Electric Imp, Inc.

IMP004M

FCC 15.207:2017

FCC 15.247:2017

Bluetooth Radio

Report # ELIM0013.2

NVLAP Lab Code: 200676-0

CERTIFICATE OF TEST

2017-1-25

Last Date of Test: June 6, 2017
Electric Imp, Inc.
Model: IMP004M

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2017	ANSI C63.10:2013
FCC 15.247:2017	

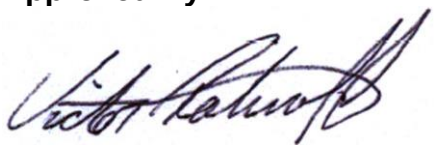
Results

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

Deviations From Test Standards

None

Approved By:



Victor Ratinoff, 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

2017.5.15

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 – Validated by the European Commission as a Notified Body under the R&TTE Directive. 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

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

Japan

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

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

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

SCOPE

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

MEASUREMENT UNCERTAINTY

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.

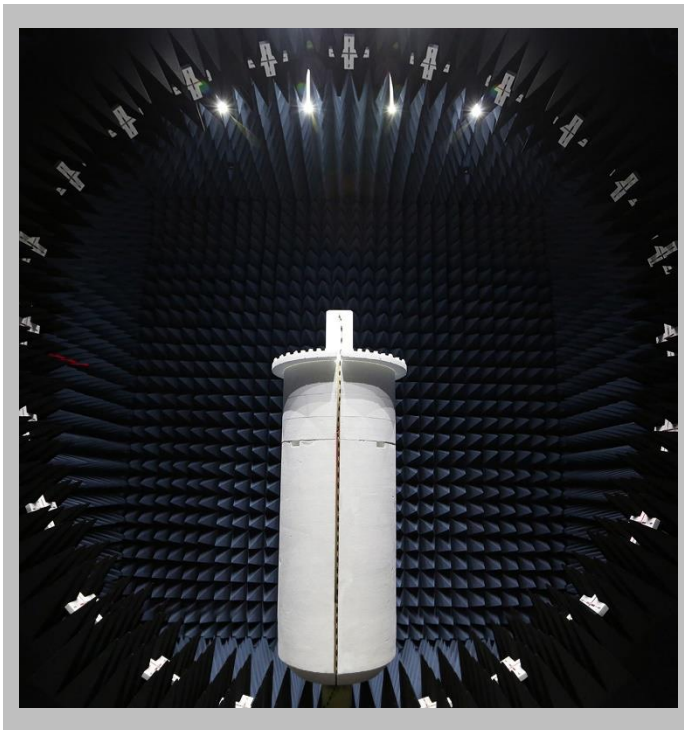
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

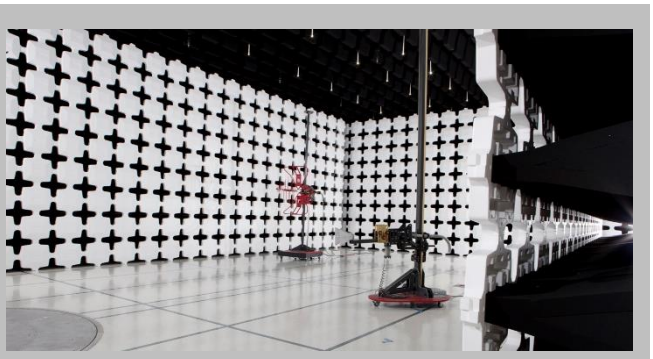
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%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

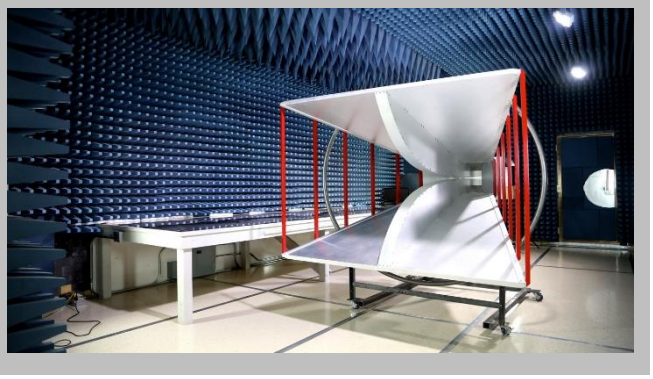
FACILITIES

2017.3.2

California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP					
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Innovation, Science and Economic Development Canada					
2834B-1, 2834B-3	2834E-1	N/A	2834D-1, 2834D-*2*	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157

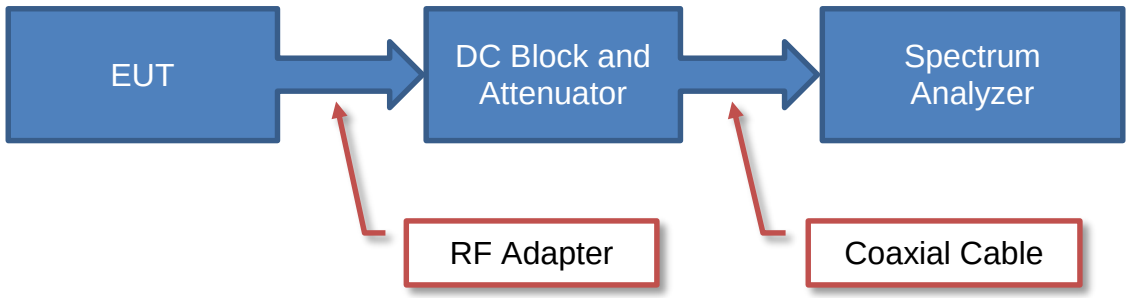




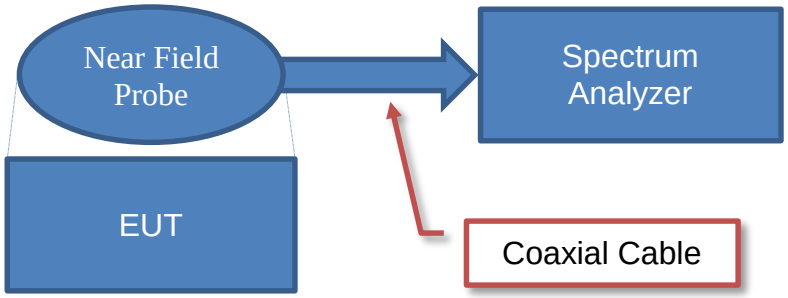


Test Setup Block Diagrams

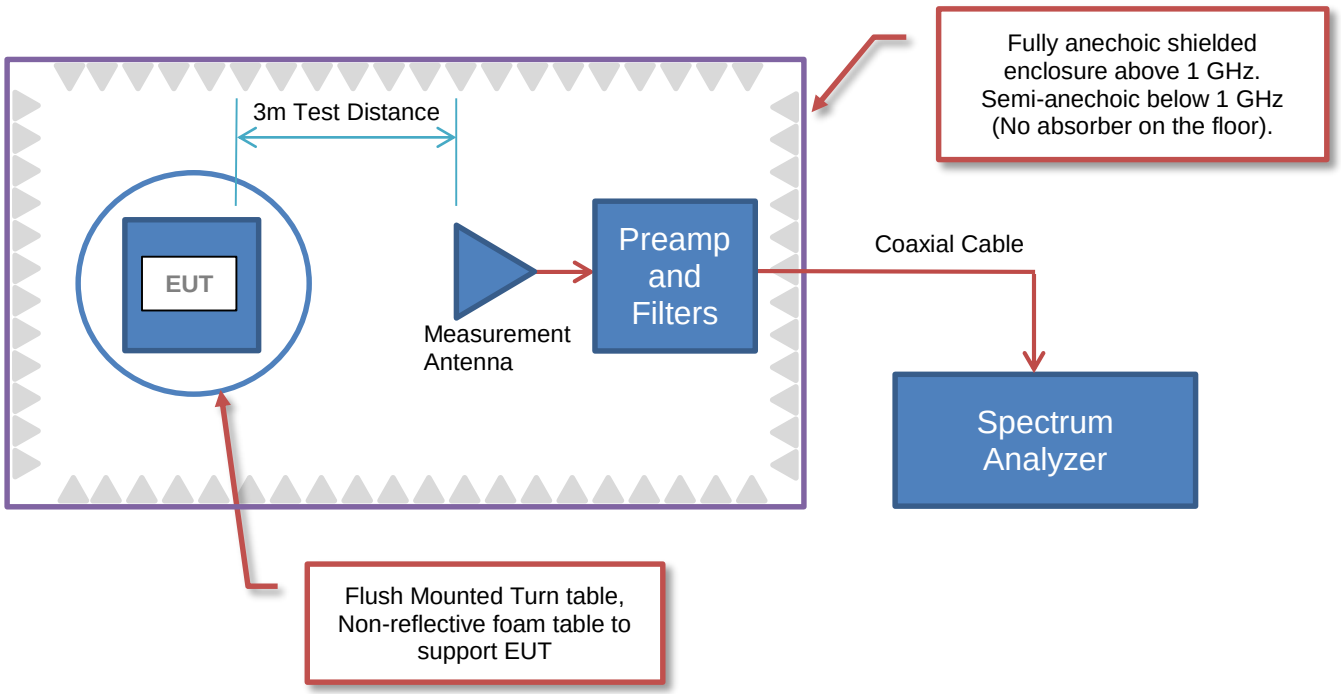
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

2017-1-25

Client and Equipment Under Test (EUT) Information

Company Name:	Electric Imp, Inc.
Address:	5150 El Camino Real, Ste C-31
City, State, Zip:	Los Altos, CA 94022
Test Requested By:	Hugo Fiennes
Model:	IMP004M
First Date of Test:	May 25, 2017
Last Date of Test:	June 6, 2017
Receipt Date of Samples:	May 23, 2017
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
802.11bgn SISO radio WiFi module with added Bluetooth radio, with embedded OS that works with the Electric Imp cloud to allow internet connectivity for devices that use this WiFi/BT module.

Testing Objective:
To demonstrate compliance of the Bluetooth radio under FCC 15.247 requirements.

CONFIGURATIONS

Configuration ELIM0013- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
WiFi Radio Module	Murata	IMP004M	IMP0107

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Host Laptop	HP	15-ba009dx	CND71420K3
Laptop Power Supply	HP	HSTNN-DA40	1WFTLD0CAR63O5H

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	Yes	2.0m	No	USB Extension	WiFi Radio Module
AC Cable	No	1.1m	No	AC Mains	Laptop Power Supply
DC Cable	No	2.0m	No	Host Laptop	Laptop Power Supply

Configuration ELIM0013- 2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
WiFi Radio Module	Murata	IMP004M	IMP0107

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Host Laptop	HP	15-ba009dx	CND71420K3
Laptop Power Supply	HP	HSTNN-DA40	1WFTLD0CAR63O5H

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	Yes	2.0m	No	USB Extension	WiFi Radio Module
AC Cable	No	1.1m	No	AC Mains	Laptop Power Supply
DC Cable	No	2.0m	No	Host Laptop	Laptop Power Supply
USB Extension Cable	No	2.0m	No	Host Laptop	USB Cable

CONFIGURATIONS

2017-1-25

Configuration ELIM0013- 3

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
WiFi Radio Module	Murata	IMP004M	IMP0107

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Host Laptop	HP	15-ba009dx	CND71420K3
Laptop Power Supply	HP	HSTNN-DA40	1WFTLD0CAR63O5H
DC Power Supply	HQ Power	PS3003U	DK10103872

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	Yes	2.0m	No	USB Extension	WiFi Radio Module
AC Cable	No	1.1m	No	AC Mains	Laptop Power Supply
DC Cable	No	2.0m	No	Host Laptop	Laptop Power Supply
AC Cable	No	1.8m	No	AC Mains	DC Power Supply
DC Cables	No	1.0m	No	WiFi Radio Module	DC Power Supply

MODIFICATIONS

2017-1-25

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	5/25/2017	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	5/31/2017	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.
3	5/31/2017	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	5/31/2017	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.
5	5/31/2017	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
6	5/31/2017	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.
7	5/31/2017	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.
8	6/6/2017	Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWERLINE CONDUCTED EMISSIONS

PSA-ESCI 2017.01.26

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.

MODES OF OPERATION

Transmitting Bluetooth LE at Mid Ch 20-2442MHz

POWER SETTINGS INVESTIGATED

3.3VDC

CONFIGURATIONS INVESTIGATED

ELIM0013 - 3

SAMPLE CALCULATIONS

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Cable - Conducted Cable Assembly	Element	OCP, HFP, AWC	OCPA	3/28/2017	12 mo
LISN	Solar Electronics	9252-50-24-BNC	LIB	1/25/2017	12 mo
LISN	Solar Electronics	9252-50-24-BNC	LIA	2/17/2017	12 mo
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	4/25/2017	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

Measurements were made using the bandwidths and detectors specified. No video filter was used.

MEASUREMENT UNCERTAINTY

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

TEST DESCRIPTION

The EUT will be powered either directly or indirectly from the AC power line. Therefore, conducted emissions measurements were made on the AC input of the EUT, or on the AC input of the device used to power the EUT.

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

POWERLINE CONDUCTED EMISSIONS

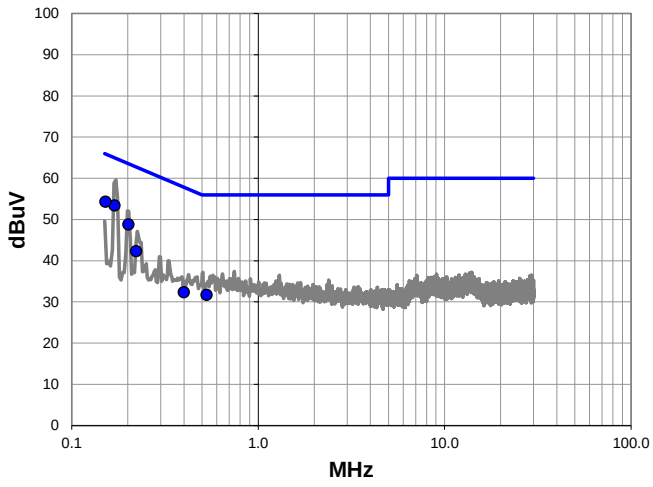
EmiR5 2017.01.25 PSA-ESCI 2017.01.26

Work Order:	ELIM0013	**Date:**	06/06/17		
Project:	None	**Temperature:**	22.6 °C		
Job Site:	OC06	**Humidity:**	48.3% RH		
Serial Number:	IMP0107	**Barometric Pres.:**	1015 mbar	**Tested by:**	Mark Baytan
EUT:	IMP004M				
Configuration:	3				
Customer:	Electric Imp, Inc.				
Attendees:	None				
EUT Power:	3.3VDC				
Operating Mode:	Transmitting Bluetooth LE at Mid Ch 20-2442MHz				
Deviations:	None				
Comments:	Board powered through external DC power supply.				

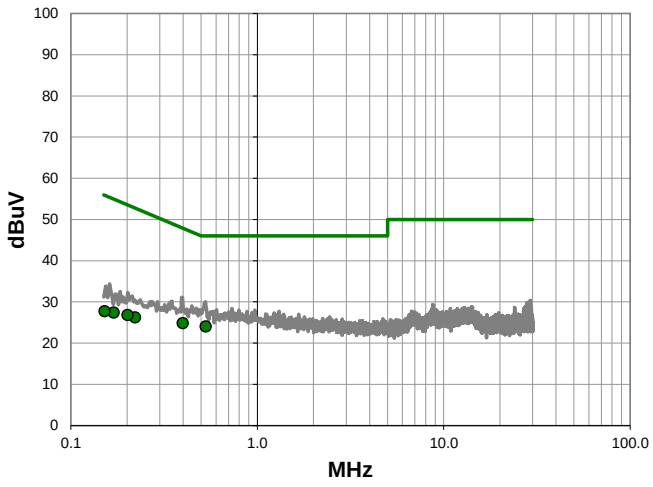
Test Specifications	**Test Method**
FCC 15.207:2017	ANSI C63.10:2013

Run #	4	**Line:**	Neutral	**Ext. Attenuation:**	0	**Results**	Pass

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.170	33.2	20.2	53.4	65.0	-11.6
0.151	34.1	20.2	54.3	65.9	-11.6
0.201	28.7	20.1	48.8	63.6	-14.8
0.221	22.2	20.1	42.3	62.8	-20.5
0.528	11.7	20.0	31.7	56.0	-24.3
0.398	12.3	20.0	32.3	57.9	-25.6

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.528	4.0	20.0	24.0	46.0	-22.0
0.398	4.8	20.0	24.8	47.9	-23.1
0.221	6.1	20.1	26.2	52.8	-26.6
0.201	6.7	20.1	26.8	53.6	-26.8
0.170	7.2	20.2	27.4	55.0	-27.6
0.151	7.5	20.2	27.7	55.9	-28.2

POWERLINE CONDUCTED EMISSIONS

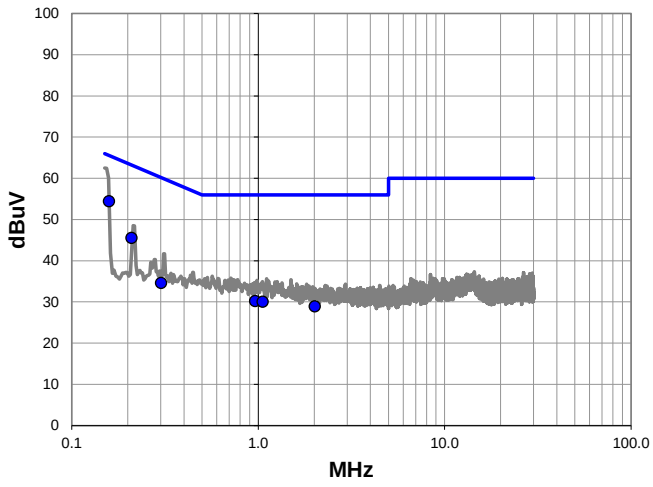
EmiR5 2017.01.25 PSA-ESCI 2017.01.26

Work Order:	ELIM0013	**Date:**	06/06/17		
Project:	None	**Temperature:**	22.6 °C		
Job Site:	OC06	**Humidity:**	48.3% RH		
Serial Number:	IMP0107	**Barometric Pres.:**	1015 mbar	**Tested by:**	Mark Baytan
EUT:	IMP004M				
Configuration:	3				
Customer:	Electric Imp, Inc.				
Attendees:	None				
EUT Power:	3.3VDC				
Operating Mode:	Transmitting Bluetooth LE at Mid Ch 20-2442MHz				
Deviations:	None				
Comments:	Board powered through external DC power supply.				

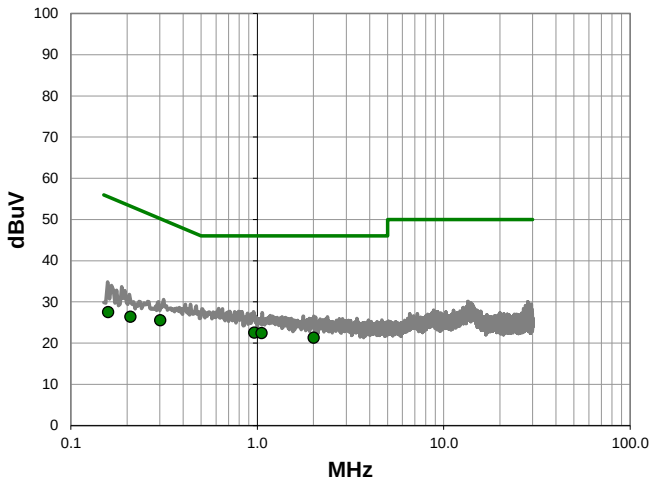
Test Specifications	**Test Method**
FCC 15.207:2017	ANSI C63.10:2013

Run #	5	**Line:**	High Line	**Ext. Attenuation:**	0	**Results**	Pass

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.158	34.2	20.2	54.4	65.5	-11.1
0.209	25.4	20.1	45.5	63.3	-17.8
0.301	14.5	20.1	34.6	60.2	-25.6
0.963	10.2	20.0	30.2	56.0	-25.8
1.055	10.0	20.0	30.0	56.0	-26.0
2.010	8.8	20.1	28.9	56.0	-27.1

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.963	2.5	20.0	22.5	46.0	-23.5
1.055	2.4	20.0	22.4	46.0	-23.6
2.010	1.2	20.1	21.3	46.0	-24.7
0.301	5.4	20.1	25.5	50.2	-24.7
0.209	6.3	20.1	26.4	53.3	-26.9
0.158	7.3	20.2	27.5	55.5	-28.0

SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2017.01.26

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 BLE at Low Ch 0-2402MHz, Mid Ch 19-2440MHz, High Ch 39-2480MHz

POWER SETTINGS INVESTIGATED

3.3VDC regulated down from USB 5V

CONFIGURATIONS INVESTIGATED

ELIM0013 - 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	ESM Cable Corp.	8-18GHz cables	OCY	5/15/2017	12 mo
Amplifier - Pre-Amplifier	Miteq	JSDWK42-18004000-60-5P	PAN	1/4/2017	12 mo
Cable	ESM Cable Corp.	1-8GHz cables	OCX	5/15/2017	12 mo
Cable	D-Coax	None	OC4	1/4/2017	12 mo
Antenna - Double Ridge	A.H. Systems, Inc.	SAS-574	AXV	5/3/2016	24 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVP	8/15/2016	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVL	10/17/2016	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVJ	8/15/2016	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AIR	6/23/2016	24 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AHX	NCR	0 mo
Antenna - Standard Gain	EMCO	3160-08	AHK	NCR	0 mo
Cable	ESM Cable Corp.	30-1GHz cables	OCW	5/15/2017	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	PAD	8/15/2016	12 mo
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAY	10/25/2016	12 mo

TEST DESCRIPTION

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

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

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

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

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

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

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

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

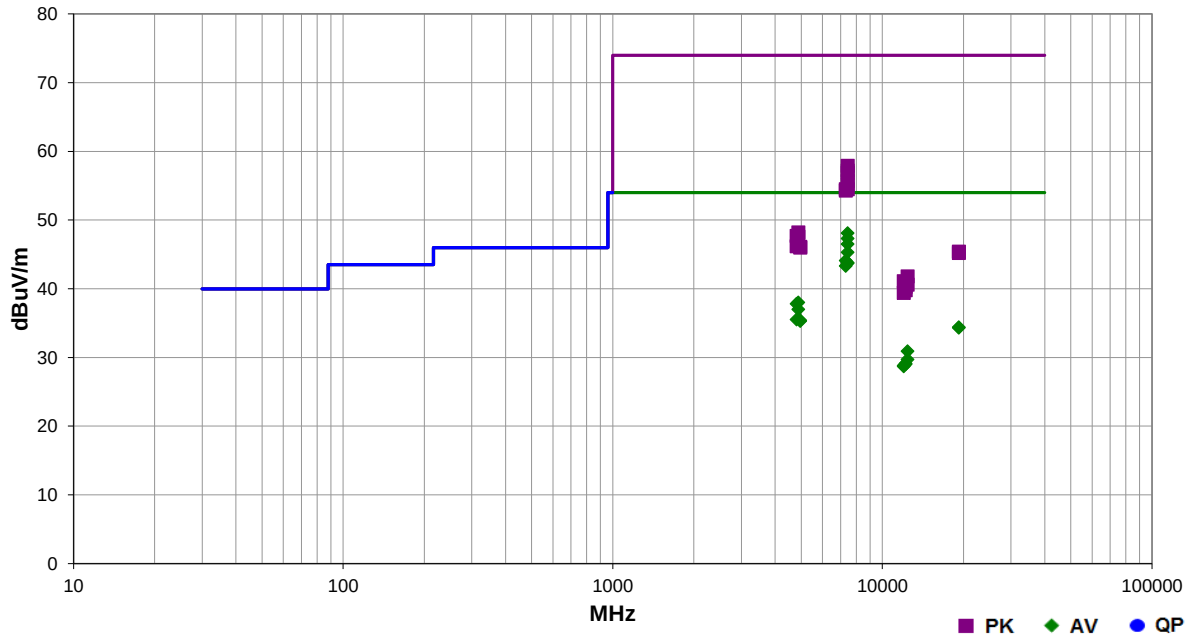
SPURIOUS RADIATED EMISSIONS

EmiR5 2017.01.25 PSA-ESCI 2017.01.26

Work Order:	ELIM0013	**Date:**	05/25/17		
Project:	None	**Temperature:**	22.4 °C		
Job Site:	OC07	**Humidity:**	44.3% RH		
Serial Number:	IMP0107	**Barometric Pres.:**	1014 mbar	**Tested by:**	Mike Tran
EUT:	IMP004M				
Configuration:	1				
Customer:	Electric Imp, Inc.				
Attendees:	Jonathan Dillon				
EUT Power:	3.3VDC regulated down from USB 5V				
Operating Mode:	Transmitting BLE at Low Ch 0-2402MHz, Mid Ch 19-2440MHz, High Ch 39-2480MHz				
Deviations:	None				
Comments:	TX Power value = 5.				

Test Specifications	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

Run #	29	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



EUT (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
7439.495	36.1	12.0	2.4	259.0	3.0	0.0	Vert	AV	0.0	48.1	54.0	-5.9	EUT Ver, High Ch
7439.500	35.3	12.0	1.0	276.0	3.0	0.0	Horz	AV	0.0	47.3	54.0	-6.7	EUT Hor, High Ch
7439.610	34.5	12.0	1.1	76.0	3.0	0.0	Horz	AV	0.0	46.5	54.0	-7.5	EUT Ver, High Ch
7439.305	33.3	12.0	1.0	164.0	3.0	0.0	Vert	AV	0.0	45.3	54.0	-8.7	EUT Hor, High Ch
7319.475	33.3	10.8	2.6	286.0	3.0	0.0	Horz	AV	0.0	44.1	54.0	-9.9	EUT Hor, Mid Ch
7438.685	31.8	12.0	3.3	169.0	3.0	0.0	Horz	AV	0.0	43.8	54.0	-10.2	EUT on Side, High Ch
7438.920	31.7	12.0	1.0	8.0	3.0	0.0	Vert	AV	0.0	43.7	54.0	-10.3	EUT on Side, High Ch
7319.595	32.5	10.8	1.0	330.0	3.0	0.0	Vert	AV	0.0	43.3	54.0	-10.7	EUT Ver, Mid Ch
4879.790	34.1	3.9	2.4	203.0	3.0	0.0	Vert	AV	0.0	38.0	54.0	-16.0	EUT Ver, Mid Ch
7440.830	45.9	12.0	2.4	259.0	3.0	0.0	Vert	PK	0.0	57.9	74.0	-16.1	EUT Ver, High Ch
4803.705	34.2	3.6	1.0	329.0	3.0	0.0	Horz	AV	0.0	37.8	54.0	-16.2	EUT Hor, Low Ch
7439.395	45.2	12.0	1.0	276.0	3.0	0.0	Horz	PK	0.0	57.2	74.0	-16.8	EUT Hor, High Ch
4880.000	33.1	3.9	1.0	325.0	3.0	0.0	Horz	AV	0.0	37.0	54.0	-17.0	EUT Hor, Mid Ch
7439.640	44.9	12.0	1.1	76.0	3.0	0.0	Horz	PK	0.0	56.9	74.0	-17.1	EUT Ver, High Ch
7440.525	43.7	12.0	1.0	164.0	3.0	0.0	Vert	PK	0.0	55.7	74.0	-18.3	EUT Hor, High Ch
4803.870	31.9	3.6	1.5	164.0	3.0	0.0	Vert	AV	0.0	35.5	54.0	-18.5	EUT Ver, Low Ch
4958.880	31.0	4.4	1.0	158.0	3.0	0.0	Horz	AV	0.0	35.4	54.0	-18.6	EUT Hor, High Ch
4958.855	30.9	4.4	1.6	17.0	3.0	0.0	Vert	AV	0.0	35.3	54.0	-18.7	EUT Ver, High Ch

EUT (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
7438.965	43.1	12.0	3.3	169.0	3.0	0.0	Horz	PK	0.0	55.1	74.0	-18.9	EUT on Side, High Ch
7441.500	42.5	12.0	1.0	8.0	3.0	0.0	Vert	PK	0.0	54.5	74.0	-19.5	EUT on Side, High Ch
7320.295	43.7	10.8	1.0	330.0	3.0	0.0	Vert	PK	0.0	54.5	74.0	-19.5	EUT Ver, Mid Ch
19216.120	45.2	-10.8	1.0	186.0	3.0	0.0	Horz	AV	0.0	34.4	54.0	-19.6	EUT Hor, Low Ch
7319.755	43.5	10.8	2.6	286.0	3.0	0.0	Horz	PK	0.0	54.3	74.0	-19.7	EUT Hor, Mid Ch
19216.580	45.1	-10.8	1.0	113.0	3.0	0.0	Vert	AV	0.0	34.3	54.0	-19.7	EUT Vert, Low Ch
12397.540	33.3	-2.4	1.0	231.0	3.0	0.0	Vert	AV	0.0	30.9	54.0	-23.1	EUT Vert, High Ch
12397.630	32.1	-2.4	1.3	321.0	3.0	0.0	Horz	AV	0.0	29.7	54.0	-24.3	EUT Hor, High Ch
12200.880	33.0	-3.9	3.9	305.0	3.0	0.0	Horz	AV	0.0	29.1	54.0	-24.9	EUT Hor, Mid Ch
12201.350	32.9	-3.9	1.8	5.0	3.0	0.0	Vert	AV	0.0	29.0	54.0	-25.0	EUT Ver, Mid Ch
12011.500	34.0	-5.2	3.1	121.0	3.0	0.0	Vert	AV	0.0	28.8	54.0	-25.2	EUT Ver, Low Ch
12011.140	33.9	-5.2	1.3	277.0	3.0	0.0	Horz	AV	0.0	28.7	54.0	-25.3	EUT Horz, Low Ch
4879.515	44.3	3.9	2.4	203.0	3.0	0.0	Vert	PK	0.0	48.2	74.0	-25.8	EUT Ver, Mid Ch
4804.285	44.1	3.6	1.0	329.0	3.0	0.0	Horz	PK	0.0	47.7	74.0	-26.3	EUT Hor, Low Ch
4880.675	43.7	3.9	1.0	325.0	3.0	0.0	Horz	PK	0.0	47.6	74.0	-26.4	EUT Hor, Mid Ch
4804.475	42.6	3.6	1.5	164.0	3.0	0.0	Vert	PK	0.0	46.2	74.0	-27.8	EUT Ver, Low Ch
4959.870	41.7	4.4	1.0	158.0	3.0	0.0	Horz	PK	0.0	46.1	74.0	-27.9	EUT Hor, High Ch
4959.850	41.6	4.4	1.6	17.0	3.0	0.0	Vert	PK	0.0	46.0	74.0	-28.0	EUT Ver, High Ch
19215.390	56.2	-10.8	1.0	113.0	3.0	0.0	Vert	PK	0.0	45.4	74.0	-28.6	EUT Vert, Low Ch
19215.140	56.0	-10.8	1.0	186.0	3.0	0.0	Horz	PK	0.0	45.2	74.0	-28.8	EUT Hor, Low Ch
12398.570	44.2	-2.4	1.0	231.0	3.0	0.0	Vert	PK	0.0	41.8	74.0	-32.2	EUT Vert, High Ch
12011.110	46.3	-5.2	3.1	121.0	3.0	0.0	Vert	PK	0.0	41.1	74.0	-32.9	EUT Ver, Low Ch
12397.980	43.0	-2.4	1.3	321.0	3.0	0.0	Horz	PK	0.0	40.6	74.0	-33.4	EUT Hor, High Ch
12199.130	44.2	-3.9	3.9	305.0	3.0	0.0	Horz	PK	0.0	40.3	74.0	-33.7	EUT Hor, Mid Ch
12200.610	43.7	-3.9	1.8	5.0	3.0	0.0	Vert	PK	0.0	39.8	74.0	-34.2	EUT Ver, Mid Ch
12007.550	44.6	-5.2	1.3	277.0	3.0	0.0	Horz	PK	0.0	39.4	74.0	-34.6	EUT Horz, Low Ch

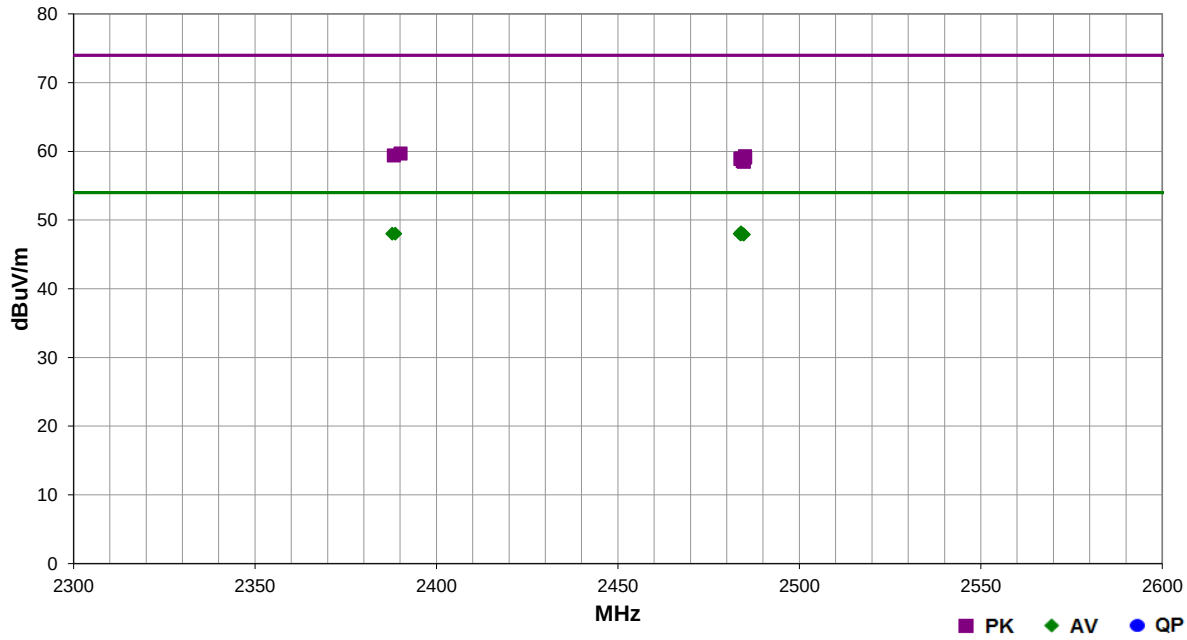
SPURIOUS RADIATED EMISSIONS

EmiR5 2017.01.25 PSA-ESCI 2017.01.26

Work Order:	ELIM0013	**Date:**	05/25/17		
Project:	None	**Temperature:**	22.4 °C		
Job Site:	OC07	**Humidity:**	44.3% RH		
Serial Number:	IMP0107	**Barometric Pres.:**	1014 mbar	**Tested by:**	Mike Tran
EUT:	IMP004M				
Configuration:	1				
Customer:	Electric Imp, Inc.				
Attendees:	Jonathan Dillon				
EUT Power:	3.3VDC regulated down from USB 5V				
Operating Mode:	Transmitting BLE at Low Ch 0-2402MHz, High Ch 39-2480MHz				
Deviations:	None				
Comments:	TX Power value = 5.				

Test Specifications	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

Run #	31	**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
2483.967	32.7	-4.5	1.0	345.0	3.0	20.0	Vert	AV	0.0	48.2	54.0	-5.8	EUT Vert, High Ch
2388.703	32.9	-4.9	1.0	279.0	3.0	20.0	Horz	AV	0.0	48.0	54.0	-6.0	EUT Hor, Low Ch
2387.833	32.9	-4.9	1.8	177.0	3.0	20.0	Vert	AV	0.0	48.0	54.0	-6.0	EUT Vert, Low Ch
2484.107	32.5	-4.5	1.0	196.0	3.0	20.0	Vert	AV	0.0	48.0	54.0	-6.0	EUT on Side, High Ch
2483.600	32.5	-4.5	1.2	85.0	3.0	20.0	Horz	AV	0.0	48.0	54.0	-6.0	EUT Hor, High Ch
2484.670	32.4	-4.5	1.0	359.0	3.0	20.0	Horz	AV	0.0	47.9	54.0	-6.1	EUT Vert, High Ch
2483.860	32.4	-4.5	2.6	124.0	3.0	20.0	Vert	AV	0.0	47.9	54.0	-6.1	EUT Hor, High Ch
2484.703	32.4	-4.5	1.0	7.0	3.0	20.0	Horz	AV	0.0	47.9	54.0	-6.1	EUT on Side, High Ch
2390.125	44.6	-4.9	1.8	177.0	3.0	20.0	Vert	PK	0.0	59.7	74.0	-14.3	EUT Vert, Low Ch
2388.240	44.3	-4.9	1.0	279.0	3.0	20.0	Horz	PK	0.0	59.4	74.0	-14.6	EUT Hor, Low Ch
2485.037	43.8	-4.5	2.6	124.0	3.0	20.0	Vert	PK	0.0	59.3	74.0	-14.7	EUT Hor, High Ch
2485.070	43.6	-4.5	1.0	196.0	3.0	20.0	Vert	PK	0.0	59.1	74.0	-14.9	EUT on Side, High Ch
2483.983	43.5	-4.5	1.0	345.0	3.0	20.0	Vert	PK	0.0	59.0	74.0	-15.0	EUT Vert, High Ch
2483.773	43.4	-4.5	1.2	85.0	3.0	20.0	Horz	PK	0.0	58.9	74.0	-15.1	EUT Hor, High Ch
2484.367	43.1	-4.5	1.0	359.0	3.0	20.0	Horz	PK	0.0	58.6	74.0	-15.4	EUT Vert, High Ch
2484.700	43.0	-4.5	1.0	7.0	3.0	20.0	Horz	PK	0.0	58.5	74.0	-15.5	EUT on Side, High Ch

DUTY CYCLE

XMit 2017.02.08

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	E8257D	TGU	2/5/2015	2/5/2018
Attenuator	Fairview Microwave	SA18E-20	TKS	3/6/2017	3/6/2018
Block - DC	Aeroflex	INMET 8535	AMO	3/27/2017	3/27/2018
Cable	Fairview Microwave	SCA1814-0101-120	OCZ	NCR	NCR
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	11/2/2016	11/2/2017

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The Duty Cycle (x) of the single channel operation of the radio as controlled by the provided test software was measured for each of the EUT operating modes.

There is no compliance requirement to be met by this test, so therefore no Pass / Fail criteria.

The measurements were made using a zero span on the spectrum analyzer to see the pulses in the time domain. The transmit power was set to its default maximum.

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

If the transmit duty cycle < 98 percent, burst gating may have been used during some of the other tests in this report to only take the measurement during the burst duration.

DUTY CYCLE

TbtTx 2017.01.27 XMit 2017.02.08

EUT:	**IMP004M**			**Work Order:**	**ELIM0013**
Serial Number:	**IMP0107**			**Date:**	**05/31/17**
Customer:	**Electric Imp, Inc.**			**Temperature:**	**21.3 °C**
Attendees:	**Jonathan Dillon**			**Humidity:**	**49% RH**
Project:	**None**			**Barometric Pres.:**	**1014 mbar**
Tested by:	**Mike Tran**	**Power:**	**3.3VDC regulated down from USB 5V**	**Job Site:**	**OC13**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

COMMENTS

Total Offset 22.92dB (20dB pad + DC Block + coax cable + client provided patch cable) at 2.4GHz

DEVIATIONS FROM TEST STANDARD

None

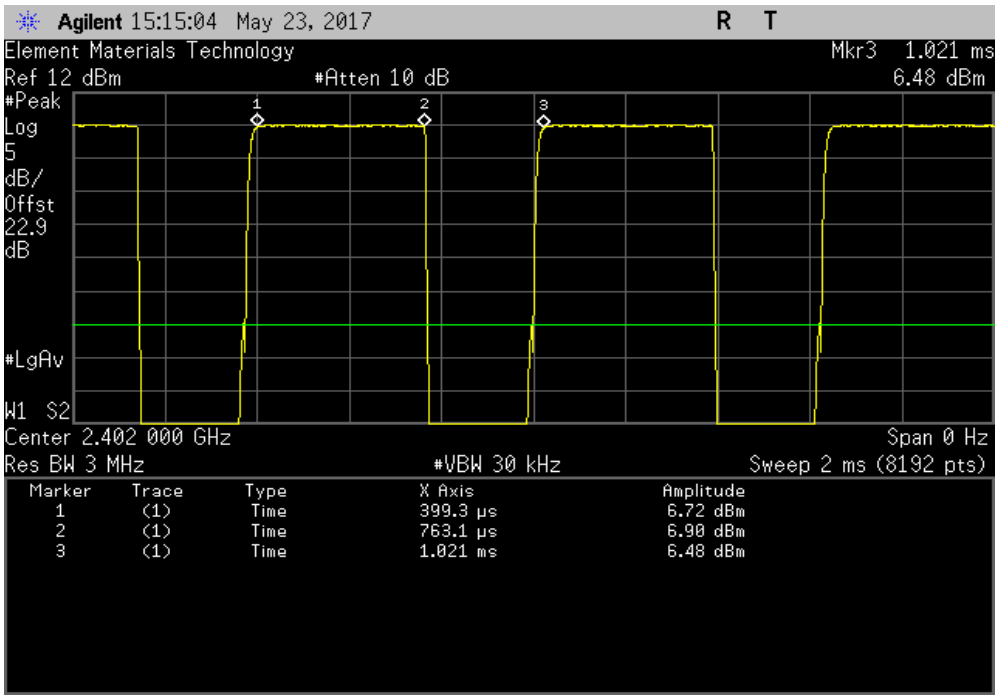
Configuration #	**2**	*Signature*

	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
BLE/GFSK Low Channel, 2402 MHz	363.809 us	621.626 us	1	58.5	N/A	N/A
BLE/GFSK Low Channel, 2402 MHz	N/A	N/A	6	N/A	N/A	N/A
BLE/GFSK Mid Channel, 2442 MHz	363.765 us	621.87 us	1	58.5	N/A	N/A
BLE/GFSK Mid Channel, 2442 MHz	N/A	N/A	5	N/A	N/A	N/A
BLE/GFSK High Channel, 2480 MHz	364.309 us	626.021 us	1	58.2	N/A	N/A
BLE/GFSK High Channel, 2480 MHz	N/A	N/A	5	N/A	N/A	N/A

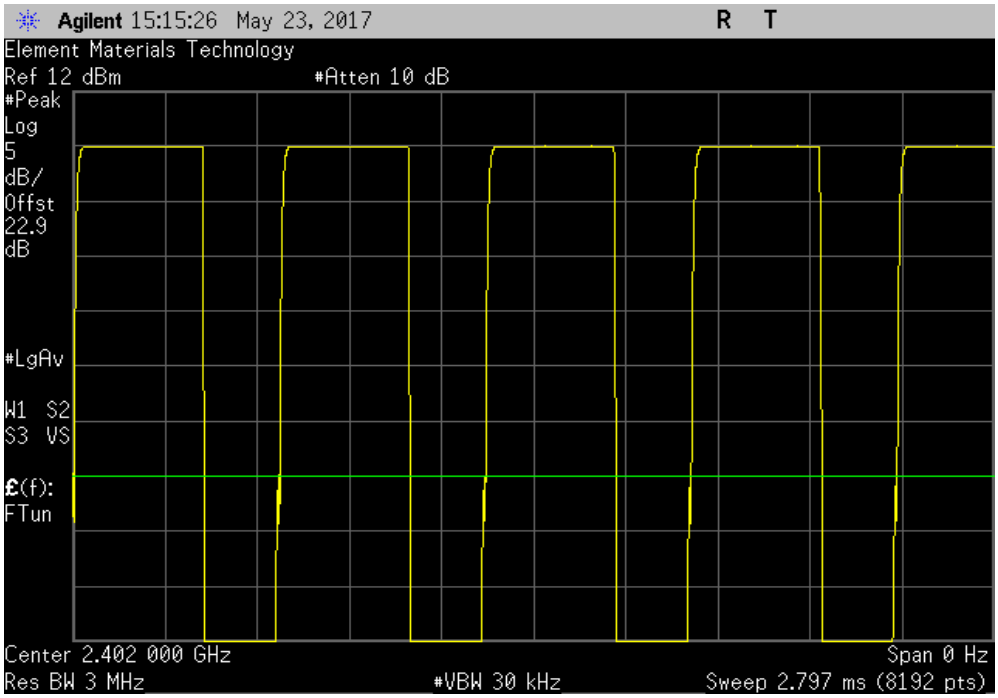
DUTY CYCLE

TbtTx 2017.01.27 XMit 2017.02.08

BLE/GFSK Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	363.809 us	621.626 us	1	58.5	N/A	N/A

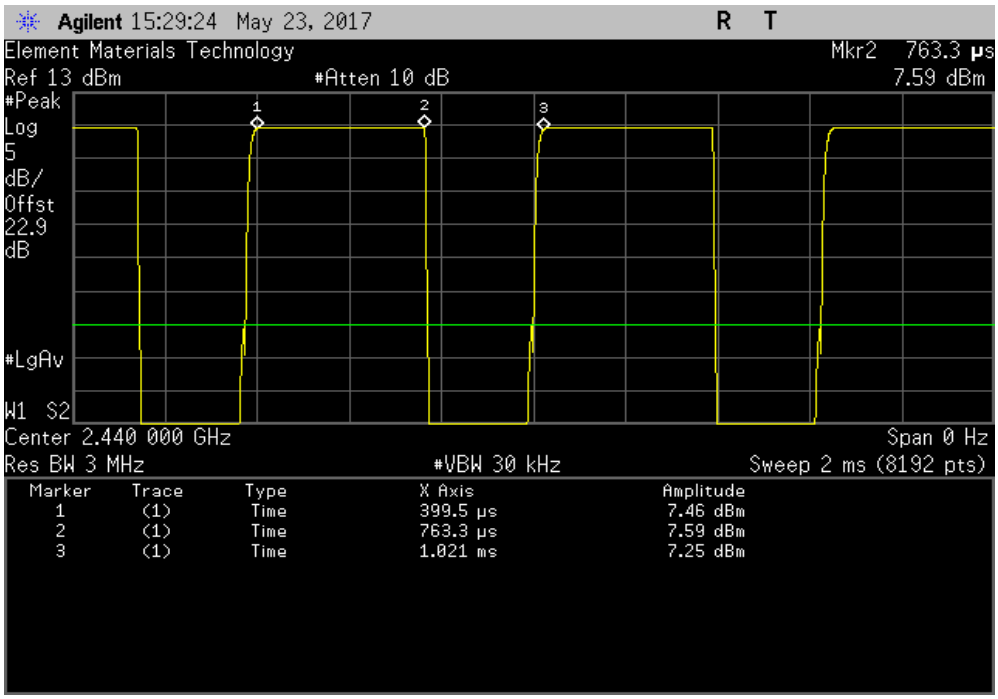


BLE/GFSK Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	6	N/A	N/A	N/A

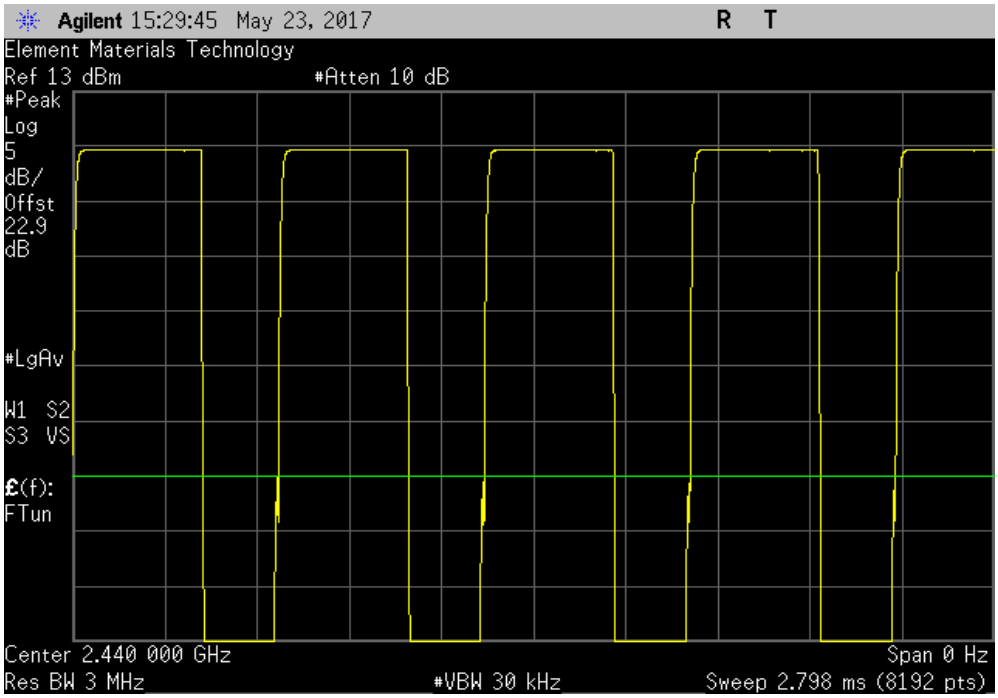


DUTY CYCLE

BLE/GFSK Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	363.765 us	621.87 us	1	58.5	N/A	N/A



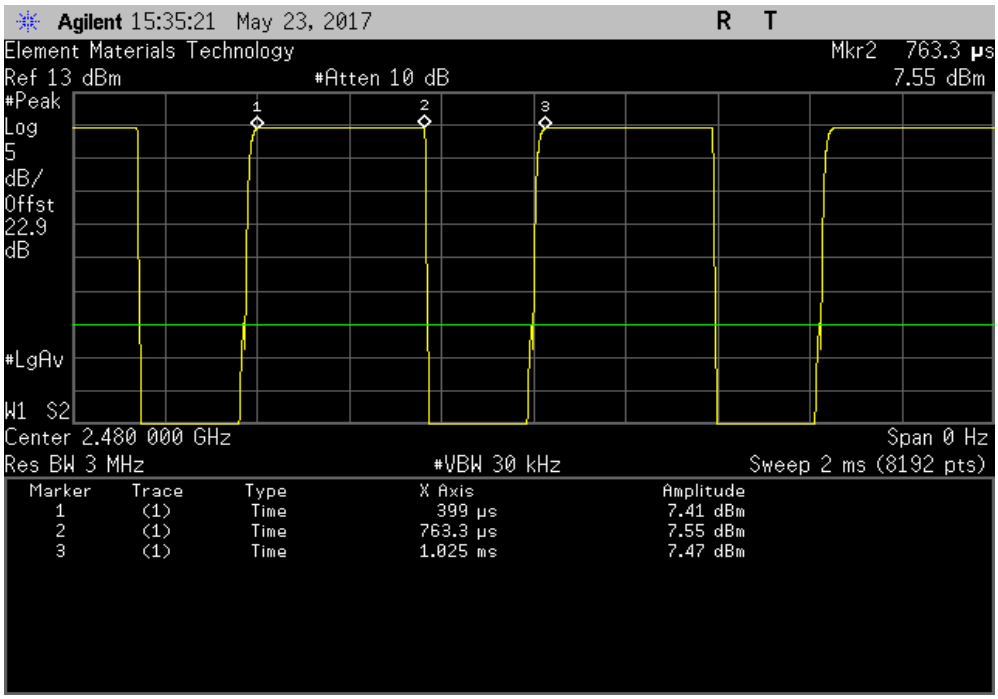
BLE/GFSK Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



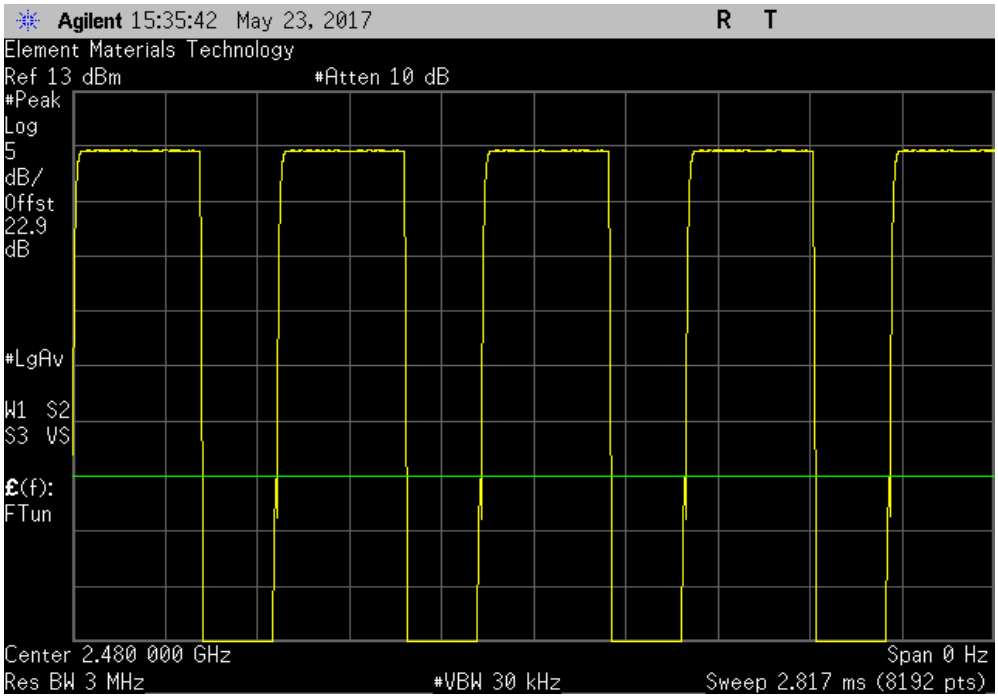
DUTY CYCLE

TbtTx 2017.01.27 XMit 2017.02.08

BLE/GFSK High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	364.309 us	626.021 us	1	58.2	N/A	N/A



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



OCCUPIED BANDWIDTH

XMit 2017.02.08

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	E8257D	TGU	2/5/2015	2/5/2018
Attenuator	Fairview Microwave	SA18E-20	TKS	3/6/2017	3/6/2018
Block - DC	Aeroflex	INMET 8535	AMO	3/27/2017	3/27/2018
Cable	Fairview Microwave	SCA1814-0101-120	OCZ	NCR	NCR
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	11/2/2016	11/2/2017

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The 20 dB occupied bandwidth was measured with the EUT set to low, medium and high transmit frequencies in the band. The EUT was transmitting at the data rate(s) listed in the datasheet in a no-hop mode.

OCCUPIED BANDWIDTH

TbtTx 2017.01.27 XMit 2017.02.08

EUT:	**IMP004M**			**Work Order:**	**ELIM0013**
Serial Number:	**IMP0107**			**Date:**	**05/31/17**
Customer:	**Electric Imp, Inc.**			**Temperature:**	**21.3 °C**
Attendees:	**Jonathan Dillon**			**Humidity:**	**49% RH**
Project:	**None**			**Barometric Pres.:**	**1014 mbar**
Tested by:	**Mike Tran**	**Power:**	**3.3VDC regulated down from USB 5V**	**Job Site:**	**OC13**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

COMMENTS

Total Offset 22.92dB (20dB pad + DC Block + coax cable + client provided patch cable) at 2.4GHz

DEVIATIONS FROM TEST STANDARD

None

Configuration #	**2**	*Signature*

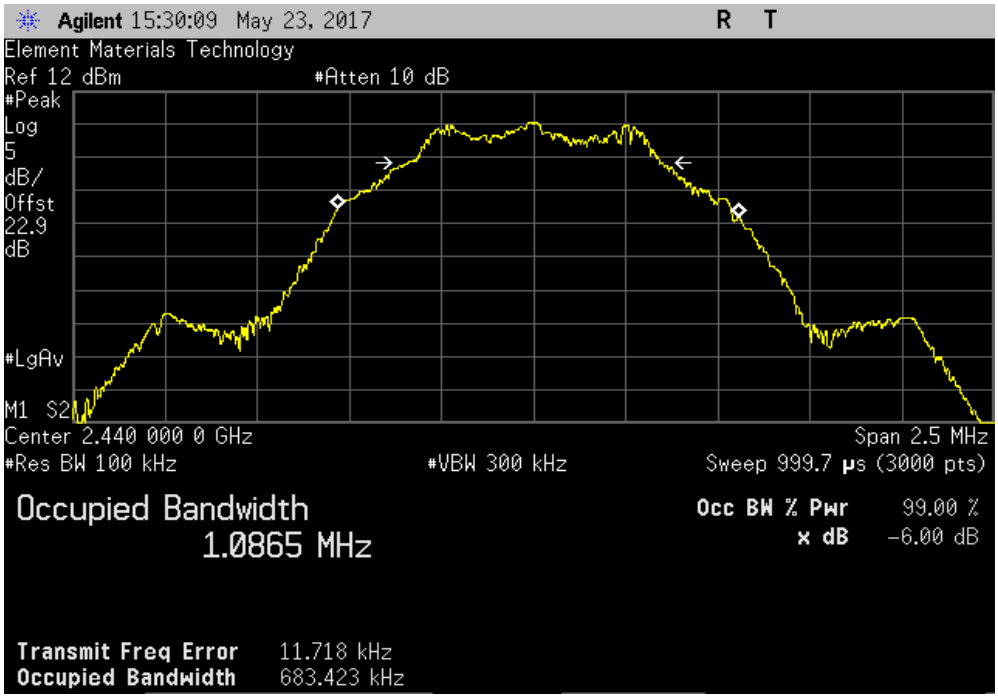
	Value	**Limit (≥)**	**Result**
BLE/GFSK Low Channel, 2402 MHz	676.758 kHz	500 kHz	Pass
BLE/GFSK Mid Channel, 2442 MHz	683.423 kHz	500 kHz	Pass
BLE/GFSK High Channel, 2480 MHz	654.945 kHz	500 kHz	Pass

OCCUPIED BANDWIDTH

TbtTx 2017.01.27 XMit 2017.02.08

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

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



OCCUPIED BANDWIDTH

TbtTx 2017.01.27 XMit 2017.02.08

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

OUTPUT POWER

XMit 2017.02.08

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	E8257D	TGU	2/5/2015	2/5/2018
Attenuator	Fairview Microwave	SA18E-20	TKS	3/6/2017	3/6/2018
Block - DC	Aeroflex	INMET 8535	AMO	3/27/2017	3/27/2018
Cable	Fairview Microwave	SCA1814-0101-120	OCZ	NCR	NCR
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	11/2/2016	11/2/2017

TEST DESCRIPTION

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

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

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

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

OUTPUT POWER

TbtTx 2017.01.27 XMit 2017.02.08

EUT:	**IMP004M**			**Work Order:**	**ELIM0013**
Serial Number:	**IMP0107**			**Date:**	**05/31/17**
Customer:	**Electric Imp, Inc.**			**Temperature:**	**21.3 °C**
Attendees:	**Jonathan Dillon**			**Humidity:**	**49% RH**
Project:	**None**			**Barometric Pres.:**	**1014 mbar**
Tested by:	**Mike Tran**	**Power:**	**3.3VDC regulated down from USB 5V**	**Job Site:**	**OC13**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

COMMENTS

Total Offset 22.92dB (20dB pad + DC Block + coax cable + client provided patch cable) at 2.4GHz

DEVIATIONS FROM TEST STANDARD

None

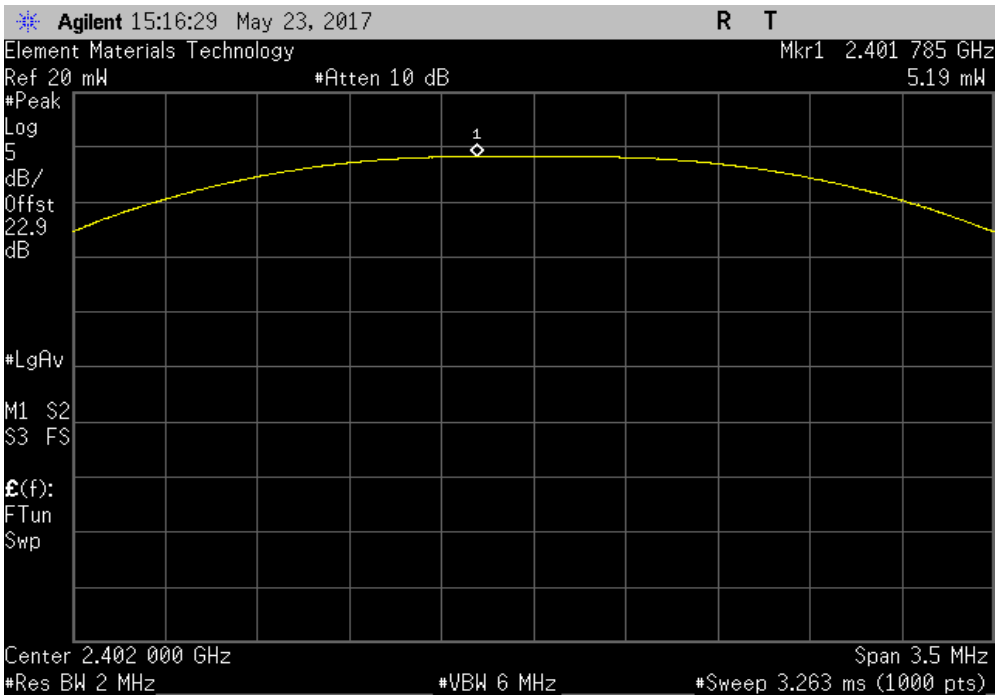
Configuration #	**2**	*Signature*

	Value	**Limit (<)**	**Result**
BLE/GFSK Low Channel, 2402 MHz	5.189 mW	1 W	Pass
BLE/GFSK Mid Channel, 2440 MHz	6.121 mW	1 W	Pass
BLE/GFSK High Channel, 2480 MHz	6.256 mW	1 W	Pass

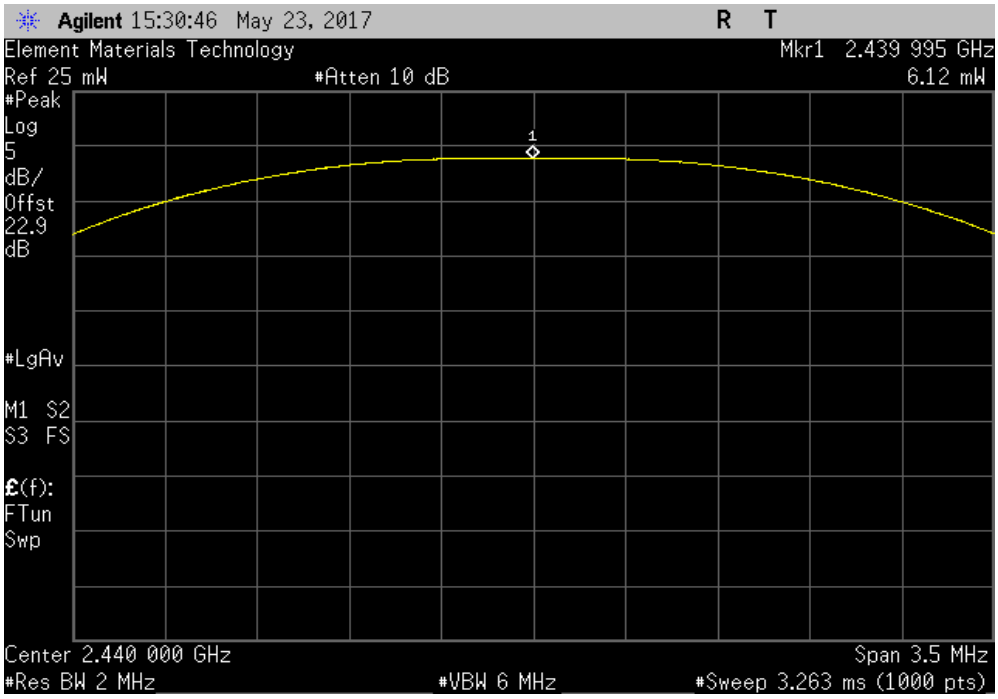
OUTPUT POWER

TbtTx 2017.01.27 XMit 2017.02.08

BLE/GFSK Low Channel, 2402 MHz							
					Value	Limit (<)	Result
					5.189 mW	1 W	Pass

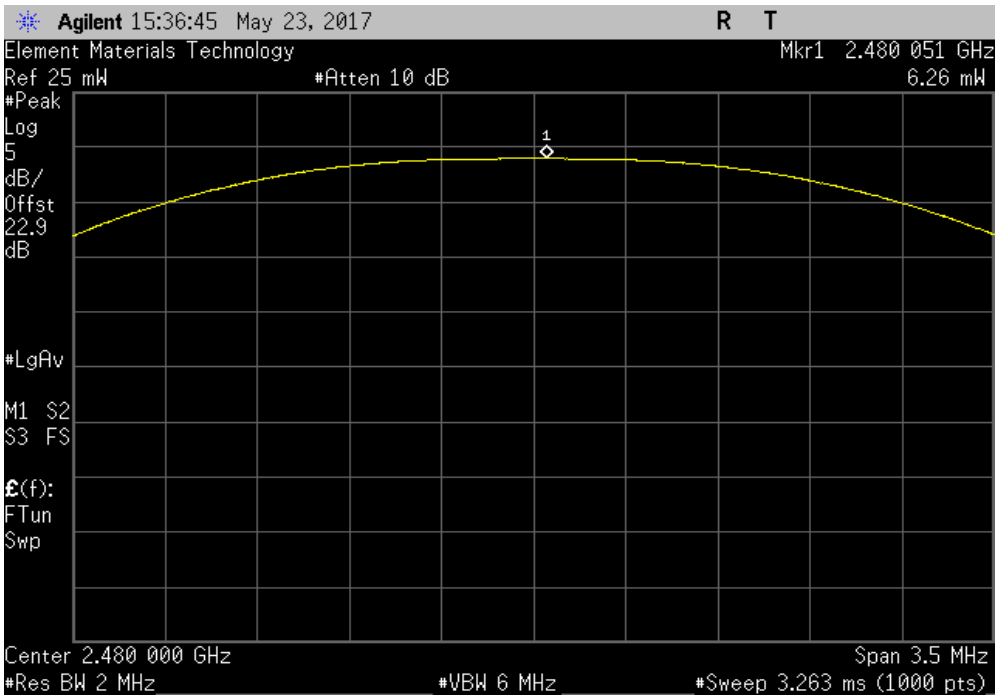


BLE/GFSK Mid Channel, 2440 MHz							
					Value	Limit (<)	Result
					6.121 mW	1 W	Pass



OUTPUT POWER

BLE/GFSK High Channel, 2480 MHz						
				Value	Limit (<)	Result
				6.256 mW	1 W	Pass



POWER SPECTRAL DENSITY

XMit 2017.02.08

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TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	E8257D	TGU	2/5/2015	2/5/2018
Attenuator	Fairview Microwave	SA18E-20	TKS	3/6/2017	3/6/2018
Block - DC	Aeroflex	INMET 8535	AMO	3/27/2017	3/27/2018
Cable	Fairview Microwave	SCA1814-0101-120	OCZ	NCR	NCR
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	11/2/2016	11/2/2017

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 2017.01.27 XMit 2017.02.08

EUT:	**IMP004M**			**Work Order:**	**ELIM0013**
Serial Number:	**IMP0107**			**Date:**	**05/31/17**
Customer:	**Electric Imp, Inc.**			**Temperature:**	**21.3 °C**
Attendees:	**Jonathan Dillon**			**Humidity:**	**49% RH**
Project:	**None**			**Barometric Pres.:**	**1014 mbar**
Tested by:	**Mike Tran**	**Power:**	**3.3VDC regulated down from USB 5V**	**Job Site:**	**OC13**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

COMMENTS

Total Offset 22.92dB (20dB pad + DC Block + coax cable + client provided patch cable) at 2.4GHz

DEVIATIONS FROM TEST STANDARD

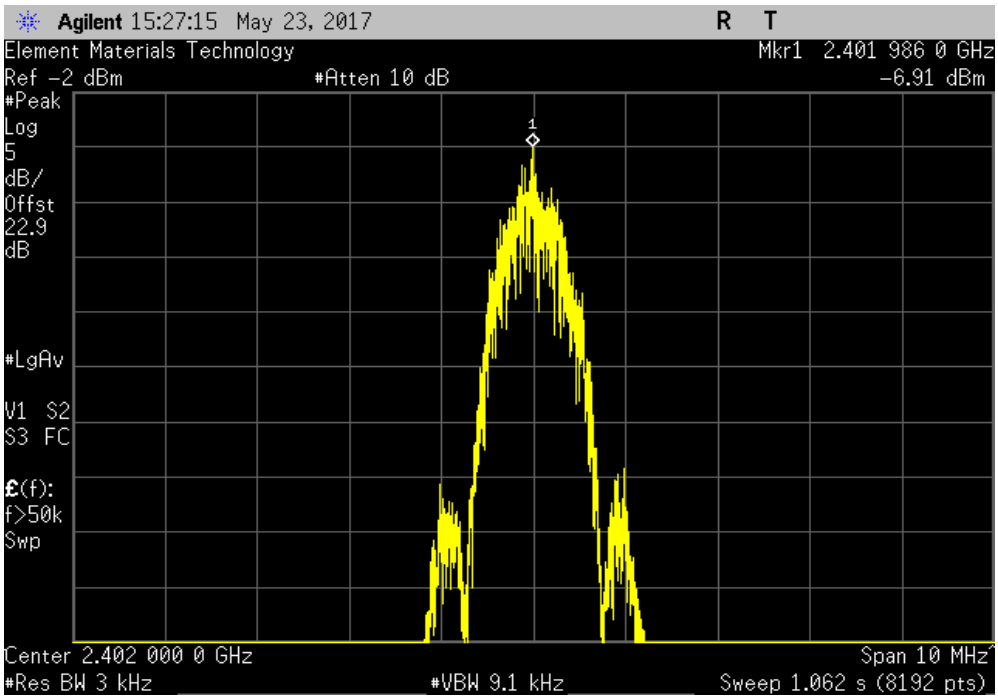
None

Configuration #	**2**	*Signature*

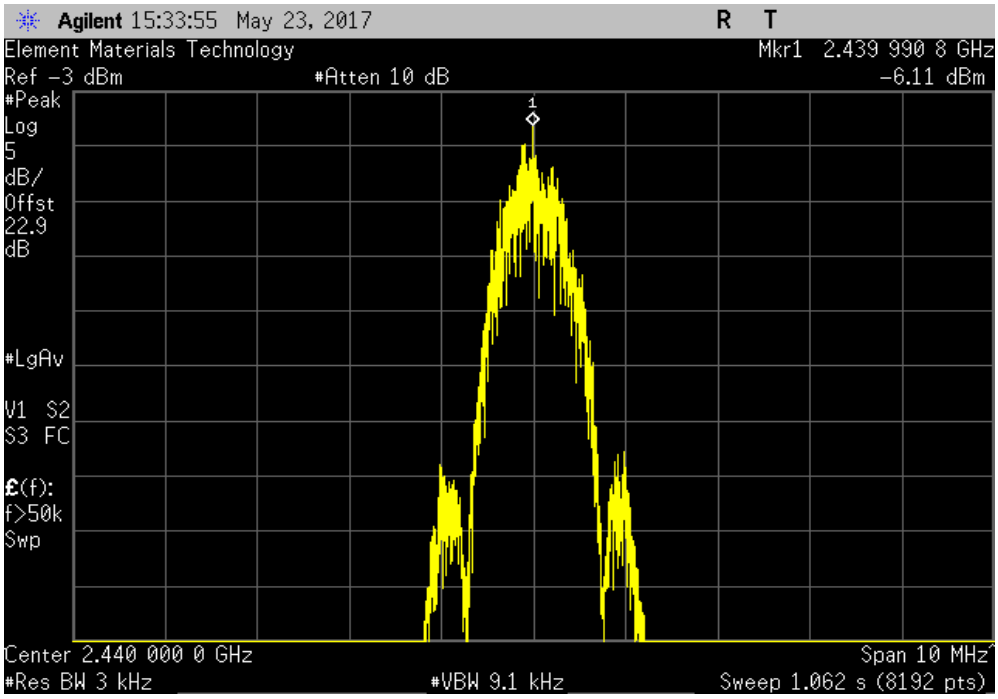
	Value dBm/3kHz	**Limit < dBm/3kHz**	**Results**
BLE/GFSK Low Channel, 2402 MHz	-6.909	8	Pass
BLE/GFSK Mid Channel, 2440 MHz	-6.105	8	Pass
BLE/GFSK High Channel, 2480 MHz	-7.698	8	Pass

POWER SPECTRAL DENSITY

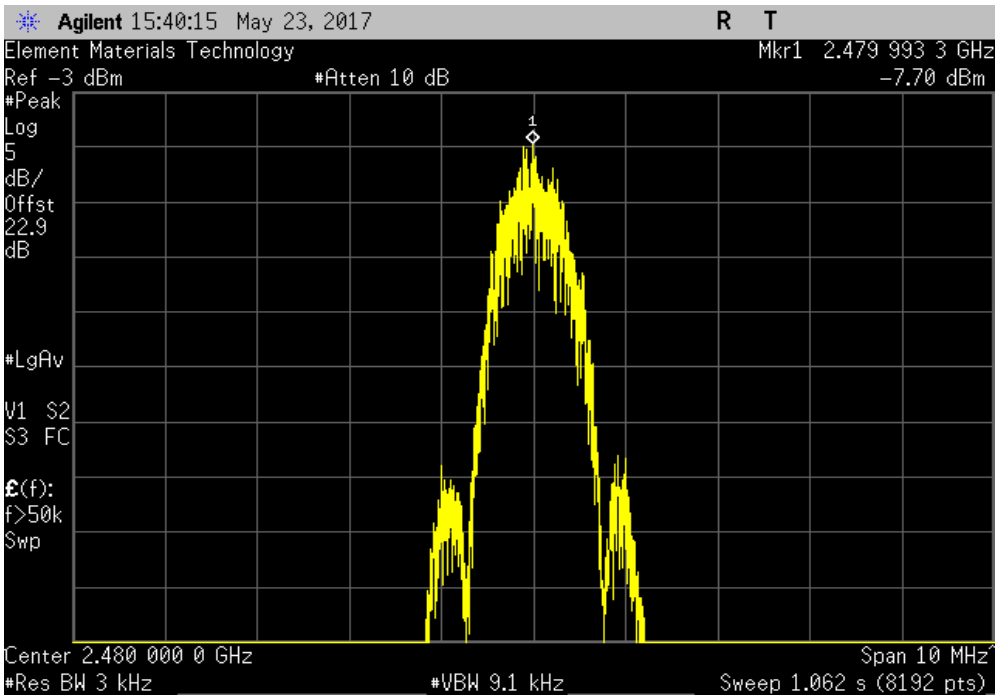
BLE/GFSK Low Channel, 2402 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-6.909	8	Pass



BLE/GFSK Mid Channel, 2440 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-6.105	8	Pass



BLE/GFSK High Channel, 2480 MHz							
					Value dBm/3kHz	Limit < dBm/3kHz	Results
					-7.698	8	Pass



BAND EDGE COMPLIANCE

XMit 2017.02.08

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	E8257D	TGU	2/5/2015	2/5/2018
Attenuator	Fairview Microwave	SA18E-20	TKS	3/6/2017	3/6/2018
Block - DC	Aeroflex	INMET 8535	AMO	3/27/2017	3/27/2018
Cable	Fairview Microwave	SCA1814-0101-120	OCZ	NCR	NCR
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	11/2/2016	11/2/2017

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 band were measured with the EUT set to low and high transmit frequencies. The EUT was transmitting at the data rate(s) listed in the datasheet in a no hop mode. The channels closest to the band edges were selected.

The spectrum was scanned below the lower band edge and above the higher band edge.

BAND EDGE COMPLIANCE

TbtTx 2017.01.27 XMit 2017.02.08

EUT:	**IMP004M**			**Work Order:**	**ELIM0013**
Serial Number:	**IMP0107**			**Date:**	**05/31/17**
Customer:	**Electric Imp, Inc.**			**Temperature:**	**21.3 °C**
Attendees:	**Jonathan Dillon**			**Humidity:**	**49% RH**
Project:	**None**			**Barometric Pres.:**	**1014 mbar**
Tested by:	**Mike Tran**	**Power:**	**3.3VDC regulated down from USB 5V**	**Job Site:**	**OC13**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

COMMENTS

Total Offset 22.92dB (20dB pad + DC Block + coax cable + client provided patch cable) at 2.4GHz

DEVIATIONS FROM TEST STANDARD

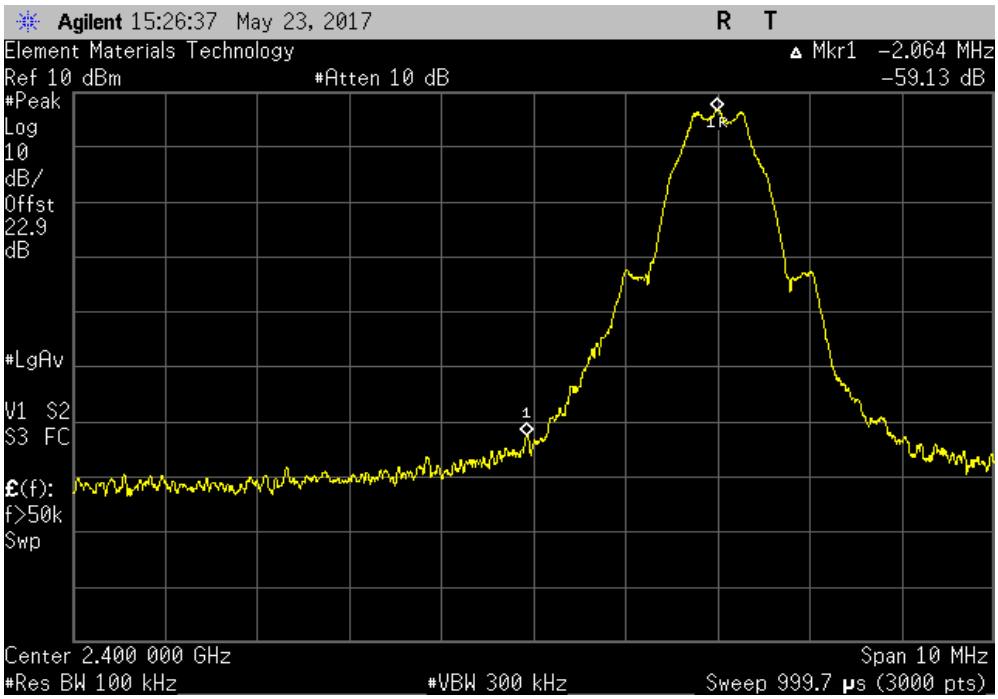
None

Configuration #	**2**	*Signature*

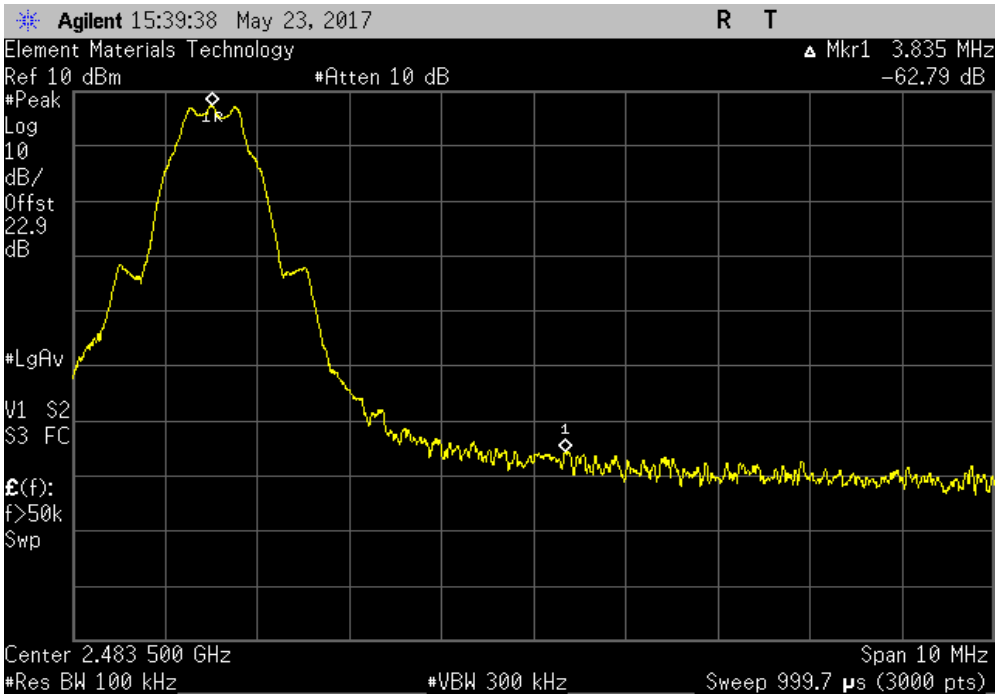
	Value (dBc)	**Limit ≤ (dBc)**	**Result**
BLE/GFSK Low Channel, 2402 MHz	-59.13	-20	Pass
BLE/GFSK High Channel, 2480 MHz	-62.79	-20	Pass

BAND EDGE COMPLIANCE

BLE/GFSK Low Channel, 2402 MHz							
					Value (dBc)	Limit ≤ (dBc)	Result
					-59.13	-20	Pass



BLE/GFSK High Channel, 2480 MHz							
					Value (dBc)	Limit ≤ (dBc)	Result
					-62.79	-20	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2017.02.08

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	E8257D	TGU	2/5/2015	2/5/2018
Attenuator	Fairview Microwave	SA18E-20	TKS	3/6/2017	3/6/2018
Block - DC	Aeroflex	INMET 8535	AMO	3/27/2017	3/27/2018
Cable	Fairview Microwave	SCA1814-0101-120	OCZ	NCR	NCR
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	11/2/2016	11/2/2017

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 in a no-hop mode. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.

SPURIOUS CONDUCTED EMISSIONS

TbtTx 2017.01.27 XMit 2017.02.08

EUT:	**IMP004M**			**Work Order:**	**ELIM0013**
Serial Number:	**IMP0107**			**Date:**	**05/31/17**
Customer:	**Electric Imp, Inc.**			**Temperature:**	**21.3 °C**
Attendees:	**Jonathan Dillon**			**Humidity:**	**49% RH**
Project:	**None**			**Barometric Pres.:**	**1014 mbar**
Tested by:	**Mike Tran**	**Power:**	**3.3VDC regulated down from USB 5V**	**Job Site:**	**OC13**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

COMMENTS

Total Offset 22.92dB (20dB pad + DC Block + coax cable + client provided patch cable) at 2.4GHz

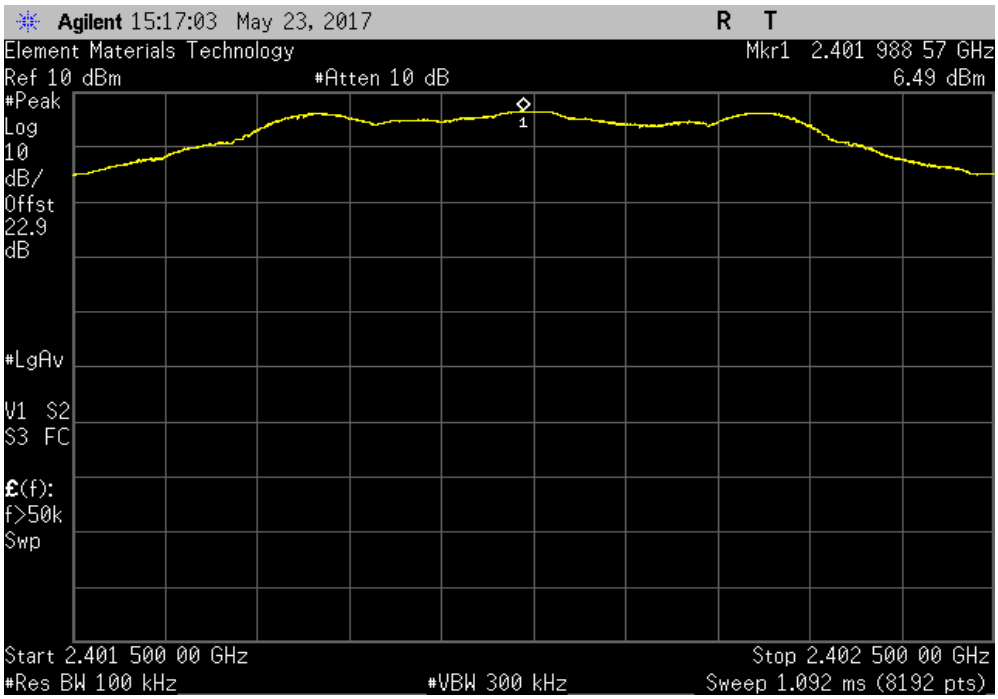
DEVIATIONS FROM TEST STANDARD

None

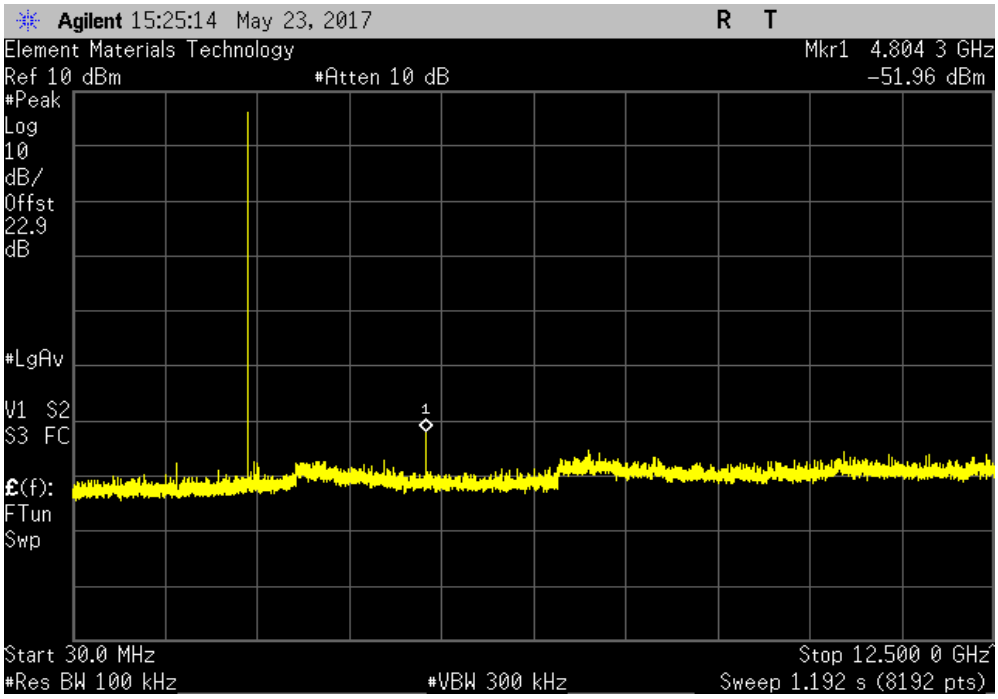
Configuration #	**2**	*Signature*

	Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result
BLE/GFSK Low Channel, 2402 MHz	Fundamental	N/A	N/A	N/A
BLE/GFSK Low Channel, 2402 MHz	30 MHz - 12.5 GHz	-58.45	-20	Pass
BLE/GFSK Low Channel, 2402 MHz	12.5 GHz - 25 GHz	-58.31	-20	Pass
BLE/GFSK Mid Channel, 2440 MHz	Fundamental	N/A	N/A	N/A
BLE/GFSK Mid Channel, 2440 MHz	30 MHz - 12.5 GHz	-59.67	-20	Pass
BLE/GFSK Mid Channel, 2440 MHz	12.5 GHz - 25 GHz	-58.98	-20	Pass
BLE/GFSK High Channel, 2480 MHz	Fundamental	N/A	N/A	N/A
BLE/GFSK High Channel, 2480 MHz	30 MHz - 12.5 GHz	-58.34	-20	Pass
BLE/GFSK High Channel, 2480 MHz	12.5 GHz - 25 GHz	-59.32	-20	Pass

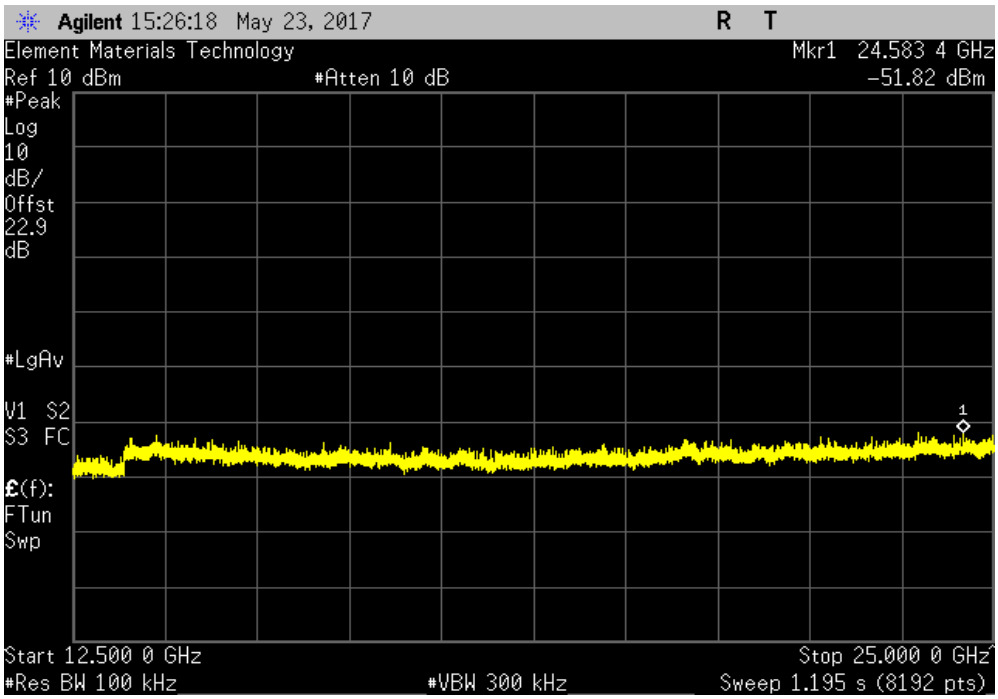
BLE/GFSK Low Channel, 2402 MHz						
	Frequency Range			**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
	Fundamental			N/A	N/A	N/A



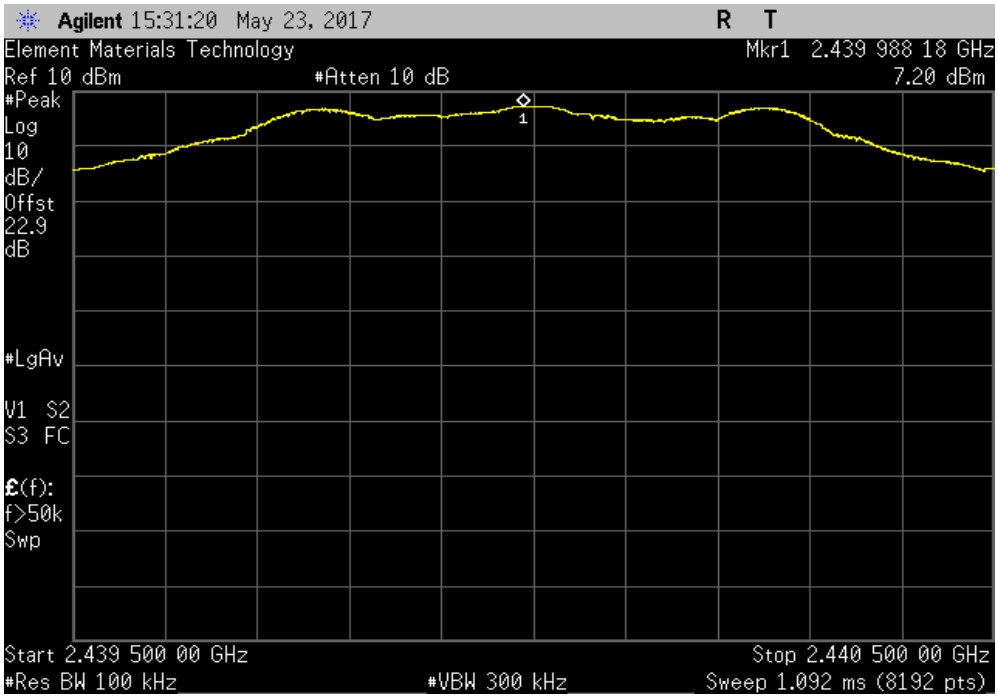
BLE/GFSK Low Channel, 2402 MHz					
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
30 MHz - 12.5 GHz		-58.45	-20	Pass



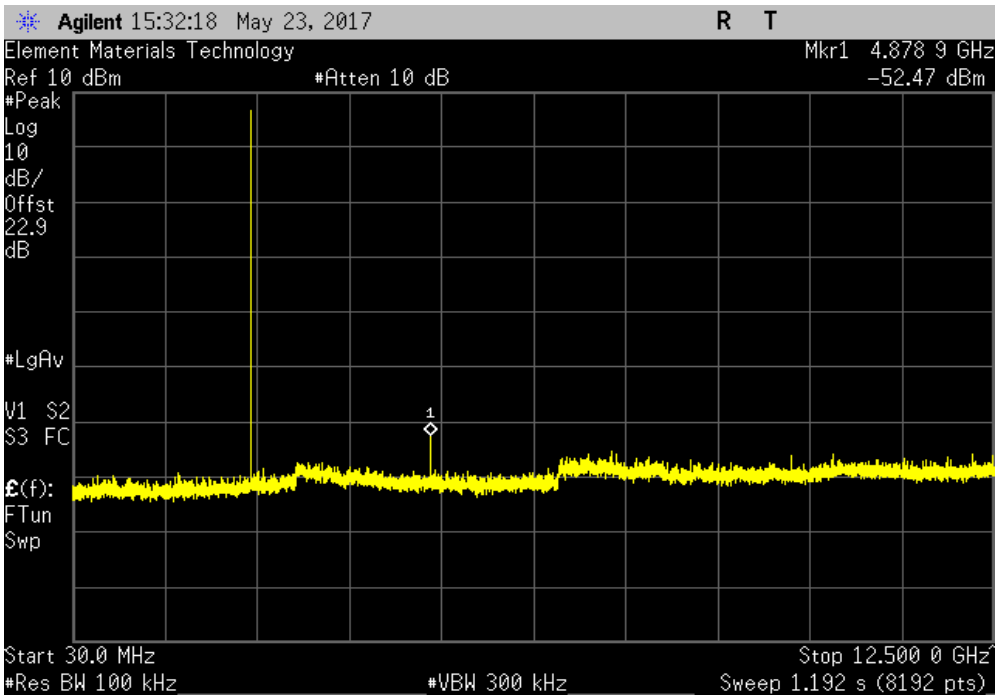
BLE/GFSK Low Channel, 2402 MHz				
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz		-58.31	-20	Pass



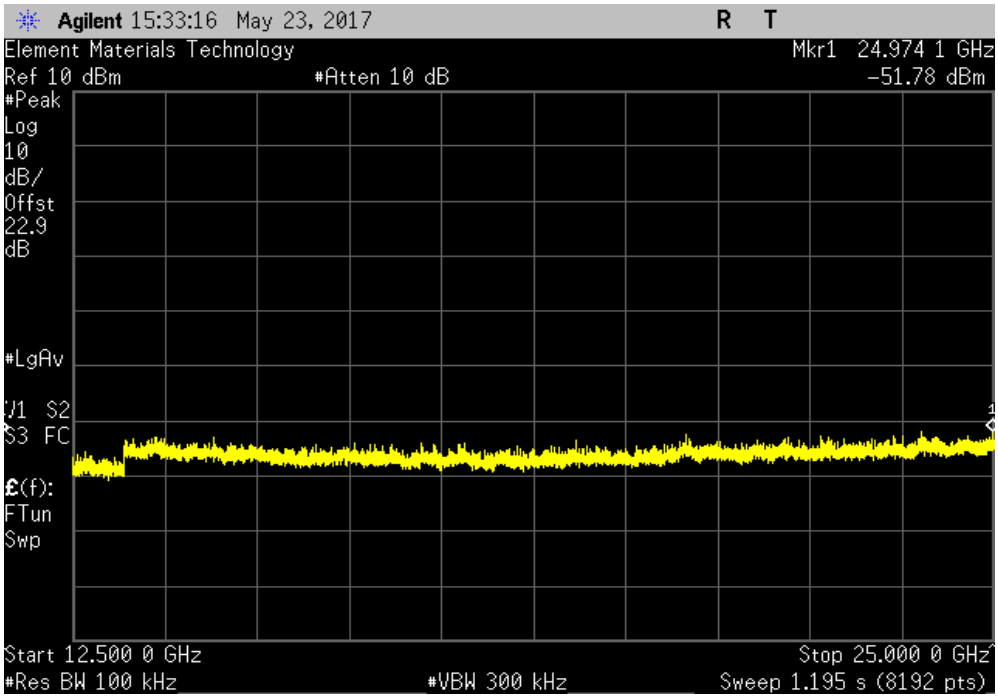
BLE/GFSK Mid Channel, 2440 MHz					
	Frequency Range			**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
	Fundamental			N/A	N/A	N/A



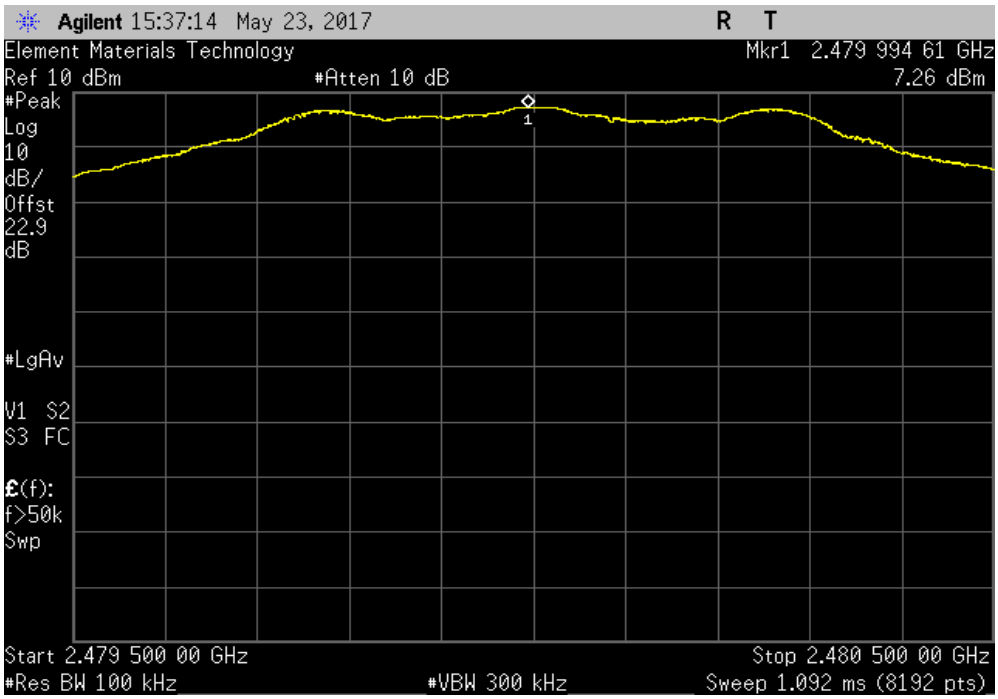
BLE/GFSK Mid Channel, 2440 MHz				
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
30 MHz - 12.5 GHz		-59.67	-20	Pass



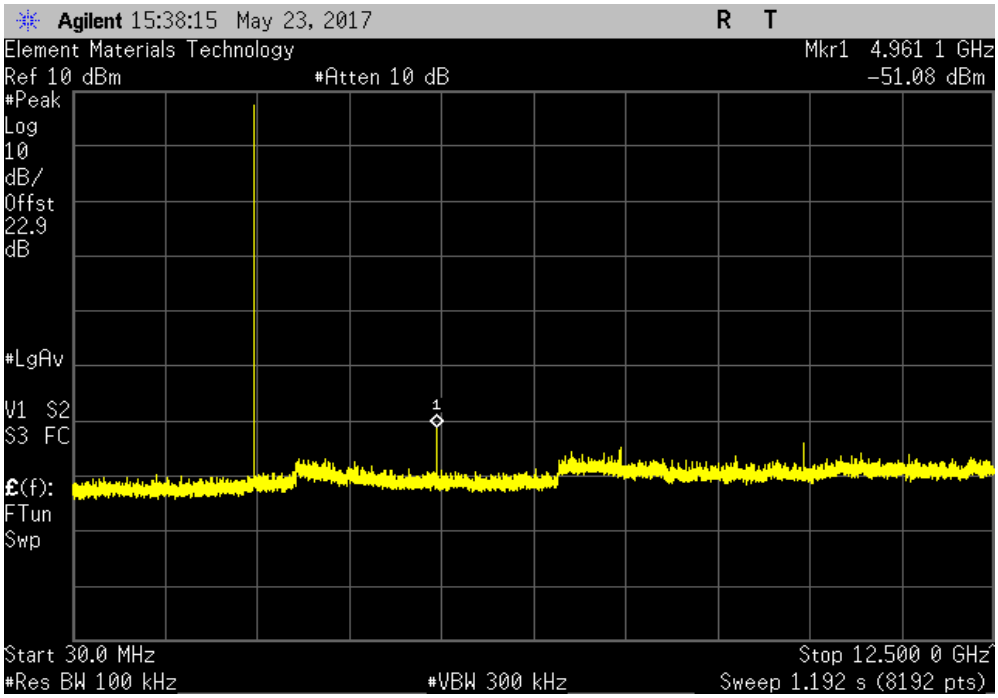
BLE/GFSK Mid Channel, 2440 MHz				
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz		-58.98	-20	Pass



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



BLE/GFSK High Channel, 2480 MHz						
	Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
	30 MHz - 12.5 GHz			-58.34	-20	Pass



BLE/GFSK High Channel, 2480 MHz				
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz		-59.32	-20	Pass