Starkey Laboratories, Inc.

Hearing Aid

FCC 15.247:2018

Bluetooth LE (DTS) Radio

Report # STAK0116 Rev. 1

NVLAP LAB CODE: 200881-0

CERTIFICATE OF TEST

Last Date of Test: April 26, 2018
Starkey Laboratories, Inc.
Model: Hearing Aid

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2018	ANSI C63.10:2013, KDB 558074

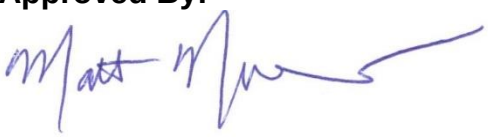
Results

Method Clause	Test Description	Applied	Results	Comments
6.5, 6.6, 11.12.1, 11.13.2	Spurious Radiated Emissions	Yes	Pass	
6.2	Powerline Conducted Emissions	No	N/A	Not required for a battery powered EUT.
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:



Matt Nuernberg, 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

Revision Number	Description	Date	Page Number
00	None		
01	Updated Test Equipment	6-21-2018	11

ACCREDITATIONS AND AUTHORIZATIONS

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 Element 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 – Within Element, we have a EU Notified Body validated for the EMCD and RED Directives.

Australia/New Zealand

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

Korea

MSIT / 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

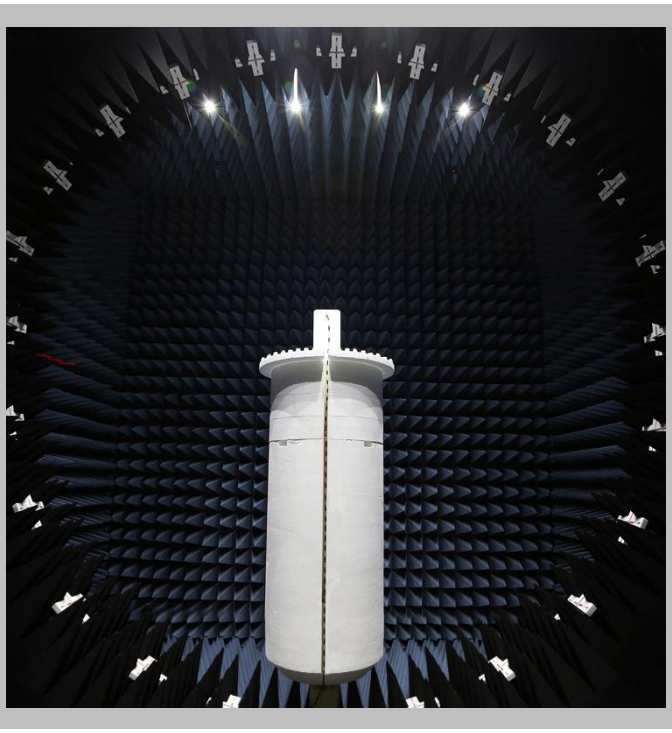
MIC – Recognized by MIC as a CAB for the acceptance of test data.

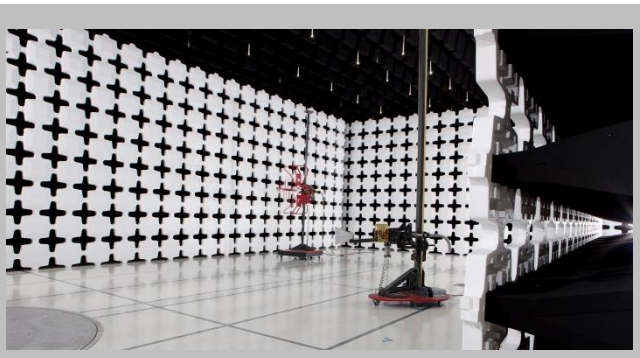
SCOPE

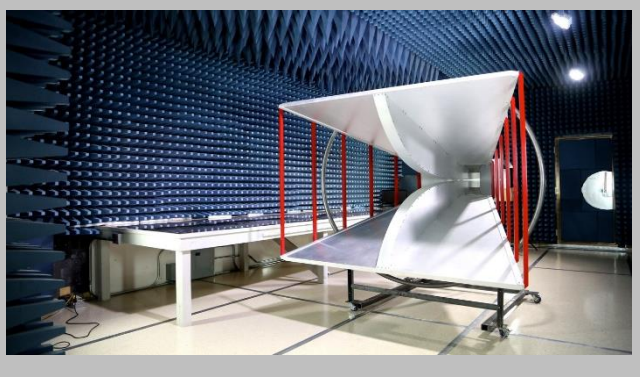
For details on the Scopes of our Accreditations, please visit:
http://portlandcustomer.element.com/ts/scope/scope.htm
http://gsi.nist.gov/global/docs/cabs/designations.html

FACILITIES

California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-10 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 6775 NE Evergreen Pkwy #400 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, 2834E-3	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

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.

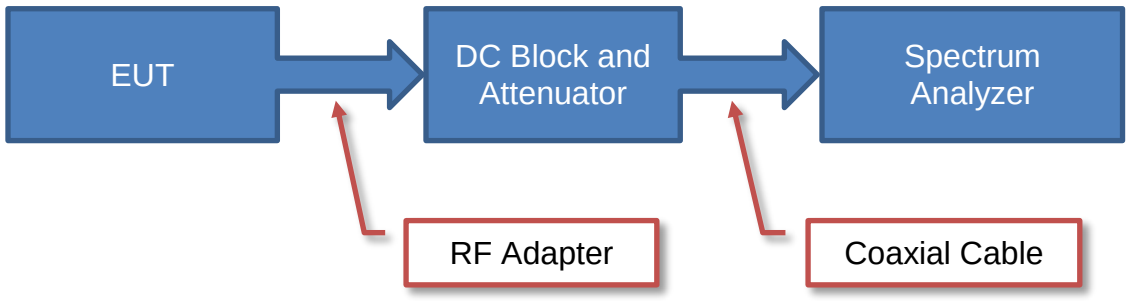
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable 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.

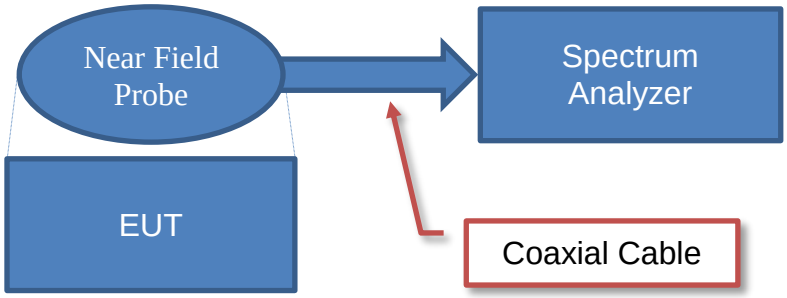
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%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

Test Setup Block Diagrams

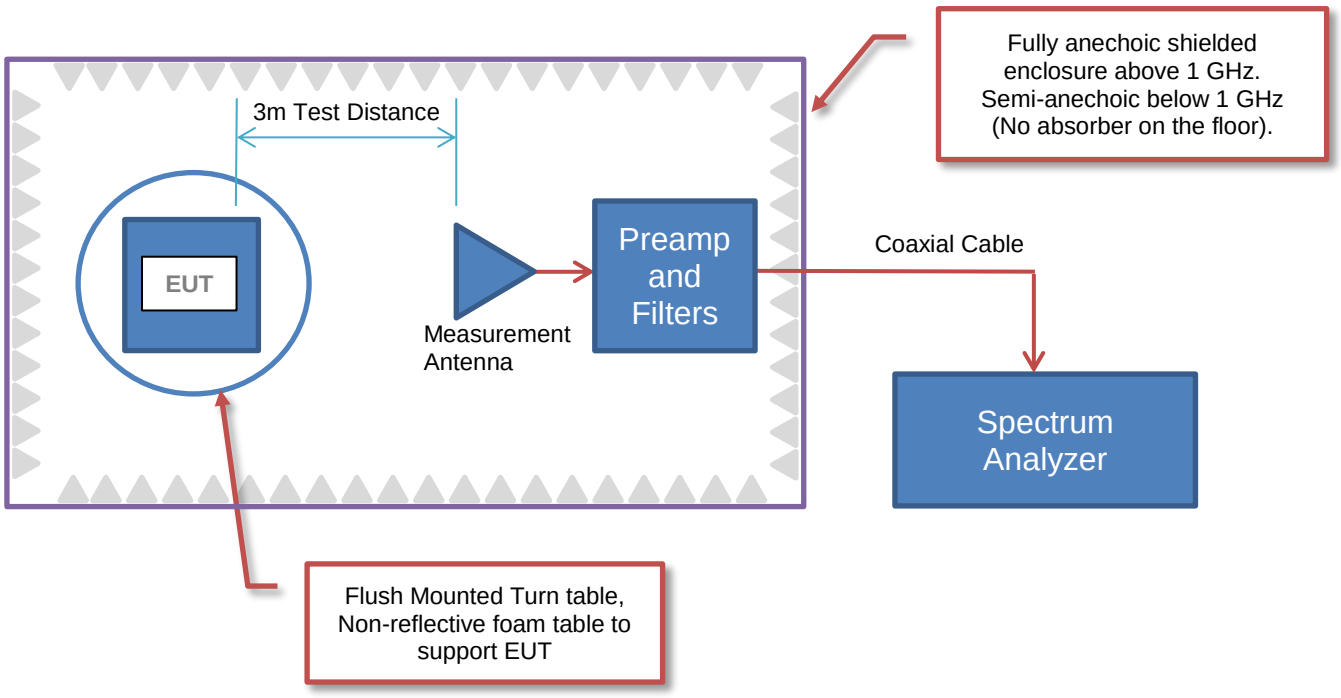
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

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:	April 23, 2018
Last Date of Test:	April 26, 2018
Receipt Date of Samples:	April 23, 2018
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 which communicates using a 2.4 GHz Bluetooth Low Energy (BLE) radio and a 10.2 MHz Near Field Magnetic Induction (NFMI) radio.

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

CONFIGURATIONS

Configuration STAK0116- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Hearing Aid	Starkey Laboratories, Inc.	Livio ONE RIC 312	180367056

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Bluetooth Dongle Dock	TruLink	None	None
Bluetooth Dongle	Anatel	BLE0112	Unknown
Laptop	Lenovo	ThinkPad T430	11306
Power Supply (Laptop)	Lenovo	ADLX90NCT2A	11S45N0311Z1ZLZ633M0T4

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable (Bluetooth Dongle Dock)	No	1.8m	No	Bluetooth Dongle Dock	Laptop
AC Cable (Laptop)	No	1.0m	No	AC Mains	Power Supply (Laptop)
DC Cable (Laptop)	No	1.8m	Yes	Power Supply (Laptop)	Laptop

Configuration STAK0116- 5

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Hearing Aid	Starkey Laboratories, Inc.	Livio ONE RIC 312	180367053

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	4/23/2018	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	4/23/2018	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	4/23/2018	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	4/23/2018	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
5	4/23/2018	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
6	4/23/2018	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
7	4/26/2018	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 2017.12.19

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

Battery

CONFIGURATIONS INVESTIGATED

STAK0116 - 5

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
Antenna - Biconilog	ETS Lindgren	3142D	AXO	15-Dec-2017	24 mo
Filter - Low Pass	Micro-Tronics	LPM50004	HGG	21-Sep-2017	12 mo
Filter - High Pass	Micro-Tronics	HPM50111	HFM	24-Feb-2018	12 mo
Attenuator	Coaxicom	3910-20	AXY	24-Feb-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVX	24-Feb-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1064-9079 and SA18E-10	AOO	24-Feb-2018	12 mo
Antenna	ETS-Lindgren	3160-08	AJP	NCR	0 mo
Antenna	ETS-Lindgren	3160-07	AJJ	NCR	0 mo
Antenna - Double Ridge	ETS-Lindgren	3115	AJQ	14-Nov-2016	24 mo
Cable	Element	Standard Gain Cable	MNW	24-Feb-2018	12 mo
Cable	Element	Double Ridge Guide Horn Cables	MNV	24-Feb-2018	12 mo
Cable	Element	Biconilog Cable	MNX	24-Feb-2018	12 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	26-Mar-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	12-Sep-2017	12 mo
Cable	ESM Cable Corp	TTBJ141 KMKM-72	MNP	12-Sep-2017	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AHG	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVC	24-Feb-2018	12 mo
Amplifier - Pre-Amplifier	L-3 Narda-MITEQ	AMF-6F-12001800-30-10P	PAP	24-Feb-2018	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 antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Measurements at the edges of the allowable band may be presented in an alternative method as provided for in the ANSI C63.10 Marker-Delta method. This method involves performing an in-band fundamental measurement followed by a screen capture of the fundamental and out-of-band emission using reduced measurement instrumentation bandwidths. The amplitude delta measured on this screen capture is applied to the fundamental emission value to show the out-of-band emission level as applied to the limit.

Where the radio test software does not provide for a duty cycle at continuous transmit conditions (> 98%) and the RMS (power average) measurements were made across the on and off times of the EUT transmissions, a duty cycle correction is added to the measurements using the formula of 10*LOG(dc).

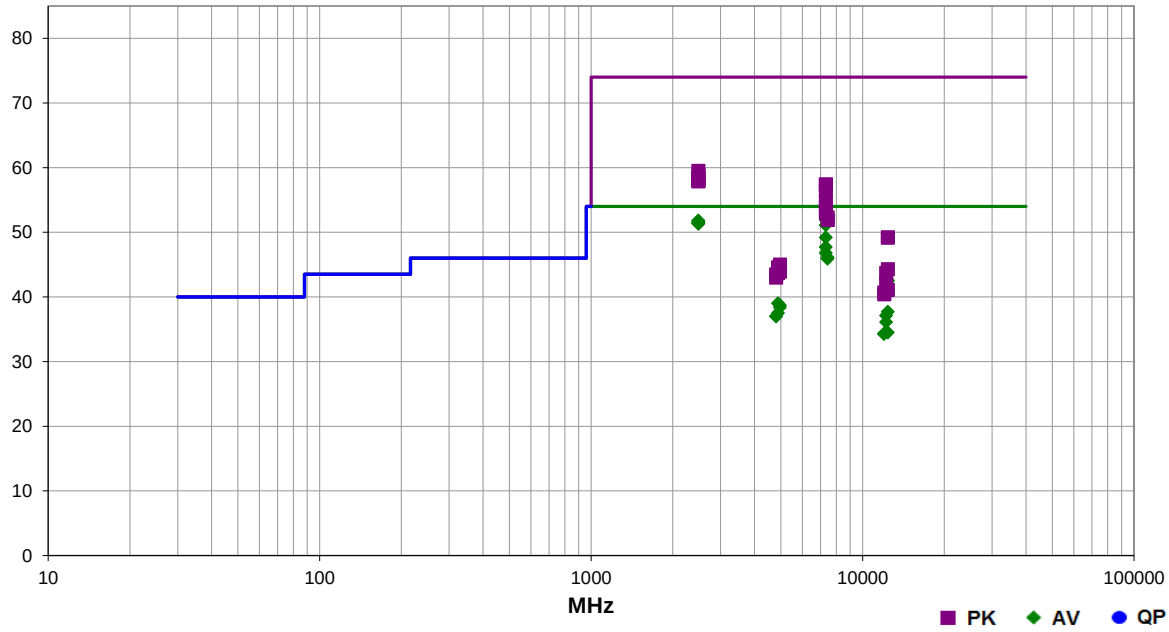
SPURIOUS RADIATED EMISSIONS

EmiR5 2018.02.06 PSA-ESCI 2017.12.19

Work Order:	STAK0116	**Date:**	26-Apr-2018		
Project:	None	**Temperature:**	21.4 °C		
Job Site:	MN09	**Humidity:**	28.3% RH		
Serial Number:	180367053	**Barometric Pres.:**	1014 mbar	**Tested by:**	Dustin Sparks
EUT:	Hearing Aid				
Configuration:	5				
Customer:	Starkey Laboratories, Inc.				
Attendees:	Charlie Esch				
EUT Power:	Battery				
Operating Mode:	Transmitting BLE - low channel (2402 MHz), mid channel (2442 MHz), and high channel (2480 MHz)				
Deviations:	None				
Comments:	EUT operating at 35% duty cycle - 4.6 dB correction factor added to all average data (DCCF = 10*log[1/0.35]).				

Test Specifications	**Test Method**
FCC 15.247:2018	ANSI C63.10:2013

Run #	16	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7325.442	35.6	12.1	2.3	230.0	4.6	0.0	Vert	AV	0.0	52.3	54.0	-1.7	Mid ch, EUT vertical
7325.542	35.2	12.1	2.3	232.0	4.6	0.0	Horz	AV	0.0	51.9	54.0	-2.1	Mid ch, EUT on side
2485.067	31.4	-4.2	1.0	195.0	4.6	20.0	Horz	AV	0.0	51.8	54.0	-2.2	High ch, EUT vertical
2483.925	31.3	-4.2	1.0	283.0	4.6	20.0	Vert	AV	0.0	51.7	54.0	-2.3	High ch, EUT vertical
2484.733	31.1	-4.2	1.4	265.0	4.6	20.0	Horz	AV	0.0	51.5	54.0	-2.5	High ch, EUT on side
2483.933	31.0	-4.2	1.0	293.0	4.6	20.0	Vert	AV	0.0	51.4	54.0	-2.6	High ch, EUT on side
2483.892	31.0	-4.2	1.0	339.0	4.6	20.0	Horz	AV	0.0	51.4	54.0	-2.6	High ch, EUT horizontal
2484.617	31.0	-4.2	1.0	268.0	4.6	20.0	Horz	AV	0.0	51.4	54.0	-2.6	Low ch, EUT vertical
2484.217	30.9	-4.2	1.0	335.0	4.6	20.0	Vert	AV	0.0	51.3	54.0	-2.7	High ch, EUT horizontal
7325.467	34.4	12.1	2.3	179.0	4.6	0.0	Horz	AV	0.0	51.1	54.0	-2.9	Mid ch, EUT horizontal
7325.608	32.5	12.1	4.0	123.0	4.6	0.0	Vert	AV	0.0	49.2	54.0	-4.8	Mid ch, EUT on side
7325.533	31.0	12.1	1.0	230.0	4.6	0.0	Vert	AV	0.0	47.7	54.0	-6.3	Mid ch, EUT horizontal
7325.542	30.1	12.1	4.0	154.0	4.6	0.0	Horz	AV	0.0	46.8	54.0	-7.2	Mid ch, EUT vertical
7439.592	29.0	12.5	1.1	62.0	4.6	0.0	Horz	AV	0.0	46.1	54.0	-7.9	High ch, EUT on side
7439.425	28.8	12.5	2.6	77.0	4.6	0.0	Vert	AV	0.0	45.9	54.0	-8.1	High ch, EUT vertical
12402.340	25.5	12.4	1.0	235.0	4.6	0.0	Horz	AV	0.0	42.5	54.0	-11.5	High ch, EUT on side
12401.640	25.5	12.4	1.0	147.0	4.6	0.0	Vert	AV	0.0	42.5	54.0	-11.5	High ch, EUT vertical
2483.517	43.7	-4.2	1.0	283.0	0.0	20.0	Vert	PK	0.0	59.5	74.0	-14.5	High ch, EUT vertical

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4883.833	30.5	3.9	2.6	216.0	4.6	0.0	Vert	AV	0.0	39.0	54.0	-15.0	Mid ch, EUT vertical
2486.492	43.1	-4.2	1.0	195.0	0.0	20.0	Horz	PK	0.0	58.9	74.0	-15.1	High ch, EUT vertical
4959.958	30.1	4.0	1.0	311.0	4.6	0.0	Vert	AV	0.0	38.7	54.0	-15.3	High ch, EUT vertical
2484.567	42.6	-4.2	1.4	265.0	0.0	20.0	Horz	PK	0.0	58.4	74.0	-15.6	High ch, EUT on side
4960.092	29.8	4.0	2.3	33.0	4.6	0.0	Horz	AV	0.0	38.4	54.0	-15.6	High ch, EUT on side
2483.958	42.5	-4.2	1.0	339.0	0.0	20.0	Horz	PK	0.0	58.3	74.0	-15.7	High ch, EUT horizontal
2485.942	42.4	-4.2	1.0	268.0	0.0	20.0	Horz	PK	0.0	58.2	74.0	-15.8	Low ch, EUT vertical
2484.250	42.1	-4.2	1.0	293.0	0.0	20.0	Vert	PK	0.0	57.9	74.0	-16.1	High ch, EUT on side
2485.100	42.1	-4.2	1.0	335.0	0.0	20.0	Vert	PK	0.0	57.9	74.0	-16.1	High ch, EUT horizontal
12398.950	33.6	-0.5	1.8	50.0	4.6	0.0	Horz	AV	0.0	37.7	54.0	-16.3	High ch, EUT on side
4883.758	29.0	3.9	1.0	226.0	4.6	0.0	Horz	AV	0.0	37.5	54.0	-16.5	Mid ch, EUT on side
7327.100	45.3	12.1	2.3	230.0	0.0	0.0	Vert	PK	0.0	57.4	74.0	-16.6	Mid ch, EUT vertical
7326.658	45.3	12.1	2.3	232.0	0.0	0.0	Horz	PK	0.0	57.4	74.0	-16.6	Mid ch, EUT on side
12208.900	32.6	-0.1	2.2	68.0	4.6	0.0	Horz	AV	0.0	37.1	54.0	-16.9	Mid ch, EUT on side
4802.533	28.1	4.3	1.7	355.0	4.6	0.0	Vert	AV	0.0	37.0	54.0	-17.0	Low ch, EUT vertical
4802.950	28.1	4.3	1.0	303.0	4.6	0.0	Horz	AV	0.0	37.0	54.0	-17.0	Low ch, EUT on side
7326.267	44.4	12.1	2.3	179.0	0.0	0.0	Horz	PK	0.0	56.5	74.0	-17.5	Mid ch, EUT horizontal
12208.830	31.6	-0.1	2.9	8.0	4.6	0.0	Vert	AV	0.0	36.1	54.0	-17.9	Mid ch, EUT vertical
7326.258	42.8	12.1	4.0	123.0	0.0	0.0	Vert	PK	0.0	54.9	74.0	-19.1	Mid ch, EUT on side
12398.800	30.4	-0.5	1.0	248.0	4.6	0.0	Vert	AV	0.0	34.5	54.0	-19.5	High ch, EUT vertical
12007.580	31.5	-1.8	1.0	145.0	4.6	0.0	Horz	AV	0.0	34.3	54.0	-19.7	Low ch, EUT on side
12008.480	31.5	-1.8	1.0	43.0	4.6	0.0	Vert	AV	0.0	34.3	54.0	-19.7	Low ch, EUT vertical
7326.217	41.7	12.1	1.0	230.0	0.0	0.0	Vert	PK	0.0	53.8	74.0	-20.2	Mid ch, EUT horizontal
7326.508	40.9	12.1	4.0	154.0	0.0	0.0	Horz	PK	0.0	53.0	74.0	-21.0	Mid ch, EUT vertical
7439.183	39.8	12.5	2.6	77.0	0.0	0.0	Vert	PK	0.0	52.3	74.0	-21.7	High ch, EUT vertical
7441.200	39.4	12.5	1.1	62.0	0.0	0.0	Horz	PK	0.0	51.9	74.0	-22.1	High ch, EUT on side
12402.050	36.8	12.4	1.0	235.0	0.0	0.0	Horz	PK	0.0	49.2	74.0	-24.8	High ch, EUT on side
12401.290	36.8	12.4	1.0	147.0	0.0	0.0	Vert	PK	0.0	49.2	74.0	-24.8	High ch, EUT vertical
4960.375	41.0	4.0	1.0	311.0	0.0	0.0	Vert	PK	0.0	45.0	74.0	-29.0	High ch, EUT vertical
4883.275	40.7	3.9	2.6	216.0	0.0	0.0	Vert	PK	0.0	44.6	74.0	-29.4	Mid ch, EUT vertical
12398.840	44.8	-0.5	1.8	50.0	0.0	0.0	Horz	PK	0.0	44.3	74.0	-29.7	High ch, EUT on side
4959.617	39.9	4.0	2.3	33.0	0.0	0.0	Horz	PK	0.0	43.9	74.0	-30.1	High ch, EUT on side
4884.667	39.8	3.9	1.0	226.0	0.0	0.0	Horz	PK	0.0	43.7	74.0	-30.3	Mid ch, EUT on side
12208.780	43.8	-0.1	2.2	68.0	0.0	0.0	Horz	PK	0.0	43.7	74.0	-30.3	Mid ch, EUT on side
4803.283	39.2	4.3	1.0	303.0	0.0	0.0	Horz	PK	0.0	43.5	74.0	-30.5	Low ch, EUT on side
4805.217	38.7	4.3	1.7	355.0	0.0	0.0	Vert	PK	0.0	43.0	74.0	-31.0	Low ch, EUT vertical
12211.000	42.2	-0.1	2.9	8.0	0.0	0.0	Vert	PK	0.0	42.1	74.0	-31.9	Mid ch, EUT vertical
12398.620	41.6	-0.5	1.0	248.0	0.0	0.0	Vert	PK	0.0	41.1	74.0	-32.9	High ch, EUT vertical
12010.780	42.4	-1.7	1.0	43.0	0.0	0.0	Vert	PK	0.0	40.7	74.0	-33.3	Low ch, EUT vertical
12009.570	42.2	-1.8	1.0	145.0	0.0	0.0	Horz	PK	0.0	40.4	74.0	-33.6	Low ch, EUT on side

DUTY CYCLE

XMit 2017.12.13

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	E4422B	TGQ	15-Mar-18	15-Mar-21
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-18	15-Mar-19
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-18	13-Feb-19
Block - DC	Fairview Microwave	SD3379	AMI	12-Sep-17	12-Sep-18
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	19-Dec-17	19-Dec-18

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

TbtTx 2017.12.14 XMit 2017.12.13

EUT:	**Hearing Aid**			**Work Order:**	**STAK0116**
Serial Number:	**180367056**			**Date:**	**23-Apr-18**
Customer:	**Starkey Laboratories, Inc.**			**Temperature:**	**22.1 °C**
Attendees:	**Charlie Esch**			**Humidity:**	**29.7% RH**
Project:	**None**			**Barometric Pres.:**	**1027 mbar**
Tested by:	**Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2018	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

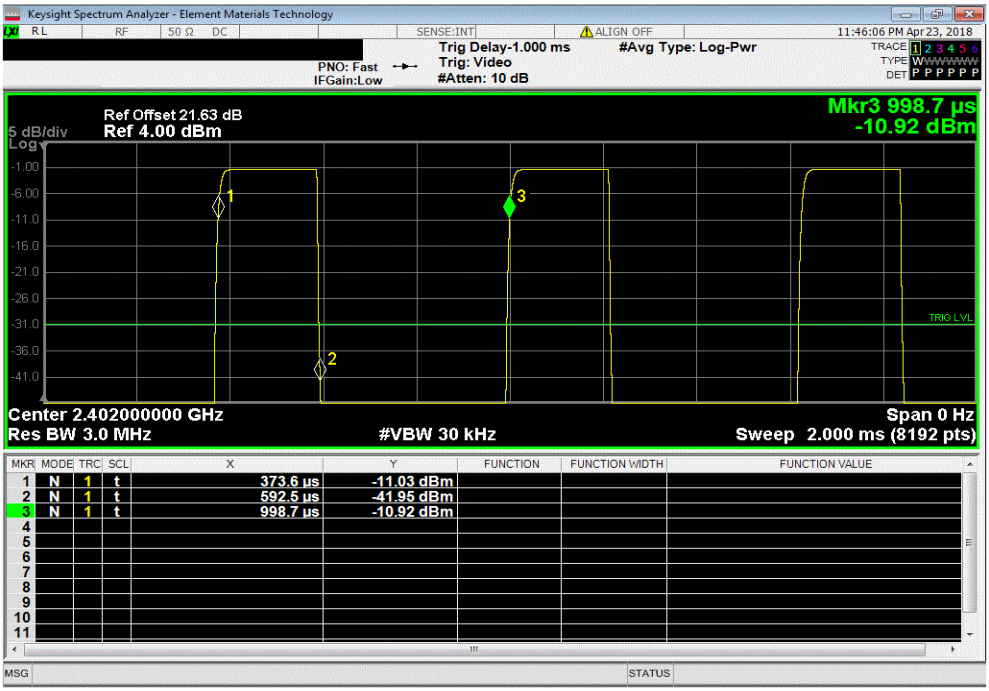
Configuration #	**1**	*Signature* Dustin Sparks

	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
BLE/GFSK Low Channel, 2402 MHz	218.9 us	625.1 us	1	35	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	219.1 us	625.2 us	1	35	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	218.7 us	625 us	1	35	N/A	N/A
BLE/GFSK High Channel, 2480 MHz	N/A	N/A	5	N/A	N/A	N/A

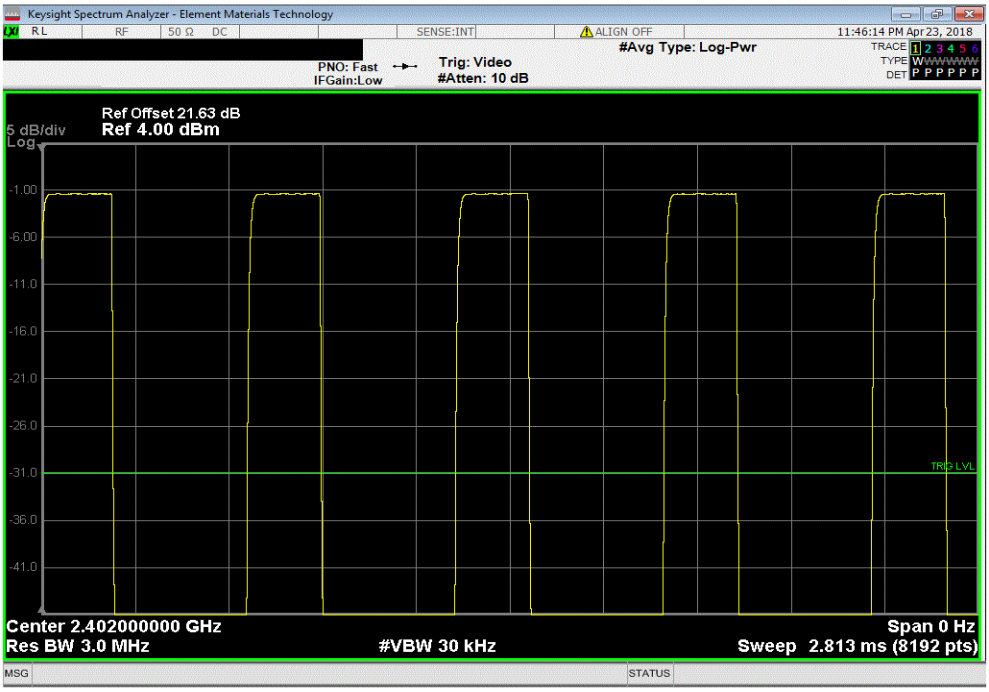
DUTY CYCLE

TbtTx 2017.12.14 XMit 2017.12.13

BLE/GFSK Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	218.9 us	625.1 us	1	35	N/A	N/A



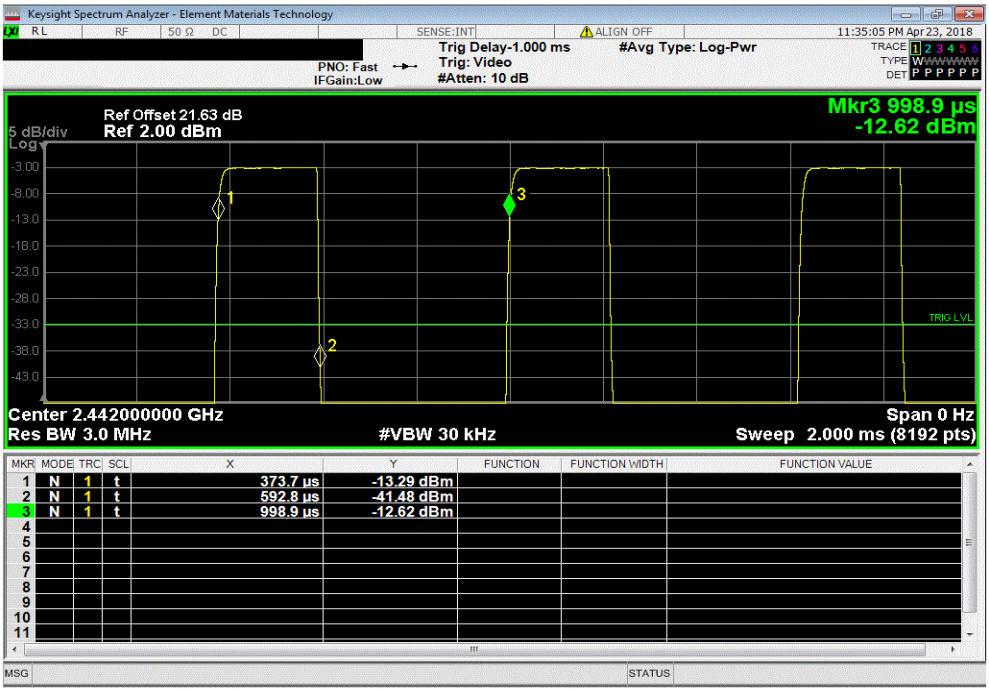
BLE/GFSK Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



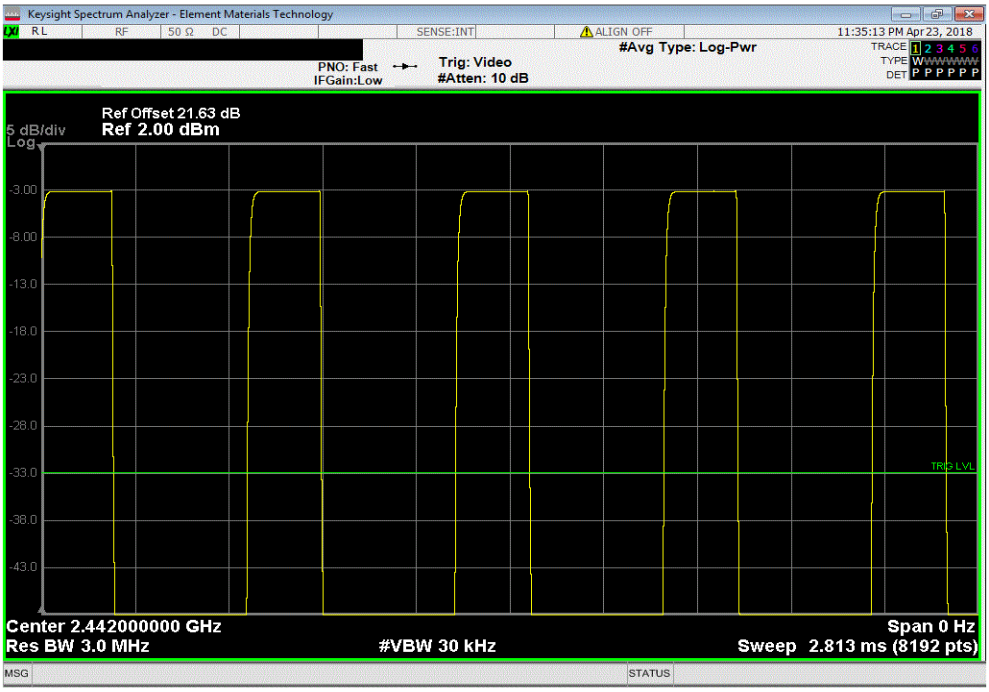
DUTY CYCLE

TbtTx 2017.12.14 XMit 2017.12.13

BLE/GFSK Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	219.1 us	625.2 us	1	35	N/A	N/A



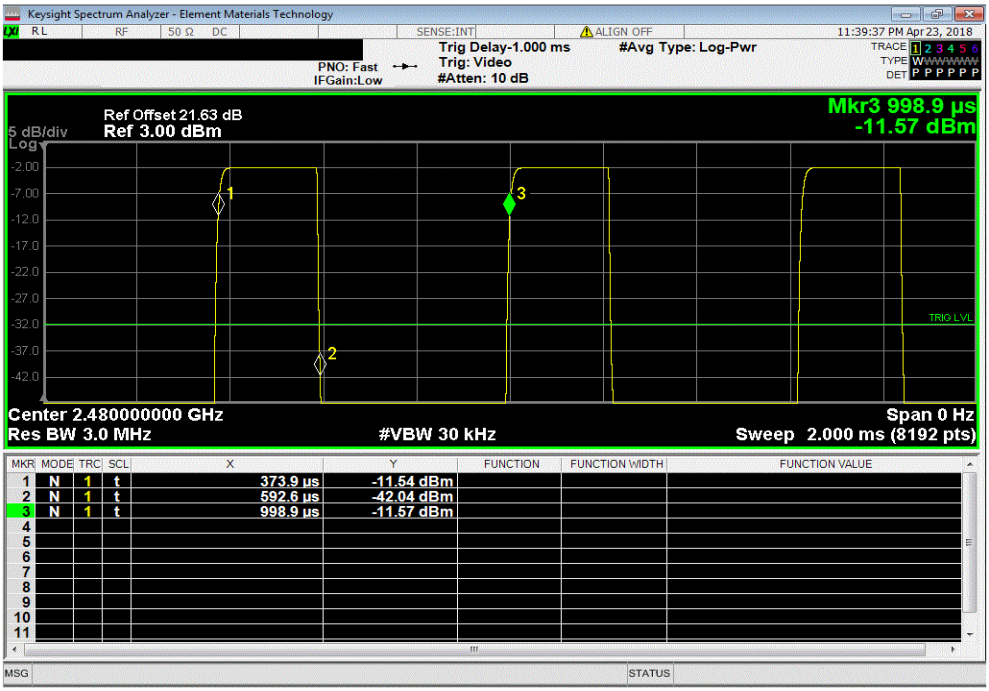
BLE/GFSK Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



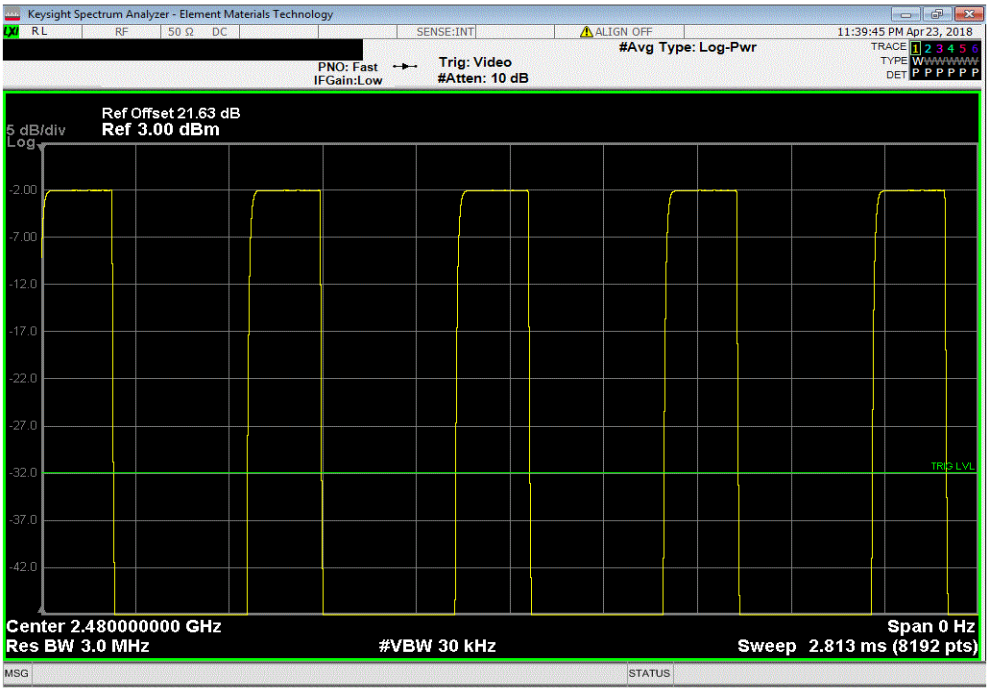
DUTY CYCLE

TbtTx 2017.12.14 XMit 2017.12.13

BLE/GFSK High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	218.7 us	625 us	1	35	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

XMit 2017.12.13

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	E4422B	TGQ	15-Mar-18	15-Mar-21
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-18	15-Mar-19
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-18	13-Feb-19
Block - DC	Fairview Microwave	SD3379	AMI	12-Sep-17	12-Sep-18
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	19-Dec-17	19-Dec-18

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

TbtTx 2017.12.14 XMit 2017.12.13

EUT:	**Hearing Aid**			**Work Order:**	**STAK0116**
Serial Number:	**180367056**			**Date:**	**23-Apr-18**
Customer:	**Starkey Laboratories, Inc.**			**Temperature:**	**22 °C**
Attendees:	**Charlie Esch**			**Humidity:**	**29.7% RH**
Project:	**None**			**Barometric Pres.:**	**1027 mbar**
Tested by:	**Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2018	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

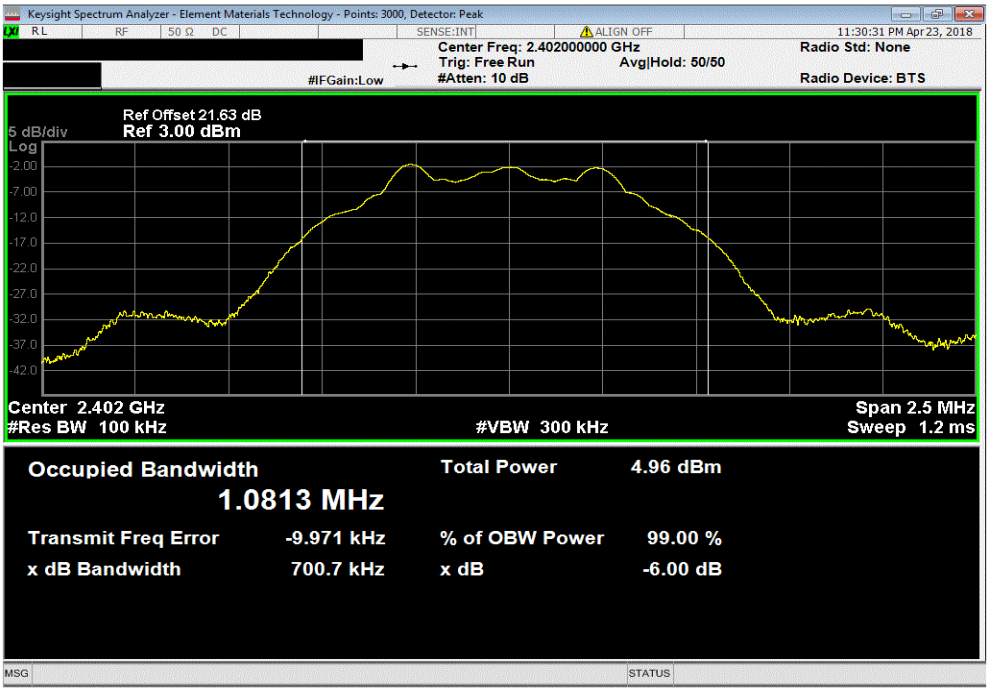
Configuration #	**1**	*Signature* Dustin Sparks

	Value	**Limit (≥)**	**Result**
BLE/GFSK Low Channel, 2402 MHz	700.65 kHz	500 kHz	Pass
BLE/GFSK Mid Channel, 2442 MHz	701.053 kHz	500 kHz	Pass
BLE/GFSK High Channel, 2480 MHz	679.822 kHz	500 kHz	Pass

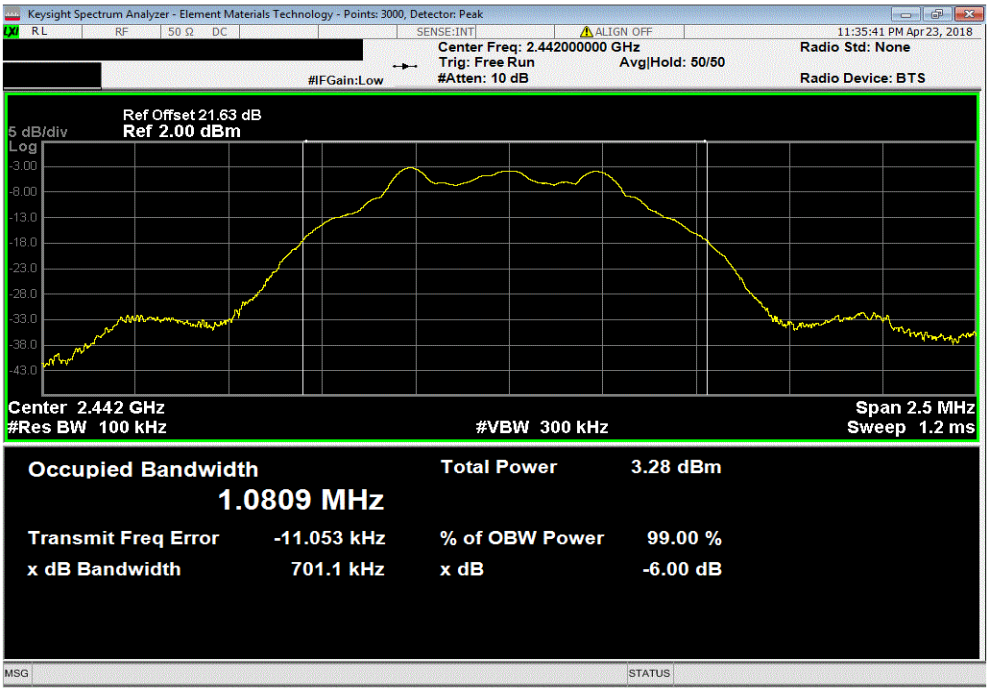
OCCUPIED BANDWIDTH

TbtTx 2017.12.14 XMit 2017.12.13

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



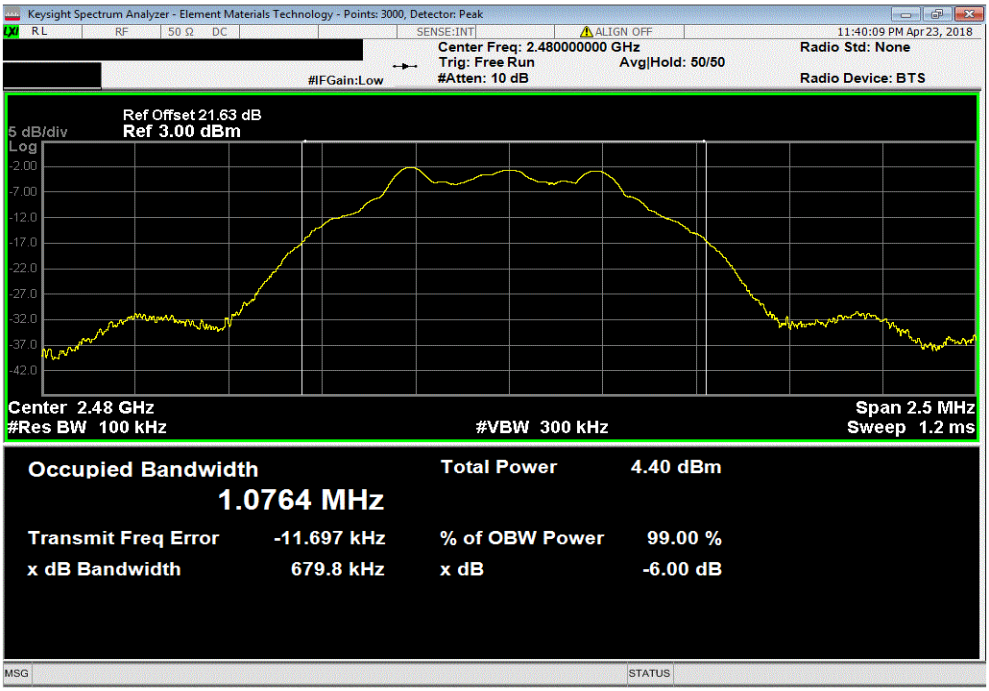
BLE/GFSK Mid Channel, 2442 MHz						
				Value	Limit (≥)	Result
				701.053 kHz	500 kHz	Pass



OCCUPIED BANDWIDTH

TbtTx 2017.12.14 XMit 2017.12.13

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



OUTPUT POWER

XMit 2017.12.13

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	E4422B	TGQ	15-Mar-18	15-Mar-21
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-18	15-Mar-19
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-18	13-Feb-19
Block - DC	Fairview Microwave	SD3379	AMI	12-Sep-17	12-Sep-18
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	19-Dec-17	19-Dec-18

TEST DESCRIPTION

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

TbtTx 2017.12.14 XMit 2017.12.13

EUT:	**Hearing Aid**			**Work Order:**	**STAK0116**
Serial Number:	**180367056**			**Date:**	**23-Apr-18**
Customer:	**Starkey Laboratories, Inc.**			**Temperature:**	**22 °C**
Attendees:	**Charlie Esch**			**Humidity:**	**29.8% RH**
Project:	**None**			**Barometric Pres.:**	**1027 mbar**
Tested by:	**Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2018	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

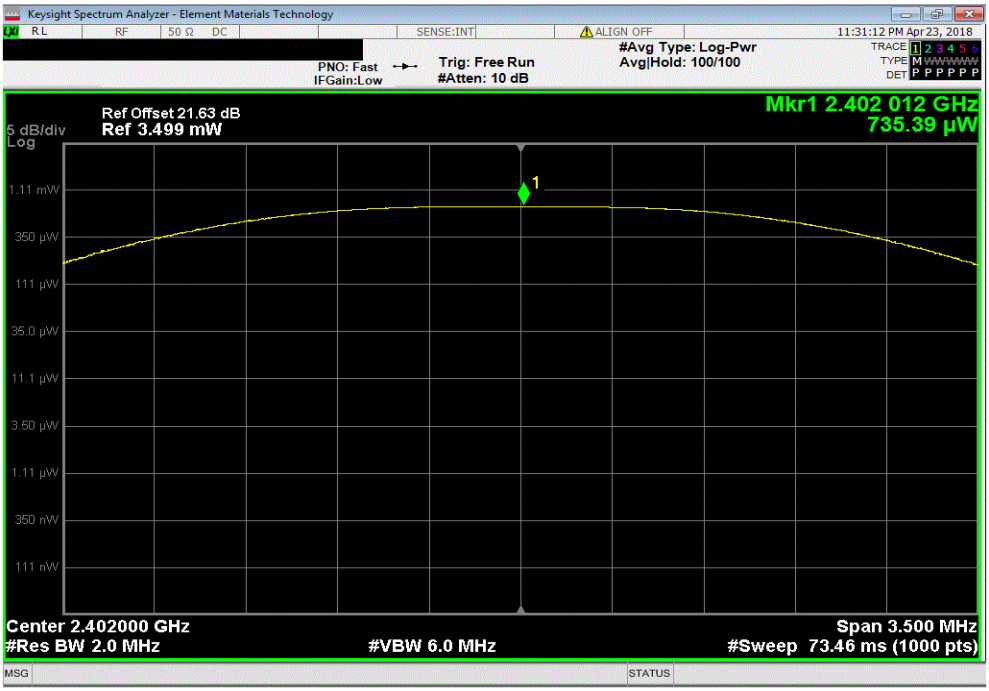
Configuration #	**1**	*Signature* Dustin Sparks

	Value	**Limit (<)**	**Result**
BLE/GFSK Low Channel, 2402 MHz	735.39 uW	1 W	Pass
BLE/GFSK Mid Channel, 2442 MHz	499.69 uW	1 W	Pass
BLE/GFSK High Channel, 2480 MHz	645.7 uW	1 W	Pass

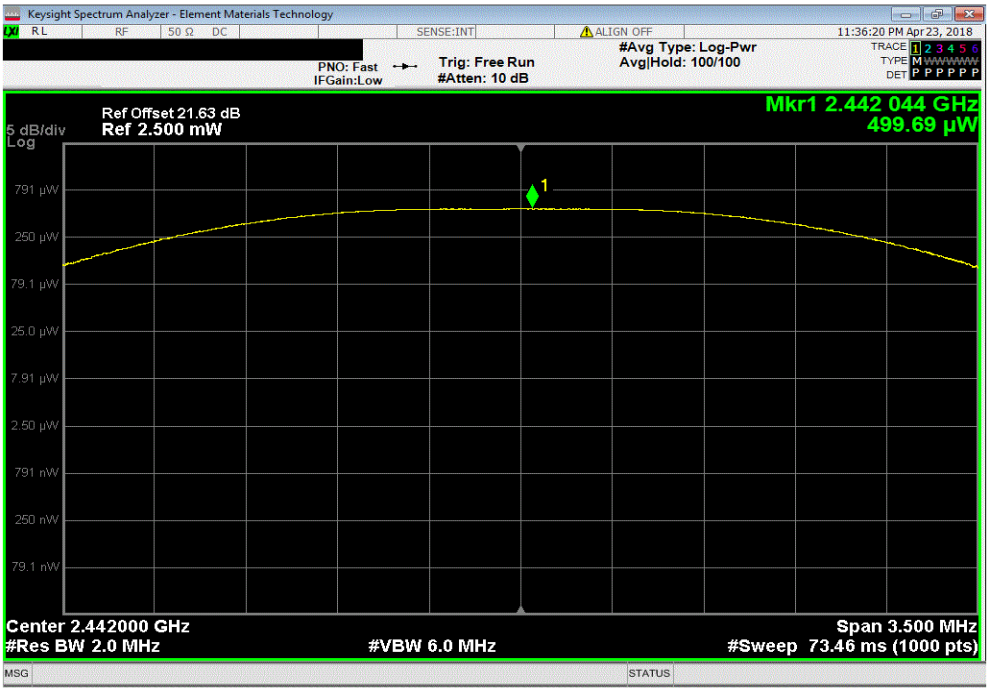
OUTPUT POWER

TbtTx 2017.12.14 XMit 2017.12.13

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



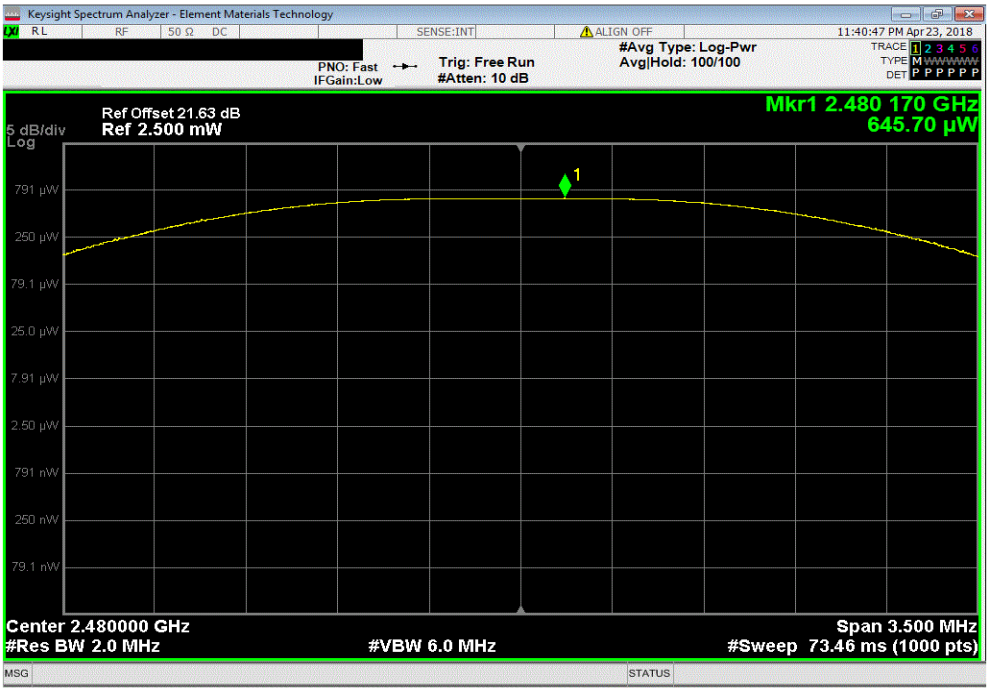
BLE/GFSK Mid Channel, 2442 MHz						
				Value	Limit (<)	Result
				499.69 uW	1 W	Pass



OUTPUT POWER

TbtTx 2017.12.14 XMit 2017.12.13

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



POWER SPECTRAL DENSITY

XMit 2017.12.13

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	E4422B	TGQ	15-Mar-18	15-Mar-21
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-18	15-Mar-19
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-18	13-Feb-19
Block - DC	Fairview Microwave	SD3379	AMI	12-Sep-17	12-Sep-18
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	19-Dec-17	19-Dec-18

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

TbtTx 2017.12.14 XMit 2017.12.13

EUT:	Hearing Aid			**Work Order:**	STAK0116
Serial Number:	180367056			**Date:**	23-Apr-18
Customer:	Starkey Laboratories, Inc.			**Temperature:**	22 °C
Attendees:	Charlie Esch			**Humidity:**	29.8% RH
Project:	None			**Barometric Pres.:**	1027 mbar
Tested by:	Dustin Sparks	**Power:**	Battery	**Job Site:**	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2018	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

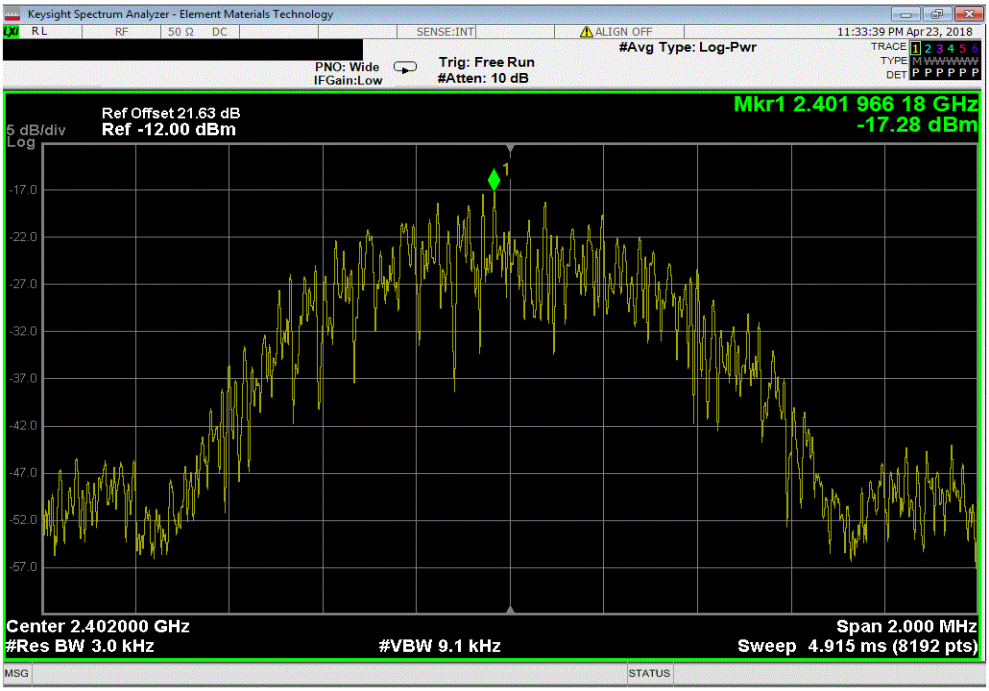
Configuration #	1	Signature

	Value dBm/3kHz	Limit < dBm/3kHz	Results
BLE/GFSK Low Channel, 2402 MHz	-17.278	8	Pass
BLE/GFSK Mid Channel, 2442 MHz	-19.034	8	Pass
BLE/GFSK High Channel, 2480 MHz	-17.834	8	Pass

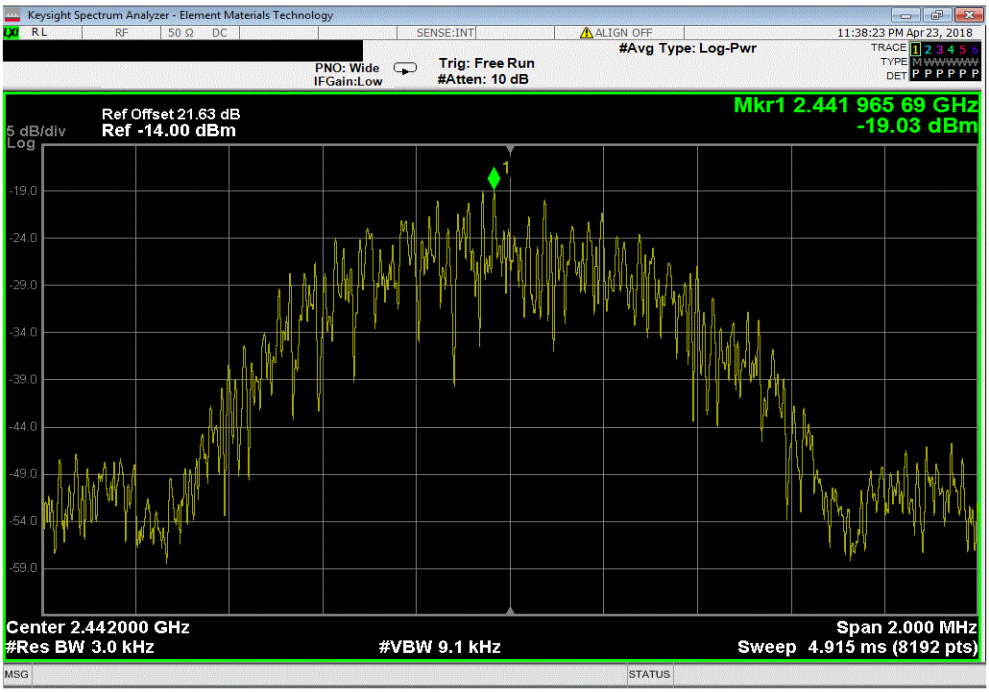
POWER SPECTRAL DENSITY

TbtTx 2017.12.14 XMit 2017.12.13

BLE/GFSK Low Channel, 2402 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-17.278	8	Pass



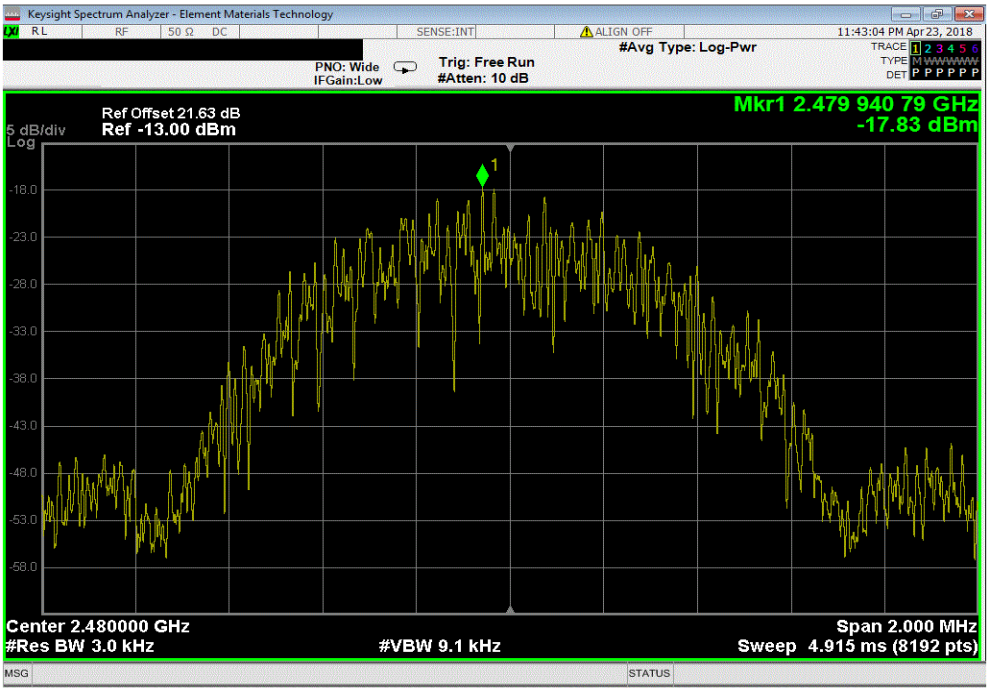
BLE/GFSK Mid Channel, 2442 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-19.034	8	Pass



POWER SPECTRAL DENSITY

TbtTx 2017.12.14 XMit 2017.12.13

BLE/GFSK High Channel, 2480 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-17.834	8	Pass



BAND EDGE COMPLIANCE

XMit 2017.12.13

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	E4422B	TGQ	15-Mar-18	15-Mar-21
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-18	15-Mar-19
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-18	13-Feb-19
Block - DC	Fairview Microwave	SD3379	AMI	12-Sep-17	12-Sep-18
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	19-Dec-17	19-Dec-18

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

TbtTx 2017.12.14 XMit 2017.12.13

EUT:	**Hearing Aid**			**Work Order:**	**STAK0116**
Serial Number:	**180367056**			**Date:**	**23-Apr-18**
Customer:	**Starkey Laboratories, Inc.**			**Temperature:**	**22 °C**
Attendees:	**Charlie Esch**			**Humidity:**	**29.7% RH**
Project:	**None**			**Barometric Pres.:**	**1027 mbar**
Tested by:	**Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2018	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

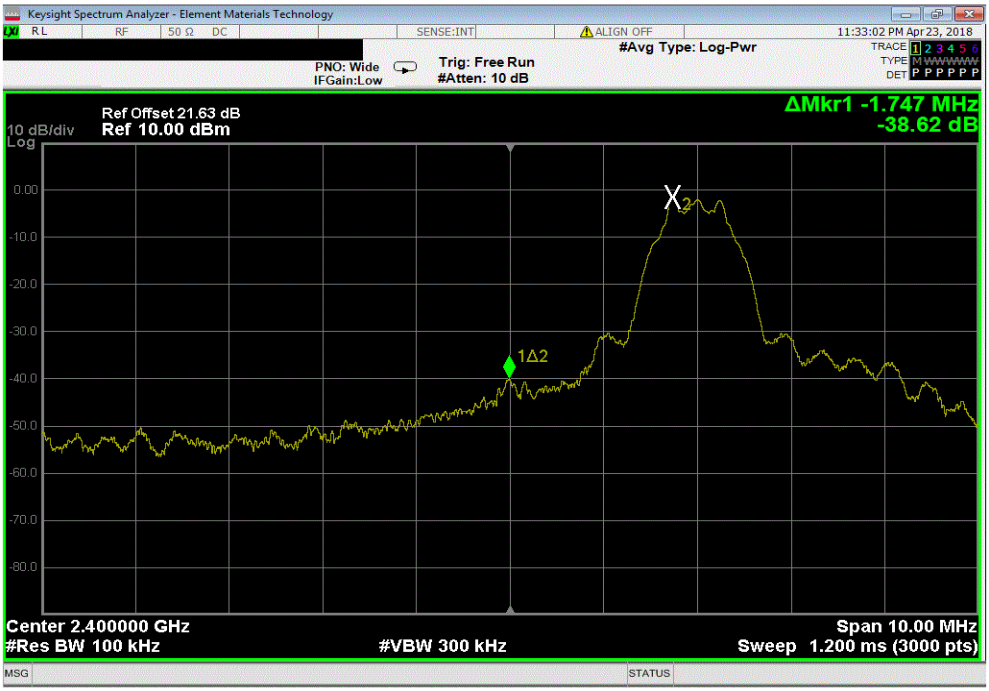
Configuration #	**1**	*Signature* Dustin Sparks

	Value (dBc)	**Limit ≤ (dBc)**	**Result**
BLE/GFSK Low Channel, 2402 MHz	-38.62	-20	Pass
BLE/GFSK High Channel, 2480 MHz	-44.49	-20	Pass

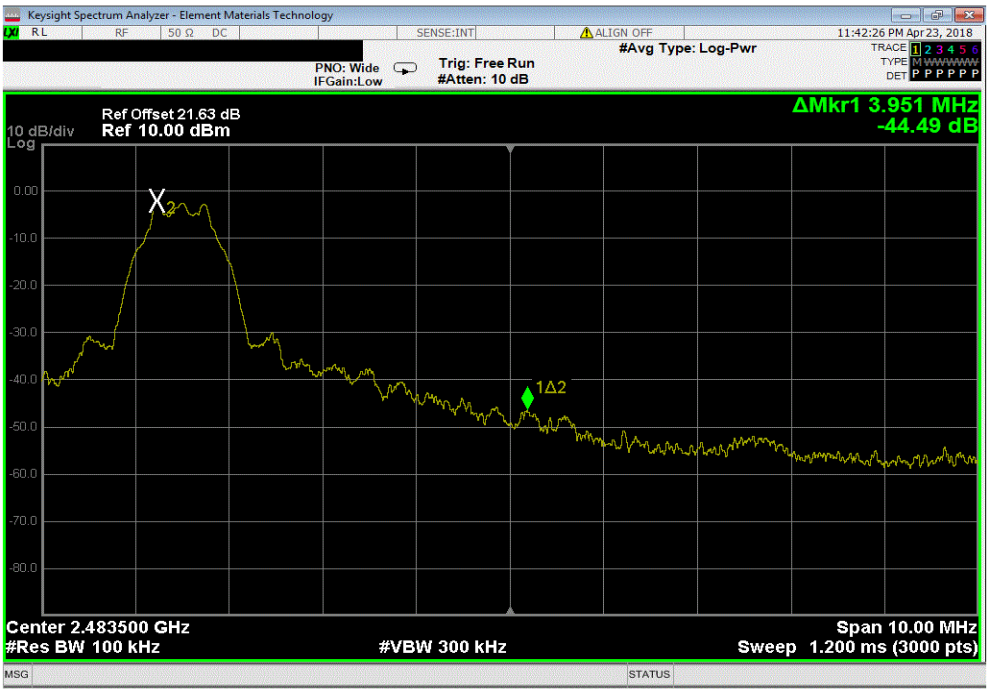
BAND EDGE COMPLIANCE

TbtTx 2017.12.14 XMit 2017.12.13

BLE/GFSK Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-38.62	-20	Pass



BLE/GFSK High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-44.49	-20	Pass



SPURIOUS CONDUCTED EMISSIONS

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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	E4422B	TGQ	15-Mar-18	15-Mar-21
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-18	15-Mar-19
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-18	13-Feb-19
Block - DC	Fairview Microwave	SD3379	AMI	12-Sep-17	12-Sep-18
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	19-Dec-17	19-Dec-18

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

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EUT:	**Hearing Aid**			**Work Order:**	**STAK0116**
Serial Number:	**180367056**			**Date:**	**23-Apr-18**
Customer:	**Starkey Laboratories, Inc.**			**Temperature:**	**22 °C**
Attendees:	**Charlie Esch**			**Humidity:**	**29.7% RH**
Project:	**None**			**Barometric Pres.:**	**1027 mbar**
Tested by:	**Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2018	ANSI C63.10:2013

COMMENTS

None

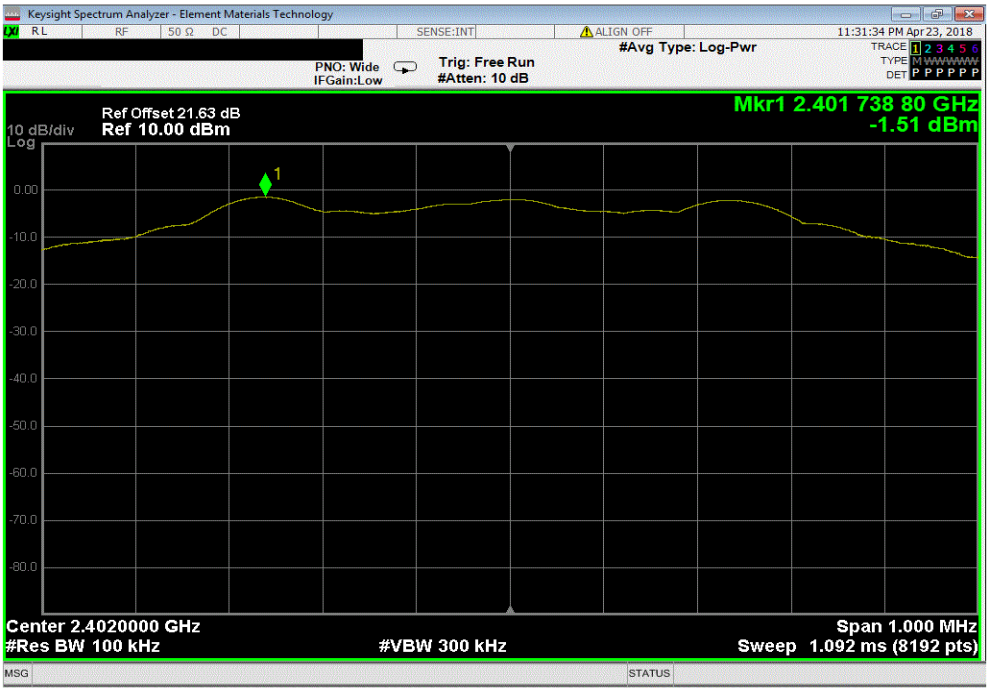
DEVIATIONS FROM TEST STANDARD

None

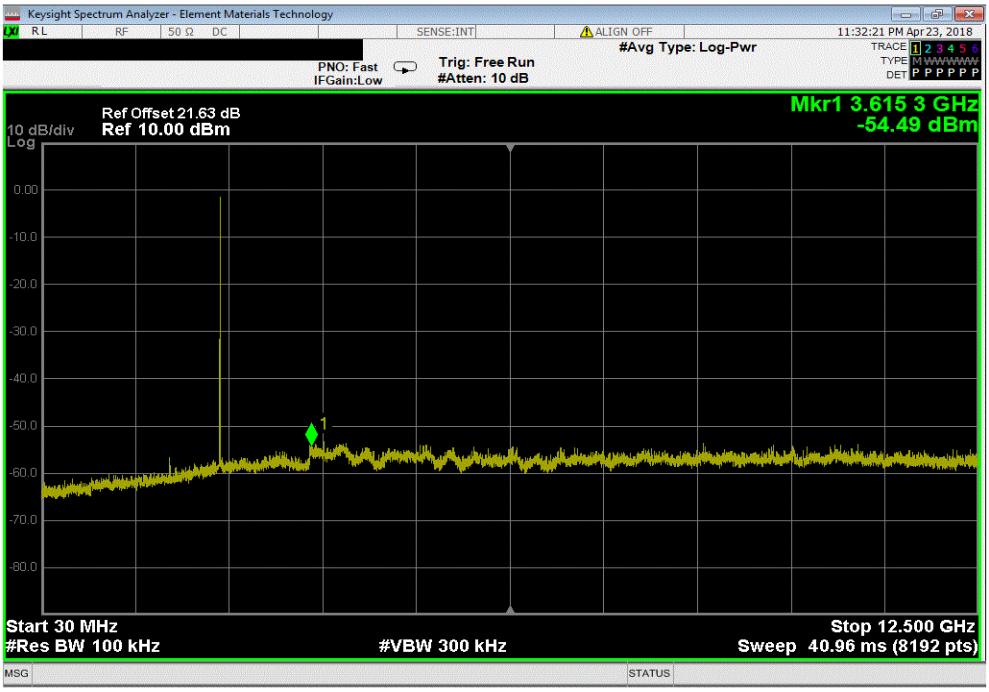
Configuration #	**1**	*Signature* Dustin Sparks

	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	-52.98	-20	Pass
BLE/GFSK Low Channel, 2402 MHz	12.5 GHz - 25 GHz	-48.99	-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	-50.05	-20	Pass
BLE/GFSK Mid Channel, 2442 MHz	12.5 GHz - 25 GHz	-47.33	-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	-50.77	-20	Pass
BLE/GFSK High Channel, 2480 MHz	12.5 GHz - 25 GHz	-48.21	-20	Pass

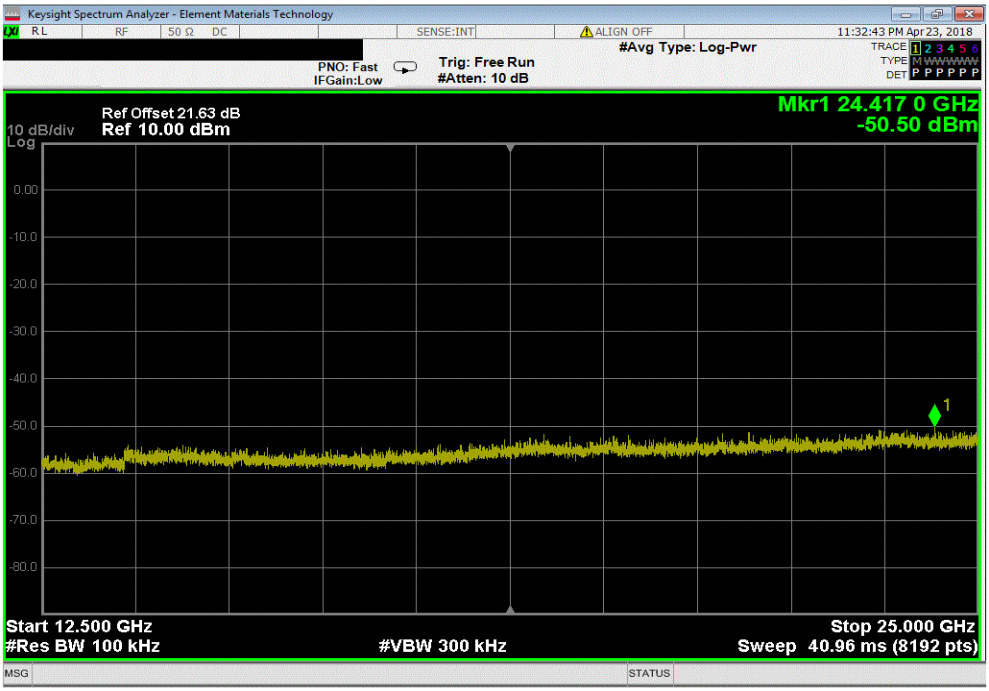
BLE/GFSK Low Channel, 2402 MHz						
	Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



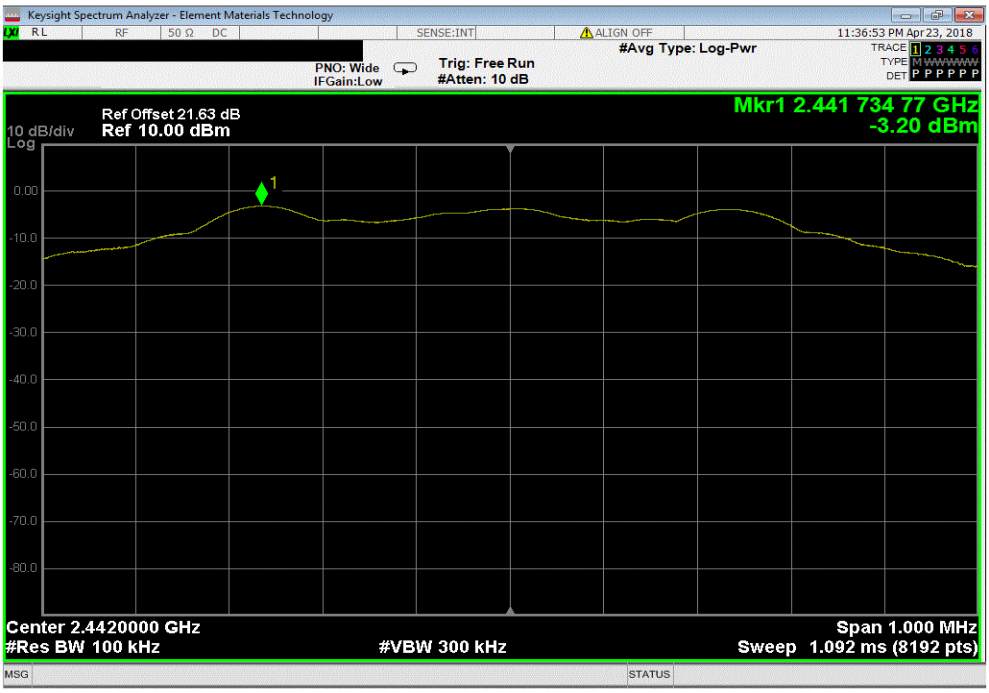
BLE/GFSK Low Channel, 2402 MHz					
Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz			-52.98	-20	Pass



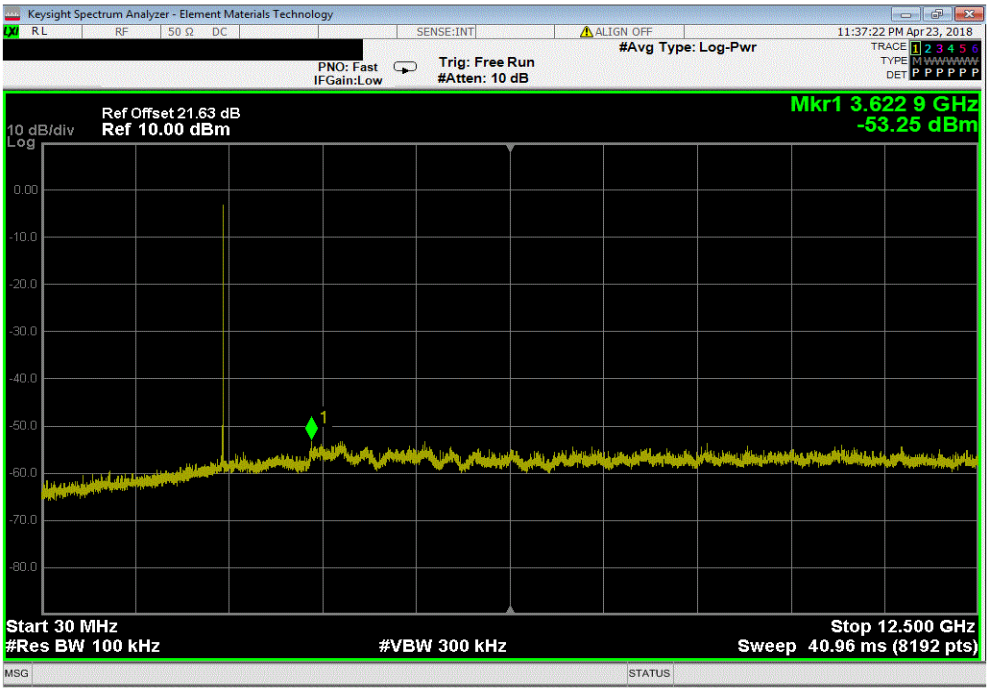
BLE/GFSK Low Channel, 2402 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-48.99	-20	Pass



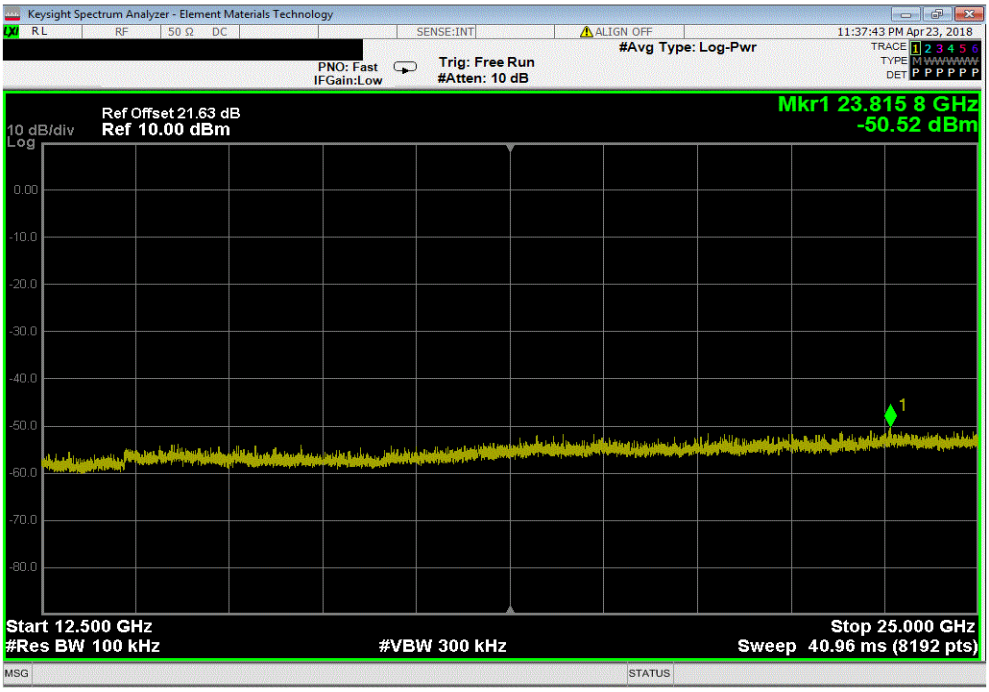
BLE/GFSK Mid Channel, 2442 MHz						
Frequency Range				Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



BLE/GFSK Mid Channel, 2442 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz		-50.05	-20	Pass



BLE/GFSK Mid Channel, 2442 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-47.33	-20	Pass



SPURIOUS CONDUCTED EMISSIONS

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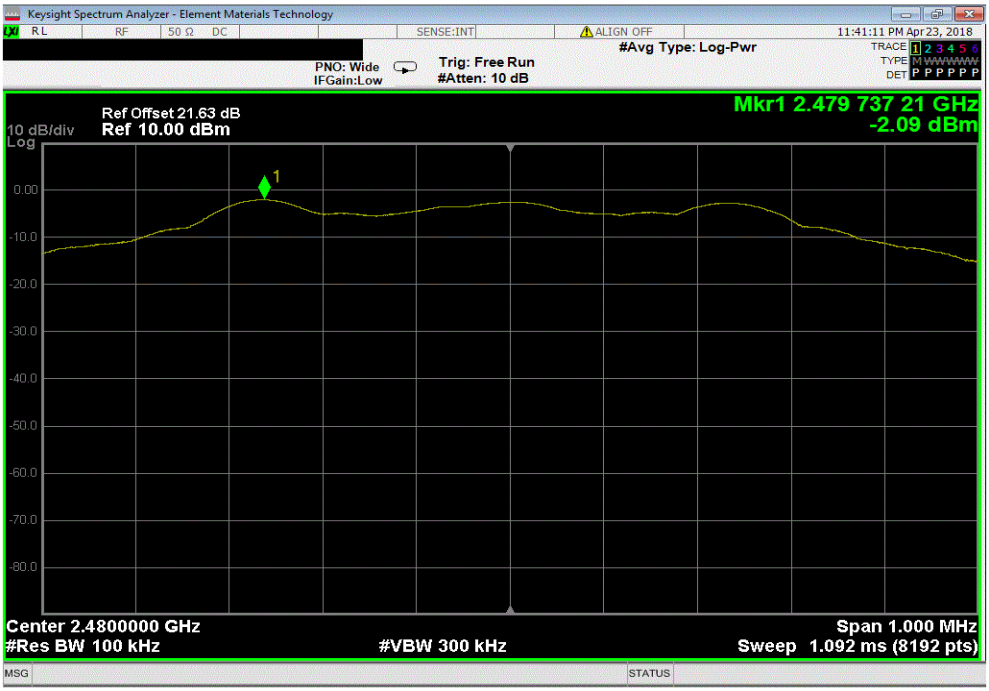
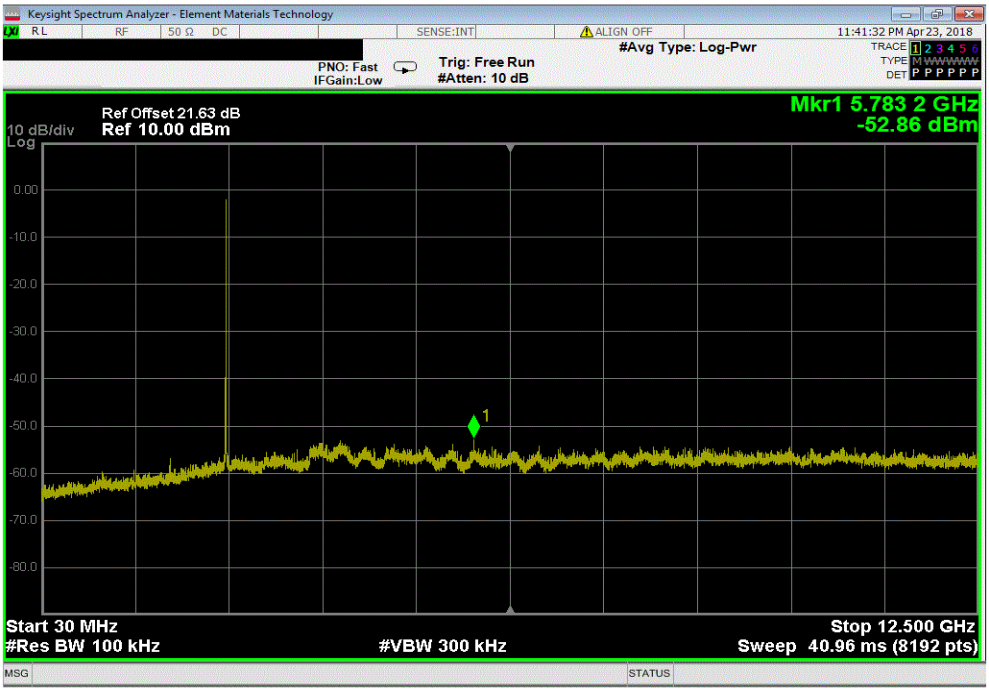
BLE/GFSK High Channel, 2480 MHz						
	Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



BLE/GFSK High Channel, 2480 MHz					
Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz			-50.77	-20	Pass



SPURIOUS CONDUCTED EMISSIONS

TbtTx 2017.12.14 XMit 2017.12.13

BLE/GFSK High Channel, 2480 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-48.21	-20	Pass