TEST REPORT

Report Number: 101288157MIN-001
Project Number: G101288157

Testing performed on the
MOXY-3

FCC ID: 2AAT6001
Industry Canada ID: 11333A-001

to
47 CFR Part 15. 249:2010
RSS- 210, Issue 8, 2010
RSS-Gen, Issue 3, 2010
47 CFR, Part 15:2010, §15.107 and §15.109, Class B / ICES-003, Issue 5:2012

For
Fortiori Design LLC.

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

Test Authorized by:
Fortiori Design LLC
1155 West Shore Drive SW
Hutchinson, MN 55350 USA

Prepared by: _____ Date: September 16, 2013
Simon Khazon

Reviewed by: _____ Date: September 16, 2013
Richard Blonigen

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1.0 GENERAL DESCRIPTION

Model:	MOXY-3
Type of EUT:	Muscle Oxygen Monitor
Serial Number	Proto
FCC ID:	2AAT6001
Industry Canada ID:	11333A-001
Related Submittal(s) Grants:	None
Company:	Fortiori Design LLC.
Customer:	Mr. Roger Schmitz
Address:	1155 West Shore Drive SW Hutchinson, MN 55350 USA
Phone:	320-296-1010
E-mail:	roger@moxymonitor.com
Test Standards:	☒ 47 CFR, Part 15:2010, §15.249 ☒ RSS–210, Issue 8, 2010 ☒ RSS-Gen, Issue 3, 2010 ☒ 47 CFR, Part 15:2010, §15.107 and §15.109, Class B ☒ ICES-003, Issue 5:2012 ☐ Other
Type of radio:	☒ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	August 27 , 2013
Test Work Started:	September 11, 2013
Test Work Completed:	September 16, 2013

1.1 Product Description; Test Facility

Product Description:	Muscle Oxygen Monitor
Operating Frequency	2403-2480 MHz
Number of channels:	1 (factory pre selected in the frequency range 2403-2480MHz)
Modulation:	GFSK
Emission Designator:	1M1F1D
Antenna(s) Info:	Integral 2.4 GHz Surface Mount Device (SMD) On-ground Antenna
Antenna Installation:	☐ User ☐ Professional ☒ Factory
Transmitter Power Configuration:	☒ Internal battery ☐ External power source ☐ 120VAC ☐ 230VAC ☐ 400VAC ☒ 3.8VDC from internal battery ☐ Other: Amp. ☐ 50Hz ☐ 60Hz
Special Test Arrangement:	N/A
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 modulated mode
☐ - Continuous un-modulated
☐ - Continuous receiving mode
☒ - Normal (see below)

Operating modes of the EUT:

No.	Description
1	The device was pre-programmed to operate continuously in low, middle, and upper frequency channels, one channel being transmitted at a given time.
2	Normal operation mode was used as a Receiving mode for FCC Part 15.109 Standard

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:

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: 2403-2480MHz

Test result: **Pass**

Max. Emissions margin at fundamental: 6.5dB below the limits

Notes: None

Date:	September 11-14, 2013	**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:	None	

Table 3.1.1

Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	Peak Reading	Total @ 3m	AVG Limit	Margin
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBµV	dBµV/m	dBµV/m	dB
Fundamental									
2403MHz									
2402.9	V	100	28.5	3.5	0.0	48.3	80.3	94.0	-13.7
2402.9	H	242	28.5	3.5	0.0	54.7	86.7	94.0	-7.3
2457MHz									
2457.1	V	100	28.6	3.6	0.0	48.0	80.1	94.0	-13.9
2457.1	H	242	28.6	3.6	0.0	55.4	87.5	94.0	-6.5
2480MHz									
2480.1	V	100	28.6	3.6	0.0	51.6	83.8	94.0	-10.2
2480.1	H	229	28.6	3.6	0.0	55.2	87.4	94.0	-6.6

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-26GHz

Test result: **Pass**

Max. margin of harmonics and spurious emissions: 12.8dB below the limits

Notes: Transmitting fundamental frequencies were excluded from the table.

Date:	September 11-14, 2013	**Result:** **Pass**
Standard:	FCC 15.249(a) and (d) / RSS-210 A2.9	
Tested by:	Simon Khazon	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	30-2000MHz	

Table 3.2.1

Frequency	Ant. Polarity	Peak Reading dBµV	Total C.F. dB1/m	Total at 3m dBµV/m	Limit dBµV/m	Margin dB
			2403MHz			
132.43 MHz	V	13.6	13.8	27.4	43.5	-16.1
143.25 MHz	V	12.7	13.0	25.7	43.5	-17.8
837.85 MHz	V	2.9	24.6	27.5	46.0	-18.5
30.386 MHz	H	-2.7	20.0	17.3	40.0	-22.7
318.6 MHz	H	4.9	16.5	21.4	46.0	-24.7
332.99 MHz	H	3.4	16.8	20.2	46.0	-25.8
			2457MHz			
132.5 MHz	V	13.4	13.8	27.1	43.5	-16.4
138.5 MHz	V	14.4	13.4	27.8	43.5	-15.8
143.25 MHz	V	13.6	13.0	26.7	43.5	-16.9
31.439 MHz	H	-2.3	19.3	17.0	40.0	-23.0
304.39 MHz	H	5.3	16.0	21.3	46.0	-24.7
332.99 MHz	H	4.0	16.8	20.8	46.0	-25.2
			2480MHz			
30.035 MHz	V	7.0	20.2	27.2	40.0	-12.8
132.43 MHz	V	15.0	13.8	28.7	43.5	-14.8
138.01 MHz	V	15.6	13.4	29.0	43.5	-14.5
143.25 MHz	V	14.5	13.0	27.5	43.5	-16.0
30.333 MHz	H	7.2	20.0	27.3	40.0	-12.8
104.18 MHz	H	11.1	13.0	24.1	43.5	-19.5

Table 3.2.2

Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	Peak Reading	Total @ 3m	AVG Limit	Margin
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBµV	dBµV/m	dBµV/m	dB
Band Edge Compliance									
2400.00	V	100	28.5	3.5	0.0	12.3	44.3	54.0	-9.7
2400.00	H	242	28.5	3.5	0.0	14.8	46.8	54.0	-7.2
2483.50	V	100	28.6	3.6	0.0	11.6	43.8	54.0	-10.2
2483.50	H	229	28.6	3.6	0.0	13.0	45.2	54.0	-8.8

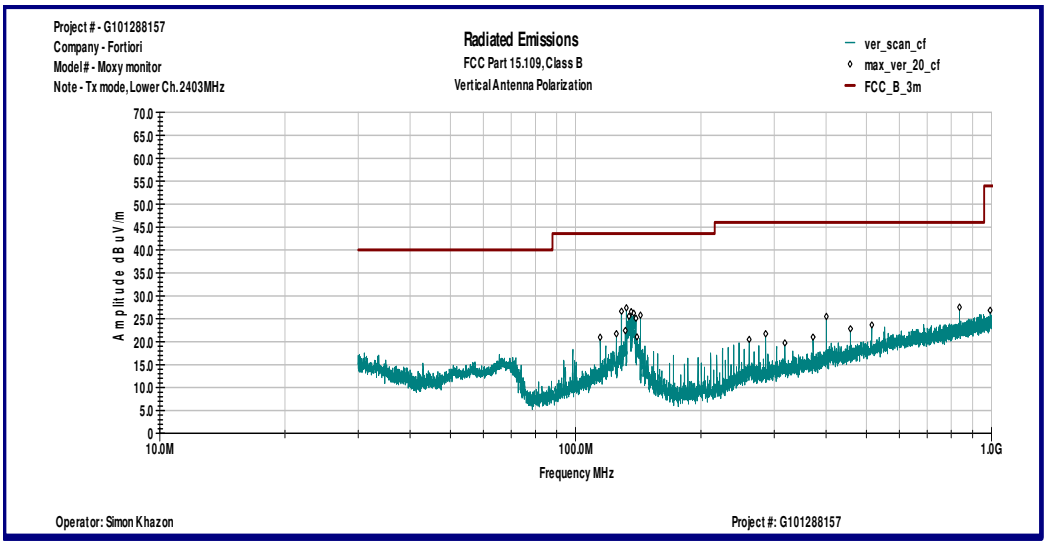
Date:	September 11-14, 2013	**Result:** **Pass**
Standard:	FCC 15.249(a) and (d) / RSS-210 A2.9	
Tested by:	Simon Khazon	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	2-26GHz	

Table 3.2.3

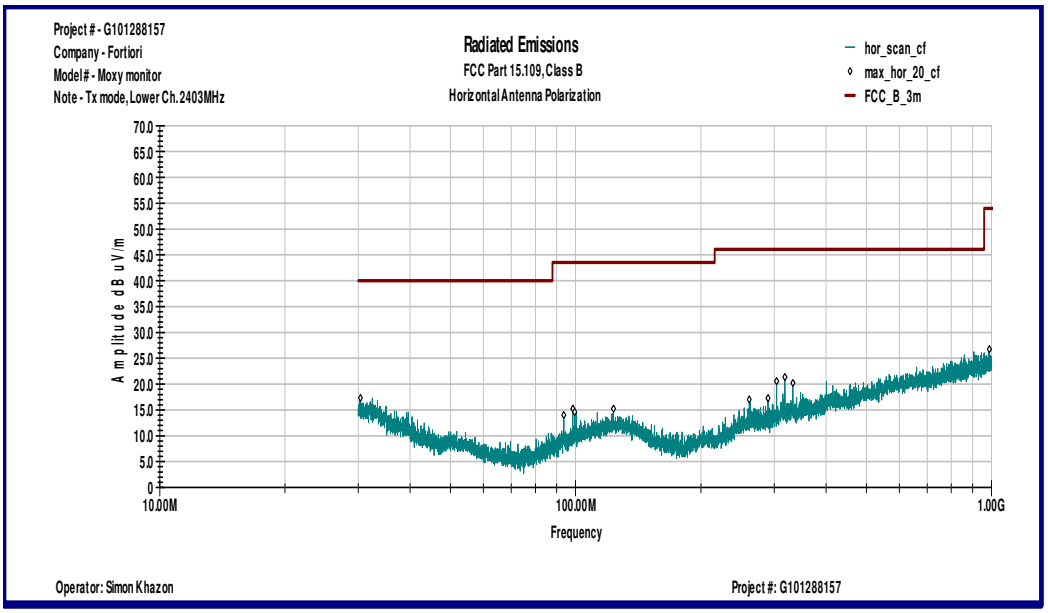
Frequency MHz	Antenna Polarity	Peak Reading dBµV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBµV/m	Limit dBµV/m	Margin dB
			2403MHz				
3.917 GHz	V	12.0	36.3	0.0	48.3	54.0	-5.7
3.929 GHz	H	12.0	36.1	0.0	48.1	54.0	-5.9
14.712 GHz	H	41.8	48.6	38.6	51.8	54.0	-2.2
			2457MHz				
3.931 GHz	V	12.9	36.3	0.0	49.2	54.0	-4.8
14.98 GHz	V	42.6	47.7	38.3	52.0	54.0	-2.0
3.936 GHz	H	11.8	36.1	0.0	47.8	54.0	-6.1
14.452 GHz	H	41.0	49.3	38.8	51.5	54.0	-2.5
			2480MHz				
2.422 GHz	V	15.2	31.4	0.0	46.6	54.0	-7.4
2.484 GHz	V	15.3	31.6	0.0	46.8	54.0	-7.1
3.913 GHz	V	12.7	36.3	0.0	49.0	54.0	-5.0
3.784 GHz	H	12.4	35.6	0.0	48.0	54.0	-6.0
4.22 GHz	H	43.5	36.5	39.8	40.2	54.0	-13.8
14.804 GHz	H	41.9	48.3	38.5	51.7	54.0	-2.2

Graph 3.2.1

Vertical antenna polarization

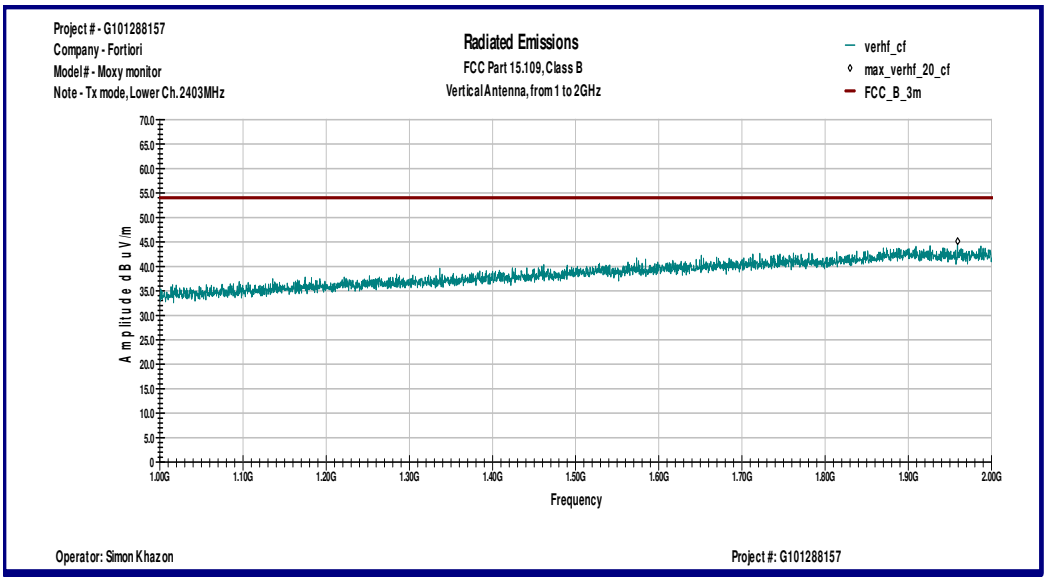


Horizontal antenna polarization

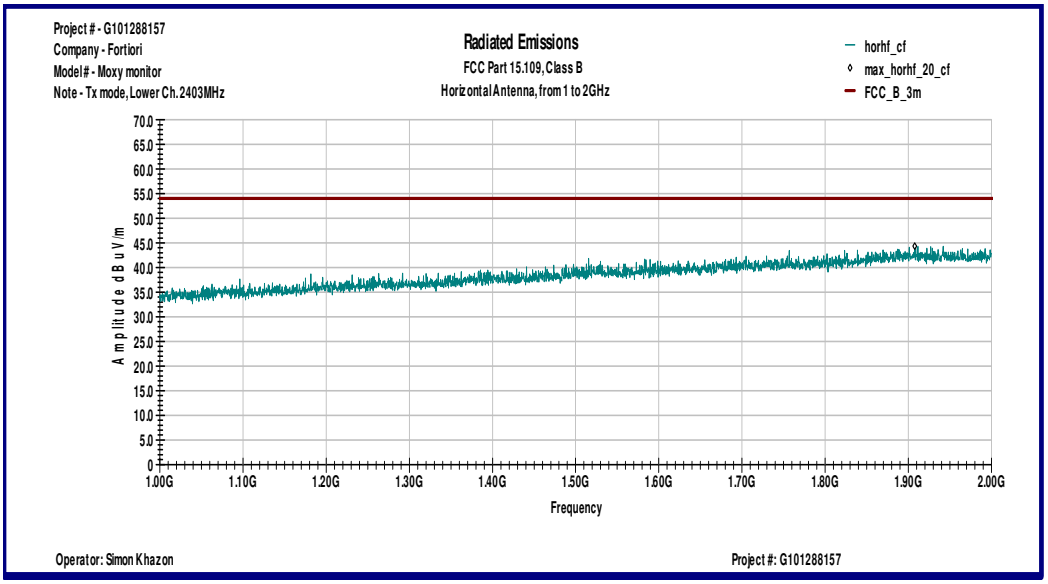


Graph 3.2.2

Vertical antenna polarization

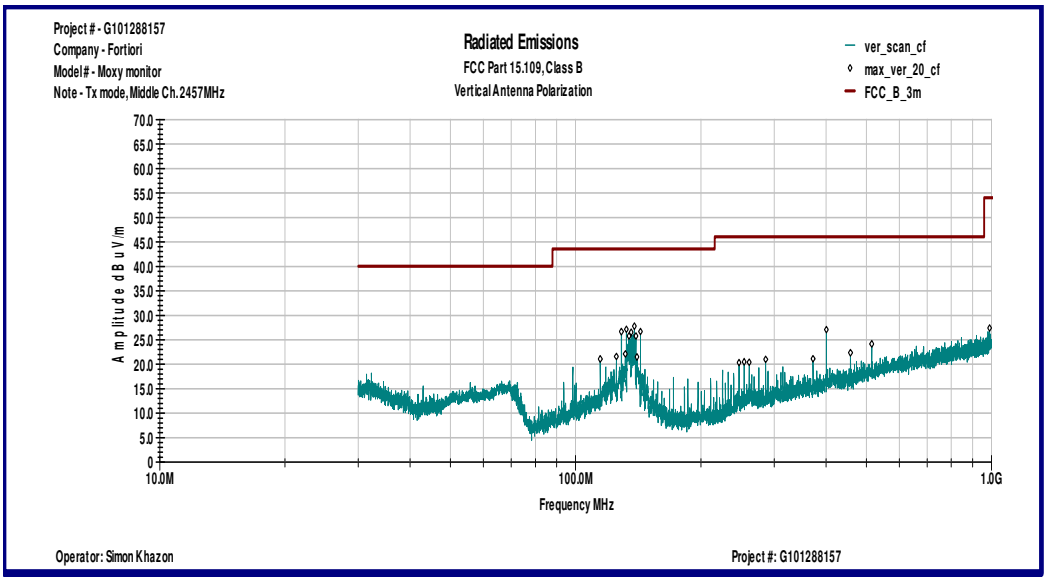


Horizontal antenna polarization

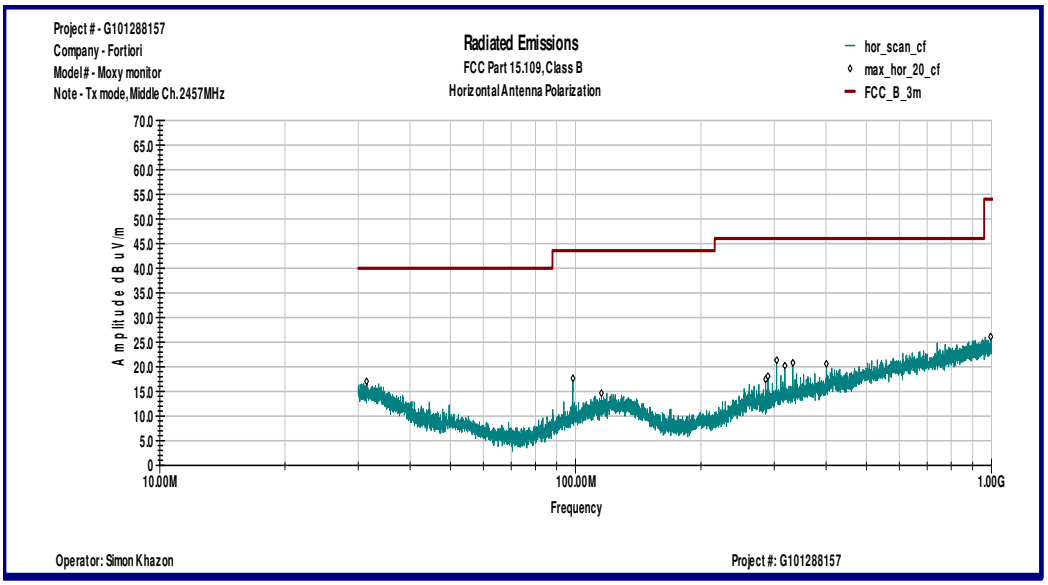


Graph 3.2.3

Vertical antenna polarization

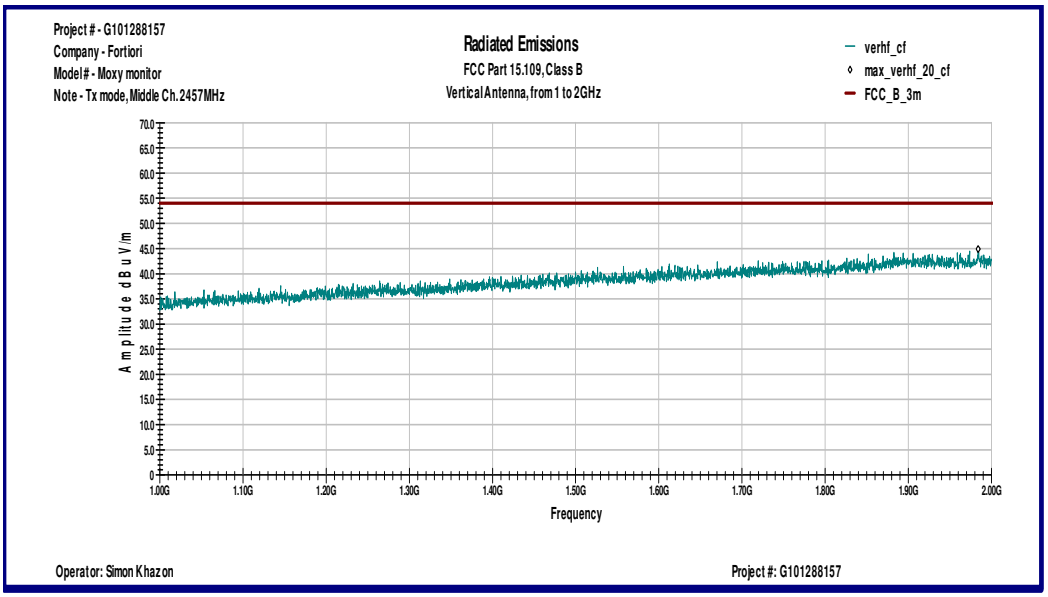


Horizontal antenna polarization

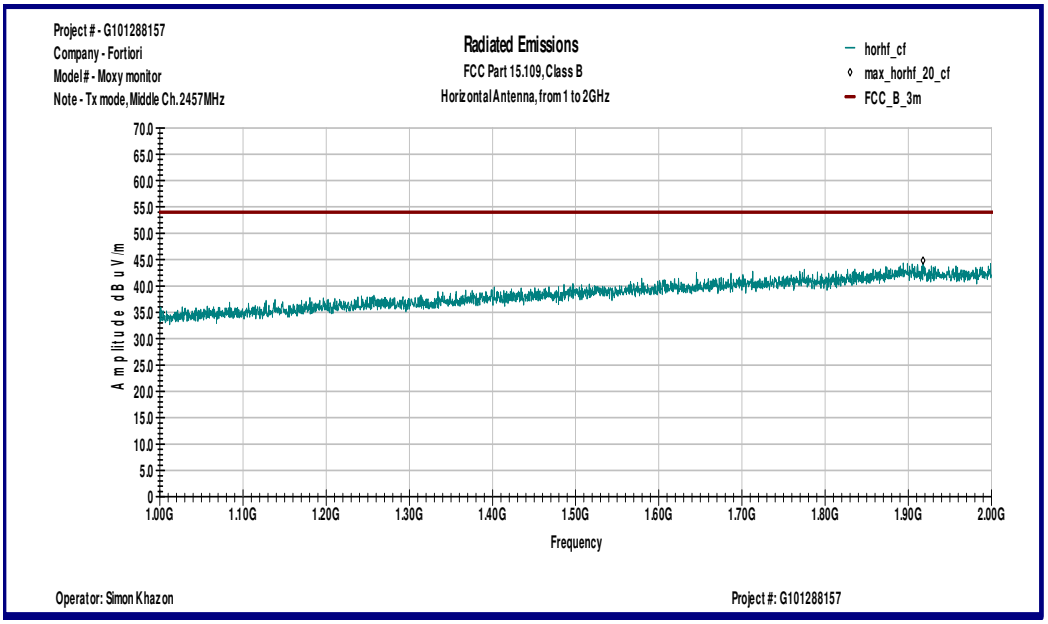


Graph 3.2.4

Vertical antenna polarization

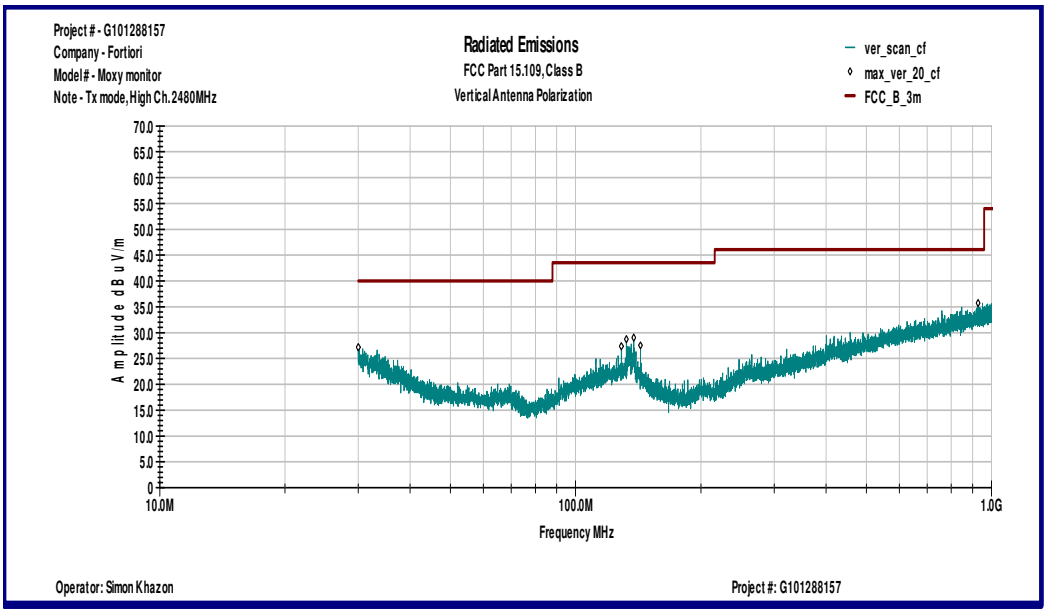


Horizontal antenna polarization

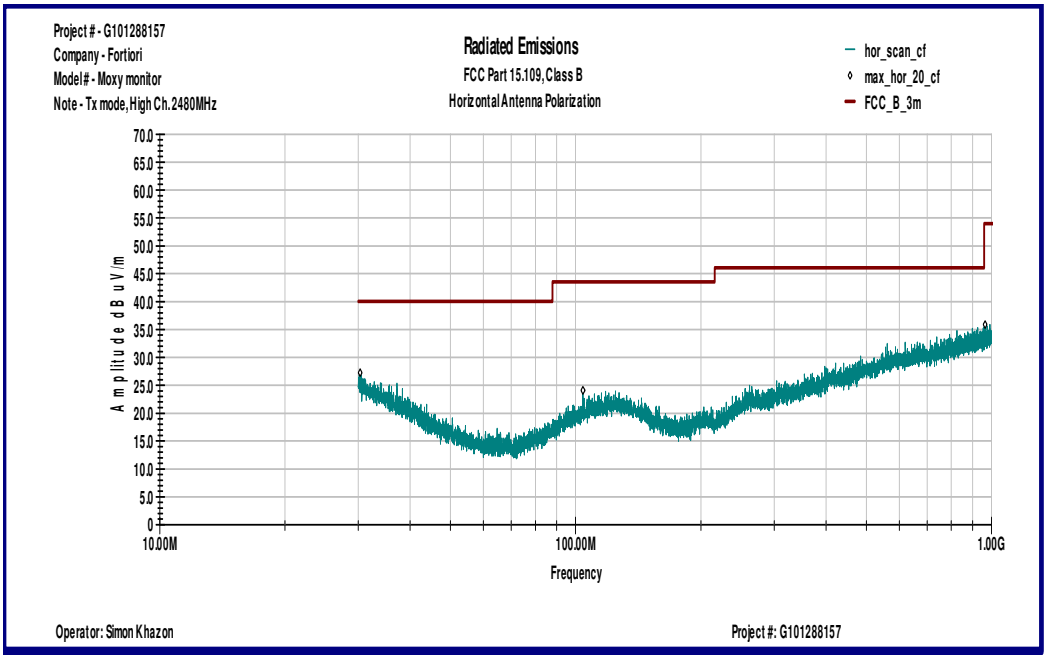


Graph 3.2.5

Vertical antenna polarization

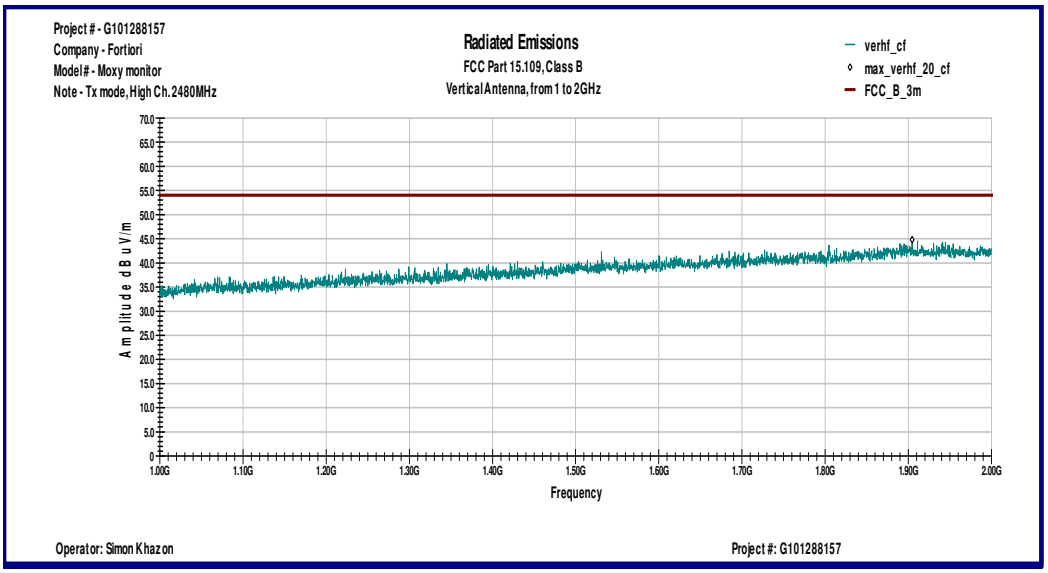


Horizontal antenna polarization

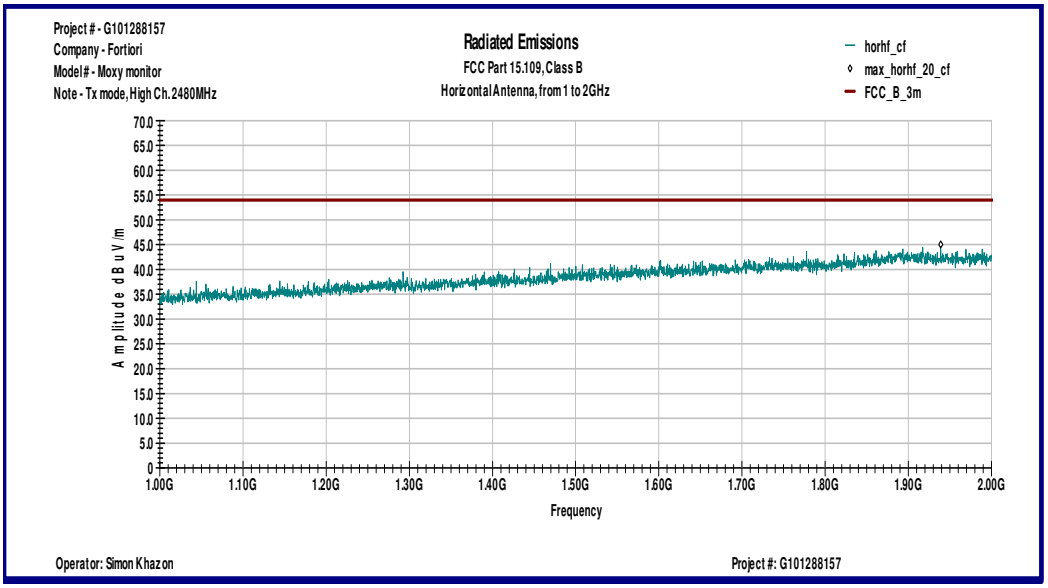


Graph 3.2.6

Vertical antenna polarization

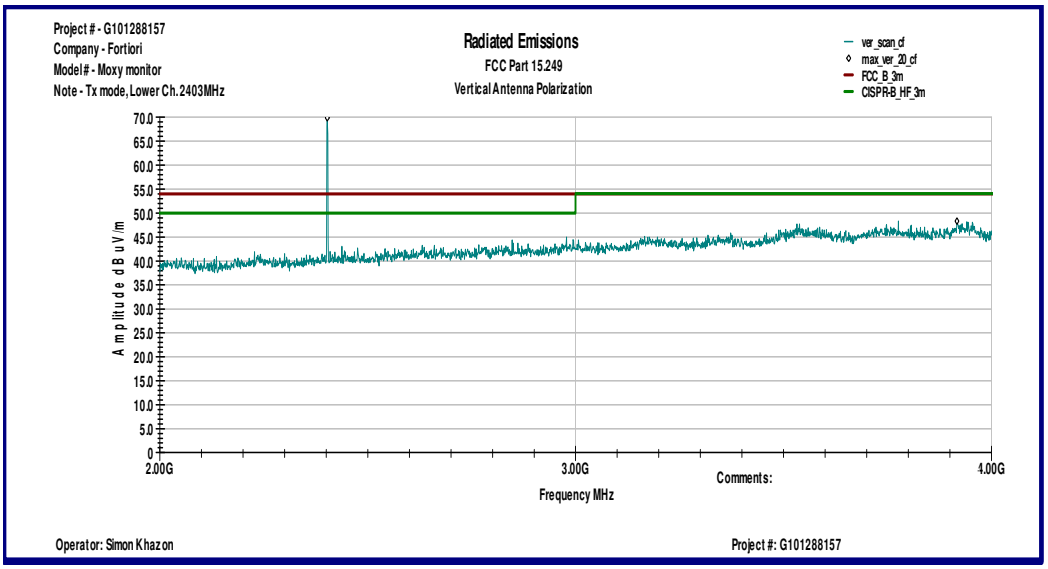


Horizontal antenna polarization

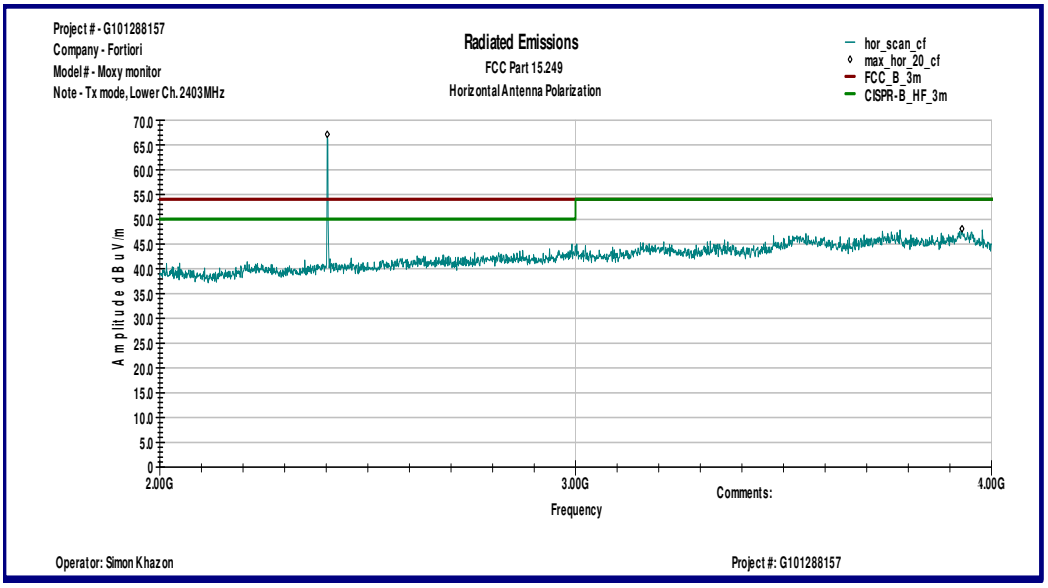


Graph 3.2.7

Vertical antenna polarization

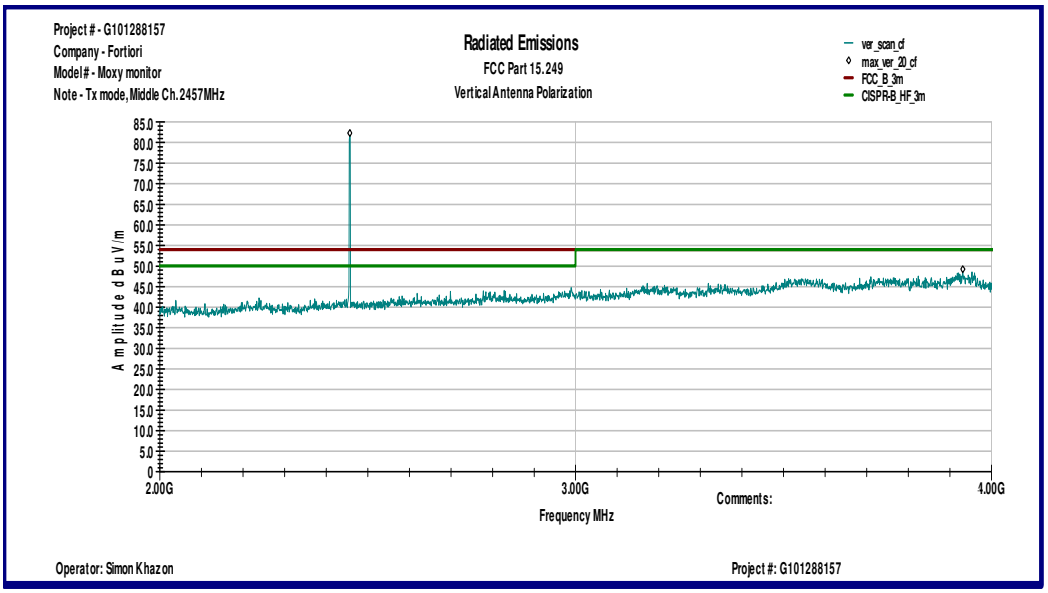


Horizontal antenna polarization

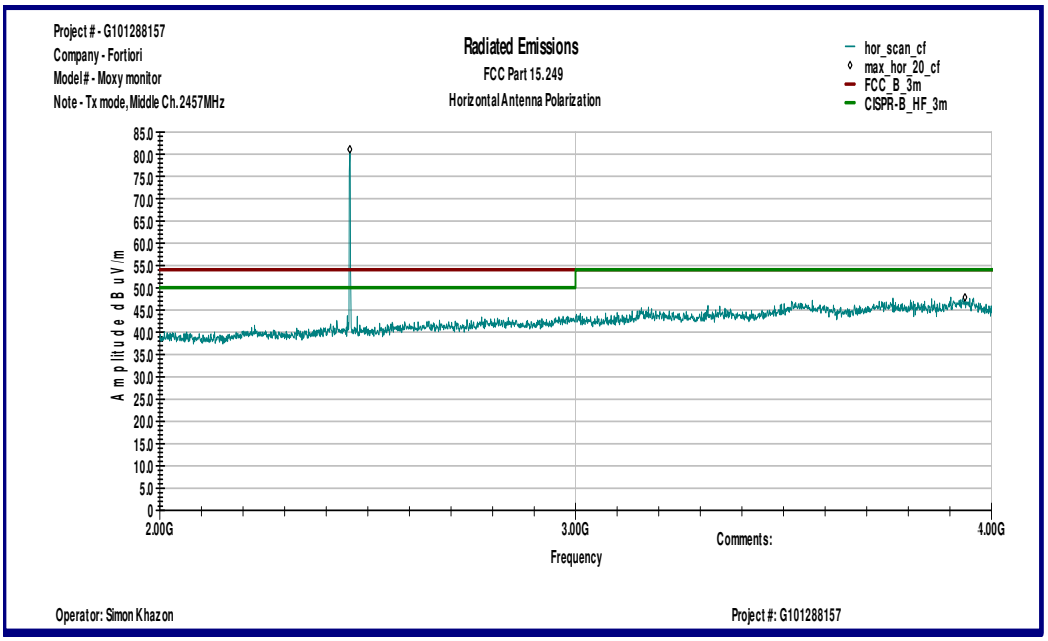


Graph 3.2.8

Vertical antenna polarization

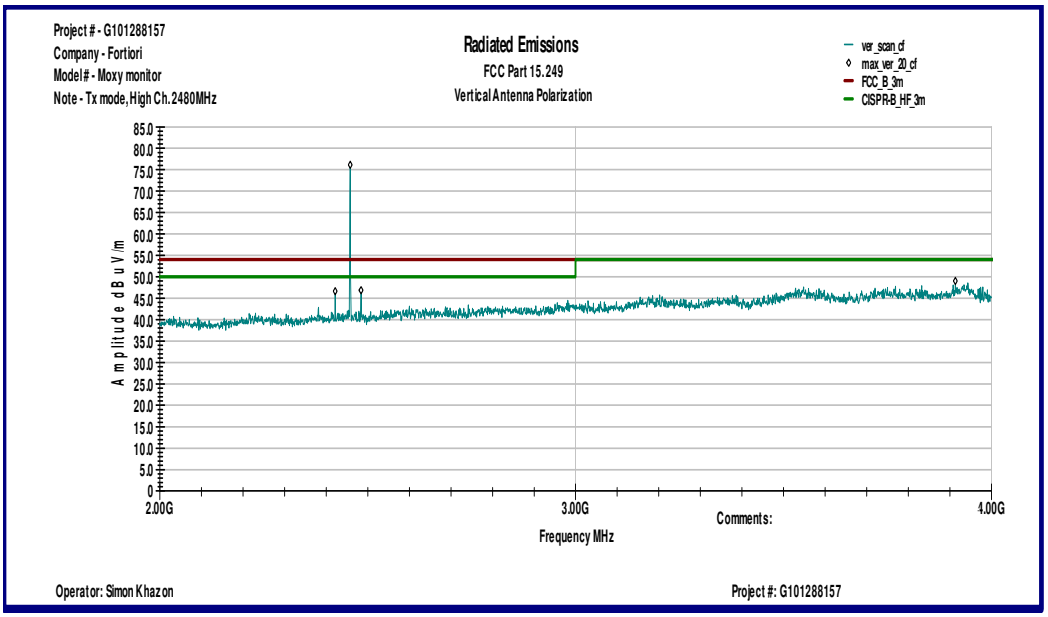


Horizontal antenna polarization

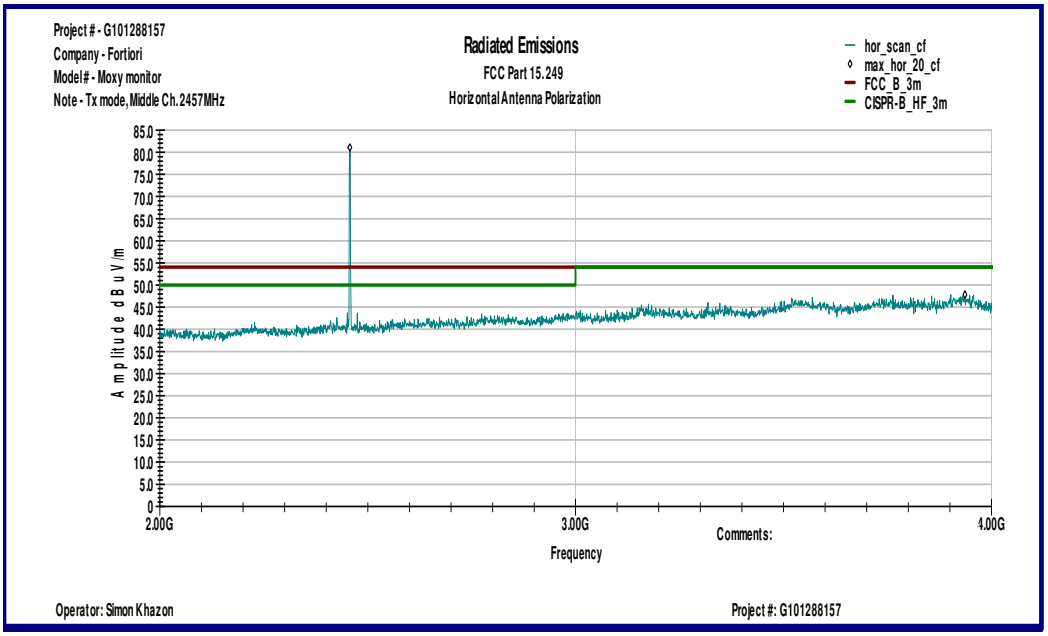


Graph 3.2.9

Vertical antenna polarization

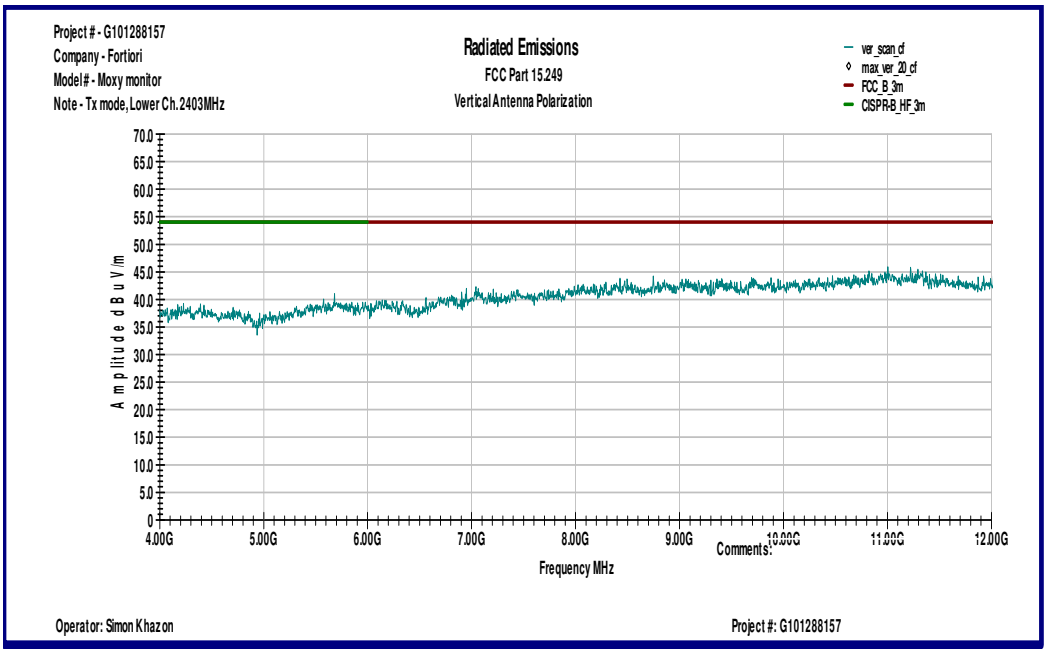


Horizontal antenna polarization

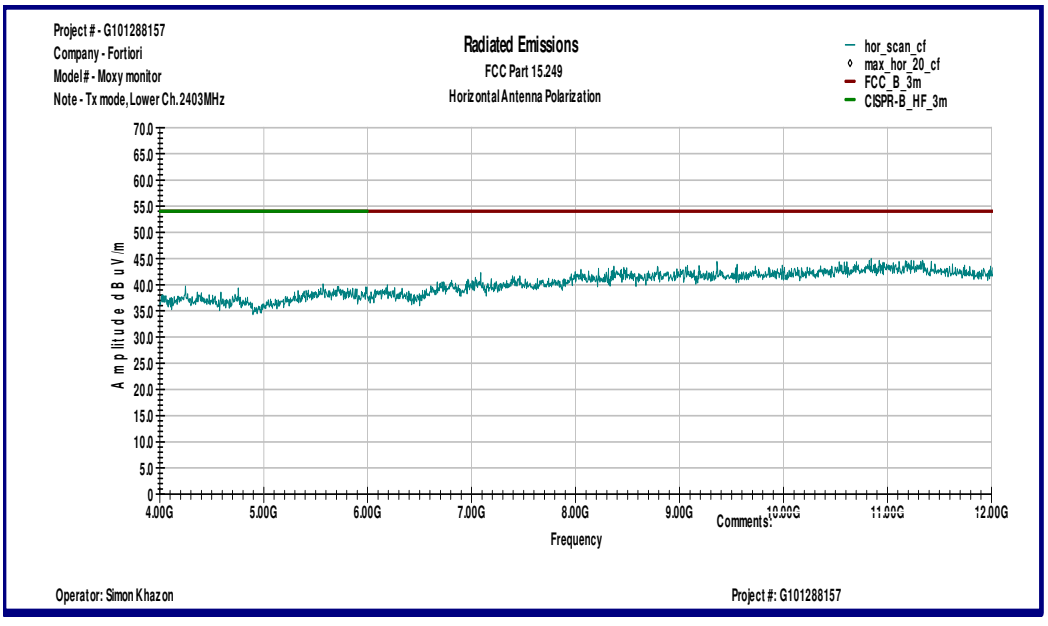


Graph 3.2.10

Vertical antenna polarization

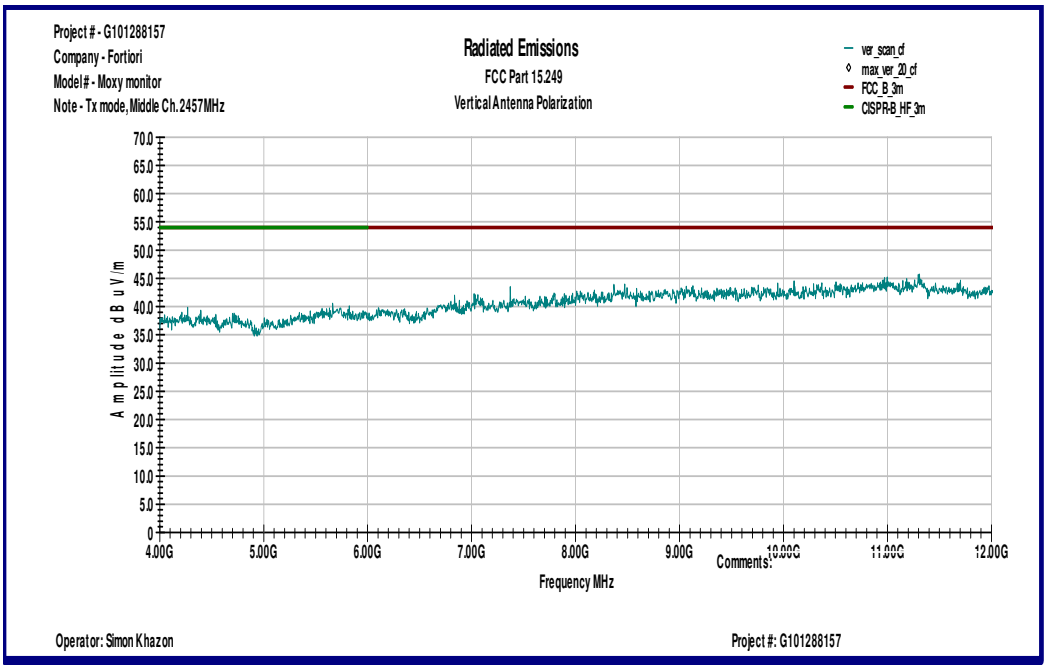


Horizontal antenna polarization

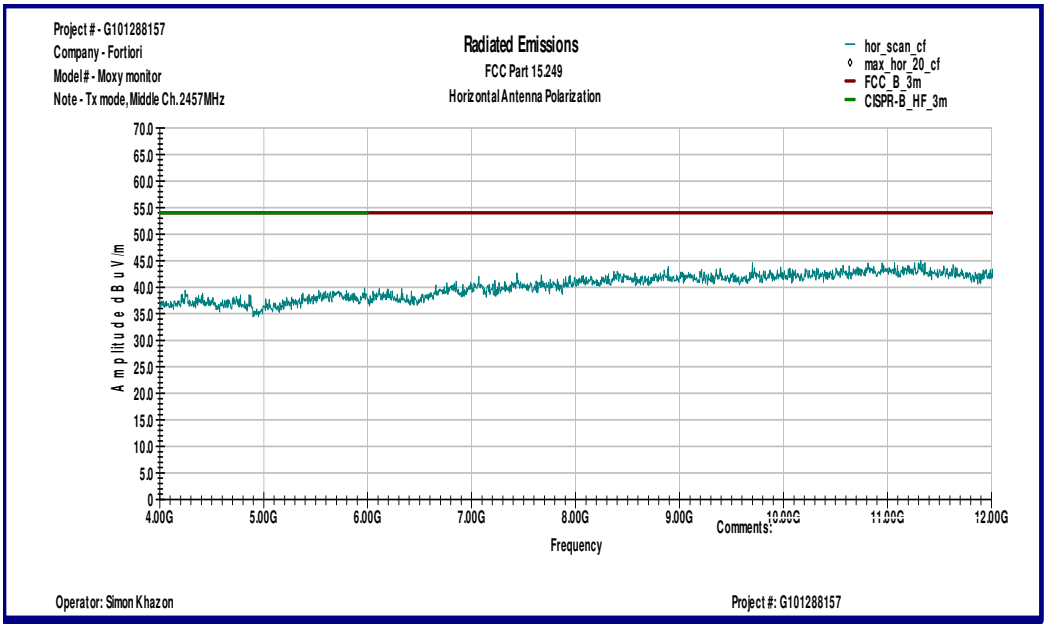


Graph 3.2.11

Vertical antenna polarization

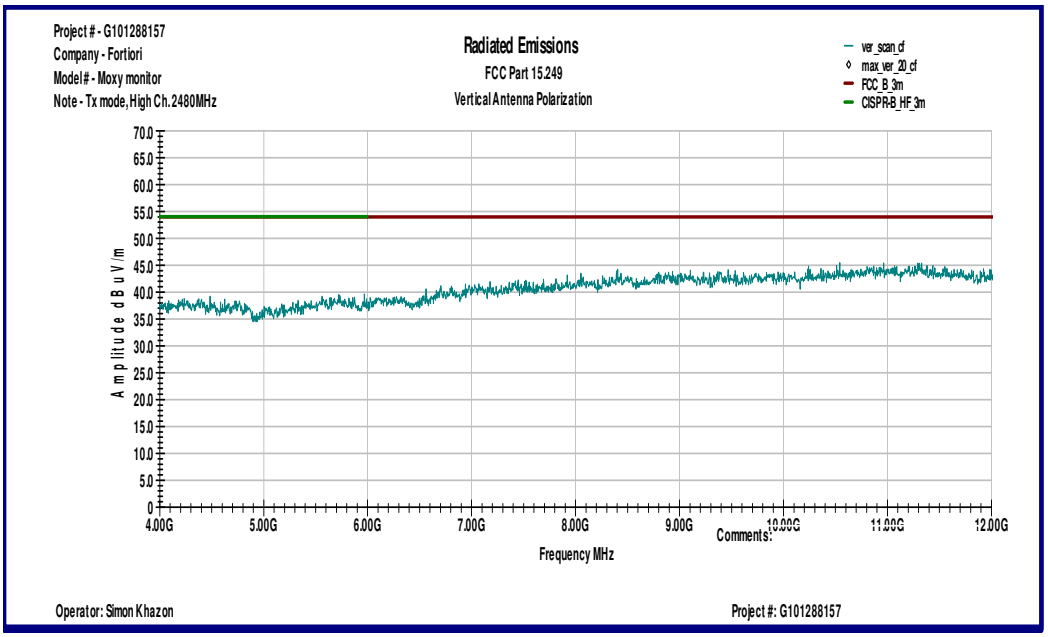


Horizontal antenna polarization

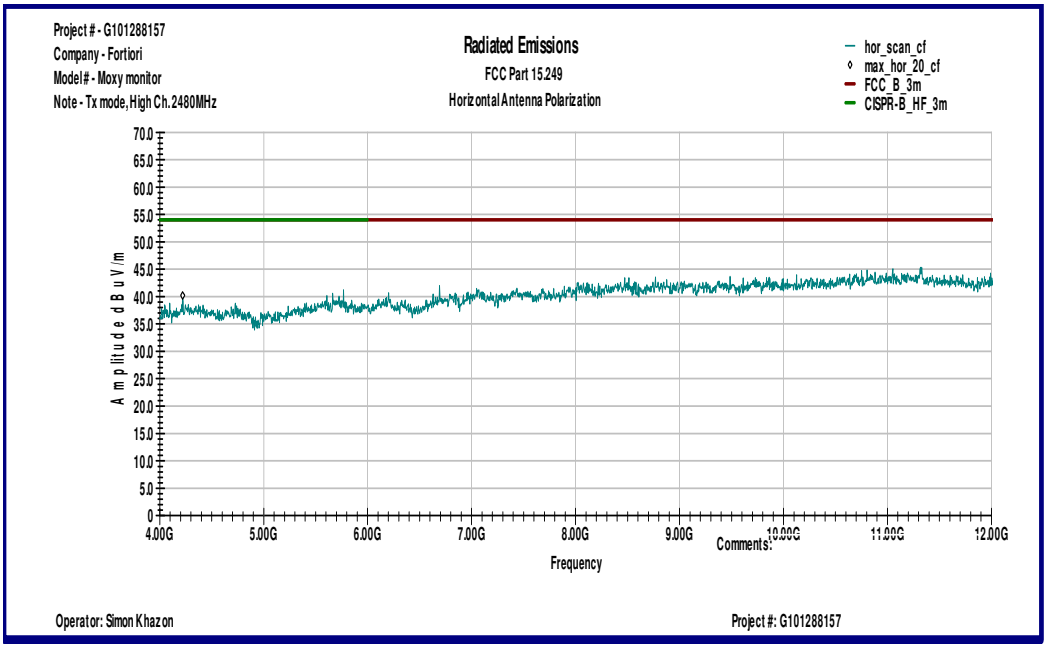


Graph 3.2.12

Vertical antenna polarization

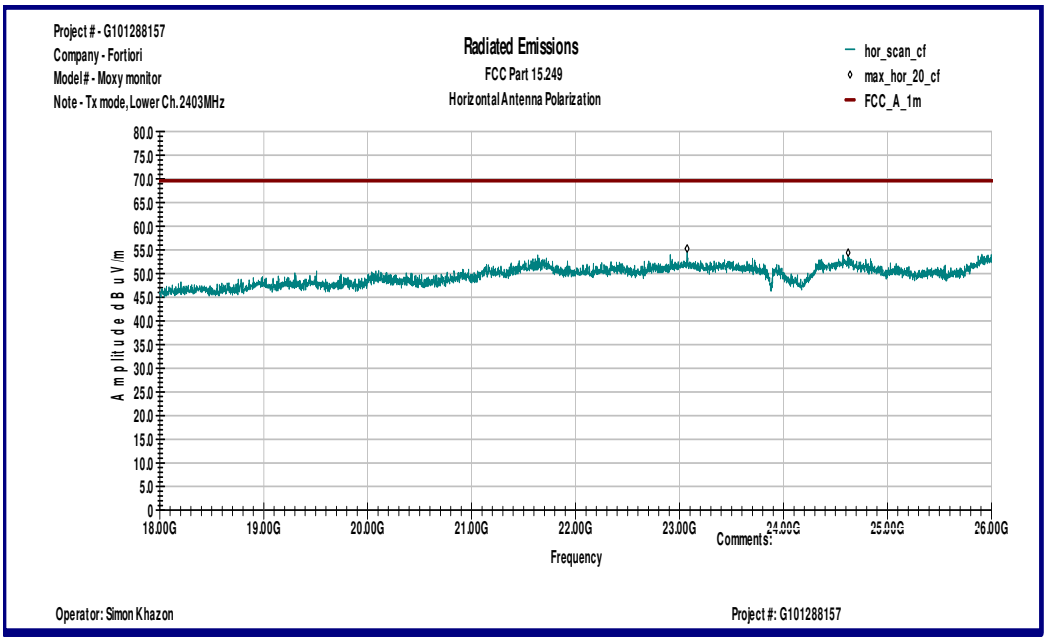


Horizontal antenna polarization

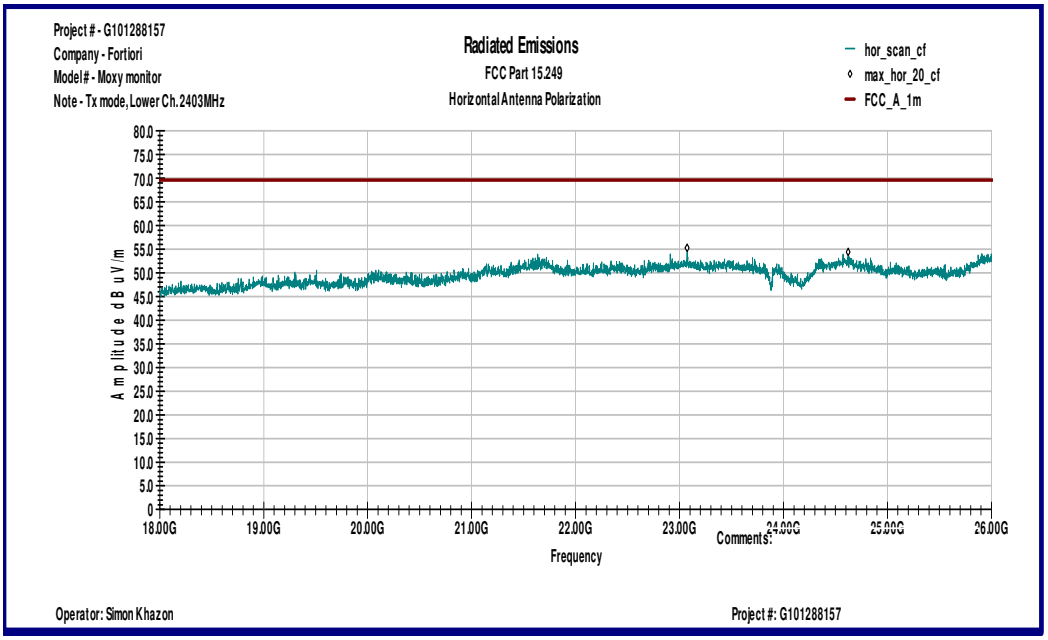


Graph 3.2.13

Vertical antenna polarization

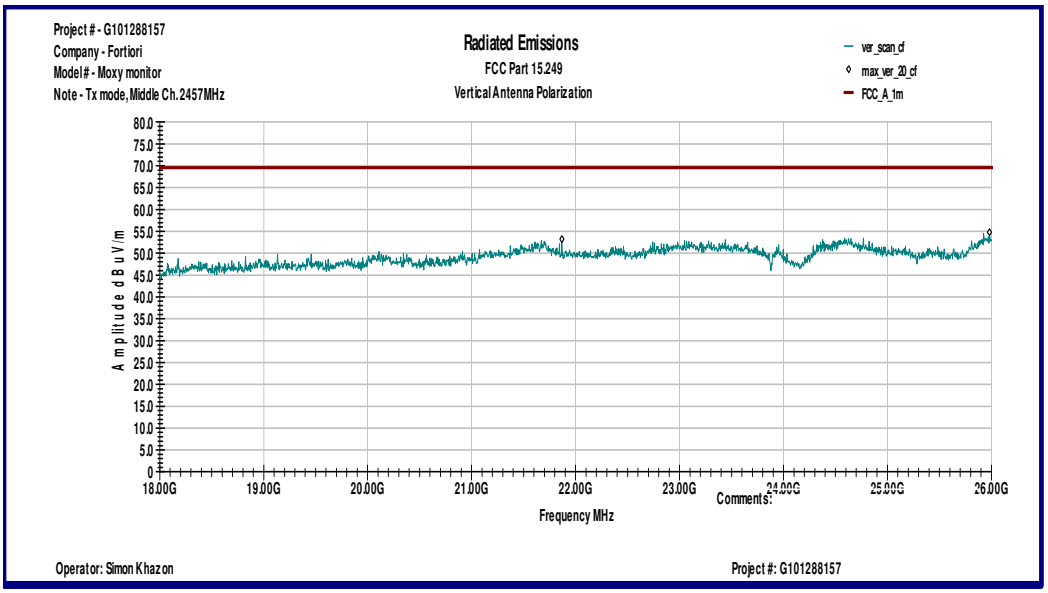


Horizontal antenna polarization

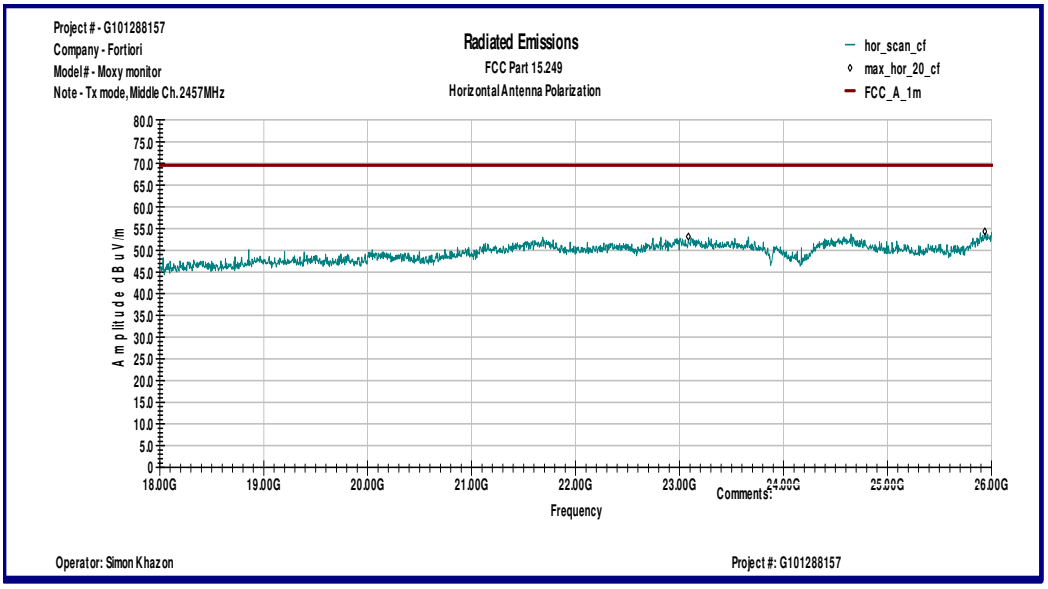


Graph 3.2.14

Vertical antenna polarization

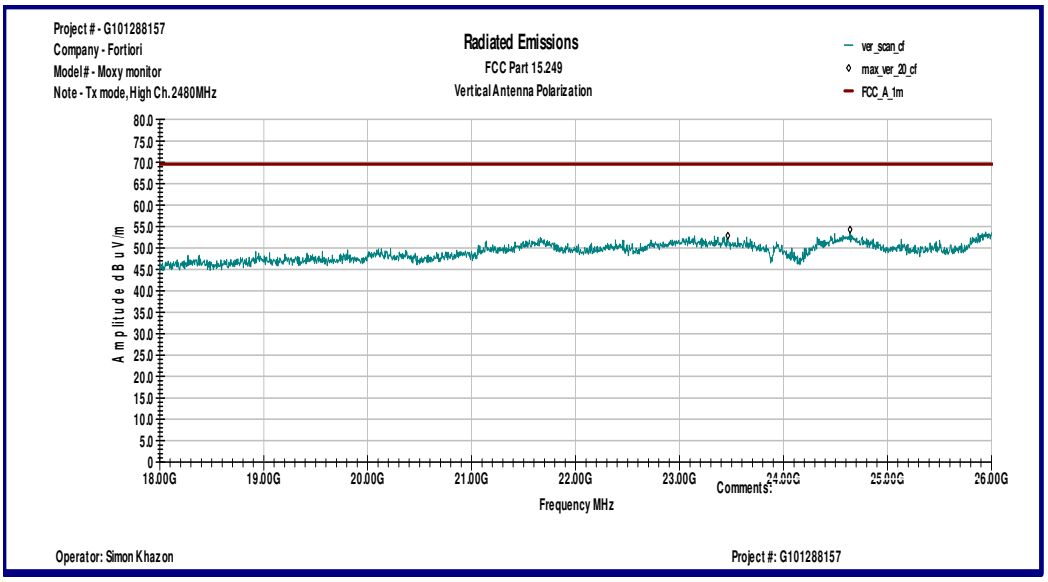


Horizontal antenna polarization

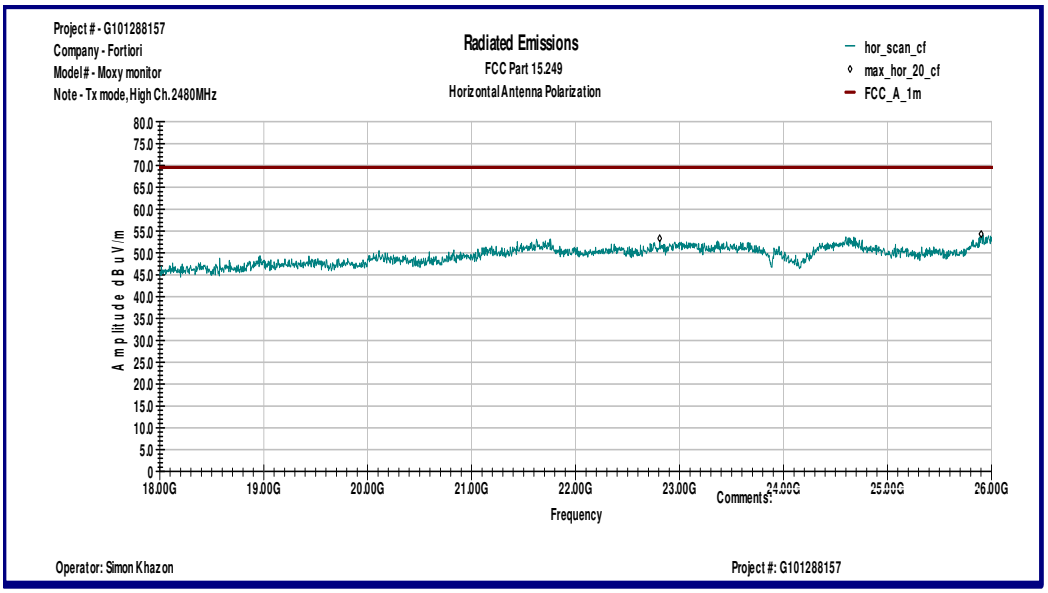


Graph 3.2.15

Vertical antenna polarization



Horizontal antenna polarization



3.3 Bandwidth of Emissions

Center Frequency of operation MHz	Measured 20dB bandwidth MHz	Measured 99% bandwidth kHz
2403	1.096	954
2457	1.102	972
2480	1.087	958

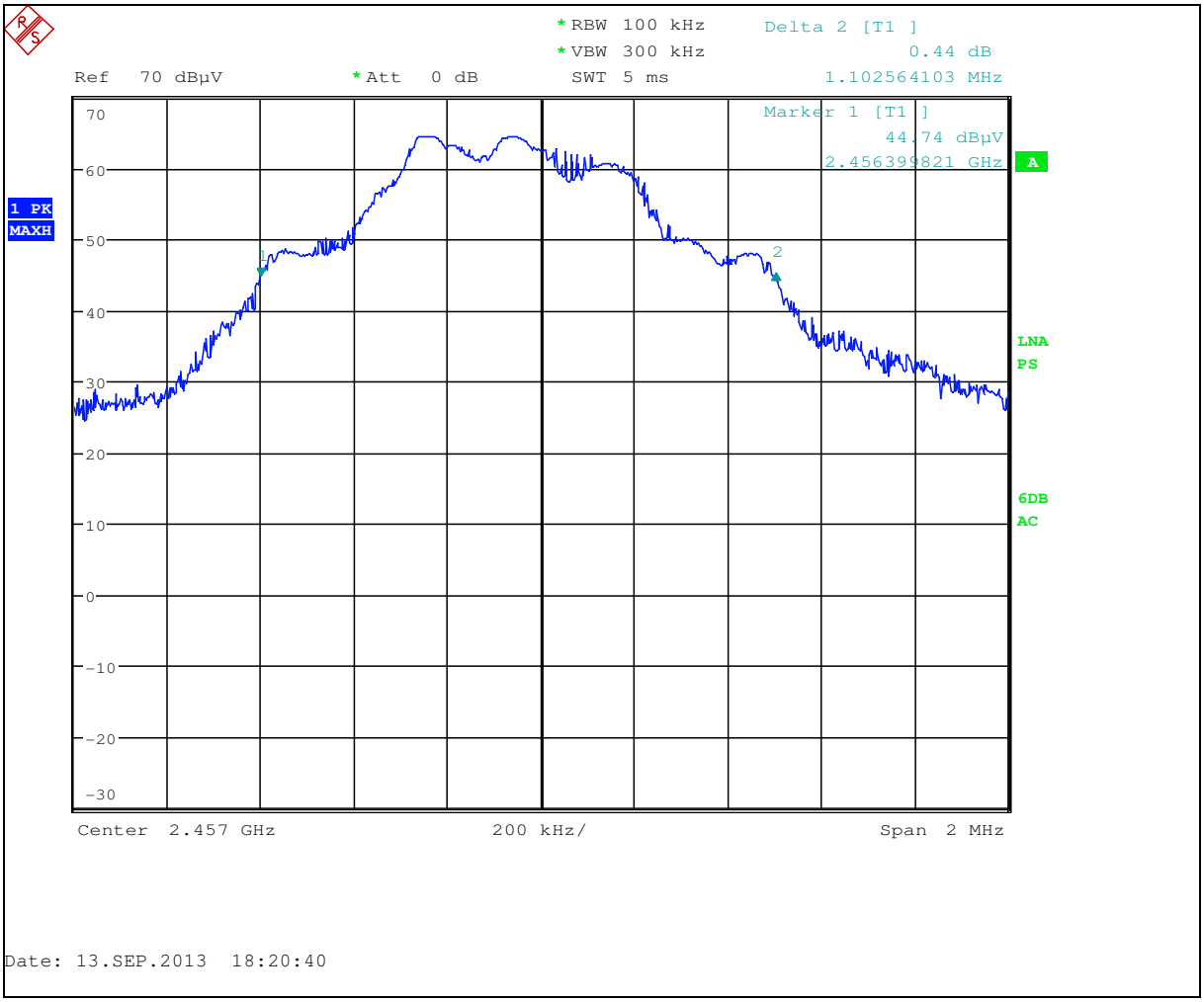
Graphs 3-3-1 and 3-3-6 are show bandwidth of emissions

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

Graph 3.3.1


*RBW 100 kHz
*VBW 300 kHz
Ref 70 dBµV
*Att 0 dB
SWT 5 ms
Delta 2 [T1]
0.09 dB
1.096153846 MHz
Marker 1 [T1]
43.11 dBµV
2.402399718 GHz
A
1 PK
MAXH
LNA
PS
6DB
AC
70
60
50
40
30
20
10
0
-10
-20
-30
Center 2.402933897 GHz
200 kHz/
Span 2 MHz
Date: 13.SEP.2013 18:14:32

Graph 3.3.2


*RBW 100 kHz
*VBW 300 kHz
Ref 70 dBµV
*Att 0 dB
SWT 5 ms
Delta 2 [T1]
0.44 dB
1.102564103 MHz
Marker 1 [T1]
44.74 dBµV
2.456399821 GHz
1 PK
MAXH
A
LNA
PS
6DB
AC
70
60
50
40
30
20
10
0
-10
-20
-30
Center 2.457 GHz
200 kHz/
Span 2 MHz
Date: 13.SEP.2013 18:20:40

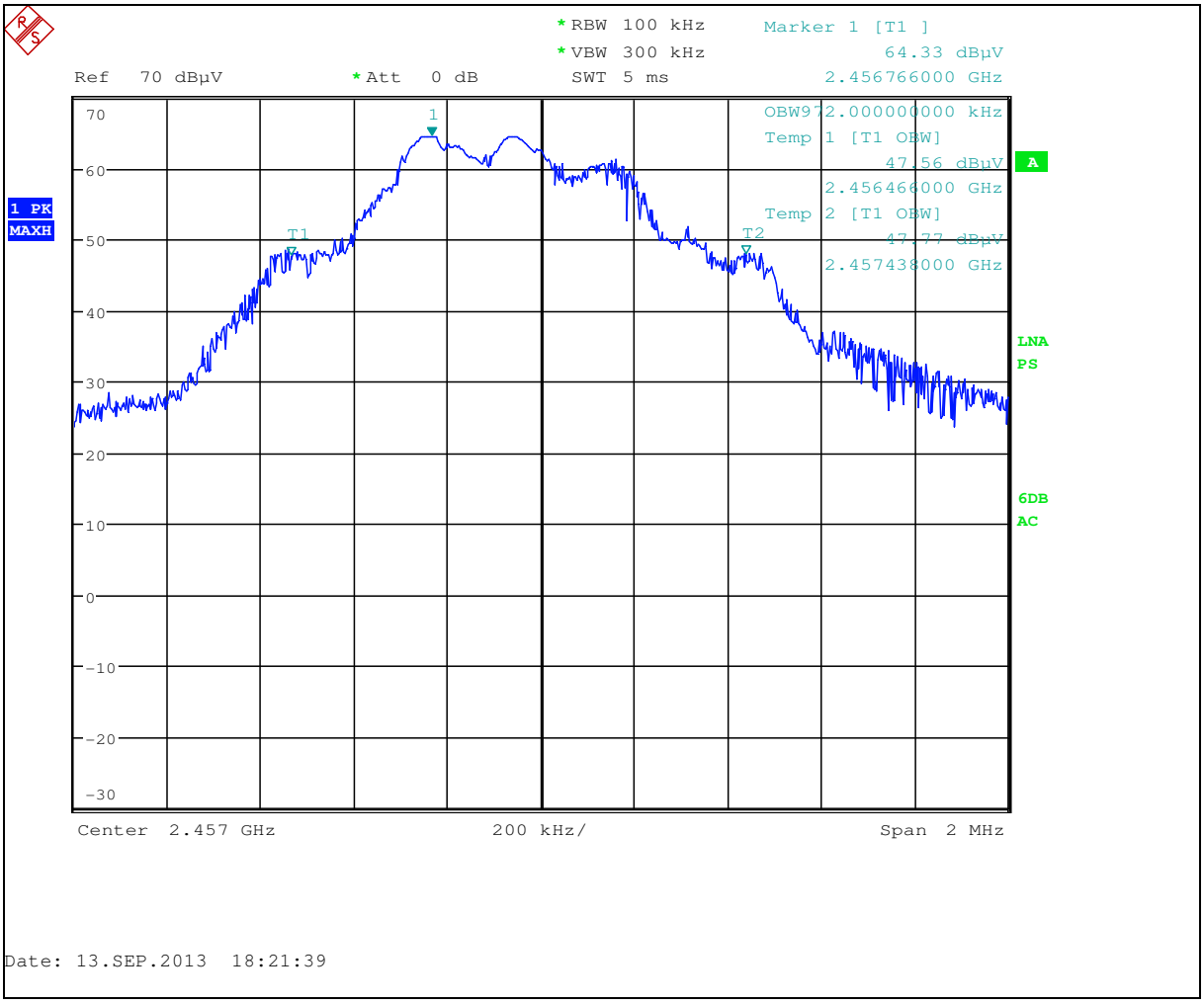
Graph 3.3.3


*RBW 100 kHz
*VBW 300 kHz
Ref 70 dBµV
*Att 0 dB
SWT 5 ms
Delta 2 [T1]
-0.09 dB
1.087769231 MHz
Marker 1 [T1]
44.29 dBµV
2.479399410 GHz
1 PK
MAXH
A
LNA
PS
6DB
AC
70
60
50
40
30
20
10
0
-10
-20
-30
Center 2.479752 GHz
200 kHz/
Span 2 MHz
Date: 13.SEP.2013 18:26:17

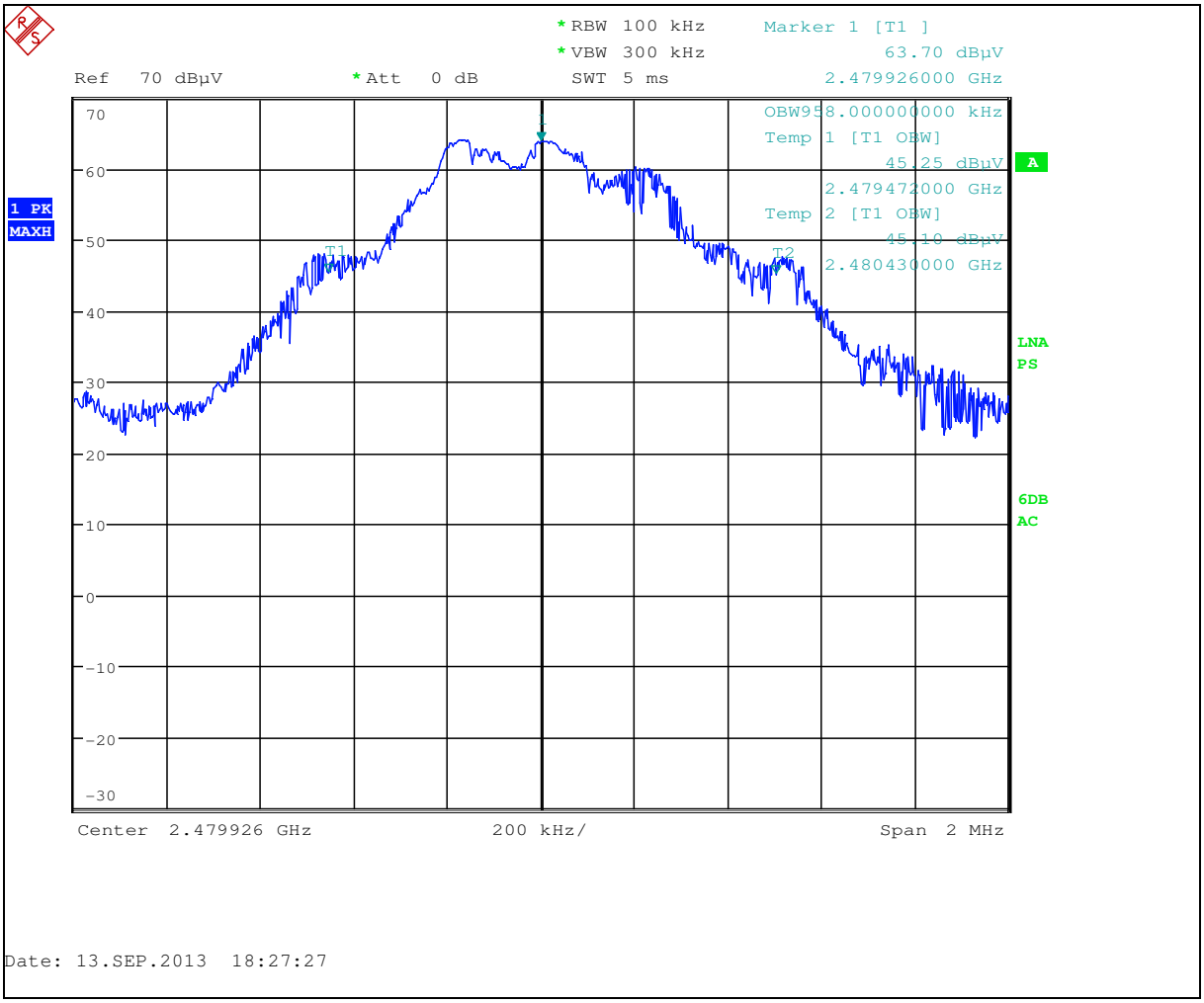
Graph 3.3.4


*RBW 100 kHz
*VBW 300 kHz
Ref 70 dBµV
*Att 0 dB
SWT 5 ms
Marker 1 [T1]
62.83 dBµV
2.402759897 GHz
OBW954.000000000 kHz
Temp 1 [T1 OBW]
45.40 dBµV
2.402479897 GHz
Temp 2 [T1 OBW]
45.64 dBµV
2.403433897 GHz
1 PK
MAXH
A
LNA
PS
6DB
AC
70
60
50
40
30
20
10
0
-10
-20
-30
T1
T2
Center 2.402933897 GHz
200 kHz/
Span 2 MHz
Date: 13.SEP.2013 18:16:13

Graph 3.3.5


*RBW 100 kHz
*VBW 300 kHz
Ref 70 dBµV
*Att 0 dB
SWT 5 ms
Marker 1 [T1]
64.33 dBµV
2.456766000 GHz
OBW 2.000000000 kHz
Temp 1 [T1 OBW]
47.56 dBµV
2.456466000 GHz
Temp 2 [T1 OBW]
47.77 dBµV
2.457438000 GHz
1 PK
MAXH
A
LNA
PS
6DB
AC
70
60
50
40
30
20
10
0
-10
-20
-30
T1
T2
Center 2.457 GHz
200 kHz/
Span 2 MHz
Date: 13.SEP.2013 18:21:39

Graph 3.3.6


*RBW 100 kHz
*VBW 300 kHz
Ref 70 dBµV
*Att 0 dB
SWT 5 ms
Marker 1 [T1]
63.70 dBµV
2.479926000 GHz
OBW958.000000000 kHz
Temp 1 [T1 OBW]
45.25 dBµV
2.479472000 GHz
Temp 2 [T1 OBW]
45.10 dBµV
2.480430000 GHz
1 PK
MAXH
A
LNA
PS
6DB
AC
70
60
50
40
30
20
10
0
-10
-20
-30
T1
T2
Center 2.479926 GHz
200 kHz/
Span 2 MHz
Date: 13.SEP.2013 18:27:27

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

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).

3.5 Receiver/digital device radiated emissions

Test location: ☐ OATS ☒ Anechoic Chamber

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Frequency range: 30MHz-12GHz

Max. Emissions margin: 17.7dB below the limits

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

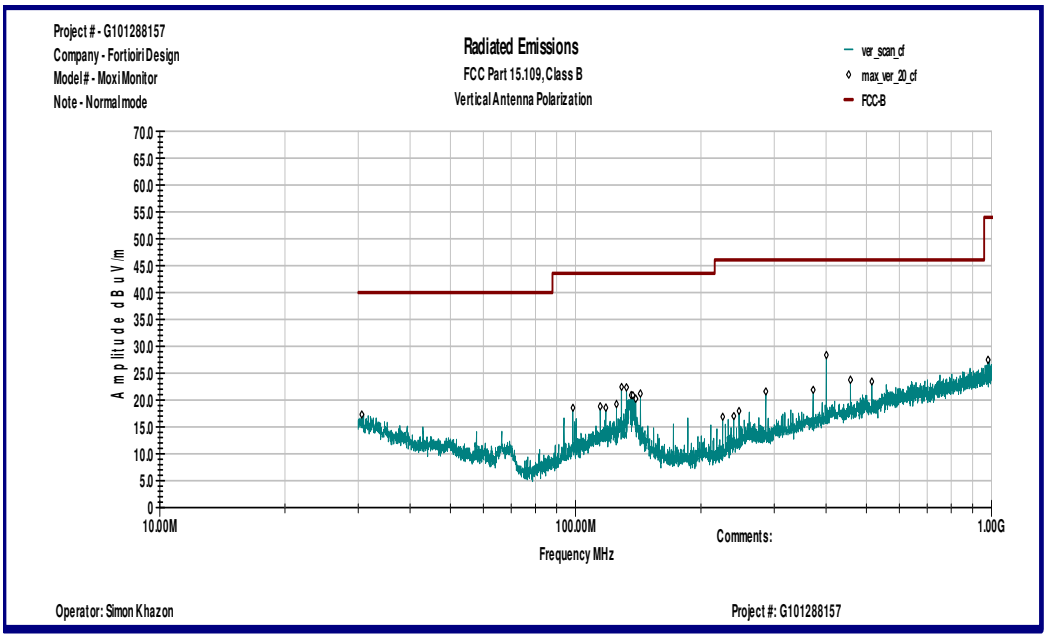
Date:	September 11-14, 2013	**Result:** **Pass**
Standard:	FCC Part 15.109, Class B	
Tested by:	Simon Khazon	
Test Point:	Enclosure	
Operation mode:	Receiving	
Note:	30MHz-12GHz	

Table 3.5.1

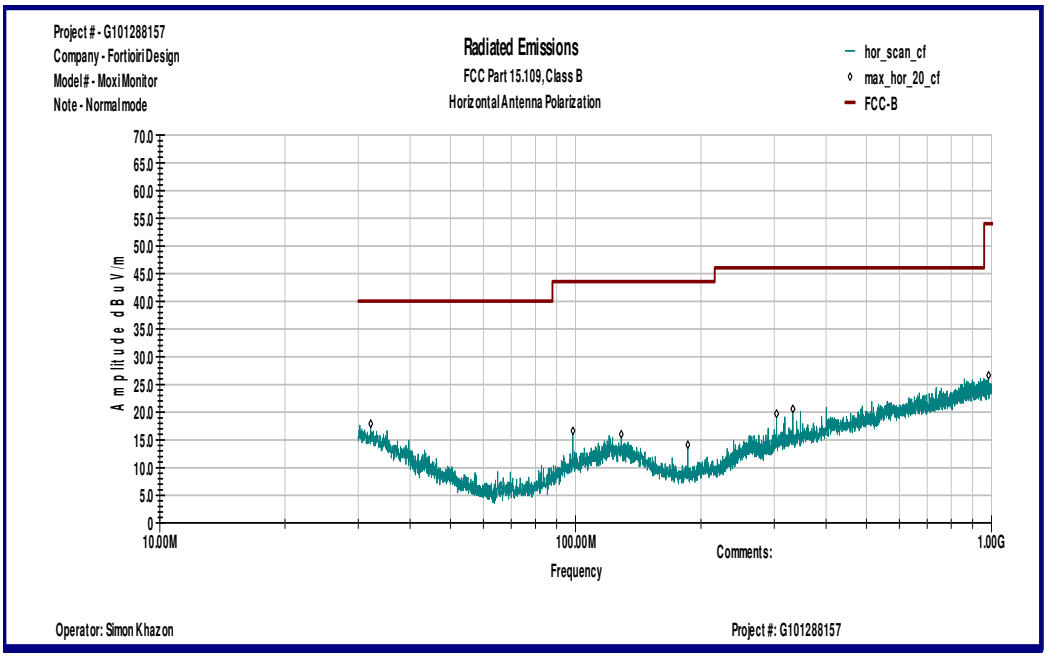
Frequency	Ant. Polarity	Peak Reading dBµV	Total C.F. dB1/m	Total at 3m dBµV/m	Limit dBµV/m	Margin dB
114.62 MHz	V	5.1	13.7	18.8	43.5	-24.7
128.95 MHz	V	8.4	14.0	22.4	43.5	-21.1
132.53 MHz	V	8.6	13.8	22.3	43.5	-21.2
286.5 MHz	V	6.1	15.5	21.6	46.0	-24.4
400.78 MHz	V	9.4	18.9	28.4	46.0	-17.7
458.27 MHz	V	4.0	19.7	23.7	46.0	-22.3
515.76 MHz	V	2.9	20.5	23.4	46.0	-22.6
32.147 MHz	H	-1.0	18.9	17.9	40.0	-22.1
98.508 MHz	H	4.5	12.2	16.6	43.5	-26.9
128.73 MHz	H	2.1	14.0	16.0	43.5	-27.5
186.19 MHz	H	2.8	11.3	14.1	43.5	-29.4
304.16 MHz	H	3.7	16.0	19.7	46.0	-26.3
332.9 MHz	H	3.8	16.8	20.6	46.0	-25.4

Graph 3.5.1

Vertical antenna polarization

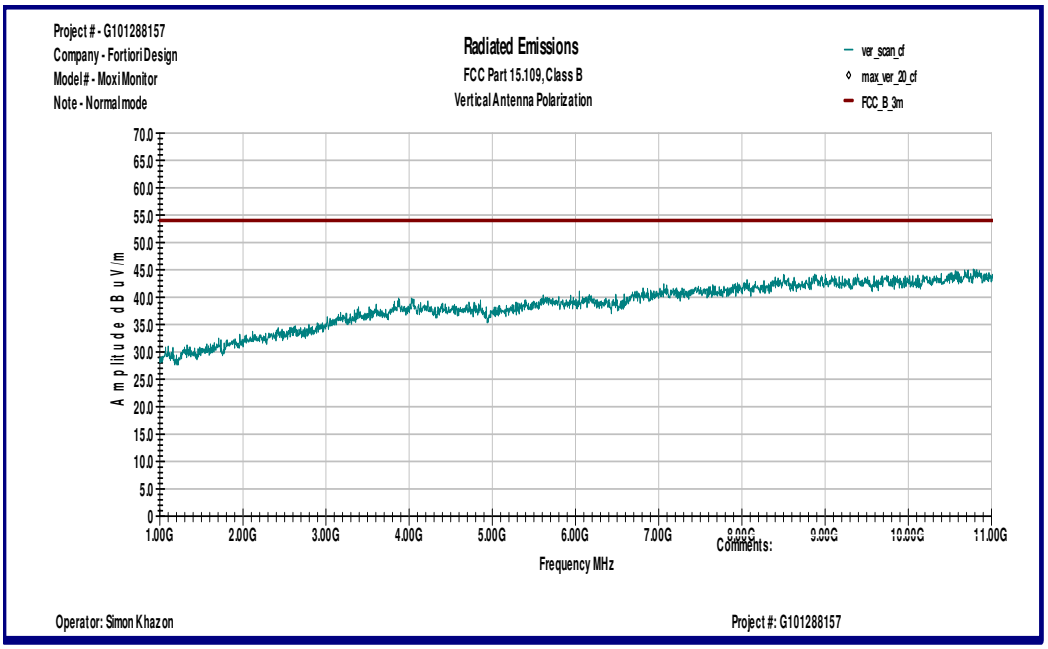


Horizontal antenna polarization

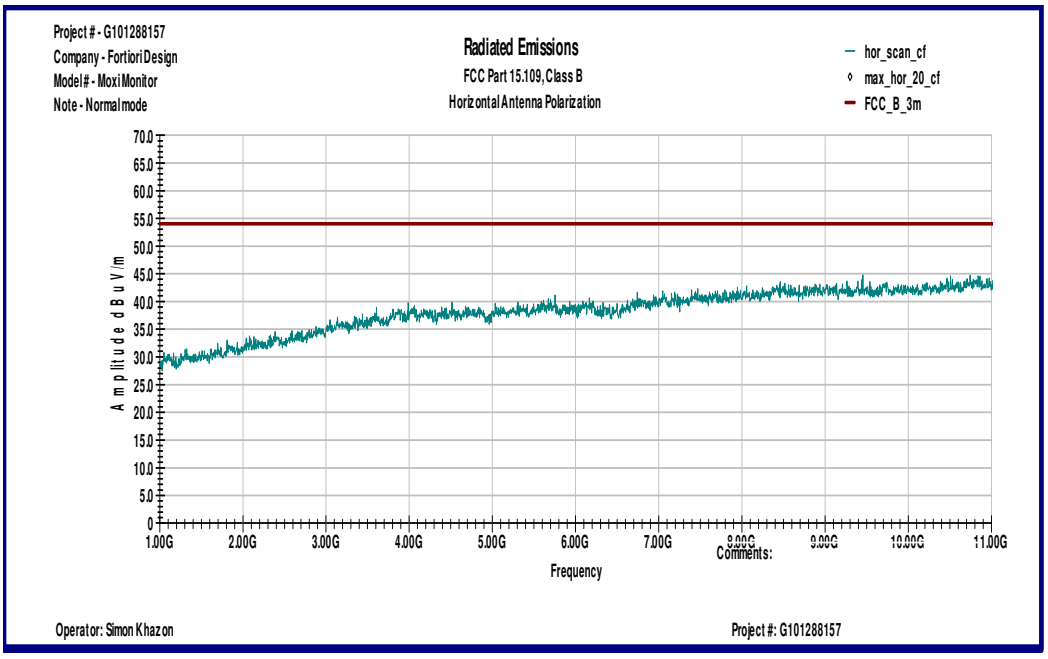


Graph 3.5.2

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: 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	11/29/2013	☒
Spectrum Analyzer	R & S	ESU	100398	25283	12/19/2013	☒
Bicono-Log Antenna	Schaffner-Teseq	CBL6112B	2468	9734	11/30/2013	☒
Horn Antenna	EMCO	3115	6579	15580	07/19/2013	☒
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1122951	13475	11/01/2013	☒
High Pass Filter	Reactel	7HS-1G-S12	0223	15275	VBU	☒
System	Quantum Change	TILE! Instrument Control	Ver. 3.4.K.29	15259	VBU	☒