Global EMC Inc. Labs

EMC & RF Test Report

As per

RSS 210 Issue 8:2010

&

FCC Part 15 Subpart C:2014

Unlicensed Intentional Radiators

on the

Hearing Aid, Model 4360

Min Xie
Project Engineer
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Gormley, ON, L0H 1G0 Canada
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Testing produced for

soundquest HEARING AIDS, LLC

See Appendix A for full customer & EUT details.

Industry Canada
LAB REGISTRATION #6844A-3

FCC REGISTRATION #377448

R-4023, G-506 T-1246, C-4498

Testing Laboratory Certificate #2555.01

Table of Contents

Report Scope

This report addresses the EMC verification testing and test results of Sound Quest LLC's Hearing Aid, Model 4360, herein referred to as EUT (Equipment Under Test) performed at Global EMC Labs.

The EUT was tested for compliance against the following standards:

RSS 210 Issue 8:2010
FCC Part 15 Subpart C 15:2014

Test procedures, results, justifications, and engineering considerations, if any, follow later in this report.

The results contained in this report relate only to the item(s) tested.

This report does not imply product endorsement by A2LA or any other accreditation agency, any government, or Global EMC Inc.

Opinions/interpretations expressed in this report, if any, are outside the scope of Global EMC Inc accreditation. Any opinions expressed do not necessarily reflect the opinions of Global EMC Inc, unless otherwise stated.

Client	**Sound Quest, LLC**
Product	**Hearing Aid, Model: 4360**
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014

Summary

The results contained in this report relate only to the item(s) tested.

EUT FCC Certification #, FCC ID:	2AC2WSQ4360
EUT Industry Canada Certification #, IC:	12599A-SQ4360
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Min Xie

Client	**Sound Quest, LLC**
Product	**Hearing Aid, Model: 4360**
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique	Pass See Justification
FCC 15.205 RSS-GEN (Table 6)	Restricted Bands for intentional operation	QuasiPeak Average	Pass
FCC 15.207 RSS-GEN (Table 3)	Power line conducted emissions	QuasiPeak Average	N/A See Justification
FCC 15.209 RSS-GEN (Table 4, 5)	Radiated emissions	QuasiPeak Average	Pass
Overall Result			**PASS**

All tests were performed by Min Xie.

If the product as tested or otherwise complies with the specification, the EUT is deemed to comply with the requirement and is deemed a ‘PASS’ grade. If not ‘FAIL’ grade will be issued. Note that ‘PASS’ / ‘FAIL’ grade is independent of any measurement uncertainties. A ‘PASS’ / ‘FAIL’ grade within measurement uncertainty is marked with a ‘*’.

Justifications, Descriptions, or Deviations

The following justifications for tests not performed or deviations from the above listed specifications apply:

For the Antenna requirement specified in FCC 15.203 (RSS 210 section 5.5), the unit uses a permanently connected coil antenna.

For the Restricted Bands of operation, the EUT is designed to only operate at 10.579 MHz band.

FCC 15.207 Power line conducted emissions requirements are not applicable as the EUT is a battery powered device.

The Receiver were tested together with the transmitter for spurious radiated emissions.

Applicable Standards, Specifications and Methods

ANSI C63.4:2009	- Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10:2009	- American national standard for testing unlicensed wireless devices
CFR 47 FCC 15	- Code of Federal Regulations – Radio Frequency Devices
ICES-003:2012	- Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard
ISO 17025:2005	- General Requirements for the competence of testing and calibration laboratories
RSS-GEN: Issue 4	General Requirements for Compliance of Radio Apparatus
RSS 210:2010	- Issue 8: Spectrum Management and Telecommunications Policy. Radio Standards Specification Low Power License-Exempt Radiocommunication Devices

Sample calculation(s)

Margin = limit – (received signal + antenna factor + cable loss – pre-amp gain)
Margin = 50.5dBuV/m – (50dBuV + 10dB + 2.5dB – 20dB)
Margin = 8.5 dB

Document Revision Status

Revision 1 - Jan 20, 2015
Initial release

Revision 2 - March 23, 2015
Updated as per ACB requests.

Definitions and Acronyms

The following definitions and acronyms are applicable in this report.
See also ANSI C63.14.

AE – Auxiallary Equipment.

BW – Bandwidth. Unless otherwise stated, this is refers to the 6 dB bandwidth.

EMC – Electro-Magnetic Compatibility

EMI – Electro-Magnetic Immunity

EUT – Equipment Under Test

ITE – Information Technology Equipment with a primary function(s) of entry, storage, display, retrieval, transmission, processing, switching, or control, of data.

LISN – Line impedance stabilization network

NCR – No Calibration Required

RF – Radio Frequency

Testing Facility

Testing for EMC on the EUT was carried out at Global EMC labs in Toronto, Ontario, Canada. The testing lab consists of a 3m semi-anechoic chamber calibrated to be able to allow measurements on an EUT with a maximum width or length of up to 2m and height up to 3m. The chamber is equipped with a turn table that is capable of testing devices up to 3300lb in weight. This facility is capable of testing products that are rated for 120 Vac and 240Vac single phase, or 208 Vac 3 phase input. DC capability is also available. The chamber is equipped with an antenna mast that controls polarization and height from the control room adjoining the shielded chamber. Radiated emissions measurements are performed using a Bilog, and Horn antenna where applicable. Conducted emissions, unless otherwise stated, are performed using a LISN.

Calibrations and Accreditations

The 3m semi-anechoic chamber is registered with Federal Communications Commission (FCC, 377448), Industry Canada (IC, 6844A-3) and VCCI (R-4023, G-506, T-1246, and C-4498). This semi-anechoic chamber complies with the requirements of EN55016-2-3:2006, section 7.5 and the site attenuation requirements of EN55016-1-4. This chamber was additionally calibrated for Normalized Site Attenuation (NSA) using test procedures outlined in ANSI C63.4 “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz”. The chamber is lined with ferrite tiles and absorption cones to minimize any undesired reflections. The NSA data is kept on file at Global EMC. For radiated susceptibility testing, a 16 point field calibration has been performed on the chamber. The field uniformity data is kept on file at Global EMC. Global EMC Inc is accredited to ISO 17025 by A2LA with Testing Certificate #2555.01. The laboratories current scope of accreditation listing can be found as listed on the A2LA website. All measuring equipment is calibrated on an annual or bi-annual basis as listed for each respective test.

Testing Environmental Conditions and Dates

Following were the environmental conditions in the facility during time of testing –

Date	Test	Init.	Temperature (ºC)	Humidity (%)	Pressure (kPa)
2014/11/26	All	MX	20-24ºC	39 - 50%	96 -102kPa

Detailed Test Results Section

Radiated Emissions of Fundamental

Purpose

The purpose of this test is to ensure that the RF energy intentionally emitted from the EUT does not exceed the limit listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect other periodic operating devices, and licensed broadcasting devices, and so on, from unwanted interference.

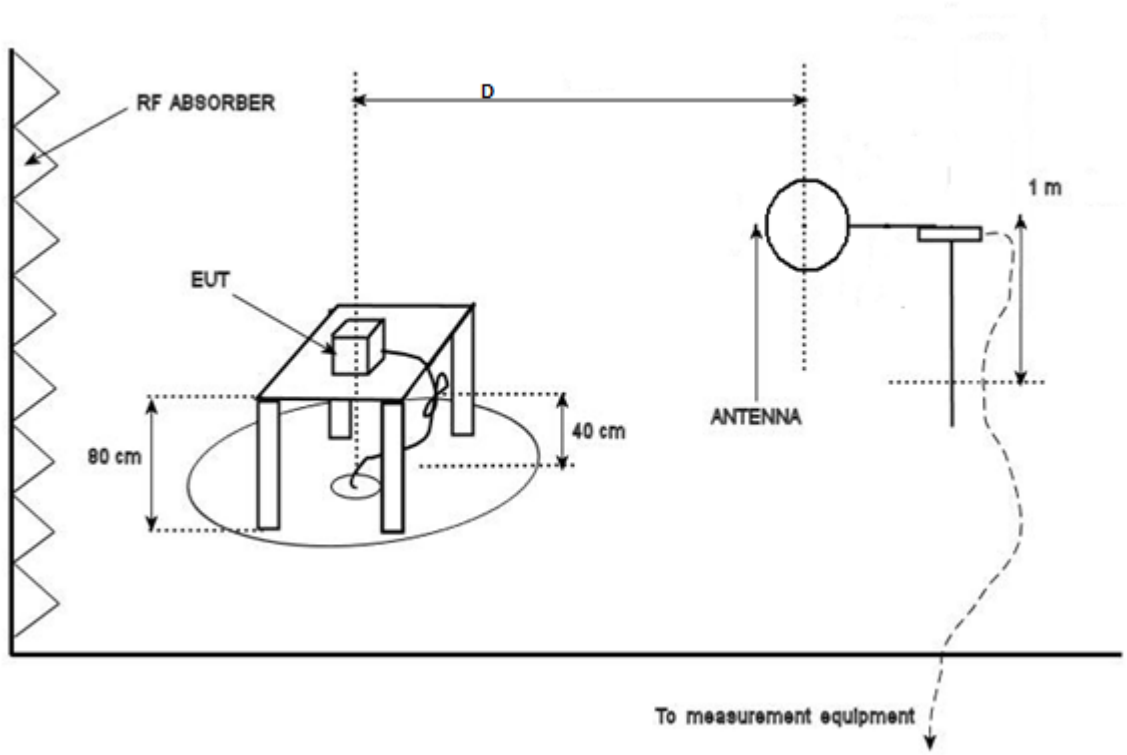
Limits and Method

The method is as defined in ANSI C63.10:2009.
The limits are as specified in FCC Part 15, Section 15.209

Frequency (MHz)	Field strength (microvolts/meter)[1]	Measurement distance (meters)
1.705-30.0	30	30

[1] Limit is with Quasi Peak detector with bandwidths as defined in CISPR-16-1-1.

Typical Radiated Emissions Setup



Measurement Uncertainty

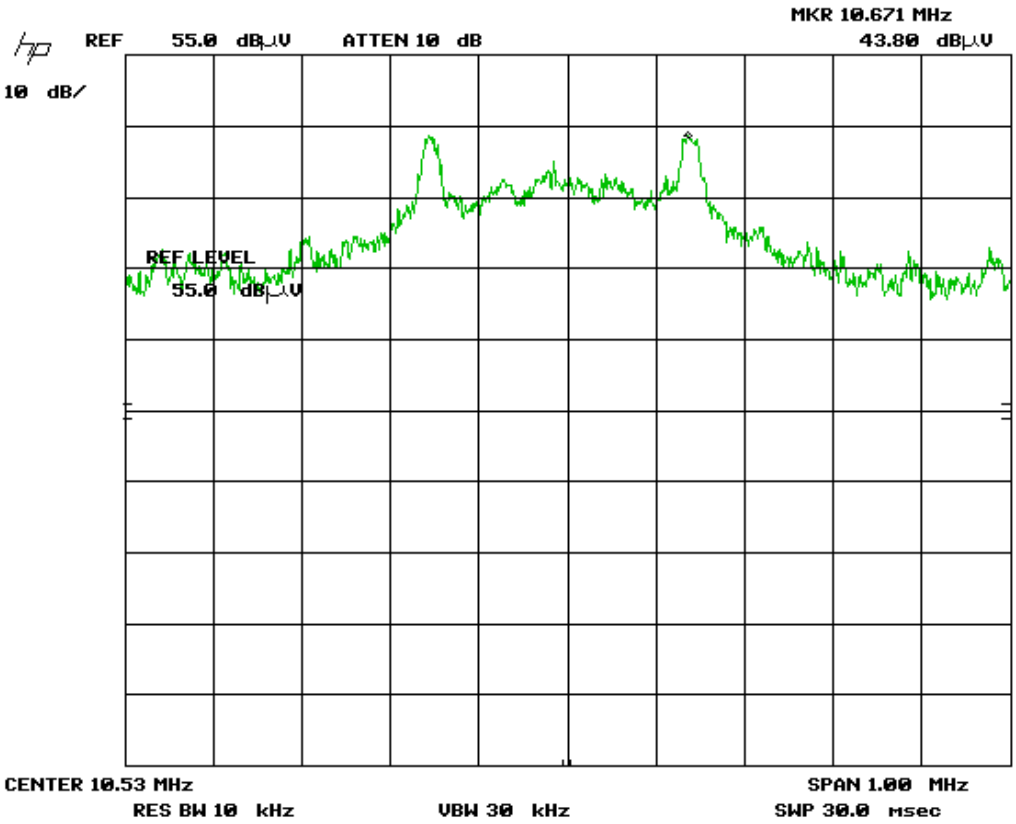
The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is +/-4.4 dB with a ‘k=2’ coverage factor and a 95% confidence level.

Preliminary Graphs

Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector, please refer to the final measurement table where applicable. The graph shown below is a maximized Quasi Peak graph, measured with a 9 kHz. The azimuth with the maximum peak emission with a 10 kHz resolution bandwidth, over a full 0-360 rotation was located.

To obtain the maximum emission, the loop antenna is positioned with its plane vertical and rotated about its vertical axis at the maximum azimuth position. This is then repeated with its plane horizontal, and rotated about the horizontal axis. The maximum obtained emission is presented.

Fundamental Emission
Peak Emission



Measurements were taken at 1 m measurement distance. Marker readings are raw reading. See Final Meassurements section for factor corrected data.

Final Measurements

Table 1: Fundamental emissions

Frequency (MHz)	Detector	Raw (dBuV)	Factors	Level (dBuV) @ 1 m	Level (dBuV) @ 30 m	Limit (dBuV/m) @ 30 m	Margin (dB)	Pass/ Fail
10.67	Peak	43.8	6.3	50.1	-9.0	29.5	38.5	Pass

Note: The fundamental emission of the EUT was measured at an alternate test distances in accordance with FCC Part 15, Subpart A, Section 15.31, and an extrapolation factor of 40 dB/decade was applied to frequencies below 30 MHz. For example, for 1 meter measurement distance, an extrapolation factor of -59.1 dB from 40 Log (1 m /30 m) is applied.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration/Verification date	Next calibration/verification due date	Asset #
Spectrum Analyzer	8566B	HP	Oct-2, 2013	Oct-2, 2015	GEMC 190
Quasi Peak Adapter	85650A	HP	Oct-1, 2013	Oct-1, 2015	GEMC 191
Loop Antenna 100kHz - 30MHz	EM 6872	Electro-Metrics	Feb-5, 2013	Feb-5, 2015	GEMC 71
9kHz-1GHz, preamp	LNA 6901	Teseq	Feb-25, 2013	Feb-5, 2015	GEMC168
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	Feb-24, 2014	Feb-24, 2015	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	Feb-24, 2014	Feb-24, 2015	GEMC 29
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	Feb-24, 2014	Feb-24, 2015	GEMC 31

This report module is based on GEMC template "FCC - 15.209 - Radiated Emissions_Rev1.doc"

20 dB Bandwidth Measurement

Test Results

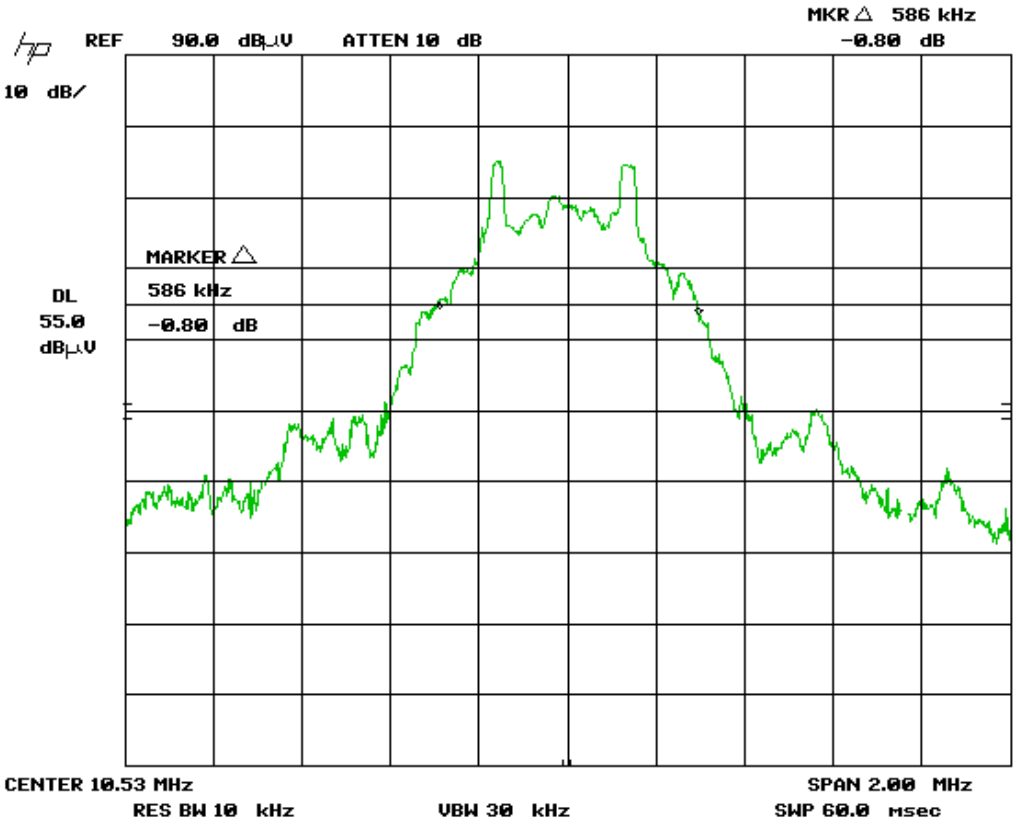
The 6 and 20 dB BW of the transmitter is given

	Measured Bandwidth (kHz)
6 dB	320
20 dB	586

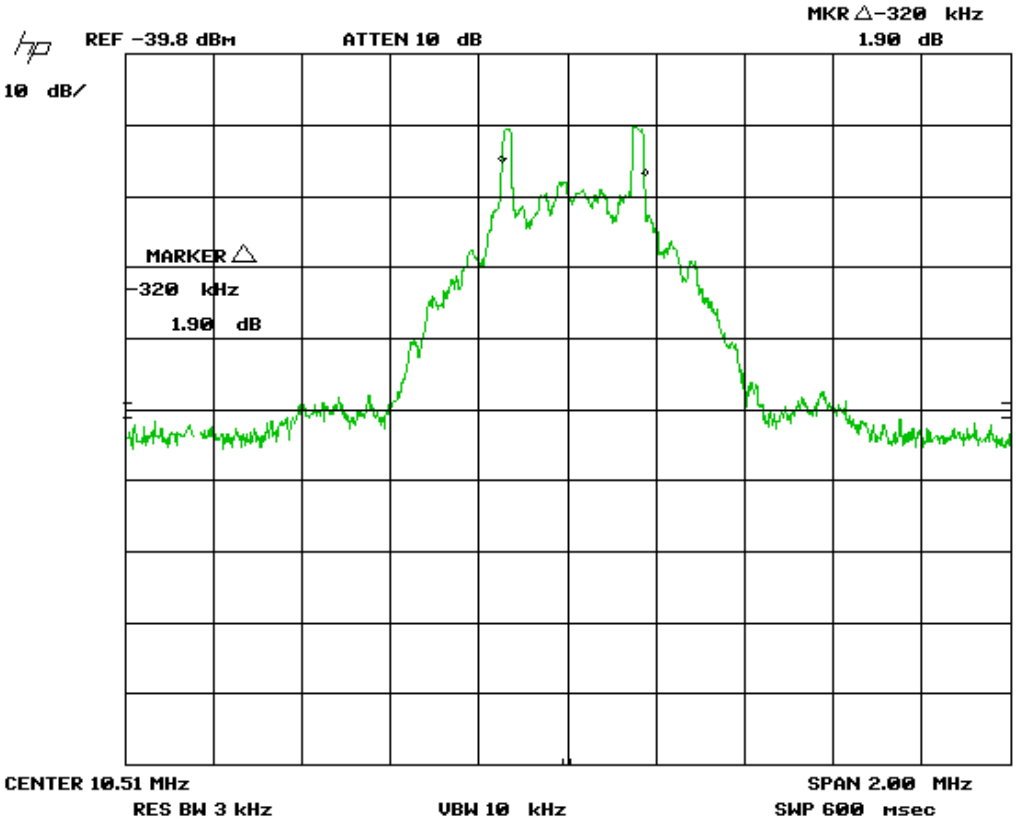
20 dB Bandwidth measurement graph

The graph below shows the 20 dB bandwidth the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the 6 and 20 dB bandwidth of a channel during operation of the EUT. This measurement is a peak measurement. Max hold is performed for a duration of not less than 1 minute.

20 dB BW



6 dB BW



Test Equipment

Equipment	Model No.	Manufacturer	Last calibration/Verification date	Next calibration/verification due date	Asset #
Spectrum Analyzer	8566B	HP	Oct-2, 2013	Oct-2, 2015	GEMC 190
Quasi Peak Adapter	85650A	HP	Oct-1, 2013	Oct-1, 2015	GEMC 191
Loop Antenna 100kHz - 30MHz	EM 6872	Electro-Metrics	Feb-5, 2013	Feb-5, 2015	GEMC 71
9kHz-1GHz, preamp	LNA 6901	Teseq	Feb-25, 2013	Feb-5, 2015	GEMC168
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	Feb-24, 2014	Feb-24, 2015	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	Feb-24, 2014	Feb-24, 2015	GEMC 29
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	Feb-24, 2014	Feb-24, 2015	GEMC 31

This report module is based on GEMC template "FCC - 15.209 - Radiated Emissions_Rev1.doc"

Spurious Radiated Emissions

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference.

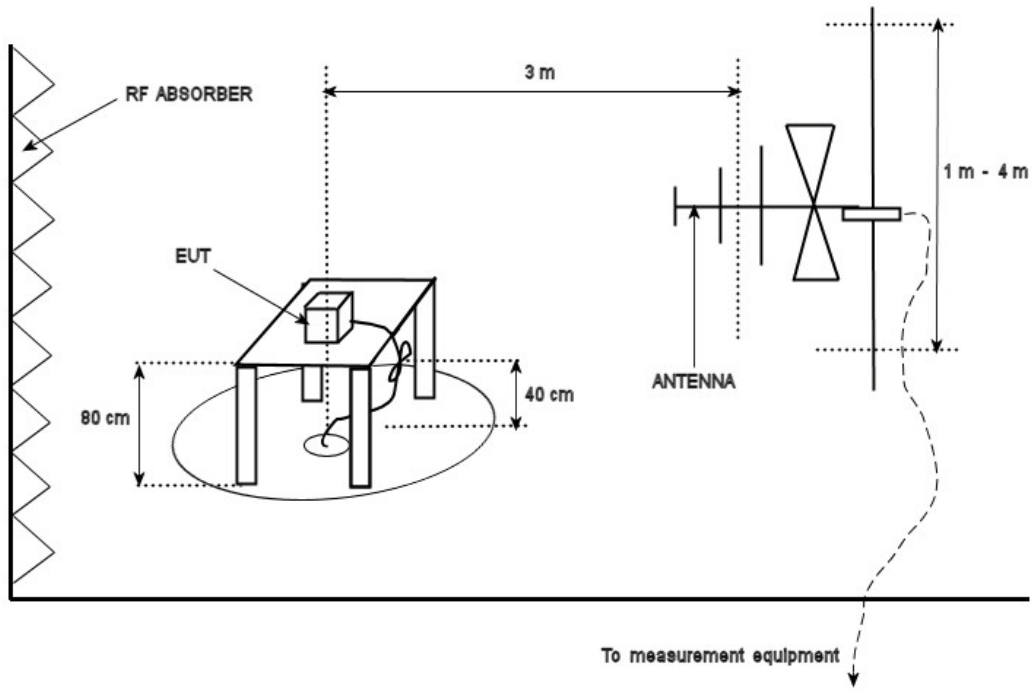
Limit(s) and Method

The method is as defined in ANSI C63.10:2009.
The limits are as defined in FCC Part 15, Section 15.209:

0.009 MHz – 0.490 MHz, 2400/F(kHz) uV/m at 300 m[1]
0.490 MHz – 1.705 MHz, 24000/F(kHz) uV/m at 30 m[1]
1.705 MHz – 30 MHz, 30 uV/m at 30 m[1]
30 MHz – 88 MHz, 100 uV/m (40.0 dBuV/m[1]) at 3 m
88 MHz – 216 MHz, 150 uV/m (43.5 dBuV/m[1]) at 3 m
216 MHz – 960 MHz, 200 uV/m (46.0 dBuV/m[1]) at 3 m
Above 960 MHz, 500 uV/m (54.0 dBuV/m[1]) at 3 m
Above 1000 MHz, 500 uV/m (54 dBuV/m[2]) at 3m
Above 1000 MHz, 500 uV/m (74 dBuV/m[3]) at 3m

[1]Limit is with Quasi Peak detector with bandwidths as defined in CISPR-16-1-1
[2]Limit is with 1 MHz measurement bandwidth and using an Average detector
[3]Limit is with 1 MHz measurement bandwidth and using a Peak detector

Typical Radiated Emissions Setup



Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is +/-4.4 dB with a 'k=2' coverage factor and a 95% confidence level.

Preliminary Graphs

Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector, please refer to the final measurement table where applicable. The graph shown below is a maximized peak measurement graph, measured with a resolution bandwidth greater than the final required detector and over a full 0-360 rotation. This peaking process is done as a worst case measurement. This process enables the detection of frequencies of concern for final measurement, and provides considerable time savings.

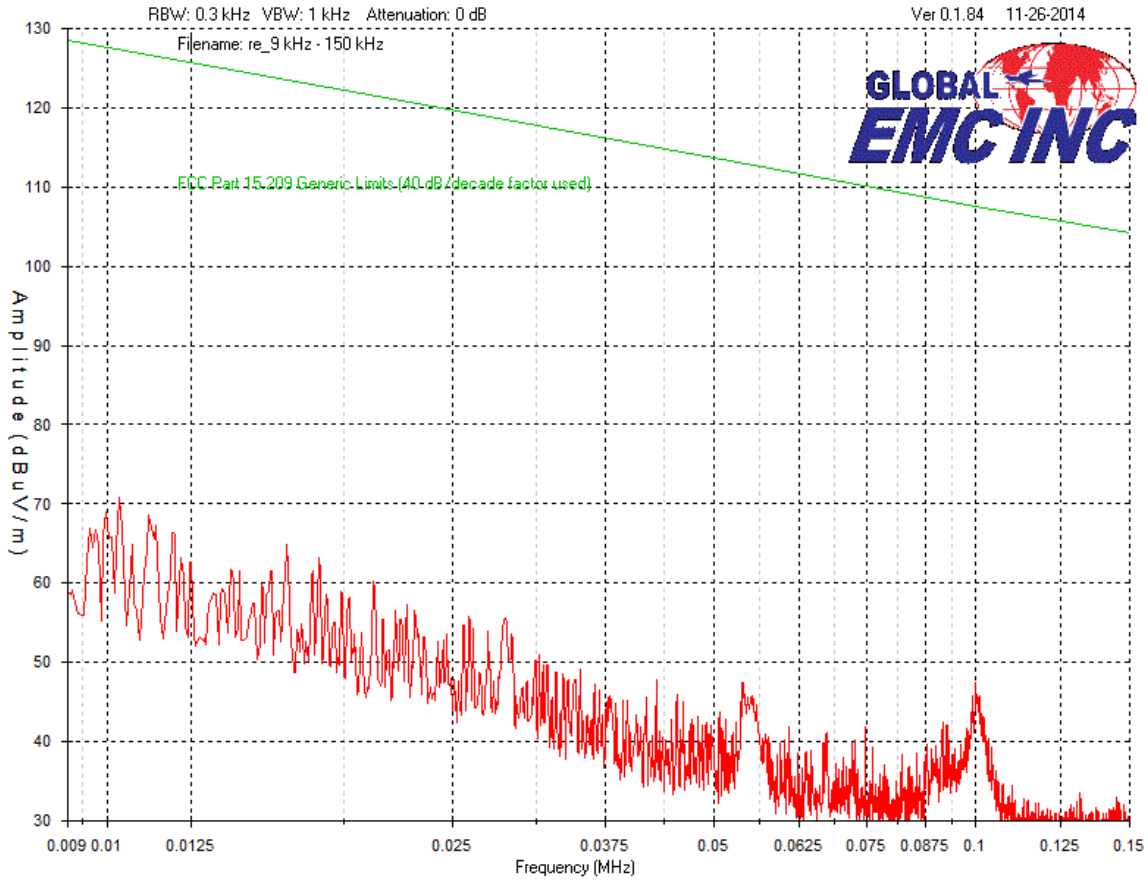
In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to the 10^{th} harmonic (a minimum of a 1 GHz).

Devices scanned may be scanned at alternate test distances, and in accordance with FCC Part 15, Subpart A, Section 15.31, an extrapolation factor of 20 dB/decade was used above

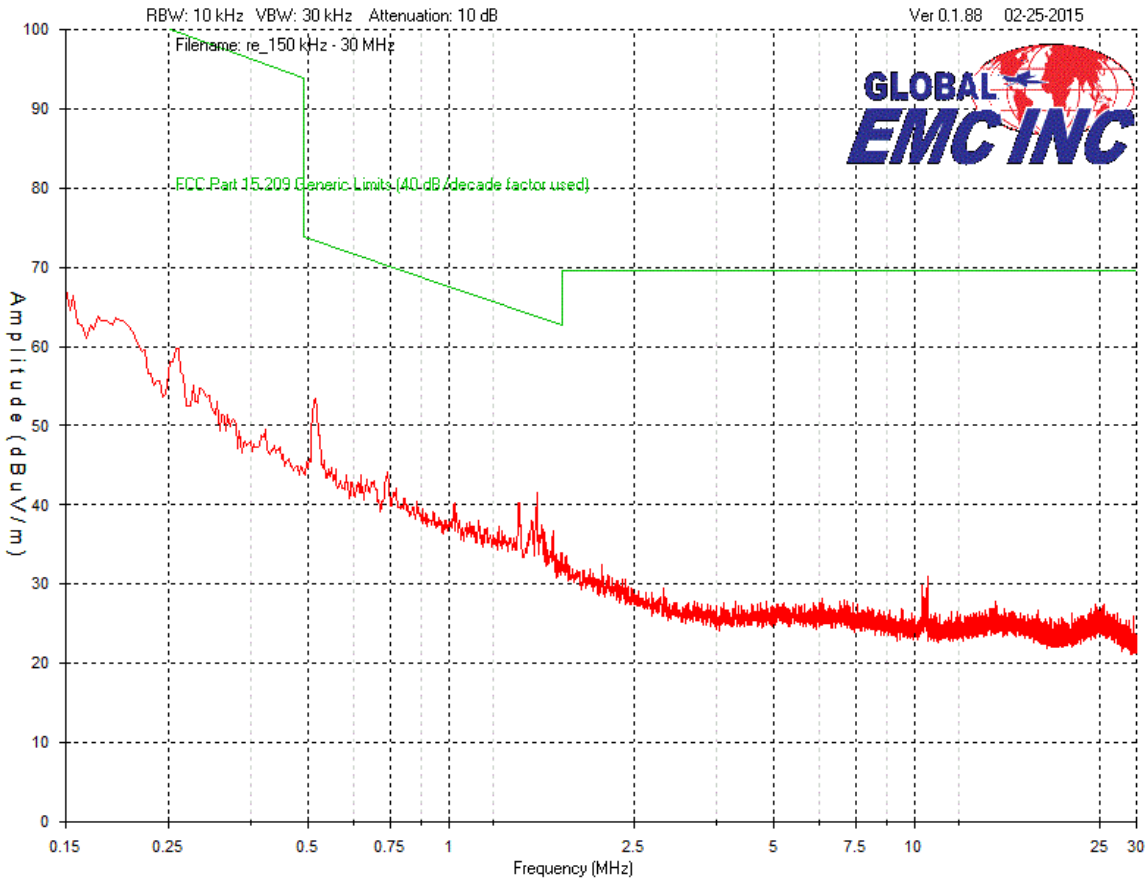
30 MHz and 40 dB/decade below 30 MHz. For example for 1 meter measurements, an extrapolation factor 9.5 dB from 20 Log (3m /1m) is applied for frequencies above 30 MHz.

To obtain the maximum emission, the loop antenna is positioned with its plane vertical and rotated about its vertical axis at the maximum azimuth position. This is then repeated with its plane horizontal, and rotated about the horizontal axis. The maximum obtained emission is presented.

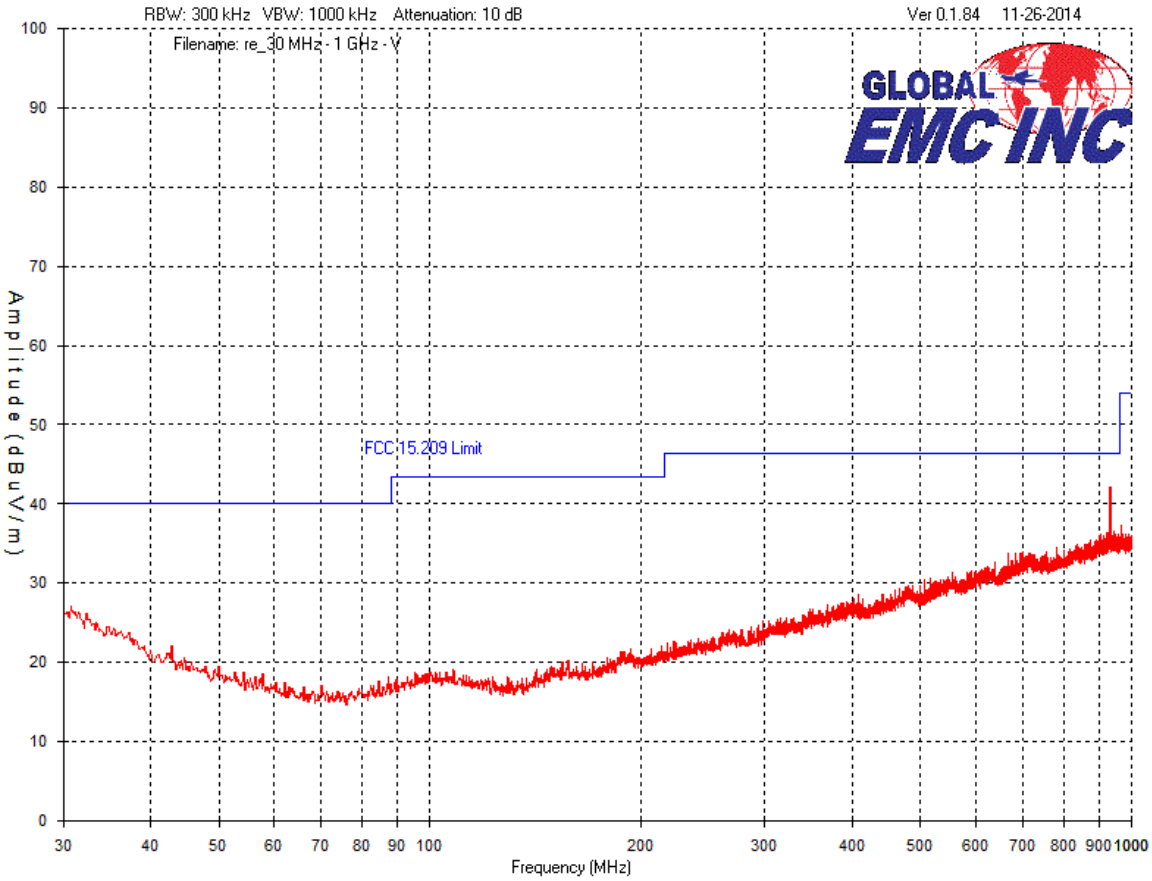
9 kHz – 150 kHz



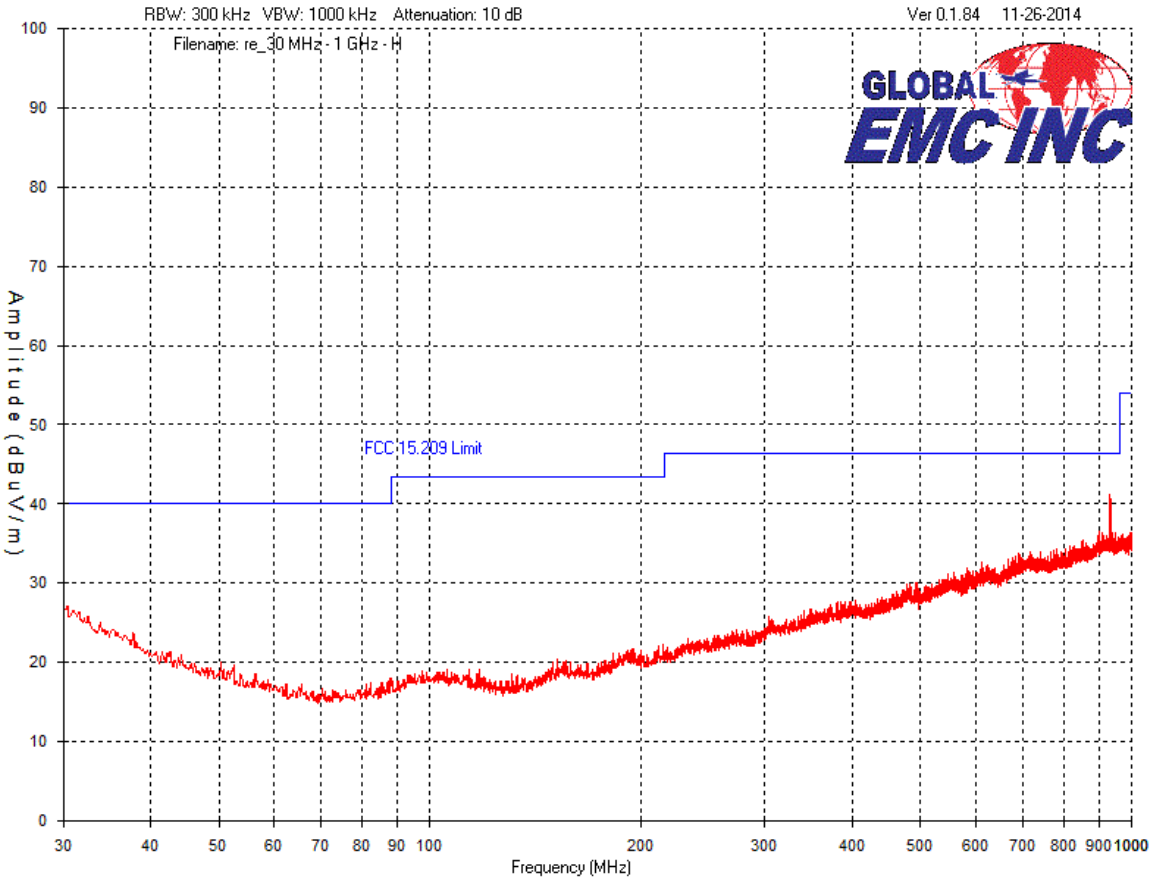
150 kHz – 30 MHz



30 MHz – 1 GHz
Vertical – Peak Emission Graph



30 MHz – 1 GHz
Horizontal - Peak Emission Graph



Final Measurements and Results

The EUT passed the limits. All peak emissions are below limit.

Test Equipment

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	Oct-2, 2013	Oct-2, 2015	GEMC 190
Quasi Peak Adapter	85650A	HP	Oct-1, 2013	Oct-1, 2015	GEMC 191
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Appendix A – EUT Summary

For further details for filing purposes, refer to filing package.

General EUT Description

Client Details	
Organization / Address	Sound Quest, LLC. 3385 Roy Orr Blvd Grand Prairie, TX 75050 United States
Contact	Susan K Reid
Phone	(267) 543-0058
Email	sreid@hlthearing.com
EUT (Equipment Under Test) Details	
EUT Name (for report title)	Hearing Aid
EUT Model / SN (if known)	4360 RITE96WL
EUT revision	B
Software version	2.0.5
Equipment category	Certification
EUT is powered using	1.25V DC Zinc-Air Battery
Input voltage range(s) (V)	1.25V~1.1V DC
Frequency range(s) (Hz)	10.199MHz~10.959MHz
Rated input current (A)	<2.5mA
Nominal power consumption (W)	<3.0mW
Number of power supplies in EUT	One (1)
Transmits RF energy? (describe)	Near-field Inductive; CP-FSK modulation
Basic EUT functionality description	Please refer to product user guide.
High level block diagram of EUT (attachment)	Please refer to attachment A.
Modes of operation	Transmit mode, receive mode.
Step by step instructions for setup and operation	Please refers to attachment B.
Customer to setup EUT on site?	Yes.
EUT response time (ms)	2500mSec typical.
EUT setup time (min)	< 5 min

Frequency of all clocks present in EUT	149kHz, 7.68MHz, 10.579MHz.
I/O cable description Specify length and type	Nil
Available connectors on EUT	Nil
Peripherals required to exercise EUT Ex. Signal generator	Nil
Dimensions of product	L 25.5 mm W 7.9 mm H 13.9 mm
Method of monitoring EUT and description of failure for immunity.	Synchronization between left and right hearing aids is used to verify correct functionality.
Other notes to test lab (URL to product, etc).	

Note the EUT is considered to have been received the date of the commencement of the first test, unless otherwise stated. For a close-up picture of the EUT, see 'Appendix B – EUT & Test Setup Photographs'.

EUT Configuration

Please see Appendix B for a picture of the unit running in normal conditions.

- Wireless were configured to transmit at 100% duty cycle

Operational Setup

These devices are required to be attached to the EUT for its normal operation.

- A receiver was paired with the transmitter.

Appendix B – EUT and Test Setup Photographs

Figure 1: Radiated emission setup – photo 1

Figure 2: Radiated emission setup – photo 2