
32.367820	V	2.1	358	28.99	22.23	-7.53	14.70	40.00	-25.30	Spurious
105.716143	V	1.1	37	37.63	36.89	-15.59	21.30	43.50	-22.20	Spurious
263.979655	V	1.9	144	32.21	29.27	-9.76	19.51	46.00	-26.49	Spurious
395.970836	V	1.1	131	36.43	33.21	-6.41	26.80	46.00	-19.20	Spurious

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

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

Notes: Y-Axis was the worst plane.

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EUT Name	Low Power Transceiver Module	**Date**	March 6, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 45%rh
EUT Serial	00000287	**Temp / Hum out**	N/A
EUT Config.	On-board Ant. (Meander) on Y-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM (Pk) Pk (dBuV/m)	FIM Ave (dBuV/m)	Total CF dBuV	E-Field Ave (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)	Type
Transmitted Data at 2412MHz										
3216.00	H	3.6	193	48.35	43.74	3.32	40.42	53.98	-13.56	Spurious
4824.10	H	1.2	170	60.08	52.83	7.63	45.20	53.98	-8.78	Harmonic
3216.00	V	3.6	123	53.62	45.78	3.36	42.42	53.98	-11.56	Spurious
4824.00	V	3.0	125	57.35	51.55	7.63	43.92	53.98	-10.06	Harmonic
Transmitted Data at 2437MHz										
3249.30	H	3.4	103	41.68	36.23	3.43	32.8	53.98	-21.18	Spurious
4874.00	H	3.4	165	58.60	51.26	7.86	43.4	53.98	-10.58	Harmonic
3249.30	V	2.7	164	46.43	41.59	3.48	38.11	53.98	-15.87	Spurious
4874.00	V	3.1	162	59.94	52.95	7.86	45.09	53.98	-8.89	Harmonic
Transmitted Data at 2462MHz										
3282.68	H	347	100	41.44	35.00	3.55	31.45	53.98	-22.53	Spurious
4924.00	H	28	100	55.24	48.10	8.06	40.04	53.98	-13.94	Harmonic
7386.00	H	31	138	64.08	57.16	11.63	45.53	53.98	-8.45	Harmonic
3282.68	V	4	152	44.24	38.65	3.60	35.05	53.98	-18.93	Spurious
4924.00	V	0	149	53.80	45.87	8.06	37.81	53.98	-16.17	Harmonic
7386.00	V	280	132	59.49	52.68	11.60	41.08	53.98	-12.90	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 $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Y-Axis was the worst plane. The harmonics were even below the spurious limit.

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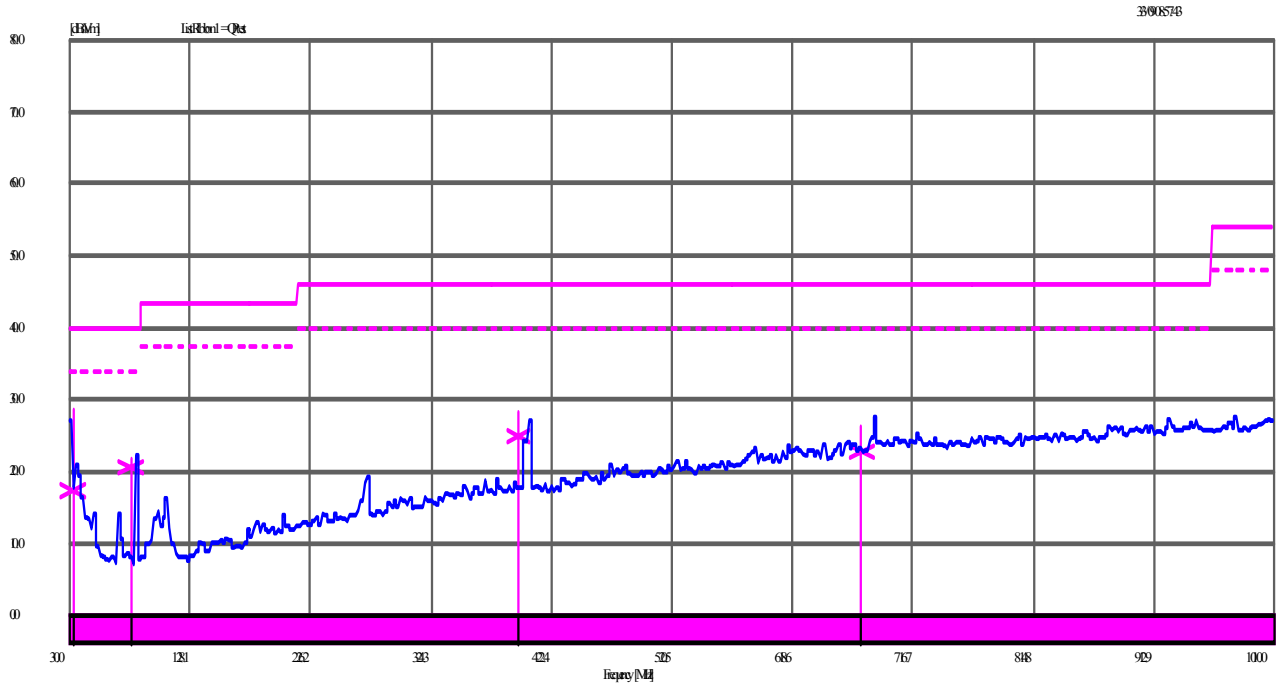
EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 48%rh
EUT Serial	0000287	**Temp / Hum out**	N/A
EUT Config.	On-board Ant. (Meander) on Y-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

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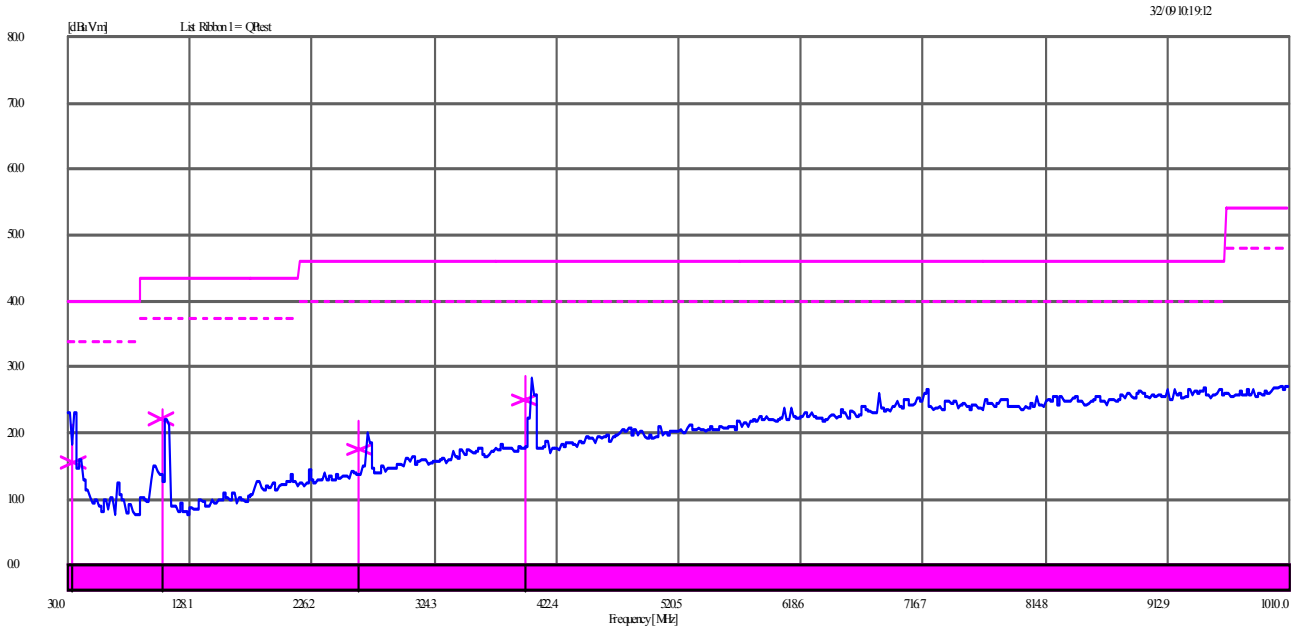
EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 48%rh
EUT Serial	0000287	**Temp / Hum out**	N/A
EUT Config.	On-board Ant. (Meander) on Y-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

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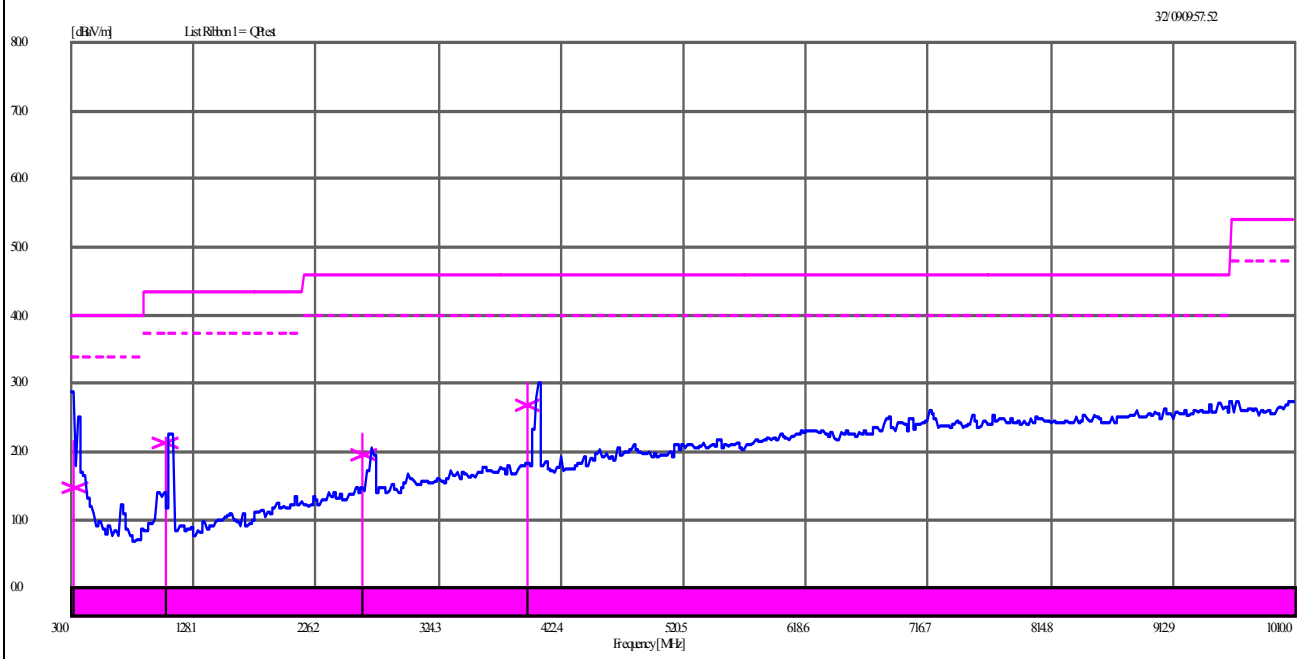
EUT Name	Low Power Transceiver Module	**Date**	March 6, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 45%rh
EUT Serial	0000287	**Temp / Hum out**	N/A
EUT Config.	On-board Ant. (Meander) on Y-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

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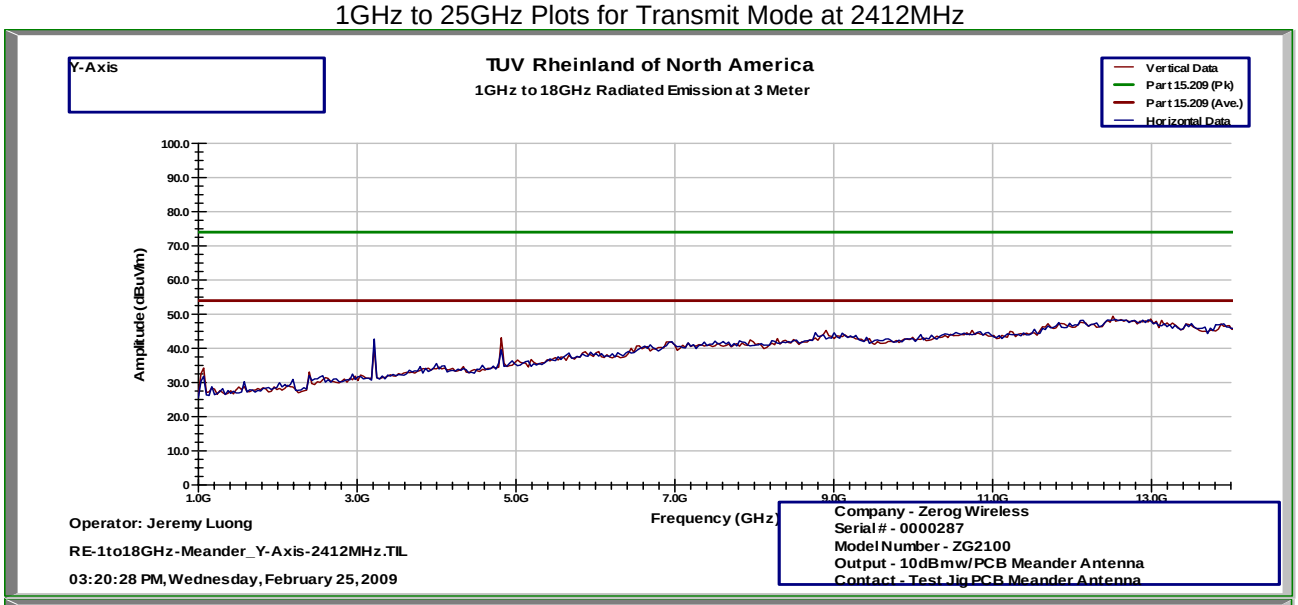
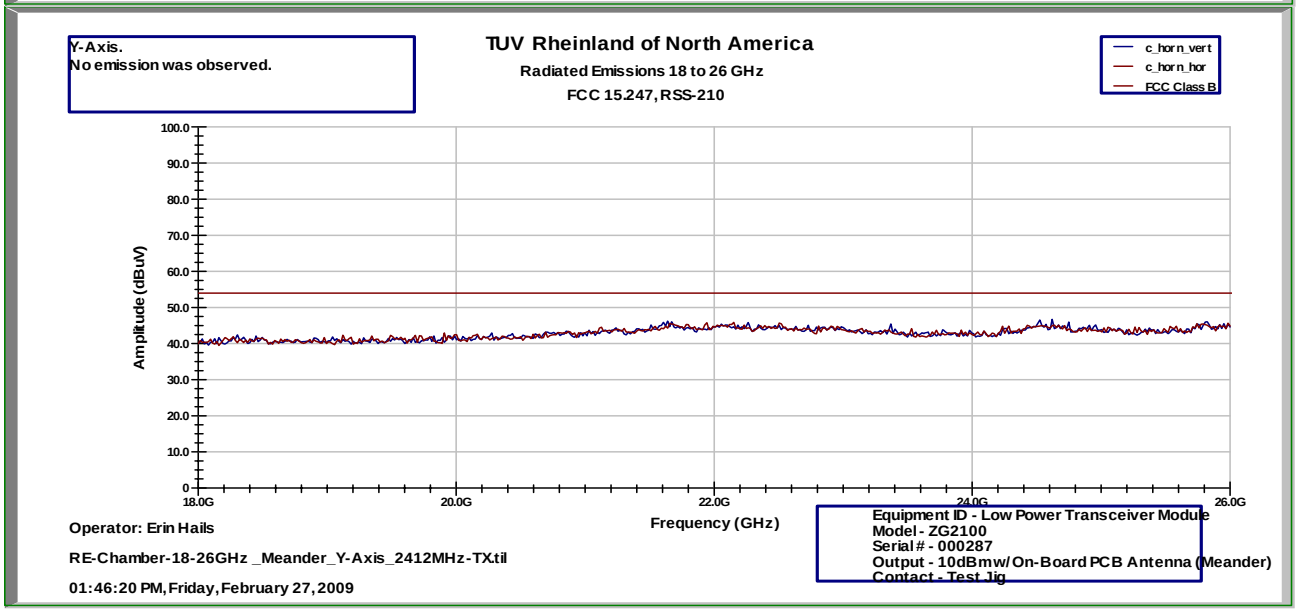
EUT Name	Low Power Transceiver Module	**Date**	February 26, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 41%rh
EUT Serial	0000287	**Temp / Hum out**	N/A
EUT Config.	On-board Ant. (Meander) on Y-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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





Notes: None.

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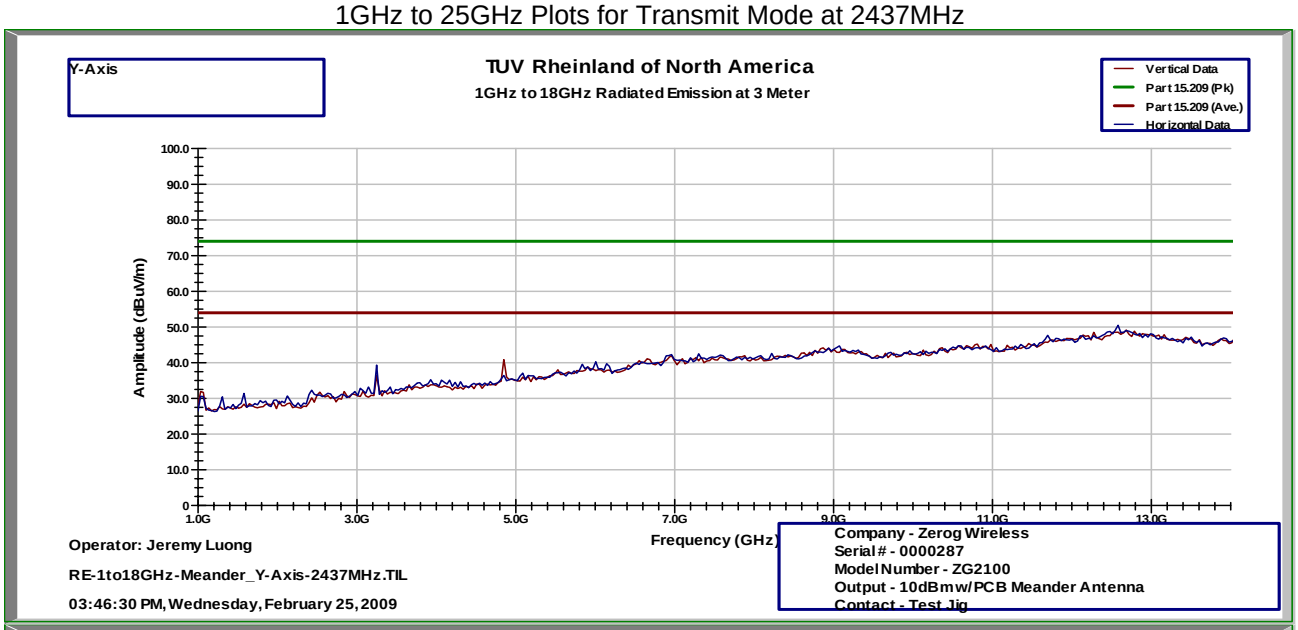
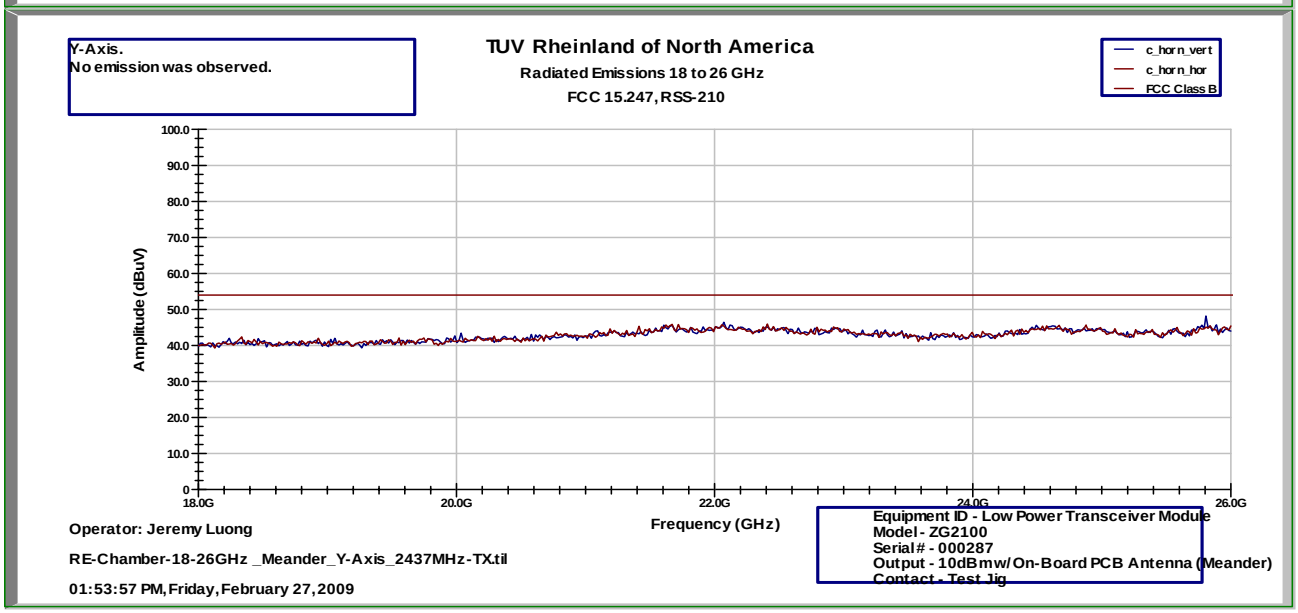
EUT Name	Low Power Transceiver Module	**Date**	February 26, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 41%rh
EUT Serial	0000287	**Temp / Hum out**	N/A
EUT Config.	On-board Ant. (Meander) on Y-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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





Notes: None.

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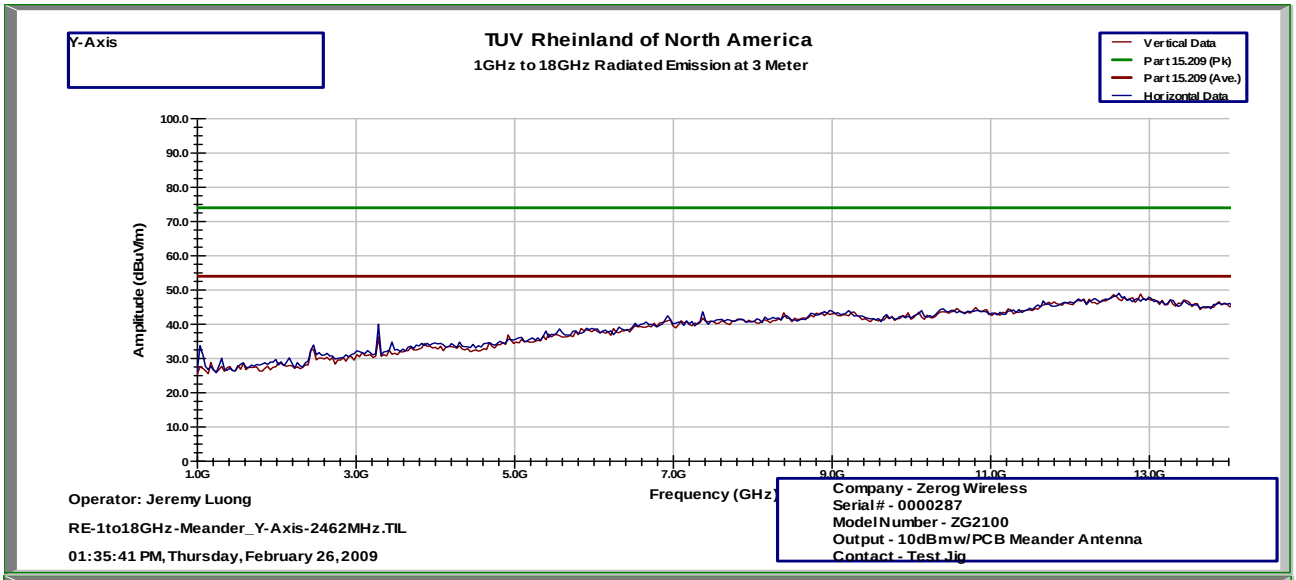
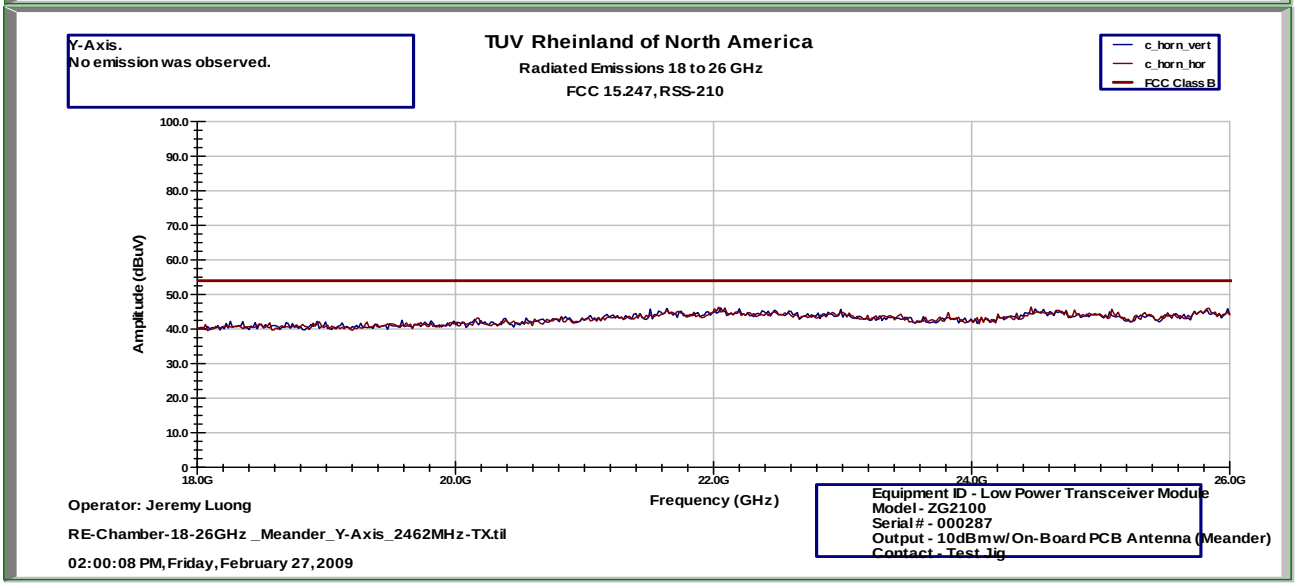
EUT Name	Low Power Transceiver Module	**Date**	February 26, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 41%rh
EUT Serial	0000287	**Temp / Hum out**	N/A
EUT Config.	On-board Ant. (Meander) on Y-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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





Notes: None.

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EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 48%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	2dBi PCB Antenna #3 on Z-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	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 2412MHz										
263.924105	H	1.1	274	34.2	29.84	-1.26	28.58	46.00	-17.42	Spurious
Transmitted Data at 2437MHz										
32.180893	V	2.9	267	28.35	21.33	-7.44	13.89	40.00	-26.11	Spurious
105.681218	V	1.1	357	42.77	41.72	-15.59	26.13	43.50	-17.37	Spurious
263.927816	H	1.0	77	43.68	39.48	-9.77	29.71	46.00	-16.29	Spurious
Transmitted Data at 2462MHz										
33.521250	V	114	115	25.44	19.78	-8.21	11.57	40.00	-28.43	Spurious
71.311234	V	194	200	27.98	22.13	-17.81	4.32	40.00	-35.68	Spurious
105.730067	V	102	318	35.36	33.32	-15.59	17.73	43.50	-25.77	Spurious
131.998720	H	147	82	33.99	32.23	-16.62	15.61	43.50	-27.89	Spurious
198.000211	H	102	77	32.44	30.58	-12.71	17.87	43.50	-25.63	Spurious
263.998230	H	98	95	43.31	41.18	-9.76	31.42	46.00	-14.58	Spurious
711.249274	V	148	102	30.81	27.55	-0.59	26.96	46.00	-19.04	Spurious

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

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

Notes: Z-Axis was the worst plane.

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EUT Name	Low Power Transceiver Module	**Date**	March 6, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 45%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	2dBi PCB Antenna #3 on Z-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM (Pk) Pk (dBuV/m)	FIM Ave (dBuV/m)	Total CF dBuV	E-Field Ave (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)	Type
Transmitted Data at 2412MHz										
3216.00	H	1.2	23	48.76	41.34	3.32	38.02	53.98	-15.96	Spurious
4824.10	H	1.1	31	57.15	49.33	7.63	41.70	53.98	-12.28	Harmonic
3216.00	V	2.5	15	46.08	41.27	3.36	37.91	53.98	-16.07	Spurious
4824.00	V	1.9	7	60.65	53.16	7.63	45.53	53.98	-8.45	Harmonic
Transmitted Data at 2437MHz										
3249.30	H	100	347	49.30	44.43	3.43	41.00	53.98	-12.98	Spurious
4874.00	H	102	120	58.63	51.35	7.86	43.49	53.98	-10.49	Harmonic
3249.00	V	129	320	47.68	43.27	3.48	39.79	53.98	-14.19	Spurious
4874.00	V	109	92	58.61	50.75	7.86	42.89	53.98	-11.09	Harmonic
Transmitted Data at 2462MHz										
3282.68	H	100	341	49.16	44.96	3.55	41.41	53.98	-12.57	Spurious
4924.00	H	103	329	58.75	51.74	8.06	43.68	53.98	-10.30	Harmonic
7386.00	H	100	87	61.92	54.51	11.63	42.88	53.98	-11.10	Harmonic
3282.68	V	100	335	46.43	41.39	3.60	37.79	53.98	-16.19	Spurious
4924.00	V	100	31	61.49	54.07	8.06	46.01	53.98	-7.97	Harmonic
7386.00	V	100	38	61.79	55.13	11.60	43.53	53.98	-10.45	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 $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Z-Axis was the worst plane. The harmonics were even below the spurious limit.

SOP 1 Radiated Emissions

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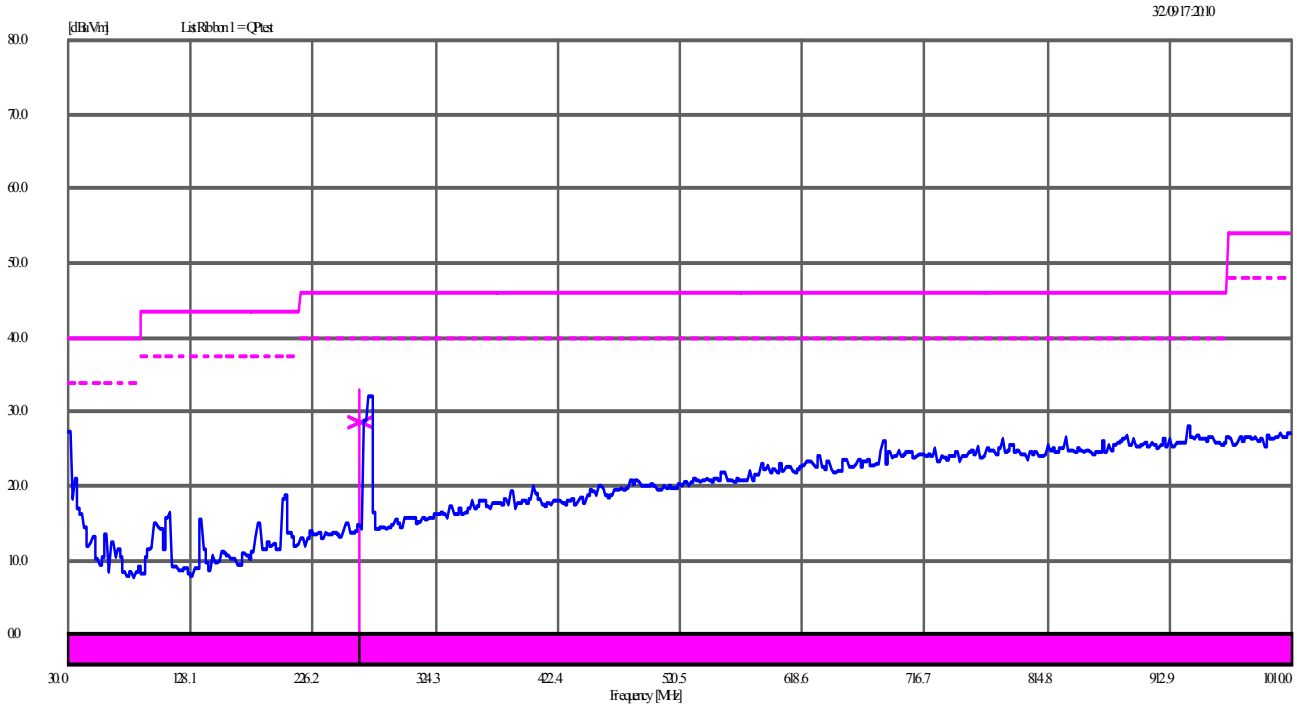
EUT Name	Low Power Transceiver Module	**Date**	March 2, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	2dBi PCB Antenna #3 on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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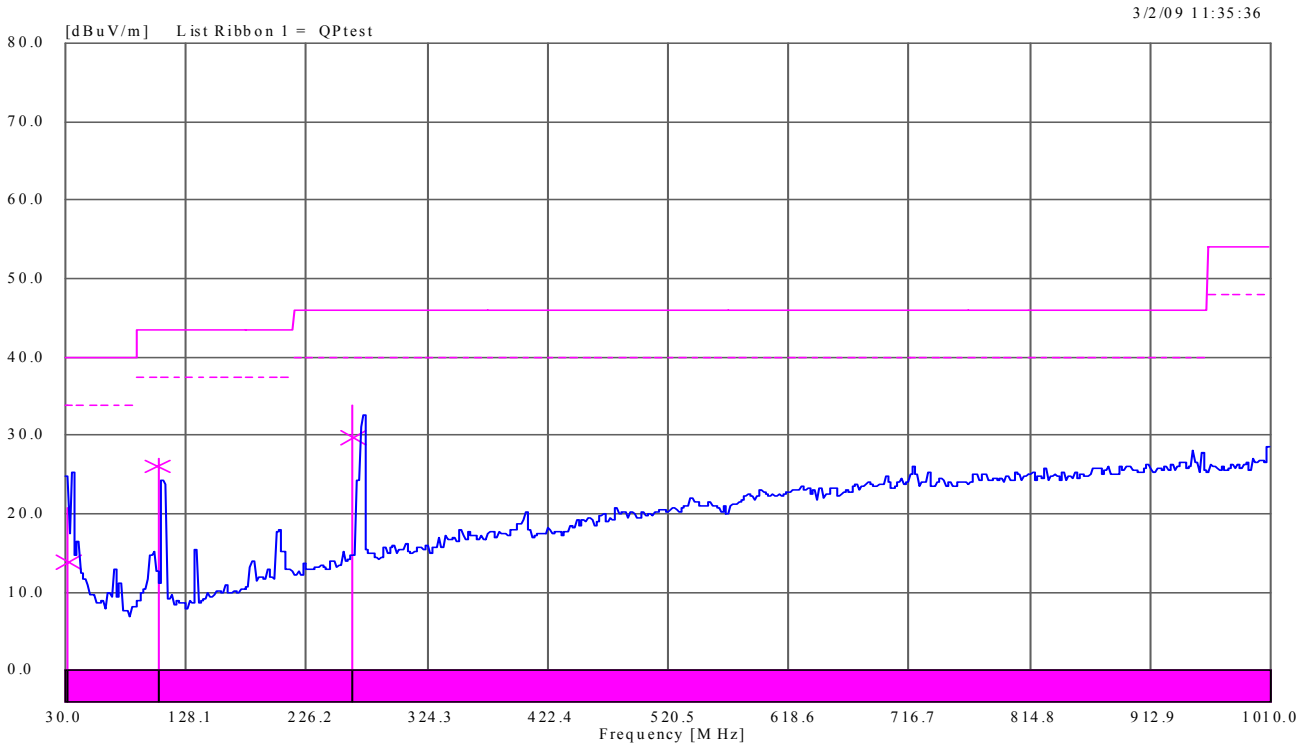
EUT Name	Low Power Transceiver Module	**Date**	March 2, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	2dBi PCB Antenna #3 on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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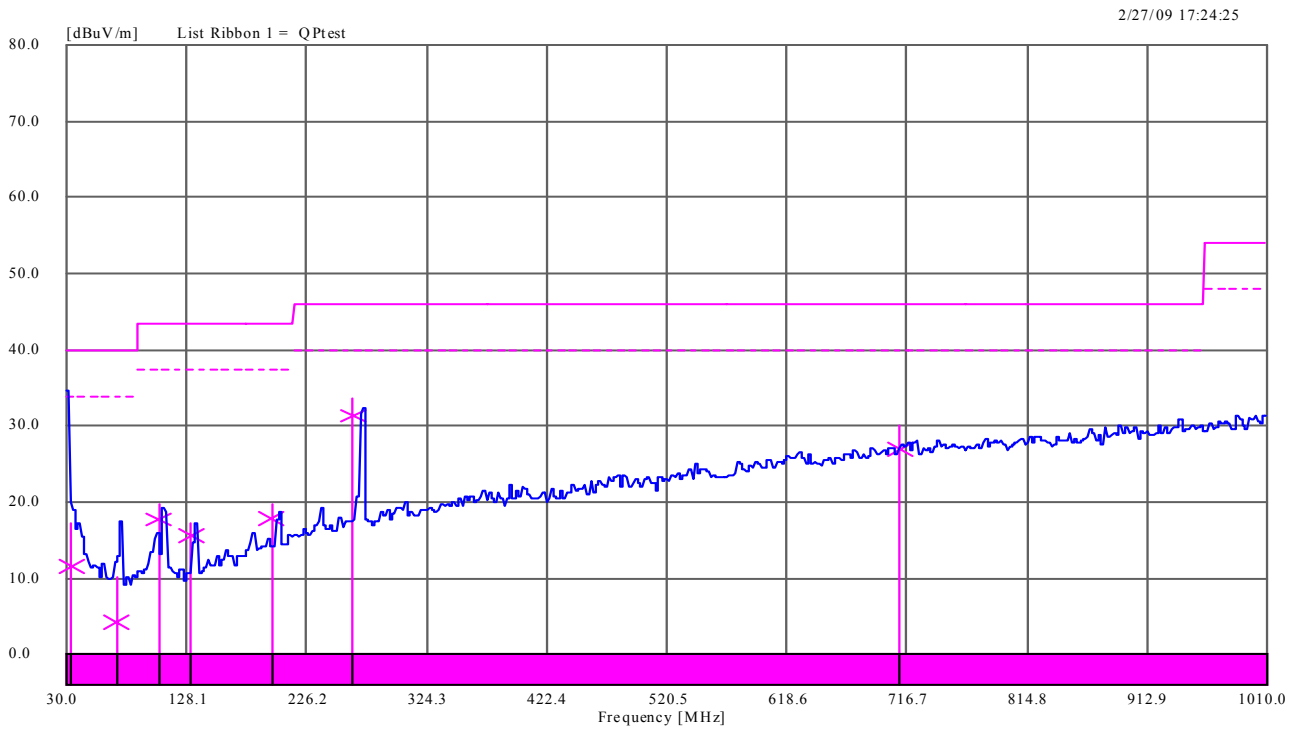
EUT Name	Low Power Transceiver Module	**Date**	February 27, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	21°C / 40%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	2dBi PCB Antenna #3 on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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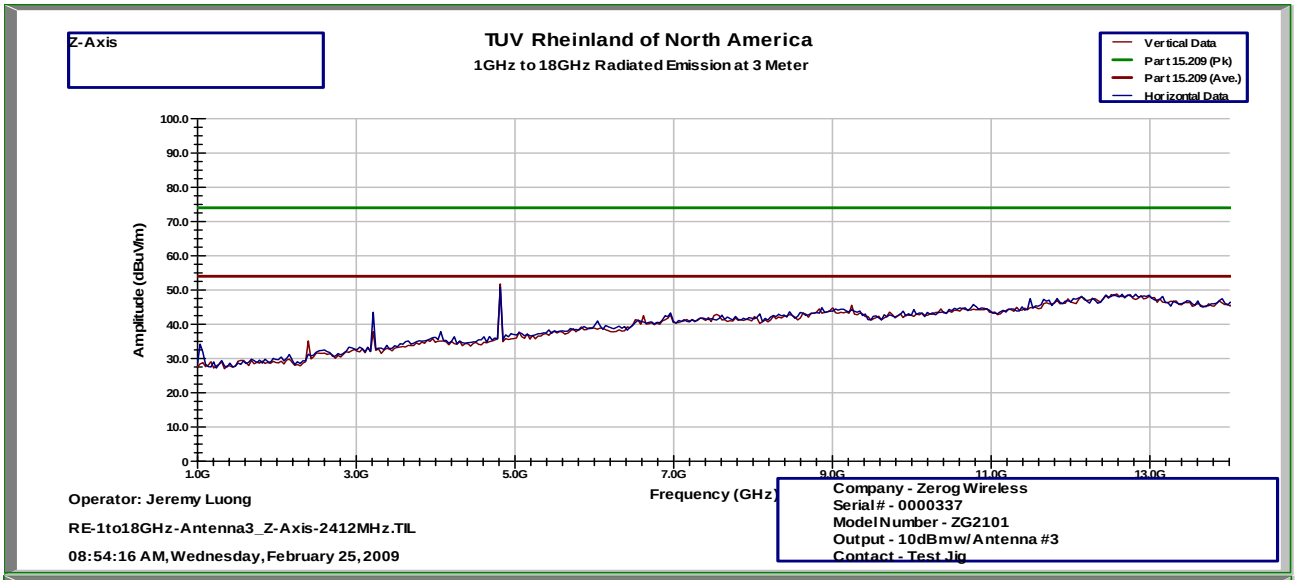
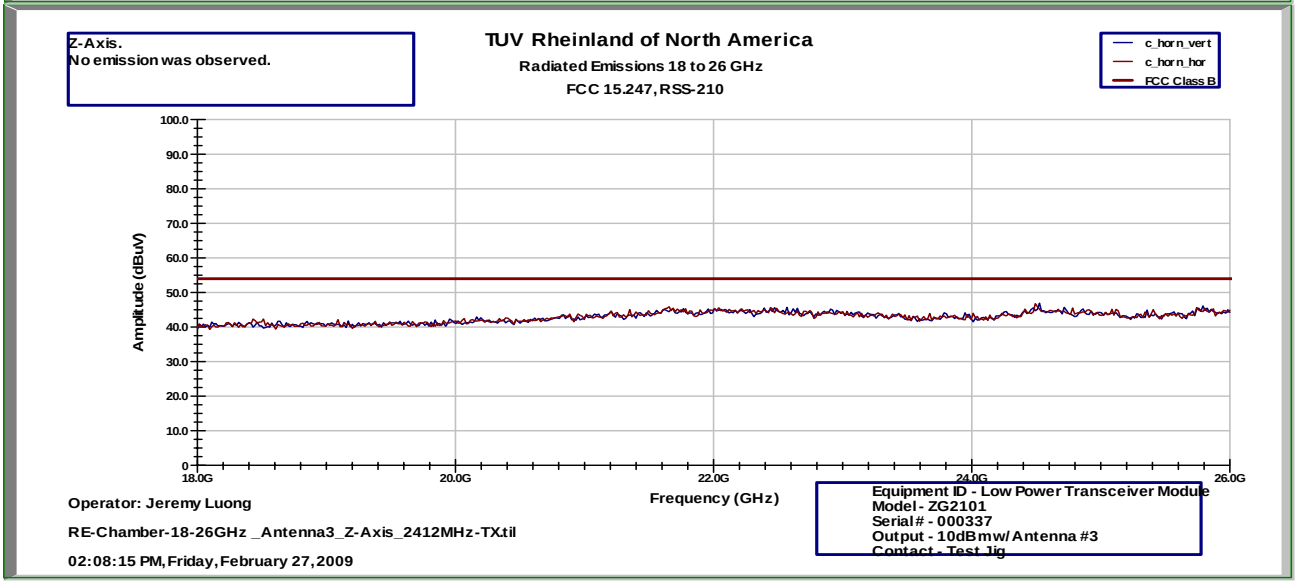
EUT Name	Low Power Transceiver Module	**Date**	February 26, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 41%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	2dBi PCB Antenna #3 on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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



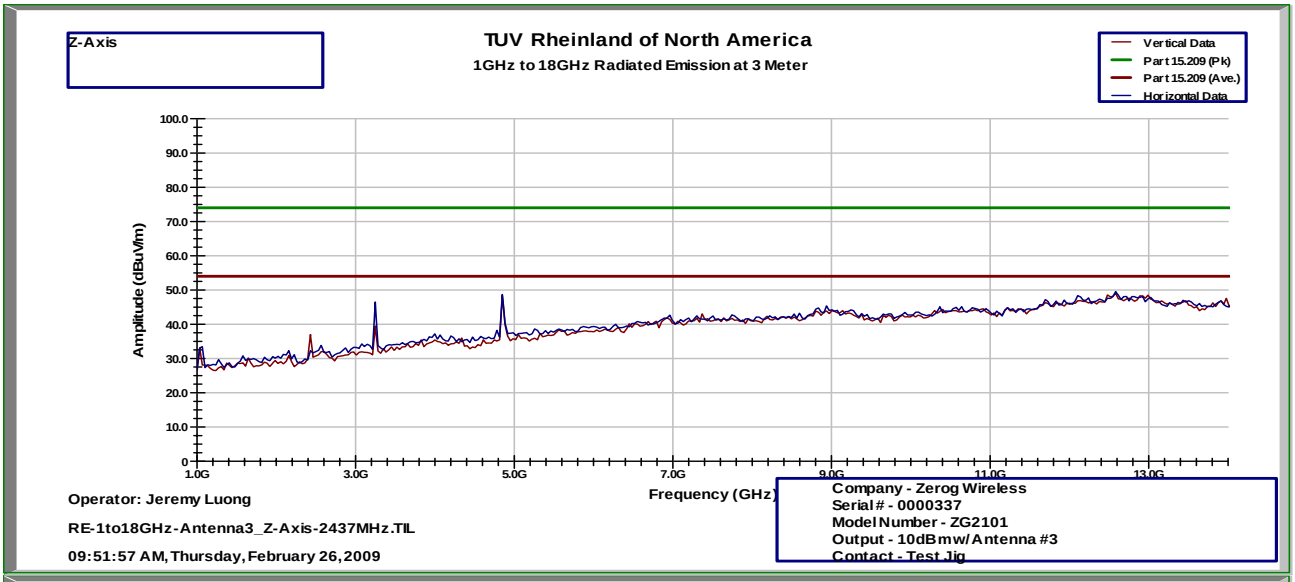


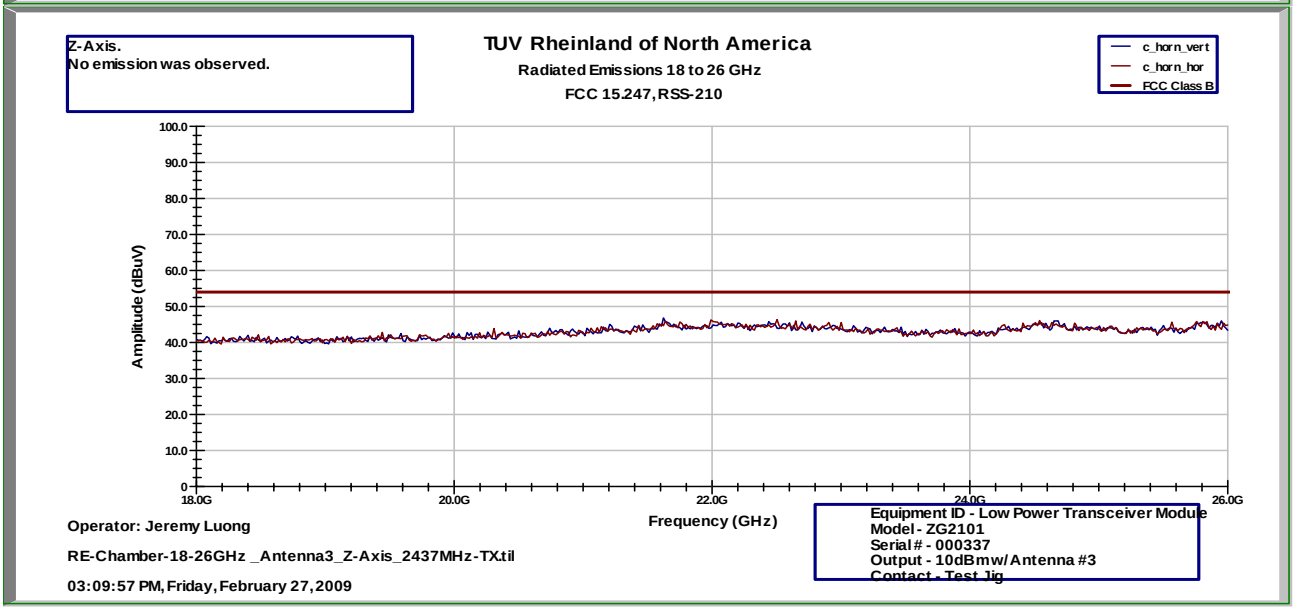
Notes: None.

SOP 1 Radiated Emissions

EUT Name	Low Power Transceiver Module	**Date**	February 26, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 41%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	2dBi PCB Antenna #3 on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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





Notes: None.

SOP 1 Radiated Emissions

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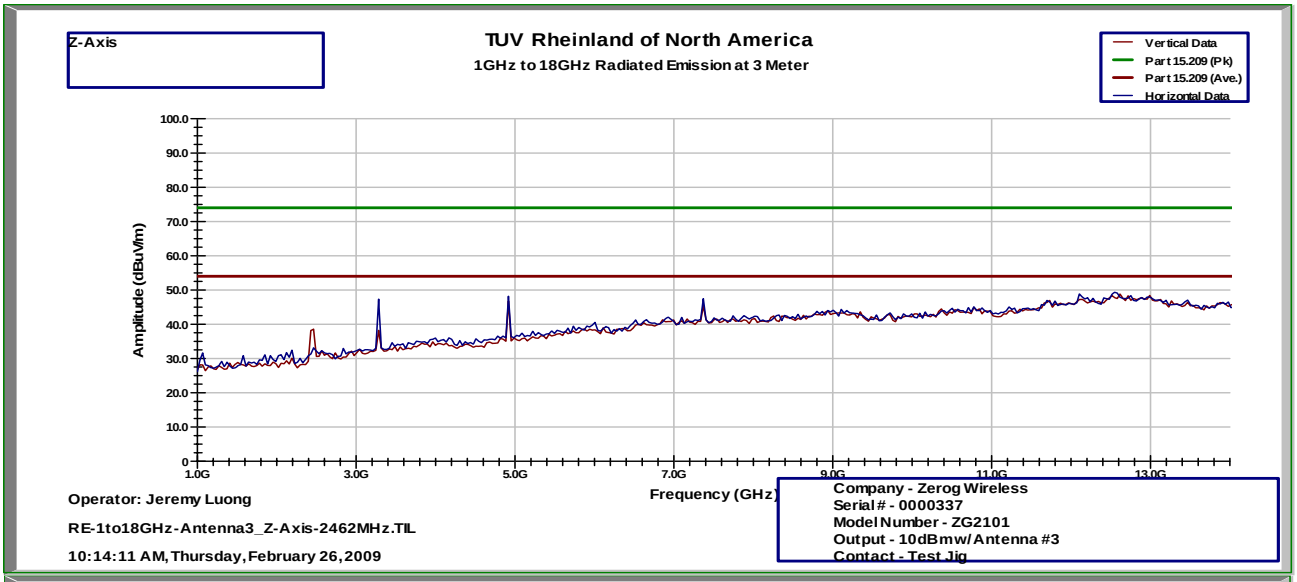
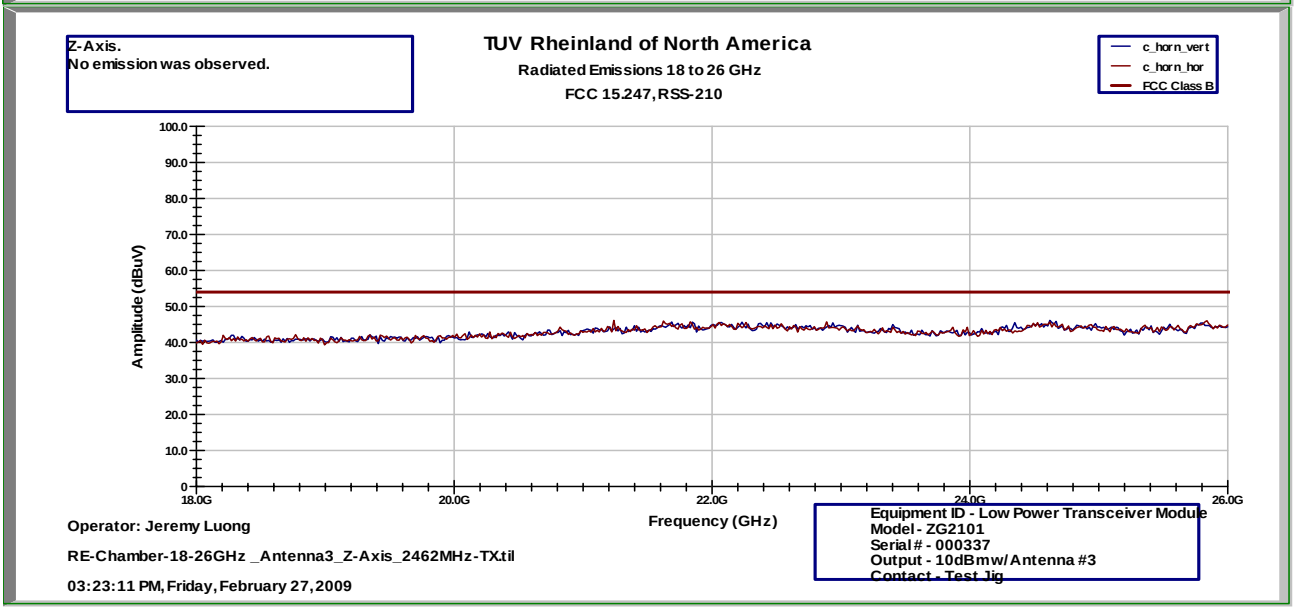
EUT Name	Low Power Transceiver Module	**Date**	February 26, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 41%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	2dBi PCB Antenna #3 on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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





Notes: None.

SOP 1 Radiated Emissions

EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 48%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Inverter F Antenna on Z-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	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 2412MHz										
31.307623	V	2.8	348	32.83	20.15	-6.87	13.28	40.00	-26.72	Spurious
197.985548	H	1.0	92	37.88	36.57	-12.71	23.86	43.50	-19.64	Spurious
263.969781	H	1.2	84	46.48	43.83	-9.76	34.07	46.00	-11.93	Spurious
Transmitted Data at 2437MHz										
32.448358	V	1.0	154	26.09	19.87	-7.57	12.30	40.00	-27.70	Spurious
105.691836	V	2.9	348	38.54	37.45	-15.59	21.86	43.50	-21.64	Spurious
198.000447	H	1.0	84	39.12	38.25	-12.71	25.54	43.50	-17.96	Spurious
264.003472	H	1.1	71	40.79	38.79	-9.76	29.03	46.00	-16.97	Spurious
396.001795	V	1.0	322	33.72	30.5	-6.41	24.09	46.00	-21.91	Spurious
711.251482	V	2.9	193	30.48	26.97	-0.59	26.38	46.00	-19.62	Spurious
929.639916	V	2.9	194	24.33	18.56	1.97	20.53	46.00	-25.47	Spurious
Transmitted Data at 2462MHz										
31.909737	V	3.1	201	25.27	20.35	-4.79	15.56	40.00	-24.44	Spurious
132.008401	H	1.6	87	35.29	33.64	-16.62	17.02	43.50	-26.48	Spurious
197.999346	H	1.1	255	39.04	38.02	-12.71	25.31	43.50	-18.19	Spurious
263.971902	H	1.0	101	41.39	38.72	-9.76	28.96	46.00	-17.04	Spurious
395.999017	V	1.0	42	34.54	31.53	-6.41	25.12	46.00	-20.88	Spurious
444.231835	H	2.9	355	24.08	18.98	-6.07	12.91	46.00	-33.09	Spurious
711.251032	V	2.7	186	30.22	27.17	-0.59	26.58	40.00	-19.42	Spurious

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

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

Notes: Z-Axis was the worst plane.

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EUT Name	Low Power Transceiver Module	**Date**	March 6, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 45%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Inverter F Antenna on Z-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM (Pk) Pk (dBuV/m)	FIM Ave (dBuV/m)	Total CF dBuV	E-Field Ave (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)	Type
Transmitted Data at 2412MHz										
3216.00	H	1.1	356	44.99	40.28	3.32	36.96	53.98	-17.02	Spurious
4824.00	H	1.0	35	58.13	50.74	7.63	43.11	53.98	-10.87	Harmonic
3216.00	V	1.0	3	47.65	39.96	3.36	36.6	53.98	-17.38	Spurious
4824.00	V	1.0	119	61.66	54.82	7.63	47.19	53.98	-6.79	Harmonic
Transmitted Data at 2437MHz										
3249.00	H	1.0	354	47.34	42.65	3.43	39.22	53.98	-14.76	Spurious
4874.00	H	1.0	85	58.69	51.73	7.86	43.87	53.98	-10.11	Harmonic
3249.00	V	1.1	279	45.72	41.29	3.48	37.81	53.98	-16.17	Spurious
4874.00	V	1.0	150	60.41	53.89	7.86	46.03	53.98	-7.95	Harmonic
Transmitted Data at 2462MHz										
3282.68	H	100	352	48.59	43.82	3.55	40.27	53.98	-13.71	Spurious
4924.00	H	101	124	55.28	48.15	8.06	40.09	53.98	-13.89	Harmonic
7386.00	H	103	105	66.85	56.33	11.63	44.7	53.98	-9.28	Harmonic
3282.68	V	100	275	45.17	39.42	3.60	35.82	53.98	-18.16	Spurious
4924.00	V	101	104	57.21	50.67	8.06	42.61	53.98	-11.37	Harmonic
7386.00	V	102	18	61.53	54.97	11.60	43.37	53.98	-10.61	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 $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Z-Axis was the worst plane. The harmonics were even below the spurious limit.

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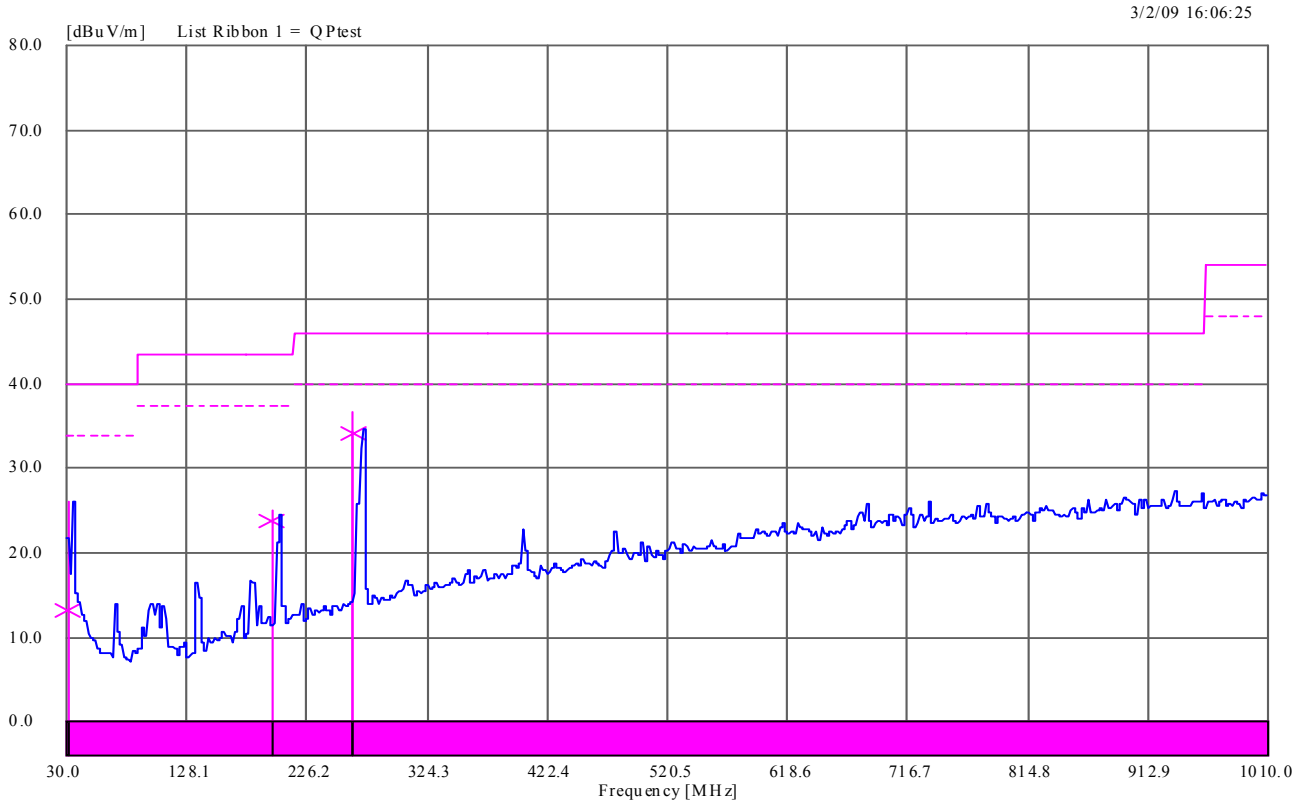
EUT Name	Low Power Transceiver Module	**Date**	March 2, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Inverter F Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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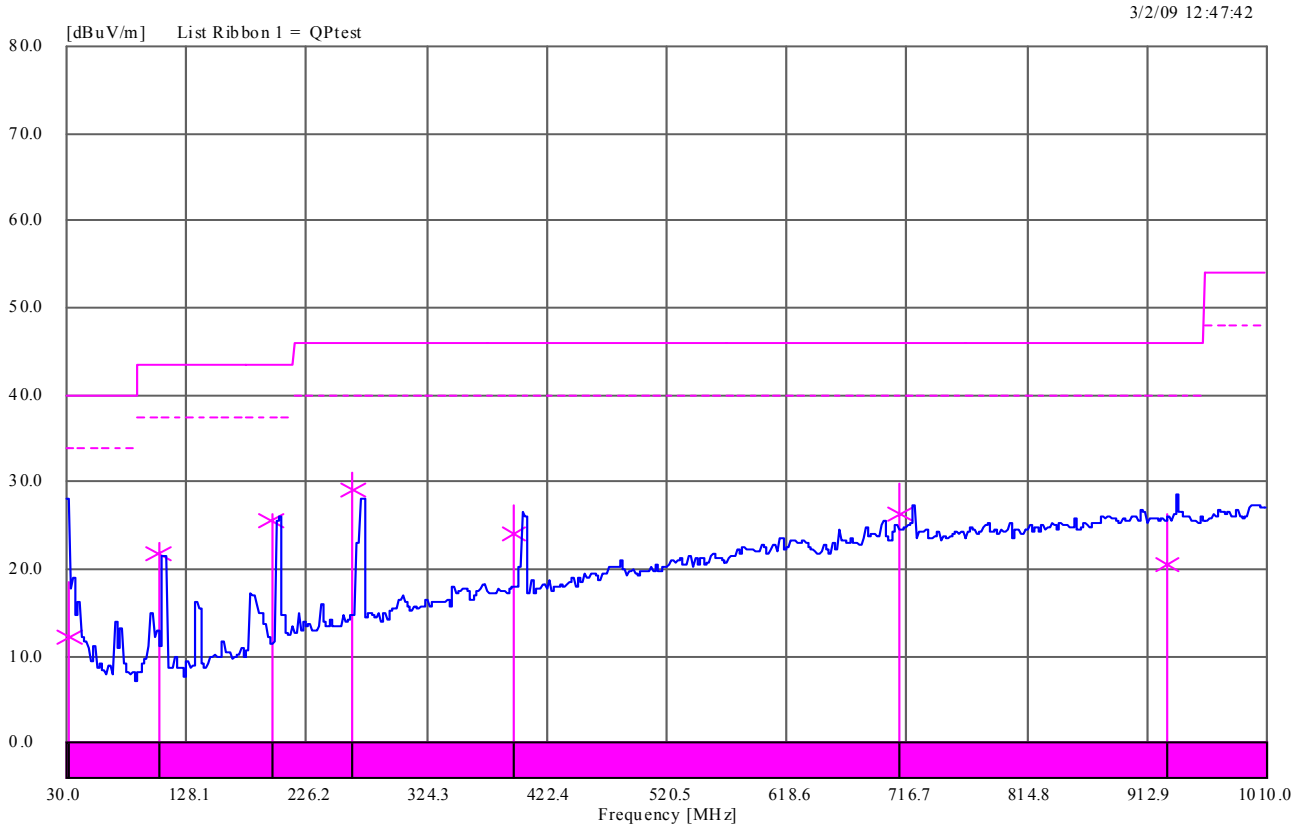
EUT Name	Low Power Transceiver Module	**Date**	March 2, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Inverter F Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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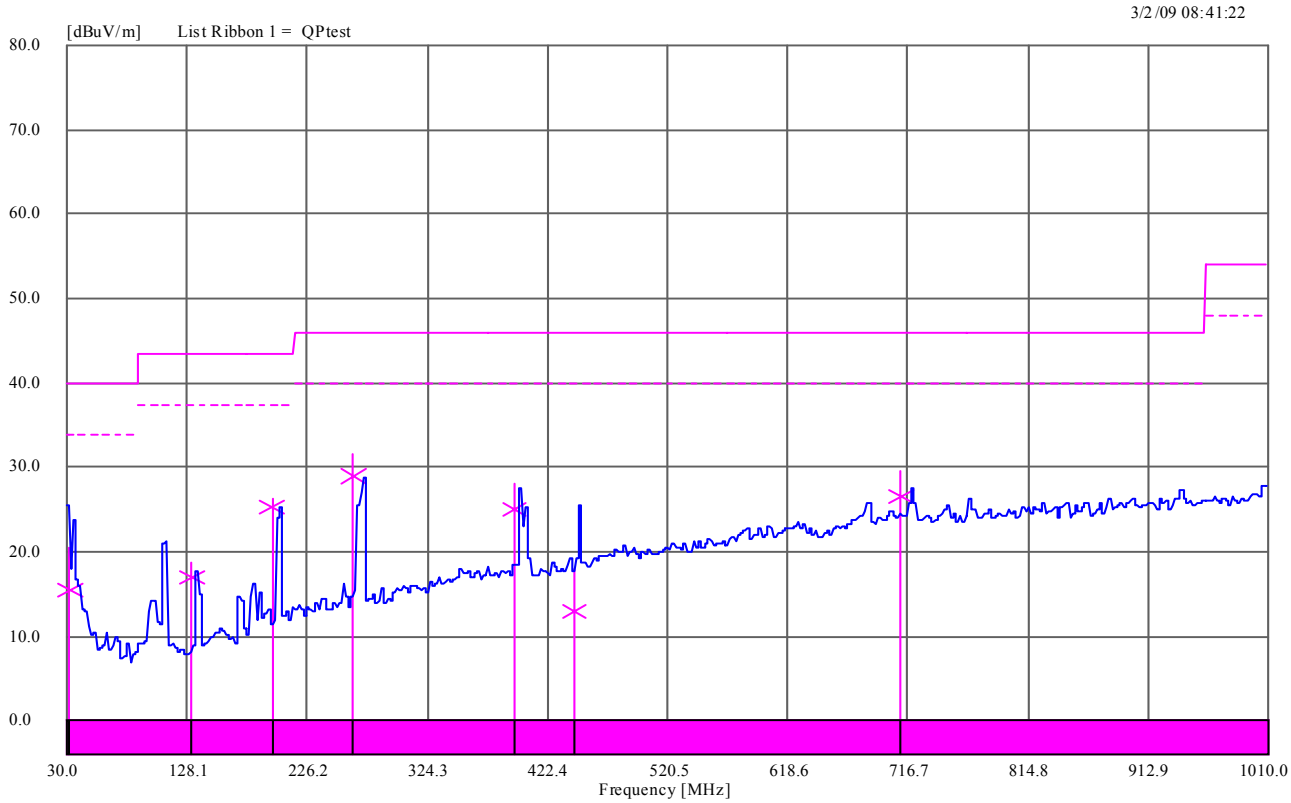
EUT Name	Low Power Transceiver Module	**Date**	March 2, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	21°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Inverter F Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

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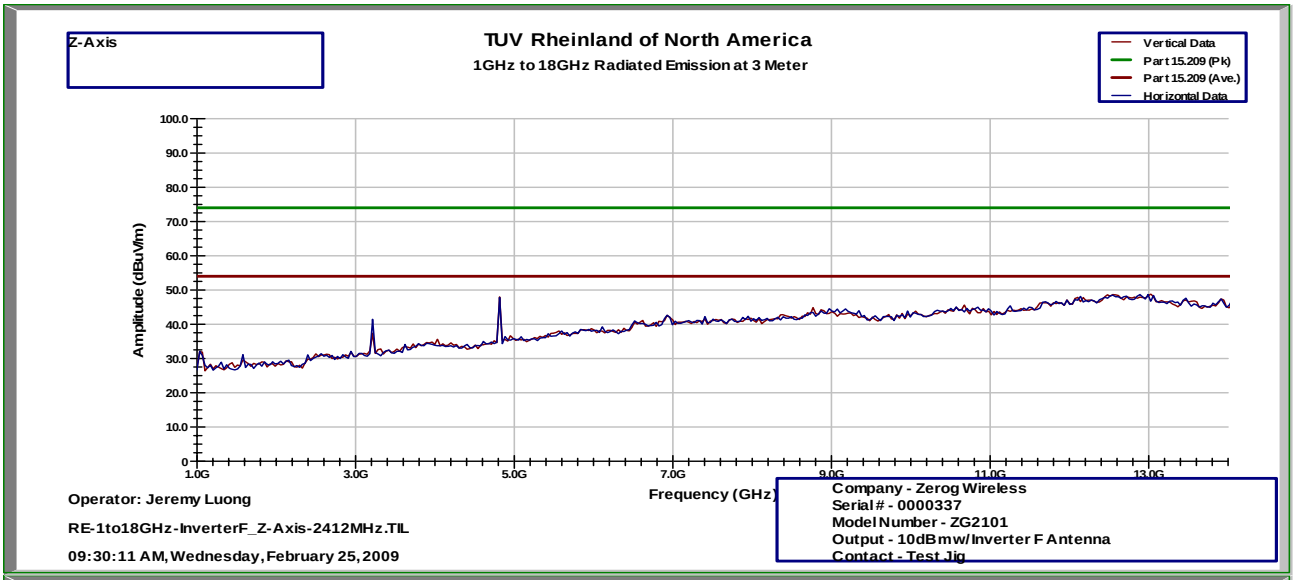
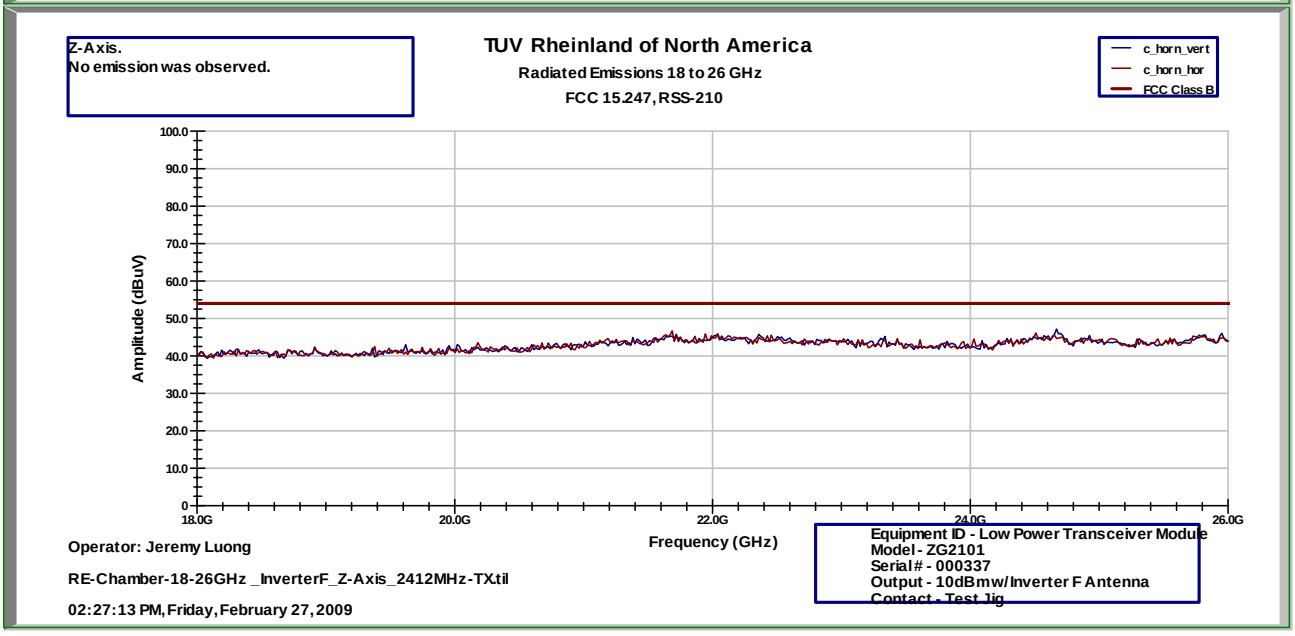
EUT Name	Low Power Transceiver Module	**Date**	February 26, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 41%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Inverter F Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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



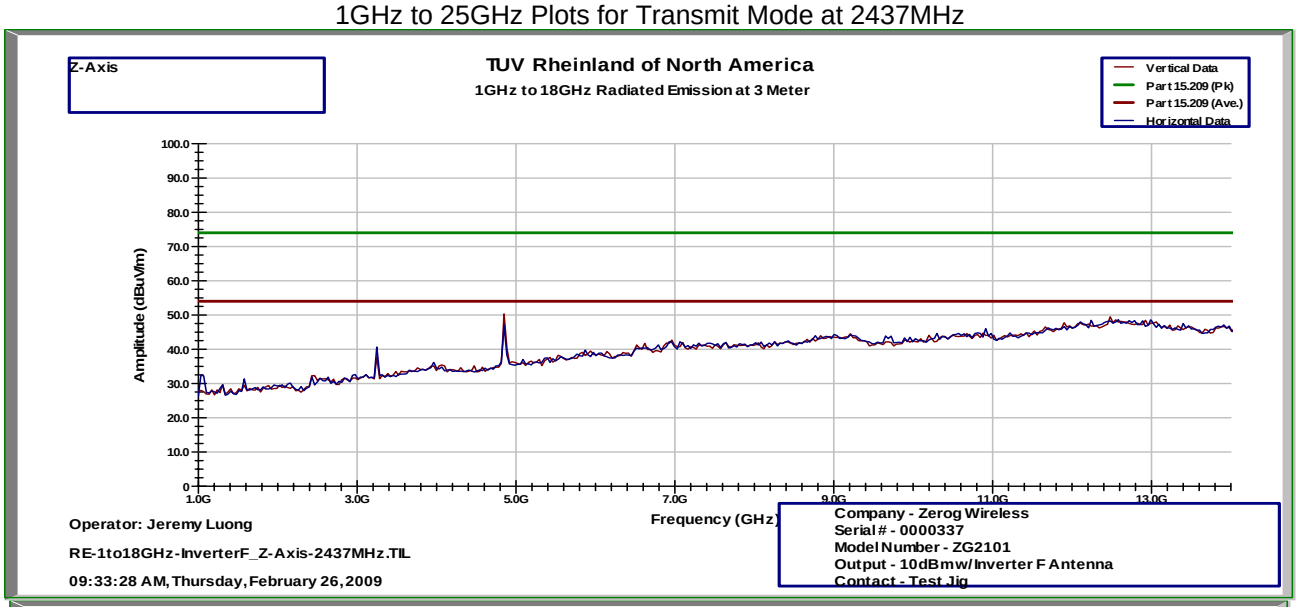


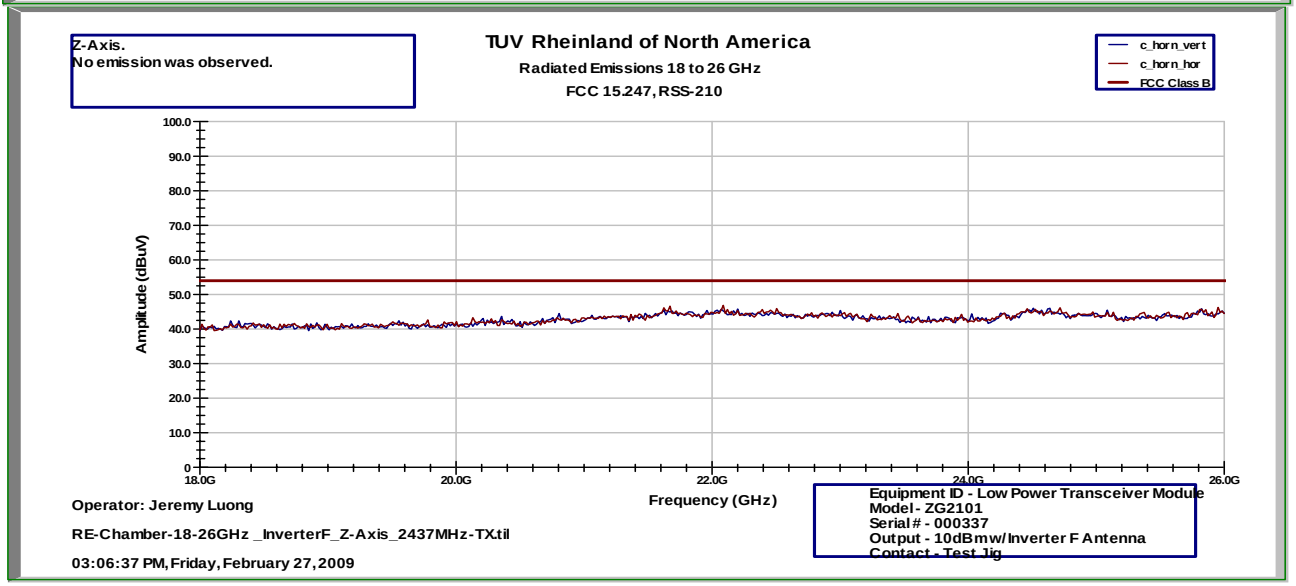
Notes: None.

SOP 1 Radiated Emissions

EUT Name	Low Power Transceiver Module	**Date**	February 26, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 41%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Inverter F Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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



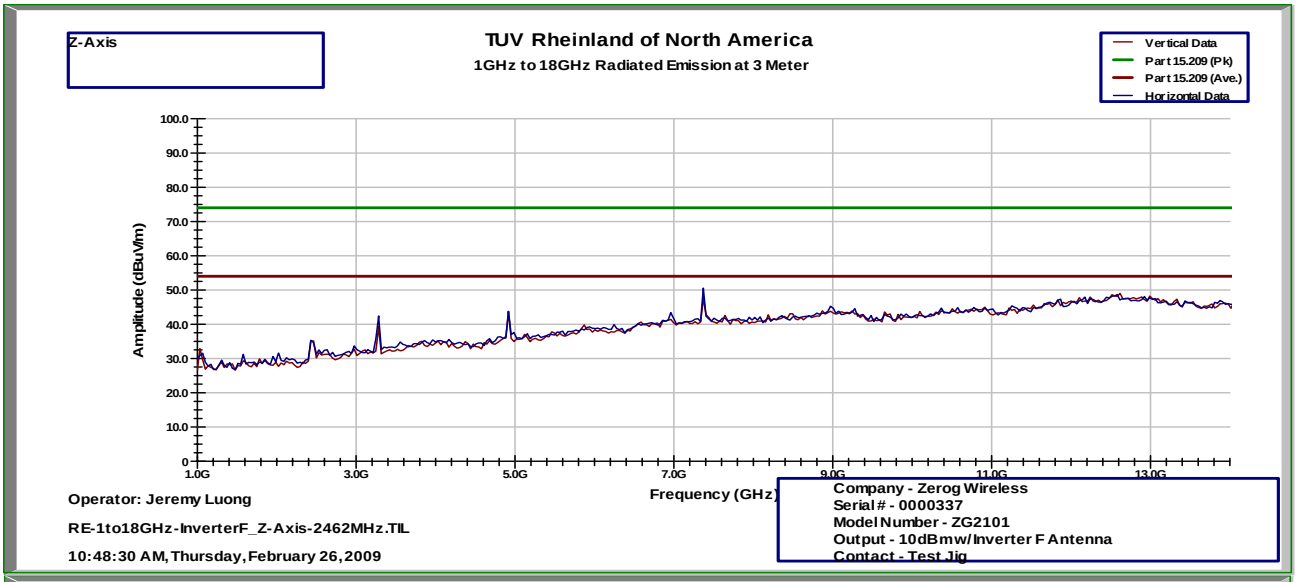


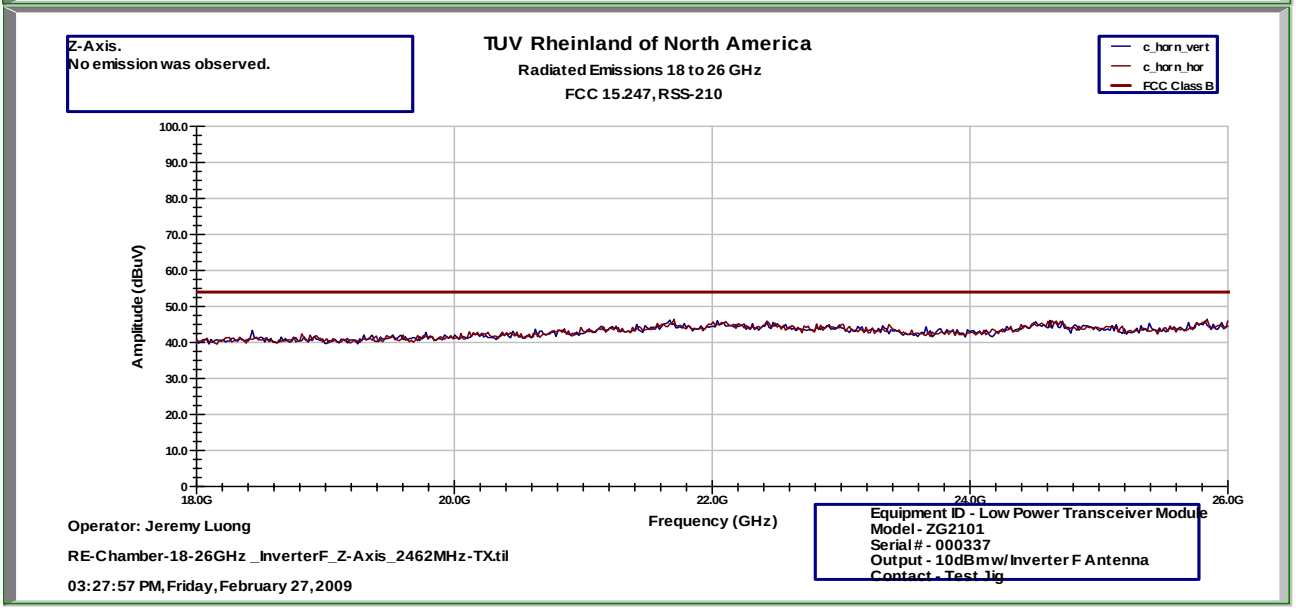
Notes: None.

SOP 1 Radiated Emissions

EUT Name	Low Power Transceiver Module	**Date**	February 26, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 41%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Inverter F Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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





Notes: None.

SOP 1 Radiated Emissions

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EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 48%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	RFA-02D3-70-100 Antenna on X-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	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 2412MHz										
32.568718	V	294	79	38.7	24.81	-7.63	17.18	40.00	-22.82	Spurious
132.002656	H	184	84	34.24	32.63	-16.62	16.01	43.50	-27.49	Spurious
198.001625	H	101	256	36.98	35.68	-12.71	22.97	43.50	-20.53	Spurious
263.947645	H	106	266	39.14	35.86	-9.76	26.10	46.00	-19.90	Spurious
396.013763	H	102	93	35.56	32.53	-6.41	26.12	46.00	-19.88	Spurious
Transmitted Data at 2437MHz										
105.700262	V	102	358	40.21	39.23	-15.59	23.64	43.50	-19.86	Spurious
198.003476	H	101	87	36.71	35.61	-12.71	22.90	43.50	-20.60	Spurious
264.014984	H	104	114	38.95	36.55	-9.76	26.79	46.00	-19.21	Spurious
396.000492	H	197	115	35.31	32.65	-6.41	26.24	46.00	-19.76	Spurious
Transmitted Data at 2462MHz										
32.339321	H	262	282	24.38	19.43	-5.69	13.74	40.00	-26.26	Spurious
131.996486	V	240	211	33.38	30.92	-16.62	14.30	43.50	-29.20	Spurious
197.950000	H	100	83	34.56	32.68	-12.55	20.13	43.50	-23.37	Spurious
263.973682	V	125	150	39.03	34.82	-9.76	25.06	46.00	-20.94	Spurious
395.955793	V	219	152	29.02	24.08	-6.41	17.67	46.00	-28.33	Spurious

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

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

Notes: X-Axis was the worst plane.

SOP 1 Radiated Emissions

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EUT Name	Low Power Transceiver Module	**Date**	March 6, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 45%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	RFA-02D3-70-100 Antenna on X-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM (Pk) Pk (dBuV/m)	FIM Ave (dBuV/m)	Total CF dBuV	E-Field Ave (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)	Type
Transmitted Data at 2412MHz										
3216.00	H	1.6	271	52.40	47.29	3.32	43.97	53.98	-10.01	Spurious
4824.00	H	1.8	7	64.40	56.99	7.63	49.36	53.98	-4.62	Harmonic
3216.00	V	1.1	21	50.12	44.80	3.36	41.44	53.98	-12.54	Spurious
4824.00	V	1.7	14	61.36	53.61	7.63	45.98	53.98	-8.00	Harmonic
Transmitted Data at 2437MHz										
3249.00	H	1.1	139	45.93	41.27	3.43	37.84	53.98	-16.14	Spurious
4874.00	H	1.4	34	62.62	55.28	7.86	47.42	53.98	-6.56	Harmonic
3249.00	V	1.0	20	48.25	43.81	3.48	40.33	53.98	-13.65	Spurious
4874.00	V	1.0	44	58.42	50.71	7.86	42.85	53.98	-11.13	Harmonic
Transmitted Data at 2462MHz										
3282.68	H	156	9	43.33	38.65	3.55	35.1	53.98	-18.88	Spurious
4924.00	H	176	32	58.50	50.98	8.06	42.92	53.98	-11.06	Harmonic
7386.00	H	105	356	62.12	52.57	11.63	40.94	53.98	-13.04	Harmonic
3282.68	V	100	12	43.09	38.08	3.60	34.48	53.98	-19.50	Spurious
4924.00	V	100	0	53.27	45.95	8.06	37.89	53.98	-16.09	Harmonic
7386.00	V	121	353	59.74	50.57	11.60	38.97	53.98	-15.01	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 $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: X-Axis was the worst plane. The harmonics were even below the spurious limit.

SOP 1 Radiated Emissions

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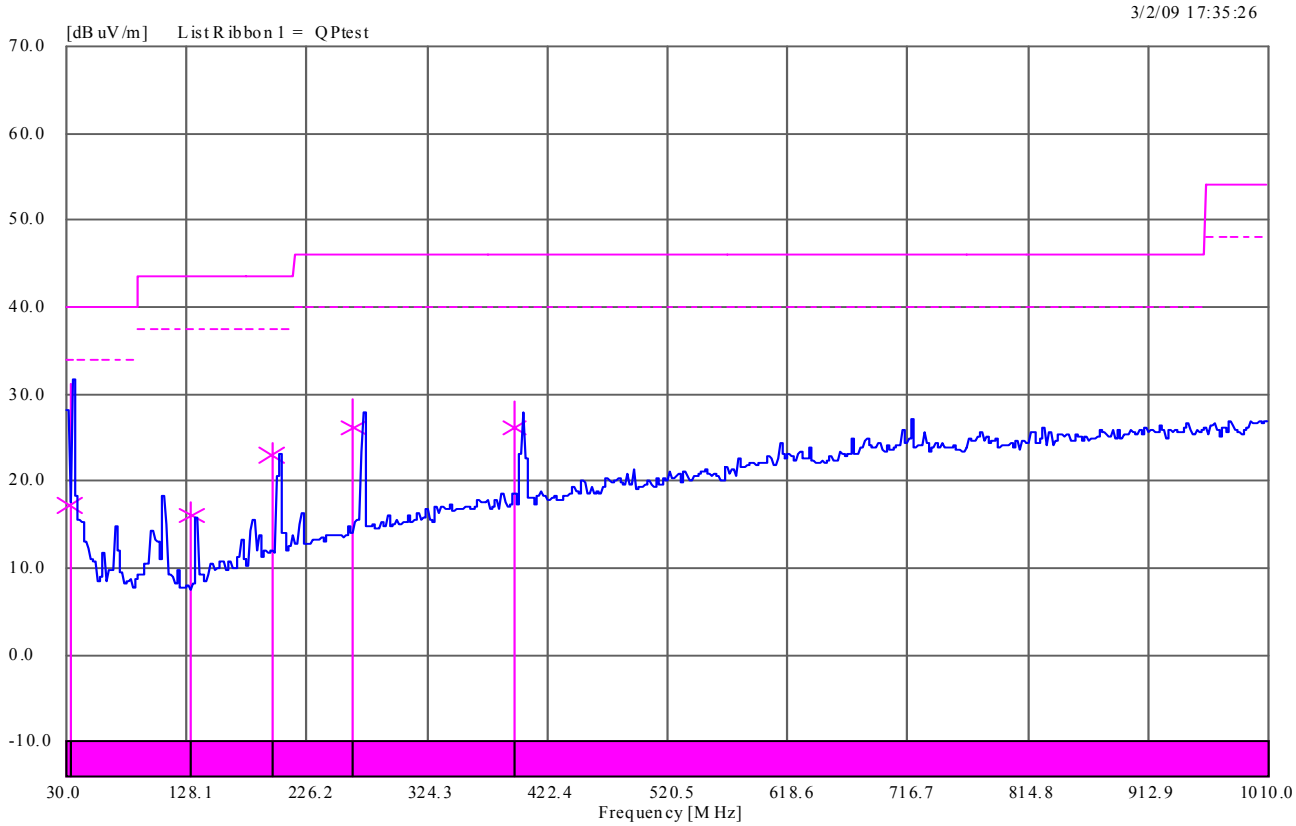
EUT Name	Low Power Transceiver Module	**Date**	March 2, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	RFA-02D3-70-100 Antenna on X-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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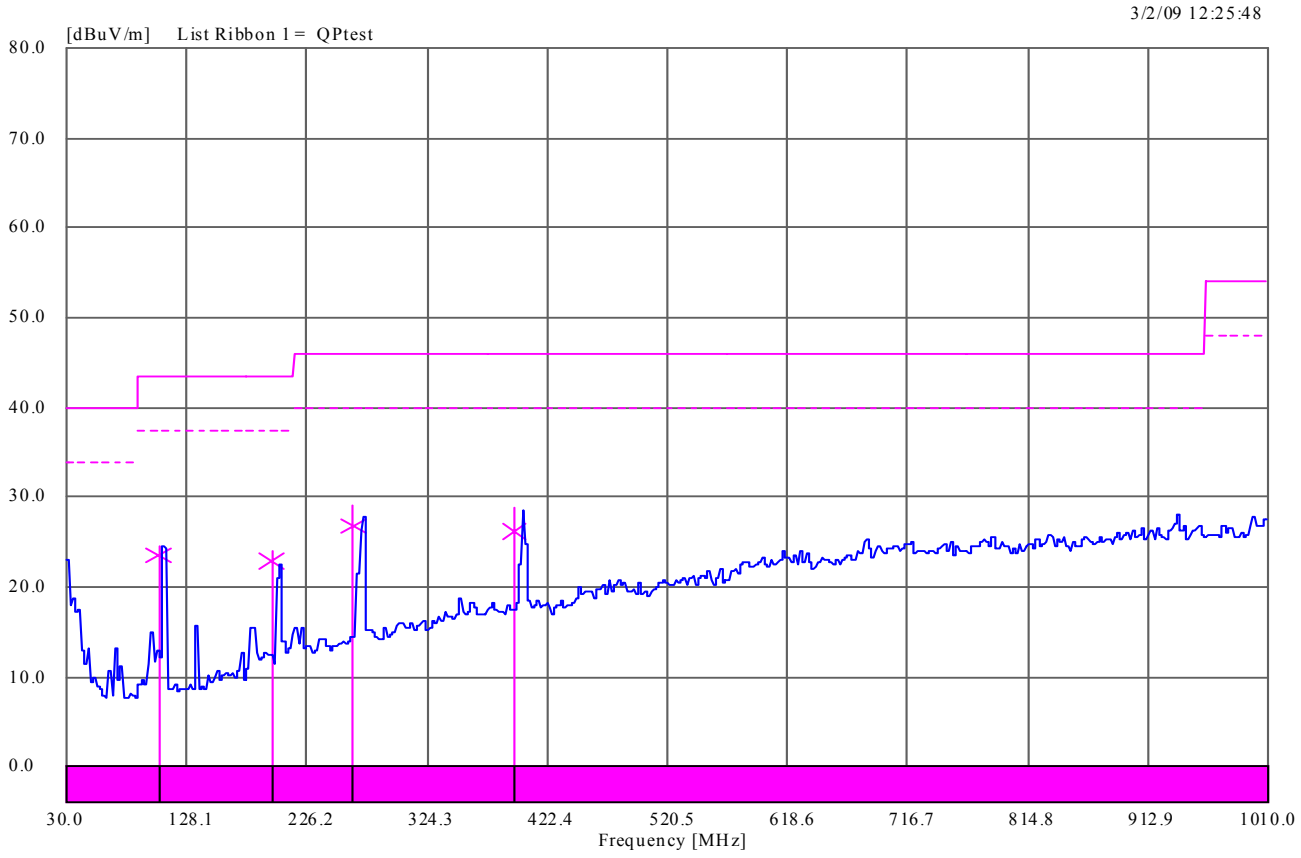
EUT Name	Low Power Transceiver Module	**Date**	March 2, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	RFA-02D3-70-100 Antenna on X-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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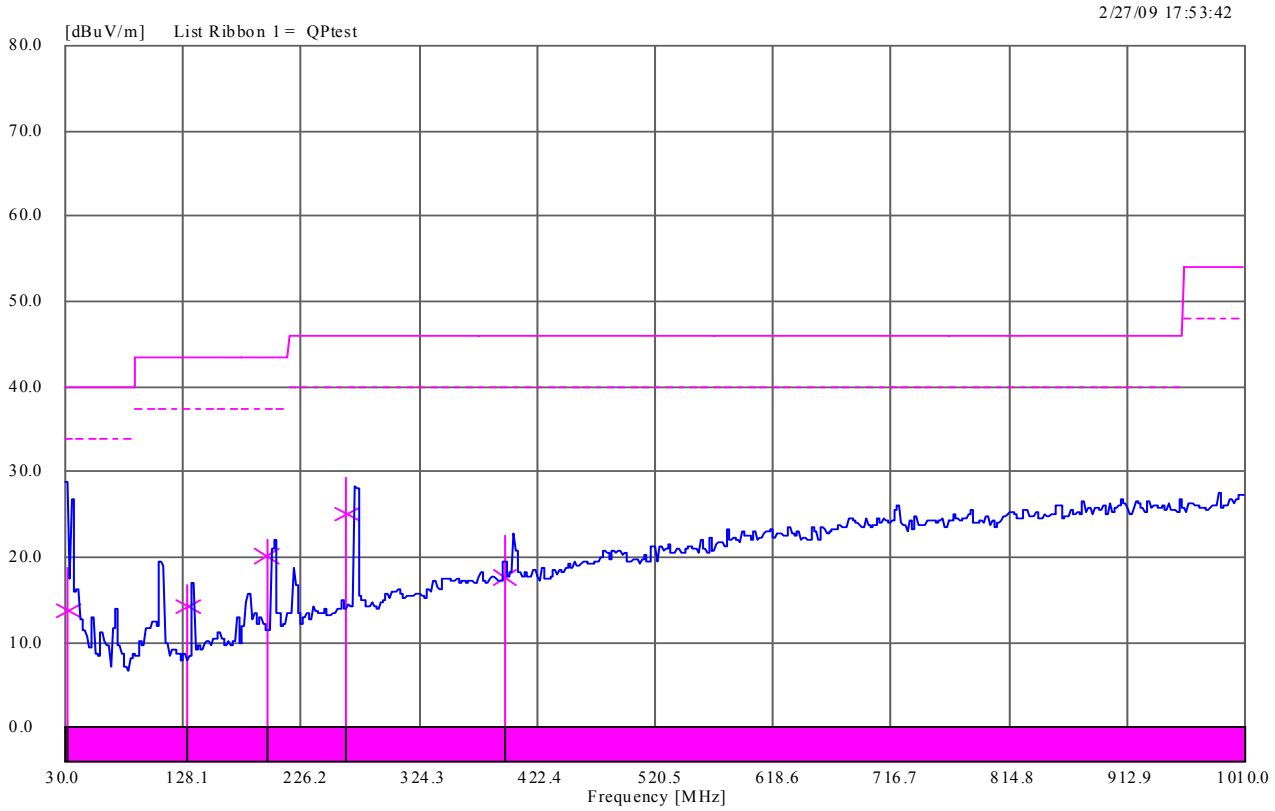
EUT Name	Low Power Transceiver Module	**Date**	February 27, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 40%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	RFA-02D3-70-100 Antenna on X-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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

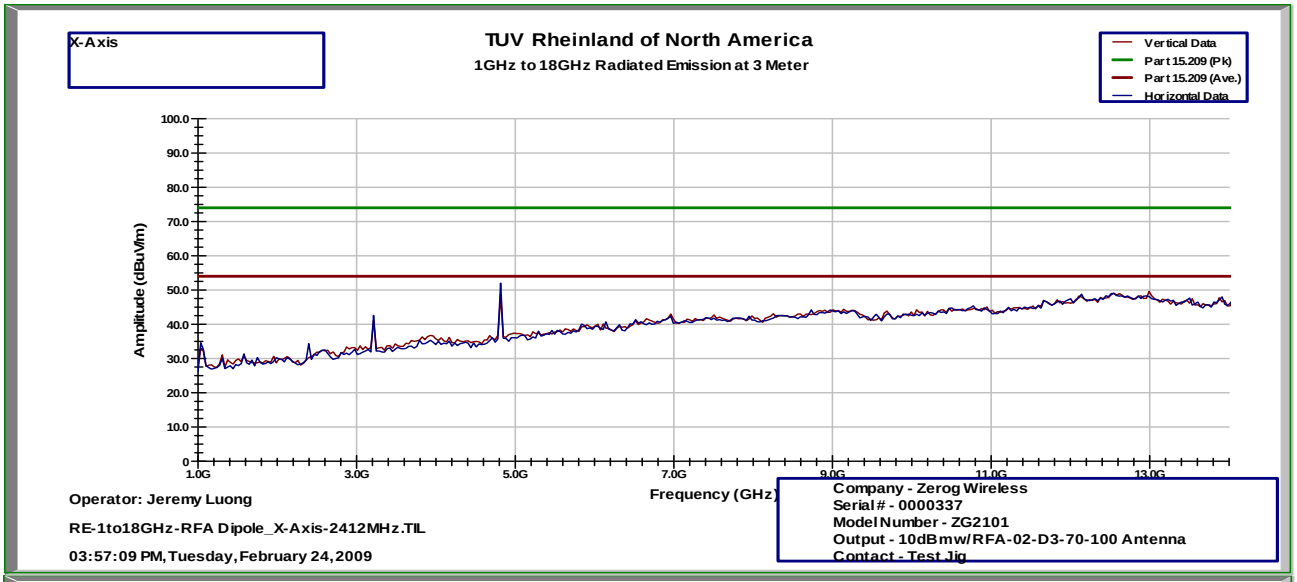


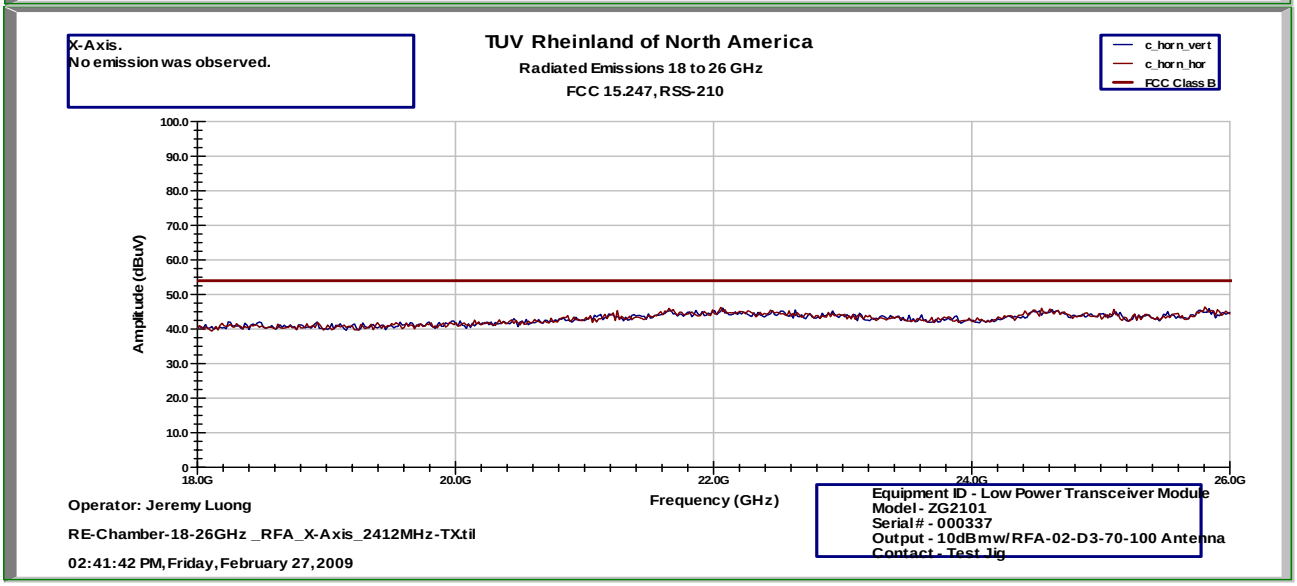
Notes: None.

SOP 1 Radiated Emissions

EUT Name	Low Power Transceiver Module	**Date**	February 24, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	23°C / 38%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	RFA-02D3-70-100 Antenna on X-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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



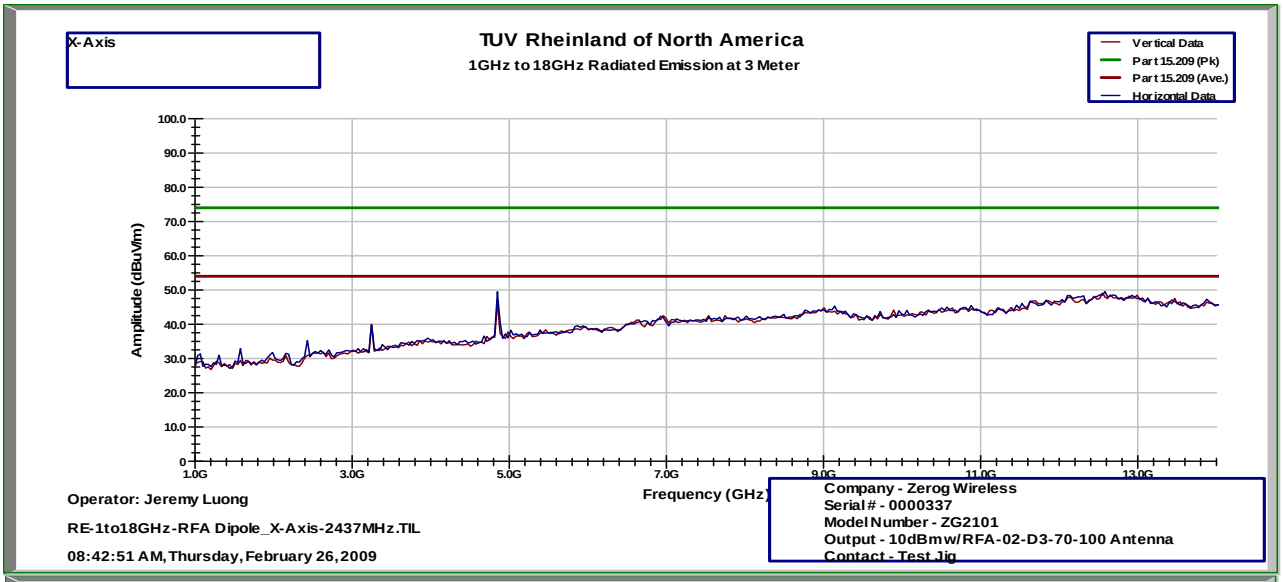


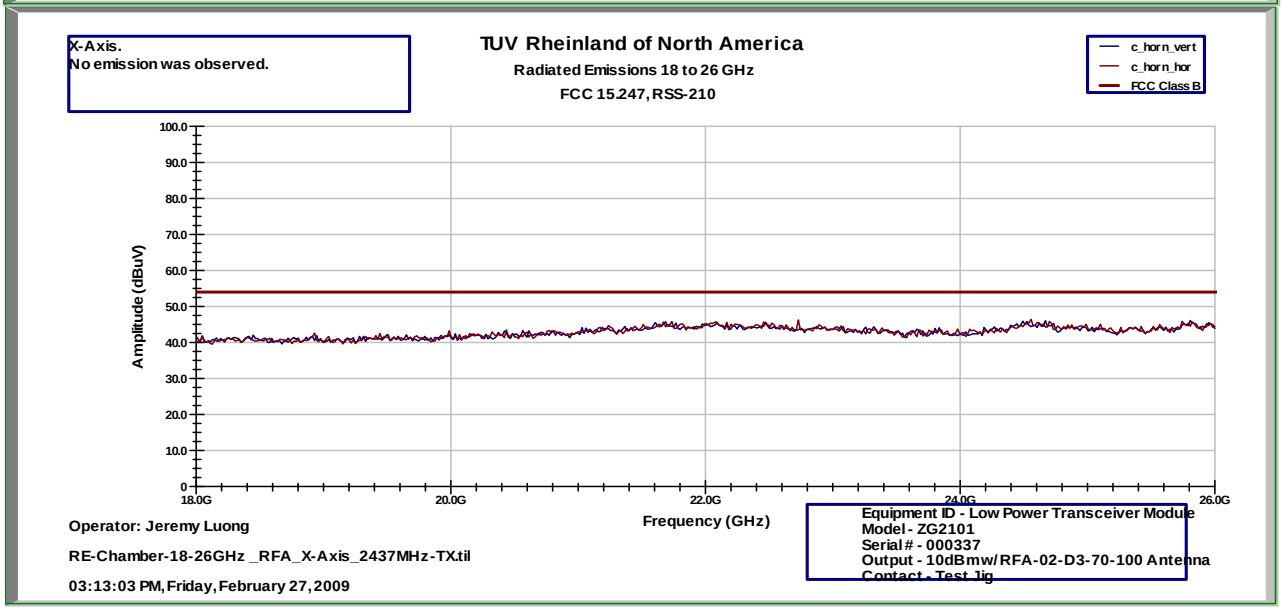
Notes: None.

SOP 1 Radiated Emissions

EUT Name	Low Power Transceiver Module	**Date**	February 26, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 41%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	RFA-02D3-70-100 Antenna on X-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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





Notes: None.

SOP 1 Radiated Emissions

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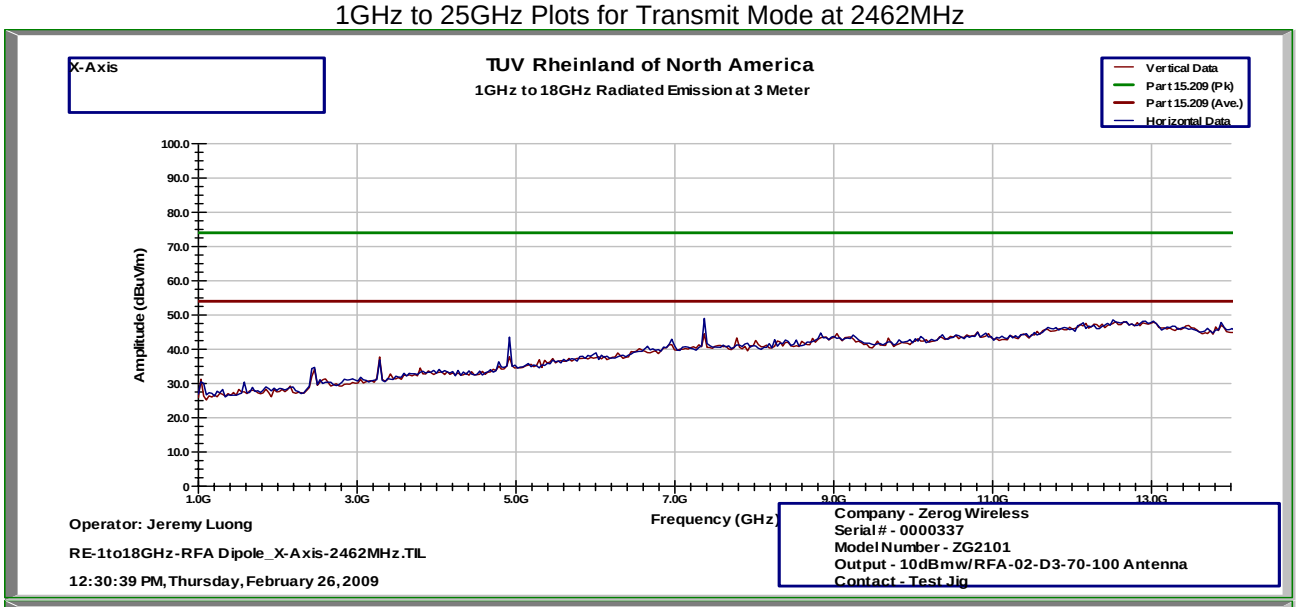
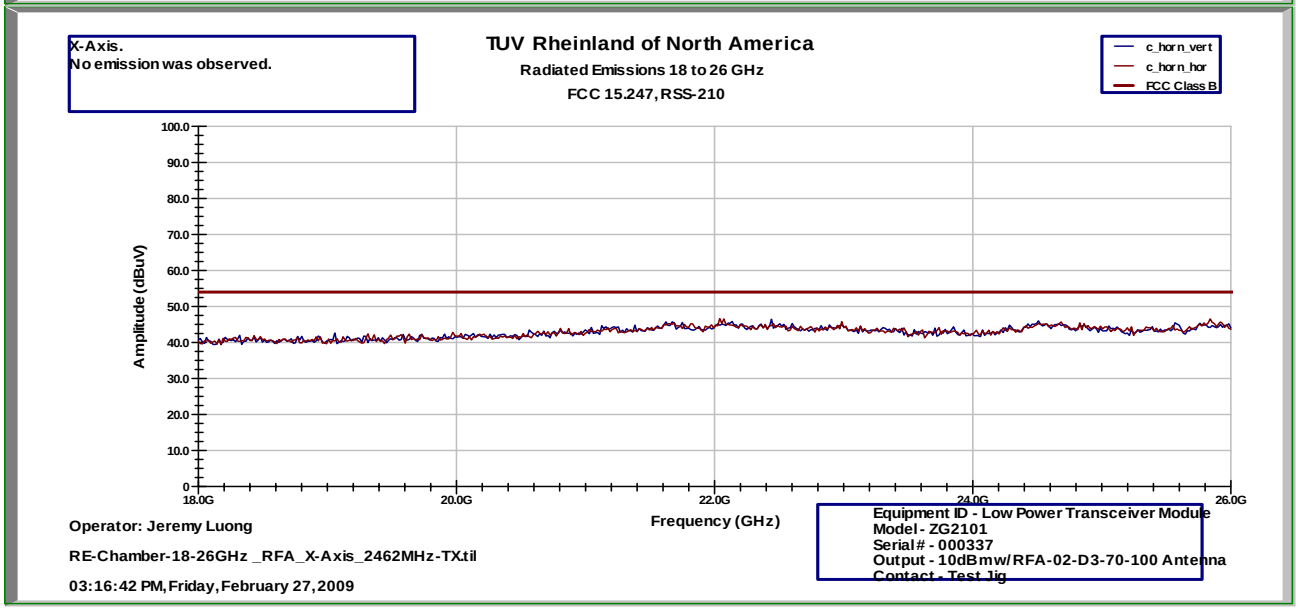
EUT Name	Low Power Transceiver Module	**Date**	February 26, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 41%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	RFA-02D3-70-100 Antenna on X-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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





Notes: None.

SOP 1 Radiated Emissions

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EUT Name	Low Power Transceiver Module	**Date**	March 2, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	23°C / 47%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Helical Antenna on Z-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	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 2412MHz										
263.949981	H	1.0	93	42.78	39.5	-9.76	29.74	46.00	-16.26	Spurious
Transmitted Data at 2437MHz										
31.149337	V	1.0	57	25.97	20.88	-4.95	15.93	40.00	-24.07	Spurious
105.675270	V	1.0	340	40.6	40.56	-15.59	24.97	43.50	-18.53	Spurious
263.975263	H	1.0	92	40.26	37.83	-9.76	28.07	46.00	-17.93	Spurious
711.256469	V	2.9	289	29.62	27.04	-0.59	26.45	46.00	-19.55	Spurious
Transmitted Data at 2462MHz										
32.339321	H	2.6	282	24.38	19.43	-5.69	13.74	40.00	-26.26	Spurious
131.996486	V	2.4	211	33.38	30.92	-16.62	14.30	43.50	-29.20	Spurious
197.950000	H	1.0	83	34.56	32.68	-12.55	20.13	43.50	-23.37	Spurious
263.973682	V	1.2	150	39.03	34.82	-9.76	25.06	46.00	-20.94	Spurious
395.955793	V	2.1	152	29.02	24.08	-6.41	17.67	46.00	-28.33	Spurious

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

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

Notes: Z-Axis was the worst plane.

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EUT Name	Low Power Transceiver Module	**Date**	February 25, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 42%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Helical Antenna on Z-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM (Pk) Pk (dBuV/m)	FIM Ave (dBuV/m)	Total CF dBuV	E-Field Ave (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)	Type
Transmitted Data at 2412MHz										
3216.00	H	1.0	300	50.23	44.50	3.32	41.18	53.98	-12.80	Spurious
4824.00	H	1.0	36	59.45	52.28	7.63	44.65	53.98	-9.33	Harmonic
3216.00	V	1.0	352	48.67	42.92	3.36	39.56	53.98	-14.42	Spurious
4824.00	V	1.0	33	64.30	57.54	7.63	49.91	53.98	-4.07	Harmonic
Transmitted Data at 2437MHz										
3249.00	H	1.0	334	44.71	39.92	3.43	36.49	53.98	-17.49	Spurious
4874.00	H	1.0	90	55.45	48.34	7.86	40.48	53.98	-13.50	Harmonic
3249.00	V	1.0	46	41.84	35.09	3.48	31.61	53.98	-22.37	Spurious
4874.00	V	1.0	34	62.53	55.45	7.86	47.59	53.98	-6.39	Harmonic
Transmitted Data at 2462MHz										
3282.68	H	1.0	345	49.46	44.96	3.55	41.41	53.98	-12.57	Spurious
4924.00	H	1.0	237	58.24	50.92	8.06	42.86	53.98	-11.12	Harmonic
7386.00	H	1.0	65	62.62	53.44	11.63	41.81	53.98	-12.17	Harmonic
3282.68	V	1.0	282	45.74	40.34	3.60	36.74	53.98	-17.24	Spurious
4924.00	V	1.0	128	61.22	53.81	8.06	45.75	53.98	-8.23	Harmonic
7386.00	V	1.0	3	59.63	51.24	11.60	39.64	53.98	-14.34	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 $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Z-Axis was the worst plane. The harmonics were even below the spurious limit.

SOP 1 Radiated Emissions

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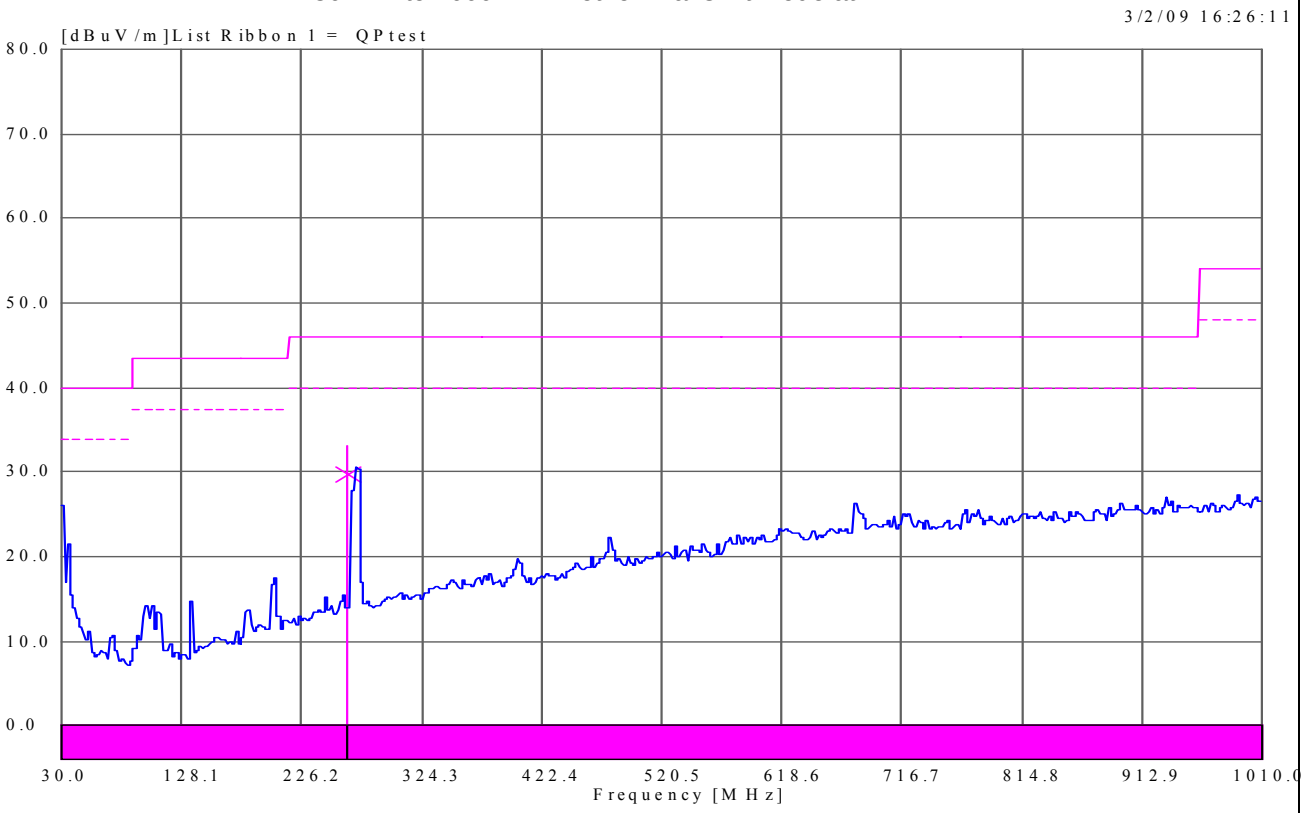
EUT Name	Low Power Transceiver Module	**Date**	March 2, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Helical Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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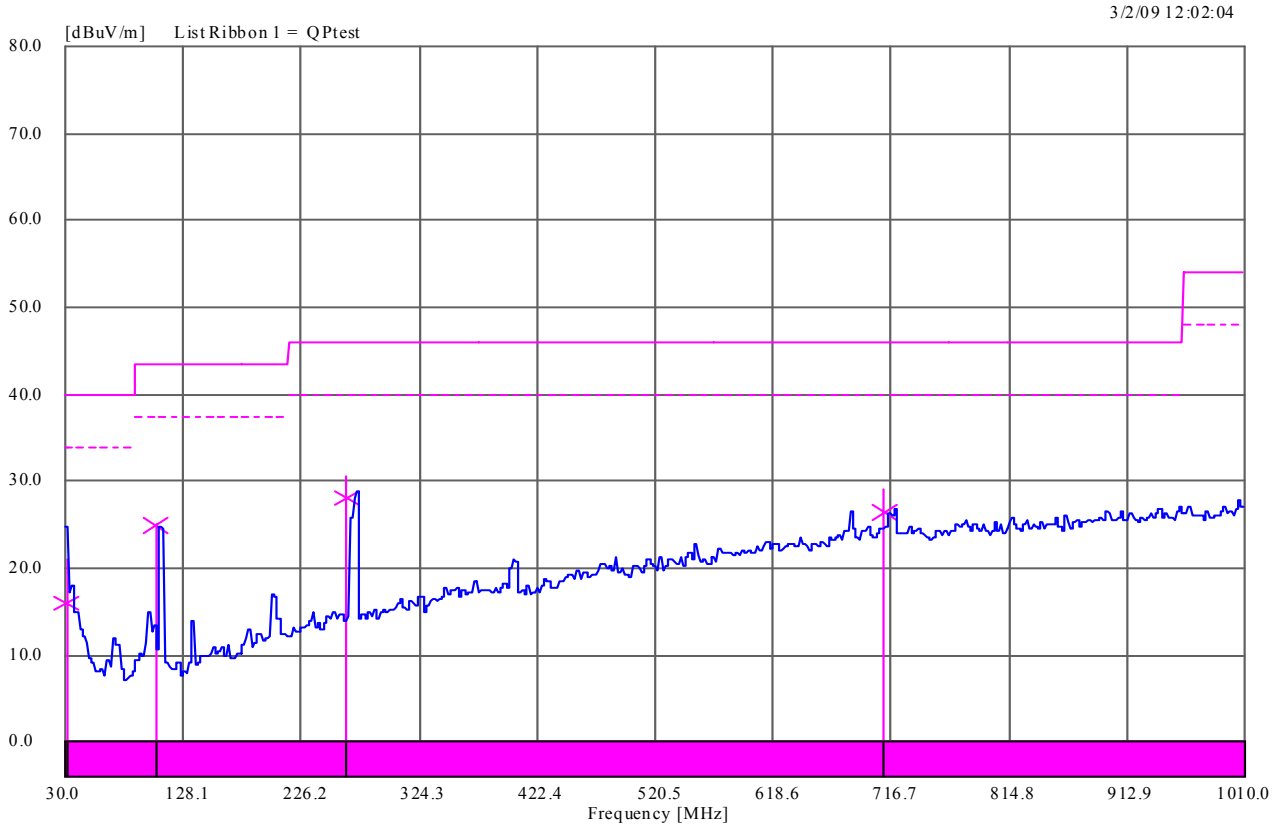
EUT Name	Low Power Transceiver Module	**Date**	March 2, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Helical Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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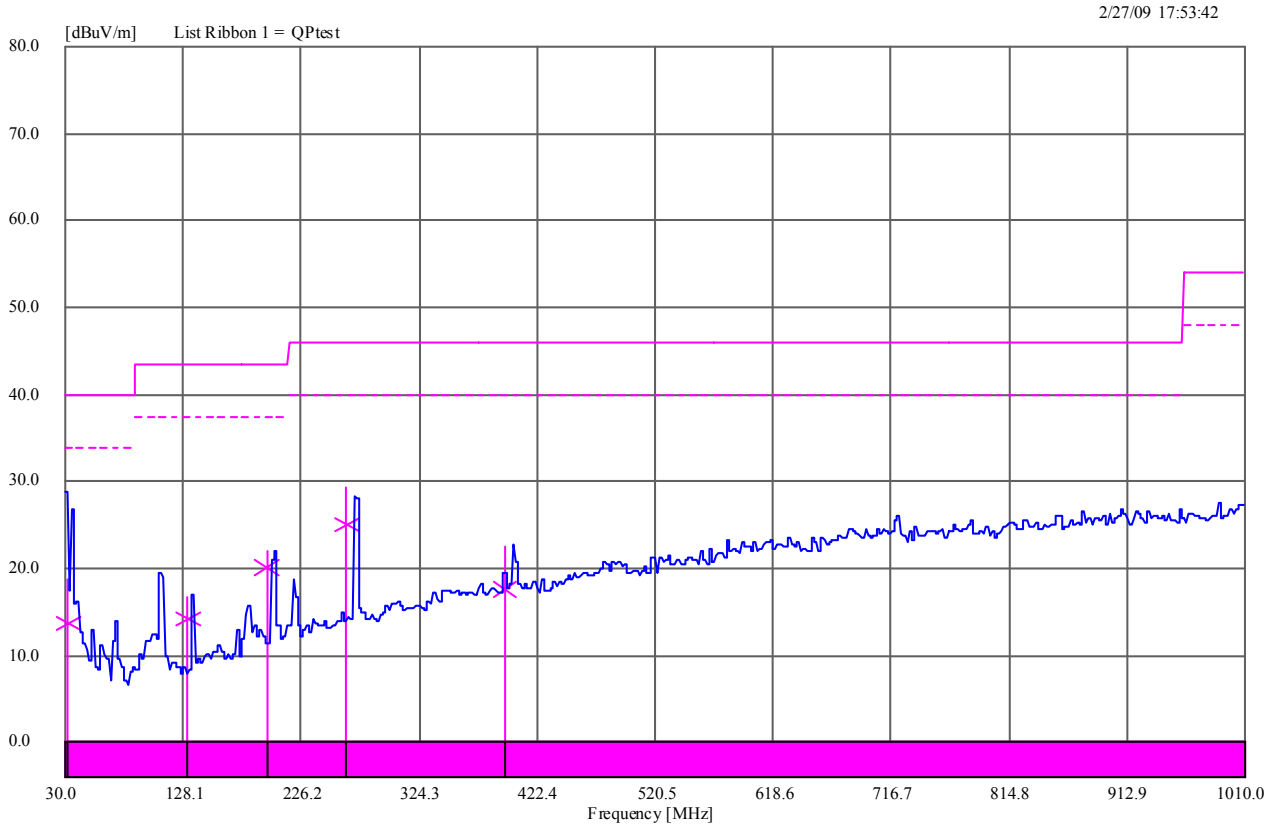
EUT Name	Low Power Transceiver Module	**Date**	February 27, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 40%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Helical Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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

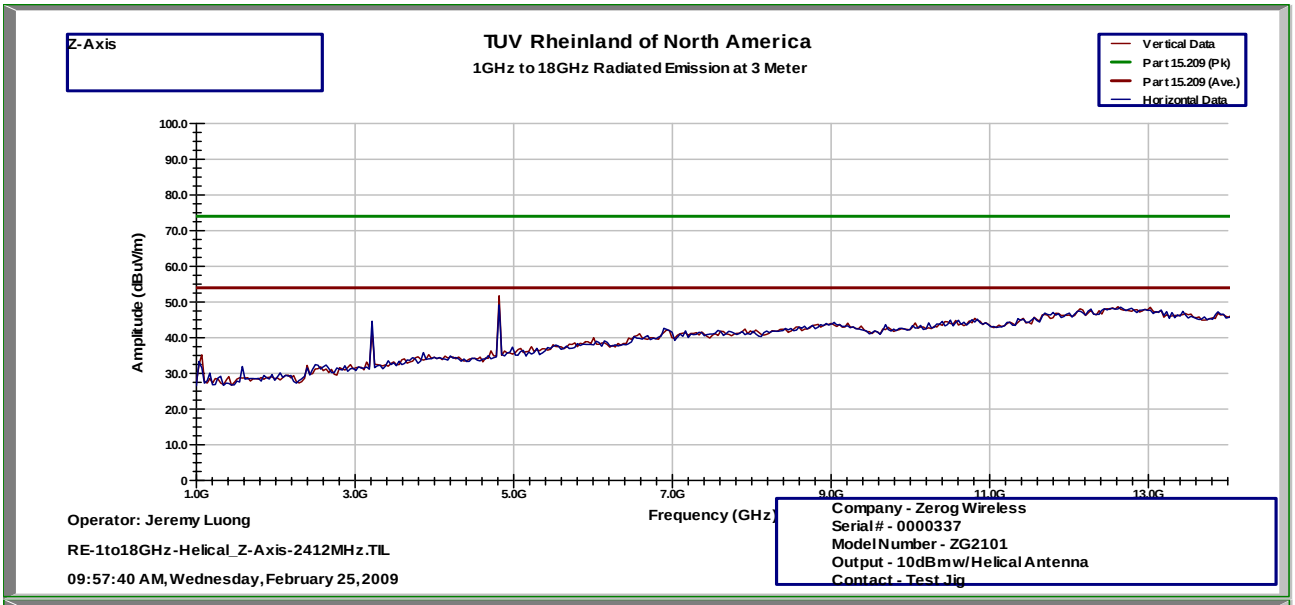


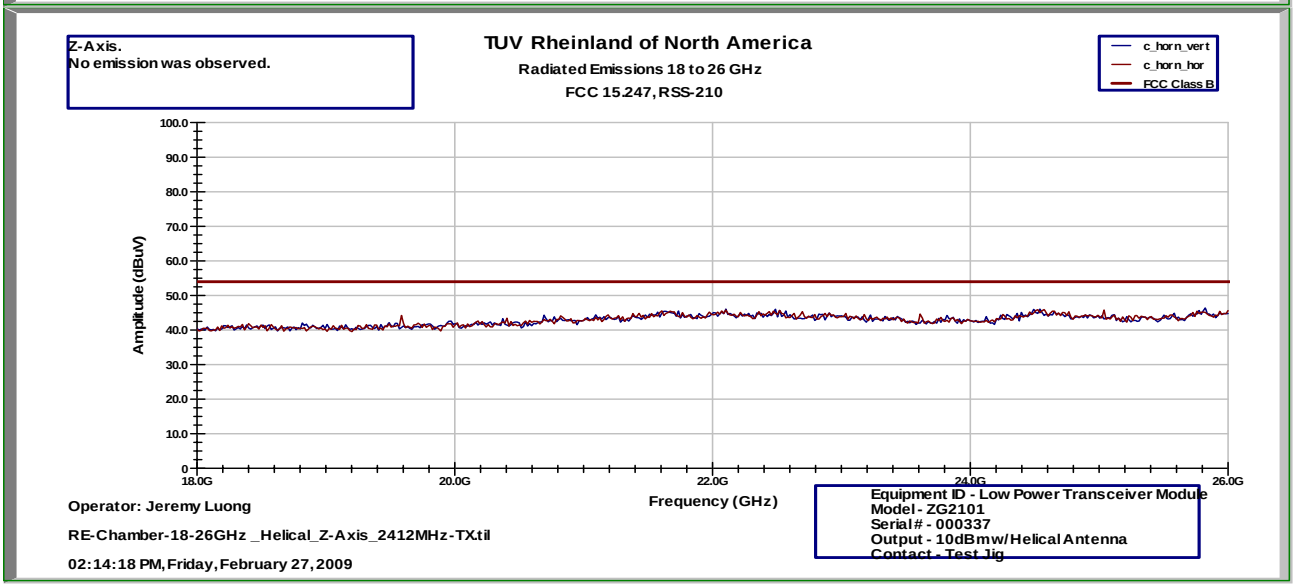
Notes: None.

SOP 1 Radiated Emissions

EUT Name	Low Power Transceiver Module	**Date**	February 24, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	23°C / 38%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Helical Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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





Notes: None.

SOP 1 Radiated Emissions

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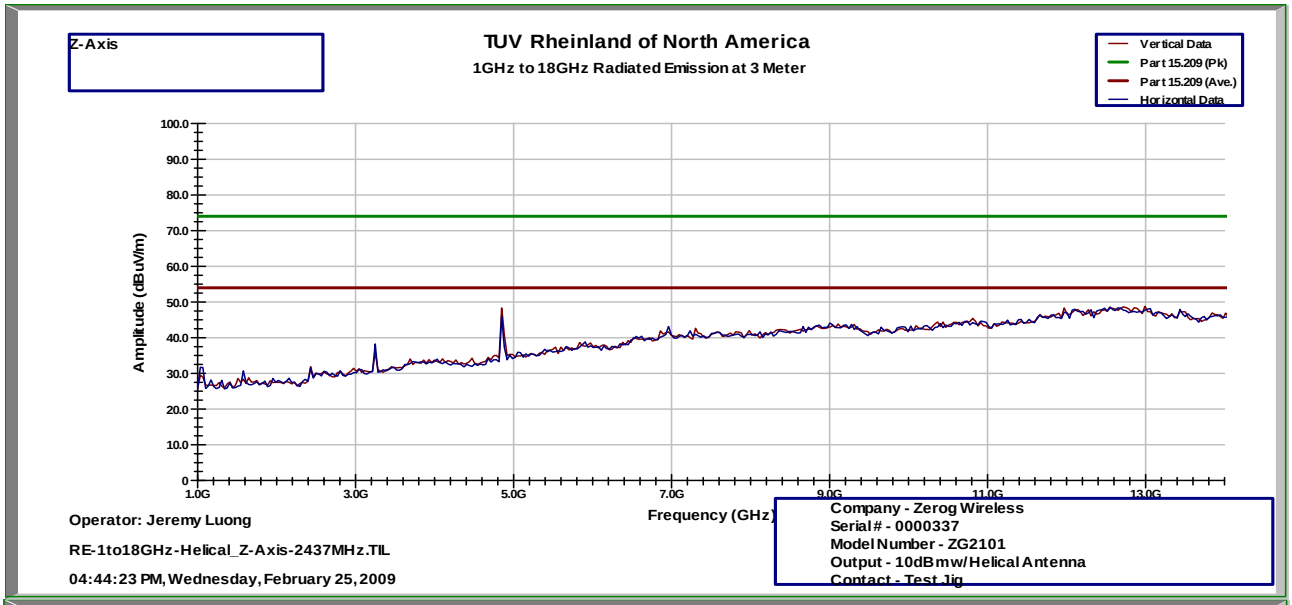
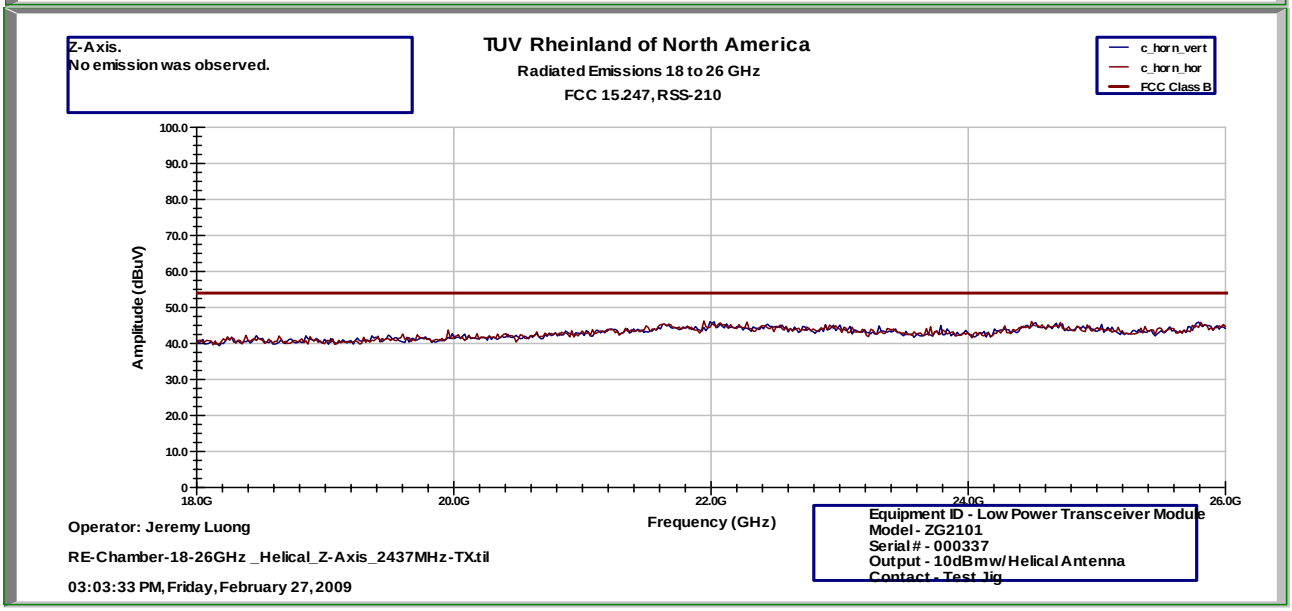
EUT Name	Low Power Transceiver Module	**Date**	February 26, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 41%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Helical Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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





Notes: None.

SOP 1 Radiated Emissions

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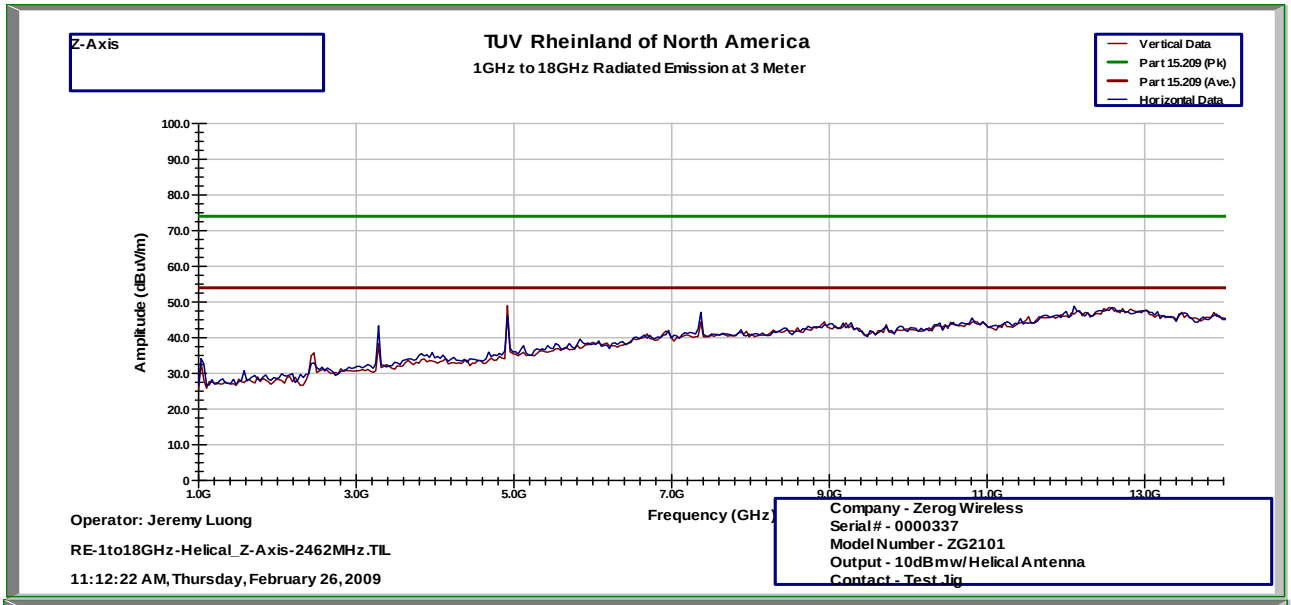
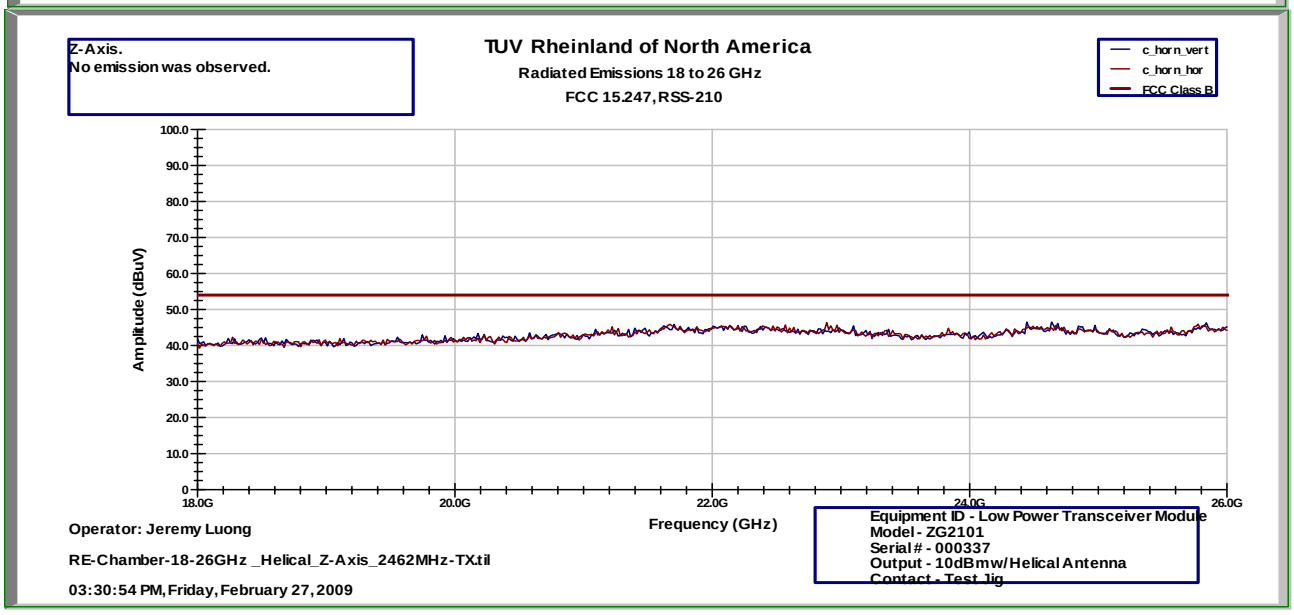
EUT Name	Low Power Transceiver Module	**Date**	February 26, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 41%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Helical Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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





Notes: None.

SOP 1 Radiated Emissions

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EUT Name	Low Power Transceiver Module	**Date**	March 2, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	23°C / 47%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna on X-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	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 2412MHz										
32.529543	V	2.9	355	40.36	27.13	-7.61	19.52	40.00	-20.48	Spurious
164.997560	H	2.0	263	37.42	36.21	-14.81	21.40	43.50	-22.10	Spurious
263.993111	H	1.0	92	31.86	29.46	-9.76	19.70	46.00	-26.30	Spurious
396.015347	V	1.2	1	34.3	31.30	-6.41	24.89	46.00	-21.11	Spurious
Transmitted Data at 2437MHz										
32.353678	V	2.9	59	30.02	22.34	-7.52	14.82	40.00	-25.18	Spurious
105.706119	H	1.0	225	41.08	39.13	-15.59	23.54	43.50	-19.96	Spurious
132.002561	H	2.0	88	37.61	35.96	-16.62	19.34	43.50	-24.16	Spurious
165.013538	H	1.9	88	37.09	35.46	-14.81	20.65	43.50	-22.85	Spurious
263.982622	V	1.0	250	33.49	31.01	-9.76	21.25	46.00	-24.75	Spurious
395.991650	V	1.0	71	35.32	32.27	-6.41	25.86	46.00	-20.14	Spurious
Transmitted Data at 2462MHz										
32.912366	V	1.0	192	32.34	25.54	-4.11	21.43	40.00	-18.57	Spurious
105.691518	H	2.3	304	34.25	32.55	-15.59	16.96	43.50	-26.54	Spurious
131.993355	H	2.4	68	38.32	36.68	-16.62	20.06	43.50	-23.44	Spurious
165.009503	H	1.0	251	37.97	36.86	-14.81	22.05	43.50	-21.45	Spurious
263.996711	V	1.0	116	31.28	28.84	-9.76	19.08	46.00	-26.92	Spurious
395.993897	V	1.0	150	35.39	32.35	-6.41	25.94	46.00	-20.06	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 $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: X-Axis was the worst plane.

SOP 1 Radiated Emissions

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EUT Name	Low Power Transceiver Module	**Date**	February 24, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 41%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna on X-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM (Pk) Pk (dBuV/m)	FIM Ave (dBuV/m)	Total CF dBuV	E-Field Ave (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)	Type
Transmitted Data at 2412MHz										
3216.00	H	1.9	360	48.35	43.74	3.32	40.42	53.98	-13.56	Spurious
4824.00	H	1.7	12	60.08	52.83	7.63	45.2	53.98	-8.78	Harmonic
3216.00	V	1.2	356	53.62	45.78	3.36	42.42	53.98	-11.56	Spurious
4824.00	V	1.2	3	57.35	51.55	7.63	43.92	53.98	-10.06	Harmonic
Transmitted Data at 2437MHz										
3249.00	H	1.0	349	41.68	36.23	3.43	32.8	53.98	-21.18	Spurious
4874.00	H	1.6	346	58.60	51.26	7.86	43.4	53.98	-10.58	Harmonic
3249.00	V	1.2	274	46.43	41.59	3.48	38.11	53.98	-15.87	Spurious
4874.00	V	1.1	31	59.94	52.95	7.86	45.09	53.98	-8.89	Harmonic
Transmitted Data at 2462MHz										
3282.68	H	1.0	347	41.44	35.00	3.55	31.45	53.98	-22.53	Spurious
4924.00	H	1.0	28	55.24	48.10	8.06	40.04	53.98	-13.94	Harmonic
7386.00	H	1.3	31	64.08	57.16	11.63	45.53	53.98	-8.45	Harmonic
3282.68	V	1.5	4	44.24	38.65	3.60	35.05	53.98	-18.93	Spurious
4924.00	V	1.4	0	53.80	45.87	8.06	37.81	53.98	-16.17	Harmonic
7386.00	V	1.3	280	59.49	52.68	11.60	41.08	53.98	-12.90	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 $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: X-Axis was the worst plane. The harmonics were even below the spurious limit.

SOP 1 Radiated Emissions

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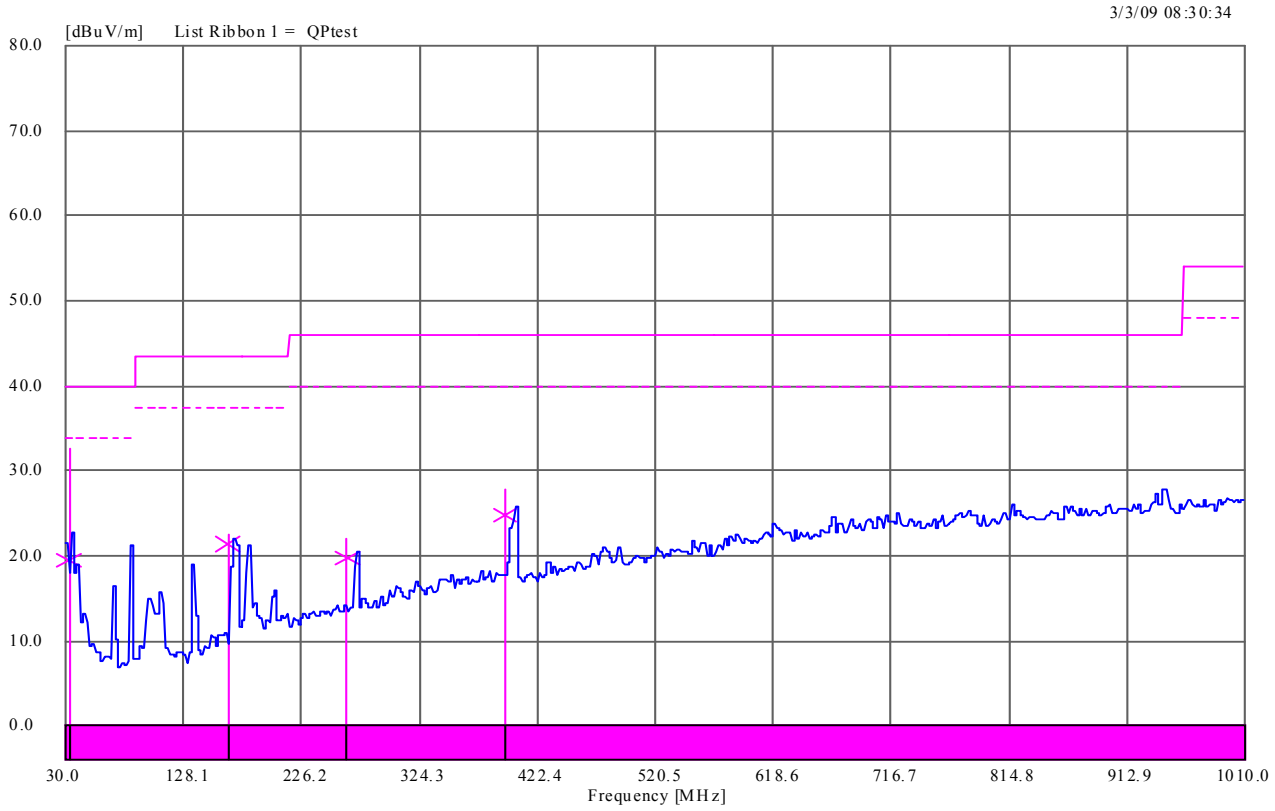
EUT Name	Low Power Transceiver Module	**Date**	March 3, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	21°C / 48%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna on X-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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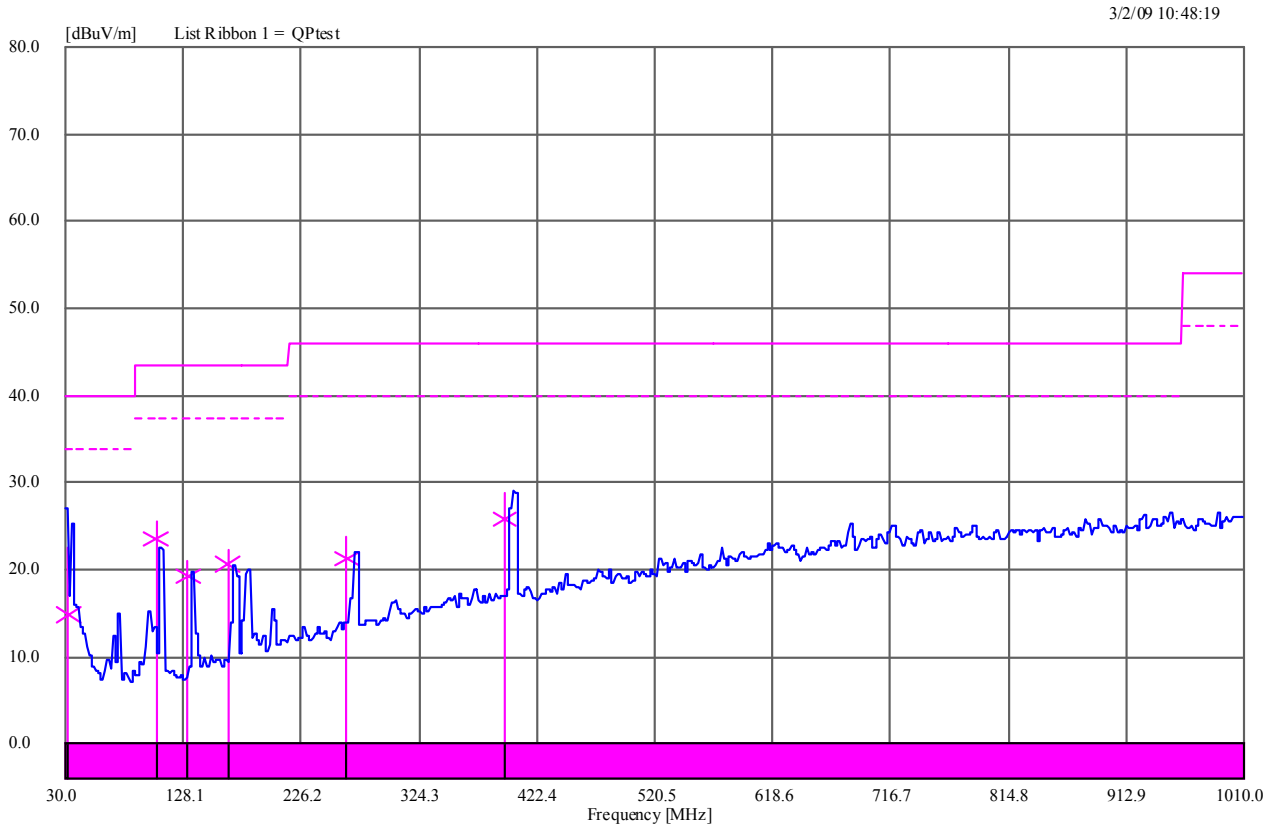
EUT Name	Low Power Transceiver Module	**Date**	March 2, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna on X-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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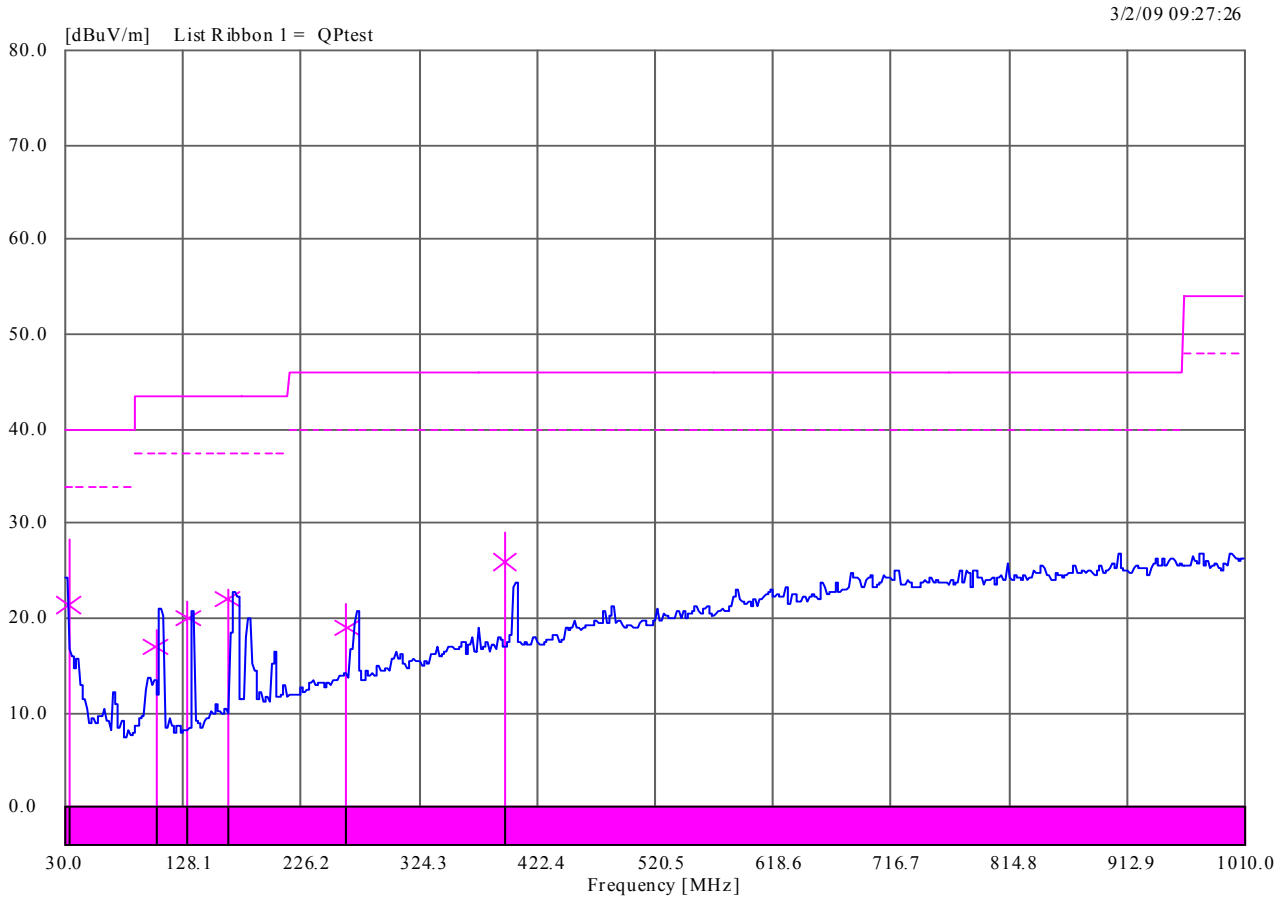
EUT Name	Low Power Transceiver Module	**Date**	March 2, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 48%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna on X-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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

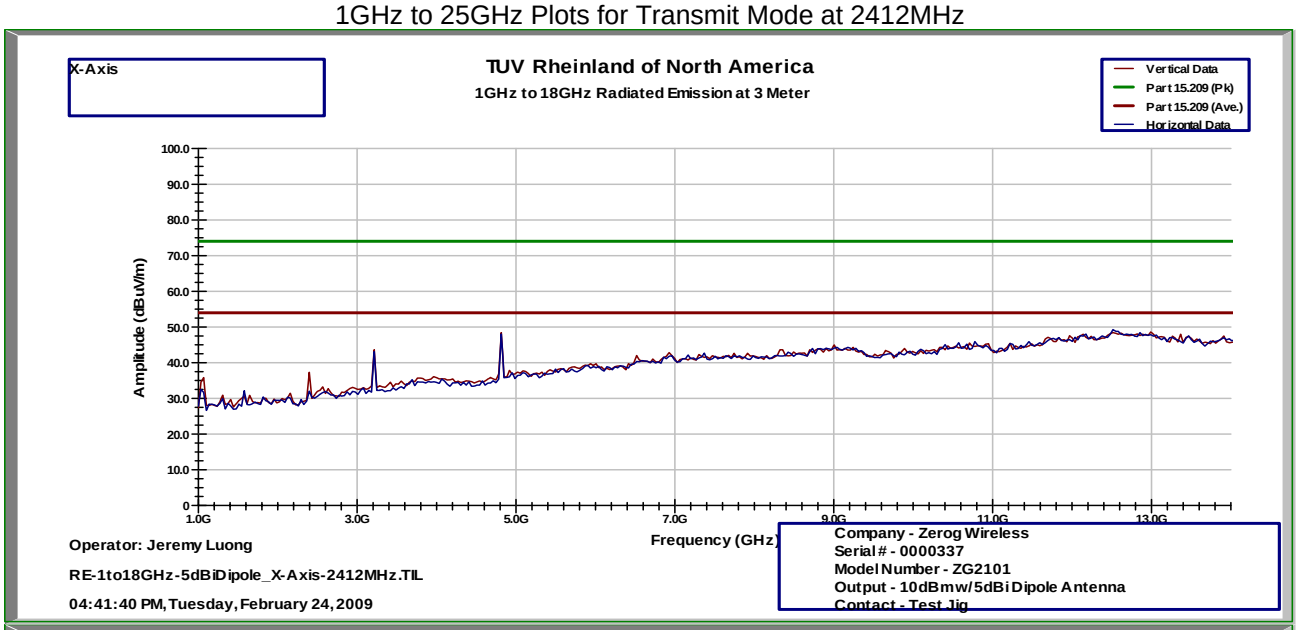


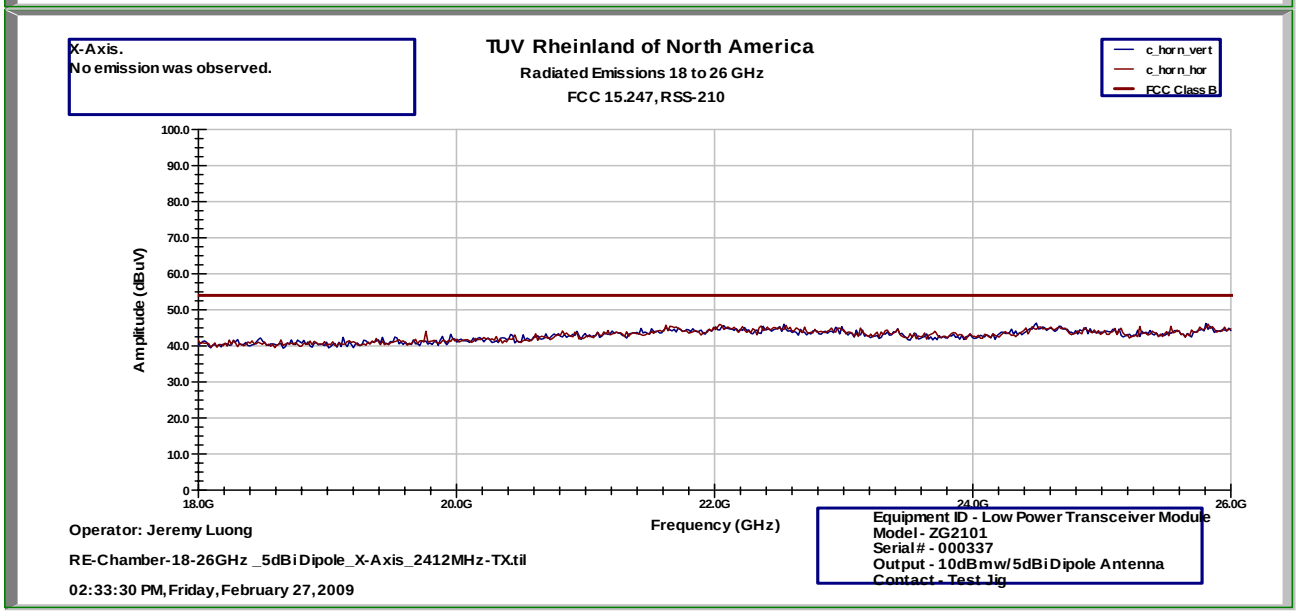
Notes: None.

SOP 1 Radiated Emissions

EUT Name	Low Power Transceiver Module	**Date**	February 24, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	23°C / 38%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna on X-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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





Notes: None.

SOP 1 Radiated Emissions

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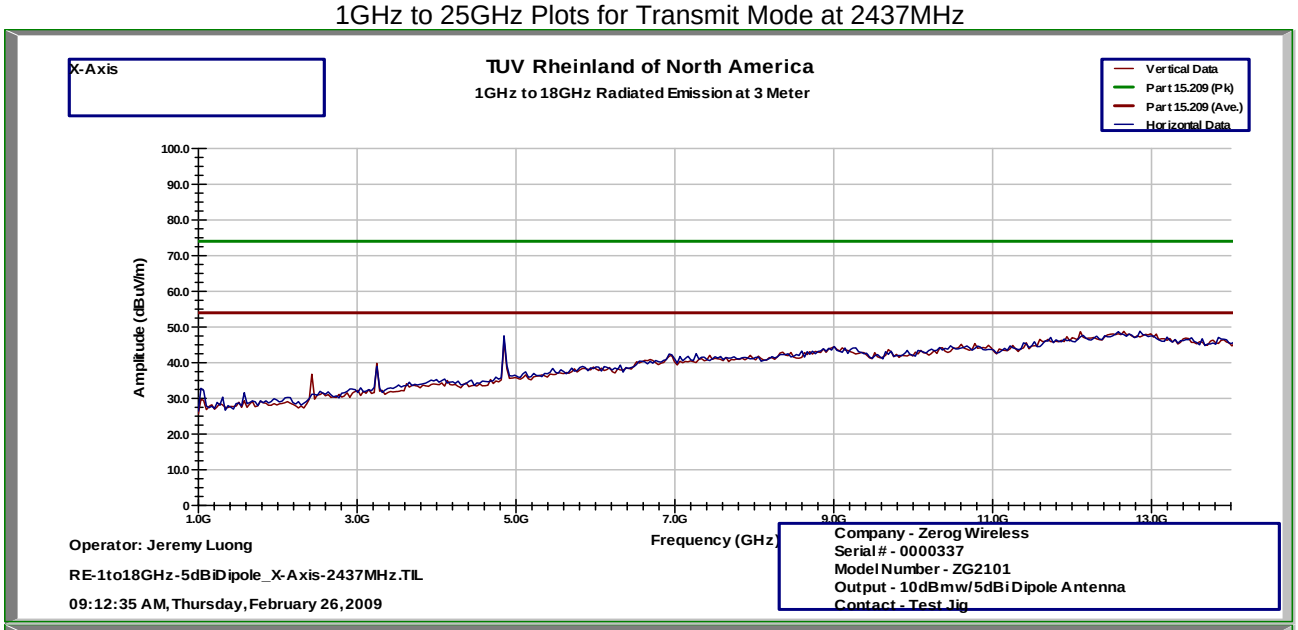
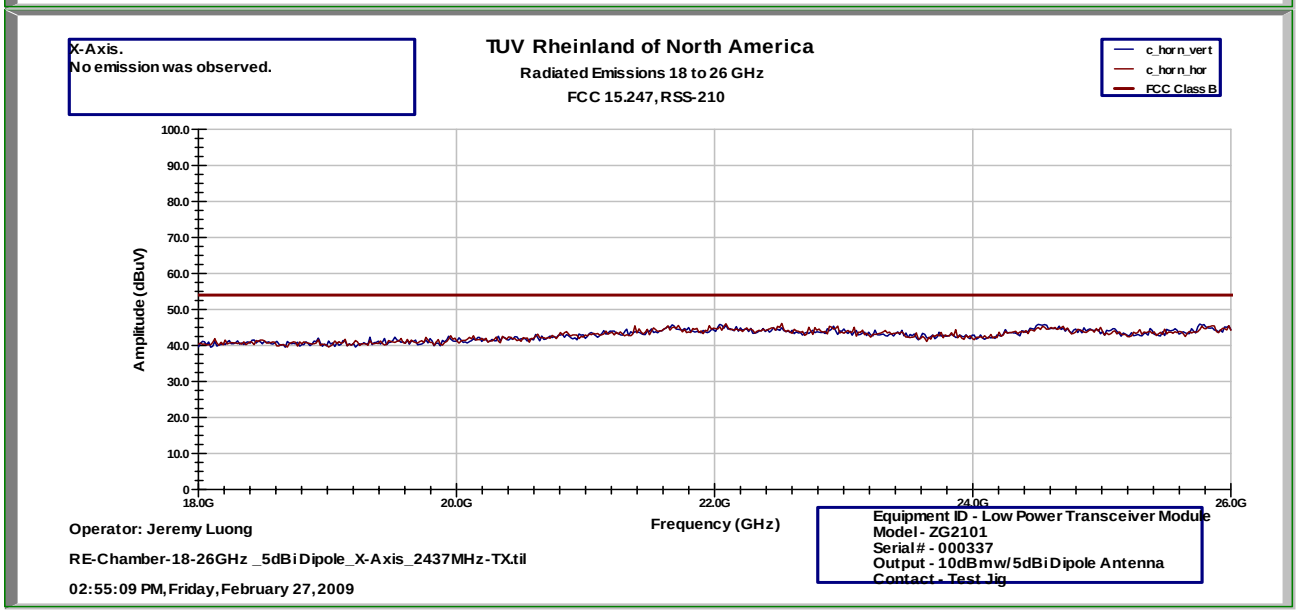
EUT Name	Low Power Transceiver Module	**Date**	February 26, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 41%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna on X-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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





Notes: None.

SOP 1 Radiated Emissions

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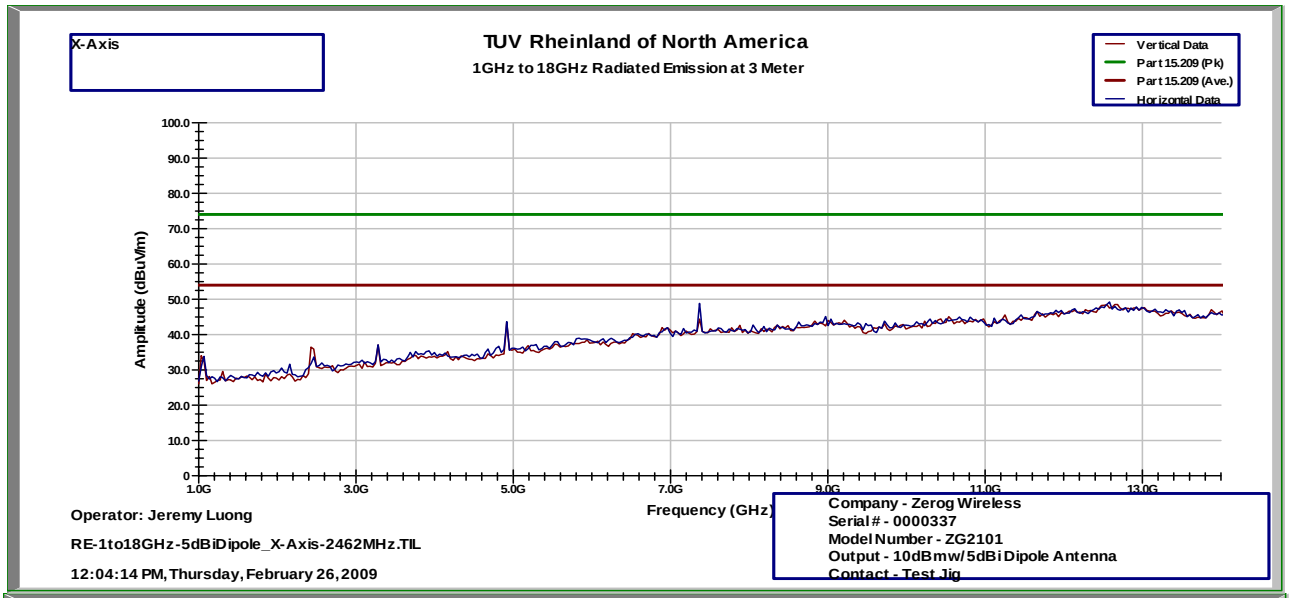
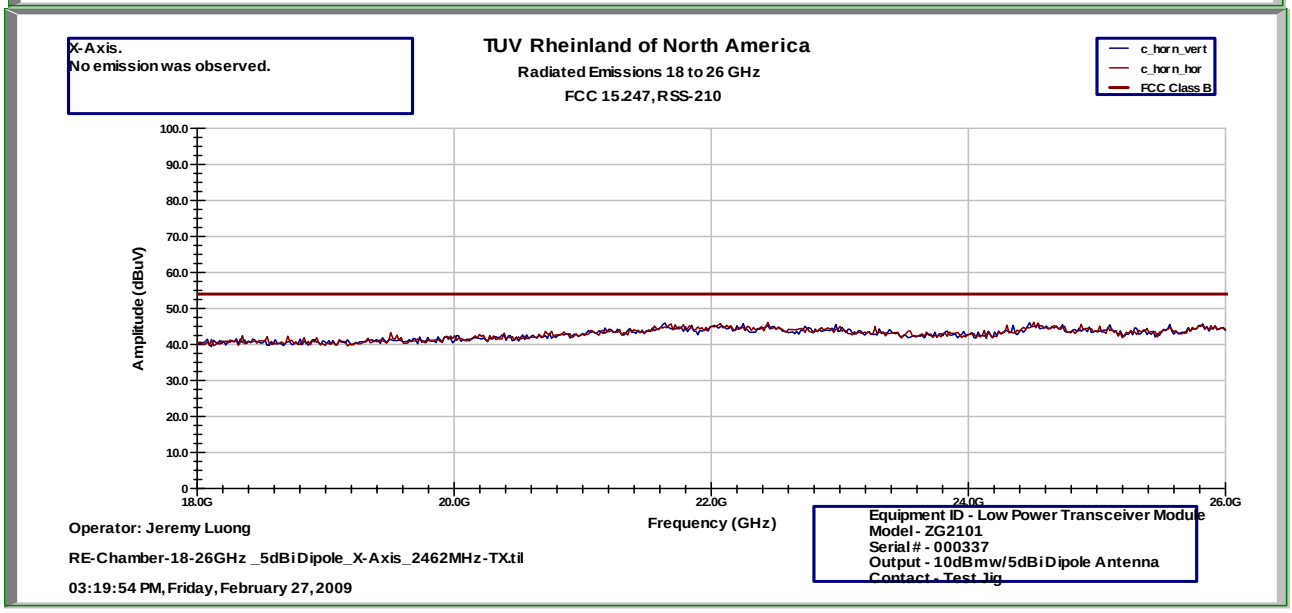
EUT Name	Low Power Transceiver Module	**Date**	February 26, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 41%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna on X-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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





Notes: None.

SOP 1 Radiated Emissions

EUT Name	Low Power Transceiver Module	**Date**	March 2, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	23°C / 47%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	10dBi Monopole Antenna on Z-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	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 2412MHz										
30.393521	V	1.0	358	24.02	19.61	-6.35	13.26	40.00	-26.74	Spurious
132.001020	V	1.0	284	38.24	36.86	-16.62	20.24	43.50	-23.26	Spurious
264.010169	H	1.0	252	33.95	31.84	-9.76	22.08	46.00	-23.92	Spurious
395.981891	V	1.0	18	31.74	28.51	-6.41	22.10	46.00	-23.90	Spurious
711.250490	V	2.9	38	30.00	26.34	-0.59	25.75	46.00	-20.25	Spurious
Transmitted Data at 2437MHz										
31.255094	V	1.0	266	24.93	19.83	-5.01	14.82	40.00	-25.18	Spurious
105.705586	V	1.0	255	39.13	38.94	-15.59	23.35	43.50	-20.15	Spurious
131.996725	V	1.0	289	38.63	37.3	-16.62	20.68	43.50	-22.82	Spurious
264.028535	H	1.0	75	33.38	30.37	-9.76	20.61	46.00	-25.39	Spurious
395.986775	V	1.6	186	33.59	30.49	-6.41	24.08	46.00	-21.92	Spurious
711.252381	V	2.9	48	28.4	25.96	-0.59	25.37	46.00	-20.63	Spurious
Transmitted Data at 2462MHz										
38.361537	V	3.9	191	24.47	19.61	-10.98	8.63	40.00	-31.37	Spurious
131.999150	H	1.0	73	39.82	38.19	-16.62	21.57	43.50	-21.93	Spurious
263.962113	H	1.0	247	34.78	32.02	-9.76	22.26	46.00	-23.74	Spurious
396.006392	H	1.0	349	29.8	25.00	-6.41	18.59	46.00	-27.41	Spurious
711.253384	V	2.9	300	28.99	24.51	-0.59	23.92	46.00	-22.08	Spurious

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

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

Notes: Z-Axis was the worst plane.

SOP 1 Radiated Emissions

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EUT Name	Low Power Transceiver Module	**Date**	February 24, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 41%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	10dBi Monopole Antenna on Z-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM (Pk) Pk (dBuV/m)	FIM Ave (dBuV/m)	Total CF dBuV	E-Field Ave (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)	Type
Transmitted Data at 2412MHz										
3216.00	H	1.0	342	48.15	42.07	3.32	38.75	53.98	-15.23	Spurious
4824.00	H	1.0	109	58.30	50.94	7.63	43.31	53.98	-10.67	Harmonic
3216.00	V	1.0	309	48.36	41.64	3.36	38.28	53.98	-15.70	Spurious
4824.00	V	1.0	345	63.12	56.06	7.63	48.43	53.98	-5.55	Harmonic
Transmitted Data at 2437MHz										
3249.00	H	100	345	47.95	41.87	3.43	38.44	53.98	-15.54	Spurious
4874.00	H	100	317	58.64	51.88	7.86	44.02	53.98	-9.96	Harmonic
3249.00	V	134	100	44.51	40.13	3.48	36.65	53.98	-17.33	Spurious
4874.00	V	128	284	59.97	53.05	7.86	45.19	53.98	-8.79	Harmonic
Transmitted Data at 2462MHz										
3282.68	H	100	348	47.64	42.77	3.55	39.22	53.98	-14.76	Spurious
4924.00	H	101	353	56.66	49.81	8.06	41.75	53.98	-12.23	Harmonic
7386.00	H	100	87	62.37	54.88	11.63	43.25	53.98	-10.73	Harmonic
3282.68	V	103	283	44.74	39.36	3.60	35.76	53.98	-18.22	Spurious
4924.00	V	100	135	59.81	52.83	8.06	44.77	53.98	-9.21	Harmonic
7386.00	V	100	286	60.79	50.34	11.60	38.74	53.98	-15.24	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 $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Z-Axis was the worst plane. The harmonics were even below the spurious limit.

SOP 1 Radiated Emissions

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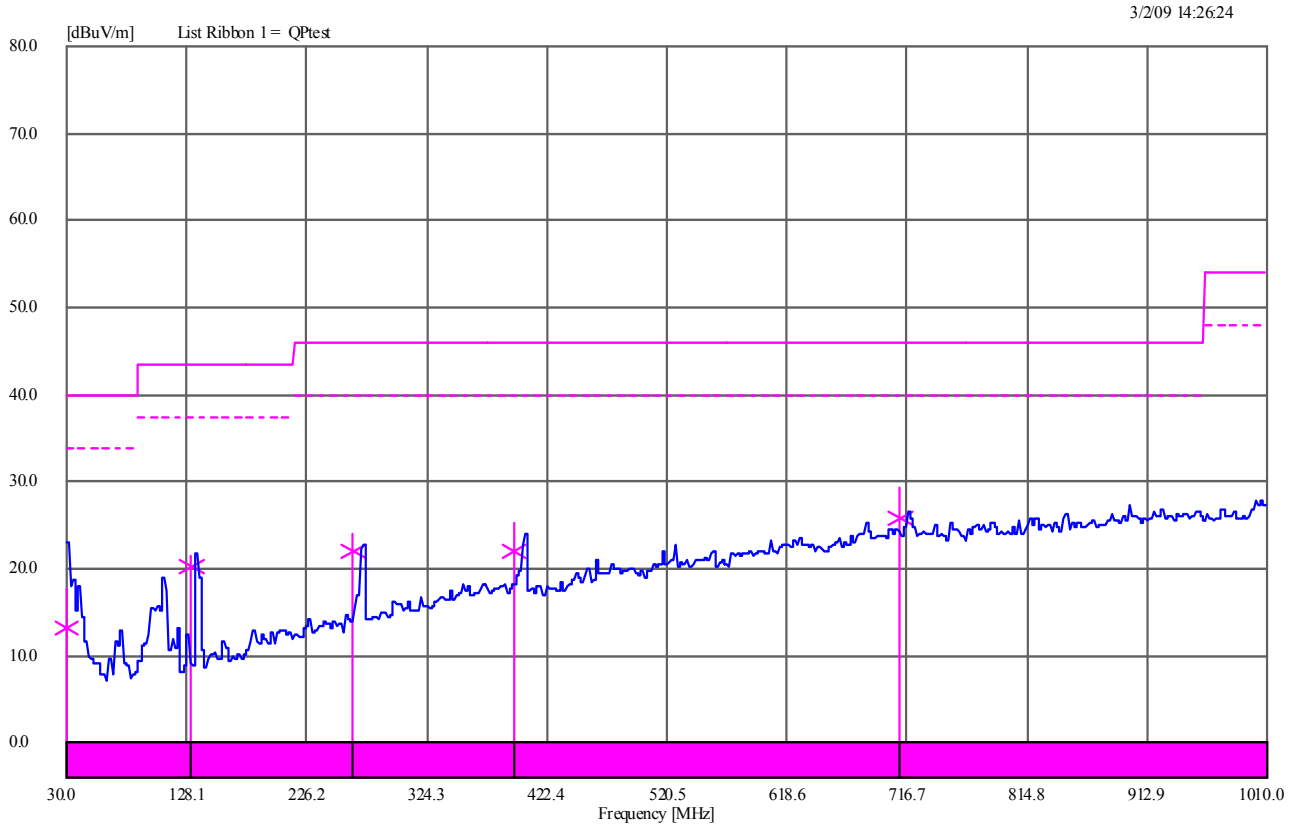
EUT Name	Low Power Transceiver Module	**Date**	March 2, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	23°C / 47%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	10dBi Monopole Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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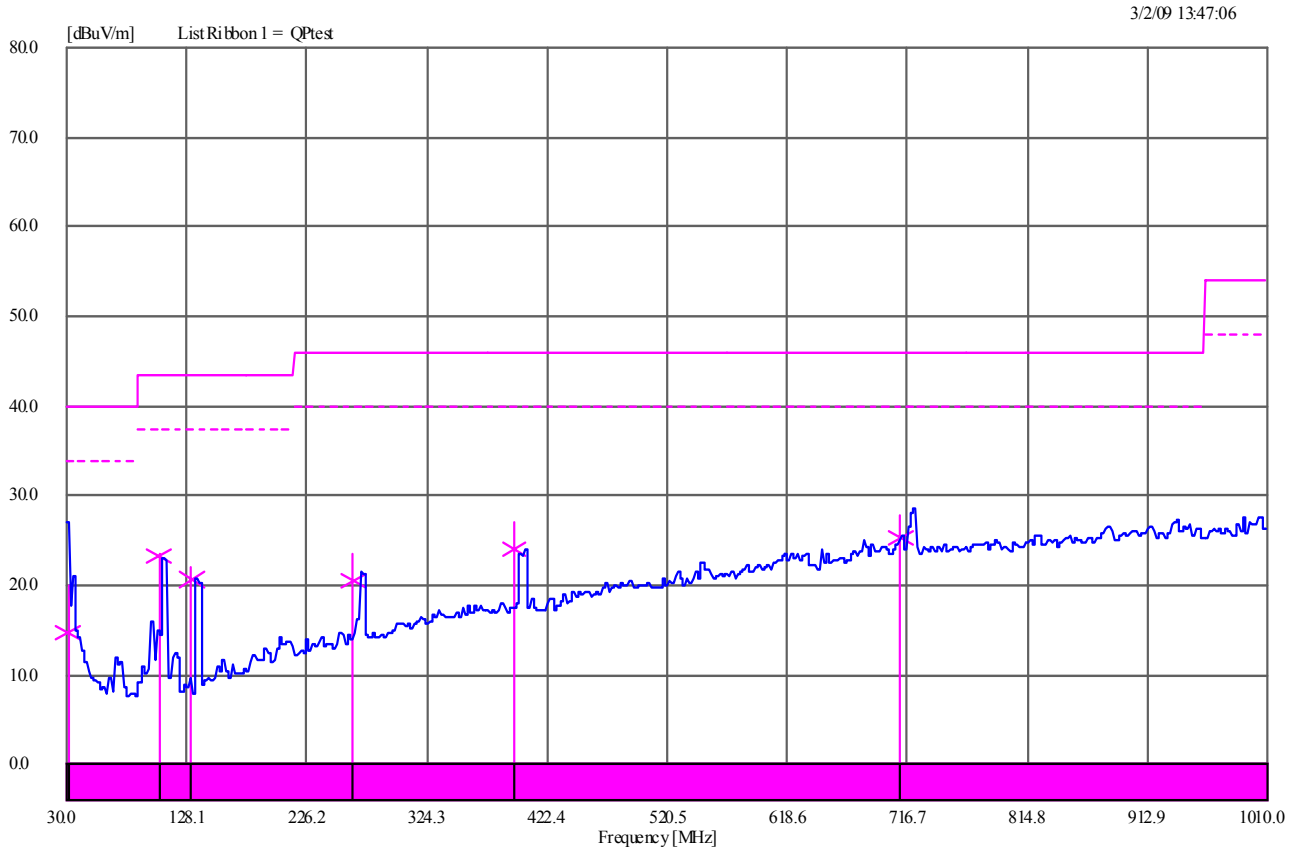
EUT Name	Low Power Transceiver Module	**Date**	March 2, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 47%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	10dBi Monopole Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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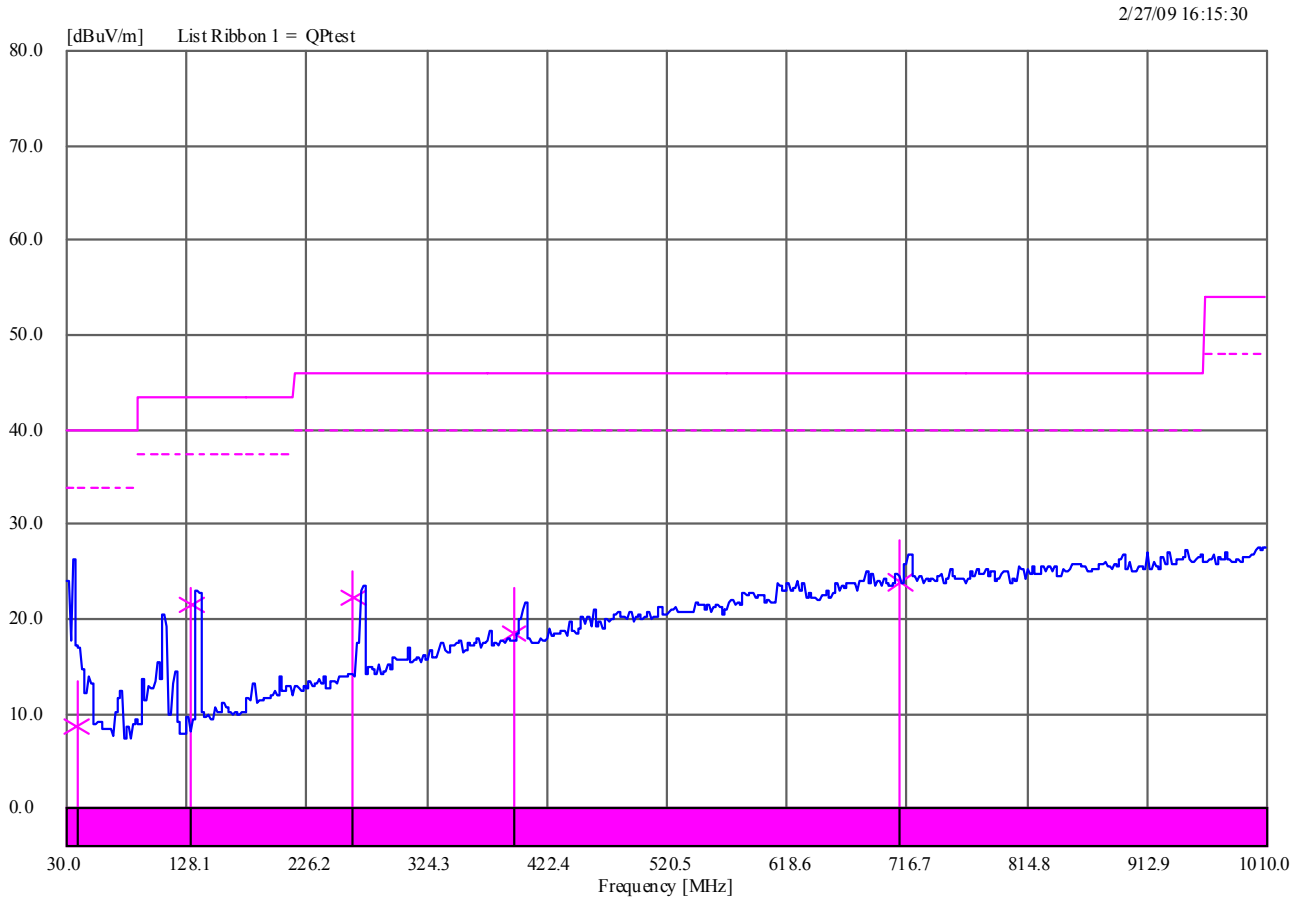
EUT Name	Low Power Transceiver Module	**Date**	February 27, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	23°C / 39%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	10dBi Monopole Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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

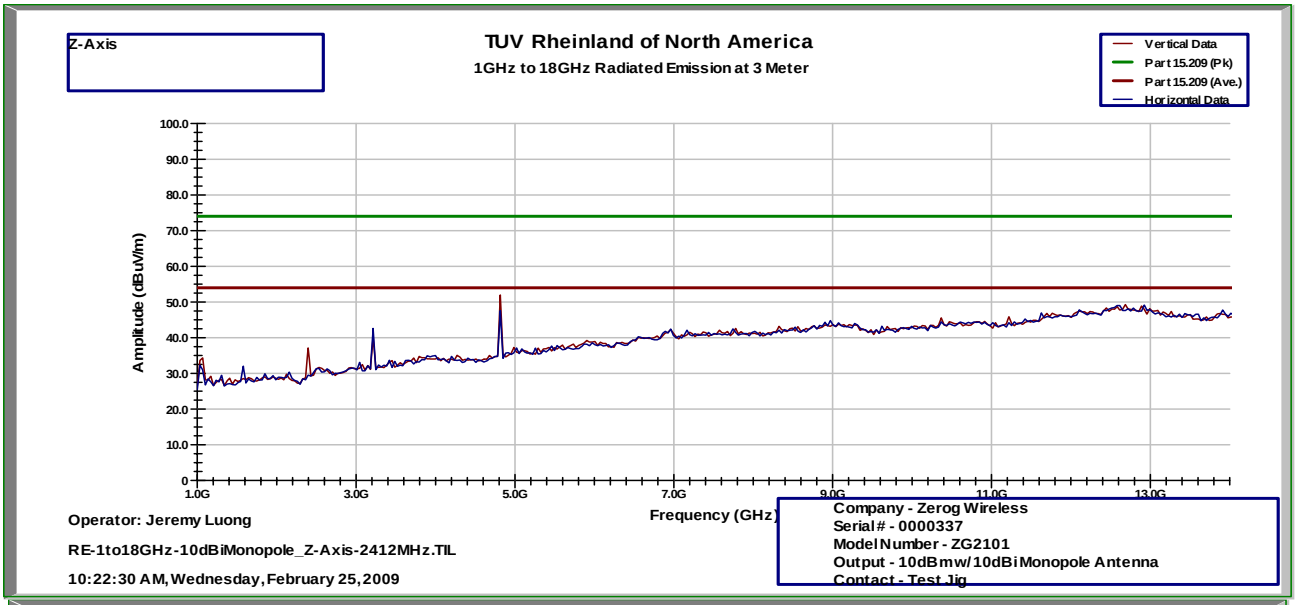


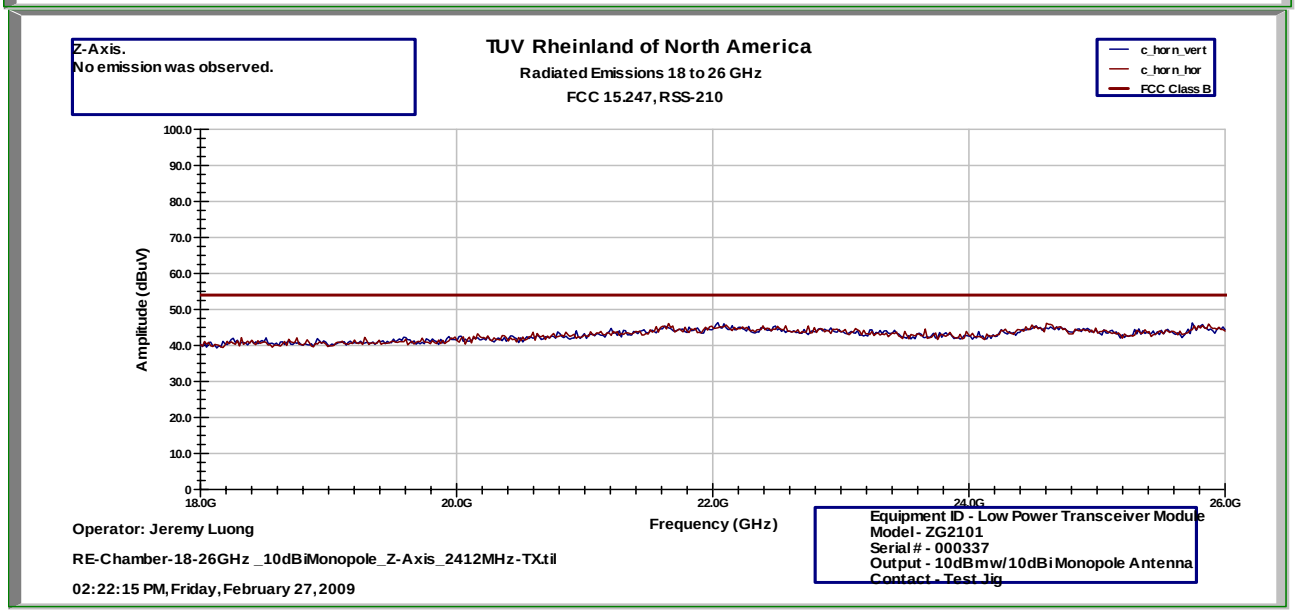
Notes: None.

SOP 1 Radiated Emissions

EUT Name	Low Power Transceiver Module	**Date**	February 25, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	23°C / 41%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	10dBi Monopole Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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



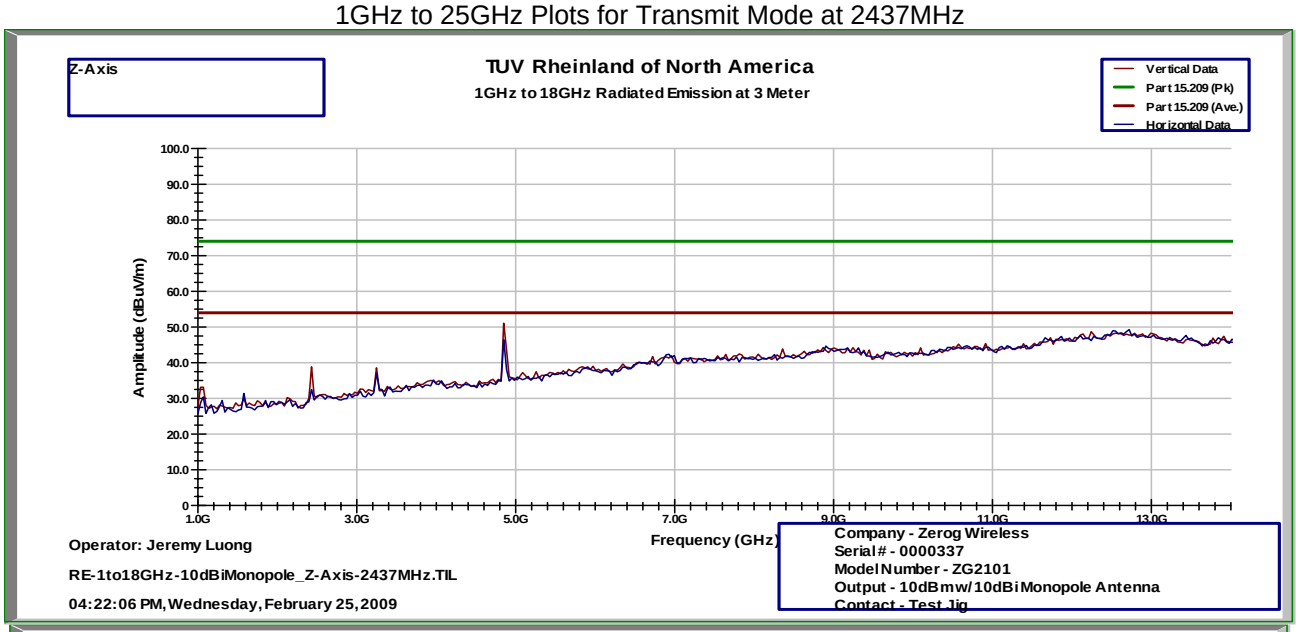


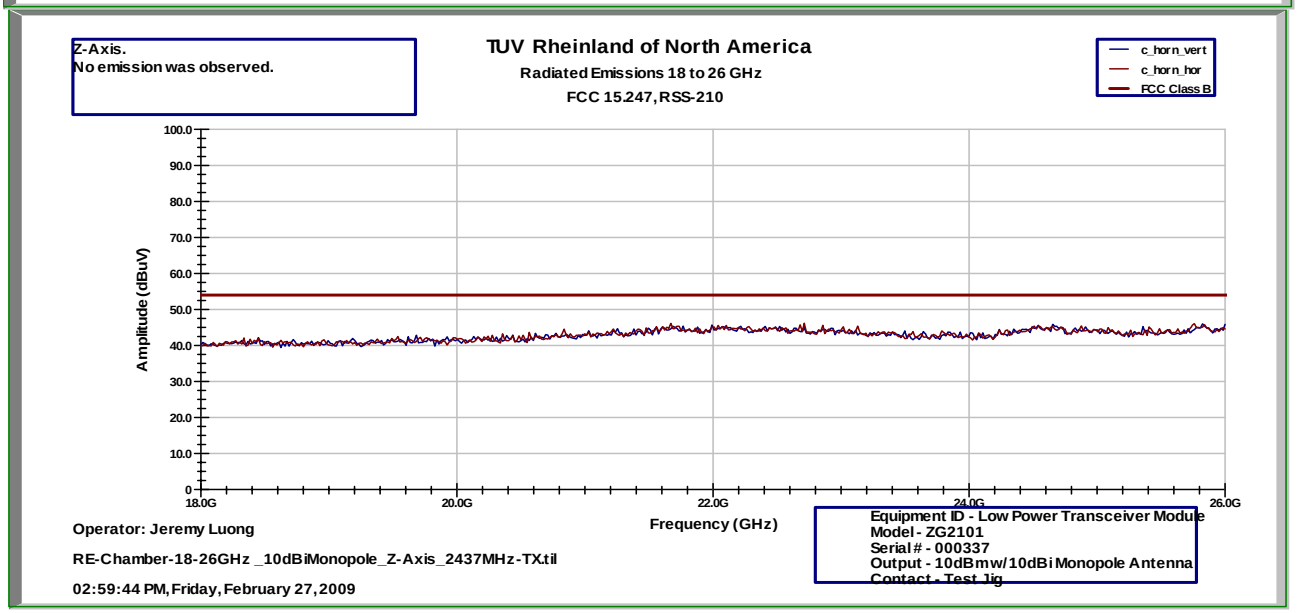
Notes: None.

SOP 1 Radiated Emissions

EUT Name	Low Power Transceiver Module	**Date**	February 25, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	23°C / 41%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	10dBi Monopole Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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





Notes: None.

SOP 1 Radiated Emissions

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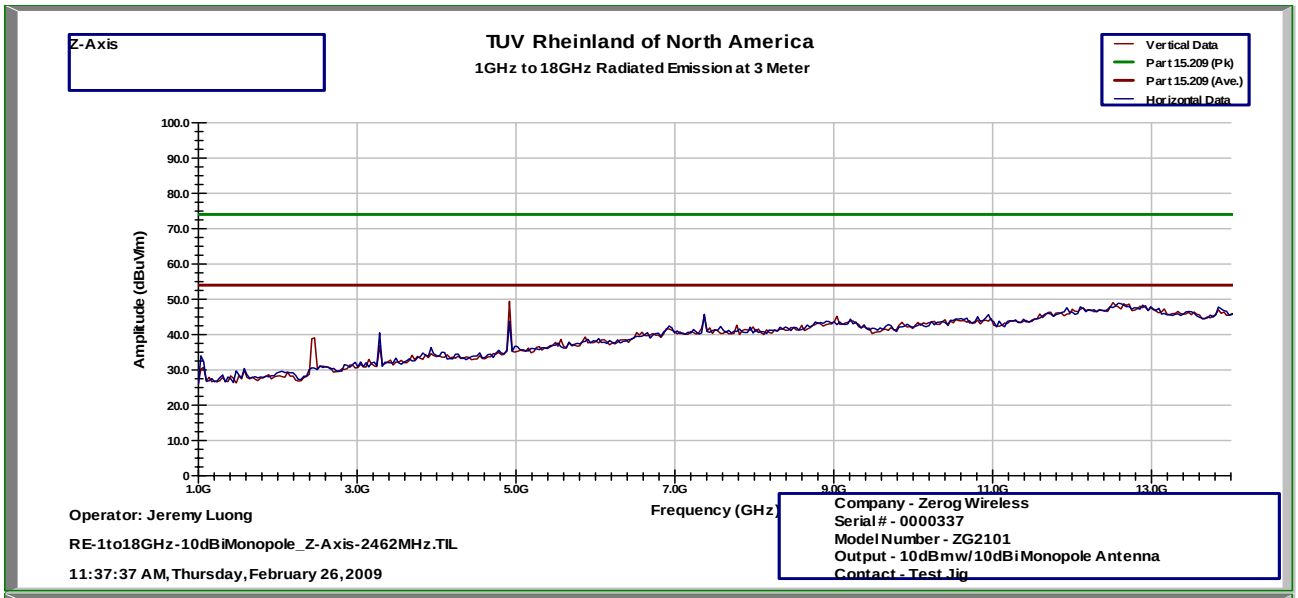
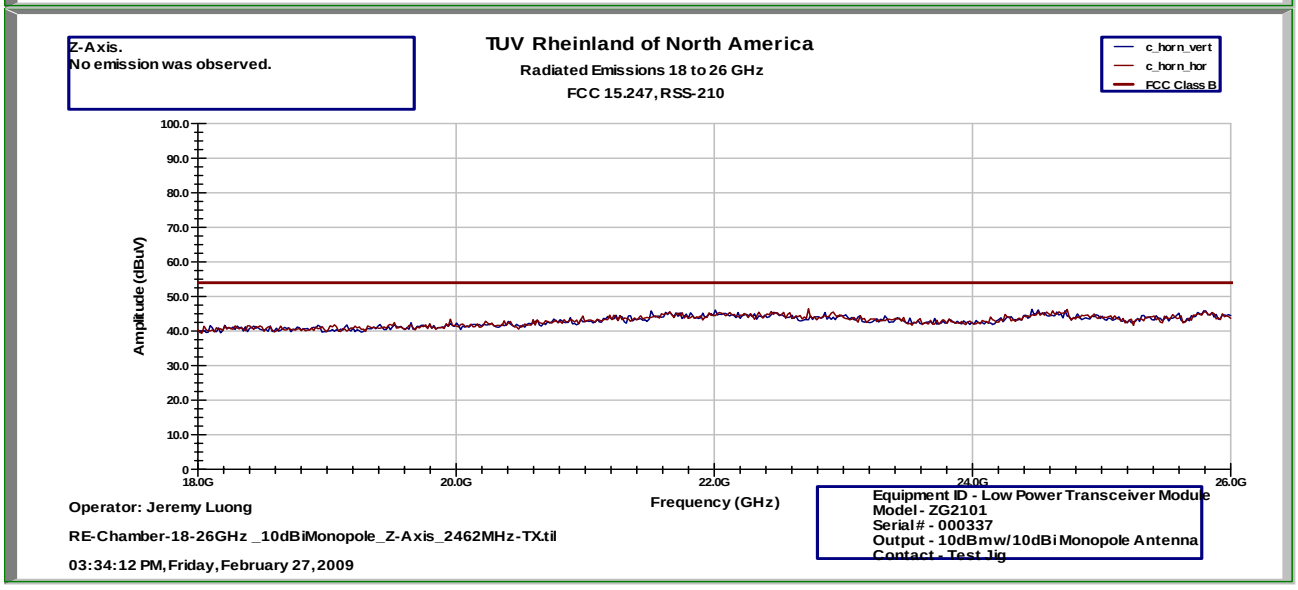
EUT Name	Low Power Transceiver Module	**Date**	February 26, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 41%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	10dBi Monopole Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / EMCO3115	**Performed by**	Jeremy Luong

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





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:

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

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

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

4.7 Receiver Spurious Emissions

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

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

4.7.1 Test Methodology

4.7.1.1 Preliminary Test

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

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

To determine the worst axis, the pre-scans performed on X-Axis, Y-Axis, and Z-Axis for each transmitting antenna family.

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 the worst axis for three receiving channels; 2412MHz, 2437MHz, and 2462MHz.

4.7.1.3 Deviations

None.

4.7.2 Receiver Spurious Emission Limit

The spurious emissions of the receiver shall not exceed the values in CFR47 Part 15.205, 15.209: 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

Section 4.6.3.12 lists the final measurement data 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).

4.7.3.1 Pre-scan Data

The data recorded in this section is used toward the final scan.

To determine the worst axis, ZG2100 and ZG2101 were scanned from 30MHz to 18GHz.

Table 9: Receiver Spurious Emissions – Pre-scan Test Results

Test Conditions: Radiated Measurement at Normal Conditions only			
Antenna Type: Integrated and detachable		**Power Setting:** +10 dBm	
Operating Frequency: 2442 MHz		**Duty Cycle:** 84.61 %	
Ambient Temperature: 23°C		**Relative Humidity:** 45 %	
Configuration	**Frequency Range**	**Measuring Distance**	**Worst Axis**
On-board PCB Antenna (Meander)	30MHz to 12.75GHz	3 m	X-Axis
2dBi Dipole Antenna (RFA-02-D3-70-100)	30MHz to 12.75GHz	3 m	Z-Axis
Helical Antenna	30MHz to 12.75GHz	3 m	Z-Axis
Inverter F Antenna	30MHz to 12.75GHz	3 m	X-Axis
2dBi PCB Antenna (#3)	30MHz to 12.75GHz	3 m	Z-Axis
5dBi Dipole Antenna	30MHz to 12.75GHz	3 m	Z-Axis
10dBi Monopole Antenna	30MHz to 12.75GHz	3 m	Z-Axis

Note: One of the middle channels was chose for pre-scan. There was no emission observed above 1GHz.

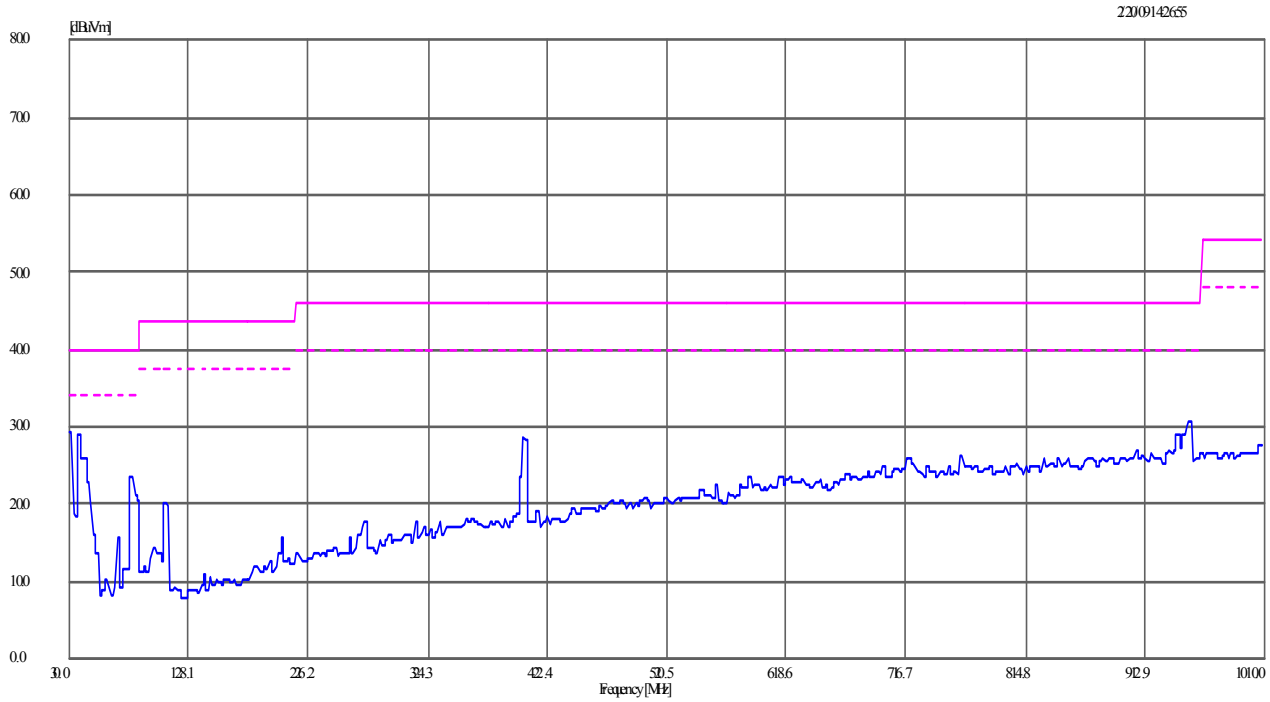


Figure 73: Emissions Pres-can, Onboard Antenna (Meander), 30 to 1000 MHz, X-Axis

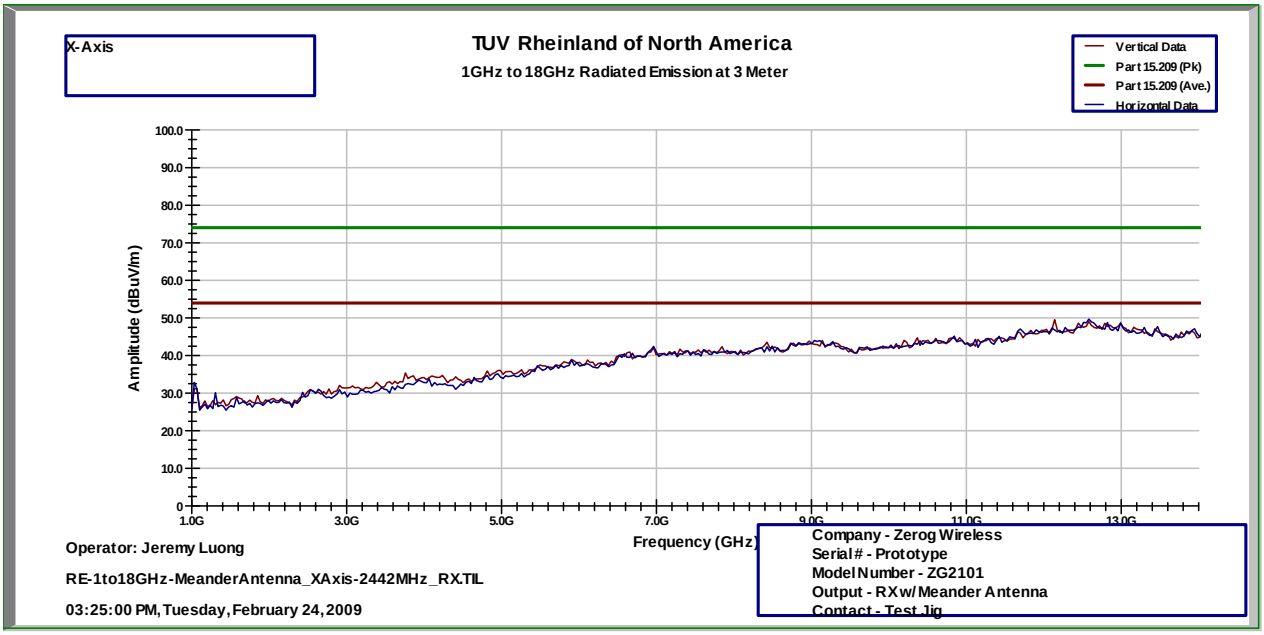


Figure 74: Emissions Pres-can, Onboard Antenna (Meander), 1GHz to 18GHz, X-Axis

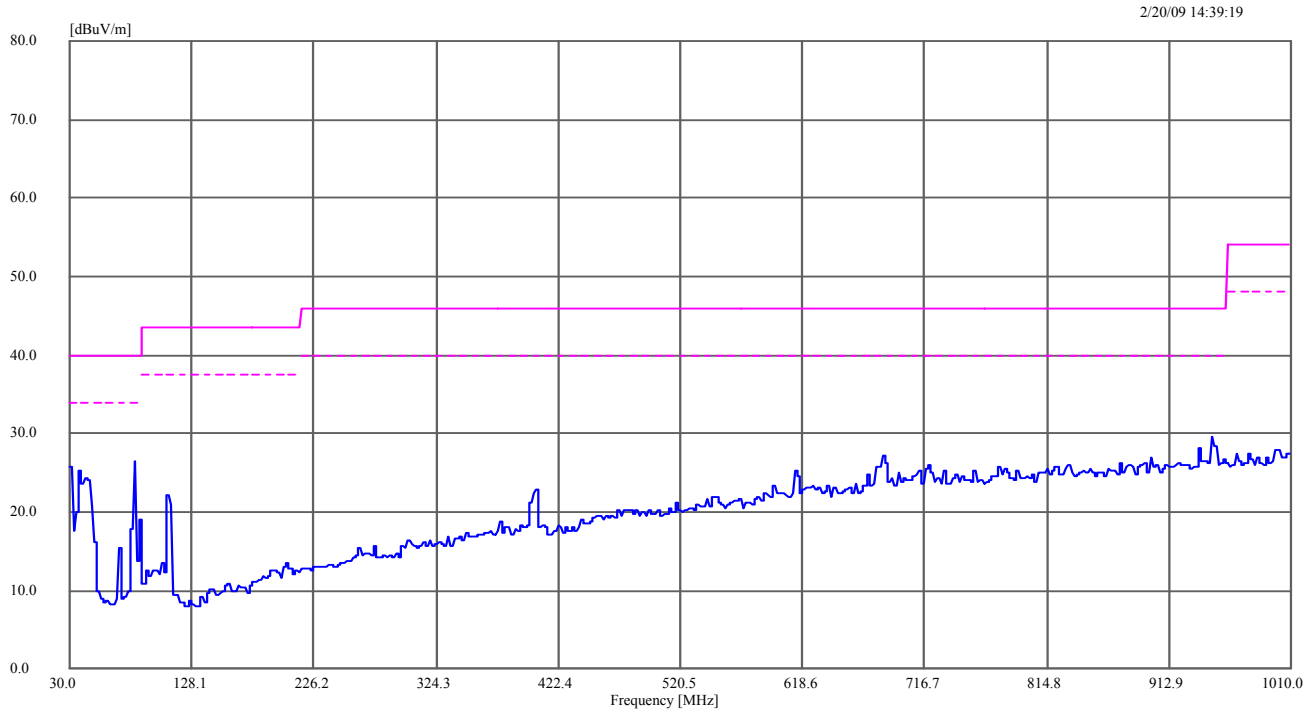


Figure 75: Emissions Pres-can, Onboard Antenna (Meander), 30 to 1000 MHz, Y-Axis

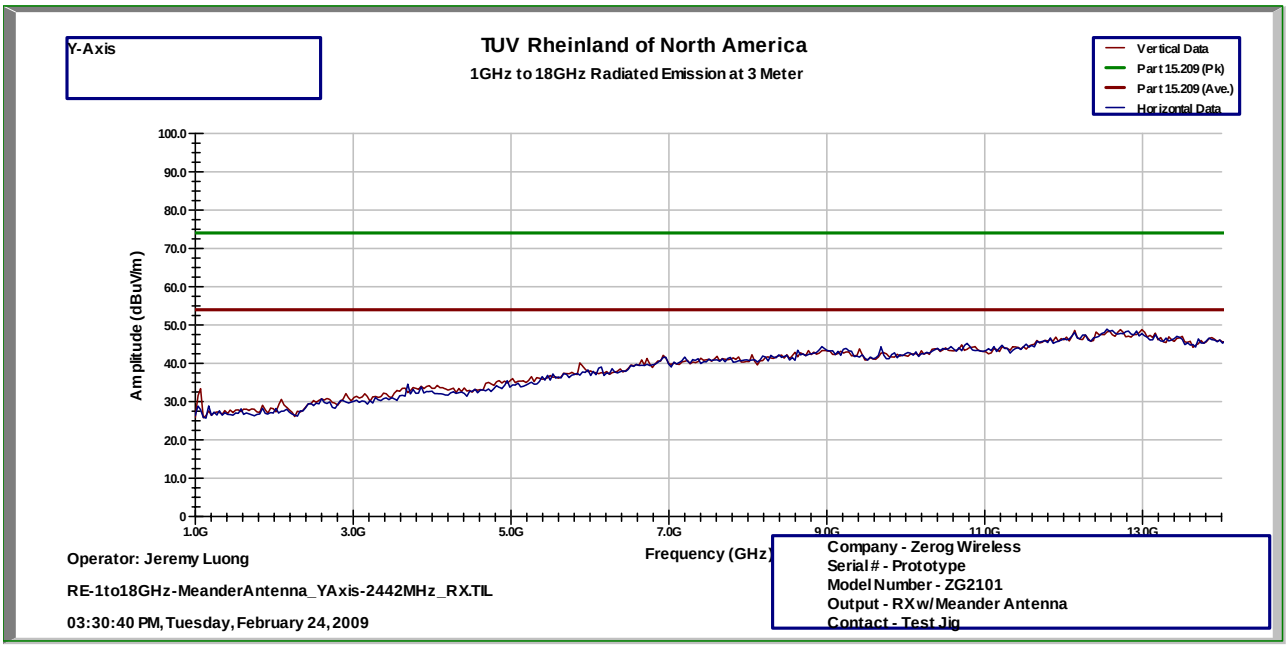


Figure 76: Emissions Pres-can, Onboard Antenna (Meander), 1GHz to 18GHz, Y-Axis

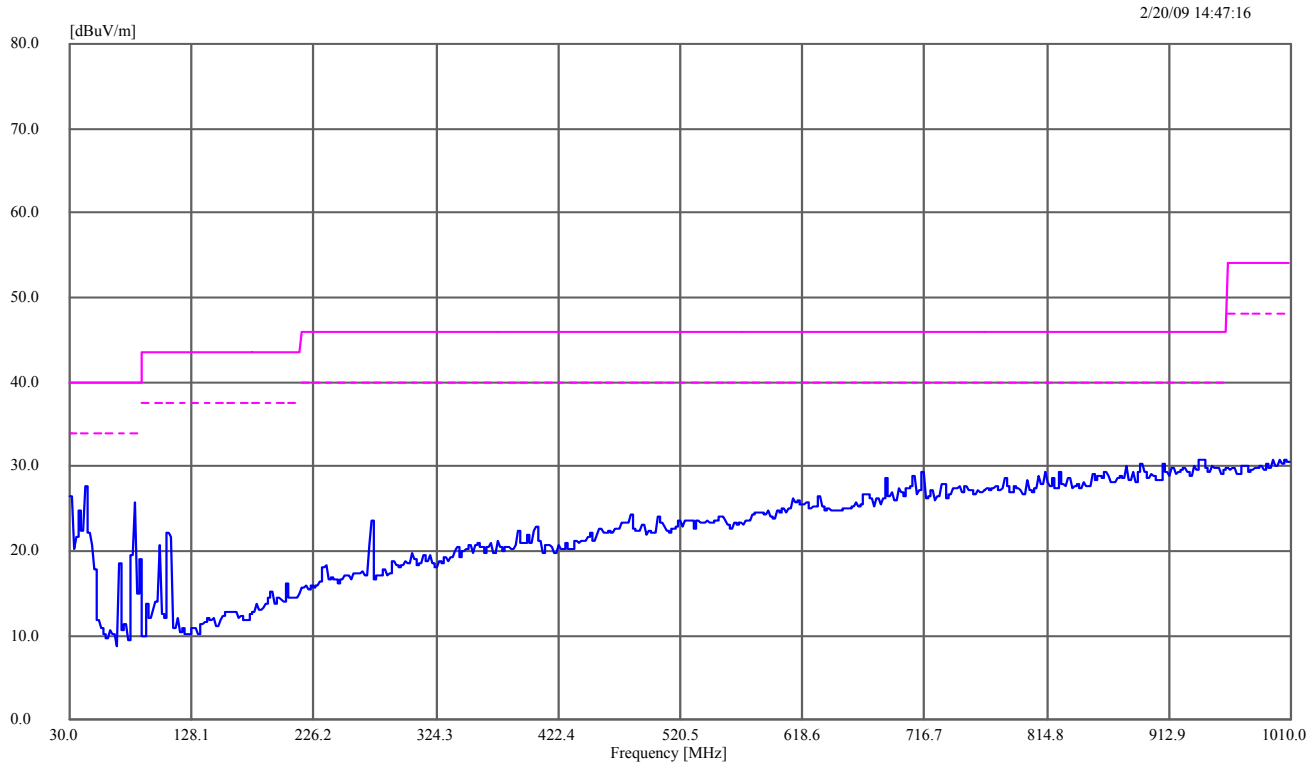


Figure 77: Emissions Pres-can, Onboard Antenna (Meander), 30 to 1000 MHz, Z-Axis

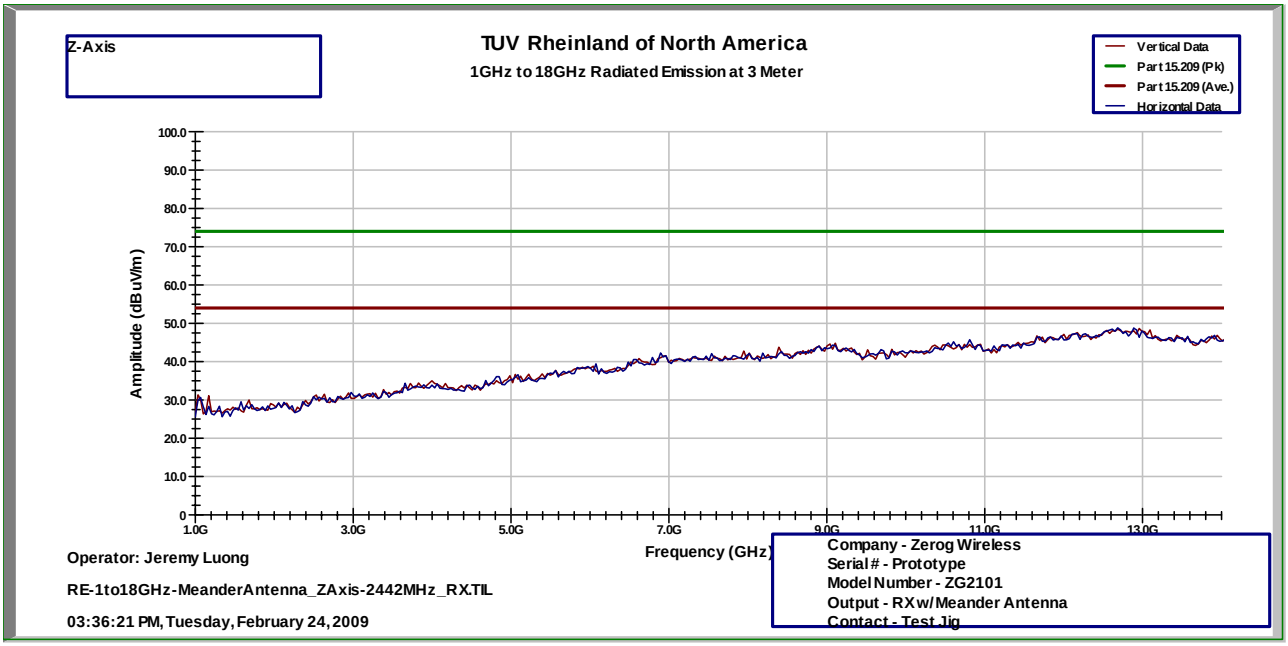


Figure 78: Emissions Pres-can, Onboard Antenna (Meander), 1GHz to 18GHz, Z-Axis

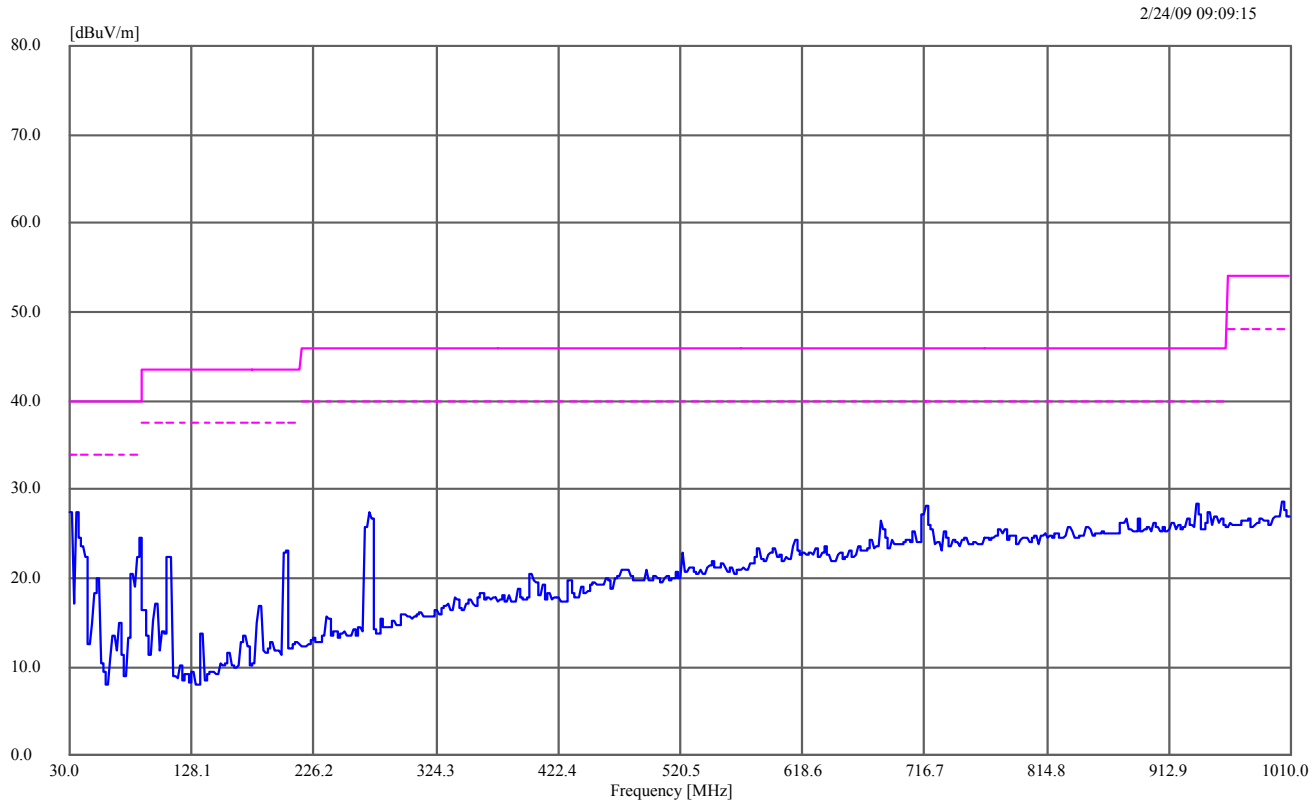


Figure 79: Emissions Pres-can, 2dBi Dipole Antenna (RFA-02-D3-70-100), 30 to 1000 MHz, X-Axis

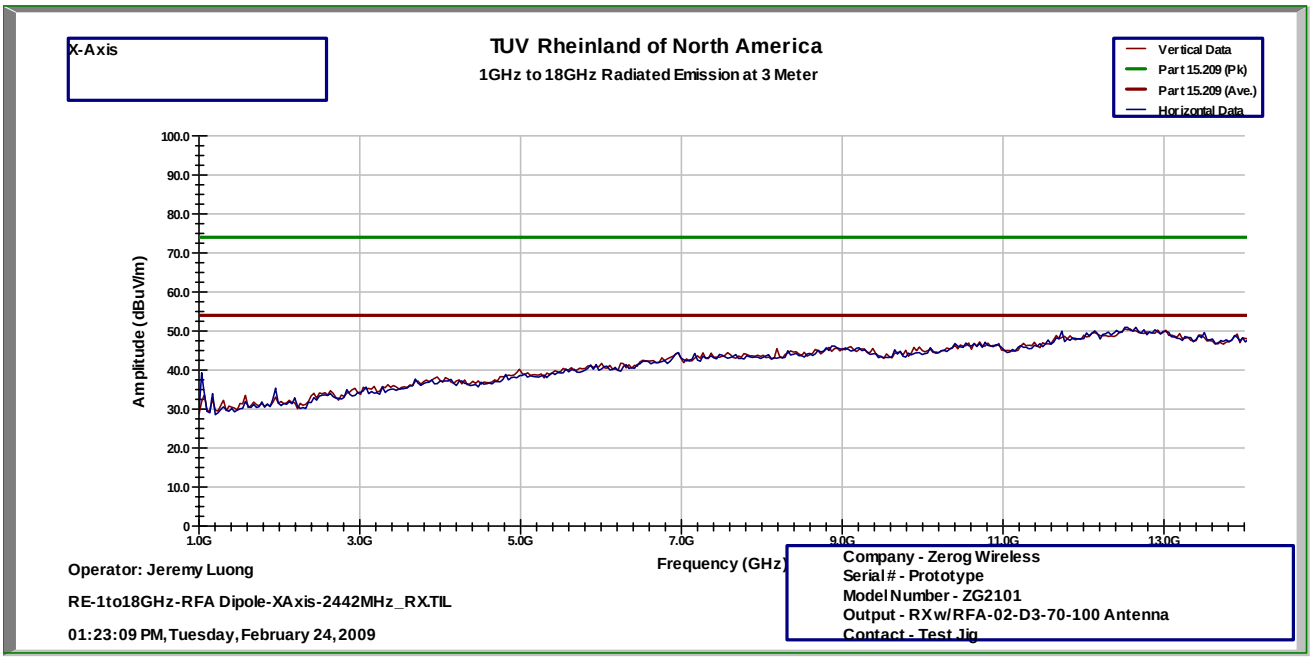


Figure 80: Emissions Pres-can, 2dBi Dipole Antenna (RFA-02-D3-70-100), 1GHz to 18GHz, X-Axis

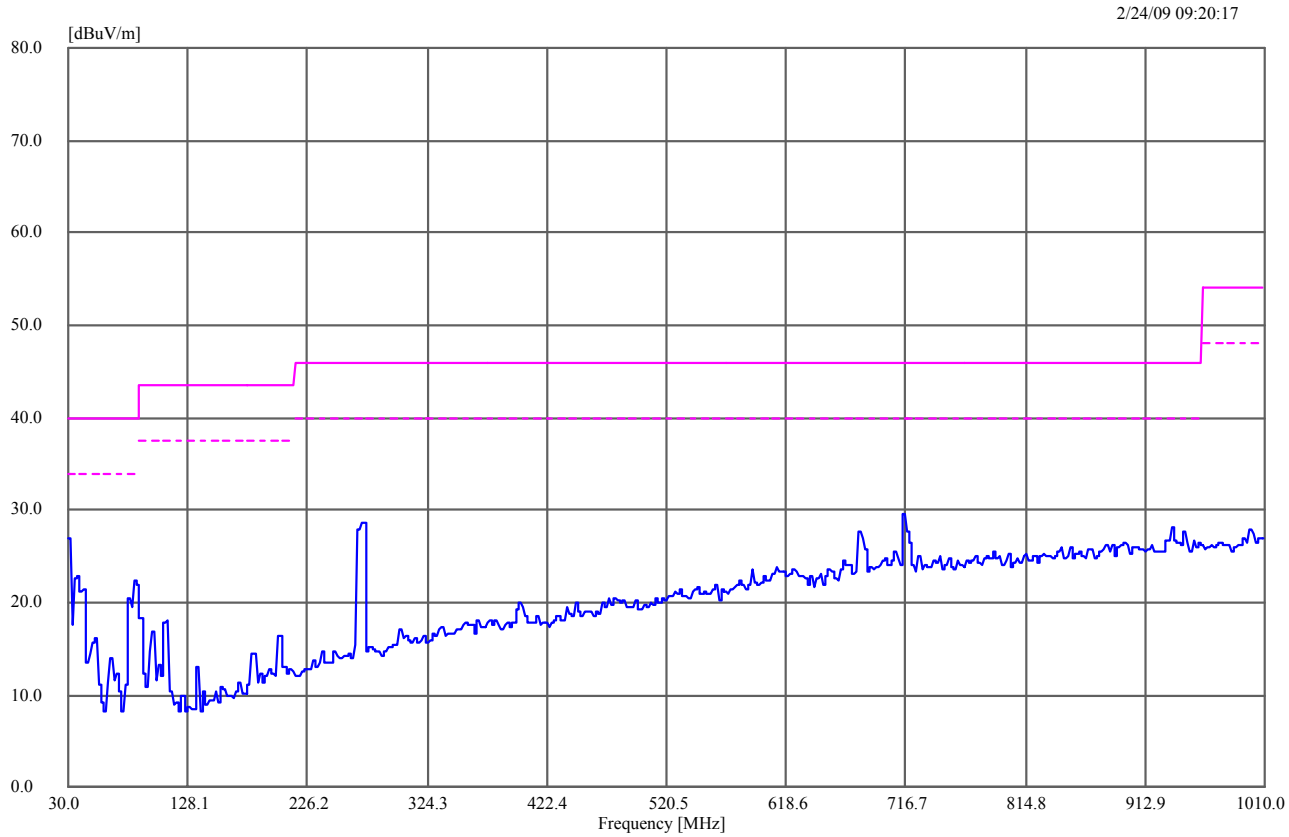


Figure 81: Emissions Pres-can, 2dBi Dipole Antenna (RFA-02-D3-70-100), 30 to 1000 MHz, Y-Axis

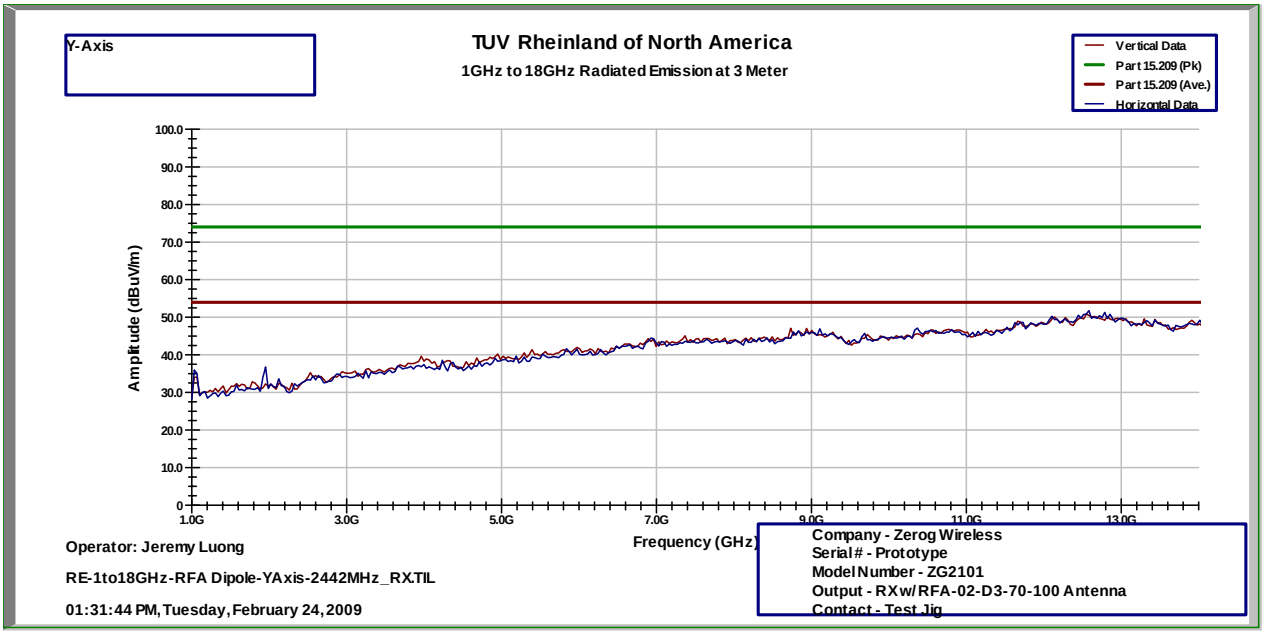


Figure 82: Emissions Pres-can, 2dBi Dipole Antenna (RFA-02-D3-70-100), 1GHz to 18GHz, Y-Axis

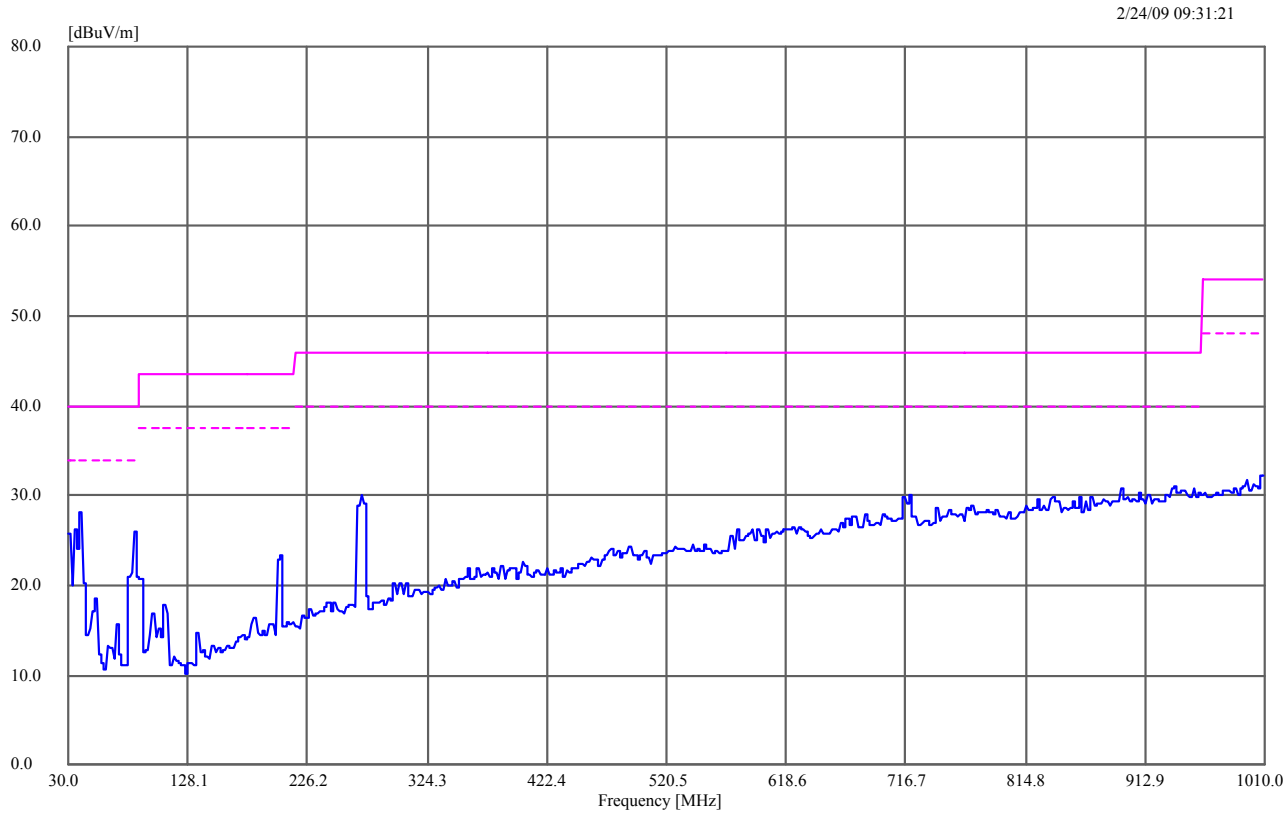


Figure 83: Emissions Pres-can, 2dBi Dipole Antenna (RFA-02-D3-70-100), 30 to 1000 MHz, Z-Axis

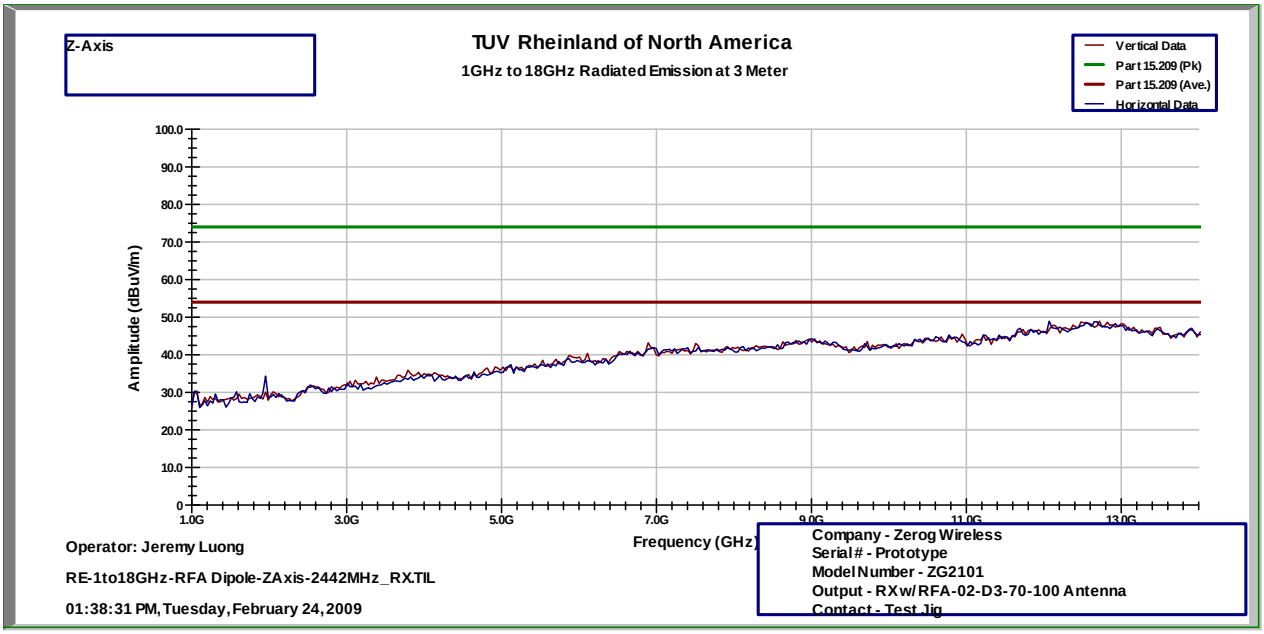


Figure 84: Emissions Pres-can, 2dBi Dipole Antenna (RFA-02-D3-70-100), 1GHz to 18GHz, Z-Axis

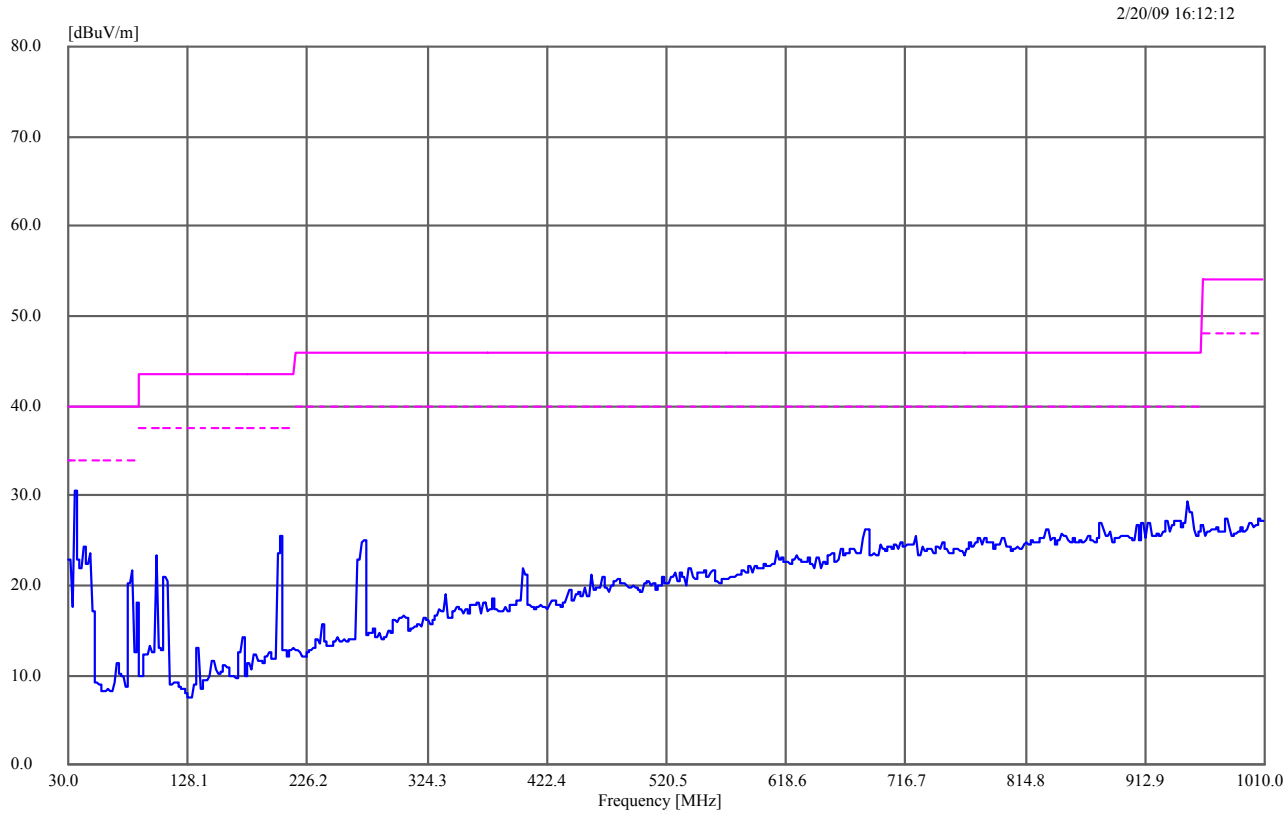


Figure 85: Emissions Pres-can, Helical Antenna, 30 to 1000 MHz, X-Axis

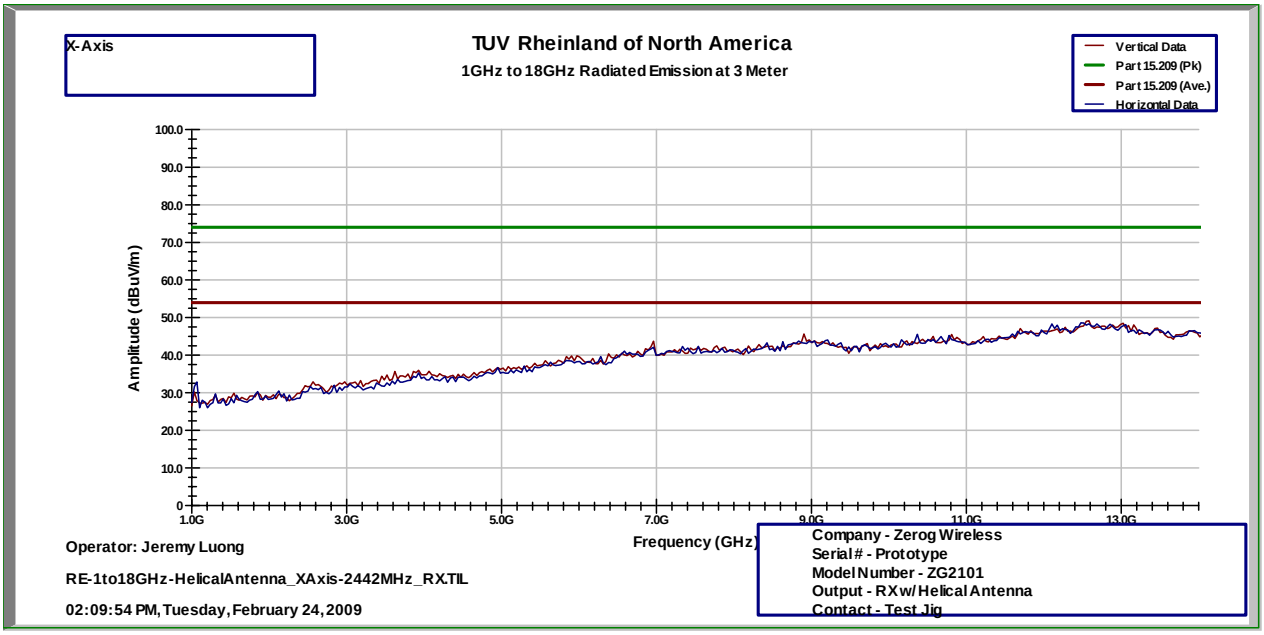


Figure 86: Emissions Pres-can, Helical Antenna, 1GHz to 18GHz, X-Axis

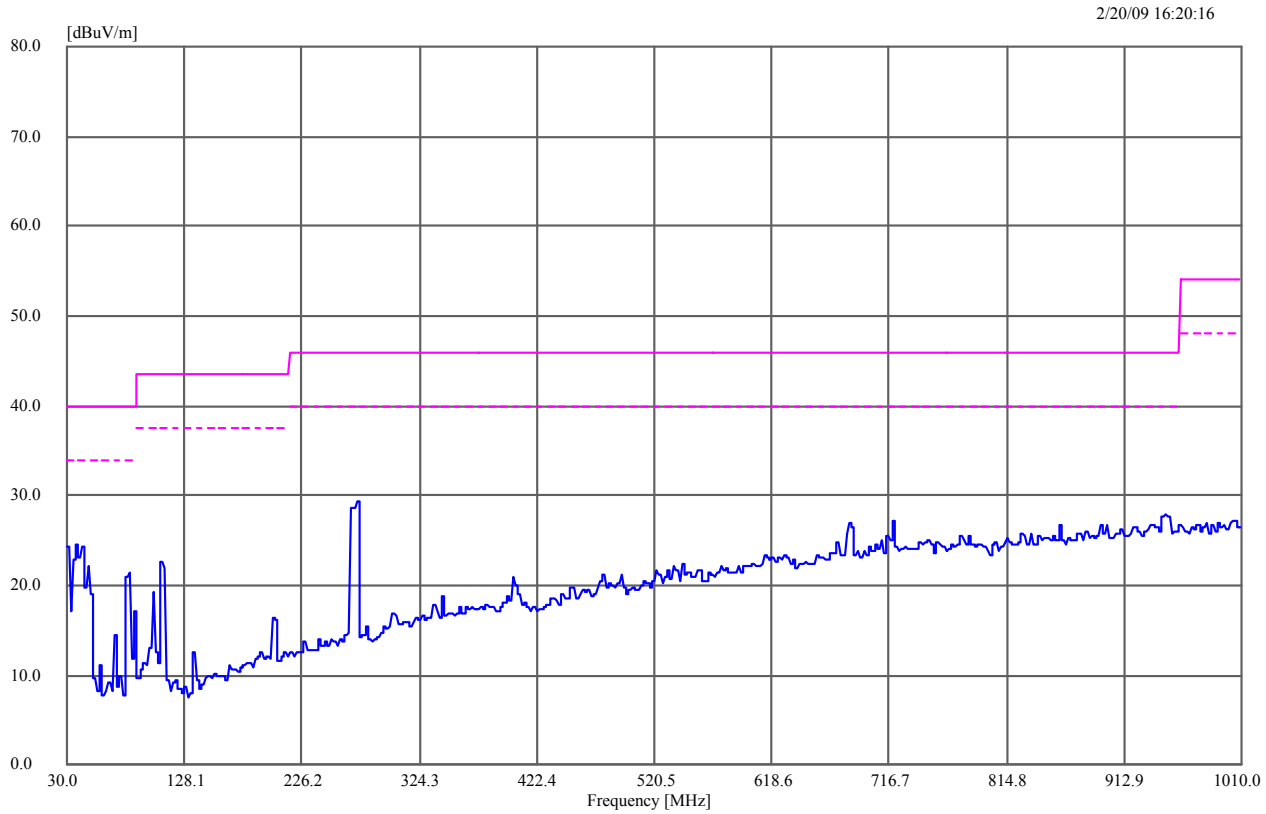


Figure 87: Emissions Pres-can, Helical Antenna, 30 to 1000 MHz, Y-Axis

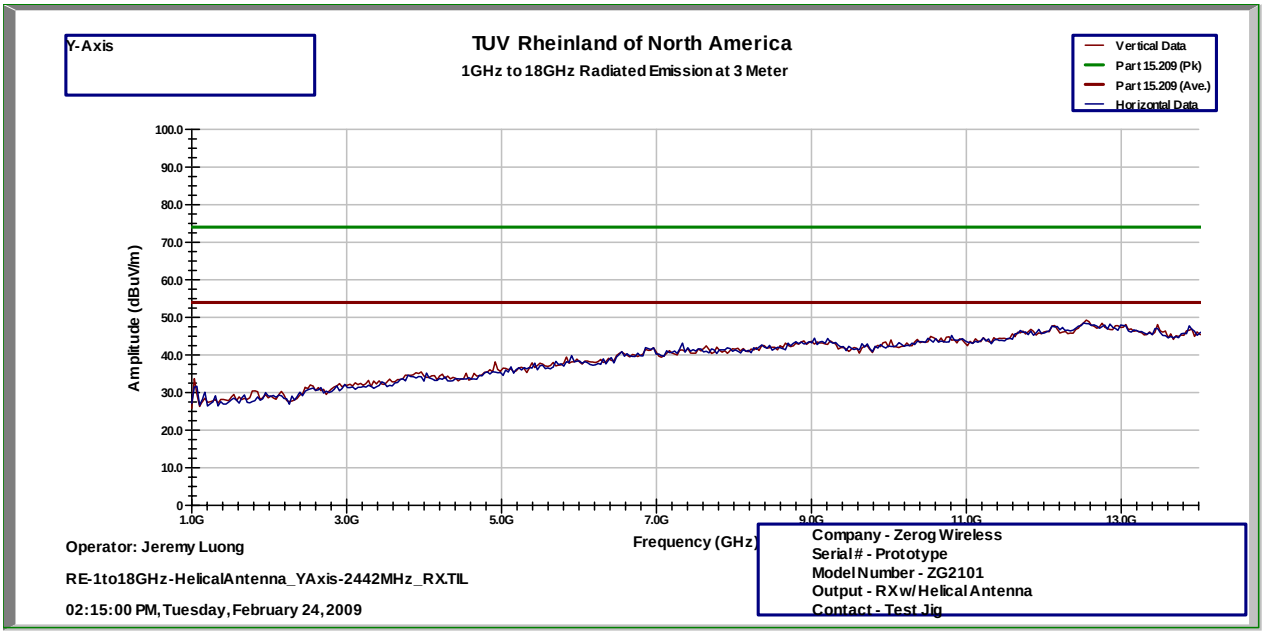


Figure 88: Emissions Pres-can, Helical Antenna, 1GHz to 18GHz, Y-Axis

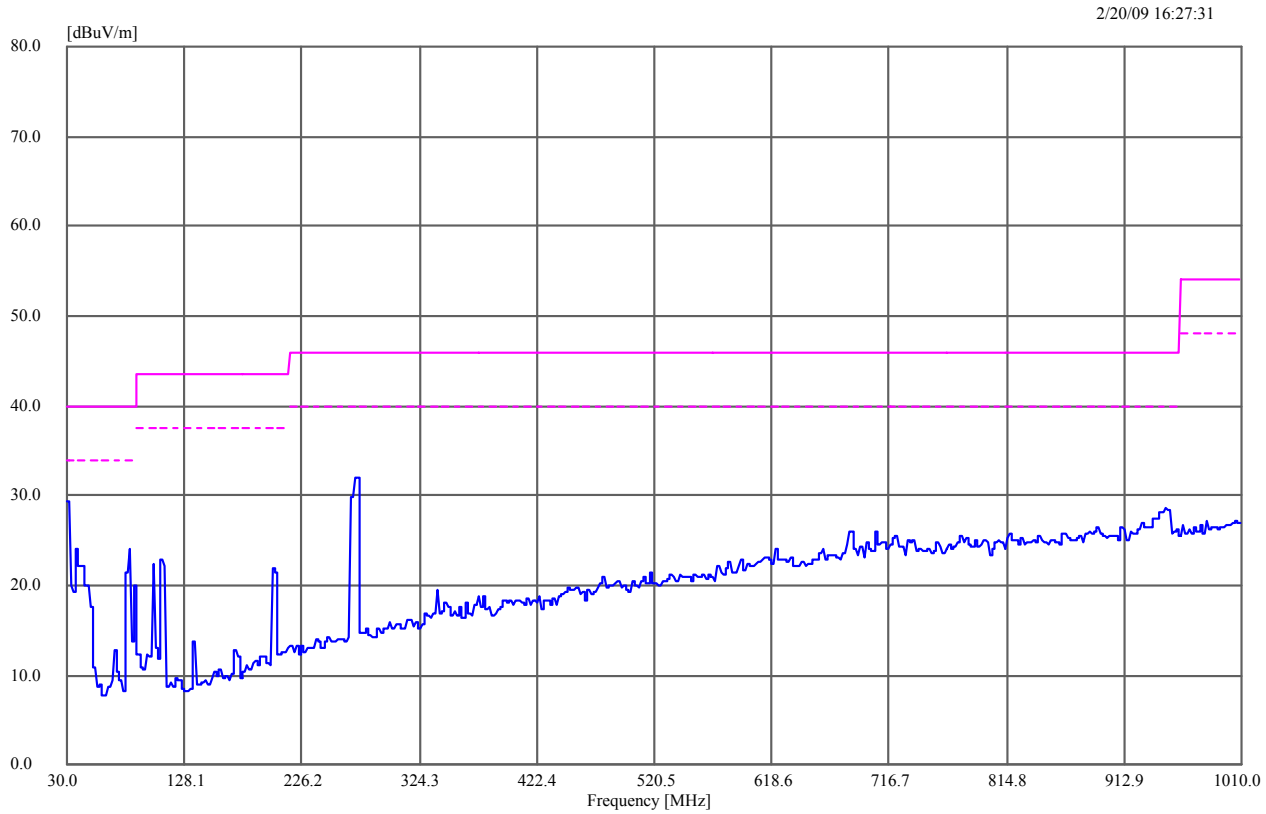


Figure 89: Emissions Pres-can, Helical Antenna, 30 to 1000 MHz, Z-Axis

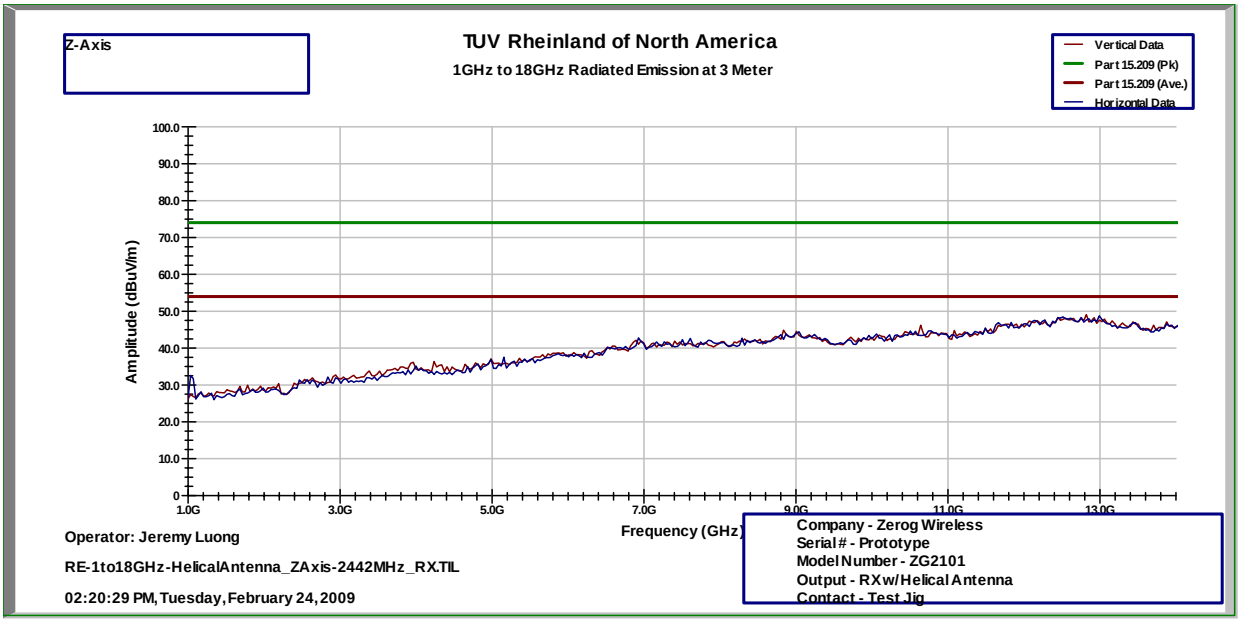


Figure 90: Emissions Pres-can, Helical Antenna, 1GHz to 18GHz, Z-Axis

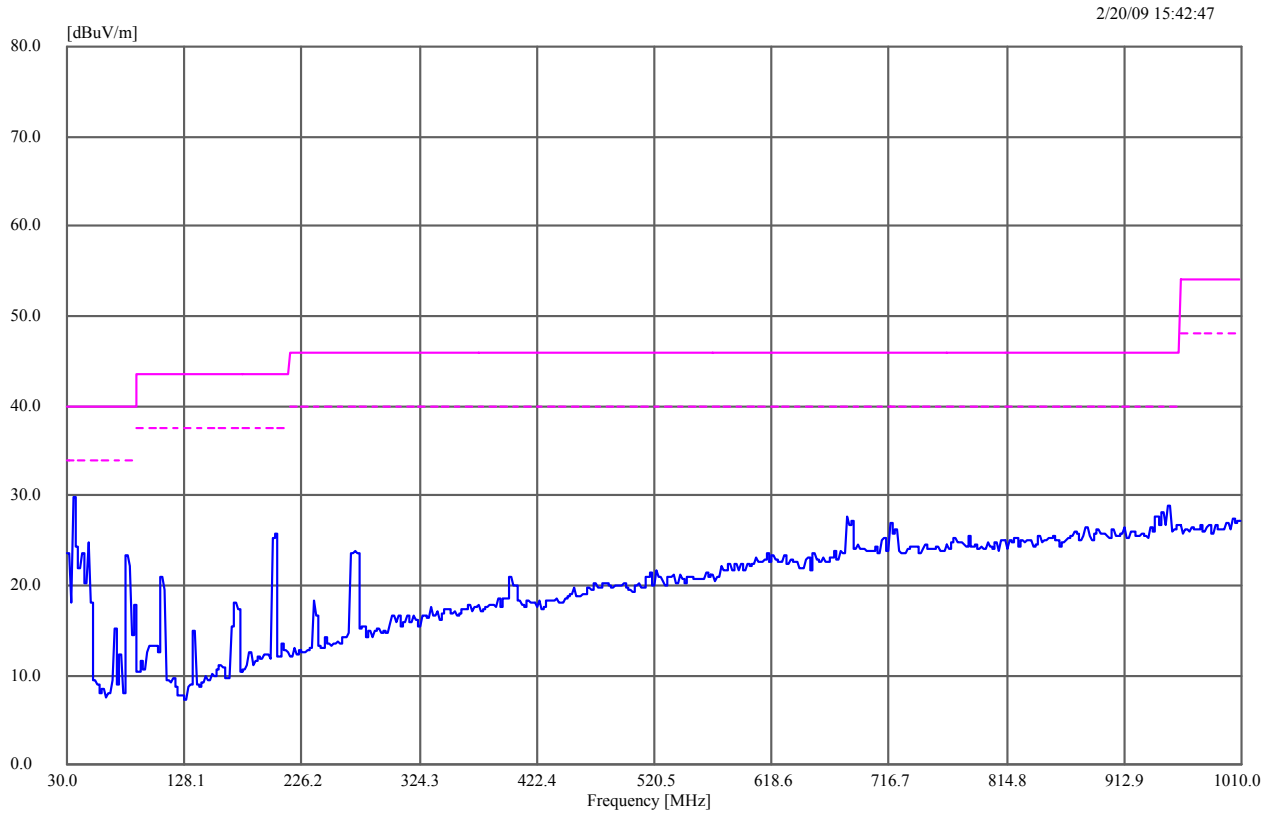


Figure 91: Emissions Pres-can, Inverter F Antenna, 30 to 1000 MHz, X-Axis

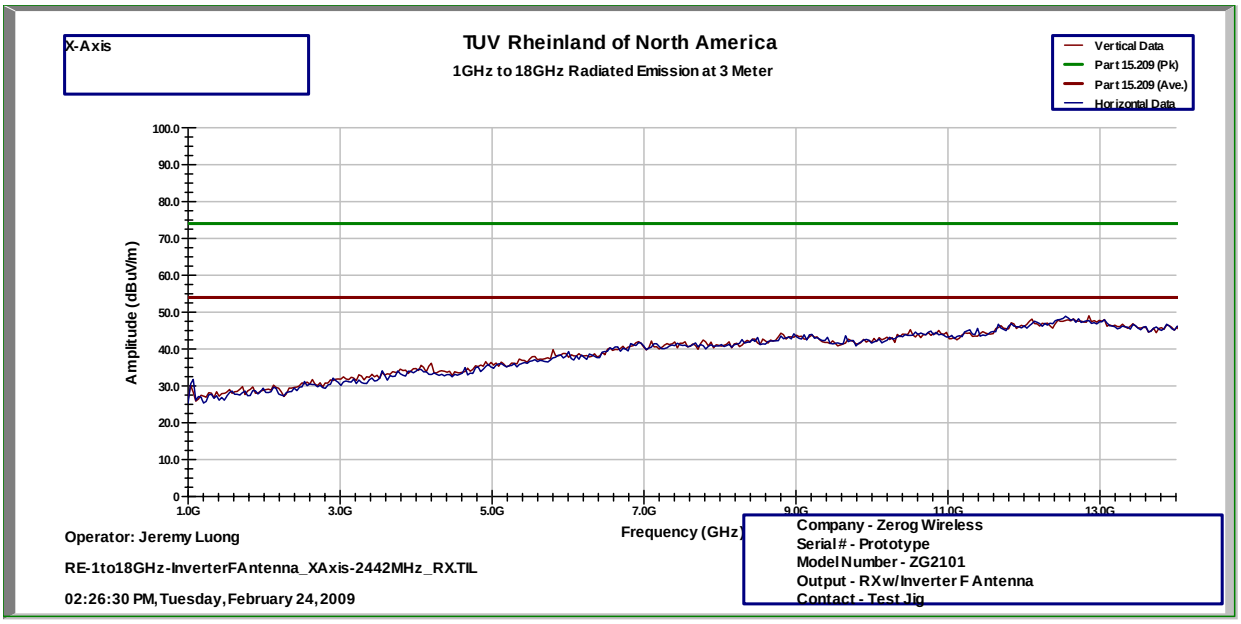


Figure 92: Emissions Pres-can, Inverter F Antenna, 1GHz to 18GHz, X-Axis

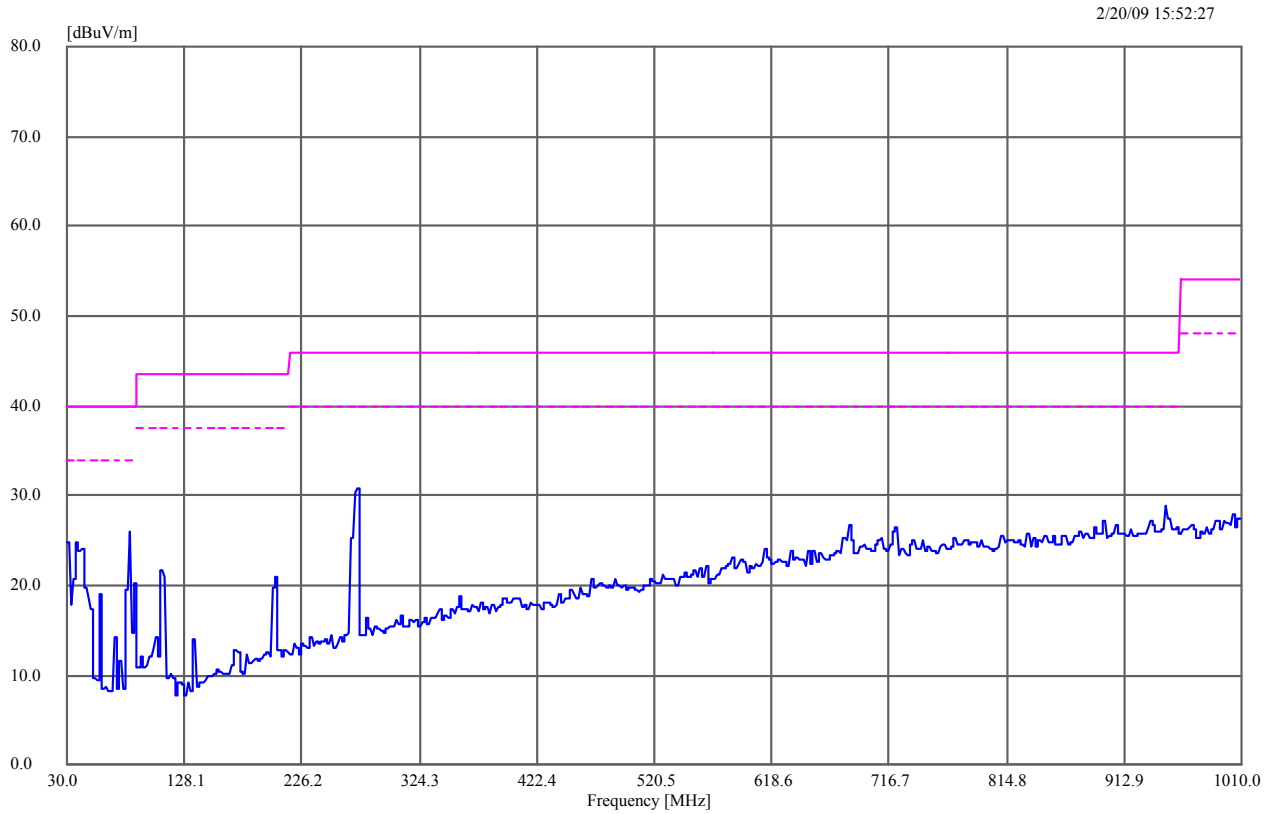


Figure 93: Emissions Pres-can, Inverter F Antenna, 30 to 1000 MHz, Y-Axis

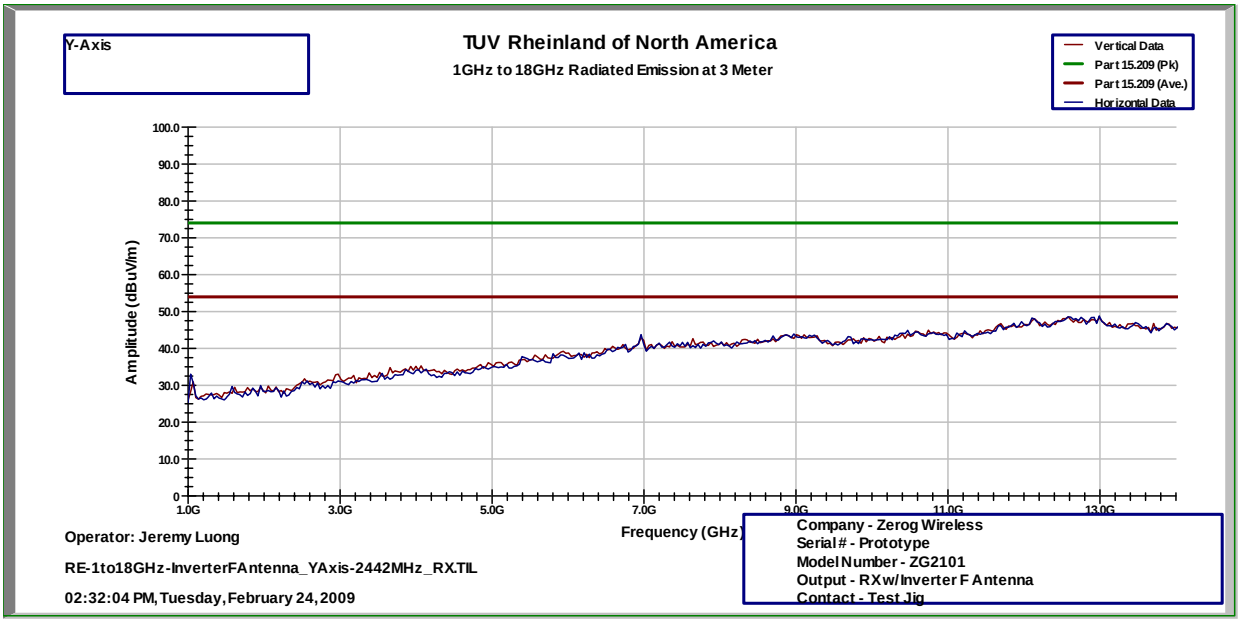


Figure 94: Emissions Pres-can, Inverter F Antenna, 1GHz to 18GHz, Y-Axis

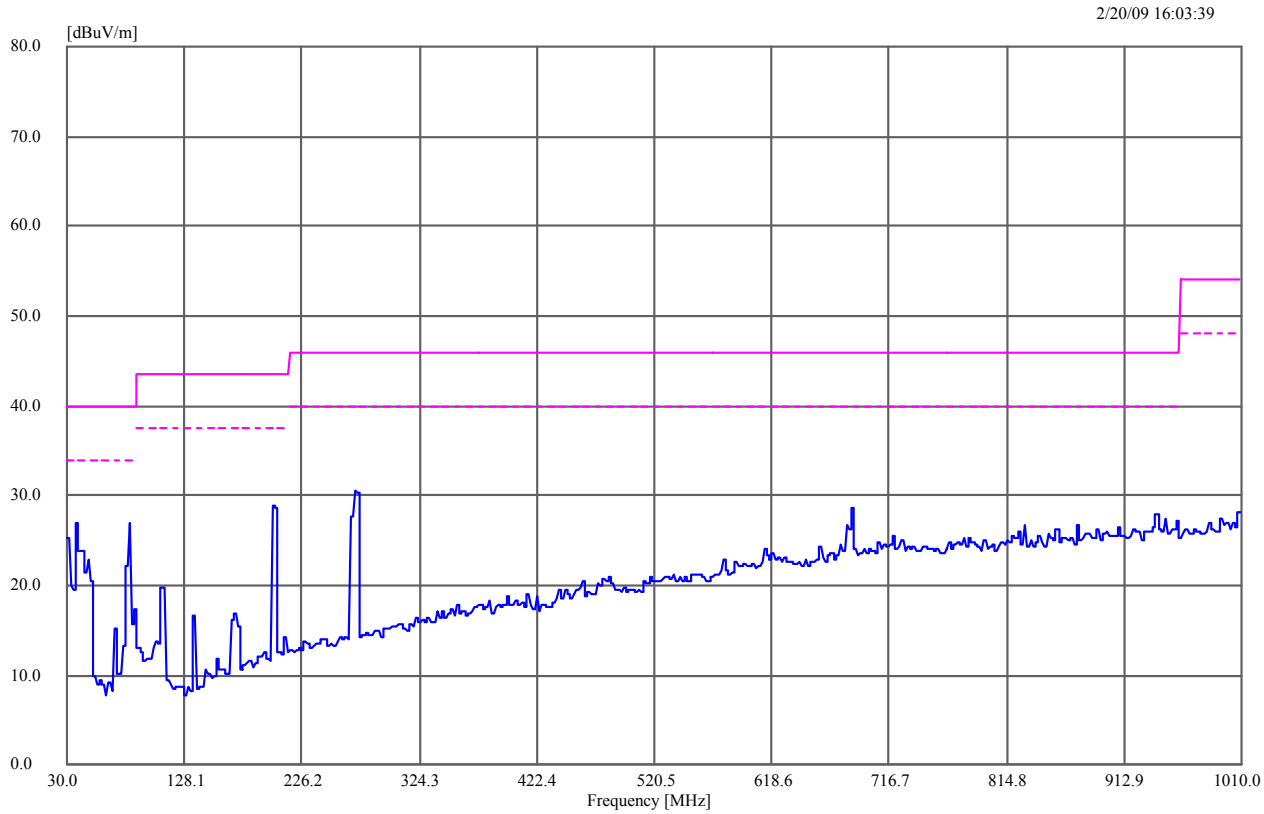


Figure 95: Emissions Pres-can, Inverter F Antenna, 30 to 1000 MHz, Z-Axis

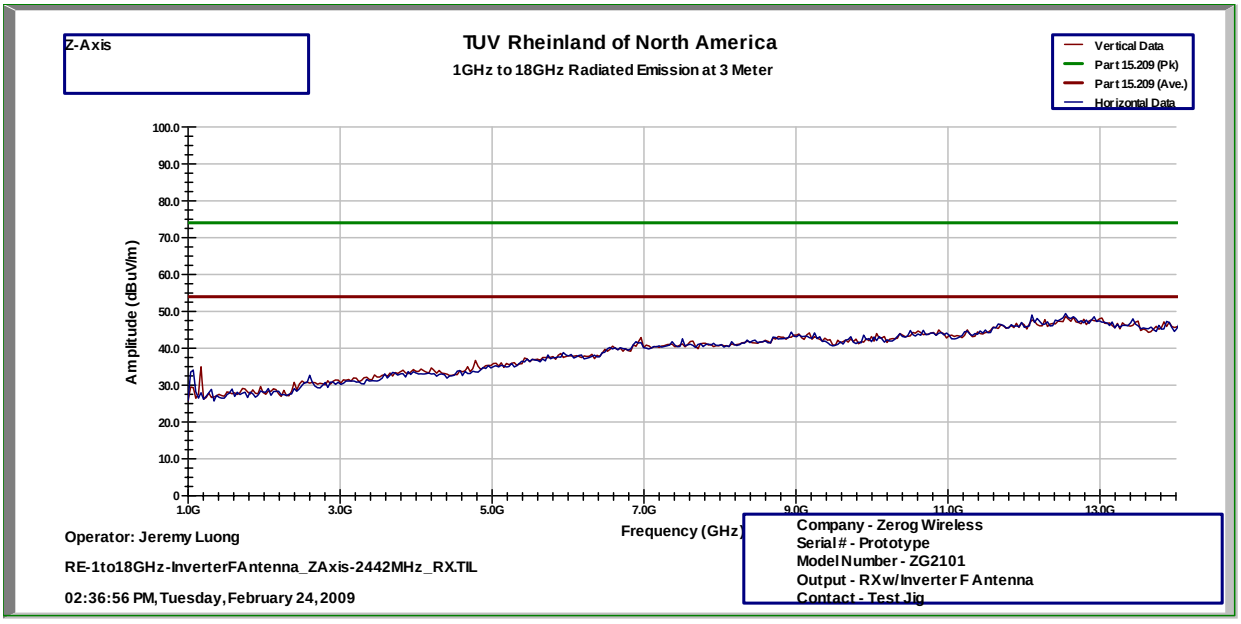


Figure 96: Emissions Pres-can, Inverter F Antenna, 1GHz to 18GHz, Z-Axis

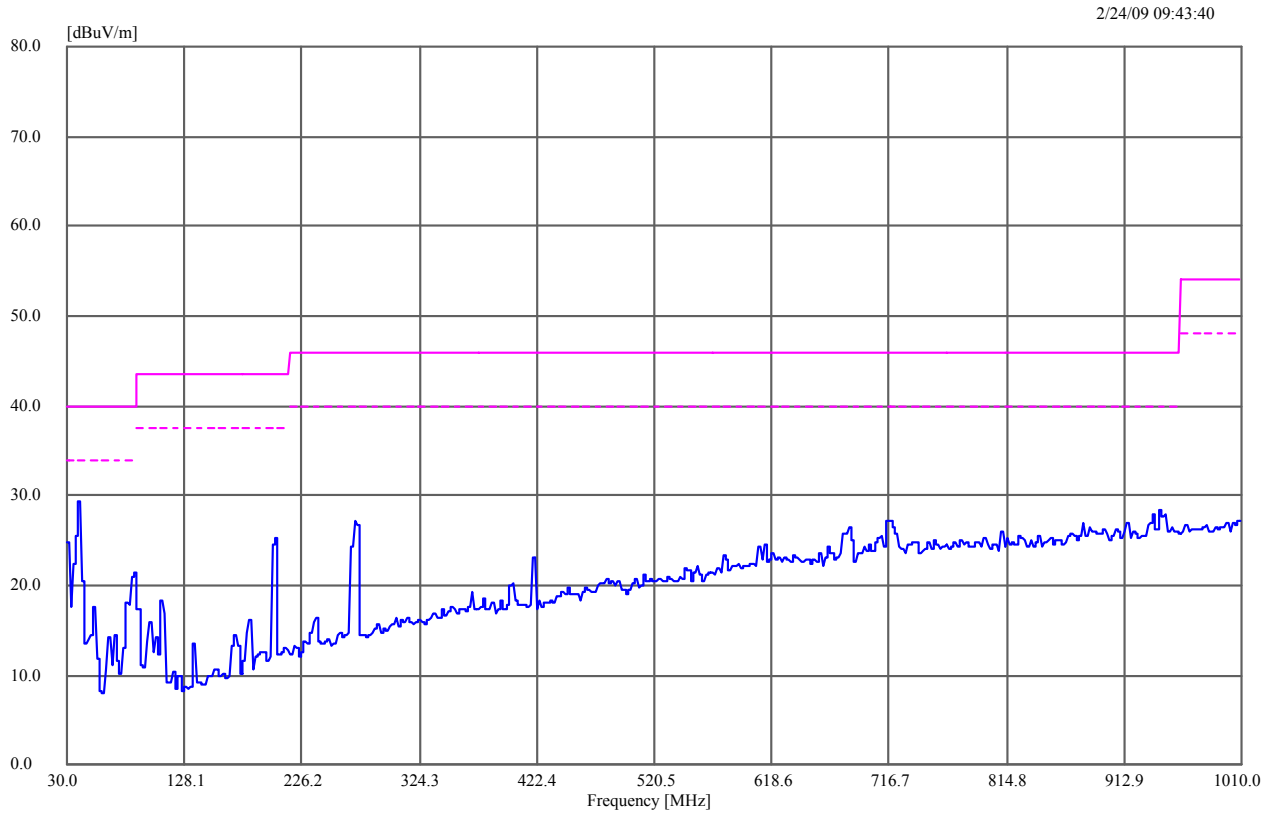


Figure 97: Emissions Pres-can, 2dBi PCB Antenna #3, 30 to 1000 MHz, X-Axis

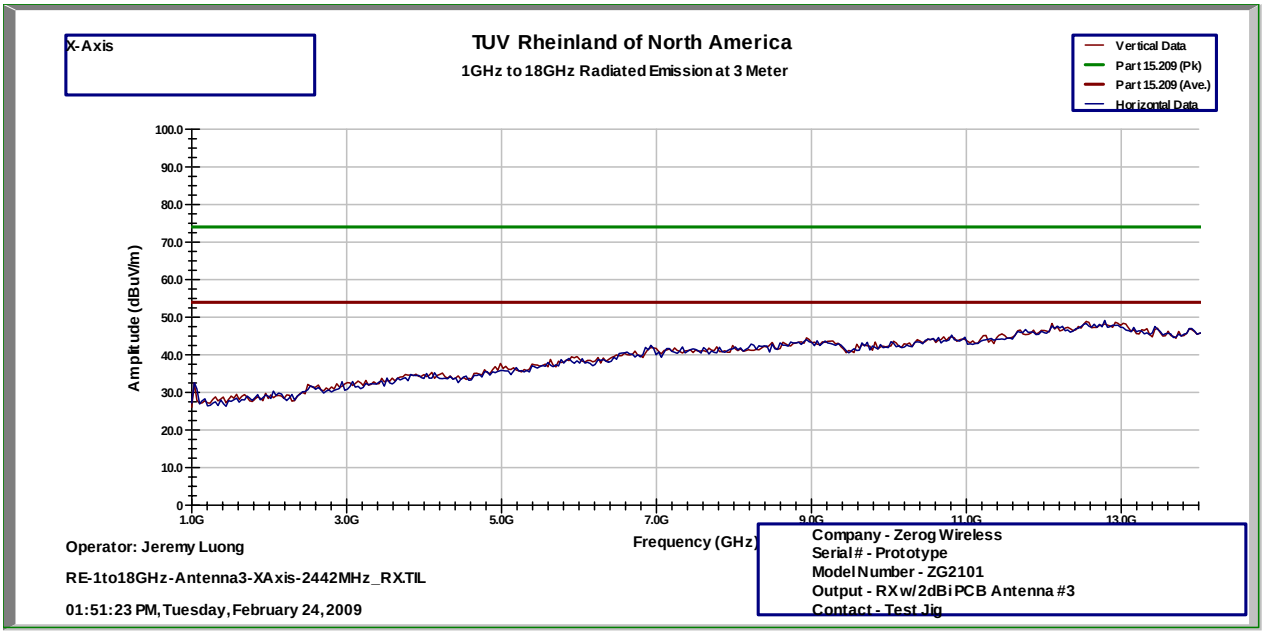


Figure 98: Emissions Pres-can, 2dBi PCB Antenna #3, 1GHz to 18GHz, X-Axis

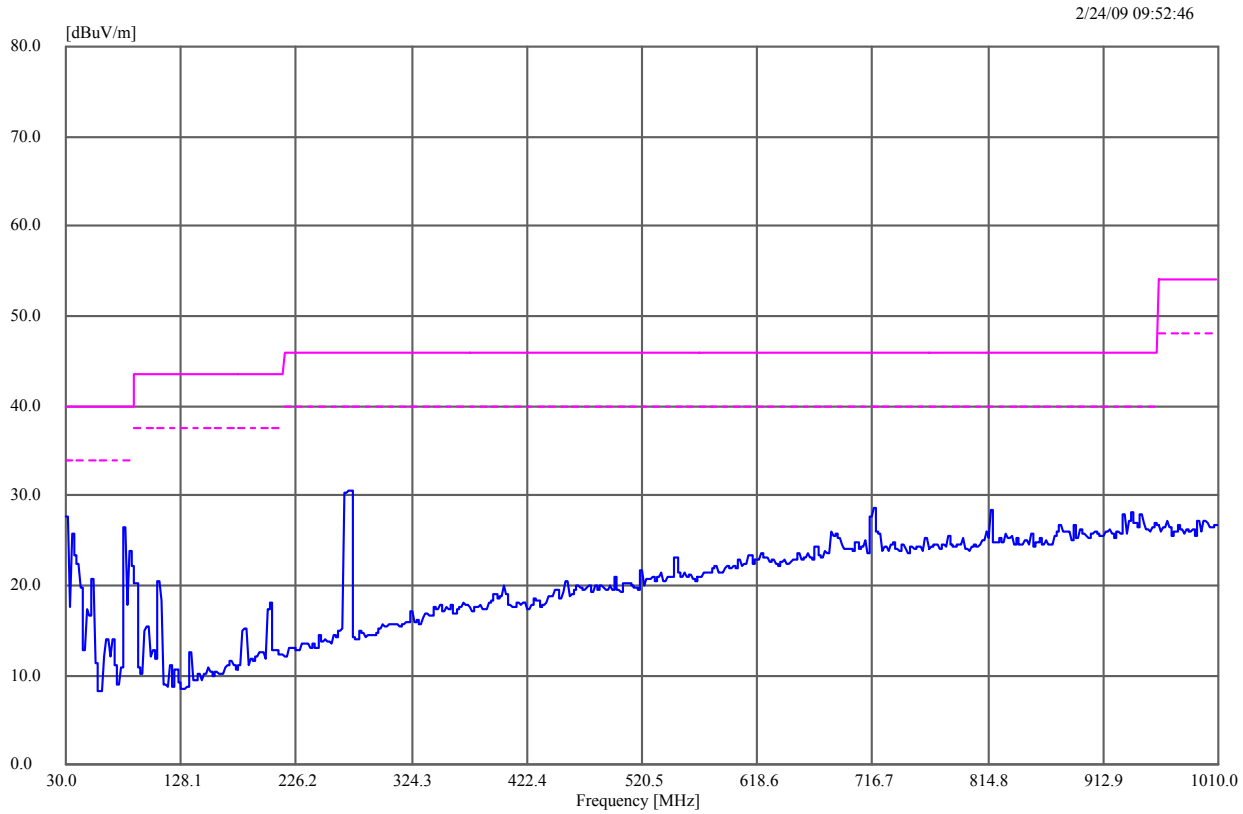


Figure 99: Emissions Pres-can, 2dBi PCB Antenna #3, 30 to 1000 MHz, Y-Axis

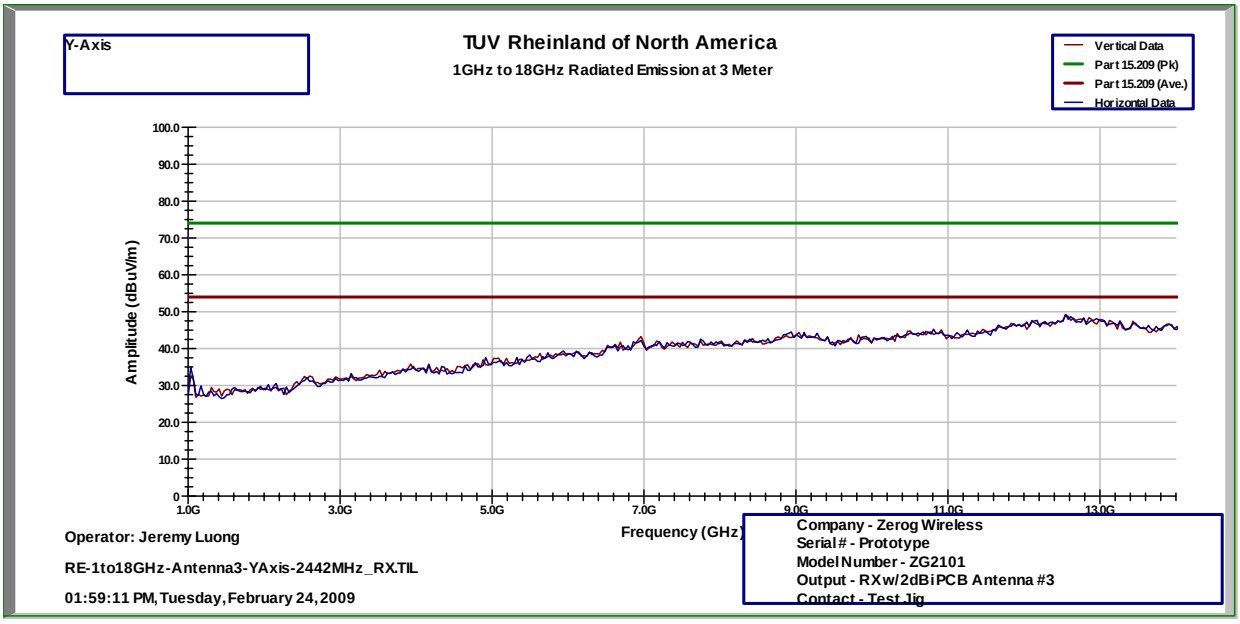


Figure 100: Emissions Pres-can, 2dBi PCB Antenna #3, 1GHz to 18GHz, Y-Axis

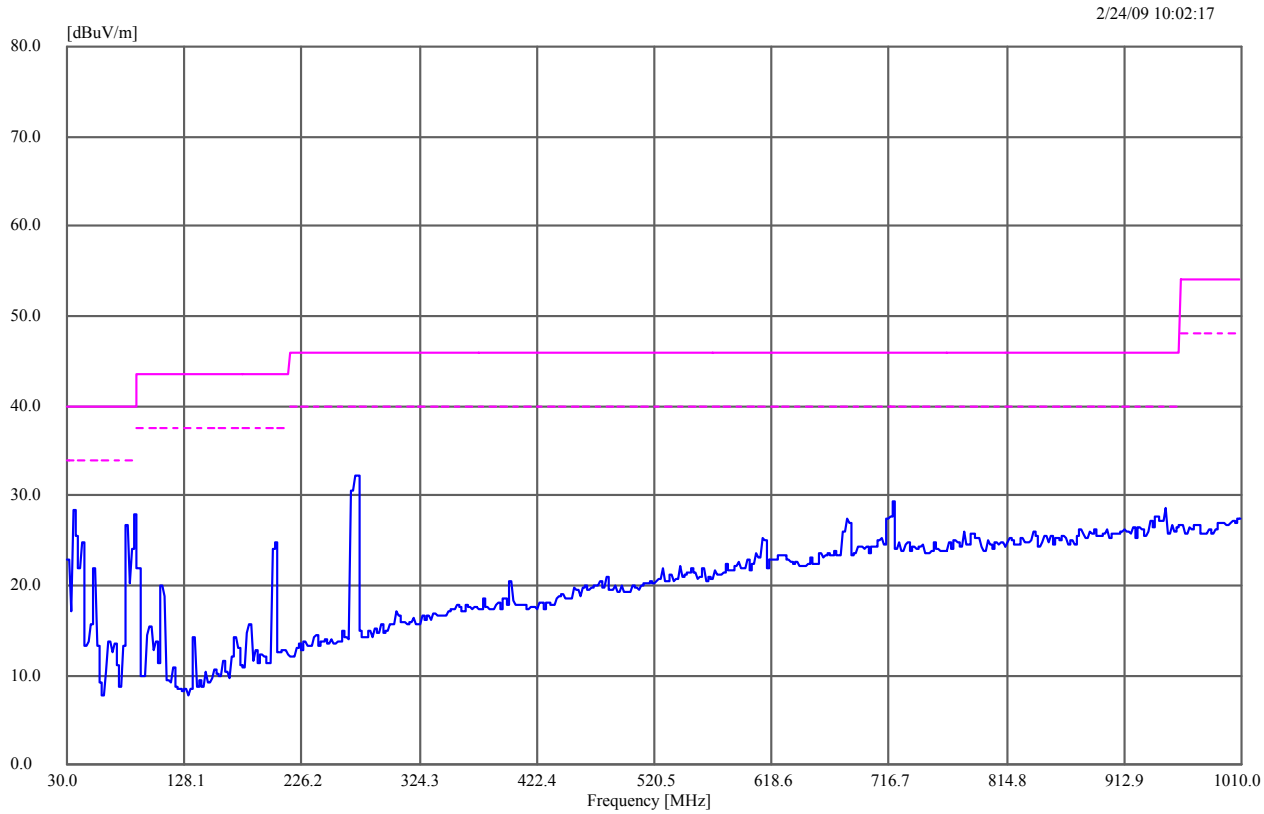


Figure 101: Emissions Pres-can, 2dBi PCB Antenna #3, 30 to 1000 MHz, Z-Axis

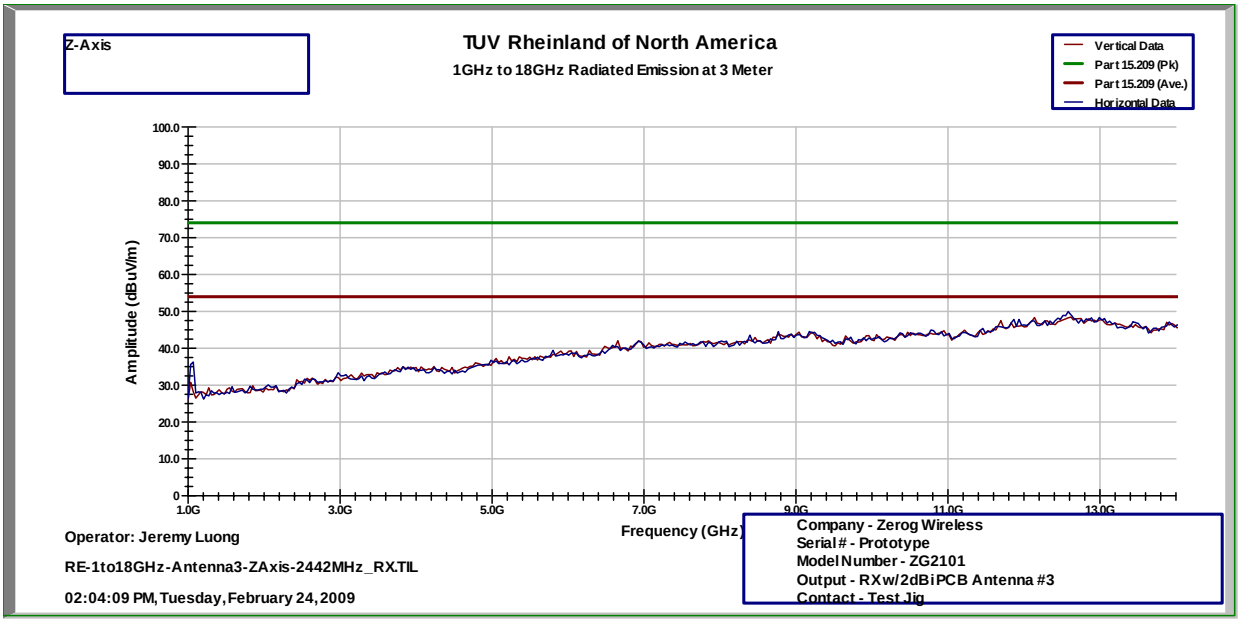


Figure 102: Emissions Pres-can, 2dBi PCB Antenna #3, 1GHz to 18GHz, Z-Axis

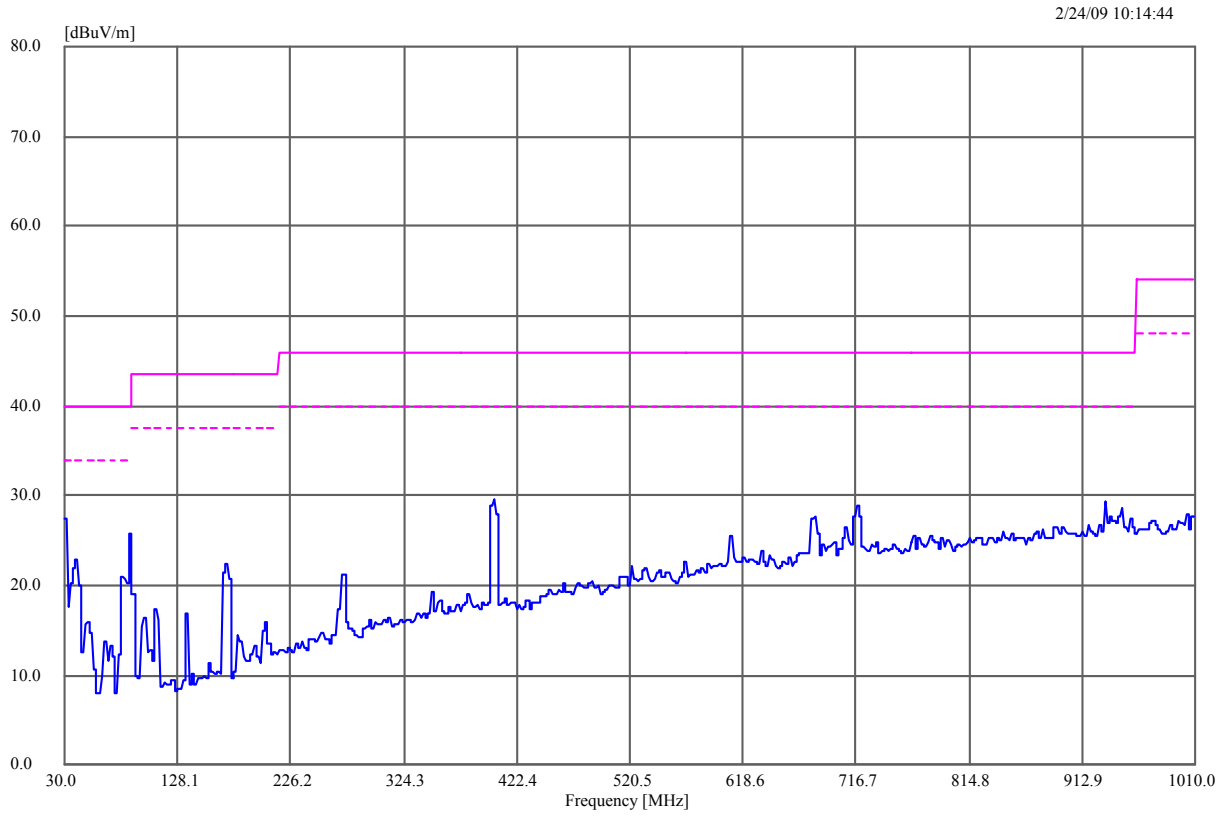


Figure 103: Emissions Pres-can, 5dBi Dipole Antenna, 30 to 1000 MHz, X-Axis

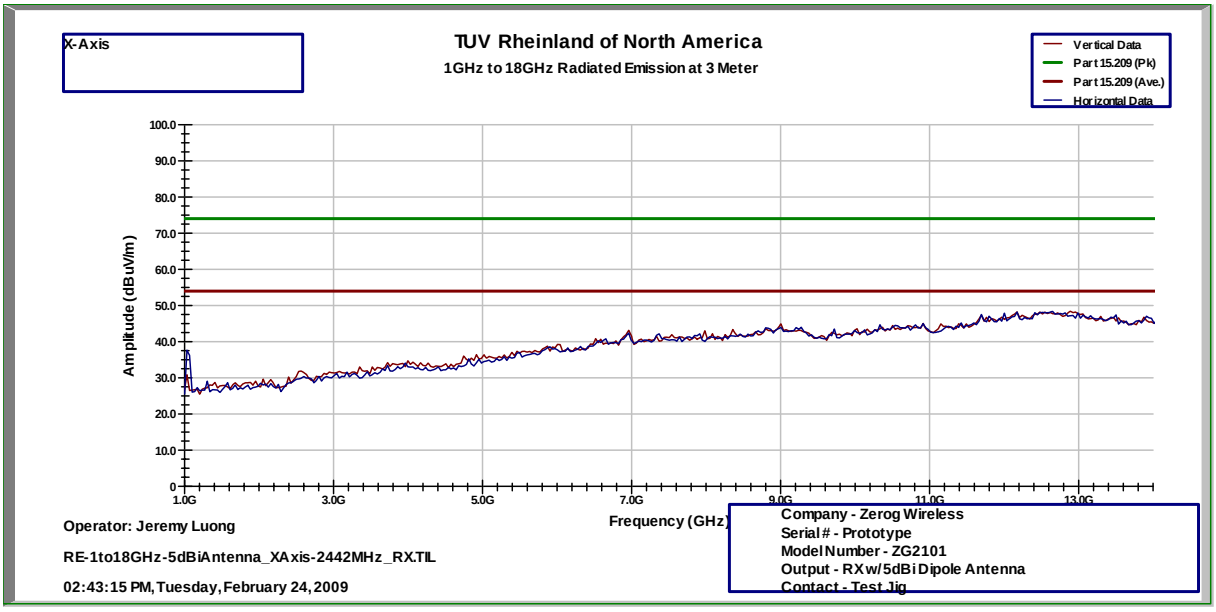


Figure 104: Emissions Pres-can, 5dBi Dipole Antenna, 1GHz to 18GHz, X-Axis

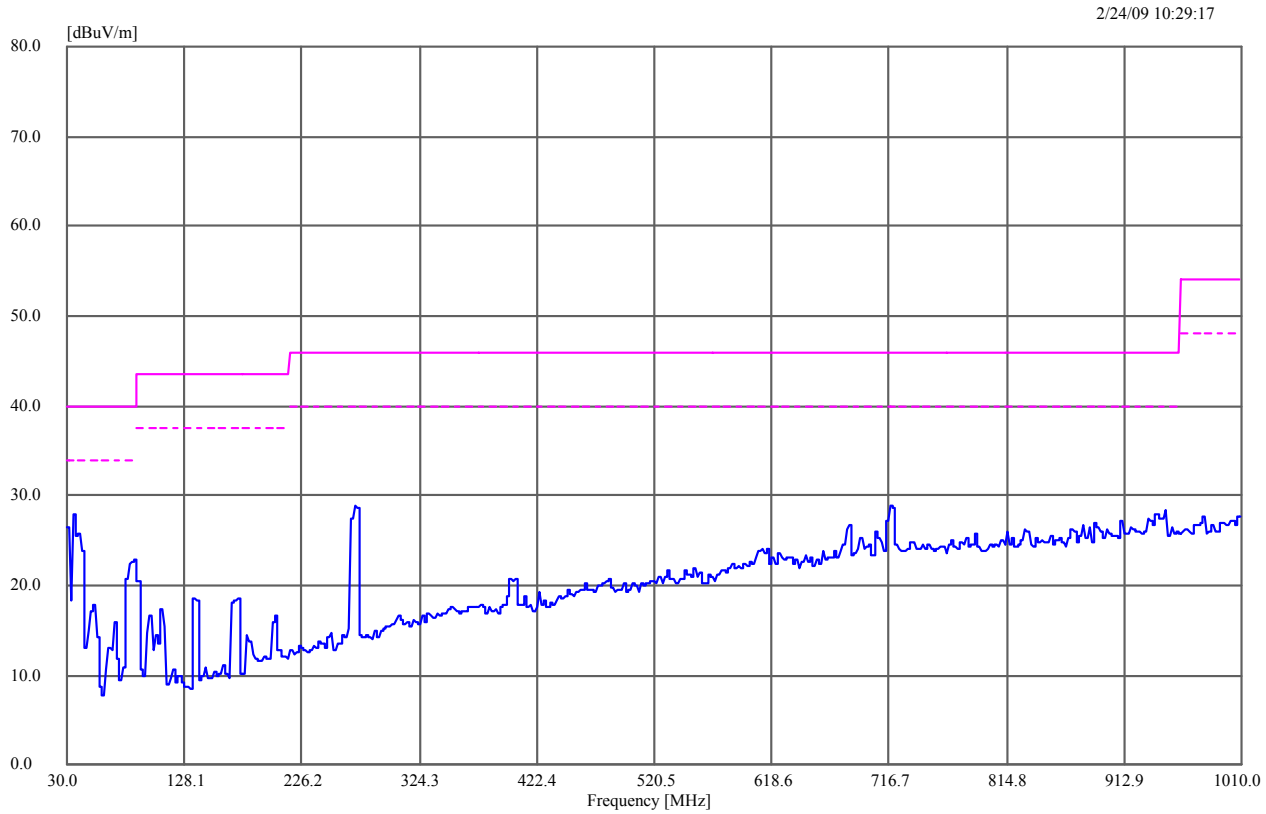


Figure 105: Emissions Pres-can, 5dBi Dipole Antenna, 30 to 1000 MHz, Y-Axis

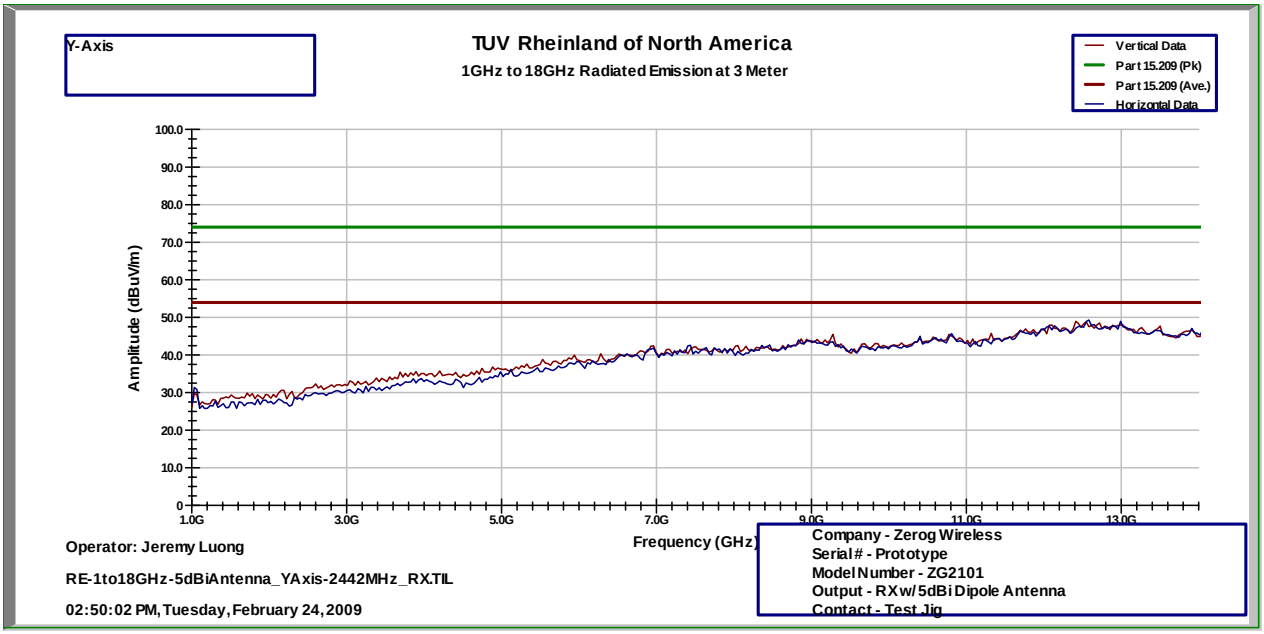


Figure 106: Emissions Pres-can, 5dBi Dipole Antenna, 1GHz to 18GHz, Y-Axis

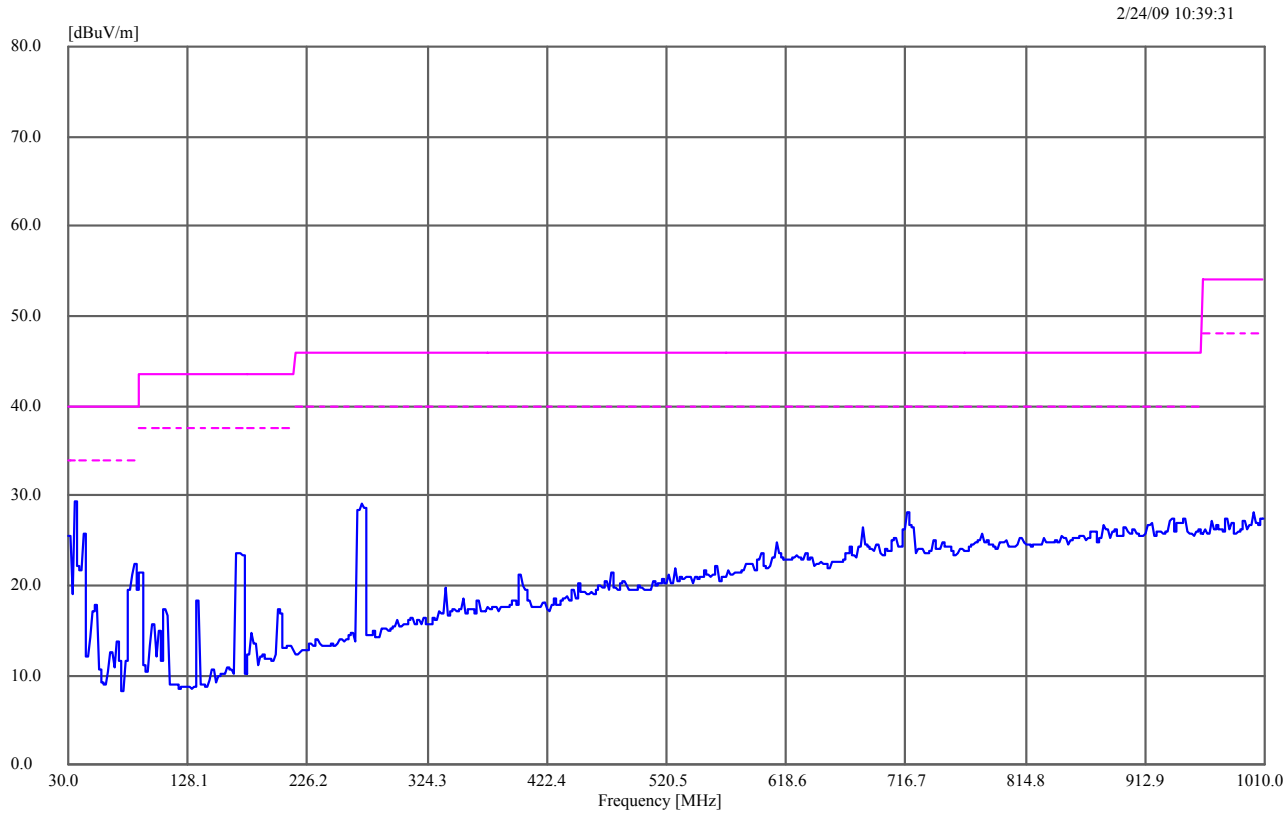


Figure 107: Emissions Pres-can, 5dBi Dipole Antenna, 30 to 1000 MHz, Z-Axis

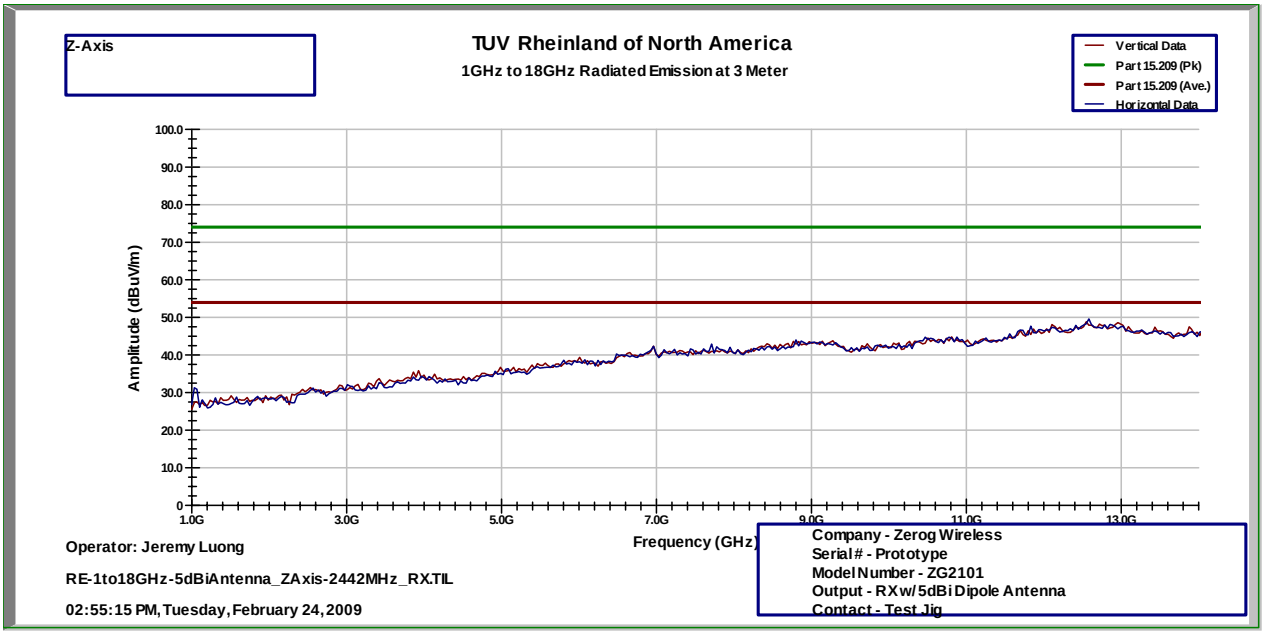


Figure 108: Emissions Pres-can, 5dBi Dipole Antenna, 1Ghz to 18GHz, Z-Axis

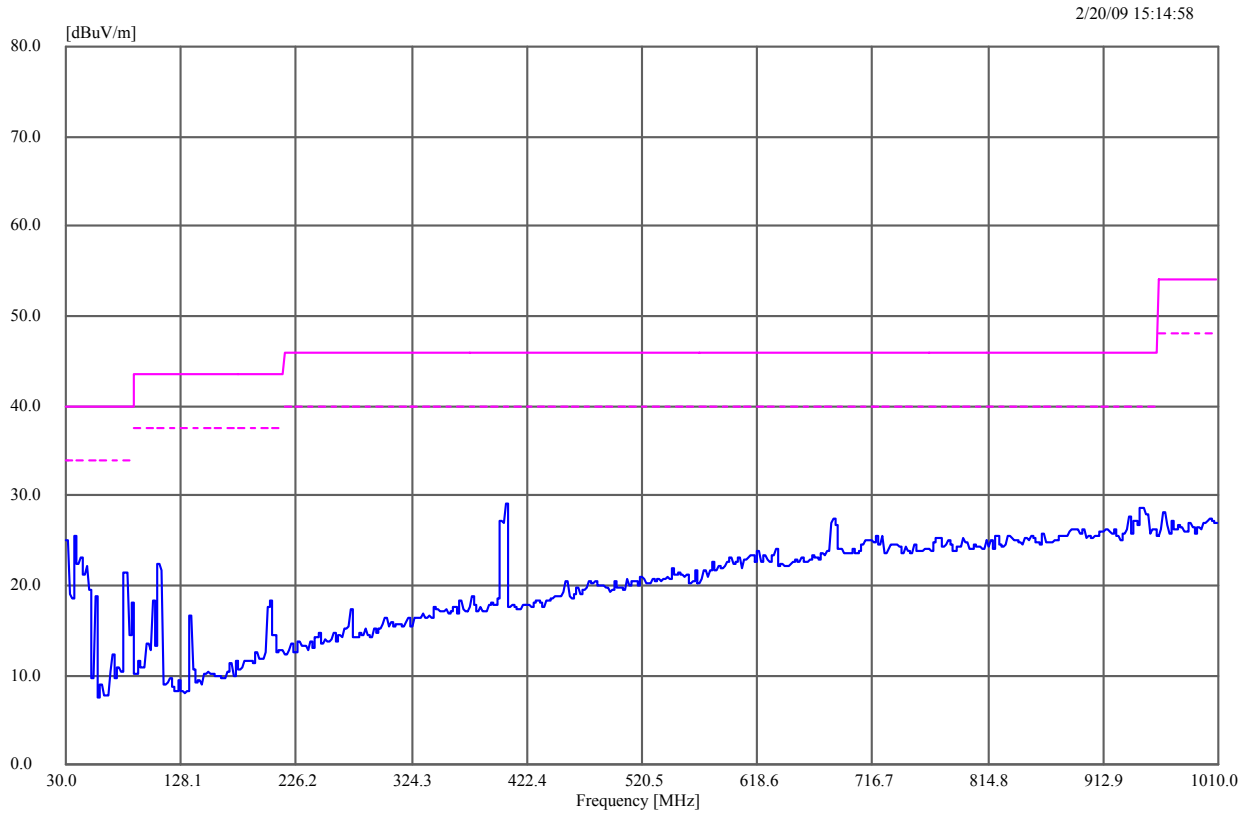


Figure 109: Emissions Pres-can, 10dBi Dipole Antenna, 30 to 1000 MHz, X-Axis

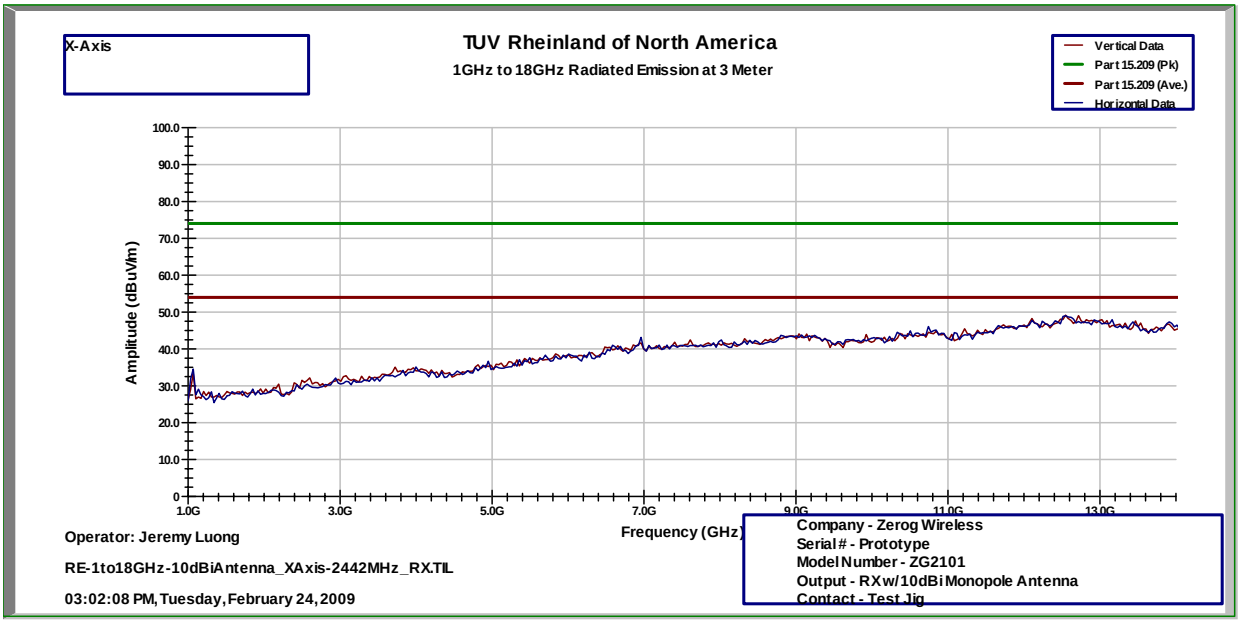


Figure 110: Emissions Pres-can, 10dBi Dipole Antenna, 1GHz to 18GHz, X-Axis

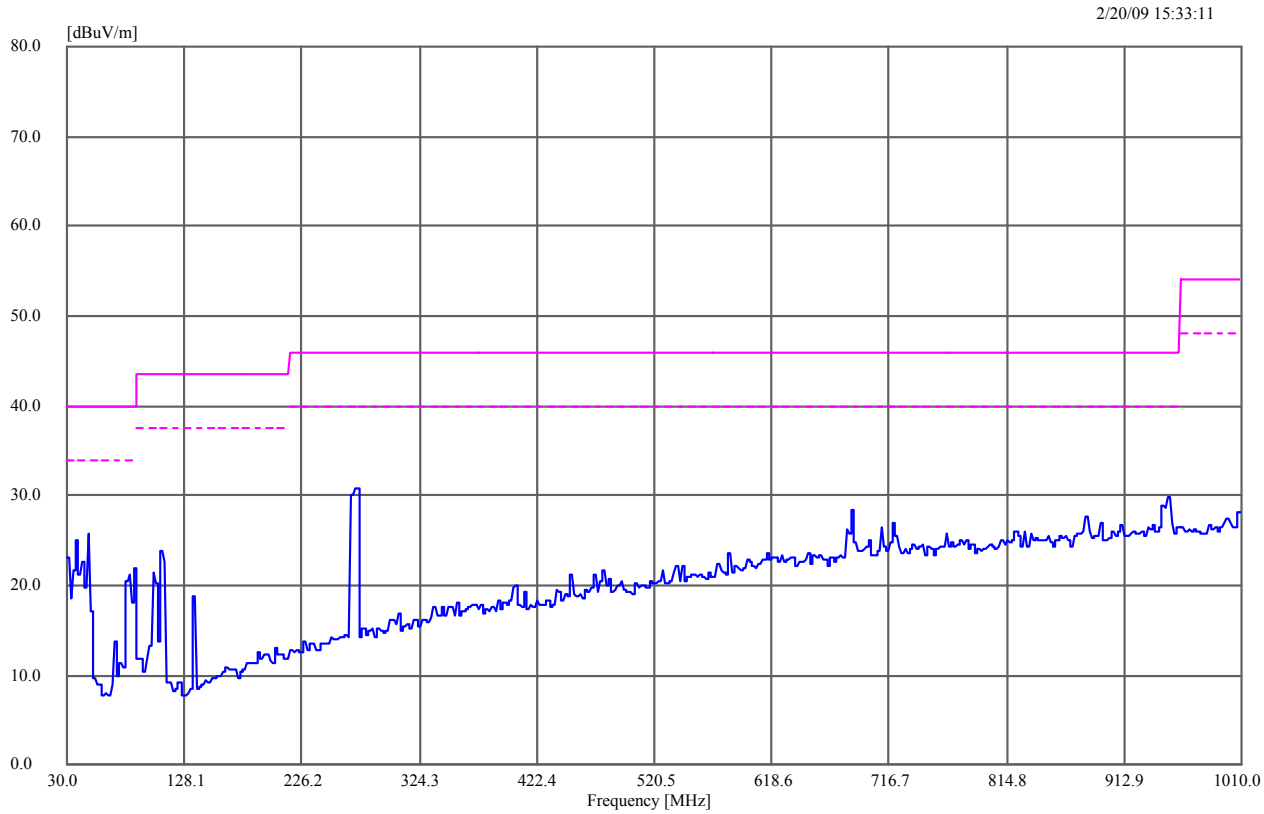


Figure 111: Emissions Pres-can, 10dBi Dipole Antenna, 30 to 1000 MHz, Y-Axis

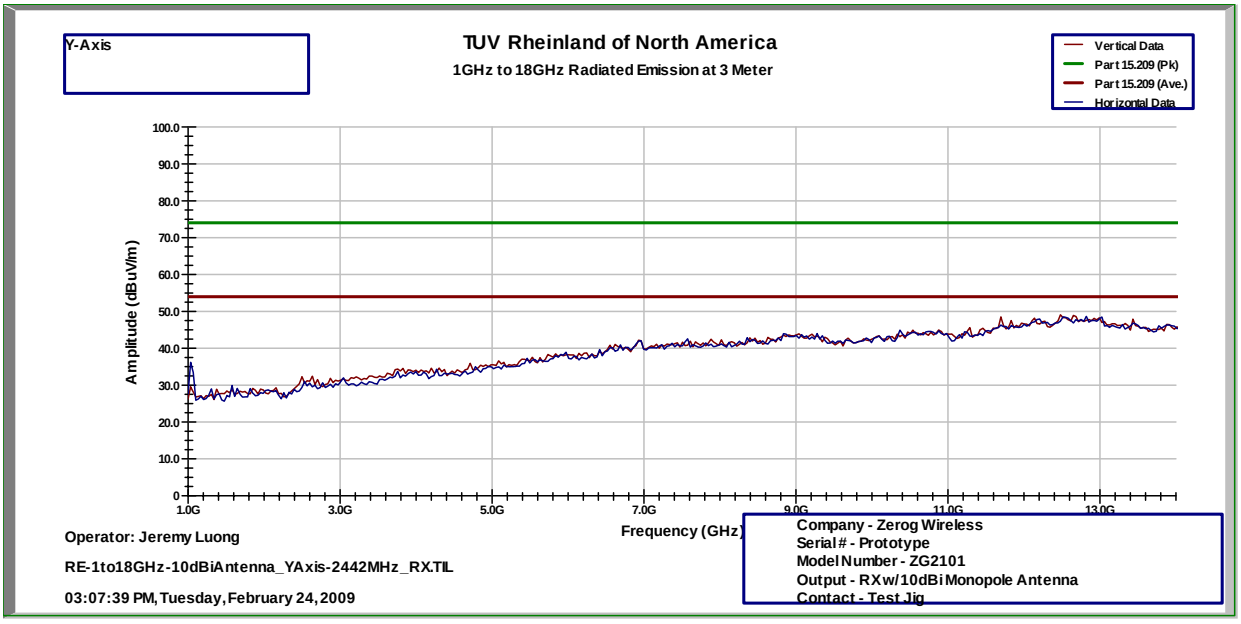


Figure 112: Emissions Pres-can, 10dBi Dipole Antenna, 1GHz to 18GHz, Y-Axis

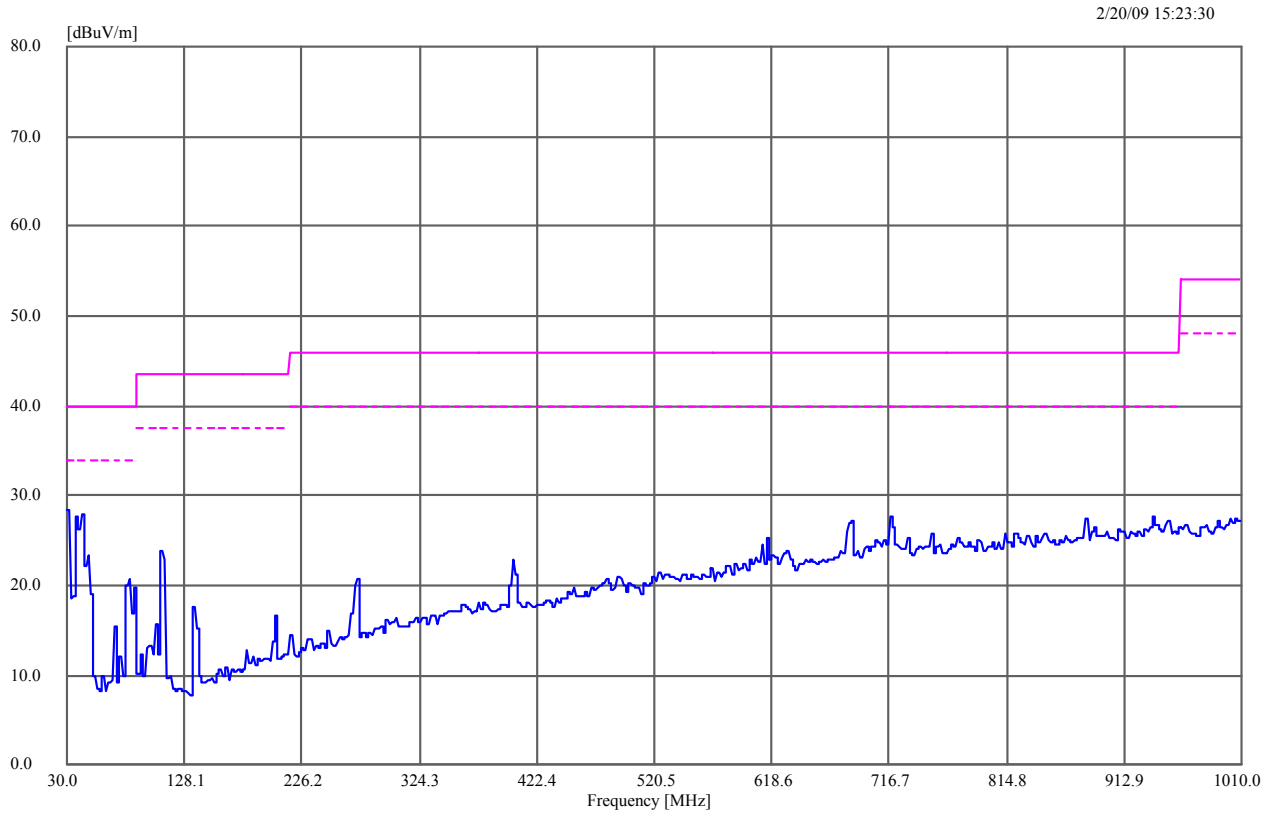


Figure 113: Emissions Pres-can, 10dBi Dipole Antenna, 30 to 1000 MHz, Z-Axis

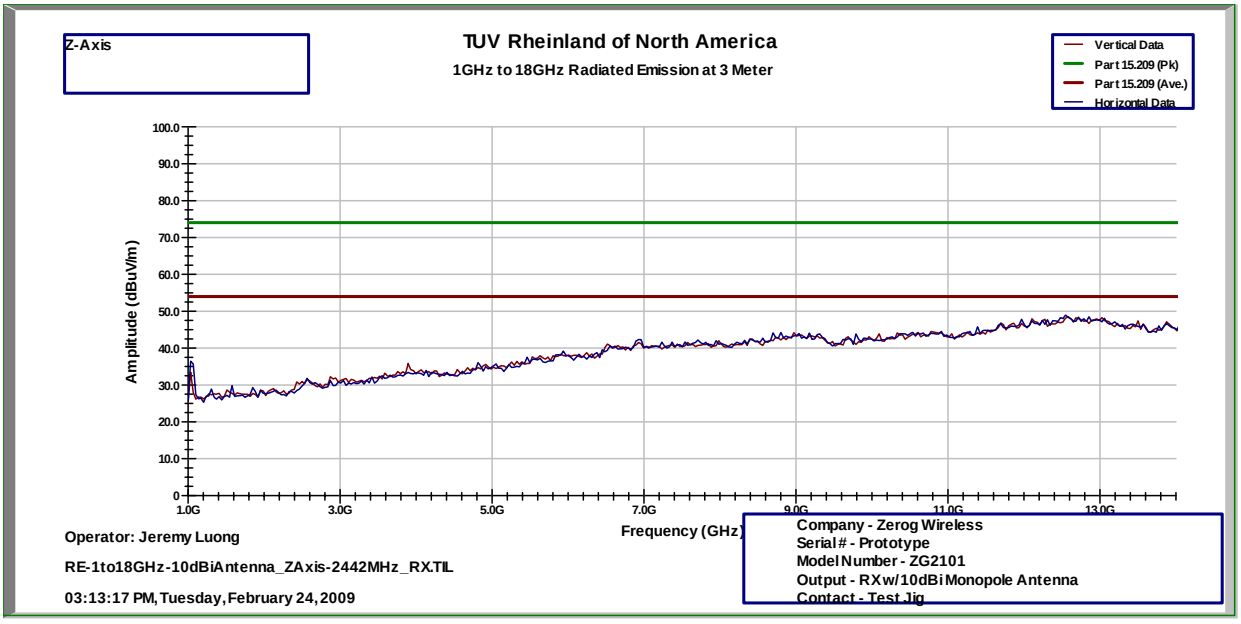


Figure 114: Emissions Pres-can, 10dBi Dipole Antenna, 1GHz to 18GHz, Z-Axis

4.7.3.2 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	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 48%rh
EUT Serial	00000287	**Temp / Hum out**	N/A
EUT Config.	On-board Ant. (Meander) on X-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	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 2412MHz										
30.464406	V	1.4	316	31.64	24.53	-5.78	18.75	40.00	-21.25	Spurious
79.992805	V	2.6	203	42.33	41.59	-17.86	23.73	40.00	-16.27	Spurious
675.236648	V	3.0	182	28.92	26.48	-1.26	25.22	46.00	-20.78	Spurious
Transmitted Data at 2437MHz										
33.869860	V	2.6	241	34.33	24.52	-8.45	16.07	40.00	-23.93	Spurious
Transmitted Data at 2462MHz										
396.036785	H	2.2	228	30.07	26.53	-6.41	20.12	46.00	-25.88	Spurious
711.255144	V	1.4	270	32.53	28.03	-0.59	27.44	46.00	-18.56	Spurious

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

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

Notes: X-Axis was the worst plane. No emission was observed above 1GHz.

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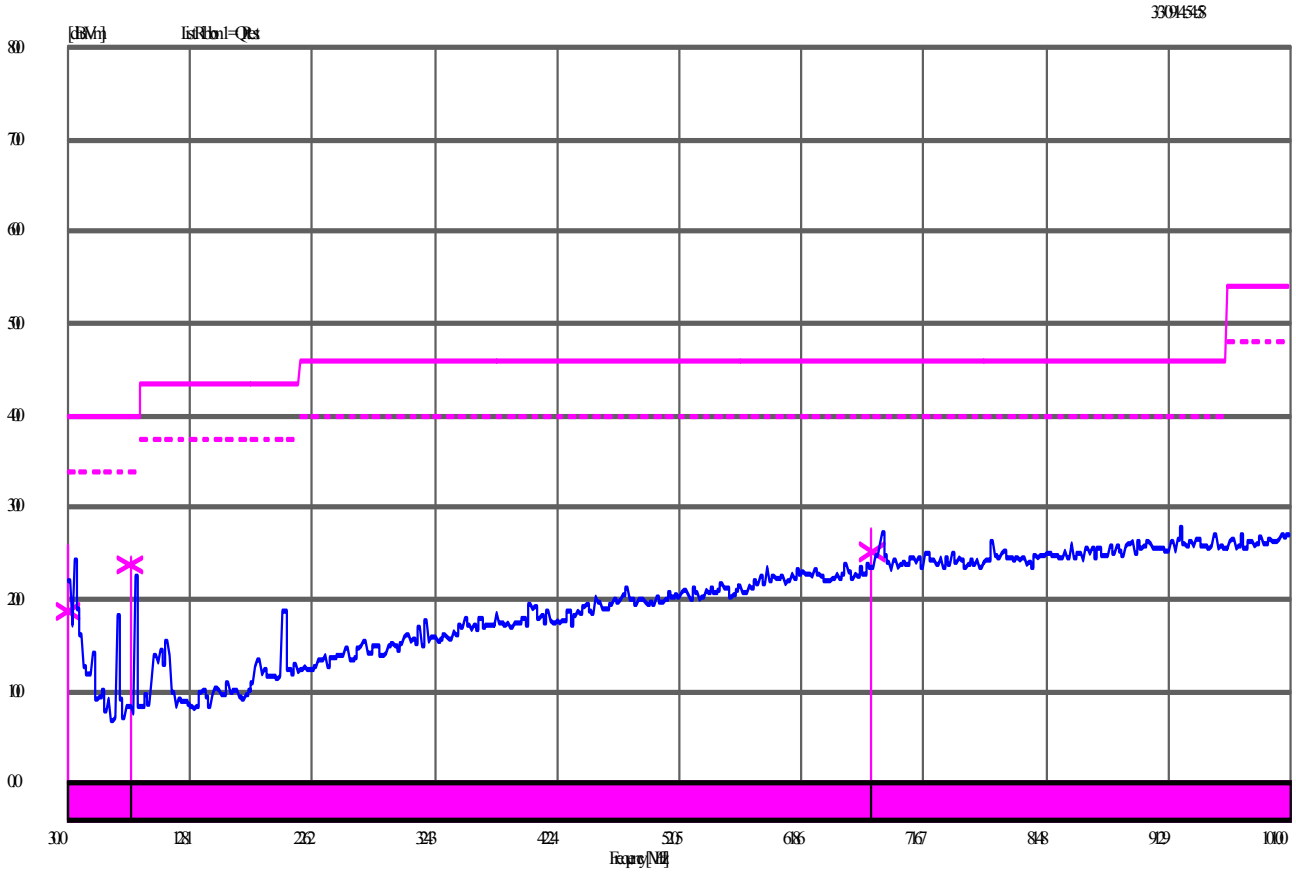
EUT Name	Low Power Transceiver Module	**Date**	March 3, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 49%rh
EUT Serial	0000287	**Temp / Hum out**	N/A
EUT Config.	On-board Ant. (Meander) on X-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

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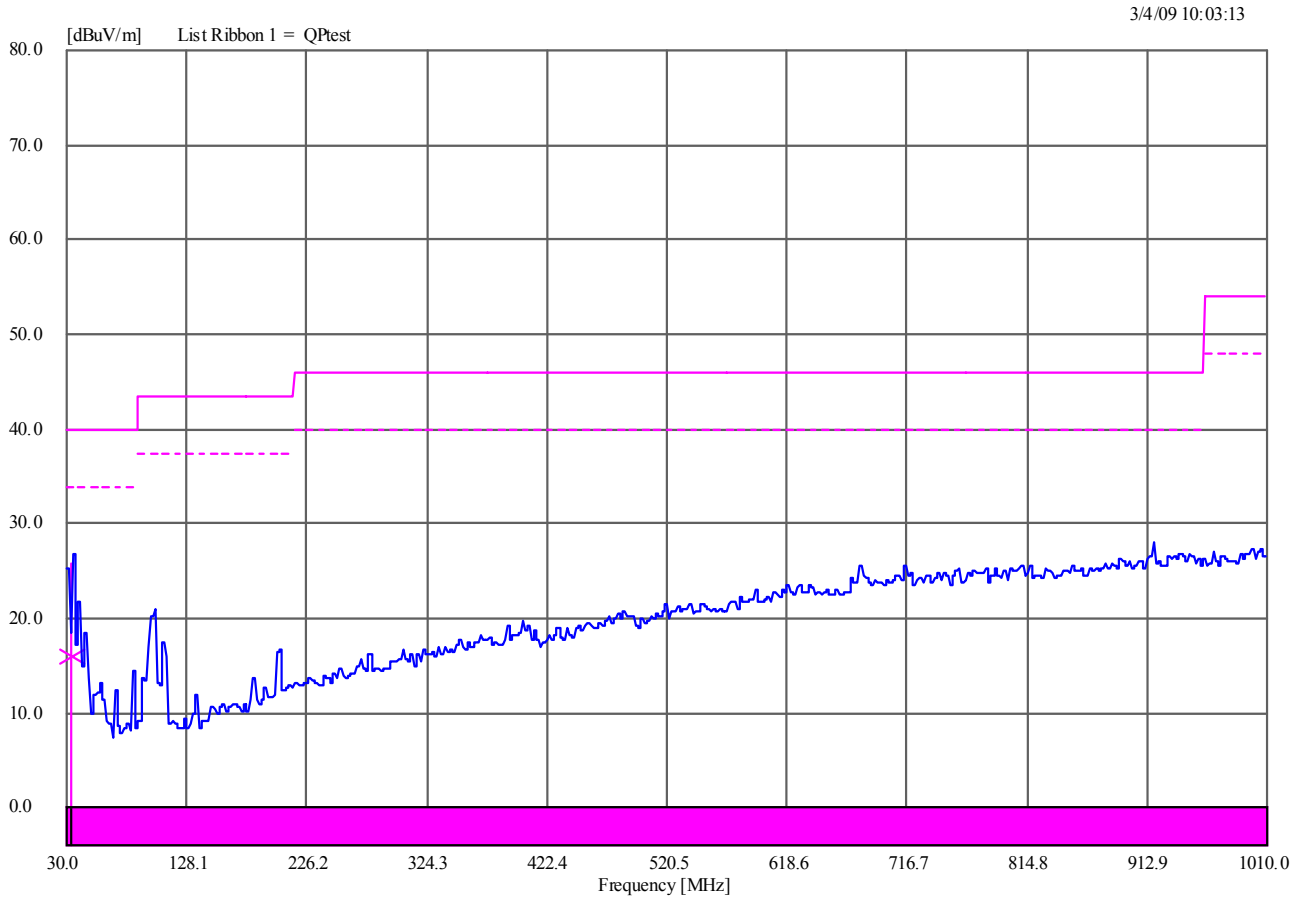
EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	21°C / 48%rh
EUT Serial	0000287	**Temp / Hum out**	N/A
EUT Config.	On-board Ant. (Meander) on X-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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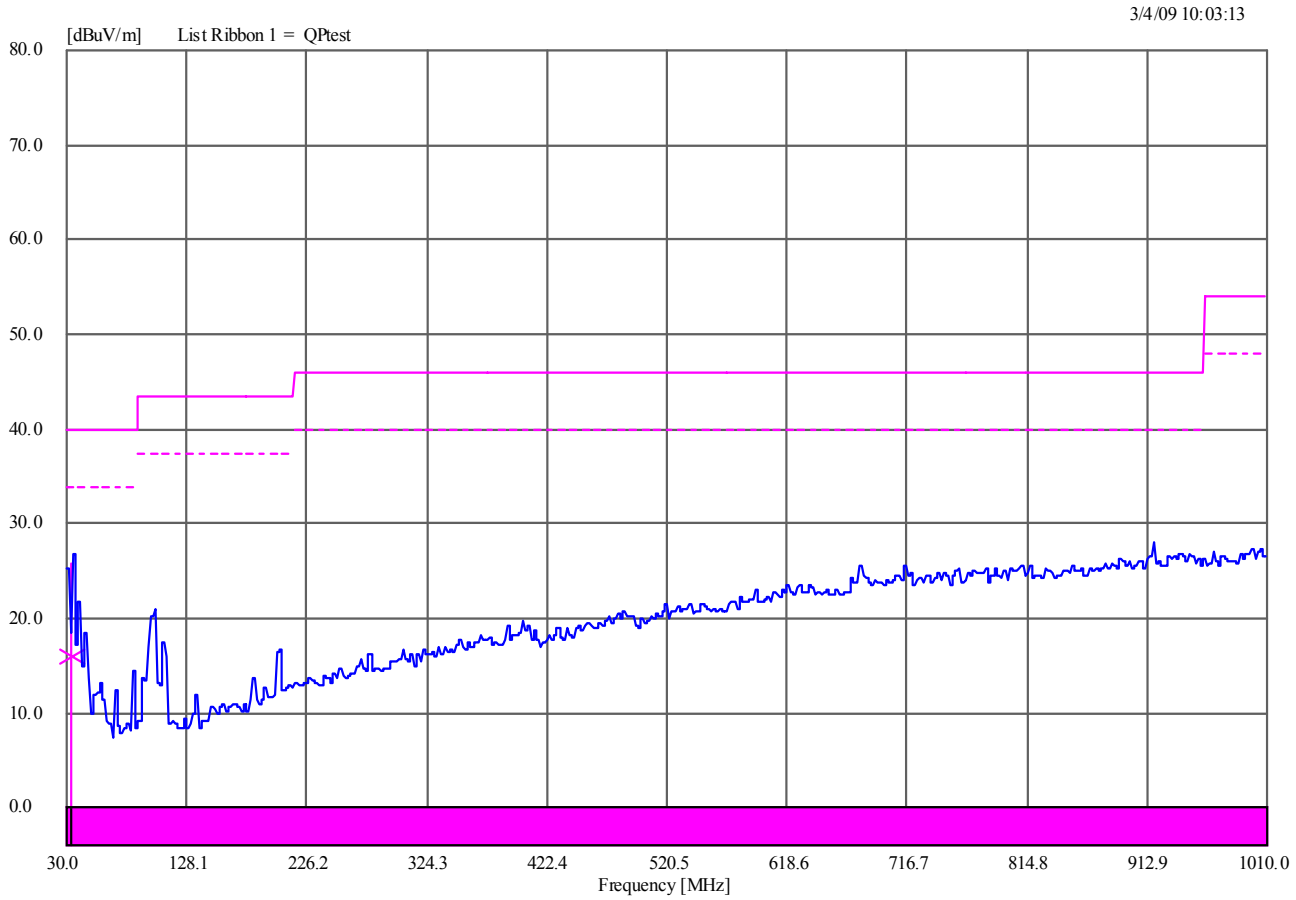
EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	21°C / 48%rh
EUT Serial	0000287	**Temp / Hum out**	N/A
EUT Config.	On-board Ant. (Meander) on X-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 48%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	2dBi Dipole Ant. (RFA-02-D3-70-100) on Z-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	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 2412MHz										
80.000958	V	2.4	17	41.37	40.59	-17.86	22.73	40.00	-17.27	Spurious
264.003140	H	1.0	84	35.27	33.48	-9.76	23.72	46.00	-22.28	Spurious
396.031404	V	1.0	311	31.00	28.00	-6.41	21.59	46.00	-24.41	Spurious
675.244675	V	2.9	173	29.23	26.23	-1.26	24.97	46.00	-21.03	Spurious
Transmitted Data at 2437MHz										
32.541739	V	3.4	280	29.61	22.44	-7.62	14.82	40.00	-25.18	Spurious
264.004052	H	1.0	89	40.38	39.33	-9.76	29.57	46.00	-16.43	Spurious
Transmitted Data at 2462MHz										
264.000990	H	1.0	73	39.65	38.61	-9.76	28.85	46.00	-17.15	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 $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Z-Axis was the worst plane. No emission was observed above 1GHz.

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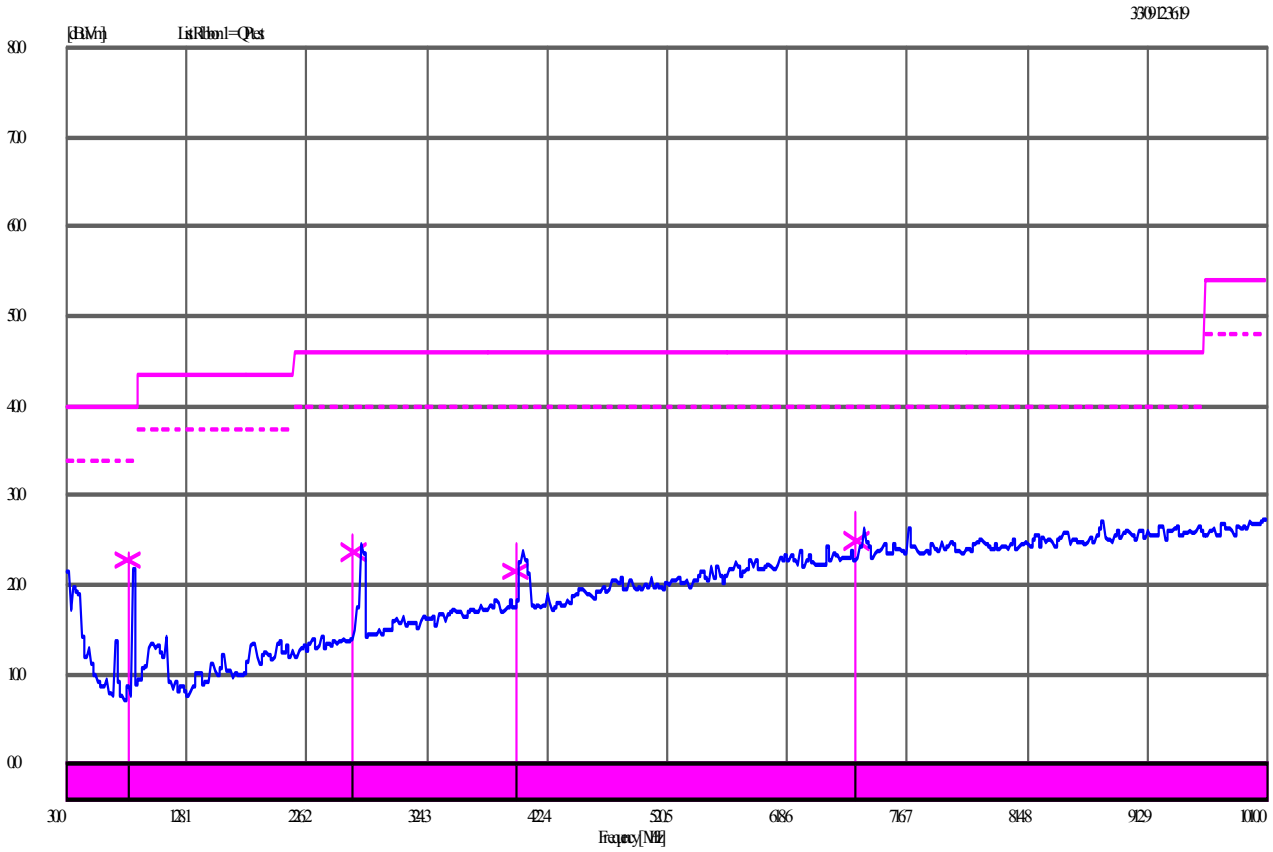
EUT Name	Low Power Transceiver Module	**Date**	March 3, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	2dBi Dipole Ant. (RFA-02-D3-70-100) on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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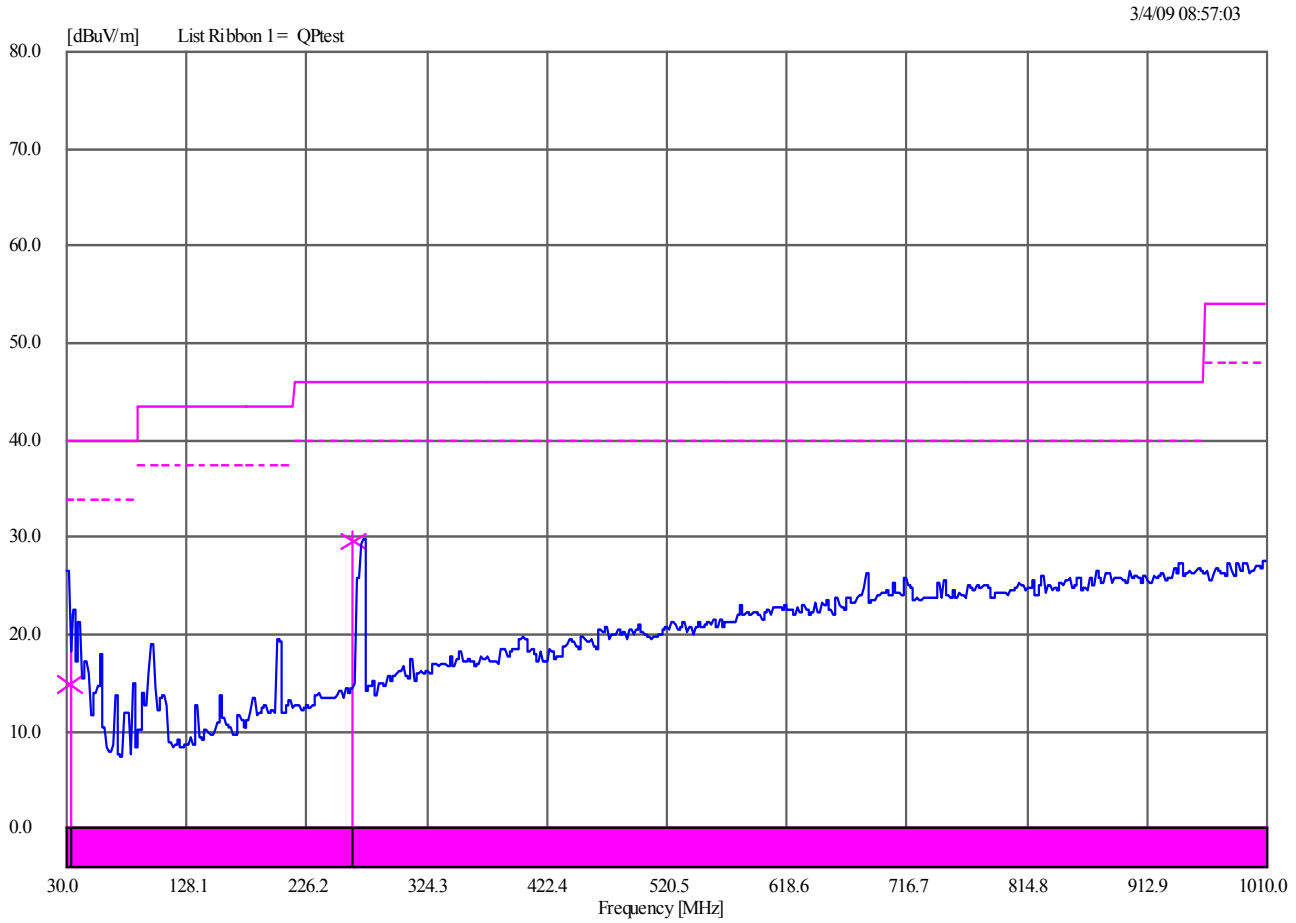
EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	21°C / 48%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	2dBi Dipole Ant. (RFA-02-D3-70-100) on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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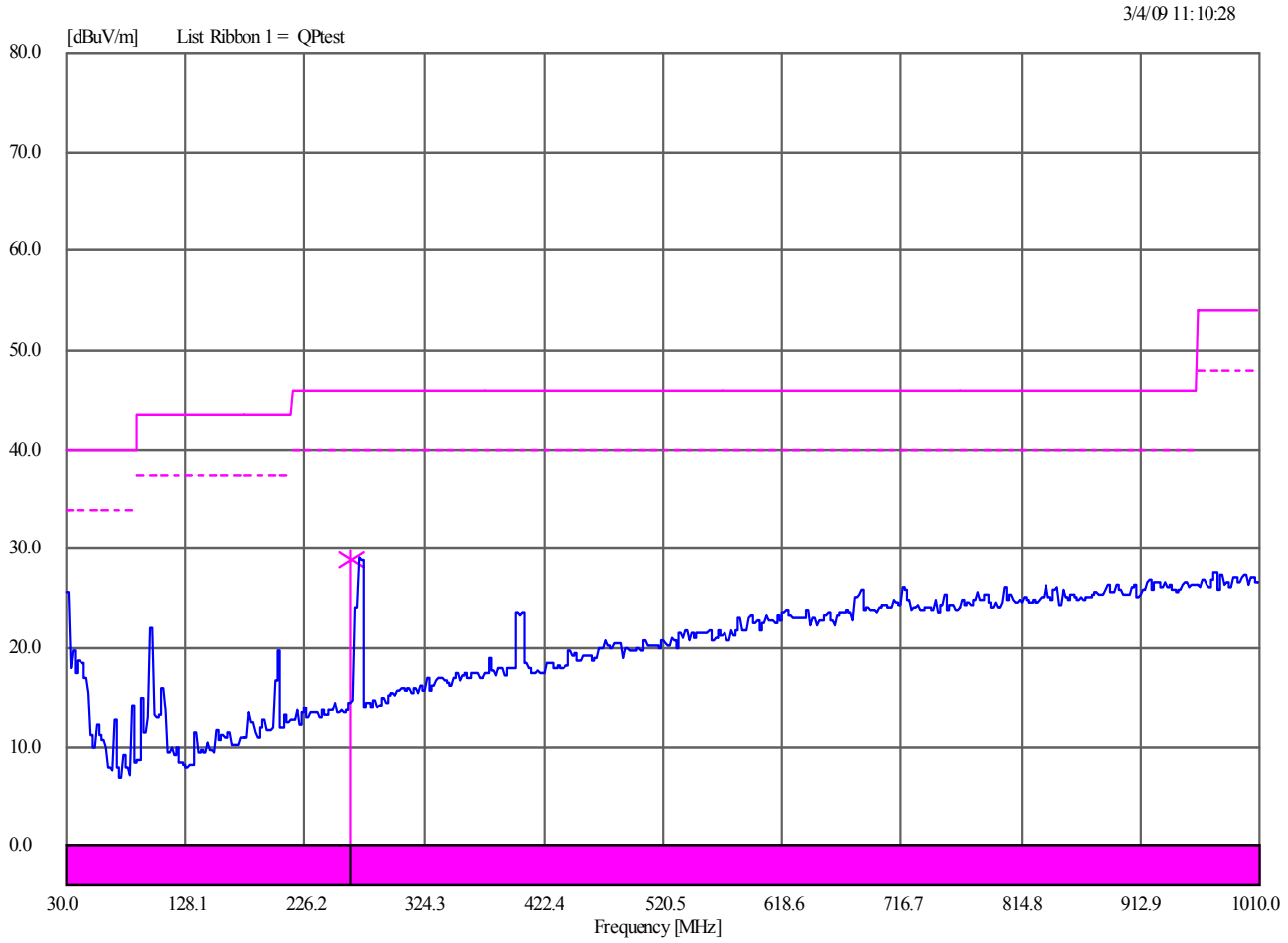
EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 48%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	2dBi Dipole Ant. (RFA-02-D3-70-100) on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

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EUT Name	Low Power Transceiver Module	**Date**	March 3, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	21°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Helical Antenna on Z-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	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 2412MHz										
80.000370	V	2.6	263	41.91	41.08	-17.86	23.22	40.00	-16.78	Spurious
263.999253	H	2.0	230	35.75	34.18	-9.76	24.42	46.00	-21.58	Spurious
810.046669	H	1.0	118	27.05	24.54	0.01	24.55	46.00	-21.45	Spurious
Transmitted Data at 2437MHz										
32.541739	V	3.4	280	29.61	22.44	-7.62	14.82	40.00	-25.18	Spurious
264.004052	H	1.0	89	40.38	39.33	-9.76	29.57	46.00	-16.43	Spurious
Transmitted Data at 2462MHz										
263.997709	H	1.0	247	40.62	39.68	-9.76	29.92	46.00	-16.08	Spurious

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

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

Notes: Z-Axis was the worst plane. No emission was observed above 1GHz.

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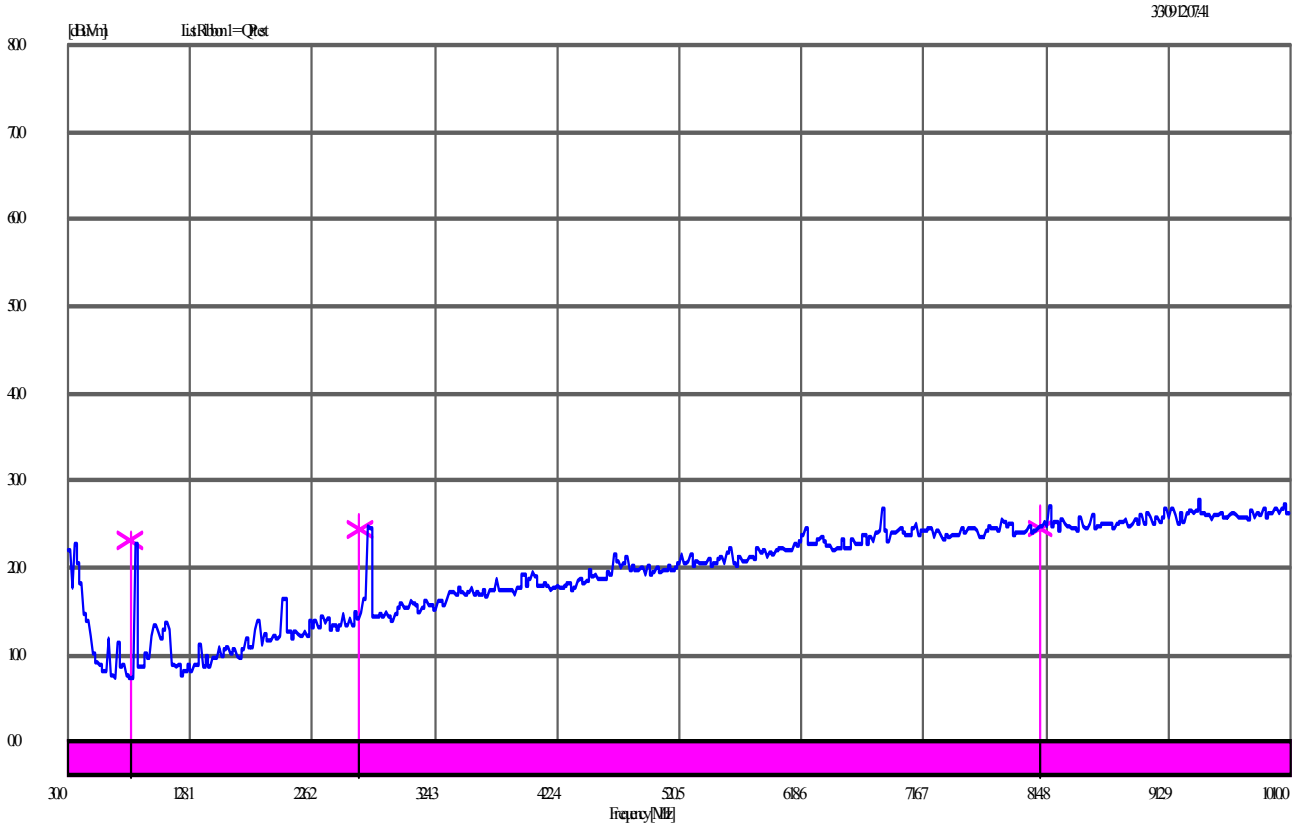
EUT Name	Low Power Transceiver Module	**Date**	March 3, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Helical Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

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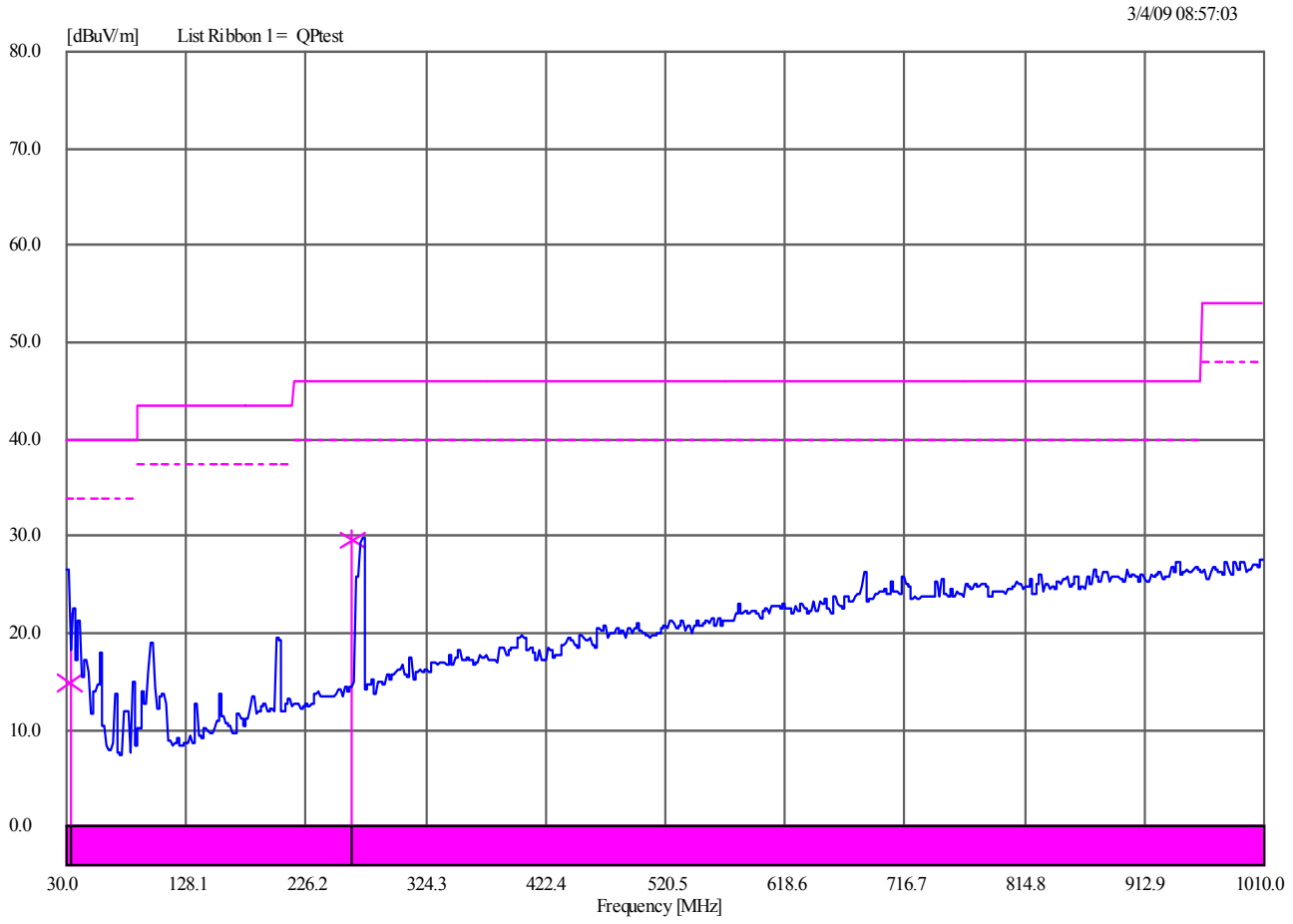
EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	21°C / 48%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Helical Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

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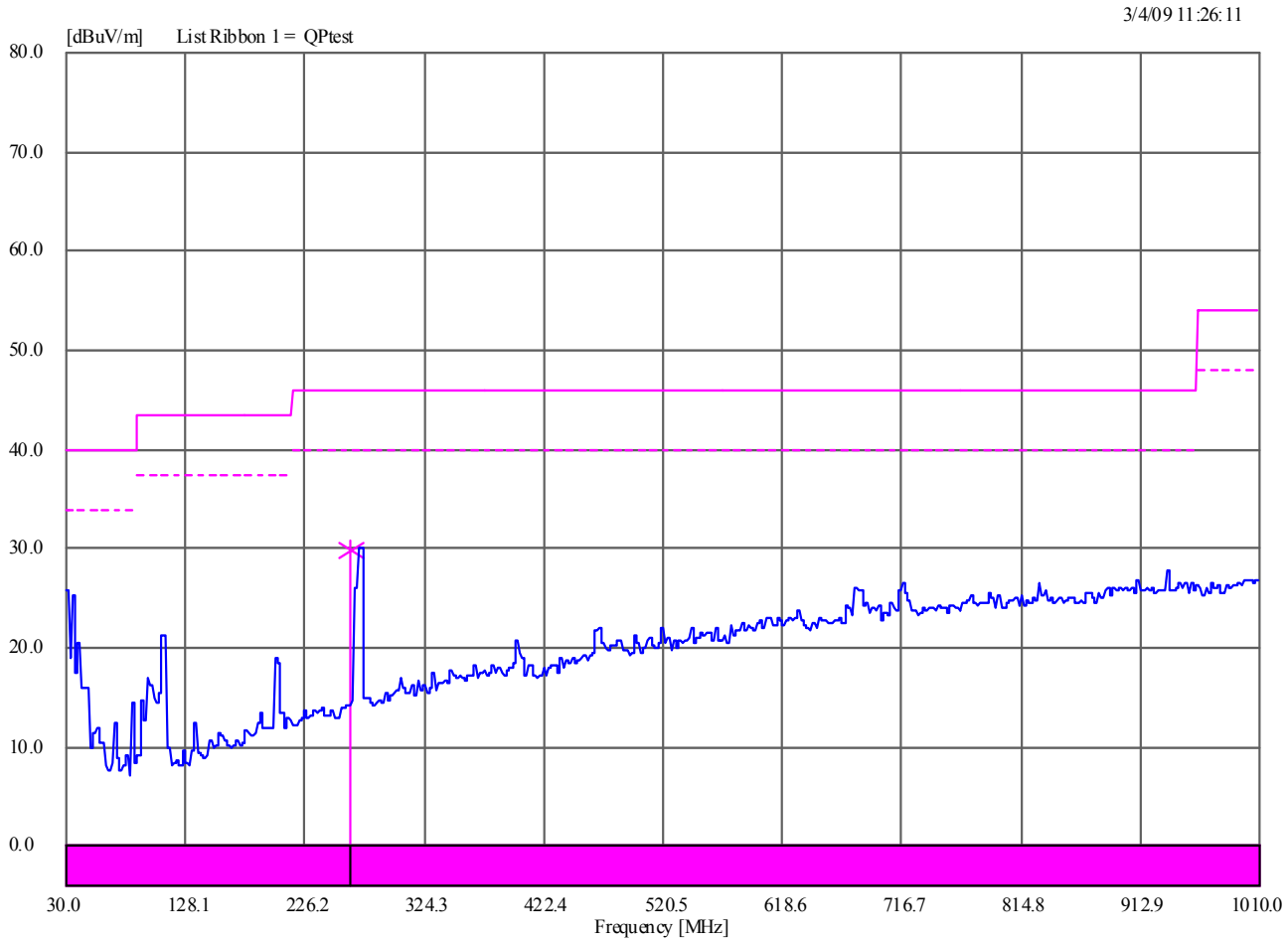
EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 48%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Helical Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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EUT Name	Low Power Transceiver Module	**Date**	March 3, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	21°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Inverter F Antenna on X-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	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 2412MHz										
40.031055	V	3.1	153	35.28	29.80	-11.84	17.96	40.00	-22.04	Spurious
80.001495	V	2.8	355	41.65	41.10	-17.86	23.24	40.00	-16.76	Spurious
197.984371	H	1.0	252	37.50	36.21	-12.71	23.50	43.50	-20.00	Spurious
Transmitted Data at 2437MHz										
32.357843	V	2.9	281	33.75	25.60	-7.52	18.08	40.00	-21.92	Spurious
198.001391	H	1.0	255	41.20	40.31	-12.71	27.60	43.50	-15.90	Spurious
Transmitted Data at 2462MHz										
30.315448	V	1.9	91	32.59	23.89	-5.68	18.21	40.00	-21.79	Spurious
197.992101	H	1.1	81	42.20	41.33	-12.71	28.62	43.50	-14.88	Spurious

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

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

Notes: X-Axis was the worst plane. No emission was observed above 1GHz.

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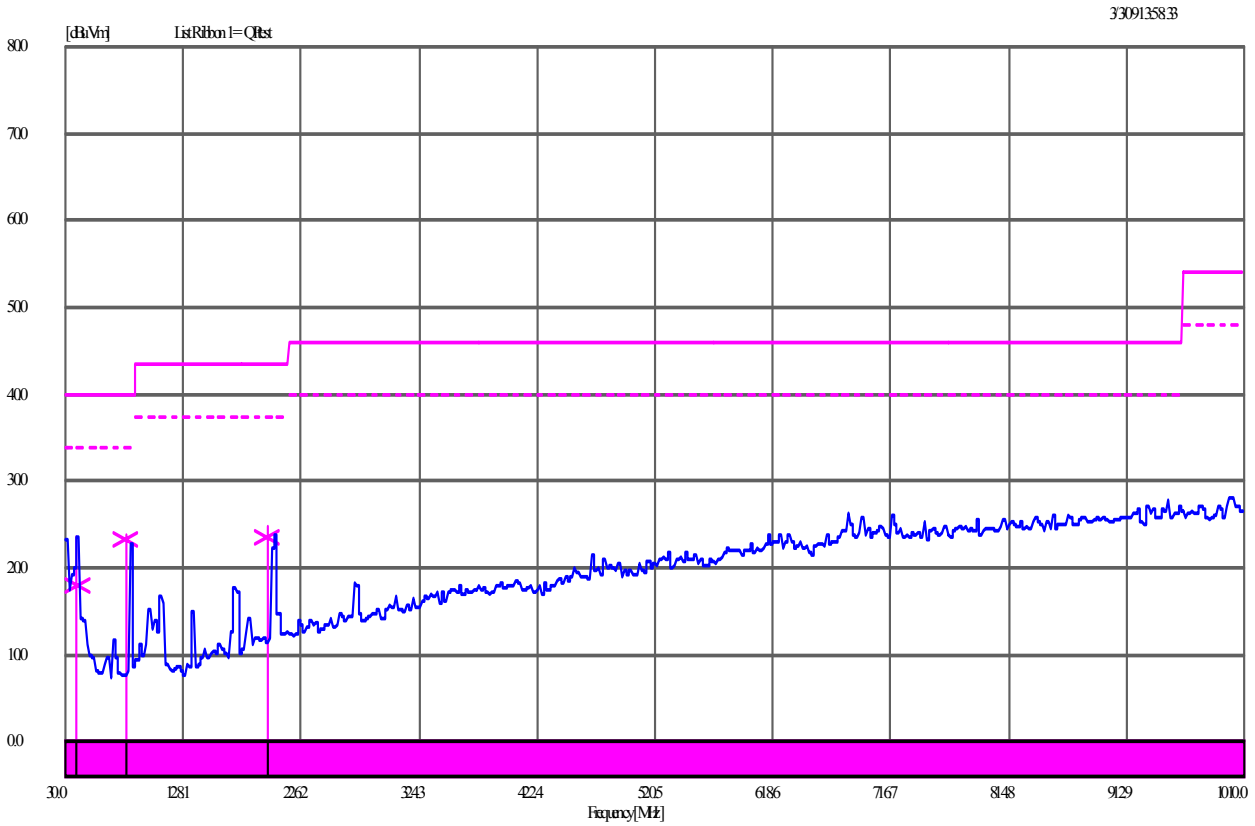
EUT Name	Low Power Transceiver Module	**Date**	March 3, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Inverter F Antenna on X-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

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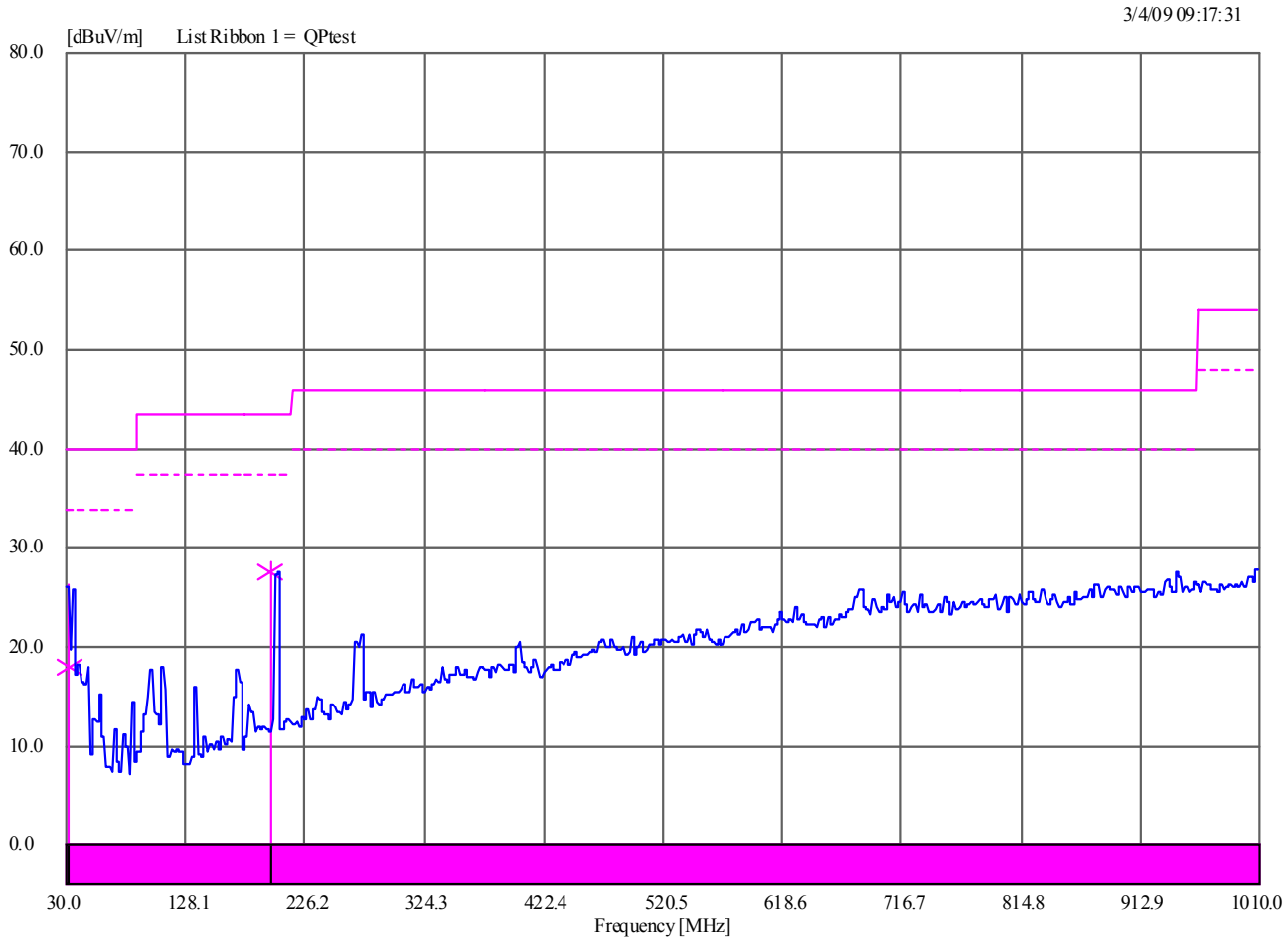
EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	21°C / 48%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Inverter F Antenna on X-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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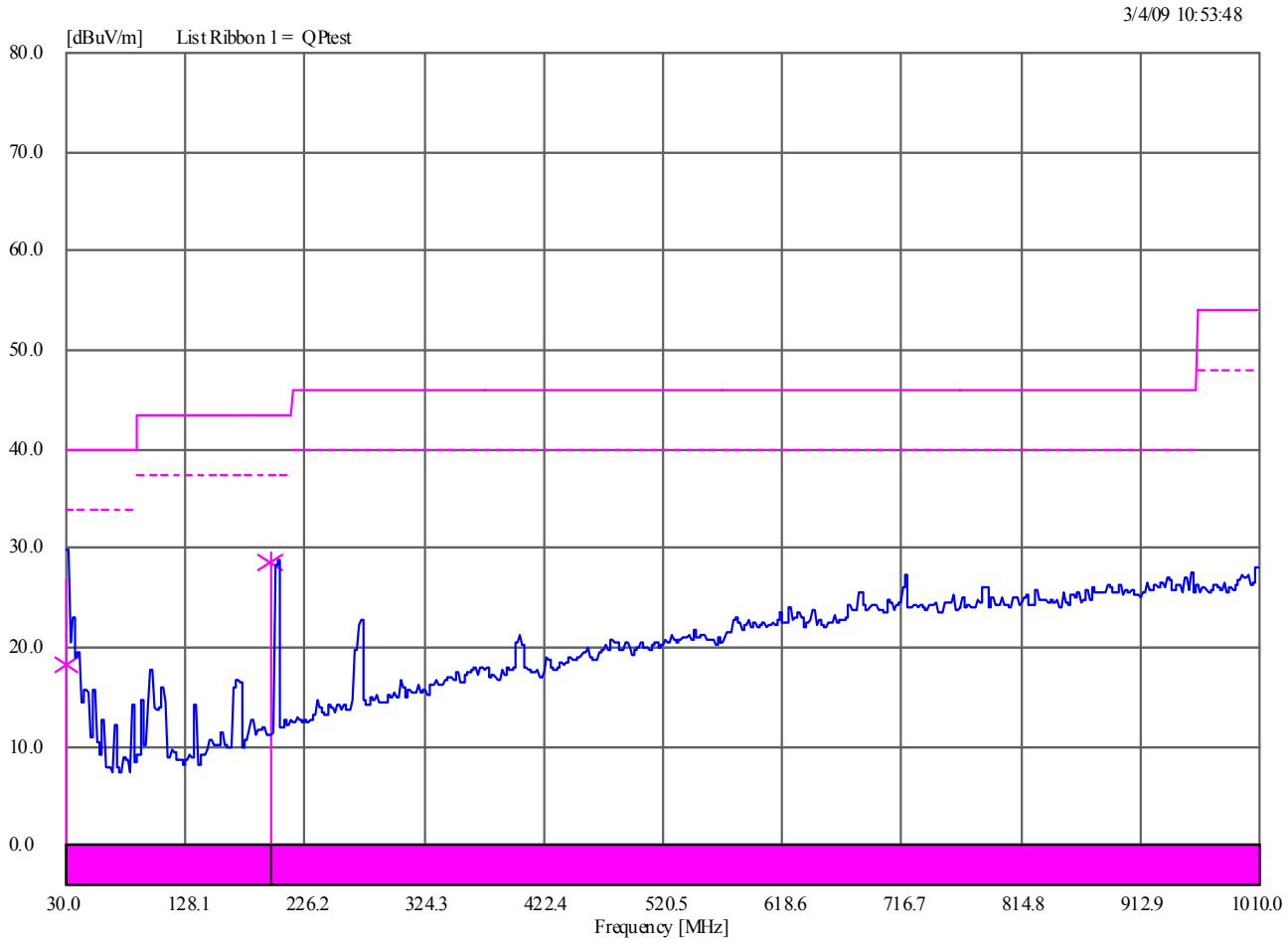
EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 48%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	Inverter F Antenna on X-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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EUT Name	Low Power Transceiver Module	**Date**	March 3, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	21°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	2dBi PCB Antenna #3 on Z-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	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 2412MHz										
33.871340	V	1.0	192	33.78	28.27	-8.45	19.82	40.00	-20.18	Spurious
80.001044	V	2.6	222	42.26	41.74	-17.86	23.88	40.00	-16.12	Spurious
264.001916	H	1.0	248	40.99	40.10	-9.76	30.34	46.00	-15.66	Spurious
Transmitted Data at 2437MHz										
32.509433	V	1.9	40	31.86	20.37	-7.60	12.77	40.00	-27.23	Spurious
264.000512	H	1.0	73	41.65	40.82	-9.76	31.06	46.00	-14.94	Spurious
Transmitted Data at 2462MHz										
264.004747	H	1.0	95	39.76	38.90	-9.76	29.14	46.00	-16.86	Spurious
675.230222	V	2.9	5	28.59	25.22	-1.26	23.96	46.00	-22.04	Spurious

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

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

Notes: Z-Axis was the worst plane. No emission was observed above 1GHz.

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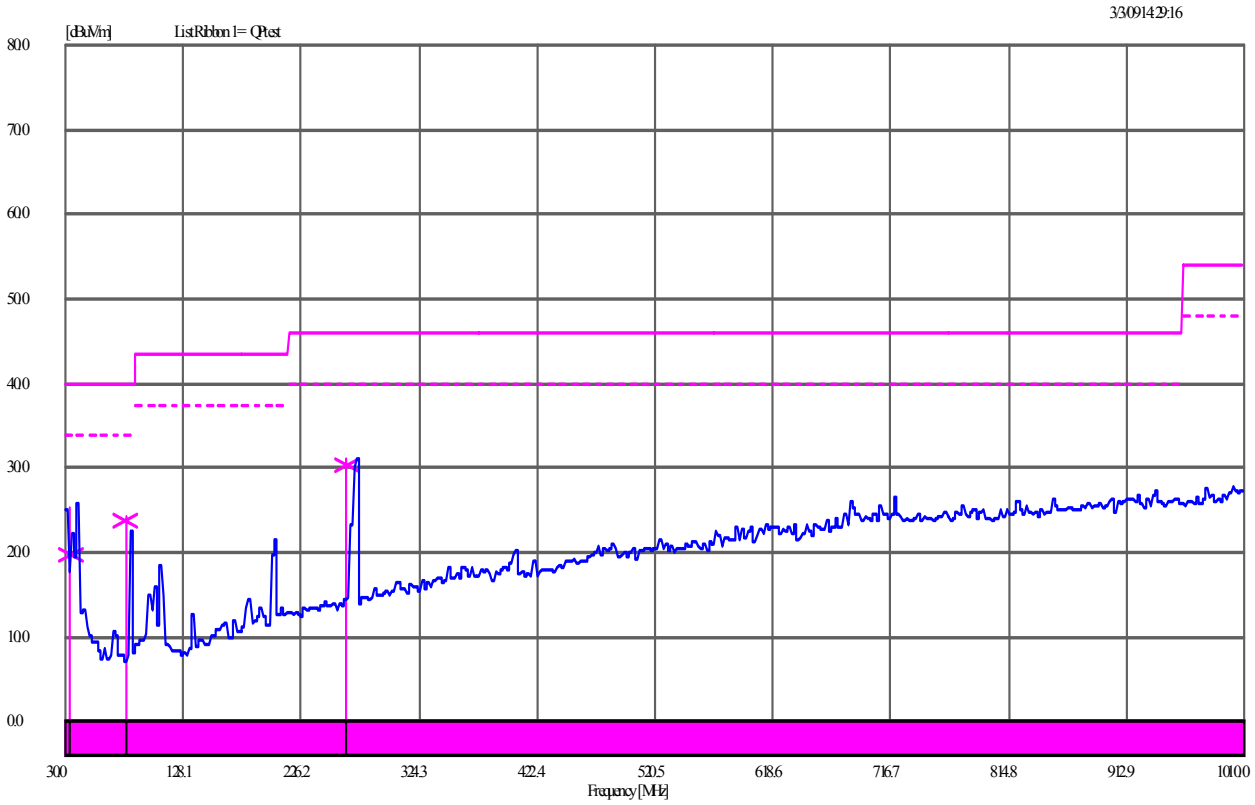
EUT Name	Low Power Transceiver Module	**Date**	March 3, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	2dBi PCB Antenna #3 on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

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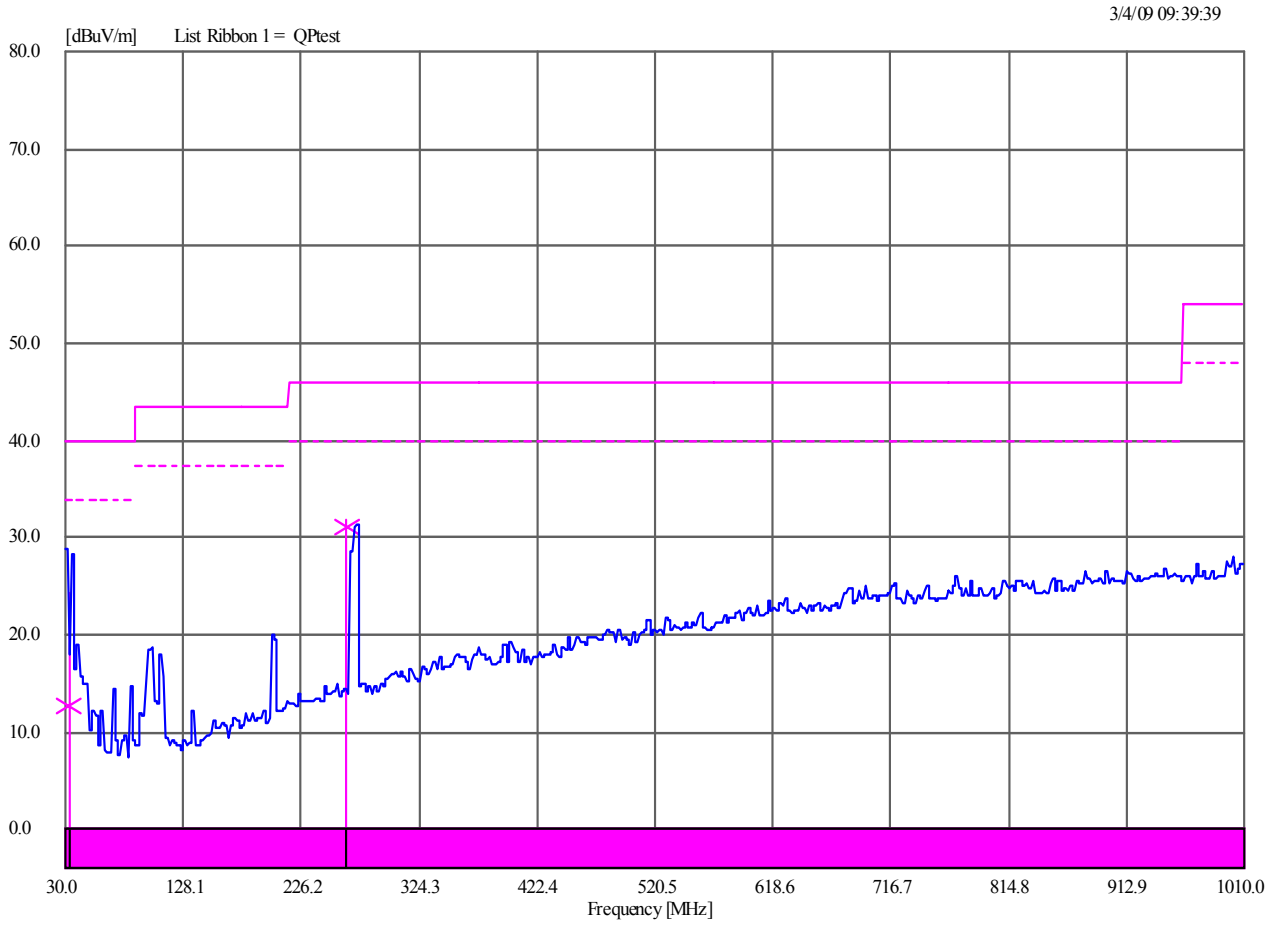
EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	21°C / 48%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	2dBi PCB Antenna #3 on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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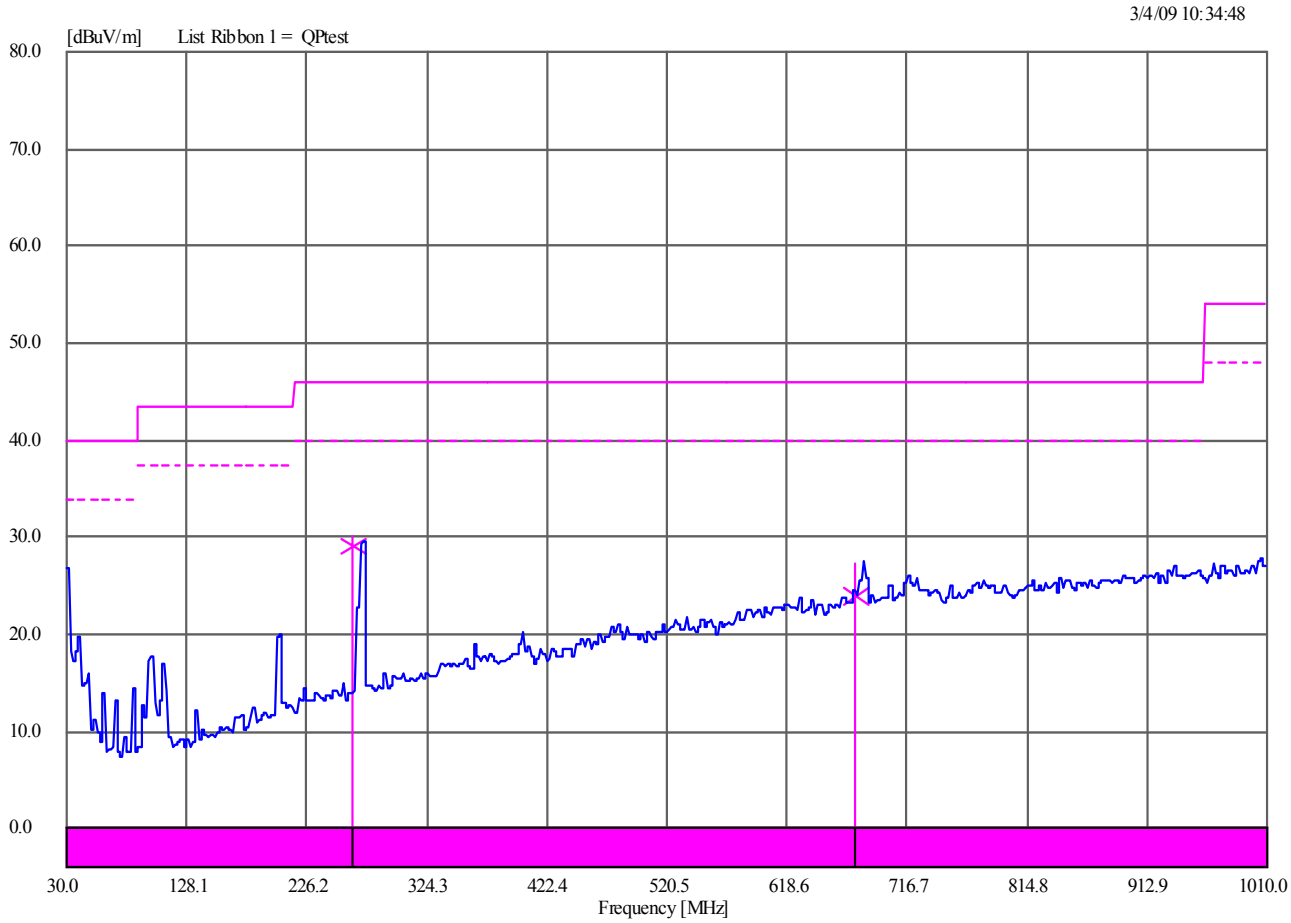
EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 48%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	2dBi PCB Antenna #3 on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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EUT Name	Low Power Transceiver Module	**Date**	March 3, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	21°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna on Z-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	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 2412MHz										
80.002003	V	2.9	333	41.26	40.39	-17.86	22.53	40.00	-17.47	Spurious
165.003866	H	1.0	84	39.46	38.04	-14.81	23.23	43.50	-20.27	Spurious
263.983816	H	1.0	87	33.57	31.76	-9.76	22.00	46.00	-24.00	Spurious
Transmitted Data at 2437MHz										
33.893930	V	2.9	1	29.85	24.62	-8.47	16.15	40.00	-23.85	Spurious
165.000091	H	1.0	81	38.50	37.42	-14.81	22.61	43.50	-20.89	Spurious
395.987766	V	1.0	283	31.11	27.76	-6.41	21.35	46.00	-24.65	Spurious
675.235070	V	2.9	349	29.53	25.97	-1.26	24.71	46.00	-21.29	Spurious
Transmitted Data at 2462MHz										
263.991911	H	1.0	76	39.43	38.53	-9.76	28.77	46.00	-17.23	Spurious

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

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

Notes: Z-Axis was the worst plane. No emission was observed above 1GHz.

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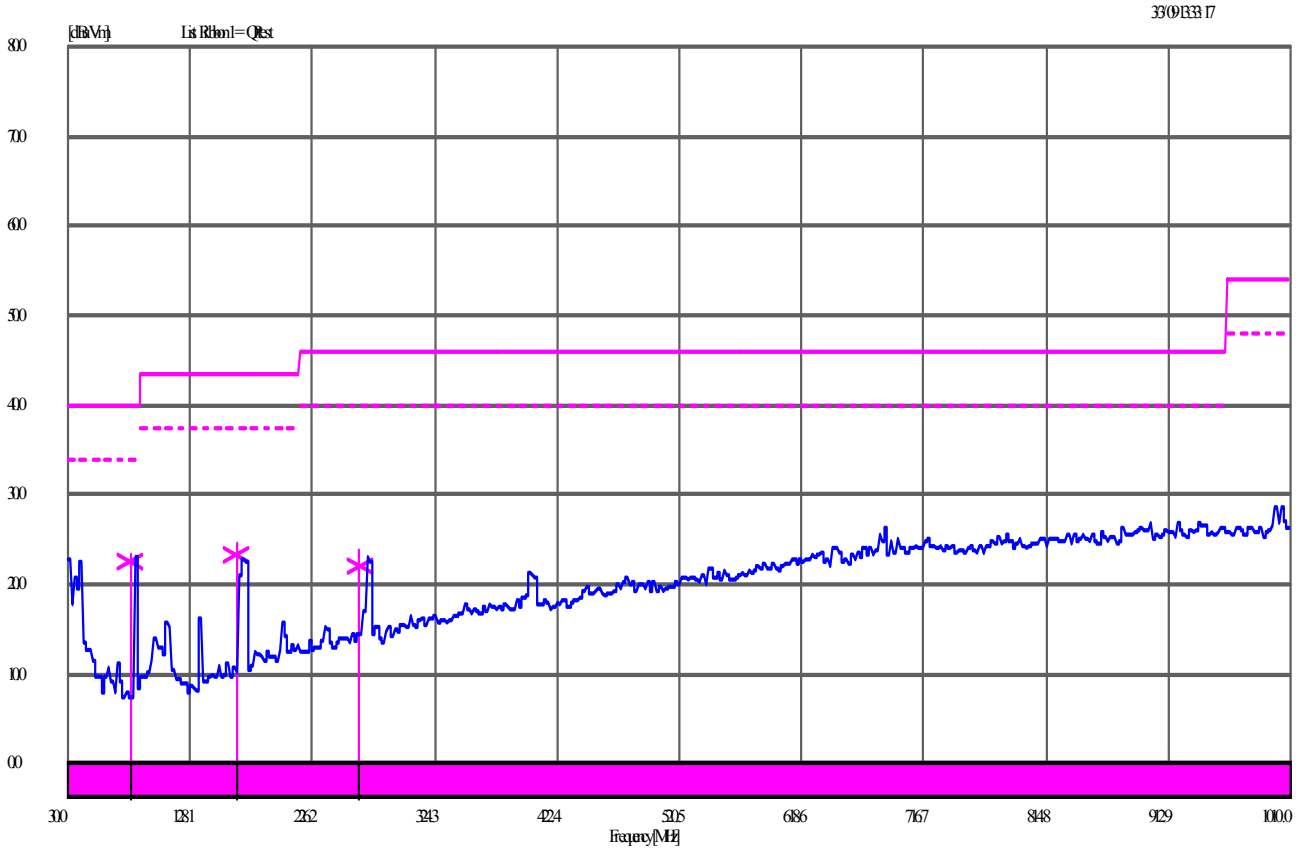
EUT Name	Low Power Transceiver Module	**Date**	March 3, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

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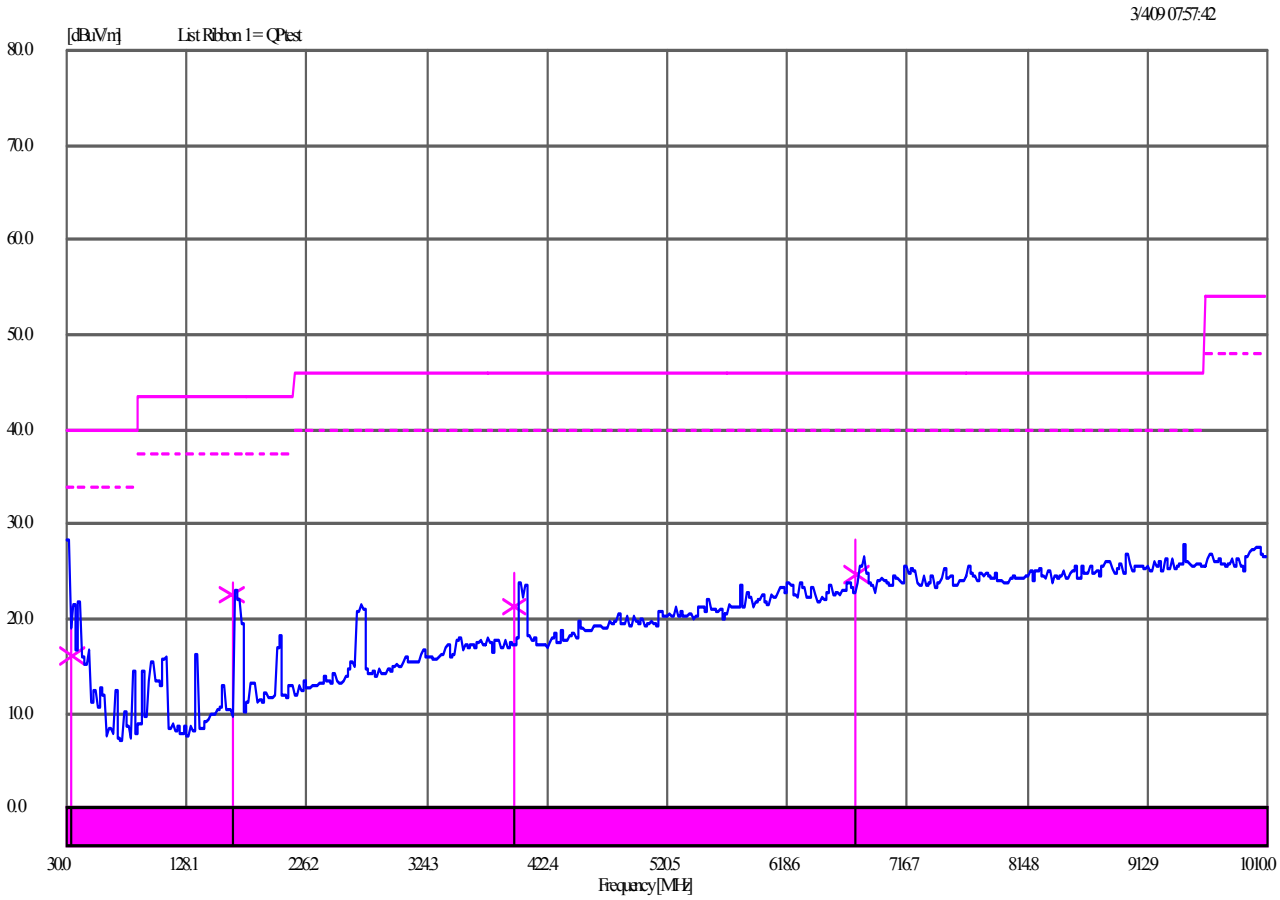
EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	21°C / 48%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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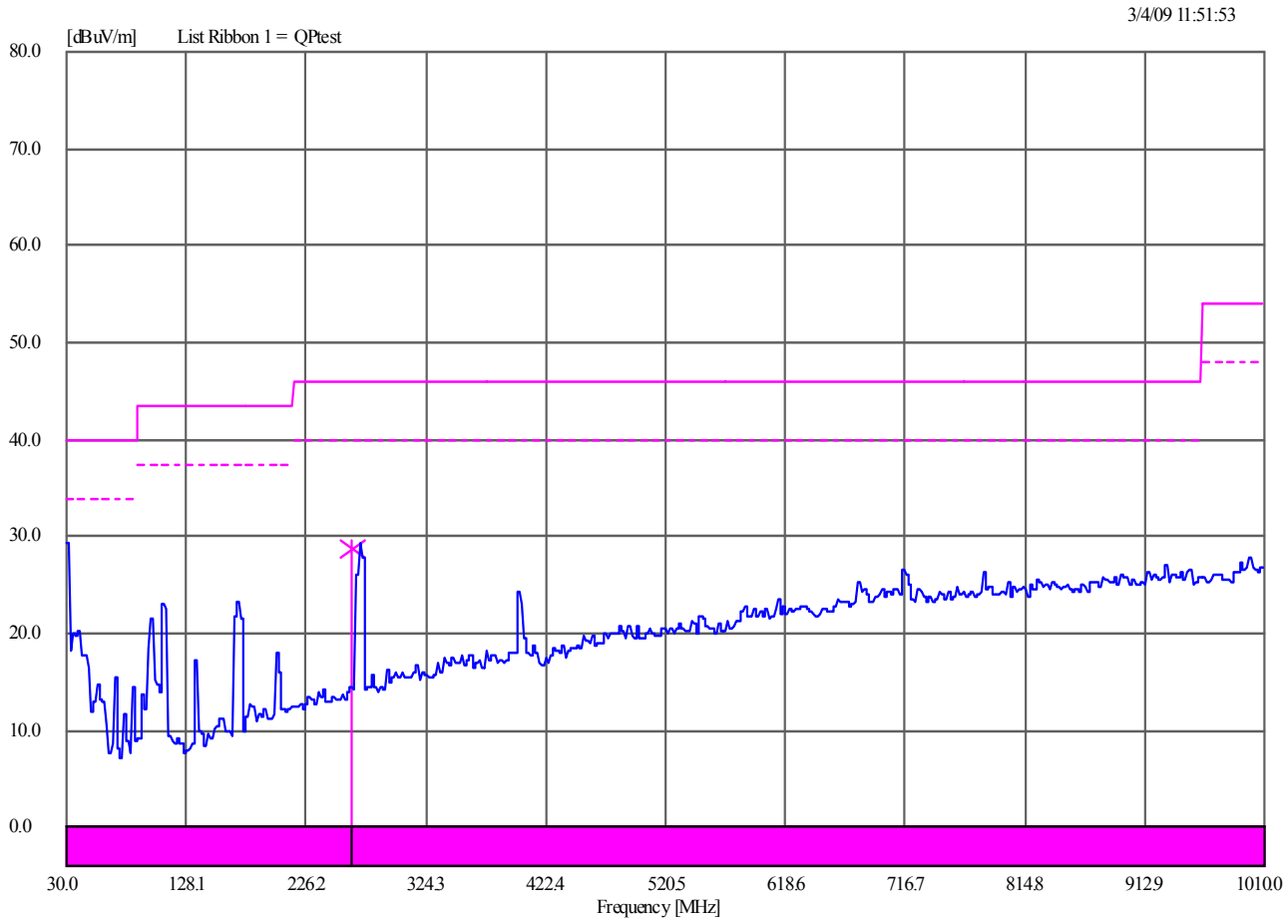
EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 48%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	5dBi Dipole Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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EUT Name	Low Power Transceiver Module	**Date**	March 3, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	21°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	10dBi Monopole Antenna on Z-Axis	**Line AC / Freq**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	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 2412MHz										
32.233747	V	2.6	184	31.47	22.33	-7.46	14.87	40.00	-25.13	Spurious
80.000975	V	2.6	340	42.61	42.06	-17.86	24.20	40.00	-15.80	Spurious
132.002177	V	2.1	133	35.17	33.45	-16.62	16.83	43.50	-26.67	Spurious
264.003033	V	1.0	150	30.03	27.71	-9.76	17.95	46.00	-28.05	Spurious
Transmitted Data at 2437MHz										
32.374313	V	2.9	287	29.03	22.44	-7.53	14.91	40.00	-25.09	Spurious
264.009305	H	1.0	252	31.23	28.85	-9.76	19.09	46.00	-26.91	Spurious
395.982833	H	1.5	110	33.17	30.87	-6.41	24.46	46.00	-21.54	Spurious
Transmitted Data at 2462MHz										
263.996005	H	1.0	249	35.68	34.31	-9.76	24.55	46.00	-21.45	Spurious
396.010916	V	1.9	168	31.97	29.42	-6.41	23.01	46.00	-22.99	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 $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Z-Axis was the worst plane. No emission was observed above 1GHz.

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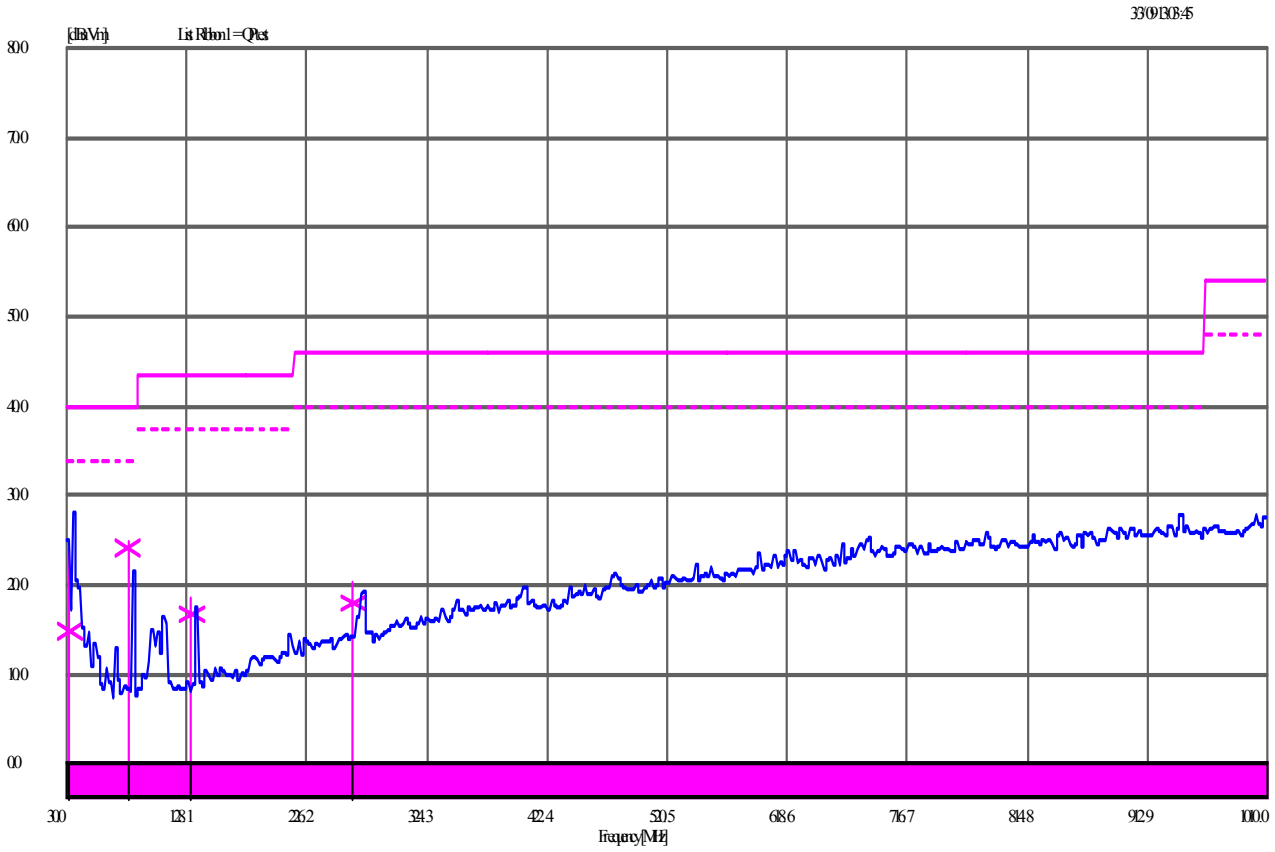
EUT Name	Low Power Transceiver Module	**Date**	March 3, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	22°C / 49%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	10dBi Monopole Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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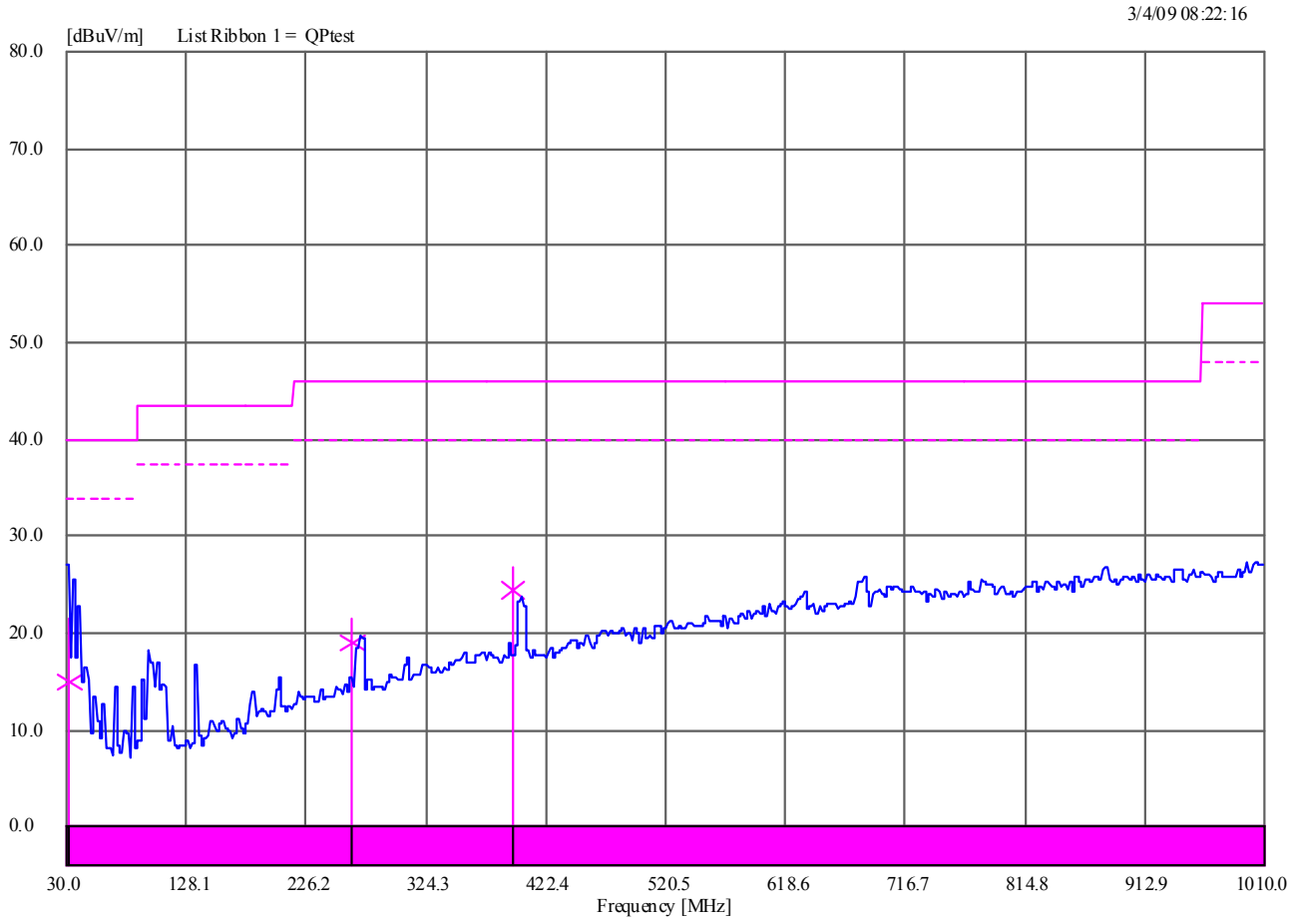
EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	21°C / 48%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	10dBi Monopole Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



Notes: None.

SOP 1 Radiated Emissions

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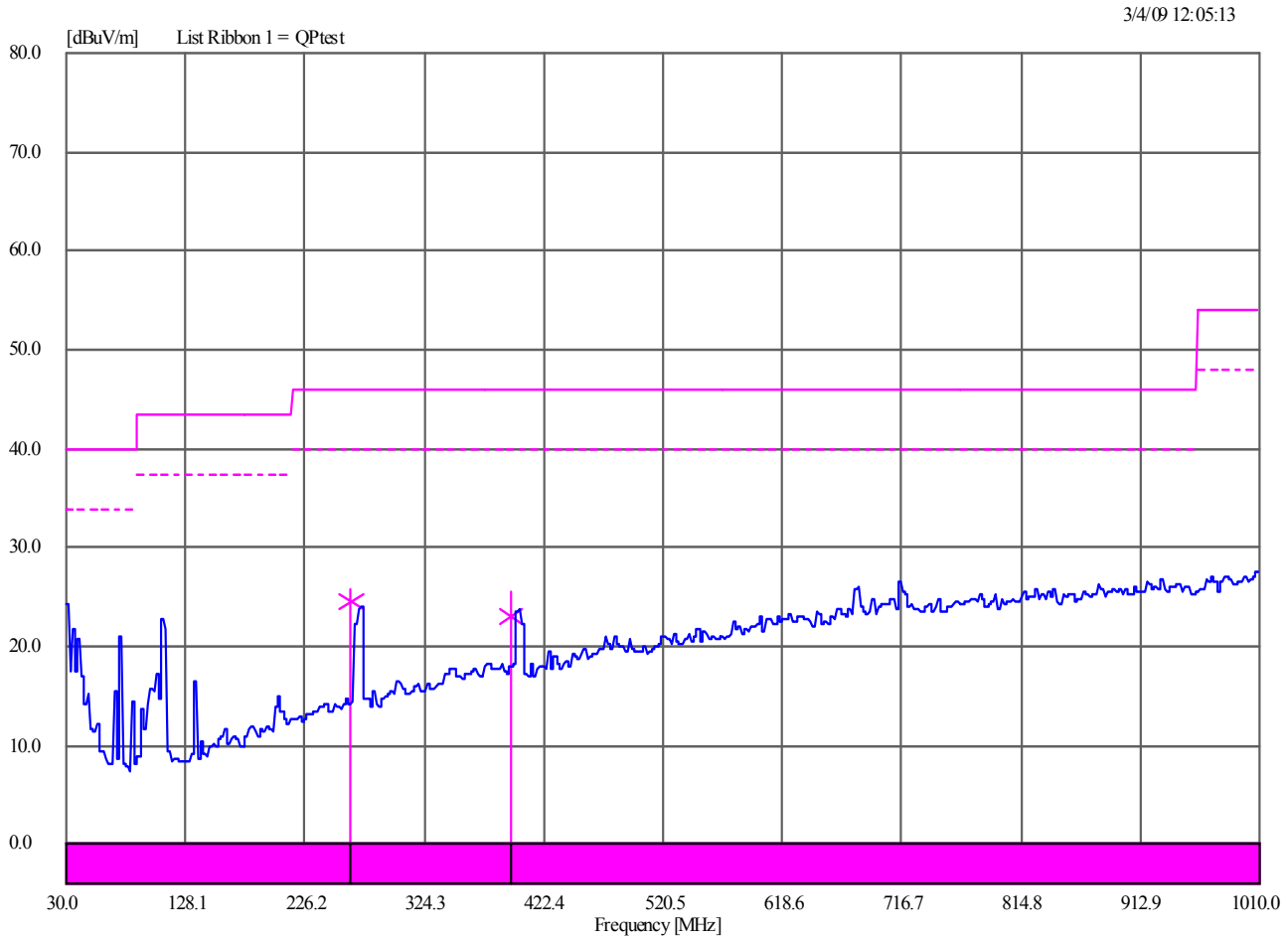
EUT Name	Low Power Transceiver Module	**Date**	March 4, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	23°C / 48%rh
EUT Serial	00000327	**Temp / Hum out**	N/A
EUT Config.	10dBi Monopole Antenna on Z-Axis	**Line AC**	Battery Powered
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / EMCO3142	**Performed by**	Jeremy Luong

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



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 Part 15.107

4.8.1 Test Methodology

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

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

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

4.8.1.1 Deviations

There were no deviations from this test methodology.

4.8.2 Test Results

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

Table 10: AC Conducted Emissions – Test Results

Test Conditions: Conducted Measurement at Normal Conditions only		
Antenna Type: Integrated and detachable	**Power Setting:** +10 dBm	
Operating Frequency: 2437MHz	**Duty Cycle:** 84.61 %	
AC Power: 120Vac/60Hz	**Mode:** Pinging.	
Ambient Temperature: 22 °C	**Relative Humidity:** 45 %	
Configuration	**Frequency Range**	**Test Result**
Line 1(Hot)	0.15 to 30 MHz	Pass
Line 2 (Neutral)	0.15 to 30 MHz	Pass

SOP 1 Radiated Emissions

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EUT Name	Low Power Transceiver Module	**Date**	March 5, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	23°C / 47%rh
EUT Serial	00000287	**Temp / Hum out**	N/A
EUT Config.	On-board PCB Antenna	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15.107	**RBW / VBW**	9kHz / 10kHz
Lab/LISN	Lab #2/ Solar Type 9348-50-R-24-BNC, Line 1	**Performed by**	Jeremy Luong

Frequency MHz	Peak dBuV	QP dBuV	QP Limit dBuV	QP Margin dB	Avg dBuV	Avg Limit dBuV	Avg Margin dB
0.3091	51.37	48.76	59.98	-11.22	44.882	49.984	-5.102
0.3092	51.37	48.26	59.98	-11.72	44.807	49.982	-5.174
0.3093	51.37	49.09	59.98	-10.89	45.080	49.979	-4.899
0.3123	51.34	49.08	59.90	-10.82	44.970	49.898	-4.928
0.6164	48.76	48.14	56.00	-7.86	44.360	46.000	-1.640
0.9231	48.05	46.97	56.00	-9.03	42.182	46.000	-3.818
1.2298	43.75	43.66	56.00	-12.34	37.900	46.000	-8.100
2.1497	43.89	43.13	56.00	-12.87	34.805	46.000	-11.195
2.4482	47.31	45.36	56.00	-10.64	35.968	46.000	-10.032
2.4639	46.40	44.55	56.00	-11.45	34.135	46.000	-11.865

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; X-Axis.

SOP 1 Radiated Emissions

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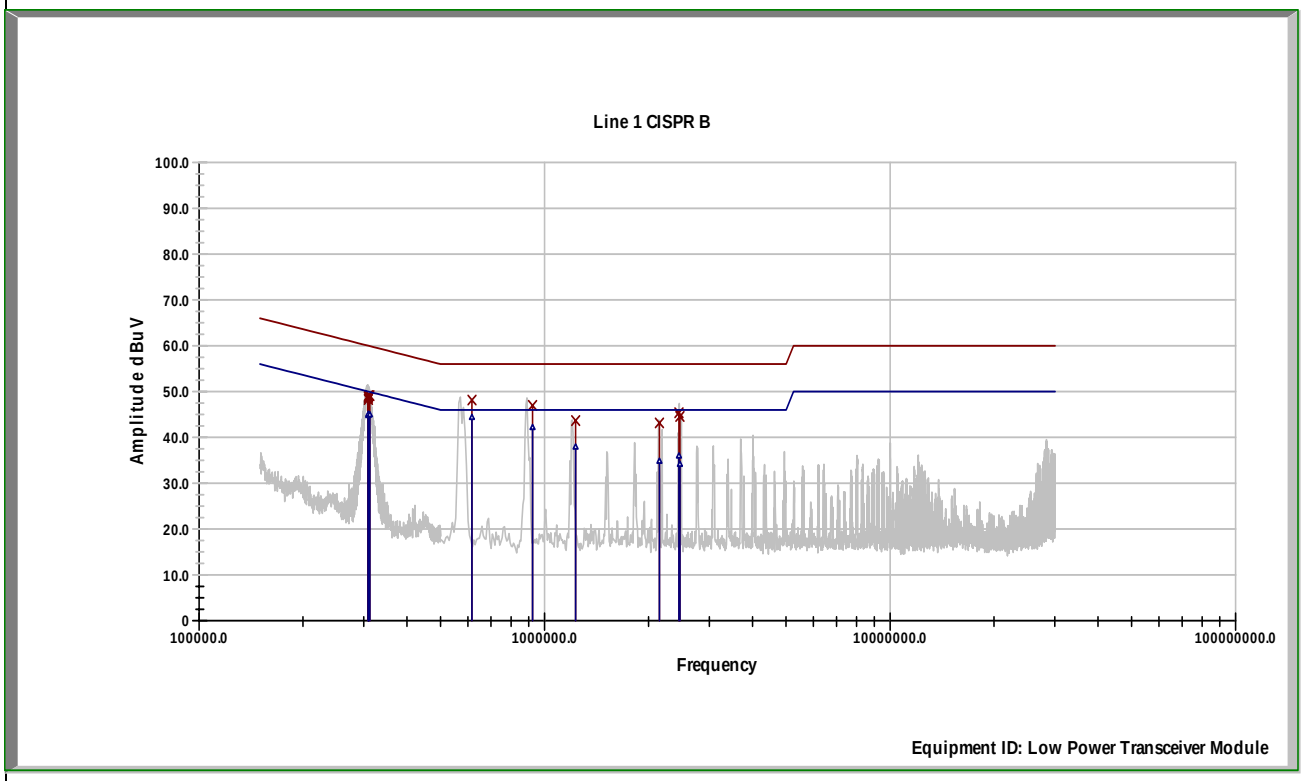
EUT Name	Low Power Transceiver Module	**Date**	March 5, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	23°C / 47%rh
EUT Serial	00000287	**Temp / Hum out**	N/A
EUT Config.	On-board PCB Antenna	**Line AC**	120Vac/60Hz
Standard	CFR47 Part 15.107	**RBW / VBW**	9kHz / 30kHz
Lab/LISN	Lab #2/ Solar Type 9348-50-R-24-BNC, Line 1	**Performed by**	Jeremy Luong

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



Notes: Using CISRP Class B Limit.

SOP 1 Radiated Emissions

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EUT Name	Low Power Transceiver Module	**Date**	March 5, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	23°C / 47%rh
EUT Serial	00000287	**Temp / Hum out**	N/A
EUT Config.	On-board PCB Antenna	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15.107	**RBW / VBW**	9kHz / 10kHz
Lab/LISN	Lab #2/ Solar Type 9348-50-R-24-BNC, Line 2	**Performed by**	Jeremy Luong

Frequency MHz	Peak dBuV	QP dBuV	QP Limit dBuV	QP Margin dB	Avg dBuV	Avg Limit dBuV	Avg Margin dB
0.3022	44.980	45.45	60.17	-14.721	39.750	50.17	-10.42
0.3073	48.039	45.48	60.03	-14.553	39.680	50.03	-10.35
0.3085	47.912	45.51	60.00	-14.491	39.737	50.00	-10.26
0.3094	47.817	41.66	59.98	-18.316	37.397	49.98	-12.58
0.6102	48.222	48.66	56.00	-7.340	44.000	46.00	-2.00
0.9209	49.050	47.75	56.00	-8.250	43.030	46.00	-2.97
1.2285	47.304	45.73	56.00	-10.270	40.922	46.00	-5.08
2.1493	44.044	42.63	56.00	-13.370	33.983	46.00	-12.02
2.4547	45.760	43.94	56.00	-12.060	35.090	46.00	-10.91
9.9995	43.163	38.80	60.00	-21.200	33.363	50.00	-16.64

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; X-Axis.

SOP 1 Radiated Emissions

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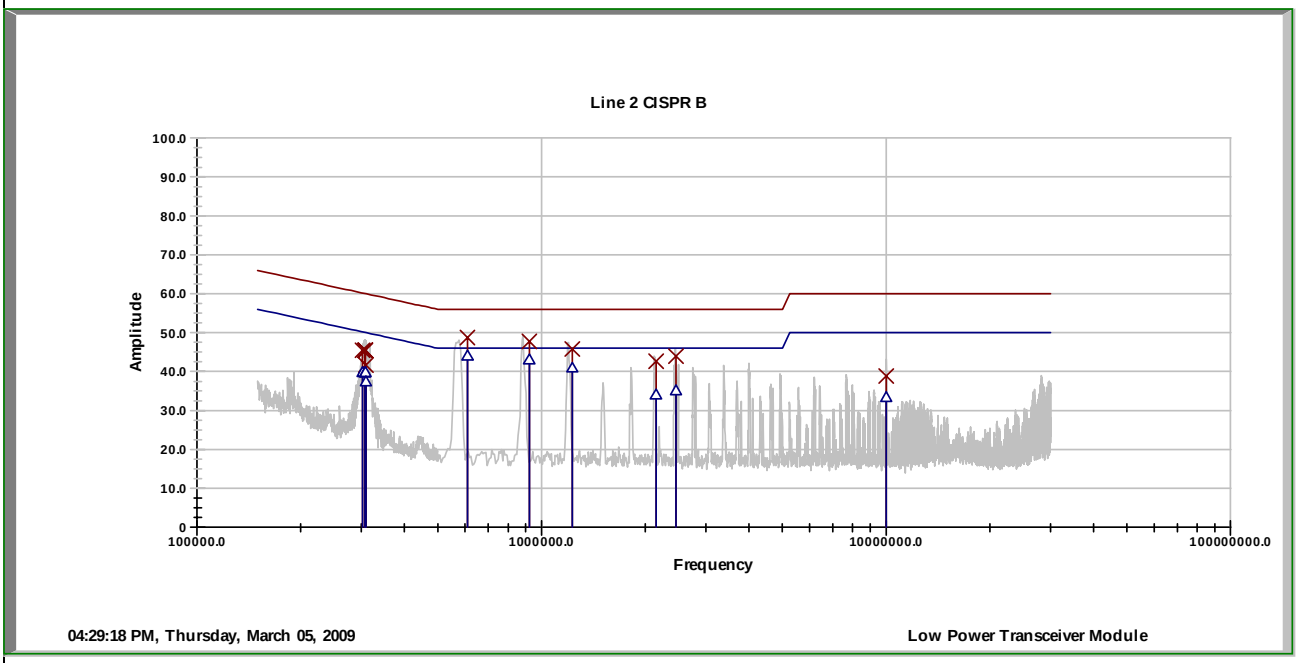
EUT Name	Low Power Transceiver Module	**Date**	March 5, 2009
EUT Model	ZG2100 and ZG2101	**Temp / Hum in**	23°C / 47%rh
EUT Serial	00000287	**Temp / Hum out**	N/A
EUT Config.	On-board PCB Antenna	**Line AC**	120Vac/60Hz
Standard	CFR47 Part 15.107	**RBW / VBW**	9kHz / 30kHz
Lab/LISN	Lab #2/ Solar Type 9348-50-R-24-BNC, Line 2	**Performed by**	Jeremy Luong

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



Notes: Using CISRP 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
Antenna Bilog	EMCO	3142	9701-1117	05/01/08	05/01/09
TuneD Dipole Antenna	A.H Systems, Inc.	TDS-200/535-1	154	01/09/09	01/09/10
TuneD Dipole Antenna	A.H Systems, Inc.	TDS-200/535-2	154	01/09/09	01/09/10
TuneD Dipole Antenna	A.H Systems, Inc.	TDS-200/535-3	154	01/09/09	01/09/10
TuneD Dipole Antenna	A.H Systems, Inc.	TDS-200/535-4	154	01/09/09	01/09/10
Antenna Horn (1-18GHz)	EMCO	3115	9602-4676	07/03/08	07/03/09
Antenna Horn (1-18GHz)	EMCO	3115	9710-5301	07/03/08	07/03/09
Antenna Horn (18-26GHz)	CMT	RA42-K-F-4B-C	020131-004	08/14/08	08/14/09
Antenna Horn (18-26GHz)	CMT	RA42-K-F-4B-C	961178-001	08/14/08	08/14/09
EMI Receiver	Hewlett Packard	8546A	3325A00166	01/21/09	01/21/10
Preselector	Hewlett Packard	85460A	3330A00162	01/21/09	01/21/10
Amplifier	Hewlett Packard	8447D	2944A07486	1/23/09	1/23/10
Spectrum Analyzer	Rhode&Schwarz	ESIB	DE31284	06/10/08	06/10/09
Amplifier	Rhode&Schwarz	TS-PR18	100019	08/14/08	08/14/09
Amplifier	Rhode&Schwarz	TS-PR26	100011	08/14/08	08/14/09
Signal Generator	Hewlett Packard	83620B	3844A01375	01/21/09	01/21/10
Spectrum Analyzer	Hewlett Packard	8568	2415A00443	01/26/09	01/26/10
S/A Display	Hewlett Packard	8568	2403A07118	01/26/09	01/26/10
Quasi-Peak Adapter	Hewlett Packard	85650A	2811A01178	01/26/09	01/26/10
LISN	Solar Electronics	Type 9348-50-R-24-BNC	00015149	01/21/09	01/21/10
Thermo Chamber	Associated Environmental	SK-3102	5999	01/22/09	01/22/10
Notch Filter	Micro-Tronics	BRM50702	037	01/24/09	01/24/10
High Pass Filter (3.5GHz)	Hewlett Packard	84300-80038	82004	01/24/09	01/24/10
High Pass Filter (8.5GHz)	Hewlett Packard	84300-80039	002	01/24/09	01/24/10
Power Supplier	Kikosui	PCR8000W	CM000912	01/21/09	01/21/10
Digital Multimeter	Fluke	77	55960854	01/22/09	01/22/10
Thermometer	Fluke	52II	96480034	09/08/08	09/08/09

* 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 Photo

6.1 Test Setup Photo

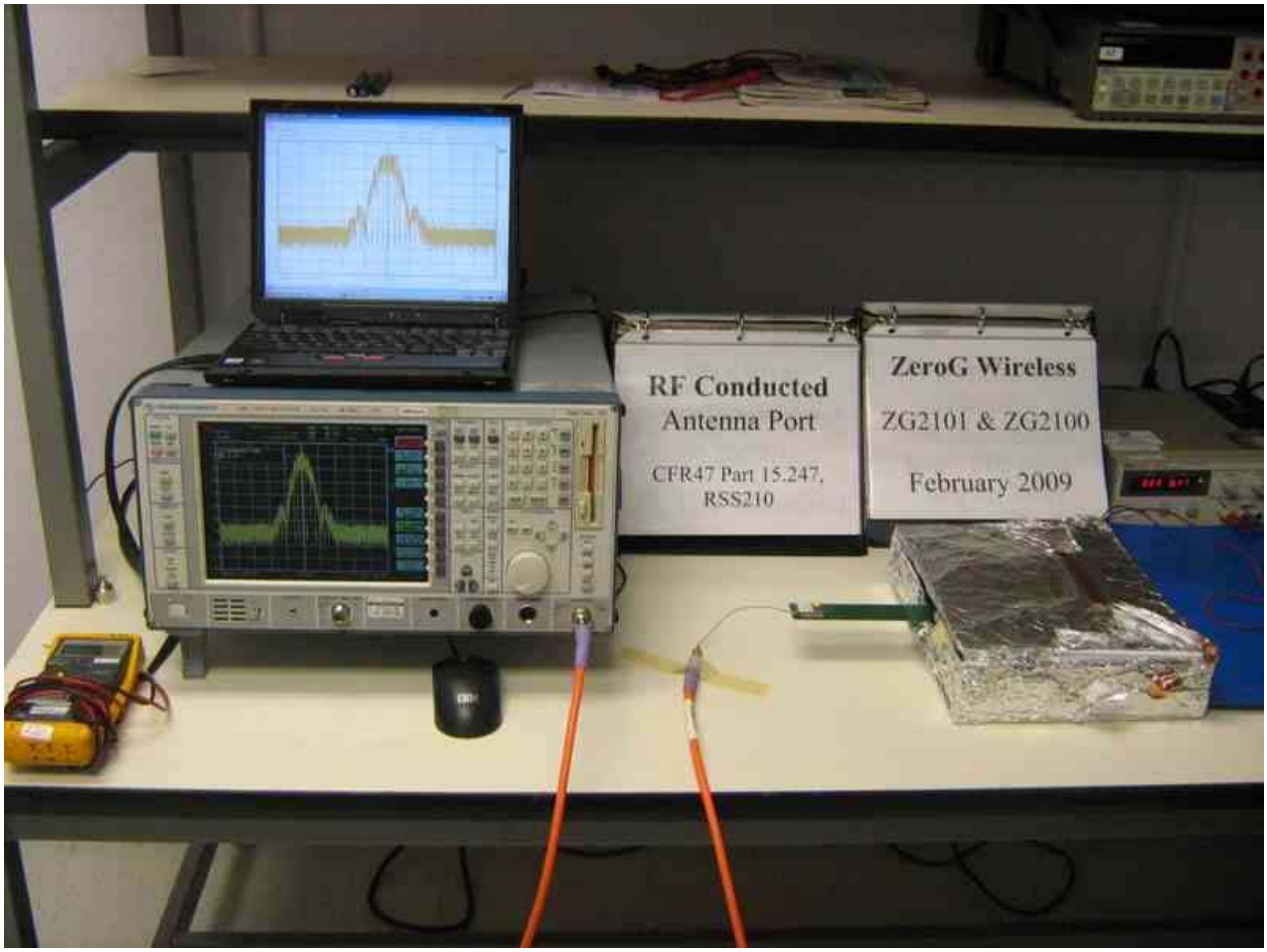


Figure 115: Photo of Test Setup for RF Conducted at the Antenna Port

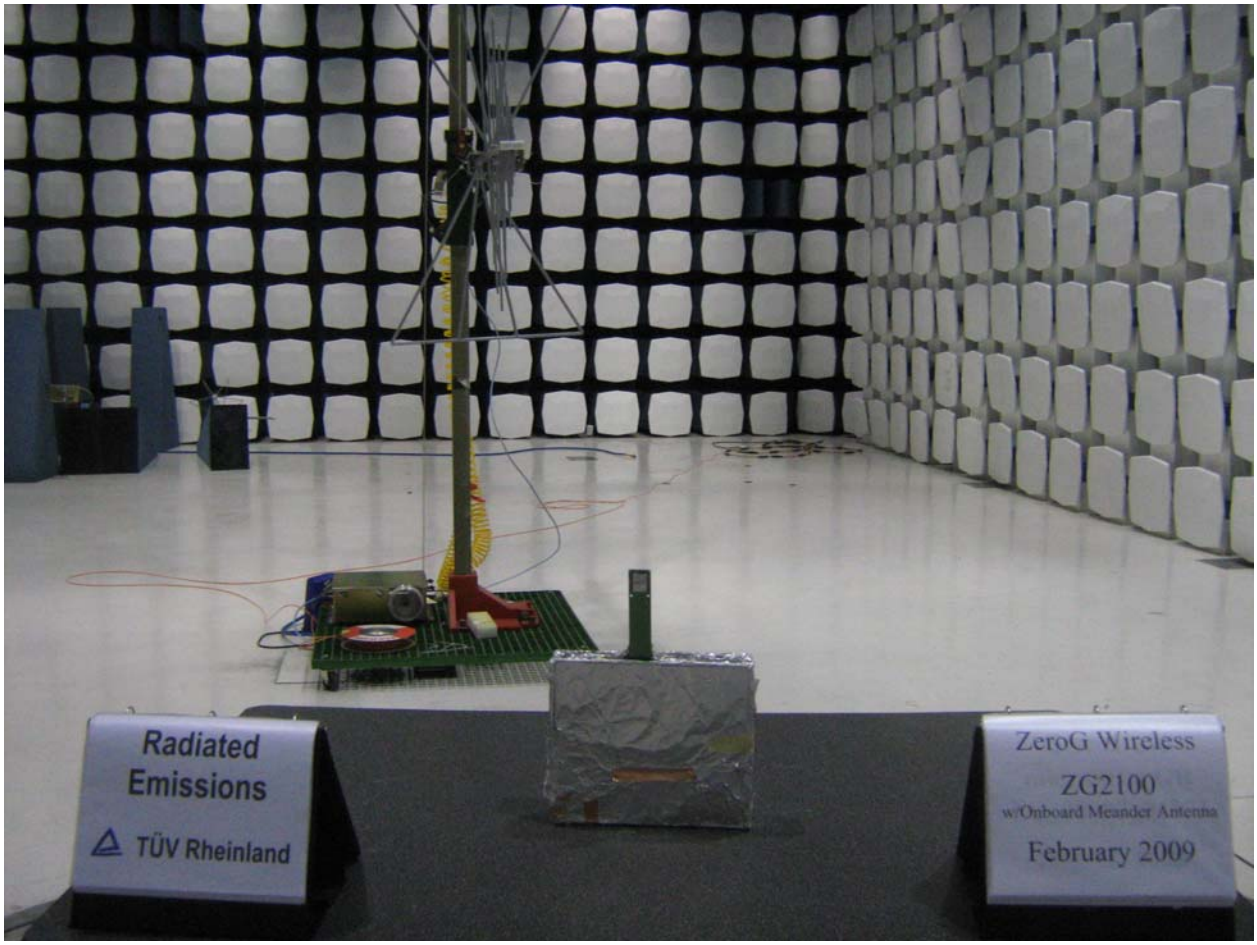


Figure 116: Photo of Test Setup for ZG2100 with On-board PCB Antenna, 30 to 1000 MHz

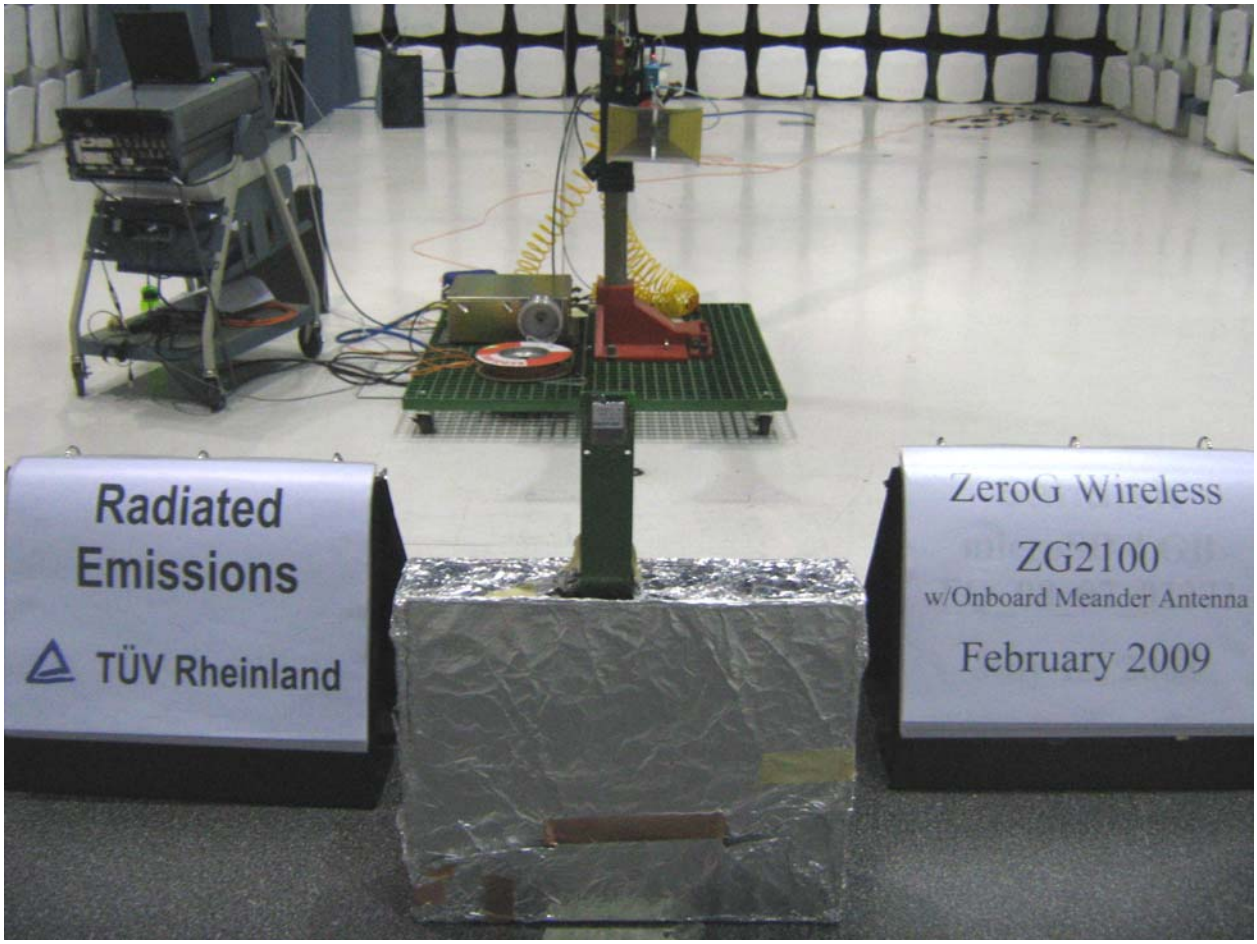


Figure 117: Photo of Test Setup for ZG2100 with On-board PCB Antenna, 1GHz to 18GHz

Figure 118: Photo of Test Setup for ZG2100 with On-board PCB Antenna, 18 GHz to 25GHz

Figure 119: Photo of Test Setup for ZG2101 with 2dBi PCB Antenna #3, 30 to 1000 MHz

Figure 120: Photo of Test Setup for ZG2101 with 2dBi PCB Antenna #3, 1GHz to 18GHz

Figure 121: Photo of Test Setup for ZG2101 with 2dBi PCB Antenna #3, 18 GHz to 25GHz

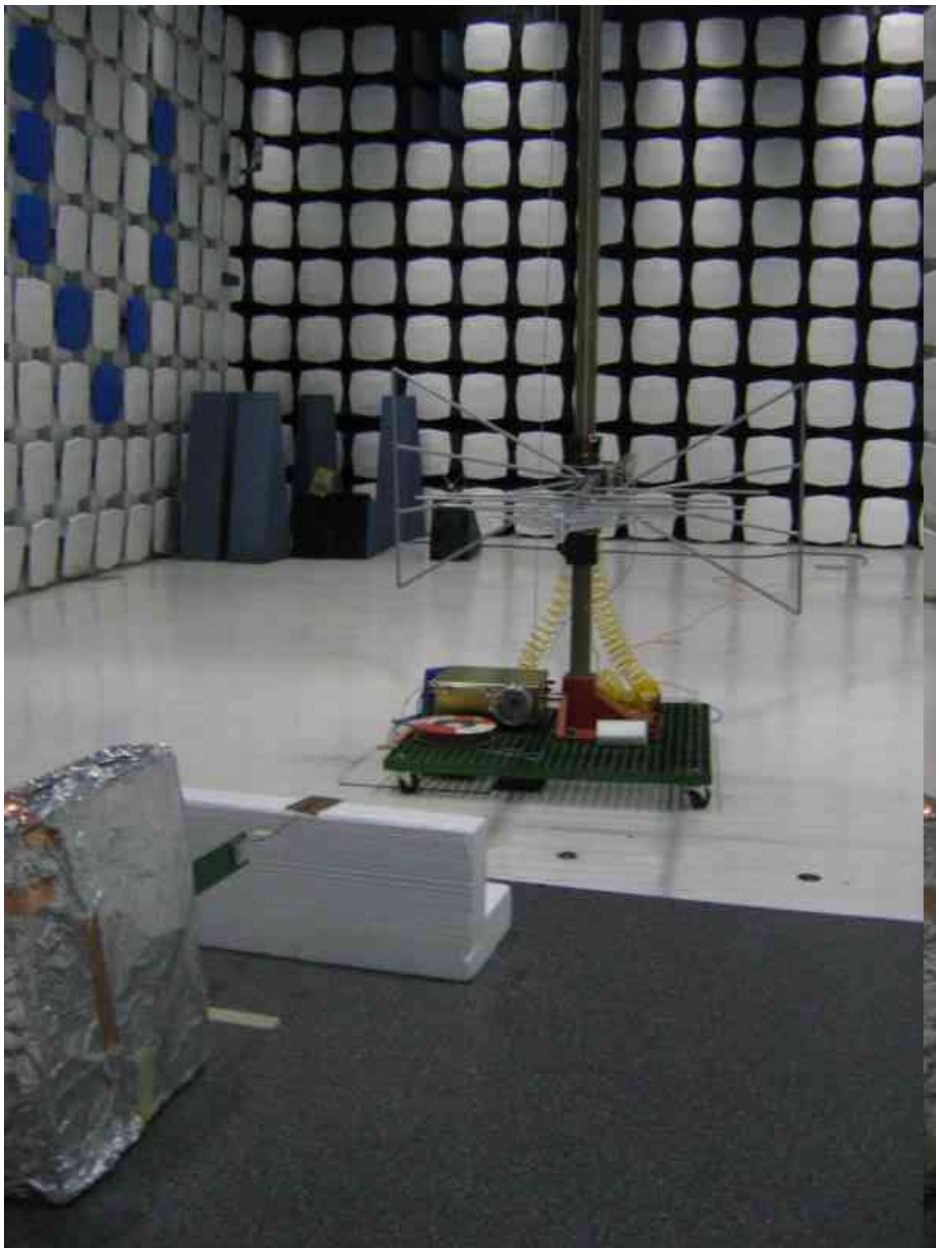


Figure 122: Photo of Test Setup for ZG2101 with Inverter F Antenna, 30 to 1000 MHz

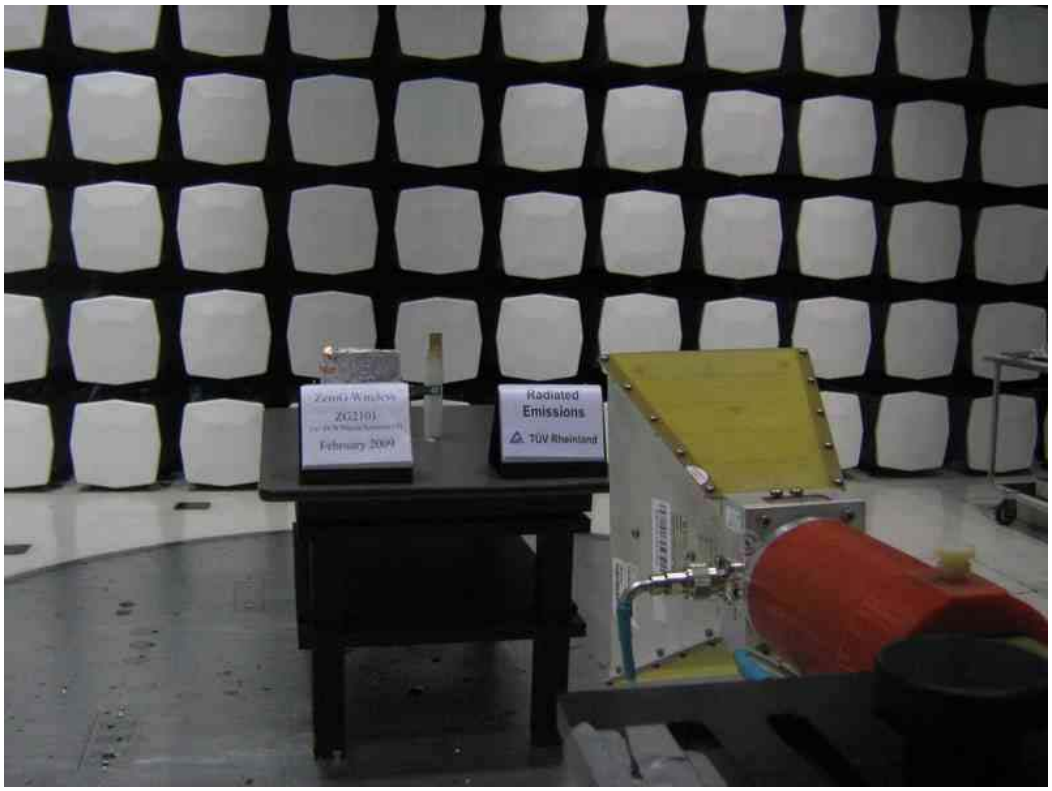


Figure 123: Photo of Test Setup for ZG2101 with Inverter F Antenna, 1GHz to 18GHz

Figure 124: Photo of Test Setup for ZG2101 with Inverter F Antenna, 18 GHz to 25GHz

Figure 125: Photo of Test Setup for ZG2101 with RFA-02-D3-70-100 Antenna, 30 to 1000 MHz

Figure 126: Photo of Test Setup for ZG2101 with RFA-02-D3-70-100 Antenna, 1GHz to 18GHz

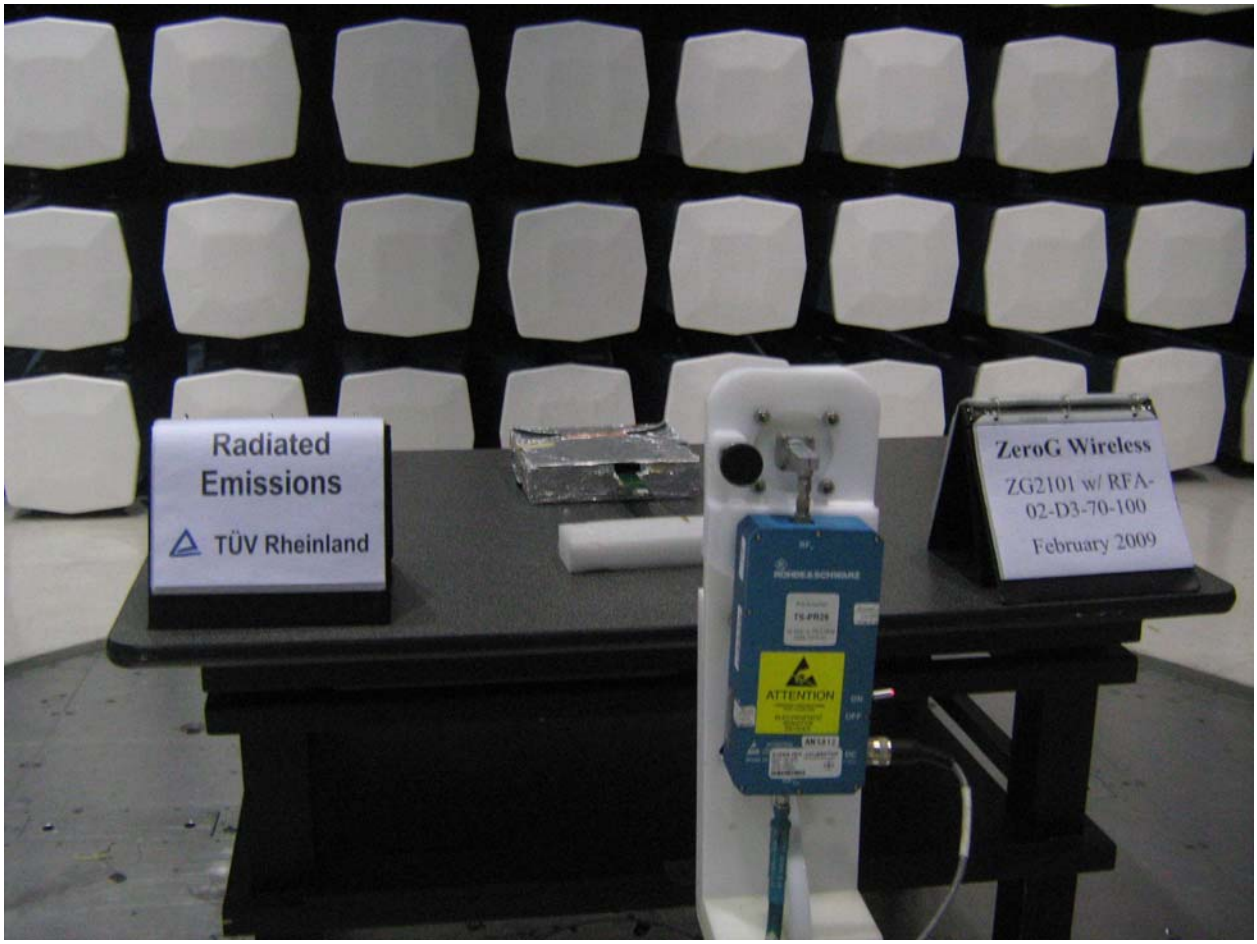


Figure 127: Photo of Test Setup for ZG2101 with RFA-02-D3-70-100 Antenna, 18 GHz to 25GHz

Figure 128: Photo of Test Setup for ZG2101 with Helical Antenna, 30 to 1000 MHz

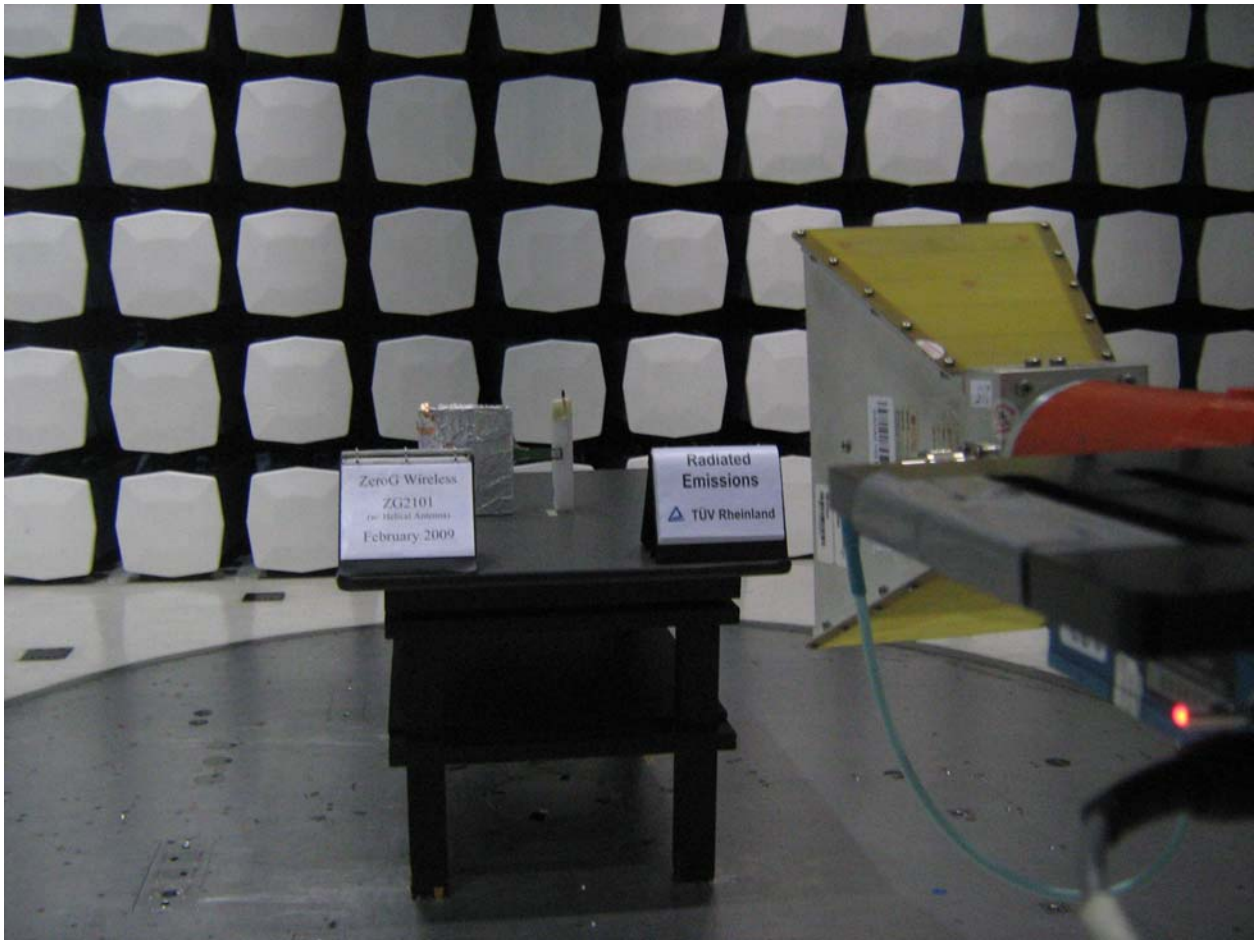


Figure 129: Photo of Test Setup for ZG2101 with Helical Antenna, 1GHz to 18GHz

Figure 130: Photo of Test Setup for ZG2101 with Helical Antenna, 18 GHz to 25GHz

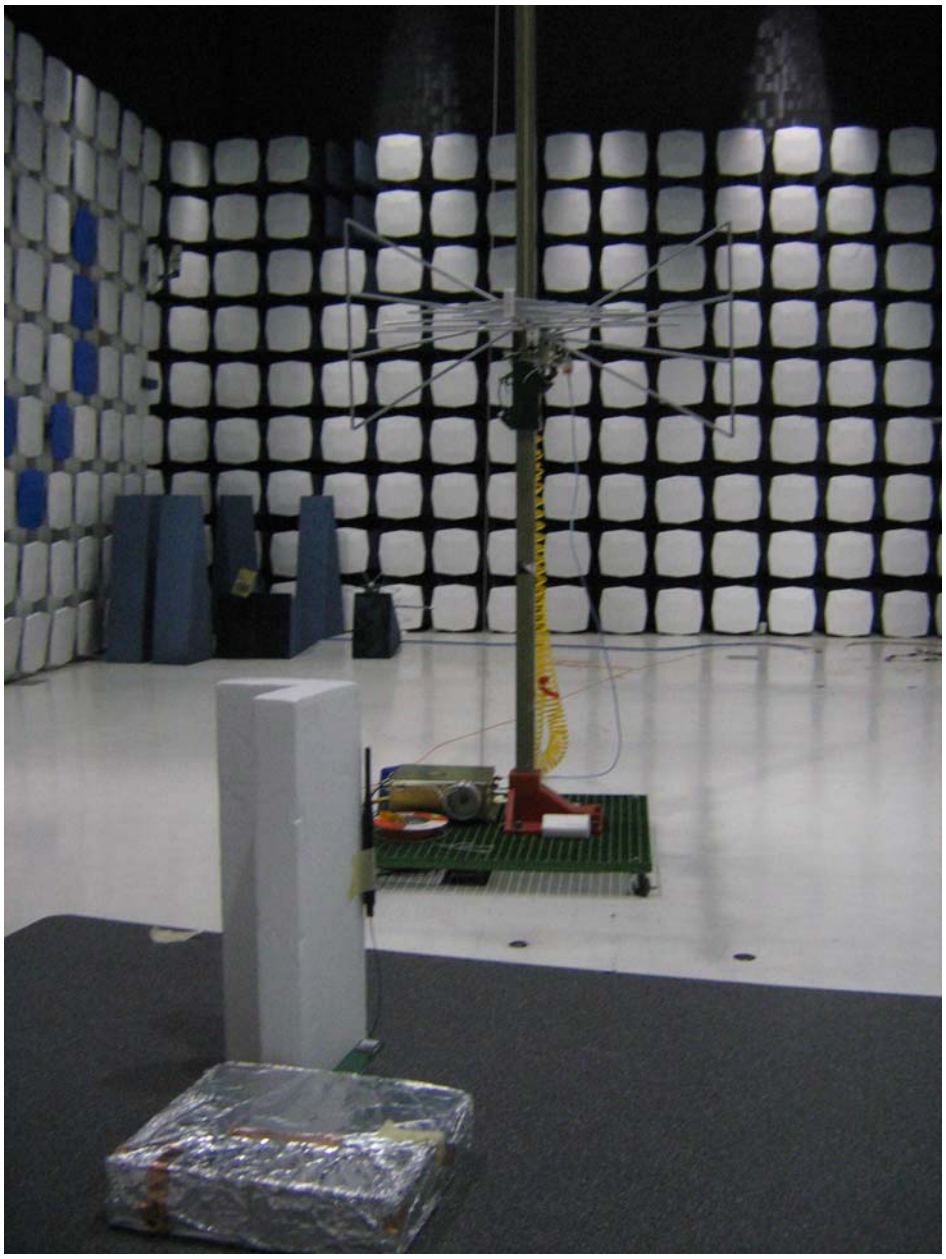


Figure 131: Photo of Test Setup for ZG2101 with 5dBi Dipole Antenna, 30 to 1000 MHz

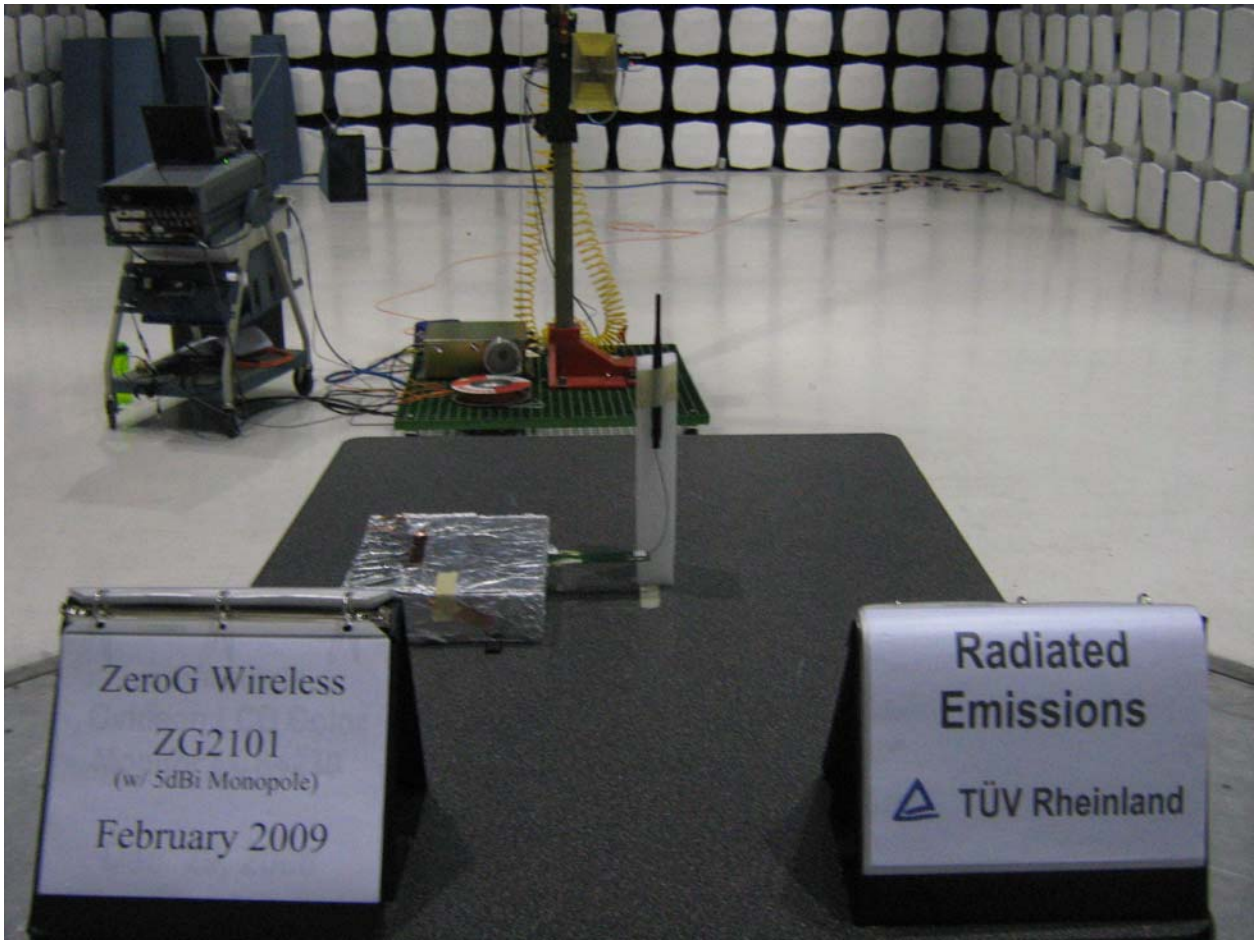


Figure 132: Photo of Test Setup for ZG2101 with 5dBi Dipole Antenna, 1GHz to 18GHz

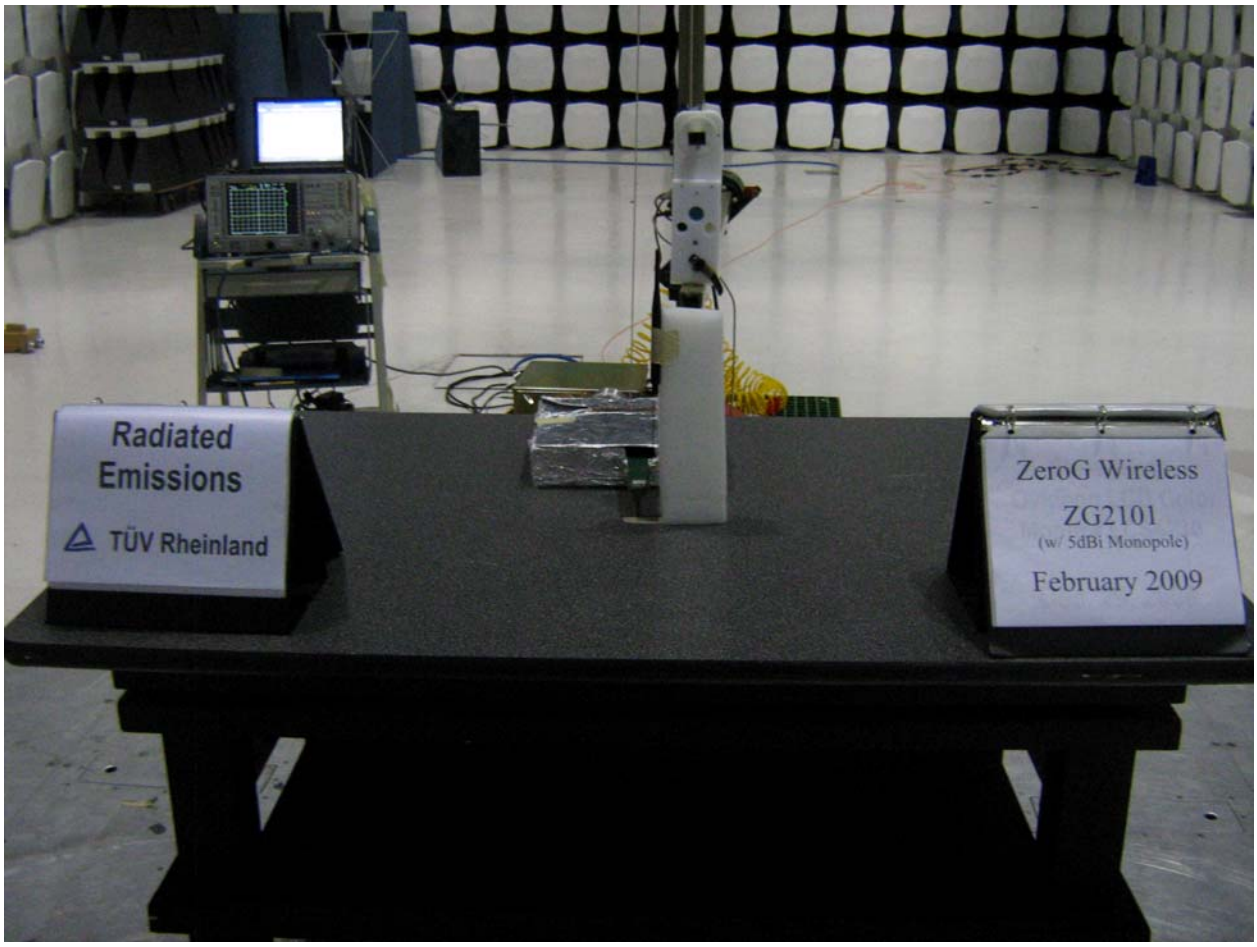


Figure 133: Photo of Test Setup for ZG2101 with 5dBi Dipole Antenna, 18 GHz to 25GHz

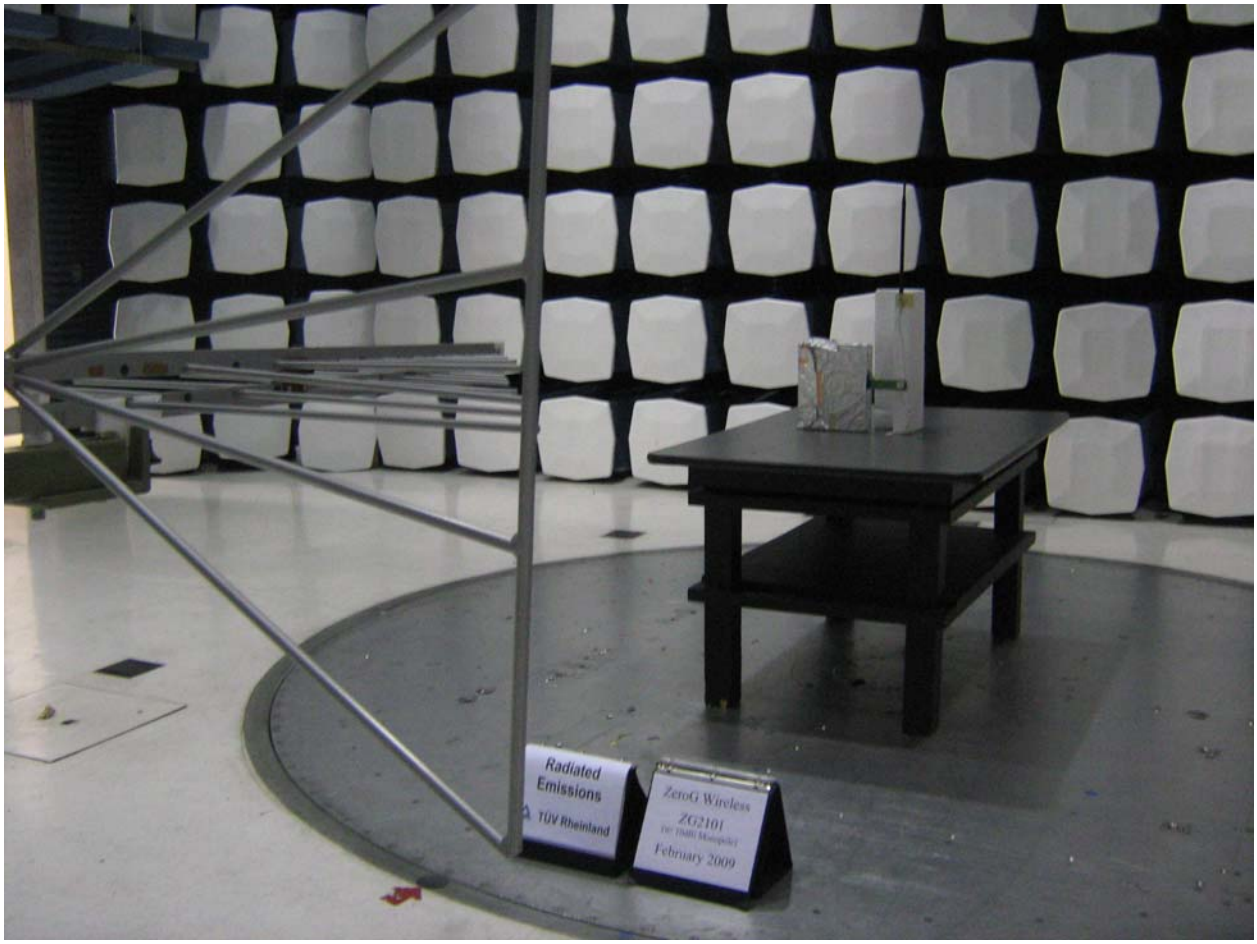


Figure 134: Photo of Test Setup for ZG2101 with 10dBi Monopole Antenna, 30 to 1000 MHz

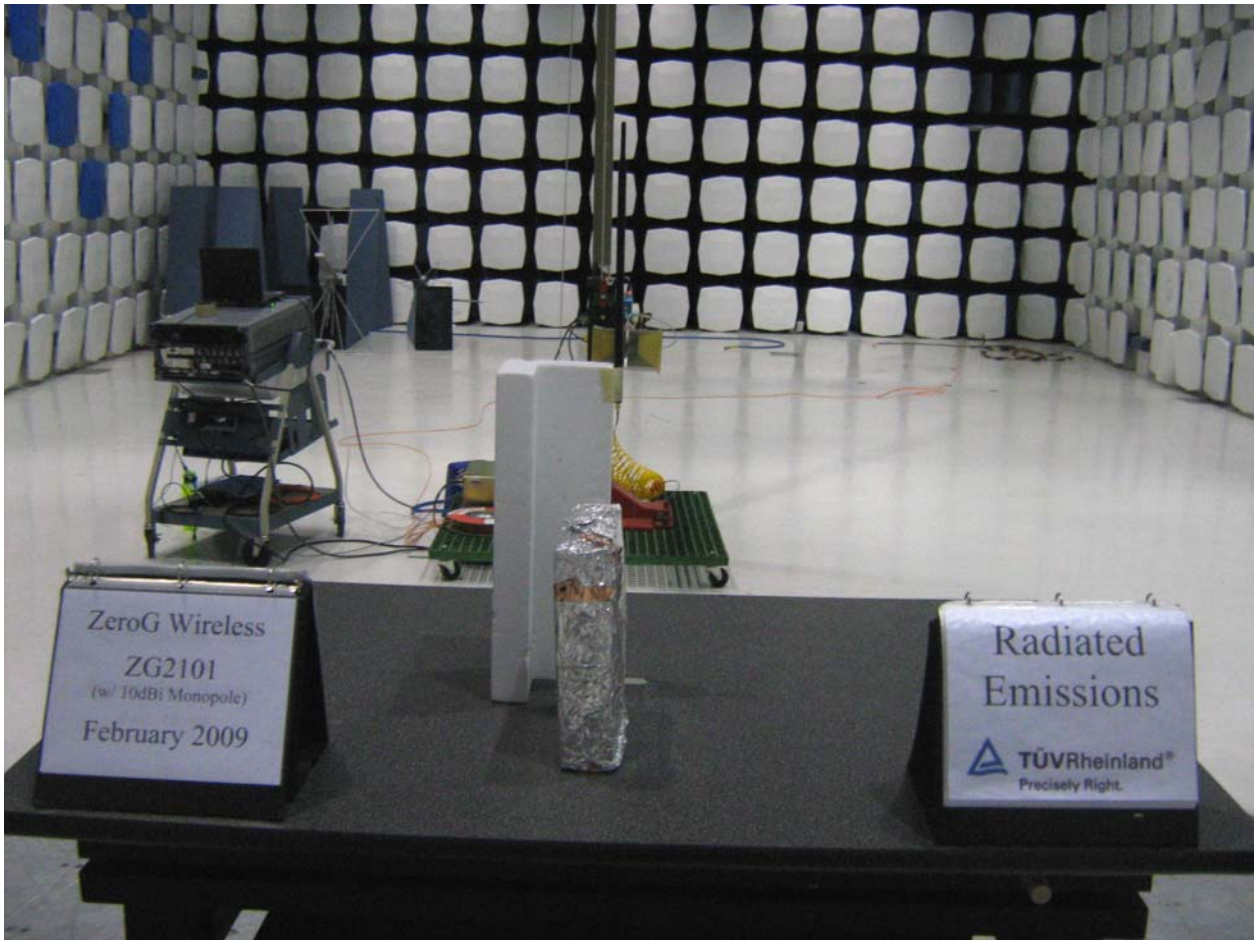


Figure 135: Photo of Test Setup for ZG2101 with 10dBi Monopole Antenna, 1GHz to 18GHz

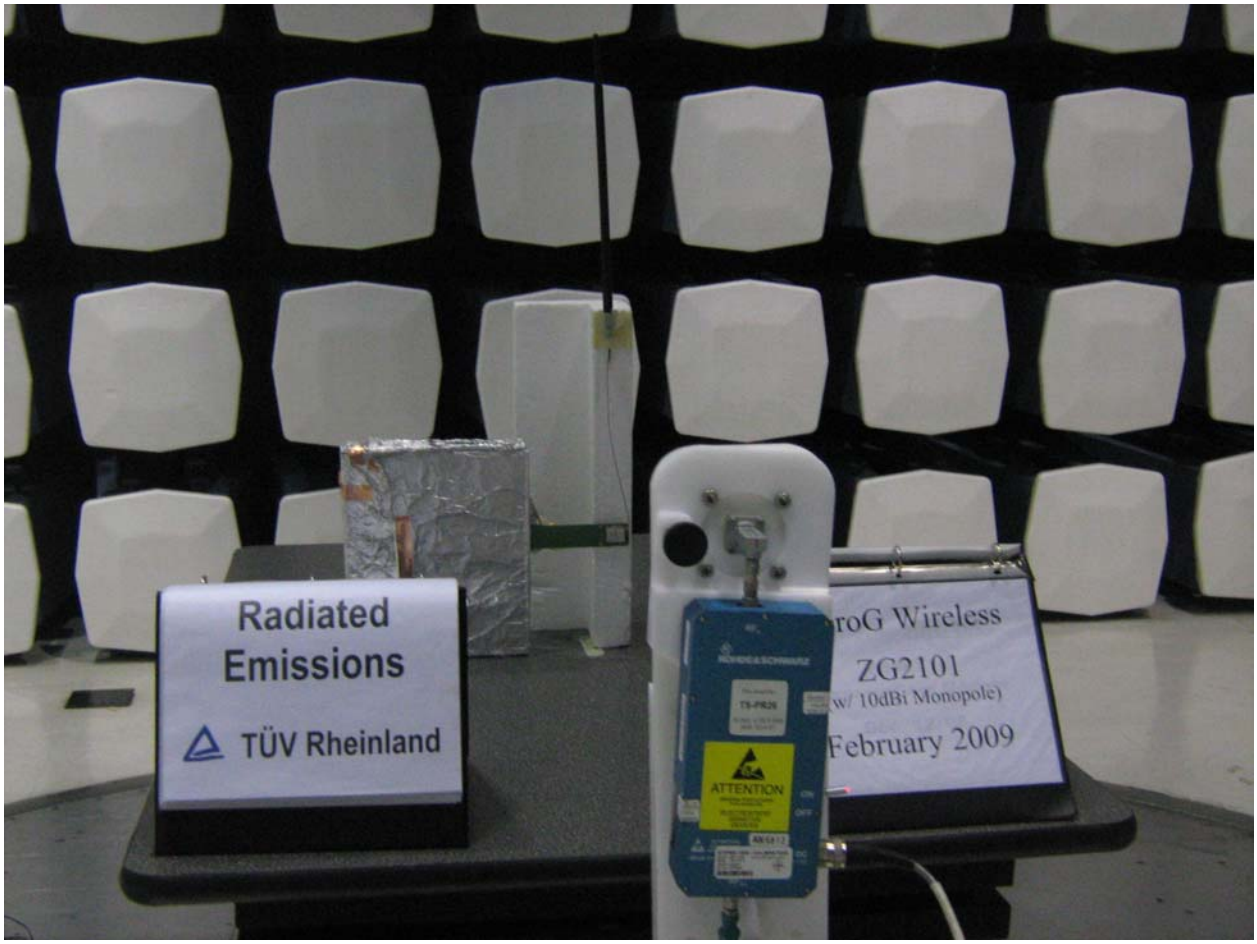


Figure 136: Photo of Test Setup for ZG2101 with 10dBi Monopole Antenna, 18 GHz to 25GHz

6.2 Product Under Test Photo

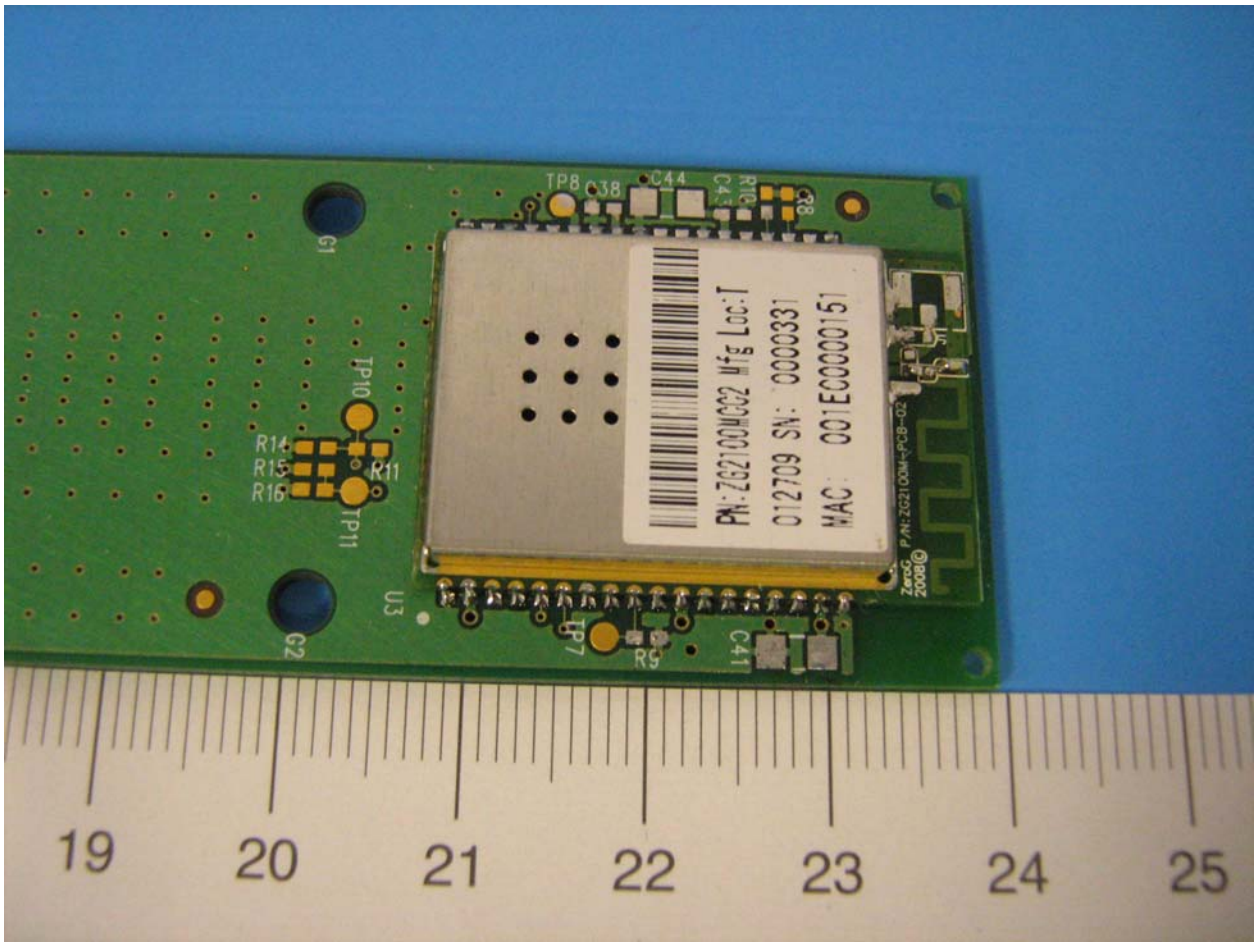


Figure 137: External Photo of ZG2100 with Extender Module – Top View

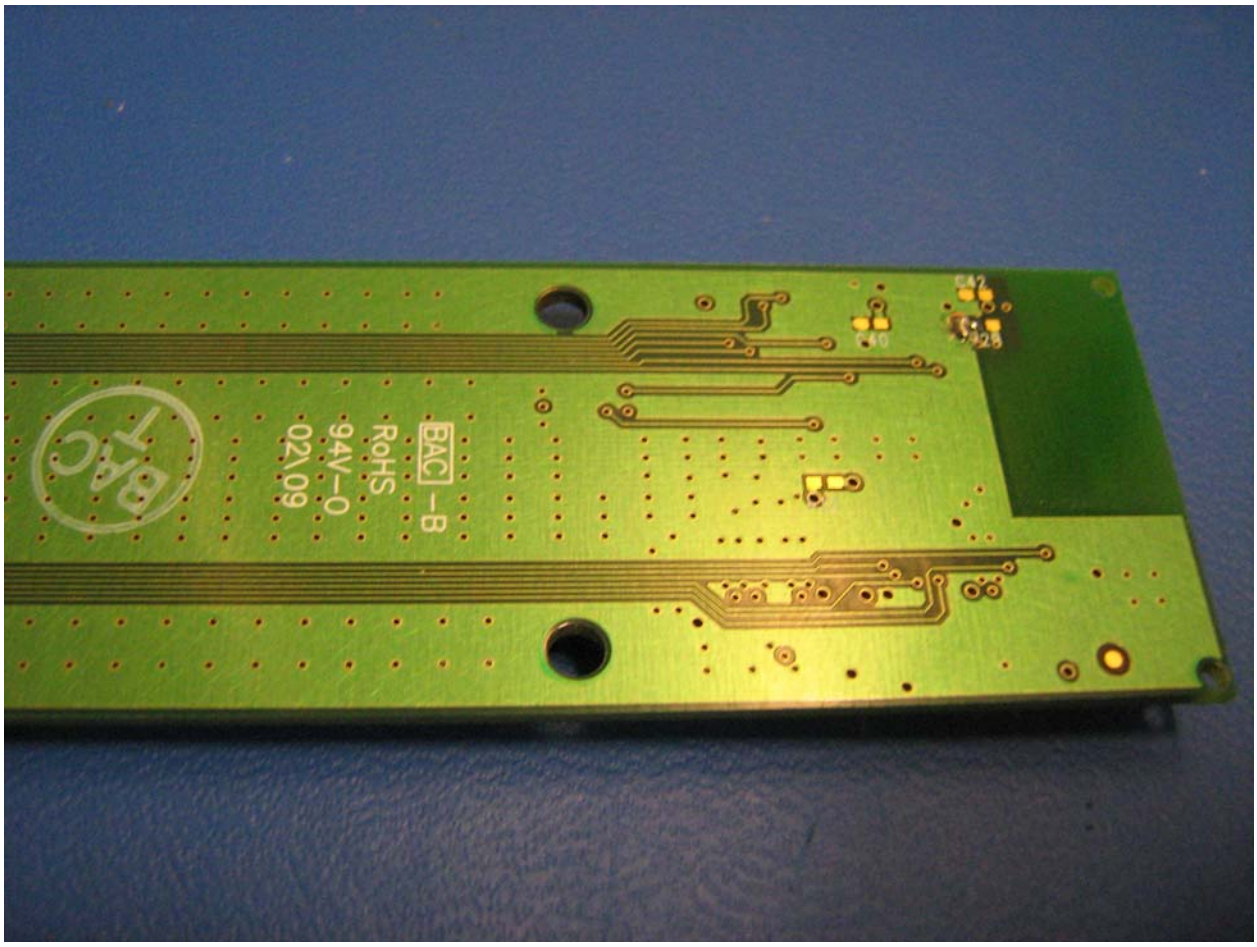


Figure 138: External Photo of ZG2100 with Extender Module – Bottom View

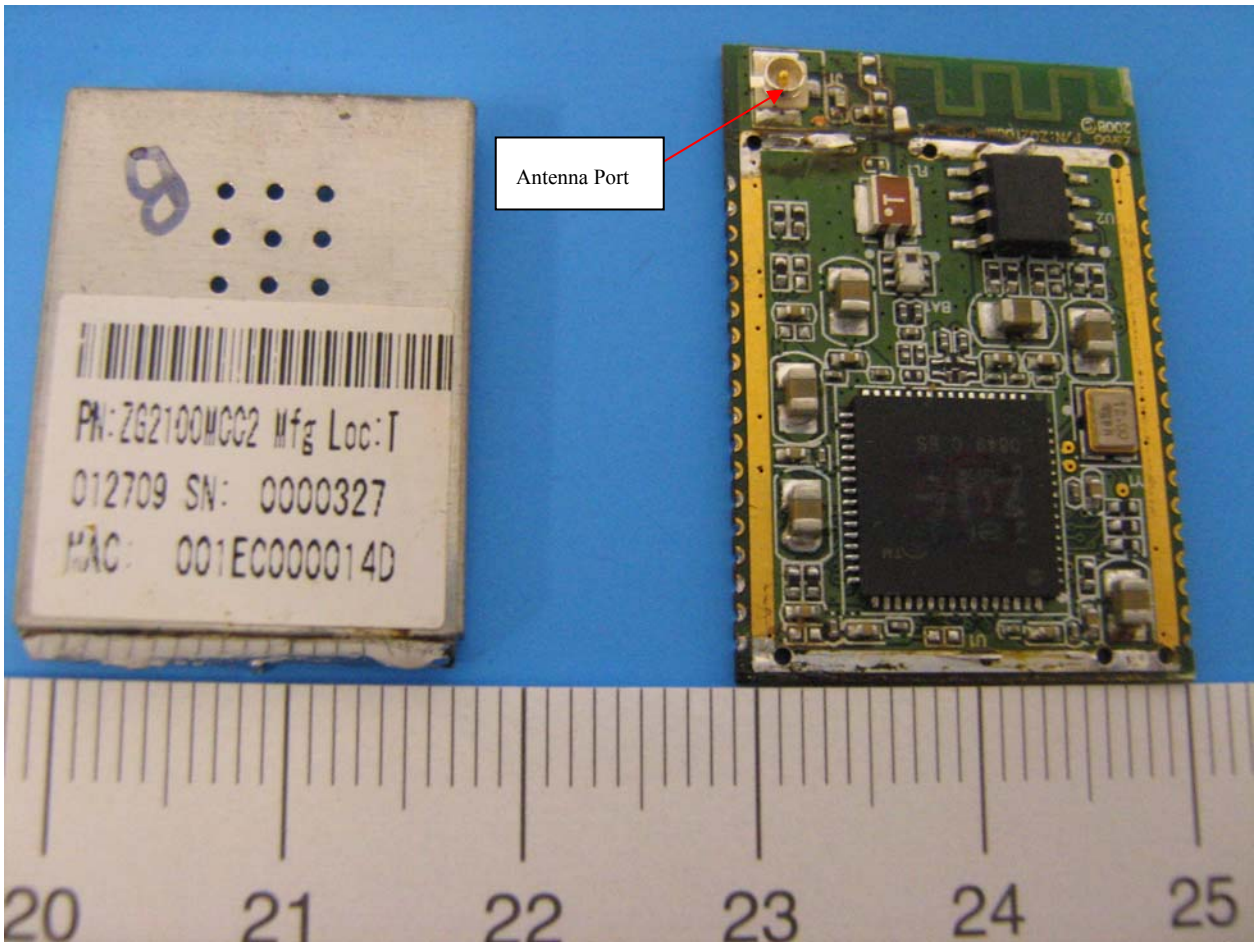


Figure 139: Internal photo of ZG2101 – Component Side

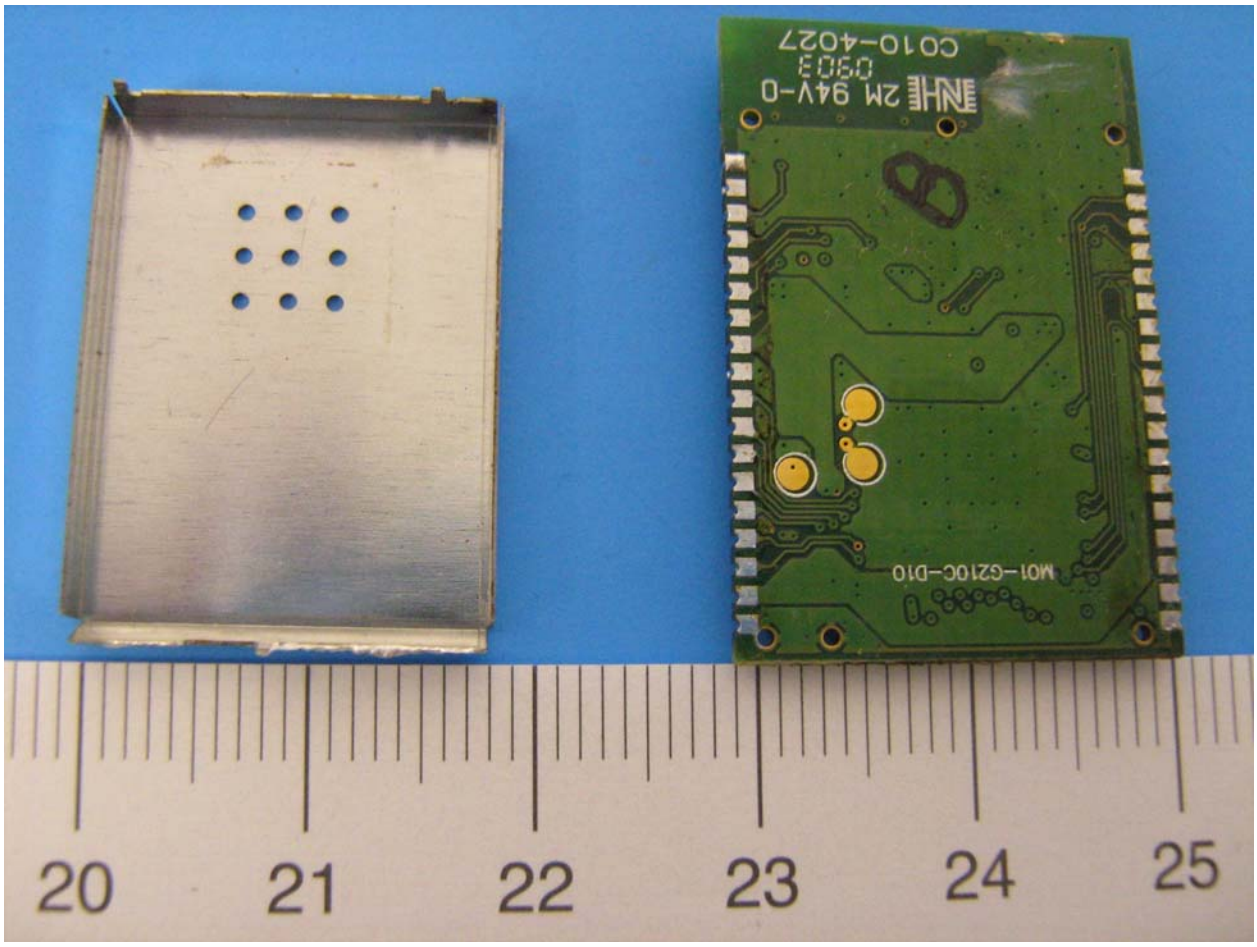


Figure 140: Internal photo of ZG2101 – Soldered Side

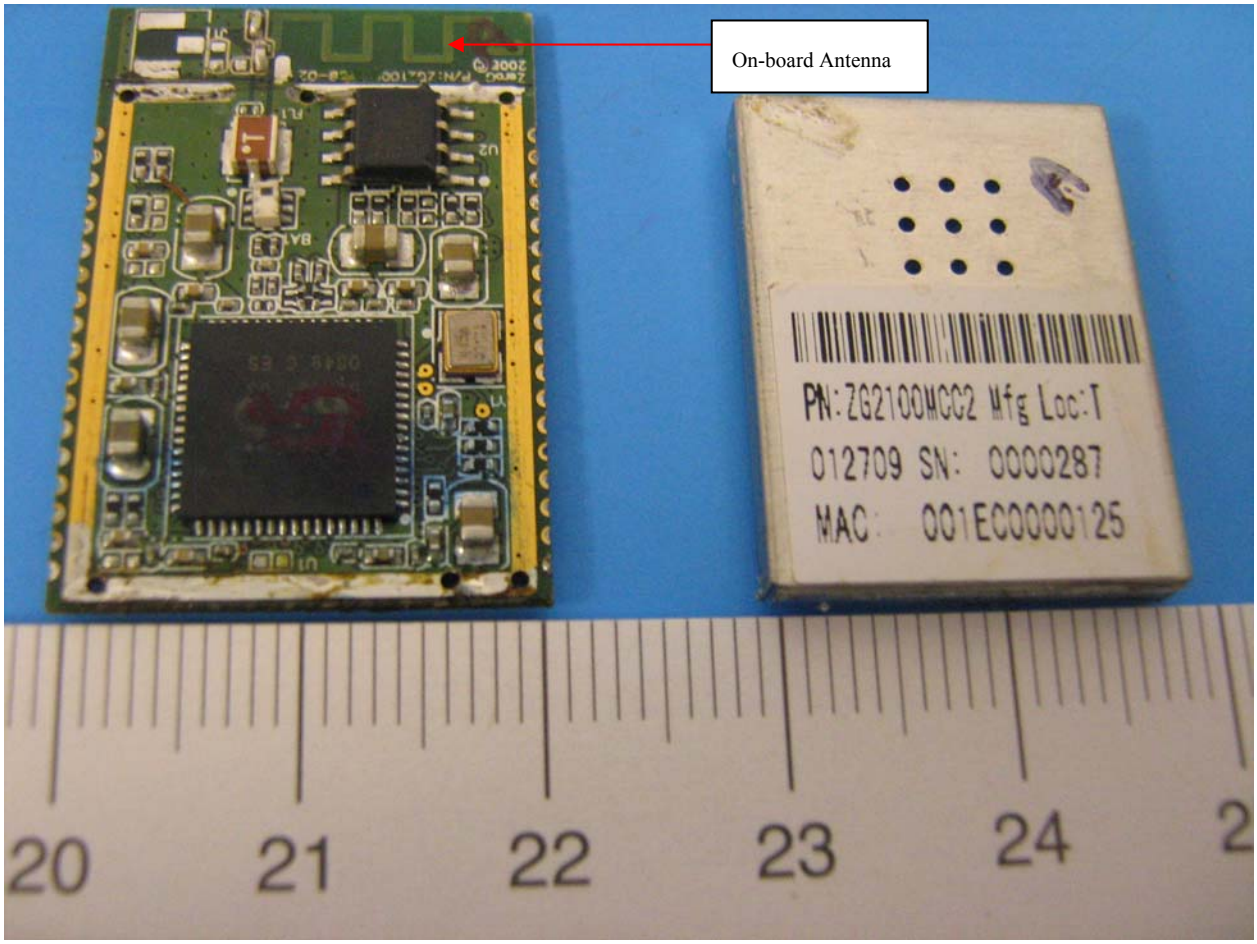


Figure 141: Internal photo of ZG2100 – Component Side

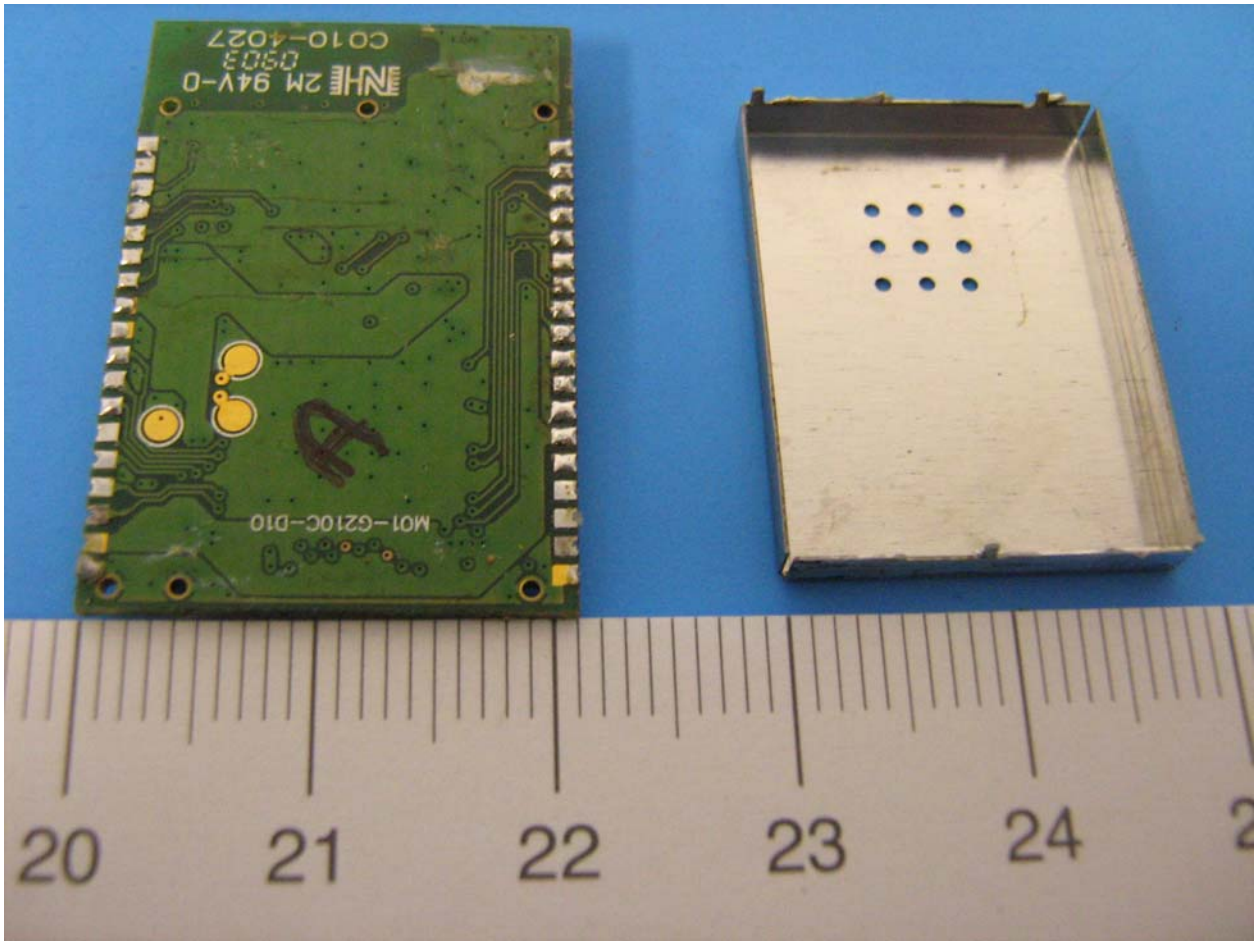


Figure 142: Internal photo of ZG2100 – Soldered Side

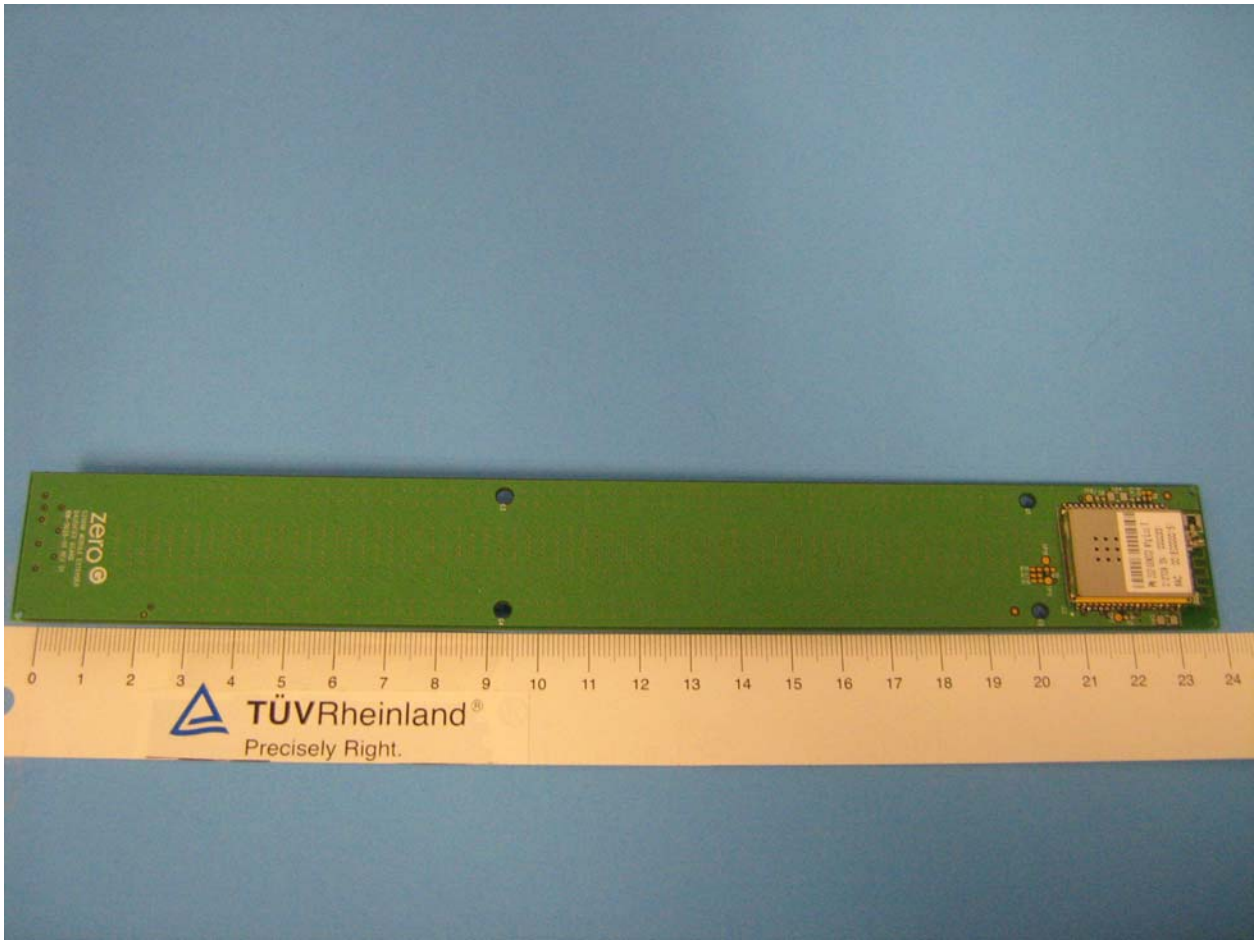


Figure 143: External photo of Extender Module – Component Side

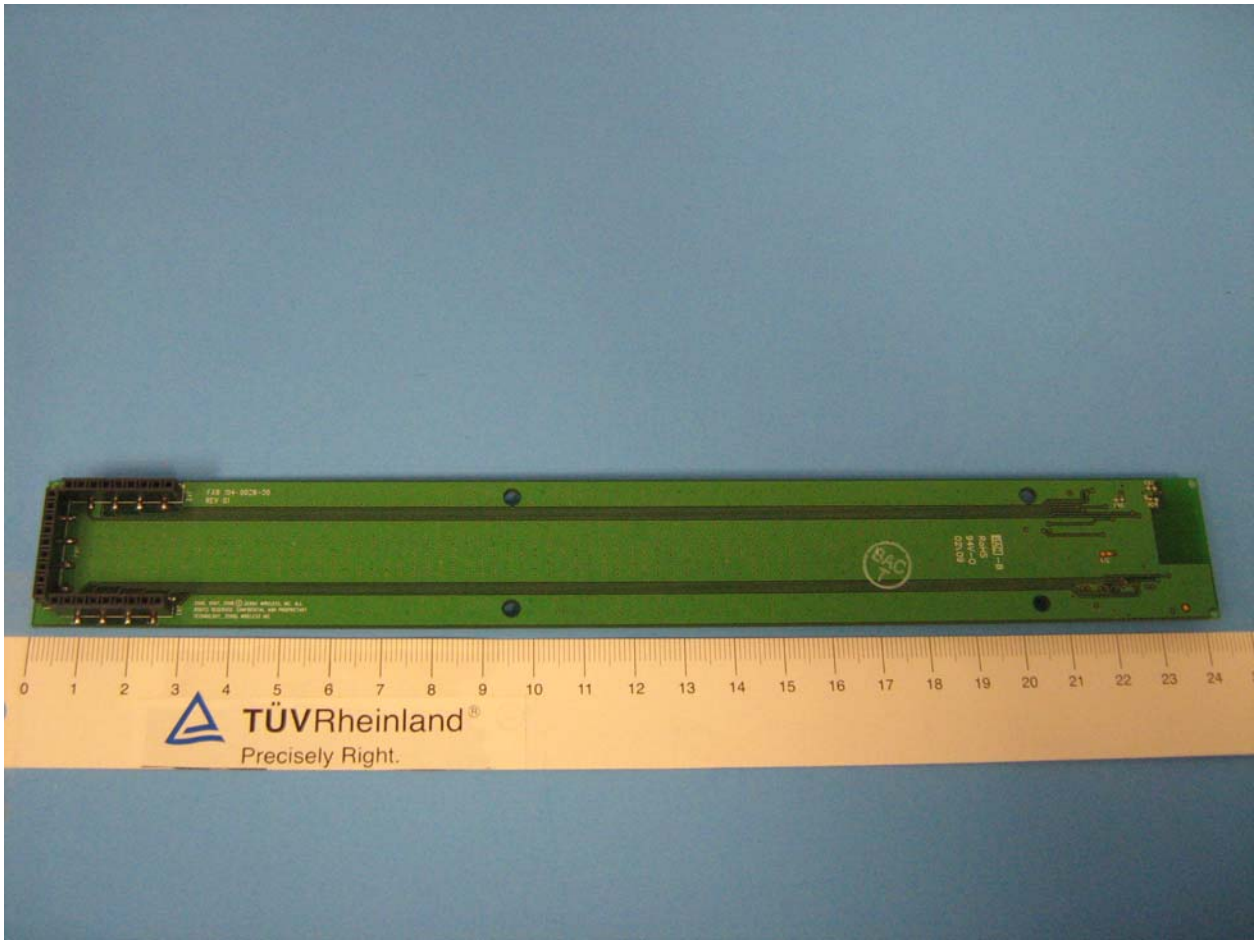


Figure 144: External photo of Extender Module – Back Side

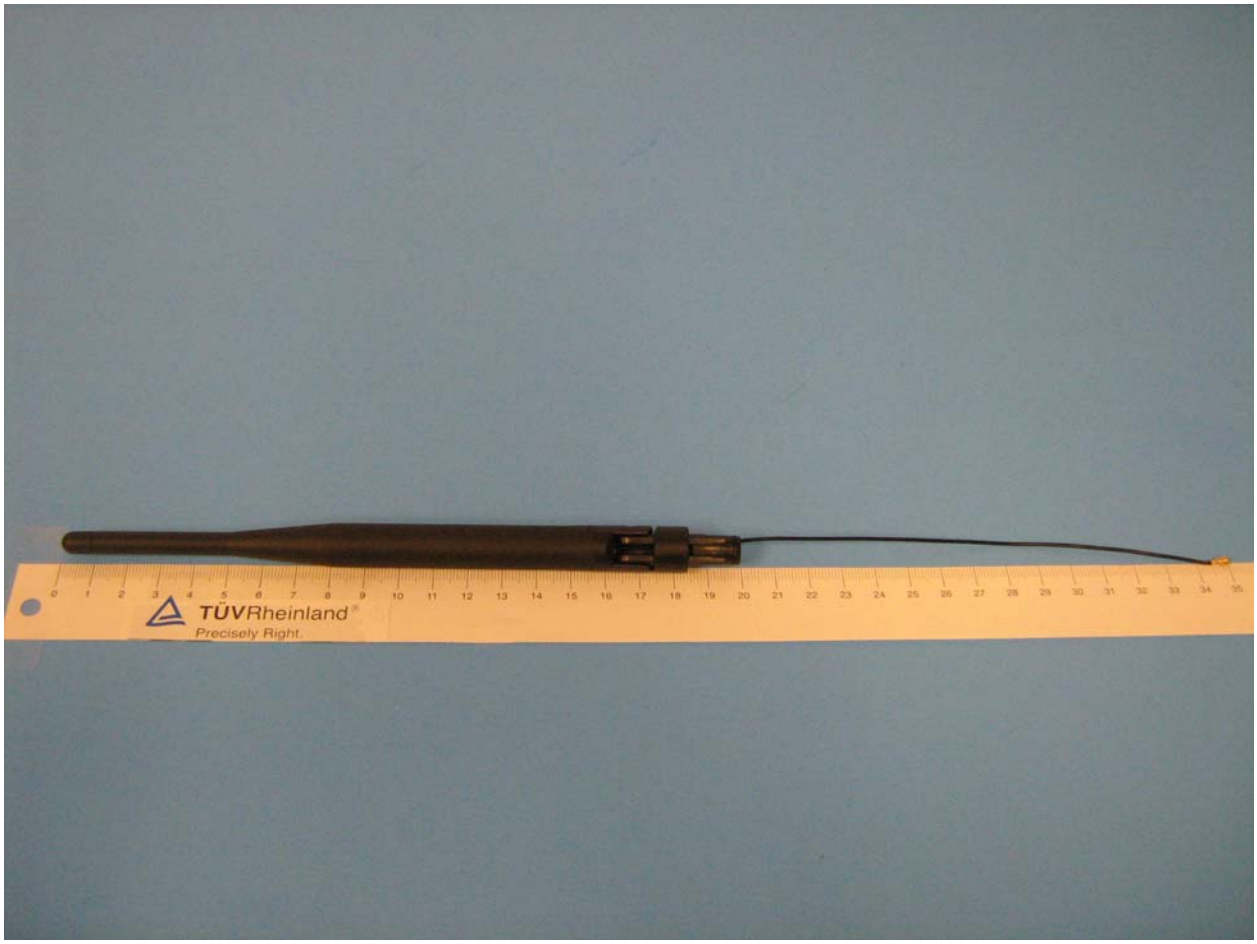


Figure 145: External Antenna for ZG2101 Module – 5dBi Dipole Antenna (WF2400-15001A)

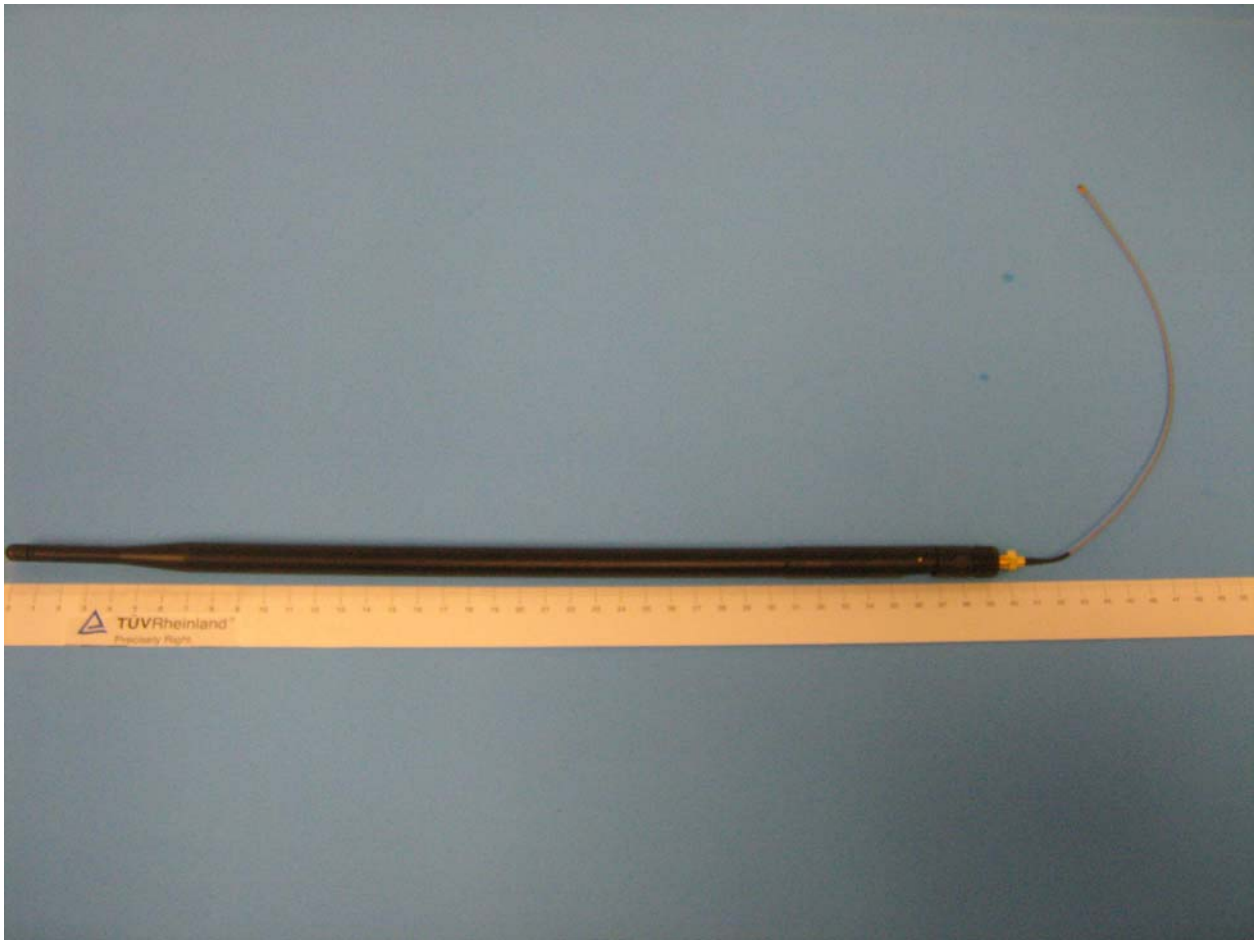


Figure 146: External Antenna for ZG2101 Module – 10dBi Monopole Antenna (AN2400-5901RS)

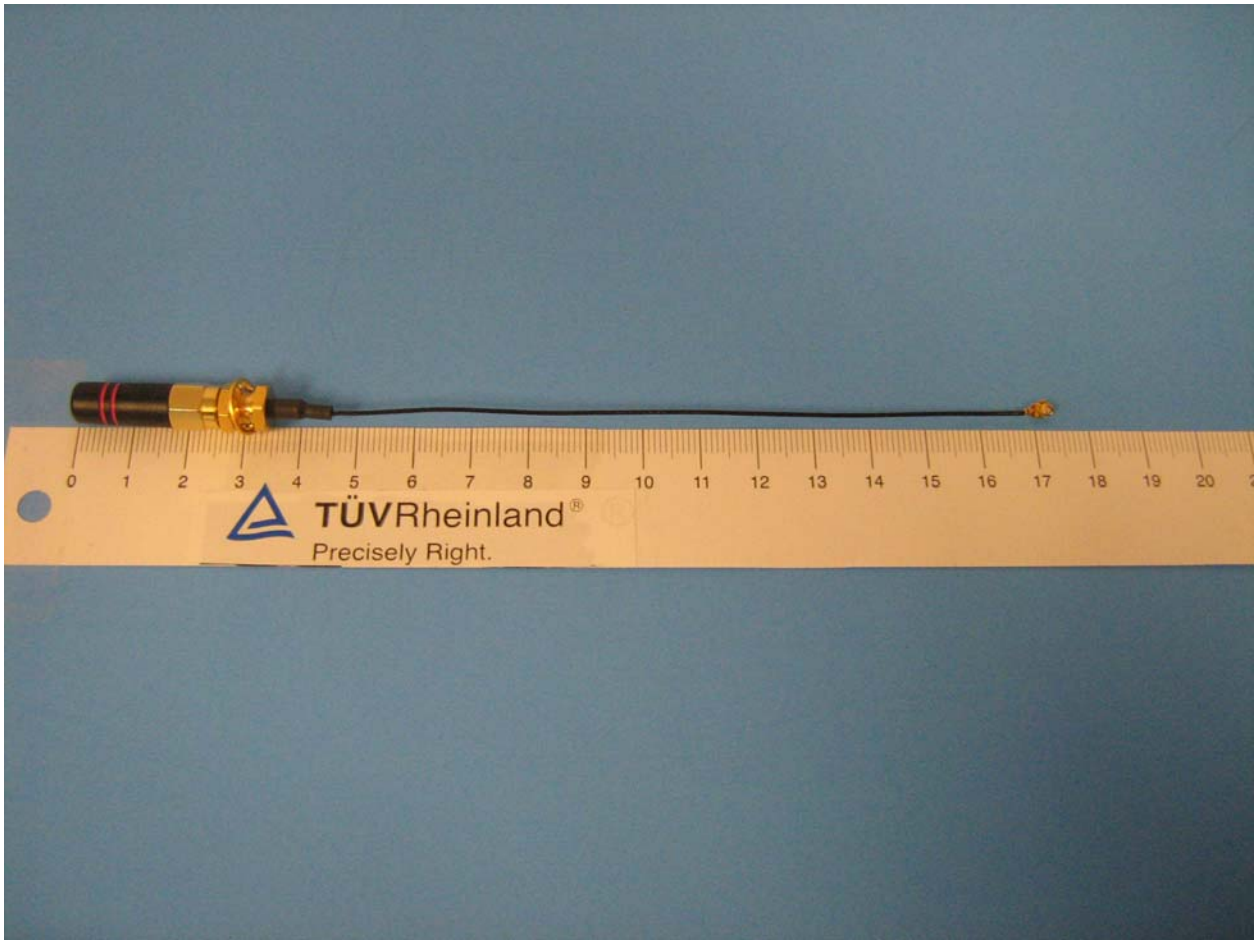


Figure 147: External Antenna for ZG2101 Module – Helical Antenna (BTC013-1-70B-150)

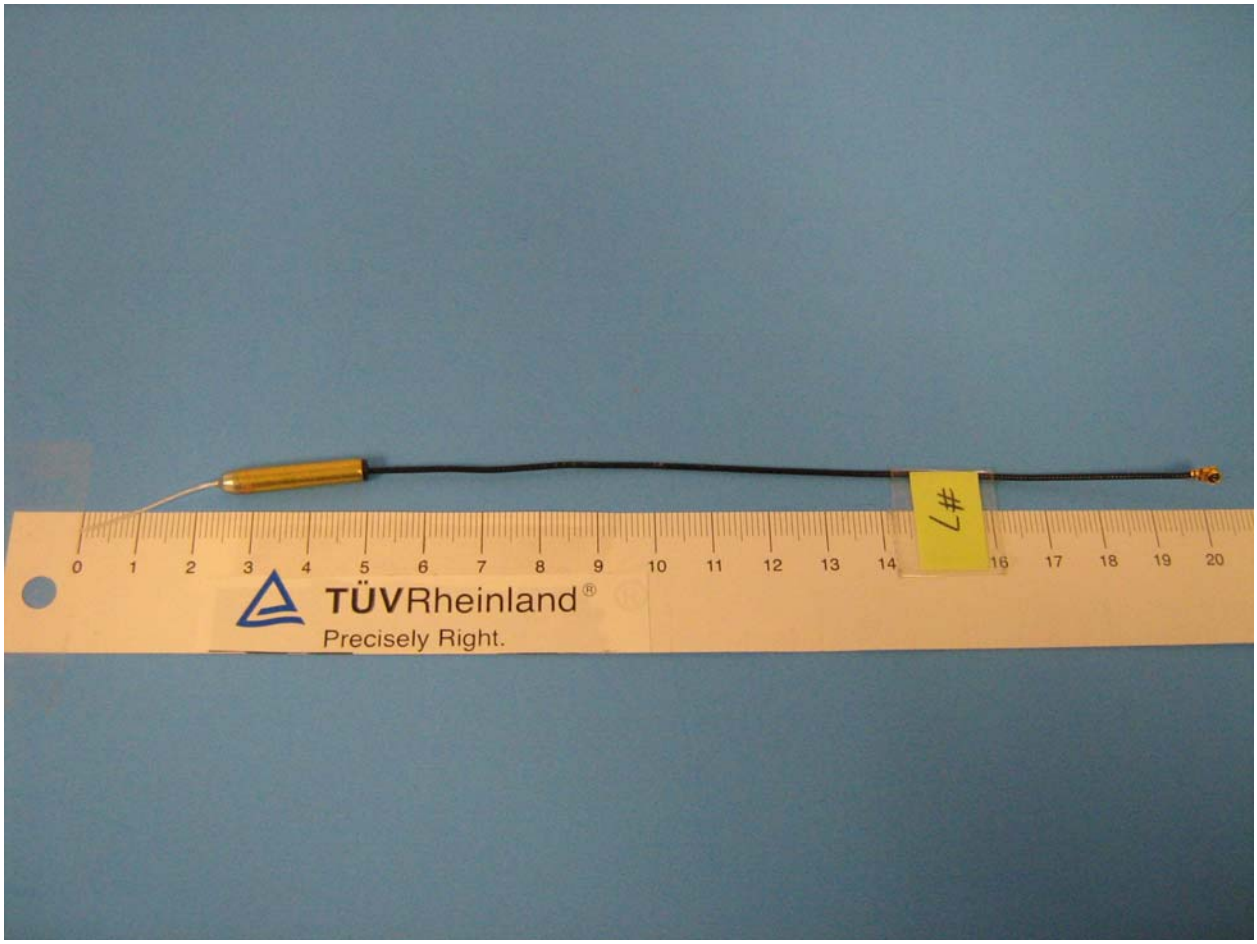


Figure 148: External Antenna for ZG2101 Module – 2dBi Dipole Antenna (RFA-02-d3-70-100)

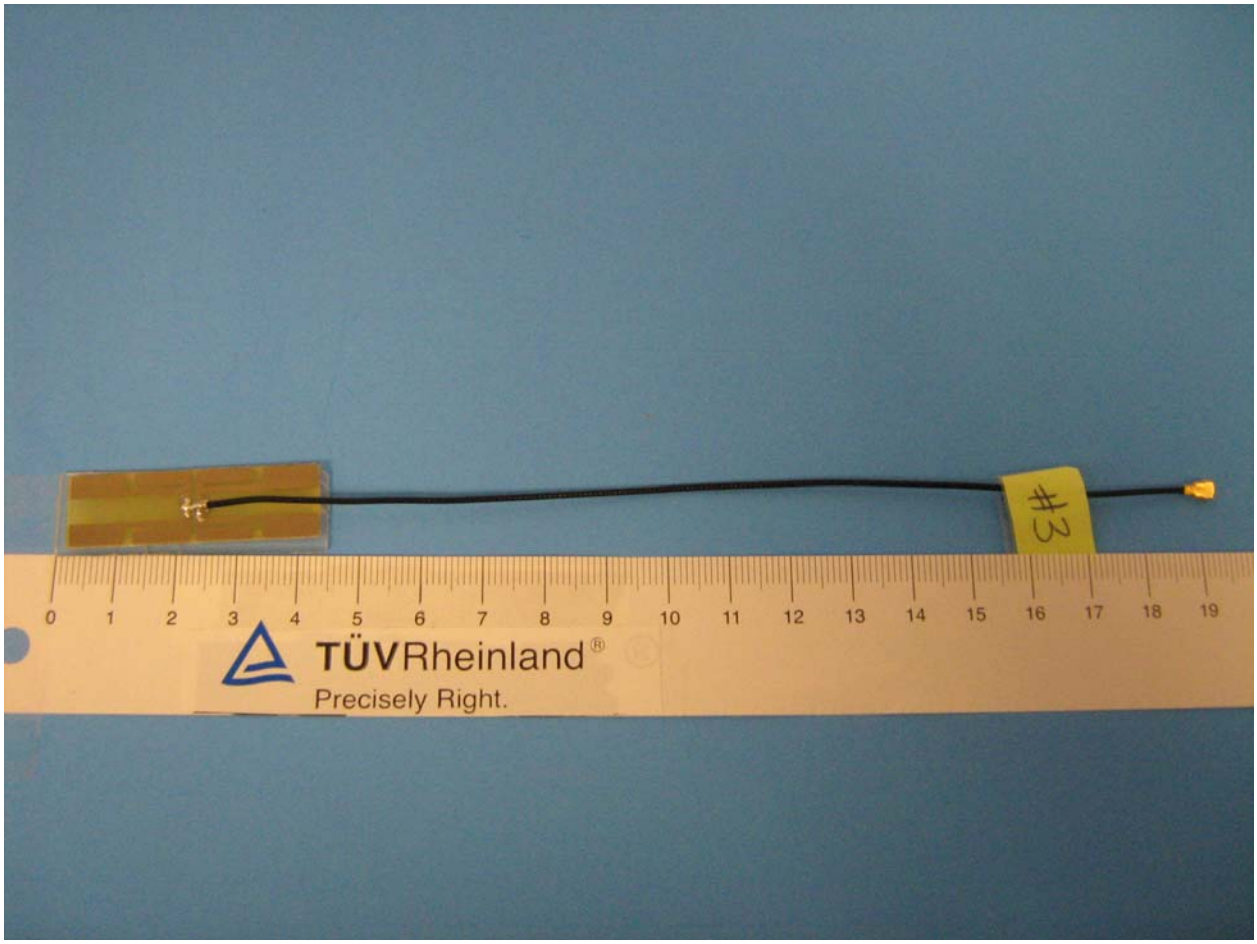


Figure 149: External Antenna for ZG2101 Module –2dBi PCB Antenna (RFA-02-P05)

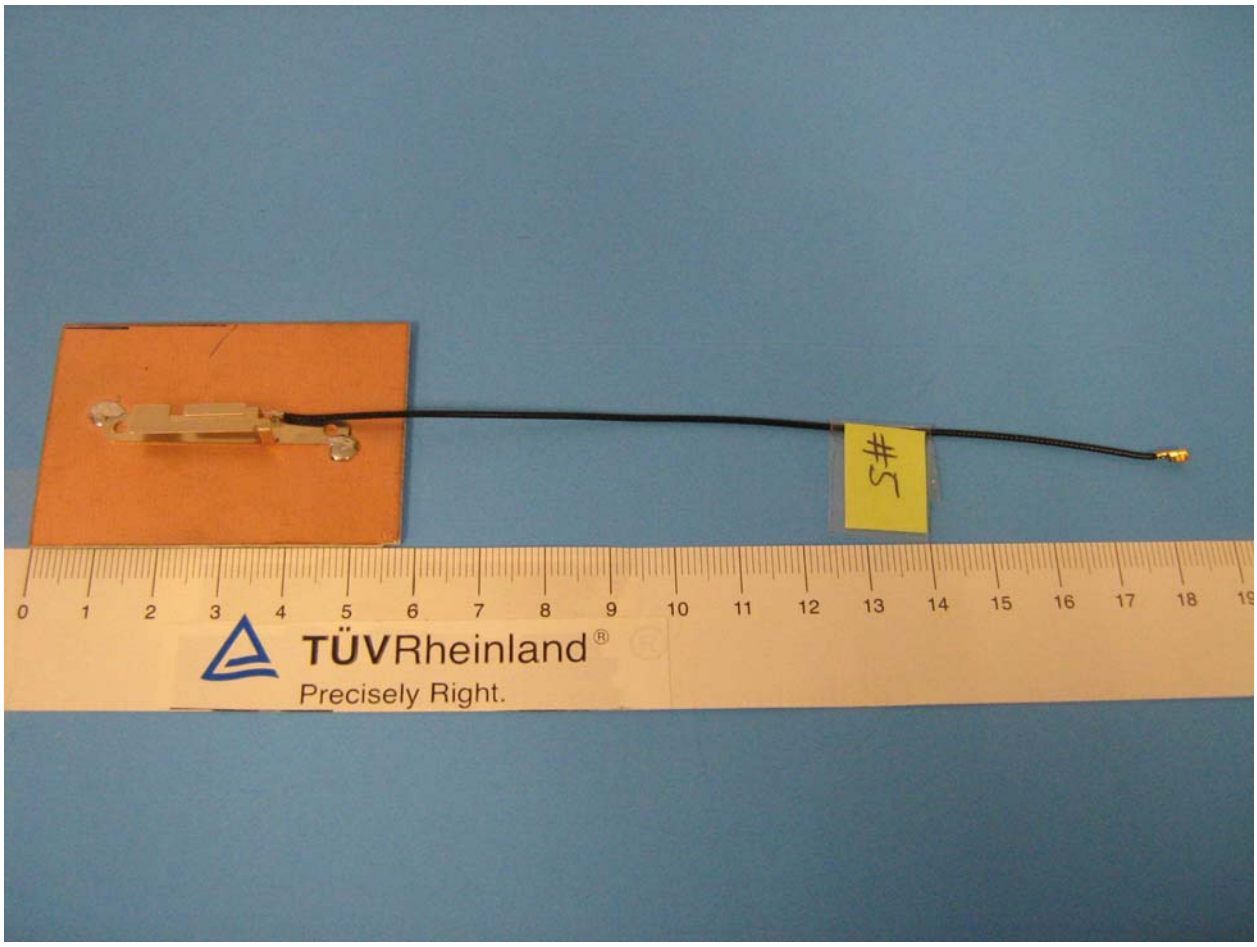


Figure 150: External Antenna for ZG2101 Module – Inverter F Antenna

7 EMC Test Plan

7.1 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.

7.2 Customer

Table 11: Customer Information

Company Name	Zerog Wireless
Address	255 San Geronimo Way
City, State, Zip	Sunnyvale, CA 94085
Country	USA
Phone	408-738-7509
Fax	408-738-7601

Table 12: Technical Contact Information

Name	Hamid Movahedi
E-mail	hmovahedi@zerogwireless.com
Phone	408-738-7509
Fax	408-738-7601

7.3 Equipment Under Test (EUT)

Table 13: EUT Specifications

ZG2101 and ZG2101 Dimensions	21mm x 31mm
ZG2101 and ZG2101	Operating Voltage: 3.3 VDC Max Current: 185 mA Max Power Consumption: 0.611W V_{min}: 2.97Vdc
Environment	Indoor and Outdoor
Operating Temperature Range:	0 to 65 degrees C
Multiple Feeds:	☐ Yes and how many ☒ No
Operating Frequencies:	2.412GHz to 2.462MHz (802.11b)
Rated Power Output for ZG2101 and ZG2101	+10.0dBm at 2.4GHz
Modulation Type	☐ AM ☐ FM ☐ Phase ☒ Other describe: Digital Modulation; 1&2Mbps
Type of Equipment	☒ Table Top ☐ Rack mount ☐ Floor standing cabinet ☐ Other *describe: Portable*

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?
SPI (x2)	N/A	☐ Yes ☐ No ☒ Na	☐ English:_____ ☐ Metric:_____ ☒ Na	☐ M ☐ C ☐ F ☒ Na

Table 15: Supported Equipment

Equipment	Manufacturer	Model	Serial	Used for
Extender Module	Zerog Wireless	106-0028-00	Na	Exposed beyond 10cm from test jig
Test jig	Renesas	D006331	75590	Hosted the ZG2100/ZG2101 Module
DC Supply	Hewlett Packard	E3610A	Na	Supplied 3.3V ±15% for RF conducted test.

Table 16: Description of Sample used for Testing

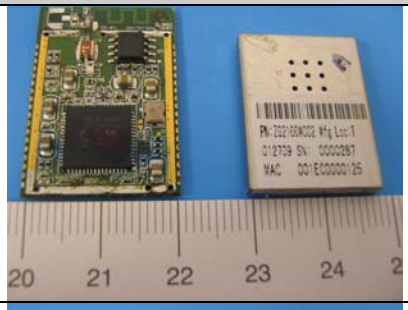
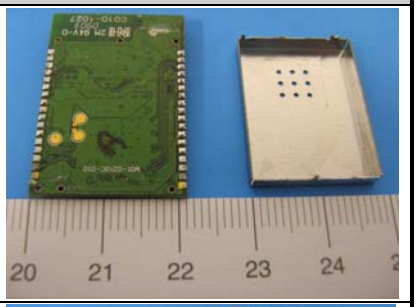
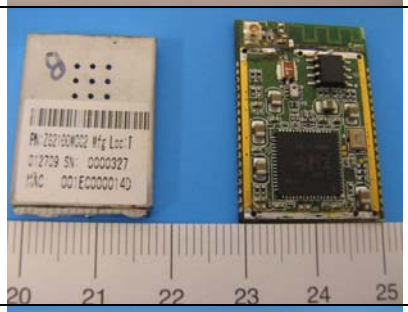
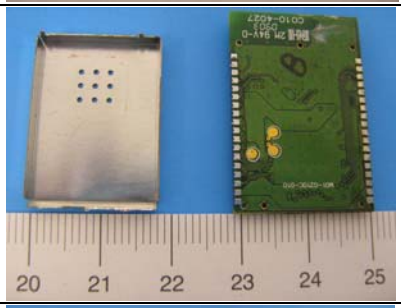
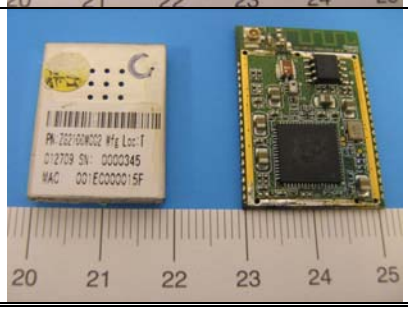
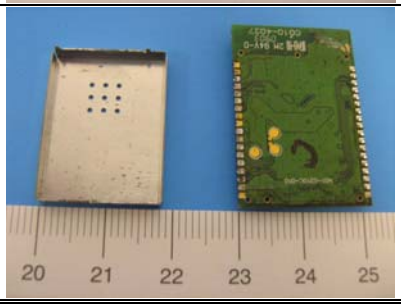
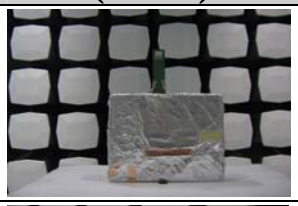
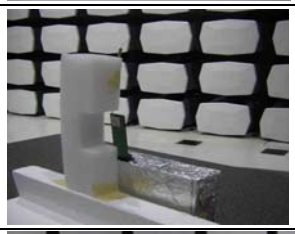
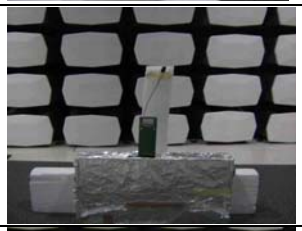
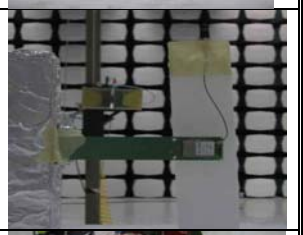
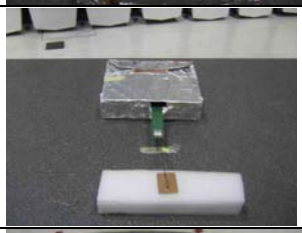
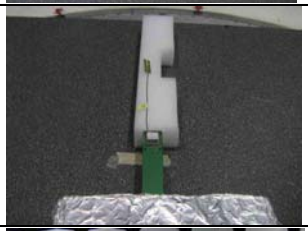
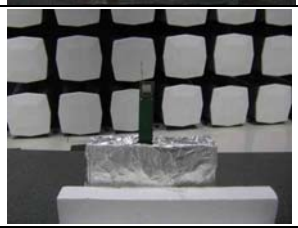
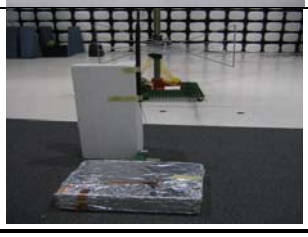
Module Type	Serial Number	Configuration	Photo (Top)	Photo (Bottom)
ZG2100	0000289	On-board PCB Antenna		
ZG2101	0000327	Used external antenna		
ZG2100	0000345	Modified w/ IPEX connector for RF Conducted testing		

Table 17: Description of Test Configuration used for Radiated Emission

Type	Gain	Mode	Setup Photo (X-Axis)	Setup Photo (Y-Axis)	Setup Photo (Z-Axis)
On-Board PCB	-2dBi	Transmit & Receive			
RFA-02-D3-70-100	2dBi	Transmit & Receive			
Helical (BTC013-1-70B-150)	2dBi	Transmit & Receive			
Inverter F	2dBi	Transmit & Receive			
Ext. PCB (RFA-02-P05)	2dBi	Transmit & Receive			
Dipole (WF2400-15001A)	5dBi	Transmit & Receive			
Monopole (AN2400-5901RS)	10dBi	Transmit & Receive			

7.4 Test Specifications

Testing requirements

Table 18: EUT Designation

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