



## TEST REPORT

Report Number: 100270879MIN-001A

Project Number: G100270879

Testing performed on the  
RM2510

FCC ID: LW2RM2510

Industry Canada ID: 2731A-RM2510

to

47 CFR Part 15. 247:2009

RSS- 210, Issue 7, 2007

For

Emerson Process Management

Test Performed by:  
Intertek Testing Services NA, Inc.  
7250 Hudson Blvd., Suite 100  
Oakdale, MN 55128 USA

Test Authorized by:  
Emerson Process Management  
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Date: December 20, 2010

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Date: December 20, 2010

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## 1.0 GENERAL DESCRIPTION

<b>Model:</b>	RM2510
<b>Type of EUT:</b>	2.4GHz Wireless HART Radio Module
<b>Serial Number:</b>	N/A
<b>FCC ID:</b>	LW2RM2510
<b>Industry Canada ID:</b>	2731A-RM2510
<b>Related Submittal(s) Grants:</b>	None
<b>Company:</b>	Emerson Process Management
<b>Customer:</b>	Mr. Merritt Pulkrabek
<b>Address:</b>	8200 Market Blvd., Mail Stop PM17 Chanhassen, MN 55317
<b>Phone:</b>	(952) 949-5193
<b>Fax:</b>	(952) 949-7626
<b>Test Standards:</b>	<input checked="" type="checkbox"/> 47 CFR, Part 15:2009, §15.247 <input checked="" type="checkbox"/> RSS-210, Issue 7, 2007 <input checked="" type="checkbox"/> RSS-Gen, Issue 2, 2007 <input type="checkbox"/> 47 CFR, Part 15:2008, §15.107 and §15.109, Class <span style="background-color: #cccccc; padding: 0 10px;"> </span> <input type="checkbox"/> Other <span style="background-color: #cccccc; padding: 0 10px;"> </span> <b>Note: Class II Permissive Changes</b>
<b>Type of radio:</b>	<input type="checkbox"/> Stand -alone <input checked="" type="checkbox"/> Module <input type="checkbox"/> Hybrid
<b>Date Sample Submitted:</b>	December 13, 2010
<b>Test Work Started:</b>	December 13, 2010
<b>Test Work Completed:</b>	December 17, 2010
<b>Test Sample Conditions:</b>	<input type="checkbox"/> Damaged <input type="checkbox"/> Poor (Usable) <input checked="" type="checkbox"/> Good



## 1.1 Product Description; Test Facility

<b>Product Description:</b>	2.4 – 2.4835GHz Transceiver
<b>Transmitter Type:</b>	<input type="checkbox"/> FHSS <input checked="" type="checkbox"/> Digital Modulation (DSSS) <input type="checkbox"/> WiFi <input type="checkbox"/> Blue Tooth
<b>Operating Frequency Range(s):</b>	From 2400 to 2483.5 MHz
<b>Number of Channels:</b>	15 (from channel 0 to 14)
<b>Modulation:</b>	QPSK
<b>Emission Designator:</b>	1M37G7D
<b>Antenna(s) Info:</b>	Type: Omni directional vertically polarized dipole    Gain: 8 dBi Connector Type: N-type
<b>Power settings:</b>	8 dBm
<b>Antenna Installation:</b>	<input type="checkbox"/> User <input type="checkbox"/> Professional <input checked="" type="checkbox"/> Factory
<b>Transmitter power configuration:</b>	<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"/> 7.2 VDC <input type="checkbox"/> Other: <div></div> <div></div> Amp. <input type="checkbox"/> 50Hz <input type="checkbox"/> 60Hz
<b>Special Test Arrangement:</b>	As a hand-held device the EUT was rotated through three orthogonal axes to determine and tested with the maximum emissions
<b>Test Facility Accreditation:</b>	A2LA (Certificate No. 1427.01)
<b>Test Methodology:</b>	Measurements performed according to the procedures in ANSI C63.4-2003 and FCC Public Notice DA 00-705

## 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)
- ☒ - The enclosure with antenna and arrestor of EUT were grounded per client request

### 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	Antenna RF cable with lightning arrestor, 0.5dB loss at 2.4GHz	41 inch	Measurements at the antenna terminal	

### 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 is modified from the original certification using a different antenna. Therefore, the Maximum Output and Spurious Radiated Emissions were measured. RF exposure was calculated to reflect a new antenna.

## 1.3 Environmental conditions

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

☒ **Normal**

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

☐ **Extreme**

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

## 1.4 Measurement uncertainty

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

$\pm 4$  dB at 10m and  $\pm 5.4$  dB at 3m

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

$\pm 1.0$  dB

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

$\pm 2.6$  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( $\mu$ V/m)

RA = Receiver Amplitude in dB( $\mu$ 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( $\mu$ 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( $\mu$ V/m).

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

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

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

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

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

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

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

### 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) / RSS-210 A8.4	Maximum peak output power	Pass
15.247(d) / RSS-210 A8.5	Radiated spurious emissions	Pass
15.247(i) / RSS- Gen 5.5	RF Exposure Compliance	Pass

### 3.0 TEST CONDITIONS AND RESULTS

#### 3.1 Maximum peak output power

Test location: ☐ OATS ☐ Anechoic Chamber ☒ Other

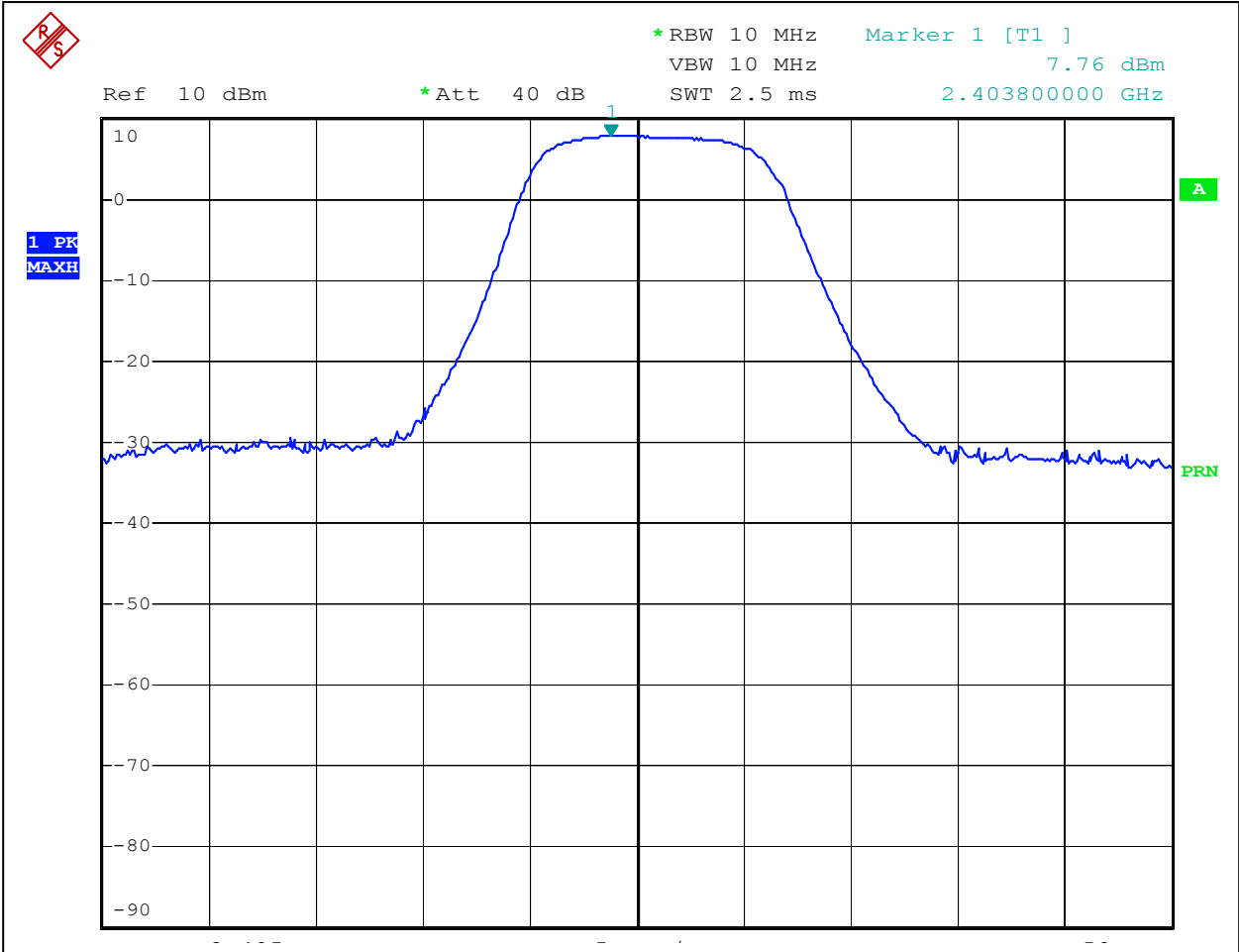
Test result: **Pass**

Max. Margin: 18.57dB below the limits

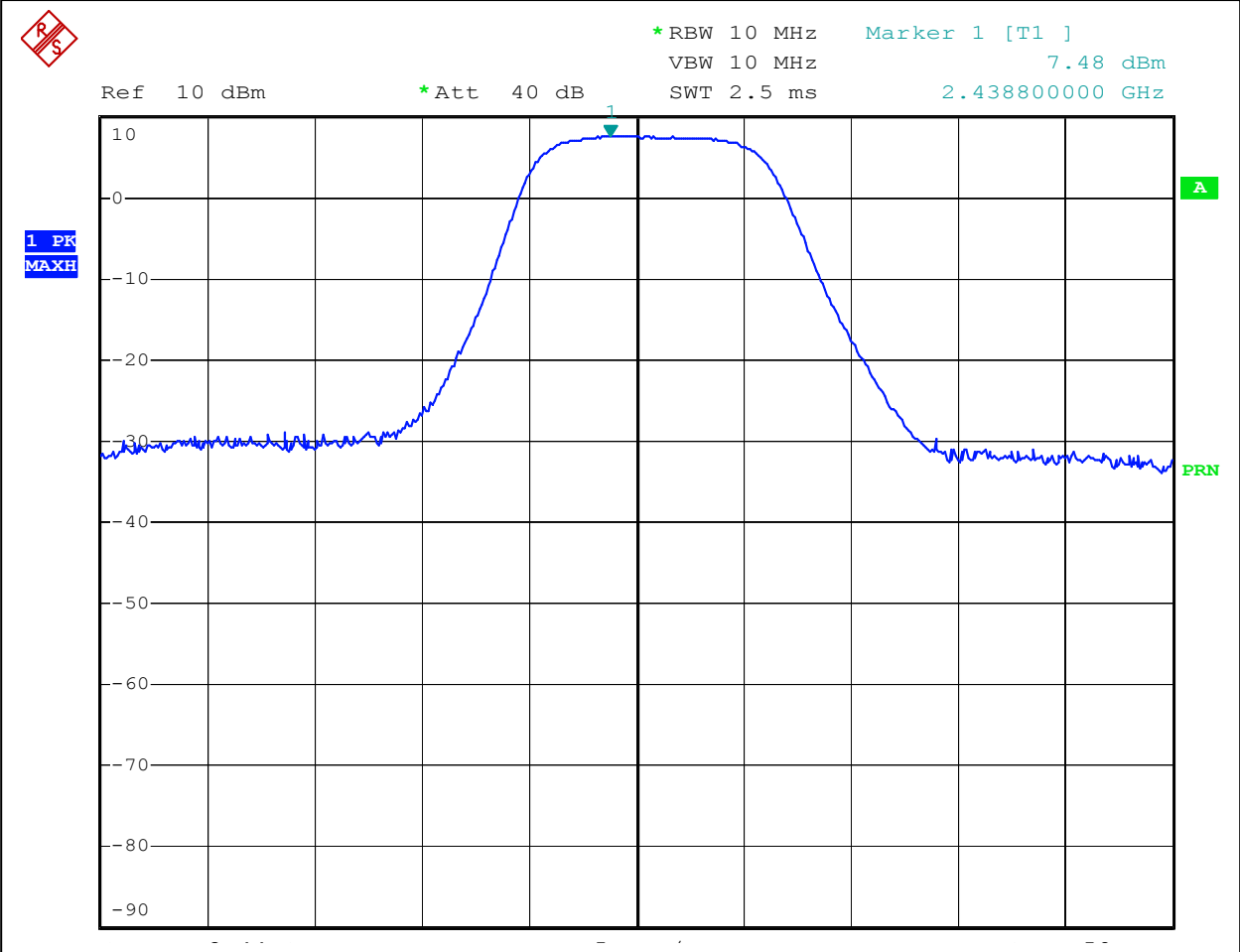
Power Output:	Conducted					
Frequency Range:	<input type="checkbox"/> 902-928MHz <input checked="" type="checkbox"/> 2400-2483.5MHz <input type="checkbox"/> 5725-5850MHz					
Low Frequency MHz	Measured power dBm	Attenuation dB	Power at Antenna dBm	Limit dBm	Limit Reduction dB	Margin dB
2404	7.76	0.25	8.01	30	2	-19.99
Middle Frequency MHz						
2439	7.48	0.25	7.73	30	2	-20.27
Upper Frequency MHz						
2475	7.12	0.25	7.37	30	2	-20.63
RBW:	<input type="checkbox"/> 1MHz <input type="checkbox"/> 3MHz <input checked="" type="checkbox"/> 10MHz					
VBW:	<input type="checkbox"/> 1MHz <input type="checkbox"/> 3MHz <input checked="" type="checkbox"/> 10MHz					
Antenna Gain:	<input type="checkbox"/> < 6dBi <input checked="" type="checkbox"/> >6dBi and = 8 dBi, Output power reduction = 2 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

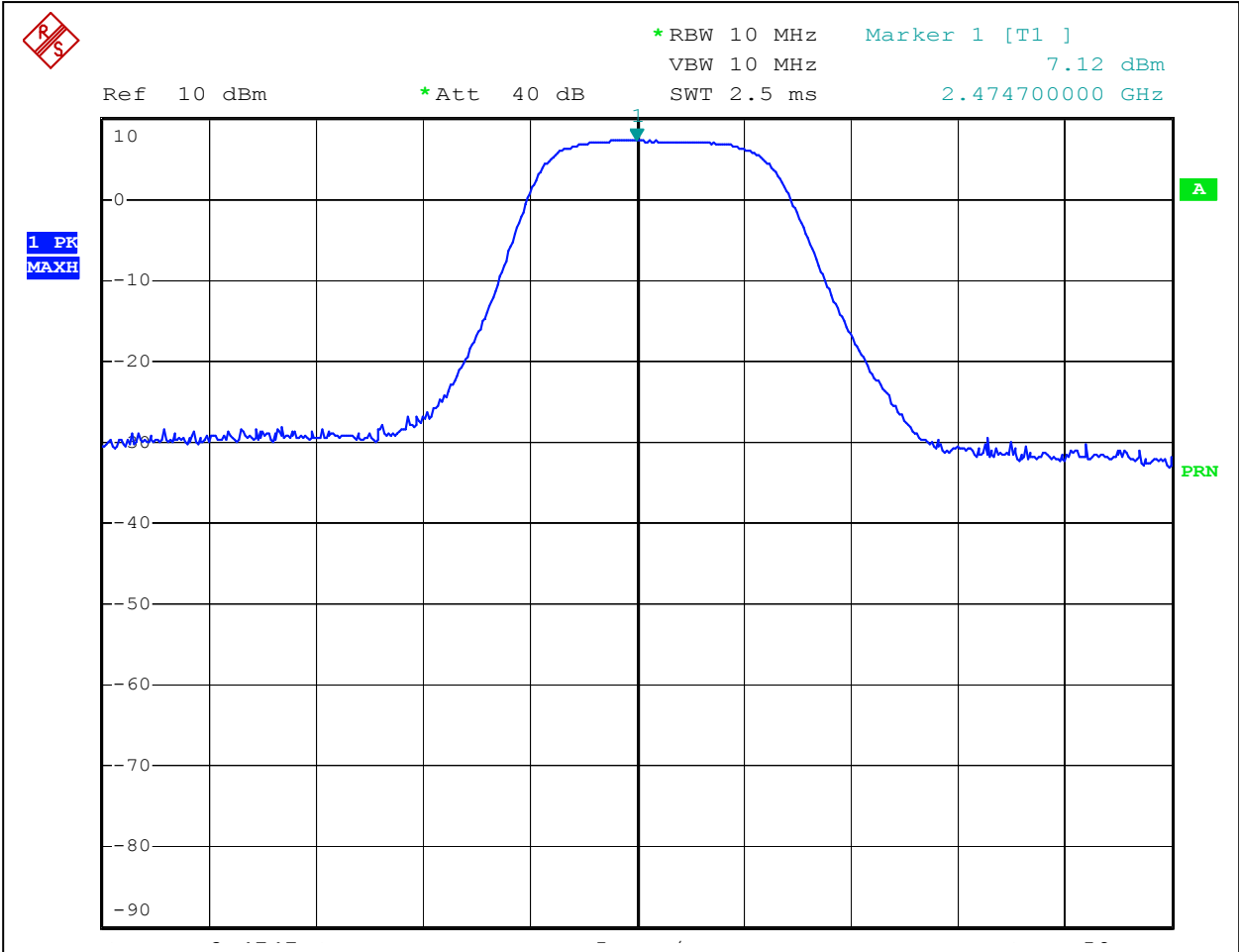




Graph 3.1.1



Graph 3.1.2



Graph 3.1.3

### 3.2 Radiated spurious emissions

**Test location:** ☐ OATS ☒ Anechoic Chamber ☐ Other

**Test distance:** ☐ 10 meters ☒ 3 meters

**Frequency Range:** 30MHz to 25GHz (10<sup>th</sup> Harmonic)

**Test result:** **Pass**

**Max. Margin:** 3.9dB below the limits

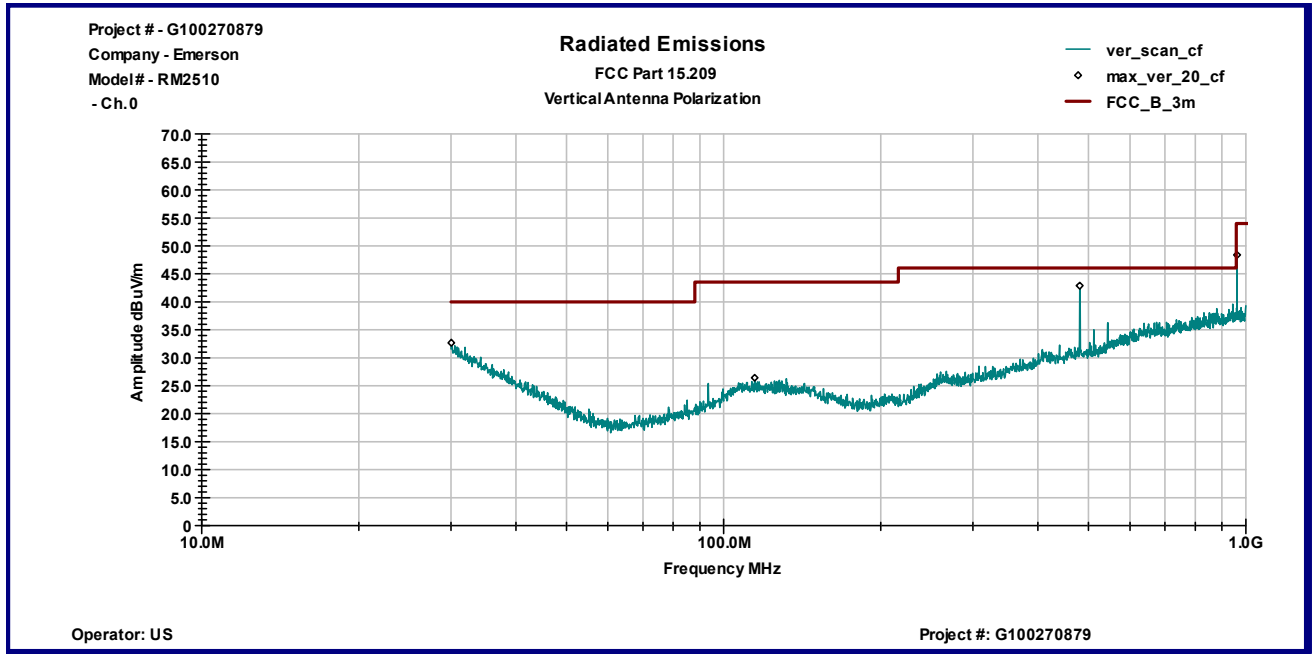
**Notes:** The table 3.2.1 shows radiated spurious and the 2nd and 3rd harmonics in restricted band of operation per FCC 15.205  
No emissions were detected above ambient at 3th and above harmonics

<b>Date:</b>	December 13-16, 2010	<b>Result: Pass</b>
<b>Standard:</b>	FCC part 15.247(d)	
<b>Tested by:</b>	Uri Spector	
<b>Test Point:</b>	Enclosure with antenna	
<b>Operation mode:</b>	See Page 5	
<b>Note:</b>		

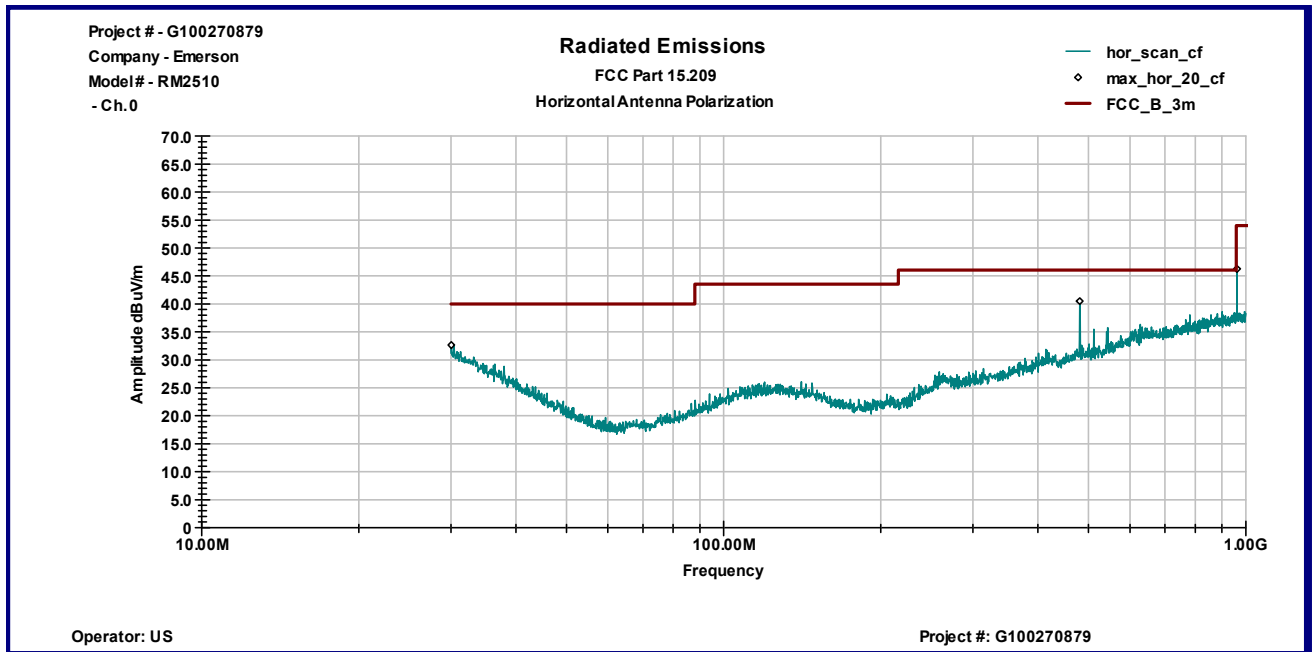
**Table 3.2.1**

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									
962.11	V	100	22.3	3.7	0.0	22.4	48.4	54.0	-5.5	peak
962.11	H	100	22.3	3.7	0.0	20.3	46.3	54.0	-7.6	peak
4809.83	V	100	32.7	4.9	36.7	45.2	46.2	54.0	-7.8	peak
7213.65	V	178	35.7	6.2	36.7	27.7	32.9	54.0	-21.1	average
7213.65	H	127	35.7	6.2	36.7	44.7	49.9	54.0	-4.1	peak
	Channel 7									
976.65	V	100	22.4	3.8	0.0	23.9	50.1	54.0	-3.9	peak
976.65	H	100	22.4	3.8	0.0	20.8	47.0	54.0	-7.0	peak
4880.80	V	250	32.9	4.9	36.6	30.4	31.6	54.0	-22.4	average
4880.80	H	100	32.9	4.9	36.6	43.6	44.8	54.0	-9.2	peak
7318.33	V	120	36.0	6.2	36.6	42.7	48.3	54.0	-5.7	peak
7318.33	H	100	36.0	6.2	36.6	43.2	48.8	54.0	-5.2	peak
	Channel 15									
990.09	V	100	22.5	3.8	0.0	23.1	49.4	54.0	-4.5	peak
990.09	H	100	22.5	3.8	0.0	13.9	40.2	54.0	-13.7	peak
4950.62	V	100	33.0	5.0	36.6	44.2	45.6	54.0	-8.4	peak
7425.50	V	100	36.2	6.3	36.5	43.9	49.9	54.0	-4.1	peak
7425.50	H	100	36.2	6.3	36.5	41.7	47.7	54.0	-6.3	peak

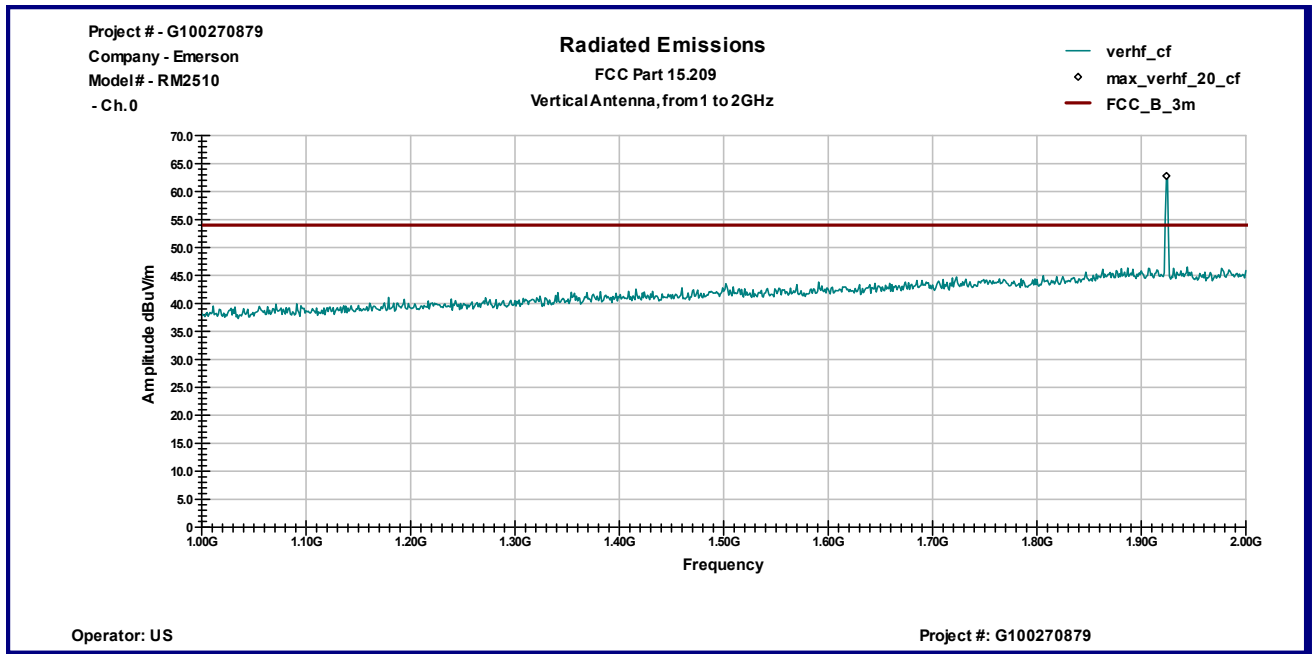
- Note:**
1. Measurements were taken using an Average Value (RBW 1MHz, VBW 10Hz), or peak detector when commented
  2. The table shows spurious emissions and the 2nd and 3rd harmonic in restricted band of operation per FCC 15.205
  3. The Frequencies from 480.78MHz to 495.33MHz and 1.923GHz to 1.985GHz are outside restricted band of operation per FCC 15.205.
  4. No emissions were detected above ambient at 3th and above harmonics



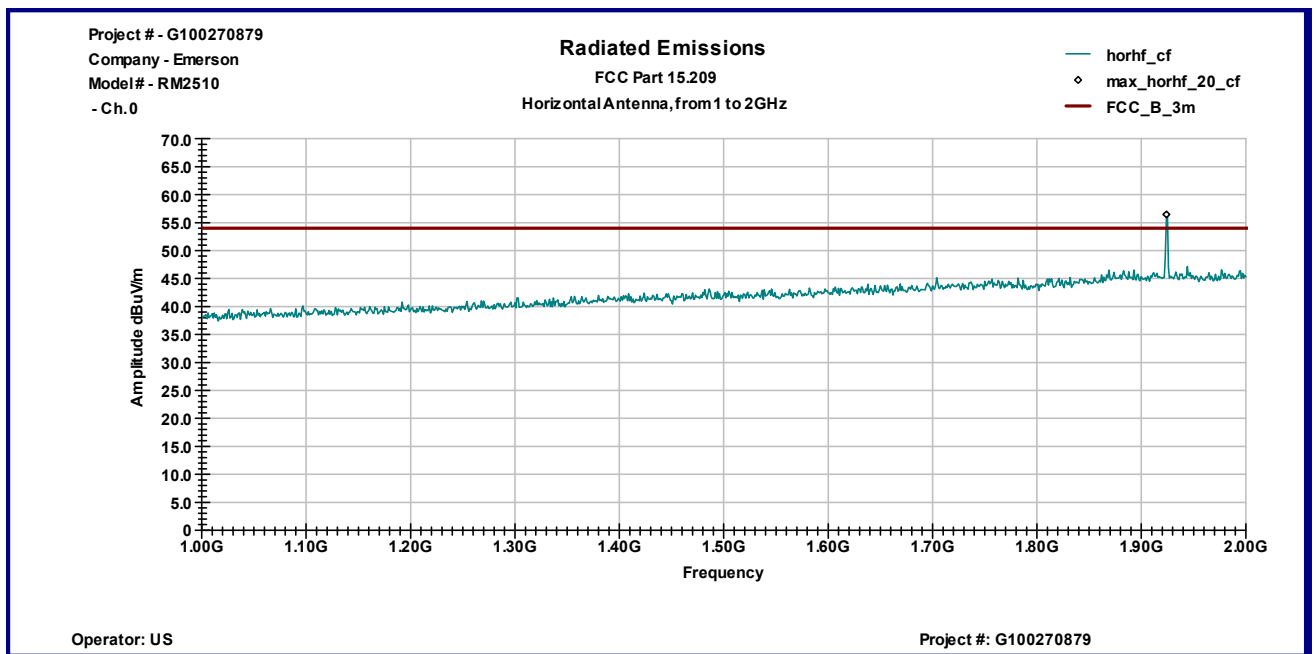
Graph 3.2.1



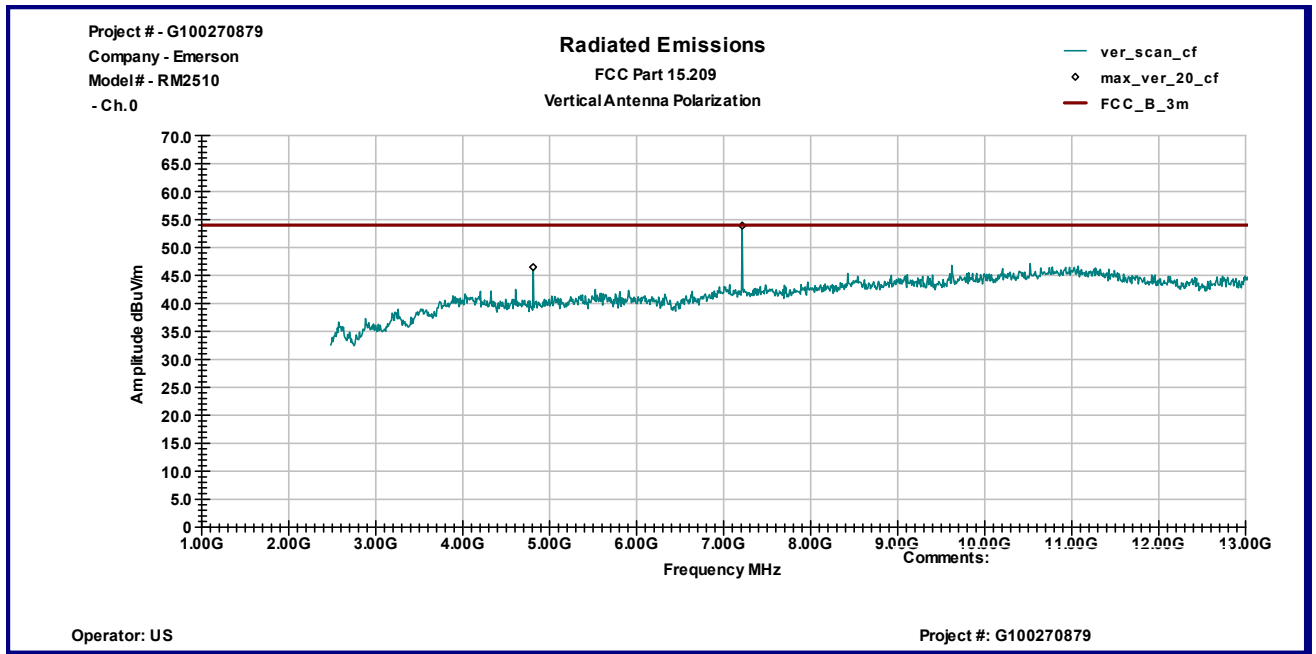
Graph 3.2.2



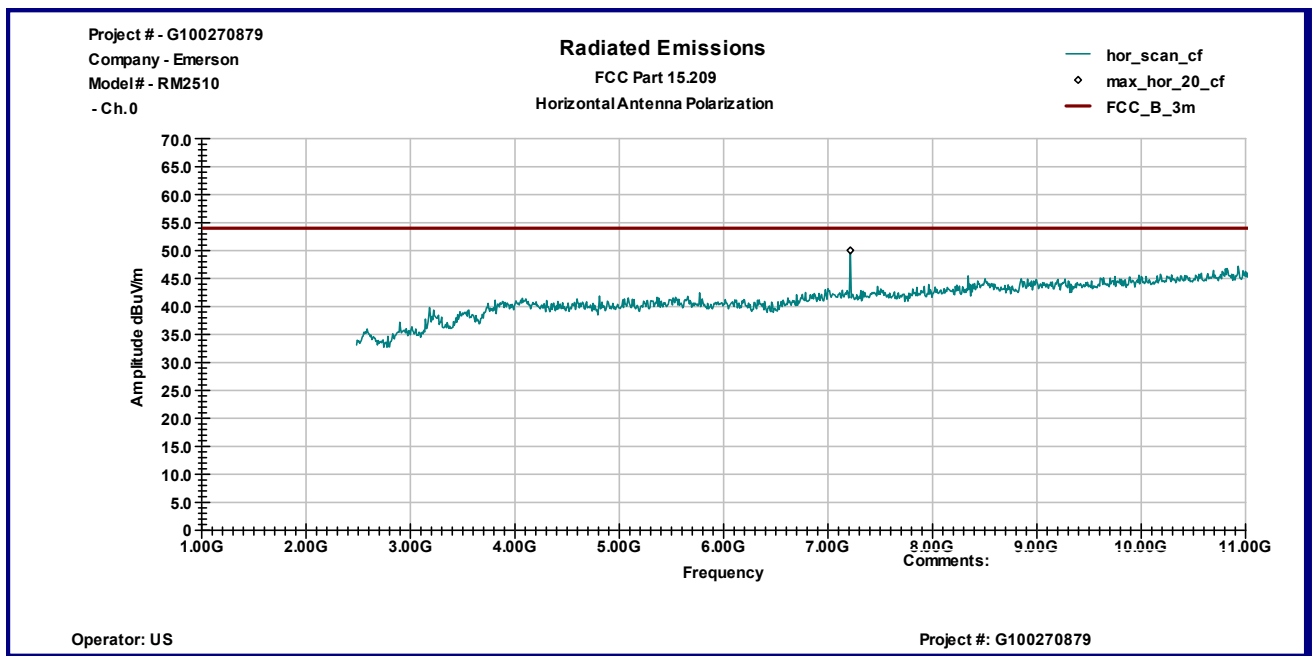
Graph 3.2.3



Graph 3.2.4

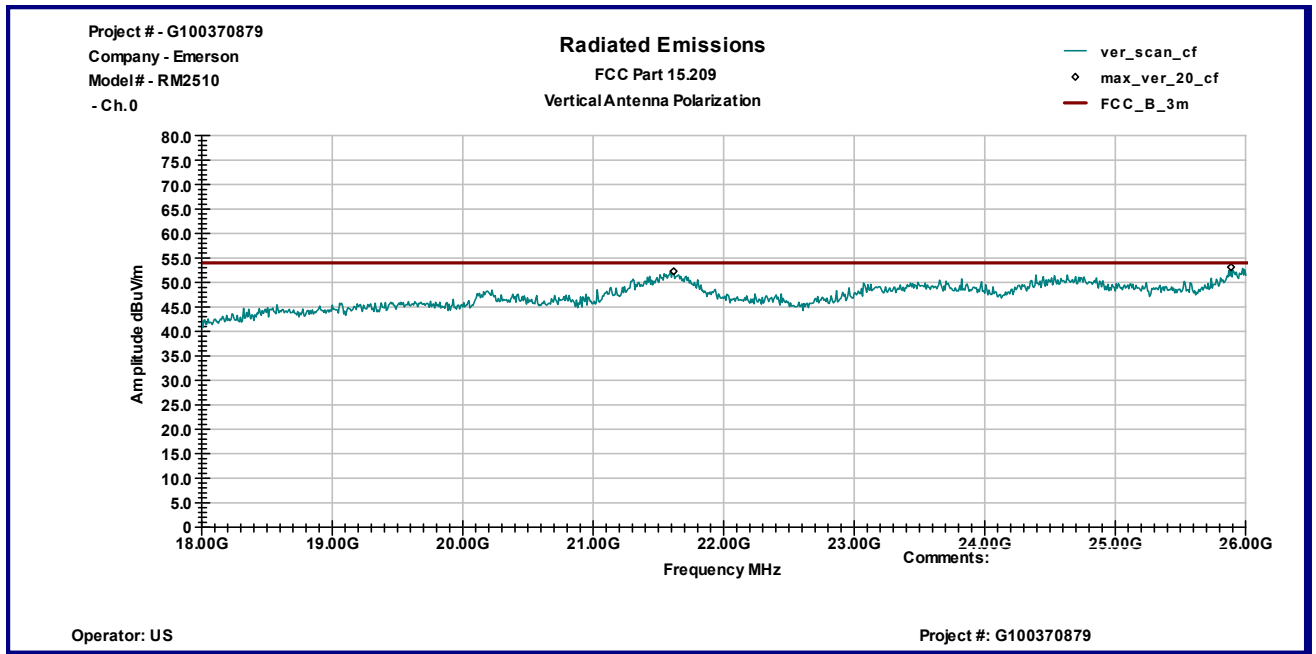


Graph 3.2.5

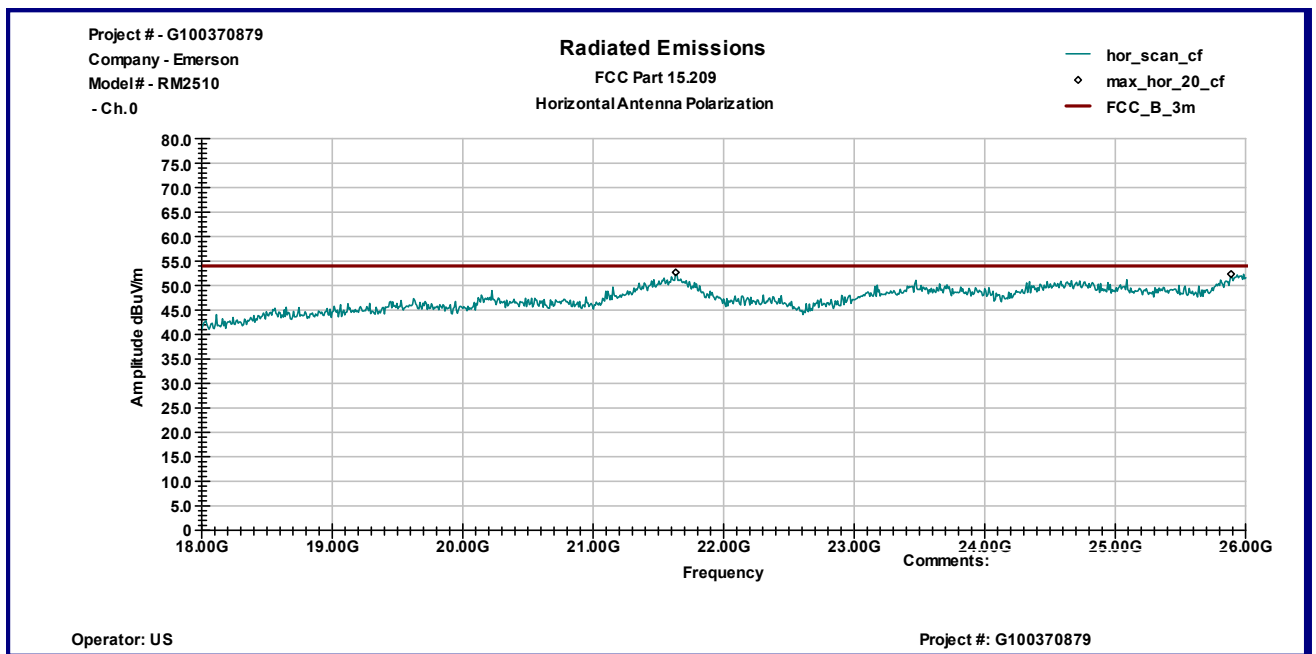


Graph 3.2.6

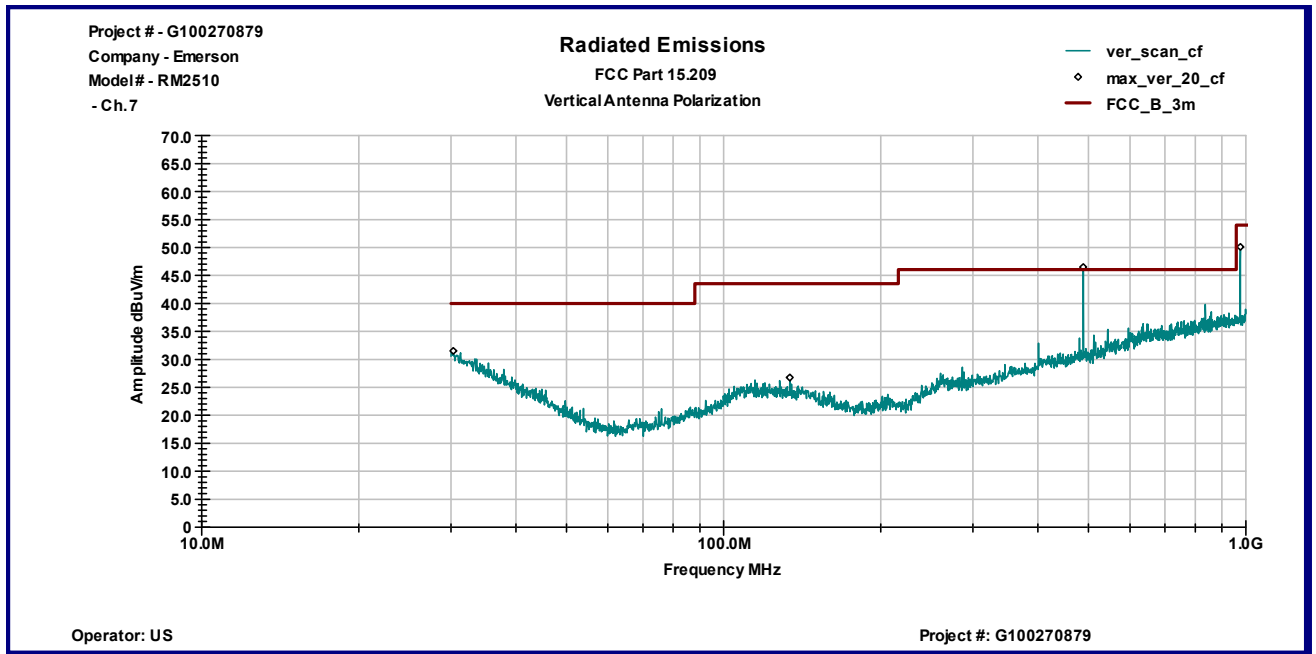




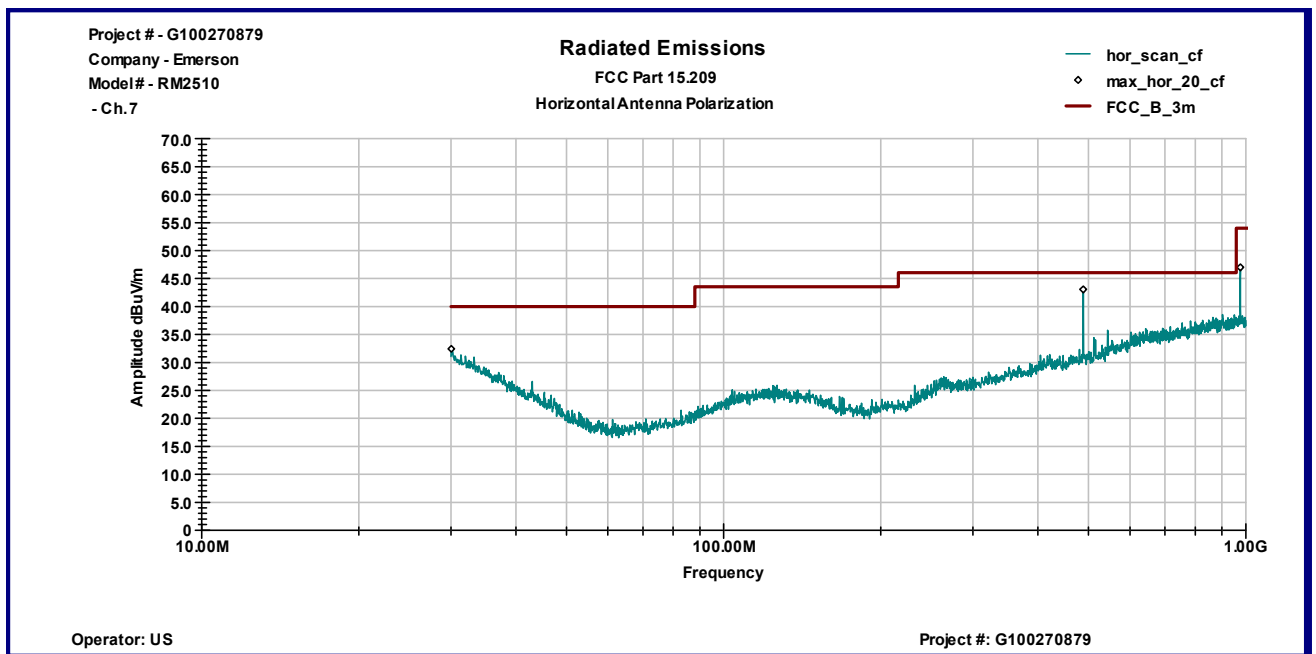
Graph 3.2.7



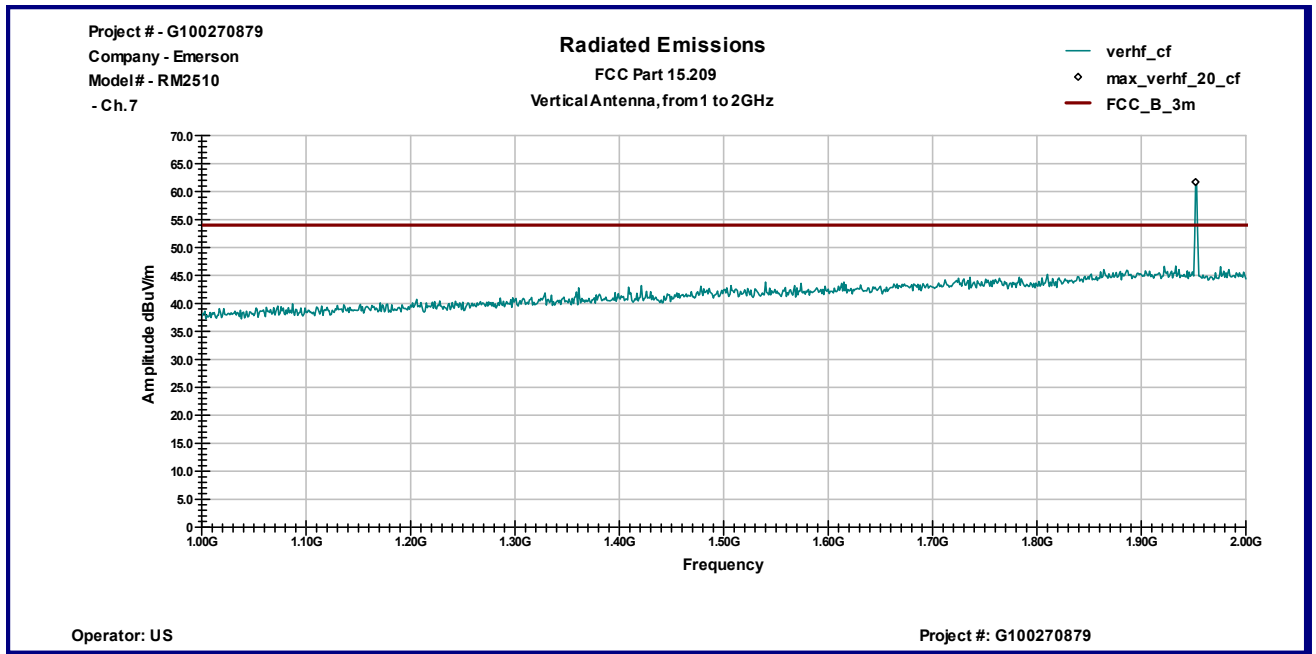
Graph 3.2.8



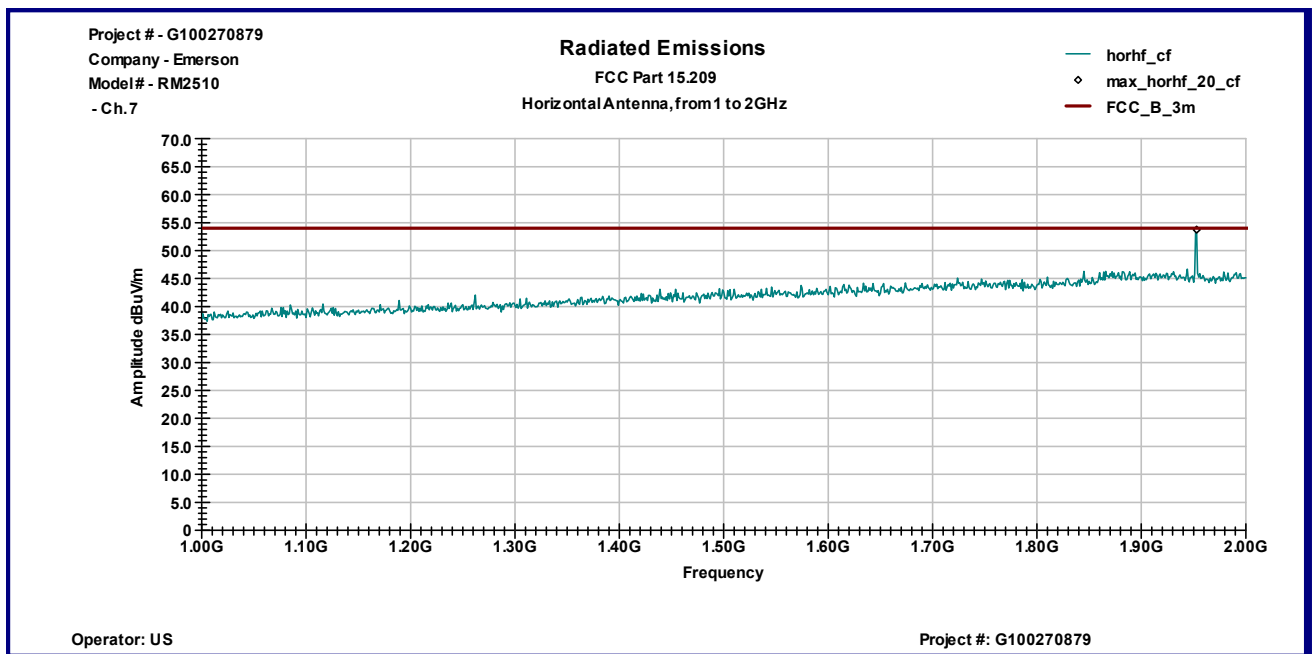
Graph 3.2.9



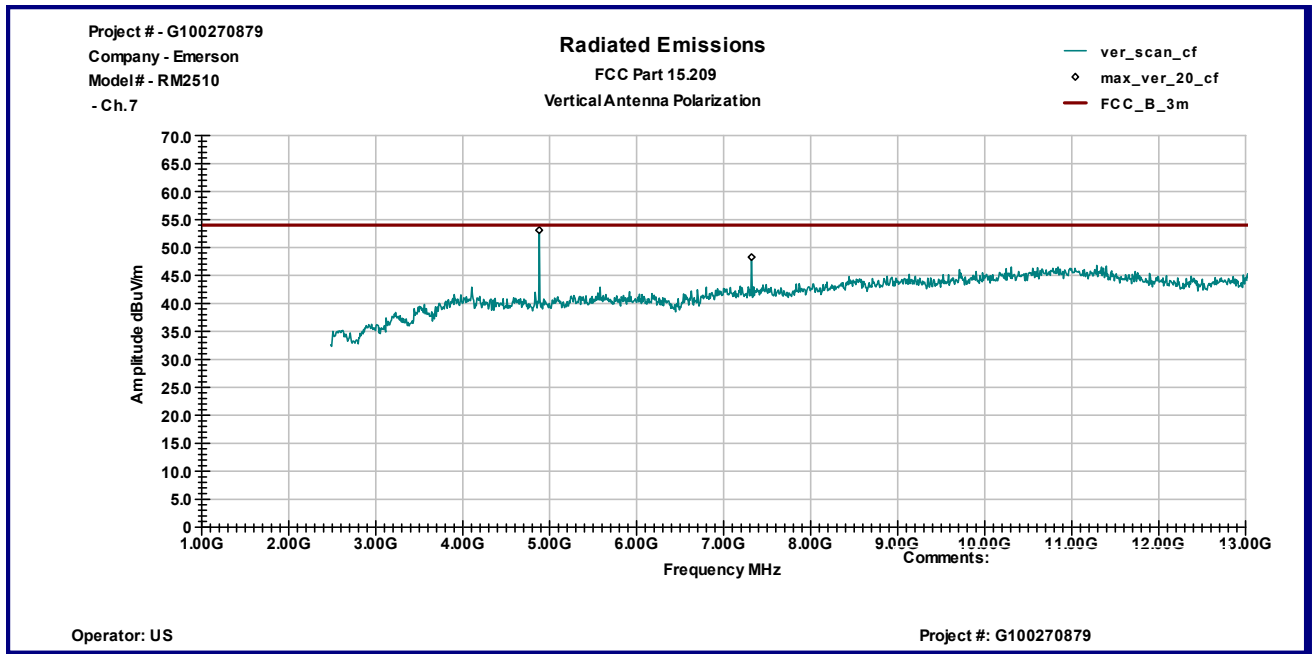
Graph 3.2.10



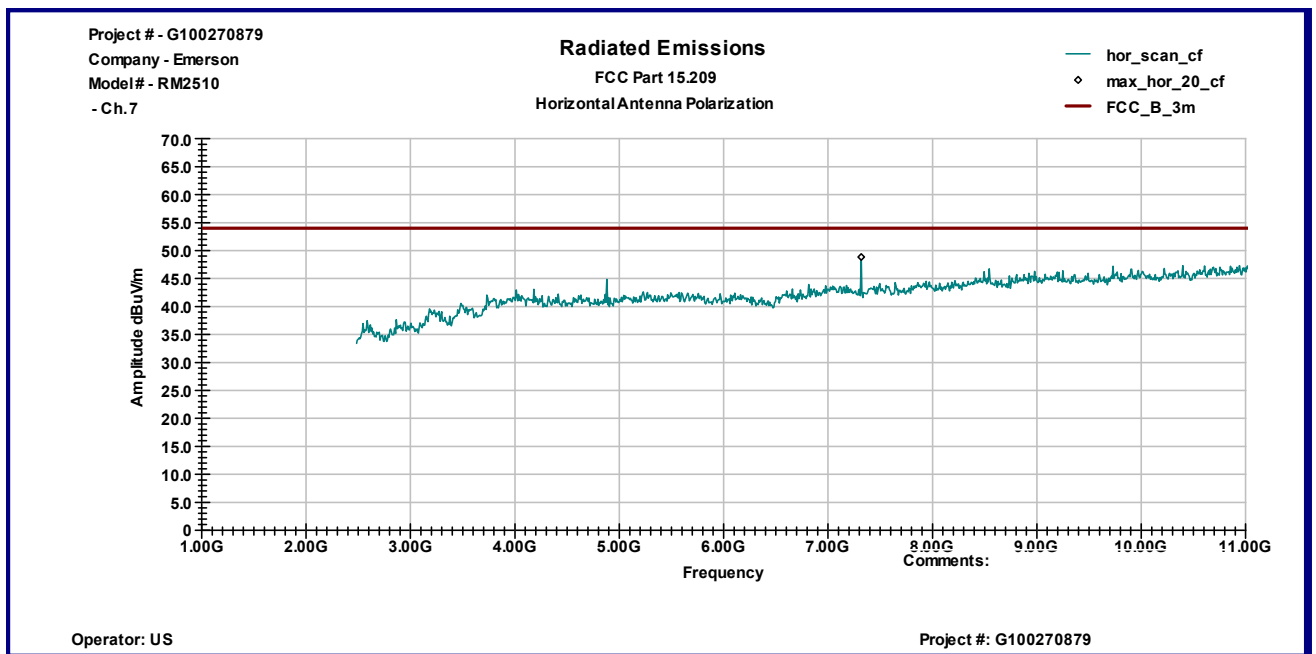
Graph 3.2.11



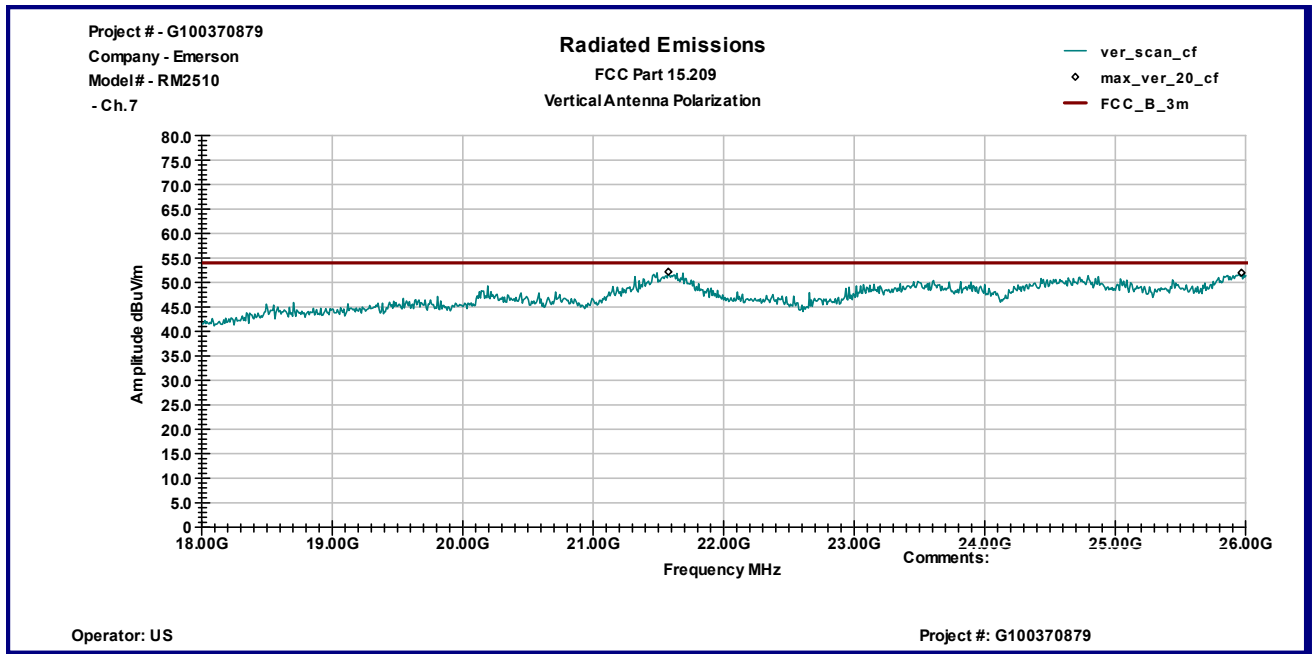
Graph 3.2.12



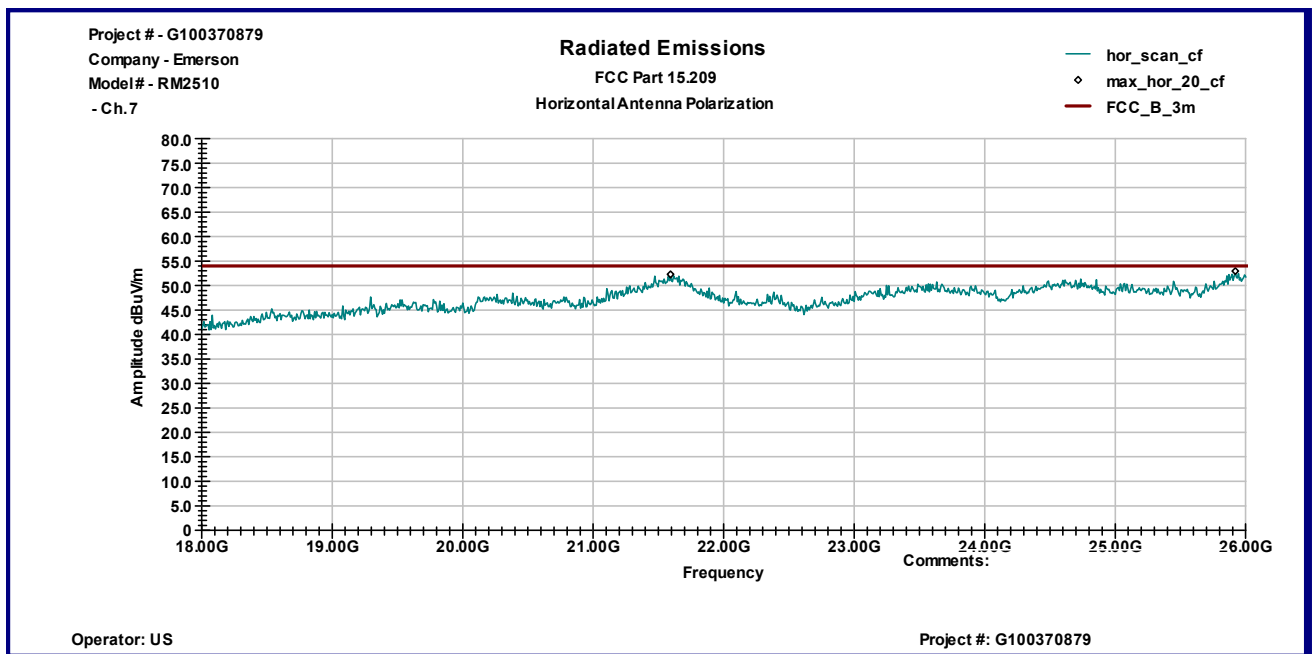
Graph 3.2.13



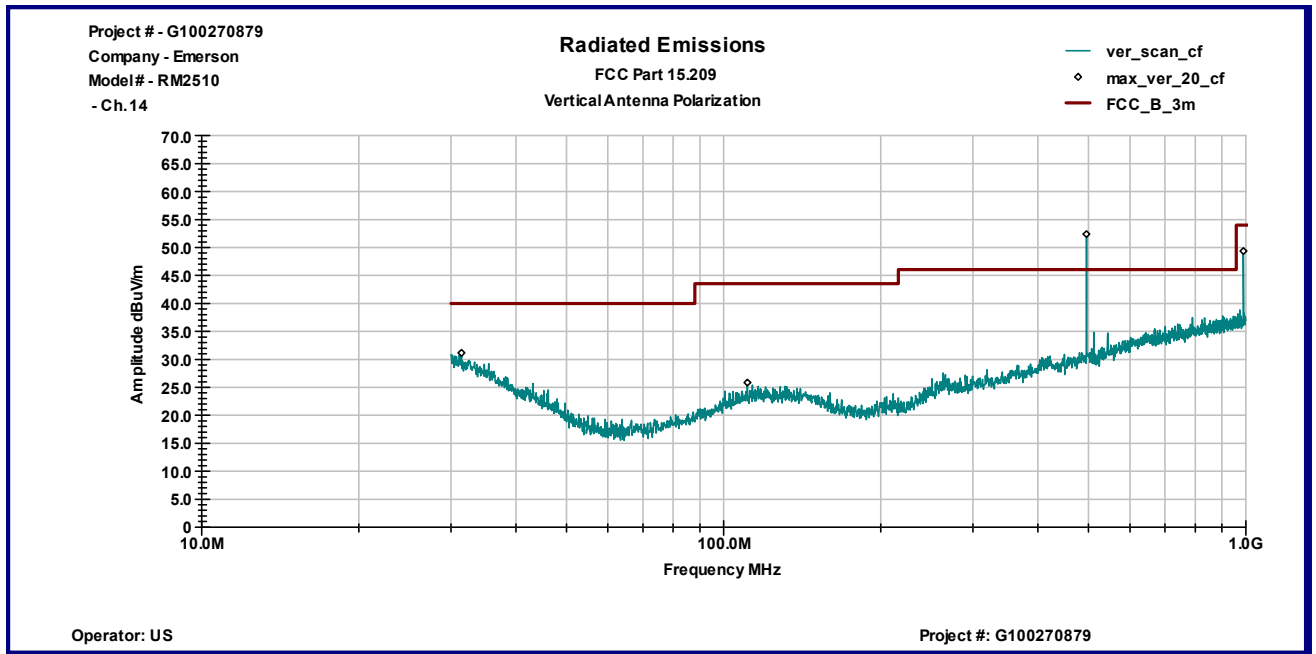
Graph 3.2.14



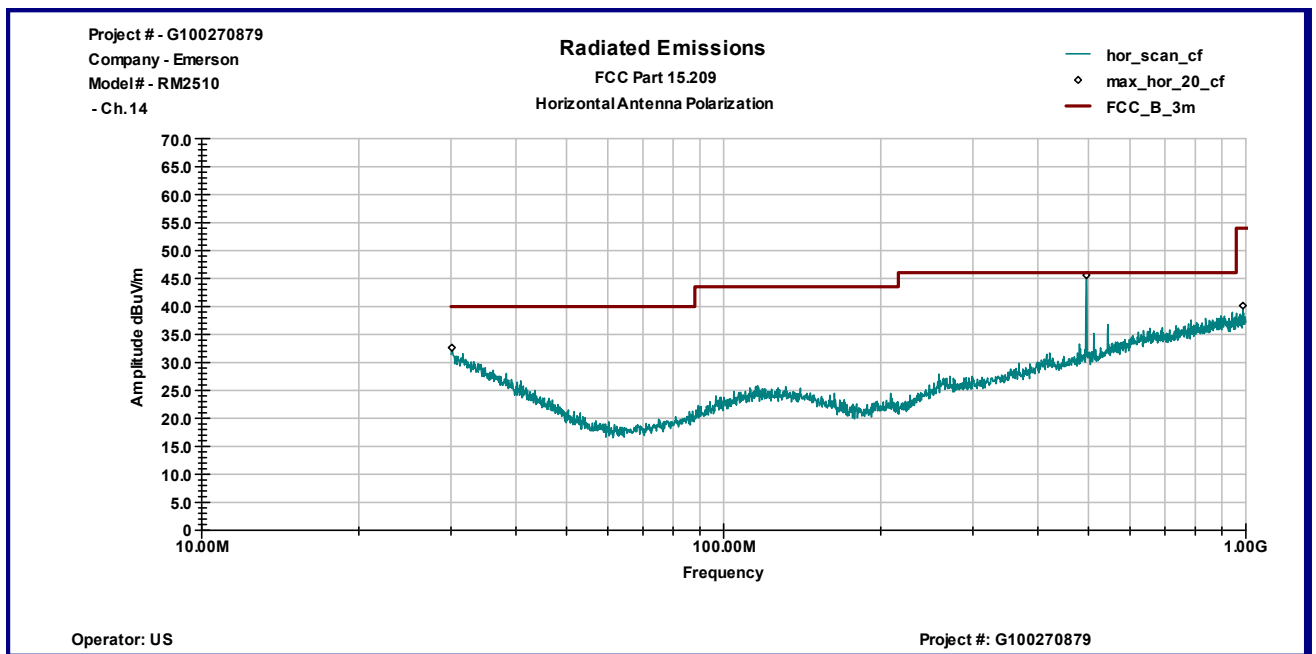
Graph 3.2.15



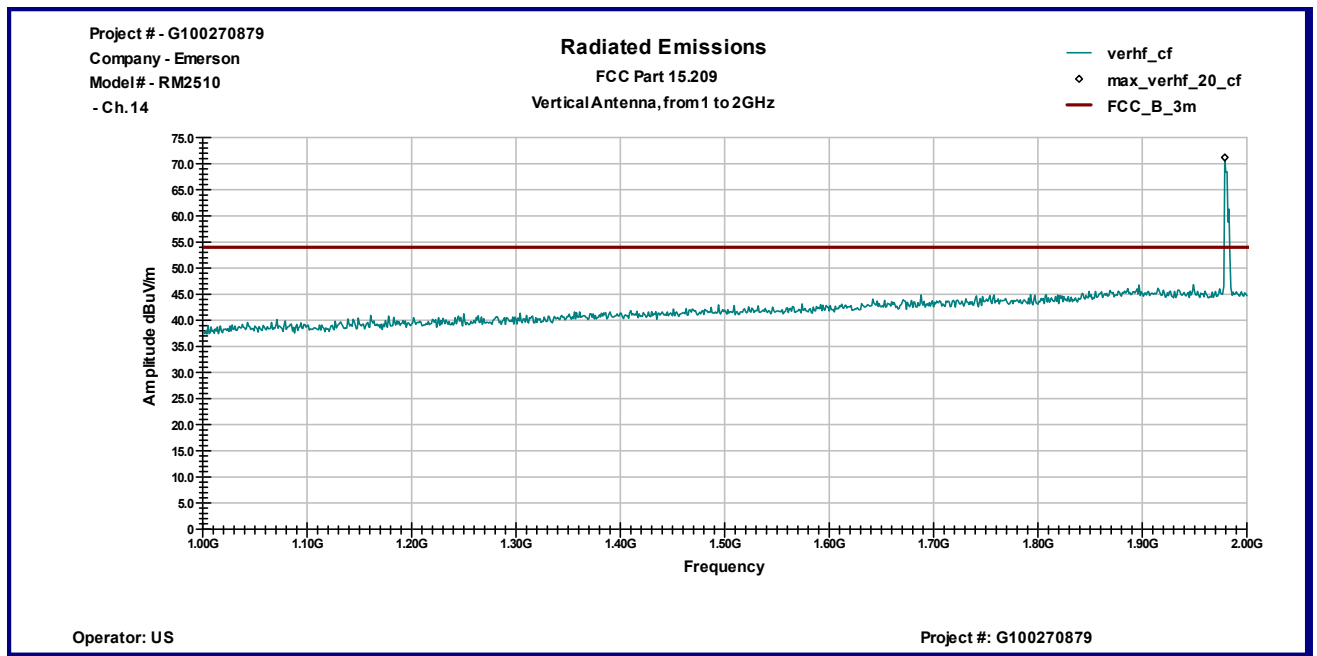
Graph 3.2.16



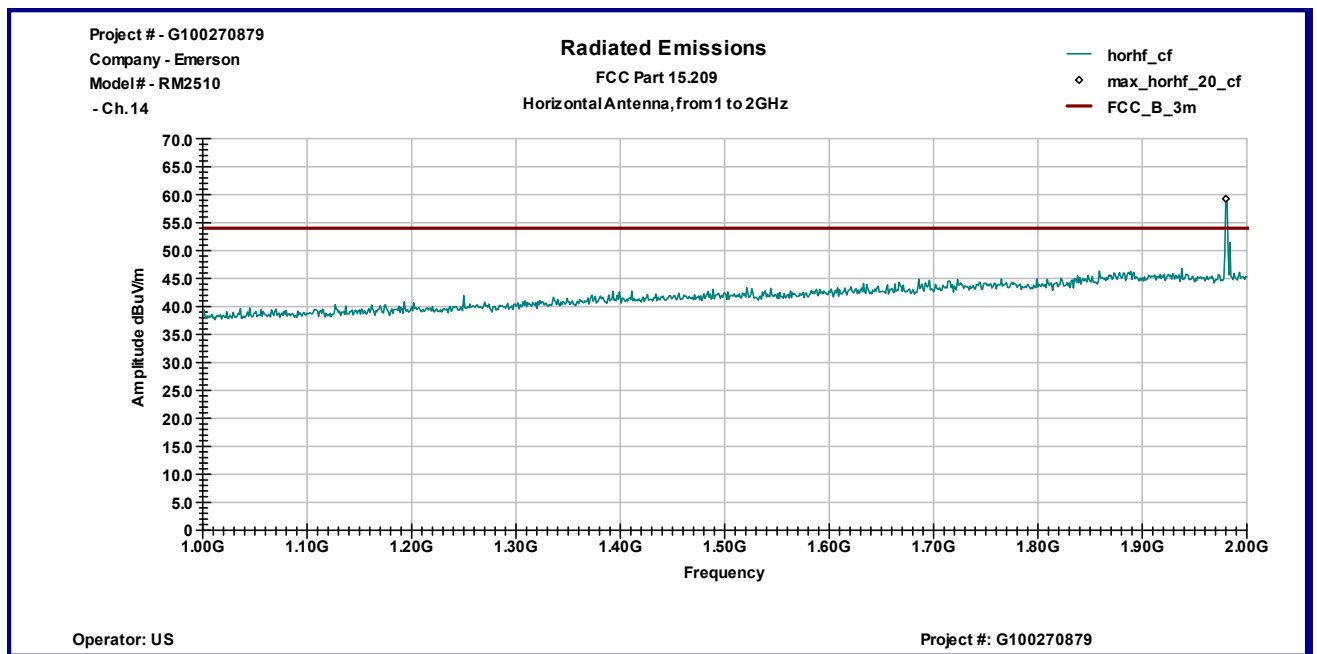
Graph 3.2.17



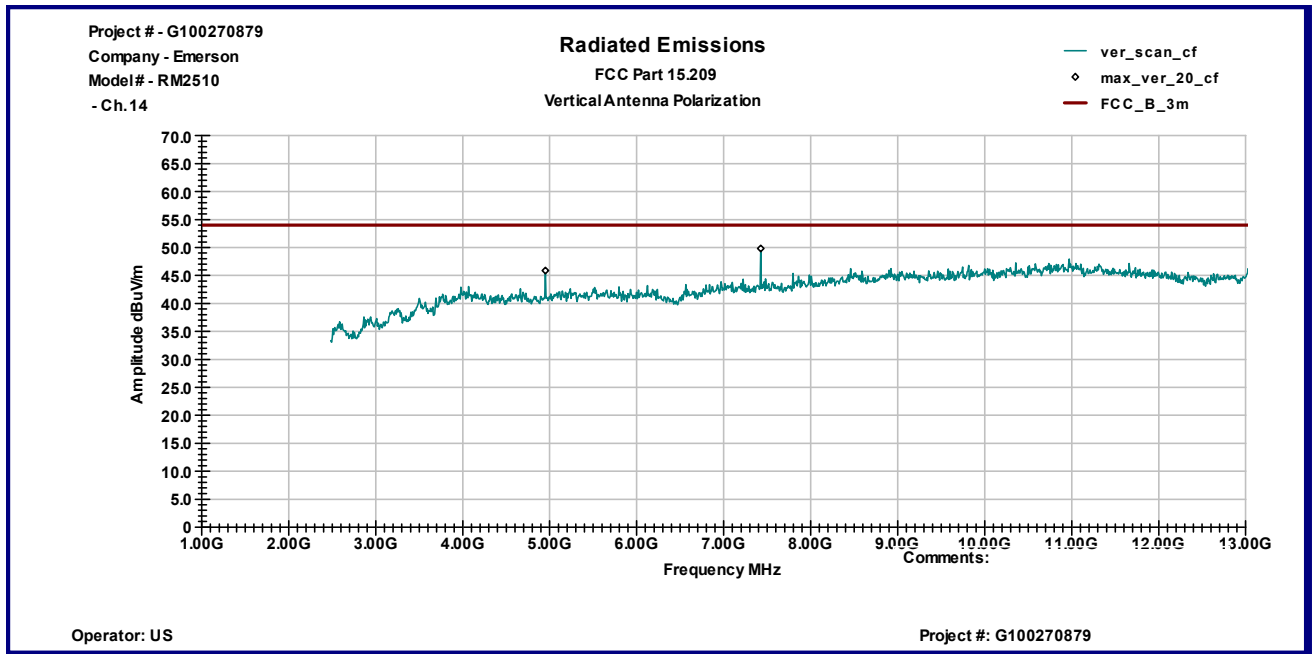
Graph 3.2.18



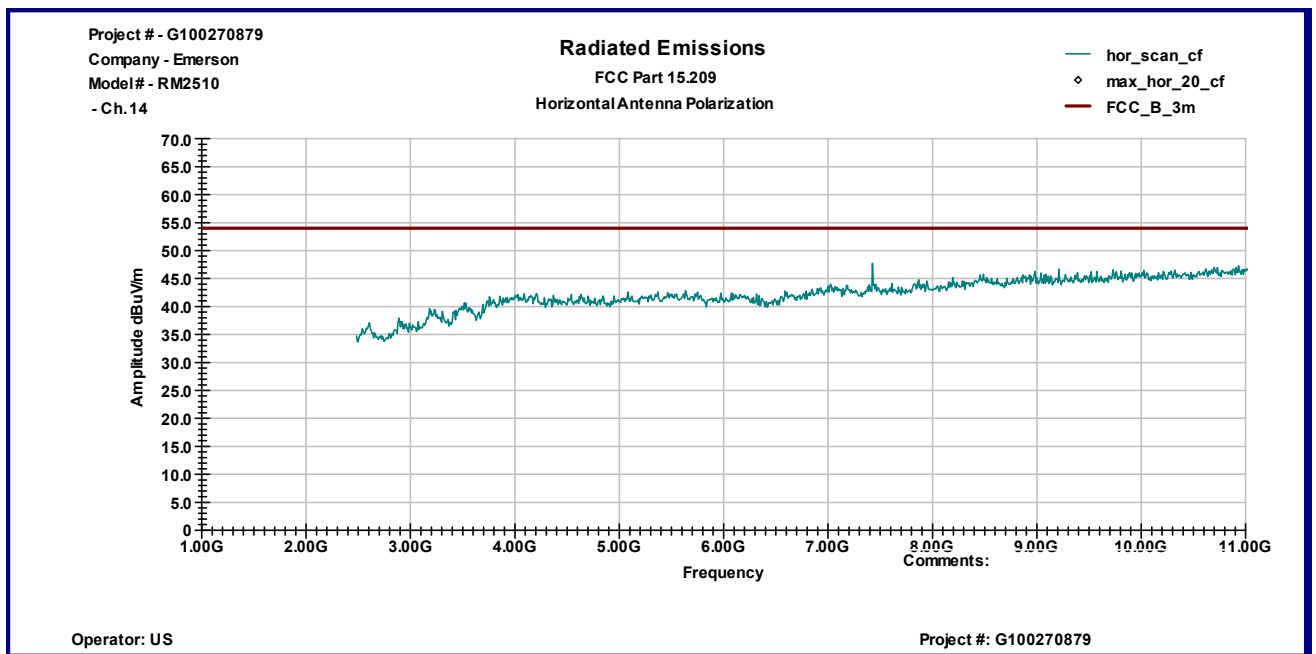
Graph 3.2.19



Graph 3.2.20

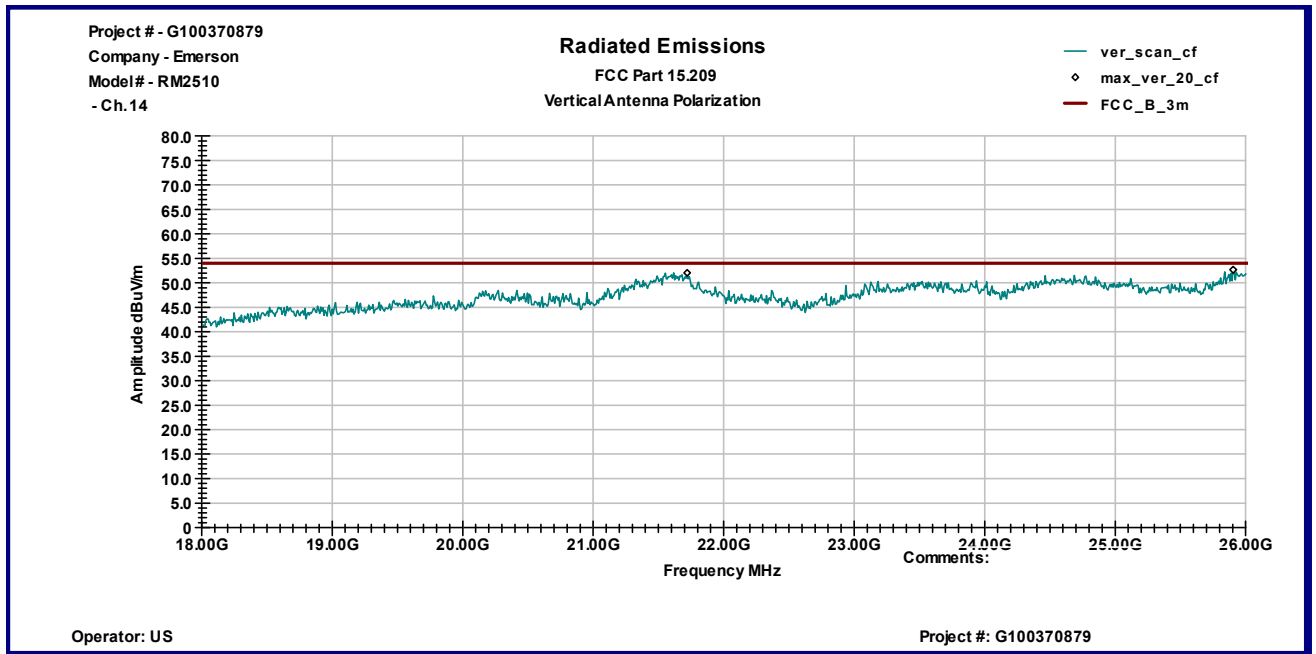


Graph 3.2.21

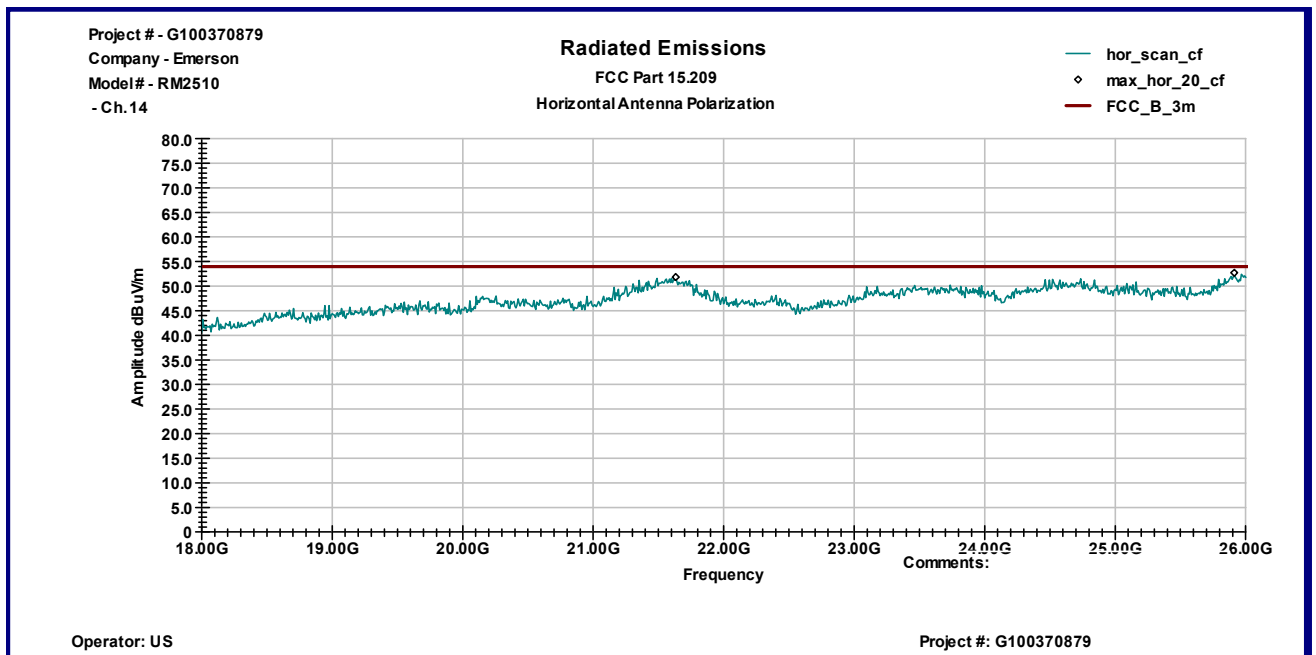


Graph 3.2.22





Graph 3.2.23



Graph 3.2.24

### 3.3 RF Exposure Compliance

The maximum measured antenna conducted power, P is 8.01dBm

The antenna gain, G is 8dBi

The maximum EIRP power = P + G  
ERP = 8.01 + 8 = 16.01dBm, or 0.04W

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

$$S = 10\text{W}/\text{m}^2$$

The Power Density is related to EIRP with the equation:  
 $S = \text{EIRP} / 4\pi D^2$ , or  $10 = 0.0553 / 4\pi D^2$ ,

The minimum safe separation distance, D = 1.8cm, 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	12/07/2011	<input checked="" type="checkbox"/>
Spectrum Analyzer	R & S	ESCI	100358	12909	07/12/2011	<input checked="" type="checkbox"/>
Bicono-Log Antenna	Schaffner-Chase	CBL 6112 B	2468	14459	10/18/2011	<input checked="" type="checkbox"/>
Horn Antenna	EMCO	3115	9507-4513	9936	04/13/2011	<input checked="" type="checkbox"/>
Waveguide Horn Antenna	EMCO	3116	9904-2423	9705	09/06/2010	<input checked="" type="checkbox"/>
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1122951	13475	10/06/2011	<input checked="" type="checkbox"/>
Pre-Amplifier	MITEQ	AMF-6F-16002600-25-10P	1222383	MIN-0065	10/06/2011	<input checked="" type="checkbox"/>
High Pass Filter	Reactel	7HS-4G-S12	0223	015274	VBV	<input checked="" type="checkbox"/>
System	TILE! Instrument Control		Ver. 3.4.K.29	15259	VBV	<input checked="" type="checkbox"/>

