BSX Athletics

XM100BLK
FCC 15.247:2014

Report # SPRX0001

NVLAP Lab Code: 201049-0

NORTHWEST EMC

WTD 13.9.30

CERTIFICATE OF TEST

Last Date of Test: November 20, 2014
BSX Athletics
Model: XM100BLK

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2014	ANSI C63.10:2009 KDB 558074 V3

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not required since the device does not transmit while charging.
6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	
6.7	Band Edge Compliance	Yes	Pass	
6.7	Spurious Conducted Emissions	Yes	Pass	
6.9.1	Occupied Bandwidth	Yes	Pass	
6.10.2	Equivalent Isotropic Radiated Power (EIRP)	Yes	Pass	
6.11.2	Power Spectral Density	Yes	Pass	
7.5	Duty Cycle	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Jeremiah Darden, 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.

REVISION HISTORY

NORTHWEST EMC
REV 2014.10.14

Revision Number	Description	Date	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

NORTHWEST EMC
REV 2014.10.08

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 Guide 65 as a product certifier. This allows Northwest EMC to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

IC - Recognized by Industry Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with IC.

European Union

European Commission – Validated by the European Commission as a Conformity Assessment Body (CAB) under the EMC directive and as a Notified Body under the R&TTE Directive.

Australia/New Zealand

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

Korea

MSIP / 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

OFTA – Recognized by OFTA 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://www.nwemc.com/accreditations/

MEASUREMENT UNCERTAINTY

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.

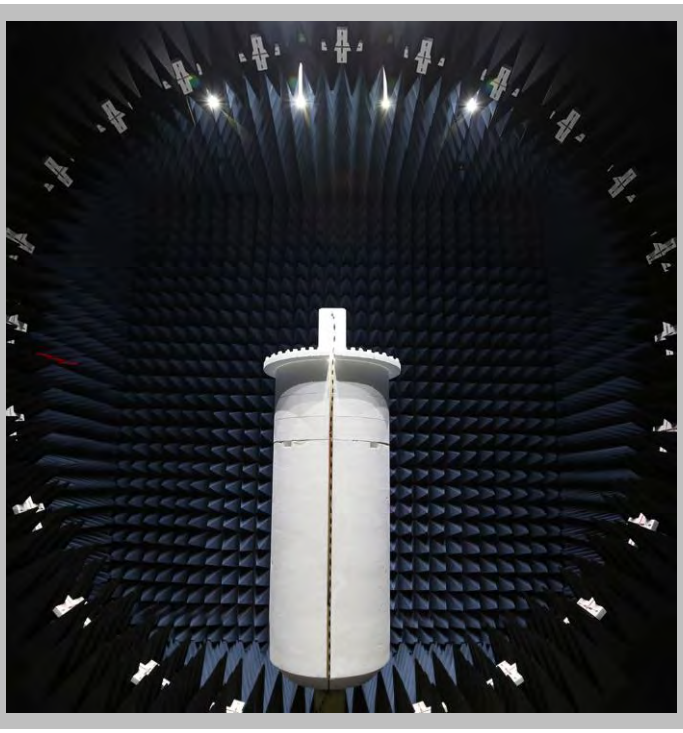
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

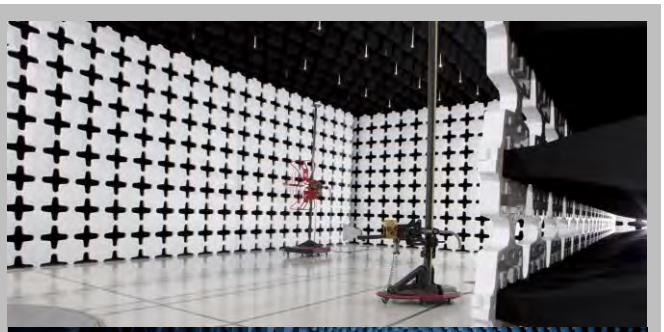
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	4.7 dB	-4.7 dB
AC Powerline Conducted Emissions (dB)	2.9 dB	-2.9 dB

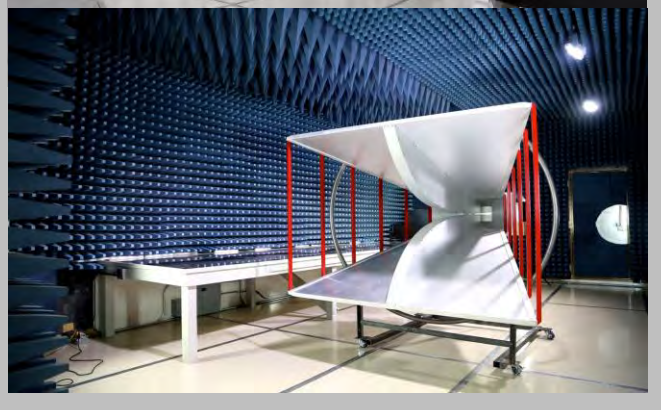
FACILITIES

REV 2014.10.08

California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 685-0796	Labs EV01-12 22975 NW Evergreen Pkwy 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 9801 (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
Industry Canada					
2834B-1, 2834B-3	2834E-1	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	In Process	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110







PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	BSX Athletics
Address:	2500 E TC Jester Blvd, Ste 325
City, State, Zip:	Houston, TX 77008
Test Requested By:	Daniel Nichols
Model:	XM100BLK
First Date of Test:	November 20, 2014
Last Date of Test:	November 20, 2014
Receipt Date of Samples:	November 20, 2014
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Wearable fitness device that attaches to the calf. The device captures blood oxygenation data to determine the athlete's oxygenation levels. It helps determine the athlete's ideal pace for finishing the run, bike or swim event. It gathers the data from the body by shinning a light into the calf and it measures the reflected data from a photo sensor on the product. The data is transmitted from the device using Bluetooth.

Client Provided information:
Models XC100BLK and XR100BLK were also tested. Electrically and Mechanically the 3 model numbers are identical. The only thing that changes between model numbers is the software that's loaded.

Testing Objective:
To demonstrate the compliance to FCC 15.247 DTS requirements.

CONFIGURATIONS

Configuration SPRX0001- 3

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Lactate Threshold Sensor	BSX Athletics	XM100BLK	3197

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	11/20/2014	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	11/20/2014	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
3	11/20/2014	Equivalent Isotropic Radiated Power (EIRP)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
4	11/20/2014	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
5	11/20/2014	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
6	11/20/2014	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
7	11/20/2014	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

SPURIOUS RADIATED EMISSIONS

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

MODES OF OPERATION

Transmitting Data GFSK Modulation. Low Channel 2402MHz, Mid Channel 2442MHz, High Channel 2480MHz

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

SPRX0001 - 3

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26500 MHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
High Pass Filter	Micro-Tronics	HPM50111	HHX	8/18/2014	12 mo
Low Pass Filter	Micro-Tronics	LPM50004	HHV	8/18/2014	12 mo
Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	PAK	10/27/2014	12 mo
Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	PAL	10/27/2014	12 mo
TX02 Cable	NWEMC	8-18GHz	TXD	10/27/2014	12mo
Pre-Amplifier	Miteq	JSDQK42-18004000-60-5P	PAM	11/21/2014	12 mo
Cable	NWEMC	18-40GHz	TXE	11/21/2014	12 mo
Antenna, Double Ridge Guide Horn	A.H. Systems, Inc.	SAS-574	AXW	4/23/2014	36 mo
Antenna, Horn	ETS Lindgren	3160-08	AJG	NCR	0 mo
Antenna, Horn	ETS Lindgren	3160-07	AJF	NCR	0 mo
Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAJ	9/22/2014	12 mo
TX02 Cable	NWEMC	1-8.2 GHz	TXC	9/22/2014	12 mo
Antenna, Horn	ETS Lindgren	3115	AJL	9/15/2014	24 mo
Pre-Amplifier	Miteq	AM-1551	PAH	9/13/2014	12 mo
TX02 Cable	N/A	RE 9kHz - 1GHz	TXB	9/22/2014	12 mo
Antenna, Biconilog	ETS Lindgren	3143B	AYF	4/7/2014	36 mo
Spectrum Analyzer	Agilent	N9010A	AFL	6/20/2014	12 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

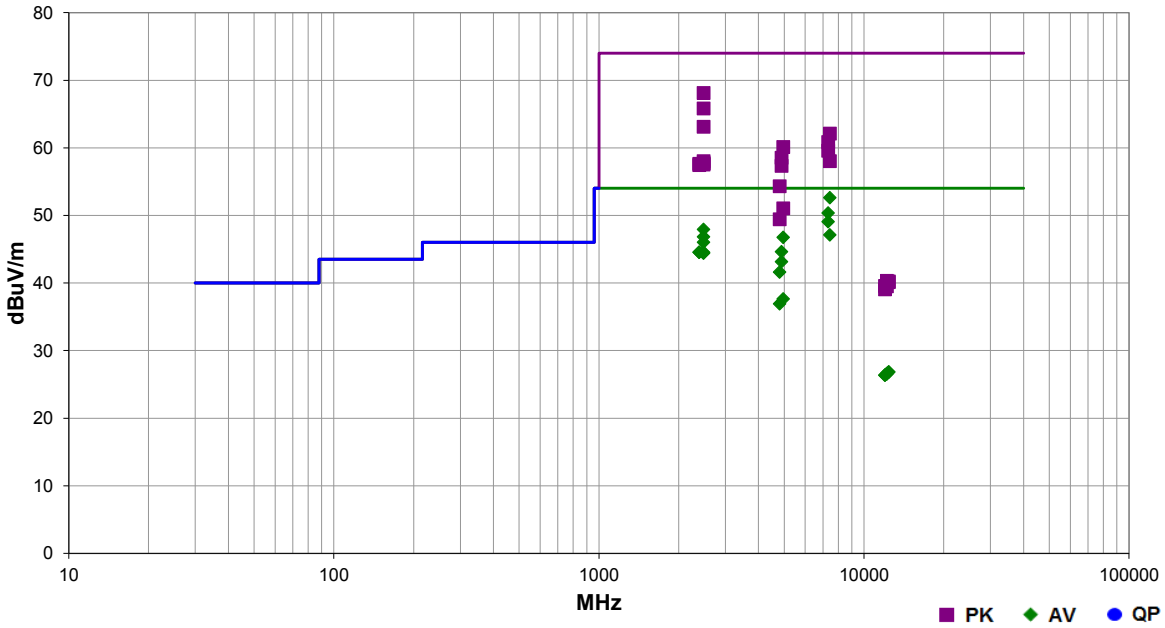
The highest gain of each type of antenna to be used with the EUT was tested. The EUT was configured for low, mid, and high band transmit frequencies. For each configuration, the spectrum was scanned throughout the specified range. In addition, measurements were made in the restricted bands to verify compliance. While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and the EUT antenna in three orthogonal axis, and adjusting measurement antenna height and polarization. A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

SPURIOUS RADIATED EMISSIONS

Work Order:	SPRX0001	**Date:**	11/20/14		
Project:	None	**Temperature:**	23.3 °C		
Job Site:	TX02	**Humidity:**	28% RH		
Serial Number:	3197	**Barometric Pres.:**	1024 mbar	**Tested by:**	Frank Sun
EUT:	XM100BLK				
Configuration:	3				
Customer:	BSX Athletics				
Attendees:	Richard Voigt, Richard Pettys, Daniel Nichols, David Smoot				
EUT Power:	Battery				
Operating Mode:	Transmitting Data GFSK Modulation. Low Channel 2402MHz, Mid Channel 2442MHz, High Channel 2480MHz				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 15.247:2014	ANSI C63.10:2009

Run #	61	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7440.367	39.2	13.4	1.0	190.9	3.0	0.0	Horz	AV	0.0	52.6	54.0	-1.4	GFSK, EUT Horz, High CH
7326.420	37.0	13.4	1.0	250.9	3.0	0.0	Horz	AV	0.0	50.4	54.0	-3.6	GFSK, EUT Horz, Mid CH
7326.420	35.7	13.4	1.3	350.0	3.0	0.0	Vert	AV	0.0	49.1	54.0	-4.9	GFSK, EUT Horz, Mid CH
2482.500	52.8	-4.7	2.2	147.0	3.0	20.0	Horz	PK	0.0	68.1	74.0	-5.9	GFSK, EUT Horz, High CH
2482.503	32.6	-4.7	2.3	343.0	3.0	20.0	Horz	AV	0.0	47.9	54.0	-6.1	GFSK, EUT Side, High CH
7440.385	33.7	13.4	1.0	333.0	3.0	0.0	Vert	AV	0.0	47.1	54.0	-6.9	GFSK, EUT Horz, High CH
2482.503	31.5	-4.7	2.2	147.0	3.0	20.0	Horz	AV	0.0	46.8	54.0	-7.2	GFSK, EUT Horz, High CH
4959.968	38.5	8.2	1.0	258.0	3.0	0.0	Horz	AV	0.0	46.7	54.0	-7.3	GFSK, EUT Horz, High CH
2482.503	30.7	-4.7	2.6	39.9	3.0	20.0	Vert	AV	0.0	46.0	54.0	-8.0	GFSK, EUT Vert, High CH
2482.503	50.5	-4.7	2.3	343.0	3.0	20.0	Horz	PK	0.0	65.8	74.0	-8.2	GFSK, EUT Side, High CH
4883.942	36.6	8.0	1.0	262.9	3.0	0.0	Horz	AV	0.0	44.6	54.0	-9.4	GFSK, EUT Horz, Mid CH
2389.953	29.3	-4.8	1.0	265.0	3.0	20.0	Horz	AV	0.0	44.5	54.0	-9.5	GFSK, EUT Horz, Low CH
2389.433	29.3	-4.8	1.0	154.9	3.0	20.0	Vert	AV	0.0	44.5	54.0	-9.5	GFSK, EUT Horz, Low CH
2482.543	29.2	-4.7	1.0	87.0	3.0	20.0	Vert	AV	0.0	44.5	54.0	-9.5	GFSK, EUT Horz, High CH
2482.727	29.1	-4.7	1.0	75.9	3.0	20.0	Vert	AV	0.0	44.4	54.0	-9.6	GFSK, EUT Side, High CH
2482.503	29.1	-4.7	1.0	13.0	3.0	20.0	Horz	AV	0.0	44.4	54.0	-9.6	GFSK, EUT Vert, High CH
4883.948	35.1	8.0	2.2	199.0	3.0	0.0	Vert	AV	0.0	43.1	54.0	-10.9	GFSK, EUT Horz, Mid CH
2482.580	47.8	-4.7	2.6	39.9	3.0	20.0	Vert	PK	0.0	63.1	74.0	-10.9	GFSK, EUT Vert, High CH
7440.140	48.7	13.4	1.0	190.9	3.0	0.0	Horz	PK	0.0	62.1	74.0	-11.9	GFSK, EUT Horz, High CH
4804.105	33.8	7.8	1.0	272.0	3.0	0.0	Horz	AV	0.0	41.6	54.0	-12.4	GFSK, EUT Horz, Low CH
7326.122	47.5	13.4	1.0	250.9	3.0	0.0	Horz	PK	0.0	60.9	74.0	-13.1	GFSK, EUT Horz, Mid CH
4959.603	51.9	8.2	1.0	258.0	3.0	0.0	Horz	PK	0.0	60.1	74.0	-13.9	GFSK, EUT Horz, High CH
7326.212	46.2	13.4	1.3	350.0	3.0	0.0	Vert	PK	0.0	59.6	74.0	-14.4	GFSK, EUT Horz, Mid CH
4883.612	50.5	8.0	1.0	262.9	3.0	0.0	Horz	PK	0.0	58.5	74.0	-15.5	GFSK, EUT Horz, Mid CH

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2484.003	42.7	-4.7	1.0	87.0	3.0	20.0	Vert	PK	0.0	58.0	74.0	-16.0	GFSK, EUT Horz, High CH
7439.813	44.6	13.4	1.0	333.0	3.0	0.0	Vert	PK	0.0	58.0	74.0	-16.0	GFSK, EUT Horz, High CH
2484.317	42.4	-4.7	1.0	75.9	3.0	20.0	Vert	PK	0.0	57.7	74.0	-16.3	GFSK, EUT Side, High CH
2389.850	42.4	-4.8	1.0	154.9	3.0	20.0	Vert	PK	0.0	57.6	74.0	-16.4	GFSK, EUT Horz, Low CH
4960.028	29.4	8.2	1.0	16.9	3.0	0.0	Vert	AV	0.0	37.6	54.0	-16.4	GFSK, EUT Horz, High CH
2483.427	42.2	-4.7	1.0	13.0	3.0	20.0	Horz	PK	0.0	57.5	74.0	-16.5	GFSK, EUT Vert, High CH
2390.477	42.2	-4.8	1.0	265.0	3.0	20.0	Horz	PK	0.0	57.4	74.0	-16.6	GFSK, EUT Horz, Low CH
4883.547	49.3	8.0	2.2	199.0	3.0	0.0	Vert	PK	0.0	57.3	74.0	-16.7	GFSK, EUT Horz, Mid CH
4804.118	29.1	7.8	1.5	271.0	3.0	0.0	Vert	AV	0.0	36.9	54.0	-17.1	GFSK, EUT Horz, Low CH
4803.608	46.5	7.8	1.0	272.0	3.0	0.0	Horz	PK	0.0	54.3	74.0	-19.7	GFSK, EUT Horz, Low CH
4959.553	42.8	8.2	1.0	16.9	3.0	0.0	Vert	PK	0.0	51.0	74.0	-23.0	GFSK, EUT Horz, High CH
4803.740	41.6	7.8	1.5	271.0	3.0	0.0	Vert	PK	0.0	49.4	74.0	-24.6	GFSK, EUT Horz, Low CH
12399.850	27.2	-0.4	1.0	313.0	3.0	0.0	Horz	AV	0.0	26.8	54.0	-27.2	GFSK, EUT Horz, High CH
12399.740	27.2	-0.4	1.0	351.9	3.0	0.0	Vert	AV	0.0	26.8	54.0	-27.2	GFSK, EUT Horz, High CH
12209.970	27.4	-0.8	1.8	8.0	3.0	0.0	Vert	AV	0.0	26.6	54.0	-27.4	GFSK, EUT Horz, Mid CH
12209.740	27.3	-0.8	1.0	132.0	3.0	0.0	Horz	AV	0.0	26.5	54.0	-27.5	GFSK, EUT Horz, Mid CH
12009.690	27.7	-1.3	1.0	213.9	3.0	0.0	Vert	AV	0.0	26.4	54.0	-27.6	GFSK, EUT Horz, Low CH
12009.660	27.7	-1.3	1.0	100.9	3.0	0.0	Horz	AV	0.0	26.4	54.0	-27.6	GFSK, EUT Horz, Low CH
12210.380	41.1	-0.8	1.8	8.0	3.0	0.0	Vert	PK	0.0	40.3	74.0	-33.7	GFSK, EUT Horz, Mid CH
12399.780	40.6	-0.4	1.0	313.0	3.0	0.0	Horz	PK	0.0	40.2	74.0	-33.8	GFSK, EUT Horz, High CH
12399.810	40.5	-0.4	1.0	351.9	3.0	0.0	Vert	PK	0.0	40.1	74.0	-33.9	GFSK, EUT Horz, High CH
12010.240	40.9	-1.3	1.0	213.9	3.0	0.0	Vert	PK	0.0	39.6	74.0	-34.4	GFSK, EUT Horz, Low CH
12210.480	40.3	-0.8	1.0	132.0	3.0	0.0	Horz	PK	0.0	39.5	74.0	-34.5	GFSK, EUT Horz, Mid CH
12009.920	40.4	-1.3	1.0	100.9	3.0	0.0	Horz	PK	0.0	39.1	74.0	-34.9	GFSK, EUT Horz, Low CH

BAND EDGE COMPLIANCE

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.	Interval (mo)
Spectrum Analyzer	Agilent	N9010A	AFL	6/20/2014	12
TX02 Cable	NWEMC	1-8.2 GHz	TXC	9/22/2014	12
Antenna, Horn	ETS Lindgren	3115	AJL	9/15/2014	24

TEST DESCRIPTION

The spurious RF 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 measurement was made using a radiated method with the EUT in the worse case position. 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

EUT:	XM100BLK			Work Order:	SPRX0001
Serial Number:	3197			Date:	11/20/14
Customer:	BSX Athletics			Temperature:	24.8°C
Attendees:	Daniel Nichols			Humidity:	31%
Project:	None			Barometric Pres.:	1025
Tested by:	Frank Sun	Power:	Battery	Job Site:	TX02

TEST SPECIFICATIONS	Test Method
FCC 15.247:2014	ANSI C63.10:2009

COMMENTS

Radiated method. EUT transmitting data in horizontal orientation. Antenna at horizontal position.

DEVIATIONS FROM TEST STANDARD

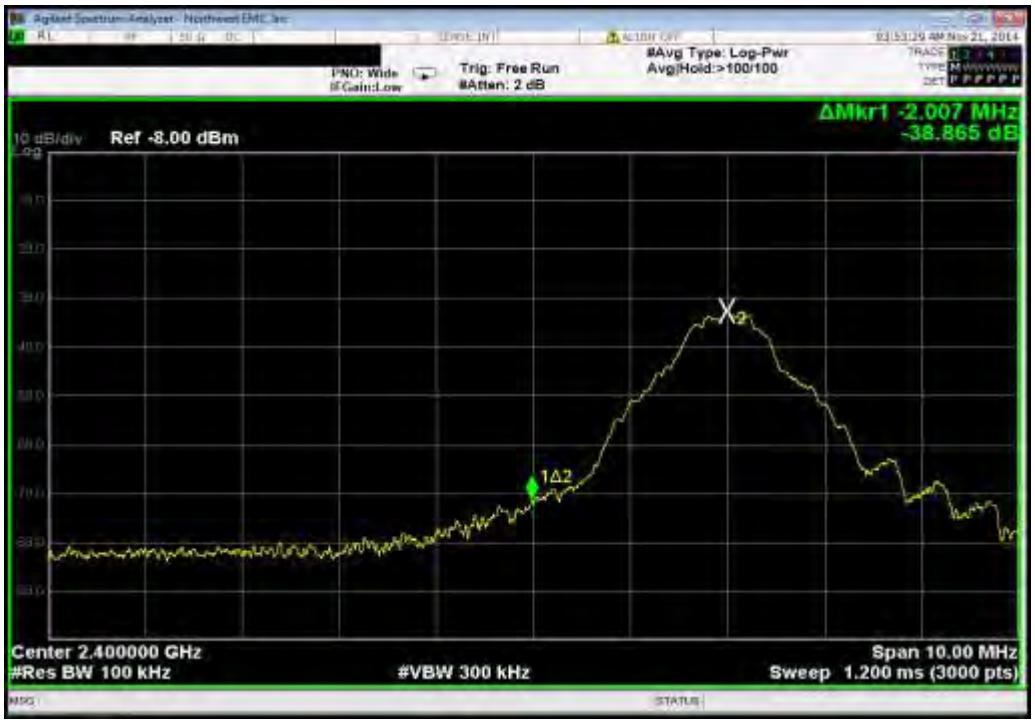
None

Configuration #	3	Signature

	Value (dBc)	Limit ≤ (dBc)	Result
BLE			
GFSK, Low Channel, 2402 MHz	-38.87	-20	Pass
GFSK, High Channel, 2480 MHz	-44.89	-20	Pass

BAND EDGE COMPLIANCE

BLE, GFSK, Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-38.87	-20	Pass



BLE, GFSK, High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-44.89	-20	Pass

SPURIOUS CONDUCTED EMISSIONS

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.	Interval
High Pass Filter	Micro-Tronics	HPM50111	HHX	8/18/2014	12 mo
Low Pass Filter	Micro-Tronics	LPM50004	HHV	8/18/2014	12 mo
Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	PAK	10/27/2014	12 mo
Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	PAL	10/27/2014	12 mo
TX02 Cable	NWEMC	8-18GHz	TXD	10/27/2014	12mo
Pre-Amplifier	Miteq	JSDQK42-18004000-60-5P	PAM	11/21/2014	12 mo
Cable	NWEMC	18-40GHz	TXE	11/21/2014	12 mo
Antenna, Double Ridge Guide Horn	A.H. Systems, Inc.	SAS-574	AXW	4/23/2014	36 mo
Antenna, Horn	ETS Lindgren	3160-08	AJG	NCR	0 mo
Antenna, Horn	ETS Lindgren	3160-07	AJF	NCR	0 mo
Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAJ	9/22/2014	12 mo
TX02 Cable	NWEMC	1-8.2 GHz	TXC	9/22/2014	12 mo
Antenna, Horn	ETS Lindgren	3115	AJL	9/15/2014	24 mo
Pre-Amplifier	Miteq	AM-1551	PAH	9/13/2014	12 mo
TX02 Cable	N/A	RE 9kHz - 1GHz	TXB	9/22/2014	12 mo
Antenna, Biconilog	ETS Lindgren	3143B	AYF	4/7/2014	36 mo
Spectrum Analyzer	Agilent	N9010A	AFL	6/20/2014	12 mo

TEST DESCRIPTION

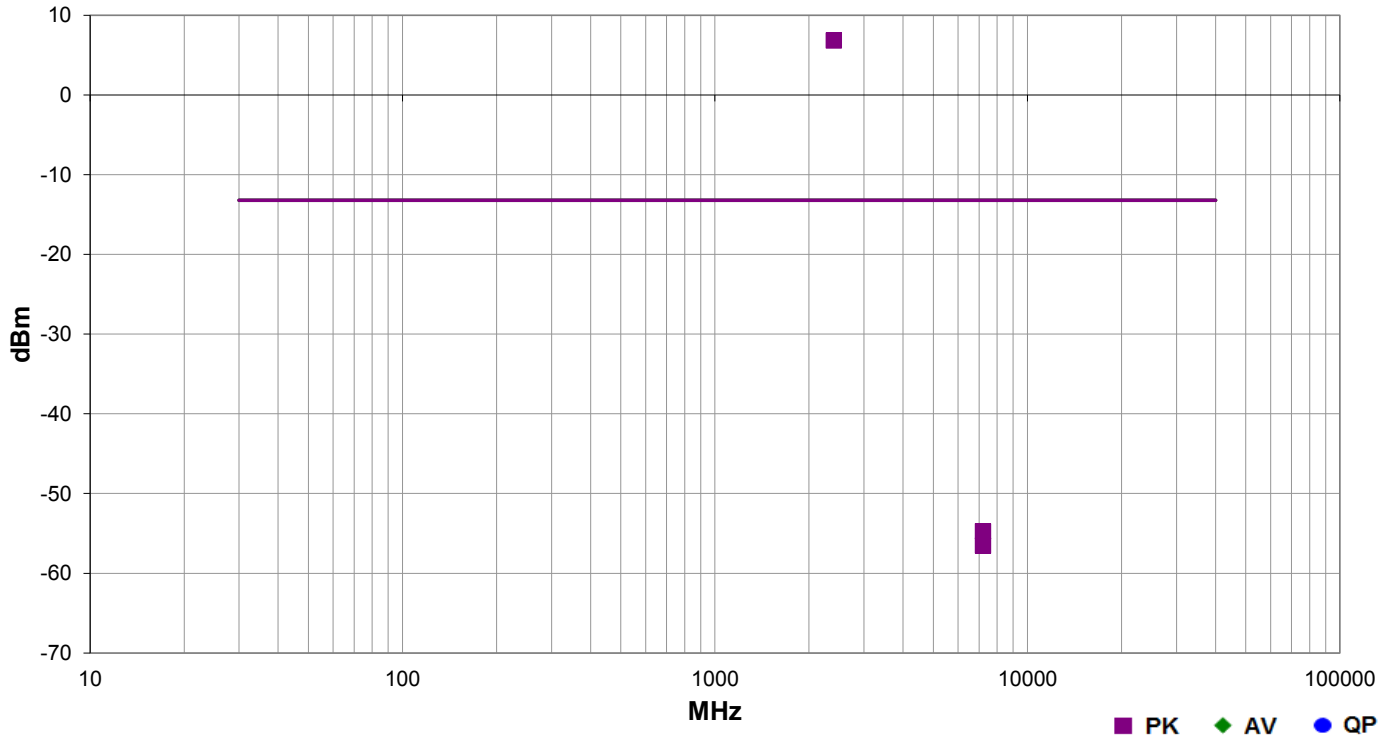
The spurious RF emissions were measured with the EUT set to low, medium and high transmit frequencies. The measurements were made using a radiated setup using an antenna and spectrum analyze with various filters and preamps to sustain an adequate sensitivity and accuracy. The EUT was transmitting at the data rate(s) listed in the datasheet. For each transmit frequency, the spectrum was scanned throughout the specified frequency range. Frequencies outside the restricted band were measured where applicable and compared to the radiated fundamental reading.

SPURIOUS CONDUCTED EMISSIONS

Work Order:	SPRX0001	**Date:**	11/20/14		
Project:	None	**Temperature:**	23.6 °C		
Job Site:	TX02	**Humidity:**	36.7% RH		
Serial Number:	3197	**Barometric Pres.:**	1024 mbar	**Tested by:**	Frank Sun
EUT:	XM100BLK				
Configuration:	3				
Customer:	BSX Athletics				
Attendees:	Daniel Nichols				
EUT Power:	Battery				
Operating Mode:	EUT Transmitting Data GFSK Modulation				
Deviations:	None				
Comments:	Spurious emissions outside restricted band. EUT transmitting data in horizontal orientation. Antenna at horizontal position.				

Test Specifications	**Test Method**
FCC 15.247:2014	ANSI C63.10:2009

Run #	83	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



	Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/ Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Value (dBc)	Limit (dBc)	Comments
	7205.945	1.0	195.9	Horz	PK	3.37E-09	-54.7	-61.6	-20.0	Low Channel, 100kHz RBW
	7205.990	1.0	219.9	Vert	PK	2.22E-09	-56.5	-63.4	-20.0	Low Channel, 100kHz RBW
	2402.317	3.0	273.0	Horz	PK	4.81E-03	6.8	N/A	N/A	Fundamental Reference

All other spurious frequencies greater than -40 dBc from fundamental

OCCUPIED BANDWIDTH

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.	Interval (mo)
Spectrum Analyzer	Agilent	N9010A	AFL	6/20/2014	12
TX02 Cable	NWEMC	1-8.2 GHz	TXC	9/22/2014	12
Antenna, Horn	ETS Lindgren	3115	AJL	9/15/2014	24

TEST DESCRIPTION

The 6dB occupied bandwidth was measured using 100 kHz resolution bandwidth and 300 kHz video bandwidth.

The EUT was set to low, medium and high transmit frequencies. The measurement was made in a radiated configuration in a semi-anechoic chamber with the fundamental of the carrier full maximized for its highest radiated power. The EUT was transmitting at the data rate(s) listed in the datasheet. A radiated method was used with the EUT in the worse case position

OCCUPIED BANDWIDTH

EUT:	XM100BLK			**Work Order:**	SPRX0001
Serial Number:	3197			**Date:**	11/20/14
Customer:	BSX Athletics			**Temperature:**	24.7°C
Attendees:	Daniel Nichols			**Humidity:**	31%
Project:	None			**Barometric Pres.:**	1025
Tested by:	Frank Sun	**Power:**	Battery	**Job Site:**	TX02

TEST SPECIFICATIONS	Test Method
FCC 15.247:2014	ANSI C63.10:2009

COMMENTS

Radiated method. EUT transmitting data in horizontal orientation. Antenna at horizontal position.

DEVIATIONS FROM TEST STANDARD

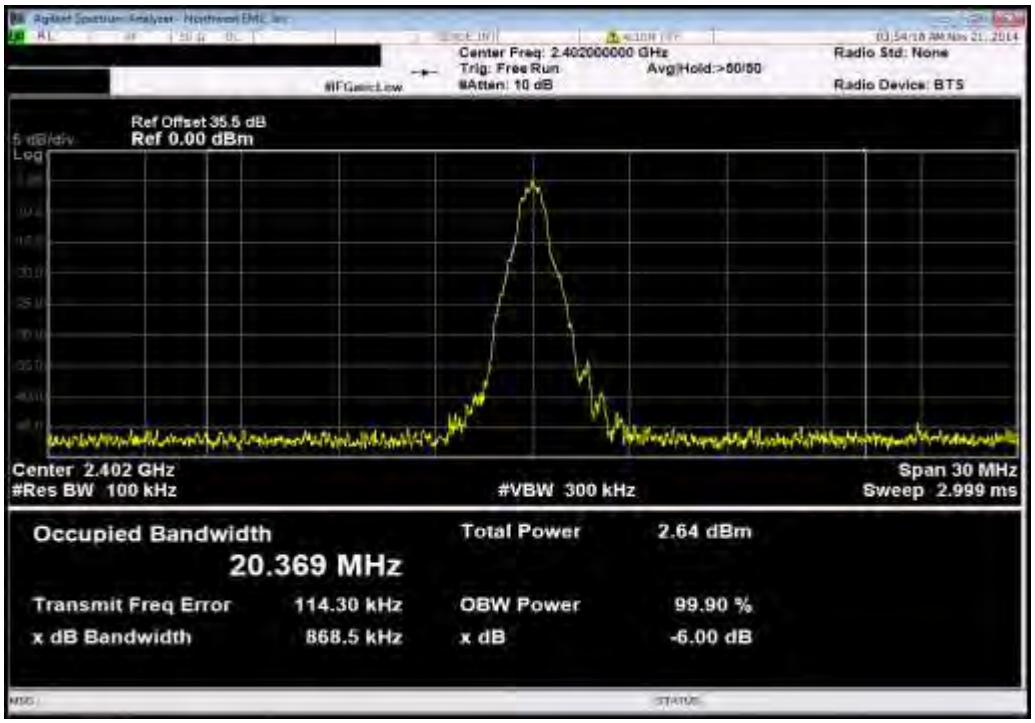
None

Configuration #	3	Signature

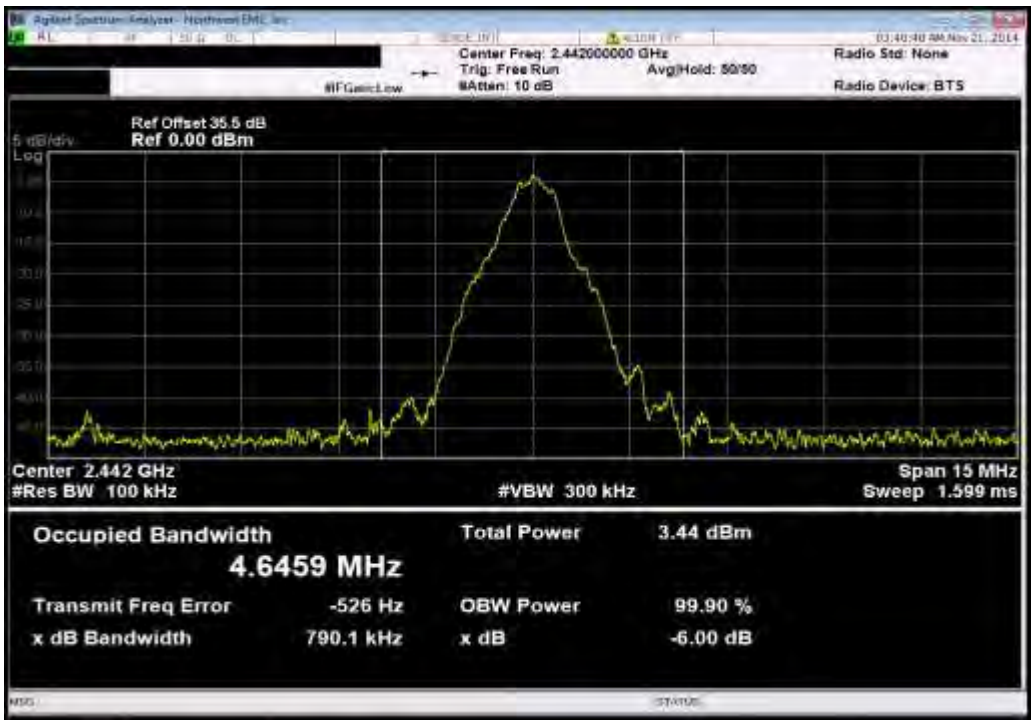
	Value	Limit (≥)	Result
BLE			
GFSK, Low Channel, 2402 MHz	868.537 kHz	500 kHz	Pass
GFSK, Mid Channel, 2442 MHz	790.147 kHz	500 kHz	Pass
GFSK, High Channel, 2480 MHz	832.171 kHz	500 kHz	Pass

OCCUPIED BANDWIDTH

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

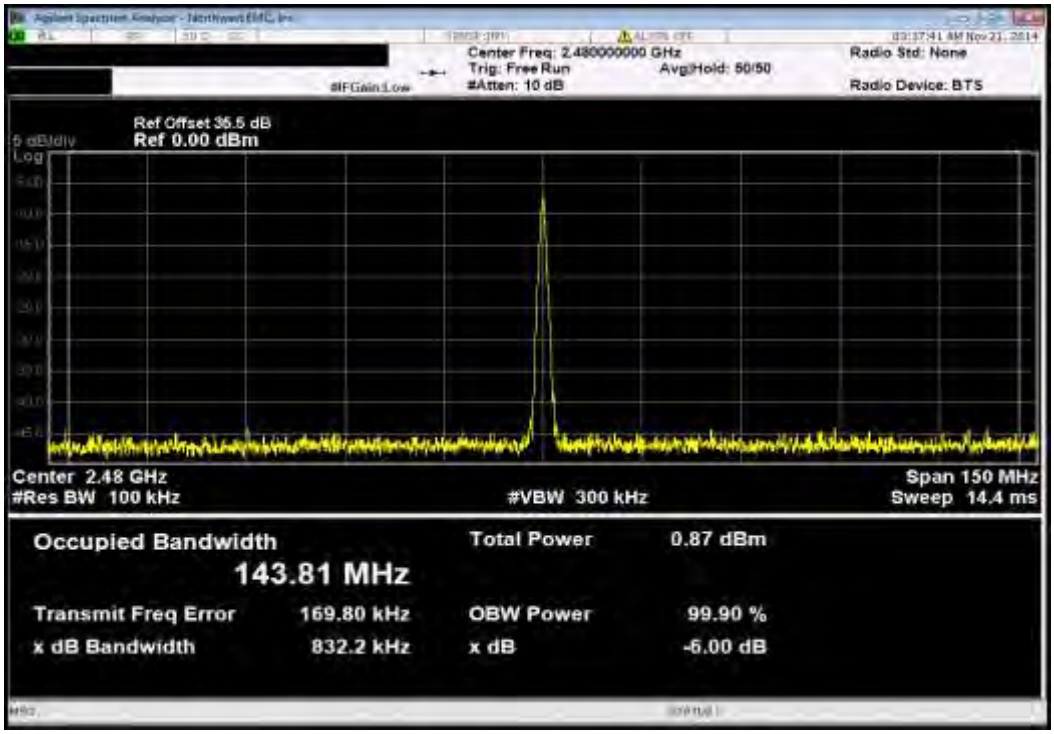


BLE, GFSK, Mid Channel, 2442 MHz						
				Value	Limit (≥)	Result
				790.147 kHz	500 kHz	Pass



OCCUPIED BANDWIDTH

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



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

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

MODES OF OPERATION

Transmitting Data GFSK Modulation. Low Channel 2402MHz, Mid Channel 2442MHz, High Channel 2480MHz

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

SPRX0001 - 3

FREQUENCY RANGE INVESTIGATED

Start Frequency	2400 MHz	Stop Frequency	2483.5 MHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
TX02 Cable	NWEMC	1-8.2 GHz	TXC	9/22/2014	12 mo
Antenna, Horn	ETS Lindgren	3115	AJL	9/15/2014	24 mo
Antenna, Horn	ETS Lindgren	3115	AJN	9/15/2014	24 mo
Power Sensor	Gigatronics	80701A	SRC	9/19/2014	12 mo
Power Meter	Gigatronics	8652A	SOZ	9/19/2014	12 mo
Spectrum Analyzer	Agilent	N9010A	AFL	6/20/2014	12 mo
Signal Generator, 40 GHz	Agilent	N5173B	TIW	7/15/2014	36

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

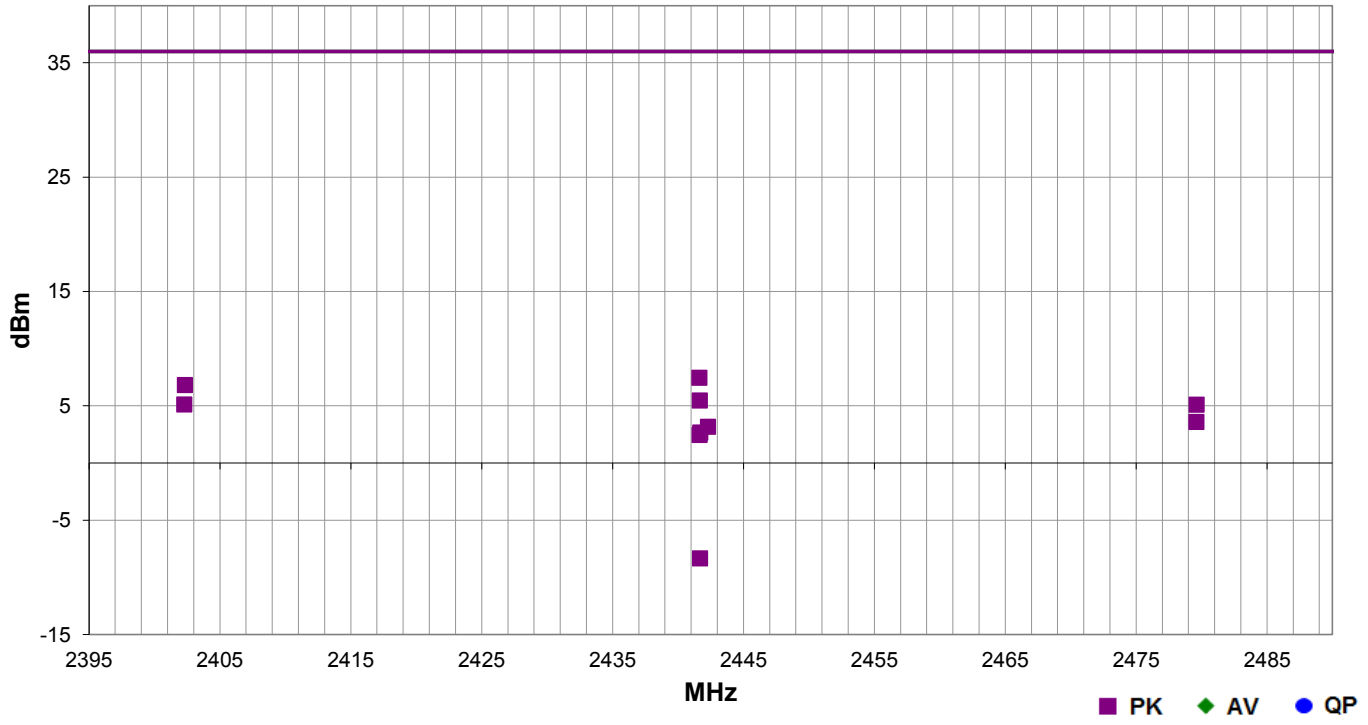
The EUT was operated in three orthogonal axis in transmit mode. While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height (1-4 meters) and polarization. The amplitude and frequency of the highest emissions were noted. The EUT was then replaced with a horn antenna. A signal generator was connected to the horn antenna and its output was adjusted to match the level previously noted for each frequency. The output of the signal generator was recorded, and by factoring in the cable loss to the horn antenna and its gain (dBi); the EIRP for the fundamental emission was determined.

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

Work Order:	SPRX0001	**Date:**	11/20/14		
Project:	None	**Temperature:**	23.4 °C		
Job Site:	TX02	**Humidity:**	27.5% RH		
Serial Number:	3197	**Barometric Pres.:**	1027 mbar	**Tested by:**	Frank Sun
EUT:	XM100BLK				
Configuration:	3				
Customer:	BSX Athletics				
Attendees:	Richard Voigt, Richard Pettys, Daniel Nichols, David Smoot				
EUT Power:	Battery				
Operating Mode:	Transmitting Data GFSK Modulation. Low Channel 2402MHz, Mid Channel 2442MHz, High Channel 2480MHz				
Deviations:	None				
Comments:	EIRP. Worst Case determined to be EUT Horizontal and Rx Antenna Horizontal				

Test Specifications	**Test Method**
FCC 15.247:2014	ANSI C63.10:2009

Run #	57	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



	Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/ Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
	2441.633	2.3	274.9	Horz	PK	5.57E-03	7.5	36.0	-28.5	Mid CH/Horz
	2402.317	3.0	273.0	Horz	PK	4.81E-03	6.8	36.0	-29.2	Low CH/Horz
	2441.667	2.3	15.0	Horz	PK	3.52E-03	5.5	36.0	-30.5	Mid CH/Side
	2402.275	2.4	357.0	Horz	PK	3.25E-03	5.1	36.0	-30.9	Low CH/Side
	2479.625	2.2	273.9	Horz	PK	3.23E-03	5.1	36.0	-30.9	High CH/Horz
	2479.608	2.8	360.0	Horz	PK	2.29E-03	3.6	36.0	-32.4	High CH/Side
	2442.292	2.1	322.9	Vert	PK	2.07E-03	3.2	36.0	-32.8	Mid CH/Vert
	2441.700	3.8	201.0	Vert	PK	1.84E-03	2.7	36.0	-33.3	Mid CH/Horz
	2441.650	3.7	301.0	Vert	PK	1.76E-03	2.5	36.0	-33.5	Mid CH/Side
	2441.675	2.8	8.0	Horz	PK	1.47E-04	-8.3	36.0	-44.3	Mid CH/Vert

POWER SPECTRAL DENSITY

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.	Interval (mo)
TX02 Cable	NWEMC	1-8.2 GHz	TXC	9/22/2014	12
Antenna, Horn	ETS Lindgren	3115	AJL	9/15/2014	24
Spectrum Analyzer	Agilent	N9010A	AFL	6/20/2014	12

TEST DESCRIPTION

The maximum power spectral density measurements were measured with the EUT set to the required transmit frequencies in each band. The EUT was transmitting at the lowest, middle, and maximum data rate for each modulation type available. A radiated method was used with the EUT in the worse case position.

The final data was converted from a field strength to a radiated power value. Equation 5 found in ANSI C63.10:2009, was used to derive this conversion formula:

dBm/m (field strength) + 11.77 = dBm EIRP

Per the procedure outlined in FCC KDB 558074 D01 DTS Measurement Section 5.3.1, the spectrum analyzer was used as follows:

- RBW = 100 kHz
- VBW = 300 kHz
- Detector = Peak (to match method used for power measurement)
- Trace = Max hold

The observed power level is then scaled to an equivalent value in 3 kHz by adding a Bandwidth Correction Factor (BWCF) where:

BWCF = 10*LOG (3 kHz / 100 kHz) = -15.2 dB

POWER SPECTRAL DENSITY

EUT:	XM100BLK			Work Order:	SPRX0001
Serial Number:	3197			Date:	11/20/14
Customer:	BSX Athletics			Temperature:	24.7°C
Attendees:	Daniel Nichols			Humidity:	31%
Project:	None			Barometric Pres.:	1025
Tested by:	Frank Sun	Power:	Battery	Job Site:	TX02

TEST SPECIFICATIONS	Test Method
FCC 15.247:2014	ANSI C63.10:2009

COMMENTS

Radiated method. EUT transmitting data in horizontal orientation. Antenna at horizontal position.

DEVIATIONS FROM TEST STANDARD

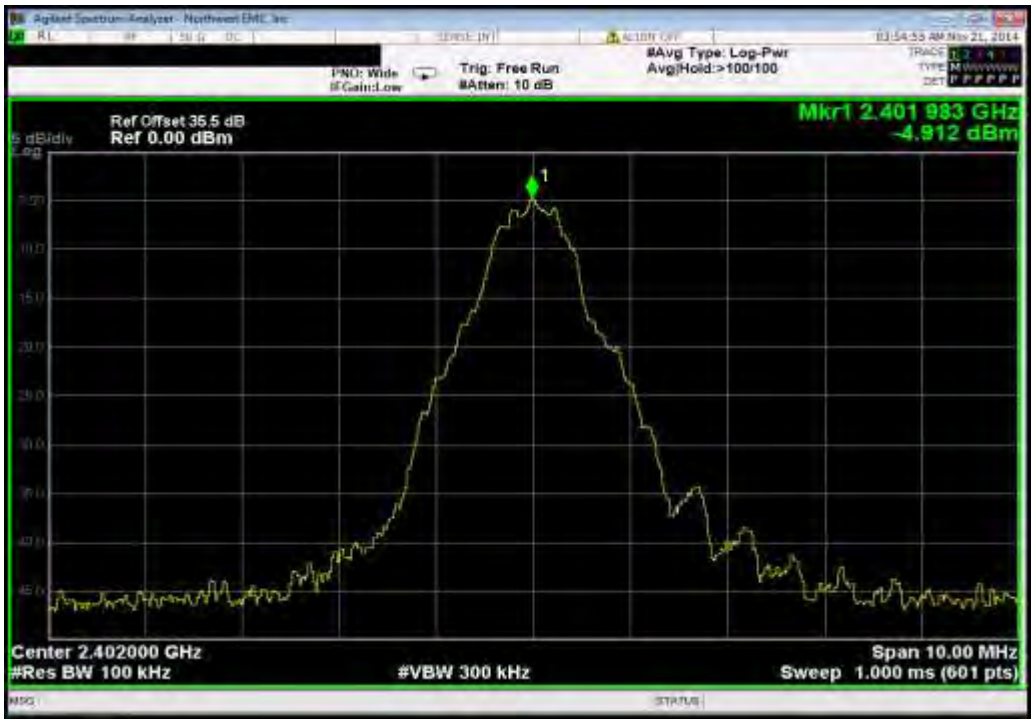
None

Configuration #	3	Signature

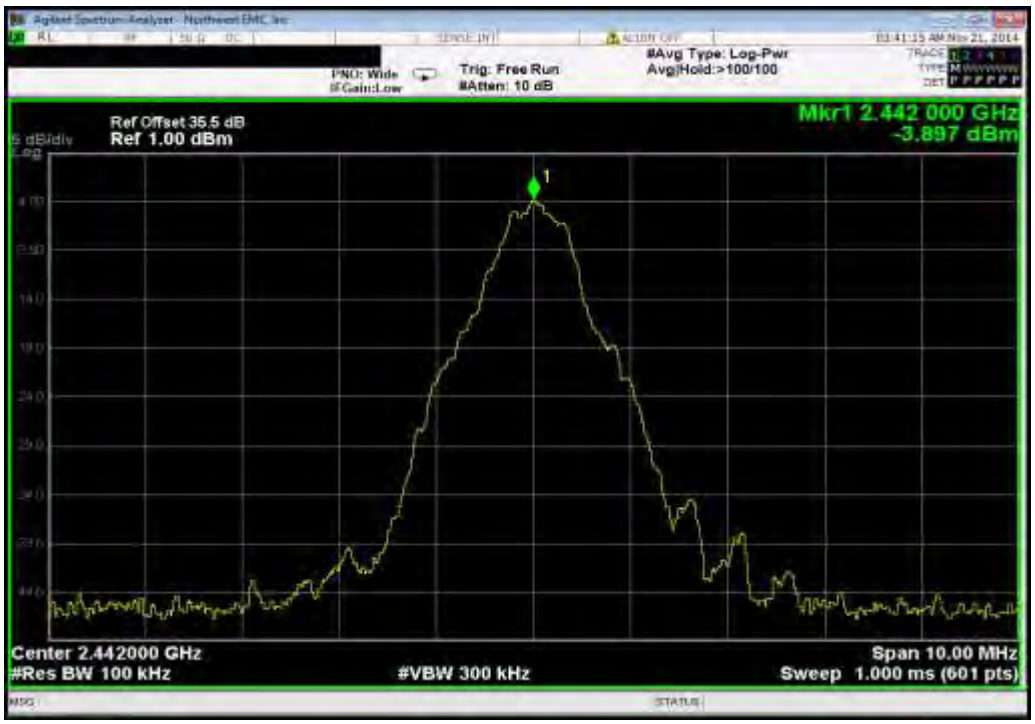
	Value dBm/100kHz	dBm/m to dBm	dBm/100kHz To dBm/3kHz	Value dBm/3kHz	Limit dBm/3kHz	Results
BLE						
GFSK, Low Channel, 2402 MHz	-4.912	11.77	-15.2	-8.342	8	Pass
GFSK, Mid Channel, 2442 MHz	-3.897	11.77	-15.2	-7.327	8	Pass
GFSK, High Channel, 2480 MHz	-6.672	11.77	-15.2	-10.102	8	Pass

POWER SPECTRAL DENSITY

BLE, GFSK, Low Channel, 2402 MHz						
	Value dBm/100kHz	dBm/m to dBm	dBm/100kHz To dBm/3kHz	Value dBm/3kHz	Limit dBm/3kHz	Results
	-4.912	11.77	-15.2	-8.342	8	Pass

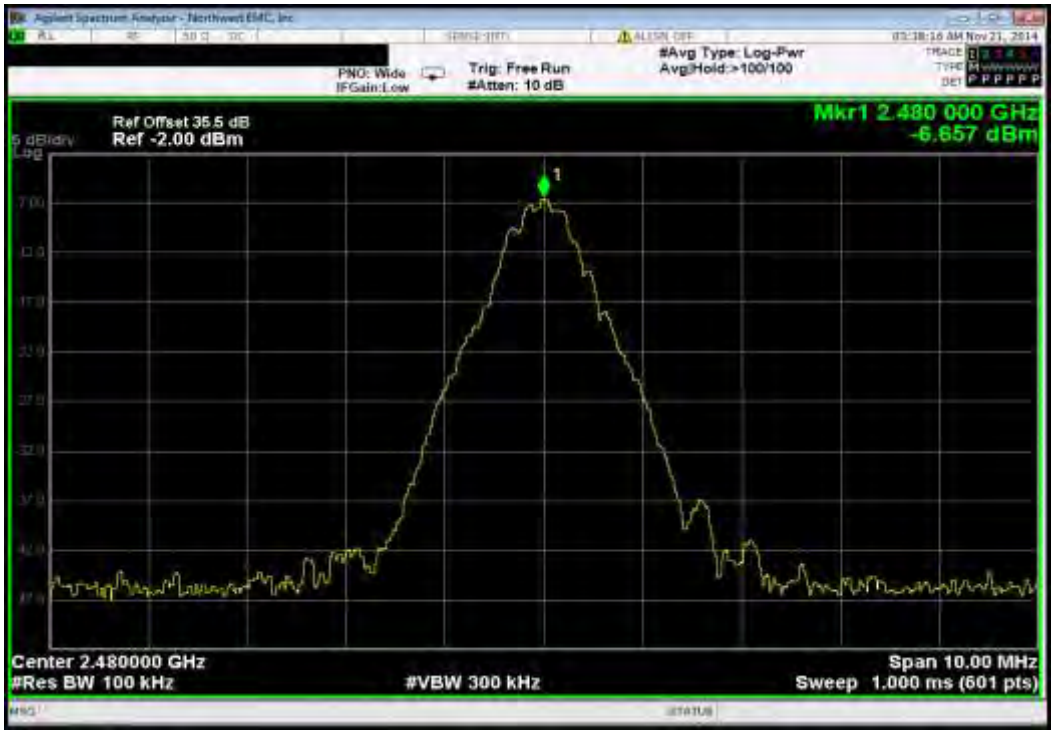


BLE, GFSK, Mid Channel, 2442 MHz						
	Value dBm/100kHz	dBm/m to dBm	dBm/100kHz To dBm/3kHz	Value dBm/3kHz	Limit dBm/3kHz	Results
	-3.897	11.77	-15.2	-7.327	8	Pass



POWER SPECTRAL DENSITY

BLE, GFSK, High Channel, 2480 MHz						
	Value dBm/100kHz	dBm/m to dBm	dBm/100kHz To dBm/3kHz	Value dBm/3kHz	Limit dBm/3kHz	Results
	-6.672	11.77	-15.2	-10.102	8	Pass



DUTY CYCLE

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.	Interval (mo)
Spectrum Analyzer	Agilent	N9010A	AFL	6/20/2014	12
TX02 Cable	NWEMC	1-8.2 GHz	TXC	9/22/2014	12
Antenna, Horn	ETS Lindgren	3115	AJL	9/15/2014	24

TEST DESCRIPTION

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.

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. A radiated method was used with the EUT in the worse case position.

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 was used during some of the other tests in this report to only measure during the burst duration.

DUTY CYCLE

EUT:	XM100BLK			**Work Order:**	SPRX0001
Serial Number:	3197			**Date:**	11/20/14
Customer:	BSX Athletics			**Temperature:**	24.7°C
Attendees:	Daniel Nichols			**Humidity:**	31%
Project:	None			**Barometric Pres.:**	1025
Tested by:	Frank Sun	**Power:**	Battery	**Job Site:**	TX02

TEST SPECIFICATIONS	Test Method
FCC 15.247:2014	ANSI C63.10:2009

COMMENTS

Radiated method. EUT transmitting data in horizontal orientation. Antenna at horizontal position.

DEVIATIONS FROM TEST STANDARD

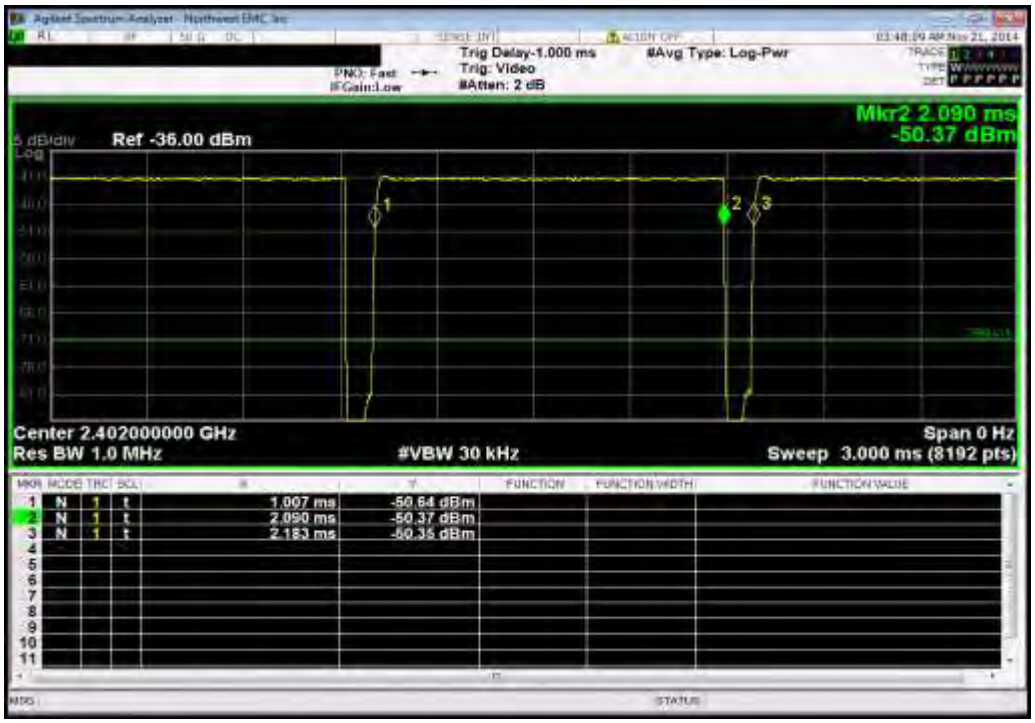
None

Configuration #	3	Signature

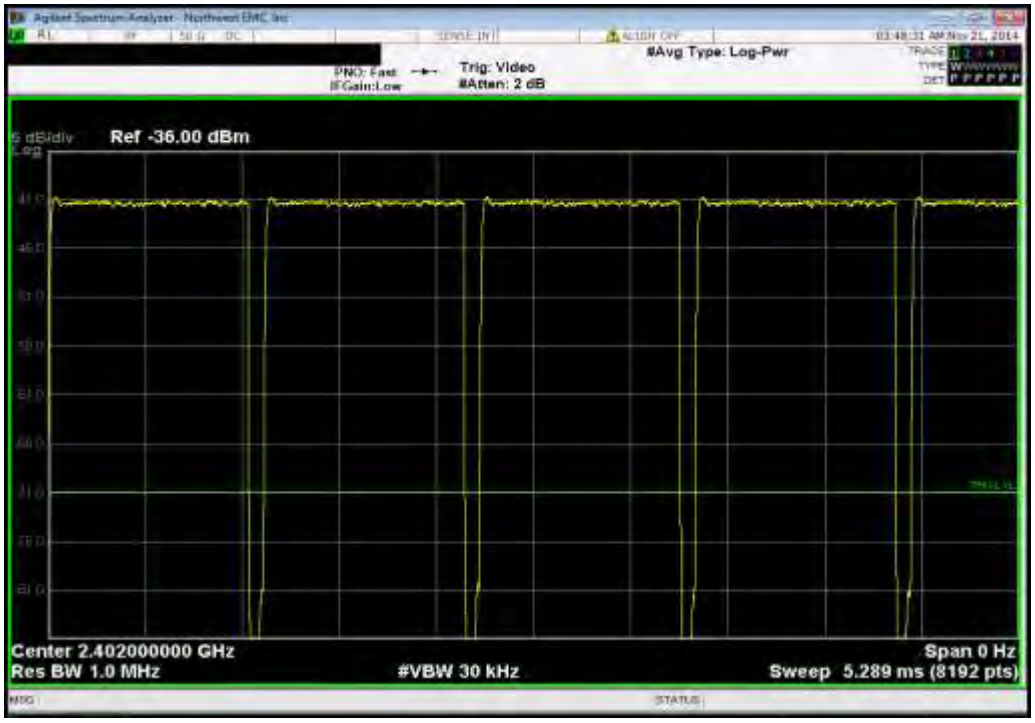
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
BLE						
GFSK, Low Channel, 2402 MHz	1.083 ms	1.175 ms	1	92.1	N/A	N/A
GFSK, Low Channel, 2402 MHz	N/A	N/A	5	N/A	N/A	N/A
GFSK, Mid Channel, 2442 MHz	1.083 ms	1.175 ms	1	92.2	N/A	N/A
GFSK, Mid Channel, 2442 MHz	N/A	N/A	5	N/A	N/A	N/A
GFSK, High Channel, 2480 MHz	1.083 ms	1.175 ms	1	92.1	N/A	N/A
GFSK, High Channel, 2480 MHz	N/A	N/A	5	N/A	N/A	N/A

DUTY CYCLE

BLE, GFSK, Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.083 ms	1.175 ms	1	92.1	N/A	N/A

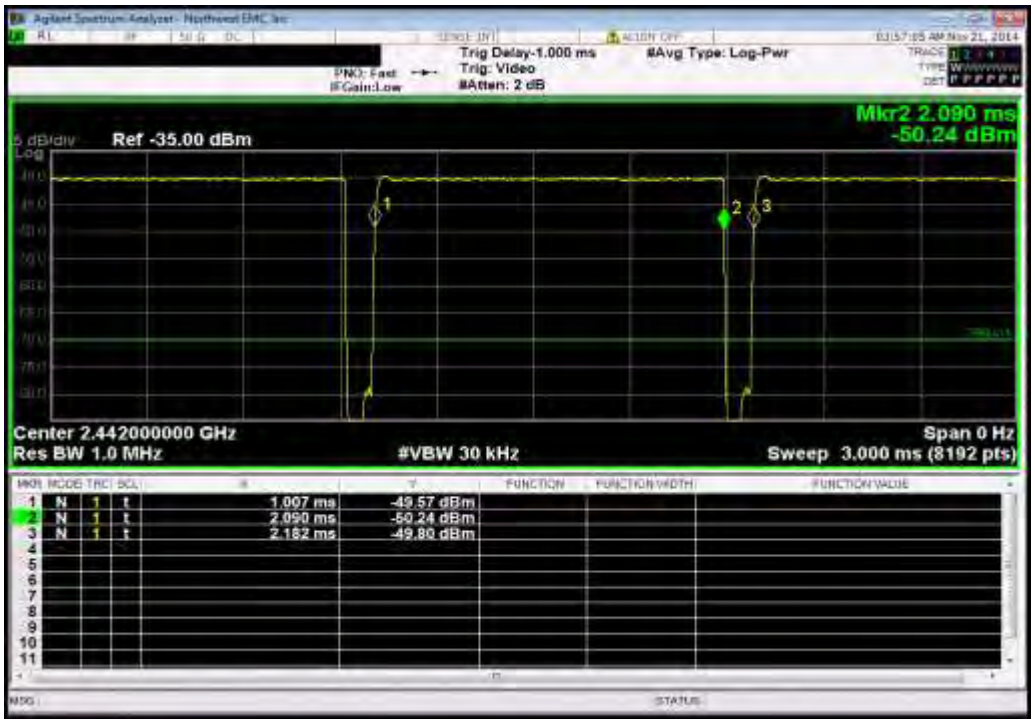


BLE, GFSK, Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

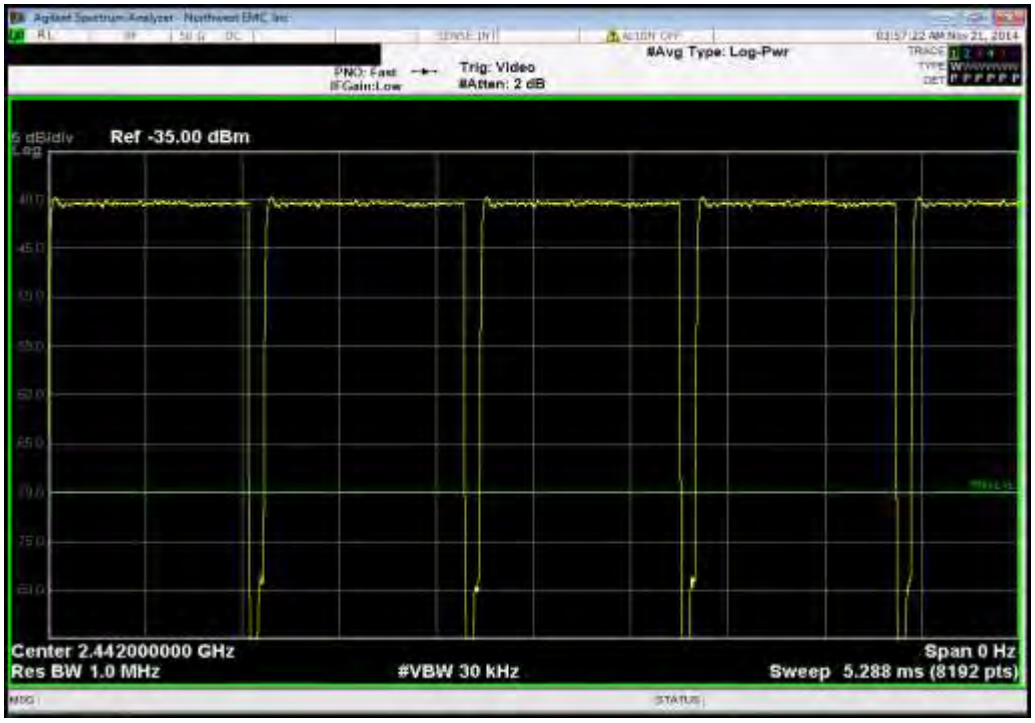


DUTY CYCLE

BLE, GFSK, Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.083 ms	1.175 ms	1	92.2	N/A	N/A

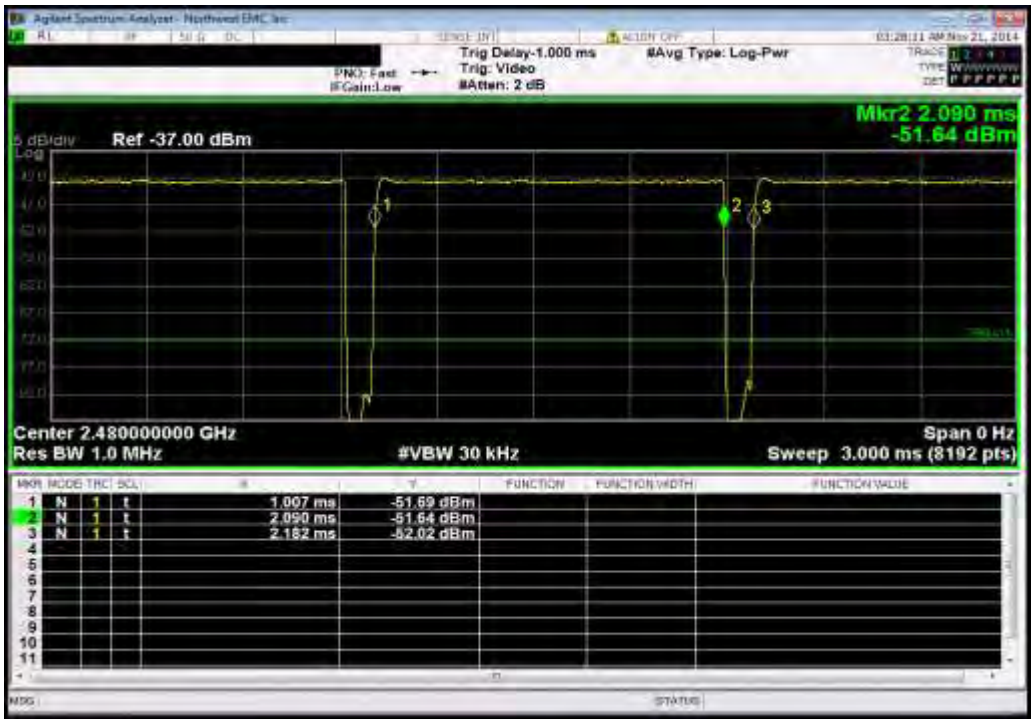


BLE, GFSK, Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



DUTY CYCLE

BLE, GFSK, High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.083 ms	1.175 ms	1	92.1	N/A	N/A



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