

TEST REPORT

Report Number: 102083608MIN-001

Project Number: G102083608

Models:

ExP CIC; A4 CIC; Start 1200 CIC; Start 1000 CIC;

ExP ITC; A4 ITC; Start 1200 ITC; Start 1000 ITC;

ExP ITE; A4 ITE; Start 1200 ITE; Start 1000 ITE

FCC ID: EOA-EXPCUSTOM

Industry Canada ID: 6903A-EXPCUSTOM

to

47 CFR Part 15.249:2015

RSS- 210, Issue 8, 2010

RSS-Gen, Issue 4, 2014

47 CFR, Part 15:2015, §15.107 and §15.109, Class / ICES-003, Issue 5:2012

For

Starkey Laboratories, Inc.

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

Test Authorized by:
Starkey Laboratories, Inc.
6700 Washington Avenue South
Eden Prairie, MN 55344, USA

Prepared by: SKhazon
Simon Khazon

Reviewed by: U. Spector
Uri Spector

Date of issue: June 4, 2015

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.



TABLE OF CONTENTS

1.0 GENERAL DESCRIPTION..... 2

1.1 Product Description; Test Facility 3

1.3 Environmental conditions..... 4

1.4 Measurement uncertainty 5

1.5 Field Strength Calculation..... 5

2.0 TEST SUMMARY..... 6

3.0 TEST CONDITIONS AND RESULTS..... 7

3.1 Field strength of fundamental 7

3.2 Field strength of harmonics and spurious emissions 9

3.2.1 Average correction factor calculation..... 18

3.3 Bandwidth of Emissions..... 19

3.4 Transmitter power line conducted emissions 26

3.5 Receiver/digital device radiated emissions..... 27

3.6 Digital device conducted emissions..... 31

4.0 TEST EQUIPMENT..... 36

5.0 REVISION HISTORY..... 37

1.0 GENERAL DESCRIPTION

Model tested:	ExP ITE
Type of EUT:	Hearing Aid
Serial Number:	2911322072
FCC ID:	EOA-EXPCUSTOM
Industry Canada ID:	6903A-EXPCUSTOM
Related Submittal(s) Grants:	None
Company:	Starkey Laboratories, Inc.
Customer:	Mr. Ken Meyer
Address:	6700 Washington Avenue South Eden Prairie, MN 55344, USA
Phone:	(952) 947-4734
Fax:	(952) 828-6972
Test Standards:	☒ 47 CFR, Part 15:2015, §15.249 ☒ RSS-210, Issue 8, 2010 ☒ RSS-Gen, Issue 4, 2014 ☒ 47 CFR, Part 15:2015, §15.107 and §15.109, Class B ☒ ICES-003, Issue 5:2012 ☐ Other
Type of radio:	☒ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	May 27, 2015
Test Work Started:	May 27, 2015
Test Work Completed:	May 29, 2015
Test Sample Conditions:	☐ Damaged ☐ Poor (Usable) ☒ Good



1.1 Product Description; Test Facility

Product Description:	Hearing Aid Transceiver
Band of Operation:	902 - 928MHz
Operating Frequencies:	902.6-926.9MHz
Modulation:	FSK
Emission Designator:	338KFXD
Antenna(s) Info:	Integral
Antenna Installation:	☐ User ☐ Professional ☒ Factory
Transmitter Power Configuration:	☒ Internal battery ☐ External power source ☐ 120VAC ☐ 230VAC ☐ 400VAC ☒ 1.45VDC ☐ Other: Amp. ☐ 50Hz ☐ 60Hz
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
- ☒ - Continuous modulated (see details below)
- ☐ - Test program (customer specific)

Operating modes of the EUT:

No.	Description
1	The device was pre-programmed to operate continuously at low (353), middle (393), and upper (433) frequency channels, one channel being transmitted at a given time.

Cables:

No.	Type	Length	Designation	Note
1	None			

Support equipment/Services:

No.	Item	Description
1	None	

General Notes: The model ExP ITE was tested as a representative model.
According to the manufacturer, the models ExP CIC; A4 CIC; Start 1200 CIC; Start 1000 CIC; ExP ITC; A4 ITC; Start 1200 ITC; Start 1000 ITC; ExP ITE; A4 ITE; Start 1200 ITE; Start 1000 ITE are electrically identical; therefore, the only model ExP ITE was tested only

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

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).

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

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

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

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

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

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

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

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: 902-928MHz

Test result: Pass

Max. Emissions margin at fundamental: 14.3dB below the limits

Notes: None



Date:	May 27-29, 2015	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 MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dBμV	Total @ 3m dBμV/m	Limit dBμV/m	Margin dB	Comments
	Polarity	Hts(cm)								
Channel 353										
902.570	V	100	21.8	3.6	0.0	54.2	79.7	94.0	-14.3	Pk
902.580	H	200	21.8	3.6	0.0	49.8	75.3	94.0	-18.7	Pk
Channel 393										
914.712	V	100	21.8	3.6	0.0	53.8	79.2	94.0	-14.8	Pk
914.837	H	200	21.8	3.6	0.0	49.9	75.3	94.0	-18.7	Pk
Channel 433										
926.970	V	100	21.7	3.7	0.0	53.9	79.3	94.0	-14.7	Pk
926.855	H	198	21.7	3.7	0.0	50.4	75.8	94.0	-18.2	Pk



3.2 Field strength of harmonics and spurious emissions

Test location: ☐ OATS ☒ Anechoic Chamber

Test distance: ☐ 10 meters ☒ 3 meters

Frequency range of measurements: 30MHz-10GHz

Test result: **Pass**

Max. Emissions margin at Spurious: 8.3 dB below the limits

Max. Emissions margin at Band edge: 8.9 dB below the limits

Notes: Transmitting fundamental frequencies and frequencies not related with transmitting operation were excluded from the table.

Date:	May 27-29, 2015	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:	Spurious Emissions	

Table 3.2.1

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 353							
1.8067 GHz	V	53.4	29.5	43.6	39.3	54.0	-14.7
2.7067 GHz	V	52.8	32.6	44.0	41.4	54.0	-12.6
9.6547 GHz	V	37.4	44.4	41.0	40.8	54.0	-13.2
2.7084 GHz	H	54.9	32.4	44.0	43.3	54.0	-10.7
3.61 GHz	H	52.2	35.4	43.6	44.1	54.0	-9.9
6.3182 GHz	H	42.4	39.1	41.8	39.7	54.0	-14.3
Channel 393							
2.746 GHz	V	52.9	32.7	44.0	41.6	54.0	-12.4
3.6604 GHz	V	47.1	35.8	43.5	39.4	54.0	-14.6
8.5096 GHz	V	37.8	43.2	40.3	40.7	54.0	-13.3
2.746 GHz	H	56.2	32.5	44.0	44.7	54.0	-9.3
3.6604 GHz	H	53.6	35.6	43.5	45.7	54.0	-8.3
6.4036 GHz	H	42.4	39.2	41.9	39.8	54.0	-14.2
8.2324 GHz	H	39.2	42.7	40.4	41.4	54.0	-12.6
Channel 433							
2.4515 GHz	V	54.6	31.7	43.9	42.3	54.0	-11.7
2.4564 GHz	V	53.8	31.7	43.9	41.6	54.0	-12.4
2.7804 GHz	V	54.3	32.9	44.0	43.1	54.0	-10.9
2.7804 GHz	H	56.5	32.7	44.0	45.2	54.0	-8.8
3.7082 GHz	H	49.3	35.7	43.4	41.6	54.0	-12.3
6.4884 GHz	H	43.6	39.3	41.9	41.0	54.0	-13.0
8.4225 GHz	H	38.3	42.9	40.3	40.9	54.0	-13.1

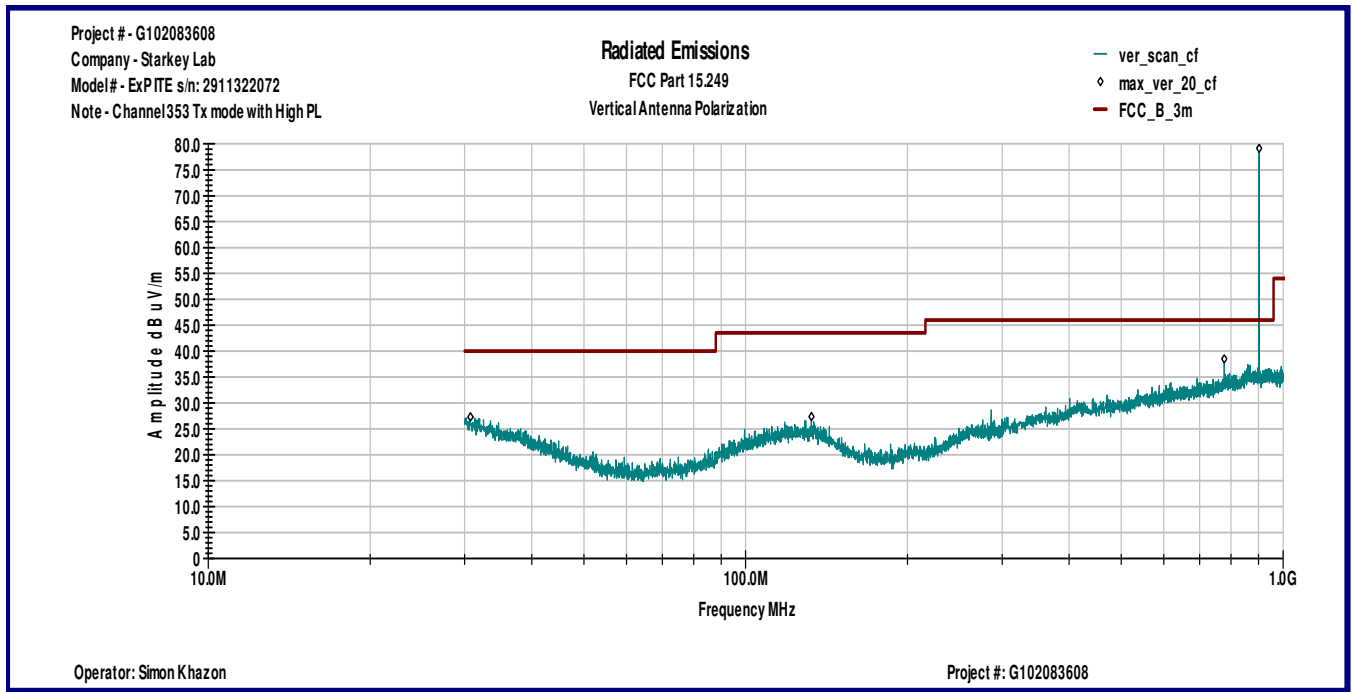
Date:	May 27-29, 2015	Result: Pass
Standard:	FCC 15.249(a) and (d) / RSS-210 A2.9	
Tested by:	Simon Khazon	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Band Edge Compliance	

Table 3.2.2

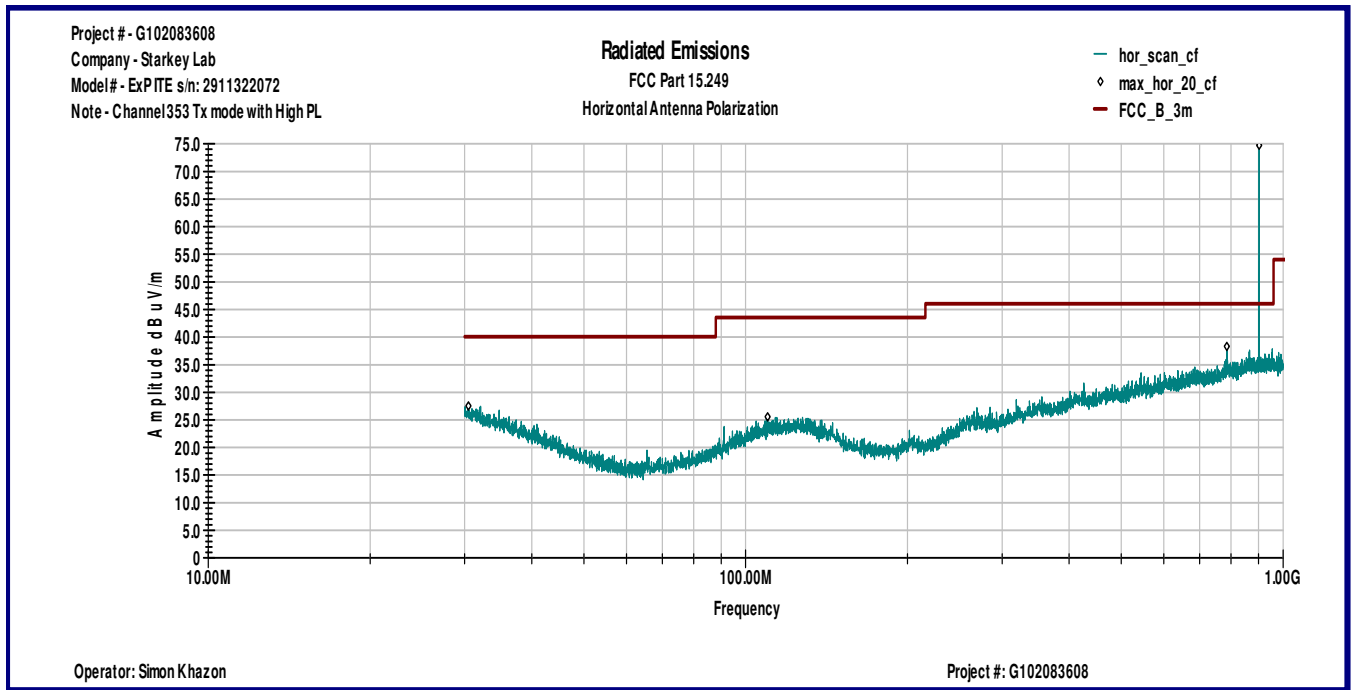
Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dBμV	Total @ 3m dBμV/m	Limit dBμV/m	Margin dB	Comments
	Polarity	Hts(cm)								
Band Edge Compliance										
902.00	V	100	21.8	3.6	0.0	11.7	37.2	46.0	-8.9	QP
902.00	H	199	21.8	3.6	0.0	10.0	35.5	46.0	-10.6	QP
928.00	V	100	21.7	3.7	0.0	8.3	33.7	46.0	-12.4	QP
928.00	H	197	21.7	3.7	0.0	7.4	32.8	46.0	-13.3	QP

Graph 3.2.1

Vertical antenna polarization

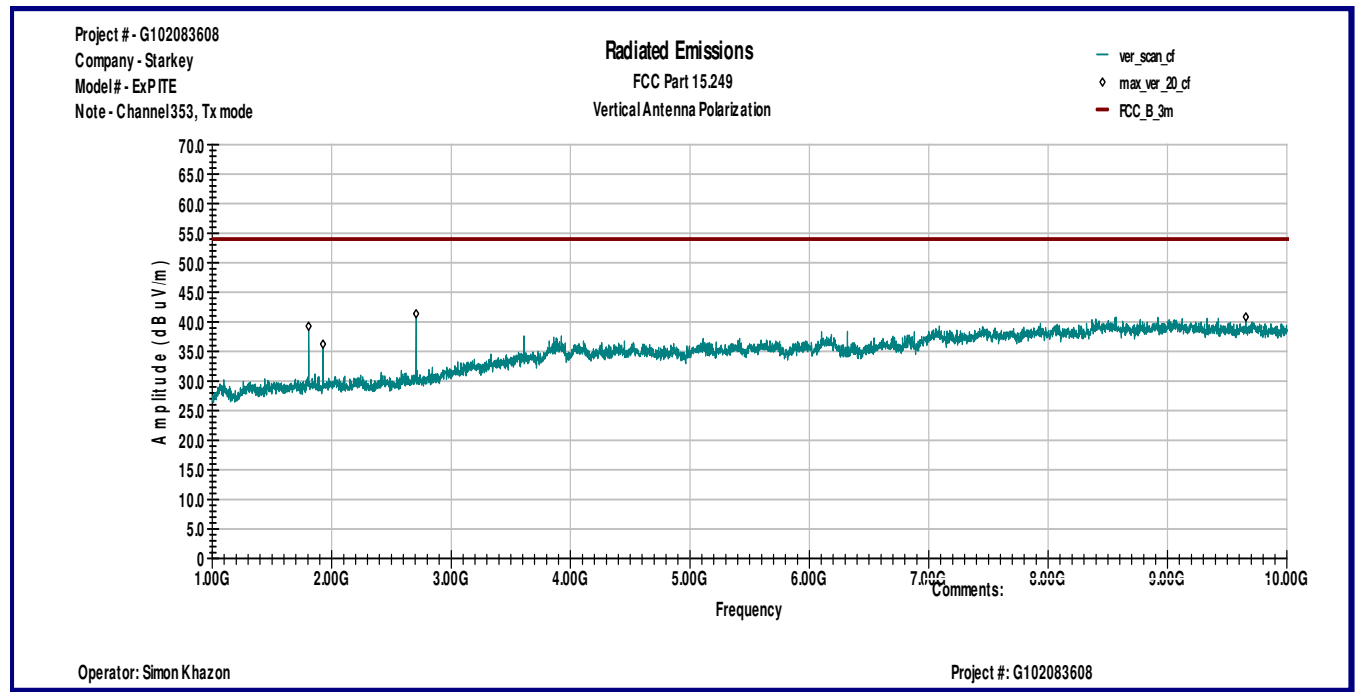


Horizontal antenna polarization

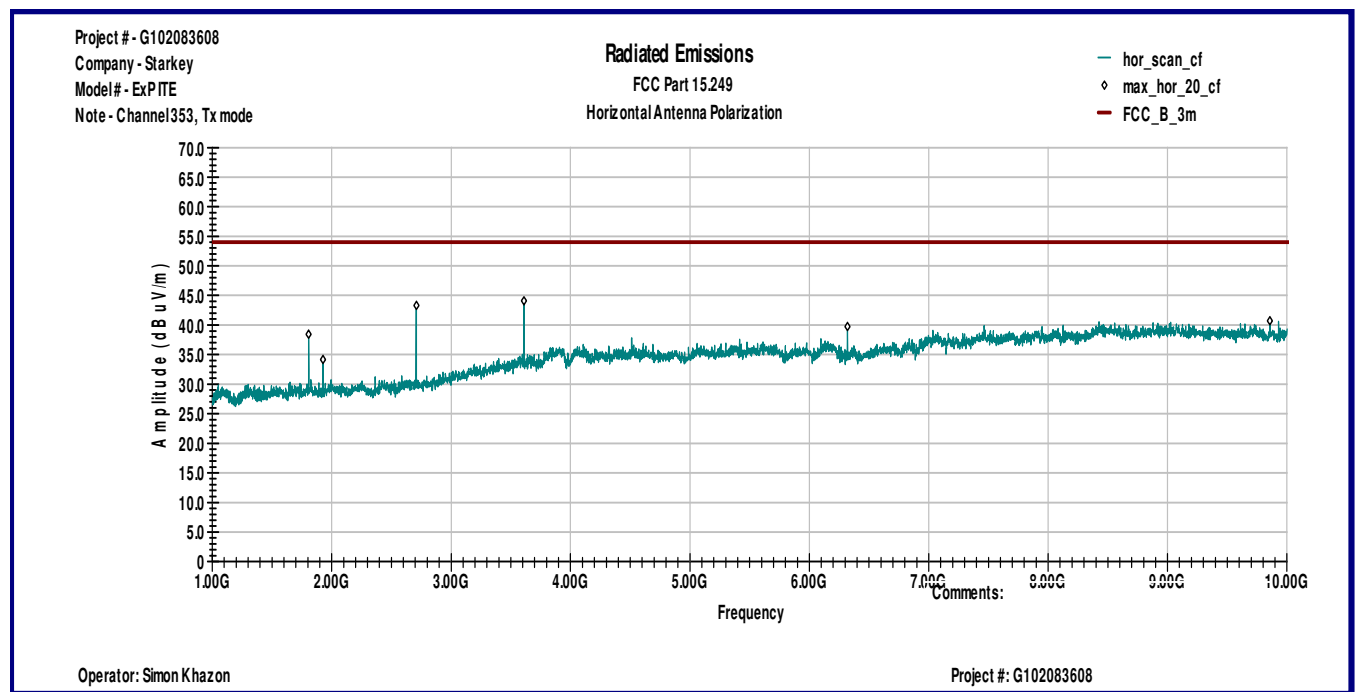


Graph 3.2.2

Vertical antenna polarization

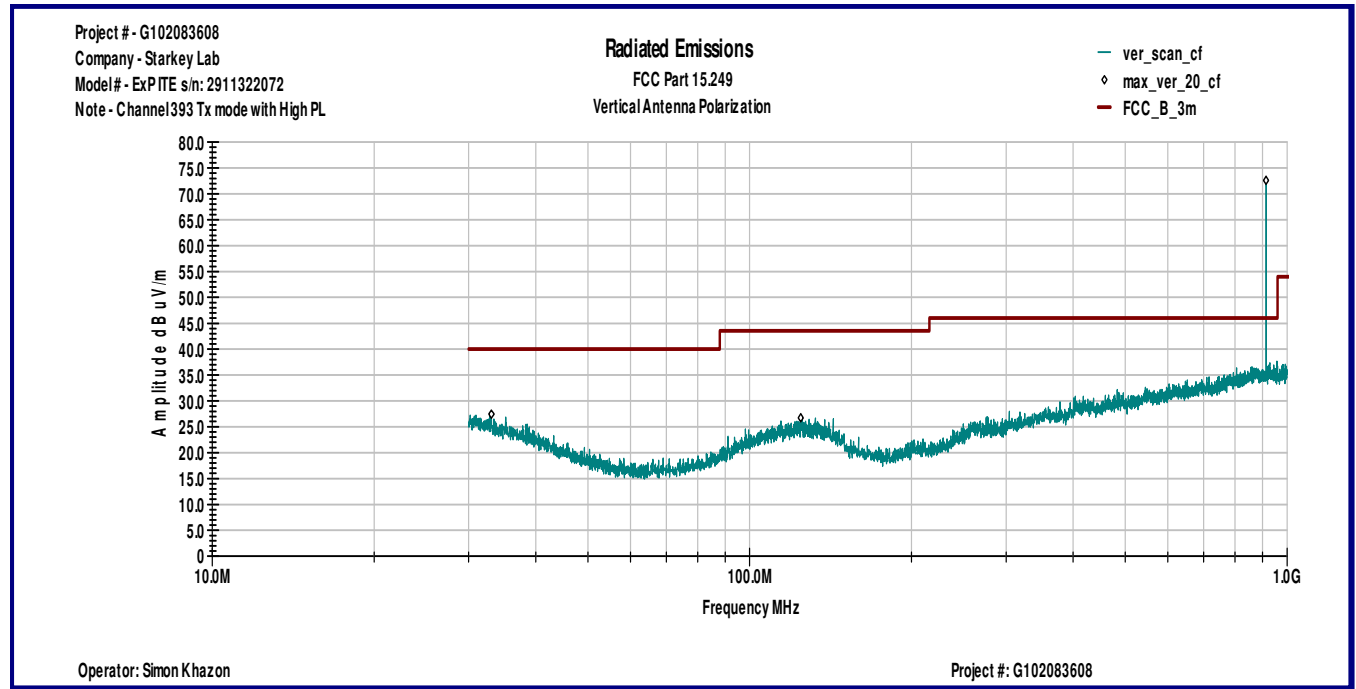


Horizontal antenna polarization

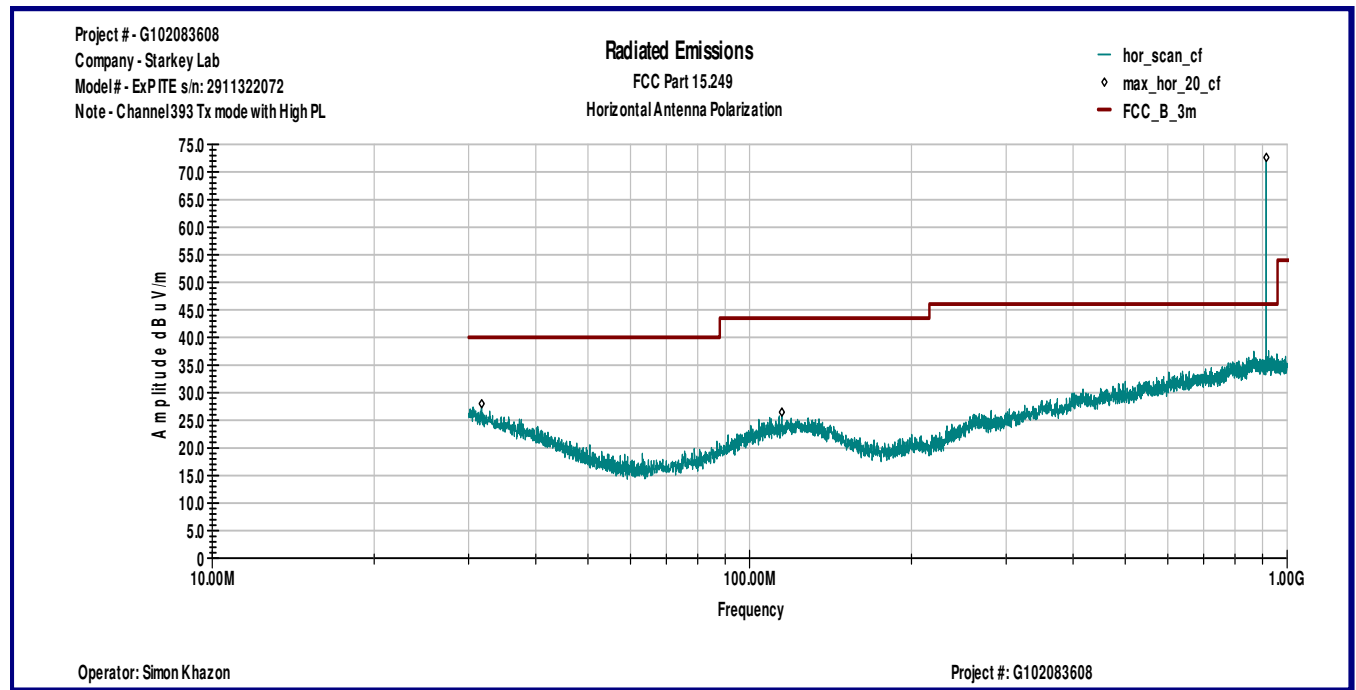


Graph 3.2.3

Vertical antenna polarization

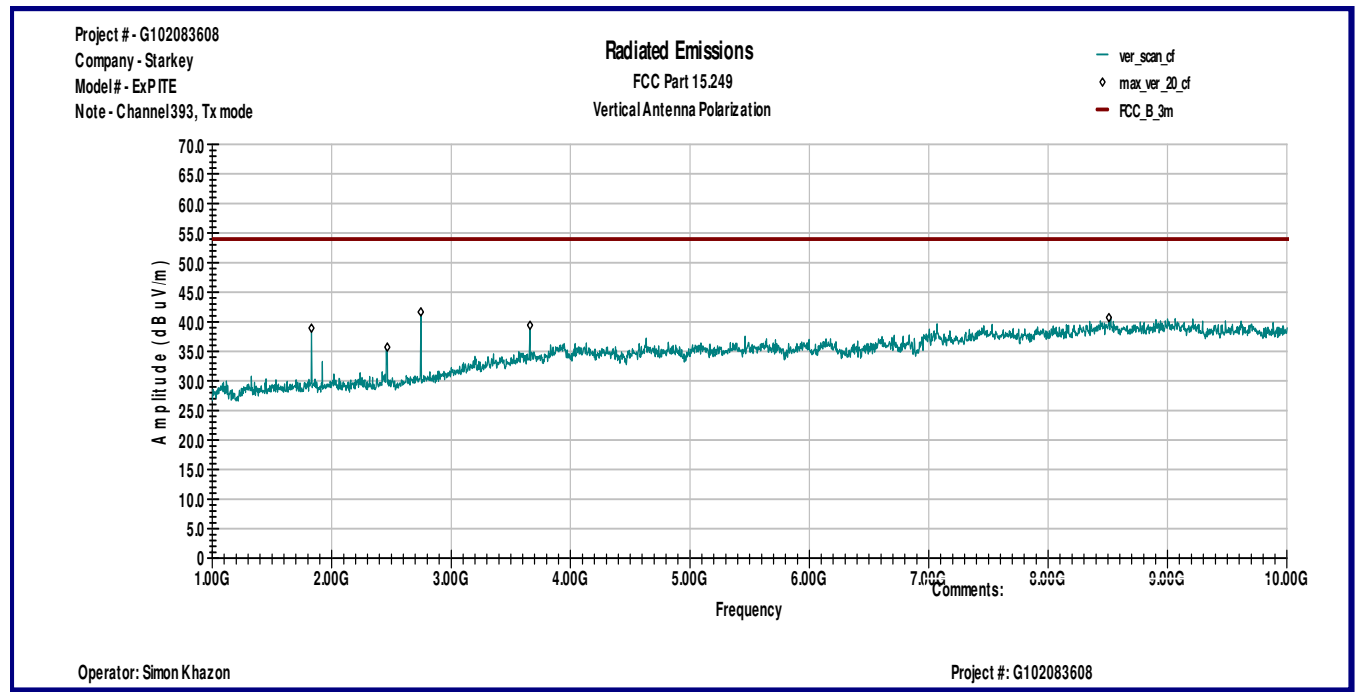


Horizontal antenna polarization

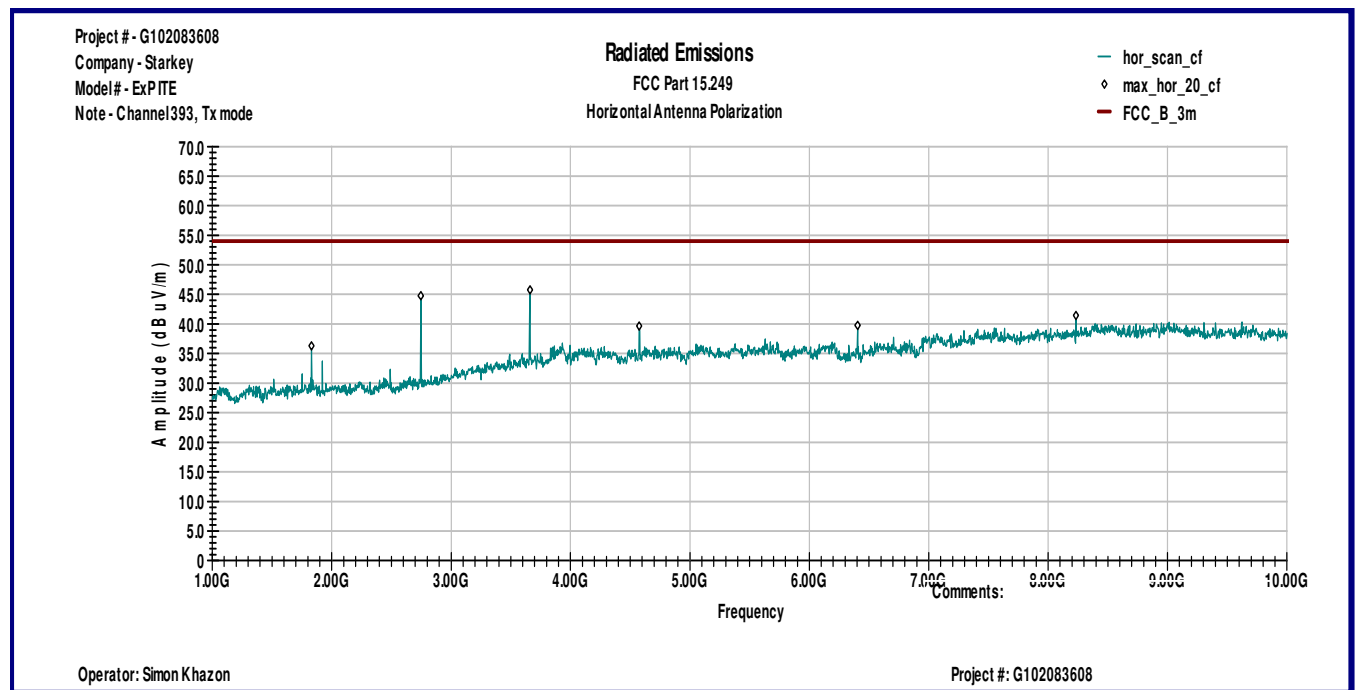


Graph 3.2.4

Vertical antenna polarization

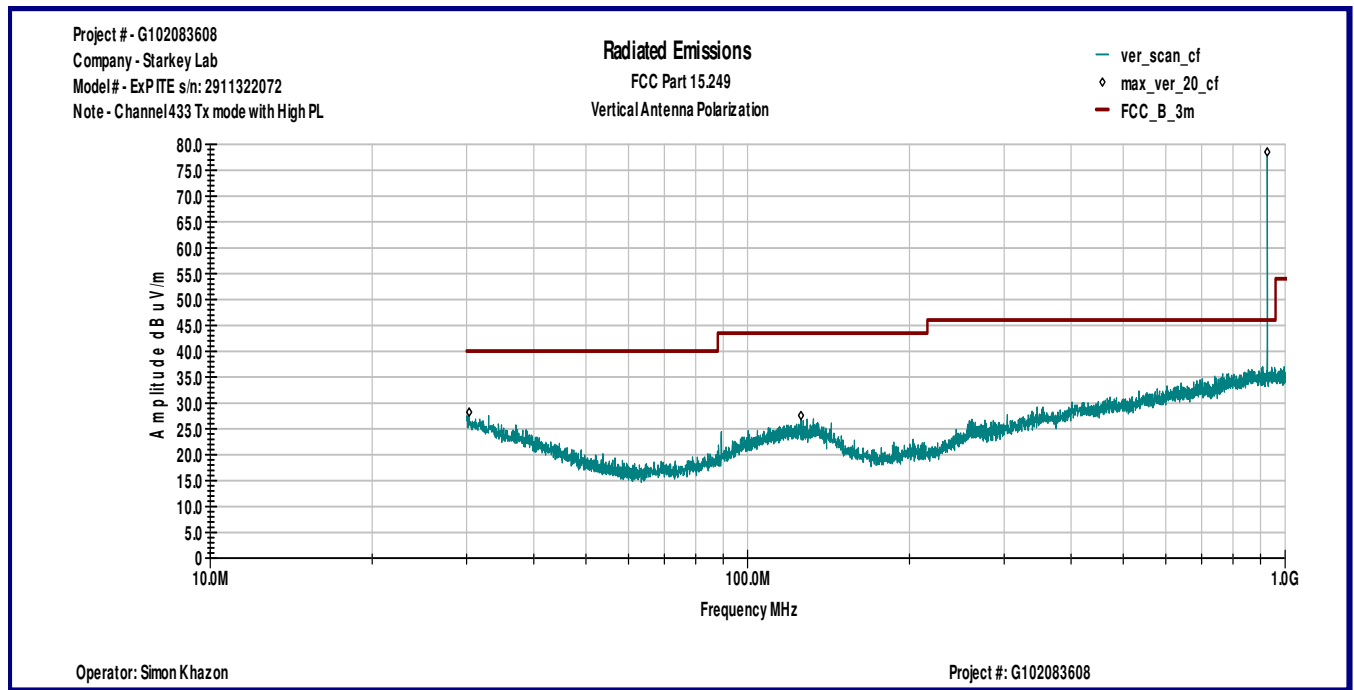


Horizontal antenna polarization

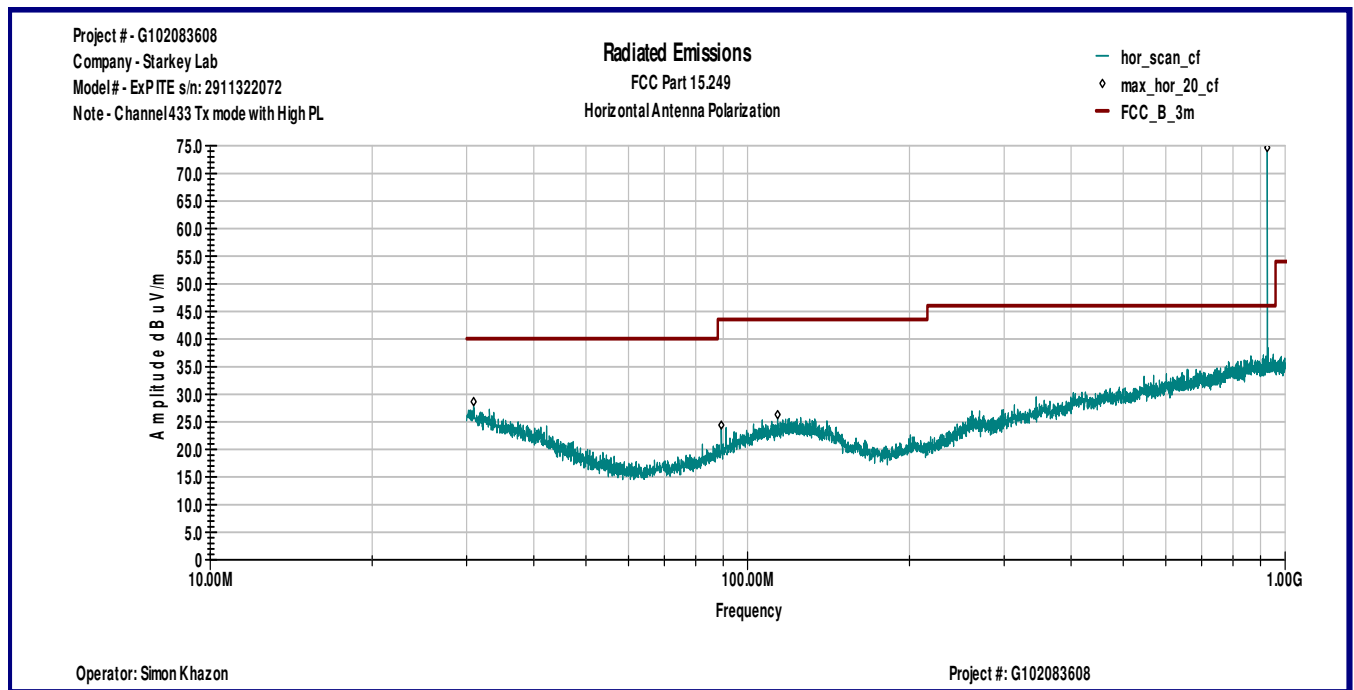


Graph 3.2.5

Vertical antenna polarization

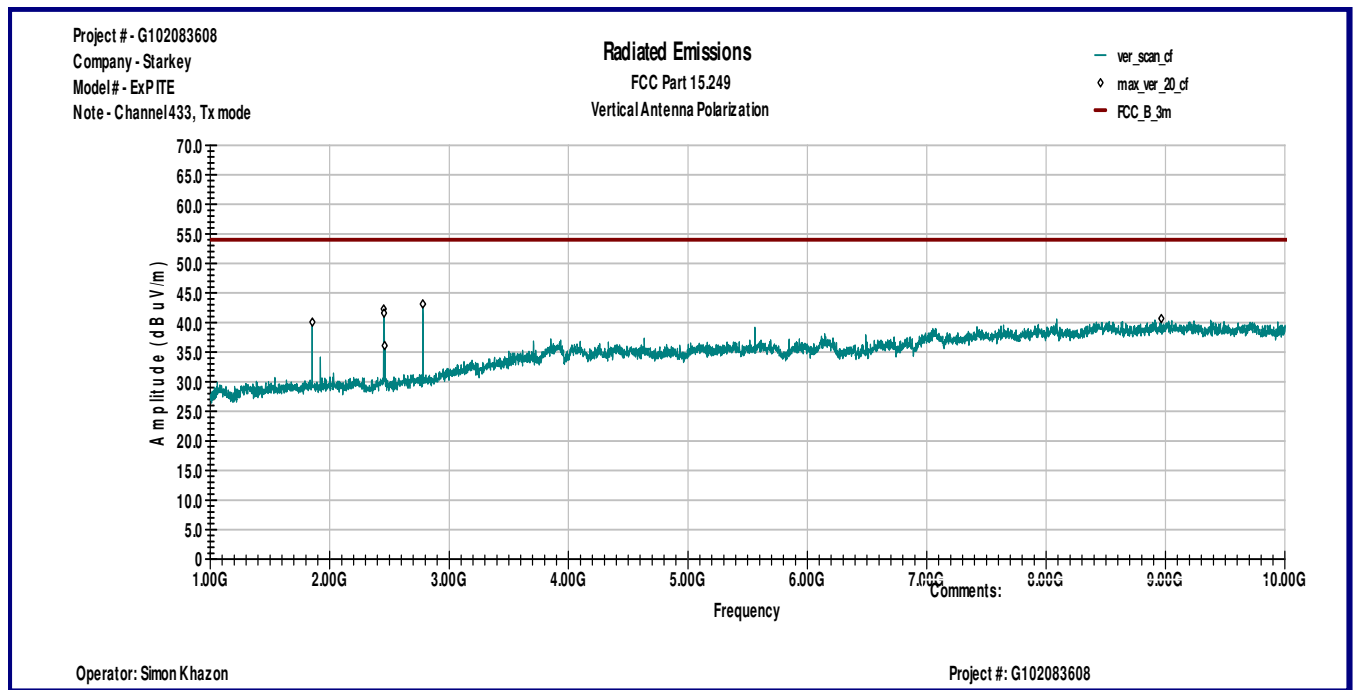


Horizontal antenna polarization

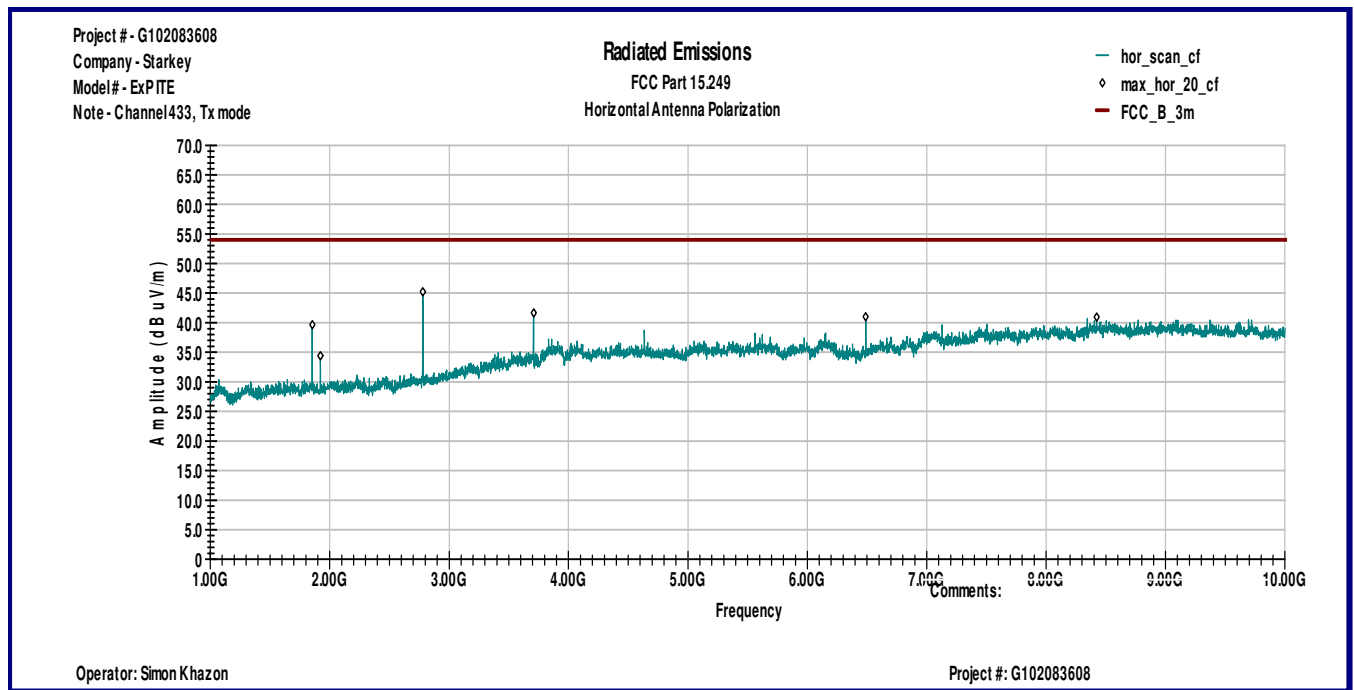


Graph 3.2.6

Vertical antenna polarization



Horizontal antenna polarization



3.2.1 Average correction factor calculation

N/A

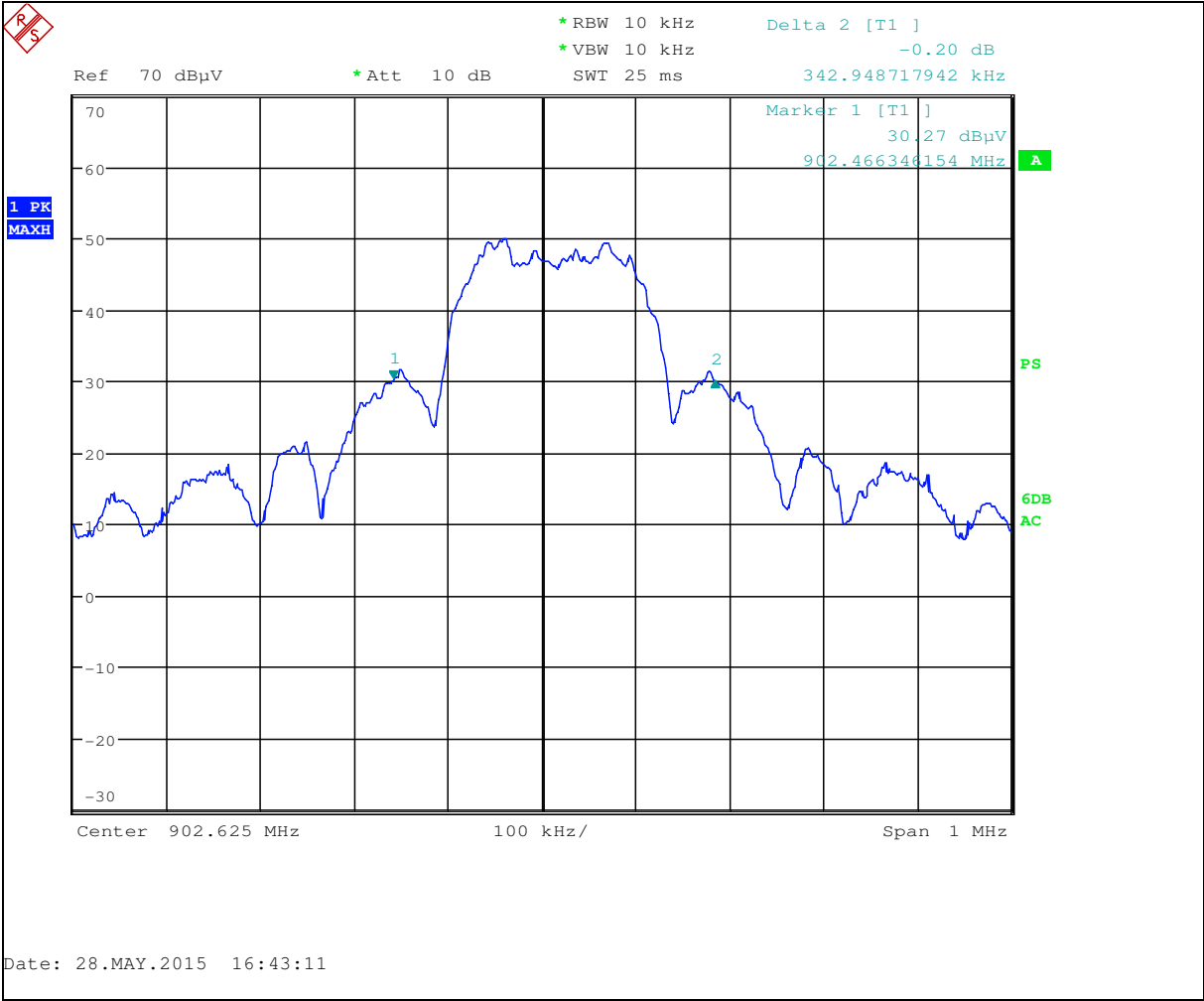
3.3 Bandwidth of Emissions

Center Frequency of operation MHz	Measured 20dB bandwidth kHz	Measured 99% bandwidth kHz
902.62	342.9 KHz	315.7 KHz
914.6	349.5 KHz	328.5 KHz
926.74	331.7 KHz	338.1 KHz

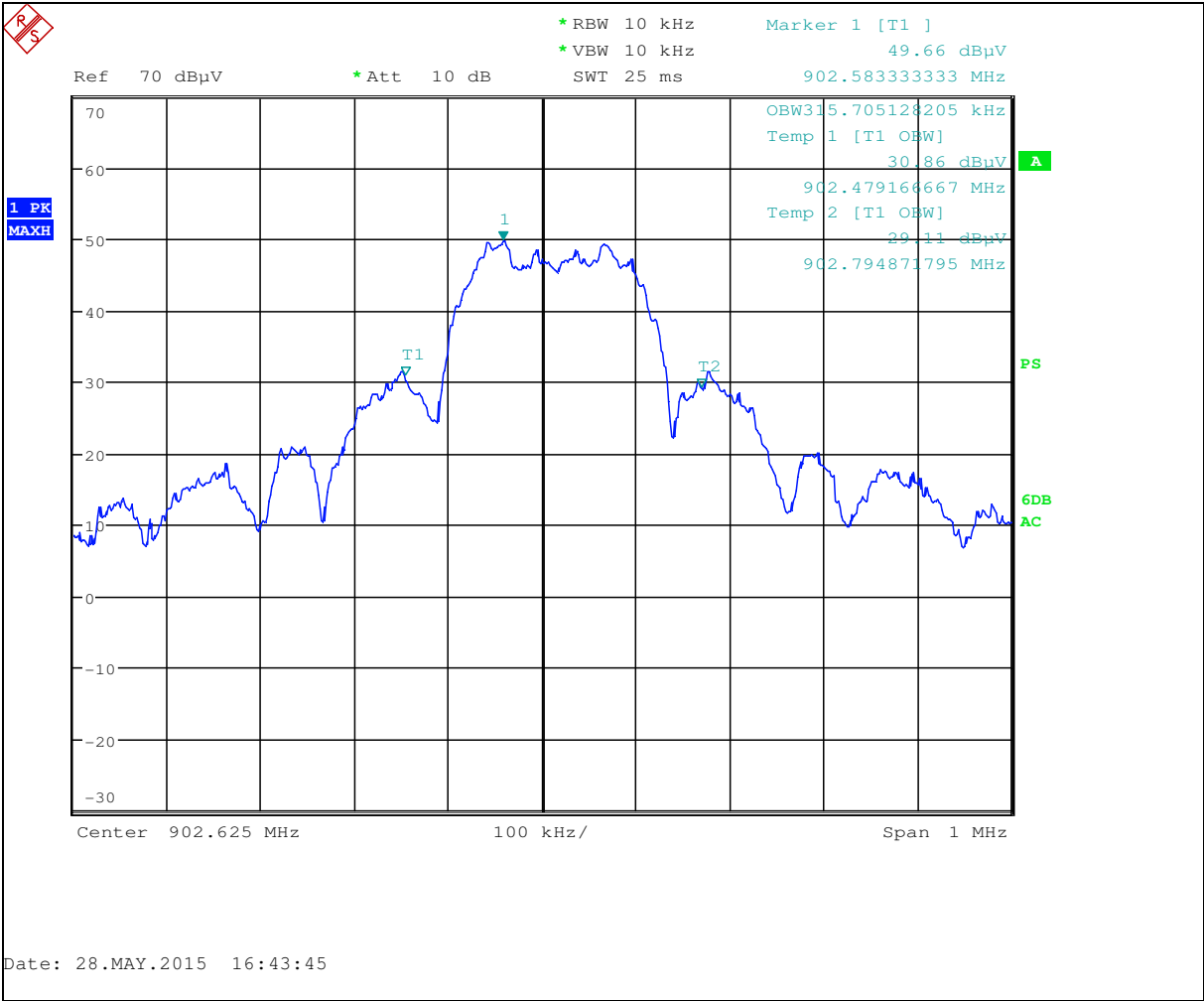
Graphs 3-3-1, 3-3-2, 3-3-3, 3-3-4, 3-3-5 and 3-3-6 show bandwidth of emissions

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

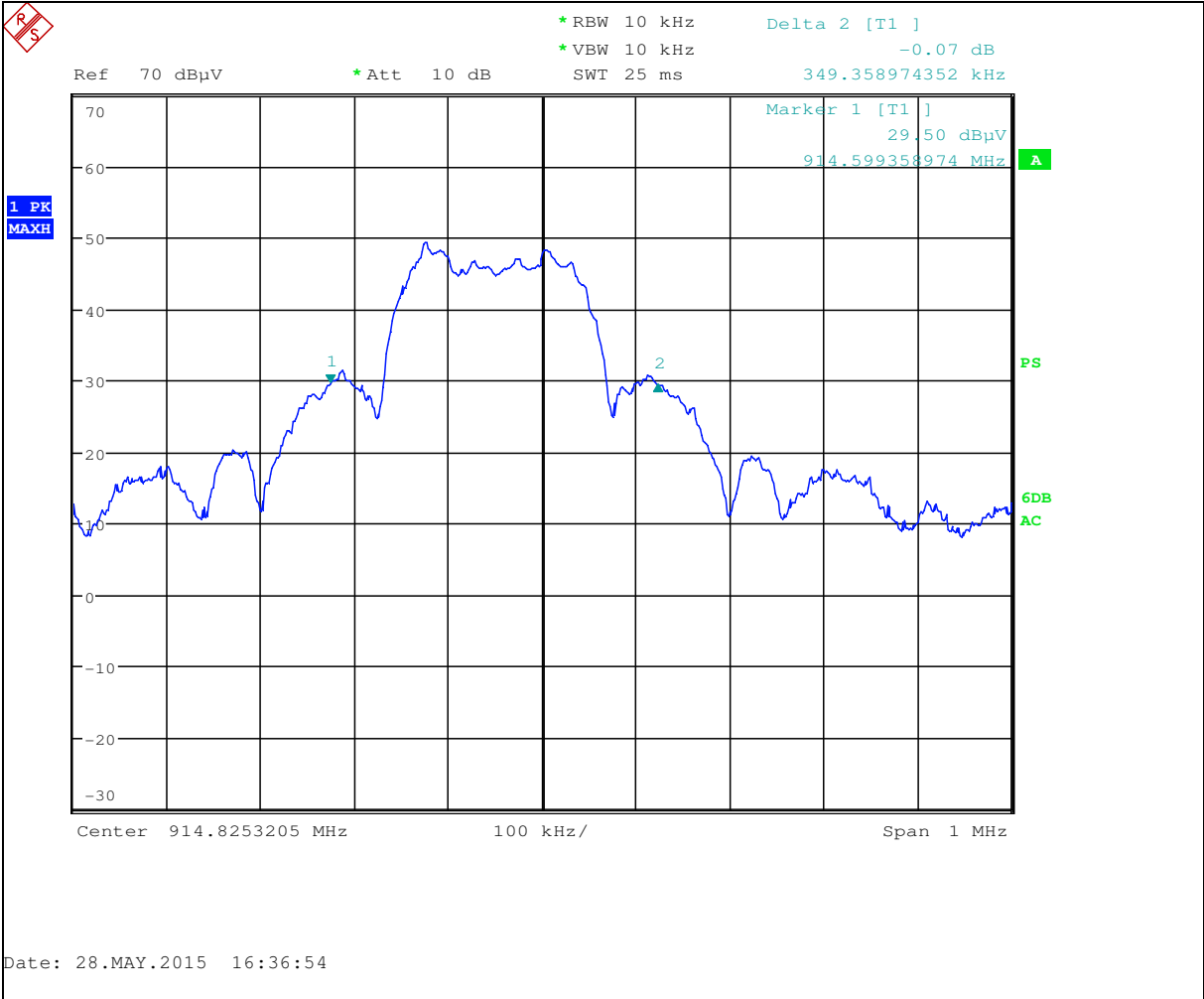
Graph 3.3.1



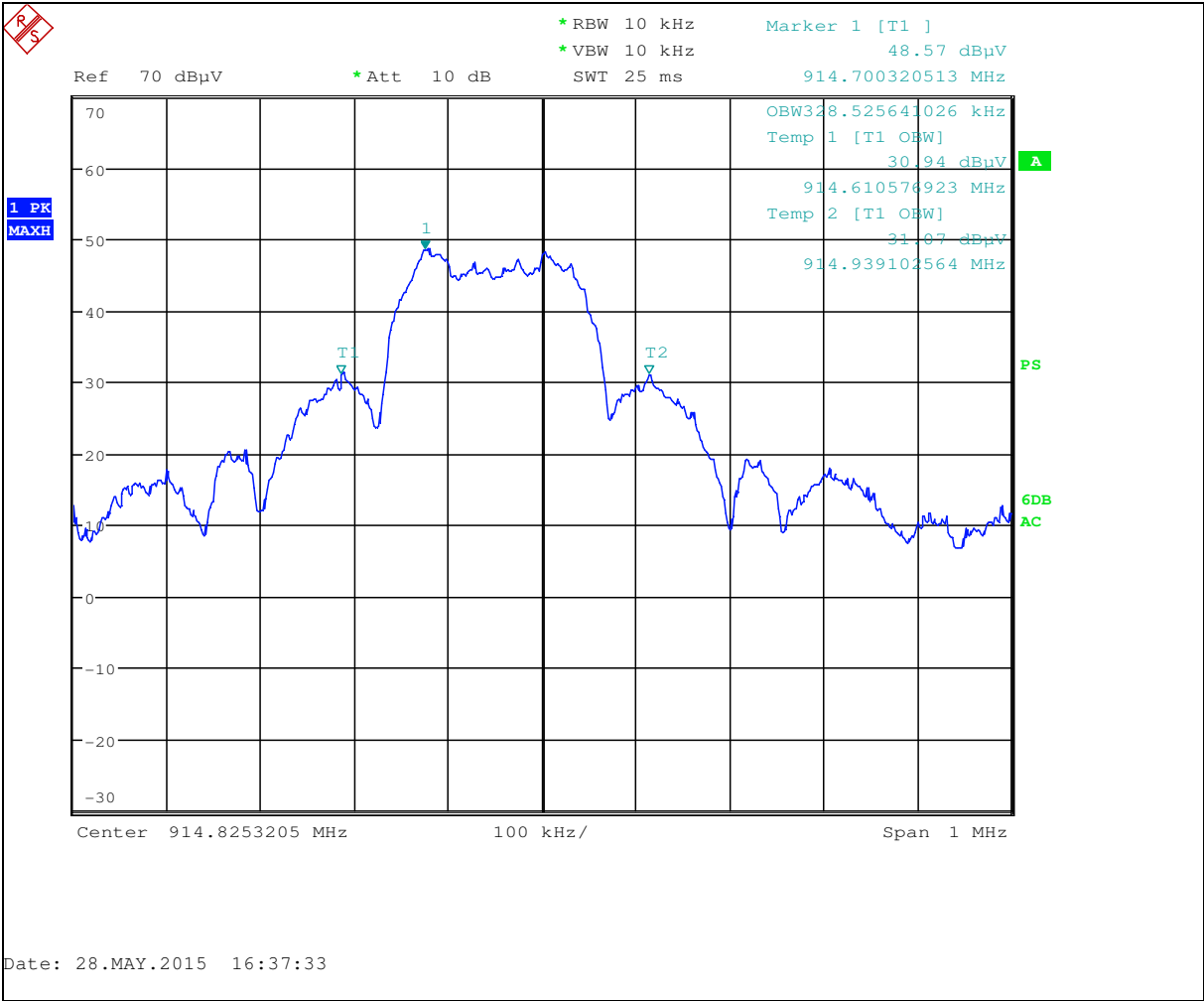
Graph 3.3.2



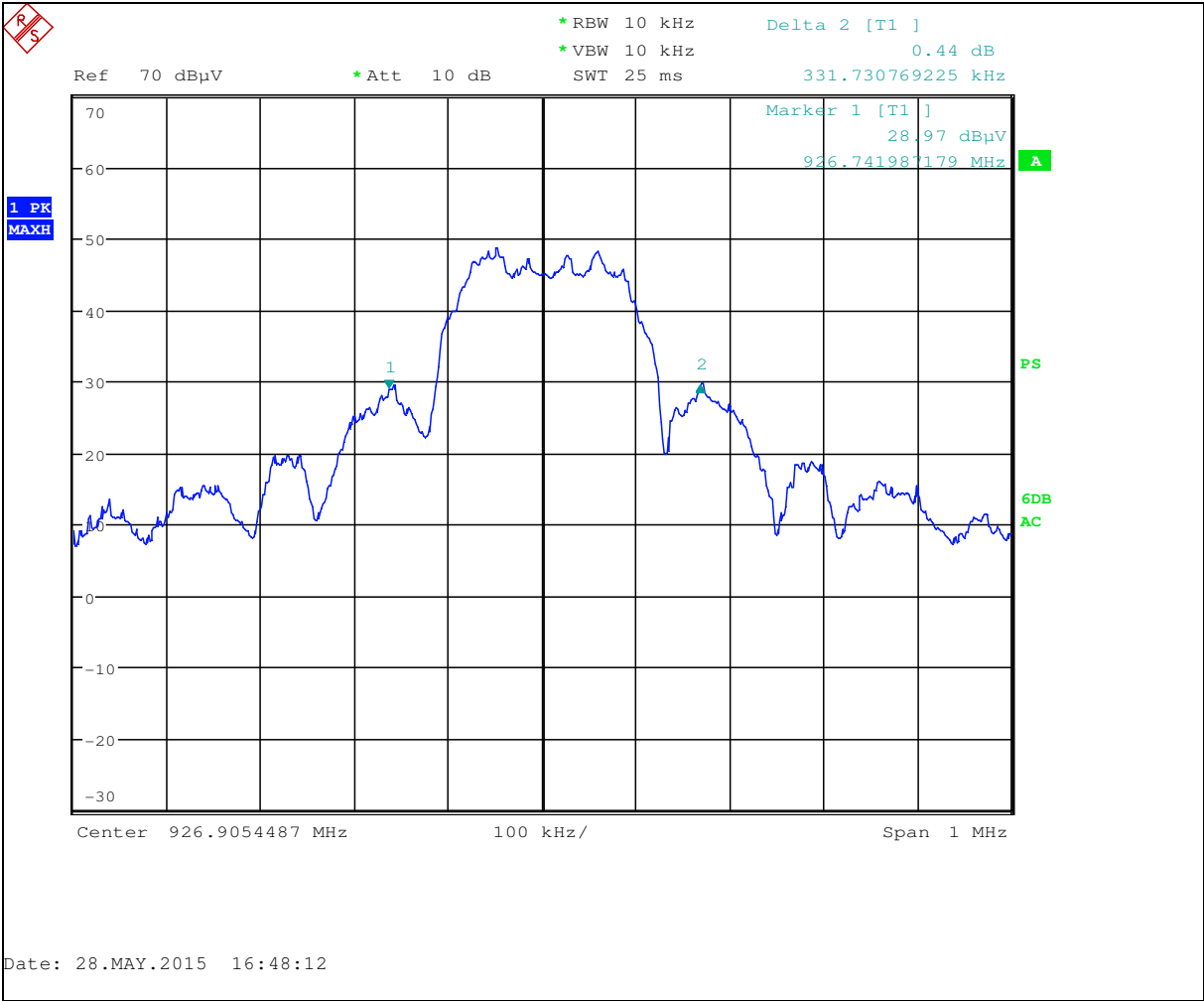
Graph 3.3.3



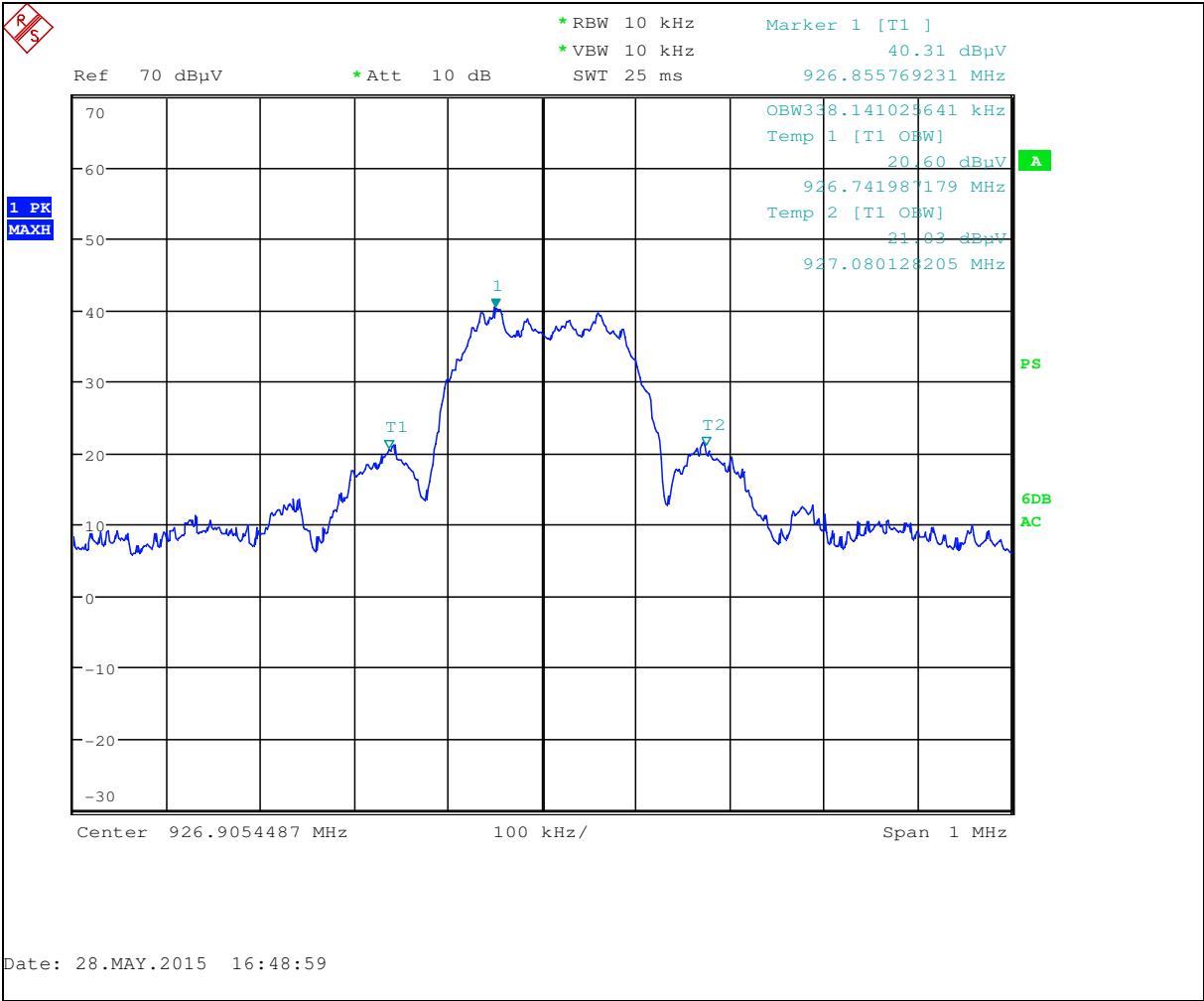
Graph 3.3.4



Graph 3.3.5



Graph 3.3.6





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-5000MHz

Max. Emissions margin: 9.1 dB 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 - 3.5.6).

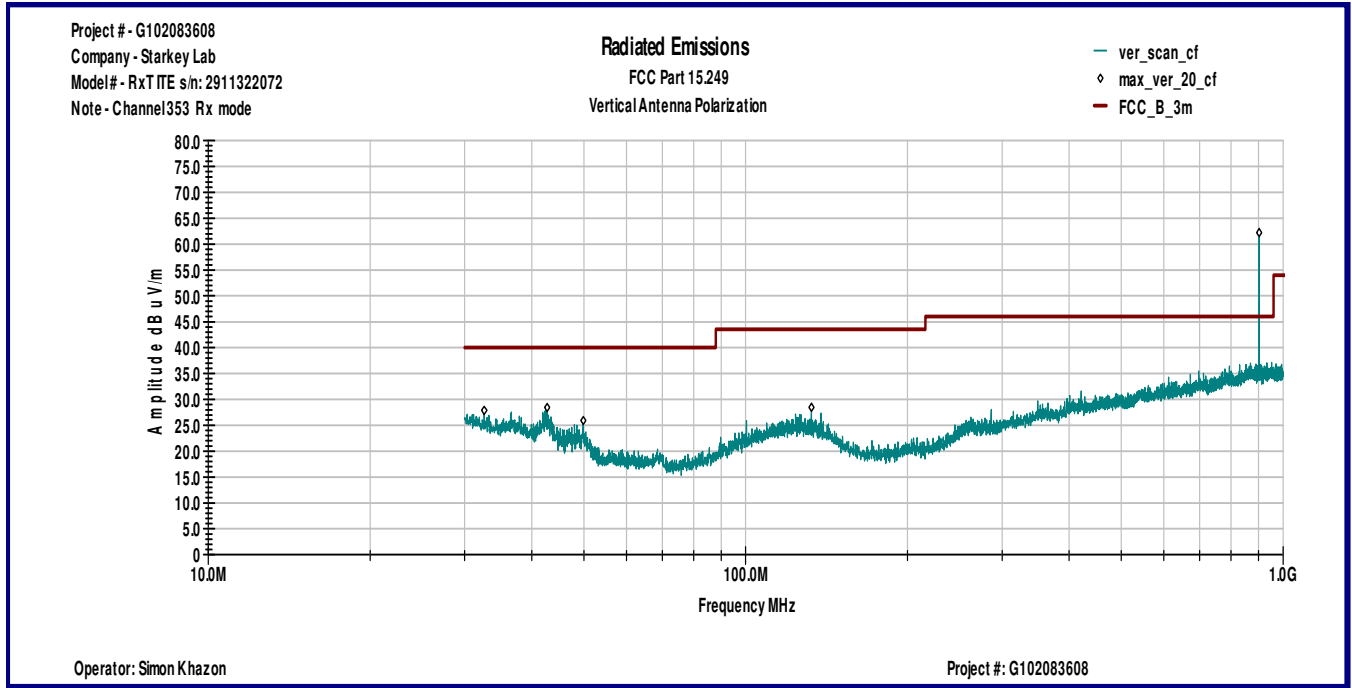
Date:	May 27-29, 2015	Result: Pass
Standard:	FCC Part 15.109, Class B	
Tested by:	Simon Khazon	
Test Point:	Enclosure	
Operation mode:	Receiving/standby	
Note:	None	

Table 3.5.1

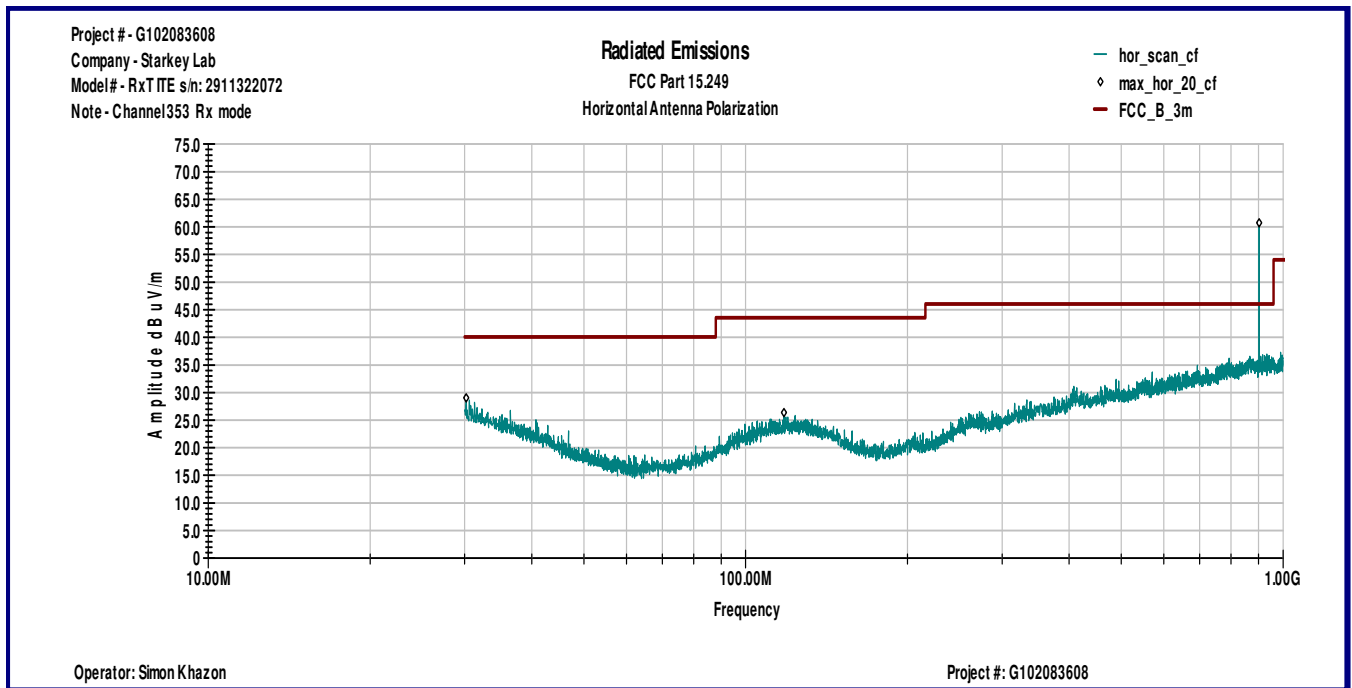
Frequency	Ant. Polarity	Peak Reading dBμV	Total C.F. dB1/m	Total at 3m dBμV/m	Limit dBμV/m	Margin dB
			Channel 353			
32.632 MHz	V	9.2	18.7	27.9	40.0	-12.1
42.745 MHz	V	15.4	13.1	28.4	40.0	-11.6
132.53 MHz	V	14.7	13.8	28.4	43.5	-15.1
30.208 MHz	H	8.9	20.1	29.0	40.0	-11.0
117.76 MHz	H	12.5	13.9	26.4	43.5	-17.2
			Channel 393			
31.212 MHz	V	8.2	19.5	27.7	40.0	-12.3
121.34 MHz	V	13.1	14.0	27.0	43.5	-16.5
30.069 MHz	H	9.1	20.2	29.3	40.0	-10.8
119.92 MHz	H	11.8	13.9	25.8	43.5	-17.7
664.01 MHz	H	14.0	23.0	36.9	46.0	-9.1
667.9 MHz	H	14.5	22.9	37.4	46.0	-8.6
			Channel 433			
31.143 MHz	V	8.2	19.5	27.7	40.0	-12.3
116.71 MHz	V	12.8	13.8	26.6	43.5	-16.9
30.381 MHz	H	7.5	20.0	27.4	40.0	-12.6
130.29 MHz	H	12.0	13.8	25.9	43.5	-17.7

Graph 3.5.1

Vertical antenna polarization

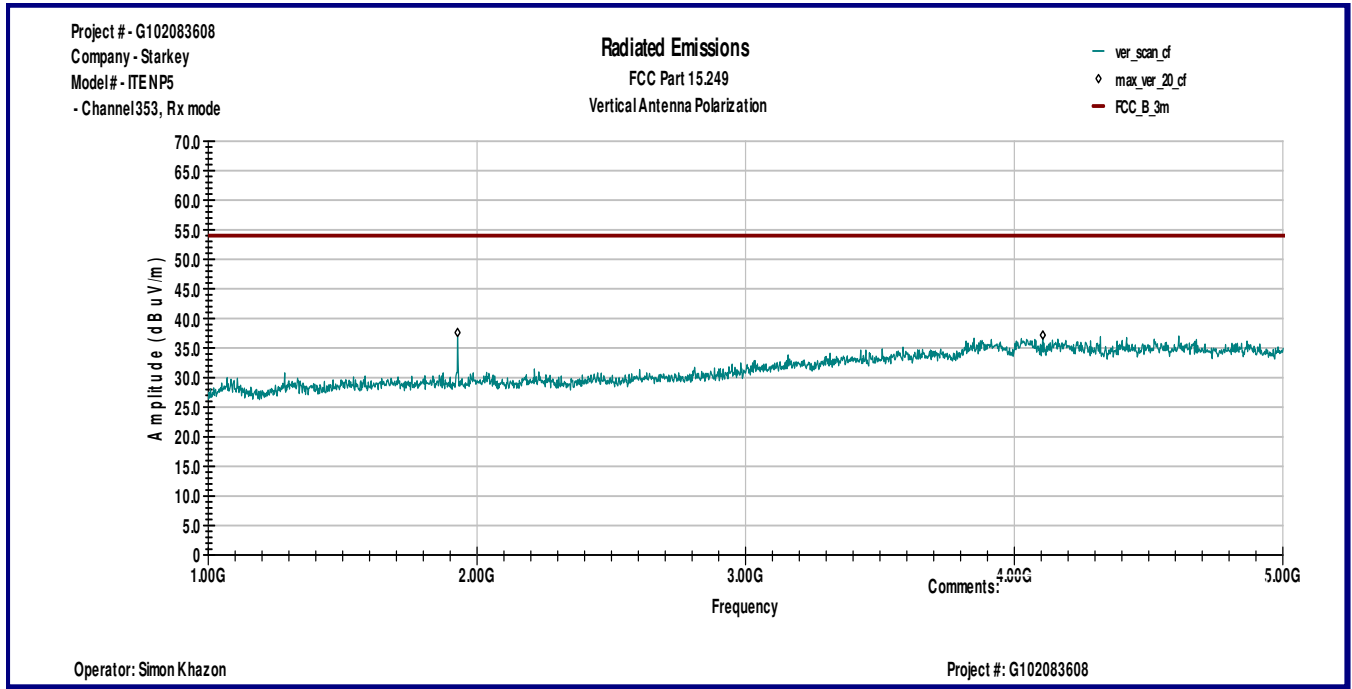


Horizontal antenna polarization

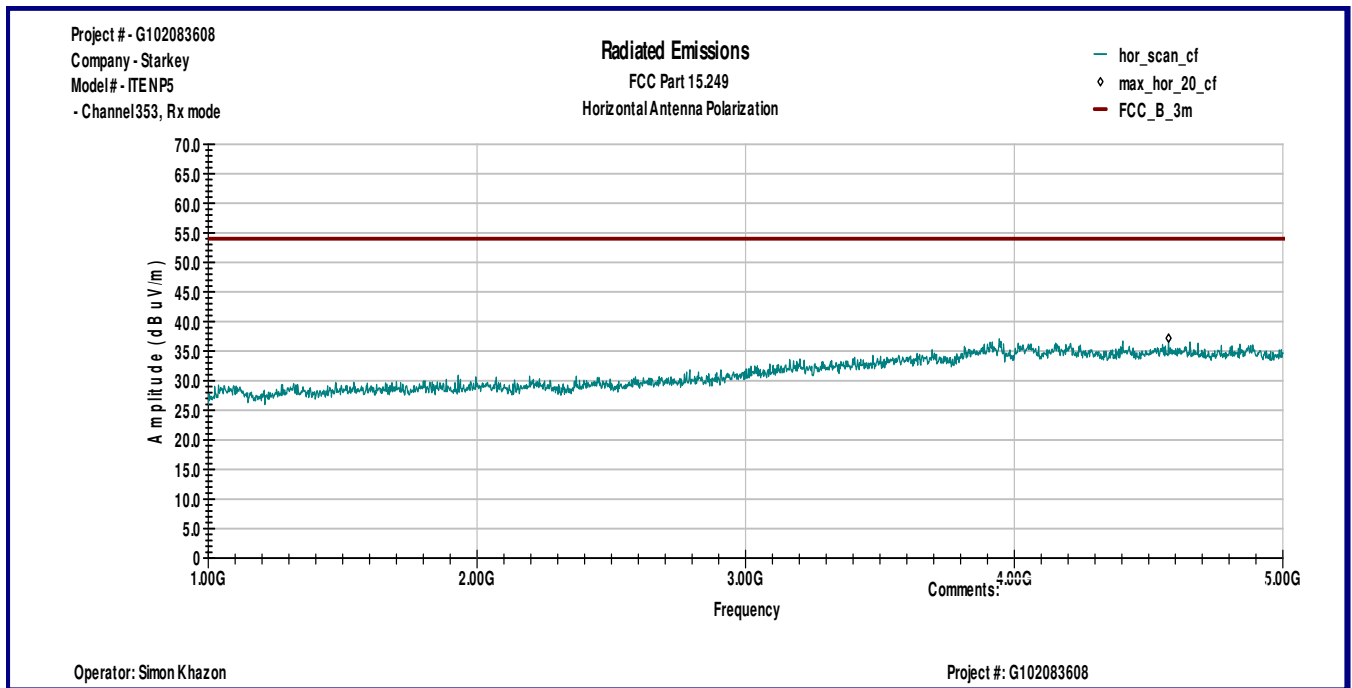


Graph 3.5.2

Vertical antenna polarization

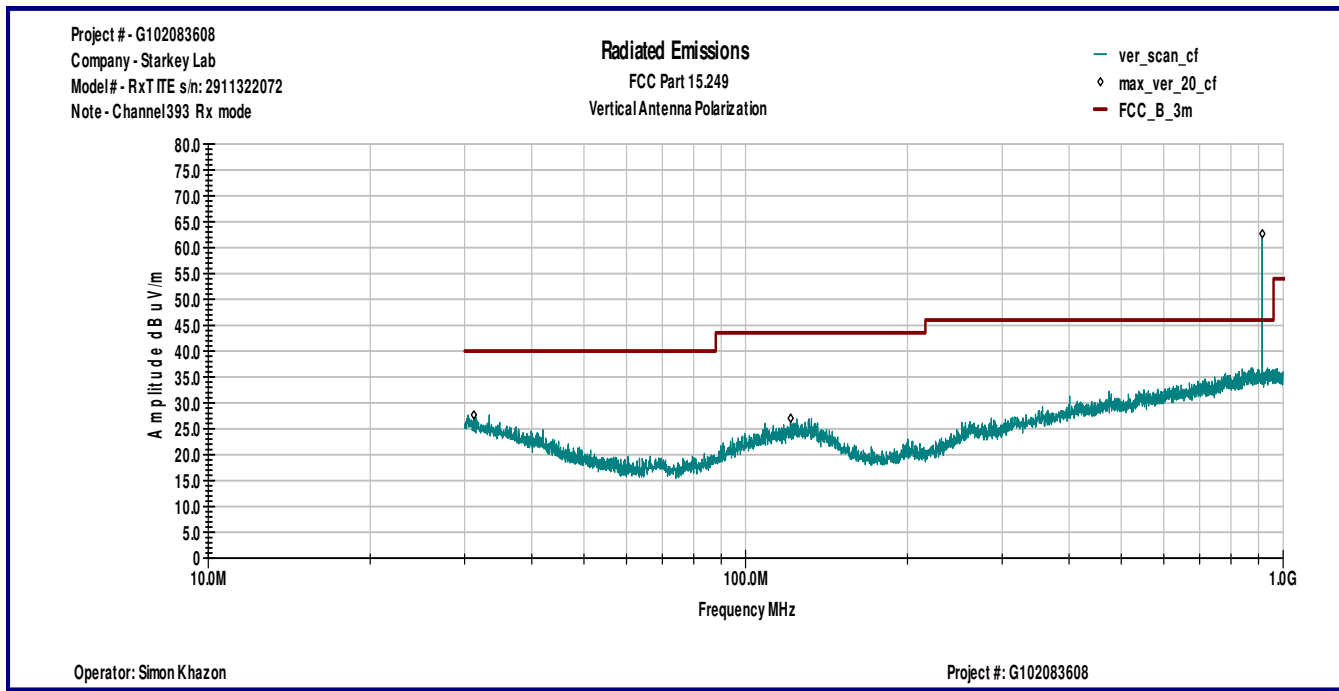


Horizontal antenna polarization

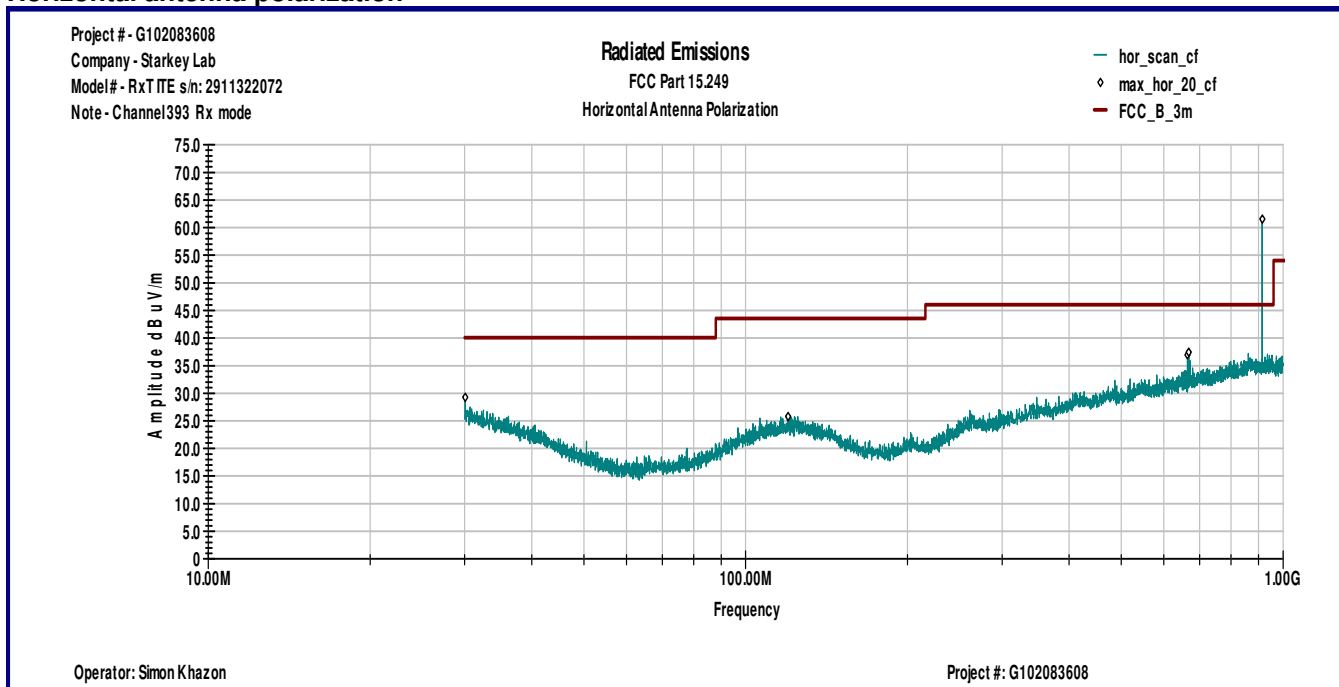


Graph 3.5.3

Vertical antenna polarization

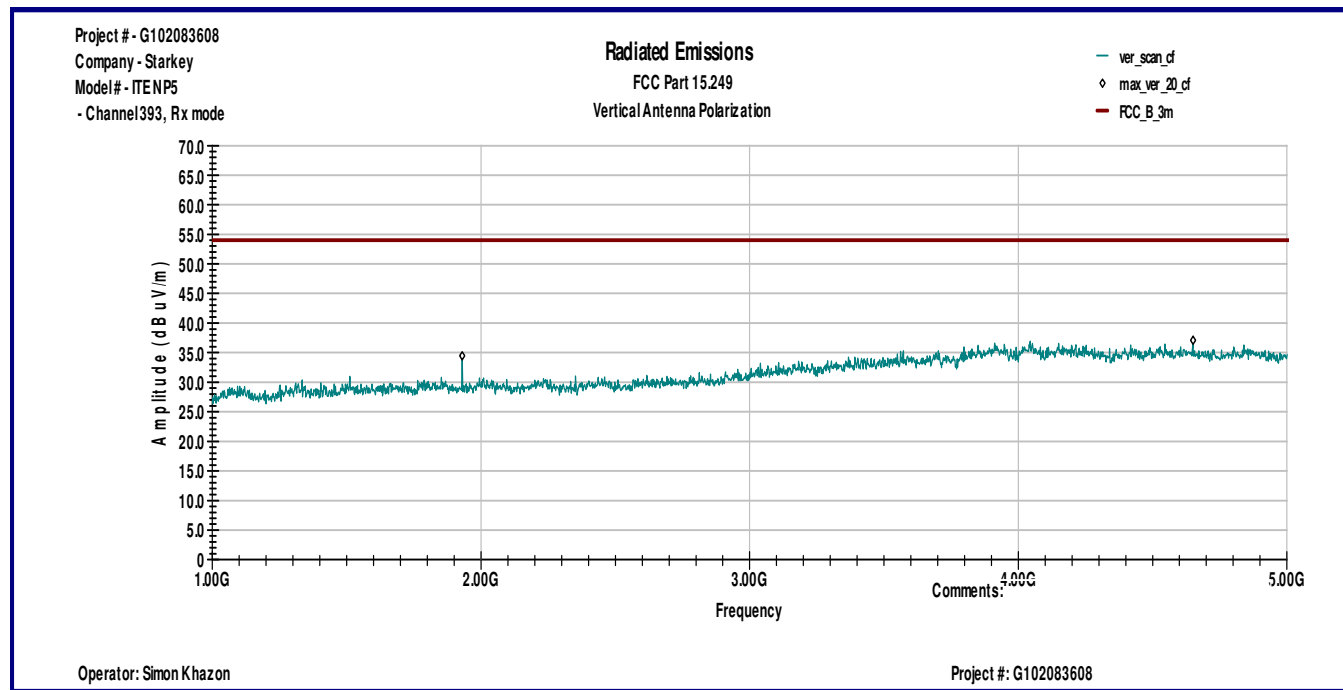


Horizontal antenna polarization

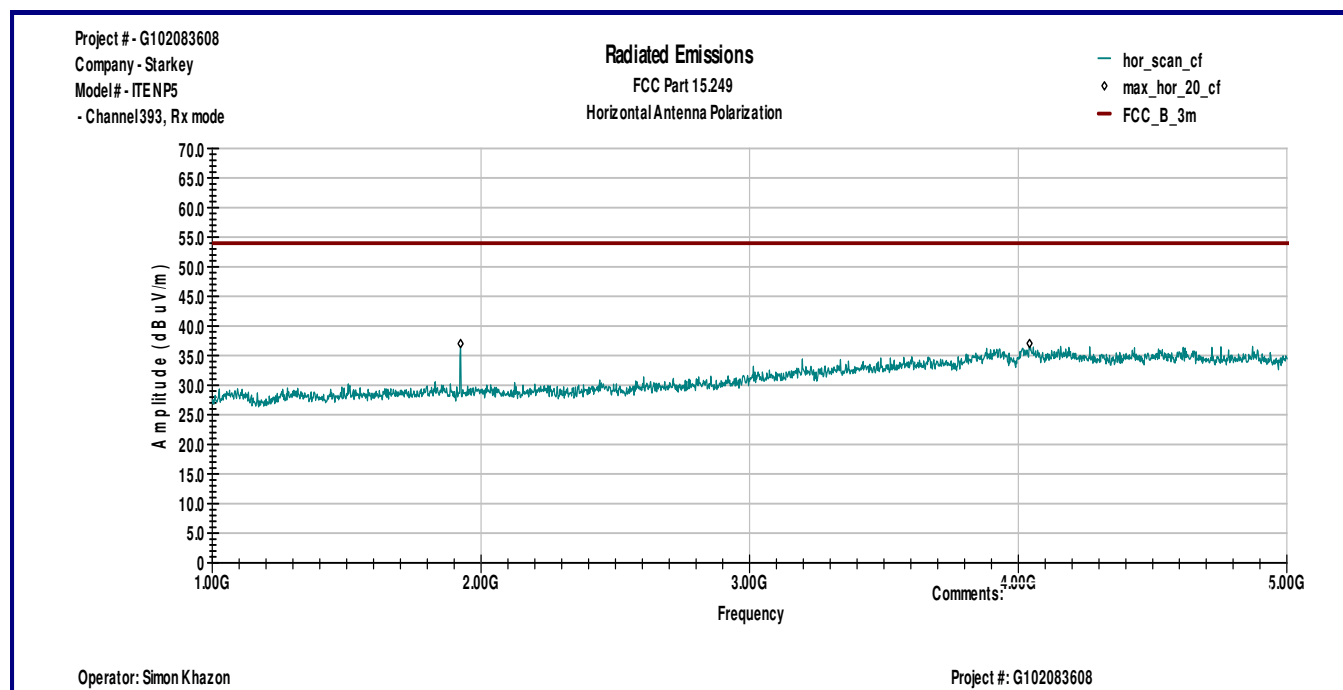


Graph 3.5.4

Vertical antenna polarization

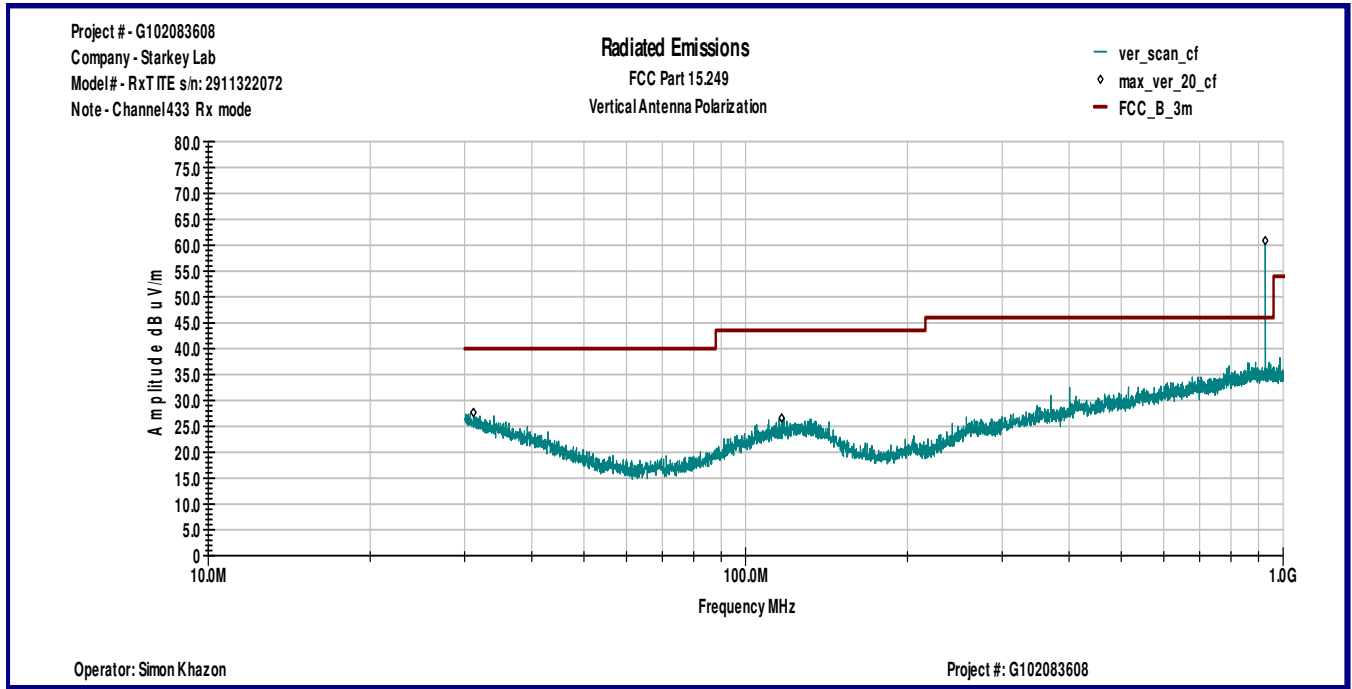


Horizontal antenna polarization

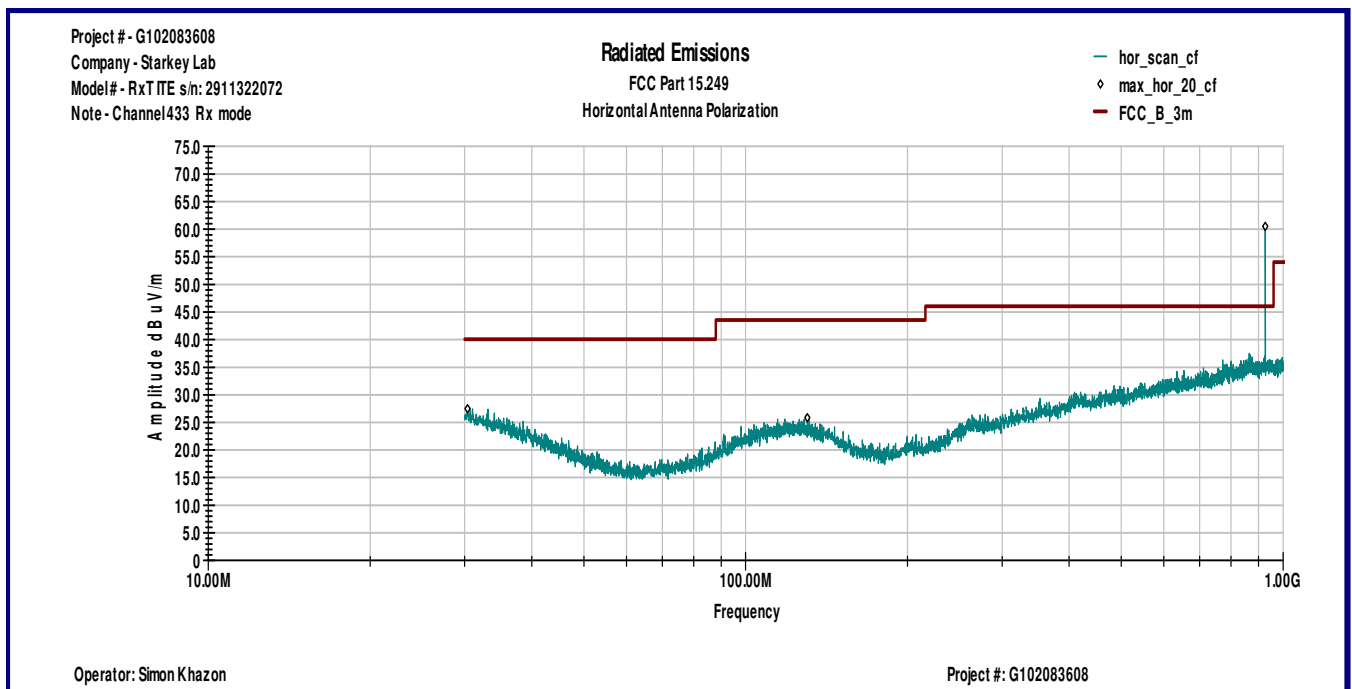


Graph 3.5.5

Vertical antenna polarization

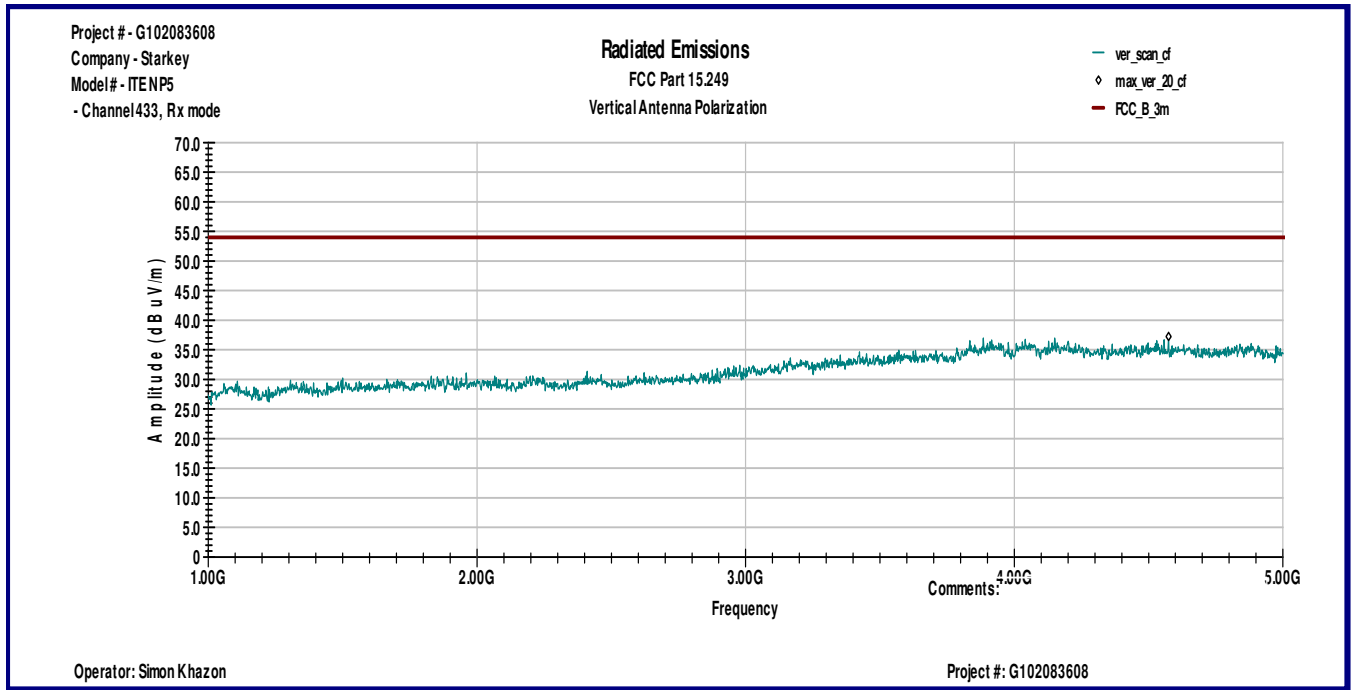


Horizontal antenna polarization

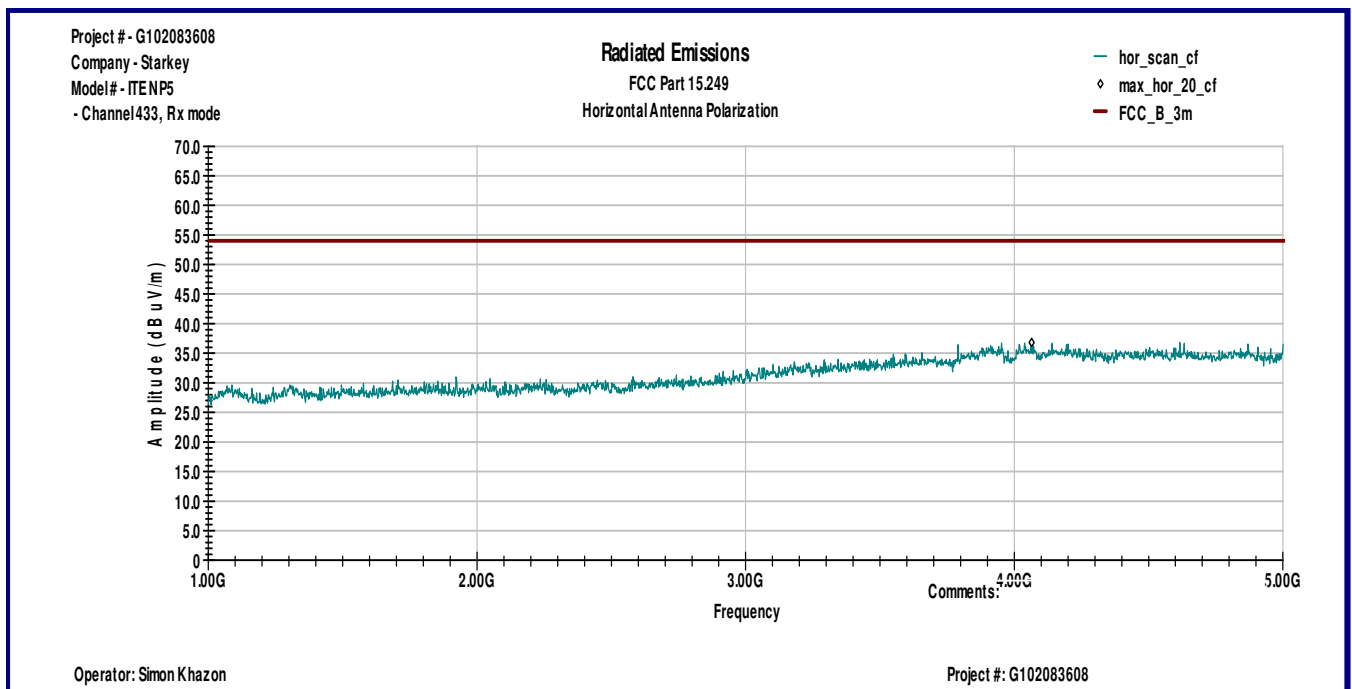


Graph 3.5.6

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: 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	01/07/2016	☐
Spectrum Analyzer	R & S	ESU	100398	25283	01/26/2016	☐
Bicono-Log Antenna	Teseq	CBL6112D	32859	25289	09/10/2015	☒
Horn Antenna	EMCO	3115	6579	15580	07/29/2015	☒
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1402232	172081	11/19/2015	☒
System	Quantum Change	TILE! Instrument Control	Ver. 3.4.K.29	15259	VBU	☒
1 GHZ high pass filter	Beactel	7HS-1G-S12	SN02-1	6015275	VBU	☒



5.0 Revision History

REVISION LEVEL	DATE	REPORT NUMBER	PREPARED	REVIEWED	NOTES
0	06-01-2015	102083608MIN-001	SK	US	Original Issue