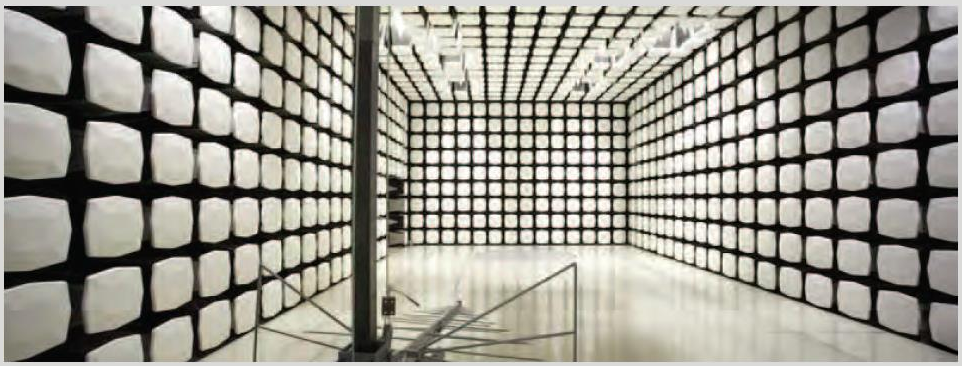
Starkey Laboratories, Inc.

Livio 2.4 GHz Rechargeable BTE hearing aid

FCC 15.247:2019

Bluetooth Low Energy DTS Radio

Report # STAK0176.1



NVLAP LAB CODE: 200881-0

CERTIFICATE OF TEST

Last Date of Test: September 19, 2019
Starkey Laboratories, Inc.
EUT: Livio 2.4 GHz Rechargeable BTE hearing aid

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2019	ANSI C63.10:2013, KDB 558074

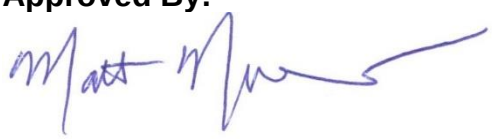
Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not required for a battery powered EUT.
11.12.1, 11.13.2, 6.5, 6.6	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	
11.9.1.1	Equivalent Isotropic Radiated 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. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.

REVISION HISTORY

Revision Number	Description	Date (yyyy-mm-dd)	Page Number
00	None		

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) and as a CAB for the acceptance of test data.

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

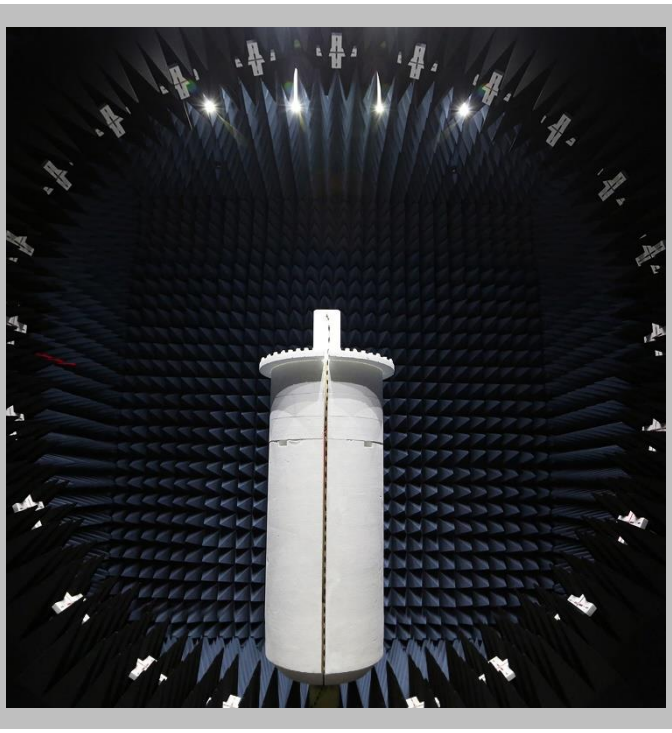
MIC – Recognized by MIC as a CAB for the acceptance of test data.

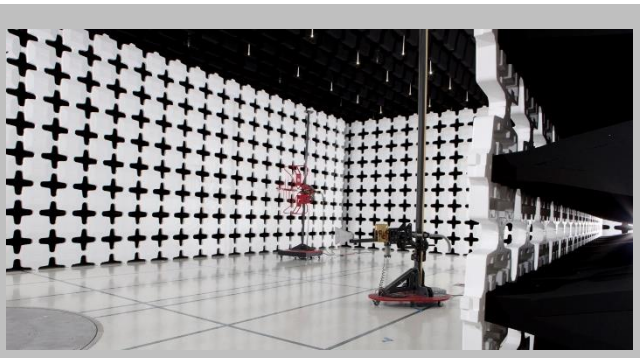
SCOPE

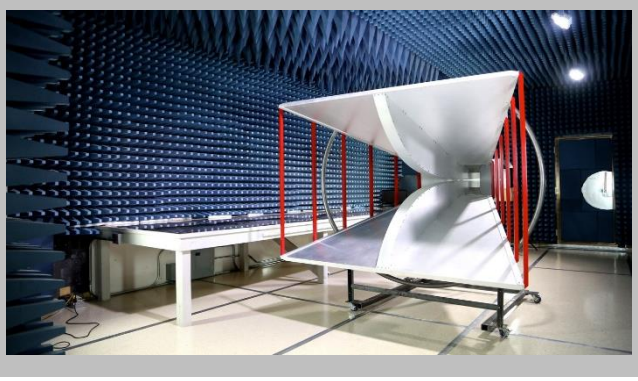
For details on the Scopes of our Accreditations, please visit:
https://www.nwemc.com/emc-testing-accreditations

FACILITIES

California	Minnesota	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 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: 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	2834D-1	2834G-1	2834F-1
BSMI				
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI				
A-0029	A-0109	A-0108	A-0201	A-0110
Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157







MEASUREMENT UNCERTAINTY

element
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.

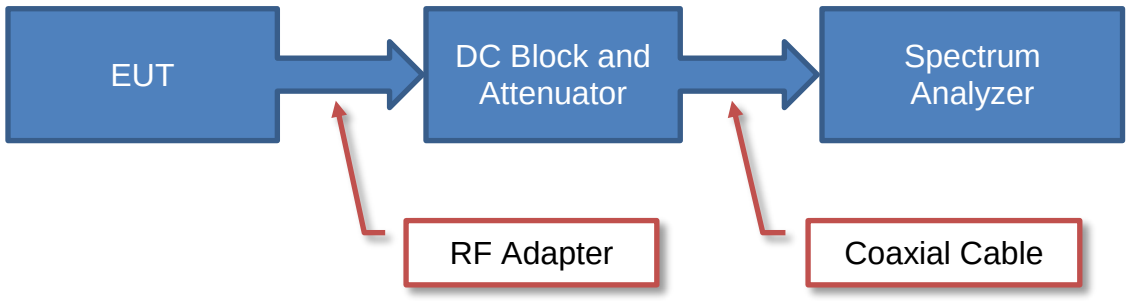
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable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

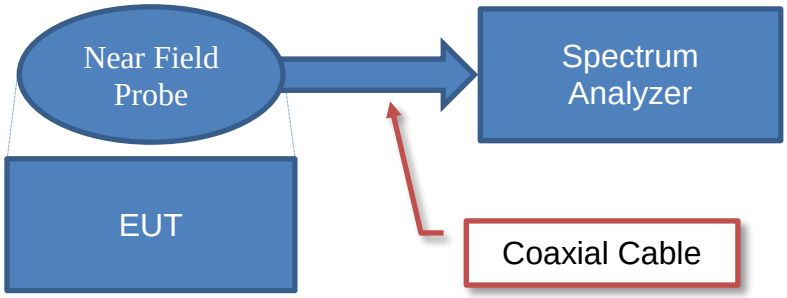
Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field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

Test Setup Block Diagrams

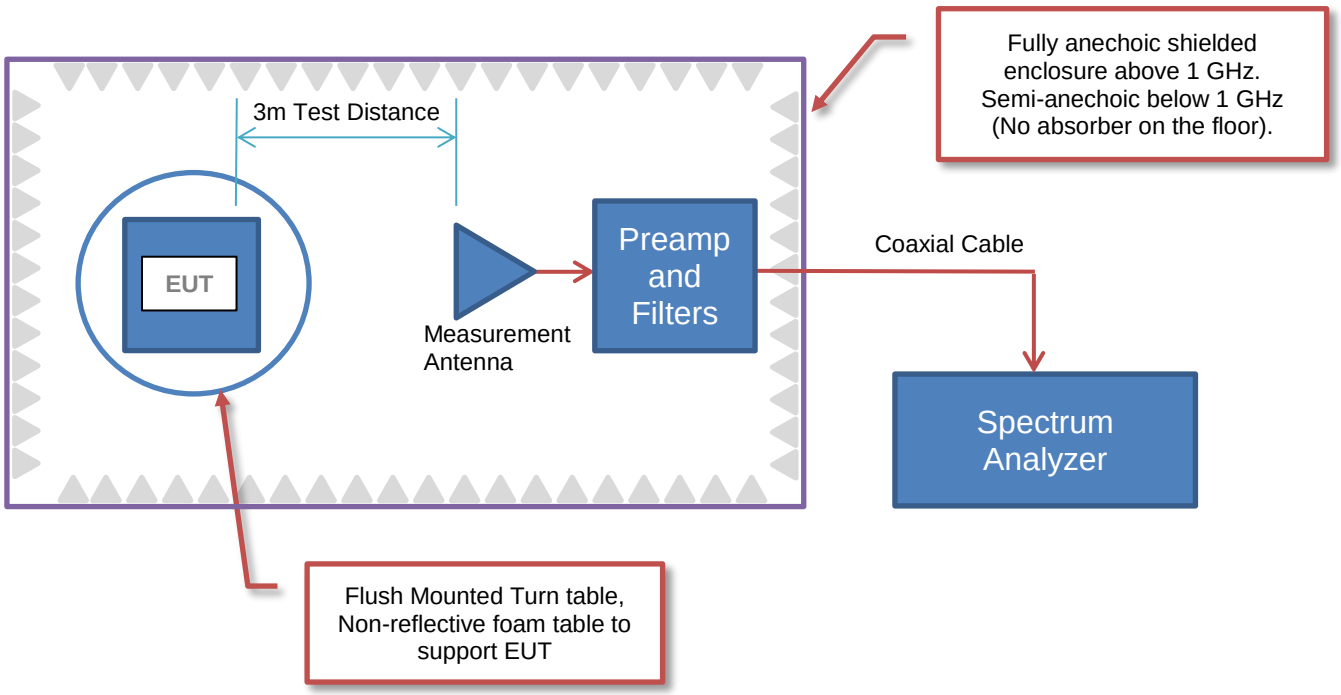
Antenna Port Conducted Measurements



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 S
City, State, Zip:	Eden Prairie, MN 55344-3404
Test Requested By:	Bill Mitchell
EUT:	Livio 2.4 GHz Rechargeable BTE hearing aid
First Date of Test:	August 19, 2019
Last Date of Test:	September 19, 2019
Receipt Date of Samples:	August 16, 2019
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Behind the ear hearing aid with a 2.4 GHz BLE radio.

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

CONFIGURATIONS

Configuration STAK0176- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Livio 2.4 GHz Rechargeable BTE hearing aid	Starkey Laboratories, Inc.	Livio BTE R	190494755

Configuration STAK0176- 3

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Livio 2.4 GHz Rechargeable BTE hearing aid	Starkey Laboratories, Inc.	Livio BTE R	190494775

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	11079

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable (Bluetooth Dongle Dock)	No	1.8m	No	Bluetooth Dongle Dock	Laptop

Configuration STAK0176- 4

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Livio 2.4 GHz Rechargeable BTE hearing aid	Starkey Laboratories, Inc.	Livio BTE R	190494757

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2019-08-19	Spurious Radiated 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.
2	2019-09-19	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.
3	2019-09-19	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.
4	2019-09-19	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.
5	2019-09-19	Equivalent Isotropic Radiated 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.
6	2019-09-19	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.
7	2019-09-19	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.
8	2019-09-19	Spurious Conducted 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 2019.05.10

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

Tx on Low Ch 0 2402 MHz, Mid Ch 18 2440 MHz, High Ch 39 2480 MHz, 1 mb Data Rate
Tx on Low Ch 0 2402 MHz, Mid Ch 18 2440 MHz, High Ch 39 2480 MHz, 2 mb Data Rate

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

STAK0176 - 1
STAK0176- 4

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26000 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 - High Pass	Micro-Tronics	HPM50111	HFM	26-Sep-2018	12 mo
Attenuator	Coaxicom	3910-20	AXY	26-Sep-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	13-Sep-2018	12 mo
Cable	ESM Cable Corp	TTBJ141 KMKM-72	MNP	12-Sep-2018	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AHG	NCR	0 mo
Amplifier - Pre-Amplifier	L-3 Narda-MITEQ	AMF-6F-12001800-30-10P	PAP	23-Feb-2019	12 mo
Antenna - Standard Gain	ETS-Lindgren	3160-08	AJP	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVC	23-Feb-2019	12 mo
Cable	Element	Standard Gain Cable	MNW	23-Feb-2019	12 mo
Antenna - Standard Gain	ETS-Lindgren	3160-07	AJJ	NCR	0 mo
Antenna - Double Ridge	A.H. Systems, Inc.	SAS-574	AXV	15-May-2018	24 mo
Cable	Element	Double Ridge Guide Horn Cables	MNV	23-Feb-2019	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AIB	27-Aug-2018	24 mo
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	13-Dec-2018	12 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-2019	12 mo
Antenna - Double Ridge	ETS-Lindgren	3115	AJQ	16-Jan-2019	12 mo
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	17-Sep-2019	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	8-Feb-2019	12 mo
Attenuator	Fairview Microwave	SA18E-20	TWZ	17-Sep-2019	12 mo
Filter - High Pass	Micro-Tronics	HPM50111	LFN	12-Sep-2019	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1064-9079 and SA18E-10	AOO	23-Feb-2019	12 mo
Antenna - Biconilog	EMCO	3141	AXE	NCR	0 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.

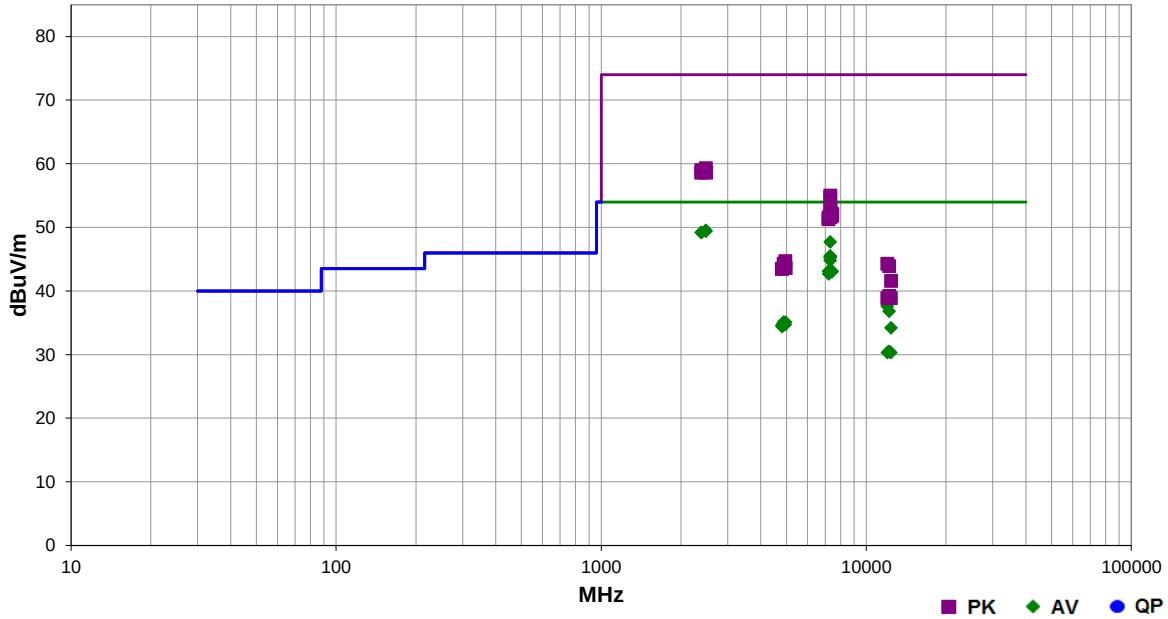
SPURIOUS RADIATED EMISSIONS

EmiR5 2019.08.01 PSA-ESCI 2019.05.10

Work Order:	STAK0176	**Date:**	19-Aug-2019		
Project:	None	**Temperature:**	22.1 °C		
Job Site:	MN09	**Humidity:**	58.8% RH		
Serial Number:	190494755	**Barometric Pres.:**	1019 mbar	**Tested by:**	Chris Patterson
EUT:	Livio 2.4 GHz Rechargeable BTE hearing aid				
Configuration:	1				
Customer:	Starkey Laboratories, Inc.				
Attendees:	Charlie Esch				
EUT Power:	Battery				
Operating Mode:	Tx on Low Ch 0 2402 MHz, Mid Ch 18 2440 MHz, High Ch 39 2480 MHz, 1 mb Data Rate				
Deviations:	None				
Comments:	Duty Cycle Correction Factor derived using this formula, DCCF = 10*LOG(1/Duty Cycle)				

Test Specifications	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

Run #	30	**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	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2483.683	31.5	-4.1	1.5	349.0	2.1	20.0	Horz	AV	0.0	49.5	54.0	-4.5	EUT On Side, High Ch, 1 mb
2485.317	31.4	-4.1	1.5	287.0	2.1	20.0	Vert	AV	0.0	49.4	54.0	-4.6	EUT On Side, High Ch, 1 mb
2388.410	31.3	-4.2	1.5	71.0	2.1	20.0	Horz	AV	0.0	49.2	54.0	-4.8	EUT On Side, Low Ch, 1 mb
2384.360	31.3	-4.2	2.6	8.0	2.1	20.0	Vert	AV	0.0	49.2	54.0	-4.8	EUT On Side, Low Ch, 1 mb
7319.417	32.9	12.7	2.5	312.0	2.1	0.0	Horz	AV	0.0	47.7	54.0	-6.3	EUT On Side, Mid Ch, 1 mb
7319.500	30.7	12.7	3.1	68.0	2.1	0.0	Vert	AV	0.0	45.5	54.0	-8.5	EUT Vert, Mid Ch, 1 mb
7319.375	30.5	12.7	1.5	124.0	2.1	0.0	Vert	AV	0.0	45.3	54.0	-8.7	EUT Horz, Mid Ch, 1 mb
7319.458	30.5	12.7	2.5	111.0	2.1	0.0	Horz	AV	0.0	45.3	54.0	-8.7	EUT Vert, Mid Ch, 1 mb
7319.417	30.0	12.7	1.9	355.0	2.1	0.0	Horz	AV	0.0	44.8	54.0	-9.2	EUT Horz, Mid Ch, 1 mb
7319.375	28.3	12.7	1.5	297.0	2.1	0.0	Vert	AV	0.0	43.1	54.0	-10.9	EUT On Side, Mid Ch, 1 mb
7439.292	28.2	12.8	2.1	320.0	2.1	0.0	Horz	AV	0.0	43.1	54.0	-10.9	EUT On Side, High Ch, 1 md
7205.375	28.7	12.3	2.9	253.0	2.1	0.0	Horz	AV	0.0	43.1	54.0	-10.9	EUT On Side, Low Ch, 1 mb
7428.167	28.1	12.8	1.1	272.0	2.1	0.0	Vert	AV	0.0	43.0	54.0	-11.0	EUT On Side, High Ch, 1 mb
7215.250	28.3	12.3	1.5	324.0	2.1	0.0	Vert	AV	0.0	42.7	54.0	-11.3	EUT On Side, Low Ch, 1 mb
2483.517	43.4	-4.1	1.5	287.0	0.0	20.0	Vert	PK	0.0	59.3	74.0	-14.7	EUT On Side, High Ch, 1 mb
2385.570	43.2	-4.2	2.6	8.0	0.0	20.0	Vert	PK	0.0	59.0	74.0	-15.0	EUT On Side, Low Ch, 1 mb
2384.000	42.8	-4.2	1.5	71.0	0.0	20.0	Horz	PK	0.0	58.6	74.0	-15.4	EUT On Side, Low Ch, 1 mb
2484.408	42.7	-4.1	1.5	349.0	0.0	20.0	Horz	PK	0.0	58.6	74.0	-15.4	EUT On Side, High Ch, 1 mb
12008.830	36.7	-1.2	2.0	176.0	2.1	0.0	Horz	AV	0.0	37.6	54.0	-16.4	EUT On Side, Low Ch, 1 mb
12198.830	35.1	-0.4	2.0	352.0	2.1	0.0	Horz	AV	0.0	36.8	54.0	-17.2	EUT On Side, Mid Ch, 1 mb

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4880.042	29.4	3.6	1.5	294.0	2.1	0.0	Horz	AV	0.0	35.1	54.0	-18.9	EUT On Side, Mid Ch, 1 mb
4959.750	29.2	3.8	1.5	242.0	2.1	0.0	Horz	AV	0.0	35.1	54.0	-18.9	EUT On Side, High Ch, 1 mb
7319.292	42.3	12.7	2.5	312.0	0.0	0.0	Horz	PK	0.0	55.0	74.0	-19.0	EUT On Side, Mid Ch, 1 mb
4868.000	29.2	3.6	1.5	230.0	2.1	0.0	Vert	AV	0.0	34.9	54.0	-19.1	EUT On Side, Mid Ch, 1 mb
4952.958	28.9	3.7	1.5	261.0	2.1	0.0	Vert	AV	0.0	34.7	54.0	-19.3	EUT On Side, High Ch, 1 md
7320.542	42.0	12.7	1.5	124.0	0.0	0.0	Vert	PK	0.0	54.7	74.0	-19.3	EUT Horz, Mid Ch, 1 mb
4804.042	29.0	3.5	1.5	338.0	2.1	0.0	Horz	AV	0.0	34.6	54.0	-19.4	EUT On Side, Low Ch, 1 mb
4815.958	28.8	3.5	1.5	219.0	2.1	0.0	Vert	AV	0.0	34.4	54.0	-19.6	EUT On Side, Low Ch, 1 mb
12398.900	32.3	-0.2	2.0	163.0	2.1	0.0	Horz	AV	0.0	34.2	54.0	-19.8	EUT On Side, High Ch, 1 mb
7319.167	40.4	12.7	2.5	111.0	0.0	0.0	Horz	PK	0.0	53.1	74.0	-20.9	EUT Vert, Mid Ch, 1 mb
7321.000	39.9	12.7	3.1	68.0	0.0	0.0	Vert	PK	0.0	52.6	74.0	-21.4	EUT Vert, Mid Ch, 1 mb
7321.208	39.8	12.7	1.9	355.0	0.0	0.0	Horz	PK	0.0	52.5	74.0	-21.5	EUT Horz, Mid Ch, 1 mb
7442.458	39.4	12.7	2.1	320.0	0.0	0.0	Horz	PK	0.0	52.1	74.0	-21.9	EUT On Side, High Ch, 1 mb
7427.583	39.0	12.8	1.1	272.0	0.0	0.0	Vert	PK	0.0	51.8	74.0	-22.2	EUT On Side, High Ch, 1 mb
7323.208	38.9	12.7	1.5	297.0	0.0	0.0	Vert	PK	0.0	51.6	74.0	-22.4	EUT On Side, Mid Ch, 1 mb
7204.000	39.3	12.3	1.5	324.0	0.0	0.0	Vert	PK	0.0	51.6	74.0	-22.4	EUT On Side, Low Ch, 1 mb
7195.667	39.0	12.3	2.9	253.0	0.0	0.0	Horz	PK	0.0	51.3	74.0	-22.7	EUT On Side, Low Ch, 1 mb
12201.210	28.8	-0.4	2.3	199.0	2.1	0.0	Vert	AV	0.0	30.5	54.0	-23.5	EUT On Side, Mid Ch, 1 mb
12018.380	29.4	-1.2	1.5	66.0	2.1	0.0	Vert	AV	0.0	30.3	54.0	-23.7	EUT On Side, Low Ch, 1 mb
12388.880	28.5	-0.3	1.5	19.0	2.1	0.0	Vert	AV	0.0	30.3	54.0	-23.7	EUT On Side, High Ch, 1 mb
4954.208	41.0	3.7	1.5	242.0	0.0	0.0	Horz	PK	0.0	44.7	74.0	-29.3	EUT On Side, High Ch, 1 mb
4878.208	40.7	3.6	1.5	294.0	0.0	0.0	Horz	PK	0.0	44.3	74.0	-29.7	EUT On Side, Mid Ch, 1 mb
12009.130	45.5	-1.2	2.0	176.0	0.0	0.0	Horz	PK	0.0	44.3	74.0	-29.7	EUT On Side, Low Ch, 1 mb
4884.250	40.6	3.5	1.5	230.0	0.0	0.0	Vert	PK	0.0	44.1	74.0	-29.9	EUT On Side, Mid Ch, 1 mb
12201.290	44.3	-0.4	2.0	352.0	0.0	0.0	Horz	PK	0.0	43.9	74.0	-30.1	EUT On Side, Mid Ch, 1 mb
4968.833	39.8	3.8	1.5	261.0	0.0	0.0	Vert	PK	0.0	43.6	74.0	-30.4	EUT On Side, High Ch, 1 mb
4806.542	40.0	3.5	1.5	338.0	0.0	0.0	Horz	PK	0.0	43.5	74.0	-30.5	EUT On Side, Low Ch, 1 mb
4796.000	40.0	3.5	1.5	219.0	0.0	0.0	Vert	PK	0.0	43.5	74.0	-30.5	EUT On Side, Low Ch, 1 mb
12398.670	41.8	-0.2	2.0	163.0	0.0	0.0	Horz	PK	0.0	41.6	74.0	-32.4	EUT On Side, High Ch, 1 mb
12210.460	39.6	-0.4	2.3	199.0	0.0	0.0	Vert	PK	0.0	39.2	74.0	-34.8	EUT On Side, Mid Ch, 1 mb
12391.190	39.2	-0.3	1.5	19.0	0.0	0.0	Vert	PK	0.0	38.9	74.0	-35.1	EUT On Side, High Ch, 1 mb
12007.420	40.1	-1.2	1.5	66.0	0.0	0.0	Vert	PK	0.0	38.9	74.0	-35.1	EUT On Side, Low Ch, 1 mb

SPURIOUS RADIATED EMISSIONS

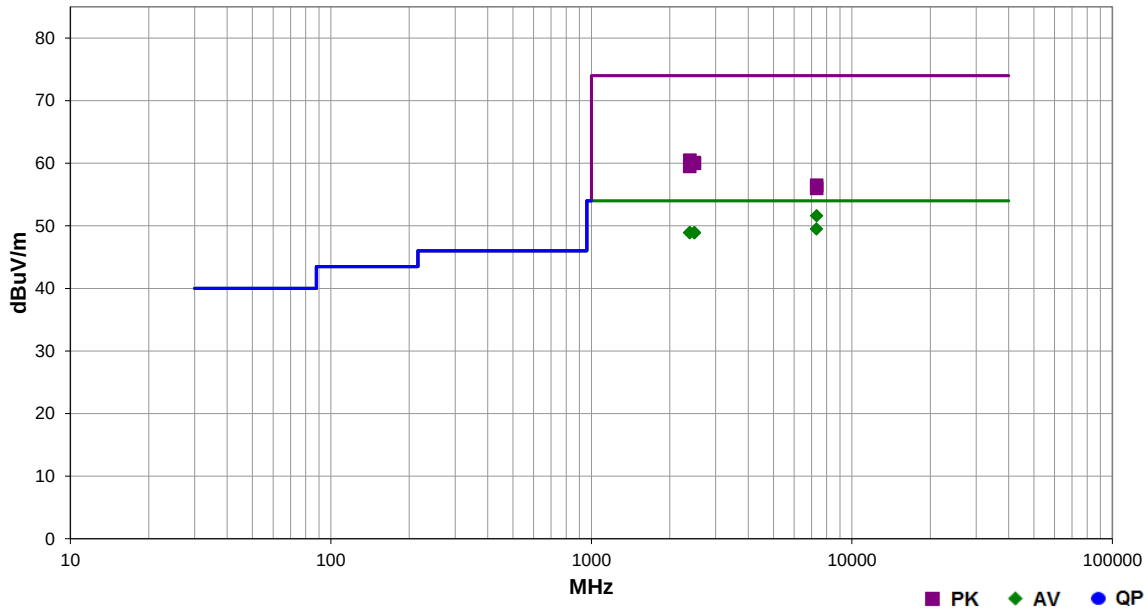
element

EmiR5 2019.08.01 PSA-ESCI 2019.05.10

Work Order:	STAK0176	**Date:**	18-Sep-2019		
Project:	None	**Temperature:**	22.4 °C		
Job Site:	MN05	**Humidity:**	61.8% RH		
Serial Number:	190494757	**Barometric Pres.:**	1015 mbar	**Tested by:**	Chris Patterson
EUT:	Livio 2.4 GHz Rechargeable BTE hearing aid				
Configuration:	4				
Customer:	Starkey Laboratories, Inc.				
Attendees:	John Quach				
EUT Power:	Battery				
Operating Mode:	Tx on Low Ch 0 2402 MHz, Mid Ch 18 2440 MHz, High Ch 39 2480 MHz, 2 mb Data Rate				
Deviations:	None				
Comments:	Duty Cycle Correction Factor derived using this formula, DCCF = 10*LOG(1/Duty Cycle)				

Test Specifications	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

Run #	13	**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	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7324.620	33.1	13.5	2.15	92.9	5.0	0.0	Horz	AV	0.0	51.6	54.0	-2.4	EUT On Side, Mid Ch, 2 mb
7317.710	31.0	13.5	1.5	131.9	5.0	0.0	Vert	AV	0.0	49.5	54.0	-4.5	EUT On Side, Mid Ch, 2 mb
7327.580	43.1	13.4	2.15	92.9	0.0	0.0	Horz	PK	0.0	56.5	74.0	-17.5	EUT On Side, Mid Ch, 2 mb
7331.620	42.6	13.4	1.5	131.9	0.0	0.0	Vert	PK	0.0	56.0	74.0	-18.0	EUT On Side, Mid Ch, 2 mb
2487.800	32.6	-3.7	1.5	339.0	0.0	20.0	Horz	AV	0.0	48.9	54.0	-5.1	EUT On Side, High Ch, 2 mb
2485.100	32.7	-3.8	1.5	189.0	0.0	20.0	Vert	AV	0.0	48.9	54.0	-5.1	EUT On Side, High Ch, 2 mb
2387.350	32.5	-3.6	2.37	52.0	0.0	20.0	Horz	AV	0.0	48.9	54.0	-5.1	EUT On Side, Low Ch, 2 mb
2389.560	32.5	-3.6	1.5	8.0	0.0	20.0	Vert	AV	0.0	48.9	54.0	-5.1	EUT On Side, Low Ch, 2 mb
2388.820	44.1	-3.6	1.5	8.0	0.0	20.0	Vert	PK	0.0	60.5	74.0	-13.5	EUT On Side, Low Ch, 2 mb
2484.083	43.9	-3.8	1.5	189.0	0.0	20.0	Vert	PK	0.0	60.1	74.0	-13.9	EUT On Side, High Ch, 2 mb
2484.542	43.8	-3.8	1.5	339.0	0.0	20.0	Horz	PK	0.0	60.0	74.0	-14.0	EUT On Side, High Ch, 2 mb
2385.780	43.1	-3.6	2.37	52.0	0.0	20.0	Horz	PK	0.0	59.5	74.0	-14.5	EUT On Side, Low Ch, 2 mb

DUTY CYCLE

XMit 2019.09.05

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	N5173B	TIW	5-Jul-17	5-Jul-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFG	11-Jul-19	11-Jul-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20

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

element

TbtTx 2019.08.02 XMit 2019.09.05

EUT:	**Livio 2.4 GHz Rechargeable BTE hearing aid**			**Work Order:**	**STAK0176**
Serial Number:	**190494775**			**Date:**	**19-Sep-19**
Customer:	**Starkey Laboratories, Inc.**			**Temperature:**	**22.3 °C**
Attendees:	**John Quach**			**Humidity:**	**56.1% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Kyle McMullan, Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

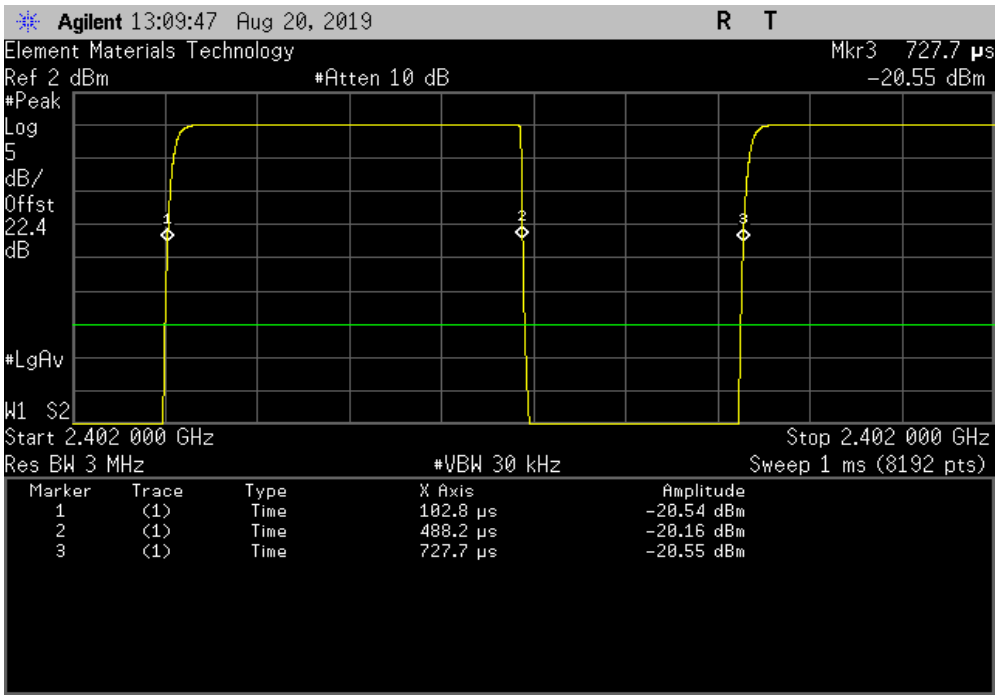
None

Configuration #	**3**	*Signature*

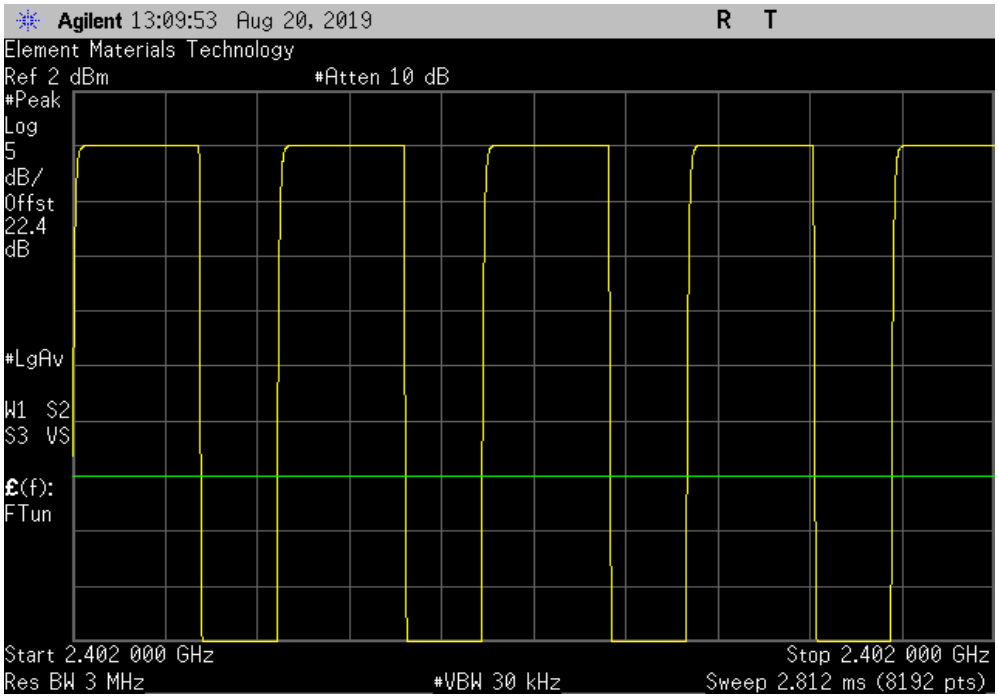
		Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
BLE, 1 Mbps							
	BLE/GFSK Low Channel, 2402 MHz	385.4 us	624.9 us	1	61.7	N/A	N/A
	BLE/GFSK Low Channel, 2402 MHz	N/A	N/A	5	N/A	N/A	N/A
	BLE/GFSK Mid Channel, 2442 MHz	385.8 us	624.9 us	1	61.7	N/A	N/A
	BLE/GFSK Mid Channel, 2442 MHz	N/A	N/A	5	N/A	N/A	N/A
	BLE/GFSK High Channel, 2480 MHz	385.8 us	625 us	1	61.7	N/A	N/A
	BLE/GFSK High Channel, 2480 MHz	N/A	N/A	5	N/A	N/A	N/A
BLE, 2 Mbps							
	BLE/GFSK Low Channel, 2402 MHz	197.6 us	625.1 us	1	31.6	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	197.256 us	625.344 us	1	31.5	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	197.556 us	625.1 us	1	31.6	N/A	N/A
	BLE/GFSK High Channel, 2480 MHz	N/A	N/A	5	N/A	N/A	N/A

DUTY CYCLE

BLE, 1 Mbps, BLE/GFSK Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	385.4 us	624.9 us	1	61.7	N/A	N/A



BLE, 1 Mbps, 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

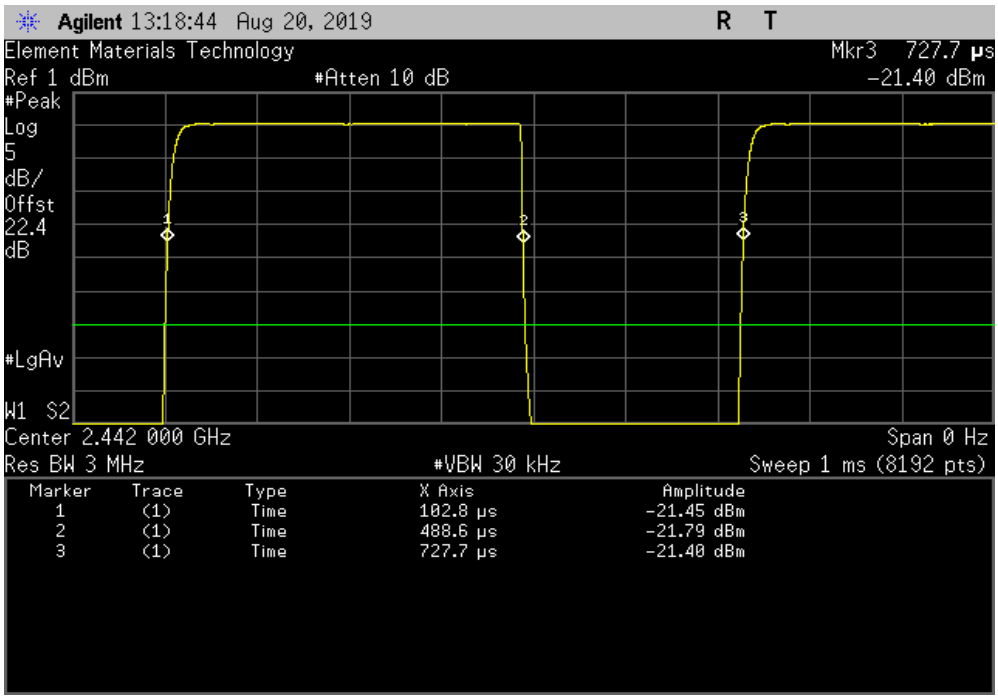


DUTY CYCLE

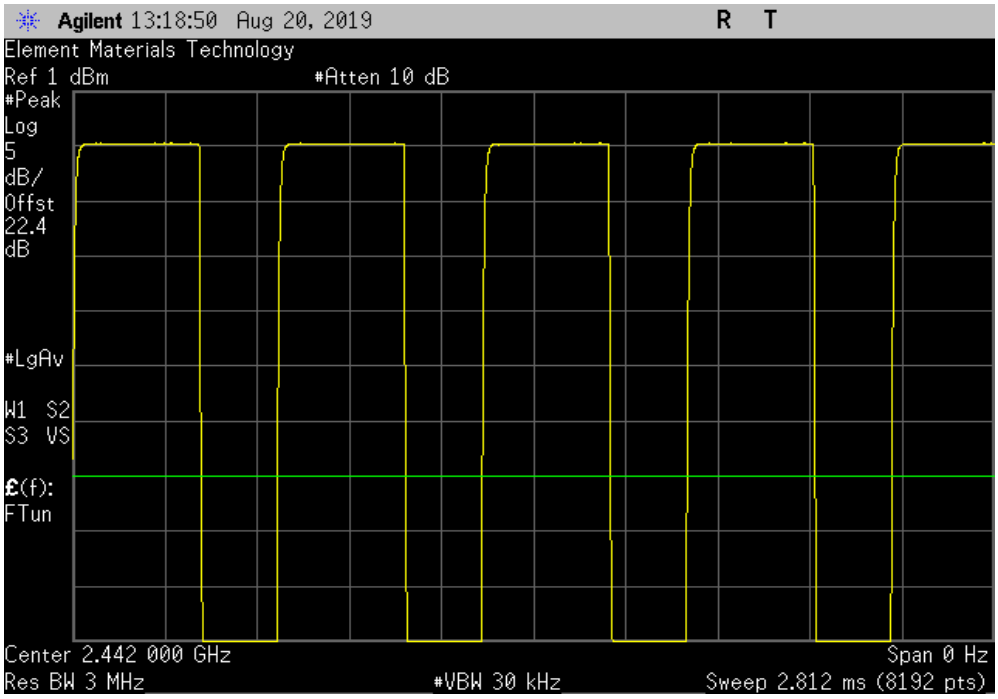
element

TbtTx 2019.08.02 XMit 2019.09.05

BLE, 1 Mbps, BLE/GFSK Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	385.8 us	624.9 us	1	61.7	N/A	N/A

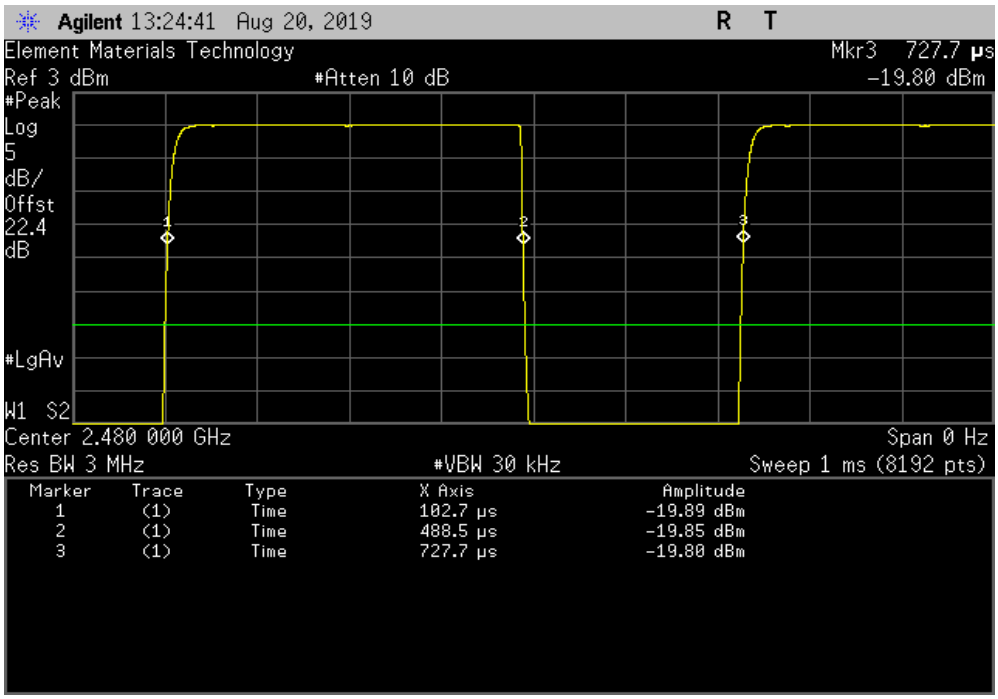


BLE, 1 Mbps, BLE/GFSK Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

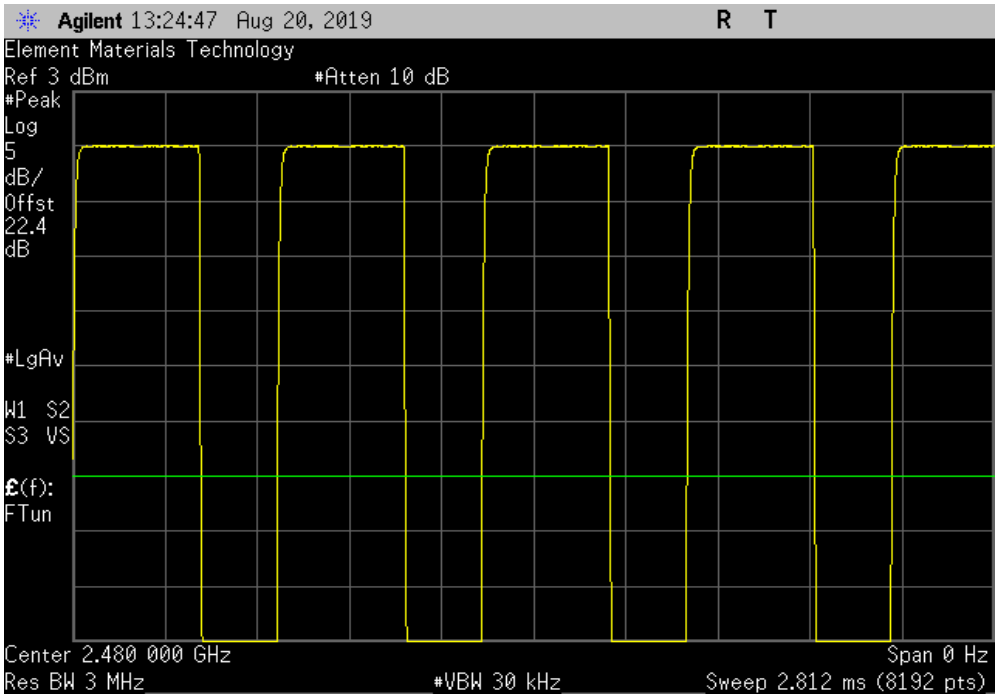


DUTY CYCLE

BLE, 1 Mbps, BLE/GFSK High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	385.8 us	625 us	1	61.7	N/A	N/A

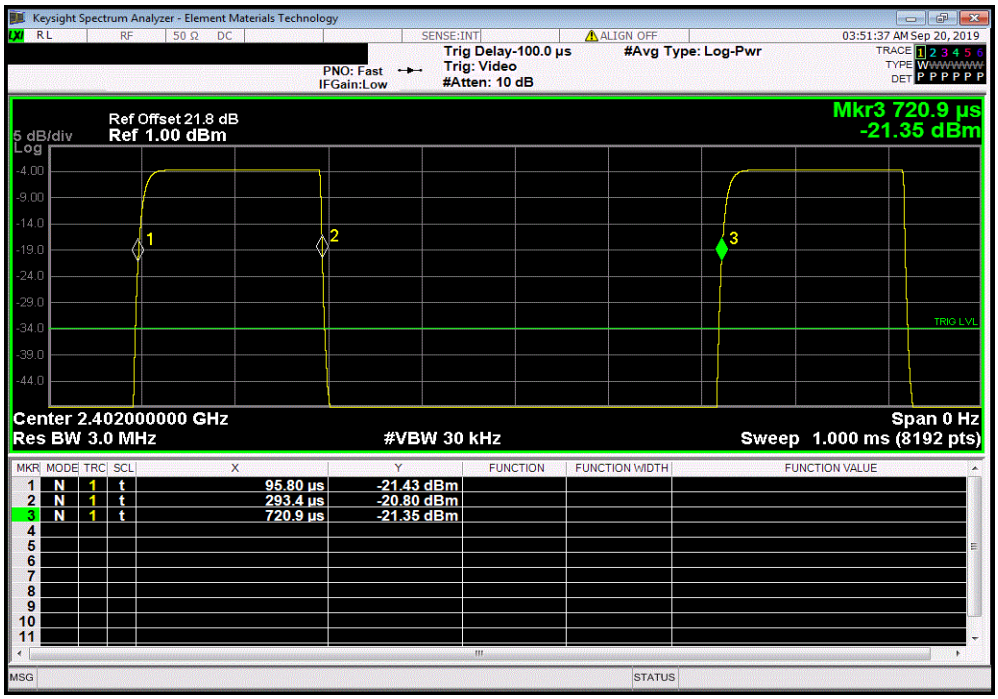


BLE, 1 Mbps, BLE/GFSK High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

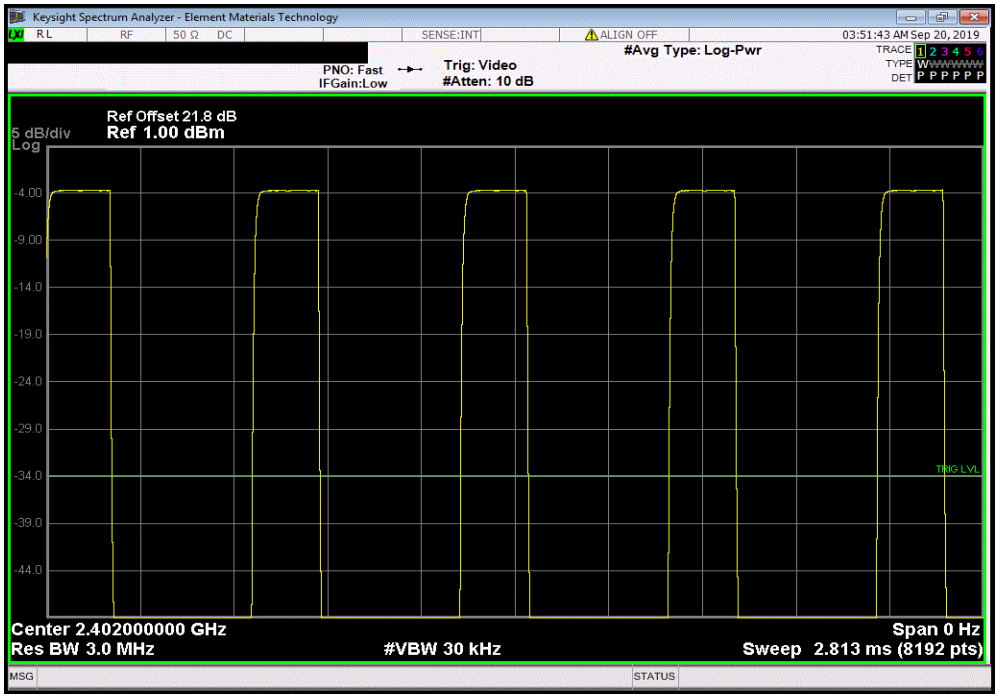


DUTY CYCLE

BLE, 2 Mbps, BLE/GFSK Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	197.6 us	625.1 us	1	31.6	N/A	N/A

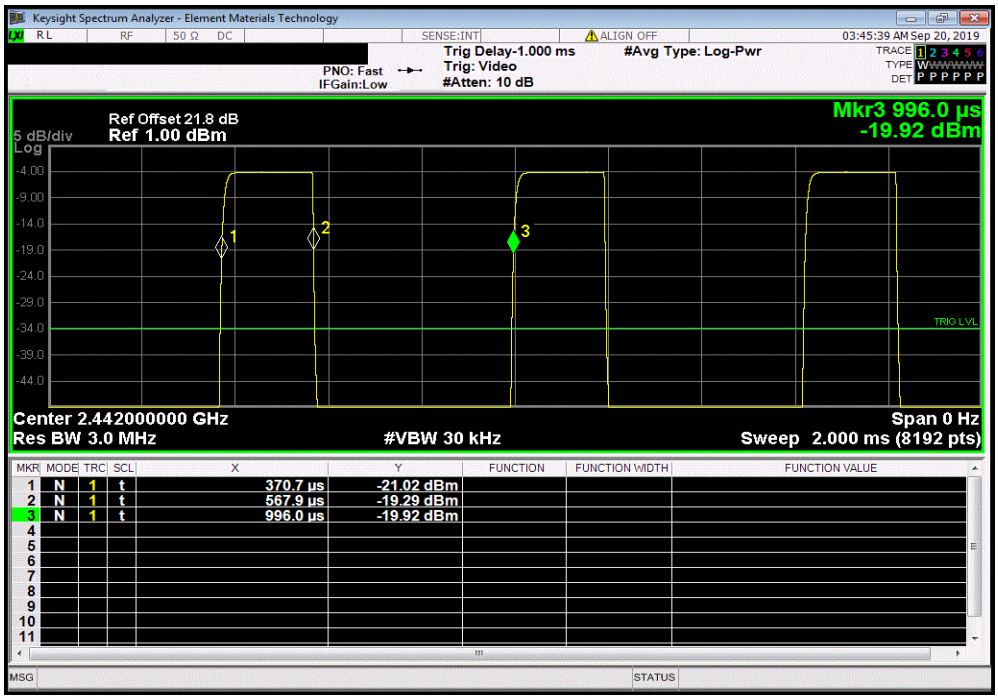


BLE, 2 Mbps, BLE/GFSK Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

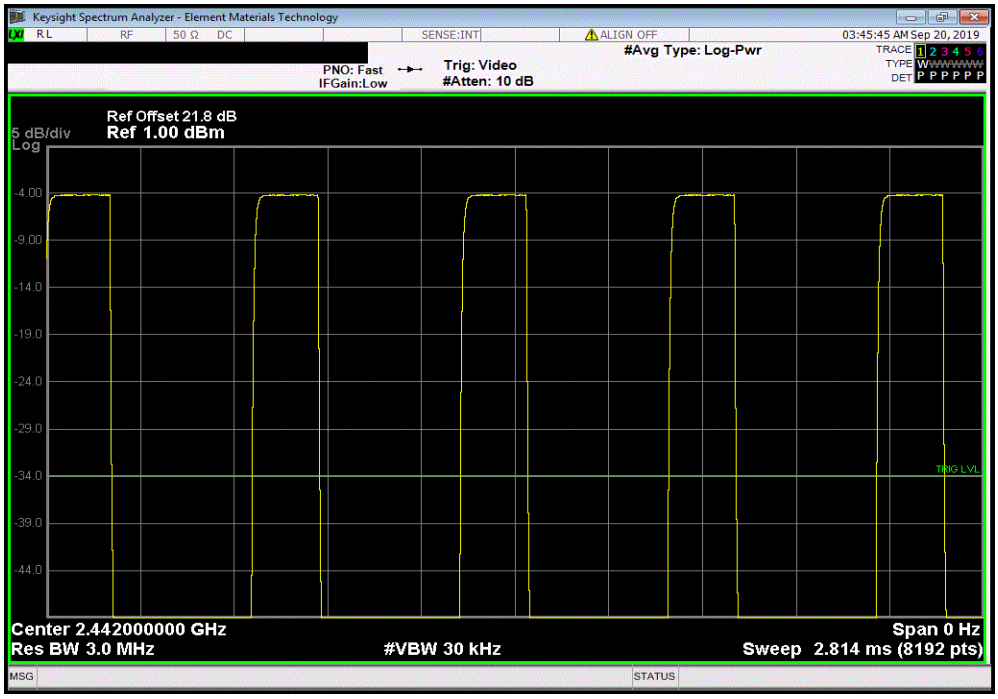


DUTY CYCLE

BLE, 2 Mbps, BLE/GFSK Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	197.256 us	625.344 us	1	31.5	N/A	N/A



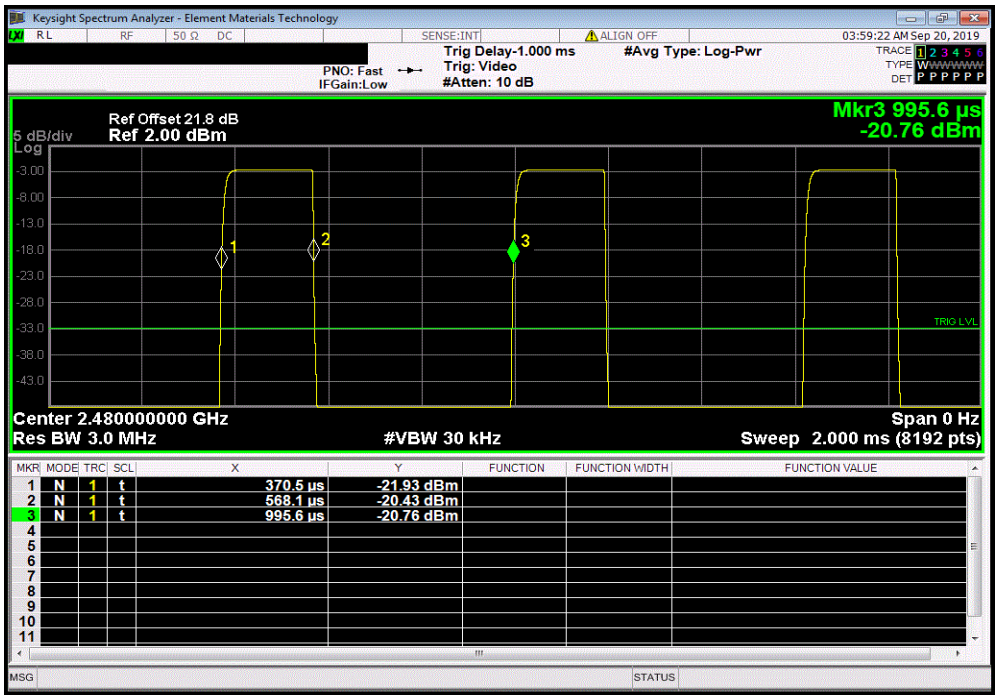
BLE, 2 Mbps, BLE/GFSK Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



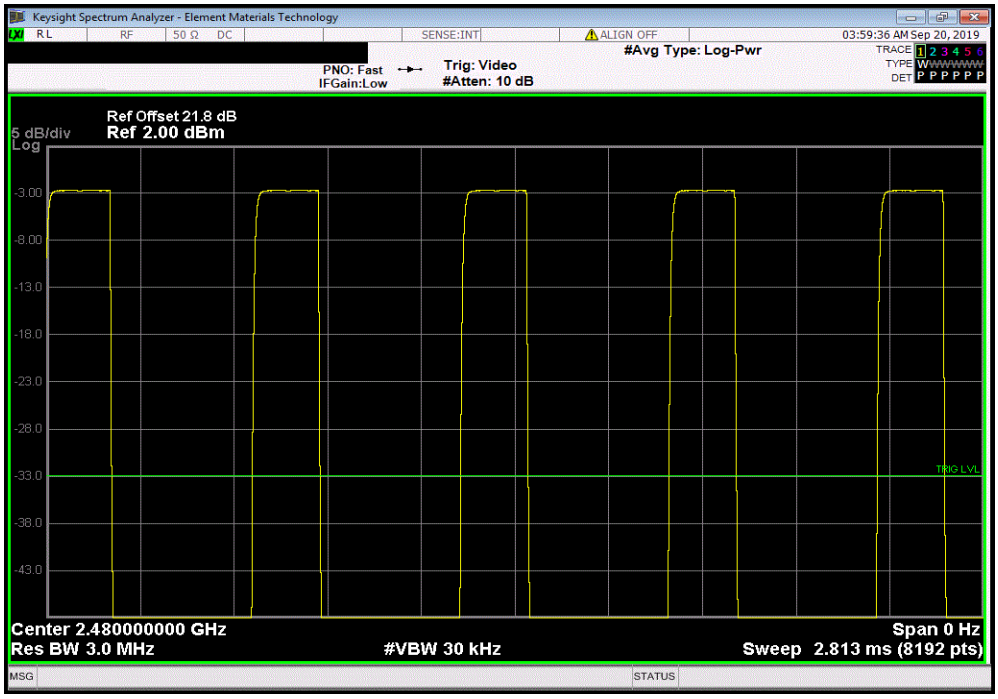
DUTY CYCLE

TbtTx 2019.08.02 XMit 2019.09.05

BLE, 2 Mbps, BLE/GFSK High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	197.556 us	625.1 us	1	31.6	N/A	N/A



BLE, 2 Mbps, 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 2019.09.05

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	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFG	11-Jul-19	11-Jul-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20

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 2019.08.02 XMit 2019.09.05

EUT:	**Livio 2.4 GHz Rechargeable BTE hearing aid**			**Work Order:**	**STAK0176**
Serial Number:	**190494775**			**Date:**	**19-Sep-19**
Customer:	**Starkey Laboratories, Inc.**			**Temperature:**	**22.3 °C**
Attendees:	**John Quach**			**Humidity:**	**56.2% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Kyle McMullan, Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

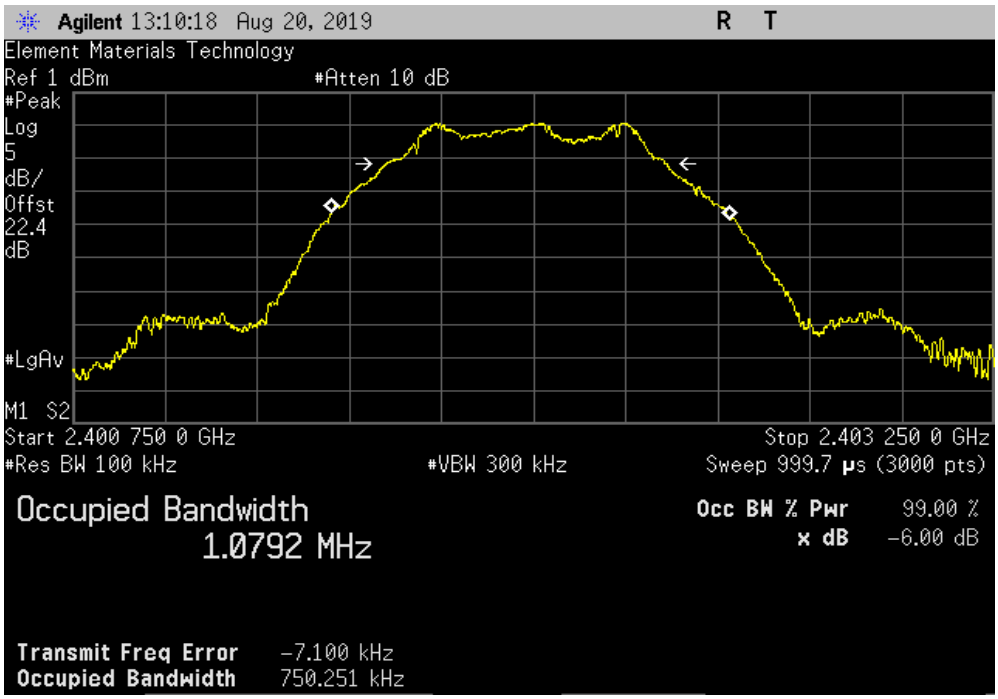
None

Configuration #	**3**	*Signature*

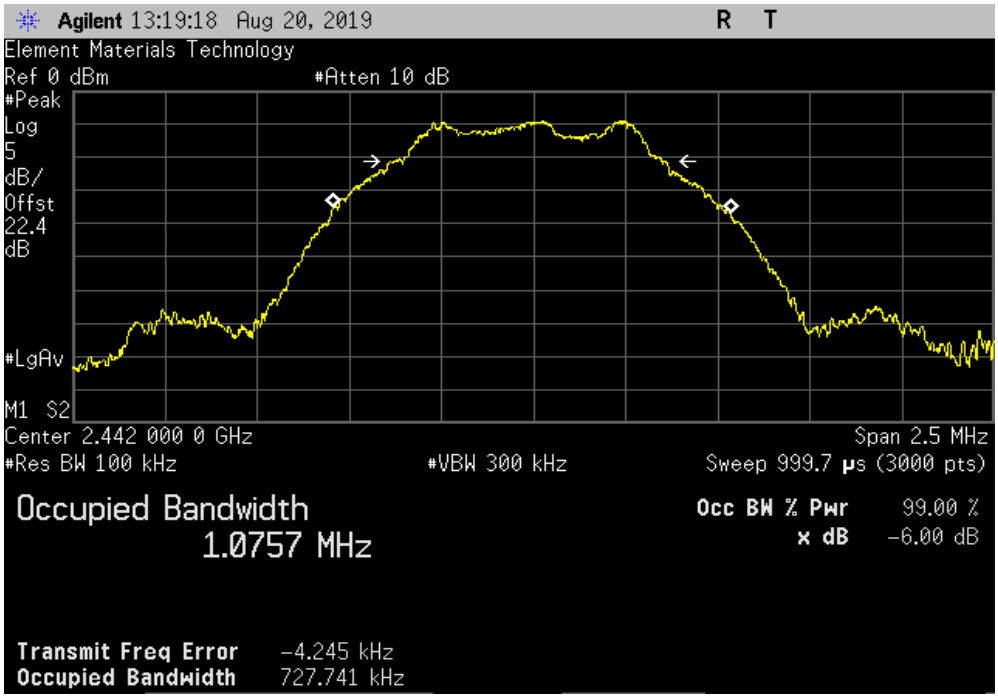
		Value	**Limit (≥)**	**Result**
BLE, 1 Mbps				
	BLE/GFSK Low Channel, 2402 MHz	750.251 kHz	500 kHz	Pass
	BLE/GFSK Mid Channel, 2442 MHz	727.741 kHz	500 kHz	Pass
	BLE/GFSK High Channel, 2480 MHz	742.402 kHz	500 kHz	Pass
BLE, 2 Mbps				
	BLE/GFSK Low Channel, 2402 MHz	1.283 MHz	500 kHz	Pass
	BLE/GFSK Mid Channel, 2442 MHz	1.28 MHz	500 kHz	Pass
	BLE/GFSK High Channel, 2480 MHz	1.28 MHz	500 kHz	Pass

OCCUPIED BANDWIDTH

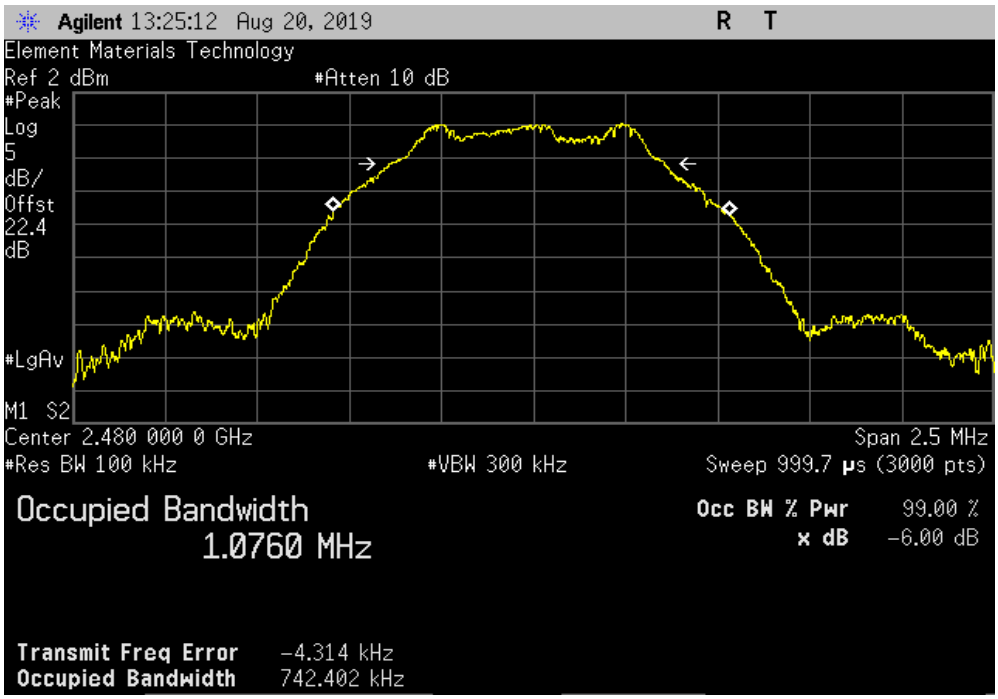
BLE, 1 Mbps, BLE/GFSK Low Channel, 2402 MHz						
				Value	Limit (≥)	Result
				750.251 kHz	500 kHz	Pass



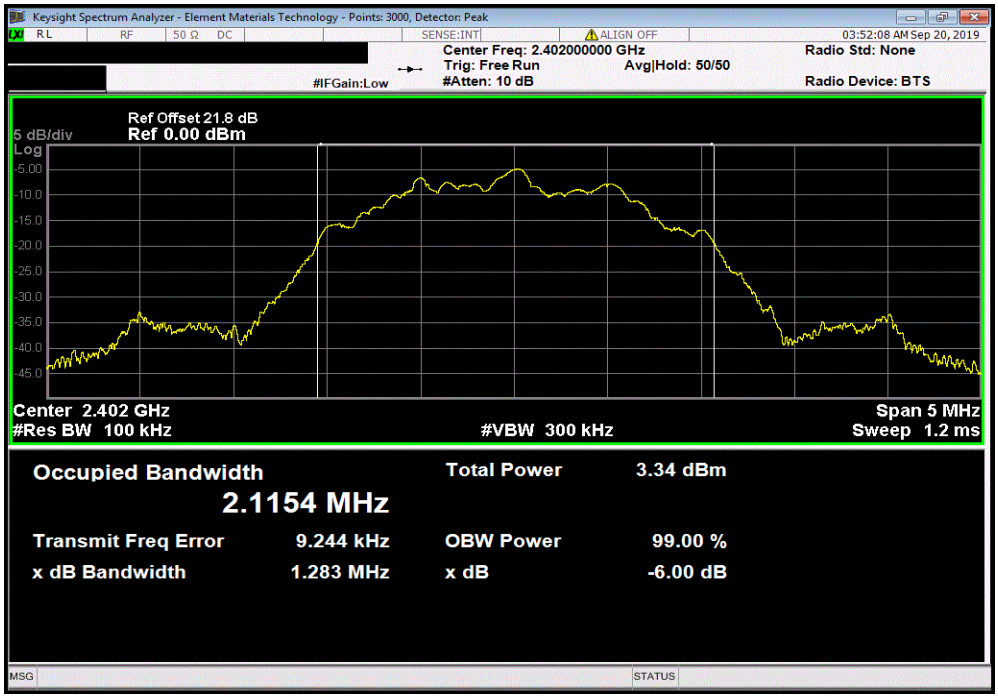
BLE, 1 Mbps, BLE/GFSK Mid Channel, 2442 MHz						
				Value	Limit (≥)	Result
				727.741 kHz	500 kHz	Pass



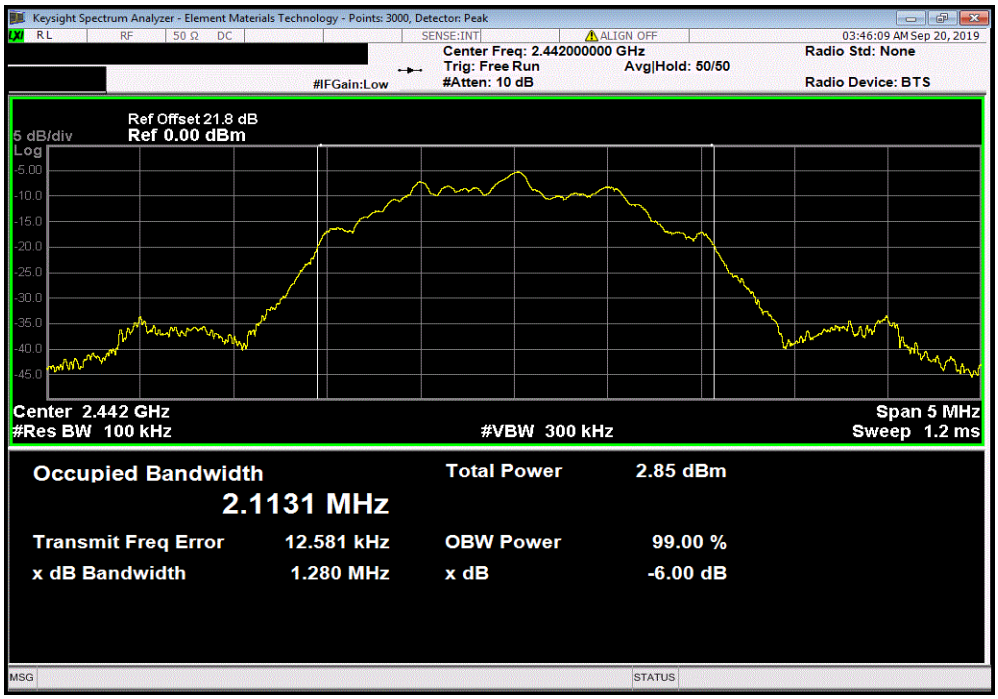
BLE, 1 Mbps, BLE/GFSK High Channel, 2480 MHz						
				Value	Limit (≥)	Result
				742.402 kHz	500 kHz	Pass



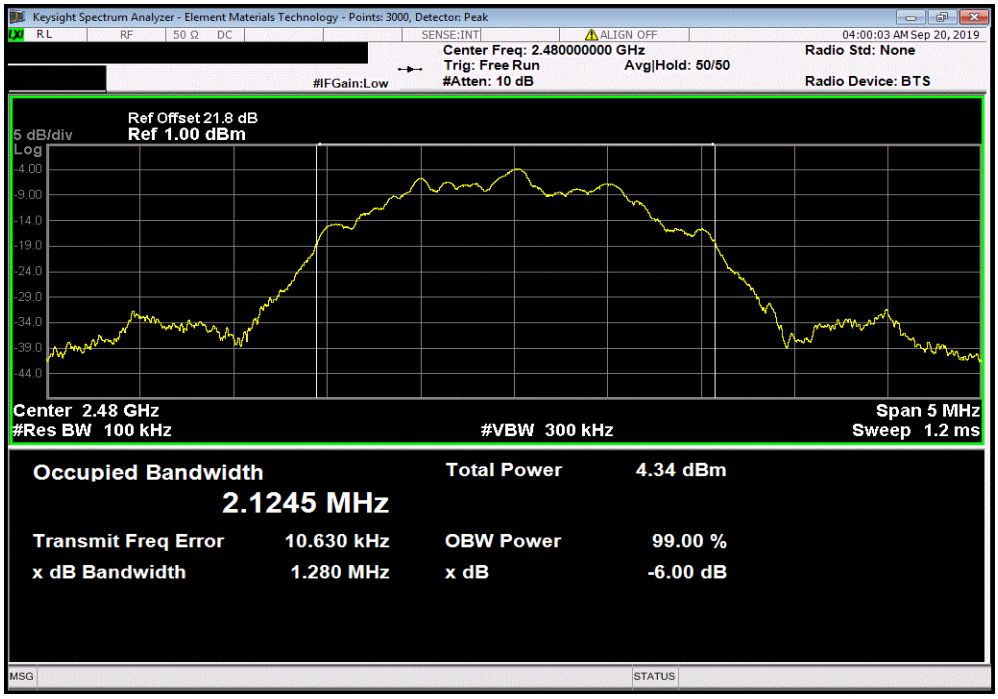
BLE, 2 Mbps, BLE/GFSK Low Channel, 2402 MHz						
				Value	Limit (≥)	Result
				1.283 MHz	500 kHz	Pass



BLE, 2 Mbps, BLE/GFSK Mid Channel, 2442 MHz						
				Value	Limit (≥)	Result
				1.28 MHz	500 kHz	Pass



BLE, 2 Mbps, BLE/GFSK High Channel, 2480 MHz						
				Value	Limit (≥)	Result
				1.28 MHz	500 kHz	Pass



OUTPUT POWER

XMit 2019.09.05

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	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFG	11-Jul-19	11-Jul-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20

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.

OUTPUT POWER

element

TbtTx 2019.08.02 XMit 2019.09.05

EUT:	**Livio 2.4 GHz Rechargeable BTE hearing aid**			**Work Order:**	**STAK0176**
Serial Number:	**190494775**			**Date:**	**19-Sep-19**
Customer:	**Starkey Laboratories, Inc.**			**Temperature:**	**22.3 °C**
Attendees:	**John Quach**			**Humidity:**	**56.1% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Kyle McMullan, Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

None

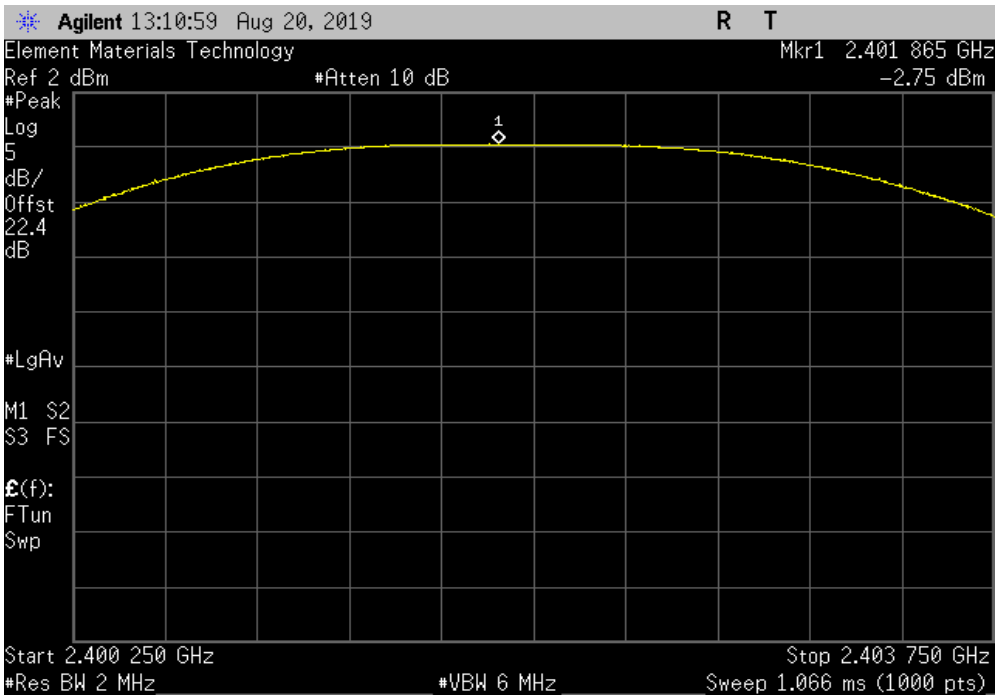
DEVIATIONS FROM TEST STANDARD

None

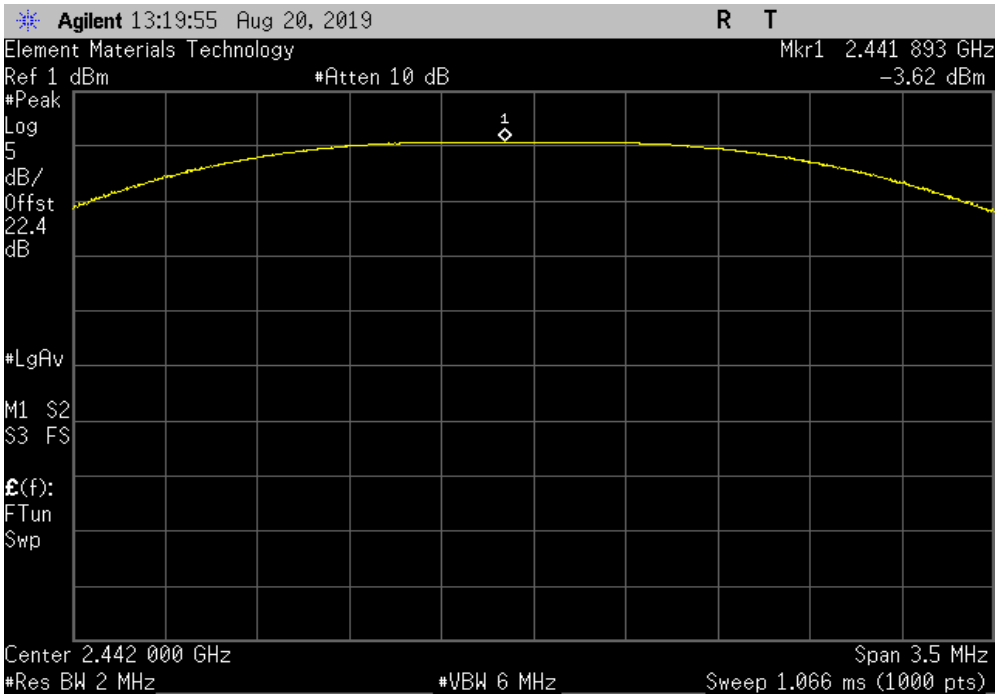
Configuration #	**3**	*Signature*

		Out Pwr (dBm)	**Limit (dBm)**	**Result**
BLE, 1 Mbps				
	BLE/GFSK Low Channel, 2402 MHz	-2.754	30	Pass
	BLE/GFSK Mid Channel, 2442 MHz	-3.621	30	Pass
	BLE/GFSK High Channel, 2480 MHz	-1.849	30	Pass
BLE, 2 Mbps				
	BLE/GFSK Low Channel, 2402 MHz	-3.272	30	Pass
	BLE/GFSK Mid Channel, 2442 MHz	-3.822	30	Pass
	BLE/GFSK High Channel, 2480 MHz	-2.305	30	Pass

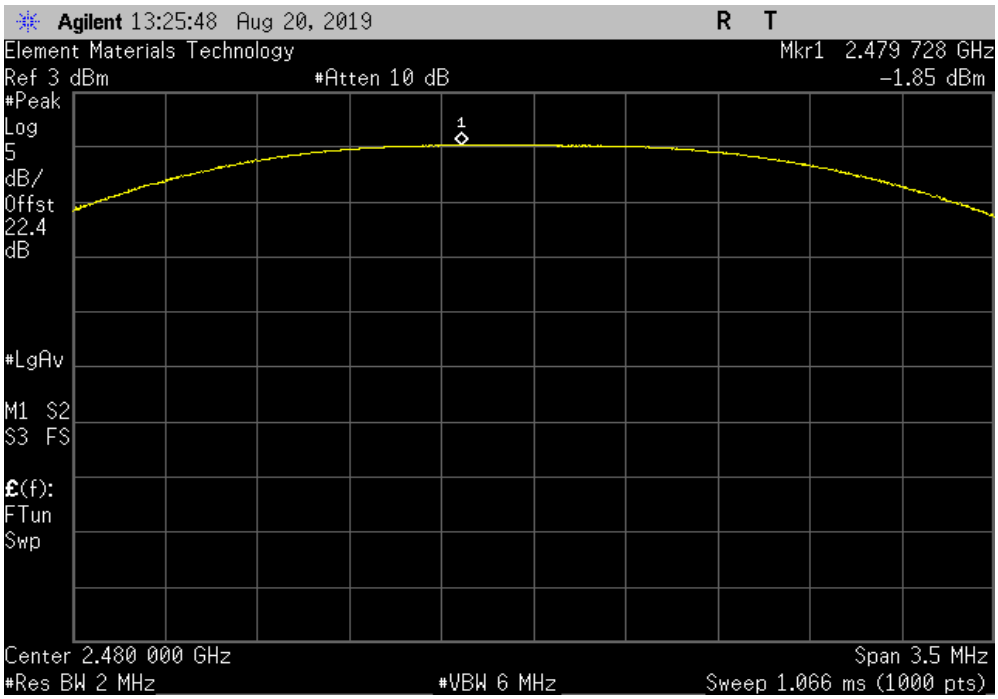
BLE, 1 Mbps, BLE/GFSK Low Channel, 2402 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-2.754	30	Pass



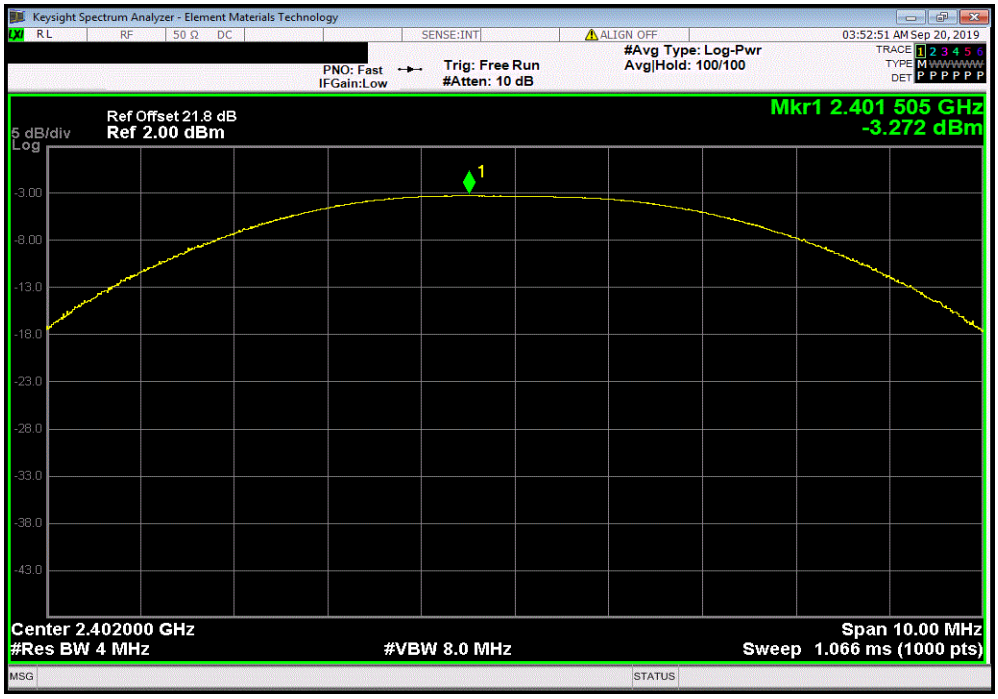
BLE, 1 Mbps, BLE/GFSK Mid Channel, 2442 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-3.621	30	Pass



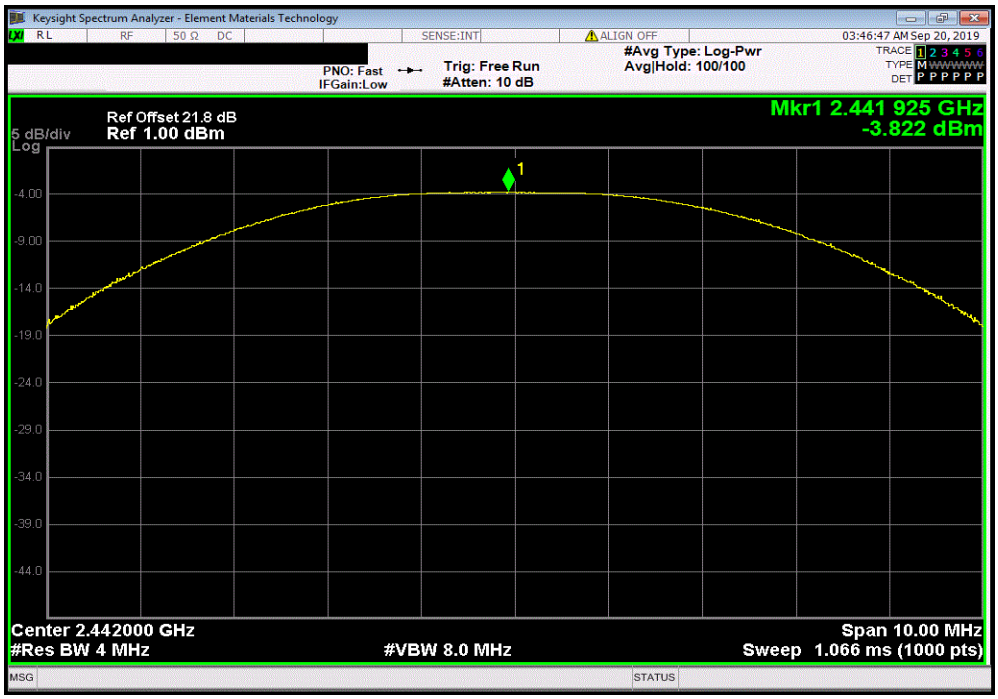
BLE, 1 Mbps, BLE/GFSK High Channel, 2480 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-1.849	30	Pass



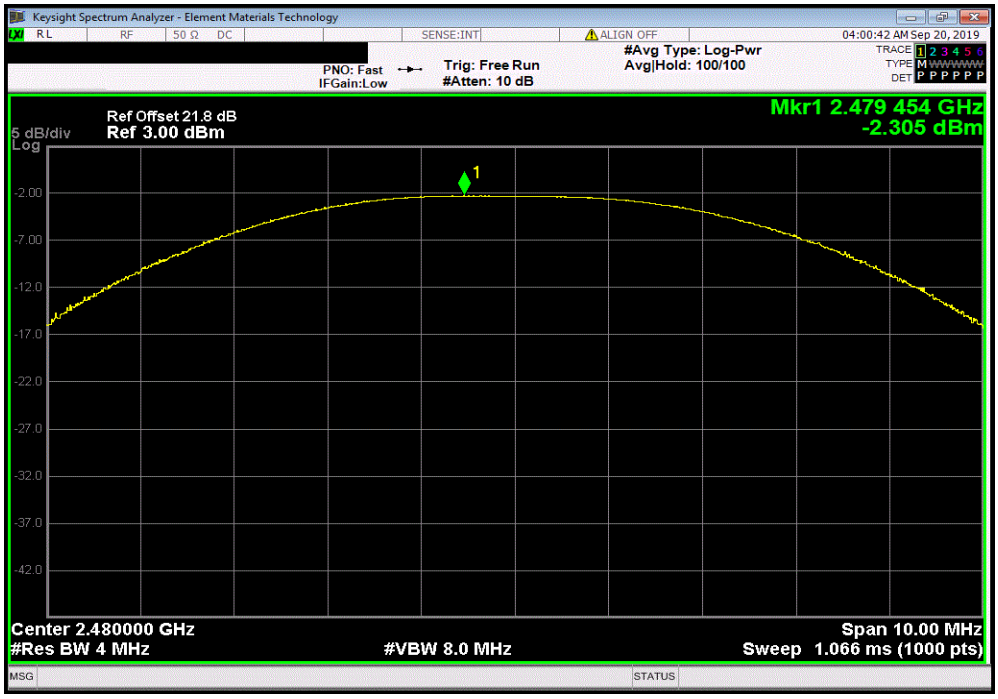
BLE, 2 Mbps, BLE/GFSK Low Channel, 2402 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-3.272	30	Pass



BLE, 2 Mbps, BLE/GFSK Mid Channel, 2442 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-3.822	30	Pass



BLE, 2 Mbps, BLE/GFSK High Channel, 2480 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-2.305	30	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

XMit 2019.09.05

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	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFG	11-Jul-19	11-Jul-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20

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.

The antenna gain was added to out the conducted output power value to calculate the EIRP.

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

element

TbtTx 2019.08.02 XMit 2019.09.05

EUT:	**Livio 2.4 GHz Rechargeable BTE hearing aid**			**Work Order:**	**STAK0176**
Serial Number:	**190494775**			**Date:**	**19-Sep-19**
Customer:	**Starkey Laboratories, Inc.**			**Temperature:**	**22.3 °C**
Attendees:	**John Quach**			**Humidity:**	**56.4% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Kyle McMullan, Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

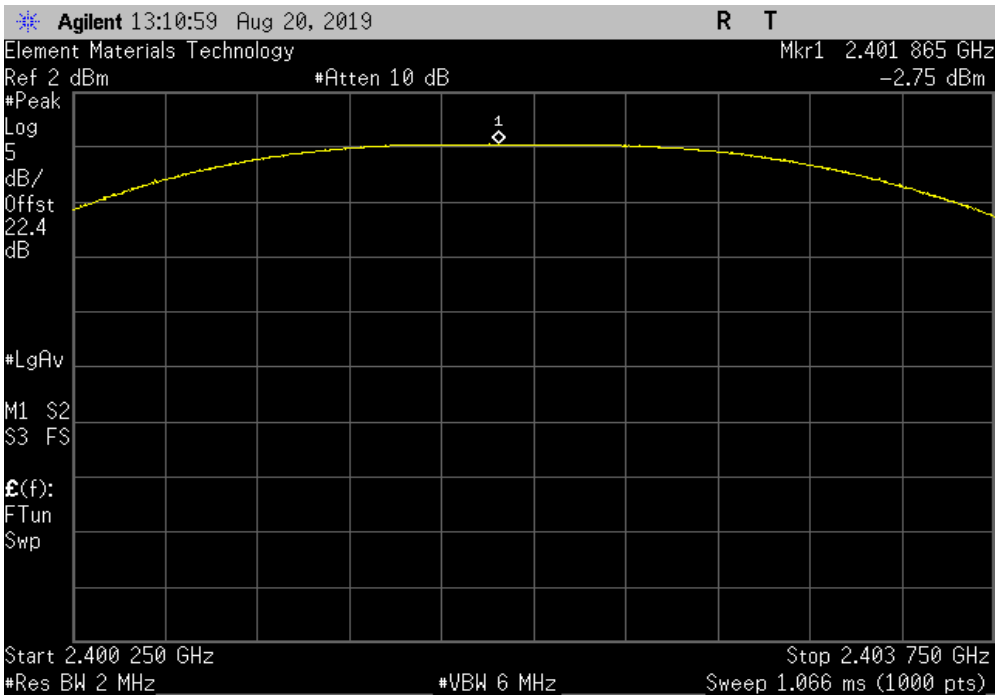
None

Configuration #	**3**	*Signature*

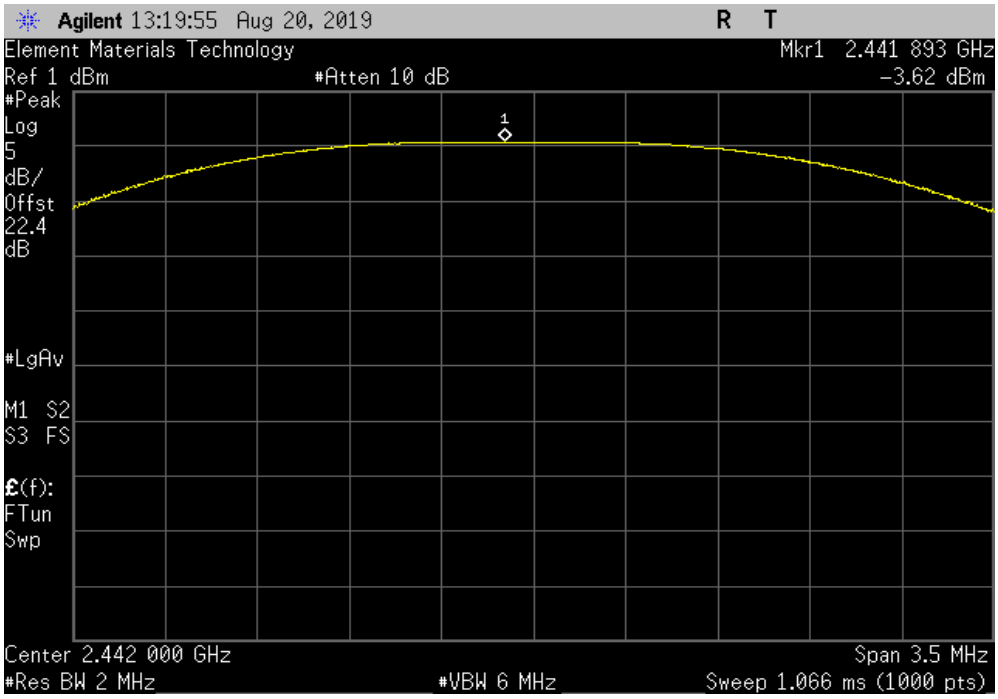
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
BLE, 1 Mbps						
	BLE/GFSK Low Channel, 2402 MHz	-2.754	-11.5	-14.254	36	Pass
	BLE/GFSK Mid Channel, 2442 MHz	-3.621	-11.5	-15.121	36	Pass
	BLE/GFSK High Channel, 2480 MHz	-1.849	-11.5	-13.349	36	Pass
BLE, 2 Mbps						
	BLE/GFSK Low Channel, 2402 MHz	-3.272	-11.5	-14.772	36	Pass
	BLE/GFSK Mid Channel, 2442 MHz	-3.822	-11.5	-15.322	36	Pass
	BLE/GFSK High Channel, 2480 MHz	-2.305	-11.5	-13.805	36	Pass

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

BLE, 1 Mbps, BLE/GFSK Low Channel, 2402 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		-2.754	-11.5	-14.254	36	Pass

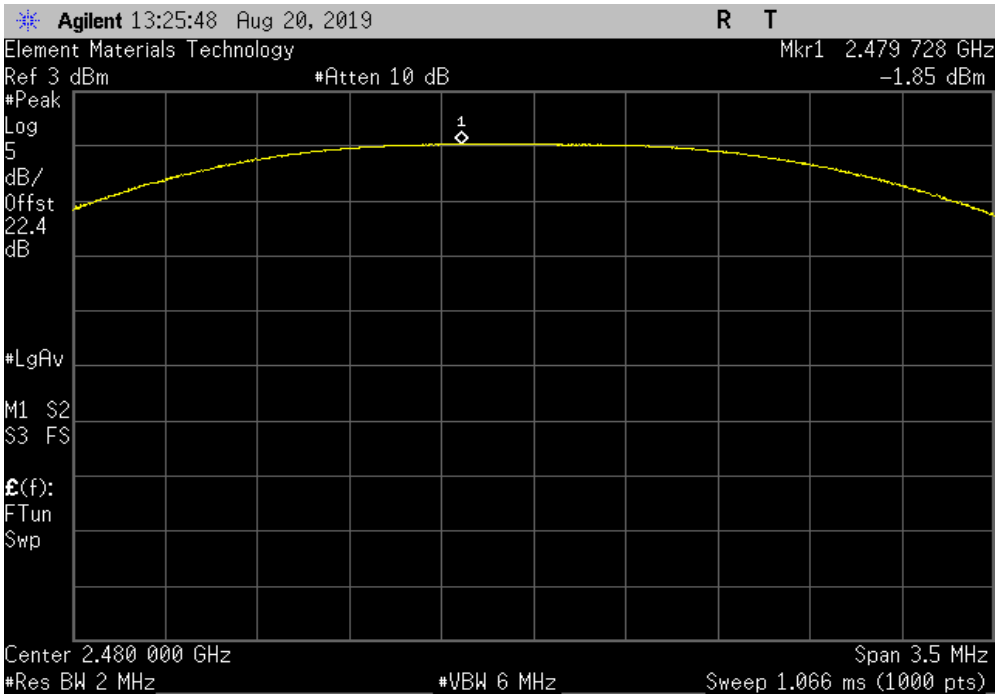


BLE, 1 Mbps, BLE/GFSK Mid Channel, 2442 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		-3.621	-11.5	-15.121	36	Pass

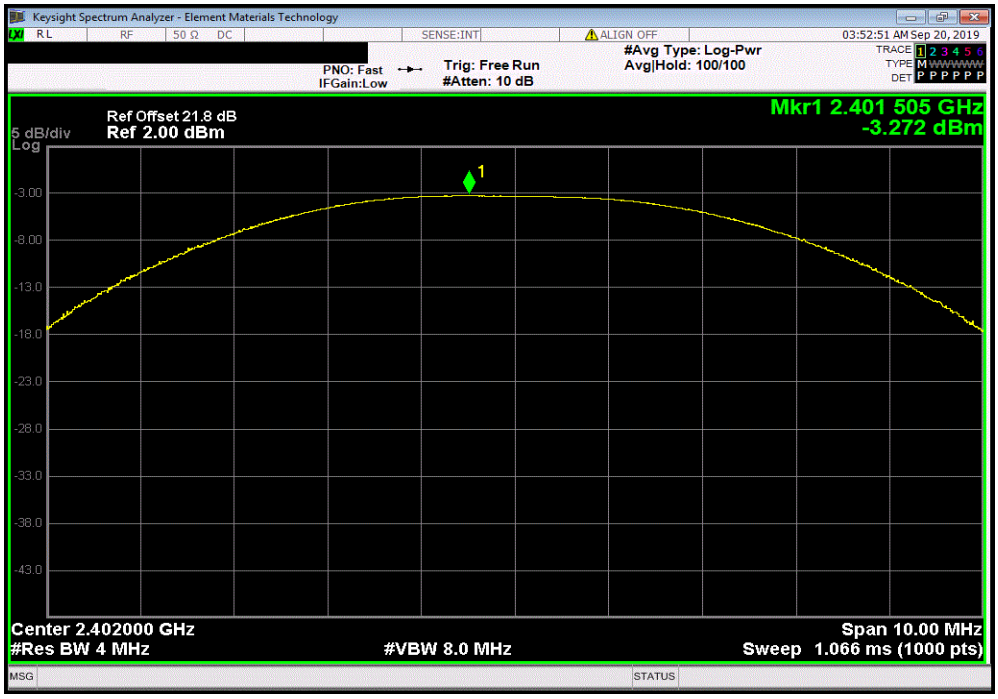


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

BLE, 1 Mbps, BLE/GFSK High Channel, 2480 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		-1.849	-11.5	-13.349	36	Pass



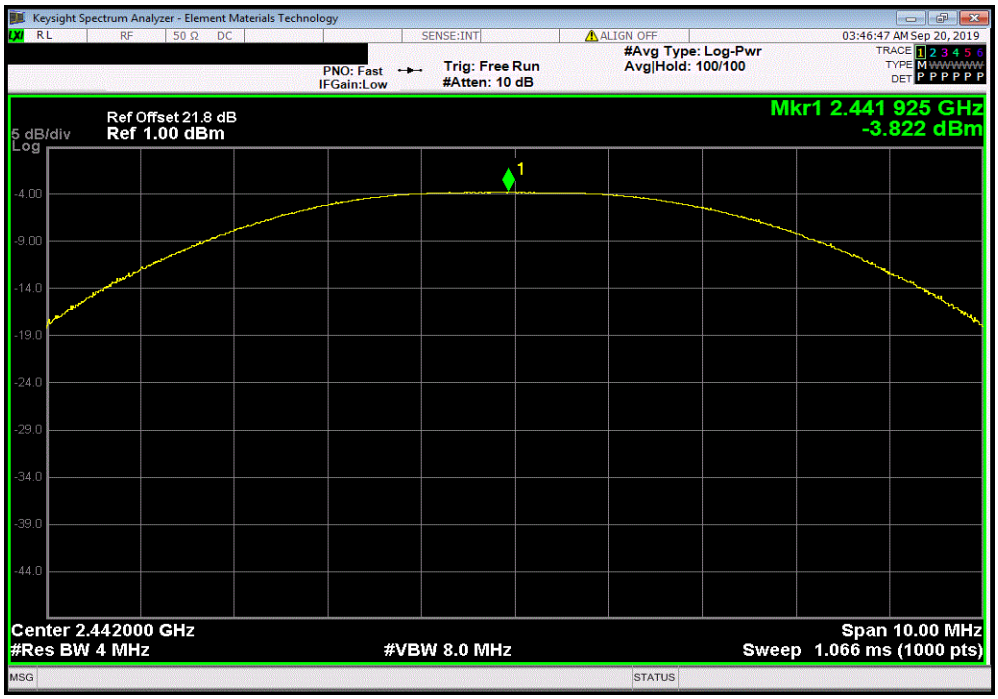
BLE, 2 Mbps, BLE/GFSK Low Channel, 2402 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		-3.272	-11.5	-14.772	36	Pass



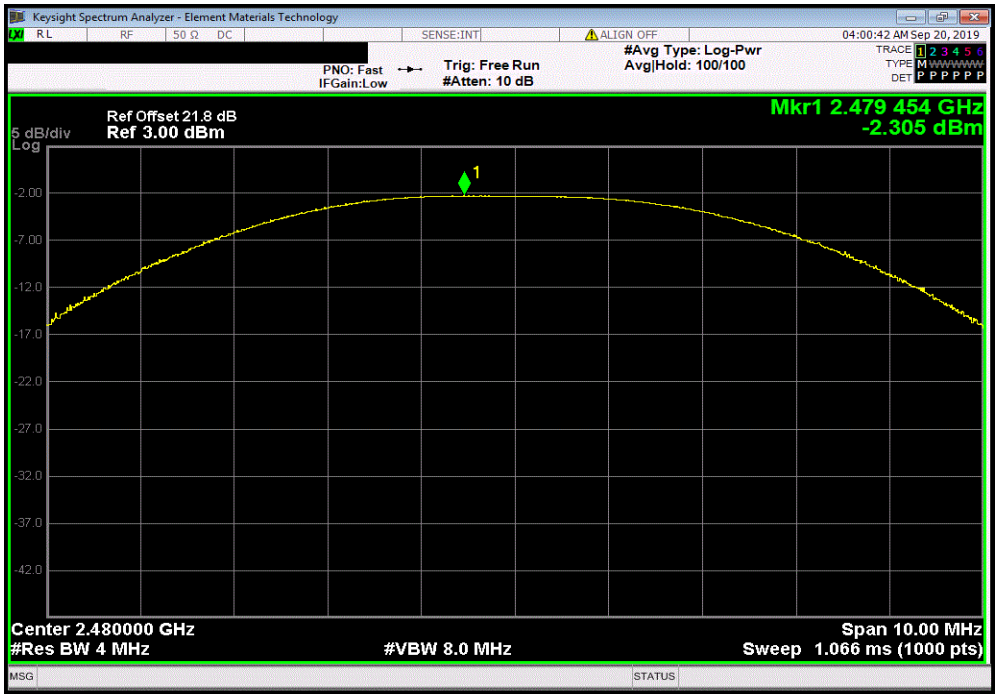
EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

TbtTx 2019.08.02 XMit 2019.09.05

BLE, 2 Mbps, BLE/GFSK Mid Channel, 2442 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		-3.822	-11.5	-15.322	36	Pass



BLE, 2 Mbps, BLE/GFSK High Channel, 2480 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		-2.305	-11.5	-13.805	36	Pass



POWER SPECTRAL DENSITY

XMit 2019.09.05

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	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFG	11-Jul-19	11-Jul-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20

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

element

TbtTx 2019.08.02 XMit 2019.09.05

EUT:	**Livio 2.4 GHz Rechargeable BTE hearing aid**			**Work Order:**	**STAK0176**
Serial Number:	**190494775**			**Date:**	**19-Sep-19**
Customer:	**Starkey Laboratories, Inc.**			**Temperature:**	**22.3 °C**
Attendees:	**John Quach**			**Humidity:**	**56% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Kyle McMullan, Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

None

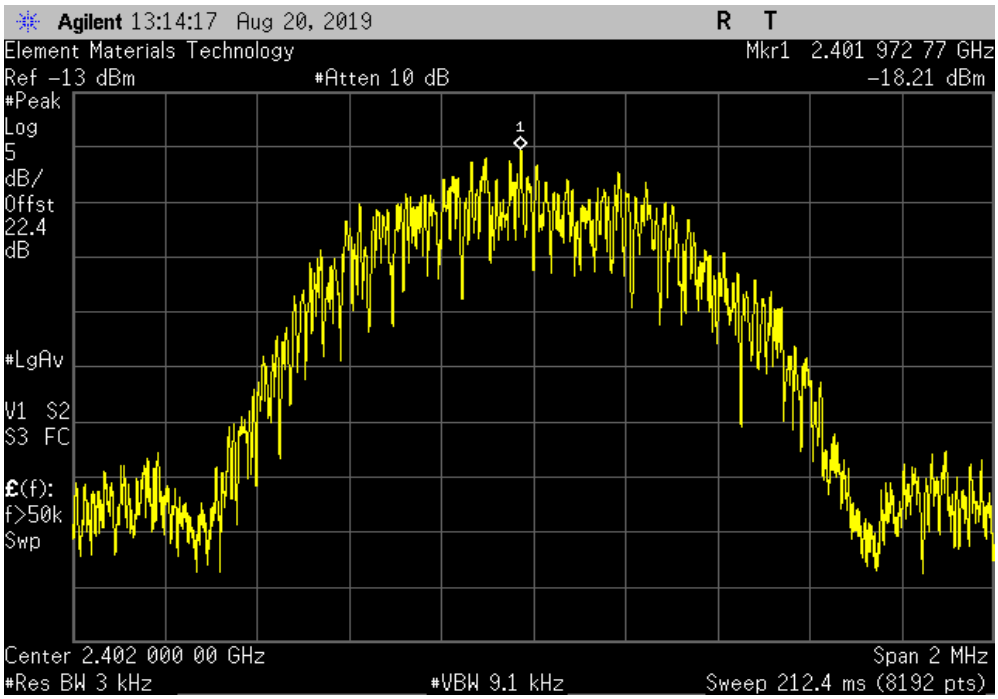
DEVIATIONS FROM TEST STANDARD

None

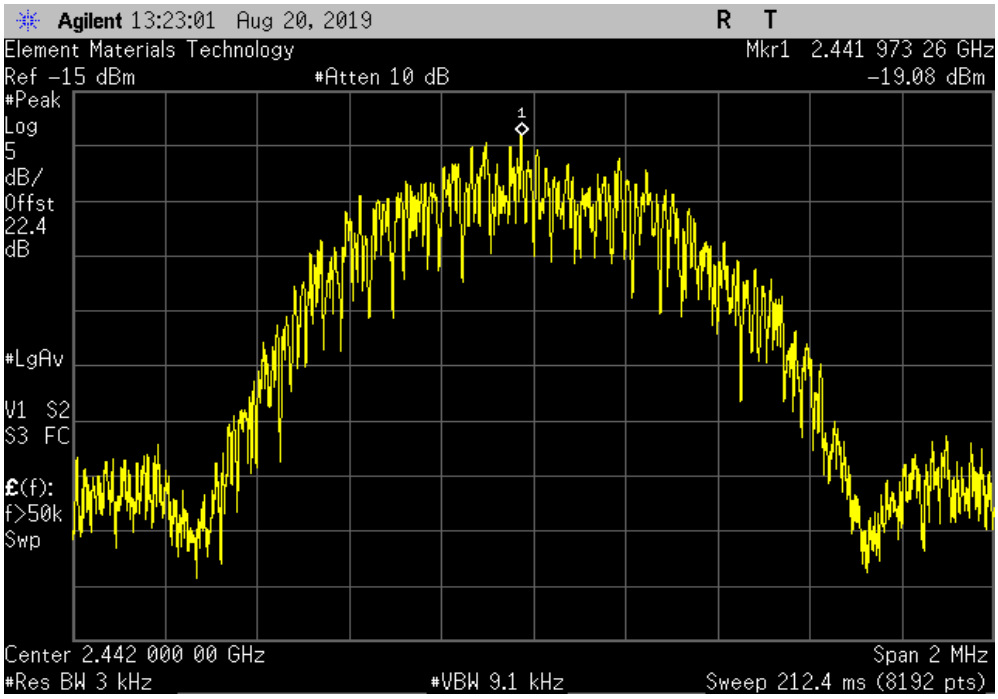
Configuration #	**3**	*Signature*

		Value dBm/3kHz	**Limit < dBm/3kHz**	**Results**
BLE, 1 Mbps				
	BLE/GFSK Low Channel, 2402 MHz	-18.206	8	Pass
	BLE/GFSK Mid Channel, 2442 MHz	-19.078	8	Pass
	BLE/GFSK High Channel, 2480 MHz	-17.265	8	Pass
BLE, 2 Mbps				
	BLE/GFSK Low Channel, 2402 MHz	-21.479	8	Pass
	BLE/GFSK Mid Channel, 2442 MHz	-22.073	8	Pass
	BLE/GFSK High Channel, 2480 MHz	-20.549	8	Pass

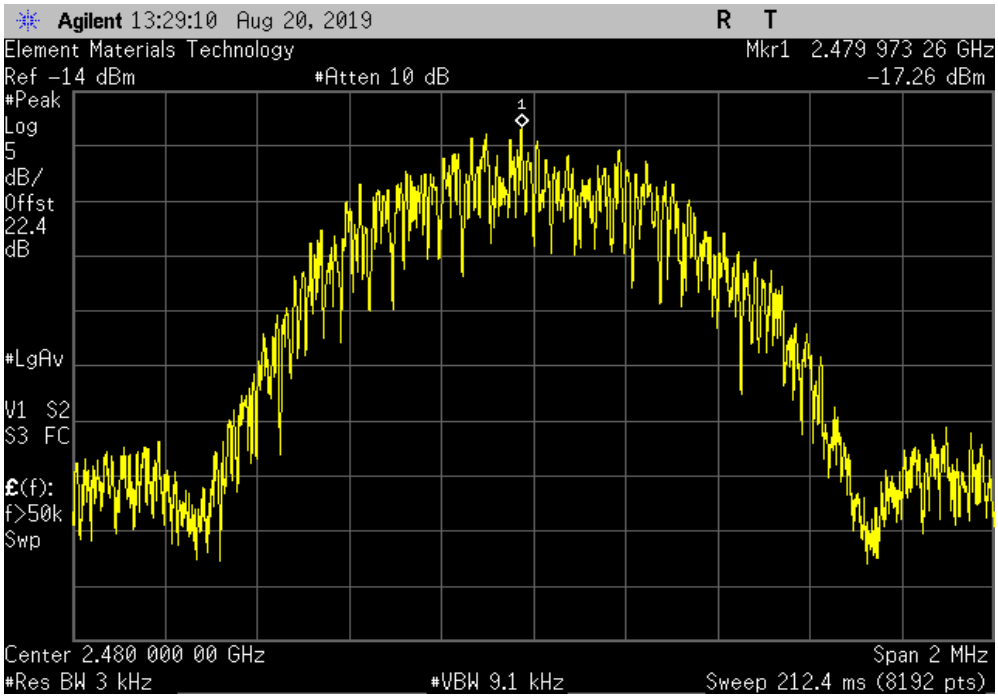
BLE, 1 Mbps, BLE/GFSK Low Channel, 2402 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-18.206	8	Pass



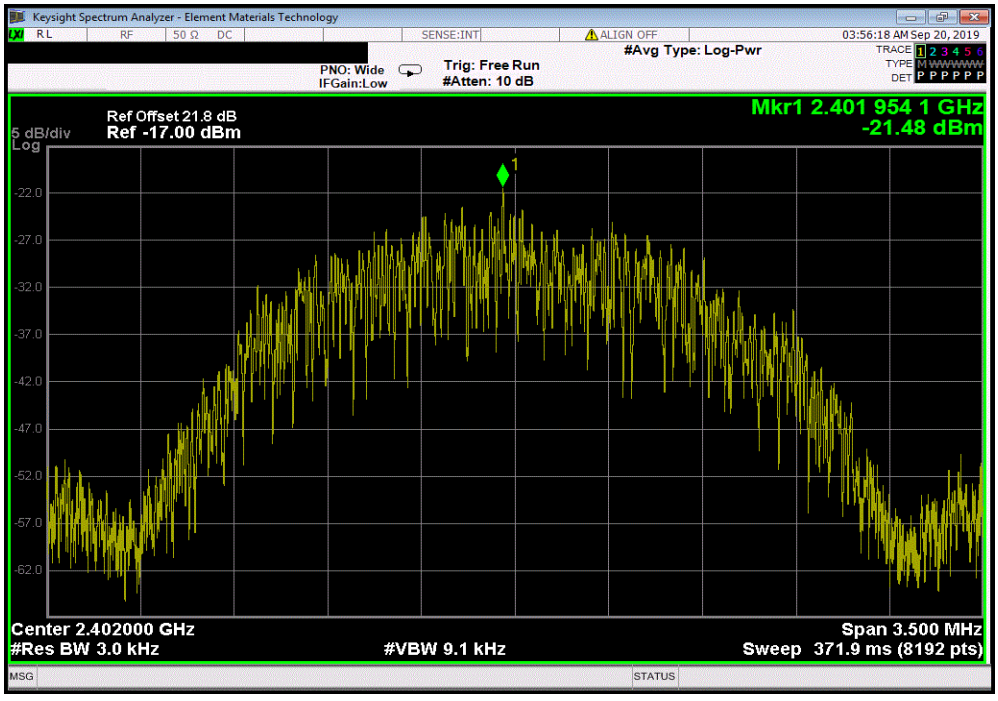
BLE, 1 Mbps, BLE/GFSK Mid Channel, 2442 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-19.078	8	Pass



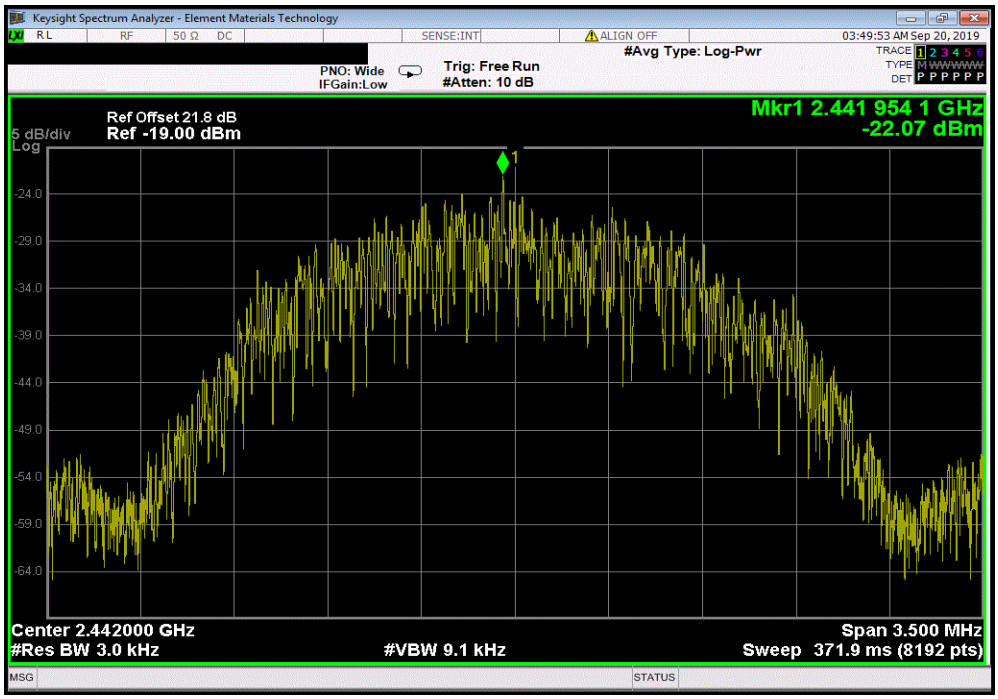
BLE, 1 Mbps, BLE/GFSK High Channel, 2480 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-17.265	8	Pass



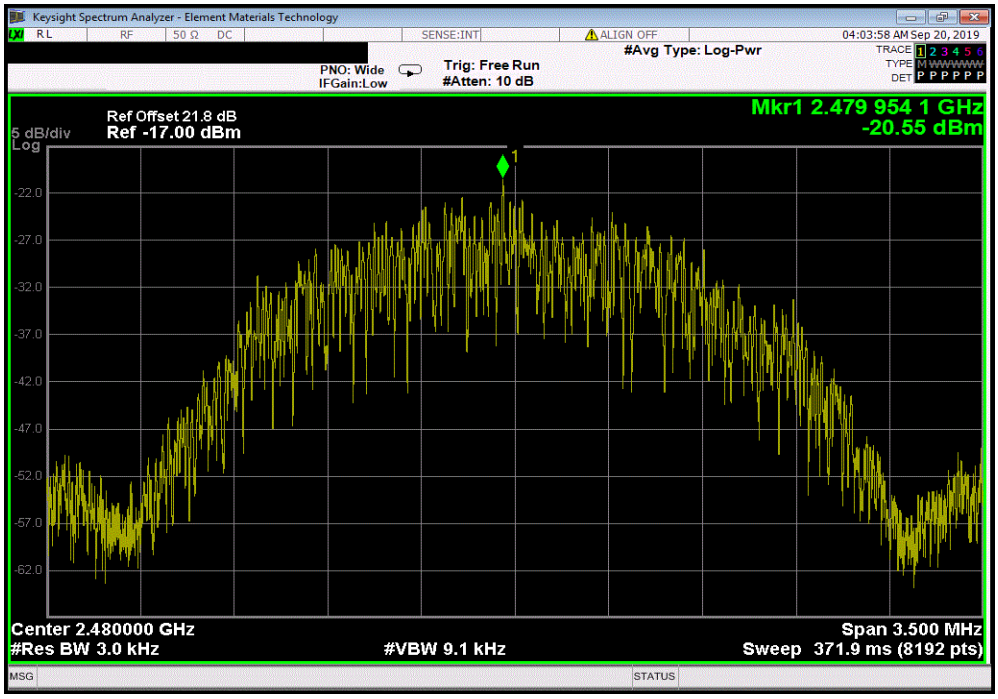
BLE, 2 Mbps, BLE/GFSK Low Channel, 2402 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-21.479	8	Pass



BLE, 2 Mbps, BLE/GFSK Mid Channel, 2442 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-22.073	8	Pass



BLE, 2 Mbps, BLE/GFSK High Channel, 2480 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-20.549	8	Pass



BAND EDGE COMPLIANCE

XMit 2019.09.05

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	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFG	11-Jul-19	11-Jul-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20

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

element

TbtTx 2019.08.02 XMit 2019.09.05

EUT:	**Livio 2.4 GHz Rechargeable BTE hearing aid**			**Work Order:**	**STAK0176**
Serial Number:	**190494775**			**Date:**	**19-Sep-19**
Customer:	**Starkey Laboratories, Inc.**			**Temperature:**	**22.2 °C**
Attendees:	**John Quach**			**Humidity:**	**56.4% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Kyle McMullan, Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

None

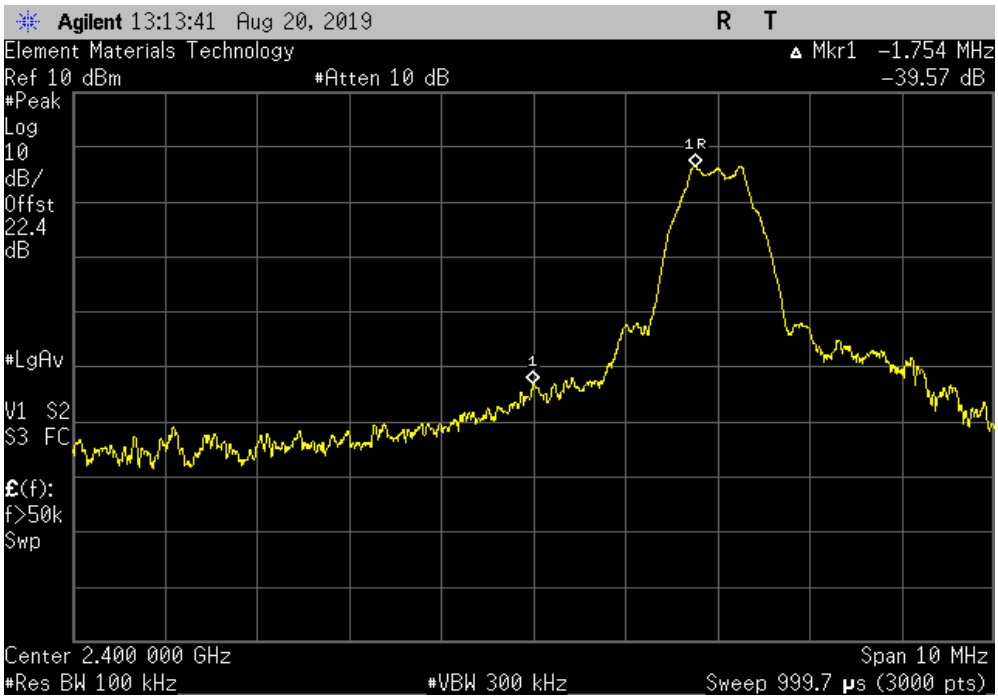
DEVIATIONS FROM TEST STANDARD

None

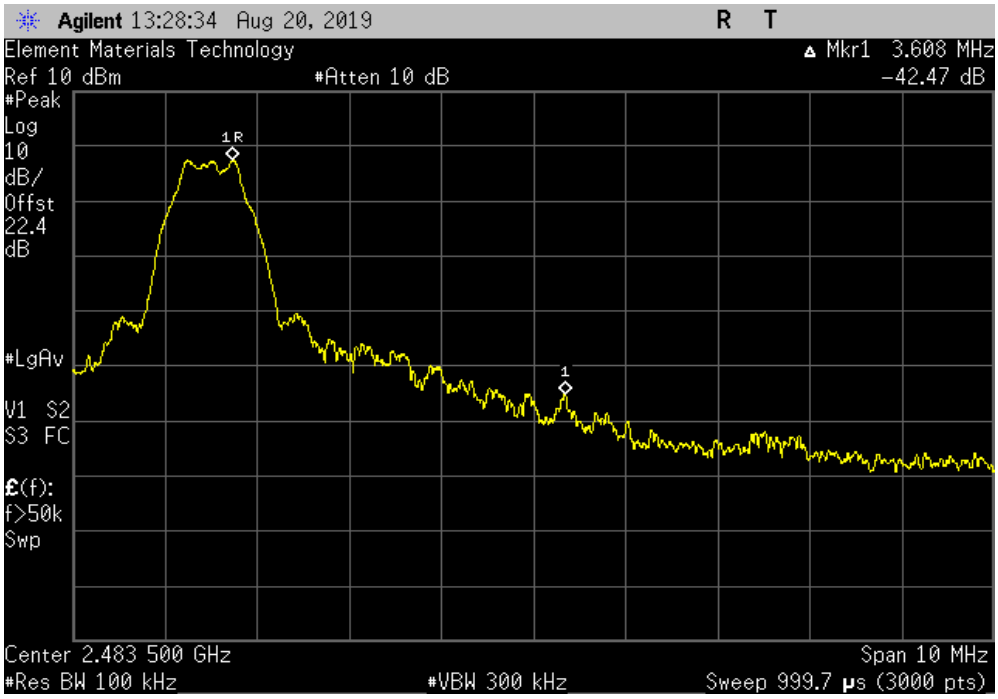
Configuration #	**3**	*Signature*

		Value (dBc)	**Limit ≤ (dBc)**	**Result**
BLE, 1 Mbps				
	BLE/GFSK Low Channel, 2402 MHz	-39.57	-20	Pass
	BLE/GFSK High Channel, 2480 MHz	-42.47	-20	Pass
BLE, 2 Mbps				
	BLE/GFSK Low Channel, 2402 MHz	-28.98	-20	Pass
	BLE/GFSK High Channel, 2480 MHz	-38.53	-20	Pass

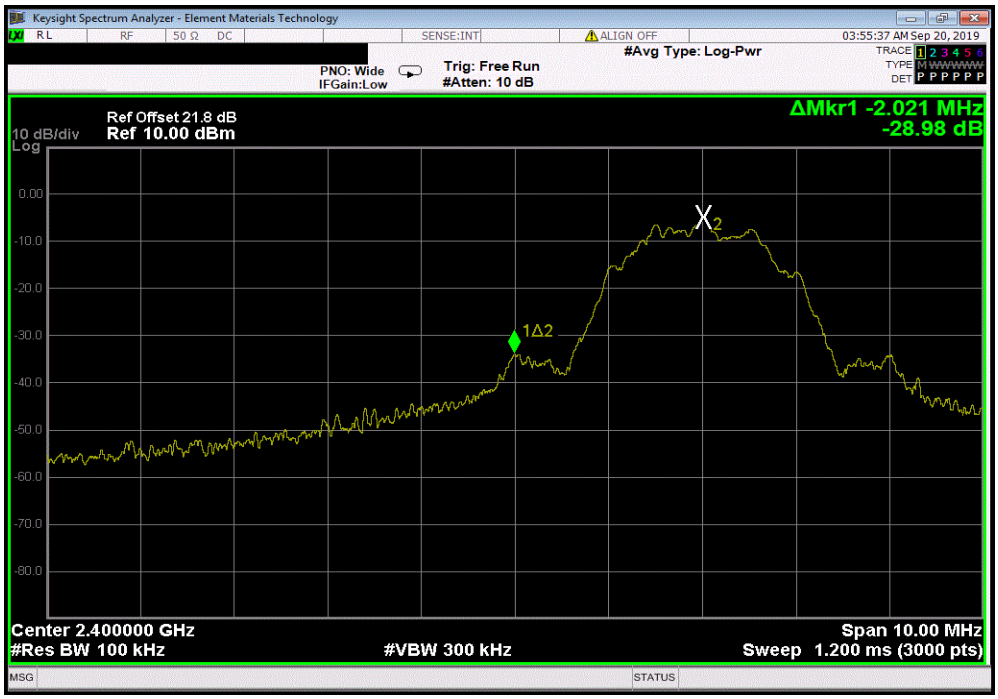
BLE, 1 Mbps, BLE/GFSK Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-39.57	-20	Pass



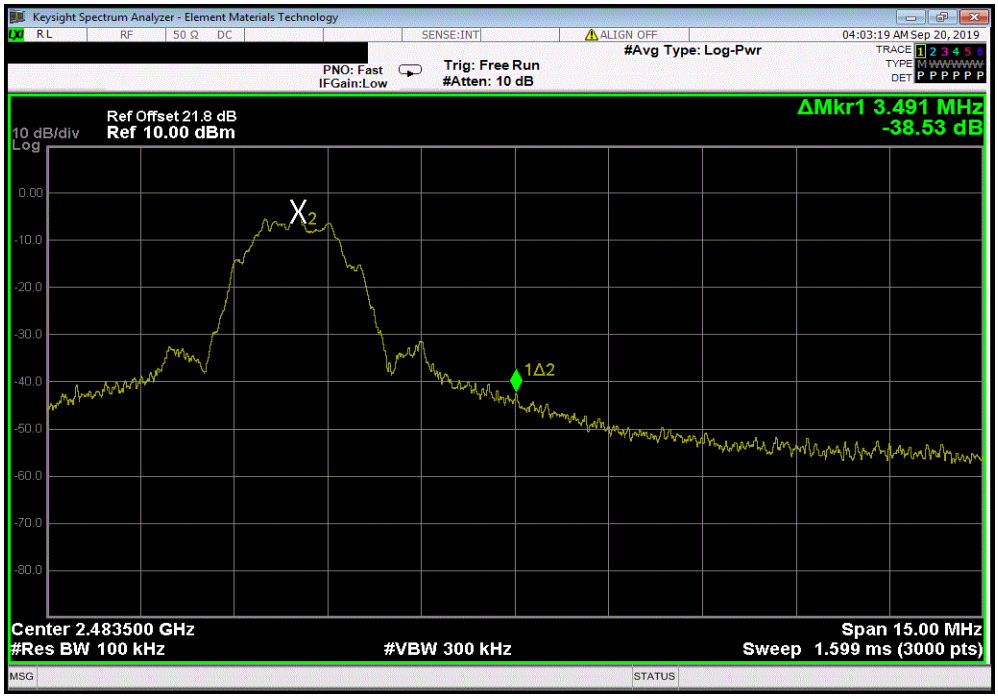
BLE, 1 Mbps, BLE/GFSK High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-42.47	-20	Pass



BLE, 2 Mbps, BLE/GFSK Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-28.98	-20	Pass



BLE, 2 Mbps, BLE/GFSK High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-38.53	-20	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2019.09.05

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	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFG	11-Jul-19	11-Jul-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20

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

element

TbtTx 2019.08.02 XMit 2019.09.05

EUT:	**Livio 2.4 GHz Rechargeable BTE hearing aid**			**Work Order:**	**STAK0176**
Serial Number:	**190494775**			**Date:**	**19-Sep-19**
Customer:	**Starkey Laboratories, Inc.**			**Temperature:**	**22.3 °C**
Attendees:	**John Quach**			**Humidity:**	**56.1% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Kyle McMullan, Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

None

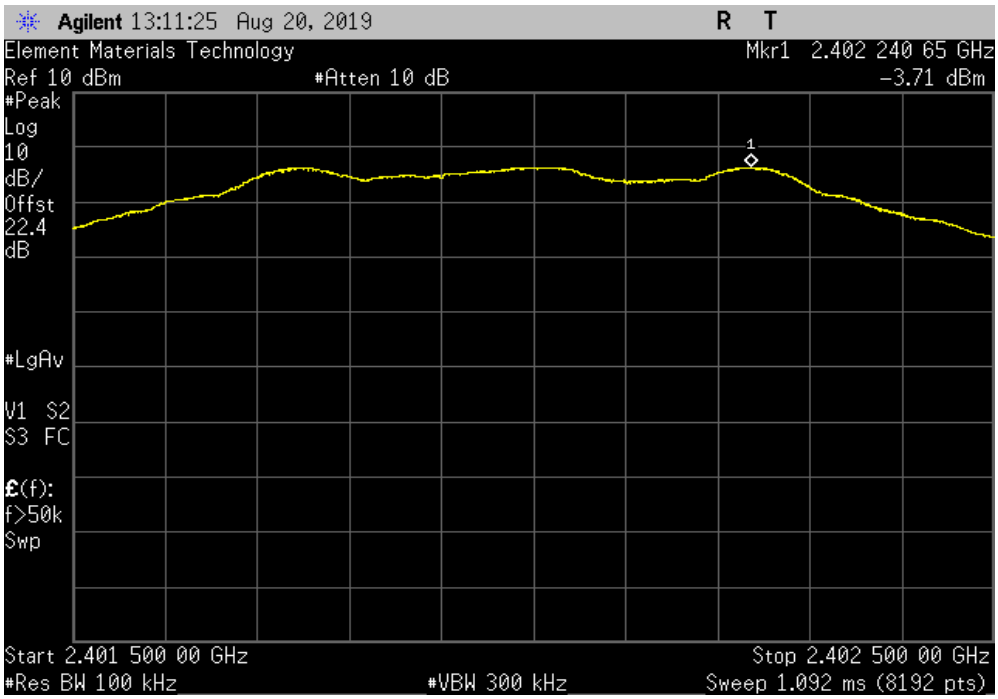
DEVIATIONS FROM TEST STANDARD

None

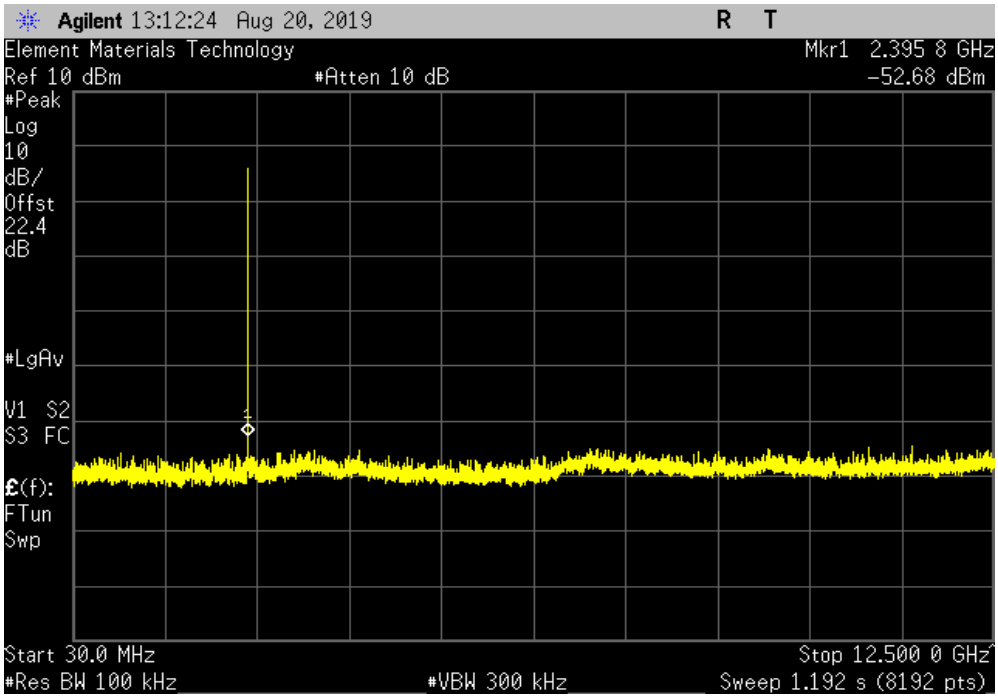
Configuration #	**3**	*Signature*

		Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
BLE, 1 Mbps						
	BLE/GFSK Low Channel, 2402 MHz	Fundamental	2402.24	N/A	N/A	N/A
	BLE/GFSK Low Channel, 2402 MHz	30 MHz - 12.5 GHz	2395.8	-48.97	-20	Pass
	BLE/GFSK Low Channel, 2402 MHz	12.5 GHz - 25 GHz	20104.4	-46.88	-20	Pass
	BLE/GFSK Mid Channel, 2442 MHz	Fundamental	2442.24	N/A	N/A	N/A
	BLE/GFSK Mid Channel, 2442 MHz	30 MHz - 12.5 GHz	3866.5	-49.95	-20	Pass
	BLE/GFSK Mid Channel, 2442 MHz	12.5 GHz - 25 GHz	24734.5	-46.38	-20	Pass
	BLE/GFSK High Channel, 2480 MHz	Fundamental	2480.24	N/A	N/A	N/A
	BLE/GFSK High Channel, 2480 MHz	30 MHz - 12.5 GHz	7561.3	-51.74	-20	Pass
	BLE/GFSK High Channel, 2480 MHz	12.5 GHz - 25 GHz	24949.6	-47.63	-20	Pass
BLE, 2 Mbps						
	BLE/GFSK Low Channel, 2402 MHz	Fundamental	2402.02	N/A	N/A	N/A
	BLE/GFSK Low Channel, 2402 MHz	30 MHz - 12.5 GHz	2397.34	-46.75	-20	Pass
	BLE/GFSK Low Channel, 2402 MHz	12.5 GHz - 25 GHz	23708.95	-46.37	-20	Pass
	BLE/GFSK Mid Channel, 2442 MHz	Fundamental	2442.02	N/A	N/A	N/A
	BLE/GFSK Mid Channel, 2442 MHz	30 MHz - 12.5 GHz	3933.44	-48.14	-20	Pass
	BLE/GFSK Mid Channel, 2442 MHz	12.5 GHz - 25 GHz	24555.92	-46.03	-20	Pass
	BLE/GFSK High Channel, 2480 MHz	Fundamental	2480.02	N/A	N/A	N/A
	BLE/GFSK High Channel, 2480 MHz	30 MHz - 12.5 GHz	3800.99	-49.63	-20	Pass
	BLE/GFSK High Channel, 2480 MHz	12.5 GHz - 25 GHz	19632.83	-47.51	-20	Pass

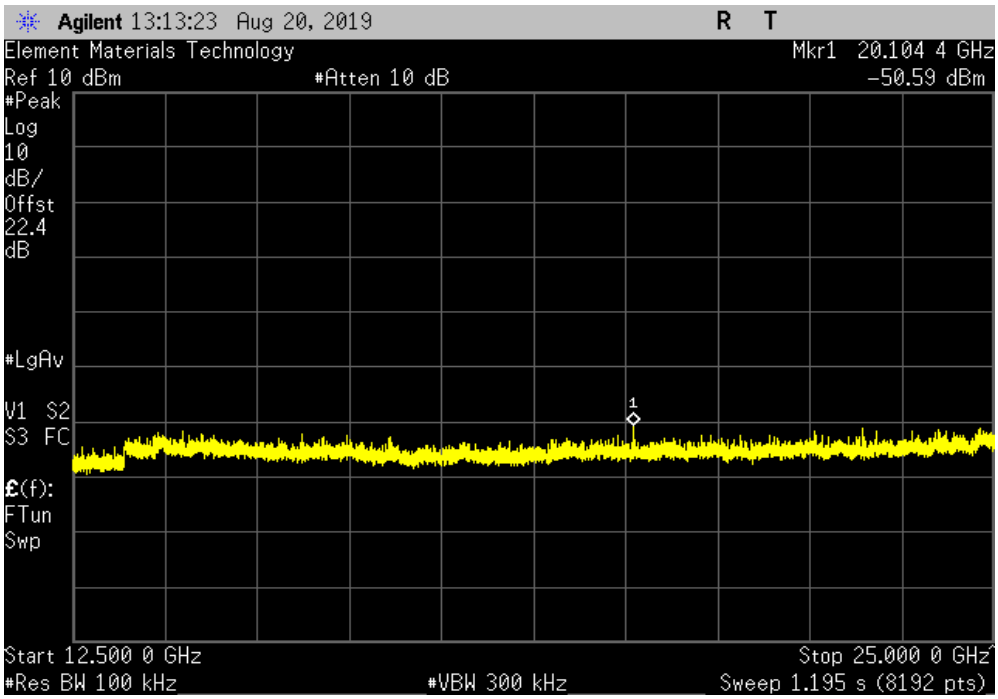
BLE, 1 Mbps, BLE/GFSK Low Channel, 2402 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	2402.24	N/A	N/A	N/A



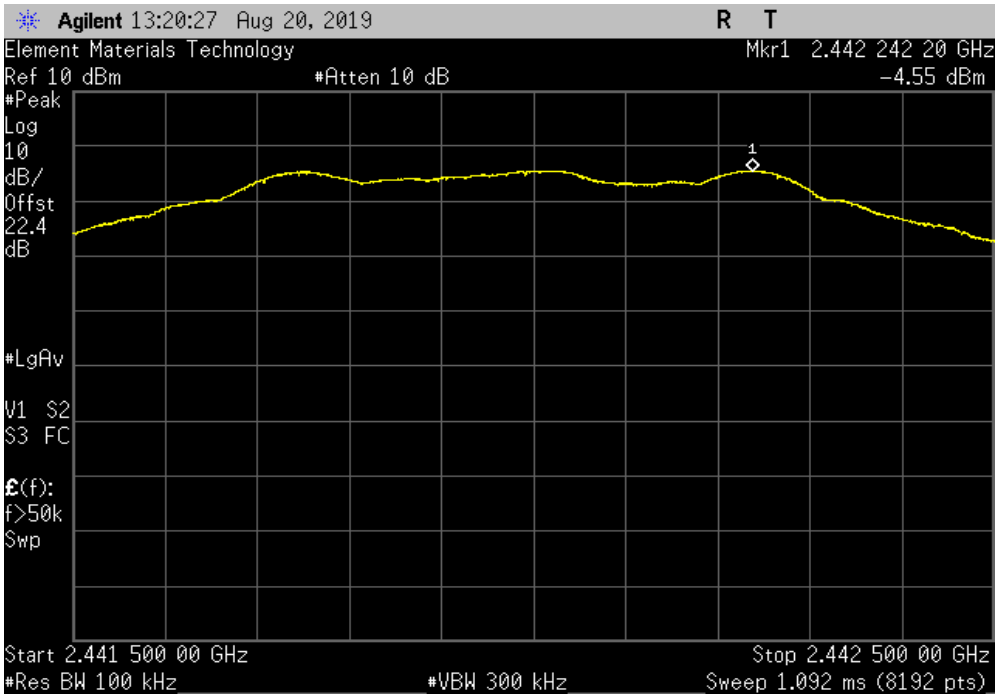
BLE, 1 Mbps, BLE/GFSK Low Channel, 2402 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	2395.8	-48.97	-20	Pass



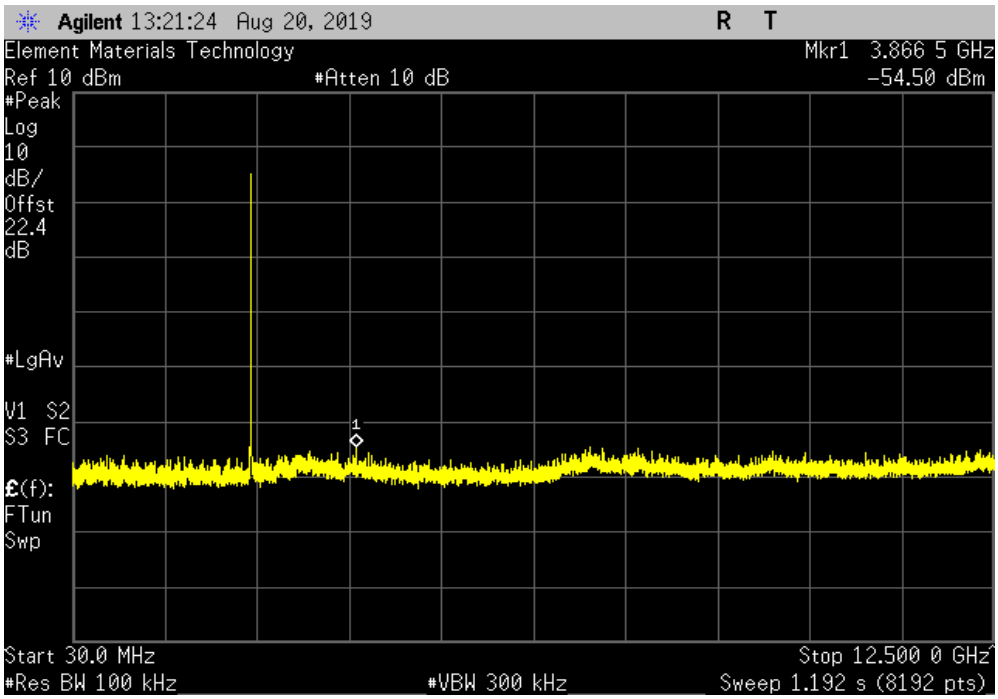
BLE, 1 Mbps, BLE/GFSK Low Channel, 2402 MHz				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz	20104.4	-46.88	-20	Pass



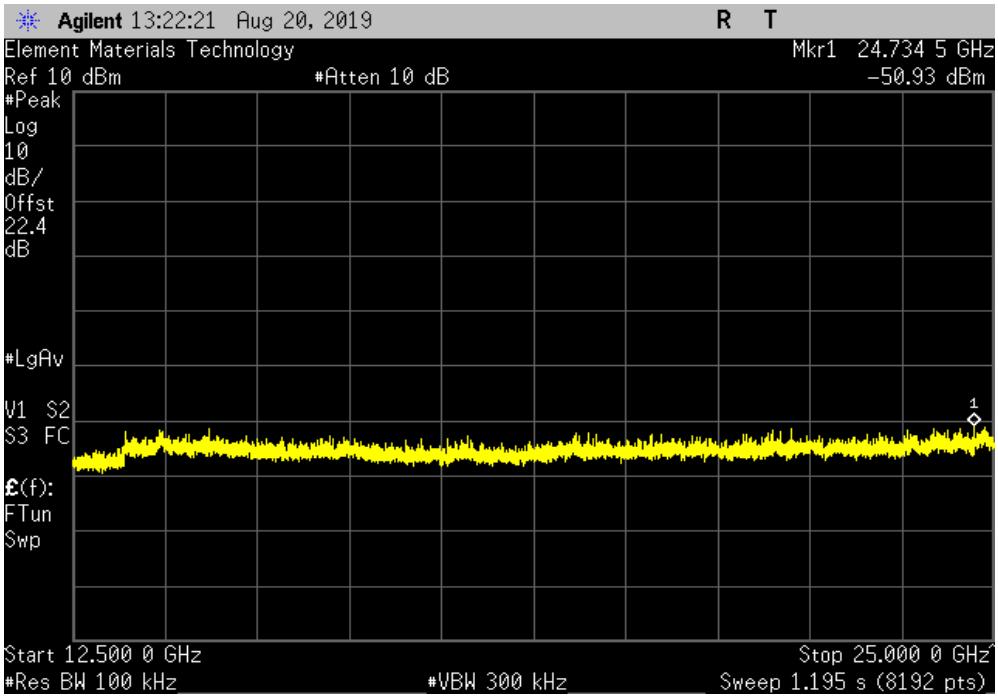
BLE, 1 Mbps, BLE/GFSK Mid Channel, 2442 MHz					
Frequency Range		**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
	Fundamental	2442.24	N/A	N/A	N/A



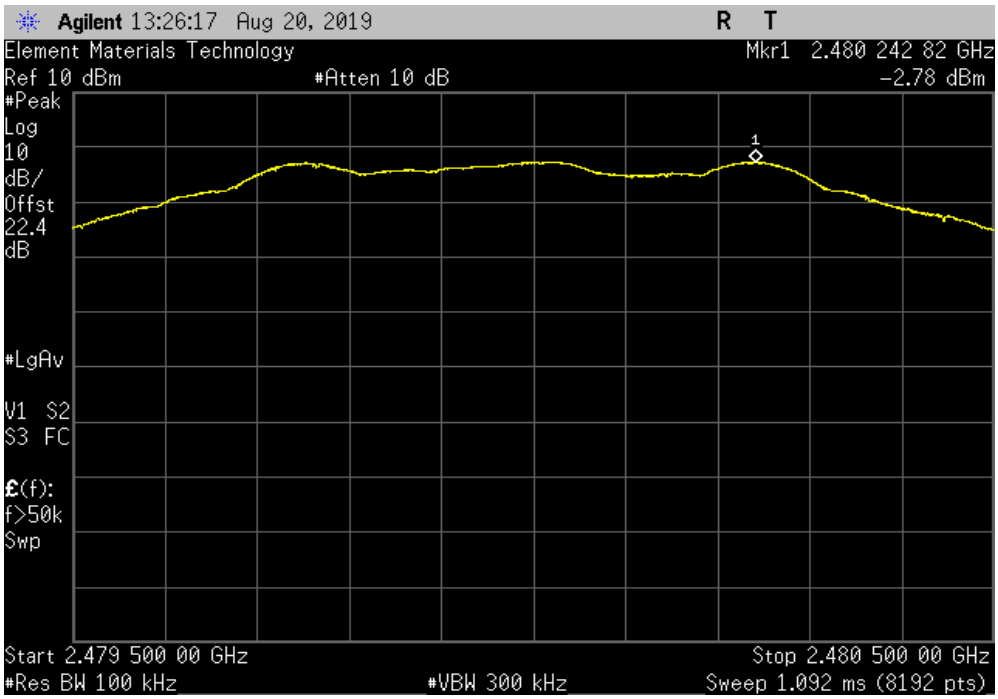
BLE, 1 Mbps, BLE/GFSK Mid Channel, 2442 MHz				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
30 MHz - 12.5 GHz	3866.5	-49.95	-20	Pass



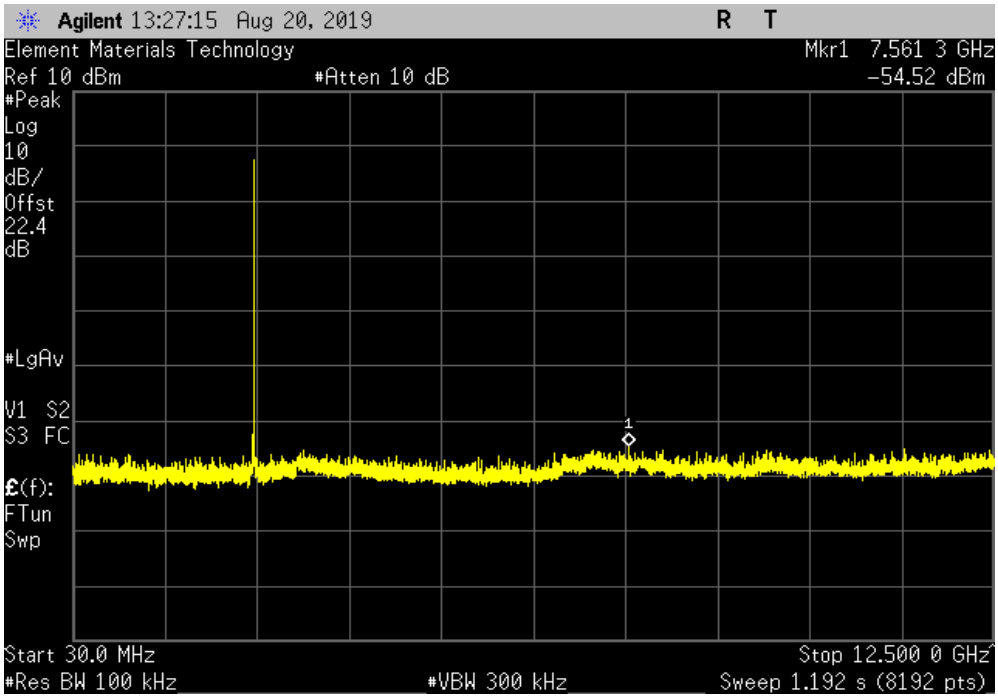
BLE, 1 Mbps, BLE/GFSK Mid Channel, 2442 MHz				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz	24734.5	-46.38	-20	Pass



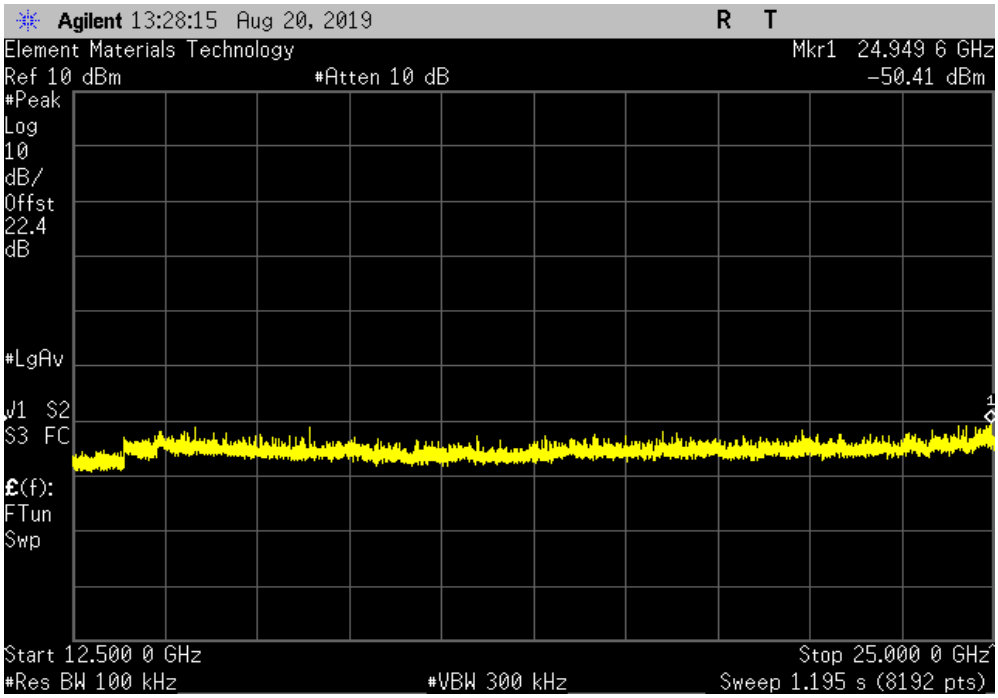
BLE, 1 Mbps, BLE/GFSK High Channel, 2480 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	2480.24	N/A	N/A	N/A



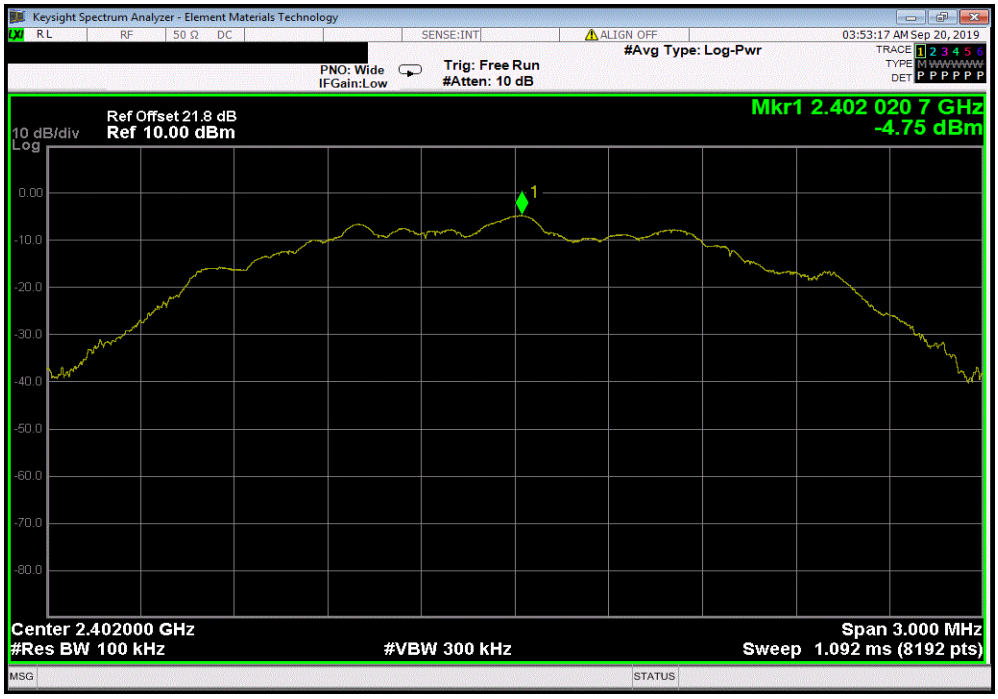
BLE, 1 Mbps, BLE/GFSK High Channel, 2480 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	7561.3	-51.74	-20	Pass



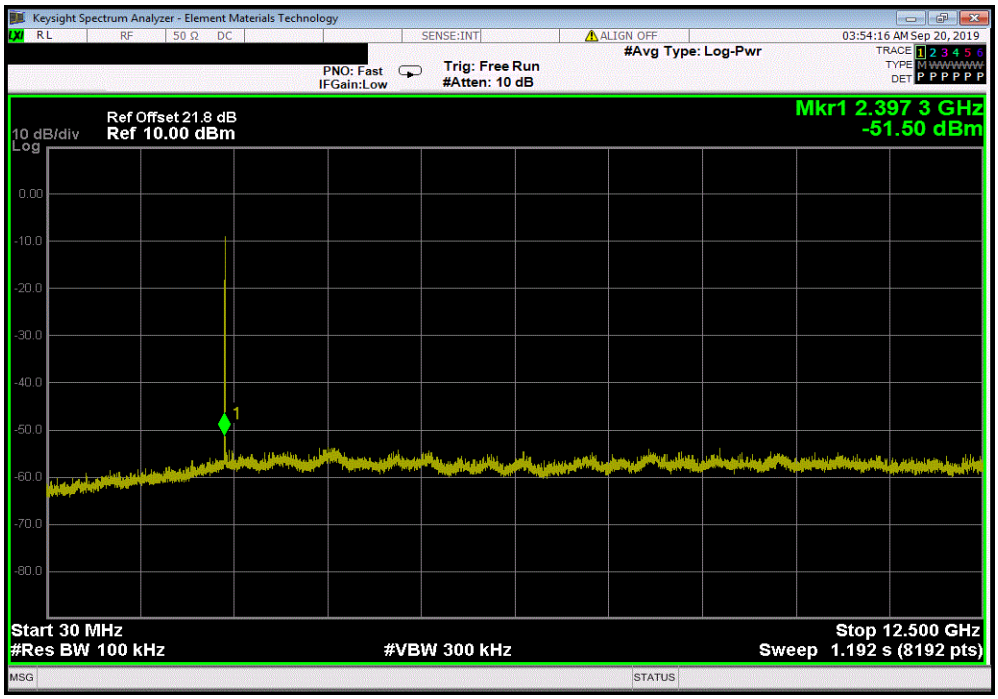
BLE, 1 Mbps, BLE/GFSK High Channel, 2480 MHz				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz	24949.6	-47.63	-20	Pass



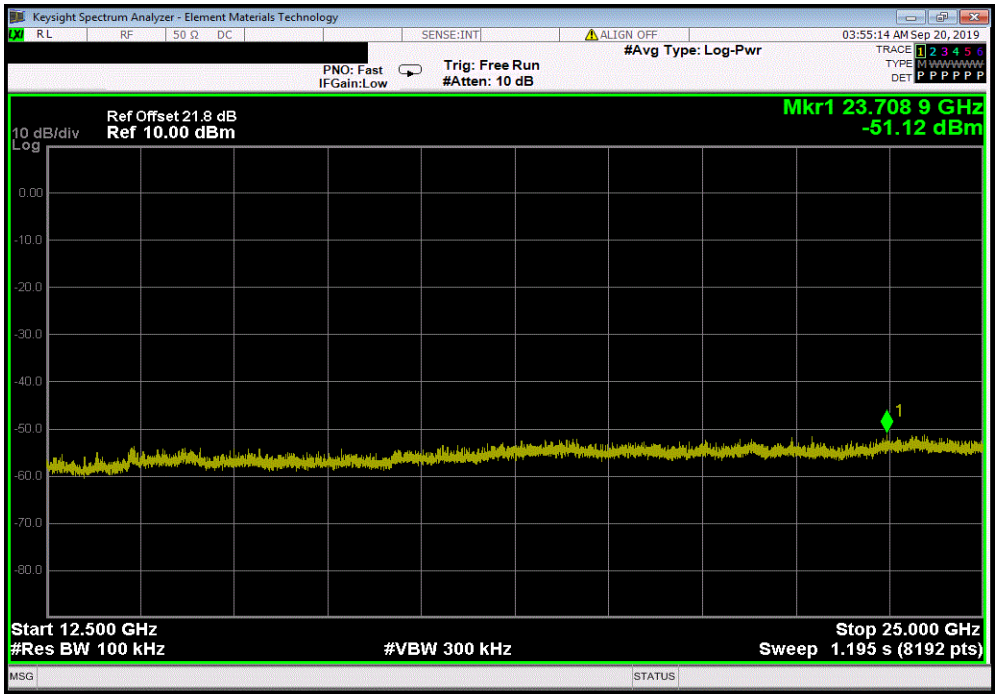
BLE, 2 Mbps, BLE/GFSK Low Channel, 2402 MHz					
Frequency Range		**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
	Fundamental	2402.02	N/A	N/A	N/A



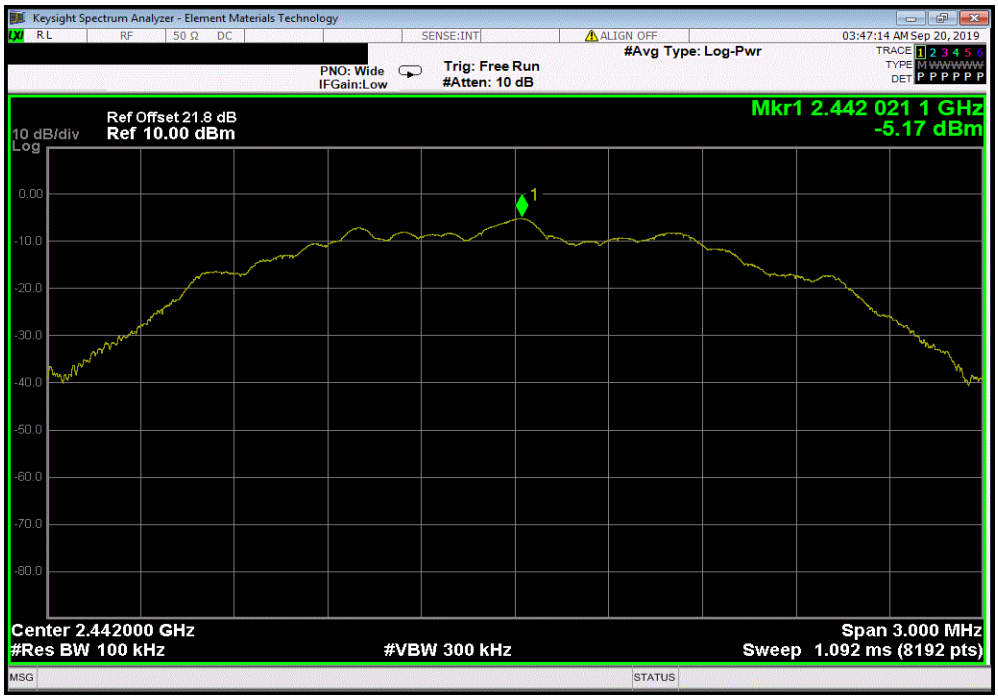
BLE, 2 Mbps, BLE/GFSK Low Channel, 2402 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	2397.34	-46.75	-20	Pass



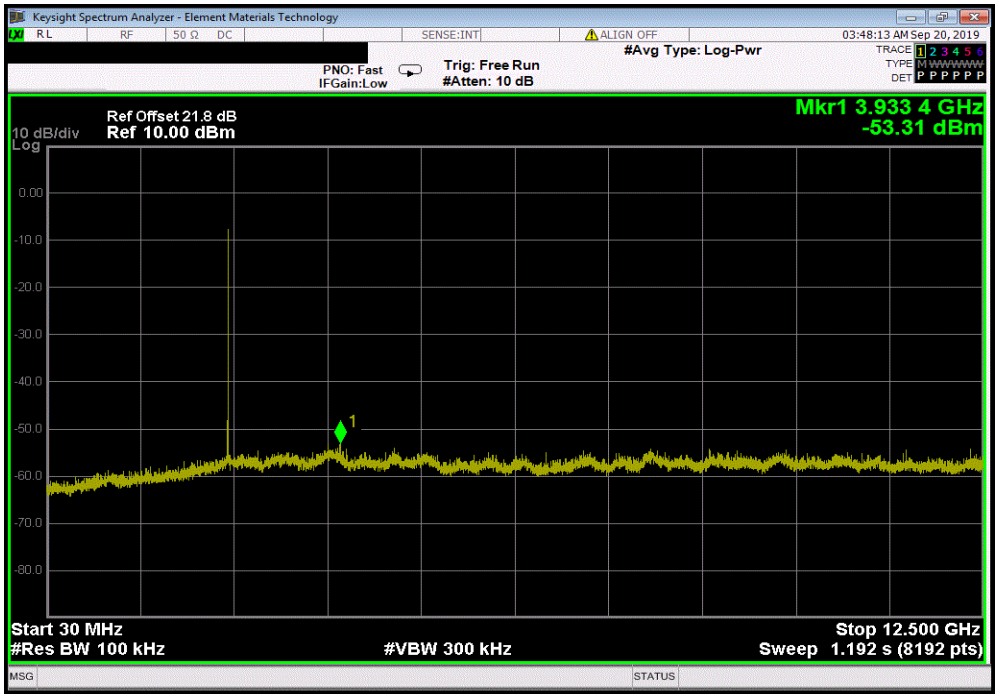
BLE, 2 Mbps, BLE/GFSK Low Channel, 2402 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	23708.95	-46.37	-20	Pass



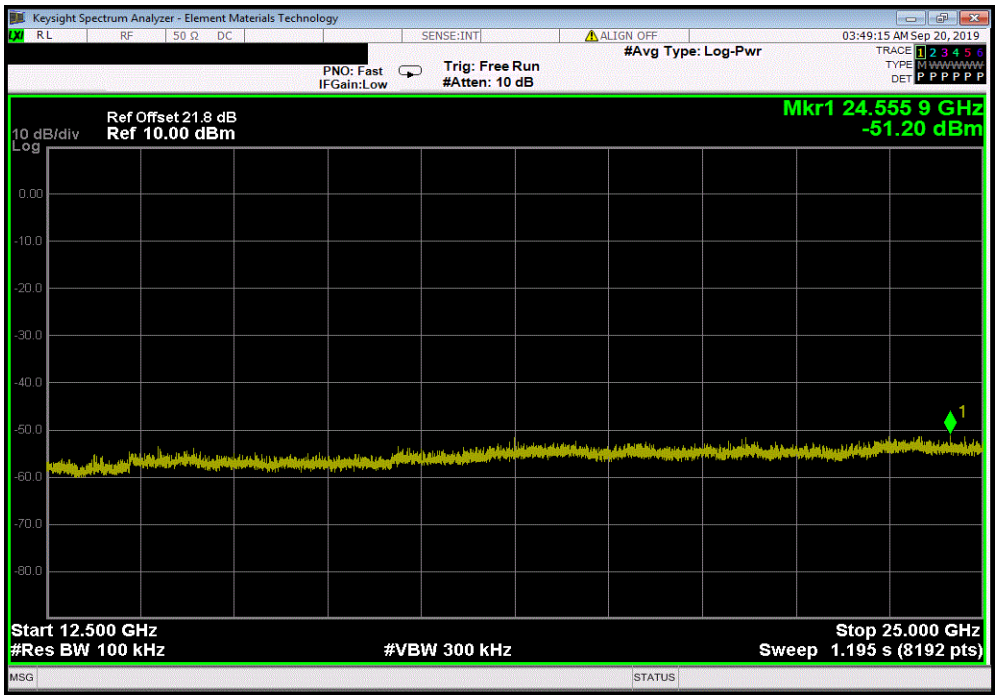
BLE, 2 Mbps, BLE/GFSK Mid Channel, 2442 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	2442.02	N/A	N/A	N/A



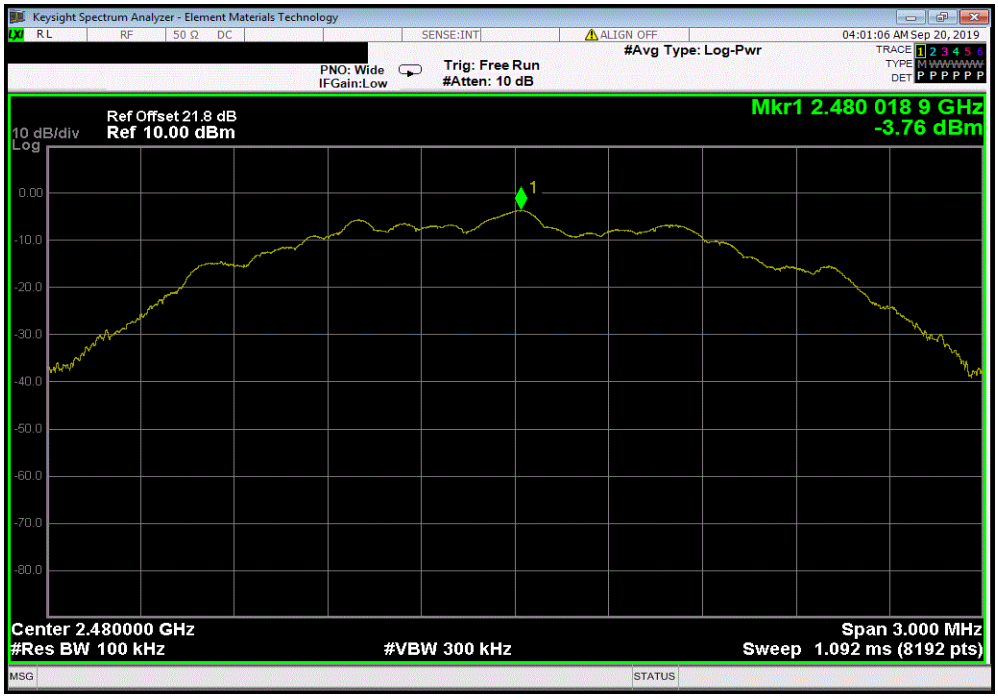
BLE, 2 Mbps, BLE/GFSK Mid Channel, 2442 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	3933.44	-48.14	-20	Pass



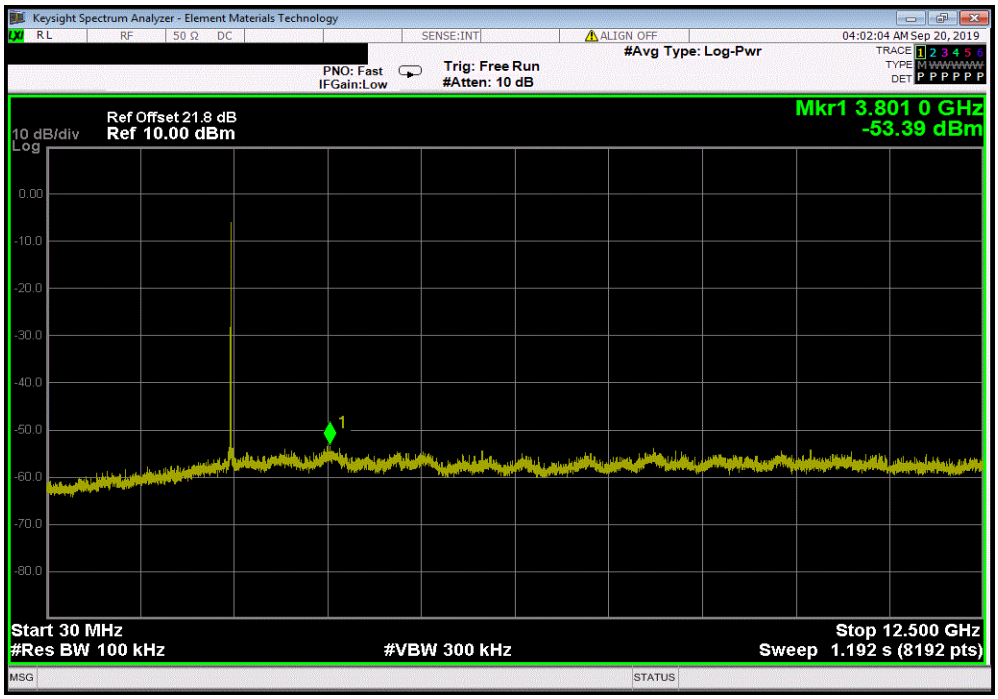
BLE, 2 Mbps, BLE/GFSK Mid Channel, 2442 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	24555.92	-46.03	-20	Pass



BLE, 2 Mbps, BLE/GFSK High Channel, 2480 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
Fundamental	2480.02	N/A	N/A	N/A



BLE, 2 Mbps, BLE/GFSK High Channel, 2480 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	3800.99	-49.63	-20	Pass



BLE, 2 Mbps, BLE/GFSK High Channel, 2480 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	19632.83	-47.51	-20	Pass