



TEST REPORT

Report Number: 100105670MIN-002

Project Number: G100105670

Testing performed on the
2.4GHz TXB-DB Dual Transmitter Module

FCC ID: MMURTI1500

Industry Canada ID: 3166A-RTI1500

to

47 CFR Part 15. 247:2009

RSS- 210, Issue 7, 2007

For

Remote Technologies Inc.

Test Performed by:
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Oakdale, MN 55128

Test Authorized by:
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Shakopee, MN 55379

Prepared by:

A handwritten signature in black ink, appearing to read "Norman Shpilsher".

Norman Shpilsher

Date: July 1, 2010

Reviewed by:

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Simon Khazon

Date: July 1, 2010

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1.0 GENERAL DESCRIPTION

Model:	2.4GHz TXB-DB
Type of EUT:	Dual Transmitter Module
Serial Number:	N/A
FCC ID:	MMURTI1500
Industry Canada ID:	3166A-RTI1500
Related Submittal(s) Grants:	None
Company:	Remote Technologies Inc.
Customer:	Mr. Mark Melville
Address:	5775-12 th Avenue East Suite 180 Shakopee MN 55379
Phone:	(952) 253-3116
Fax:	(952) 253-3131
e-mail:	Remote Technologies Inc.
Test Standards:	☒ 47 CFR, Part 15:2009, §15.247 ☒ RSS-210, Issue 7, 2007 ☒ RSS-Gen, Issue 2, 2007 ☒ 47 CFR, Part 15:2008, §15.107 and §15.109, Class B ☐ Other
Type of radio:	☐ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	May 25, 2010
Test Work Started:	May 25, 2010
Test Work Completed:	June 1, 2010
Test Sample Conditions:	☐ Damaged ☐ Poor (Usable) ☒ Good



1.1 Product Description; Test Facility

Product Description:	Dual Transmitter Module
Transmitter Type:	☐ FHSS ☒ Digital Modulation ☐ WiFi ☐ Blue Tooth
Operating Frequency Range(s):	from 2400 to 2483.5 MHz
Number of Channels:	16
Modulation:	OQPSK
Emission Designator:	1M62G7D
Antenna(s) Info:	Antenna Type: Integral. Temporary RF connector provided. Solder direct to circuit board via coax. Gain: 1.8 dBi
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 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 transmitting mode
- ☒ - Continuous receiving /standby mode
- ☐ - Test program (customer specific)
- ☐ -

Operating modes of the EUT:

No.	Description
1	The transmitter was wired to transmit continuously. Test was performed at low channel, middle channel, and upper channel.
2	

Cables:

No.	Type	Length	Designation	Note
1	N/A			
2				

Support equipment/Services:

No.	Item	Description
1	Lascar PSU 130	Power Supply

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(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).

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

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

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

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

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

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

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

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(a) / RSS-210 A8.2	6dB bandwidth of the digital modulation system	Pass
15.247(e) / RSS-210 A8.2	Power spectral density	Pass
15.247(d) / RSS-210 A8.5	Antenna conducted spurious emissions	Pass
15.247(d) / RSS-210 A8.5	Radiated spurious emissions	Pass
15.247(i) / RSS- Gen 5.5	RF Exposure Compliance	Pass
15.207 / RSS-Gen 7.2.2	Transmitter Power Line conducted emissions	N/A
15.109 / ICES-003	Receiver/digital device radiated emissions	Pass
15.107 / ICES-003	Digital device conducted emissions	N/A



3.0 TEST CONDITIONS AND RESULTS

3.1 Maximum peak output power

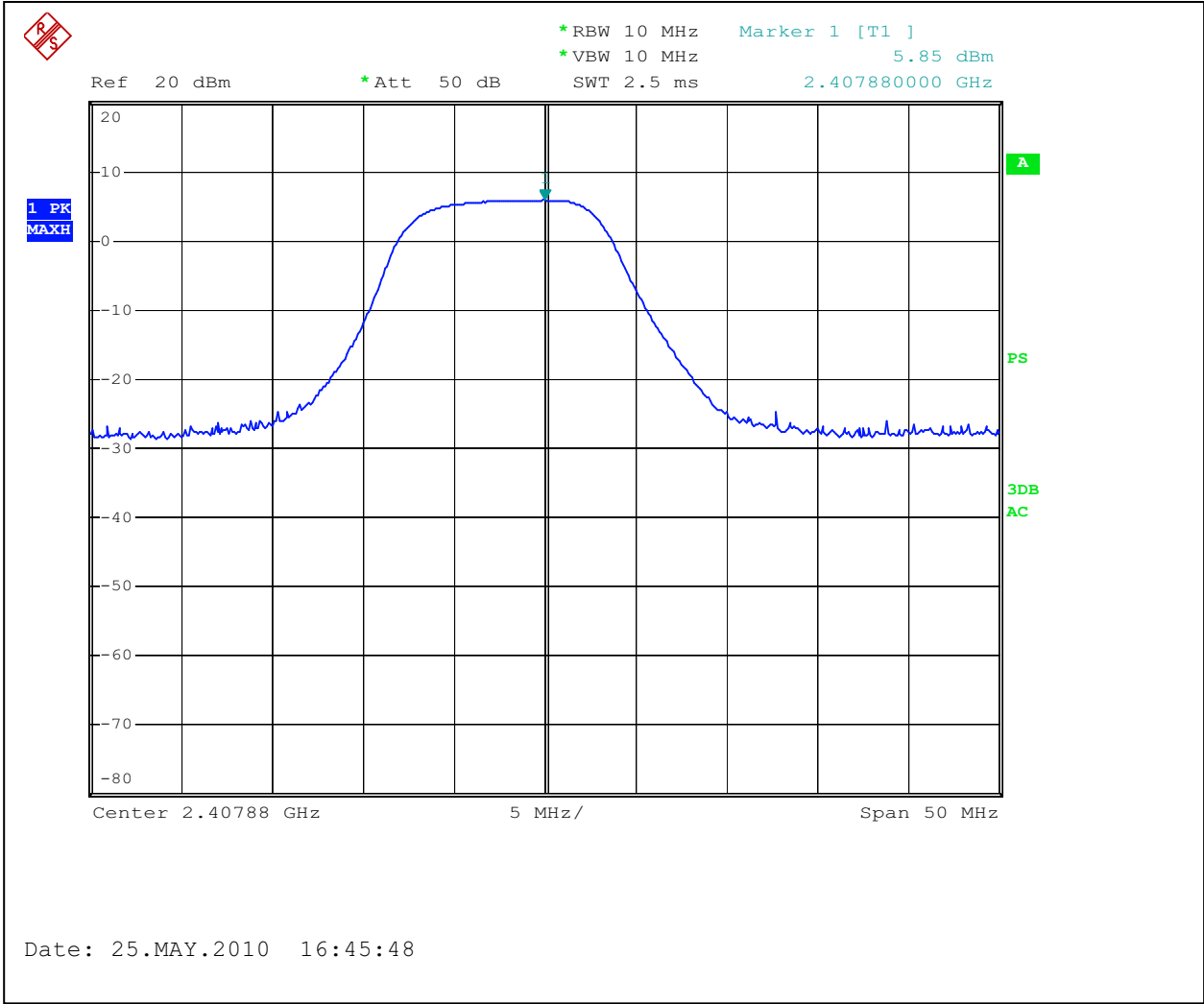
Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: Pass

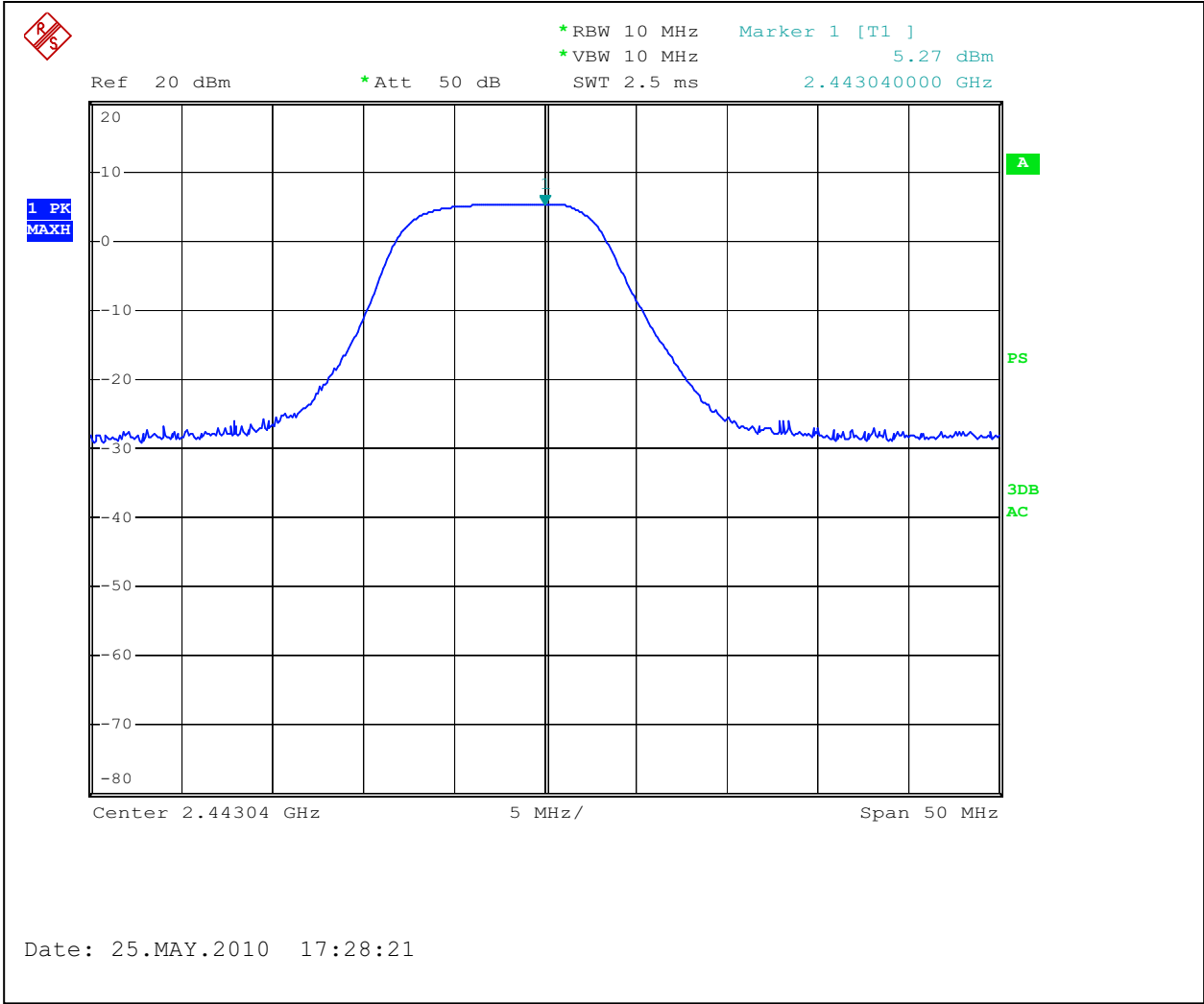
Max. Margin: 24.56dB below the limits

Power Output:	Conducted					
Frequency Range:	☐ 902-928MHz ☒ 2400-2483.5MHz ☐ 5725-5850MHz					
Low Frequency MHz	Measured power dBm	Attenuaton dB	Power at Antenna dBm	Limit dBm	Limit Reduction dB	Margin dB
	5.44	0	5.44	30	0	-24.56
Middle Frequency MHz						
	5.04	0	5.04	30	0	-24.96
Upper Frequency MHz						
	4.43	0	4.43	30	0	-25.57
RBW:	☐ 1MHz ☐ 3MHz ☒ 10MHz					
VBW:	☐ 1MHz ☐ 3MHz ☒ 10MHz					
Antenna Gain:	☒ < 6dBi ☐ >6dBi and = dBi, Output power reduction = dB					

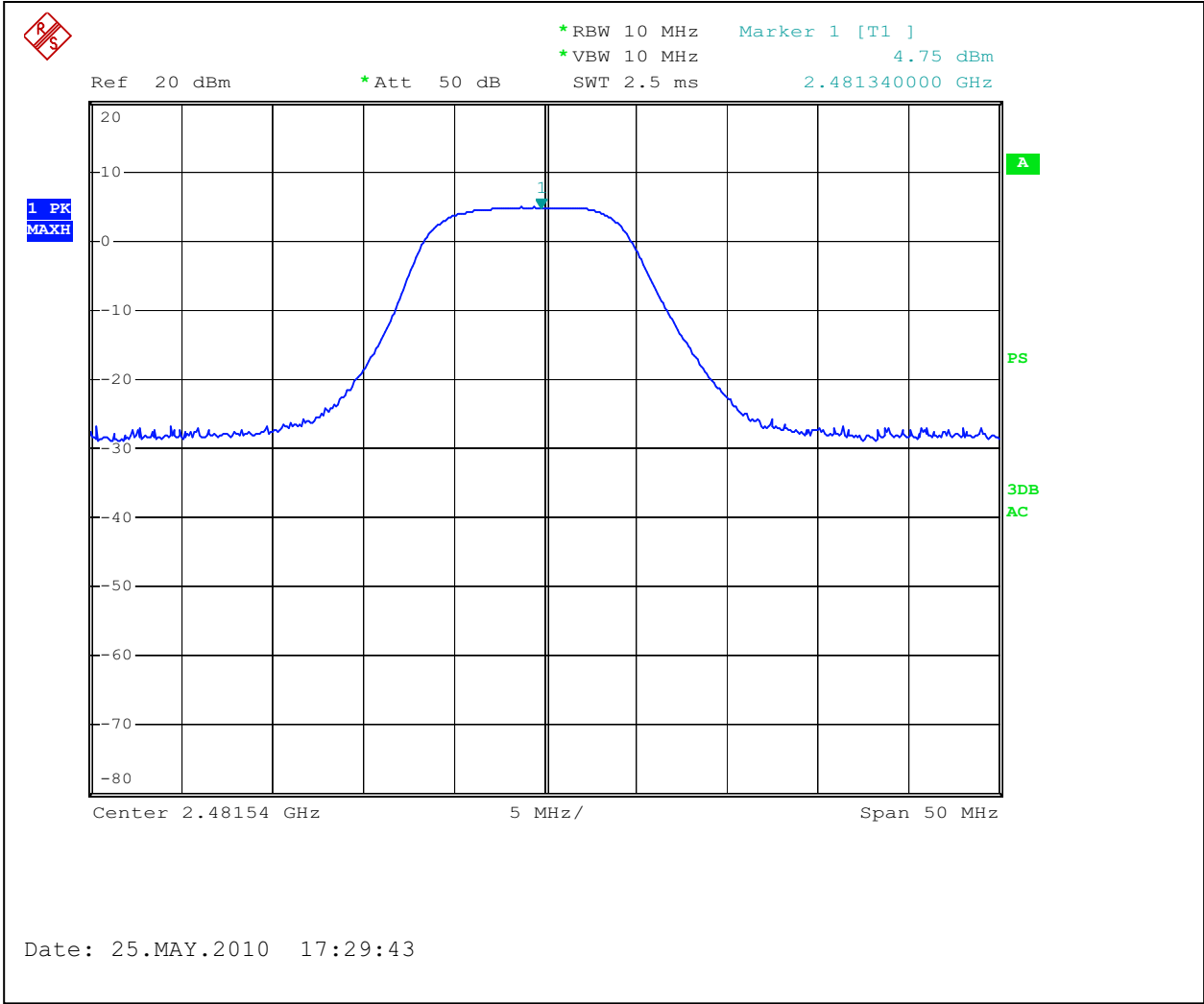
Notes:



Graph 3.1.1



Graph 3.1.2

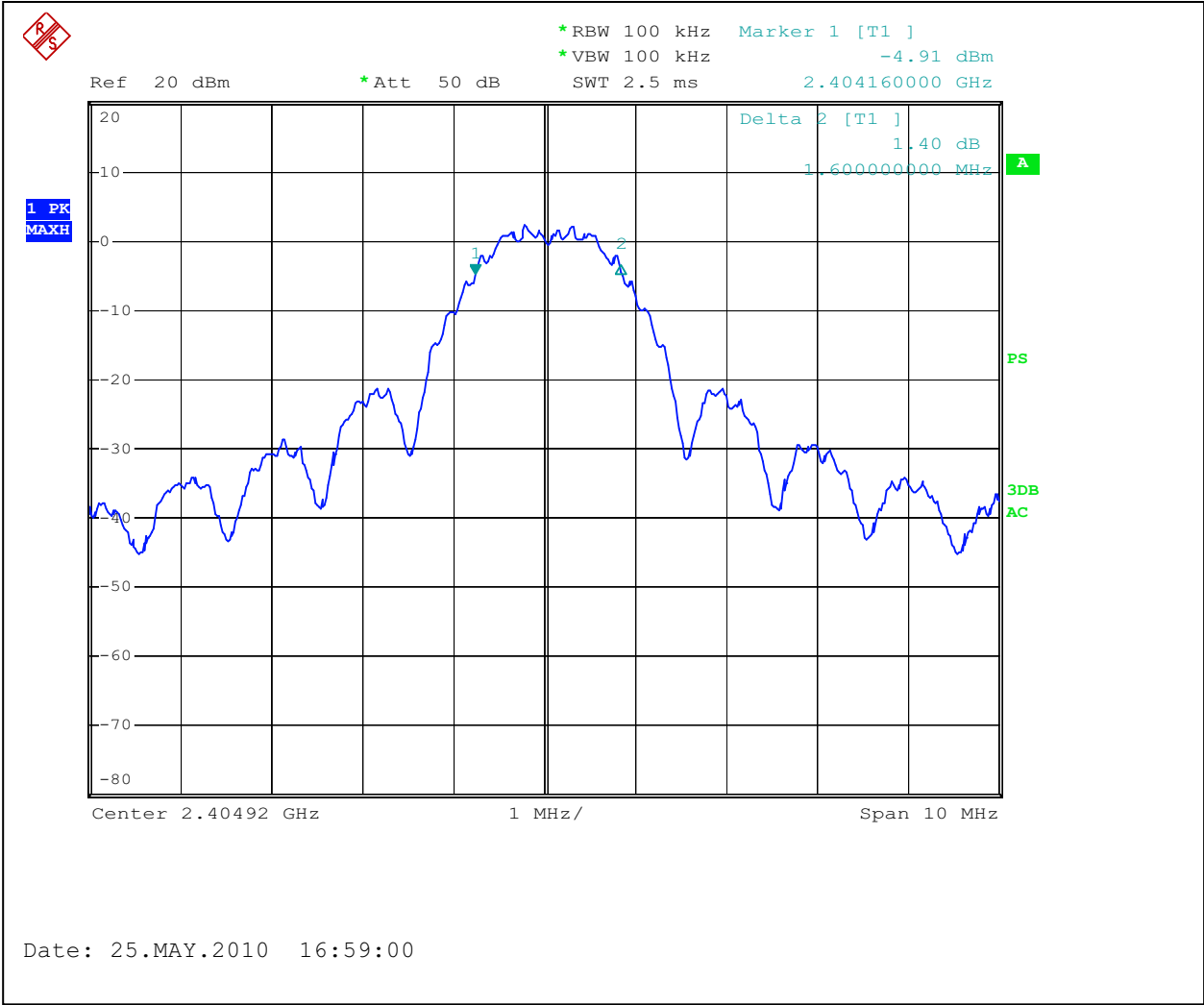


Graph 3.1.3

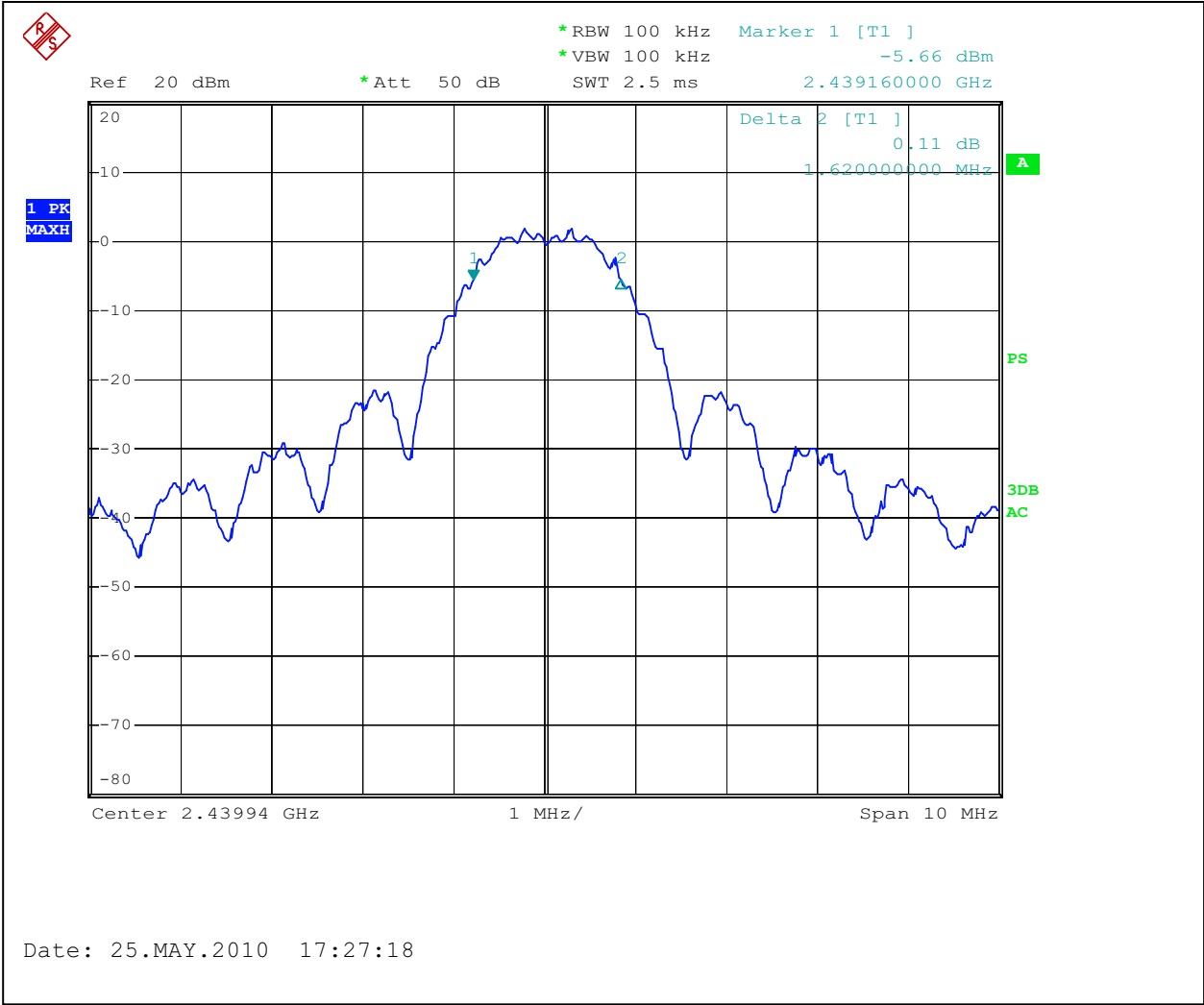
3.2 6dB bandwidth of the digital modulation

Low Frequency Channel kHz	Middle Frequency Channel MHz	Upper Frequency Channel MHz	Minimum Bandwidth kHz	Result
1.60	1.62	1.59	500	Pass
RBW: ☒ 100kHz ☐ other kHz VBW: ☒ 100kHz ☐ 300kHz ☐ other kHz				

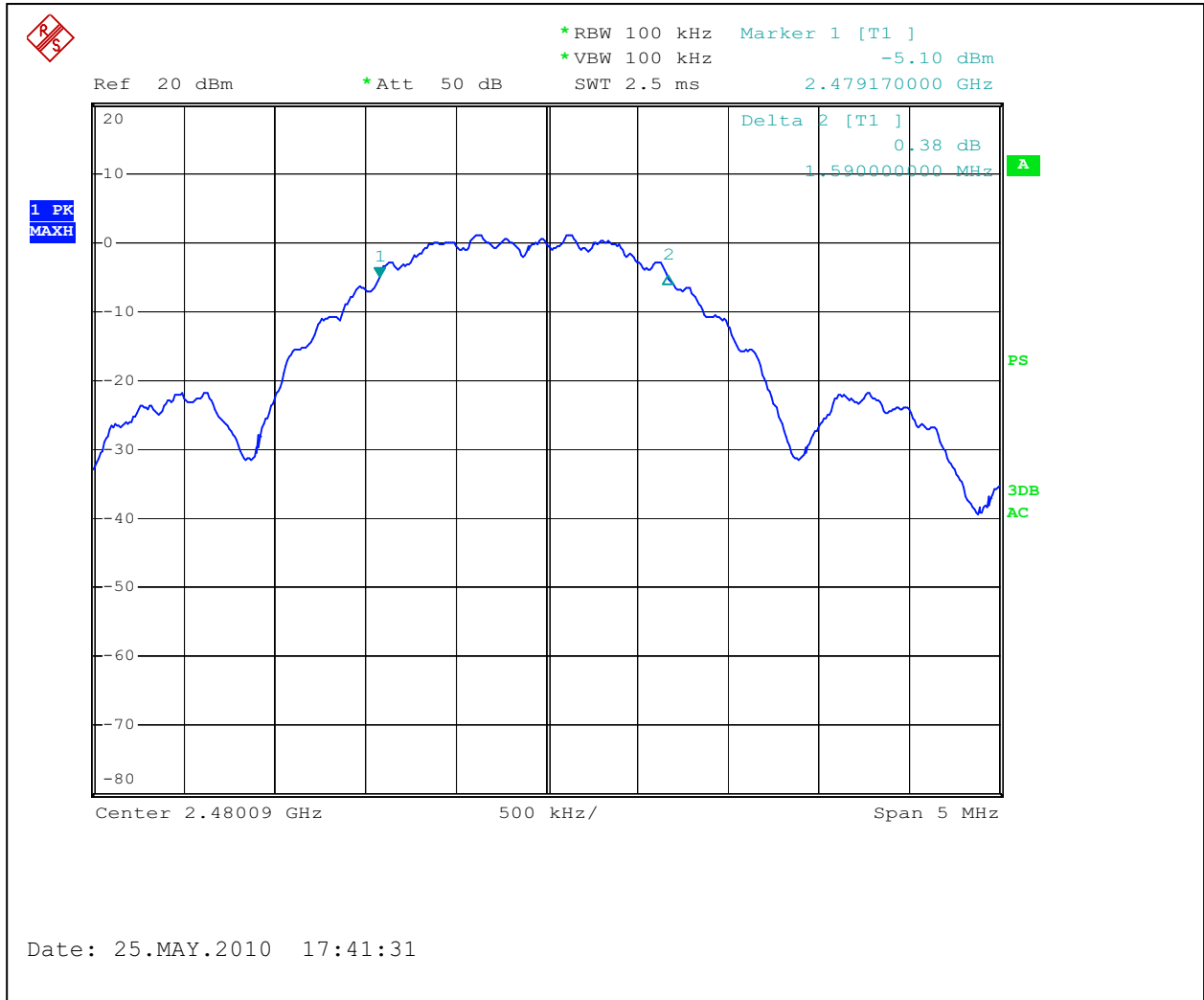
Notes: Graphs 3.2.1 to 3.2.3 show the 6dB bandwidth



Graph 3.2.1



Graph 3.2.2

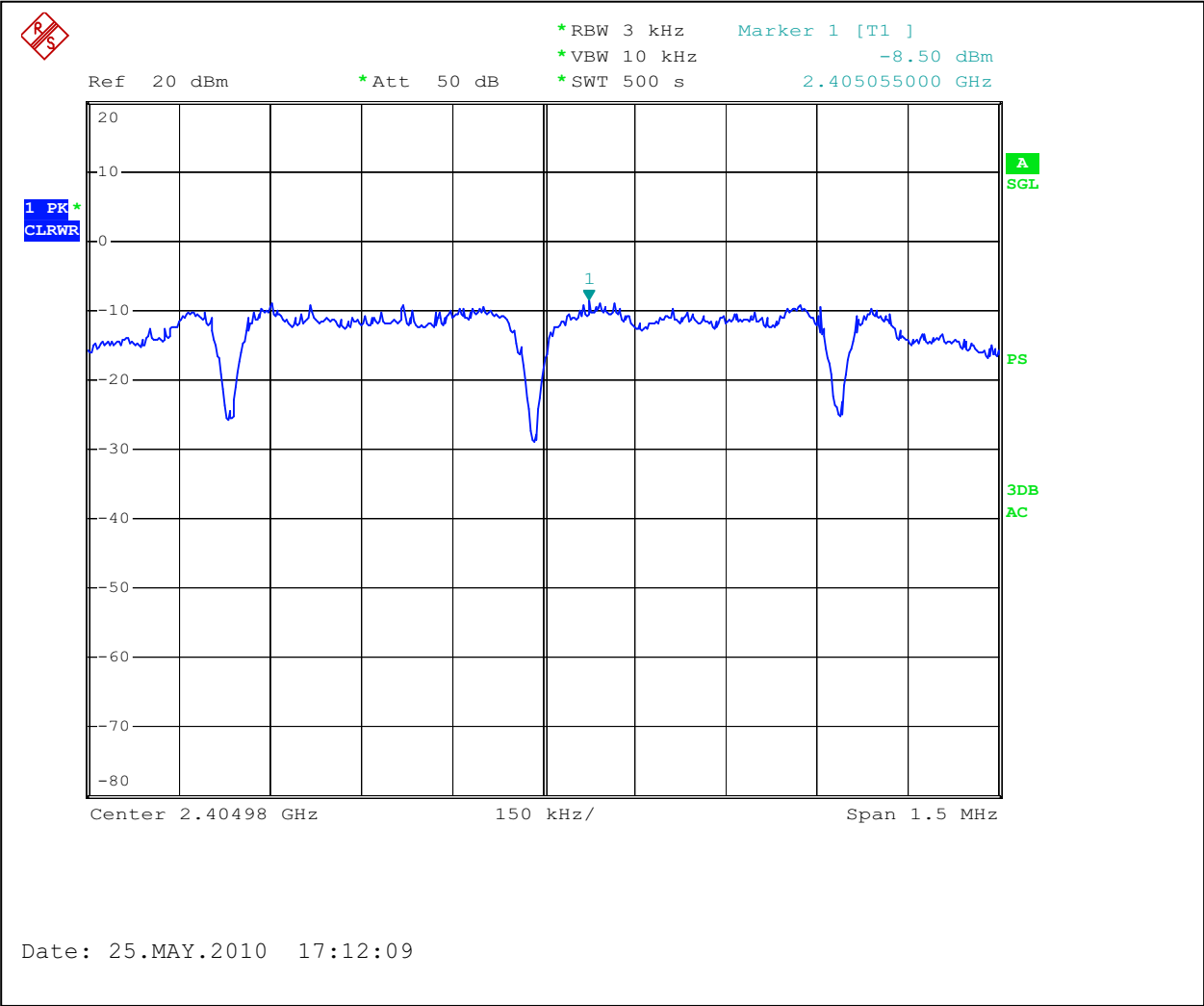


Graph 3.2.3

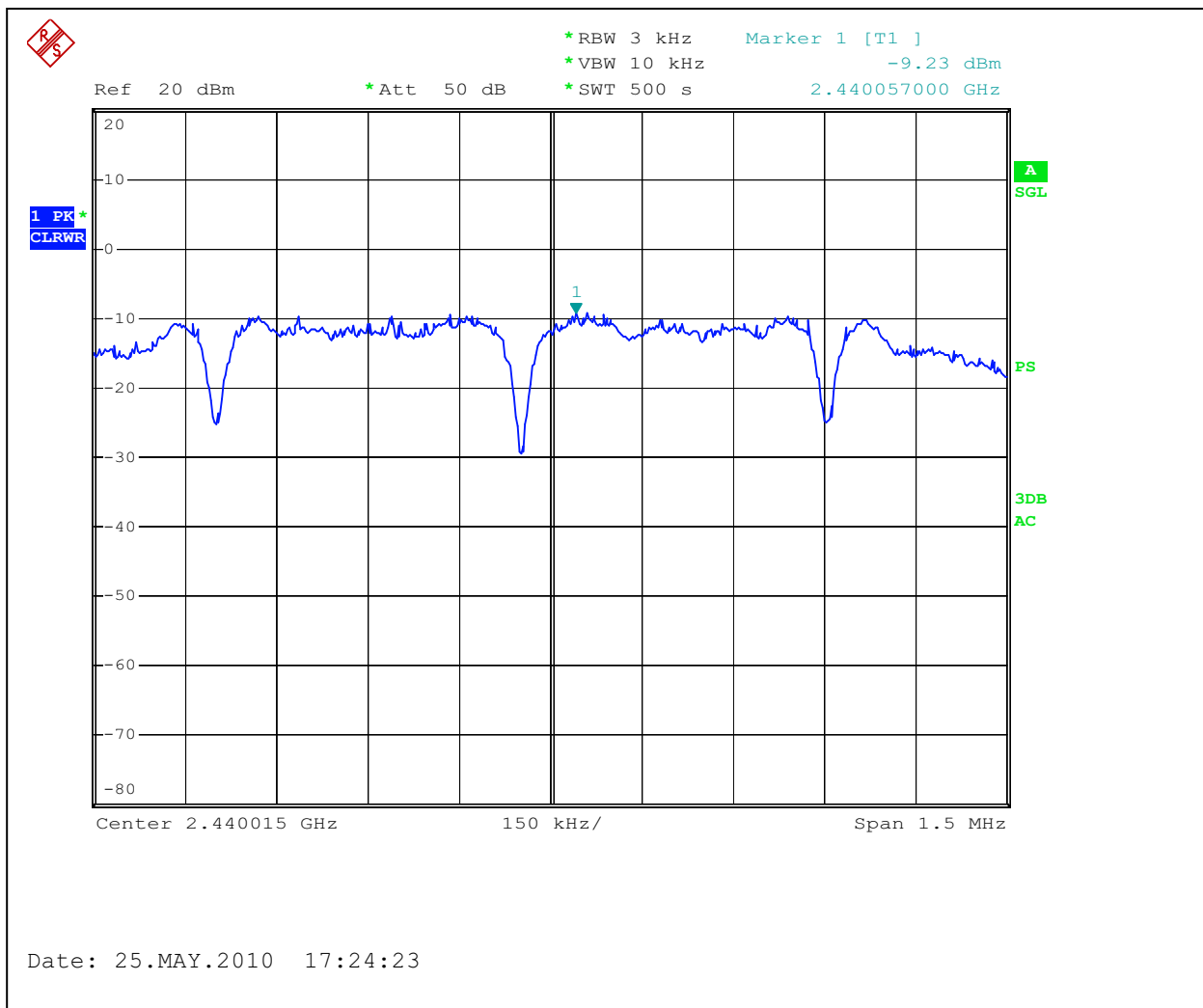
3.3 Power spectral density

Power Output:	☒ Conducted ☐ Radiated			
	Measured Density dBm or dBμV/m	Power Spectral Density dBm	Limit dBm	Margin dB
Low Frequency Channel	-8.50	-8.30	8	-16.50
Middle Frequency Channel	-9.23	-9.23	8	-17.23
Upper Frequency Channel	-9.75	-9.75	8	-17.75
Analyzer Settings:	☒ RBW=3KHz ☒ VBW=10KHz ☐ Span= MHz ☐ Sweep=300sec			
Antenna Gain:	☒ < 6dBi and = dBi ☐ >6dBi and = dBi, limit reduction = dB			

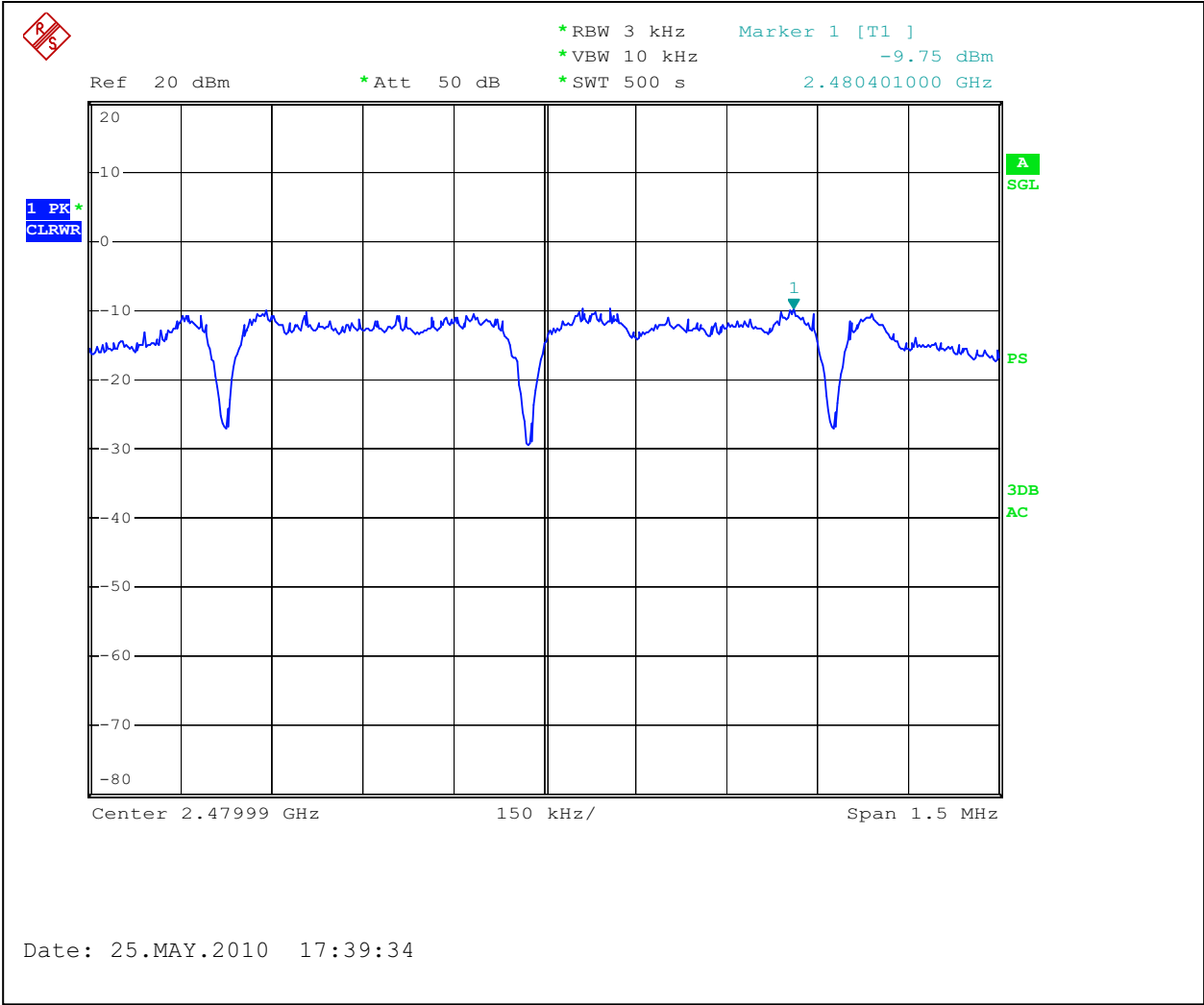
Notes: The Power Spectral Density was calculated adding the cable/attenuator loss of 0 dB from the measured density value. Graphs 3.3.1 to 3.3.3 show the Power Spectral Density



Graph 3.3.1



Graph 3.3.2

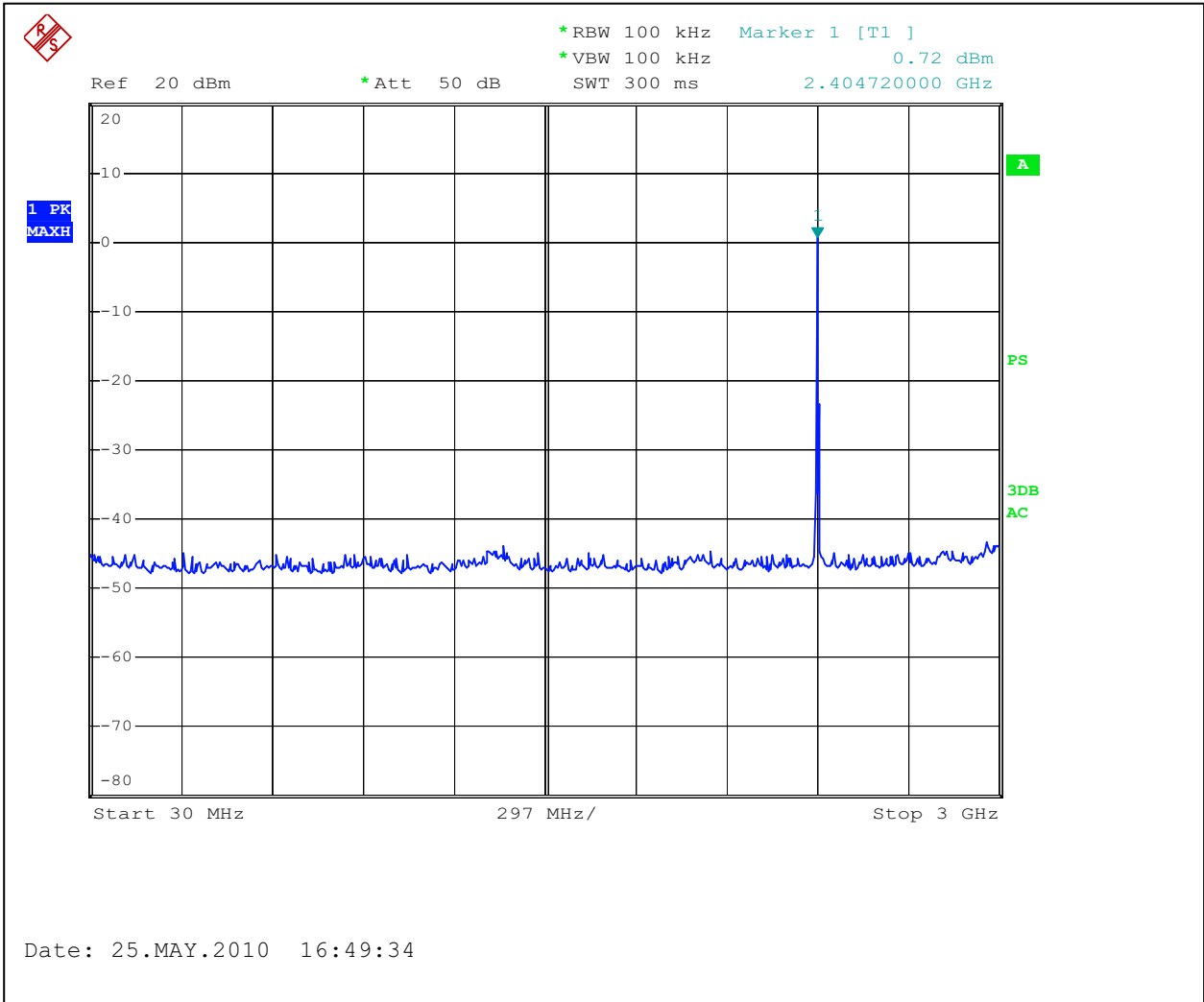


Graph 3.3.3

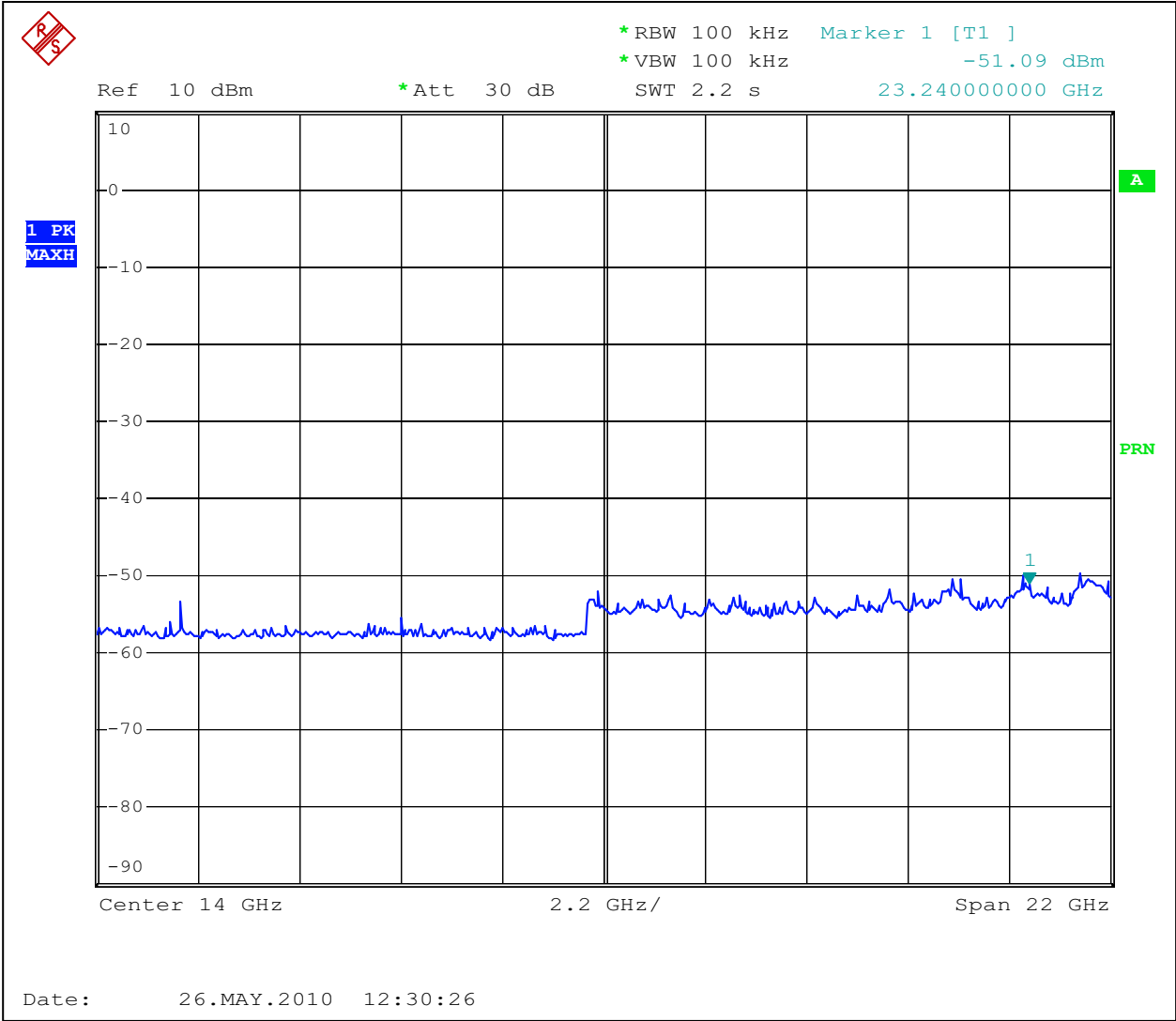
3.4 Antenna conducted spurious emissions

	Minimum Measured Attenuation dB	Minimum Allowed Attenuation dB	Margin dB
Low Frequency Channel		20	
Middle Frequency Channel		20	
Upper Frequency Channel		20	
Analyzer Settings:	☒ RBW=100KHz		
Minimum Allowed Attenuation:	☒ 20dB ☐ 30dB (for digital systems with conducted power measured using RMS averaging over a time interval)		

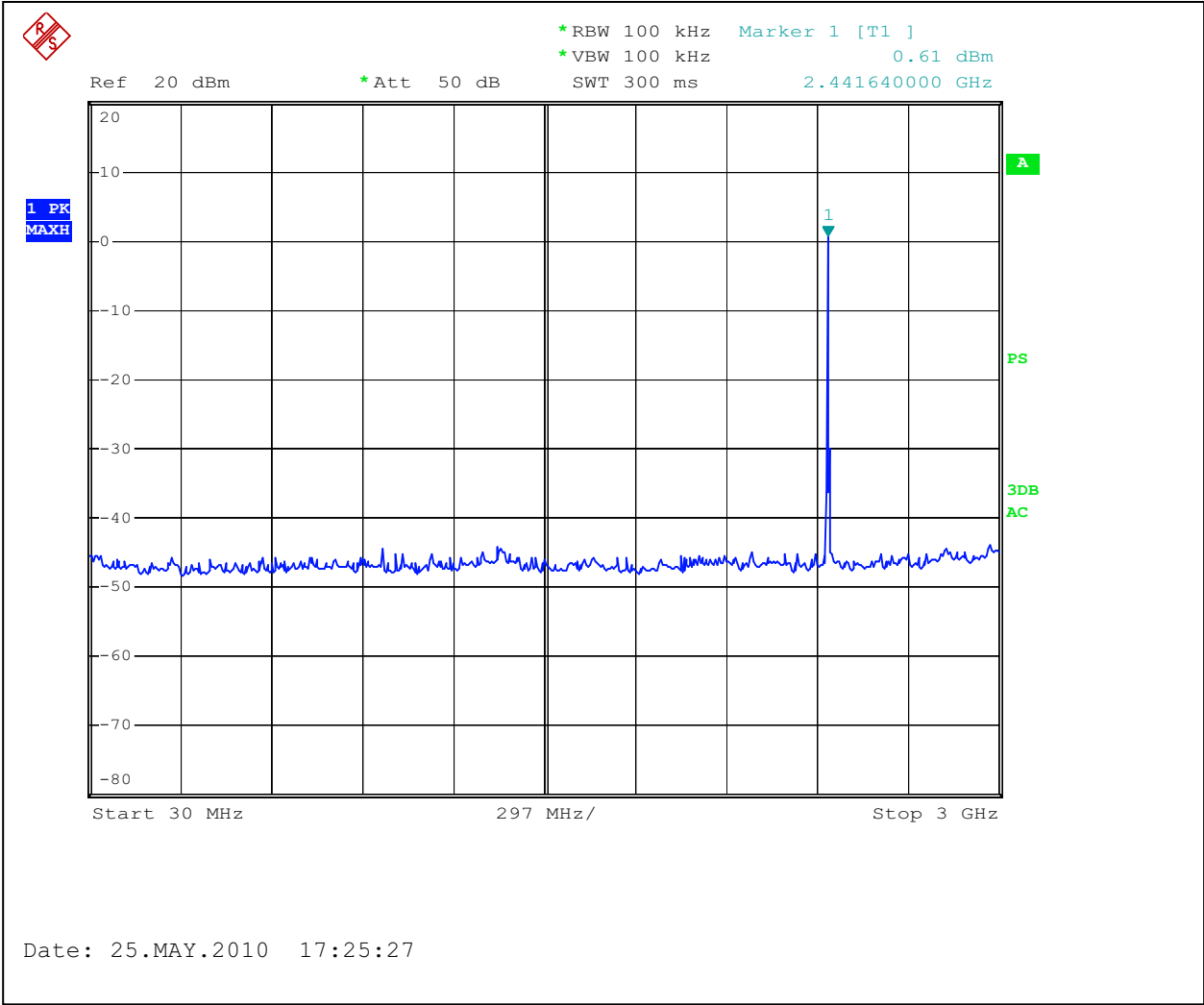
Notes: No conducted spurious emissions were detected (see Graphs 3.4.1-3.4.6). Transmitting fundamental frequency was excluded from the measurements.



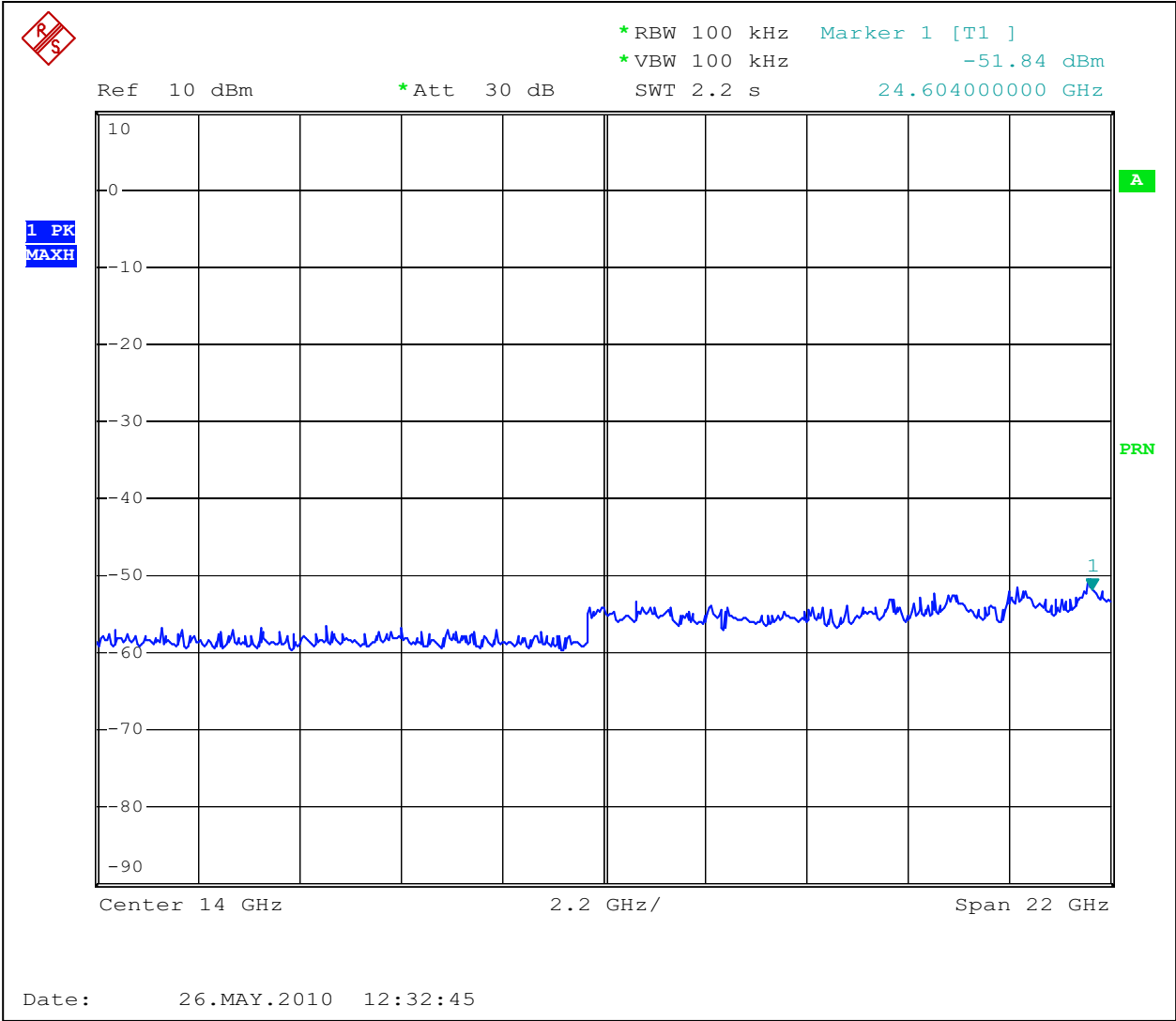
Graph 3.4.1



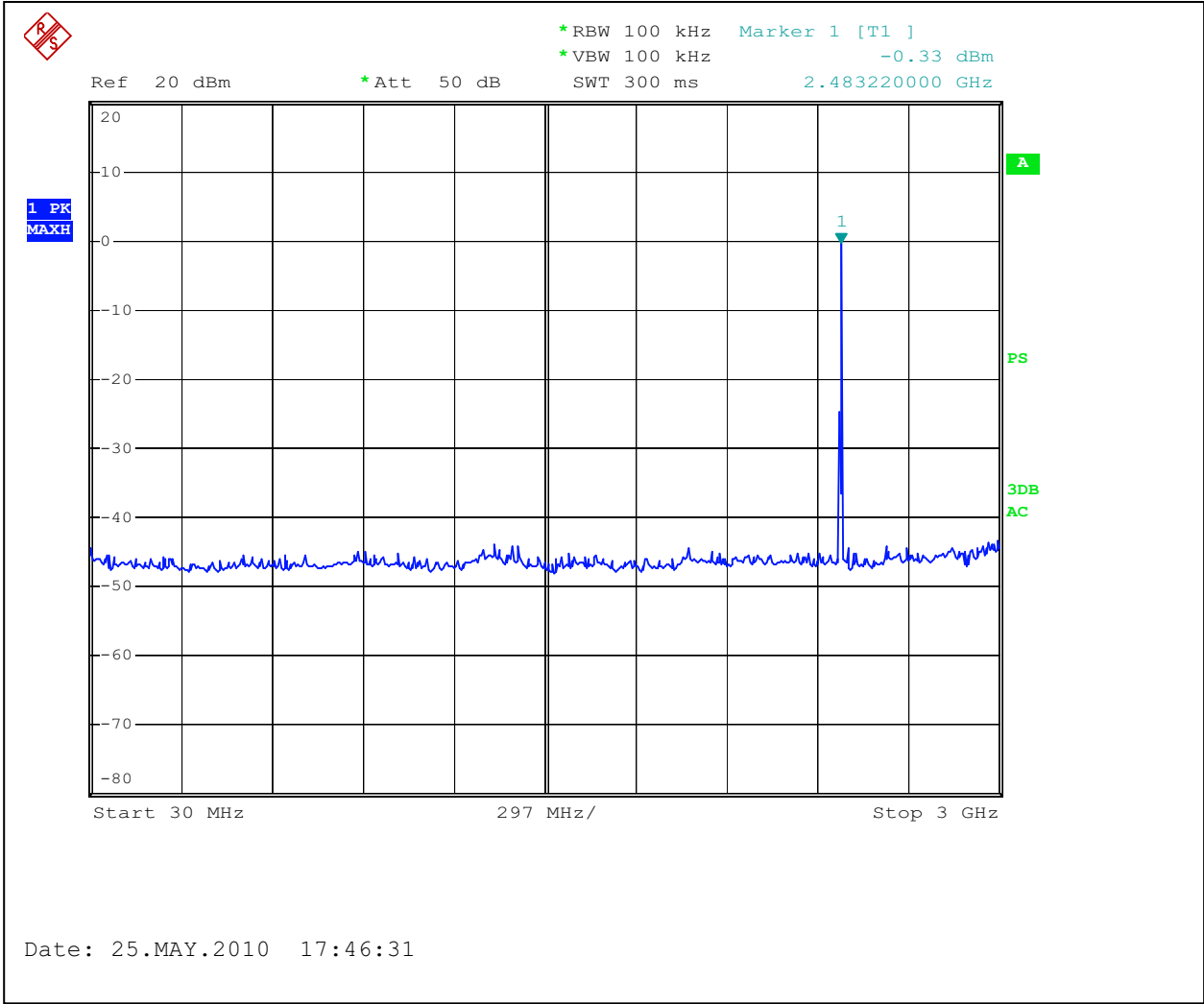
Graph 3.4.2



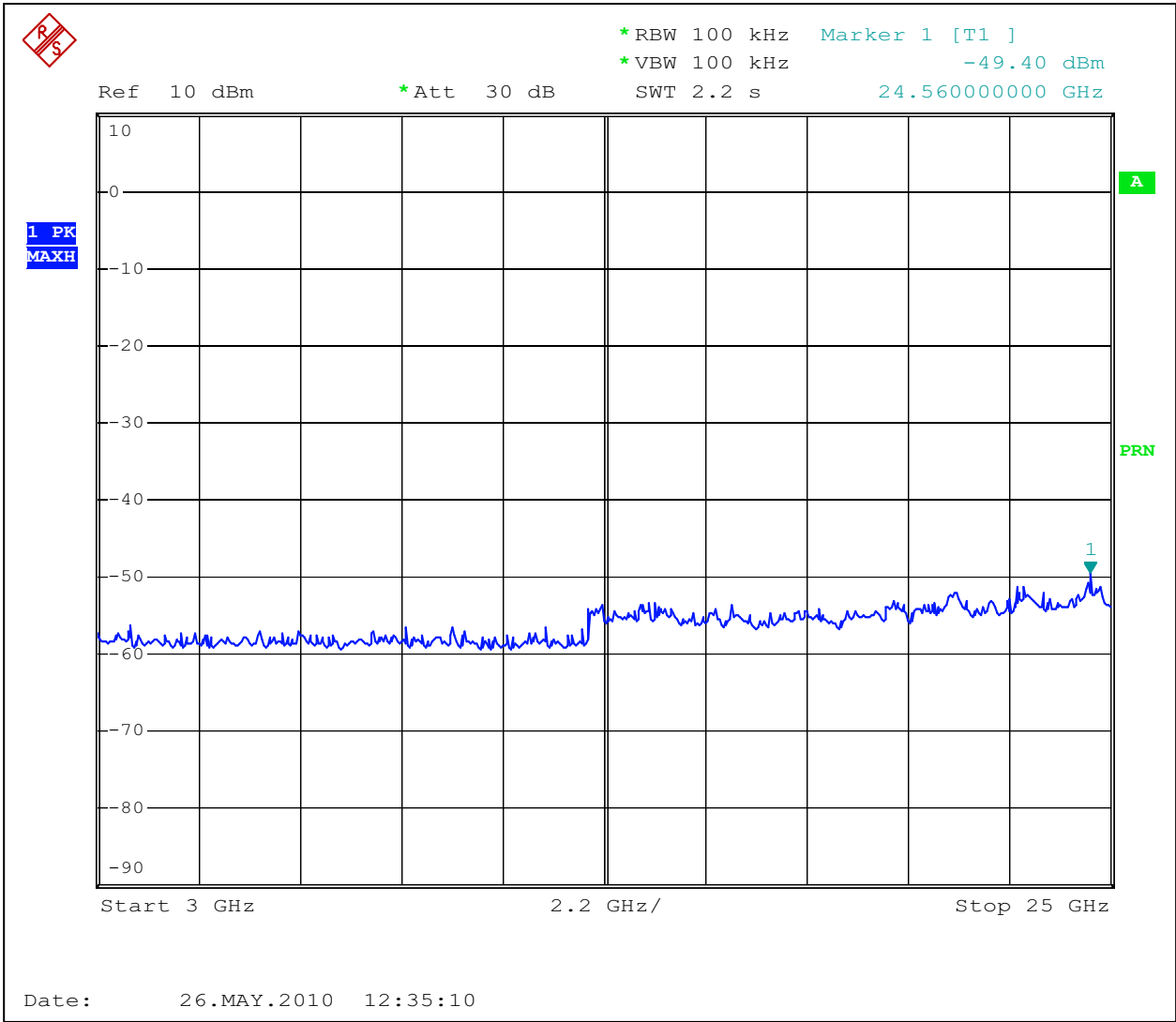
Graph 3.4.3



Graph 3.4.4



Graph 3.4.5



Graph 3.4.6

3.5 Radiated spurious emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Max. Margin: 0.4dB below the limits

Date:	May 27-June 1, 2010	Result: Pass
Standard:	FCC part 15.247(d)	
Tested by:	Norman Shpilsher	
Test Point:	Frequency Range 30MHz-1GHz	
Operation mode:	See Page 5	
Note:	Fundamental transmitting frequency was excluded from measurements	

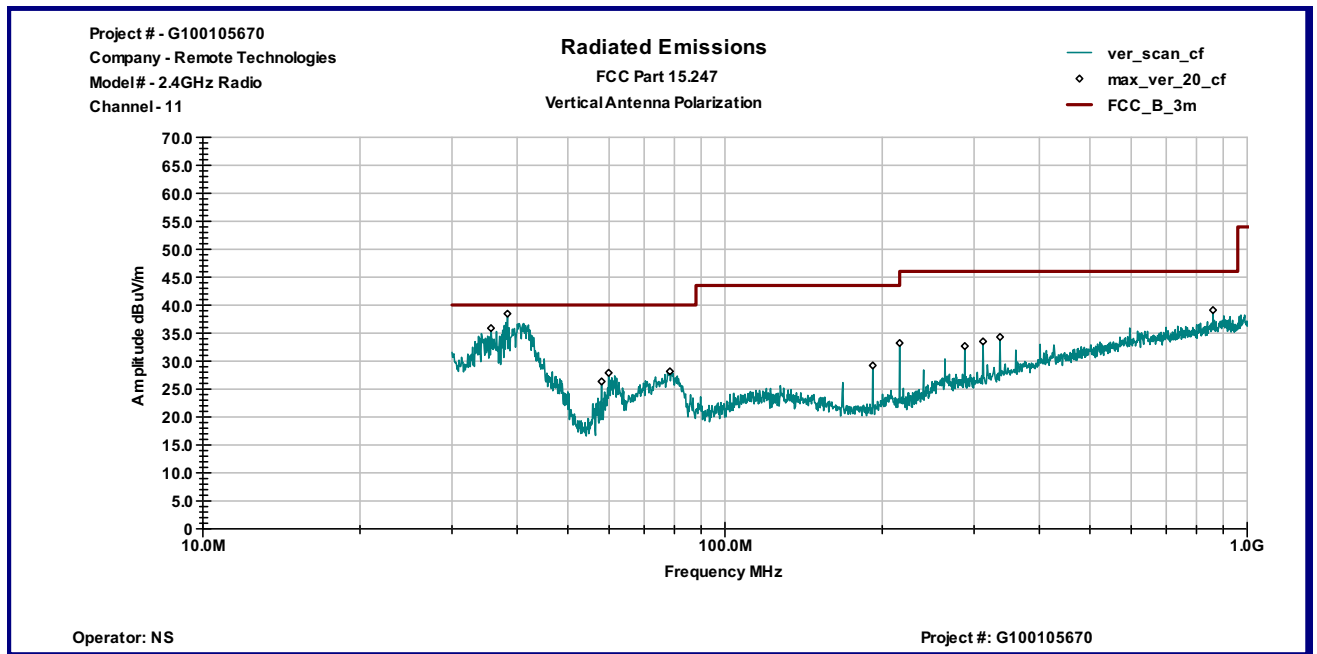
Table 3.5.1

Frequency	Ant. Polarity	Peak Reading dBμV	Ant.Factor dB1/m	Total at 3m dBμV/m	QP Limit dBμV/m	Margin dB
Channel 11						
35.628 MHz	V	18.1	17.8	35.9	40.0	-4.1
38.312 MHz	V	22.1	16.4	38.5	40.0	-1.5
860.3 MHz	V	14.1	25.0	39.1	46.0	-6.9
31.299 MHz	H	10.9	20.1	31.0	40.0	-9.0
216.01 MHz	H	31.0	11.8	42.9	46.0	-3.2
240.12 MHz	H	26.4	13.6	40.0	46.0	-6.0
287.94 MHz	H	21.4	15.5	36.9	46.0	-9.1
336.36 MHz	H	20.6	16.7	37.3	46.0	-8.7
917.77 MHz	H	14.6	25.5	40.1	46.0	-6.0
Channel 18						
33.463 MHz	V	15.1	18.9	34.0	40.0	-6.0
34.069 MHz	V	15.8	18.6	34.4	40.0	-5.6
39.264 MHz	V	22.4	15.9	38.3	40.0	-1.7
30.346 MHz	H	10.3	20.6	30.9	40.0	-9.1
191.89 MHz	H	28.3	11.2	39.6	43.5	-4.0
216.01 MHz	H	30.1	11.8	41.9	46.0	-4.1
287.94 MHz	H	23.3	15.5	38.8	46.0	-7.3
312.12 MHz	H	22.3	16.0	38.2	46.0	-7.8
336.36 MHz	H	19.8	16.7	36.5	46.0	-9.5
Channel 26						
37.533 MHz	V	20.4	16.8	37.2	40.0	-2.9
38.831 MHz	V	23.4	16.1	39.5	40.0	-0.5
39.091 MHz	V	23.6	16.0	39.6	40.0	-0.4
40.217 MHz	V	23.1	15.4	38.4	40.0	-1.6
31.991 MHz	H	11.0	19.7	30.7	40.0	-9.3
191.89 MHz	H	29.4	11.2	40.6	43.5	-3.0
216.01 MHz	H	32.0	11.8	43.8	46.0	-2.2
287.94 MHz	H	22.7	15.5	38.2	46.0	-7.9

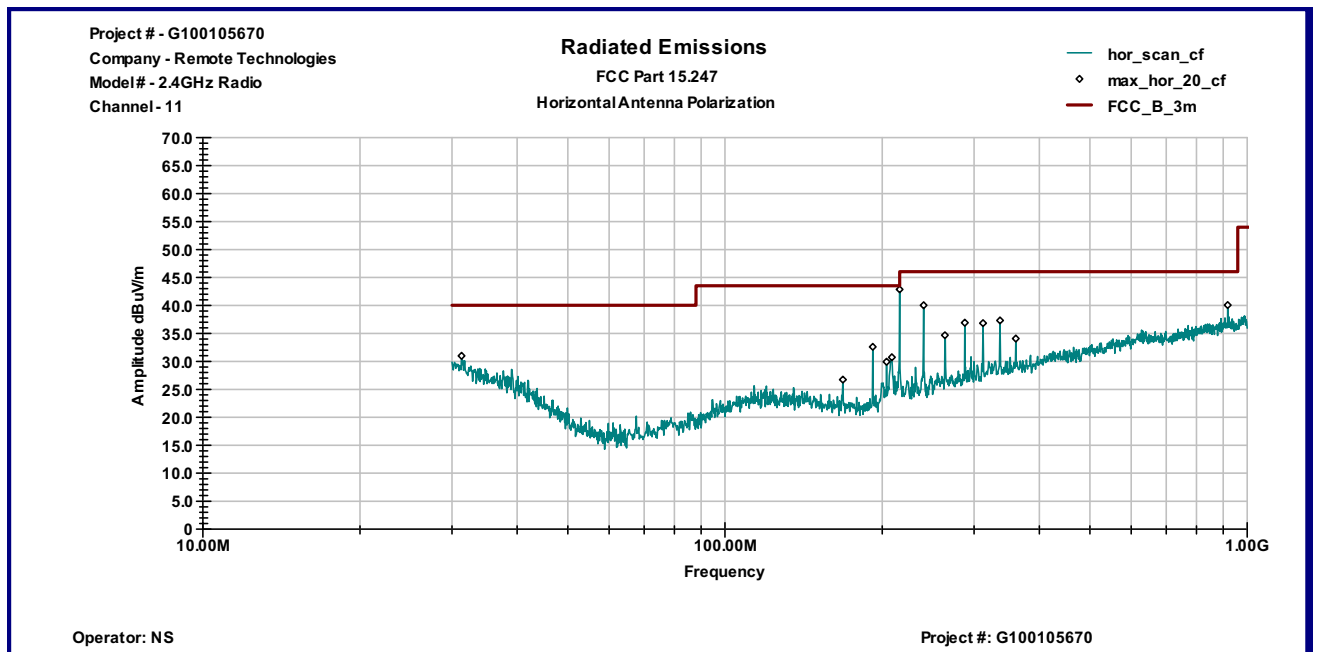
Date:	May 27-June 1, 2010	Result: Pass
Standard:	FCC part 15.247(d)	
Tested by:	Norman Shpilsher	
Test Point:	Low frequency channel	
Operation mode:	Frequency Range 1GHz-25GHz	
Note:	Fundamental transmitting frequency was excluded from measurements	

Table 3.5.2

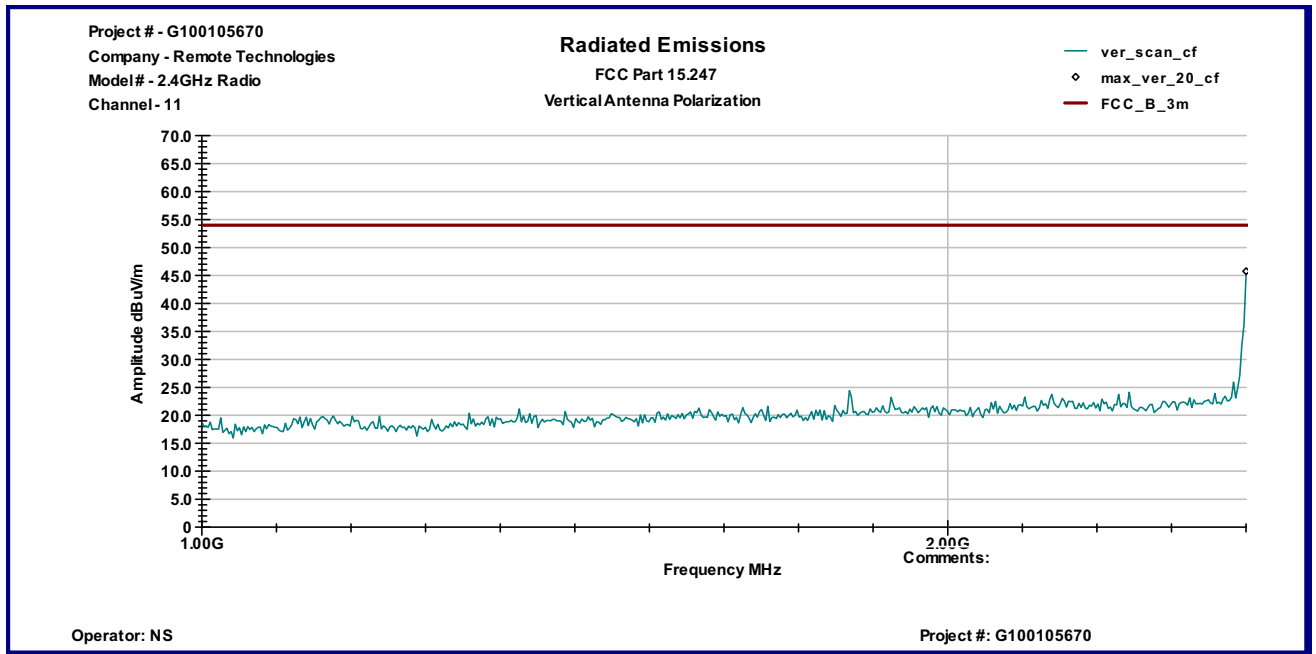
Frequency MHz	Antenna Polarity	Reading dBμV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBμV/m	Limit dBμV/m	Margin dB
Channel 11							
4.8126 GHz	V	52.5	38.0	41.9	48.6	54.0	-5.3
4.8126 GHz	H	53.2	37.9	41.9	49.3	54.0	-4.7
7.2151 GHz	H	35.2	42.0	41.4	35.8	54.0	-18.2
Channel 18							
4.8808 GHz	V	56.0	38.1	41.8	52.3	54.0	-1.7
7.3205 GHz	V	39.4	42.1	41.2	40.4	54.0	-13.6
4.8808 GHz	H	56.8	38.0	41.8	53.1	54.0	-0.9
7.3205 GHz	H	42.0	42.3	41.2	43.0	54.0	-11.0
Channel 26							
4.9583 GHz	V	51.1	38.2	41.7	47.6	54.0	-6.4
7.4383 GHz	V	40.4	42.5	41.0	41.9	54.0	-12.1
4.9614 GHz	H	55.5	38.2	41.7	52.0	54.0	-2.0
7.4414 GHz	H	41.6	42.6	41.0	43.2	54.0	-10.8



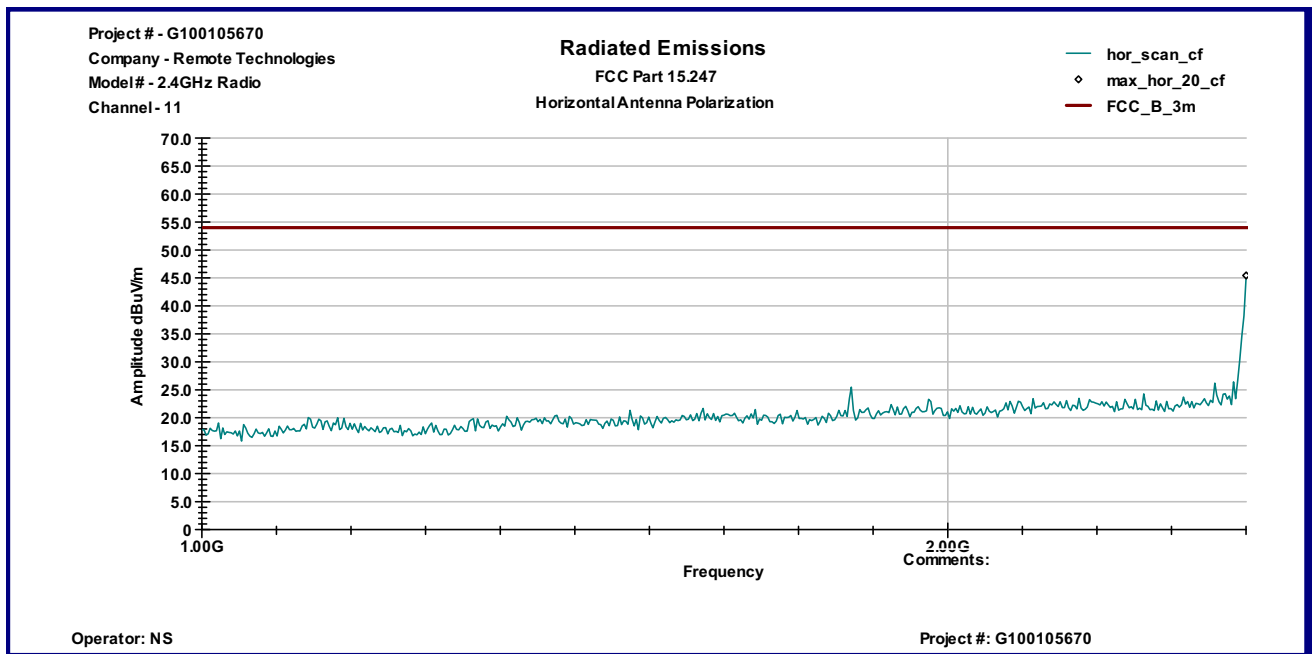
Graph 3.5.1



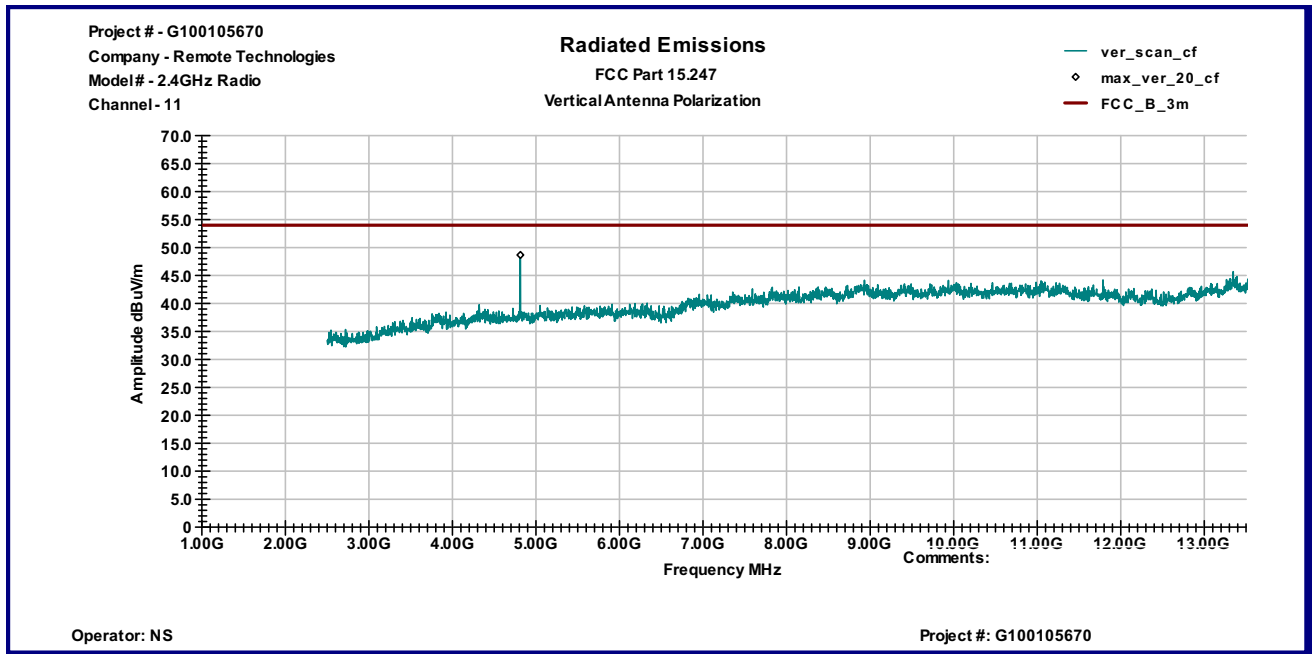
Graph 3.5.2



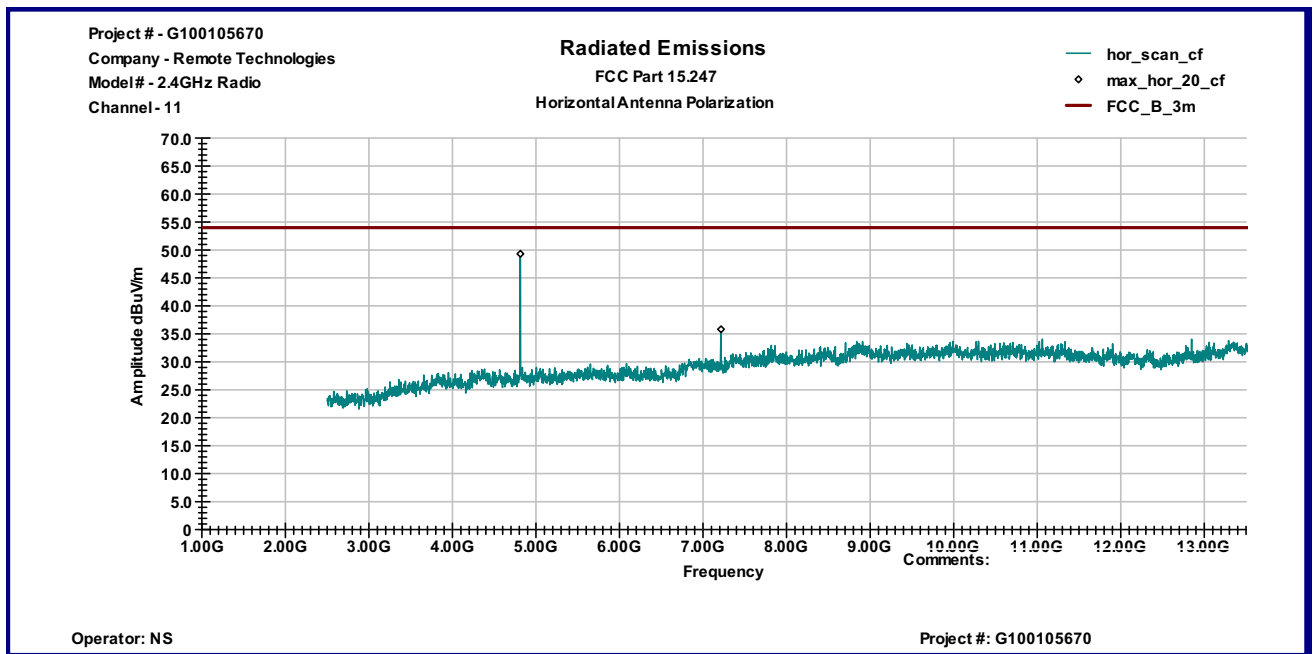
Graph 3.5.3



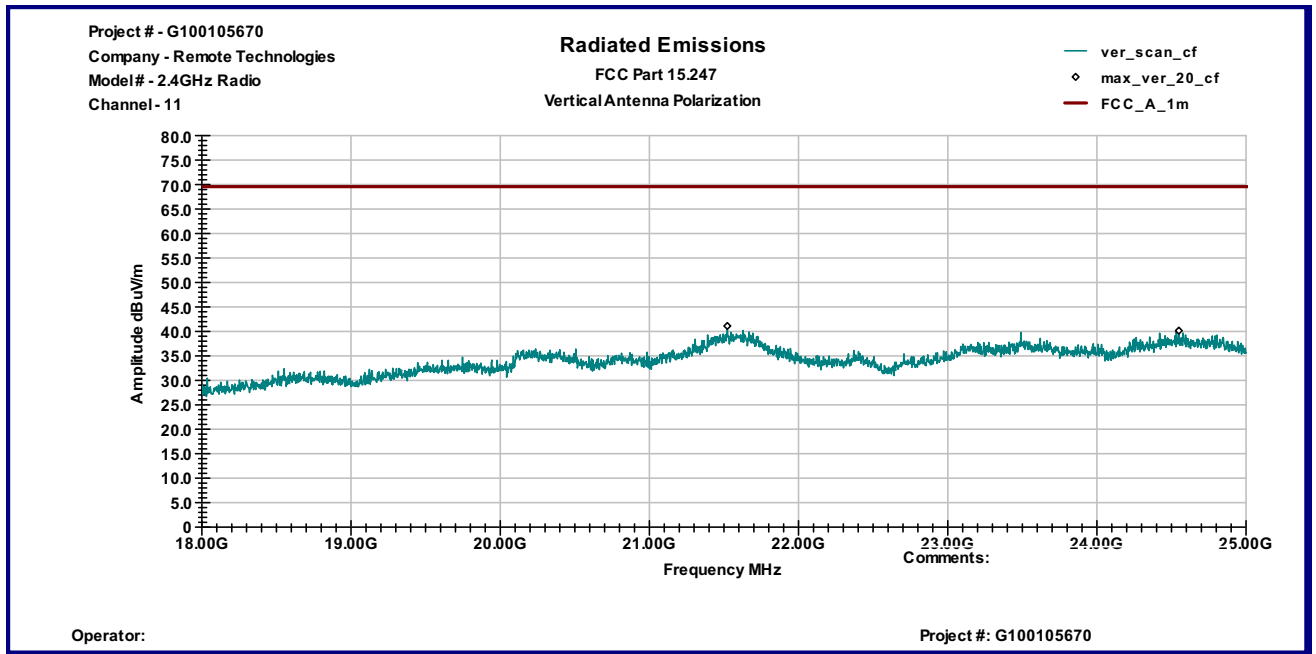
Graph 3.5.4



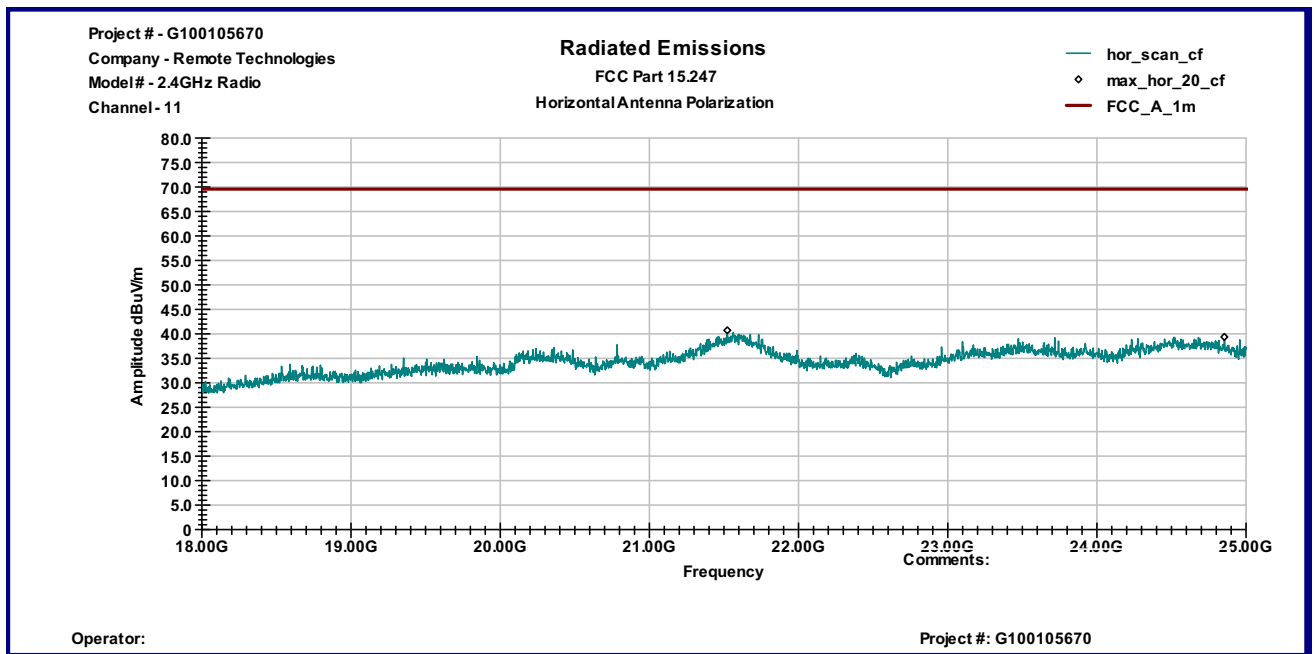
Graph 3.5.5



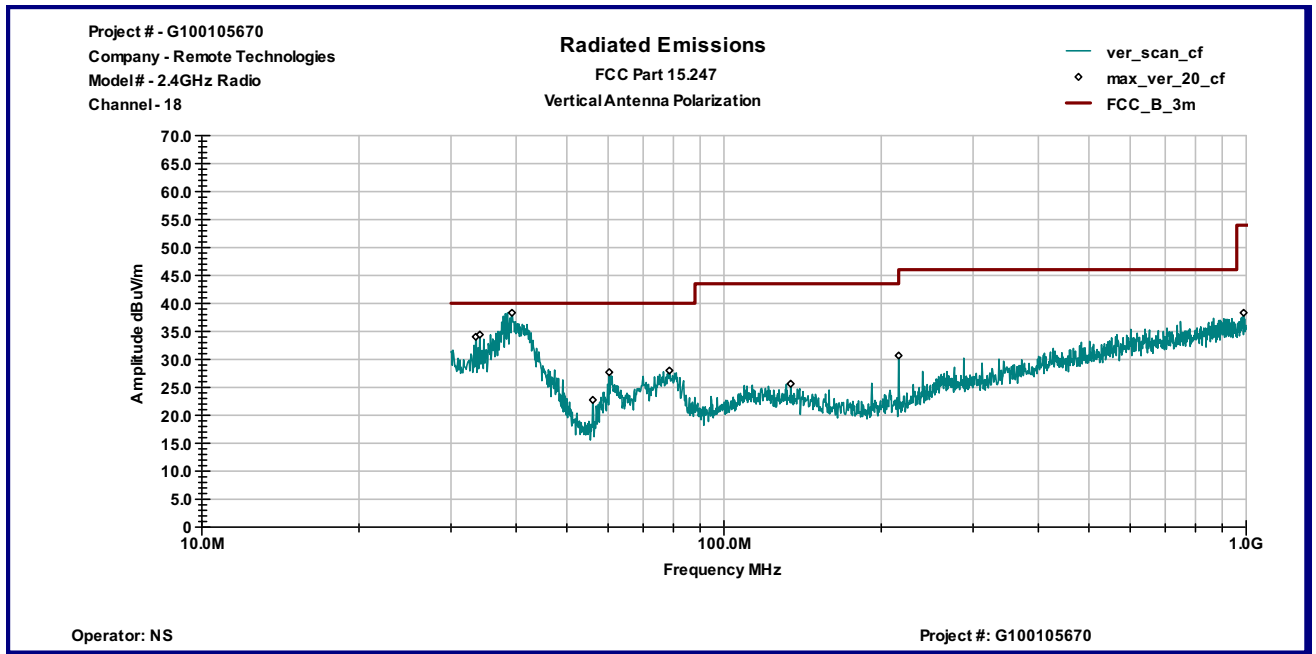
Graph 3.5.6



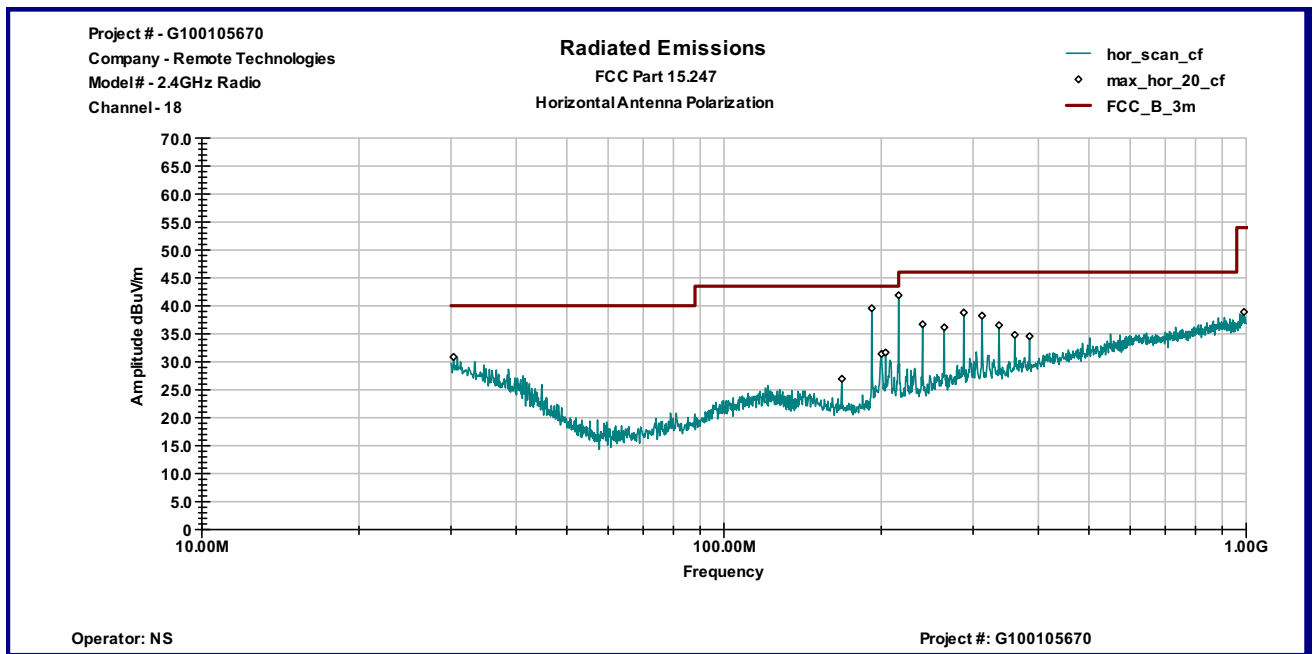
Graph 3.5.7



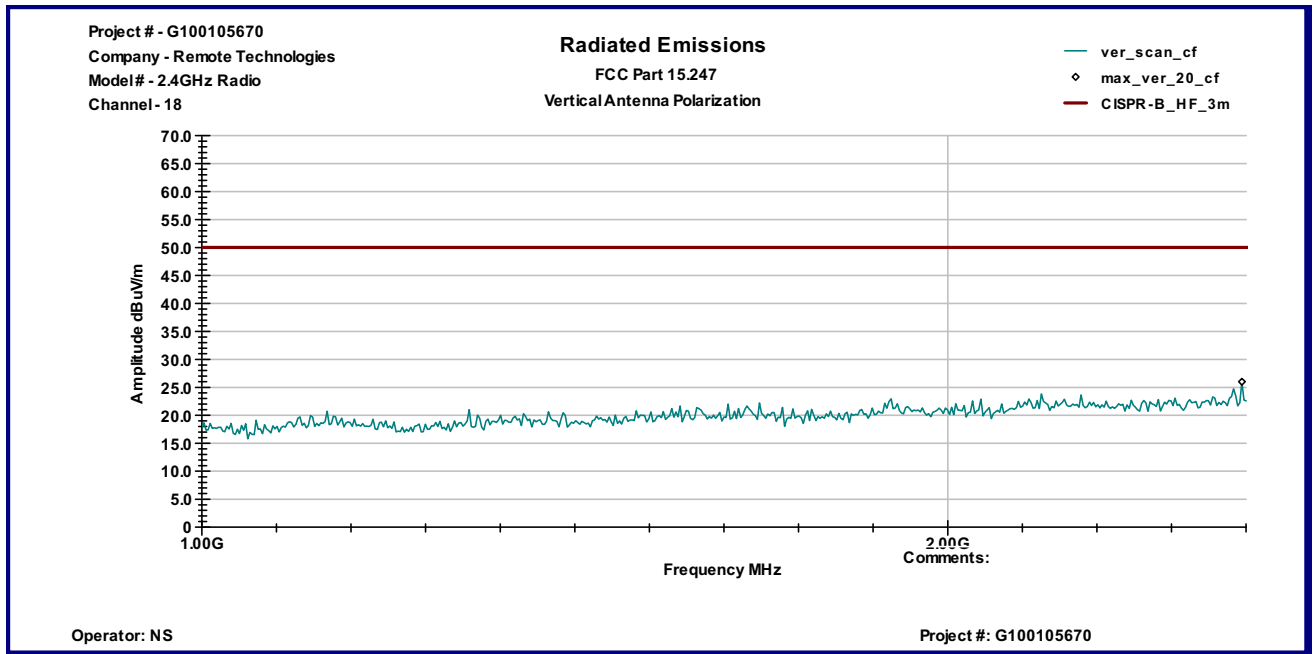
Graph 3.5.8



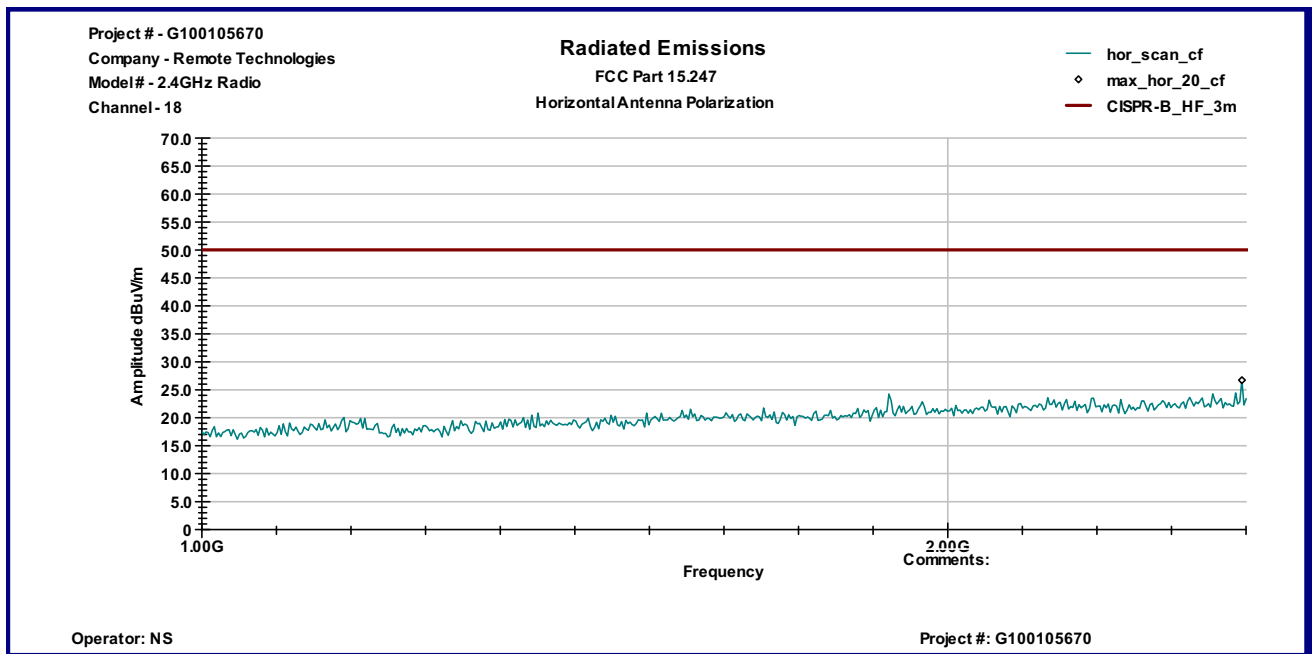
Graph 3.5.9



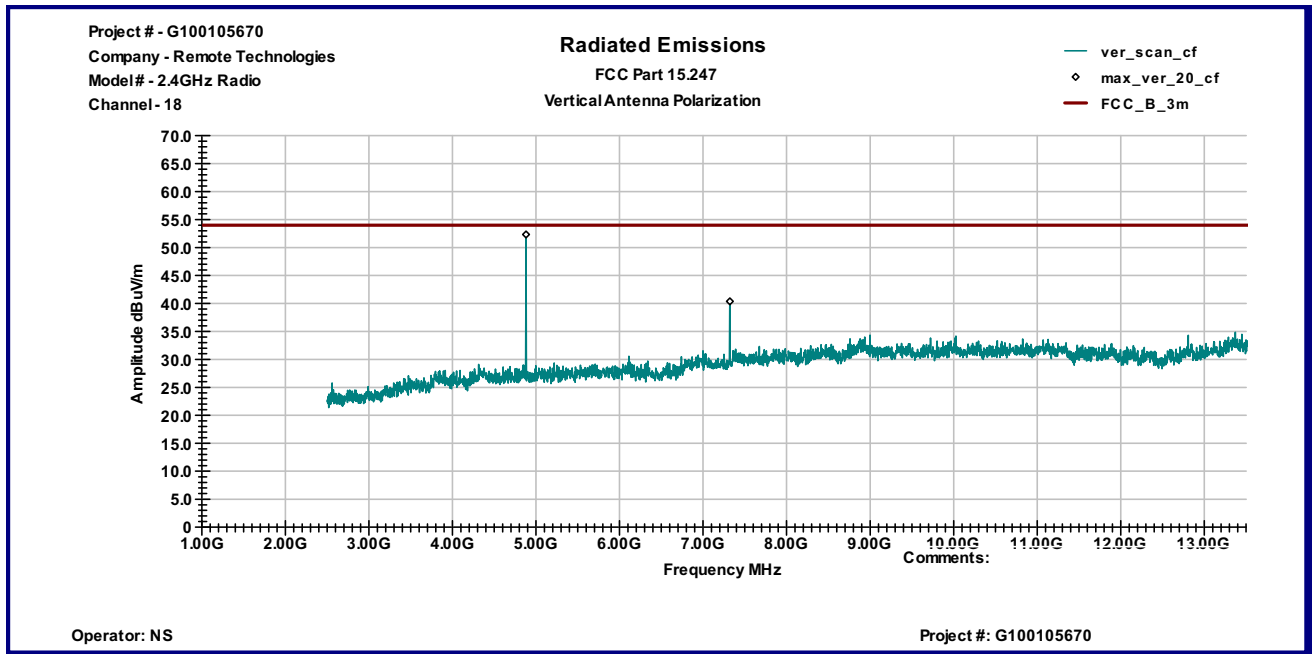
Graph 3.5.10



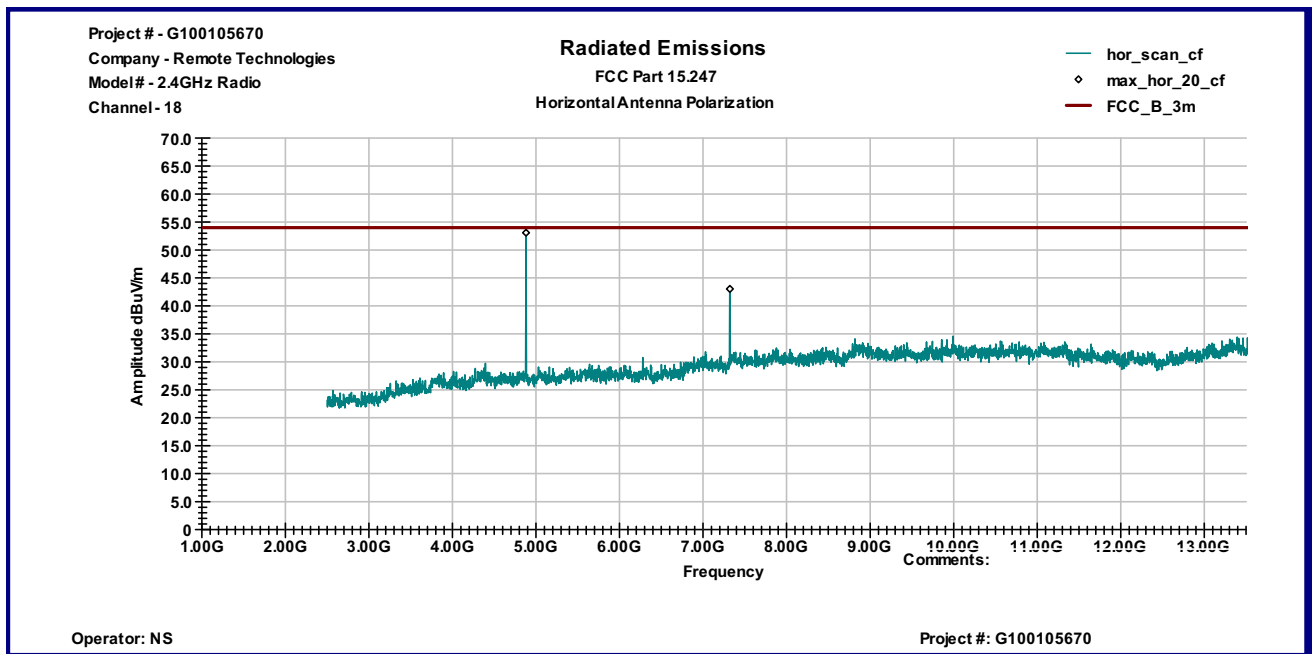
Graph 3.5.11



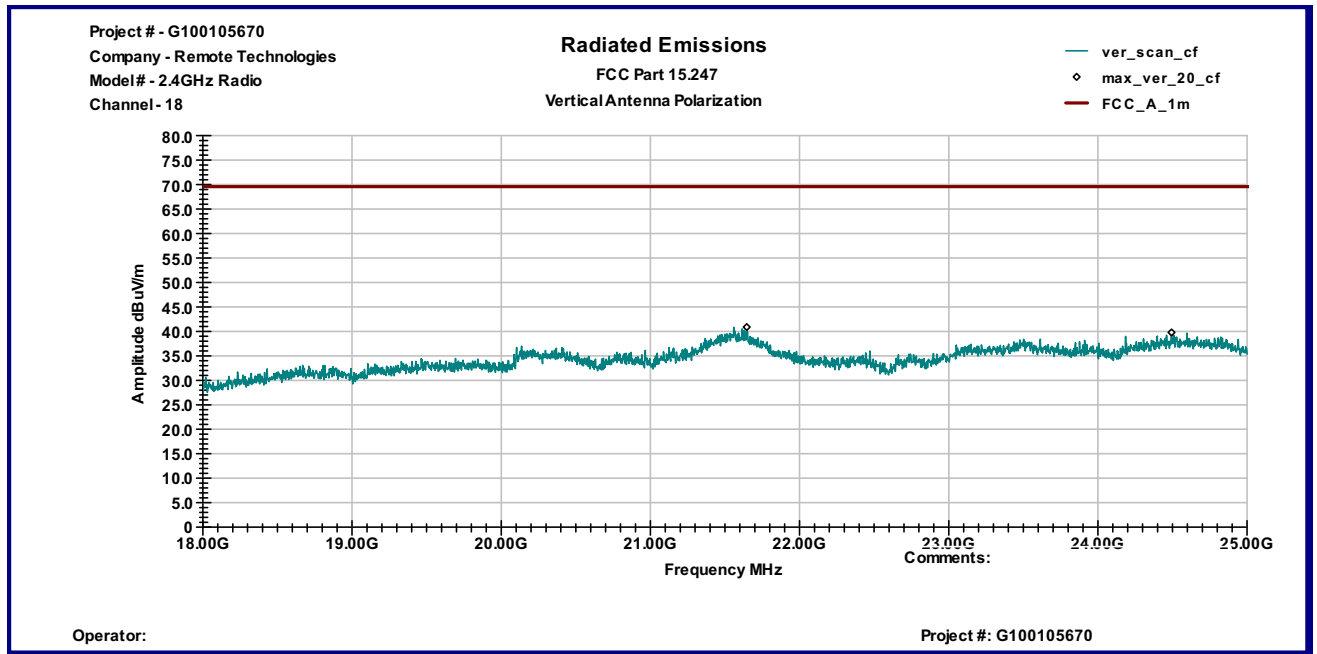
Graph 3.5.12



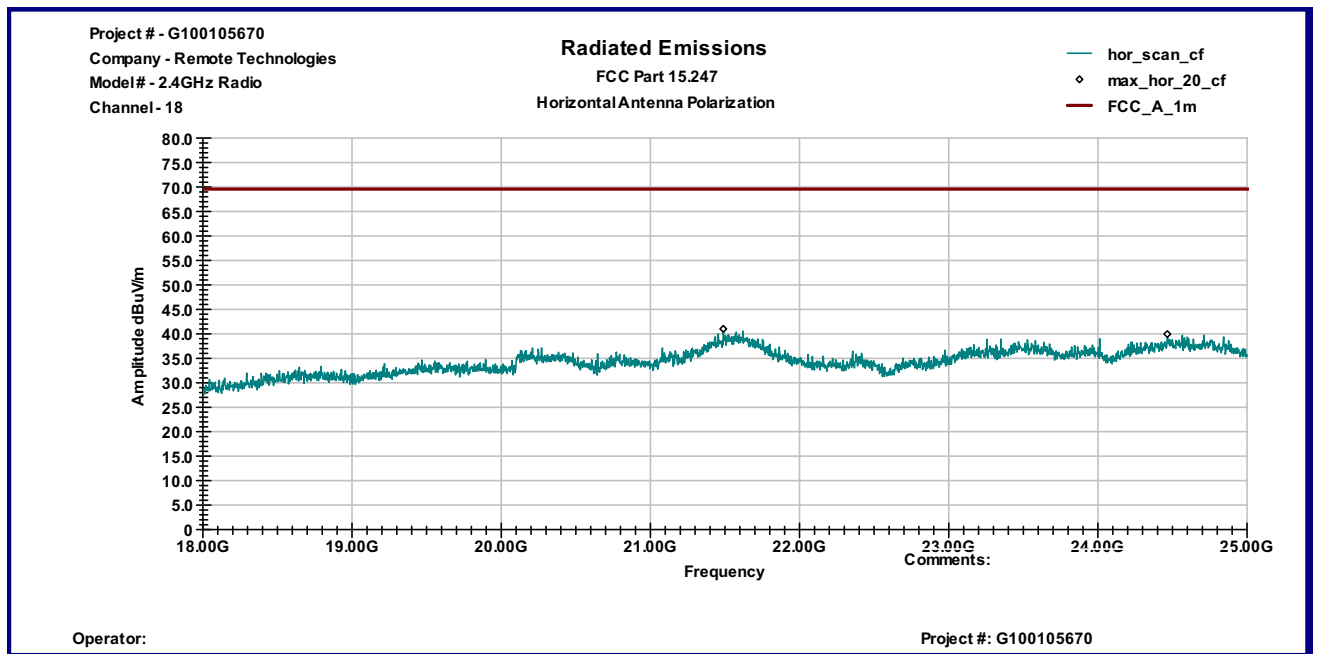
Graph 3.5.13



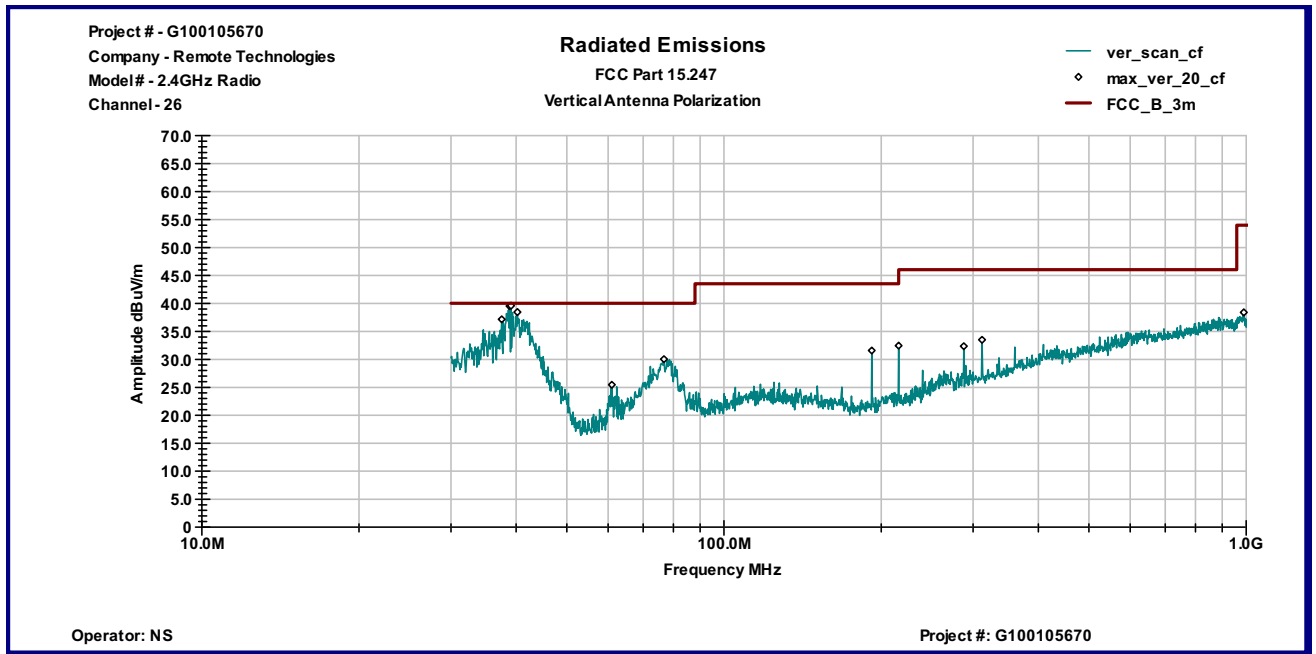
Graph 3.5.14



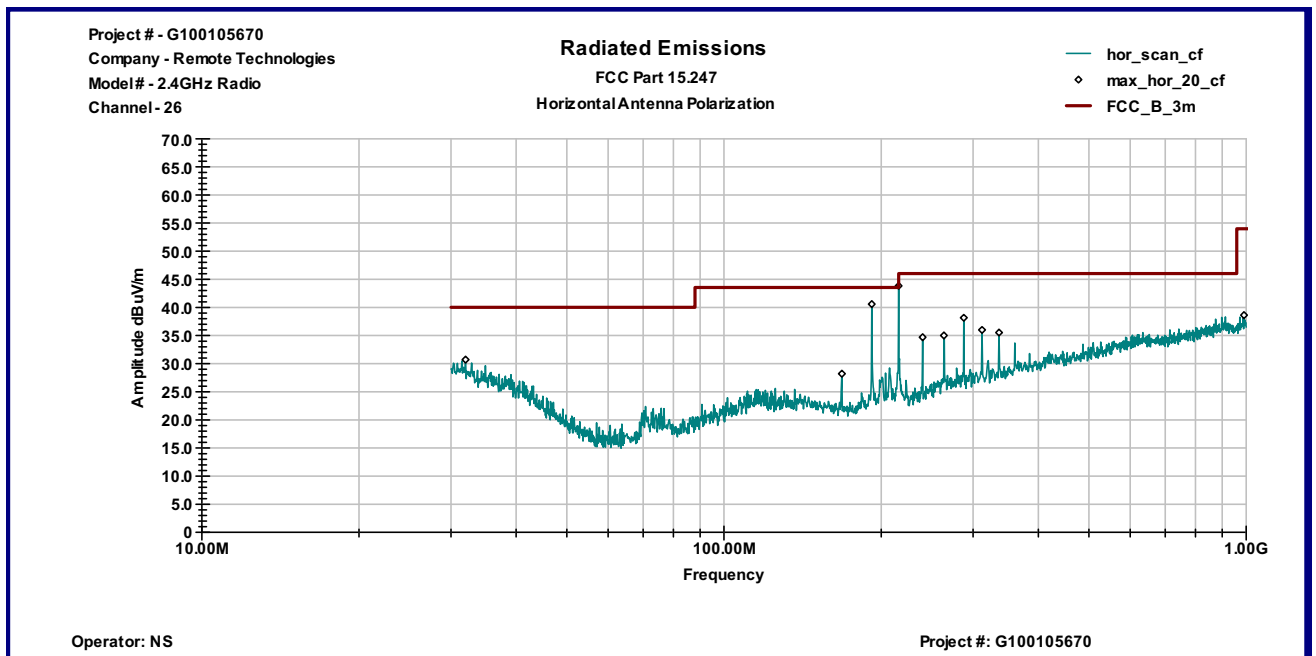
Graph 3.5.15



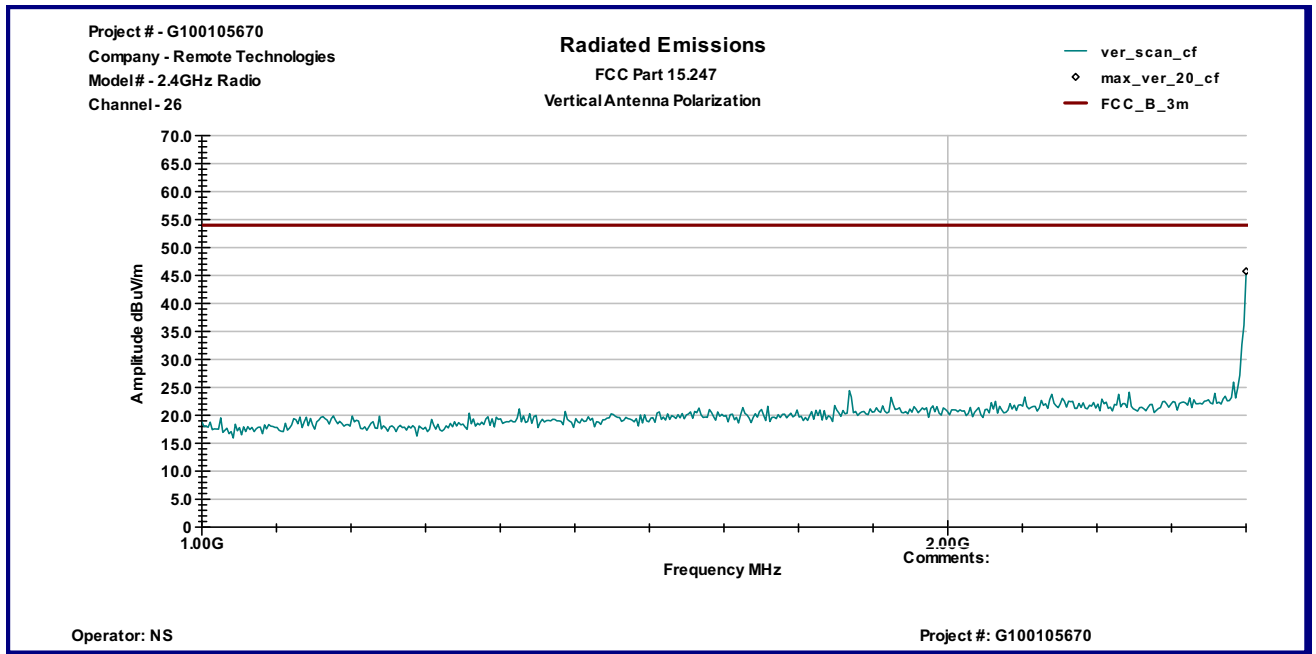
Graph 3.5.16



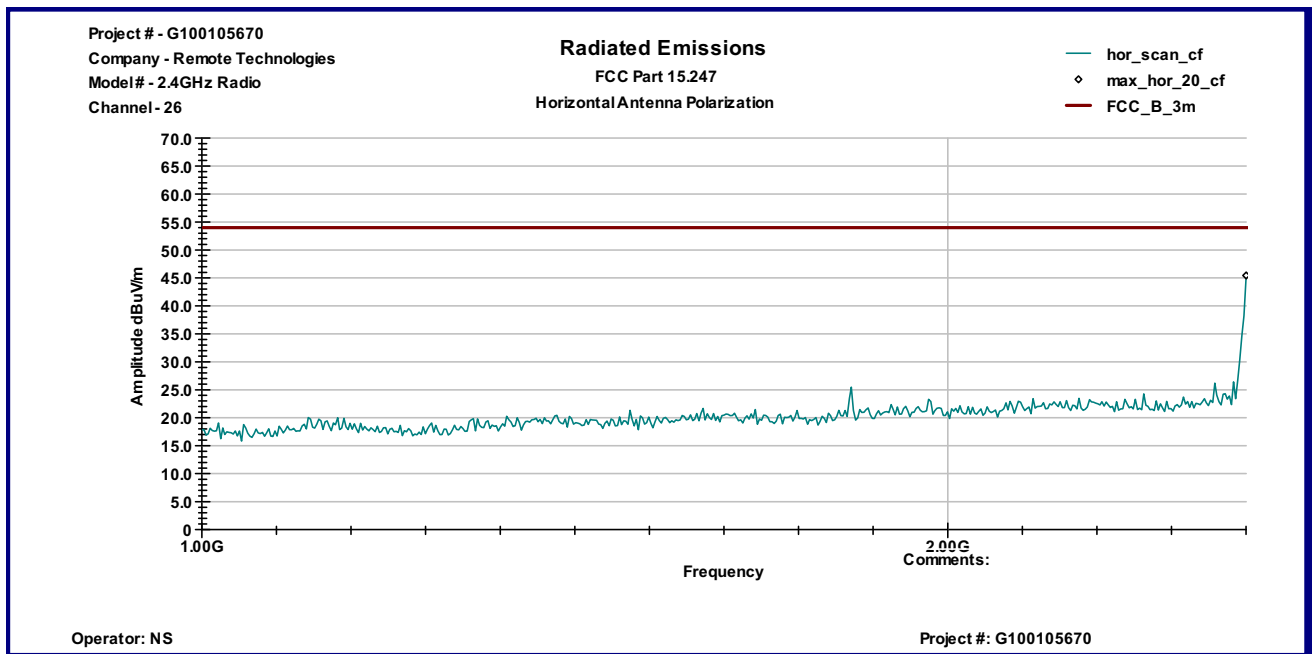
Graph 3.5.17



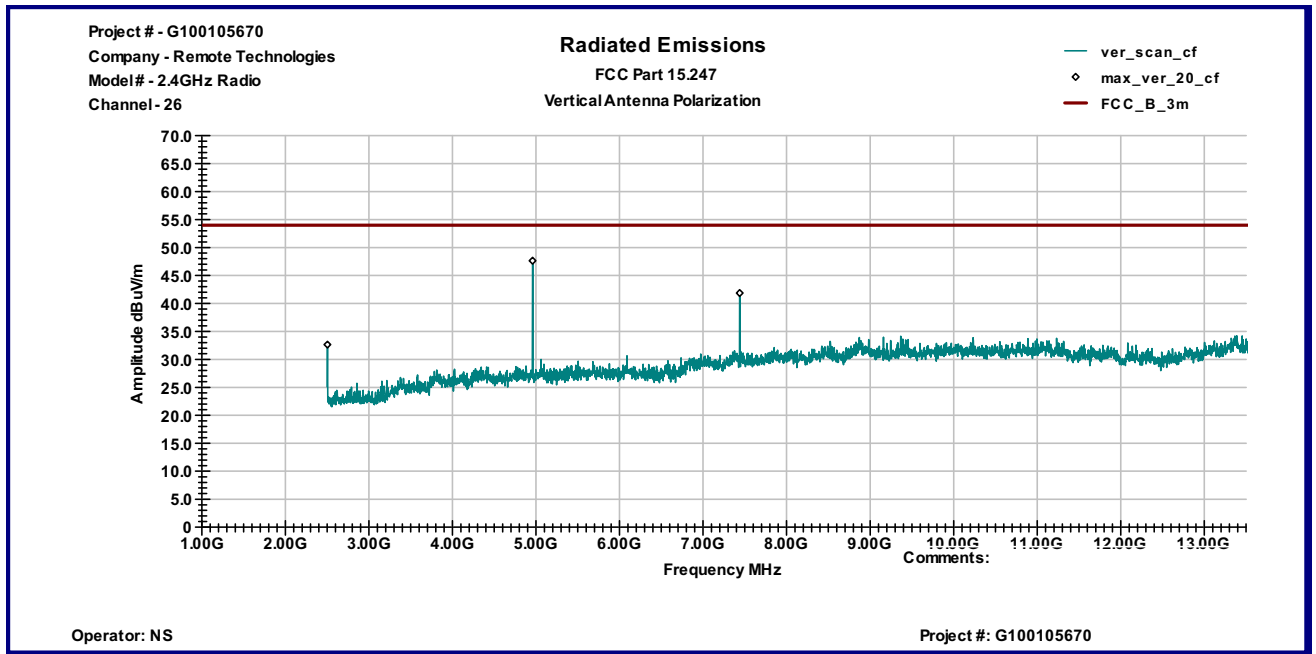
Graph 3.5.18



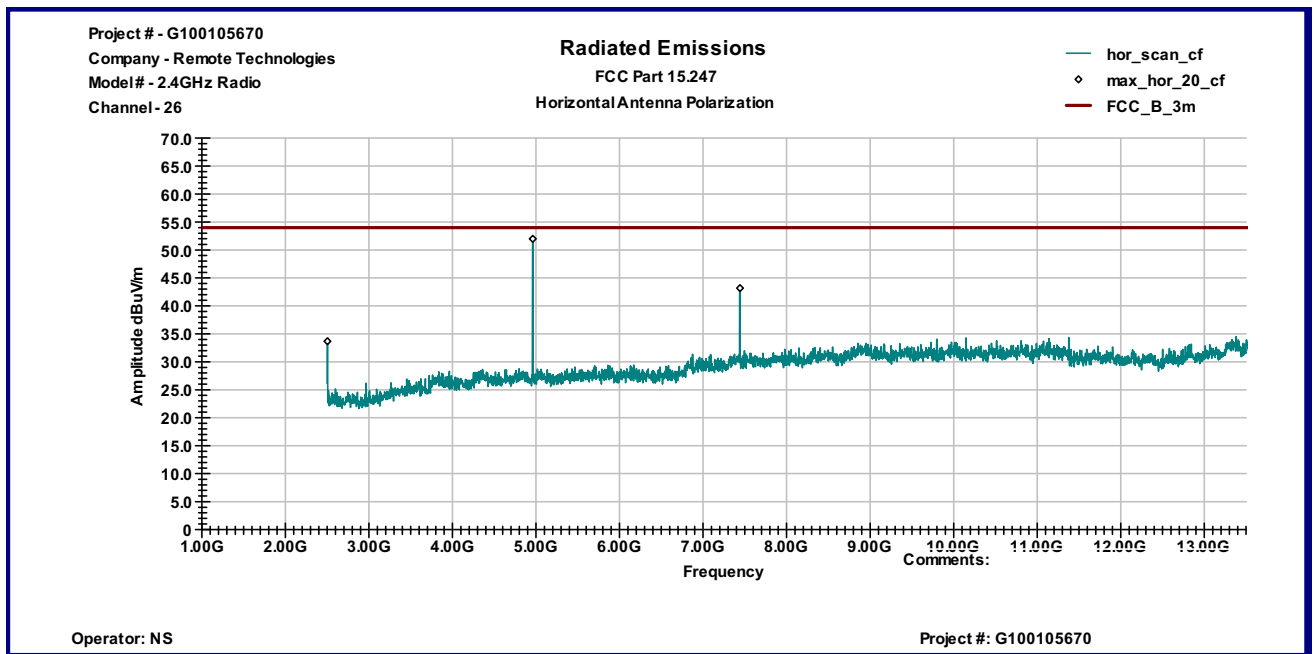
Graph 3.5.19



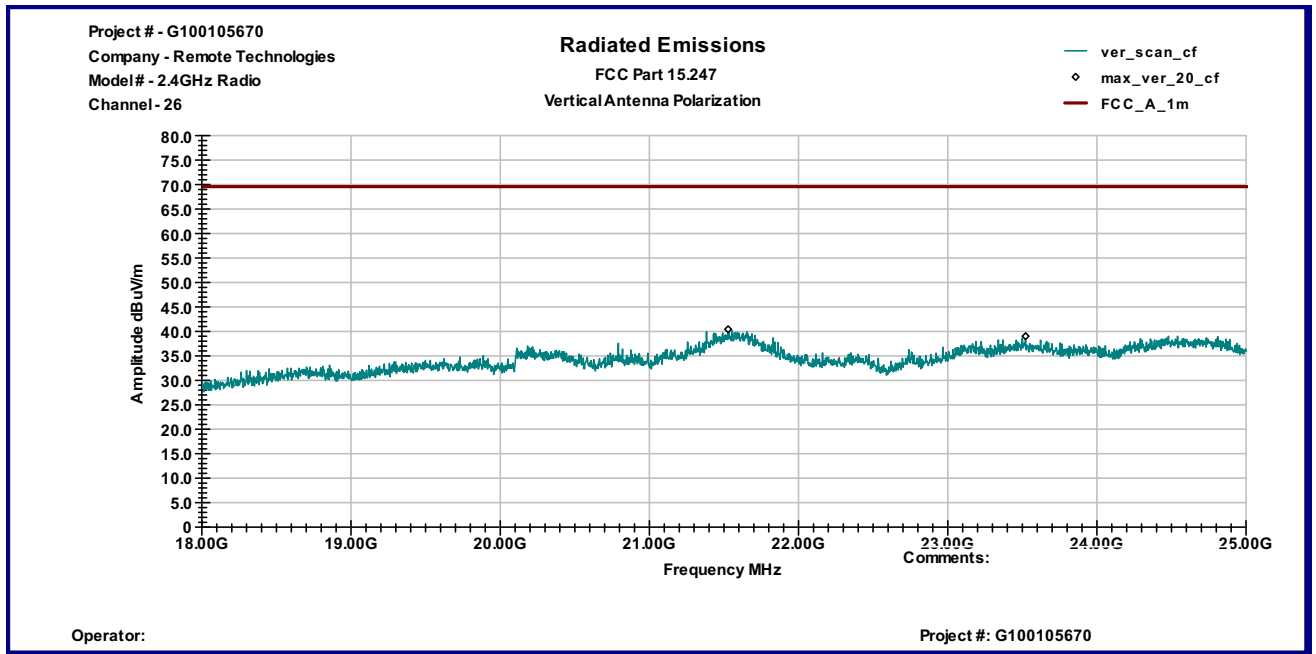
Graph 3.5.20



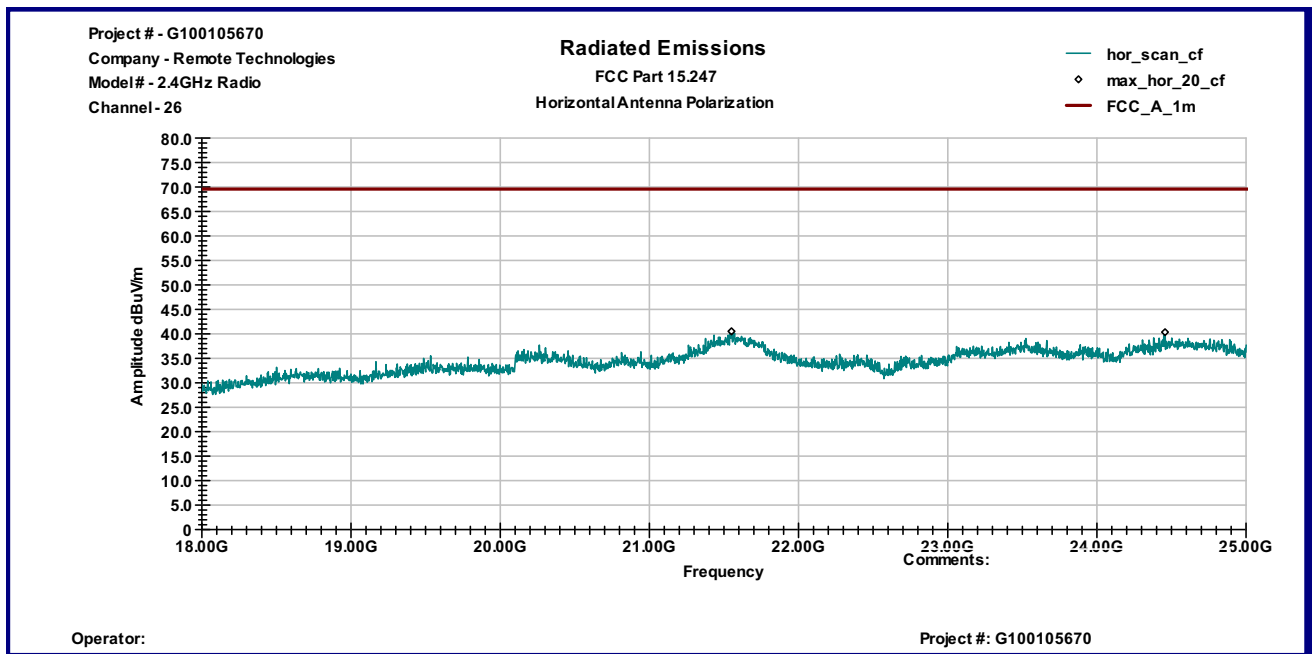
Graph 3.5.21



Graph 3.5.22



Graph 3.5.23



Graph 3.5.24

3.6 RF Exposure Compliance

The maximum measured antenna conducted power, P is 5.44dBm

The antenna gain, G is 1.8dBi

The maximum EIRP power = P + G

ERP = 5.44+ 1.8= 7.24dBm, or 0.00529W

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

The Power Density is related to EIRP with the equation:

$S = \text{EIRP} / 4\pi D^2$, or $10 = 0.00529 / 4\pi D^2$,

The minimum safe separation distance, D = 0.65cm, which is below 20cm



3.7 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

Notes: 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).



3.8 Receiver/digital device radiated emissions

Test location: ☐ OATS ☒ Anechoic Chamber

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Frequency range: 30MHz to 12.5GHz (5th Harmonic)

Max. Emissions margin: 5.2dB below the limits

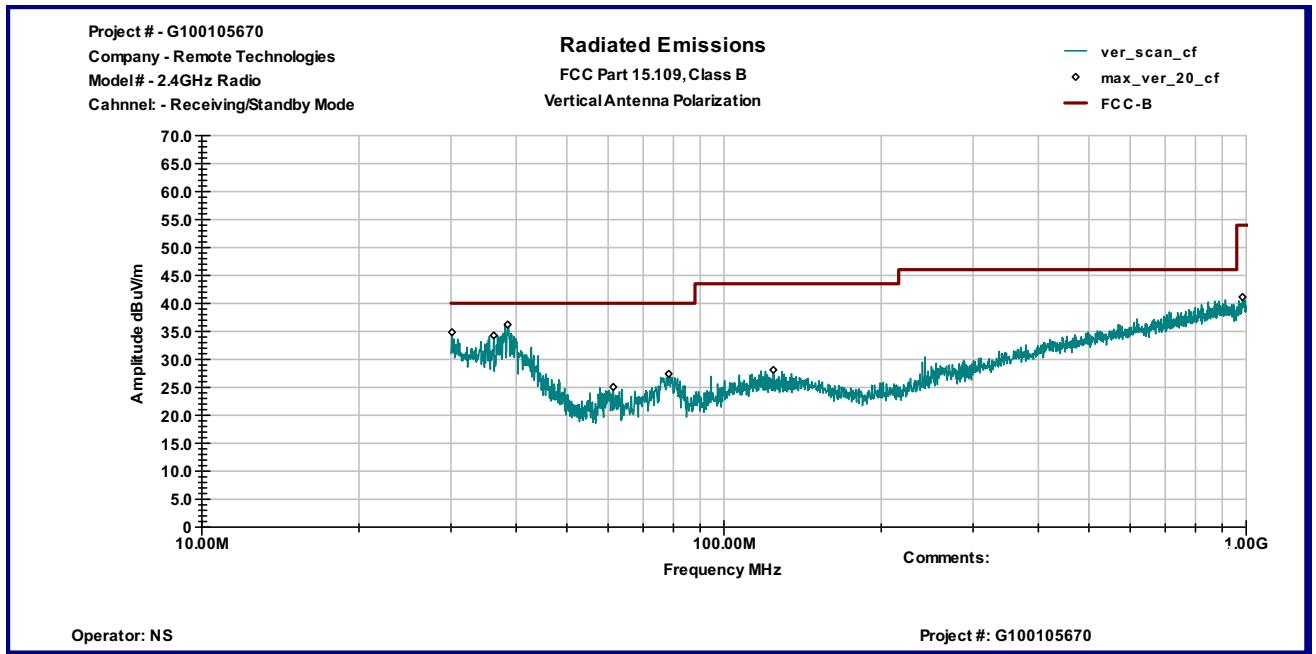
Notes: The Radiated Emissions test was performed in the Anechoic chamber at 3m measurement distance (see Table 3.8.1 and Graphs 3.8.1 and 3.8.2)

No Radiated Emissions were detected in the frequency range 1GHz-12.5GHz (see Graphs 3.8.3 and 3.8.4)

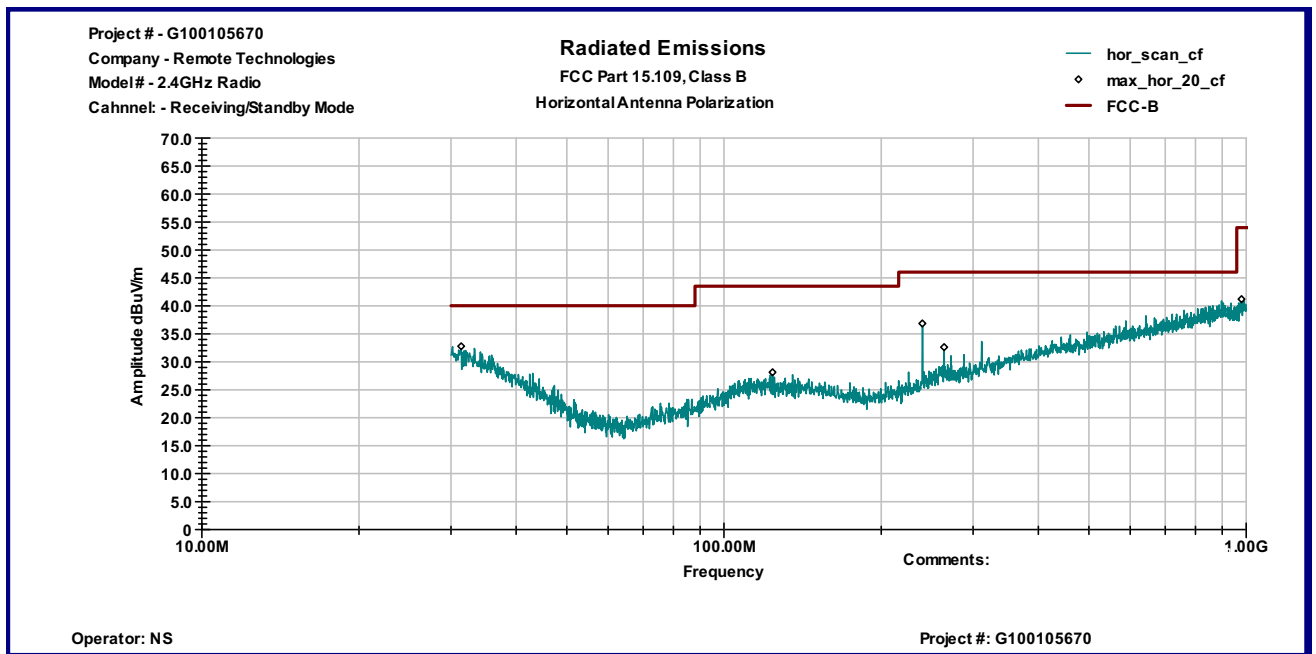
Date:	June 1, 2010	Result: Pass
Standard:	FCC Part 15.109, Class B	
Tested by:	Norman Shpilsher/Uri Spector	
Test Point:	Enclosure	
Operation mode:	See page 5	
Note:		

Table 3.8.1

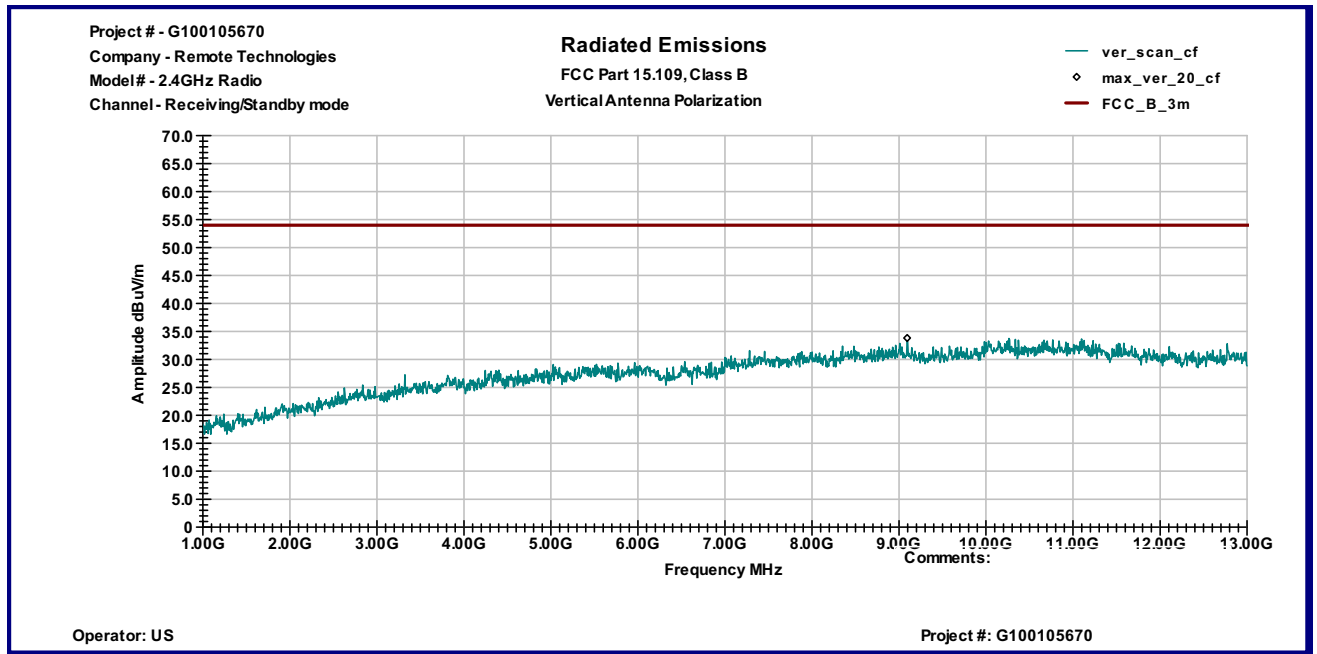
Frequency	Ant. Polarity	Peak Reading dB μ V	Ant.Factor dB1/m	Total at 3m dB μ V/m	QP Limit dB μ V/m	Margin dB
30.139 MHz	V	14.2	20.7	34.8	40.0	-5.2
36.234 MHz	V	16.8	17.5	34.3	40.0	-5.7
38.52 MHz	v	19.9	16.3	36.2	40.0	-3.8
61.378 MHz	v	18.0	7.1	25.1	40.0	-15.0
78.362 MHz	V	19.1	8.4	27.4	40.0	-12.6
124.32 MHz	V	14.3	13.8	28.1	43.5	-15.4
31.385 MHz	H	12.7	20.0	32.8	40.0	-7.2
123.88 MHz	H	14.3	13.9	28.1	40.0	-11.9
239.88 MHz	H	23.3	13.6	36.8	46.0	-9.2
263.99 MHz	H	16.8	15.9	32.6	46.0	-13.4



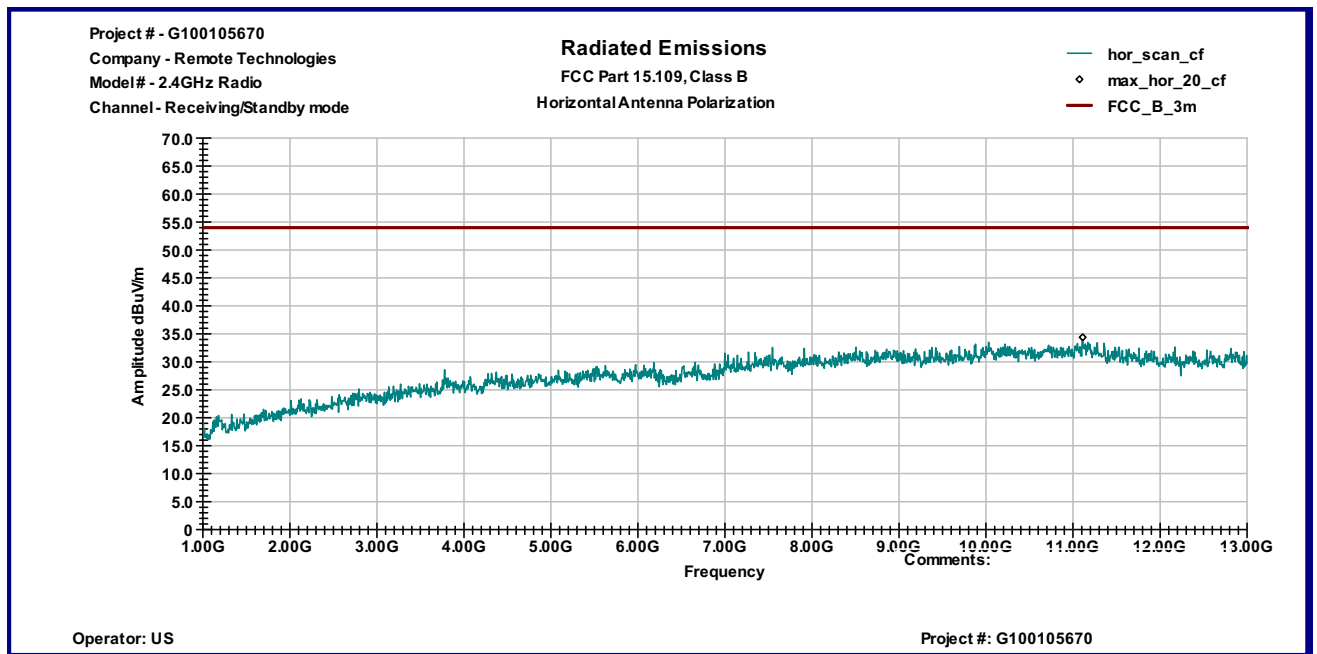
Graph 3.8.1



Graph 3.8.2



Graph 3.8.3



Graph 3.8.4



3.9 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

Notes: 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	09/10/2010	☒
Spectrum Analyzer	Agilent	E7402A	MY44212200	12660	11/20/2010	☒
Bicono-Log Antenna	Schaffner-Chase	CBL 6112 B	2468	14459	09/22/2010	☒
Bicono-Log Antenna	Schaffner-Chase	CBL 6112 B	2630	14459	10/02/2010	☒
Horn Antenna	EMCO	3115	9507-4513	9936	04/13/2011	☒
Horn Antenna	EMCO	3115	6579	15580	04/29/2011	☒
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1402232	172081	08/07/2010	☒
System	TILE! Instrument Control		Ver. 3.4.K.29	15259	VBV	☒