

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
8200 Market Blvd.
Mail Stop PM17
Chanhassen, MN 55317, USA

Prepared by: U. Spector
Uri Spector

Date: December 20, 2010

Reviewed by: N. Shpilsher
Norman Shpilsher

Date: December 20, 2010

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to copy or distribute this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program. This report must not be used to claim product endorsement by A2LA, NIST nor any other agency of the U.S. Government.

TABLE OF CONTENTS

1.0	GENERAL DESCRIPTION.....	3
1.1	Product Description; Test Facility	4
1.3	Environmental conditions.....	5
1.4	Measurement uncertainty	6
1.5	Field Strength Calculation.....	6
2.0	TEST SUMMARY.....	7
3.0	TEST CONDITIONS AND RESULTS.....	8
3.1	Maximum peak output power.....	8
3.2	Radiated spurious emissions.....	12
3.3	RF Exposure Compliance	26
4.0	TEST EQUIPMENT.....	27

1.0 GENERAL DESCRIPTION

Model:	RM2510
Type of EUT:	2.4GHz Wireless HART Radio Module
Serial Number:	N/A
FCC ID:	LW2RM2510
Industry Canada ID:	2731A-RM2510
Related Submittal(s) Grants:	None
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 15:2009, §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 [REDACTED] <input type="checkbox"/> Other [REDACTED]
	Note: Class II Permissive Changes
Type of radio:	<input type="checkbox"/> Stand -alone <input checked="" type="checkbox"/> Module <input type="checkbox"/> Hybrid
Date Sample Submitted:	December 13, 2010
Test Work Started:	December 13, 2010
Test Work Completed:	December 17, 2010
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 Transceiver
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 (from channel 0 to 14)
Modulation:	QPSK
Emission Designator:	1M37G7D
Antenna(s) Info:	Type: Omni directional vertically polarized dipole Gain: 8 dBi Connector Type: N-type
Power settings:	8 dBm
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"/> 7.2 VDC <input type="checkbox"/> Other:   Amp. <input type="checkbox"/> 50Hz <input type="checkbox"/> 60Hz
Special Test Arrangement:	As a hand-held device the EUT was rotated through three orthogonal axes to determine and tested with the maximum emissions
Test Facility Accreditation:	A2LA (Certificate No. 1427.01)
Test Methodology:	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

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).

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

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

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

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

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

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

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

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

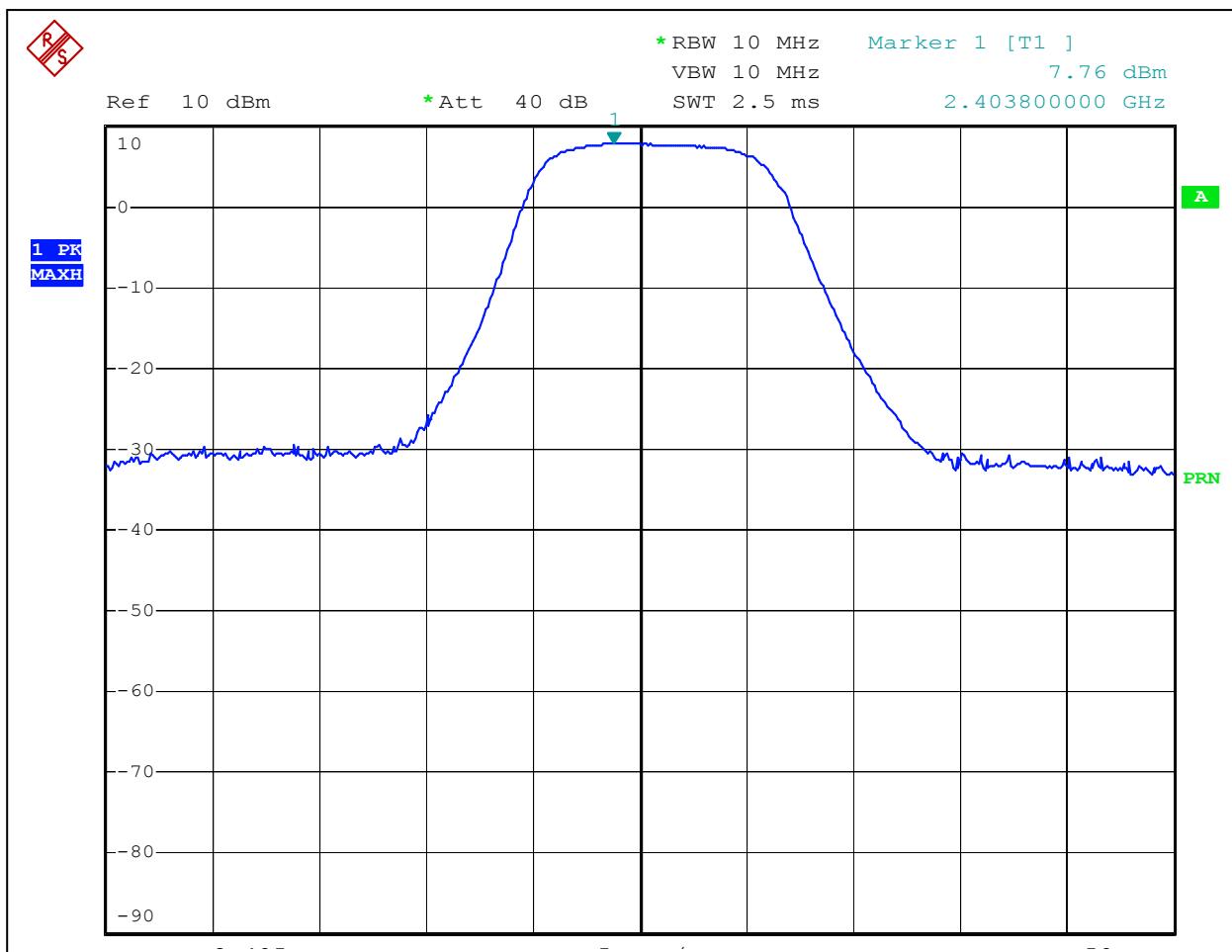
Test location: OATS Anechoic Chamber Other

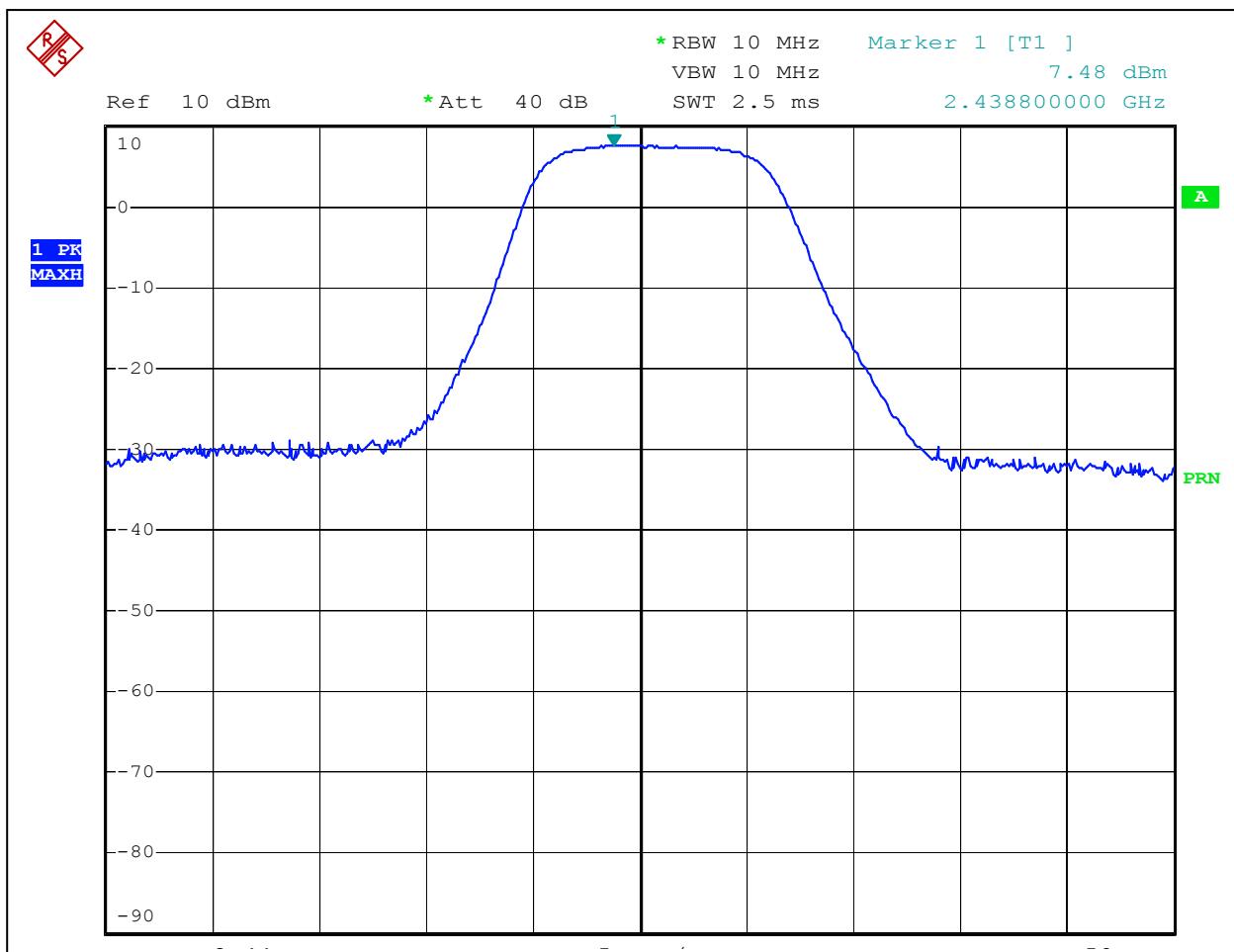
Test result: **Pass**

Max. Margin: 18.57dB below the limits

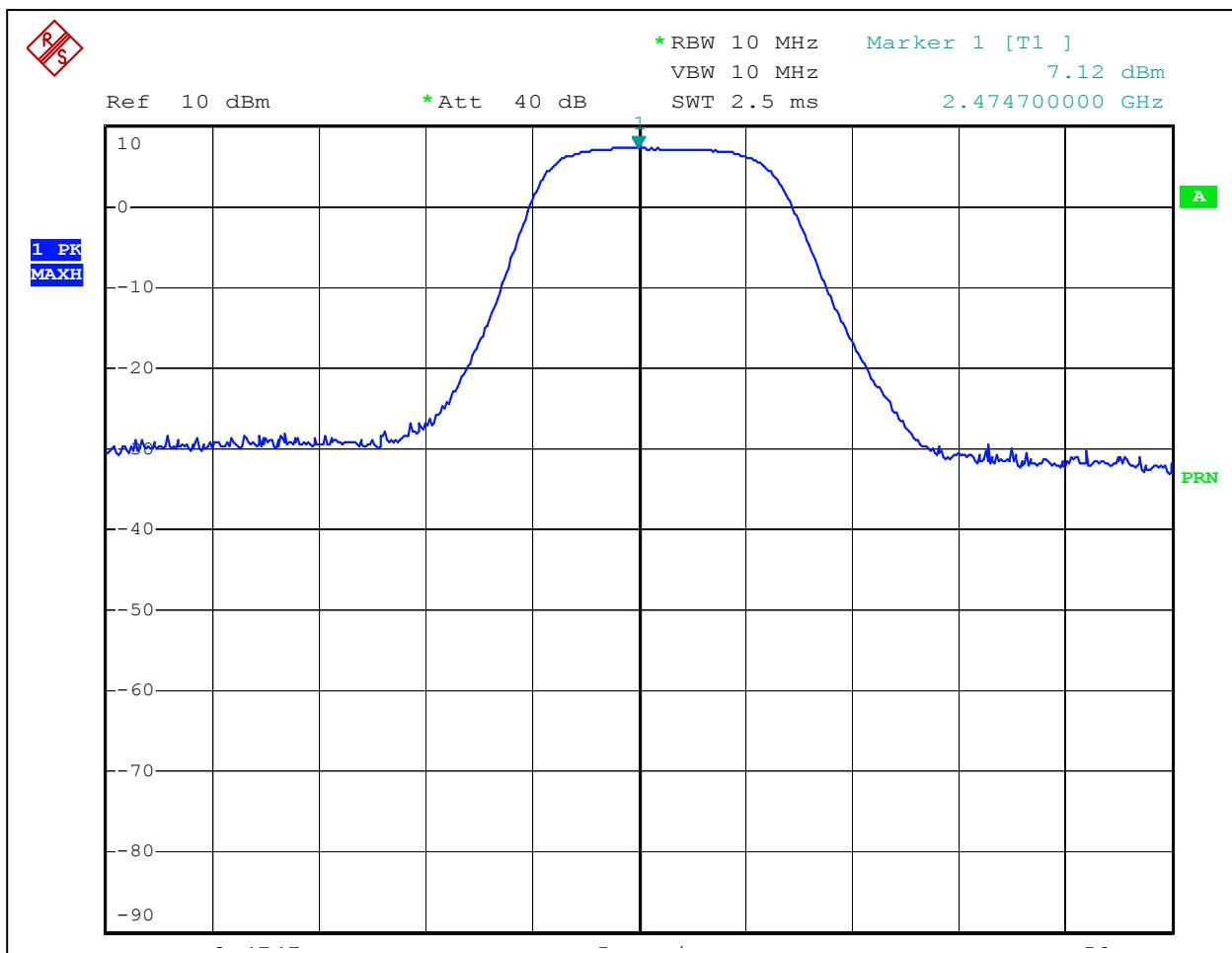
Power Output:	Conducted						
Frequency Range:	<input type="checkbox"/> 902-928MHz <input checked="" type="checkbox"/> 2400-2483.5MHz <input type="checkbox"/> 5725-5850MHz						
Low Frequency MHz	Measured power dBm	Attenuaton dB	Power at Antenna dBm	Limit dBm	Limit Reduction dB	Margin dB	
2404	7.76	0.25	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 (10th 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

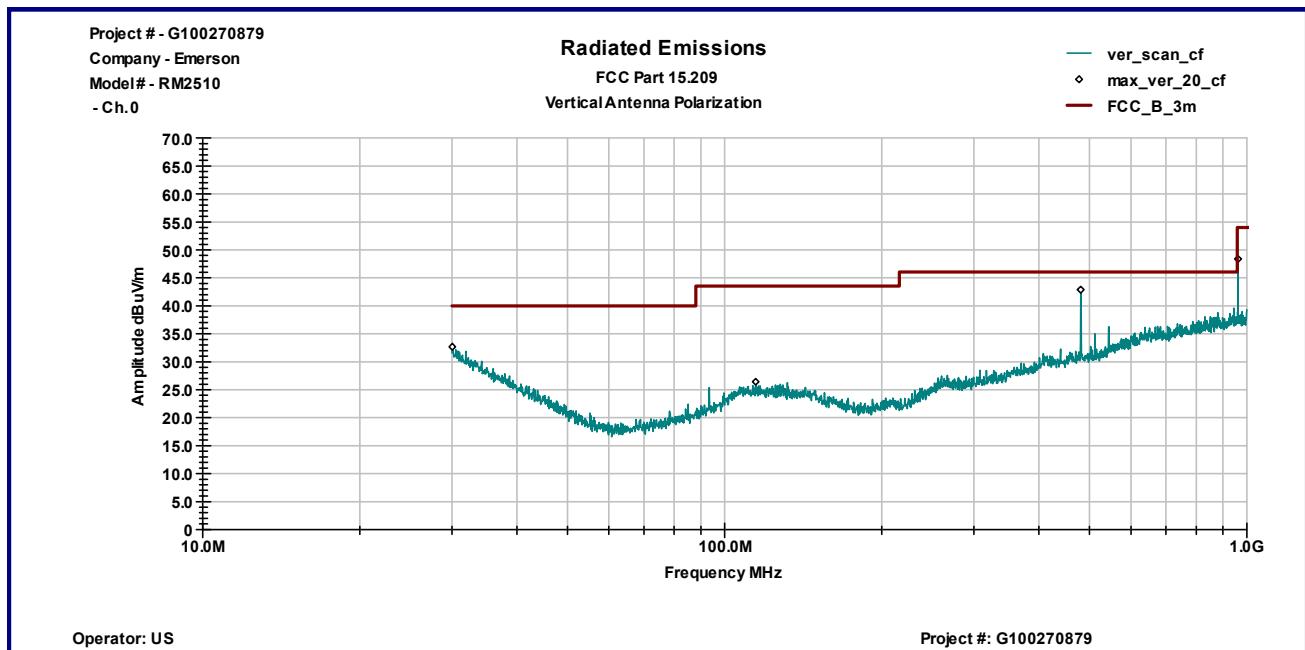
Date:	December 13-16, 2010	Result: Pass
Standard:	FCC part 15.247(d)	
Tested by:	Uri Spector	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:		

Table 3.2.1

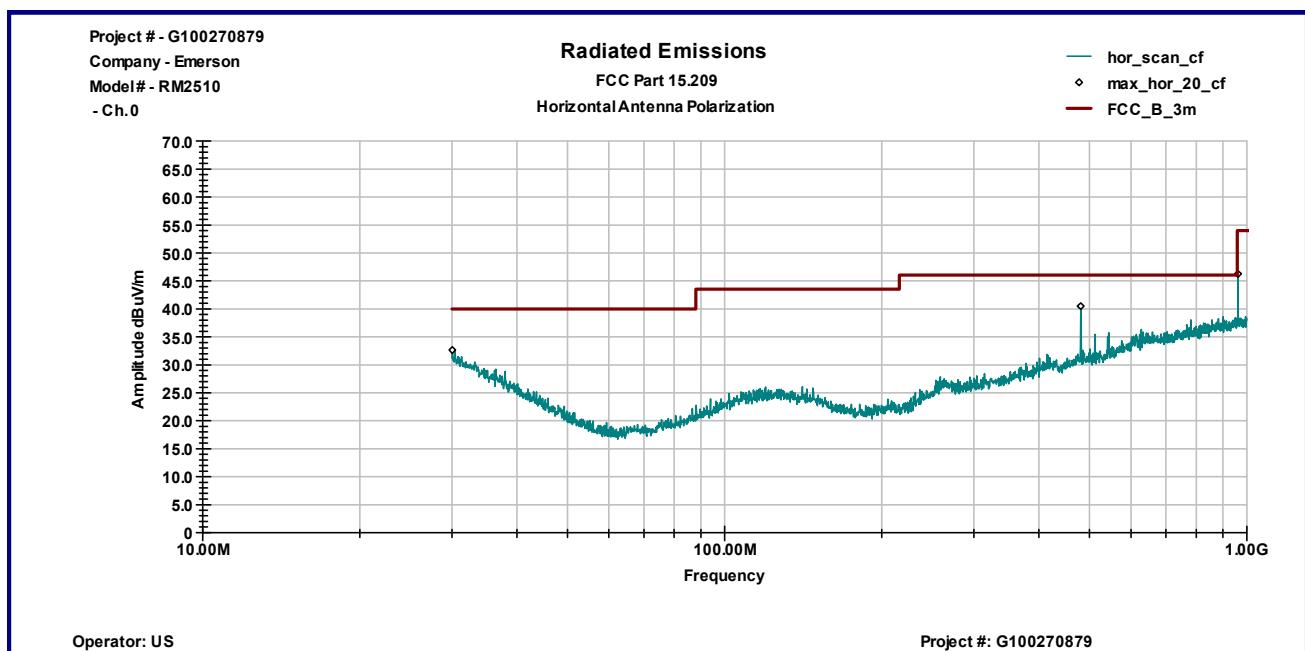
Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dB μ V	Total @ 3m dB μ V/m	Limit dB μ V/m	Margin dB	Comments
	Polarity	Hts(cm)								
Channel 0										
962.11	V	100	22.3	3.7	0.0	22.4	48.4	54.0	-5.5	peak
962.11	H	100	22.3	3.7	0.0	20.3	46.3	54.0	-7.6	peak
4809.83	V	100	32.7	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:

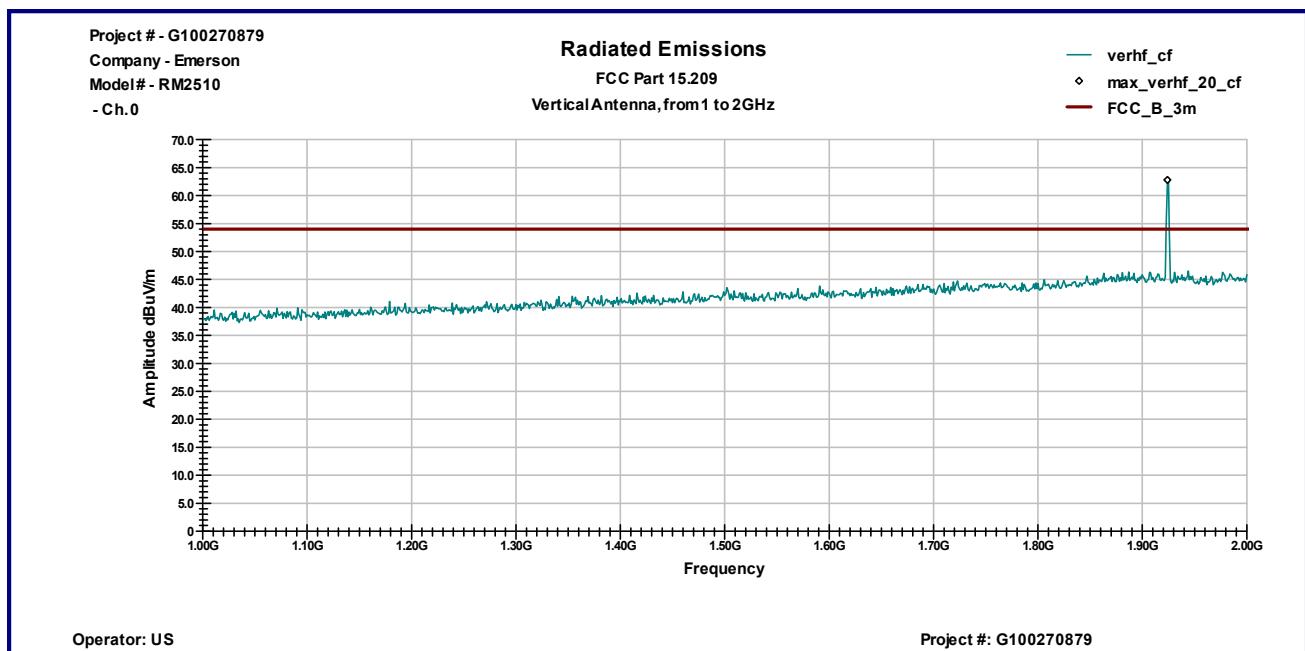
1. Measurements were taken using an Average Value (RBW 1MHz, VBW 10Hz), or peak detector when commented
2. The table shows supurius emissions and the 2nd and 3rd harmonic in restricted band of operation per FCC 15.205
3. The Frequencies from 480.78MHz to 495.33MHz and 1.923GHz to 1.985GHz are outside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



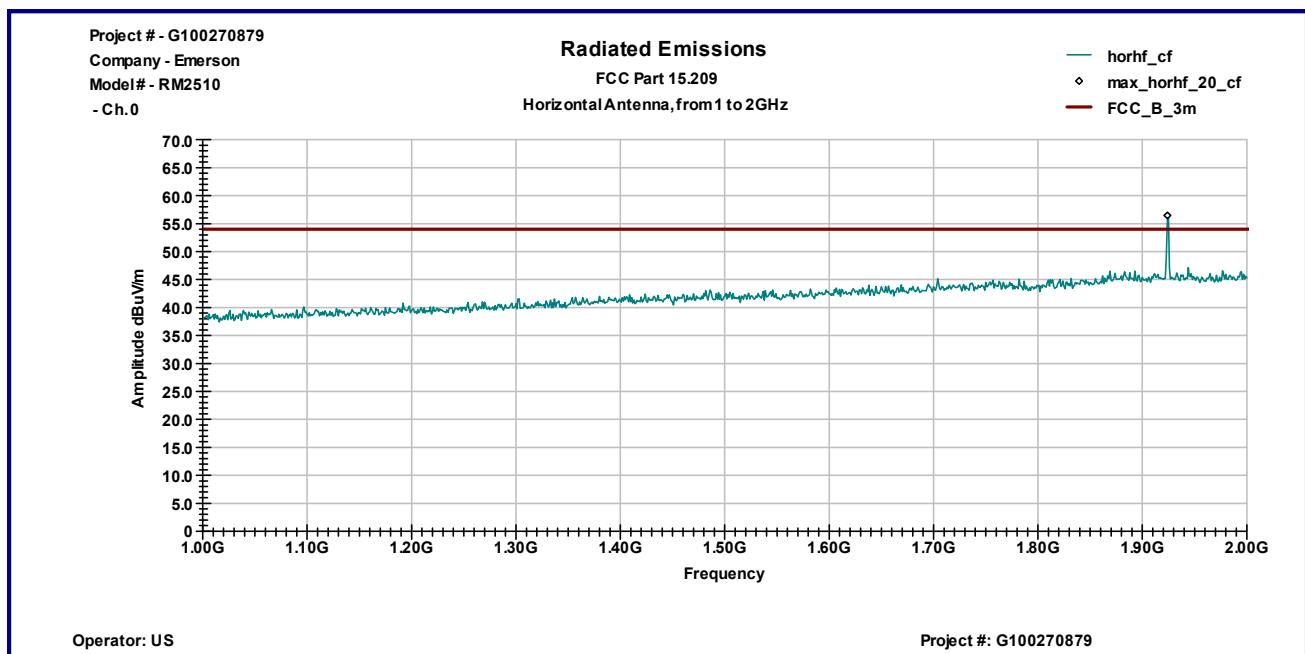
Graph 3.2.1



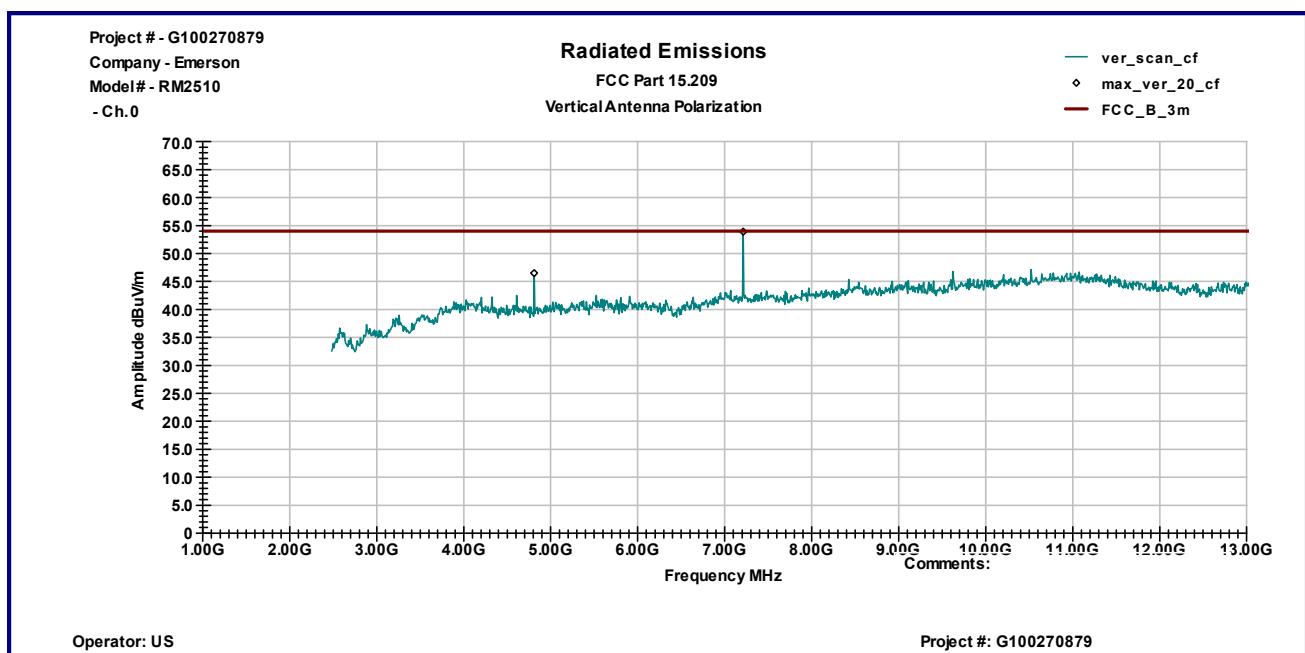
Graph 3.2.2



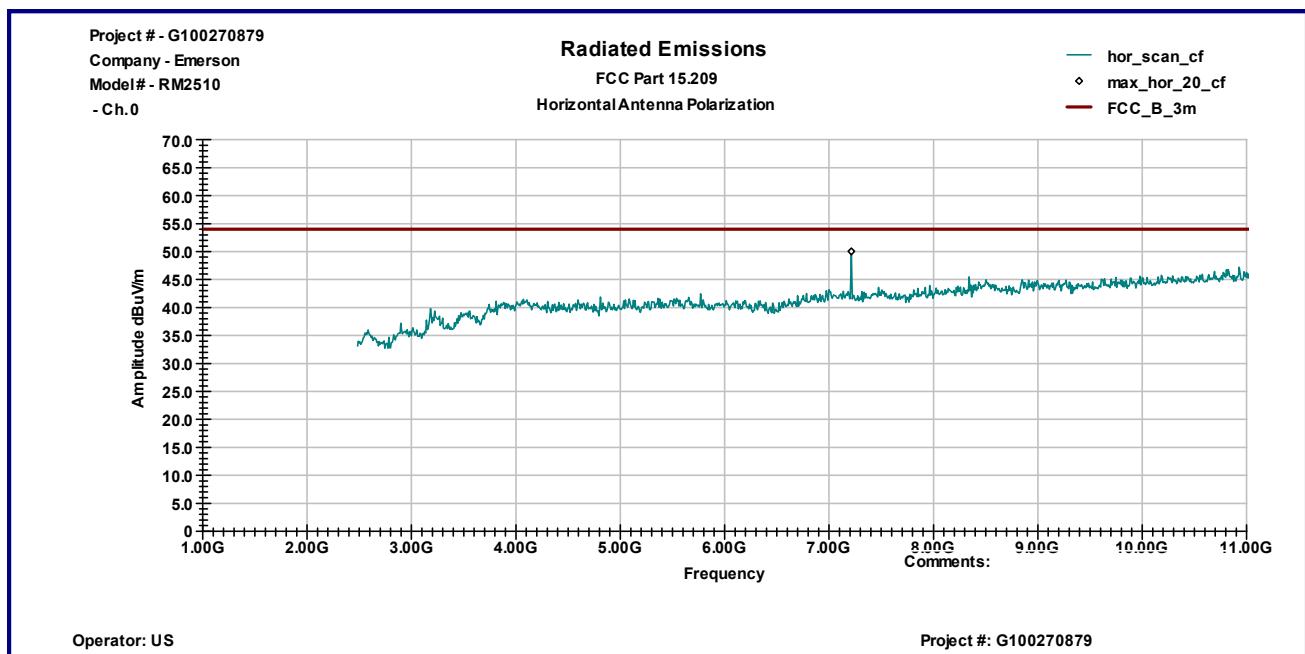
Graph 3.2.3



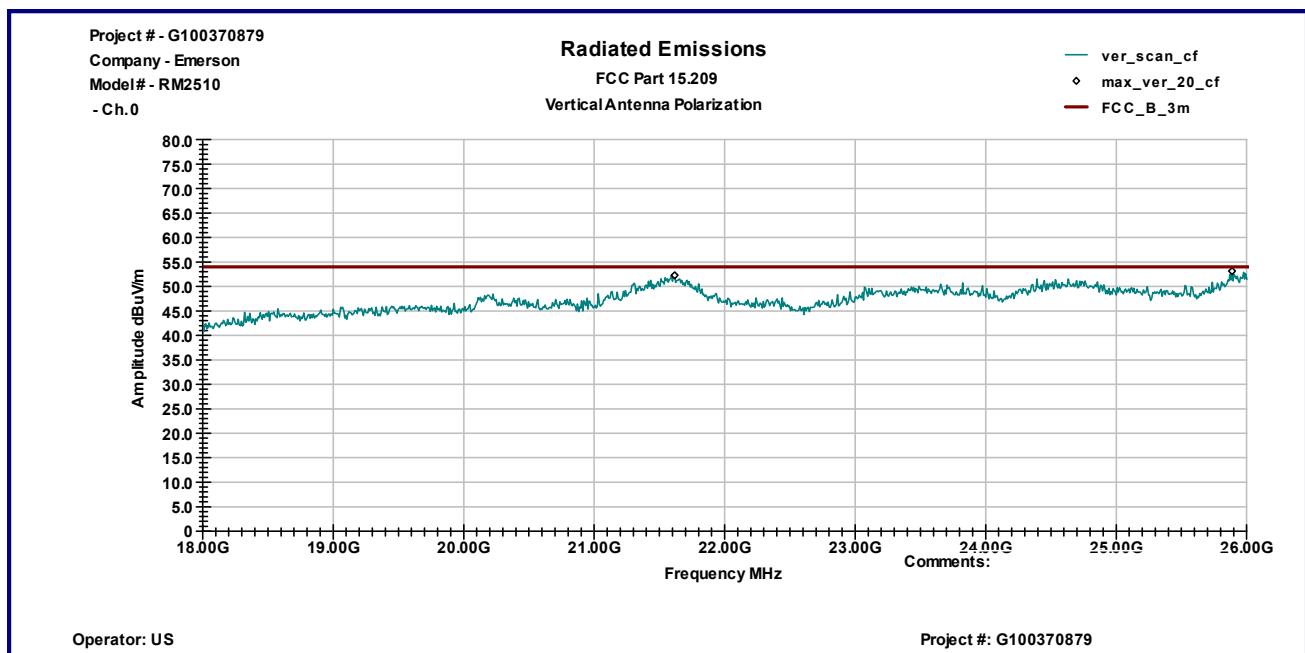
Graph 3.2.4



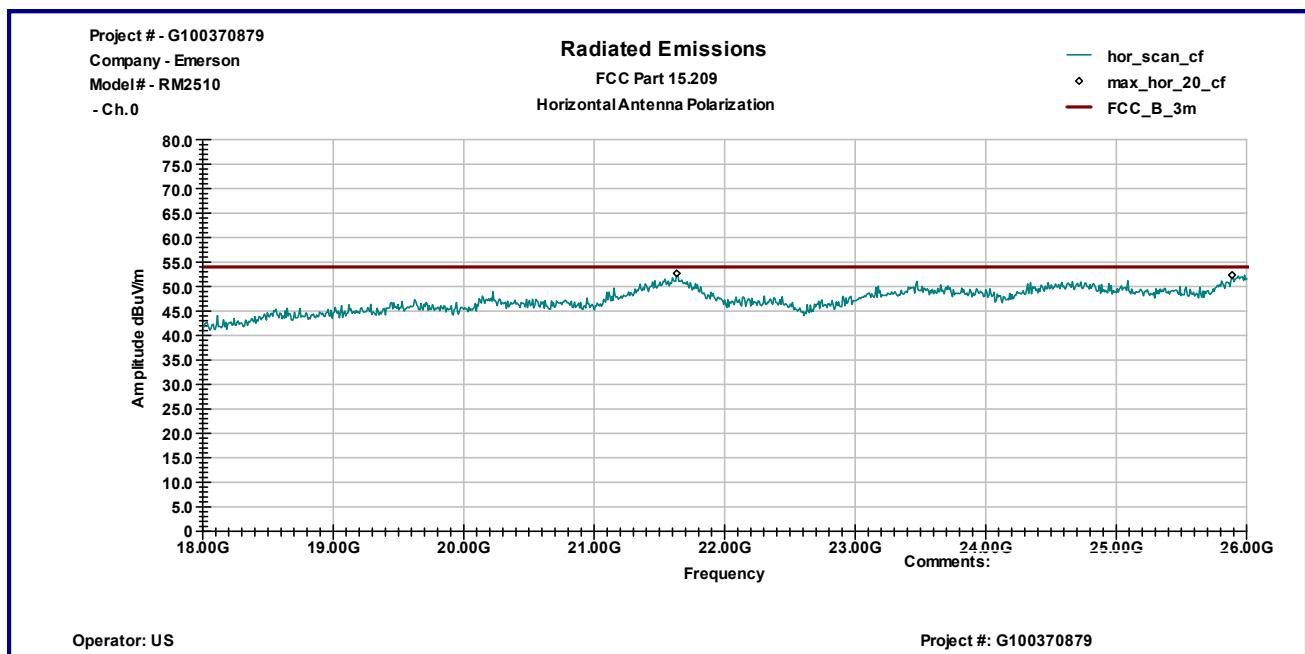
Graph 3.2.5



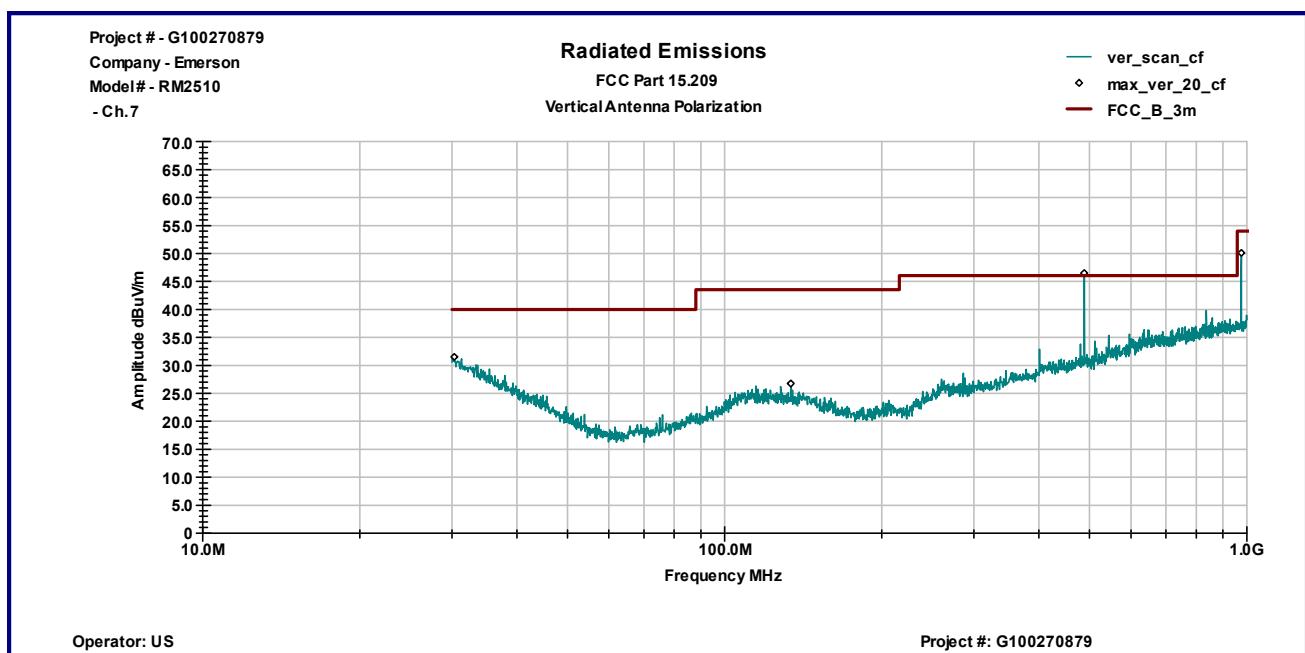
Graph 3.2.6



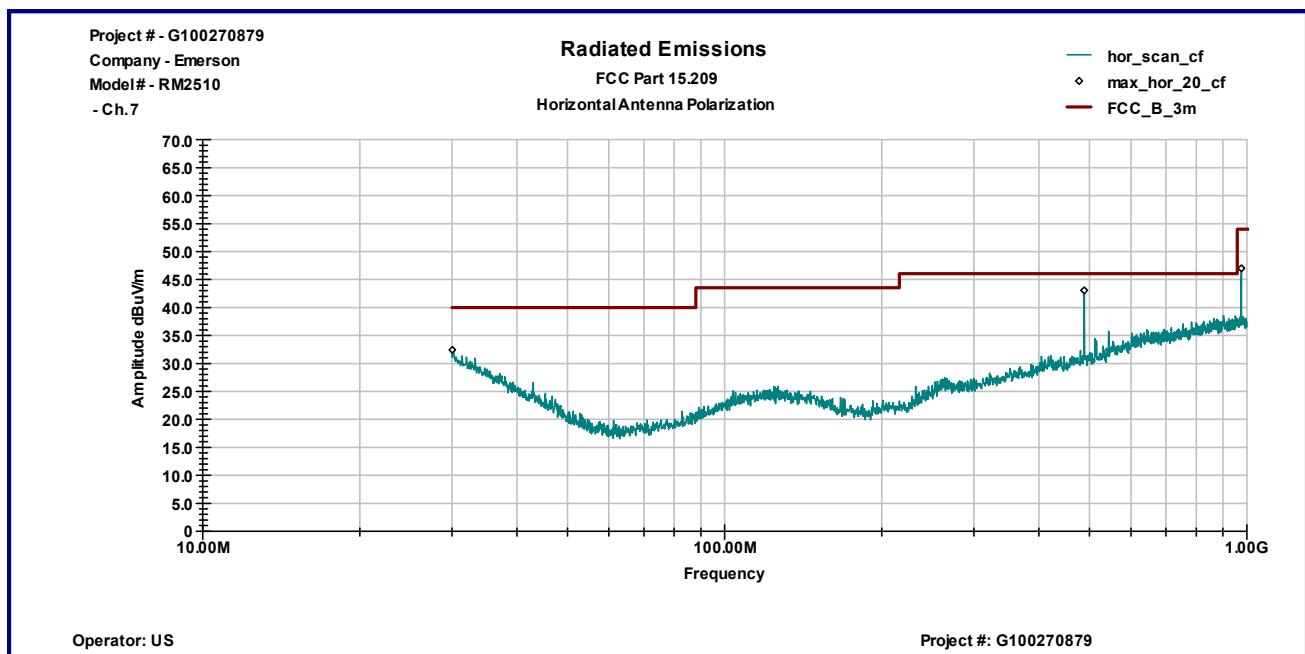
Graph 3.2.7



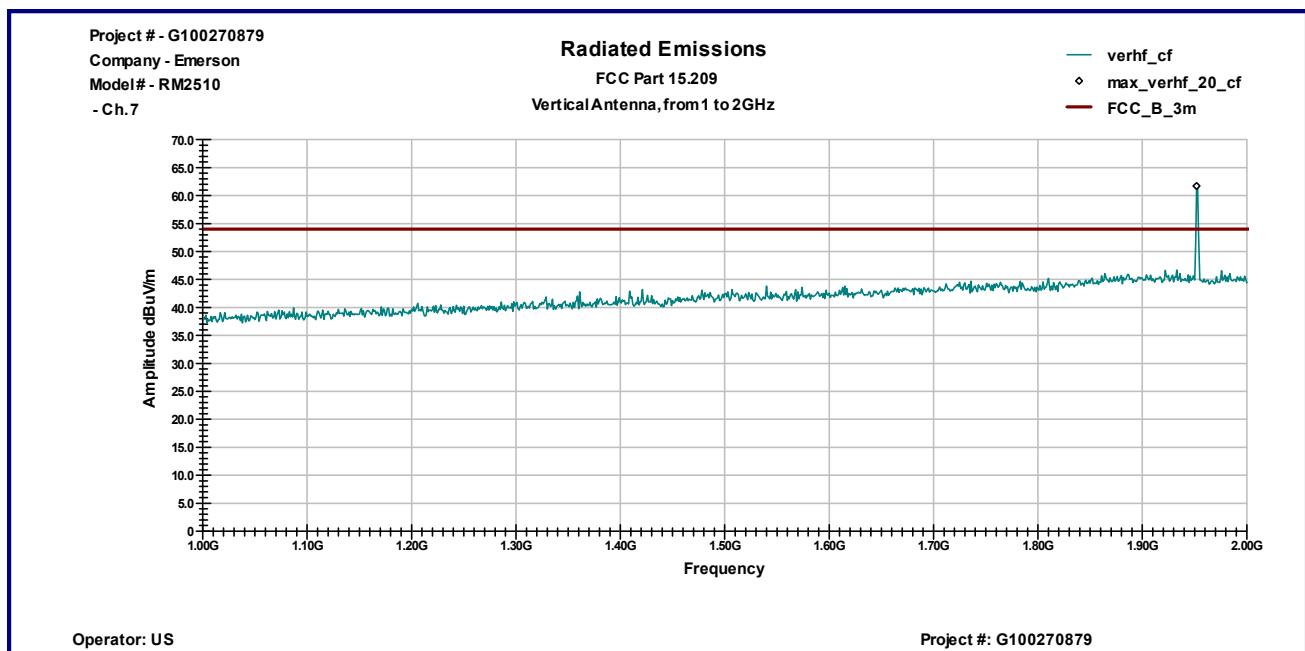
Graph 3.2.8



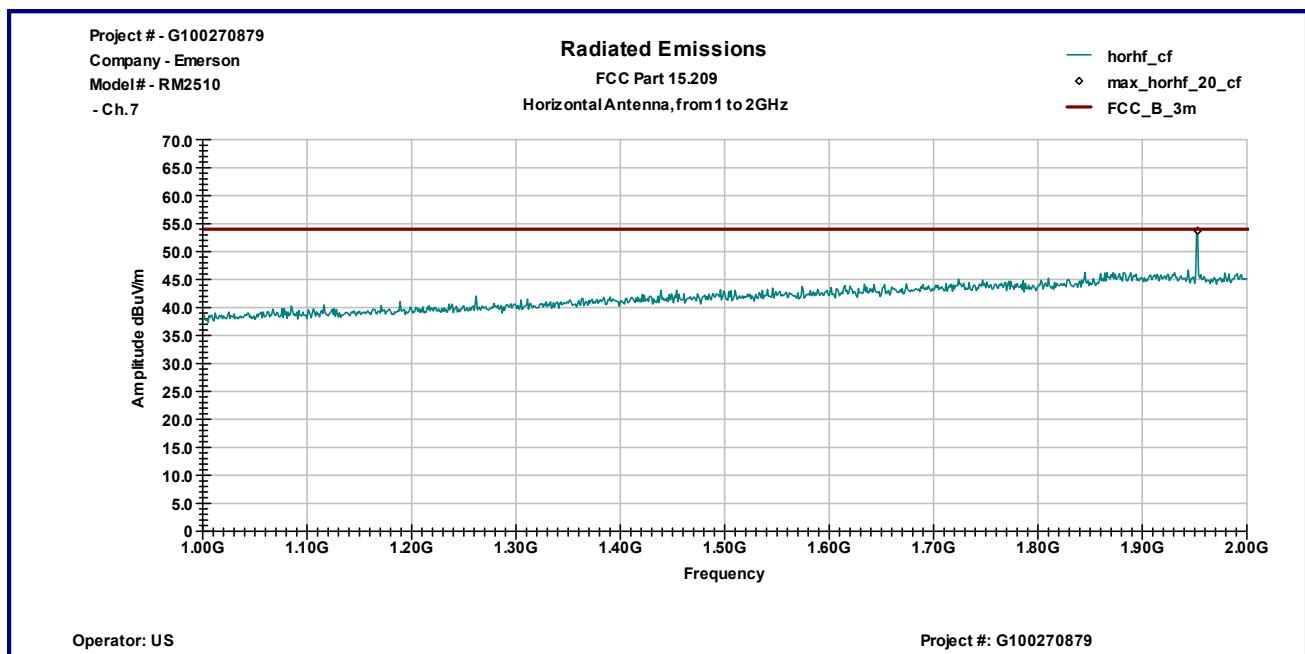
Graph 3.2.9



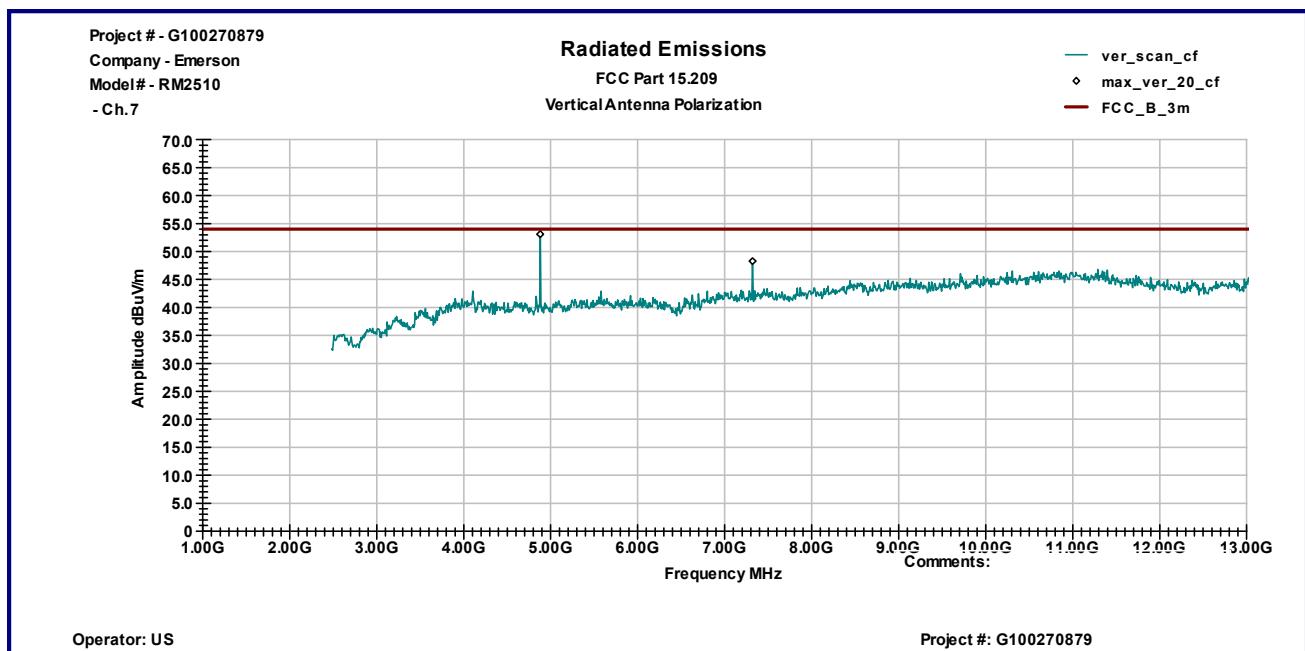
Graph 3.2.10



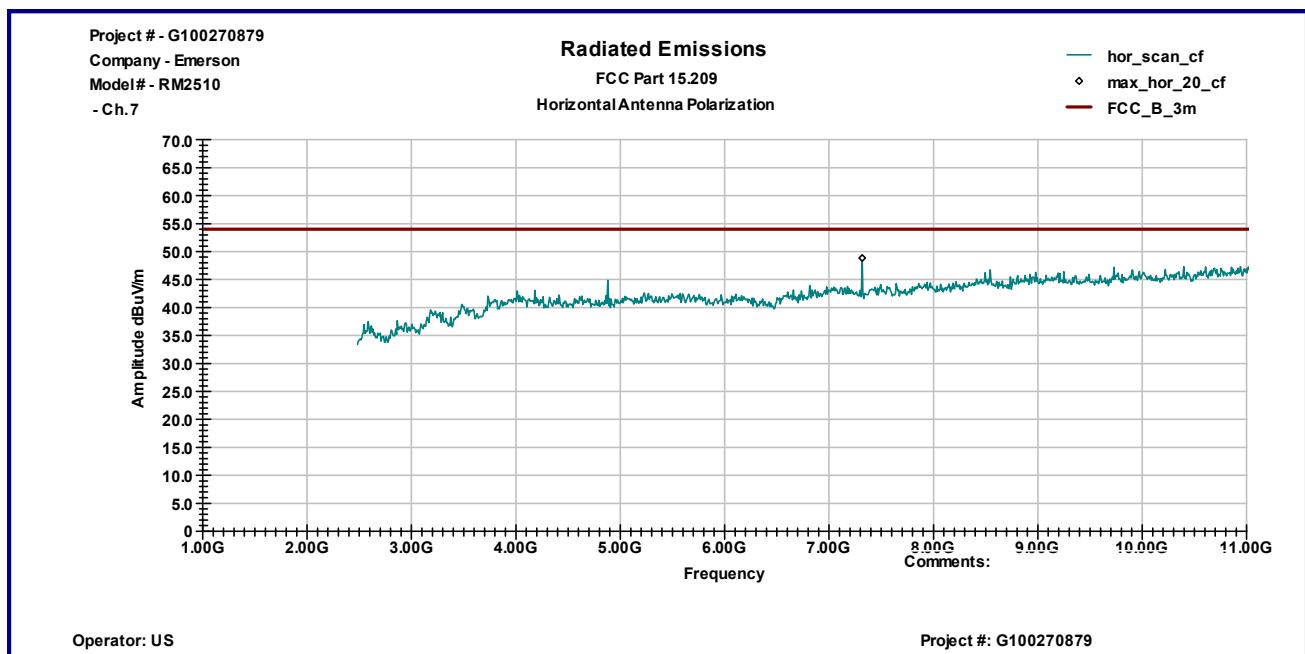
Graph 3.2.11



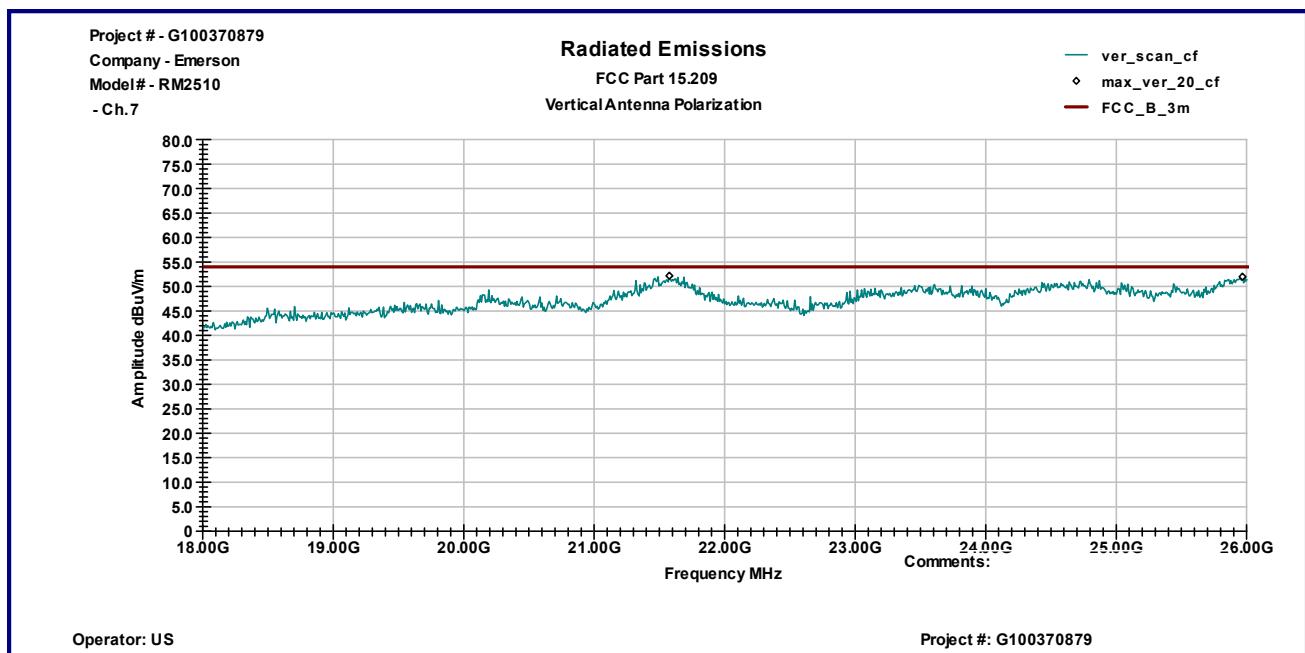
Graph 3.2.12



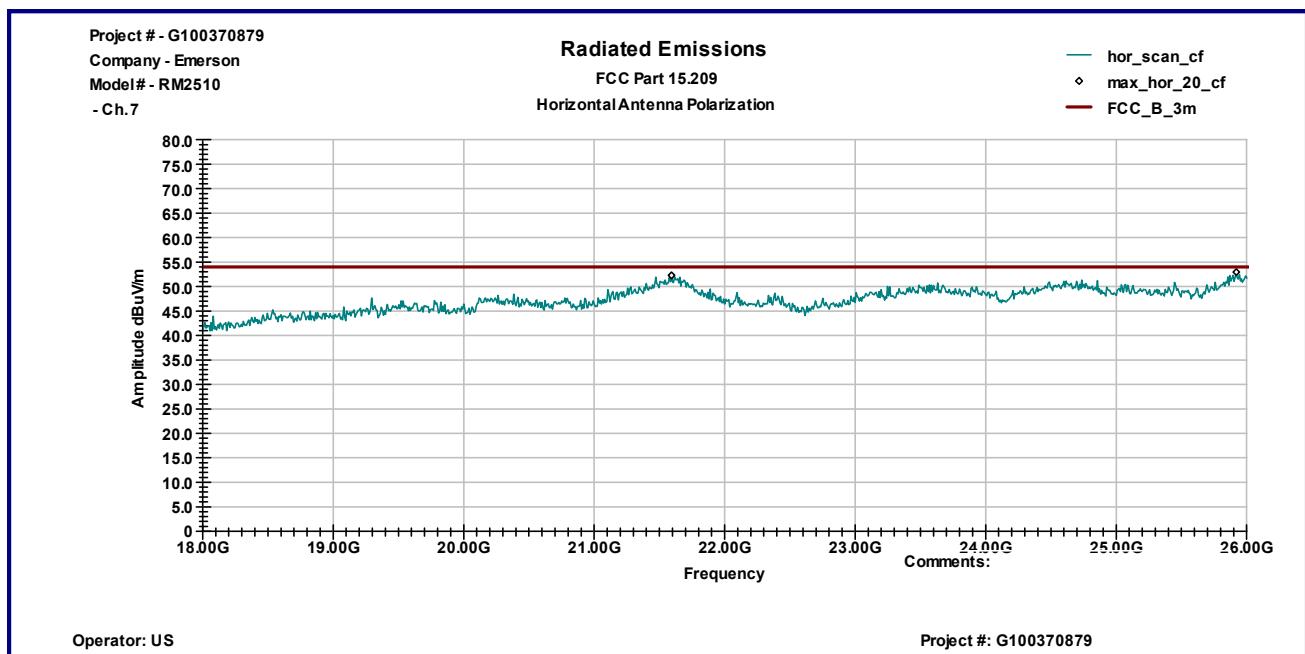
Graph 3.2.13



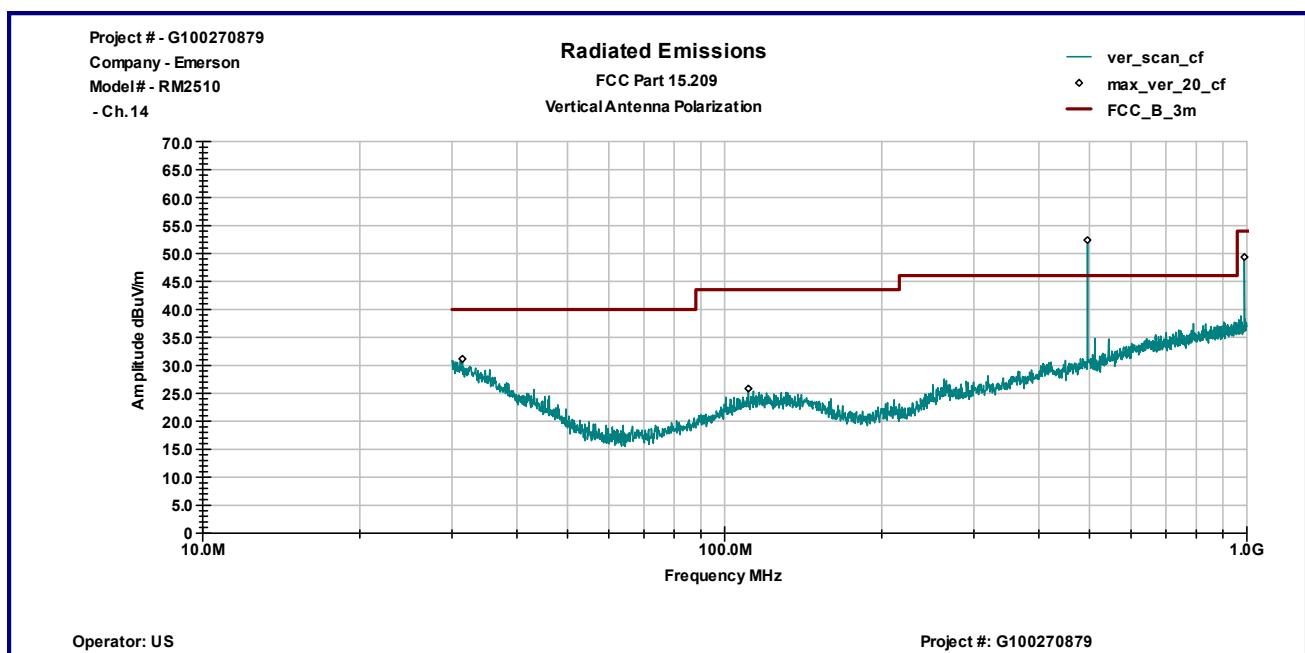
Graph 3.2.14



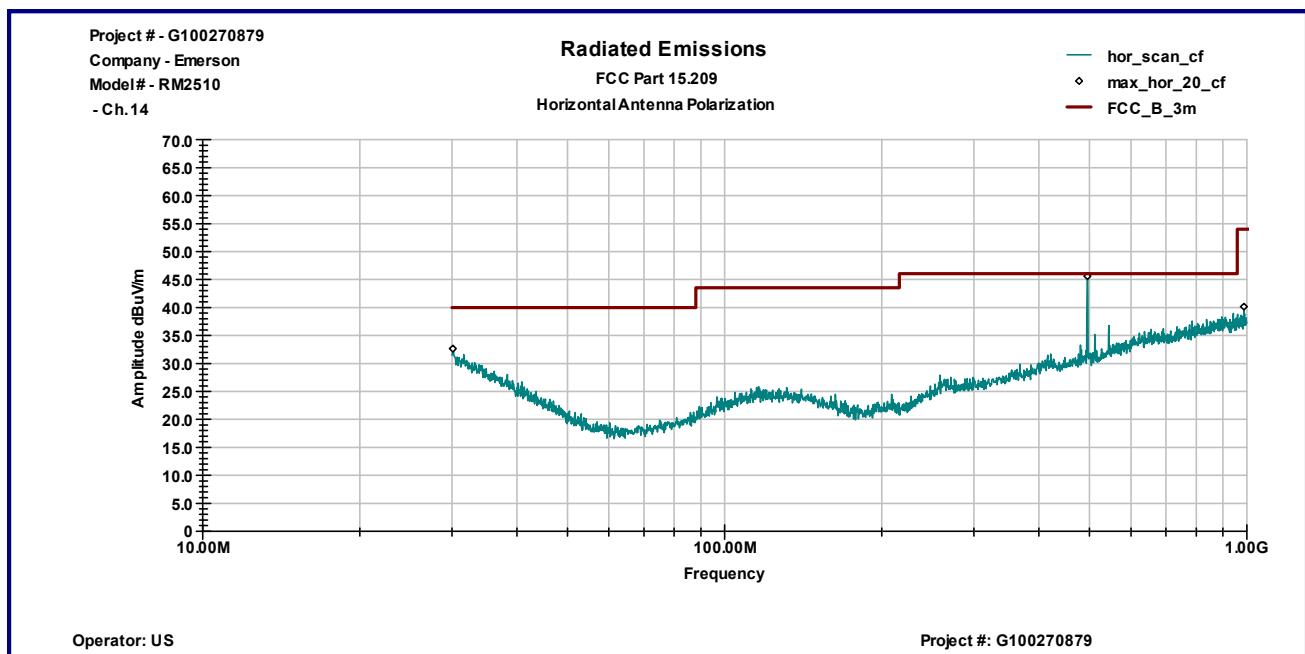
Graph 3.2.15



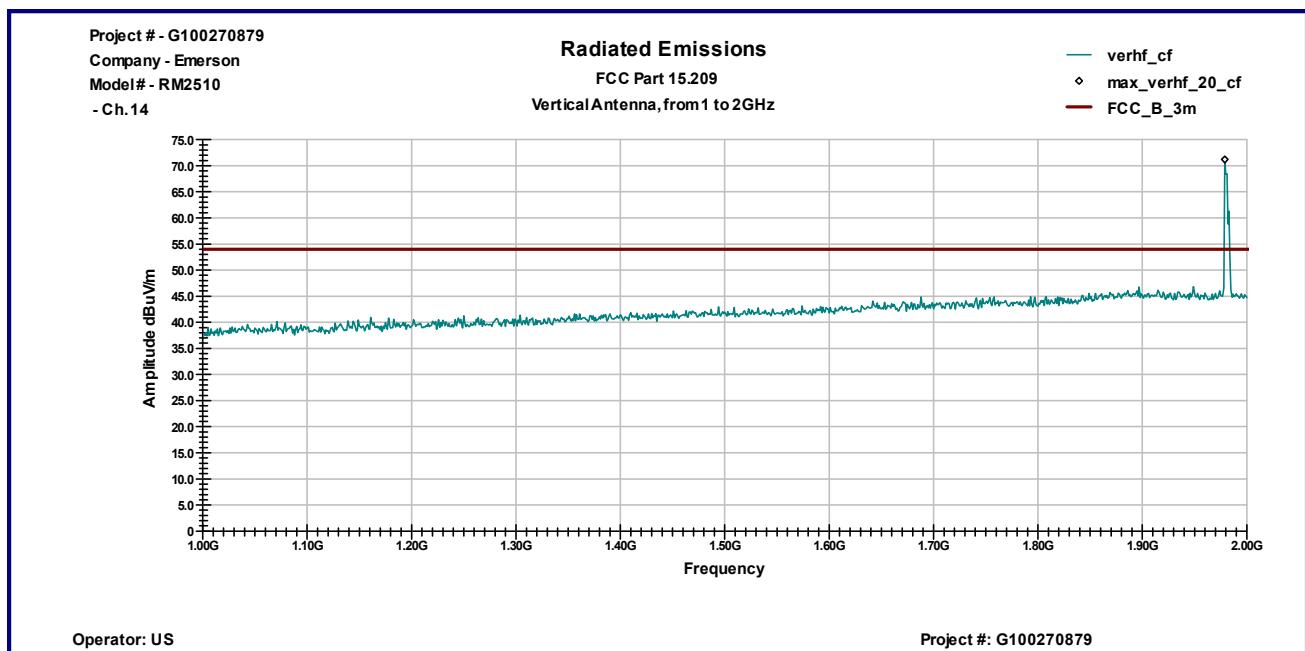
Graph 3.2.16



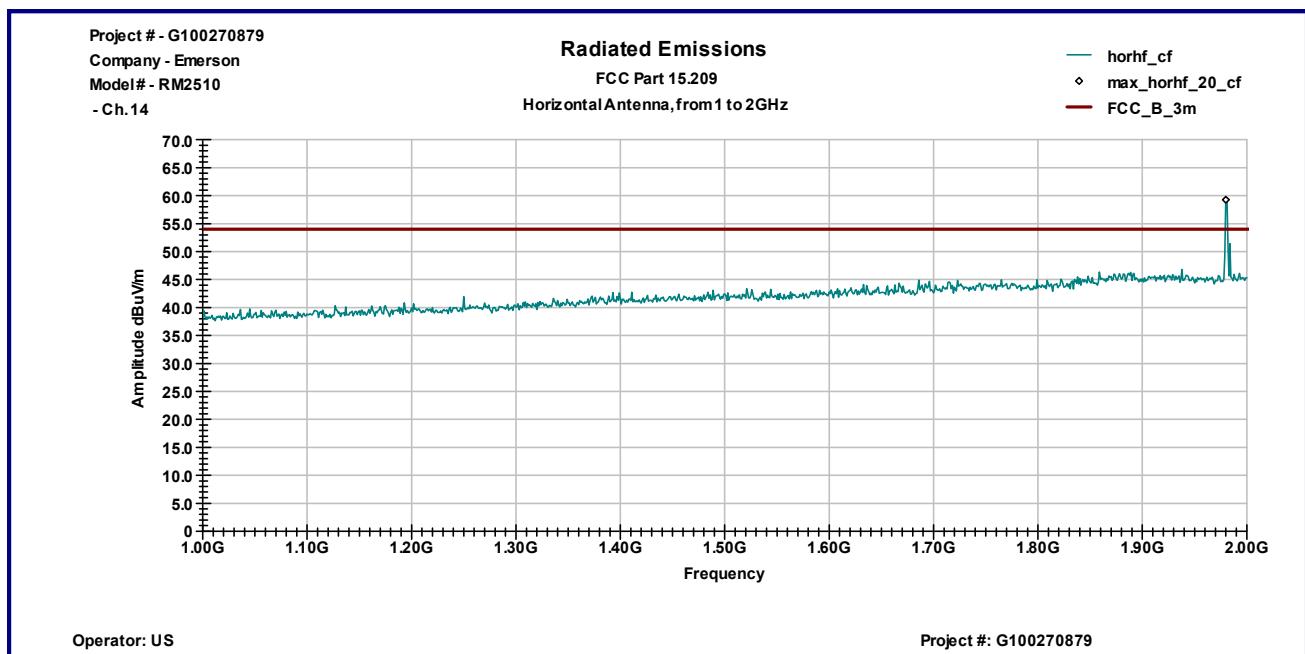
Graph 3.2.17



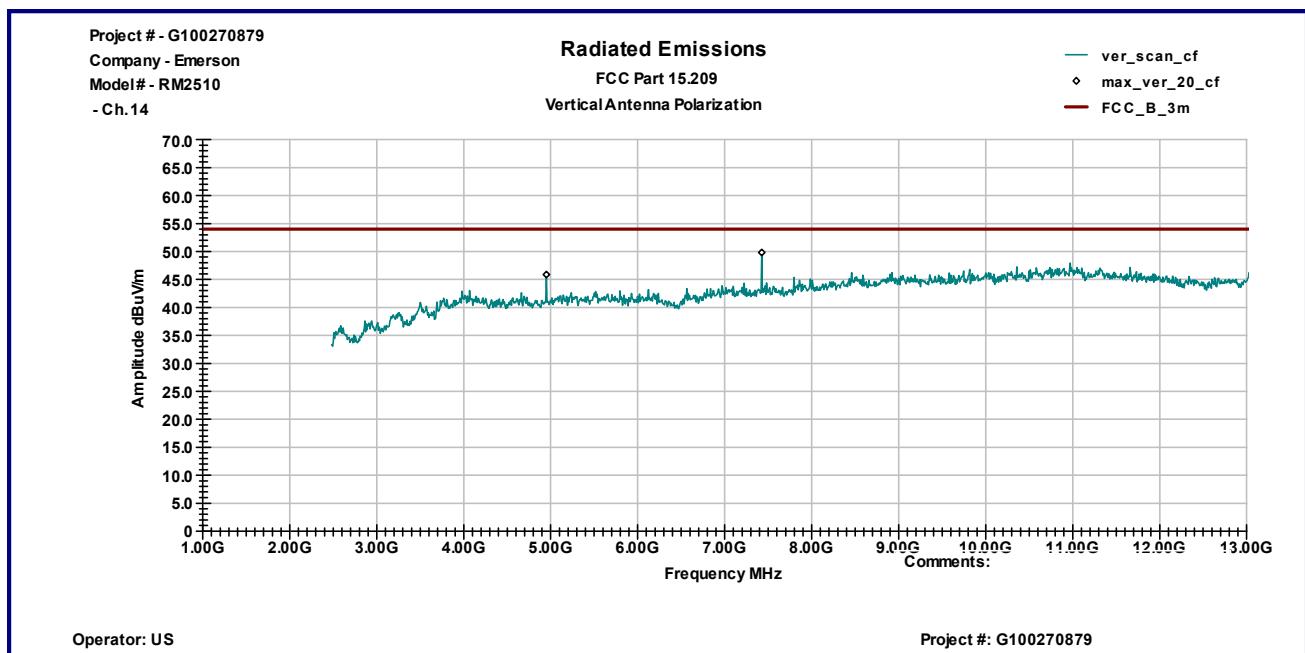
Graph 3.2.18



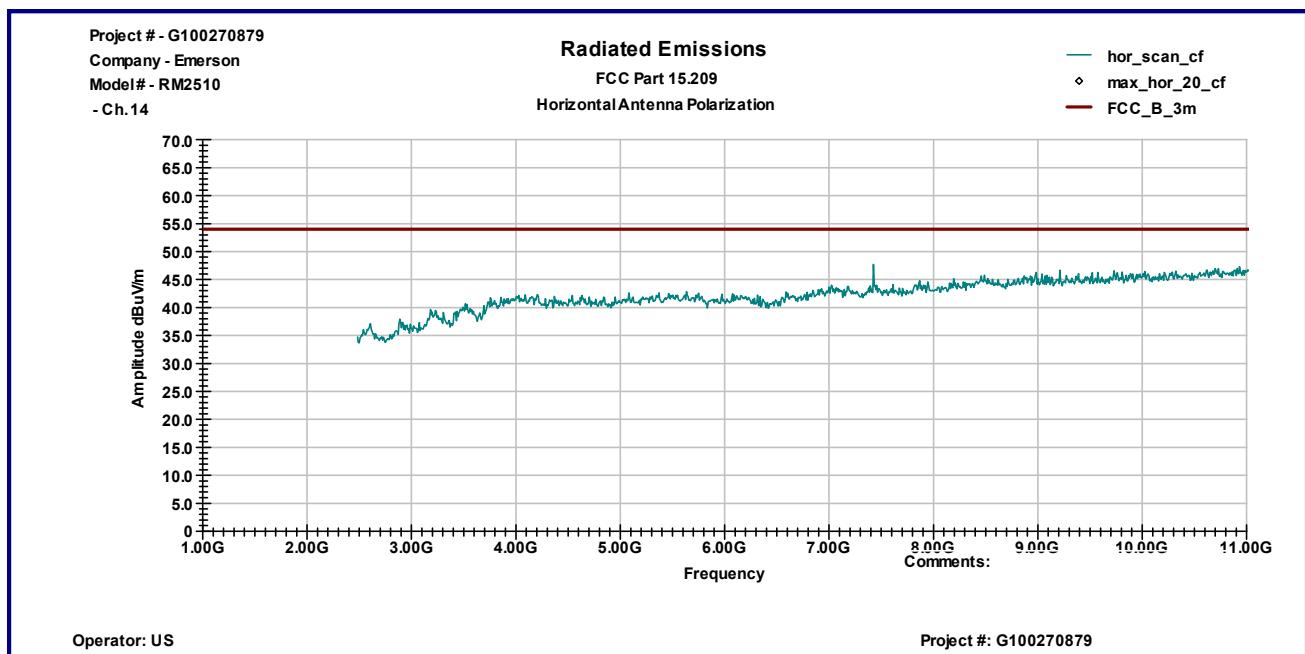
Graph 3.2.19



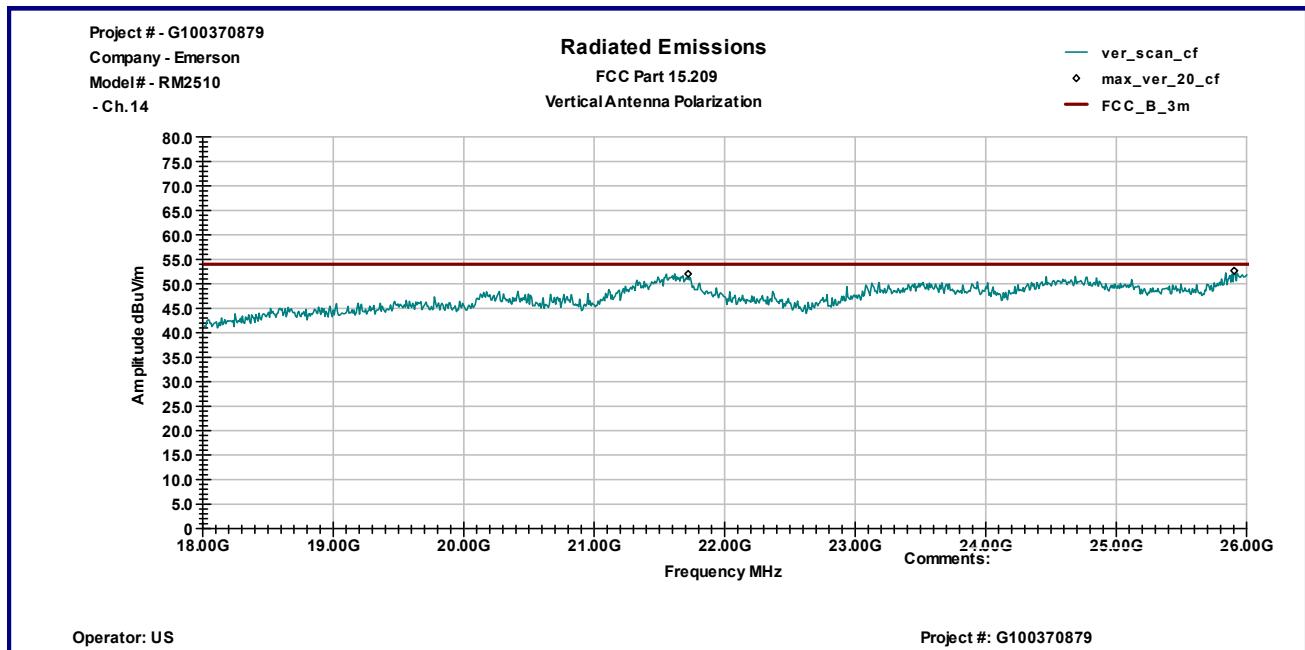
Graph 3.2.20



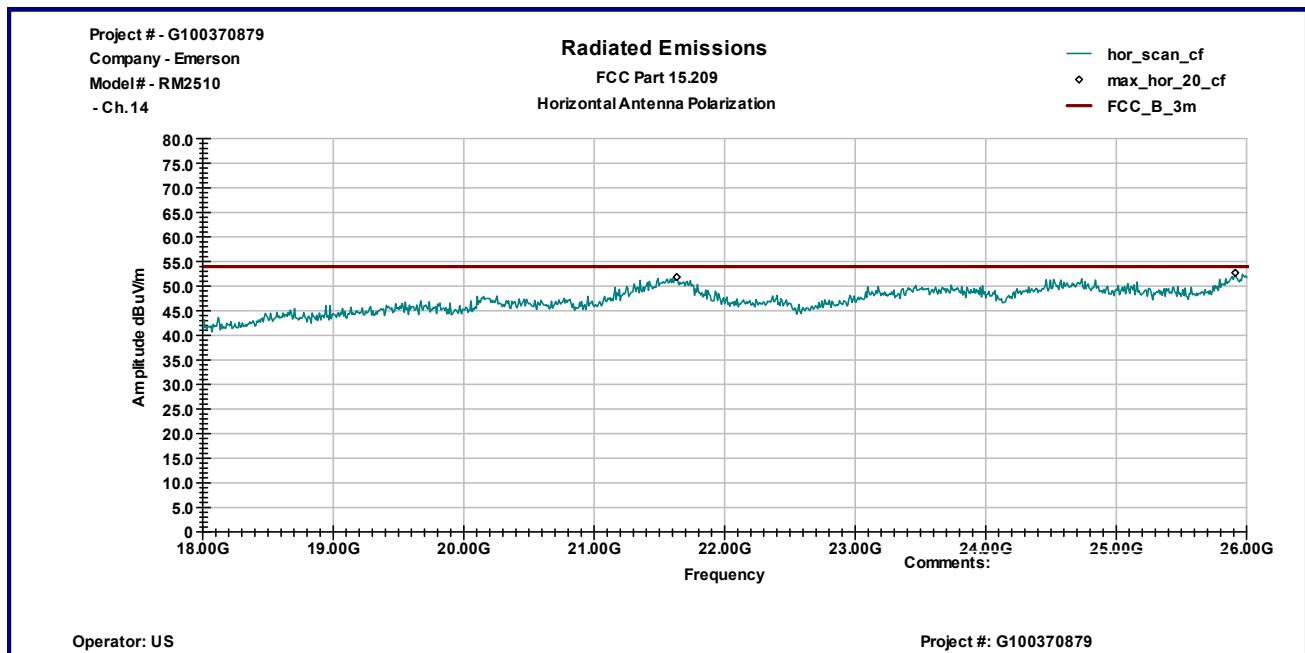
Graph 3.2.21



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 1mW/cm², or 10W/m²

S = 10W/m²

The Power Density is related to EIRP with the equation:

$S = EIRP / 4\pi D^2$, 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	VBU	<input checked="" type="checkbox"/>
System	TILE! Instrument Control		Ver. 3.4.K.29	15259	VBU	<input checked="" type="checkbox"/>

Intertek