



element

Starkey Laboratories, Inc.

Livio BTE 13

FCC 15.247:2019

Bluetooth

Report # STAK0184



NVLAP LAB CODE: 200881-0



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CERTIFICATE OF TEST

Last Date of Test: October 25, 2019
Starkey Laboratories, Inc.
EUT: Livio BTE 13

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2019	ANSI C63.10:2013

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not required for a battery powered EUT.
11.6	Duty Cycle	Yes	Pass	
11.8.2	Occupied Bandwidth	Yes	Pass	
11.9.1.1	Output Power	Yes	Pass	
11.9.1.1	Equivalent Isotropic Radiated Power	Yes	Pass	
11.10.2	Power Spectral Density	Yes	Pass	
11.11	Band Edge Compliance	Yes	Pass	
11.11	Spurious Conducted Emissions	Yes	Pass	
11.12.1, 11.13.2, 6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	

Deviations From Test Standards

None

Approved By:



Matt Nuernberg, Operations Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.

REVISION HISTORY



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

ACCREDITATIONS AND AUTHORIZATIONS



United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Element to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB) and as a CAB for the acceptance of test data.

European Union

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

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

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

SCOPE

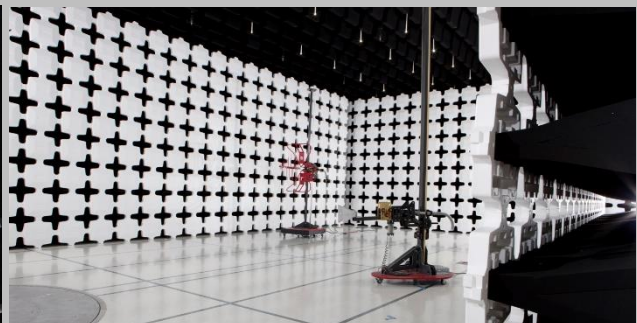
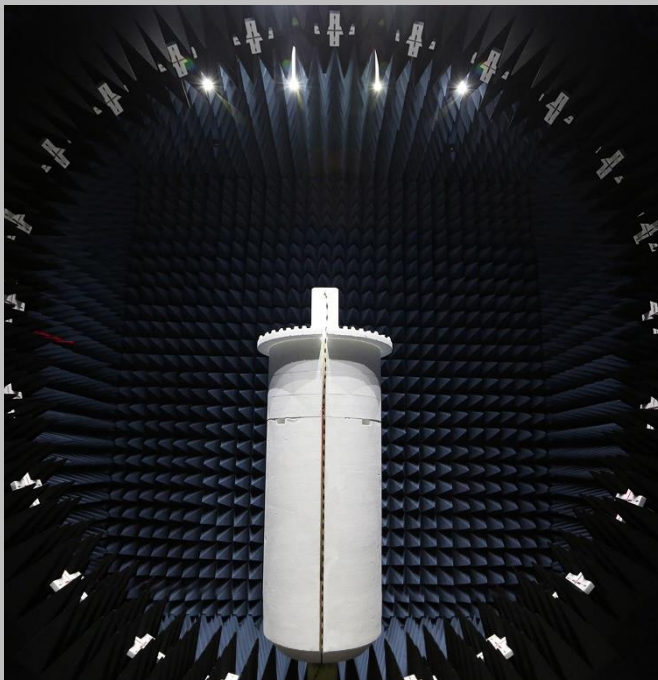
For details on the Scopes of our Accreditations, please visit:

<https://www.nwemc.com/emc-testing-accreditations>

FACILITIES



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



MEASUREMENT UNCERTAINTY



WTD.2016.12.19

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.

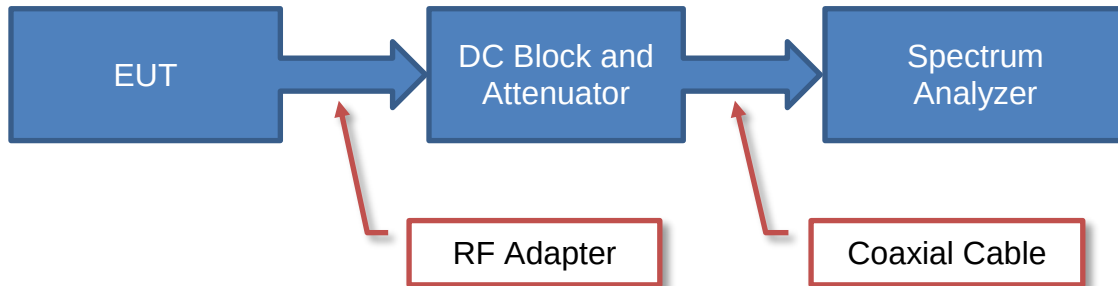
A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) for each test is on each data sheet. Our measurement 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.

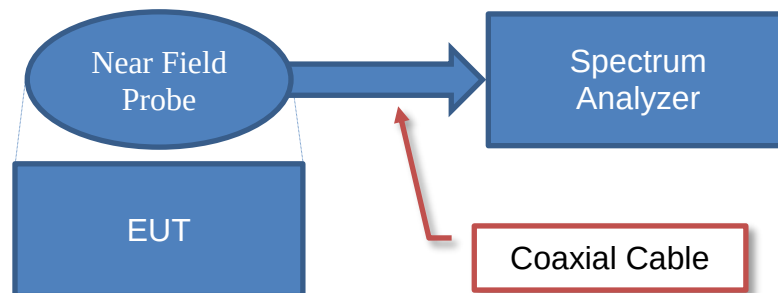
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%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

Test Setup Block Diagrams

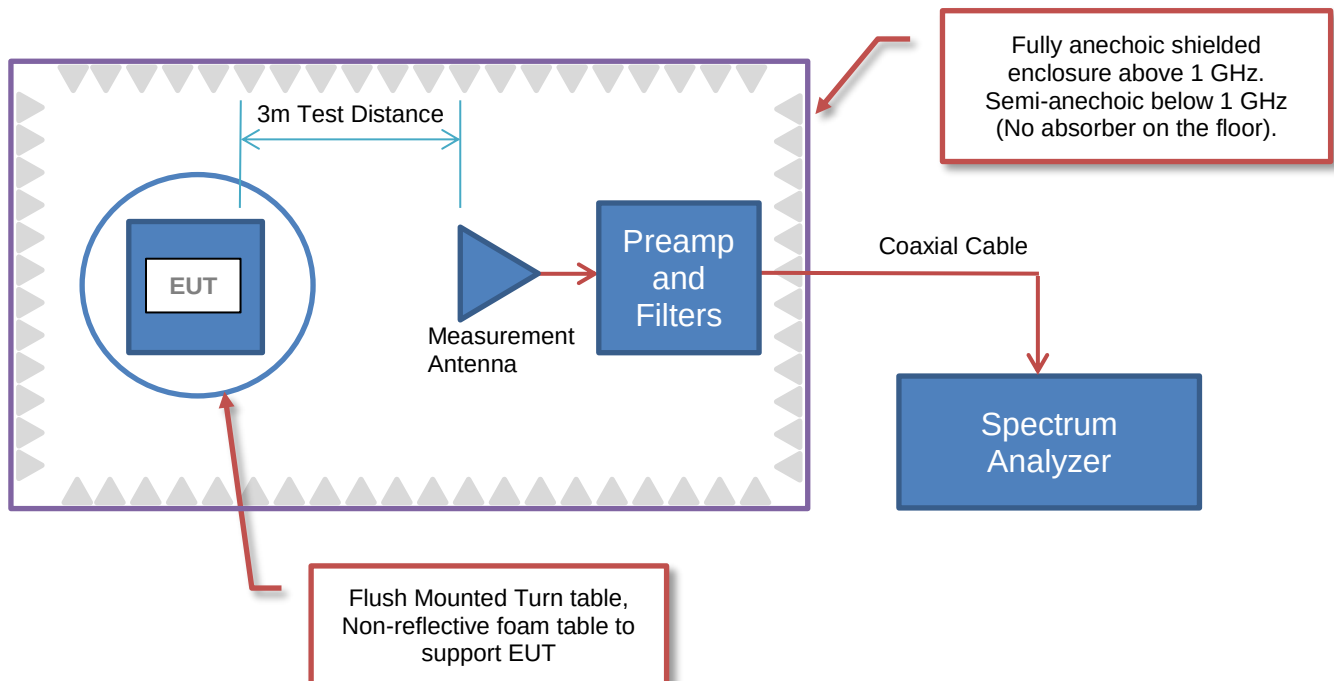
Antenna Port Conducted Measurements



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 S
City, State, Zip:	Eden Prairie, MN 55344-3404
Test Requested By:	Bill Mitchell
EUT:	Livio BTE 13
First Date of Test:	October 23, 2019
Last Date of Test:	October 25, 2019
Receipt Date of Samples:	October 23, 2019
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Hearing aid with 2.4 GHz and NFMI
Testing Objective:
To demonstrate compliance of the Bluetooth radio to FCC 15.247 requirements.

CONFIGURATIONS



Configuration STAK0184- 1

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Hearing Aid	Starkey Laboratories, Inc.	Livio BTE 13	190592167

Configuration STAK0184- 3

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Hearing Aid	Starkey Laboratories, Inc.	Livio BTE 13	190592168

MODIFICATIONS



Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2019-10-23	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	2019-10-23	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	2019-10-23	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT was taken home by the client before the next scheduled test.
4	2019-10-23	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.
5	2019-10-23	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.
6	2019-10-23	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.
7	2019-10-23	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.
8	2019-10-25	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

DUTY CYCLE



XMIT 2019.09.05

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20

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.

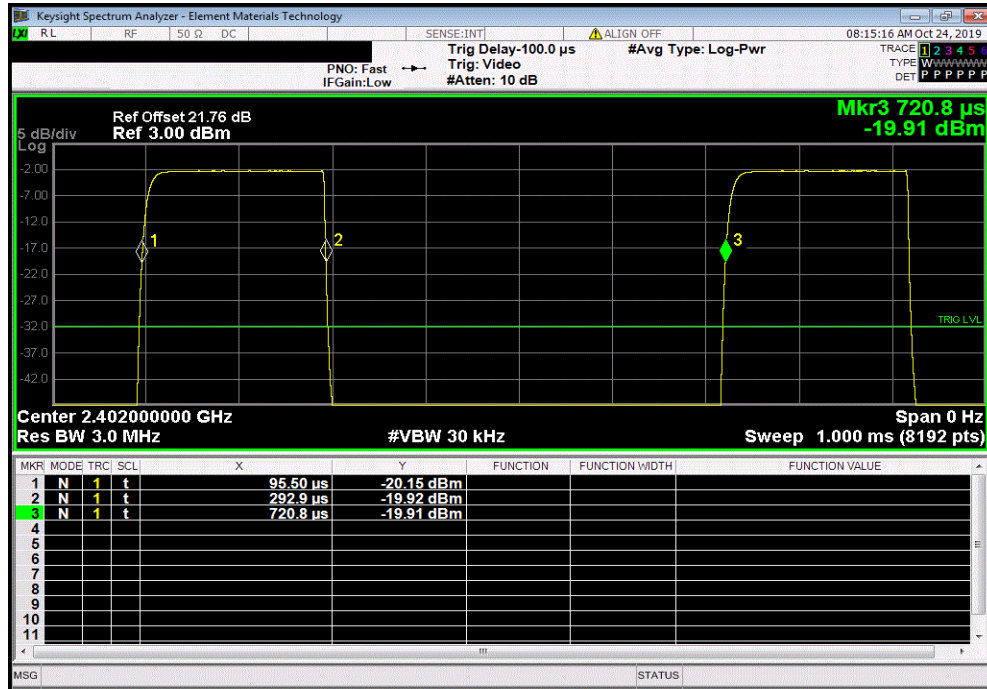
TbtTx 2019.08.30.0 XMit 2019.09.05

DUTY CYCLE

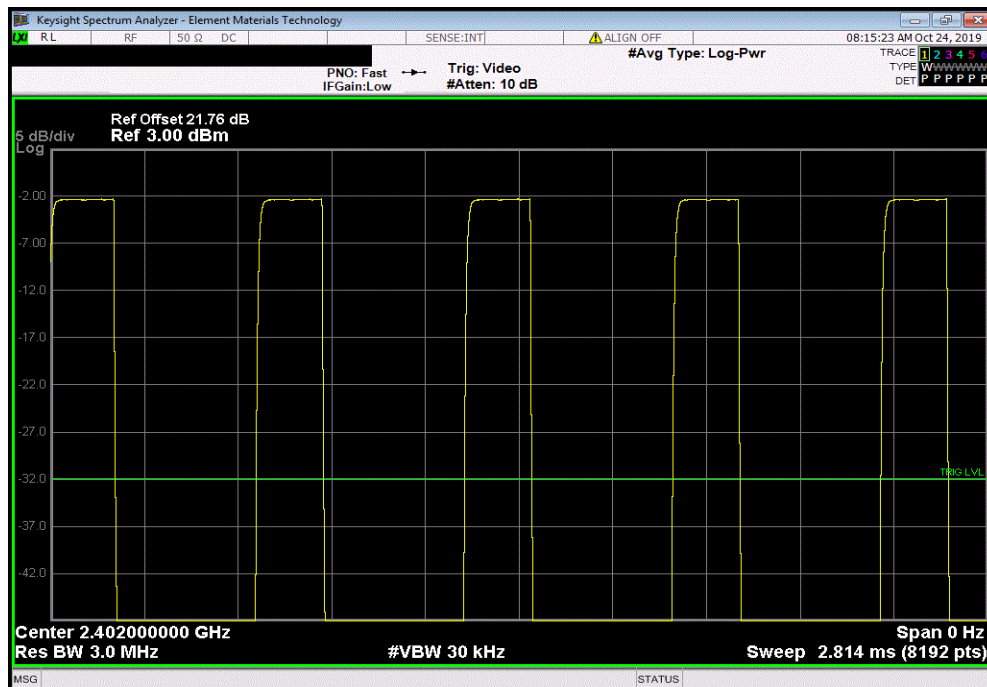


TbTx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (2 Mbps) Low Channel, 2402 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
197.4 μ s	625.3 μ s	1	31.6	N/A	N/A	



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

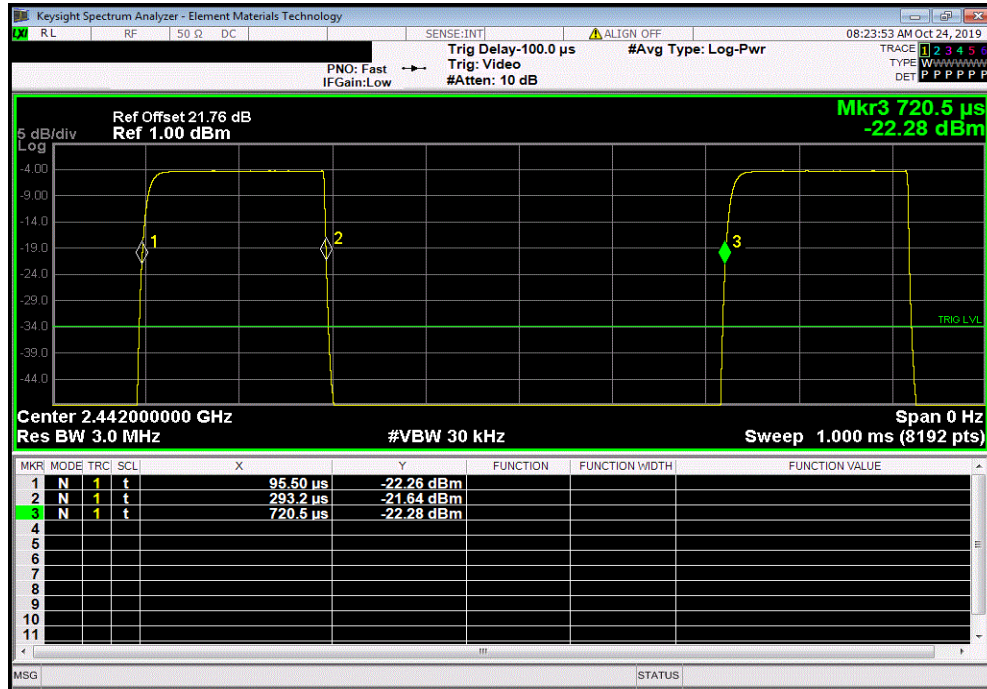


DUTY CYCLE

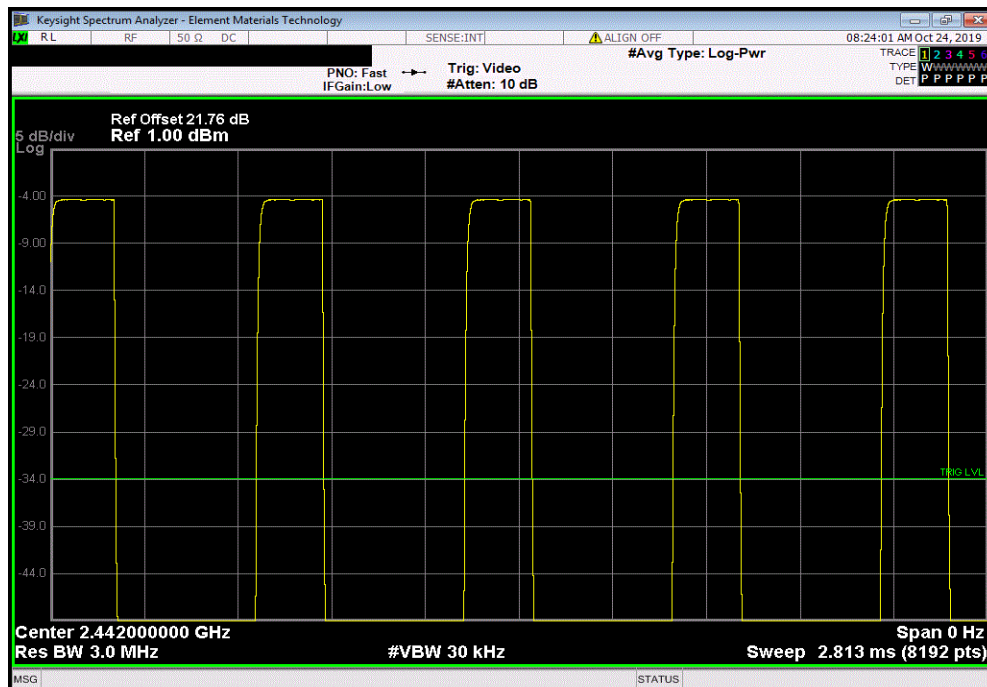


TbTx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (2 Mbps) Mid Channel, 2442 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
197.7 μ s	625 μ s	1	31.6	N/A	N/A	



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

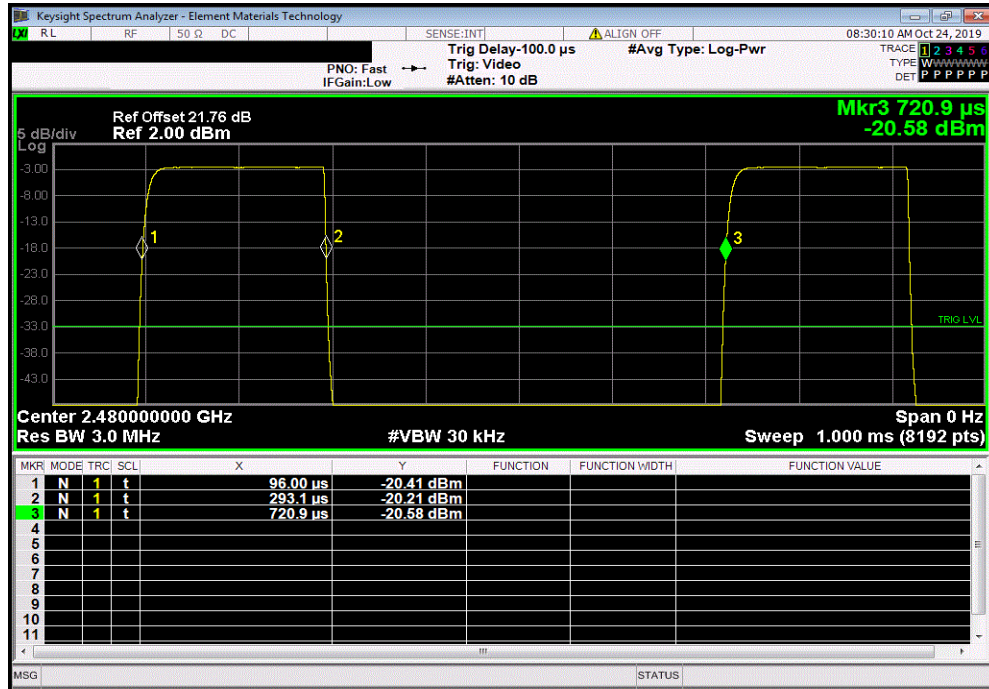


DUTY CYCLE

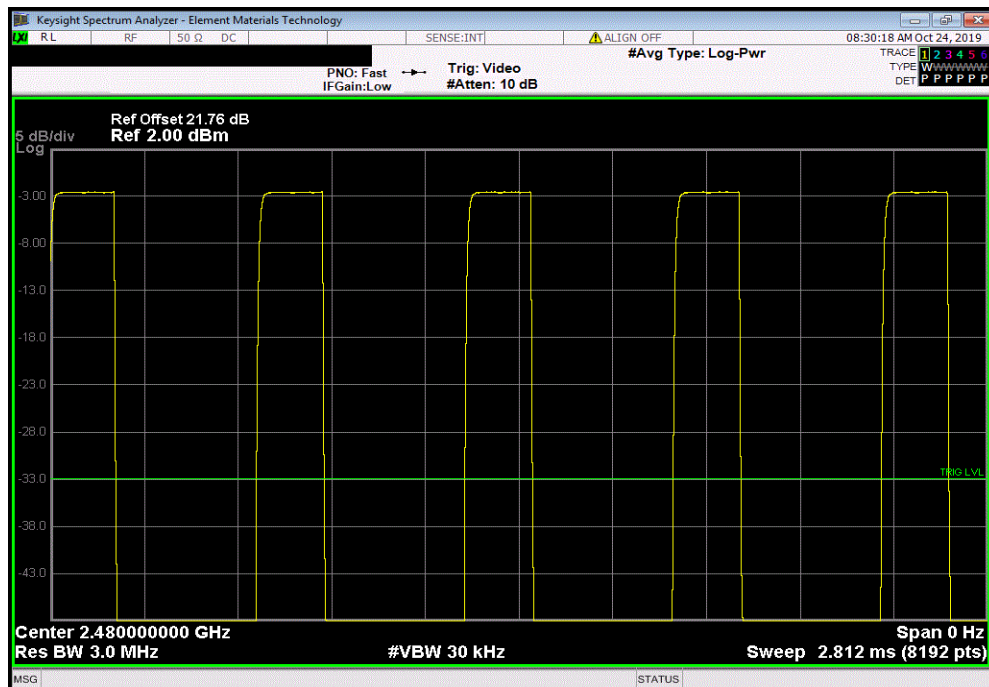


TM1Tx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (2 Mbps) High Channel, 2480 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
197.1 μ s	624.9 μ s	1	31.5	N/A	N/A	



BLE/GFSK (2 Mbps) High Channel, 2480 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	

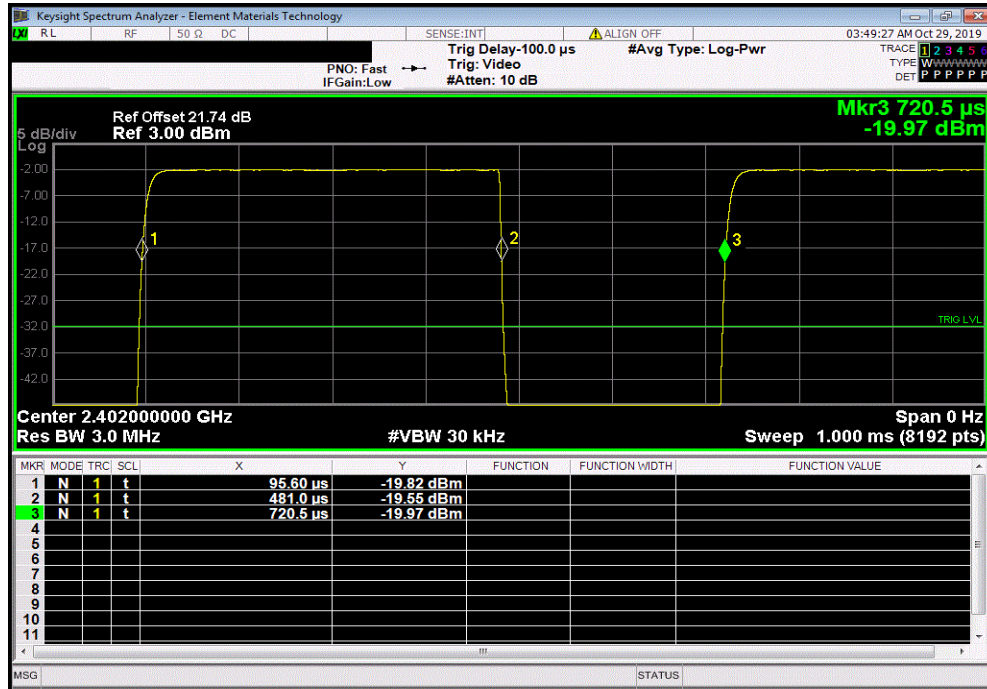


DUTY CYCLE

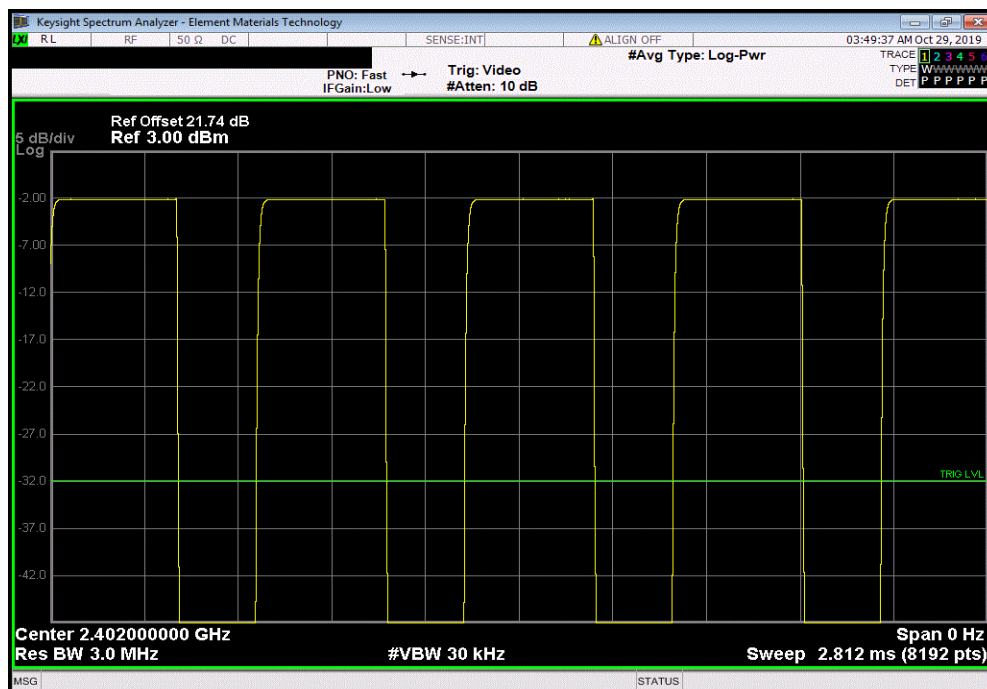


TbTx 2019.08.30.0 XMt 2019.09.05

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



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

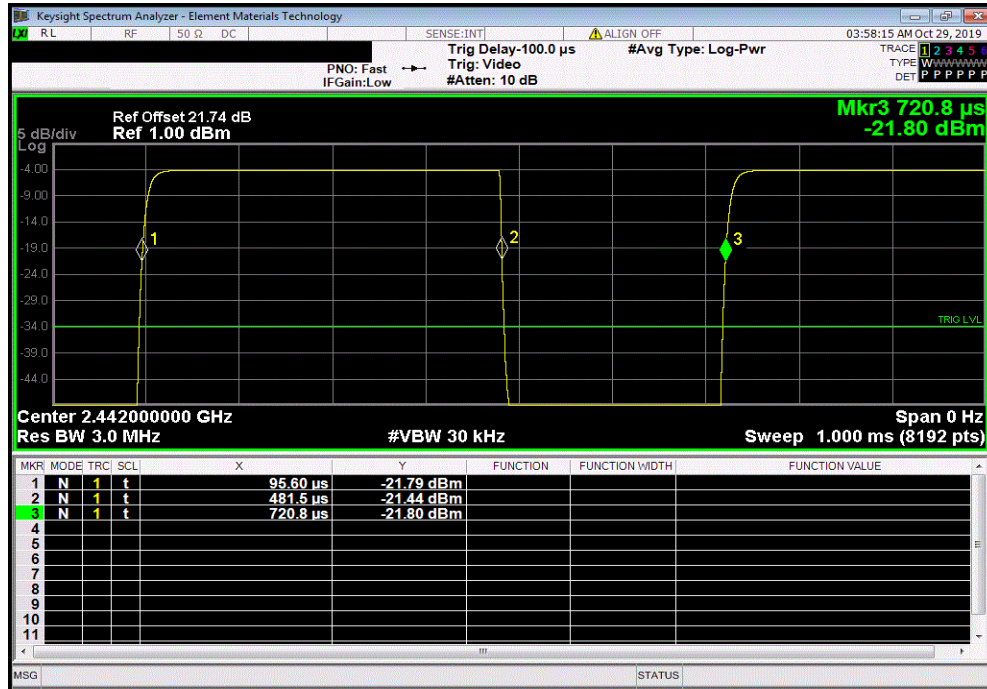


DUTY CYCLE

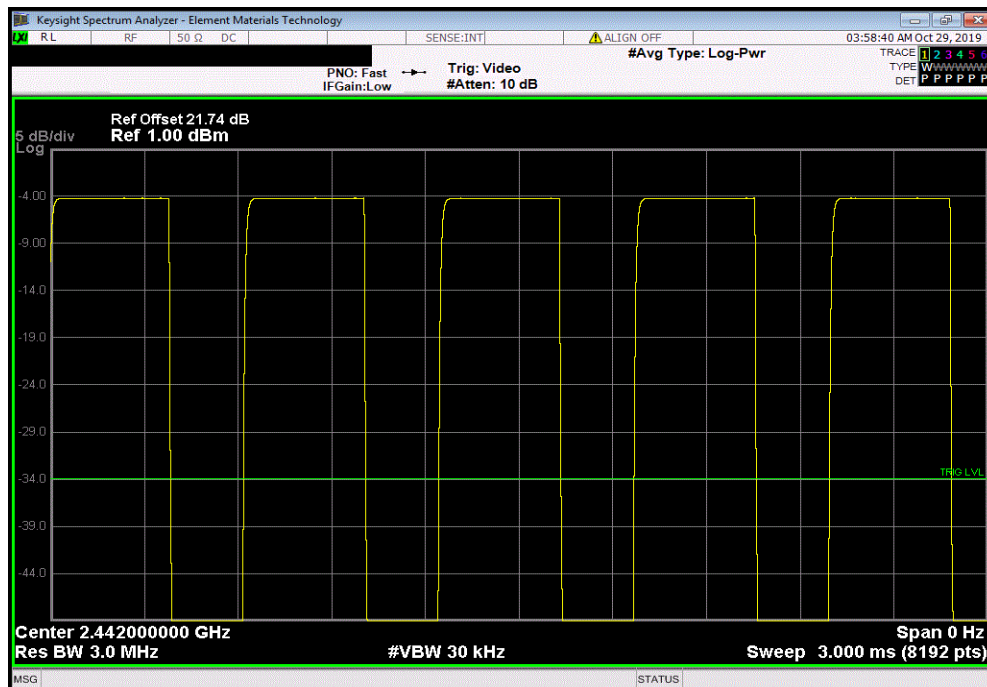


TbTx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (1 Mbps) Mid Channel, 2442 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
385.9 μ s	625.2 μ s	1	61.7	N/A	N/A	



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

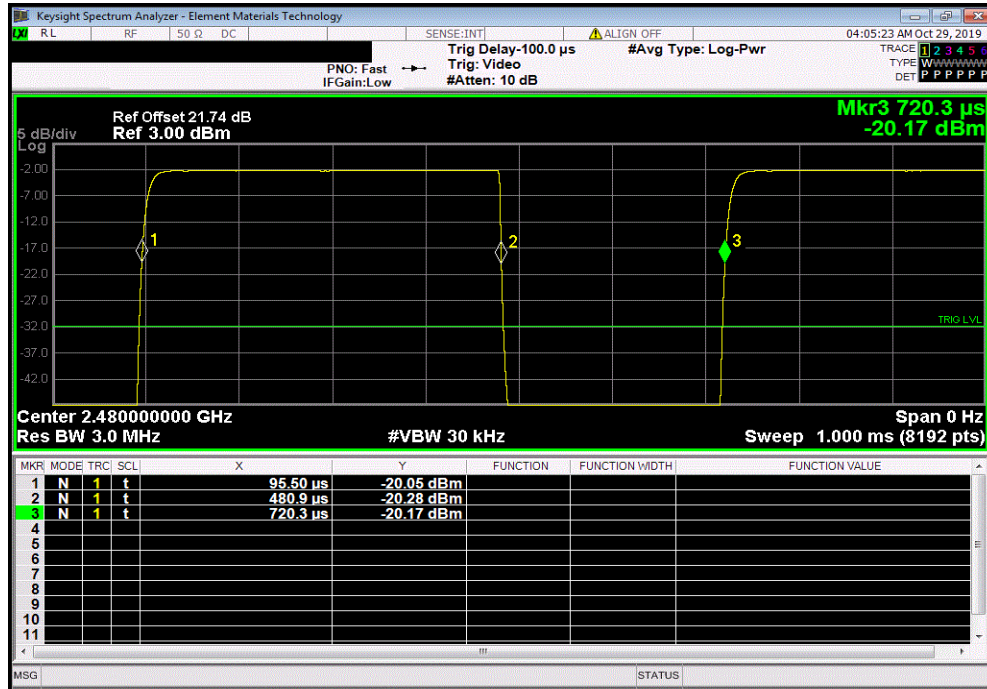


DUTY CYCLE

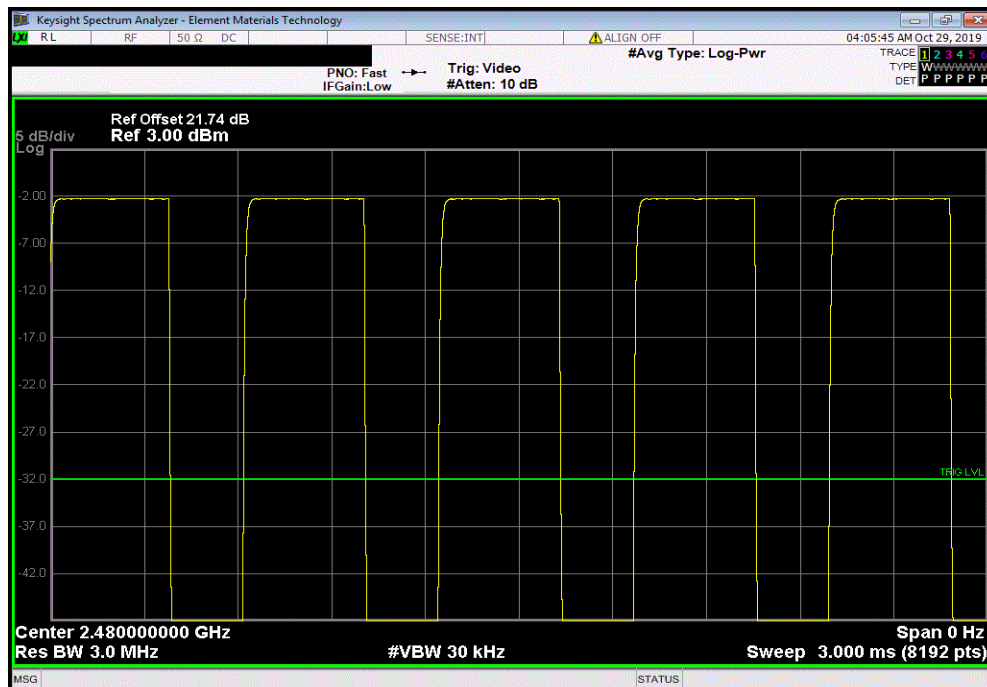


TbTx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (1 Mbps) High Channel, 2480 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
385.4 μ s	624.8 μ s	1	61.7	N/A	N/A	



BLE/GFSK (2 Mbps) High Channel, 2480 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	



OCCUPIED BANDWIDTH



XMIT 2019.09.05

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20

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



TSTx 2019.08.30.0 XMI 2019.09.05

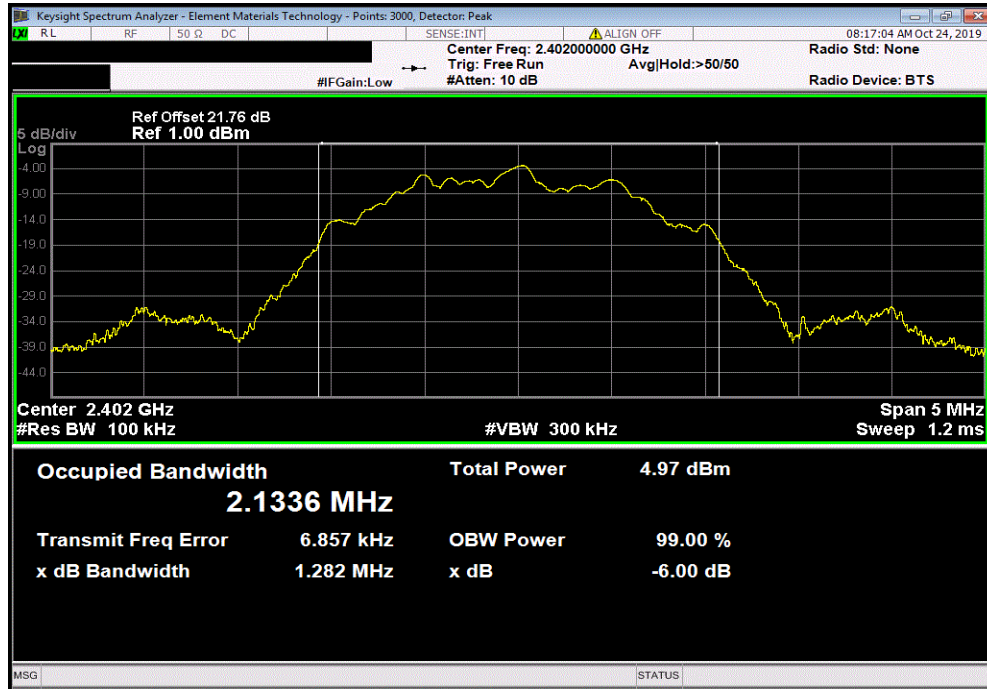
EUT: Livio BTE 13		Work Order: STAK0184	
Serial Number: 190592167		Date: 23-Oct-19	
Customer: Starkey Laboratories, Inc.		Temperature: 23.1 °C	
Attendees: Charlie Esch		Humidity: 35% RH	
Project: None		Barometric Pres.: 1015 mbar	
Tested by: Andrew Rogstad		Power: 1.25 VDC	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2019		ANSI C63.10:2013	
COMMENTS			
Reference level offset includes measurement cable, DC block, and 20 dB attenuator. Data for 2 Mbps modulation was taken on 10/23/2019 and data taken for 1 Mbps modulation was taken on 10/28/2019.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature <i>Andrew Rogstad</i>	
		Value	Limit (±) Result
BLE/GFSK (2 Mbps) Low Channel, 2402 MHz		1.282 MHz	500 kHz Pass
BLE/GFSK (2 Mbps) Mid Channel, 2442 MHz		1.281 MHz	500 kHz Pass
BLE/GFSK (2 Mbps) High Channel, 2480 MHz		1.279 MHz	500 kHz Pass
BLE/GFSK (1 Mbps) Low Channel, 2402 MHz		765.283 kHz	500 kHz Pass
BLE/GFSK (1 Mbps) Mid Channel, 2442 MHz		747.803 kHz	500 kHz Pass
BLE/GFSK (1 Mbps) High Channel, 2480 MHz		741.943 kHz	500 kHz Pass

OCCUPIED BANDWIDTH

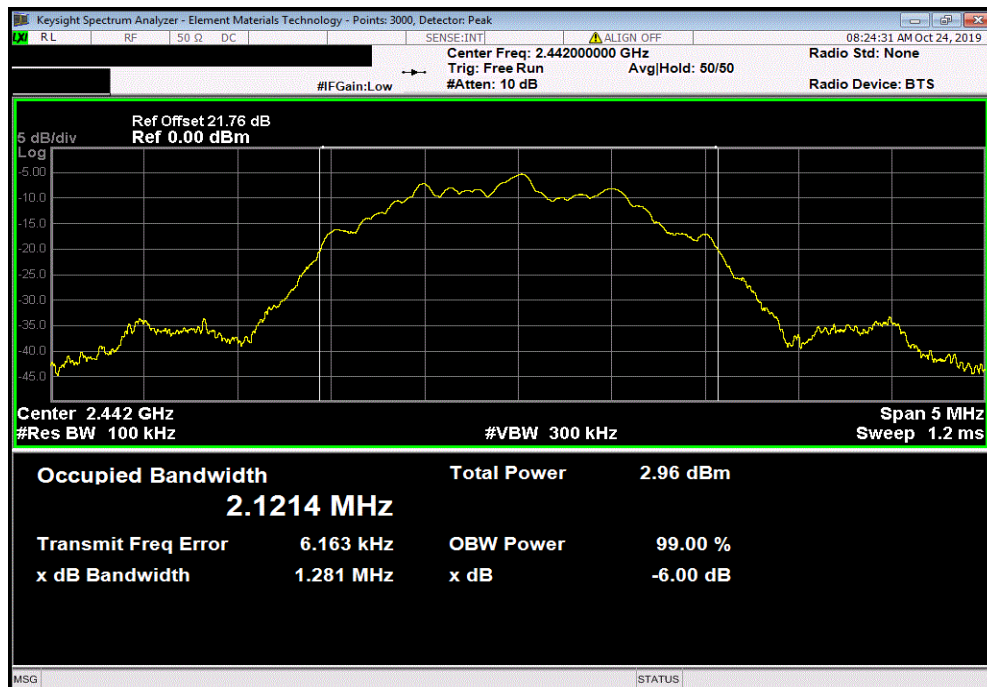


TbTx 2019.08.30.0 XMI 2019.09.05

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



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

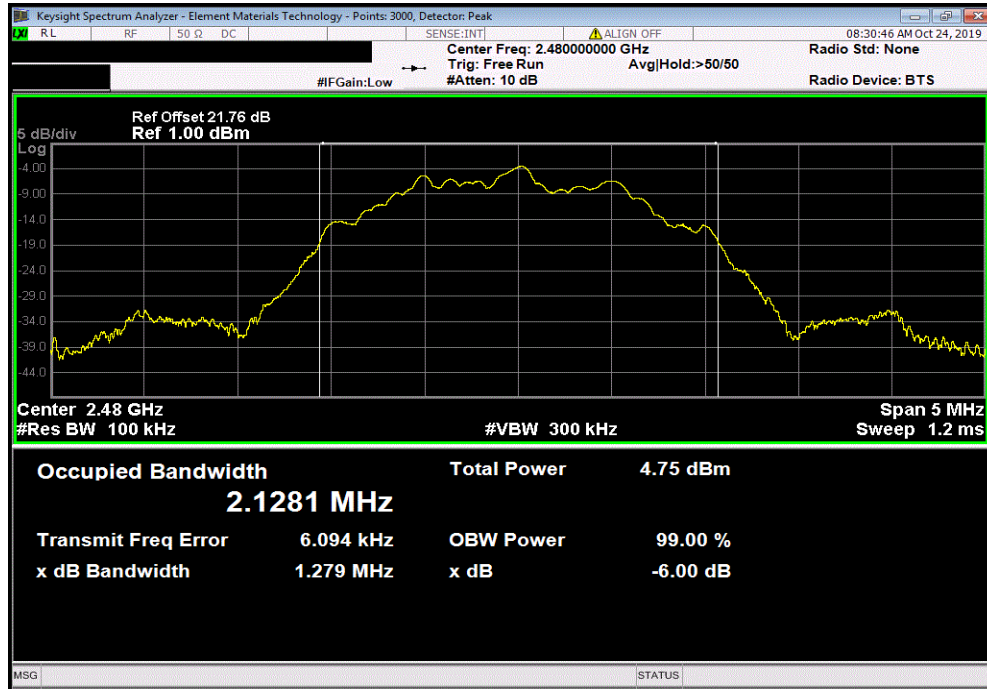


OCCUPIED BANDWIDTH



TbTx 2019.08.30.0 XMI 2019.09.05

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

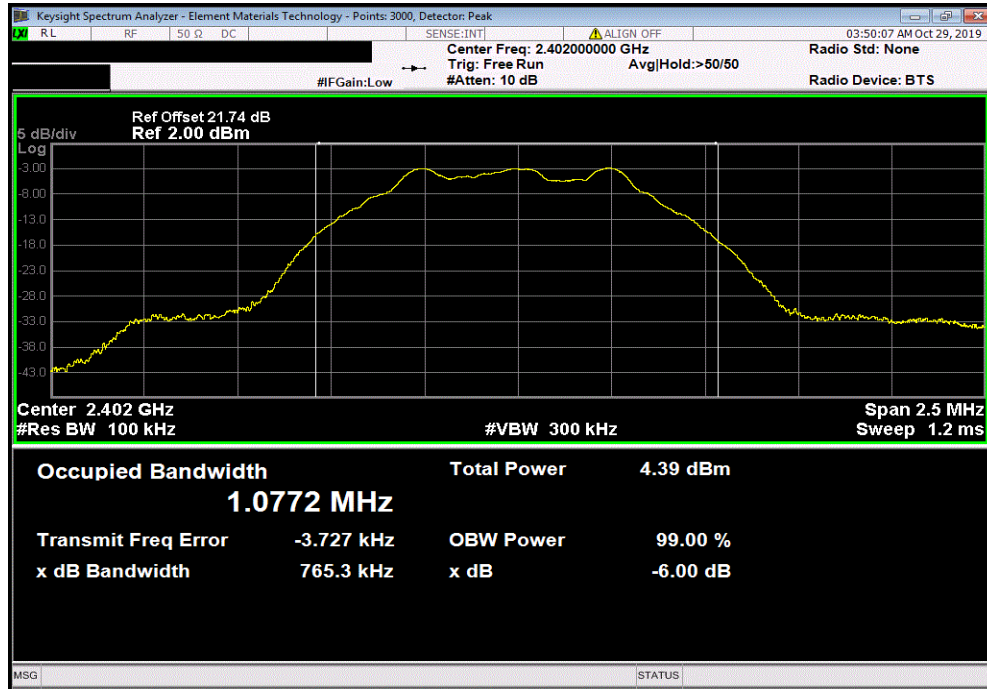


OCCUPIED BANDWIDTH

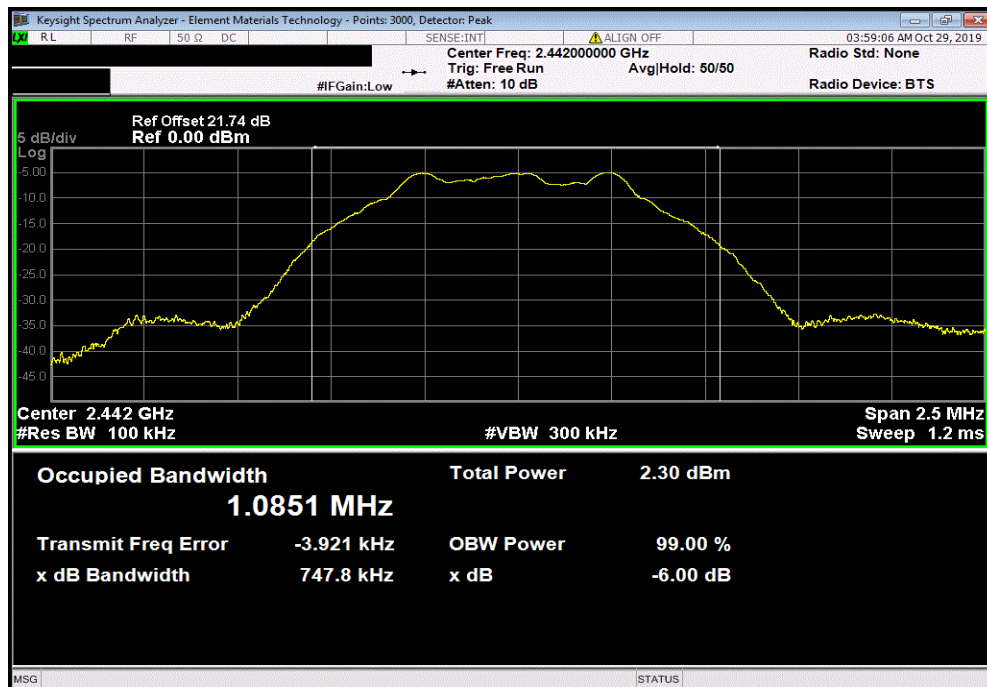


TbTx 2019.08.30.0 XMI 2019.09.05

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



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

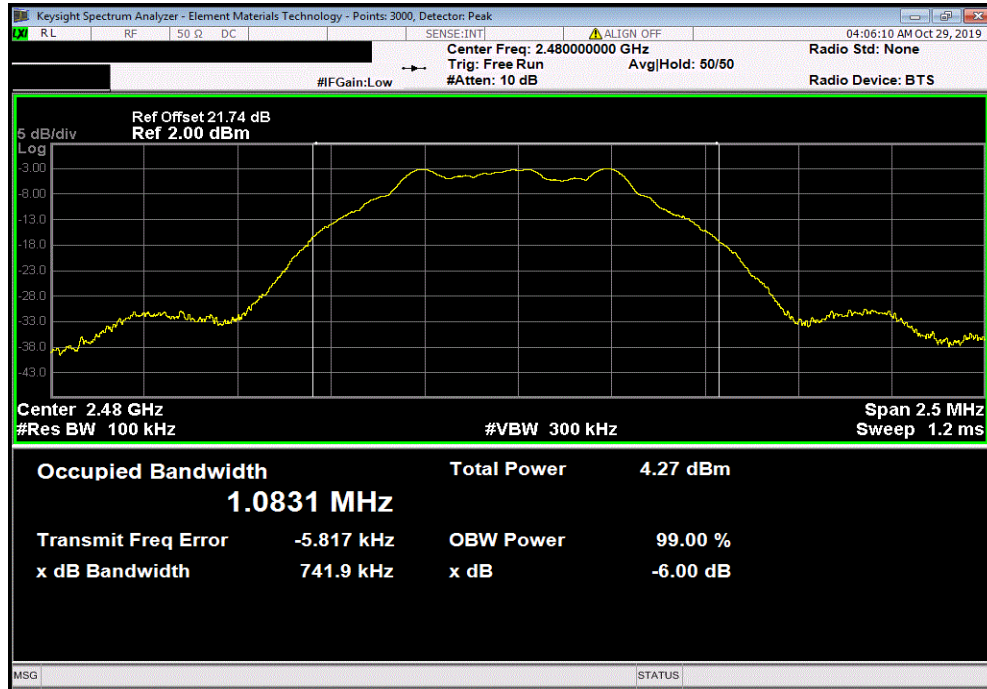


OCCUPIED BANDWIDTH



TbTx 2019.08.30.0 XMI 2019.09.05

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



OUTPUT POWER



XMIT 2019.09.05

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

TEST EQUIPMENT

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Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20

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.

OUTPUT POWER



TSTx 2019.08.30.0 XMI 2019.09.05

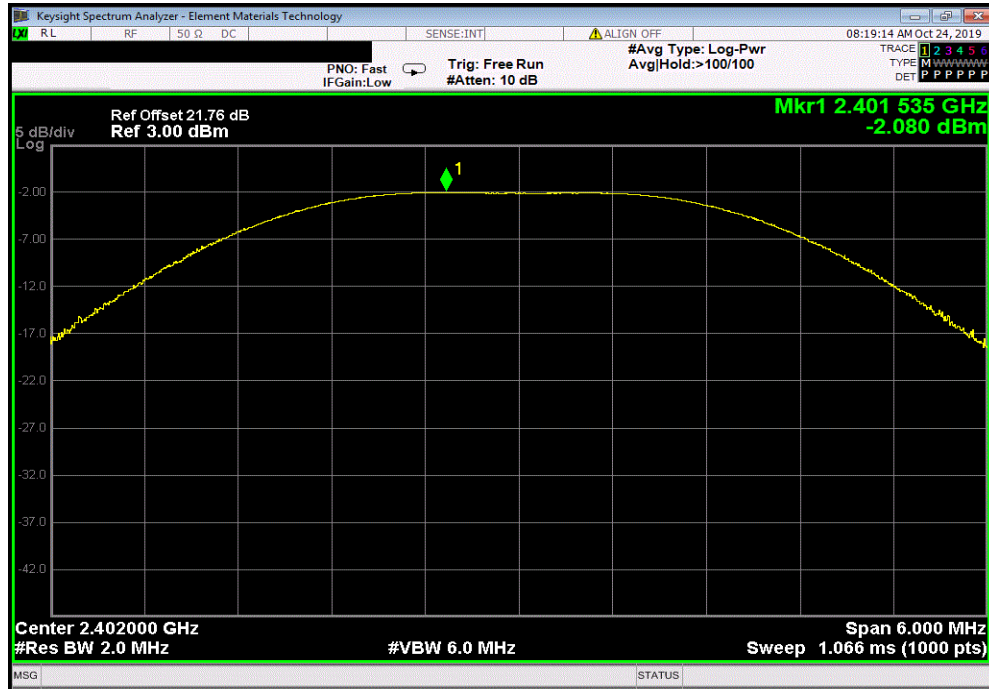
EUT: Livio BTE 13		Work Order: STAK0184	
Serial Number: 190592167		Date: 23-Oct-19	
Customer: Starkey Laboratories, Inc.		Temperature: 23.1 °C	
Attendees: Charlie Esch		Humidity: 34.8% RH	
Project: None		Barometric Pres.: 1015 mbar	
Tested by: Andrew Rogstad	Power: 1.25 VDC	Job Site: MN08	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2019		ANSI C63.10:2013	
COMMENTS			
Reference level offset includes measurement cable, DC block, and 20 dB attenuator. Data for 2 Mbps modulation was taken on 10/23/2019 and data taken for 1 Mbps modulation was taken on 10/28/2019.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature <i>Andrew Rogstad</i>	
		Out Pwr (dBm)	Limit (dBm) Result
BLE/GFSK (2 Mbps) Low Channel, 2402 MHz		-2.08	30 Pass
BLE/GFSK (2 Mbps) Mid Channel, 2442 MHz		-4.069	30 Pass
BLE/GFSK (2 Mbps) High Channel, 2480 MHz		-2.245	30 Pass
BLE/GFSK (1 Mbps) Low Channel, 2402 MHz		-1.996	30 Pass
BLE/GFSK (1 Mbps) Mid Channel, 2442 MHz		-4.101	30 Pass
BLE/GFSK (1 Mbps) High Channel, 2480 MHz		-2.142	30 Pass

OUTPUT POWER

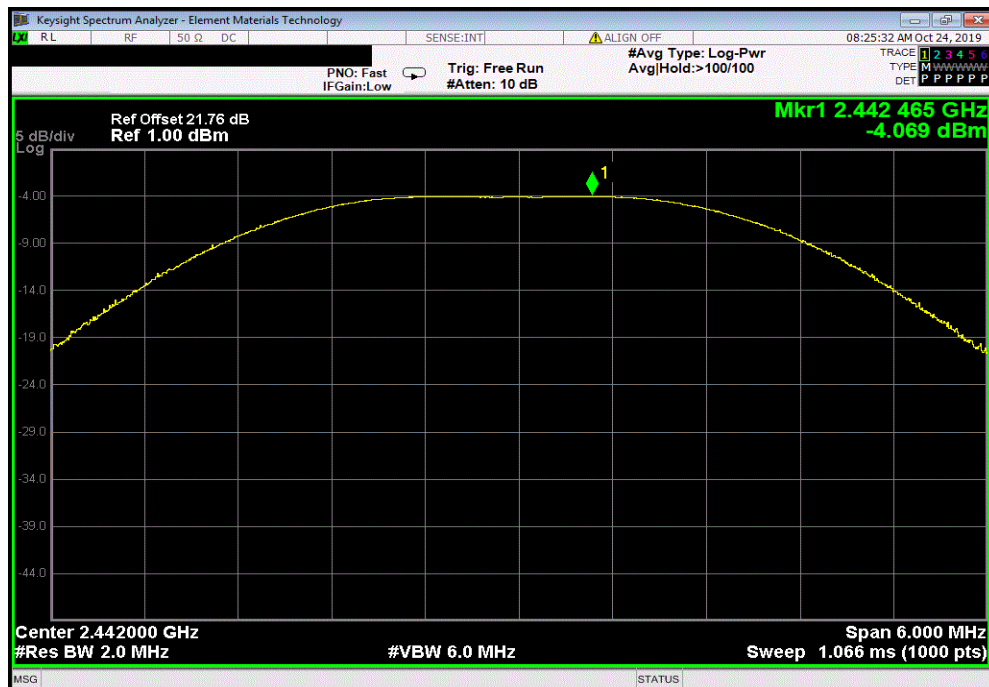


TbTx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (2 Mbps) Low Channel, 2402 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-2.08	30	Pass



BLE/GFSK (2 Mbps) Mid Channel, 2442 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-4.069	30	Pass

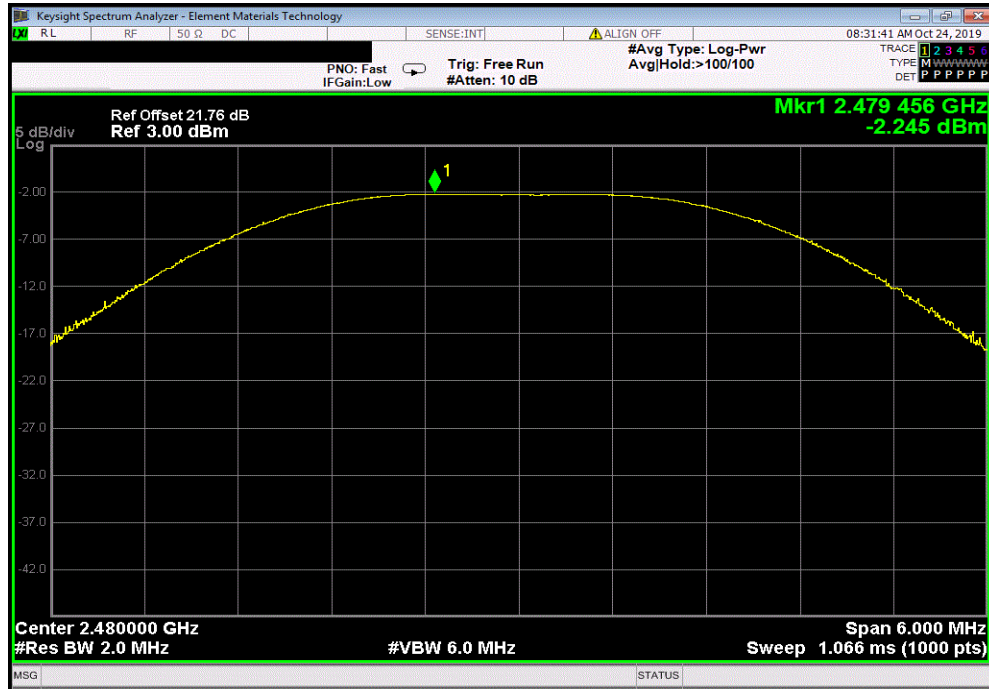


OUTPUT POWER



TbTx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (2 Mbps) High Channel, 2480 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-2.245	30	Pass

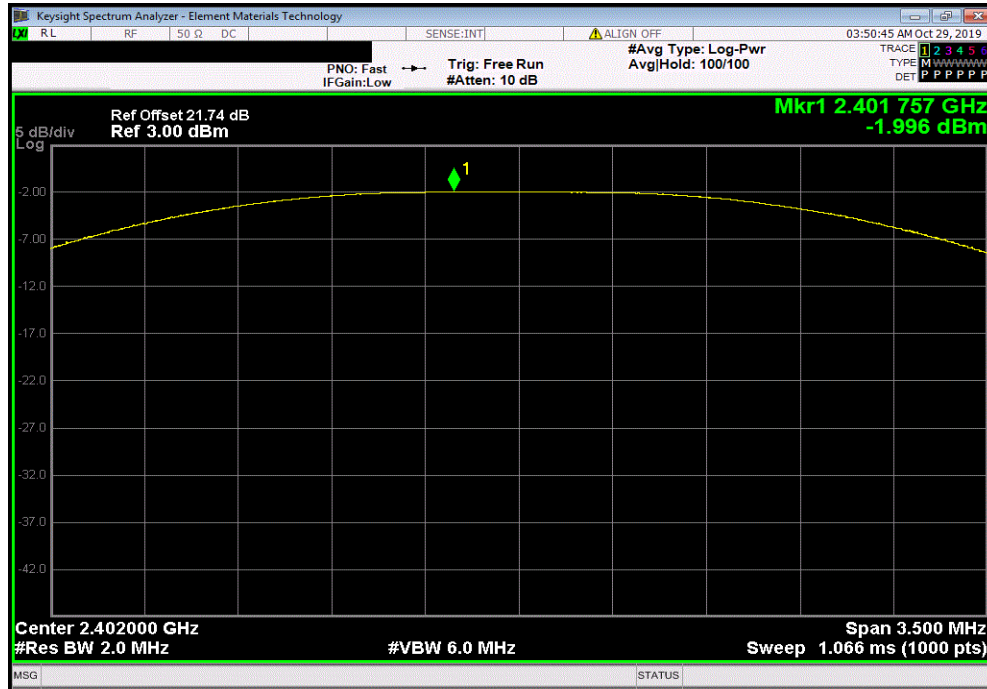


OUTPUT POWER

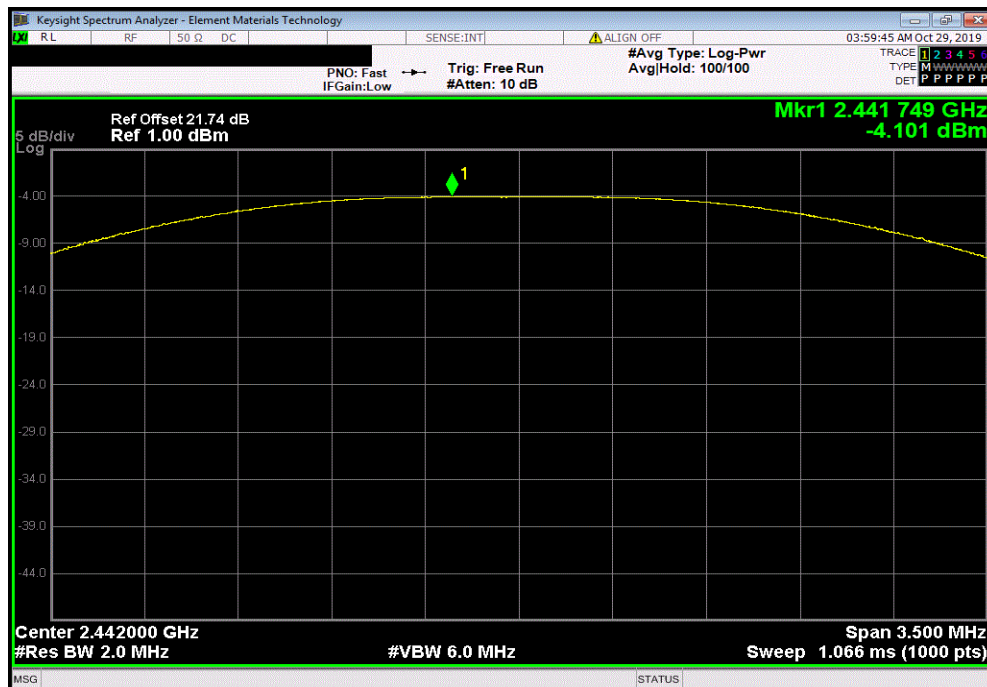


TbTtx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (1 Mbps) Low Channel, 2402 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-1.996	30	Pass



BLE/GFSK (1 Mbps) Mid Channel, 2442 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-4.101	30	Pass

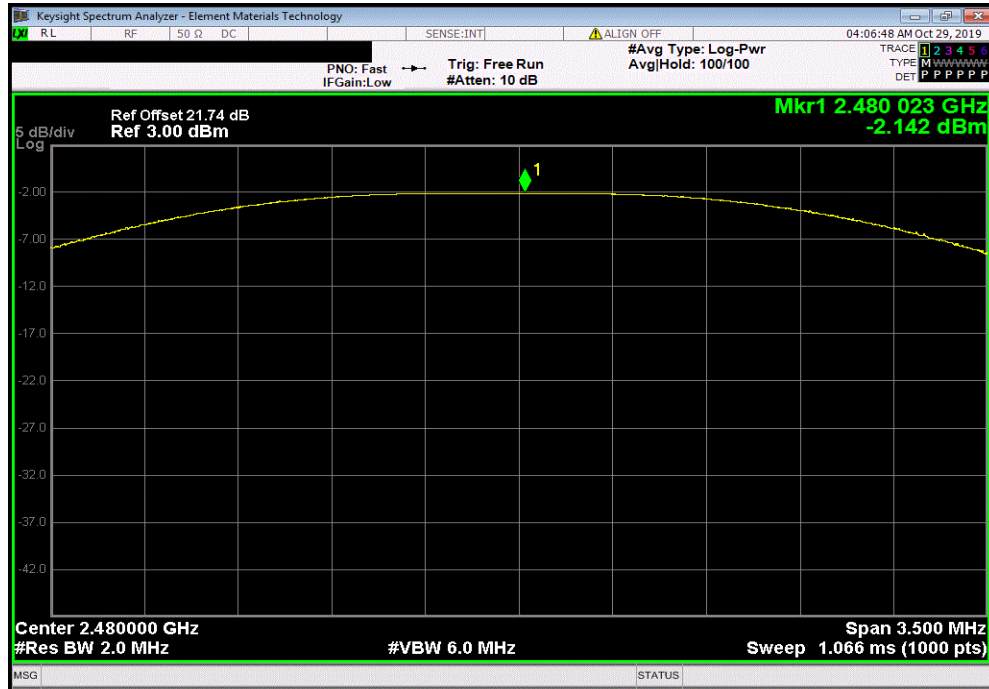


OUTPUT POWER



TbTx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (1 Mbps) High Channel, 2480 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-2.142	30	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



XMI 2019.09.05

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20

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.

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

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



TMTx 2019.08.30.0 XMI 2019.09.05

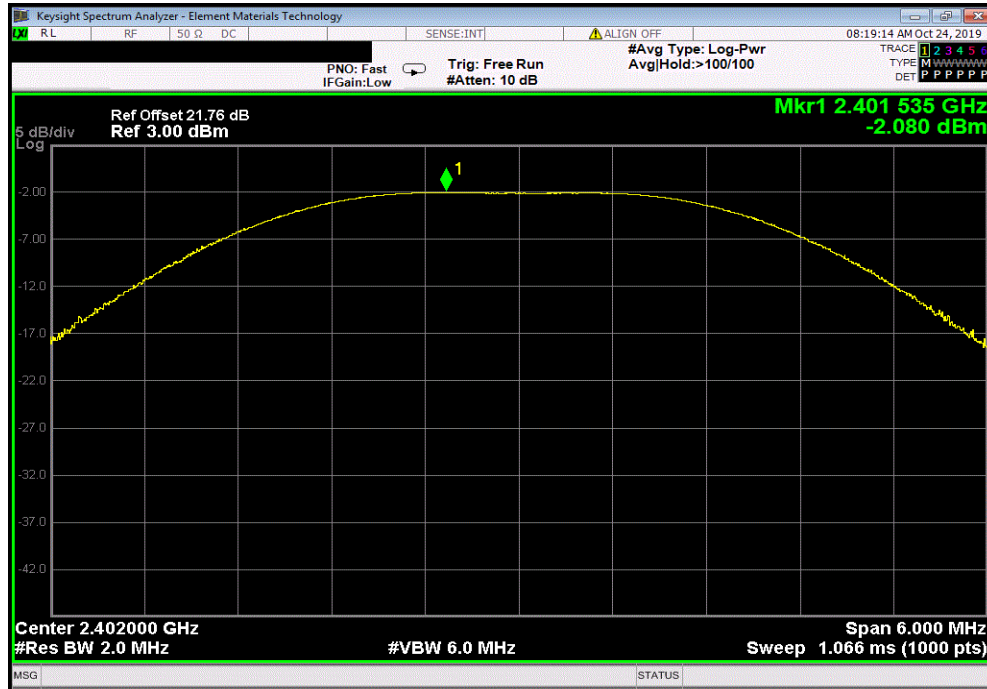
EUT: Livio BTE 13		Work Order: STAK0184	
Serial Number: 190592167		Date: 23-Oct-19	
Customer: Starkey Laboratories, Inc.		Temperature: 23.2 °C	
Attendees: Charlie Esch		Humidity: 36% RH	
Project: None		Barometric Pres.: 1015 mbar	
Tested by: Andrew Rogstad	Power: 1.25 VDC	Job Site: MN08	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2019		ANSI C63.10:2013	
COMMENTS			
Reference level offset includes measurement cable, DC block, and 20 dB attenuator. Data for 2 Mbps modulation was taken on 10/23/2019 and data taken for 1 Mbps modulation was taken on 10/28/2019.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature <i>Andrew Rogstad</i>	
		Out Pwr (dBm)	Antenna Gain (dBi)
BLE/GFSK (2 Mbps) Low Channel, 2402 MHz		-2.08	-5.5
BLE/GFSK (2 Mbps) Mid Channel, 2442 MHz		-4.069	-5.5
BLE/GFSK (2 Mbps) High Channel, 2480 MHz		-2.245	-5.5
		EIRP (dBm)	EIRP Limit (dBm)
BLE/GFSK (1 Mbps) Low Channel, 2402 MHz		-7.58	36
BLE/GFSK (1 Mbps) Mid Channel, 2442 MHz		-9.569	36
BLE/GFSK (1 Mbps) High Channel, 2480 MHz		-7.745	36
			Result
			Pass
			Pass
			Pass

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

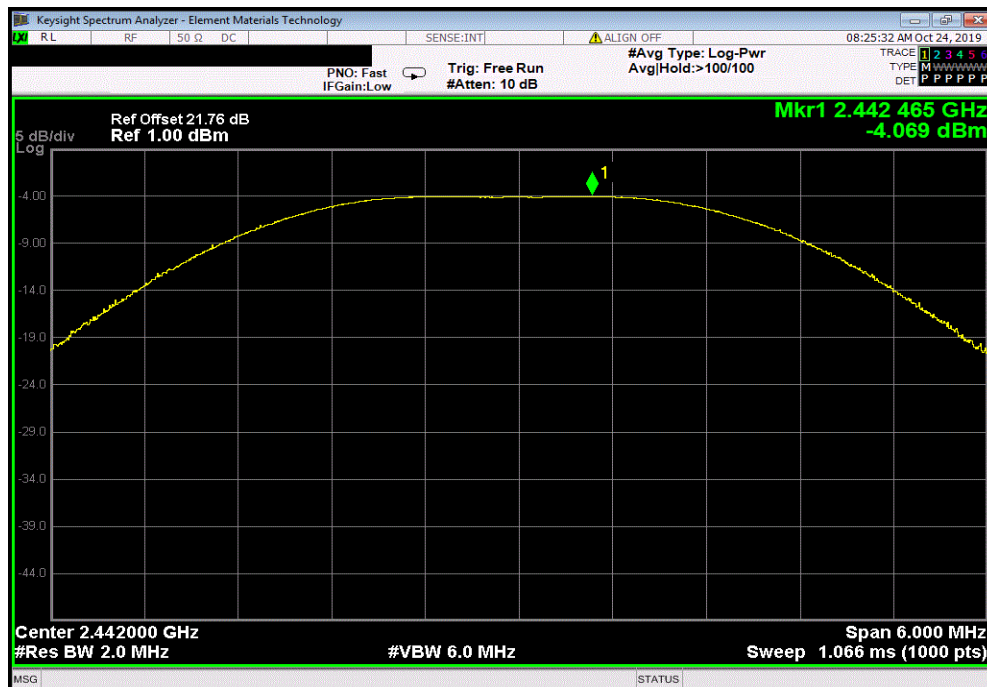


TbTx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (2 Mbps) Low Channel, 2402 MHz						
Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result		
-2.08	-5.5	-7.58	36	Pass		



BLE/GFSK (2 Mbps) Mid Channel, 2442 MHz						
Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result		
-4.069	-5.5	-9.569	36	Pass		

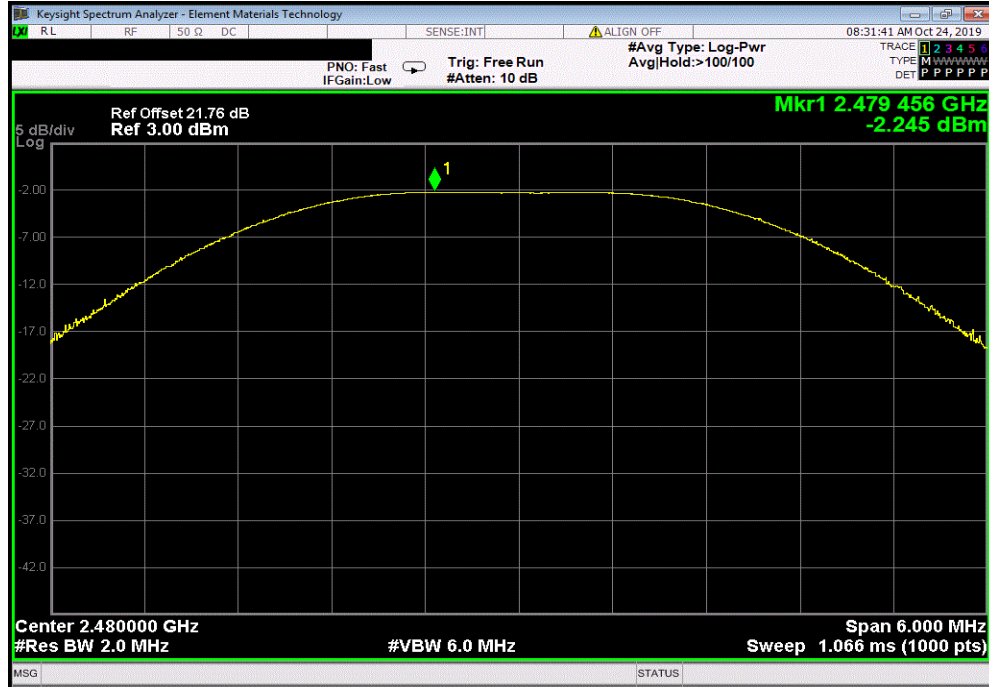


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



TbTx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (2 Mbps) High Channel, 2480 MHz					
Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
-2.245	-5.5	-7.745	36	Pass	

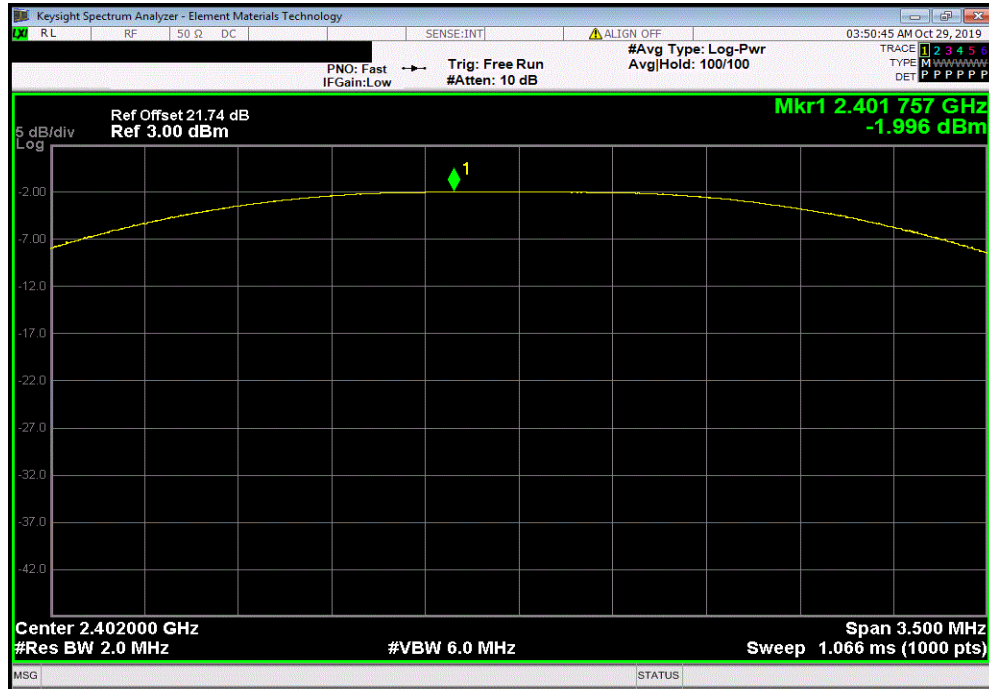


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

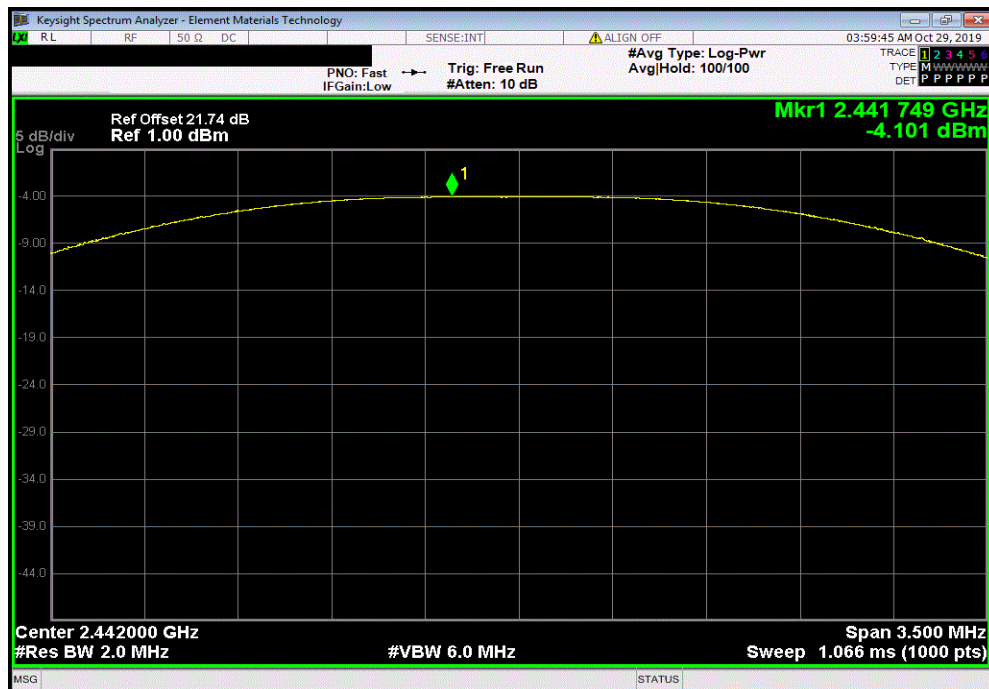


TbTx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (1 Mbps) Low Channel, 2402 MHz						
Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result		
-1.996	-5.5	-7.496	36	Pass		



BLE/GFSK (1 Mbps) Mid Channel, 2442 MHz						
Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result		
-4.101	-5.5	-9.601	36	Pass		

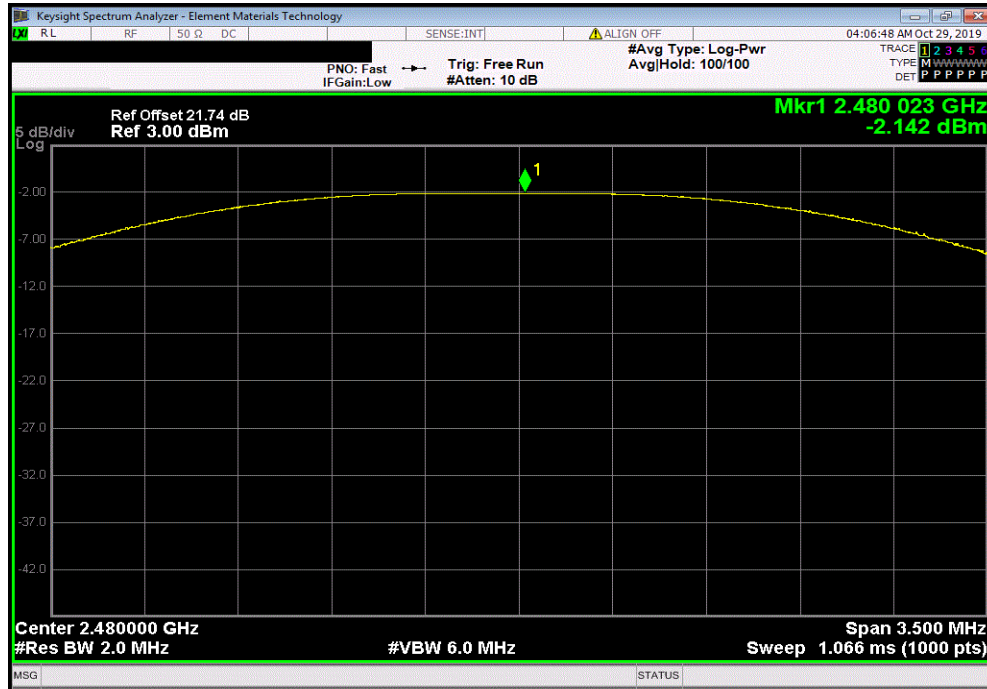


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



TbTx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (1 Mbps) High Channel, 2480 MHz					
Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
-2.142	-5.5	-7.642	36	Pass	



POWER SPECTRAL DENSITY



XMIT 2019.09.05

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20

TEST DESCRIPTION

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

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

POWER SPECTRAL DENSITY



TSTx 2019.08.30.0 XMI 2019.09.05

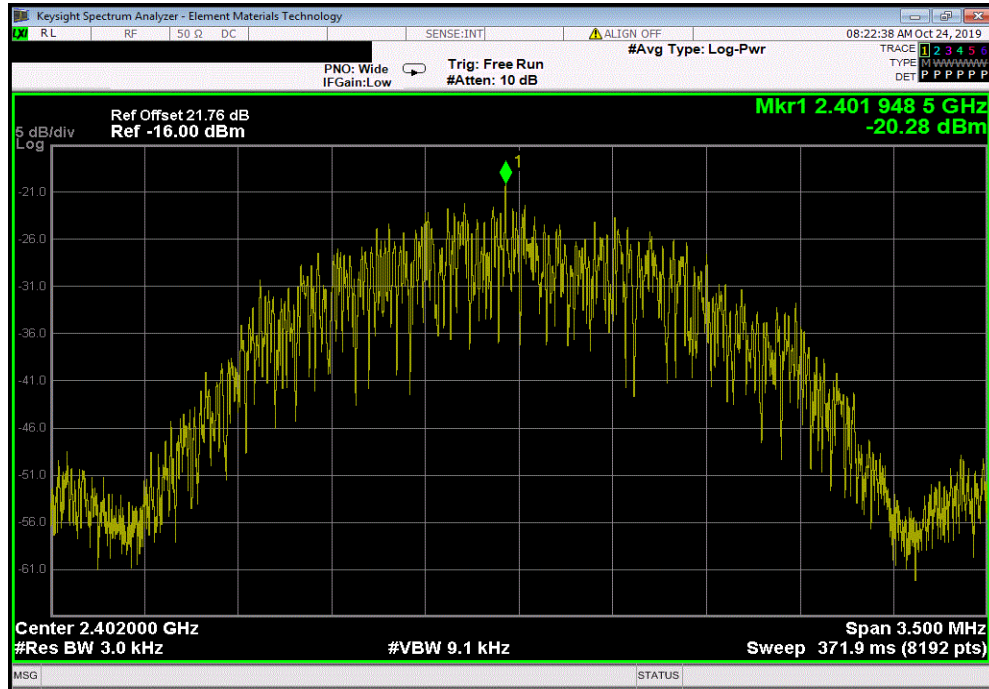
EUT: Livio BTE 13		Work Order: STAK0184	
Serial Number: 190592167		Date: 23-Oct-19	
Customer: Starkey Laboratories, Inc.		Temperature: 23.1 °C	
Attendees: Charlie Esch		Humidity: 34.8% RH	
Project: None		Barometric Pres.: 1015 mbar	
Tested by: Andrew Rogstad		Power: 1.25 VDC	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2019		ANSI C63.10:2013	
COMMENTS			
Reference level offset includes measurement cable, DC block, and 20 dB attenuator. Data for 2 Mbps modulation was taken on 10/23/2019 and data taken for 1 Mbps modulation was taken on 10/28/2019.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature <i>Andrew Rogstad</i>	
		Value dBm/3kHz	Limit < dBm/3kHz
BLE/GFSK (2 Mbps) Low Channel, 2402 MHz		-20.28	8
BLE/GFSK (2 Mbps) Mid Channel, 2442 MHz		-22.25	8
BLE/GFSK (2 Mbps) High Channel, 2480 MHz		-20.246	8
BLE/GFSK (1 Mbps) Low Channel, 2402 MHz		-17.616	8
BLE/GFSK (1 Mbps) Mid Channel, 2442 MHz		-19.731	8
BLE/GFSK (1 Mbps) High Channel, 2480 MHz		-17.758	8
			Results
			Pass
			Pass
			Pass
			Pass
			Pass
			Pass

POWER SPECTRAL DENSITY

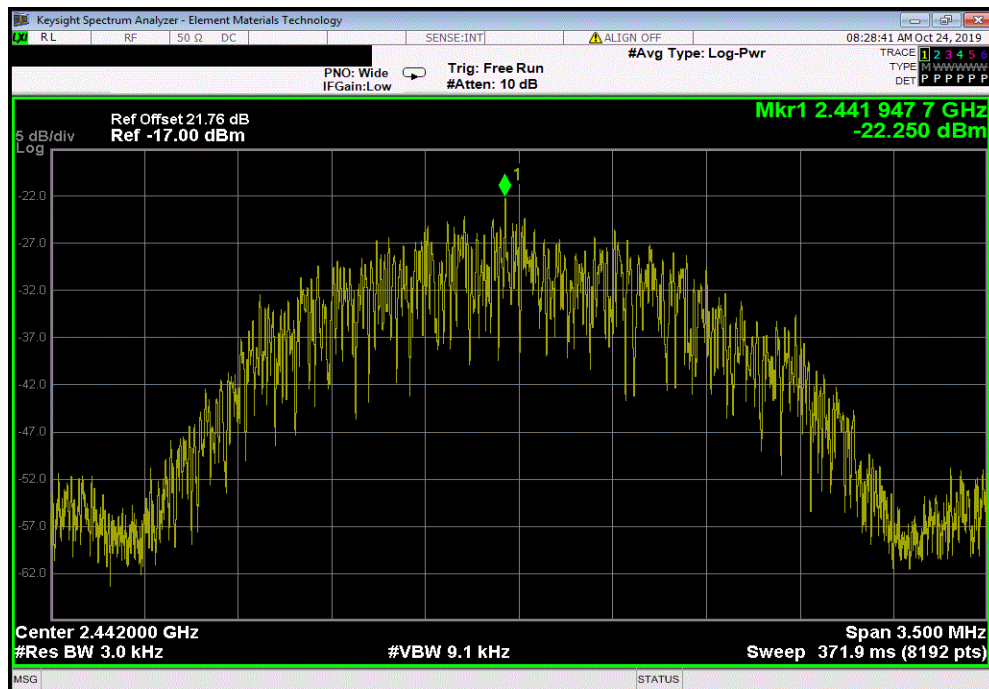


TbTx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (2 Mbps) Low Channel, 2402 MHz						
	Value	Limit				
	dBm/3kHz	< dBm/3kHz	Results			
	-20.28	8	Pass			



BLE/GFSK (2 Mbps) Mid Channel, 2442 MHz						
	Value	Limit				
	dBm/3kHz	< dBm/3kHz	Results			
	-22.25	8	Pass			

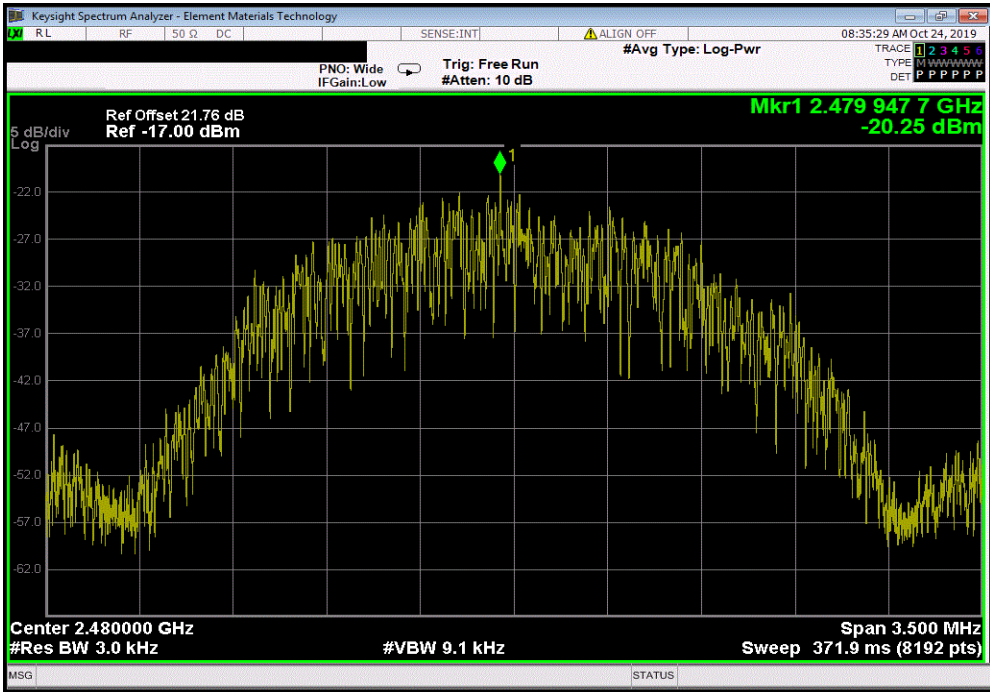


POWER SPECTRAL DENSITY



TbTtx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (2 Mbps) High Channel, 2480 MHz						
				Value	Limit	Results
				dBm/3kHz	< dBm/3kHz	
				-20.246	8	Pass

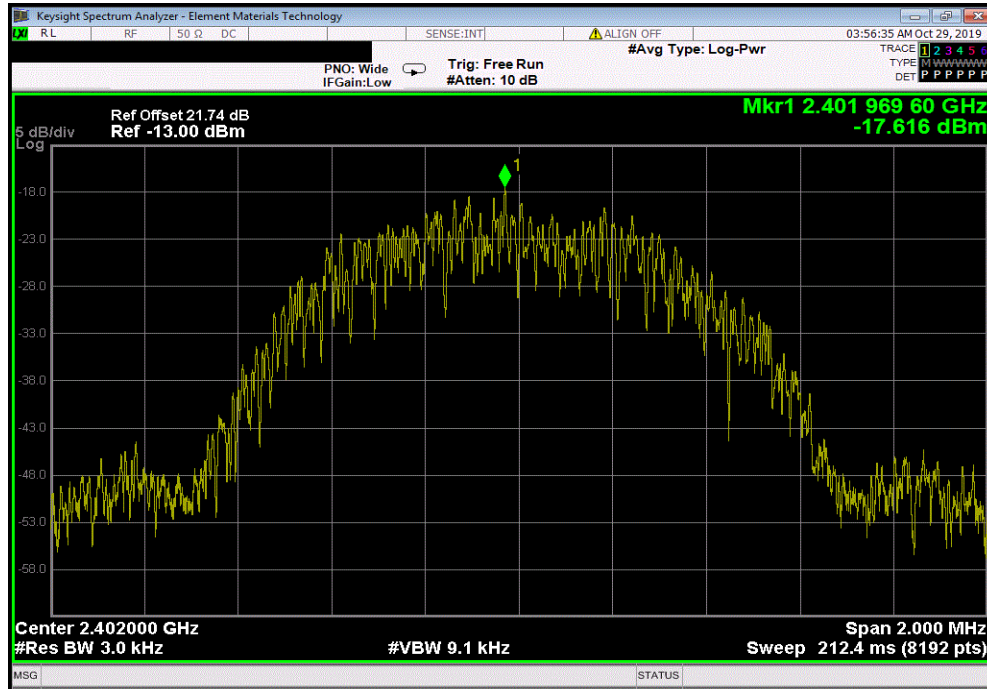


POWER SPECTRAL DENSITY

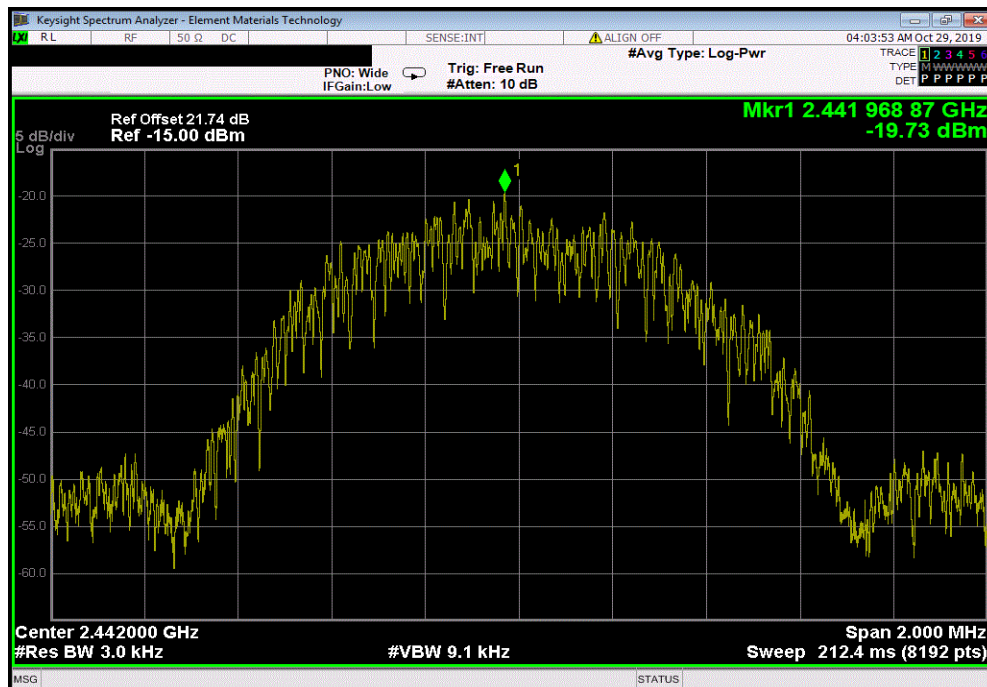


TbTtX 2019.08.30.0 XMt 2019.09.05

BLE/GFSK (1 Mbps) Low Channel, 2402 MHz						
	Value	Limit	Results			
	dBm/3kHz	< dBm/3kHz				
	-17.616	8	Pass			



BLE/GFSK (1 Mbps) Mid Channel, 2442 MHz						
	Value	Limit	Results			
	dBm/3kHz	< dBm/3kHz				
	-19.731	8	Pass			

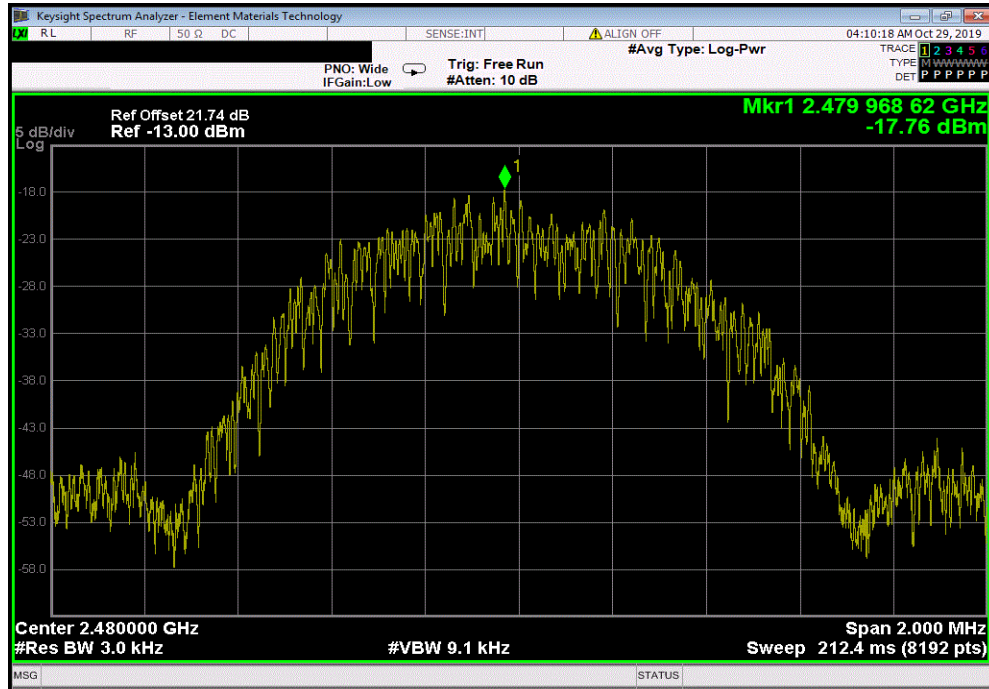


POWER SPECTRAL DENSITY



TbTtx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (1 Mbps) High Channel, 2480 MHz						
Value				Limit	Results	
dBm/3kHz				< dBm/3kHz		
			-17.758	8	Pass	



BAND EDGE COMPLIANCE



XMI 2019.09.05

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20

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



TMTx 2019.08.30.0 XMI 2019.09.05

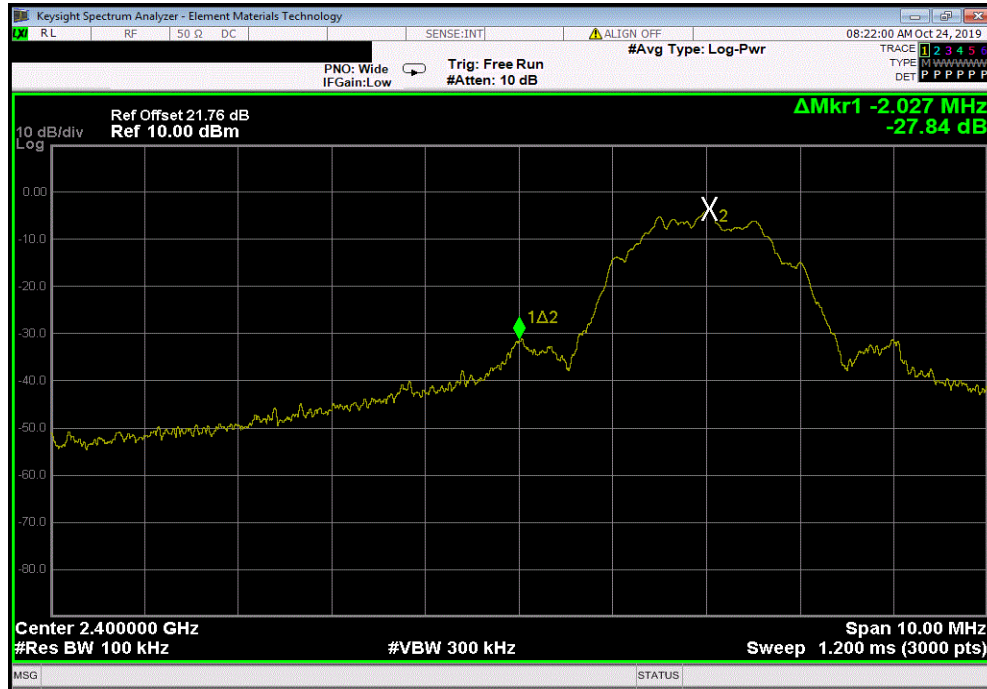
EUT: Livio BTE 13		Work Order: STAK0184	
Serial Number: 190592167		Date: 23-Oct-19	
Customer: Starkey Laboratories, Inc.		Temperature: 23.2 °C	
Attendees: Charlie Esch		Humidity: 36% RH	
Project: None		Barometric Pres.: 1015 mbar	
Tested by: Andrew Rogstad	Power: 1.25 VDC	Job Site: MN08	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2019		ANSI C63.10:2013	
COMMENTS			
Reference level offset includes measurement cable, DC block, and 20 dB attenuator. Data for 2 Mbps modulation was taken on 10/23/2019 and data taken for 1 Mbps modulation was taken on 10/28/2019.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature <i>Andrew Rogstad</i>	
		Value (dBc)	Limit ≤ (dBc) Result
BLE/GFSK (2 Mbps) Low Channel, 2402 MHz		-27.84	-20 Pass
BLE/GFSK (2 Mbps) High Channel, 2480 MHz		-38.14	-20 Pass
BLE/GFSK (1 Mbps) Low Channel, 2402 MHz		-41.79	-20 Pass
BLE/GFSK (1 Mbps) High Channel, 2480 MHz		-41.53	-20 Pass

BAND EDGE COMPLIANCE

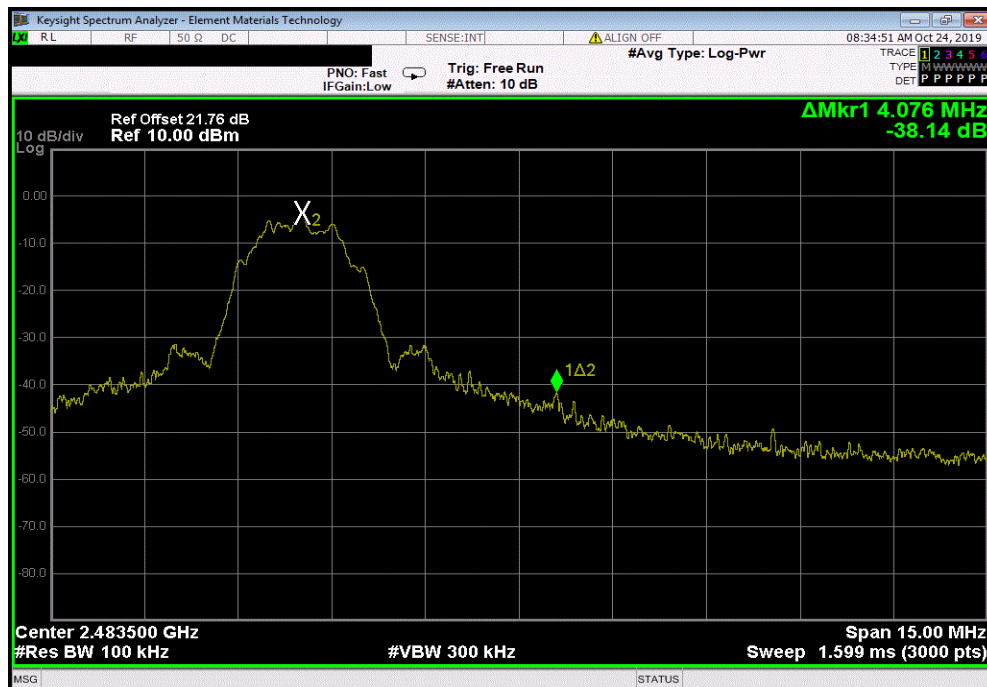


TbTtx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (2 Mbps) Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-27.84	-20	Pass



BLE/GFSK (2 Mbps) High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-38.14	-20	Pass

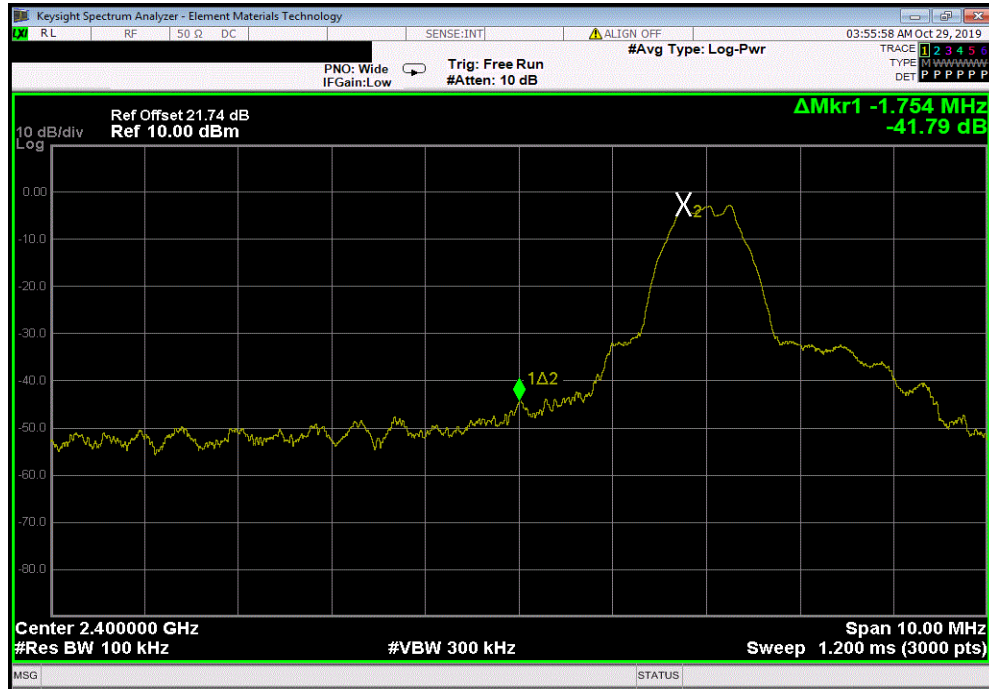


BAND EDGE COMPLIANCE



TbTtX 2019.08.30.0 XMt 2019.09.05

BLE/GFSK (1 Mbps) Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-41.79	-20	Pass



BLE/GFSK (1 Mbps) High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-41.53	-20	Pass



SPURIOUS CONDUCTED EMISSIONS



XMIT 2019.09.05

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20

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



TMTx 2019.08.30.0 XMM 2019.09.05

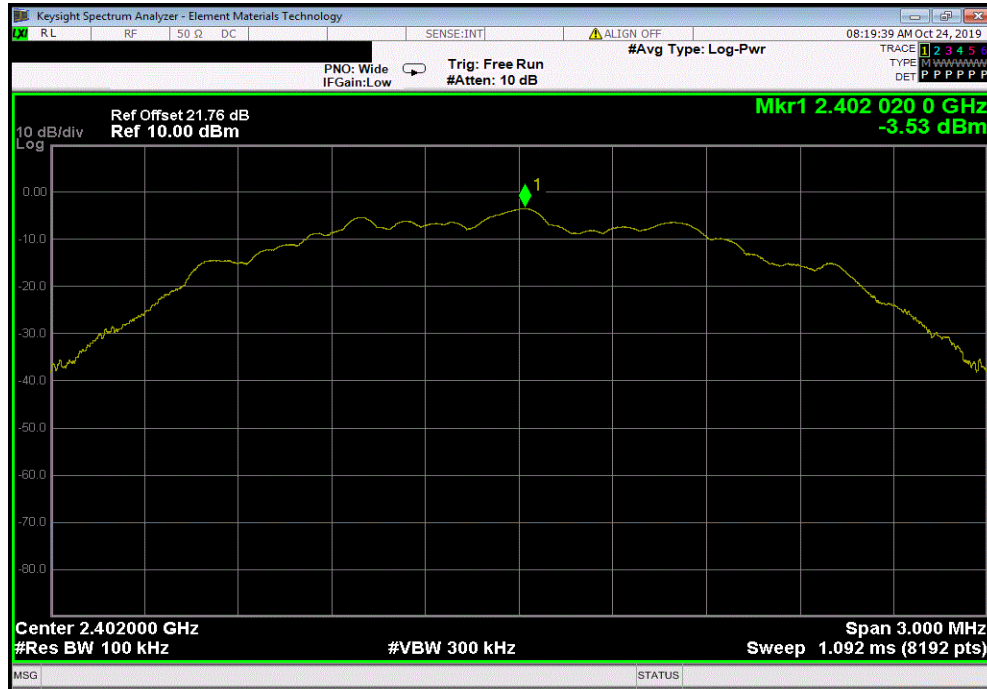
EUT: Livio BTE 13		Work Order: STAK0184	
Serial Number: 190592167		Date: 23-Oct-19	
Customer: Starkey Laboratories, Inc.		Temperature: 23 °C	
Attendees: Charlie Esch		Humidity: 34.8% RH	
Project: None		Barometric Pres.: 1015 mbar	
Tested by: Andrew Rogstad		Power: 1.25 VDC	
Job Site: MN08			
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2019		ANSI C63.10:2013	
COMMENTS			
Reference level offset includes measurement cable, DC block, and 20 dB attenuator. Data for 2 Mbps modulation was taken on 10/23/2019 and data taken for 1 Mbps modulation was taken on 10/28/2019.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature <i>Andrew Rogstad</i>	
		Frequency Range	Measured Freq (MHz)
			Max Value (dBc)
			Limit ≤ (dBc)
			Result
BLE/GFSK (2 Mbps) Low Channel, 2402 MHz		Fundamental	2402.02
BLE/GFSK (2 Mbps) Low Channel, 2402 MHz		30 MHz - 12.5 GHz	2397.34
BLE/GFSK (2 Mbps) Low Channel, 2402 MHz		12.5 GHz - 25 GHz	24272.07
BLE/GFSK (2 Mbps) Mid Channel, 2442 MHz		Fundamental	2442.02
BLE/GFSK (2 Mbps) Mid Channel, 2442 MHz		30 MHz - 12.5 GHz	3810.13
BLE/GFSK (2 Mbps) Mid Channel, 2442 MHz		12.5 GHz - 25 GHz	24030.95
BLE/GFSK (2 Mbps) High Channel, 2480 MHz		Fundamental	2480.02
BLE/GFSK (2 Mbps) High Channel, 2480 MHz		30 MHz - 12.5 GHz	2487.16
BLE/GFSK (2 Mbps) High Channel, 2480 MHz		12.5 GHz - 25 GHz	24957.27
BLE/GFSK (1 Mbps) Low Channel, 2402 MHz		Fundamental	2402.24
BLE/GFSK (1 Mbps) Low Channel, 2402 MHz		30 MHz - 12.5 GHz	2397.34
BLE/GFSK (1 Mbps) Low Channel, 2402 MHz		12.5 GHz - 25 GHz	24113.36
BLE/GFSK (1 Mbps) Mid Channel, 2442 MHz		Fundamental	2442.24
BLE/GFSK (1 Mbps) Mid Channel, 2442 MHz		30 MHz - 12.5 GHz	3747.71
BLE/GFSK (1 Mbps) Mid Channel, 2442 MHz		12.5 GHz - 25 GHz	24090.47
BLE/GFSK (1 Mbps) High Channel, 2480 MHz		Fundamental	2480.24
BLE/GFSK (1 Mbps) High Channel, 2480 MHz		30 MHz - 12.5 GHz	3852.75
BLE/GFSK (1 Mbps) High Channel, 2480 MHz		12.5 GHz - 25 GHz	23675.38

SPURIOUS CONDUCTED EMISSIONS

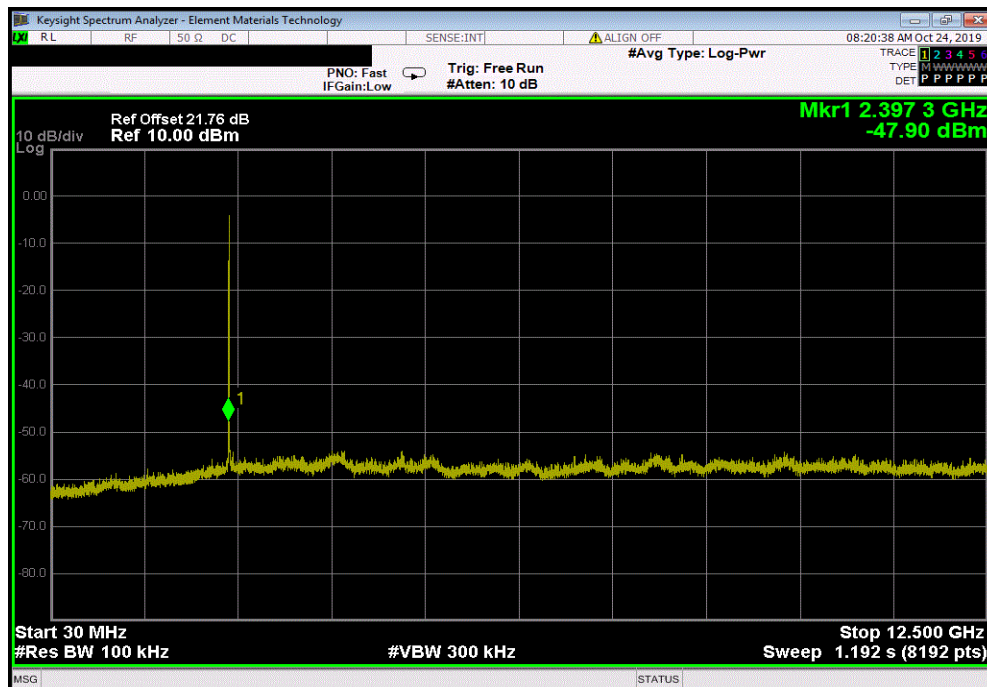


TbTtx 2019.08.30.0 XMI 2019.09.05

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



BLE/GFSK (2 Mbps) Low Channel, 2402 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	2397.34	-44.37	-20	Pass	

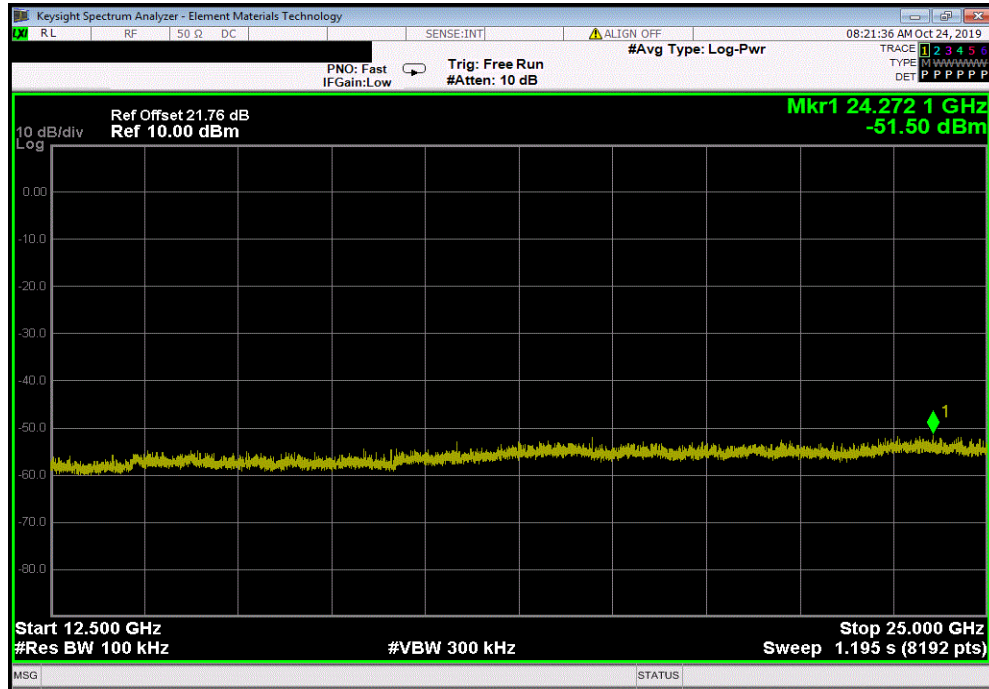


SPURIOUS CONDUCTED EMISSIONS

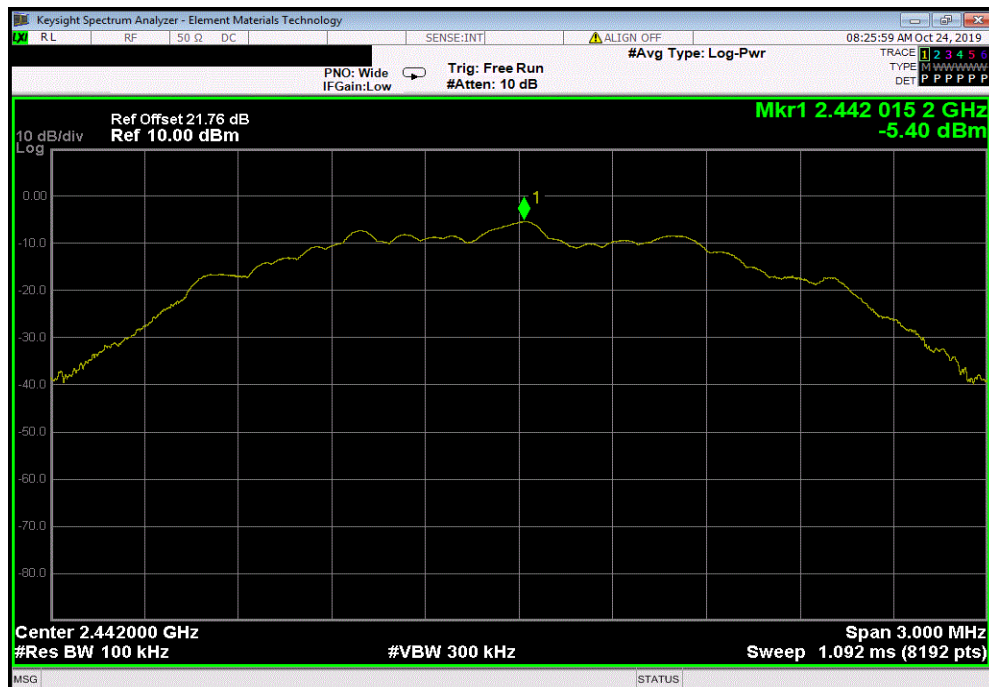


TbTtx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (2 Mbps) Low Channel, 2402 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	24272.07	-47.97	-20	Pass	



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

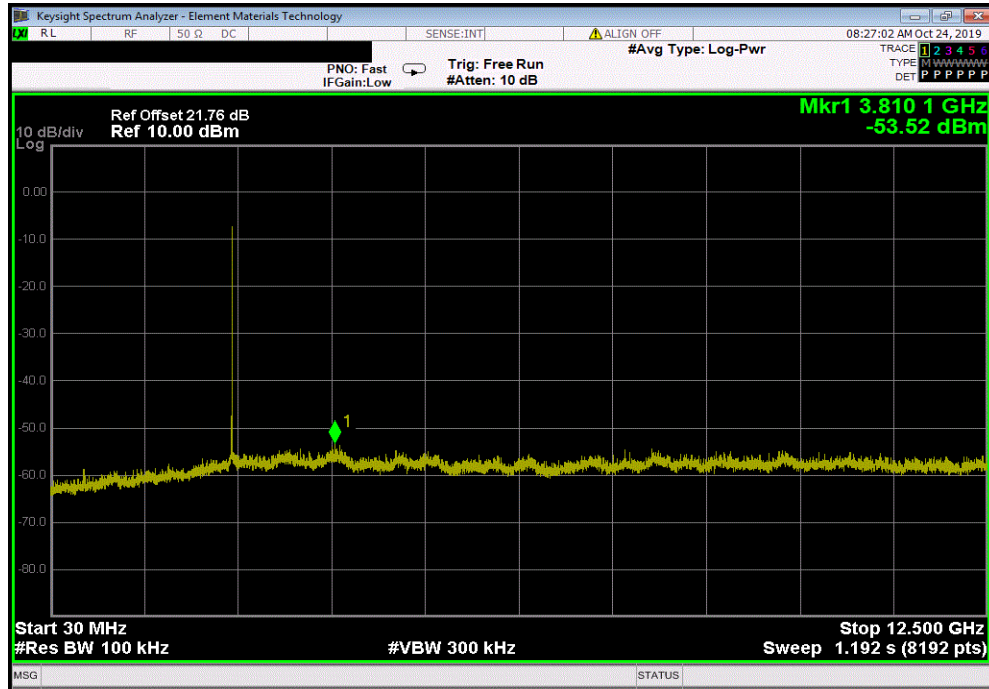


SPURIOUS CONDUCTED EMISSIONS

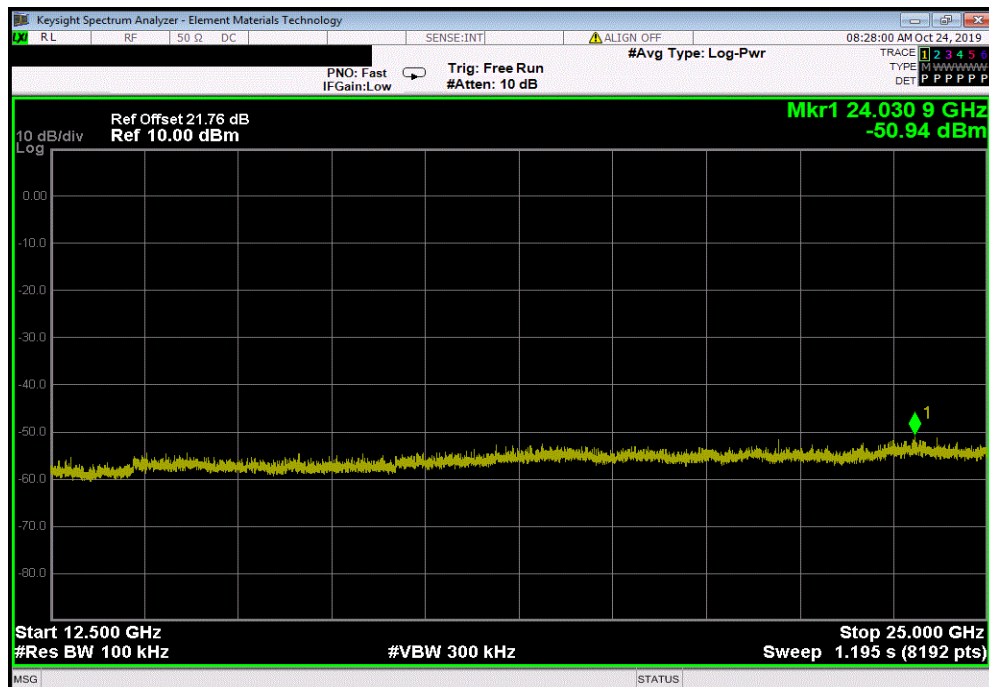


TbTx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (2 Mbps) Mid Channel, 2442 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	3810.13	-48.12	-20	Pass	



BLE/GFSK (2 Mbps) Mid Channel, 2442 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	24030.95	-45.54	-20	Pass	

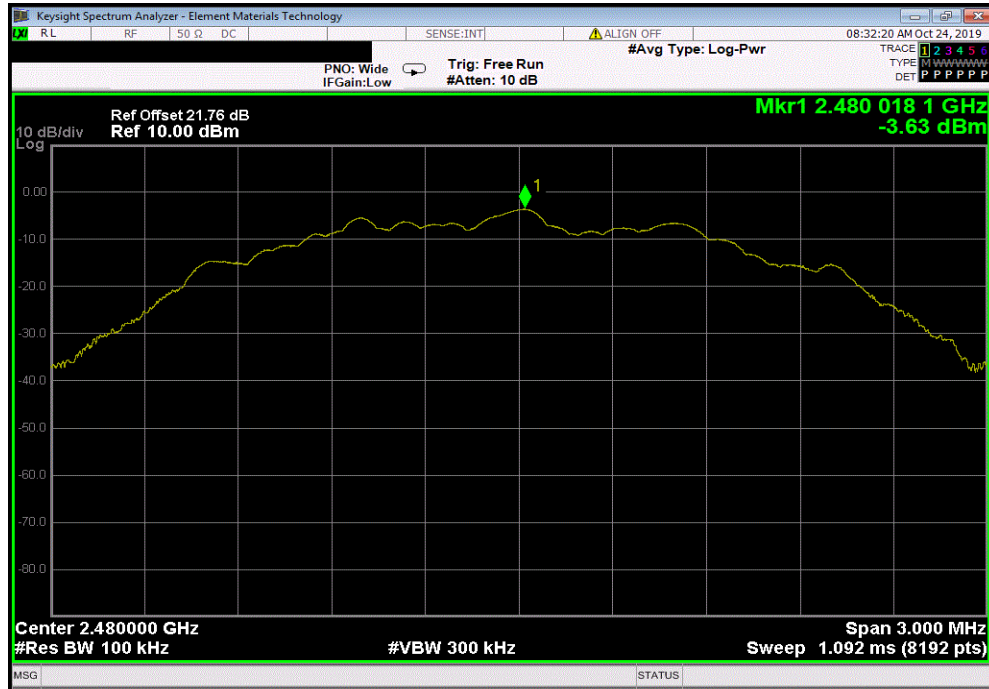


SPURIOUS CONDUCTED EMISSIONS

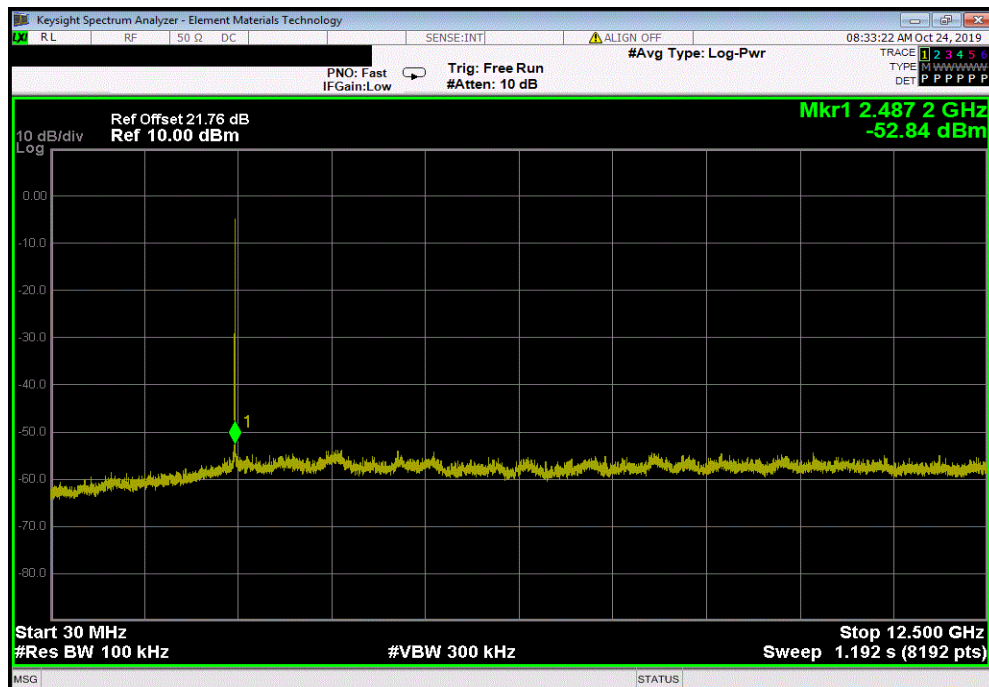


TbTx 2019.08.30.0 XMI 2019.09.05

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



BLE/GFSK (2 Mbps) High Channel, 2480 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	2487.16	-49.21	-20	Pass	

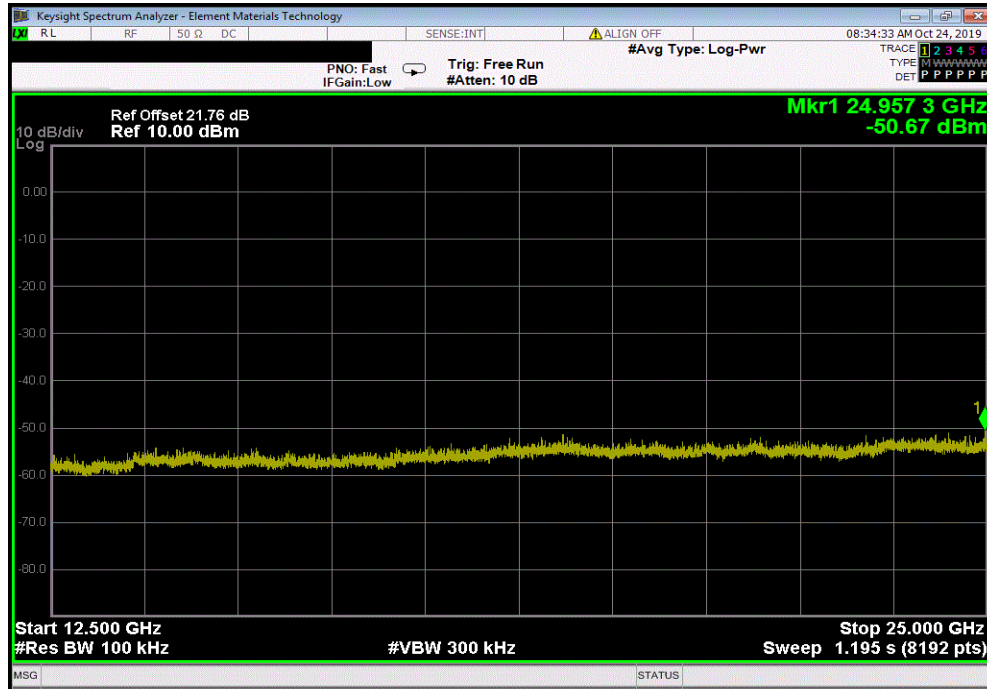


SPURIOUS CONDUCTED EMISSIONS



TbTx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (2 Mbps) High Channel, 2480 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	24957.27	-47.04	-20	Pass	

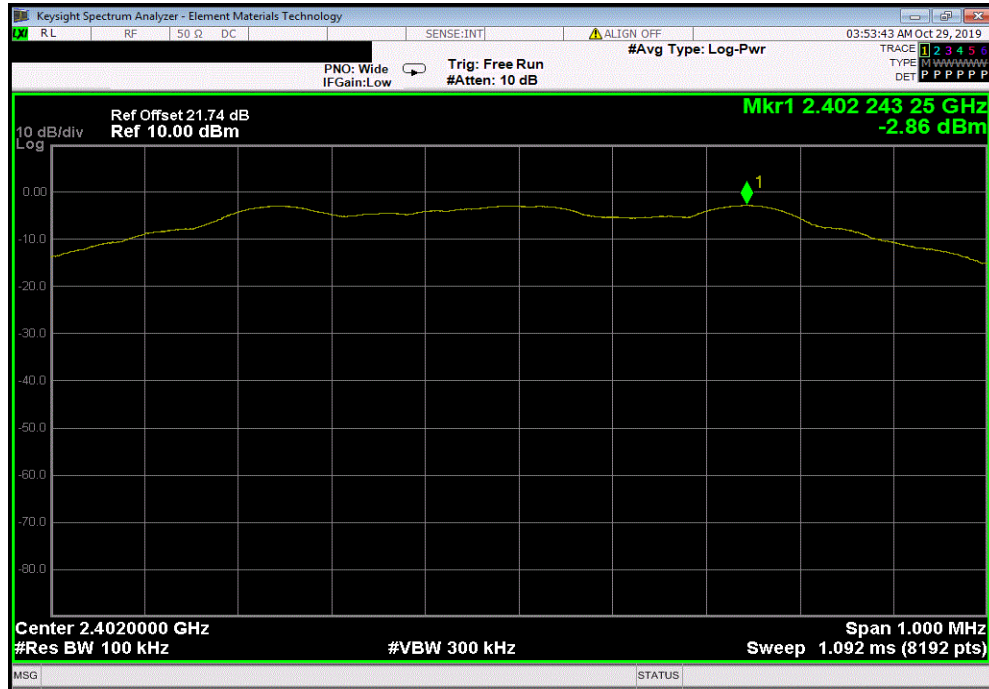


SPURIOUS CONDUCTED EMISSIONS

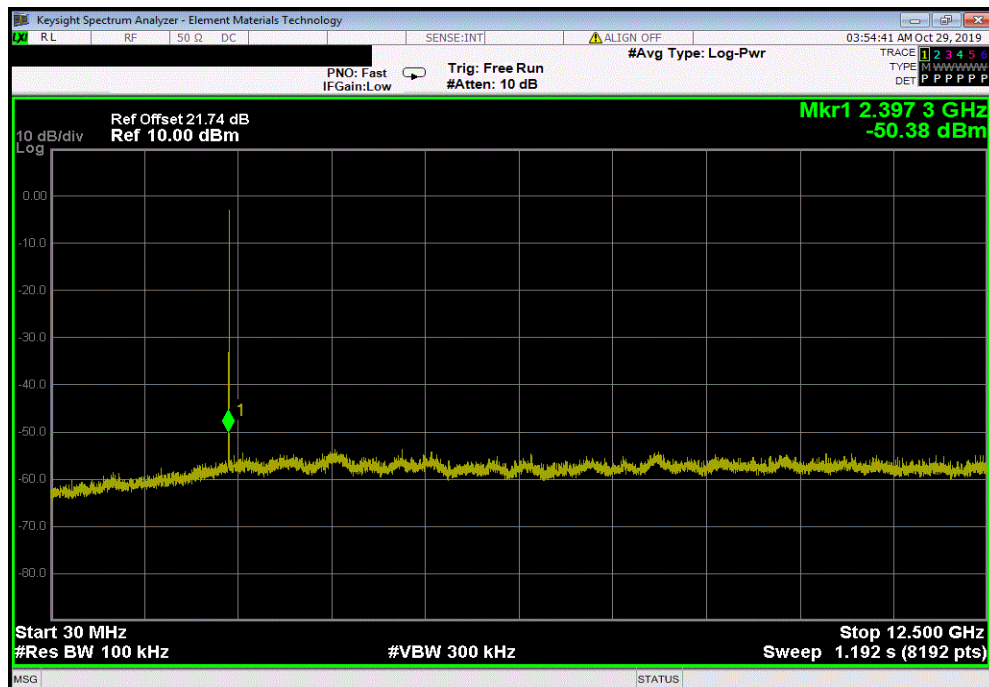


TbTx 2019.08.30.0 XMI 2019.09.05

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



BLE/GFSK (1 Mbps) Low Channel, 2402 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	2397.34	-47.52	-20	Pass	

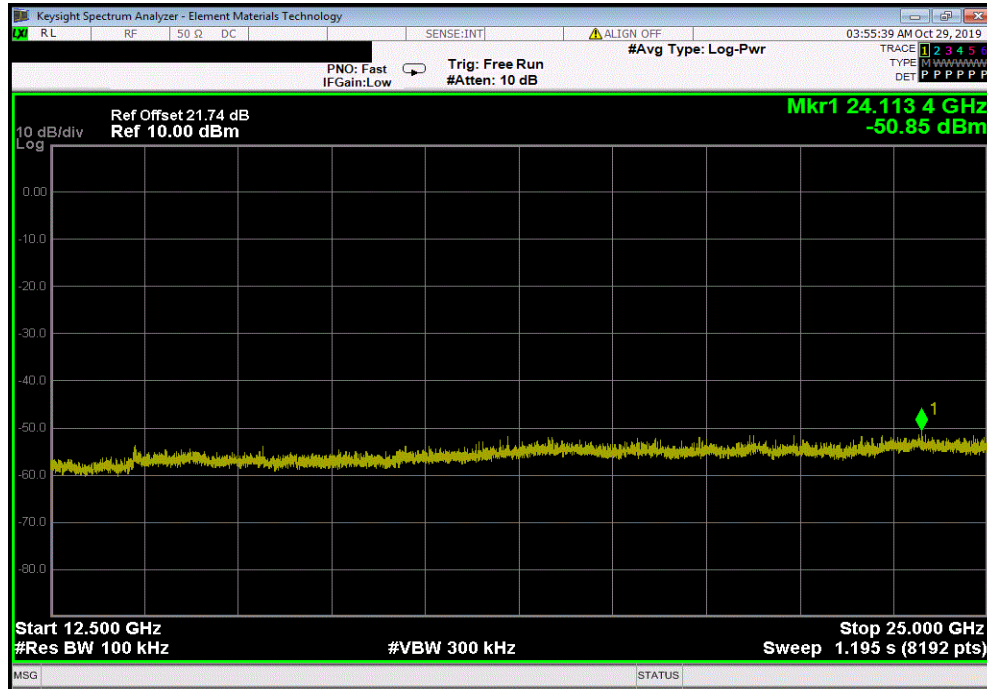


SPURIOUS CONDUCTED EMISSIONS

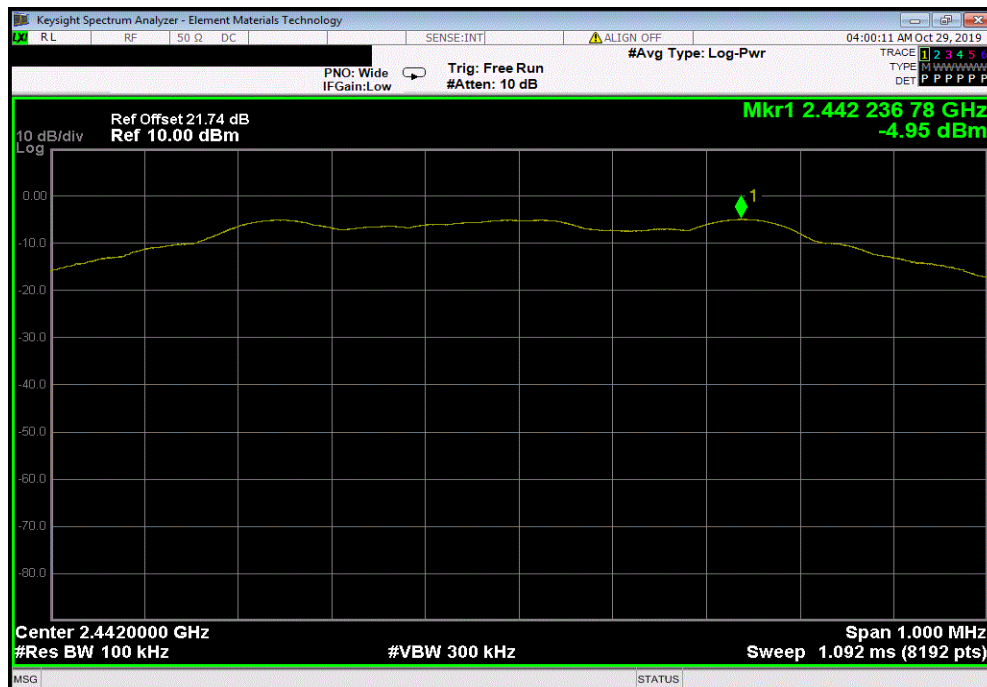


TbTx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (1 Mbps) Low Channel, 2402 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	24113.36	-47.99	-20	Pass	



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

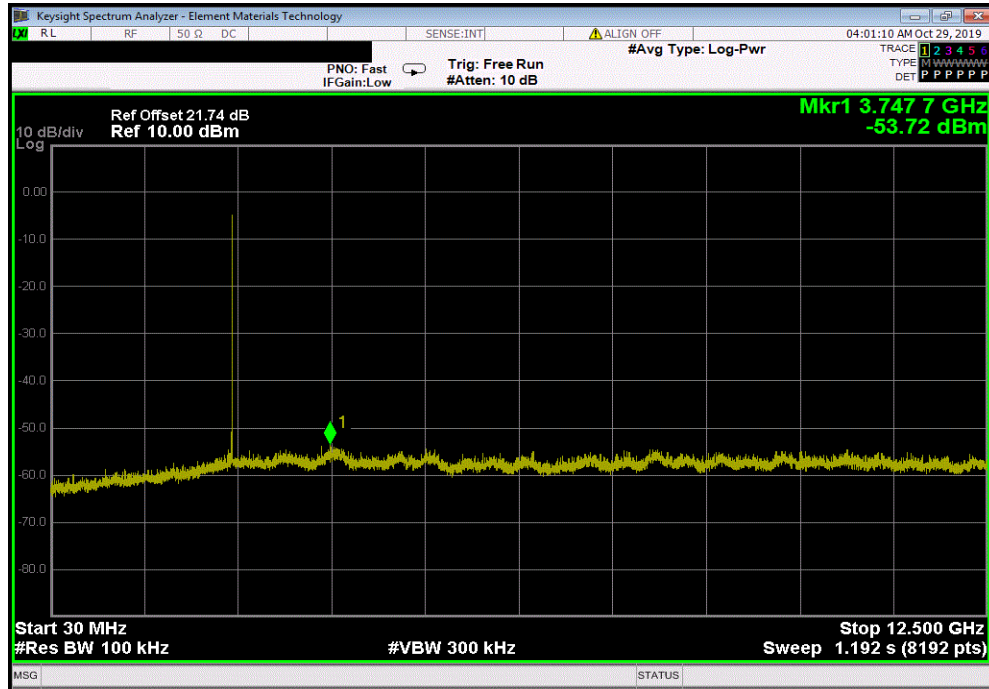


SPURIOUS CONDUCTED EMISSIONS

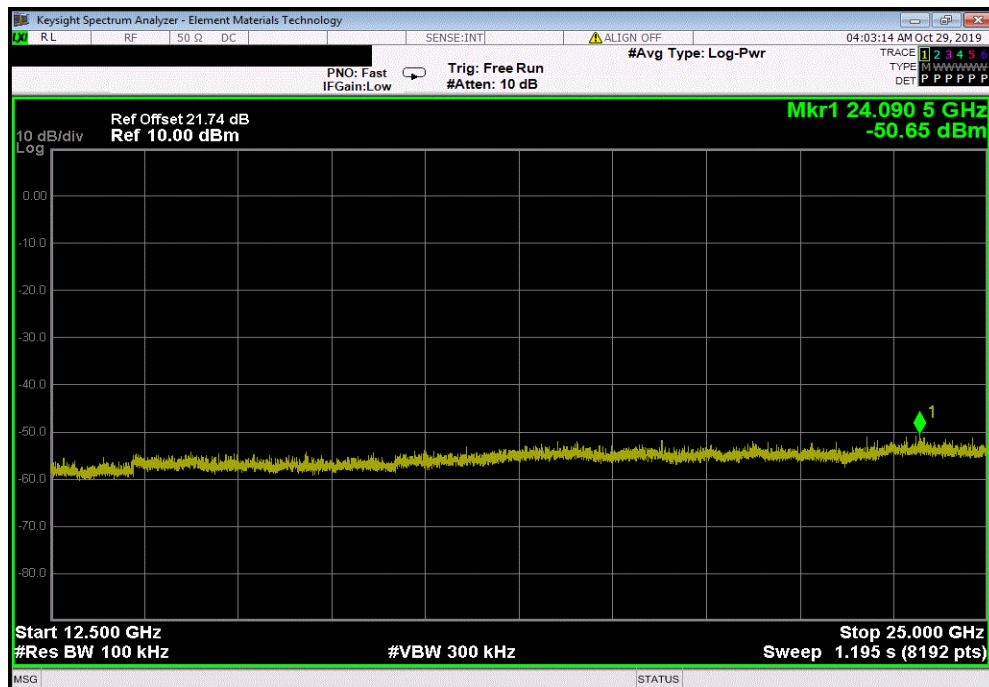


TbTx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (1 Mbps) Mid Channel, 2442 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	3747.71	-48.77	-20	Pass	



BLE/GFSK (1 Mbps) Mid Channel, 2442 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	24090.47	-45.7	-20	Pass	

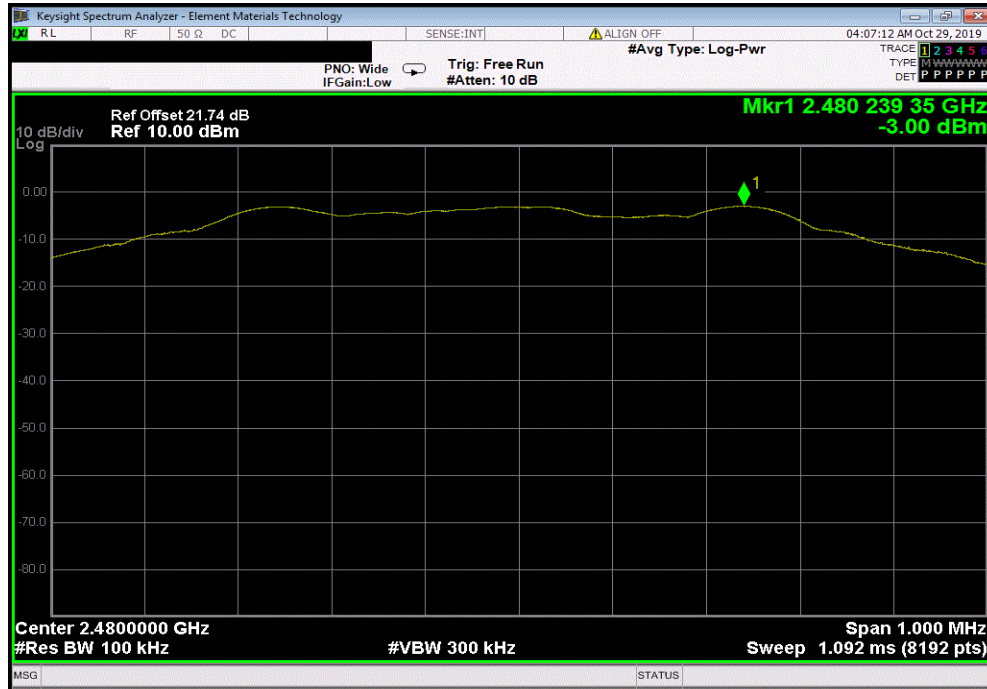


SPURIOUS CONDUCTED EMISSIONS

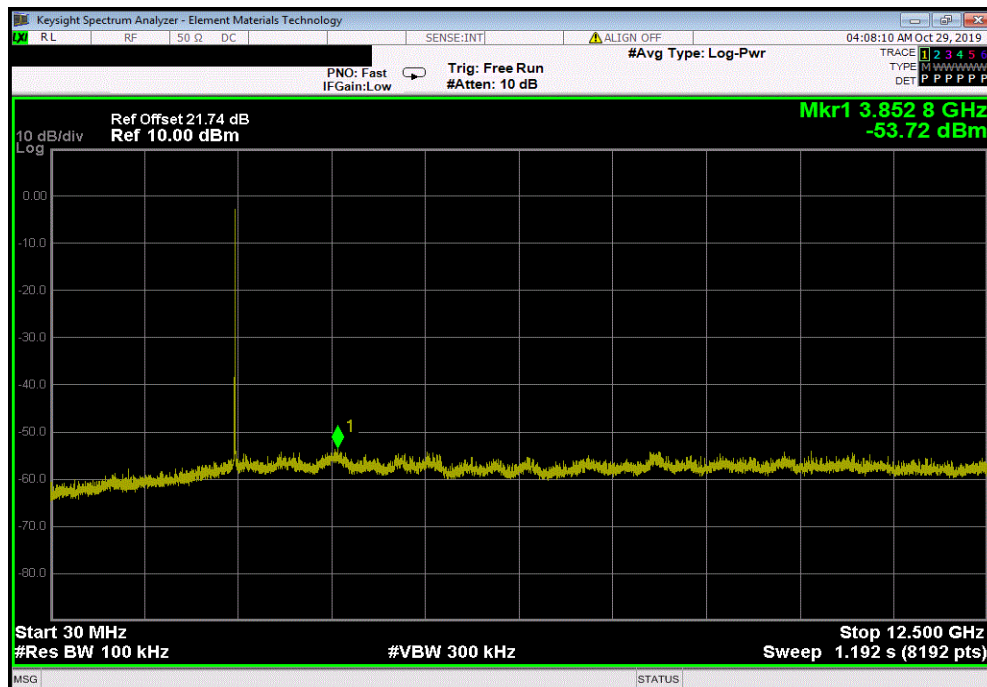


TbTx 2019.08.30.0 XMI 2019.09.05

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



BLE/GFSK (1 Mbps) High Channel, 2480 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	3852.75	-50.72	-20	Pass	

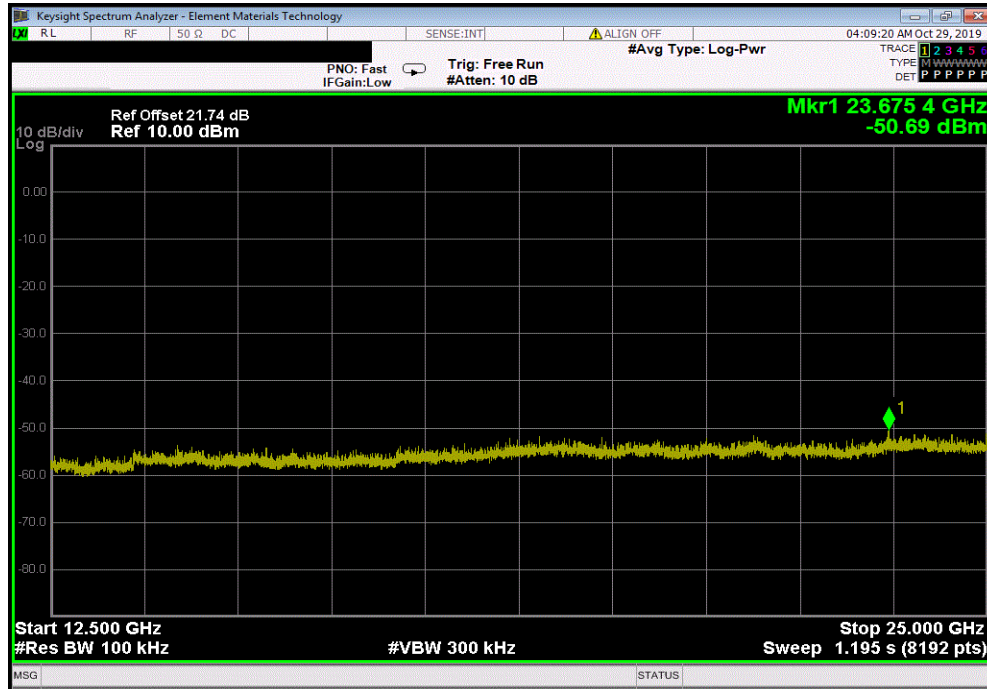


SPURIOUS CONDUCTED EMISSIONS



TbTx 2019.08.30.0 XMI 2019.09.05

BLE/GFSK (1 Mbps) High Channel, 2480 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	23675.38	-47.69	-20	Pass	



SPURIOUS RADIATED EMISSIONS



PSA-ESCI 2019.05.10

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

MODES OF OPERATION

Tx on Low channel (2402 MHz), Mid channel (2442 MHz), and High channel (2480 MHz); BLE 1 Mbps and 2 Mbps

POWER SETTINGS INVESTIGATED

1.25 VDC

CONFIGURATIONS INVESTIGATED

STAK0184 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	25000 MHz
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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
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	18-Oct-2019	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	18-Oct-2019	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AYD	25-Jan-2018	24 mo
Amplifier - Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	11-Sep-2019	12 mo
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNP	11-Sep-2019	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AHG	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVW	8-Feb-2019	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AIQ	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	8-Feb-2019	12 mo
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	8-Mar-2019	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	8-Feb-2019	12 mo
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	17-Sep-2019	12 mo
Antenna - Double Ridge	ETS-Lindgren	3115	AJQ	16-Jan-2019	24 mo
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	13-Dec-2018	12 mo

SPURIOUS RADIATED EMISSIONS



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 $10 \cdot \text{LOG}(1/\text{dc})$.

SPURIOUS RADIATED EMISSIONS



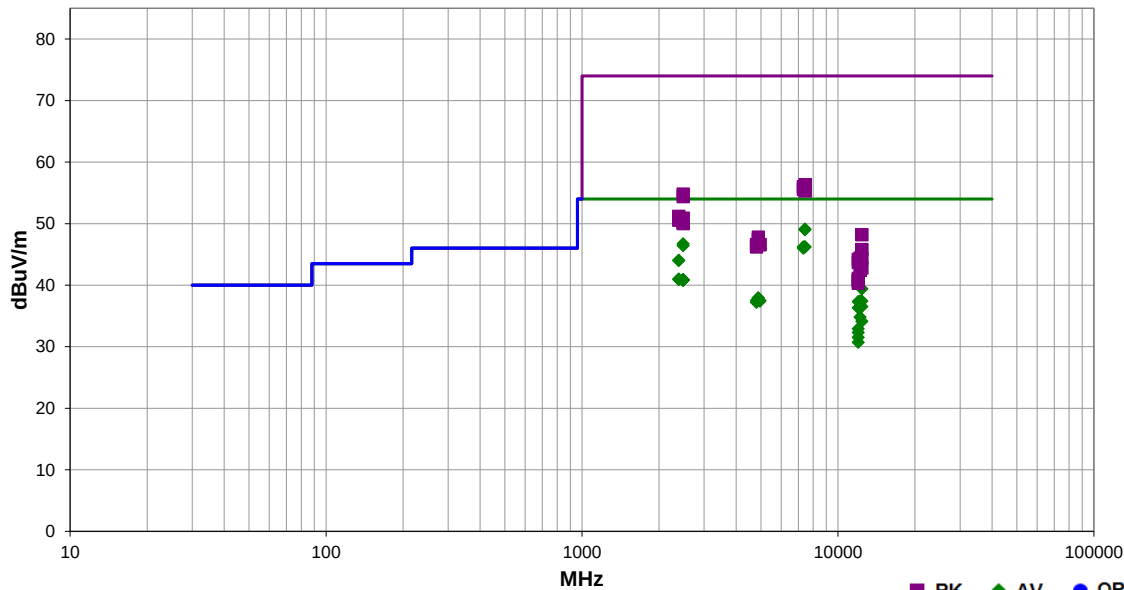
EmiRS 2019.08.15.1

PSA-ESCI 2019.05.10

Work Order:	STAK0184	Date:	25-Oct-2019	
Project:	None	Temperature:	21.4 °C	
Job Site:	MN05	Humidity:	32.5% RH	
Serial Number:	190592168	Barometric Pres.:	1029 mbar	
EUT:	Livio BTE 13			
Configuration:	3			
Customer:	Starkey Laboratories, Inc.			
Attendees:	Charlie Esch			
EUT Power:	1.25 VDC			
Operating Mode:	Tx on Low channel (2402 MHz), Mid channel (2442 MHz), and High channel (2480 MHz); BLE 1 Mbps and 2 Mbps			
Deviations:	None			
Comments:	Duty cycle correction factor of 2.1 dB was calculate from a measured duty cycle of 61.7% for 1 Mbps modulation and 5.0 dB was calculated from a measured duty cycle of 32.6% for 2 Mbps modulation($10 \cdot \log(1/dc) = DCCF$). See data comments for EUT orientation, Tx channel, and modulation.			

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

Run #	12	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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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
7440.237	30.9	13.2	1.5	357.0	5.0	0.0	Vert	AV	0.0	49.1	54.0	-4.9	EUT vert, High ch., BLE 2 Mbps
7440.403	30.8	13.2	1.5	54.0	5.0	0.0	Horz	AV	0.0	49.0	54.0	-5.0	EUT on side, High ch., BLE 2 Mbps
2483.553	35.5	-3.8	1.5	282.9	5.0	10.0	Vert	AV	0.0	46.7	54.0	-7.3	EUT on side, High ch., BLE 2 Mbps
2483.510	35.2	-3.8	1.5	360.0	5.0	10.0	Horz	AV	0.0	46.4	54.0	-7.6	EUT horz, High ch., BLE 2 Mbps
7325.433	30.6	13.5	2.3	264.9	2.1	0.0	Vert	AV	0.0	46.2	54.0	-7.8	EUT vert, Mid ch., BLE 1 Mbps
7440.160	30.9	13.2	2.2	48.0	2.1	0.0	Vert	AV	0.0	46.2	54.0	-7.8	EUT vert, High ch., BLE 1 Mbps
7440.553	30.9	13.2	3.8	288.0	2.1	0.0	Horz	AV	0.0	46.2	54.0	-7.8	EUT on side, High ch., BLE 1 Mbps
7326.757	30.4	13.5	1.6	48.0	2.1	0.0	Horz	AV	0.0	46.0	54.0	-8.0	EUT on side, Mid ch., BLE 1 Mbps
2389.667	32.6	-3.6	1.4	354.9	5.0	10.0	Horz	AV	0.0	44.0	54.0	-10.0	EUT horz, Low ch., BLE 2 Mbps
2388.753	32.6	-3.6	2.9	227.0	5.0	10.0	Vert	AV	0.0	44.0	54.0	-10.0	EUT on side, Low ch., BLE 2 Mbps
2389.573	32.5	-3.6	1.5	355.9	2.1	10.0	Vert	AV	0.0	41.0	54.0	-13.0	EUT on side, Low ch., BLE 1 Mbps
2485.190	32.5	-3.7	1.5	182.9	2.1	10.0	Horz	AV	0.0	40.9	54.0	-13.1	EUT horz, High ch., BLE 1 Mbps
2388.847	32.4	-3.6	1.5	321.0	2.1	10.0	Horz	AV	0.0	40.9	54.0	-13.1	EUT horz, Low ch., BLE 1 Mbps
2483.737	32.5	-3.8	1.5	134.0	2.1	10.0	Horz	AV	0.0	40.8	54.0	-13.2	EUT on side, High ch., BLE 1 Mbps
2483.910	32.5	-3.8	1.5	296.0	2.1	10.0	Vert	AV	0.0	40.8	54.0	-13.2	EUT on side, High ch., BLE 1 Mbps
2483.863	32.5	-3.8	1.8	29.0	2.1	10.0	Horz	AV	0.0	40.8	54.0	-13.2	EUT vert, High ch., BLE 1 Mbps
2484.107	32.5	-3.8	2.9	0.0	2.1	10.0	Vert	AV	0.0	40.8	54.0	-13.2	EUT vert, High ch., BLE 1 Mbps
2484.900	32.5	-3.8	1.5	221.9	2.1	10.0	Vert	AV	0.0	40.8	54.0	-13.2	EUT horz, High ch., BLE 1 Mbps
12401.080	31.9	5.4	2.4	63.9	2.1	0.0	Horz	AV	0.0	39.4	54.0	-14.6	EUT on side, High ch., BLE 1 Mbps
4884.493	31.1	4.7	1.5	249.0	2.1	0.0	Vert	AV	0.0	37.9	54.0	-16.1	EUT vert, Mid ch., BLE 1 Mbps
4884.440	31.1	4.7	1.5	196.0	2.1	0.0	Horz	AV	0.0	37.9	54.0	-16.1	EUT on side, Mid ch., BLE 1 Mbps
4803.260	30.8	4.6	1.5	360.0	2.1	0.0	Horz	AV	0.0	37.5	54.0	-16.5	EUT on side, Low ch., BLE 1 Mbps
4960.707	30.6	4.8	1.5	348.9	2.1	0.0	Horz	AV	0.0	37.5	54.0	-16.5	EUT on side, High ch., BLE 1 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
12398.860	35.9	-0.6	2.5	138.0	2.1	0.0	Horz	AV	0.0	37.4	54.0	-16.6	EUT on side, High ch., BLE 1 Mbps
4959.937	30.5	4.8	1.5	31.9	2.1	0.0	Vert	AV	0.0	37.4	54.0	-16.6	EUT vert, High ch., BLE 1 Mbps
12208.810	37.0	-1.7	1.9	297.0	2.1	0.0	Horz	AV	0.0	37.4	54.0	-16.6	EUT on side, Mid ch., BLE 1 Mbps
12008.780	37.4	-2.2	1.7	279.9	2.1	0.0	Horz	AV	0.0	37.3	54.0	-16.7	EUT on side, Low ch., BLE 1 Mbps
4803.043	30.5	4.6	1.5	351.9	2.1	0.0	Vert	AV	0.0	37.2	54.0	-16.8	EUT vert, Low ch., BLE 1 Mbps
12400.630	29.0	5.4	1.5	321.0	2.1	0.0	Vert	AV	0.0	36.5	54.0	-17.5	EUT vert, High ch., BLE 1 Mbps
7440.160	43.1	13.2	1.5	54.0	0.0	0.0	Horz	PK	0.0	56.3	74.0	-17.7	EUT on side, High ch., BLE 2 Mbps
12008.690	36.4	-2.2	1.7	77.0	2.1	0.0	Vert	AV	0.0	36.3	54.0	-17.7	EUT vert, Low ch., BLE 1 Mbps
7325.827	42.5	13.5	1.6	48.0	0.0	0.0	Horz	PK	0.0	56.0	74.0	-18.0	EUT on side, Mid ch., BLE 1 Mbps
7439.923	42.6	13.2	2.2	48.0	0.0	0.0	Vert	PK	0.0	55.8	74.0	-18.2	EUT vert, High ch., BLE 1 Mbps
7440.153	42.5	13.2	3.8	288.0	0.0	0.0	Horz	PK	0.0	55.7	74.0	-18.3	EUT on side, High ch., BLE 1 Mbps
7325.910	42.1	13.5	2.3	264.9	0.0	0.0	Vert	PK	0.0	55.6	74.0	-18.4	EUT vert, Mid ch., BLE 1 Mbps
7439.697	42.1	13.2	1.5	357.0	0.0	0.0	Vert	PK	0.0	55.3	74.0	-18.7	EUT vert, High ch., BLE 2 Mbps
2483.560	48.6	-3.8	1.5	282.9	0.0	10.0	Vert	PK	0.0	54.8	74.0	-19.2	EUT on side, High ch., BLE 2 Mbps
12208.920	34.4	-1.7	3.2	303.0	2.1	0.0	Vert	AV	0.0	34.8	54.0	-19.2	EUT vert, Mid ch., BLE 1 Mbps
2483.533	48.2	-3.8	1.5	360.0	0.0	10.0	Horz	PK	0.0	54.4	74.0	-19.6	EUT horz, High ch., BLE 2 Mbps
12398.810	32.6	-0.6	3.1	131.9	2.1	0.0	Vert	AV	0.0	34.1	54.0	-19.9	EUT vert, High ch., BLE 1 Mbps
12008.730	33.0	-2.2	2.0	178.9	2.1	0.0	Vert	AV	0.0	32.9	54.0	-21.1	EUT horz, Low ch., BLE 1 Mbps
12008.790	32.4	-2.2	1.8	225.9	2.1	0.0	Horz	AV	0.0	32.3	54.0	-21.7	EUT horz, Low ch., BLE 1 Mbps
12008.730	31.6	-2.2	1.5	271.0	2.1	0.0	Vert	AV	0.0	31.5	54.0	-22.5	EUT on side, Low ch., BLE 1 Mbps
2389.427	44.8	-3.6	2.9	227.0	0.0	10.0	Vert	PK	0.0	51.2	74.0	-22.8	EUT on side, Low ch., BLE 2 Mbps
2484.353	44.7	-3.8	1.5	296.0	0.0	10.0	Vert	PK	0.0	50.9	74.0	-23.1	EUT on side, High ch., BLE 1 Mbps
2484.260	44.6	-3.8	1.5	182.9	0.0	10.0	Horz	PK	0.0	50.8	74.0	-23.2	EUT horz, High ch., BLE 1 Mbps
2388.003	44.4	-3.6	1.4	354.9	0.0	10.0	Horz	PK	0.0	50.8	74.0	-23.2	EUT horz, Low ch., BLE 2 Mbps
12008.780	30.8	-2.2	1.5	227.0	2.1	0.0	Horz	AV	0.0	30.7	54.0	-23.3	EUT vert, Low ch., BLE 1 Mbps
2388.480	44.2	-3.6	1.5	321.0	0.0	10.0	Horz	PK	0.0	50.6	74.0	-23.4	EUT horz, Low ch., BLE 1 Mbps
2389.793	44.2	-3.6	1.5	355.9	0.0	10.0	Vert	PK	0.0	50.6	74.0	-23.4	EUT on side, Low ch., BLE 1 Mbps
2485.223	44.2	-3.7	2.9	0.0	0.0	10.0	Vert	PK	0.0	50.5	74.0	-23.5	EUT vert, High ch., BLE 1 Mbps
2484.787	44.0	-3.8	1.8	29.0	0.0	10.0	Horz	PK	0.0	50.2	74.0	-23.8	EUT vert, High ch., BLE 1 Mbps
2484.437	44.0	-3.8	1.5	221.9	0.0	10.0	Vert	PK	0.0	50.2	74.0	-23.8	EUT horz, High ch., BLE 1 Mbps
2484.087	43.8	-3.8	1.5	134.0	0.0	10.0	Horz	PK	0.0	50.0	74.0	-24.0	EUT on side, High ch., BLE 1 Mbps
12401.040	42.8	5.4	2.4	63.9	0.0	0.0	Horz	PK	0.0	48.2	74.0	-25.8	EUT on side, High ch., BLE 1 Mbps
4884.200	43.1	4.7	1.5	196.0	0.0	0.0	Horz	PK	0.0	47.8	74.0	-26.2	EUT on side, Mid ch., BLE 1 Mbps
4884.747	42.7	4.7	1.5	249.0	0.0	0.0	Vert	PK	0.0	47.4	74.0	-26.6	EUT vert, Mid ch., BLE 1 Mbps
4803.547	42.0	4.6	1.5	351.9	0.0	0.0	Vert	PK	0.0	46.6	74.0	-27.4	EUT vert, Low ch., BLE 1 Mbps
4960.757	41.8	4.8	1.5	31.9	0.0	0.0	Vert	PK	0.0	46.6	74.0	-27.4	EUT vert, High ch., BLE 1 Mbps
4960.257	41.8	4.8	1.5	348.9	0.0	0.0	Horz	PK	0.0	46.6	74.0	-27.4	EUT on side, High ch., BLE 1 Mbps
4803.540	41.6	4.6	1.5	360.0	0.0	0.0	Horz	PK	0.0	46.2	74.0	-27.8	EUT on side, Low ch., BLE 1 Mbps
12400.930	40.4	5.4	1.5	321.0	0.0	0.0	Vert	PK	0.0	45.8	74.0	-28.2	EUT vert, High ch., BLE 1 Mbps
12398.810	45.0	-0.6	2.5	138.0	0.0	0.0	Horz	PK	0.0	44.4	74.0	-29.6	EUT on side, High ch., BLE 1 Mbps
12211.240	46.1	-1.7	1.9	297.0	0.0	0.0	Horz	PK	0.0	44.4	74.0	-29.6	EUT on side, Mid ch., BLE 1 Mbps
12008.800	46.4	-2.2	1.7	279.9	0.0	0.0	Horz	PK	0.0	44.2	74.0	-29.8	EUT on side, Low ch., BLE 1 Mbps
12008.370	45.9	-2.2	1.7	77.0	0.0	0.0	Vert	PK	0.0	43.7	74.0	-30.3	EUT vert, Low ch., BLE 1 Mbps
12398.440	43.4	-0.6	3.1	131.9	0.0	0.0	Vert	PK	0.0	42.8	74.0	-31.2	EUT vert, High ch., BLE 1 Mbps
12208.460	44.1	-1.7	3.2	303.0	0.0	0.0	Vert	PK	0.0	42.4	74.0	-31.6	EUT vert, Mid ch., BLE 1 Mbps
12008.930	43.3	-2.2	2.0	178.9	0.0	0.0	Vert	PK	0.0	41.1	74.0	-32.9	EUT horz, Low ch., BLE 1 Mbps
12011.100	43.0	-2.2	1.8	225.9	0.0	0.0	Horz	PK	0.0	40.8	74.0	-33.2	EUT horz, Low ch., BLE 1 Mbps
12011.030	42.9	-2.2	1.5	227.0	0.0	0.0	Horz	PK	0.0	40.7	74.0	-33.3	EUT vert, Low ch., BLE 1 Mbps
12008.390	42.5	-2.2	1.5	271.0	0.0	0.0	Vert	PK	0.0	40.3	74.0	-33.7	EUT on side, Low ch., BLE 1 Mbps