

TEST REPORT

Report Number: 102056271MIN-001

Project Number: G102056271

Models:

ExP R312; A4 R312; Start 1200 R312; Start 1000 R312; ExP B312; A4 B312;
Start 1200 B312; Start 1000 B312

FCC ID: EOA-EXPSTANDARD

Industry Canada ID: 6903A-EXPSTANDARD

to

47 CFR Part 15.249:2013

RSS- 210, Issue 8, 2010

RSS-Gen, Issue 3, 2010

47 CFR, Part 15:2013, §15.107 and §15.109, Class / ICES-003, Issue 5:2012

For

Starkey Laboratories, Inc.

Test Performed by:

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Test Authorized by:

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Date:

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Date: April 23, 2015

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1.0 GENERAL DESCRIPTION

Model tested:	ExP R312
Type of EUT:	Hearing Aid
Serial Number:	41181530
FCC ID:	EOA-EXPSTANDARD
Industry Canada ID:	6903A-EXPSTANDARD
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 15:2013, §15.249 ☒ RSS-210, Issue 8, 2010 ☒ RSS-Gen, Issue 3, 2010 ☒ 47 CFR, Part 15:2013, §15.107 and §15.109, Class B ☒ ICES-003, Issue 5:2012 ☐ Other
Type of radio:	☒ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	April 6, 2015
Test Work Started:	April 6, 2015
Test Work Completed:	April 7, 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:	342KFXD
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, middle, and upper 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 R312 was tested as a representative model.
According to the manufacturer models ExP R312; A4 R312; Start 1200 R312; Start 1000 R312; ExP B312; A4 B312; Start 1200 B312; Start 1000 B312 are electrically identical

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).

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

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

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

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

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

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

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

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: 16.9dB below the limits

Notes: None

Date:	April 6, 2015	Result: Pass
Standard:	FCC 15.249(a) / RSS-210 A2.9	
Tested by:	Clay Huff	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	None	

Table 3.1.1

Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	Reading	Total @ 3m	Limit	Margin	Comments
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBμV	dBμV/m	dBμV/m	dB	
Channel 353										
902.57	V	153	21.7	2.6	0.0	52.8	77.1	94.0	-16.9	peak
902.57	H	100	21.7	2.6	0.0	49.3	73.6	94.0	-20.4	peak
Channel 393										
914.74	V	150	21.8	2.6	0.0	48.3	72.7	94.0	-21.3	peak
914.74	H	100	21.8	2.6	0.0	45.3	69.7	94.0	-24.3	peak
Channel 433										
926.85	V	144	21.9	2.6	0.0	47.8	72.3	94.0	-21.7	peak
926.85	H	100	21.9	2.6	0.0	44.1	68.6	94.0	-25.4	peak



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-10GHz

Test result: **Pass**

Max. Emissions margin at fundamental: 8.7dB below the limits

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

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

Date:	April 6, 2015	Result: Pass
Standard:	FCC 15.249(a) and (d) / RSS-210 A2.9	
Tested by:	Clay Huff	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	None	

Table 3.2.1

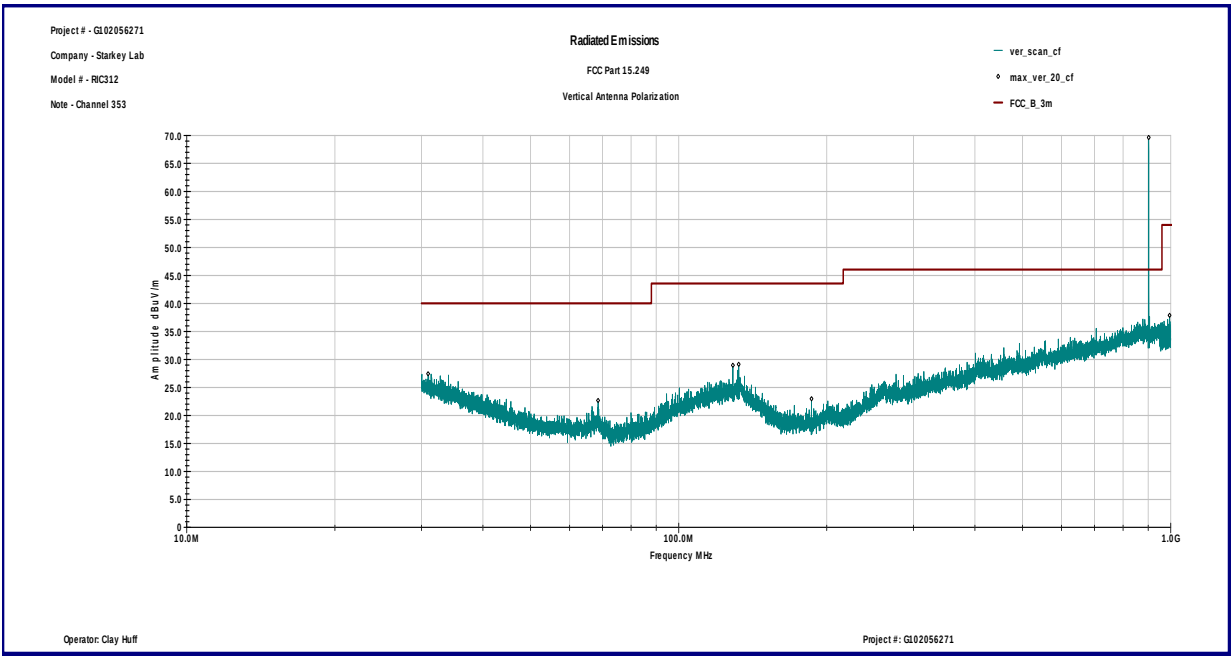
Frequency MHz	Antenna Polarity	Peak Reading dBμV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBμV/m	Limit dBμV/m	Margin dB
Channel 353							
1.8064 GHz	V	59.4	29.5	43.6	45.3	54.0	-8.7
2.71 GHz	V	46.5	32.6	44.0	35.1	54.0	-18.9
3.8512 GHz	V	43.8	36.4	43.2	37.0	54.0	-17.0
1.8064 GHz	H	53.6	29.1	43.6	39.1	54.0	-14.8
Channel 393							
1.8306 GHz	V	56.0	29.6	43.6	42.0	54.0	-12.0
2.746 GHz	V	49.3	32.7	44.0	38.0	54.0	-16.0
1.8306 GHz	H	52.4	29.2	43.6	38.1	54.0	-15.9
2.746 GHz	H	45.9	32.5	44.0	34.4	54.0	-19.6
3.6589 GHz	H	47.8	35.6	43.5	39.9	54.0	-14.1
Channel 433							
1.8537 GHz	V	54.4	29.7	43.6	40.5	54.0	-13.5
1.8537 GHz	H	54.3	29.4	43.6	40.0	54.0	-14.0

Table 3.2.2

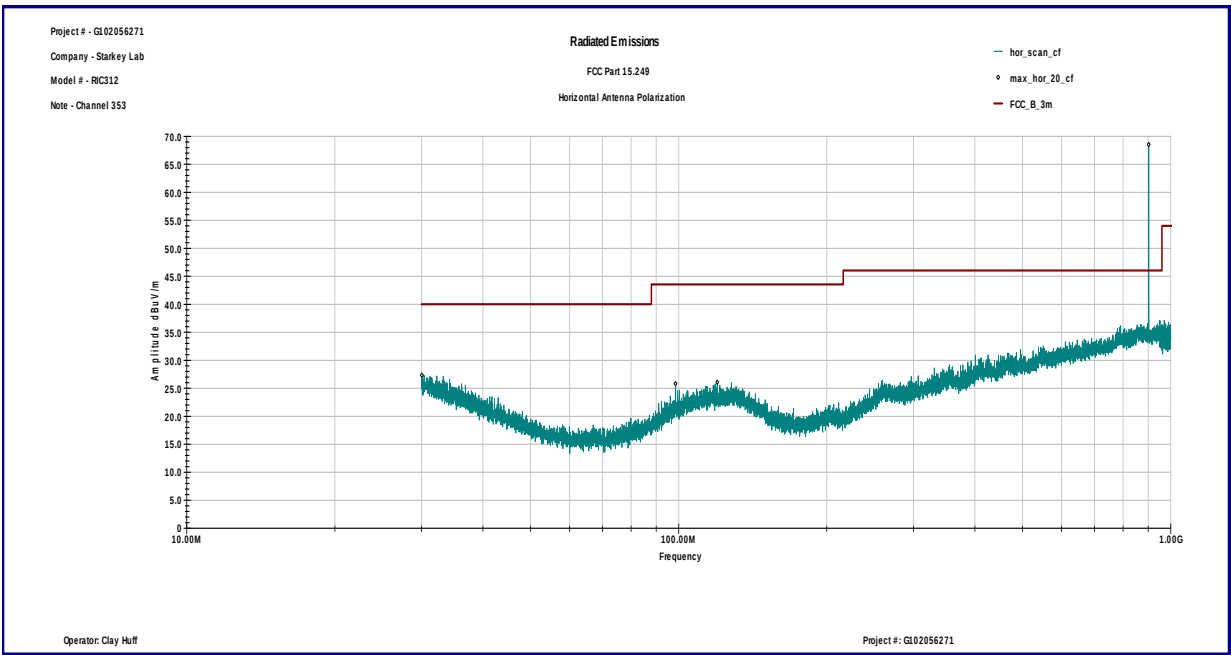
Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dBμV	Total @ 3m dBμV/m	Limit dBμV/m	Margin dB	Comments
	Polarity	Hts(cm)								
Bandege Compliance										
902.00	V	144	21.7	2.6	0.0	14.5	38.8	46.0	-7.2	peak
902.00	H	110	21.7	2.6	0.0	12.3	36.6	46.0	-9.4	peak
928.00	V	113	21.9	2.6	0.0	11.3	35.8	46.0	-10.2	peak
928.00	H	100	21.9	2.6	0.0	11.1	35.6	46.0	-10.4	peak

Graph 3.2.1

Vertical antenna polarization

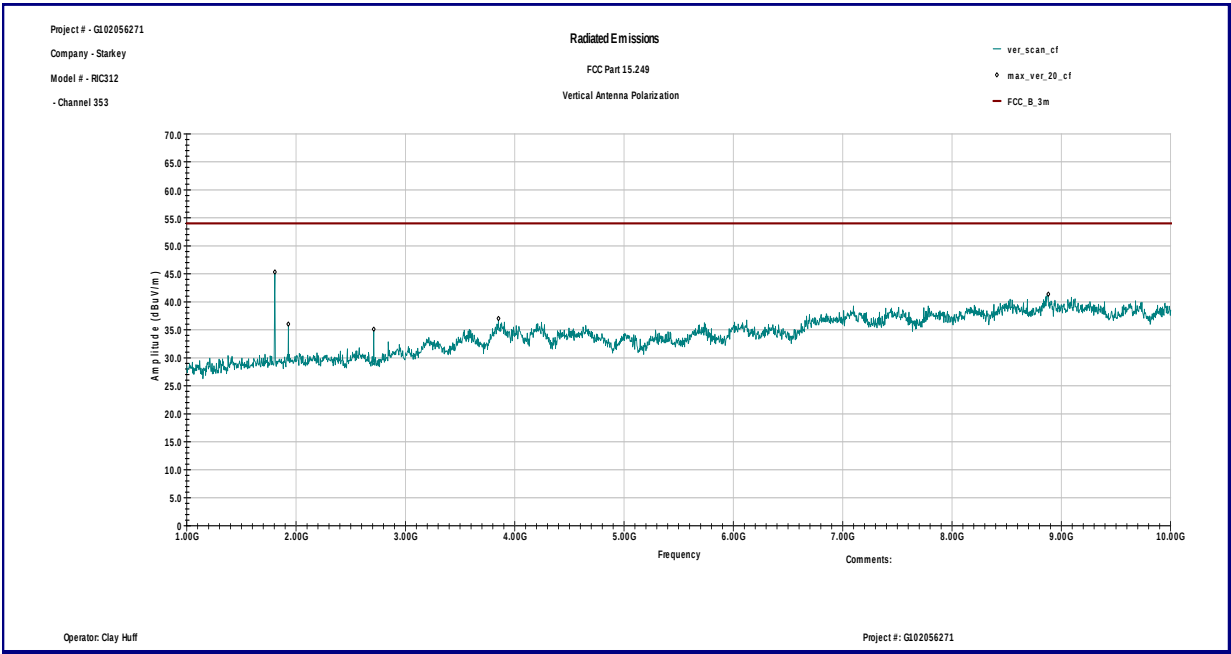


Horizontal antenna polarization

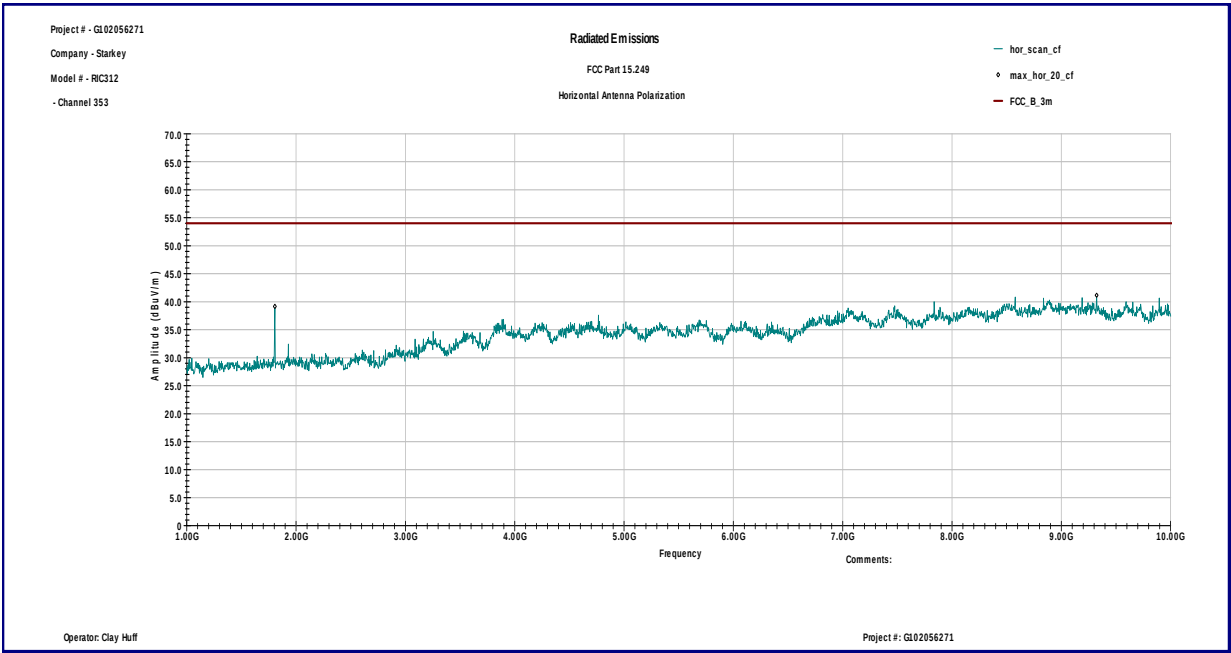


Graph 3.2.2

Vertical antenna polarization

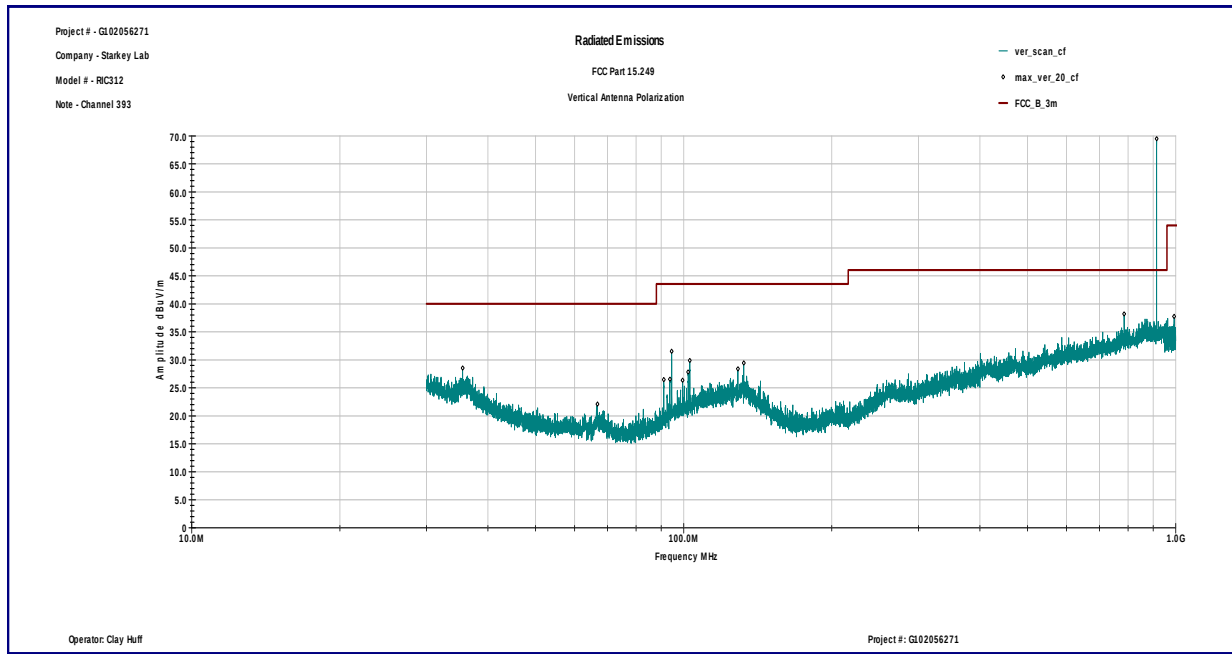


Horizontal antenna polarization

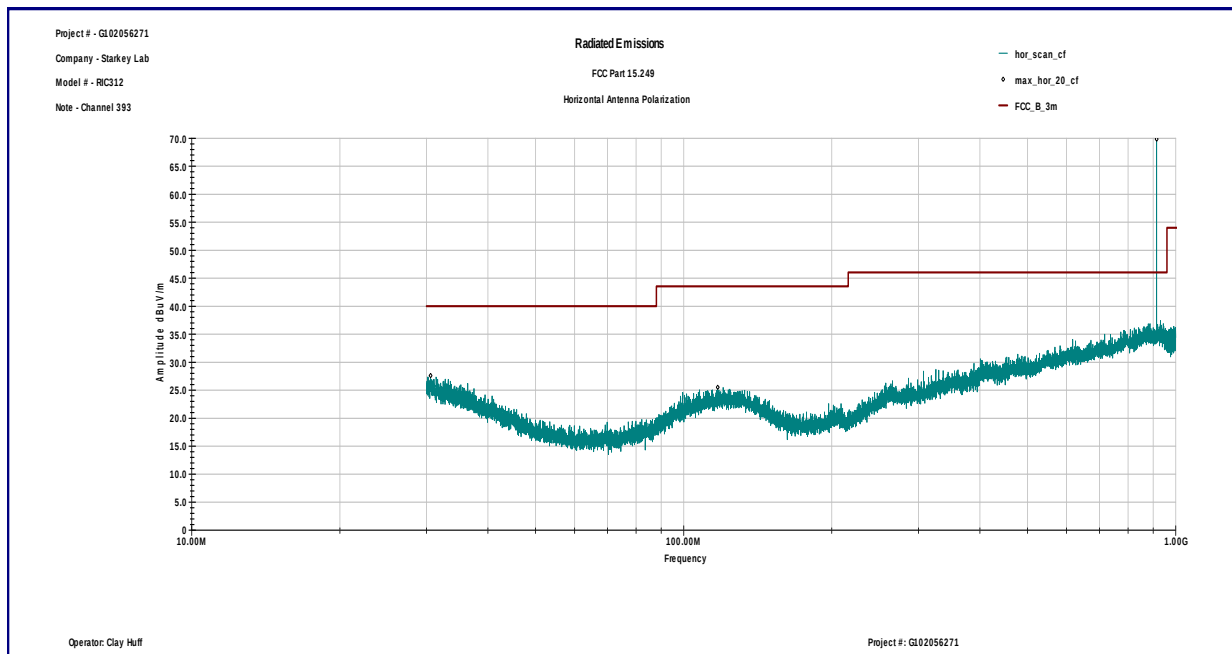


Graph 3.2.3

Vertical antenna polarization

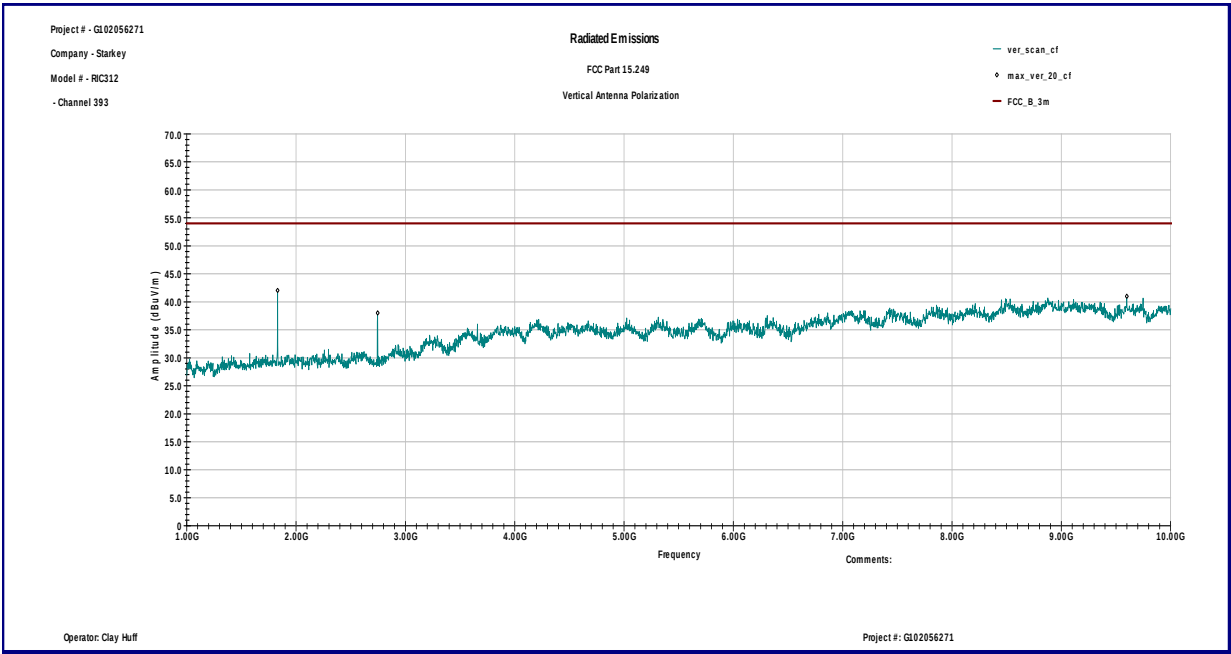


Horizontal antenna polarization

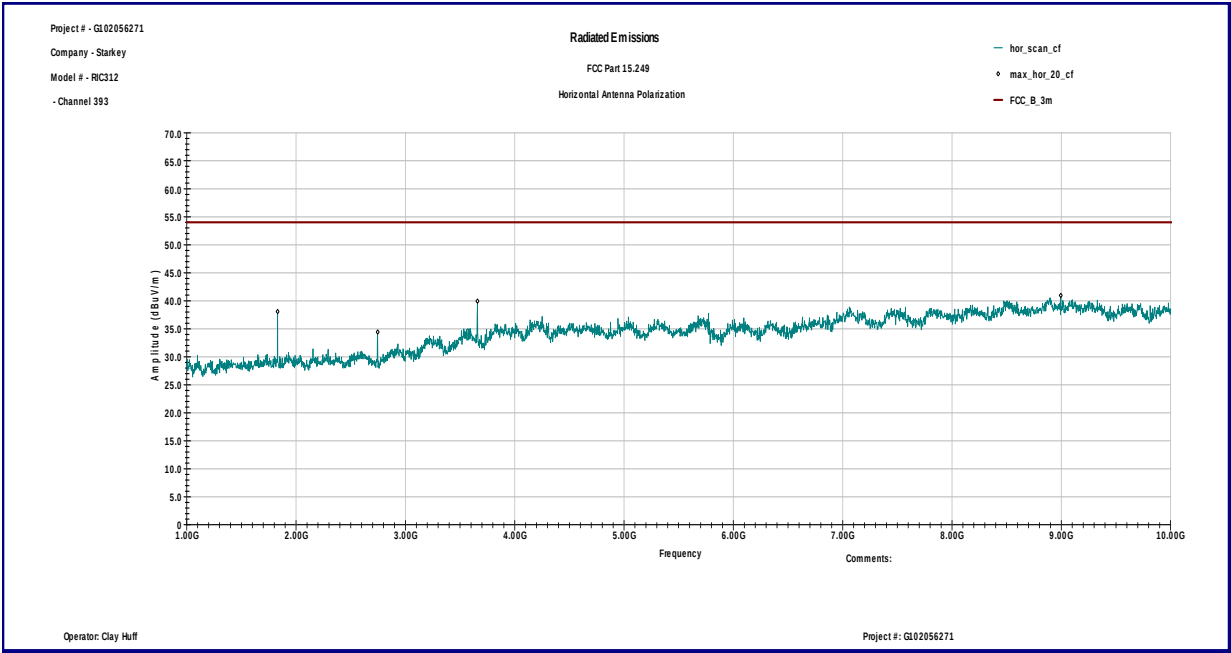


Graph 3.2.4

Vertical antenna polarization

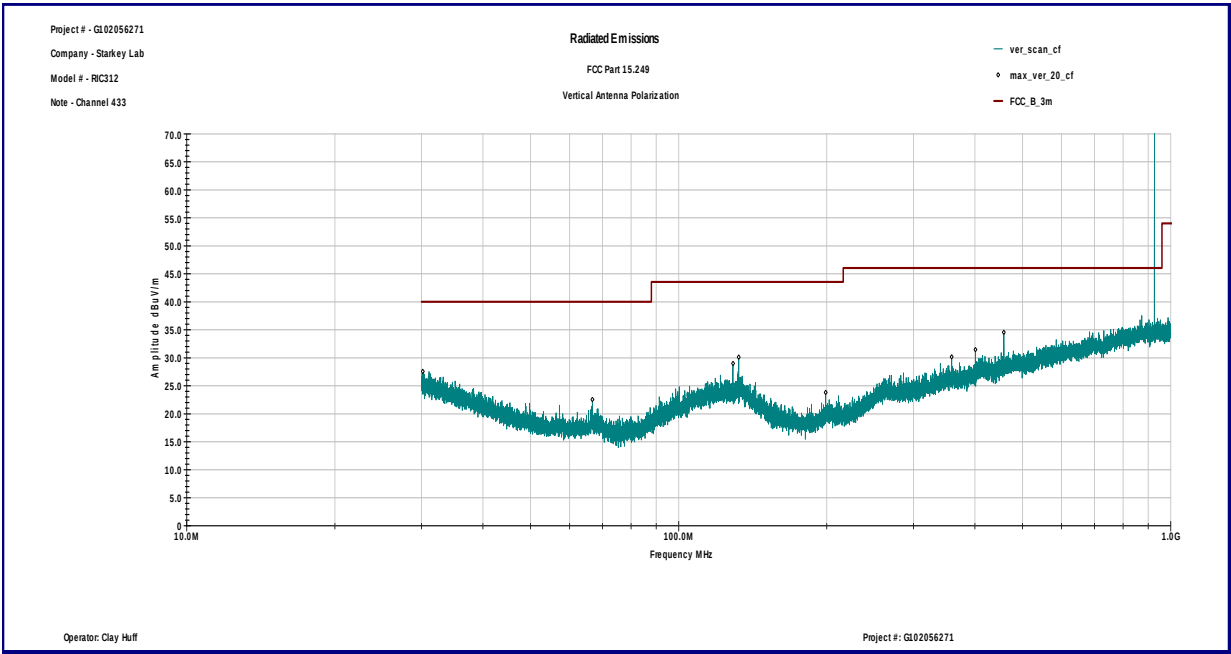


Horizontal antenna polarization

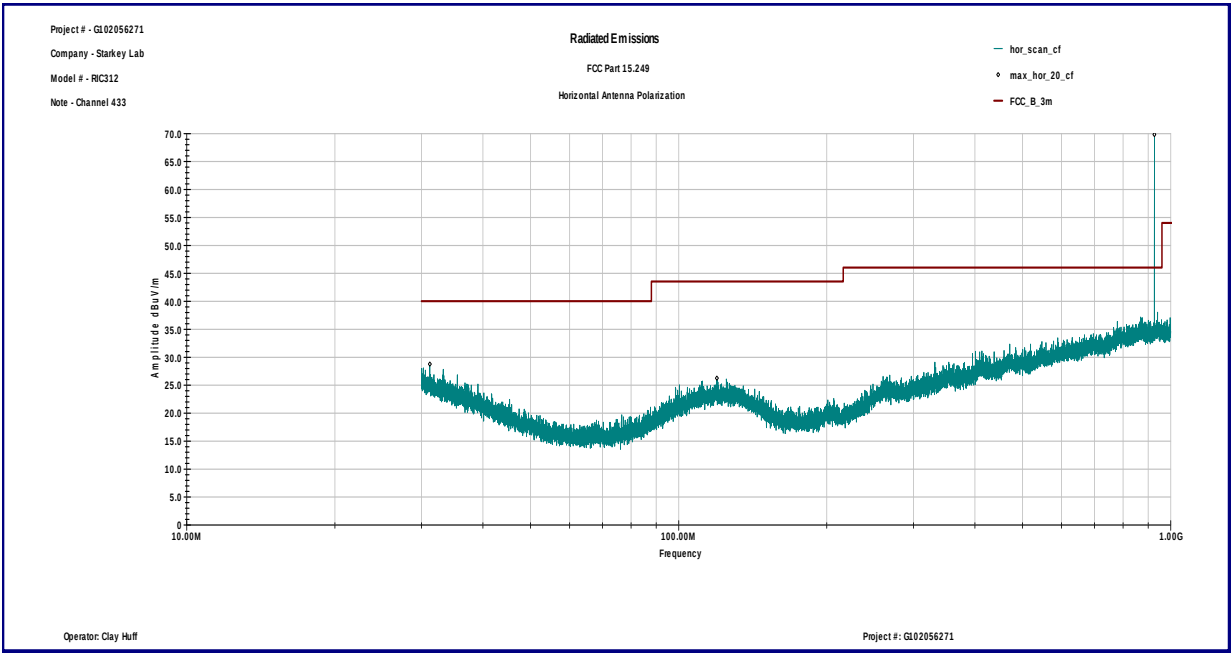


Graph 3.2.5

Vertical antenna polarization

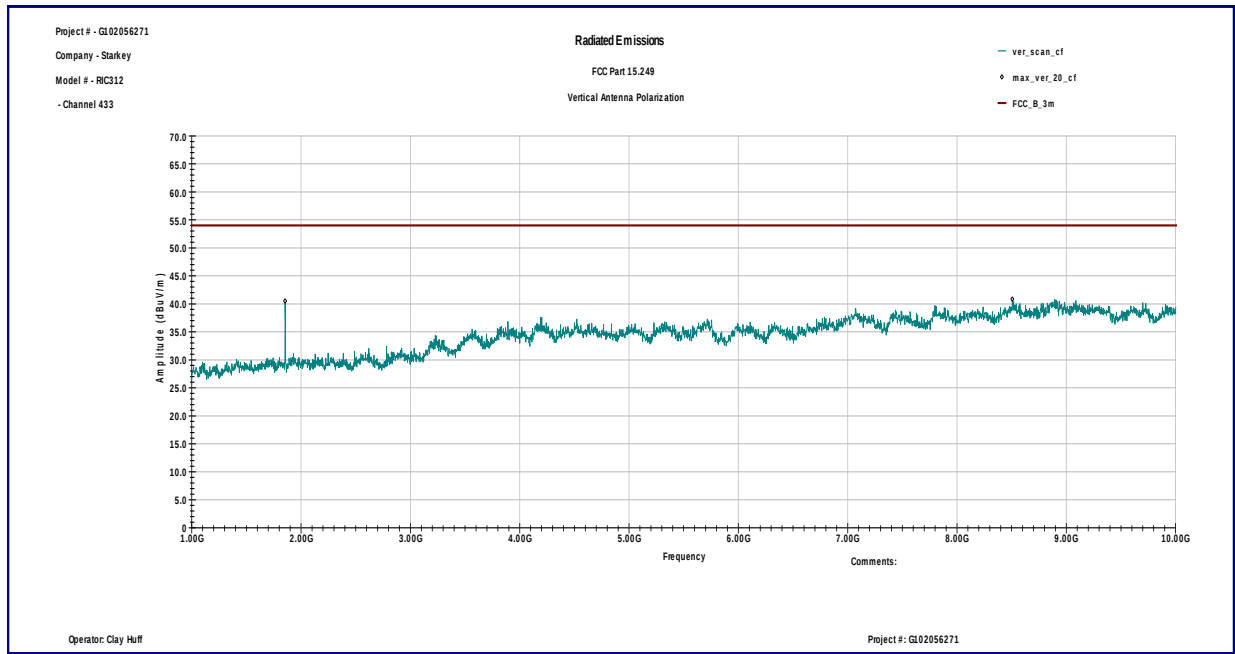


Horizontal antenna polarization

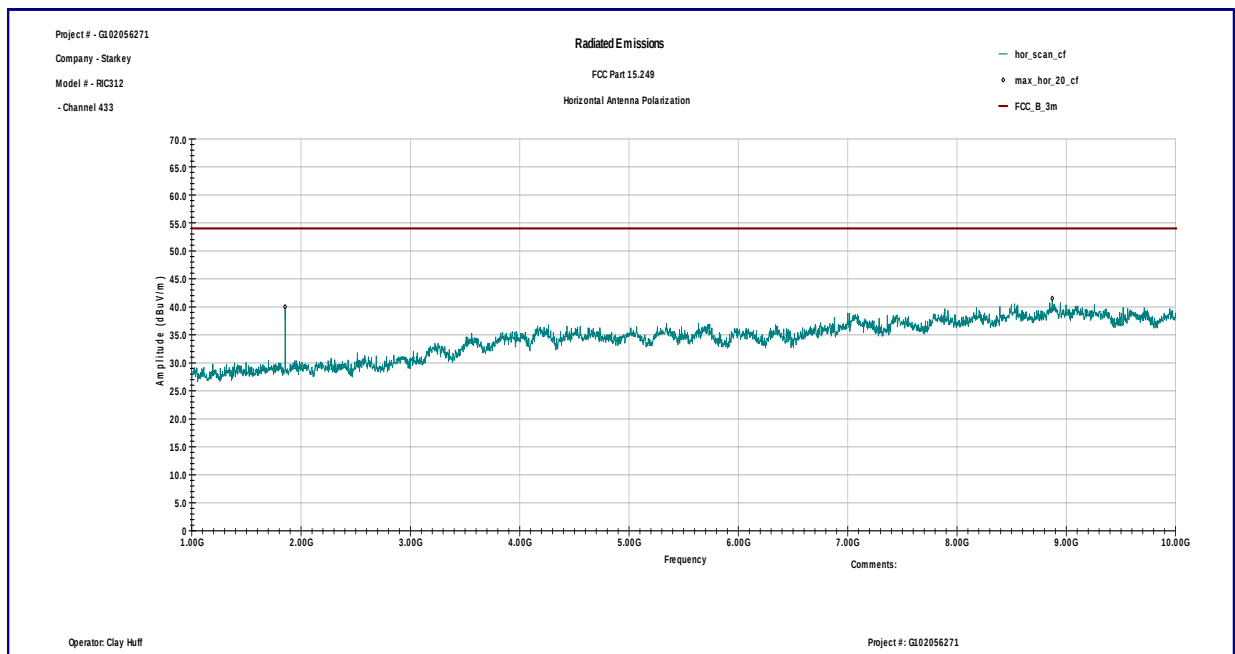


Graph 3.2.6

Vertical antenna polarization



Horizontal antenna polarization



3.2.1 Average correction factor calculation

N/A

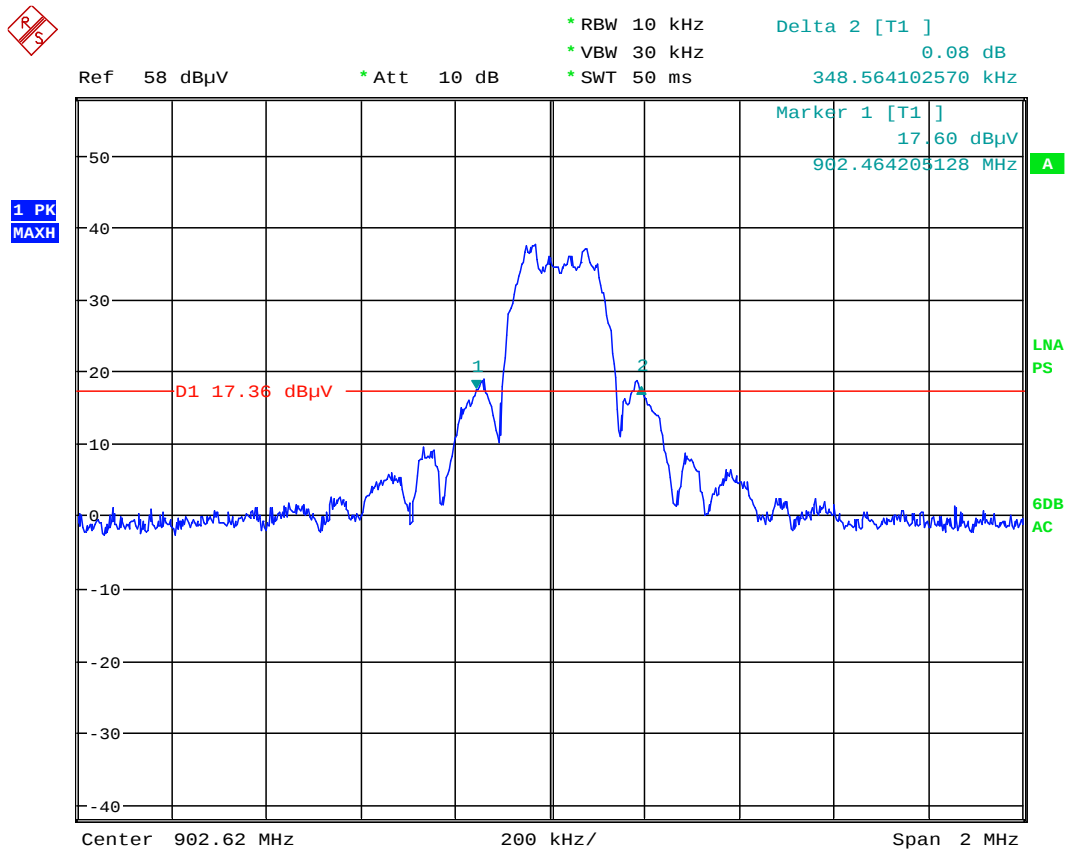
3.3 Bandwidth of Emissions

Center Frequency of operation MHz	Measured 20dB bandwidth kHz	Measured 99% bandwidth kHz
902.62	348.6 KHz	330.00 KHz
914.78	376.2 KHz	330.00 KHz
926.91	384.6 KHz	342.00 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

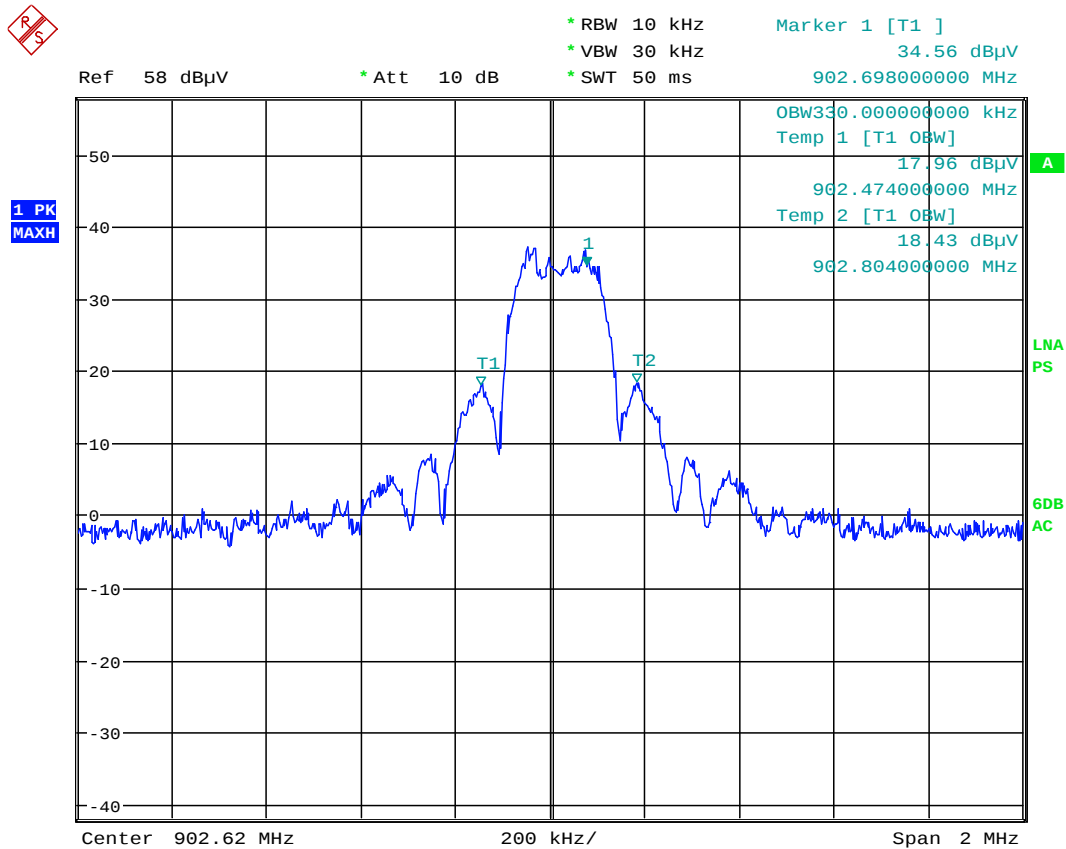
Notes: The bandwidth of emissions is contained within the frequency band of operation

Graph 3.3.1



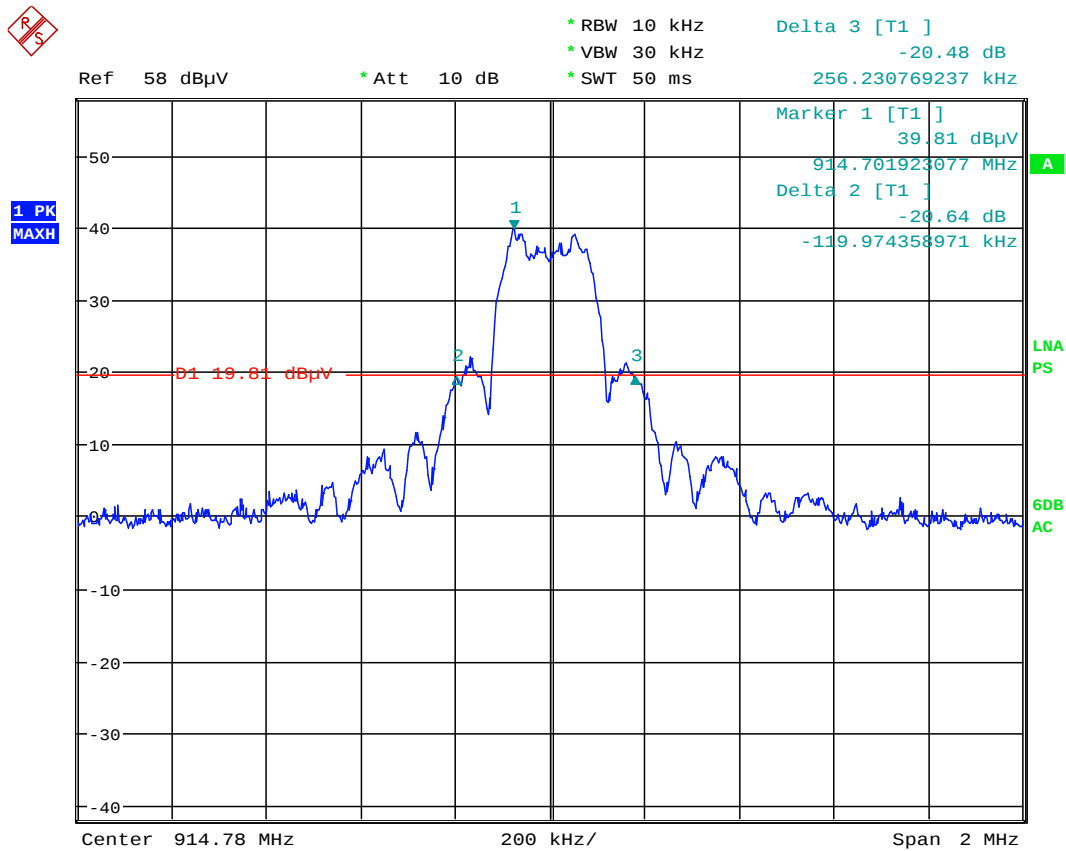
Date: 6.APR.2015 11:44:29

Graph 3.3.2



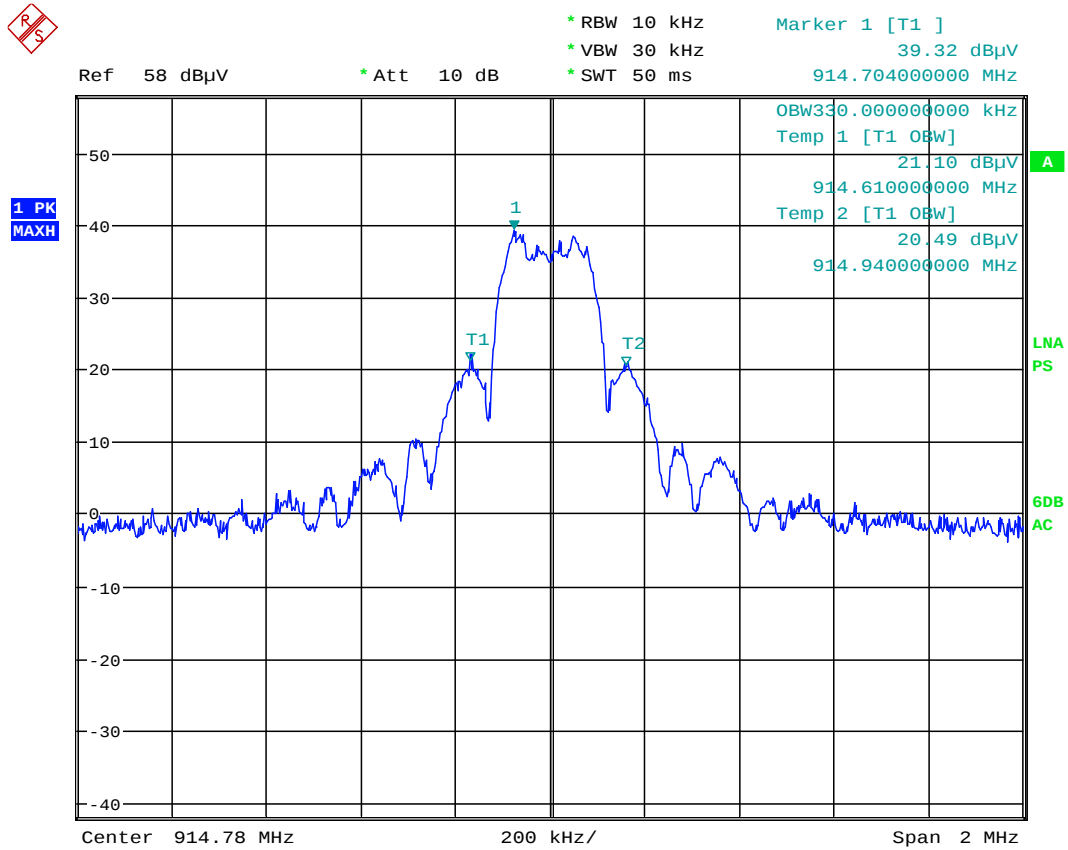
Date: 6.APR.2015 11:46:09

Graph 3.3.3



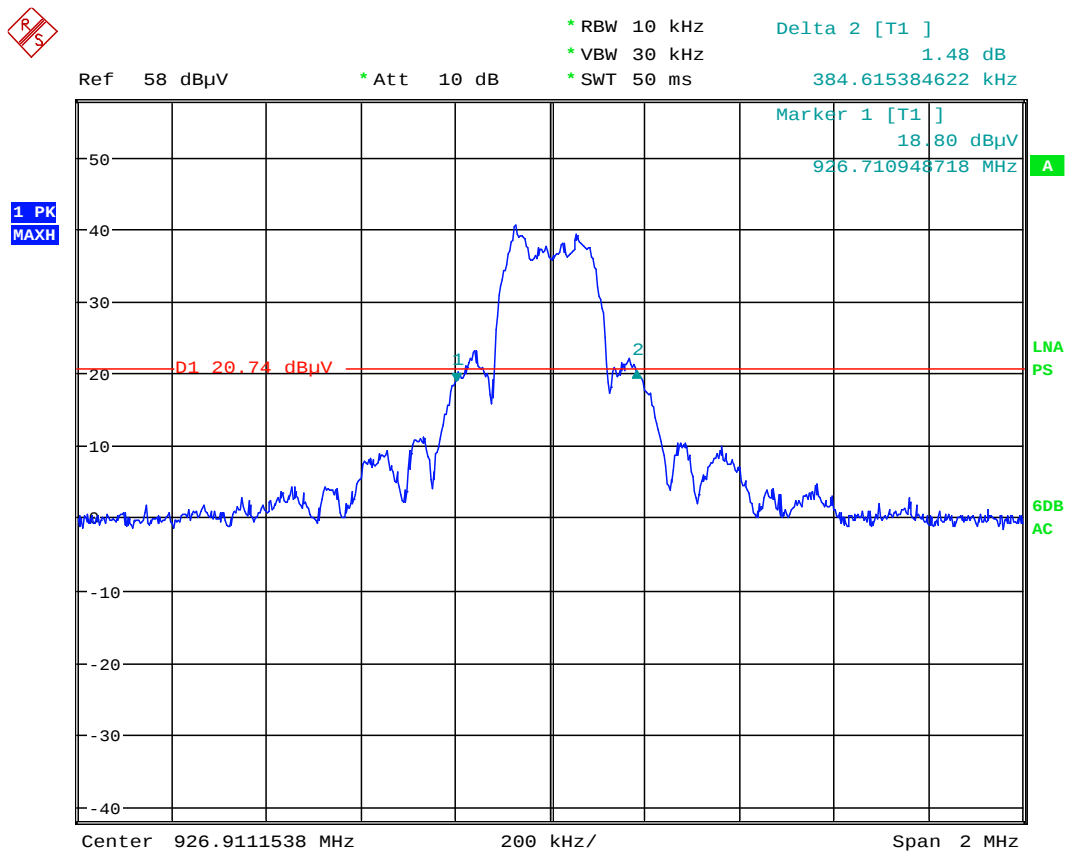
Date: 6.APR.2015 12:21:31

Graph 3.3.4



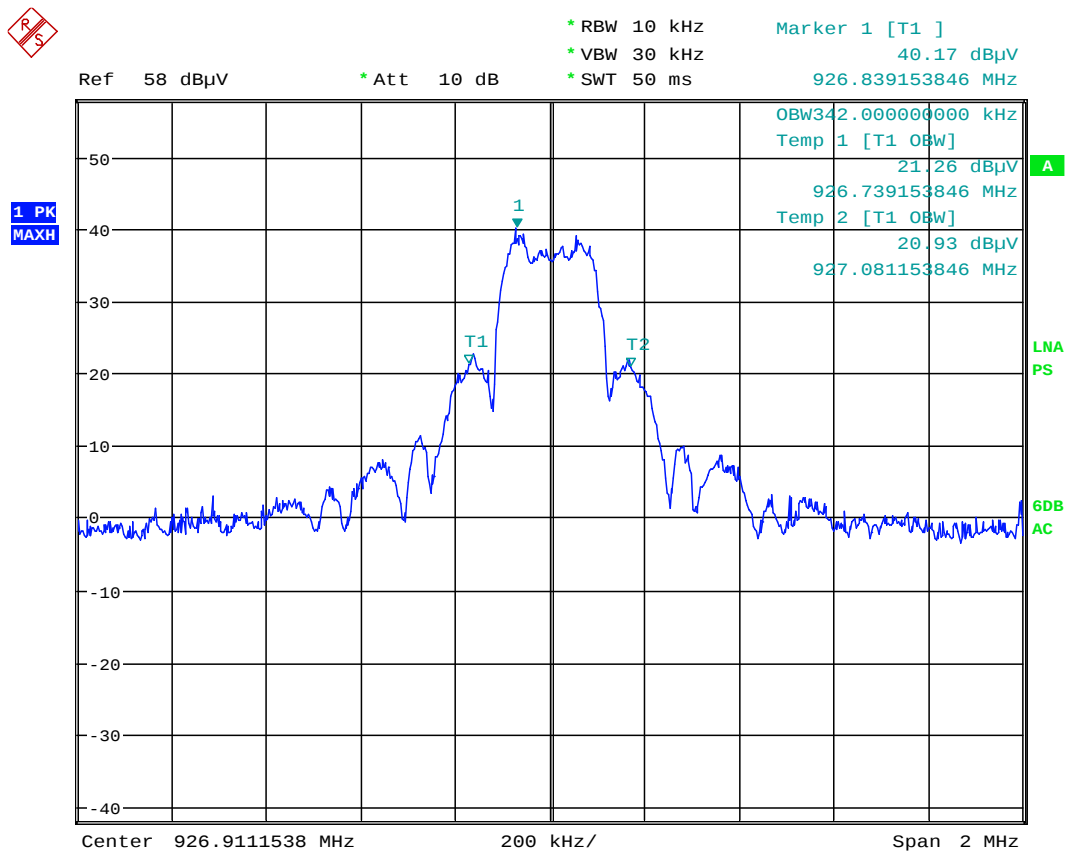
Date: 6.APR.2015 12:22:32

Graph 3.3.5



Date: 6.APR.2015 12:14:20

Graph 3.3.6



Date: 6.APR.2015 12:15:43



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: 11.5dB 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 and 3.5.2).

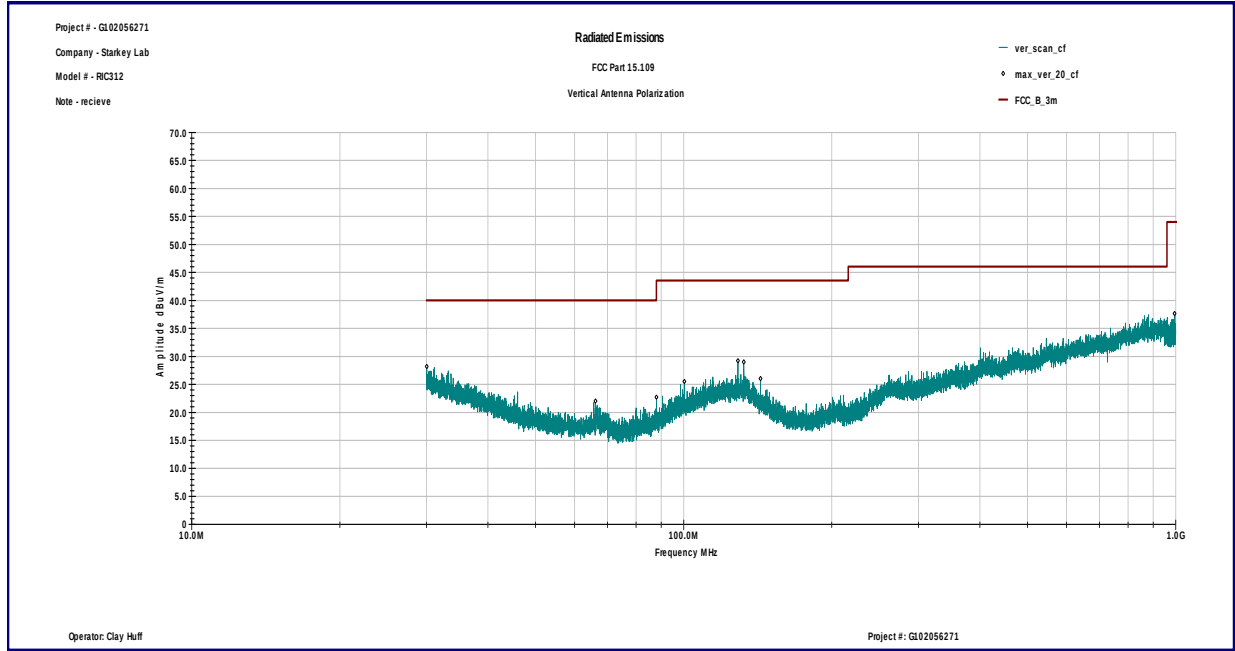
Date:	April 7, 2015	Result: Pass
Standard:	FCC Part 15.109, Class B	
Tested by:	Clay Huff	
Test Point:	Enclosure	
Operation mode:	Receiving/standby	
Note:	None	

Table 3.5.1

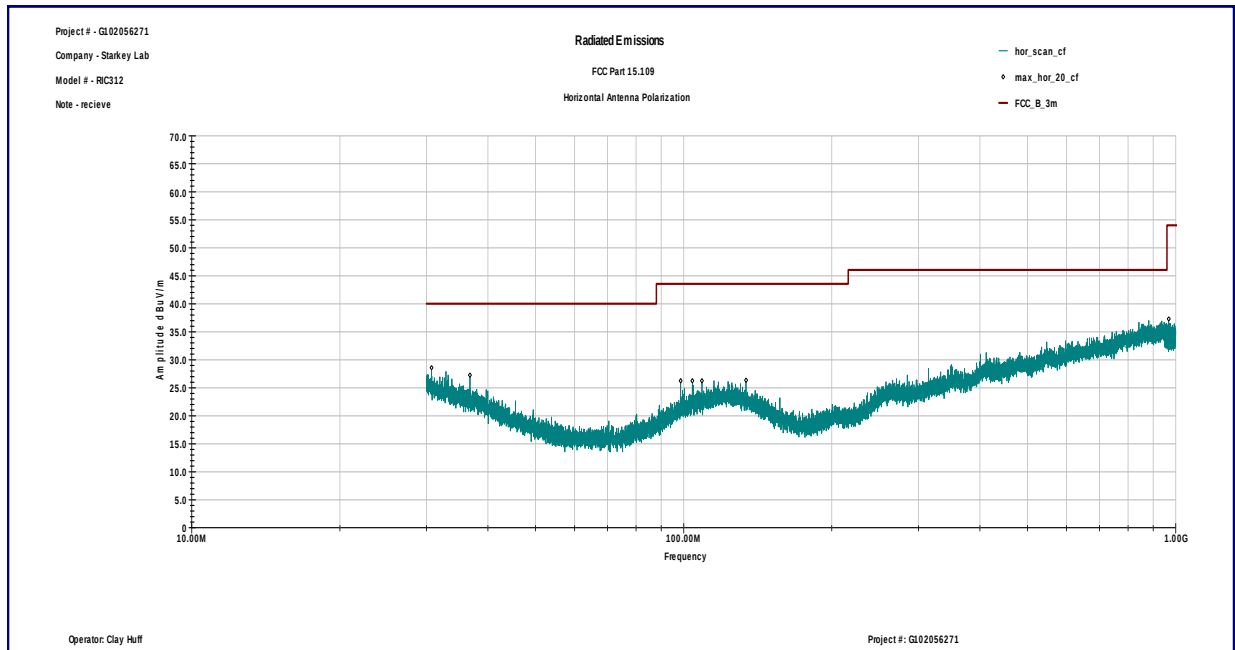
Frequency	Ant. Polarity	Peak Reading dBμV	Total C.F. dB1/m	Total at 3m dBμV/m	Limit dBμV/m	Margin dB
30.039 MHz	V	8.0	20.2	28.2	40.0	-11.8
66.166 MHz	V	15.0	7.0	22.0	40.0	-18.0
128.89 MHz	V	15.2	14.0	29.2	43.5	-14.3
132.48 MHz	V	15.2	13.8	29.0	43.5	-14.5
143.24 MHz	V	13.0	13.0	26.0	43.5	-17.5
30.715 MHz	H	8.8	19.8	28.6	40.0	-11.5
36.766 MHz	H	10.9	16.4	27.3	40.0	-12.8
108.92 MHz	H	12.9	13.4	26.2	43.5	-17.3
133.84 MHz	H	12.7	13.6	26.3	43.5	-17.2

Graph 3.5.1

Vertical antenna polarization



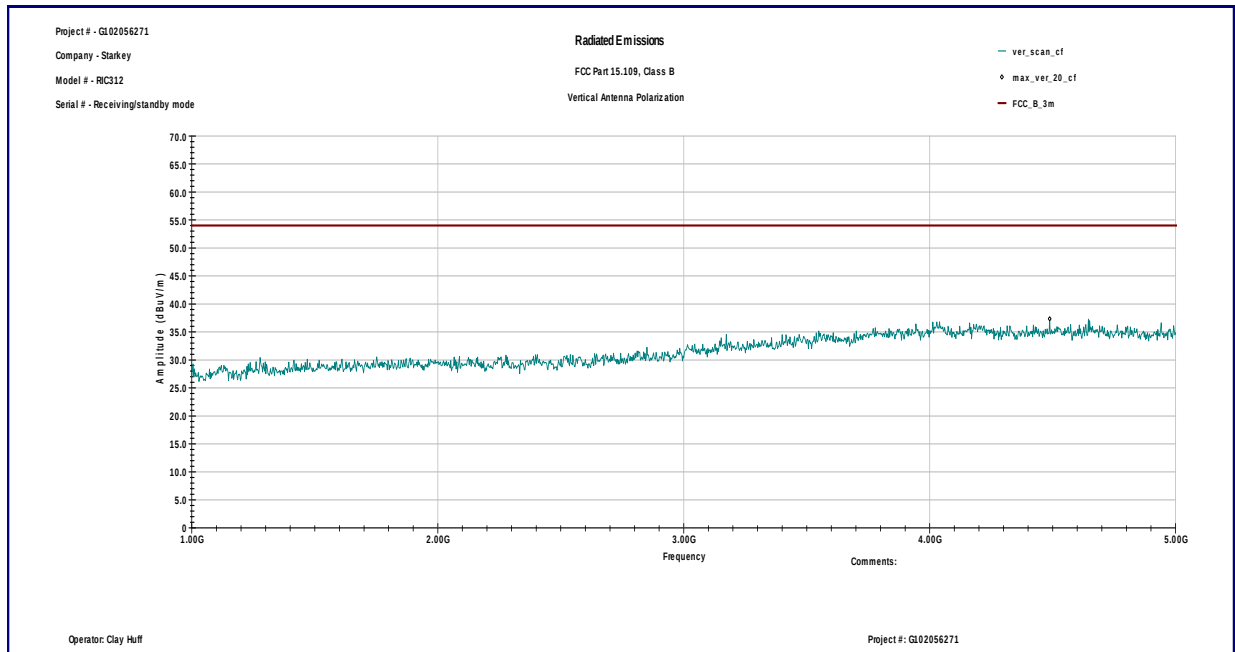
Horizontal antenna polarization



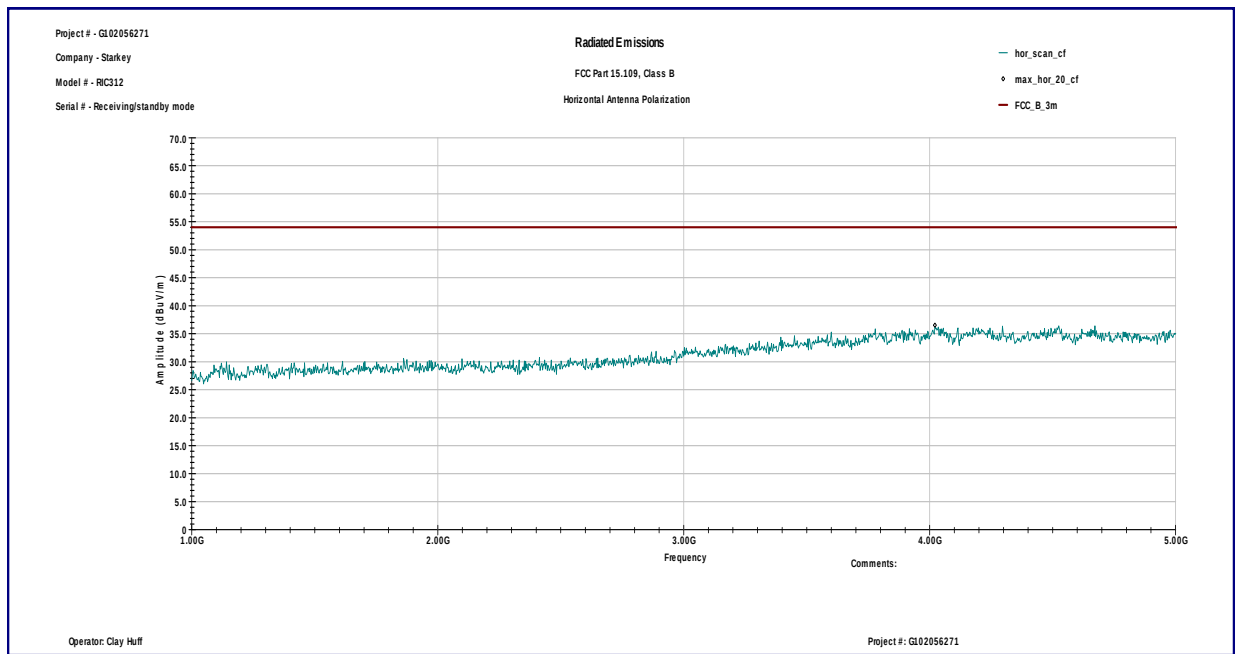


Graph 3.5.2

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	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	04-23-2015	102056271MIN-001	CH	US	Original Issue