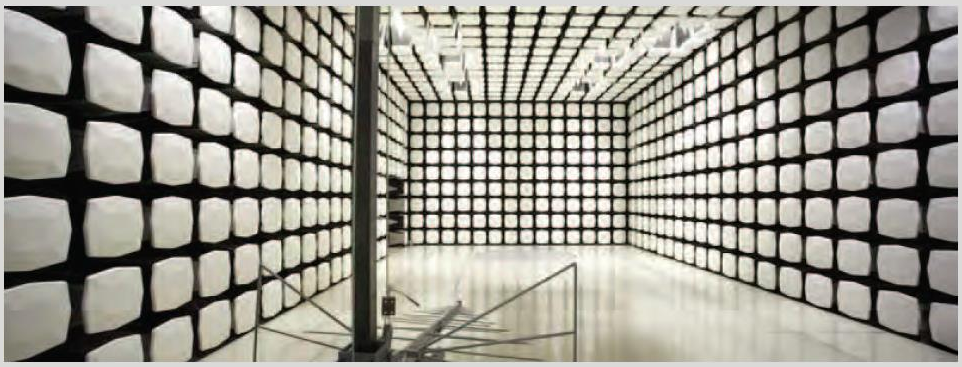
Remote Technologies, Inc.

TXB-DB2 Dual Transmitter Module

FCC 15.247:2019

2.4 GHz DTS Radio

Report # REMT0034



NVLAP LAB CODE: 200881-0

CERTIFICATE OF TEST

Last Date of Test: April 11, 2019
Remote Technologies, Inc.
Model: TXB-DB2 Dual Transmitter Module

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2019	ANSI C63.10:2013, KDB 558074

Results

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

Deviations From Test Standards

None

Approved By:

Matt Nuernberg, Operations Manager

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

REVISION HISTORY

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

ACCREDITATIONS AND AUTHORIZATIONS

United States

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

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

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

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

European Union

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

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

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

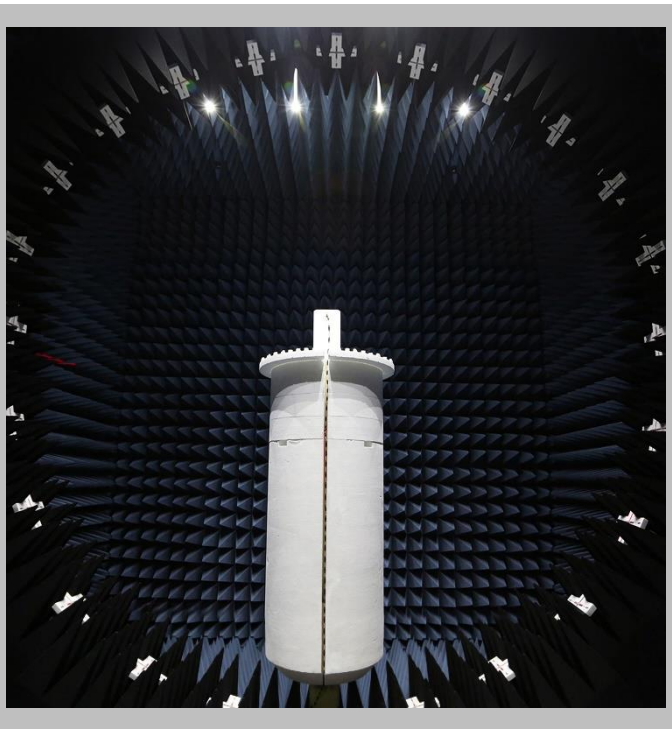
SCOPE

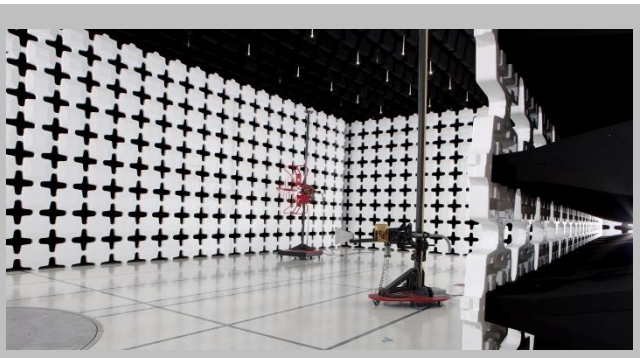
For details on the Scopes of our Accreditations, please visit:
https://www.nwemc.com/emc-testing-accreditations

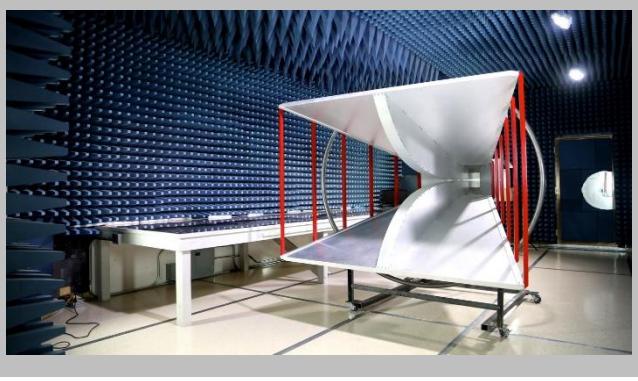
FACILITIES

element
2019.03.08

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







MEASUREMENT UNCERTAINTY

element
TMU.2015.07.10

Measurement Uncertainty

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

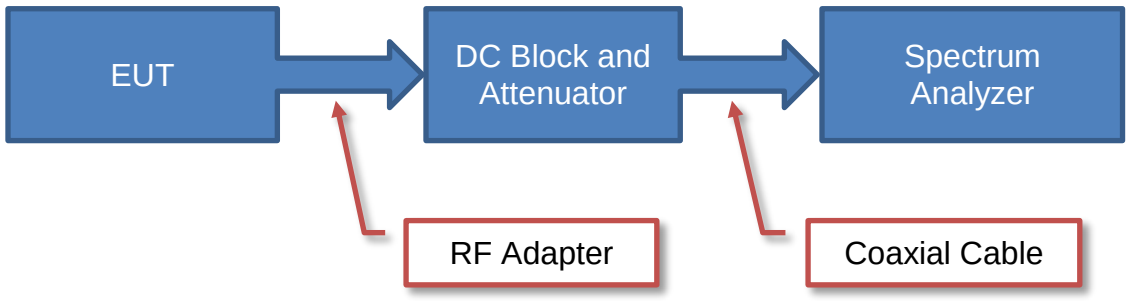
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable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

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

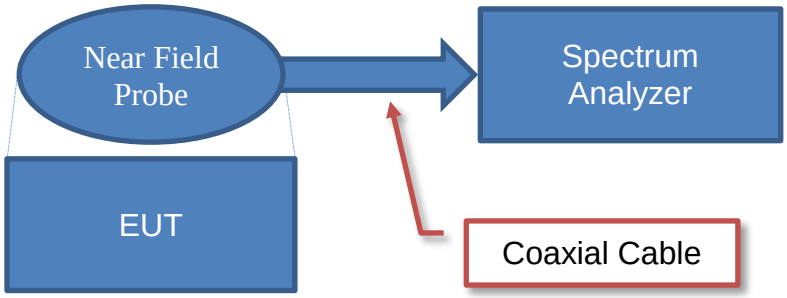
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%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

Test Setup Block Diagrams

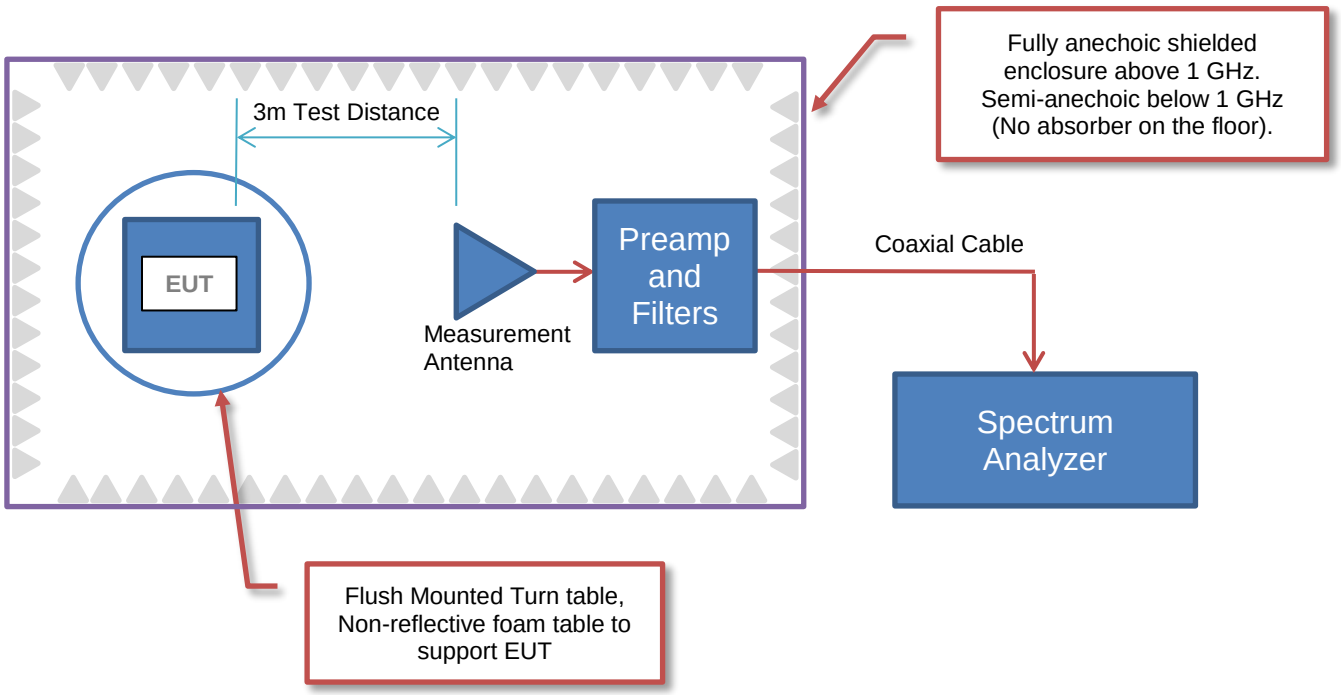
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Remote Technologies, Inc.
Address:	5775 12th Avenue East, Suite 180
City, State, Zip:	Shakopee, MN 55379
Test Requested By:	Mark Melville
Model:	TXB-DB2 Dual Transmitter Module
First Date of Test:	April 10, 2019
Last Date of Test:	April 11, 2019
Receipt Date of Samples:	April 4, 2019
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Module with ZigBee and 433 MHz radios

Testing Objective:
To demonstrate compliance of the 2.4 GHz DTS radio to FCC 15.247 requirements.

CONFIGURATIONS

Configuration REMT0034- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote	Remote Technologies Inc.	T4x	Regulatory 1

Configuration REMT0034- 2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote	Remote Technologies Inc.	T4x	Regulatory 2

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2019-04-10	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	2019-04-11	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2019-04-11	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	2019-04-11	Equivalent Isotropic Radiated Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
5	2019-04-11	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
6	2019-04-11	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
7	2019-04-11	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWER SETTINGS

The EUT was tested using the power settings provided by the manufacturer:

SETTINGS FOR ALL TESTS IN THIS REPORT

Modulation Types	Position	Power Setting
ZigBee	Low Channel	+13 dBm
	Mid Channel	+13 dBm
	High Channel	+13 dBm

SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2019.02.26

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 802.15.4 - low channel (2405 MHz), mid channel (2440 MHz), and high channel (2480 MHz) modulated

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

REMT0034 - 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
Attenuator	Fairview Microwave	SA18E-20	TWZ	24-Sep-2018	12 mo
Filter - High Pass	Micro-Tronics	HPM50111	LFN	24-Sep-2018	12 mo
Filter - Low Pass	Micro-Tronics	LPM50004	LFK	24-Sep-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	13-Sep-2018	12 mo
Cable	ESM Cable Corp	TTBJ141 KMKM-72	MNP	12-Sep-2018	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AHG	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVW	8-Feb-2019	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AIQ	NCR	0 mo
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	8-Mar-2019	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	8-Feb-2019	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	8-Feb-2019	12 mo
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	24-Sep-2018	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AJA	27-Jun-2018	24 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	2-Nov-2018	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	2-Nov-2018	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AYD	25-Jan-2018	24 mo
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	13-Dec-2018	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 antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies and the modes as showed in the data sheets.

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

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

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

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

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

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

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

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

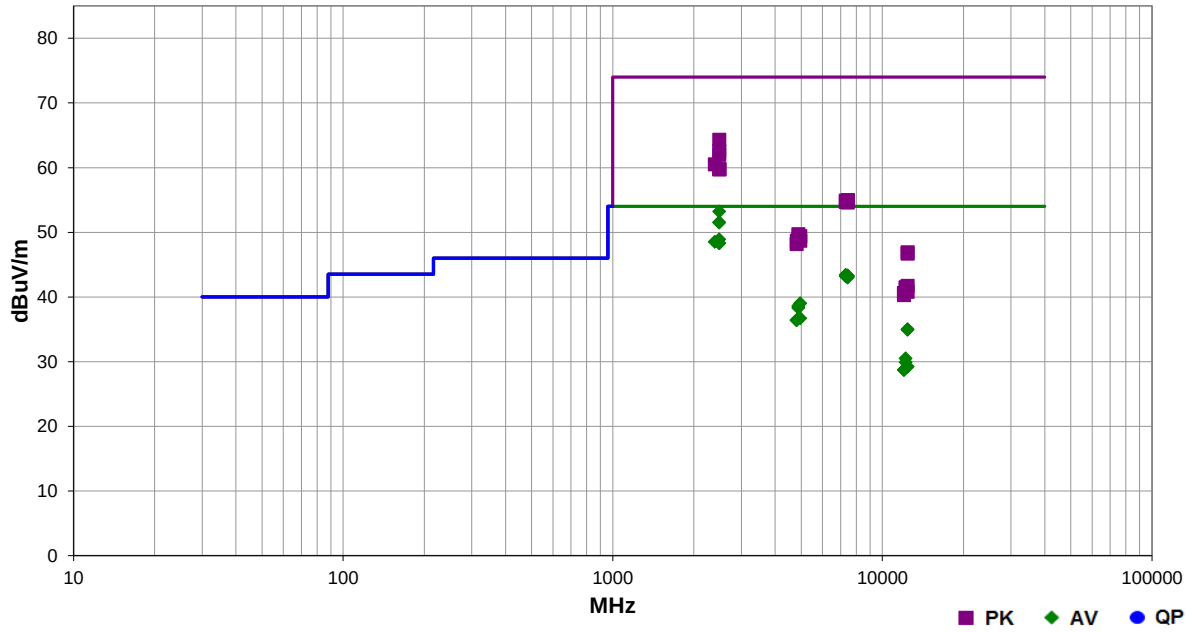
SPURIOUS RADIATED EMISSIONS

EmiR5 2018.09.26 PSA-ESCI 2019.02.26

Work Order:	REMT0034	**Date:**	10-Apr-2019		
Project:	None	**Temperature:**	22.6 °C		
Job Site:	MN05	**Humidity:**	28% RH		
Serial Number:	Regulatory 1	**Barometric Pres.:**	1020 mbar	**Tested by:**	Dustin Sparks
EUT:	TXB-DB2 Dual Transmitter Module				
Configuration:	1				
Customer:	Remote Technologies, Inc.				
Attendees:	None				
EUT Power:	Battery				
Operating Mode:	Transmitting 802.15.4 - low channel (2405 MHz), mid channel (2440 MHz), and high channel (2480 MHz) modulated				
Deviations:	None				
Comments:	100% duty cycle				

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

Run #	12	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



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
2483.500	36.9	-3.7	1.0	166.0	3.0	20.0	Horz	AV	0.0	53.2	54.0	-0.8	High ch, EUT on side
2483.517	35.2	-3.7	1.0	175.9	3.0	20.0	Horz	AV	0.0	51.5	54.0	-2.5	High ch, EUT horizontal
2483.500	35.2	-3.7	1.0	18.0	3.0	20.0	Vert	AV	0.0	51.5	54.0	-2.5	High ch, EUT horizontal
2483.533	32.6	-3.7	1.0	347.0	3.0	20.0	Vert	AV	0.0	48.9	54.0	-5.1	High ch, EUT vertical
2389.075	31.6	-3.1	1.0	70.0	3.0	20.0	Horz	AV	0.0	48.5	54.0	-5.5	Low ch, EUT on side
2483.525	32.0	-3.7	1.0	228.9	3.0	20.0	Vert	AV	0.0	48.3	54.0	-5.7	High ch, EUT on side
2483.783	32.0	-3.7	1.0	132.9	3.0	20.0	Horz	AV	0.0	48.3	54.0	-5.7	High ch, EUT vertical
2483.500	48.0	-3.7	1.0	166.0	3.0	20.0	Horz	PK	0.0	64.3	74.0	-9.7	High ch, EUT on side
7318.308	31.6	11.8	1.0	16.0	3.0	0.0	Vert	AV	0.0	43.4	54.0	-10.6	Mid ch, EUT horizontal
7441.075	31.2	12.1	1.1	16.9	3.0	0.0	Vert	AV	0.0	43.3	54.0	-10.7	High ch, EUT horizontal
7438.217	31.2	12.1	1.0	235.9	3.0	0.0	Vert	AV	0.0	43.3	54.0	-10.7	High ch, EUT vertical
7438.175	31.1	12.1	1.0	246.0	3.0	0.0	Horz	AV	0.0	43.2	54.0	-10.8	High ch, EUT on side
7317.858	31.4	11.8	1.0	256.0	3.0	0.0	Horz	AV	0.0	43.2	54.0	-10.8	Mid ch, EUT horizontal
7438.142	31.0	12.1	1.0	29.0	3.0	0.0	Horz	AV	0.0	43.1	54.0	-10.9	High ch, EUT horizontal
7438.033	31.0	12.1	1.0	109.0	3.0	0.0	Vert	AV	0.0	43.1	54.0	-10.9	High ch, EUT on side
7440.775	30.9	12.1	1.0	186.9	3.0	0.0	Horz	AV	0.0	43.0	54.0	-11.0	High ch, EUT vertical
2483.533	46.3	-3.7	1.0	175.9	3.0	20.0	Horz	PK	0.0	62.6	74.0	-11.4	High ch, EUT horizontal
2483.500	45.7	-3.7	1.0	18.0	3.0	20.0	Vert	PK	0.0	62.0	74.0	-12.0	High ch, EUT horizontal

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
2389.608	43.6	-3.1	1.0	70.0	3.0	20.0	Horz	PK	0.0	60.5	74.0	-13.5	Low ch, EUT on side
2484.583	43.5	-3.7	1.0	228.9	3.0	20.0	Vert	PK	0.0	59.8	74.0	-14.2	High ch, EUT on side
2484.350	43.5	-3.7	1.0	347.0	3.0	20.0	Vert	PK	0.0	59.8	74.0	-14.2	High ch, EUT vertical
2485.142	43.4	-3.7	1.0	132.9	3.0	20.0	Horz	PK	0.0	59.7	74.0	-14.3	High ch, EUT vertical
4958.825	34.3	4.7	1.0	286.9	3.0	0.0	Horz	AV	0.0	39.0	54.0	-15.0	High ch, EUT horizontal
4878.758	34.1	4.5	1.0	221.0	3.0	0.0	Horz	AV	0.0	38.6	54.0	-15.4	Mid ch, EUT horizontal
4878.742	33.8	4.5	1.0	0.0	3.0	0.0	Vert	AV	0.0	38.3	54.0	-15.7	Mid ch, EUT horizontal
4958.958	32.0	4.7	1.0	328.0	3.0	0.0	Vert	AV	0.0	36.7	54.0	-17.3	High ch, EUT horizontal
4808.242	32.0	4.4	1.0	357.0	3.0	0.0	Horz	AV	0.0	36.4	54.0	-17.6	Low ch, EUT horizontal
4807.900	32.0	4.4	1.0	317.0	3.0	0.0	Vert	AV	0.0	36.4	54.0	-17.6	Low ch, EUT horizontal
7442.475	42.9	12.1	1.0	186.9	3.0	0.0	Horz	PK	0.0	55.0	74.0	-19.0	High ch, EUT vertical
12400.360	29.6	5.4	1.0	67.9	3.0	0.0	Vert	AV	0.0	35.0	54.0	-19.0	High ch, EUT horizontal
7318.117	43.1	11.8	1.0	16.0	3.0	0.0	Vert	PK	0.0	54.9	74.0	-19.1	Mid ch, EUT horizontal
12400.200	29.5	5.4	1.5	109.0	3.0	0.0	Horz	AV	0.0	34.9	54.0	-19.1	High ch, EUT horizontal
7439.008	42.7	12.1	1.1	16.9	3.0	0.0	Vert	PK	0.0	54.8	74.0	-19.2	High ch, EUT horizontal
7441.875	42.7	12.1	1.0	246.0	3.0	0.0	Horz	PK	0.0	54.8	74.0	-19.2	High ch, EUT on side
7442.158	42.7	12.1	1.0	109.0	3.0	0.0	Vert	PK	0.0	54.8	74.0	-19.2	High ch, EUT on side
7441.283	42.7	12.1	1.0	235.9	3.0	0.0	Vert	PK	0.0	54.8	74.0	-19.2	High ch, EUT vertical
7318.617	42.9	11.8	1.0	256.0	3.0	0.0	Horz	PK	0.0	54.7	74.0	-19.3	Mid ch, EUT horizontal
7438.858	42.5	12.1	1.0	29.0	3.0	0.0	Horz	PK	0.0	54.6	74.0	-19.4	High ch, EUT horizontal
12202.480	32.3	-1.8	1.0	227.0	3.0	0.0	Vert	AV	0.0	30.5	54.0	-23.5	Mid ch, EUT horizontal
12202.480	31.7	-1.8	1.0	250.0	3.0	0.0	Horz	AV	0.0	29.9	54.0	-24.1	Mid ch, EUT horizontal
4880.992	45.2	4.5	1.0	221.0	3.0	0.0	Horz	PK	0.0	49.7	74.0	-24.3	Mid ch, EUT horizontal
4958.908	44.7	4.7	1.0	286.9	3.0	0.0	Horz	PK	0.0	49.4	74.0	-24.6	High ch, EUT horizontal
12397.880	29.8	-0.6	1.0	276.9	3.0	0.0	Horz	AV	0.0	29.2	54.0	-24.8	High ch, EUT horizontal
12397.720	29.8	-0.6	1.0	185.0	3.0	0.0	Vert	AV	0.0	29.2	54.0	-24.8	High ch, EUT horizontal
4878.625	44.5	4.5	1.0	0.0	3.0	0.0	Vert	PK	0.0	49.0	74.0	-25.0	Mid ch, EUT horizontal
4961.183	44.0	4.7	1.0	328.0	3.0	0.0	Vert	PK	0.0	48.7	74.0	-25.3	High ch, EUT horizontal
4812.483	44.3	4.4	1.0	357.0	3.0	0.0	Horz	PK	0.0	48.7	74.0	-25.3	Low ch, EUT horizontal
12026.960	30.8	-2.1	1.0	315.0	3.0	0.0	Horz	AV	0.0	28.7	54.0	-25.3	Low ch, EUT horizontal
12027.150	30.8	-2.1	1.0	135.0	3.0	0.0	Vert	AV	0.0	28.7	54.0	-25.3	Low ch, EUT horizontal
4809.717	43.8	4.4	1.0	317.0	3.0	0.0	Vert	PK	0.0	48.2	74.0	-25.8	Low ch, EUT horizontal
12401.940	41.5	5.4	1.0	67.9	3.0	0.0	Vert	PK	0.0	46.9	74.0	-27.1	High ch, EUT horizontal
12400.350	41.3	5.4	1.5	109.0	3.0	0.0	Horz	PK	0.0	46.7	74.0	-27.3	High ch, EUT horizontal
12397.630	42.3	-0.6	1.0	276.9	3.0	0.0	Horz	PK	0.0	41.7	74.0	-32.3	High ch, EUT horizontal
12198.110	43.3	-1.8	1.0	227.0	3.0	0.0	Vert	PK	0.0	41.5	74.0	-32.5	Mid ch, EUT horizontal
12202.260	43.2	-1.8	1.0	250.0	3.0	0.0	Horz	PK	0.0	41.4	74.0	-32.6	Mid ch, EUT horizontal
12398.190	41.4	-0.6	1.0	185.0	3.0	0.0	Vert	PK	0.0	40.8	74.0	-33.2	High ch, EUT horizontal
12024.810	42.8	-2.2	1.0	315.0	3.0	0.0	Horz	PK	0.0	40.6	74.0	-33.4	Low ch, EUT horizontal
12025.890	42.4	-2.1	1.0	135.0	3.0	0.0	Vert	PK	0.0	40.3	74.0	-33.7	Low ch, EUT horizontal

DUTY CYCLE

TEST DESCRIPTION

The Duty Cycle (x) were 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 direct connection was made between the RF output of the EUT and a spectrum analyzer. Attenuation and a DC block were used

The duty cycle was calculated by dividing the transmission pulse duration (T) by the total period of a single on and total off time.

The EUT operates at 100% Duty Cycle.

OCCUPIED BANDWIDTH

XMit 2019.02.26

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-19	15-Mar-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	27-Apr-18	27-Apr-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.

OCCUPIED BANDWIDTH

TbtTx 2018.09.13 XMit 2019.02.26

EUT:	**TXB-DB2 Dual Transmitter Module**			**Work Order:**	**REMT0034**
Serial Number:	**Regulatory 2**			**Date:**	**11-Apr-19**
Customer:	**Remote Technologies, Inc.**			**Temperature:**	**22.2 °C**
Attendees:	**None**			**Humidity:**	**27.7% RH**
Project:	**None**			**Barometric Pres.:**	**1004 mbar**
Tested by:	**Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

Configuration #	**2**	*Signature* Dustin Sparks

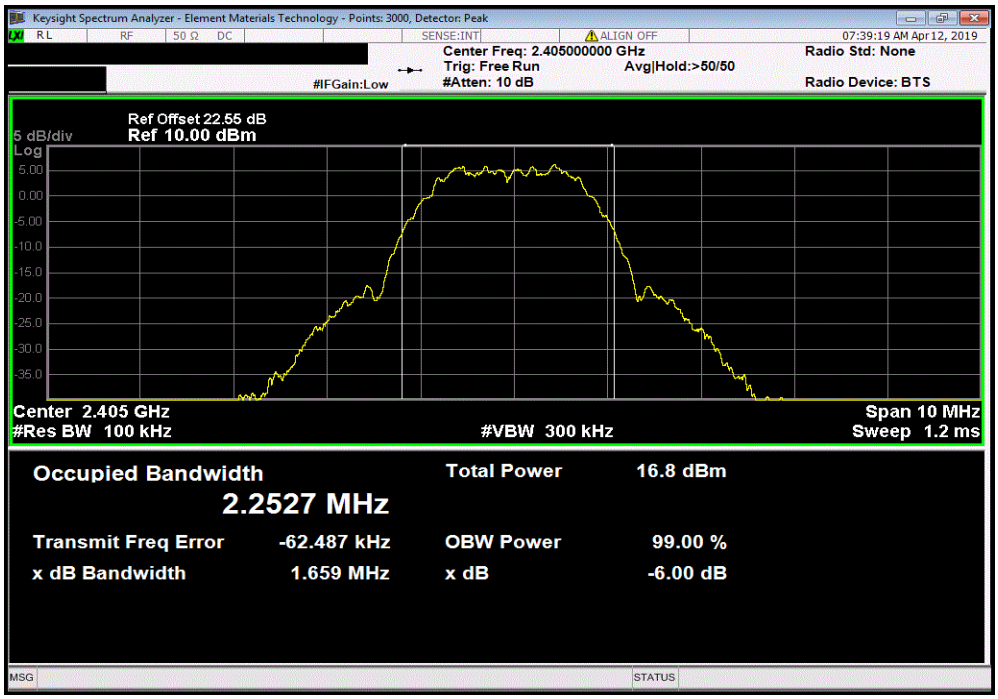
	Value	**Limit (>)**	**Result**
802.15.4, Low Channel, 2405 MHz	1.659 MHz	500 kHz	Pass
802.15.4, Mid Channel, 2440 MHz	1.659 MHz	500 kHz	Pass
802.15.4, High Channel, 2480 MHz	1.659 MHz	500 kHz	Pass

OCCUPIED BANDWIDTH

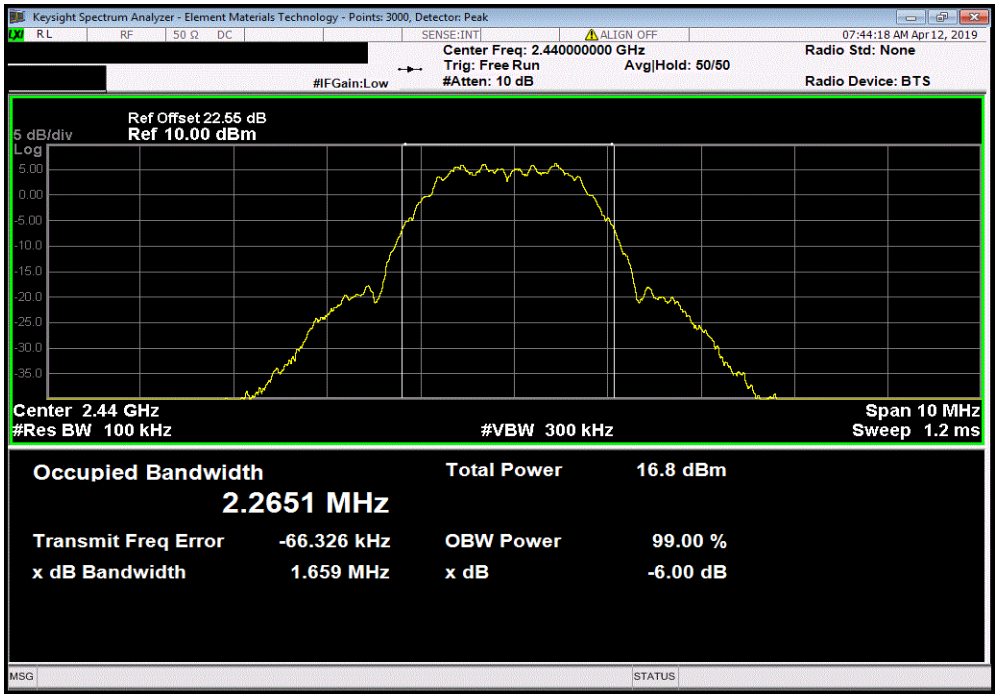
element

TbtTx 2018.09.13 XMit 2019.02.26

802.15.4, Low Channel, 2405 MHz						
				Value	Limit (>)	Result
				1.659 MHz	500 kHz	Pass

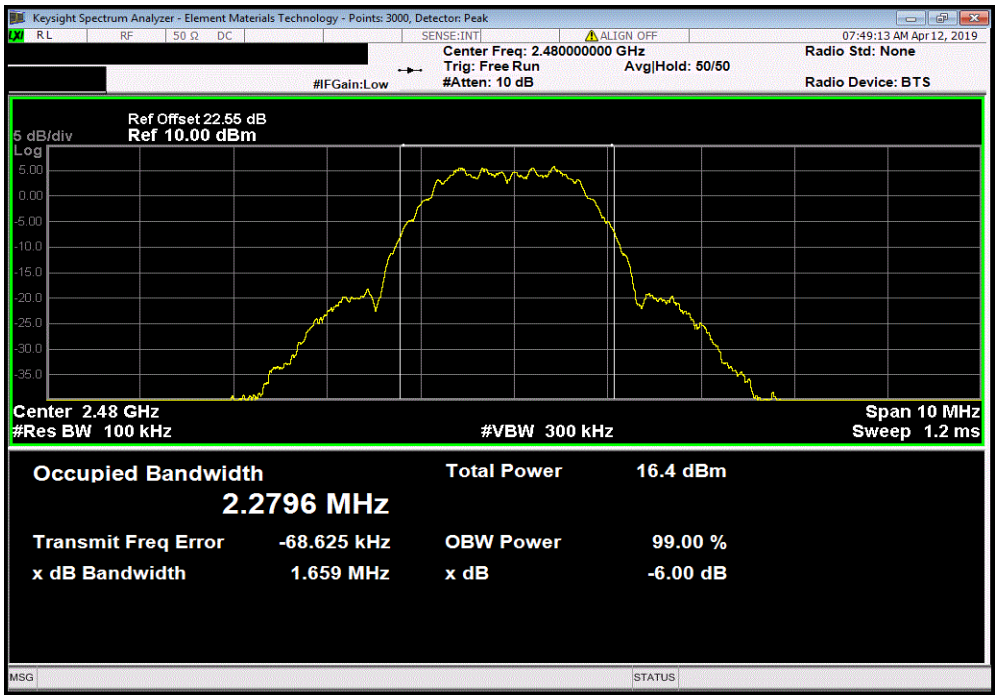


802.15.4, Mid Channel, 2440 MHz						
				Value	Limit (>)	Result
				1.659 MHz	500 kHz	Pass



OCCUPIED BANDWIDTH

802.15.4, High Channel, 2480 MHz						
				Value	Limit (>)	Result
				1.659 MHz	500 kHz	Pass



OUTPUT POWER

XMit 2019.02.26

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-19	15-Mar-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	27-Apr-18	27-Apr-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.

OUTPUT POWER

TbtTx 2018.09.13 XMit 2019.02.26

EUT:	**TXB-DB2 Dual Transmitter Module**			**Work Order:**	**REMT0034**
Serial Number:	**Regulatory 2**			**Date:**	**11-Apr-19**
Customer:	**Remote Technologies, Inc.**			**Temperature:**	**22.2 °C**
Attendees:	**None**			**Humidity:**	**27.7% RH**
Project:	**None**			**Barometric Pres.:**	**1004 mbar**
Tested by:	**Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

None

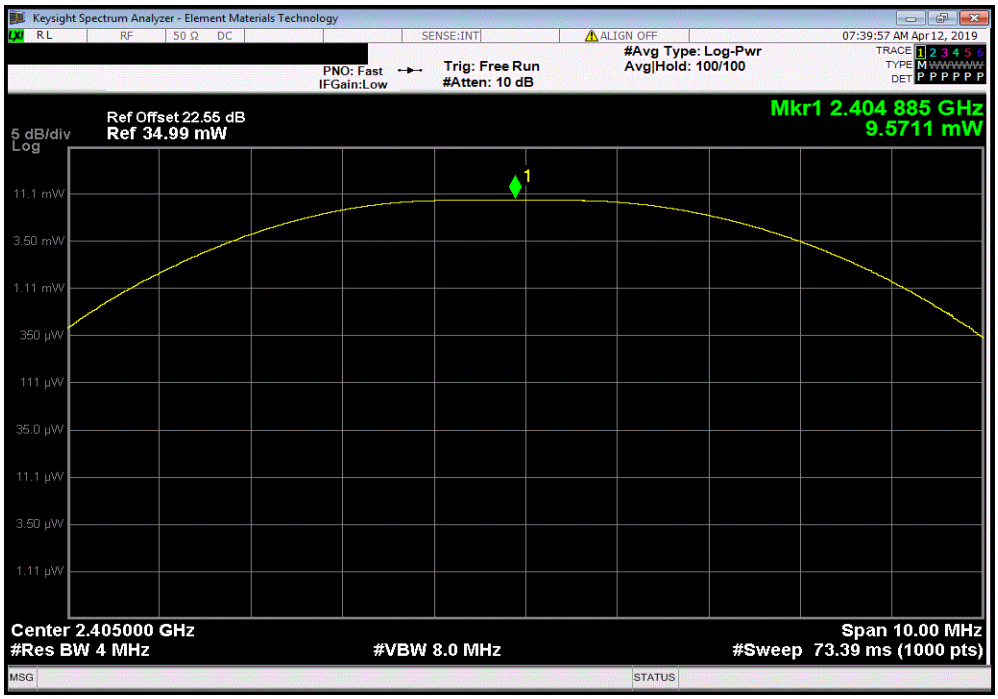
DEVIATIONS FROM TEST STANDARD

None

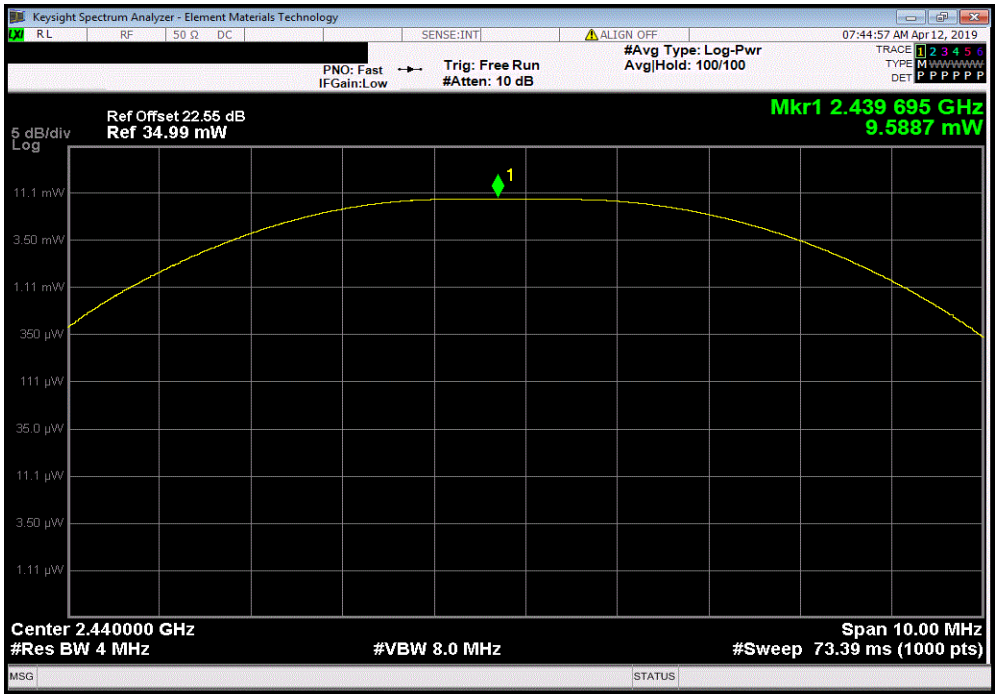
Configuration #	**2**	*Signature* Dustin Sparks

	Value	**Limit (<)**	**Result**
802.15.4, Low Channel, 2405 MHz	9.571 mW	1 W	Pass
802.15.4, Mid Channel, 2440 MHz	9.589 mW	1 W	Pass
802.15.4, High Channel, 2480 MHz	8.829 mW	1 W	Pass

802.15.4, Low Channel, 2405 MHz						
				Value	Limit (<)	Result
				9.571 mW	1 W	Pass

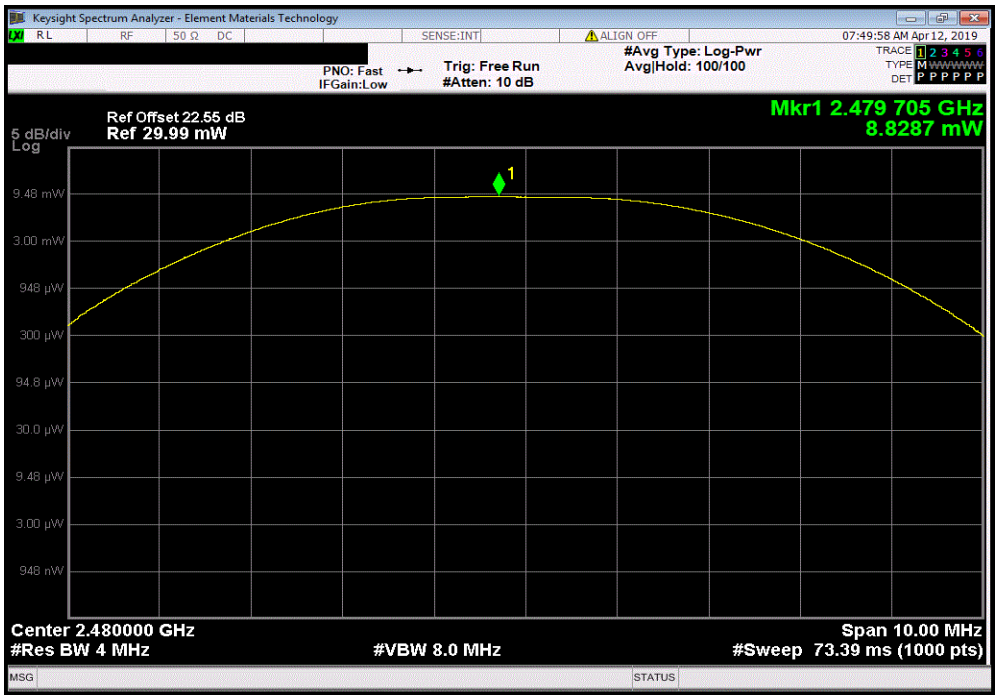


802.15.4, Mid Channel, 2440 MHz						
				Value	Limit (<)	Result
				9.589 mW	1 W	Pass



OUTPUT POWER

802.15.4, High Channel, 2480 MHz						
				Value	Limit (<)	Result
				8.829 mW	1 W	Pass



EQUIVALENT ISOTROPIC RADIATED POWER

XMit 2019.02.26

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-19	15-Mar-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	27-Apr-18	27-Apr-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.

The antenna gain in dBi was added to the measured value to obtain the EIRP.

EQUIVALENT ISOTROPIC RADIATED POWER

element

TbtTx 2018.09.13 XMit 2019.02.26

EUT:	**TXB-DB2 Dual Transmitter Module**			**Work Order:**	**REMT0034**
Serial Number:	**Regulatory 2**			**Date:**	**11-Apr-19**
Customer:	**Remote Technologies, Inc.**			**Temperature:**	**22.2 °C**
Attendees:	**None**			**Humidity:**	**27.7% RH**
Project:	**None**			**Barometric Pres.:**	**1004 mbar**
Tested by:	**Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

Configuration #	**2**	*Signature* Dustin Sparks

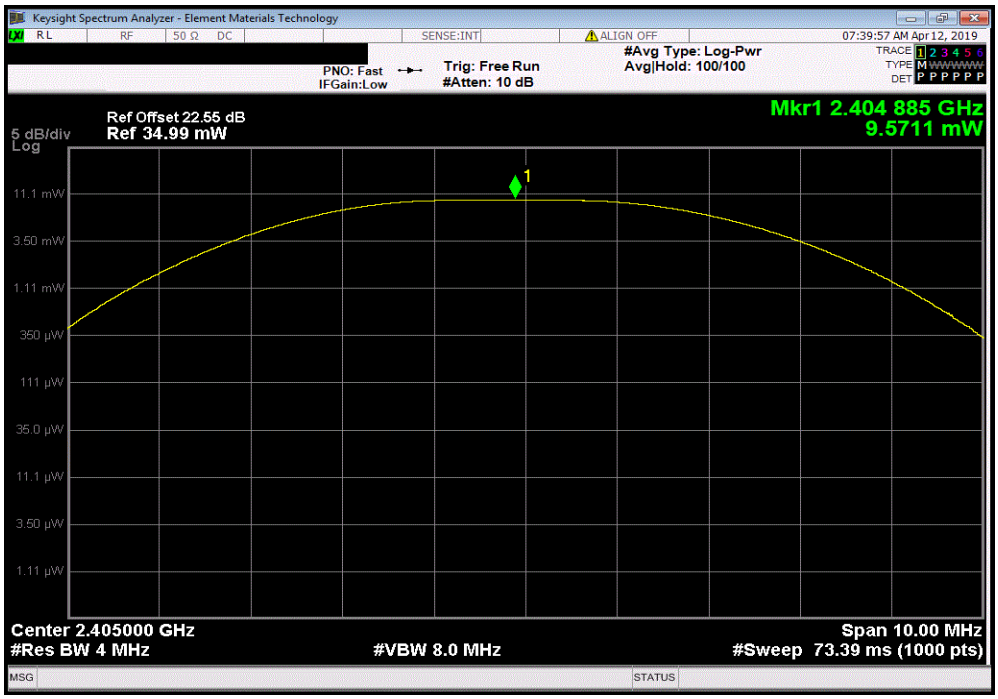
	Value	Value (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (<)	Result
802.15.4, Low Channel, 2405 MHz	9.571 mW	9.81	1.8	11.61	36 dBm	Pass
802.15.4, Mid Channel, 2440 MHz	9.589 mW	9.82	1.8	11.62	36 dBm	Pass
802.15.4, High Channel, 2480 MHz	8.829 mW	9.46	1.8	11.26	36 dBm	Pass

EQUIVALENT ISOTROPIC RADIATED POWER

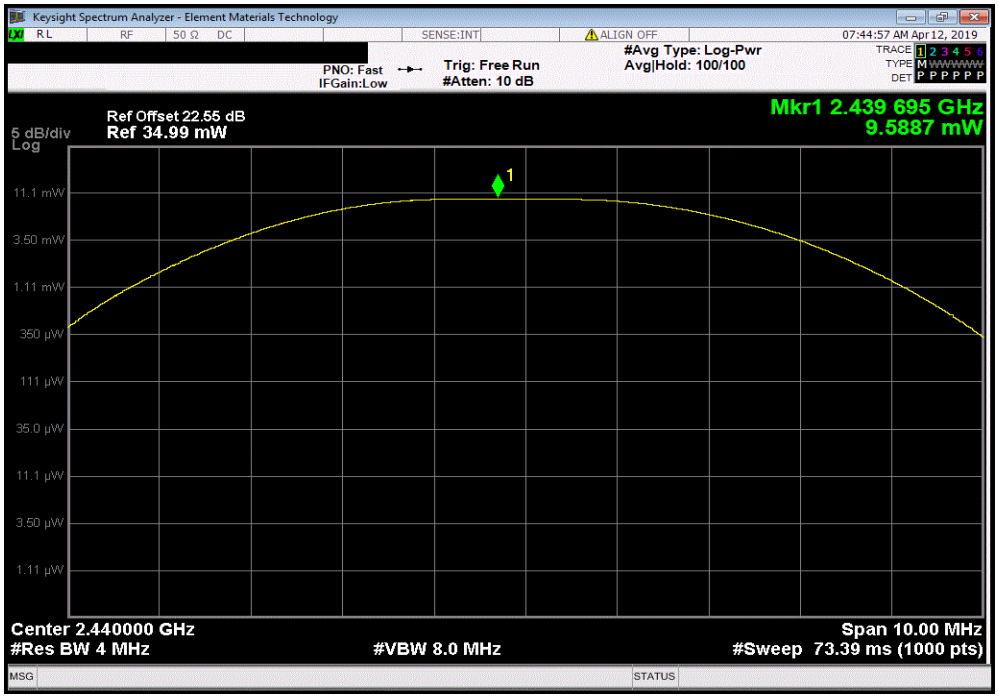
element

TbtTx 2018.09.13 XMit 2019.02.26

802.15.4, Low Channel, 2405 MHz						
	Value	Value (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (<)	Result
	9.571 mW	9.81	1.8	11.61	36 dBm	Pass

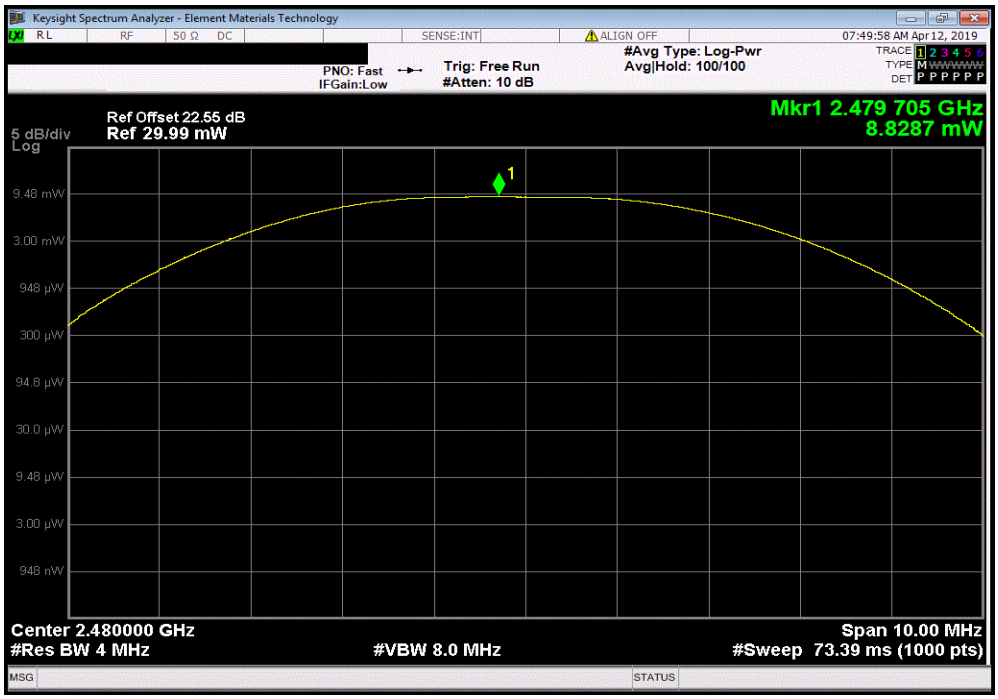


802.15.4, Mid Channel, 2440 MHz						
	Value	Value (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (<)	Result
	9.589 mW	9.82	1.8	11.62	36 dBm	Pass



EQUIVALENT ISOTROPIC RADIATED POWER

802.15.4, High Channel, 2480 MHz						
	Value	Value (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (<)	Result
	8.829 mW	9.46	1.8	11.26	36 dBm	Pass



POWER SPECTRAL DENSITY

XMit 2019.02.26

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-19	15-Mar-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	27-Apr-18	27-Apr-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.

POWER SPECTRAL DENSITY

TbtTx 2018.09.13 XMit 2019.02.26

EUT:	**TXB-DB2 Dual Transmitter Module**			**Work Order:**	**REMT0034**
Serial Number:	**Regulatory 2**			**Date:**	**11-Apr-19**
Customer:	**Remote Technologies, Inc.**			**Temperature:**	**22.2 °C**
Attendees:	**None**			**Humidity:**	**27.7% RH**
Project:	**None**			**Barometric Pres.:**	**1004 mbar**
Tested by:	**Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

None

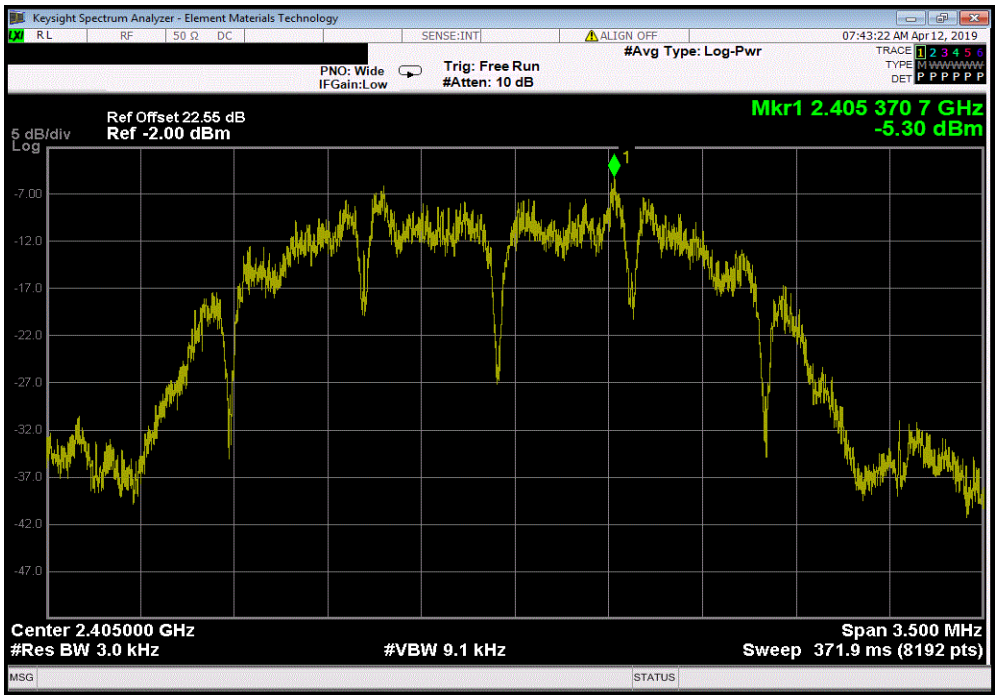
DEVIATIONS FROM TEST STANDARD

None

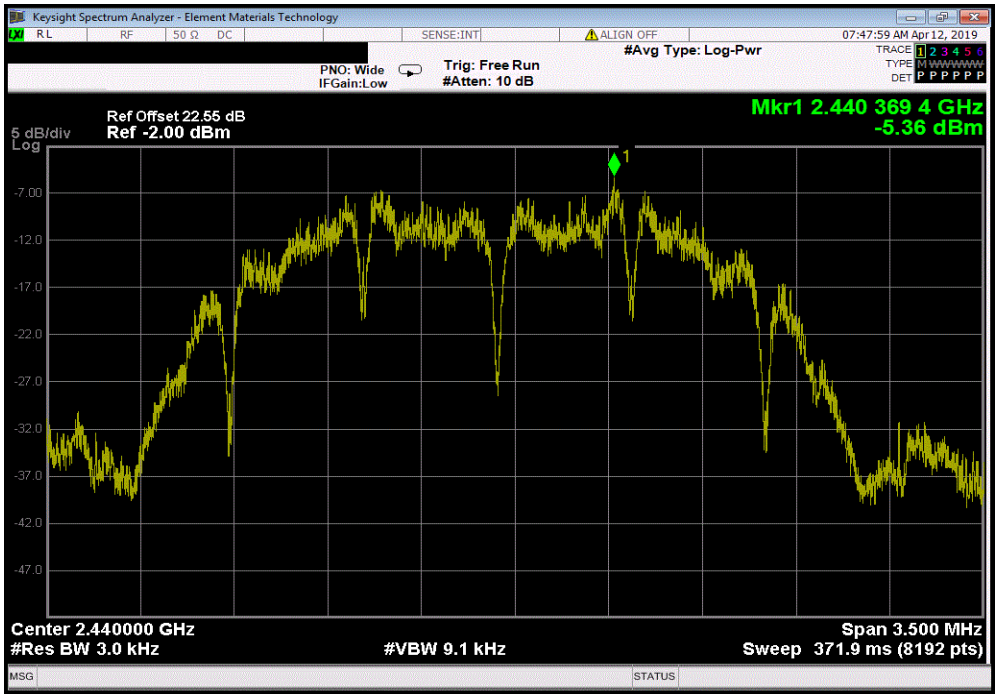
Configuration #	**2**	*Signature* Dustin Sparks

	Value dBm/3kHz	**Limit < dBm/3kHz**	**Results**
802.15.4, Low Channel, 2405 MHz	-5.303	8	Pass
802.15.4, Mid Channel, 2440 MHz	-5.358	8	Pass
802.15.4, High Channel, 2480 MHz	-6	8	Pass

802.15.4, Low Channel, 2405 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-5.303	8	Pass

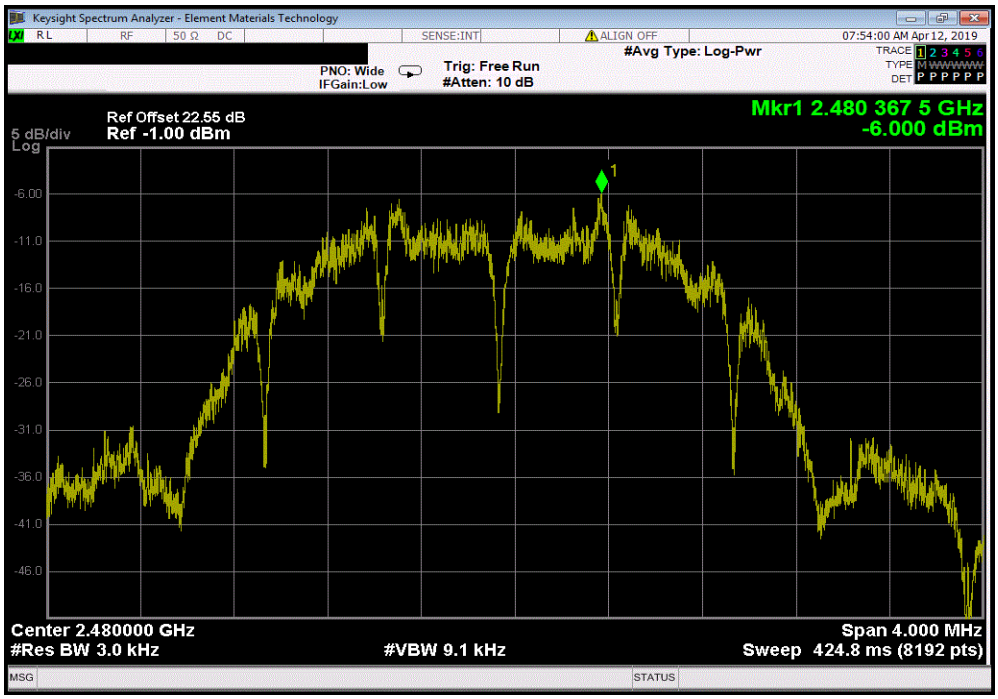


802.15.4, Mid Channel, 2440 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-5.358	8	Pass



POWER SPECTRAL DENSITY

802.15.4, High Channel, 2480 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-6	8	Pass



BAND EDGE COMPLIANCE

XMit 2019.02.26

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-19	15-Mar-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	27-Apr-18	27-Apr-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

TbtTx 2018.09.13 XMit 2019.02.26

EUT:	TXB-DB2 Dual Transmitter Module			Work Order:	REMT0034
Serial Number:	Regulatory 2			Date:	11-Apr-19
Customer:	Remote Technologies, Inc.			Temperature:	22.2 °C
Attendees:	None			Humidity:	27.8% RH
Project:	None			Barometric Pres.:	1004 mbar
Tested by:	Dustin Sparks	Power:	Battery	Job Site:	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

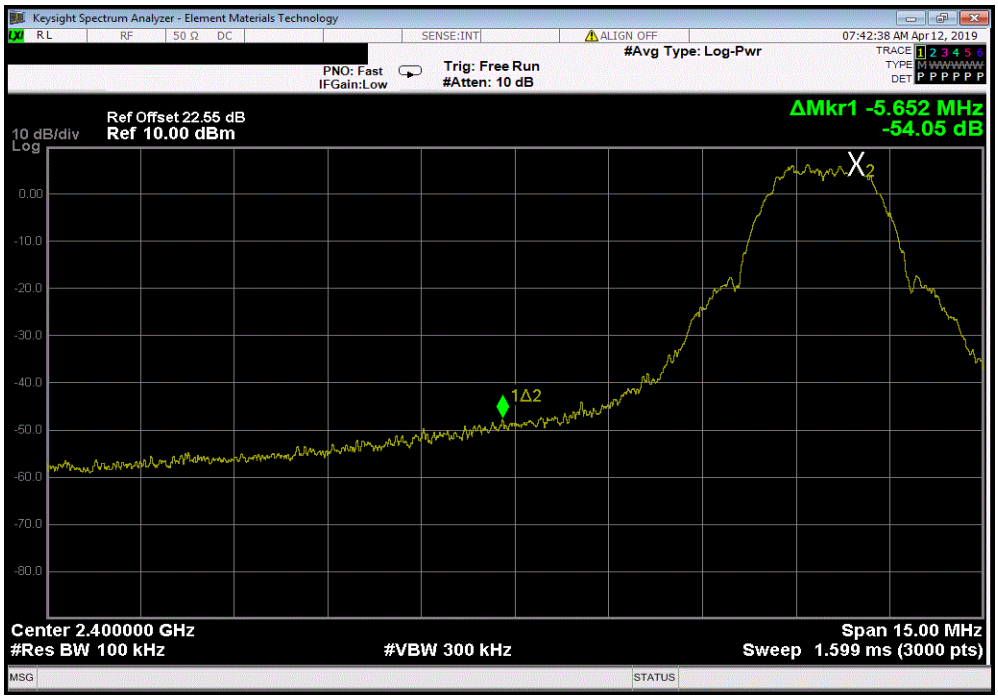
None

Configuration #	2	Signature

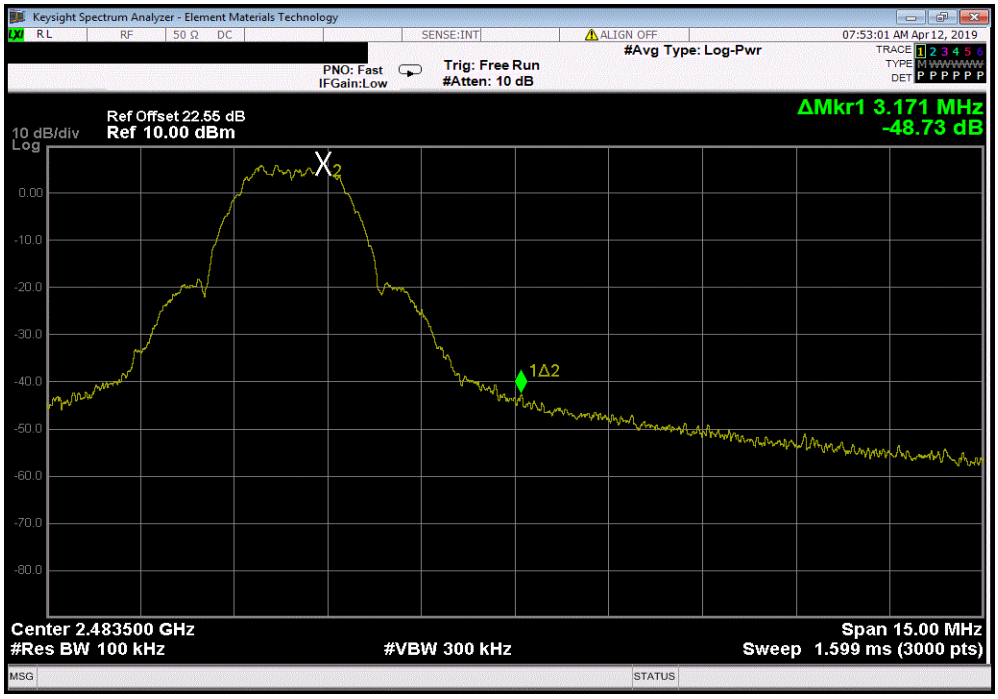
	Value (dBc)	Limit ≤ (dBc)	Result
802.15.4, Low Channel, 2405 MHz	-54.05	-20	Pass
802.15.4, High Channel, 2480 MHz	-48.73	-20	Pass

BAND EDGE COMPLIANCE

802.15.4, Low Channel, 2405 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-54.05	-20	Pass



802.15.4, High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-48.73	-20	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2019.02.26

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5173B	TIW	5-Jul-17	5-Jul-20
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-19	15-Mar-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	27-Apr-18	27-Apr-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.

SPURIOUS CONDUCTED EMISSIONS

TbtTx 2018.09.13 XMit 2019.02.26

EUT:	**TXB-DB2 Dual Transmitter Module**			**Work Order:**	**REMT0034**
Serial Number:	**Regulatory 2**			**Date:**	**11-Apr-19**
Customer:	**Remote Technologies, Inc.**			**Temperature:**	**22.1 °C**
Attendees:	**None**			**Humidity:**	**27.9% RH**
Project:	**None**			**Barometric Pres.:**	**1004 mbar**
Tested by:	**Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2019	ANSI C63.10:2013

COMMENTS

None

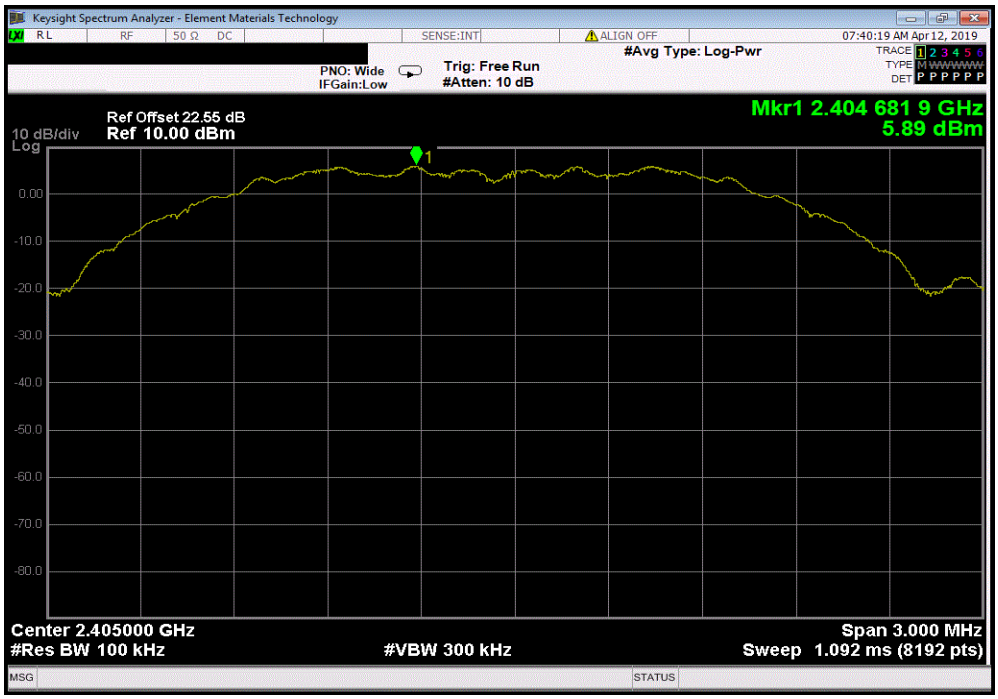
DEVIATIONS FROM TEST STANDARD

None

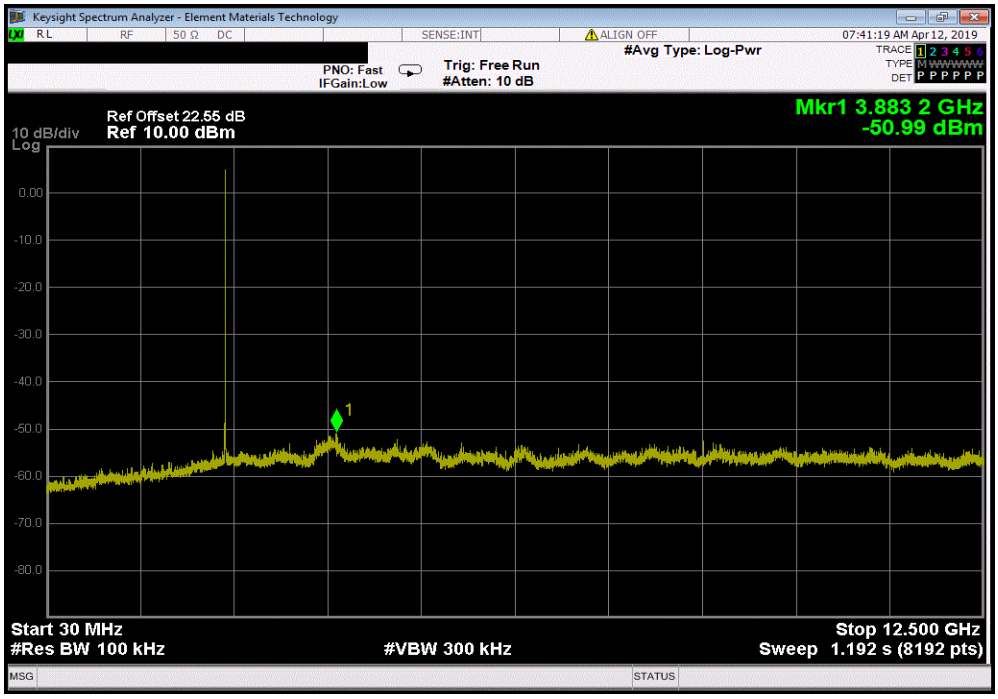
Configuration #	**2**	*Signature* Dustin Sparks

	Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
802.15.4, Low Channel, 2405 MHz	Fundamental	2404.68	N/A	N/A	N/A
802.15.4, Low Channel, 2405 MHz	30 MHz - 12.5 GHz	3883.2	-56.88	-20	Pass
802.15.4, Low Channel, 2405 MHz	12.5 GHz - 25 GHz	23788.3	-56.18	-20	Pass
802.15.4, Mid Channel, 2440 MHz	Fundamental	2439.68	N/A	N/A	N/A
802.15.4, Mid Channel, 2440 MHz	30 MHz - 12.5 GHz	3747.71	-56.91	-20	Pass
802.15.4, Mid Channel, 2440 MHz	12.5 GHz - 25 GHz	23683.01	-55.55	-20	Pass
802.15.4, High Channel, 2480 MHz	Fundamental	2479.67	N/A	N/A	N/A
802.15.4, High Channel, 2480 MHz	30 MHz - 12.5 GHz	2487.16	-56.38	-20	Pass
802.15.4, High Channel, 2480 MHz	12.5 GHz - 25 GHz	24143.88	-56	-20	Pass

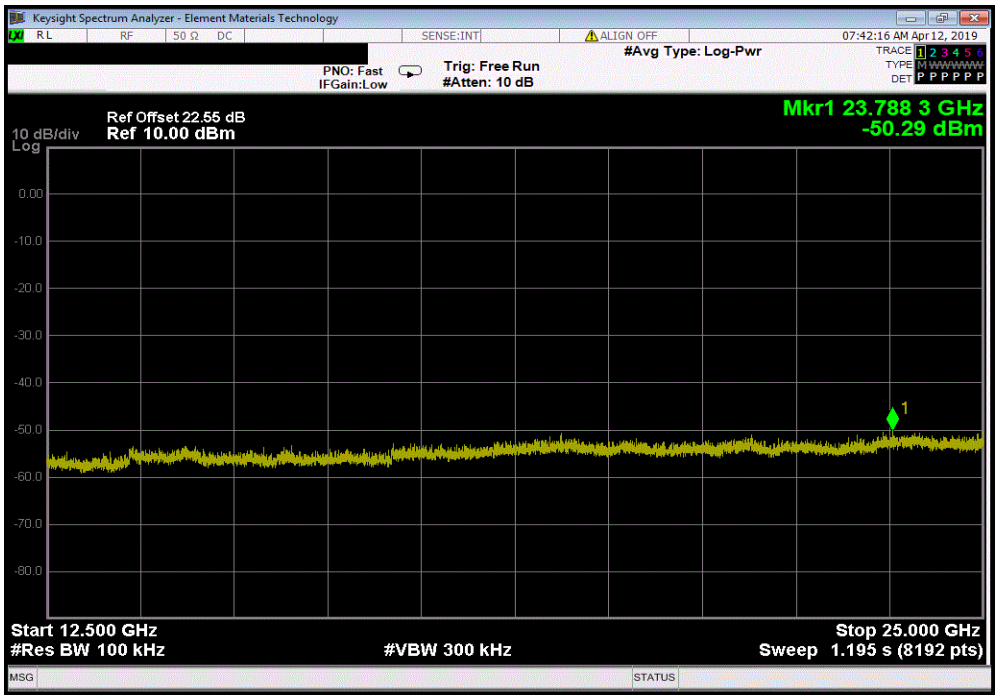
802.15.4, Low Channel, 2405 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	2404.68	N/A	N/A	N/A



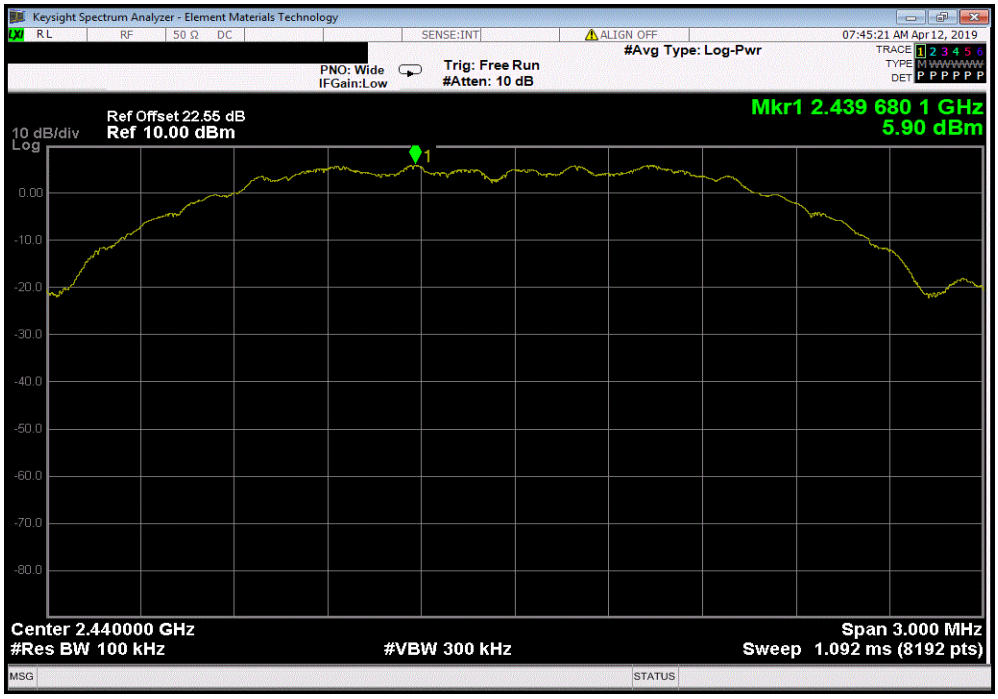
802.15.4, Low Channel, 2405 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	3883.2	-56.88	-20	Pass



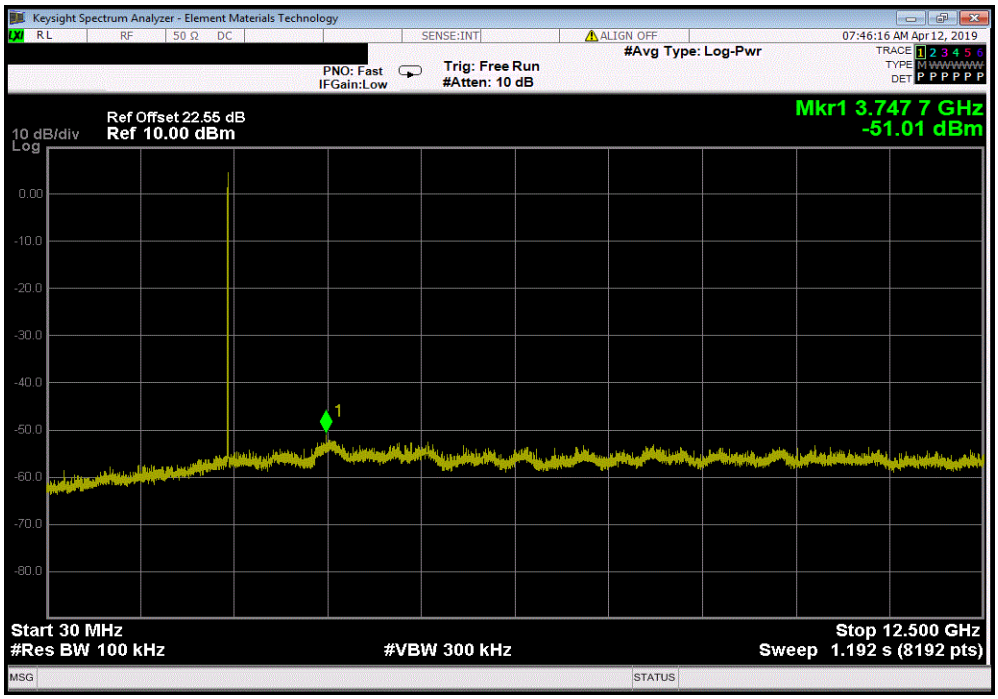
802.15.4, Low Channel, 2405 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	23788.3	-56.18	-20	Pass



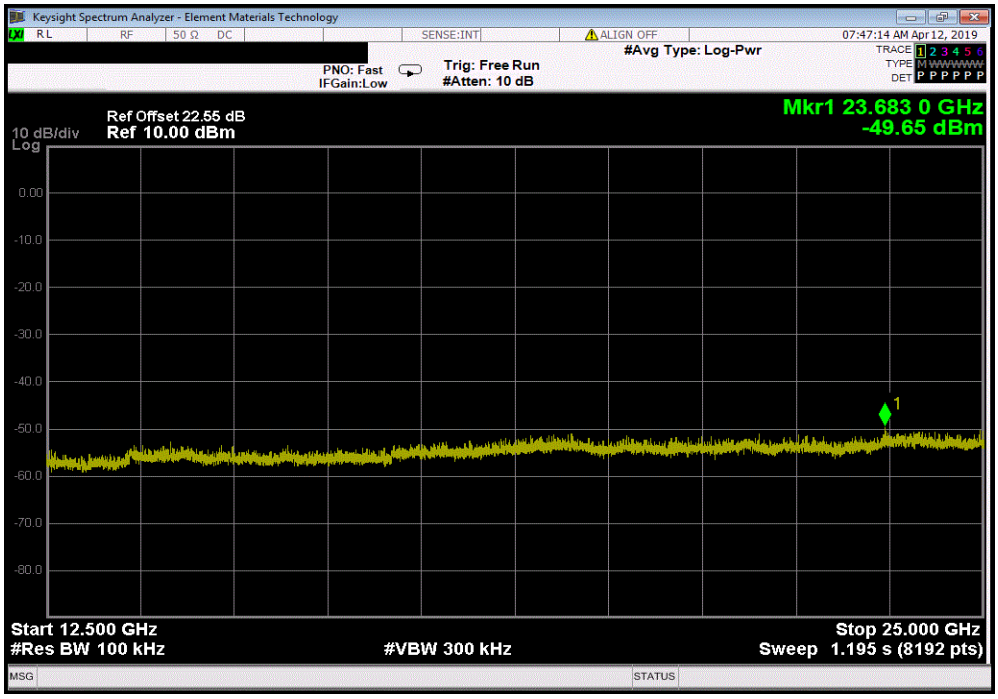
802.15.4, Mid Channel, 2440 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
Fundamental	2439.68	N/A	N/A	N/A



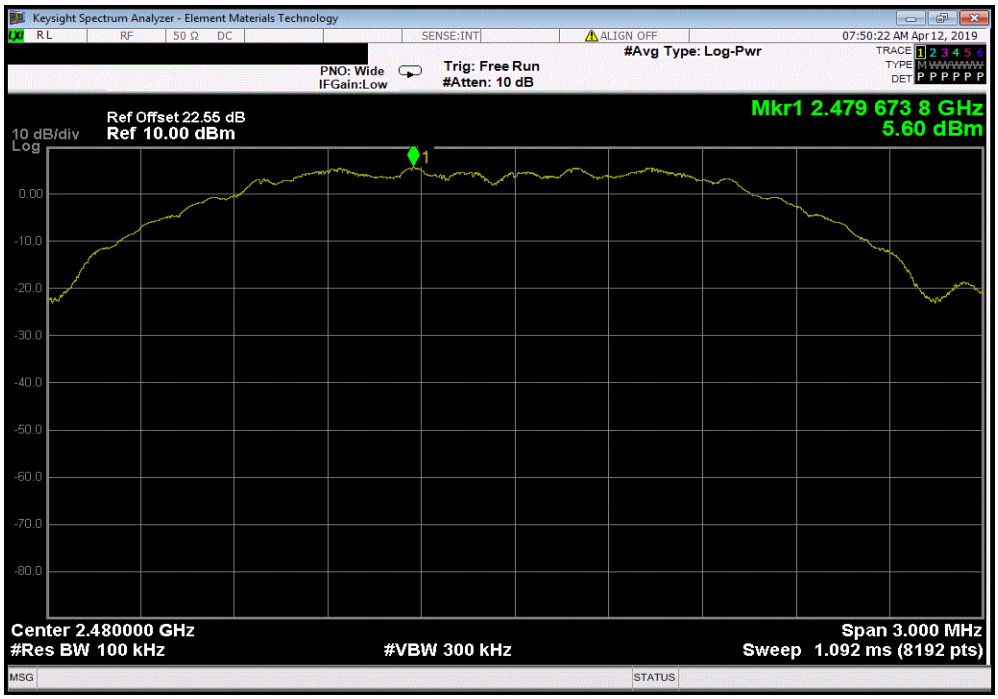
802.15.4, Mid Channel, 2440 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	3747.71	-56.91	-20	Pass



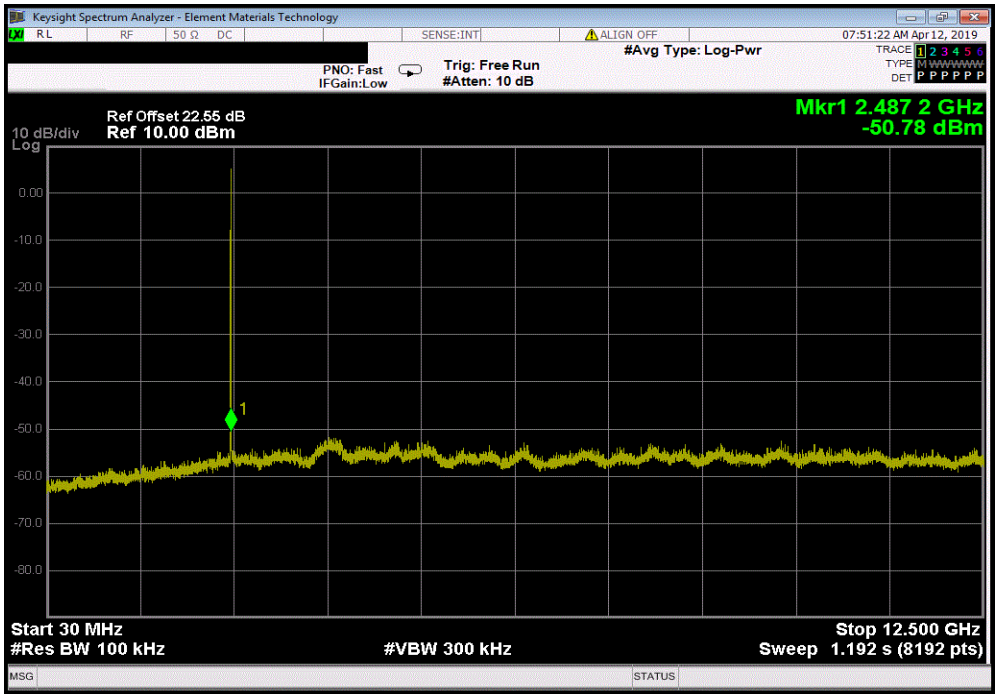
802.15.4, Mid Channel, 2440 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	23683.01	-55.55	-20	Pass



802.15.4, High Channel, 2480 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	2479.67	N/A	N/A	N/A



802.15.4, High Channel, 2480 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	2487.16	-56.38	-20	Pass



802.15.4, High Channel, 2480 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	24143.88	-56	-20	Pass