



TEST REPORT

Report Number: 100511823MIN-001

Rev 1.1

Project Number: G100511823

Testing performed on the
2102 IPG

FCC ID: SVHBAROSTIMIPG1
Industry Canada ID: 9464A-IPG210A

to
47 CFR Part 95 Subpart I:2013
RSS- 243, Issue 3, November 2010
47 CFR, Part 15:2013, §15.109, Class B

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1.0 GENERAL DESCRIPTION

Model:	2102 IPG
Type of EUT:	Implantable Pulse Generator
Serial Number:	3
FCC ID:	SVHBAROSTIMIPG1
Industry Canada ID:	9464A-IPG210A
Related Submittal(s) Grants:	N/A
Company:	CVRx Inc.
Customer:	Dan Kollman
Address:	9201 West Broadway Avenue, Suite 650 Minneapolis, MN 55445
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Test Standards:	☒ 47 CFR, Part 95 Subpart I: 2013 ☒ RSS-243, Issue 3, November 2010 ☐ RSS-Gen, Issue 2, 2007 ☒ 47 CFR, Part 15:2013, §15.109, Class B ☐ Other
Type of radio:	☒ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	October 13, 2011
Test Work Started:	October 13, 2011
Test Work Completed:	October 17, 2011
Test Sample Conditions:	☐ Damaged ☐ Poor (Usable) ☒ Good



1.1 Product Description; Test Facility

Product Description:	Implantable Pulse Generator
Operating Frequency	403.3MHz
Modulation:	FSK
Emission Designator:	234KF1D
Antenna(s) Info:	-25dBi Integral antenna
Antenna Installation:	☐ User ☐ Professional ☒ Factory
Transmitter power configuration:	☒ Internal battery ☐ External power source ☐ 120VAC ☐ 230VAC ☐ 400VAC ☒ 3.25VDC ☐ Other: ☐ 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 / TIA 603-C

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 EUT was wired to transmit continuously at 403.3MHz

Cables:

No.	Type	Length	Designation	Note
1	Carotid sinus leads	1.5ft.	Patient leads	

Support equipment/Services:

No.	Item	Description
1	9011 Programmer	Remote Monitoring System
2	Human Body Torso simulator	

General notes: None

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

☒ **Extreme**

☒ Temperature:	+25 to +45 ° C
☐ Temperature:	-20 to +55 ° C
☒ DC power:	± 10%
☐ Battery:	0.85 -1.15 times

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).

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

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

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

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

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

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

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

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
FCC §2.1046 / FCC §95.639(f) / RSS-243 Section 5.4	Effective Radiated Power at Fundamental	Pass
FCC §2.1049 / FCC §95.633(e) / RSS-243 Section 5.1	Bandwidth of the emission	Pass
FCC §2.1053 / FCC §95.635 / RSS-243 Sections 5.5, 5.6	Radiated Spurious Emissions	Pass
FCC §2.1055 / FCC §95.627(e) / RSS-243 Sections 5.3	Frequency Error	Pass
FCC Part 15.109/ICES-003	Receiver/digital device radiated emissions	Pass
FCC §95.627(a)(1-4) / RSS-243 Sections 5.7	The MedRadio Communication Sessions (Threshold Power Levels, Monitoring System Bandwidth, Scan Cycle Time, Minimum Channel Monitoring Period, Channel Access, Discontinuation of a MedRadio Session, and Use of Pre-Scanned Alternate Channel)	N/A (See note below)

Note: The Implantable Pulse Generator does not initiate telemetry, therefore the MedRadio Communication sessions evaluation is unnecessary.



3.0 TEST CONDITIONS AND RESULTS

3.1 Effective Radiated Power at Fundamental

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☐ 10 meters ☒ 3 meters

Frequency range of measurements: 403.30MHz

Test result: Pass

Max. Emissions margin at fundamental: 23.5dB below the limits

Notes: Per FCC 95.627 (g)(3), the maximum effective radiated power measurement was determined by measuring radiated field from the equipment under test at 3m distance.
The equivalent radiated field strength at 3 meters for 25μW is 18.2mV/meter at 3m test distance (85.2dBμV/m at 3m).



Date:	October 13, 2011	Result: Pass
Standard:	FCC 95 Subpart I / RSS-243	
Tested by:	Uri Spector	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	None	

Table 3.1

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)								
403.30	V	100	16.7	2.3	0.0	42.7	61.7	85.2	-23.5	
403.30	H	155	16.7	2.3	0.0	40.1	59.1	85.2	-26.1	

Comments: Measurements were taken using an Peak reading at RBW 300kHz, VBW 1MHz



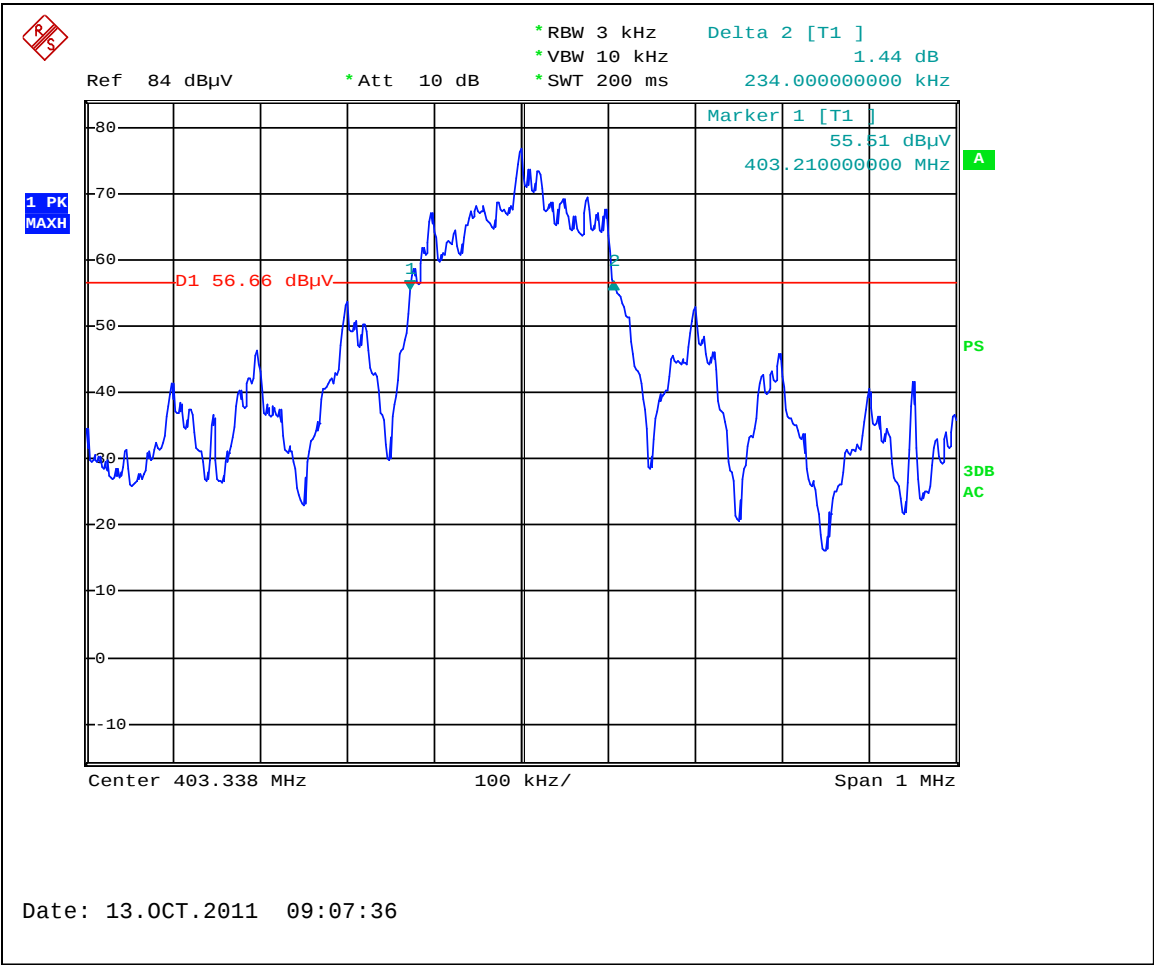
3.2 Bandwidth of Emissions

Center Frequency of operation MHz	Measured 20dB bandwidth kHz	Maximum bandwidth allowed kHz
403.3	234	300

Graph 3.2.1 shows bandwidth of emissions

Notes: None

Graph 3.2.1





3.3 Radiated Spurious Emissions

Test location: ☐ OATS ☒ Anechoic Chamber

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Frequency range: 30MHz-5000MHz

Max. Emissions margin: 6.9dB below the limits

Notes: The Radiated Spurious Emissions test was performed in the Anechoic chamber at 3m measurement distance (see Tables 3.3.1, 3.3.2 and Graphs 3.3.1. 3.3.2).

Date:	January 7, 2011	Result: Pass
Standard:	FCC Part 95 Subpart I / RSS-243	
Tested by:	Uri Spector	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	The fundamental frequency was removed from the table	

Spurious emissions more than 250 kHz removed from the MedRadio band (402-405MHz) at 3 meters test distance must not exceed 40dB μ V/m in the range from 30-88 MHz, 43.5 from 88-216 MHz, 46dB μ V/m from 216-960 MHz and 54dB μ V/m above 960 MHz.

Emissions within 250kHz of the MedRadio band must be attenuated by at least 20dB below the maximum permitted output power, using an instrument resolution bandwidth approximately equal to 1% of the emissions bandwidth.

Emissions within the MedRadio band more than 150kHz away from the center frequency of the spectrum the transmission is intended to occupy, will be attenuated below the transmitter output power by at least 20dB, using an instrument resolution bandwidth approximately equal to 1% of the emissions bandwidth.

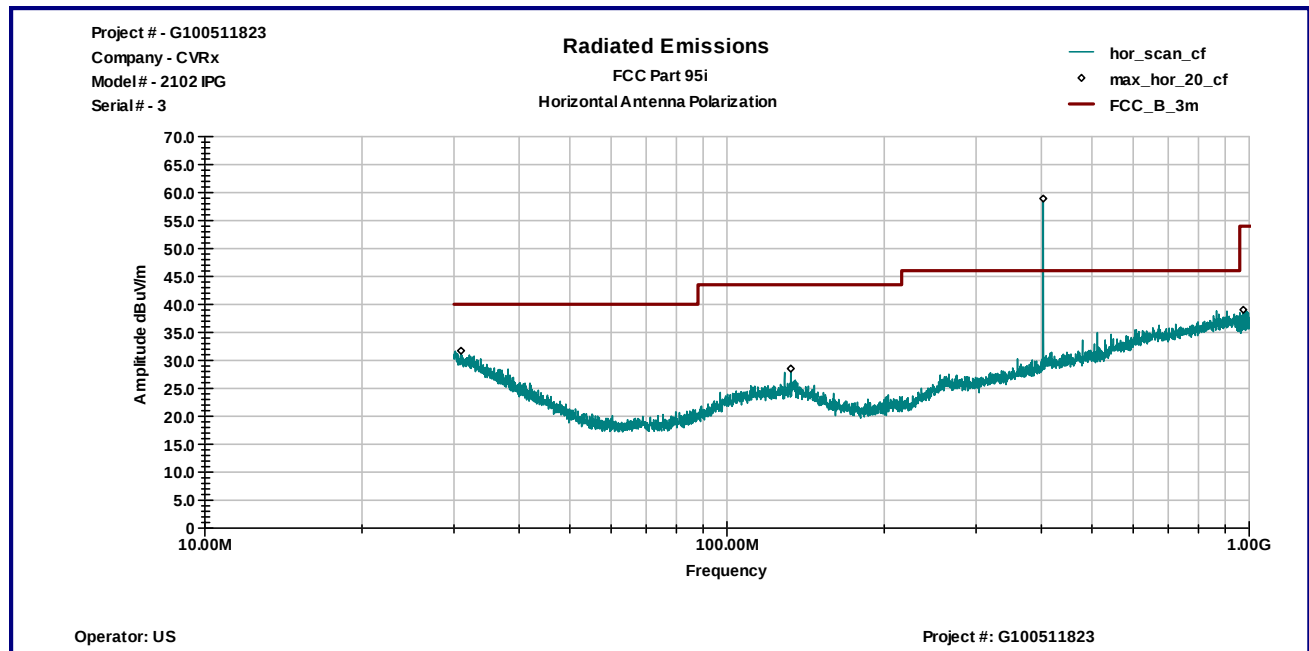
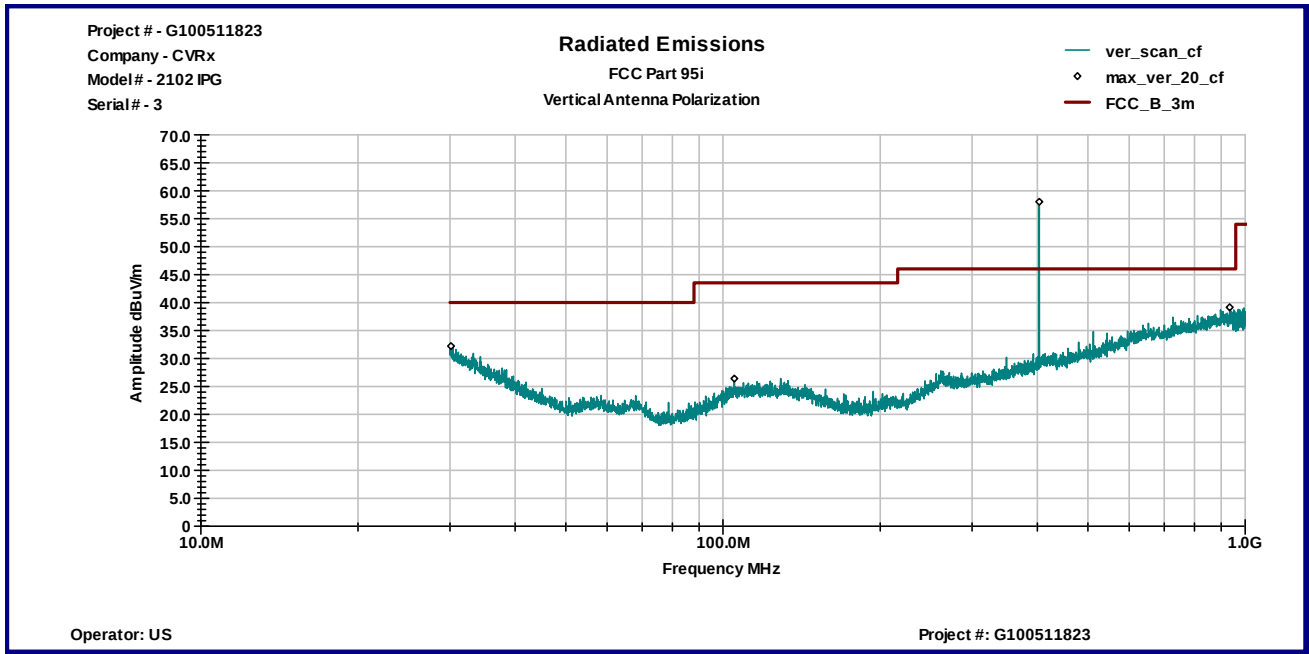
Table 3.3.1

Frequency	Ant. Polarity	Peak Reading dB μ V	Ant.Factor dB1/m	Total at 3m dB μ V/m	QP Limit dB μ V/m	Margin dB
30.14 MHz	V	12.0	20.2	32.2	40.0	-7.8
105.16 MHz	V	13.2	13.2	26.4	43.5	-17.1
934.17 MHz	V	13.5	25.7	39.1	46.0	-6.9
30.954 MHz	H	11.9	19.8	31.7	40.0	-8.3
132.5 MHz	H	14.7	13.8	28.5	43.5	-15.0
975.06 MHz	H	12.9	26.2	39.0	54.0	-15.0

Table 3.3.2

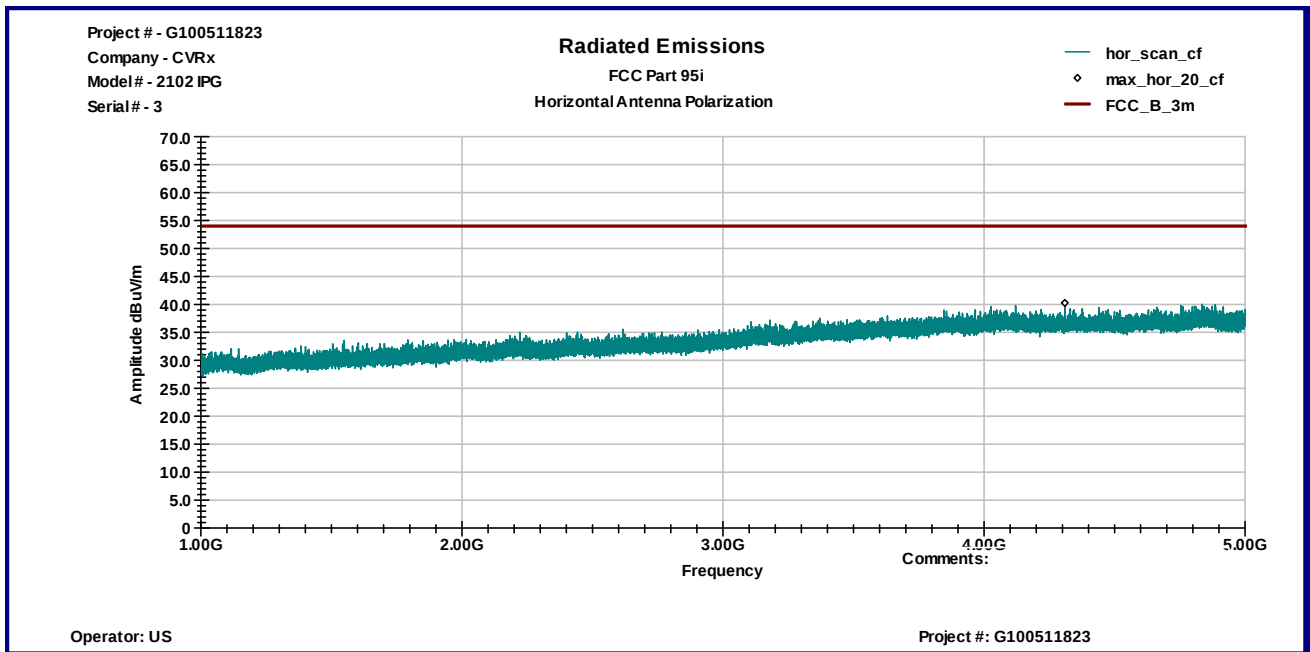
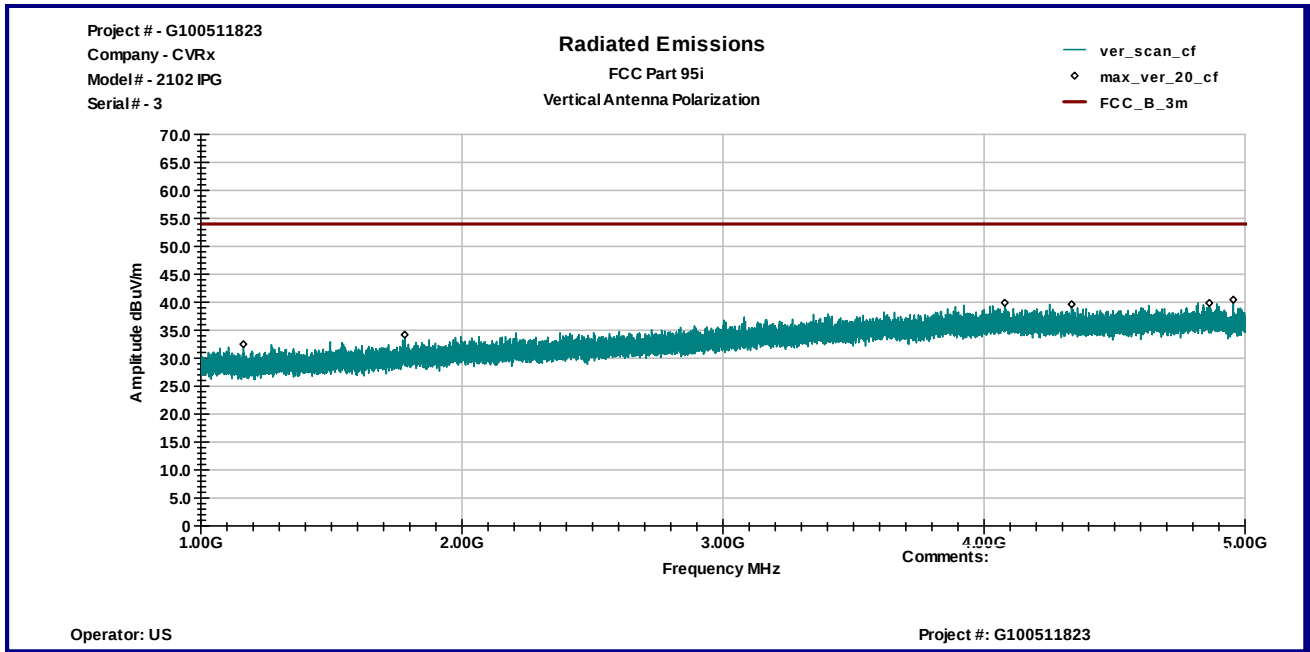
Frequency MHz	Antenna Polarity	Reading dB μ V	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dB μ V/m	QP Limit dB μ V/m	Margin dB
1.163 GHz	V	44.6	26.9	38.9	32.5	54.0	-21.5
1.7807 GHz	V	43.2	29.6	38.6	34.2	54.0	-19.8
4.0795 GHz	V	39.6	37.4	37.1	39.9	54.0	-14.1
4.3355 GHz	V	39.1	37.5	36.9	39.6	54.0	-14.4
4.8628 GHz	V	38.2	38.3	36.7	39.9	54.0	-14.1
4.9546 GHz	V	38.6	38.4	36.6	40.4	54.0	-13.5
4.3095 GHz	H	39.8	37.5	37.0	40.3	54.0	-13.7

Graph 3.3.1

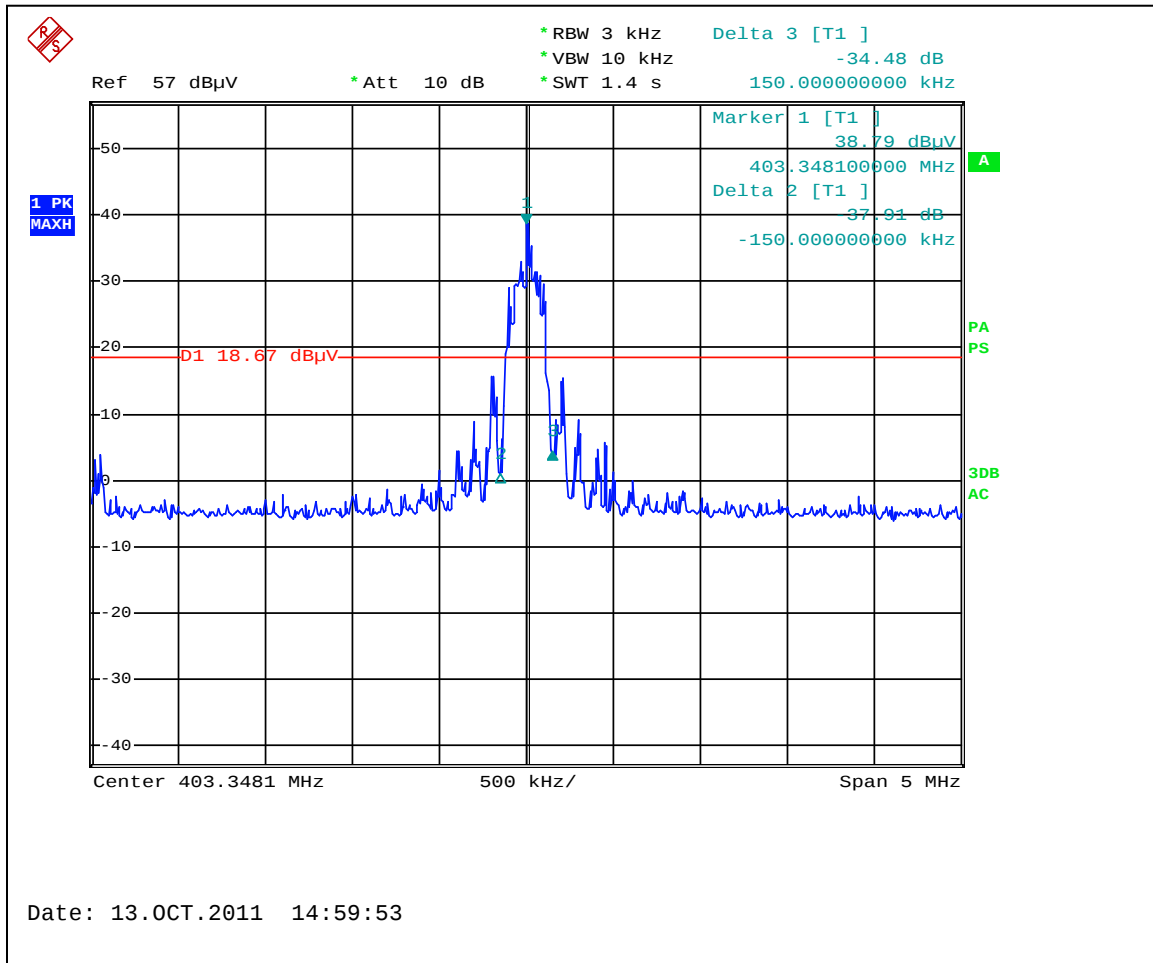




Graph 3.3.2

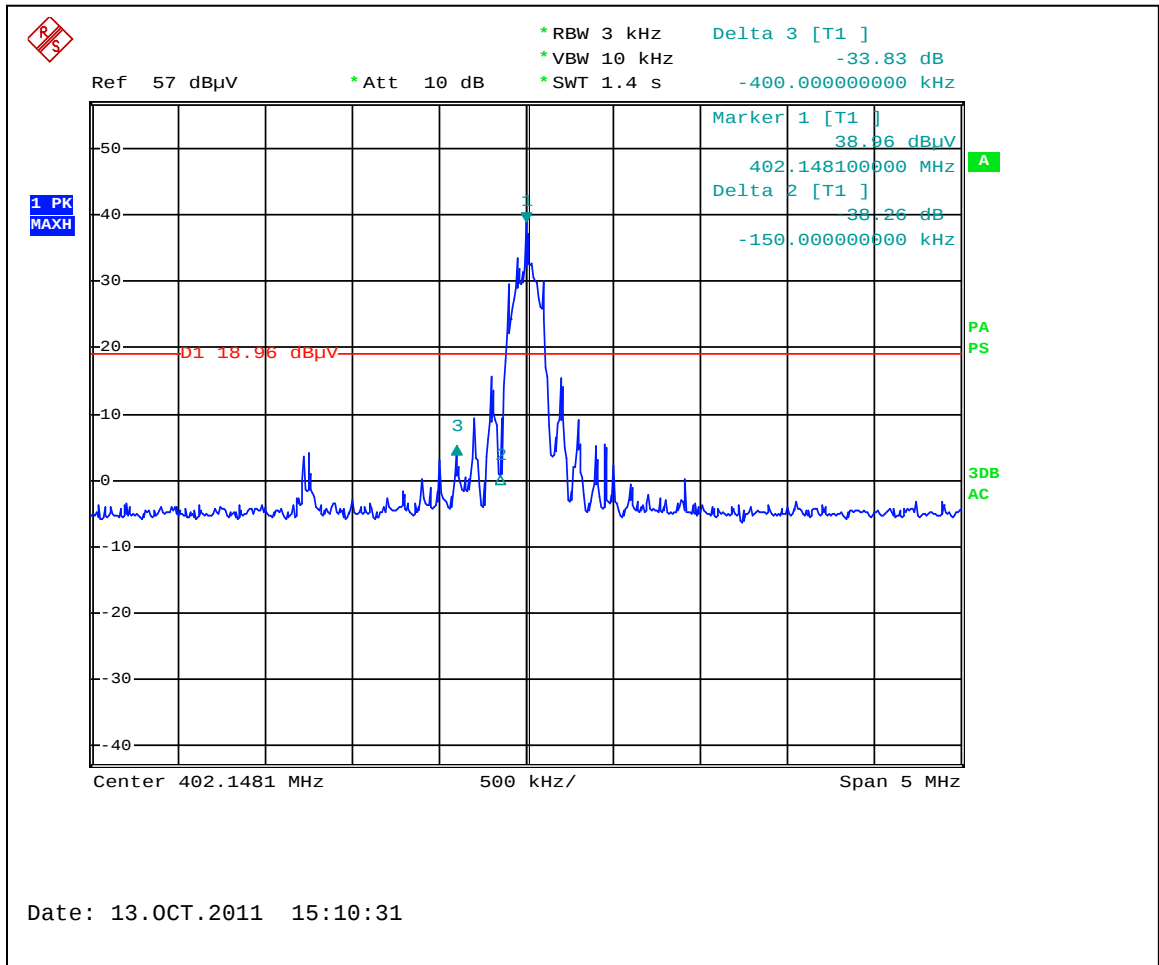


Graph 3.3.3
Emissions outside 150kHz offset from the intended frequency



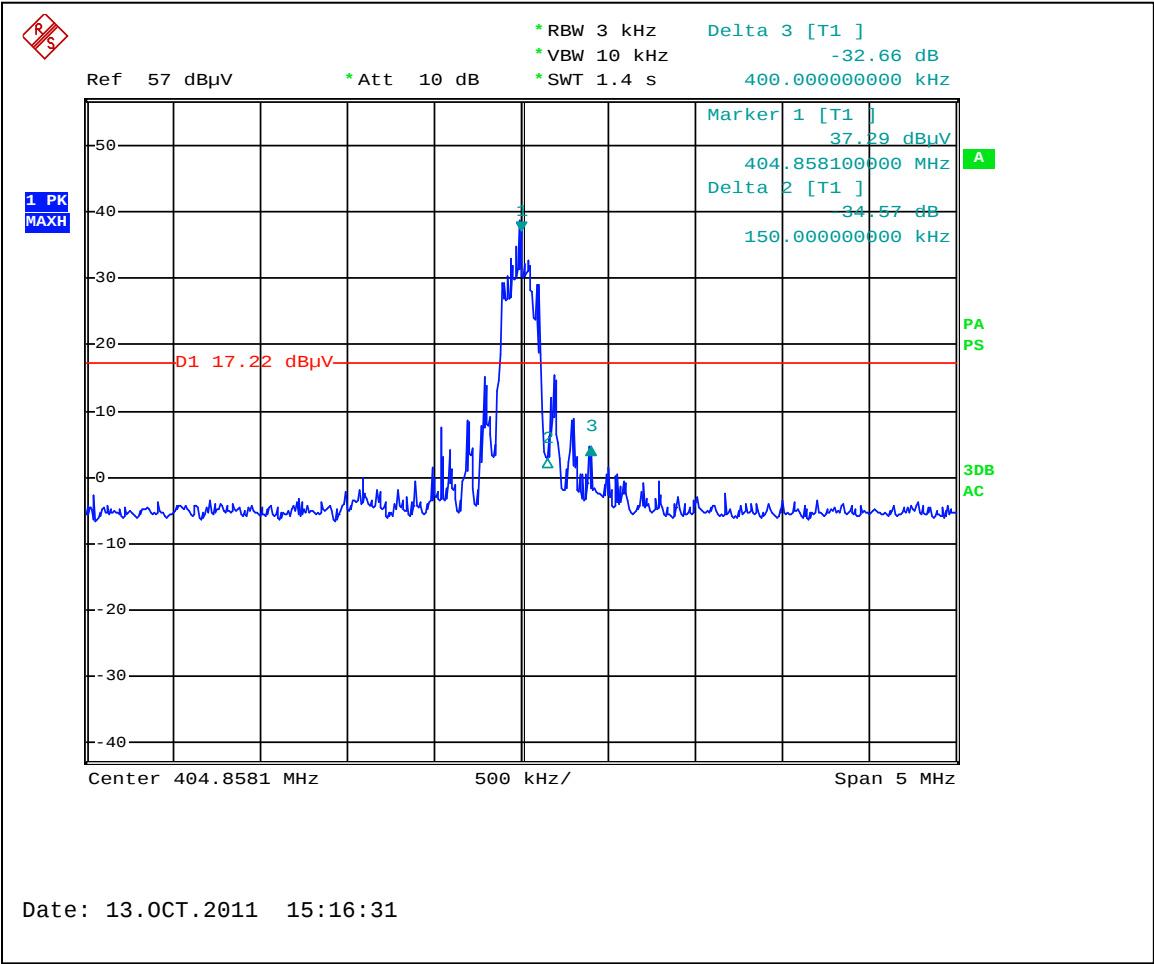


Graph 3.3.4
Lower 250kHz band edge





Graph 3.3.5
Upper 250kHz band edge



3.4 Frequency Error

Table 3.4.1

Temperature Degree C	Output Frequency MHz	Frequency Deviation kHz	Frequency Stability ppm	Frequency error limit ppm	Test Result
25	403.3496	0.0	0.0	±100	Pass
37	403.3489	0.7	1.7	±100	Pass
45	403.3481	1.5	3.7	±100	Pass

Table 3.4.2

Input Voltage V	Input Voltage Description	Output Frequency MHz	Frequency Band MHz	Test Result
3.25	Rated Voltage	403.3366	402-405	Pass
2.30	End of Service	403.3362	402-405	Pass
2.95	-10% Rated Voltage	403.3364	402-405	Pass
0.00	No Voltage	No signal	402-405	Pass

3.5 MedRadio Operation

N/A



3.6 Receiver/digital device radiated emissions

Test location: ☐ OATS ☒ Anechoic Chamber

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Frequency range: 30MHz-5000MHz

Max. Emissions margin: 7.8dB below the limits

Notes: The Radiated Emissions test was performed in the Anechoic chamber at 3m measurement distance (see Tables 3.6.1, 3.6.2 and Graphs 3.6.1 to 3.6.2).

Date:	October 14, 2011	Result: Pass
Standard:	EN 55022, Class B	
Tested by:	Uri Spector	
Test Point:	Enclosure	
Operation mode:	Standby/Receiving mode	
Note:	None	

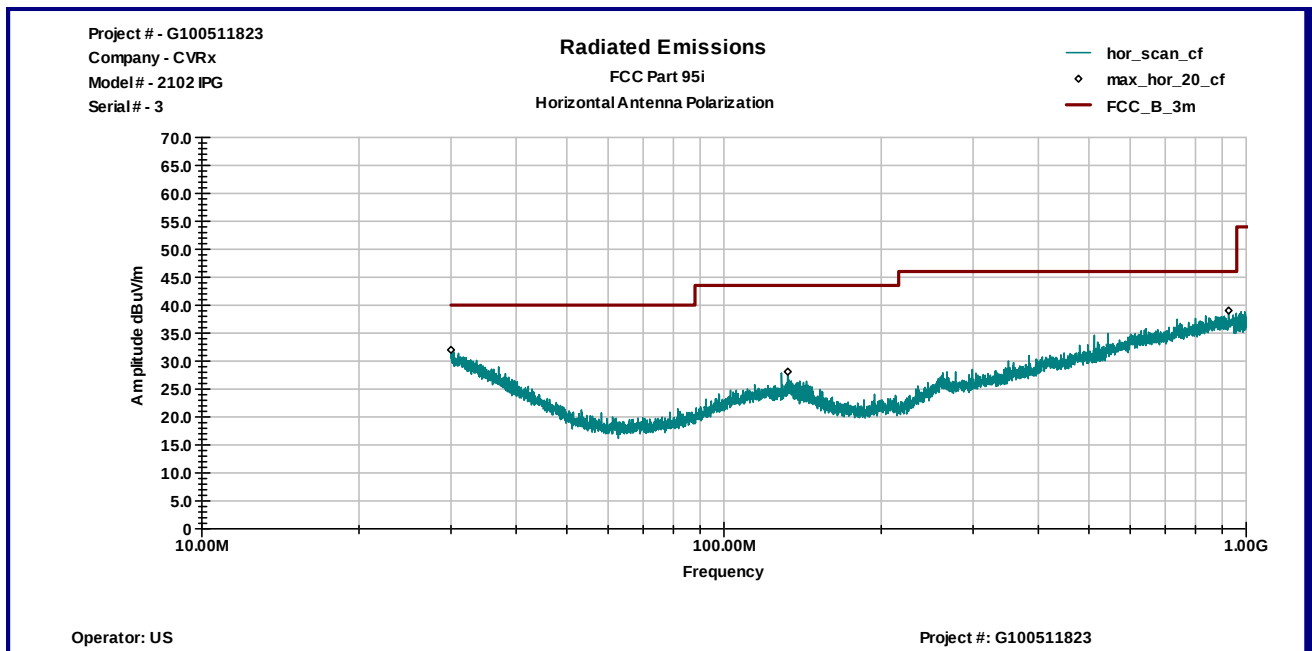
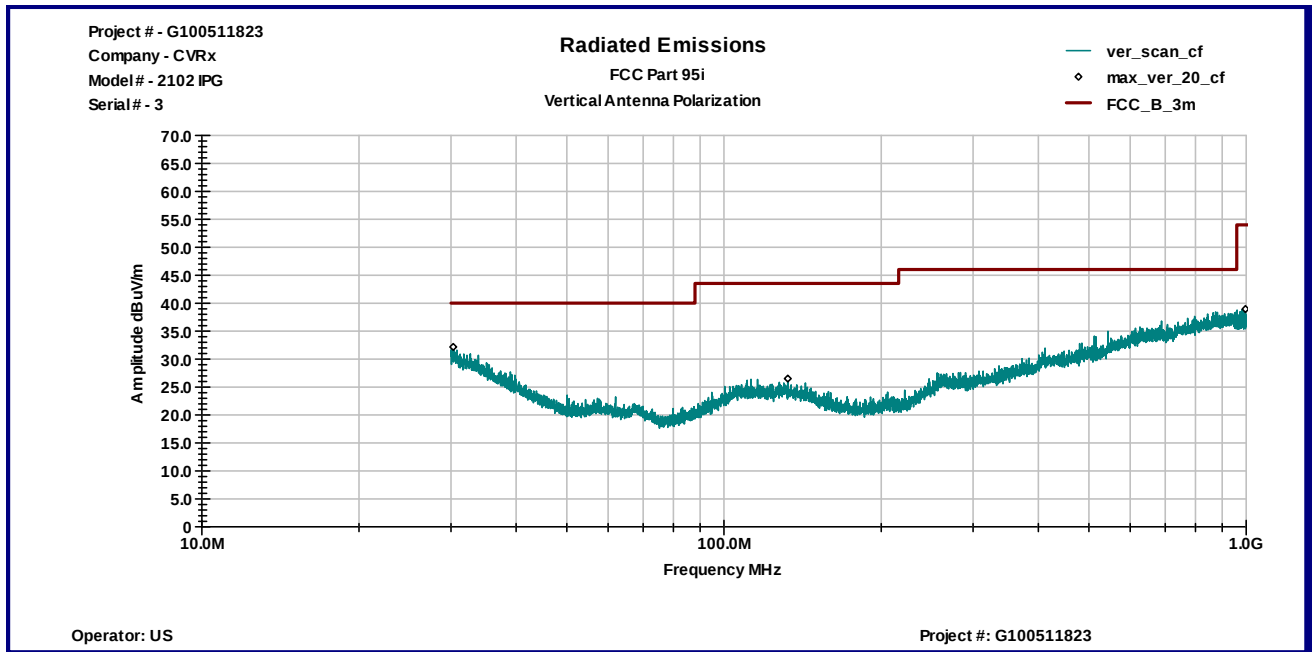
Table 3.6.1

Frequency	Ant. Polarity	Peak Reading dBμV	Ant.Factor dB1/m	Total at 3m dBμV/m	QP Limit dBμV/m	Margin dB
30.3 MHz	V	12.0	20.2	32.2	40.0	-7.8
132.5 MHz	V	12.7	13.8	26.5	43.5	-17.0
30.0 MHz	H	11.7	20.3	32.0	40.0	-8.0
132.5 MHz	H	14.3	13.8	28.1	43.5	-15.4

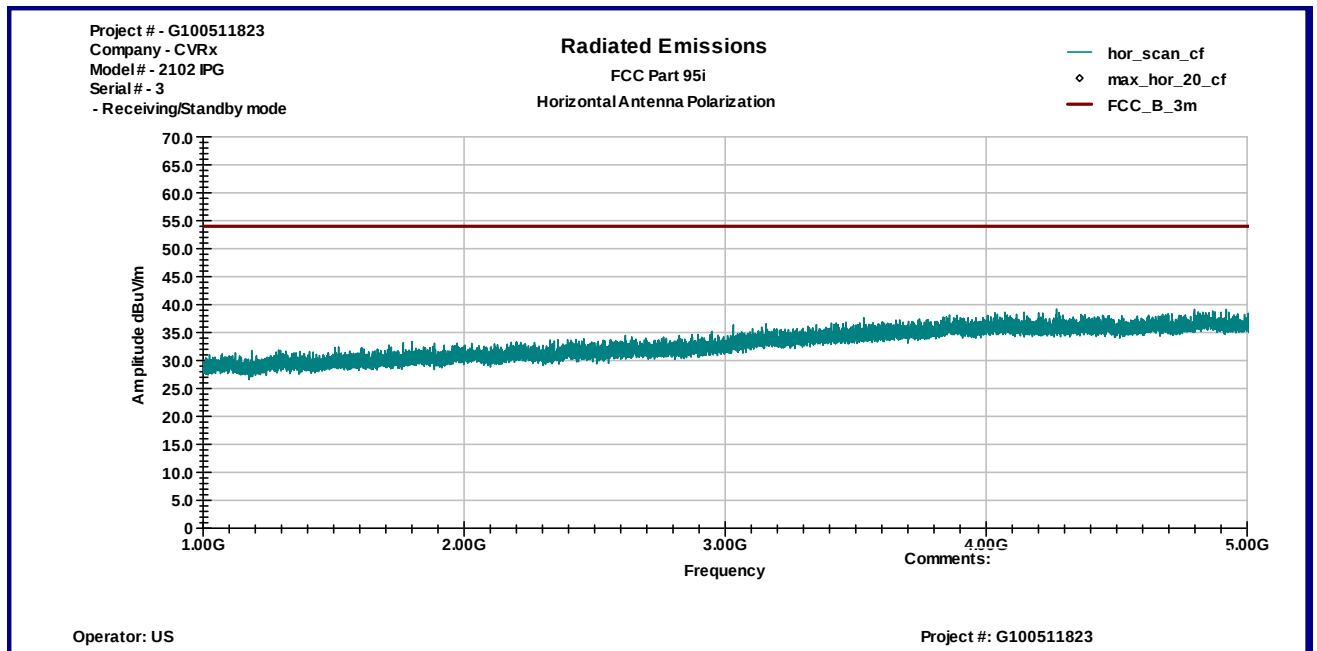
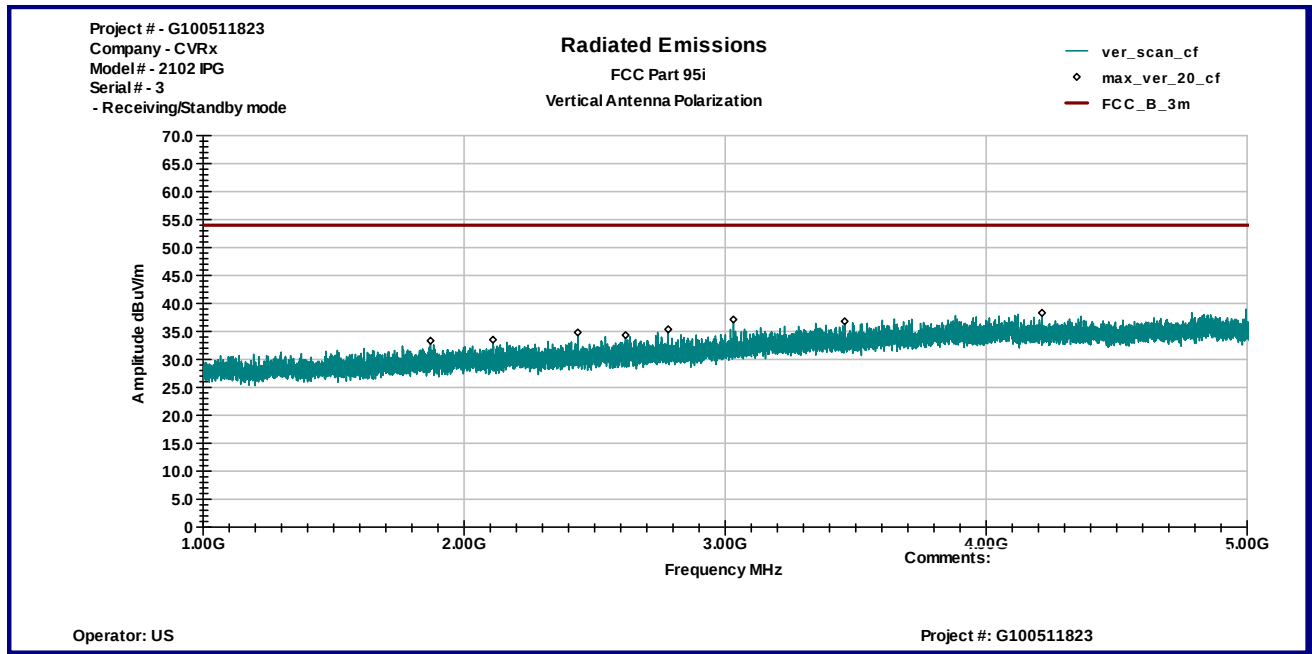
Table 3.6.2

Frequency MHz	Antenna Polarity	Reading dBμV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBμV/m	QP Limit dBμV/m	Margin dB
1.8712 GHz	V	41.8	30.1	38.5	33.3	54.0	-20.7
2.1107 GHz	V	40.7	31.1	38.2	33.5	54.0	-20.5
2.4355 GHz	V	40.5	32.1	37.8	34.8	54.0	-19.2
2.6185 GHz	V	39.3	32.8	37.7	34.3	54.0	-19.7
2.782 GHz	V	39.7	33.4	37.7	35.4	54.0	-18.6
3.0317 GHz	V	40.5	34.3	37.7	37.1	54.0	-16.9
3.458 GHz	V	38.7	35.7	37.5	36.8	54.0	-17.2
4.214 GHz	V	37.9	37.4	37.0	38.3	54.0	-15.7

Graph 3.6.1



Graph 3.6.2





4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	CAL DUE	USED
Spectrum Analyzer	R & S	FCV 30	1307.9002K30.1 010-TC	12559	11/09/2011	☒
Spectrum Analyzer	R & S	ESCI	100358	12909	05/12/2012	☒
Bicono-Log Antenna	Schaffner-Chase	CBL 6112 B	2468	14459	10/18/2011	☒
Horn Antenna	EMCO	3115	9507-4513	9936	04/29/2012	☒
Signal Generator	R & S	SMR20	101469	25233	10/03/2012	☒
Pre-Amplifier	MITEQ	AMF-5D-00501800-28- 13P	1122951	13475	11/06/2011	☒
System	TILE! Instrument Control		Ver. 3.4.K.29	15259	VBU	☒

5.0 REVISION HISTORY

REVISION LEVEL	DATE	REPORT NUMBER	NOTE
1.0	October 17, 2011	100511823MIN-001	Original Issue
1.1	November 8, 2013	100511823MIN-001	Updated reference to the newest sections of FCC standards Added reference to applicable sections of FCC Part 2 MICS Radio term was changed to MedRadio The note on the page 8 was revised