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January 23, 2015

Sanchali Deb
Ingersoll Rand
6200 Troup Highway
Tyler, TX 75701

Sanchali:

Thank you for allowing Professional Testing (EMI), Inc. an opportunity to perform testing for Ingersoll Rand. Enclosed is the Wireless Certification Report for the AZONE950AC52Z. This report can be used to demonstrate compliance with requirements for wireless devices in North America.

If you have any questions, please contact me.

Sincerely,

Jeffrey A. Lenk
President

Attachment

Project 16536-15

Ingersoll Rand
AZONE950AC52Z
TZONE950AC52Z

Wireless Certification Report

Prepared for:

Sanchali Deb
Ingersoll Rand
6200 Troup Highway
Tyler, TX 75701

By

Professional Testing (EMI), Inc.
1601 North A.W. Grimes Blvd., Suite B
Round Rock, Texas 78665

January 23, 2015

Reviewed by

A handwritten signature in black ink, appearing to read 'Larry Finn'.

Larry Finn
Chief Technical Officer

Written by

A handwritten signature in black ink, appearing to read 'Eric Lifsey'.

Eric Lifsey
Test Engineer

Revision History

Revision Number	Description	Date
00	Draft for client and internal review.	January 19, 2015
01	Draft revised with client and internal review changes.	January 20, 2015
02	Draft revised with new model information.	January 23, 2015
02	Released.	January 26, 2015
03	Revised per comments of TCB.	January 28, 2015

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NOTICE: (1) This Report must not be used to claim product endorsement, by NVLAP, NIST, the FCC or any other Agency. This report also does not warrant certification by NVLAP or NIST. (2) This report shall not be reproduced except in full, without the written approval of Professional Testing (EMI), Inc. (3) The significance of this report is dependent on the representative character of the test sample submitted for evaluation and the results apply only in reference to the sample tested. The manufacturer must continuously implement the changes shown herein to attain and maintain the required degree of compliance.



Compliance Certificate

Applicant	Device & Test Identification
Sanchali Deb 6200 Troup Highway Tyler, TX 75701 Certificate Date: January 20, 2015	FCC ID: XVRZONE950B Industry Canada ID: 6178D-ZONE950B Model(s): AZONE950AC52Z, TZONE950AC52Z Laboratory Project ID: 16536-15

The device named above was tested utilizing the following documents and found to be in compliance with the required criteria:

Standard	Reference	Detail
FCC 47 CFR Part 15 C	15.247	Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
FCC 47 CFR Part 15 C	15.209	Radiated emission limits; general requirements.
FCC 47 CFR Part 15 C	15.207	Conducted emission limits.
FCC 47 CFR Part 15 C	15.205	Restricted Bands of Operation
KDB 558074 D01	DR01	DTS Measurement Guidance v03r02
KDB 412172	D01	Guidelines for Determining the ERP and EIRP of an RF Transmitting System
OET Bulletin 65*	Edition 97-01, and Supplement C, Ed. 01-01	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
RSS-210	Issue 8	Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
RSS-Gen	Issue 4	General Requirements and Information for the Certification of Radio Apparatus
RSS-102	Issue 4	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

*MPE is reported separately from this document.

I, Eric Lifsey, for Professional Testing (EMI), Inc., being familiar with the above rules and test procedures have reviewed the test setup, measured data, and this report. I believe them to be true and accurate.

Eric Lifsey
EMC Engineer

This report has been reviewed and accepted by the Applicant. The undersigned is responsible for ensuring that this device will continue to comply with the rules listed above.

Representative of Applicant

1.0 Introduction

1.1 Scope

This report describes the extent to which the equipment under test (EUT) conformed to the intentional radiator requirements of the United States and Canada.

Professional Testing (EMI), Inc., (PTI) follows the guidelines of National Institute of Standards and Technology (NIST) for all uncertainty calculations, estimates, and expressions thereof for electromagnetic compatibility testing. The procedures of ANSI C63.4: 2009 were used for making all radiated enclosure and mains emission measurements.

1.2 EUT Description

Table 1.2.1: Equipment Under Test		
Manufacturer / Model	Serial #	Description
Ingersoll Rand / AZONE950AC52Z*	1450AX2139	2400-2483.5 MHz transceiver for smart HVAC thermostat.

*Includes electrically identical model TZONE950AC52Z.

Table 1.2.2: Support Equipment		
Manufacturer / Model	Serial #	Description
Trane / BAY24VRPAC52DBA	1418WR2900	Relay panel, for exercising EUT I/O ports.
Philmore / TR241	None	AC transformer, 100-120 VAC Input, 12V+12V AC Output (24 VAC for entire system.)
Trane / ZZSENSAL0400AAA	None	Indoor temperature sensor, wired.
Trane / BAYSEN01ATEMPAA	None	Outdoor temperature sensor, wired.

This device is a smart thermostat for monitoring room air and the control of heating and/or cooling systems by wire. It is accessible by wireless (WiFi) means or direct control via the front touch screen. The antenna for the radio section is a printed circuit inverted-F antenna type etched in the circuit board and not subject to user modification. The models listed above are electrically identical.

The EUT measures approximately 185 x 120 x 30 cm and is designed for wall mounting. It is powered by a 24 VAC transformer.

1.3 EUT Operation

The EUT was exercised in a manner consistent with normal operations. A fixture composed of cardboard was used to support the EUT and its mounting bracket in a normal vertical orientation. The EUT was operated in unmodulated CW mode for measurements of power and spurious emissions.

Note that Zigbee chip U8 is populated but only used as an analog to digital converter; its wireless functions are disabled. All RF functions are performed by the WiFi chip U16.

1.4 Modifications to Equipment

No modifications were made to the EUT during the performance of the test program.

1.5 Test Site

Measurements were made at the PTI semi-anechoic facility designated Site 45 (FCC 459644, IC 3036B-1) in Austin, Texas. The site is registered with the FCC under Section 2.948 and Industry Canada per RSS-GEN, and is subsequently confirmed by laboratory accreditation (NVLAP). The test site is located at 11400 Burnet Road, Austin, Texas 78758, while the main office is located at 1601 North A.W. Grimes Boulevard, Suite B, Round Rock, Texas, 78665.

1.6 Applicable Documents and Clauses

Table 1.6.1: Applicable Documents	
Document	Title
47 CFR	Part 15 – Radio Frequency Devices Subpart C -Intentional Radiators
RSS-210 Issue 8	Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
RSS-Gen Issue 4	General Requirements and Information for the Certification of Radio Apparatus
ANSI C63.4 2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment

Table 1.6.2: Applicable Clauses		
Parameter	FCC Part 15 Rule Paragraphs	IC RSS References
Transmitter Characteristics	15.247	RSS 210 A2.9, RSS-Gen
Power Spectral Density	15.247e	RSS 210 A2.9
Bandwidth	15.247(a)(2), 2.1049, KDB 558074 D01	RSS-Gen 4.6
Spurious Radiated Power	15.247, 15.209, 15.205	RSS 210 A1.1, RSS-GEN 4.9, 4.10
Band Edge	15.274, 15.205	RSS-Gen 4.9
Antenna Requirement	15.203	RSS-Gen
Conducted Emissions, Mains	15.207	RSS-Gen

2.0 Fundamental Power

2.1 Test Procedure

Modulation is disabled and peak power is measured using radiated means.

2.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date
15.247(a)(3) // RSS-210 Issue 8, A2.9	Fundamental Power Conducted Limit: 1 Watt	2015-01-12

2.3 Test Results

The EUT has no antenna port or connector so power was measured as a radiated field. The EUT designed for wall-mounting only.

<p>Fundamental Power Measured as Field Strength Conducted Limit 1 Watt (30 dBm) Restated as Radiated Limit 125.23 dBμV/m at 3 meters</p>

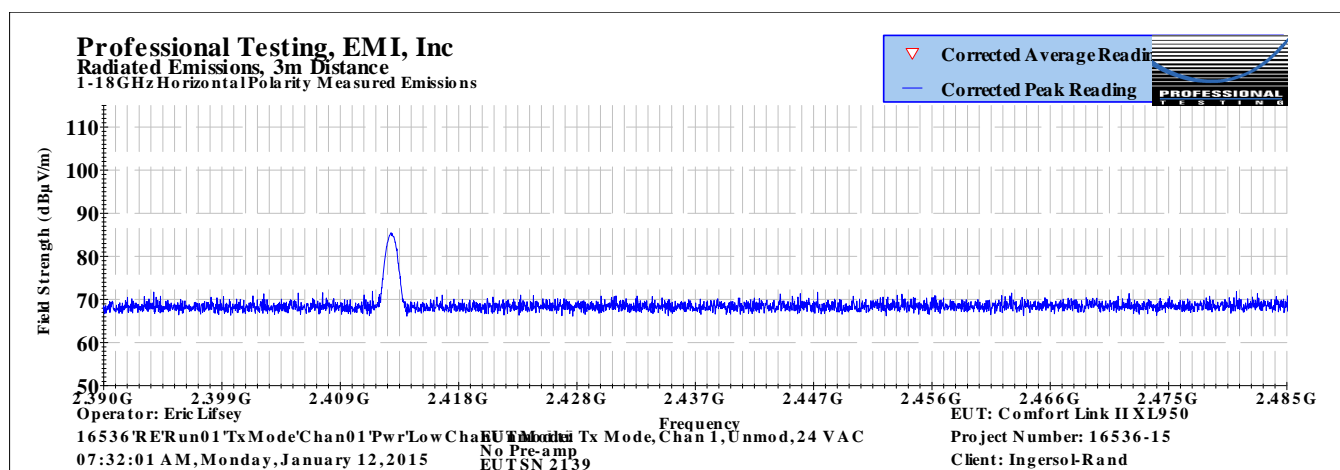
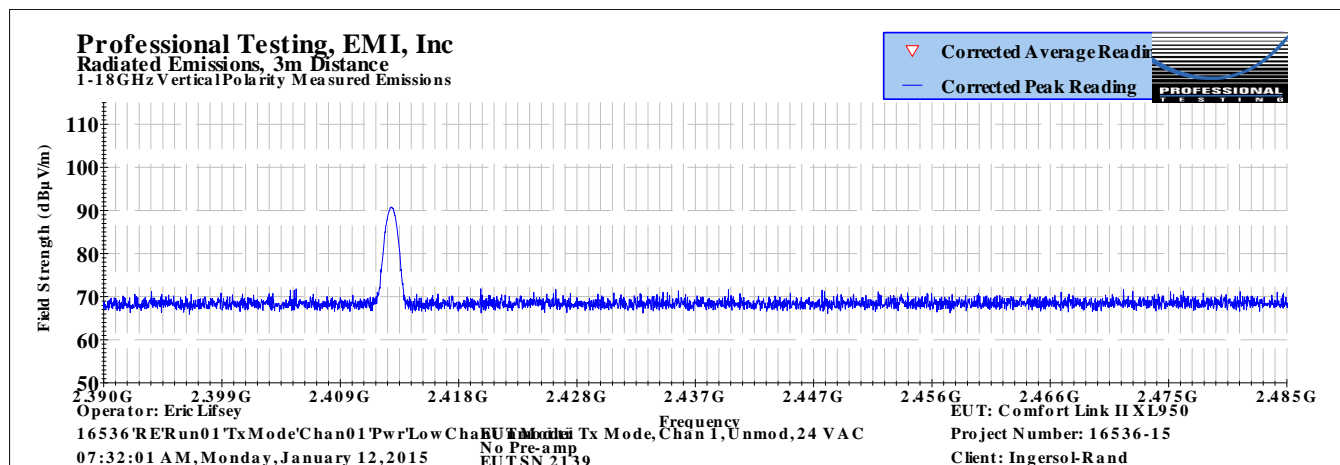
Table 2.3.1 Field Strength, Maximum Polarity Per Channel		
Frequency (MHz)	Maximum Power Polarity	Measured Peak Power (dBμV/m)
2412	Vertical	90.8
2437	Vertical	89.3
2462	Vertical	89.3

Measured in 1 MHz RBW, 3 MHz VBW.

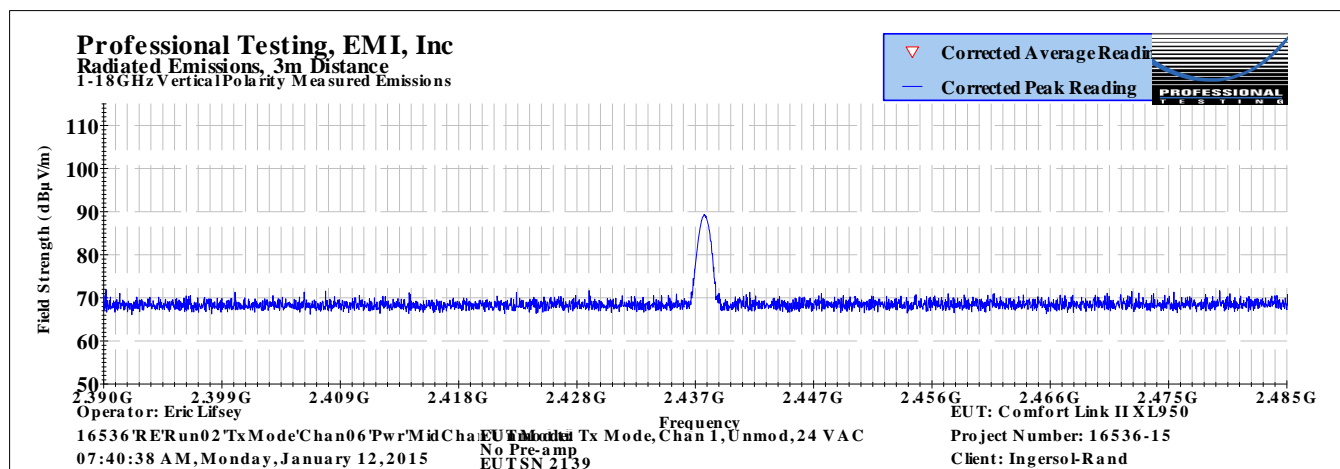
Table 2.3.2 Maximum Power Restated as EIRP, Linear Units
Calculated EIRP (mW)
0.361

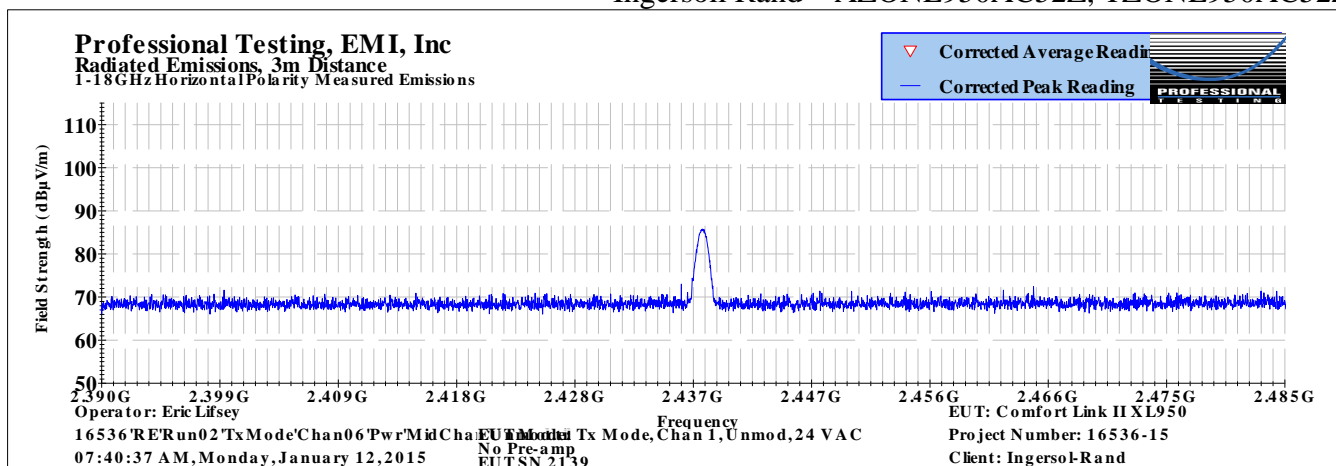
The EUT was found to be in compliance with the applicable criteria. Charted measurements appear below.

2.3.1 Low Channel

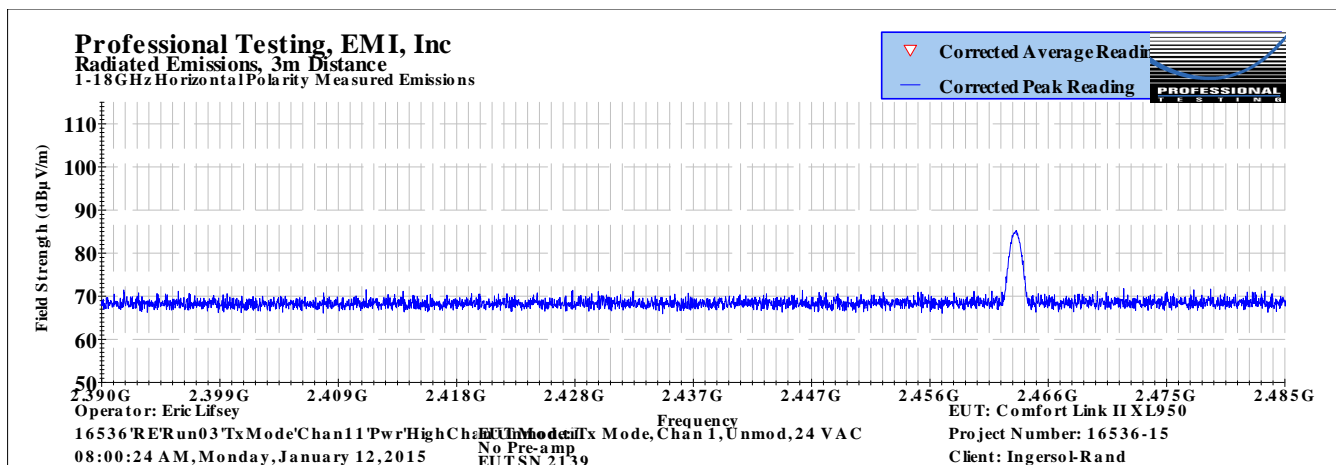
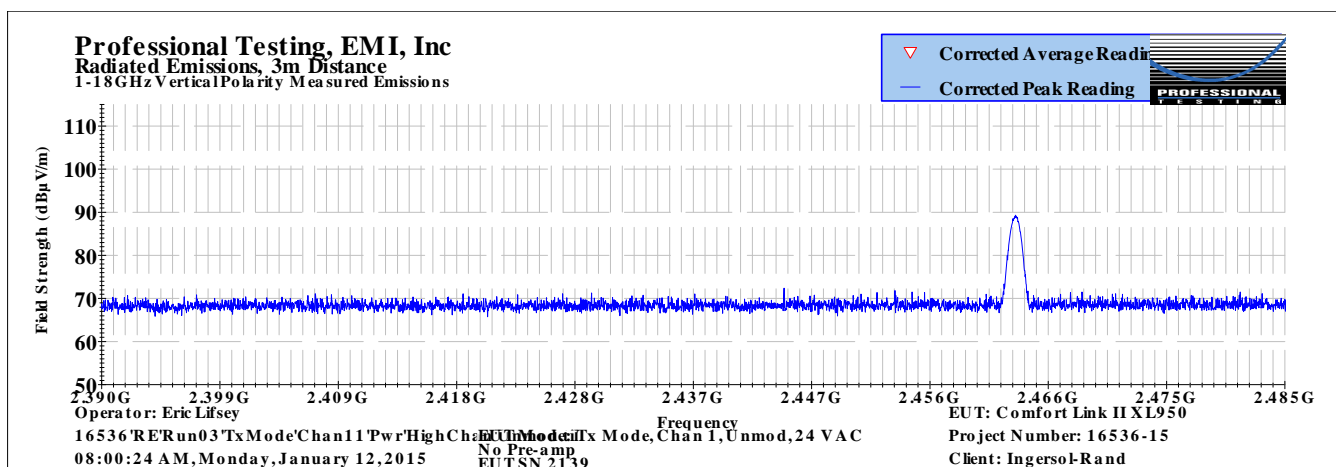


2.3.2 Middle Channel





2.3.3 High Channel



3.0 Power Spectral Density

3.1 Test Procedure

This procedure was found to be unnecessary as the peak power measured significantly lower than the power spectral density limit.

4.0 Transmitter Duty Cycle

4.1 Test Procedure

This measurement was not needed due to the low transmitter power.

5.0 Occupied Bandwidth

5.1 Test Procedure

Bandwidth is measured by radiated means. A recording of the results is included.

5.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
14.247(a)(2), 2.1049, KDB 558074 D01 // RSS-Gen Issue 4, 4.6	Bandwidth, 6 dB, 20 dB	2015-01-12

5.3 Test Results

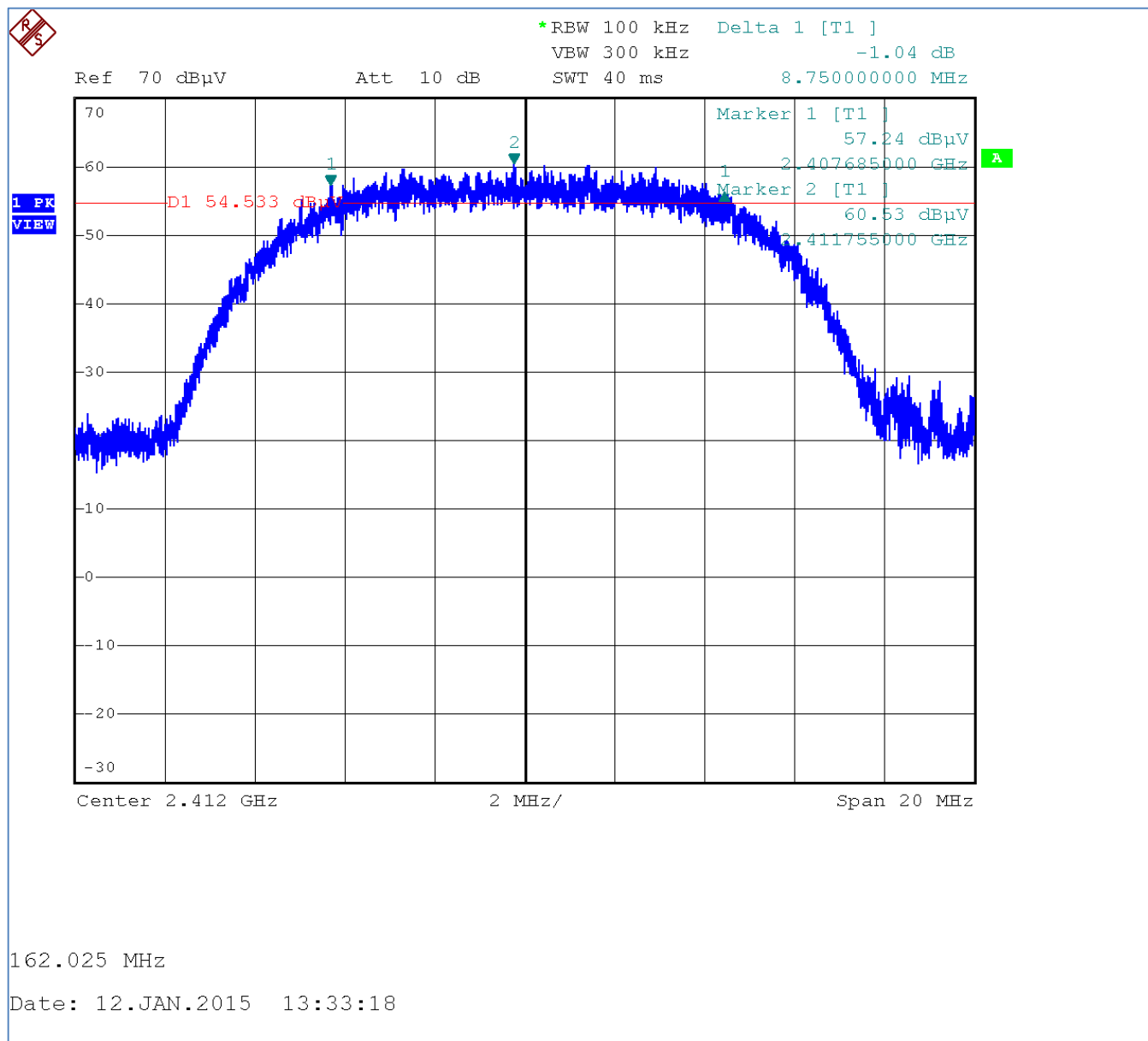
Bandwidth was measured at the highest data rate mode of each modulation mode. EUT was found to be in compliance with applicable requirements.

Table 5.3.1 Bandwidth 6 dB, Minimum 500 kHz			
Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	Minimum BW (kHz)
Modulation DSSS 802.11b			
8750	8750	8948	8750
Modulation OFDM 802.11g			
16250	16360	16360	16250

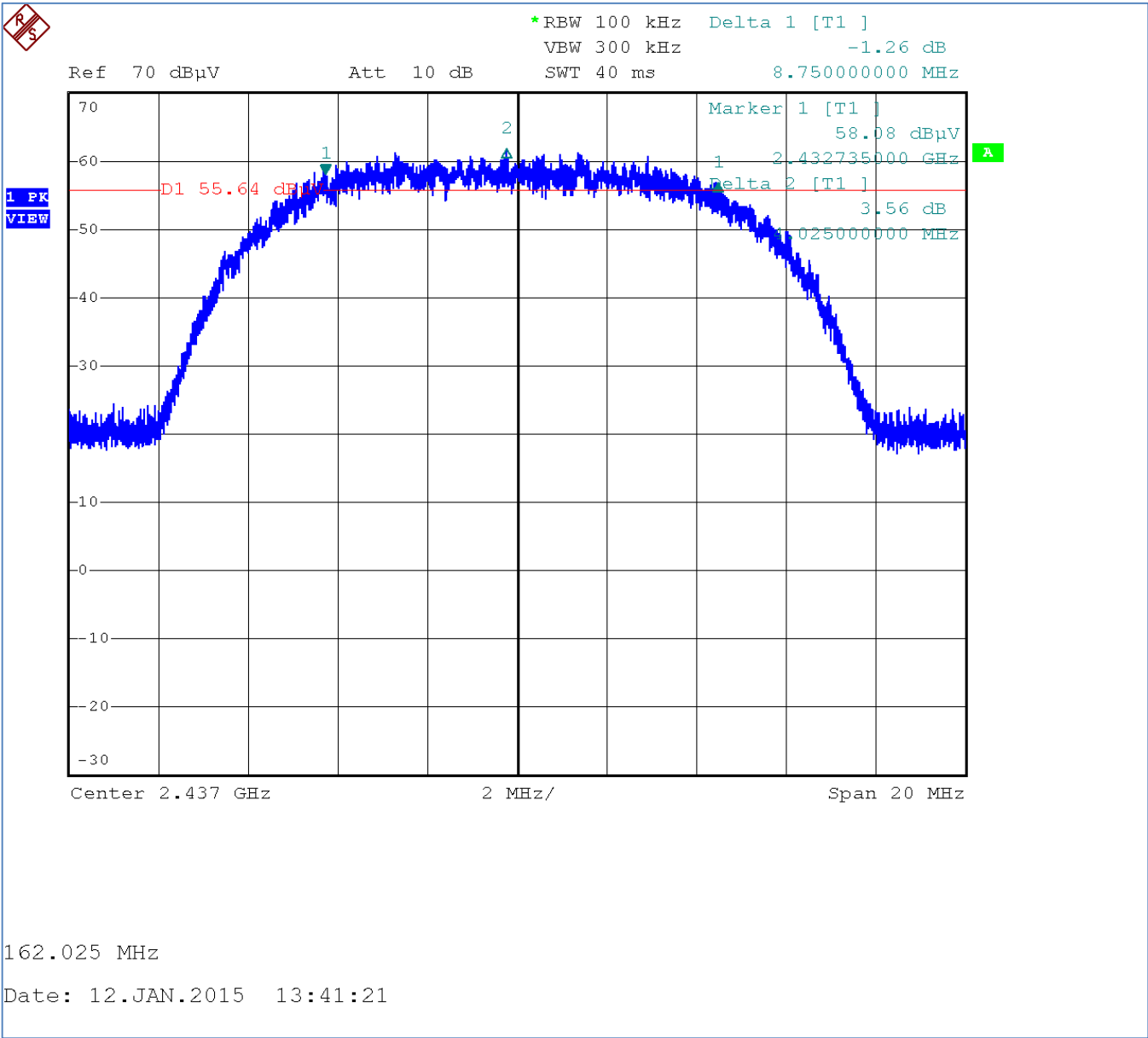
Table 5.3.2 Bandwidth 20 dB, Measure and Report			
Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	Reported Maximum BW (kHz)
Modulation DSSS 802.11b			
13600	13600	13680	13680
Modulation OFDM 802.11g			
19040	18680	18960	19040

Plotted measurements appear on the following pages.

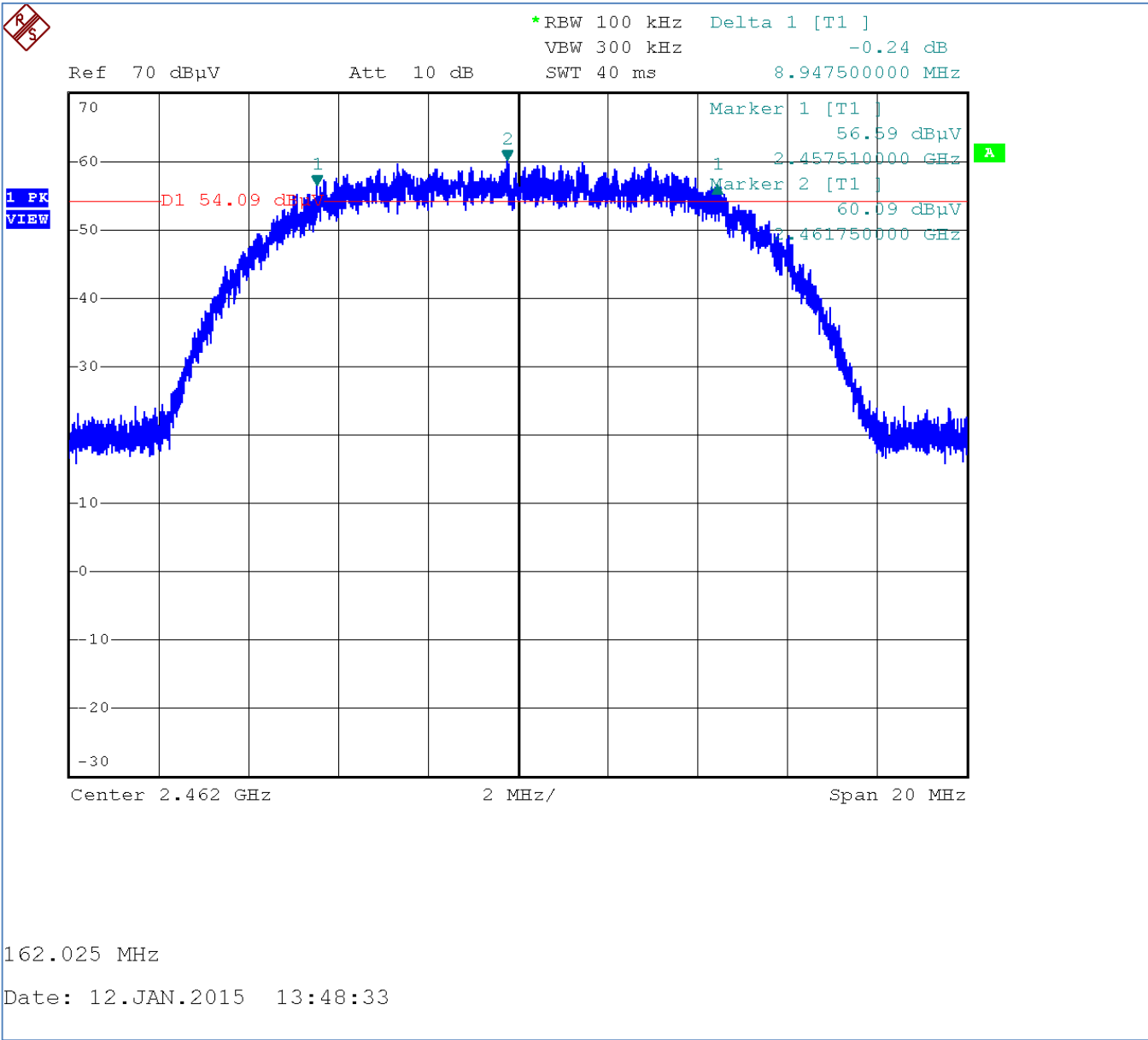
5.3.1 Bandwidth Plots, DSSS 802.11b, 6 dB



6 dB, Low Channel

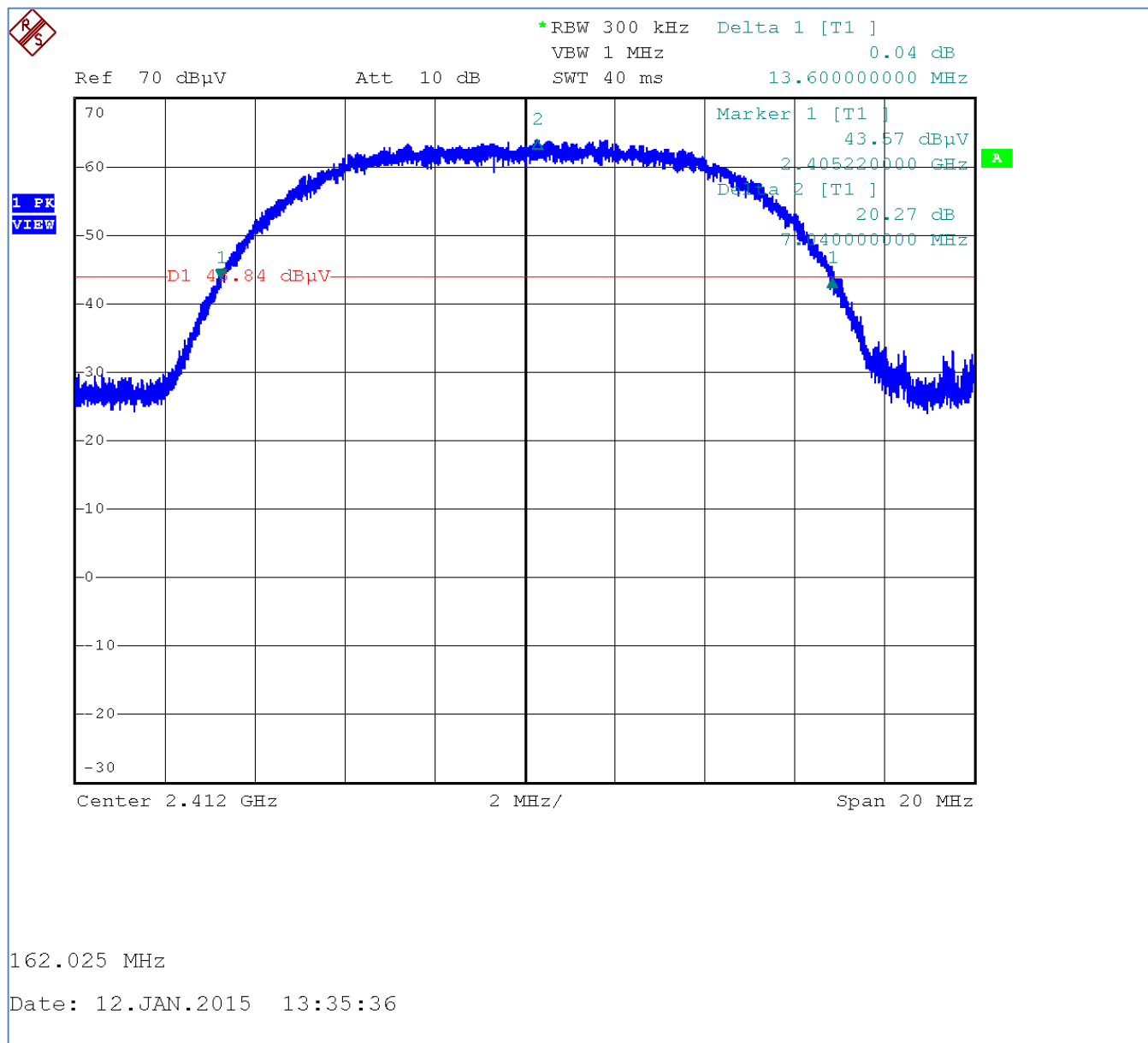


6 dB, Middle Channel

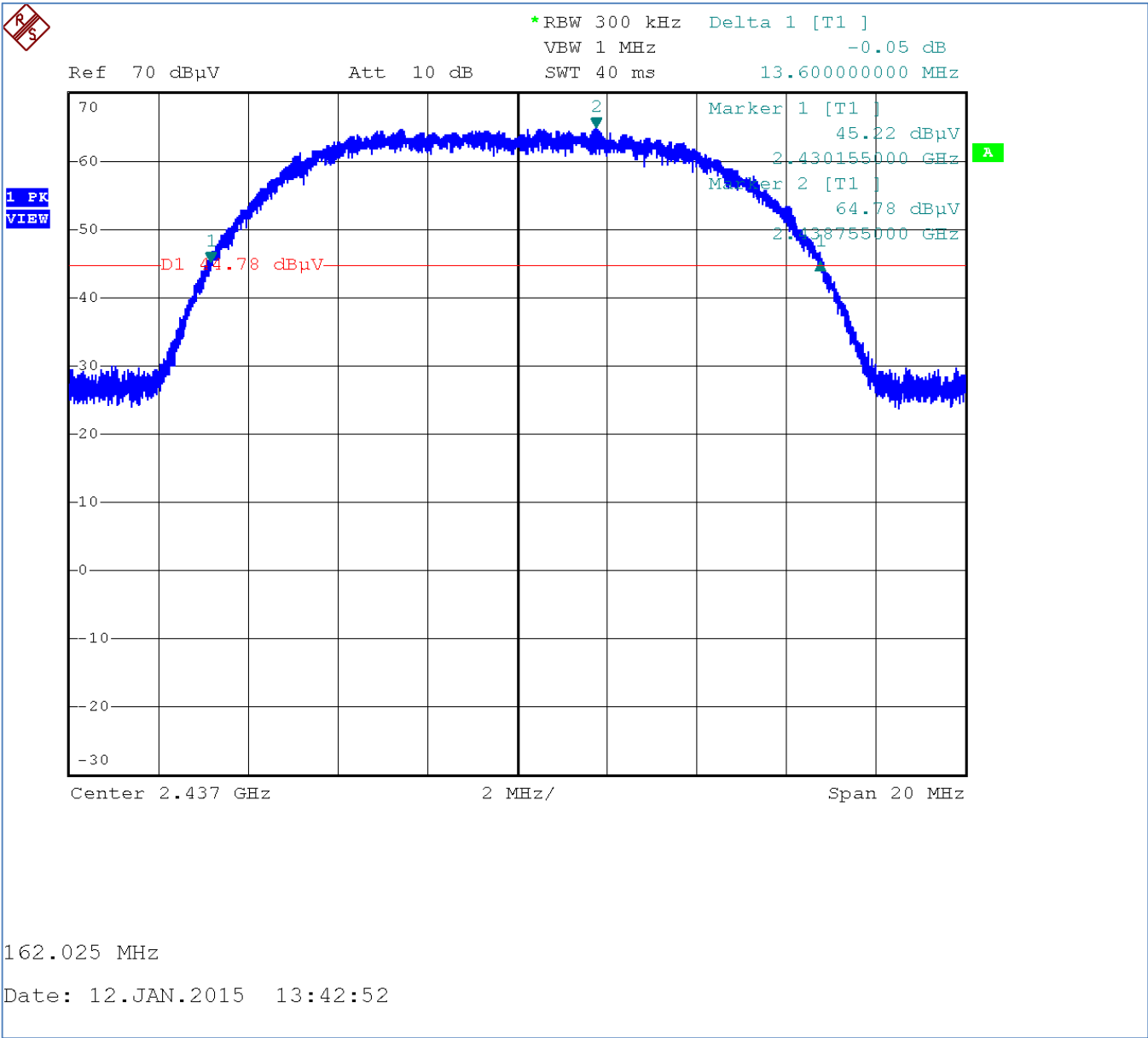


6 dB, High Channel

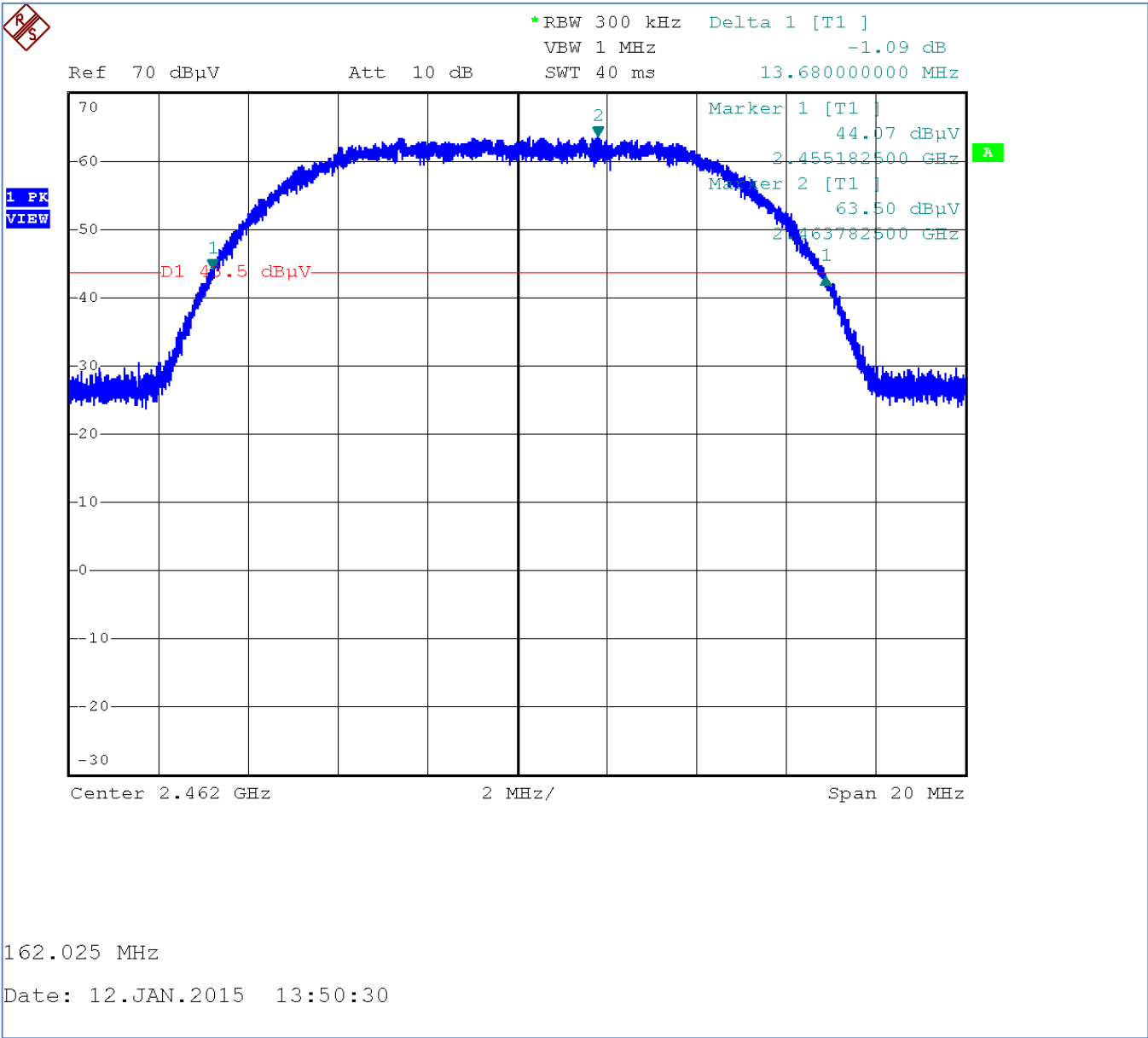
5.3.2 Bandwidth Plots, DSSS 802.11b, 20 dB



20 dB, Low Channel

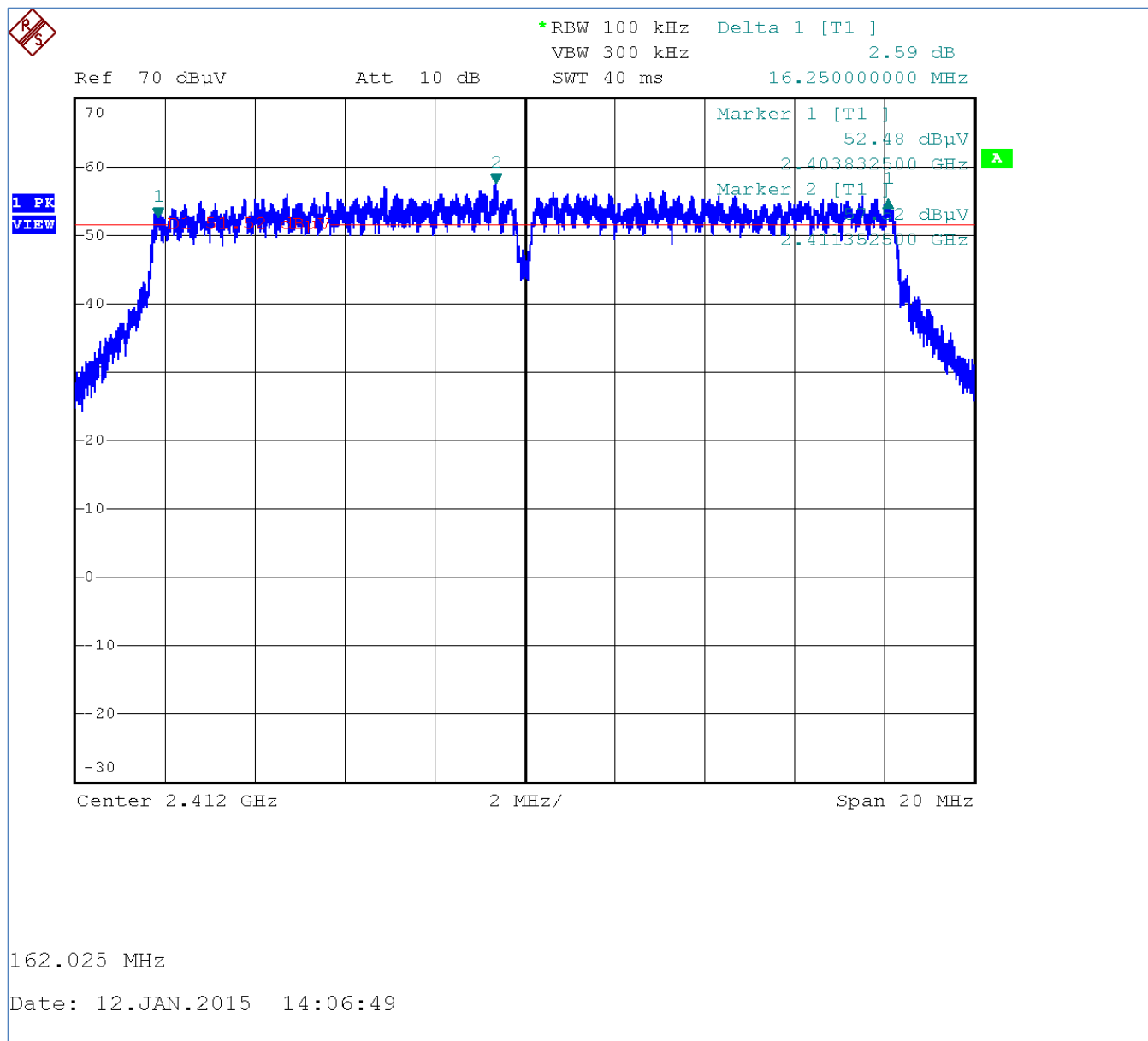


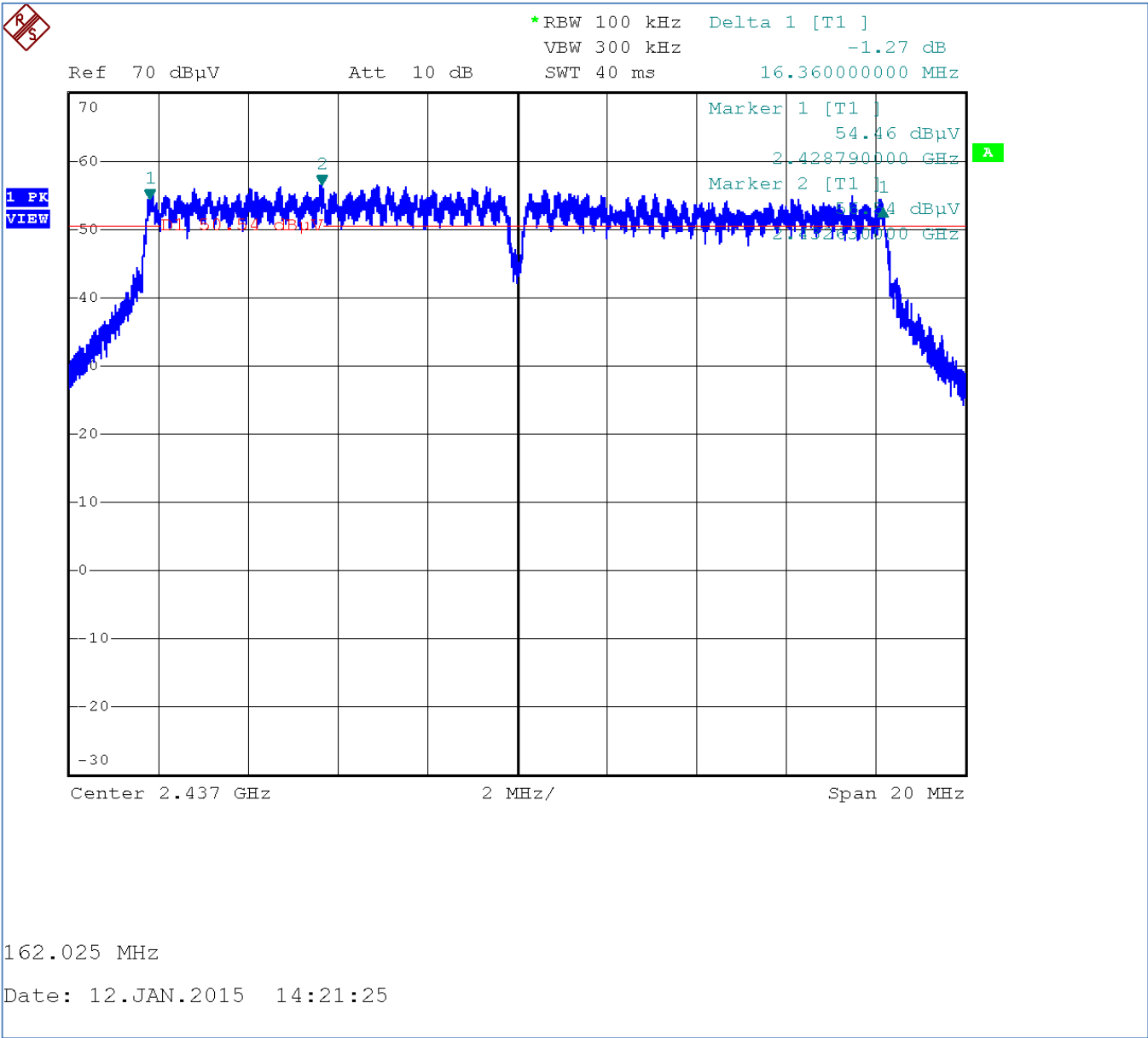
20 dB, Middle Channel



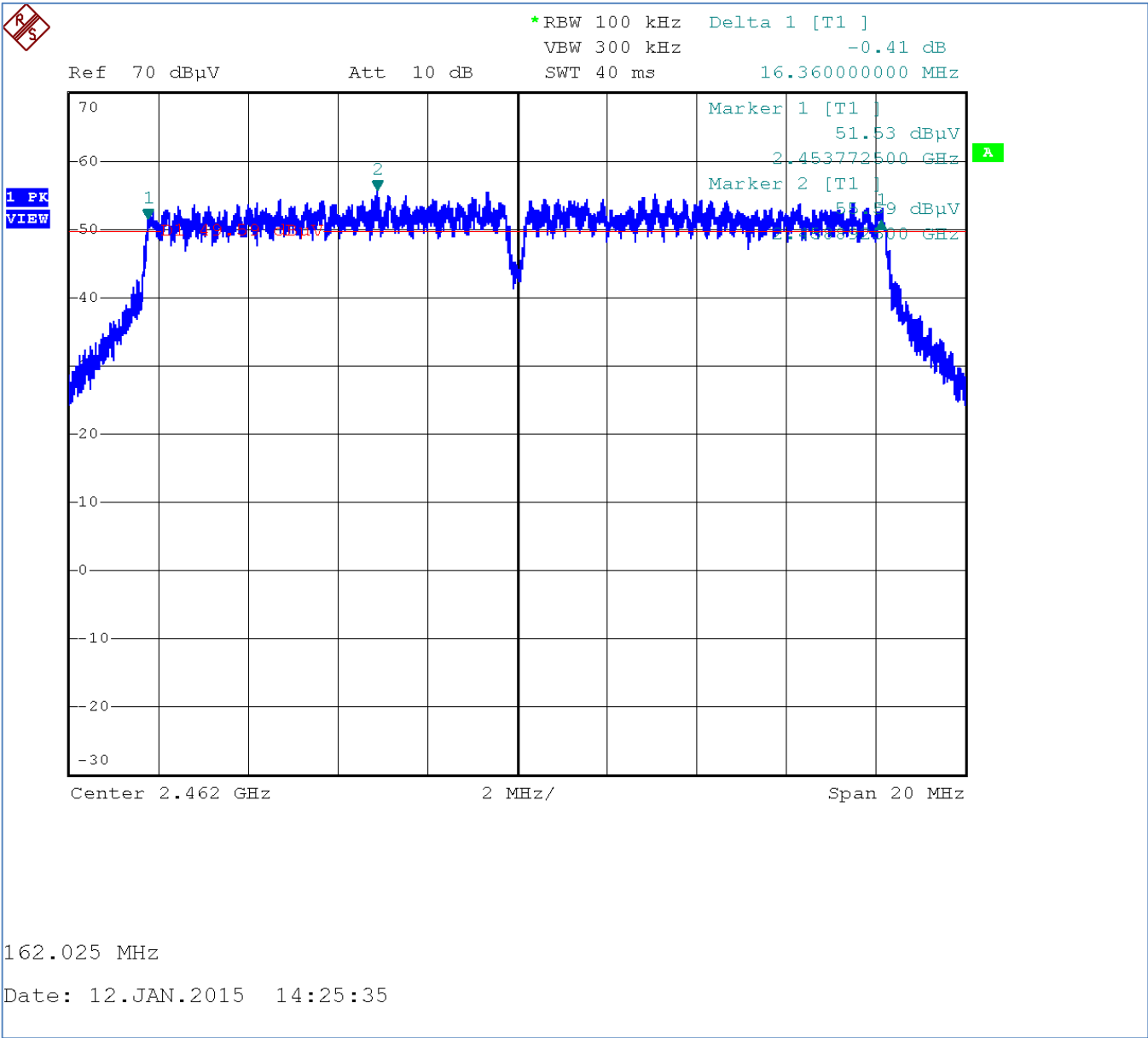
20 dB, High Channel

5.3.3 Bandwidth Plots, OFDM 802.11g, 6 dB



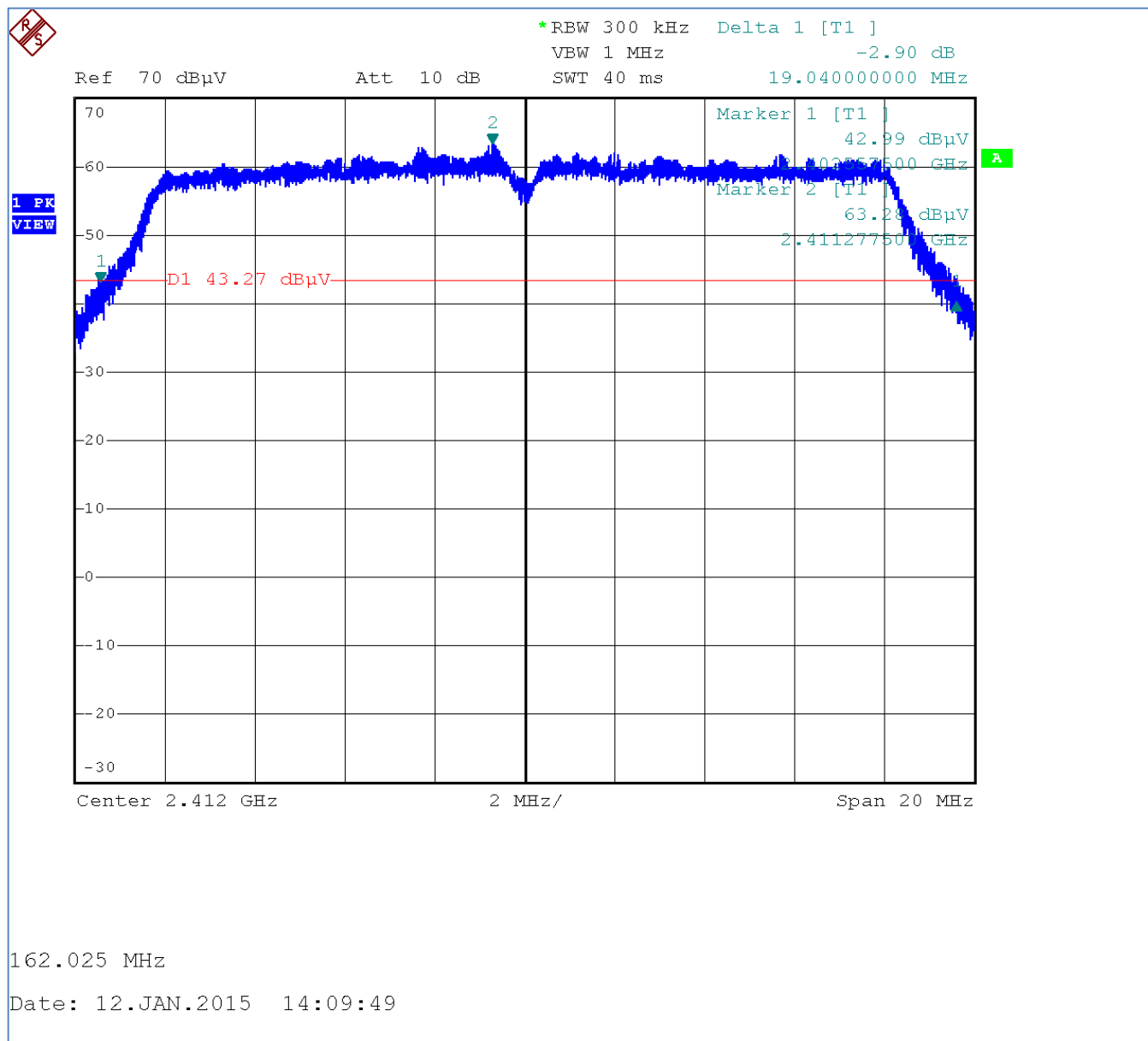


6 dB, Middle Channel

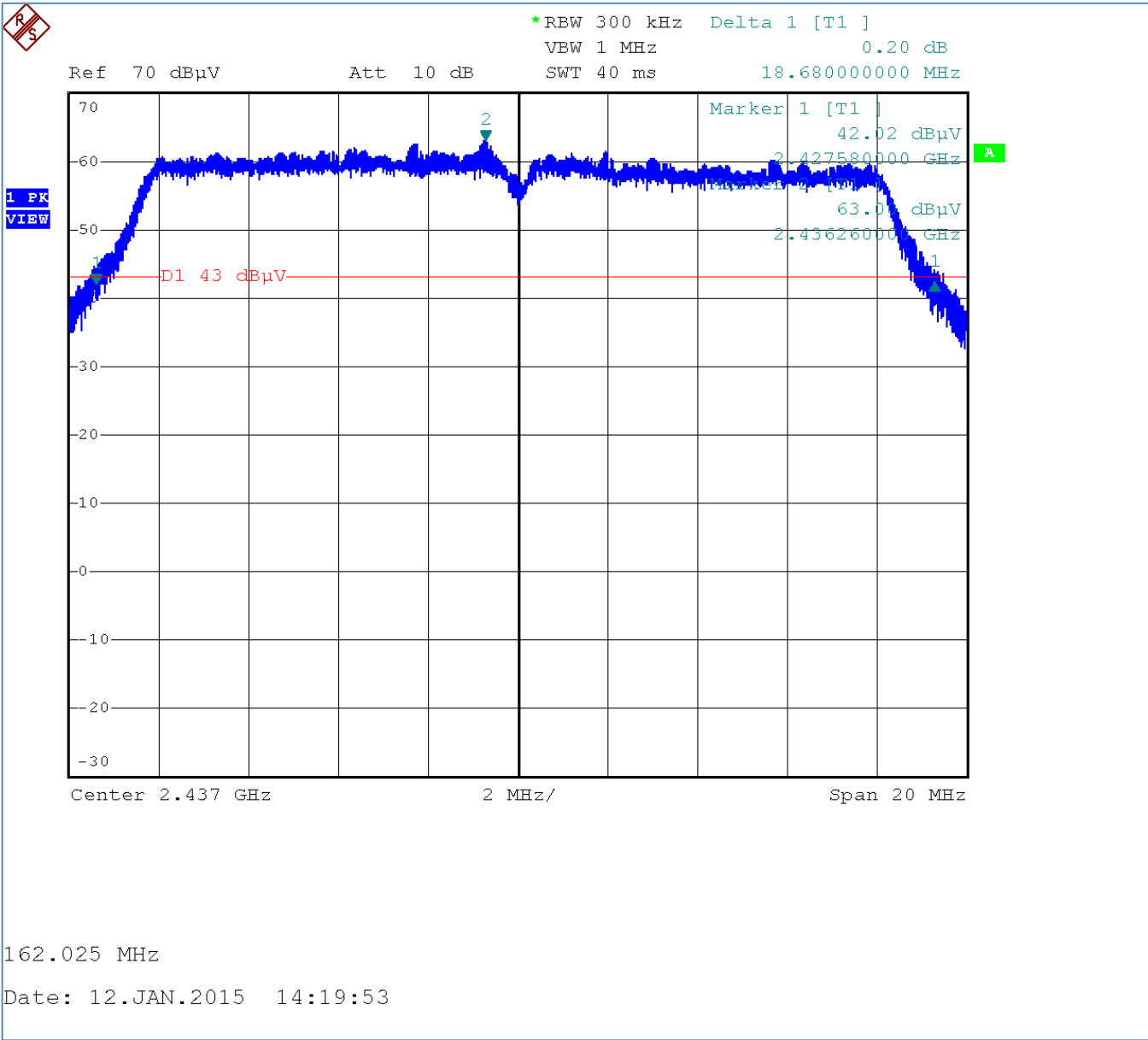


6 dB, High Channel

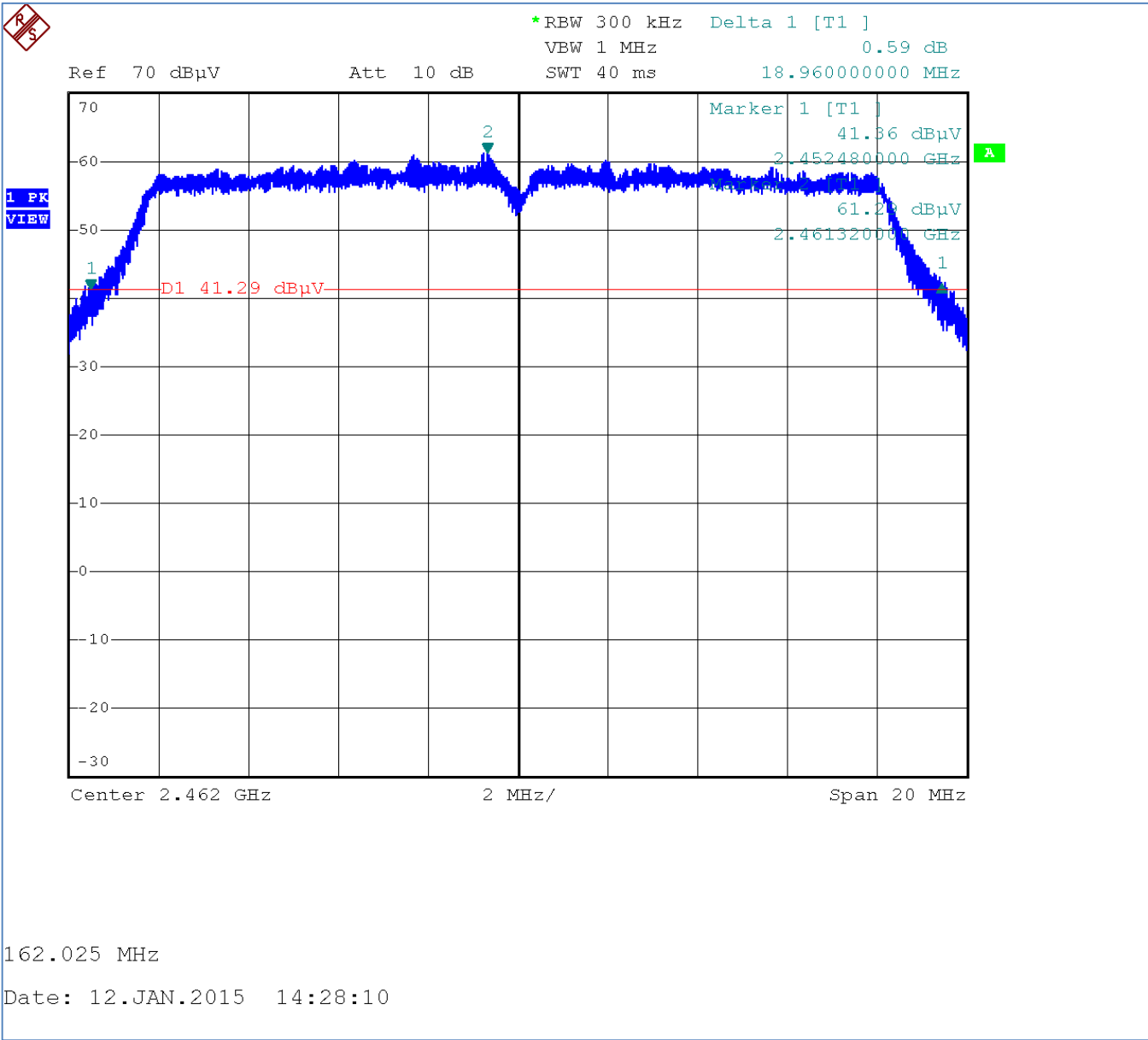
5.3.4 Bandwidth Plots, OFDM 802.11g, 20 dB



20 dB, Low Channel



20 dB, Middle Channel



20 dB, High Channel

6.0 Band Edge

6.1 Test Procedure

EUT is placed into normal transmit operation on the nearest band edge channel. The spectrum analyzer is centered on the band edge frequency with span sufficient to include the peak of the adjacent fundamental signal. Measurement includes at least two standard bandwidths from the respective band edge. If required, the band-edge marker-delta method of C63.4 is utilized.

6.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.205 // RSS-Gen Issue 4, 4.9	Unwanted Emissions Adjacent to Authorized Band, Radiated	2015-01-12

6.3 Test Results

Measurements included more than 2 standard bandwidths (standard bandwidth 1 MHz) from the band edges to provide a clear view of the fundamental and the declining emission levels. Peak detection with max-hold was employed. Measurements were relative radiated at 1 meter with resulting deltas applied to the peak power measurements taken at 3 meters to determine corrected emission levels. Pre-amplification employed for best dynamic range. The general emission limits are applied using average limit 54 dBμV/m for 3 meters as that was the reference power measurement distance.

Table 6.3.1 Low Band Edge Relative to Final Calculation (Peak Detection), Limit 54 dBμV/m		
Measured Peak Power* (dBμV/m at 3m)	Measured Band Edge Delta (dB)	Corrected Band Edge Level (dBμV/m)
DSSS 802.11b		
90.8*	-50.48	39.52
OFDM 802.11g		
90.8*	-38.53	52.27

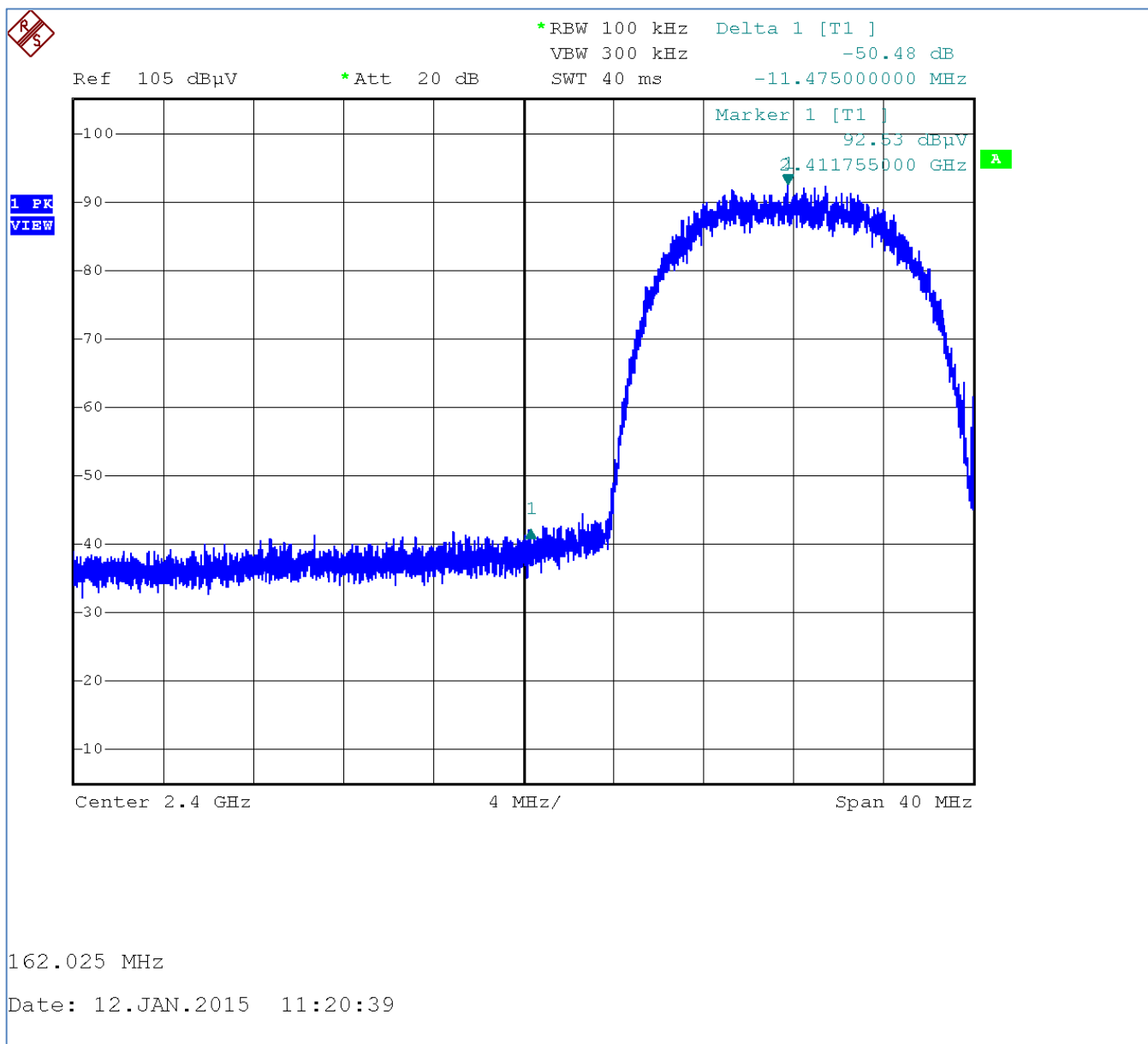
*From peak measurements in Section 2.0 Fundamental Power.

Table 6.3.2 High Band Edge Relative to Final Calculation (Peak Detection), Limit 54 dBμV/m		
Measured Peak Power* (dBμV/m at 3m)	Measured Band Edge Delta (dB)	Corrected Band Edge Level (dBμV/m)
DSSS 802.11b		
89.3*	-53.15	36.15
OFDM 802.11g		
89.3*	-52.36	36.94

*From peak measurements in Section 2.0 Fundamental Power.

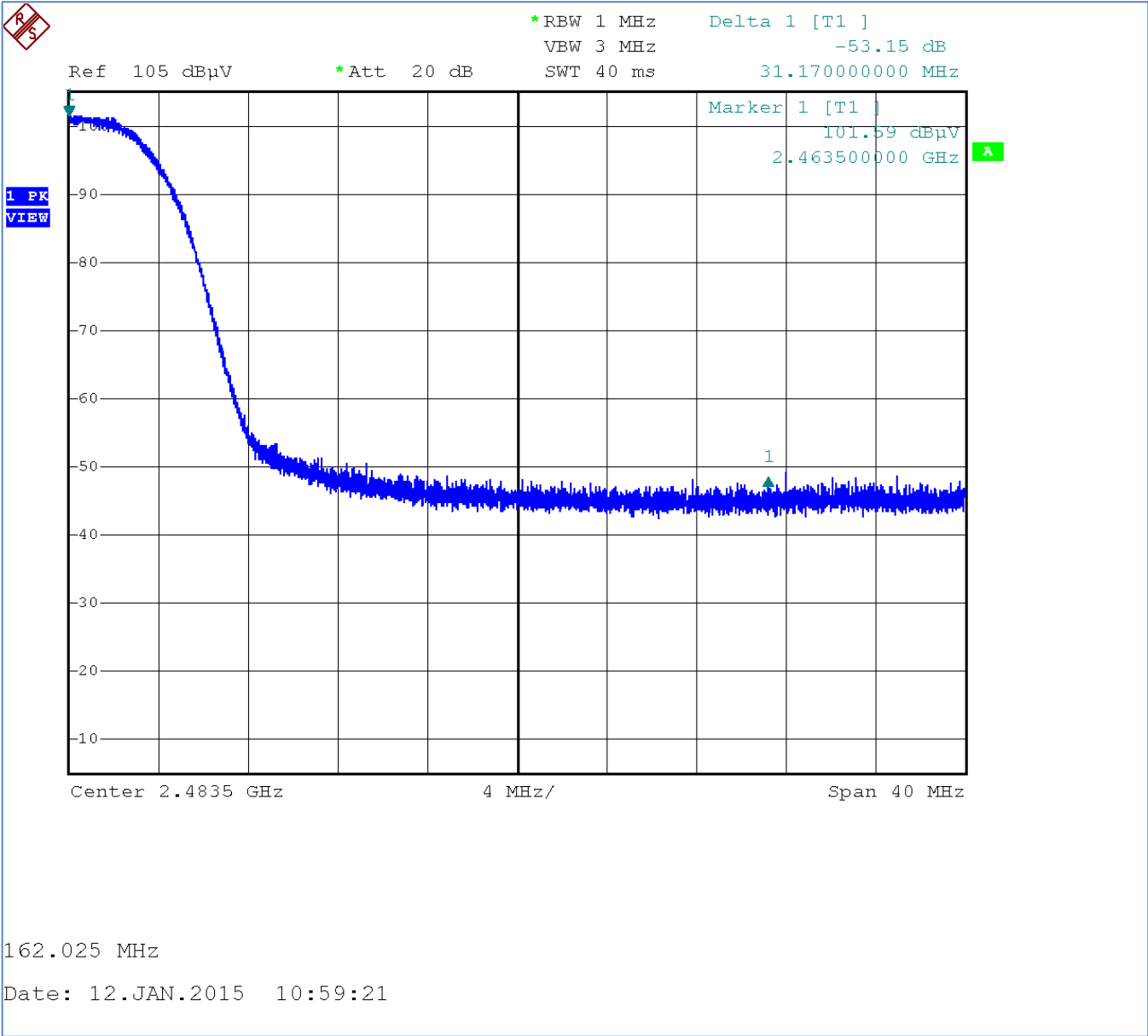
Peak detection of emissions at band edges were below the FCC 15.209 general emission limits. The EUT satisfied the criteria. Plotted results appears on the following pages.

6.3.1 Low Channel Band Edge, DSSS 802.11b



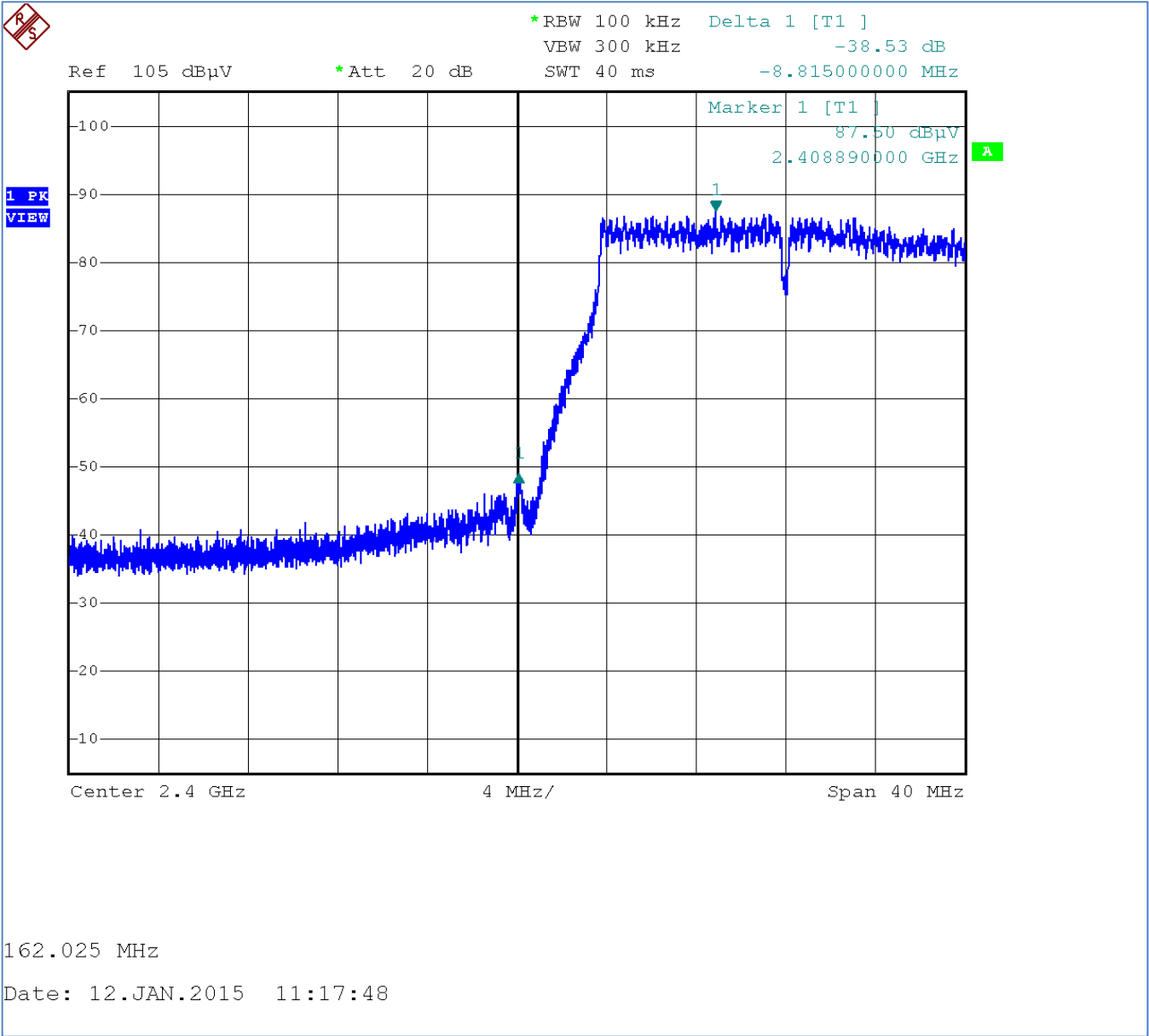
Band Edge Emission, Satisfies -20dBc and 15.209 Criteria

6.3.2 High Channel Band Edge, DSSS 802.11b



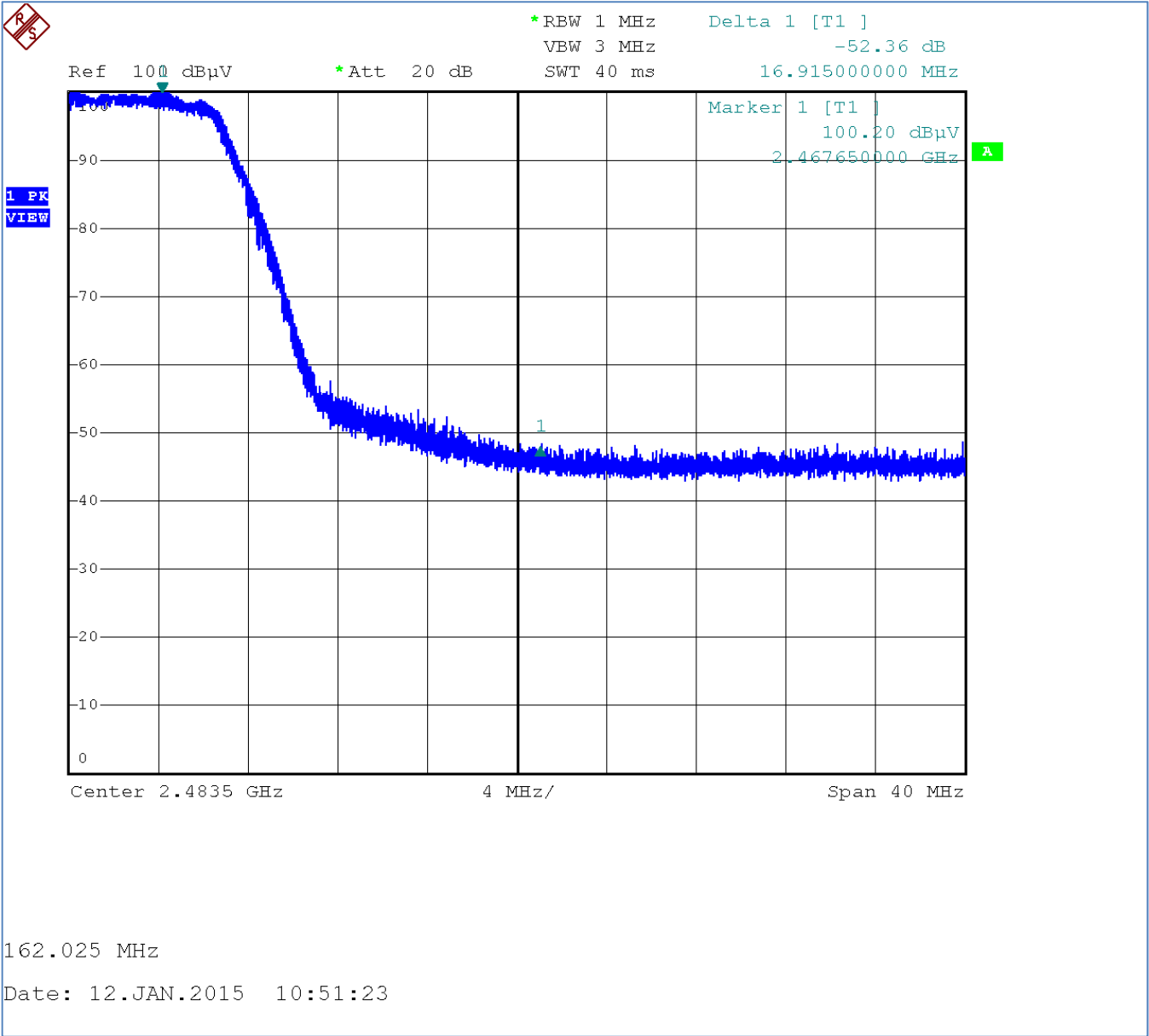
Band Edge Emission, Satisfies -20dBc and 15.209 Criteria

6.3.3 Low Channel Band Edge, OFDM 802.11g



Band Edge Emission, Satisfies -20dBc and 15.209 Criteria

6.3.4 High Channel Band Edge, OFDM 802.11g



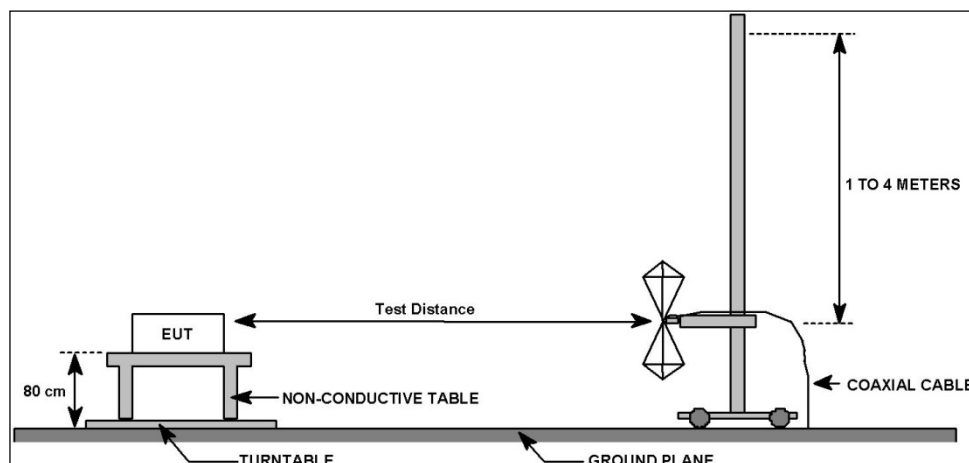
Band Edge Emission, Satisfies -20dBc and 15.209 Criteria

7.0 Radiated Spurious Emissions, Receive Mode

7.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The EUT was centered on a rotating turntable. Measurements below 1 GHz were taken at a test distance of 10 meters from the measurement antenna. Above 1 GHz the measurement distance was 3 meters.

Spurious emissions below 1 GHz were measured with quasi-peak detection with a resolution bandwidth of 120 kHz. Above 1 GHz peak measurements were taken and average measured where appropriate. A diagram showing the test setup appears below.



7.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.209 // RSS-Gen Issue 4, 4.9, 4.10	Field Strength of Radiated Spurious/Harmonic Emissions Receive Mode	2014-12-23

7.3 Test Results

The EUT was tuned to the middle channel and placed in receive mode.

The EUT satisfied the criteria. Recorded data is presented below.

Table 7.3.1: Radiated Spurious Emissions, Receive Mode, Below 1 GHz, Vertical Polarity

Professional Testing, EMI, Inc.									
Test Method:		ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).							
In accordance with:		FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits							
Section:		15.109							
Test Date(s):		12/23/2014			EUT Serial #:		1450AX2139		
Customer:		Ingersol-Rand			EUT Part #:		XL950		
Project Number:		16536-15			Test Technician:		Eric Lifsey		
Purchase Order #:		0			Supervisor:		Lisa Arndt		
Equip. Under Test:		Comfort Link II			Witness' Name:		John Hughes		
Radiated Emissions Test Results Data Sheet							Page: 1 of 1		
EUT Line Voltage:		24 VAC		EUT Power Frequency:		60 Hz			
Antenna Orientation:		Vertical			Frequency Range:		30MHz to 1GHz		
EUT Mode of Operation:					Receive Mode				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
39.3789	10	65	1.56	Quasi-peak	39.2	23.572	30.0	-6.4	Pass
54.4495	10	210	1.54	Quasi-peak	40.8	20.838	30.0	-9.2	Pass
133.012	10	184	1.64	Quasi-peak	45.1	25.27	33.0	-7.7	Pass
200.214	10	234	1.26	Quasi-peak	42.6	26.715	33.0	-6.3	Pass
785.618	10	58	2.71	Quasi-peak	21.7	21.317	37.0	-15.7	Pass
912.801	10	260	3.17	Quasi-peak	21.2	23.153	37.0	-13.8	Pass

Professional Testing, EMI, Inc

Radiated Emissions, 10m Distance

30MHz - 1GHz Vertical Polarity Measured Emissions

Quasi-peak Limit Level

Corrected Quasi-peak Reading

Peak Limit Level

Corrected Peak Value

Verified Low-PRE QP Reading

Operator: Eric Lifsey

16536 RERun05 RxModel.fl

08:30:02 AM, Tuesday, December 23, 2014

EUT Mode: Receive

EUT Power: 24 VAC

Support equipment on table.

EUT: Comfort Link II XL950

Project Number: 16536-15

Client: Ingersol-Rand

≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 7.3.2: Radiated Spurious Emissions, Receive Mode, Below 1 GHz, Horizontal Polarity

Professional Testing, EMI, Inc.										
Test Method:		ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).								
In accordance with:		FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits								
Section:		15.109								
Test Date(s):		12/23/2014			EUT Serial #:		1450AX2139			
Customer:		Ingersol-Rand			EUT Part #:		XL950			
Project Number:		16536-15			Test Technician:		Eric Lifsey			
Purchase Order #:		0			Supervisor:		Lisa Arndt			
Equip. Under Test:		Comfort Link II			Witness' Name:		John Hughes			
Radiated Emissions Test Results Data Sheet							Page: 1 of 1			
EUT Line Voltage:		24		VAC		EUT Power Frequency:		60		Hz
Antenna Orientation:		Horizontal				Frequency Range:		30MHz to 1GHz		
EUT Mode of Operation:					Receive Mode					
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results	
31.5527	10	3	2.03	Quasi-peak	24.2	12.733	30.0	-17.3	Pass	
133.033	10	242	3.88	Quasi-peak	44.7	24.869	33.0	-8.1	Pass	
182.867	10	349	3.63	Quasi-peak	44.2	27.992	33.0	-5.0	Pass	
199.48	10	240	3.14	Quasi-peak	43.3	27.409	33.0	-5.6	Pass	
398.999	10	305	1.74	Quasi-peak	42.6	34.092	37.0	-2.9	Pass	

Professional Testing, EMI, Inc

Radiated Emissions, 10m Distance

30MHz - 1GHz Horizontal Polarity Measured Emissions

— Quasi-peak Limit Level

▽ Corrected Quasi-peak Reading

— Peak Limit Level

— Corrected Peak Value

▽ Verified Low-PRE QP Reading

PROFESSIONAL TESTING

Operator: Eric Lifsey

16536'RERun05'RxModel

08:30:02 AM, Tuesday, December 23, 2014

EUT Mode: Receive

EUT Power: 24 VAC

Support equipment on table.

EUT: Comfort Link II XL950

Project Number: 16536-15

Client: Ingersol-Rand

≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 7.3.3: Radiated Spurious Emissions, Receive Mode, Above 1 GHz, Vertical Polarity

Professional Testing, EMI, Inc.									
Test Method:		ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).							
In accordance with:		FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits							
Section:		15.109							
Test Date(s):		12/23/2014		EUT Serial #:		1450AX2139			
Customer:		Ingersoll-Rand		EUT Part #:		XL950			
Project Number:		16536-15		Test Technician:		Eric Lifsey			
Purchase Order #:		0		Supervisor:		Lisa Arndt			
Equip. Under Test:		Comfort Link II		Witness' Name:		John Hughes			
Radiated Emissions Test Results Data Sheet								Page: 1 of 1	
EUT Line Voltage:		24 VAC		EUT Power Frequency:		60 Hz			
Antenna Orientation:		Vertical		Frequency Range:		Above 1GHz			
EUT Mode of Operation:					Receive Mode				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1063.85	3	31	0	Average	39.3	25.609	54.0	-28.4	Pass
2114.74	3	345	0	Average	35.6	25.531	54.0	-28.5	Pass
4834.84	3	325	0	Average	33.6	27.754	54.0	-26.2	Pass
6333.11	3	149	0	Average	30.3	28.795	54.0	-25.2	Pass
9648	3	291	0	Average	26.6	31.556	54.0	-22.4	Pass

Professional Testing, EMI, Inc
Radiated Emissions, 3m Distance
1-18GHz Vertical Polarity Measured Emissions

Field Strength (dBµV/m)

Frequency

Operator: Eric Lifsey
16536'RERun05'RxModel.fl
09:20:01 AM, Tuesday, December 23, 2014

EUT Mode: Receive
EUT Power: 24 VAC
Support equipment on table.

EUT: Comfort Link II XL950
Project Number: 16536-15
Client: Ingersoll-Rand


> 1GHz Vertical Antenna Polarity Measured Emissions

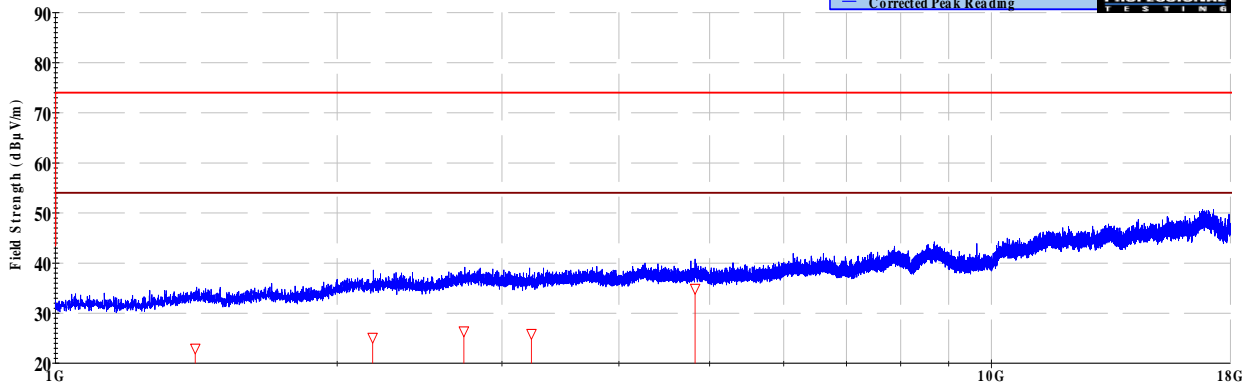
Table 7.3.4: Radiated Spurious Emissions, Receive Mode, Above 1 GHz, Vertical Polarity

Professional Testing, EMI, Inc.									
Test Method:		ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).							
In accordance with:		FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits							
Section:		15.109							
Test Date(s):		12/23/2014		EUT Serial #:		1450AX2139			
Customer:		Ingersoll-Rand		EUT Part #:		XL950			
Project Number:		16536-15		Test Technician:		Eric Lifsey			
Purchase Order #:		0		Supervisor:		Lisa Arndt			
Equip. Under Test:		Comfort Link II		Witness' Name:		John Hughes			
Radiated Emissions Test Results Data Sheet								Page: 1 of 1	
EUT Line Voltage:		24 VAC		EUT Power Frequency:		60 Hz			
Antenna Orientation:		Horizontal		Frequency Range:		Above 1GHz			
EUT Mode of Operation:					Receive Mode				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
1411.05	3	323	0	Average	36.1	22.995	54.0	-31.0	Pass
2182.53	3	232	0	Average	34.9	25.131	54.0	-28.9	Pass
2731.56	3	68	0	Average	34.8	26.414	54.0	-27.6	Pass
3226.16	3	24	0	Average	34.2	25.928	54.0	-28.1	Pass
4824	3	86	0	Average	40.7	34.925	54.0	-19.1	Pass

Professional Testing, EMI, Inc
Radiated Emissions, 3m Distance
1-18GHz Horizontal Polarity Measured Emissions

— Average Limit Level
▽ Corrected Average Reading
— Peak Limit Level
— Corrected Peak Reading





Operator: Eric Lifsey
16536'RERun05'RxModel
09:20:01 AM, Tuesday, December 23, 2014

EUT Mode: Receive
EUT Power: 24 VAC
Support equipment on table.

EUT: Comfort Link II XL950
Project Number: 16536-15
Client: Ingersoll-Rand

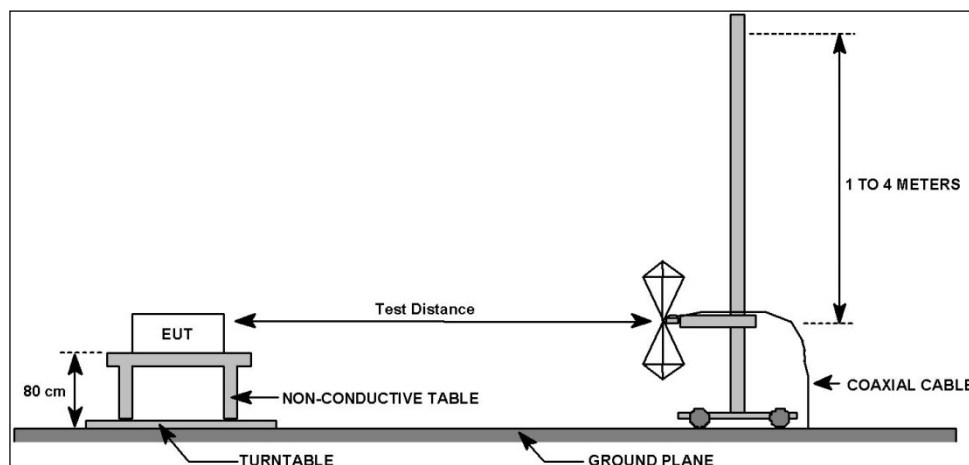
> 1GHz Horizontal Antenna Polarity Measured Emissions

8.0 Radiated Spurious Emissions, Transmit Mode

8.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The EUT was centered on a rotating turntable. Measurements below 1 GHz were taken at a test distance of 10 meters from the measurement antenna. Above 1 GHz the measurement distance was 3 meters.

Spurious emissions below 1 GHz were measured with quasi-peak detection with a resolution bandwidth of 120 kHz. Above 1 GHz peak measurements were taken and average measured where appropriate. A diagram showing the test setup appears below.



8.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.209 // RSS-Gen Issue 4, 4.9, 4.10	Field Strength of Radiated Spurious/Harmonic Emissions Transmit Mode	2014-12-23 2015-01-09

8.3 Test Results

Below 1 GHz measurements were taken for the middle channel. Above 1 GHz measurements were taken for the three standard channels of the band.

Modulation was disabled for this test and the transmitter was placed into continuous transmit mode.

All measurements used peak detection. The duty cycle factor for averaging was not required due to the low power level.

A pre-scan at 20 cm distance was done of the 18 to 25 GHz range and no emissions were found to record. Plots are included of the combined vertical and horizontal max-hold uncorrected results. Pre-amplification was employed but no factor was included since no signal was observed. The noise floor is at least 30 dB lower than shown.

Table 8.3.1: TX Mode, Below 1 GHz, Vertical Polarity, Mid. Channel

Professional Testing, EMI, Inc.									
Test Method:		ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).							
In accordance with:		FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits							
Section:		15.209							
Test Date(s):		12/23/2014		EUT Serial #:		1450AX2139			
Customer:		Ingersol-Rand		EUT Part #:		XL950			
Project Number:		16536-15		Test Technician:		Eric Lifsey			
Purchase Order #:		0		Supervisor:		Lisa Arndt			
Equip. Under Test:		Comfort Link II		Witness' Name:		Patrick Herron			
Radiated Emissions Test Results Data Sheet								Page: 1 of 1	
EUT Line Voltage:		24 VAC		EUT Power Frequency:		60 Hz			
Antenna Orientation:		Vertical		Frequency Range:		30MHz to 1GHz			
EUT Mode of Operation:				Transmit Mode, Unmodulated, Chan 06					
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
49.0343	10	347	2.73	Quasi-peak	37.6	18.528	29.5	-11.0	Pass
49.7963	10	325	3.8	Quasi-peak	32.1	12.802	29.5	-16.7	Pass
50.6287	10	339	3.54	Quasi-peak	31	11.512	29.5	-18.0	Pass

Professional Testing, EMI, Inc
Radiated Emissions, 10m Distance
30MHz - 1GHz Vertical Polarity Measured Emissions

Quasi-peak Limit Level
Corrected Quasi-peak
Peak Limit Level
Corrected Peak Value
Verified Low-PRI Q

Operator: Eric Lifsey
16536'RERun07'TxMode'Chan06'MHzGHzUnmodulated, Chan 6, Unmod
04:01:07 PM, Tuesday, December 23, 2014
EUT Power: 24 VAC
EUT SN 2139 & support equipment on table.

EUT: Comfort Link II XL950
Project Number: 16536-15
Client: Ingersol-Rand

≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 8.3.2: TX Mode, Below 1 GHz, Horizontal Polarity, Mid. Channel

Professional Testing, EMI, Inc.									
Test Method:		ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).							
In accordance with:		FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits							
Section:		15.209							
Test Date(s):		12/23/2014		EUT Serial #:		1450AX2139			
Customer:		Ingersoll-Rand		EUT Part #:		XL950			
Project Number:		16536-15		Test Technician:		Eric Lifsey			
Purchase Order #:		0		Supervisor:		Lisa Arndt			
Equip. Under Test:		Comfort Link II		Witness' Name:		Patrick Herron			
Radiated Emissions Test Results Data Sheet								Page: 1 of 1	
EUT Line Voltage:		24 VAC		EUT Power Frequency:		60 Hz			
Antenna Orientation:		Horizontal		Frequency Range:		30MHz to 1GHz			
EUT Mode of Operation:				Transmit Mode, Unmodulated, Chan 06					
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
189.363	10	253	2.43	Quasi-peak	44.1	27.999	33.0	-5.0	Pass

Professional Testing, EMI, Inc
Radiated Emissions, 10m Distance
30MHz - 1GHz Horizontal Polarity Measured Emissions

Quasi-peak Limit Level
Corrected Quasi-peak Limit Level
Corrected Peak Value
Verified Low-PRI Q

Operator: Eric Lifsey
16536'RERun07'TxMode'Chan06'MHzGHz'Unmod Mode, Chan 6, Unmod
04:01:07 PM, Tuesday, December 23, 2014
EUT Power: 24 VAC
EUTSN 2139 & support equipment on table.

EUT: Comfort Link II XL950
Project Number: 16536-15
Client: Ingersoll-Rand

≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 8.3.3: TX Mode, Above 1 GHz, Vertical Polarity, Low Channel

Professional Testing, EMI, Inc.									
Test Method:		ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).							
In accordance with:		FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits							
Section:		15.209							
Test Date(s):		12/23/2014		EUT Serial #:		1450AX2139			
Customer:		Ingersoll-Rand		EUT Part #:		XL950			
Project Number:		16536-15		Test Technician:		Eric Lifsey			
Purchase Order #:		0		Supervisor:		Lisa Arndt			
Equip. Under Test:		Comfort Link II		Witness' Name:		Patrick Herron			
Radiated Emissions Test Results Data Sheet								Page: 1 of 1	
EUT Line Voltage:		24 VAC		EUT Power Frequency:		60 Hz			
Antenna Orientation:		Vertical		Frequency Range:		Above 1GHz			
EUT Mode of Operation:				Transmit Mode, Unmodulated, Chan 01					
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
4826	3	0	1	Peak	50.24	50.24	54.0	-3.8	Pass

Professional Testing, EMI, Inc
Radiated Emissions, 3m Distance
1-18 GHz Vertical Polarity Measured Emissions

Average Limit Level
Corrected Average Reading
Peak Limit Level
Corrected Peak Reading

Operator: Eric Lifsey
16536'RERun08'TxMode'Chan01'GHzUnmod' EUT Mode: Tx Mode, Chan 1, Unmod
05:01:36 PM, Tuesday, December 23, 2014 EUT Power: 24 VAC
EUT SN 2139 & support equipment on table.

EUT: Comfort Link II XL950
Project Number: 16536-15
Client: Ingersoll-Rand

> 1GHz Vertical Antenna Polarity Measured Emissions

Table 8.3.4: TX Mode, Above 1 GHz, Horizontal Polarity, Low Channel

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	12/23/2014	EUT Serial #:	1450AX2139
Customer:	Ingersoll-Rand	EUT Part #:	XL950
Project Number:	16536-15	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	Comfort Link II	Witness' Name:	Patrick Herron
Radiated Emissions Test Results Data Sheet		Page:	1 of 1
EUT Line Voltage:	24 VAC	EUT Power Frequency:	60 Hz
Antenna Orientation:	Horizontal	Frequency Range:	Above 1GHz
EUT Mode of Operation:	Transmit Mode, Unmodulated, Chan 01		
<div> <div> Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18 GHz Horizontal Polarity Measured Emissions </div> <div> <div> Average Limit Level Corrected Average Reading Peak Limit Level Corrected Peak Reading </div> </div> </div> <div> Operator: Eric Lifsey 16536'RERun08'TxMode'Chan01'GHzUnmod'EMI Mode, Chan 1, Unmod 05:01:32 PM, Tuesday, December 23, 2014 </div> <div> EUT: Comfort Link II XL950 EUT Power: 24 VAC EUT SN 2139 & support equipment on table. </div> <div> Project Number: 16536-15 Client: Ingersoll-Rand </div>			
> 1GHz Horizontal Antenna Polarity Measured Emissions			

Table 8.3.5: TX Mode, Above 1 GHz, Vertical Polarity, Middle Channel


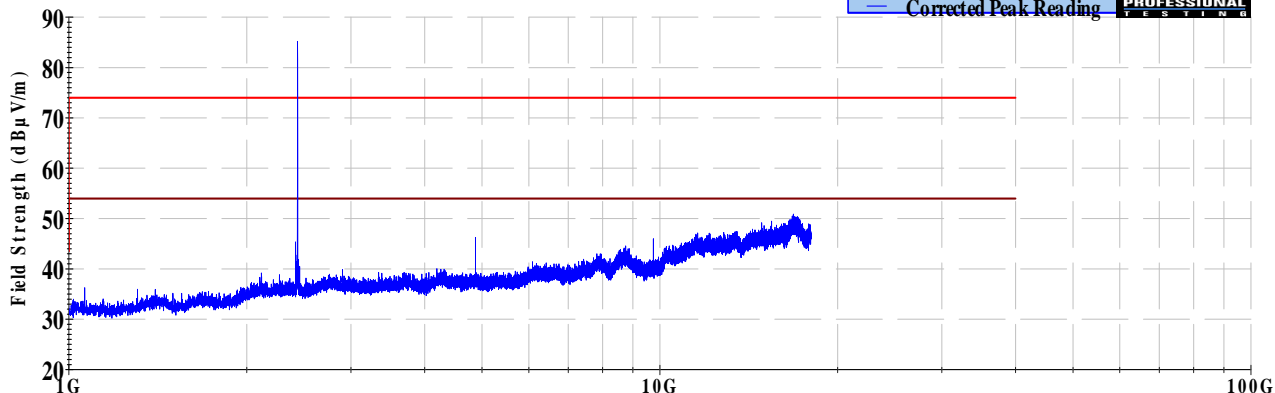
Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	12/23/2014	EUT Serial #:	1450AX2139
Customer:	Ingersoll-Rand	EUT Part #:	XL950
Project Number:	16536-15	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	Comfort Link II	Witness' Name:	Patrick Herron
Radiated Emissions Test Results Data Sheet		Page:	1 of 1
EUT Line Voltage:	24 VAC	EUT Power Frequency:	60 Hz
Antenna Orientation:	Vertical	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Transmit Mode, Unmodulated, Chan 06	
<div> <div> Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18 GHz Vertical Polarity Measured Emissions </div> <div> <div> Average Limit Level Corrected Average Reading Peak Limit Level Corrected Peak Reading </div>  </div> </div>  <div> Operator: Eric Lifsey 16536'RERun07'TxMode'Chan06'MHzGHzUnmodulated, Chan 6, Unmod 04:31:38 PM, Tuesday, December 23, 2014 EUT Mode: Transmit EUT Power: 24 VAC EUT SN 2139 & support equipment on table. </div> <div> EUT: Comfort Link II XL950 Project Number: 16536-15 Client: Ingersoll-Rand </div>			
> 1GHz Vertical Antenna Polarity Measured Emissions			

Table 8.3.6: TX Mode, Above 1 GHz, Horizontal Polarity, Middle Channel


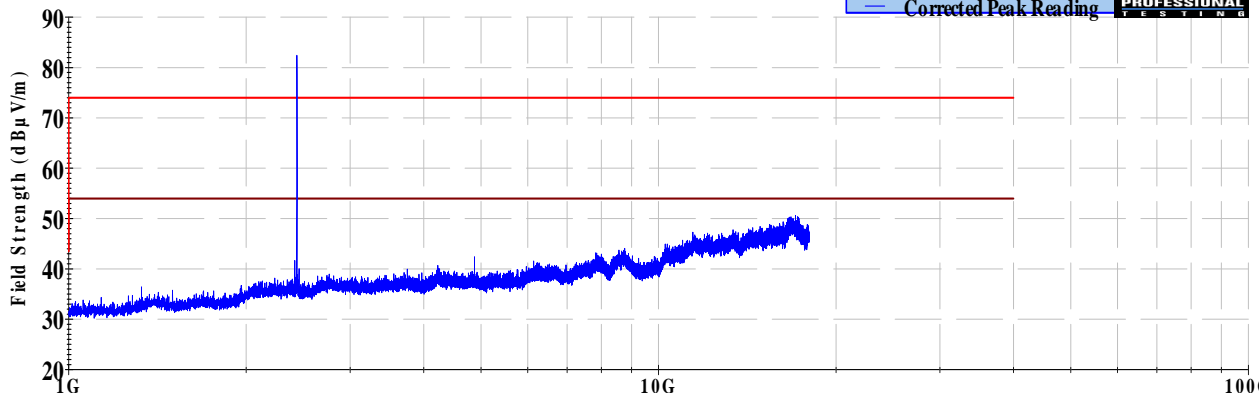
Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	12/23/2014	EUT Serial #:	1450AX2139
Customer:	Ingersoll-Rand	EUT Part #:	XL950
Project Number:	16536-15	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	Comfort Link II	Witness' Name:	Patrick Herron
Radiated Emissions Test Results Data Sheet		Page:	1 of 1
EUT Line Voltage:	24 VAC	EUT Power Frequency:	60 Hz
Antenna Orientation:	Horizontal	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Transmit Mode, Unmodulated, Chan 06	
<div> <div> Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Horizontal Polarity Measured Emissions </div> <div> <div> Average Limit Level Corrected Average Reading Peak Limit Level Corrected Peak Reading </div>  </div> </div>  <div> Operator: Eric Lifsey 16536'RERun07'TxMode'Chan06'MHzGHz'Unmodulated, Chan 6, Unmod 04:31:34 PM, Tuesday, December 23, 2014 </div> <div> EUT: Comfort Link II XL950 EUT Power: 24 VAC EUT SN 2139 & support equipment on table. </div> <div> Project Number: 16536-15 Client: Ingersoll-Rand </div>			
> 1GHz Horizontal Antenna Polarity Measured Emissions			

Table 8.3.7: TX Mode, Above 1 GHz, Vertical Polarity, High Channel


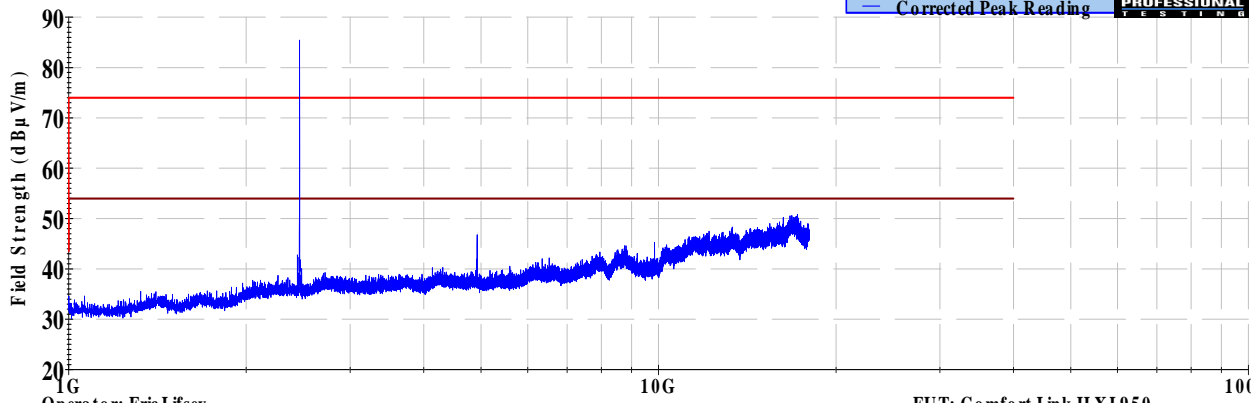
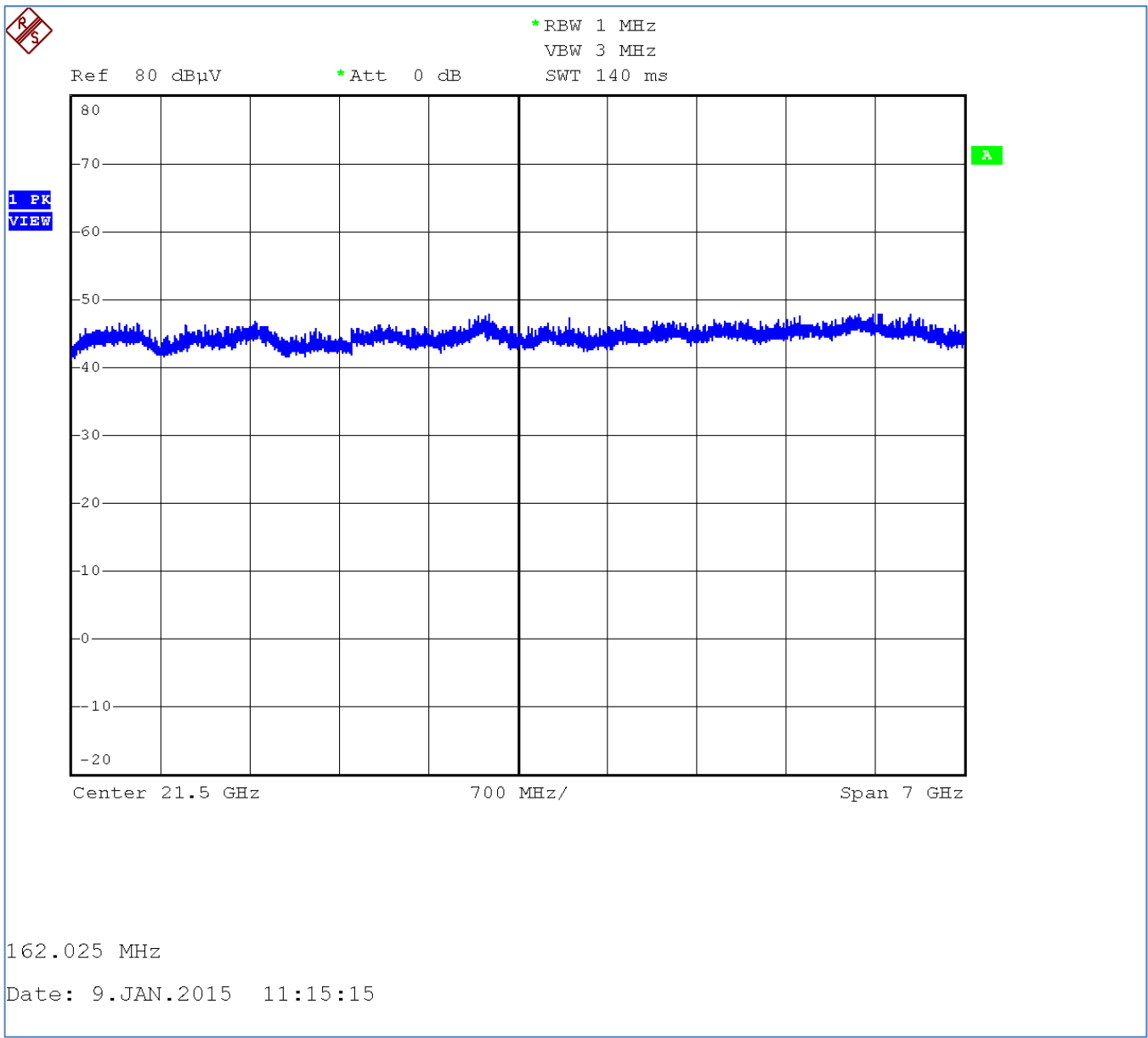
Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	12/23/2014	EUT Serial #:	1450AX2139
Customer:	Ingersoll-Rand	EUT Part #:	XL950
Project Number:	16536-15	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	Comfort Link II	Witness' Name:	Patrick Herron
Radiated Emissions Test Results Data Sheet		Page:	1 of 1
EUT Line Voltage:	24 VAC	EUT Power Frequency:	60 Hz
Antenna Orientation:	Vertical	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Transmit Mode, Unmodulated, Chan 11	
<div> <div> Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions </div> <div> <div> Average Limit Level Corrected Average Reading Peak Limit Level Corrected Peak Reading </div>  </div> </div>  <div> Operator: Eric Lifsey 16536'RERun01'TxMode'Chan11'GHzUnmod. 10:12:08 AM, Tuesday, December 23, 2014 </div> <div> EUT Mode: Chan 11 Transmit Unmod EUT Power: 24 VAC Support equipment on table. </div> <div> EUT: Comfort Link II XL950 Project Number: 16536-15 Client: Ingersoll-Rand </div>			
> 1GHz Vertical Antenna Polarity Measured Emissions			

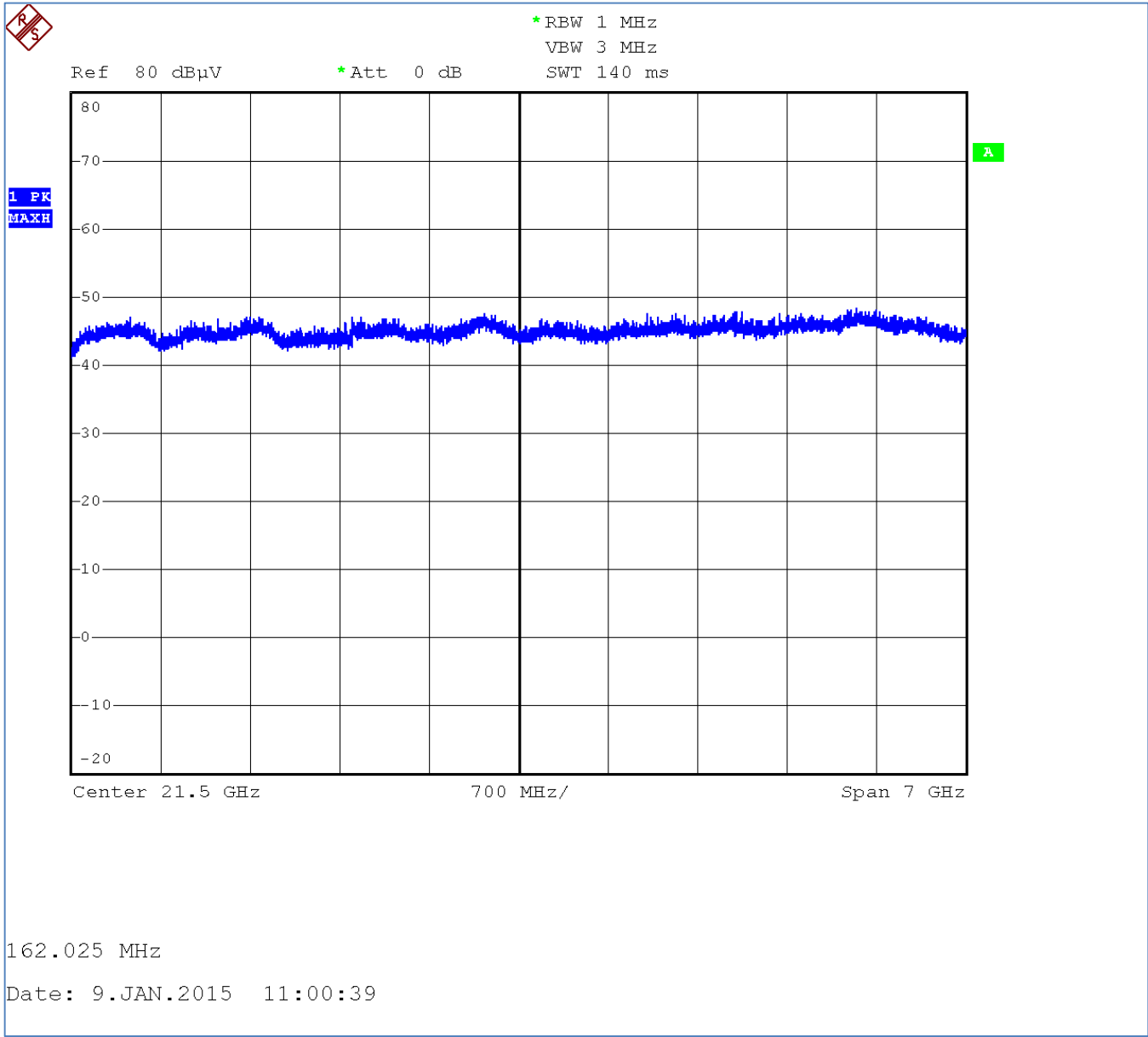
Table 8.3.8: TX Mode, Above 1 GHz, Horizontal Polarity, High Channel

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	12/23/2014	EUT Serial #:	1450AX2139
Customer:	Ingersoll-Rand	EUT Part #:	XL950
Project Number:	16536-15	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Lisa Arndt
Equip. Under Test:	Comfort Link II	Witness' Name:	Patrick Herron
Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	24 VAC	EUT Power Frequency:	60 Hz
Antenna Orientation:	Horizontal	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Transmit Mode, Unmodulated, Chan 11	
<div> <div> Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18 GHz Horizontal Polarity Measured Emissions </div> <div> <p>The graph displays the measured radiated emissions for the EUT. The y-axis represents Field Strength in dBµV/m, ranging from 20 to 90. The x-axis represents Frequency in GHz, ranging from 1 to 100. Two horizontal red lines indicate the Average Limit Level at approximately 75 dBµV/m and the Peak Limit Level at approximately 55 dBµV/m. The measured emissions (blue line) show a significant peak at approximately 4 GHz, reaching about 85 dBµV/m. The emissions generally increase with frequency, reaching about 50 dBµV/m at 10 GHz and 55 dBµV/m at 100 GHz.</p> </div> </div> <div> Operator: Eric Lifsey 16536'RERun01'TxMode'Chan11'GHzUnmod. 10:12:04 AM, Tuesday, December 23, 2014 </div> <div> EUT Mode: Chan 11 Transmit Unmod EUT Power: 24 VAC Support equipment on table. </div> <div> EUT: Comfort Link II XL950 Project Number: 16536-15 Client: Ingersoll-Rand </div>			
> 1GHz Horizontal Antenna Polarity Measured Emissions			

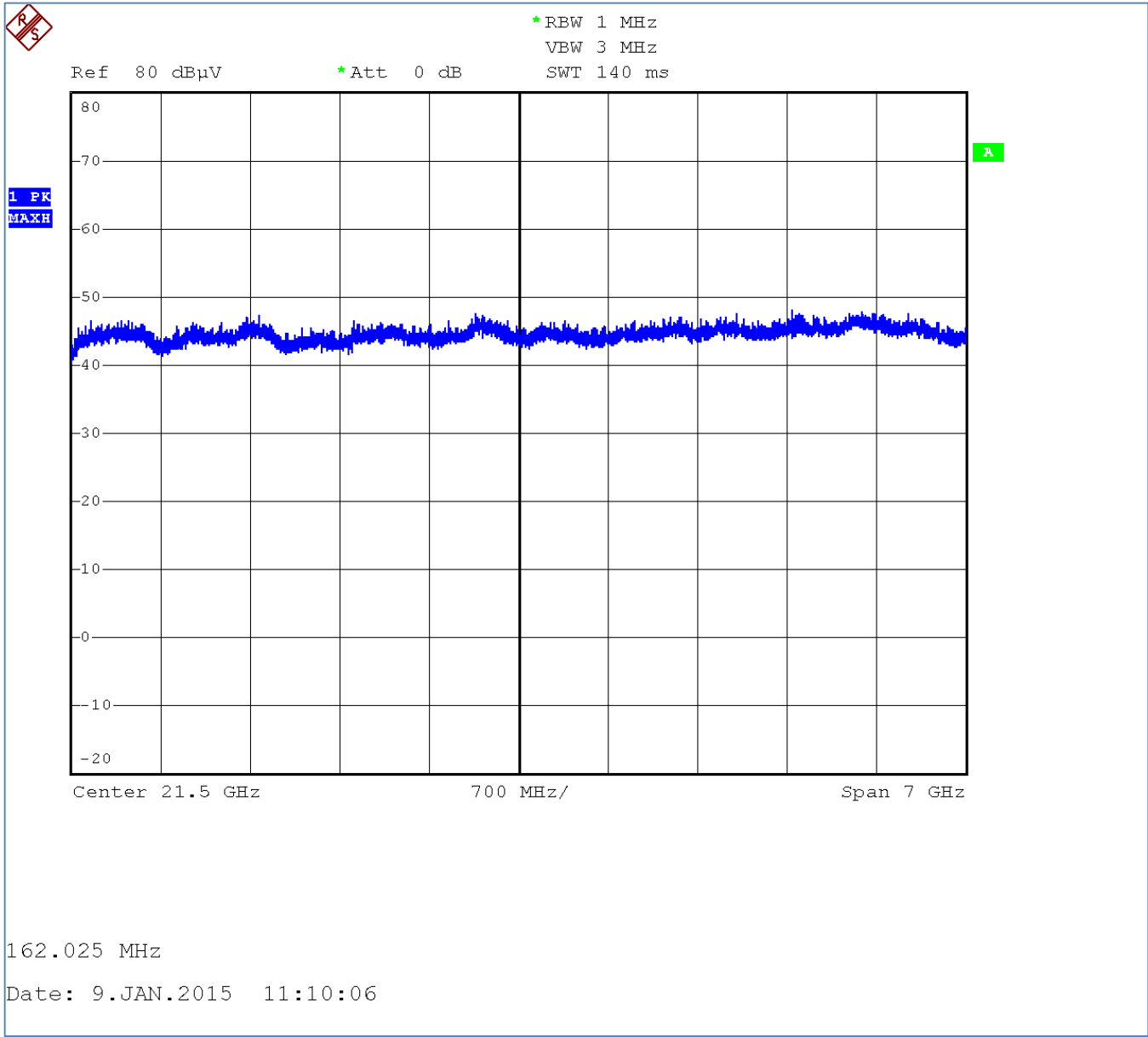
8.3.9 TX Mode, 18 GHz to 25 GHz, Low Channel



8.3.10 TX Mode, 18 GHz to 25 GHz, Middle Channel



8.3.11 TX Mode, 18 GHz to 25 GHz, High Channel



8.4 Transmit Timing and Duty Cycle

This measurement was not taken due to the low power and low spurious emissions observed.

9.0 Antenna Construction Requirements

The design was investigated for meeting the antenna construction requirements of the applicable rules.

9.1 Procedure

A direct examination of the antenna construction is performed and compared to rule criteria that prevent wireless device antennas from being modified by end users in ways that would void their authorization to use the device.

9.2 Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.203 // RSS-210 Issue 8, A2.9	Antenna Construction	2015-01-19

9.3 Results

Table 9.3.1 Antenna Construction Details	
Antenna Manufacturer and Model	Specifications
Manufacturer Ingersoll Rand Model: N/A	Printed circuit inverted-F style antenna. Located near U16.

- Antenna is internal only.
- Antenna is etched into the circuit board.
- There is no external antenna connector.

The antenna design above satisfies the requirements of the rules.

10.0 Conducted Emissions, Mains

10.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the floor and 0.4 meters from the conductive reference plane (wall). The EUT is powered through a line impedance stabilization network (LISN) that provides a measurement tap and a termination approximating 50 Ohms in the measurement range of 150 kHz to 30 MHz. A spectrum analyzer is connected, in turn, to each mains line measurement tap and software is employed to measure the radio frequency noise generated by the EUT.

10.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.207 // RSS-210 Issue 8	Mains conducted emissions	2014-05-20

10.3 Test Results

The EUT satisfied the criteria.

Tabular and plotted measurements appear on the following pages.

10.3.1 Mains, Neutral

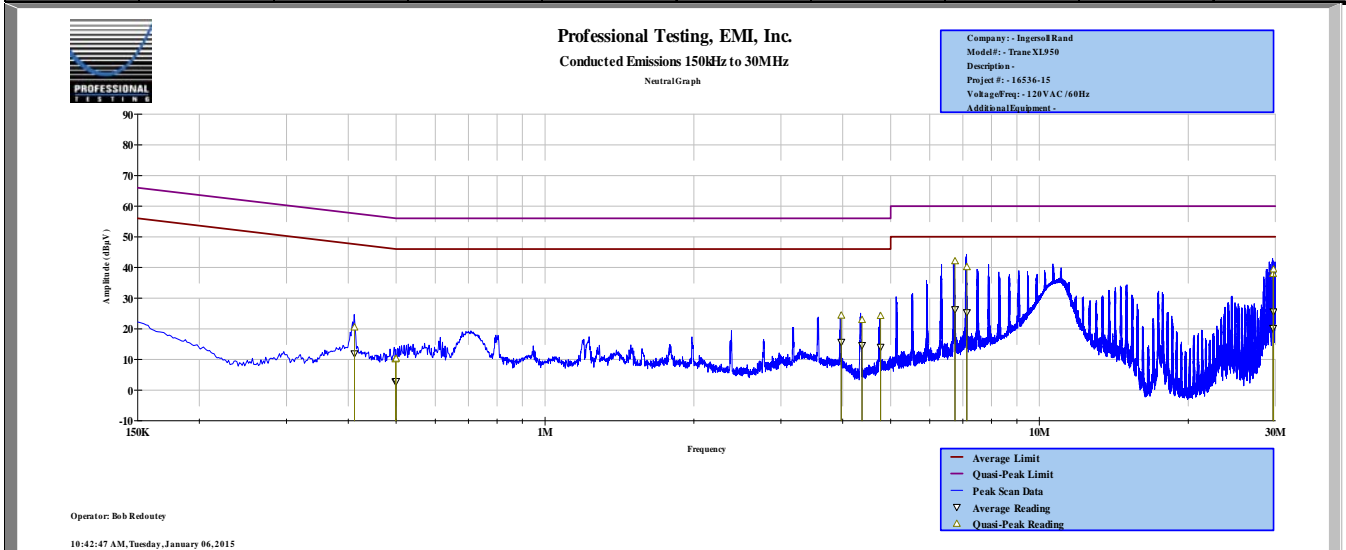
Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2009: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits		
Section:	15.207		
Test Date(s):	1/6/2015	EUT Serial #:	1450AX2148
Customer:	Ingersoll Rand	EUT Part #:	XL950
Project Number:	16536-15	Test Technician:	Bob Redoutey / Eric Lifsey
Purchase Order #:	Not Listed	Supervisor:	Lisa Arndt
Equip. Under Test:	Trane XL950	Witness' Name:	None

Conducted Emissions Test Results Data Sheet - Neutral Lead

Page: 1 of 2

EUT Line Voltage:		120	VAC	EUT Line Frequency:		60	Hz		
Frequency Measured (MHz)	Peak Detector Reading (dBμV)	Quasi-peak Detector Reading (dBμV)	Quasi-peak Detector Limit (dBμV)	Quasi-peak Detector Margin (dB)	Quasi-peak Detector Test Results	Average Detector Reading (dBμV)	Average Detector Limit (dBμV)	Average Detector Margin (dB)	Average Detector Test Results
0.41167	24.7	20.5	57.6	-37.1	PASS	12	47.6	-35.6	PASS
0.498195	17.4	10.1	56	-45.9	PASS	2.8	46	-43.2	PASS
0.500005	17.5	10.3	56	-45.7	PASS	2.9	46	-43.1	PASS
3.9745	28.1	24.3	56	-31.7	PASS	15.7	46	-30.3	PASS
4.3763	27.2	22.9	56	-33.1	PASS	14.6	46	-31.4	PASS
4.7732	29.3	24.2	56	-31.8	PASS	14	46	-32	PASS
6.7522	45.5	42.1	60	-17.9	PASS	26.3	50	-23.7	PASS
7.1329	44.8	40.2	60	-19.8	PASS	25.3	50	-24.7	PASS
29.6938	42.4	38	60	-22	PASS	20.2	50	-29.8	PASS
29.7499	42.7	39.4	60	-20.6	PASS	25.6	50	-24.4	PASS



Measured Conducted Emissions - Neutral Lead

10.3.2 Mains, Phase

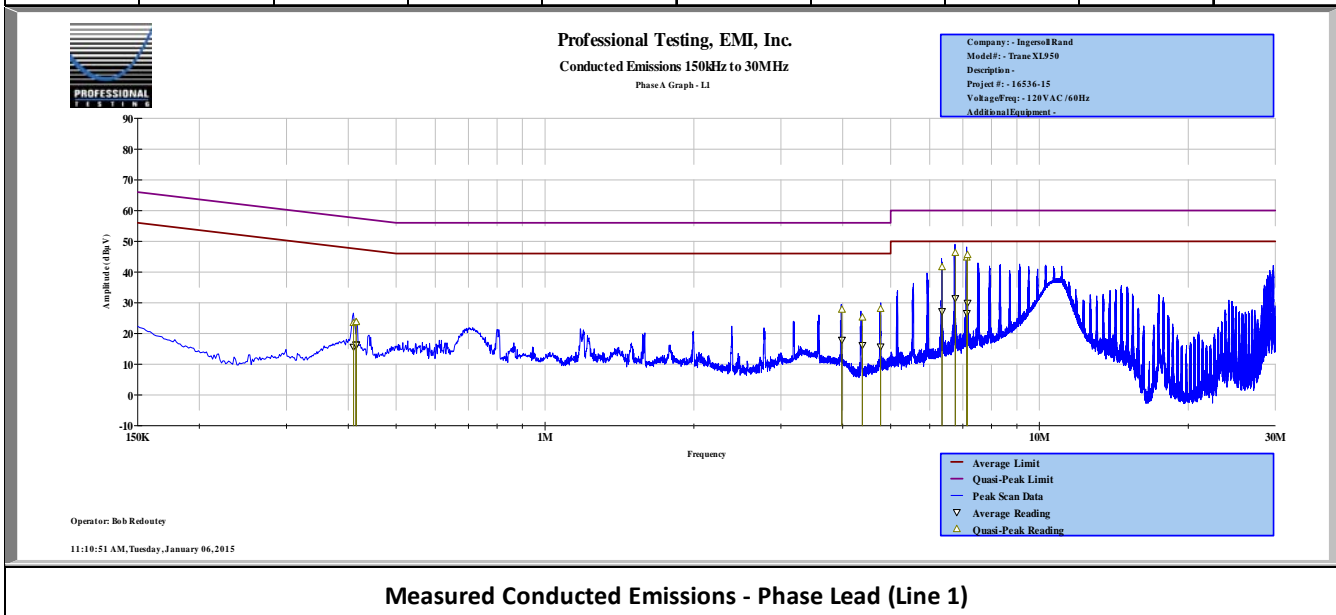
Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4-2009: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits		
Section:	15.207		
Test Date(s):	1/6/2015	EUT Serial #:	1450AX2148
Customer:	Ingersoll Rand	EUT Part #:	XL950
Project Number:	16536-15	Test Technician:	Bob Redoutey / Eric Lifsey
Purchase Order #:	Not Listed	Supervisor:	Lisa Arndt
Equip. Under Test:	Trane XL950	Witness' Name:	None

Conducted Emissions Test Results Data Sheet - Phase Lead (Line 1)

Page: 2 of 2

EUT Line Voltage:		120	VAC	EUT Line Frequency:		60	Hz		
Frequency Measured (MHz)	Peak Detector Reading (dBμV)	Quasi-peak Detector Reading (dBμV)	Quasi-peak Detector Limit (dBμV)	Quasi-peak Detector Margin (dB)	Quasi-peak Detector Test Results	Average Detector Reading (dBμV)	Average Detector Limit (dBμV)	Average Detector Margin (dB)	Average Detector Test Results
0.40997	27.4	23.4	57.6	-34.2	PASS	15.7	47.6	-32	PASS
0.41512	27.4	23.7	57.5	-33.8	PASS	16.4	47.5	-31.2	PASS
0.41526	28.1	23.7	57.5	-33.8	PASS	16.3	47.5	-31.3	PASS
3.9852	30.6	27.8	56	-28.2	PASS	18	46	-28	PASS
4.3844	30.5	25.2	56	-30.8	PASS	16.2	46	-29.8	PASS
4.7729	32.4	28	56	-28	PASS	15.7	46	-30.3	PASS
6.3541	45.8	41.6	60	-18.4	PASS	27.2	50	-22.8	PASS
6.7592	50.7	46.3	60	-13.7	PASS	31.5	50	-18.5	PASS
7.1305	48.6	44.7	60	-15.3	PASS	26.6	50	-23.4	PASS
7.156	48.8	45.6	60	-14.4	PASS	30	50	-20	PASS



11.0 Equipment

11.1 Spurious Radiated Emissions 30 MHz to 18 GHz and Fundamental Power

Professional Testing, EMI, Inc.					
Test Method:		ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators,			
In accordance with:		Radiated Emissions Limits			
Section:		15.209			
Test Date(s):	12/23/2014	EUT Serial #:	1450AX2139		
Customer:	Ingersol-Rand	EUT Part #:	XL950		
Project Number:	16536-15	Test Technician:	Eric Lifsey		
Purchase Order #:	0	Supervisor:	Lisa Arndt		
Equip. Under Test:	Comfort Link II	Witness' Name:	Patrick Herron		
Radiated Emissions Test Equipment List					
Tile! Software Version:		4.2.A, May 23, 2010, 08:38:52 AM			
Test Profile:		Radiated Emissions_Profile Version October 12, 2011			
Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1509A	Braden	N/A	TDK 10M Chamber, NSA < 1 GHz	DAC-012915-005	1/29/2015
1890	HP	8447F	Preamp/Amp, 9kHz-1300MHz, 28/25dB	3313A05298	1/22/2015
1937	Agilent	E4440A	Spectrum Analyzer, 3 Hz - 26.5 GHz	MY44303298	3/29/2015
2172	ETS-Lindgren	3142C	Antenna, Biconilog, 26 MHz-3GHz	49383	12/5/2015
C027	N/A	RG214	Cable Coax, N-N, 25m	none	10/22/2015
1327	EMCO	1050	Controller, Antenna Mast	none	N/A
0942	EMCO	11968D	Turntable, 4ft.	9510-1835	N/A
1969	HP	11713A	Attenuator/Switch Driver	3748A04113	N/A
1509B	Braden	N/A	TDK 10M Chamber, VSWR > 1 GHz	DAC-012915-005	2/16/2015
2004	Miteq	AFS44-00101800-2S-10P-44	Amplifier, 40dB, .1-18GHz	0	12/29/2015
C030	N/A	0	Cable Coax, N-N, 30m	none	10/10/2015
1325	EMCO	1050	Controller, Antenna Mast	9003-1461	N/A
1780	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	00110313	1/21/2015

Note – asset 2004, preamp, not used for fundamental power measurement.

11.2 Bandwidth Measurements

Asset #	Manufacturer	Model #	Description	Calibration Due
ALN-077	Rohde & Schwarz	FSP-30	Spectrum Analyzer	2015-01-29
0582	EMCO	3115	Horn, DRG, 1-18 GHz	2015-10-14
C248	Pasternack	NA	Cable, microwave, low loss	CNR

11.3 Mains Conducted Emissions

Professional Testing, EMI, Inc.					
Test Method:		ANSI C63.4–2009: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (incorporated by reference, see §15.38).			
In accordance with:		FCC Part 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits			
Section:		15.207			
Test Date(s):		1/6/2015	EUT Serial #:		1450AX2148
Customer:		Ingersoll Rand	EUT Part #:		XL950
Project Number:		16536-15	Test Technician:		Bob Redoutey / Eric Lifsey
Purchase Order #:		Not Listed	Supervisor:		Lisa Arndt
Equip. Under Test:		Trane XL950	Witness' Name:		None
Conducted Emissions Test Equipment List					
Tile! Software Version:		4.1.A.0, April 14, 2009, 11:01:00PM			
Test Profile:		Profile#: CE_2014_R3.TIL, dated May 1, 2014			
Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1145	HP	8568B	Spectrum Analyzer 100Hz-1.5GHz	2517A01821	5/22/2015
0045	HP	85662A	Spec Anal Dsply for AN1842	2816A16413	N/A
0238	HP	85685A	RF Preselector	2887A00841	5/22/2015
0085	HP	85650A	Quasi-Peak Adapter CISPR	3033A01458	5/22/2015
1173	PTI	100k HPF	Filter, High Pass, 100kHz	none	1/15/2016
1086	PTI	PTI-ALF2	Attenuator Limiter Filter	none	5/7/2015
C107	Pomona	RG-223	Cable 9 ft BNC RG-223 (black)	none	8/11/2015
C108	HP	11170 C	Cable 5 ft BNC (Grey)	none	8/11/2015
C109	HP	none	Cable 19 inch BNC (grey)	none	8/11/2015
1185	EMCO	3825/2	LISN, 10kHz-100MHz	1235	11/11/2015

11.4 Spurious Measurements 18-25 GHz

Asset #	Manufacturer	Model #	Description	Calibration Due
ALN-077	Rohde & Schwarz	FSP-30	Spectrum Analyzer	2015-01-29
1974	Agilent	83017	Microwave Amplifier	2015-02-05
1542	AH Systems	SAS-572	Horn, Standard Gain, 18-26.5 GHz	CNR

12.0 Measurement Bandwidths, Radiated Emissions, Spurious

Radiated Emissions Spectrum Analyzer Bandwidth and Measurement Time - Peak Scan				
Frequency Band Start (MHz)	Frequency Band Stop (MHz)	6 dB Bandwidth (kHz)	Number of Ranges Used	Measurement Time per Range
0.009	0.15	0.3	2	Multiple Sweeps
0.15	30	9	6	Multiple Sweeps
30	1000	120	2	Multiple 800 mS Sweeps
1000	6000	1000	2	Multiple Sweeps
6000	18000	300	2	Multiple Sweeps
<p>*Notes:</p> <ol style="list-style-type: none"> 1. The settings above are specifically calculated for the E4440A series of spectrum analyzers, which have 8,000 data points per range. 2. The measurement receiver resolution bandwidth setting was 300 Hz for quasi-peak measurements from 9-150 kHz. 3. The measurement receiver resolution bandwidth setting was 9 kHz for quasi-peak measurements from 0.15-30 MHz. 4. The measurement receiver resolution bandwidth setting was 120 kHz for quasi-peak measurements from 30-1000 MHz. 5. The measurement receiver resolution bandwidth setting was 1 MHz for average measurements from 1-18 GHz. 				

Appendix: Policy, Rationale, and Evaluation of EMC Measurement Uncertainty

All uncertainty calculations, estimates and expressions thereof shall be in accordance with NIST policy. Since PTI operates in accordance with NIST (NVLAP) Handbook 150-11: 2007, all instrumentation having an effect on the accuracy or validity of tests shall be periodically calibrated or verified traceable to national standards by a competent calibration laboratory. The certificates of calibration or verification on this instrumentation shall include estimates of uncertainty as required by NIST Handbook 150-11.

1. Rationale and Summary of Expanded Uncertainty.

Each piece of instrumentation at PTI that is used in making measurements for determining conformance to a standard (or limit), shall be assessed to evaluate its contribution to the overall uncertainty of the measurement in which it is used. The assessment of each item will be based on either a type A evaluation or a type B evaluation. Most of the evaluations will be type B, since they will be based on the manufacturer's statements or specifications of the calibration tolerances, or uncertainty will be stated along with a brief rationale for the type of evaluation and the resulting stated uncertainties.

The individual uncertainties included in the combined standard uncertainty for a specific test result will depend on the configuration in which the item of instrumentation is used. The combination will always be based on the law of propagation of uncertainty. Any systematic effects will be accommodated by including their uncertainties, in the calculation of the combined standard uncertainty; except that if the direction and amount of the systematic effect cannot be determined and separated from its uncertainty, the whole effect will be treated as uncertainty and combined along with the other elements of the test setup.

Type A evaluations of standard uncertainty will usually be based on calculating the standard deviation of the mean of a series of independent observations, but may be based on a least-squares curve fit or the analysis of variance for unusual situations. Type B evaluations of standard uncertainty will usually be based on manufacturer's specifications, data provided in calibration reports, and experience. The type of probability distribution used (normal, rectangular, a priori, or u-shaped) will be stated for each Type B evaluation.

In the evaluation of the uncertainty of each type of measurement, the uncertainty caused by the operator will be estimated. One notable operator contribution to measurement uncertainty is the manipulation of cables to maximize the measured values of radiated emissions. The operator contribution to measurement uncertainty is evaluated by having several operators independently repeat the same test. This results in a Type A evaluation of operator-contributed measurement uncertainty.

A summary of the expanded uncertainties of PTI measurements is shown as Table 1. These are the worst-case uncertainties considering all operative influence factors.

Table 1: Summary of Measurement Uncertainties for Site 45

Type of Measurement	Frequency Range	Meas. Dist.	Expanded Uncertainty U, dB (k=2)
Mains Conducted Emissions	150 kHz to 30 MHz	N/A	2.9
Telecom Conducted Emissions	150 kHz to 30 MHz	N/A	2.8
Radiated Emissions	30 to 1,000 MHz	10 m	4.8
	1 to 18 GHz	3 m	5.7

End of Report

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