



TEST REPORT

Report Number: 100991914MIN-001
Project Number: G100991914

Testing performed on the
3308A Wireless Guided Wave Radar Level Transmitter
Class II Permissive Changes

FCC ID: LW23308A

to
47 CFR Part 15. 247: 2010

For
Emerson Process Management

Test Performed by:
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Oakdale, MN 55128 USA

Test Authorized by:
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Date: January 14, 2013

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Date: January 14, 2013

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1.0 GENERAL DESCRIPTION

Model:	3308A
Type of EUT:	Wireless Guided Wave Radar Level Transmitter
Serial Number:	N/A
FCC ID:	LW23308A
Related Submittal(s) Grants:	Class II Permissive Changes
Company:	Emerson Process Management
Customer:	Mr. Merritt Pulkrabek
Address:	8200 Market Blvd., Mail Stop PM17 Chanhassen, MN 55317
Phone:	(952) 949-5193
Fax:	(952) 949-7626
Test Standards:	<input checked="" type="checkbox"/> 47 CFR, Part 15:2010, §15.247 <input type="checkbox"/> RSS-210, Issue 8, 2010 <input type="checkbox"/> RSS-Gen, Issue 3, 2010 <input type="checkbox"/> 47 CFR, Part 15:2010, §15.107 and §15.109, Class [REDACTED] <input type="checkbox"/> Other [REDACTED]
Type of radio:	<input type="checkbox"/> Stand -alone <input checked="" type="checkbox"/> Module <input type="checkbox"/> Hybrid
Date Sample Submitted:	December 17, 2012
Test Work Started:	December 17, 2012
Test Work Completed:	January 4, 2013
Test Sample Conditions:	<input type="checkbox"/> Damaged <input type="checkbox"/> Poor (Usable) <input checked="" type="checkbox"/> Good



1.1 Product Description; Test Facility

Product Description:	2.4 – 2.4835GHz Wireless Guided Wave Radar Level Transmitter
Transmitter Type:	<input type="checkbox"/> FHSS <input checked="" type="checkbox"/> Digital Modulation (DSSS) <input type="checkbox"/> WiFi <input type="checkbox"/> Blue Tooth
Operating Frequency Range(s):	From 2400 to 2483.5 MHz
Number of Channels:	15
Modulation:	QPSK
Antenna(s) Info:	Antenna Type: Dipole, Omni-directional, connected internally via an MMCX connector Gain: 4.5dBi
Antenna Installation:	<input type="checkbox"/> User <input type="checkbox"/> Professional <input checked="" type="checkbox"/> Factory
Transmitter power configuration:	<input checked="" type="checkbox"/> Internal battery <input type="checkbox"/> External power source <input type="checkbox"/> 120VAC <input type="checkbox"/> 230VAC <input type="checkbox"/> 400VAC <input checked="" type="checkbox"/> 3.6VDC <input type="checkbox"/> Other: <input type="checkbox"/> <input type="checkbox"/> Amp. <input type="checkbox"/> 50Hz <input type="checkbox"/> 60Hz
Special Test Arrangement:	None
Test Facility Accreditation:	A2LA (Certificate No. 1427.01)
Test Methodology:	Measurements performed according to the procedures in ANSI C63.10-2009 and FCC DTS Measurement Guide

1.2 EUT Configuration

The equipment under test was operated during the measurement under the following conditions:

- Standby
- Continuous transmissions (modulated signal)
- Continuous transmissions (un-modulated signal)
- Continuous receiving
- Test program (customer specific)

Operating modes of the EUT:

No.	Description
1	Test was performed at low channel, middle channel, and upper channel

Cables:

No.	Type	Length	Designation	Note
1	2-wire communication cable	<10ft	USB HART cable	

Support equipment/Services:

No.	Item	Description
1	Laptop PC	Interface PCB
2	Viator HART interface	USB HART interface to control EUT

General Note: The EUT had the following modification since the original certification: Modifications to the on circuit board include moving the 3VDC plane under the radio chip to enhance radiated immunity performance, and changed resistors R562 and R528 to a value of 10 ohms to reduce noise in the power supply. Therefore, the following limited testing to cover Class II Permissive Changes was performed: Maximum Output Power, Emissions Bandwidth and Spurious Radiated Emissions were measured. RF exposure was calculated to reflect a new measured Maximum Output Power.

1.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal

Temperature:	+15 to +35 ° C
Humidity:	20-75 %
Atmospheric pressure:	86-106 kPa

Extreme

<input type="checkbox"/> Temperature:	-20 to +50 ° C
<input type="checkbox"/> Supply voltage:	85% to +115%

1.4 Measurement uncertainty

The expanded uncertainty ($k = 2$) for radiated measurements has been determined to be:

± 4 dB at 10m and ± 5.4 dB at 3m

The expanded uncertainty ($k = 2$) for conducted measurements at antenna terminal has been determined to be:

± 1.0 dB

The expanded uncertainty ($k = 2$) for line conducted measurements has been determined to be:

± 2.6 dB

1.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.

The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where: FS = Field Strength in dB(μ V/m)

RA = Receiver Amplitude in dB(μ V)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB(m^{-1})

AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB(μ V) is obtained. The antenna factor of 7.4 dB(m^{-1}) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB(μ V/m).

$$RA = 48.1 \text{ dB}(\mu\text{V})$$

$$AF = 7.4 \text{ dB}(m^{-1})$$

$$CF = 1.6 \text{ dB}$$

$$AG = 16.0 \text{ dB}$$

$$FS = RA + AF + CF - AG$$

$$FS = 48.1 + 7.4 + 1.6 - 16.0$$

$$FS = 41.1 \text{ dB}(\mu\text{V}/\text{m})$$

General notes:



2.0 TEST SUMMARY

Referring to the performance criteria and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards.

TEST SPECIFICATION	TEST PARAMETERS	RESULT
15.247(b), (c)	Maximum peak output power	Pass
15.247(a)	6dB bandwidth of the digital modulation system and Emissions Bandwidth	Pass
15.247(d)	Radiated spurious emissions	Pass
15.247(i)	RF Exposure Compliance	Pass



3.0 TEST CONDITIONS AND RESULTS

3.1 Maximum peak output power

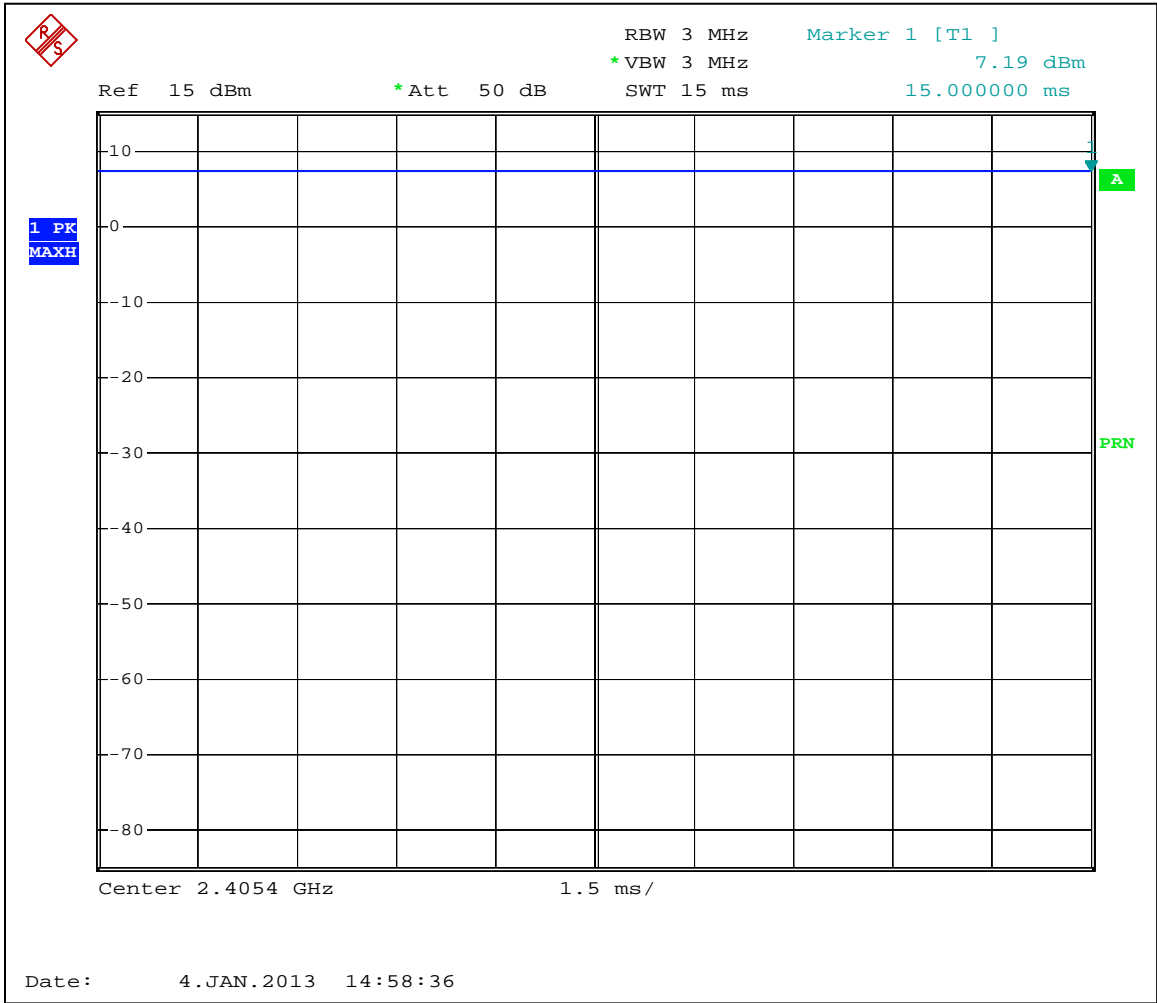
Test location: OATS Anechoic Chamber Other

Test result: **Pass**

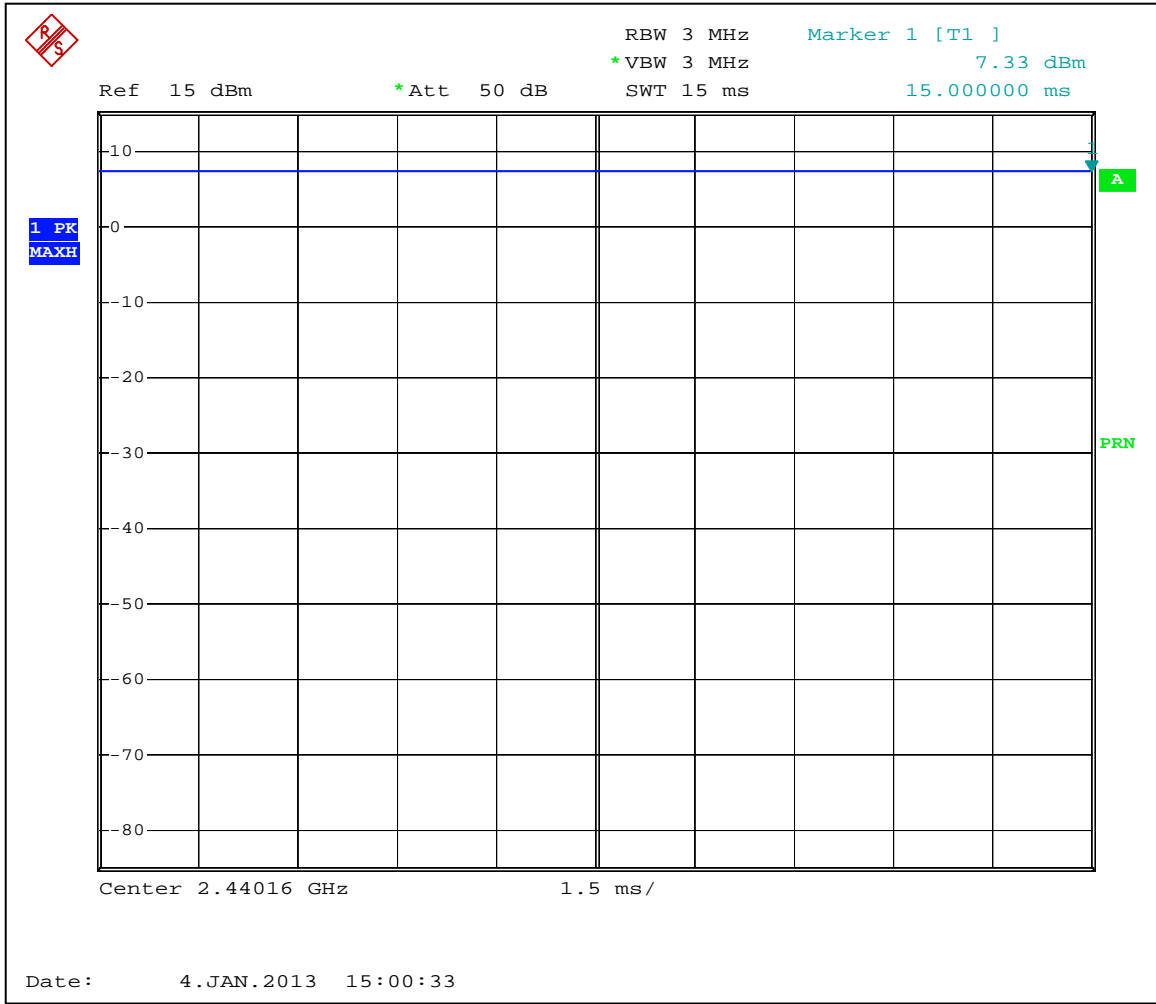
Max. Margin: 22.1dB below the limits

Power Output:	Conducted					
Frequency Range:	<input type="checkbox"/> 902-928MHz		<input checked="" type="checkbox"/> 2400-2483.5MHz		<input type="checkbox"/> 5725-5850MHz	
Low Frequency MHz	Measured power dBm	Attenuation dB	Power at Antenna dBm	Limit dBm	Limit Reduction dB	Margin dB
2405.4	7.2	1.3	8.5	30	0	-21.5
Middle Frequency MHz						
2440.2	7.3	1.3	8.6	30	0	-21.4
Upper Frequency MHz						
2475.0	6.6	1.3	7.9	30	0	-22.1
RBW:	<input type="checkbox"/> 1MHz <input checked="" type="checkbox"/> 3MHz <input type="checkbox"/> 10MHz					
VBW:	<input type="checkbox"/> 1MHz <input checked="" type="checkbox"/> 3MHz <input type="checkbox"/> 10MHz					
Antenna Gain:	<input checked="" type="checkbox"/> < 6dBi <input type="checkbox"/> >6dBi <input type="checkbox"/> dB, Output power reduction = <input type="checkbox"/> dB					

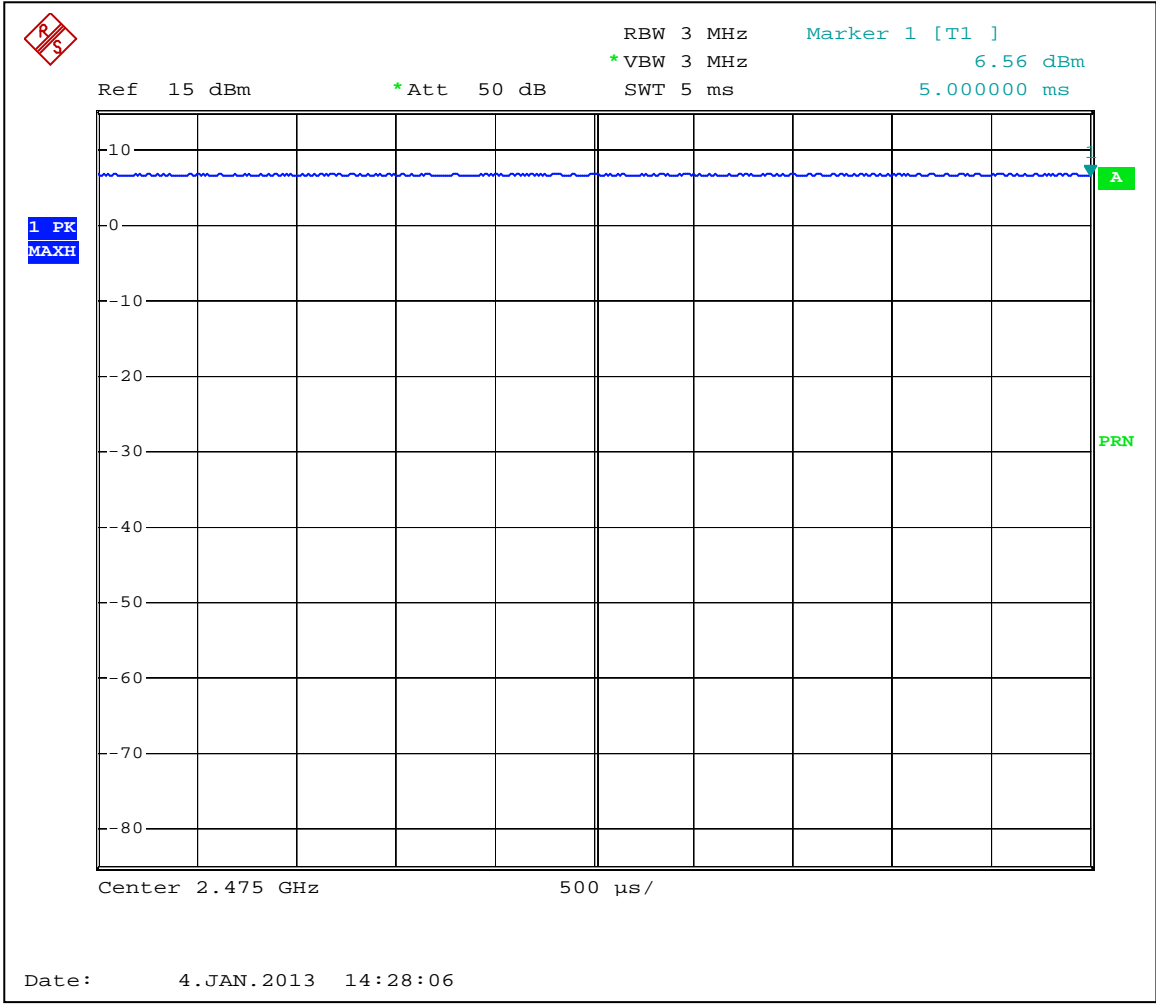
Notes: The maximum peak conducted output power limit is 1 W, or 30dBm
 Graphs 3.1.1 to 3.1.3 show the conducted output power



Graph 3.1.1



Graph 3.1.2



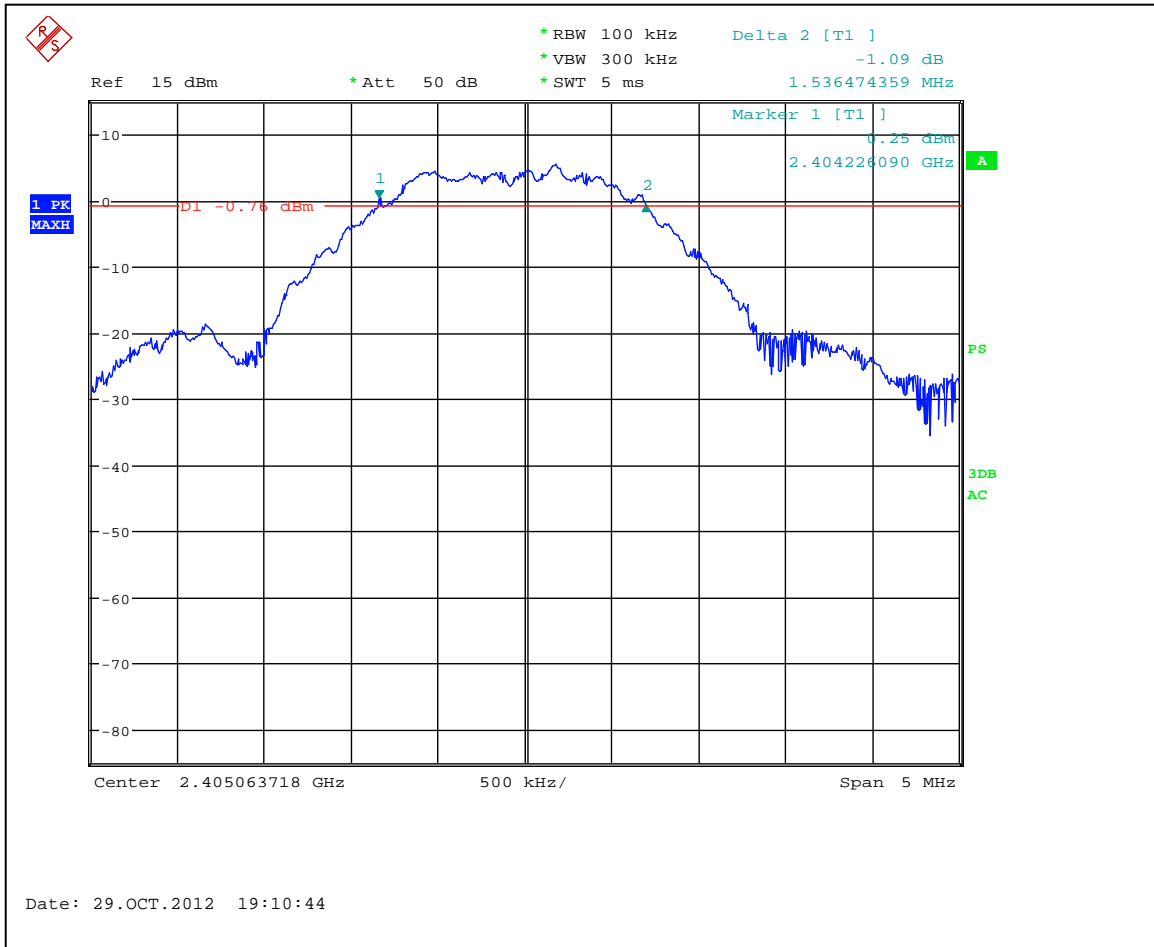
Graph 3.1.3



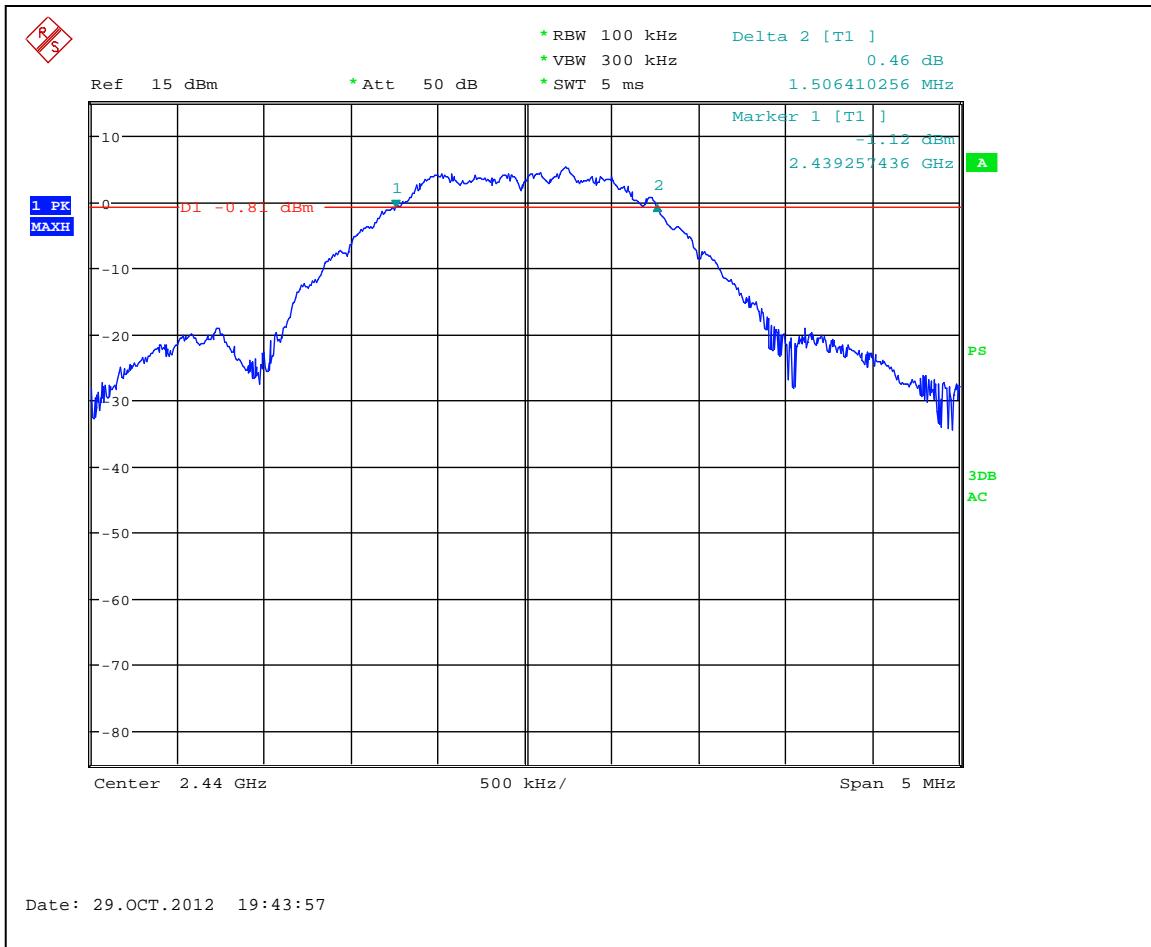
3.2 6dB bandwidth of the digital modulation

Low Frequency Channel kHz	Middle Frequency Channel kHz	Upper Frequency Channel kHz	Minimum Bandwidth kHz	Result
1536.47	1506.41	1578.52	500	Pass
RBW:	<input checked="" type="checkbox"/> 100kHz	<input type="checkbox"/> other [] kHz		
VBW:	<input checked="" type="checkbox"/> 300kHz	<input type="checkbox"/> 300kHz	<input type="checkbox"/> other [] kHz	

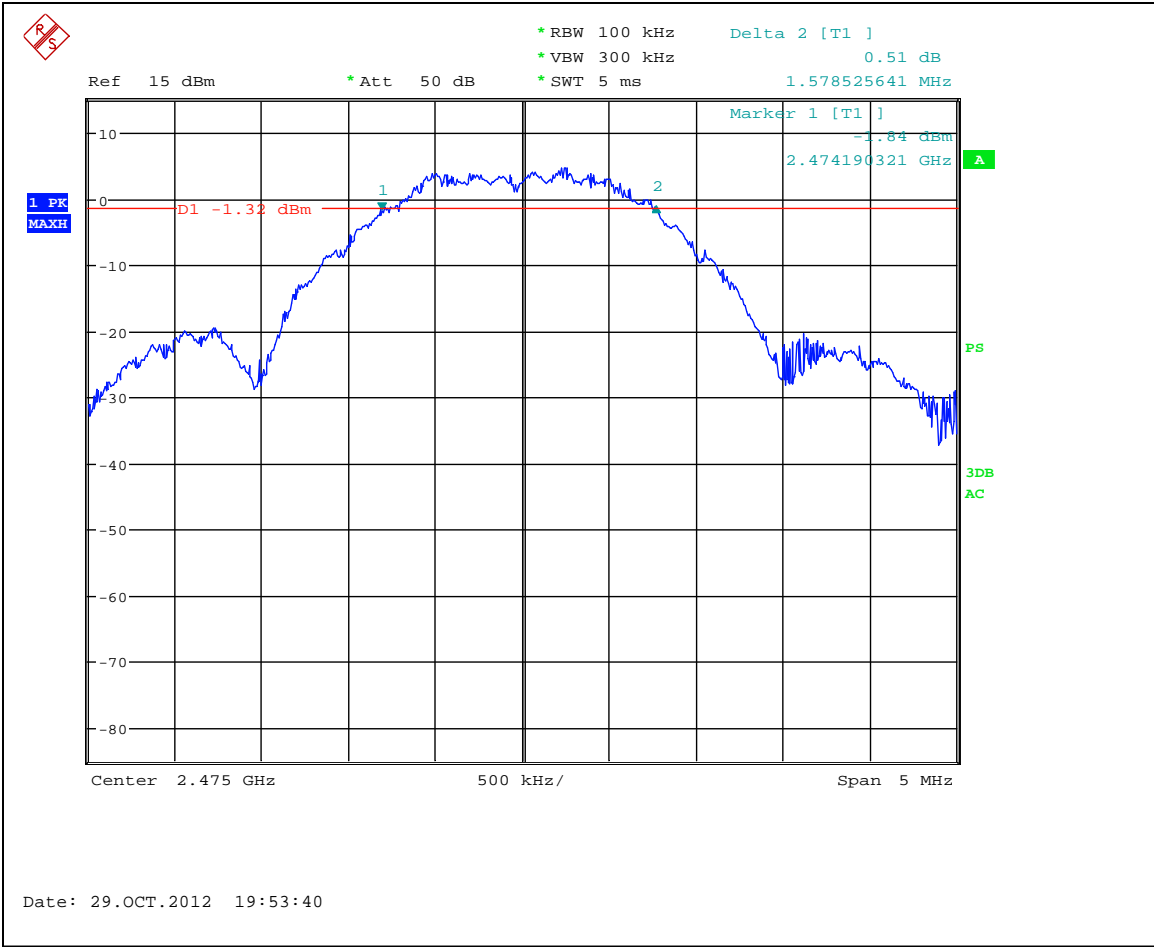
Notes:



Graph 3.2.1



Graph 3.2.2

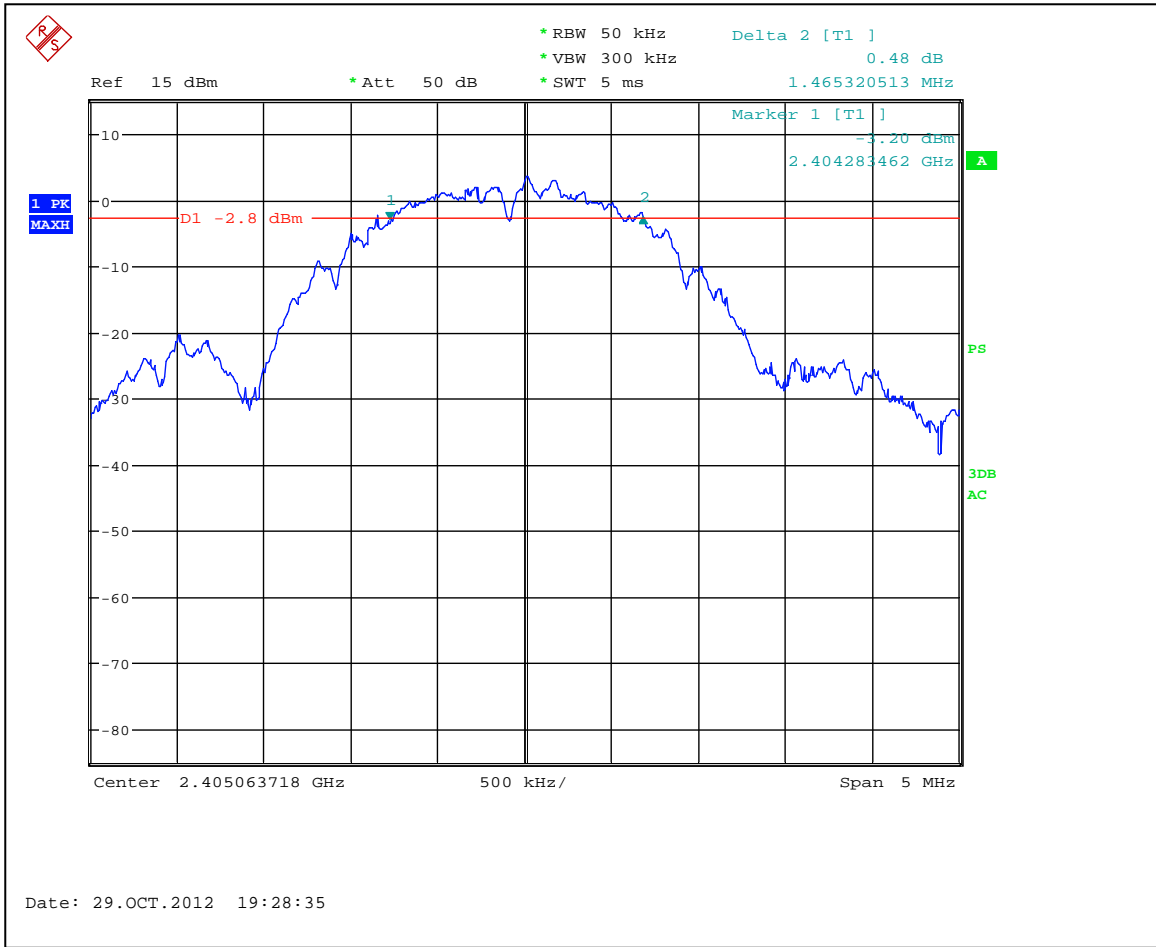


Graph 3.2.3

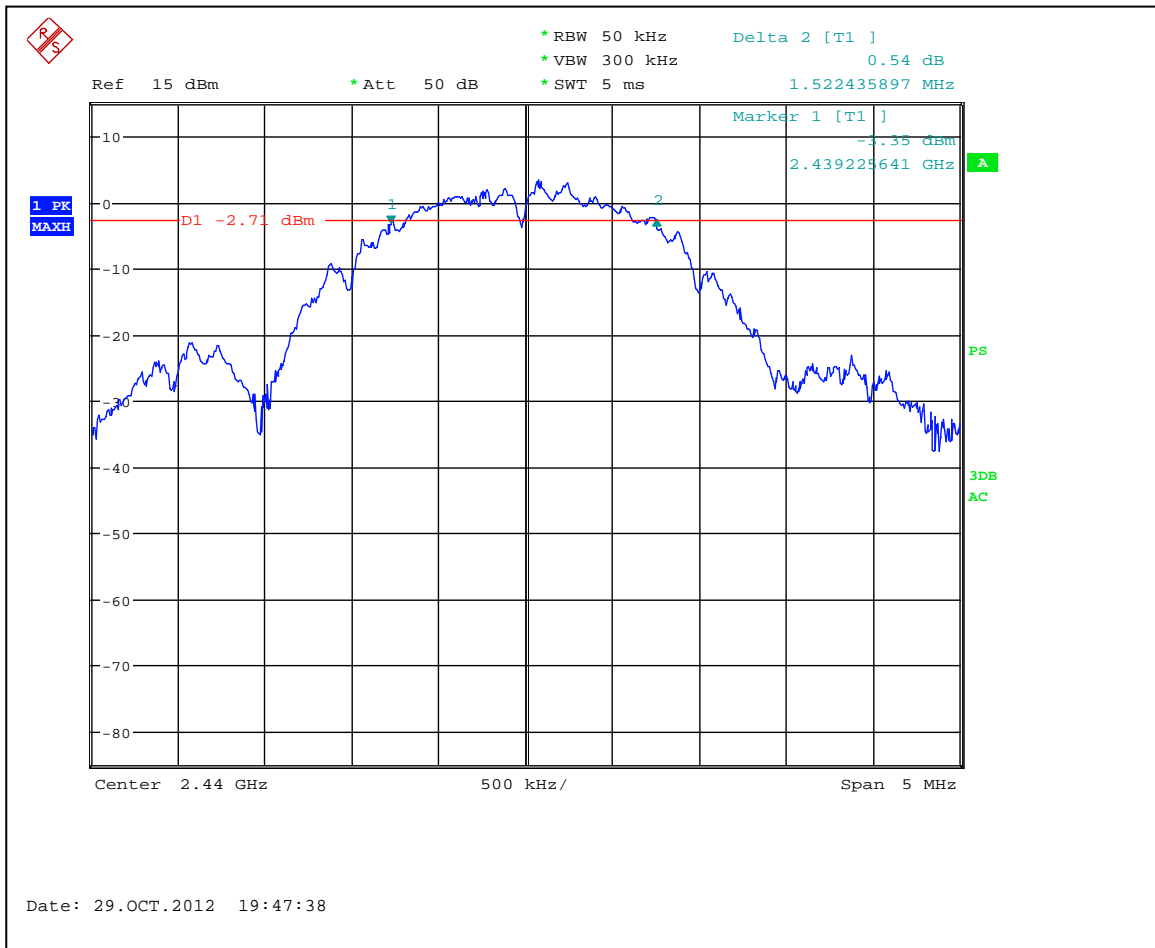


3.2.1 Emission bandwidth (EBW) of the digital modulation

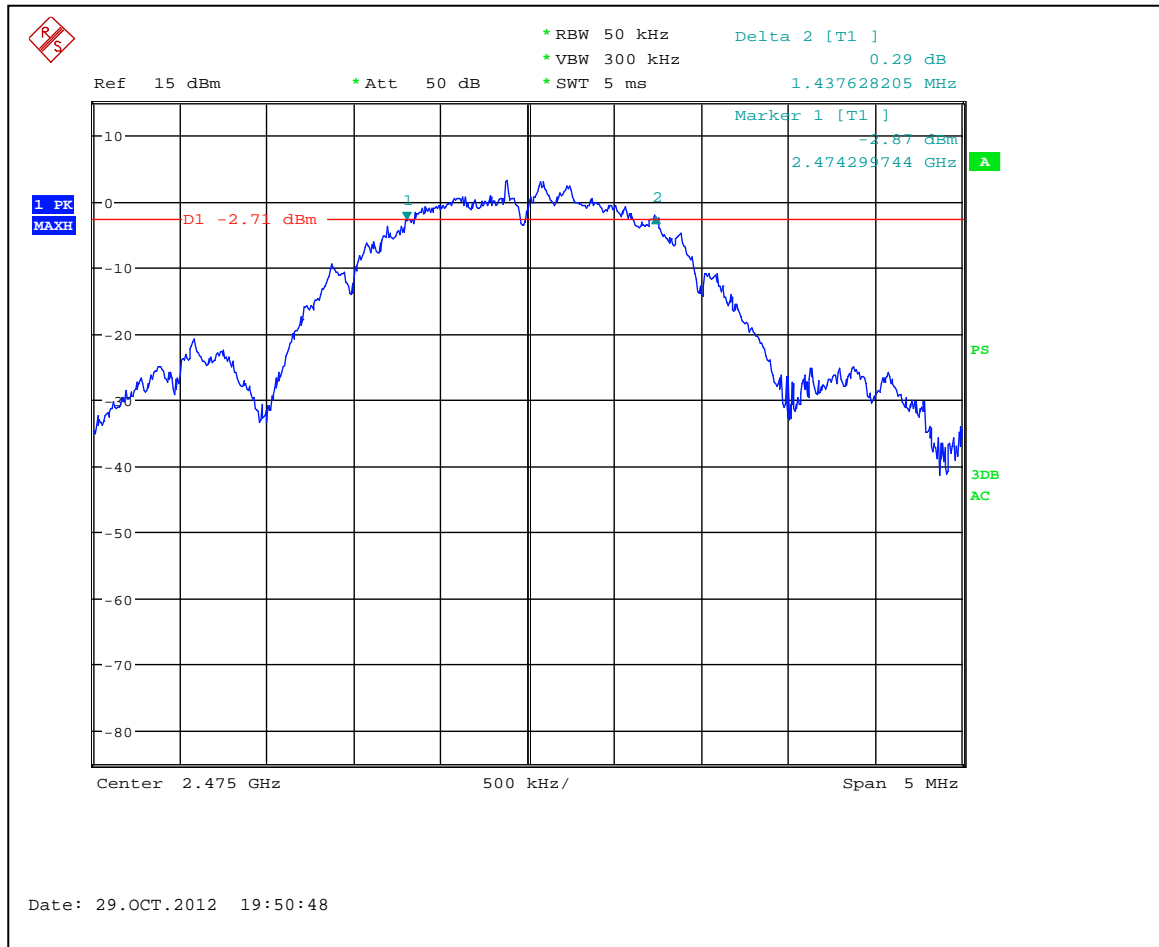
Low Frequency Channel kHz	Middle Frequency Channel kHz	Upper Frequency Channel kHz	Minimum Bandwidth kHz	Result
1465.32	1522.43	1437.62	500	Pass
RBW:	<input checked="" type="checkbox"/> 50kHz <input type="checkbox"/> other [] kHz			
VBW:	<input checked="" type="checkbox"/> 300kHz <input type="checkbox"/> 300kHz <input type="checkbox"/> other [] kHz			



Graph 3.2.1.1



Graph 3.2.1.2



Graph 3.2.1.3



3.3 Radiated spurious emissions

Test location: OATS Anechoic Chamber Other

Test distance: 10 meters 3 meters

Frequency Range: 30MHz to 25GHz (10th Harmonic)

Test result: **Pass**

Max. Margin: 17.4dB below the limits

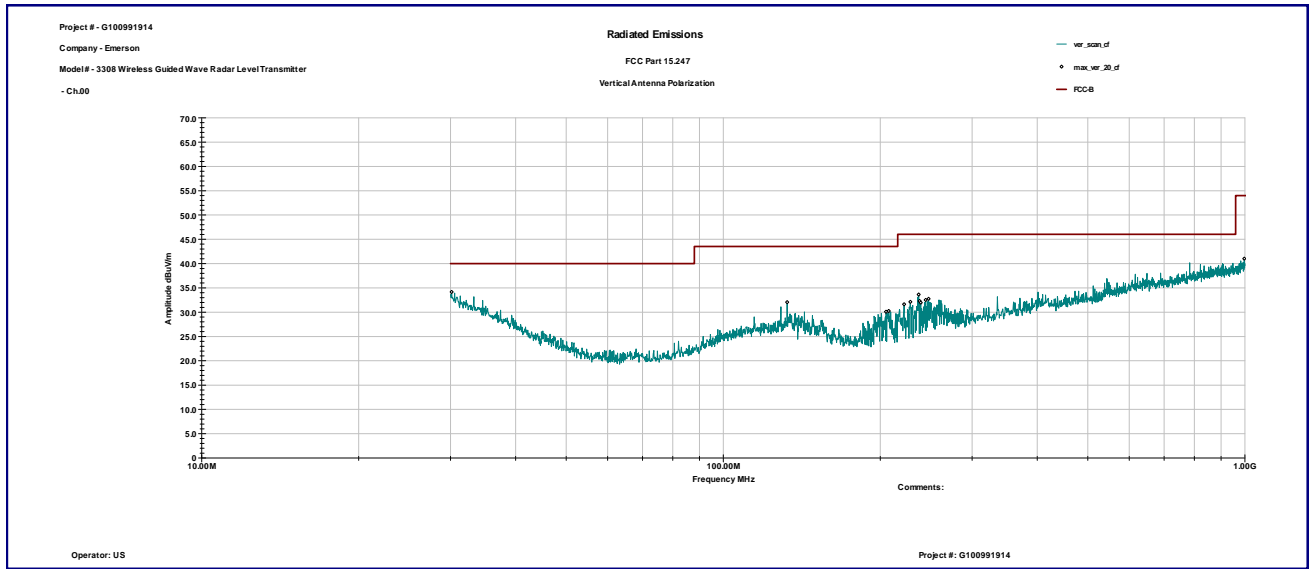
Notes: A High Pass Filter with cut off frequency of 4GHz was used during Radiated Emissions measurements above 2GHz; therefore, fundamental frequencies appeared on the graphs attenuated



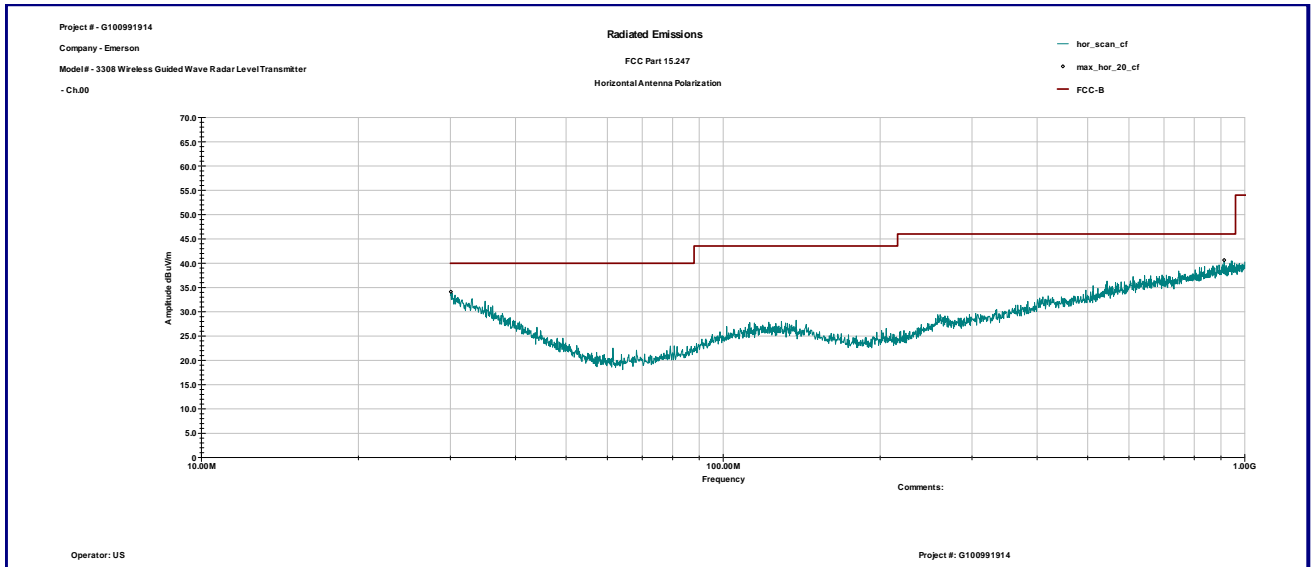
Date:	December 19, 2012	Result: Pass
Standard:	FCC part 15.247(d)	
Tested by:	Uri Spector	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Measurements were taken using an Average detector, or peak detector when commented. Emissions at fundamental frequency, spurious emissions and harmonics outside restricted band of operation per FCC 15.205, and spurious emissions not related with transmitter operations were excluded from the Table.	

Table 3.2.1

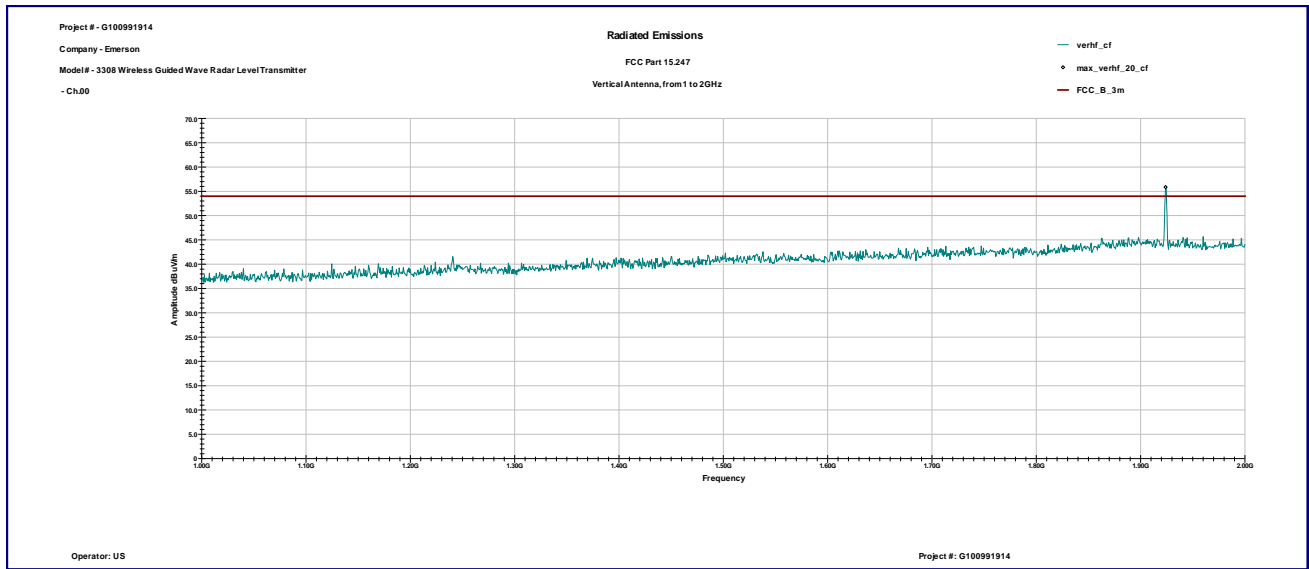
Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dBµV	Total @ 3m dBµV/m	Limit dBµV/m	Margin dB	Comments
	Polarity	Hts(cm)								
Channel 0										
7216.00	V	165	35.7	4.9	41.5	57.4	56.6	74.0	-17.4	Peak
7216.00	V	165	35.7	4.9	41.5	29.1	28.3	54.0	-25.7	AVG
Channel 7										
4880.92	V	223	33.1	4.2	42.0	57.9	53.1	74.0	-20.9	Peak
4880.92	V	223	33.1	4.2	42.0	29.2	24.4	54.0	-29.6	AVG
7321.52	V	229	36.0	5.0	41.4	55.1	54.7	74.0	-19.3	Peak
7321.52	V	229	36.0	5.0	41.4	29.0	28.6	54.0	-25.4	AVG
Channel 14										
4950.92	V	204	33.1	4.2	41.9	57.3	52.7	74.0	-21.3	Peak
4950.92	V	204	33.1	4.2	41.9	30.7	26.1	54.0	-27.9	AVG



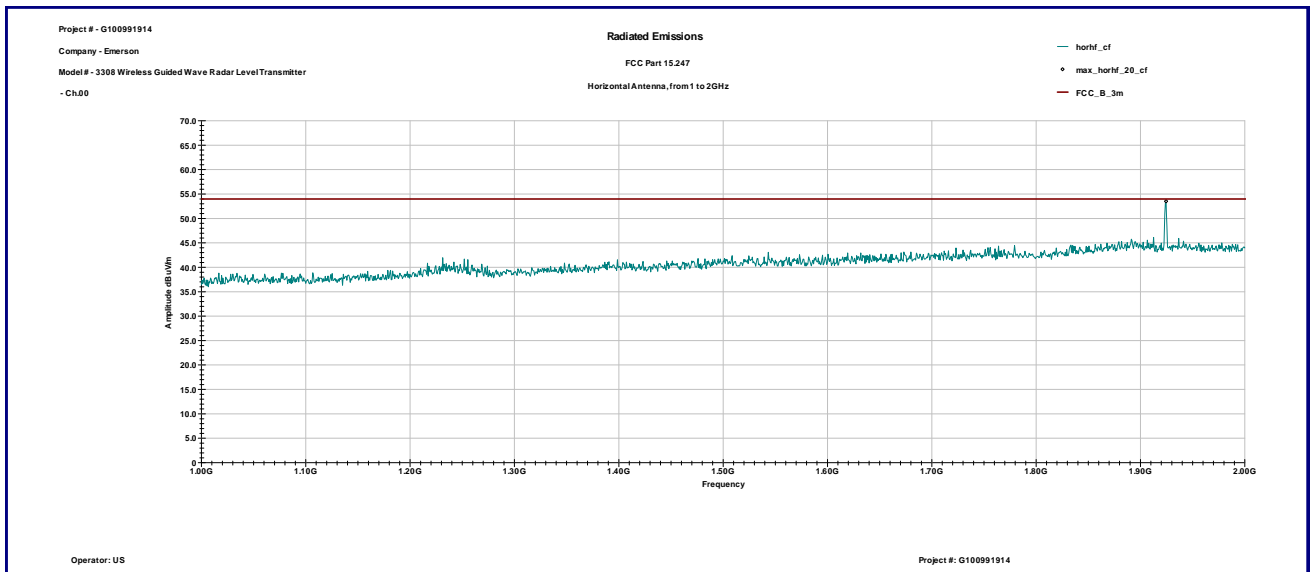
Graph 3.2.1



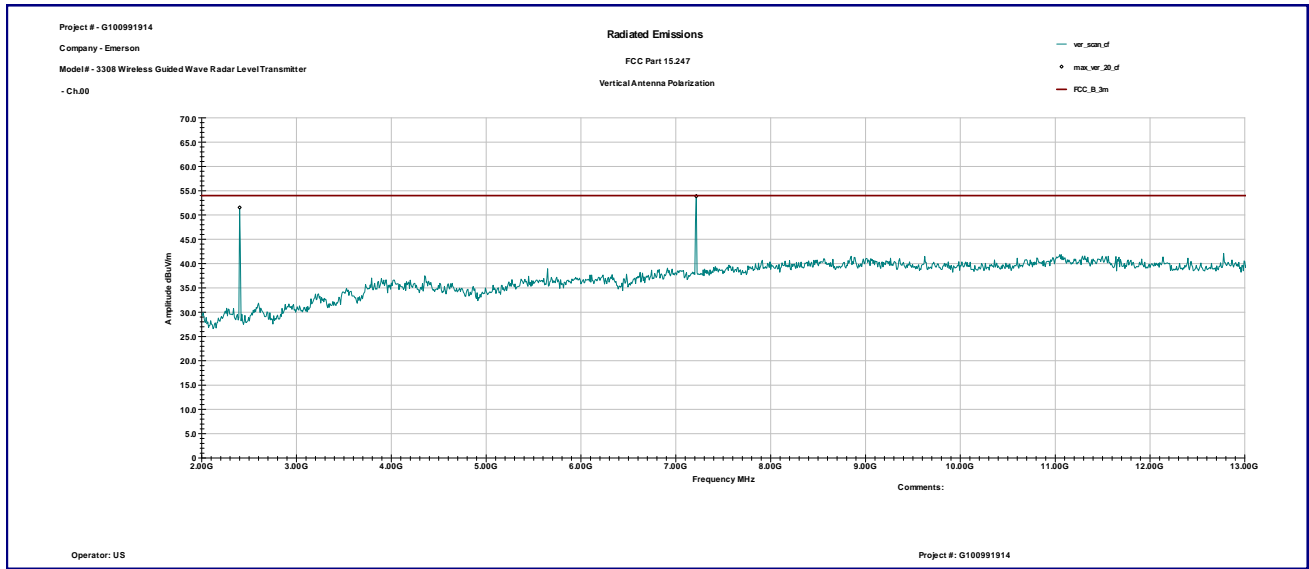
Graph 3.2.2



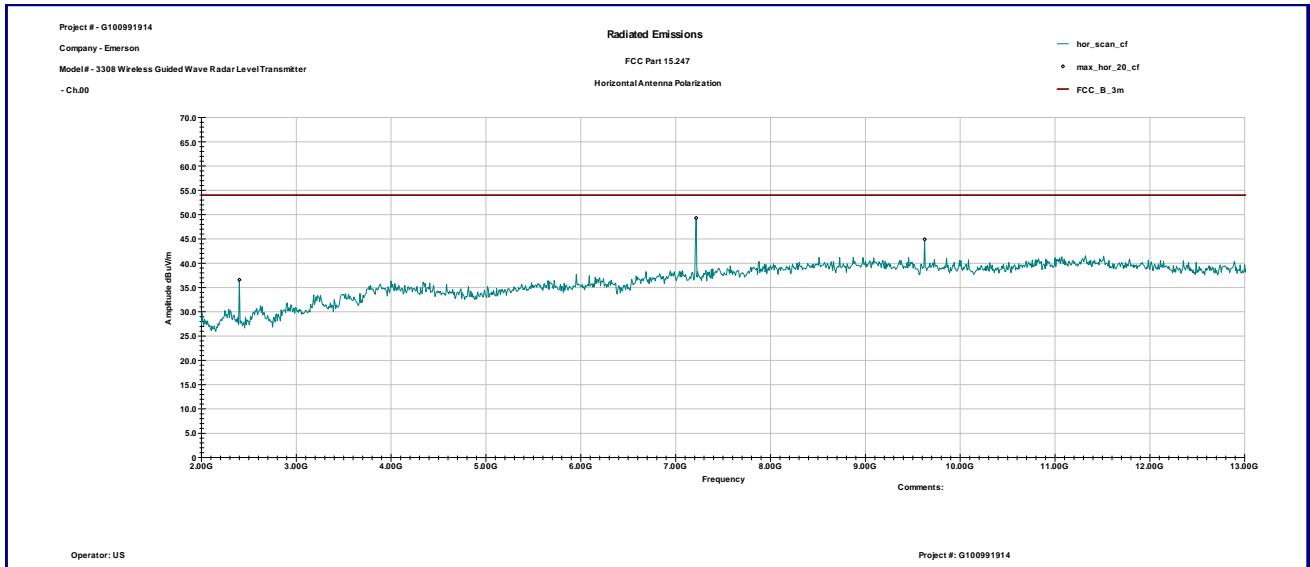
Graph 3.2.3



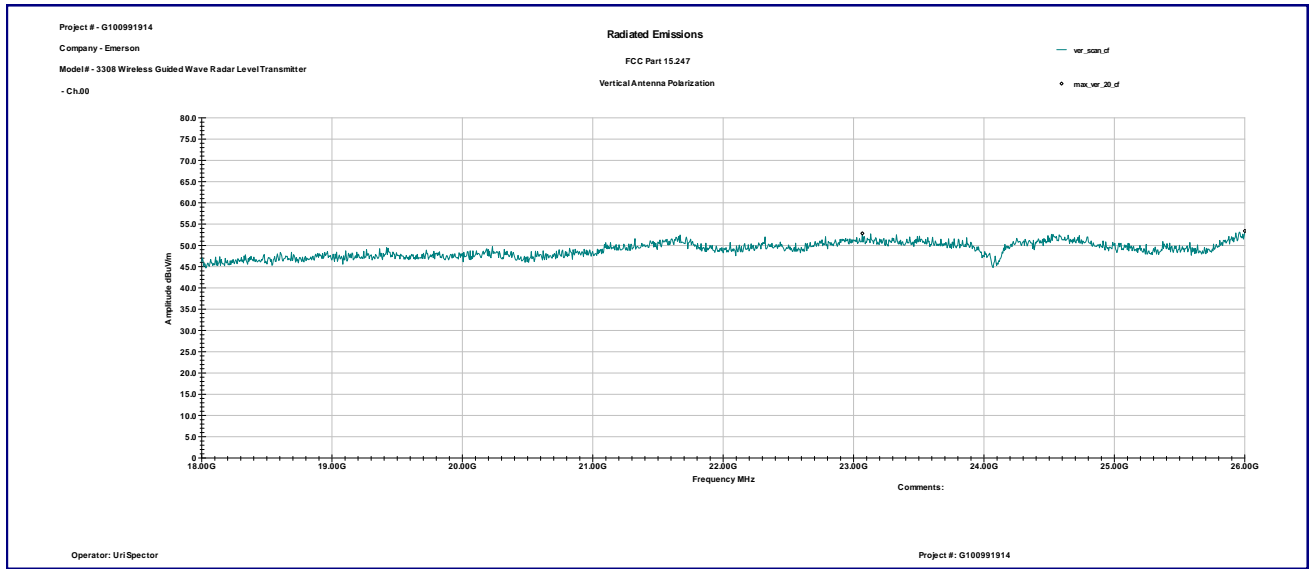
Graph 3.2.4



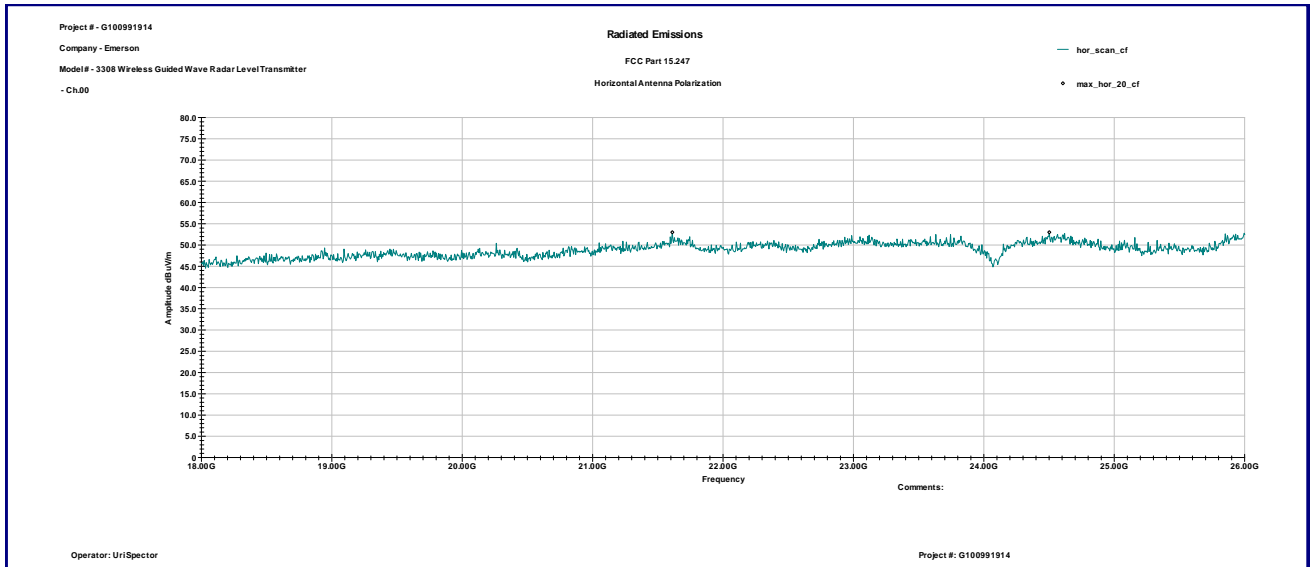
Graph 3.2.5



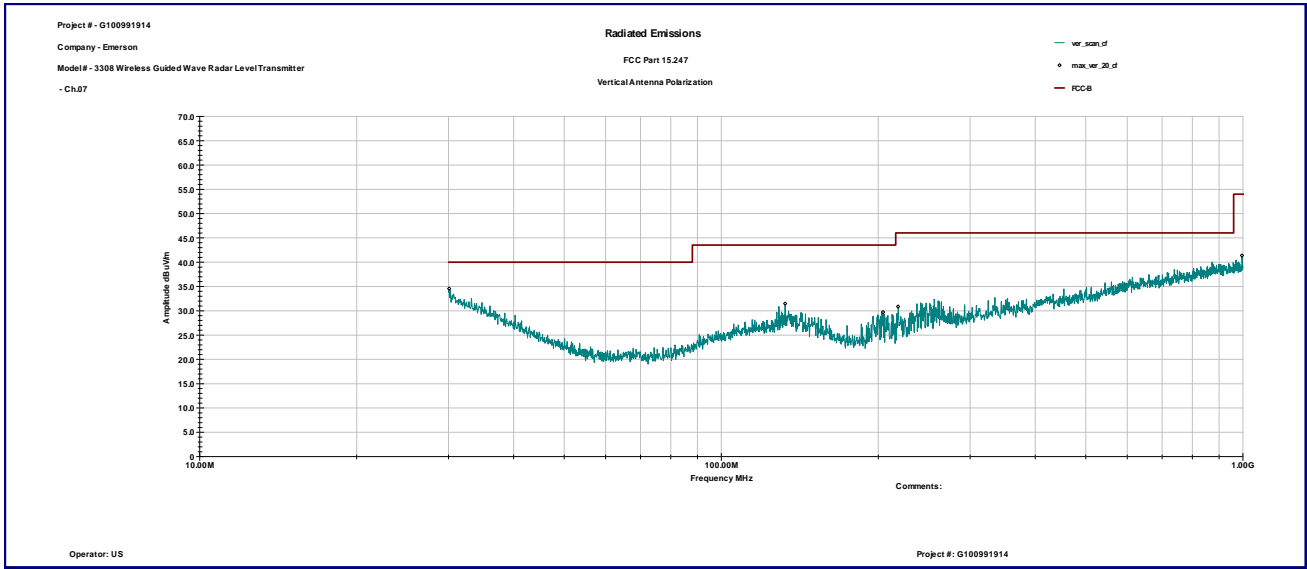
Graph 3.2.6



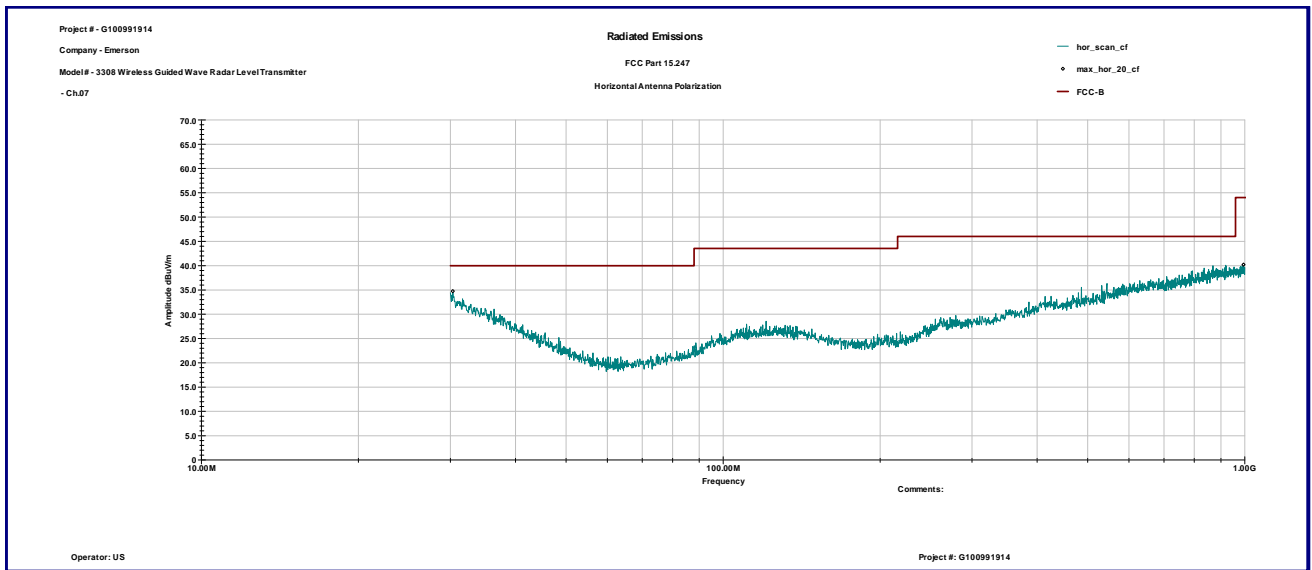
Graph 3.2.7



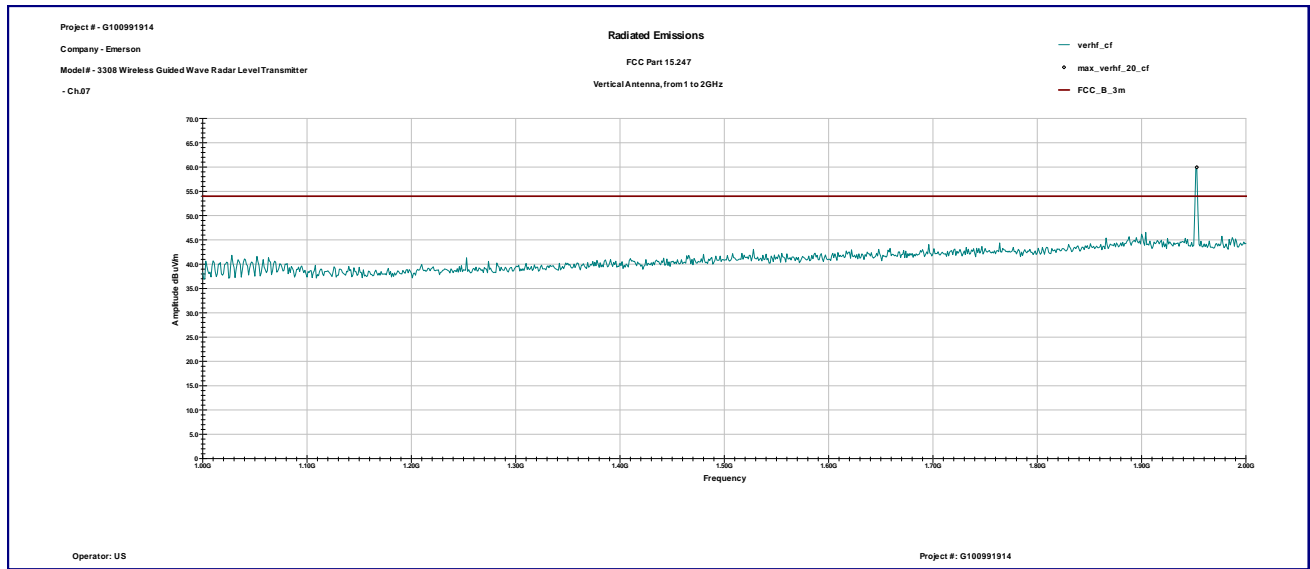
Graph 3.2.8



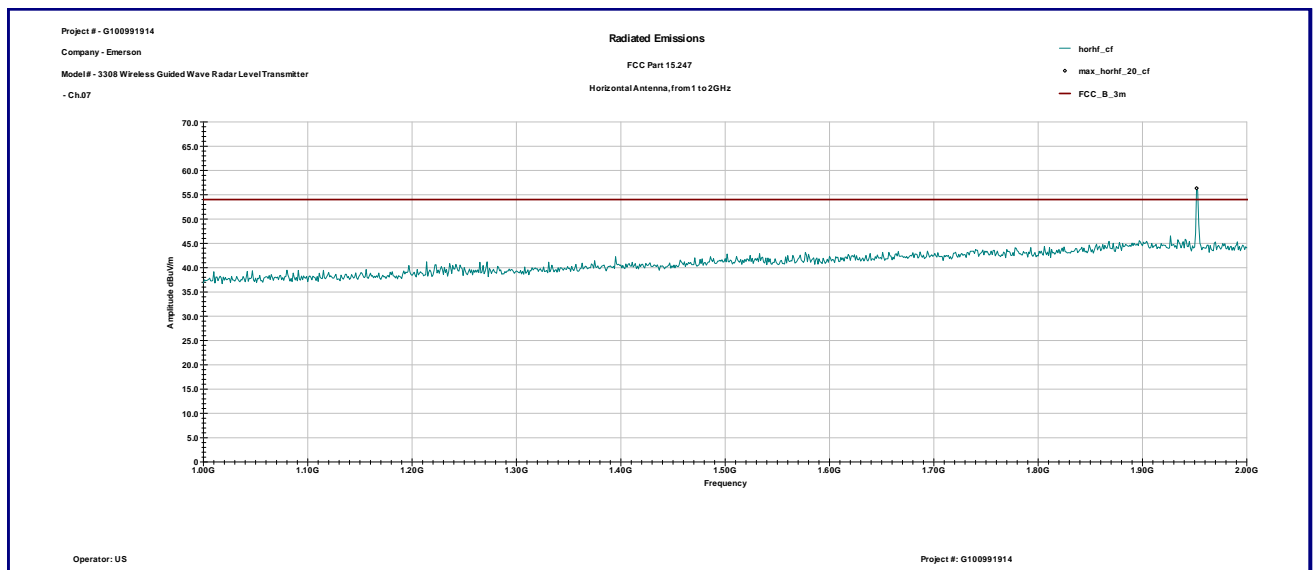
Graph 3.2.9



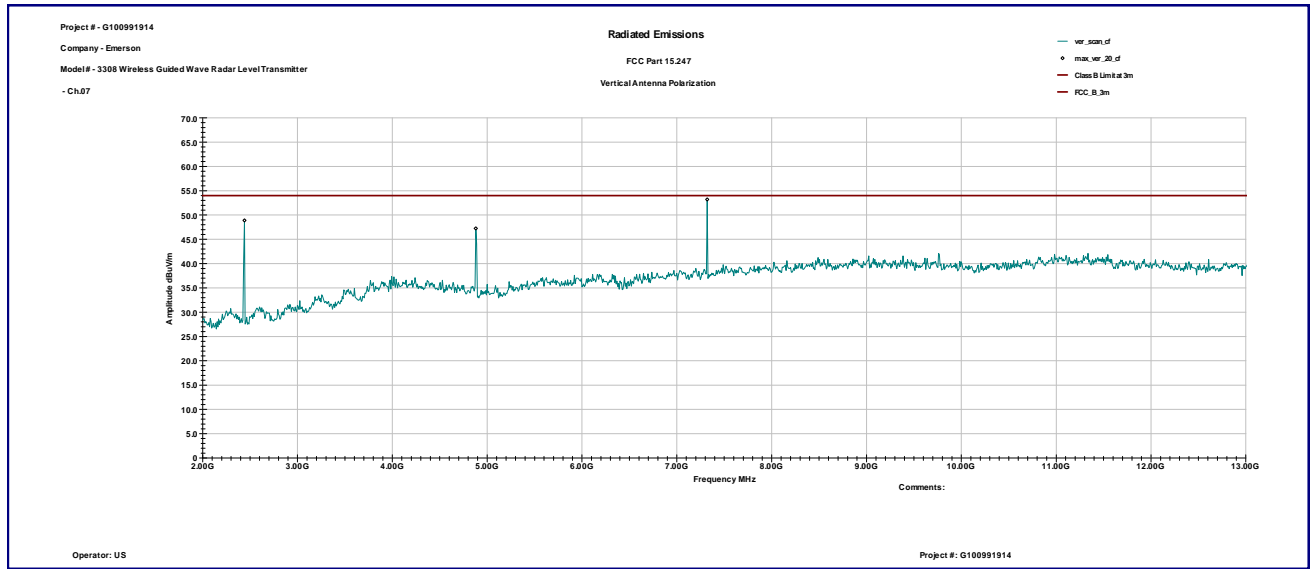
Graph 3.2.10



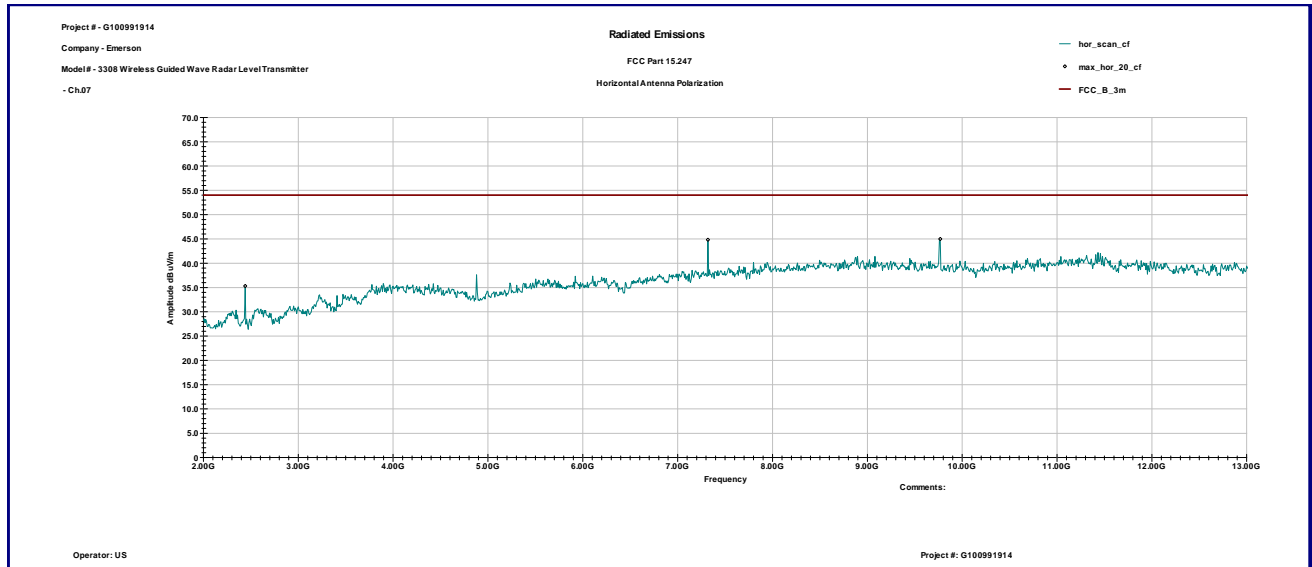
Graph 3.2.11



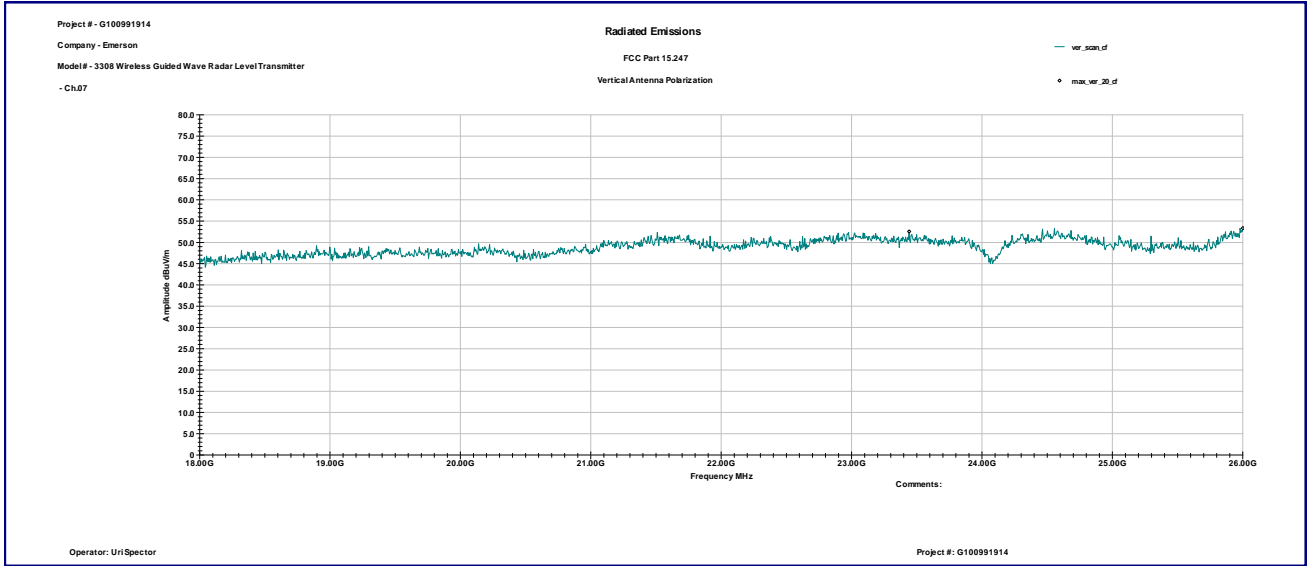
Graph 3.2.12



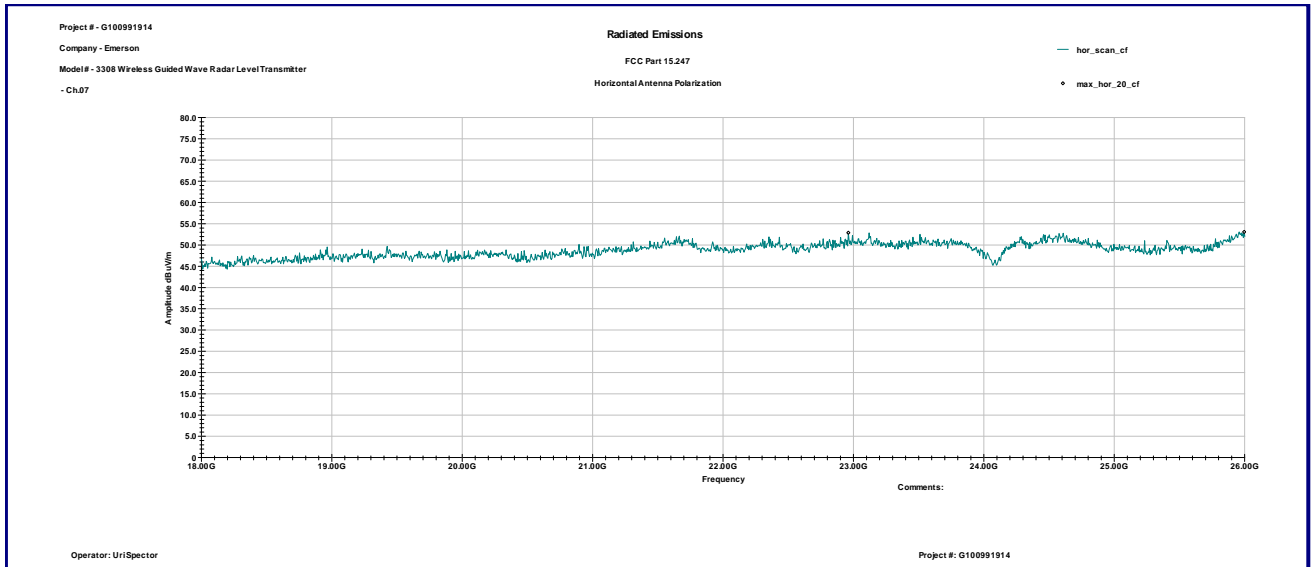
Graph 3.2.13



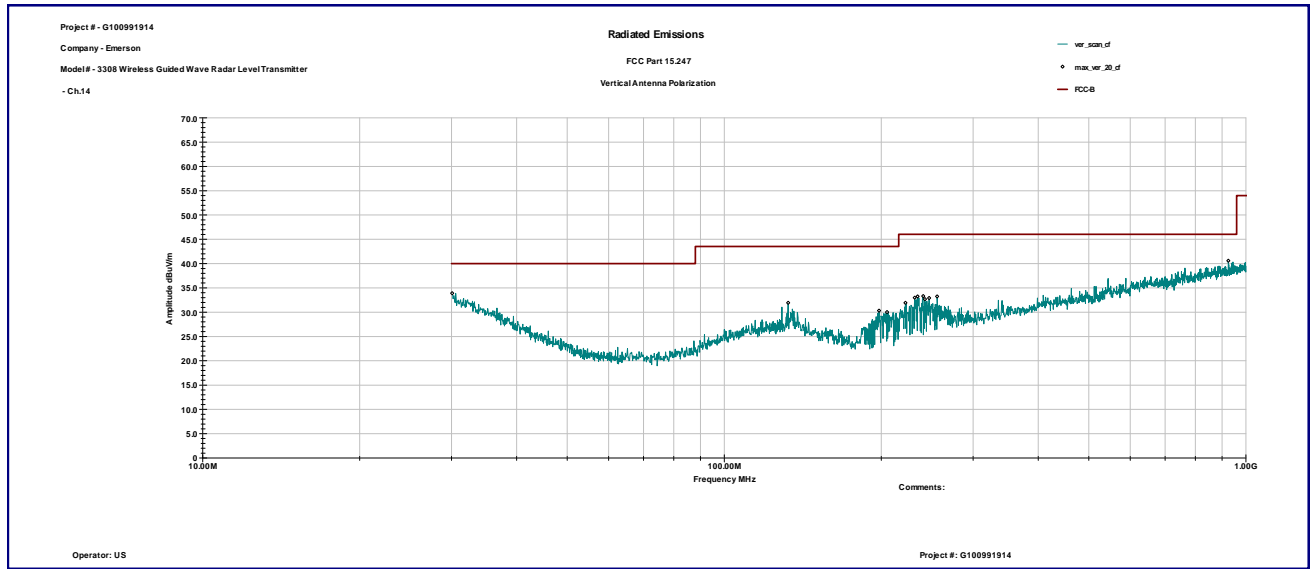
Graph 3.2.14



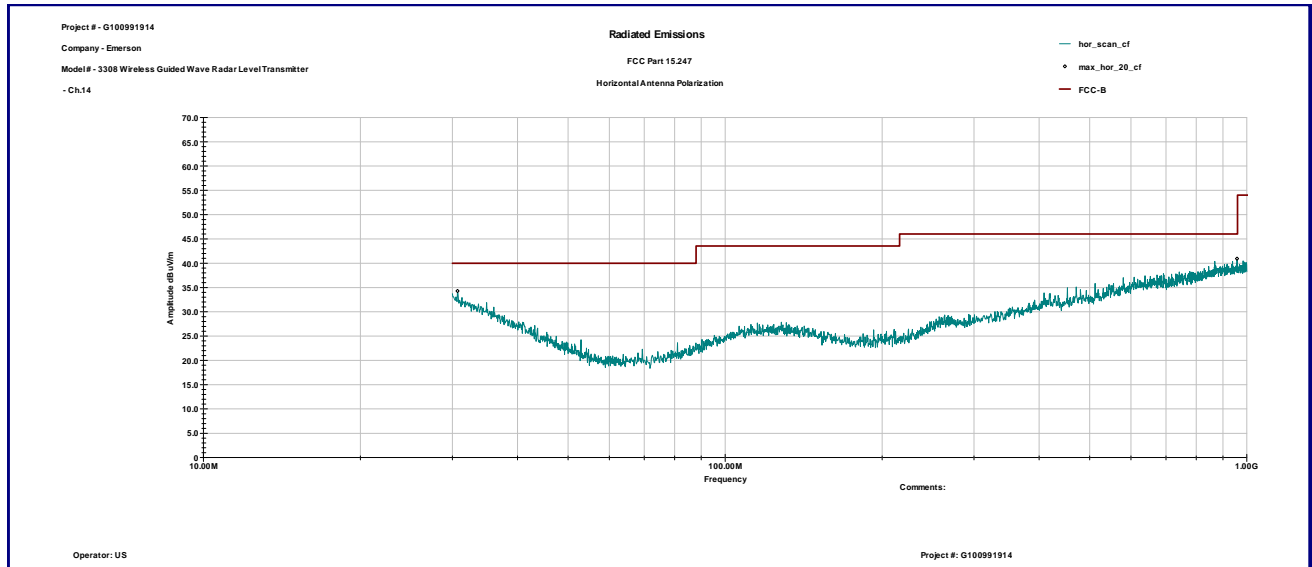
Graph 3.2.15



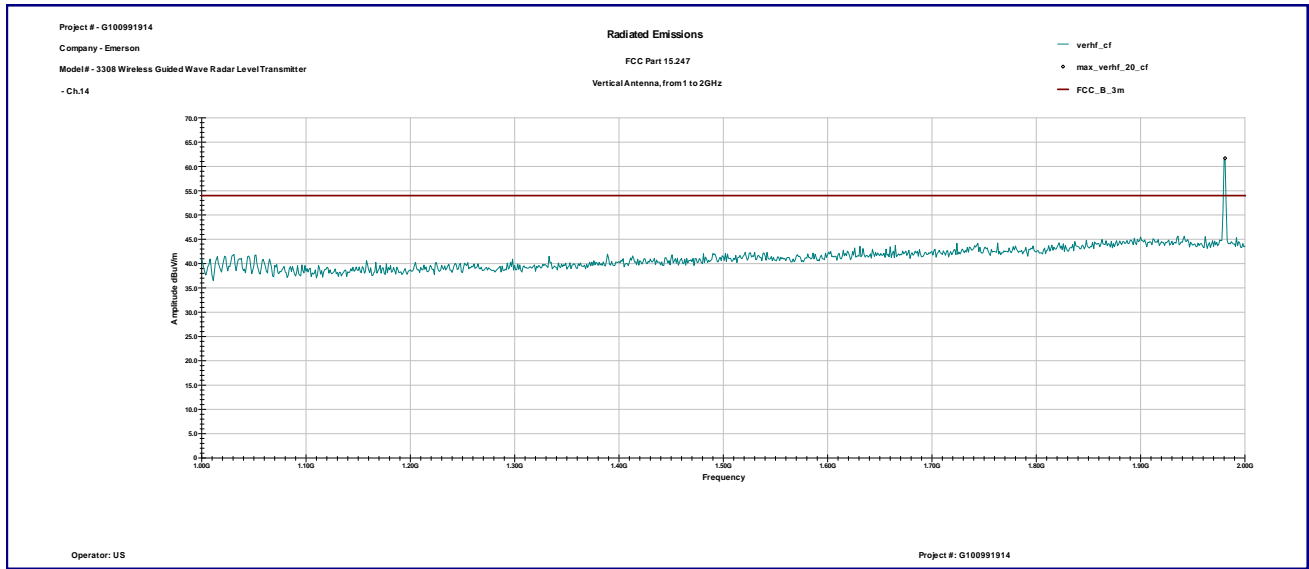
Graph 3.2.16



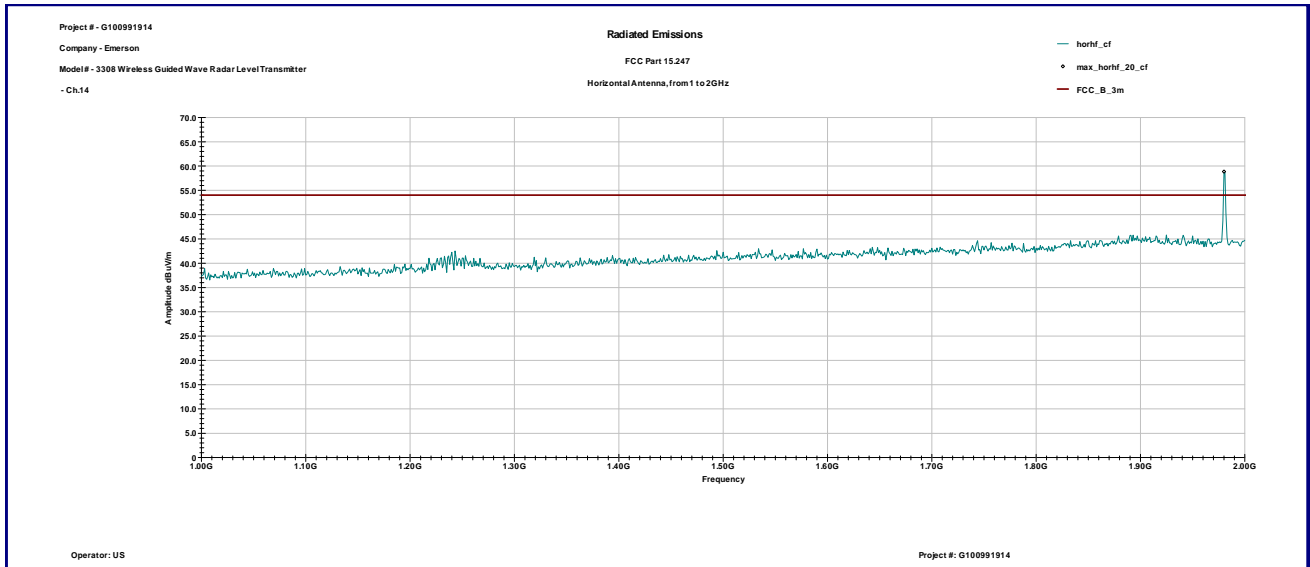
Graph 3.2.17



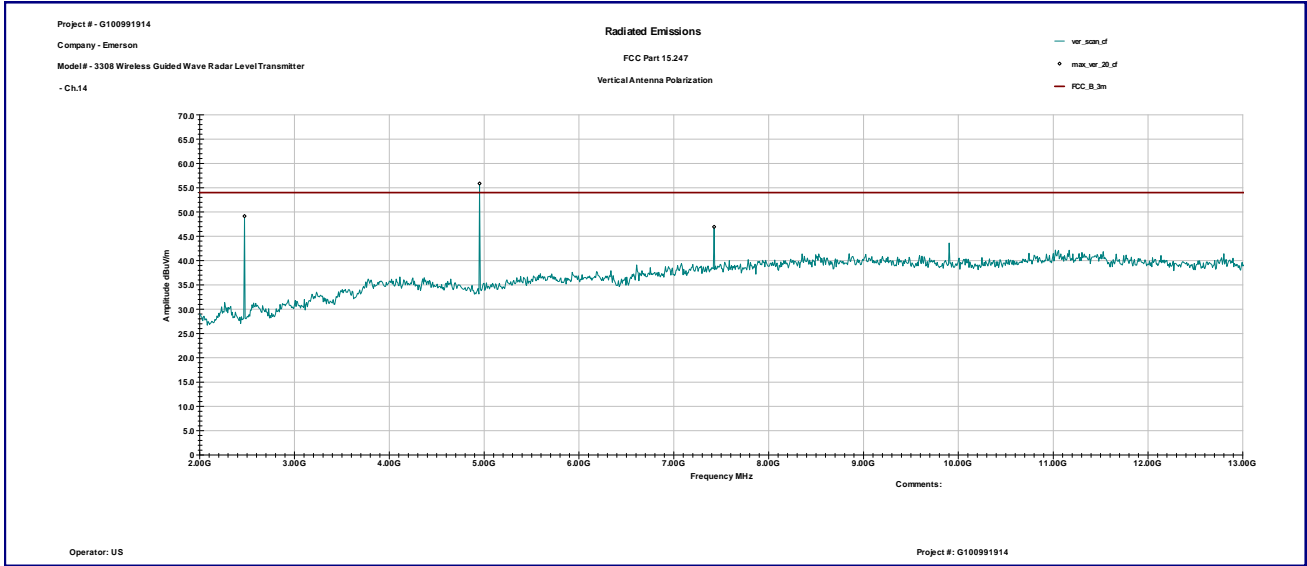
Graph 3.2.18



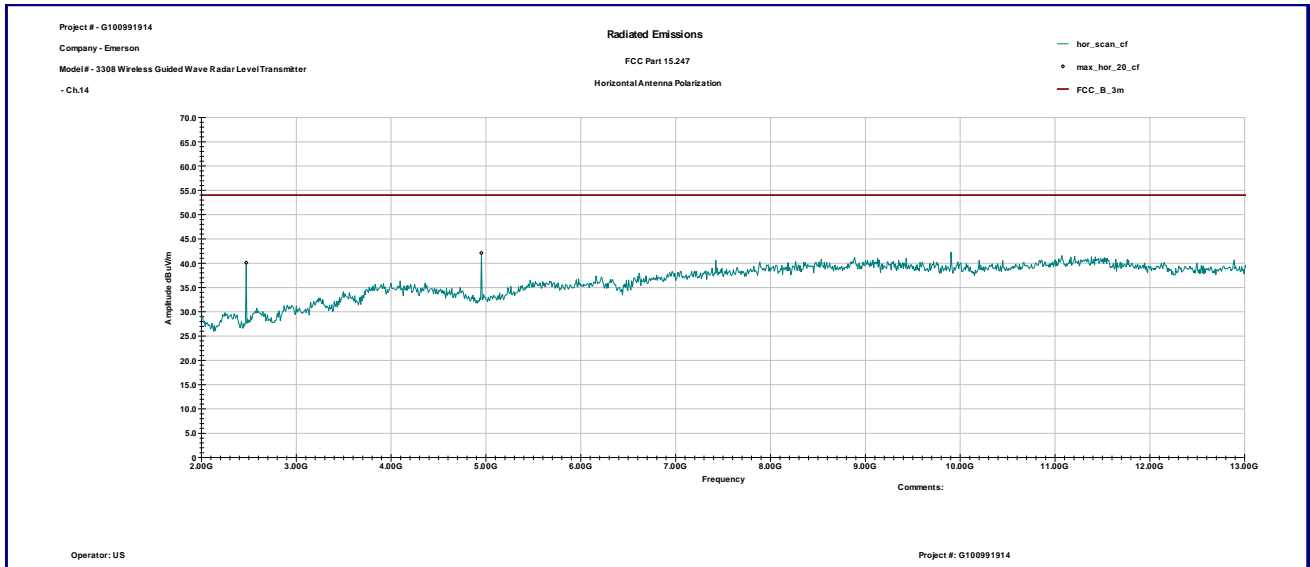
Graph 3.2.19



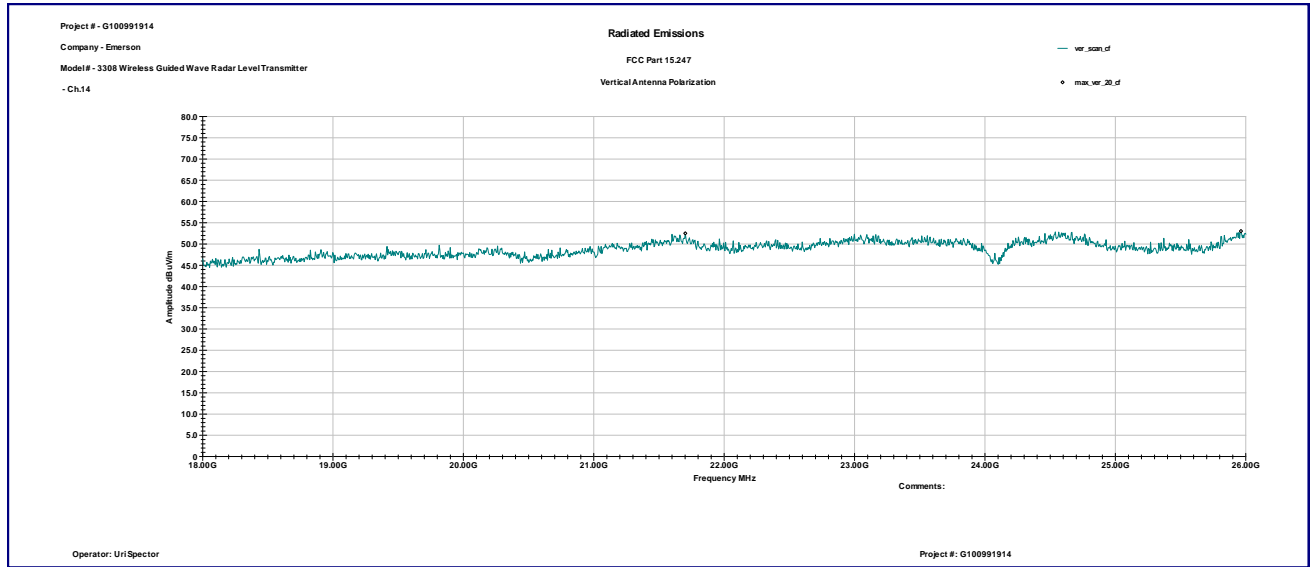
Graph 3.2.20



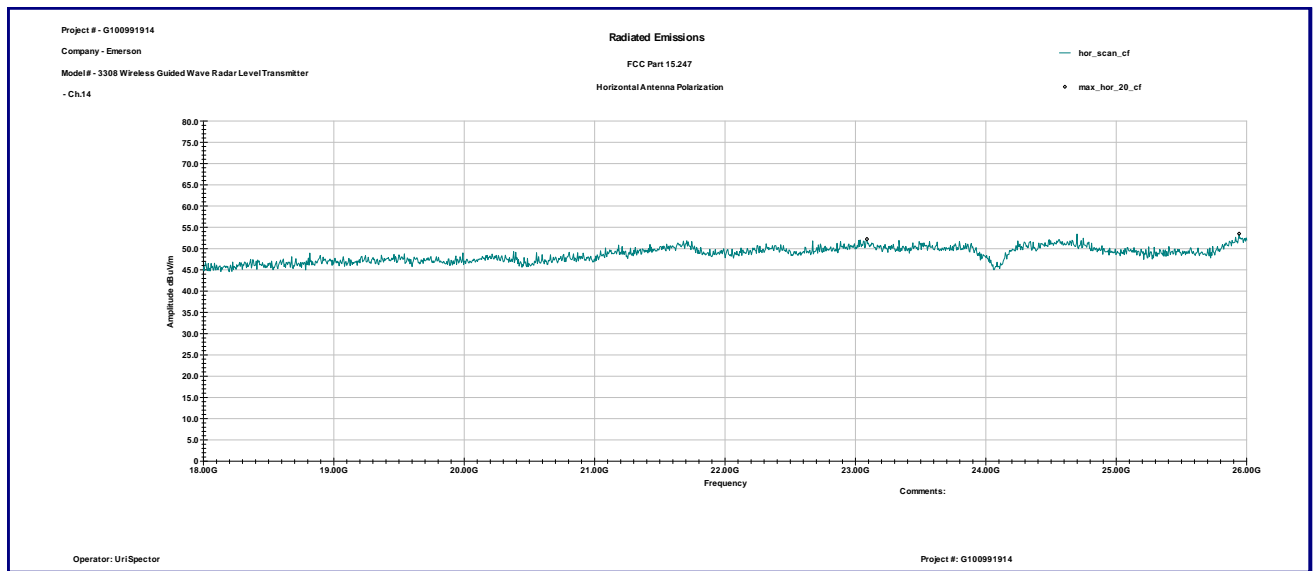
Graph 3.2.21



Graph 3.2.22



Graph 3.2.23



Graph 3.2.24



3.4 RF Exposure Compliance

The maximum measured antenna conducted power, P is 8.6dBm

The antenna gain, G is 4.5dBi

The maximum EIRP power = P + G
ERP = 8.6+ 4.5= 13.1dBm, or 0.02W

The limits for Maximum Permissible Exposure (MPE) for transmitter operating at 2.4Hz, MPE is 1mW/cm², or 10W/m²

$$S = 10W/m^2$$

The Power Density is related to EIRP with the equation:

$$S = EIRP / 4\pi D^2, \text{ or } 10 = 0.02 / 4\pi D^2,$$

The minimum safe separation distance, D = 1.26cm, which is below 20cm



4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	CAL DUE	USED
Spectrum Analyzer	R & S	FSP 40	100024	12559	11/29/2013	<input checked="" type="checkbox"/>
Spectrum Analyzer	R & S	ESCI	100358	12909	07/02/2013	<input checked="" type="checkbox"/>
Bicono-Log Antenna	Teseq	CBL6112D	32859	25289	08/09/2013	<input checked="" type="checkbox"/>
Horn Antenna	EMCO	3115	9507-4513	9936	05/16/2013	<input checked="" type="checkbox"/>
Horn Antenna	EMCO	3115	6579	15580	07/19/2013	<input checked="" type="checkbox"/>
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1122951	13475	11/01/2013	<input checked="" type="checkbox"/>
Pre-Amplifier	MITEQ	AMF-6F-16002600-25-10P	1222383	MIN-0065	11/01/2013	<input checked="" type="checkbox"/>
High Pass Filter	Reactel	7HS-4G-S12	0223	015274	VBU	<input checked="" type="checkbox"/>
System	Quantum Change	TILE! Instrument Control	Ver. 3.4.K.29	15259	VBU	<input checked="" type="checkbox"/>