TEST REPORT

Report Number: 100173241MIN-005M
Project Number: G100173241

Testing performed on the
W2SW0001

FCC ID: MMU-RTI1600
Industry Canada ID: 3166A- RTI1600

to
47 CFR Part 15. 247:2009
RSS- 210, Issue 7, 2007

For
Remote Technologies Inc.

Test Performed by:	Test Authorized by:
Intertek Testing Services NA, Inc.	Remote Technologies Inc.
7250 Hudson Blvd., Suite 100	5775 12th Avenue East, Suite 180
Oakdale, MN 55128	Shakopee, MN 55379

Prepared by: _____ Date: August 2, 2010
Uri Spector

Reviewed by: _____ Date: August 2, 2010
Norman Shpilsher

TABLE OF CONTENTS

1.0 GENERAL DESCRIPTION

Model:	W2SW0001
Type of EUT:	Digital Transmission Module
Serial Number:	N/A
FCC ID:	MMU-RTI1600
Industry Canada ID:	3166A- RTI1600
Related Submittal(s) Grants:	None
Company:	Remote Technologies Inc.
Customer:	Mr. Mark Melville
Address:	5775-12th Avenue East Suite 180 Shakopee MN 55379
Phone:	(952) 253-3116
Fax:	(952) 253-3131
e-mail:	markm@rticorp.com
Test Standards:	☒ 47 CFR, Part 15:2009, §15.247 ☒ RSS–210, Issue 7, 2007 ☒ RSS-Gen, Issue 2, 2007 ☐ 47 CFR, Part 15:2009, §15.107 and §15.109, Class B ☐ Other **Note: Enclosure Radiated Emissions measurements, Maximum Peak Output Power and Exposure Compliance calculations were performed for Class II Permissive Changes**
Type of radio:	☐ Stand -alone ☒ Module ☐ Hybrid
Date Sample Submitted:	July 19, 2010
Test Work Started:	July 19, 2010
Test Work Completed:	July 28, 2010
Test Sample Conditions:	☐ Damaged ☐Poor (Usable) ☒ Good

1.1 Product Description; Test Facility

Product Description:	2.40 – 2.4835GHz Digital Transmission Module
Transmitter Type:	☐ FHSS ☐ Digital Modulation ☒ WiFi ☐ Blue Tooth
Operating Frequency Range(s):	Range From 2400 to 24835 MHz
Number of Channels:	11
Modulation:	OFDM for 802.11/g
Emission Designator:	16M5F9X
Antenna(s) Info:	Antenna Type: Omni directional Gain: 2.2dBi Connector Type: Solder direct to circuit board (The EUT does not have antenna port connector, therefore no measurements were performed at antenna port)
Antenna Installation:	☐ User ☐ Professional ☒ Factory
Transmitter power configuration:	☒ Internal battery ☐ External power source ☐ 120VAC ☐ 230VAC ☐ 400VAC ☒ 3.3VDC ☐ Other: Amp. ☐ 50Hz ☐ 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)
☐ -

Operating modes of the EUT:

No.	Description
1	Test was performed at low channel 1, middle channel 6, and upper channel 11 and was transmitting CW signal.

Cables:

No.	Type	Length	Designation	Note
1	None			

Support equipment/Services:

No.	Item	Description
1	None	

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(μV/m)
RA = Receiver Amplitude in dB(μV)
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(μV) 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(μV/m).

RA = 48.1 dB(μV)
AF = 7.4 dB(m^{-1})
CF = 1.6 dB
AG = 16.0 dB
FS = RA + AF + CF - AG
FS = 48.1 + 7.4 + 1.6 – 16.0
FS = 41.1 dB(μV/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: 28.64dB below the limits

Power Output: Distance:	**Radiated** ☒ **3m** ☐ **10m**				
Frequency Range:	☐ 902-928MHz ☒ 2400-2483.5MHz ☐ 5725-5850MHz				
Low Frequency 2404.2MHz	**Measured field dBµV/m**	**Tx Peak Power dBm**	**Limit dBm**	**Limit Reduction dB**	**Margin dB**
Vertical Antenna	96.8	-0.63	30	0	-30.63
Horizontal Antenna	98.8	1.36	30	0	-28.64
Middle Frequency 2439MHz					
Vertical Antenna	95.1	-2.34	30	0	-32.34
Horizontal Antenna	97.9	0.46	30	0	-29.54
Upper Frequency 2478.62MHz					
Vertical Antenna	95.1	-2.34	30	0	-32.34
Horizontal Antenna	96.9	-0.54	30	0	-30.54
RBW: ☐ 1MHz ☐ 3MHz ☒ 10MHz **VBW:** ☐ 1MHz ☐ 3MHz ☒ 10MHz					
Antenna Gain:	☒ < 6dBi and = 2.2dBi ☐ >6dBi and = dBi, Output power reduction = dB				

Notes: The Maximum Peak Output Power was calculated from equitation $P=(E \times d)^2/30G$, where P is the power in watts; E is the measured field strength in V/m; d is the measurement distance and = 3m; G is the numerical antenna gain of the transmitter

Date:	July 28, 2010	**Result:** **Pass**
Standard:	FCC Part 15.247	
Tested by:	Uri Spector	
Test Point:	Emissions at Fundamental	
Operation mode:	See Page 5	
Note:	Table shows worst-case emissions	

Table 3.1.1

Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	Peak Reading	Total @ 3m	Limit	Margin	Comments
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBµV	dBµV/m	dBµV/m	dB	
2411.96	V	107	27.9	3.5	0.0	65.3	96.8	N/A	N/A	
2411.96	H	123	27.9	3.5	0.0	67.3	98.8	N/A	N/A	
2436.97	V	121	28.0	3.6	0.0	63.5	95.1	N/A	N/A	
2436.97	H	179	28.0	3.6	0.0	66.3	97.9	N/A	N/A	
2461.97	V	141	28.1	3.6	0.0	63.5	95.1	N/A	N/A	
2461.97	H	144	28.1	3.6	0.0	65.3	96.9	N/A	N/A	

3.2 Radiated spurious emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Max. Margin: 6.4dB below the limits

Notes: Testing was performed at the frequency range 30-25000MHz. The Tables 3.2.1 and 3.2.2 and Graphs 3.2.1-3.2.24 show spurious emissions in restricted band of operation per FCC 15.205. Fundamental frequency was excluded from the table.
No emissions were detected above ambient at the 4th and above harmonics.

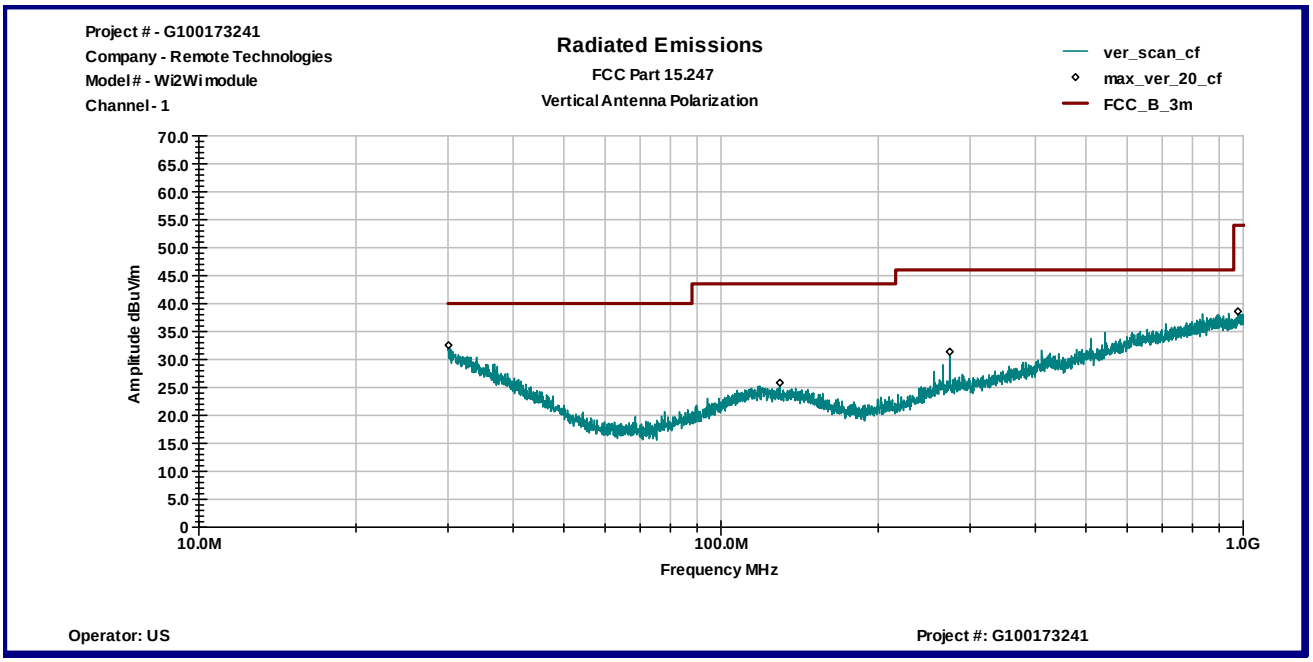
Date:	July 19-29, 2010	**Result:** **Pass**
Standard:	FCC part 15.247(d)	
Tested by:	Uri Spector	
Test Point:	Enclosure with Antenna	
Operation mode:	See Page 5	
Note:		

Table 3.2.1

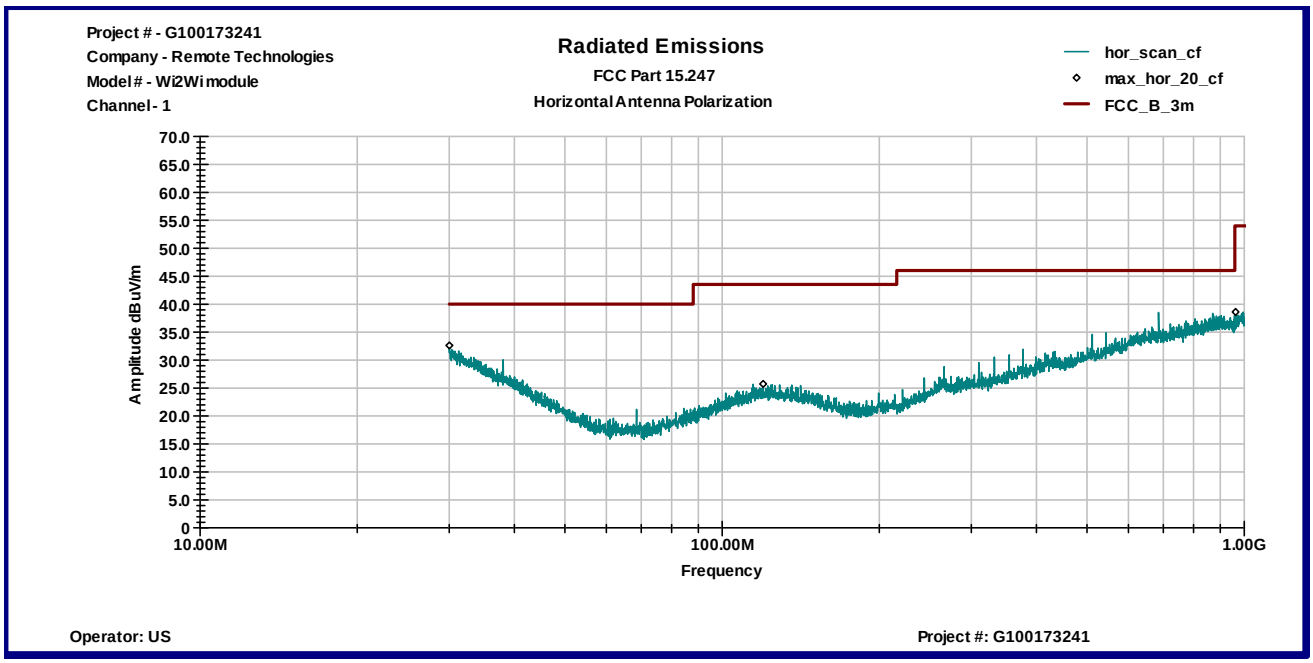
Frequency	Ant. Polarity	Peak Reading dBµV	Ant.Factor dB1/m	Total at 3m dBµV/m	QP Limit dBµV/m	Margin dB
Ch. 1						
274.31 MHz	V	16.1	15.3	31.4	46.0	-14.6
Ch. 6						
274.31 MHz	V	15.0	15.3	30.3	46.0	-15.7
332.29 MHz	H	14.7	16.5	31.2	46.0	-14.8
376.85 MHz	H	16.0	18.1	34.1	46.0	-12.0
685.71 MHz	H	16.6	23.1	39.7	46.0	-6.4
Ch. 11						
274.31 MHz	V	16.1	15.3	31.4	46.0	-14.6
511.62 MHz	V	15.9	20.7	36.6	46.0	-9.4

Table 3.2.2

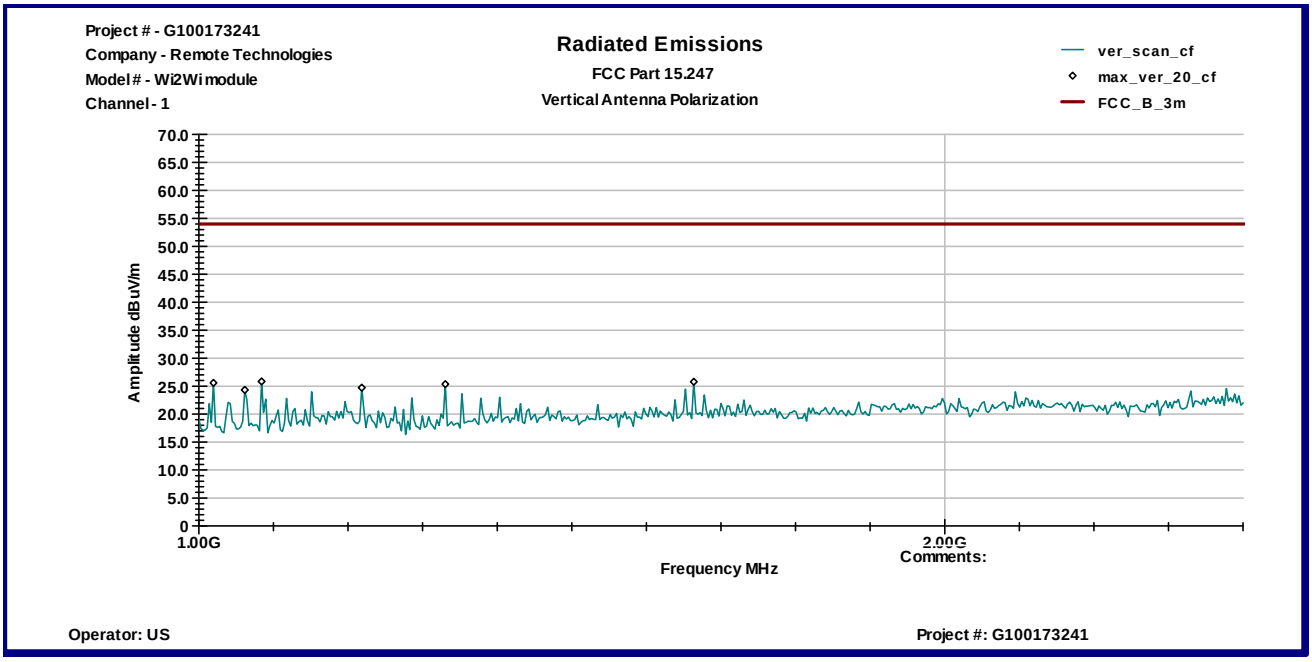
Frequency MHz	Antenna Polarity	Peak Reading dBµV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBµV/m	AVG Limit dBµV/m	Margin dB
Ch. 1							
1.084 GHz	V	41.7	26.6	42.5	25.8	54.0	-28.2
1.6636 GHz	V	39.8	28.9	42.9	25.8	54.0	-28.2
4.825 GHz	V	45.2	38.0	41.8	41.4	54.0	-12.6
7.6253 GHz	V	41.0	42.7	40.8	42.9	54.0	-11.1
1.378 GHz	H	39.6	27.6	42.6	24.6	54.0	-29.4
1.4032 GHz	H	39.2	27.7	42.7	24.3	54.0	-29.7
4.825 GHz	H	41.2	38.0	41.8	37.4	54.0	-16.6
Ch. 6							
1.0196 GHz	V	42.2	26.4	42.5	26.1	54.0	-27.8
1.6636 GHz	V	39.6	28.9	42.9	25.6	54.0	-28.4
4.8767 GHz	V	39.0	38.1	41.8	35.3	54.0	-18.7
1.3528 GHz	H	40.1	27.5	42.6	25.0	54.0	-29.0
1.378 GHz	H	39.5	27.6	42.6	24.4	54.0	-29.6
1.462 GHz	H	39.3	27.9	42.7	24.5	54.0	-29.4
4.8767 GHz	H	40.7	38.0	41.8	36.9	54.0	-17.1
Ch. 11							
1.0196 GHz	V	40.3	26.4	42.5	24.3	54.0	-29.7
1.4032 GHz	V	41.3	27.7	42.7	26.4	54.0	-27.6
4.9283 GHz	V	39.8	38.2	41.7	36.3	54.0	-17.7
1.378 GHz	H	41.2	27.6	42.6	26.2	54.0	-27.8
1.4032 GHz	H	40.3	27.7	42.7	25.3	54.0	-28.7
1.9548 GHz	H	39.3	30.7	43.2	26.7	54.0	-27.3
4.9283 GHz	H	41.6	38.1	41.7	38.0	54.0	-16.0



Graph 3.2.1



Graph 3.2.2



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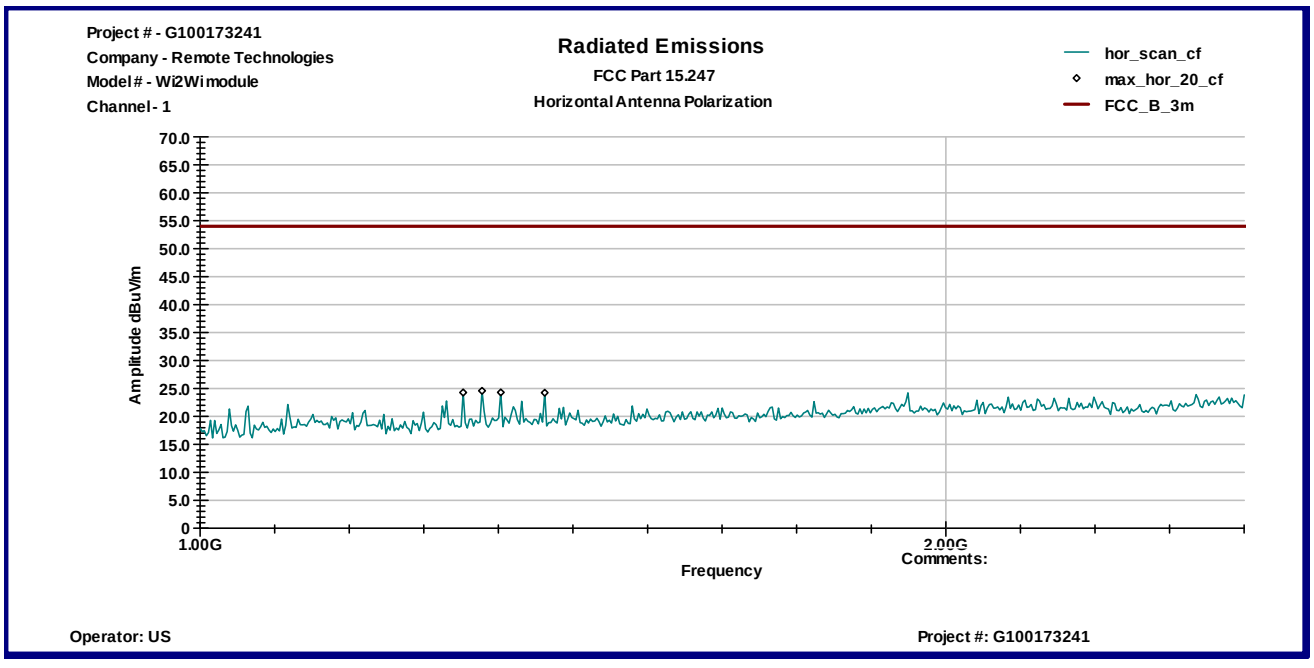

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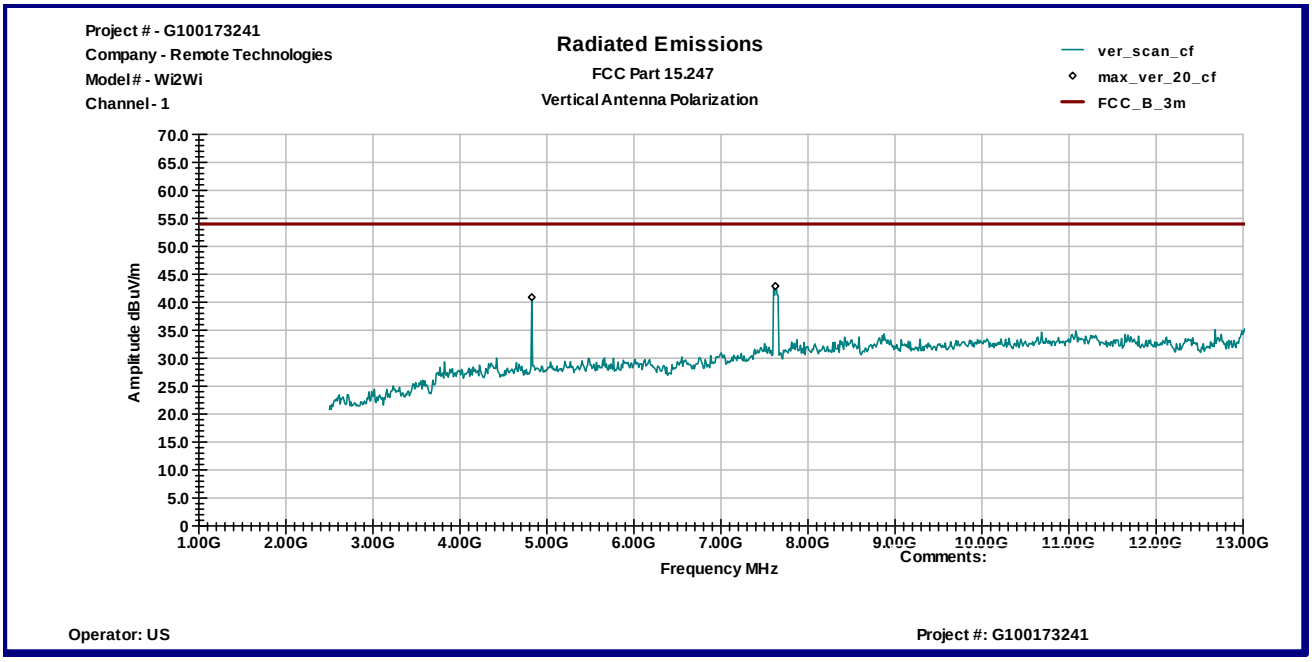

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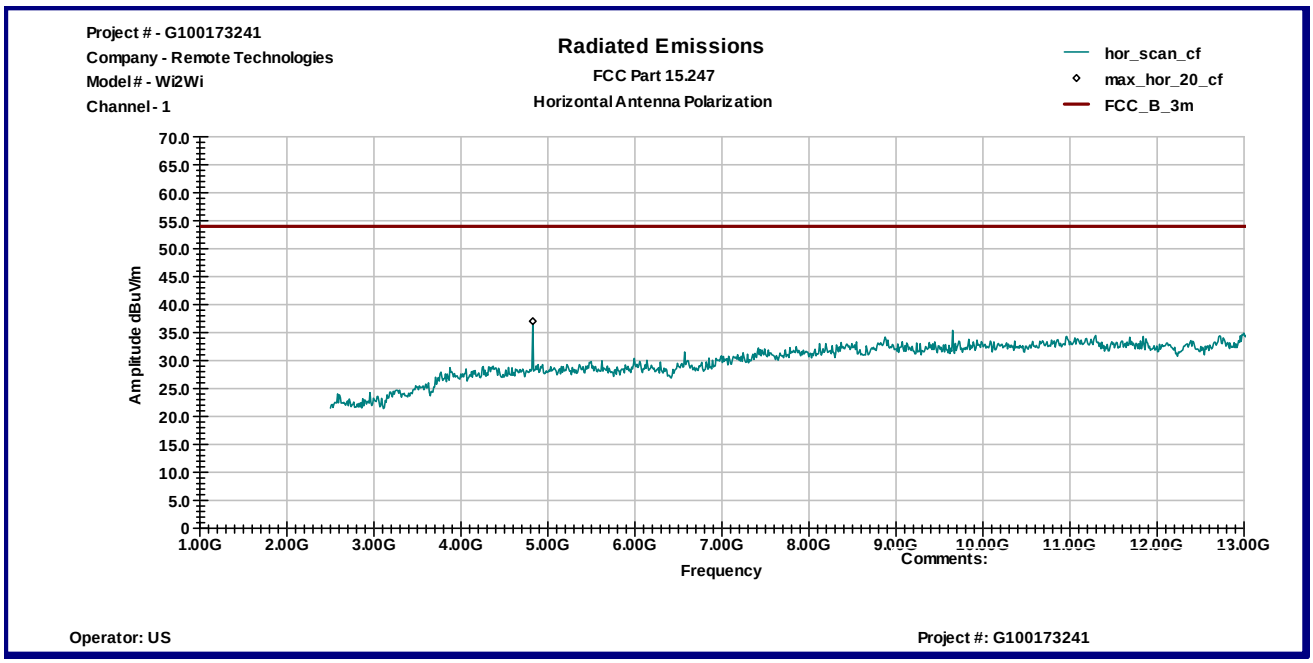
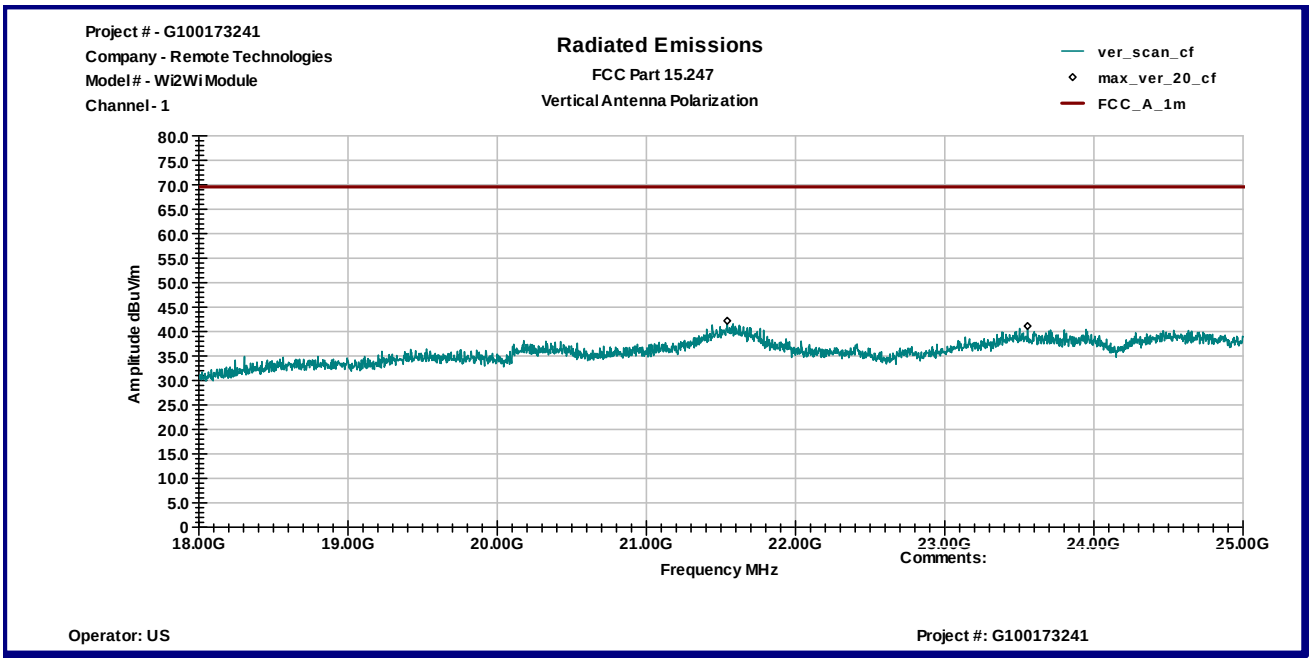


Graph 3.2.6



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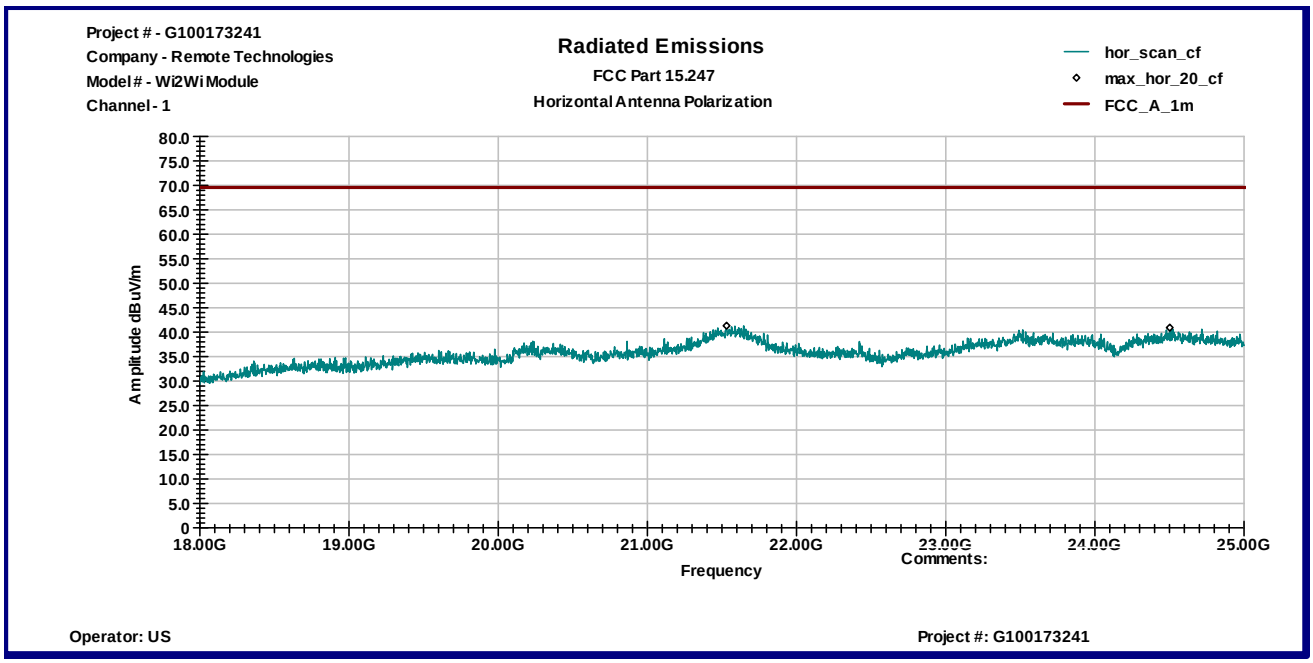
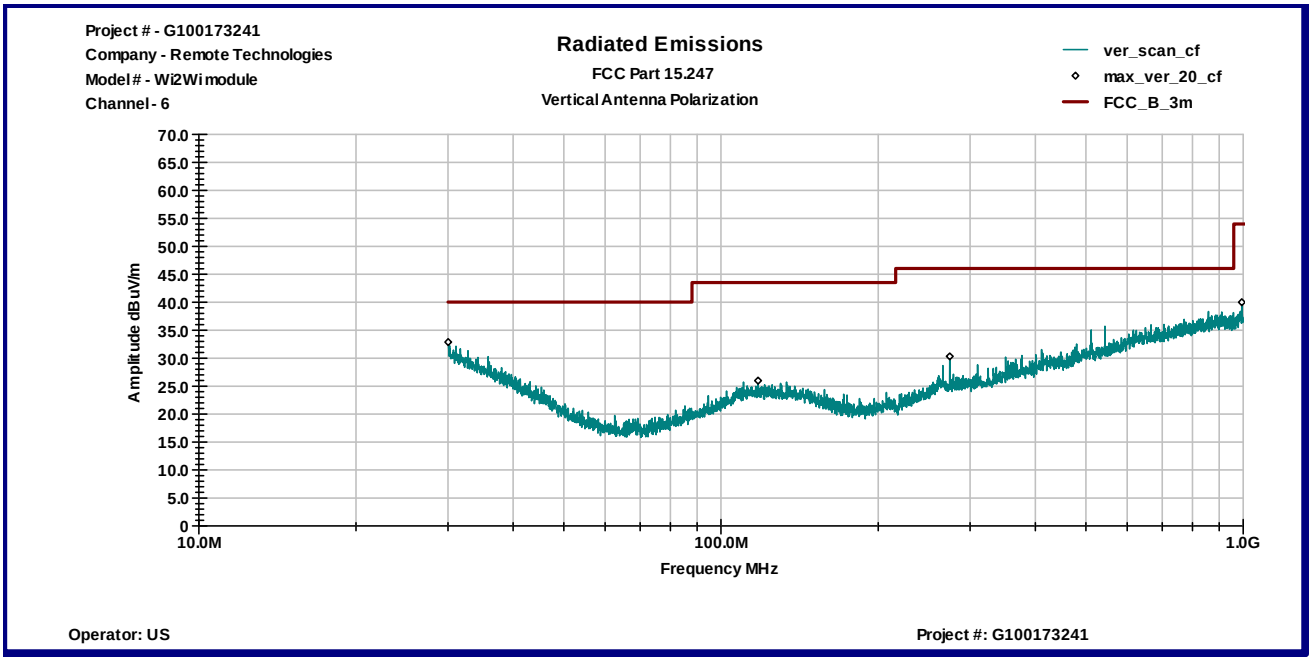
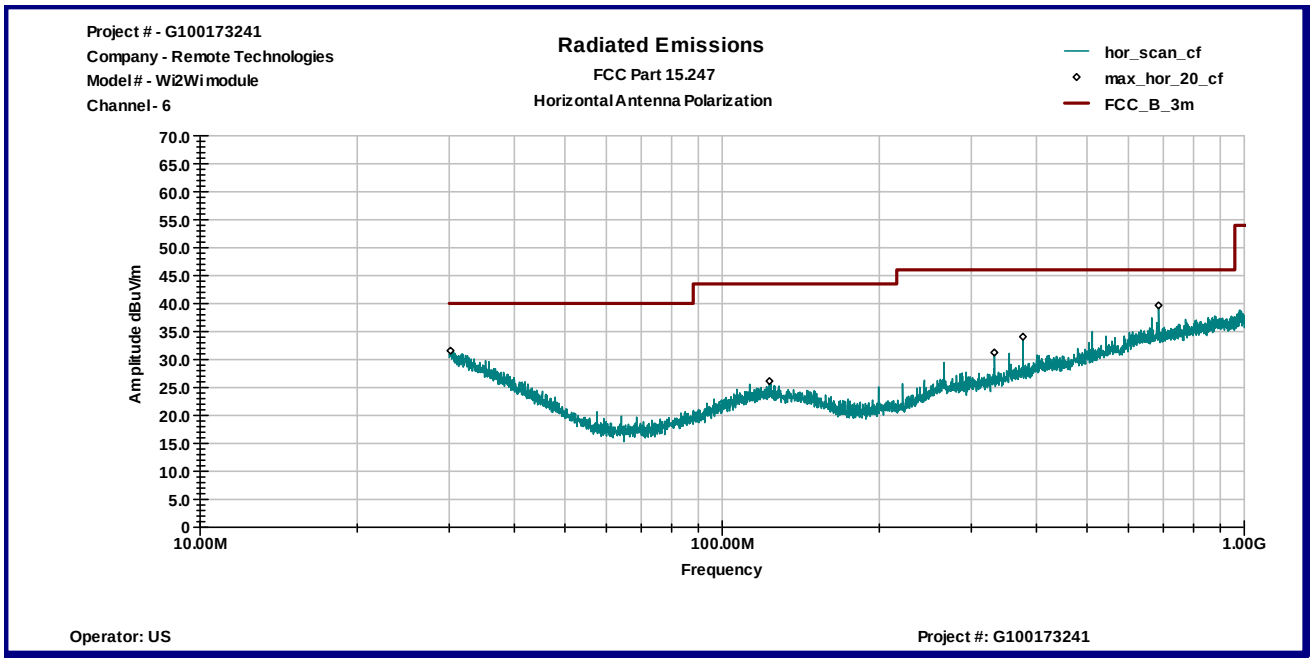


Graph 3.2.8



Graph 3.2.9



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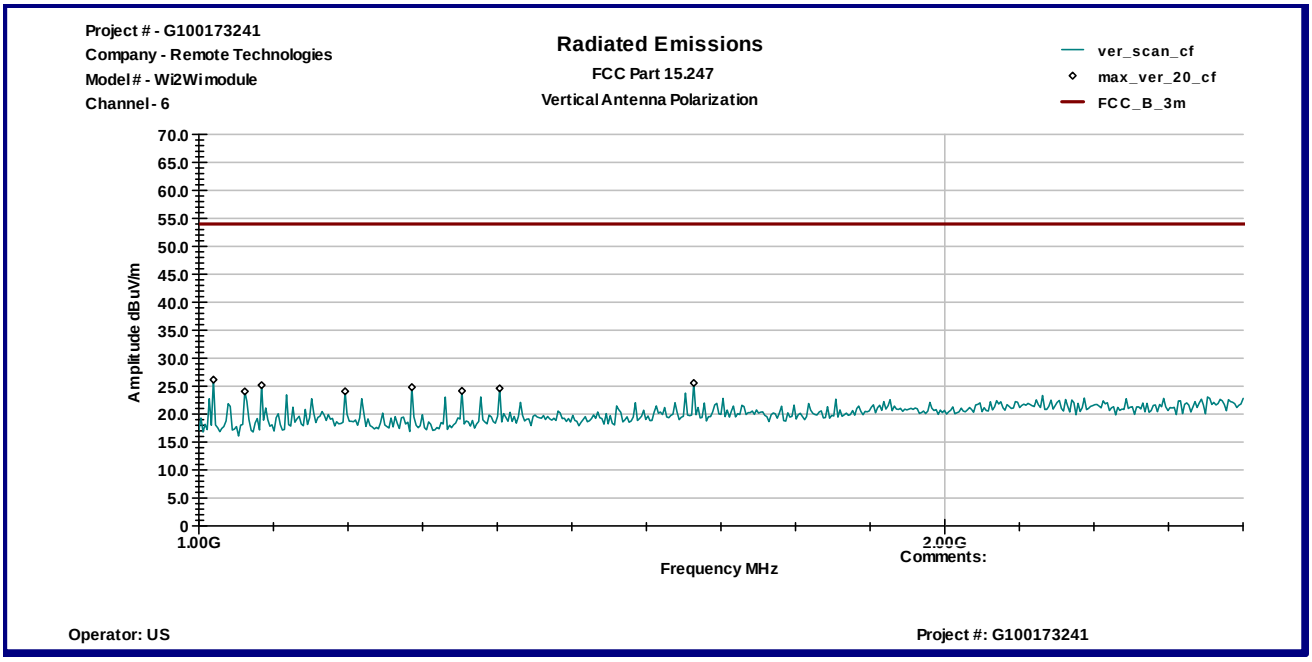

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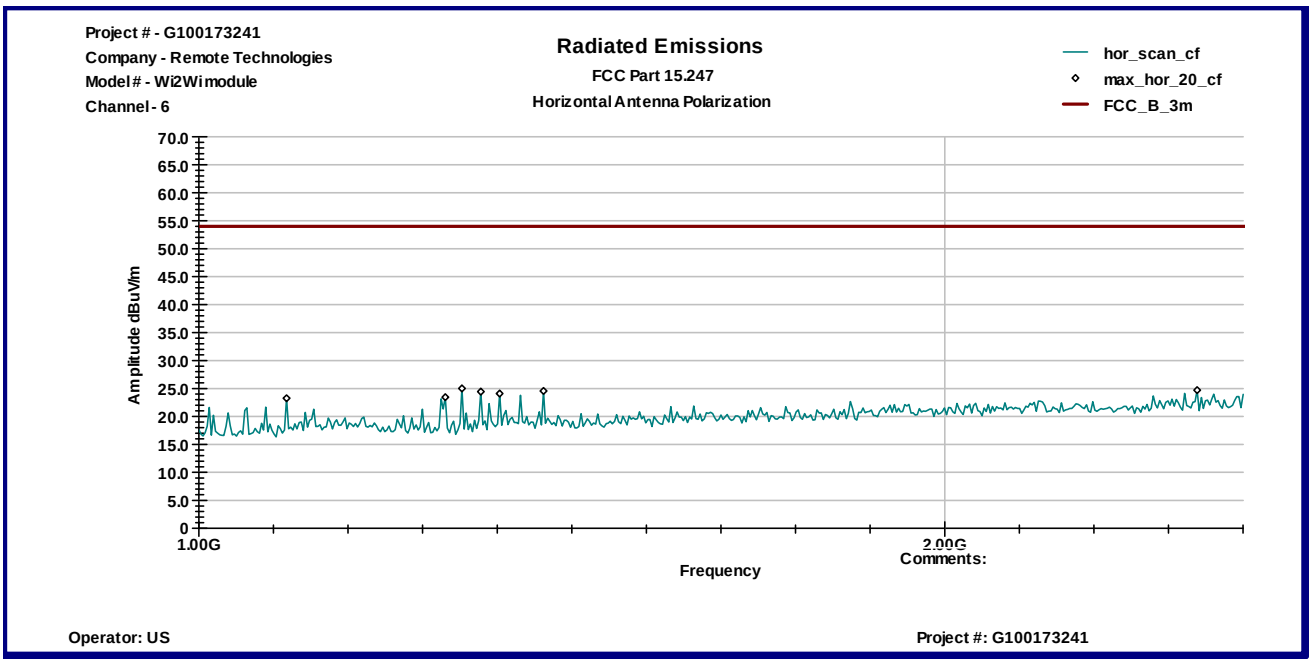

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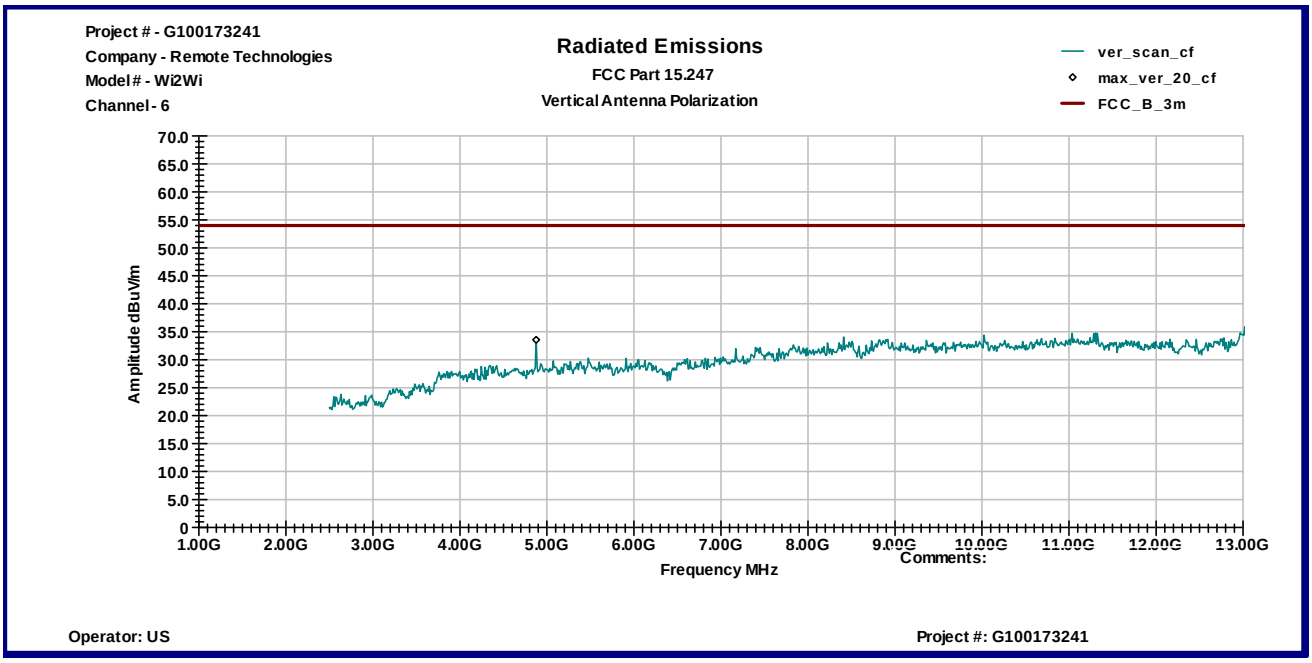

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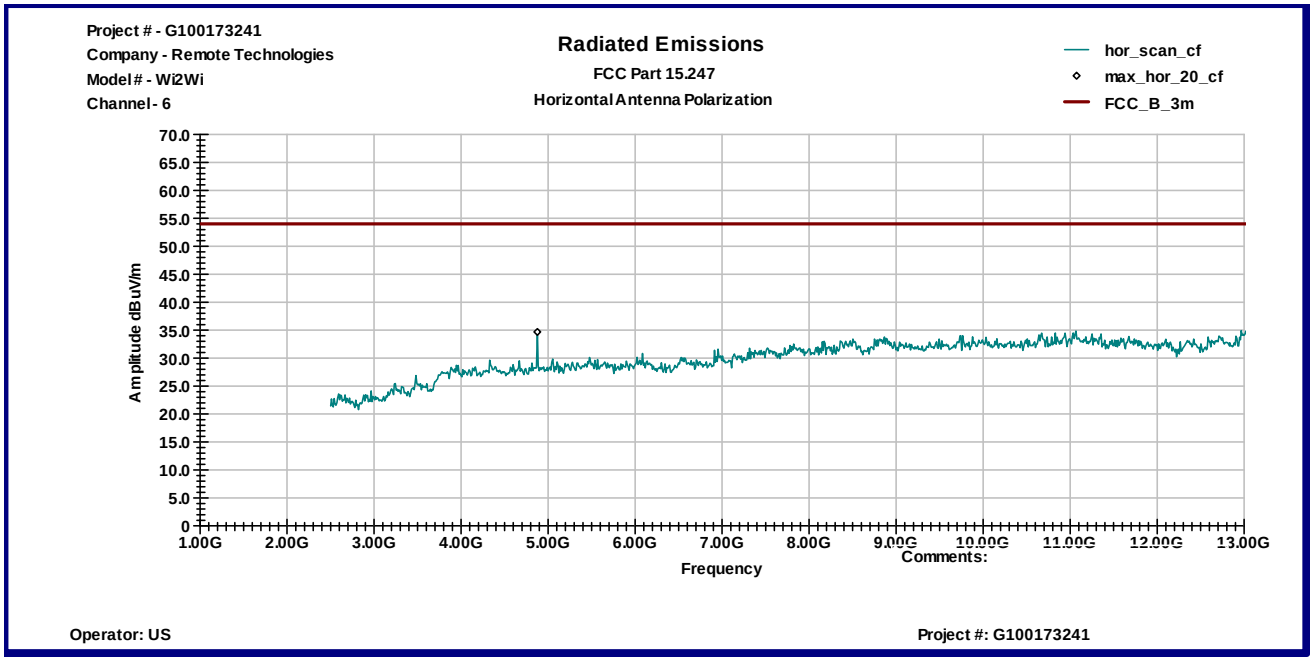

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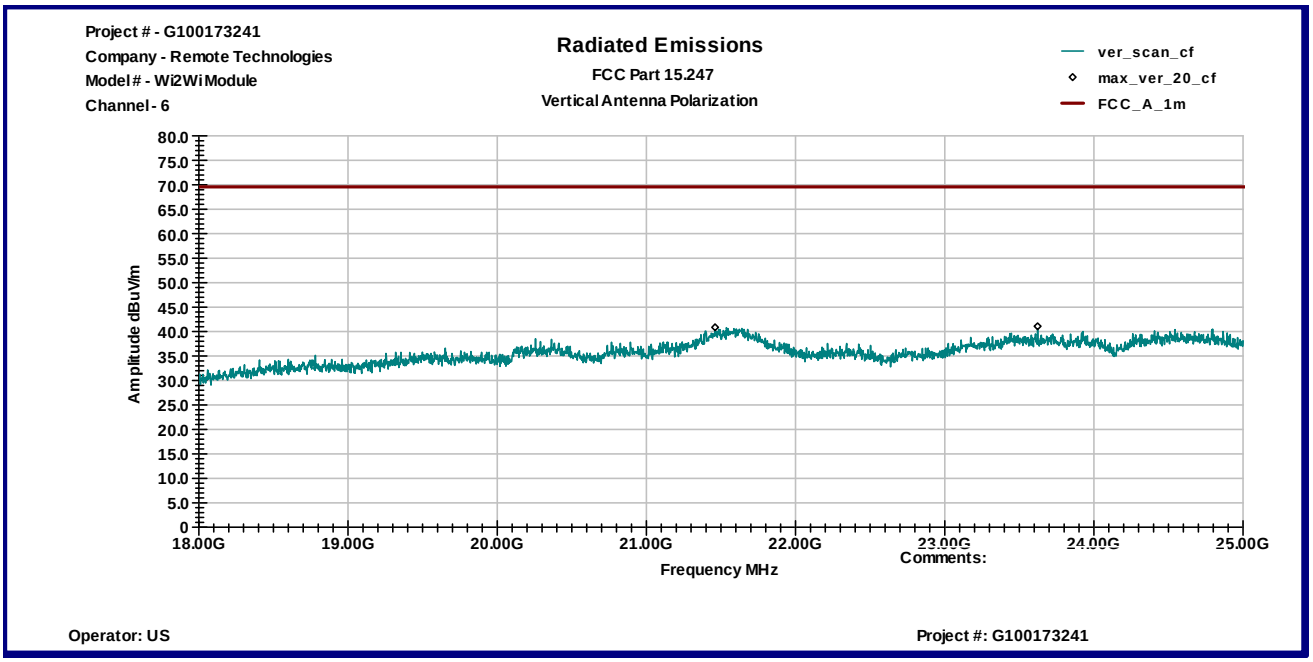

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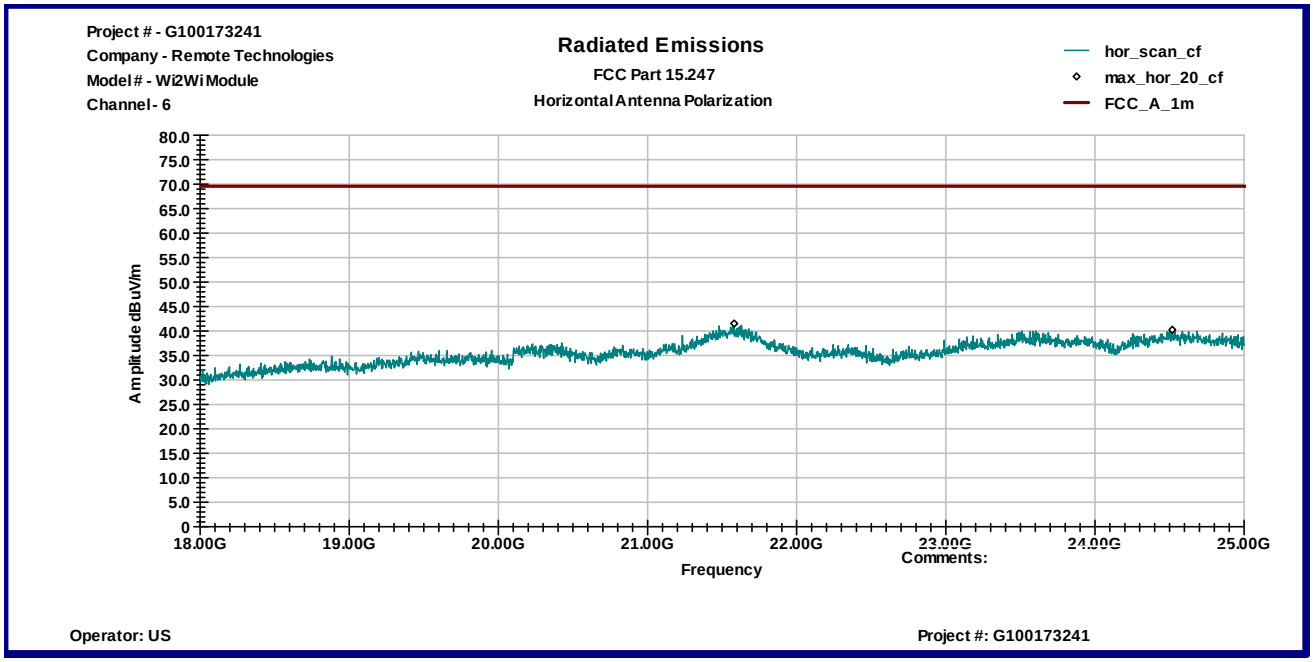

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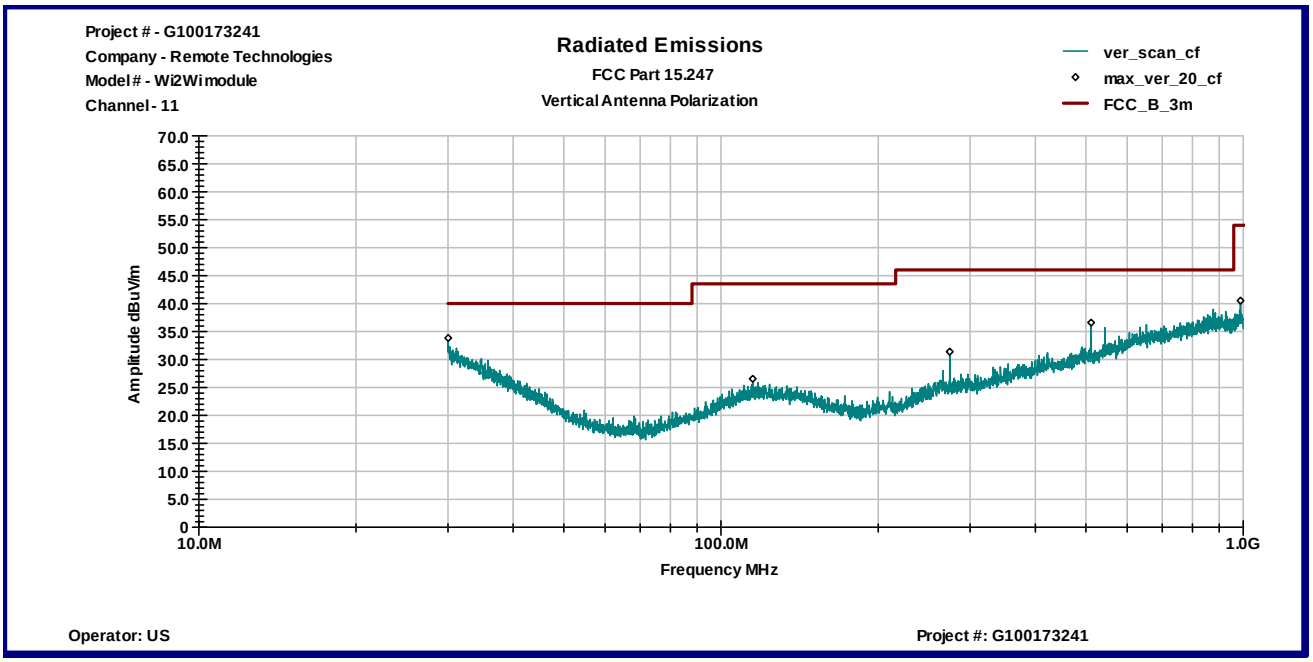

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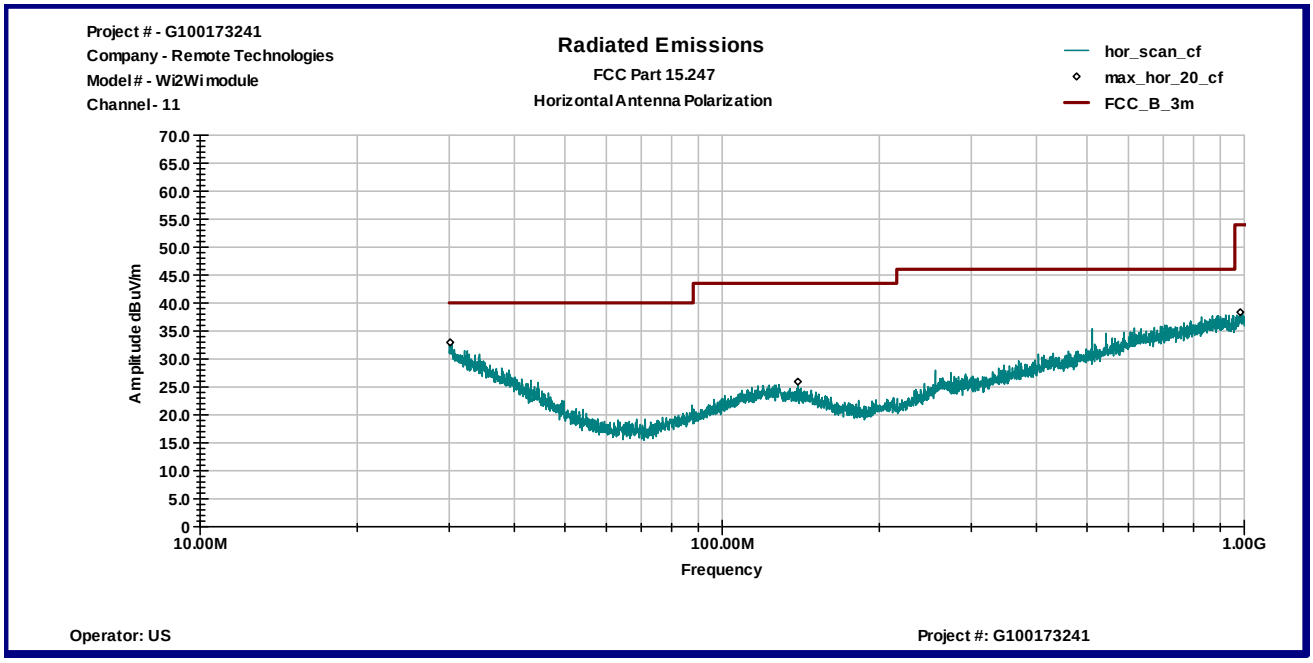

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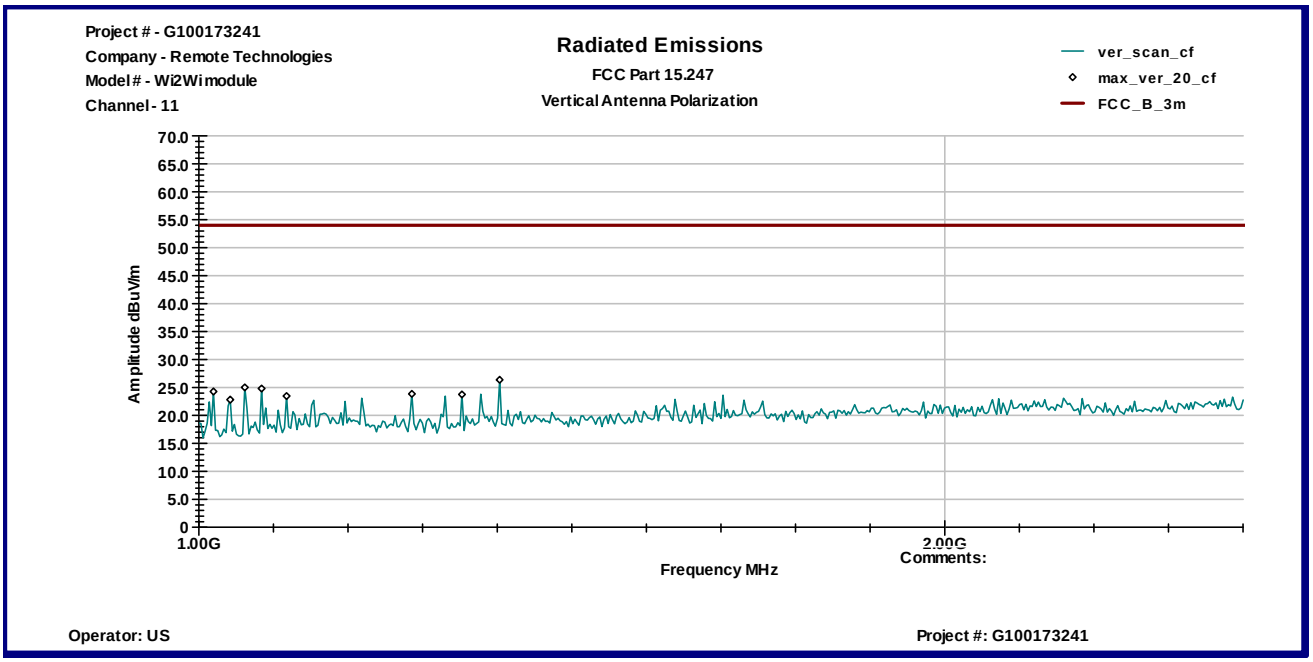
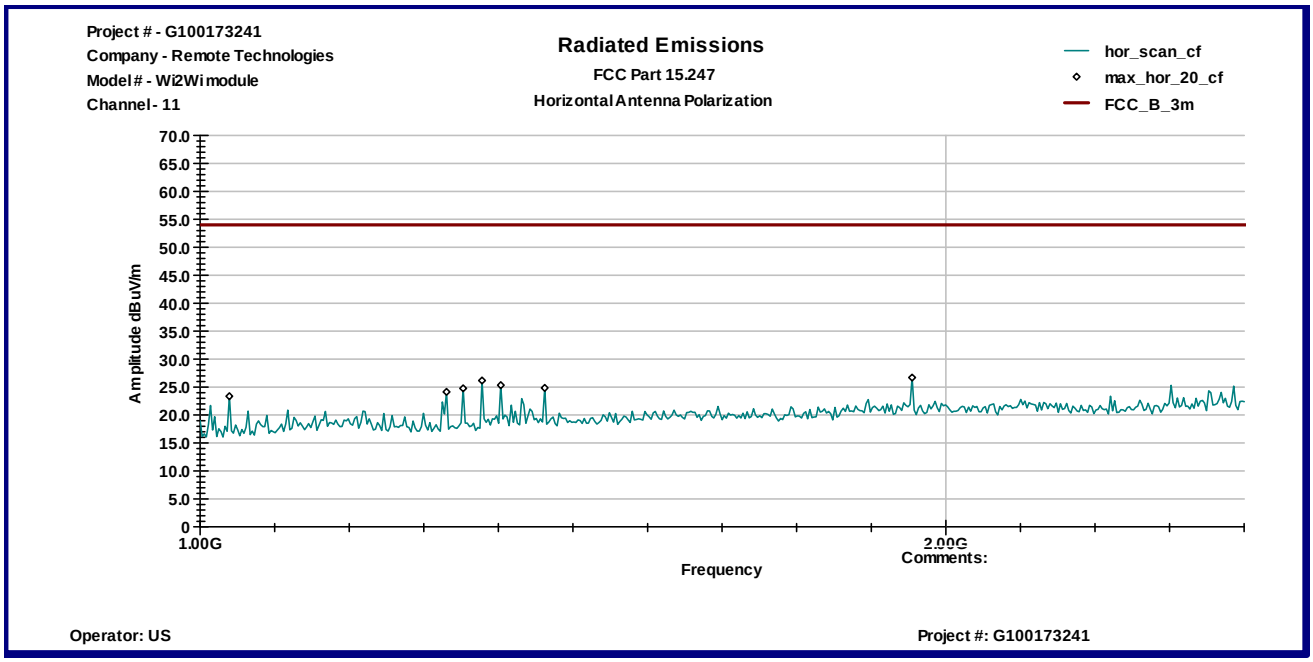


Graph 3.2.19



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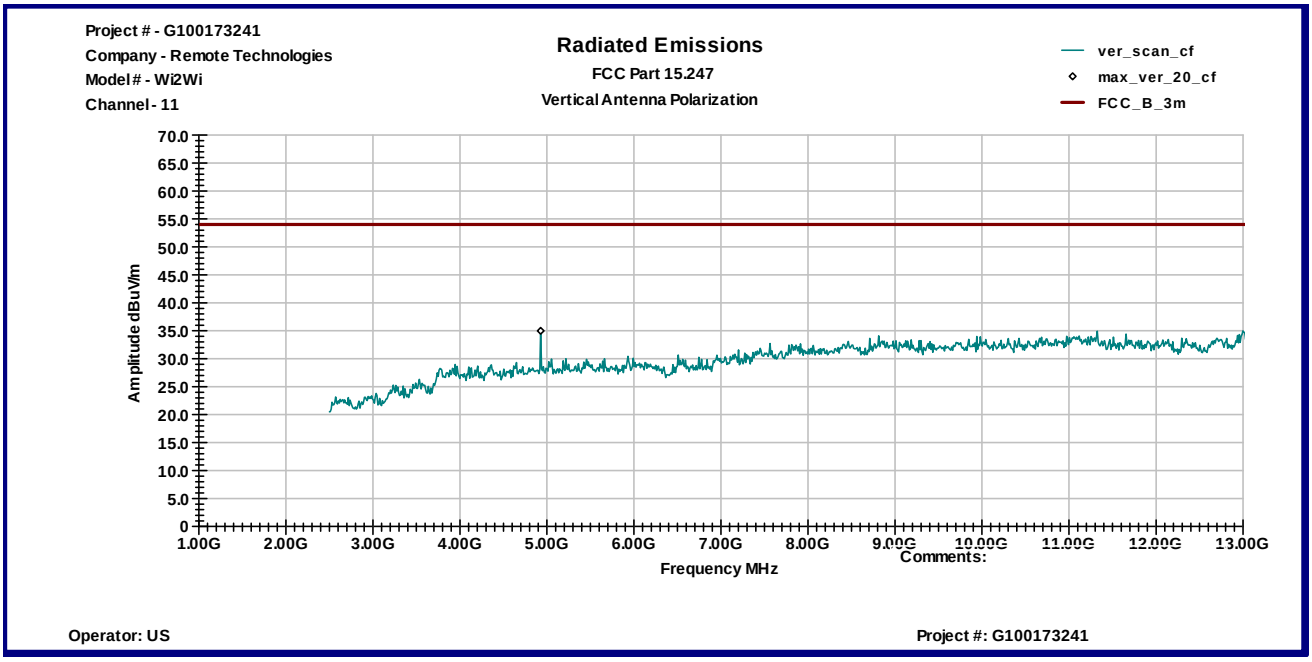

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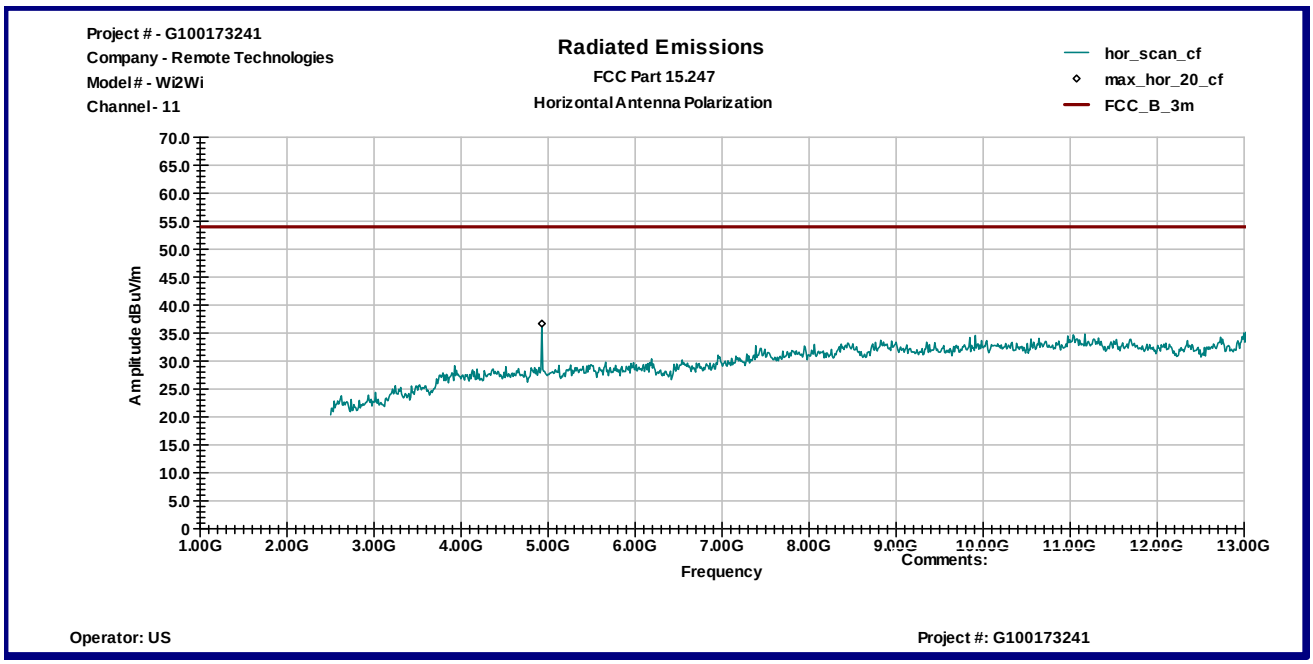

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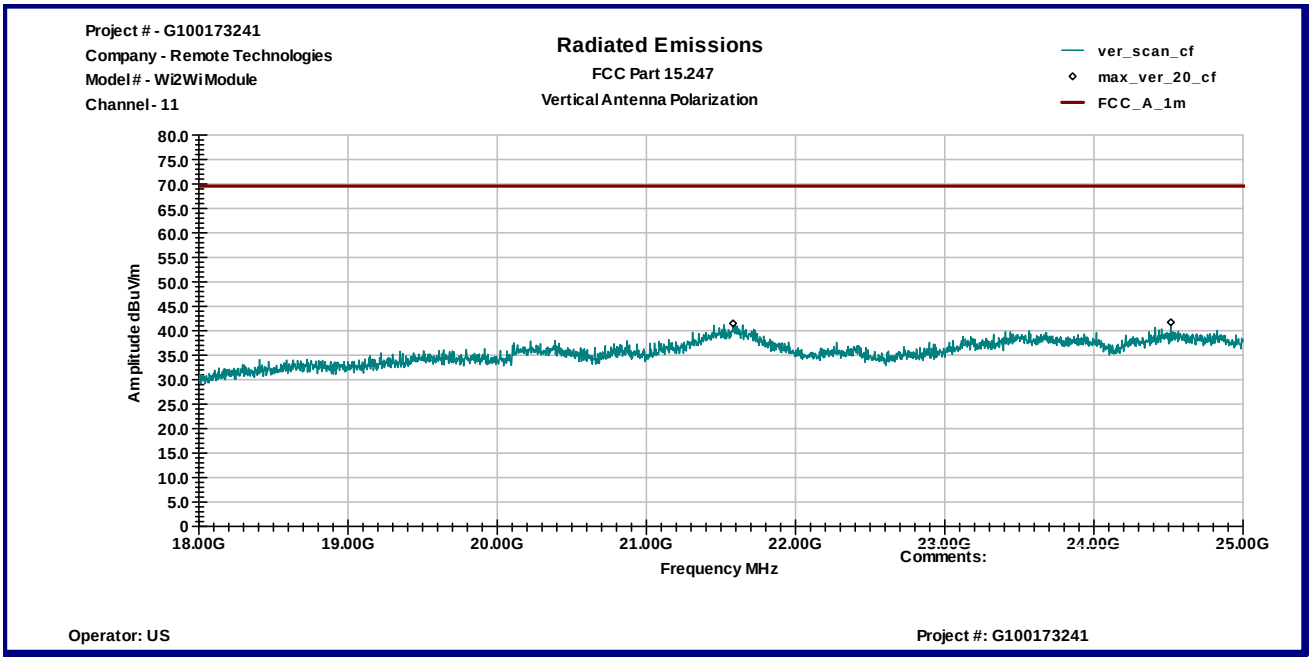
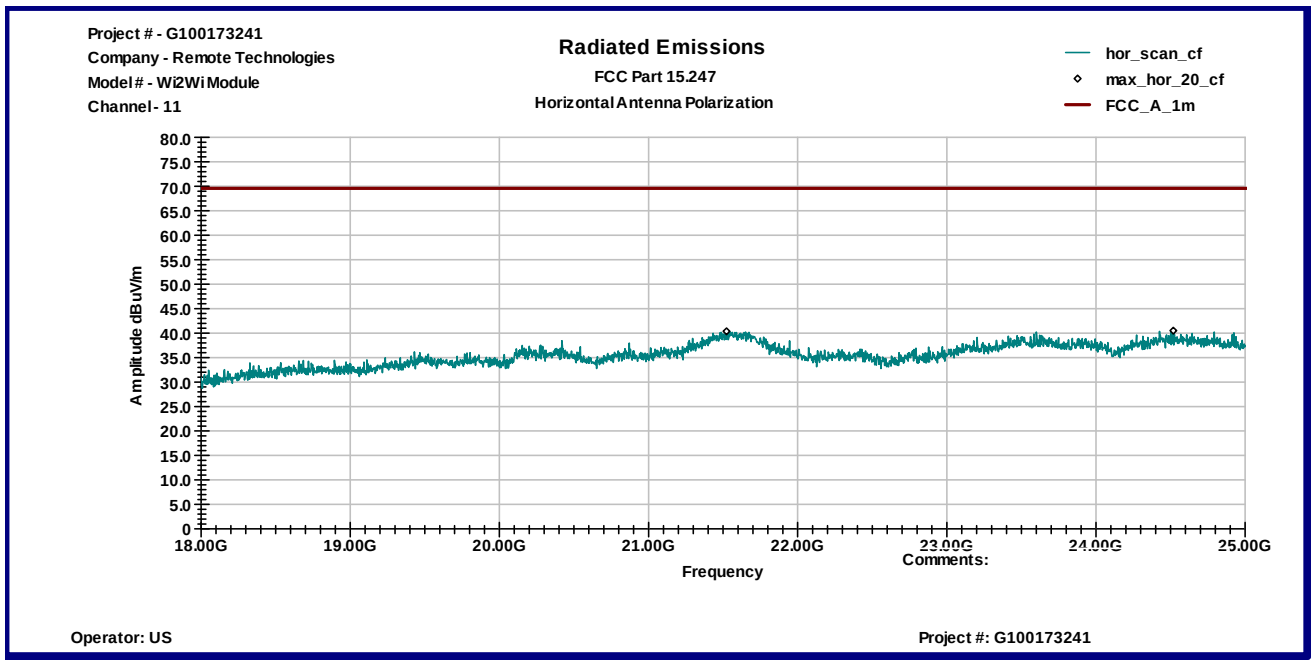


Graph 3.2.23



Graph 3.2.24

3.3 RF Exposure Compliance

The maximum measured power, P is 1.36dBm

The antenna gain, G is 2.2dBi

The maximum EIRP power = P + G
ERP = 1.36+ 2.2= 3.56dBm, or 0.00227W

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

The Power Density is related to EIRP with the equation:
$S = EIRP / 4\pi D^2$, or $10 = 0.00227 / 4\pi D^2$,

The minimum safe separation distance, D = 0.425cm, 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	09/10/2010	☒
Spectrum Analyzer	R & S	ESCI	100358	12909	07/12/2011	☒
Bicono-Log Antenna	Schaffner-Chase	CBL 6112 B	2468	14459	09/22/2010	☒
Horn Antenna	EMCO	3115	6579	15580	04/29/2011	☒
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1402232	172081	08/07/2010	☒
High Pass Filter	Reactel	7HS-4G-S12	0223	015274	VBU	☒
System	TILE! Instrument Control		Ver. 3.4.K.29	15259	VBU	☒