



TEST REPORT

Report Number: 101726931MIN-001

Project Number: G101726931

Testing performed on the
Zseries B13d; A3 B13d; Start B13d, Zseries B312d; A3 B312d; Start B312d
Zseries 13P+; A3 13P+; Start 13P+; Zseries CIC; A3 CIC; Start CIC
Zseries ITC; A3 ITC; Start ITC; Zseries R312d; A3 R312d; Start R312d
Zseries mR312d; A3 mR312d; Start mR312d

FCC ID: EOA-ZSERIES-HI
Industry Canada ID: 6903A-ZSERIESHI

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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Oakdale, MN 55128 USA

Test Authorized by:
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Date: July 18, 2014

Reviewed by: Simon Khazon
Simon Khazon

Date: July 18, 2014

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1.0 GENERAL DESCRIPTION

Model:	Zseries R312d
Type of EUT:	Hearing Aid
Serial Number:	14044022
FCC ID:	EOA-ZSERIES-HI
Industry Canada ID:	6903A-ZSERIESHI
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:	July 14, 2014
Test Work Started:	July 14, 2014
Test Work Completed:	July 18, 2014
Test Sample Conditions:	☐ Damaged ☐ Poor (Usable) ☒ Good



1.1 Product Description; Test Facility

Product Description:	Hearing Aid
Operating Frequency	902.63-926.90MHz
Modulation:	FSK
Emission Designator:	322KFXD
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 un-modulated
- ☐ - 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	

Note: According to the manufacturer models: Zseries B13d; A3 B13d; Start B13d; A3 312d; Start B312d; Zseries 13P+; A3 13P+; Start 13P+; Zseries CIC; A3 CIC; Start CIC; Zseries ITC; A3 ITC; Start ITC; Zseries R312d; A3 R312d; Start R312d; Zseries mR312d; A3 mR312d; Start mR312d are electrically identical.

Model: Zseries R312d was tested as a representative model.

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(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).

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

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

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

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

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

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

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

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: 17.6dB below the limits

Notes: None



Date:	July 17, 2014	Result: Pass
Standard:	FCC 15.249(a) / RSS-210 A2.9	
Tested by:	Uri Spector	
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										
902.70	V	134	21.5	2.6	0.0	52.3	76.4	94.0	-17.6	Peak
902.70	H	208	21.5	2.6	0.0	48.3	72.4	94.0	-21.6	Peak
Channel 393										
914.83	V	125	21.7	2.6	0.0	51.8	76.1	94.0	-17.9	Peak
914.83	H	191	21.7	2.6	0.0	47.2	71.5	94.0	-22.5	Peak
Channel 433										
926.97	V	114	21.8	2.6	0.0	50.3	74.8	94.0	-19.2	Peak
926.97	H	188	21.8	2.6	0.0	45.9	70.4	94.0	-23.6	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: 5.1dB 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:	July 16-17, 2014	Result: Pass
Standard:	FCC 15.249(a) and (d) / RSS-210 A2.9	
Tested by:	Uri Spector	
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	63.0	29.5	43.6	48.9	54.0	-5.1
2.71 GHz	V	50.5	32.6	44.0	39.1	54.0	-14.9
4.5172 GHz	V	46.9	37.0	42.3	41.5	54.0	-12.4
1.8064 GHz	H	55.5	29.1	43.6	41.0	54.0	-13.0
4.5172 GHz	H	46.7	36.8	42.3	41.2	54.0	-12.8
Channel 393							
1.8316 GHz	V	62.6	29.6	43.6	48.6	54.0	-5.4
2.746 GHz	V	48.9	32.7	44.0	37.6	54.0	-16.4
1.8316 GHz	H	53.9	29.2	43.6	39.6	54.0	-14.4
Channel 433							
1.8568 GHz	V	62.5	29.7	43.6	48.6	54.0	-5.4
1.8568 GHz	H	50.9	29.4	43.6	36.7	54.0	-17.3

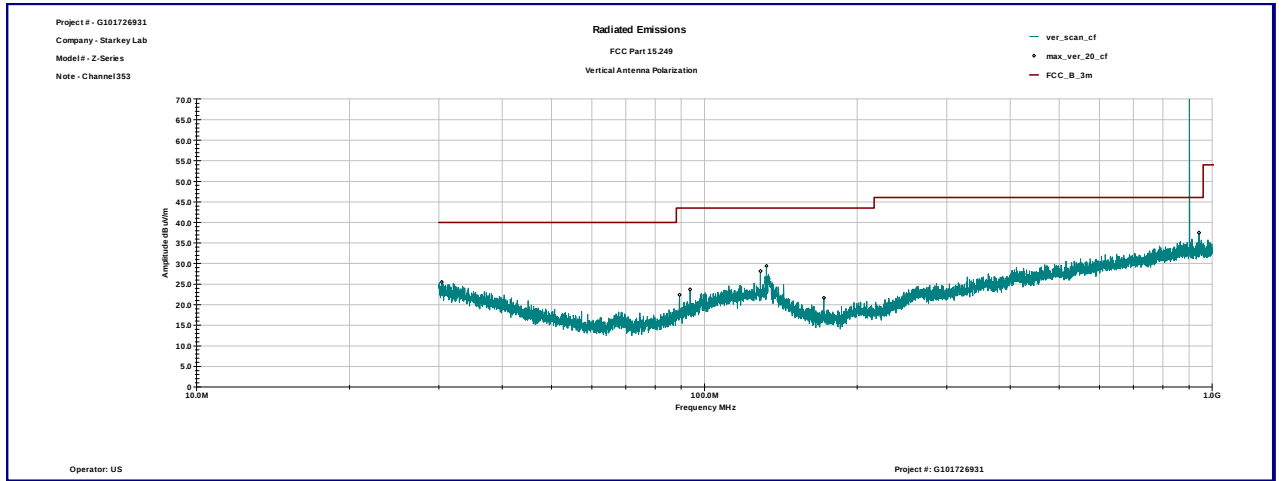
Table 3.2.2

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)								
Bandedge Compliance										
902.00	V	133	21.5	2.6	0.0	14.7	38.8	46.0	-7.2	Peak
902.00	H	203	21.5	2.6	0.0	13.0	37.1	46.0	-8.9	Peak
928.00	V	100	21.8	2.6	0.0	10.1	34.6	46.0	-11.4	Peak
928.00	H	100	21.8	2.6	0.0	9.9	34.4	46.0	-11.6	Peak

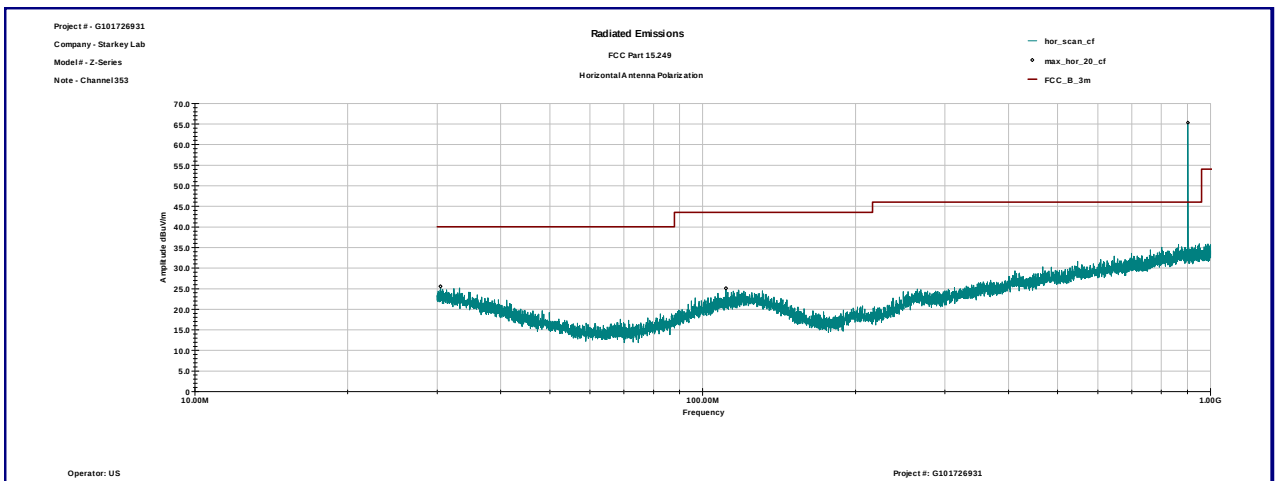


Graph 3.2.1

Vertical antenna polarization



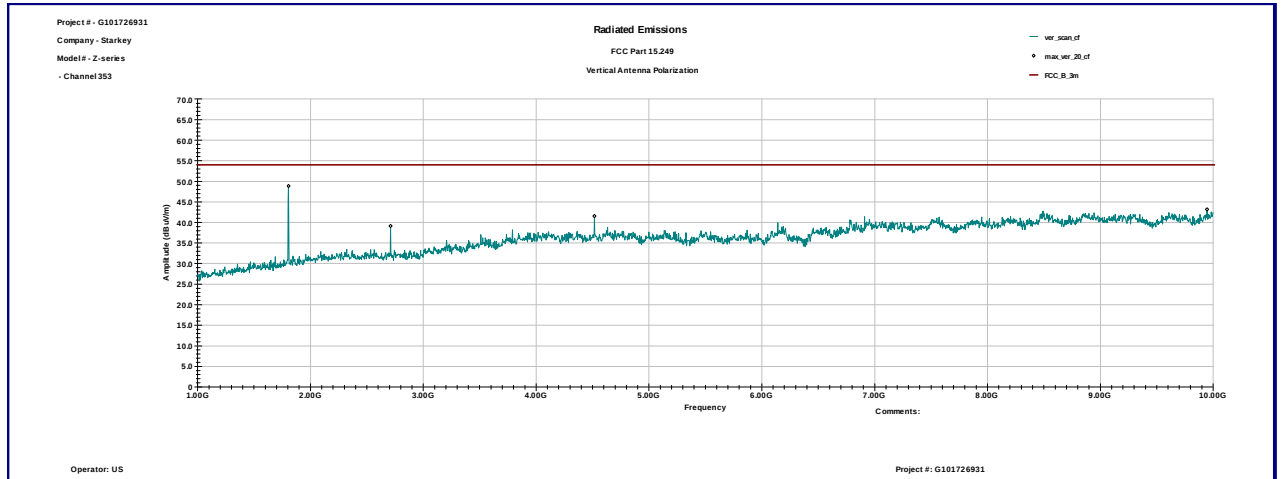
Horizontal antenna polarization



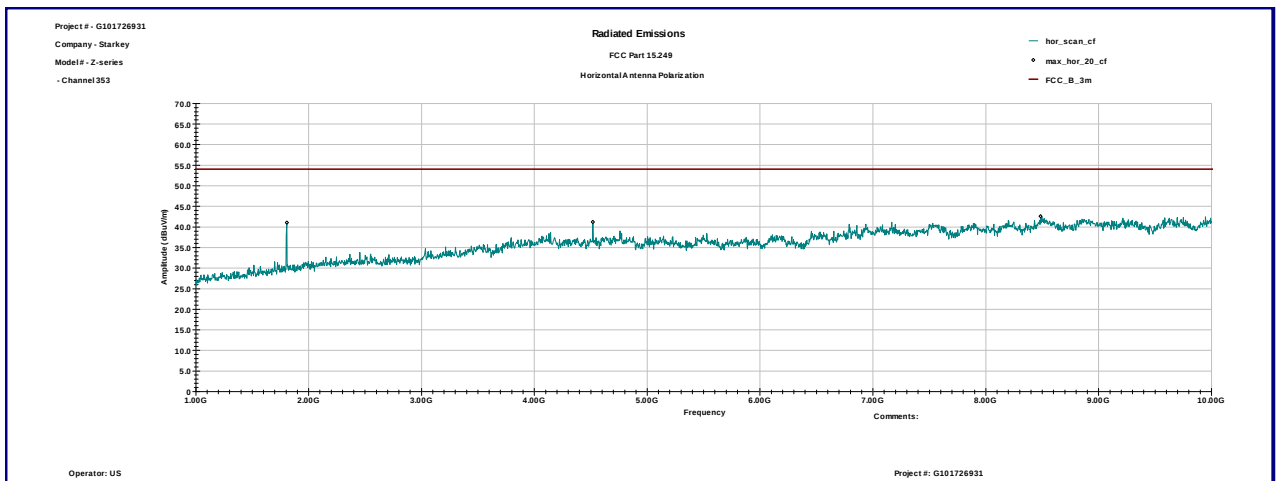


Graph 3.2.2

Vertical antenna polarization



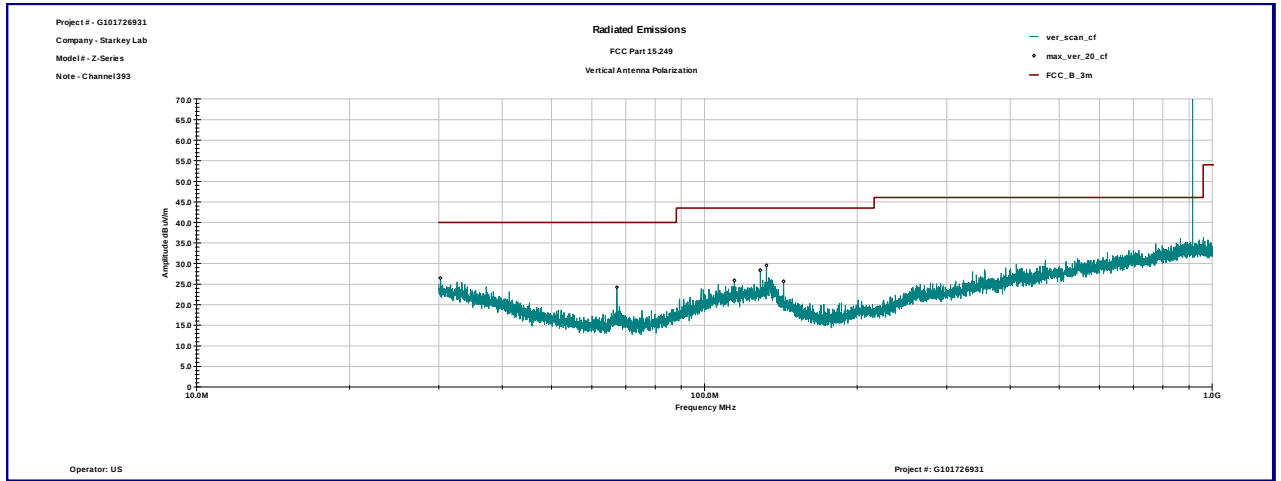
Horizontal antenna polarization



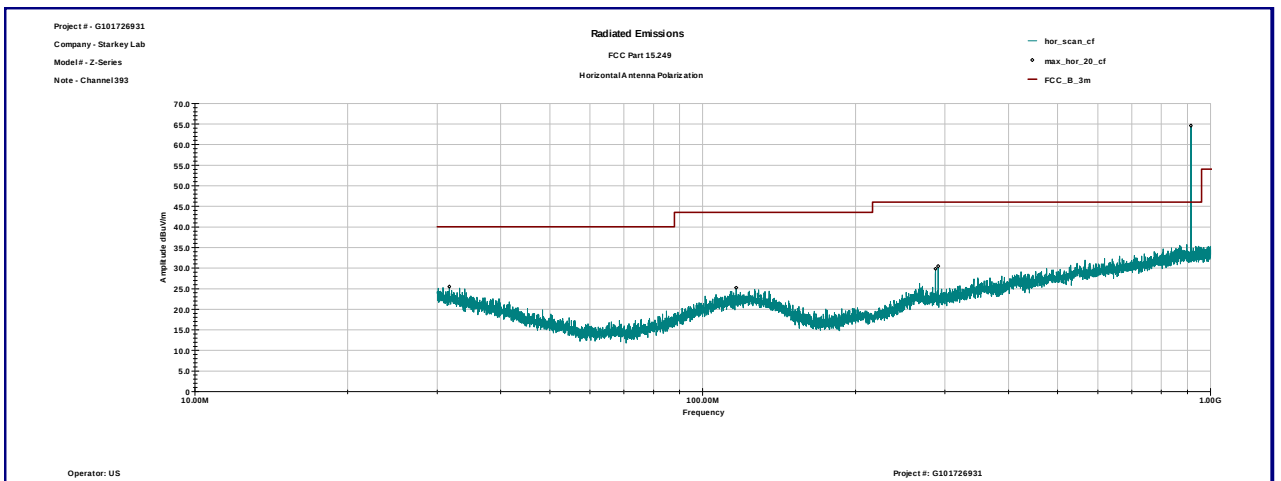


Graph 3.2.3

Vertical antenna polarization



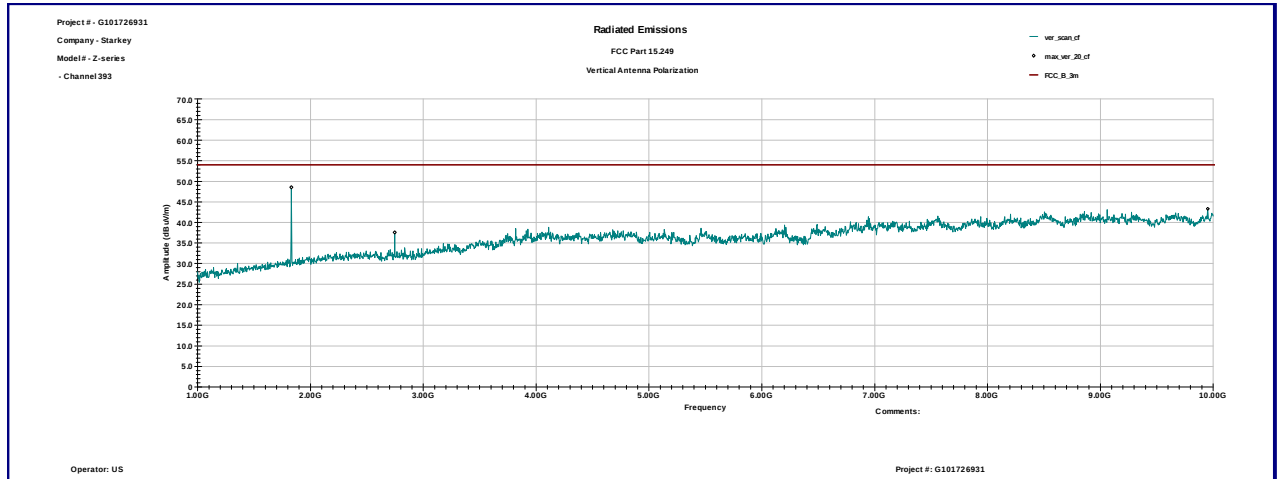
Horizontal antenna polarization



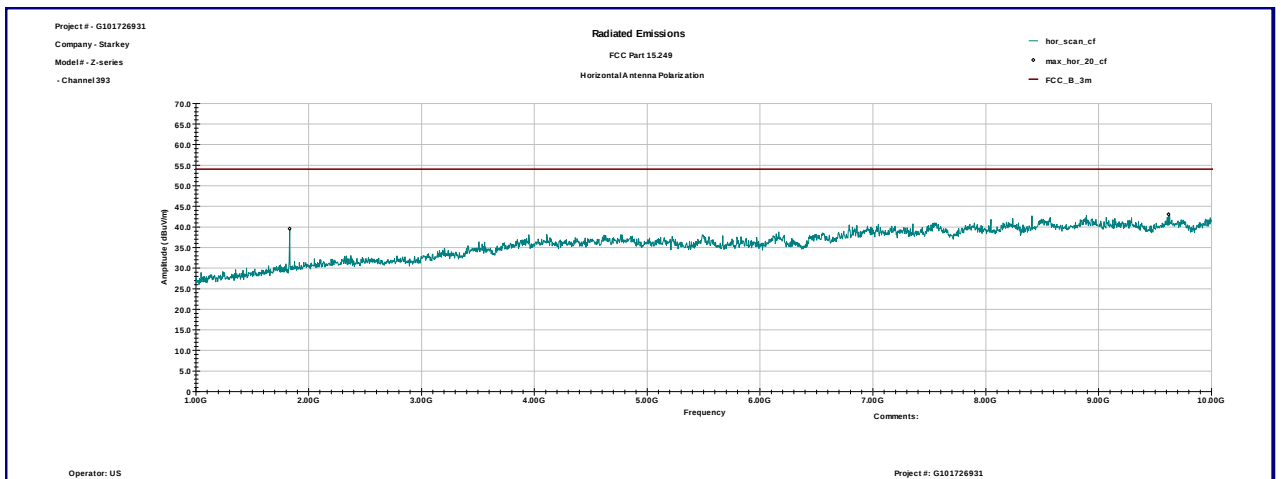


Graph 3.2.4

Vertical antenna polarization



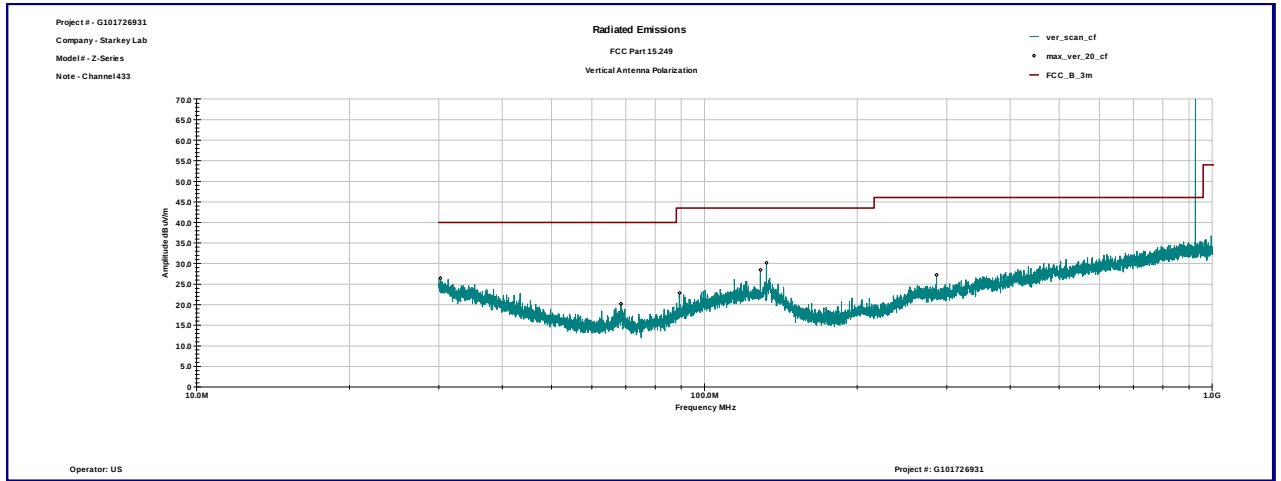
Horizontal antenna polarization



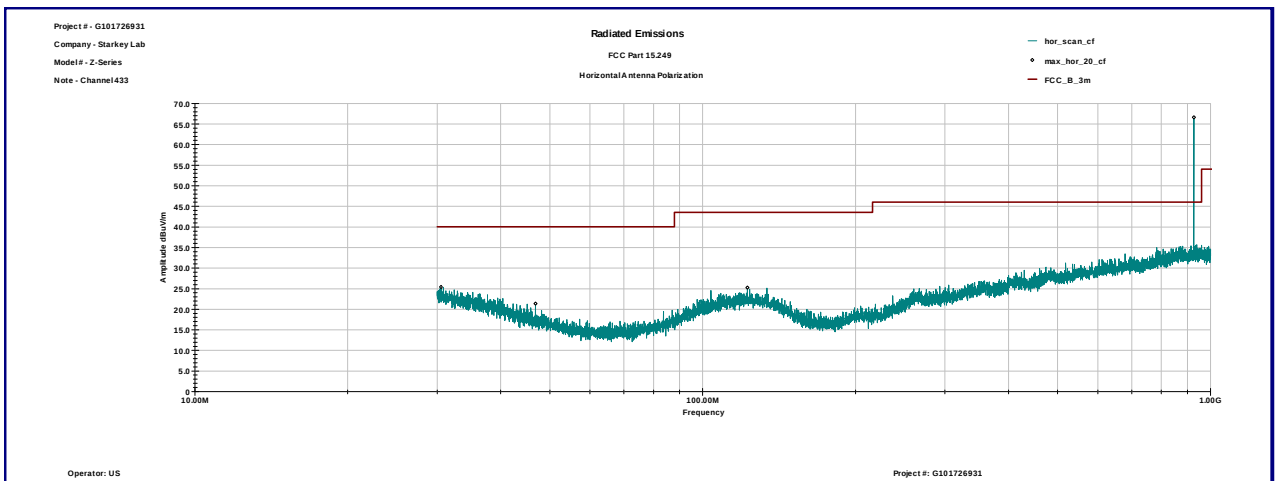


Graph 3.2.5

Vertical antenna polarization



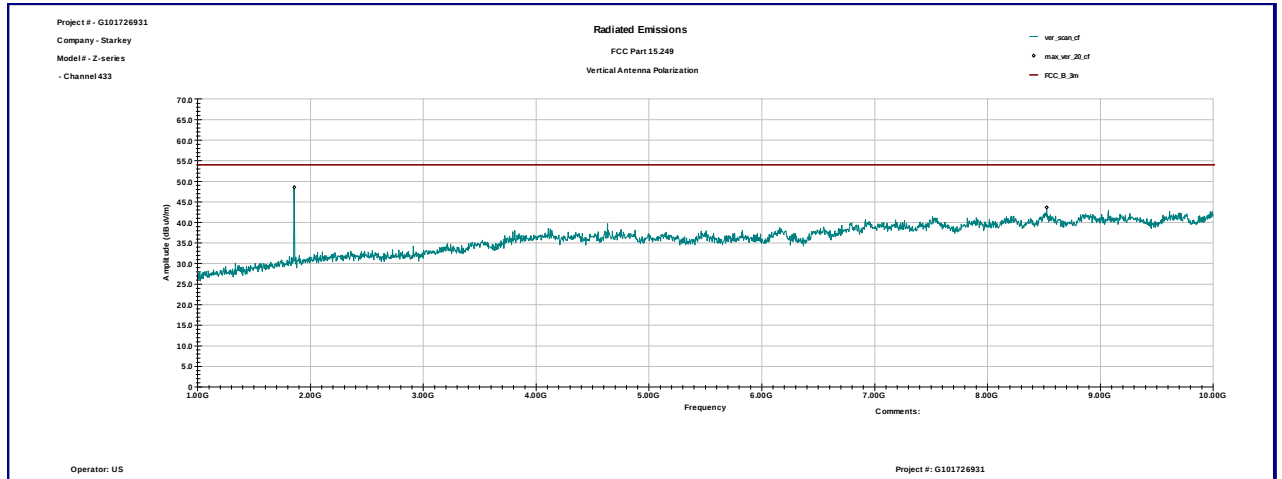
Horizontal antenna polarization



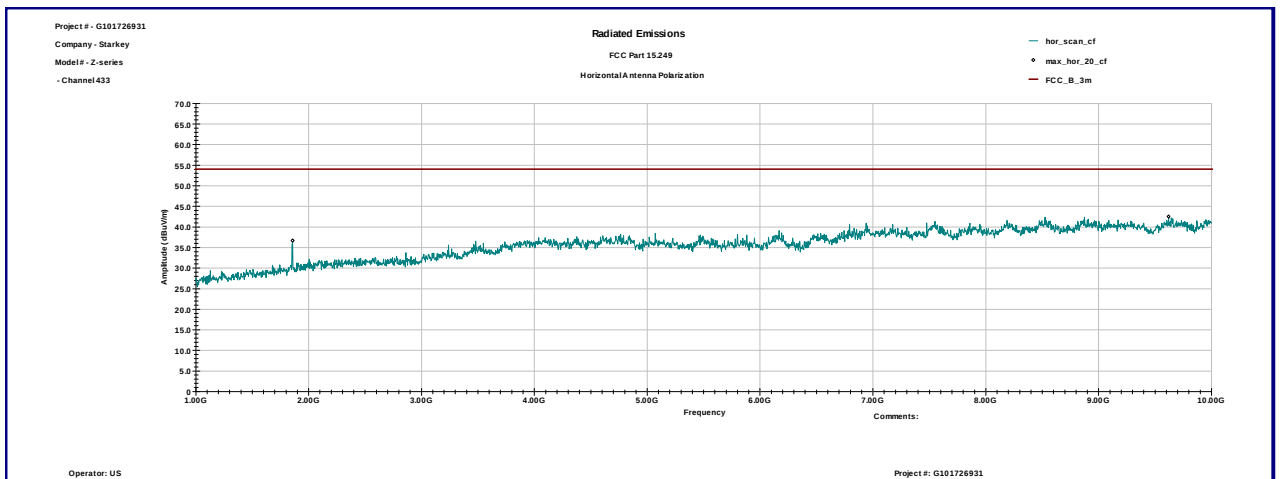


Graph 3.2.6

Vertical antenna polarization



Horizontal antenna polarization





3.2.1 Average correction factor calculation

N/A



3.3 Bandwidth of Emissions

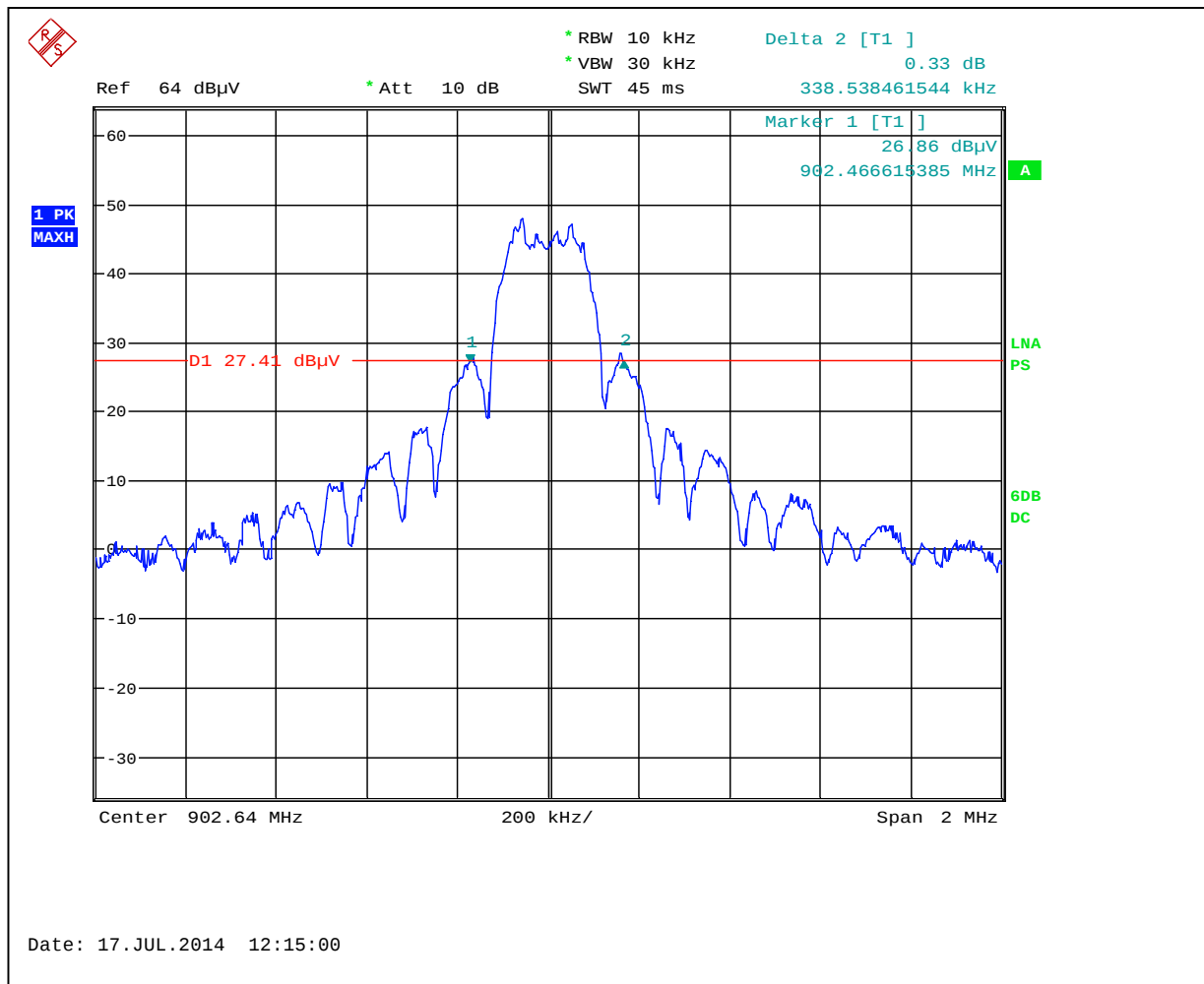
Center Frequency of operation MHz	Measured 20dB bandwidth kHz	Measured 99% bandwidth kHz
902.64	338.54	256.00
914.77	354.56	322.00
926.91	353.54	280.00

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



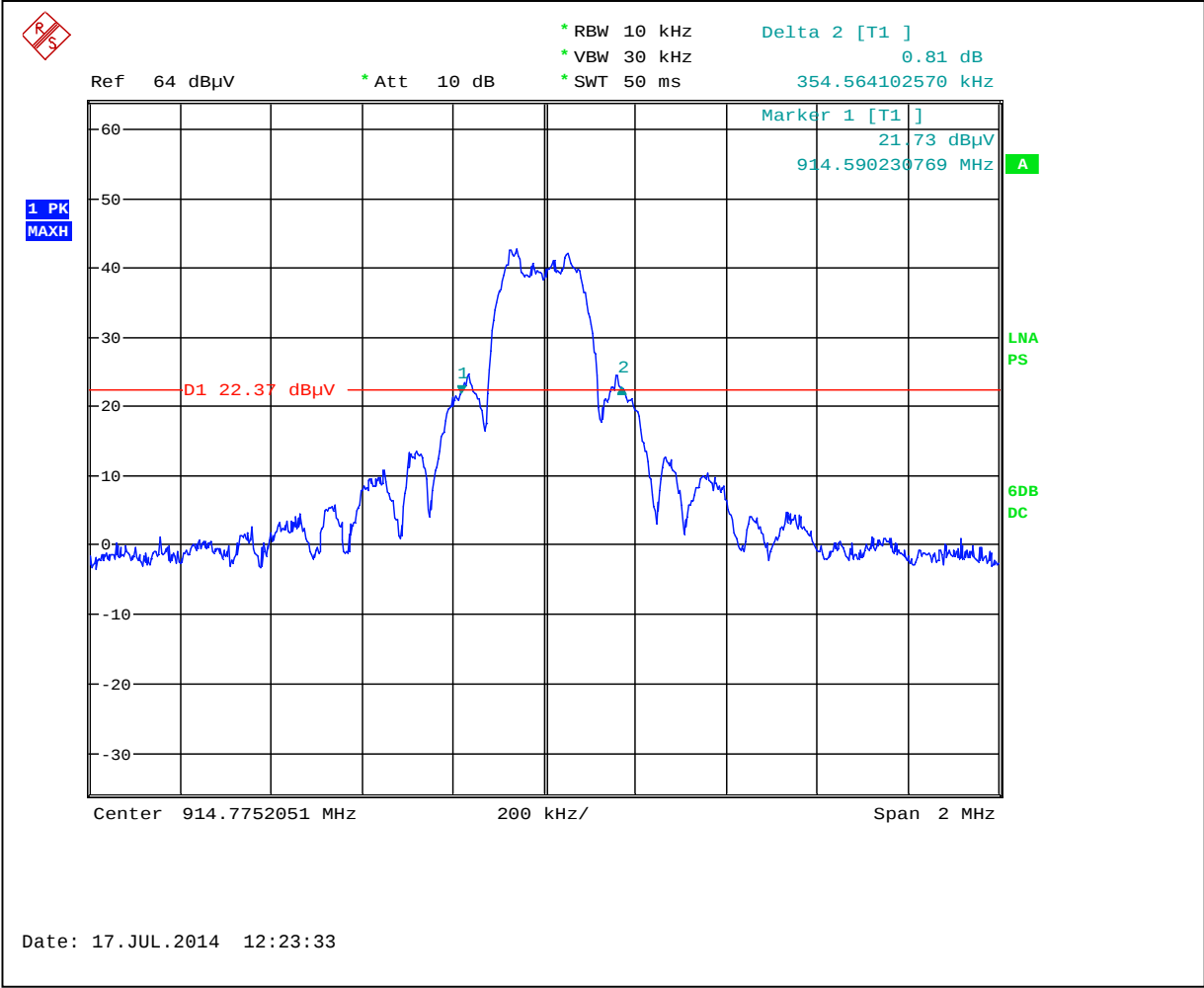


Graph 3.3.2





Graph 3.3.3

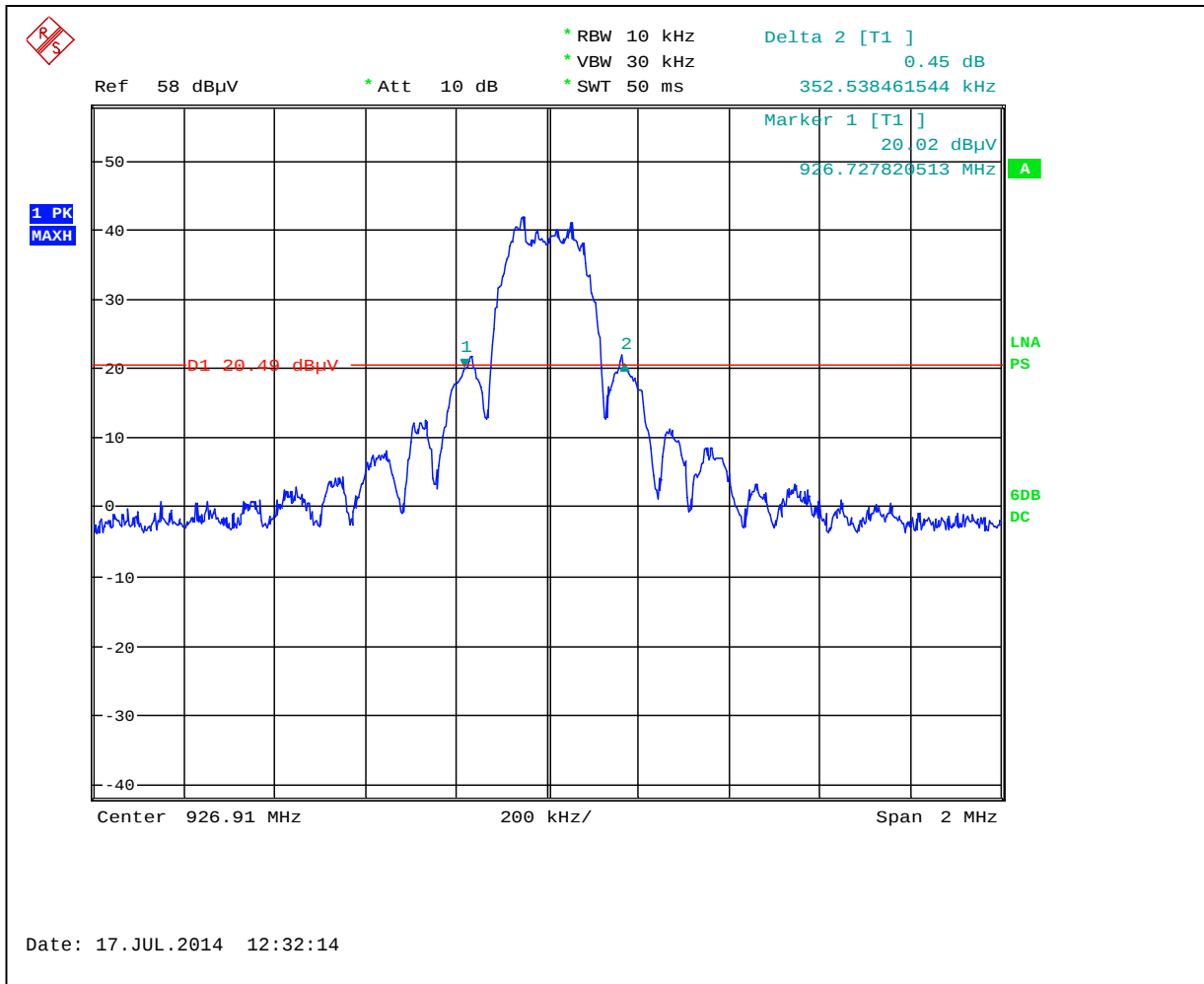




Graph 3.3.4

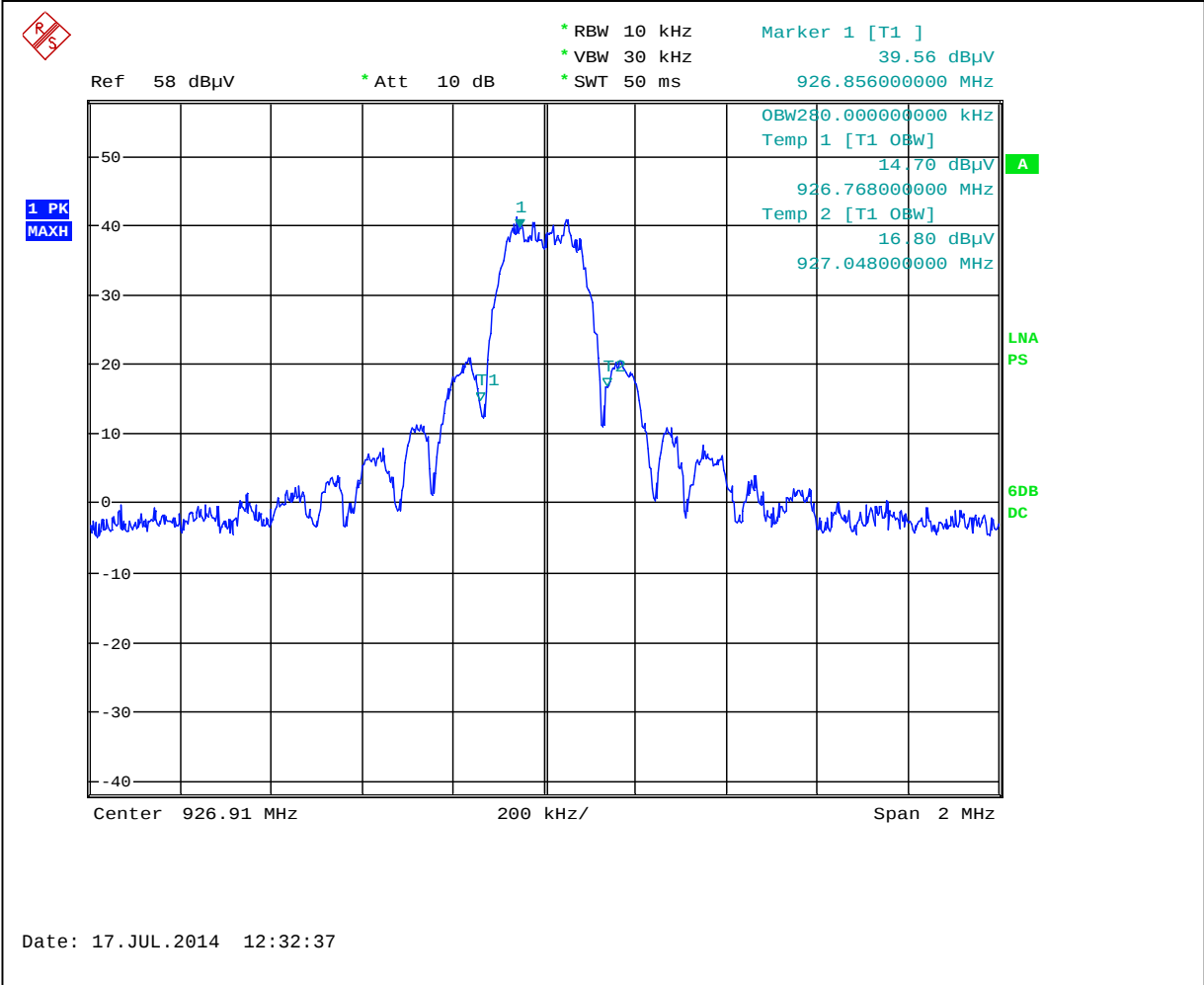


Graph 3.3.5





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: 13.9dB 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:	July 15-16, 2014	Result: Pass
Standard:	FCC Part 15.109, Class B	
Tested by:	Uri Spector	
Test Point:	Enclosure	
Operation mode:	Receiving/standby	
Note:	None	

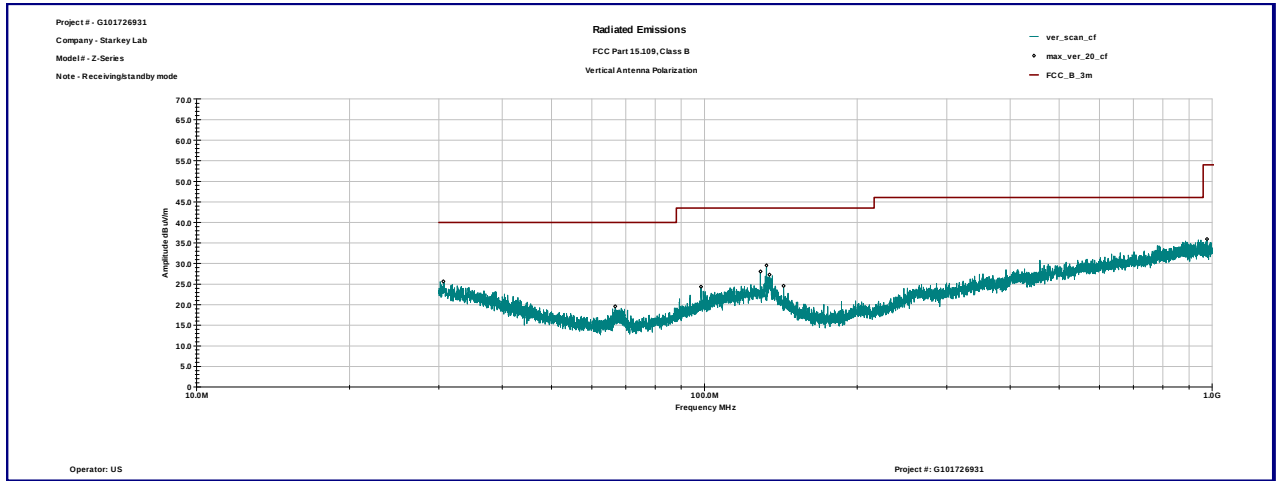
Table 3.5.1

Frequency	Ant. Polarity	Peak Reading dB μ V	Total C.F. dB1/m	Total at 3m dB μ V/m	Limit dB μ V/m	Margin dB
30.614 MHz	V	5.8	19.9	25.7	40.0	-14.3
66.736 MHz	V	12.6	7.0	19.6	40.0	-20.4
98.496 MHz	V	12.2	12.2	24.4	43.5	-19.2
128.93 MHz	V	14.1	14.0	28.1	43.5	-15.5
132.5 MHz	V	15.8	13.8	29.6	43.5	-13.9
134.24 MHz	V	13.7	13.6	27.3	43.5	-16.2
143.25 MHz	V	11.5	13.0	24.6	43.5	-19.0
30.018 MHz	H	5.0	20.2	25.2	40.0	-14.8
123.55 MHz	H	11.0	14.0	24.9	43.5	-18.6

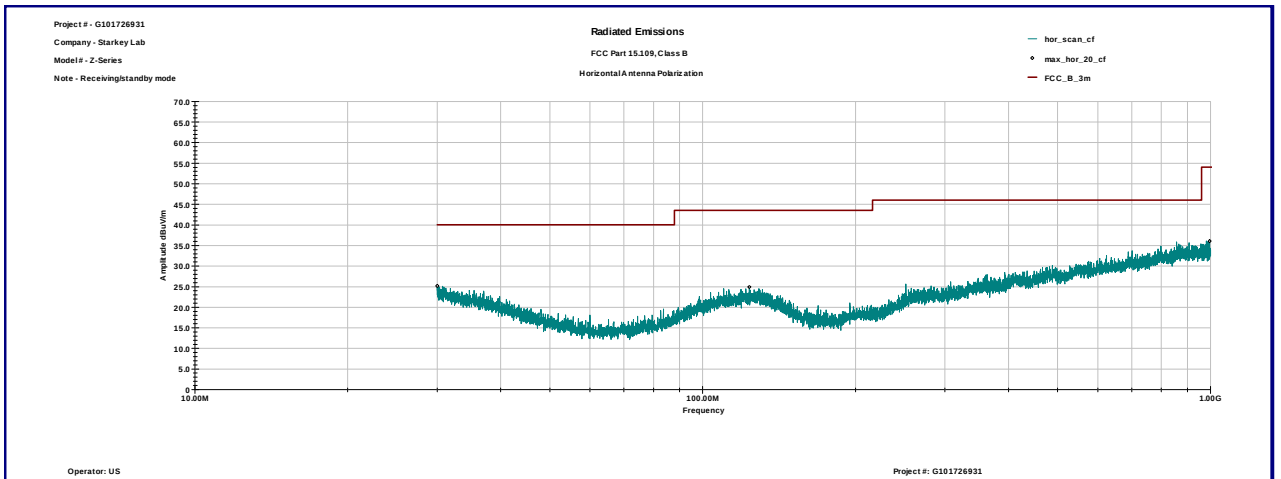


Graph 3.5.1

Vertical antenna polarization



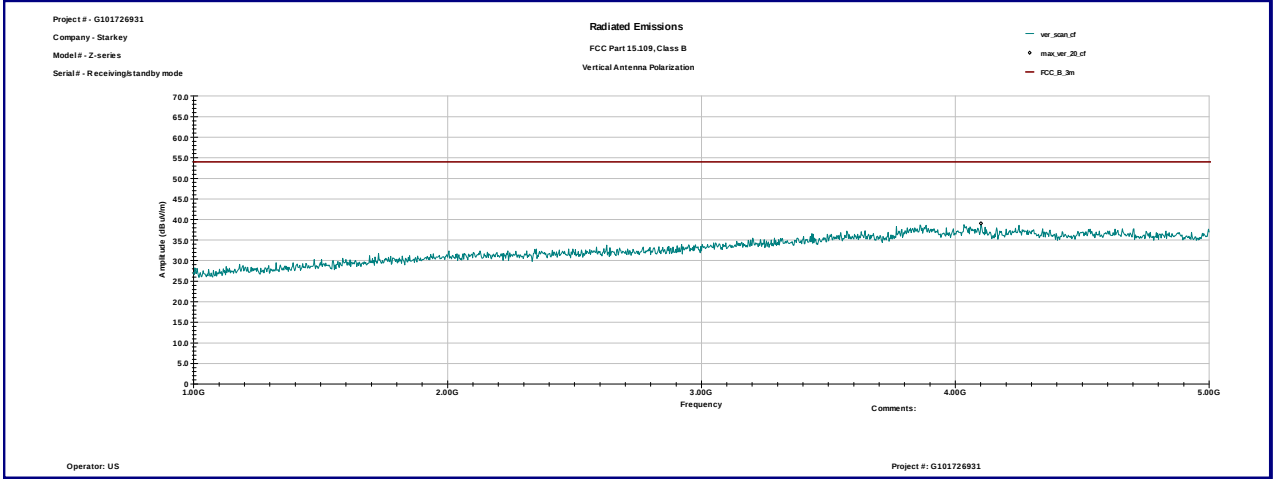
Horizontal antenna polarization



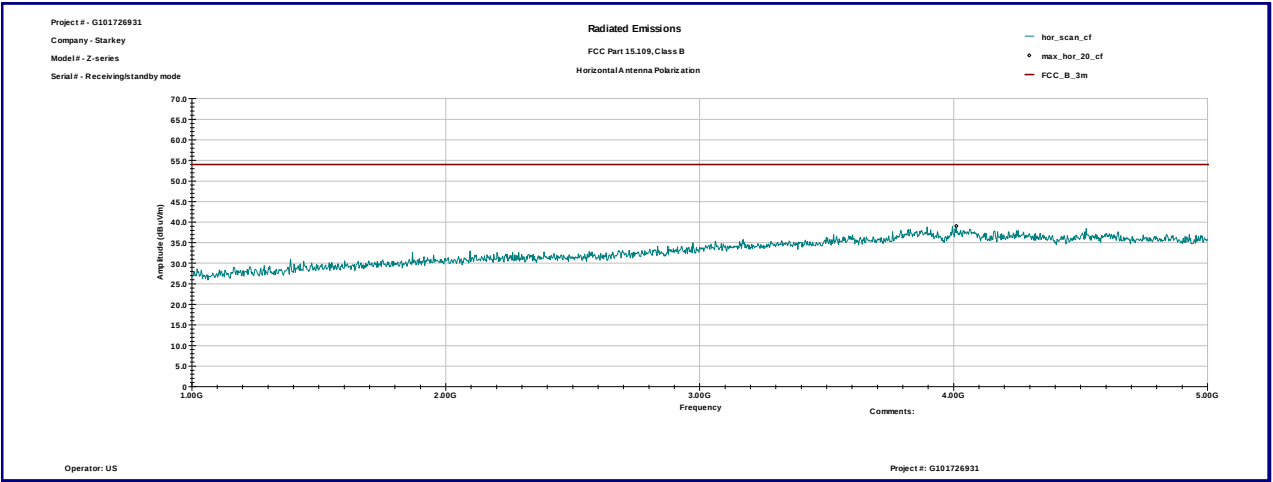
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Graph 3.5.2

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	12/12/2014	☒
Spectrum Analyzer	R & S	ESU	100398	25283	01/07/2015	☒
Bicono-Log Antenna	Schaffner-Teseq	CBL6112B	2468	9734	12/12/2014	☒
Horn Antenna	EMCO	3115	6579	15580	07/18/2014	☒
LISN	Fischer Custom Communications	FCC-LISN-50-25-2	2014	9665	04/21/2015	☐
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1402232	172081	11/12/2014	☒
System	Quantum Change	TILE! Instrument Control	Ver. 3.4.K.29	15259	VBU	☒



5.0 Revision History

REVISION LEVEL	DATE	REPORT NUMBER	PREPARED	REVIEWED	NOTES
0	07-17-2014	101726931MIN-001	US	SK	Original Issue