



TEST REPORT

Report Number: 101363577MIN-001B

Project Number: G101363577

**Testing performed on the
9010 / 9011 Programmer**

**FCC ID: SVHBAROSTIMPGM1
Industry Canada ID: 9464A-PGM901**

**to
47 CFR Part 15. 249:2013
RSS- 210, Issue 8, 2010**

**For
CVRx Inc.**

Test Performed by:
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Oakdale, MN 55128 USA

Test Authorized by:
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Date: December 4, 2013

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Date: December 4, 2013

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1.0 GENERAL DESCRIPTION

Model:	9010 / 9011 Programmer
Type of EUT:	MedRadio Programmer
Serial Number:	N/A
FCC ID:	SVHBAROSTIMPGM1
Industry Canada ID:	9464A-PGM901
Related Submittal(s) Grants:	SVHBAROSTIMIPG1, Implantable Device
Company:	CVRx Inc.
Customer:	Mr. Russell Anderson
Address:	9201 West Broadway Avenue, Suite 650 Minneapolis, MN 55445
Phone:	(763) 416-2332
e-mail:	randerson@cvrx.com
Test Standards:	☒ 47 CFR, Part 15:2013, §15.249 ☒ RSS-210, Issue 8, 2010 ☒ RSS-Gen, Issue 2, 2007 ☒ 47 CFR, Part 15:2013, §15.107 and §15.109, Class B ☐ Other
Type of radio:	☒ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	January 5, 2011
Test Work Started:	January 10, 2011
Test Work Completed:	January 14, 2011
Test Sample Conditions:	☐ Damaged ☐ Poor (Usable) ☒ Good



1.1 Product Description; Test Facility

Product Description:	MedRadio Programmer
Operating Frequency	2400-2483.5 MHz
Modulation:	ASK
Emission Designator:	2M97A7D
Antenna(s) Info:	Integral antenna
Antenna Installation:	☐ User ☐ Professional ☐ Factory
Transmitter Power Configuration:	☐ Internal battery ☐ External power source ☐ 120VAC ☐ 230VAC ☐ 400VAC ☐ VDC ☒ Other: USB 5VDC from the Host PC 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 C63.4-2003

Notes: This Report is issued to reflect updated reference to the newest editions of FCC standards; to change technical terms from MICS Radio to MedRadio; to change the customer name, telephone and email address; to add Model 9010 Programmer to the scope of testing.

The radio equipment for the Model 9010 Programmer Interface is identical to the radio equipment used in the Model 9011 Programmer Interface. Both models use the same RF components, circuitry and antennas. The differences between the two models are the addition of a plastic hook to the mechanical enclosure and an update to the firmware for improved robustness and reliability of the communication link; therefore, testing was performed on Model 9011 Programmer and covers also the Model 9010 Programmer.

1.2 EUT Configuration

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

- ☐ - Standby
- ☒ - Continuous
- ☐ - Continuous un-modulated
- ☐ - Test program (customer specific)
- ☐ -

Operating modes of the EUT:

No.	Description
1	The device was pre-programmed to transmit continuously in three separate frequency channels, low, middle, and upper frequency channel, one channel being transmitted at a given time.

Cables:

No.	Type	Length	Designation	Note
1	Power and communication	6ft.	USB cable	

Support equipment/Services:

No.	Item	Description
1	Lenovo Notebook	Host PC

1.3 Environmental conditions

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

☒ Normal

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

1.4 Measurement uncertainty

The expanded uncertainty ($k = 2$) for radiated emissions from 30 to 1000 MHz has been determined to be: ± 4 dB at 10m and ± 5.4 dB at 3m

The expanded uncertainty ($k = 2$) for conducted emissions from 150 kHz to 30 MHz 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
15.249(a) / RSS-210 A2.9(a)	Field strength of fundamental	Pass
15.249(a) / RSS-210 A2.9(a)	Field strength of harmonics	Pass
15.249(d) / RSS-210 A2.9(b)	Field strength of spurious emissions	Pass
15.215(c) / RSS- Gen 4.6.1	Bandwidth of the emission	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 Field strength of fundamental and of harmonics and spurious emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☐ 10 meters ☒ 3 meters

Frequency range of measurements: 30MHz-25MHz

Test result: **Pass**

Max. Emissions margin at fundamental: 0.1dB below the limits

Max. margin of harmonics and spurious emissions: 2.2dB below the limits

Notes: None

Date:	January 5, 2011	Result: Pass
Standard:	FCC 15.249(a) / RSS-210 A2.9	
Tested by:	Uri Spector	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Emissions at fundamentals	

Table 3.1.1

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)									
Peak Limits										
2405.98	V	131	28.2	3.5	0.0	78.1	109.8	114.0	-4.2	
2405.98	H	130	28.2	3.5	0.0	79.9	111.6	114.0	-2.4	
2440.09	V	154	28.3	3.6	0.0	79.2	111.0	114.0	-3.0	
2440.09	H	145	28.3	3.6	0.0	80.7	112.5	114.0	-1.5	
2477.02	V	103	28.3	3.6	0.0	78.9	110.8	114.0	-3.2	
2477.02	H	131	28.3	3.6	0.0	82.0	113.9	114.0	-0.1	
Average Limits										
2405.98	V	131	28.2	3.5	0.0	56.2	87.9	94.0	-6.1	
2405.98	H	130	28.2	3.5	0.0	58.1	89.8	94.0	-4.2	
2440.09	V	154	28.3	3.6	0.0	57.3	89.1	94.0	-4.9	
2440.09	H	145	28.3	3.6	0.0	58.8	90.6	94.0	-3.4	
2477.02	V	103	28.3	3.6	0.0	57.1	89.0	94.0	-5.0	
2477.02	H	131	28.3	3.6	0.0	60.3	92.2	94.0	-1.8	

Date:	January 6, 2011	Result: Pass
Standard:	FCC 15.249(a) / RSS-210 A2.9	
Tested by:	Uri Spector	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Spurious emissions	

Table 3.1.2

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 2405.98MHz										
4812.20	V	100	32.7	4.9	36.7	42.6	43.6	54.0	-10.4	
4812.20	H	159	32.7	4.9	36.7	45.1	46.1	54.0	-7.9	
7218.28	V	111	35.7	6.2	36.7	32.7	37.9	54.0	-16.0	
9624.40	V	100	38.0	7.0	35.4	33.3	42.9	54.0	-11.1	
9624.40	H	140	38.0	7.0	35.4	30.0	39.6	54.0	-14.4	
Channel 2440.09MHz										
4880.21	V	100	32.9	4.9	36.6	39.5	40.7	54.0	-13.3	
4880.21	H	104	32.9	4.9	36.6	45.4	46.6	54.0	-7.4	
7320.32	V	137	36.0	6.2	36.6	40.8	46.4	54.0	-7.6	
7320.32	H	100	36.0	6.2	36.6	33.5	39.1	54.0	-14.9	
9760.36	V	106	38.3	7.0	35.3	38.2	48.1	54.0	-5.9	
9760.36	H	148	38.3	7.0	35.3	32.8	42.7	54.0	-11.3	
Channel 2477.02MHz										
4952.84	V	108	33.0	5.0	36.6	37.7	39.1	54.0	-14.9	
4952.84	H	100	33.0	5.0	36.6	44.9	46.3	54.0	-7.7	
7431.05	V	117	36.3	6.3	36.5	38.7	44.7	54.0	-9.2	
7431.05	H	114	36.3	6.3	36.5	33.5	39.5	54.0	-14.4	
9908.34	V	100	38.5	7.0	35.2	41.5	51.8	54.0	-2.2	
9908.34	H	100	38.5	7.0	35.2	36.9	47.2	54.0	-6.8	
12387.46	V	100	39.1	7.6	35.9	27.7	38.5	54.0	-15.5	
12387.46	H	169	39.1	7.6	35.9	26.7	37.5	54.0	-16.5	

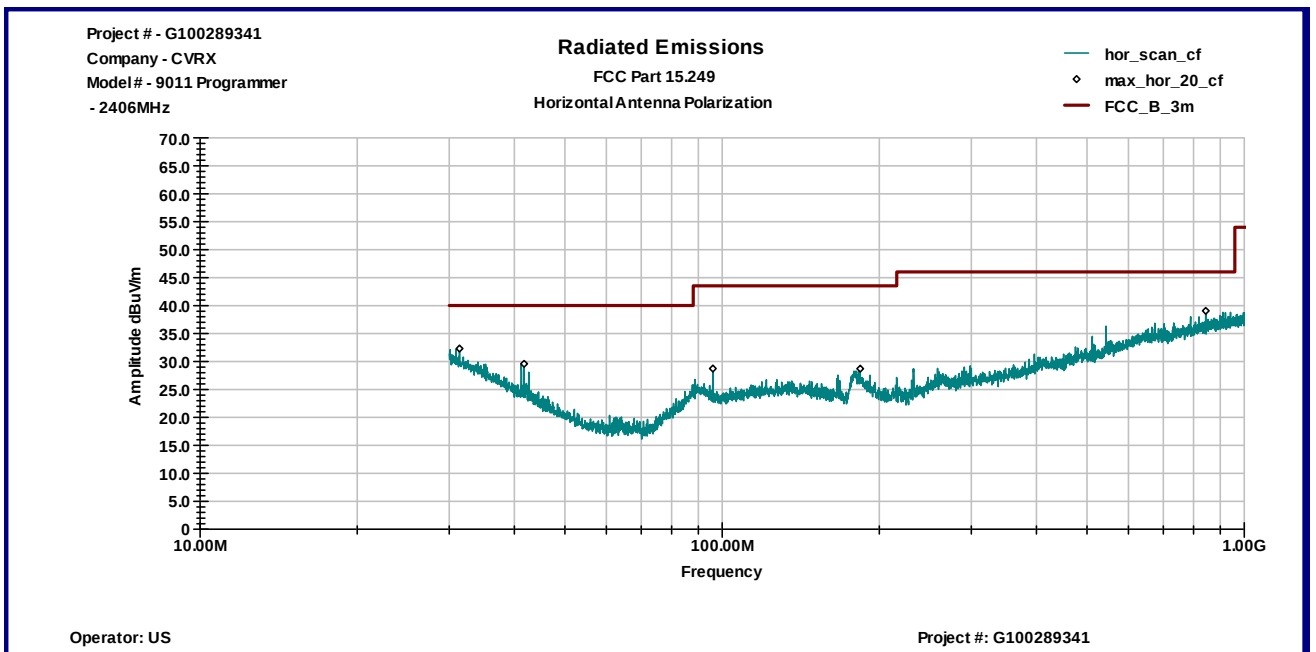
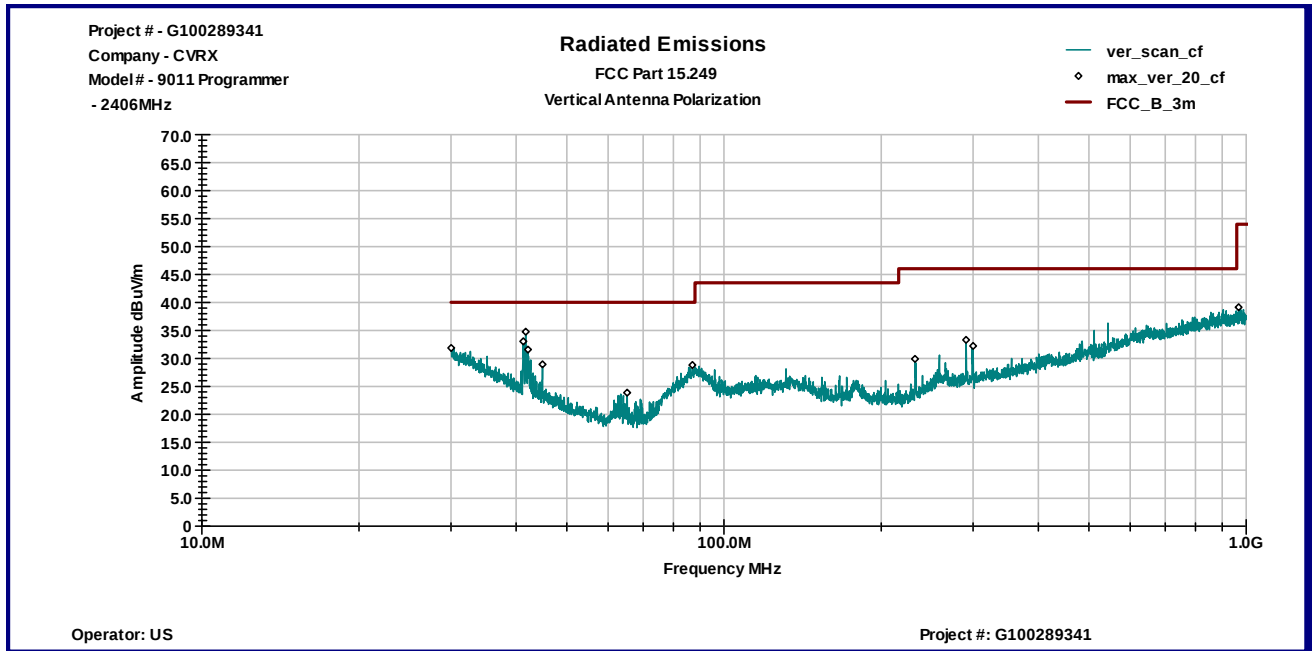
Comments: All measurements were taken using an Average Detector

Table 3.1.3

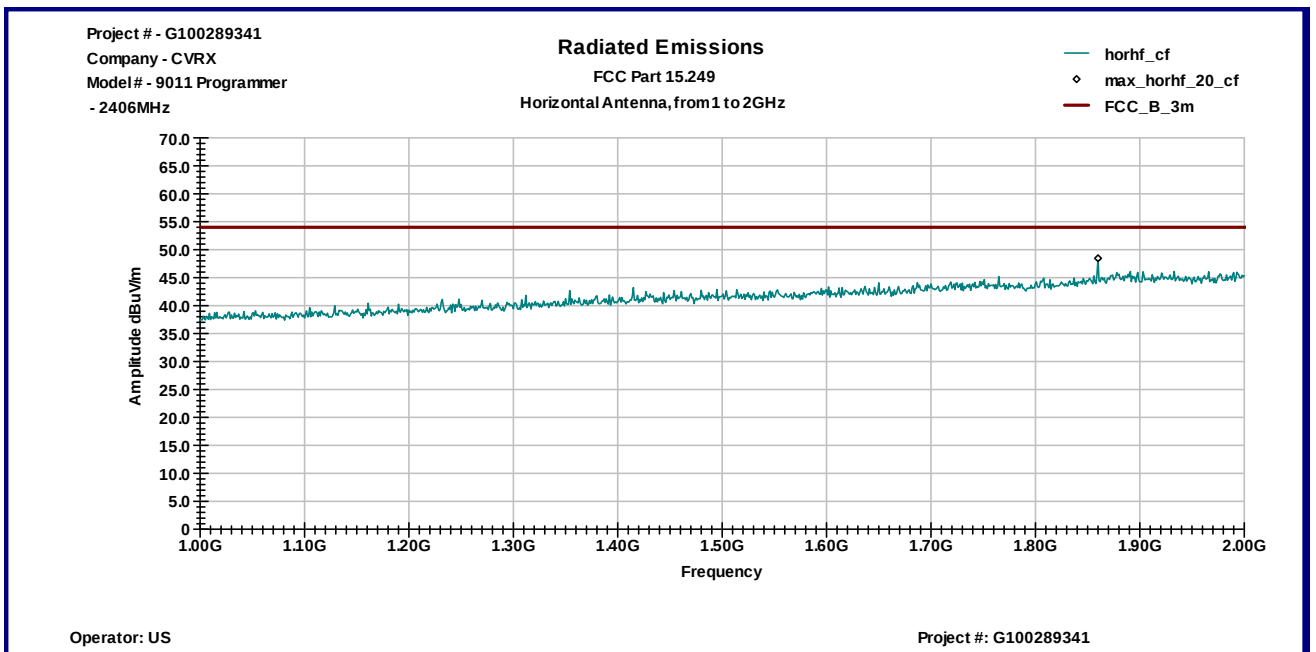
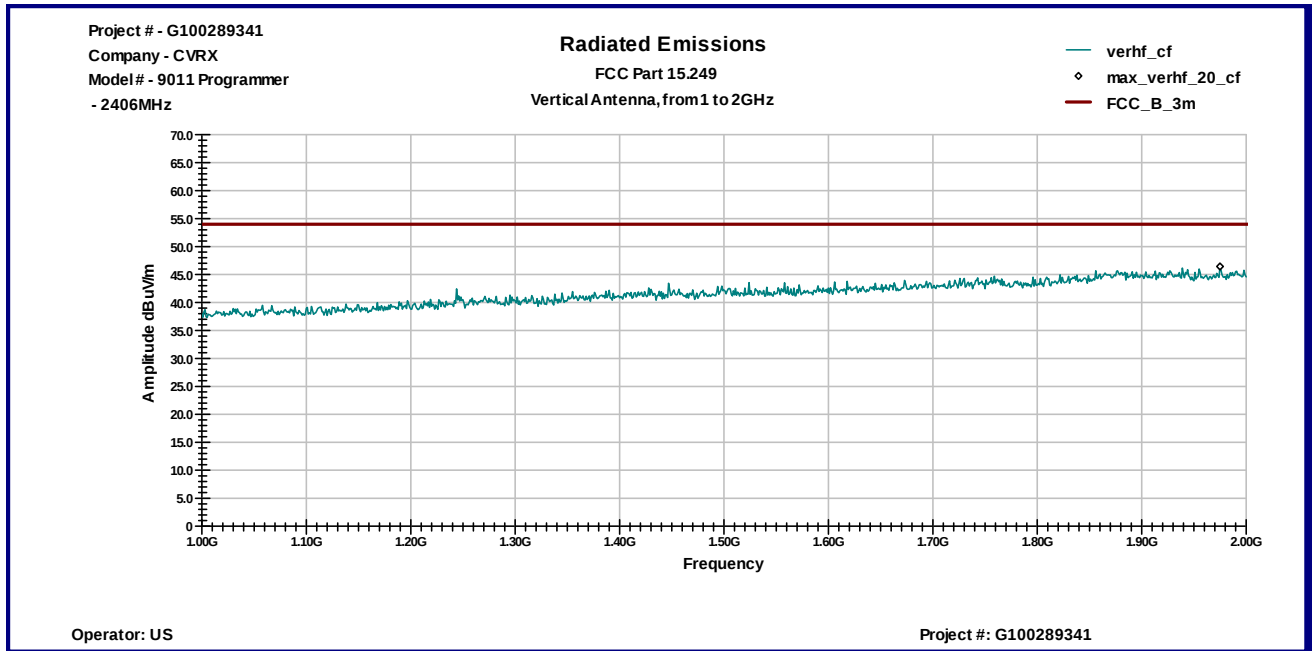
Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dBμV	Total @ 3m dBμV/m	Limit dBμV/m	Margin dB	Comments
	Polarity	Hts(cm)								
Spurious Emissions Band Edge Compliance										
2400.00	V	145	28.2	3.5	0.0	18.7	50.4	54.0	-3.6	
2400.00	H	137	28.2	3.5	0.0	20.1	51.8	54.0	-2.2	
2483.50	V	140	28.4	3.6	0.0	19.2	51.2	54.0	-2.8	
2483.50	H	163	28.4	3.6	0.0	19.9	51.9	54.0	-2.1	

Comments: Measurements were taken using a Average detector

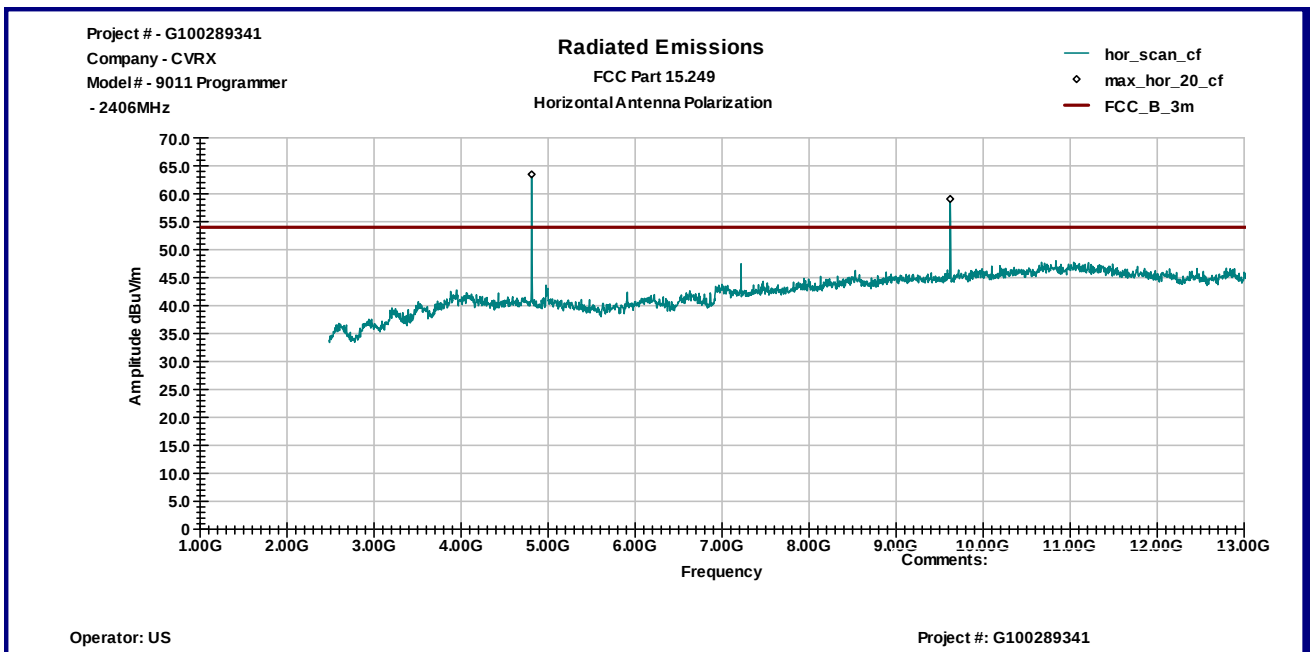
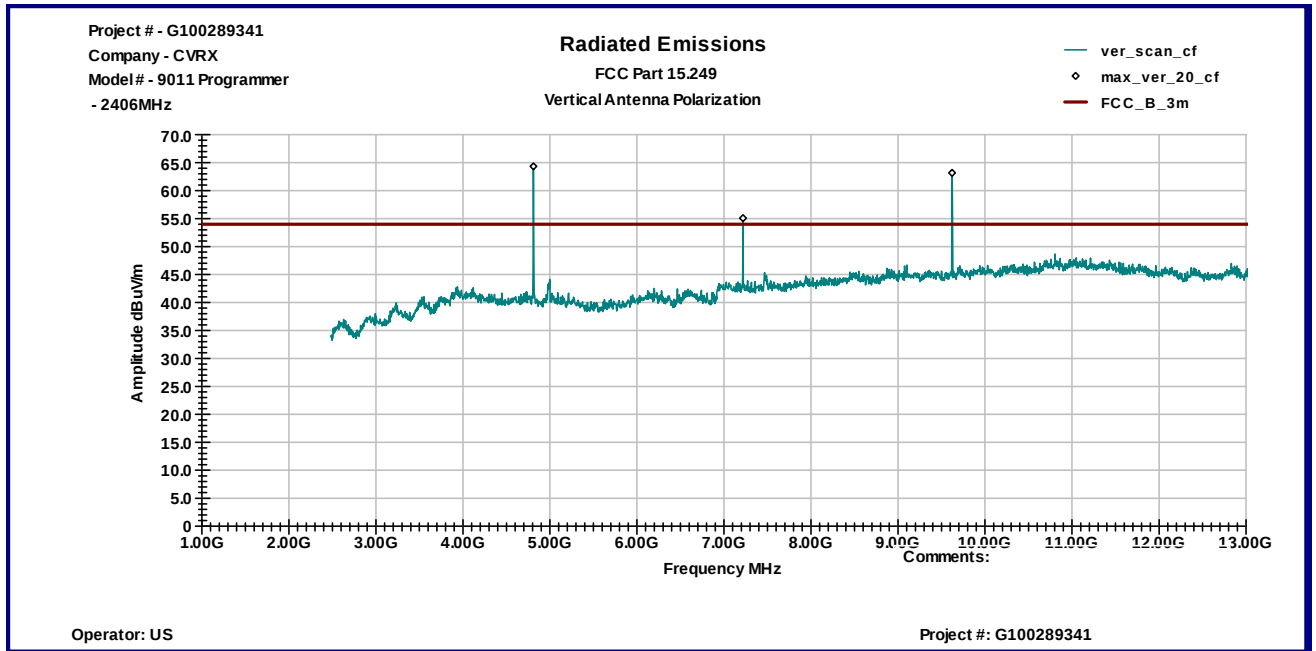
Graph 3.1.1



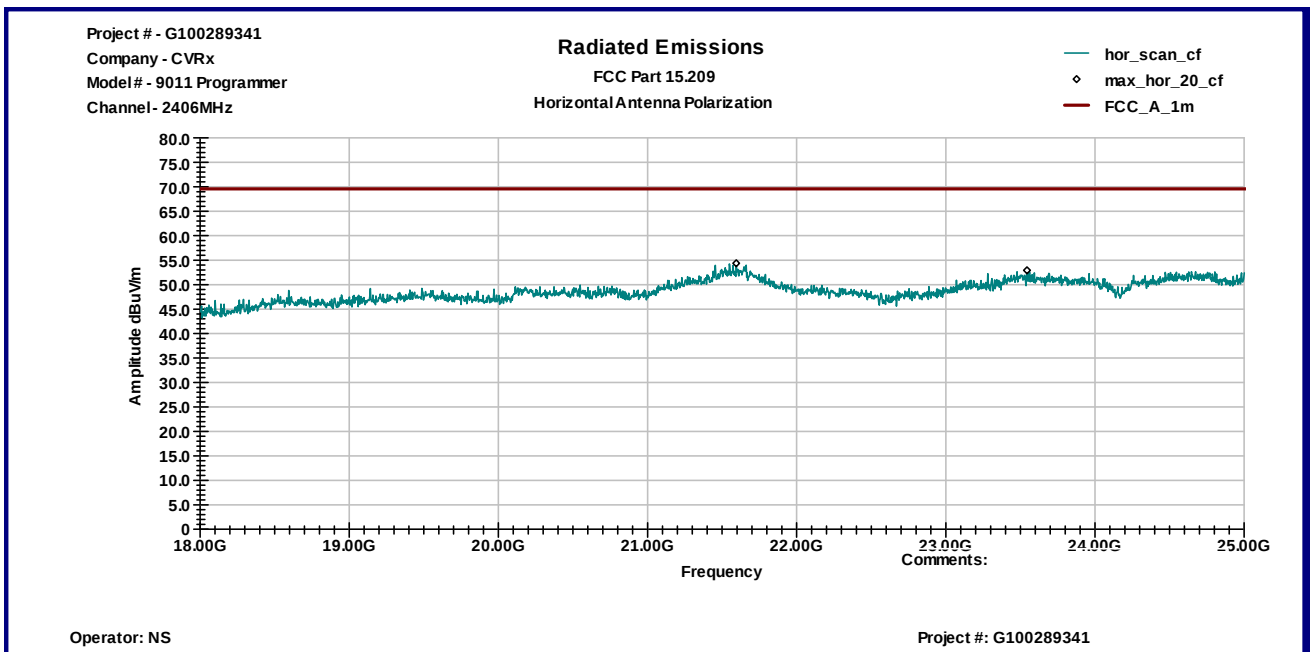
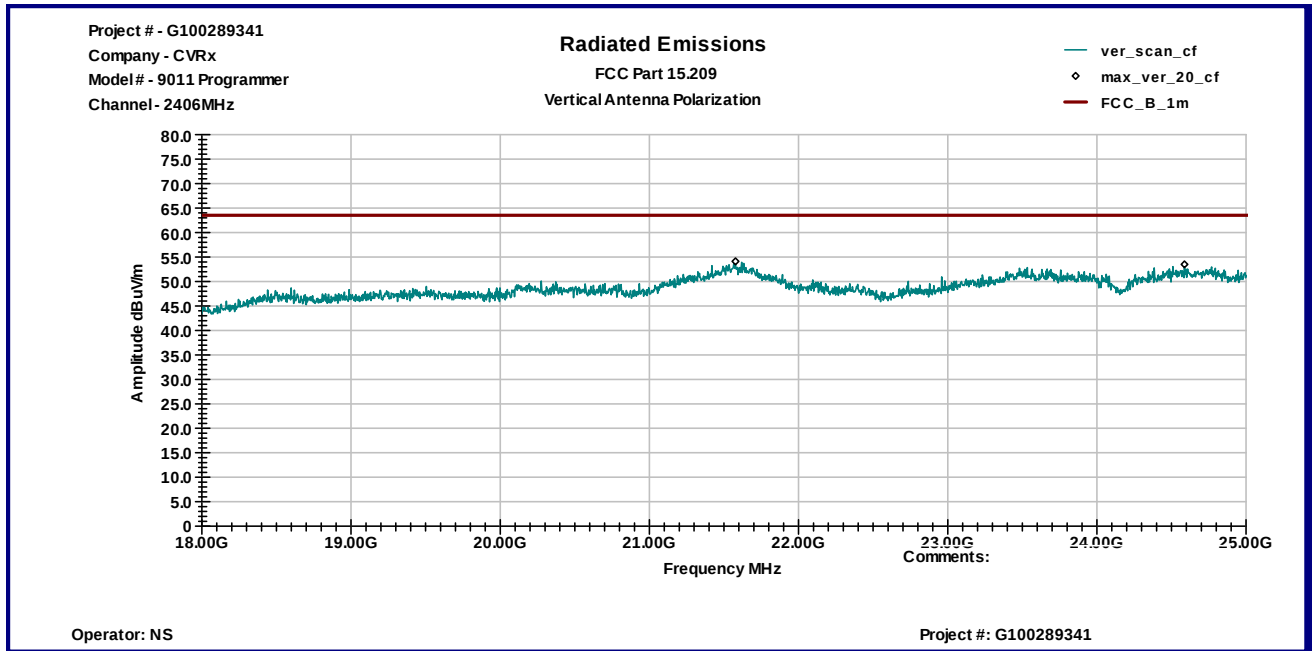
Graph 3.1.2



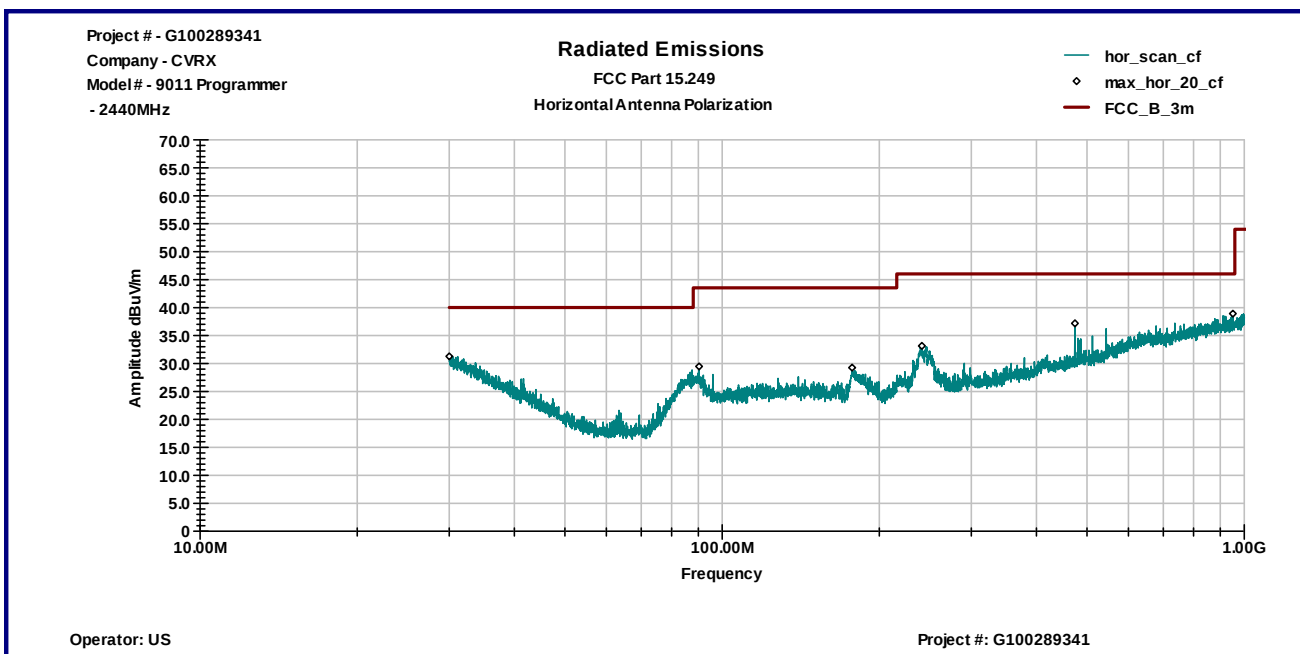
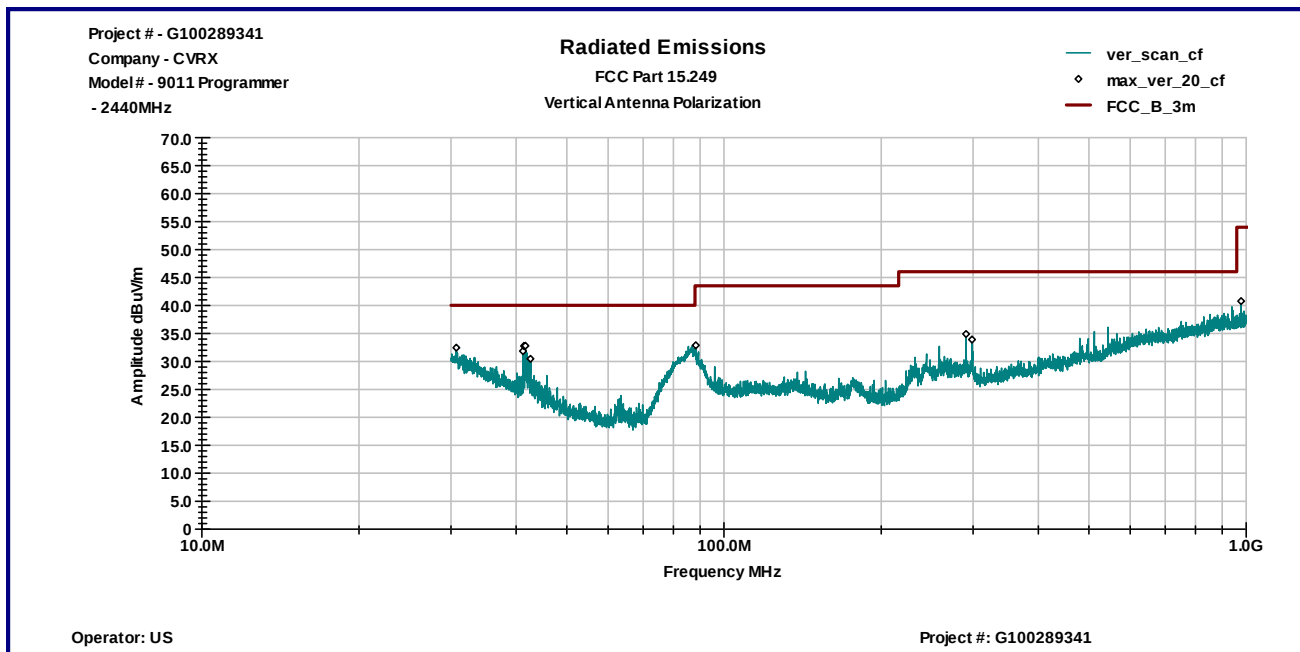
Graph 3.1.3



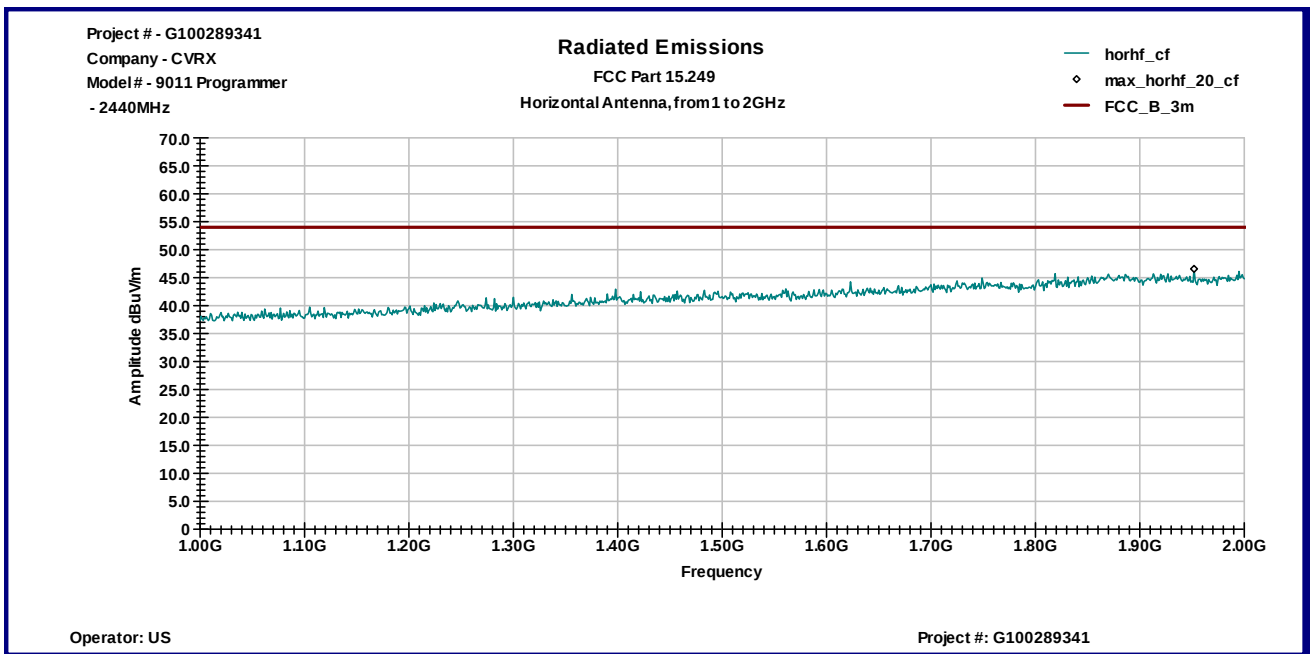
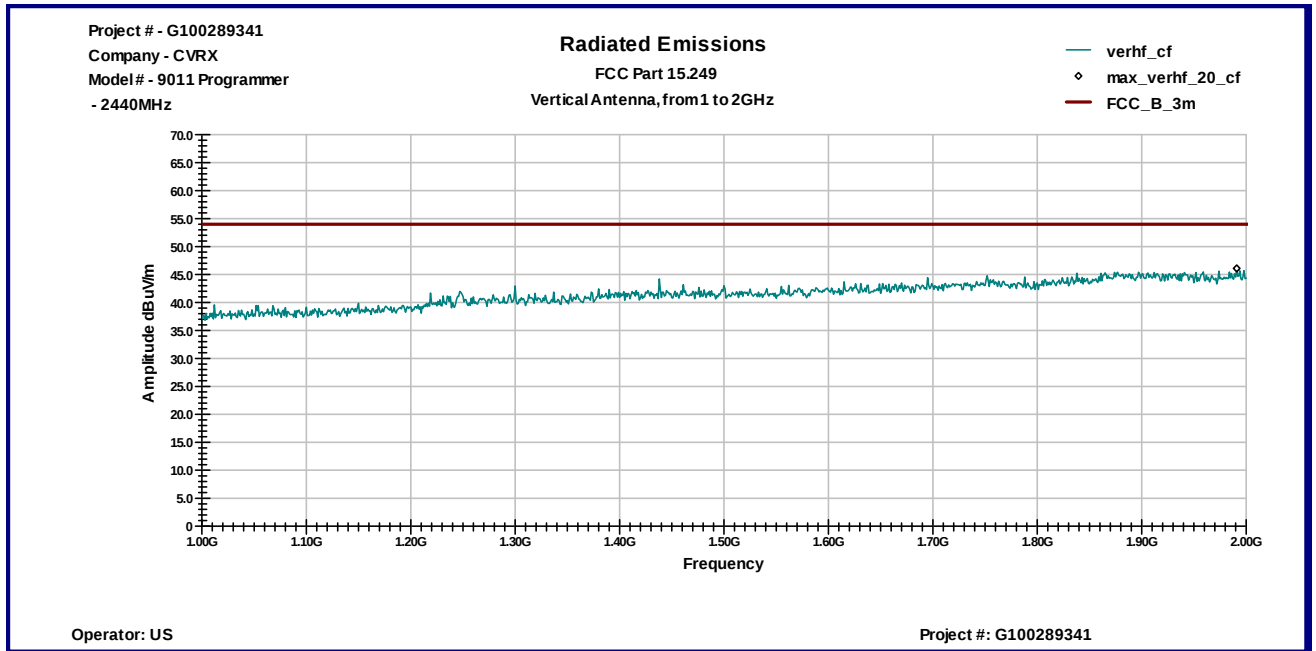
Graph 3.1.4



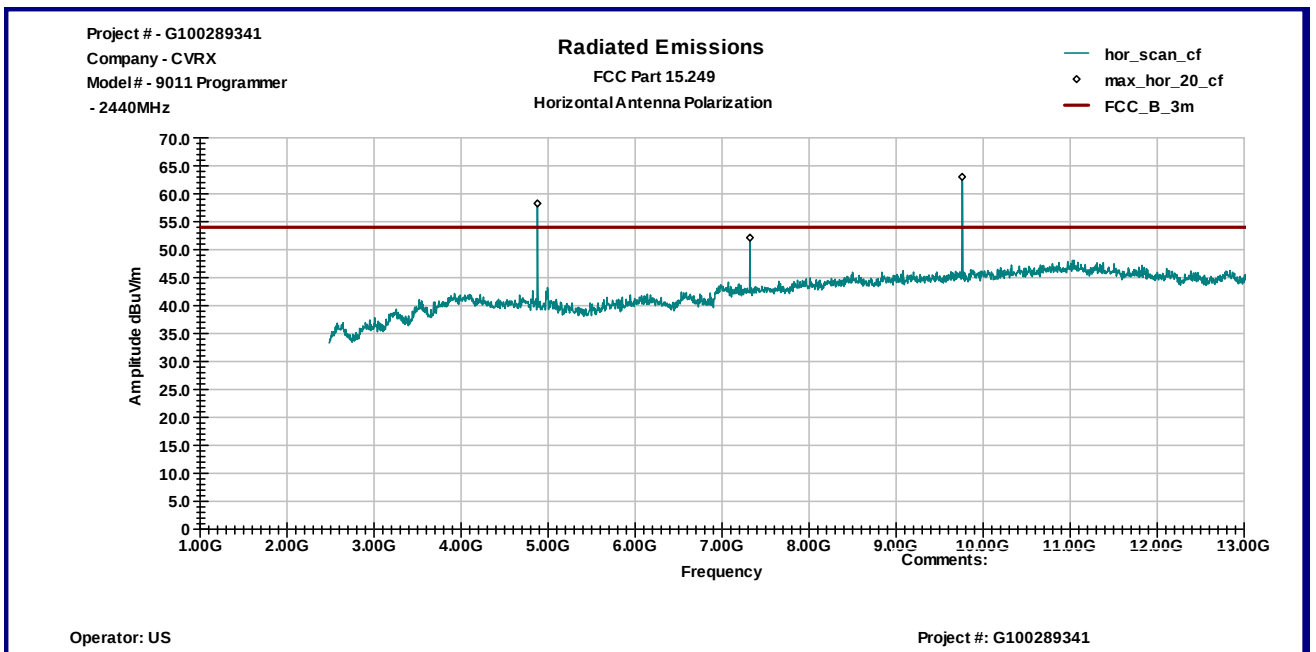
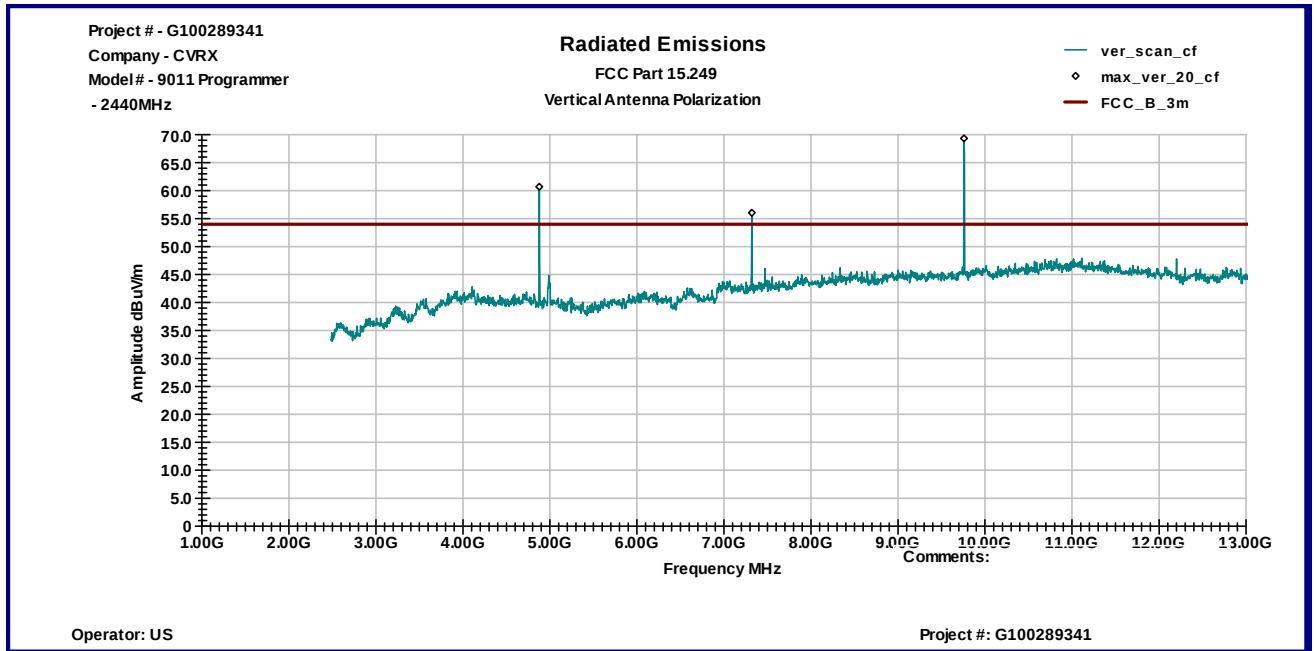
Graph 3.1.5



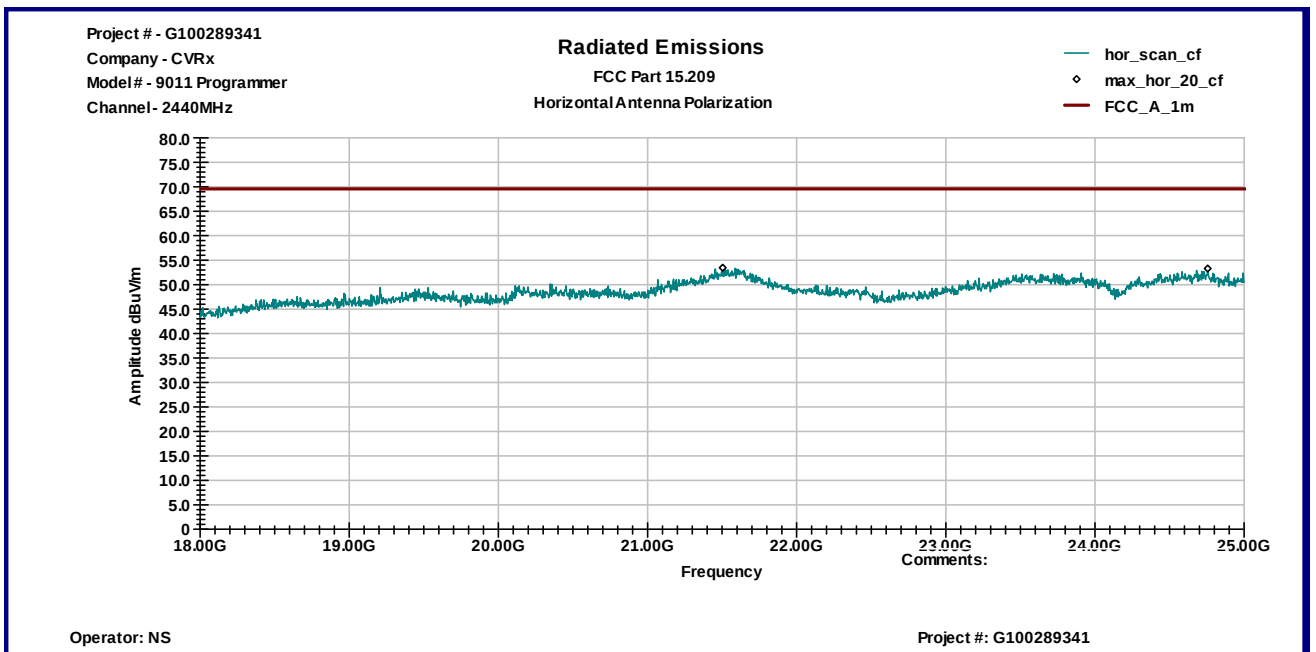
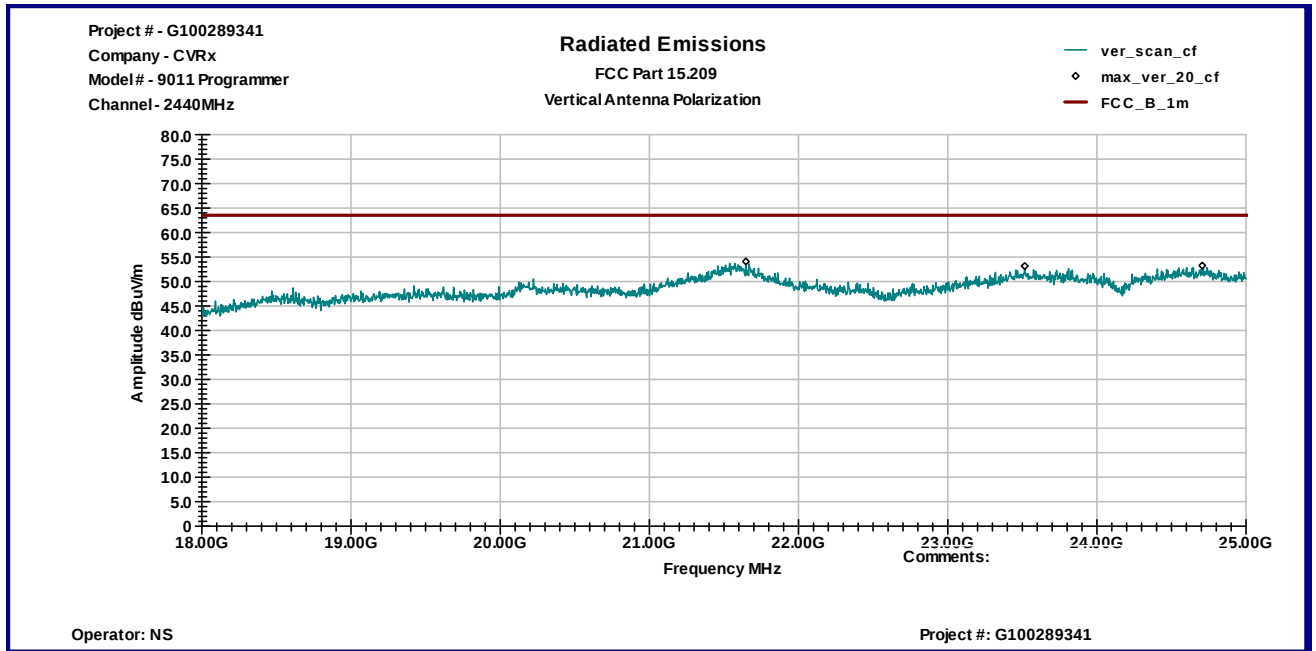
Graph 3.1.6



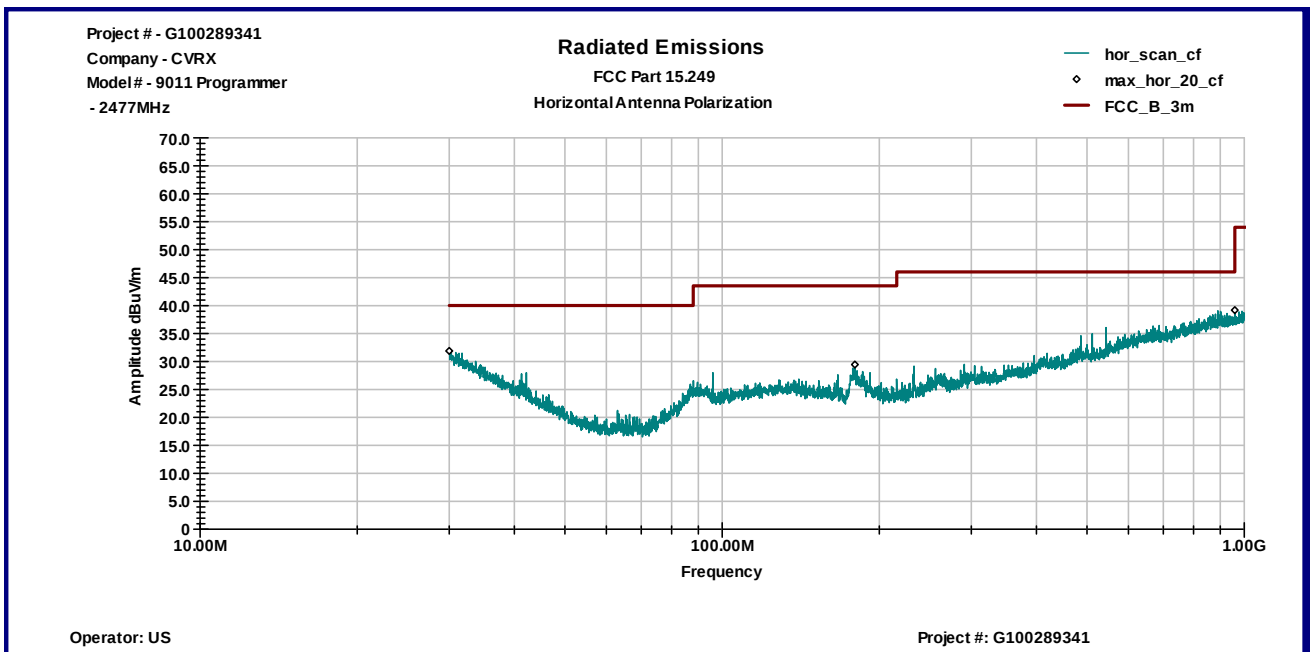
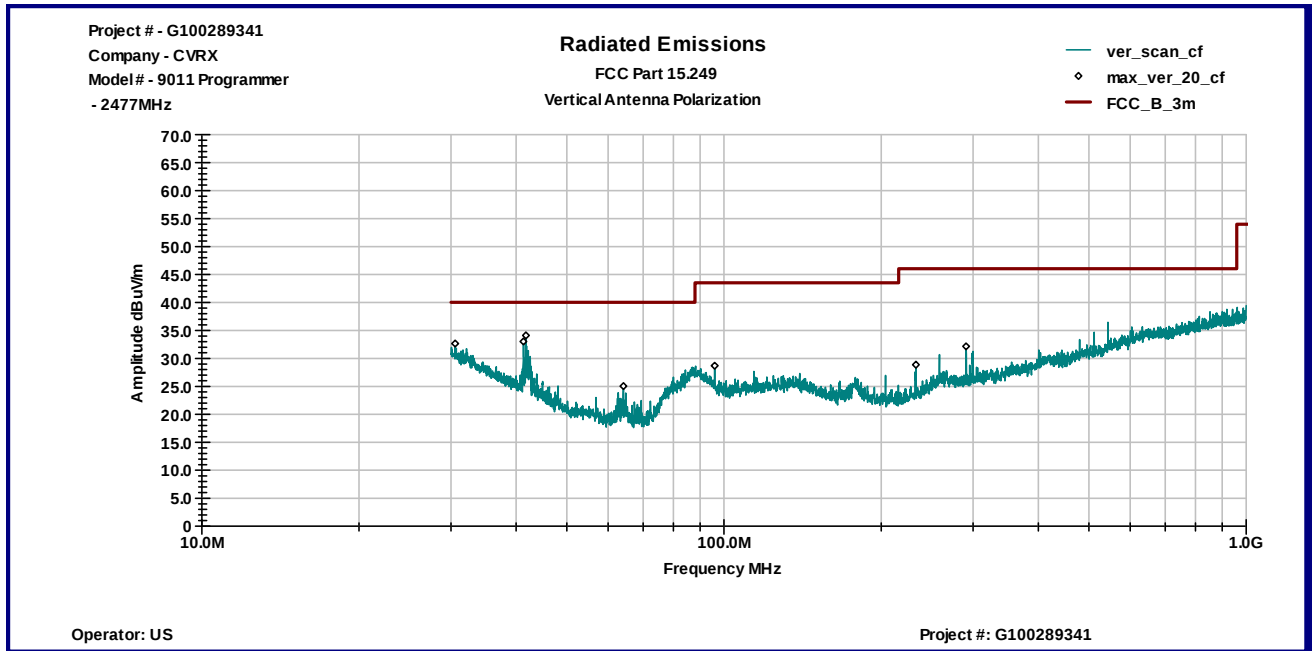
Graph 3.1.7



Graph 3.1.8

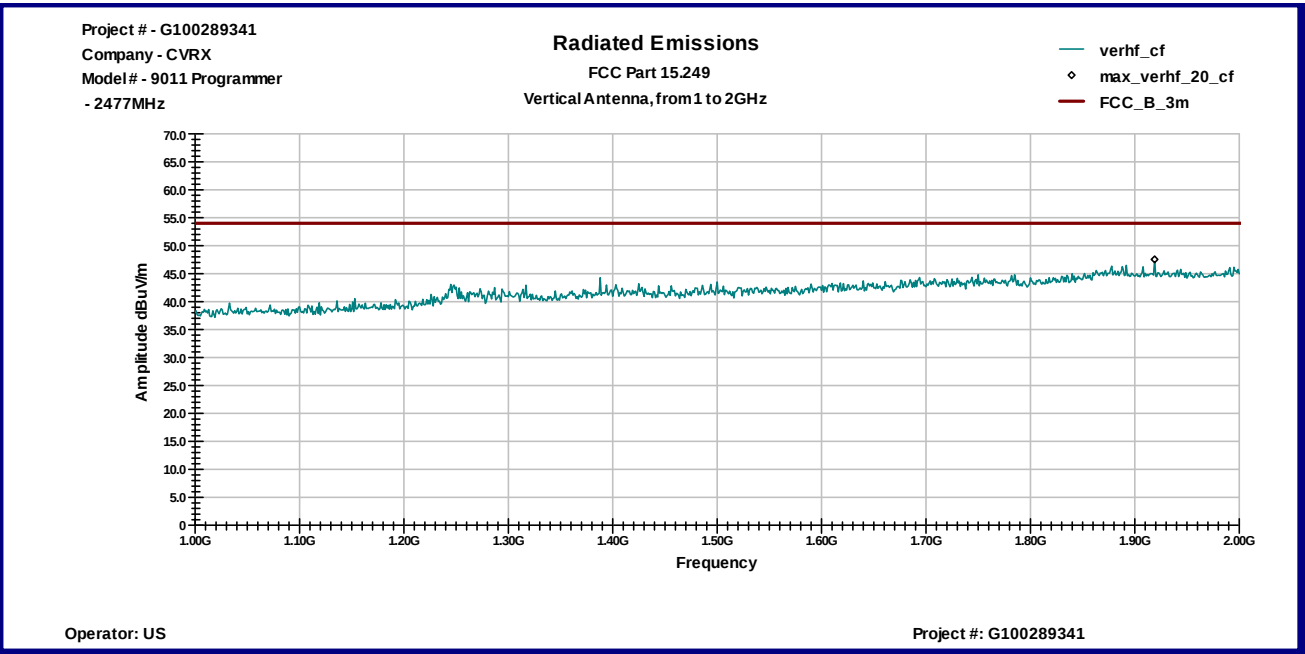
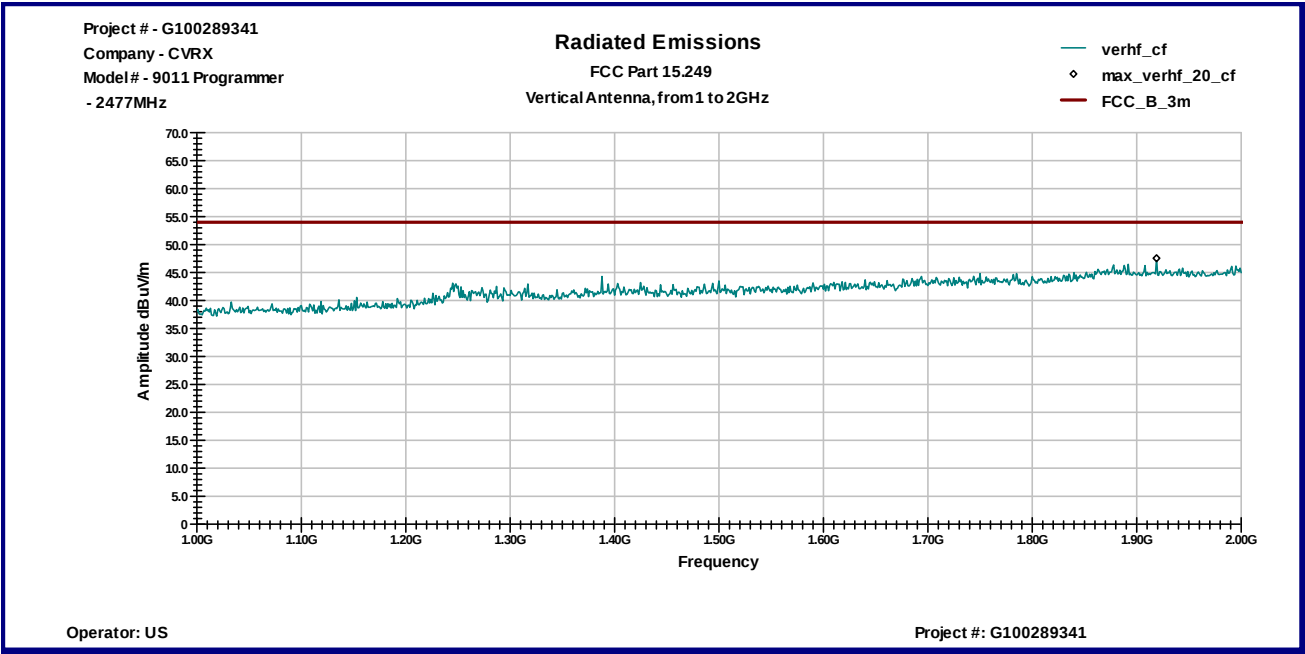


Graph 3.1.9

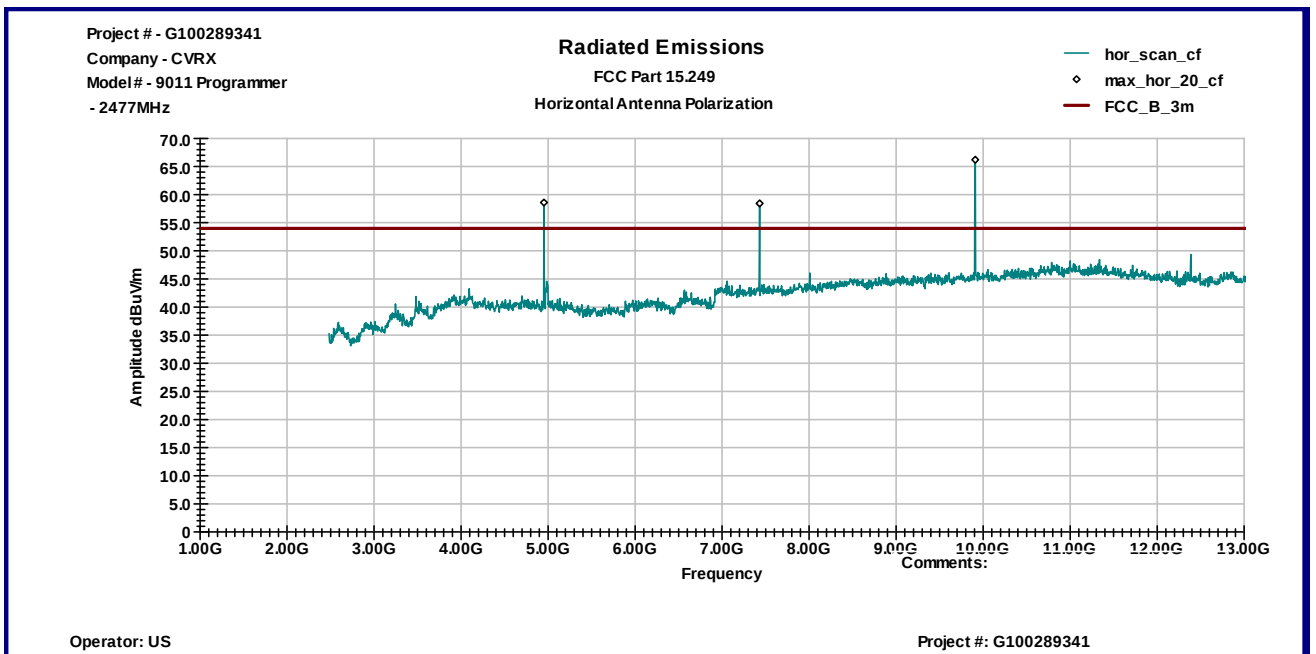
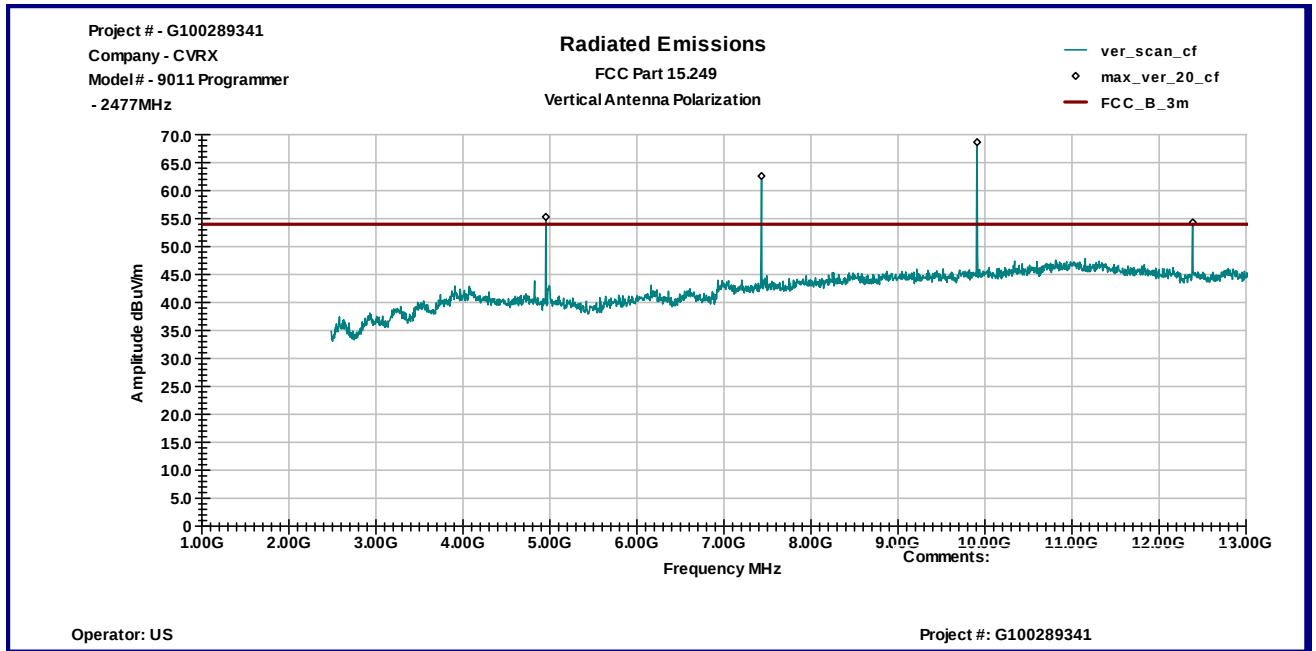




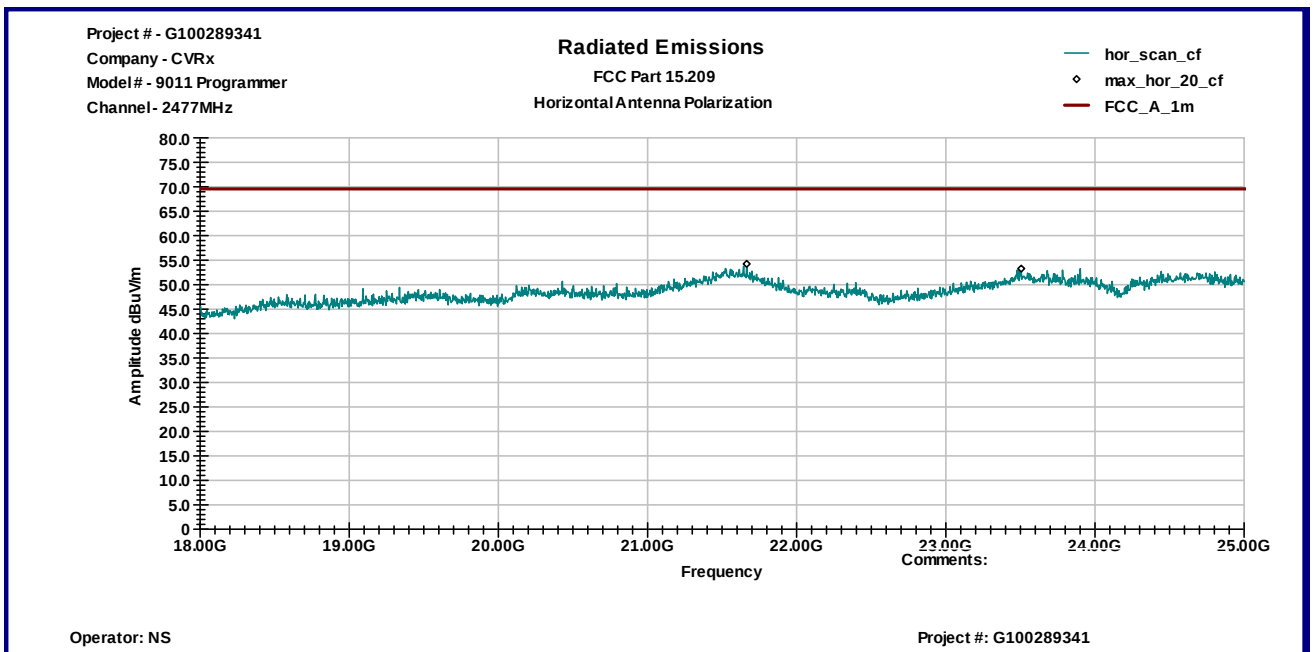
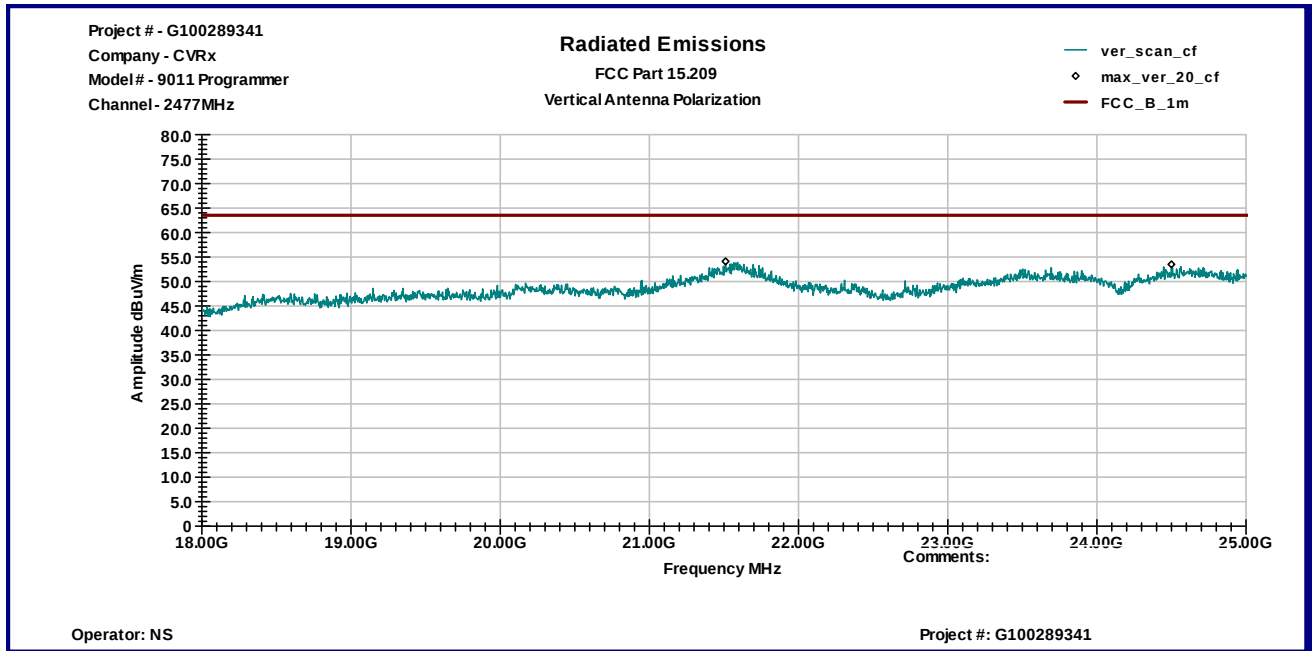
Graph 3.1.10



Graph 3.1.11



Graph 3.1.12



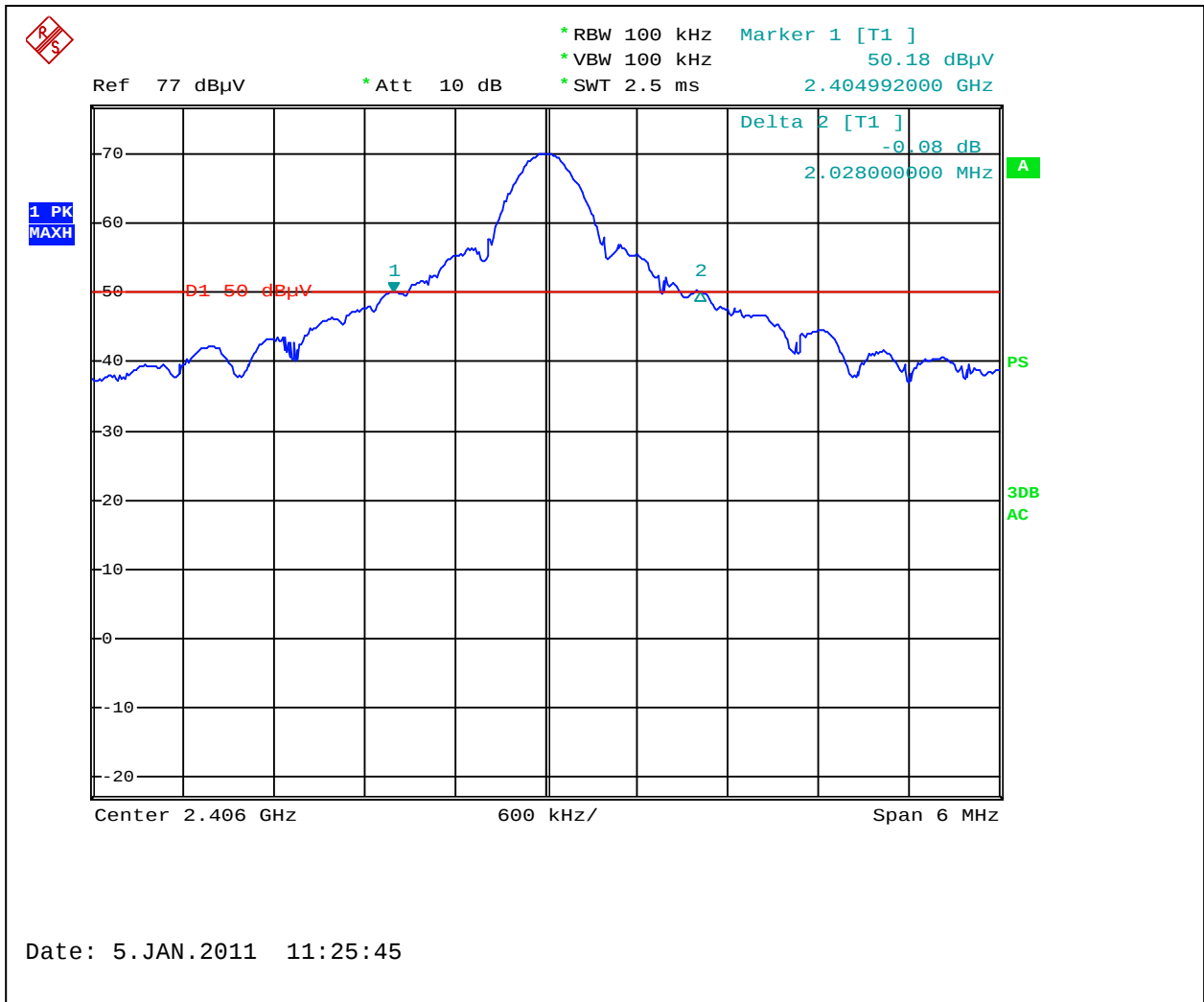
3.2 Bandwidth of Emissions

Center Frequency of operation MHz	Measured 20dB bandwidth MHz	Measured 99% bandwidth MHz
2406	2.028	2.940
2440	2.088	2.932
2477	2.316	2.976

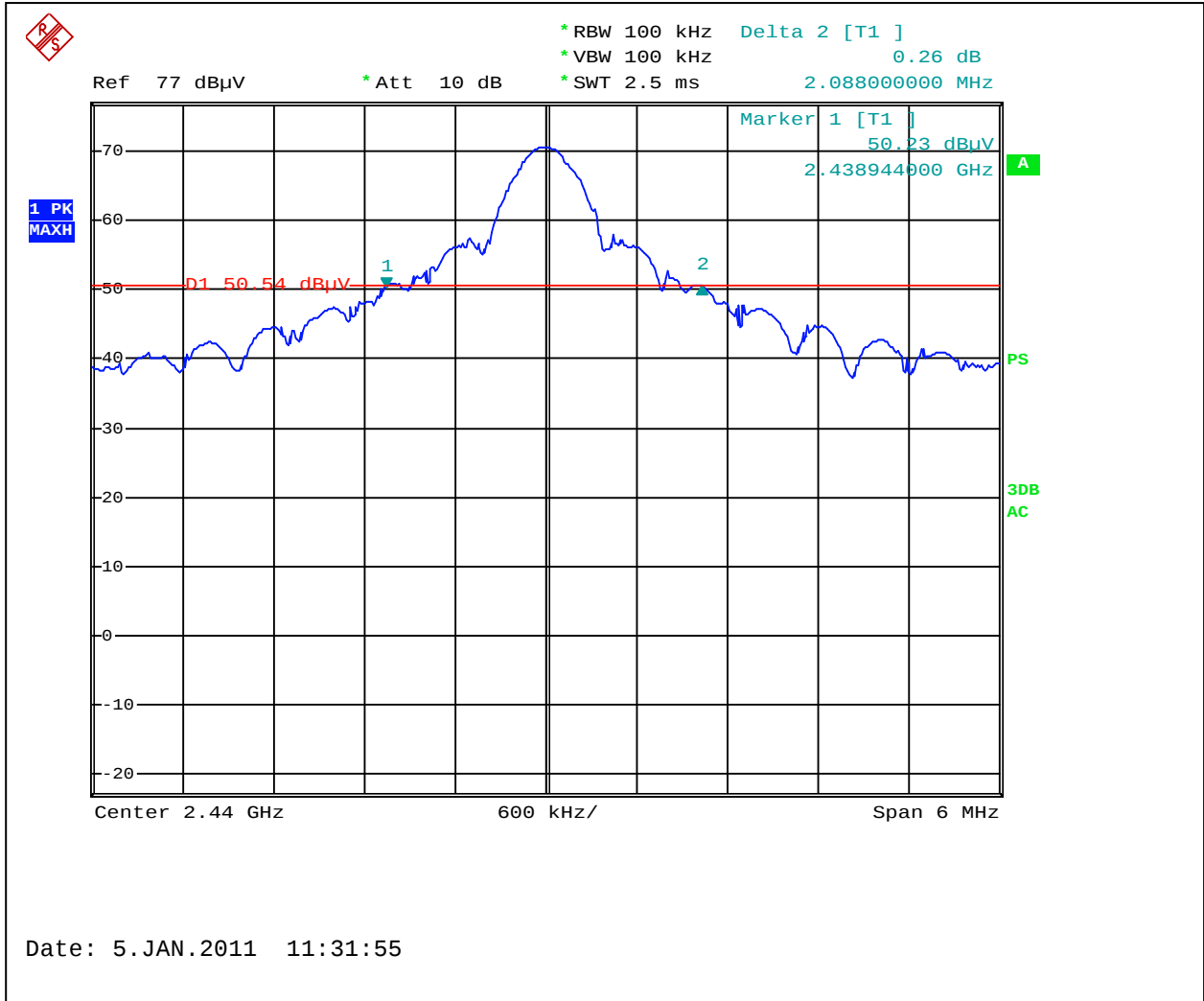
Graphs from 3-2-1 to 3-2-6 are show bandwidth of emissions

Notes: The bandwidth of emissions is contained within the frequency band of operation

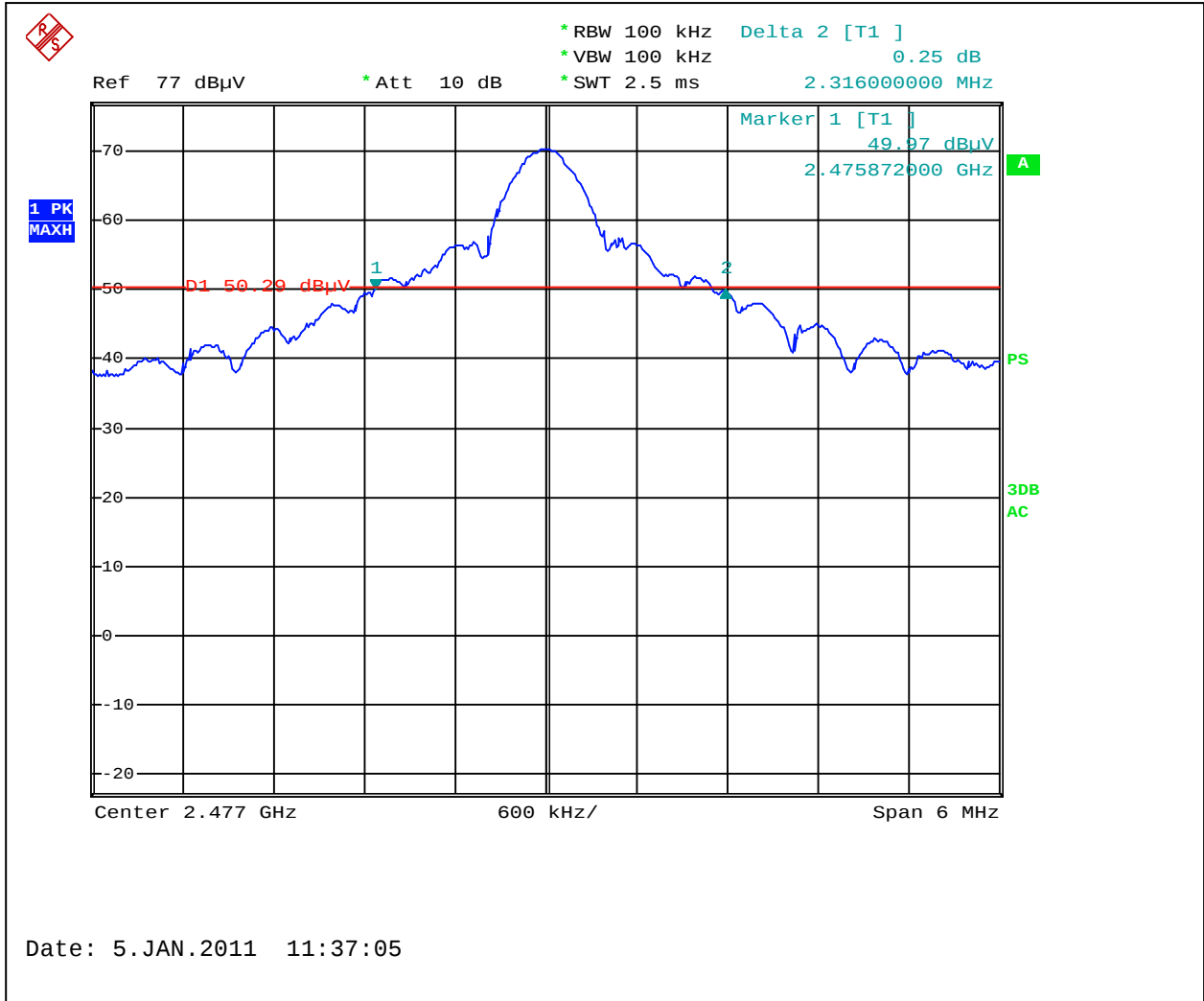
Graph 3.2.1



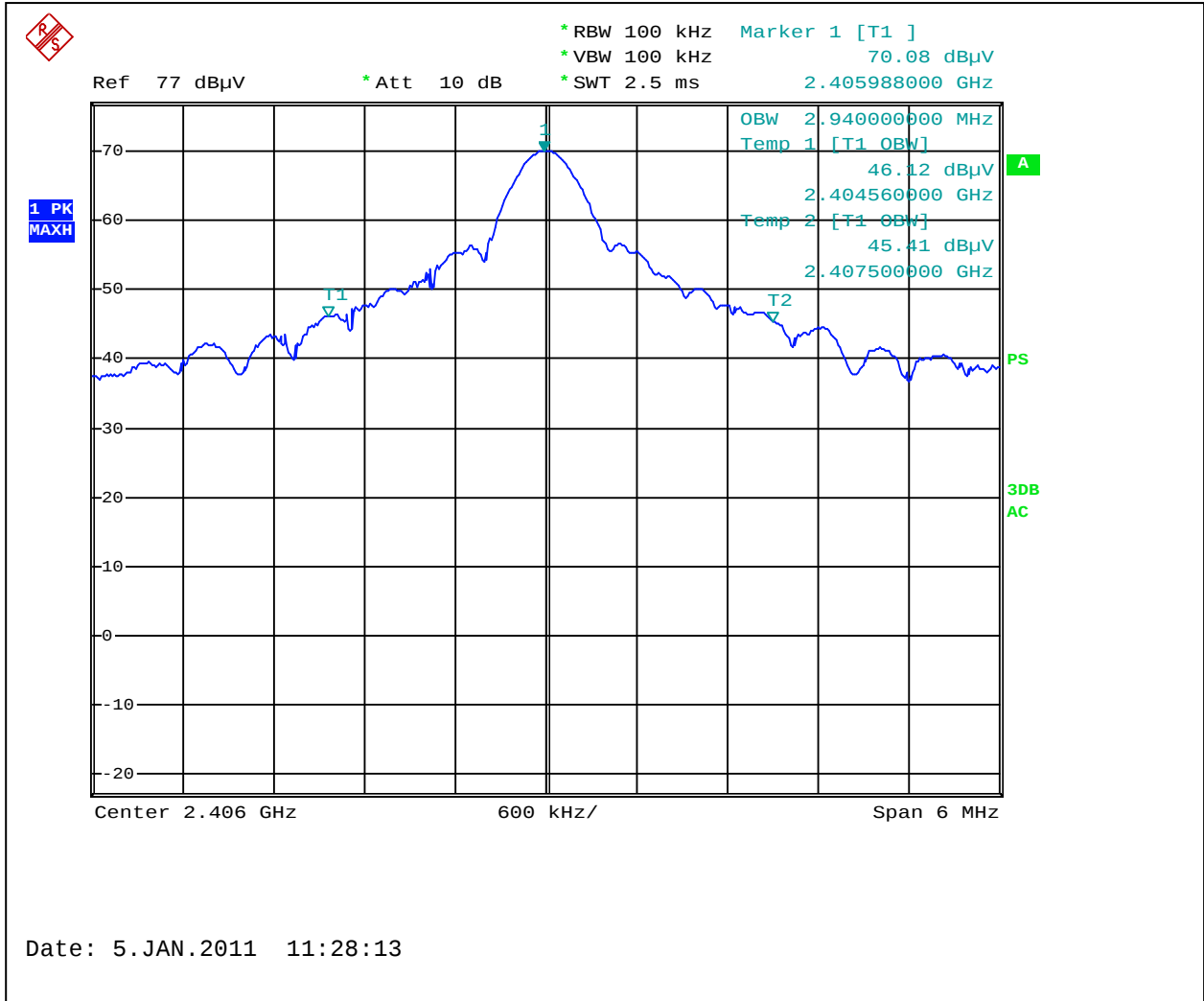
Graph 3.2.2



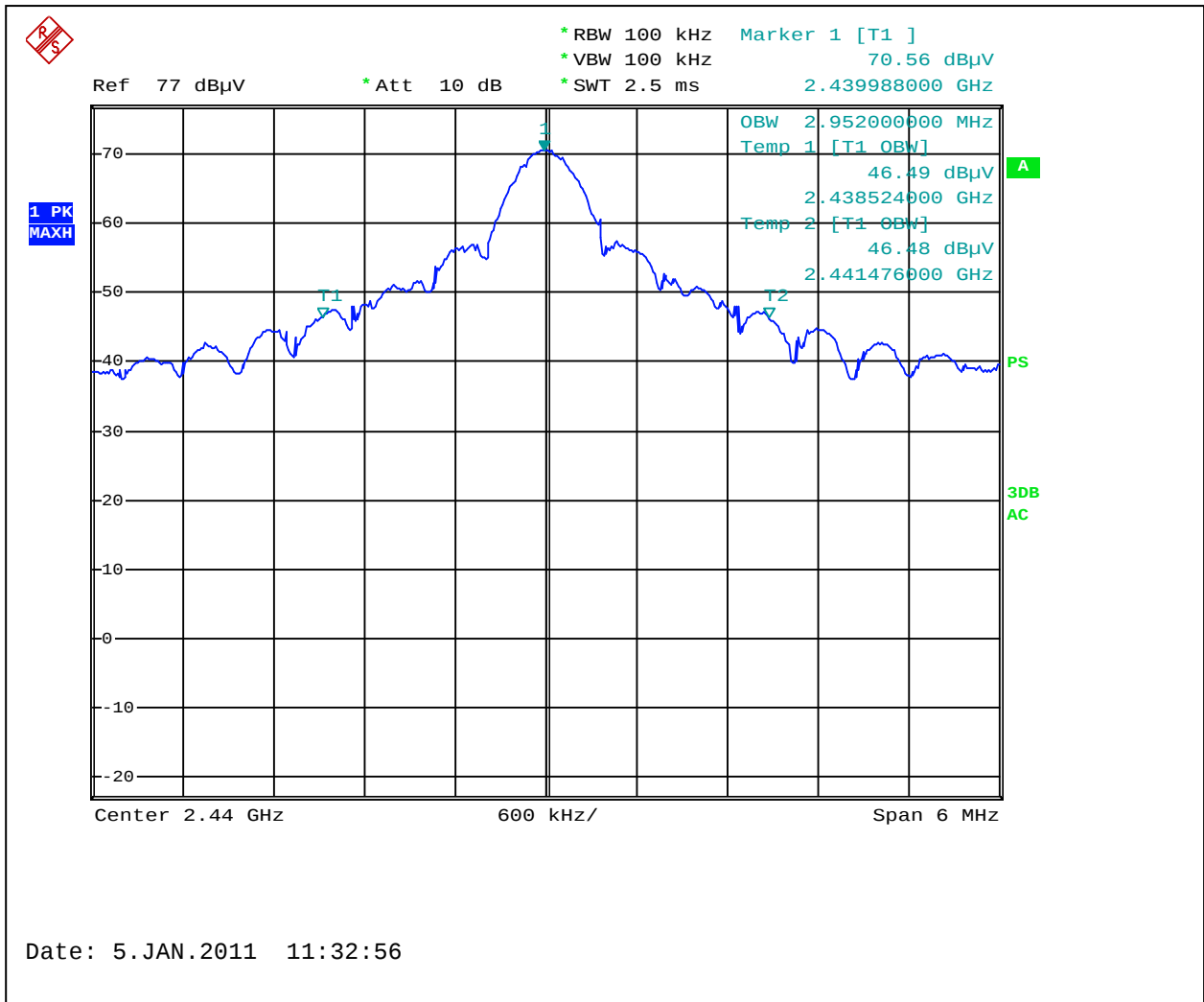
Graph 3.2.3



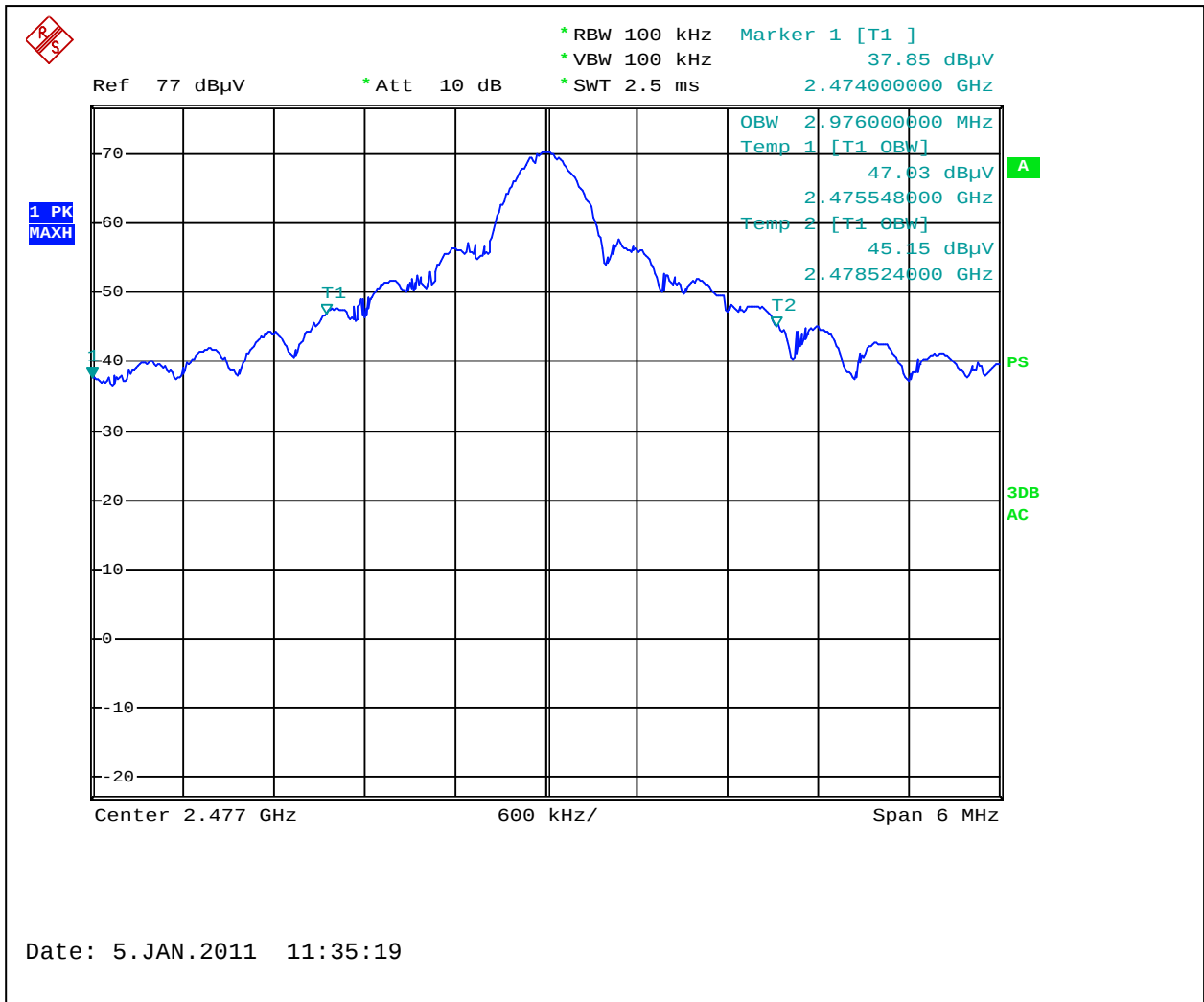
Graph 3.2.4



Graph 3.2.5



Graph 3.2.6





3.3 Transmitter power line conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 16.5dB below the limits

Notes: None

Date:	January 6, 2011	Result: Pass
Standard:	FCC 15.207	
Tested by:	Norman Shpilsher	
Test Point:	Power Line	
Operation mode:	See Page 5	
Note:		

Table 3.3.1

Line 1

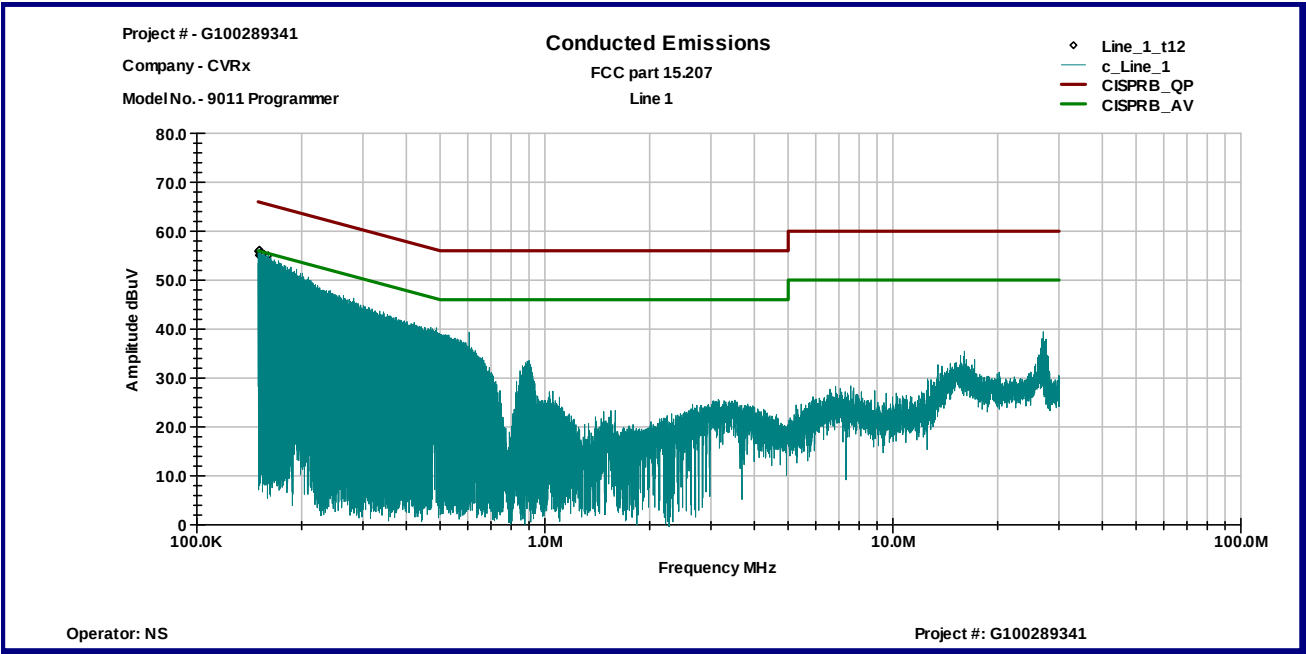
Frequency	QP dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
150.94 KHz	48.9	20.0	66.0	56.0	-17.1	-36.0
171.09 KHz	46.8	18.6	64.9	54.9	-18.1	-36.3
204.6 KHz	43.1	23.0	63.4	53.4	-20.4	-30.5
491.69 KHz	30.9	11.5	56.1	46.1	-25.2	-34.6
500.69 KHz	30.5	9.6	56.0	46.0	-25.5	-36.4
881.36 KHz	24.3	7.8	56.0	46.0	-31.7	-38.2
27.226 MHz	31.1	21.7	60.0	50.0	-28.9	-28.3

Line 2

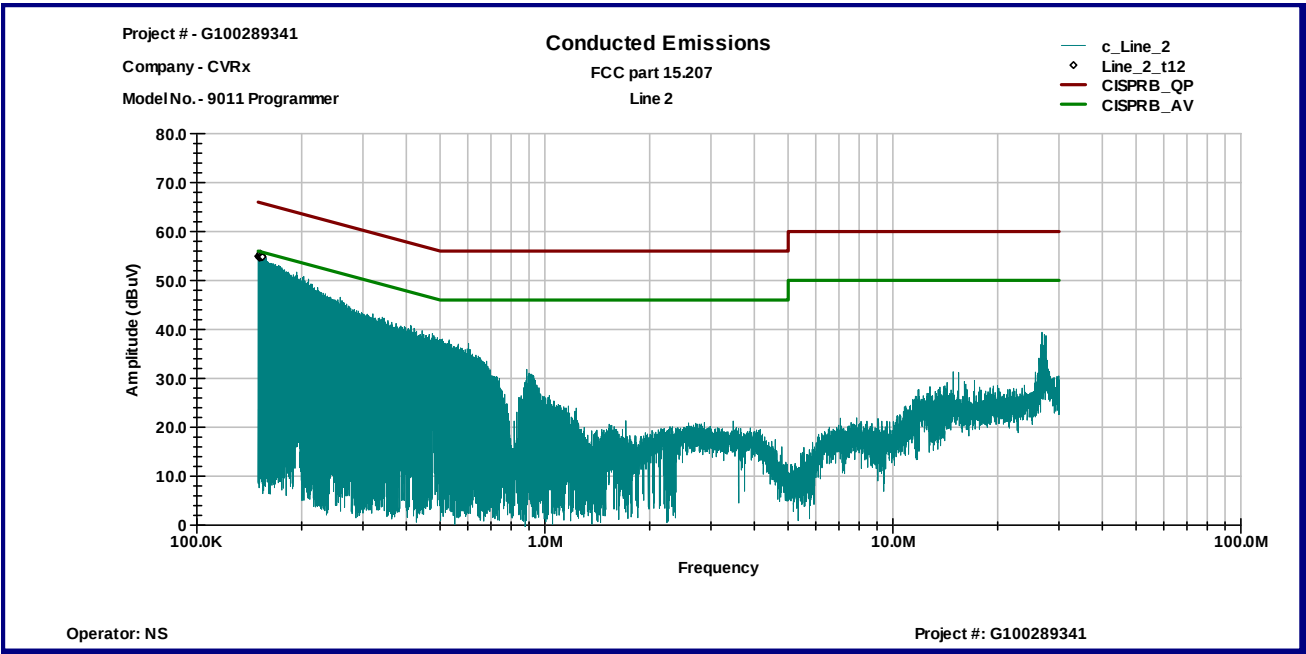
Frequency	QP dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
150.71 KHz	49.5	20.5	66.0	56.0	-16.5	-35.5
169.08 KHz	47.1	19.1	65.0	55.0	-17.9	-36.0
210.94 KHz	43.0	21.1	63.2	53.2	-20.1	-32.1
478.86 KHz	31.5	14.5	56.4	46.4	-24.9	-31.8
517.01 KHz	30.2	11.9	56.0	46.0	-25.9	-34.1
902.72 KHz	22.6	8.1	56.0	46.0	-33.4	-37.9
27.242 MHz	31.0	21.8	60.0	50.0	-29.0	-28.2

Graph 3.4.1

Line 1



Line 2





3.4 Receiver/digital device radiated emissions

Test location: ☐ OATS ☒ Anechoic Chamber

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Frequency range: 30MHz-1300MHz

Max. Emissions margin: 6.1dB below the limits

Notes: The Radiated Emissions test was performed in the Anechoic chamber at 3m measurement distance (see Tables 3.4.1, 3.4.2 and Graphs 3.4.1 to 3.4.2)

Date:	January 6, 2011	Result: Pass
Standard:	FCC Part 15.109, Class B	
Tested by:	Uri Spector	
Test Point:	Enclosure	
Operation mode:	Standby mode/Receiver mode	
Note:		

Table 3.4.1

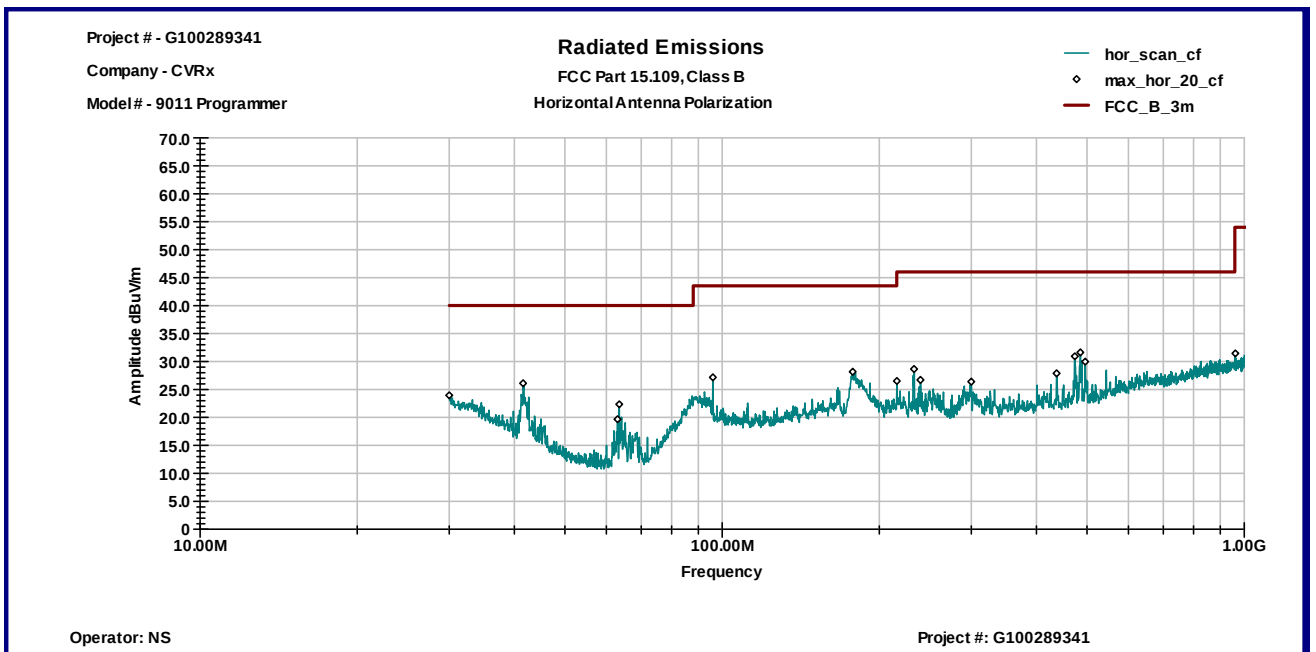
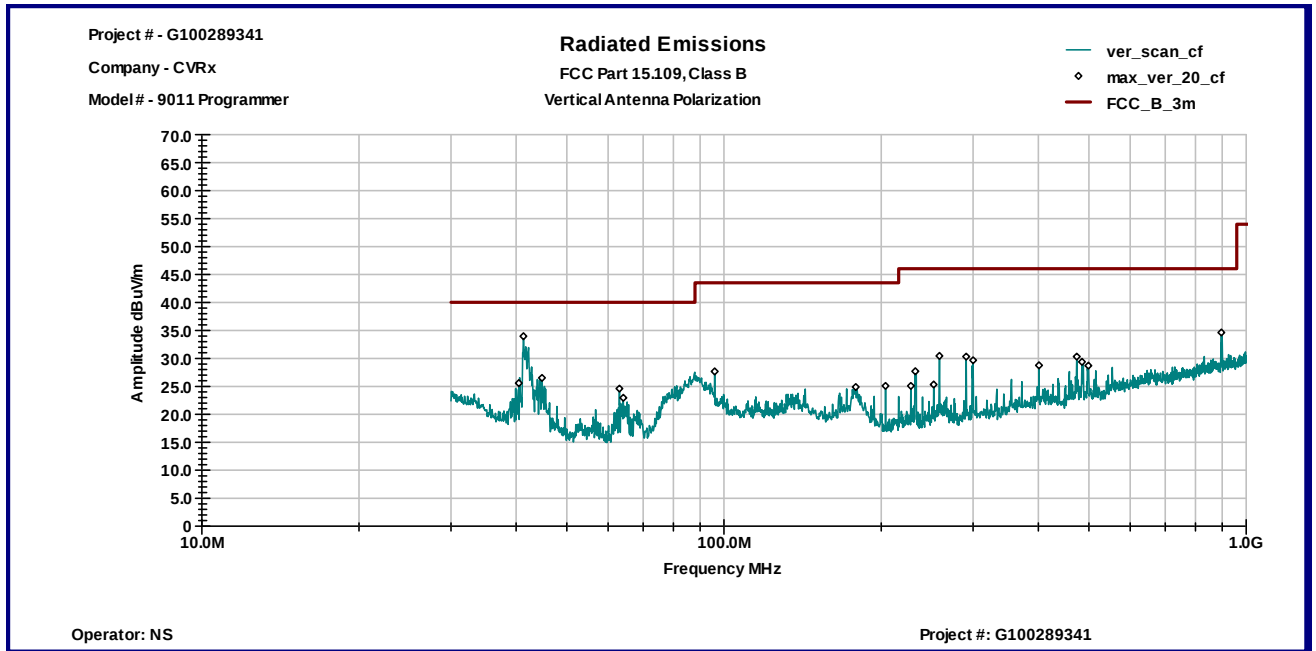
Frequency	Ant. Polarity	Peak Reading dBμV	Ant.Factor dB1/m	Total at 3m dBμV/m	QP Limit dBμV/m	Margin dB
40.459 MHz	V	11.1	14.5	25.6	40.0	-14.4
41.29 MHz	V	19.9	14.1	34.0	40.0	-6.1
44.823 MHz	V	14.1	12.4	26.5	40.0	-13.5
63.04 MHz	V	17.6	7.0	24.6	40.0	-15.4
95.971 MHz	V	16.1	11.6	27.7	43.5	-15.9
178.79 MHz	V	13.7	11.2	24.9	43.5	-18.7
203.87 MHz	V	12.9	12.2	25.1	43.5	-18.5
232.48 MHz	V	14.5	13.2	27.7	46.0	-18.3
252.1 MHz	V	10.3	15.0	25.3	46.0	-20.7
258.53 MHz	V	14.6	15.9	30.4	46.0	-15.6
291.0 MHz	V	14.6	15.7	30.3	46.0	-15.7
300.0 MHz	V	13.7	15.9	29.6	46.0	-16.4
401.13 MHz	V	9.7	19.1	28.7	46.0	-17.3
473.86 MHz	V	10.0	20.3	30.3	46.0	-15.7
30.0 MHz	H	3.6	20.3	23.9	40.0	-16.1
41.567 MHz	H	12.1	14.0	26.1	40.0	-13.9
63.04 MHz	H	12.7	7.0	19.7	40.0	-20.3
63.525 MHz	H	15.4	7.0	22.3	40.0	-17.7
95.971 MHz	H	15.6	11.6	27.1	43.5	-16.4
177.83 MHz	H	17.0	11.2	28.2	43.5	-15.4
216.09 MHz	H	14.5	12.0	26.5	46.0	-19.5
233.13 MHz	H	15.4	13.3	28.6	46.0	-17.4
239.88 MHz	H	12.7	14.0	26.7	46.0	-19.3
300.0 MHz	H	10.4	15.9	26.4	46.0	-19.7
437.15 MHz	H	8.4	19.5	27.9	46.0	-18.2
473.86 MHz	H	10.6	20.3	30.9	46.0	-15.1
485.63 MHz	H	11.1	20.6	31.6	46.0	-14.4
496.02 MHz	H	9.3	20.7	30.0	46.0	-16.1



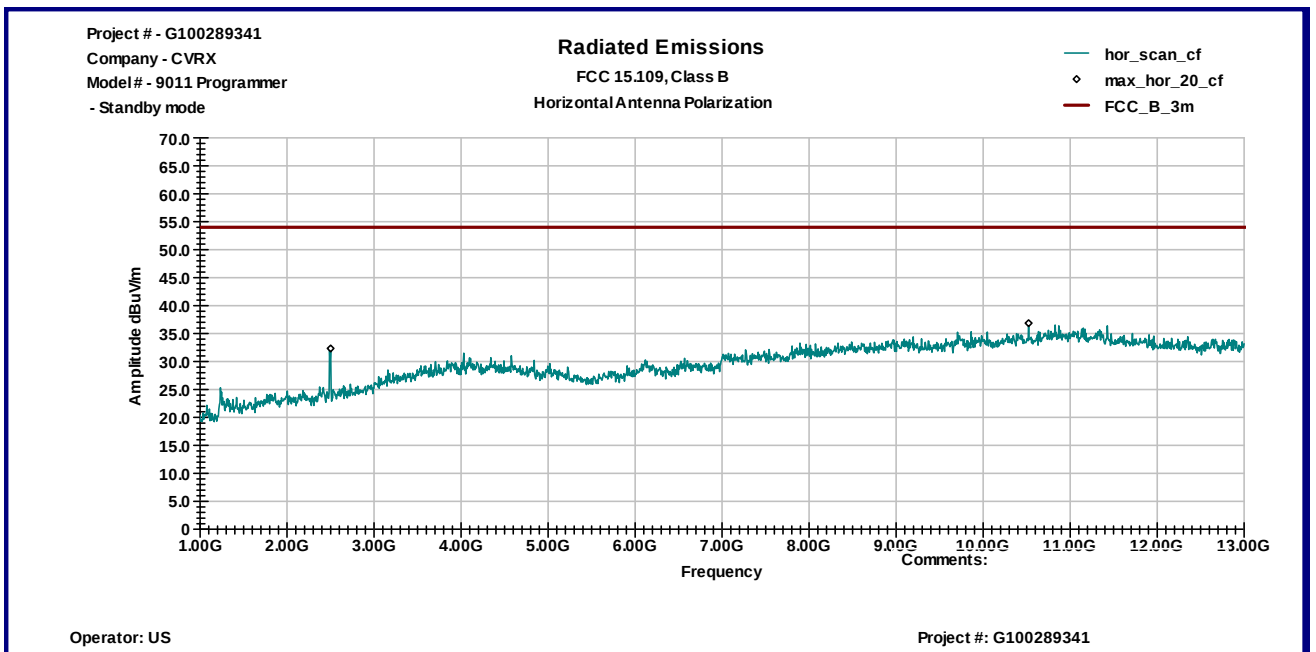
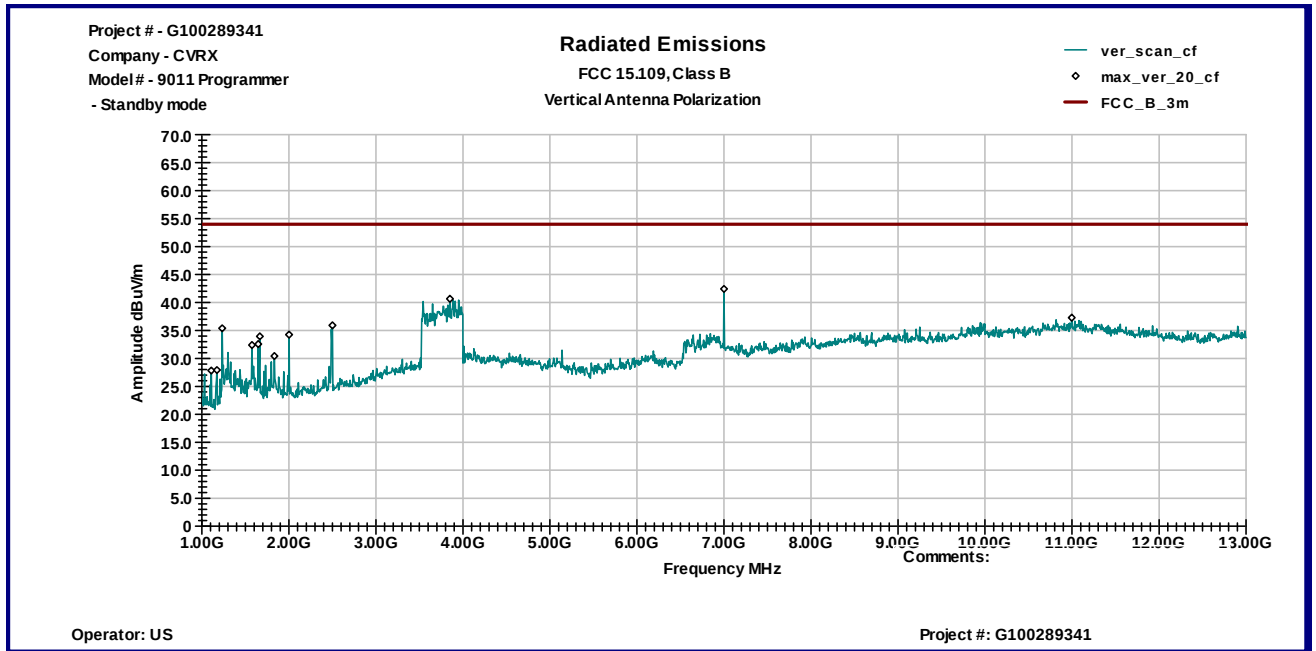
Table 3.4.2

Frequency MHz	Antenna Polarity	Reading dB μ V	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dB μ V/m	QP Limit dB μ V/m	Margin dB
1.108 GHz	V	40.1	26.7	38.9	27.8	54.0	-26.2
1.174 GHz	V	39.9	26.9	38.9	27.9	54.0	-26.1
1.234 GHz	V	47.2	27.1	38.9	35.4	54.0	-18.6
1.576 GHz	V	42.8	28.4	38.8	32.4	54.0	-21.6
1.648 GHz	V	42.5	28.8	38.8	32.5	54.0	-21.4
1.666 GHz	V	43.8	28.9	38.7	33.9	54.0	-20.1
1.834 GHz	V	39.3	29.7	38.5	30.4	54.0	-23.6
2.002 GHz	V	42.1	30.5	38.3	34.2	54.0	-19.7
2.5 GHz	V	41.6	32.1	37.8	35.9	54.0	-18.1
3.85 GHz	V	41.3	36.6	37.2	40.6	54.0	-13.3
7.0 GHz	V	37.9	41.3	36.8	42.4	54.0	-11.6
2.5 GHz	H	37.8	32.2	37.8	32.3	54.0	-21.7

Graph 3.4.1



Graph 3.4.2





3.5 Digital device conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 16.7dB below the limits

Notes: None

Date:	January 6, 2011	Result: Pass
Standard:	FCC 15.107, Class B	
Tested by:	Uri Spector	
Test Point:	Power Line	
Operation mode:	Standby mode	
Note:		

Table 3.5.1

Line 1

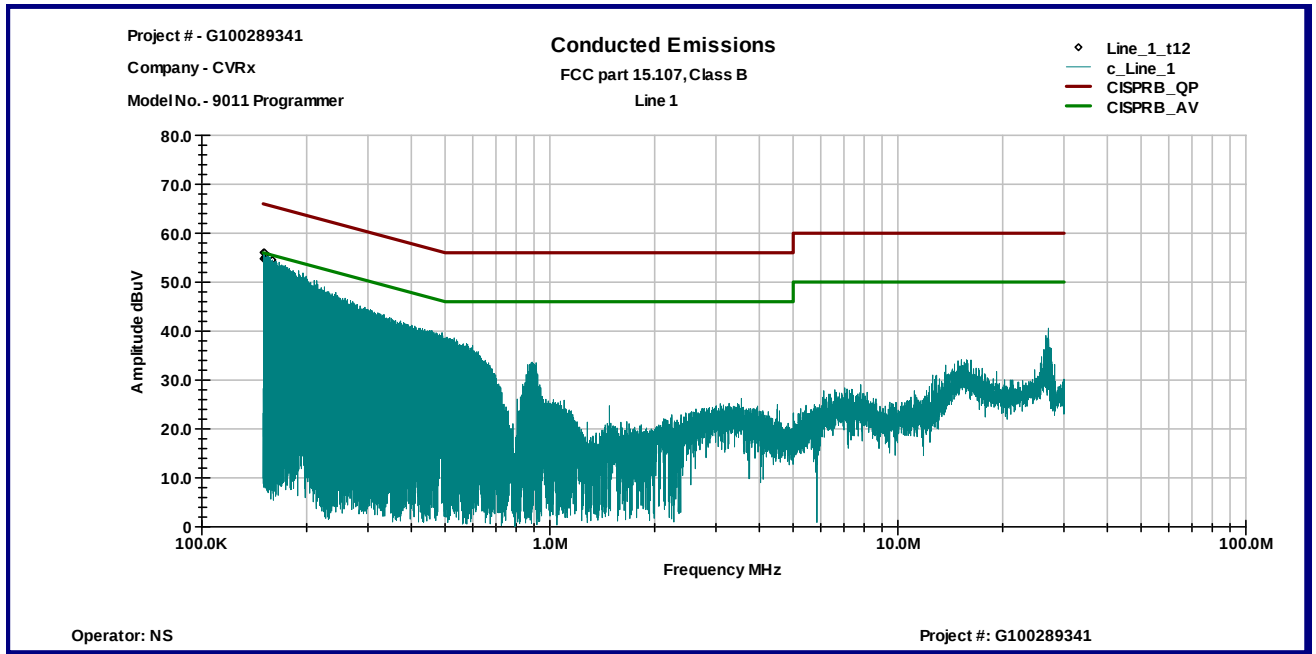
Frequency	QP dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
153.84 KHz	48.3	19.7	65.8	55.8	-17.5	-36.1
166.19 KHz	46.5	18.7	65.2	55.2	-18.7	-36.5
216.61 KHz	41.6	15.9	63.0	53.0	-21.3	-37.1
480.68 KHz	30.8	11.7	56.3	46.3	-25.5	-34.6
519.58 KHz	29.7	10.1	56.0	46.0	-26.3	-35.9
889.38 KHz	24.5	8.2	56.0	46.0	-31.5	-37.8
26.491 MHz	29.7	23.6	60.0	50.0	-30.3	-26.5

Line 2

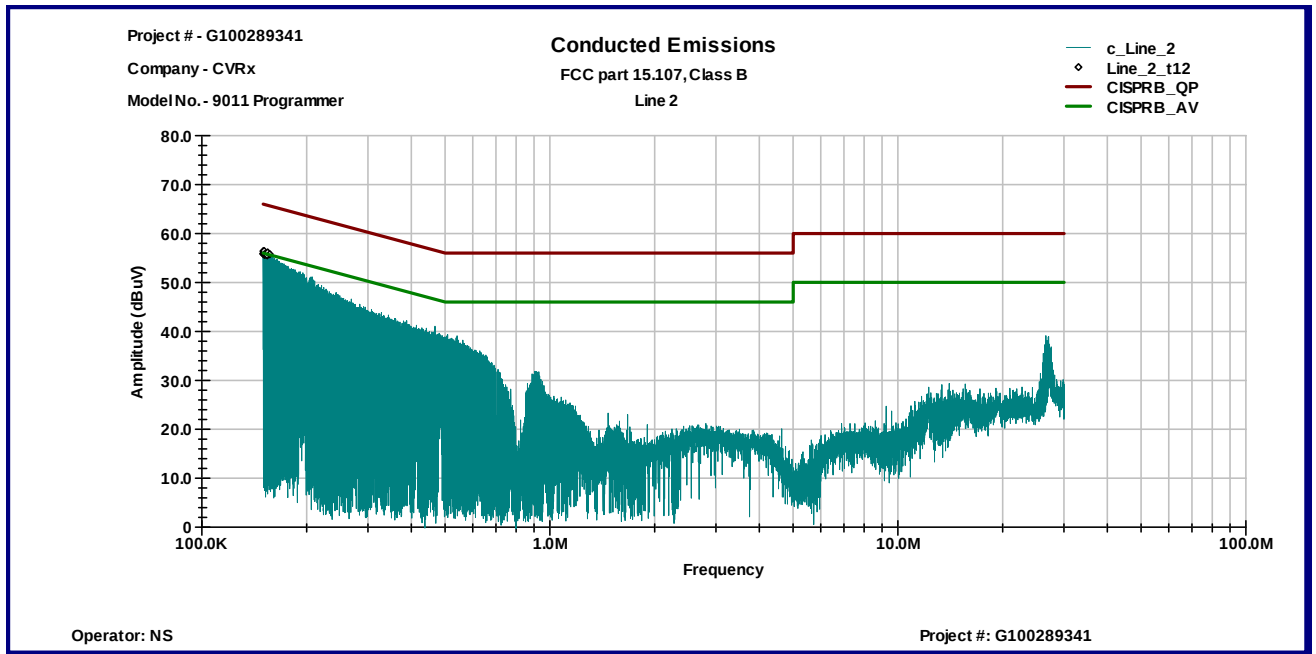
Frequency	QP dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
150.47 KHz	49.3	20.7	66.0	56.0	-16.7	-35.3
166.9 KHz	46.8	18.7	65.1	55.1	-18.3	-36.4
206.55 KHz	42.9	22.9	63.3	53.3	-20.4	-30.5
499.61 KHz	29.8	10.2	56.0	46.0	-26.2	-35.8
512.31 KHz	29.8	11.9	56.0	46.0	-26.3	-34.1
885.27 KHz	21.1	7.6	56.0	46.0	-34.9	-38.4
26.955 MHz	29.1	21.9	60.0	50.0	-31.0	-28.1

Graph 3.6.1

Line 1



Line 2





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	☒
Spectrum Analyzer	R & S	ESCI	100358	12909	07/12/2011	☒
Bicono-Log Antenna	Schaffner-Chase	CBL 6112 B	2468	14459	10/18/2011	☒
Horn Antenna	EMCO	3115	9507-4513	9936	04/13/2011	☒
Horn Antenna	EMCO	3115	6579	15580	04/29/2011	☒
Waveguide Horn Antenna	EMCO	3116	9904-2423	9705	10/04/2011	☒
LISN	Fischer Custom Communications	FCC-LISN-2 MOD.SD	316	9945	03/11/2011	☒
High Pass Filter	Reactel	7HS-4G-S12	0223	015274	VBV	☒
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1122951	13475	10/06/2011	☒
Pre-Amplifier	MITEQ	AMF-6F-26004000-40-8P	13224444	MIN-0064	10/06/2011	☒
System	TILE! Instrument Control		Ver. 3.4.K.29	15259	VBV	☒