TEST REPORT

Report Number: 100658121MIN-005A
Project Number: G100658121

Testing performed on the
Lumen 1000/Earpiece

FCC ID: POMRX92480

To
47 CFR Part 15. 249:2010
RSS-210, Issue 8, 2010
47 CFR, Part 15:2009, §15.109, Class B

For
IntriCon Corporation

Test Performed by:
Intertek Testing Services NA, Inc.
7250 Hudson Blvd., Suite 100
Oakdale, MN 55128 USA

Test Authorized by:
IntriCon Corporation
1260 Red Fox Road
Arden Hills, MN 55112-6944, USA

Prepared by: _____ Date: September 4, 2012
Simon Khazon

Reviewed by: _____ Date: September 4, 2012
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1.0 GENERAL DESCRIPTION

Model:	Lumen 1000 / Earpiece
Type of EUT:	Hearing Aid
FCC ID:	GJO92480
Related Submittal(s) Grants:	None
Company:	IntriCon Corporation.
Customer:	Mr. Vijay Sundermurthy
Address:	1260 Red Fox Road Arden Hills, MN 55112-6944, USA
Phone:	(651) 604-9534
Fax:	(612) 636-8944
e-mail:	VSundermurthy@intricon.com
Test Standards:	☒ 47 CFR, Part 15:2010, §15.249 ☒ RSS–210, Issue 8, 20010 ☒ RSS-Gen, Issue 3, 2010 ☒ 47 CFR, Part 15:2010, §15.109, Class B ☒ ICES-003, Issue 4:2004 ☐ Other
Type of radio:	☒ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	March 2, 2012
Test Work Started:	March 2, 2012
Test Work Completed:	March 19, 2012
Test Sample Conditions:	☐ Damaged ☐Poor (Usable) ☒ Good

1.1 Product Description; Test Facility

Product Description:	Transceiver
Operating Frequency	2400-2483.5 MHz
Modulation:	FSK
Antenna(s) Info:	Type Integral Gain 2.0dBi
Antenna Installation:	☐ User ☒ Professional ☐ Factory
Transmitter Power Configuration:	☒ Internal battery ☐ External power source ☐ 120VAC ☐ 230VAC ☐ 400VAC ☐ VDC ☐ Other: Amp. ☐ 50Hz ☐ 60Hz
Special Test Arrangement:	Testing was performed on the EUT with fully charged internal battery.
Test Facility Accreditation:	A2LA (Certificate No. 1427.01)
Test Methodology:	Measurements performed according to the procedures in ANSI C63.10-2009

1.2 EUT Configuration

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

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

Operating modes of the EUT:

No.	Description
1	Test was performed at low channel of 2402MHz, middle channel of 2441MHz, and upper channel of 2481MHz
2	Standby/Receiving mode

Cables:

No.	Type	Length	Designation	Note
	None			

Support equipment/Services:

No.	Item	Description
	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(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: None

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	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 Field strength of fundamental

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☐ 10 meters ☒ 3 meters

Frequency range of measurements: 30MHz-26GHz

Test result: **Pass**

Max. Emissions margin at fundamental: 7.2dB below the limits

Notes: None

Date:	March 7, 2012	**Result:** **Pass**
Standard:	FCC 15.249(a) / RSS-210 A2.9	
Tested by:	Simon Khazon	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Measurements at Fundamental Frequency	

Table 3.1.1

Frequency MHz	Antenna Polarity	Antenna Hts(cm)	Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Peak Reading dBµV	Total @ 3m dBµV/m	Limit dBµV/m	Margin dB	Comments
				Channel 2402						
2402.12	V	100	28.5	2.9	0.0	55.4	86.8	94.0	-7.2	
2402.12	H	240	28.5	2.9	0.0	54.8	86.2	94.0	-7.8	
				Channel 2441						
2441.39	V	100	28.6	2.9	0.0	53.4	84.9	94.0	-9.1	
2441.39	H	247	28.6	2.9	0.0	52.8	84.3	94.0	-9.7	
				Channel 2481						
2481.30	V	100	28.7	3.0	0.0	50.9	82.6	94.0	-11.4	
2481.30	H	244	28.7	3.0	0.0	51.6	83.3	94.0	-10.7	

3.2 Field strength of harmonics and spurious emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☐ 10 meters ☒ 3 meters

Frequency range of measurements: 30MHz-1000MHz

Test result: **Pass**

Max. margin of harmonics and spurious emissions: 7.6dB below the limits

Notes: None

Date:	March 8-9, 2012	**Result:** **Pass**
Standard:	FCC 15.249(a) / RSS-210 A2.9	
Tested by:	Simon Khazon	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Spurious emissions below 1 GHz	

Table 3.2.1

Frequency	Ant. Polarity	Peak Reading dBµV	Ant.Factor dB1/m	Total at 3m dBµV/m	Limit dBµV/m	Margin dB
		Channel 2402				
33.186 MHz	V	10.2	18.6	28.8	40.0	-11.2
89.33 MHz	V	15.2	10.0	25.2	40.0	-14.8
91.121 MHz	V	15.7	10.4	26.1	40.0	-13.9
93.733 MHz	V	16.9	11.1	28.0	40.0	-12.0
30.104 MHz	H	7.5	20.3	27.7	40.0	-12.3
91.121 MHz	H	13.0	10.4	23.4	40.0	-16.6
93.807 MHz	H	13.1	11.2	24.3	40.0	-15.7
125.37 MHz	H	11.1	14.0	25.0	40.0	-15.0
		Channel 2441				
30.416 MHz	V	7.7	20.1	27.8	40.0	-12.2
89.33 MHz	V	16.2	10.0	26.2	40.0	-13.9
91.121 MHz	V	16.7	10.4	27.1	40.0	-12.9
93.733 MHz	V	17.3	11.1	28.5	40.0	-11.5
132.53 MHz	V	12.7	13.8	26.5	40.0	-13.5
746.77 MHz	V	10.6	23.7	34.3	47.0	-12.7
998.94 MHz	V	9.6	26.4	36.1	47.0	-10.9
30.312 MHz	H	7.5	20.2	27.7	40.0	-12.3
124.7 MHz	H	11.1	14.0	25.1	40.0	-15.0
995.05 MHz	H	10.0	26.4	36.4	47.0	-10.6
		Channel 2481				
30.069 MHz	V	7.4	20.3	27.7	40.0	-12.3
89.33 MHz	V	15.5	10.0	25.5	40.0	-14.5
91.121 MHz	V	15.3	10.4	25.7	40.0	-14.3
93.733 MHz	V	17.8	11.1	28.9	40.0	-11.1
102.91 MHz	V	12.6	12.8	25.4	40.0	-14.6
132.53 MHz	V	12.6	13.8	26.4	40.0	-13.6
989.74 MHz	V	10.1	26.3	36.4	47.0	-10.6
30.0 MHz	H	7.8	20.3	28.1	40.0	-11.9
109.77 MHz	H	10.5	13.6	24.1	40.0	-15.9
985.85 MHz	H	10.2	26.2	36.4	47.0	-10.6

Date:	March 8-9, 2012	**Result:** **Pass**
Standard:	FCC 15.249(a) / RSS-210 A2.9	
Tested by:	Simon Khazon	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Spurious and Harmonics emissions above 1 GHz and Band Edge Compliance	

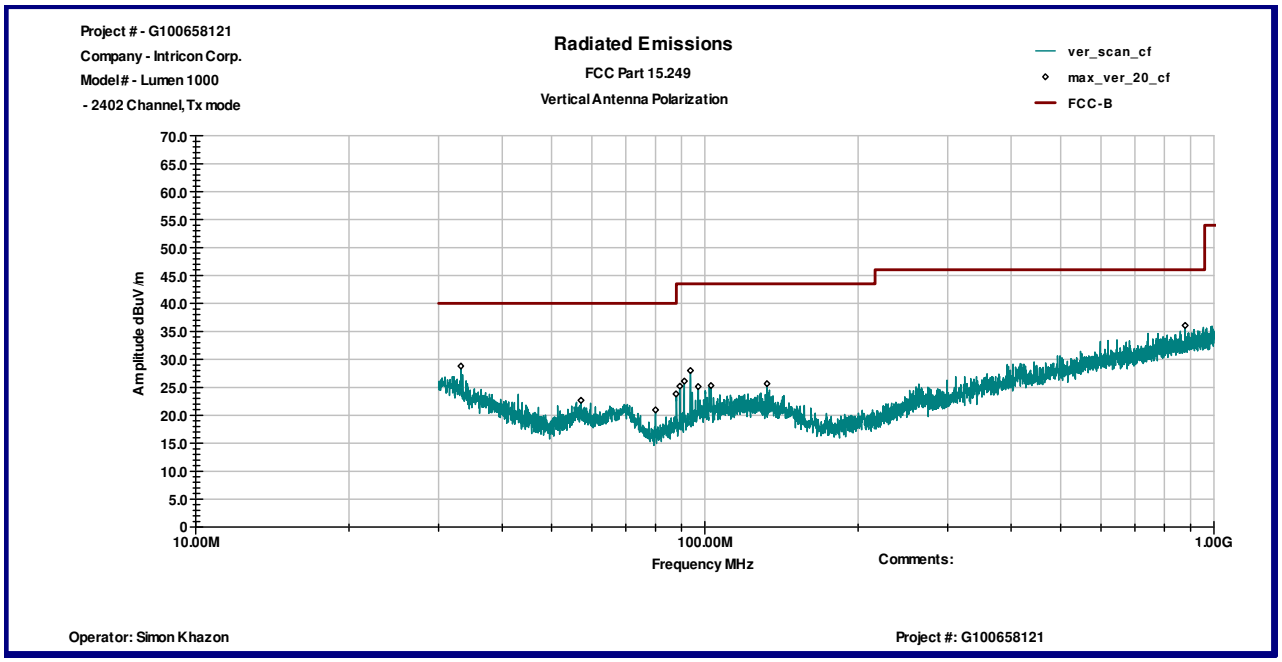
Table 3.2.2

Frequency MHz	Antenna Polarity	Antenna Hts(cm)	Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dBµV	Total @ 3m dBµV/m	Limit dBµV/m	Margin dB	Comments
				Channel 2402MHz						
4806.40	H	163	33.2	4.1	42.0	50.7	46.0	54.0	-8.0	Peak
4806.40	V	100	33.2	4.1	42.0	51.1	46.4	54.0	-7.6	Peak
9609.59	H	184	38.2	5.8	40.9	34.2	37.3	54.0	-16.7	Peak
9609.59	V	100	38.2	5.8	40.9	29.1	32.2	54.0	-21.8	Peak
				Band Edge Compliance						
2400.00	V	100	28.5	2.9	0.0	17.8	49.2	54.0	-4.8	Peak
2400.00	H	167	28.5	2.9	0.0	11.3	42.7	54.0	-11.3	Peak
				Channel 2441MHz						
4884.00	H	161	33.4	4.2	42.0	45.4	40.9	54.0	-13.1	Peak
4884.00	V	100	33.4	4.2	42.0	49.3	44.8	54.0	-9.2	Peak
				Channel 2481MHz						
4962.30	H	155	33.5	4.2	41.9	43.1	38.8	54.0	-15.1	Peak
4962.30	V	100	33.5	4.2	41.9	50.4	46.1	54.0	-7.8	Peak
				Band Edge Compliance						
2483.50	V	100	28.7	3.0	0.0	12.0	43.7	54.0	-10.3	Peak
2483.50	H	166	28.7	3.0	0.0	7.9	39.6	54.0	-14.4	Peak

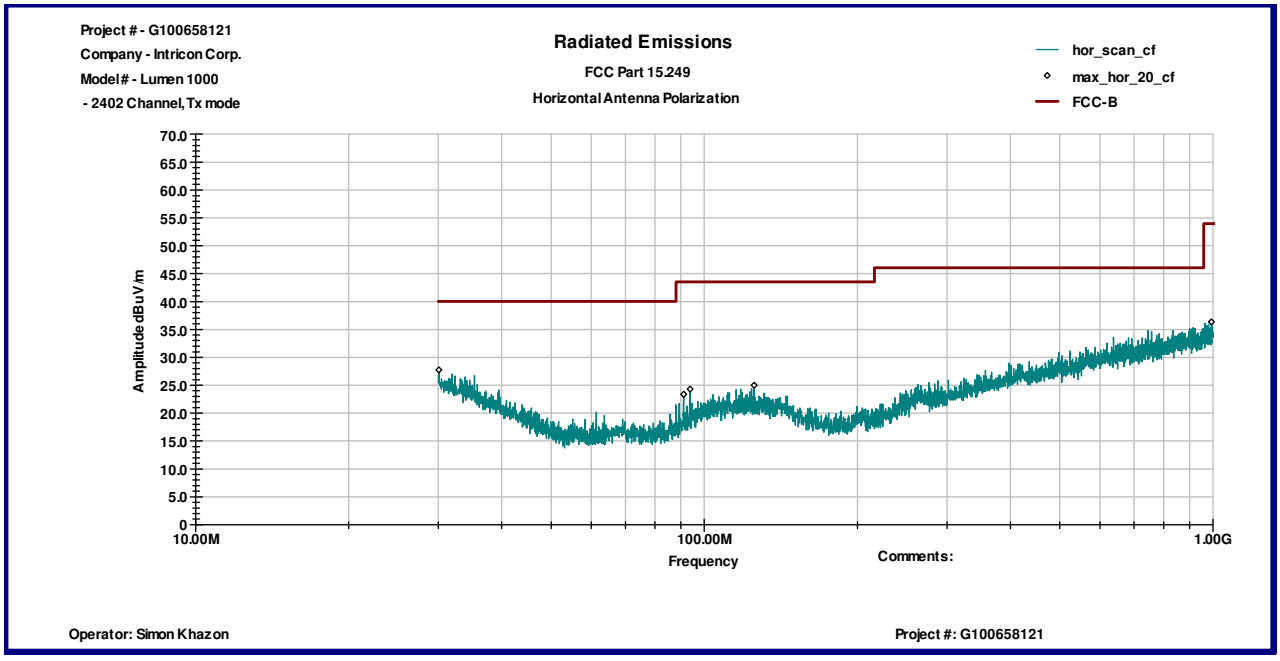
Note: Measurements were taken using a Peak detector or Average Value (RBW 1MHz, VBW 1Hz) - see Comments

Graph 3.2.1

Vertical antenna polarization

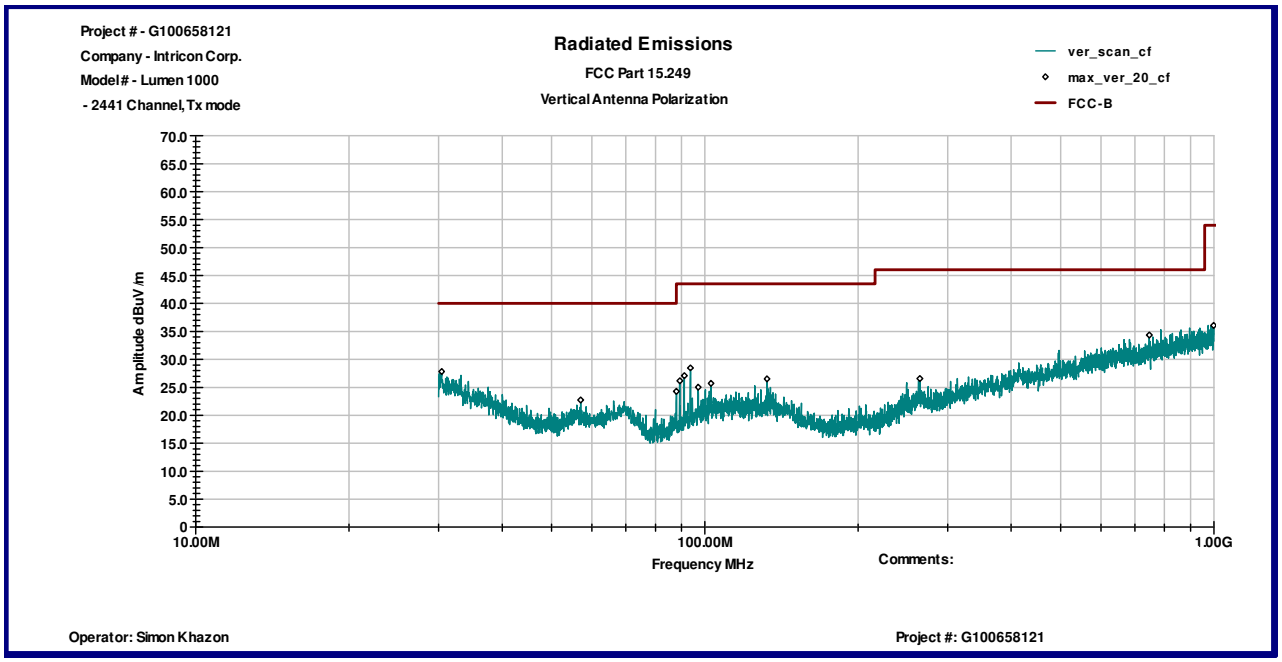


Horizontal antenna polarization

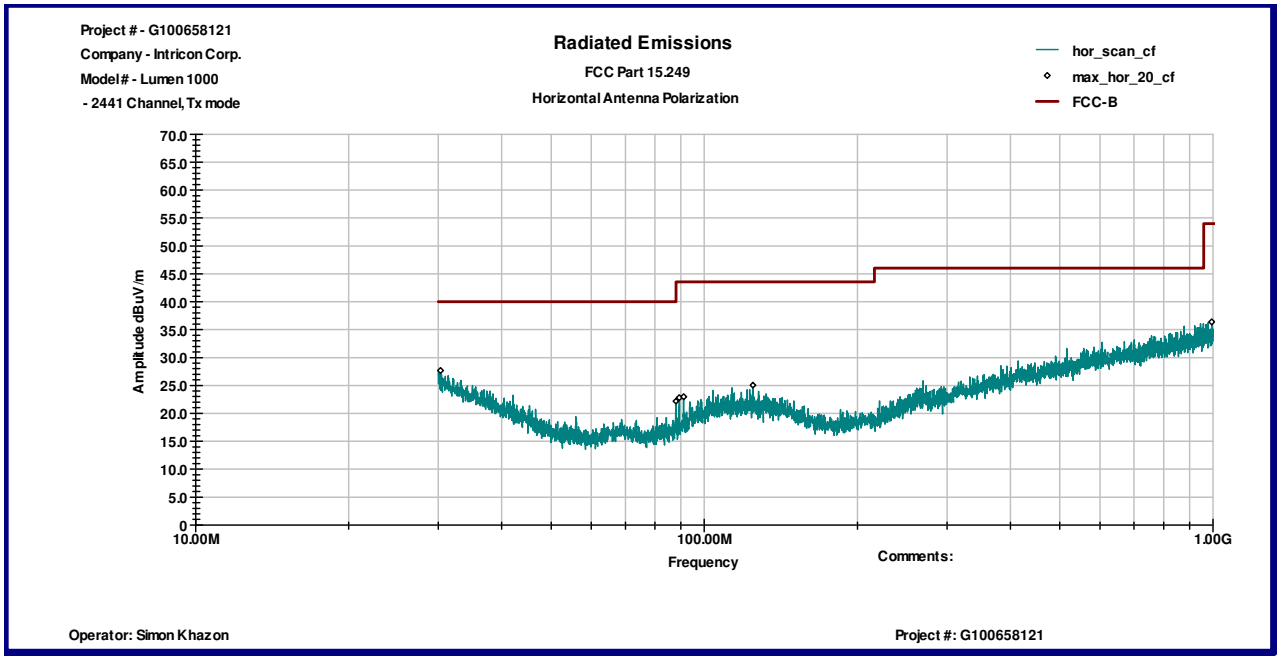


Graph 3.2.2

Vertical antenna polarization

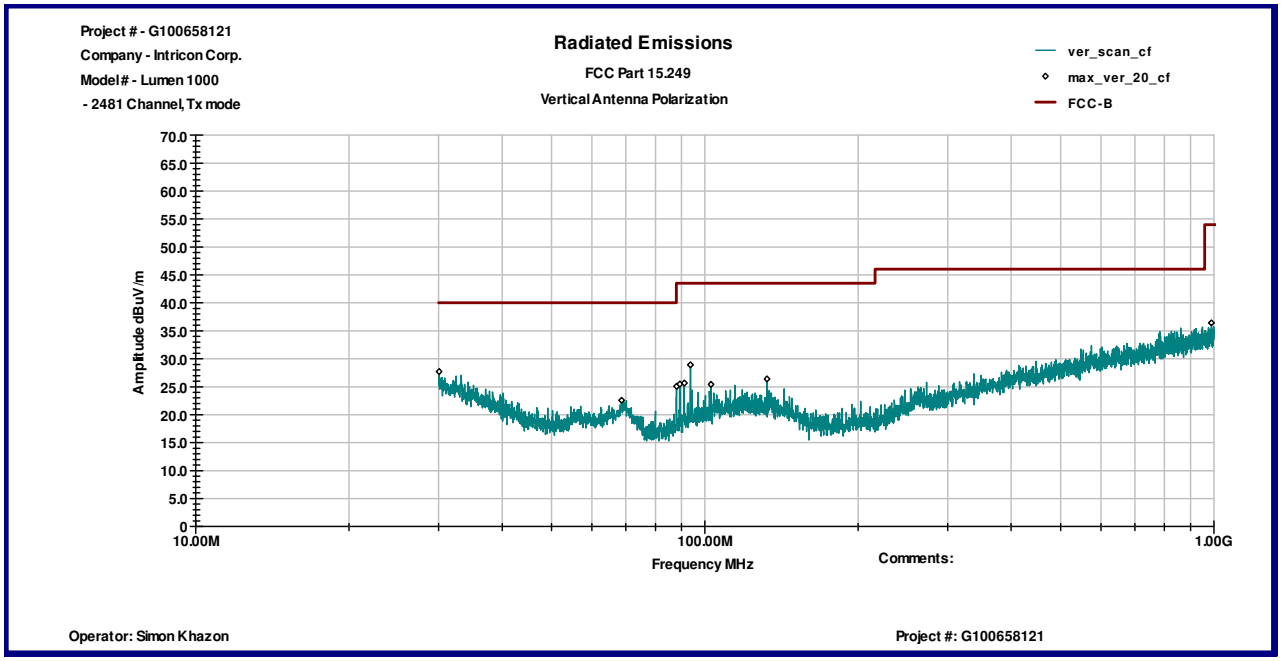


Horizontal antenna polarization

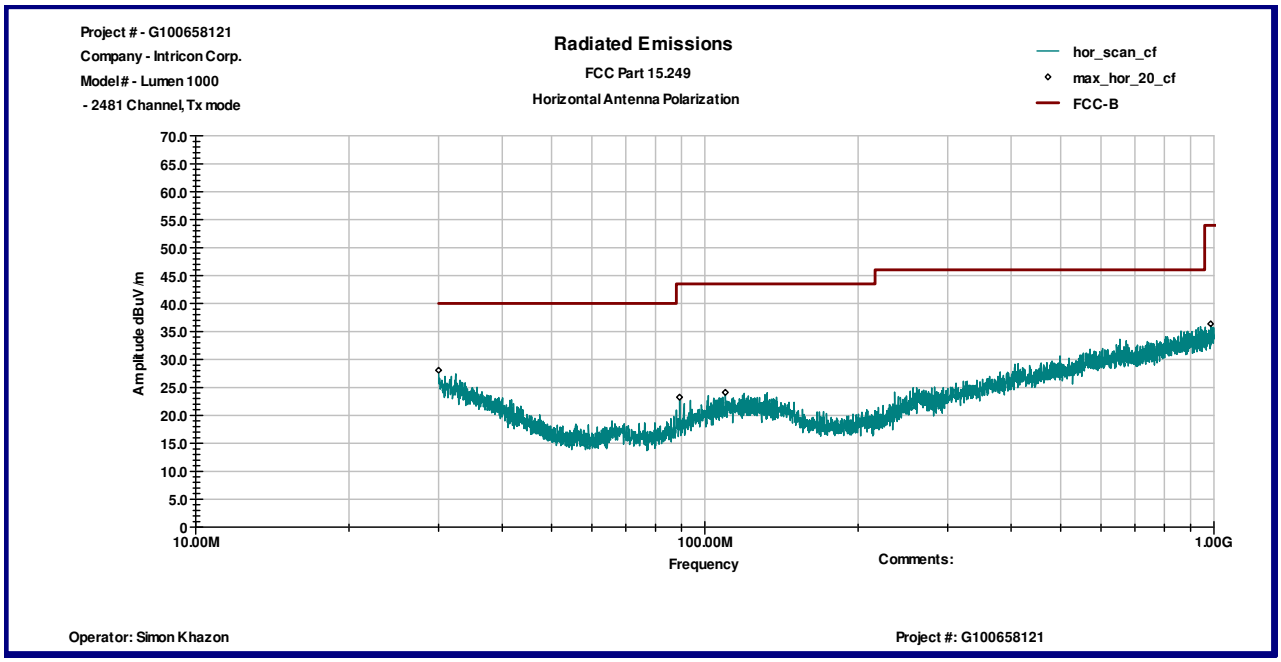


Graph 3.2.3

Vertical antenna polarization

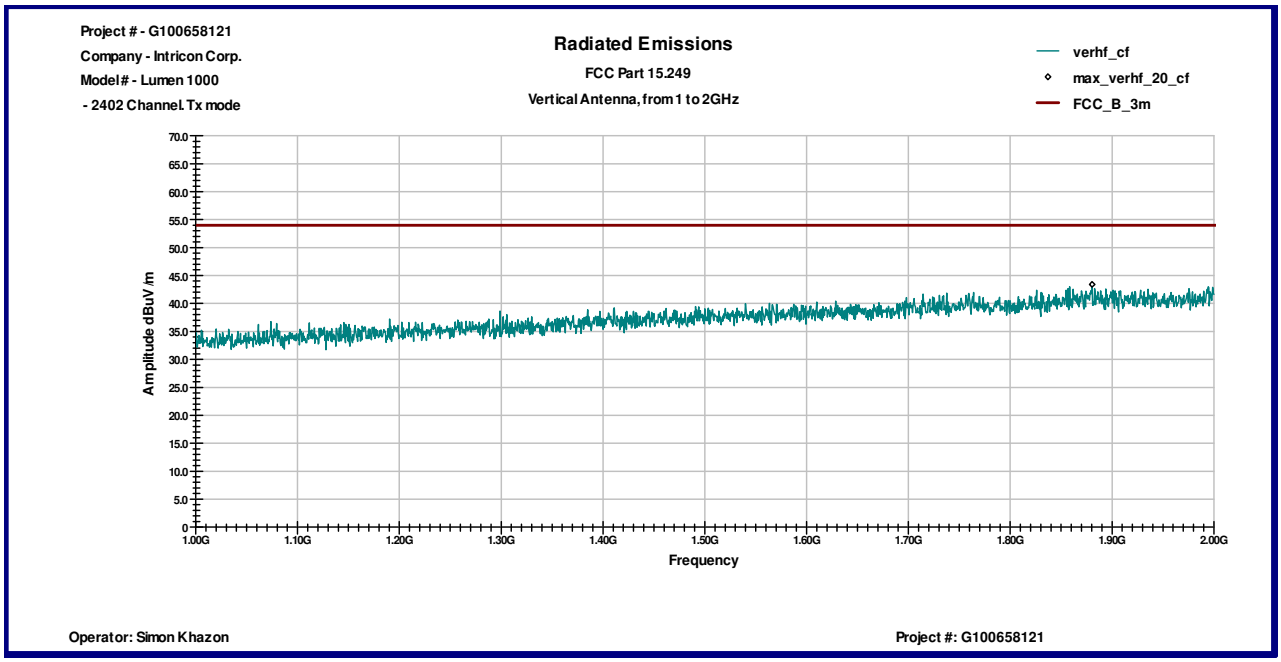


Horizontal antenna polarization

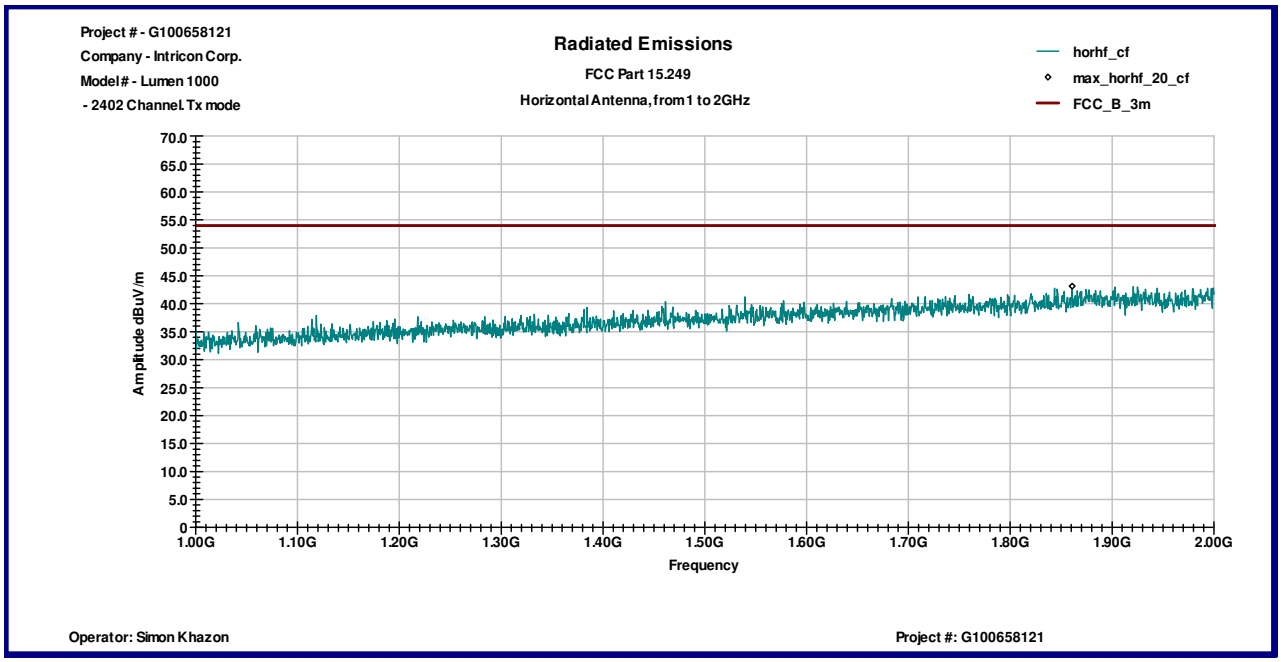


Graph 3.2.4

Vertical antenna polarization

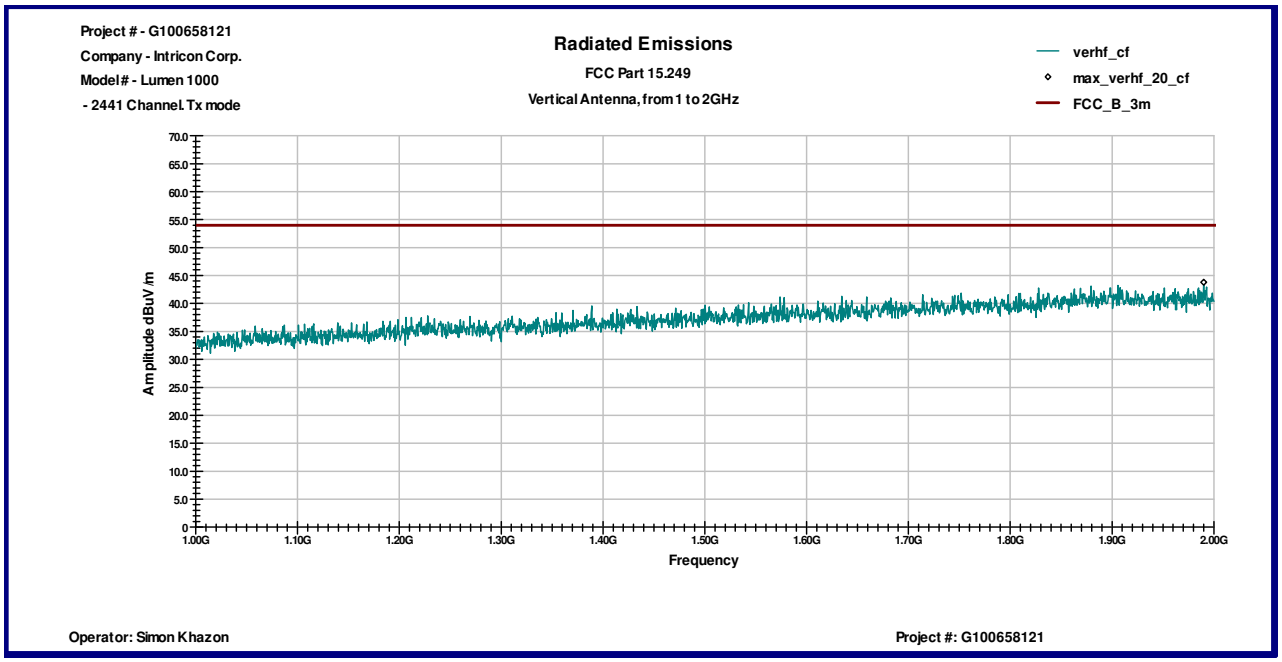


Horizontal antenna polarization

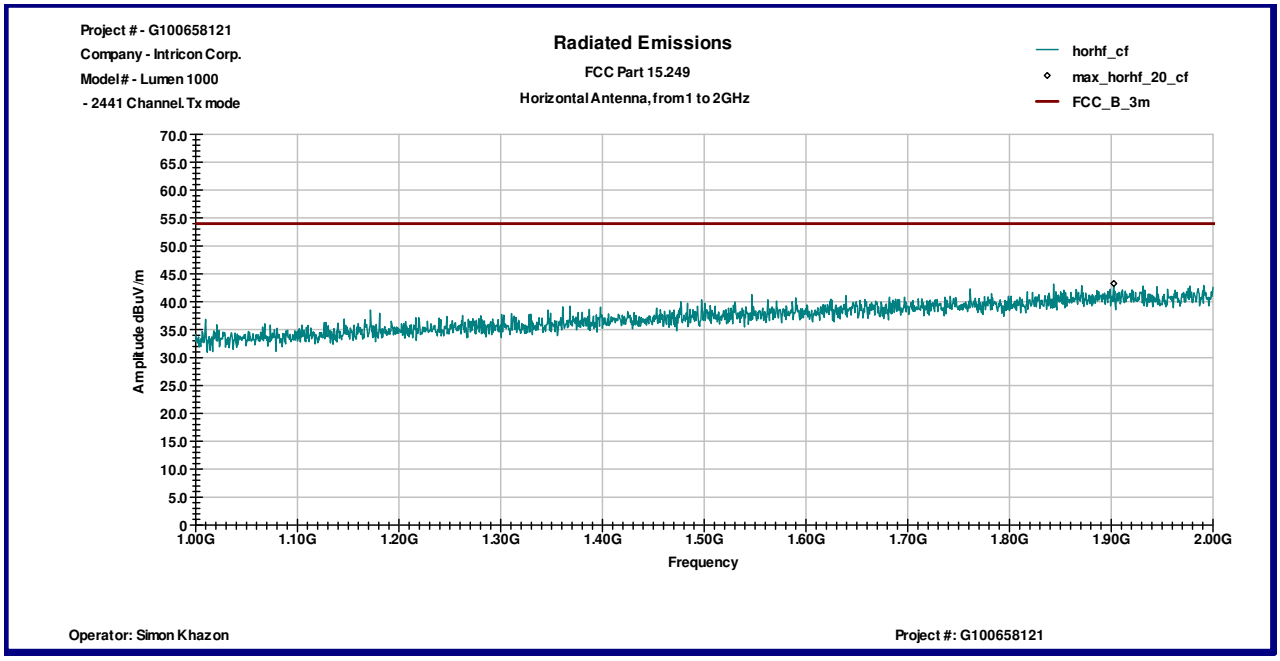


Graph 3.2.5

Vertical antenna polarization

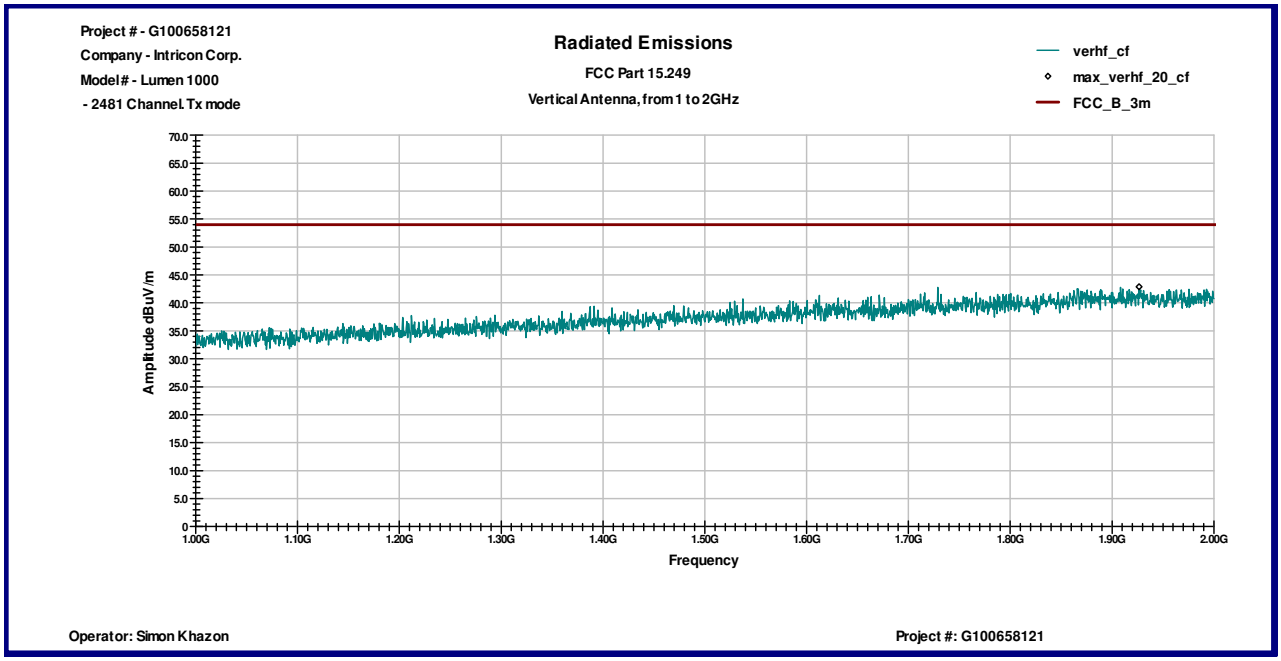


Horizontal antenna polarization

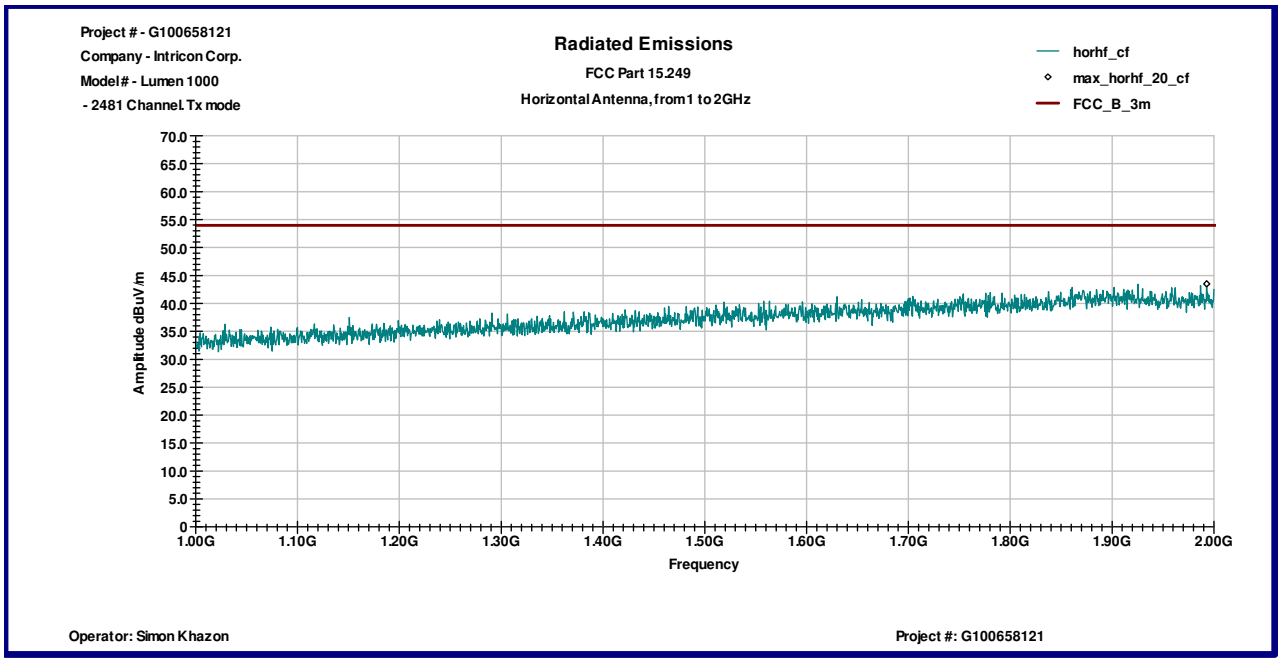


Graph 3.2.6

Vertical antenna polarization

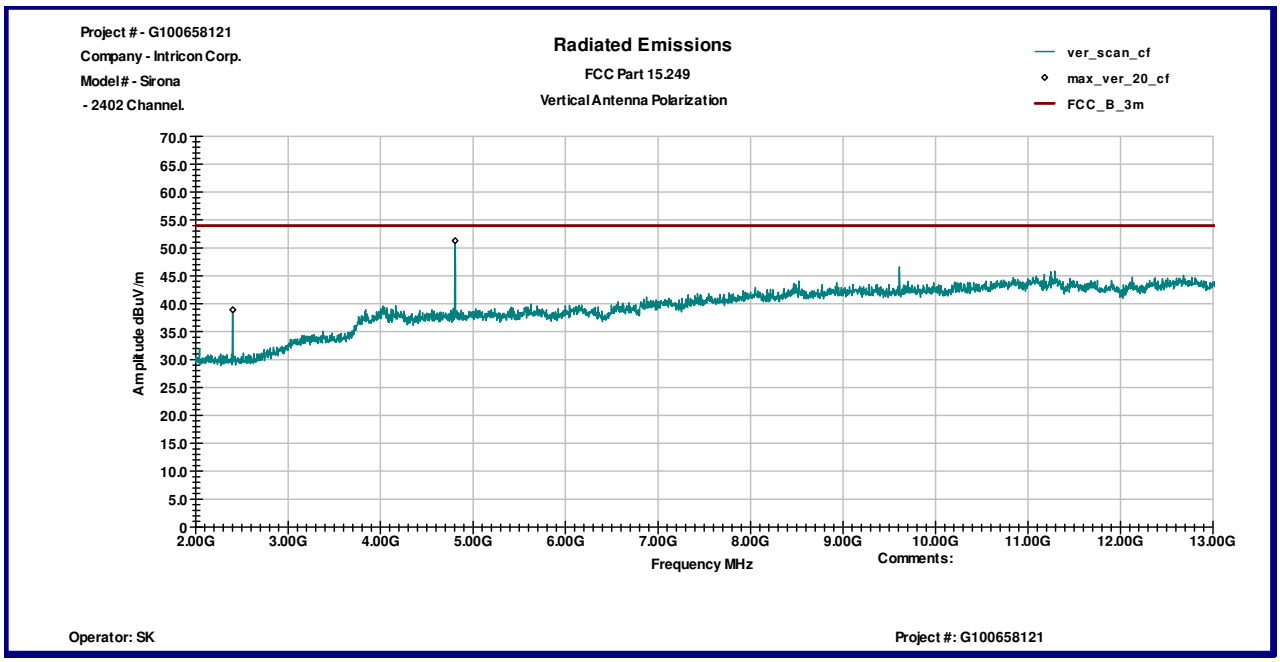


Horizontal antenna polarization

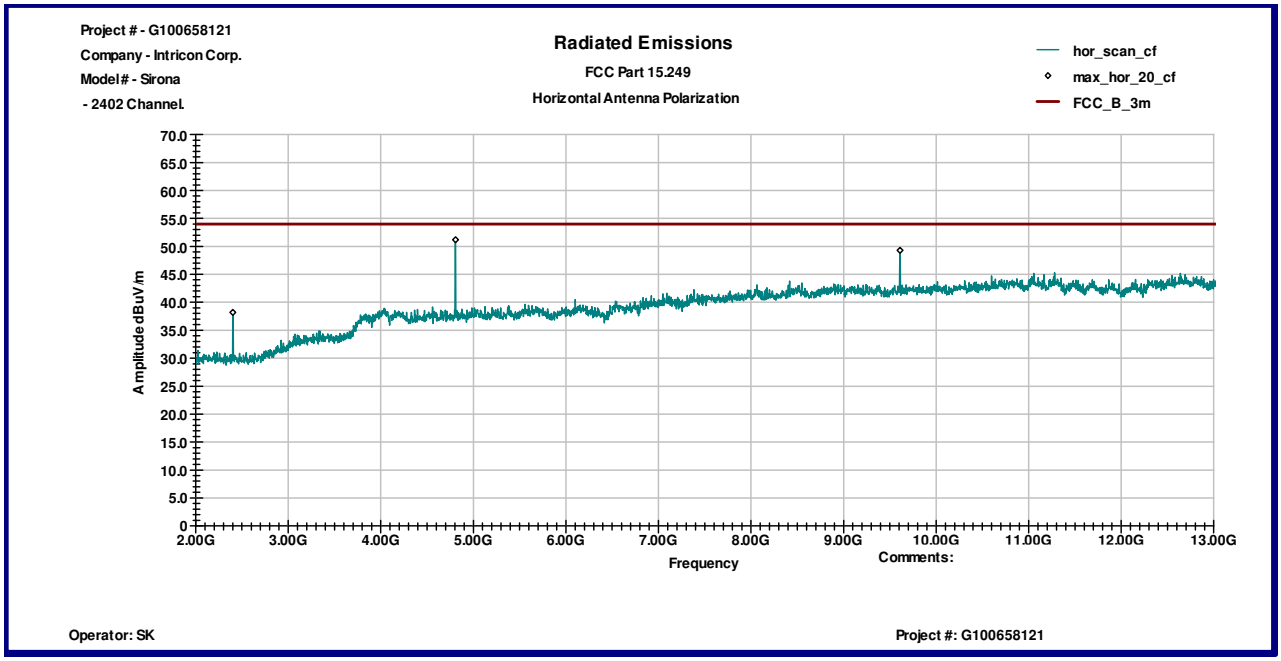


Graph 3.2.7

Vertical antenna polarization

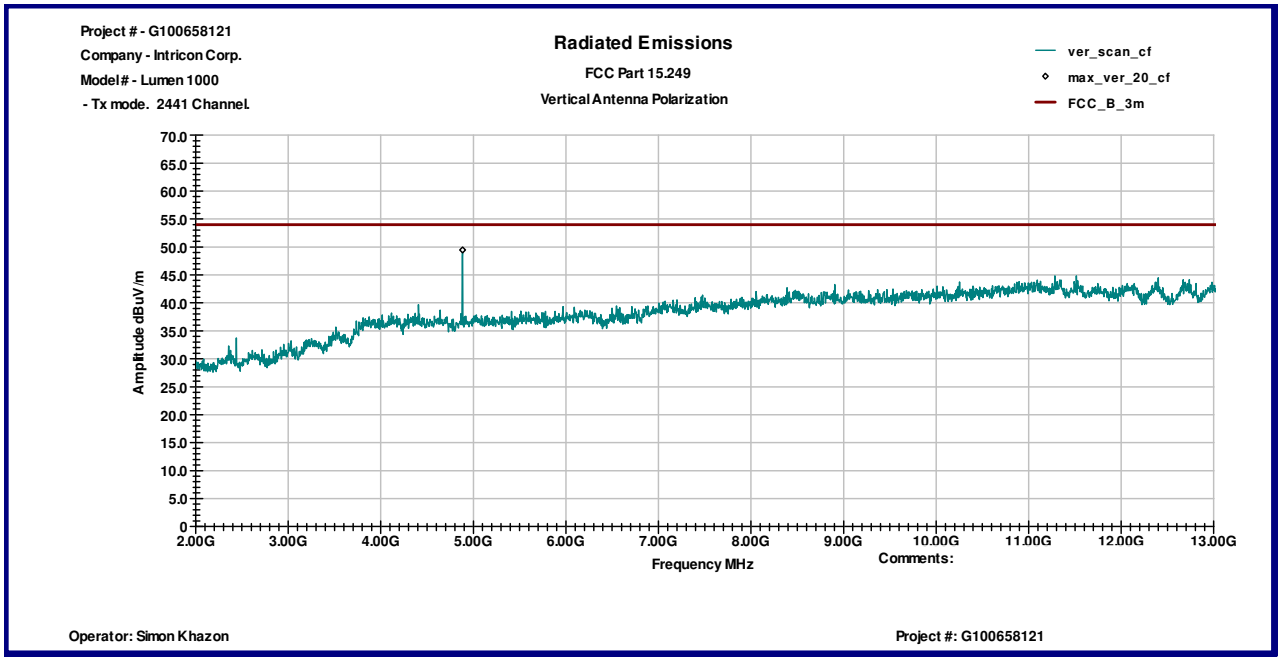


Horizontal antenna polarization

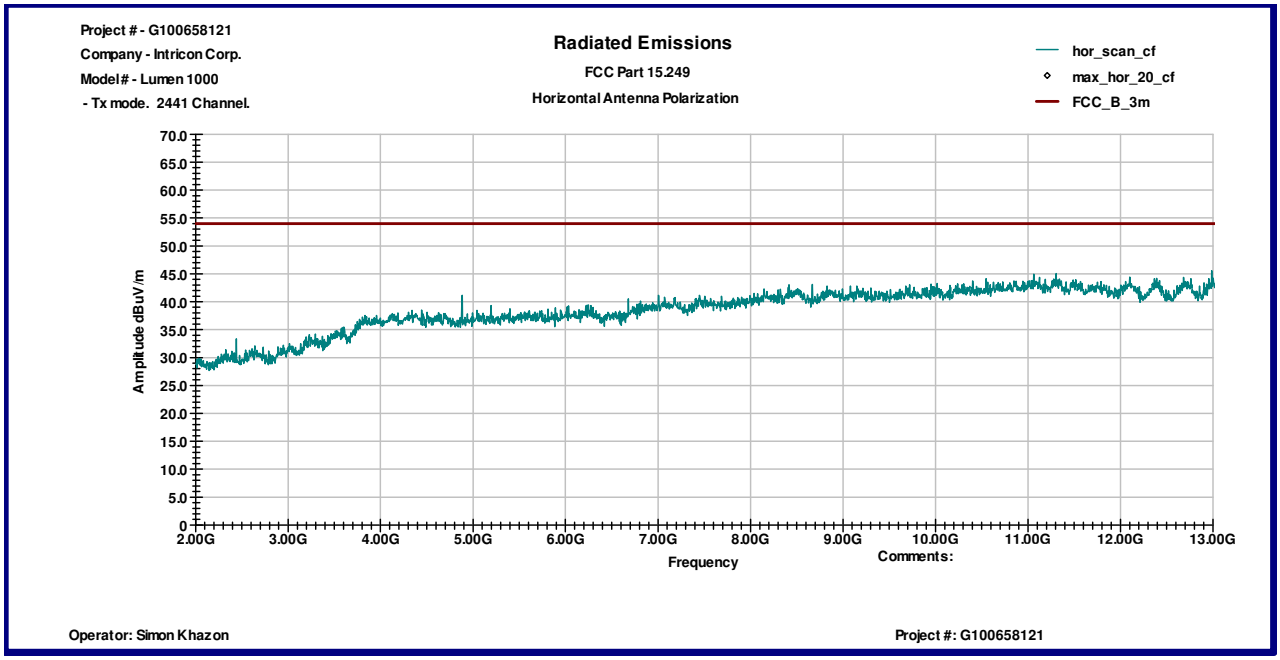


Graph 3.2.8

Vertical antenna polarization

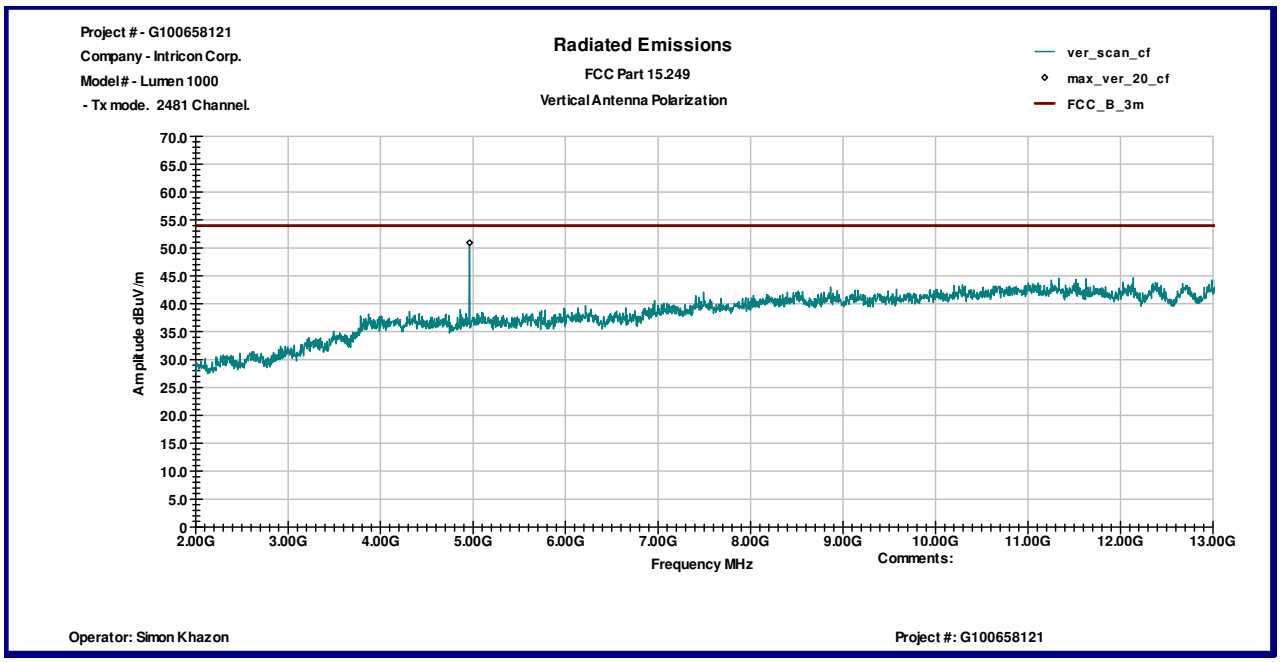


Horizontal antenna polarization

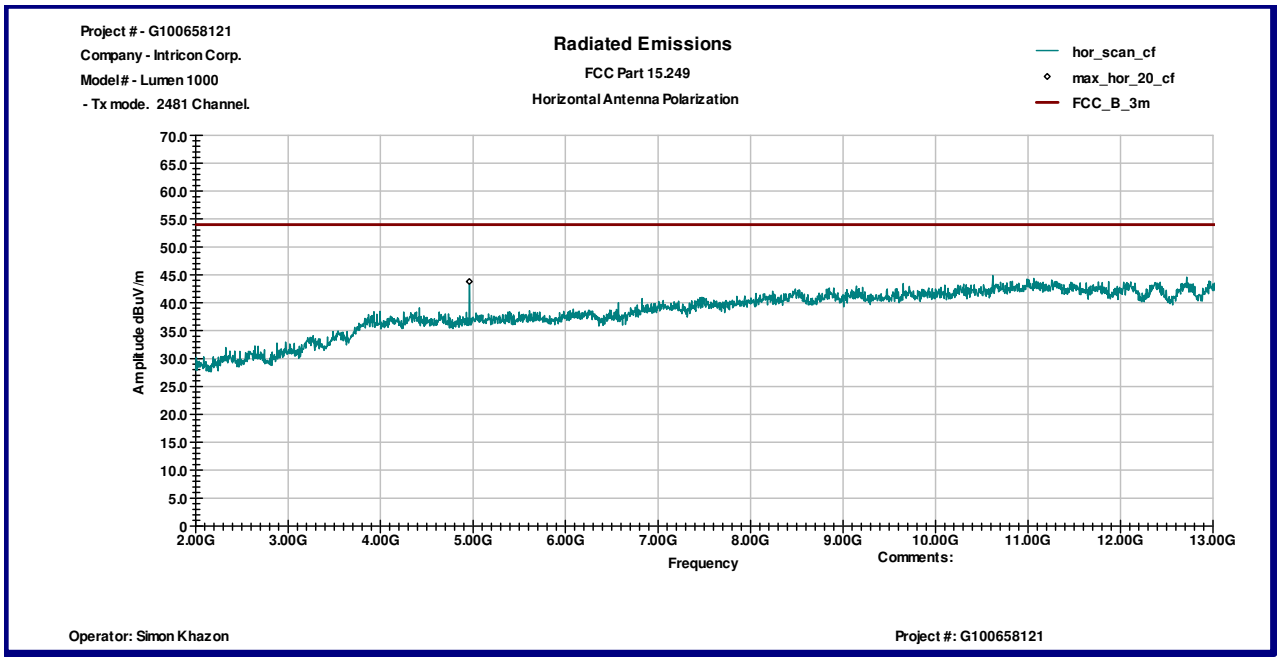


Graph 3.2.9

Vertical antenna polarization

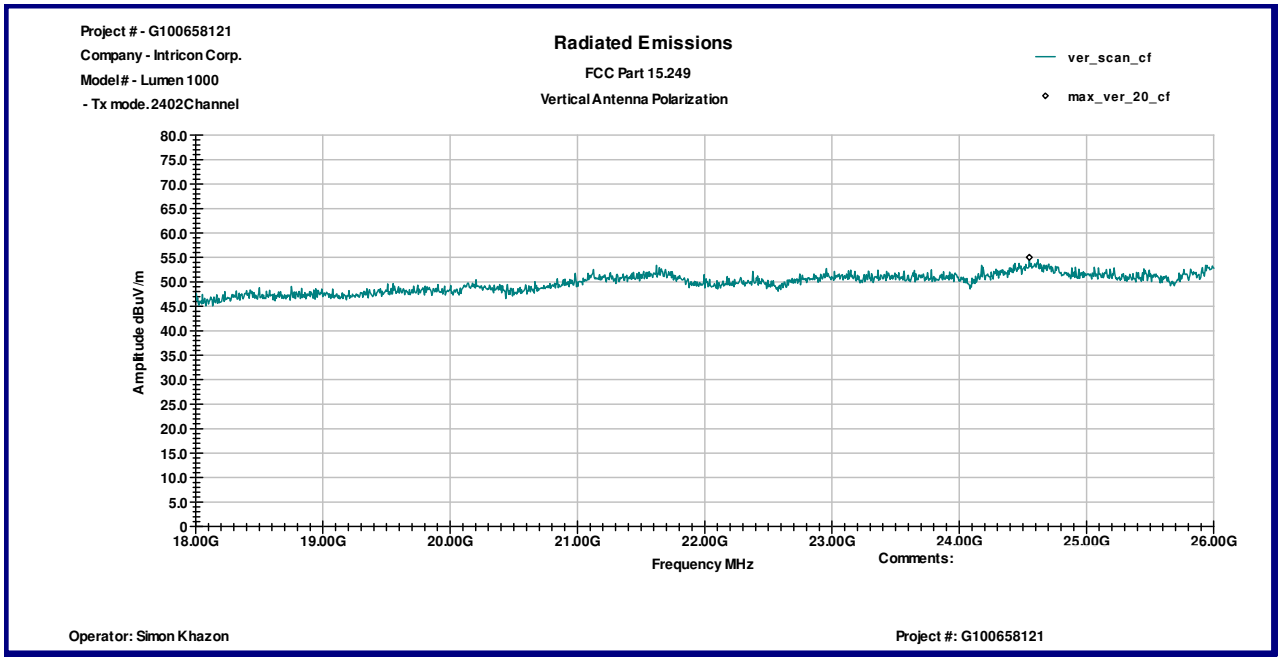


Horizontal antenna polarization

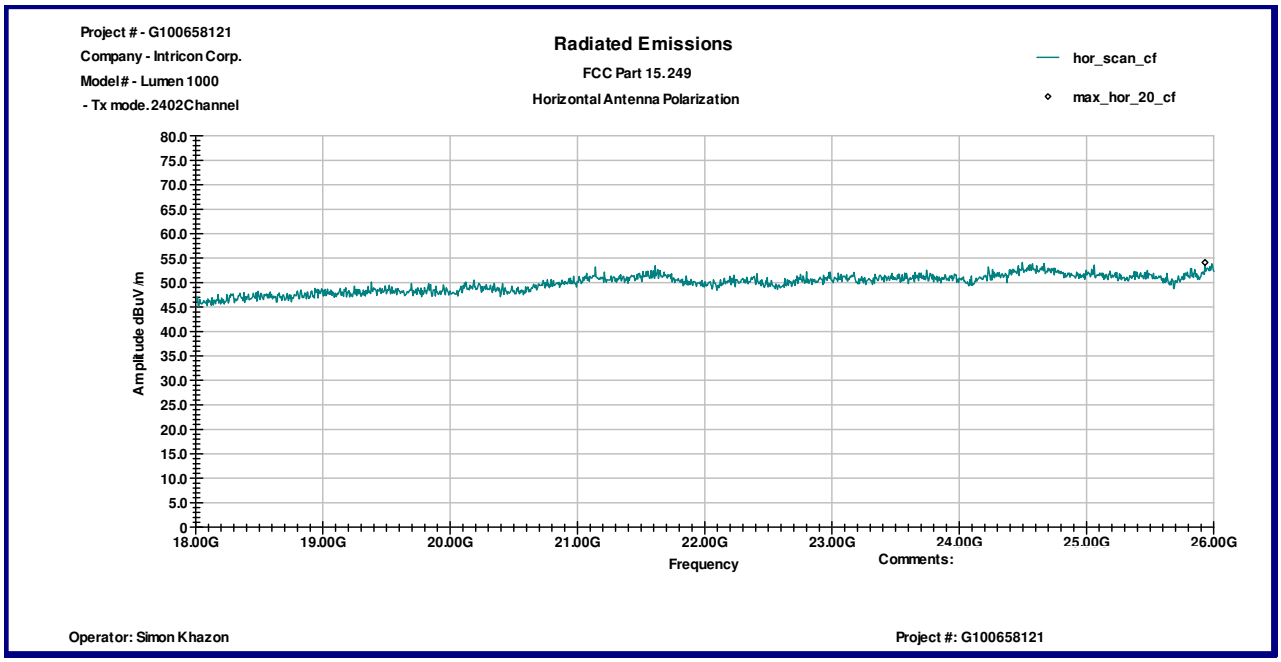


Graph 3.2.10

Vertical antenna polarization

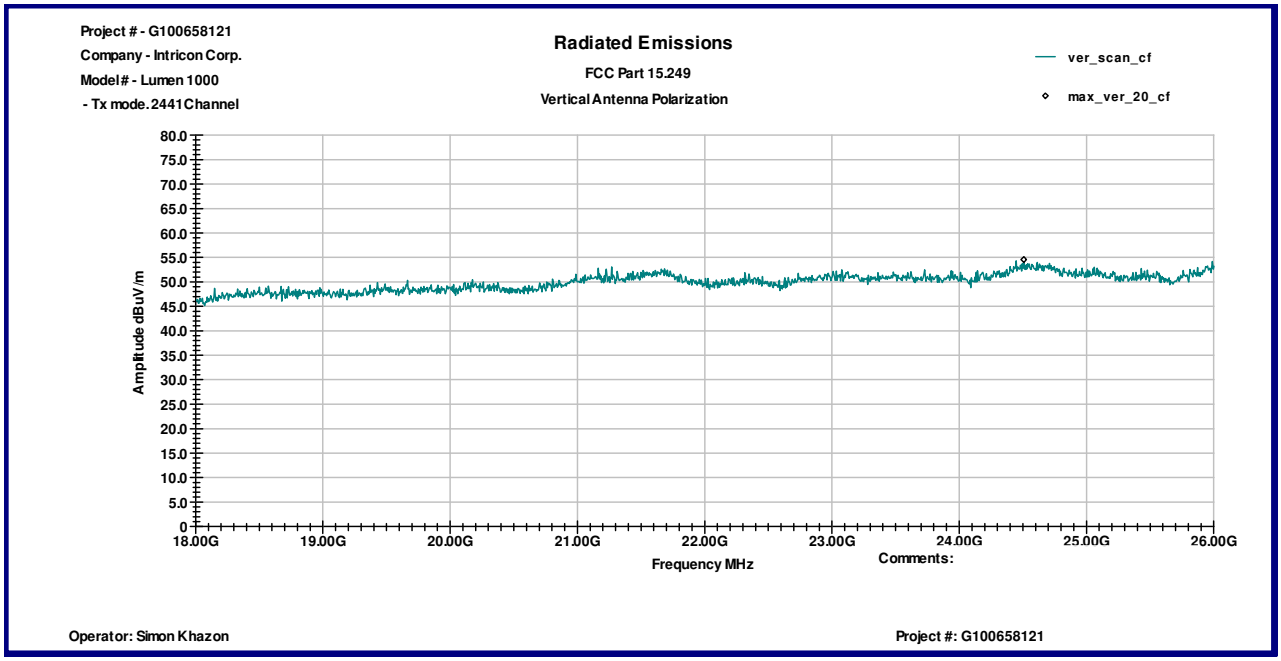


Horizontal antenna polarization

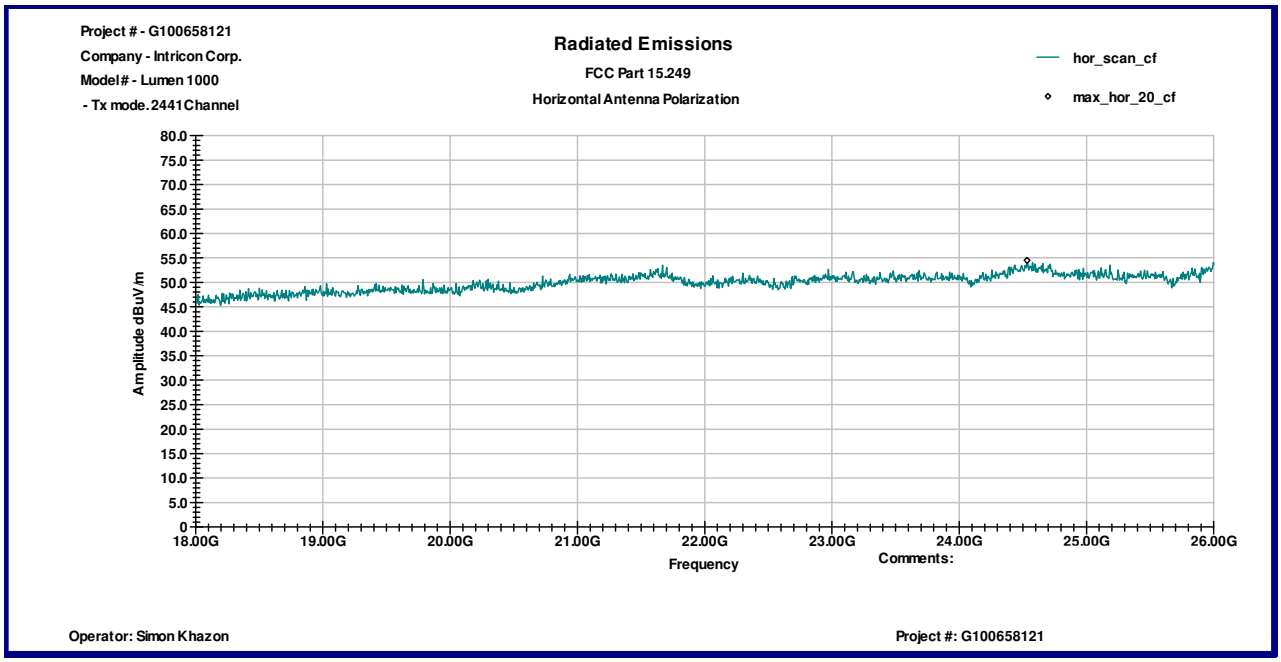


Graph 3.2.11

Vertical antenna polarization

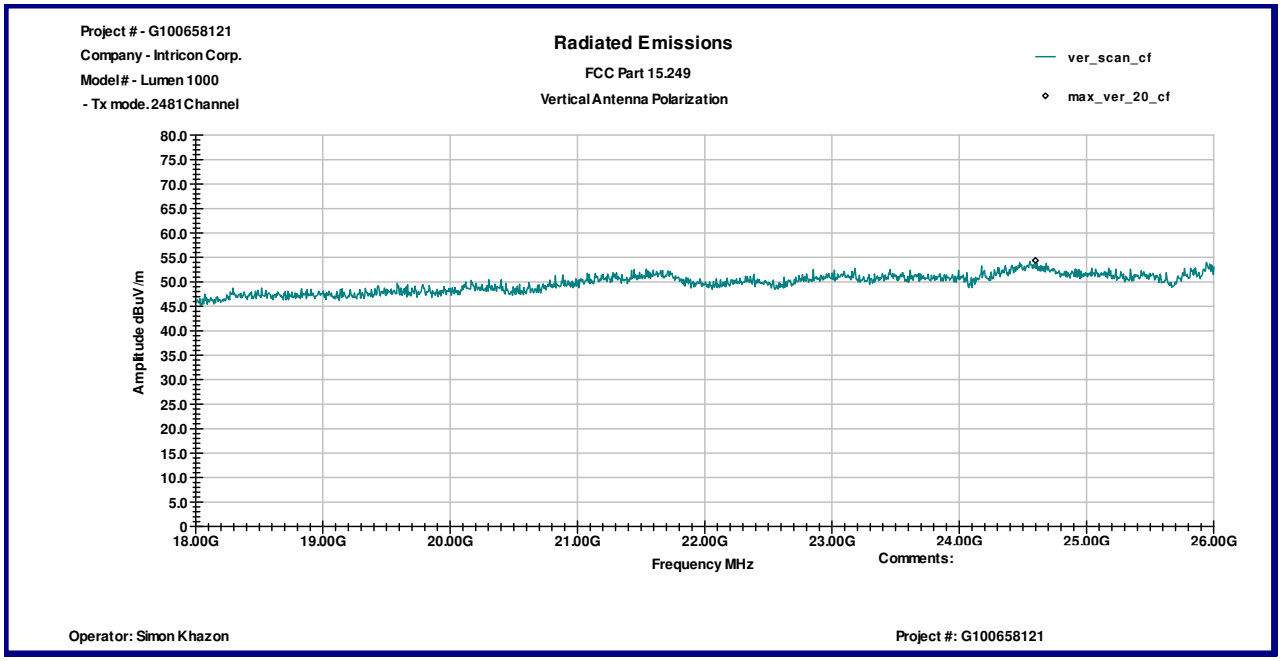


Horizontal antenna polarization

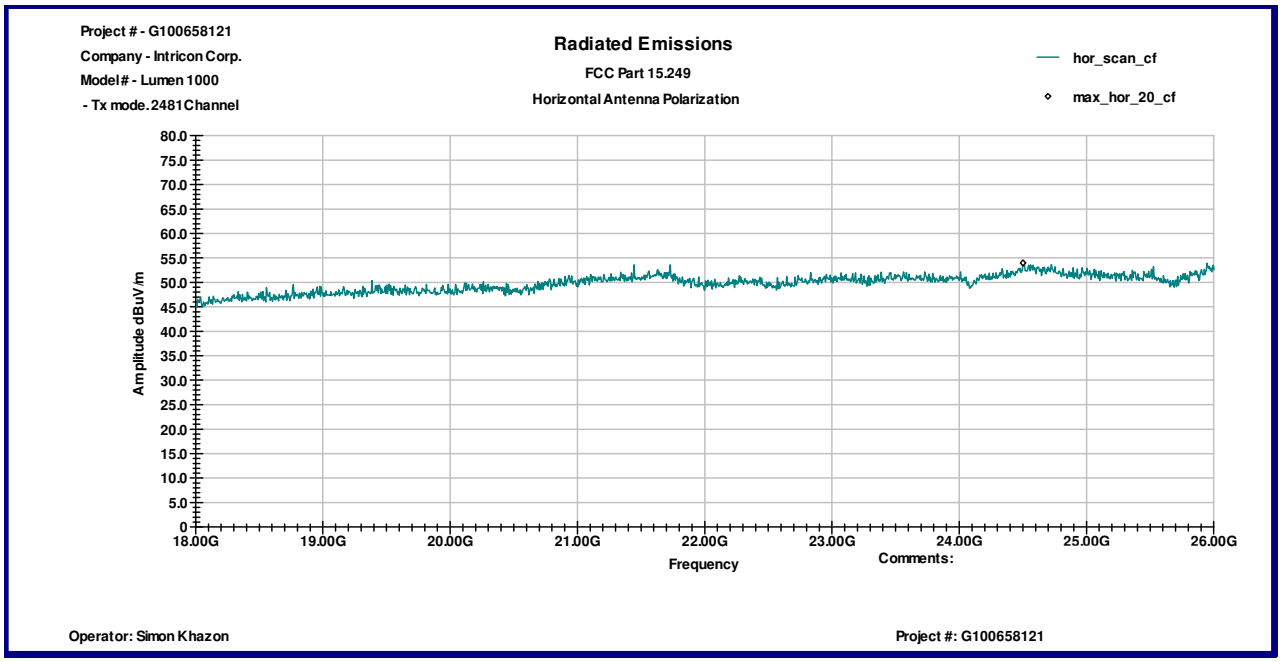


Graph 3.2.12

Vertical antenna polarization



Horizontal antenna polarization



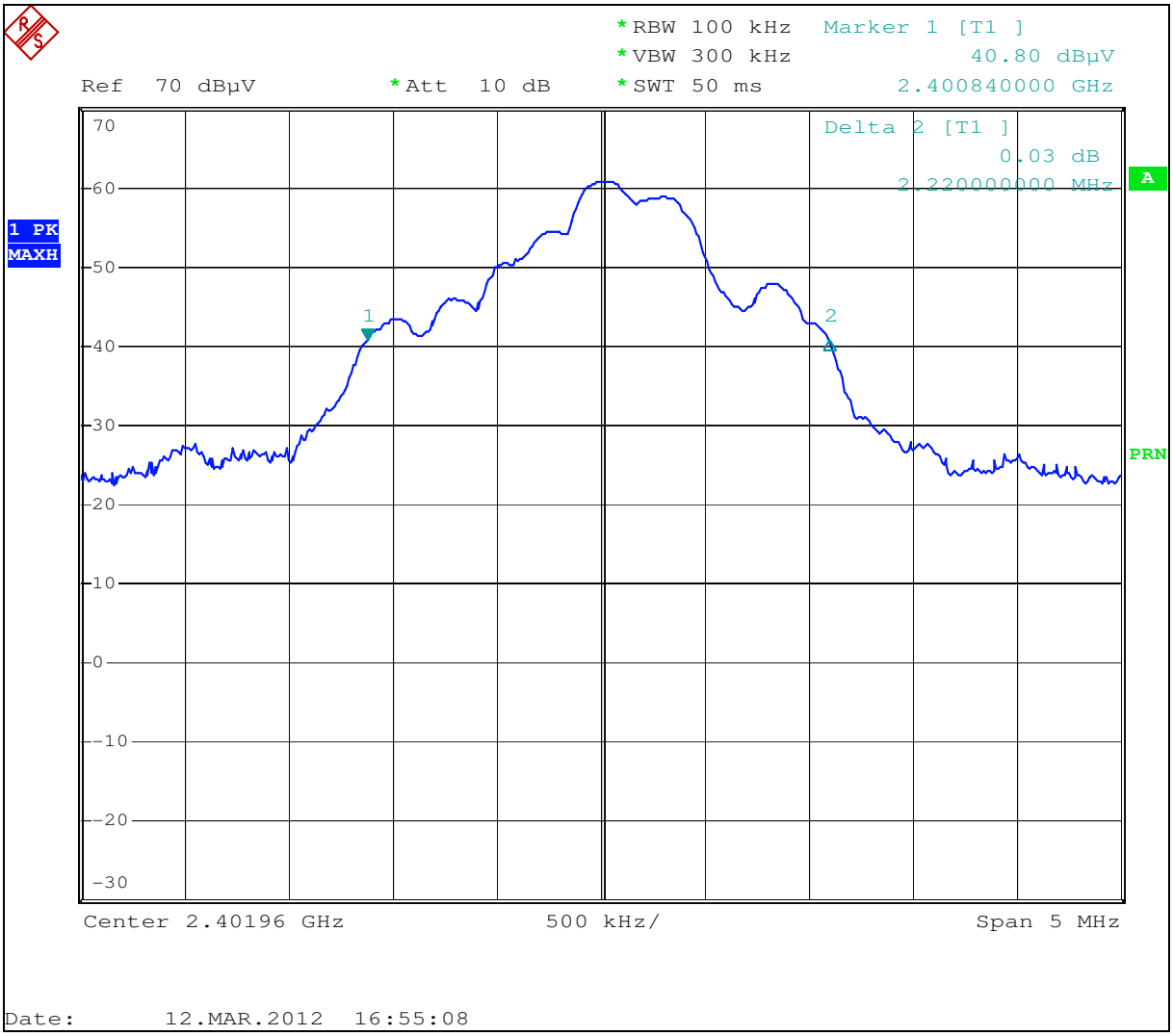
3.3 Bandwidth of Emissions

Center Frequency of operation MHz	Measured 20dB bandwidth MHz	Measured 99% bandwidth MHz
2402	2.22	2.01
2441	1.96	1.95
2481	1.99	2.03

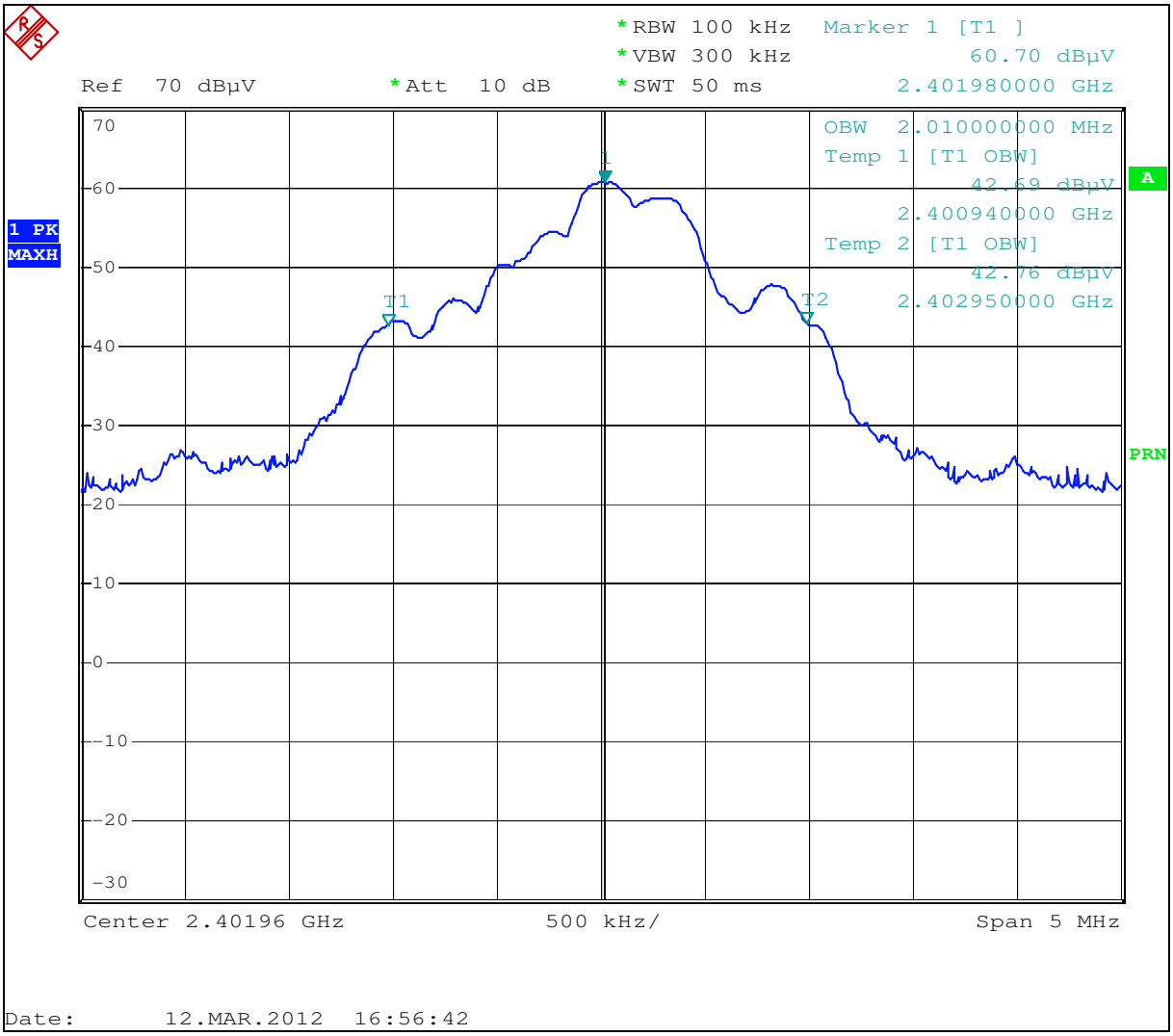
Graphs from 3-3-1 to 3-3-6 show bandwidth of emissions

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

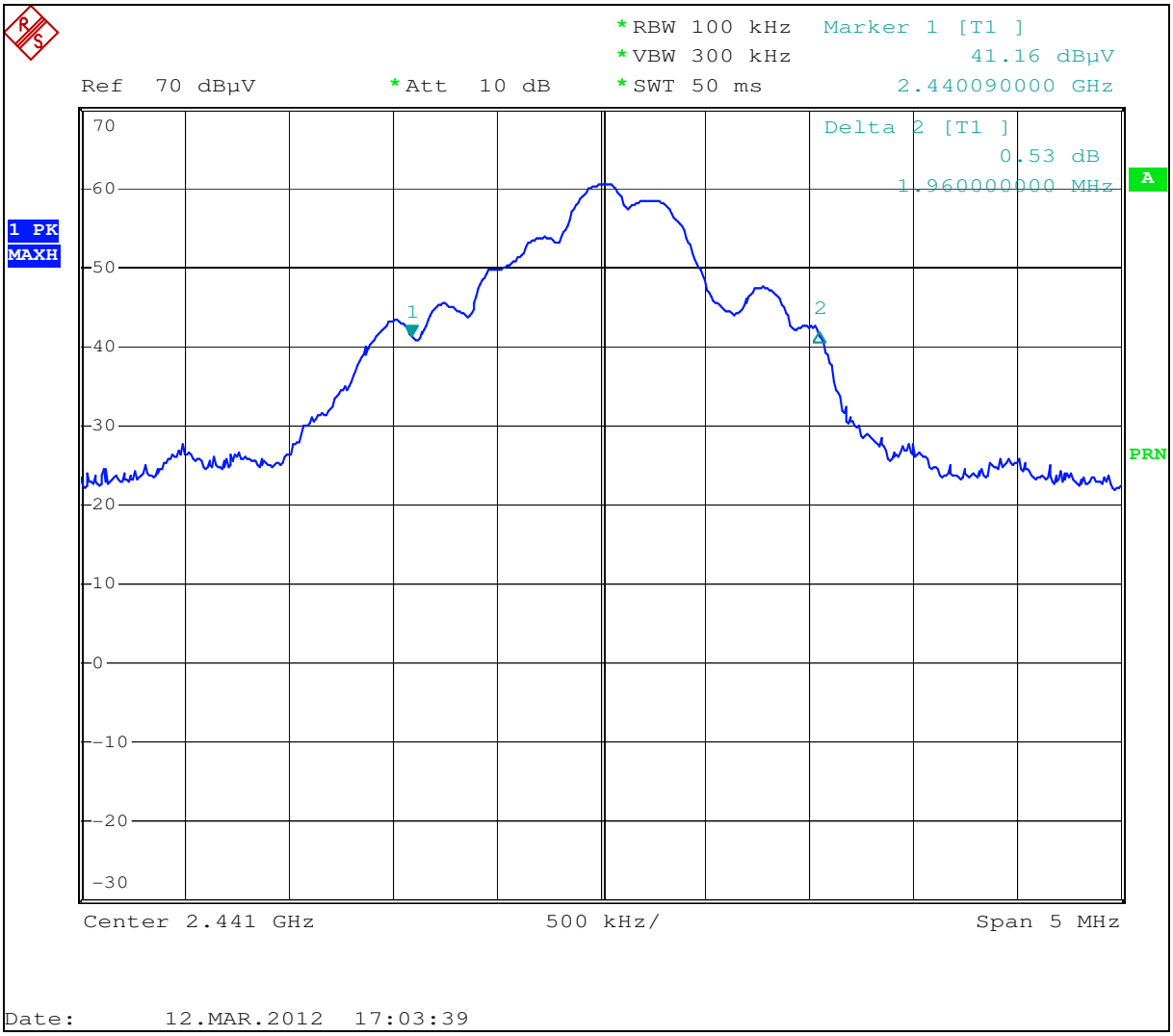
Graph 3.3.1


*RBW 100 kHz
*VBW 300 kHz
*SWT 50 ms
Marker 1 [T1]
40.80 dBµV
2.400840000 GHz
Ref 70 dBµV
*Att 10 dB
Delta 2 [T1]
0.03 dB
2.220000000 MHz
1 PK
MAXH
A
PRN
70
60
50
40
30
20
10
0
-10
-20
-30
Center 2.40196 GHz
500 kHz/
Span 5 MHz
Date: 12.MAR.2012 16:55:08

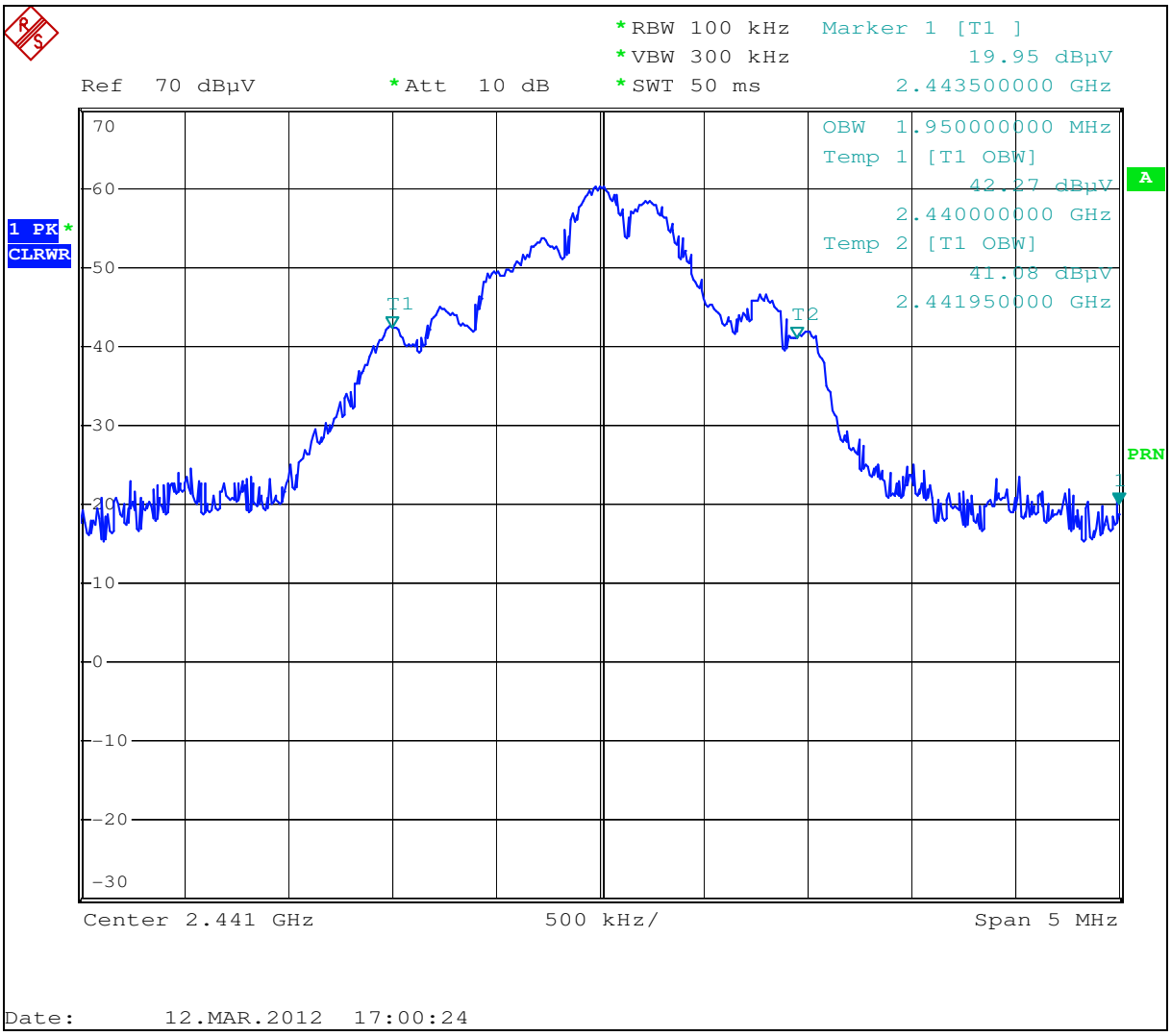
Graph 3.3.2


*RBW 100 kHz
*VBW 300 kHz
Ref 70 dBµV
*Att 10 dB
*SWT 50 ms
Marker 1 [T1]
60.70 dBµV
2.401980000 GHz
OBW 2.010000000 MHz
Temp 1 [T1 OBW]
42.69 dBµV
2.400940000 GHz
Temp 2 [T1 OBW]
42.76 dBµV
2.402950000 GHz
1 PK
MAXH
A
PRN
T1
T2
70
60
50
40
30
20
10
0
-10
-20
-30
Center 2.40196 GHz
500 kHz/
Span 5 MHz
Date: 12.MAR.2012 16:56:42

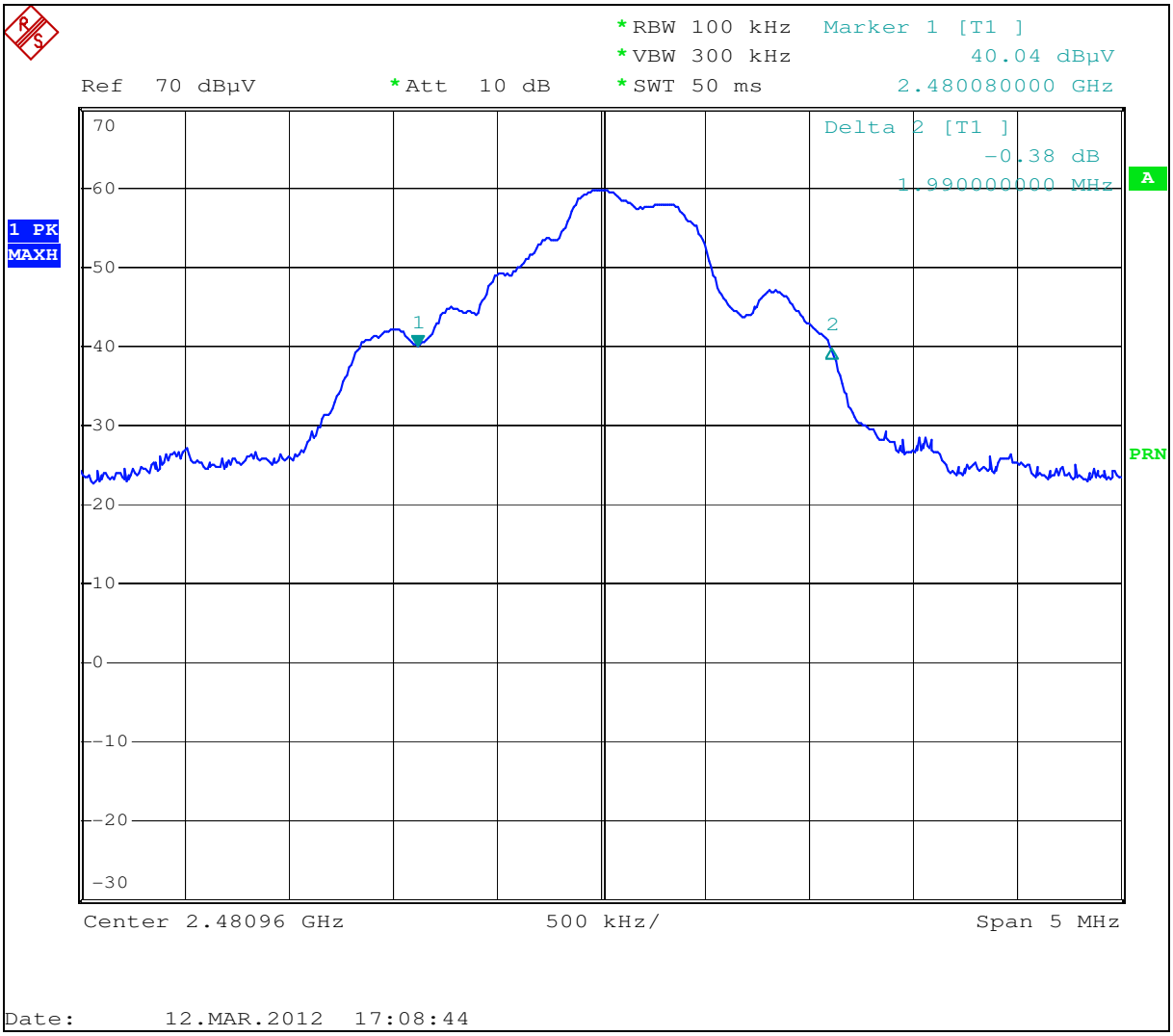
Graph 3.3.3


*RBW 100 kHz
*VBW 300 kHz
*SWT 50 ms
Marker 1 [T1]
41.16 dBµV
2.440090000 GHz
Ref 70 dBµV
*Att 10 dB
Delta 2 [T1]
0.53 dB
1.960000000 MHz
1 PK
MAXH
A
PRN
70
60
50
40
30
20
10
0
-10
-20
-30
Center 2.441 GHz
500 kHz/
Span 5 MHz
Date: 12.MAR.2012 17:03:39

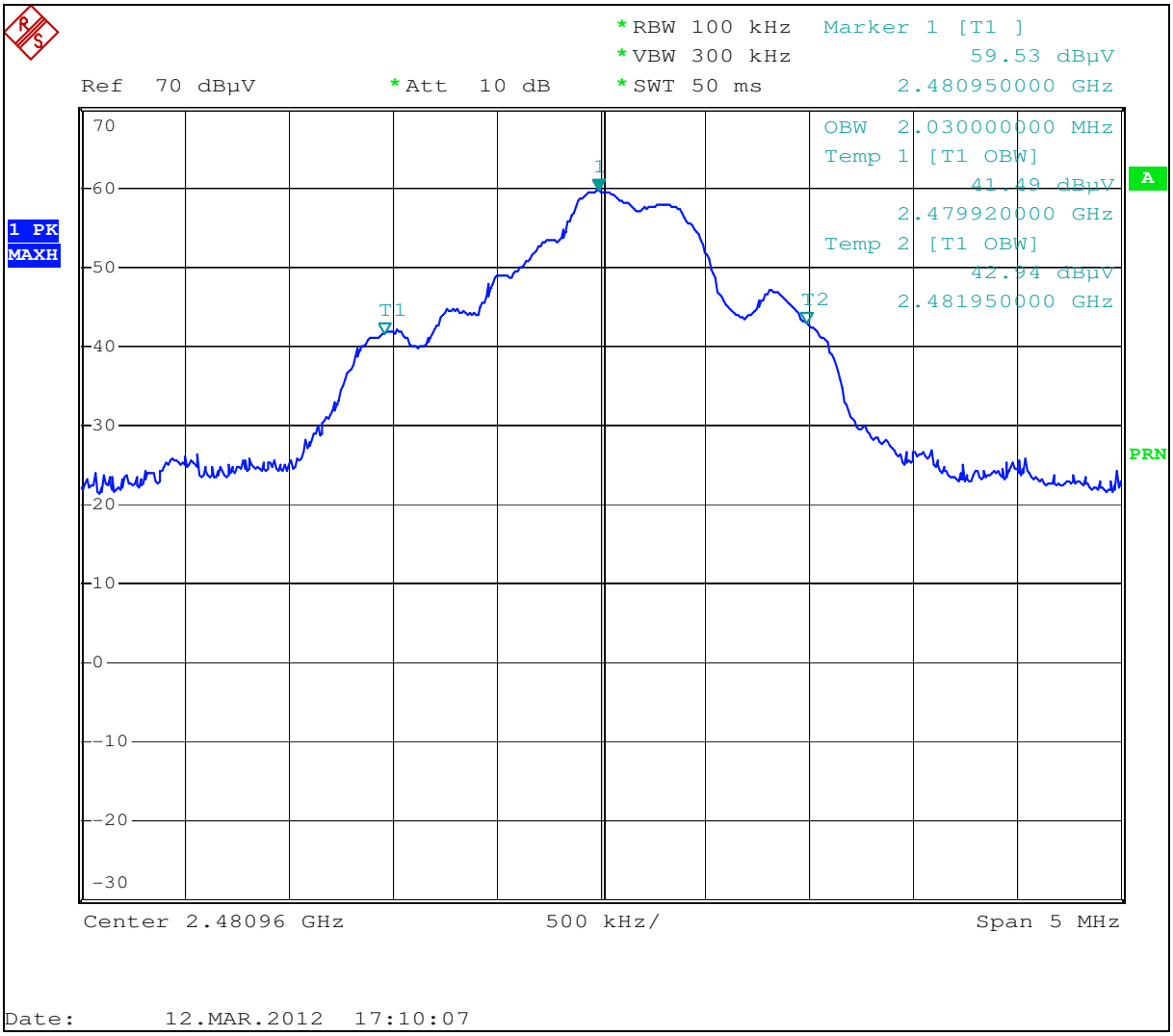
Graph 3.3.4


*RBW 100 kHz
*VBW 300 kHz
Ref 70 dBµV
*Att 10 dB
*SWT 50 ms
Marker 1 [T1]
19.95 dBµV
2.443500000 GHz
OBW 1.950000000 MHz
Temp 1 [T1 OBW]
42.27 dBµV
2.440000000 GHz
Temp 2 [T1 OBW]
41.08 dBµV
2.441950000 GHz
1 PK
CLRWR
A
PRN
T1
T2
70
60
50
40
30
20
10
0
-10
-20
-30
Center 2.441 GHz
500 kHz/
Span 5 MHz
Date: 12.MAR.2012 17:00:24

Graph 3.3.5


*RBW 100 kHz
*VBW 300 kHz
*SWT 50 ms
Marker 1 [T1]
40.04 dBµV
2.480080000 GHz
Ref 70 dBµV
*Att 10 dB
Delta 2 [T1]
-0.38 dB
1.990000000 MHz
1 PK
MAXH
A
PRN
70
60
50
40
30
20
10
0
-10
-20
-30
Center 2.48096 GHz
500 kHz/
Span 5 MHz
Date: 12.MAR.2012 17:08:44

Graph 3.3.6


*RBW 100 kHz
*VBW 300 kHz
Ref 70 dBµV
*Att 10 dB
*SWT 50 ms
Marker 1 [T1]
59.53 dBµV
2.480950000 GHz
OBW 2.030000000 MHz
Temp 1 [T1 OBW]
41.49 dBµV
2.479920000 GHz
Temp 2 [T1 OBW]
42.94 dBµV
2.481950000 GHz
1 PK
MAXH
A
PRN
T1
T2
70
60
50
40
30
20
10
0
-10
-20
-30
Center 2.48096 GHz
500 kHz/
Span 5 MHz
Date: 12.MAR.2012 17:10:07

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:

Notes: EUT is battery operated unit.

3.5 Receiver/digital device radiated emissions

Test location: ☐ OATS ☒ Anechoic Chamber

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Frequency range: 30MHz-13GHz

Max. Emissions margin: 10.3dB below the limits

Notes: The Radiated Emissions test was performed in the Anechoic chamber at 3m measurement distance (see Tables 3.5.1 and Graphs 3.5.1 to 3.5.2)

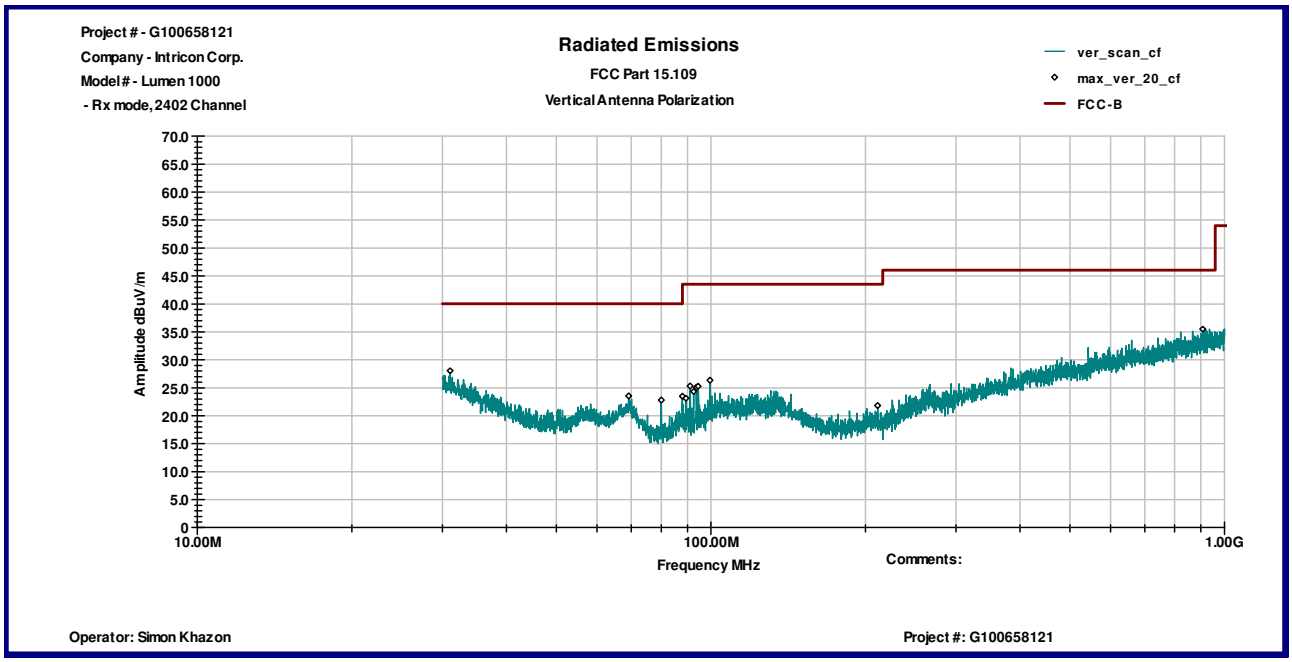
Date:	March 10-15, 2012	**Result:** **Pass**
Standard:	FCC Part 15.109, Class B	
Tested by:	Simon Khazon	
Test Point:	Enclosure	
Operation mode:	Standby mode/Receiver mode	
Note:	None	

Table 3.5.1

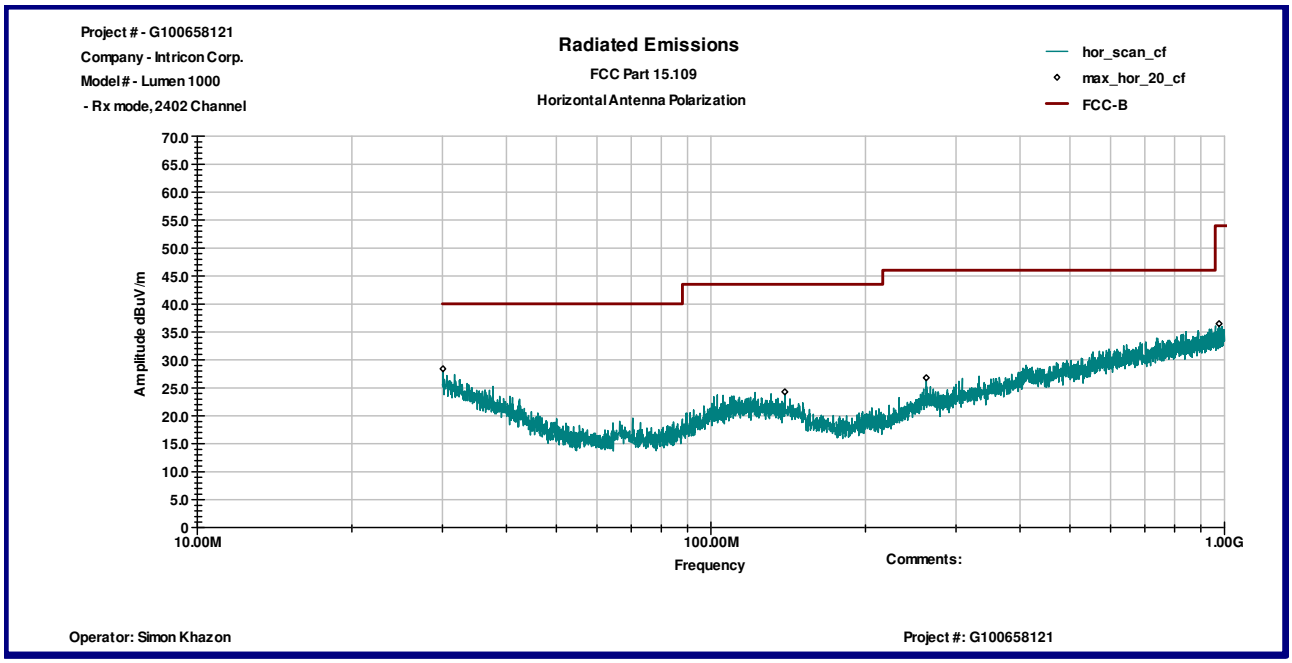
Frequency	Ant. Polarity	Peak Reading dBµV	Ant.Factor dB1/m	Total at 3m dBµV/m	Limit dBµV/m	Margin dB
		Channel 2402				
31.074 MHz	V	8.3	19.7	28.0	40.0	-12.0
91.121 MHz	V	14.9	10.4	25.3	40.0	-14.7
99.627 MHz	V	14.0	12.4	26.3	40.0	-13.7
211.26 MHz	V	9.7	12.2	21.8	40.0	-18.2
907.34 MHz	V	10.0	25.4	35.5	47.0	-11.5
30.069 MHz	H	8.1	20.3	28.4	40.0	-11.6
139.25 MHz	H	10.9	13.4	24.3	40.0	-15.7
975.6 MHz	H	10.3	26.2	36.5	47.0	-10.5
		Channel 2441				
31.974 MHz	V	8.0	19.2	27.3	40.0	-12.8
91.121 MHz	V	14.9	10.4	25.3	40.0	-14.7
133.05 MHz	V	12.3	13.8	26.1	40.0	-13.9
949.07 MHz	V	10.9	25.8	36.7	47.0	-10.3
30.346 MHz	H	7.1	20.1	27.2	40.0	-12.8
127.68 MHz	H	11.5	13.9	25.4	40.0	-14.6
907.34 MHz	H	10.9	25.4	36.3	47.0	-10.7
		Channel 2481				
30.727 MHz	V	7.6	19.9	27.5	40.0	-12.5
87.838 MHz	V	14.4	9.8	24.1	40.0	-15.9
89.33 MHz	V	15.6	10.0	25.6	40.0	-14.4
91.121 MHz	V	15.9	10.4	26.2	40.0	-13.8
93.733 MHz	V	14.7	11.1	25.8	40.0	-14.2
94.479 MHz	V	14.9	11.3	26.3	40.0	-13.7
913.0 MHz	V	10.8	25.4	36.3	47.0	-10.7
30.381 MHz	H	7.4	20.1	27.5	40.0	-12.5
102.91 MHz	H	13.4	12.8	26.1	40.0	-13.9
967.46 MHz	H	10.6	26.1	36.7	47.0	-10.3

Graph 3.5.1

Vertical antenna polarization

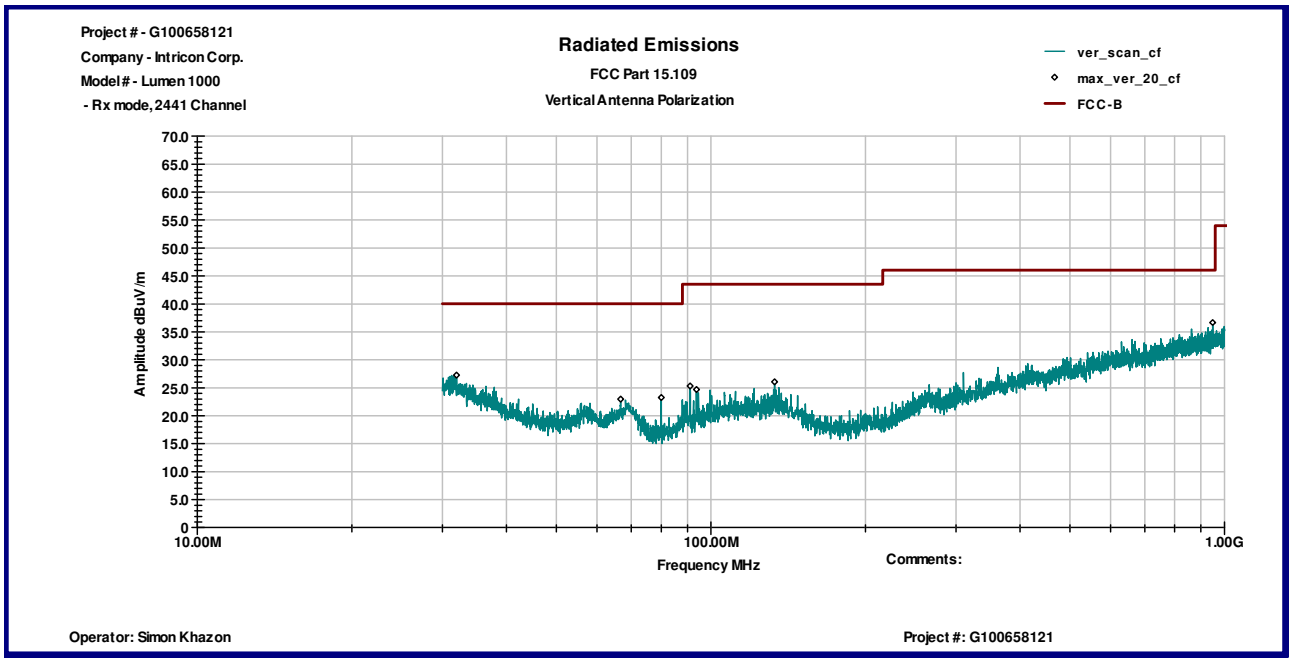


Horizontal antenna polarization

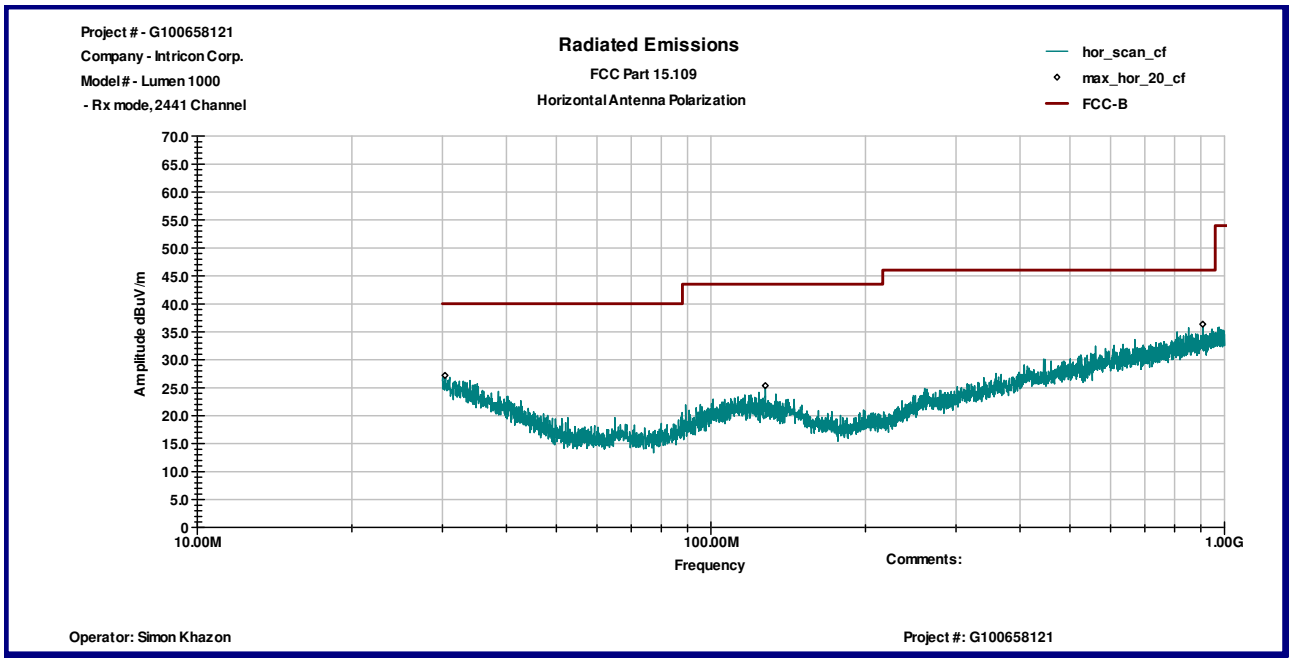


Graph 3.5.2

Vertical antenna polarization

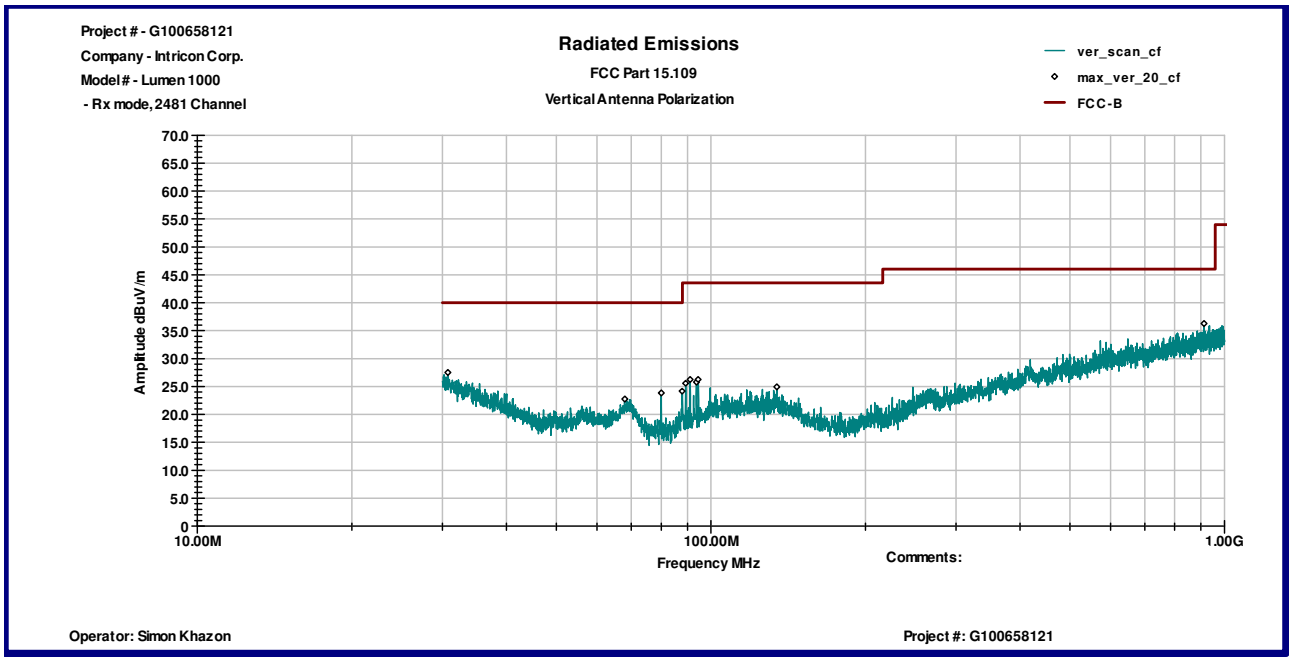


Horizontal antenna polarization

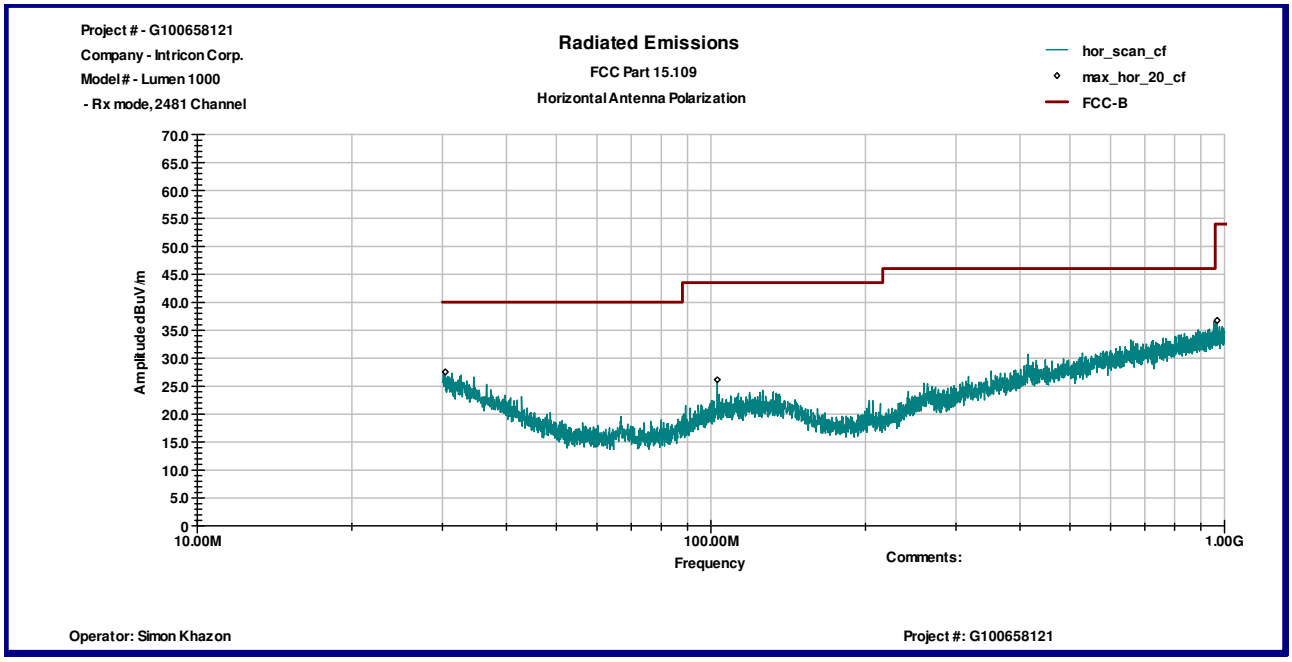


Graph 3.5.3

Vertical antenna polarization

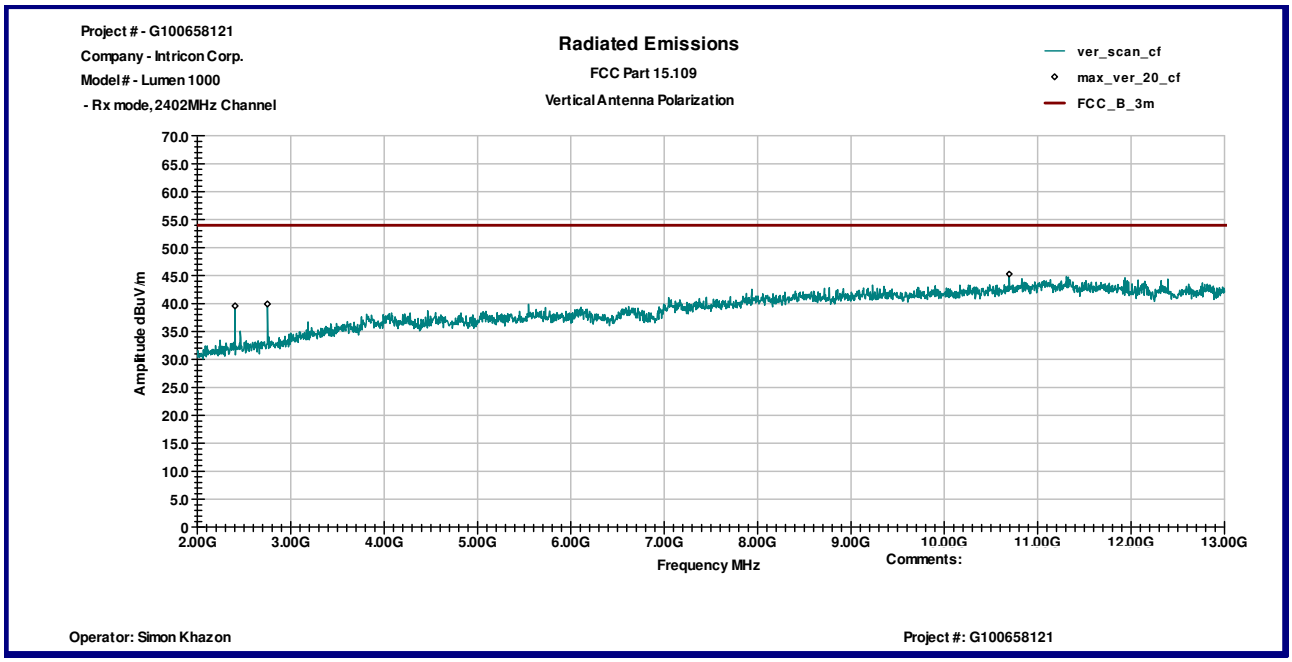


Horizontal antenna polarization

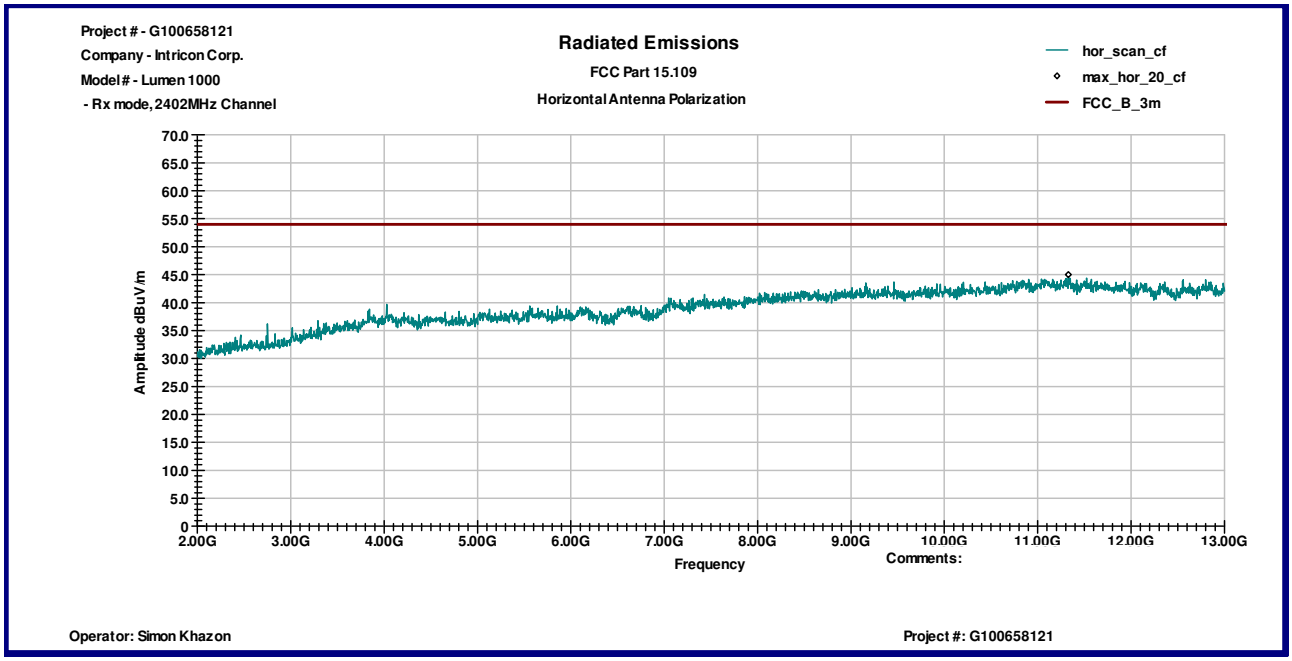


Graph 3.5.4

Vertical antenna polarization

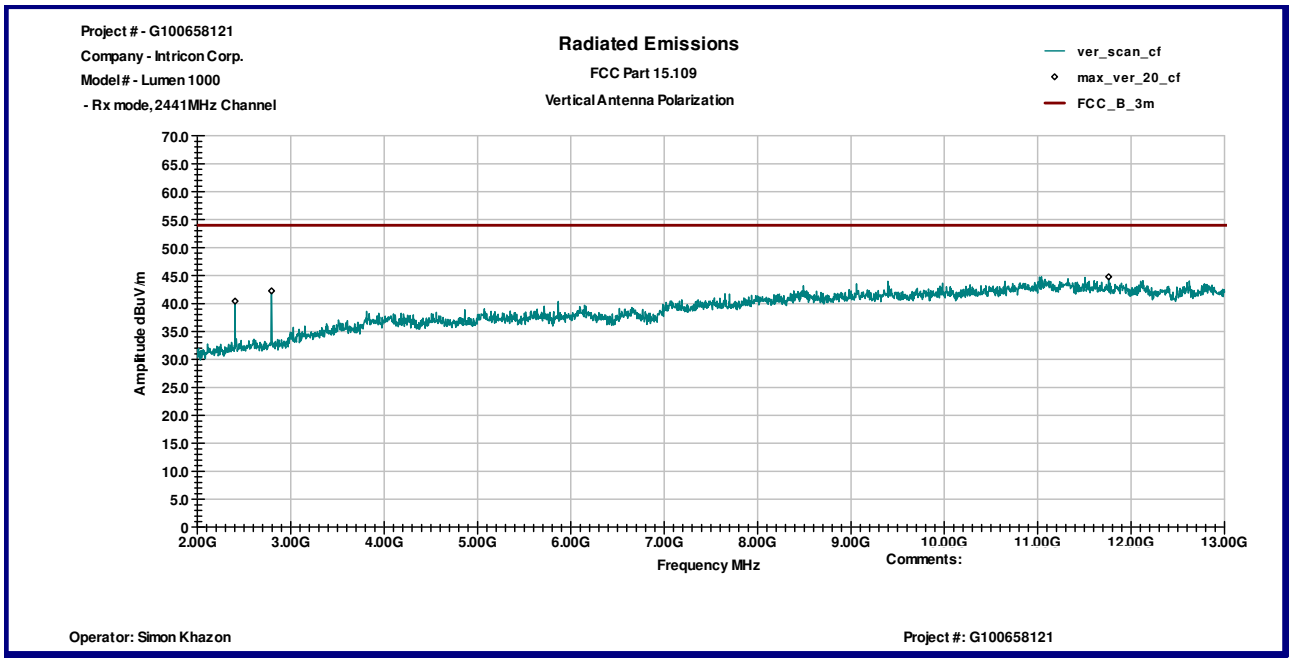


Horizontal antenna polarization

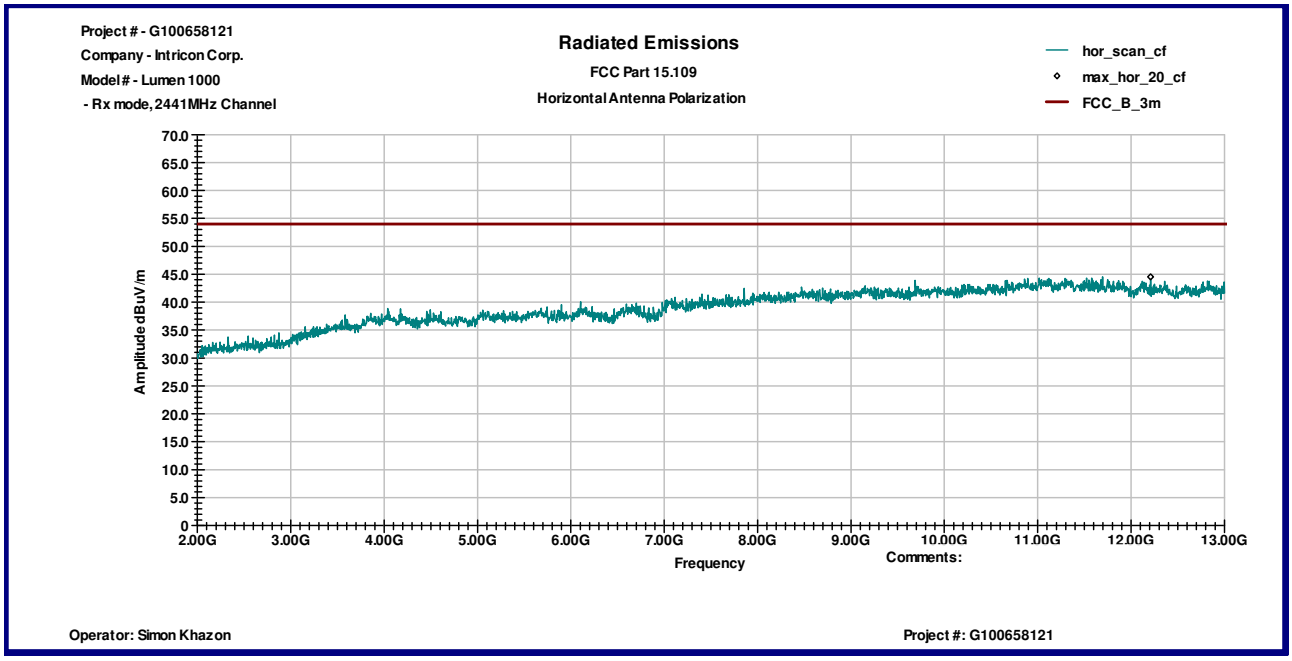


Graph 3.5.5

Vertical antenna polarization

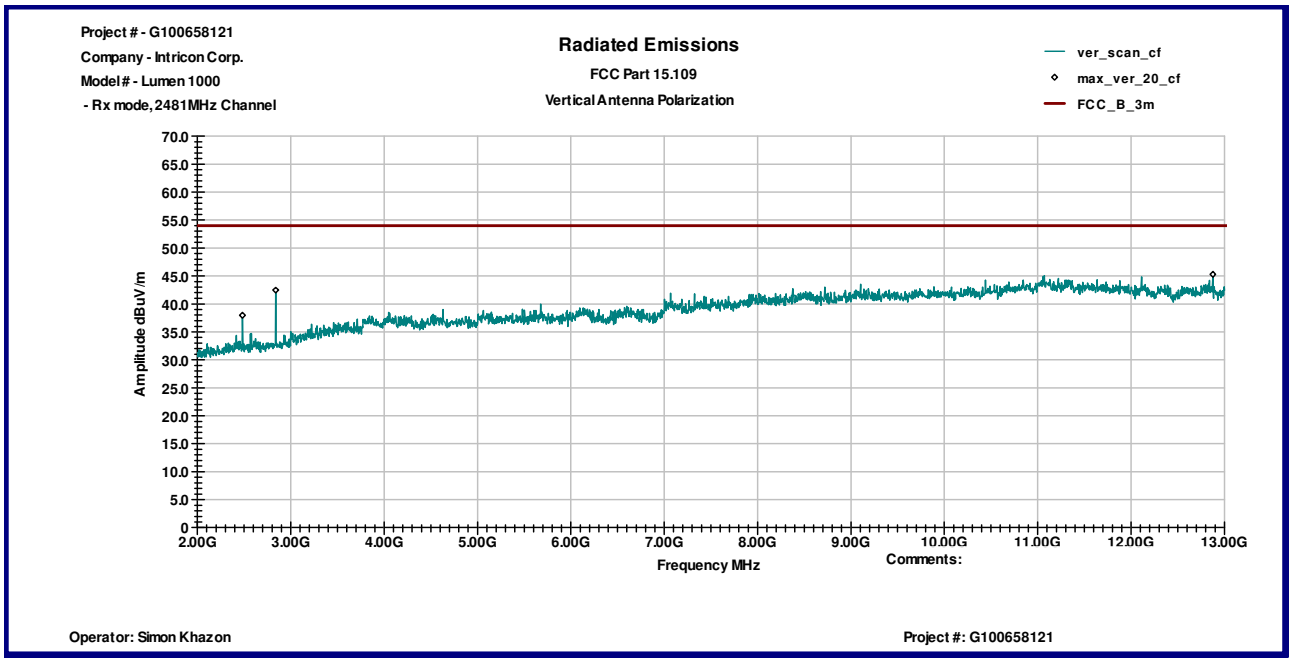


Horizontal antenna polarization

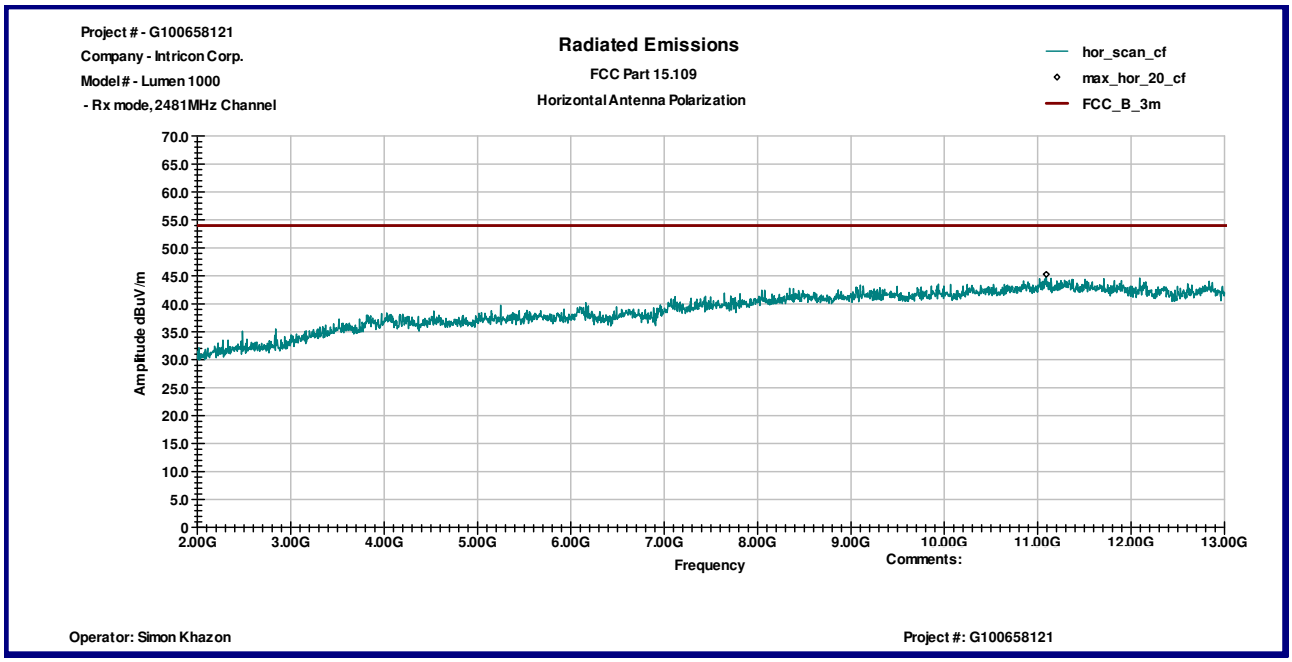


Graph 3.5.6

Vertical antenna polarization



Horizontal antenna polarization



3.6 Digital device conducted emissions

Test location: ☐ OATS ☐ Anechoic Chamber ☐ Other

Test result: **N/A**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin:

Notes: EUT is battery operated device.

4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	CAL DUE	USED
Spectrum Analyzer	R & S	FSP 40	100024	12559	11/17/2012	☒
Spectrum Analyzer	R & S	ESU	100398	25283	12/09/2012	☒
Bicono-Log Antenna	Schaffner-Chase	CBL 6112 B	2468	9734	11/08/2012	☒
Horn Antenna	EMCO	3115	9507-4513	9936	04/29/2012	☒
Horn Antenna	EMCO	3115	6579	15580	05/25/2012	☒
LISN	Fischer Custom Communications	FCC-LISN-50-25-2	2014	9665	03/23/2012	☐
High Pass Filter	Reactel	7HS-4G-S12	0223	015274	VBU	☒
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1122951	13475	10/31/2012	☒
Pre-Amplifier	MITEQ	AMF-6F-26004000-40-8P	13224444	MIN-0064	10/31/2012	☒
System	TILE! Instrument Control		Ver. 3.4.K.29	15259	VBU	☒