Starkey Laboratories, Inc.

TV Streamer

FCC 15.247:2018

Bluetooth Low Energy (DTS) Radio

Report # STAK0135

NVLAP LAB CODE: 200881-0

CERTIFICATE OF TEST

Last Date of Test: August 2, 2018
Starkey Laboratories, Inc.
Model: TV Streamer

Radio Equipment Testing

Standards

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

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	Yes	Pass	
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	
11.10.2	Power Spectral Density	Yes	Pass	
11.11	Band Edge Compliance	Yes	Pass	
11.11	Spurious Conducted Emissions	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Matt Nuernberg, Operations Manager

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

REVISION HISTORY

Revision Number	Description	Date (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). Certification chambers and Open Area Test Sites are filed with ISED.

European Union

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

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

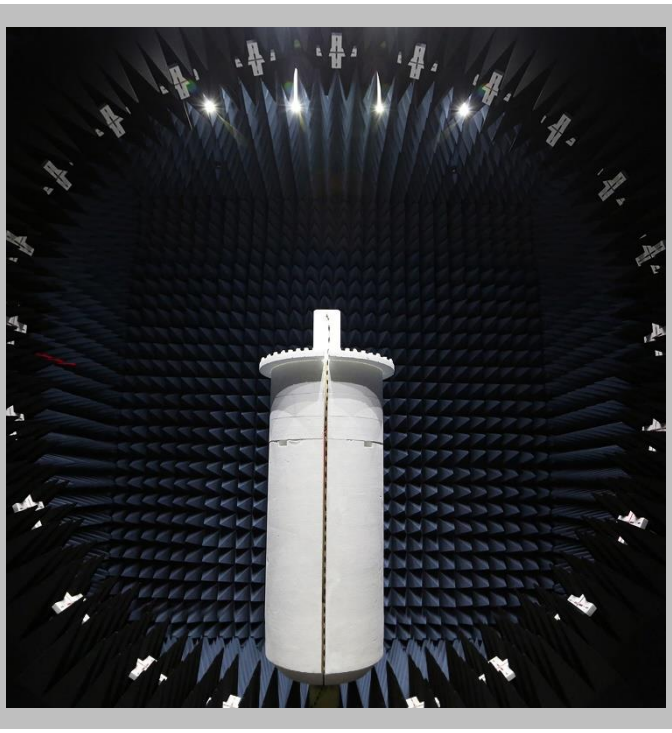
MIC – Recognized by MIC as a CAB for the acceptance of test data.

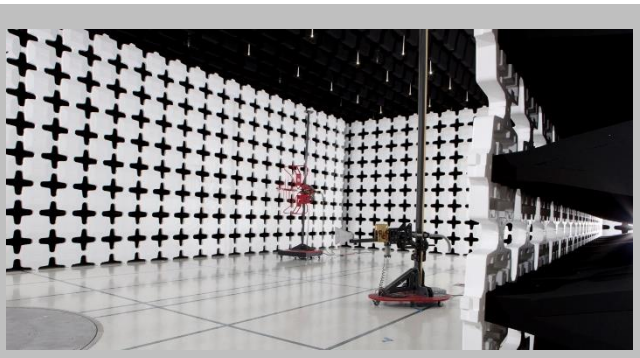
SCOPE

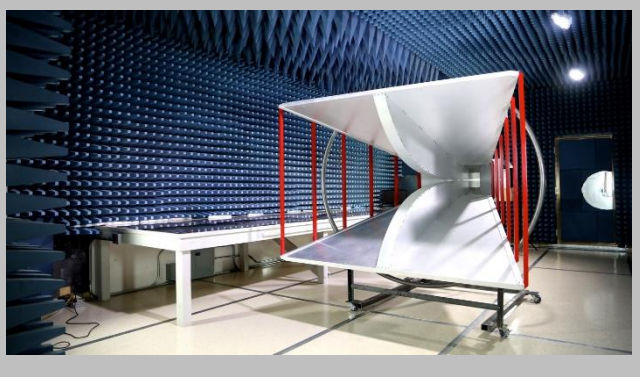
For details on the Scopes of our Accreditations, please visit:
http://portlandcustomer.element.com/ts/scope/scope.htm
http://gsi.nist.gov/global/docs/cabs/designations.html

FACILITIES

California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP					
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Innovation, Science and Economic Development Canada					
2834B-1, 2834B-3	2834E-1, 2834E-3	N/A	2834D-1, 2834D-*2*	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157







MEASUREMENT UNCERTAINTY

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.

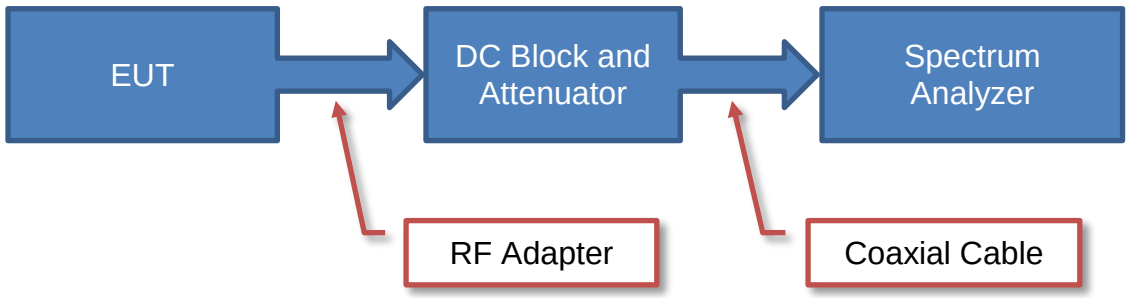
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable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

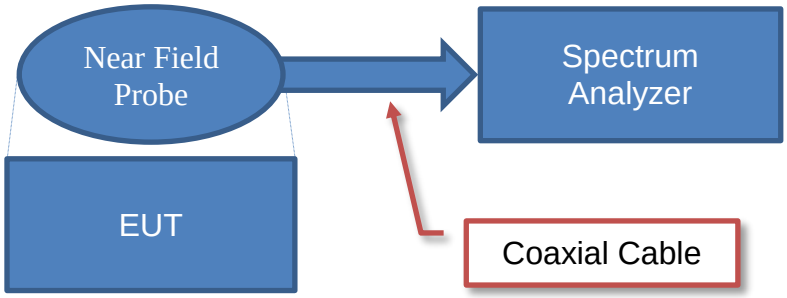
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%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

Test Setup Block Diagrams

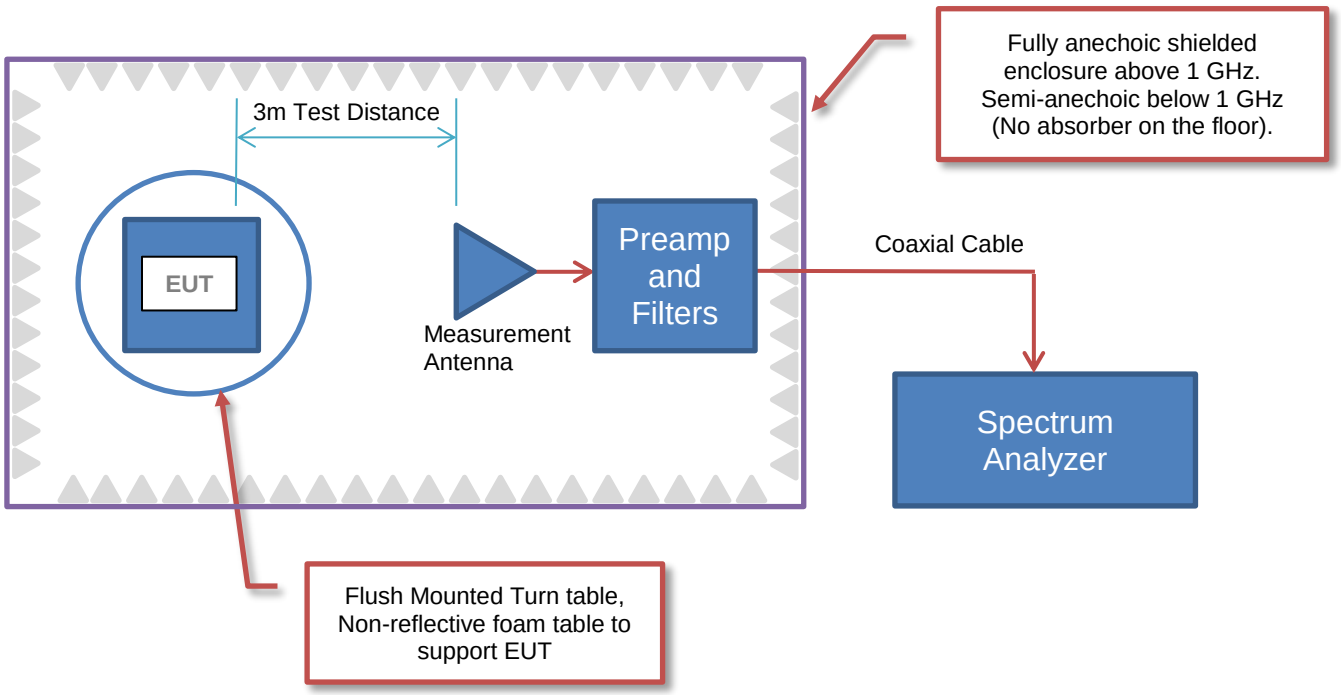
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Starkey Laboratories, Inc.
Address:	6600 Washington Ave. SO.
City, State, Zip:	Eden Prairie, MN 55344
Test Requested By:	Bill Mitchell
Model:	TV Streamer
First Date of Test:	August 1, 2018
Last Date of Test:	August 2, 2018
Receipt Date of Samples:	August 1, 2018
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
TV streaming device for the 2.4 GHz hearing aids using BLE

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

CONFIGURATIONS

Configuration STAK0135- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
TV Streaming Device	Starkey Laboratories, Inc.	800	182220800B

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Dell	Latitude E6420	2GK1DS1
Power Supply (Laptop)	Dell	DA130PE1-00	CN-0JU012-48661-08A-1HHP-A04

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	No	1.5 m	Yes	TV Streaming Device	USB Extender
USB Extender	No	1.5 m	No	USB Cable	Laptop
AC Cable (Laptop)	No	0.9 m	No	AC Mains	Power Supply (Laptop)
DC Cable (Laptop)	No	1.5 m	Yes	Power Supply (Laptop)	Laptop

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2018-08-01	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	2018-08-01	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2018-08-01	Output Power	Modified from delivered configuration.	Output power was lowered by 2 dB by the customer for FCC for the 2 Mbps modulation. Modification authorized by Aaron Anderson.	EUT remained at Element following the test.
4	2018-08-01	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
5	2018-08-01	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
6	2018-08-01	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
7	2018-08-02	Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
8	2018-08-02	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWERLINE CONDUCTED EMISSIONS

element
WTD.2017.11.22.1

TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, conducted emissions tests were performed. The frequency range investigated (scanned), is also noted in this report. Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Per the standard, an insulating material was also added to ground plane between the EUT's power and remote I/O cables. Equipment is tested with power cords that are normally used or that have electrical or shielding characteristics that are the same as those cords normally used. Typically those measurements are made using a LISN (Line Impedance Stabilization Network), the 50ohm measuring port is terminated by a 50ohm EMI meter or a 50ohm resistive load. All 50ohm measuring ports of the LISN are terminated by 50ohm. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
LISN	Solar Electronics	9252-50-R-24-BNC	LIY	3/15/2018	3/15/2019
Cable - Conducted Cable Assembly	Northwest EMC	MNC	MNCC	1/24/2018	1/24/2019
Receiver	Rohde & Schwarz	ESR7	ARI	6/26/2018	6/26/2019
Meter - Multimeter	Fluke	117	MLS	1/23/2017	1/23/2020
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

STAK0135-1

MODES INVESTIGATED

Tx at 1 Mbps, Mid channel (2442 MHz)
Tx at 2 Mbps, Mid channel (2442 MHz)

POWERLINE CONDUCTED EMISSIONS

element
WTD.2017.11.22.1

EUT:	TV Streamer	Work Order:	STAK0135
Serial Number:	182220800B	Date:	08/02/2018
Customer:	Starkey Laboratories, Inc.	Temperature:	21.4°C
Attendees:	Charlie Esch	Relative Humidity:	46.3%
Customer Project:	None	Bar. Pressure:	1018 mb
Tested By:	Andrew Rogstad, Trevor Buls	Job Site:	MN03
Power:	5VDC via 110VAC/60Hz	Configuration:	STAK0135-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2018	ANSI C63.10:2013

TEST PARAMETERS

Run #:	4	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

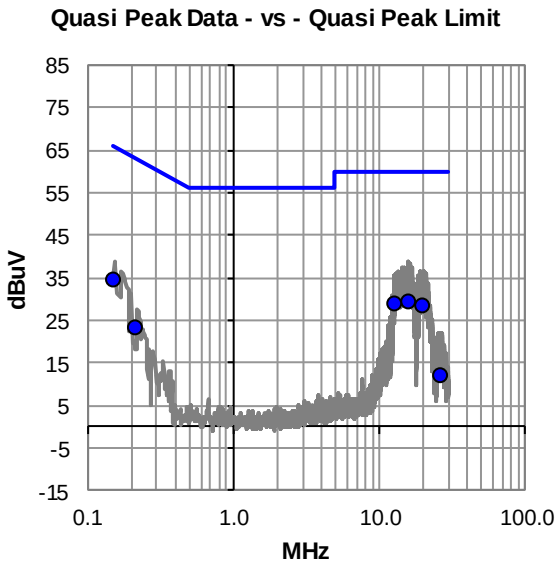
None

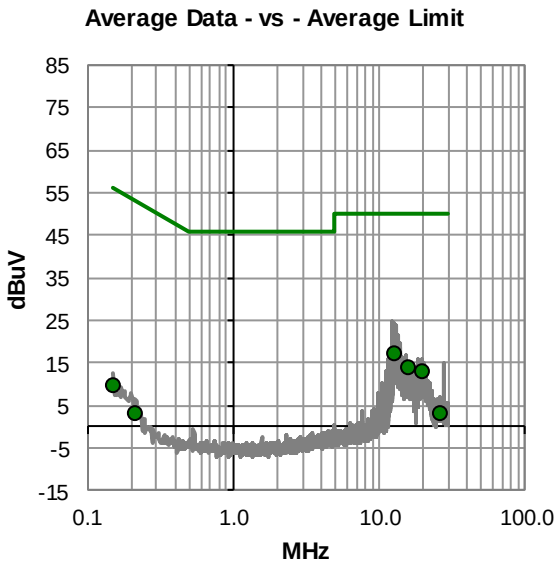
EUT OPERATING MODES

Tx at 2 Mbps, Mid channel (2442 MHz)

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

element
WTD.2017.11.22.1

RESULTS - Run #4

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
16.017	27.7	1.5	29.2	60.0	-30.8
0.154	34.2	0.3	34.5	65.8	-31.3
13.025	27.5	1.2	28.7	60.0	-31.3
20.164	25.9	2.2	28.1	60.0	-31.9
0.213	22.8	0.3	23.1	63.1	-40.0
26.372	9.1	3.0	12.1	60.0	-47.9

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.025	15.9	1.2	17.1	50.0	-32.9
16.017	12.1	1.5	13.6	50.0	-36.4
20.164	10.4	2.2	12.6	50.0	-37.4
0.154	9.1	0.3	9.4	55.8	-46.4
26.372	-0.2	3.0	2.8	50.0	-47.2
0.213	2.8	0.3	3.1	53.1	-50.0

CONCLUSION

Pass

Trevor Buls

Tested By

POWERLINE CONDUCTED EMISSIONS

element
WTD.2017.11.22.1

EUT:	TV Streamer	Work Order:	STAK0135
Serial Number:	182220800B	Date:	08/02/2018
Customer:	Starkey Laboratories, Inc.	Temperature:	21.4°C
Attendees:	Charlie Esch	Relative Humidity:	46.3%
Customer Project:	None	Bar. Pressure:	1018 mb
Tested By:	Andrew Rogstad, Trevor Buls	Job Site:	MN03
Power:	5VDC via 110VAC/60Hz	Configuration:	STAK0135-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2018	ANSI C63.10:2013

TEST PARAMETERS

Run #:	5	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

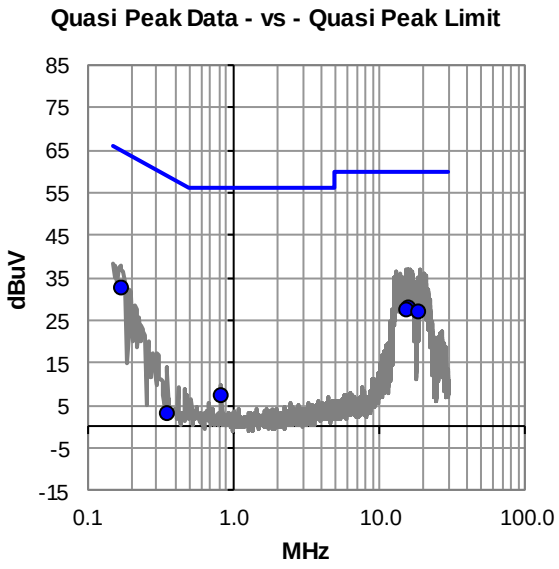
None

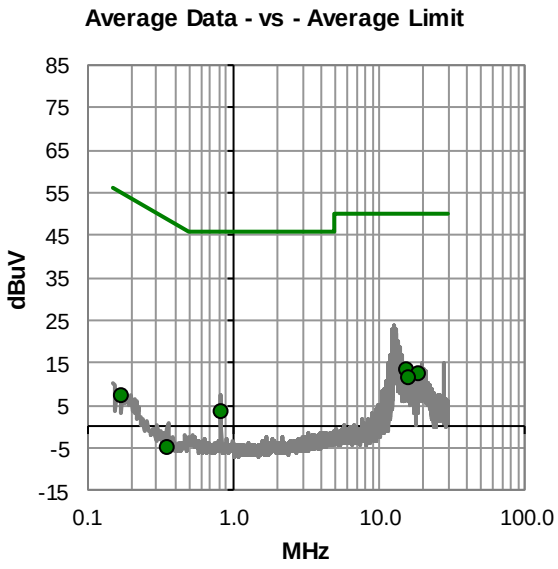
EUT OPERATING MODES

Tx at 2 Mbps, Mid channel (2442 MHz)

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

element
WTD.2017.11.22.1

RESULTS - Run #5

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
16.242	26.0	1.6	27.6	60.0	-32.4
15.340	26.1	1.4	27.5	60.0	-32.5
0.172	32.0	0.3	32.3	64.9	-32.6
19.005	24.9	2.0	26.9	60.0	-33.1
0.830	6.8	0.2	7.0	56.0	-49.0
0.357	3.0	0.2	3.2	58.8	-55.6

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
15.340	11.9	1.4	13.3	50.0	-36.7
19.005	10.2	2.0	12.2	50.0	-37.8
16.242	10.0	1.6	11.6	50.0	-38.4
0.830	3.4	0.2	3.6	46.0	-42.4
0.172	6.9	0.3	7.2	54.9	-47.7
0.357	-5.1	0.2	-4.9	48.8	-53.7

CONCLUSION

Pass

Trevor Buls

Tested By

POWERLINE CONDUCTED EMISSIONS

element
WTD.2017.11.22.1

EUT:	TV Streamer	Work Order:	STAK0135
Serial Number:	182220800B	Date:	08/02/2018
Customer:	Starkey Laboratories, Inc.	Temperature:	21.4°C
Attendees:	Charlie Esch	Relative Humidity:	46.3%
Customer Project:	None	Bar. Pressure:	1018 mb
Tested By:	Andrew Rogstad, Trevor Buls	Job Site:	MN03
Power:	5VDC via 110VAC/60Hz	Configuration:	STAK0135-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2018	ANSI C63.10:2013

TEST PARAMETERS

Run #:	6	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

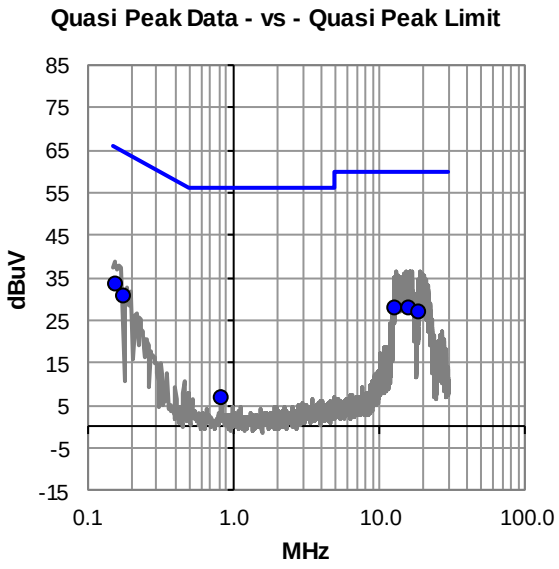
None

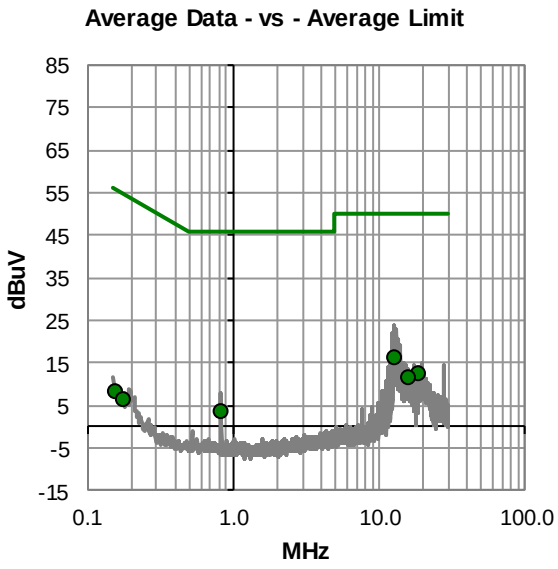
EUT OPERATING MODES

Tx at 1 Mbps, Mid channel (2442 MHz)

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

element
WTD.2017.11.22.1

RESULTS - Run #6

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.158	33.1	0.3	33.4	65.5	-32.1
13.064	26.5	1.3	27.8	60.0	-32.2
16.278	26.1	1.6	27.7	60.0	-32.3
19.004	24.9	2.0	26.9	60.0	-33.1
0.178	30.5	0.3	30.8	64.6	-33.8
0.829	6.7	0.2	6.9	56.0	-49.1

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.064	14.9	1.3	16.2	50.0	-33.8
19.004	10.2	2.0	12.2	50.0	-37.8
16.278	9.9	1.6	11.5	50.0	-38.5
0.829	3.2	0.2	3.4	46.0	-42.6
0.158	7.6	0.3	7.9	55.5	-47.6
0.178	5.9	0.3	6.2	54.6	-48.4

CONCLUSION

Pass

Trevor Buls

Tested By

POWERLINE CONDUCTED EMISSIONS

element
WTD.2017.11.22.1

EUT:	TV Streamer	Work Order:	STAK0135
Serial Number:	182220800B	Date:	08/02/2018
Customer:	Starkey Laboratories, Inc.	Temperature:	21.4°C
Attendees:	Charlie Esch	Relative Humidity:	46.3%
Customer Project:	None	Bar. Pressure:	1018 mb
Tested By:	Andrew Rogstad, Trevor Buls	Job Site:	MN03
Power:	5VDC via 110VAC/60Hz	Configuration:	STAK0135-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2018	ANSI C63.10:2013

TEST PARAMETERS

Run #:	7	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

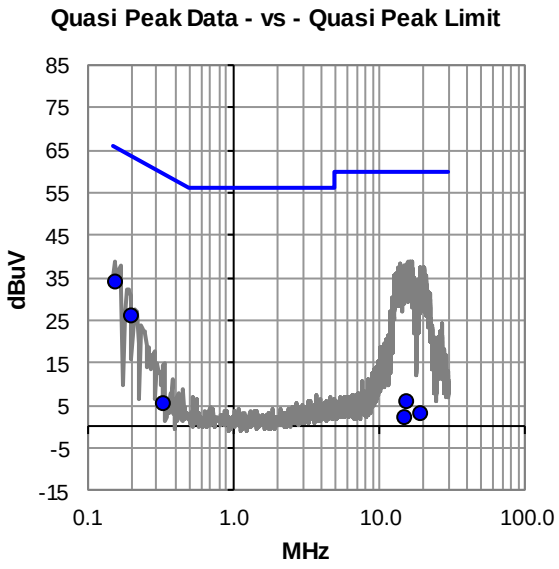
None

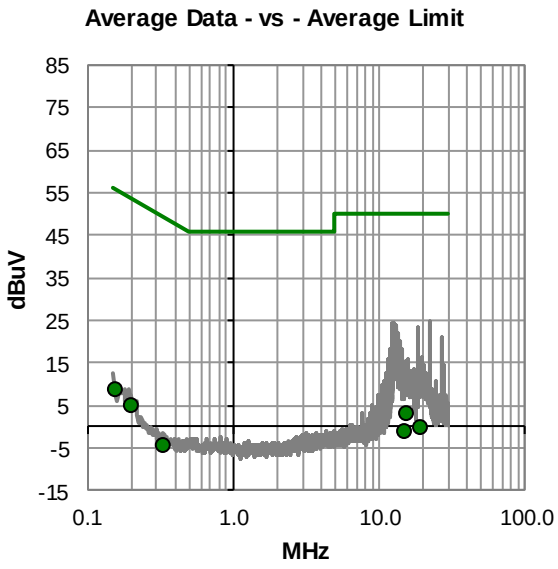
EUT OPERATING MODES

Tx at 1 Mbps, Mid channel (2442 MHz)

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

element
WTD.2017.11.22.1

RESULTS - Run #7

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.156	33.7	0.3	34.0	65.7	-31.7
0.202	25.6	0.3	25.9	63.5	-37.6
0.335	5.0	0.2	5.2	59.3	-54.1
15.556	4.1	1.5	5.6	60.0	-54.4
19.678	0.8	2.1	2.9	60.0	-57.1
15.069	0.5	1.4	1.9	60.0	-58.1

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.156	8.4	0.3	8.7	55.7	-47.0
15.556	1.4	1.5	2.9	50.0	-47.1
0.202	4.7	0.3	5.0	53.5	-48.5
19.678	-2.2	2.1	-0.1	50.0	-50.1
15.069	-2.5	1.4	-1.1	50.0	-51.1
0.335	-4.9	0.2	-4.7	49.3	-54.0

CONCLUSION

Pass

Trevor Buls

Tested By

SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2018.05.04

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 at 2 Mbps (GFSK), Low channel (2402 MHz), Mid channel (2442 MHz), High channel (2476 MHz); Tx at 1 Mbps (BLE/GFSK), Low channel (2402 MHz), Mid channel (2442 MHz), High channel (2480 MHz)

POWER SETTINGS INVESTIGATED

5 VDC

CONFIGURATIONS INVESTIGATED

STAK0135 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26.5 GHz

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
Cable	ESM Cable Corp	TTBJ141 KMKM-72	MNP	12-Sep-2017	12 mo
Amplifier - Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	12-Sep-2017	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AHG	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVW	13-Feb-2018	12 mo
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	12-Jul-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	13-Feb-2018	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AIB	25-Aug-2016	24 mo
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	21-Nov-2017	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	13-Feb-2018	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AIQ	NCR	0 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	9-Nov-2017	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AYD	25-Jan-2018	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	26-Mar-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	9-Nov-2017	12 mo
Filter - High Pass	Micro-Tronics	HPM50111	LFN	20-Sep-2017	12 mo
Filter - Low Pass	Micro-Tronics	LPM50004	LFK	20-Sep-2017	12 mo
Attenuator	Fairview Microwave	SA18E-20	TWZ	20-Sep-2017	12 mo

TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies and the modes as showed in the data sheets.

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

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

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

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

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

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

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

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

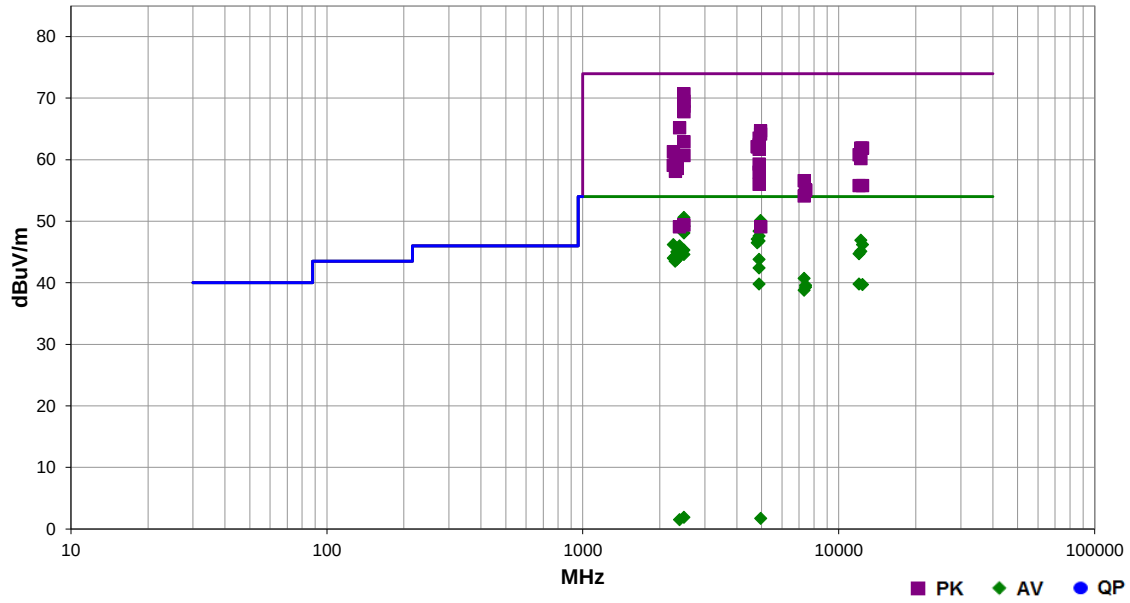
SPURIOUS RADIATED EMISSIONS

EmiR5 2018.05.07 PSA-ESCI 2018.05.04

Work Order:	STAK0135	**Date:**	2-Aug-2018	Trevor Buls	
Project:	None	**Temperature:**	19.2 °C		
Job Site:	MN05	**Humidity:**	47.1% RH		
Serial Number:	182220800B	**Barometric Pres.:**	1020 mbar	**Tested by:**	Andrew Rogstad, Trevor Buls
EUT:	TV Streamer				
Configuration:	1				
Customer:	Starkey Laboratories, Inc.				
Attendees:	Charlie Esch				
EUT Power:	5 VDC				
Operating Mode:	Tx at 2 Mbps (GFSK), Low channel (2402 MHz), Mid channel (2442 MHz), High channel (2476 MHz); Tx at 1 Mbps (BLE/GFSK), Low channel (2402 MHz), Mid channel (2442 MHz), High channel (2480 MHz)				
Deviations:	None				
Comments:	See data comments for EUT orientation, transmitting channel, and modulation type. A duty cycle correction factor (DCCF) was applied per ANSI C63.10:2013 Section 11.12.2.5.2 and per the provisions of pulsed operation. The DCCF first compensates for radio operation of less than 100% by using the formula (10*Log(1/x)) to add to the measured value. A correction is then applied against the measurement to adjust for the device's fixed duty cylce using the formula (20*Log(x)) (2 Mbps GFSK duty cycle is 30% and 1 Mbps BLE duty cycle is 1%).				

Test Specifications	**Test Method**
FCC 15.247:2018	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 (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2483.925	55.2	-4.5	1.0	289.0		20.0	Vert	PK	0.0	70.7	74.0	-3.3	EUT on side; High Ch., 2 Mbps
2483.550	38.1	-4.5	1.2	13.0	-3.0	20.0	Horz	AV	0.0	50.6	54.0	-3.4	EUT horz; High Ch., 2 Mbps
4951.008	47.1	5.6	2.7	308.9	-2.6	0.0	Horz	AV	0.0	50.1	54.0	-3.9	EUT on side; High Ch., 2 Mbps
4951.058	46.7	5.6	1.0	289.9	-2.6	0.0	Vert	AV	0.0	49.7	54.0	-4.3	EUT vert; High Ch., 2 Mbps
2483.792	54.0	-4.5	1.0	268.9		20.0	Horz	PK	0.0	69.5	74.0	-4.5	EUT vert; High Ch., 2 Mbps
2483.533	36.7	-4.5	1.0	289.0	-3.0	20.0	Vert	AV	0.0	49.2	54.0	-4.8	EUT on side; High Ch., 2 Mbps
2483.500	36.7	-4.5	1.0	268.9	-3.0	20.0	Horz	AV	0.0	49.2	54.0	-4.8	EUT vert; High Ch., 2 Mbps
2483.583	53.2	-4.5	1.0	28.0		20.0	Horz	PK	0.0	68.7	74.0	-5.3	EUT horz; High Ch., 2 Mbps
4883.042	46.0	5.4	1.0	306.0	-3.0	0.0	Vert	AV	0.0	48.4	54.0	-5.6	EUT vert, Mid Ch., 2 Mbps
2483.525	35.2	-4.5	1.0	218.0	-2.6	20.0	Vert	AV	0.0	48.1	54.0	-5.9	EUT vert; High Ch., 2 Mbps
2483.508	52.3	-4.5	1.0	218.0		20.0	Vert	PK	0.0	67.8	74.0	-6.2	EUT vert; High Ch., 2 Mbps
4882.950	44.8	5.4	1.0	61.0	-2.6	0.0	Vert	AV	0.0	47.6	54.0	-6.4	EUT horz; Mid Ch., 2 Mbps
4802.975	45.1	5.0	2.0	236.9	-3.0	0.0	Horz	AV	0.0	47.1	54.0	-6.9	EUT on side; Low Ch., 2 Mbps
12207.520	49.8	-0.3	2.3	286.0	-2.6	0.0	Horz	AV	0.0	46.9	54.0	-7.1	EUT on side; Mid Ch., 2 Mbps
4882.992	44.0	5.4	1.2	215.0	-2.6	0.0	Horz	AV	0.0	46.8	54.0	-7.2	EUT on side; Mid Ch., 2 Mbps
4803.083	44.5	5.0	1.1	304.9	-3.0	0.0	Vert	AV	0.0	46.5	54.0	-7.5	EUT vert; Low Ch.; 2 Mbps
12377.520	48.3	0.8	1.0	260.0	-2.9	0.0	Vert	AV	0.0	46.2	54.0	-7.8	EUT vert; High Ch., 2 Mbps
2257.855	32.8	-3.6	1.0	160.1	-3.0	20.0	Vert	AV	0.0	46.2	54.0	-7.8	EUT vert; Low Ch., 2 Mbps
2389.908	33.4	-4.4	1.0	10.0	-3.0	20.0	Horz	AV	0.0	46.0	54.0	-8.0	EUT horz; Low Ch., 2 Mbps
2483.517	32.8	-4.5	3.0	147.0	-3.0	20.0	Horz	AV	0.0	45.3	54.0	-8.7	EUT on side; High Ch., 2 Mbps
2389.067	49.6	-4.4	1.0	10.0		20.0	Horz	PK	0.0	65.2	74.0	-8.8	EUT horz; Low Ch., 2 Mbps

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
12207.500	48.0	-0.3	1.0	275.0	-2.6	0.0	Vert	AV	0.0	45.1	54.0	-8.9	EUT vert; Mid Ch., 2 Mbps
2331.930	32.1	-4.1	1.0	196.1	-3.0	20.0	Vert	AV	0.0	45.0	54.0	-9.0	EUT vert; High Ch., 2 Mbps
12012.170	48.2	-0.9	1.0	292.0	-2.6	0.0	Vert	AV	0.0	44.7	54.0	-9.3	EUT vert; Low Ch., 2 Mbps
4950.908	59.1	5.6	2.7	308.9		0.0	Horz	PK	0.0	64.7	74.0	-9.3	EUT on side; High Ch., 2 Mbps
2483.500	32.1	-4.5	1.0	90.0	-3.0	20.0	Vert	AV	0.0	44.6	54.0	-9.4	EUT horz; High Ch., 2 Mbps
2297.982	31.4	-4.1	1.0	191.1	-3.0	20.0	Vert	AV	0.0	44.3	54.0	-9.7	EUT vert; Mid Ch., 2 Mbps
4950.858	58.6	5.6	1.0	289.9		0.0	Vert	PK	0.0	64.2	74.0	-9.8	EUT vert; High Ch., 2 Mbps
2259.272	30.6	-3.6	2.5	97.0	-3.0	20.0	Horz	AV	0.0	44.0	54.0	-10.0	EUT on side; Low Ch., 2 Mbps
4883.017	41.3	5.4	1.0	286.9	-2.9	0.0	Horz	AV	0.0	43.8	54.0	-10.2	EUT horz; Mid Ch., 2 Mbps
2333.913	30.9	-4.1	1.0	151.0	-3.0	20.0	Horz	AV	0.0	43.8	54.0	-10.2	EUT on side; High Ch., 2 Mbps
4882.842	58.1	5.4	1.0	306.0		0.0	Vert	PK	0.0	63.5	74.0	-10.5	EUT vert, Mid Ch., 2 Mbps
2295.915	30.5	-4.0	1.0	183.0	-3.0	20.0	Horz	AV	0.0	43.5	54.0	-10.5	EUT on side; Mid Ch., 2 Mbps
2483.500	47.4	-4.5	3.0	147.0		20.0	Horz	PK	0.0	62.9	74.0	-11.1	EUT on side; High Ch., 2 Mbps
4882.967	39.6	5.4	3.3	220.1	-2.6	0.0	Horz	AV	0.0	42.4	54.0	-11.6	EUT vert, Mid Ch., 2 Mbps
4882.800	57.0	5.4	1.0	61.0		0.0	Vert	PK	0.0	62.4	74.0	-11.6	EUT horz; Mid Ch., 2 Mbps
4804.967	57.1	5.0	2.0	236.9		0.0	Horz	PK	0.0	62.1	74.0	-11.9	EUT on side; Low Ch., 2 Mbps
4804.983	57.1	5.0	1.1	304.9		0.0	Vert	PK	0.0	62.1	74.0	-11.9	EUT vert; Low Ch.; 2 Mbps
12379.780	61.1	0.8	1.0	260.0		0.0	Vert	PK	0.0	61.9	74.0	-12.1	EUT vert; High Ch., 2 Mbps
12209.760	62.1	-0.2	2.3	286.0		0.0	Horz	PK	0.0	61.9	74.0	-12.1	EUT on side; Mid Ch., 2 Mbps
4882.925	56.3	5.4	1.2	215.0		0.0	Horz	PK	0.0	61.7	74.0	-12.3	EUT on side; Mid Ch., 2 Mbps
2258.555	44.9	-3.6	1.0	160.1		20.0	Vert	PK	0.0	61.3	74.0	-12.7	EUT vert; Low Ch., 2 Mbps
12012.410	61.7	-0.9	1.0	292.0		0.0	Vert	PK	0.0	60.8	74.0	-13.2	EUT vert; Low Ch., 2 Mbps
2483.967	45.2	-4.5	1.0	90.0		20.0	Vert	PK	0.0	60.7	74.0	-13.3	EUT horz; High Ch., 2 Mbps
7324.433	32.7	10.6	1.1	308.9	-2.6	0.0	Horz	AV	0.0	40.7	54.0	-13.3	EUT on side; Mid Ch., 2 Mbps
12209.830	60.4	-0.2	1.0	275.0		0.0	Vert	PK	0.0	60.2	74.0	-13.8	EUT vert; Mid Ch., 2 Mbps
4883.008	37.0	5.4	1.0	202.1	-2.6	0.0	Vert	AV	0.0	39.8	54.0	-14.2	EUT on side; Mid Ch., 2 Mbps
12007.530	43.3	-0.9	1.0	264.0	-2.6	0.0	Horz	AV	0.0	39.8	54.0	-14.2	EUT on side; Low Ch., 2 Mbps
12377.500	41.5	0.8	1.0	335.0	-2.6	0.0	Horz	AV	0.0	39.7	54.0	-14.3	EUT on side; High Ch., 2 Mbps
2331.097	43.8	-4.1	1.0	196.1		20.0	Vert	PK	0.0	59.7	74.0	-14.3	EUT vert; High Ch., 2 Mbps
2298.173	43.7	-4.1	1.0	191.1		20.0	Vert	PK	0.0	59.6	74.0	-14.4	EUT vert; Mid Ch., 2 Mbps
7426.433	31.6	10.6	2.1	257.9	-2.6	0.0	Vert	AV	0.0	39.6	54.0	-14.4	EUT vert; High Ch., 2 Mbps
4882.858	53.9	5.4	1.0	286.9		0.0	Horz	PK	0.0	59.3	74.0	-14.7	EUT horz; Mid Ch., 2 Mbps
7426.492	31.3	10.6	1.4	27.0	-2.6	0.0	Horz	AV	0.0	39.3	54.0	-14.7	EUT on side; High Ch., 2 Mbps
2255.430	42.6	-3.5	2.5	97.0		20.0	Horz	PK	0.0	59.1	74.0	-14.9	EUT on side; Low Ch., 2 Mbps
7324.492	31.1	10.6	1.0	243.9	-2.9	0.0	Vert	AV	0.0	38.8	54.0	-15.2	EUT vert; Mid Ch., 2 Mbps
2333.322	42.7	-4.1	1.0	151.0		20.0	Horz	PK	0.0	58.6	74.0	-15.4	EUT on side; High Ch., 2 Mbps
2298.998	42.2	-4.1	1.0	183.0		20.0	Horz	PK	0.0	58.1	74.0	-15.9	EUT on side; Mid Ch., 2 Mbps
4882.800	52.6	5.4	3.3	220.1		0.0	Horz	PK	0.0	58.0	74.0	-16.0	EUT vert, Mid Ch., 2 Mbps
7327.150	46.0	10.6	1.1	308.9		0.0	Horz	PK	0.0	56.6	74.0	-17.4	EUT on side; Mid Ch., 2 Mbps
4884.708	50.6	5.4	1.0	202.1		0.0	Vert	PK	0.0	56.0	74.0	-18.0	EUT on side; Mid Ch., 2 Mbps
12379.760	55.0	0.8	1.0	335.0		0.0	Horz	PK	0.0	55.8	74.0	-18.2	EUT on side; High Ch., 2 Mbps
12012.250	56.7	-0.9	1.0	264.0		0.0	Horz	PK	0.0	55.8	74.0	-18.2	EUT on side; Low Ch., 2 Mbps
7426.417	44.5	10.6	2.1	257.9		0.0	Vert	PK	0.0	55.1	74.0	-18.9	EUT vert; High Ch., 2 Mbps
7429.200	44.3	10.7	1.4	27.0		0.0	Horz	PK	0.0	55.0	74.0	-19.0	EUT on side; High Ch., 2 Mbps
7324.542	43.5	10.6	1.0	243.9		0.0	Vert	PK	0.0	54.1	74.0	-19.9	EUT vert; Mid Ch., 2 Mbps
2483.733	43.9	-4.5	1.0	164.0		10.0	Horz	PK	0.0	49.4	74.0	-24.6	EUT horz; High Ch., 1 Mbps
2385.733	43.5	-4.4	1.0	312.9		10.0	Horz	PK	0.0	49.1	74.0	-24.9	EUT horz; Low Ch., 1 Mbps
4962.050	43.4	5.7	1.4	286.0		0.0	Horz	PK	0.0	49.1	74.0	-24.9	EUT on side; High Ch., 1 Mbps
2483.525	31.9	-4.5	1.0	164.0	-35.5	10.0	Horz	AV	0.0	1.9	54.0	-52.1	EUT horz; High Ch., 1 Mbps
4959.800	31.5	5.7	1.4	286.0	-35.5	0.0	Horz	AV	0.0	1.7	54.0	-52.3	EUT on side; High Ch., 1 Mbps
2389.967	31.4	-4.4	1.0	312.9	-35.5	10.0	Horz	AV	0.0	1.5	54.0	-52.5	EUT horz; Low Ch., 1 Mbps

DUTY CYCLE

XMit 2017.12.13

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	29-Sep-17	29-Sep-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	26-Mar-18	26-Mar-19
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-18	15-Mar-19
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-18	13-Feb-19
Block - DC	Fairview Microwave	SD3379	AMI	12-Sep-17	12-Sep-18

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 2017.12.14 XMit 2017.12.13

EUT:	**TV Streamer**			**Work Order:**	**STAK0135**
Serial Number:	**182220800B**			**Date:**	**1-Aug-18**
Customer:	**Starkey Laboratories, Inc.**			**Temperature:**	**23 °C**
Attendees:	**Charlie Esch**			**Humidity:**	**54.2% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Andrew Rogstad, Trevor Buls**	**Power:**	**5 VDC**	**Job Site:**	**MN09**

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

COMMENTS

U.FL to SMA adapter cable included in measurement cable offset.

DEVIATIONS FROM TEST STANDARD

None

Configuration #	**1**	*Signature* Trevor Buls

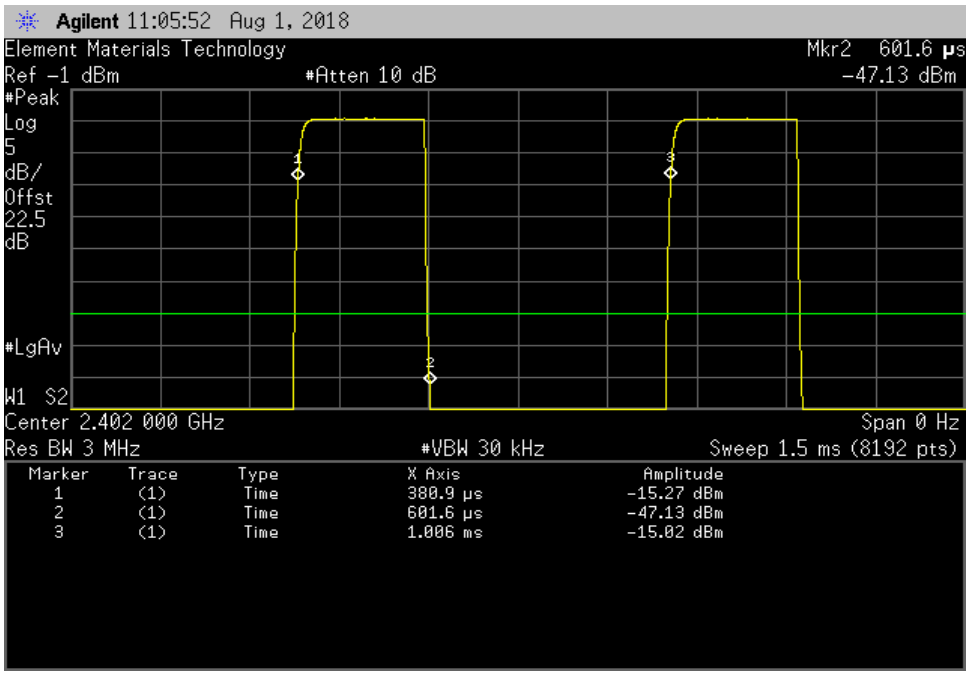
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
BLE/GFSK Low Channel, 1 Mbps, 2402 MHz	220.655 us	625.119 us	1	35.3	N/A	N/A
BLE/GFSK Low Channel, 1 Mbps, 2402 MHz	N/A	N/A	5	N/A	N/A	N/A
BLE/GFSK Mid Channel, 1 Mbps, 2442 MHz	219.238 us	624.921 us	1	35.1	N/A	N/A
BLE/GFSK Mid Channel, 1 Mbps, 2442 MHz	N/A	N/A	5	N/A	N/A	N/A
BLE/GFSK High Channel, 1 Mbps, 2480 MHz	220.105 us	624.954 us	1	35.2	N/A	N/A
BLE/GFSK High Channel, 1 Mbps, 2480 MHz	N/A	N/A	5	N/A	N/A	N/A
GFSK Low Channel, 2 Mbps, 2402 MHz	107.995 us	624.958 us	1	17.3	N/A	N/A
GFSK Low Channel, 2 Mbps, 2402 MHz	N/A	N/A	5	N/A	N/A	N/A
GFSK Mid Channel, 2 Mbps, 2442 MHz	107.929 us	625.001 us	1	17.3	N/A	N/A
GFSK Mid Channel, 2 Mbps, 2442 MHz	N/A	N/A	5	N/A	N/A	N/A
GFSK High Channel, 2 Mbps, 2476 MHz	108.01 us	624.903 us	1	17.3	N/A	N/A
GFSK High Channel, 2 Mbps, 2476 MHz	N/A	N/A	5	N/A	N/A	N/A

DUTY CYCLE

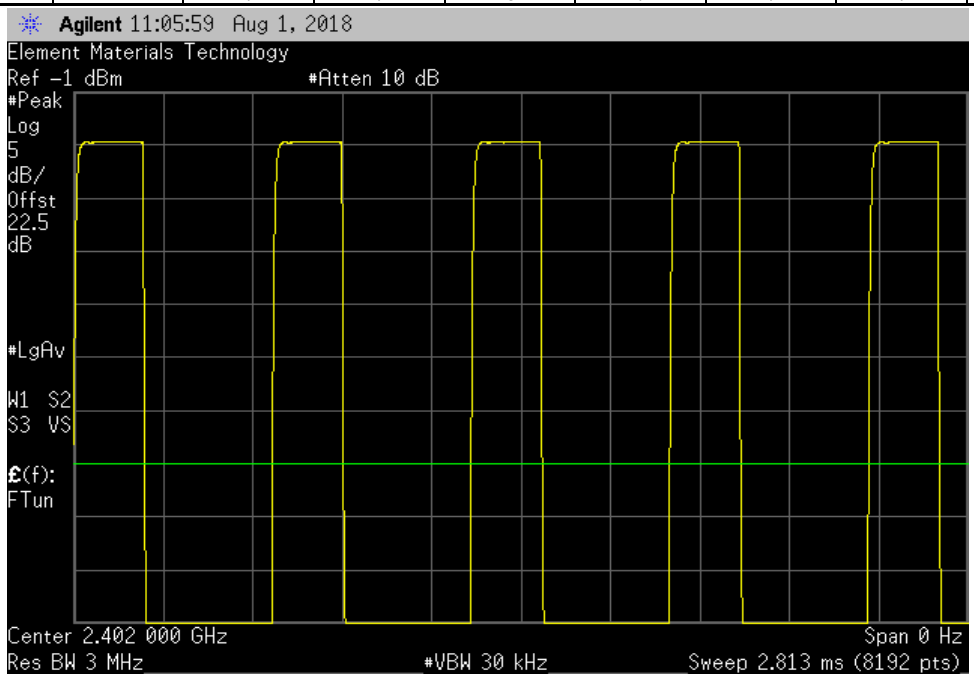
element

TbtTx 2017.12.14 XMit 2017.12.13

BLE/GFSK Low Channel, 1 Mbps, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	220.655 us	625.119 us	1	35.3	N/A	N/A

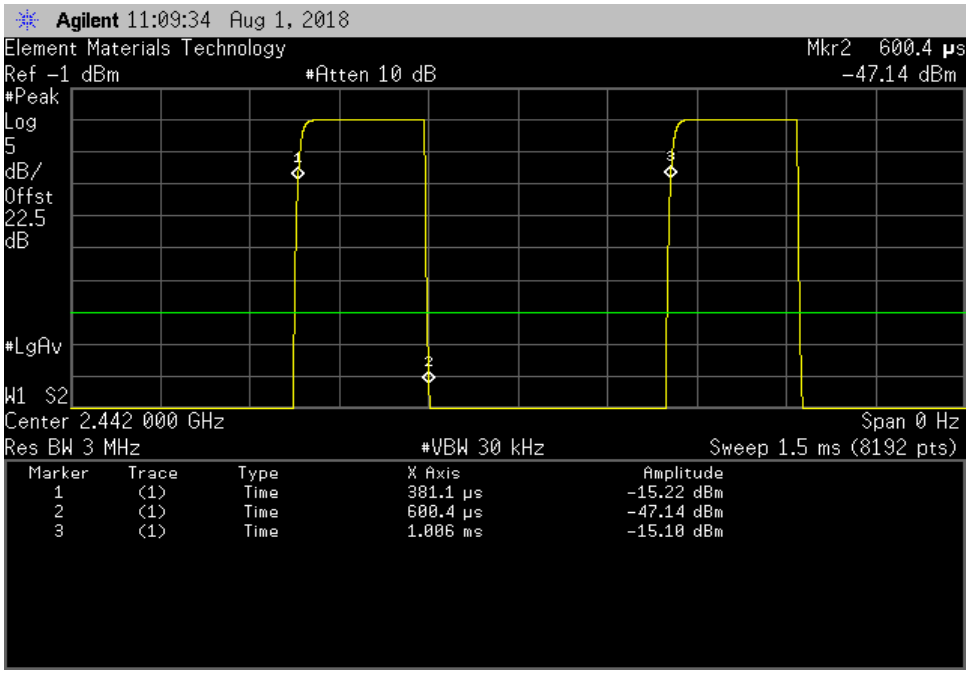


BLE/GFSK Low Channel, 1 Mbps, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

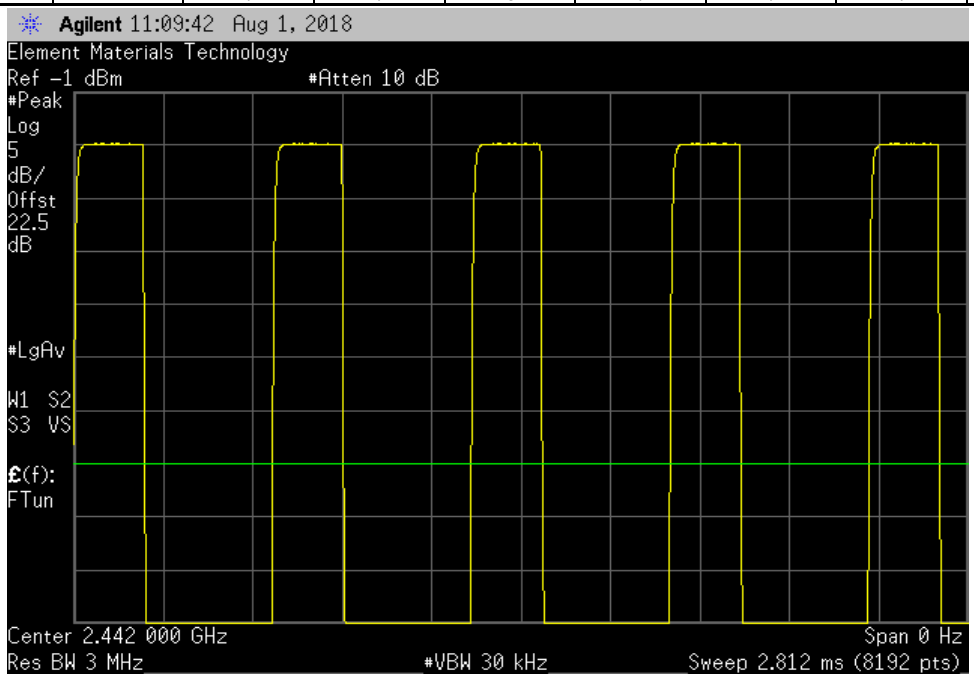


DUTY CYCLE

BLE/GFSK Mid Channel, 1 Mbps, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	219.238 us	624.921 us	1	35.1	N/A	N/A



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

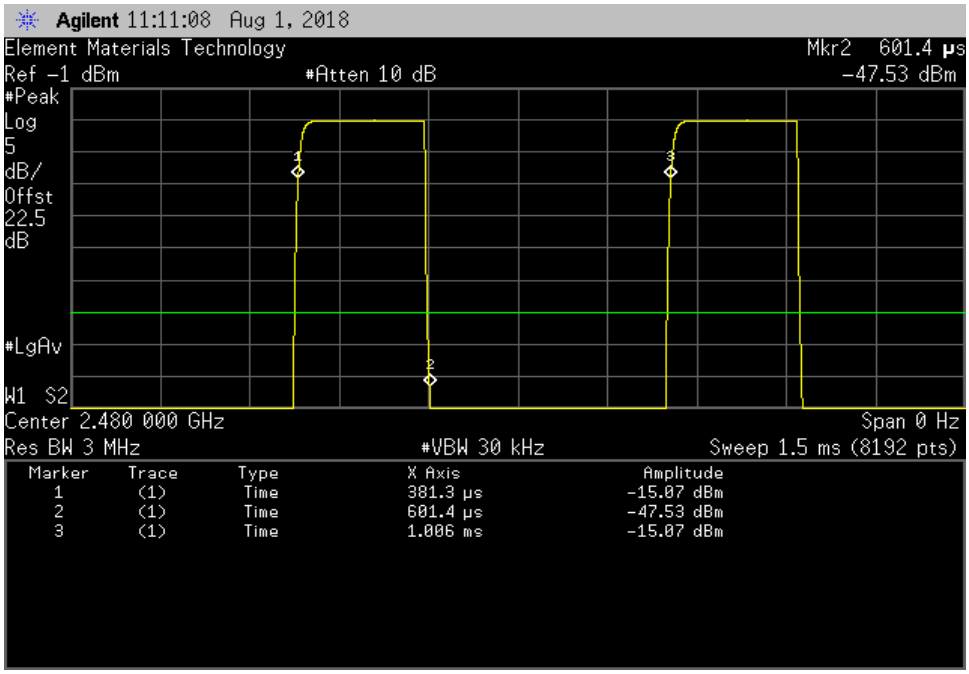


DUTY CYCLE

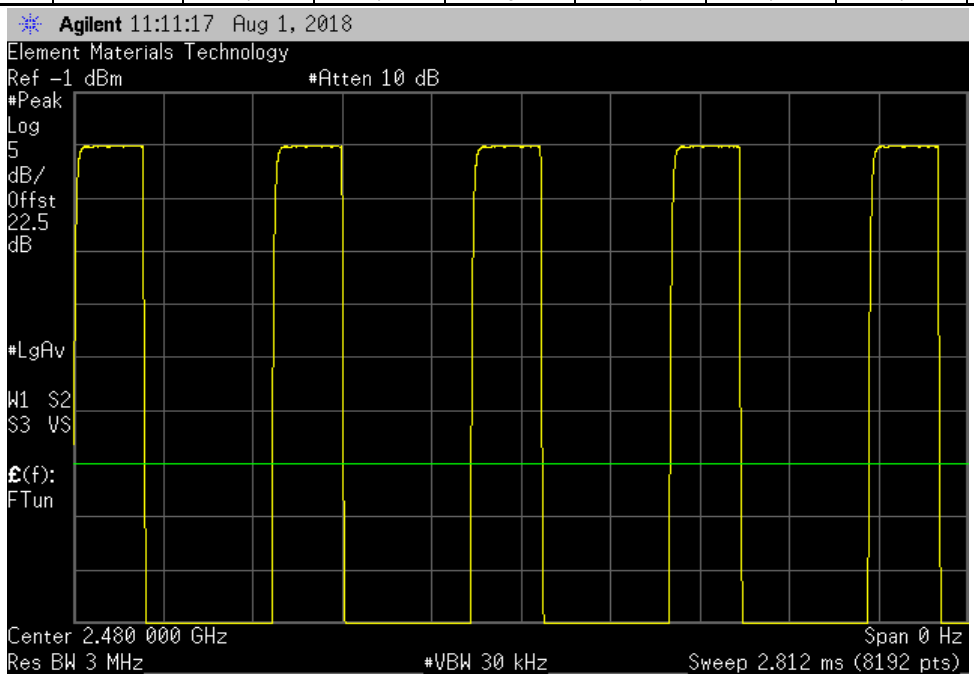
element

TbtTx 2017.12.14 XMit 2017.12.13

BLE/GFSK High Channel, 1 Mbps, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	220.105 us	624.954 us	1	35.2	N/A	N/A

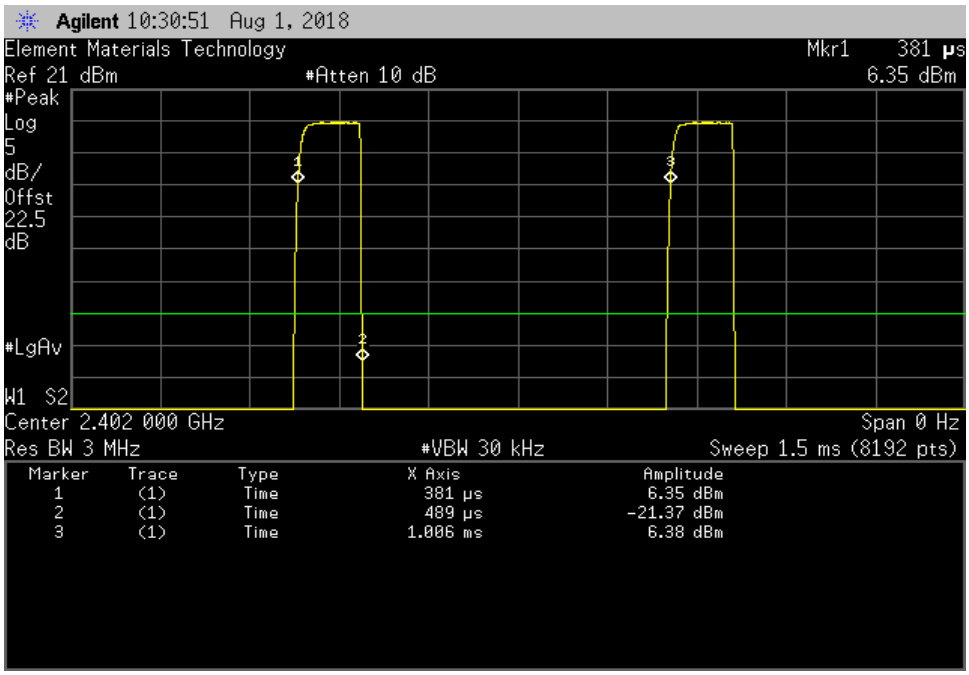


BLE/GFSK High Channel, 1 Mbps, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

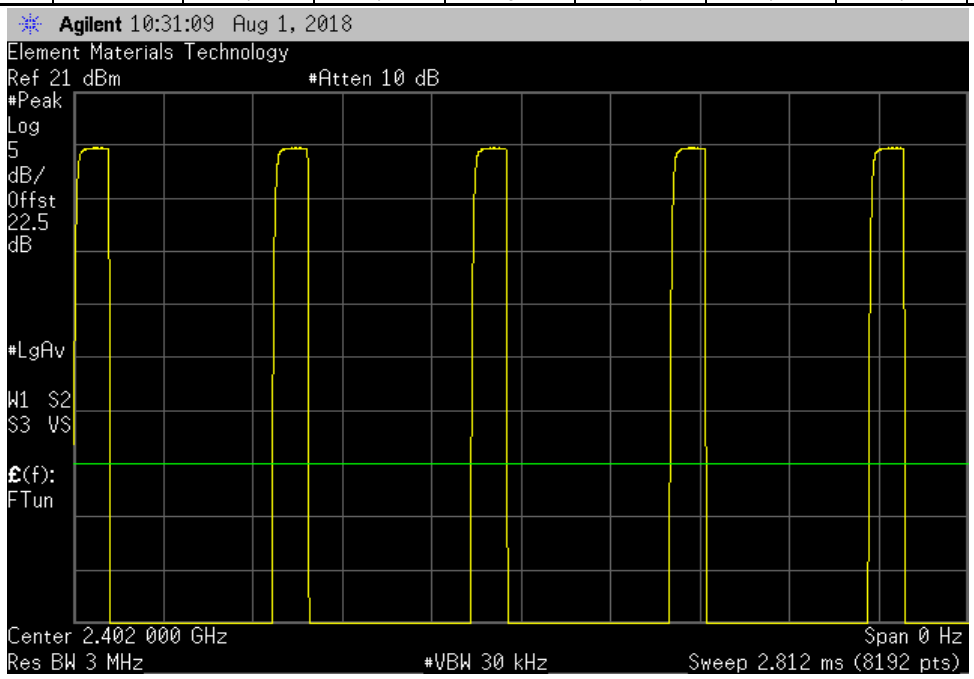


DUTY CYCLE

GFSK Low Channel, 2 Mbps, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	107.995 us	624.958 us	1	17.3	N/A	N/A

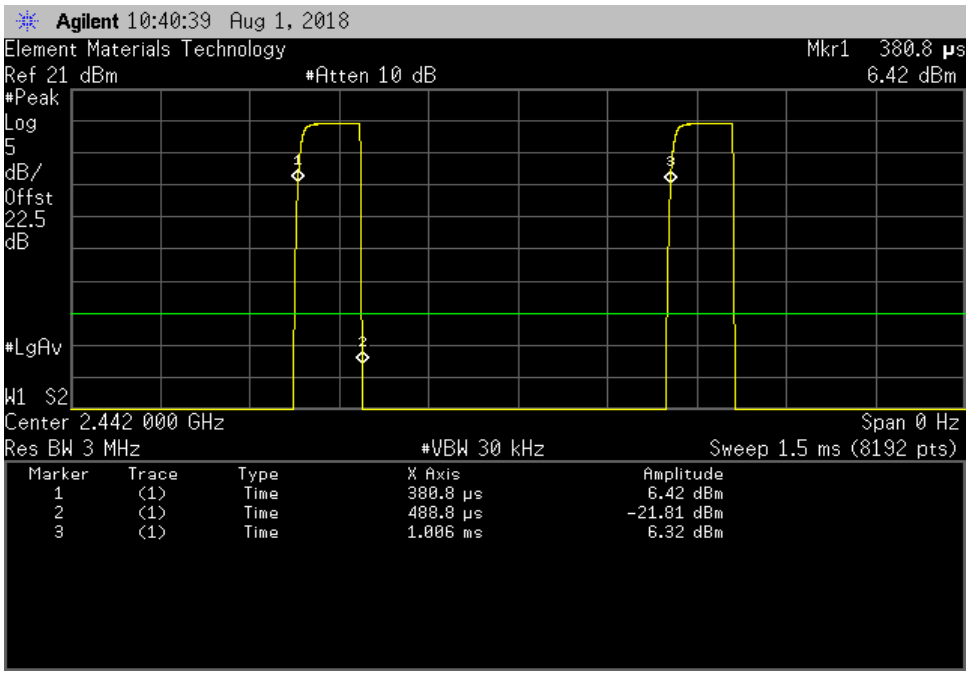


GFSK Low Channel, 2 Mbps, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

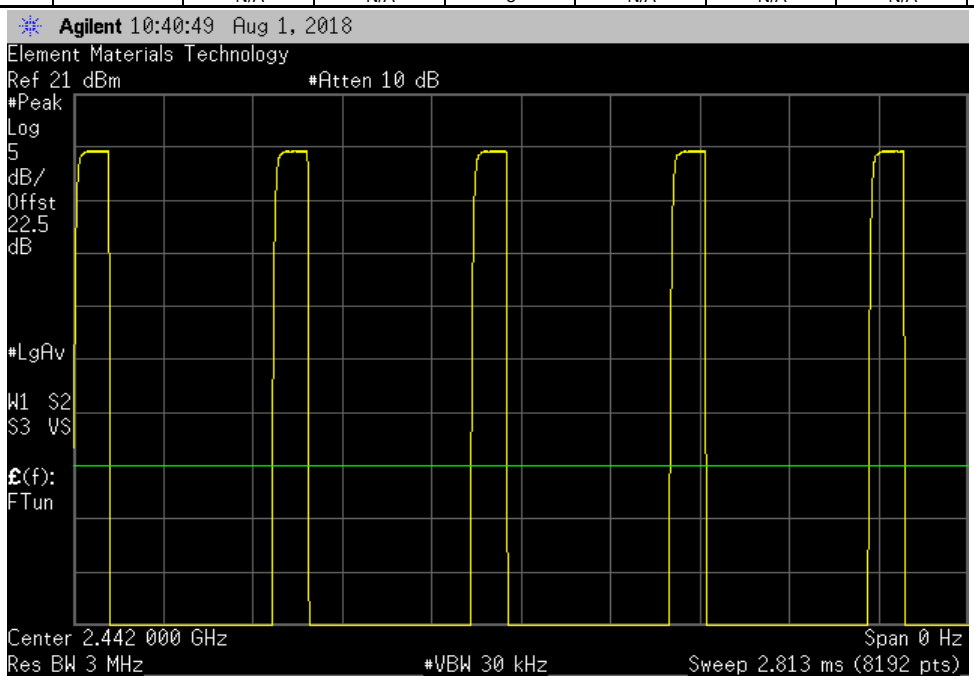


DUTY CYCLE

GFSK Mid Channel, 2 Mbps, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	107.929 us	625.001 us	1	17.3	N/A	N/A

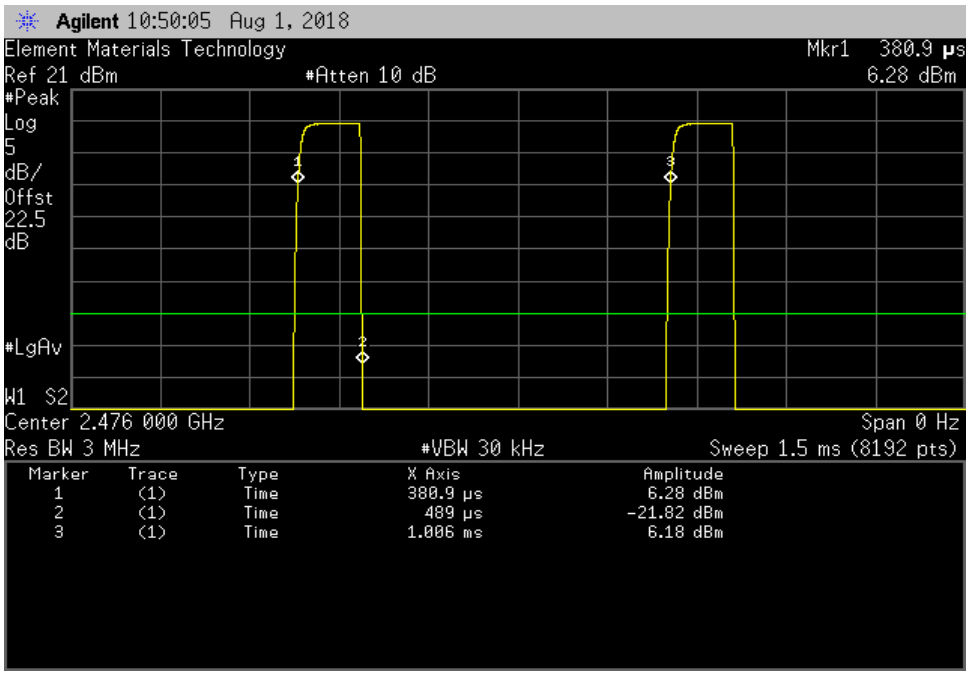


GFSK Mid Channel, 2 Mbps, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

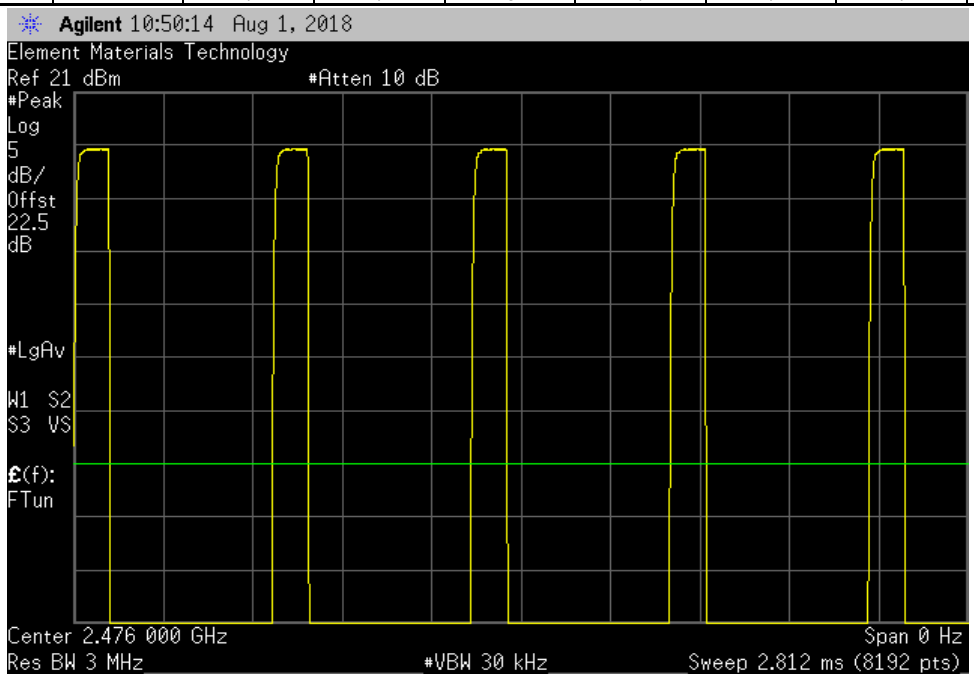


DUTY CYCLE

GFSK High Channel, 2 Mbps, 2476 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	108.01 us	624.903 us	1	17.3	N/A	N/A



GFSK High Channel, 2 Mbps, 2476 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



OCCUPIED BANDWIDTH

XMit 2017.12.13

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	29-Sep-17	29-Sep-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	26-Mar-18	26-Mar-19
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-18	15-Mar-19
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-18	13-Feb-19
Block - DC	Fairview Microwave	SD3379	AMI	12-Sep-17	12-Sep-18

TEST DESCRIPTION

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

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

OCCUPIED BANDWIDTH

TbtTx 2017.12.14 XMit 2017.12.13

EUT:	**TV Streamer**			**Work Order:**	**STAK0135**
Serial Number:	**182220800B**			**Date:**	**1-Aug-18**
Customer:	**Starkey Laboratories, Inc.**			**Temperature:**	**23 °C**
Attendees:	**Charlie Esch**			**Humidity:**	**54.2% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Andrew Rogstad, Trevor Buls**	**Power:**	**5 VDC**	**Job Site:**	**MN09**

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

COMMENTS

U.FL to SMA adapter cable included in measurement cable offset.

DEVIATIONS FROM TEST STANDARD

None

Configuration #	**1**	*Signature* Trevor Buls

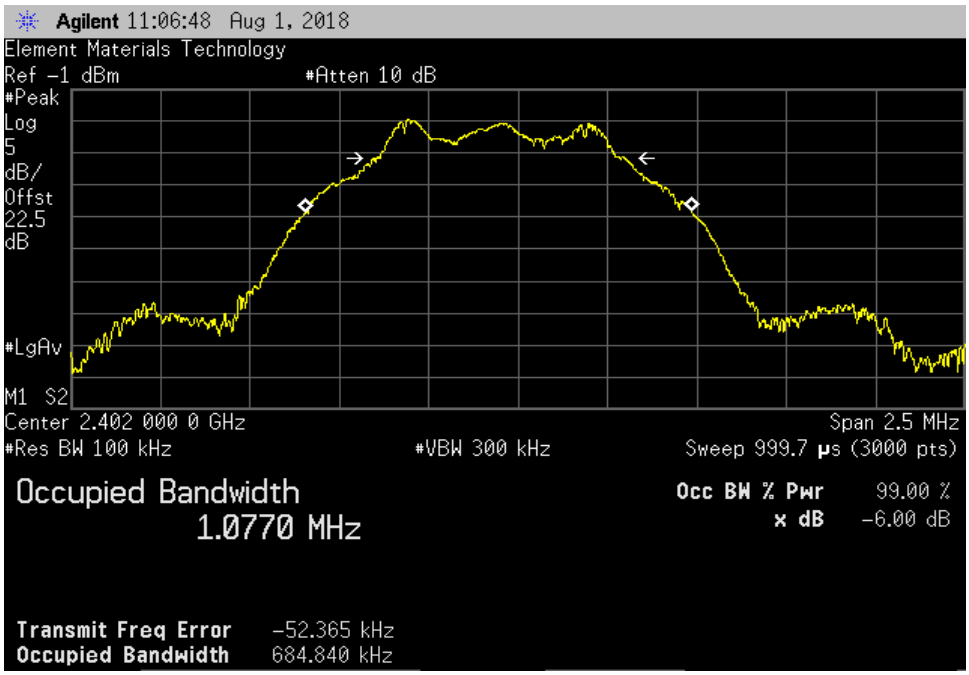
	Value	**Limit (≥)**	**Result**
BLE/GFSK Low Channel, 1 Mbps, 2402 MHz	684.84 kHz	500 kHz	Pass
BLE/GFSK Mid Channel, 1 Mbps, 2442 MHz	672.657 kHz	500 kHz	Pass
BLE/GFSK High Channel, 1 Mbps, 2480 MHz	672.417 kHz	500 kHz	Pass
GFSK Low Channel, 2 Mbps, 2402 MHz	1.223 MHz	500 kHz	Pass
GFSK Mid Channel, 2 Mbps, 2442 MHz	1.184 MHz	500 kHz	Pass
GFSK High Channel, 2 Mbps, 2476 MHz	1.211 MHz	500 kHz	Pass

OCCUPIED BANDWIDTH

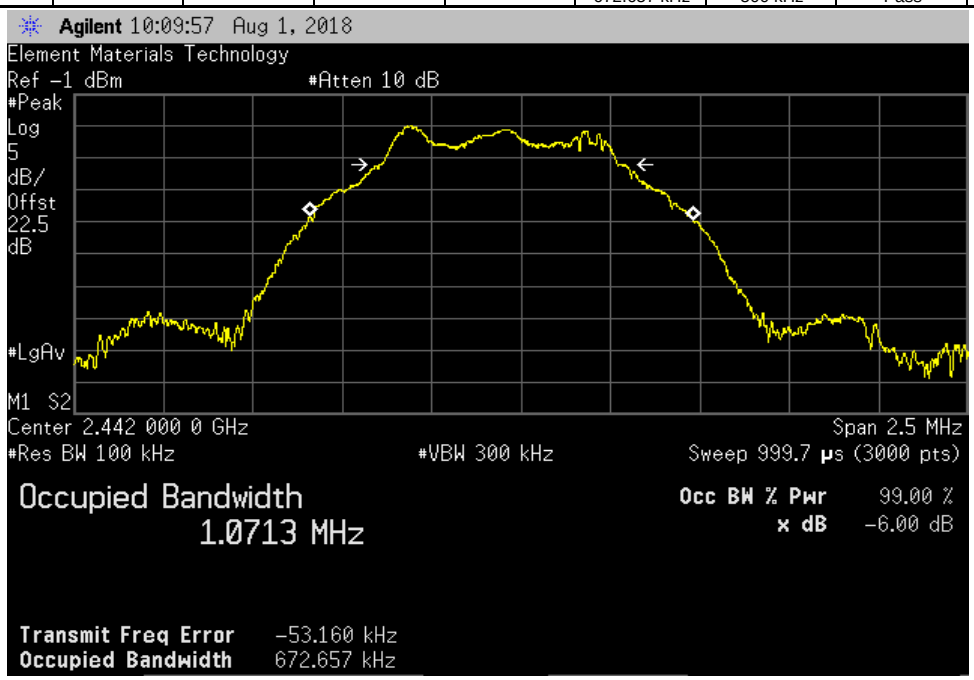
element

TbtTx 2017.12.14 XMit 2017.12.13

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



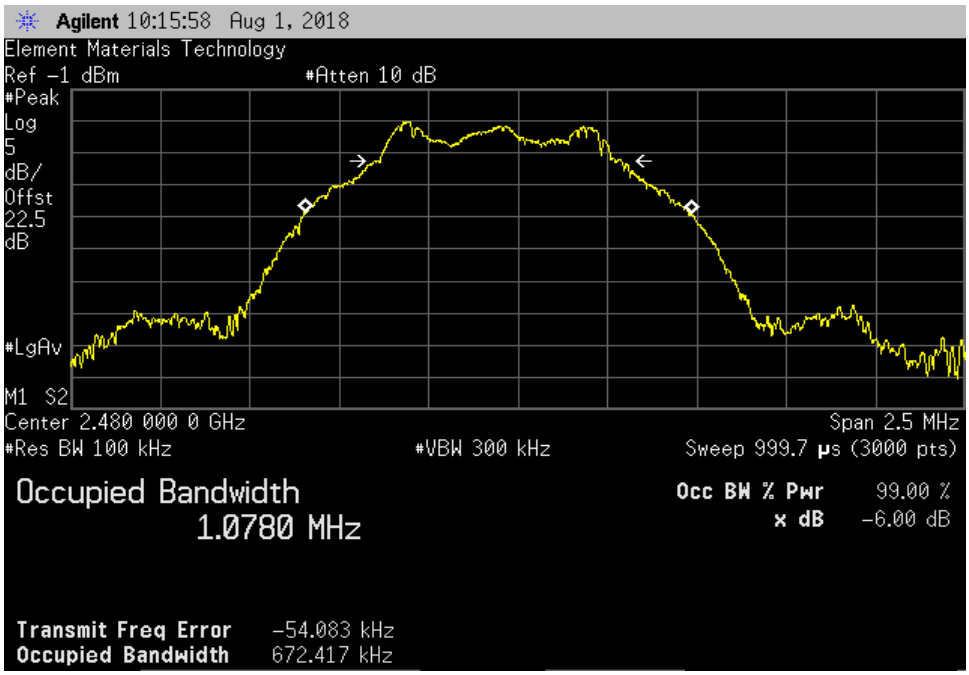
BLE/GFSK Mid Channel, 1 Mbps, 2442 MHz						
				Value	Limit (≥)	Result
				672.657 kHz	500 kHz	Pass



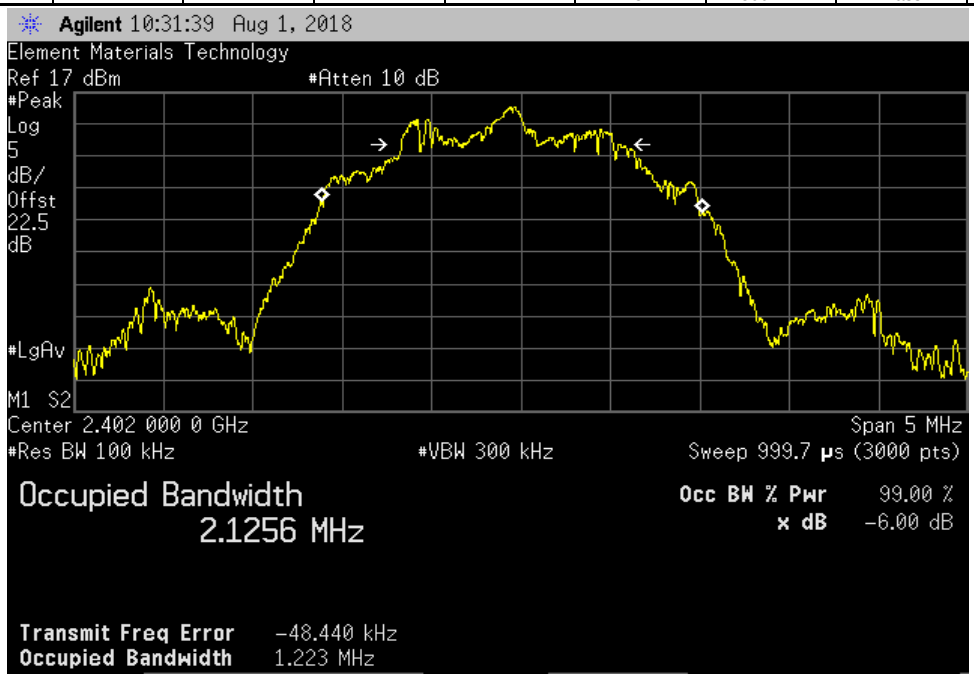
OCCUPIED BANDWIDTH

TbtTx 2017.12.14 XMit 2017.12.13

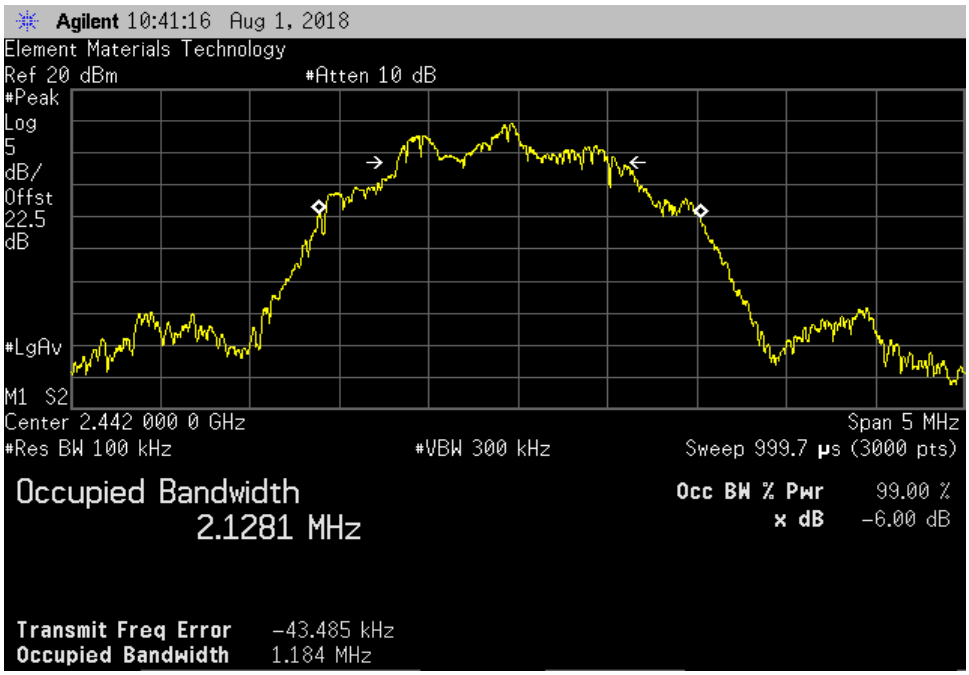
BLE/GFSK High Channel, 1 Mbps, 2480 MHz						
				Value	Limit (≥)	Result
				672.417 kHz	500 kHz	Pass



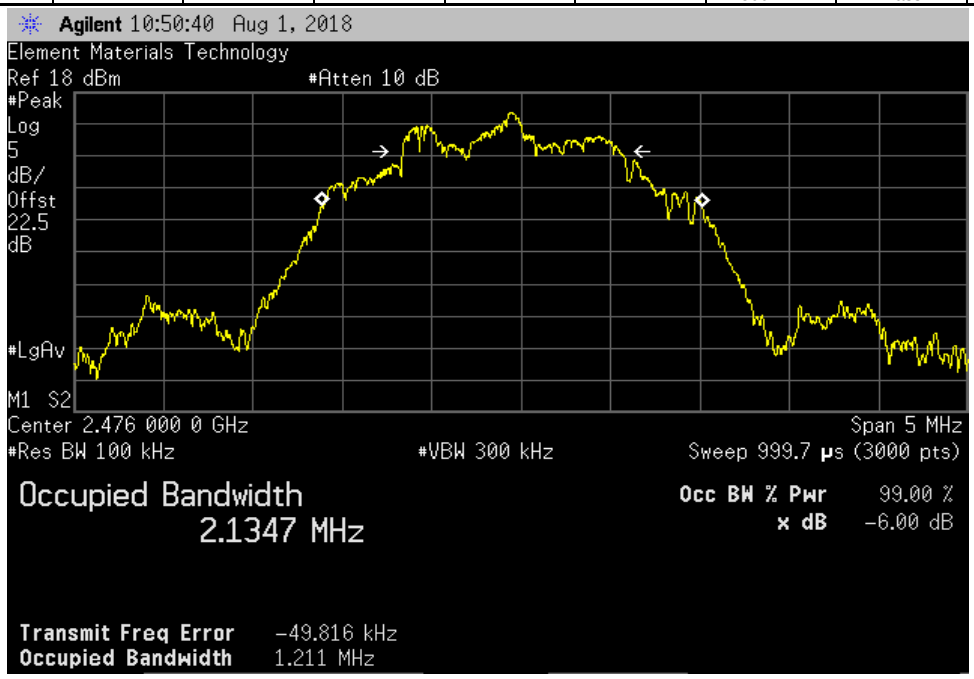
GFSK Low Channel, 2 Mbps, 2402 MHz						
				Value	Limit (≥)	Result
				1.223 MHz	500 kHz	Pass



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



GFSK High Channel, 2 Mbps, 2476 MHz						
				Value	Limit (≥)	Result
				1.211 MHz	500 kHz	Pass



OUTPUT POWER

XMit 2017.12.13

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	29-Sep-17	29-Sep-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	26-Mar-18	26-Mar-19
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-18	15-Mar-19
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-18	13-Feb-19
Block - DC	Fairview Microwave	SD3379	AMI	12-Sep-17	12-Sep-18

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

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

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

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

OUTPUT POWER

TbtTx 2017.12.14 XMit 2017.12.13

EUT:	TV Streamer			**Work Order:**	STAK0135
Serial Number:	182220800B			**Date:**	1-Aug-18
Customer:	Starkey Laboratories, Inc.			**Temperature:**	23 °C
Attendees:	Charlie Esch			**Humidity:**	54.2% RH
Project:	None			**Barometric Pres.:**	1018 mbar
Tested by:	Andrew Rogstad, Trevor Buls	**Power:**	5 VDC	**Job Site:**	MN09

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

COMMENTS

U.FL to SMA adapter cable included in measurement cable offset. Output power was lowered by 2 dB by the customer for FCC for the 2 Mbps modulation. Modification authorized by Aaron Anderson.

DEVIATIONS FROM TEST STANDARD

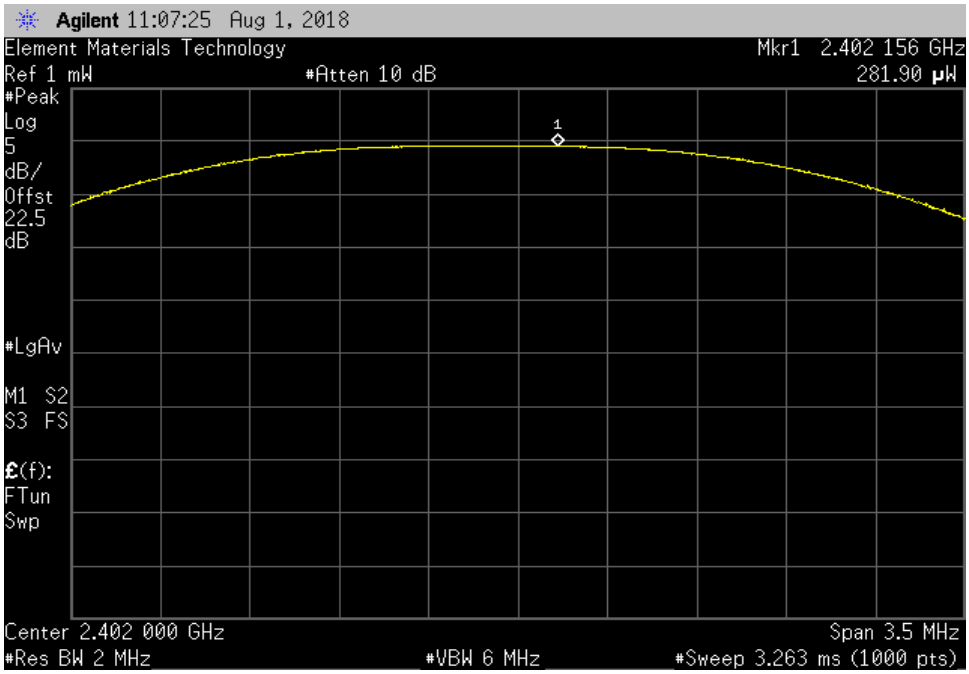
None

Configuration #	1	Signature Trevor Buls

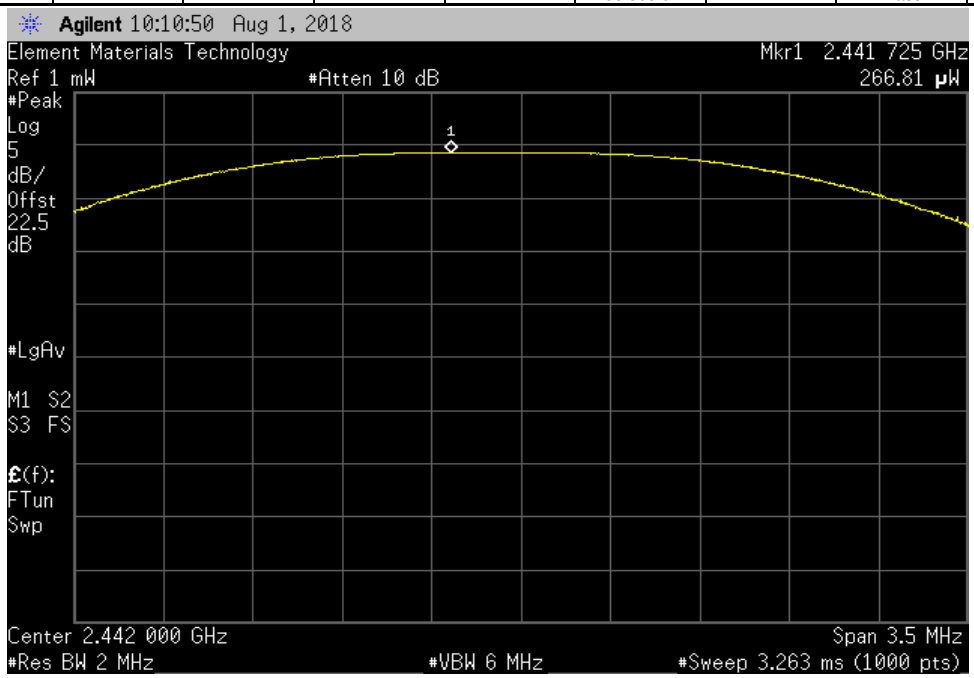
	Value	Limit (<)	Result
BLE/GFSK Low Channel, 1 Mbps, 2402 MHz	281.903 uW	1 W	Pass
BLE/GFSK Mid Channel, 1 Mbps, 2442 MHz	266.809 uW	1 W	Pass
BLE/GFSK High Channel, 1 Mbps, 2480 MHz	255.211 uW	1 W	Pass
GFSK Low Channel, 2 Mbps, 2402 MHz	27.052 mW	1 W	Pass
GFSK Mid Channel, 2 Mbps, 2442 MHz	26.835 mW	1 W	Pass
GFSK High Channel, 2 Mbps, 2476 MHz	27.473 mW	1 W	Pass

OUTPUT POWER

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

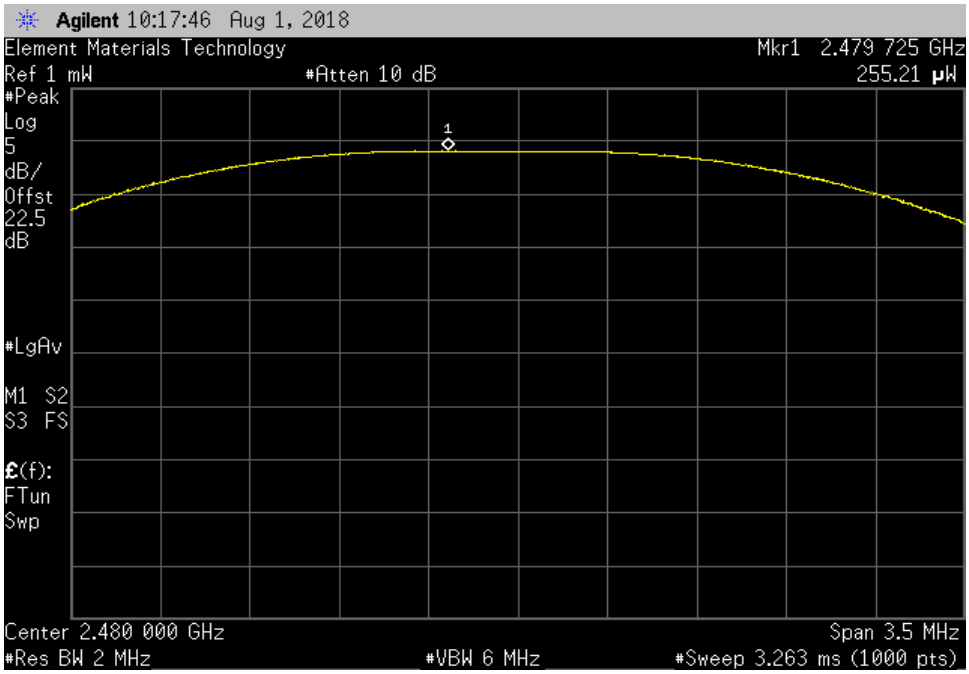


BLE/GFSK Mid Channel, 1 Mbps, 2442 MHz						
				Value	Limit (<)	Result
				266.809 uW	1 W	Pass

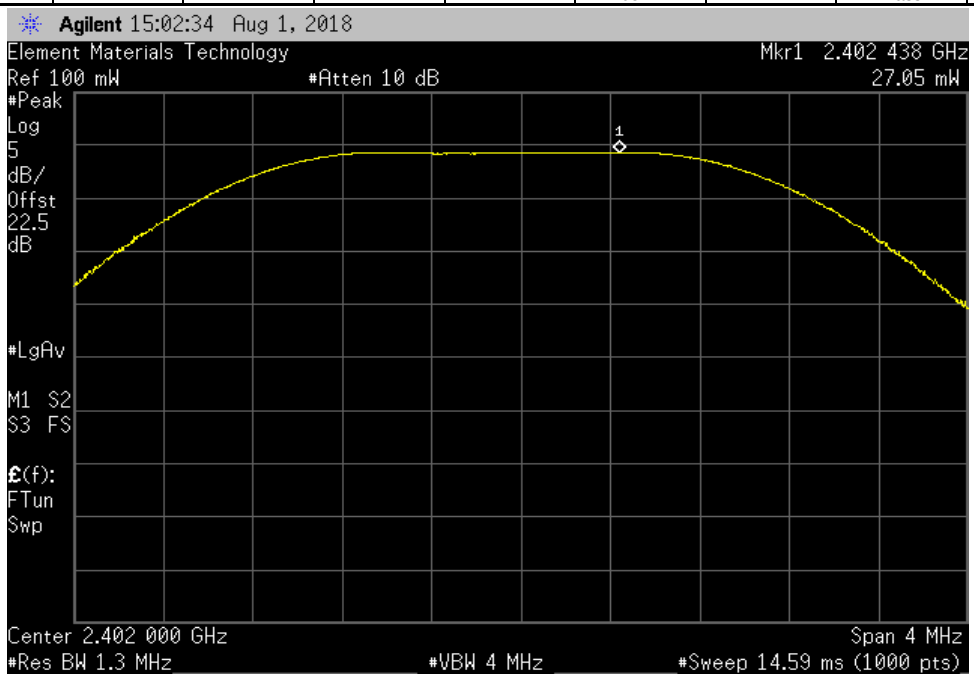


OUTPUT POWER

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

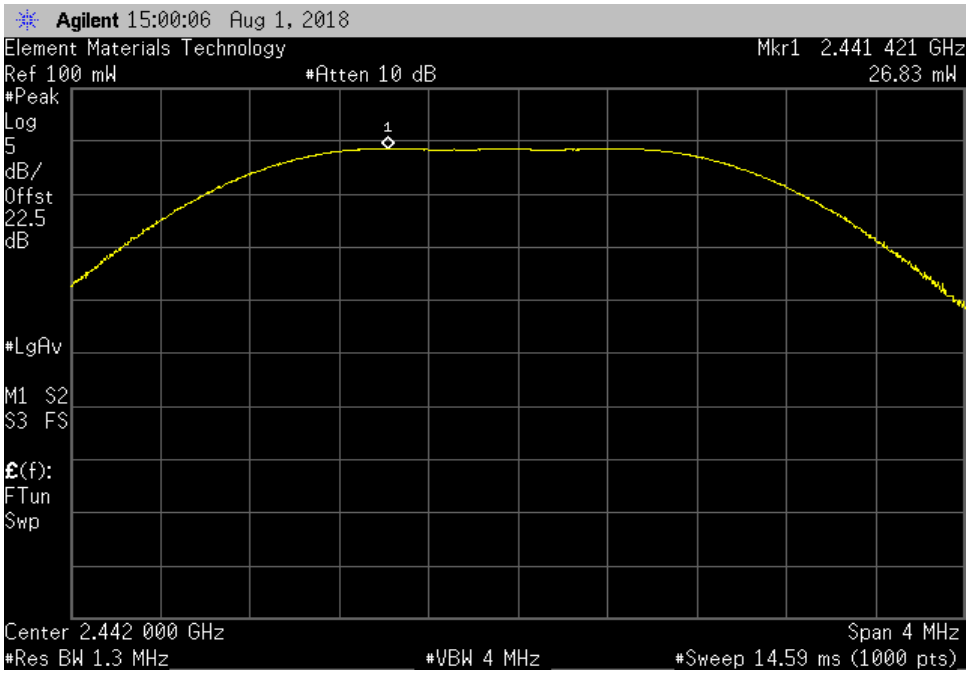


GFSK Low Channel, 2 Mbps, 2402 MHz						
				Value	Limit (<)	Result
				27.052 mW	1 W	Pass

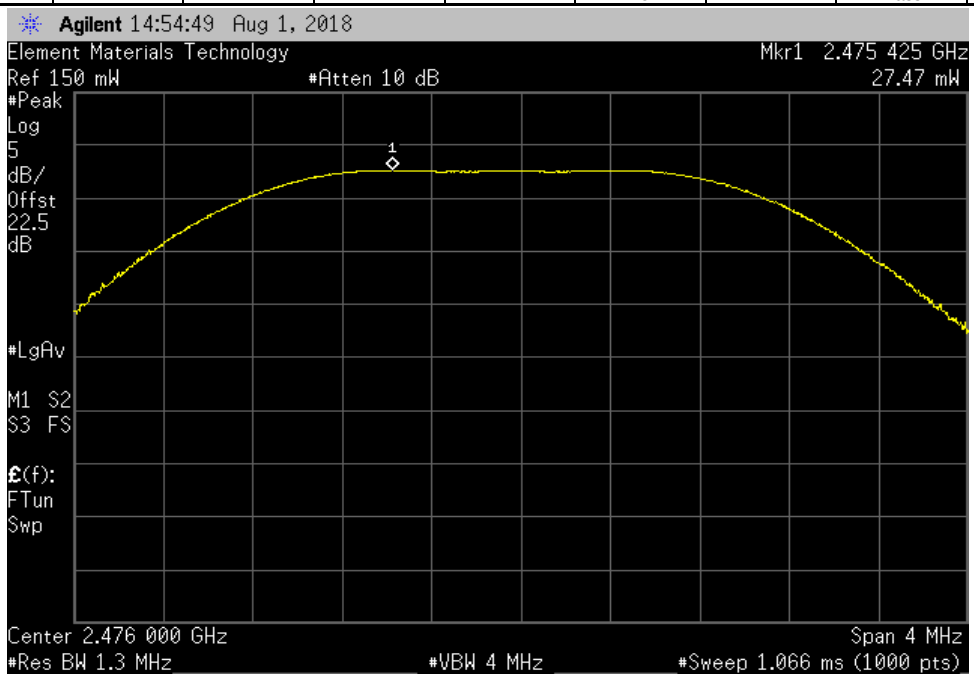


OUTPUT POWER

GFSK Mid Channel, 2 Mbps, 2442 MHz						
				Value	Limit (<)	Result
				26.835 mW	1 W	Pass



GFSK High Channel, 2 Mbps, 2476 MHz						
				Value	Limit (<)	Result
				27.473 mW	1 W	Pass



POWER SPECTRAL DENSITY

XMit 2017.12.13

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	29-Sep-17	29-Sep-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	26-Mar-18	26-Mar-19
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-18	15-Mar-19
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-18	13-Feb-19
Block - DC	Fairview Microwave	SD3379	AMI	12-Sep-17	12-Sep-18

TEST DESCRIPTION

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 2017.12.14 XMit 2017.12.13

EUT:	**TV Streamer**			**Work Order:**	**STAK0135**
Serial Number:	**182220800B**			**Date:**	**1-Aug-18**
Customer:	**Starkey Laboratories, Inc.**			**Temperature:**	**23 °C**
Attendees:	**Charlie Esch**			**Humidity:**	**54.2% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Andrew Rogstad, Trevor Buls**	**Power:**	**5 VDC**	**Job Site:**	**MN09**

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

COMMENTS

U.FL to SMA adapter cable included in measurement cable offset.

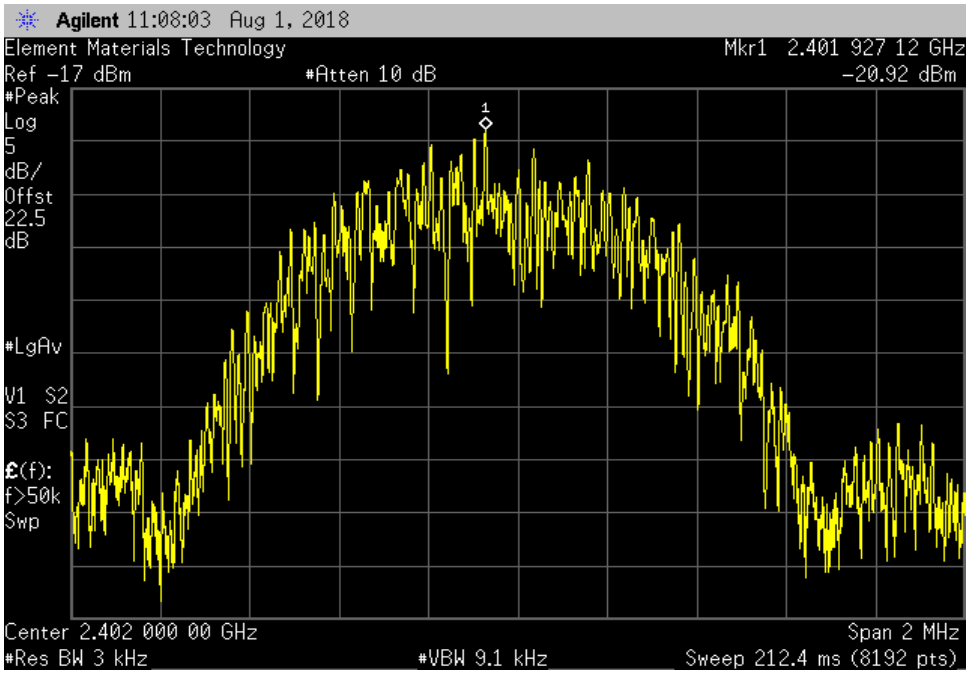
DEVIATIONS FROM TEST STANDARD

None

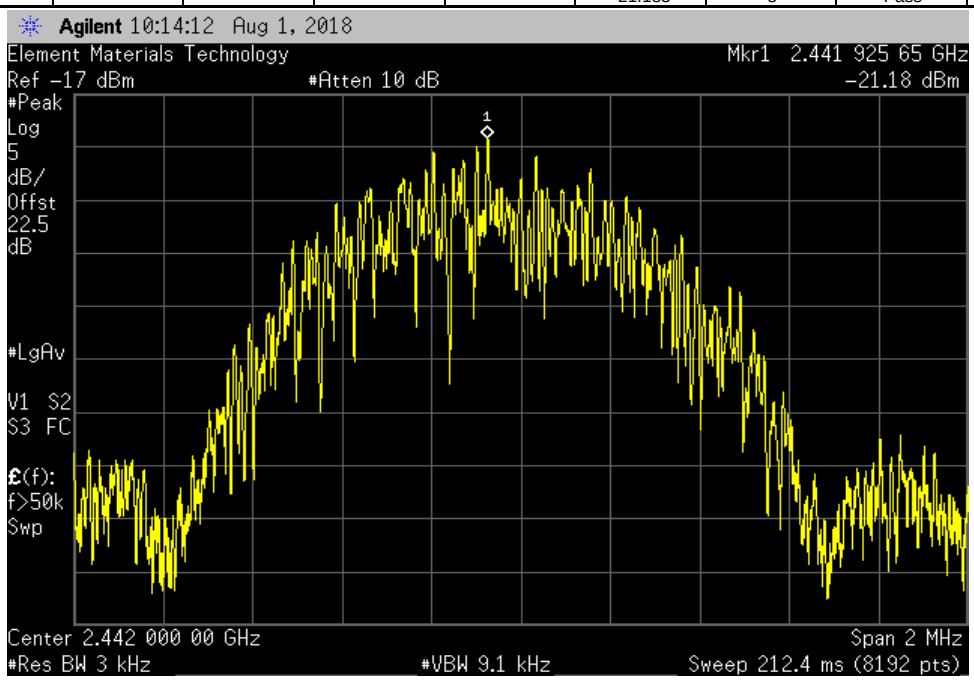
Configuration #	**1**	*Signature* Trevor Buls

	Value dBm/3kHz	**Limit < dBm/3kHz**	**Results**
BLE/GFSK Low Channel, 1 Mbps, 2402 MHz	-20.915	8	Pass
BLE/GFSK Mid Channel, 1 Mbps, 2442 MHz	-21.183	8	Pass
BLE/GFSK High Channel, 1 Mbps, 2480 MHz	-21.333	8	Pass
GFSK Low Channel, 2 Mbps, 2402 MHz	-3.651	8	Pass
GFSK Mid Channel, 2 Mbps, 2442 MHz	-3.743	8	Pass
GFSK High Channel, 2 Mbps, 2476 MHz	-3.759	8	Pass

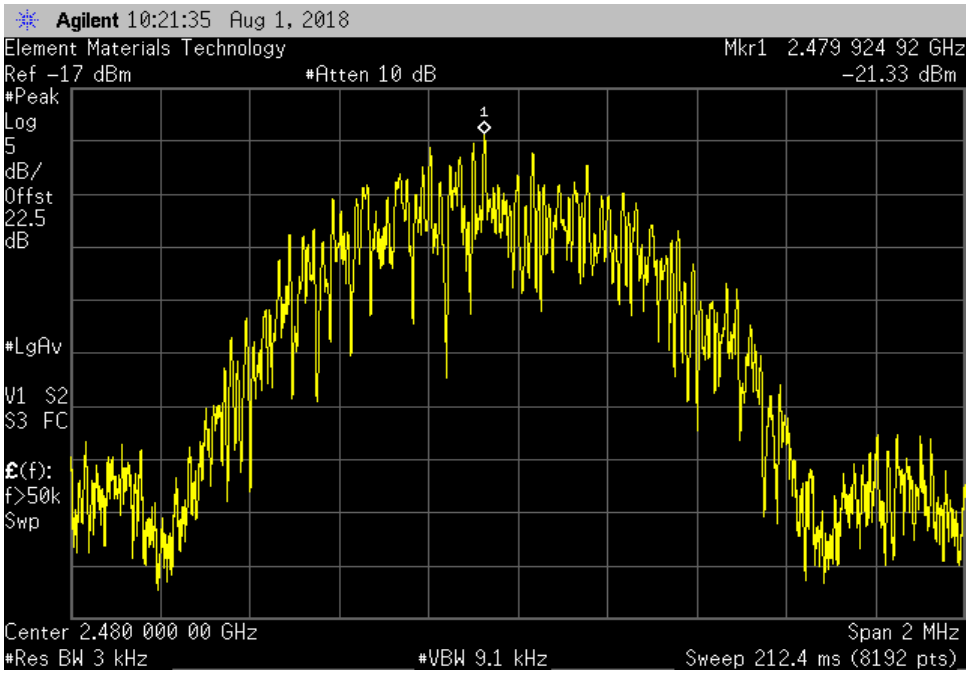
BLE/GFSK Low Channel, 1 Mbps, 2402 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-20.915	8	Pass



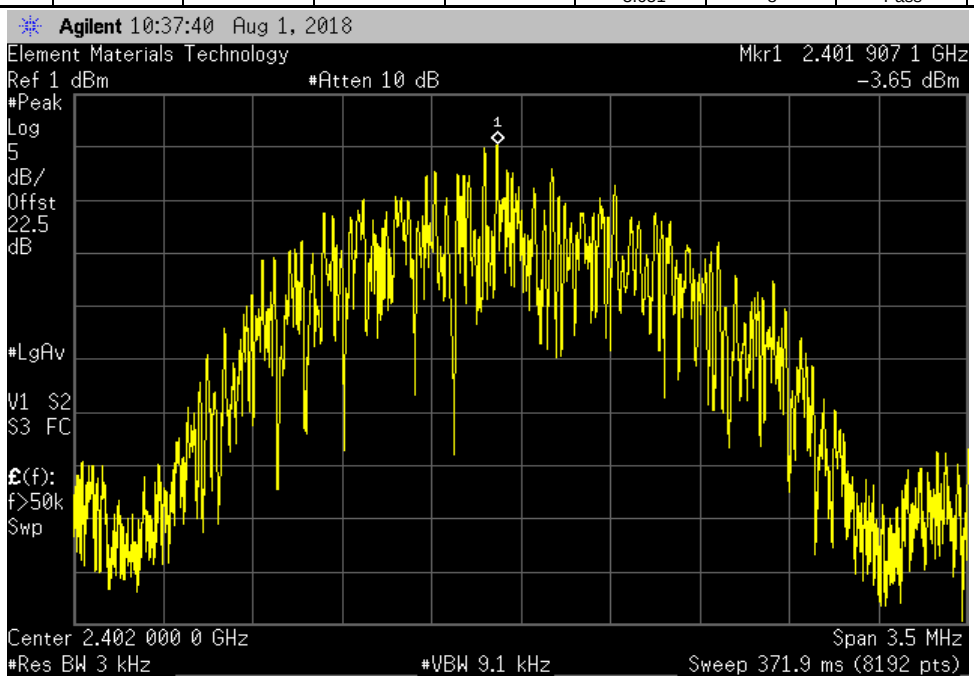
BLE/GFSK Mid Channel, 1 Mbps, 2442 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-21.183	8	Pass



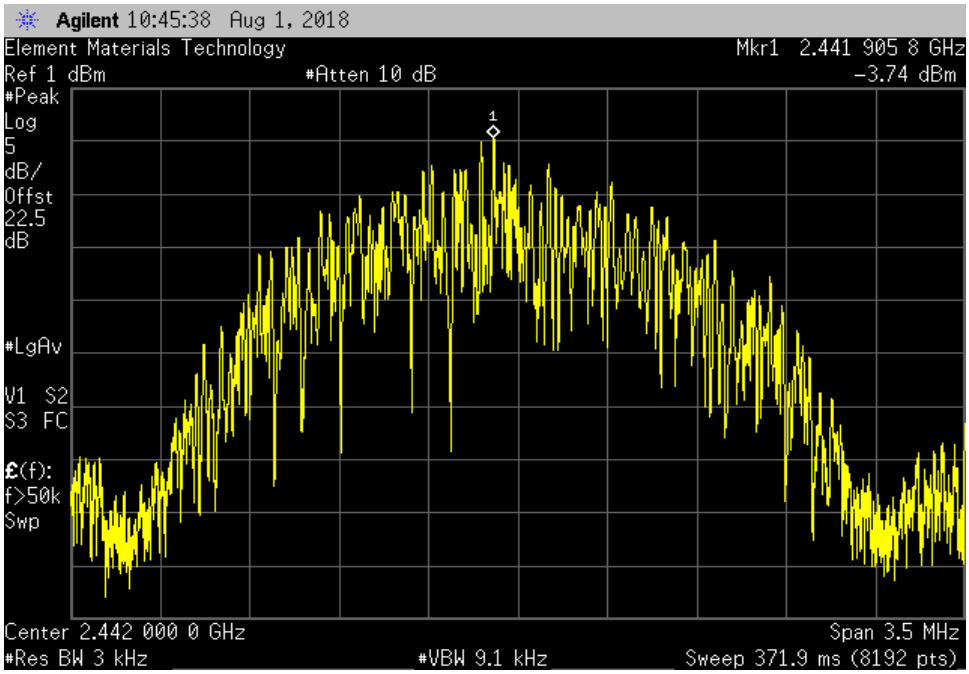
BLE/GFSK High Channel, 1 Mbps, 2480 MHz							
					Value dBm/3kHz	Limit < dBm/3kHz	Results
					-21.333	8	Pass



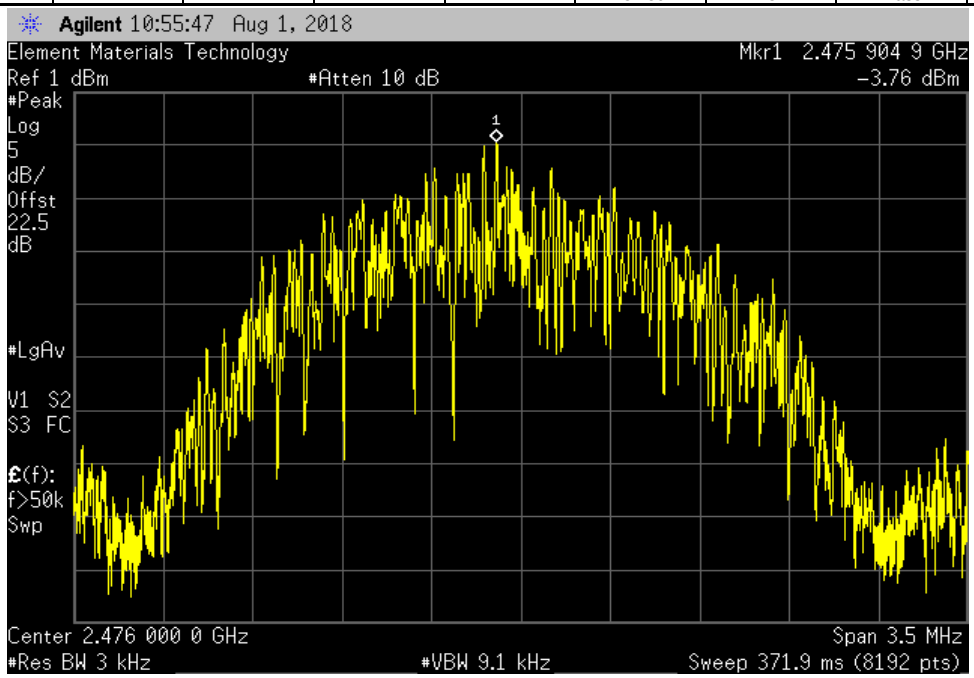
GFSK Low Channel, 2 Mbps, 2402 MHz							
					Value dBm/3kHz	Limit < dBm/3kHz	Results
					-3.651	8	Pass



GFSK Mid Channel, 2 Mbps, 2442 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-3.743	8	Pass



GFSK High Channel, 2 Mbps, 2476 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-3.759	8	Pass



BAND EDGE COMPLIANCE

XMit 2017.12.13

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	29-Sep-17	29-Sep-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	26-Mar-18	26-Mar-19
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-18	15-Mar-19
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-18	13-Feb-19
Block - DC	Fairview Microwave	SD3379	AMI	12-Sep-17	12-Sep-18

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 2017.12.14 XMit 2017.12.13

EUT:	**TV Streamer**			**Work Order:**	**STAK0135**
Serial Number:	**182220800B**			**Date:**	**1-Aug-18**
Customer:	**Starkey Laboratories, Inc.**			**Temperature:**	**22.9 °C**
Attendees:	**Charlie Esch**			**Humidity:**	**54.4% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Andrew Rogstad, Trevor Buls**	**Power:**	**5 VDC**	**Job Site:**	**MN09**

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

COMMENTS

U.FL to SMA adapter cable included in measurement cable offset.

DEVIATIONS FROM TEST STANDARD

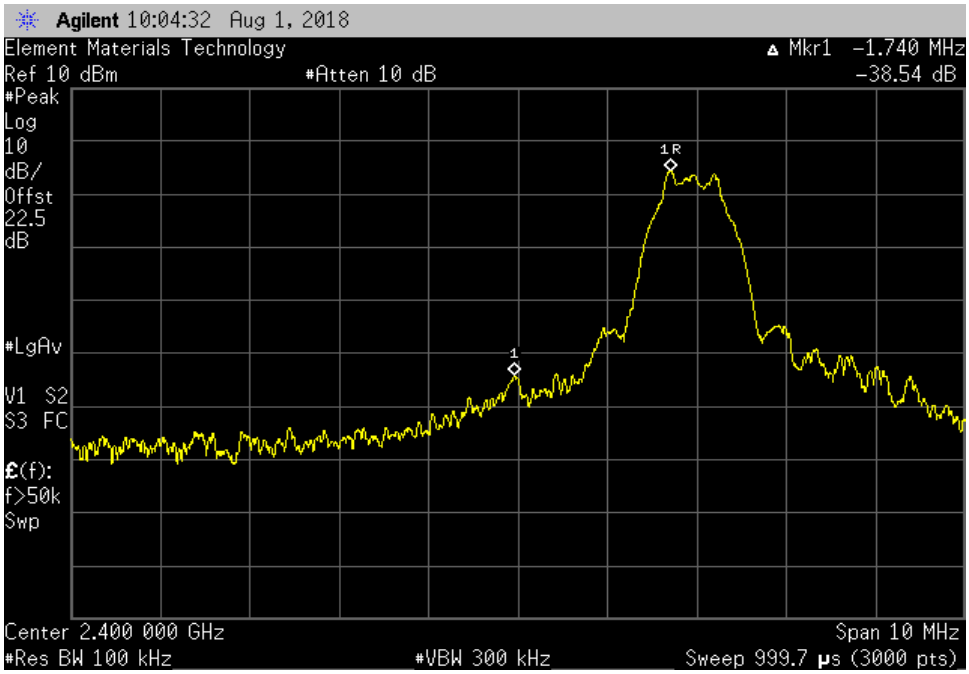
None

Configuration #	**1**	*Signature* Trevor Buls

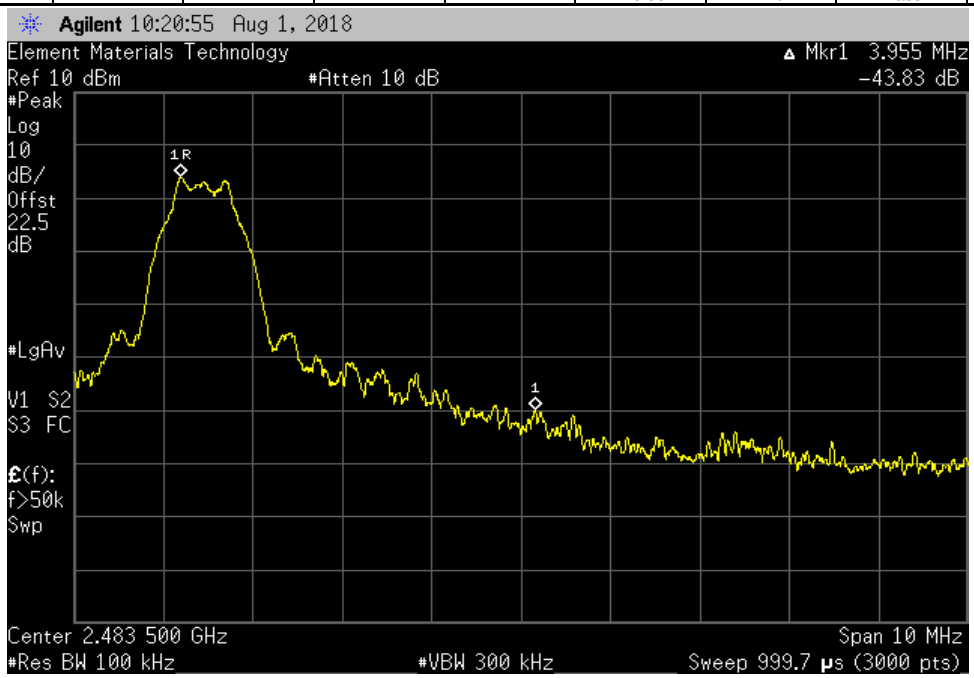
	Value (dBc)	**Limit ≤ (dBc)**	**Result**
BLE/GFSK Low Channel, 1 Mbps, 2402 MHz	-38.54	-20	Pass
BLE/GFSK High Channel, 1 Mbps, 2480 MHz	-43.83	-20	Pass
GFSK Low Channel, 2 Mbps, 2402 MHz	-28.53	-20	Pass
GFSK High Channel, 2 Mbps, 2476 MHz	-49.13	-20	Pass

BAND EDGE COMPLIANCE

BLE/GFSK Low Channel, 1 Mbps, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-38.54	-20	Pass

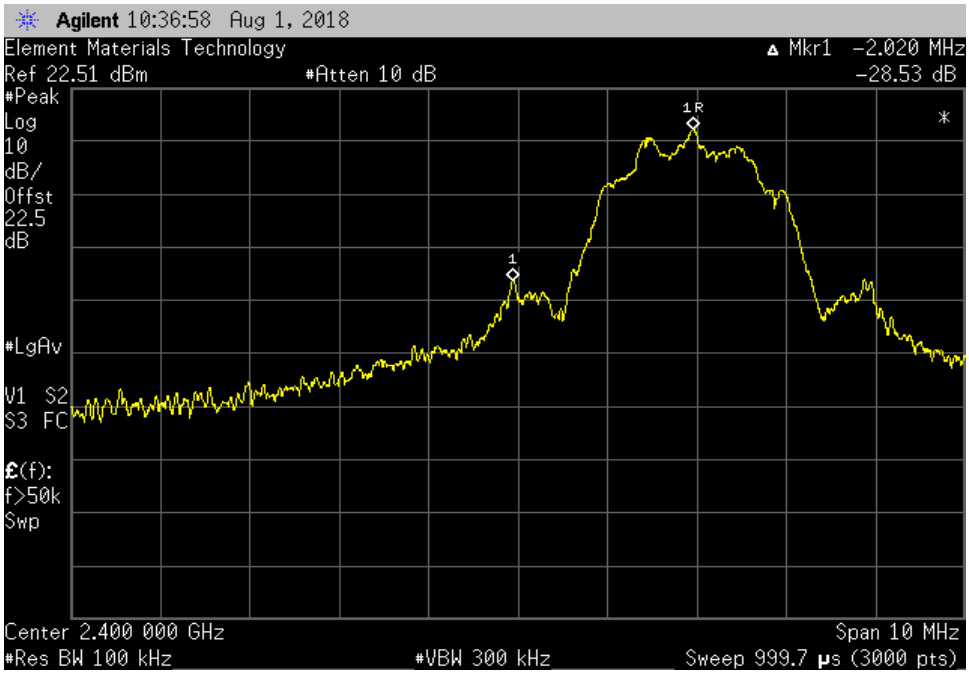


BLE/GFSK High Channel, 1 Mbps, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-43.83	-20	Pass

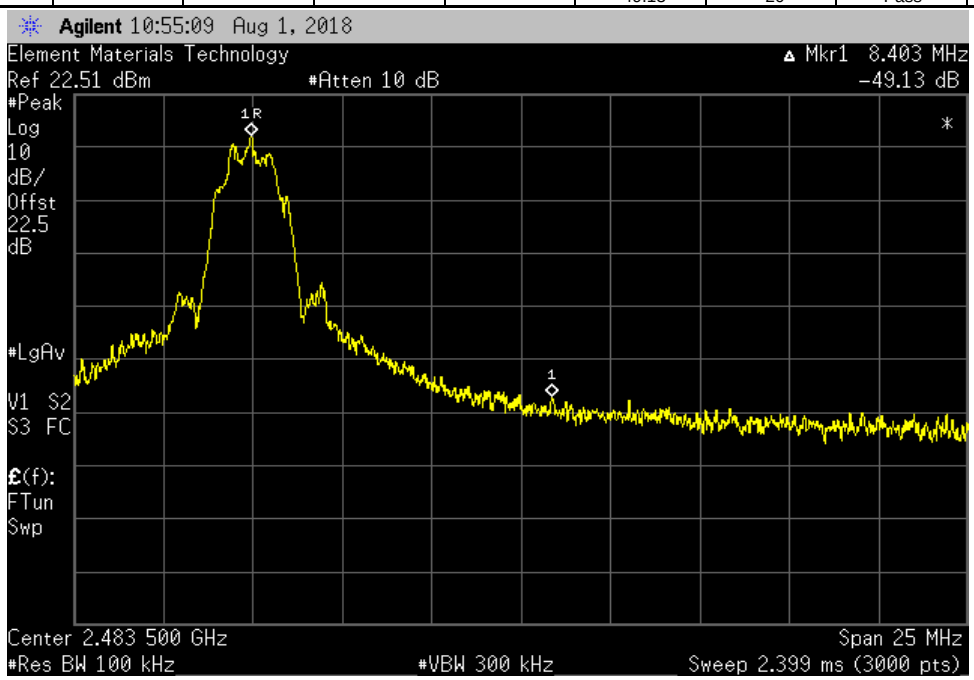


BAND EDGE COMPLIANCE

GFSK Low Channel, 2 Mbps, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-28.53	-20	Pass



GFSK High Channel, 2 Mbps, 2476 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-49.13	-20	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2017.12.13

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	29-Sep-17	29-Sep-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	26-Mar-18	26-Mar-19
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-18	15-Mar-19
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-18	13-Feb-19
Block - DC	Fairview Microwave	SD3379	AMI	12-Sep-17	12-Sep-18

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 2017.12.14 XMit 2017.12.13

EUT:	**TV Streamer**			**Work Order:**	**STAK0135**
Serial Number:	**182220800B**			**Date:**	**1-Aug-18**
Customer:	**Starkey Laboratories, Inc.**			**Temperature:**	**23 °C**
Attendees:	**Charlie Esch**			**Humidity:**	**54.2% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Andrew Rogstad, Trevor Buls**	**Power:**	**5 VDC**	**Job Site:**	**MN09**

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

COMMENTS

U.FL to SMA adapter cable included in measurement cable offset.

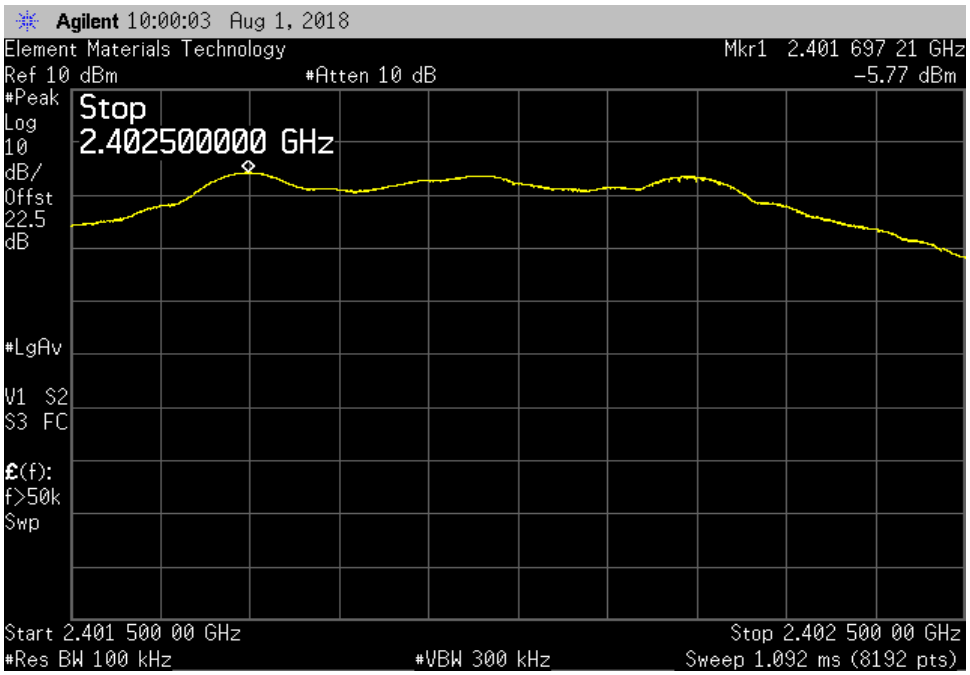
DEVIATIONS FROM TEST STANDARD

None

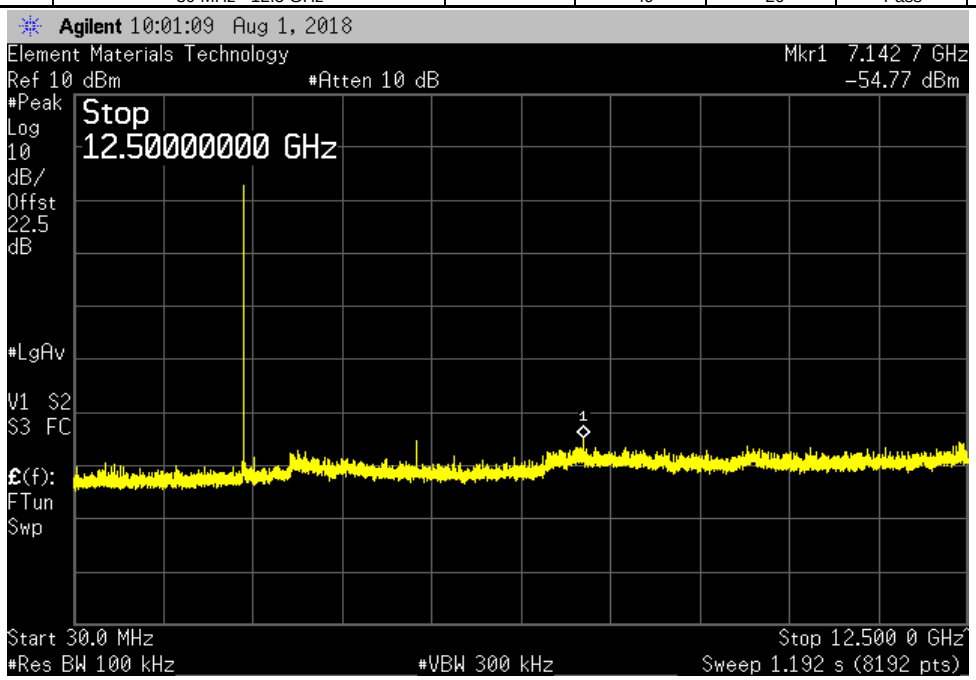
Configuration #	**1**	*Signature* Trevor Buls

	Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result
BLE/GFSK Low Channel, 1 Mbps, 2402 MHz	Fundamental	N/A	N/A	N/A
BLE/GFSK Low Channel, 1 Mbps, 2402 MHz	30 MHz - 12.5 GHz	-49	-20	Pass
BLE/GFSK Low Channel, 1 Mbps, 2402 MHz	12.5 GHz - 25 GHz	-46.46	-20	Pass
BLE/GFSK Mid Channel, 1 Mbps, 2442 MHz	Fundamental	N/A	N/A	N/A
BLE/GFSK Mid Channel, 1 Mbps, 2442 MHz	30 MHz - 12.5 GHz	-49.95	-20	Pass
BLE/GFSK Mid Channel, 1 Mbps, 2442 MHz	12.5 GHz - 25 GHz	-44.94	-20	Pass
BLE/GFSK High Channel, 1 Mbps, 2480 MHz	Fundamental	N/A	N/A	N/A
BLE/GFSK High Channel, 1 Mbps, 2480 MHz	30 MHz - 12.5 GHz	-49.83	-20	Pass
BLE/GFSK High Channel, 1 Mbps, 2480 MHz	12.5 GHz - 25 GHz	-45.54	-20	Pass
GFSK Low Channel, 2 Mbps, 2402 MHz	Fundamental	N/A	N/A	N/A
GFSK Low Channel, 2 Mbps, 2402 MHz	30 MHz - 12.5 GHz	-47.32	-20	Pass
GFSK Low Channel, 2 Mbps, 2402 MHz	12.5 GHz - 25 GHz	-66.79	-20	Pass
GFSK Mid Channel, 2 Mbps, 2442 MHz	Fundamental	N/A	N/A	N/A
GFSK Mid Channel, 2 Mbps, 2442 MHz	30 MHz - 12.5 GHz	-51.61	-20	Pass
GFSK Mid Channel, 2 Mbps, 2442 MHz	12.5 GHz - 25 GHz	-66.28	-20	Pass
GFSK High Channel, 2 Mbps, 2476 MHz	Fundamental	N/A	N/A	N/A
GFSK High Channel, 2 Mbps, 2476 MHz	30 MHz - 12.5 GHz	-51.97	-20	Pass
GFSK High Channel, 2 Mbps, 2476 MHz	12.5 GHz - 25 GHz	-66.15	-20	Pass

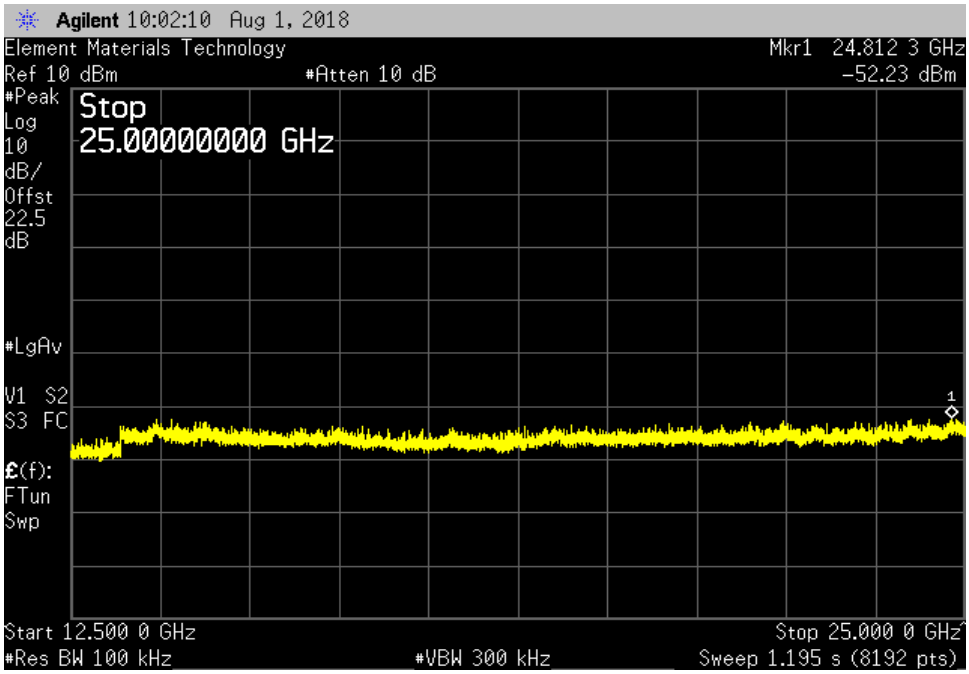
BLE/GFSK Low Channel, 1 Mbps, 2402 MHz						
	Frequency Range			**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
	Fundamental			N/A	N/A	N/A



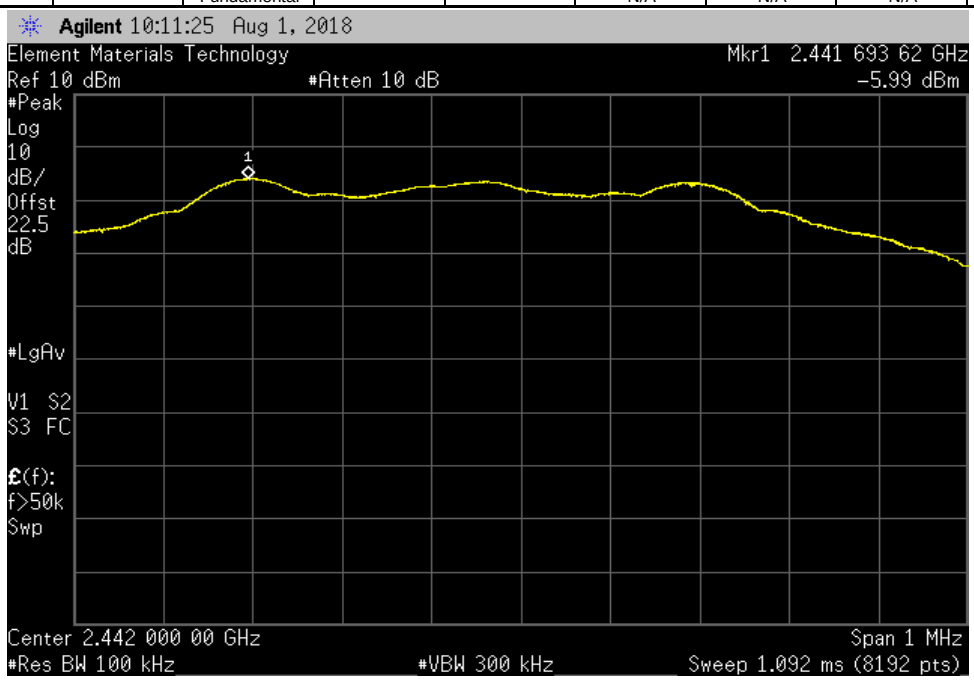
BLE/GFSK Low Channel, 1 Mbps, 2402 MHz					
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
30 MHz - 12.5 GHz		-49	-20	Pass



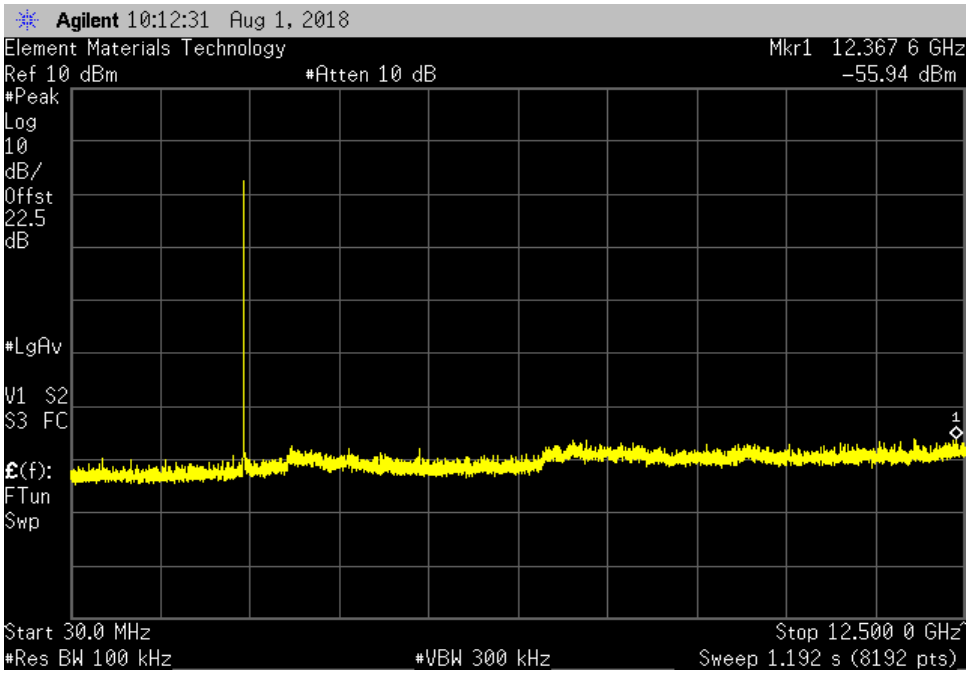
BLE/GFSK Low Channel, 1 Mbps, 2402 MHz				
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz		-46.46	-20	Pass



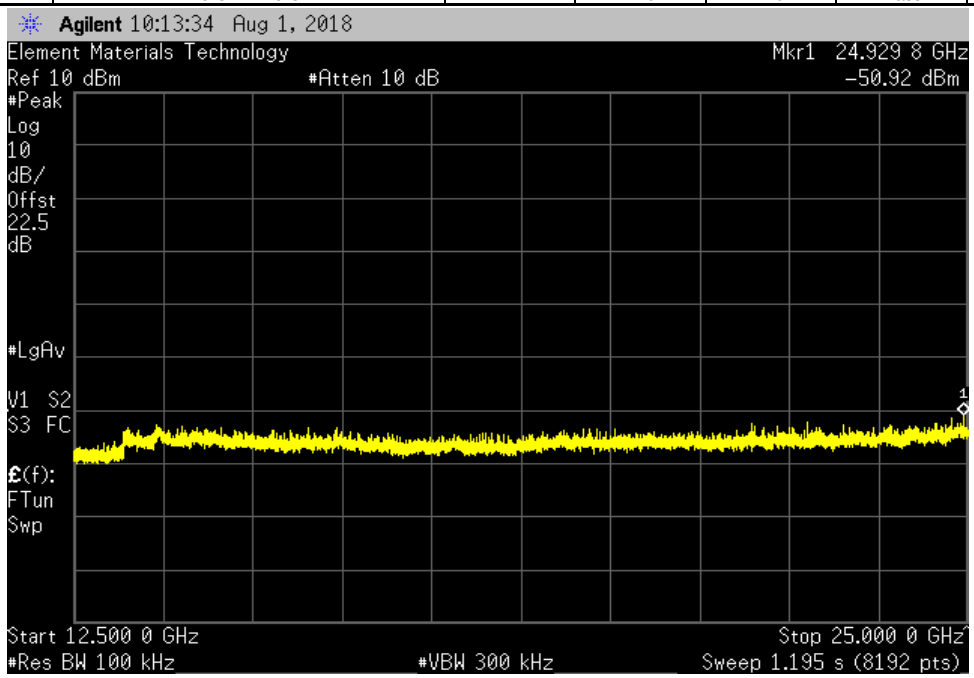
BLE/GFSK Mid Channel, 1 Mbps, 2442 MHz						
	Frequency Range			**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
	Fundamental			N/A	N/A	N/A



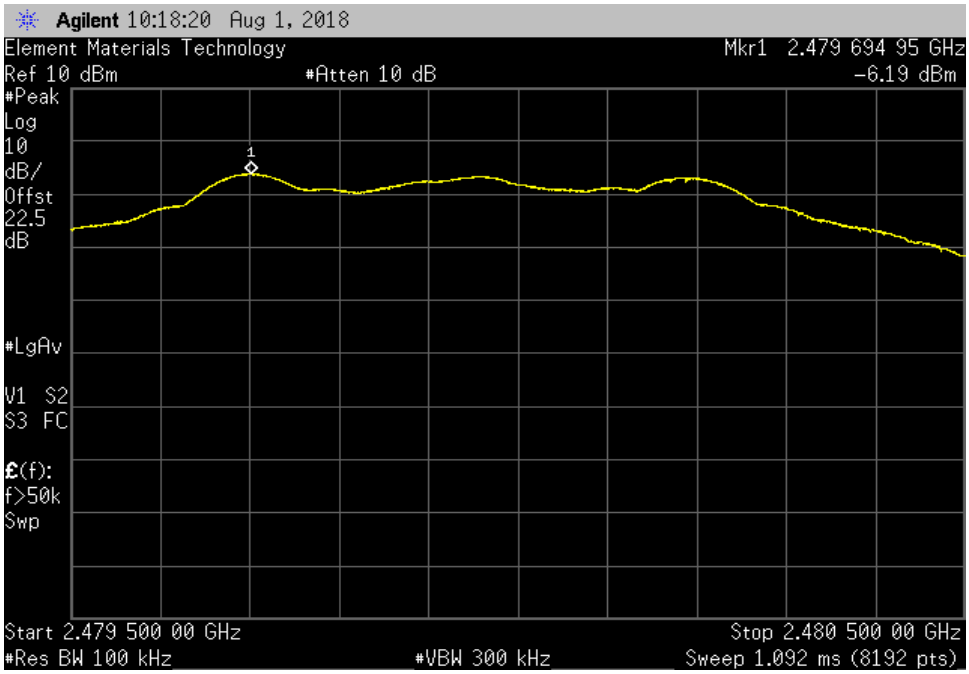
BLE/GFSK Mid Channel, 1 Mbps, 2442 MHz				
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
30 MHz - 12.5 GHz		-49.95	-20	Pass



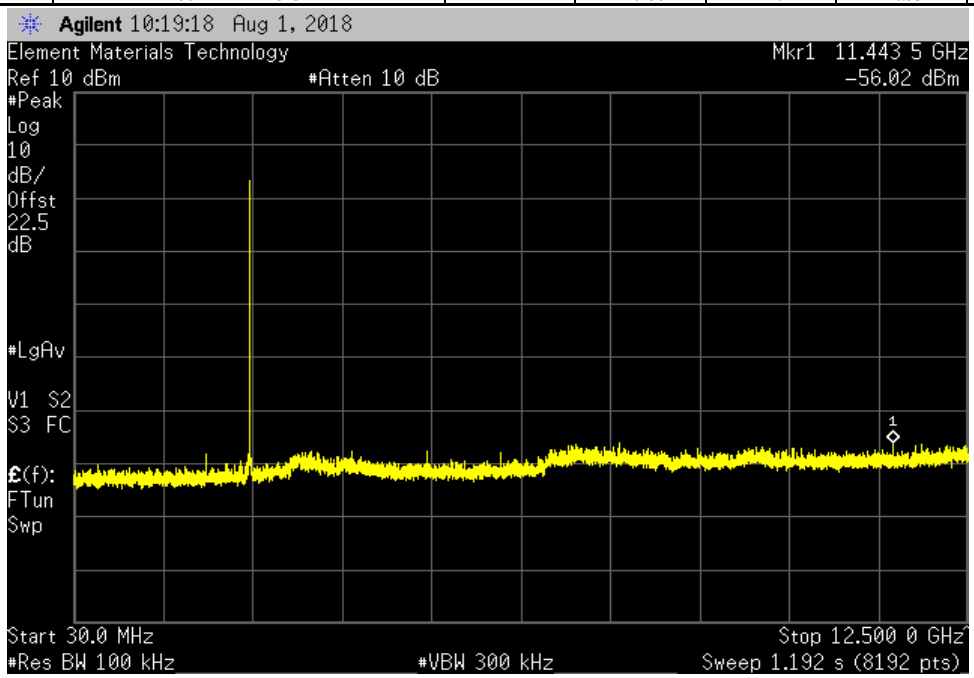
BLE/GFSK Mid Channel, 1 Mbps, 2442 MHz				
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz		-44.94	-20	Pass



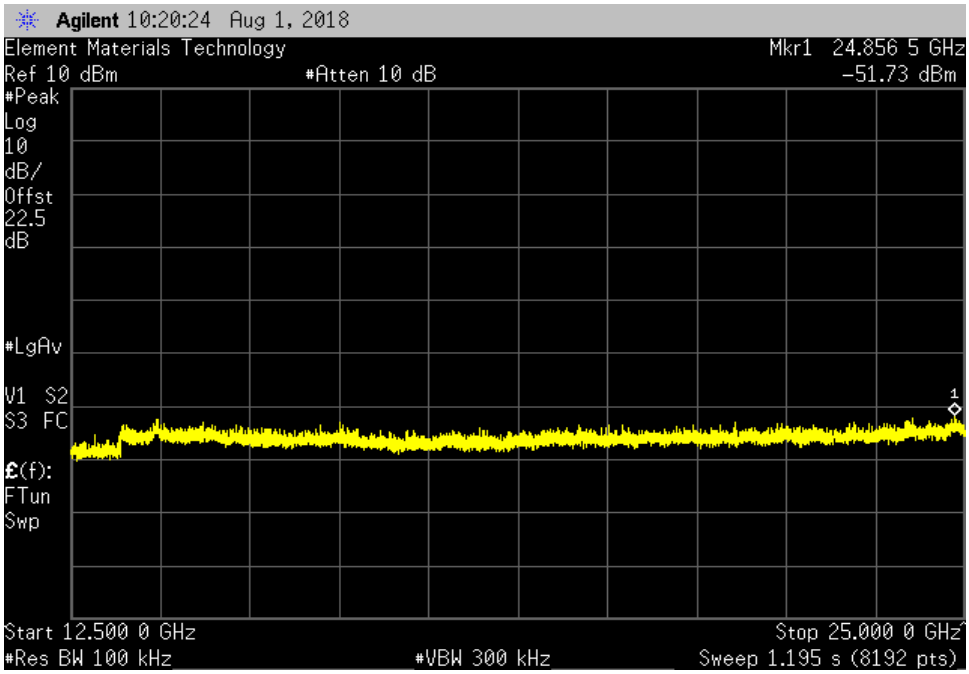
BLE/GFSK High Channel, 1 Mbps, 2480 MHz						
	Frequency Range			**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
	Fundamental			N/A	N/A	N/A



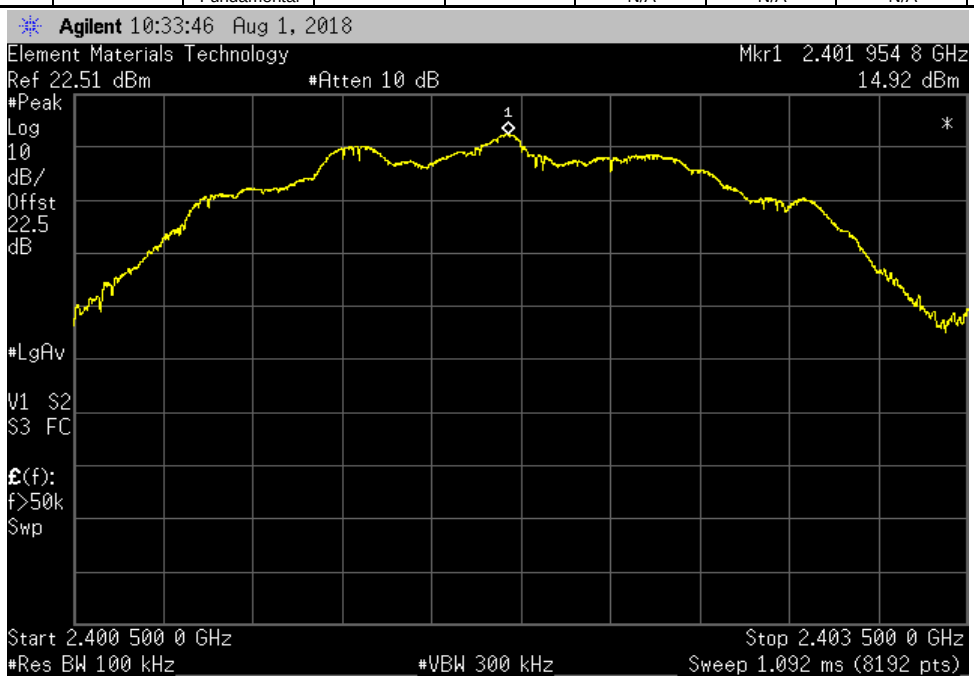
BLE/GFSK High Channel, 1 Mbps, 2480 MHz					
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
30 MHz - 12.5 GHz		-49.83	-20	Pass



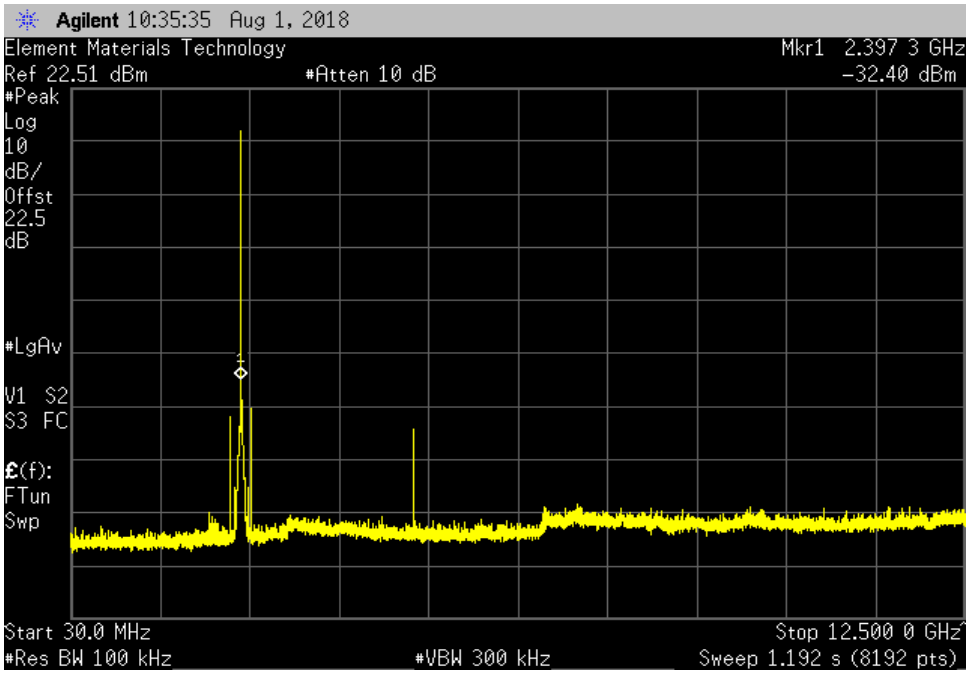
BLE/GFSK High Channel, 1 Mbps, 2480 MHz				
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz		-45.54	-20	Pass



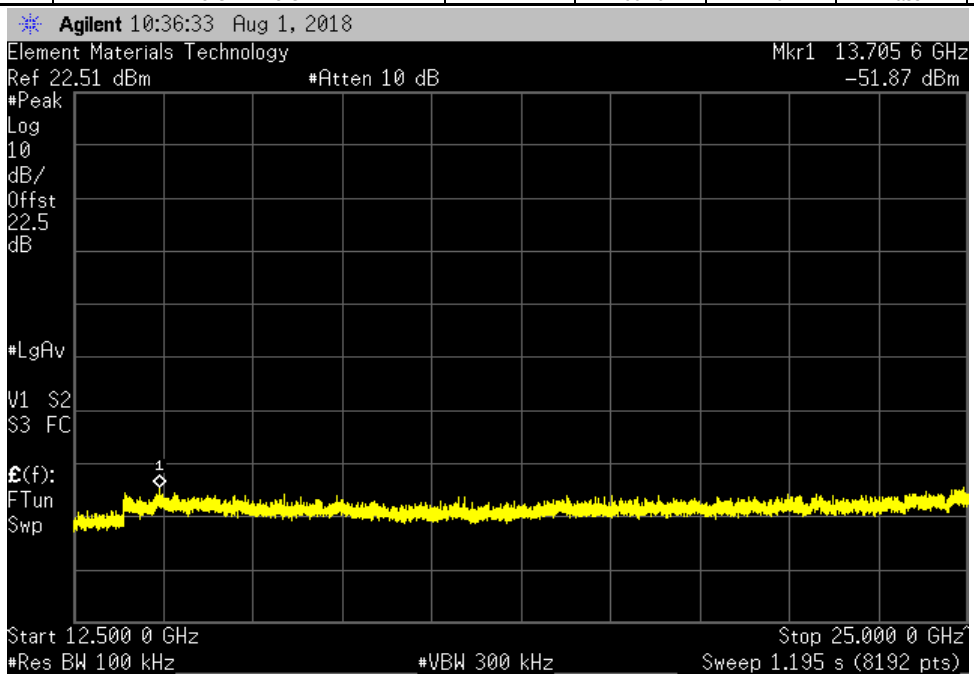
GFSK Low Channel, 2 Mbps, 2402 MHz						
	Frequency Range			**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
	Fundamental			N/A	N/A	N/A



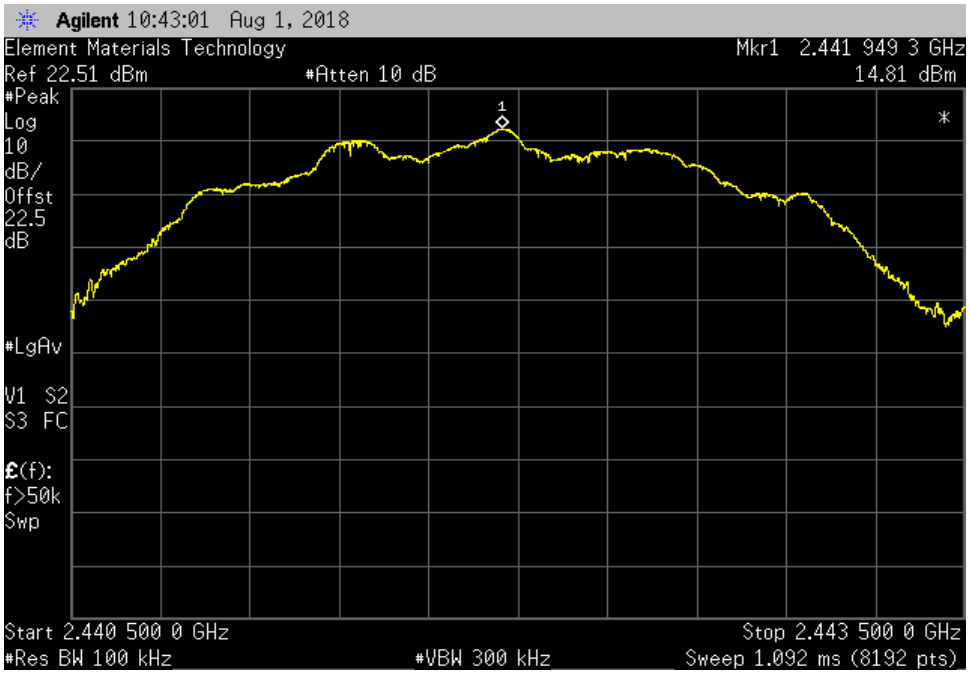
GFSK Low Channel, 2 Mbps, 2402 MHz				
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
30 MHz - 12.5 GHz		-47.32	-20	Pass



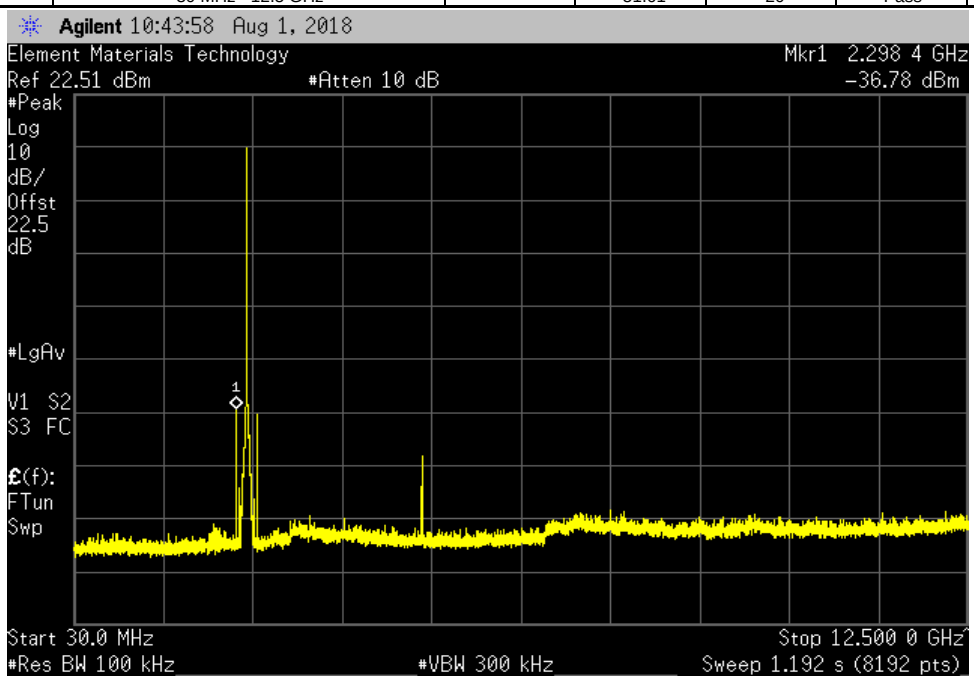
GFSK Low Channel, 2 Mbps, 2402 MHz				
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz		-66.79	-20	Pass



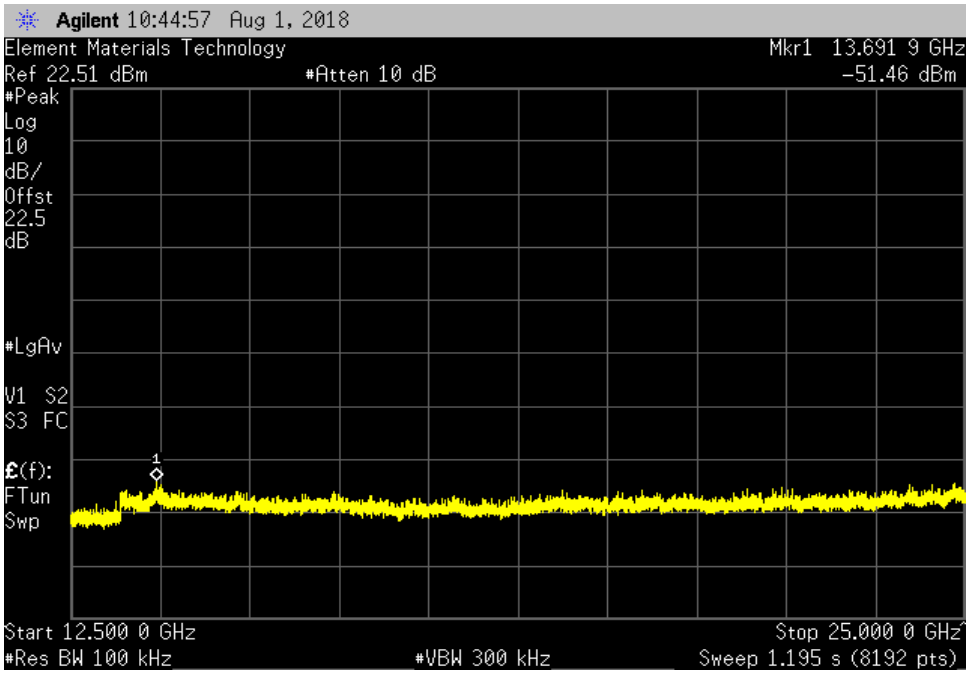
GFSK Mid Channel, 2 Mbps, 2442 MHz						
	Frequency Range			**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
	Fundamental			N/A	N/A	N/A



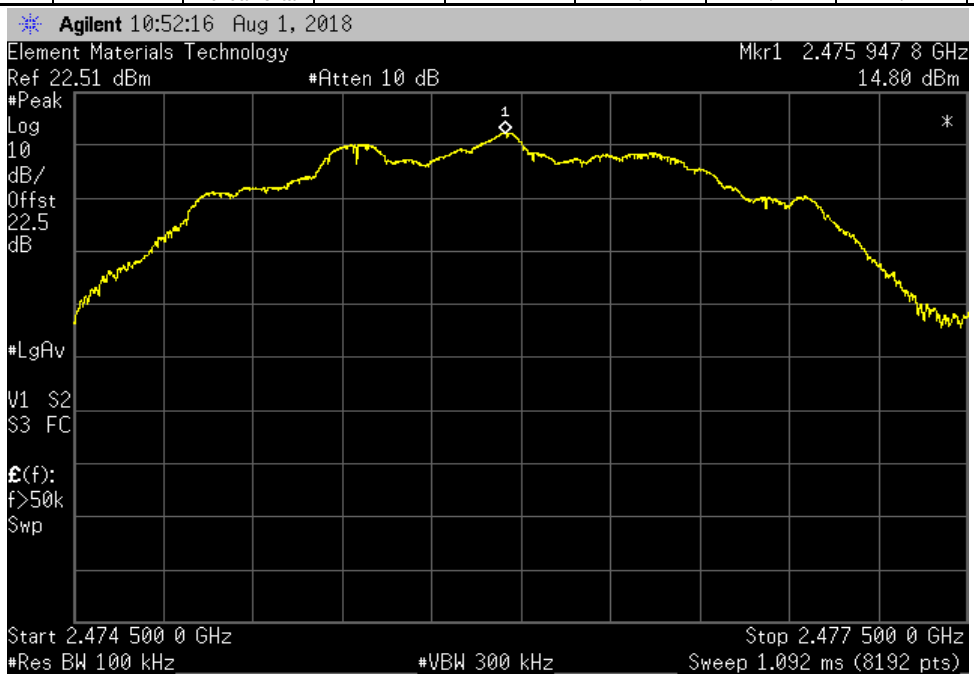
GFSK Mid Channel, 2 Mbps, 2442 MHz					
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
30 MHz - 12.5 GHz		-51.61	-20	Pass



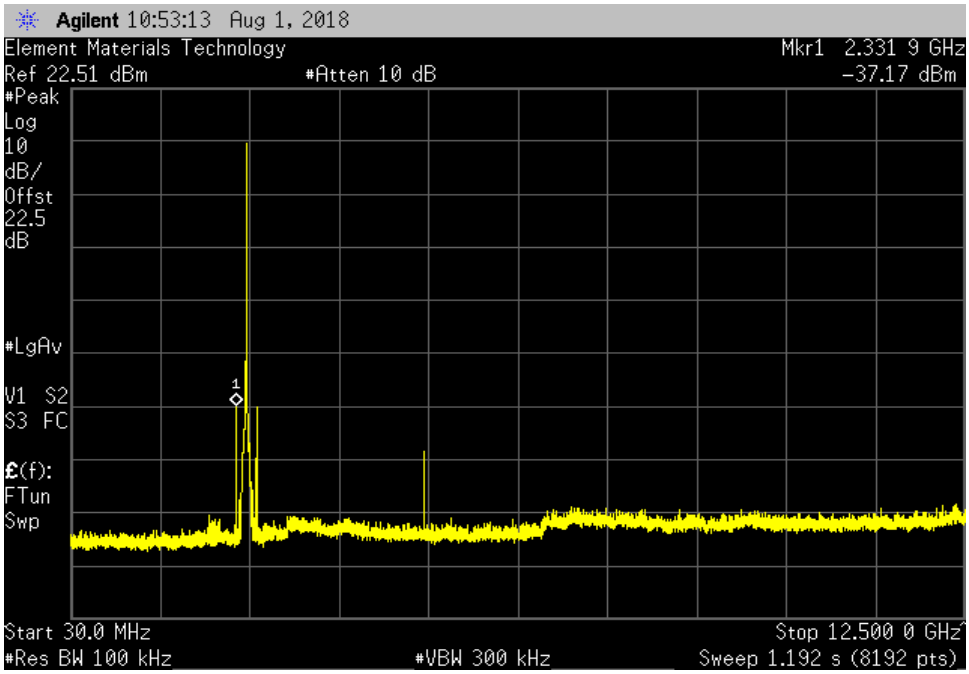
GFSK Mid Channel, 2 Mbps, 2442 MHz				
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz		-66.28	-20	Pass



GFSK High Channel, 2 Mbps, 2476 MHz						
	Frequency Range			**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
	Fundamental			N/A	N/A	N/A



GFSK High Channel, 2 Mbps, 2476 MHz				
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
30 MHz - 12.5 GHz		-51.97	-20	Pass



GFSK High Channel, 2 Mbps, 2476 MHz				
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz		-66.15	-20	Pass