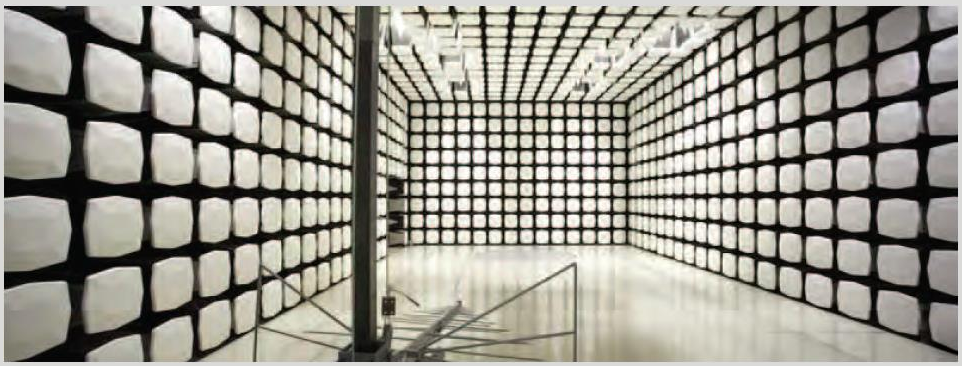
Starkey Laboratories, Inc.

Starkey Signature CIC-R

Bluetooth Left Ear Radio

FCC 15.247:2023, RSS-247 Issue 3:2023
RSS-Gen Issue 5:2018+A1:2019+A2:2021

Report: STAK0324.0 Rev. 1, Issue Date: January 26, 2024



ACCREDITED
CERT #3310.05

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element
2023.04.17

Section	Page Number

CERTIFICATE OF TEST

Last Date of Test: November 8, 2023
Starkey Laboratories, Inc.
EUT: Starkey Signature CIC-R

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023	
RSS-Gen Issue 5:2018+A1:2019+A2:2021	

Guidance

FCC KDB 558074 v05r02:2019
Notice 2021 - CEB0001

Results

Test Description	Result	FCC Section(s)	RSS Section(s)	ANSI C63.10 Section(s)	Comments
Powerline Conducted Emissions	N/A	15.207	RSS-Gen 8.8	6.2	Not required for a battery powered EUT.
Duty Cycle	Pass	KDB 558074 -6.0	RSS-Gen 3.2	11.6	
DTS Bandwidth (6 dB)	Pass	15.247(a)(2), KDB 558074 -8.2	RSS-247 5.2(a)	11.8.2	
Occupied Bandwidth (99%)	Pass	KDB 558074 -2.1	RSS-Gen 6.7	6.9.3	
Output Power	Pass	15.247(b)(3), KDB 558074 -8.3.1	RSS-247 5.4(d, f), RSS-Gen 6.12	11.9.1.1	
Equivalent Isotropic Radiated Power	Pass	15.247(b)(3), KDB 558074 -8.3.1	RSS-247 5.4(d, f), RSS-Gen 6.12	11.9.1.1	
Power Spectral Density	Pass	15.247(e), KDB 558074 -8.4	RSS-247 5.2(b)	11.10.2	
Band Edge Compliance	Pass	15.247(d), KDB 558074 -8.5	RSS-247 5.5	11.11	
Spurious Conducted Emissions	Pass	15.247(d), KDB 558074 -8.5	RSS-247 5.5	11.11	
Spurious Radiated Emissions	Pass	15.247(d), KDB 558074 - 8.6, 8.7	RSS-247 5.5, RSS-Gen 6.13, 8.10	11.12.1, 11.13.2, 6.5, 6.6	

Deviations From Test Standards

None

Approved By:

Trevor Buls

Trevor Buls, Principal EMC Test Engineer

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		
01	Corrected Specifications	26-Jan-2024	1,3,16,19,23,27,31,33,27,40,48

ACCREDITATIONS AND AUTHORIZATIONS

element
2021.09.01

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 - Each laboratory is accredited by A2LA to ISO / IEC 17025, and as a product certifier to ISO / IEC 17065 which allows Element to certify transmitters to FCC and IC specifications.

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 – Recognized as an EU Notified Body validated for the EMCD and RED Directives.

United Kingdom

BEIS – Recognized by the UK as an Approved Body under the UK Radio Equipment and UK EMC Regulations.

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

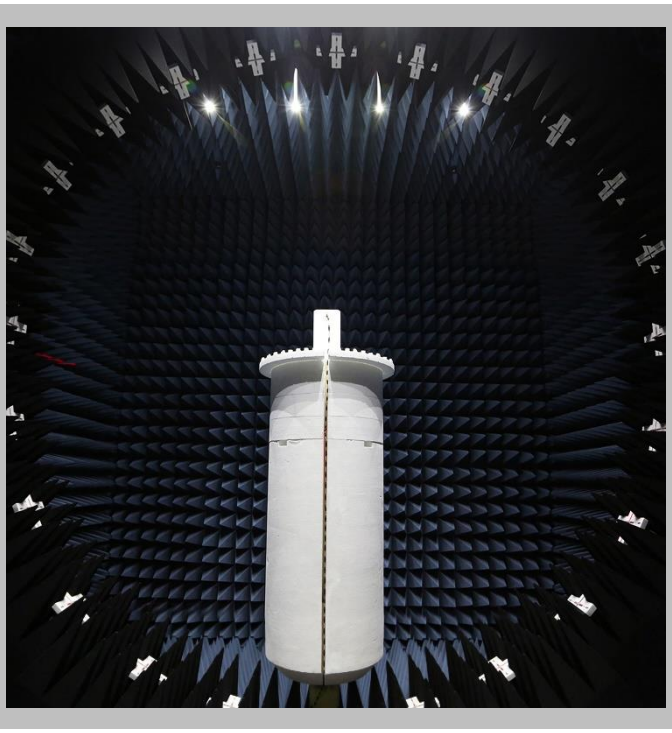
For details on the Scopes of our Accreditations, please visit:

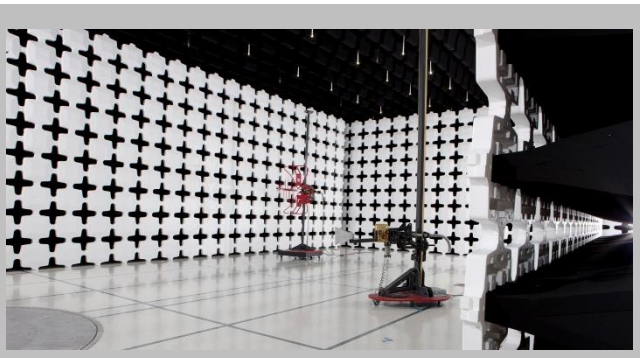
California Minnesota Oregon Texas Washington

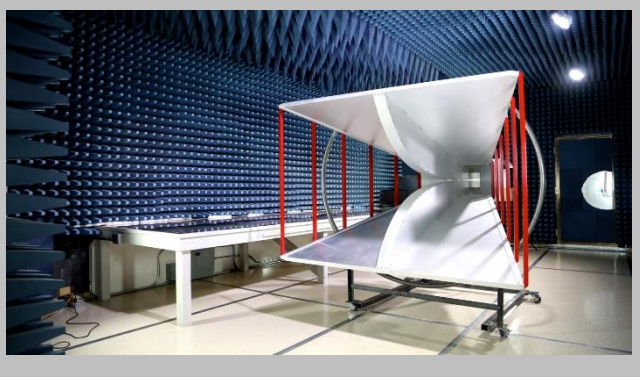
FACILITIES

element
2020.12.15

California	Minnesota	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-11 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
A2LA				
Lab Code: 3310.04	Lab Code: 3310.05	Lab Code: 3310.02	Lab Code: 3310.03	Lab Code: 3310.06
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
MU 2023-09-21

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 in the table below. A lab specific value may also be found in the applicable test description section. 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.

Various Measurements

Test	All Labs (+/-)
Frequency Accuracy (%)	0.0007
Amplitude Accuracy (dB)	1.2
Conducted Power (dB)	1.2
Radiated Power via Substitution (dB)	0.7
Temperature (degrees C)	0.7
Humidity (% RH)	2.5
Voltage (AC) (%)	1
Voltage (DC) (%)	0.7

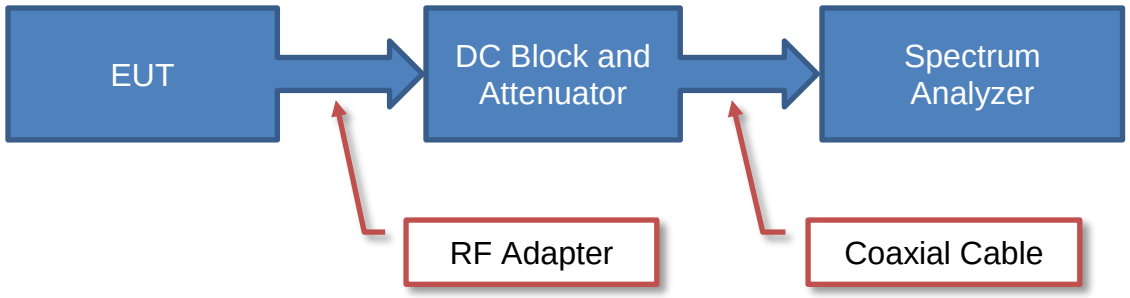
TEST SETUP BLOCK DIAGRAMS

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

Unless otherwise stated, measurements were made using the bandwidths and detectors specified. No video filter was used.

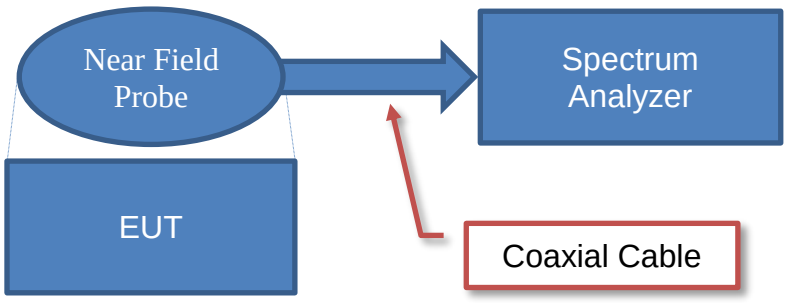
Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

Measured Value		Measured Level		Reference Level Offset
71.2	=	42.6	+	28.6

Near Field Test Fixture Measurements

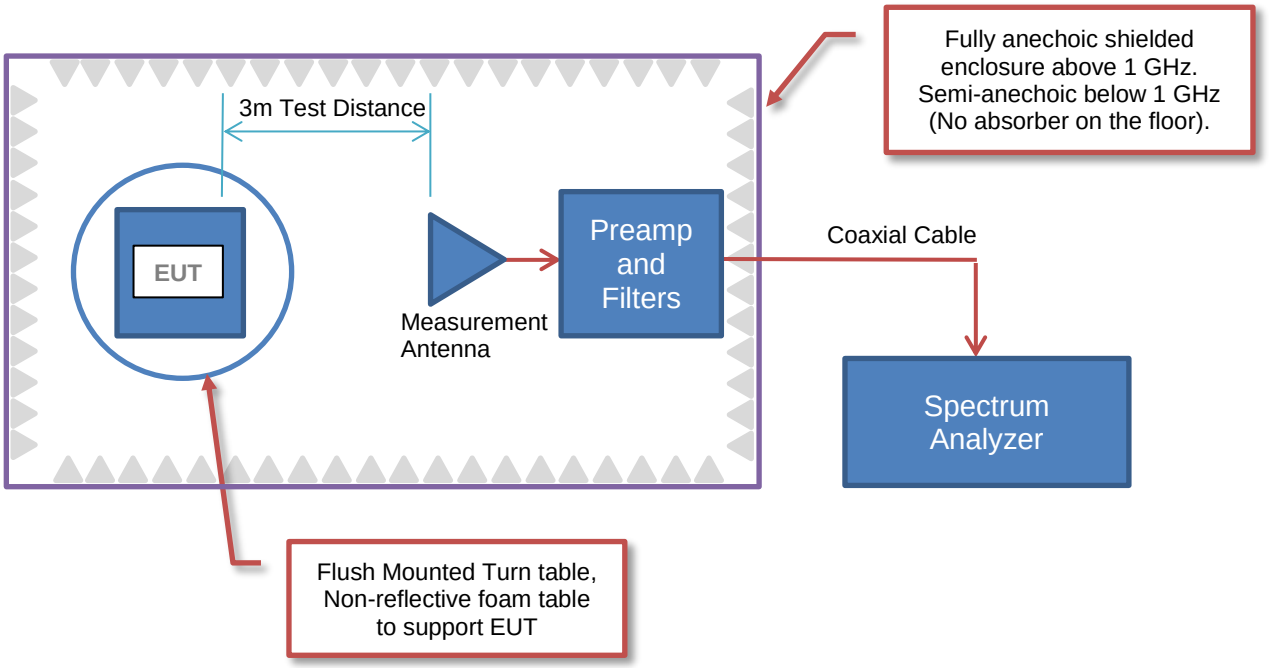


Sample Calculation (logarithmic units)

Measured Value		Measured Level		Reference Level Offset
71.2	=	42.6	+	28.6

TEST SETUP BLOCK DIAGRAMS

Emissions Measurements



Sample Calculation (logarithmic units)

Radiated Emissions:

Measured Level (Amplitude)		Factor: Antenna Factor		Factor: Cable Factor		Factor: Amplifier Gain		Distance Adjustment Factor		External Attenuation		Field Strength
42.6	+	28.6	+	3.1	-	40.8	+	0.0	+	0.0	=	**33.5**

Conducted Emissions:

Measured Level (Amplitude)		Factor: Transducer Factor		Factor: Cable Factor		External Attenuation		Adjusted Level
26.7	+	0.3	+	0.1	+	20.0	=	**47.1**

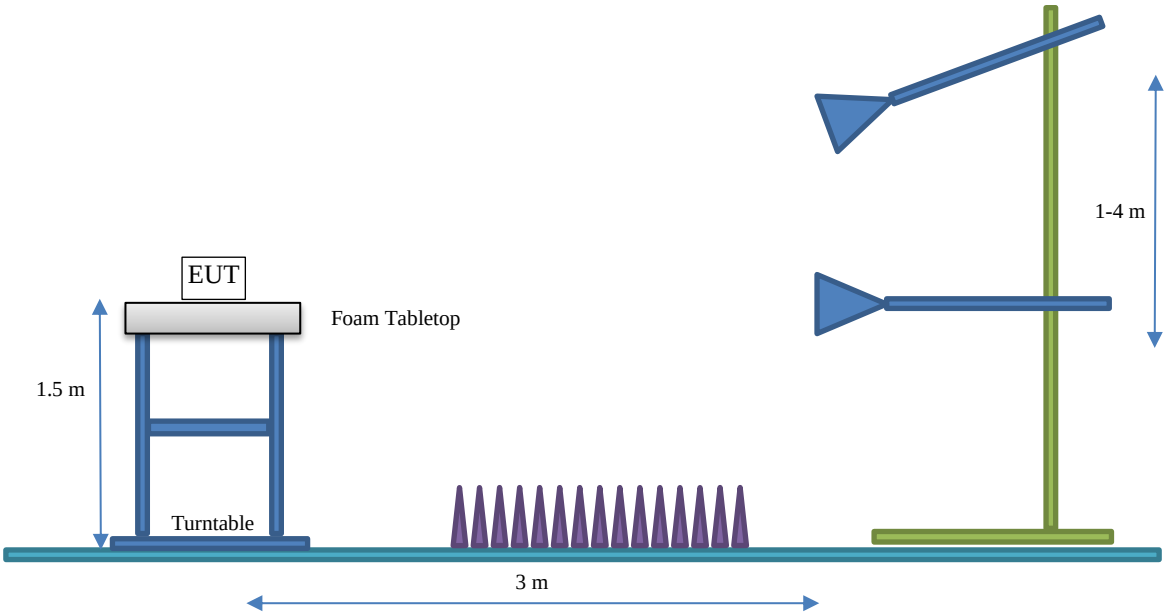
Radiated Power (ERP/EIRP) – Substitution Method:

Measured Level into Substitution Antenna (Amplitude dBm)		Substitution Antenna Factor (dBi)		EIRP to ERP (if applicable)		Measured power (dBm ERP/EIRP)
10.0	+	6.0	-	2.15	=	**13.9/16.0**

TEST SETUP BLOCK DIAGRAMS

Bore Sighting (>1GHz)

The diameter of the illumination area is the dimension of the line tangent to the EUT formed by 3 dB beamwidth of the measurement antenna at the measurement distance. At a 3 meter test distance, the diameter of the illumination area was 3.8 meters at 1 GHz and greater than 2.1 meters up to 6 GHz. Above 1 GHz, when required by the measurement standard, the antenna is pointed for both azimuth and elevation to maintain the receive antenna within the cone of radiation from the EUT. The specified measurement detectors were used for comparison of the emissions to the peak and average specification limits.



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:	Starkey Signature CIC-R
First Date of Test:	November 2, 2023
Last Date of Test:	November 8, 2023
Receipt Date of Samples:	November 2, 2023
Equipment Design Stage:	Prototype
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Hearing Aid with Bluetooth Low Energy

Testing Objective:
To demonstrate compliance of the Bluetooth Left Ear radio to FCC 15.247/RSS-247 requirements.

POWER SETTINGS AND ANTENNAS

The power settings, antenna gain value(s) and cable loss (if applicable) used for the testing contained in this report were provided by the customer and will affect the validity of the results. Element assumes no responsibility for the accuracy of this information. The power settings below reflect the maximum power that the EUT is allowed to transmit at during normal operation.

ANTENNA GAIN (dBi)

Type	Provided By:	Frequency Range (MHz)	Gain (dBi)
Flex PCB	Starkey Laboratories, Inc	2400-2483.5	-2

The EUT was tested using the power settings provided by the manufacturer which were based upon:

☒ Test software settings Test software/firmware installed on EUT: Firmware version 8.4.0.5
☐ Rated power settings

SETTINGS FOR ALL TESTS IN THIS REPORT

Modulation Types / Data Rates	Type	Channel	Frequency (MHz)	Power Setting (dBm)
BLE GFSK 1 Mbps, 2 Mbps	DTS	0 or 37	2402	+2
		20 or 18	2442	+2
		39	2480	+2

CONFIGURATIONS

Configuration STAK0324-2

Software/Firmware Running During Test	
Description	**Version**
Firmware	8.4.0.5

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Starkey Signature CIC-R (Left Ear)	Starkey Laboratories Inc	P00002130	2911338292

Configuration STAK0324-7

Software/Firmware Running During Test	
Description	**Version**
Firmware	8.4.0.5
Ignite	8.3.9.0

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Starkey Signature CIC-R (Left Ear)	Starkey Laboratories Inc	P00002130	2911338320

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Dell	Precision 5530	00329-00000-00003-AA430
Noah Link	Himsa	CPD-1	1981280195

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	Yes	1.8 m	No	Laptop	Noah Link

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2023-11-02	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	2023-11-08	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	2023-11-08	DTS 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	2023-11-08	Occupied Bandwidth (99%)	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	2023-11-08	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.
6	2023-11-08	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.
7	2023-11-08	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.
8	2023-11-08	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.
9	2023-11-08	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

DUTY CYCLE

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0

TEST DESCRIPTION

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 measurement was made using a direct connection between the RF output of the EUT and a RF Power Sensor capable of 1 million samples per second, which only measures across the high time of the burst of the carrier. The measured level was offset by the cable loss, attenuator, and DC block that was used between the power sensor and EUT. This offset was determined prior to testing using a signal generator and 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.

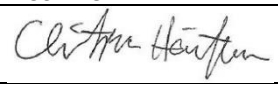
If the transmit duty cycle < 98 percent, burst gating may have been used during some of the other tests in this report to only take the measurement during the burst duration.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2023-05-01	2024-05-01
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Attenuator	Fairview Microwave	SA4014-20	AQI	2023-09-05	2024-09-05
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR
Meter - Power	ETS Lindgren	7002-008	SRA	2023-02-21	2024-02-21

DUTY CYCLE

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0

EUT:	Starkey Signature CIC-R	Work Order:	STAK0324
Serial Number:	2911338320	Date:	2023-11-08
Customer:	Starkey Laboratories, Inc.	Temperature:	22.1°C
Attendees:	John Quach	Relative Humidity:	36.6%
Customer Project:	None	Bar. Pressure (PMSL):	1006 mbar
Tested By:	Christopher Heintzelman	Job Site:	MN11
Power:	1.35VDC	Configuration:	STAK0324-7
Signature:			

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

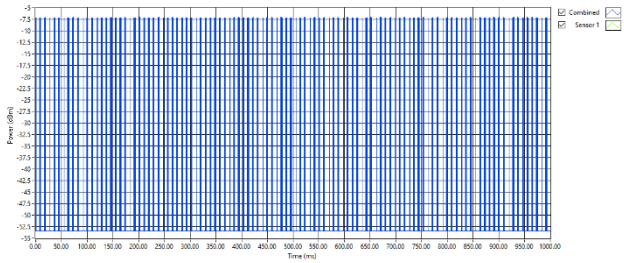
None

TEST RESULTS

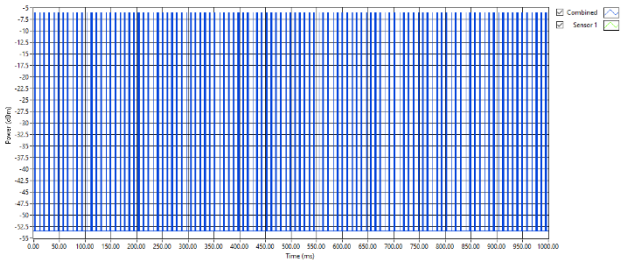
	Value (%)	Limit	Results
BLE/GFSK 1 Mbps			
Low Channel, 2402 MHz	14.83	N/A	N/A
Mid Channel, 2442 MHz	14.89	N/A	N/A
High Channel, 2480 MHz	14.799	N/A	N/A
BLE/GFSK 2 Mbps			
Low Channel, 2402 MHz	7.768	N/A	N/A
Mid Channel, 2442 MHz	8.44	N/A	N/A
High Channel, 2480 MHz	7.52	N/A	N/A

DUTY CYCLE

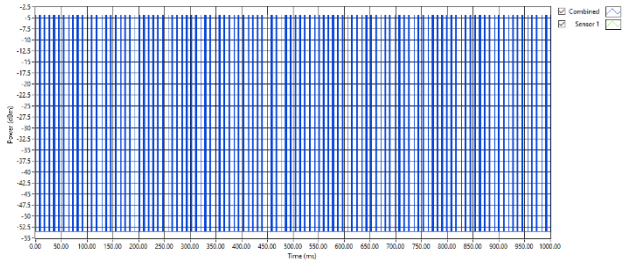
element
TbtTx 2023.10.30.0
WTD.2023.10.23.0



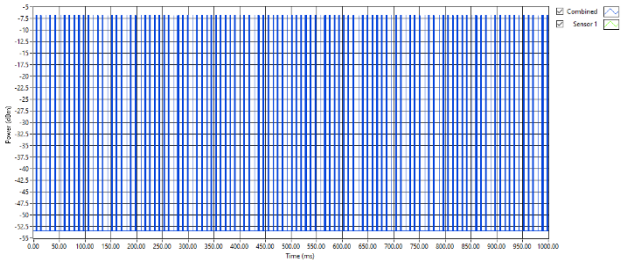
BLE/GFSK 1 Mbps
Low Channel, 2402 MHz



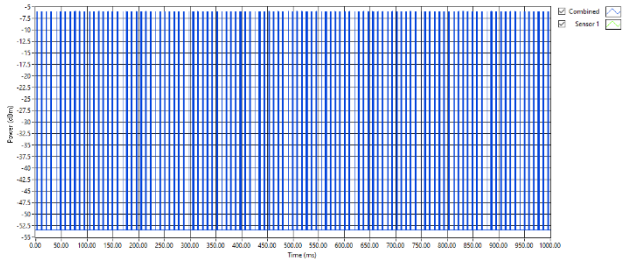
BLE/GFSK 1 Mbps
Mid Channel, 2442 MHz



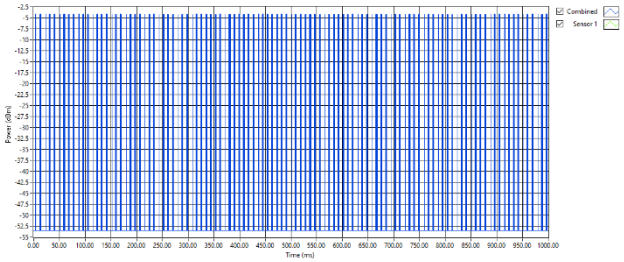
BLE/GFSK 1 Mbps
High Channel, 2480 MHz



BLE/GFSK 2 Mbps
Low Channel, 2402 MHz



BLE/GFSK 2 Mbps
Mid Channel, 2442 MHz



BLE/GFSK 2 Mbps
High Channel, 2480 MHz

DTS BANDWIDTH (6 dB)

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0

TEST DESCRIPTION

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 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.

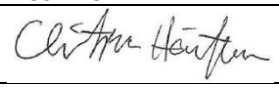
The 6dB DTS bandwidth was measured using 100 kHz resolution bandwidth and 300 kHz video bandwidth. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2023-05-01	2024-05-01
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Attenuator	Fairview Microwave	SA4014-20	AQI	2023-09-05	2024-09-05
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR

DTS BANDWIDTH (6 dB)

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0

EUT:	Starkey Signature CIC-R	Work Order:	STAK0324
Serial Number:	2911338320	Date:	2023-11-08
Customer:	Starkey Laboratories, Inc.	Temperature:	22.1°C
Attendees:	John Quach	Relative Humidity:	36.6%
Customer Project:	None	Bar. Pressure (PMSL):	1006 mbar
Tested By:	Christopher Heintzelman	Job Site:	MN11
Power:	1.35VDC	Configuration:	STAK0324-7
Signature:			

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block.

DEVIATIONS FROM TEST STANDARD

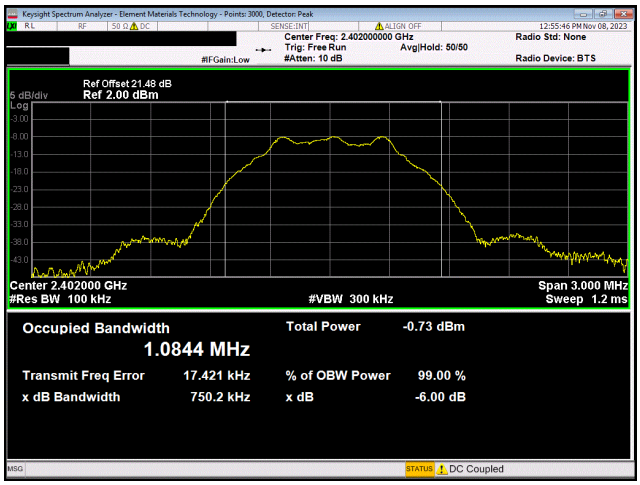
None

TEST RESULTS

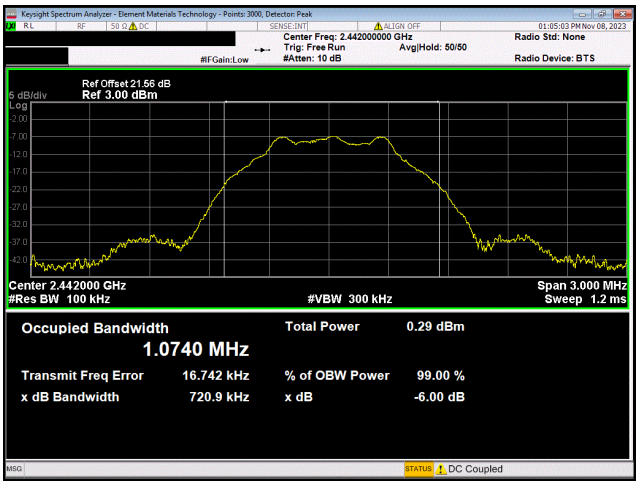
	Value	Limit (≥)	Result
BLE/GFSK 1 Mbps			
Low Channel, 2402 MHz	750.228 kHz	500 kHz	Pass
Mid Channel, 2442 MHz	720.914 kHz	500 kHz	Pass
High Channel, 2480 MHz	735.757 kHz	500 kHz	Pass
BLE/GFSK 2 Mbps			
Low Channel, 2402 MHz	1.266 MHz	500 kHz	Pass
Mid Channel, 2442 MHz	1.263 MHz	500 kHz	Pass
High Channel, 2480 MHz	1.265 MHz	500 kHz	Pass

DTS BANDWIDTH (6 dB)

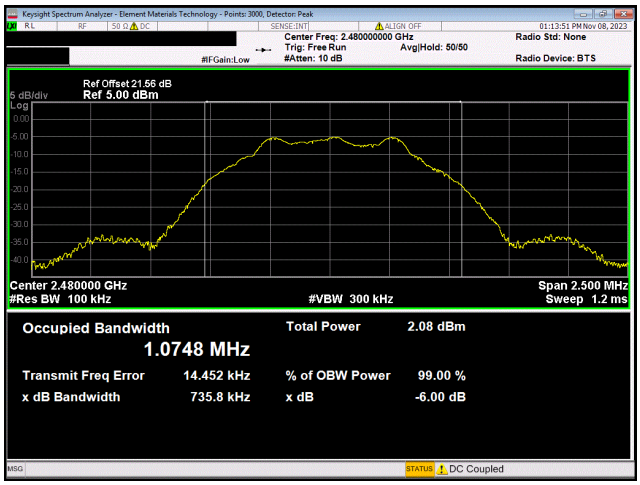
element
TbtTx 2023.10.30.0
WTD.2023.10.23.0



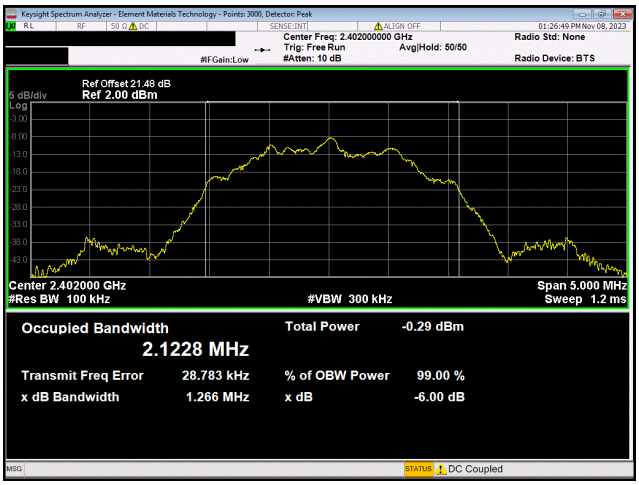
BLE/GFSK 1 Mbps
Low Channel, 2402 MHz



BLE/GFSK 1 Mbps
Mid Channel, 2442 MHz



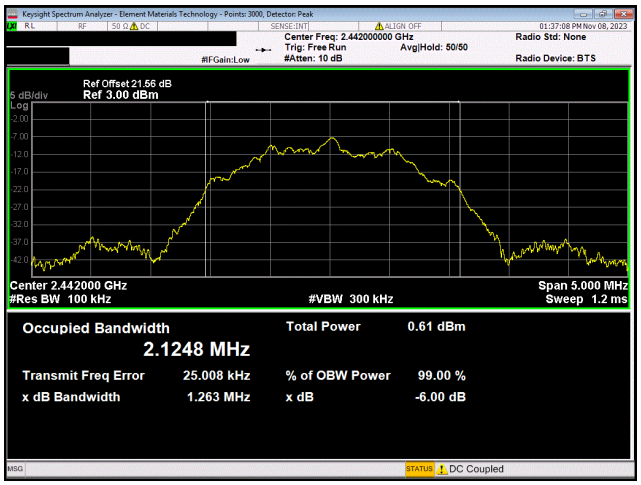
BLE/GFSK 1 Mbps
High Channel, 2480 MHz



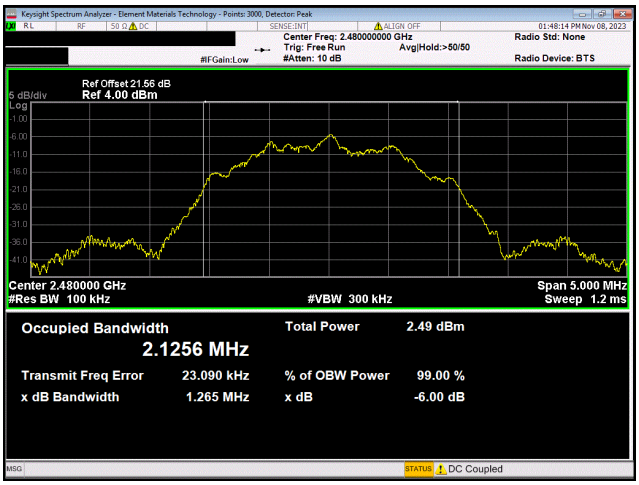
BLE/GFSK 2 Mbps
Low Channel, 2402 MHz

DTS BANDWIDTH (6 dB)

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0



BLE/GFSK 2 Mbps
Mid Channel, 2442 MHz



BLE/GFSK 2 Mbps
High Channel, 2480 MHz

OCCUPIED BANDWIDTH (99%)

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0

TEST DESCRIPTION

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

The 99% occupied bandwidth was measured with the EUT configured for continuous modulated operation.

Per ANSI C63.10:2013, 6.9.3, the spectrum analyzer was configured as follows:

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) of the spectrum analyzer was set to the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) bandwidth was set to at least 3 times the resolution bandwidth. The analyzer sweep time was set to auto to prevent video filtering or averaging. A sample detector was used unless the device was not able to be operated in a continuous transmit mode, in which case a peak detector was used.

The spectrum analyzer occupied bandwidth measurement function was used to sum the power of the transmission in linear terms to obtain the 99% bandwidth.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2023-05-01	2024-05-01
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Attenuator	Fairview Microwave	SA4014-20	AQI	2023-09-05	2024-09-05
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR

OCCUPIED BANDWIDTH (99%)

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0

EUT:	Starkey Signature CIC-R	Work Order:	STAK0324
Serial Number:	2911338320	Date:	2023-11-08
Customer:	Starkey Laboratories, Inc.	Temperature:	22.1°C
Attendees:	John Quach	Relative Humidity:	36.6%
Customer Project:	None	Bar. Pressure (PMSL):	1006 mbar
Tested By:	Christopher Heintzelman	Job Site:	MN11
Power:	1.35VDC	Configuration:	STAK0324-7
Signature:			

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block.

DEVIATIONS FROM TEST STANDARD

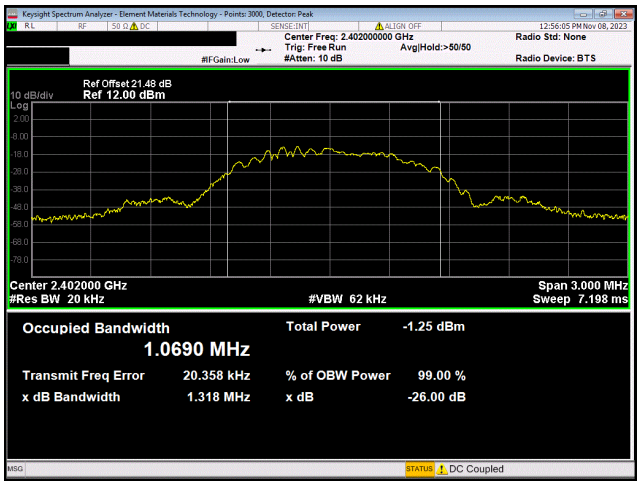
None

TEST RESULTS

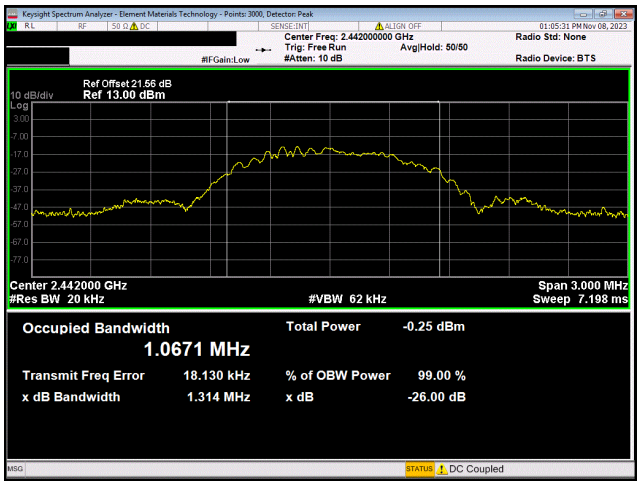
	Value	Limit	Result
BLE/GFSK 1 Mbps			
Low Channel, 2402 MHz	1.069 MHz	N/A	N/A
Mid Channel, 2442 MHz	1.067 MHz	N/A	N/A
High Channel, 2480 MHz	1.068 MHz	N/A	N/A
BLE/GFSK 2 Mbps			
Low Channel, 2402 MHz	2.137 MHz	N/A	N/A
Mid Channel, 2442 MHz	2.142 MHz	N/A	N/A
High Channel, 2480 MHz	2.139 MHz	N/A	N/A

OCCUPIED BANDWIDTH (99%)

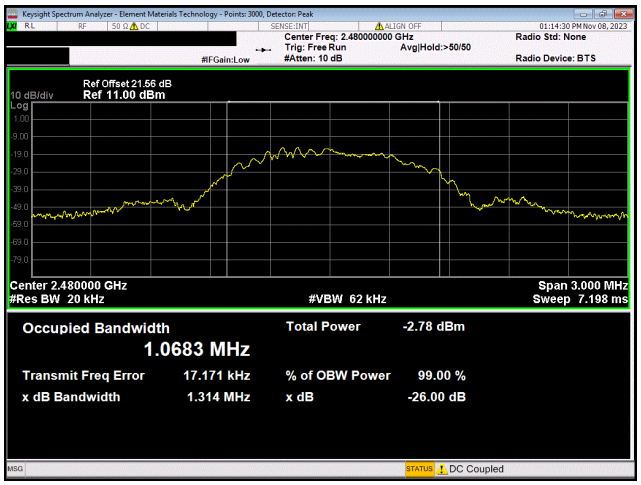
element
TbtTx 2023.10.30.0
WTD.2023.10.23.0



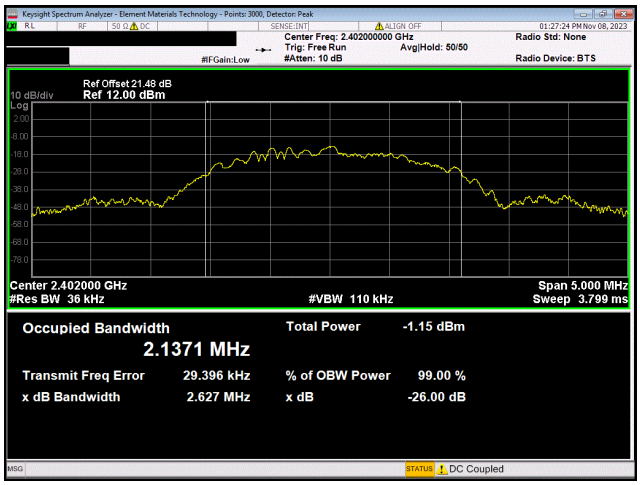
BLE/GFSK 1 Mbps
Low Channel, 2402 MHz



BLE/GFSK 1 Mbps
Mid Channel, 2442 MHz



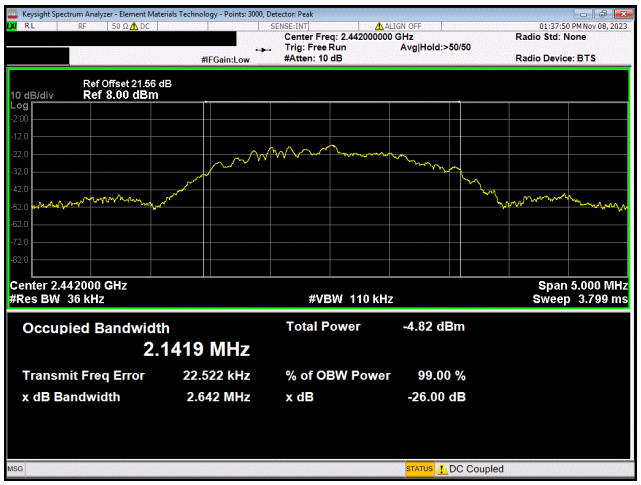
BLE/GFSK 1 Mbps
High Channel, 2480 MHz



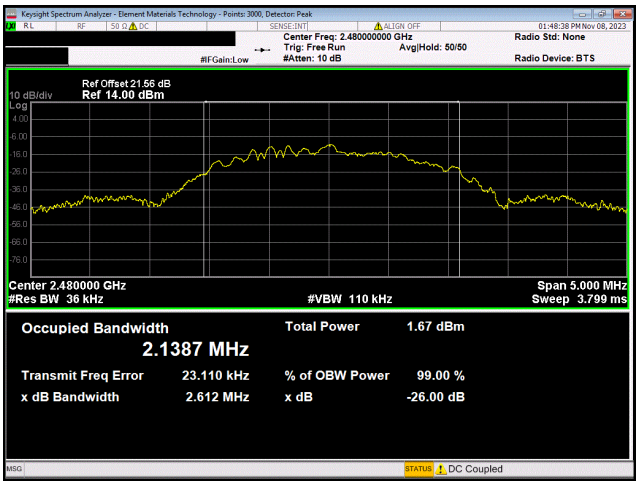
BLE/GFSK 2 Mbps
Low Channel, 2402 MHz

OCCUPIED BANDWIDTH (99%)

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0



BLE/GFSK 2 Mbps
Mid Channel, 2442 MHz



BLE/GFSK 2 Mbps
High Channel, 2480 MHz

OUTPUT POWER

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0

TEST DESCRIPTION

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 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.

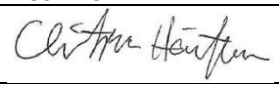
The method found in ANSI C63.10:2013 Section 11.9.1.1 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2023-05-01	2024-05-01
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Attenuator	Fairview Microwave	SA4014-20	AQI	2023-09-05	2024-09-05
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR

OUTPUT POWER

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0

EUT:	Starkey Signature CIC-R	Work Order:	STAK0324
Serial Number:	2911338320	Date:	2023-11-08
Customer:	Starkey Laboratories, Inc.	Temperature:	22°C
Attendees:	John Quach	Relative Humidity:	36.9%
Customer Project:	None	Bar. Pressure (PMSL):	1008 mbar
Tested By:	Christopher Heintzelman	Job Site:	MN11
Power:	1.35VDC	Configuration:	STAK0324-7
Signature:			

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block.

DEVIATIONS FROM TEST STANDARD

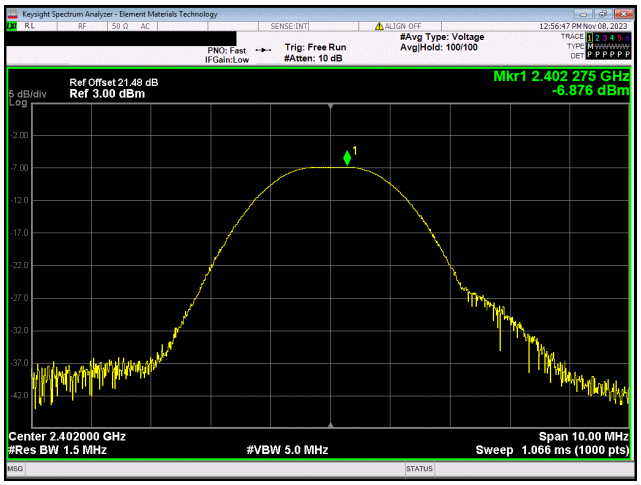
None

TEST RESULTS

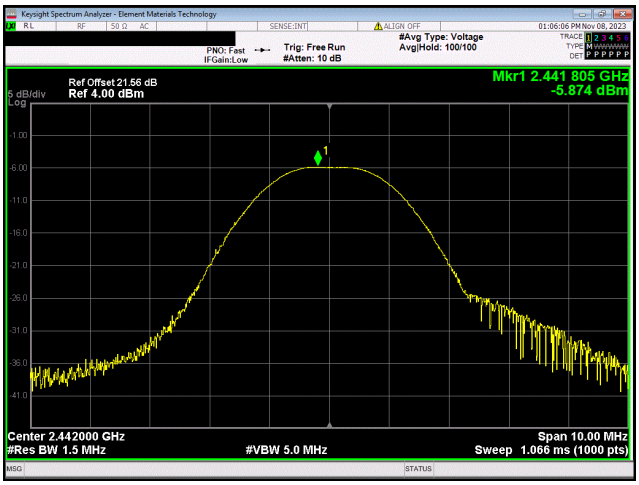
	Out Pwr (dBm)	Limit (dBm)	Result
BLE/GFSK 1 Mbps			
Low Channel, 2402 MHz	-6.876	30	Pass
Mid Channel, 2442 MHz	-5.874	30	Pass
High Channel, 2480 MHz	-4.043	30	Pass
BLE/GFSK 2 Mbps			
Low Channel, 2402 MHz	-6.785	30	Pass
Mid Channel, 2442 MHz	-5.868	30	Pass
High Channel, 2480 MHz	-3.964	30	Pass

OUTPUT POWER

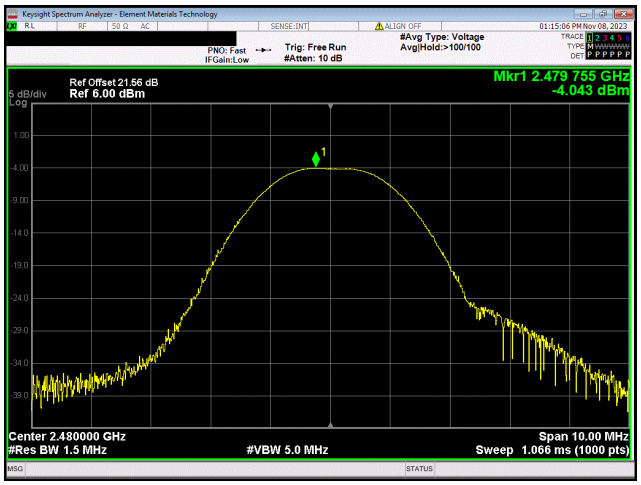
element
TbtTx 2023.10.30.0
WTD.2023.10.23.0



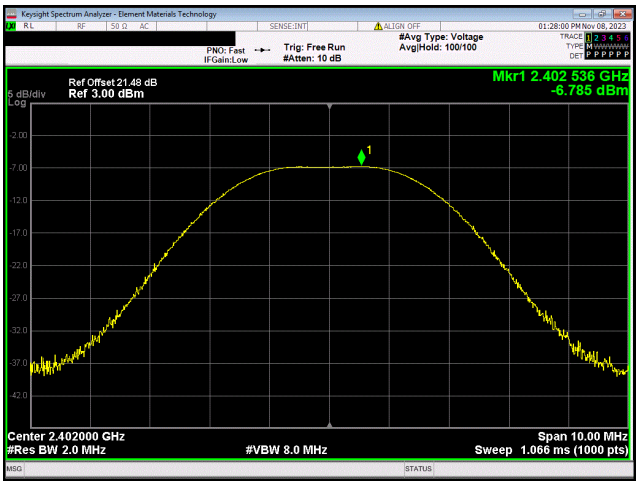
BLE/GFSK 1 Mbps
Low Channel, 2402 MHz



BLE/GFSK 1 Mbps
Mid Channel, 2442 MHz



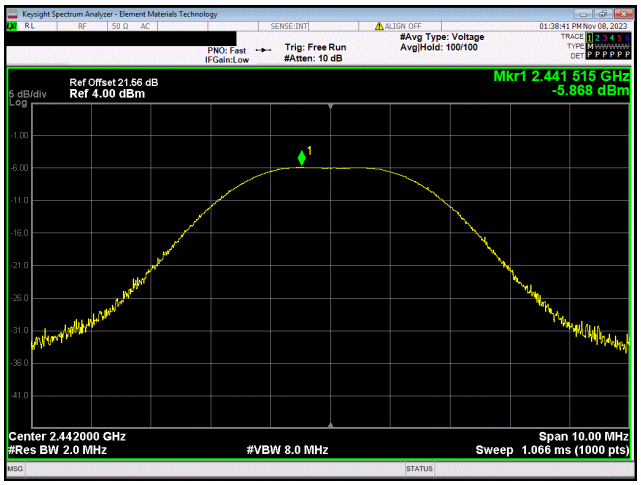
BLE/GFSK 1 Mbps
High Channel, 2480 MHz



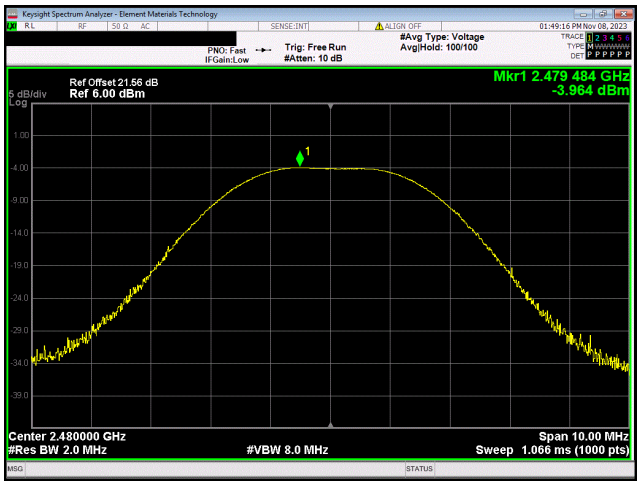
BLE/GFSK 2 Mbps
Low Channel, 2402 MHz

OUTPUT POWER

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0



BLE/GFSK 2 Mbps
Mid Channel, 2442 MHz



BLE/GFSK 2 Mbps
High Channel, 2480 MHz

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0

TEST DESCRIPTION

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 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.

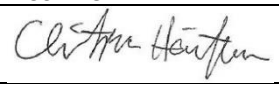
Equivalent Isotropic Radiated Power (EIRP) = Max Measured Power + Antenna gain (dBi)

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2023-05-01	2024-05-01
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Attenuator	Fairview Microwave	SA4014-20	AQI	2023-09-05	2024-09-05
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0

EUT:	Starkey Signature CIC-R	Work Order:	STAK0324
Serial Number:	2911338320	Date:	2023-11-08
Customer:	Starkey Laboratories, Inc.	Temperature:	22.1°C
Attendees:	John Quach	Relative Humidity:	36.8%
Customer Project:	None	Bar. Pressure (PMSL):	1008 mbar
Tested By:	Christopher Heintzelman	Job Site:	MN11
Power:	1.35VDC	Configuration:	STAK0324-7
Signature:			

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block.

DEVIATIONS FROM TEST STANDARD

None

TEST RESULTS

	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
BLE/GFSK 1 Mbps					
Low Channel, 2402 MHz	-6.876	-2	-8.876	36	Pass
Mid Channel, 2442 MHz	-5.874	-2	-7.874	36	Pass
High Channel, 2480 MHz	-4.043	-2	-6.043	36	Pass
BLE/GFSK 2 Mbps					
Low Channel, 2402 MHz	-6.785	-2	-8.785	36	Pass
Mid Channel, 2442 MHz	-5.868	-2	-7.868	36	Pass
High Channel, 2480 MHz	-3.964	-2	-5.964	36	Pass

POWER SPECTRAL DENSITY

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0

TEST DESCRIPTION

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 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.

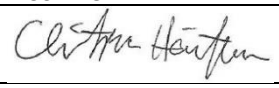
Per the procedure outlined in ANSI C63.10 the peak power spectral density was measured in a 3 kHz RBW.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2023-05-01	2024-05-01
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Attenuator	Fairview Microwave	SA4014-20	AQI	2023-09-05	2024-09-05
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR

POWER SPECTRAL DENSITY

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0

EUT:	Starkey Signature CIC-R	Work Order:	STAK0324
Serial Number:	2911338320	Date:	2023-11-08
Customer:	Starkey Laboratories, Inc.	Temperature:	22.1°C
Attendees:	John Quach	Relative Humidity:	36.1%
Customer Project:	None	Bar. Pressure (PMSL):	1008 mbar
Tested By:	Christopher Heintzelman	Job Site:	MN11
Power:	1.35VDC	Configuration:	STAK0324-7
Signature:			

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block.

DEVIATIONS FROM TEST STANDARD

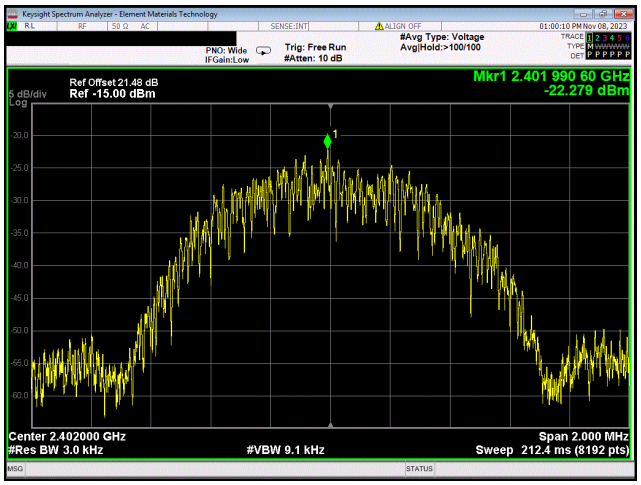
None

TEST RESULTS

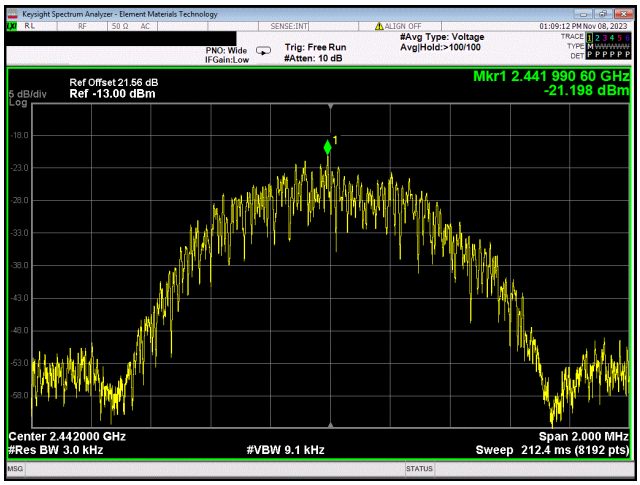
	Value dBm/3kHz	Limit ≤ (dBm/3kHz)	Results
BLE/GFSK 1 Mbps			
Low Channel, 2402 MHz	-22.279	8	Pass
Mid Channel, 2442 MHz	-21.198	8	Pass
High Channel, 2480 MHz	-19.412	8	Pass
BLE/GFSK 2 Mbps			
Low Channel, 2402 MHz	-24.696	8	Pass
Mid Channel, 2442 MHz	-23.915	8	Pass
High Channel, 2480 MHz	-21.793	8	Pass

POWER SPECTRAL DENSITY

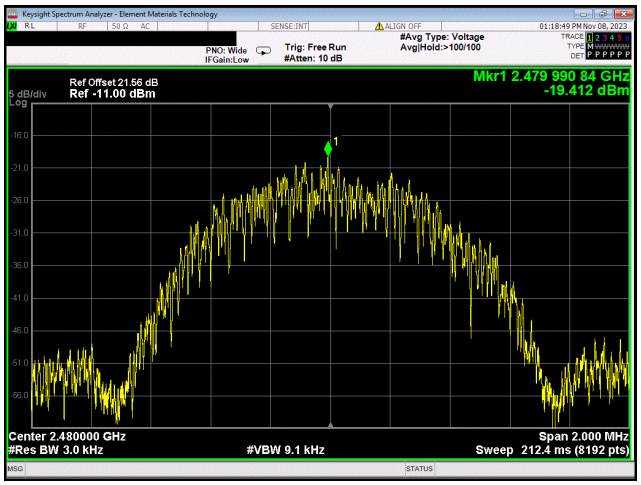
element
TbtTx 2023.10.30.0
WTD.2023.10.23.0



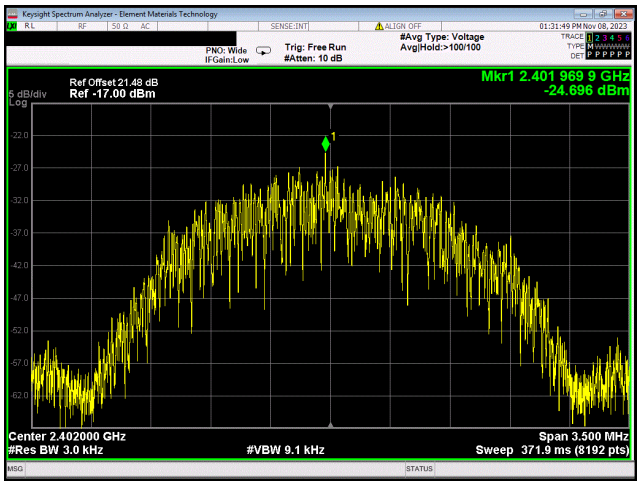
BLE/GFSK 1 Mbps
Low Channel, 2402 MHz



BLE/GFSK 1 Mbps
Mid Channel, 2442 MHz



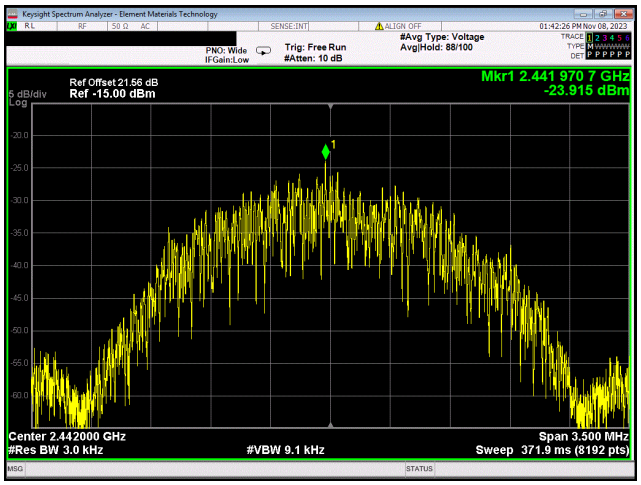
BLE/GFSK 1 Mbps
High Channel, 2480 MHz



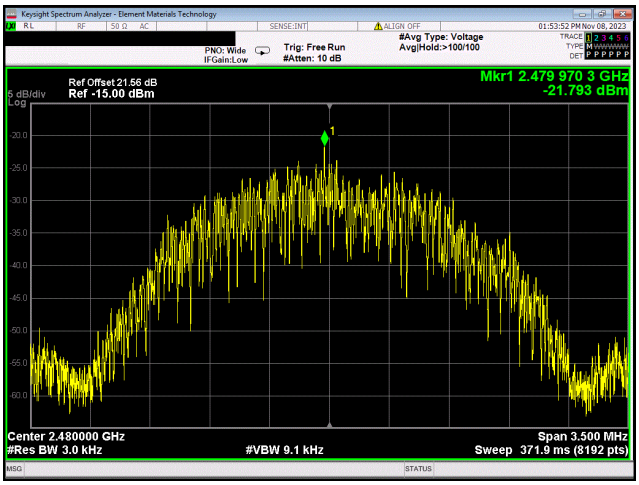
BLE/GFSK 2 Mbps
Low Channel, 2402 MHz

POWER SPECTRAL DENSITY

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0



BLE/GFSK 2 Mbps
Mid Channel, 2442 MHz



BLE/GFSK 2 Mbps
High Channel, 2480 MHz

BAND EDGE COMPLIANCE

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0

TEST DESCRIPTION

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 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.

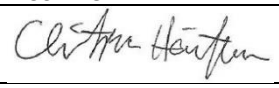
The spectrum was scanned below the lower band edge and above the higher band edge. The analyzer screen captures for this test show an example of the emission mask for the test mode also used during the radiated spurious emissions at the restricted band edges test.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2023-05-01	2024-05-01
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Attenuator	Fairview Microwave	SA4014-20	AQI	2023-09-05	2024-09-05
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR

BAND EDGE COMPLIANCE

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0

EUT:	Starkey Signature CIC-R	Work Order:	STAK0324
Serial Number:	2911338320	Date:	2023-11-08
Customer:	Starkey Laboratories, Inc.	Temperature:	22.1°C
Attendees:	John Quach	Relative Humidity:	36.1%
Customer Project:	None	Bar. Pressure (PMSL):	1008 mbar
Tested By:	Christopher Heintzelman	Job Site:	MN11
Power:	1.35VDC	Configuration:	STAK0324-7
Signature:			

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block.

DEVIATIONS FROM TEST STANDARD

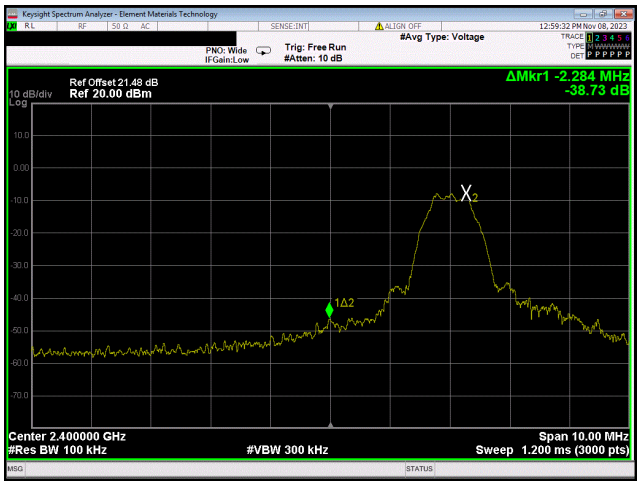
None

TEST RESULTS

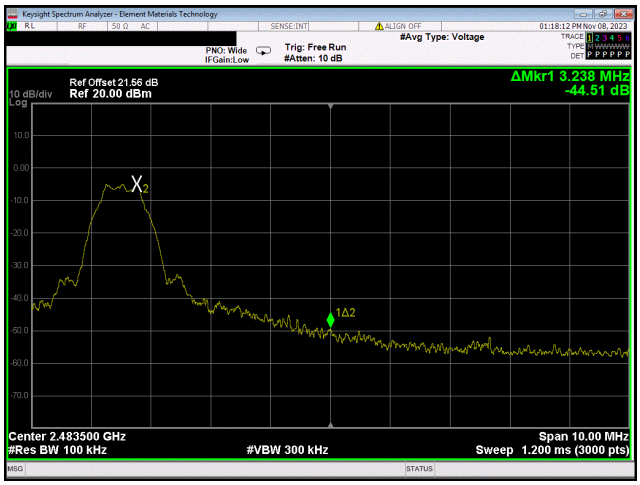
	Value (dBc)	Limit ≤ (dBc)	Result
BLE/GFSK 1 Mbps			
Low Channel, 2402 MHz	-38.73	-20	Pass
High Channel, 2480 MHz	-44.51	-20	Pass
BLE/GFSK 2 Mbps			
Low Channel, 2402 MHz	-29.43	-20	Pass
High Channel, 2480 MHz	-38.68	-20	Pass

BAND EDGE COMPLIANCE

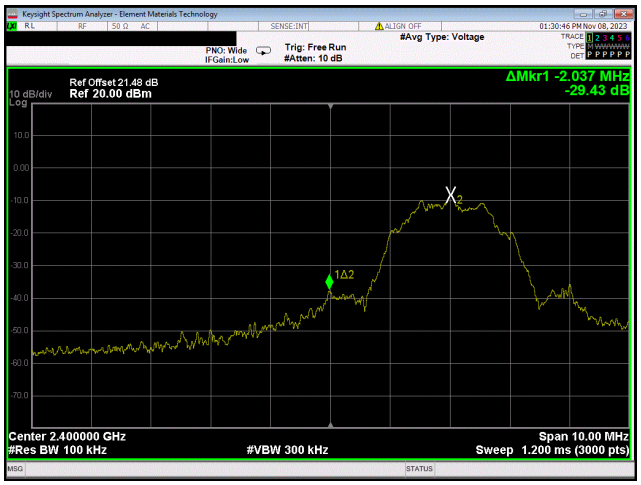
element
TbtTx 2023.10.30.0
WTD.2023.10.23.0



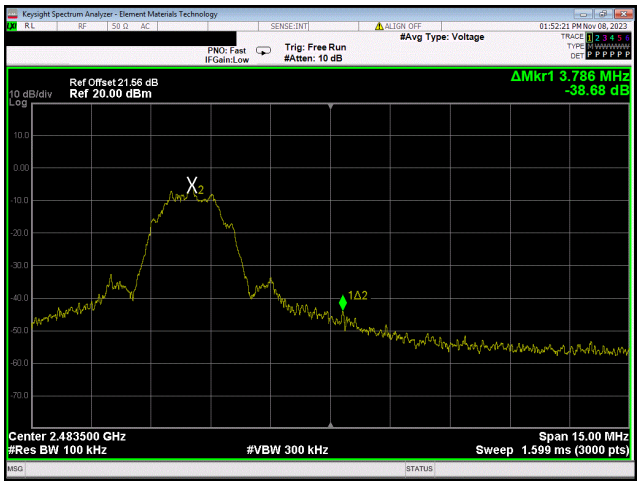
BLE/GFSK 1 Mbps
Low Channel, 2402 MHz



BLE/GFSK 1 Mbps
High Channel, 2480 MHz



BLE/GFSK 2 Mbps
Low Channel, 2402 MHz



BLE/GFSK 2 Mbps
High Channel, 2480 MHz

SPURIOUS CONDUCTED EMISSIONS

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0

TEST DESCRIPTION

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 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 fundamental was measured with a 100 kHz resolution bandwidth and the highest value was recorded. The rest of the spectrum was then measured with a 100 kHz resolution bandwidth and the highest value was found. The difference between the value found on the fundamental and the rest of the spectrum was compared against the limit to determine compliance.

The reference level offset for the fundamental screen capture was based on a measured value of the loss between the spectrum analyzer and the EUT which was verified at the time of test. The remaining screen capture(s) use an internal transducer factor on the analyzer to correct the displayed trace based on the cable loss over frequency. The reference level offset for the additional screen capture(s) is then based on the expected attenuator value and any other losses.

Fundamental Offset = Ref Lvl Offset showing measured composite factor of all losses

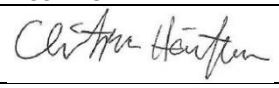
Remaining Screen capture(s) Offset = “Internal” cable loss factor not shown on screen capture + Ref Lvl Offset showing expected attenuator value and any other losses

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2023-05-01	2024-05-01
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Attenuator	Fairview Microwave	SA4014-20	AQI	2023-09-05	2024-09-05
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR

SPURIOUS CONDUCTED EMISSIONS

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0

EUT:	Starkey Signature CIC-R	Work Order:	STAK0324
Serial Number:	2911338320	Date:	2023-11-08
Customer:	Starkey Laboratories, Inc.	Temperature:	22.1°C
Attendees:	John Quach	Relative Humidity:	36%
Customer Project:	None	Bar. Pressure (PMSL):	1008 mbar
Tested By:	Christopher Heintzelman	Job Site:	MN11
Power:	1.35VDC	Configuration:	STAK0324-7
Signature:			

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block.

DEVIATIONS FROM TEST STANDARD

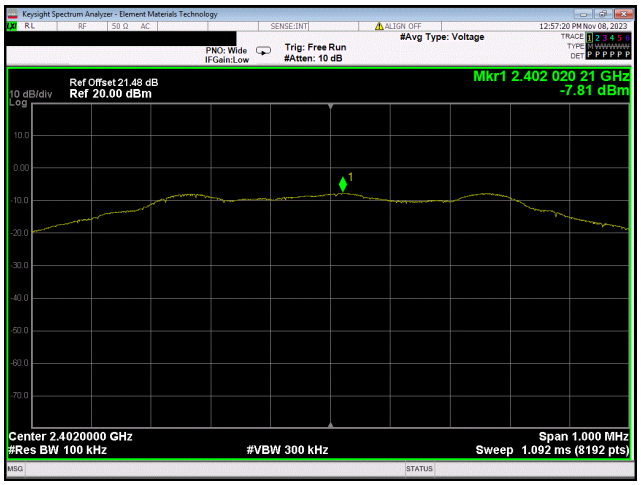
None

TEST RESULTS

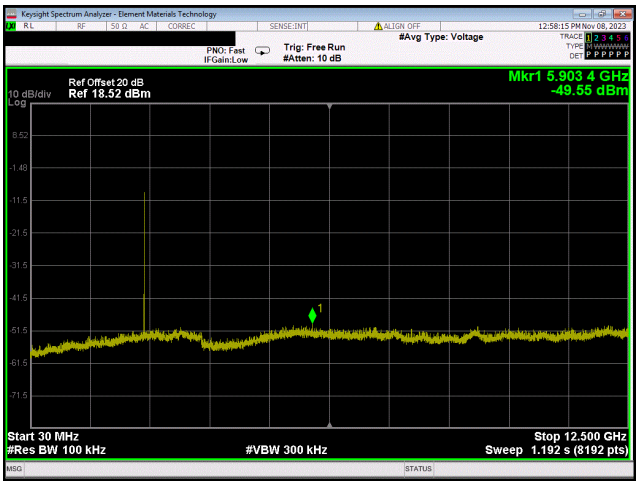
	Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
BLE/GFSK 1 Mbps					
Low Channel, 2402 MHz	Fundamental	2402.02	N/A	N/A	N/A
	30 MHz - 12.5 GHz	5903.43	-41.74	-20	Pass
	12.5 GHz - 25 GHz	24902.33	-29.83	-20	Pass
Mid Channel, 2442 MHz	Fundamental	2442.02	N/A	N/A	N/A
	30 MHz - 12.5 GHz	1850.79	-32.39	-20	Pass
	12.5 GHz - 25 GHz	24993.9	-30.25	-20	Pass
High Channel, 2480 MHz	Fundamental	2480.03	N/A	N/A	N/A
	30 MHz - 12.5 GHz	1850.79	-31.8	-20	Pass
	12.5 GHz - 25 GHz	24758.88	-32.8	-20	Pass
BLE/GFSK 2 Mbps					
Low Channel, 2402 MHz	Fundamental	2402.02	N/A	N/A	N/A
	30 MHz - 12.5 GHz	1753.36	-32.98	-20	Pass
	12.5 GHz - 25 GHz	24967.95	-29.23	-20	Pass
Mid Channel, 2442 MHz	Fundamental	2442.02	N/A	N/A	N/A
	30 MHz - 12.5 GHz	7549.15	-42.23	-20	Pass
	12.5 GHz - 25 GHz	24897.75	-30.34	-20	Pass
High Channel, 2480 MHz	Fundamental	2480.01	N/A	N/A	N/A
	30 MHz - 12.5 GHz	1753.36	-35.18	-20	Pass
	12.5 GHz - 25 GHz	24888.6	-32.28	-20	Pass

SPURIOUS CONDUCTED EMISSIONS

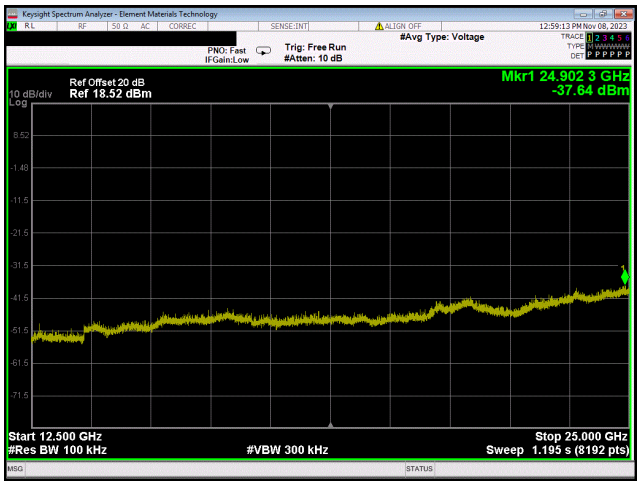
element
TbtTx 2023.10.30.0
WTD.2023.10.23.0



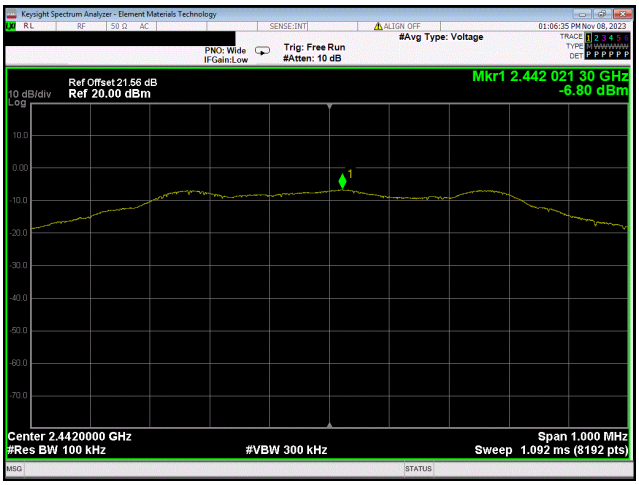
BLE/GFSK 1 Mbps
Low Channel, 2402 MHz



BLE/GFSK 1 Mbps
Low Channel, 2402 MHz



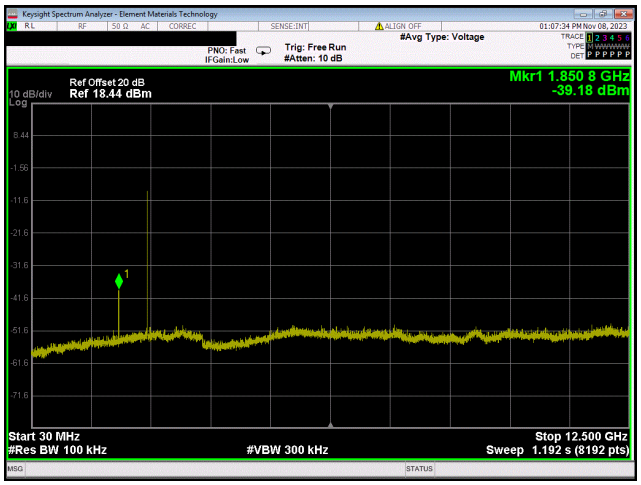
BLE/GFSK 1 Mbps
Low Channel, 2402 MHz



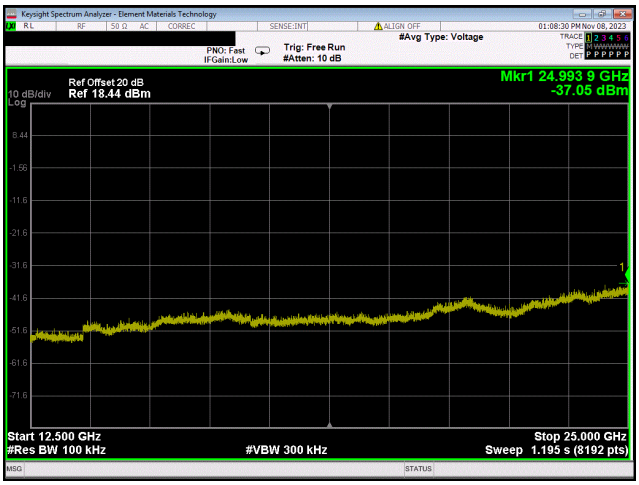
BLE/GFSK 1 Mbps
Mid Channel, 2442 MHz

SPURIOUS CONDUCTED EMISSIONS

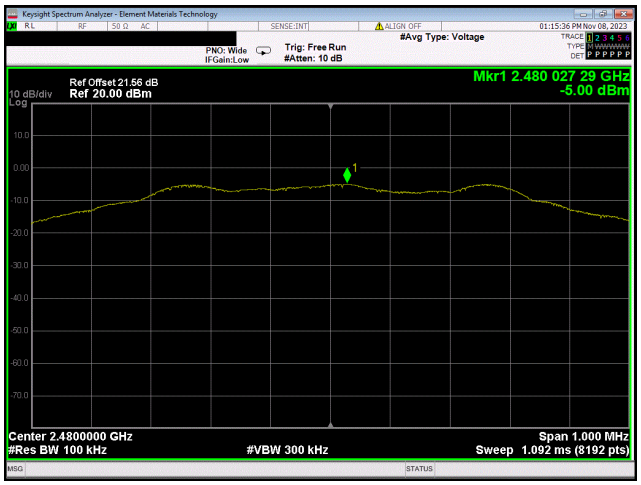
element
TbtTx 2023.10.30.0
WTD.2023.10.23.0



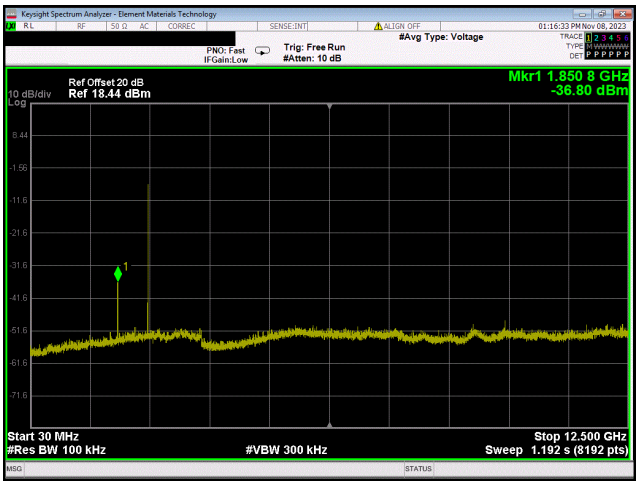
BLE/GFSK 1 Mbps
Mid Channel, 2442 MHz



BLE/GFSK 1 Mbps
Mid Channel, 2442 MHz



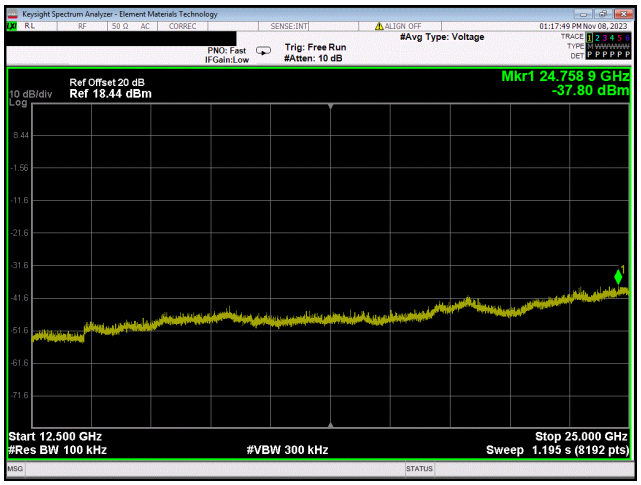
BLE/GFSK 1 Mbps
High Channel, 2480 MHz



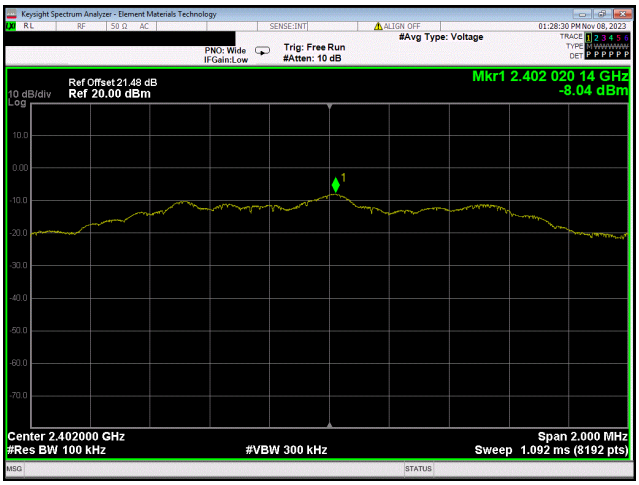
BLE/GFSK 1 Mbps
High Channel, 2480 MHz

SPURIOUS CONDUCTED EMISSIONS

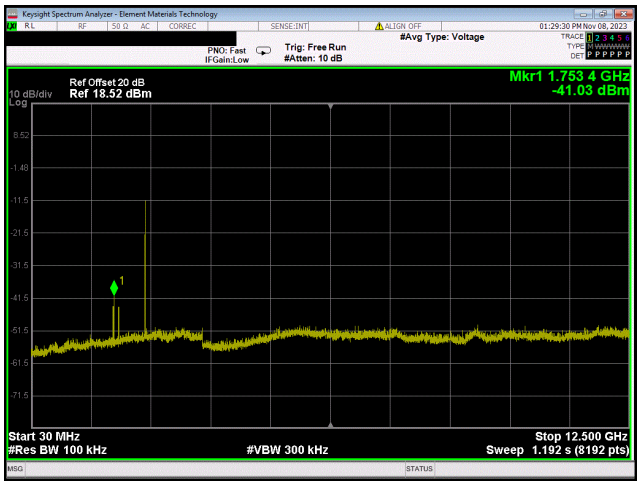
element
TbtTx 2023.10.30.0
WTD.2023.10.23.0



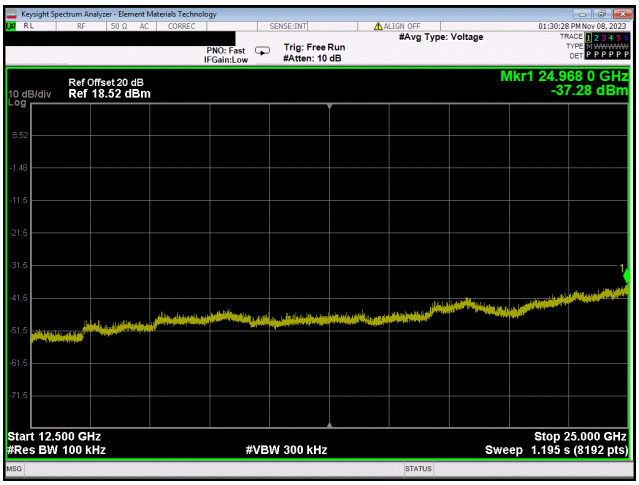
BLE/GFSK 1 Mbps
High Channel, 2480 MHz



BLE/GFSK 2 Mbps
Low Channel, 2402 MHz



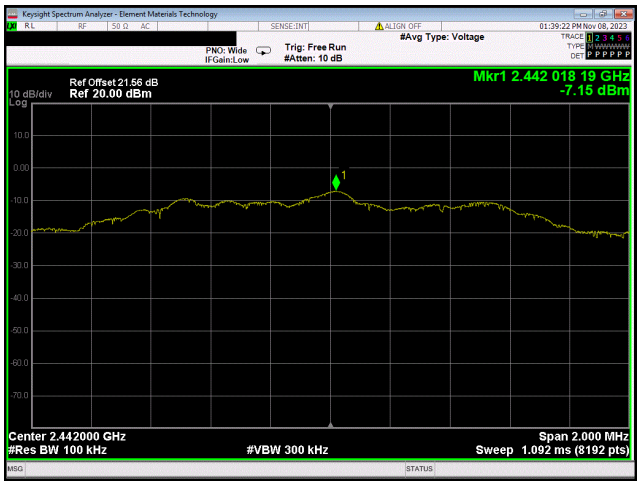
BLE/GFSK 2 Mbps
Low Channel, 2402 MHz



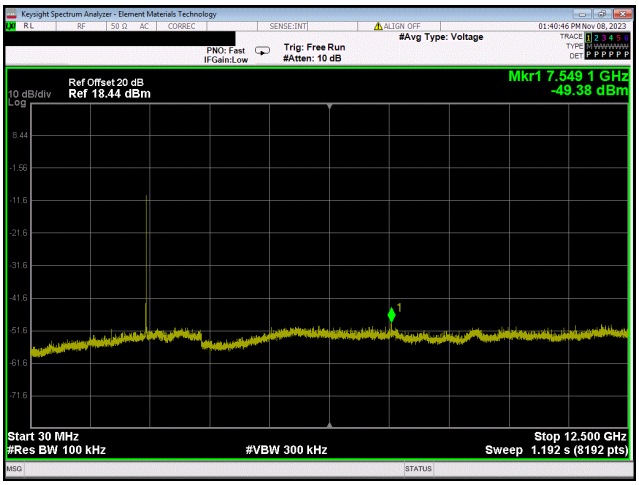
BLE/GFSK 2 Mbps
Low Channel, 2402 MHz

SPURIOUS CONDUCTED EMISSIONS

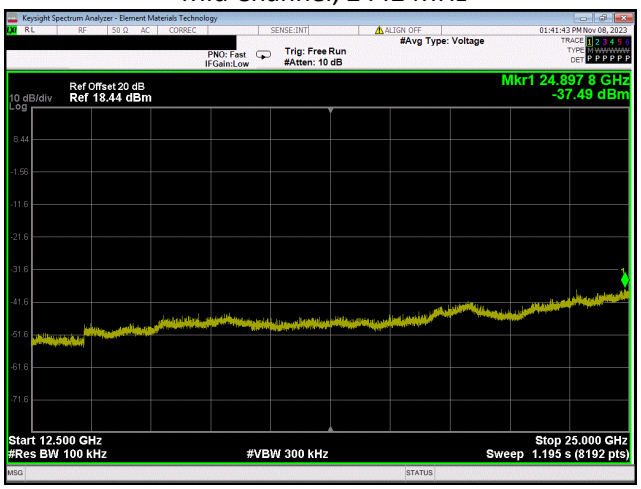
element
TbtTx 2023.10.30.0
WTD.2023.10.23.0



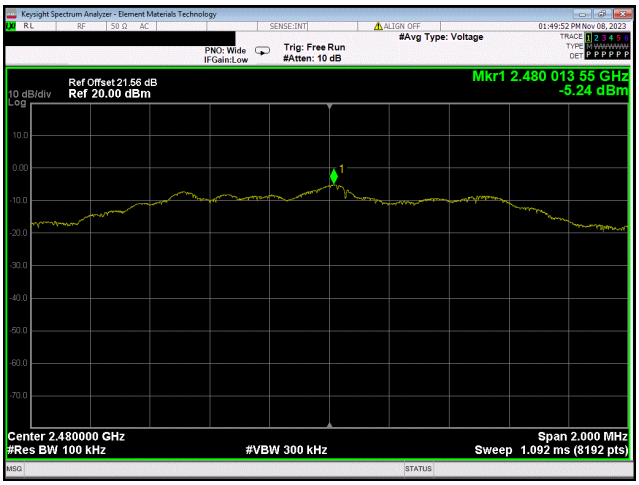
BLE/GFSK 2 Mbps
Mid Channel, 2442 MHz



BLE/GFSK 2 Mbps
Mid Channel, 2442 MHz



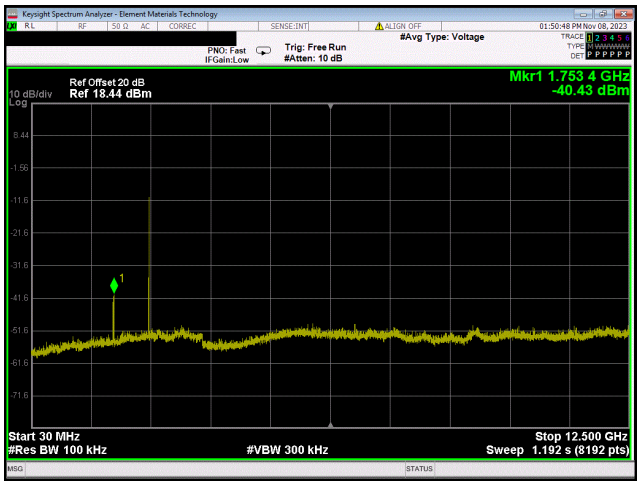
BLE/GFSK 2 Mbps
Mid Channel, 2442 MHz



BLE/GFSK 2 Mbps
High Channel, 2480 MHz

SPURIOUS CONDUCTED EMISSIONS

element
TbtTx 2023.10.30.0
WTD.2023.10.23.0



BLE/GFSK 2 Mbps
High Channel, 2480 MHz

BLE/GFSK 2 Mbps
High Channel, 2480 MHz

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

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 within 2 MHz of the allowable band may have been taken using the integration method from ANSI C63.10 clause 11.13.3. This procedure uses the channel power feature of the spectrum analyzer to integrate the power of the emission within a 1 MHz bandwidth.

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(1/dc).

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Antenna - Double Ridge	ETS Lindgren	3115	AIP	2022-07-20	2024-07-20
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	2023-01-14	2024-01-14
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	2023-01-14	2024-01-14
Attenuator	Fiarview Microwave	SA18H-20	VAF	2023-09-11	2024-09-11
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	2023-02-06	2024-02-06
Filter - High Pass	Micro-Tronics	HPM50111	LFN	2023-08-23	2024-08-23
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	NCR
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	2023-01-14	2024-01-14
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	2023-01-14	2024-01-14
Antenna - Standard Gain	ETS Lindgren	3160-08	AIQ	NCR	NCR
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVW	2023-01-14	2024-01-14
Antenna - Biconilog	Ametek	CBL 6141B	AYS	2023-03-28	2025-03-28
Cable	ESM Cable Corp.	Bilog Cables	MNH	2023-10-08	2024-10-08
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	2023-10-08	2024-10-08
Filter - Low Pass	Micro-Tronics	LPM50004	LFK	2023-08-23	2024-08-23
Antenna - Standard Gain	ETS Lindgren	3160-09	AHG	NCR	NCR
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNP	2023-09-05	2024-09-05
Amplifier - Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	2023-09-05	2024-09-05

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	5.2 dB	-5.2 dB

FREQUENCY RANGE INVESTIGATED

30 MHz TO 26500 MHz

POWER INVESTIGATED

Lithium Battery

CONFIGURATIONS INVESTIGATED

STAK0324-2

MODES INVESTIGATED

Transmitting BLE Low, Mid and High Chs (2402, 2402 and 2480 MHz) 1 Mbps, 2 Mbps
Transmitting BLE Low and High Chs (2402 and 2480 MHz) 1 Mbps, 2 Mbps

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

EUT:	Starkey Signature CIC-R	Work Order:	STAK0324
Serial Number:	2911338292	Date:	2023-11-02
Customer:	Starkey Laboratories, Inc.	Temperature:	21°C
Attendees:	John Quach	Relative Humidity:	28.4%
Customer Project:	None	Bar. Pressure (PMSL):	1019 mb
Tested By:	Marcelo Aguayo	Job Site:	MN05
Power:	Lithium Battery	Configuration:	STAK0324-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	28	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

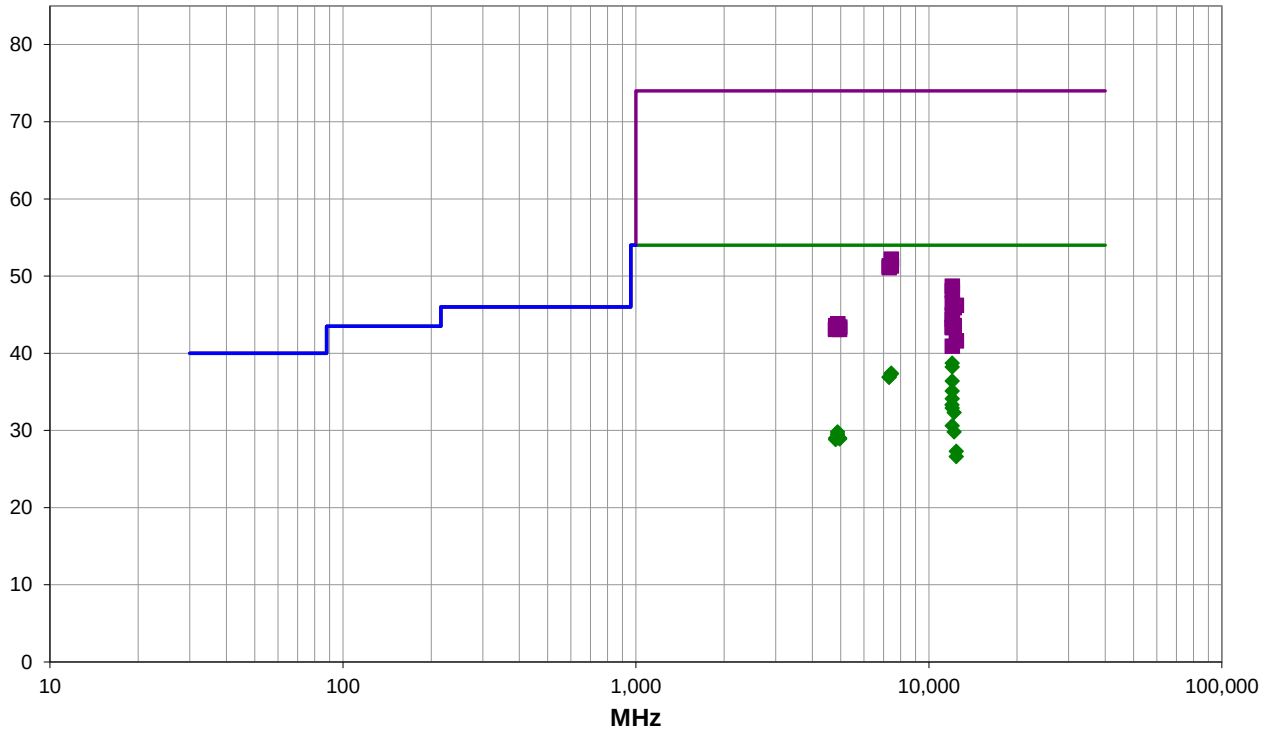
Power level +2dBm. Test mode duty cycle is 41% (1 Mbps) and 7.5% (2 Mbps). Correction applied based on 10*log(1/Duty cycle) = 3.9 dB (1 Mbps) and 11.2 dB (2 Mbps). Operational duty cycle is 17% (1 Mbps), 7% (2 Mbps). Duty cycle correction factor (DCCF) applied using DCCF=[10*log(1/test mode DC)]+[10*log(operational DC)]= -3.8 dB (1Mbps), -0.3 dB (2 Mbps)

EUT OPERATING MODES

Transmitting BLE Low, Mid, and High Chs (2402, 2442, and 2480 MHz), 1 and 2 Mbps.

DEVIATIONS FROM TEST STANDARD

None



Run #: 28 ■ PK ◆ AV ● QP

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

RESULTS - Run #28

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
12009.990	42.1	0.4	1.0	102.0	-3.8	0.0	Horz	AV	0.0	38.7	54.0	-15.3	EUT Horz, Low Ch 1 Mbps
12009.990	41.6	0.4	2.4	81.0	-3.8	0.0	Horz	AV	0.0	38.2	54.0	-15.8	EUT On Side, Low Ch 1 Mbps
7438.267	29.3	11.9	1.5	144.0	-3.8	0.0	Vert	AV	0.0	37.4	54.0	-16.6	EUT On Side, High Ch 1 Mbps
7438.108	29.2	11.9	1.5	214.0	-3.8	0.0	Horz	AV	0.0	37.3	54.0	-16.7	EUT Horz, High Ch 1 Mbps
7324.467	29.0	11.7	2.0	109.9	-3.8	0.0	Horz	AV	0.0	36.9	54.0	-17.1	EUT Horz, Mid Ch 1 Mbps
7325.275	29.0	11.7	1.5	95.0	-3.8	0.0	Vert	AV	0.0	36.9	54.0	-17.1	EUT On Side, Mid Ch 1 Mbps
12010.030	39.7	0.5	2.1	192.9	-3.8	0.0	Vert	AV	0.0	36.4	54.0	-17.6	EUT On Side, Low Ch 1 Mbps
12010.040	38.4	0.5	2.2	211.9	-3.8	0.0	Horz	AV	0.0	35.1	54.0	-18.9	EUT Vert, Low Ch 1 Mbps
7437.908	40.3	11.9	1.5	144.0	0.0	0.0	Vert	PK	0.0	52.2	74.0	-21.8	EUT On Side, High Ch 1 Mbps
12010.060	37.4	0.5	3.6	5.0	-3.8	0.0	Vert	AV	0.0	34.1	54.0	-19.9	EUT Vert, Low Ch 1 Mbps
7438.308	39.4	11.9	1.5	214.0	0.0	0.0	Horz	PK	0.0	51.3	74.0	-22.7	EUT Horz, High Ch 1 Mbps
7323.900	39.6	11.7	2.0	109.9	0.0	0.0	Horz	PK	0.0	51.3	74.0	-22.7	EUT Horz, Mid Ch 1 Mbps
7323.817	39.4	11.7	1.5	95.0	0.0	0.0	Vert	PK	0.0	51.1	74.0	-22.9	EUT On Side, Mid Ch 1 Mbps
12010.080	36.2	0.5	1.5	52.0	-3.8	0.0	Vert	AV	0.0	32.9	54.0	-21.1	EUT Horz, Low Ch 1 Mbps
12208.980	34.3	1.8	1.1	20.9	-3.8	0.0	Vert	AV	0.0	32.3	54.0	-21.7	EUT On Side, Mid Ch 1 Mbps
12009.830	48.3	0.4	1.0	102.0	0.0	0.0	Horz	PK	0.0	48.7	74.0	-25.3	EUT Horz, Low Ch 1 Mbps
12009.520	47.7	0.4	2.4	81.0	0.0	0.0	Horz	PK	0.0	48.1	74.0	-25.9	EUT On Side, Low Ch 1 Mbps
12208.980	31.8	1.8	3.1	229.9	-3.8	0.0	Horz	AV	0.0	29.8	54.0	-24.2	EUT Horz, Mid Ch 1 Mbps
4883.667	30.2	3.4	2.8	113.9	-3.8	0.0	Vert	AV	0.0	29.8	54.0	-24.2	EUT On Side, Mid Ch 1 Mbps
4884.258	29.9	3.4	1.5	265.9	-3.8	0.0	Horz	AV	0.0	29.5	54.0	-24.5	EUT Horz, Mid Ch 1 Mbps
12010.230	46.0	0.5	2.1	264.0	0.0	0.0	Horz	PK	0.0	46.5	74.0	-27.5	EUT Horz, Low Ch 2 Mbps
12399.830	44.3	1.9	2.3	19.9	0.0	0.0	Horz	PK	0.0	46.2	74.0	-27.8	EUT Horz, High Ch 1 Mbps
4803.967	29.5	3.3	1.5	235.9	-3.8	0.0	Horz	AV	0.0	29.0	54.0	-25.0	EUT Horz, Low Ch 1 Mbps
4960.292	29.2	3.6	1.5	59.0	-3.8	0.0	Horz	AV	0.0	29.0	54.0	-25.0	EUT Horz, High Ch 1 Mbps
4960.267	29.1	3.6	1.5	138.0	-3.8	0.0	Vert	AV	0.0	28.9	54.0	-25.1	EUT On Side, High Ch 1 Mbps
4805.850	29.3	3.3	1.5	274.0	-3.8	0.0	Vert	AV	0.0	28.8	54.0	-25.2	EUT On Side, Low Ch 1 Mbps
12007.680	33.2	0.4	2.1	264.0	-0.3	0.0	Horz	AV	0.0	33.3	54.0	-20.7	EUT Horz, Low Ch 2 Mbps
12210.940	44.1	1.8	1.1	20.9	0.0	0.0	Vert	PK	0.0	45.9	74.0	-28.1	EUT On Side, Mid Ch 1 Mbps
12009.930	44.6	0.4	2.1	192.9	0.0	0.0	Vert	PK	0.0	45.0	74.0	-29.0	EUT On Side, Low Ch 1 Mbps
12398.700	29.2	1.9	1.5	351.0	-3.8	0.0	Vert	AV	0.0	27.3	54.0	-26.7	EUT On Side, High Ch 1 Mbps
12010.570	43.9	0.5	3.6	5.0	0.0	0.0	Vert	PK	0.0	44.4	74.0	-29.6	EUT Vert, Low Ch 1 Mbps
12399.890	28.5	1.9	2.3	19.9	-3.8	0.0	Horz	AV	0.0	26.6	54.0	-27.4	EUT Horz, High Ch 1 Mbps
4886.383	40.4	3.4	1.5	265.9	0.0	0.0	Horz	PK	0.0	43.8	74.0	-30.2	EUT Horz, Mid Ch 1 Mbps
4805.050	40.3	3.3	1.5	274.0	0.0	0.0	Vert	PK	0.0	43.6	74.0	-30.4	EUT On Side, Low Ch 1 Mbps
12210.080	41.8	1.8	3.1	229.9	0.0	0.0	Horz	PK	0.0	43.6	74.0	-30.4	EUT Horz, Mid Ch 1 Mbps
12009.870	43.0	0.4	1.5	52.0	0.0	0.0	Vert	PK	0.0	43.4	74.0	-30.6	EUT Horz, Low Ch 1 Mbps
4962.325	39.8	3.6	1.5	138.0	0.0	0.0	Vert	PK	0.0	43.4	74.0	-30.6	EUT On Side, High Ch 1 Mbps
4882.058	40.0	3.4	2.8	113.9	0.0	0.0	Vert	PK	0.0	43.4	74.0	-30.6	EUT On Side, Mid Ch 1 Mbps
12009.950	42.9	0.4	2.2	211.9	0.0	0.0	Horz	PK	0.0	43.3	74.0	-30.7	EUT Vert, Low Ch 1 Mbps
12012.480	30.4	0.5	1.5	286.0	-0.3	0.0	Vert	AV	0.0	30.6	54.0	-23.4	EUT Horz, Low Ch 2 Mbps

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4802.550	39.8	3.3	1.5	235.9	0.0	0.0	Horz	PK	0.0	43.1	74.0	-30.9	EUT Horz, Low Ch 1 Mbps
4958.442	39.5	3.6	1.5	59.0	0.0	0.0	Horz	PK	0.0	43.1	74.0	-30.9	EUT Horz, High Ch 1 Mbps
12398.530	39.7	1.9	1.5	351.0	0.0	0.0	Vert	PK	0.0	41.6	74.0	-32.4	EUT On Side, High Ch 1 Mbps
12009.750	40.5	0.4	1.5	286.0	0.0	0.0	Vert	PK	0.0	40.9	74.0	-33.1	EUT Horz, Low Ch 2 Mbps

CONCLUSION

Pass

Tested By

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

EUT:	Starkey Signature CIC-R	Work Order:	STAK0324
Serial Number:	2911338292	Date:	2023-11-02
Customer:	Starkey Laboratories, Inc.	Temperature:	21°C
Attendees:	John Quach	Relative Humidity:	28.4%
Customer Project:	None	Bar. Pressure (PMSL):	1019 mb
Tested By:	Marcelo Aguayo	Job Site:	MN05
Power:	Lithium Battery	Configuration:	STAK0324-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 3:2023 RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	31	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

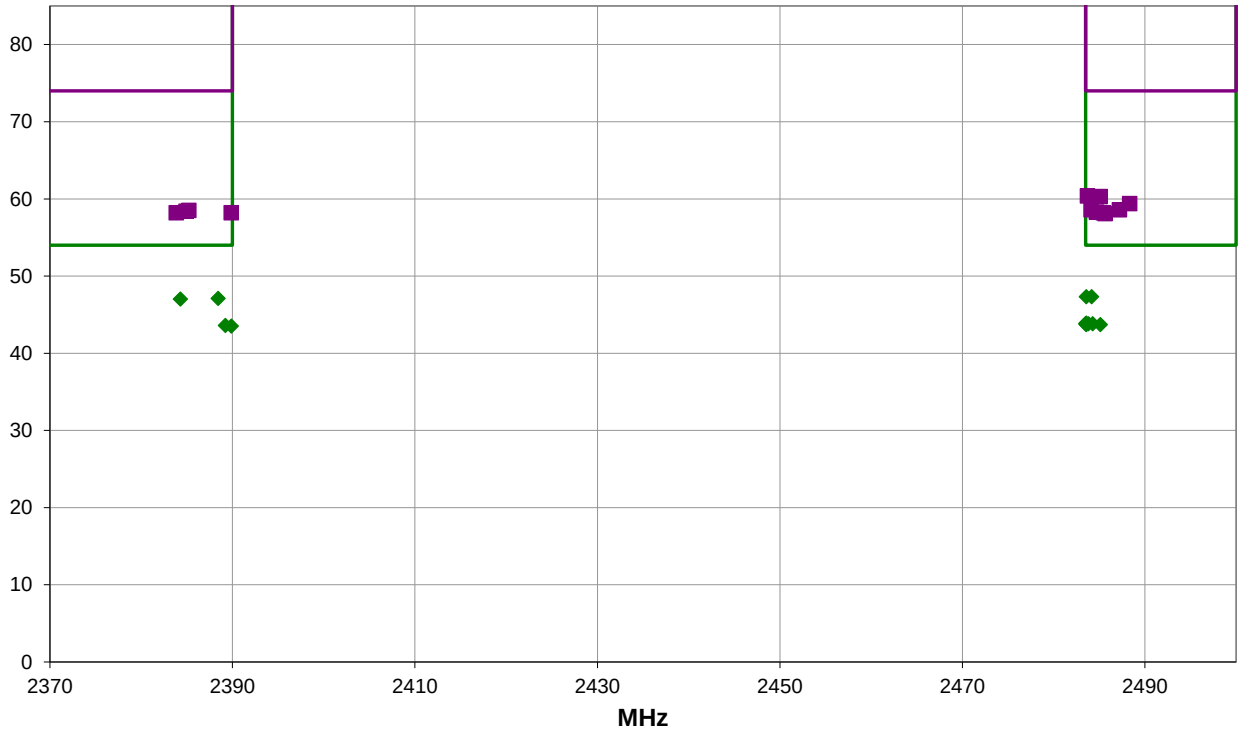
Power level +2dBm. Test mode duty cycle is 41% (1 Mbps) and 7.5% (2 Mbps). Correction applied based on 10*log(1/Duty cycle) = 3.9 dB (1 Mbps) and 11.2 dB (2 Mbps). Operational duty cycle is 17% (1 Mbps), 7% (2 Mbps). Duty cycle correction factor (DCCF) applied using DCCF=[10*log(1/test mode DC)]+[10*log(operational DC)]= -3.8 dB (1Mbps), -0.3 dB (2 Mbps)

EUT OPERATING MODES

Transmitting BLE Low and High Chs (2402 and 2480 MHz), 1 and 2 Mbps.

DEVIATIONS FROM TEST STANDARD

None



Run #: 31 ■ PK ◆ AV ● QP

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.10.23.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

RESULTS - Run #31

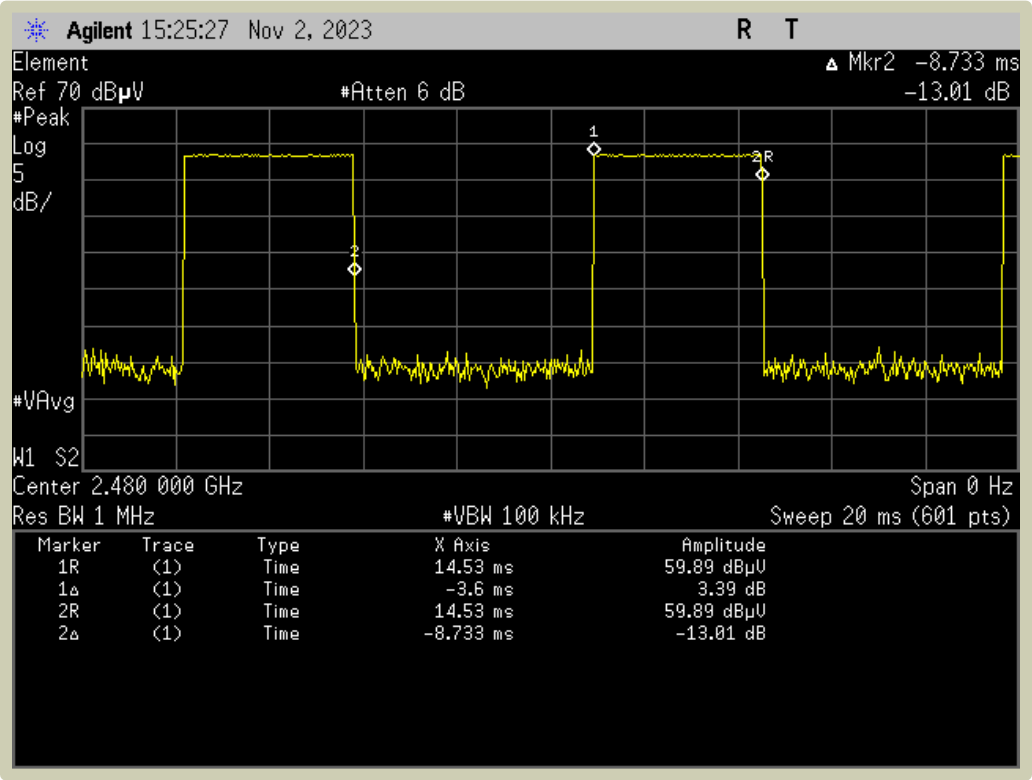
Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2483.583	31.9	-4.2	1.5	325.9	-3.8	20.0	Horz	AV	0.0	43.9	54.0	-10.1	EUT On Side, High Ch 1Mbps
2483.525	31.8	-4.2	1.5	1.9	-3.8	20.0	Horz	AV	0.0	43.8	54.0	-10.2	EUT Horz, High Ch 1Mbps
2484.283	31.8	-4.2	1.6	358.9	-3.8	20.0	Vert	AV	0.0	43.8	54.0	-10.2	EUT On Side, High Ch 1Mbps
2483.833	31.8	-4.2	2.8	144.0	-3.8	20.0	Vert	AV	0.0	43.8	54.0	-10.2	EUT Vert, High Ch, 1Mbps
2483.592	31.8	-4.2	1.5	4.0	-0.3	20.0	Horz	AV	0.0	47.3	54.0	-6.7	EUT On Side, High Ch 2Mbps
2484.167	31.8	-4.2	1.5	206.0	-0.3	20.0	Vert	AV	0.0	47.3	54.0	-6.7	EUT On Side, High Ch 2Mbps
2483.600	31.7	-4.2	3.2	257.9	-3.8	20.0	Vert	AV	0.0	43.7	54.0	-10.3	EUT Horz, High Ch 1Mbps
2485.125	31.7	-4.2	3.3	258.9	-3.8	20.0	Horz	AV	0.0	43.7	54.0	-10.3	EUT Vert, High Ch, 1Mbps
2389.225	31.7	-4.3	1.3	246.0	-3.8	20.0	Vert	AV	0.0	43.6	54.0	-10.4	EUT On Side, Low Ch 1Mbps
2388.433	31.7	-4.3	1.5	105.0	-0.3	20.0	Horz	AV	0.0	47.1	54.0	-6.9	EUT On Side, Low Ch 2Mbps
2389.875	31.6	-4.3	2.7	322.9	-3.8	20.0	Horz	AV	0.0	43.5	54.0	-10.5	EUT On Side, Low Ch 1Mbps
2384.292	31.6	-4.3	1.5	30.0	-0.3	20.0	Vert	AV	0.0	47.0	54.0	-7.0	EUT On Side, Low Ch 2Mbps
2483.700	44.6	-4.2	1.5	325.9	0.0	20.0	Horz	PK	0.0	60.4	74.0	-13.6	EUT On Side, High Ch 1Mbps
2485.108	44.5	-4.2	1.5	206.0	0.0	20.0	Vert	PK	0.0	60.3	74.0	-13.7	EUT On Side, High Ch 2Mbps
2488.325	43.5	-4.1	1.5	4.0	0.0	20.0	Horz	PK	0.0	59.4	74.0	-14.6	EUT On Side, High Ch 2Mbps
2484.100	42.8	-4.2	1.6	358.9	0.0	20.0	Vert	PK	0.0	58.6	74.0	-15.4	EUT Horz, High Ch 1Mbps
2487.225	42.8	-4.2	2.8	144.0	0.0	20.0	Vert	PK	0.0	58.6	74.0	-15.4	EUT Vert, High Ch, 1Mbps
2385.208	42.8	-4.3	1.3	246.0	0.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	EUT On Side, Low Ch 1Mbps
2384.908	42.7	-4.3	1.5	105.0	0.0	20.0	Horz	PK	0.0	58.4	74.0	-15.6	EUT On Side, Low Ch 2Mbps
2484.692	42.5	-4.2	3.2	257.9	0.0	20.0	Vert	PK	0.0	58.3	74.0	-15.7	EUT On Side, High Ch 1Mbps
2389.867	42.5	-4.3	2.7	322.9	0.0	20.0	Horz	PK	0.0	58.2	74.0	-15.8	EUT On Side, Low Ch 1Mbps
2485.442	42.4	-4.2	1.5	1.9	0.0	20.0	Horz	PK	0.0	58.2	74.0	-15.8	EUT Horz, High Ch 1Mbps
2383.842	42.5	-4.3	1.5	30.0	0.0	20.0	Vert	PK	0.0	58.2	74.0	-15.8	EUT On Side, Low Ch 2Mbps
2485.650	42.3	-4.2	3.3	258.9	0.0	20.0	Horz	PK	0.0	58.1	74.0	-15.9	EUT Vert, High Ch, 1Mbps

CONCLUSION

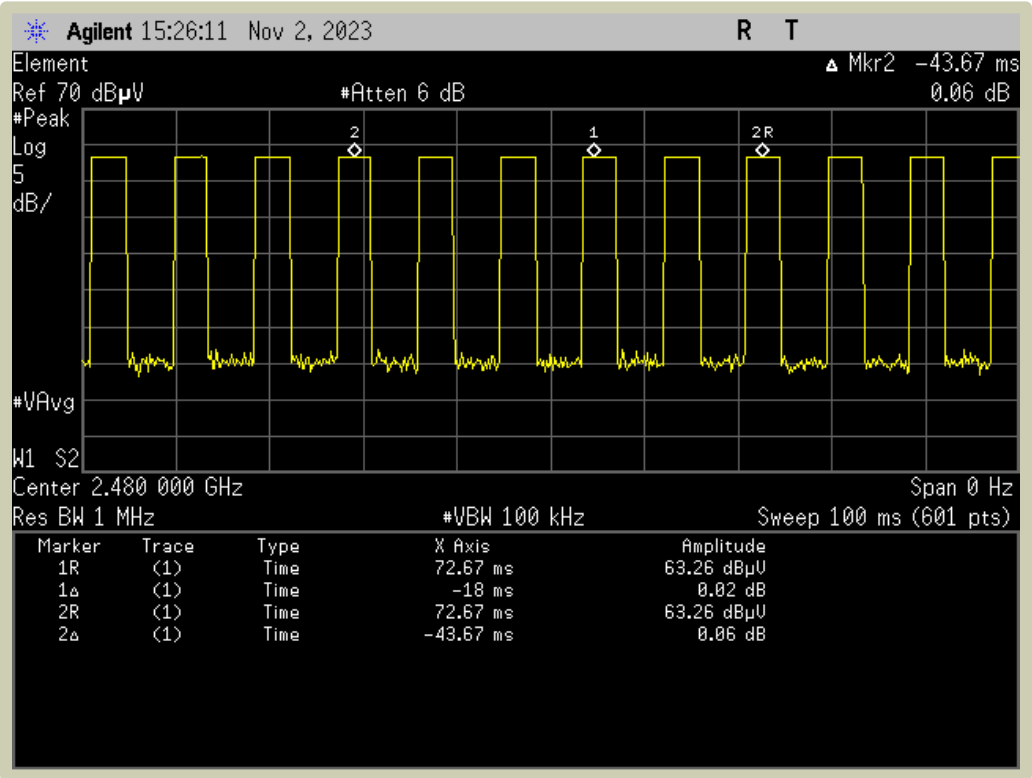
Pass

Tested By

SPURIOUS RADIATED EMISSIONS



1 Mbps Duty Cycle



1 Mbps Duty Cycle

End of Test Report