NORTHWEST EMC

Starkey Laboratories, Inc.

Hearing Aid
Halo 2 R13, A4i R13, Start 1200i R13, and Start 1000i R13

FCC 15.247:2015

Report # STAK0061.1

NVLAP Lab Code: 200881-0

CERTIFICATE OF TEST

NORTHWEST EMC
2014-12-10

Last Date of Test: November 23, 2015
Starkey Laboratories, Inc.
Model: Hearing Aid

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2015	ANSI C63.10:2013

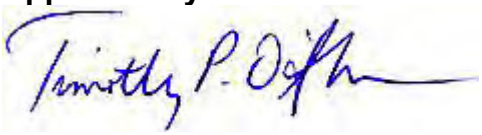
Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not required for a battery powered EUT.
6.5, 6.6, 11.12.1, 11.13.2	Spurious Radiated Emissions	Yes	Pass	
11.6	Duty Cycle	Yes	Pass	
11.8.2	Occupied Bandwidth	Yes	Pass	
11.10.2	Power Spectral Density	Yes	Pass	
11.9.2.2.4	Output Power	Yes	Pass	
11.11	Band Edge Compliance	Yes	Pass	
11.11	Spurious Conducted Emissions	Yes	Pass	

Deviations From Test Standards

None

Approved By:



Tim O'Shea, Operations Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information.

REVISION HISTORY

NORTHWEST EMC
REV 2014.10.14

Revision Number	Description	Date	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

REV 2015.2.19

United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Northwest EMC to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

IC - Recognized by Industry Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with IC.

European Union

European Commission – Validated by the European Commission as a Conformity Assessment Body (CAB) under the EMC directive and as a Notified Body under the R&TTE Directive.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

MSIP / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Israel

MOC – Recognized by MOC as a CAB for the acceptance of test data.

Hong Kong

OFCA – Recognized by OFCA as a CAB for the acceptance of test data.

Vietnam

MIC – Recognized by MIC as a CAB for the acceptance of test data.

SCOPE

For details on the Scopes of our Accreditations, please visit:
http://www.nwemc.com/accreditations/
http://gsi.nist.gov/global/docs/cabs/designations.html

MEASUREMENT UNCERTAINTY

TMU.2015.07.10

Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) for each test is on each data sheet. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

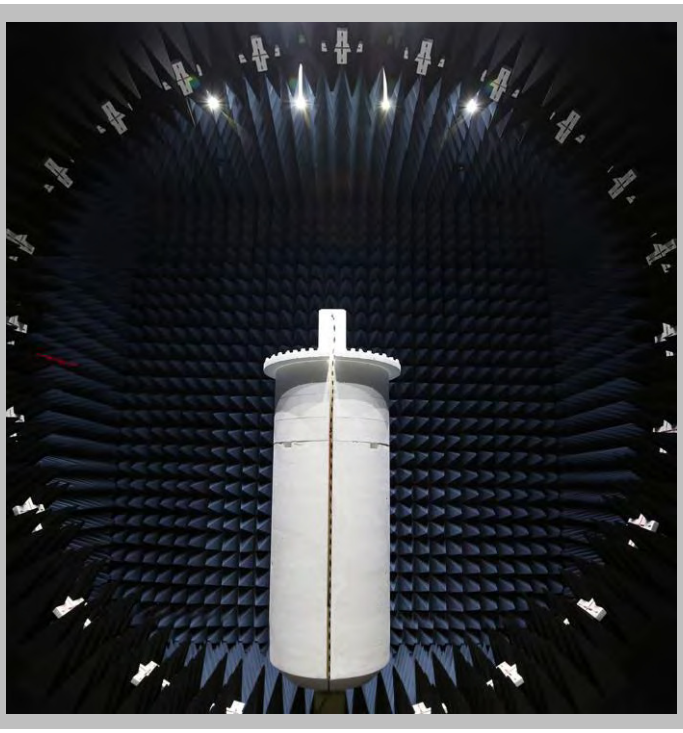
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

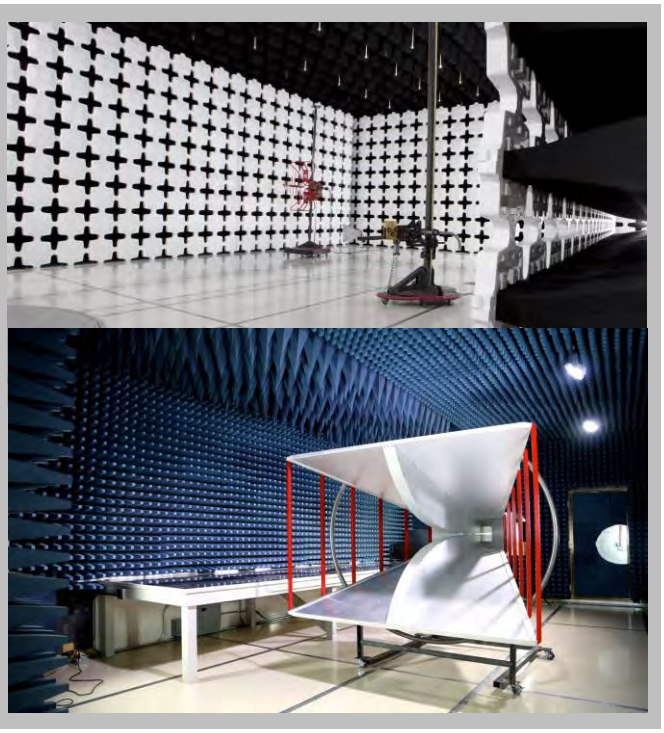
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

FACILITIES

NORTHWEST EMC
REV 2015.2.19

California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 9801 (425)984-6600
NVLAP					
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Industry Canada					
2834B-1, 2834B-3	2834E-1	N/A	2834D-1, 2834D-*2*	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157





PRODUCT DESCRIPTION

NORTHWEST EMC
2014-12-10

Client and Equipment Under Test (EUT) Information

Company Name:	Starkey Laboratories, Inc.
Address:	6600 Washington Ave. SO.
City, State, Zip:	Eden Prairie, MN 55344
Test Requested By:	Bill Mitchell
Model:	Hearing Aid
First Date of Test:	November 20, 2015
Last Date of Test:	November 23, 2015
Receipt Date of Samples:	November 16, 2015
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Hearing aid with a BLE radio.

Statement of Similarity:
The hearing aid models listed in the cover page are electrically and physically identical; the only difference is that they are sold under different brand names (Starkey or Audibel) and different model names (Halo 2 R13, A4i R13, Start 1200i R13, and Start 1000i R13).

Testing Objective:
To demonstrate compliance of the Bluetooth radio to FCC 15.247 requirements.

CONFIGURATIONS

NORTHWEST EMC
2014-12-10

Configuration STAK0061- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Hearing Aid	Starkey Laboratories, Inc.	64118-020	151250094

Configuration STAK0061- 3

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Hearing Aid	Starkey Laboratories, Inc.	64118-020	151250091

MODIFICATIONS

NORTHWEST EMC
2014-12-10

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	11/20/2015	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT was taken home by the client before the next scheduled test.
2	11/20/2015	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
3	11/20/2015	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
4	11/20/2015	Output Power	Modified from delivered configuration.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
5	11/20/2015	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
6	11/20/2015	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
7	11/23/2015	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

SPURIOUS RADIATED EMISSIONS

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmitting Bluetooth Low Energy - low channel (2402 MHz), mid channel (2442 MHz), and high channel (2480 MHz)

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

STAK0061 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26500 MHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Filter - Low Pass	Micro-Tronics	LPM50004	HGK	3/2/2015	12 mo
Filter - High Pass	Micro-Tronics	HPM50111	HGQ	3/2/2015	12 mo
Attenuator	S.M. Electronics	SA6-20	REO	3/2/2015	12 mo
Amplifier - Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	9/18/2015	12 mo
Cable	Northwest EMC	18-26GHz Standard Gain Horn Cable	MNP	9/18/2015	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AHG	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVW	3/2/2015	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AIQ	NCR	0 mo
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	11/13/2015	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	3/2/2015	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVX	3/2/2015	12 mo
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	5/5/2015	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AJA	6/3/2014	24 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	PAD	3/2/2015	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	3/30/2015	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AYD	12/17/2013	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFG	6/5/2015	12 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

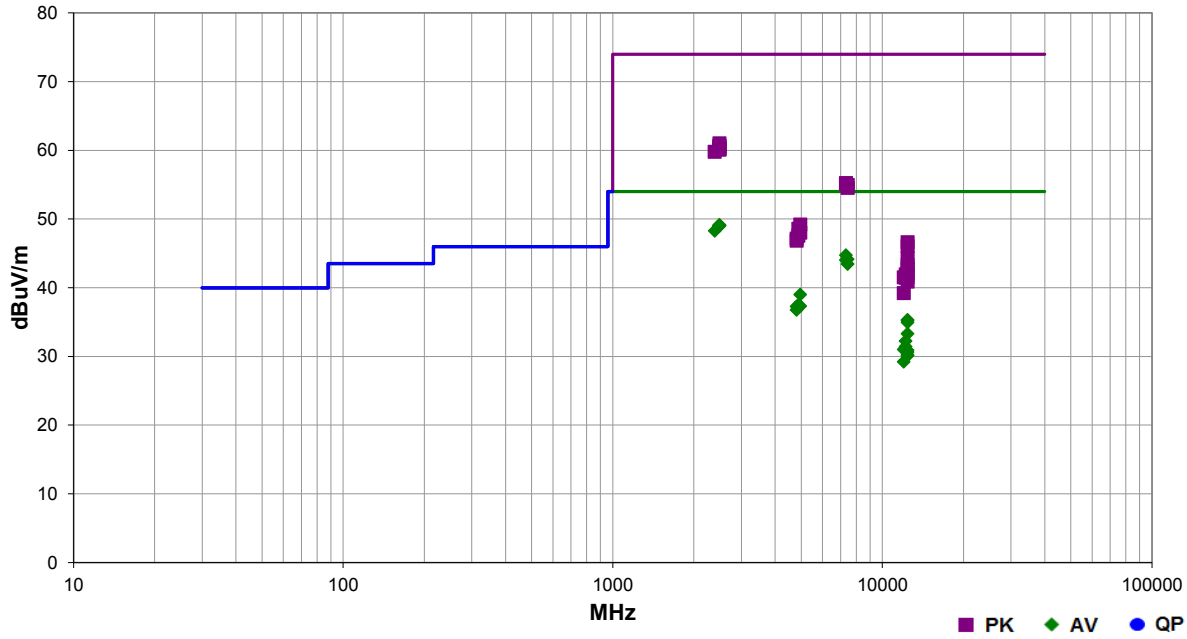
The highest gain of each type of antenna to be used with the EUT was tested. The EUT was configured for low, mid, and high band transmit frequencies. For each configuration, the spectrum was scanned throughout the specified range. In addition, measurements were made in the restricted bands to verify compliance. While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and the EUT antenna in three orthogonal axis, and adjusting measurement antenna height and polarization. A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

SPURIOUS RADIATED EMISSIONS

Work Order:	STAK0061	**Date:**	11/23/15		
Project:	None	**Temperature:**	22.3 °C		
Job Site:	MN05	**Humidity:**	22.6% RH		
Serial Number:	151250094	**Barometric Pres.:**	983.7 mbar	**Tested by:**	Dustin Sparks
EUT:	Hearing Aid				
Configuration:	1				
Customer:	Starkey Laboratories, Inc.				
Attendees:	Charlie Esch				
EUT Power:	Battery				
Operating Mode:	Transmitting Bluetooth Low Energy - low channel (2402 MHz), mid channel (2442 MHz), and high channel (2480 MHz)				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 15.247:2015	ANSI C63.10:2013

Run #	17	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2485.783	31.0	-1.9	2.1	178.1	3.0	20.0	Vert	AV	0.0	49.1	54.0	-4.9	High ch, EUT vert
2485.108	31.0	-1.9	1.0	234.0	3.0	20.0	Horz	AV	0.0	49.1	54.0	-4.9	High ch, EUT on side
2486.650	30.9	-1.9	1.0	159.1	3.0	20.0	Vert	AV	0.0	49.0	54.0	-5.0	High ch, EUT horz
2485.892	30.9	-1.9	1.0	158.0	3.0	20.0	Horz	AV	0.0	49.0	54.0	-5.0	High ch, EUT horz
2484.867	30.9	-1.9	1.2	297.0	3.0	20.0	Horz	AV	0.0	49.0	54.0	-5.0	High ch, EUT vert
2484.367	30.9	-1.9	1.0	66.1	3.0	20.0	Vert	AV	0.0	49.0	54.0	-5.0	High ch, EUT on side
2389.500	30.5	-2.2	1.0	127.1	3.0	20.0	Horz	AV	0.0	48.3	54.0	-5.7	Low ch, EUT on side
7325.733	30.5	14.2	1.0	0.0	3.0	0.0	Vert	AV	0.0	44.7	54.0	-9.3	Mid ch, EUT vert
7439.533	29.5	14.6	1.0	194.0	3.0	0.0	Horz	AV	0.0	44.1	54.0	-9.9	High ch, EUT horz
7325.217	29.8	14.2	1.0	328.0	3.0	0.0	Horz	AV	0.0	44.0	54.0	-10.0	Mid ch, EUT horz
7437.592	28.8	14.6	2.0	129.0	3.0	0.0	Vert	AV	0.0	43.4	54.0	-10.6	High ch, EUT vert
2487.925	42.9	-1.9	1.2	297.0	3.0	20.0	Horz	PK	0.0	61.0	74.0	-13.0	High ch, EUT vert
2488.483	42.5	-1.9	1.0	159.1	3.0	20.0	Vert	PK	0.0	60.6	74.0	-13.4	High ch, EUT horz
2486.875	42.5	-1.9	1.0	66.1	3.0	20.0	Vert	PK	0.0	60.6	74.0	-13.4	High ch, EUT on side
2485.575	42.2	-1.9	2.1	178.1	3.0	20.0	Vert	PK	0.0	60.3	74.0	-13.7	High ch, EUT vert
2486.392	42.0	-1.9	1.0	234.0	3.0	20.0	Horz	PK	0.0	60.1	74.0	-13.9	High ch, EUT on side
2485.742	42.0	-1.9	1.0	158.0	3.0	20.0	Horz	PK	0.0	60.1	74.0	-13.9	High ch, EUT horz
2385.492	42.0	-2.2	1.0	127.1	3.0	20.0	Horz	PK	0.0	59.8	74.0	-14.2	Low ch, EUT on side
4959.733	32.2	6.8	2.0	68.0	3.0	0.0	Horz	AV	0.0	39.0	54.0	-15.0	High ch, EUT horz
4883.850	31.0	6.5	1.5	124.1	3.0	0.0	Vert	AV	0.0	37.5	54.0	-16.5	Mid ch, EUT vert
4960.033	30.5	6.8	1.7	183.0	3.0	0.0	Vert	AV	0.0	37.3	54.0	-16.7	High ch, EUT vert
4804.133	30.9	6.4	1.0	110.0	3.0	0.0	Horz	AV	0.0	37.3	54.0	-16.7	Low ch, EUT horz

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4885.275	30.7	6.5	1.0	229.9	3.0	0.0	Horz	AV	0.0	37.2	54.0	-16.8	Mid ch, EUT horz
4803.917	30.4	6.4	1.0	214.1	3.0	0.0	Vert	AV	0.0	36.8	54.0	-17.2	Low ch, EUT vert
12399.230	37.8	-2.5	1.8	197.0	3.0	0.0	Horz	AV	0.0	35.3	54.0	-18.7	High ch, EUT horz
7326.708	41.0	14.2	1.0	0.0	3.0	0.0	Vert	PK	0.0	55.2	74.0	-18.8	Mid ch, EUT vert
12402.300	32.8	2.4	1.0	78.0	3.0	0.0	Horz	AV	0.0	35.2	54.0	-18.8	High ch, EUT horz
7323.675	40.9	14.2	1.0	328.0	3.0	0.0	Horz	PK	0.0	55.1	74.0	-18.9	Mid ch, EUT horz
7441.025	40.3	14.6	1.0	194.0	3.0	0.0	Horz	PK	0.0	54.9	74.0	-19.1	High ch, EUT horz
12402.290	32.5	2.4	1.0	11.1	3.0	0.0	Vert	AV	0.0	34.9	54.0	-19.1	High ch, EUT vert
7440.300	39.9	14.6	2.0	129.0	3.0	0.0	Vert	PK	0.0	54.5	74.0	-19.5	High ch, EUT vert
12399.080	35.8	-2.5	3.9	48.1	3.0	0.0	Horz	AV	0.0	33.3	54.0	-20.7	High ch, EUT vert
12209.080	34.9	-2.7	1.0	296.0	3.0	0.0	Horz	AV	0.0	32.2	54.0	-21.8	Mid ch, EUT horz
12208.810	34.1	-2.7	1.8	300.9	3.0	0.0	Vert	AV	0.0	31.4	54.0	-22.6	Mid ch, EUT vert
12008.730	34.5	-3.5	1.0	190.0	3.0	0.0	Horz	AV	0.0	31.0	54.0	-23.0	Low ch, EUT horz
12399.160	33.4	-2.5	2.3	76.1	3.0	0.0	Vert	AV	0.0	30.9	54.0	-23.1	High ch, EUT vert
12399.350	33.1	-2.5	1.0	114.0	3.0	0.0	Horz	AV	0.0	30.6	54.0	-23.4	High ch, EUT on side
12400.000	32.7	-2.5	1.2	301.9	3.0	0.0	Vert	AV	0.0	30.2	54.0	-23.8	High ch, EUT horz
12398.970	32.6	-2.5	2.7	11.1	3.0	0.0	Vert	AV	0.0	30.1	54.0	-23.9	High ch, EUT on side
12008.650	32.7	-3.5	1.0	235.0	3.0	0.0	Vert	AV	0.0	29.2	54.0	-24.8	Low ch, EUT vert
4959.117	42.4	6.8	2.0	68.0	3.0	0.0	Horz	PK	0.0	49.2	74.0	-24.8	High ch, EUT horz
4882.500	42.1	6.5	1.5	124.1	3.0	0.0	Vert	PK	0.0	48.6	74.0	-25.4	Mid ch, EUT vert
4961.708	41.2	6.8	1.7	183.0	3.0	0.0	Vert	PK	0.0	48.0	74.0	-26.0	High ch, EUT vert
4881.675	41.1	6.5	1.0	229.9	3.0	0.0	Horz	PK	0.0	47.6	74.0	-26.4	Mid ch, EUT horz
4803.808	40.8	6.4	1.0	110.0	3.0	0.0	Horz	PK	0.0	47.2	74.0	-26.8	Low ch, EUT horz
4806.058	40.5	6.4	1.0	214.1	3.0	0.0	Vert	PK	0.0	46.9	74.0	-27.1	Low ch, EUT vert
12402.060	44.2	2.4	1.0	78.0	3.0	0.0	Horz	PK	0.0	46.6	74.0	-27.4	High ch, EUT horz
12402.010	43.6	2.4	1.0	11.1	3.0	0.0	Vert	PK	0.0	46.0	74.0	-28.0	High ch, EUT vert
12399.330	46.8	-2.5	1.8	197.0	3.0	0.0	Horz	PK	0.0	44.3	74.0	-29.7	High ch, EUT horz
12398.760	45.8	-2.5	3.9	48.1	3.0	0.0	Horz	PK	0.0	43.3	74.0	-30.7	High ch, EUT vert
12399.140	45.2	-2.5	1.2	301.9	3.0	0.0	Vert	PK	0.0	42.7	74.0	-31.3	High ch, EUT horz
12398.540	44.7	-2.5	1.0	114.0	3.0	0.0	Horz	PK	0.0	42.2	74.0	-31.8	High ch, EUT on side
12208.800	44.6	-2.7	1.0	296.0	3.0	0.0	Horz	PK	0.0	41.9	74.0	-32.1	Mid ch, EUT horz
12399.290	44.1	-2.5	2.3	76.1	3.0	0.0	Vert	PK	0.0	41.6	74.0	-32.4	High ch, EUT vert
12008.440	45.0	-3.5	1.0	190.0	3.0	0.0	Horz	PK	0.0	41.5	74.0	-32.5	Low ch, EUT horz
12212.370	44.1	-2.6	1.8	300.9	3.0	0.0	Vert	PK	0.0	41.5	74.0	-32.5	Mid ch, EUT vert
12399.760	43.4	-2.5	2.7	11.1	3.0	0.0	Vert	PK	0.0	40.9	74.0	-33.1	High ch, EUT on side
12009.870	42.7	-3.5	1.0	235.0	3.0	0.0	Vert	PK	0.0	39.2	74.0	-34.8	Low ch, EUT vert

DUTY CYCLE

XMit 2015.01.14

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mos)
Meter - Multimeter	Fluke	117/EFSP	MLR	5/27/2015	36
Power Supply - DC	EZ Digital Co	GP-4303D	TPY	NCR	0
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Attenuator	S.M. Electronics	SA26B-20	RFW	3/10/2015	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	4/20/2015	12

TEST DESCRIPTION

The Duty Cycle (x) of the single channel operation of the radio as controlled by the provided test software was measured for each of the EUT operating modes.

There is no compliance requirement to be met by this test, so therefore no Pass / Fail criteria.

The measurements were made using a zero span on the spectrum analyzer to see the pulses in the time domain. The transmit power was set to its default maximum. A direct connection was made between the RF output of the EUT and a spectrum analyzer. Attenuation and a DC block were used.

The duty cycle was calculated by dividing the transmission pulse duration (T) by the total period of a single on and total off time.

If the transmit duty cycle < 98 percent, burst gating may have been used during some of the other tests in this report to only take the measurement during the burst duration.

DUTY CYCLE

NORTHWEST EMC

XMit 2015.01.14

EUT:	Hearing Aid			Work Order:	STAK0061
Serial Number:	151250091			Date:	11/20/15
Customer:	Starkey Laboratories, Inc.			Temperature:	20.8°C
Attendees:	Charlie Esch			Humidity:	25%
Project:	None			Barometric Pres.:	993.3
Tested by:	Trevor Buls	Power:	Battery	Job Site:	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2015	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

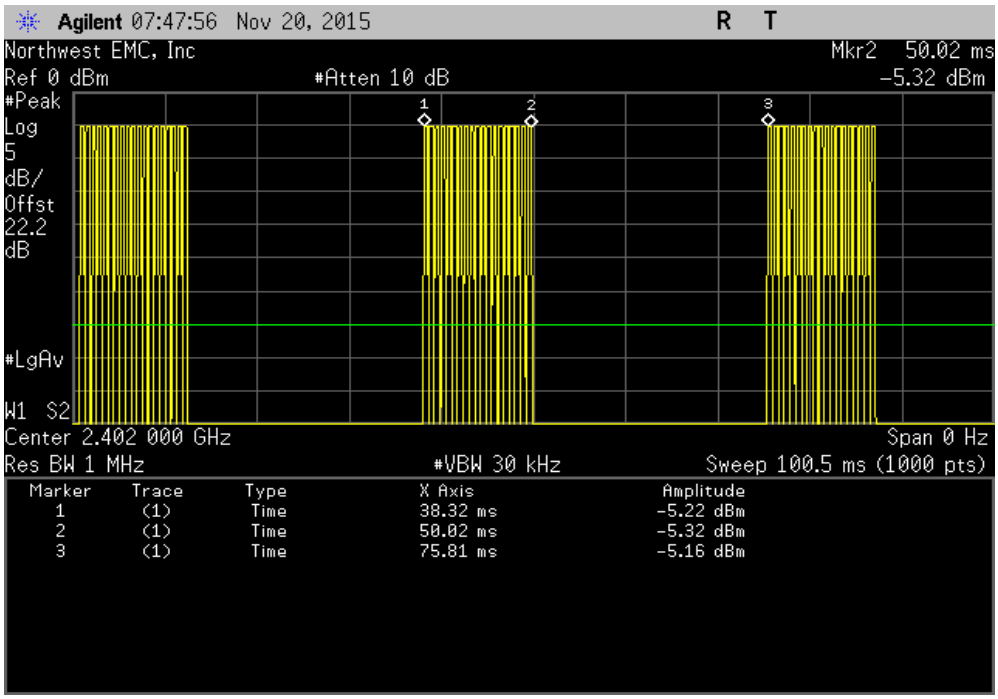
Configuration #	3	Signature	Trevor Buls

	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
Low Channel, 2402 MHz	11.702 ms	37.485 ms	1	31.2	N/A	N/A
Low Channel, 2402 MHz	N/A	N/A	95	N/A	N/A	N/A
Mid Channel, 2442 MHz	11.733 ms	37.546 ms	1	31.3	N/A	N/A
Mid Channel, 2442 MHz	N/A	N/A	90	N/A	N/A	N/A
High Channel, 2480 MHz	11.682 ms	37.566 ms	1	31.1	N/A	N/A
High Channel, 2480 MHz	N/A	N/A	95	N/A	N/A	N/A

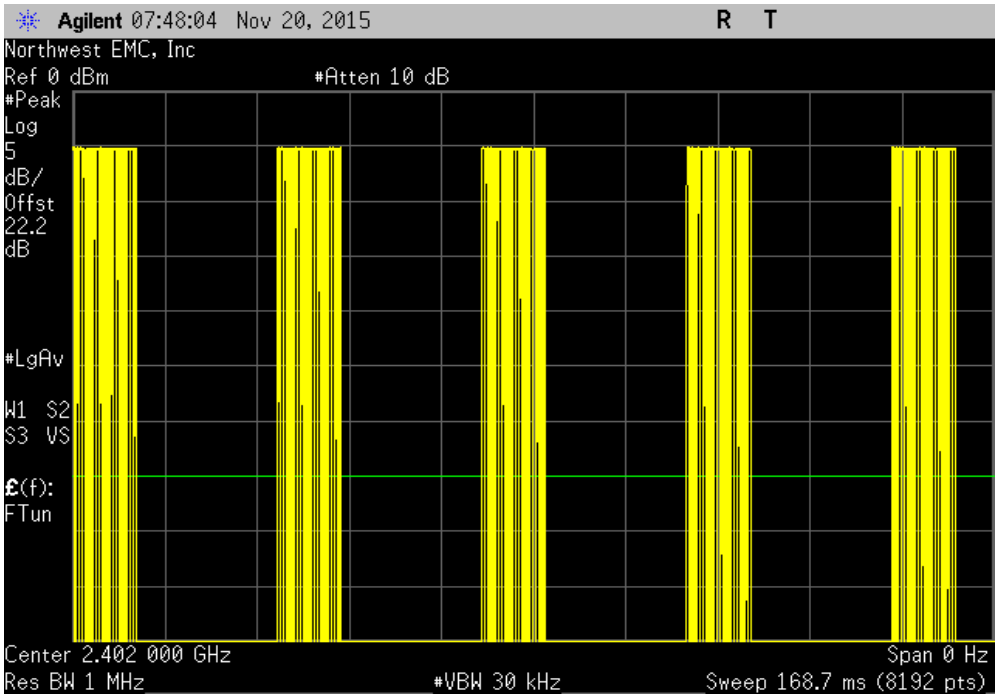
DUTY CYCLE

XMit 2015.01.14

Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	11.702 ms	37.485 ms	1	31.2	N/A	N/A



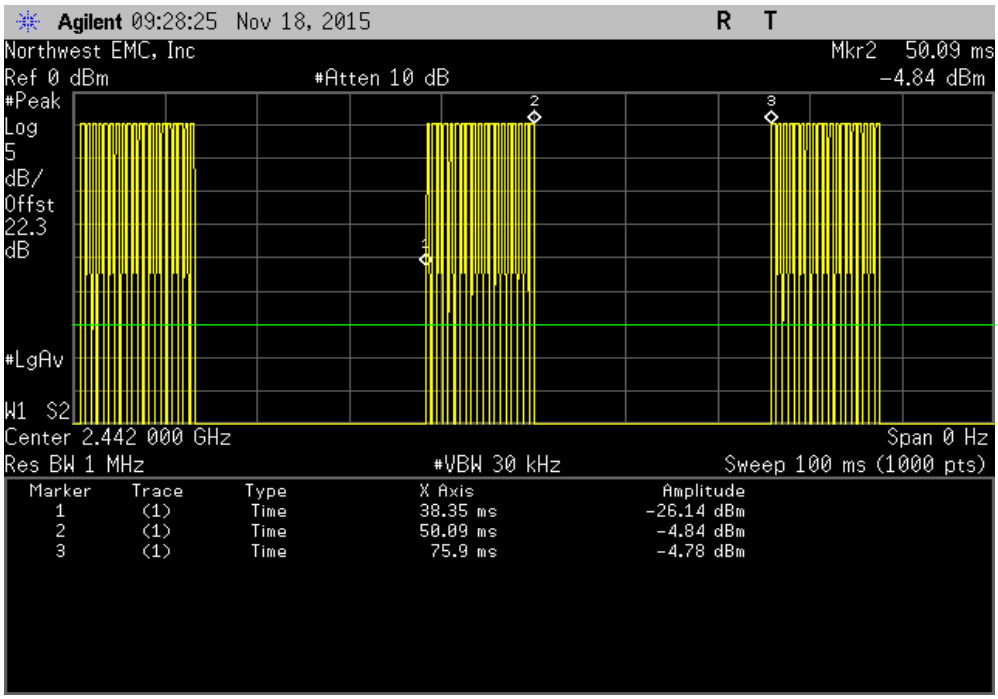
Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	95	N/A	N/A	N/A



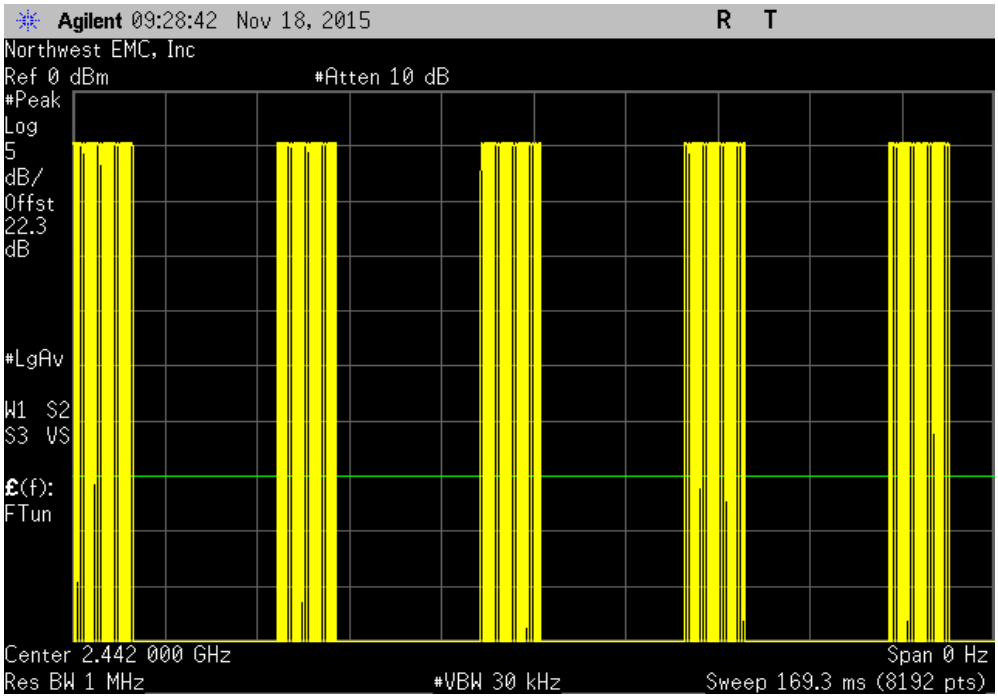
DUTY CYCLE

XMit 2015.01.14

Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	11.733 ms	37.546 ms	1	31.3	N/A	N/A



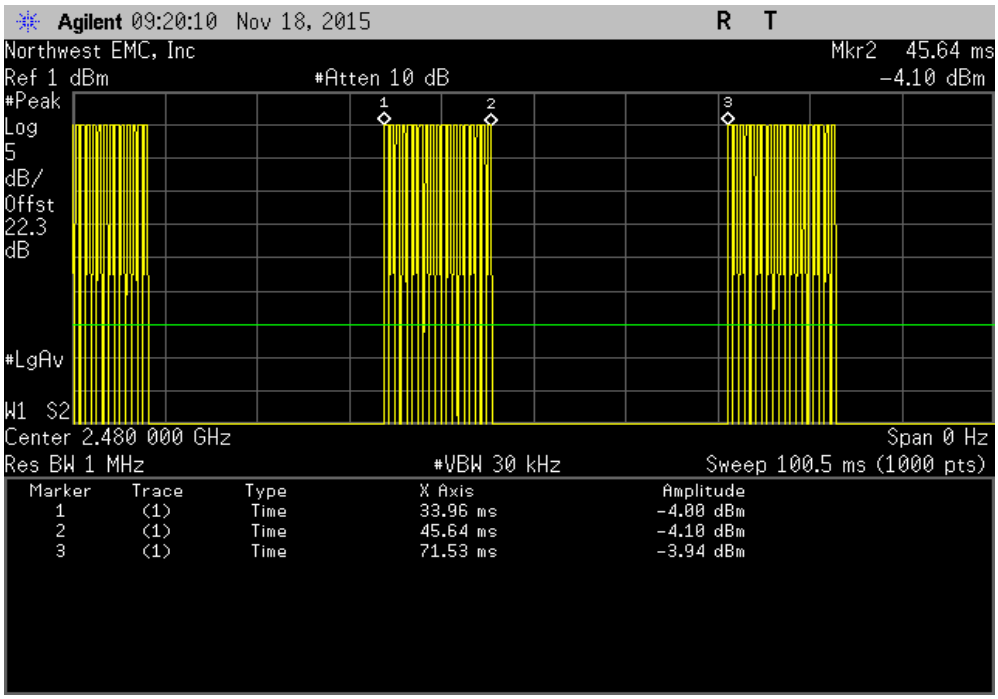
Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	90	N/A	N/A	N/A



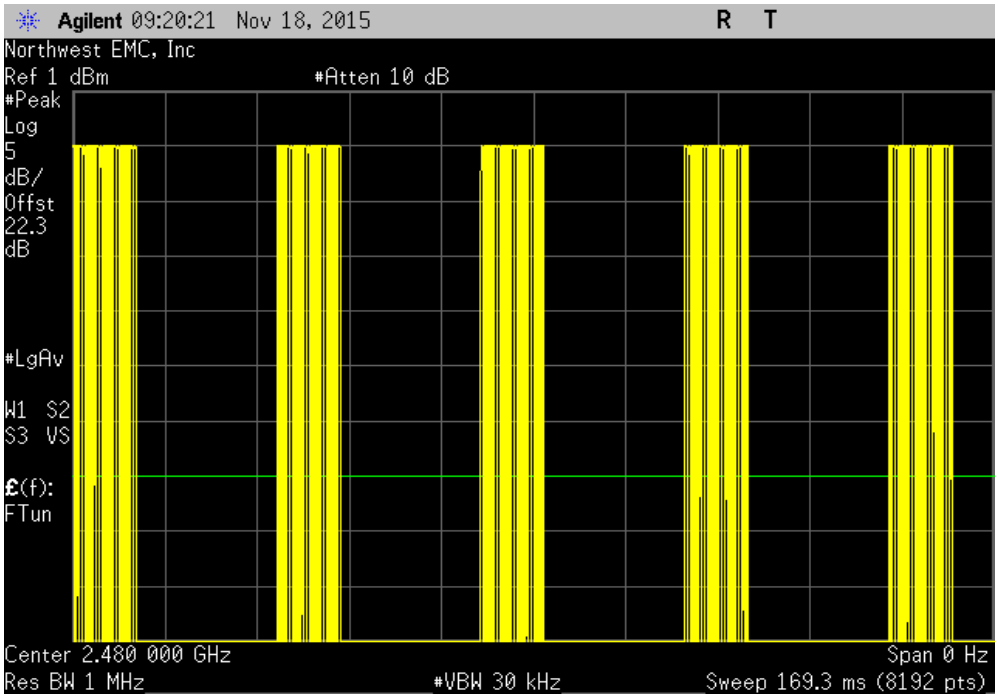
DUTY CYCLE

XMit 2015.01.14

High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	11.682 ms	37.566 ms	1	31.1	N/A	N/A



High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	95	N/A	N/A	N/A



OCCUPIED BANDWIDTH

NORTHWEST EMC

XMit 2015.01.14

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mos)
Meter - Multimeter	Fluke	117/EFSP	MLR	5/27/2015	36
Power Supply - DC	EZ Digital Co	GP-4303D	TPY	NCR	0
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Attenuator	S.M. Electronics	SA26B-20	RFW	3/10/2015	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	4/20/2015	12

TEST DESCRIPTION

The 6dB occupied bandwidth was measured using 100 kHz resolution bandwidth and 300 kHz video bandwidth. The 99.0% (approximate 26 dB) emission bandwidth (EBW) was also measured at the same time.

The EUT was set to the channels and modes listed in the datasheet. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer.

OCCUPIED BANDWIDTH

NORTHWEST EMC

XMit 2015.01.14

EUT:	Hearing Aid			**Work Order:**	STAK0061
Serial Number:	151250091			**Date:**	11/20/15
Customer:	Starkey Laboratories, Inc.			**Temperature:**	20.8°C
Attendees:	Charlie Esch			**Humidity:**	25%
Project:	None			**Barometric Pres.:**	993.3
Tested by:	Trevor Buls	**Power:**	Battery	**Job Site:**	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2015	ANSI C63.10:2013

COMMENTS

None

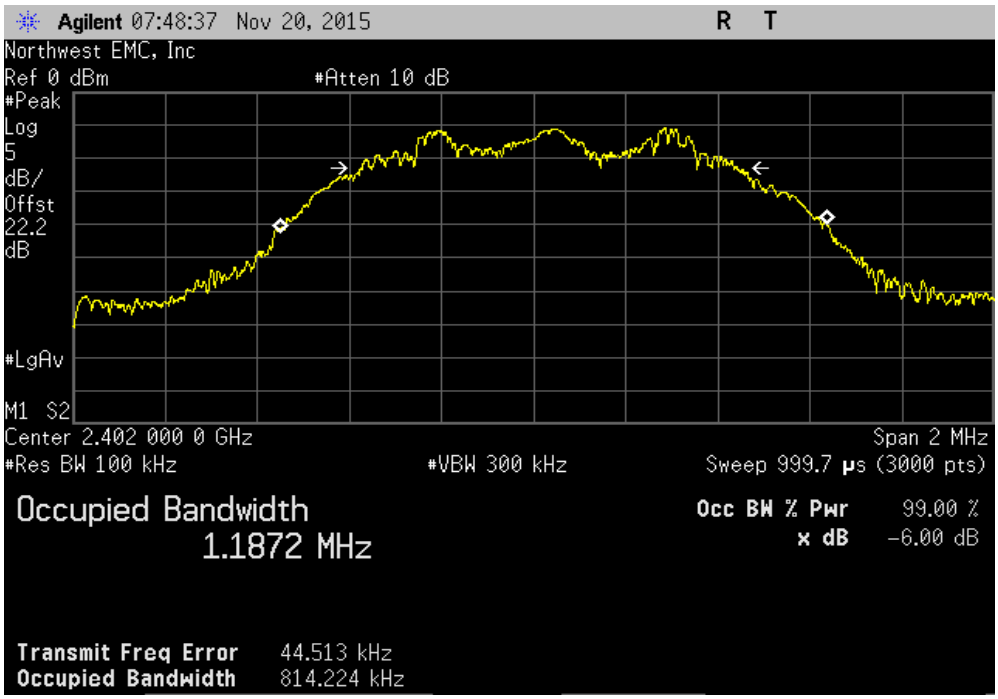
DEVIATIONS FROM TEST STANDARD

None

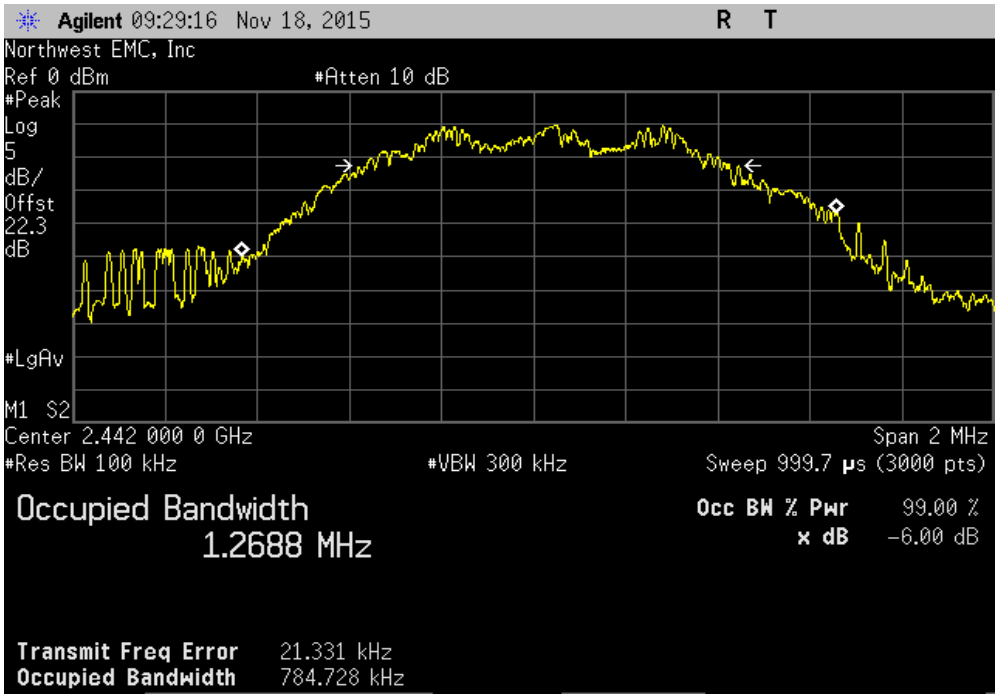
Configuration #	3	Signature	Trevor Buls

	Value	Limit (≥)	Result
Low Channel, 2402 MHz	814.224 kHz	500 kHz	Pass
Mid Channel, 2442 MHz	784.728 kHz	500 kHz	Pass
High Channel, 2480 MHz	787.559 kHz	500 kHz	Pass

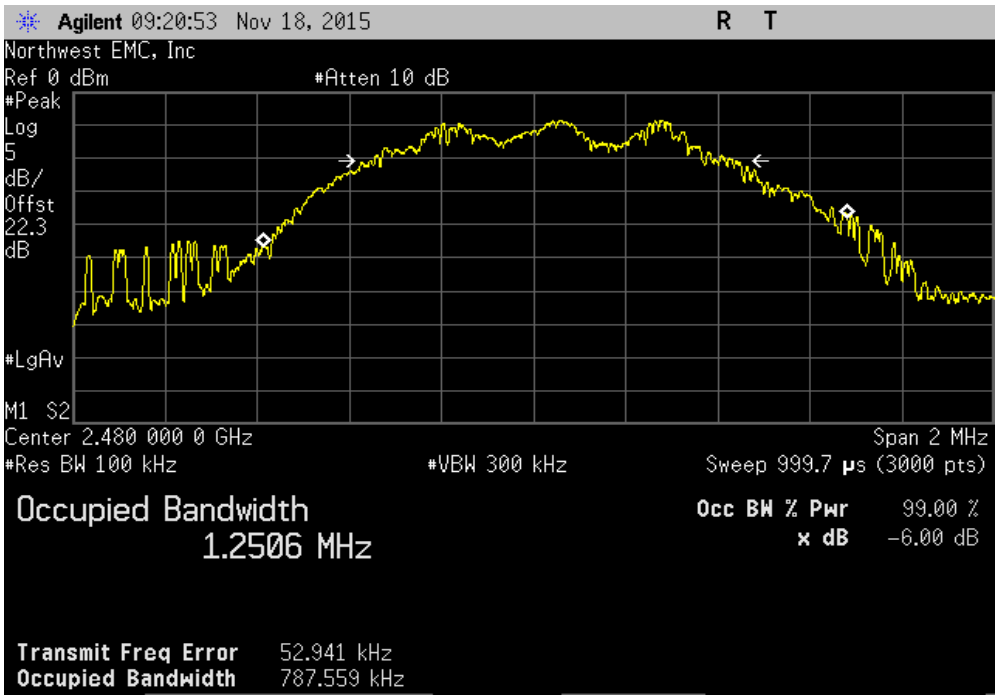
Low Channel, 2402 MHz						
				Value	Limit (≥)	Result
				814.224 kHz	500 kHz	Pass



Mid Channel, 2442 MHz						
				Value	Limit (≥)	Result
				784.728 kHz	500 kHz	Pass



High Channel, 2480 MHz						
				Value	Limit (≥)	Result
				787.559 kHz	500 kHz	Pass



POWER SPECTRAL DENSITY

XMit 2015.01.14

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mos)
Meter - Multimeter	Fluke	117/EFSP	MLR	5/27/2015	36
Power Supply - DC	EZ Digital Co	GP-4303D	TPY	NCR	0
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Attenuator	S.M. Electronics	SA26B-20	RFW	3/10/2015	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	4/20/2015	12

TEST DESCRIPTION

The maximum power spectral density measurements was measured using the channels and modes as called out on the following data sheets.

A direct connection was made between the RF output of the EUT and a spectrum analyzer. External attenuation and a DC block were used. The reference level offset on the spectrum analyzer was adjusted to compensate for cable loss and the external attenuation used between the RF output and the spectrum analyzer input.

Per the procedure outlined in ANSI C63.10 the peak power spectral density was measured in a 3 kHz RBW.

POWER SPECTRAL DENSITY

NORTHWEST EMC

XMit 2015.01.14

EUT:	Hearing Aid			**Work Order:**	STAK0061
Serial Number:	151250091			**Date:**	11/20/15
Customer:	Starkey Laboratories, Inc.			**Temperature:**	20.8°C
Attendees:	Charlie Esch			**Humidity:**	25%
Project:	None			**Barometric Pres.:**	993.3
Tested by:	Trevor Buls	**Power:**	Battery	**Job Site:**	MN08

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2015	ANSI C63.10:2013

COMMENTS

None

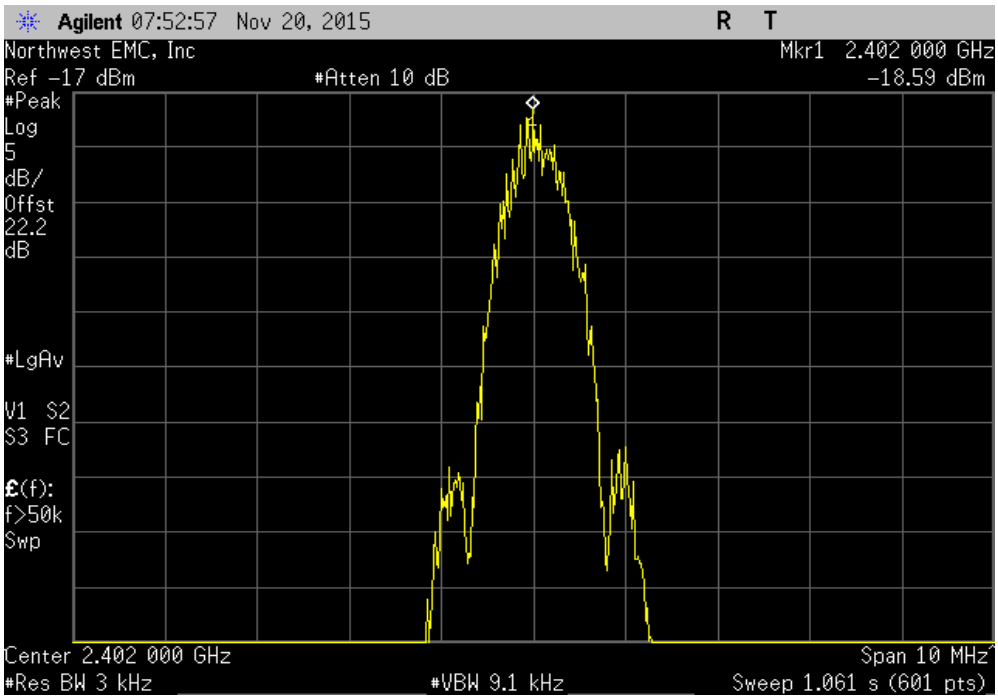
DEVIATIONS FROM TEST STANDARD

None

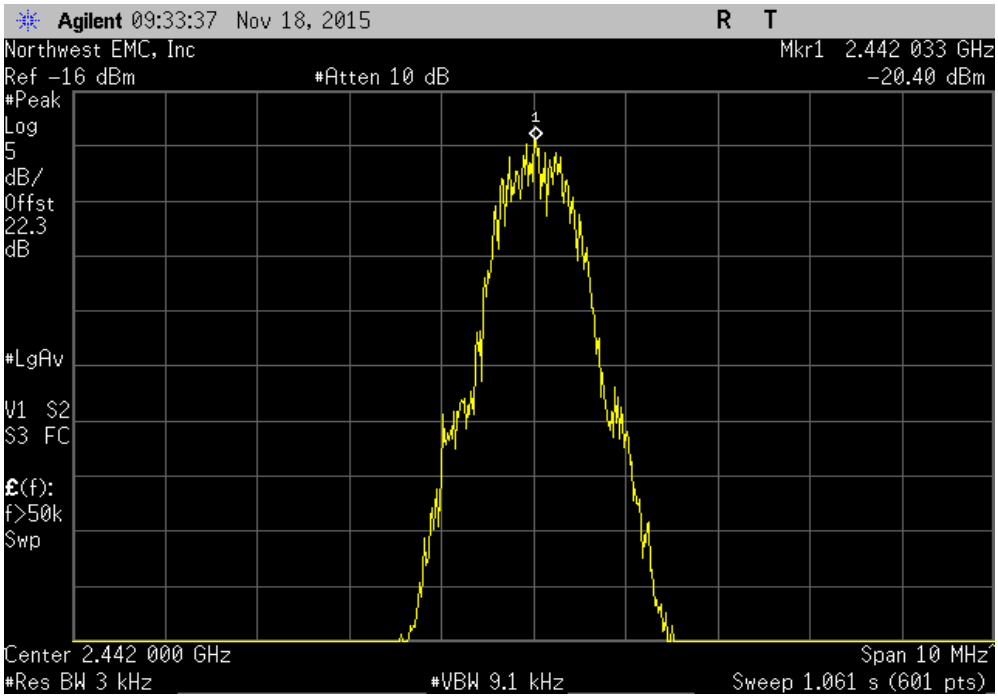
Configuration #	3	*Signature* Trevor Buls

	Value dBm/3kHz	Limit < dBm/3kHz	Results
Low Channel, 2402 MHz	-18.587	8	Pass
Mid Channel, 2442 MHz	-20.398	8	Pass
High Channel, 2480 MHz	-18.412	8	Pass

Low Channel, 2402 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-18.587	8	Pass



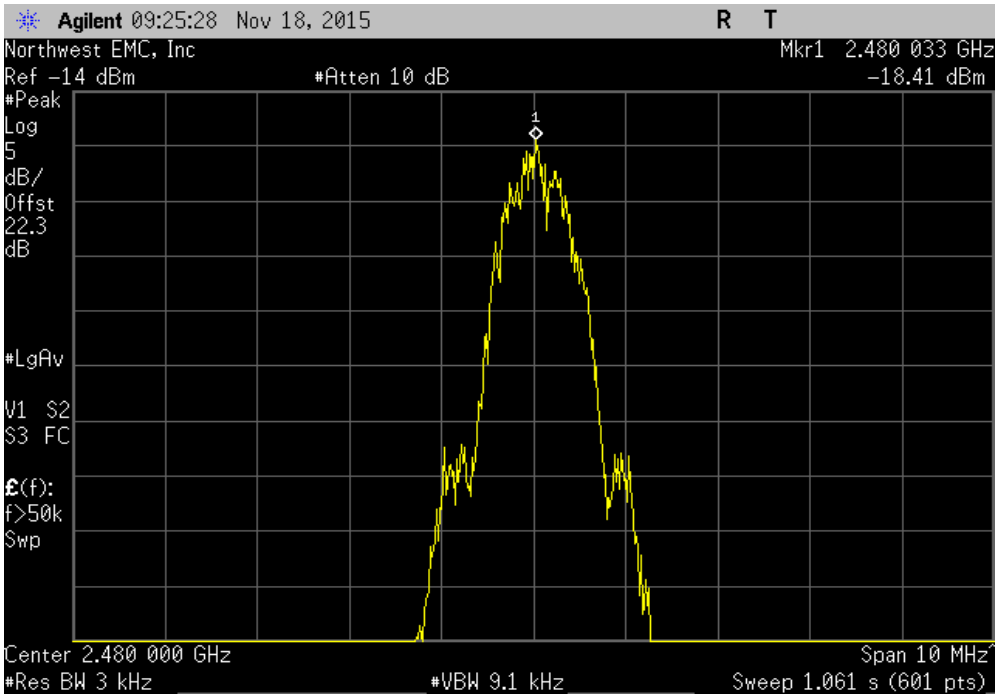
Mid Channel, 2442 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-20.398	8	Pass



POWER SPECTRAL DENSITY

XMit 2015.01.14

High Channel, 2480 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-18.412	8	Pass



OUTPUT POWER

NORTHWEST EMC

XMit 2015.01.14

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mos)
Meter - Multimeter	Fluke	117/EFSP	MLR	5/27/2015	36
Power Supply - DC	EZ Digital Co	GP-4303D	TPY	NCR	0
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Attenuator	S.M. Electronics	SA26B-20	RFW	3/10/2015	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	4/20/2015	12

TEST DESCRIPTION

The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum. A direct connection was made between the RF output of the EUT and a spectrum analyzer. Attenuation and a DC block were used. The reference level offset on the spectrum analyzer was adjusted to compensate for cable loss and the external attenuation used between the RF output and the spectrum analyzer input.

Prior to measuring peak transmit power the DTS bandwidth (B) and the transmission pulse duration (T) were measured. Both are required to determine the method of measuring Maximum Conducted Output Power. The transmission pulse duration (T) was measured using a zero span on the spectrum analyzer to see the pulses in the time domain.

The method found in ANSI C63.10:2013 Section 11.10.2 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio..

De Facto EIRP Limit: Per 47 CFR 15.247 (b)(1-3), the EUT meets the de facto EIRP limit of +36 dBm.

OUTPUT POWER

NORTHWEST EMC

XMit 2015.01.14

EUT:	Hearing Aid			**Work Order:**	STAK0061
Serial Number:	151250091			**Date:**	11/20/15
Customer:	Starkey Laboratories, Inc.			**Temperature:**	20.8°C
Attendees:	Charlie Esch			**Humidity:**	25%
Project:	None			**Barometric Pres.:**	993.3
Tested by:	Trevor Buls	**Power:**	Battery	**Job Site:**	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2015	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

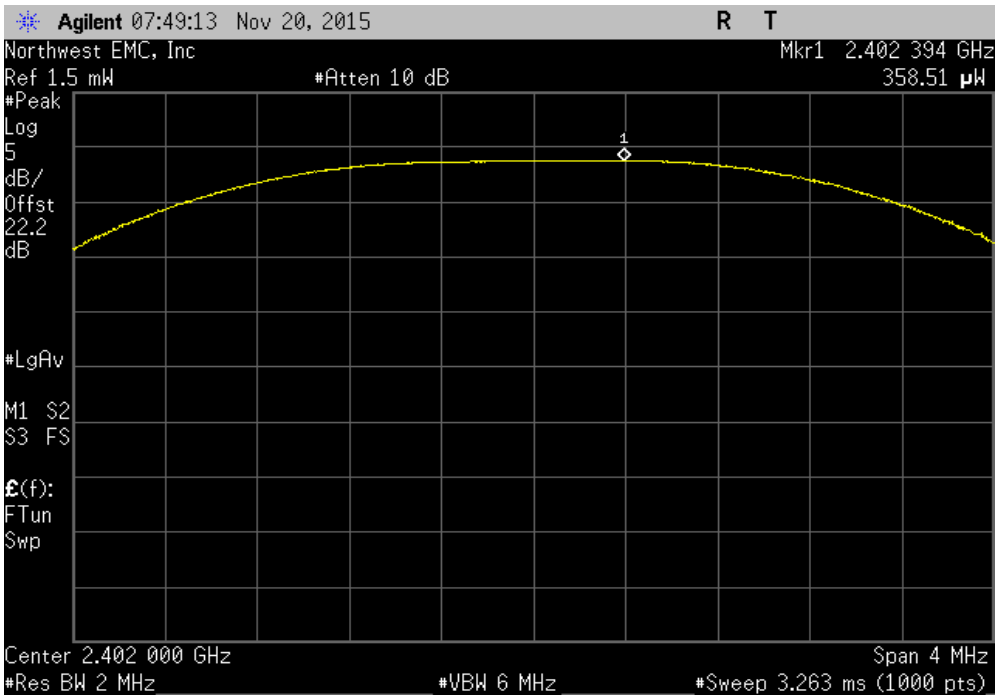
Configuration #	3	Signature	Trevor Buls

	Value	Limit (<)	Result
Low Channel, 2402 MHz	358.509 uW	1 W	Pass
Mid Channel, 2442 MHz	385.301 uW	1 W	Pass
High Channel, 2480 MHz	459.939 uW	1 W	Pass

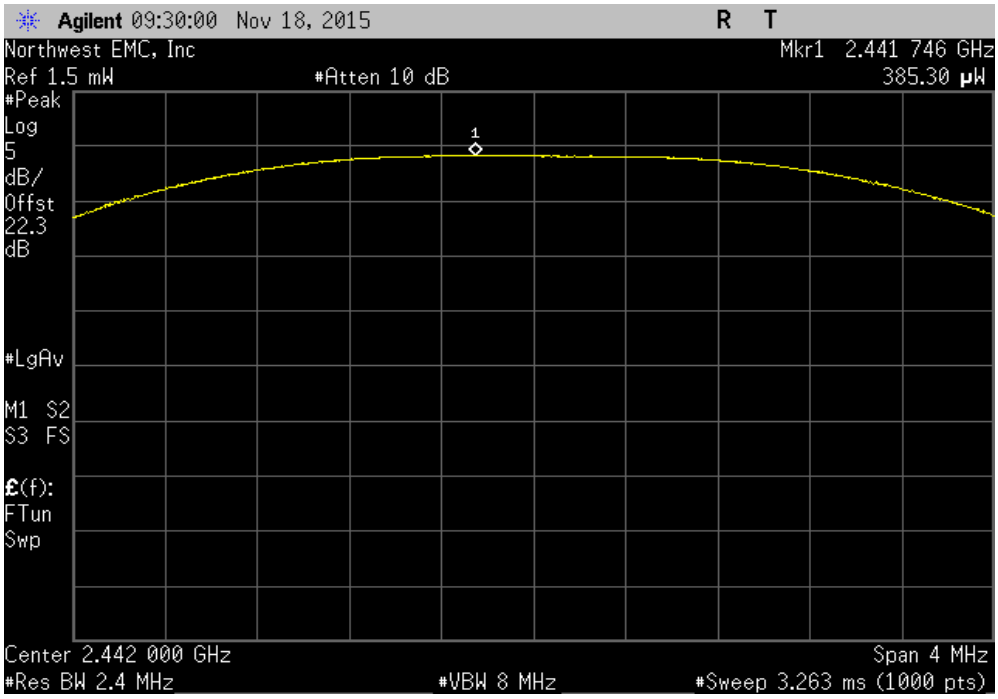
OUTPUT POWER

XMit 2015.01.14

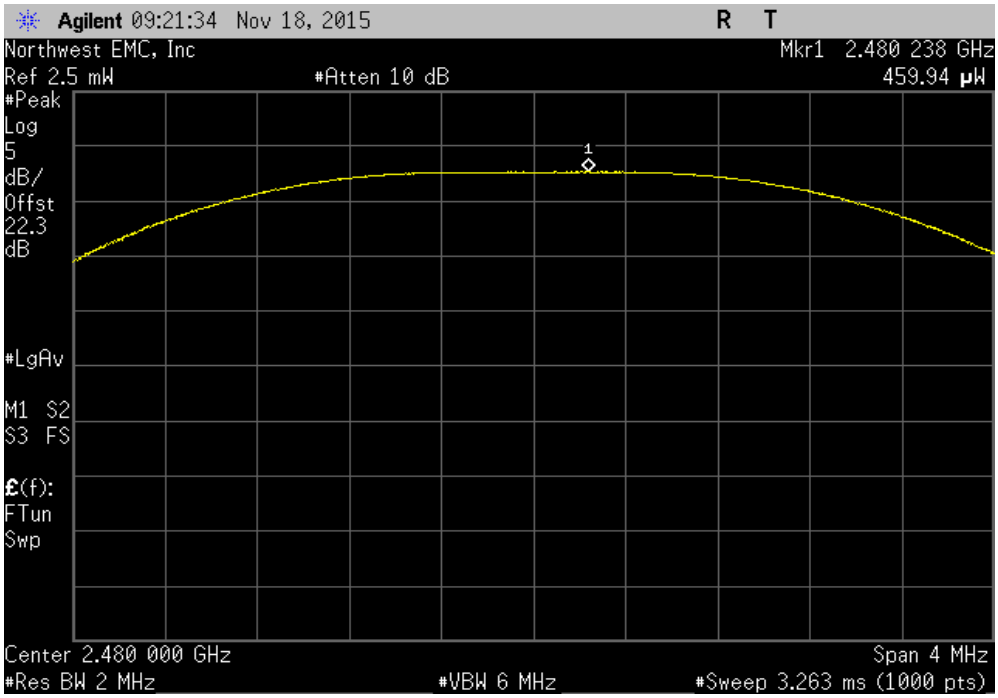
Low Channel, 2402 MHz						
				Value	Limit (<)	Result
				358.509 uW	1 W	Pass



Mid Channel, 2442 MHz						
				Value	Limit (<)	Result
				385.301 uW	1 W	Pass



High Channel, 2480 MHz						
				Value	Limit (<)	Result
				459.939 uW	1 W	Pass



BAND EDGE COMPLIANCE

XMit 2015.01.14

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mos)
Power Supply - DC	EZ Digital Co	GP-4303D	TPY	NCR	0
Meter - Multimeter	Fluke	117/EFSP	MLR	5/27/2015	36
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Attenuator	S.M. Electronics	SA26B-20	RFW	3/10/2015	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	4/20/2015	12

TEST DESCRIPTION

The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in each available band. The channels closest to the band edges were selected. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at the data rate(s) listed in the datasheet.

The spectrum was scanned below the lower band edge and above the higher band edge.

An RMS detector was used to match the method called out for Output Power. Because the reference level was taken with an RMS detector, the attenuation requirement is -30 dBc.

BAND EDGE COMPLIANCE

NORTHWEST EMC

XMit 2015.01.14

EUT:	Hearing Aid			**Work Order:**	STAK0061
Serial Number:	151250091			**Date:**	11/20/15
Customer:	Starkey Laboratories, Inc.			**Temperature:**	20.8°C
Attendees:	Charlie Esch			**Humidity:**	25%
Project:	None			**Barometric Pres.:**	993.3
Tested by:	Trevor Buls	**Power:**	Battery	**Job Site:**	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2015	ANSI C63.10:2013

COMMENTS

None

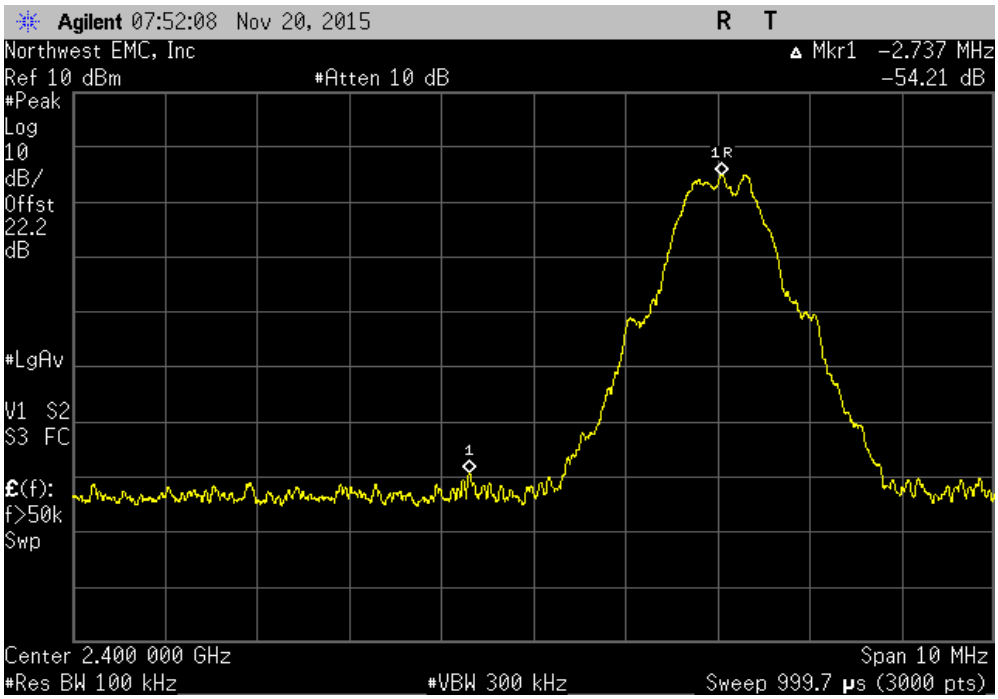
DEVIATIONS FROM TEST STANDARD

None

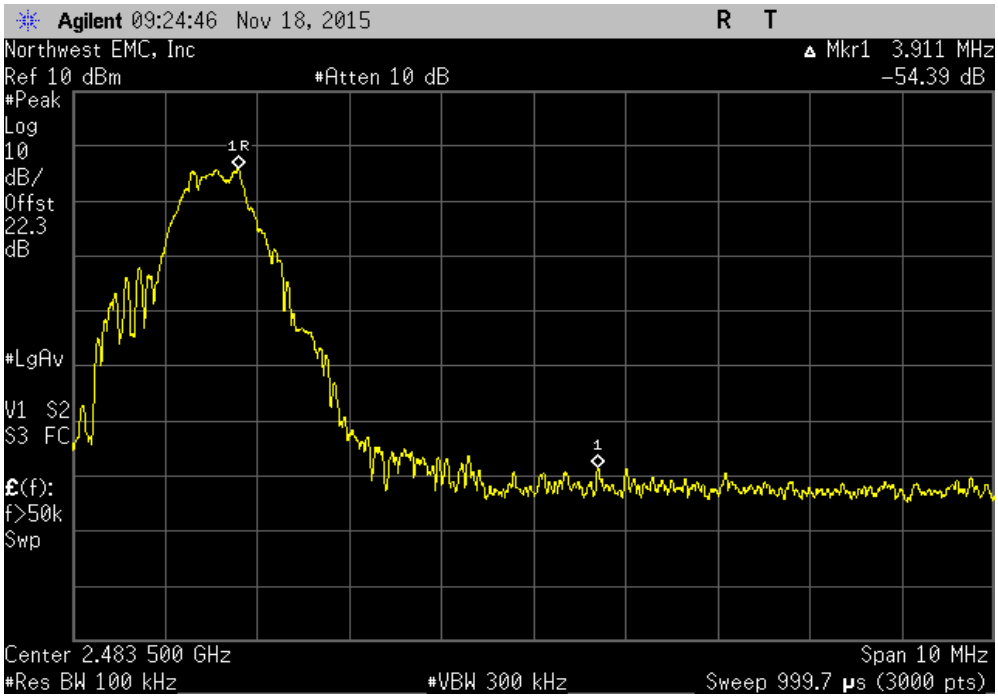
Configuration #	3	Signature	Trevor Buls

	Value (dBc)	Limit ≤ (dBc)	Result
Low Channel, 2402 MHz	-54.21	-20	Pass
High Channel, 2480 MHz	-54.39	-20	Pass

Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-54.21	-20	Pass



High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-54.39	-20	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2015.01.14

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mos)
Power Supply - DC	EZ Digital Co	GP-4303D	TPY	NCR	0
Meter - Multimeter	Fluke	117/EFSP	MLR	5/27/2015	36
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Attenuator	S.M. Electronics	SA26B-20	RFW	3/10/2015	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	4/20/2015	12

TEST DESCRIPTION

The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at the data rate(s) listed in the datasheet. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.

SPURIOUS CONDUCTED EMISSIONS

NORTHWEST EMC

XMit 2015.01.14

EUT:	Hearing Aid			**Work Order:**	STAK0061
Serial Number:	151250091			**Date:**	11/20/15
Customer:	Starkey Laboratories, Inc.			**Temperature:**	20.8°C
Attendees:	Charlie Esch			**Humidity:**	25%
Project:	None			**Barometric Pres.:**	993.3
Tested by:	Trevor Buls	**Power:**	Battery	**Job Site:**	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2015	ANSI C63.10:2013

COMMENTS

None

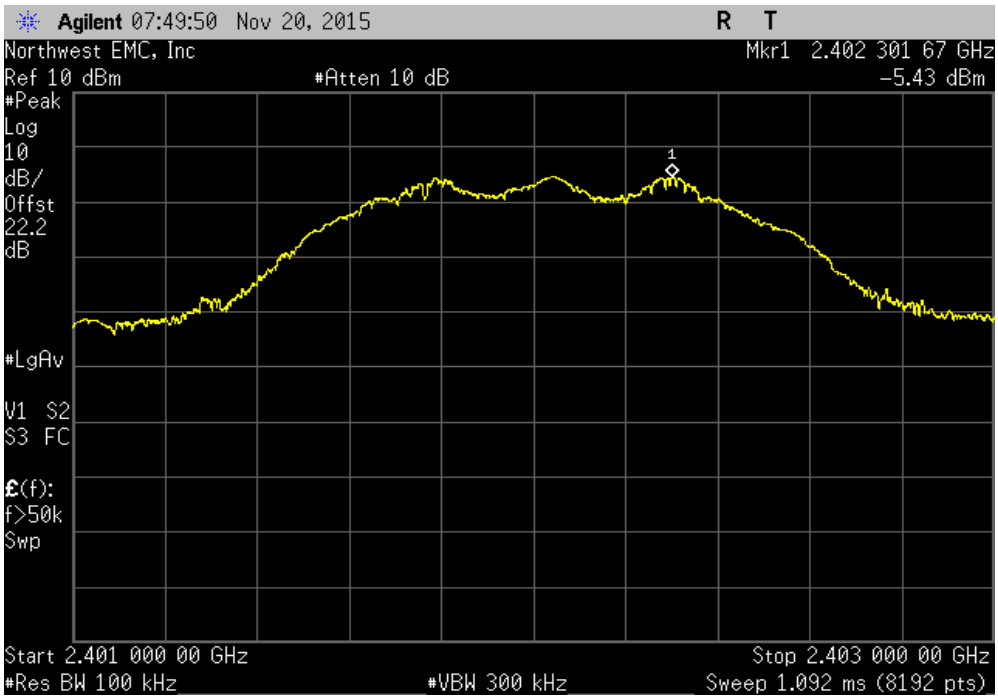
DEVIATIONS FROM TEST STANDARD

None

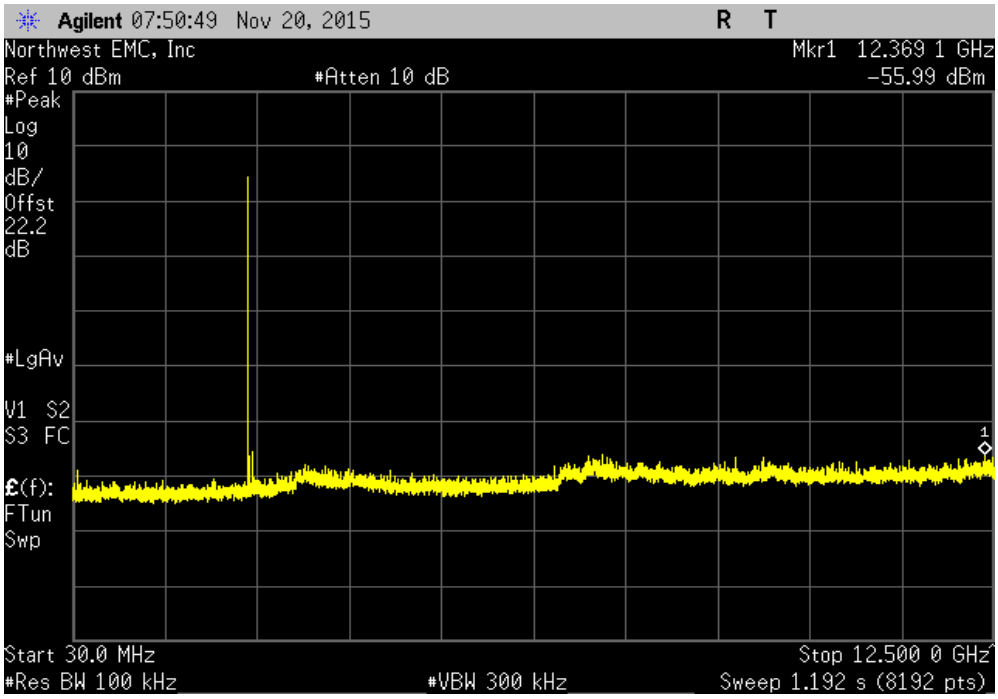
Configuration #	3	Signature	Trevor Buls

	Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result
Low Channel, 2402 MHz	Fundamental	N/A	N/A	N/A
Low Channel, 2402 MHz	30 MHz - 12.5 GHz	-50.57	-20	Pass
Low Channel, 2402 MHz	12.5 GHz - 25 GHz	-46.99	-20	Pass
Mid Channel, 2442 MHz	Fundamental	N/A	N/A	N/A
Mid Channel, 2442 MHz	30 MHz - 12.5 GHz	-51.32	-20	Pass
Mid Channel, 2442 MHz	12.5 GHz - 25 GHz	-45.78	-20	Pass
High Channel, 2480 MHz	Fundamental	N/A	N/A	N/A
High Channel, 2480 MHz	30 MHz - 12.5 GHz	-52.26	-20	Pass
High Channel, 2480 MHz	12.5 GHz - 25 GHz	-48.16	-20	Pass

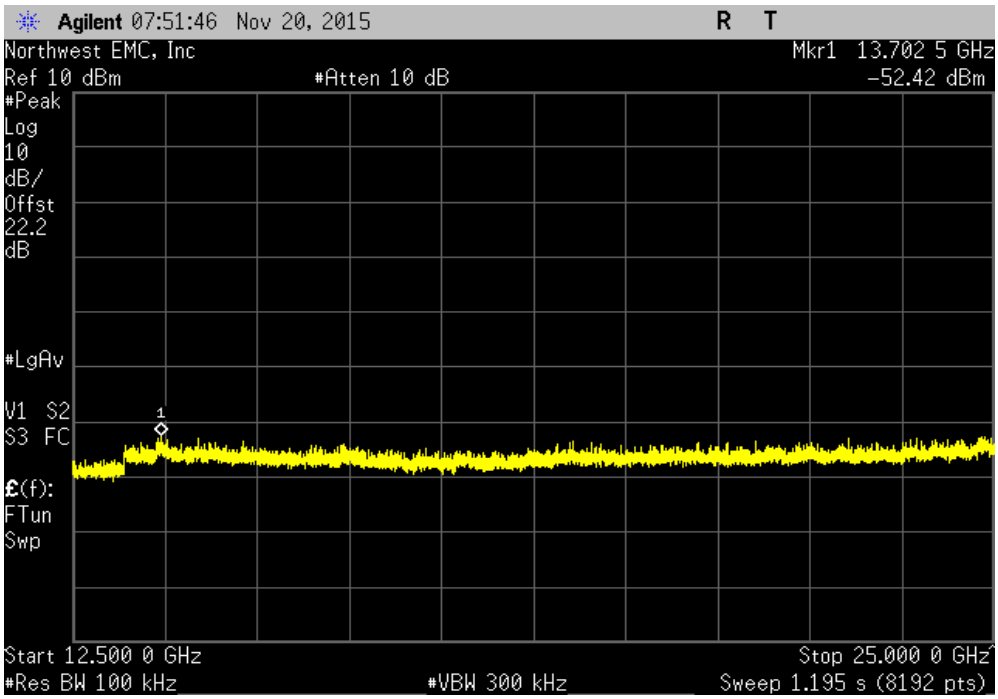
Low Channel, 2402 MHz						
	Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



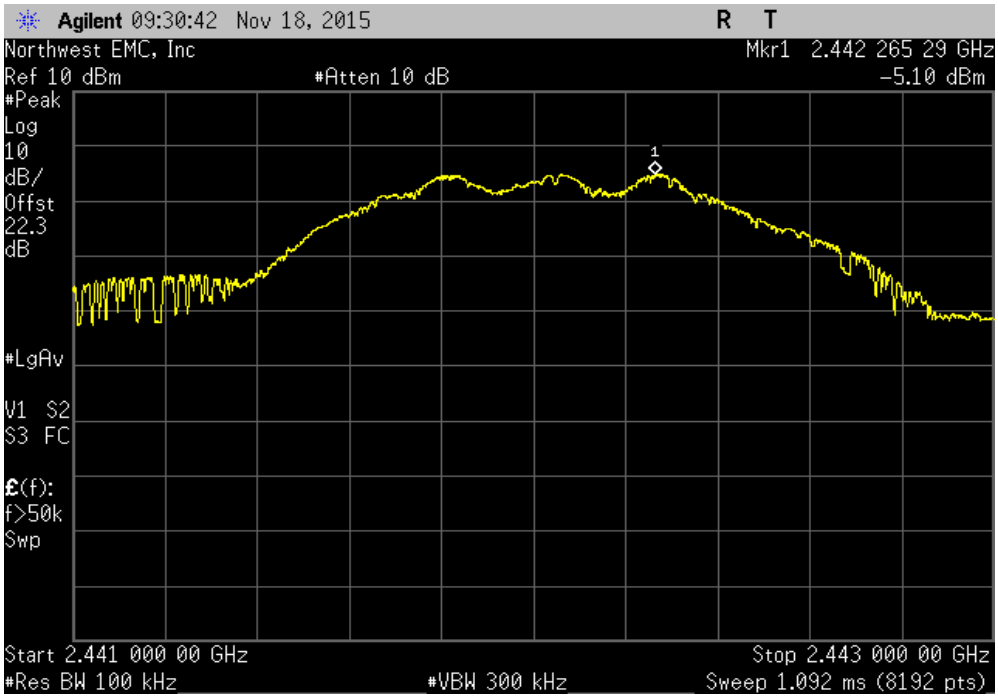
Low Channel, 2402 MHz					
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz		-50.57	-20	Pass



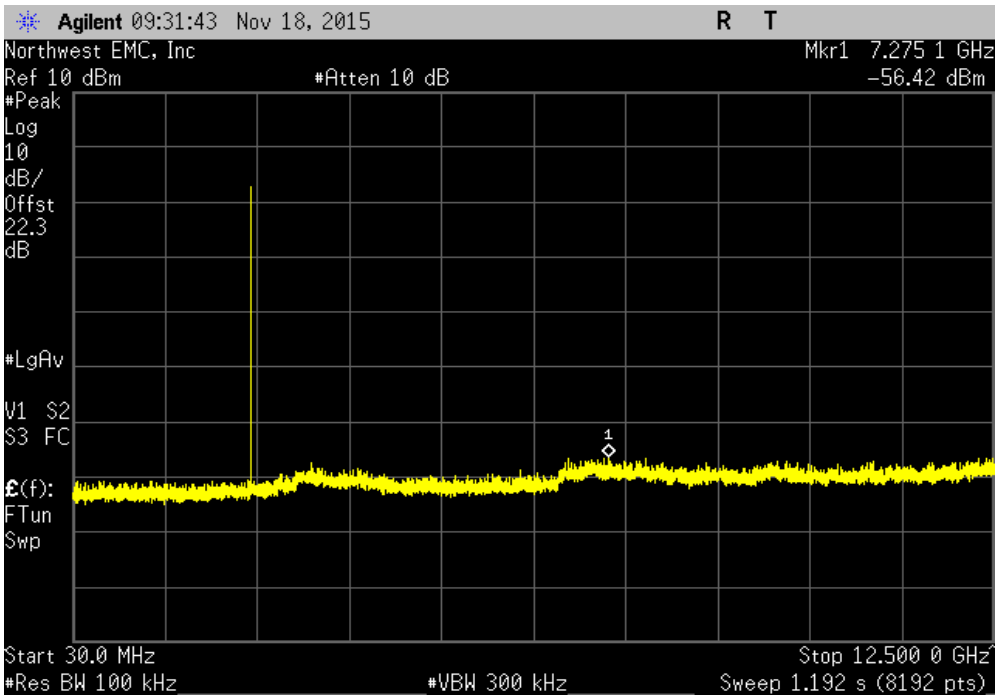
Low Channel, 2402 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-46.99	-20	Pass



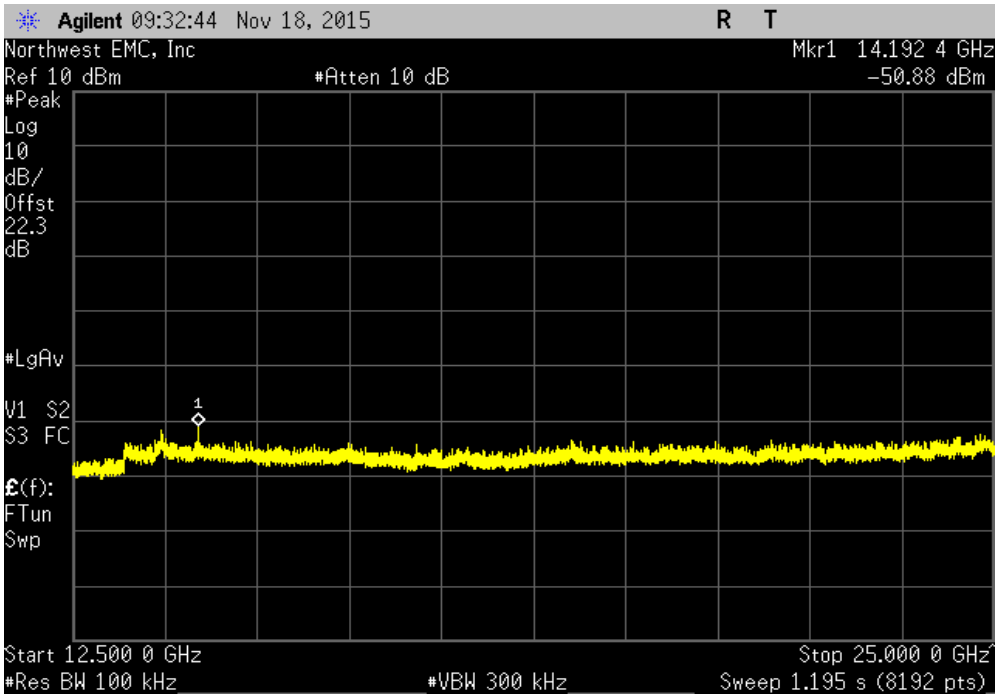
Mid Channel, 2442 MHz						
	Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



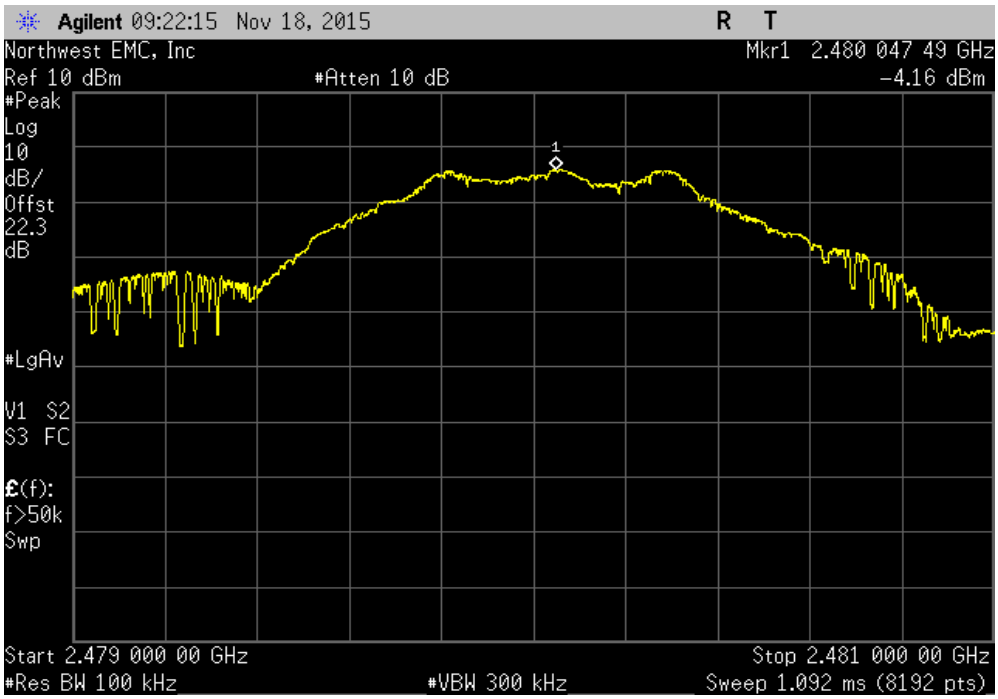
Mid Channel, 2442 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz		-51.32	-20	Pass



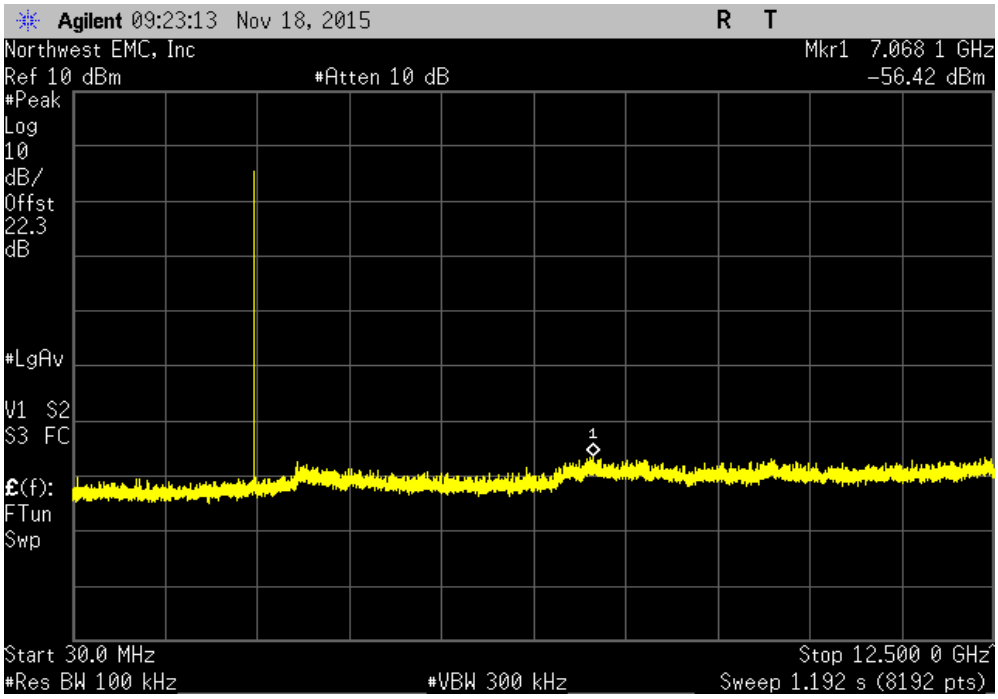
Mid Channel, 2442 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-45.78	-20	Pass



High Channel, 2480 MHz						
	Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



High Channel, 2480 MHz					
Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz			-52.26	-20	Pass



High Channel, 2480 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-48.16	-20	Pass