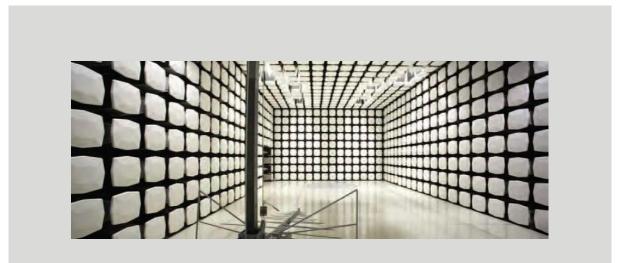


Shottracker WPTX

FCC 15.247:2018 Bluetooth Low Energy (DTS) Radio

Report # SHOT0005.1



TESTING NVLAP LAB CODE: 201049-0



This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government of the United States of America. This Report shall not be reproduced, except in full without written approval of the laboratory.

CERTIFICATE OF TEST



Last Date of Test: July 26, 2018 Shottracker Model: WPTX

Radio Equipment Testing

Standards	
Specification	Method
FCC 15.207:2018	ANSI C63.10:2013, KDB 558074
FCC 15.247:2018	ANSI C03.10.2013, RDB 330074

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	Yes	Pass	
11.12.1, 11.13.2, 6.5, 6.6	Solutions Radiated Emissions		Pass	
11.6	Duty Cycle	Yes	Pass	
11.8.2	Occupied Bandwidth	Yes	Pass	
11.9.1.1	Output Power	Yes	Pass	
11.10.2	Power Spectral Density	Yes	Pass	
11.11	Band Edge Compliance	Yes	Pass	
11.11	Spurious Conducted Emissions	Yes	Pass	

Deviations From Test Standards

None

Approved By:

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. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information.

REVISION HISTORY



Revision Number	Description	Date	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS



United States

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

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

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with ISED.

European Union

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

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

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

SCOPE

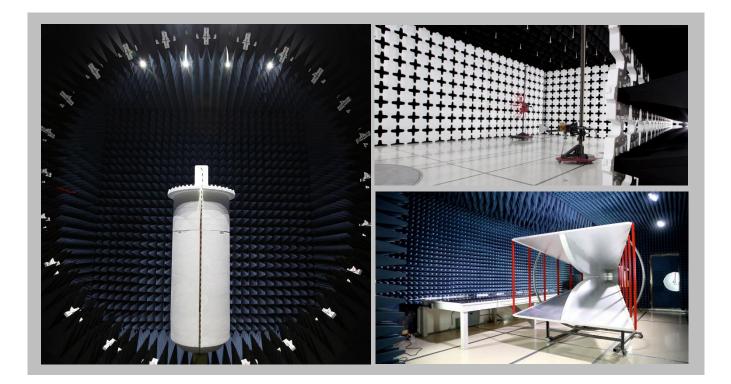
For details on the Scopes of our Accreditations, please visit: <u>http://portlandcustomer.element.com/ts/scope/scope.htm</u> <u>http://gsi.nist.gov/global/docs/cabs/designations.html</u>

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	New York Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	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	
		NV	LAP			
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0	
	Innovation, Science and Economic Development Canada					
2834B-1, 2834B-3	2834E-1, 2834E-3	N/A	2834D-1, 2834D-2	2834G-1	2834F-1	
		BS	МІ			
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R	
		VC	CI			
A-0029	A-0109	N/A	A-0108	A-0201	A-0110	
	Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157	



MEASUREMENT UNCERTAINTY



Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

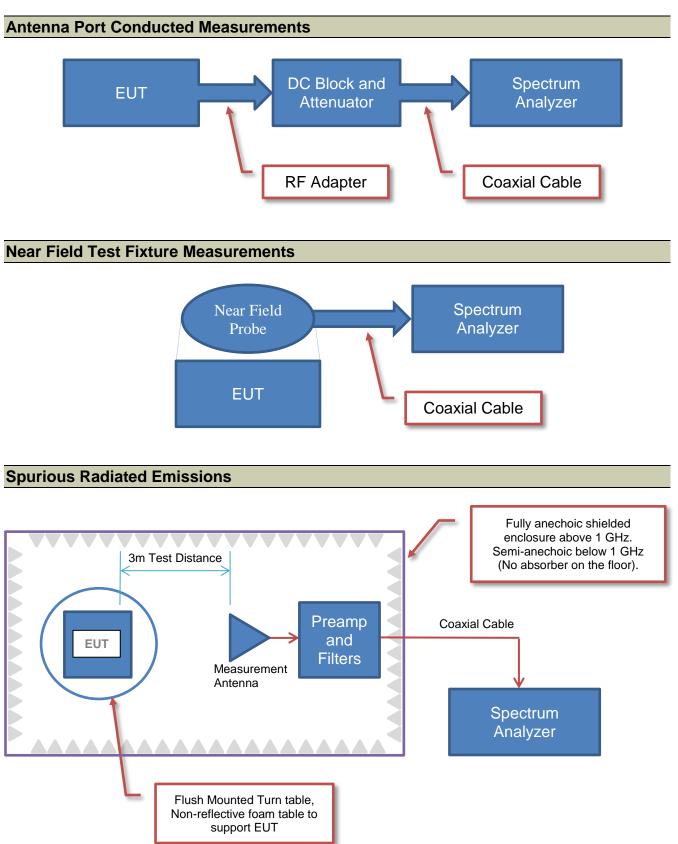
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

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

Test	+ MU	<u>- MU</u>
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)	5.1 dB	-5.1 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

Test Setup Block Diagrams





PRODUCT DESCRIPTION



Client and Equipment Under Test (EUT) Information

Company Name:	Shottracker
Address:	7220 W. Frontage Rd.
City, State, Zip:	Merriam, KS 66203
Test Requested By:	Patrick Herron
Model:	WPTX
First Date of Test:	July 24, 2018
Last Date of Test:	July 26, 2018
Receipt Date of Samples:	July 24, 2018
Equipment Design Stage:	Prototype
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

ShotTracker is a sensor based system that autonomously captures statistical and performance analytics for an entire team in real-time during practice and games. Use ShotTracker analytics to motivate players, engage fans and improve your team's record. Includes Wireless Charging and Bluetooth Low Energy.

Testing Objective:

To demonstrate compliance of the Bluetooth radio to FCC 15.247 requirements.





Configuration SHOT0005-1

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
WPTX	Shottracker	S8D1	30

Peripherals in test setup boundary						
Description	Manufacturer	Model/Part Number	Serial Number			
AC/DC Brick	Intai	IN2405000	None			

Cables						
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2	
AC Cable	No	1.7m	No	AC Mains	AC/DC Brick	
DC Cable	No	.2m	No	AC/DC Brick	WPTX	

Configuration SHOT0005-3

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
WPTX (Direct Connect)	Shottracker	S8D1	30

Peripherals in test setup boundary						
Description	Manufacturer	Model/Part Number	Serial Number			
AC/DC Brick	Intai	IN2405000	None			

Cables						
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2	
AC Cable	No	1.7m	No	AC Mains	AC/DC Brick	
DC Cable	No	.2m	No	AC/DC Brick	WPTX	

MODIFICATIONS



Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT		
		Spurious	Tested as	No EMI suppression	EUT remained at		
1	7/24/2018	Radiated	delivered to	devices were added or	Element following the		
		Emissions	Test Station.	modified during this test.	test.		
		Powerline	Tested as	No EMI suppression	EUT remained at		
2	7/25/2018	Conducted	delivered to	devices were added or	Element following the		
		Emissions	Test Station.	modified during this test.	test.		
			Tested as	No EMI suppression	EUT remained at		
3	7/26/2018	Duty Cycle	delivered to	devices were added or	Element following the		
			Test Station.	modified during this test.	test.		
		Occupied	Tested as	No EMI suppression	EUT remained at		
4	7/26/2018	Bandwidth	delivered to	devices were added or	Element following the		
		Banawiati	Test Station.	modified during this test.	test.		
		3 Output Power	Tested as	No EMI suppression	EUT remained at		
5	7/26/2018		delivered to	devices were added or	Element following the		
			Test Station.	modified during this test.	test.		
		Power	Tested as	No EMI suppression	EUT remained at		
6	7/26/2018	Spectral	delivered to	devices were added or	Element following the		
		Density	Test Station.	modified during this test.	test.		
		Band Edge	Tested as	No EMI suppression	EUT remained at		
7	7/26/2018	Compliance	delivered to	devices were added or	Element following the		
		Compliance	Test Station.	modified during this test.	test.		
		Spurious	Tested as	No EMI suppression	Scheduled testing		
8	7/26/2018	Conducted	delivered to	devices were added or	was completed.		
		Emissions	Test Station.	modified during this test.	was completed.		



TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, conducted emissions tests were performed. The frequency range investigated (scanned), is also noted in this report. Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Per the standard, an insulating material was also added to ground plane between the EUT's power and remote I/O cables. Equipment is tested with power cords that are normally used or that have electrical or shielding characteristics that are the same as those cords normally used. Typically those measurements are made using a LISN (Line Impedance Stabilization Network), the 500hm measuring port is terminated by a 500hm EMI meter or a 500hm resistive load. All 500hm measuring ports of the LISN are terminated by 500hm. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
LISN	Solar Electronics	9252-50-R-24-BNC	LJK	9/11/2017	9/11/2018
Cable - Conducted Cable Assembly	Northwest EMC	TXA, HHZ, TQU	TXAA	1/31/2018	1/31/2019
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	3/19/2018	3/19/2019

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

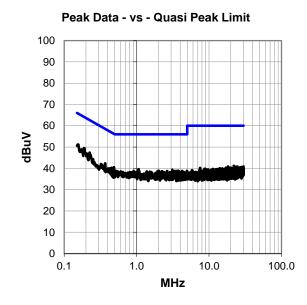
SHOT0005-1

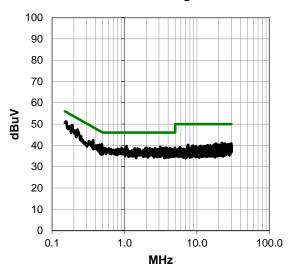
MODES INVESTIGATED

Continuously Transmitting at Mid Ch 2440 MHz



EUT:	WPTX				Work Order:	SHOT0005			
Serial Number:	30				Date:	07/25/2018			
Customer:	Shottracker			Temperature:	23°C				
Attendees:	Patrick Herro	n		Relative Humidity:	53.5%				
Customer Project:	None				Bar. Pressure:	1019 mb			
Tested By:	Marty Martin				Job Site:	TX01			
Power:	110VAC/60H	Z			Configuration:	SHOT0005-1			
TEST SPECIFICATIONS									
Specification:				Method:	bd:				
FCC 15.207:2018				ANSI C63.10):2013				
TEST PARAME	TERS								
Run #: 4		Line:	Neutral	A	dd. Ext. Attenuation (dB): 0				
COMMENTS									
Standard Configura	tion								
EUT OPERATIN									
Continuously Transmitting at Mid Ch 2440 MHz									
DEVIATIONS FROM TEST STANDARD									
None									





Peak Data - vs - Average Limit



RESULTS - Run #4

Peak Data - vs - Quasi Peak Limit										
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)					
0.154	31.1	20.1	51.2	65.8	-14.6					
0.187	29.4	20.1	49.5	64.2	-14.7					
0.225	27.4	20.0	47.4	62.6	-15.2					
0.486	20.3	20.2	40.5	56.2	-15.7					
0.366	22.2	20.1	42.3	58.6	-16.3					
1.060	19.6	20.0	39.6	56.0	-16.4					
0.452	20.1	20.2	40.3	56.8	-16.5					
3.112	19.2	20.1	39.3	56.0	-16.7					
2.015	18.7	20.2	38.9	56.0	-17.1					
4.944	18.7	20.2	38.9	56.0	-17.1					
0.911	18.6	20.2	38.8	56.0	-17.2					
3.373	18.7	20.1	38.8	56.0	-17.2					
3.728	18.6	20.2	38.8	56.0	-17.2					
1.948	18.6	20.1	38.7	56.0	-17.3					
2.635	18.5	20.2	38.7	56.0	-17.3					
3.523	18.5	20.2	38.7	56.0	-17.3					
3.851	18.5	20.2	38.7	56.0	-17.3					
4.254	18.5	20.2	38.7	56.0	-17.3					
1.381	18.5	20.1	38.6	56.0	-17.4					
2.213	18.5	20.1	38.6	56.0	-17.4					
2.250	18.5	20.1	38.6	56.0	-17.4					
3.295	18.5	20.1	38.6	56.0	-17.4					
3.802	18.4	20.2	38.6	56.0	-17.4					
1.512	18.4	20.1	38.5	56.0	-17.5					
1.605	18.2	20.1	38.3	56.0	-17.7					
2.176	18.2	20.1	38.3	56.0	-17.7					

Peak Data - vs - Average Limit										
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)					
0.154	31.1	20.1	51.2	55.8	-4.6					
0.187	29.4	20.1	49.5	54.2	-4.7					
0.225	27.4	20.0	47.4	52.6	-5.2					
0.486	20.3	20.2	40.5	46.2	-5.7					
0.366	22.2	20.1	42.3	48.6	-6.3					
1.060	19.6	20.0	39.6	46.0	-6.4					
0.452	20.1	20.2	40.3	46.8	-6.5					
3.112	19.2	20.1	39.3	46.0	-6.7					
2.015	18.7	20.2	38.9	46.0	-7.1					
4.944	18.7	20.2	38.9	46.0	-7.1					
0.911	18.6	20.2	38.8	46.0	-7.2					
3.373	18.7	20.1	38.8	46.0	-7.2					
3.728	18.6	20.2	38.8	46.0	-7.2					
1.948	18.6	20.1	38.7	46.0	-7.3					
2.635	18.5	20.2	38.7	46.0	-7.3					
3.523	18.5	20.2	38.7	46.0	-7.3					
3.851	18.5	20.2	38.7	46.0	-7.3					
4.254	18.5	20.2	38.7	46.0	-7.3					
1.381	18.5	20.1	38.6	46.0	-7.4					
2.213	18.5	20.1	38.6	46.0	-7.4					
2.250	18.5	20.1	38.6	46.0	-7.4					
3.295	18.5	20.1	38.6	46.0	-7.4					
3.802	18.4	20.2	38.6	46.0	-7.4					
1.512	18.4	20.1	38.5	46.0	-7.5					
1.605	18.2	20.1	38.3	46.0	-7.7					
2.176	18.2	20.1	38.3	46.0	-7.7					

CONCLUSION

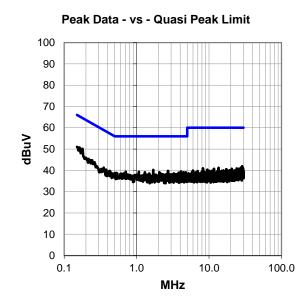
Pass

Marty Marti

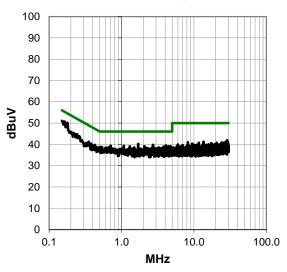
Tested By



EUT:	WPTX				Work Order:	SHOT0005			
Serial Number:	30				Date:	07/25/2018			
Customer:	Shottracker			Temperature:	23°C				
Attendees:	Patrick Herro	n		Relative Humidity:	53.5%				
Customer Project:	None				Bar. Pressure:	1019 mb			
Tested By:	Marty Martin				Job Site:	TX01			
Power:	110VAC/60H	z			Configuration:	SHOT0005-1			
TEST SPECIFICATIONS									
Specification:				Method:					
FCC 15.207:2018				ANSI C63.2	10:2013				
TEST PARAMETERS									
Run #: 5		Line:	High Line		Add. Ext. Attenuation (dB	dd. Ext. Attenuation (dB): 0			
COMMENTS									
Standard Configura	ation								
EUT OPERATII									
Continuously Trans	mitting at Mid	Ch 2440 M	Hz						
	DEVIATIONS FROM TEST STANDARD								
None									



Peak Data - vs - Average Limit





RESULTS - Run #5

_					Peak Data - vs - Quasi Peak Limit										
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)	Freq (MHz)									
0.150	30.9	20.1	51.0	66.0	-15.0	0.150									
1.698	20.1	20.1	40.2	56.0	-15.8	1.698									
2.724	19.7	20.1	39.8	56.0	-16.2	2.724									
4.105	19.2	20.2	39.4	56.0	-16.6	4.105									
0.706	19.0	20.3	39.3	56.0	-16.7	0.706									
1.075	19.2	20.1	39.3	56.0	-16.7	1.075									
1.299	19.1	20.0	39.1	56.0	-16.9	1.299									
2.068	18.9	20.2	39.1	56.0	-16.9	2.068									
4.772	18.9	20.2	39.1	56.0	-16.9	4.772									
4.448	18.8	20.2	39.0	56.0	-17.0	4.448									
3.799	18.7	20.2	38.9	56.0	-17.1	3.799									
4.623	18.5	20.2	38.7	56.0	-17.3	4.623									
1.497	18.5	20.1	38.6	56.0	-17.4	1.497									
2.679	18.4	20.2	38.6	56.0	-17.4	2.679									
3.269	18.5	20.1	38.6	56.0	-17.4	3.269									
4.090	18.3	20.2	38.5	56.0	-17.5	4.090									
2.773	18.3	20.1	38.4	56.0	-17.6	2.773									
4.582	18.2	20.2	38.4	56.0	-17.6	4.582									
4.813	18.2	20.2	38.4	56.0	-17.6	4.813									
4.243	18.1	20.2	38.3	56.0	-17.7	4.243									
4.993	18.1	20.2	38.3	56.0	-17.7	4.993									
3.123	18.1	20.1	38.2	56.0	-17.8	3.123									
3.422	18.0	20.2	38.2	56.0	-17.8	3.422									
3.530	18.0	20.2	38.2	56.0	-17.8	3.530									
2.911	18.1	20.0	38.1	56.0	-17.9	2.911									
3.922	17.9	20.2	38.1	56.0	-17.9	3.922									

			<u> </u>				
Freq	Amp.	Factor	Adjusted	Spec. Limit	Margin		
(MHz)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dB)		
0.150	30.9	20.1	51.0	56.0	-5.0		
1.698	20.1	20.1	40.2	46.0	-5.8		
2.724	19.7	20.1	39.8	46.0	-6.2		
4.105	19.2	20.2	39.4	46.0	-6.6		
0.706	19.0	20.3	39.3	46.0	-6.7		
1.075	19.2	20.1	39.3	46.0	-6.7		
1.299	19.1	20.0	39.1	46.0	-6.9		
2.068	18.9	20.2	39.1	46.0	-6.9		
4.772	18.9	20.2	39.1	46.0	-6.9		
4.448	18.8	20.2	39.0	46.0	-7.0		
3.799	18.7	20.2	38.9	46.0	-7.1		
4.623	18.5	20.2	38.7	46.0	-7.3		
1.497	18.5	20.1	38.6	46.0	-7.4		
2.679	18.4	20.2	38.6	46.0	-7.4		
3.269	18.5	20.1	38.6	46.0	-7.4		
4.090	18.3	20.2	38.5	46.0	-7.5		
2.773	18.3	20.1	38.4	46.0	-7.6		
4.582	18.2	20.2	38.4	46.0	-7.6		
4.813	18.2	20.2	38.4	46.0	-7.6		
4.243	18.1	20.2	38.3	46.0	-7.7		
4.993	18.1	20.2	38.3	46.0	-7.7		
3.123	18.1	20.1	38.2	46.0	-7.8		
3.422	18.0	20.2	38.2	46.0	-7.8		
3.530	18.0	20.2	38.2	46.0	-7.8		
2.911	18.1	20.0	38.1	46.0	-7.9		
3.922	17.9	20.2	38.1	46.0	-7.9		

Peak Data - vs - Average Limit

CONCLUSION

Pass

Marty Marti

Tested By

SPURIOUS RADIATED EMISSIONS



PSA-ESCI 2018.05.0

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

Continuously Transmitting at Low Ch 2402 MHz, Mid Ch 2440 MHz, High Ch 2480 MHz

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

SHOT0005 - 1

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
Cable	Northwest EMC	18-40GHz	TXE	17-Nov-2017	12 mo
Cable	Northwest EMC	8-18GHz	TXD	31-May-2018	12 mo
Cable	Northwest EMC	1-8.2 GHz	TXC	31-May-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	JSDWK42-18004000-60-5P	PAM	17-Nov-2017	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	PAL	9-Oct-2017	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	PAK	9-Oct-2017	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAJ	31-May-2018	12 mo
Antenna - Double Ridge	A.H. Systems, Inc.	SAS-574	AXW	5-Aug-2016	24 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AJG	NCR	0 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AJF	NCR	0 mo
Filter - High Pass	Micro-Tronics	HPM50111	HGC	3/16/2018	12 mo
Filter - Low Pass	Micro-Tronics	LPM50004	HHV	8/3/2017	12 mo
Antenna - Biconilog	ETS Lindgren	3143B	AYF	5/10/2018	24 mo
Cable	Northwest EMC	RE 9kHz - 1GHz	TXB	10/10/2017	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1551	PAH	10/10/2017	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AJN	9/15/2016	24 mo
Attenuator	Weinschel Corp	4H-20	AWB	3/16/2018	12 mo
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	15-Mar-2018	12 mo

TEST DESCRIPTION

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

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

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

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

PK = Peak Detector AV = RMS Detector

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

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

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

SPURIOUS RADIATED EMISSIONS



						EmiR5 2018.05.07	PSA-ESCI 2018.05.04					
	k Order:		Date:		m	× 11						
	Project:	None	Temperature:	22 °C	Man	4 116	arti					
	Job Site:	TX02	Humidity:	50.1% RH	<	1						
Serial I	Number:		Barometric Pres.:	1020 mbar	Teste	Tested by: Marty Martin						
		WPTX										
	guration:											
	Istomer:	Shottracker Patrick Herron										
		110VAC/60Hz										
		0 I T	itting at Low Ch 2402 I									
Operatin	ng Mode:	Continuousiy mansin	itting at Low Ch 2402 i		IVINZ, NIGH CH 2460 I	VINZ						
Dev	viations:	None	ne									
Comments: Standard Configuration. Duty Cycle Correction Factor of 10*log(1/DC) = 1*log(1/.6) = 2.2 dB added to Average detector measurements.												
Test Specifi	ications			Test	lethod							
FCC 15.247:					C63.10:2013							
Run #	57	Test Distance (m)	3 Antenna	a Height(s)	1 to 4(m)	Results	Pass					
00												
80												
70												
10												
60												
00												
				│ │ │ <mark></mark>								
50					◆							
						_						
40					_							
30						▼						
20												
10 🗕												
10		100		1000	100	00	100000					
				MHz								
						PK 🕨	🕨 AV 🗢 QP					

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
2484.587	32.8	-3.4	1.0	271.0	2.2	20.0	Vert	AV	0.0	51.6	54.0	-2.4	EUT X, High Ch
2485.250	32.6	-3.4	3.6	358.9	2.2	20.0	Horz	AV	0.0	51.4	54.0	-2.6	EUT Y, High Ch
2484.423	32.6	-3.4	1.4	144.0	2.2	20.0	Vert	AV	0.0	51.4	54.0	-2.6	EUT Y, High Ch
2484.170	32.6	-3.4	1.8	69.9	2.2	20.0	Horz	AV	0.0	51.4	54.0	-2.6	EUT X, High Ch
2485.147	32.6	-3.4	3.8	204.0	2.2	20.0	Horz	AV	0.0	51.4	54.0	-2.6	EUT Z, High Ch
2484.653	32.6	-3.4	1.0	88.9	2.2	20.0	Vert	AV	0.0	51.4	54.0	-2.6	EUT Z, High Ch
2388.980	32.8	-4.0	3.1	202.9	2.2	20.0	Vert	AV	0.0	51.0	54.0	-3.0	EUT X, Low Ch
2389.900	32.6	-4.0	1.0	73.0	2.2	20.0	Horz	AV	0.0	50.8	54.0	-3.2	EUT X, Low Ch
7327.150	29.8	14.7	1.0	25.0	2.2	0.0	Vert	AV	0.0	46.7	54.0	-7.3	EUT X, Mid Ch
7326.390	29.7	14.7	1.0	271.0	2.2	0.0	Horz	AV	0.0	46.6	54.0	-7.4	EUT Y, Mid Ch
7441.065	29.4	14.7	1.0	32.0	2.2	0.0	Horz	AV	0.0	46.3	54.0	-7.7	EUT Y, High Ch
7441.370	29.3	14.7	1.0	309.0	2.2	0.0	Vert	AV	0.0	46.2	54.0	-7.8	EUT X, High Ch
4960.030	34.6	7.1	2.0	36.0	2.2	0.0	Vert	AV	0.0	43.9	54.0	-10.1	EUT X, High Ch
4803.935	32.9	6.8	2.0	261.0	2.2	0.0	Vert	AV	0.0	41.9	54.0	-12.1	EUT X, Low Ch

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	
													Comments
2483.573	45.3	-3.4	1.4	144.0	0.0	20.0	Vert	PK	0.0	61.9	74.0	-12.1	EUT Y, High Ch
2483.610	44.6	-3.4	3.8	204.0	0.0	20.0	Horz	PK	0.0	61.2	74.0	-12.8	EUT Z, High Ch
2483.537	44.5	-3.4	1.0	271.0	0.0	20.0	Vert	PK	0.0	61.1	74.0	-12.9	EUT X, High Ch
2485.317	44.3	-3.4	3.6	358.9	0.0	20.0	Horz	PK	0.0	60.9	74.0	-13.1	EUT Y, High Ch
4960.200	31.5	7.1	3.7	261.0	2.2	0.0	Horz	AV	0.0	40.8	54.0	-13.2	EUT Y, High Ch
2485.083	44.2	-3.4	1.8	69.9	0.0	20.0	Horz	PK	0.0	60.8	74.0	-13.2	EUT X, High Ch
2483.977	44.1	-3.4	1.0	88.9	0.0	20.0	Vert	PK	0.0	60.7	74.0	-13.3	EUT Z, High Ch
4803.570	31.7	6.8	1.3	274.9	2.2	0.0	Horz	AV	0.0	40.7	54.0	-13.3	EUT Y, Low Ch
2389.783	44.5	-4.0	1.0	73.0	0.0	20.0	Horz	PK	0.0	60.5	74.0	-13.5	EUT X, Low Ch
4804.035	31.2	6.8	1.0	7.0	2.2	0.0	Horz	AV	0.0	40.2	54.0	-13.8	EUT Z, Low Ch
2389.783	44.0	-4.0	3.1	202.9	0.0	20.0	Vert	PK	0.0	60.0	74.0	-14.0	EUT X, Low Ch
4803.970	31.0	6.8	1.0	267.0	2.2	0.0	Vert	AV	0.0	40.0	54.0	-14.0	EUT Z, Low Ch
4803.780	30.8	6.8	1.7	90.0	2.2	0.0	Vert	AV	0.0	39.8	54.0	-14.2	EUT Y, Low Ch
4882.660	29.8	7.0	2.3	242.0	2.2	0.0	Horz	AV	0.0	39.0	54.0	-15.0	EUT Y, Mid Ch
4883.680	29.8	7.0	1.0	217.0	2.2	0.0	Vert	AV	0.0	39.0	54.0	-15.0	EUT X, Mid Ch
4803.195	29.3	6.8	1.0	3.0	2.2	0.0	Horz	AV	0.0	38.3	54.0	-15.7	EUT X, Low Ch
7324.725	42.1	14.7	1.0	271.0	0.0	0.0	Horz	PK	0.0	56.8	74.0	-17.2	EUT Y, Mid Ch
7326.920	41.3	14.7	1.0	25.0	0.0	0.0	Vert	PK	0.0	56.0	74.0	-18.0	EUT X, Mid Ch
7440.655	40.9	14.7	1.0	32.0	0.0	0.0	Horz	PK	0.0	55.6	74.0	-18.4	EUT Y, High Ch
7441.385	40.9	14.7	1.0	309.0	0.0	0.0	Vert	PK	0.0	55.6	74.0	-18.4	EUT X, High Ch
12398.720	30.4	0.6	1.0	302.0	2.2	0.0	Vert	AV	0.0	33.2	54.0	-20.8	EUT X, High Ch
12209.870	30.4	0.1	2.8	334.9	2.2	0.0	Vert	AV	0.0	32.7	54.0	-21.3	EUT X, Mid Ch
12399.640	29.8	0.6	1.0	255.9	2.2	0.0	Horz	AV	0.0	32.6	54.0	-21.4	EUT Y, High Ch
12008.800	30.8	-0.5	1.0	199.0	2.2	0.0	Vert	AV	0.0	32.5	54.0	-21.5	EUT X, Low Ch
12211.100	30.3	0.0	1.0	133.0	2.2	0.0	Horz	AV	0.0	32.5	54.0	-21.5	EUT Y, Mid Ch
12009.880	30.5	-0.5	1.0	322.9	2.2	0.0	Horz	AV	0.0	32.2	54.0	-21.8	EUT Y, Low Ch
4960.720	44.3	7.1	2.0	36.0	0.0	0.0	Vert	PK	0.0	51.4	74.0	-22.6	EUT X, High Ch
4960.545	42.8	7.1	3.7	261.0	0.0	0.0	Horz	PK	0.0	49.9	74.0	-24.1	EUT Y, High Ch
4803.090	42.7	6.8	1.3	274.9	0.0	0.0	Horz	PK	0.0	49.5	74.0	-24.5	EUT Y, Low Ch
4803.325	42.5	6.8	2.0	261.0	0.0	0.0	Vert	PK	0.0	49.3	74.0	-24.7	EUT X, Low Ch
4803.755	42.4	6.8	1.0	7.0	0.0	0.0	Horz	PK	0.0	49.2	74.0	-24.8	EUT Z, Low Ch
4883.605	42.0	7.0	2.3	242.0	0.0	0.0	Horz	PK	0.0	49.0	74.0	-25.0	EUT Y, Mid Ch
4803.505	41.6	6.8	1.7	90.0	0.0	0.0	Vert	PK	0.0	48.4	74.0	-25.6	EUT Y, Low Ch
4882.830	41.1	7.1	1.0	217.0	0.0	0.0	Vert	PK	0.0	48.2	74.0	-25.8	EUT X, Mid Ch
4803.655	41.2	6.8	1.0	267.0	0.0	0.0	Vert	PK	0.0	48.0	74.0	-26.0	EUT Z, Low Ch
4804.520	41.0	6.8	1.0	3.0	0.0	0.0	Horz	PK	0.0	47.8	74.0	-26.2	EUT X, Low Ch
12398.790	42.1	0.6	1.0	302.0	0.0	0.0	Vert	PK	0.0	42.7	74.0	-31.3	EUT X, High Ch
12210.660	42.1	0.1	2.8	334.9	0.0	0.0	Vert	PK	0.0	42.2	74.0	-31.8	EUT X, Mid Ch
12010.940	42.5	-0.5	1.0	199.0	0.0	0.0	Vert	PK	0.0	42.0	74.0	-32.0	EUT X, Low Ch
12399.690	41.4	0.6	1.0	255.9	0.0	0.0	Horz	PK	0.0	42.0	74.0	-32.0	EUT Y, High Ch
12008.710	42.2	-0.5	1.0	322.9	0.0	0.0	Horz	PK	0.0	41.7	74.0	-32.3	EUT Y, Low Ch
12210.170	41.4	0.1	1.0	133.0	0.0	0.0	Horz	PK	0.0	41.5	74.0	-32.5	EUT Y, Mid Ch



XMit 2017.12.13

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-21
Attenuator	Fairview Microwave	SA4018-20	TYE	17-Nov-17	17-Nov-18
Block - DC	Fairview Microwave	SD3379	AMT	11-Oct-17	11-Oct-18
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	28-Nov-17	28-Nov-18
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	15-Mar-18	15-Mar-19

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 2017.12.14	4 XMit 2017.
	WPTX					Work Order:		
Serial Number:							26-Jul-18	
	Shottracker					Temperature:		
	Patrick Herron				Humidity: 49.4% RH			
Project:					E	Barometric Pres.:		
	Jonathan Kiefer		Power: 110VAC/60Hz			Job Site:	TX09	
TEST SPECIFICAT	IONS		Test Method					
FCC 15.247:2018			ANSI C63.10:2013					
COMMENTS								
None								
DEVIATIONS EPON								
	M TEST STANDARD							
	M TEST STANDARD							
None			o the xiele					
None	M TEST STANDARD	Signature	Jonsthan Kiefer					
		Signature	Jonathan Kiefer		Number of	Value	Limit	
None		Signature	Jonathan Niefer Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
None Configuration #	3	Signature	Pulse Width			Value (%) 58.9	Limit (%) N/A	Results N/A
None Configuration # BLE/GFSK Low Cha	3 annel, 2402 MHz	Signature	Pulse Width 370.593 us	629.295 us		(%) 58.9	(%) N/A	N/A
None Configuration # BLE/GFSK Low Cha BLE/GFSK Low Cha	3 annel, 2402 MHz annel, 2402 MHz	Signature	Pulse Width 370.593 us N/A	629.295 us N/A		(%) 58.9 N/A	(%) N/A N/A	N/A N/A
None Configuration # BLE/GFSK Low Cha BLE/GFSK Low Cha BLE/GFSK Mid Cha	3 annel, 2402 MHz annel, 2402 MHz Innel, 2440 MHz	Signature	Pulse Width 370.593 us N/A 374.466 us	629.295 us N/A 627.219 us		(%) 58.9 N/A 59.7	(%) N/A N/A N/A	N/A N/A N/A
None	3 annel, 2402 MHz annel, 2402 MHz annel, 2440 MHz nnel, 2440 MHz	Signature	Pulse Width 370.593 us N/A	629.295 us N/A		(%) 58.9 N/A	(%) N/A N/A	N/A N/A



TbtTx 2017.12.14 XMit 2017.12.13

		BLE/GES	SK Low Channel, 2	2402 MH7		
		222,010	Number of	Value	Limit	
	Pulse Width	Period	Pulses	(%)	(%)	Results
	370.593 us	629.295 us	1	58.9	N/A	N/A
	yzer - Element Materials Techr					
LXI RL RF	50 Ω DC	SE	Trig Delay-900.0 µs		: Log-Pwr	02:26:33 PM Jul 26, 2018 TRACE 1 2 3 4 5
		PNO: Fast 🔸	Trig: Video #Atten: 10 dB			TYPE WWWWWW
		IFGain:Low	#Atten: 10 dB			
Ref Of	fset 21.02 dB 2.00 dBm					Mkr3 917.3 µ -7.38 dBr
5 dB/div Ref -2	2.00 dBm	A 1		∆ 2		_7.58 dBi
-7.00		<u>2</u>		Y ²		²
-12.0		/				
-17.0						
-22.0						
-27.0						
-32.0						1
-37.0						, TRIG LV
-42.0						
-47.0						
-47.0						
Center 2.402000						Span 0 H
Res BW 3.0 MHz						
		#VBN	V 30 kHz			1.000 ms (8192 pts
MKR MODELTRO SOL	х	Y	FUNCTION	FUNCTION WIDTH		1.000 ms (8192 pts TION VALUE
MKR MODELTRO SOL	× 288.0 658.6	ү µs -7.74 d µs -7.07 d	FUNCTION IBm IBm	FUNCTION WIDTH		· ·
MKR MODE TRC SCL 1 N 1 t 2 N 1 t 3 N 1 t 4 4 1 t	х	ү µs -7.74 d µs -7.07 d	FUNCTION IBm IBm	FUNCTION WIDTH		· ·
MKR MODE TRC SCL 1 N 1 t 2 N 1 t 3 N 1 t 4 5 5 5	× 288.0 658.6	ү µs -7.74 d µs -7.07 d	FUNCTION IBm IBm	FUNCTION WIDTH		· ·
MKR MODE TRC SCL 1 N 1 t 2 N 1 t 3 N 1 t 4 5 6 6 7 7 7 7	× 288.0 658.6	ү µs -7.74 d µs -7.07 d	FUNCTION IBm IBm	FUNCTION WIDTH		· ·
MKR MODE TRC SCL 1 N 1 t 2 N 1 t 3 N 1 t 4 5 5 5 6 7 5 5 7 8 5 5	× 288.0 658.6	ү µs -7.74 d µs -7.07 d	FUNCTION IBm IBm	FUNCTION WIDTH		· ·
MKR MODE TRC SCLI 1 N 1 t 2 N 1 t 3 N 1 t 4 5 6 6 7 8 9 9	× 288.0 658.6	ү µs -7.74 d µs -7.07 d	FUNCTION IBm IBm	FUNCTION WIDTH		· ·
MKR MODE TRC SCL 1 N 1 t 2 N 1 t 3 N 1 t 4 5 5 5 6 7 7 7 8 9 9 10	× 288.0 658.6	ү µs -7.74 d µs -7.07 d	FUNCTION IBm IBm	FUNCTION WIDTH		· ·
MKR MODE TRC SCL 1 N 1 t 2 N 1 t 3 N 1 t 4 5 5 5 6 7 7 7 8 9 9 10	× 288.0 658.6	ү µs -7.74 d µs -7.07 d	FUNCTION IBm IBm	FUNCTION WIDTH		· ·
MKR MODE TRC SCL 1 N 1 t 2 N 1 t 3 N 1 t 4 5 6 6 7 8 9 9 10 11 8 4 1 4 5 6 7 8 9 10 11 8 7 8 9 9 10 11 8 1 8 1 8 1 8 1 8 1 8 1 8 1	× 288.0 658.6	μ <u>s</u> -7.74 d μs -7.78 d μs -7.38 d	FUNCTION IBm IBm IBm	STATUS		· ·
MKR MODE TRC SCL 1 N 1 t 2 N 1 t 3 N 1 t 4 5 6 6 7 8 9 9 10 11 8 4 1 4 5 6 7 8 9 10 11 8 7 8 9 9 10 11 8 1 8 1 8 1 8 1 8 1 8 1 8 1	× 288.0 658.6	μ <u>s</u> -7.74 d μs -7.78 d μs -7.38 d	FUNCTION	STATUS 2402 MHz	FUNC	· ·
MKR MODE TRC SCL 1 N 1 t 2 N 1 t 3 N 1 t 4 5 6 6 7 8 9 9 10 11 8 4 1 4 5 6 7 8 9 10 11 8 7 8 9 9 10 11 8 1 8 1 8 1 8 1 8 1 8 1 8 1	× 288.0 658.6	μ <u>s</u> -7.74 d μs -7.78 d μs -7.38 d	FUNCTION IBm IBm IBm	STATUS		· ·

Res BW 3.0 MHz	#VBW 30	Sweep 2.832 n	ns (8192 pts)
Center 2.402000000 GHz			Snan () Hz
-47.0			
-42.0			
-37.0			
			TRIG LVL
-32.0			
-27.0			
-22.0			
-17.0			
-12.0			

Keysight

5 dB/di Log



TbtTx 2017.12.14 XMit 2017.12.13 BLE/GFSK Mid Channel, 2440 MHz Number of Value Limit **(%)** 59.7 Pulse Width Period Pulses **(%)** N/A Results 374.466 us 627.219 us N/A 1 02:03:29 PM Jul 26, 2018 TRACE 1 2 3 4 5 6 TYPE WWWWW DET P P P P P P ent Materials Technology SENSE:INT ALIGN OFF Trig Delay-900.0 µs Trig: Video #Atten: 10 dB PNO: Fast +++ IFGain:Low Mkr3 910.6 µs -8.09 dBm ∳³ Ref Offset 21.02 dB Ref -2.00 dBm **⊘**2 \wedge^1

Center 2.440000000	GHz		ļ		S	pan 0 F
Res BW 3.0 MHz		#VBW 30	kHz		Sweep 1.000 ms (8192 pt
MKR MODE TRC SCL	x	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	
1 N 1 t	283.4 µs	-8.72 dBm				
2 N 1 t 3 N 1 t	657.8 μs 910.6 μs	-6.98 dBm -8.09 dBm				
4	010.0 µ0	0.00 0200				
5						
7						
8						
9						
10						

BLE/GFSK Mid Channel, 2440 MHz								
	Number of Value Limit							
	Pulse Width	Period	Pulses	(%)	(%)	Results		
	N/A N/A 5 N/A N/A N/A							

RL	RF	50 Ω C	C		5	SENSE:INT		🛕 ALI	IGN OFF		02:03	34 PM Jul 26, 2018
				PNO: F IFGain:I	ast ↔→ ₋ow	Trig: Vi #Atten:			#Avg Typ	e: Log-Pwr		TRACE 1 2 3 4 5 TYPE WWWWW DET P P P P P
dB/div	Ref Offs Ref -2	set 21.02 .00 dBn	dB N									
					_							
2.0												
7.0												
2.0												
7.0												
2.0												
7.0												TRIG L
2.0												
7.0												
enter 2	.4400000	00 GHz										Span 0 H
	3.0 MHz				#VB۱	№ 30 kH	z			Swee	p 2.822 n	ns (8192 pt



TbtTx 2017.12.14 XMit 2017.12.13

		BLE/GFS	K High Channel, 24			
			Number of	Value	Limit	
	Pulse Width	Period	Pulses	(%)	(%)	Results
	370.216 us	625.389 us	1	59.2	N/A	N/A
Keyright Spectrum Ap	alyzer - Element Materials Technol					
IXI RL RF	50 Ω DC		NSE:INT	ALIGN OFF		02:14:04 PM Jul 26, 2018
		PNO: Fast ↔ → → FGain:Low	Trig Delay-900.0 μs Trig: Video #Atten: 10 dB	#Avg Type:	Log-Pwr	TRACE 1 2 3 4 5 6 TYPE WWWWWW DET P P P P P P
5 dB/div Ref	offset 21.02 dB - 2.00 dBm					Mkr3 914.3 µs -7.48 dBm
Log)1		2		A 3
-7.00						
-12.0						
-17.0						
-22.0						
-27.0						
-32.0						
-37.0						TRIG LVL
-42.0						
-47.0						
Center 2.48000 Res BW 3.0 MH		#VBN	/ 30 kHz		Sweep	Span 0 Hz 1.000 ms (8192 pts)
MKR MODE TRC SCL	X	Y	FUNCTION F	UNCTION WIDTH	FUNC	TION VALUE
1 1						
2 <u>1</u> 3 1						
4						
6						E.
7 8						
9						
10						
		1	m			•
MSG				STATUS		
		BLE/GFS	K High Channel, 24	80 MHz		
			Number of	Value	Limit	
	Pulse Width	Period	Pulses	(%)	(%)	Results
	N/A	N/A	5	N/A	N/A	N/A

RL RF	50 Ω DC		SENSE:INT	ALIGN OFF	02:14:10 PM Jul 26, 2018
		PNO: Fast ↔ IFGain:Low	. Trig: Video #Atten: 10 dB	#Avg Type: Log-Pwr	TRACE 1 2 3 4 5 TYPE WWWW DET P P P P P
Ref Offs dB/div Ref -2	set 21.02 dB .00 dBm				
- .00 7					
2.0					
·.o					
.0					
.0					
.0					
.0					TRIG
.0					
.0					
enter 2.4800000 es BW 3.0 MHz	000 GHz		3W 30 kHz	Sw	Span 0 H eep 2.814 ms (8192 pt
S DW J.V WINZ		#VE	JW JU KHZ	SW	eep 2.814 ills (8192 pl



XMit 2017.12.13

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Attenuator	Fairview Microwave	SA4018-20	TYE	17-Nov-17	17-Nov-18
Block - DC	Fairview Microwave	SD3379	AMT	11-Oct-17	11-Oct-18
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	28-Nov-17	28-Nov-18
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-21
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	15-Mar-18	15-Mar-19

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.

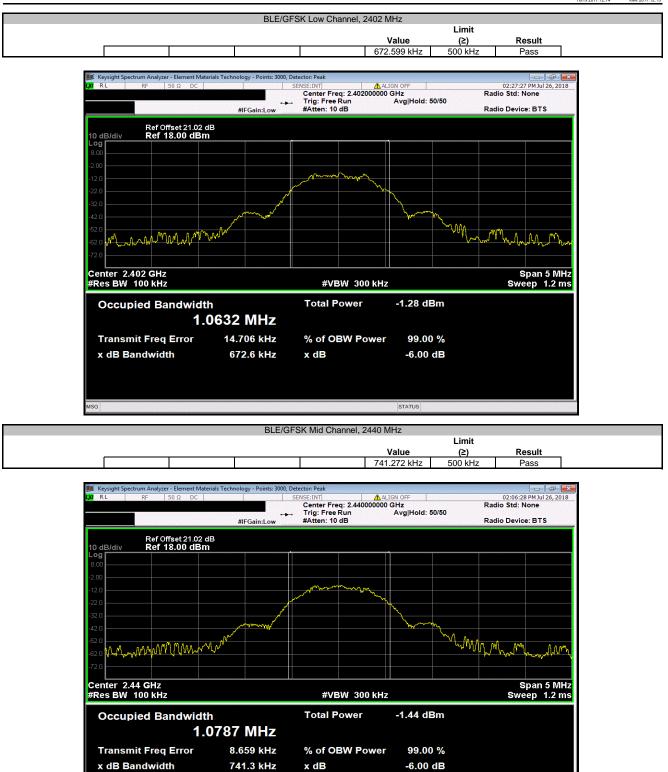
The 6dB occupied bandwidth was measured using 100 kHz resolution bandwidth and 300 kHz video bandwidth. The 99.0% occupied bandwidth was also measured at the same time which can be needed during Output Power depending on the applicable method.



						TbtTx 2017.12.14	XMit 2017.12
EUT: WF	РТХ				Work Order:		AMIL 2017.12
Serial Number: 30						26-Jul-18	
Customer: Sh					Temperature:		
Attendees: Par						50.8% RH	
Project: No	one				Barometric Pres.:	1019 mbar	
Tested by: Jo	nathan Kiefer		Power:	110VAC/60Hz	Job Site:	TX09	
EST SPECIFICATION	S			Test Method			
CC 15.247:2018				ANSI C63.10:2013			
COMMENTS							
lone							
DEVIATIONS FROM TE	EST STANDARD						
lone							
Configuration #	3		Jonathan	Krefer			
		Signature	0				
						Limit	
					Value	(≥)	Result
BLE/GFSK Low Channe					672.599 kHz	500 kHz	Pass
BLE/GFSK Mid Channel					741.272 kHz	500 kHz	Pass
BLE/GFSK High Channe	el. 2480 MHz				694.065 kHz	500 kHz	Pass



TbtTx 2017.12.14 XMit 2017.12.13



STATUS



TbtTx 2017.12.14 XMit 2017.12.13





XMit 2017.12.13

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Attenuator	Fairview Microwave	SA4018-20	TYE	17-Nov-17	17-Nov-18
Block - DC	Fairview Microwave	SD3379	AMT	11-Oct-17	11-Oct-18
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	28-Nov-17	28-Nov-18
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-21
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	15-Mar-18	15-Mar-19

TEST DESCRIPTION

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

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

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

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

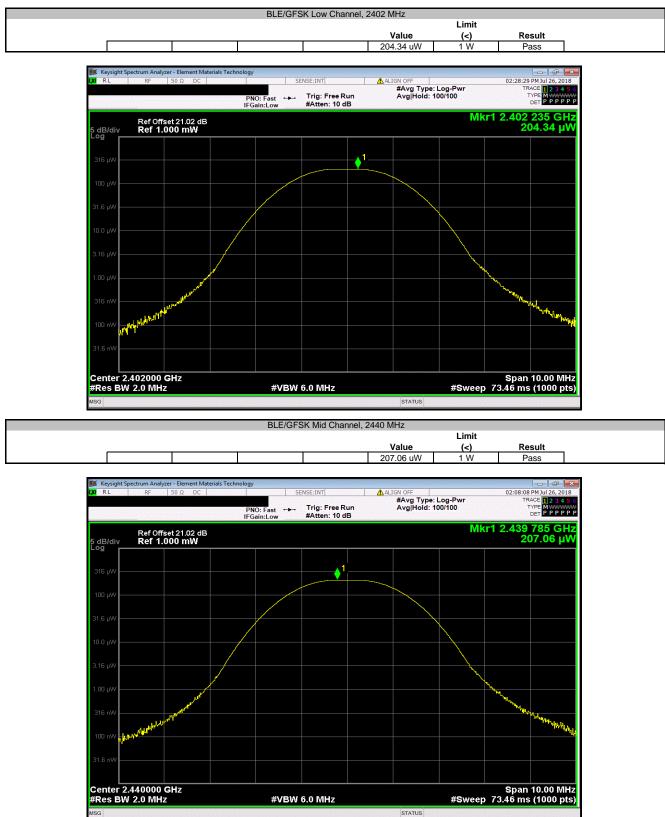


mum have					TbtTx 2017.12.14	XMit 2017.12.
EUT: WF				Work Order:		
Serial Number: 30					26-Jul-18	
Customer: She				Temperature:		
Attendees: Pat					52.5% RH	
Project: No				Barometric Pres.:		
Tested by: Jor			Power: 110VAC/60Hz	Job Site:	TX09	
TEST SPECIFICATIONS	S		Test Method			
FCC 15.247:2018			ANSI C63.10:2013			
COMMENTS						
None						
DEVIATIONS FROM TE	EST STANDARD					
None	-					
Configuration #	3		Jonathan Kiefer			
sonnguration #	5	Signature	Jonathan meger			
	1	2			Limit	
				Value	(<)	Result
BLE/GFSK Low Channe	el. 2402 MHz			204.34 uW	1 W	Pass
						r doo
BLE/GFSK Mid Channel				207.06 uW	1 W	Pass

Report No. SHOT0005.1



TbtTx 2017.12.14 XMit 2017.12.13





TbtTx 2017.12.14 XMit 2017.12.13





XMit 2017.12.13

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Attenuator	Fairview Microwave	SA4018-20	TYE	17-Nov-17	17-Nov-18
Block - DC	Fairview Microwave	SD3379	AMT	11-Oct-17	11-Oct-18
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	28-Nov-17	28-Nov-18
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-21
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	15-Mar-18	15-Mar-19

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.

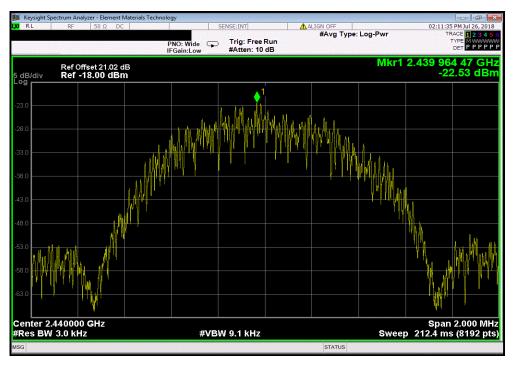


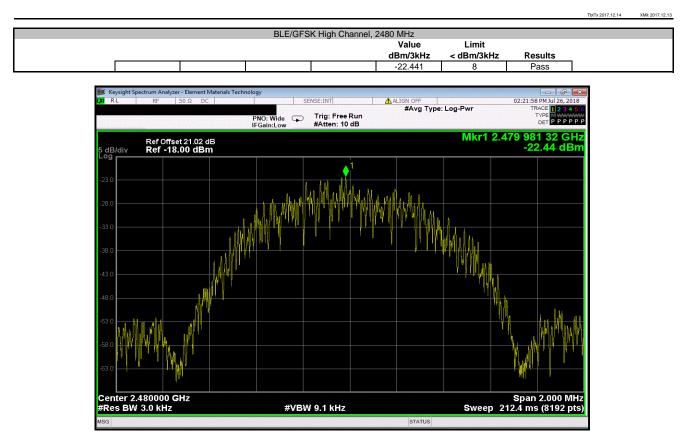
EUT: W					Work Order:		
Serial Number: 30					Date:	26-Jul-18	
Customer: Sh	nottracker				Temperature:	22.8 °C	
Attendees: Pa						53.6% RH	
Project: No					Barometric Pres.:	1019 mbar	
Tested by: Jo			Pov	ver: 110VAC/60Hz	Job Site:	TX09	
EST SPECIFICATION	IS			Test Method			
CC 15.247:2018				ANSI C63.10:2013			
COMMENTS							
None							
None	EST STANDARD						
None DEVIATIONS FROM TR	EST STANDARD						
None	EST STANDARD						
None DEVIATIONS FROM TI None	EST STANDARD		0	Xiele			
None DEVIATIONS FROM TR		Simatura	Joneth	an Kiefer			
None DEVIATIONS FROM TI None		Signature	Jonath	an Kiefe	Value	Limit	
None DEVIATIONS FROM TI None		Signature	Jonath	an Kiefer	Value dBm/2kWz	Limit	Posulte
None DEVIATIONS FROM TI None Configuration #	3	Signature	Jonath	an Kiefer	dBm/3kHz	< dBm/3kHz	Results
None DEVIATIONS FROM TH None Configuration # BLE/GFSK Low Channe	3 el, 2402 MHz	Signature	Jonath	an Kiefe	dBm/3kHz -22.669		Pass
None DEVIATIONS FROM TI None Configuration #	3 el, 2402 MHz J, 2440 MHz	Signature	Jonath	an Kiefer	dBm/3kHz	< dBm/3kHz	



TbtTx 2017.12.14 XMit 2017.12.13 BLE/GFSK Low Channel, 2402 MHz Value Limit dBm/3kHz < dBm/3kHz Results -22.669 8 Pass 02:32:07 PM Jul 26, 2018 RL 🚹 ALI #Avg Type: Log-Pwr RACE 1 2 3 4 5 PNO: Wide Trig: Free Run IFGain:Low #Atten: 10 dB Mkr1 2.401 963 74 GHz -22.67 dBm Ref Offset 21.02 dB Ref -18.00 dBm 5 dB/div Center 2.402000 GHz #Res BW 3.0 kHz Span 2.000 MHz Sweep 212.4 ms (8192 pts) #VBW 9.1 kHz STATUS BLE/GFSK Mid Channel, 2440 MHz Value Limit









BAND EDGE COMPLIANCE



XMit 2017.12.13

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

TEST EQUIPMENT

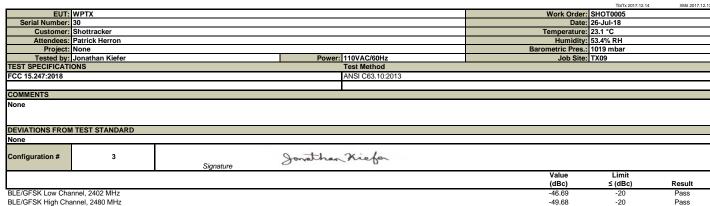
Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Attenuator	Fairview Microwave	SA4018-20	TYE	17-Nov-17	17-Nov-18
Block - DC	Fairview Microwave	SD3379	AMT	11-Oct-17	11-Oct-18
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	28-Nov-17	28-Nov-18
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-21
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	15-Mar-18	15-Mar-19

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

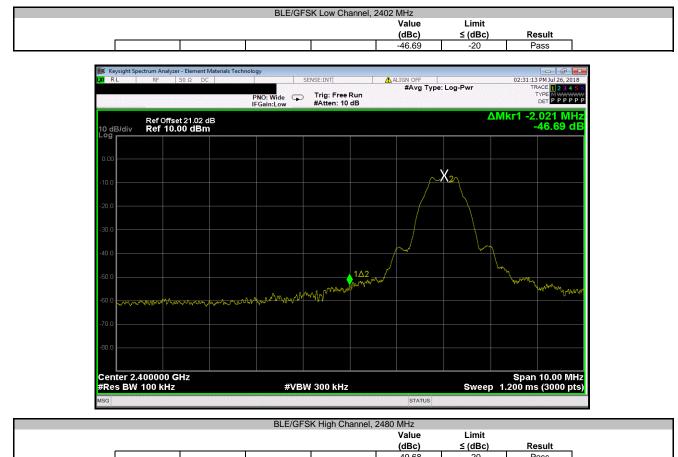


BLE/GFSK High Channel, 2480 MHz

BAND EDGE COMPLIANCE



TbtTx 2017.12.14 XMit 2017.12.13







XMit 2017.12.13

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

TEST EQUIPMENT

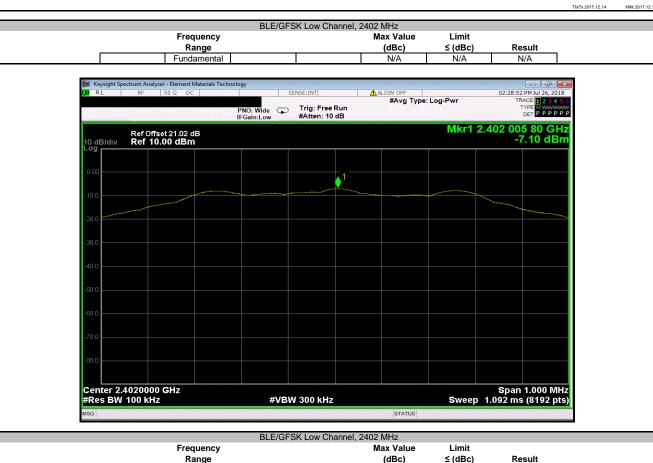
Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Attenuator	Fairview Microwave	SA4018-20	TYE	17-Nov-17	17-Nov-18
Block - DC	Fairview Microwave	SD3379	AMT	11-Oct-17	11-Oct-18
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	28-Nov-17	28-Nov-18
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-21
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	15-Mar-18	15-Mar-19

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.



						TbtTx 2017.12.14	XMit 2017.12.
EUT: WPT	X				Work Order:		
Serial Number: 30						26-Jul-18	
Customer: Shot	tracker				Temperature:	23.3 °C	
Attendees: Patri	ck Herron					52.3% RH	
Project: None	9				Barometric Pres.:	1019 mbar	
Tested by: Jona	ithan Kiefer		Power:	110VAC/60Hz	Job Site:	TX09	
TEST SPECIFICATIONS				Test Method			
FCC 15.247:2018				ANSI C63.10:2013			
COMMENTS							
None							
DEVIATIONS FROM TES	T STANDARD						
None							
				21.1			
Configuration #	3		Jonathan	Kiefer			
Configuration #	3	Signature	Jonathan				
Configuration #	3	Signature	Jonathan	Frequency	Max Value	Limit	
-		Signature	Jonathan	Frequency Range	(dBc)	≤ (dBc)	Result
BLE/GFSK Low Channel, :	2402 MHz	Signature		Frequency Range Fundamental	(dBc) N/A	≤ (dBc) N/A	N/A
BLE/GFSK Low Channel, : BLE/GFSK Low Channel, :	2402 MHz 2402 MHz	Signature		Frequency Range Fundamental 30 MHz - 12.5 GHz	(dBc) N/A -38.43	≤ (dBc) N/A -20	N/A Pass
BLE/GFSK Low Channel, BLE/GFSK Low Channel, BLE/GFSK Low Channel, :	2402 MHz 2402 MHz 2402 MHz 2402 MHz	Signature		Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz	(dBc) N/A -38.43 -45.23	≤ (dBc) N/A -20 -20	N/A Pass Pass
BLE/GFSK Low Channel, BLE/GFSK Low Channel, BLE/GFSK Low Channel, :	2402 MHz 2402 MHz 2402 MHz 2402 MHz	Signature		Frequency Range Fundamental 30 MHz - 12.5 GHz	(dBc) N/A -38.43	≤ (dBc) N/A -20	N/A Pass
BLE/GFSK Low Channel, BLE/GFSK Low Channel, BLE/GFSK Low Channel, BLE/GFSK Mid Channel, 2	2402 MHz 2402 MHz 2402 MHz 2402 MHz 2440 MHz	Signature		Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz	(dBc) N/A -38.43 -45.23	≤ (dBc) N/A -20 -20	N/A Pass Pass
BLE/GFSK Low Channel, BLE/GFSK Low Channel, 3 BLE/GFSK Low Channel, 3 BLE/GFSK Mid Channel, 2 BLE/GFSK Mid Channel, 2	2402 MHz 2402 MHz 2402 MHz 2400 MHz 2440 MHz 2440 MHz	Signature		Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental	(dBc) N/A -38.43 -45.23 N/A	≤ (dBc) N/A -20 -20 N/A	N/A Pass Pass N/A
BLE/GFSK Low Channel, BLE/GFSK Low Channel, BLE/GFSK Low Channel, BLE/GFSK Mid Channel, 2 BLE/GFSK Mid Channel, 2 BLE/GFSK Mid Channel, 2	2402 MHz 2402 MHz 2402 MHz 2400 MHz 2440 MHz 2440 MHz 2440 MHz	Signature		Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz	(dBc) N/A -38.43 -45.23 N/A -45.11	≤ (dBc) N/A -20 -20 N/A -20	N/A Pass Pass N/A Pass
Configuration # BLE/GFSK Low Channel, BLE/GFSK Low Channel, BLE/GFSK Mid Channel, BLE/GFSK Mid Channel, BLE/GFSK Mid Channel, BLE/GFSK High Channel, BLE/GFSK High Channel,	2402 MHz 2402 MHz 2402 MHz 2400 MHz 2440 MHz 2440 MHz 2440 MHz 2480 MHz	Signature		Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz	(dBc) N/A -38.43 -45.23 N/A -45.11 -45.11 -44.73	≤ (dBc) N/A -20 -20 N/A -20 -20	N/A Pass Pass N/A Pass Pass



522, 61 6				
Frequency		Max Value	Limit	
Range		(dBc)	≤ (dBc)	Result
30 MHz - 12.5 GHz		-38.43	-20	Pass

RL	RF 50 \$	2 DC		SENSE:INT	ALIGN OFF	and the second second	02:29:55	PM Jul 26, 2018
			PNO: Fast G		#Avg Type	: Log-Pwr	TR 1	ACE 1 2 3 4 5 TYPE MWWWW DET PPPP
) dB/div	Ref Offset 2 ⁴ Ref 10.00					1	Mkr1 4.8 -45	04 3 GH 5.53 dBi
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.0				dia				
.0	William des and the state	And a second			an a	a di kana di kili kana di kili kana di kili kana di kili kana di kana di kana di kana di kana di kana di kana d	مناجل <u>اور المنامر العن</u>	
.0								
art 0.03	0 GHz						Stop_1	2.500 GF
	100 kHz		#VE	300 kHz		Swe	ep 1.192 s	(8192 pi

XMit 2017.12.13

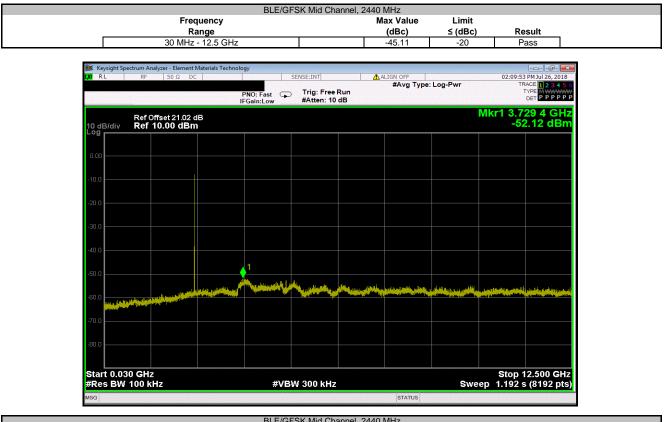


TbtTx 2017.12.14 XMit 2017.12.13 BLE/GFSK Low Channel, 2402 MHz Frequency Max Value Limit Range 12.5 GHz - 25 GHz ≤ (dBc) (dBc) Result -45.23 -20 Pass er - Element Materials Techno 02:30:53 PM Jul 26, 2018 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P P P P P P Keysight S RL GN OFF #Avg Type: Log-Pwr ALI PNO: Fast Trig: Free Run IFGain:Low #Atten: 10 dB Mkr1 24.989 3 GHz -52.33 dBm Ref Offset 21.02 dB Ref 10.00 dBm 10 dB/div Log a ball the base بالطغ a la sub de la sub d فعلول حرور فال Stop 25.000 GHz Sweep 1.195 s (8192 pts) Start 12.500 GHz #Res BW 100 kHz #VBW 300 kHz STATUS

		BLE/GFSK Mid Channel,	2440 MHz			
	Frequency		Max Value	Limit		
_	Range		(dBc)	≤ (dBc)	Result	
	Fundamental		N/A	N/A	N/A	

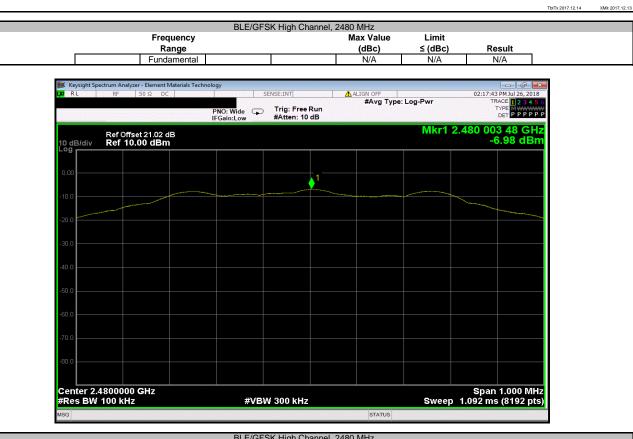
RL RF 50	Ω DC	1	SENSE:INT	ALIGN OFF	02:08:44 PM Jul 26, 201
		PNO: Wide 😱	Trig: Free Run #Atten: 10 dB	#Avg Type: Log-Pwr	TRACE 1 2 3 4 5 TYPE M WWW DET P P P P
Ref Offset 2 dB/div Ref 10.00	1.02 dB dBm			M	kr1 2.440 007 75 GH -7.01 dBi
).0		~			
0.0					
I.O					
).0					
.0					
.0					
.0					
enter 2.4400000 GH	iz				Span 1.000 MI veep 1.092 ms (8192 pt
Res BW 100 kHz		#VB	W 300 kHz	Sv	veep 1.092 ms (8192 pt

TbtTx 2017.12.14 XMit 2017.12.13



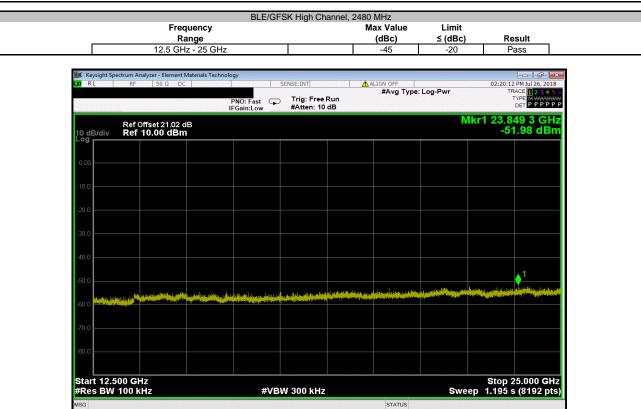
	BLE/GFS	SK Mid Channel, 2440 MHz			
	Frequency Max Value Limit				
	Range	(dBc)	≤ (dBc)	Result	
[12.5 GHz - 25 GHz	-44.73	-20	Pass	

RL	RF 50 Ω DC		S	ENSE:INT	٨۵	LIGN OFF		02:10:	52 PM Jul 26, 201
	, por co	PNO: F IFGain:	ast 🖵	Trig: Free F #Atten: 10	Run	#Avg Type:	Log-Pwr		TYPE MWWW DET PPPP
) dB/div	Ref Offset 21.02 di Ref 10.00 dBm	3						Mkr1 23. -5	713 5 GH 1.74 dB
.00									
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D.O									
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		Torthean and a series of a second	nen an fer sin der sin						
).0									
tart 12.50 Res BW 1			#VBV	V 300 kHz			Sw	Stop eep 1.195	25.000 GH s (8192 pt



BLE/GFSK High Channel, 2480 MHz							
Frequency	Max Value	Limit					
Range	(dBc)	≤ (dBc)	Result				
30 MHz - 12.5 GHz	-43.71	-20	Pass				

PNO: Fast IFGain:Low Trig: Free Run #Atten: 10 dB #Avg Type: Log-Pwr Type: Log-Pwr Trace II 2 and Type: Log-Pwr Ref Offset 21.02 dB Mkr1 4.961 1 G -50.69 dI	RL	Spectrum Analyzer - El	2 DC	55	SENSE:INT		LIGN OFF		02:18:45	PM Jul 26, 2018
Balain Ref 10.00 dBm -50.69 dE 000 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - <				PNO: Fast (IFGain:Low	Trig: Free	Run		Log-Pwr	TF	ACE 1 2 3 4 5 TYPE M WWWW DET P P P P P
1000 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				1				1	Mkr1 4.9 -50	61 1 GH).69 dBr
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	.00									
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	.0	المتعادية والمحاجلين	and the start from	A here a state of the second state of the seco		فالملجع وإراده المتعلم	ak in all in an all in a sub	al the second		
).0									
art 0.030 GHz Stop 12.500 G Res BW 100 kHz #VBW 300 kHz Sweep 1.192 s (8192				#\	/BW 300 kHz	<u>.</u>		Swe	Stop 1 eep 1.192 s	2.500 GI (8192 pi





TbtTx 2017.12.14 XMit 2017.12.13