



TEST REPORT

Report Number: 101507452MIN-001F

Project Number: G101507452

Testing performed on the

775

FCC ID: LW2775-WM

to

47 CFR Part 15.247:2013

RSS- 210, Issue 8, 2010

RSS-Gen, Issue 3, 2010

47 CFR, Part 15:2013, §15.107 and §15.109, Class / ICES-003, Issue 5:2012

For

Emerson Process Management

Test Performed by:

Intertek Testing Services NA, Inc.
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Oakdale, MN 55128 USA

Test Authorized by:

Emerson Process Management
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Chanhassen, MN 55317

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Uri Spector

Date: January 31, 2014

Reviewed by: Simon Khazon
Simon Khazon

Date: January 31, 2014

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1.0 GENERAL DESCRIPTION

Model:	775
Type of EUT:	Industrial Wireless communication adapter
Serial Number:	N/A
FCC ID:	LW2775-WM
Related Submittal(s) Grants:	None
Company:	Emerson Process Management
Customer:	Mr. Merritt Pulkrabek
Address:	8200 Market Blvd., Mail Stop SB4L Chanhassen, MN 55317
Phone:	(952) 949-5193
Fax:	(952) 949-7626
e-mail:	merritt.pulkrabek@emerson.com
Test Standards:	☒ 47 CFR, Part 15:2013, §15.247 ☒ RSS-210, Issue 8, 2010 ☒ RSS-Gen, Issue 3, 2010 ☒ 47 CFR, Part 15:2013, §15.107 and §15.109, Class B ☒ ICES-003, Issue 5:2012 ☐ Other
Type of radio:	☐ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	January 27, 2014
Test Work Started:	January 27, 2014
Test Work Completed:	January 31, 2014
Test Sample Conditions:	☐ Damaged ☐ Poor (Usable) ☒ Good



1.1 Product Description; Test Facility

Product Description:	2.4 – 2.4835GHz Transceiver
Transmitter Type:	☐ FHSS ☒ Digital Modulation ☐ WiFi ☐ Blue Tooth
Operating Frequency Range(s):	From 2400 to 24835 MHz
Number of Channels:	16
Modulation:	QPSK
Emission Designator:	1M5G7D
Antenna(s) Info:	Antenna 1. Type: Omni directional Gain: 2dBi Connector Type: Solder direct to circuit board via coax
Antenna Installation:	☐ User ☐ Professional ☒ Factory
Transmitter power configuration:	☐ Internal battery ☐ External power source ☐ 120VAC ☐ 230VAC ☐ 400VAC ☒ 6VDC ☐ Other: Amp. ☐ 50Hz ☐ 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 558074 D01 DTS Measurement Guidance

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
2	

Cables:

No.	Type	Length	Designation	Note
1	2-wire DC power cable	>10ft	DC power	
2	2-wire communication cable	>10ft		

Support equipment/Services:

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

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

☐ Temperature:	-20 to +50 ° C
☐ 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(a) / RSS-210 A8.2	6dB DTS bandwidth of the digital modulation	Pass
15.247(b), (c) / RSS-210 A8.4	Maximum peak output power	Pass
15.247(e) / RSS-210 A8.2	Power spectral density	Pass
15.247(d) / RSS-210 A8.5	Antenna conducted spurious emissions	Pass
15.247(d) / RSS-210 A8.5	Radiated spurious emissions	Pass
15.247(i) / RSS- Gen 5.5	RF Exposure Compliance	Pass
15.207 / RSS-Gen 7.2.2	Transmitter Power Line conducted emissions	Pass
15.109 / ICES-003	Receiver/digital device radiated emissions	Pass
15.107 / ICES-003	Digital device conducted emissions	Pass

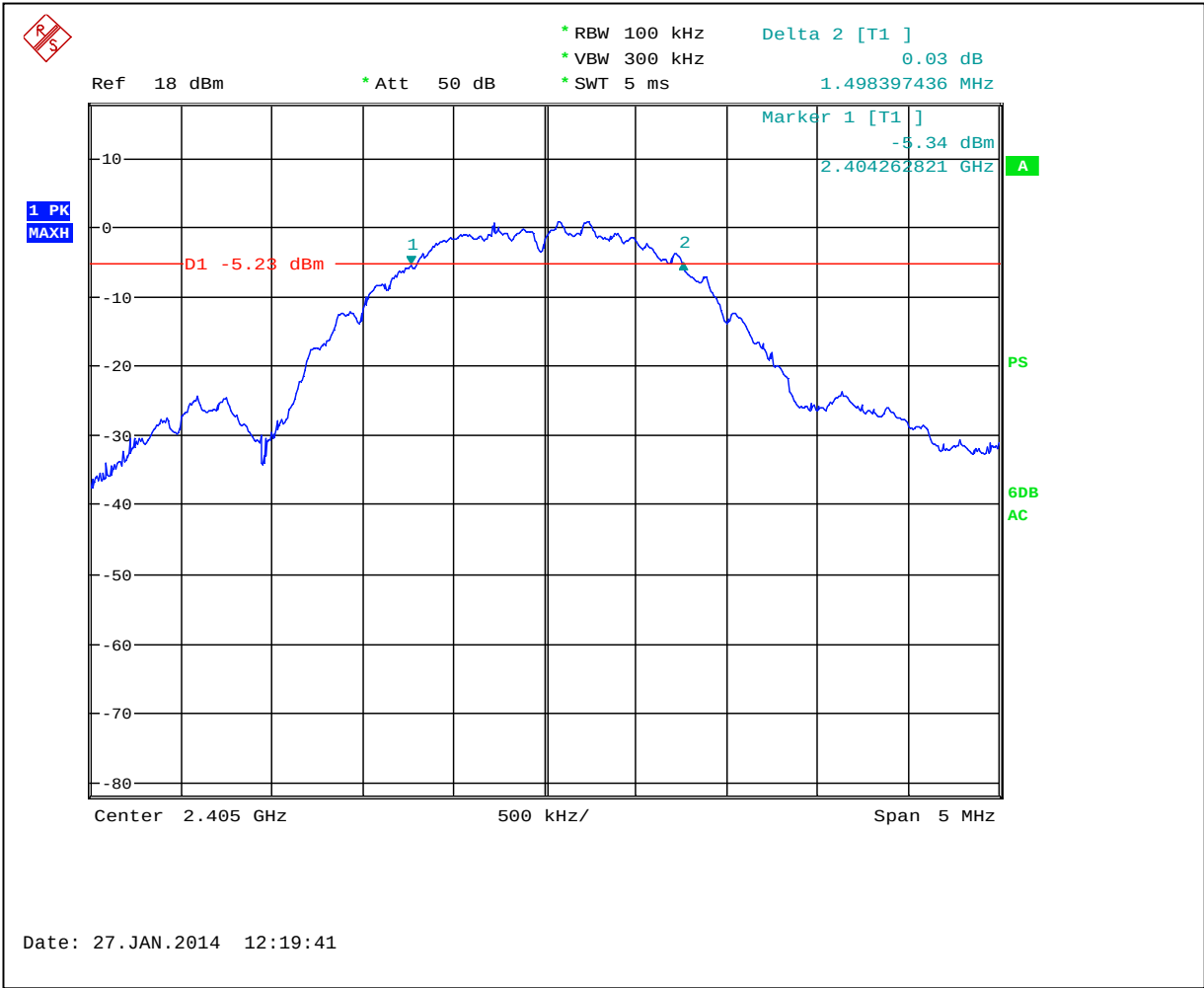


3.0 TEST CONDITIONS AND RESULTS

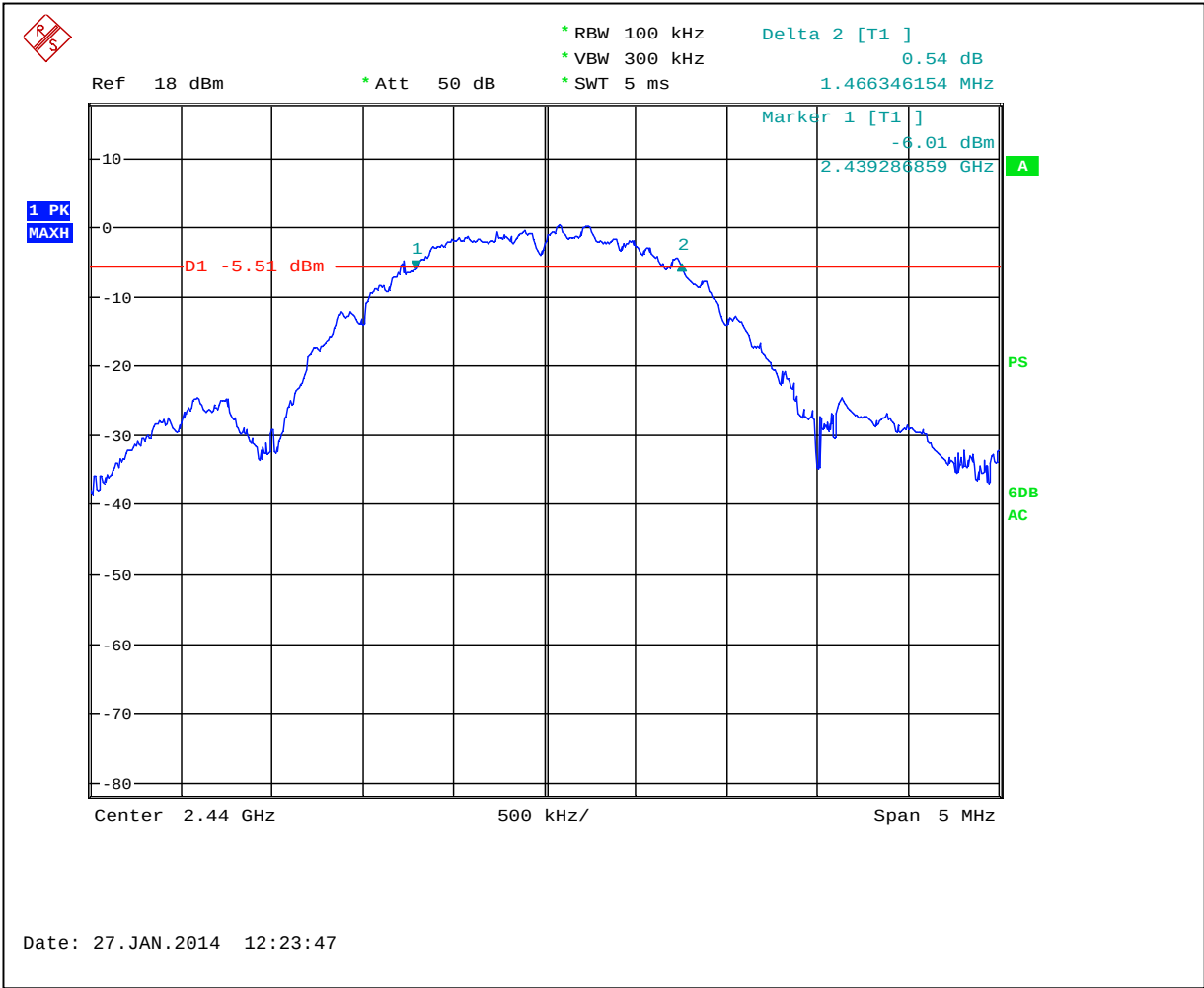
3.1 6dB DTS bandwidth of the digital modulation

Low Frequency Channel kHz	Middle Frequency Channel kHz	Upper Frequency Channel kHz	Minimum Bandwidth kHz	Result
1498.39	1466.34	1474..35	500	Pass
RBW:	☒ 100kHz			
VBW:	☒ 300kHz			

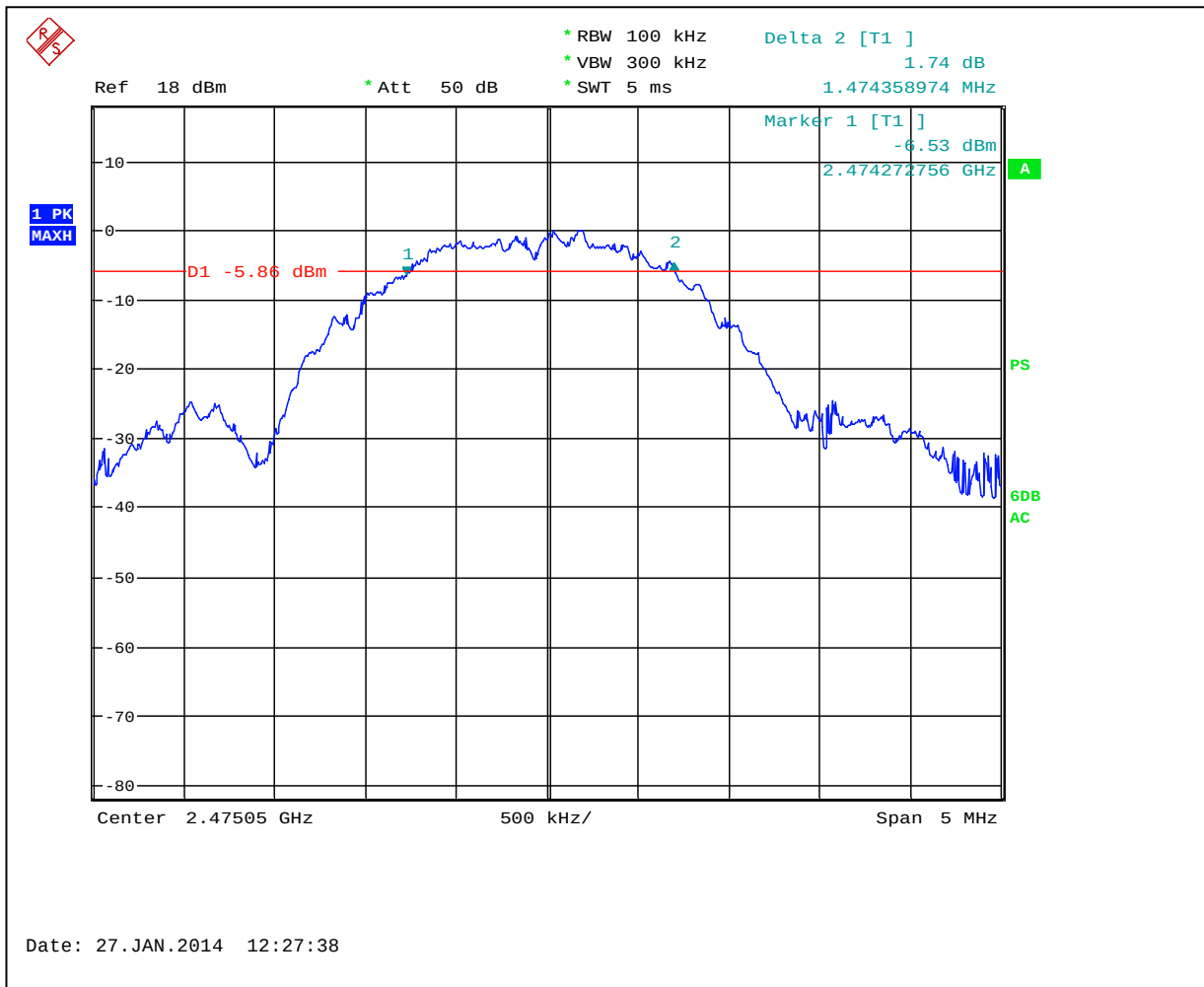
Notes: Graphs 3.1.1 to 3.1.3 show the 6dB bandwidth



Graph 3.1.1



Graph 3.1.2



Graph 3.1.3



3.2 Maximum peak output power

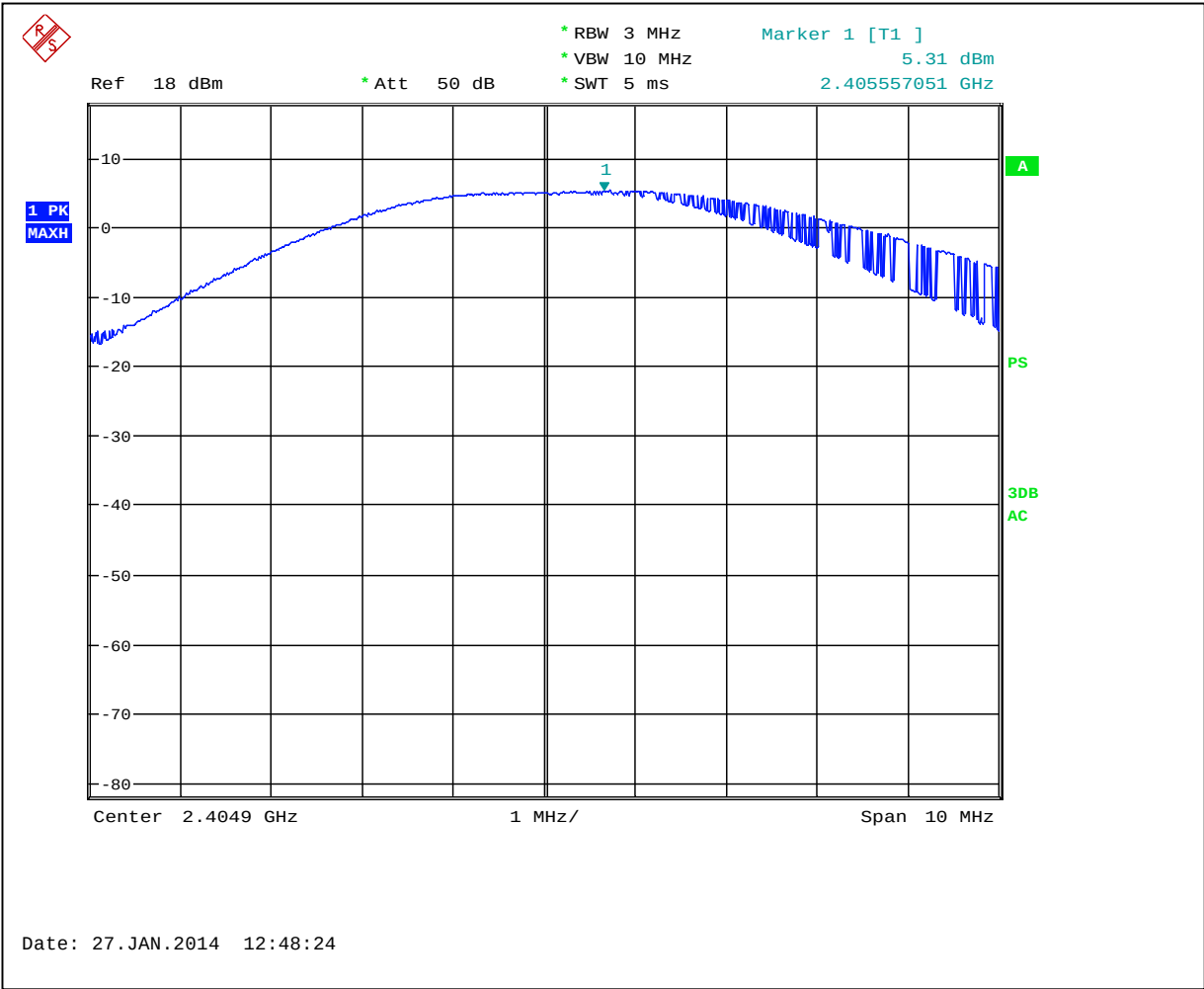
Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

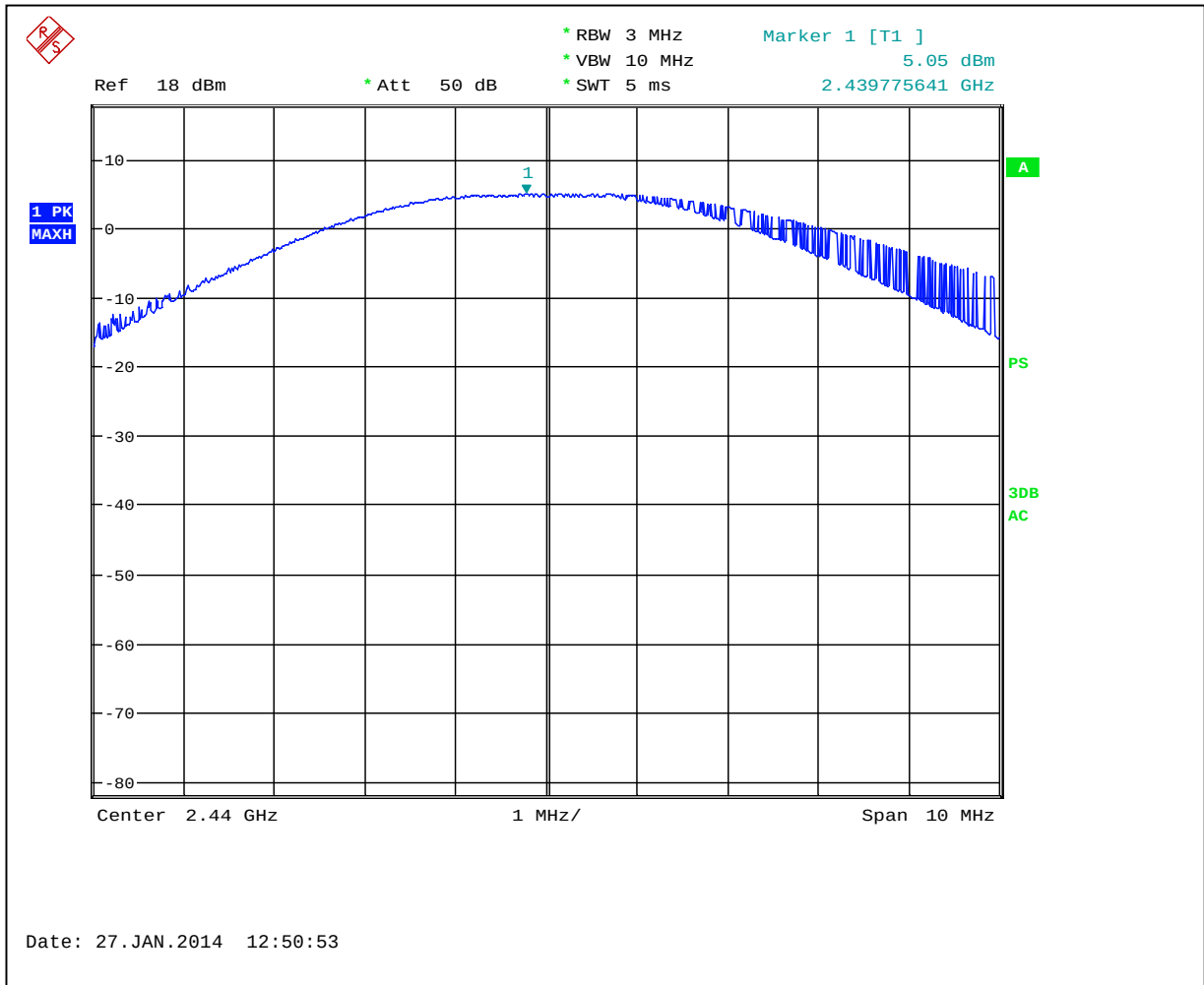
Max. Margin: 21.99dB below the limits

Power Output:	Conducted					
Frequency Range:	☐ 902-928MHz ☒ 2400-2483.5MHz ☐ 5725-5850MHz					
Low Frequency MHz	Measured power dBm	Attenuation dB	Power at Antenna dBm	Limit dBm	Limit Reduction dB	Margin dB
2404.90	5.31	2.7	8.01	30	0	-21.99
Middle Frequency MHz						
2440.00	5.05	2.7	7.75	30	0	-22.25
Upper Frequency MHz						
2475.05	4.53	2.7	7.23	30	0	-22.77
RBW:	☐ 1MHz ☒ 3MHz ☐ 10MHz					
VBW:	☐ 1MHz ☐ 3MHz ☒ 10MHz					
Antenna Gain:	☒ < 6dBi ☐ >6dBi and = dBi, Output power reduction = dB					

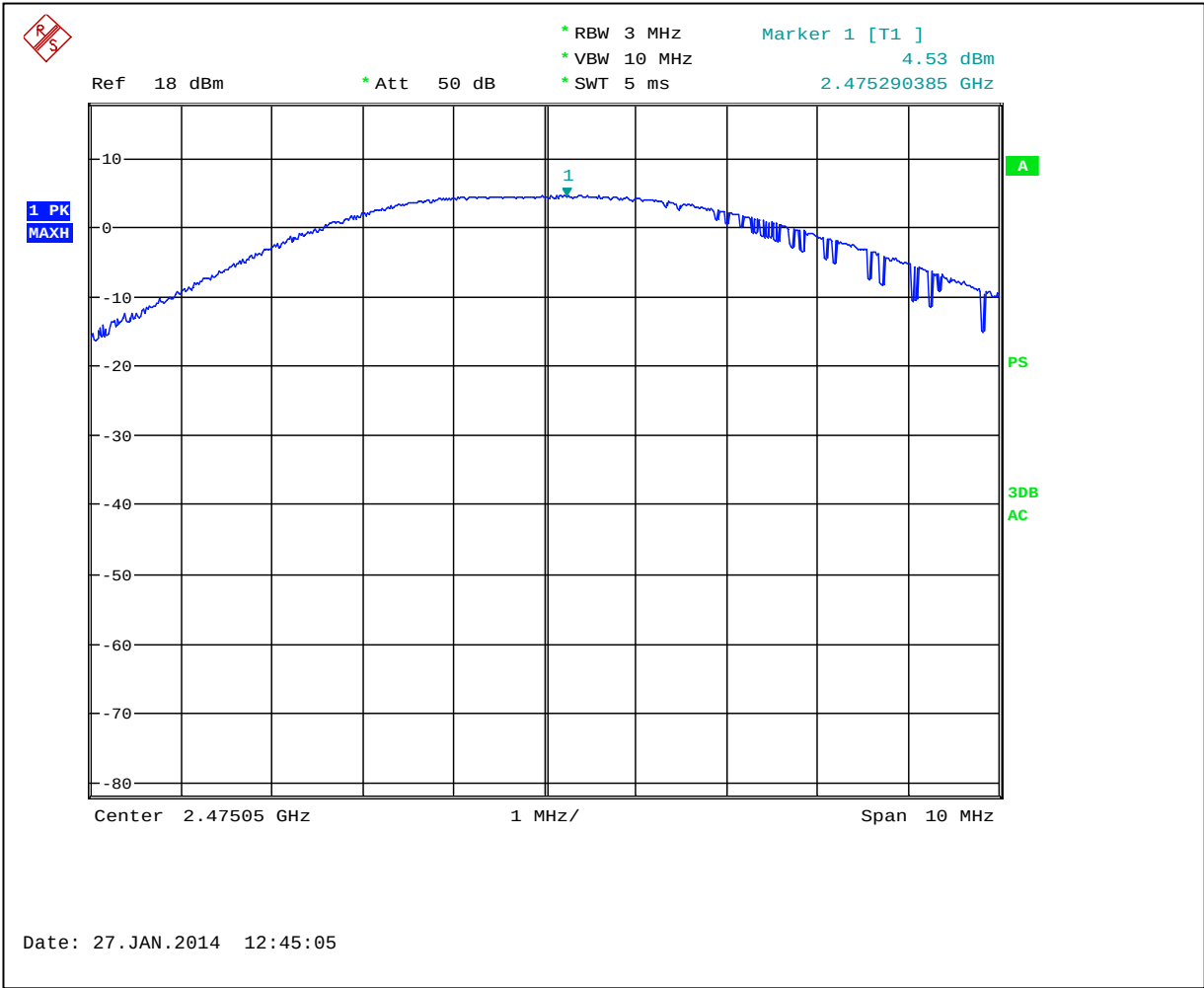
Notes:



Graph 3.2.1



Graph 3.2.2



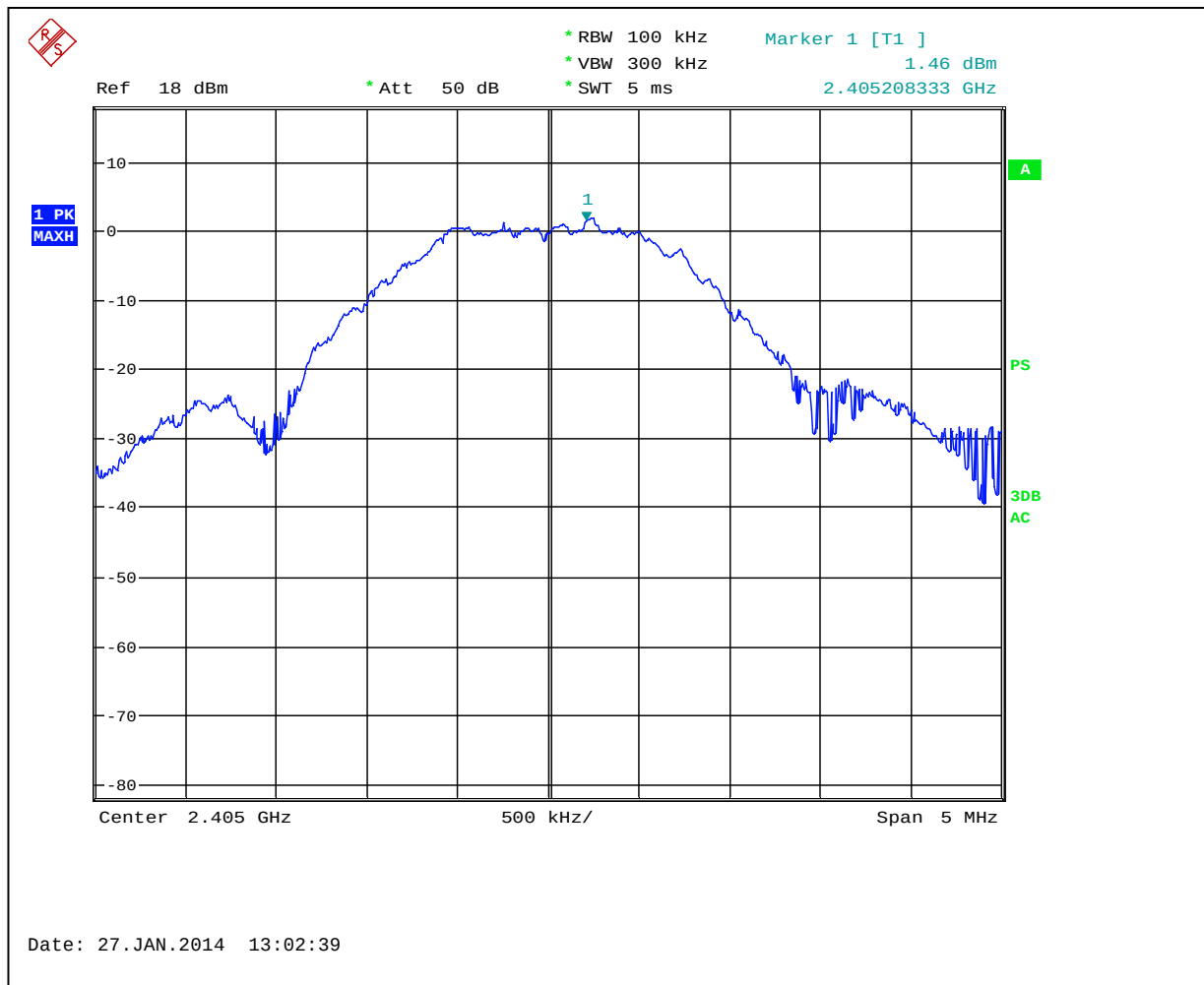
Graph 3.2.3



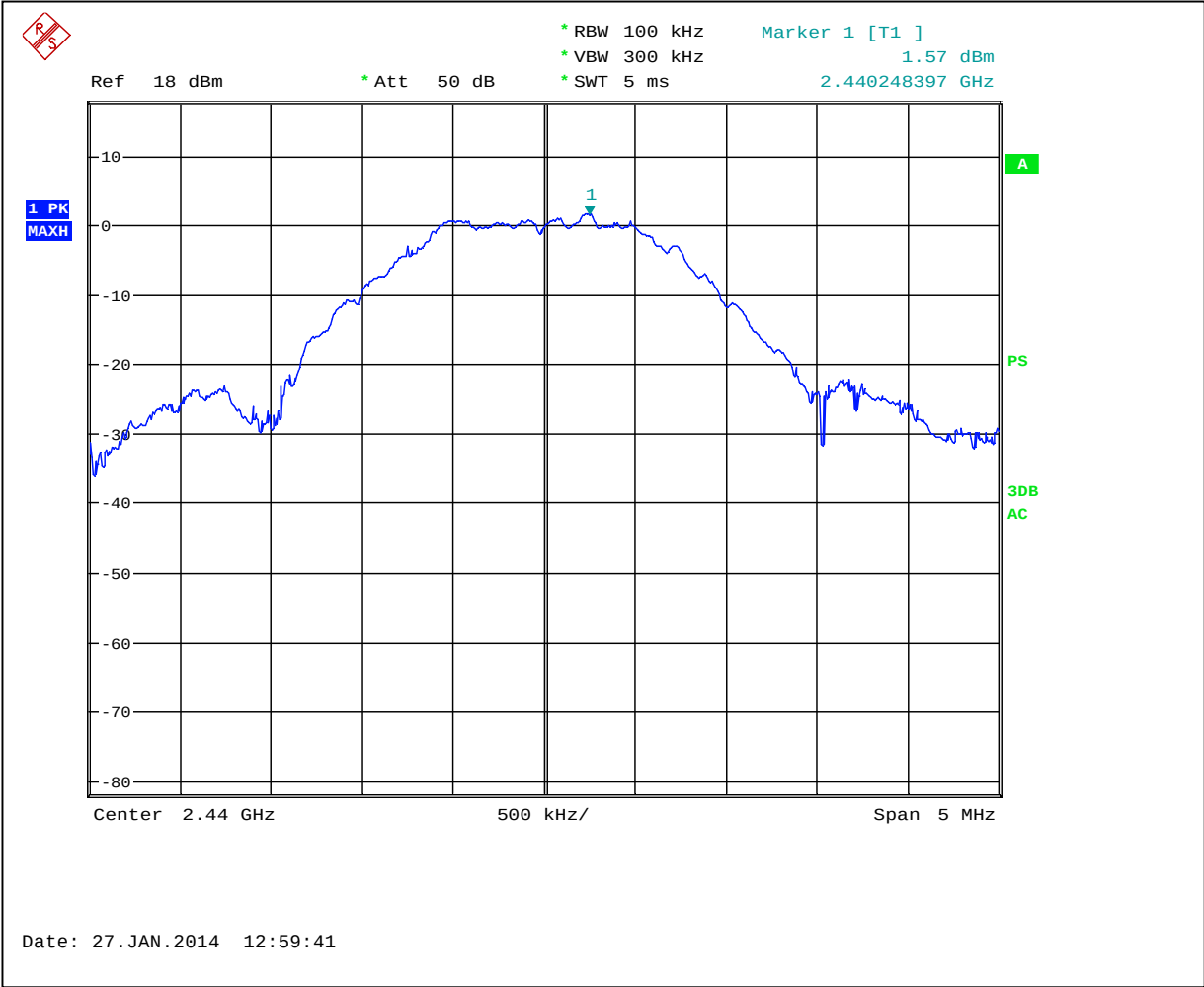
3.3 Power spectral density

Power Output:	☒ Conducted ☐ Radiated			
	Measured Density dBm	Power Spectral Density dBm	Limit dBm	Margin dB
Low Frequency Channel	1.46	4.16	8	-3.84
Middle Frequency Channel	1.57	4.27	8	-3.73
Upper Frequency Channel	1.14	3.84	8	-4.16
Analyzer Settings:	☒ RBW=100KHz ☒ VBW=300KHz ☒ Span=5MHz ☒ Sweep=Auto			
Antenna Gain:	☒ < 6dBi and = 2dBi ☐ >6dBi and = dBi, limit reduction = dB			

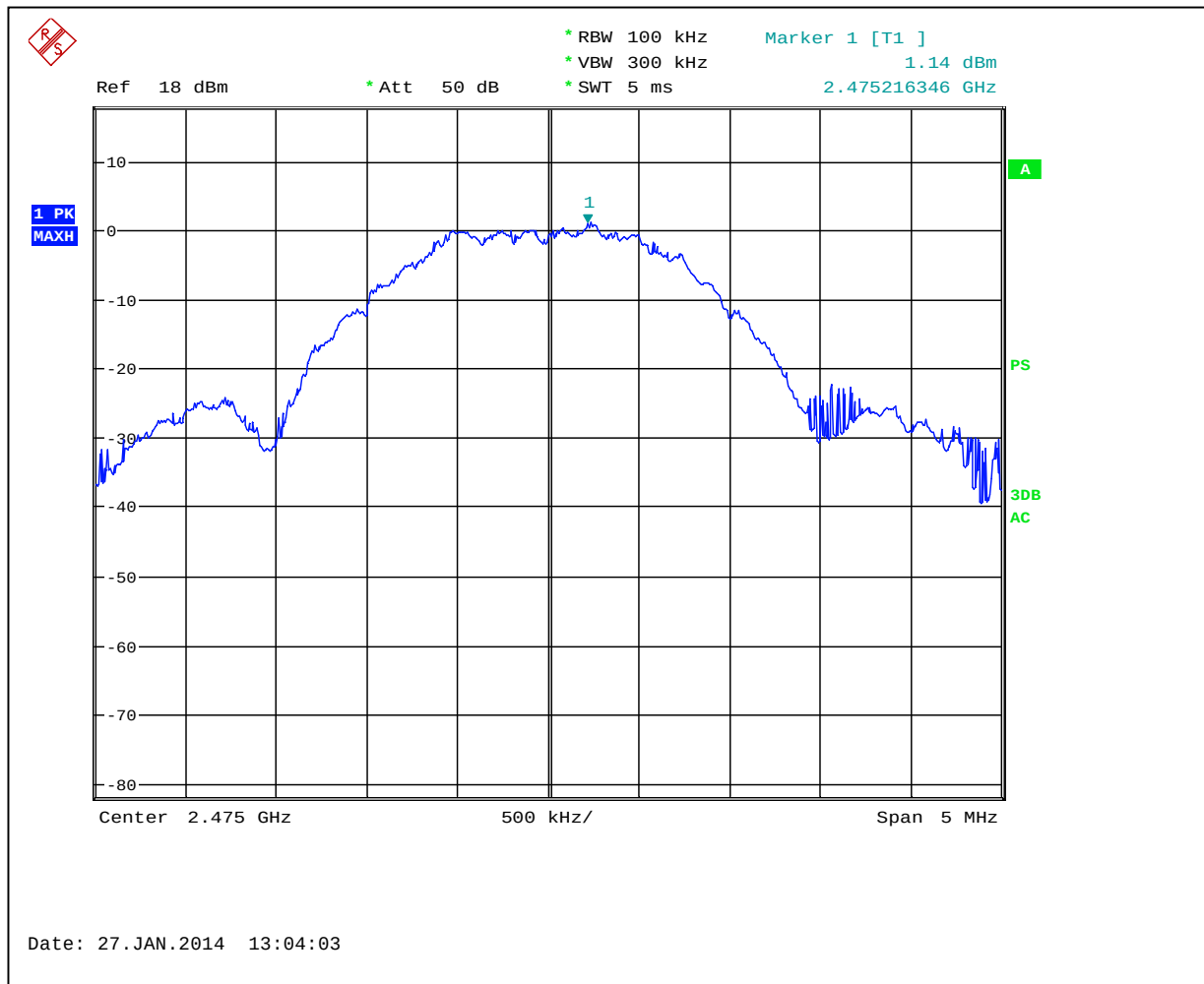
Notes: The Power Spectral Density was calculated adding the cable/attenuator loss of 2.7 dB from the measured density value.
Graphs 3.3.1 to 3.3.3 show the Power Spectral Density



Graph 3.3.1



Graph 3.3.2



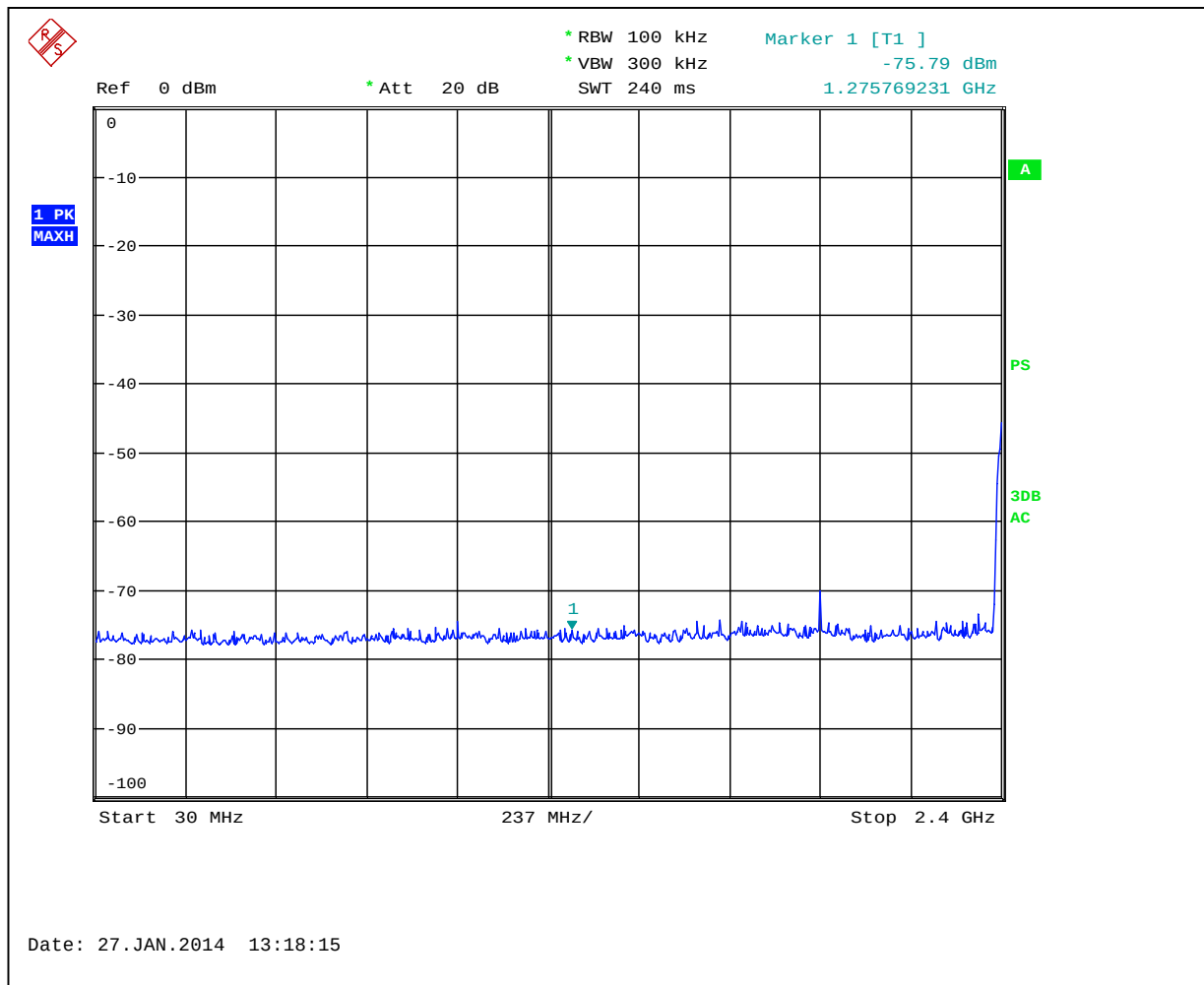
Graph 3.3.3



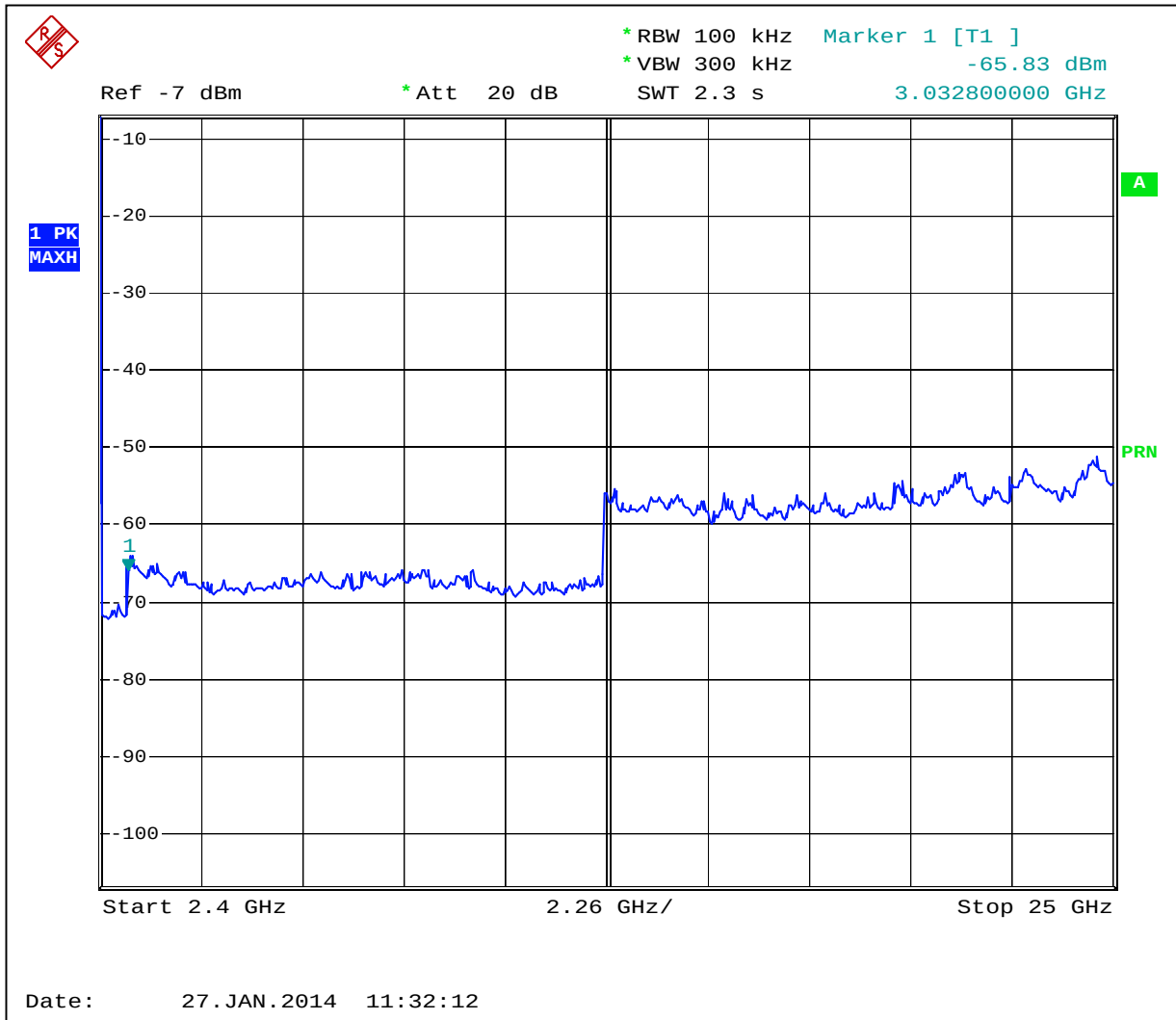
3.4 Antenna conducted spurious emissions

	Minimum Measured Attenuation dB	Minimum Allowed Attenuation dB	Margin dB
Low Frequency Channel	71.1	20	-51.1
Middle Frequency Channel	70.5	20	-50.5
Upper Frequency Channel	66.7	20	-46.7
Analyzer Settings:	☒ RBW=100KHz		
Minimum Allowed Attenuation:	☒ 20dB ☐ 30dB (for digital systems with conducted power measured using RMS averaging over a time interval)		

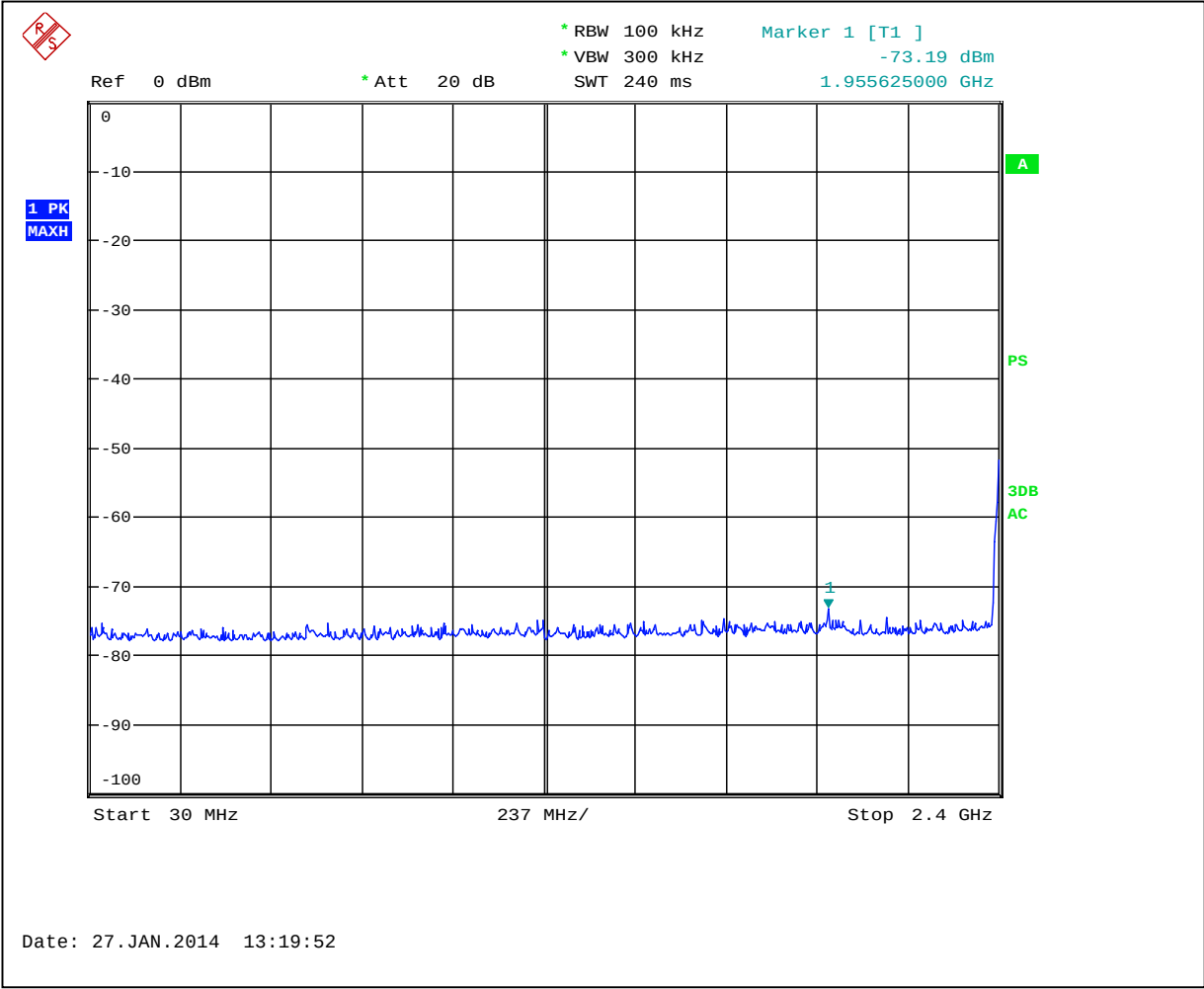
Notes: Test was performed in frequency range from 30MHz to 25GHz
Graphs 3.4.1 to 3.4.2 show the Antenna Conducted Spurious Emissions for channel 0
Graphs 3.4.3 to 3.4.4 show the Antenna Conducted Spurious Emissions for channel 7
Graphs 3.4.5 to 3.4.6 show the Antenna Conducted Spurious Emissions for channel 14
Graph 3.4.7 shows band edge compliance at 2400MHz
Graph 3.4.8 shows band edge compliance at 2483.5MHz



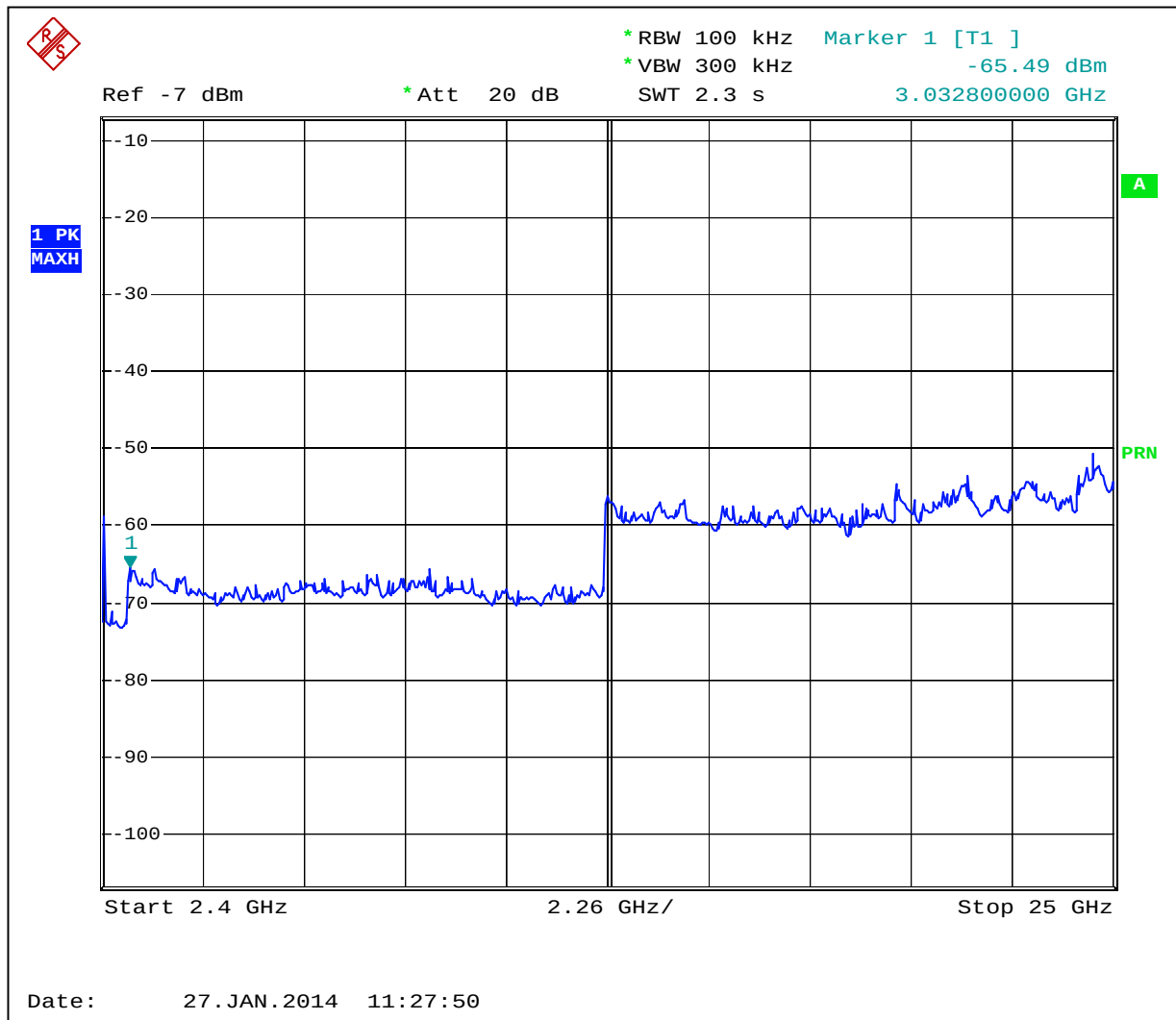
Graph 3.4.1



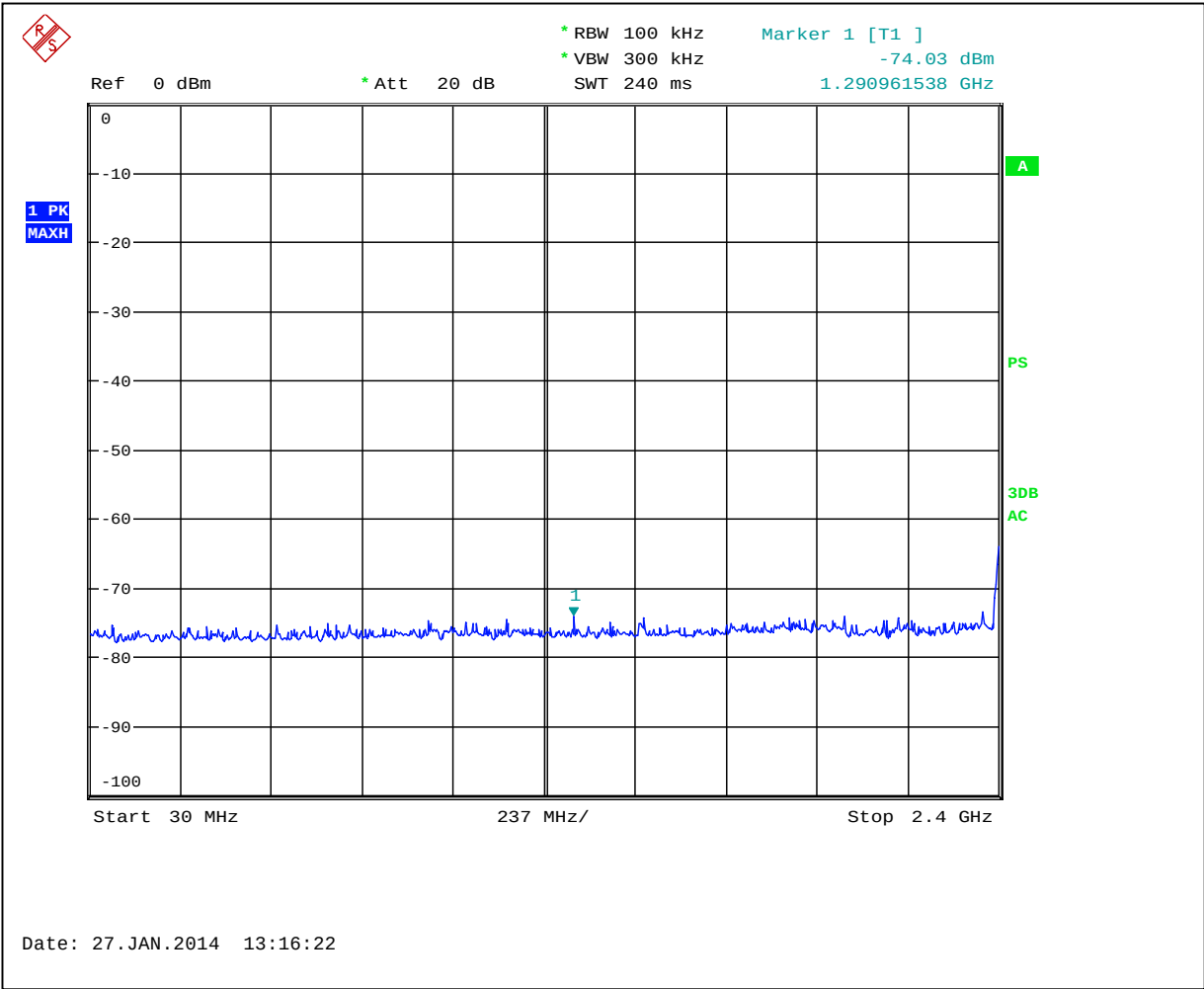
Graph 3.4.2



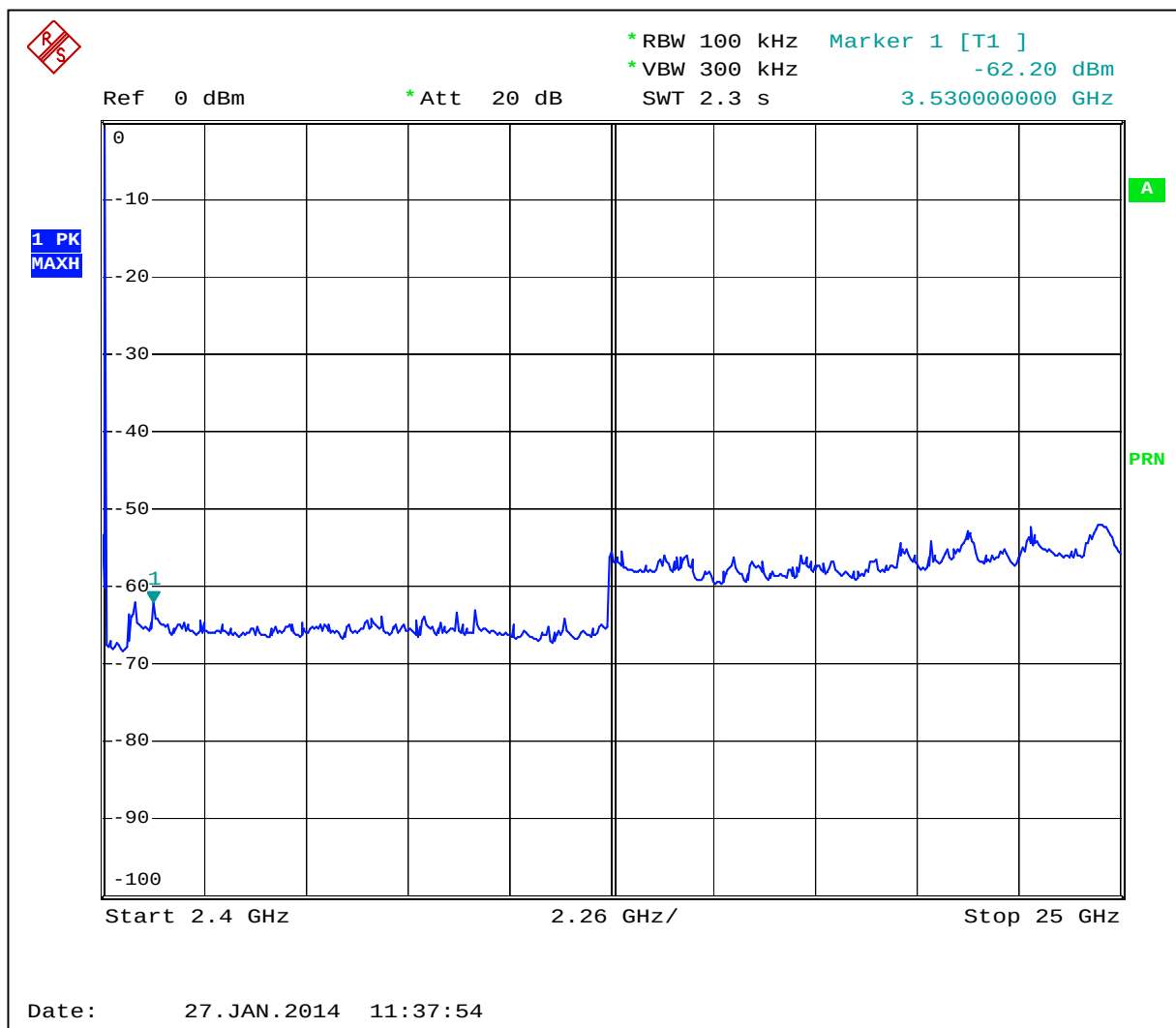
Graph 3.4.3



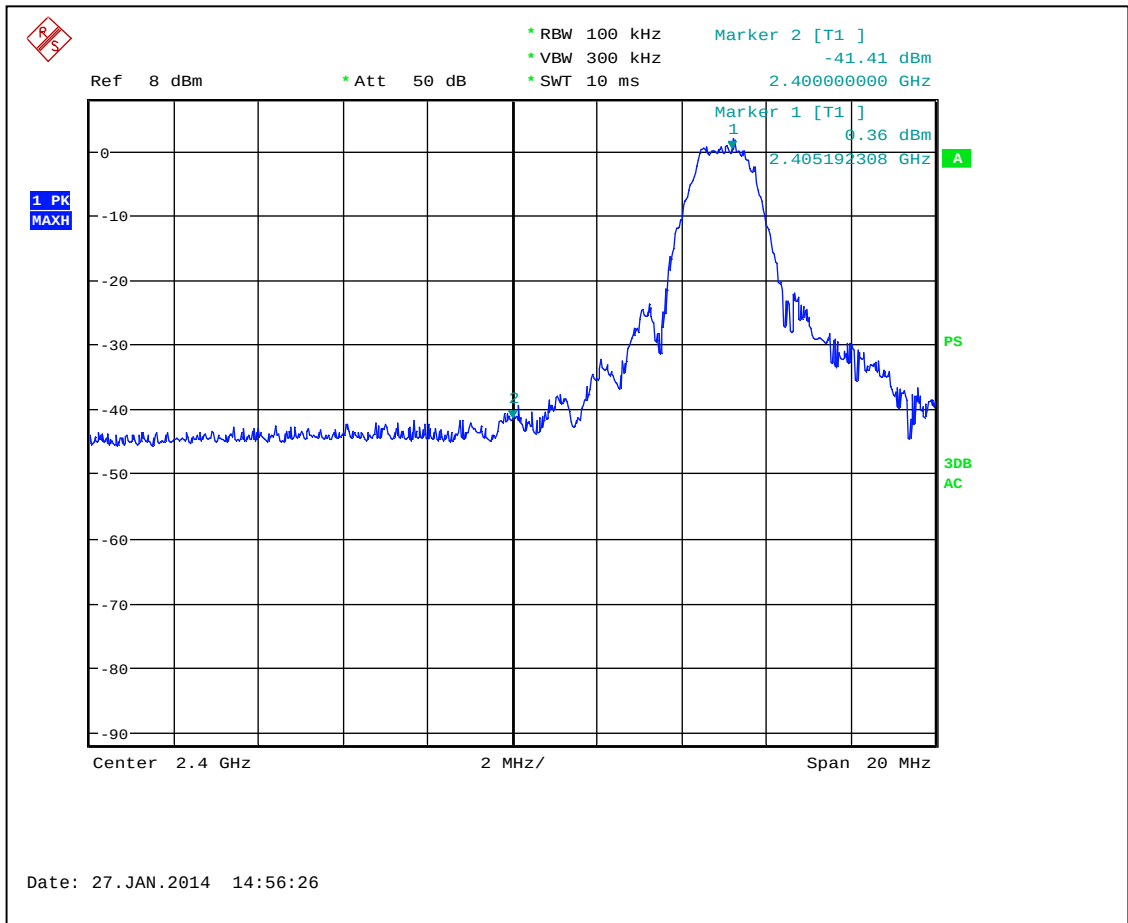
Graph 3.4.4



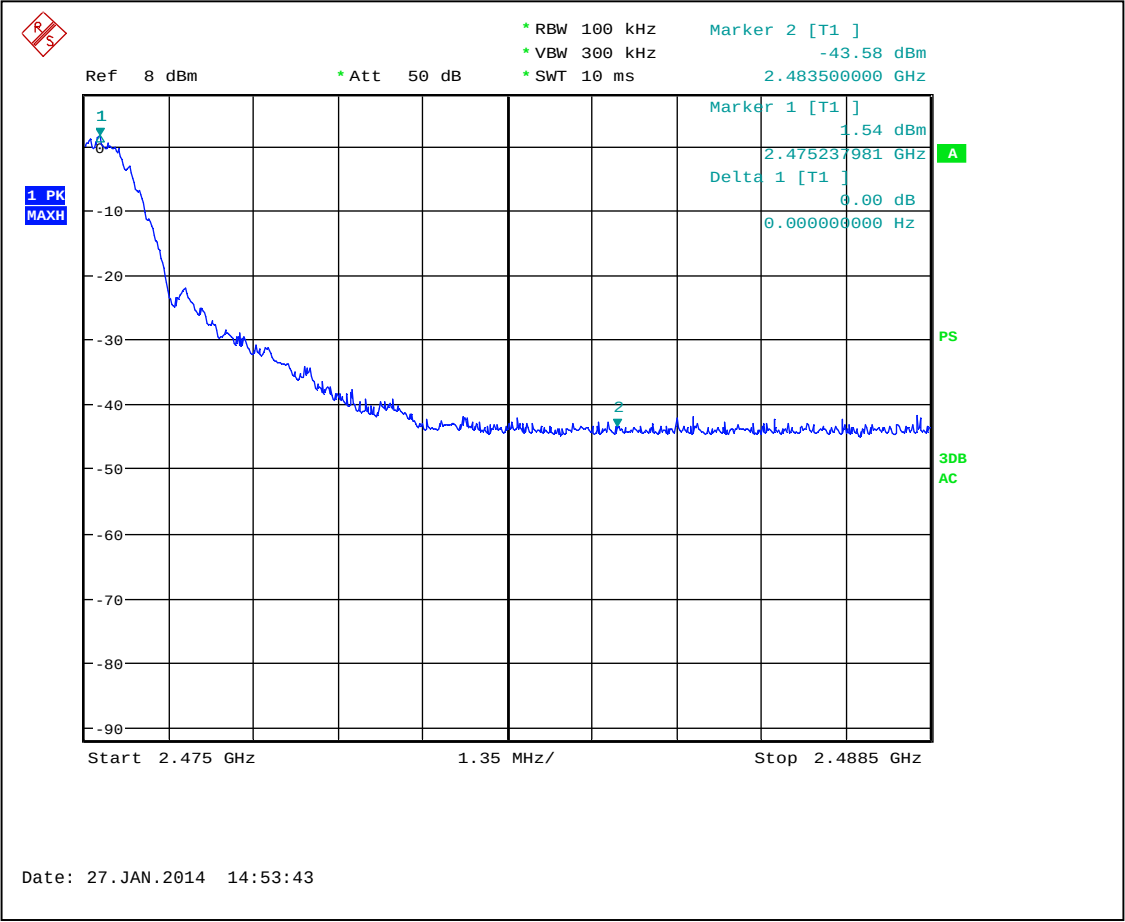
Graph 3.4.5



Graph 3.4.6



Graph 3.4.7



Graph 3.4.8



3.5 Radiated spurious emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

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

Test result: **Pass**

Max. Margin: 10.9dB below the limits

Notes: The table 3.5.1 shows the 2nd harmonics in restricted band of operation per FCC 15.205 Emissions not related with transmission operation, at fundamental frequencies and outside restricted band of operation per FCC 15.205 were excluded from the table.
No emissions were detected above ambient at 4th and above harmonics.

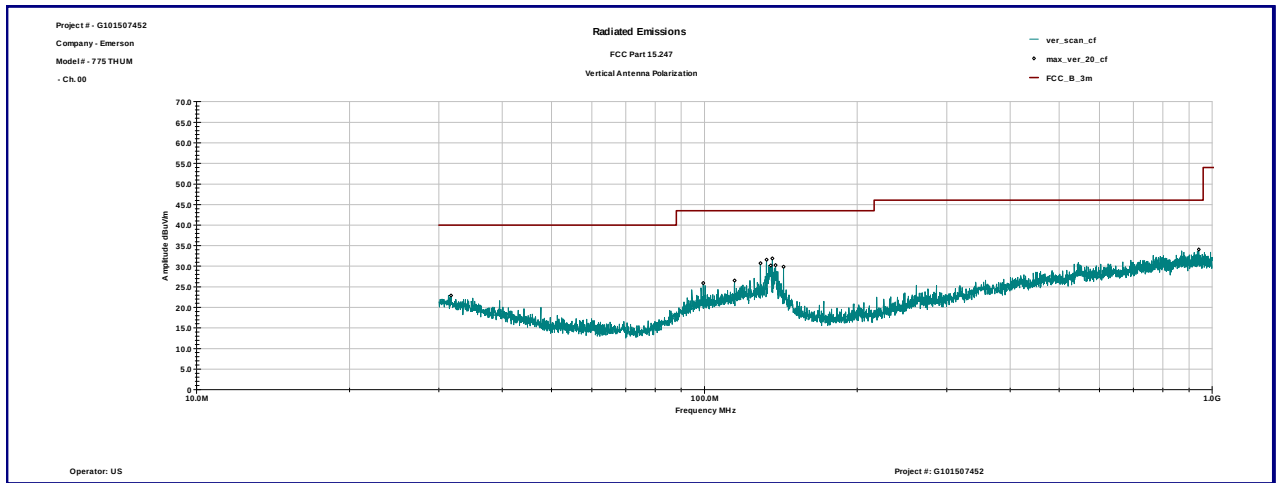
Graphs 3.5.1 to 3.5.10 show Radiated Spurious Emissions for channel 0
Graphs 3.5.11 to 3.5.20 show Radiated Spurious Emissions for channel 7
Graphs 3.5.21 to 3.3.30 show Radiated Spurious Emissions for channel 14



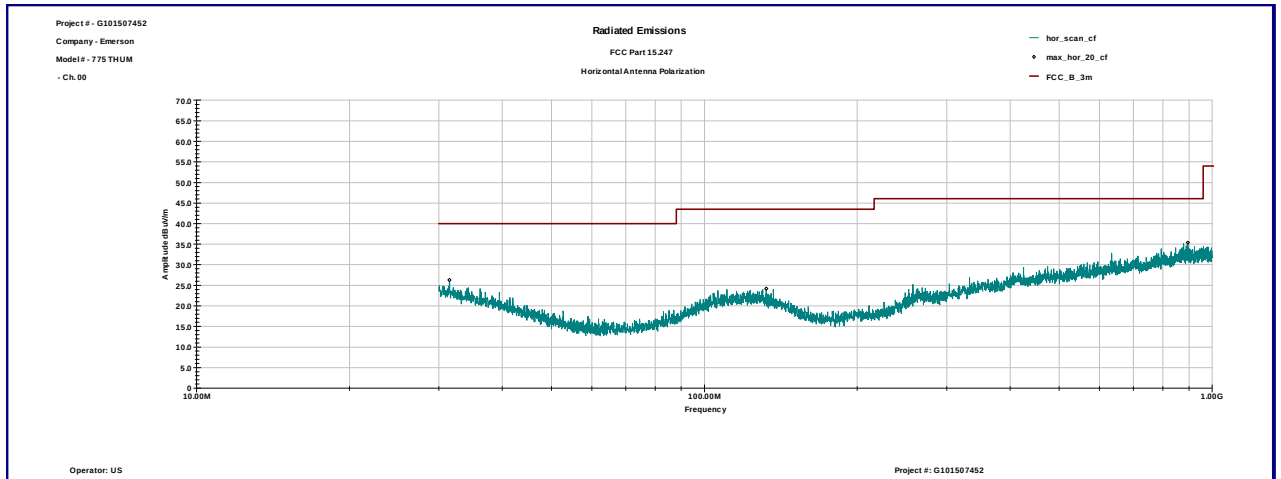
Date:	January 27-30, 2014	Result: Pass
Standard:	FCC part 15.247(d)	
Tested by:	Uri Spector	
Test Point:	Enclosure with Antenna	
Operation mode:	See Page 5	
Note:	None	

Table 3.5.1

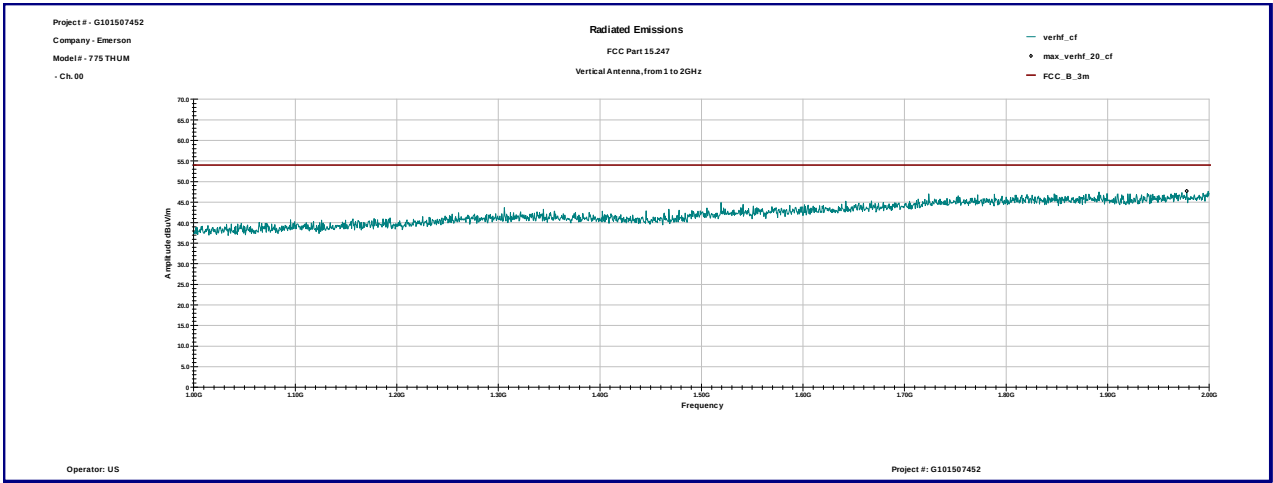
Frequency MHz	Antenna Polarity	Peak Reading dBμV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBμV/m	Limit dBμV/m	Margin dB
Channel 0							
4.812 GHz	H	48.0	37.2	42.1	43.1	54.0	-10.9



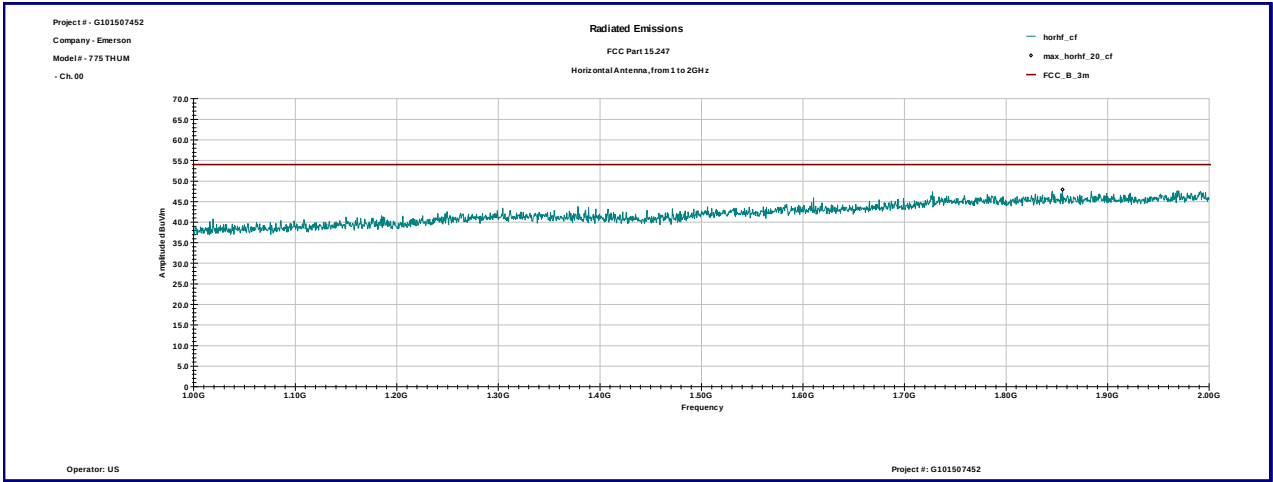
Graph 3.5.1



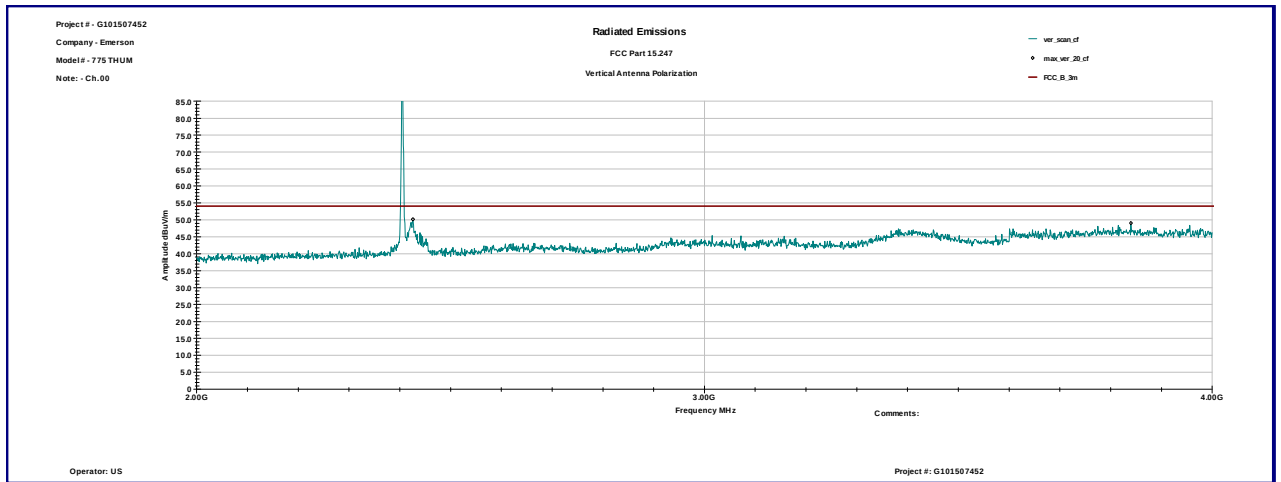
Graph 3.5.2



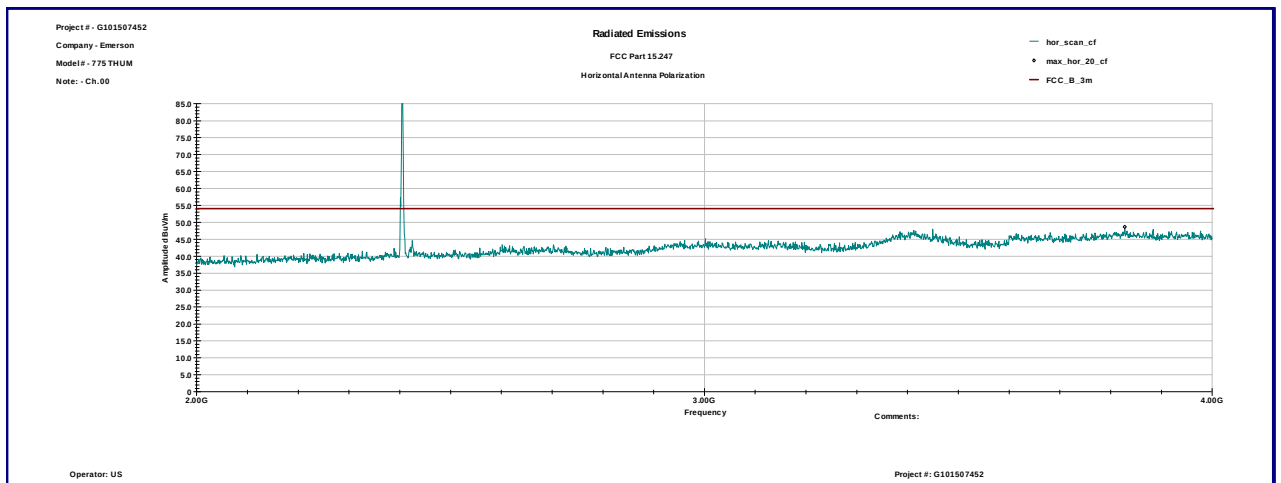
Graph 3.5.3



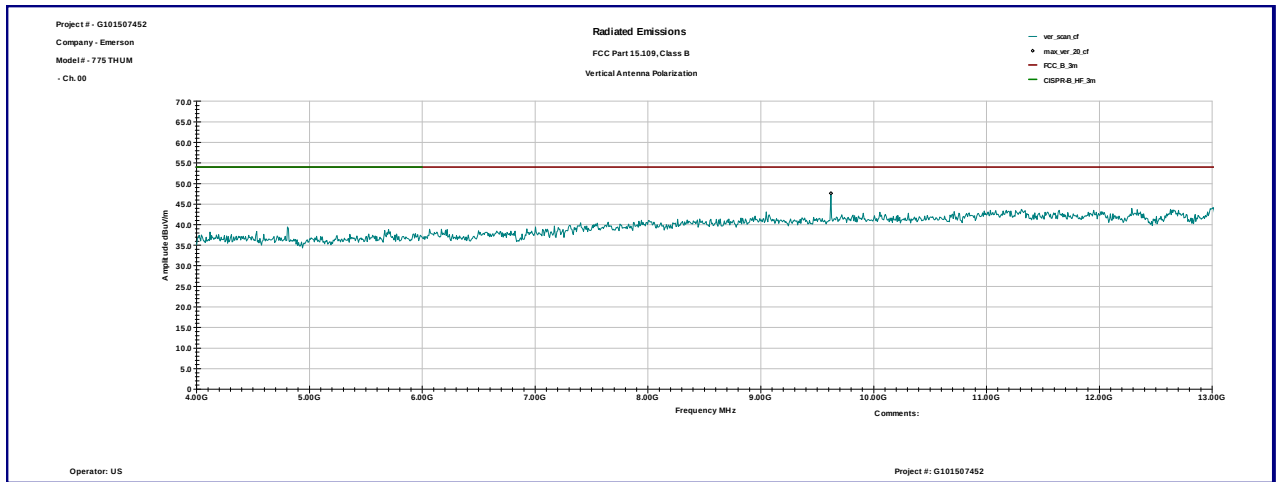
Graph 3.5.4



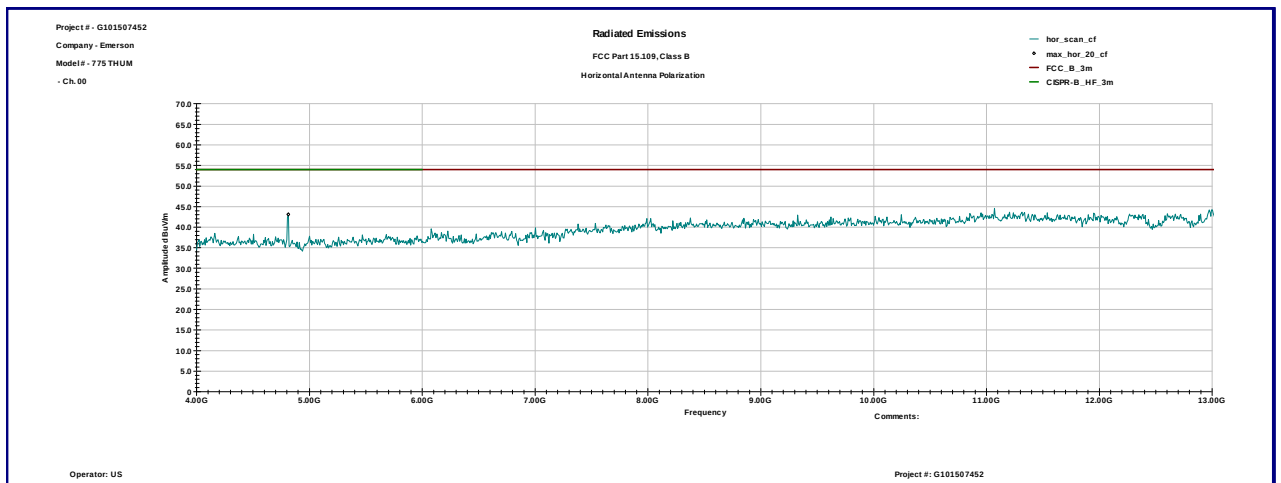
Graph 3.5.5



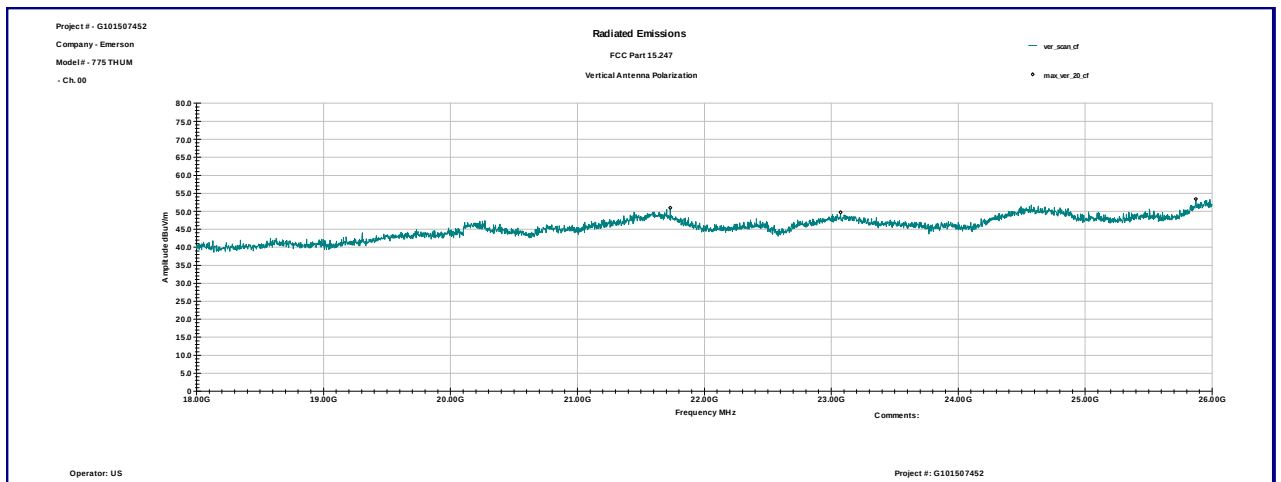
Graph 3.5.6



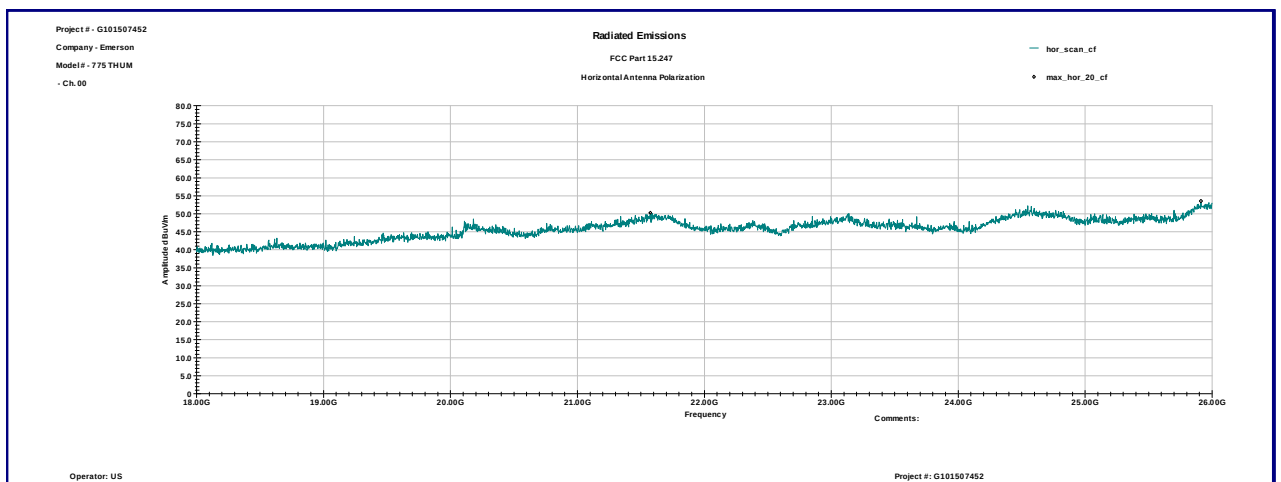
Graph 3.5.7



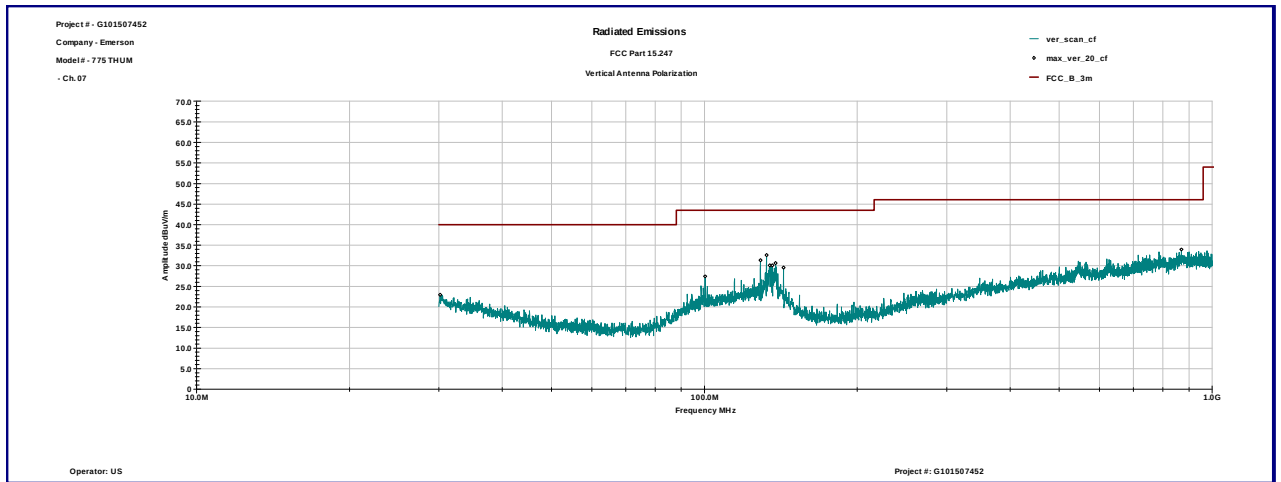
Graph 3.5.8



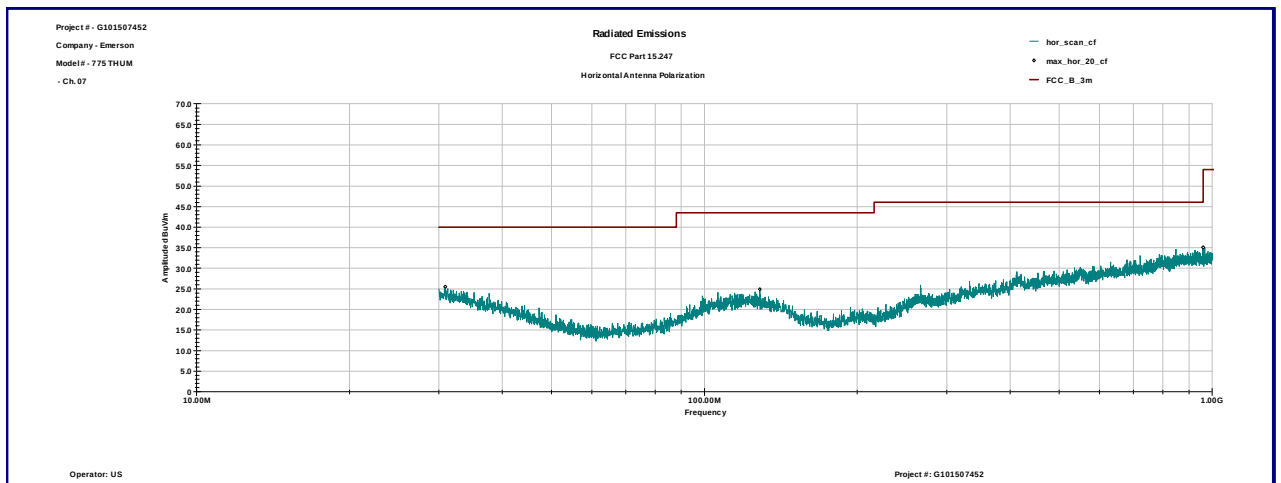
Graph 3.5.9



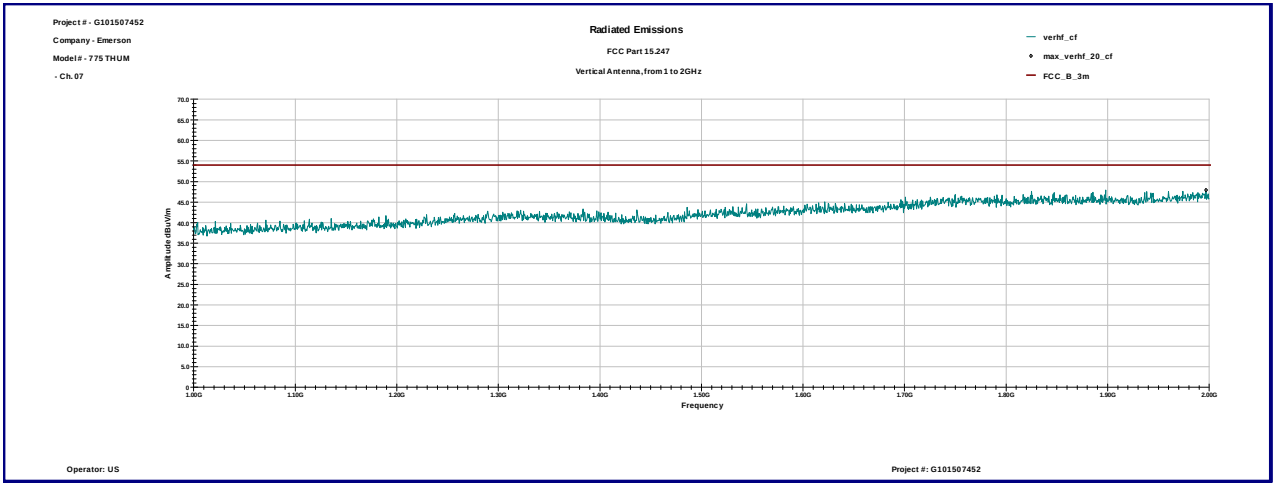
Graph 3.5.10



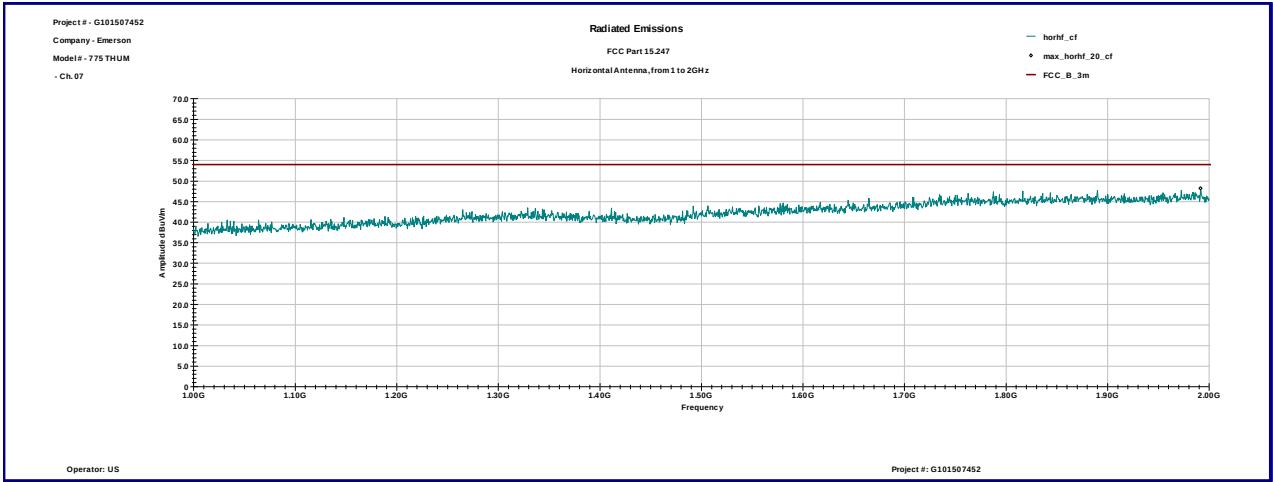
Graph 3.5.11



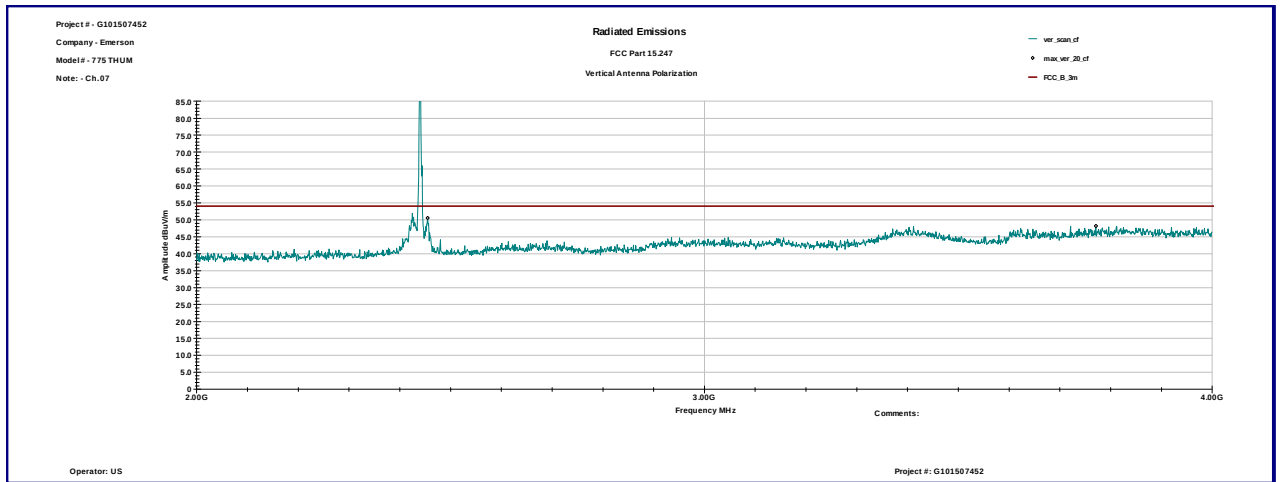
Graph 3.5.12



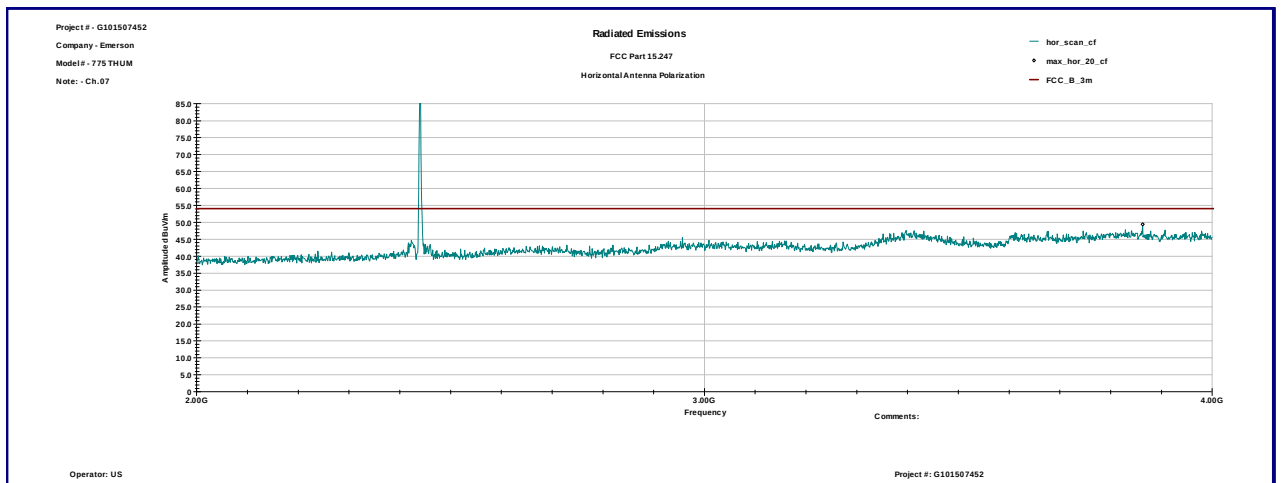
Graph 3.5.13



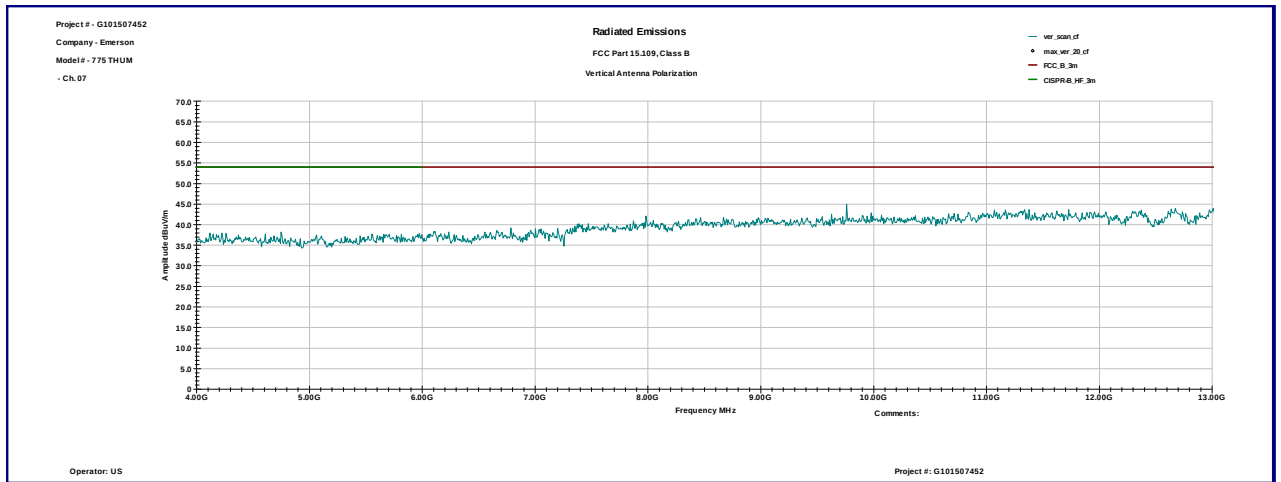
Graph 3.5.14



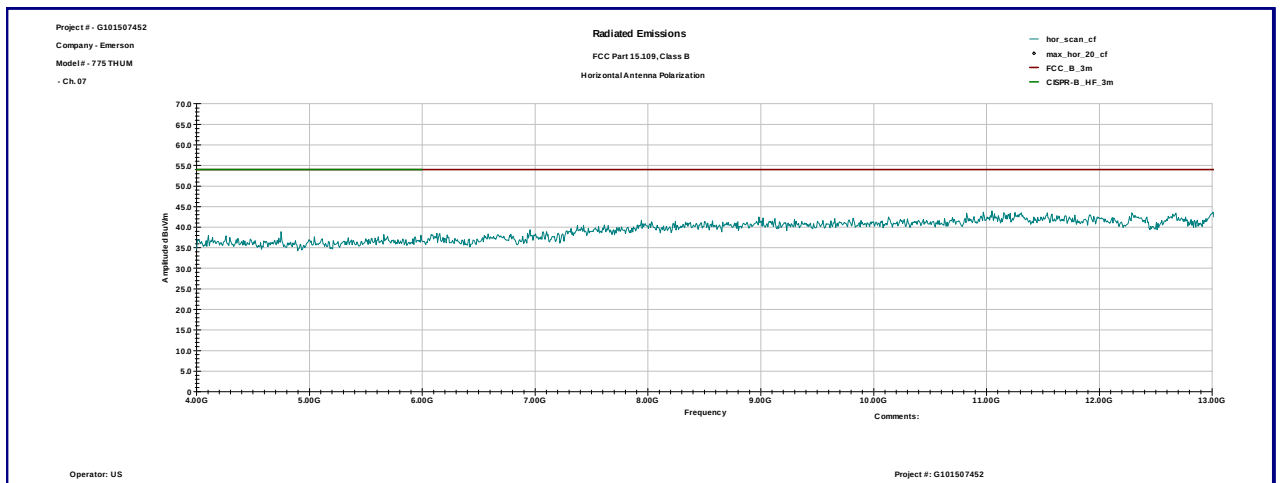
Graph 3.5.15



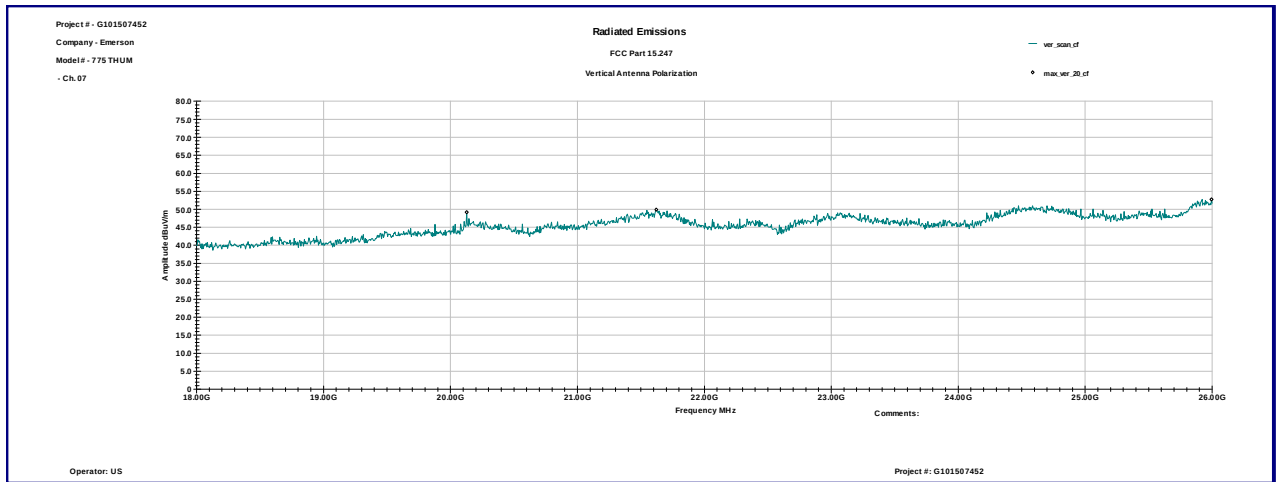
Graph 3.5.16



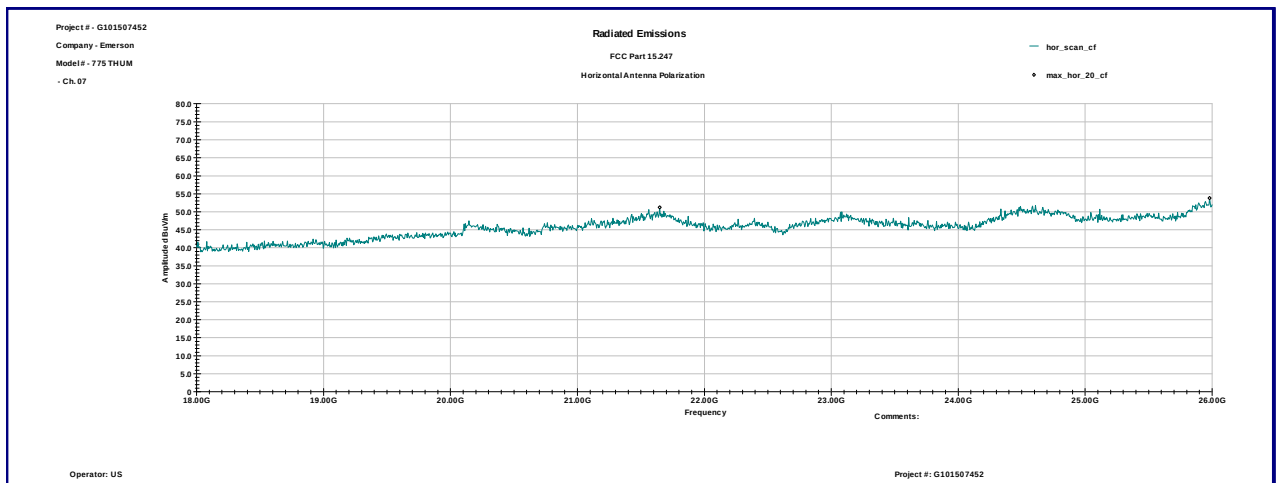
Graph 3.5.17



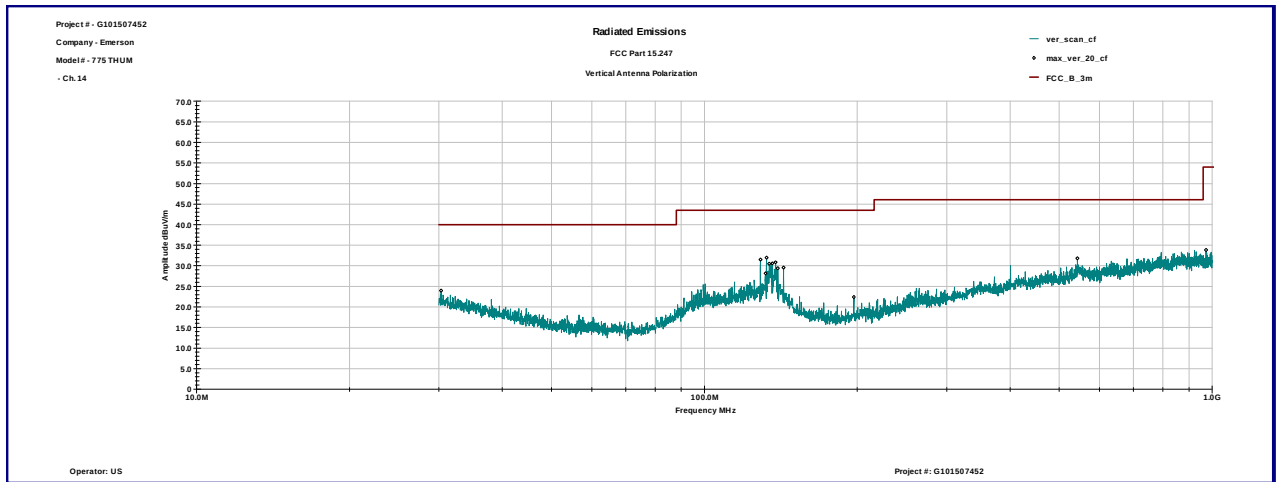
Graph 3.5.18



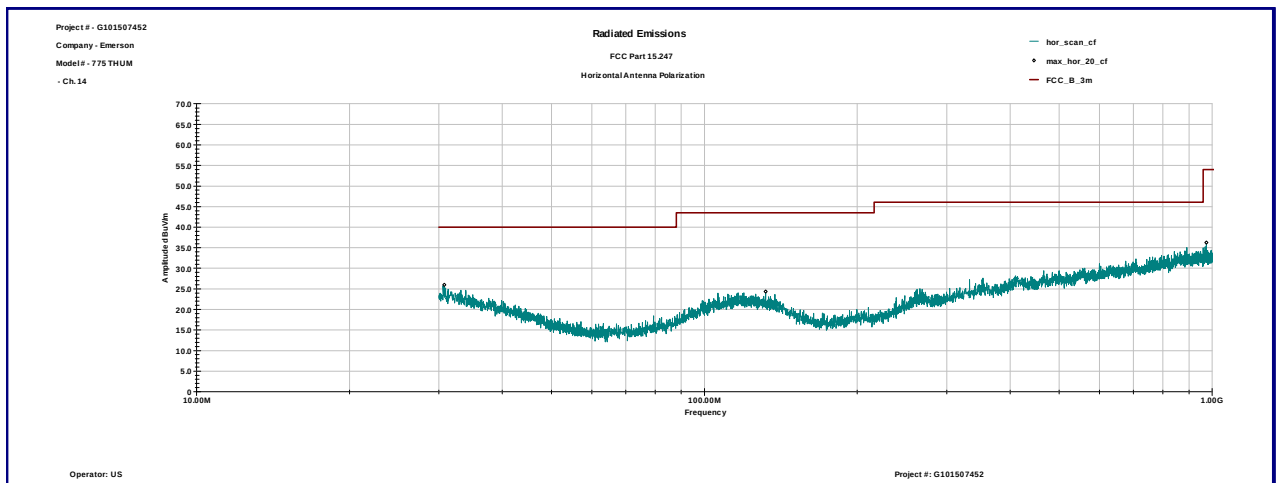
Graph 3.5.19



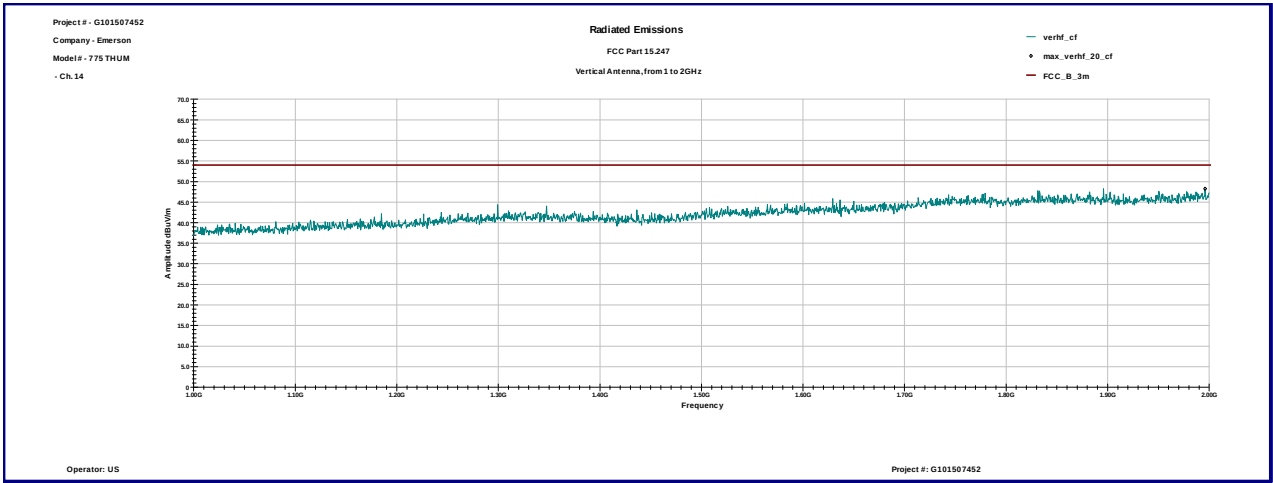
Graph 3.5.20



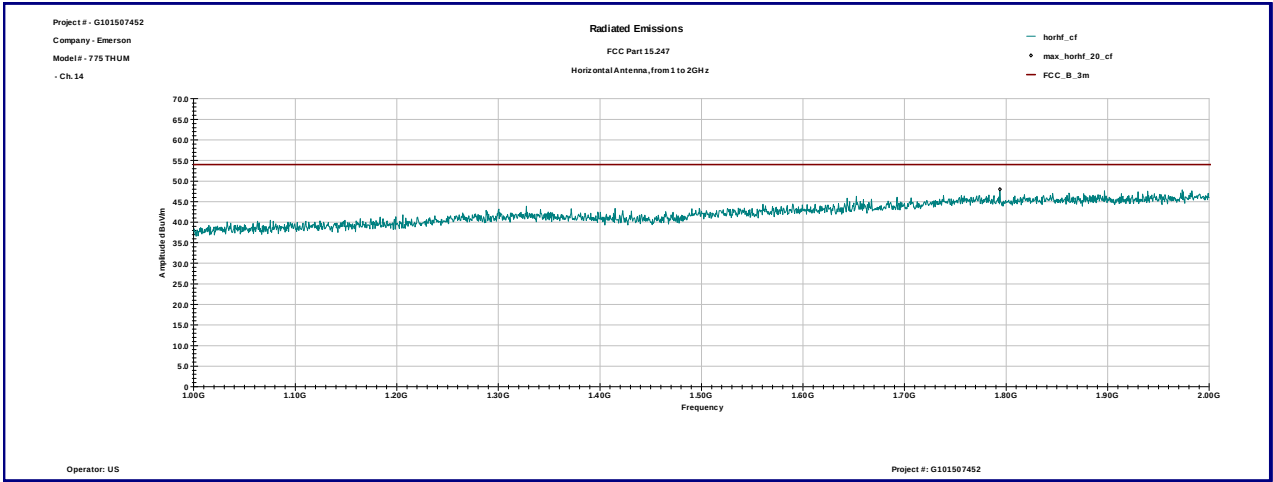
Graph 3.5.21



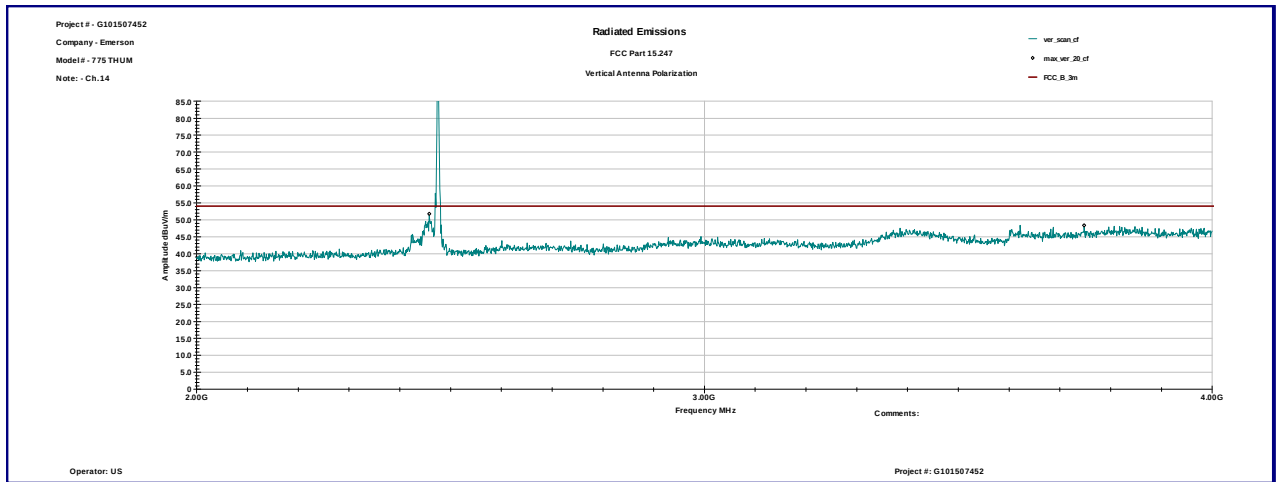
Graph 3.5.22



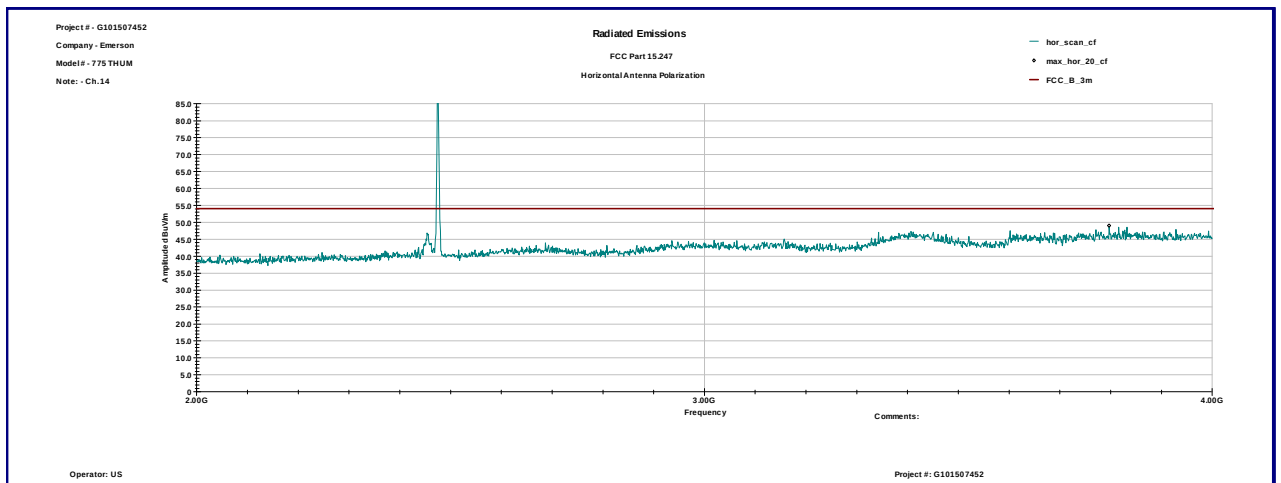
Graph 3.5.23



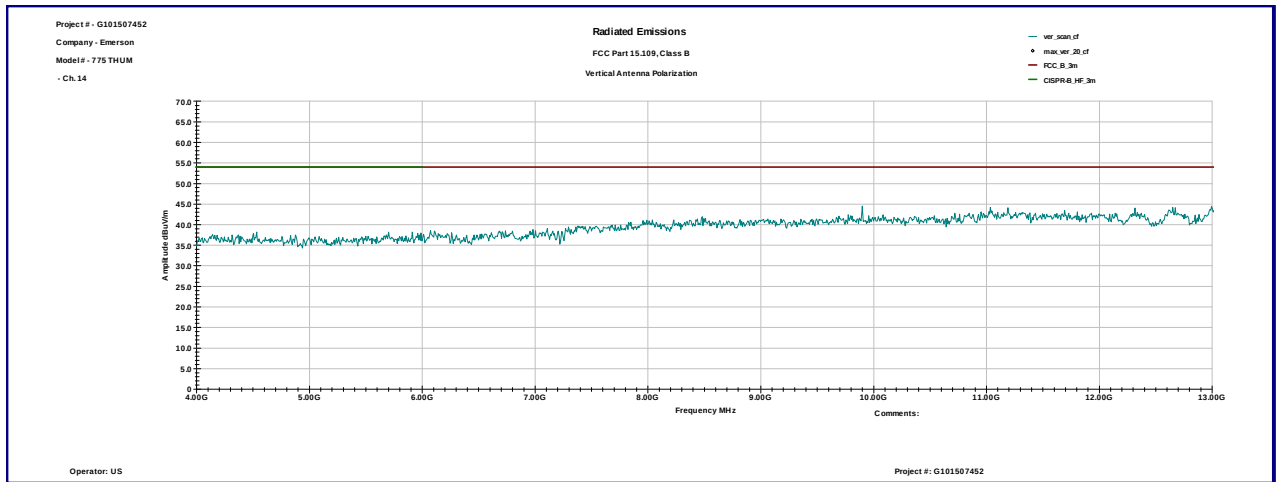
Graph 3.5.24



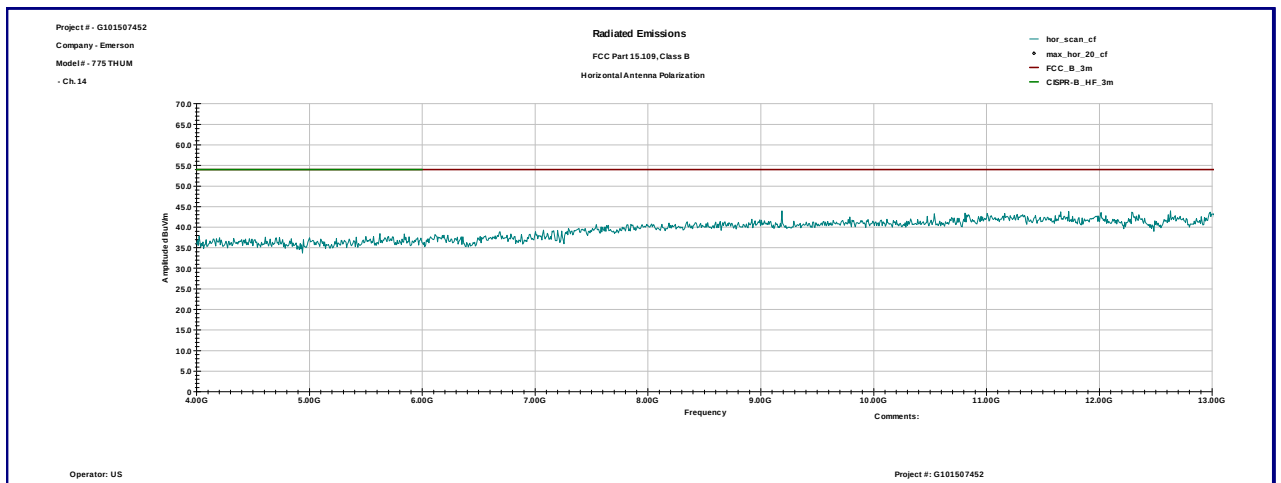
Graph 3.5.25



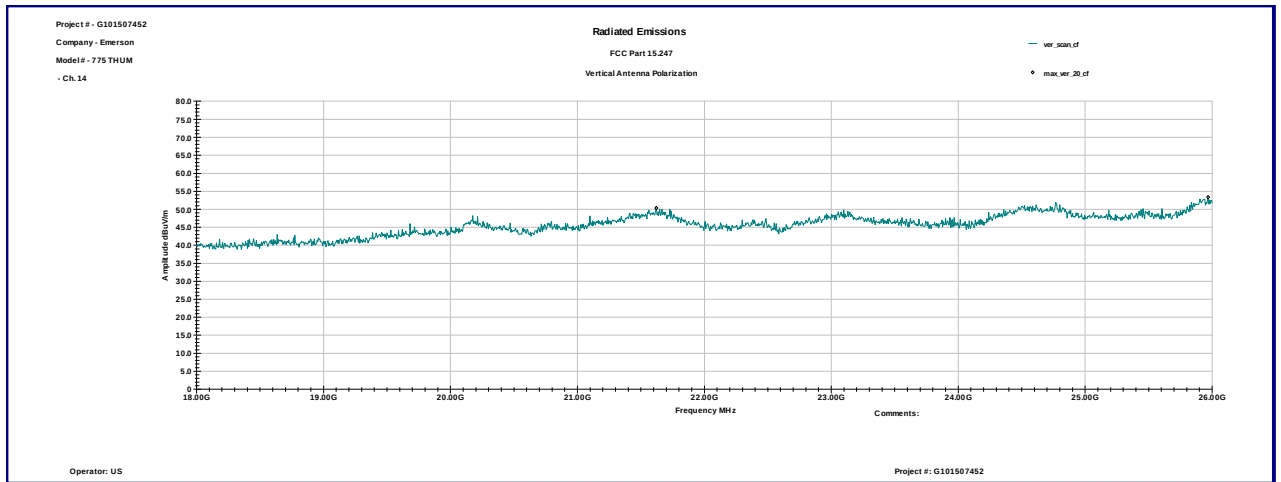
Graph 3.5.26



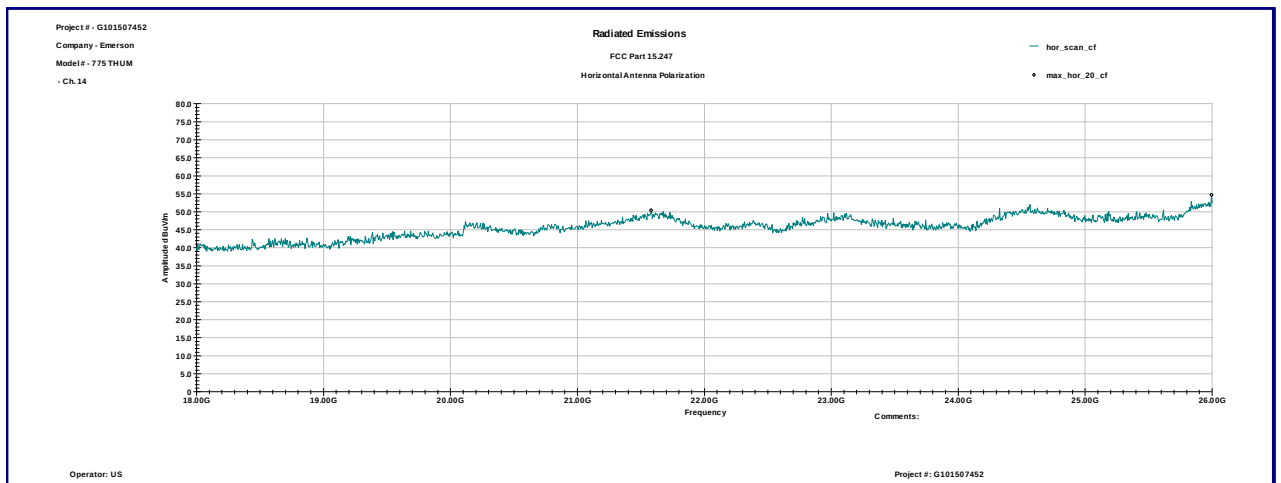
Graph 3.5.27



Graph 3.5.28



Graph 3.5.29



Graph 3.5.30



3.6 RF Exposure Compliance

The maximum measured antenna conducted power, P is 8.01dBm

The antenna gain, G is 2dBi

The maximum EIRP power = P + G
ERP = 8.01 + 2 = 10.01dBm, or 0.01W

The limits for Maximum Permissible Exposure (MPE) for transmitter operating at 2.4Hz, MPE is $1\text{mW}/\text{cm}^2$, or $10\text{W}/\text{m}^2$

The Power Density is related to EIRP with the equation:
 $S = \text{EIRP} / 4\pi D^2$, or $10 = 0.01 / 4\pi D^2$,

The minimum safe separation distance, D = 0.9cm, which is below 20cm, or RF exposure at 20cm distance is $0.002\text{mW}/\text{cm}^2$



3.7 Transmitter power line conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 25.7dB below the limits

Notes: None



Date:	January 30, 2014	Result: Pass
Standard:	FCC 15.207	
Tested by:	Uri Spector	
Test Point:	Power Line	
Operation mode:	See Page 5	
Note:	None	

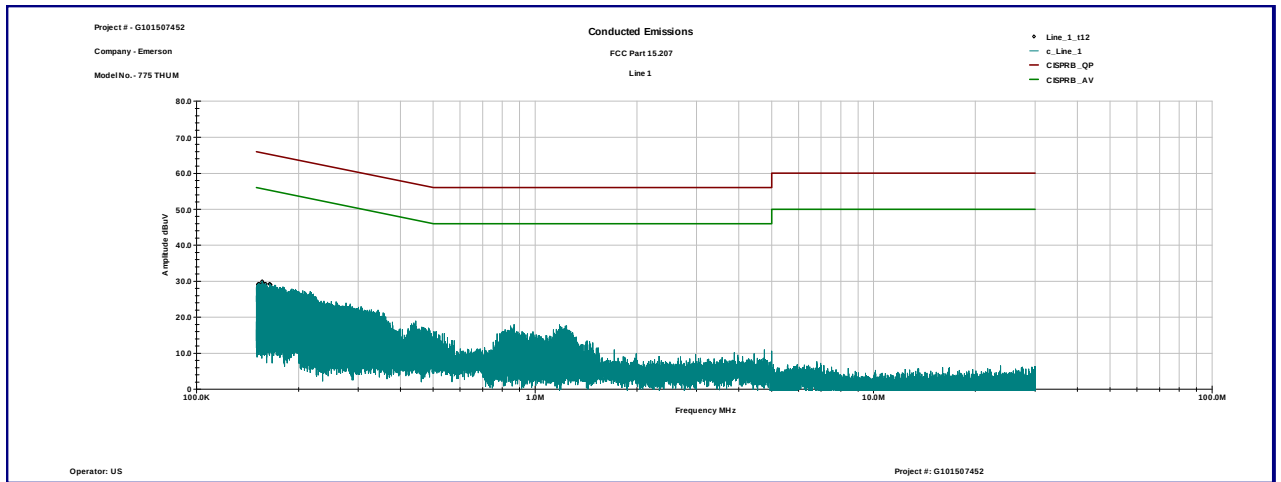
Table 3.7.1

Line 1

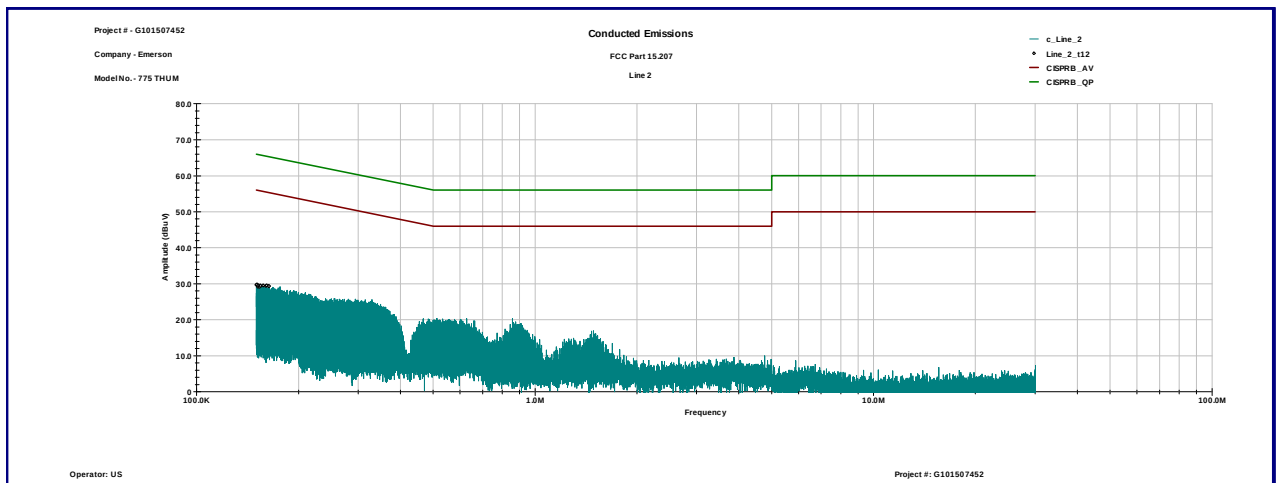
Frequency	Peak dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
151.63 KHz	29.1	65.9	55.9	-36.9	-26.9
152.91 KHz	29.2	65.8	55.8	-36.6	-26.6
156.1 KHz	30.0	65.7	55.7	-35.7	-25.7
164.06 KHz	29.2	65.3	55.3	-36.0	-26.0
866.23 KHz	18.0	56.0	46.0	-38.0	-28.0
1.180 MHz	17.8	56.0	46.0	-38.2	-28.2

Line 2

Frequency	Peak dBμV	QP Limit dBmV	AVG Limit dBmV	QP Margin dB	AVG Margin dB
150.85 KHz	29.8	66.0	56.0	-36.2	-26.2
152.17 KHz	29.5	65.9	55.9	-36.4	-26.4
154.0 KHz	29.5	65.8	55.8	-36.3	-26.3
161.03 KHz	29.5	65.4	55.4	-35.9	-25.9
663.02 kHz	19.6	56.0	46.0	-36.4	-26.4
857.08 kHz	20.3	56.0	46.0	-35.7	-25.7



Graph 3.7.1



Graph 3.7.2



3.8 Receiver/digital device radiated emissions

Test location: ☐ OATS ☒ Anechoic Chamber

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Frequency Range: 30MHz to 12.5GHz (5th Harmonic)

Test result: **Pass**

Frequency range: 30MHz-12.5GHz

Max. Emissions margin: 10.0dB below the limits

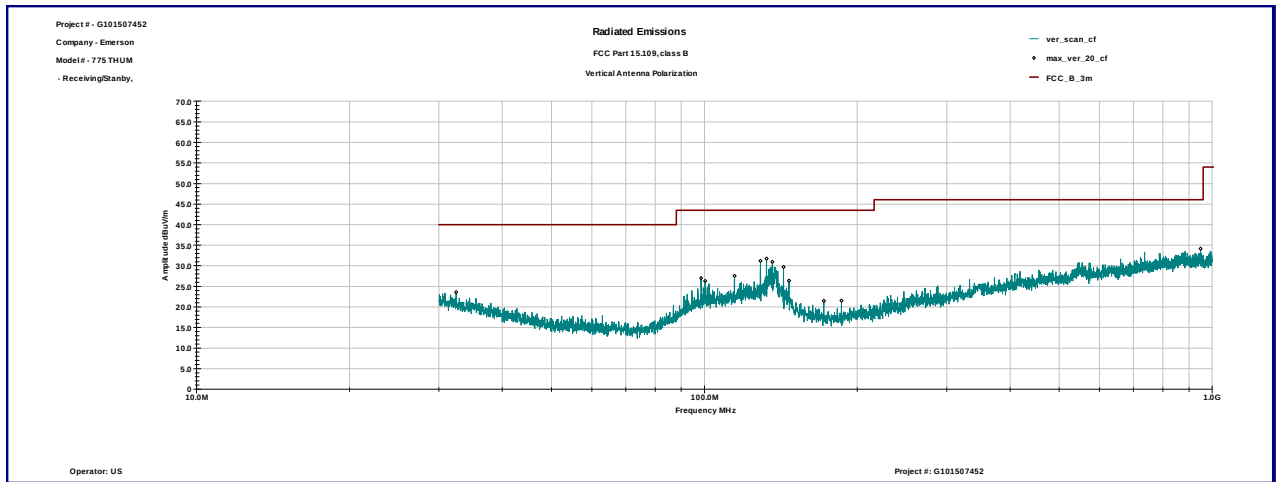
Notes: No Radiated Emissions were detected above 1GHz (see Graphs 3.8.1-3.8.4).



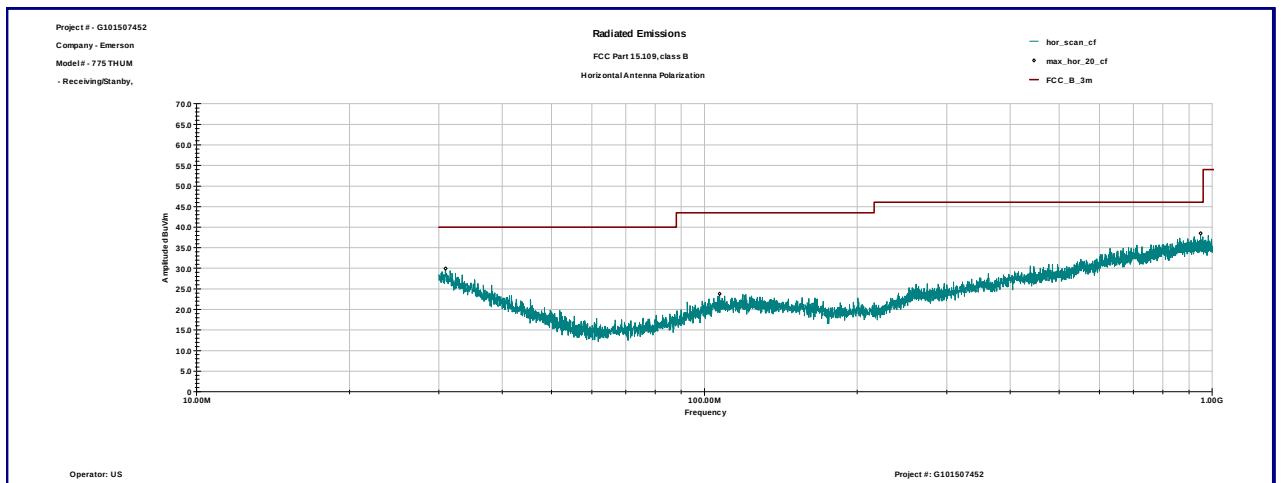
Date:	January 29, 2014	Result: Pass
Standard:	FCC Part 15.109, Class B	
Tested by:	Uri Spector	
Test Point:	Enclosure	
Operation mode:	Receiving mode	
Note:	None	

Table 3.8.1

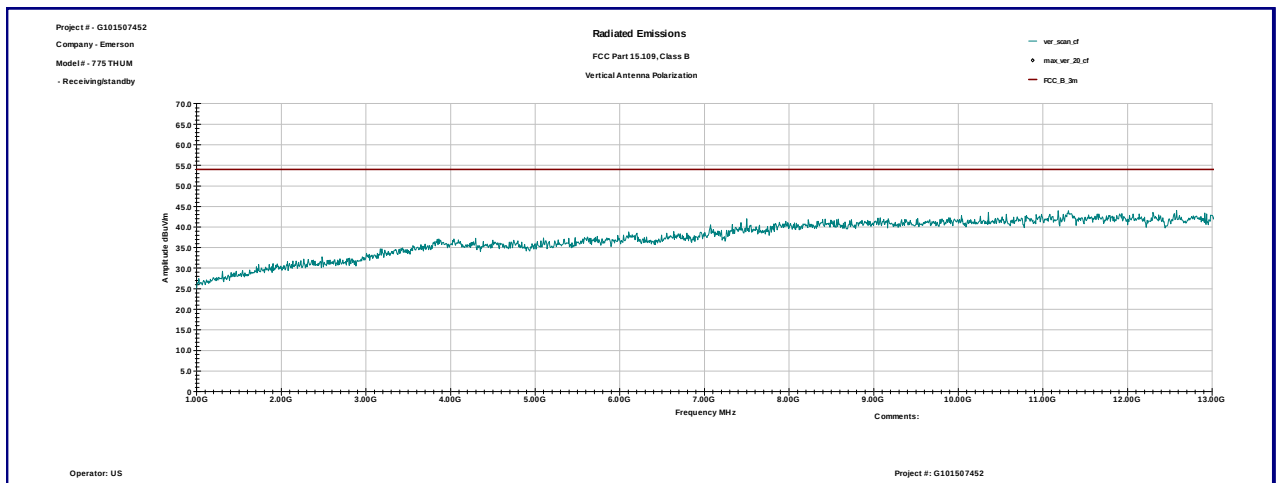
Frequency	Ant. Polarity	Peak Reading dBμV	Total C.F. dB1/m	Total at 3m dBμV/m	Limit dBμV/m	Margin dB
32.424 MHz	V	6.9	18.9	23.5	40.0	-16.5
98.508 MHz	V	13.8	11.9	27.0	43.5	-16.6
100.3 MHz	V	13.0	12.3	26.3	43.5	-17.2
114.62 MHz	V	13.6	13.6	27.5	43.5	-16.0
128.95 MHz	V	16.8	13.7	31.2	43.5	-12.3
132.53 MHz	V	17.6	13.5	31.7	43.5	-11.8
143.11 MHz	V	16.6	12.7	29.7	43.5	-13.8
171.88 MHz	V	9.7	11.3	21.5	43.5	-22.0
186.19 MHz	V	10.5	11.0	21.6	43.5	-22.0
30.935 MHz	H	10.2	19.7	30.0	40.0	-10.0
107.16 MHz	H	10.6	13.2	23.8	43.5	-19.7



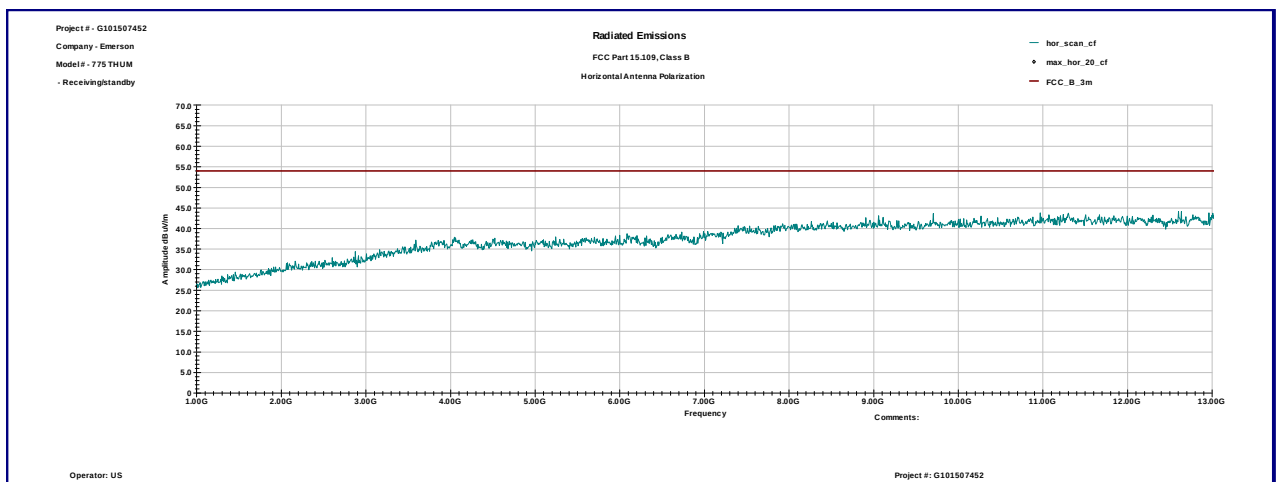
Graph 3.8.1



Graph 3.8.2



Graph 3.8.3



Graph 3.8.4



3.9 Digital device conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 24.8dB below the limits

Notes: None



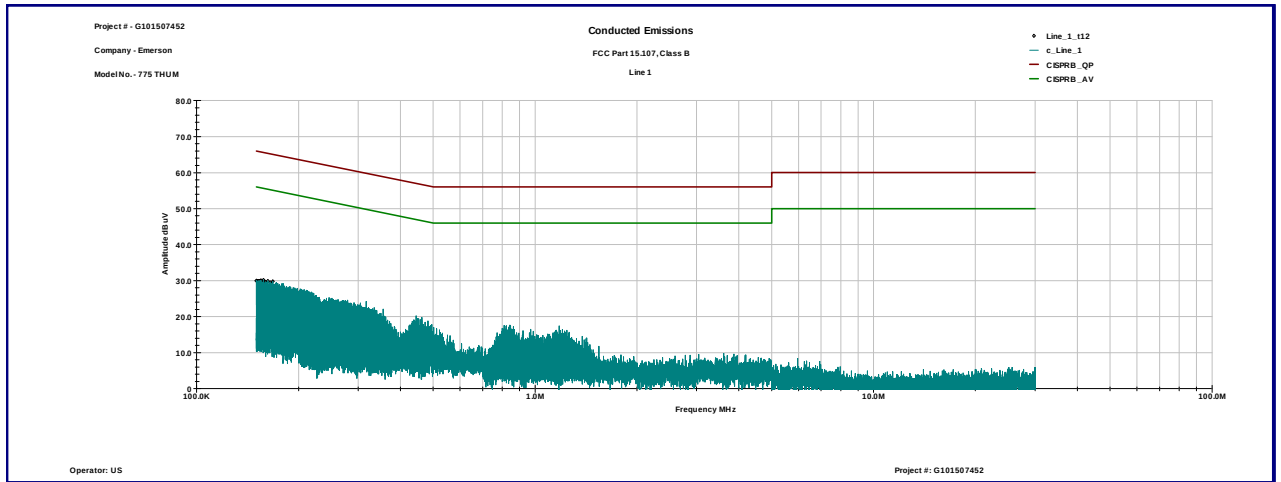
Date:	January 30, 2014	Result: Pass
Standard:	FCC 15.107, Class B	
Tested by:	Uri Spector	
Test Point:	Power Line	
Operation mode:	Receiving/standby mode	
Note:	None	

Table 3.9.1

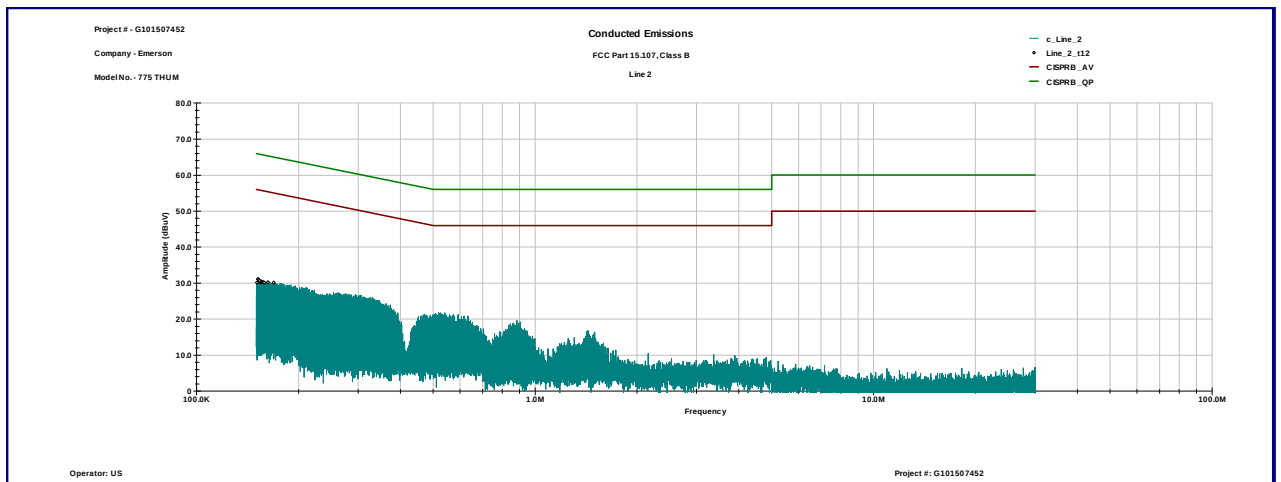
Line 1

Frequency	Peak dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
150.04 KHz	29.9	66.0	56.0	-36.1	-26.1
155.01 KHz	30.1	65.7	55.7	-35.7	-25.7
160.41 KHz	29.5	65.4	55.4	-36.0	-26.0
162.23 KHz	29.9	65.4	55.4	-35.5	-25.5
845.79 kHz	17.4	56.0	46.0	-38.6	-28.6
1.176 MHz	17.4	56.0	46.0	-38.6	-28.6

Frequency	Peak dBμV	QP Limit dBmV	AVG Limit dBmV	QP Margin dB	AVG Margin dB
151.86 KHz	31.1	65.9	55.9	-34.8	-24.8
155.13 KHz	30.4	65.7	55.7	-35.3	-25.3
157.22 KHz	30.3	65.6	55.6	-35.3	-25.3
158.31 KHz	30.1	65.6	55.6	-35.4	-25.4
168.88 KHz	30.1	65.0	55.0	-34.9	-24.9
883.17 kHz	19.5	56.0	46.0	-36.5	-26.5
1.422 MHz	16.8	56.0	46.0	-39.2	-29.2



Graph 3.9.1



Graph 3.9.2



4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	CAL DUE	USED
Spectrum Analyzer	R & S	FSP 40	100024	12559	12/12/2014	☒
Spectrum Analyzer	R & S	ESU	100398	25283	01/07/2015	☒
Bicono-Log Antenna	Teseq	CBL6112D	32859	25289	08/30/2014	☒
Horn Antenna	EMCO	3115	9507-4513	9936	05/28/2014	☒
Waveguide Horn Antenna	EMCO	3116	9904-2423	9705	11/12/2014	☒
LISN	Fischer Custom Communications	FCC-LISN-50-25-2	2014	9665	04/23/2014	☒
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1402232	172081	11/12/2014	☒
Pre-Amplifier	MITEQ	AMF-6F-16002600-25-10P	1222383	MIN-0065	11/12/2014	☒
System	Quantum Change	TILE! Instrument Control	Ver. 3.4.K.29	15259	VBU	☒