NORTHWEST EMC

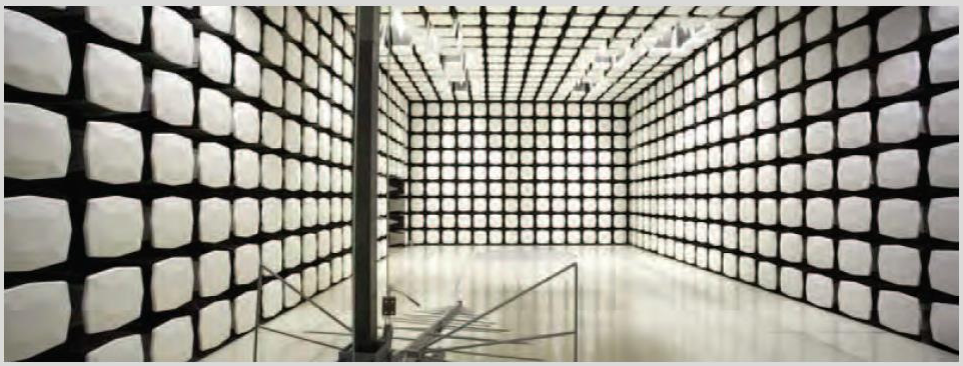
Starkey Laboratories, Inc.

Halo 2 RIC 312 Hearing Aid

FCC 15.247:2016

Bluetooth Radio

Report # STAK0074



NVLAP TESTING

NVLAP Lab Code: 200881-0

CERTIFICATE OF TEST

NORTHWEST EMC
2014-12-10

Last Date of Test: November 17, 2016
Starkey Laboratories, Inc.
Model: Hearing Aid

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2016	ANSI C63.10:2013, KDB 558074

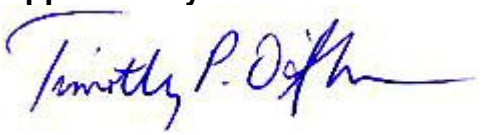
Results

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	
11.9.1.1	Output Power	Yes	Pass	
11.10.2	Power Spectral Density	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

NORTHWEST EMC
REV 2016.7.25

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

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with ISED.

European Union

European Commission – Validated by the European Commission 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.

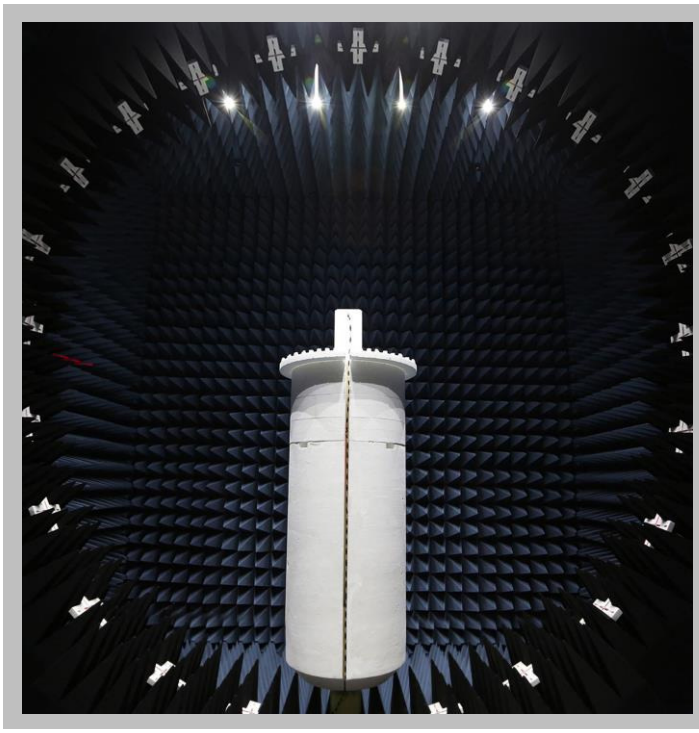
SCOPE

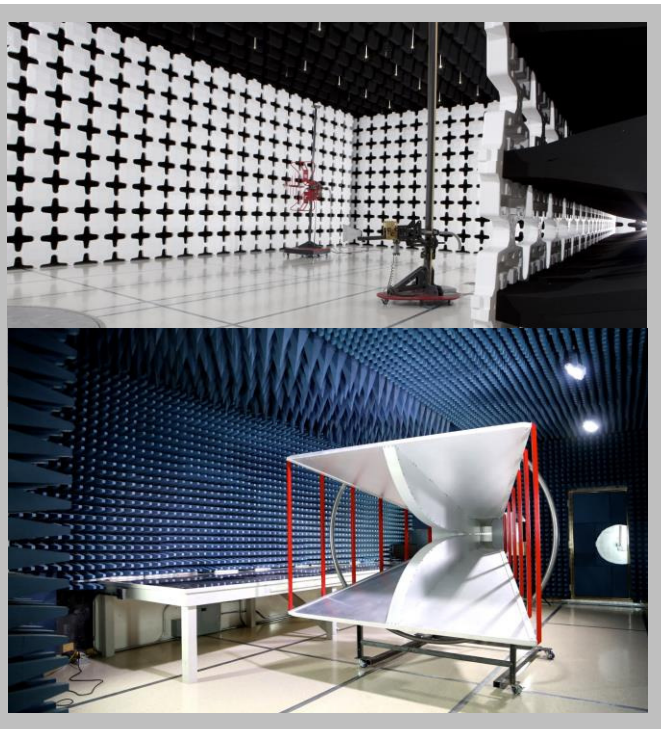
For details on the Scopes of our Accreditations, please visit:
http://www.nwemc.com/accreditations/
http://gsi.nist.gov/global/docs/cabs/designations.html

FACILITIES

REV 2016.7.25

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 98011 (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
Innovation, Science and Economic Development 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





MEASUREMENT UNCERTAINTY

NORTHWEST EMC
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 QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. 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.

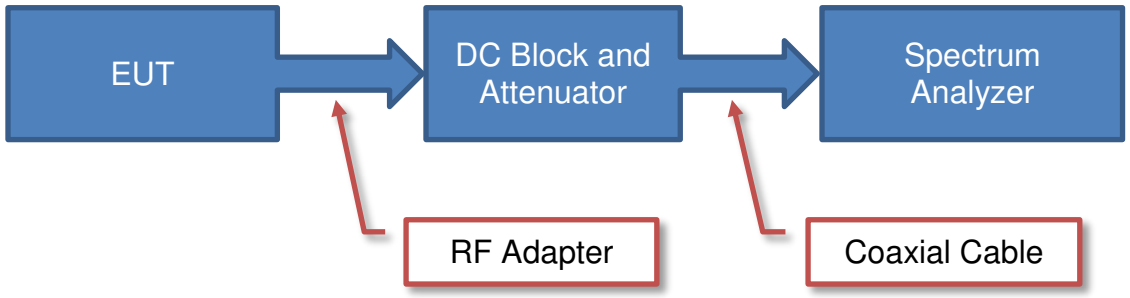
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

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

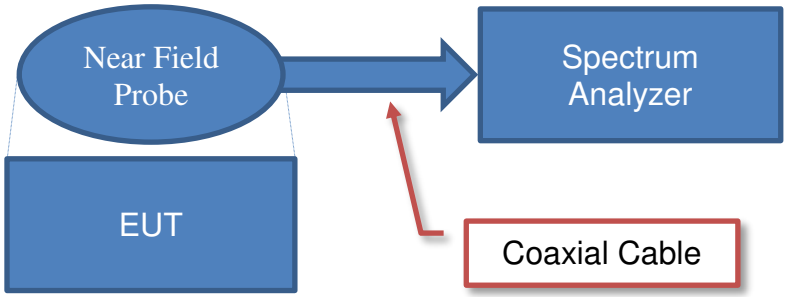
Test Setup Block Diagrams

NORTHWEST EMC
REV 2016.10.04

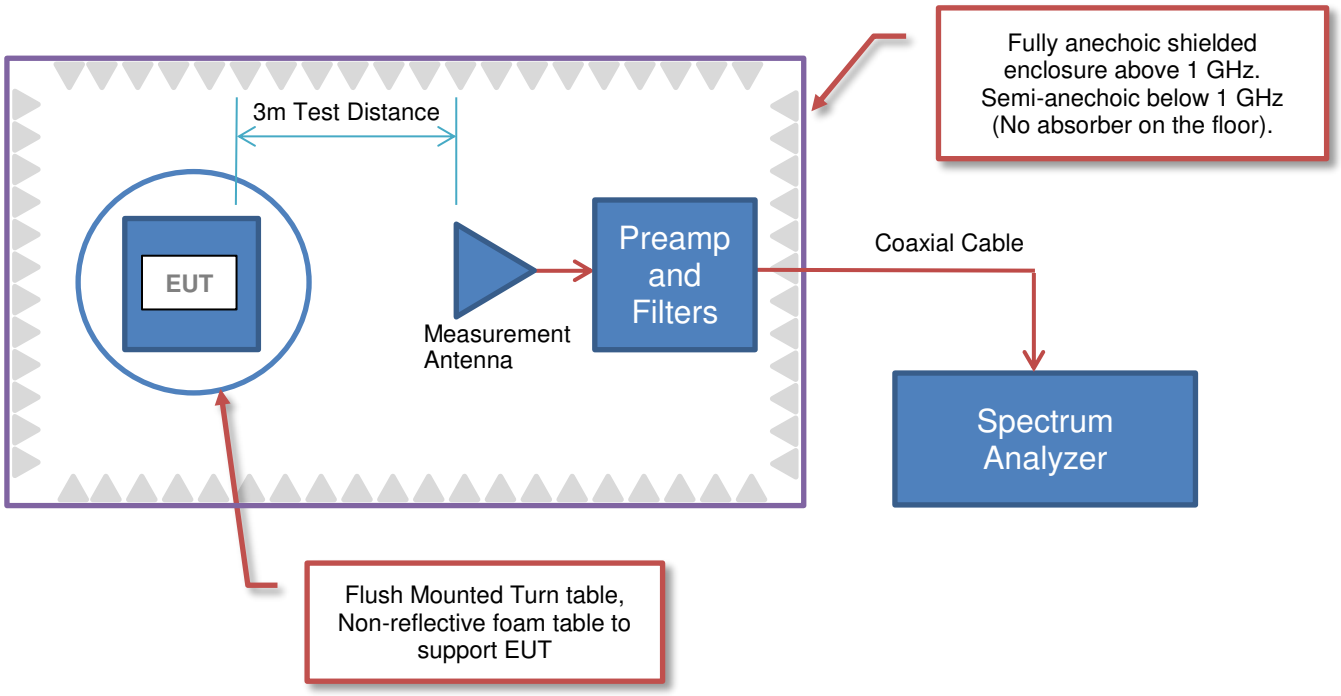
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



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 17, 2016
Last Date of Test:	November 17, 2016
Receipt Date of Samples:	November 17, 2016
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Hearing Aid with Bluetooth Low Energy radio and one antenna. Changing to a smaller battery (size 13 to size 312).

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

CONFIGURATIONS

NORTHWEST EMC 2014-12-10

Configuration STAK0074- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Hearing Aid	Starkey Laboratories, Inc.	Halo 2 RIC312	161034686

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
DC Power Supply	Agilent	E3630A	MY40009424

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Leads	No	2.5m	No	Hearing Aid	DC Power Supply
AC Mains Cable	No	1.8m	No	AC Mains	DC Power Supply

Configuration STAK0074- 2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Hearing Aid	Starkey Laboratories, Inc.	Halo 2 RIC312	161307836

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
DC Power Supply	Agilent	E3630A	MY40009424

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Leads	No	2.5m	No	Hearing Aid	DC Power Supply
AC Mains Cable	No	1.8m	No	AC Mains	DC Power Supply

MODIFICATIONS

NORTHWEST EMC
2014-12-10

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	11/17/2016	Duty Cycle	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.
2	11/17/2016	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	11/17/2016	Output Power	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	11/17/2016	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.
5	11/17/2016	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	11/17/2016	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	11/17/2016	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

PSA-ESCI 2016.07.22

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 BLE - low channel (2402 MHz), mid channel (2442 MHz), and high channel (2480 MHz)

POWER SETTINGS INVESTIGATED

1.45VDC

CONFIGURATIONS INVESTIGATED

STAK0074 - 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
Attenuator	Fairview Microwave	SA18E-20	TWZ	9/23/2016	12 mo
Cable	Northwest EMC	18-26GHz Standard Gain Horn Cable	MNP	9/15/2016	12 mo
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	7/29/2016	12 mo
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	12/7/2015	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	12/7/2015	12 mo
Filter - High Pass	Micro-Tronics	HPM50111	LFN	9/23/2016	12 mo
Filter - Low Pass	Micro-Tronics	LPM50004	LFK	9/22/2016	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AYD	1/6/2016	24 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVW	3/1/2016	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	3/1/2016	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	3/1/2016	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	12/10/2015	12 mo
Amplifier - Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	9/15/2016	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AJA	6/23/2016	24 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AIQ	NCR	0 mo
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2016	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

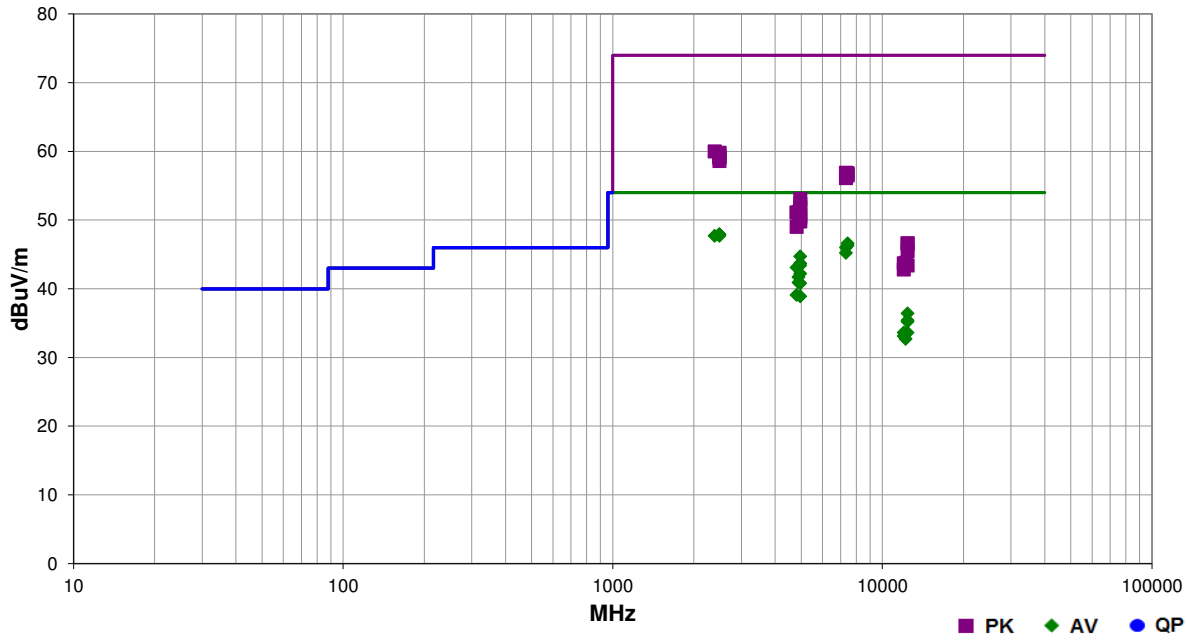
NORTHWEST EMC

PSA-ESCI 2016.07.22
EmiR5 2016.08.26

Work Order:	STAK0074	**Date:**	11/17/16		
Project:	None	**Temperature:**	22.4 °C		
Job Site:	MN05	**Humidity:**	37.5% RH		
Serial Number:	161034686	**Barometric Pres.:**	1005 mbar	**Tested by:**	Dustin Sparks
EUT:	Hearing Aid				
Configuration:	1				
Customer:	Starkey Laboratories, Inc.				
Attendees:	Charlie Esch				
EUT Power:	1.45VDC				
Operating Mode:	Transmitting BLE - low channel (2402 MHz), mid channel (2442 MHz), and high channel (2480 MHz)				
Deviations:	None				
Comments:	Battery replaced by DC power supply.				

Test Specifications	**Test Method**
FCC 15.247:2016	ANSI C63.10:2013

Run #	12	**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
2484.858	31.3	-3.4	1.4	65.1	3.0	20.0	Horz	AV	0.0	47.9	54.0	-6.1	High ch, EUT vert
2484.358	31.3	-3.4	1.0	314.0	3.0	20.0	Vert	AV	0.0	47.9	54.0	-6.1	High ch, EUT vert
2487.350	31.3	-3.4	1.0	232.0	3.0	20.0	Horz	AV	0.0	47.9	54.0	-6.1	High ch, EUT on side
2485.883	31.3	-3.4	3.6	104.0	3.0	20.0	Vert	AV	0.0	47.9	54.0	-6.1	High ch, EUT on side
2484.317	31.2	-3.4	1.0	65.1	3.0	20.0	Vert	AV	0.0	47.8	54.0	-6.2	High ch, EUT horz
2486.425	31.1	-3.4	1.0	134.1	3.0	20.0	Horz	AV	0.0	47.7	54.0	-6.3	High ch, EUT horz
2388.025	31.0	-3.3	1.0	162.0	3.0	20.0	Horz	AV	0.0	47.7	54.0	-6.3	Low ch, EUT on side
7439.683	33.0	13.6	1.0	172.0	3.0	0.0	Vert	AV	0.0	46.6	54.0	-7.4	High ch, EUT vert
7440.258	32.7	13.6	1.0	336.9	3.0	0.0	Horz	AV	0.0	46.3	54.0	-7.7	High ch, EUT horz
7325.542	32.8	13.2	2.4	93.0	3.0	0.0	Vert	AV	0.0	46.0	54.0	-8.0	Mid ch, EUT vert
7325.483	32.0	13.2	1.0	172.0	3.0	0.0	Horz	AV	0.0	45.2	54.0	-8.8	Mid ch, EUT horz
4960.108	39.2	5.5	1.0	45.0	3.0	0.0	Vert	AV	0.0	44.7	54.0	-9.3	High ch, EUT vert
4960.017	38.2	5.5	1.5	151.0	3.0	0.0	Vert	AV	0.0	43.7	54.0	-10.3	High ch, EUT on side
4960.133	37.9	5.5	1.4	80.1	3.0	0.0	Horz	AV	0.0	43.4	54.0	-10.6	High ch, EUT horz
4804.083	38.0	5.1	3.1	314.0	3.0	0.0	Horz	AV	0.0	43.1	54.0	-10.9	Low ch, EUT horz
4960.117	36.7	5.5	1.0	107.0	3.0	0.0	Horz	AV	0.0	42.2	54.0	-11.8	High ch, EUT on side
4883.983	36.4	5.3	1.0	68.0	3.0	0.0	Vert	AV	0.0	41.7	54.0	-12.3	Mid ch, EUT vert
4883.908	35.6	5.3	1.0	93.0	3.0	0.0	Horz	AV	0.0	40.9	54.0	-13.1	Mid 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
4960.100	35.3	5.5	1.0	130.1	3.0	0.0	Horz	AV	0.0	40.8	54.0	-13.2	High ch, EUT vert
2386.517	43.3	-3.3	1.0	162.0	3.0	20.0	Horz	PK	0.0	60.0	74.0	-14.0	Low ch, EUT on side
2487.025	43.2	-3.4	1.0	232.0	3.0	20.0	Horz	PK	0.0	59.8	74.0	-14.2	High ch, EUT on side
2484.542	43.1	-3.4	3.6	104.0	3.0	20.0	Vert	PK	0.0	59.7	74.0	-14.3	High ch, EUT on side
2486.067	42.7	-3.4	1.0	65.1	3.0	20.0	Vert	PK	0.0	59.3	74.0	-14.7	High ch, EUT horz
4804.083	34.0	5.1	1.0	97.0	3.0	0.0	Vert	AV	0.0	39.1	54.0	-14.9	Low ch, EUT vert
2488.417	42.5	-3.4	1.0	134.1	3.0	20.0	Horz	PK	0.0	59.1	74.0	-14.9	High ch, EUT horz
2486.692	42.5	-3.4	1.0	314.0	3.0	20.0	Vert	PK	0.0	59.1	74.0	-14.9	High ch, EUT vert
4959.925	33.4	5.5	1.0	17.0	3.0	0.0	Vert	AV	0.0	38.9	54.0	-15.1	High ch, EUT horz
2487.950	42.0	-3.4	1.4	65.1	3.0	20.0	Horz	PK	0.0	58.6	74.0	-15.4	High ch, EUT vert
7326.767	43.7	13.2	2.4	93.0	3.0	0.0	Vert	PK	0.0	56.9	74.0	-17.1	Mid ch, EUT vert
7441.075	43.2	13.6	1.0	172.0	3.0	0.0	Vert	PK	0.0	56.8	74.0	-17.2	High ch, EUT vert
7440.683	42.9	13.6	1.0	336.9	3.0	0.0	Horz	PK	0.0	56.5	74.0	-17.5	High ch, EUT horz
12398.930	35.7	0.7	1.7	250.9	3.0	0.0	Vert	AV	0.0	36.4	54.0	-17.6	High ch, EUT vert
7327.033	42.9	13.2	1.0	172.0	3.0	0.0	Horz	PK	0.0	56.1	74.0	-17.9	Mid ch, EUT horz
12401.370	29.2	6.2	1.0	211.0	3.0	0.0	Vert	AV	0.0	35.4	54.0	-18.6	High ch, EUT vert
12401.260	29.0	6.2	1.6	308.9	3.0	0.0	Horz	AV	0.0	35.2	54.0	-18.8	High ch, EUT horz
12009.060	34.7	-1.1	1.6	261.9	3.0	0.0	Horz	AV	0.0	33.6	54.0	-20.4	Low ch, EUT horz
12398.930	32.9	0.7	3.0	17.0	3.0	0.0	Horz	AV	0.0	33.6	54.0	-20.4	High ch, EUT horz
12209.290	34.0	-0.5	1.0	77.1	3.0	0.0	Horz	AV	0.0	33.5	54.0	-20.5	Mid ch, EUT horz
4960.750	47.6	5.5	1.4	80.1	3.0	0.0	Horz	PK	0.0	53.1	74.0	-20.9	High ch, EUT horz
12008.970	34.2	-1.1	1.0	267.0	3.0	0.0	Vert	AV	0.0	33.1	54.0	-20.9	Low ch, EUT vert
12209.150	33.2	-0.5	1.9	303.0	3.0	0.0	Vert	AV	0.0	32.7	54.0	-21.3	Mid ch, EUT vert
4959.700	46.9	5.5	1.0	45.0	3.0	0.0	Vert	PK	0.0	52.4	74.0	-21.6	High ch, EUT vert
4960.658	46.3	5.5	1.5	151.0	3.0	0.0	Vert	PK	0.0	51.8	74.0	-22.2	High ch, EUT on side
4883.300	45.8	5.4	1.0	93.0	3.0	0.0	Horz	PK	0.0	51.2	74.0	-22.8	Mid ch, EUT horz
4803.467	46.0	5.1	3.1	314.0	3.0	0.0	Horz	PK	0.0	51.1	74.0	-22.9	Low ch, EUT horz
4884.533	45.5	5.3	1.0	68.0	3.0	0.0	Vert	PK	0.0	50.8	74.0	-23.2	Mid ch, EUT vert
4960.800	45.2	5.5	1.0	107.0	3.0	0.0	Horz	PK	0.0	50.7	74.0	-23.3	High ch, EUT on side
4959.450	44.8	5.5	1.0	130.1	3.0	0.0	Horz	PK	0.0	50.3	74.0	-23.7	High ch, EUT vert
4960.942	44.3	5.5	1.0	17.0	3.0	0.0	Vert	PK	0.0	49.8	74.0	-24.2	High ch, EUT horz
4804.158	43.9	5.1	1.0	97.0	3.0	0.0	Vert	PK	0.0	49.0	74.0	-25.0	Low ch, EUT vert
12401.490	40.4	6.2	1.0	211.0	3.0	0.0	Vert	PK	0.0	46.6	74.0	-27.4	High ch, EUT vert
12401.150	40.4	6.2	1.6	308.9	3.0	0.0	Horz	PK	0.0	46.6	74.0	-27.4	High ch, EUT horz
12399.100	44.8	0.7	1.7	250.9	3.0	0.0	Vert	PK	0.0	45.5	74.0	-28.5	High ch, EUT vert
12208.620	44.3	-0.5	1.0	77.1	3.0	0.0	Horz	PK	0.0	43.8	74.0	-30.2	Mid ch, EUT horz
12008.530	44.8	-1.1	1.6	261.9	3.0	0.0	Horz	PK	0.0	43.7	74.0	-30.3	Low ch, EUT horz
12210.940	44.1	-0.5	1.9	303.0	3.0	0.0	Vert	PK	0.0	43.6	74.0	-30.4	Mid ch, EUT vert
12398.960	42.7	0.7	3.0	17.0	3.0	0.0	Horz	PK	0.0	43.4	74.0	-30.6	High ch, EUT horz
12011.570	43.9	-1.1	1.0	267.0	3.0	0.0	Vert	PK	0.0	42.8	74.0	-31.2	Low ch, EUT vert

DUTY CYCLE

NORTHWEST EMC

XMit 2016.05.06

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.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	10/17/2017
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/15/2016	9/15/2017
Block - DC	Fairview Microwave	SD3379	AMI	9/15/2016	9/15/2017
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	2/26/2017
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	3/24/2017

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. 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.

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 2016.05.06

EUT:	Hearing Aid			**Work Order:**	STAK0074
Serial Number:	161307836			**Date:**	11/17/16
Customer:	Starkey Laboratories, Inc.			**Temperature:**	21.5 °C
Attendees:	Charlie Esch			**Humidity:**	40.6% RH
Project:	None			**Barometric Pres.:**	1007 mbar
Tested by:	Dustin Sparks	**Power:**	1.45VDC	**Job Site:**	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

Transmitting BLE modulated. Battery replaced with DC power supply

DEVIATIONS FROM TEST STANDARD

None

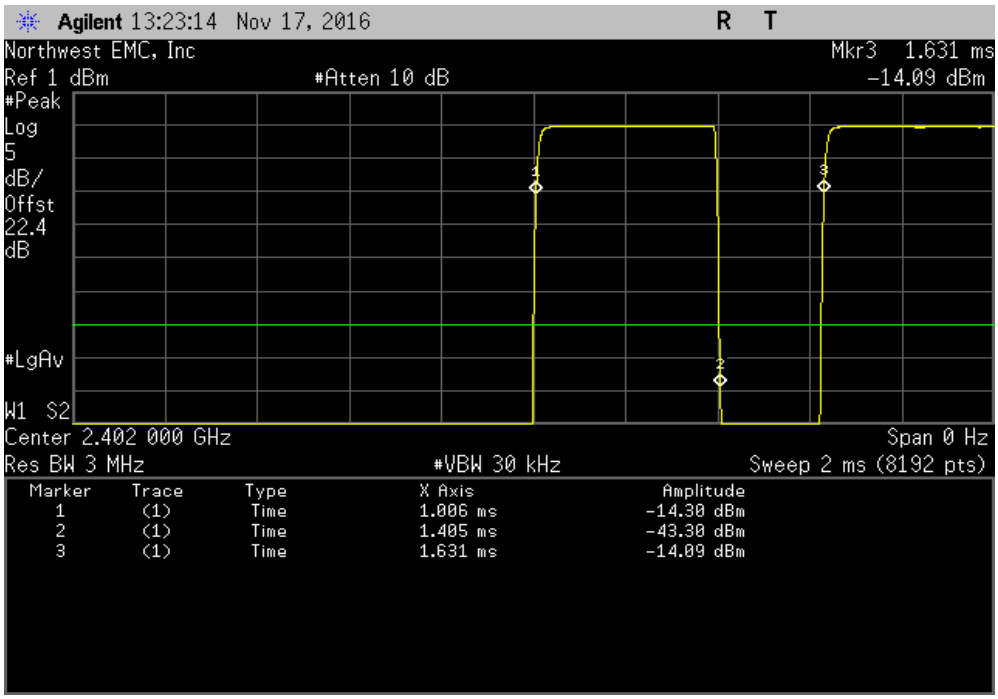
Configuration #	2	Signature

	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
BLE/GFSK Low Channel, 2402 MHz	399.7 us	625.1 us	1	63.9	N/A	N/A
BLE/GFSK Low Channel, 2402 MHz	N/A	N/A	5	N/A	N/A	N/A
BLE/GFSK Mid Channel, 2442 MHz	399.5 us	625.1 us	1	63.9	N/A	N/A
BLE/GFSK Mid Channel, 2442 MHz	N/A	N/A	5	N/A	N/A	N/A
BLE/GFSK High Channel, 2480 MHz	400.4 us	625.2 us	1	64	N/A	N/A
BLE/GFSK High Channel, 2480 MHz	N/A	N/A	5	N/A	N/A	N/A

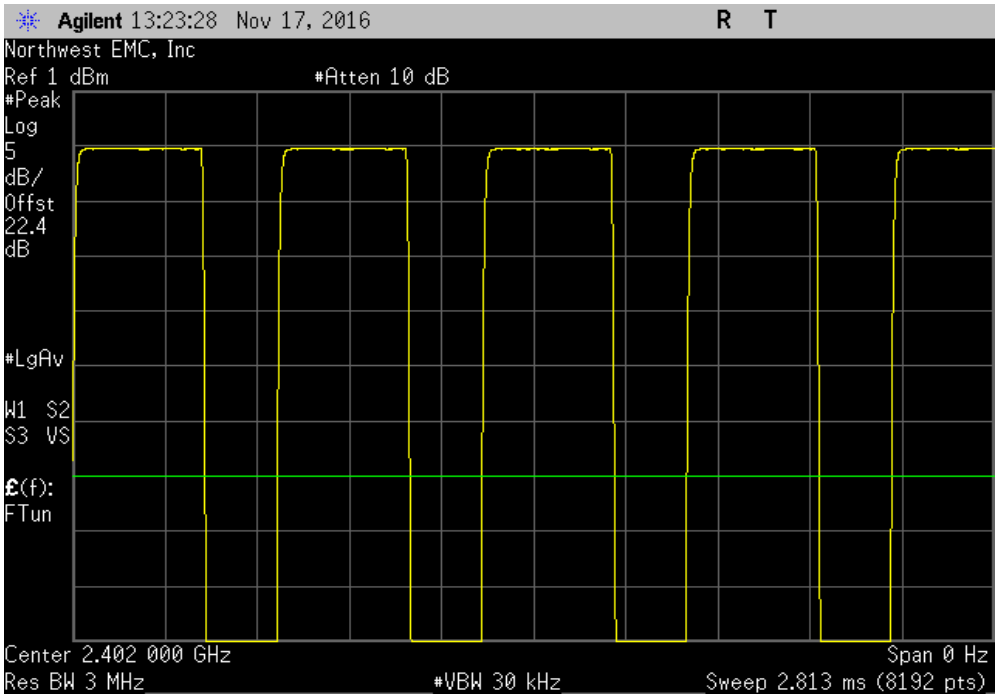
DUTY CYCLE

XMit 2016.05.06

BLE/GFSK Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	399.7 us	625.1 us	1	63.9	N/A	N/A



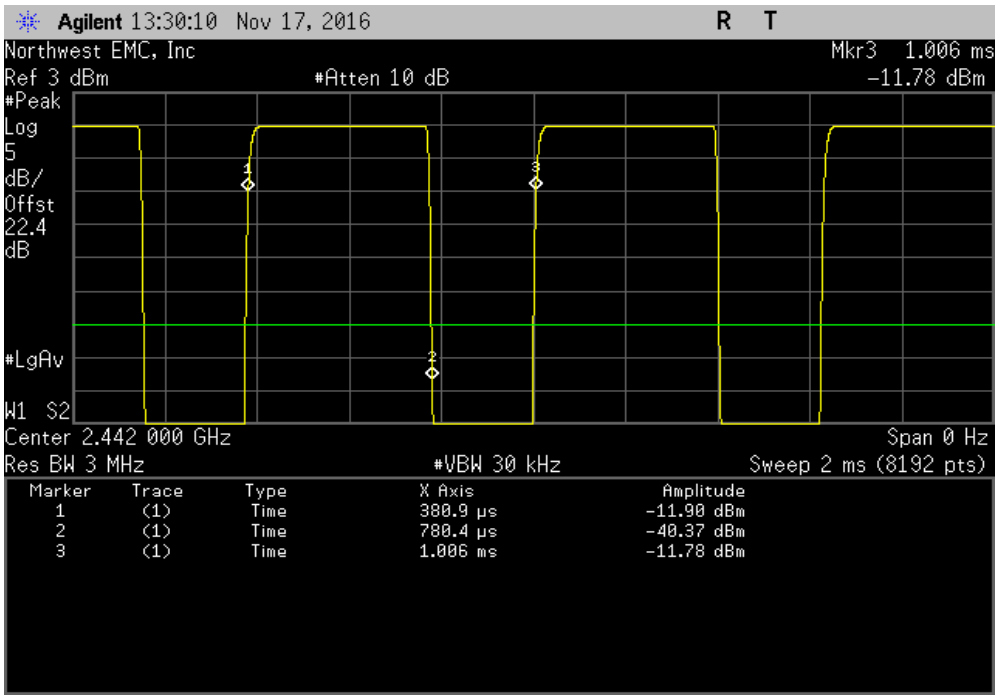
BLE/GFSK Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



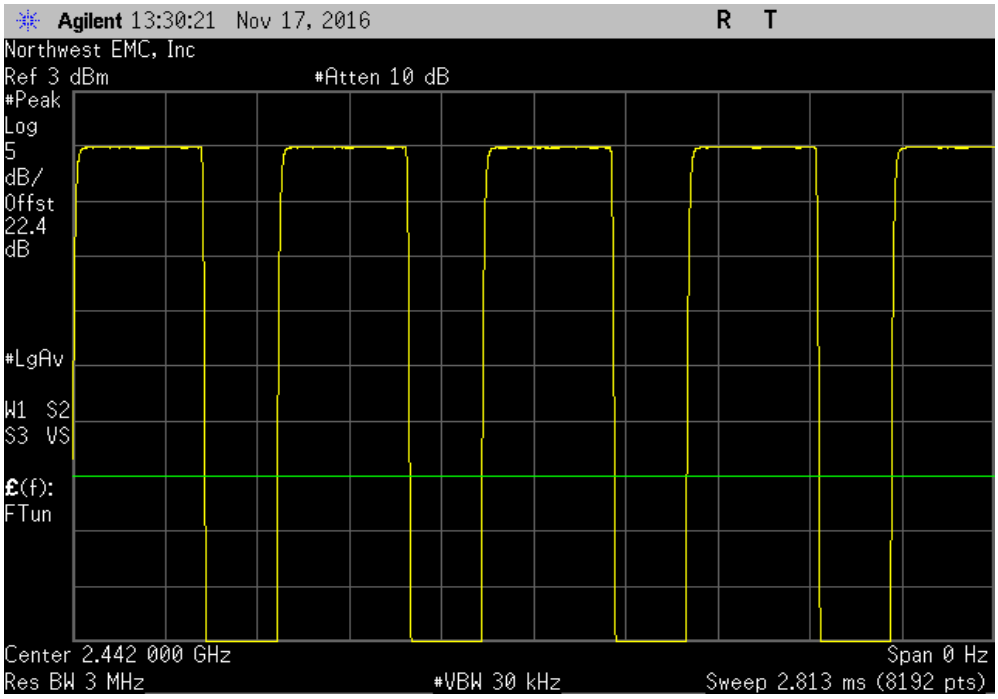
DUTY CYCLE

XMit 2016.05.06

BLE/GFSK Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	399.5 us	625.1 us	1	63.9	N/A	N/A



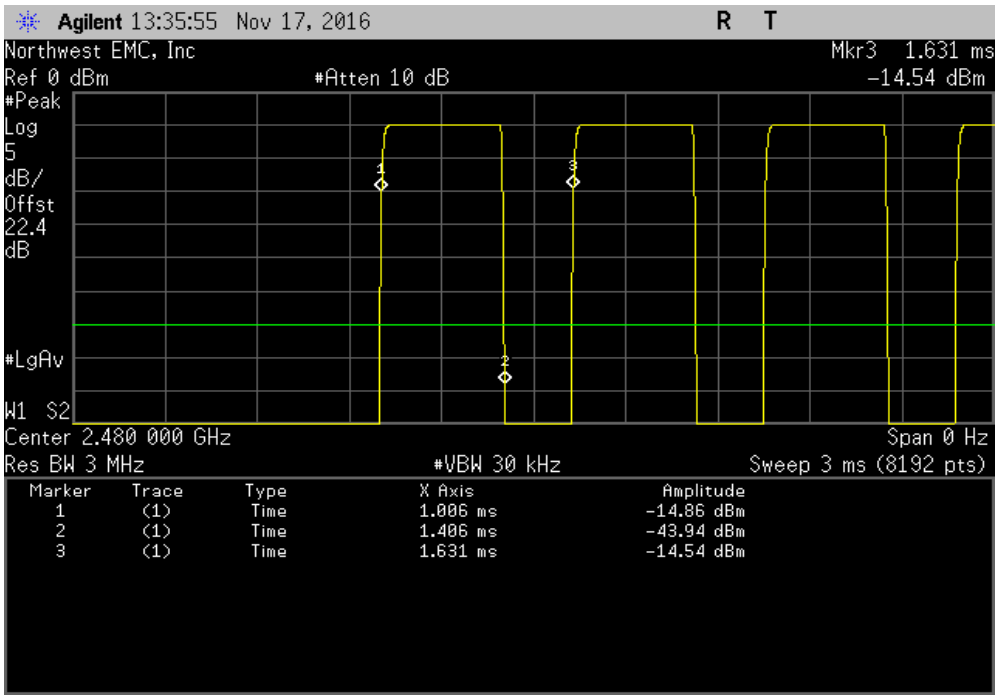
BLE/GFSK Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



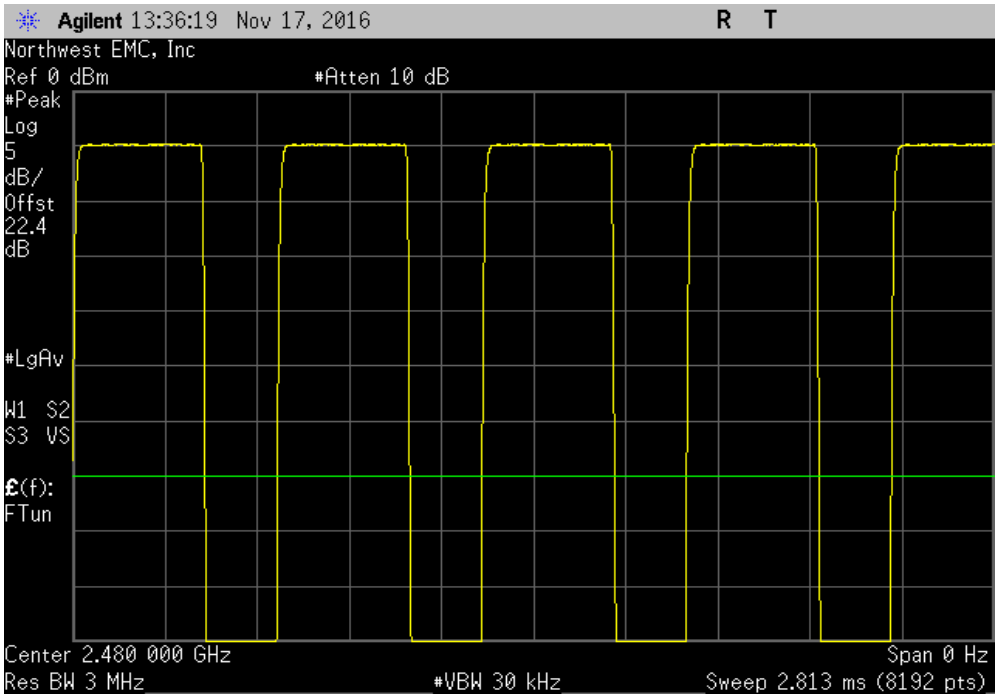
DUTY CYCLE

XMit 2016.05.06

BLE/GFSK High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	400.4 us	625.2 us	1	64	N/A	N/A



BLE/GFSK High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



OCCUPIED BANDWIDTH

NORTHWEST EMC

XMit 2016.05.06

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.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	10/17/2017
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/15/2016	9/15/2017
Block - DC	Fairview Microwave	SD3379	AMI	9/15/2016	9/15/2017
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	2/26/2017
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	3/24/2017

TEST DESCRIPTION

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

The 6dB occupied bandwidth was measured using 100 kHz resolution bandwidth and 300 kHz video bandwidth. The 99.0% occupied bandwidth was also measured at the same time which can be needed during Output Power depending on the applicable method.

OCCUPIED BANDWIDTH

NORTHWEST EMC

XMit 2016.05.06

EUT:	Hearing Aid			**Work Order:**	STAK0074
Serial Number:	161307836			**Date:**	11/17/16
Customer:	Starkey Laboratories, Inc.			**Temperature:**	21.7 °C
Attendees:	Charlie Esch			**Humidity:**	40.2% RH
Project:	None			**Barometric Pres.:**	1006 mbar
Tested by:	Dustin Sparks	**Power:**	1.45VDC	**Job Site:**	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

Transmitting BLE modulated. Battery replaced with DC power supply

DEVIATIONS FROM TEST STANDARD

None

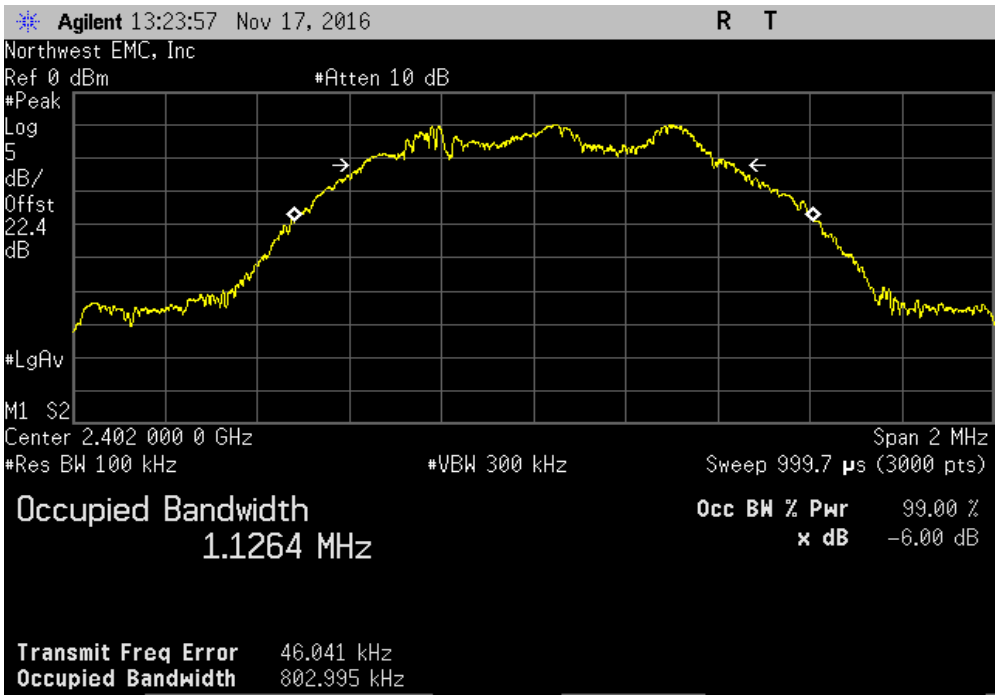
Configuration #	2	Signature Dustin Sparks

	Value	Limit (≥)	Result
BLE/GFSK Low Channel, 2402 MHz	802.995 kHz	500 kHz	Pass
BLE/GFSK Mid Channel, 2442 MHz	781.182 kHz	500 kHz	Pass
BLE/GFSK High Channel, 2480 MHz	702.509 kHz	500 kHz	Pass

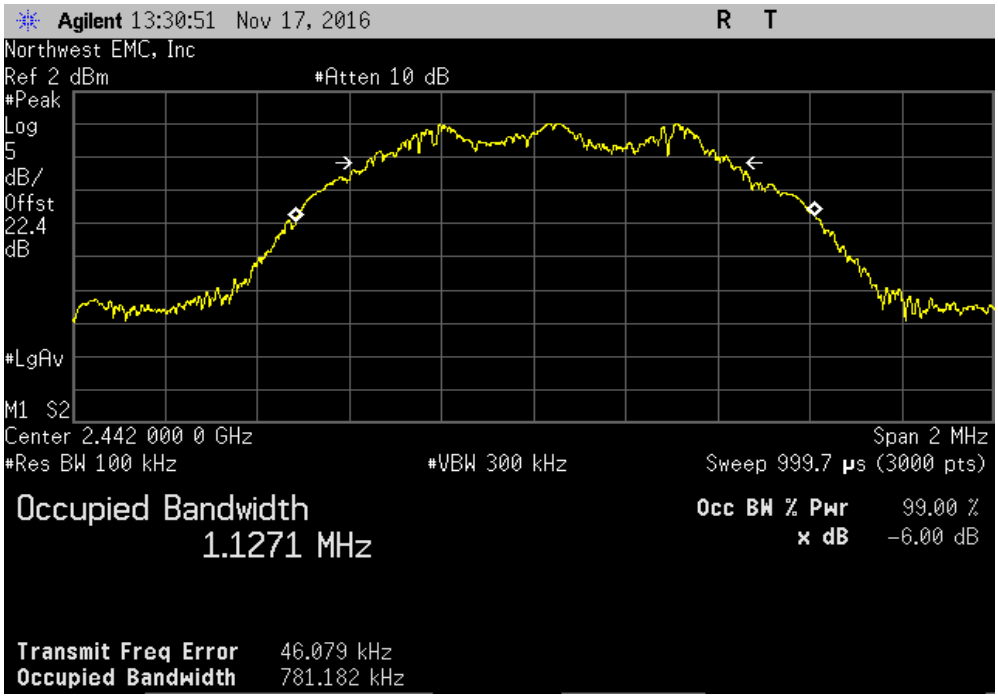
OCCUPIED BANDWIDTH

XMit 2016.05.06

BLE/GFSK Low Channel, 2402 MHz						
				Value	Limit (≥)	Result
				802.995 kHz	500 kHz	Pass



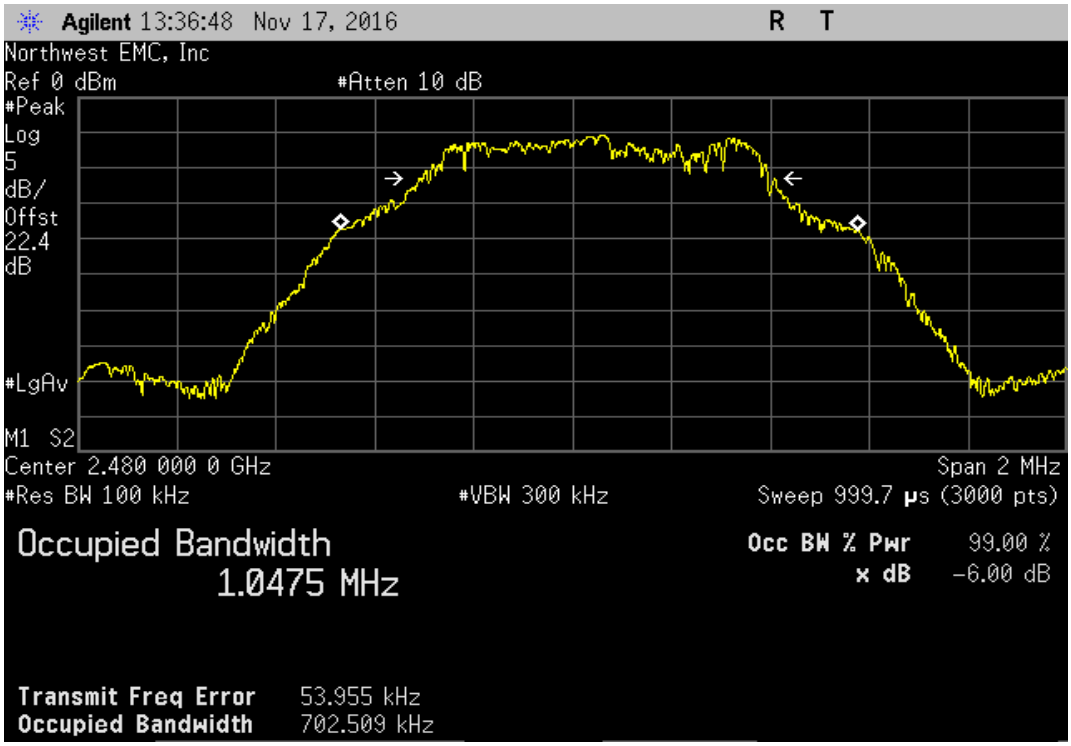
BLE/GFSK Mid Channel, 2442 MHz						
				Value	Limit (≥)	Result
				781.182 kHz	500 kHz	Pass



OCCUPIED BANDWIDTH

XMit 2016.05.06

BLE/GFSK High Channel, 2480 MHz							
					Value	Limit (≥)	Result
					702.509 kHz	500 kHz	Pass



OUTPUT POWER

XMit 2016.05.06

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.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	10/17/2017
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/15/2016	9/15/2017
Block - DC	Fairview Microwave	SD3379	AMI	9/15/2016	9/15/2017
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	2/26/2017
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	3/24/2017

TEST DESCRIPTION

The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

Prior to measuring peak transmit power the DTS bandwidth (B) was measured.

The method found in ANSI C63.10:2013 Section 11.9.1.1 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio..

De Facto EIRP Limit: The EUT meets the de facto EIRP limit of +36 dBm.

OUTPUT POWER

NORTHWEST EMC

XMit 2016.05.06

EUT:	Hearing Aid			**Work Order:**	STAK0074
Serial Number:	161307836			**Date:**	11/17/16
Customer:	Starkey Laboratories, Inc.			**Temperature:**	21.6 °C
Attendees:	Charlie Esch			**Humidity:**	40.3% RH
Project:	None			**Barometric Pres.:**	1007 mbar
Tested by:	Dustin Sparks	**Power:**	1.45VDC	**Job Site:**	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

Transmitting BLE modulated. Battery replaced with DC power supply

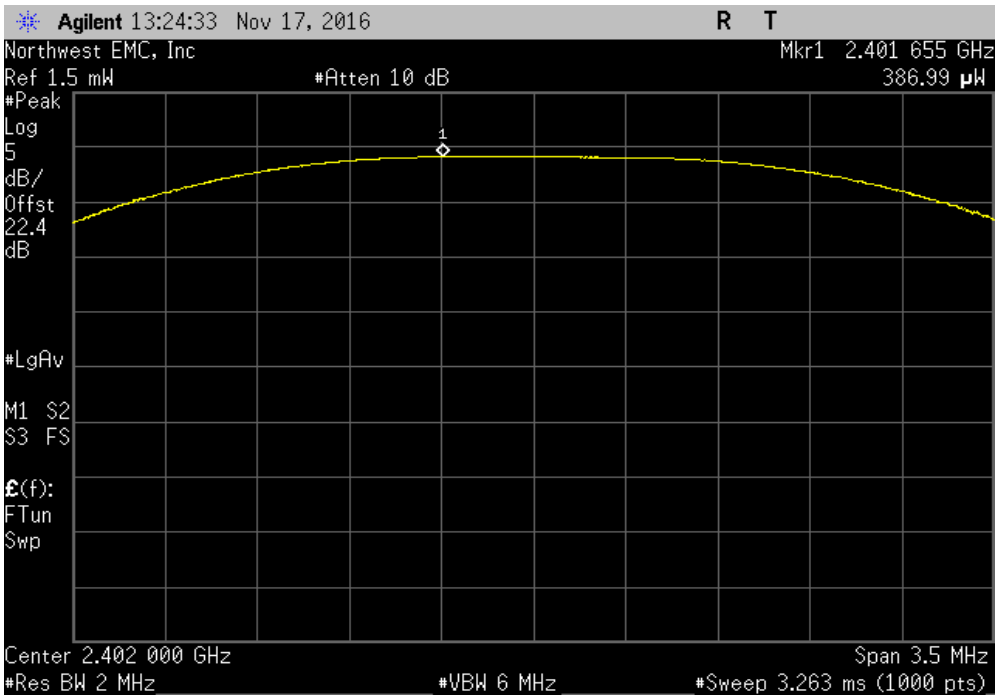
DEVIATIONS FROM TEST STANDARD

None

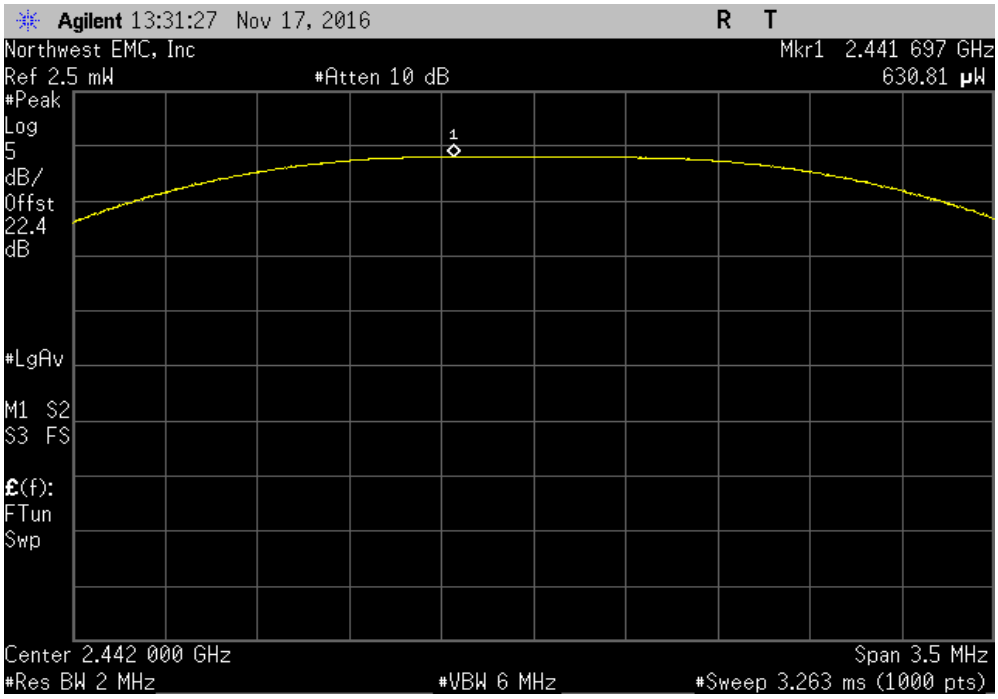
Configuration #	2	Signature Dustin Sparks

	Value	Limit (<)	Result
BLE/GFSK Low Channel, 2402 MHz	386.99 uW	1 W	Pass
BLE/GFSK Mid Channel, 2442 MHz	630.812 uW	1 W	Pass
BLE/GFSK High Channel, 2480 MHz	332.2 uW	1 W	Pass

BLE/GFSK Low Channel, 2402 MHz						
				Value	Limit (<)	Result
				386.99 uW	1 W	Pass



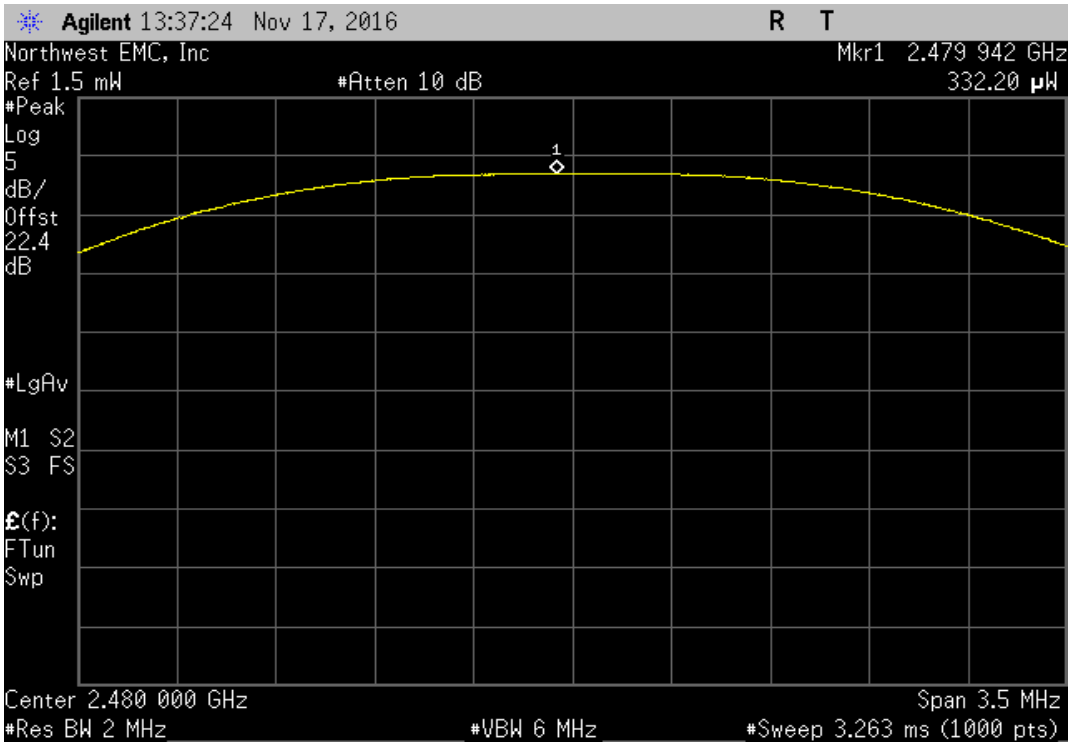
BLE/GFSK Mid Channel, 2442 MHz						
				Value	Limit (<)	Result
				630.812 uW	1 W	Pass



OUTPUT POWER

XMit 2016.05.06

BLE/GFSK High Channel, 2480 MHz						
				Value	Limit (<)	Result
				332.2 uW	1 W	Pass



POWER SPECTRAL DENSITY

NORTHWEST EMC

XMit 2016.05.06

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.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	10/17/2017
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/15/2016	9/15/2017
Block - DC	Fairview Microwave	SD3379	AMI	9/15/2016	9/15/2017
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	2/26/2017
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	3/24/2017

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The maximum power spectral density measurements was measured using the channels and modes as called out on the following data sheets.

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 2016.05.06

EUT:	Hearing Aid			**Work Order:**	STAK0074
Serial Number:	161307836			**Date:**	11/17/16
Customer:	Starkey Laboratories, Inc.			**Temperature:**	21.5 °C
Attendees:	Charlie Esch			**Humidity:**	40.5% RH
Project:	None			**Barometric Pres.:**	1007 mbar
Tested by:	Dustin Sparks	**Power:**	1.45VDC	**Job Site:**	MN08

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

Transmitting BLE modulated. Battery replaced with DC power supply

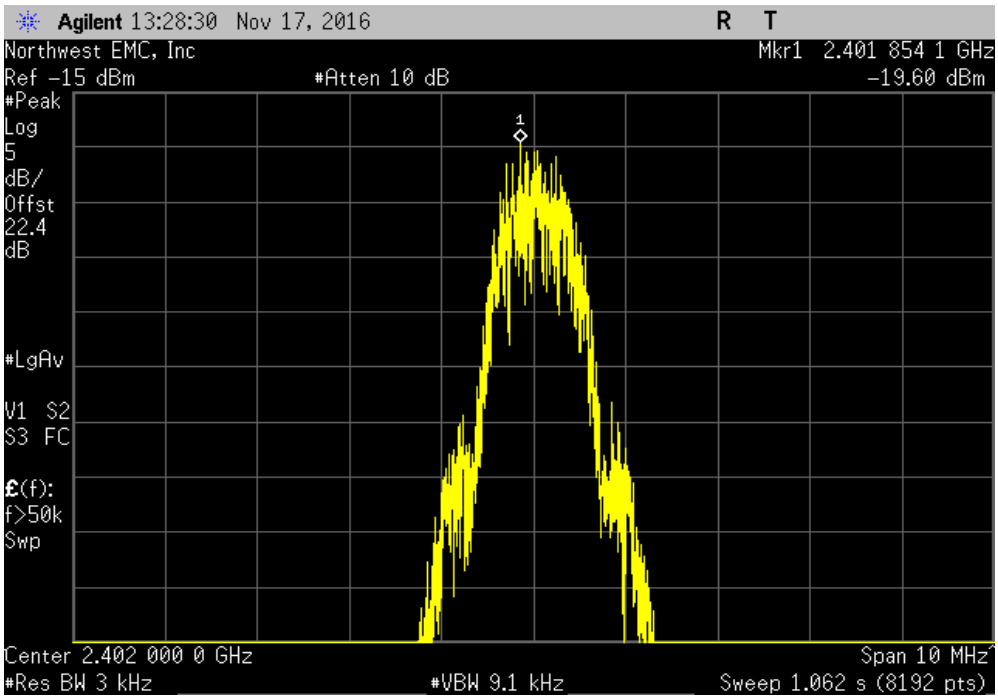
DEVIATIONS FROM TEST STANDARD

None

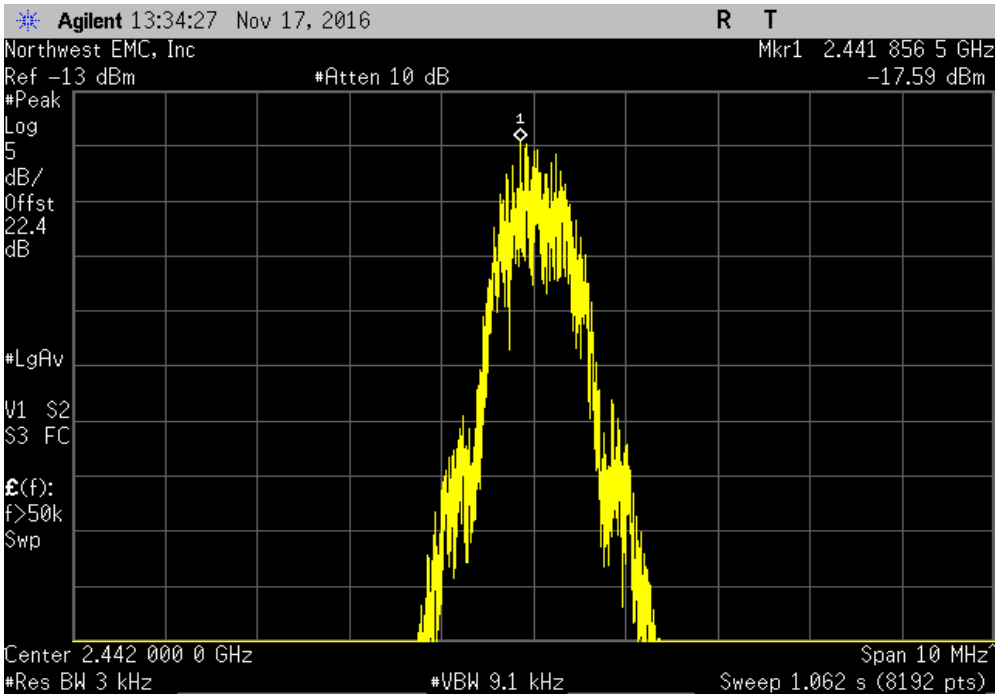
Configuration #	2	*Signature* Dustin Sparks

	Value dBm/3kHz	Limit < dBm/3kHz	Results
BLE/GFSK Low Channel, 2402 MHz	-19.599	8	Pass
BLE/GFSK Mid Channel, 2442 MHz	-17.592	8	Pass
BLE/GFSK High Channel, 2480 MHz	-17.968	8	Pass

BLE/GFSK Low Channel, 2402 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-19.599	8	Pass



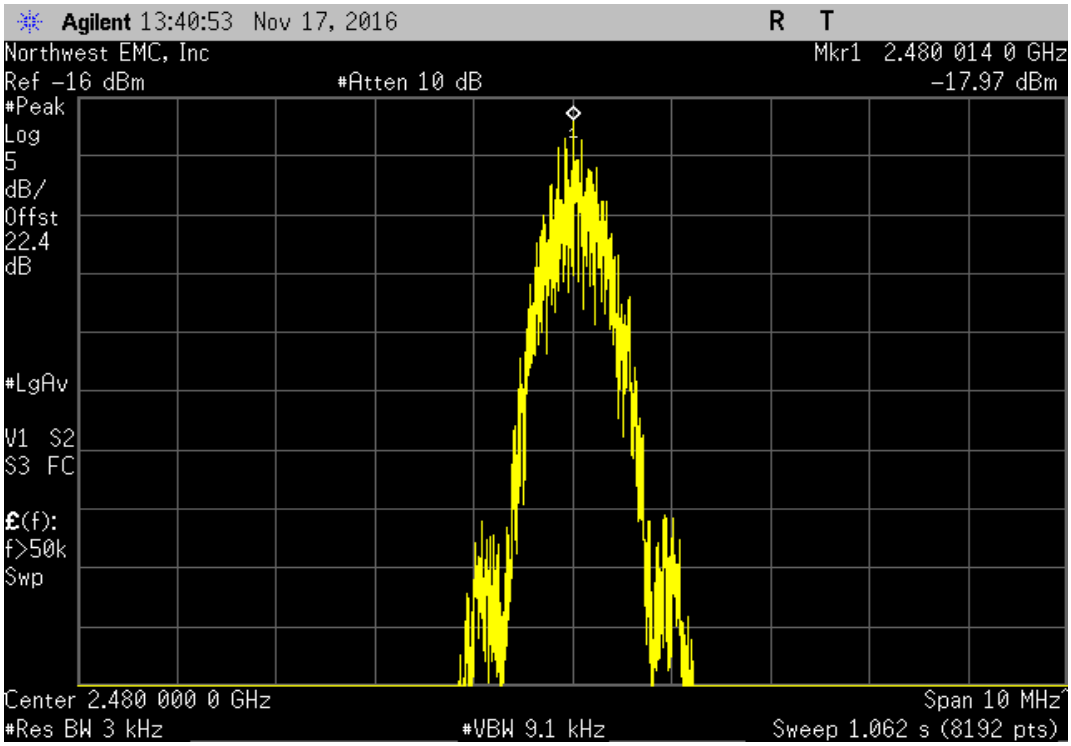
BLE/GFSK Mid Channel, 2442 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-17.592	8	Pass



POWER SPECTRAL DENSITY

XMit 2016.05.06

BLE/GFSK High Channel, 2480 MHz							
					Value dBm/3kHz	Limit < dBm/3kHz	Results
					-17.968	8	Pass



BAND EDGE COMPLIANCE

NORTHWEST EMC

XMit 2016.05.06

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.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	10/17/2017
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/15/2016	9/15/2017
Block - DC	Fairview Microwave	SD3379	AMI	9/15/2016	9/15/2017
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	2/26/2017
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	3/24/2017

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. 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 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.

BAND EDGE COMPLIANCE

NORTHWEST EMC

XMit 2016.05.06

EUT:	Hearing Aid			**Work Order:**	STAK0074
Serial Number:	161307836			**Date:**	11/17/16
Customer:	Starkey Laboratories, Inc.			**Temperature:**	22.1 °C
Attendees:	Charlie Esch			**Humidity:**	39.5% RH
Project:	None			**Barometric Pres.:**	1006 mbar
Tested by:	Dustin Sparks	**Power:**	1.45VDC	**Job Site:**	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

Transmitting BLE modulated. Battery replaced with DC power supply

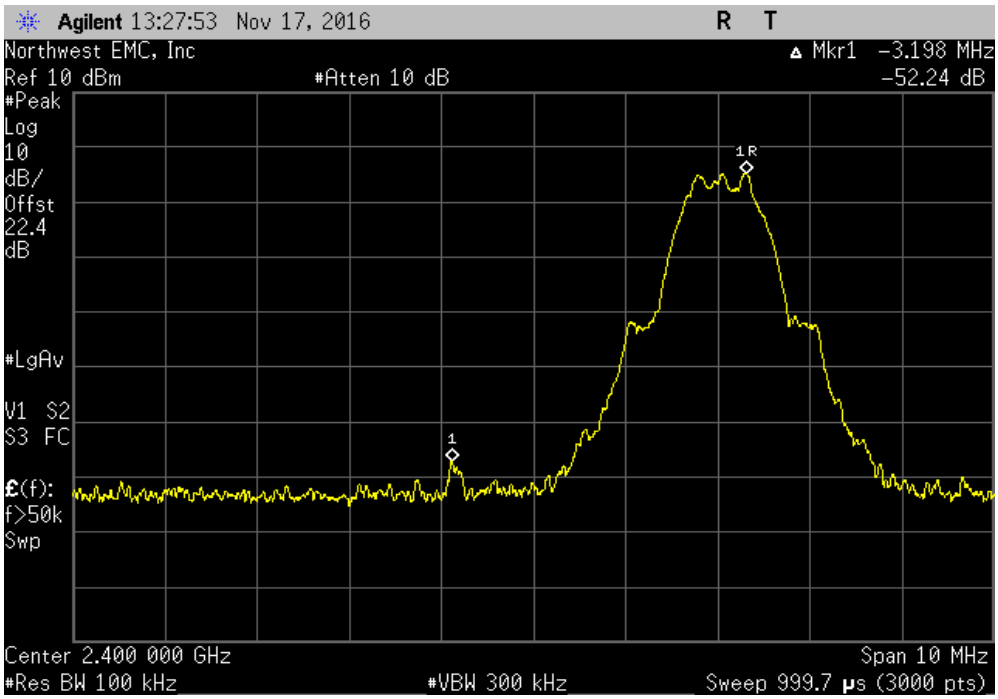
DEVIATIONS FROM TEST STANDARD

None

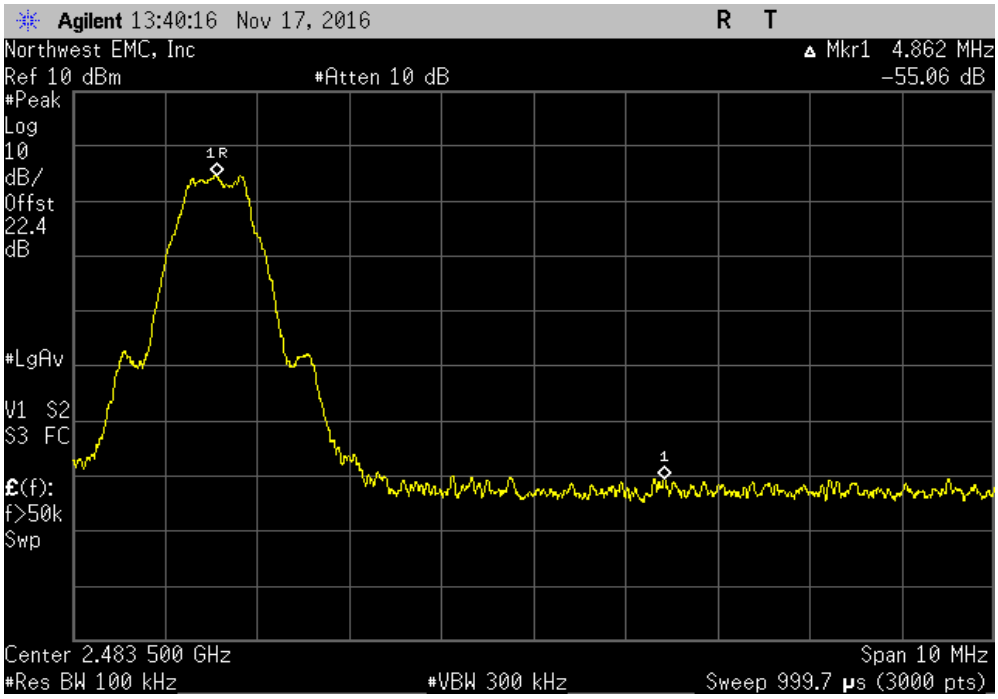
Configuration #	2	Signature Dustin Sparks

	Value (dBc)	Limit ≤ (dBc)	Result
BLE/GFSK Low Channel, 2402 MHz	-52.24	-20	Pass
BLE/GFSK High Channel, 2480 MHz	-55.06	-20	Pass

BLE/GFSK Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-52.24	-20	Pass



BLE/GFSK High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-55.06	-20	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2016.05.06

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.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	10/17/2017
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/15/2016	9/15/2017
Block - DC	Fairview Microwave	SD3379	AMI	9/15/2016	9/15/2017
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	2/26/2017
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	3/24/2017

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. 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 2016.05.06

EUT:	Hearing Aid			**Work Order:**	STAK0074
Serial Number:	161307836			**Date:**	11/17/16
Customer:	Starkey Laboratories, Inc.			**Temperature:**	21.5 °C
Attendees:	Charlie Esch			**Humidity:**	40.6% RH
Project:	None			**Barometric Pres.:**	1007 mbar
Tested by:	Dustin Sparks	**Power:**	1.45VDC	**Job Site:**	MN08

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

Transmitting BLE modulated. Battery replaced with DC power supply

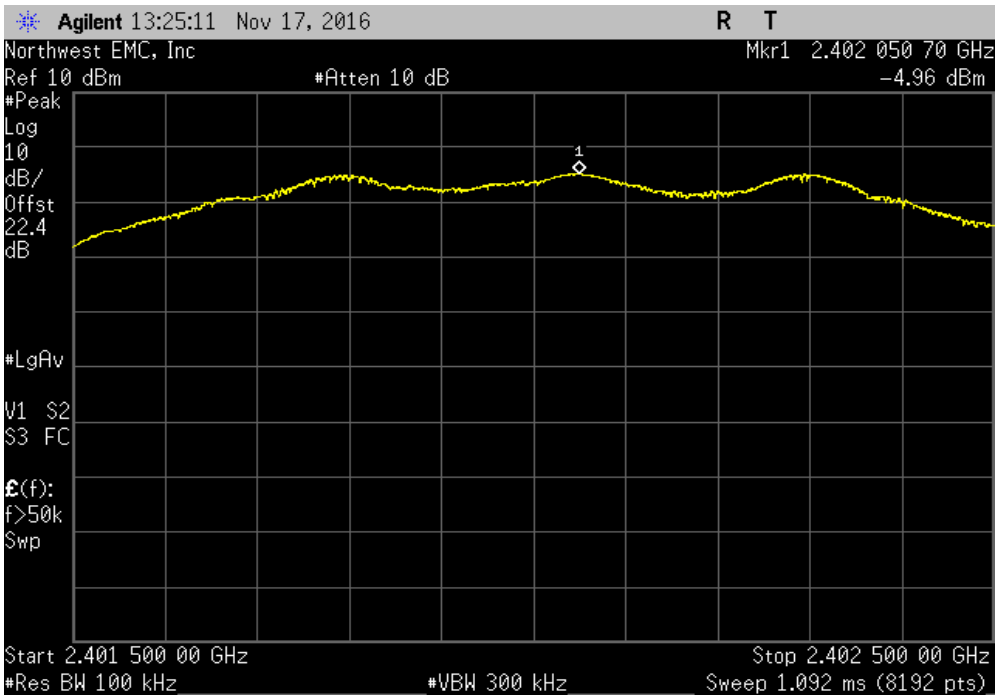
DEVIATIONS FROM TEST STANDARD

None

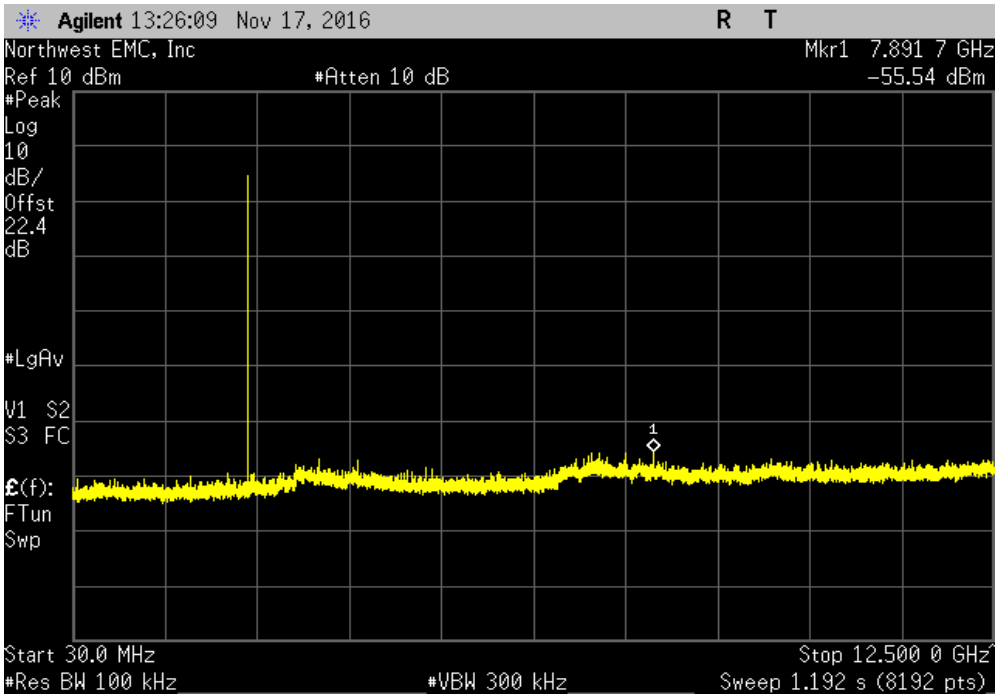
Configuration #	2	*Signature* Dustin Sparks

	Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result
BLE/GFSK Low Channel, 2402 MHz	Fundamental	N/A	N/A	N/A
BLE/GFSK Low Channel, 2402 MHz	30 MHz - 12.5 GHz	-50.58	-20	Pass
BLE/GFSK Low Channel, 2402 MHz	12.5 GHz - 25 GHz	-47.31	-20	Pass
BLE/GFSK Mid Channel, 2442 MHz	Fundamental	N/A	N/A	N/A
BLE/GFSK Mid Channel, 2442 MHz	30 MHz - 12.5 GHz	-50.99	-20	Pass
BLE/GFSK Mid Channel, 2442 MHz	12.5 GHz - 25 GHz	-49.2	-20	Pass
BLE/GFSK High Channel, 2480 MHz	Fundamental	N/A	N/A	N/A
BLE/GFSK High Channel, 2480 MHz	30 MHz - 12.5 GHz	-49.88	-20	Pass
BLE/GFSK High Channel, 2480 MHz	12.5 GHz - 25 GHz	-46.35	-20	Pass

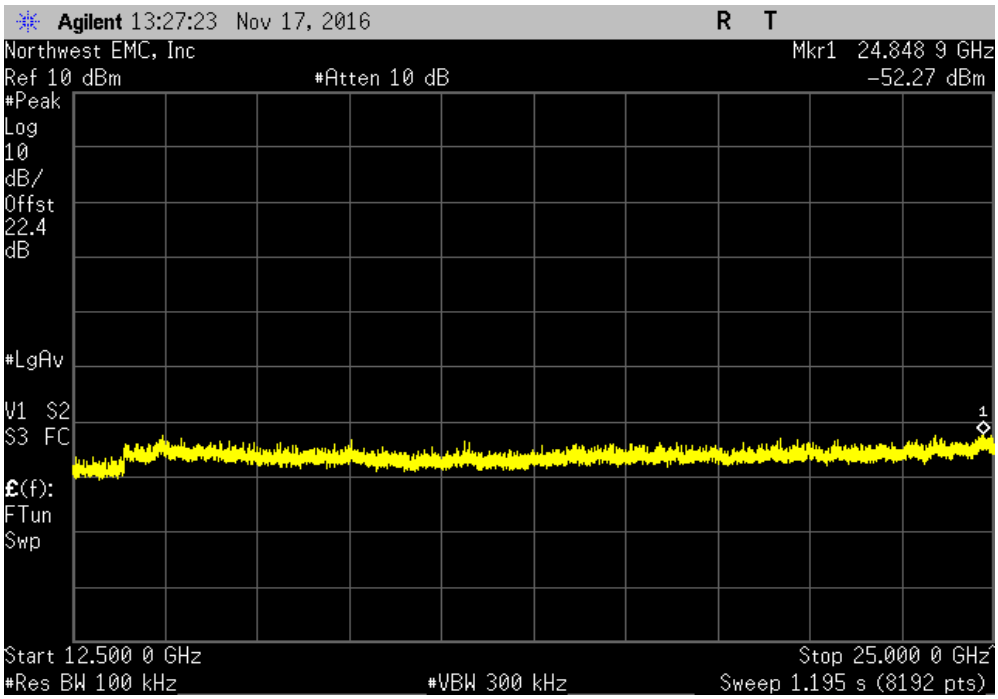
BLE/GFSK Low Channel, 2402 MHz						
	Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



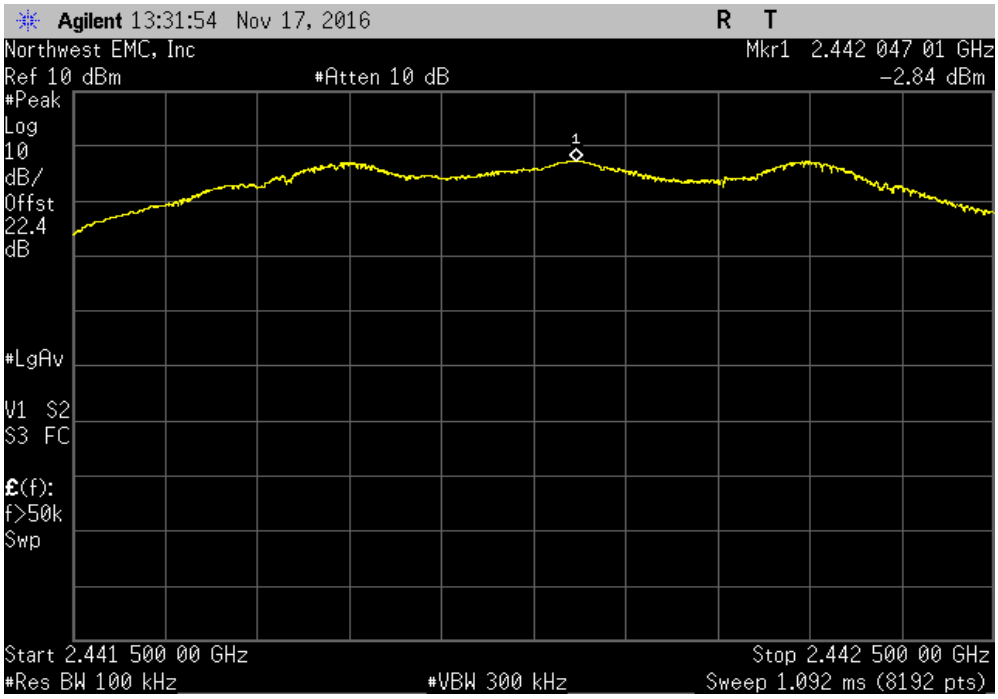
BLE/GFSK Low Channel, 2402 MHz					
Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz			-50.58	-20	Pass



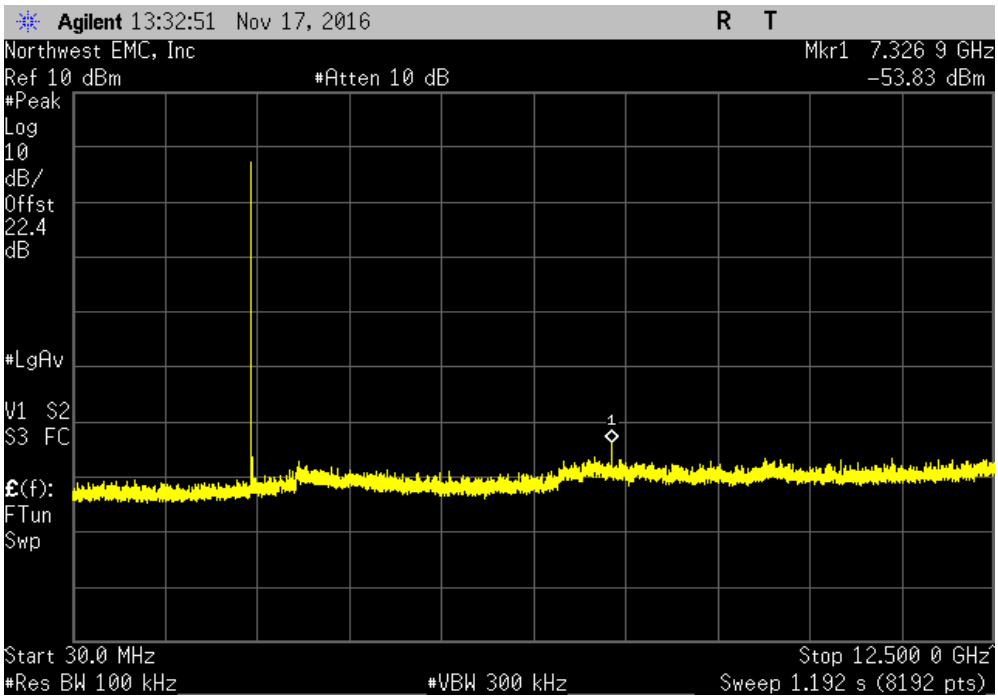
BLE/GFSK Low Channel, 2402 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-47.31	-20	Pass



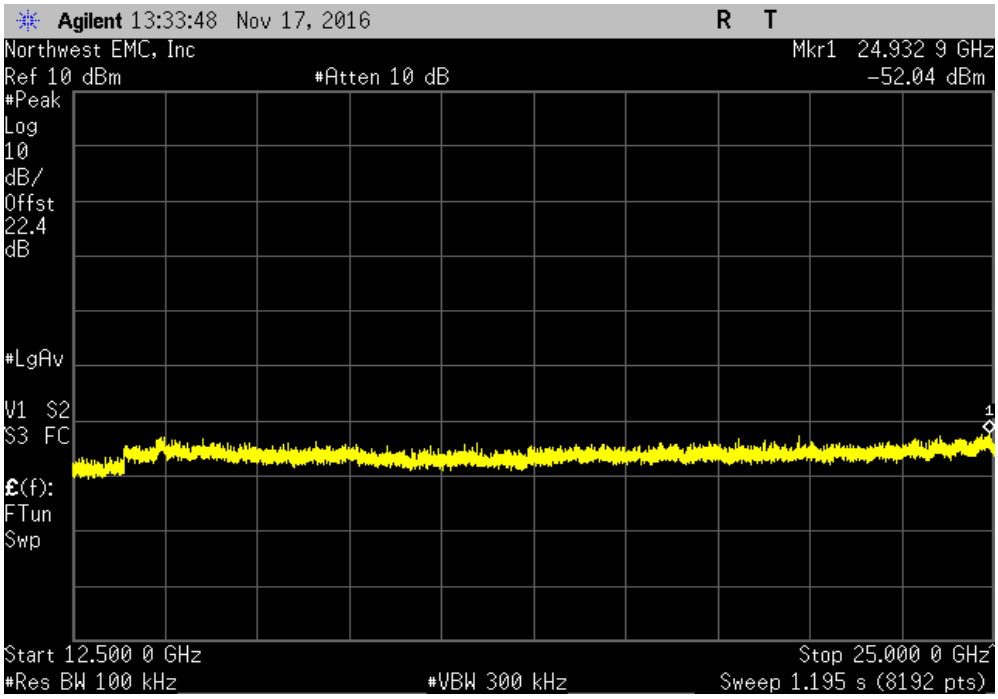
BLE/GFSK Mid Channel, 2442 MHz						
	Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



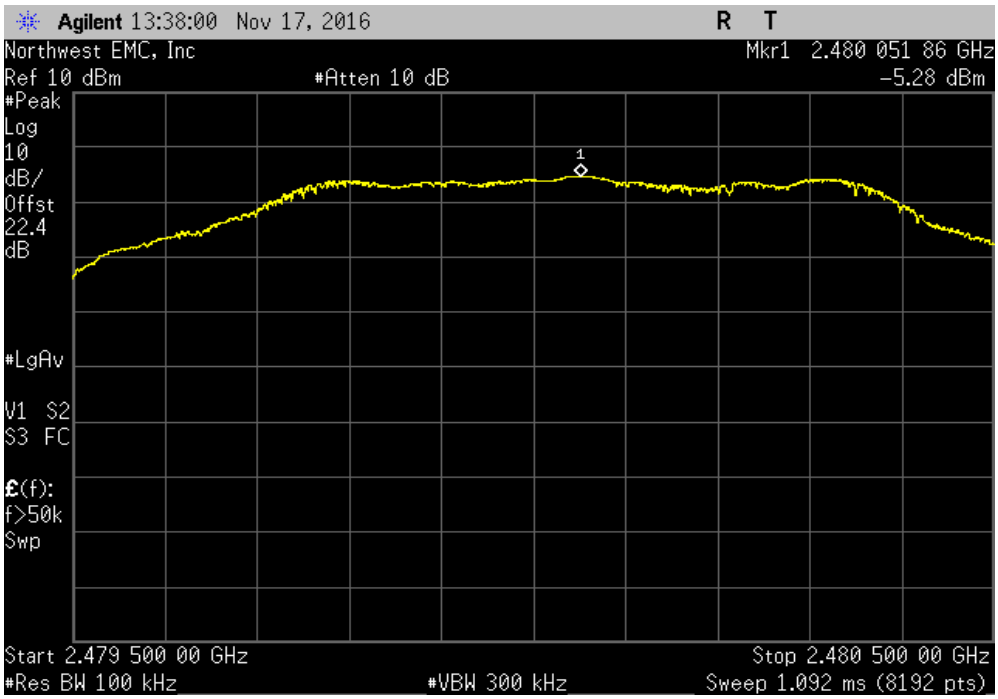
BLE/GFSK Mid Channel, 2442 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz		-50.99	-20	Pass



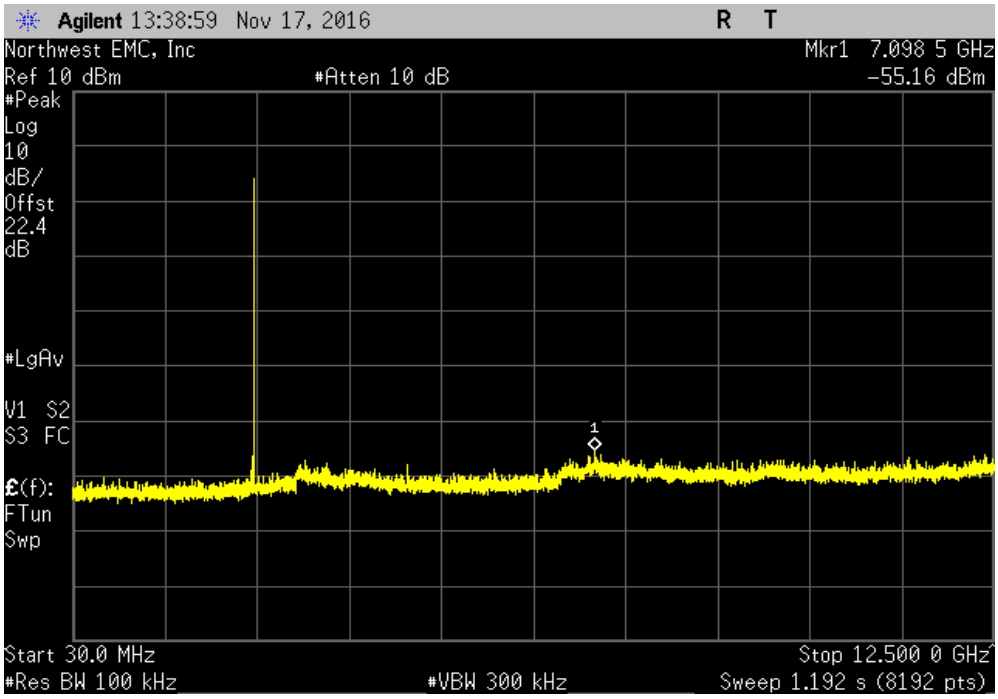
BLE/GFSK Mid Channel, 2442 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-49.2	-20	Pass



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



BLE/GFSK High Channel, 2480 MHz					
Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz			-49.88	-20	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2016.05.06

BLE/GFSK High Channel, 2480 MHz				
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz		-46.35	-20	Pass