



TEST REPORT

Report Number: 100984244MIN-001

Project Number: G100984244

**Testing performed on the
PRO 24.r**

**FCC ID: MMURTI1700
Industry Canada ID: 3166A-RTI1700
Class II Permissive Changes**

**to
47 CFR Part 15. 231:2010
RSS- 210, Issue 8, 2010**

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1.0 GENERAL DESCRIPTION

Model:	PRO 24.r
Type of EUT:	Remote Control
FCC ID:	MMURTI1700
Industry Canada ID:	3166A-RTI1700
Related Submittal(s) Grants:	Class II Permissive Changes
Company:	Remote Technologies Inc.
Customer:	Mr. Mark Melville
Address:	5775-12 th Avenue East Suite 180 Shakopee MN 55379
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Test Standards:	☒ 47 CFR, Part 15:2010, §15.231 ☒ RSS-210, Issue 8, 2010 ☒ RSS-Gen, Issue 3, 2010 ☒ 47 CFR, Part 15:2009, §15.107 and §15.109, Class B ☐ Other
Type of radio:	☒ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	November 19, 2012
Test Work Started:	November 19, 2012
Test Work Completed:	November 26, 2012
Test Sample Conditions:	☐ Damaged ☐ Poor (Usable) ☒ Good



1.1 Product Description; Test Facility

Product Description:	Transmitter
Operating Frequency	433.075 – 434.726MHz
Numbers of Channels	13
Modulation:	GFSK
Emission Designator:	47K8F1D
Antenna(s) Info:	Integral
Antenna Installation:	☐ User ☐ Professional ☒ Factory
Transmitter power configuration:	☒ Internal battery ☐ External power source ☐ 120VAC ☐ 230VAC ☐ 400VAC ☒ 3.3 VDC ☐ 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

1.2 EUT Configuration

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

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

Operating modes of the EUT:

No.	Description
1	The transmitter was programmed to transmit continuously, or in regular mode
2	The 2 channels were tested: Channel 1 = 433.075195MHz Channel 13 = 434.725586MHz.

Cables:

No.	Type	Length	Designation	Note
	N/A			

Support equipment/Services:

No.	Item	Description
	N/A	

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

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).

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

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

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

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

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

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

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

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
15.231(a) / RSS-210 A1.1.1(a)	Transmitter deactivation time	Pass
15.231(b) / RSS-210 A1.1.2	Transmitter field strength of emissions	Pass
15.231(c) / RSS-210 A1.1.3	Bandwidth of the emission	Pass
15.207/RSS-Gen 7.2.2	Transmitter Power Line conducted emissions	Pass
15.109/ICES-003/ RSS-Gen 4.10	Receiver/digital device radiated emissions	Pass
15.107/ ICES-003	Digital device conducted emissions	Pass



3.0 TEST CONDITIONS AND RESULTS

3.1 Transmitter deactivation time

Maximum allowed deactivation time: 5 sec

Measured deactivation time: within about 1 sec

Test result: Pass

Notes: None.



3.2 Transmitter field strength of emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☐ 10 meters ☒ 3 meters

Frequency range of measurements: 30MHz-5000MHz

Test result: **Pass**

Max. Emissions margin at fundamental: 0.6 dB below the limits

Max. margin of harmonics and spurious emissions: 6.2 dB below the limits

Notes: Field Strength of Fundamental and Spurious Emissions measurements were made at Fundamental frequency of 433.05MHz and 434.73MHz; Spurious Emissions were tested up to 5GHz (10th harmonic).

The Table 3.2.1 shows the Field Strength of Fundamental Radiation. Table 3.2.2-3.2.3 and Graphs 3.2.1 - 3.2.4 show the Field Strength of Spurious Emissions.

Date:	November 19-26, 2011	Result: Pass
Standard:	FCC 15.231(b) / RSS-210 A1.1.2	
Tested by:	Simon Khazon	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Measurements at Fundamental Frequency	

Table 3.2.1

[illegible]

Date:	November 19-26, 2012	Result: Pass
Standard:	FCC 15.231(b) / RSS-210 A1.1.2	
Tested by:	Simon Khazon	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Spurious Radiated Emissions 30MHz-1000MHz	

Table 3.2.2

Frequency	Ant. Polarity	Peak Reading dBμV	Total C.F. dB1/m	Total at 3m dBμV/m	Limit dBμV/m	Margin dB
Channel 433.075MHz						
32.544 MHz	V	8.9	18.7	27.6	40.0	-12.4
712.41 MHz	V	13.5	23.0	36.5	46.0	-9.6
866.19 MHz	V	16.9	25.0	42.0	46.0	-4.1
30.93 MHz	H	7.4	19.7	27.0	40.0	-13.0
866.19 MHz	H	16.4	25.0	41.4	46.0	-4.6
944.31 MHz	H	12.0	25.7	37.7	46.0	-8.3
Channel 434.725MHz						
30.614 MHz	V	8.2	19.9	28.1	40.0	-12.0
132.43 MHz	V	14.8	13.8	28.5	43.5	-15.0
869.39 MHz	V	17.7	25.0	42.8	46.0	-3.2
30.351 MHz	H	7.3	20.0	27.3	40.0	-12.7
89.284 MHz	H	16.1	10.2	26.3	43.5	-17.2
869.39 MHz	H	14.2	25.0	39.2	46.0	-6.8

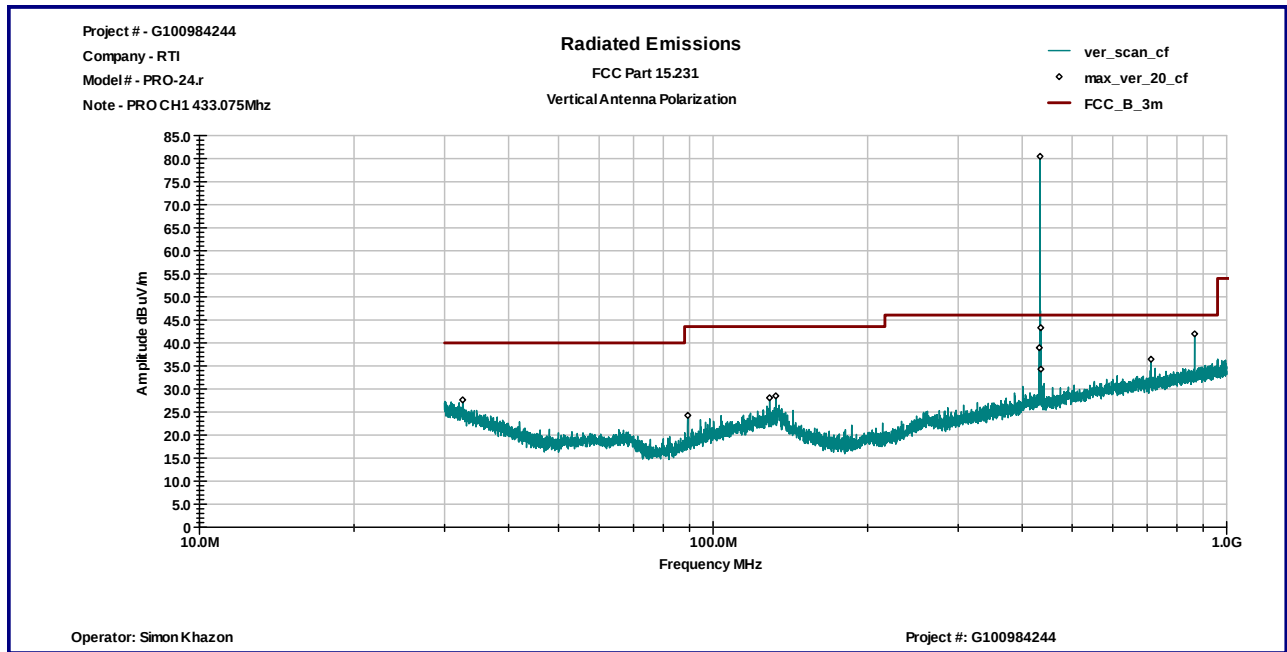
Date:	November 19-26, 2012	Result: Pass
Standard:	FCC 15.231(b) / RSS-210 A1.1.2	
Tested by:	Simon Khazon	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Spurious Radiated Emissions 1000MHz-5000MHz	

Table 3.2.3

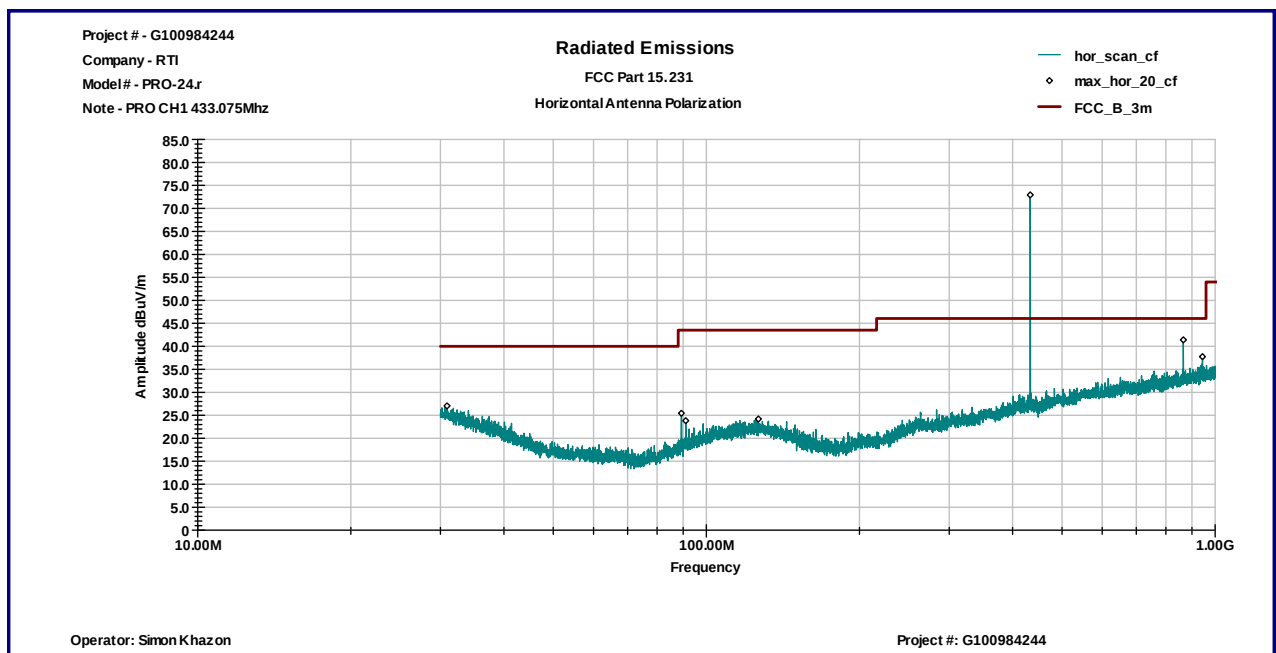
Frequency MHz	Antenna Polarity	Peak Reading dBμV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBμV/m	Limit dBμV/m	Margin dB
Channel 433.075MHz							
2.168 GHz	V	57.6	31.0	38.1	50.5	60.8	-10.3
2.5973 GHz	V	54.8	32.4	37.7	49.4	60.8	-11.4
3.4667 GHz	V	56.7	35.5	37.5	54.6	60.8	-6.2
3.8987 GHz	V	52.6	36.7	37.2	52.2	60.8	-8.6
2.5973 GHz	H	58.1	32.5	37.7	52.9	60.8	-7.9
3.032 GHz	H	56.4	33.9	37.7	52.6	60.8	-8.2
3.4667 GHz	H	58.9	35.6	37.5	56.9	60.8	-3.9
3.8987 GHz	H	58.1	36.8	37.2	57.8	60.8	-3.0
4.7653 GHz	H	52.4	37.9	36.7	53.6	60.8	-7.2
Channel 434.725MHz							
2.176 GHz	V	56.3	31.1	38.1	49.3	60.8	-11.5
2.608 GHz	V	55.6	32.4	37.7	50.3	60.8	-10.6
3.48 GHz	V	56.3	35.5	37.5	54.3	60.8	-6.5
3.912 GHz	V	51.9	36.8	37.2	51.5	60.8	-9.3
4.3467 GHz	V	49.0	37.3	36.9	49.4	60.8	-11.4
1.304 GHz	H	60.7	27.3	38.9	49.1	60.8	-11.7
2.608 GHz	H	57.9	32.6	37.7	52.8	60.8	-8.1
3.0427 GHz	H	56.4	33.9	37.7	52.6	60.8	-8.2
3.48 GHz	H	59.3	35.6	37.5	57.4	60.8	-3.4
3.912 GHz	H	53.2	36.9	37.2	52.9	60.8	-7.9
4.784 GHz	H	47.5	37.9	36.7	48.7	60.8	-12.1

Graph 3.2.1

Vertical antenna polarization

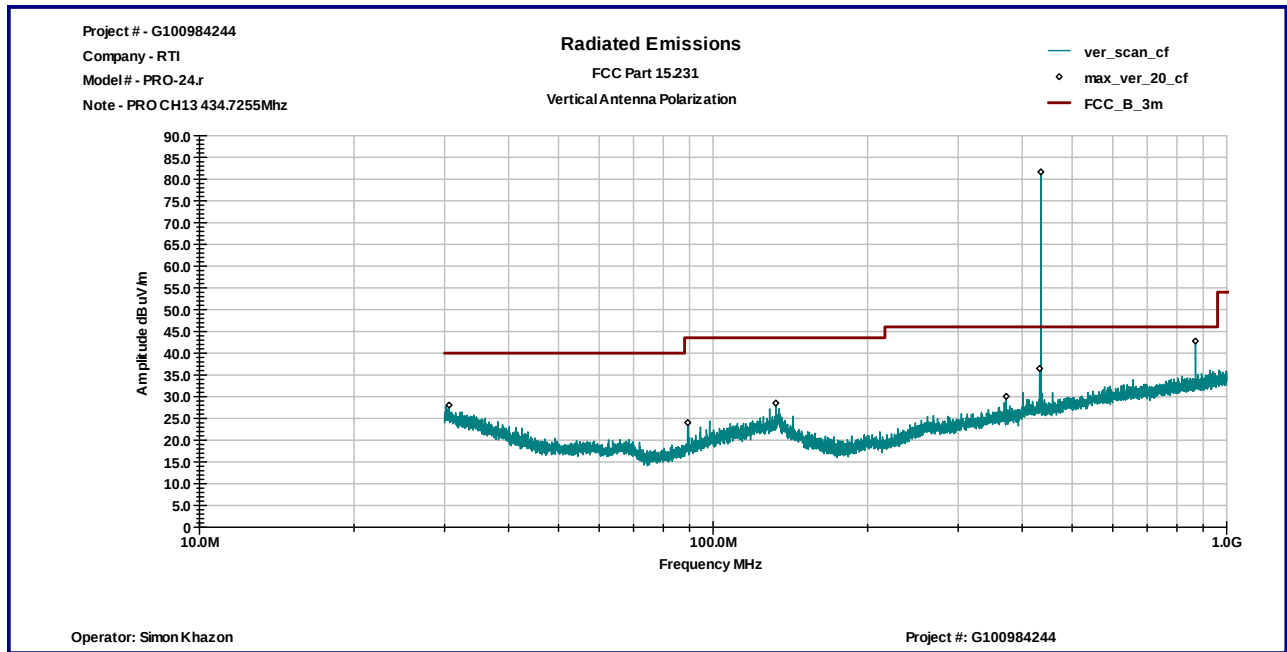


Horizontal antenna polarization

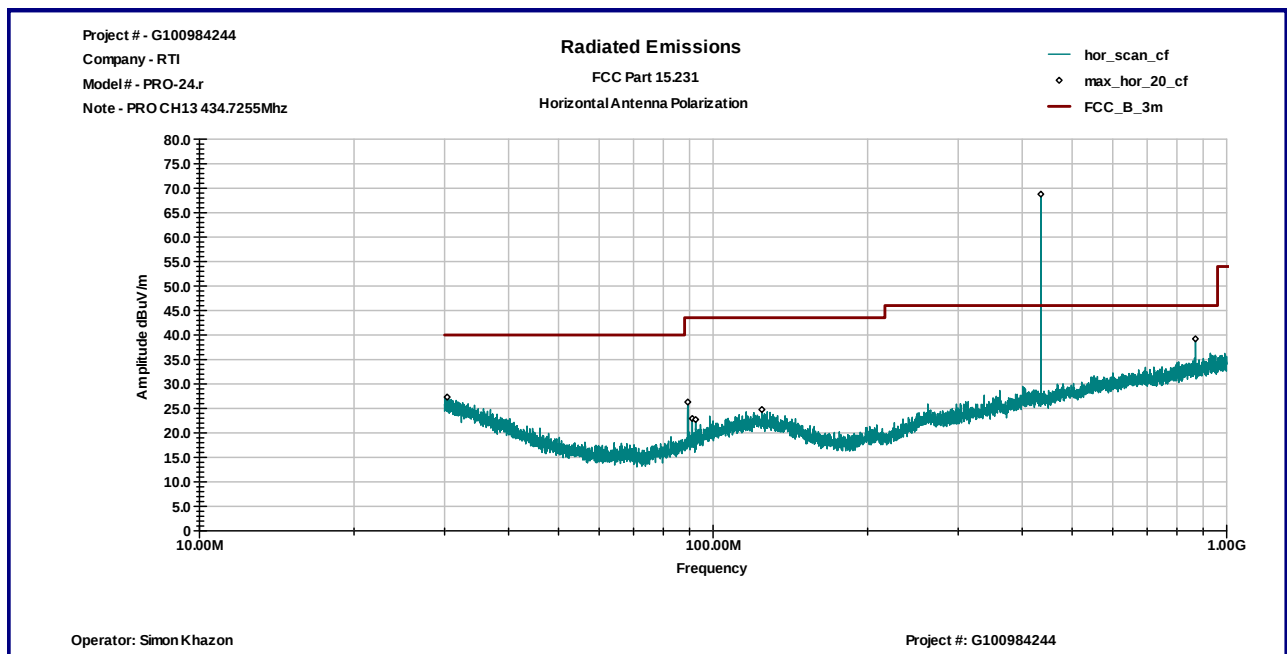


Graph 3.2.2

Vertical antenna polarization

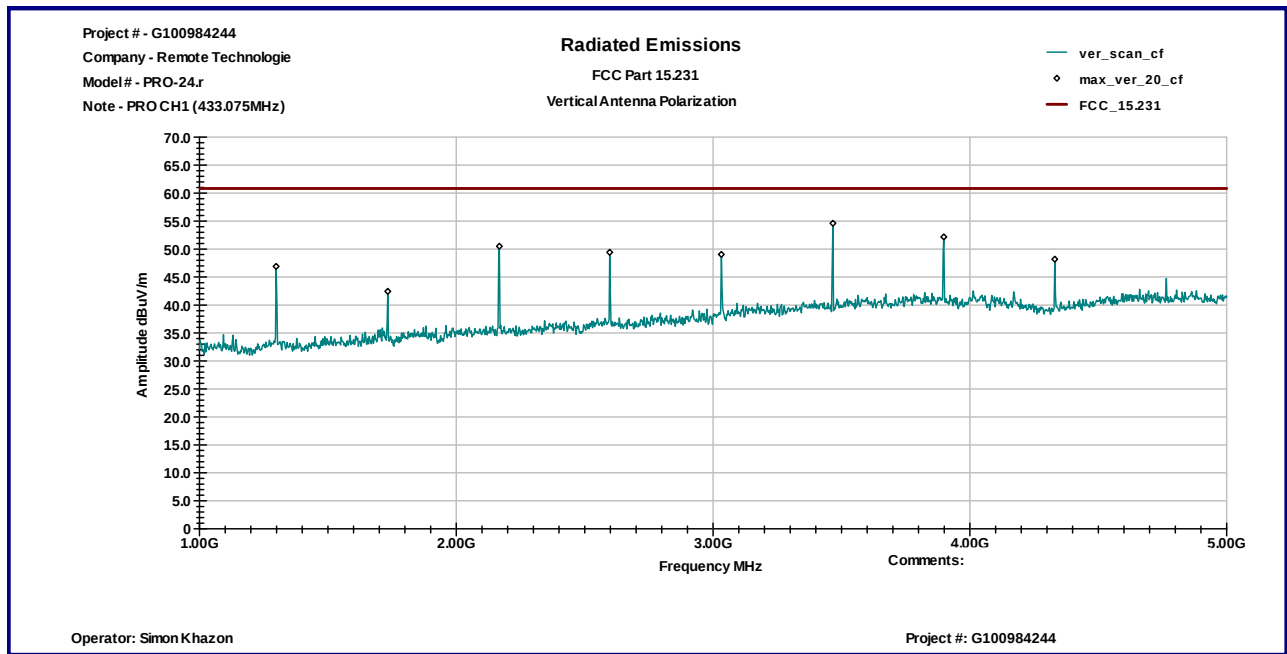


Horizontal antenna polarization

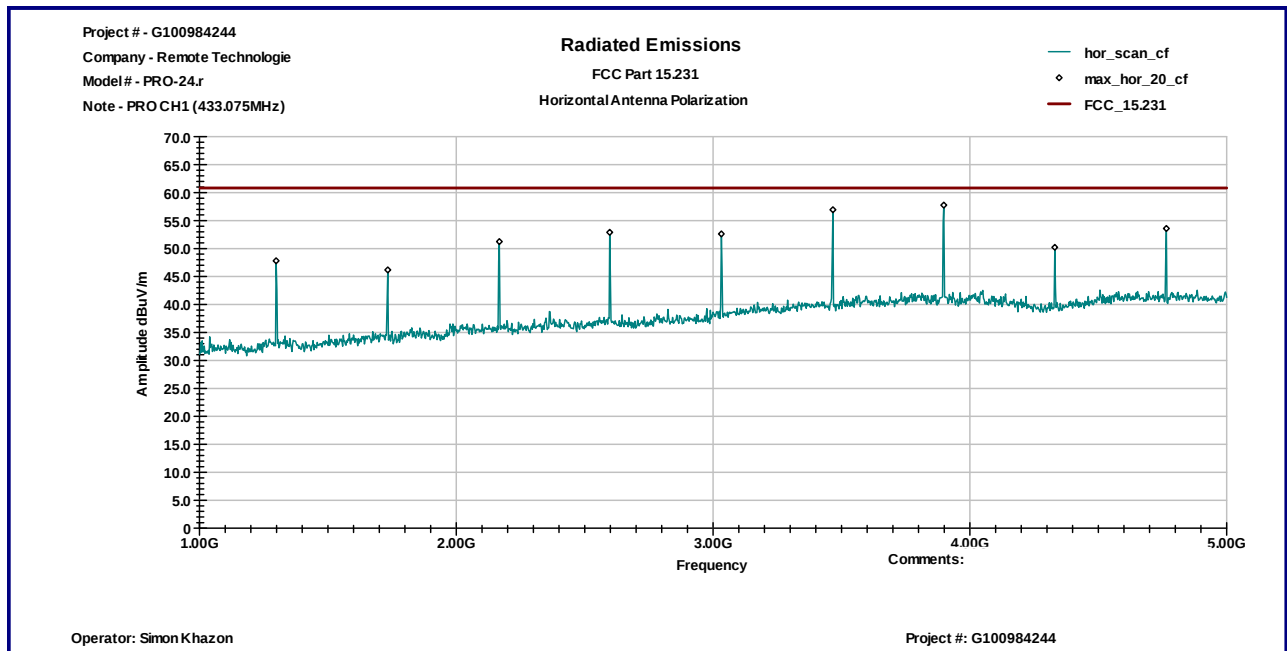


Graph 3.2.3

Vertical antenna polarization

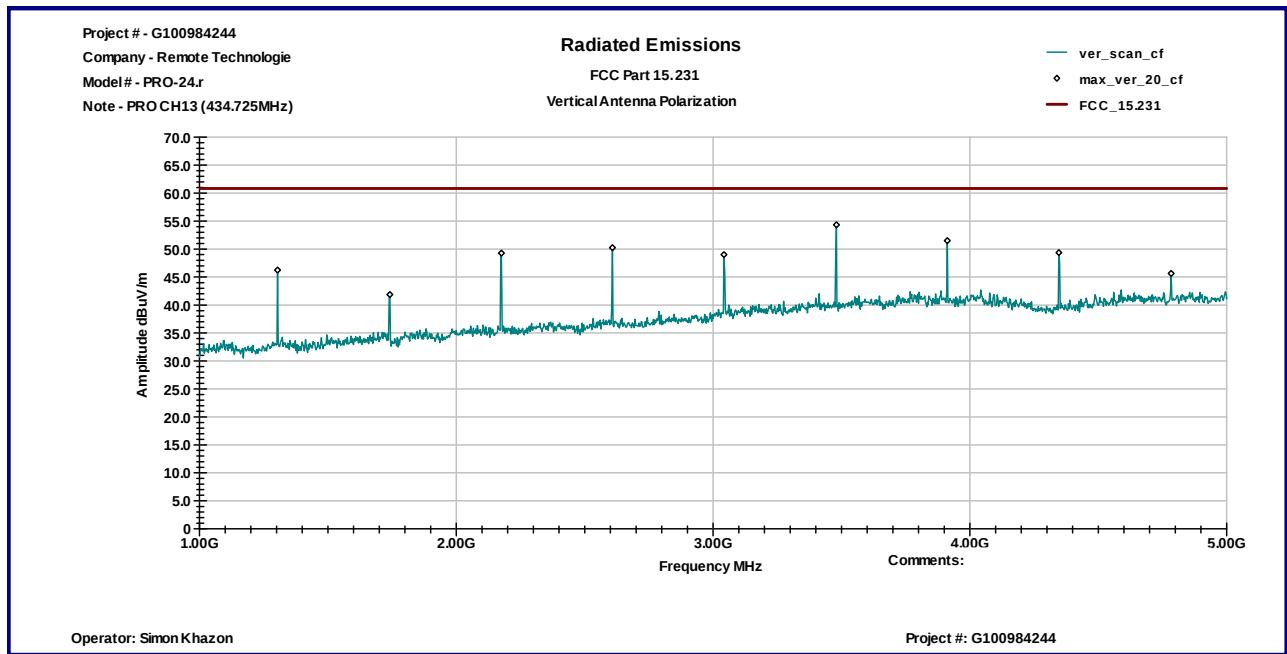


Horizontal antenna polarization

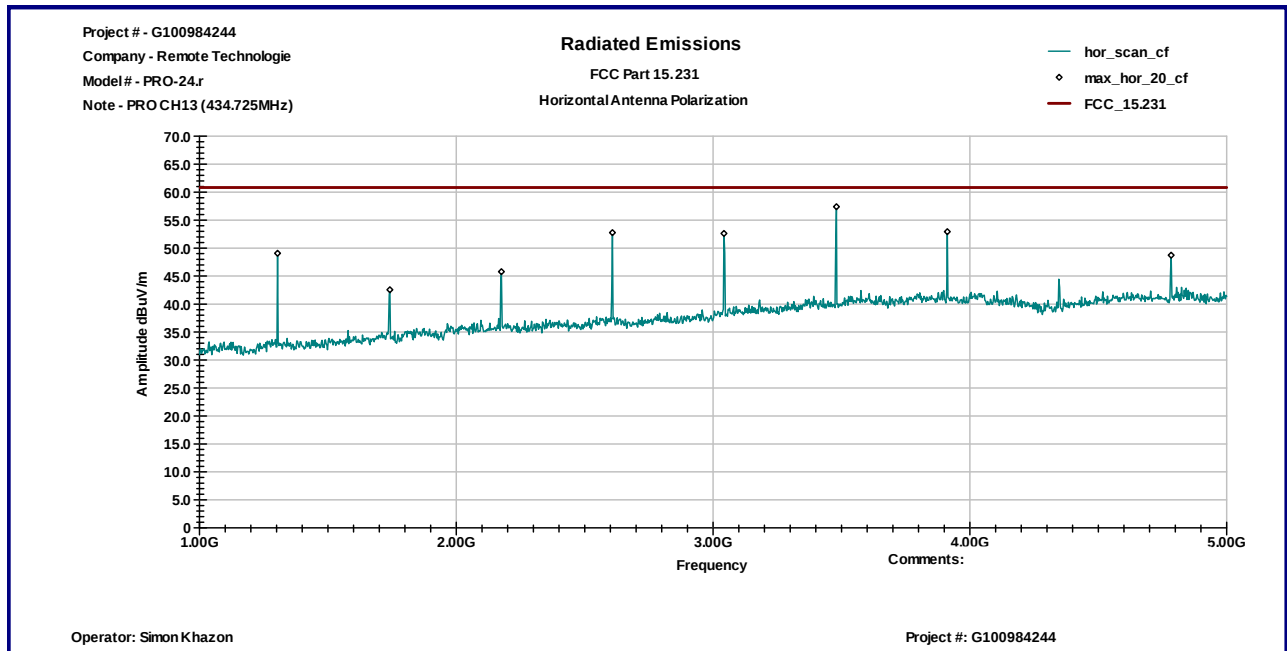


Graph 3.2.4

Vertical antenna polarization



Horizontal antenna polarization



3.2.1 Average correction factor calculation

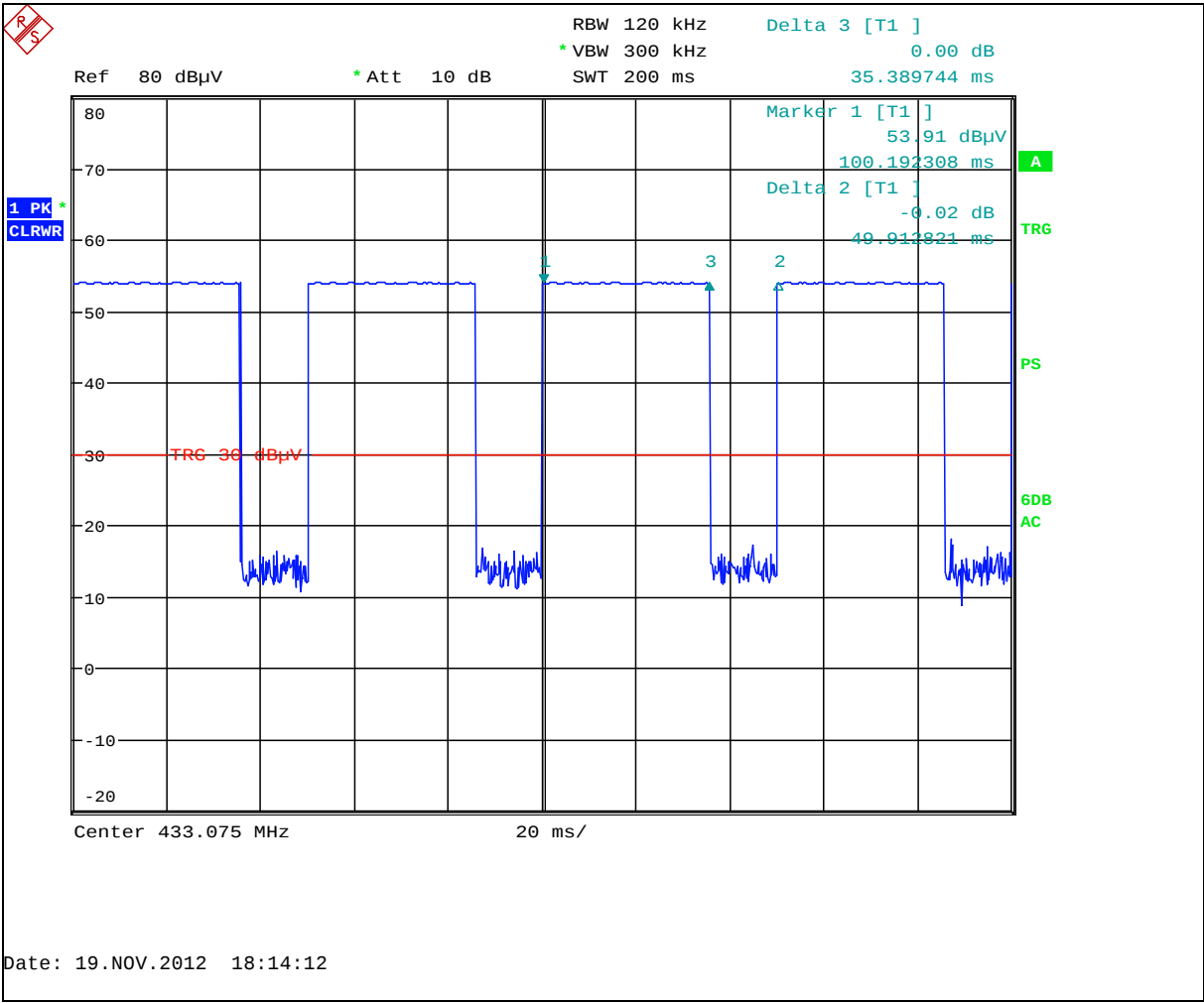
An Average correction factor is calculated by averaging one complete pulse train over complete cycle.

$$\text{Average Factor} = 20\text{Log} (\text{On air/Cycle}) = 20\text{Log} (35.4/49.9) = -2.9\text{dB}$$

Cycle = 49.9msec (According to the Modulation Scheme)

On air Time = 35.4msec (According to the Modulation Scheme)

Graph 3.2.5



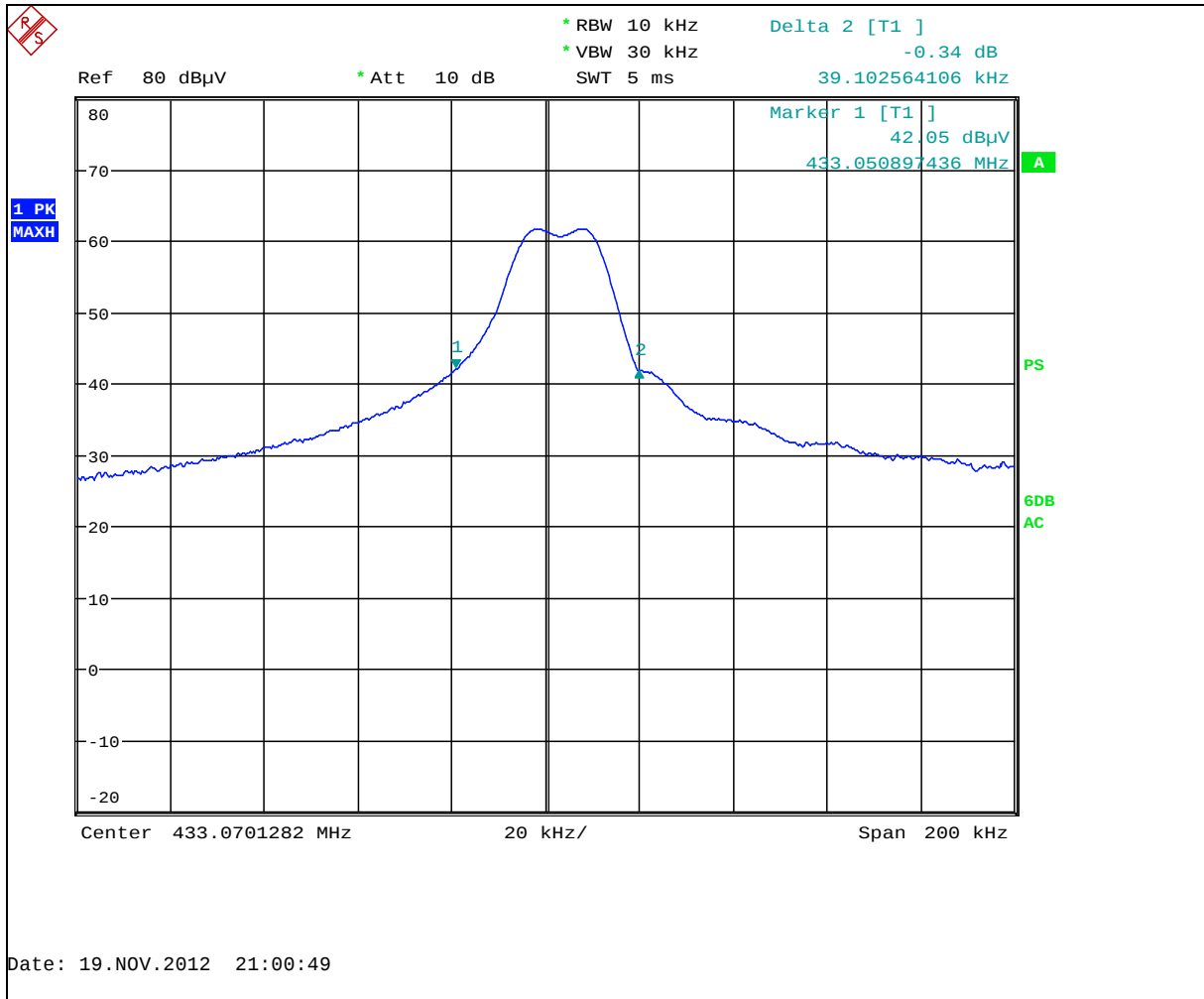
3.3 Bandwidth of Emissions

Center Frequency of operation MHz	Maximum allowed bandwidth kHz	Measured 20dB bandwidth kHz	Measured 99% bandwidth kHz	Result
433.05	1082.625	42.1	47.8	Pass
434.73	1086.825	34.5	43.2	Pass
Maximum allowed bandwidth:	☒ 0.25% of the centre operating frequency ☐ 0.5% of the centre operating frequency			
RBW:	☒ 10kHz	☐ 100kHz	☐ other	kHz
VBW:	☒ 30kHz	☐ 300kHz	☐ other	kHz

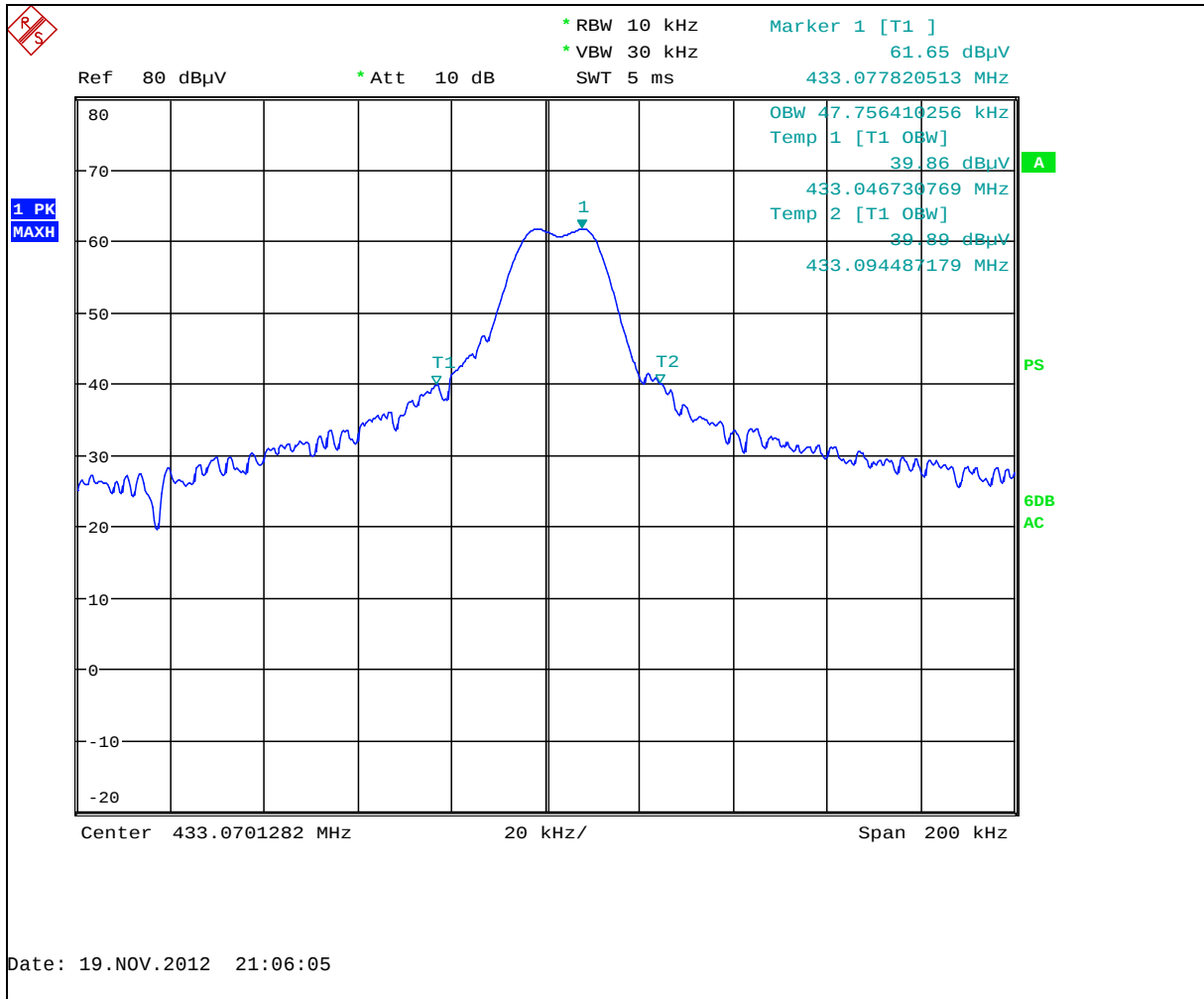
Graphs 3-3-1 and 3-3-2 are show bandwidth of emissions

Notes: None

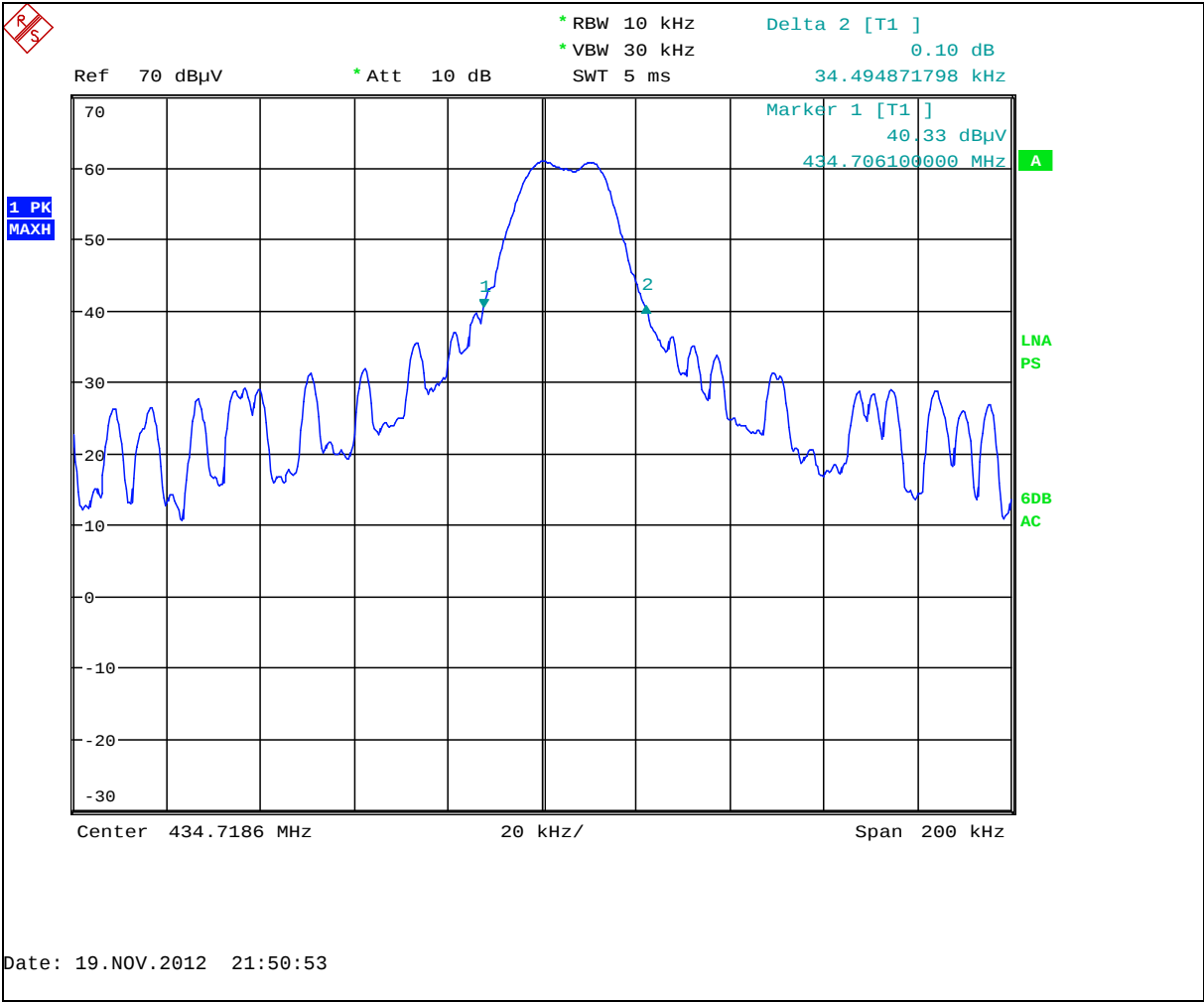
Graph 3.3.1



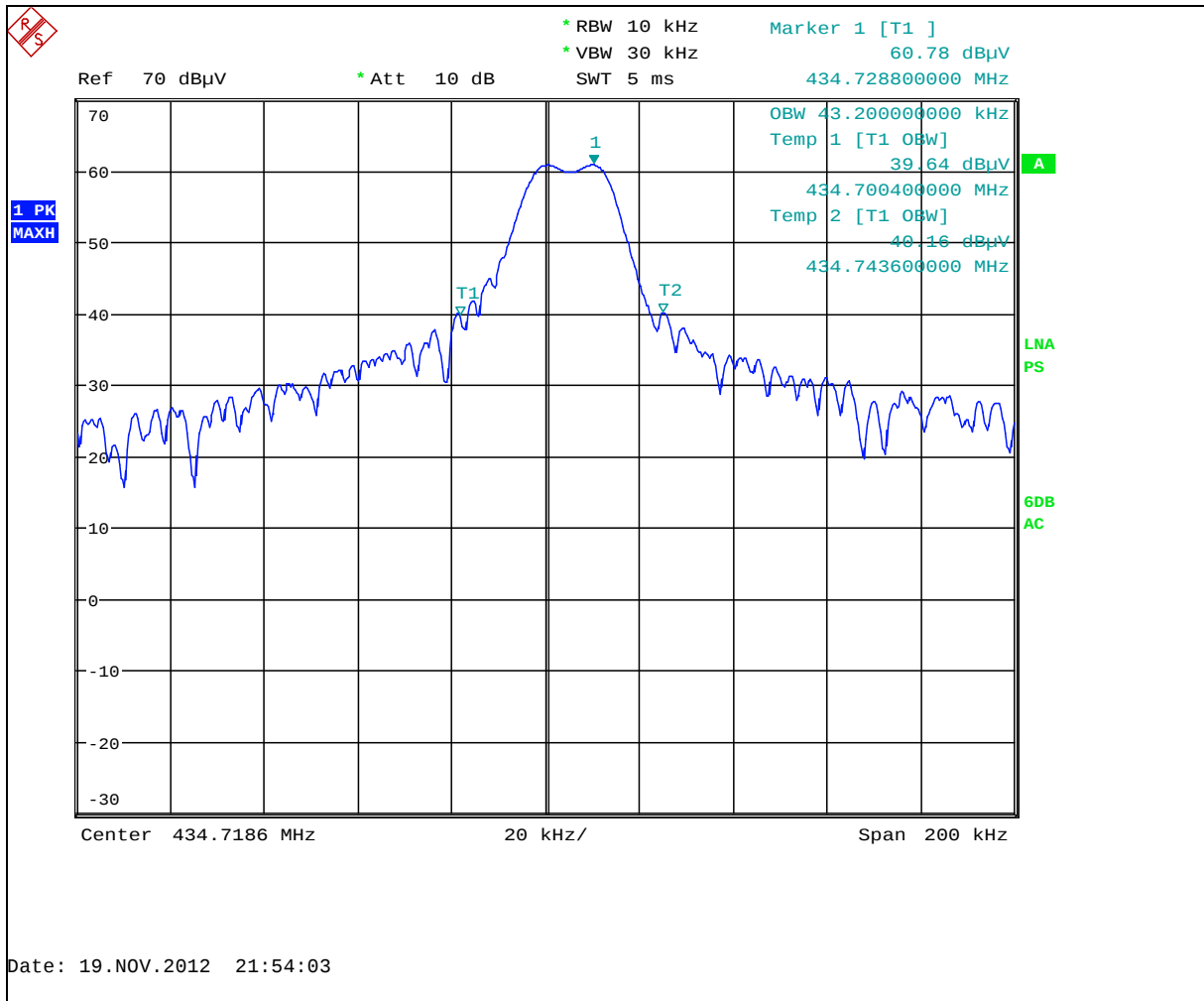
Graph 3.3.2



Graph 3.3.3



Graph 3.3.4





3.4 Transmitter power line conducted emissions

Test location: ☐ OATS ☐ Anechoic Chamber ☐ Other

Test result: N/A

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: dB below the limits

Note: It was determined from consideration of the electrical characteristics and usage of particular apparatus that Conducted Emissions testing is inappropriate and therefore unnecessary (as battery operated equipment).



3.5 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: 1.4 dB below the limits

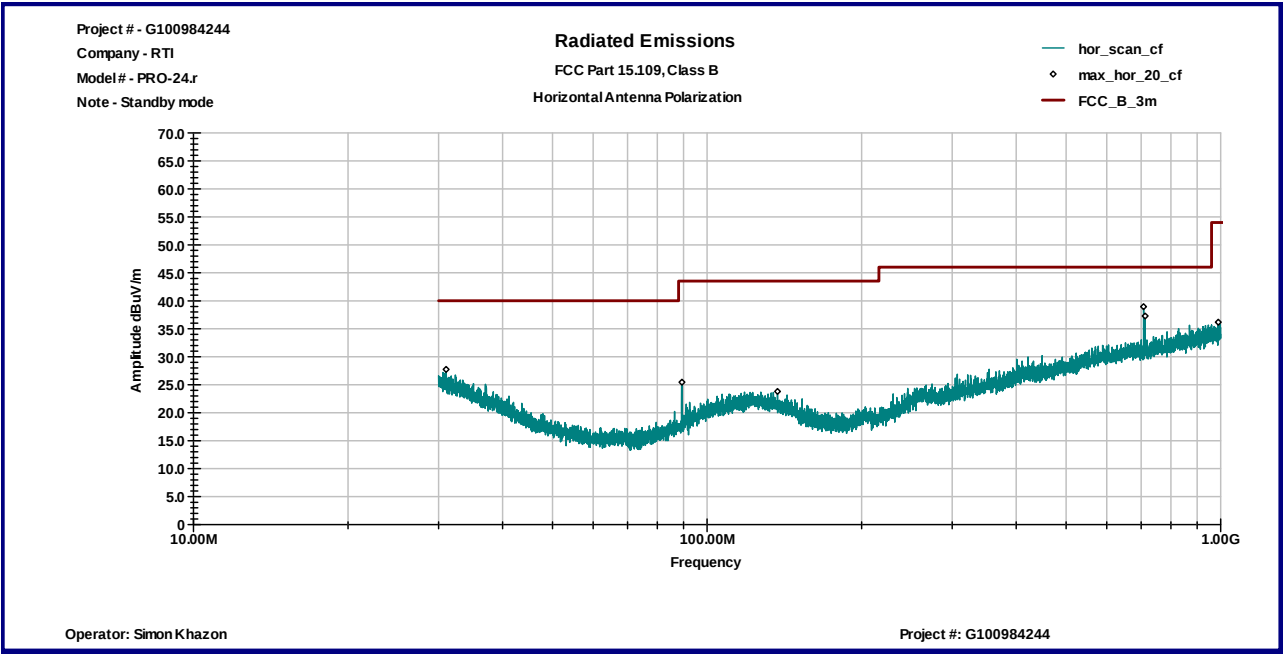
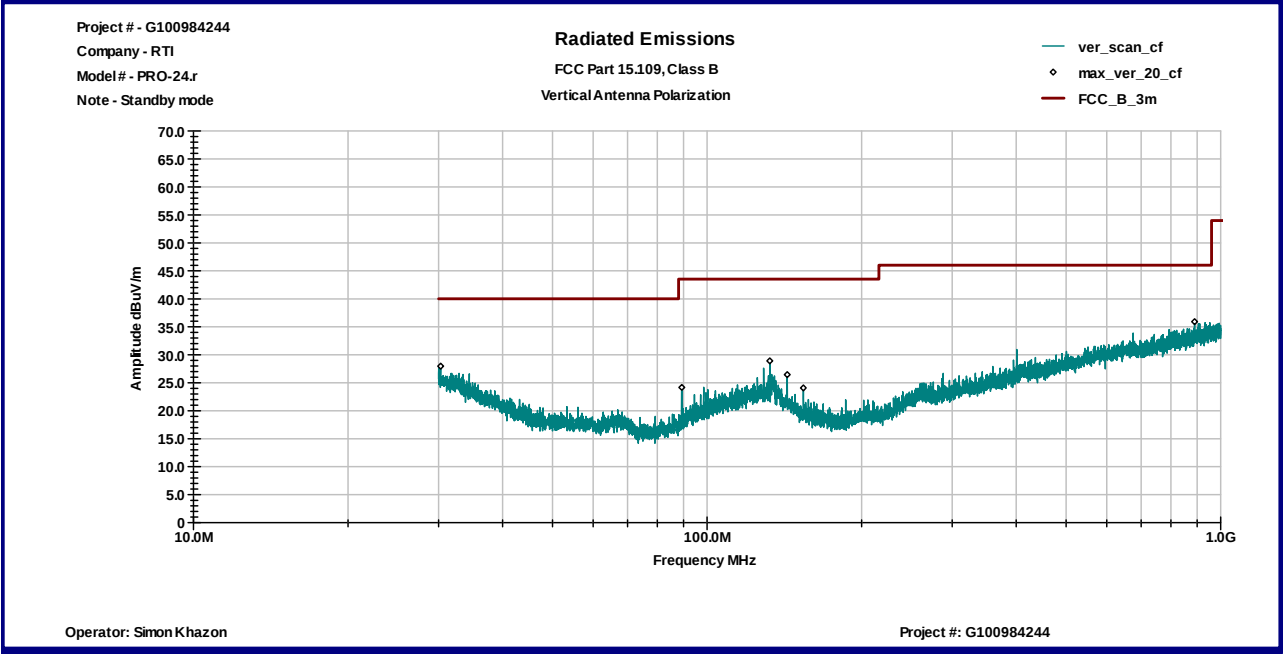
Note: The Radiated Emissions test was performed in the Anechoic chamber at 3m measurement distance (see Table 3.5.1 and Graphs 3.5.1 and 3.5.2).

Date:	January 10, 2011	Result: Pass
Standard:	FCC Part 15.109, Class B	
Tested by:	Simon Khazon	
Test Point:	Enclosure	
Operation mode:	See page 5	
Note:	Standby Mode	

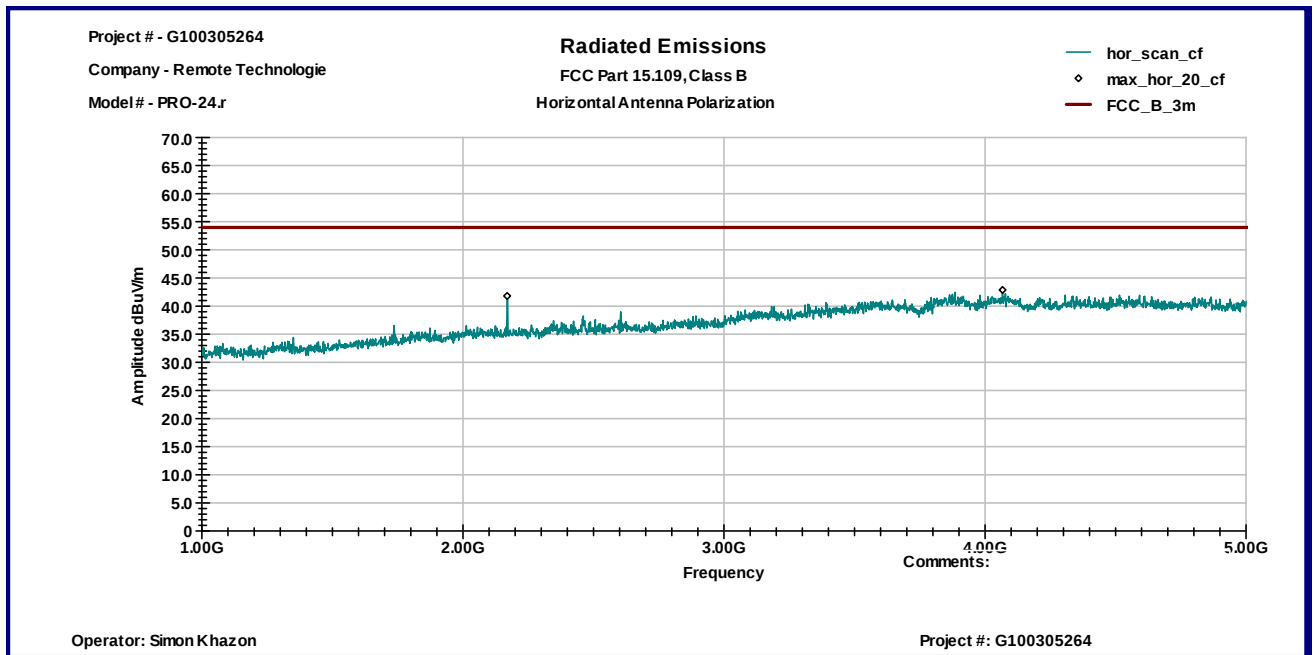
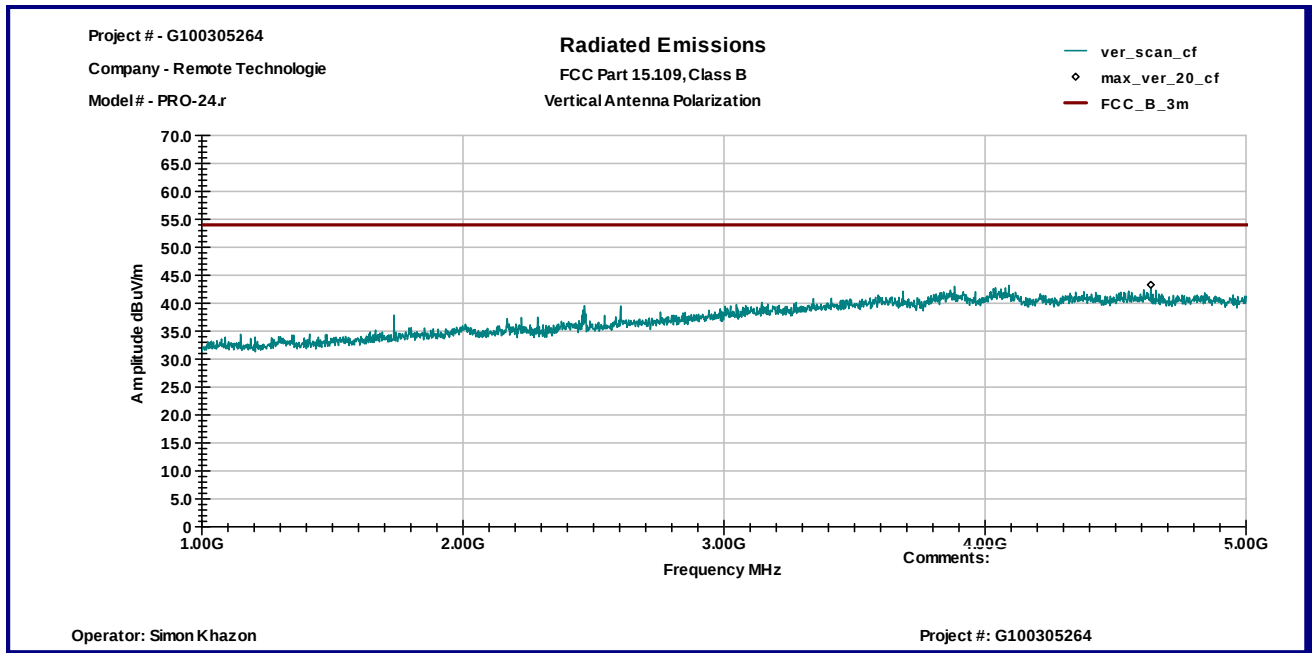
Table 3.5.1

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
2.4608 GHz	V	47.4	31.9	37.8	41.5	54.0	-12.5
4.048 GHz	V	43.1	37.1	37.1	43.0	54.0	-11.0
2.1696 GHz	H	50.9	31.4	38.1	44.1	54.0	-9.9
2.6048 GHz	H	46.3	32.6	37.7	41.2	54.0	-12.8
4.6256 GHz	H	42.9	37.7	36.8	43.8	54.0	-10.2

Graph 3.4.1



Graph 3.5.1





3.6 Digital device conducted emissions

Test location: ☐ OATS ☐ Anechoic Chamber ☐ Other

Test result: N/A

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: dB below the limits

Note: It was determined from consideration of the electrical characteristics and usage of particular apparatus that Conducted Emissions testing is inappropriate and therefore unnecessary (as battery operated equipment).



4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	CAL DUE	USED
Spectrum Analyzer	R & S	FSP 40	100024	12559	11/29/2013	☒
Spectrum Analyzer	R & S	ESU	100398	25283	12/09/2012	☒
Bicono-Log Antenna	Teseq	CBL6112D	32859	25289	08/09/2013	☒
Horn Antenna	EMCO	3115	9507-4513	9936	05/16/2013	☒
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1402232	172081	11/01/2013	☒
System	Quantum Change	TILE! Instrument Control	Ver. 3.4.K.29	15259	VBU	☒