



TEST REPORT

Report Number: 100105325MIN-002A

Project Number: G100105325

Testing performed on the

Opal RIC 312

FCC ID: EOA-IRIS-HA

Industry Canada ID: 6903A-IRISHA

to

47 CFR Part 15. 249:2009

RSS- 210, Issue 7, 2007

For

Starkey Laboratories, Inc.

Test Performed by:

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Test Authorized by:

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6700 Washington Avenue South
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Prepared by:

A handwritten signature in black ink, appearing to read "Richard Blonigen".

Richard Blonigen

Date: July 8, 2010

Reviewed by:

A handwritten signature in black ink, appearing to read "Uri Spector".

Uri Spector

Date: July 8, 2010

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1.0 GENERAL DESCRIPTION

Model:	Opal RIC 312
Type of EUT:	Hearing Aid
Serial Number:	N/A
FCC ID:	EOA-IRIS-HA
Industry Canada ID:	6903A-IRISHA
Related Submittal(s) Grants:	None
Company:	Starkey Laboratories Inc.
Customer:	Mr. Ken Meyer
Address:	6700 Washington Avenue South Eden Prairie, MN 55344
Phone:	(952) 947-4734
Fax:	(952) 828-9262
Email:	ken_meyer@starkey.com
Test Standards:	☒ 47 CFR, Part 15:2009, §15.249 ☒ RSS-210, Issue 7, 2007 ☒ RSS-Gen, Issue 2, 2007 ☒ 47 CFR, Part 15:2008, §15.107 and §15.109, Class B ☐ Other
Type of radio:	☒ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	July 7, 2010
Test Work Started:	July 7, 2010
Test Work Completed:	July 7, 2010
Test Sample Conditions:	☐ Damaged ☐ Poor (Usable) ☒ Good



1.1 Product Description; Test Facility

Product Description:	Hearing Aid
Operating Frequency	902-928 MHz
Number of Channels	11 Channels
Modulation:	FSK
Emission Designator:	323KFXD
Antenna(s) Info:	Integral
Antenna Installation:	☐ User ☐ Professional ☒ Factory
Transmitter Power Configuration:	☒ Internal battery ☐ External power source ☐ 120VAC ☐ 230VAC ☐ 400VAC ☐ [redacted] VDC ☐ Other: [redacted] [redacted] Amp. ☐ 50Hz ☐ 60Hz
Test Facility Accreditation:	A2LA (Certificate No. 1427.01)
Test Methodology:	Measurements performed according to the procedures in ANSI C63.4-2003

1.2 EUT Configuration

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

- ☐ - Standby
- ☒ - Continuous transmission in modulated mode
- ☒ - Continuous standby/receive mode
- ☐ - Test program (customer specific)
- ☐ -

Operating modes of the EUT:

No.	Description
1	Testing consisted of lower, middle, and upper channel transmitting continuously with one channel being transmitted at a given time.
2	Standby / Receiving mode was used for FCC Part 15.109 and ICES-003 testing.

Cables:

No.	Type	Length	Designation	Note
1	None			
2				

Support equipment/Services:

No.	Item	Description
1	R and S SMR 20 Generator	Signal Source during FCC 15.109 testing

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).

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

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

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

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

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

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

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

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

Test result: **Pass**

Max. Emissions margin at fundamental: 21.1 dB below the limits

Notes: Test performed at low, middle and upper channel

Date:	July 7, 2010	Result: Pass
Standard:	FCC 15.249(a) / RSS-210 A2.9	
Tested by:	Richard Blonigen	
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)								
Fundamental										
Channel 366										
906.60	V	154	21.8	3.6	0.0	46.0	71.4	94.0	-22.6	Pk
906.60	H	253	21.8	3.6	0.0	41.3	66.7	94.0	-27.3	Pk
Channel 393										
914.77	V	155	21.8	3.6	0.0	46.3	71.7	94.0	-22.3	Pk
914.77	H	277	21.8	3.6	0.0	42.5	67.9	94.0	-26.1	Pk
Channel 417										
922.05	V	149	21.7	3.7	0.0	47.5	72.9	94.0	-21.1	Pk
922.05	H	258	21.7	3.7	0.0	42.6	68.0	94.0	-26.0	Pk



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. margin of harmonics and spurious emissions: 3.3 dB below the limits

Notes: No Spurious Emissions related to transmitter were detected at the frequency range 30MHz-1000MHz. For Harmonics Emissions see Table 3.2.1 and Graphs 3.2.1-3.2.3. Test performed at low, middle and upper channel.

Band Edge Compliance is shown in the Table 3.2.2

Date:	July 7, 2010	Result: Pass
Standard:	FCC 15.249(a) and (d) / RSS-210 A2.9	
Tested by:	Richard Blonigen	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	None	

Table 3.2.1

Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	Peak Reading	Total @ 3m	Limit	Margin
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBμV	dBμV/m	dBμV/m	dB
Harmonics Emissions									
Channel 366 (906.58MHz)									
1813.15	V	150	26.2	3.6	43.1	60.9	47.7	54.0	-6.3
2719.80	V	202	28.7	4.0	43.2	55.9	45.4	54.0	-8.5
4532.90	V	174	32.3	6.1	42.2	50.5	46.7	54.0	-7.3
1813.15	H	231	26.2	3.6	43.1	63.5	50.3	54.0	-3.7
2719.80	H	249	28.7	4.0	43.2	45.6	35.1	54.0	-18.8
4532.90	H	155	32.3	6.1	42.2	42.6	38.8	54.0	-15.2
Channel 393 (914.77MHz)									
1829.50	V	148	26.3	3.6	43.1	60.5	47.3	54.0	-6.6
2744.35	V	110	28.8	4.0	43.3	60.7	50.3	54.0	-3.7
4573.90	V	168	32.3	6.1	42.2	53.7	50.0	54.0	-4.0
1829.50	H	180	26.3	3.6	43.1	62.7	49.5	54.0	-4.4
2744.35	H	211	28.8	4.0	43.3	48.3	37.9	54.0	-16.1
4573.90	H	154	32.3	6.1	42.2	45.1	41.4	54.0	-12.6
Channel 417 (922.05MHz)									
1844.10	V	130	26.3	3.7	43.1	58.5	45.4	54.0	-8.6
2766.20	V	106	28.9	4.0	43.3	60.6	50.2	54.0	-3.8
4610.30	V	160	32.4	6.2	42.1	54.2	50.7	54.0	-3.3
1844.10	H	235	26.3	3.7	43.1	61.4	48.3	54.0	-5.7
2766.16	H	206	28.9	4.0	43.3	46.2	35.8	54.0	-18.2
4610.30	H	171	32.4	6.2	42.1	47.8	44.2	54.0	-9.7

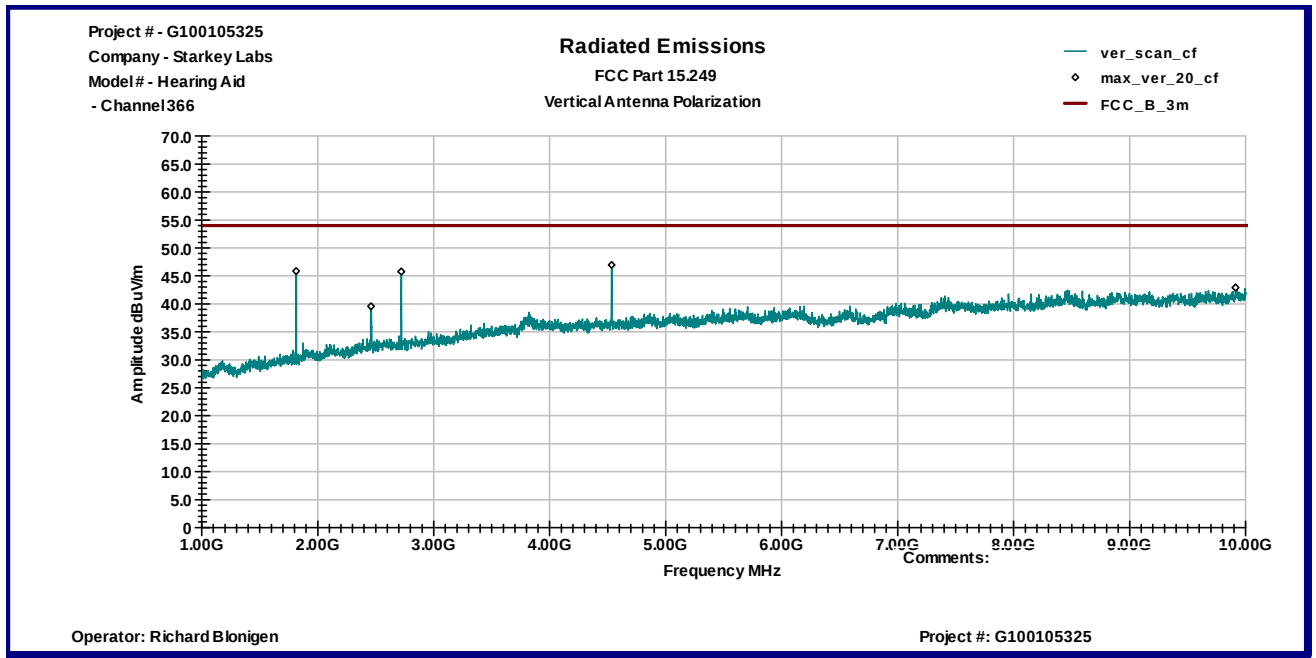
Date:	July 7, 2010	Result: Pass
Standard:	FCC 15.249(a) and (d) / RSS-210 A2.9	
Tested by:	Richard Blonigen	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Band Edge Compliance	

Table 3.2.1

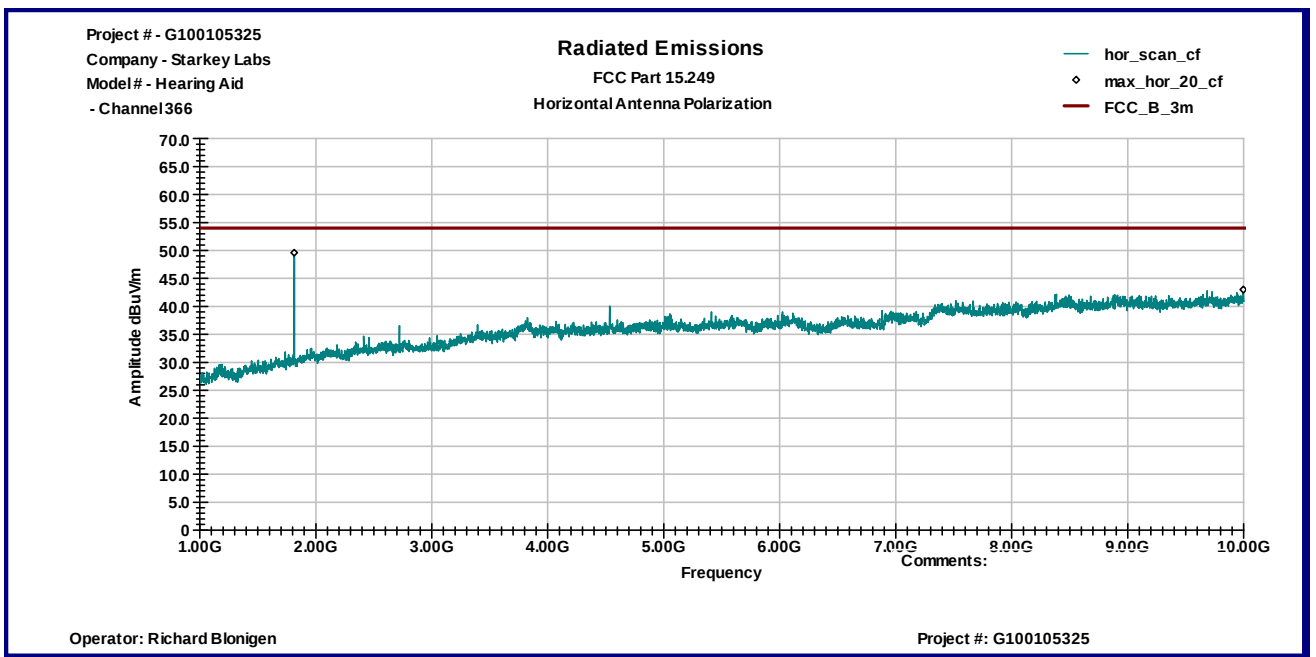
Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	Peak Reading	Total @ 3m	Limit	Margin
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBμV	dBμV/m	dBμV/m	dB
Band Edge Compliance									
902.00	V	100	21.8	3.6	0.0	7.9	33.4	46.0	-12.7
902.00	H	100	21.8	3.6	0.0	7.8	33.3	46.0	-12.8
928.00	V	100	21.7	3.7	0.0	7.8	33.2	46.0	-12.9
928.00	H	100	21.7	3.7	0.0	7.9	33.3	46.0	-12.8

Graph 3.2.1

Vertical antenna polarization

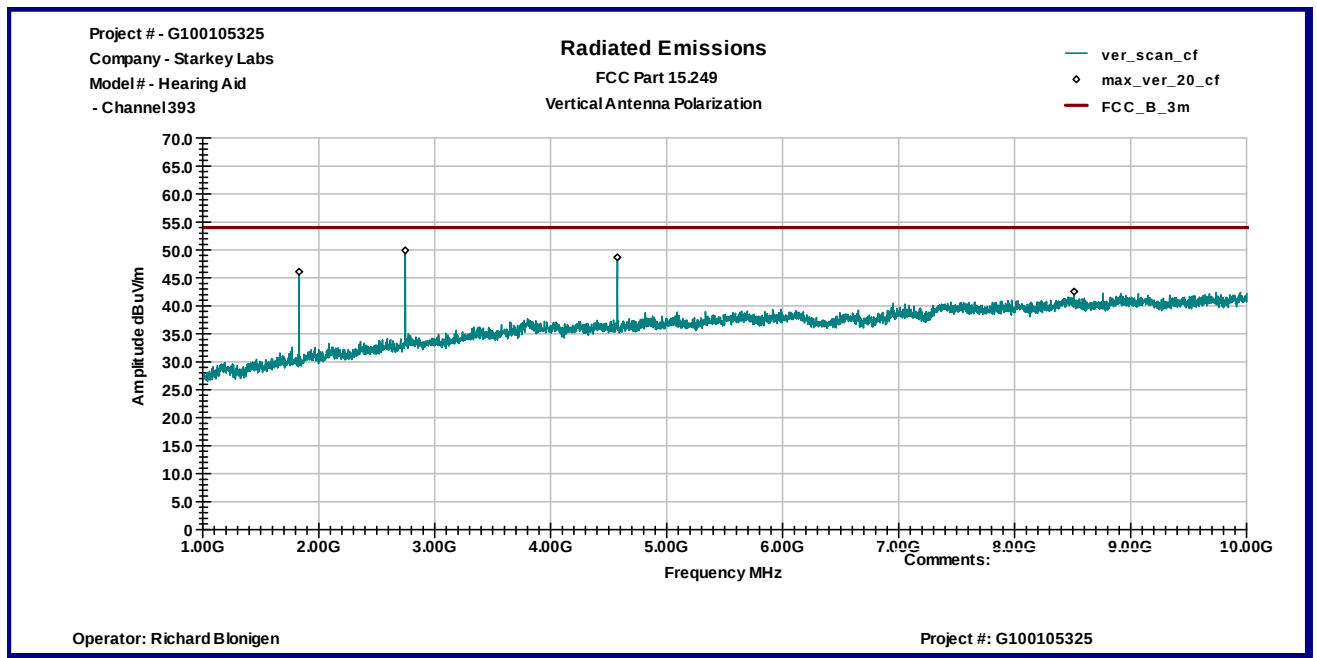


Horizontal antenna polarization

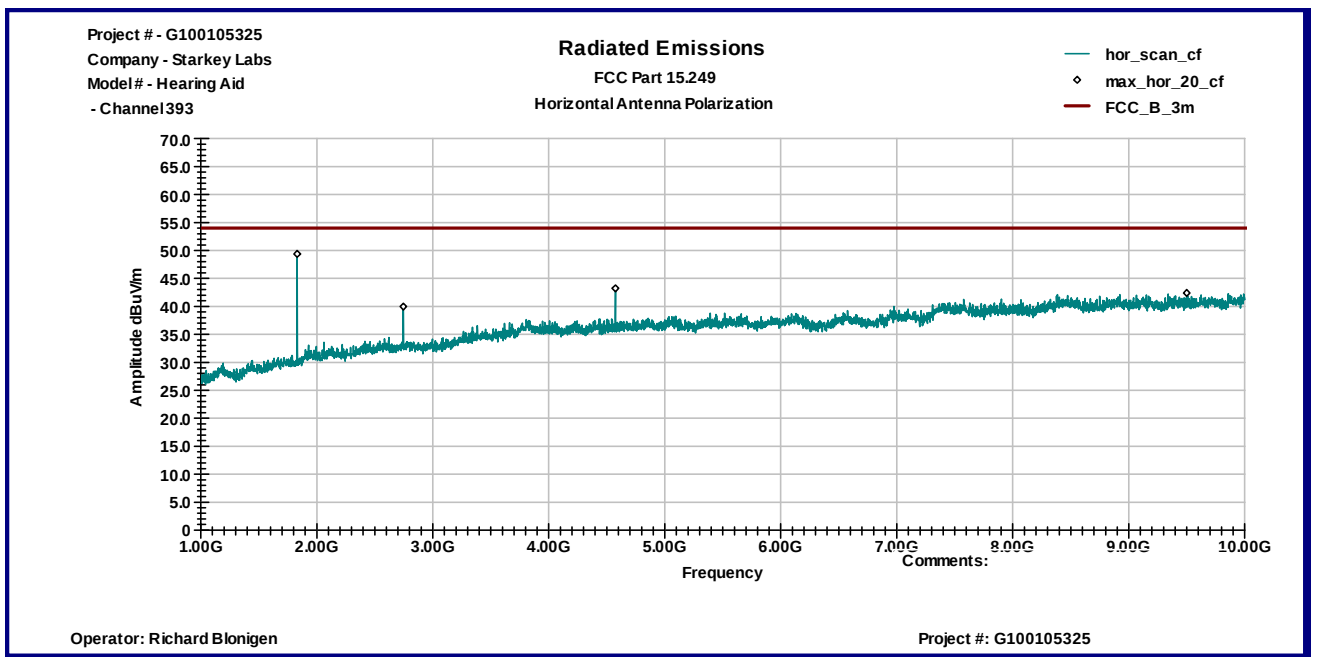


Graph 3.2.2

Vertical antenna polarization

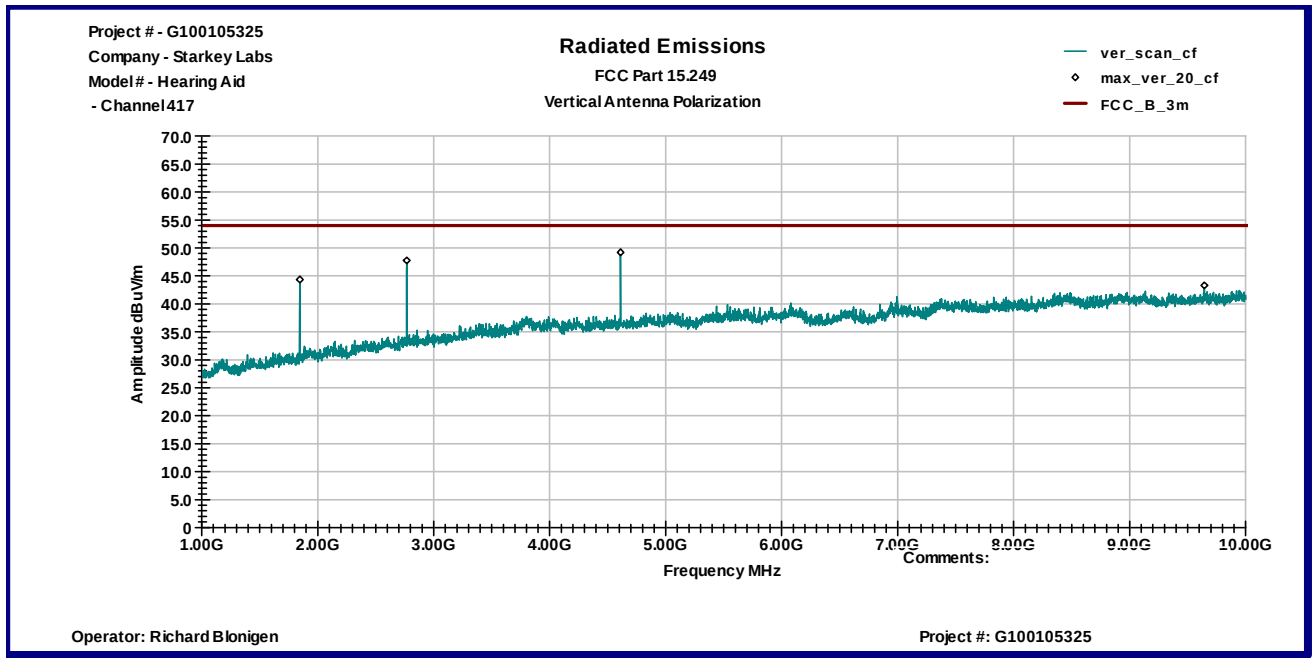


Horizontal antenna polarization

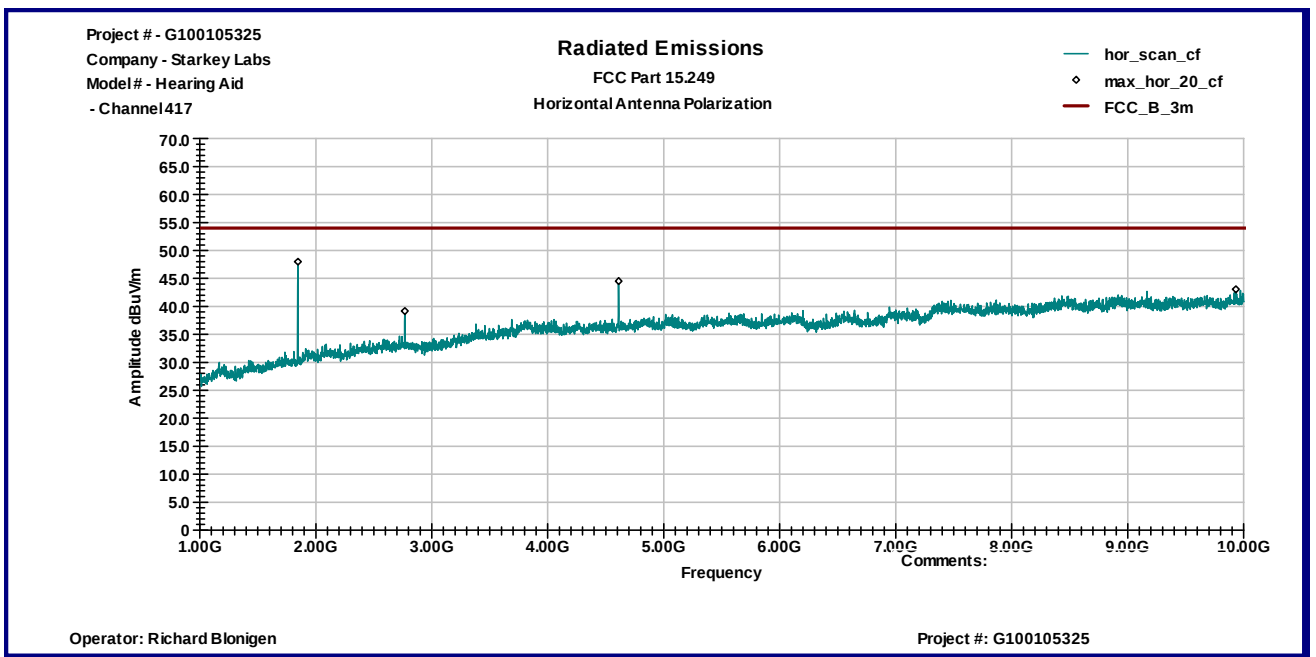


Graph 3.2.3

Vertical antenna polarization



Horizontal antenna polarization



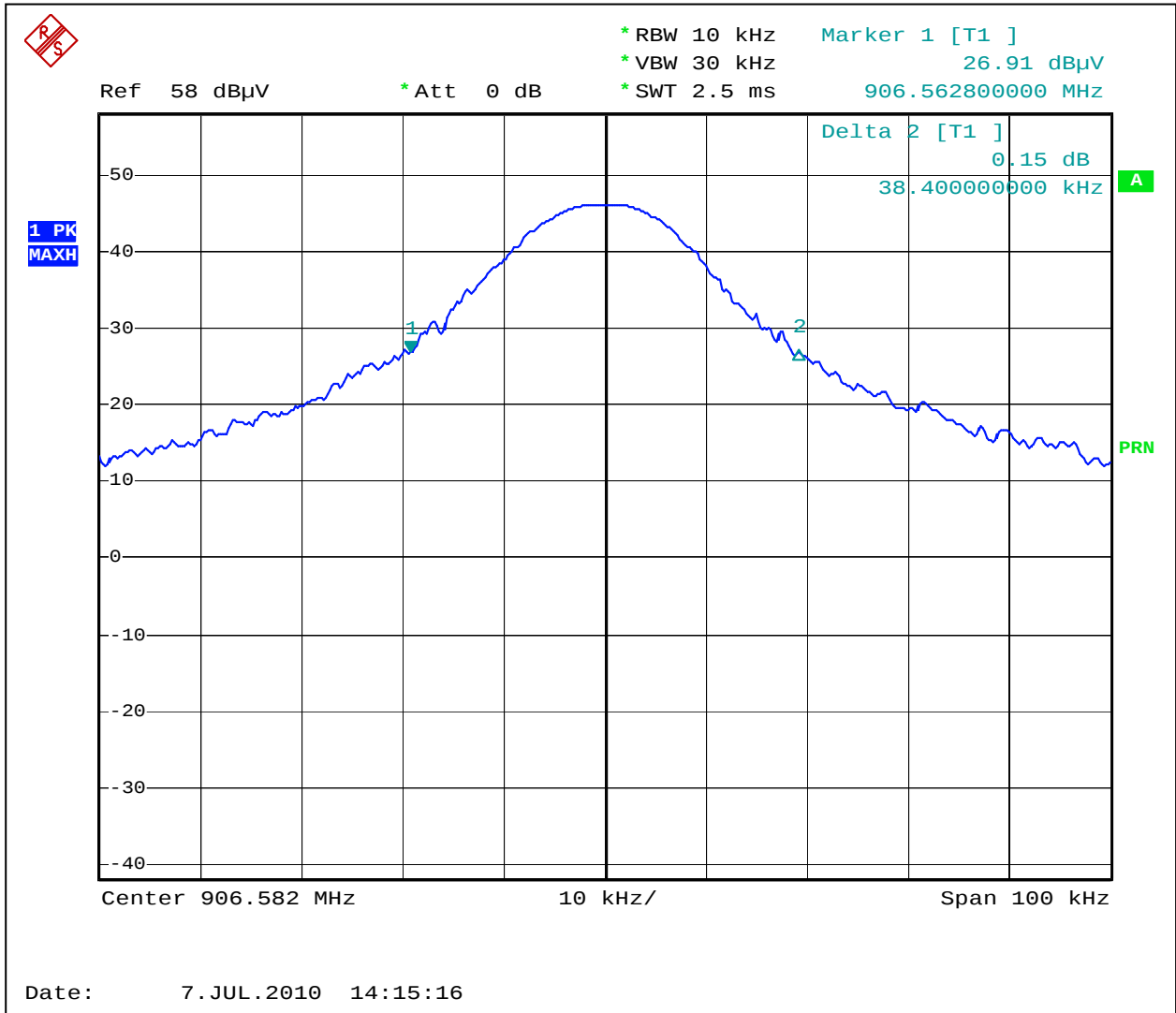
3.3 Bandwidth of Emissions

Center Frequency of operation MHz	Measured 20dB bandwidth kHz	Measured 99% bandwidth kHz
906.6	38.4	39.6
914.77	43.2	42.6
922.05	43.5	44.0

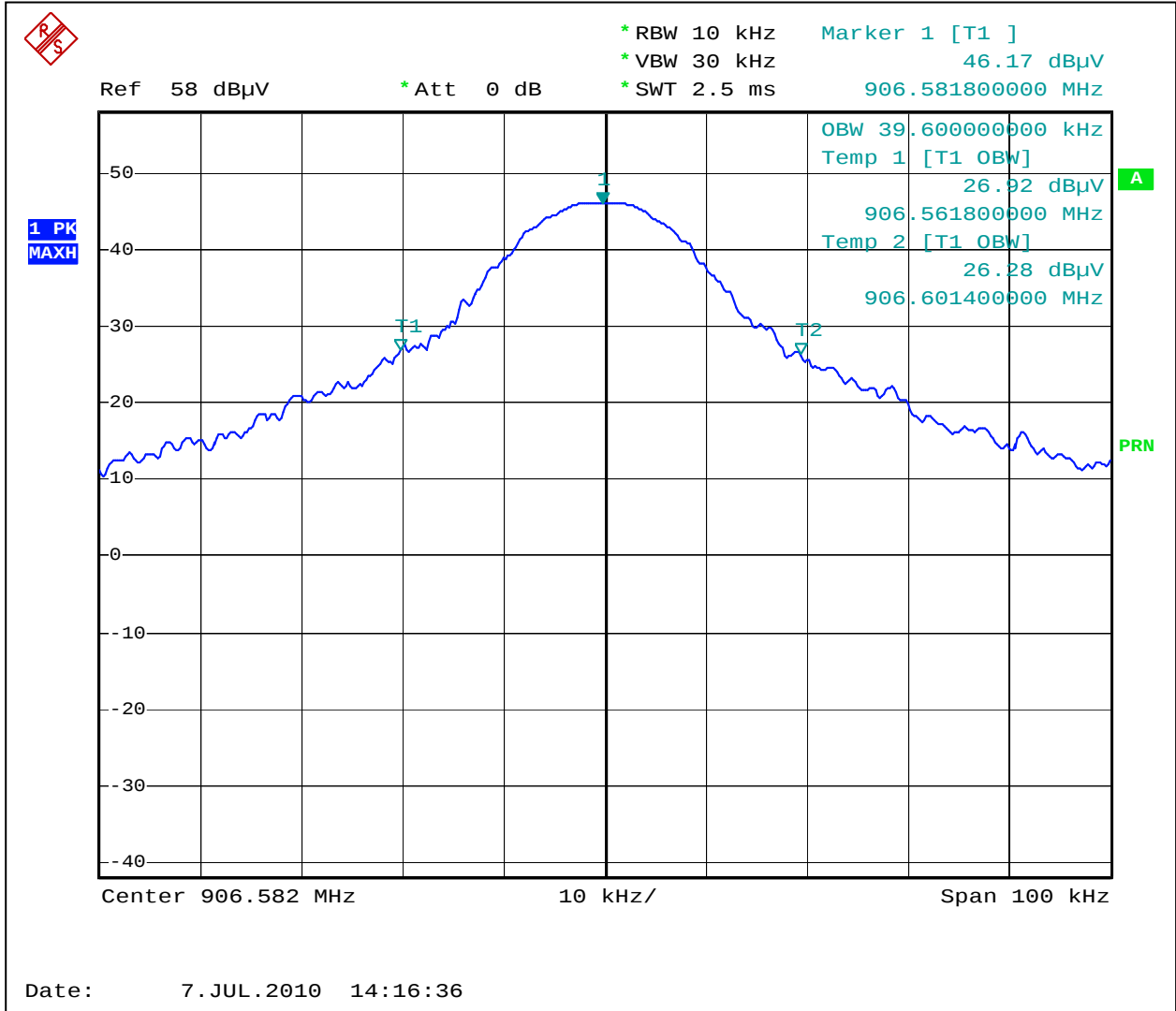
Graphs 3-3-1, 3-3-3, and 3-3-5 show 20dB Bandwidth.
Graphs 3-3-2, 3-3-4, and 3-3-6 show 99% Bandwidth.

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

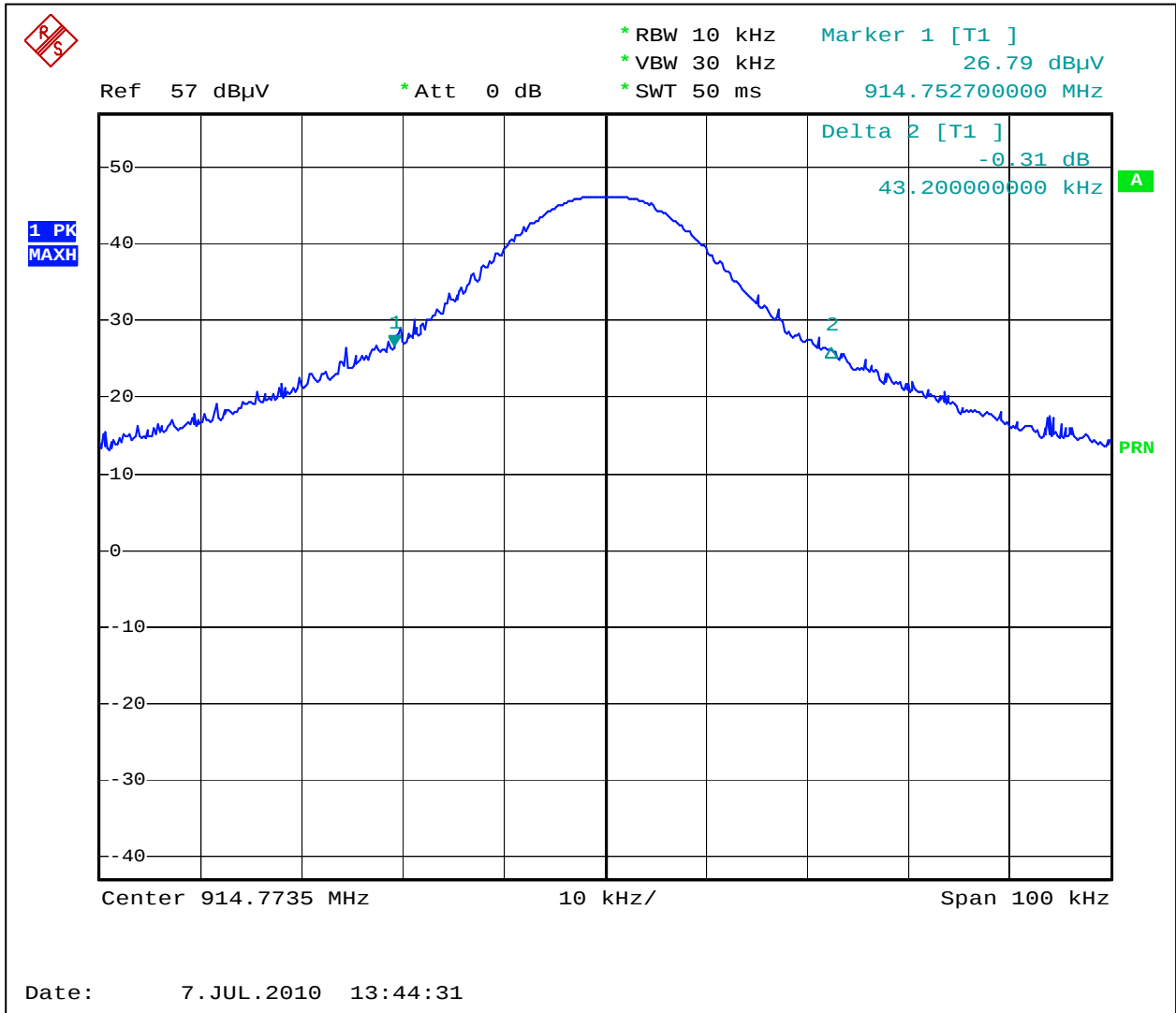
Graph 3.3.1



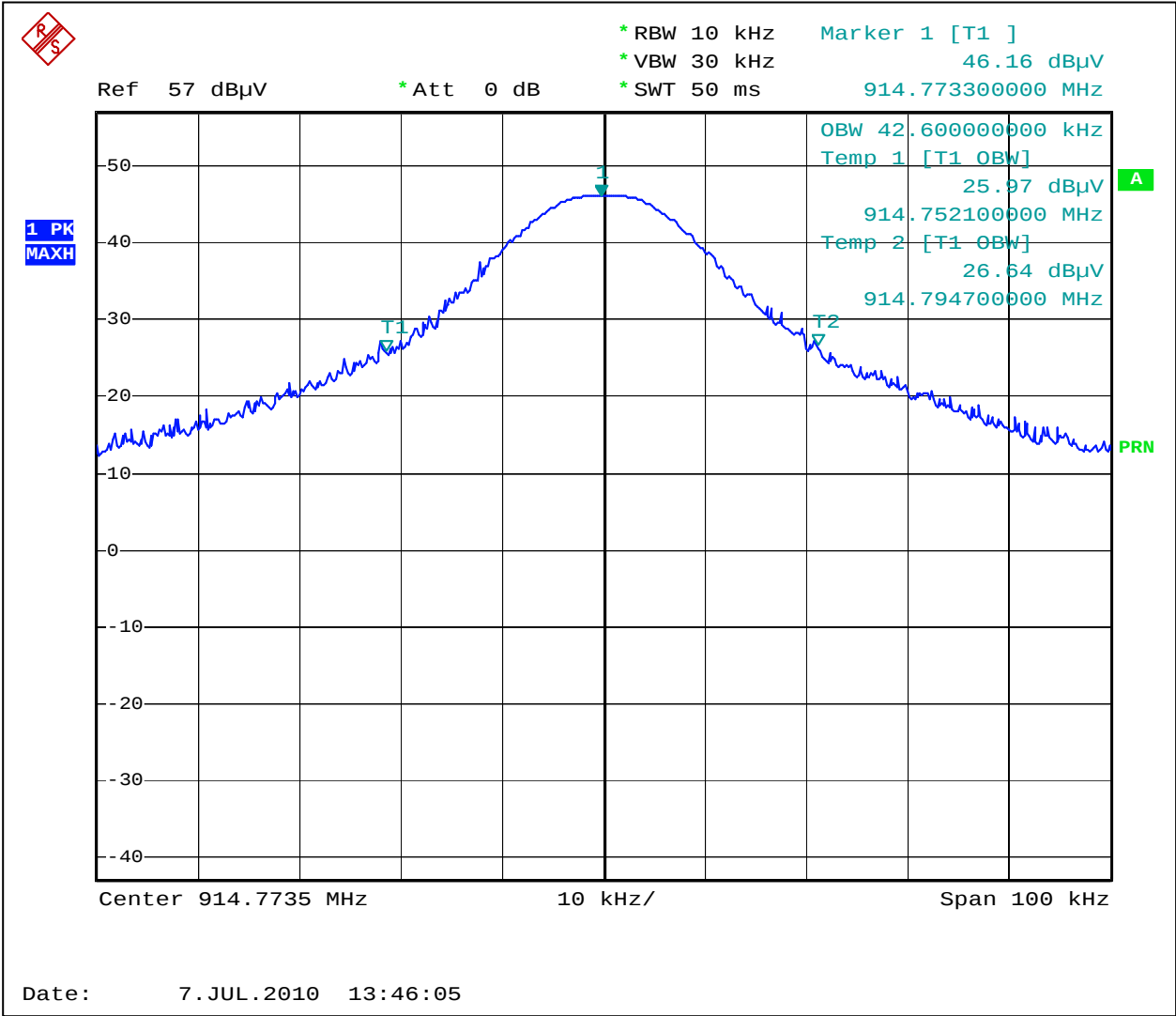
Graph 3.3.2



Graph 3.3.3

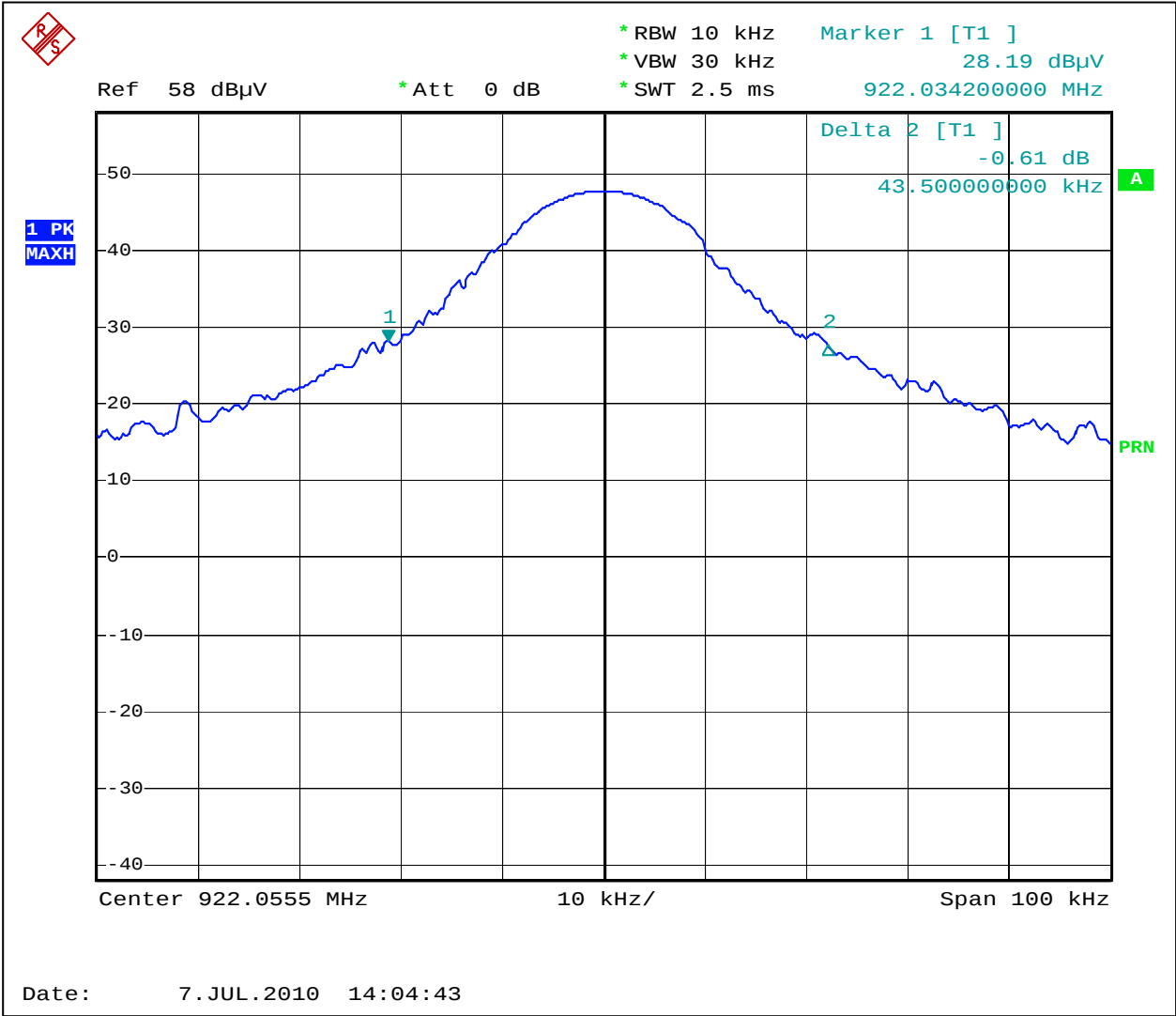


Graph 3.3.4

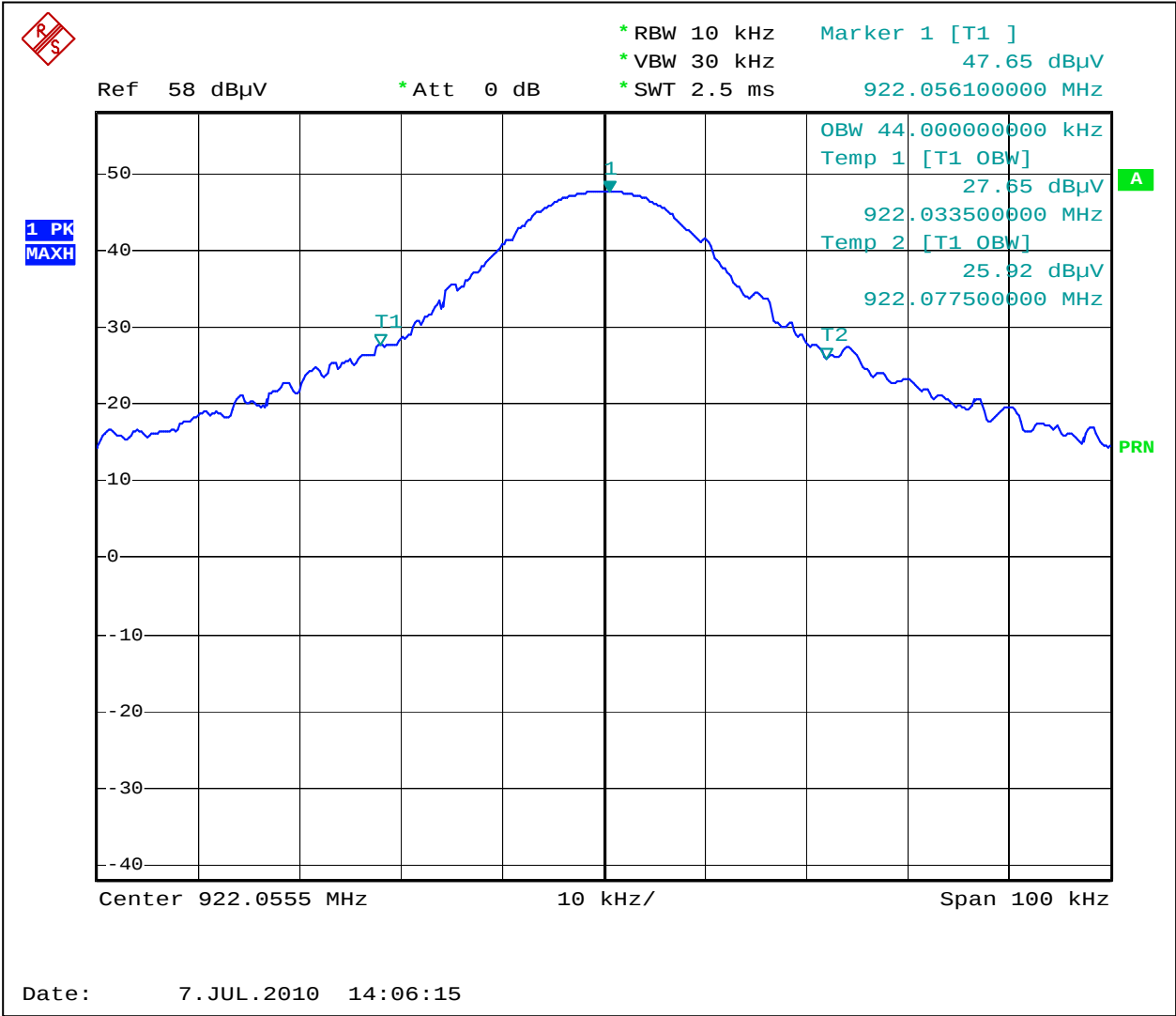




Graph 3.3.5



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: Testing was deemed not necessary as EUT is powered by an internal battery



3.5 Receiver/digital device radiated emissions

Test location: ☐ OATS ☒ Anechoic Chamber

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Frequency range: 30MHz-5GHz

Max. Emissions margin: 7.0 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 3.5.2 and Graphs 3.5.1 - 3.5.4)

Date:	July 7, 2010	Result: Pass
Standard:	FCC Part 15.109, Class B	
Tested by:	Richard Blonigen and Norman Shpilsher	
Test Point:	Enclosure	
Operation mode:	See Page 5	
Note:	None	

Table 3.5.1

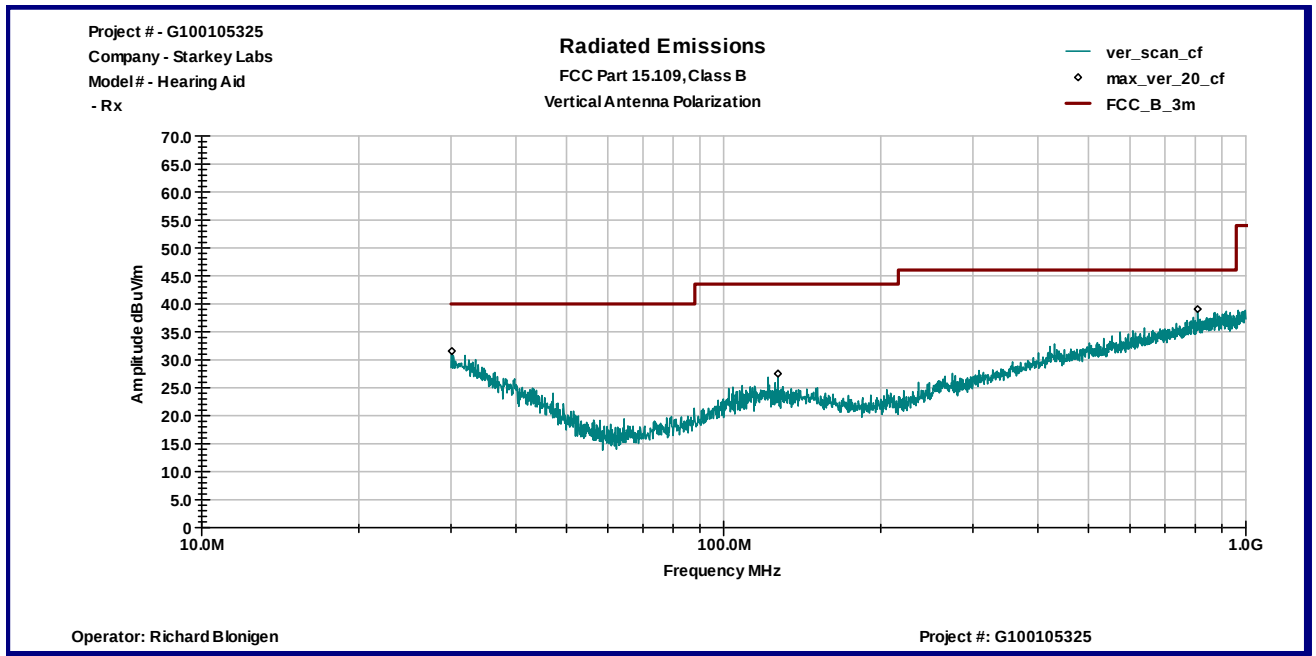
Frequency	Ant. Polarity	Peak Reading dBμV	Ant.Factor dB1/m	Total at 3m dBμV/m	QP Limit dBμV/m	Margin dB
30.139 MHz	V	10.9	20.7	31.6	40.0	-8.5
127.01 MHz	V	13.8	13.7	27.5	43.5	-16.0
809.02 MHz	V	14.6	24.4	39.1	46.0	-7.0
30.139 MHz	H	10.8	20.7	31.5	40.0	-8.5
124.62 MHz	H	13.1	13.8	26.9	43.5	-16.7
994.34 MHz	H	12.8	26.5	39.2	54.0	-14.8

Table 3.5.2

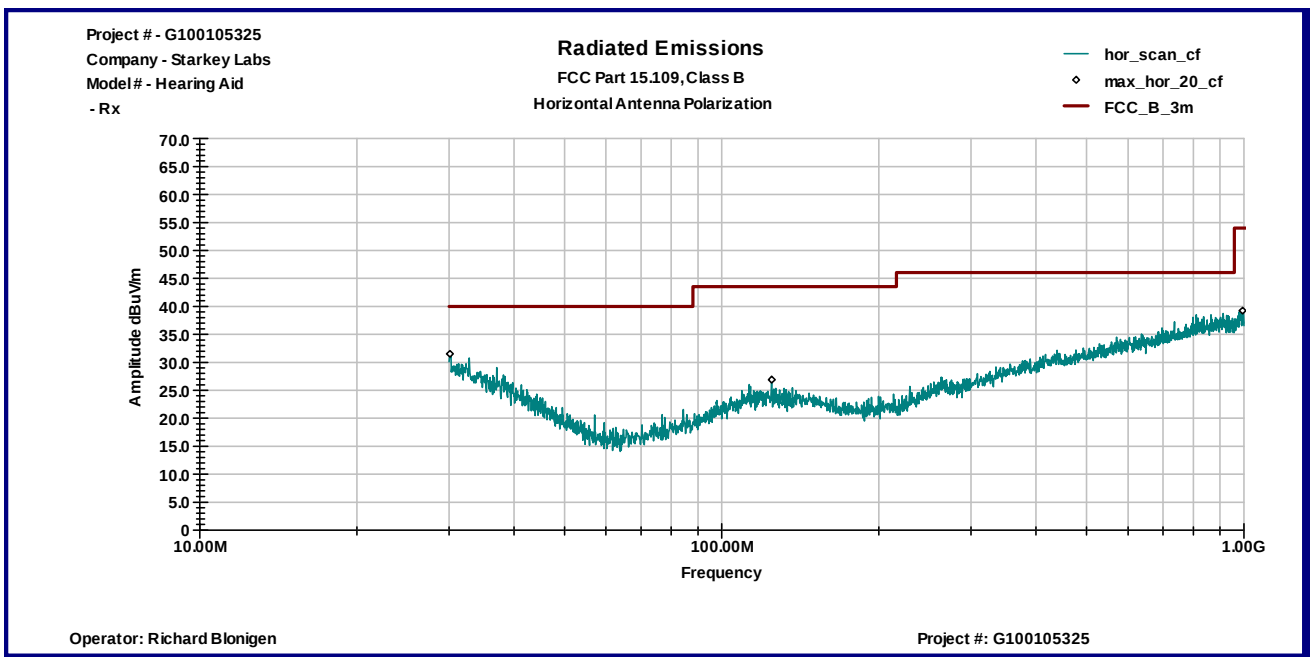
Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dBμV	Total @ 3m dBμV/m	Limit dBμV/m	Margin dB	Comments
	Polarity	Hts(cm)								
1691.20	V	100	26.2	3.0	42.9	29.6	15.8	54.0	-38.2	
2619.20	V	100	28.9	3.7	43.2	33.9	23.3	54.0	-30.7	
3836.80	V	100	32.2	4.5	43.0	37.3	31.0	54.0	-23.0	
4860.00	V	100	33.1	4.9	41.8	38.7	34.9	53.98	-19.0	
1649.60	H	100	26.0	3.0	42.9	30.9	16.9	54.0	-37.1	
2632.00	H	100	29.0	3.7	43.2	34.2	23.7	54.0	-30.3	
3836.80	H	100	32.2	4.5	43.0	38.3	31.9	54.0	-22.1	
4860.00	H	100	33.1	4.9	41.8	38.6	34.8	54.0	-19.2	

Graph 3.5.1

Vertical antenna polarization

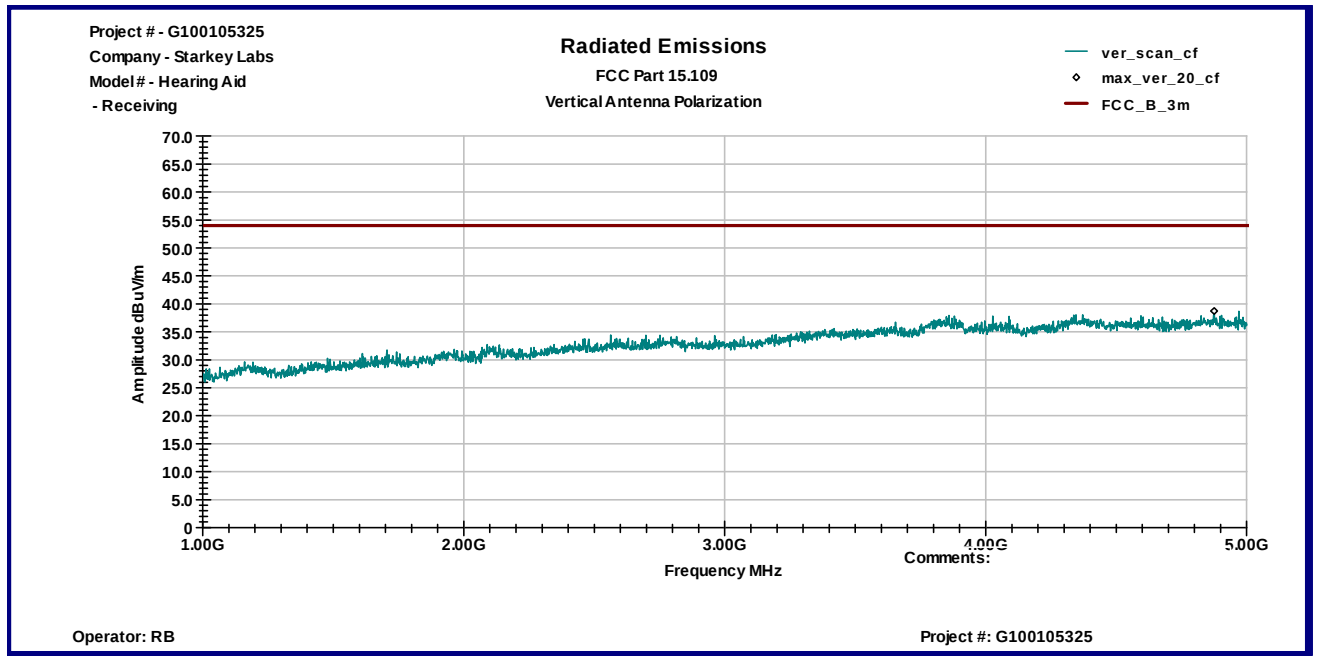


Horizontal antenna polarization

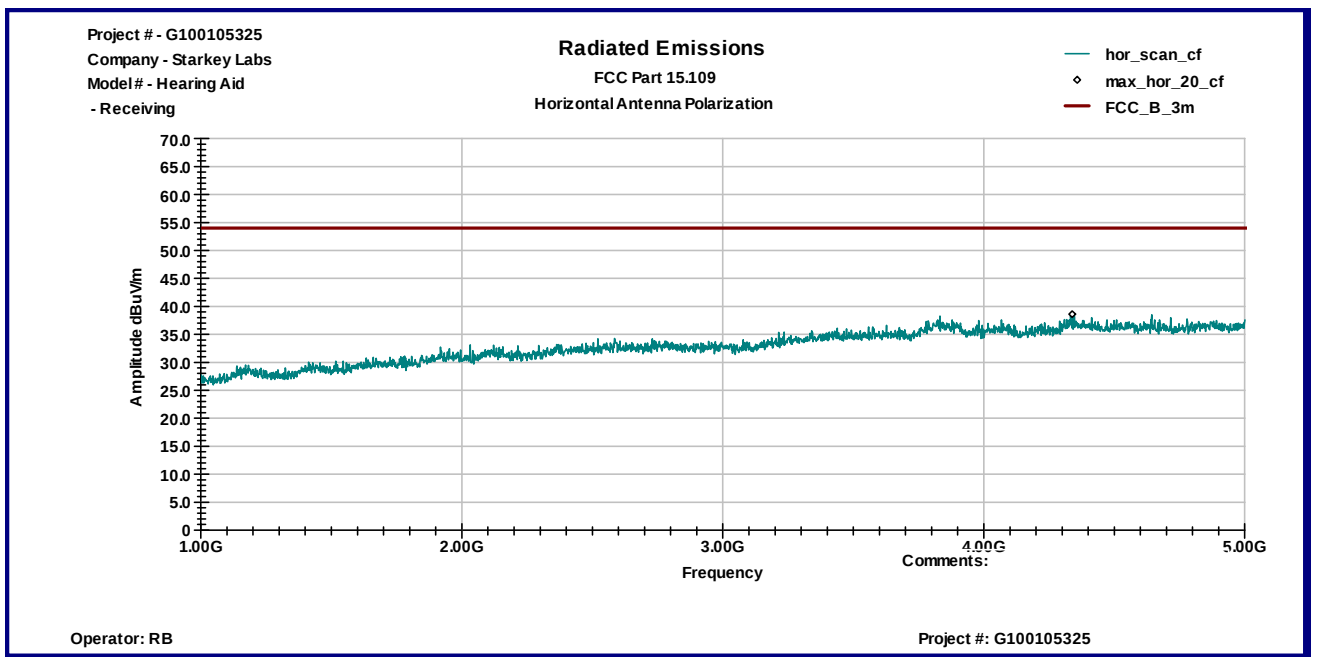


Graph 3.5.1

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: Testing was deemed not necessary as EUT is powered by an internal battery



4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	CAL DUE	USED
Spectrum Analyzer	R & S	FSP 40	100024	12559	09/10/2010	☒
Spectrum Analyzer	Agilent	E7402A	MY44212200	12660	11/20/2010	☒
Bicono-Log Antenna	Schaffner-Chase	CBL 6112 B	2468	14459	09/22/2010	☒
Horn Antenna	EMCO	3115	9507-4513	9936	04/13/2011	☒
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1402232	172081	08/07/2010	☒
System	TILE! Instrument Control		Ver. 3.4.K.29	15259	VBU	☒



Test Setup Photos

