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Emissions
Test Report

EUT Name: Single Wireless Gas Detector

Model No: CNX1-X1-Y-NA, CNX1-H1-Y-NA, CNX1-M1-Y-NA and CNX1-S1-Y-NA

CFR 47 Part 15.247 2009 and RSS 210: 2010

Prepared for:

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Report/Issue Date: March 31, 2012
Report Number: 31153356.001

Statement of Compliance

Manufacturer:	BW Technologies, LTD. 2840 2nd Avenue SE Calgary, Alberta, Canada T2A 7X9
Requester / Applicant:	Paul Silva
Name of Equipment:	Single Wireless Gas Detector
Model No.	CNX1-X1-Y-NA, CNX1-H1-Y-NA, CNX1-M1-Y-NA and CNX1-S1-Y-NA
Type of Equipment:	Intentional Radiator
Application of Regulations:	CFR 47 Part 15.247 2009 and RSS 210: 2010
Test Dates:	February 01 to Feb 29, 2012

Guidance Documents:

Emissions: ANSI C63.10-2009

Test Methods:

Emissions: ANSI C63.10-2009

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

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

Suresh Kondapalli	March 31, 2012	Conan Boyle	March 31, 2012
Test Engineer	Date	NVLAP Signatory	Date

500011-0 **US5254** **2932M-1**

Industry Canada

1 Executive Summary

1.1 Scope

This report is intended to document the status of conformance with the requirements of the CFR 47 Part 15.247 2009 and RSS 210: 2010 based on the results of testing performed on Feb 01 to Feb 29, 2012 on the Single Wireless Gas Detector Models CNX1-X1-Y-NA, CNX1-H1-Y-NA, CNX1-M1-Y-NA and CNX1-S1-Y-NA manufactured by *BW Technologies, LTD.* This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

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

1.3 Summary of Test Results

Table 1: Summary of Test Results

Test	Test Method ANSI C63.4	Test Parameters (from Standard)	Result
2400 MHz to 2483.5 MHz Band			
Spurious Emission in Received Mode	CFR47 15.109, RSS-GEN Sect.7.2.3	Class B	**Complied**
Spurious Emission in Transmitted Mode	CFR47 15.209, RSS-GEN Sect.7.2.3	Class B	**Complied**
Restricted Bands of Operation	CFR47 15.205, RSS 210 Sect.2.6	Class B	**Complied**
AC Power Conducted Emission	CFR47 15.207, RSS-GEN Sect.7.2.2	Class B	**Complied**
Occupied Bandwidth	CFR47 15.247 (a2), RSS GEN Sect.4.4.1	≥ 500 kHz	**Complied**
Maximum Transmitted Power	CFR47 15.247 (b3), RSS 210 Sect. A.8.4	30 dBm	**Complied**
Peak Power Spectral Density	CFR47 15.247 (e), RSS 210 Sect. A.8.2	8 dBm/ 3 kHz.	**Complied**
Bandedge Measurement	CFR47 15.247 (d), RSS 210 Sect. A.8.5	-30 dBr	**Complied**

Note: Since EUT is portable device where the end user will have the direct contact, RF Exposure/ SAR test requirements are evaluated separately

1.3.1 Measured values of key parameters

Test	Test Method ANSI C63.4	Measured value	Result
2400 MHz to 2483.5 MHz Band			
Maximum Transmitted Power	CFR47 15.247 (b3), RSS 210 Sect. A.8.4	12.12 dBm (16.30 mWatts)	Complied
Occupied Bandwidth	CFR47 15.247 (a2), RSS GEN Sect.4.4.1	10.23 MHz (6 dB BW) 15.97 MHz (99% OCBW)	Complied
Peak Power Spectral Density	CFR47 15.247 (e), RSS 210 Sect. A.8.2	-8.30 dBm	Complied
Spurious Emission in Transmitted Mode	CFR47 15.209, RSS-GEN Sect.7.2.3	53.37 dBuV@ 12.06 GHz	Complied
Spurious Emission in Received Mode	CFR47 15.109, RSS-GEN Sect.7.2.3	32.15 dBuV@ 5.48 GHz	Complied

Note: These are final results after applying duty cyvcle factor of -6.19dB

1.4 Special Accessories

No special accessories were necessary in order to achieve compliance.

1.5 Equipment Modifications

None

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

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

2.1.2 NIST / NVLAP

TUV Rheinland of North America is accredited by the National Voluntary Laboratory Accreditation Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Guide 17025:1999 and ISO 9002 (Lab Code 500011-0). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Canada – Industry Canada

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

2.1.4 Japan – VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland of North America at 1279 Quarry Ln, Pleasanton, CA 94566 has been assessed and approved in accordance with the Regulations for Voluntary Control Measures. (Registration Nos. R-3715, G-460, C-4161, C-4162, T-1176, T-1189).

2.1.5 Acceptance by Mutual Recognition Arrangement

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

2.2 Test Facilities

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

2.2.1 Emission Test Facility

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

2.2.2 Immunity Test Facility

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

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

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

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

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

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

2.3 Measurement Uncertainty

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

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

2.3.1 Sample Calculation – radiated & conducted emissions

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

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

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

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

Sample radiated emissions calculation @ 30 MHz

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

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

2.3.2 Measurement Uncertainty

	U_{lab}	U_{cispr}
Radiated Disturbance		
30 MHz – 40,000 MHz	3.2 dB	5.2 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	2.4 dB	3.6 dB
Disturbance Power		
30 MHz – 300 MHz	3.92 dB	4.5 dB

Measurement Uncertainty – Immunity Testing

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

Measurement Uncertainty – Radio Testing

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

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

2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2005. Equipment calibration records are kept on file at the test facility.

3 Product Information

3.1 Product Description

The ConneX1* wireless gas detector is a new single gas portable gas detector with wireless communication/location features compatible with the current wireless infrastructure mode developed under the Impact Xtreme project (software / firmware / security methods / location engine). The product is primarily designed to meet the refinery (H2S) / chemical plant markets.

It safety function is to drive a safety alarm when the monitored gas exceeds its threshold limit set.

ConneX1 employs approved radio module with FCC ID: U30-G2M5477. New Inverted F antenna built on to the host PCB and connects to the Udot FL port available on the Transmitter module. Product was modified to transmit at >99% duty cycle for test purpose.

BW Technologies declares that all four models have identical electronics except for gas sensor employed. The diffrences and silmilarities of four models are as documented as below

CNX1-X1-Y-NA	ConneX1, O2 Sensor
CNX1-H1-Y-NA	ConneX1, H2S Sensor
CNX1-M1-Y-NA	ConneX1, CO Sensor
CNX1-S1-Y-NA	ConneX1, SO2 Sensor

Model CNX1-H1-Y-NA was used for testing

.*Note: ConneX1 is generic name to represent all four models

3.2 Equipment Configuration

A description of the equipment configuration is given in the Test Plan Section. The EUT was tested as called for in the test standard and was configured and operated in a manner consistent with test standards. The EUT was programed 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 EUT that can operate in more than one configuration, preliminary testing was performed to determine the configuration that produced maximum radiation.

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

3.3 Operating Mode

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

EUT was programed to operate at > 99% duty for the purpose of testing. This 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 Duty Cycle:

ConneX1 operates with worst case duty cycle of 49%, ON time of 49ms in 100ms.

Duty calculated as follows 20log (0.49) = -6.19.

See the manufactures description of duty cycle placed under test plan Para 6.0 and table 15.0

3.5 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.

3.5.1 Results

The Single Wireless Gas Detector has one internal antenna. The antenna is Inverted F antenna and is integral part of Host PCB. EUT is compliant.

4 Emission Requirements – 2400 MHz to 2483.5 MHz Band

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

4.1 Output Power Requirements

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

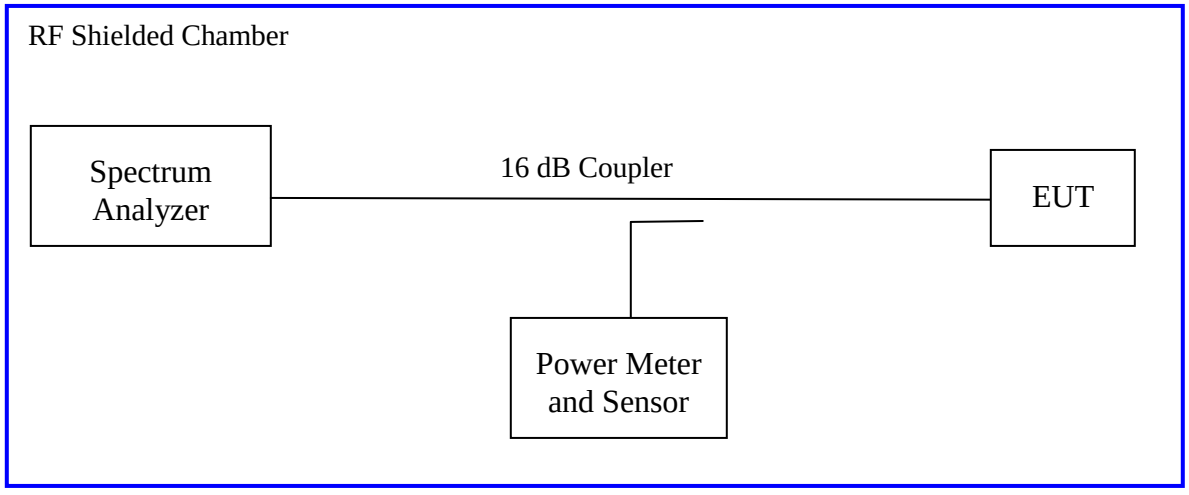
The maximum output power and harmonics shall not exceed CFR47 Part 15.247 (b3):2009 and RSS 210 A.8.4: 2010

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

4.1.1 Test Method

The conducted method was used to measure the channel power output according to ANSI C63.10:2009 Section 6.10.3.1. The measurement was performed with modulation per CFR47 Part 15.247 (b3):2009 and RSS 210 A.8.4. This test was conducted on 3 channels in each operating range. The worst mode result indicated below.

Test Setup:



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

Each chain was measured individually and applied the measure-and-sum approach per KDB662911.

4.1.2 Results

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

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

Test Conditions: Conducted Measurement, Normal Temperature					
Antenna Type: Internal			**Power Setting:** See test plan		
Max. Antenna Gain: + 0.0 dBi			**Signal State:** Modulated @ 99%		
Ambient Temp.: 21 °C			**Relative Humidity:**39%		
802.11b Mode					
Operating Channel	**Limit [dBm]**	**[dBm]**	**Duty Cycle**	**Corrected Power [dBm]**	**Margin [dB]**
2412 MHz	+30.00	18.29	-6.19	12.09	-17.91
2437 MHz	+30.00	18.31	-6.19	12.12	-17.82
2462 MHz	+30.00	18.31	-6.19	12.12	-17.82
Note: EUT has duty cycle EUT was modified to transmit at 99% for test purpose. EUT normal data rate is1Mbps.					

Note: Power measurements were performed as indicated in the above table. Only worst case/ limited number of plots are placed in the report.

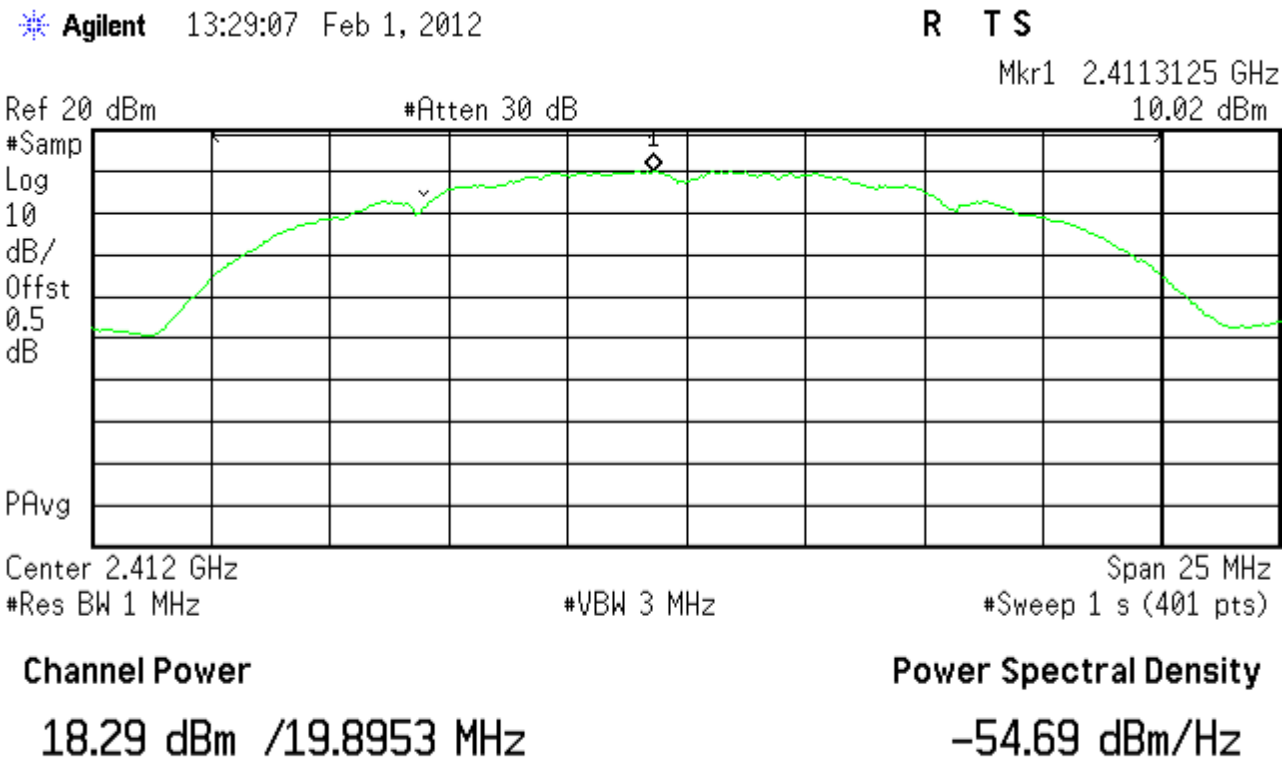


Figure 1: Maximum Transmitted Power, 2412 MHz at 802.11b,

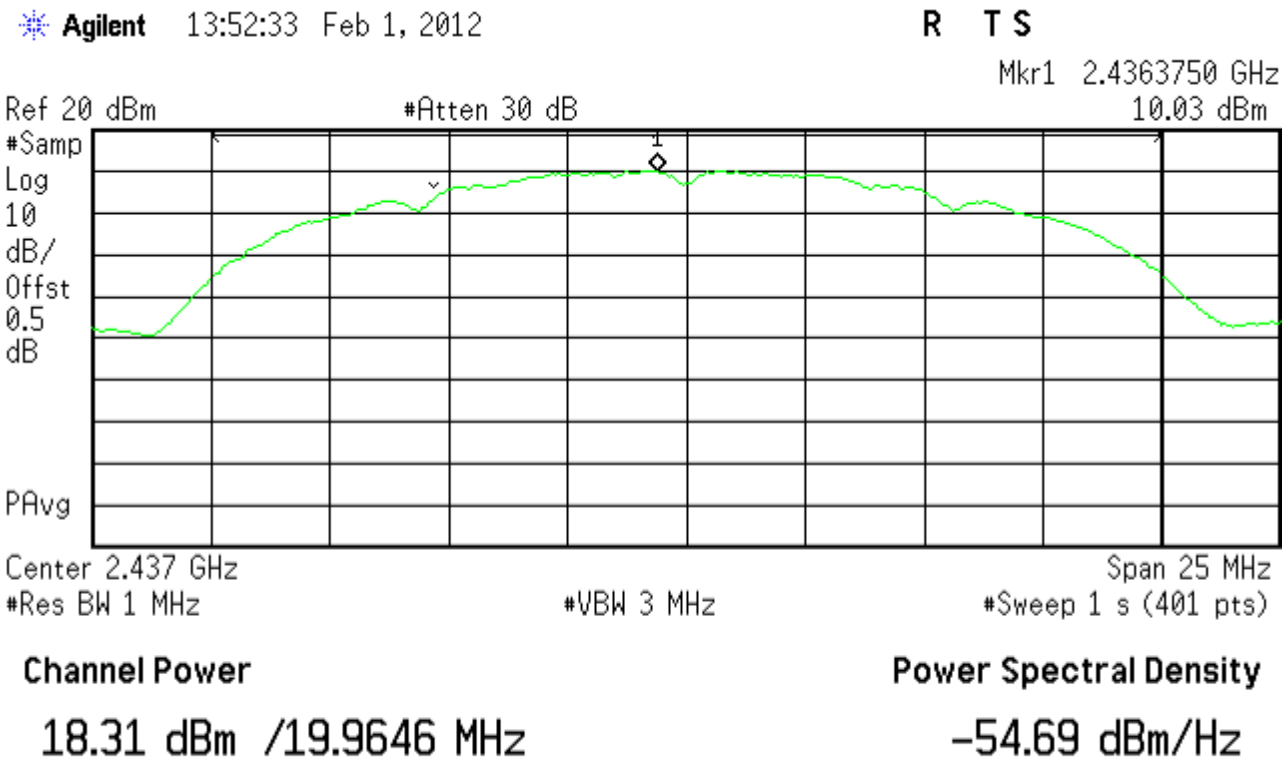


Figure 2: Maximum Transmitted Power, 2437 MHz at 802.11b,

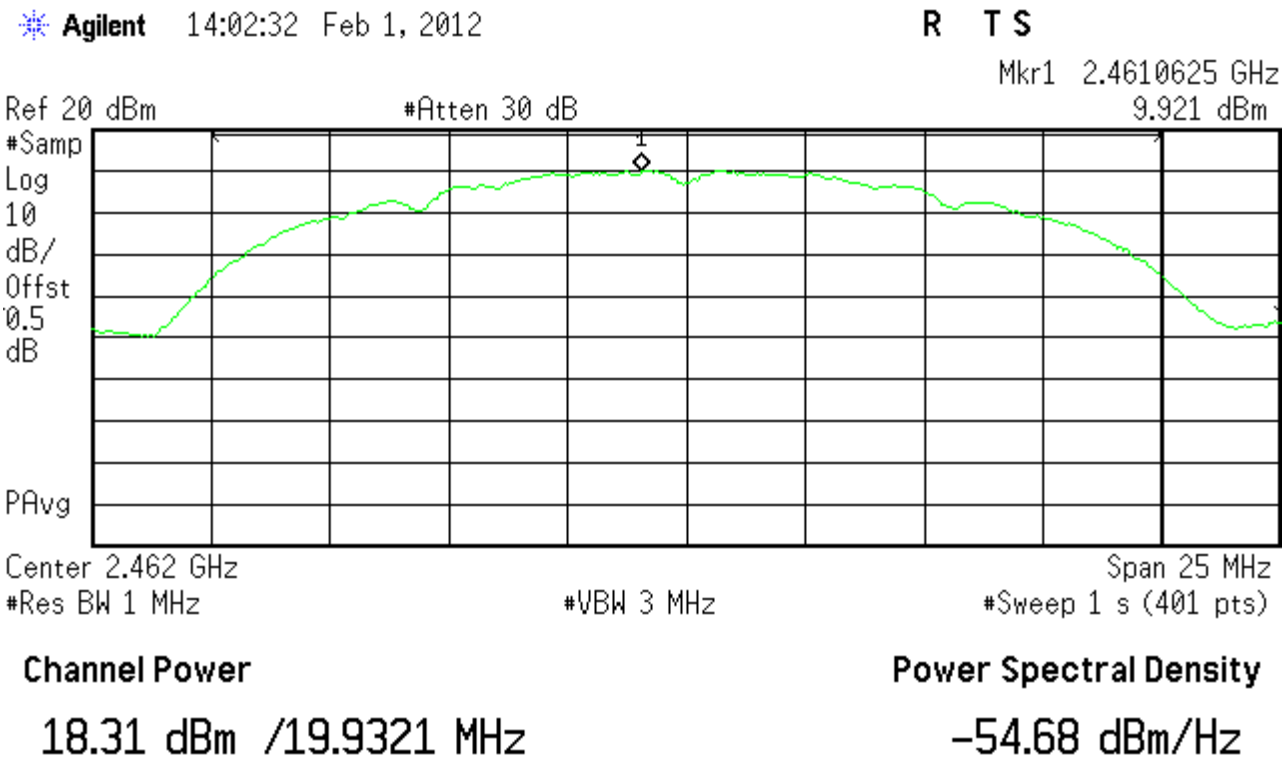


Figure 3: Maximum Transmitted Power, 2462 MHz at 802.11b, 1 Mbps

4.2 Occupied Bandwidth

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

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

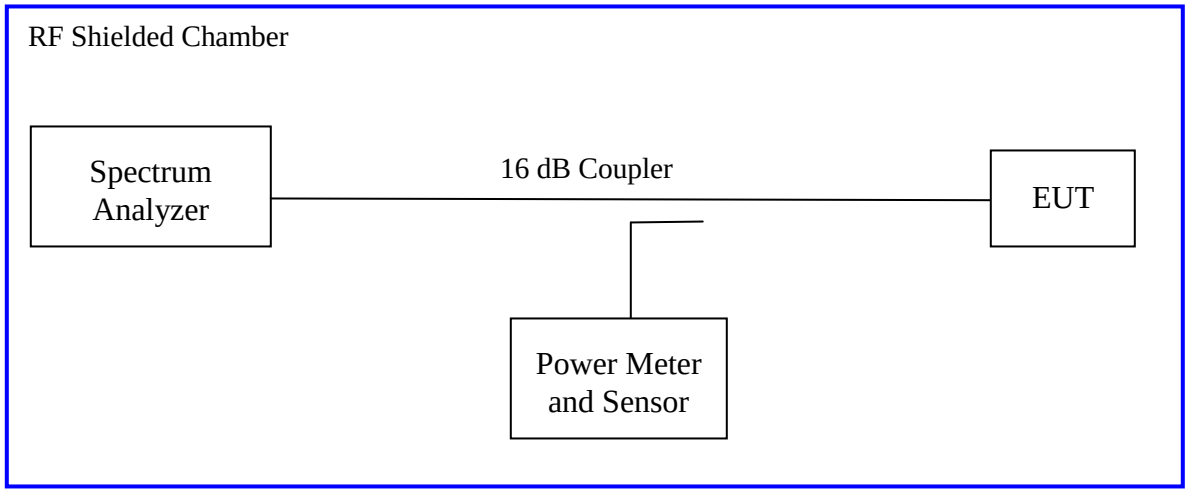
The 6 dB bandwidth is defined the bandwidth of 6 dBr from highest transmitted level of the fundamental frequency.

The bandwidth shall be at least 500 kHz per Section CFR47 15.247(a2) 2009 and RSS Gen Sect. 4.4.1: 2010.

4.2.1 Test Method

The conducted method was used to measure the occupied bandwidth. The measurement was performed with modulation per CFR47 15.247(a2) 2009 and RSS Gen Sect. 4.4.1:2010. Initial investigation was performed at different data rates and TX chains. The narrowest bandwidths at each operational mode were measured on 3 operating channels. The worst sample result indicated below.

Test Setup:



4.2.2 Results

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

Table 3: Occupied Bandwidth – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only				
Antenna Type: Internal			**Power Setting:** See test plan	
Max. Antenna Gain: + 0.0 dBi			**Signal State:** Modulated	
Ambient Temp.: 21 °C			**Relative Humidity:**33%	
Bandwidth (MHz) for 802.11b				
Freq. (MHz)	**Limit (kHz)**	**99% BW**	**6 dB BW**	**Results**
2412	500	15.95	10.23	Pass
2437	500	15.96	10.23	Pass
2462	500	15.97	10.23	Pass
Note: The bandwidth was measured at 1 Mbps for 802.11b mode.				

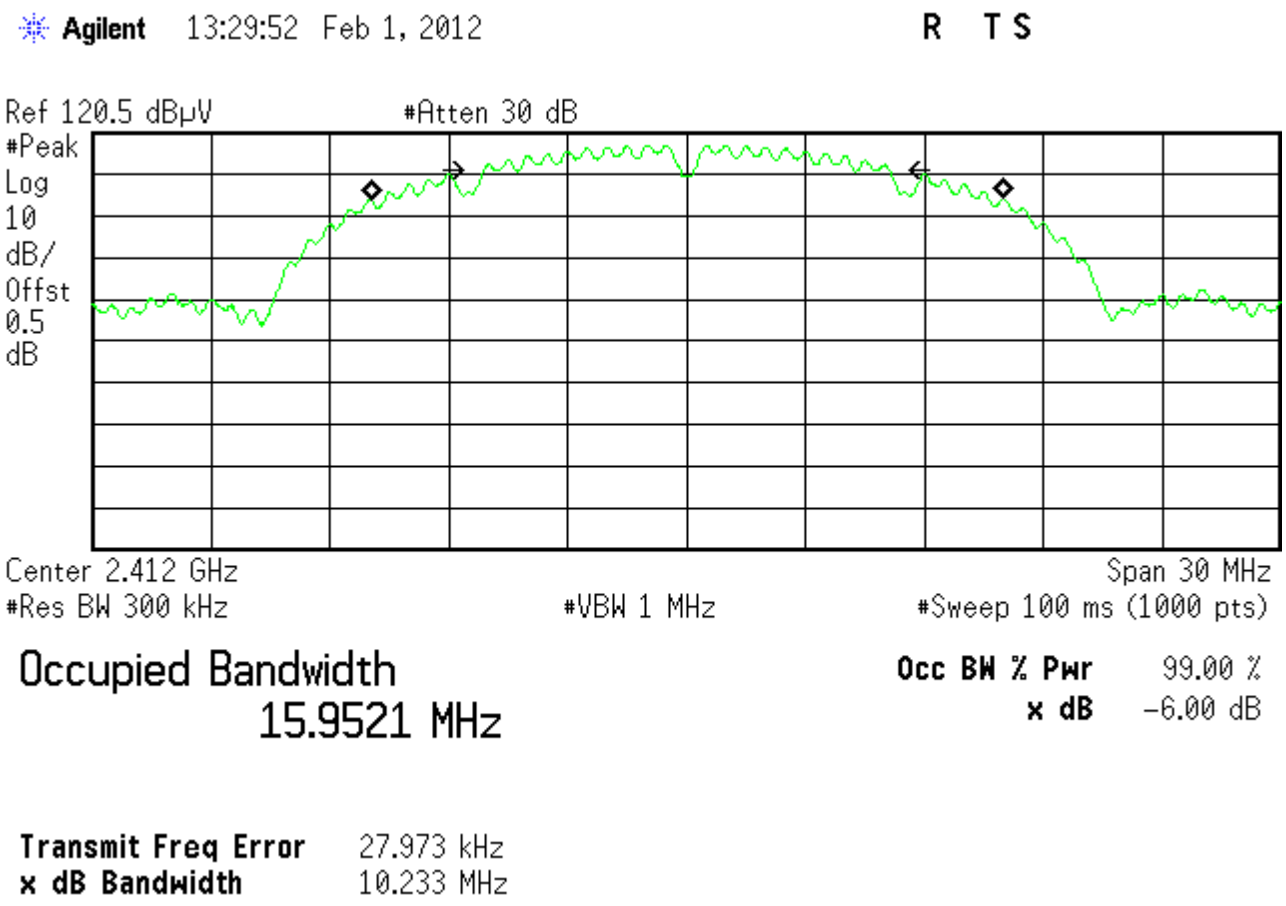


Figure 4: 6 dB Bandwidth at 1Mbit/s – Operating Channel 2412 MHz

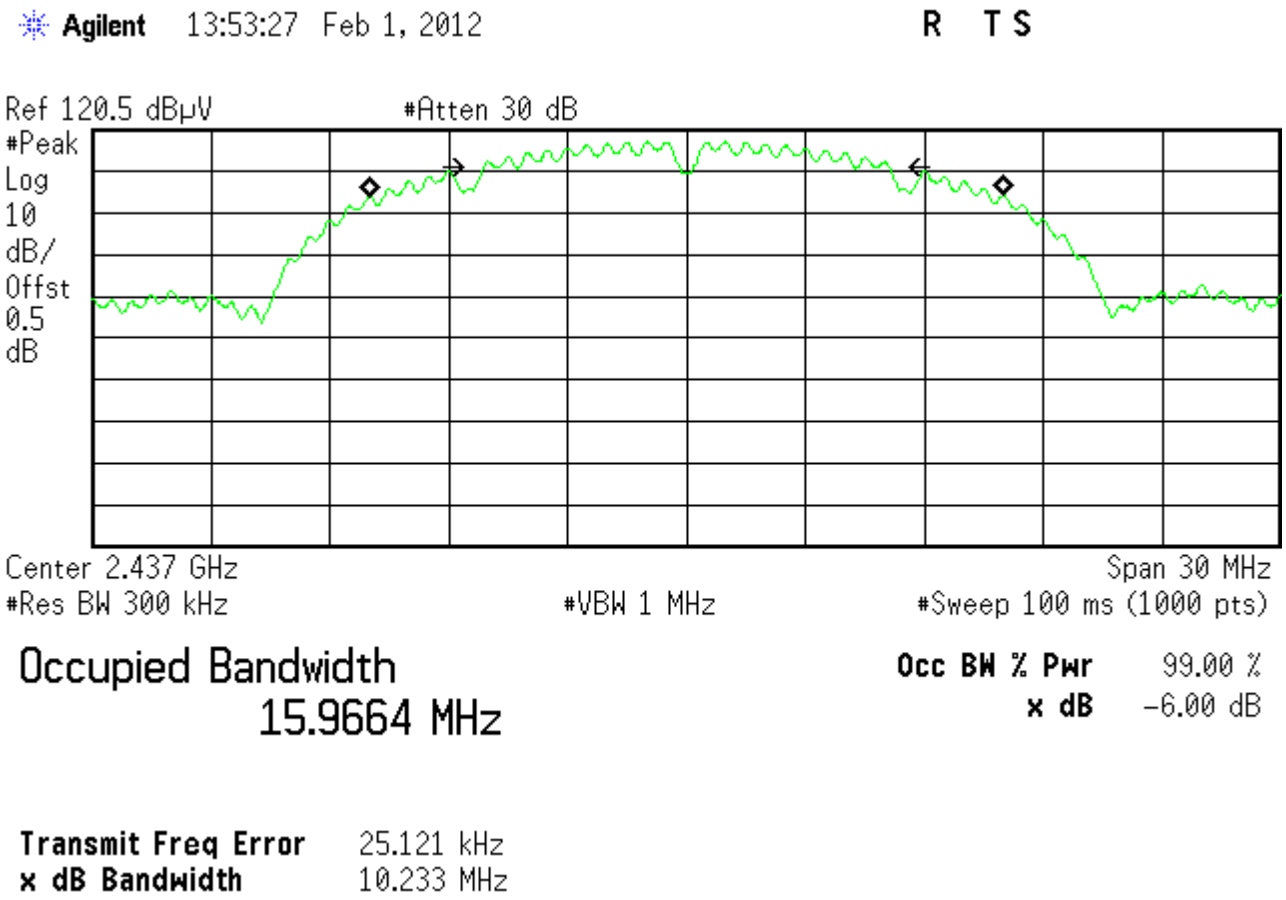


Figure 5: 6 dB Bandwidth at 1Mbit/s – Operating Channel 2437 MHz

F

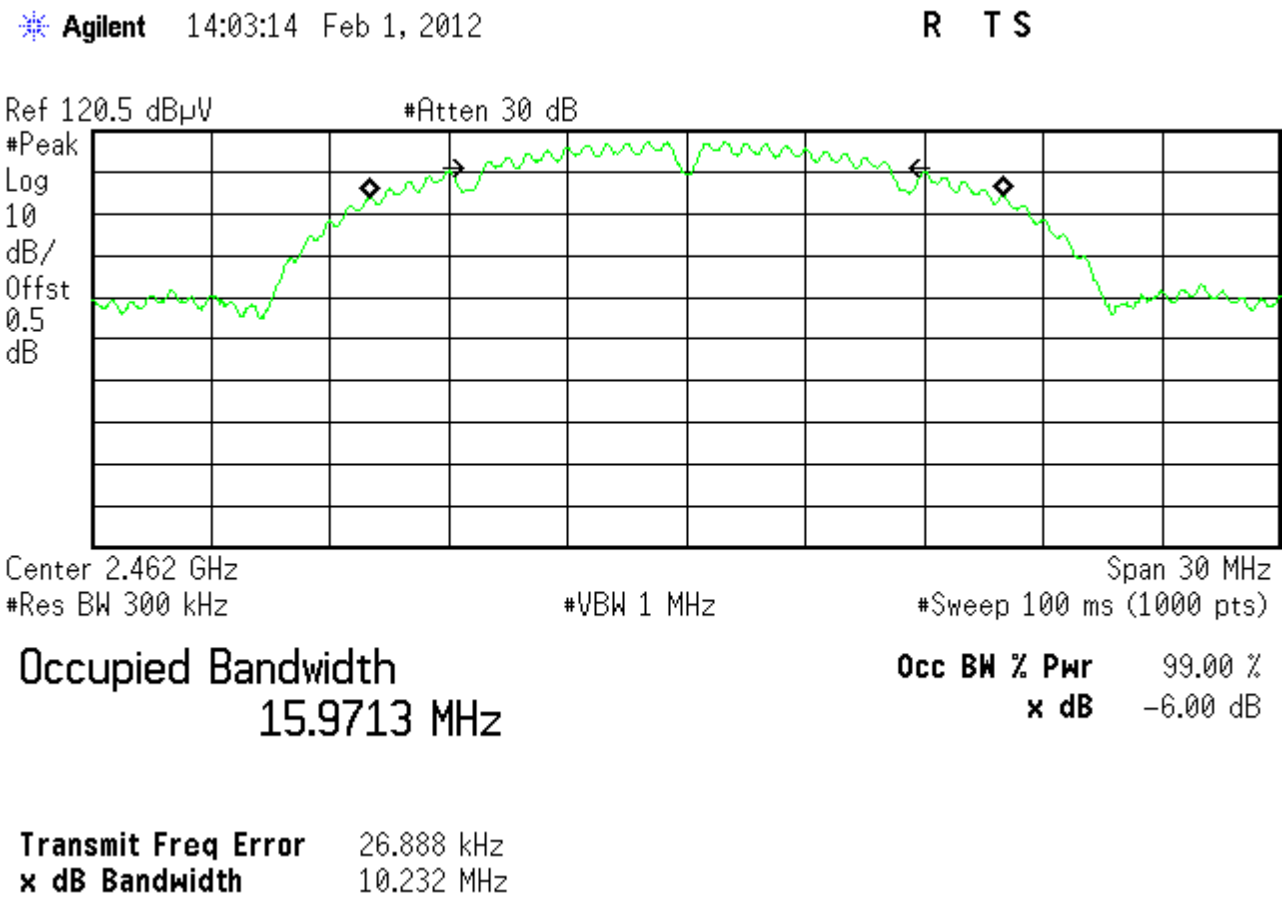


Figure 6: 6 dB Bandwidth at 1Mbit/s – Operating Channel 2462 MHz

4.3 Band-edge Requirements

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

Any frequency outside the band of 2400 MHz to 2483.5 MHz, the power output level must be below 30 dB from the in-band transmitting signal; CFR 47 Part 15.215, 15.247(d) and RSS 210 A8.5

4.3.1 Results

The Out of band emission was performed on the conducted test Sample.

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

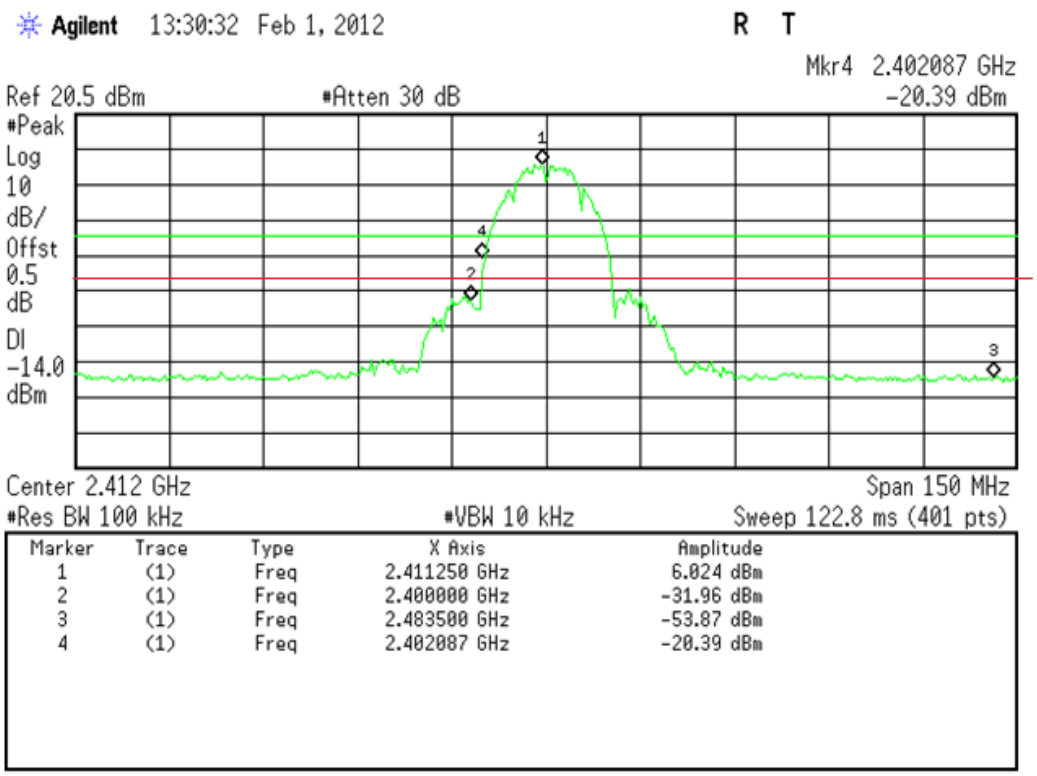
Table 4: Band-Edge Requirements – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only				
Antenna Type: Internal		**Power Setting:** See test plan		
Max. Antenna Gain: + 0.0 dBi		**Signal State:** Modulated		
Ambient Temp.: 21 °C		**Relative Humidity:**39%		
-30 dB Band-Edge Results				
Operating Freq.	**Mode**	**Limit (dBm)**	**Measured Value (dBm)**	**Result**
2412 MHz	1Mbps	-23.2	-31.96	Pass
2437 MHz	1Mbps	-23.2	-30.20	Pass
2462 MHz	1Mbps	-23.4	-30.10	Pass
Note: The stated limits for -30 dBr are relative to each individual output per KDB 662911 Method.				

Note: All bandedge measurements were performed as indicated in the above table. Only worst case/ limited number of plots are placed in the report.

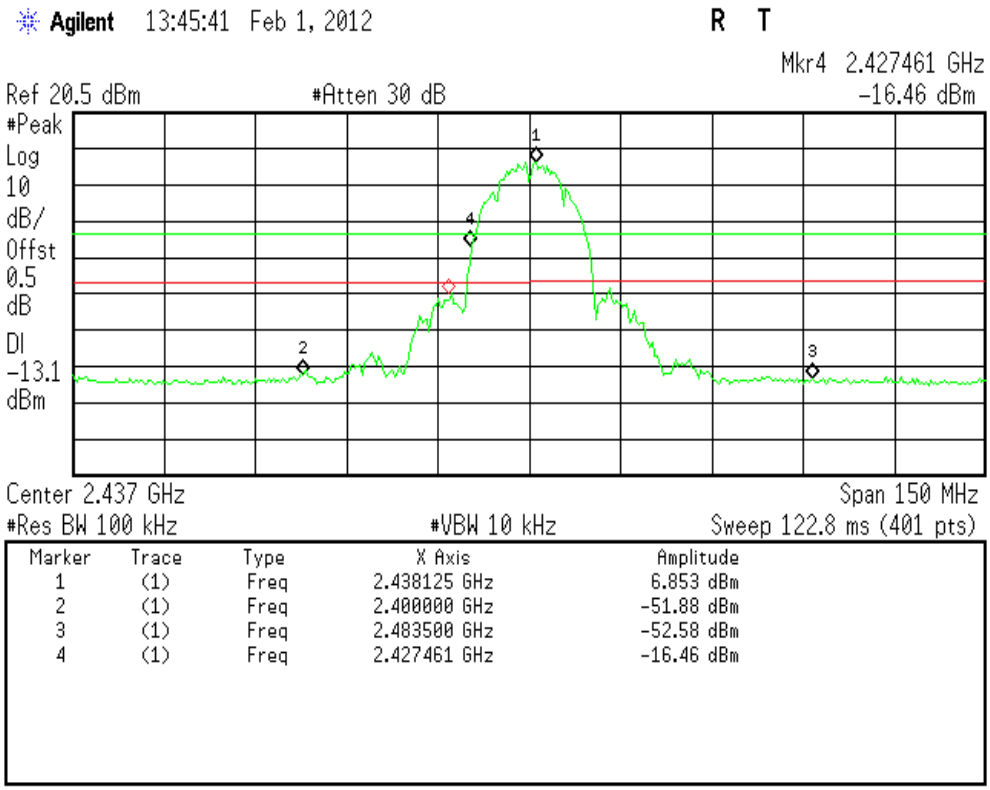
Table 5: Out of band Conducted Emission – Test Results

Operating Freq.	Mode	Result
2412 MHz	1Mbps	Pass
2437 MHz	1Mbps	Pass
2462 MHz	1Mbps	Pass



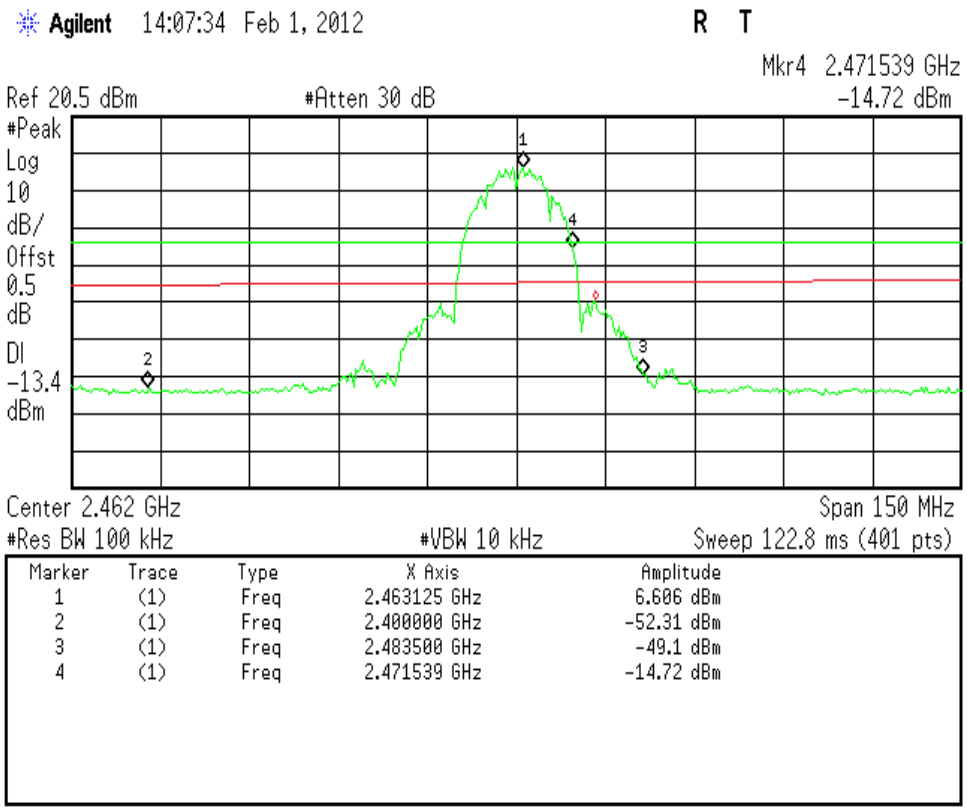
Note: Green Limit Line -20dBr
Red Limit line -30dBr

Figure 7: Band-edge Requirement at Operating Channel 2412 MHz,



Note: Green Limit Line -20dBr
Red Limit line -30dBr

Figure 8: Band-edge Requirement at Operating Channel 2437 MHz



Note: Green Limit Line -20dBr
Red Limit line -30dBr

Figure 9: Band-edge Requirement at Operating Channel 2462 MHz

4.4 Peak Power Spectral Density

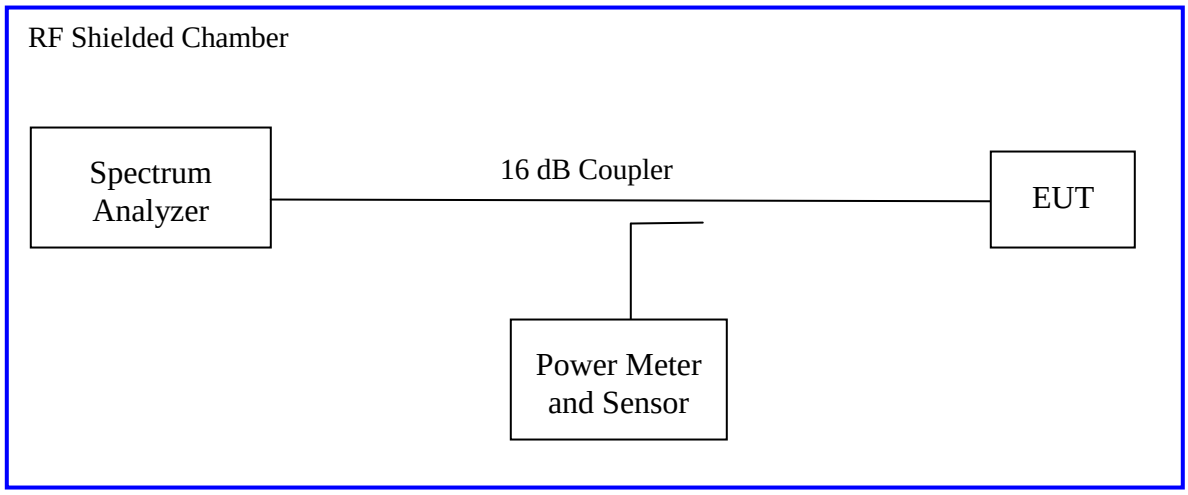
According to the CFR47 Part 15.247 (e) and RSS 210 (A8.2), the spectral power density output of the antenna port shall be less than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

4.4.1 Test Method

The conducted method was used to measure the channel power output per ANSI C63.10:2009 Section 6.11.2

The measurement was performed with modulation per CFR47 Part 15.247 (e) and RSS 210 (A8.2). This test was conducted on 3 channels in each mode. The worst sample result indicated below.

Test Setup:



4.4.2 Results

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

Table 6: Peak Power Spectral Density – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only						
Antenna Type: *Internal*			**Power Setting:** See test plan			
Max. Antenna Gain: 0.0 dBi			**Signal State:** Modulated			
Ambient Temp.: 21 °C			**Relative Humidity:**39%			
Peak Power Spectral Density						
Freq. (MHz)	**Mode**	**[dBm]**	**Duty Cycle CF [dB]**	**Max. PPSD [dBm]**	**Limit [dBm]**	**Margin [dB]**
2412	1Mbps	-2.11	-6.19	-8.30	8.00	-16.30
2437	1Mbps	-2.92	-6.19	-9.11	8.00	-17.11
2462	1Mbps	-2.87	-6.19	-9.06	8.00	-17.06
.						

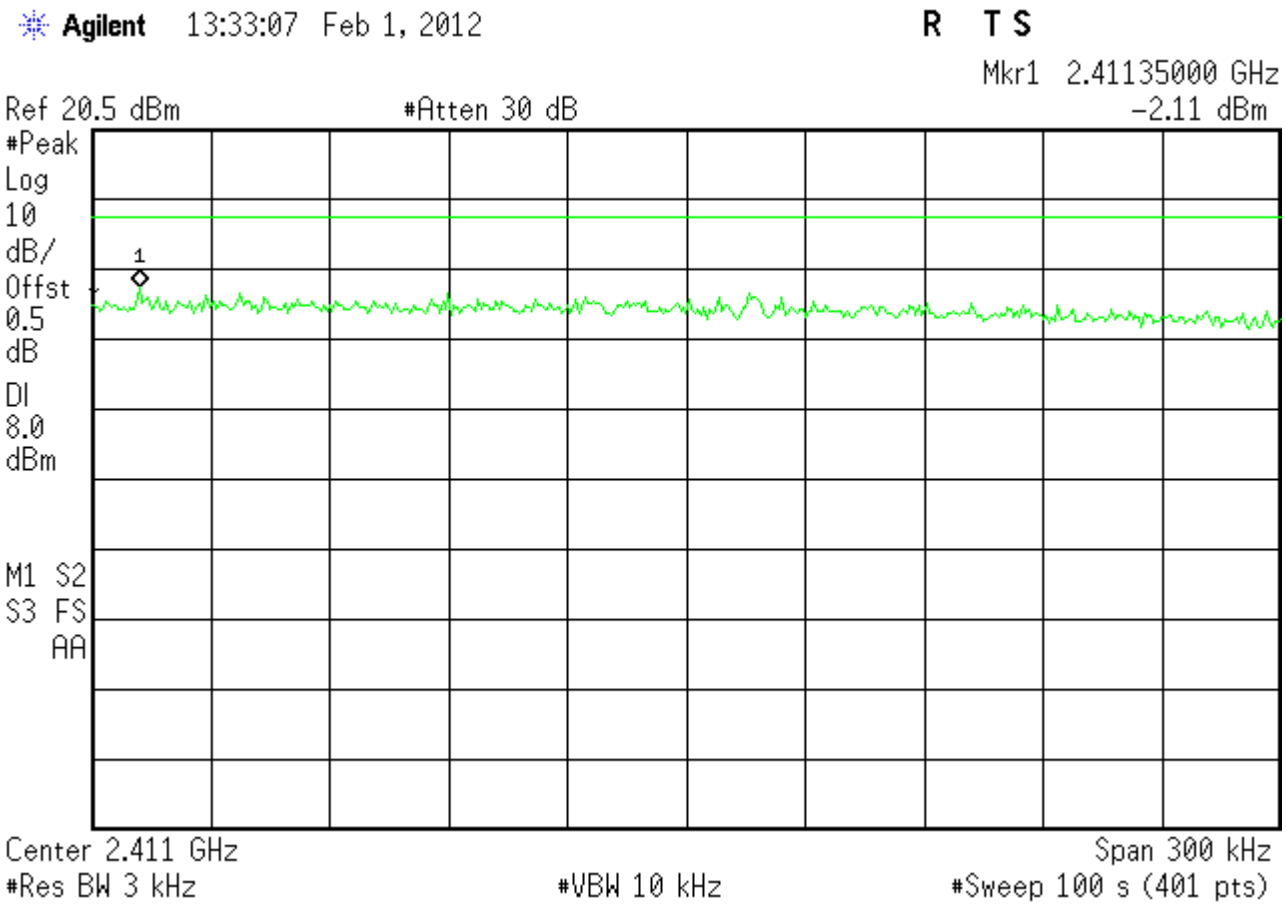


Figure 10: Peak Power Spectral Density for Operating Channel 2412 MHz

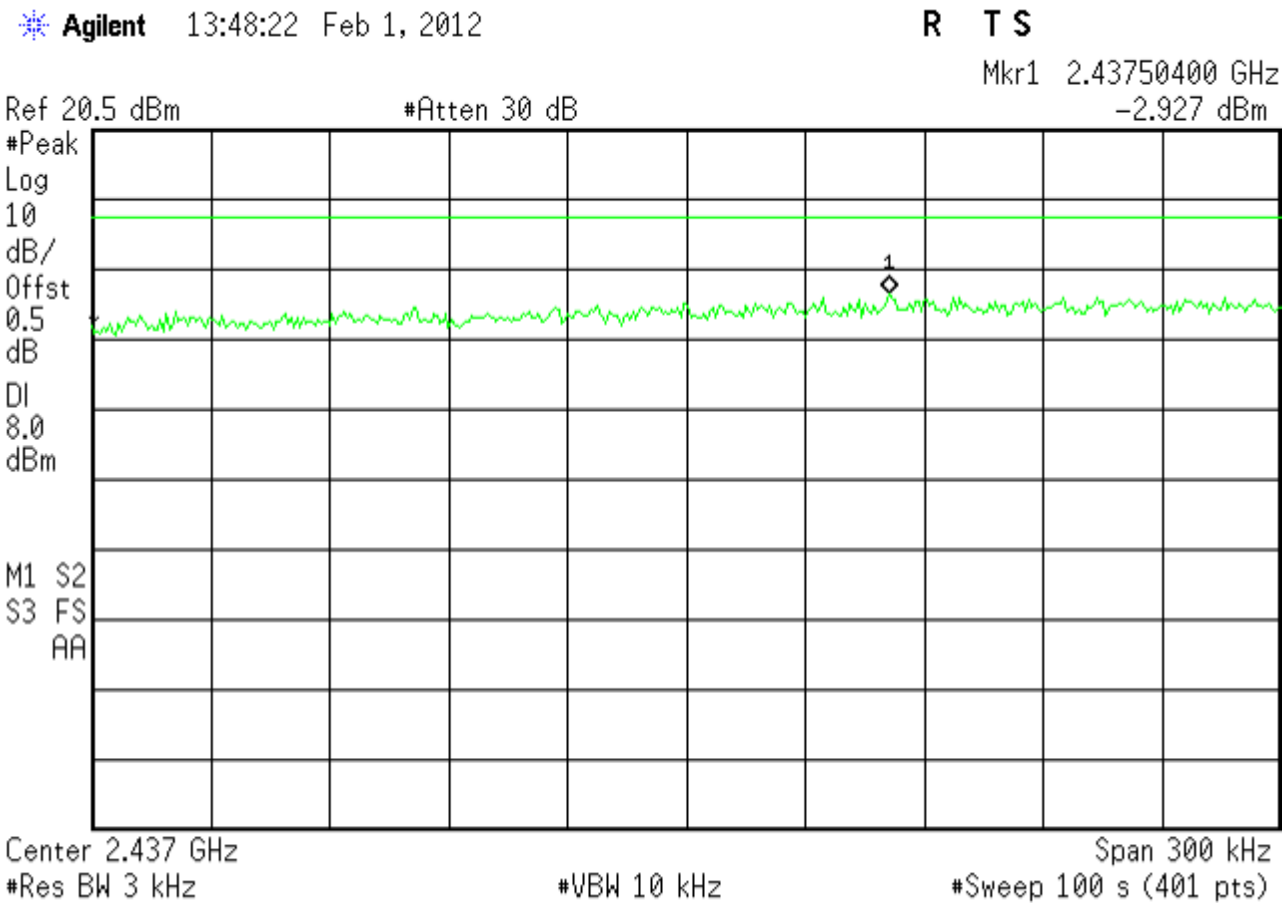


Figure 11: Peak Power Spectral Density for Operating Channel 2437 MHz

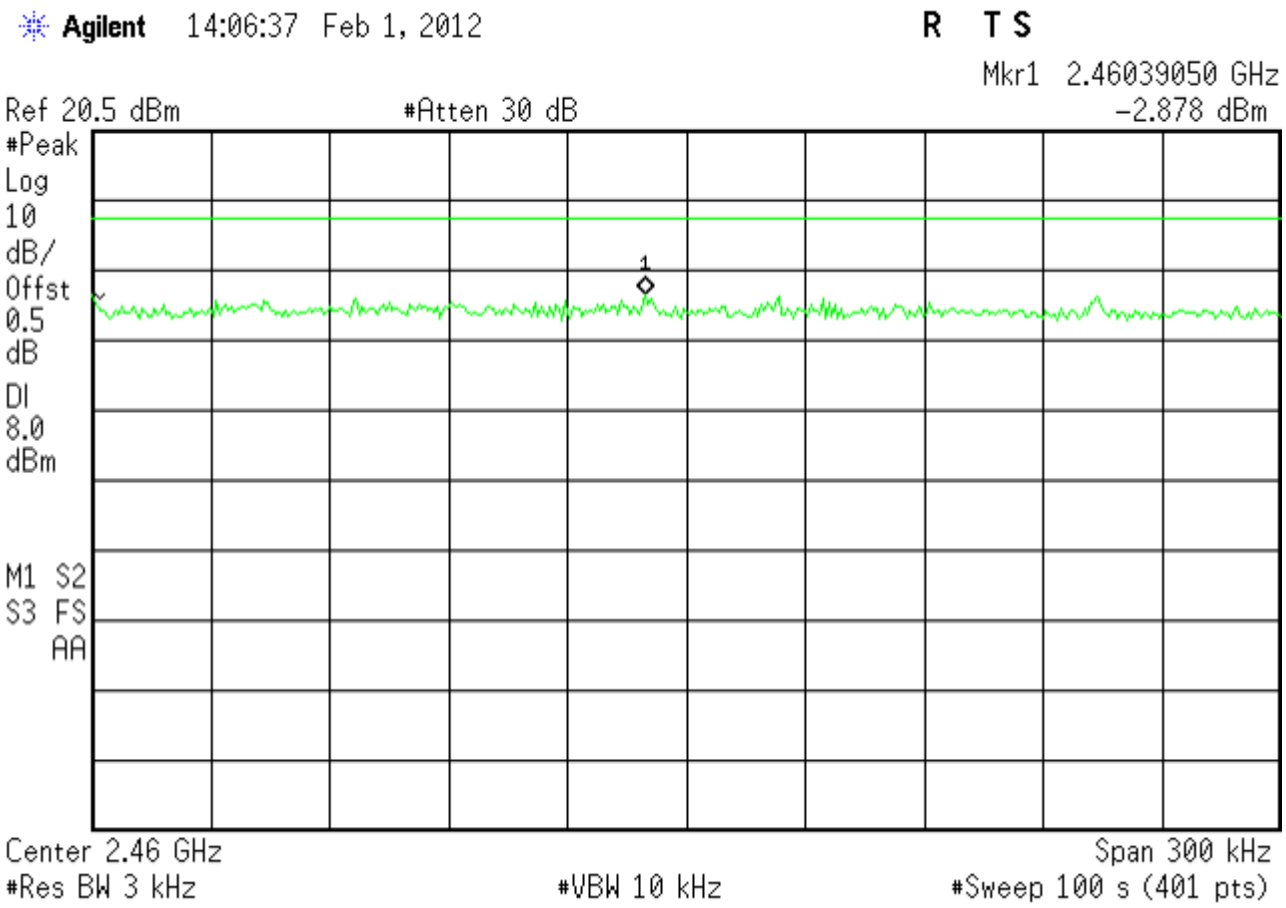


Figure 12: Peak Power Spectral Density for Operating Channel 2462 MHz

4.5 Transmitter Spurious Emissions

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

4.5.1 Test Methodology

4.5.1.1 Preliminary Test

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

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

4.5.1.2 Final Test

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

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

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

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

4.5.1.3 Deviations

None.

4.5.2 Transmitter Spurious Emission Limit

The spurious emissions of the transmitter shall not exceed the values in CFR47 Part 15.205, 15.209: 2009 and RSS 210 A1.1.2 2010.

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

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

4.5.3 Test Results

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

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

Table 7: Transmit Spurious Emission at Band-Edge Requirements

Test Conditions: Radiated Measurement, Normal Temperature and Voltage only										
Antenna Type: Internal				**Power Setting:** See test plan						
Max. Antenna Gain: + 0 dBi				**Signal State:** Modulated at 99%						
Ambient Temp.: 22 °C				**Relative Humidity:**34%						
Band-Edge Results										
Operating Channel MHz	**Polarity**	**Peak Field Strength Measured dBuV**	**Corrected level dBuV**	**Peak Limit dBuV**	**Margin dB**	**Avg Field Strength Measured dBuV**	**Corrected level dBuV**	**Avg Limit dBuV**	**Margin dB**	**Result**
2412	H	64.07	57.88	74.0	-16.12	54.08	51.59	54.00	-6.11	Pass
2412	V	61.35	55.16	74.0	-18.84	48.68	46.19	54.00	-11.51	Pass
2462	H	63.59	57.4	74.0	-16.60	53.41	50.92	54.00	-6.78	Pass
2462	V	62.69	56.5	74.0	-17.50	50.69	48.2	54.00	-9.50	Pass

Note: All bandedge measurements were performed as indicated in the above table. Only worst case/ limited number of plots are placed in the report. Duty Cycle correction factor of -6.19dB was applied to the measured field strength.

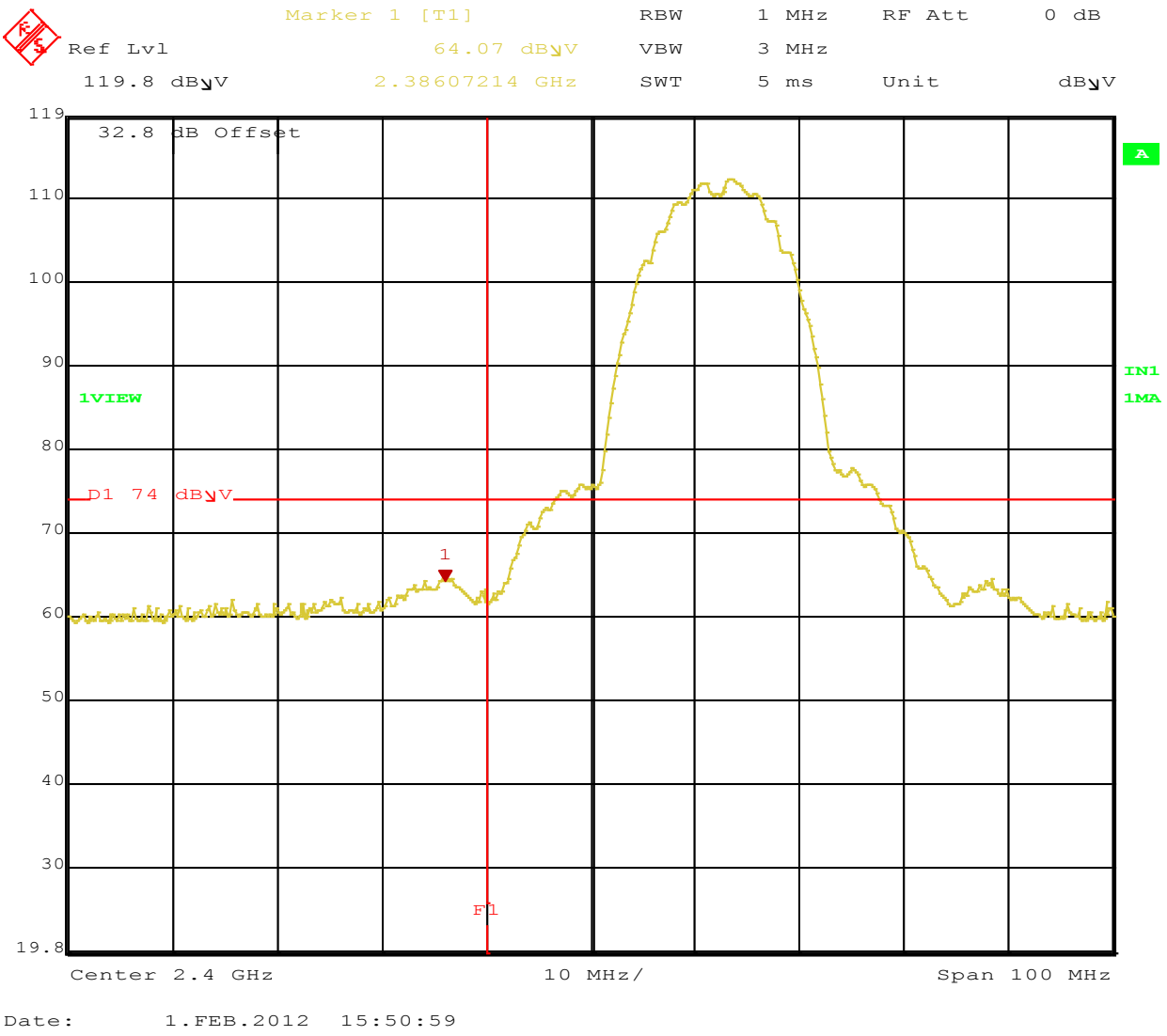


Figure 13: Radiated Emission at the Edge for Channel 2412 MHz at 1Mbps – Horizontal (Peak)

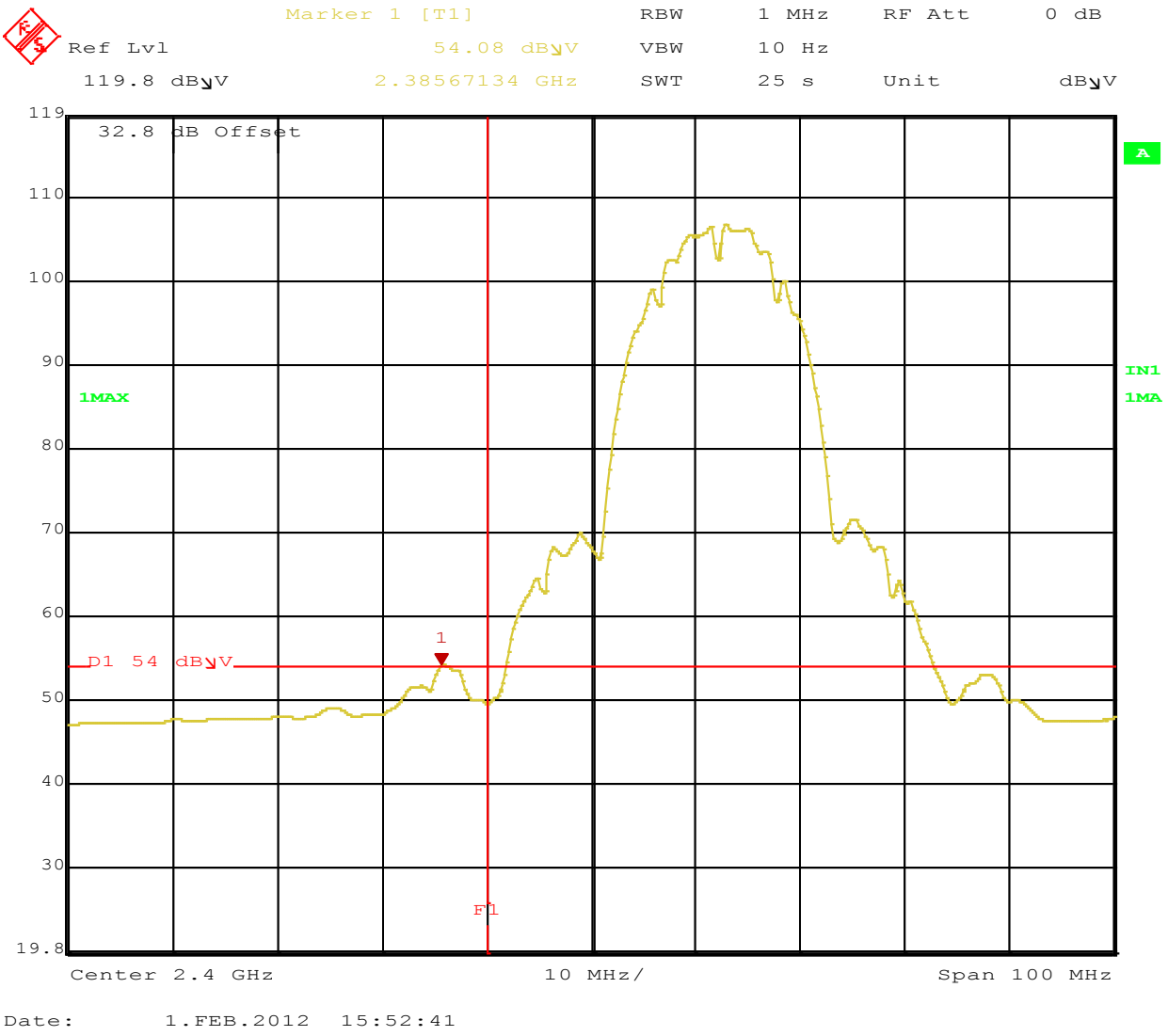


Figure 14: Radiated Emission at the Edge for Channel 2412 MHz at 1Mbps – Horizontal (Avg)

Band edge after duty cycle correction 54.08- 6.19 = 47.89dBuV

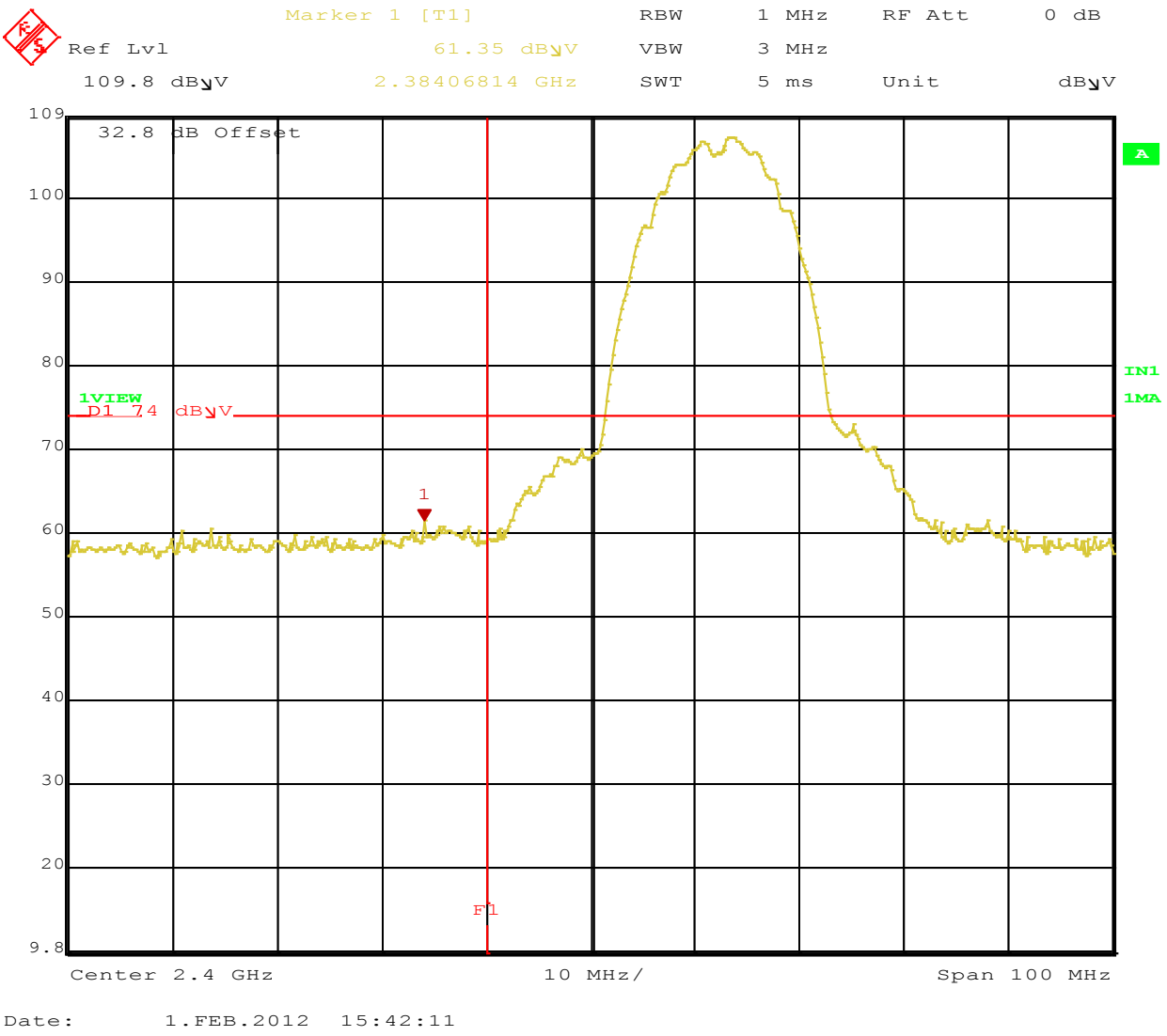


Figure 14: Radiated Emission at the Edge for Channel 2412 MHz at 1 Mbps – Vertical (Peak)

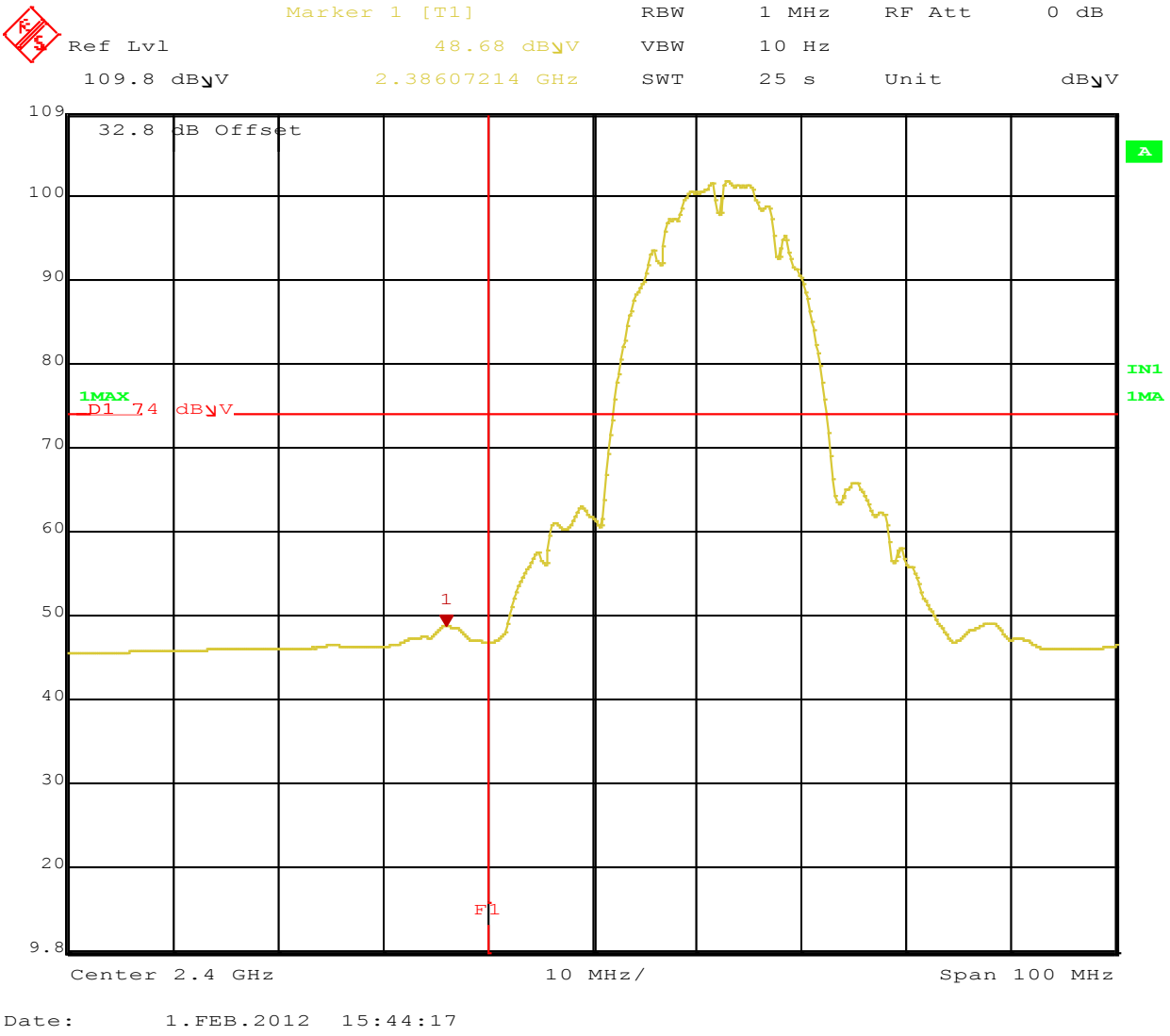
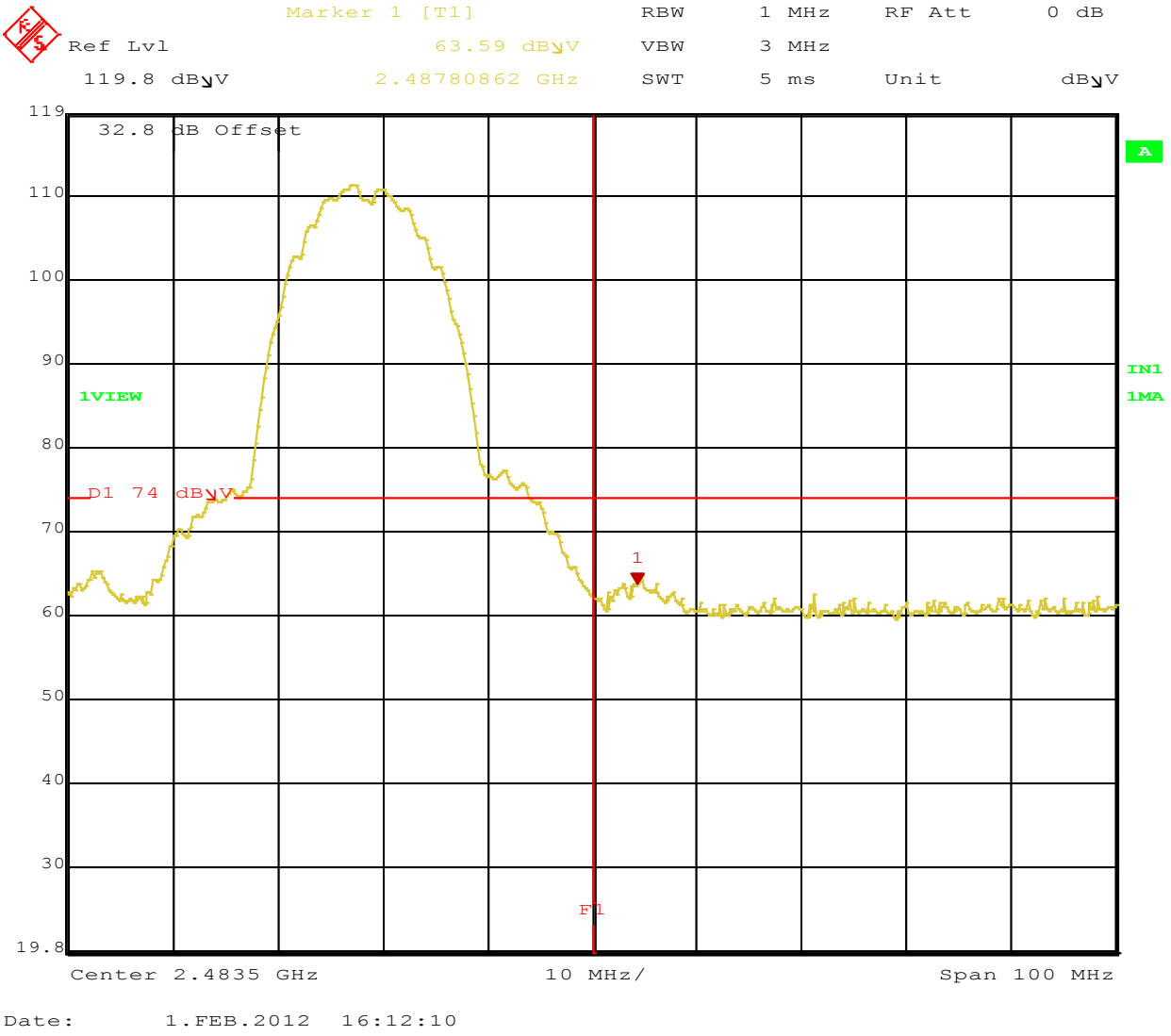
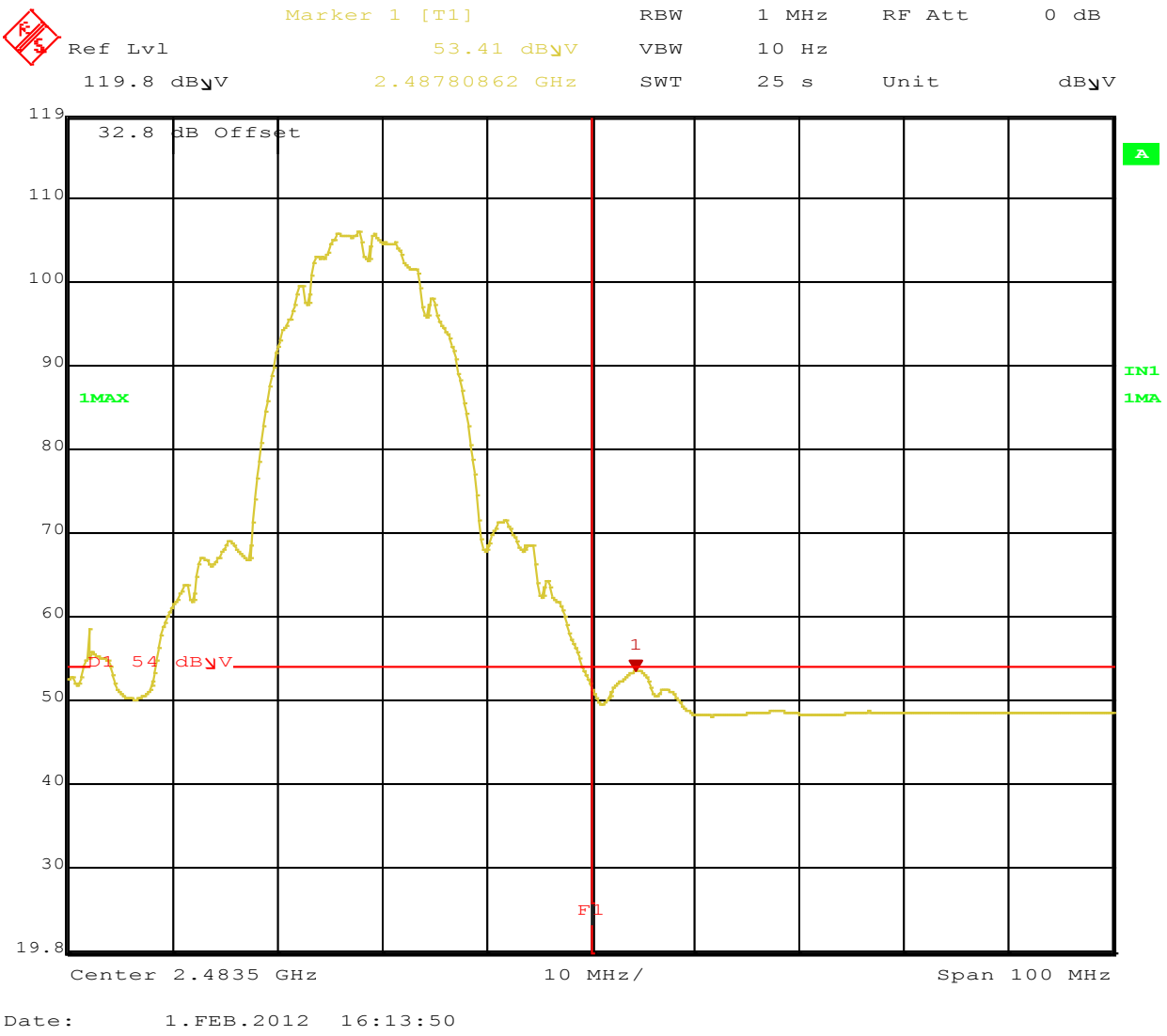
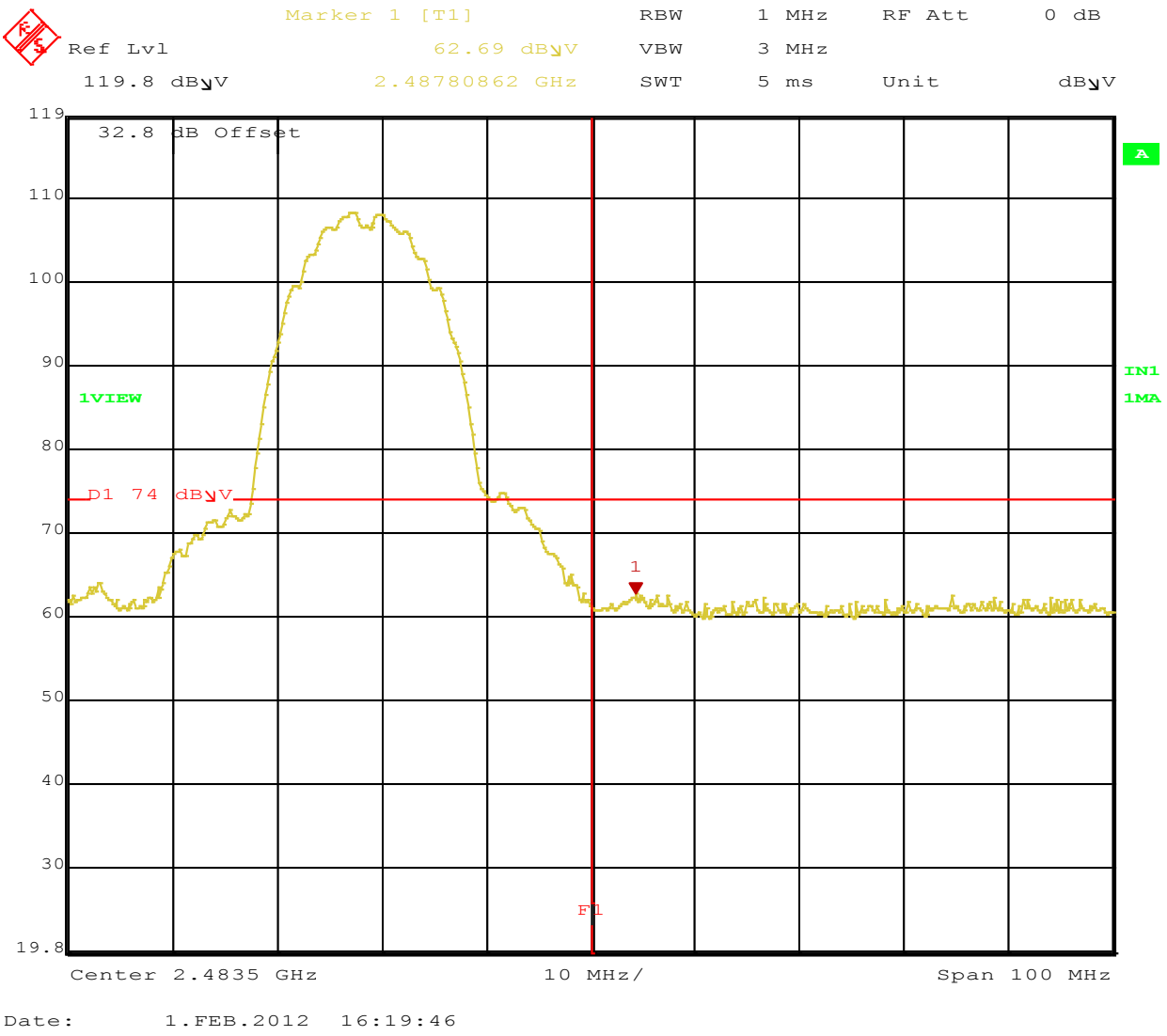
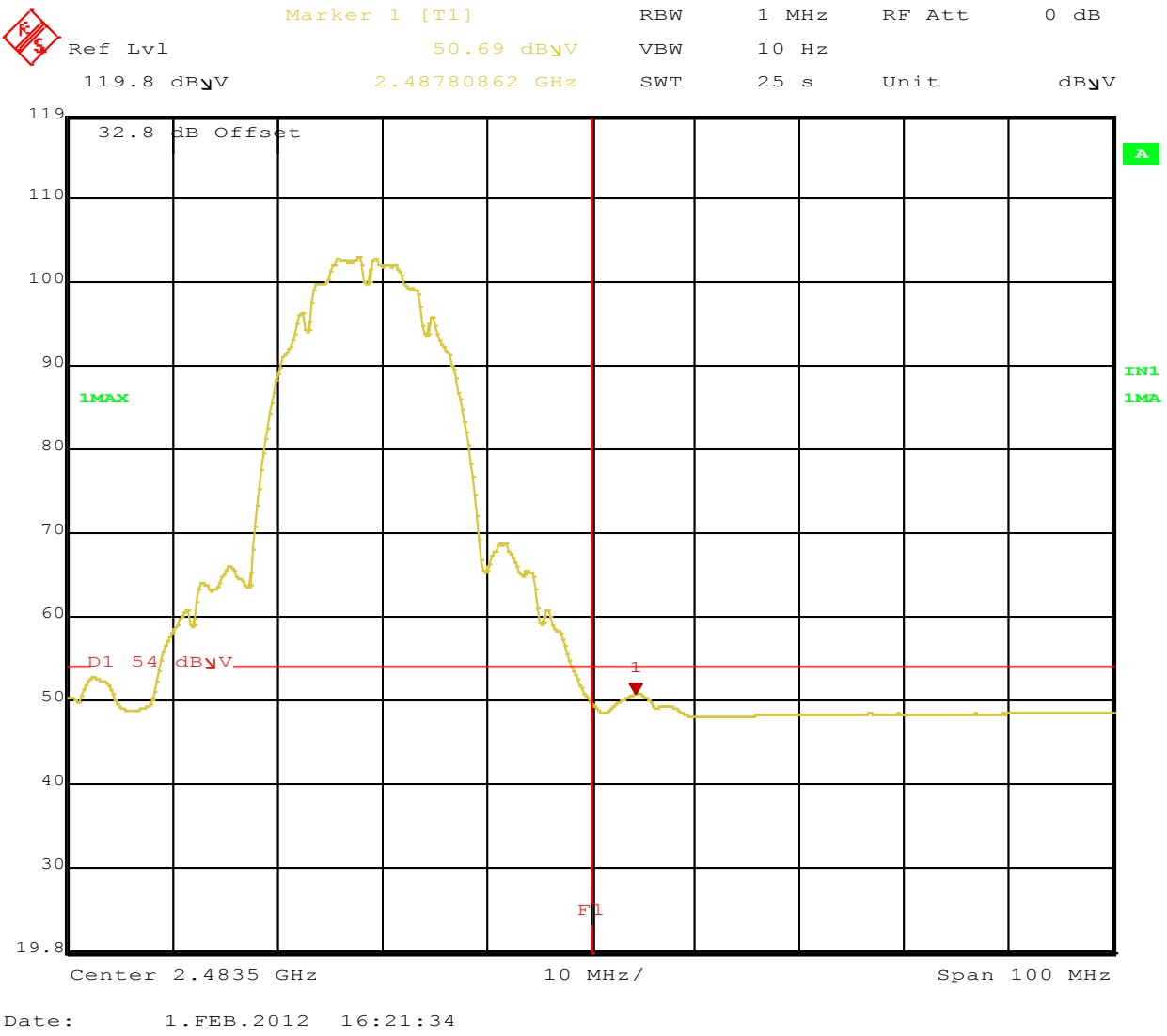


Figure 14: Radiated Emission at the Edge for Channel 2412 MHz at 1 Mbps – Vertical (Avg)


Marker 1 [T1]
RBW 1 MHz
RF Att 0 dB
Ref Lvl
63.59 dBµV
VBW 3 MHz
119.8 dBµV
2.48780862 GHz
SWT 5 ms
Unit dBµV
119
32.8 dB Offset
110
100
90
1VIEW
80
D1 74 dBµV
70
60
50
40
30
19.8
A
IN1
1MA
1
F1
Center 2.4835 GHz
10 MHz/
Span 100 MHz
Date: 1.FEB.2012 16:12:10


Marker 1 [T1]
RBW 1 MHz
RF Att 0 dB
Ref Lvl 53.41 dBµV
VBW 10 Hz
119.8 dBµV 2.48780862 GHz
SWT 25 s
Unit dBµV
32.8 dB Offset
A
IN1
1MA
1MAX
D1 54 dBµV
1
F1
119
110
100
90
80
70
60
50
40
30
19.8
Center 2.4835 GHz
10 MHz/
Span 100 MHz
Date: 1.FEB.2012 16:13:50


Marker 1 [T1]
RBW 1 MHz
RF Att 0 dB
Ref Lvl
62.69 dBµV
VBW 3 MHz
119.8 dBµV
2.48780862 GHz
SWT 5 ms
Unit dBµV
119
110
100
90
80
70
60
50
40
30
19.8
32.8 dB Offset
A
IN1
1MA
1VIEW
D1 74 dBµV
1
F1
Center 2.4835 GHz
10 MHz/
Span 100 MHz
Date: 1.FEB.2012 16:19:46


Marker 1 [T1]
RBW 1 MHz
RF Att 0 dB
Ref Lvl 50.69 dBµV
VBW 10 Hz
119.8 dBµV 2.48780862 GHz
SWT 25 s
Unit dBµV
32.8 dB Offset
A
IN1
1MA
1MAX
D1 54 dBµV
1
F1
119
110
100
90
80
70
60
50
40
30
19.8
Center 2.4835 GHz
10 MHz/
Span 100 MHz
Date: 1.FEB.2012 16:21:34

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EUT Name	Single Gas wireless detector	**Date**	Feb 06, 2012
EUT Model	CNX1-X1-Y-NA, CNX1-H1-Y-NA, CNX1-M1-Y-NA and CNX1-S1-Y-NA	**Temp / Hum in**	23°C / 39%rh
EUT Serial	CNX1-H1-Y-NA	**Temp / Hum out**	N/A
EUT Comfit.	Y-Axis, 18dBm, 802.11b at 1 Mbps	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz/ 3 MHz
Dist/Ant Used	3m / EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

Emission Freq MHz	FIM Pk dBuV	FIM Ave dBuV	Total CF dB	E-Field Ave dBuV	Spec Limit dBuV	Spec Margin dB	Table Pos deg	ANT Pos cm	ANT Pola	Type
Transmitted Data at 2412 MHz										
1329.03	45.78	28.8	-7.61	21.19	53.98	-32.79	173	136	V	Spurious
1332.58	47.59	27.97	-7.61	20.36	53.98	-33.62	154	100	V	Spurious
2040.03	56.88	38.16	-4.59	33.57	53.98	-20.41	124	150	H	Spurious
2120.02	51.87	40.29	-4.42	35.87	53.98	-18.11	184	100	V	Spurious
2120.02	52.99	41.49	-4.42	37.07	53.98	-16.91	176	198	H	Spurious
4824.09	46.78	43.15	2.42	45.57	53.98	-8.41	280	121	H	Harmonic
7235.04	43.52	31.66	8.02	39.68	53.98	-14.3	178	175	H	Harmonic
9648.03	40.86	31.24	10.59	41.83	53.98	-12.15	208	110	H	Harmonic
12060.9	46.74	39.36	14.01	53.37	53.98	-0.61	180	124	H	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 $u_c(y)$ = ± 3.2 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Worst case was observed on Y-axis, 1 Mbps. No duty cycle reduction was applied. Low, mid and high channels were evaluated for 30 MHz to 26MHz, only worst case results are reported here.

SOP 1 Radiated Emissions

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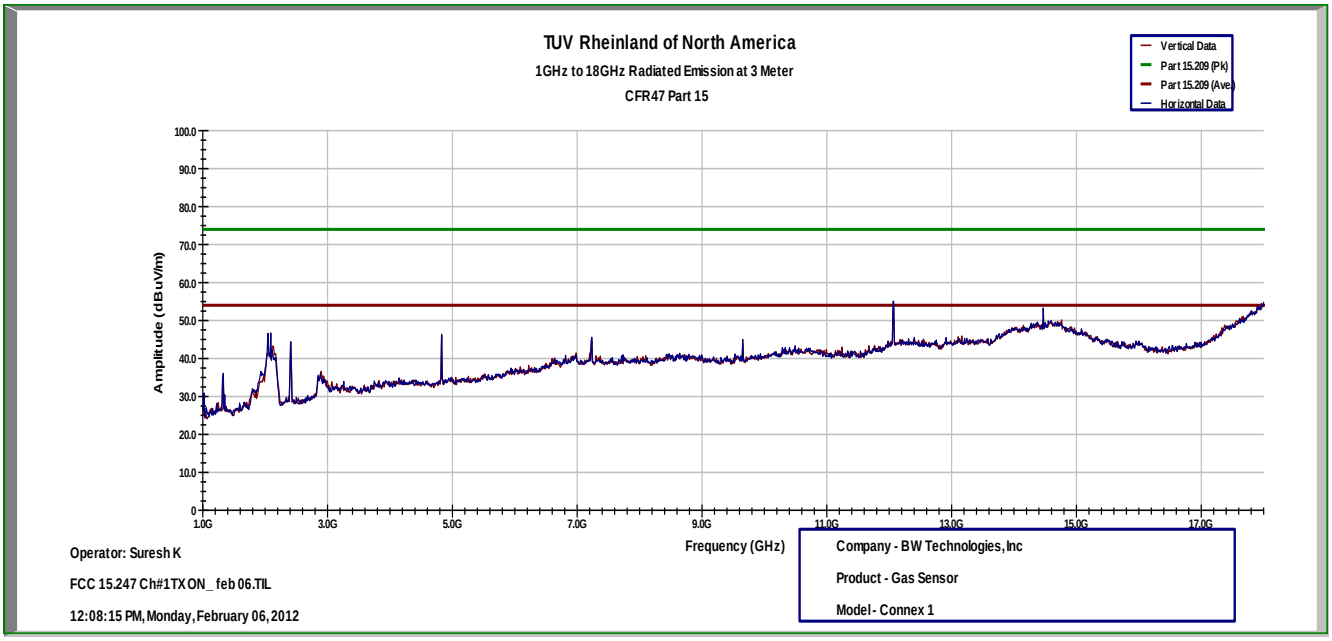
EUT Name	Single Gas Wireless Detector	**Date**	
EUT Model	CNX1-X1-Y-NA, CNX1-H1-Y-NA, CNX1-M1-Y-NA and CNX1-S1-Y-NA	**Temp / Hum in**	23°C / 39%rh
EUT Serial	CNX1-H1-Y-NA	**Temp / Hum out**	N/A
EUT Config.	Y-Axis, 18dBm, 1 Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

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



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

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EUT Name	Single Gas detector	**Date**	Feb 06, 2012
EUT Model	CNX1-X1-Y-NA, CNX1-H1-Y-NA, CNX1-M1-Y-NA and CNX1-S1-Y-NA	**Temp / Hum in**	23°C / 39%rh
EUT Serial	CNX1-H1-Y-NA	**Temp / Hum out**	N/A
EUT Config.	Y-Axis, 18dBm, 802.11b at 1 Mbps	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz/ 3 MHz
Dist/Ant Used	3m / EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

Emission Freq MHz	FIM Pk dBuV	FIM QP/Ave dBuV	Total CF dB	E-Field QP/Ave dBuV	Spec Limit dBuV	Spec Margin dB	Table Pos deg	ANT Pos cm	ANT Pola	Type
Transmitted Data at 2437 MHz										
62.048	56.19	49.23	-16.45	32.78	40.00	-7.22	159	100	V	Spurious
240.05	54.28	50.17	-10.33	39.84	46.02	-6.18	21	100	V	Spurious
374.97	48.79	47.62	-7.46	40.16	46.02	-5.86	163	156	V	Spurious
406.00	45.11	44.52	-6.57	37.94	46.02	-8.08	15	106	H	Spurious
1128.56	40.69	27.81	-8.55	19.26	53.98	-34.72	173	136	H	Spurious
1225.2	44.97	28.61	-7.95	20.66	53.98	-33.32	154	100	H	Spurious
1956.71	40.14	25.76	-4.73	21.03	53.98	-32.95	124	150	H	Spurious
2144.26	51.63	39.65	-4.25	35.4	53.98	-18.58	184	100	H	Spurious
4873.95	45.93	41.14	2.52	43.66	53.98	-10.32	176	198	H	Harmonic
4874.03	45.63	40.81	2.52	43.33	53.98	-10.65	280	121	H	Harmonic
7310.16	45.47	35.57	8.29	43.86	53.98	-10.12	178	175	H	Harmonic
7312.08	44.35	33.52	8.29	41.81	53.98	-12.17	208	110	V	Harmonic
9747.97	44.28	37.74	10.66	48.4	53.98	-5.58	180	124	H	Harmonic
12185.8	41.2	33.64	14.37	48.01	53.98	-5.97	173	136	H	Harmonic
14622.0	38.51	31.8	18.75	50.55	53.98	-3.43	154	100	H	Harmonic
19495.9	55.04	39.38	11.55	50.93	53.98	-3.07	175	100	V	Harmonic
19495.9	53.82	37.25	11.55	48.8	53.98	-5.18	227	100	H	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 $u_c(y)$ = ± 3.2 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence
Notes: Worst case was observed on Y-axis, 1 Mbps. No duty cycle reduction was applied. Low, mid and high channels were evaluated for 30 MHz to 26MHz, only worst case results are reported here.

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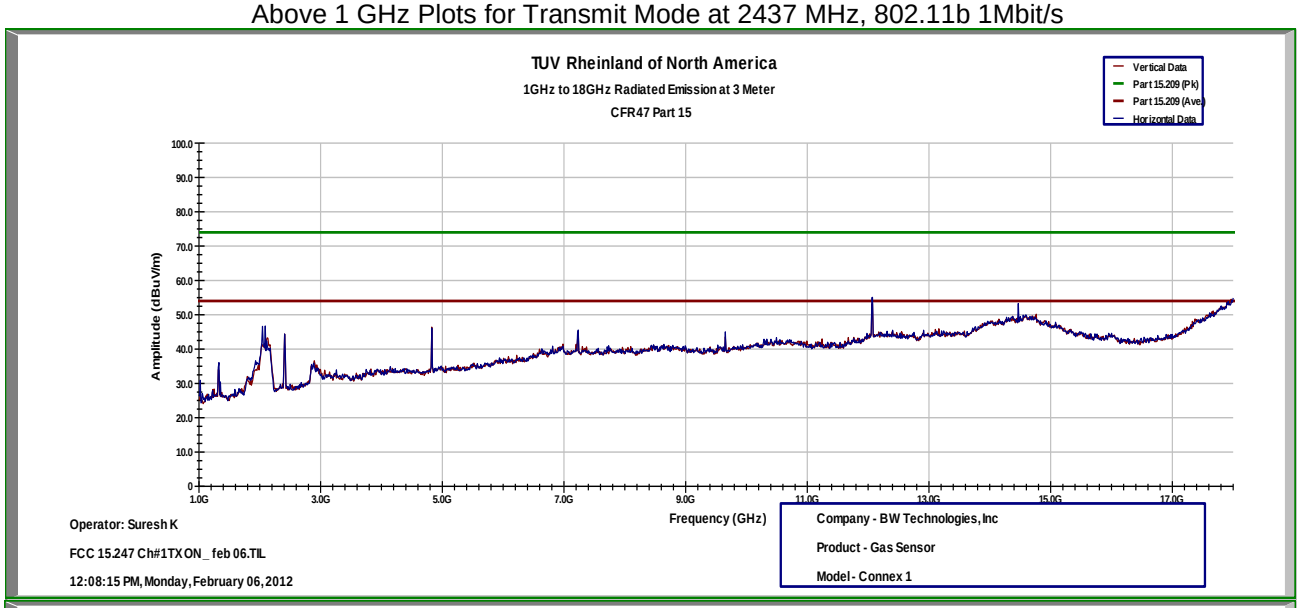
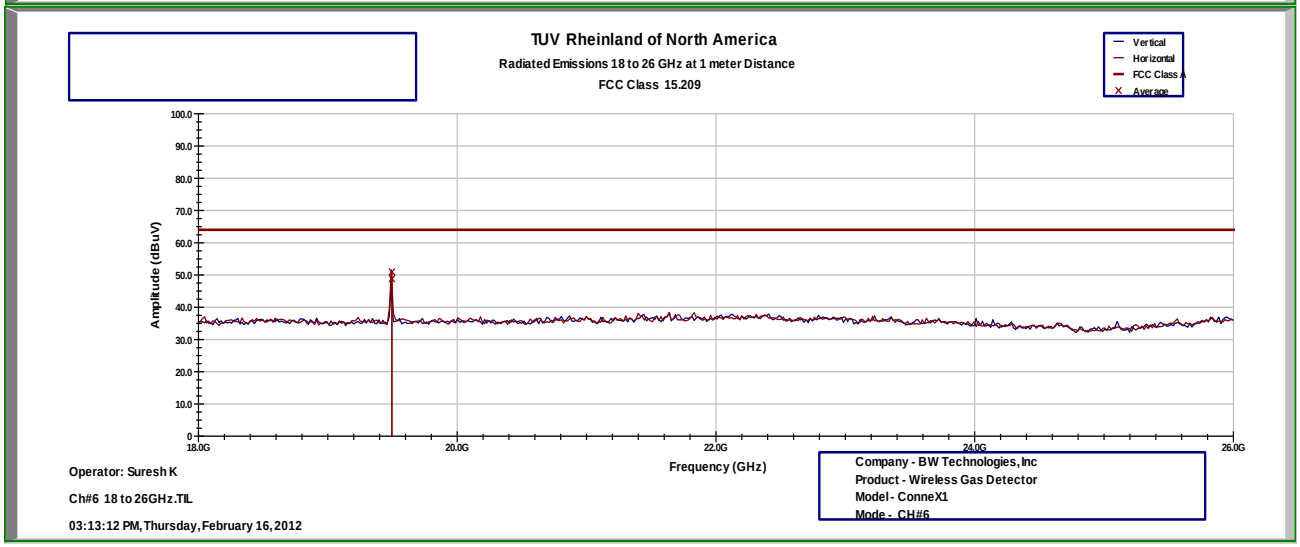
EUT Name	Single Wireless Gas Detector	**Date**	Feb 06, 2012
EUT Model	CNX1-X1-Y-NA, CNX1-H1-Y-NA, CNX1-M1-Y-NA and CNX1-S1-Y-NA	**Temp / Hum in**	23°C / 39%rh
EUT Serial	CNX1-H1-Y-NA	**Temp / Hum out**	N/A
EUT Config.	Y-Axis, 18dBm, 1 Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

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





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

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EUT Name	Single Gas detector	**Date**	Feb 06, 2012
EUT Model	CNX1-X1-Y-NA, CNX1-H1-Y-NA, CNX1-M1-Y-NA and CNX1-S1-Y-NA	**Temp / Hum in**	23°C / 39%rh
EUT Serial	CNX1-H1-Y-NA	**Temp / Hum out**	N/A
EUT Config.	Y-Axis, 18dBm, 802.11b at 1 Mbps	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz/ 3 MHz
Dist/Ant Used	3m / EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

Emission Freq	FIM Pk	FIM Ave	Total CF	E-Field Ave	Spec Limit	Spec Margin	Table Pos	ANT Pos	ANT Pola	Type
Transmitted Data at 2472 MHz										
1329.75	46	29.22	-7.61	21.61	53.98	-32.37	124	100	H	Spurious
2142.41	56.05	42.06	-4.26	37.79	53.98	-16.19	220	121	H	Spurious
4923.97	47.34	43.12	2.6	45.72	53.98	-8.26	97	110	H	Harmonic
7385.34	44.88	36.03	8.24	44.27	53.98	-9.71	103	108	H	Harmonic
9848.09	45.52	38.48	11.13	49.61	53.98	-4.37	128	178	H	Harmonic
12309.1	40.71	33.9	14.39	48.29	53.98	-5.69	141	156	V	Harmonic
12310.9	44.91	36.2	14.39	50.59	53.98	-3.39	138	182	H	Harmonic
14772.2	34.8	23.02	19.05	42.07	53.98	-11.91	94	100	H	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 $u_c(y)$ = ± 3.2 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Worst case was observed on Y-axis, 1 Mbps. No duty cycle reduction was applied. Low, mid and high channels were evaluated for 30 MHz to 26MHz, only worst case results are reported here.

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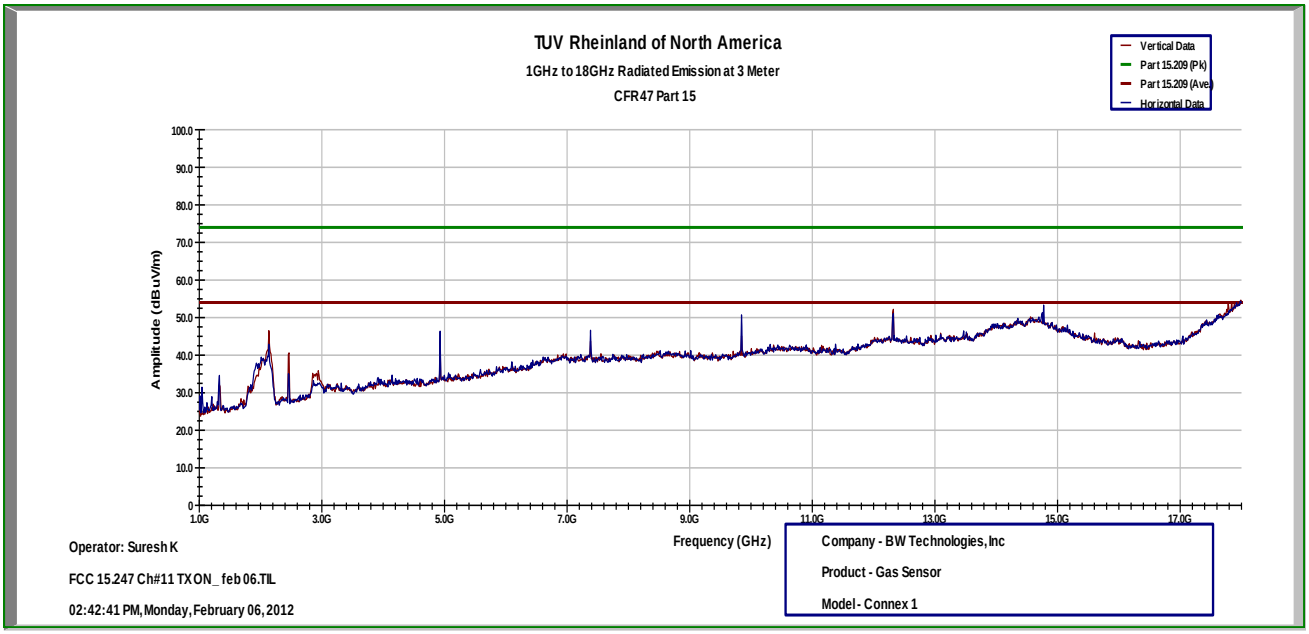
EUT Name	Single Wireless Gas Detector	**Date**	February 08, 2012
EUT Model	CNX1-X1-Y-NA, CNX1-H1-Y-NA, CNX1-M1-Y-NA and CNX1-S1-Y-NA	**Temp / Hum in**	23°C / 40%rh
EUT Serial	CNX1-H1-Y-NA	**Temp / Hum out**	N/A
EUT Config.	Y-Axis, 1 Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

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



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

4.5.4 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:

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

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

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

4.6 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 GEN Sect 6.1.

4.6.1 Test Methodology

4.6.1.1 Preliminary Test

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

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

4.6.1.2 Final Test

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

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

4.6.1.3 Deviations

None.

4.6.2 Receiver Spurious Emission Limit

The spurious emissions of the receiver shall not exceed the values in CFR47 Part 15.109: 2009 and RSS GEN Sect 6.1 2010.

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

4.6.3 Test Results

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

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

4.6.3.1 Final Data

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

SOP 1 Radiated Emissions

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EUT Name	Single Wireless Gas Detector	**Date**	February 13, 2012
EUT Model	CNX1-X1-Y-NA, CNX1-H1-Y-NA, CNX1-M1-Y-NA and CNX1-S1-Y-NA	**Temp / Hum in**	23°C / 39%rh
EUT Serial	CNX1-H1-Y-NA	**Temp / Hum out**	N/A
EUT Config.	Y-Axis, 802.11b, RX at Ch6, 1 Mbps	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz/ 3 MHz
Dist/Ant Used	3m / EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

Emission Freq	FIM Pk	FIM QP/Ave	Total CF	E-Field Ave	Spec Limit	Spec Margin	Table Pos	ANT Pos	ANT Pola	Type
32.9238	23.19	19.47	-6.49	12.98	40.00	-27.02	201	100	V	Spurious
52.2725	28.38	21.04	-17.35	3.69	40.00	-36.31	126	224	V	Spurious
125.299	22.85	19.09	-9.41	9.68	43.52	-33.84	204	150	V	Spurious
137.579	22.66	19.29	-10.19	9.1	43.52	-34.42	126	209	H	Spurious
170.898	22.19	18.95	-11.05	7.90	43.52	-35.62	325	258	V	Spurious
545.137	23.1	19.06	-4.88	14.18	46.02	-31.84	220	110	V	Spurious
898.904	21.36	18.27	0.68	18.95	46.02	-27.07	184	120	V	Spurious
1328.94	45.25	29.32	-7.61	21.71	53.98	-32.27	220	134	H	Spurious
2116.25	40.97	26.29	-4.45	21.84	53.98	-32.14	325	100	H	Spurious
5486.87	29.16	27.87	4.28	32.15	53.98	-21.83	124	100	H	Spurious

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

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

Notes: Worst case was observed on Y-axis, 1 Mbps.
Notes: Tested on the Y-Axis at Ch 6. 30 MHz – 1 GHz: RBW=120 kHz,VBW=300 kHz 1 GHz – 25 GHz: RBW=1MHz, VBW=3MHz

SOP 1 Radiated Emissions

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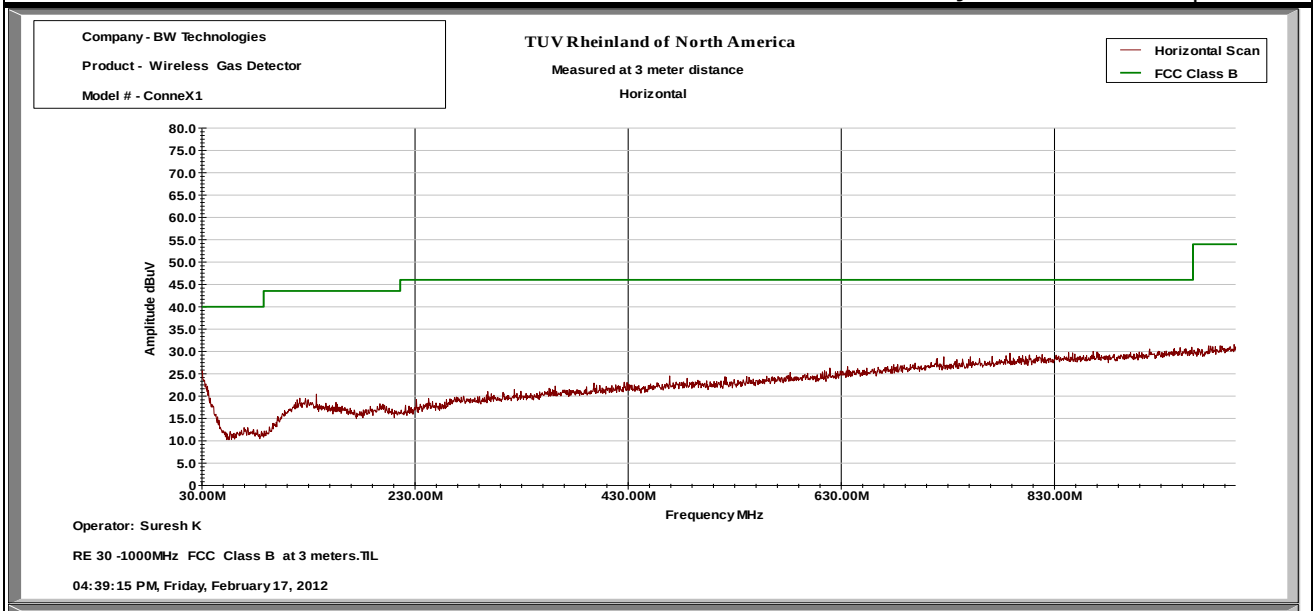
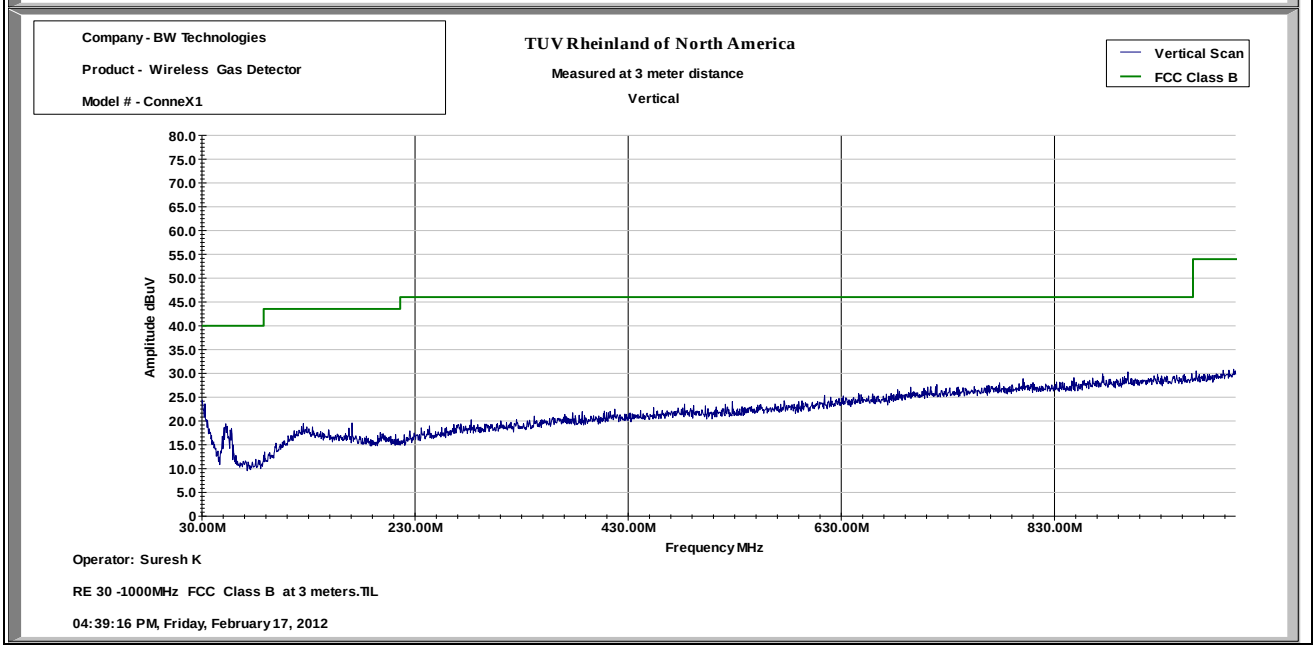
EUT Name	Single Wireless gas Detector	**Date**	February 13, 2012
EUT Model	CNX1-X1-Y-NA, CNX1-H1-Y-NA, CNX1-M1-Y-NA and CNX1-S1-Y-NA	**Temp / Hum in**	22°C / 40%rh
EUT Serial	CNX1-H1-Y-NA	**Temp / Hum out**	N/A
EUT Config.	Y-Axis, 802.11b, RX at Ch6	**Line AC / Freq**	120Vac 60Hz
Standard	CFR47 Part 15.109, Class A	**RBW / VBW**	See Note
Dist/Ant Used	3m / JB3 & EMCO3115	**Performed by**	Suresh Kondapalli

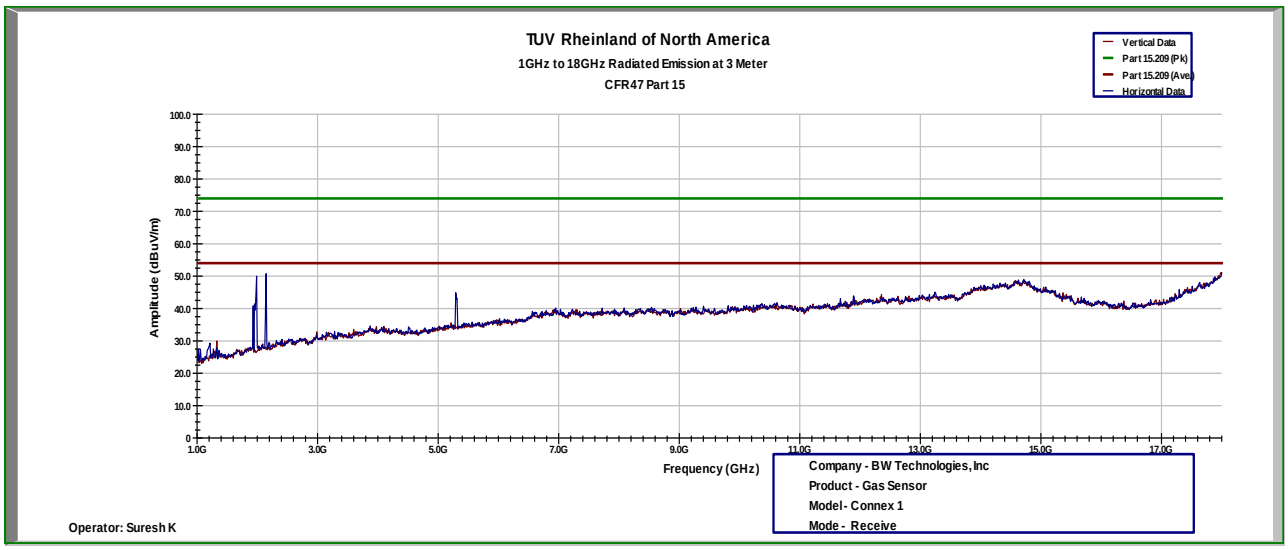




Notes : None

SOP 1 Radiated Emissions		Tracking # 31153356.00 1	Page 3 of 3
EUT Name	Single Wireless Gas Detector	**Date**	February 13, 2012
EUT Model	CNX1-X1-Y-NA, CNX1-H1-Y-NA, CNX1-M1-Y-NA and CNX1-S1-Y-NA	**Temp / Hum in**	22°C / 40%rh
EUT Serial	CNX1-H1-Y-NA	**Temp / Hum out**	N/A
EUT Config.	Y-Axis, 802.11b, RX at Ch6	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15.109, Class A	**RBW / VBW**	120 kHz / 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Suresh Kondapali

Above 1 GHz Plot for Receive Mode



Notes: All emission above 18GHz are at least 20dB below the limit

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:

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

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

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

4.7 AC Conducted Emissions

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

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

The AC conducted emissions of equipment under test shall not exceed the values in CFR47 Part 15.207: 2009 and RSS 210: 2010.

4.7.1 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 inLab 5. 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.

4.7.1.1 Deviations

There were no deviations from this test methodology.

4.7.2 Test Results

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

Table 8: AC Conducted Emissions – Test Results

Test Conditions: Conducted Measurement at Normal Conditions only		
Antenna Type: Internal	**Power Level:** See Test Plan	
AC Power: 120 Vac/60 Hz	**Configuration:** Tabletop/ Portable	
Ambient Temperature: 23° C	**Relative Humidity:** 34% RH	
Configuration	**Frequency Range**	**Test Result**

Line 1 (Hot)	0.15 to 30 MHz	Pass
Line 2 (Neutral)	0.15 to 30 MHz	Pass

SOP 2 Conducted Emissions

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EUT Name	Single Wireless Gas Detector	**Date**	February 07, 2012
EUT Model	CNX1-X1-Y-NA, CNX1-H1-Y-NA, CNX1-M1-Y-NA and CNX1-S1-Y-NA	**Temp / Hum in**	23° C / 34% rh
EUT Serial	CNX1-H1-Y-NA	**Temp / Hum out**	N/A
EUT Config.	Internal Antenna	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15.207	**RBW / VBW**	9kHz / 30 kHz
Lab/LISN	Lab #5 / Com-Power LI-215, Line 1	**Performed by**	Suresh Kondapalli

Frequency	Quasi-Peak	QP Limit	QP Margin	Average	Ave Limit	Ave Margin
MHz	dBuV	dBuV	dB	dBuV	dBuV	dB
0.150	44.03	65.99	-21.96	14.05	55.99	-41.94
0.182	42.92	65.08	-22.16	11.50	55.08	-43.58
0.372	37.85	59.65	-21.80	6.77	49.65	-42.87
0.504	36.60	56.00	-19.40	5.21	46.00	-40.79
0.536	36.16	56.00	-19.84	4.72	46.00	-41.28
0.915	25.54	56.00	-30.46	-4.52	46.00	-50.52

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

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

SOP 2 Conducted Emissions

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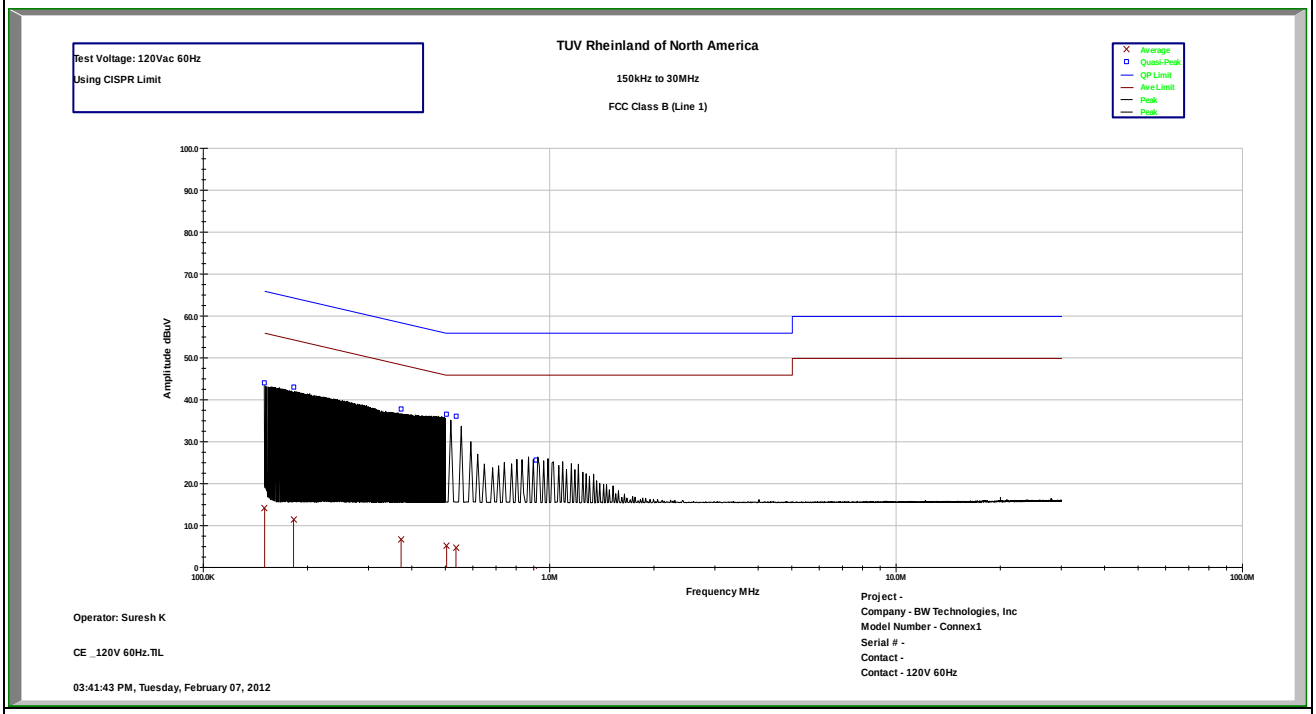
EUT Name	Single Wireless Gas Detector	**Date**	February 07, 2012
EUT Model	CNX1-X1-Y-NA, CNX1-H1-Y-NA, CNX1-M1-Y-NA and CNX1-S1-Y-NA	**Temp / Hum in**	23° C / 34% rh
EUT Serial	CNX1-H1-Y-NA	**Temp / Hum out**	N/A
EUT Config.	Internal Antenna	**Line AC**	120Vac/60Hz
Standard	CFR47 Part 15.207	**RBW / VBW**	9kHz / 30 kHz
Lab/LISN	Lab #5 / Com-Paq LI-215, Line 1	**Performed by**	Suresh Kondapalli

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



Notes: Met FCC Class B limit.

SOP 2 Conducted Emissions

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EUT Name	**Single Wireless Gas Detector**	**Date**	February 07, 2012
EUT Model	CNX1-X1-Y-NA, CNX1-H1-Y-NA, CNX1-M1-Y-NA and CNX1-S1-Y-NA	**Temp / Hum in**	23° C / 34% rh
EUT Serial	CNX1-H1-Y-NA	**Temp / Hum out**	N/A
EUT Config.	Internal Antenna	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15.107	**RBW / VBW**	9kHz / 30 kHz
Lab/LISN	Lab #5 / Com-Power LI-215, Line 2	**Performed by**	Suresh Kondapalli

Frequency	Quasi-Peak	QP Limit	QP Margin	Average	Ave Limit	Ave Margin
MHz	dBuV	dBuV	dB	dBuV	dBuV	dB
0.151	45.54	65.98	-20.44	15.18	55.98	-40.80
0.184	44.09	65.03	-20.94	12.68	55.03	-42.35
0.372	38.01	59.66	-21.65	6.61	49.66	-43.05
0.498	36.14	56.05	-19.91	5.37	46.05	-40.67
0.521	35.69	56.00	-20.31	4.60	46.00	-41.39
0.610	27.07	56.00	-28.93	-2.40	46.00	-48.40

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

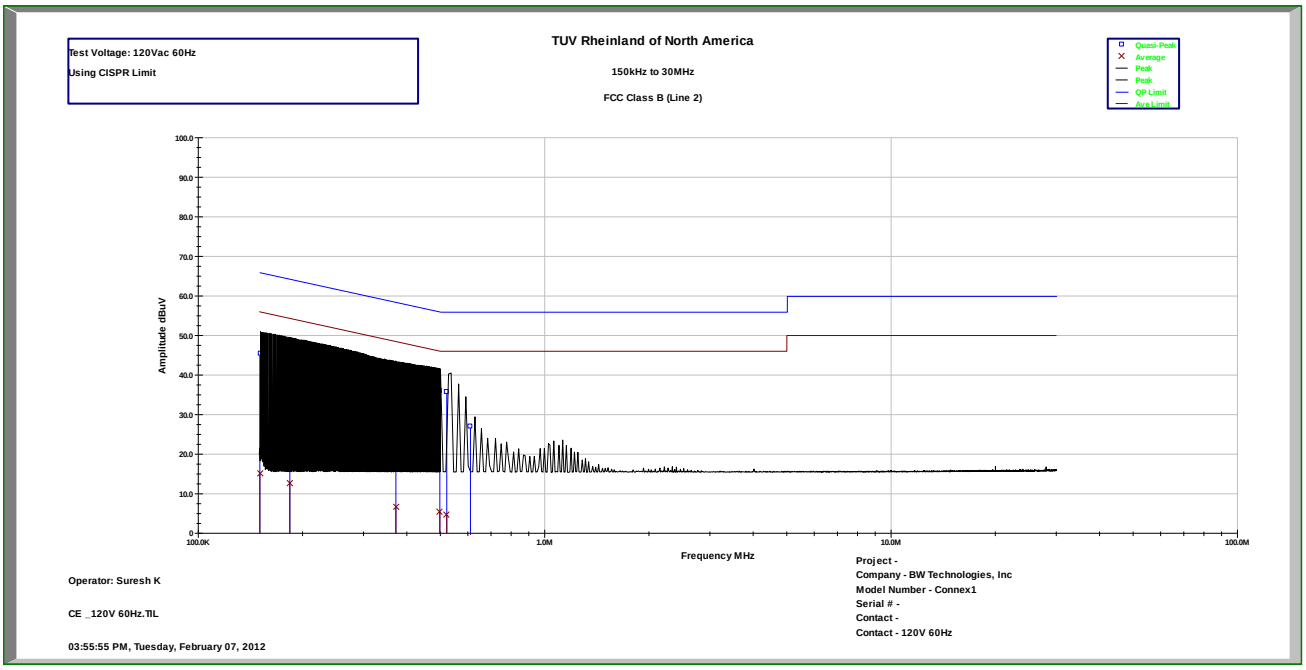
Combined Standard Uncertainty $u_c(y)$ = ± 1.2 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

SOP 2 Conducted Emissions

Tracking # 31153356.001 Page 4 of 4

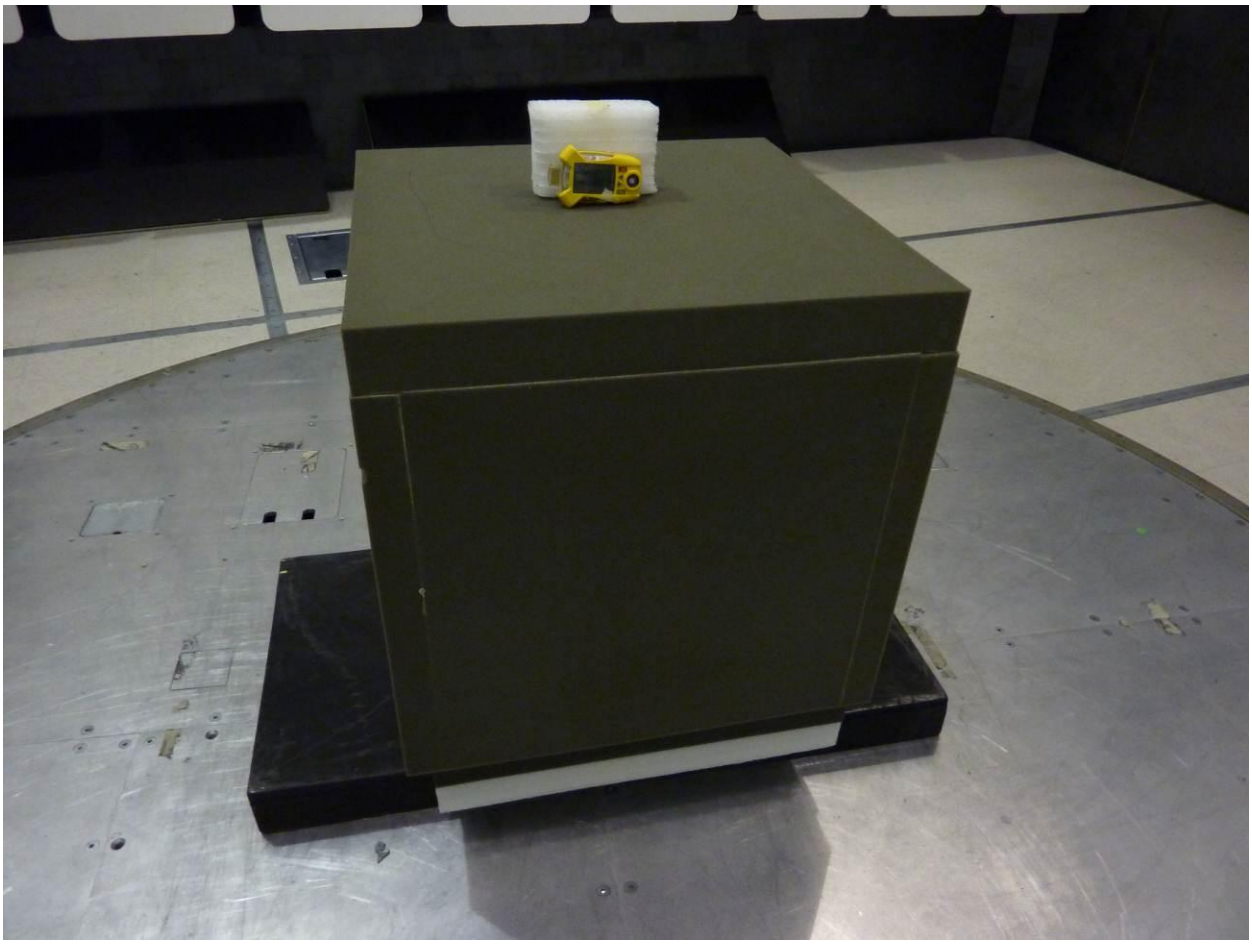
EUT Name	Single Wireless Gas Detector	**Date**	February 07, 2012
EUT Model	CNX1-X1-Y-NA, CNX1-H1-Y-NA, CNX1-M1-Y-NA and CNX1-S1-Y-NA	**Temp / Hum in**	23° C / 34% rh
EUT Serial	CNX1-H1-Y-NA	**Temp / Hum out**	N/A
EUT Config.	Internal Antenna	**Line AC**	120Vac/60Hz
Standard	CFR47 Part 15.107	**RBW / VBW**	9kHz / 30 kHz
Lab/LISN	Lab #5/ Com-Paq LI-215, Line 2	**Performed by**	Suresh Kondapalli

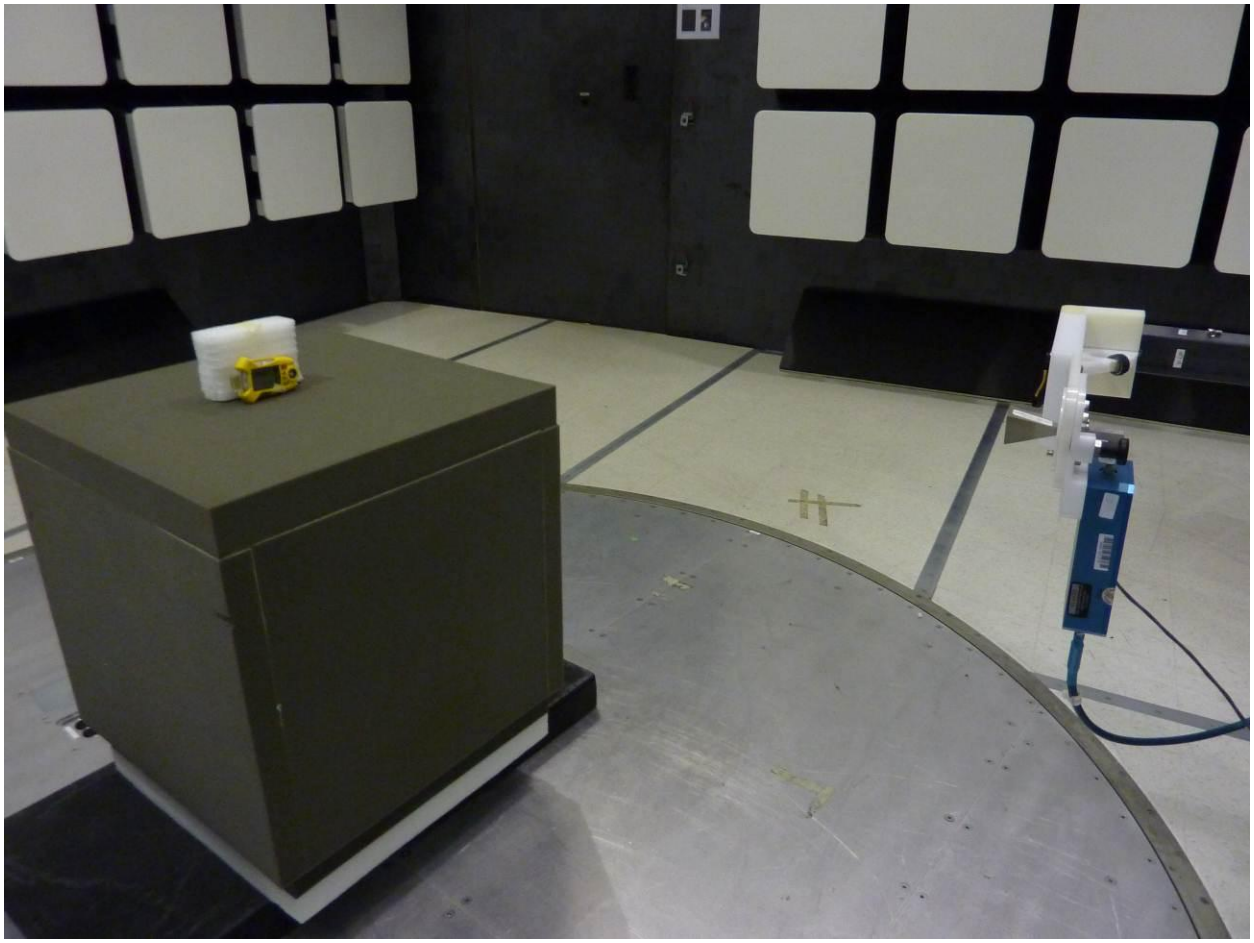
150 kHz to 30 MHz Plot for Line 2 (Neutral)

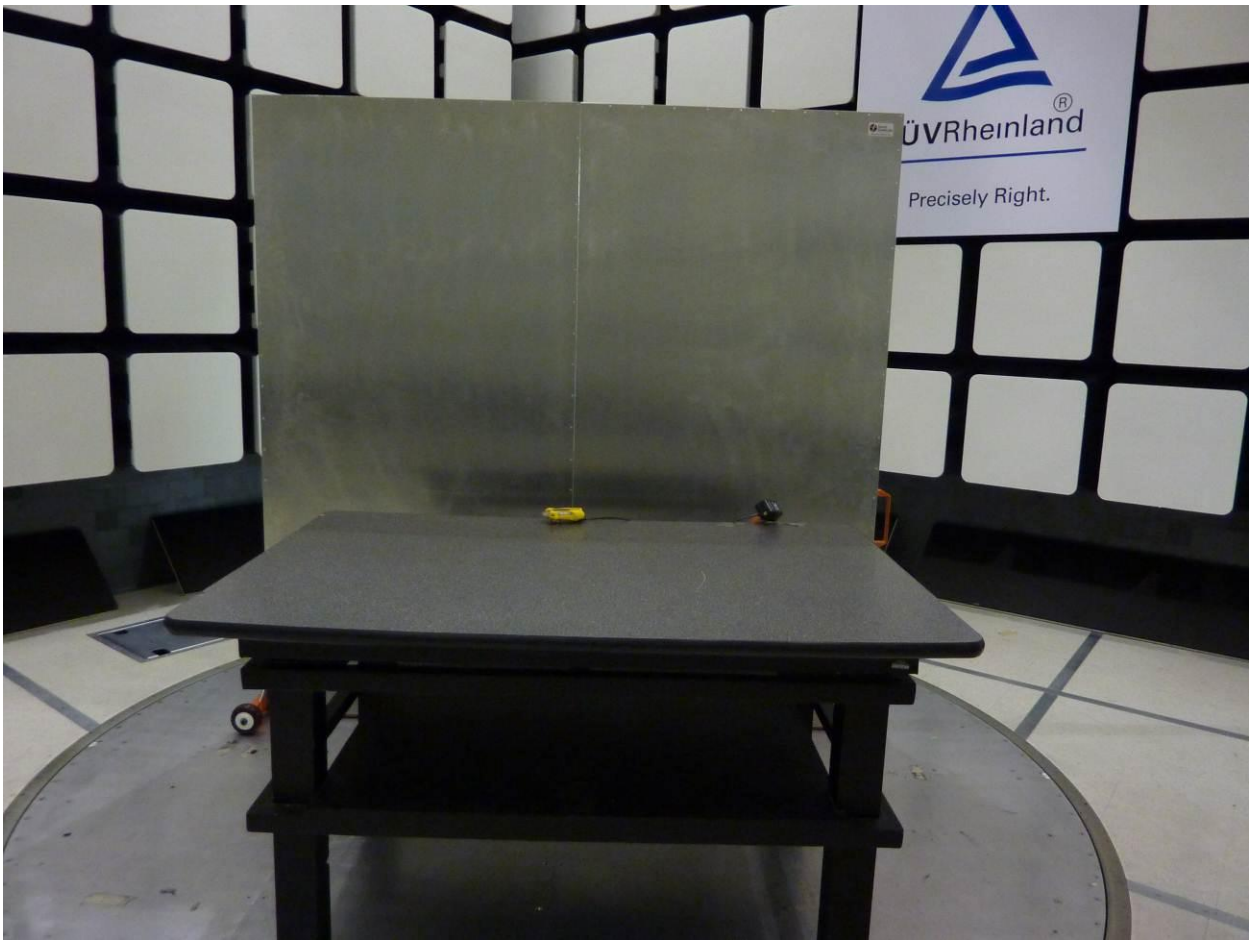


Note: Meet FCC Class B Limit.

4.7.3 Test Setup Photos






ÜVRheinland
Precisely Right.

5 Test Equipment Use List

5.1 Equipment List

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
Bilog Antenna	Sunol Science	JB3	A061907	5/14/2010	5/14/2012
Horn Antenna	Sunol Scienece	DRH-118	A040806	9/29/2010	9/29/2012
Antenna (18-26GHz)	CMT	RA42-K-F-4B-C	020131-004	1/17/2012	1/17/2013
EMI Receiver	Hewlett Packard	8546A	3807A00445	1/17/2012	1/17/2013
Preselector	Hewlett Packard	85460A	3704A00407	1/17/2012	1/17/2013
Amplifier	Hewlett Packard	8447D	2944A07996	1/16/2012	1/16/2013
Spectrum Analyzer	Rhode&Schwarz	ESIB	832427/002	1/17/2012	1/17/2013
Amplifier	Rhode&Schwarz	TS-PR18	3545.7008.03	9/29/2010	9/29/2012
Amplifier	Rhode&Schwarz	TS-PR26	100011	1/16/2012	1/16/2013
Signal Generator	Anritsu	MG3694A	42803	1/17/2012	1/17/2013
Notch Filter	Micro-Tronics	BRM50702	37	1/17/2012	1/17/2013
Notch Filter	Micro-Tronics	BRC50705	9	1/17/2012	1/17/2013
High Pass Filter (3.5 GHz)	Hewlett Packard	84300-80038	820004	1/17/2012	1/17/2013
High Pass Filter (8.5 GHz)	Micro-Tronics	HPM50107	4	1/17/2012	1/17/2013
Digital Multimeter	Fluke	177	92780314	1/18/2012	1/18/2013
LISN	Com-Paq	LI-215	24548	1/19/2012	1/19/2013
Signal Generator	Anritsu	MG3694A	42803	1/17/2012	1/17/2013
Spectrum Analyzer	Agilent	E4407B	SG43330468	10/05/2011	10/05/2012

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

6 EMC Test Plan

6.1 Introduction

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

6.2 Customer

Table 9: Customer Information

Company Name	BW Technologies, LTD
Address	2840 2nd Avenue SE
City, State, Zip	Calgary, Alberta, T2A 7X9
Country	Canada
Phone	781-708-6777
Fax	None

Table 10: Technical Contact Information

Name	Paul Silva
E-mail	*Paul.silva@honeywell.com*
Phone	781-708-6777
Fax	None

6.3 Equipment Under Test (EUT)

Table 11: EUT Specifications

EUT Specification	
Dimensions	116mm x 72mm x 37mm
AC Adapter (For charging only)	Input Voltage: 100- 240 Vac, 50-60 Hz Input Current: 600 mA Output Voltage: 3.4 – 4.2 Vdc Output Current: 400 mA Peak
Environment	Portable Hoz Loc
Operating Temperature Range:	-20 to +55 degrees C
Multiple Feeds:	☐ Yes and how many ☒ No
Hardware Version	None
Part Number	None
RF Software Version	None
Radio Module 802.11-radio module	
Operating Mode	802.11b,
Transmitter Frequency Band	2.400 GHz to 2.4835 GHz
Max. Rated Power Output	See Channel Planning Table.
Power Setting @ Operating Channel	See Channel Planning Table.
Antenna Type	Internal Antenna 0.0 dBi
Modulation Type	☐ AM ☐ FM ☐ DSSS ☐ OFDM ☒Other describe: CCK,
Date Rate	802.11b: 1 Mbps
TX/RX Chain (s)	1
Directional Gain Type	☒ Uncorrelated ☒ No Beam-Forming ☐ Other describe:
Type of Equipment	☐ Table Top ☐Wall-mount ☐ Floor standing cabinet ☒Other *Portable*

Table 12: EUT Channel Power Specifications

No.	Frequency (MHz)	
		802.11b
1	2412	18.29
2	2417	18.31
3	2422	18.31
Note: 1. The power levels shown here are with 100% duty cycle. Duty cycle factor for a comparison with limits. 2. This report only documents frequency ranges 2400-2483.5 MHz		

Table 13: Interface Specifications: None

Table 14: Supported Equipment : None

Table 15: Description of Sample used for Testing

Duty cycle description: EUT in actual operation works on duty cycle as described below by BW technologies;

The following text is taken from email received from BW Technologies

The software limits set on the radio
Normal Operation:
Radio transmits 1(255 bit) transmission every 120 seconds
Fault Condition:
Radio transmits 1(255 bit) transmission per second for 10 - 20 seconds every 120 seconds
Since the fault condition is our worse case duty cycle.

ConneX1 transmitts max 255bits in 1min. Max transmit time 49msec for 100ms. The duty cycle calculated as follows

Duty cycle 20log (0.49) = -6.19dB

Device	Model/Serial	RF Connection	CFR47 Part 15.247
Single wireless Gas Detector	CNX1-H1-Y-NA	Internal antenna	TX Emission, RX Emission, AC Conducted Emission
	CNX1-H1-Y-NA	SMA Connector (This was setup by BW Technologies for test purposes only)	RF Power Output, Out of Band Emission, Peak Power Spectral Density, Occupied Bandwidth

Table 16: Description of Test Configuration used for Radiated Measurement.

Device	Antenna	Mode	Setup Photo (X-Axis)	Setup Photo (Y-Axis)	Setup Photo (Z-Axis)
Single Wireless Gas Detector	Internal	* Transmit * Receive	 Flat on table	 EUT set on wall laying on longer side.	 EUT vertical
Note: Pre-scans were performed in 3 orthogonal axes and **Y-Axis was worst case.**					

Table 17: Final Test Mode for 2400 MHz to 2483.5 MHz Band

Test	802.11b
Occupied Bandwidth	2412, 2437, 2462 MHz @ 1 Mbps
Output Power	2412, 2437, 2462 MHz @ 1 Mbps
Peak Power Spectral Density	2412, 2437, 2462 MHz @ 1 Mbps
Out-of-Band (-20 dBr)	2412, 2437, 2462 MHz @ 11 Mbps
Band-Edge (Radiated)	2412, and 2462 MHz @ 1 Mbps
Transmitted Spurious Emission	2412, 2437, 2462 MHz @ 1 Mbps
Received Spurious Emission	2437 MHz
AC Conducted Emission	2437 MHz @ 1 Mbps

6.4 Test Specifications

Testing requirements

Table 18: Test Specifications

Emissions and Immunity	
Standard	Requirement
CFR 47 Part 15.247: 2009	All
RSS 210 Issue 8, 2010	All

END OF REPORT