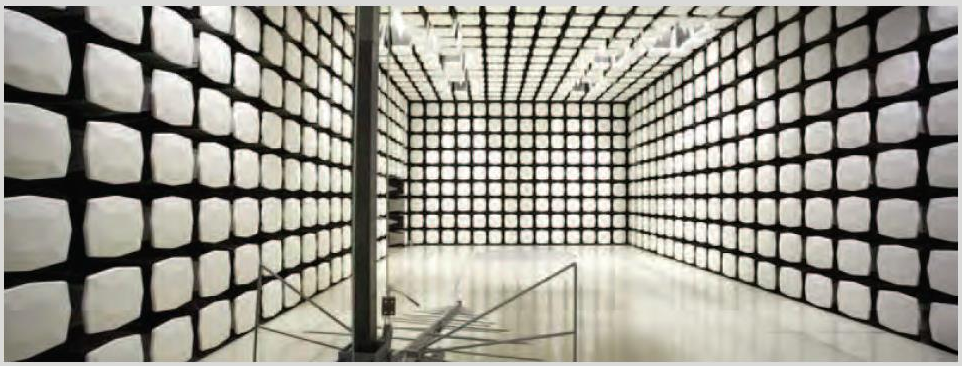
Leviton Mfg Co, Inc

Zigbee BLE Module C0945

FCC 15.247:2021
Bluetooth Low Energy (DTS) Radio

Report: LEVT0137 Rev. 1, Issue Date: April 15, 2022



CERT #3310.02

CERTIFICATE OF TEST

Last Date of Test: November 10, 2021
Leviton Mfg Co, Inc
EUT: Zigbee BLE Module C0945

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2021	ANSI C63.10:2013, KDB 558074
FCC 15.247:2021	

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted 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	
11.12.1, 11.13.2, 6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Kyle Holgate, 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
01	Changed the rated power to 19dBm.	2022-04-15	11
	Renamed the data to DTS bandwidth; removed the reference to the 99% OBW measurement, this is a holdover test description from previous reporting formats	2022-04-15	23-26
	Added the correct updated block diagram that properly shows the calculations.	2022-04-15	7-9

ACCREDITATIONS AND AUTHORIZATIONS

element
2021.09.01

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 - Each laboratory is accredited by A2LA to ISO / IEC 17025, and as a product certifier to ISO / IEC 17065 which allows Element to certify transmitters to FCC and IC specifications.

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 – Recognized as an EU Notified Body validated for the EMCD and RED Directives.

United Kingdom

BEIS – Recognized by the UK as an Approved Body under the UK Radio Equipment and UK EMC Regulations.

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

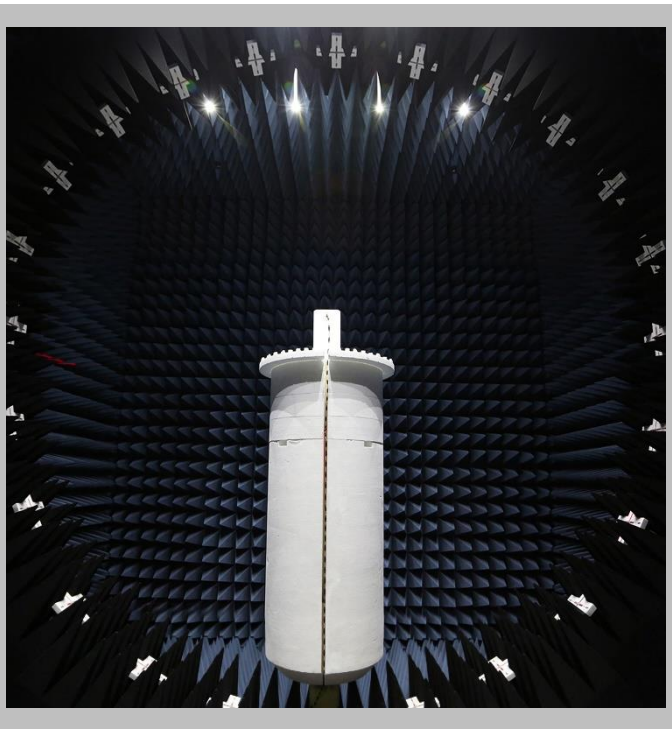
For details on the Scopes of our Accreditations, please visit:

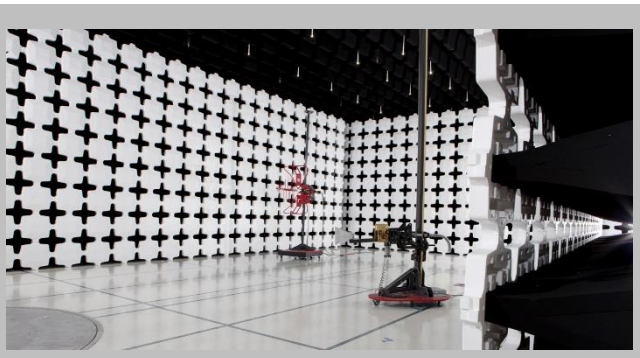
California Minnesota Oregon Texas Washington

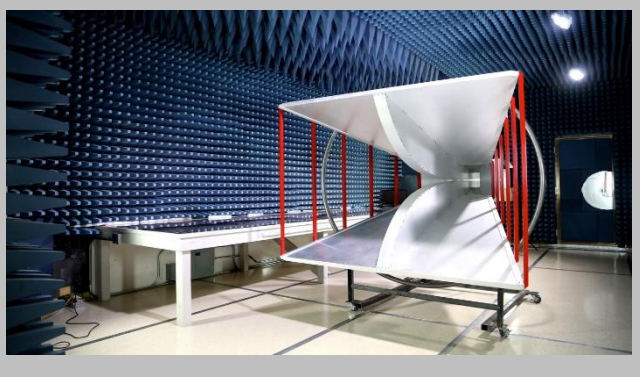
FACILITIES

element
2020.12.15

California	Minnesota	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-11 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
A2LA				
Lab Code: 3310.04	Lab Code: 3310.05	Lab Code: 3310.02	Lab Code: 3310.03	Lab Code: 3310.06
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 in the table below. A lab specific value may also be found in the applicable test description section. 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	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 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)	3.2 dB	-3.2 dB

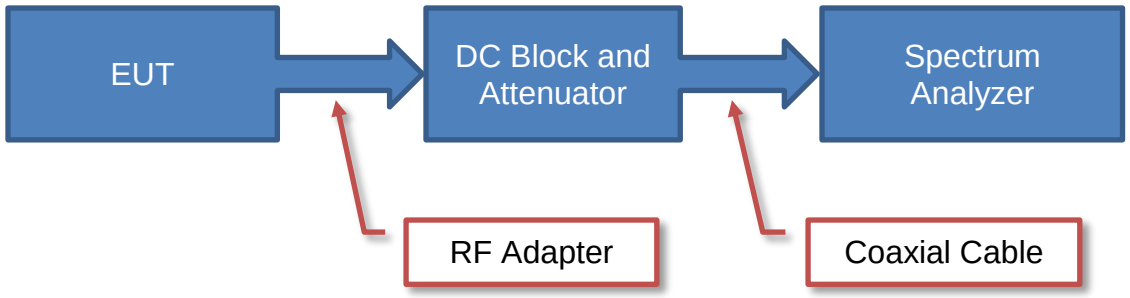
TEST SETUP BLOCK DIAGRAMS

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

Unless otherwise stated, measurements were made using the bandwidths and detectors specified. No video filter was used.

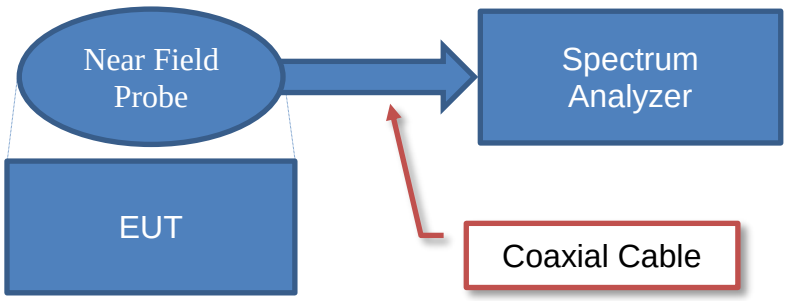
Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

Measured Value		Measured Level		Reference Level Offset
71.2	=	42.6	+	28.6

Near Field Test Fixture Measurements

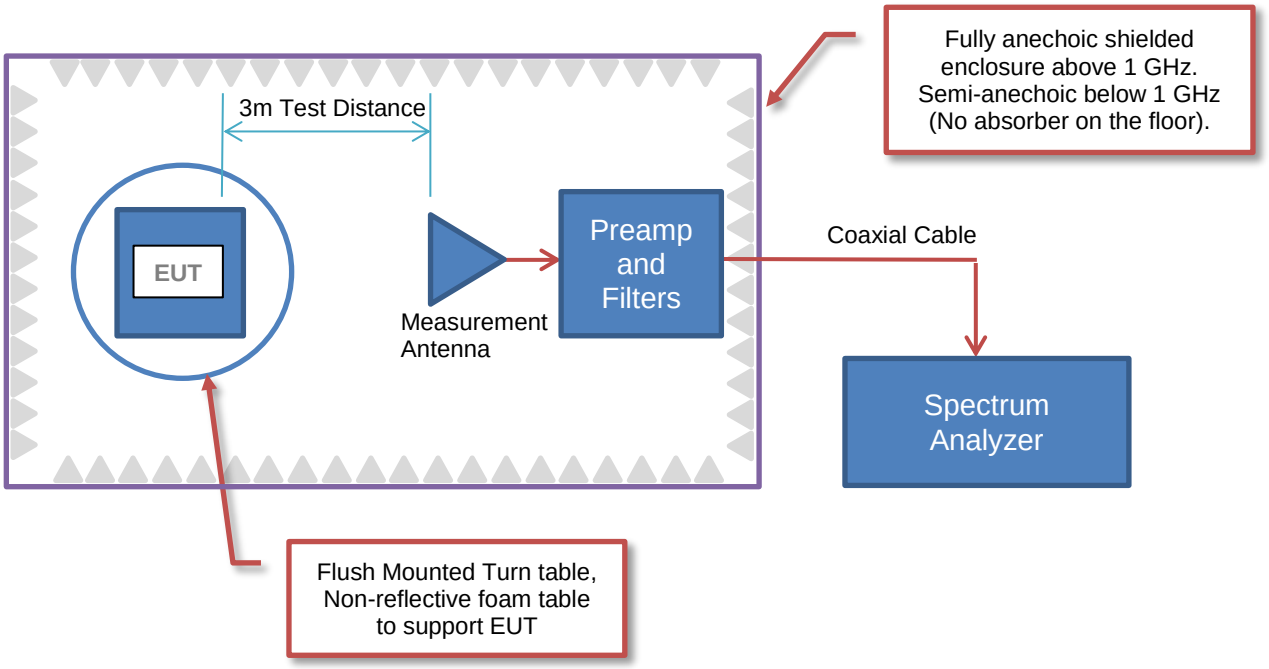


Sample Calculation (logarithmic units)

Measured Value		Measured Level		Reference Level Offset
71.2	=	42.6	+	28.6

TEST SETUP BLOCK DIAGRAMS

Emissions Measurements



Sample Calculation (logarithmic units)

Radiated Emissions:

			Factor										
Measured Level (Amplitude)		Antenna Factor		Cable Factor		Amplifier Gain		Distance Adjustment Factor		External Attenuation		Field Strength
42.6	+	28.6	+	3.1	-	40.8	+	0.0	+	0.0	=	**33.5**

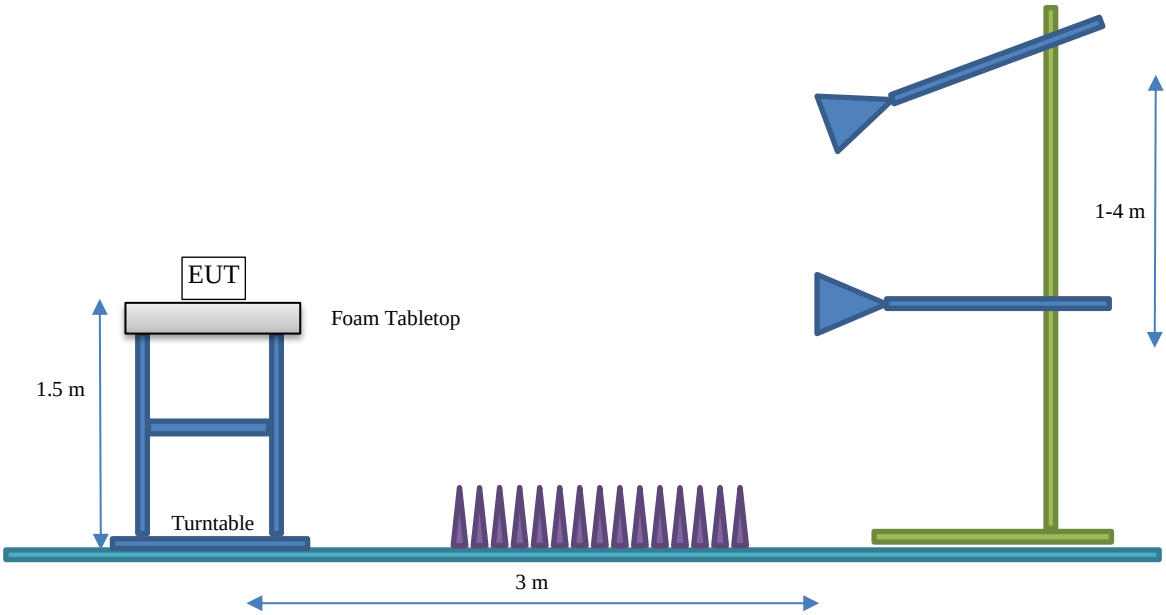
Conducted Emissions:

		Factor						
Measured Level (Amplitude)		Transducer Factor		Cable Factor		External Attenuation		Adjusted Level
26.7	+	0.3	+	0.1	+	20.0	=	**47.1**

TEST SETUP BLOCK DIAGRAMS

Bore Sighting (>1GHz)

The diameter of the illumination area is the dimension of the line tangent to the EUT formed by 3 dB beamwidth of the measurement antenna at the measurement distance. At a 3 meter test distance, the diameter of the illumination area was 3.8 meters at 1 GHz and greater than 2.1 meters up to 6 GHz. Above 1 GHz, when required by the measurement standard, the antenna is pointed for both azimuth and elevation to maintain the receive antenna within the cone of radiation from the EUT. The specified measurement detectors were used for comparison of the emissions to the peak and average specification limits.



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Leviton Mfg Co, Inc
Address:	PO Box 10600
City, State, Zip:	Melville, OR 11747-3138
Test Requested By:	Dmitriy Moskovkin
EUT:	Zigbee BLE Module C0945
First Date of Test:	September 27, 2021
Last Date of Test:	November 10, 2021
Receipt Date of Samples:	November 9, 2021
Equipment Design Stage:	Prototype
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Bluetooth LE and Zigbee radio module

Testing Objective:
To demonstrate compliance of the Bluetooth Low Energy (DTS) radio to FCC 15.247 requirements.

POWER SETTINGS AND ANTENNAS

The power settings, antenna gain value(s) and cable loss (if applicable) used for the testing contained in this report were provided by the customer and will affect the validity of the results. Element assumes no responsibility for the accuracy of this information.

ANTENNA GAIN (dBi)

Type	Provided by:	Frequency Range (MHz)	Gain (dBi)
Ceramic Chip	Manufacturer	2400 - 2500	1.5

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

SETTINGS FOR ALL TESTS IN THIS REPORT

Modulation Types / Data Rates	Type	Channel	Frequency (MHz)	Power Setting
BLE, GFSK, 1 Mbps	DTS	0 or 37	2402	19 dBm
		20 or 18	2440	19 dBm
		39	2480	19 dBm

CONFIGURATIONS

Configuration LEVT0137- 1

Software/Firmware Running During Test	
Description	**Version**
Rail Test App	2.8.1.0

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
BLE / ZigBee Module	Leviton MFG Co Inc.	C0945	Sample 1

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Host PCB	Leviton MFG Co Inc.	B2183	Sample 1
Switch Mode Power Supply	V-Infinity	EMSA050100	None

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	HP	Probook 640 G3	5CG72466R3

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB	Yes	1.5 m	No	Host PCB	Switch Mode Power Supply

CONFIGURATIONS

Configuration LEVT0137- 2

Software/Firmware Running During Test	
Description	**Version**
Rail Test App	2.8.1.0

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
BLE / ZigBee Module	Leviton MFG Co Inc.	C0945	Sample 2

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Host PCB	Leviton MFG Co Inc.	B2183	Sample 1
Host PCB	Leviton MFG Co Inc.	B2183	Sample 2

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Switch Mode Power Supply	V-Infinity	EMSA050100	None
Laptop	HP	Probook 640 G3	5CG72466R3

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
FTDI	Yes	1.5 m	No	Host PCB	Laptop
USB	Yes	1.5 m	No	Host PCB	Switch Mode Power Supply

CONFIGURATIONS

Configuration LEVT0137- 3

Software/Firmware Running During Test	
Description	**Version**
Rail Test App	2.8.1.0

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
BLE / ZigBee Module	Leviton MFG Co Inc.	C0945	Sample 1

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Host PCB	Leviton MFG Co Inc.	B2183	Sample 1

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	HP	Probook 640 G3	5CG72466R3

CONFIGURATIONS

Configuration LEVT0136- 1

Software/Firmware Running During Test	
Description	**Version**
Rail Test App	2.8.1.0

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
BLE / ZigBee Module	Leviton MFG Co Inc.	C0945	Sample 1

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Host PCB	Leviton MFG Co Inc.	B2183	Sample 1
Switch Mode Power Supply	V-Infinity	EMSA050100	None

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	HP	Probook 640 G3	5CG72466R3

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB	Yes	1.5 m	No	Host PCB	Switch Mode Power Supply

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2021-09-27	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	2021-11-10	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	2021-11-10	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	2021-11-10	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	2021-11-10	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	2021-11-10	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	2021-11-10	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
8	2021-11-10	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

element
WTD.2021.09.21.0
EmiR5 2021.09.09.0
PSA-ESCI 2021.03.17.0

TEST DESCRIPTION

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2021-01-06	2022-01-06
Cable - Conducted Cable Assembly	Northwest EMC	EVG, HHD, RKT	EVGA	2021-01-05	2022-01-05
LISN	Solar Electronics	9252-50-R-24-BNC	LIR	2021-09-10	2022-09-10
Power Supply - DC	Topward	TPS-2000	TPD	NCR	NCR

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	3.2 dB	-3.2 dB

CONFIGURATIONS INVESTIGATED

LEVT0137-3

MODES INVESTIGATED

Continuous TX, BLE GFSK, 1 Mbps, Mid Ch = 2440 MHz

POWERLINE CONDUCTED EMISSIONS

element
WTD.2021.09.21.0
EmiR5 2021.09.09.0
PSA-ESCI 2021.03.17.0

EUT:	Zigbee BLE Module C0945	Work Order:	LEVT0137
Serial Number:	Sample 1	Date:	2021-11-10
Customer:	Leviton Mfg Co, Inc	Temperature:	22.3°C
Attendees:	Vikas Asthana	Relative Humidity:	39.6%
Customer Project:	None	Bar. Pressure (PMSL):	1029 mb
Tested By:	Jeff Alcoke	Job Site:	EV07
Power:	3.3VDC via 110VAC/60Hz	Configuration:	LEVT0137-3

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	2	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

Measuring AC mains of lab DC power supply.

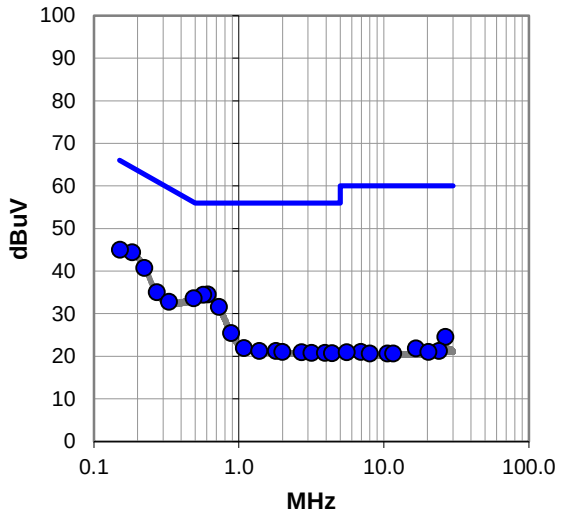
EUT OPERATING MODES

Continuous TX, BLE GFSK, 1 Mbps, Mid Ch = 2440 MHz

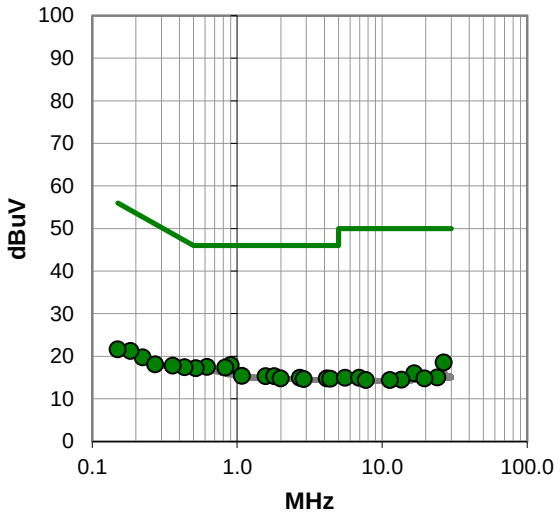
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

element
WTD.2021.09.21.0
EmiR5 2021.09.09.0
PSA-ESCI 2021.03.17.0

RESULTS - Run #2

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.184	24.3	20.1	44.4	64.3	-19.9
0.152	24.9	20.1	45.0	65.9	-20.9
0.611	14.5	20.0	34.5	56.0	-21.5
0.570	14.4	20.0	34.4	56.0	-21.6
0.223	20.6	20.1	40.7	62.7	-22.0
0.487	13.6	20.0	33.6	56.2	-22.6
0.728	11.6	20.0	31.6	56.0	-24.4
0.272	15.0	20.0	35.0	61.1	-26.1
0.330	12.8	20.0	32.8	59.5	-26.7
0.884	5.4	20.0	25.4	56.0	-30.6
1.082	1.9	20.0	21.9	56.0	-34.1
1.383	1.2	20.0	21.2	56.0	-34.8
1.802	1.2	20.0	21.2	56.0	-34.8
1.996	1.0	20.0	21.0	56.0	-35.0
2.704	0.9	20.0	20.9	56.0	-35.1
3.176	0.8	20.0	20.8	56.0	-35.2
3.928	0.8	20.0	20.8	56.0	-35.2
4.390	0.6	20.1	20.7	56.0	-35.3
26.609	3.4	21.1	24.5	60.0	-35.5
16.633	1.2	20.6	21.8	60.0	-38.2
24.011	0.2	21.0	21.2	60.0	-38.8
6.934	0.8	20.2	21.0	60.0	-39.0
20.384	0.2	20.8	21.0	60.0	-39.0
5.547	0.7	20.2	20.9	60.0	-39.1
8.020	0.4	20.2	20.6	60.0	-39.4

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.902	-2.1	20.0	17.9	46.0	-28.1
0.618	-2.5	20.0	17.5	46.0	-28.5
0.829	-2.7	20.0	17.3	46.0	-28.7
0.518	-2.8	20.0	17.2	46.0	-28.8
0.434	-2.6	20.0	17.4	47.2	-29.8
1.079	-4.6	20.0	15.4	46.0	-30.6
1.569	-4.7	20.0	15.3	46.0	-30.7
1.802	-4.7	20.0	15.3	46.0	-30.7
0.359	-2.2	20.0	17.8	48.8	-31.0
2.704	-5.1	20.0	14.9	46.0	-31.1
1.998	-5.2	20.0	14.8	46.0	-31.2
4.160	-5.2	20.0	14.8	46.0	-31.2
4.389	-5.4	20.1	14.7	46.0	-31.3
2.884	-5.4	20.0	14.6	46.0	-31.4
26.609	-2.6	21.1	18.5	50.0	-31.5
0.223	-0.4	20.1	19.7	52.7	-33.0
0.272	-1.9	20.0	18.1	51.1	-33.0
0.184	1.1	20.1	21.2	54.3	-33.1
16.633	-4.6	20.6	16.0	50.0	-34.0
0.150	1.5	20.1	21.6	56.0	-34.4
24.011	-6.0	21.0	15.0	50.0	-35.0
5.547	-5.3	20.2	14.9	50.0	-35.1
6.934	-5.3	20.2	14.9	50.0	-35.1
19.653	-6.0	20.8	14.8	50.0	-35.2
13.577	-6.0	20.5	14.5	50.0	-35.5

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

element
WTD.2021.09.21.0
EmiR5 2021.09.09.0
PSA-ESCI 2021.03.17.0

EUT:	Zigbee BLE Module C0945	Work Order:	LEVT0137
Serial Number:	Sample 1	Date:	2021-11-10
Customer:	Leviton Mfg Co, Inc	Temperature:	22.3°C
Attendees:	Vikas Asthana	Relative Humidity:	39.6%
Customer Project:	None	Bar. Pressure (PMSL):	1029 mb
Tested By:	Jeff Alcoke	Job Site:	EV07
Power:	3.3VDC via 110VAC/60Hz	Configuration:	LEVT0137-3

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	3	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

Measuring AC mains of lab DC power supply.

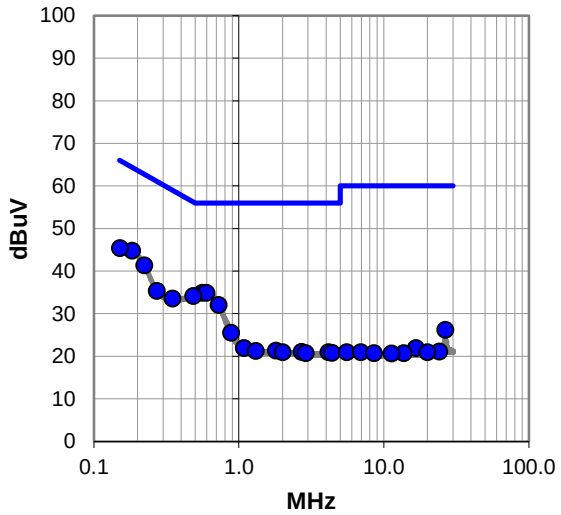
EUT OPERATING MODES

Continuous TX, BLE GFSK, 1 Mbps, Mid Ch = 2440 MHz

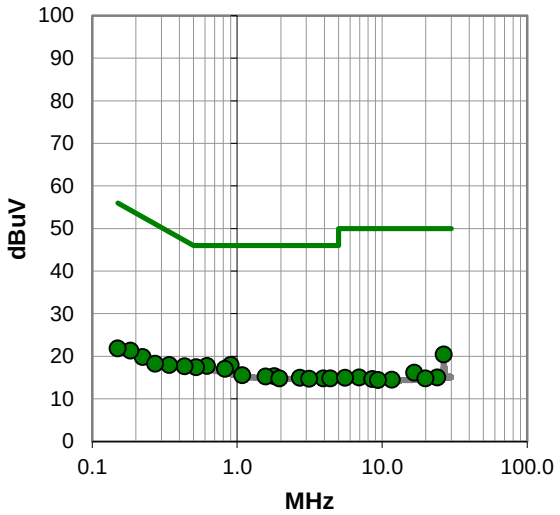
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

element
WTD.2021.09.21.0
EmiR5 2021.09.09.0
PSA-ESCI 2021.03.17.0

RESULTS - Run #3

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.184	24.7	20.1	44.8	64.3	-19.5
0.152	25.3	20.1	45.4	65.9	-20.5
0.560	14.9	20.0	34.9	56.0	-21.1
0.597	14.9	20.0	34.9	56.0	-21.1
0.223	21.2	20.1	41.3	62.7	-21.4
0.486	14.1	20.0	34.1	56.2	-22.1
0.727	12.0	20.0	32.0	56.0	-24.0
0.348	13.5	20.0	33.5	59.0	-25.5
0.272	15.3	20.0	35.3	61.1	-25.8
0.884	5.5	20.0	25.5	56.0	-30.5
26.611	5.1	21.1	26.2	60.0	-33.8
1.082	1.9	20.0	21.9	56.0	-34.1
1.804	1.3	20.0	21.3	56.0	-34.7
1.311	1.2	20.0	21.2	56.0	-34.8
2.706	1.0	20.0	21.0	56.0	-35.0
2.005	0.9	20.0	20.9	56.0	-35.1
4.160	0.9	20.0	20.9	56.0	-35.1
4.393	0.7	20.1	20.8	56.0	-35.2
2.895	0.7	20.0	20.7	56.0	-35.3
16.635	1.3	20.6	21.9	60.0	-38.1
24.133	0.1	21.0	21.1	60.0	-38.9
5.545	0.7	20.2	20.9	60.0	-39.1
6.932	0.7	20.2	20.9	60.0	-39.1
20.059	0.1	20.8	20.9	60.0	-39.1
8.551	0.5	20.2	20.7	60.0	-39.3

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.902	-2.1	20.0	17.9	46.0	-28.1
0.620	-2.3	20.0	17.7	46.0	-28.3
0.522	-2.6	20.0	17.4	46.0	-28.6
0.824	-3.0	20.0	17.0	46.0	-29.0
26.611	-0.7	21.1	20.4	50.0	-29.6
0.434	-2.4	20.0	17.6	47.2	-29.6
1.087	-4.5	20.0	15.5	46.0	-30.5
1.804	-4.7	20.0	15.3	46.0	-30.7
1.571	-4.8	20.0	15.2	46.0	-30.8
2.704	-5.1	20.0	14.9	46.0	-31.1
1.960	-5.2	20.0	14.8	46.0	-31.2
3.929	-5.2	20.0	14.8	46.0	-31.2
4.392	-5.3	20.1	14.8	46.0	-31.2
3.142	-5.3	20.0	14.7	46.0	-31.3
0.339	-2.1	20.0	17.9	49.2	-31.3
0.223	-0.3	20.1	19.8	52.7	-32.9
0.272	-1.8	20.0	18.2	51.1	-32.9
0.184	1.2	20.1	21.3	54.3	-33.0
16.635	-4.5	20.6	16.1	50.0	-33.9
0.150	1.7	20.1	21.8	56.0	-34.2
6.934	-5.2	20.2	15.0	50.0	-35.0
24.029	-6.0	21.0	15.0	50.0	-35.0
5.545	-5.3	20.2	14.9	50.0	-35.1
19.941	-6.0	20.8	14.8	50.0	-35.2
8.569	-5.6	20.2	14.6	50.0	-35.4

CONCLUSION

Pass

Tested By

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.

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.

DTS BANDWIDTH

XMit 2020.12.30.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5181A	TIG	2020-04-16	2023-04-16
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Attenuator	Fairview Microwave	SA26B-20	TWJ	2021-03-14	2022-03-14
Block - DC	Fairview Microwave	SD3379	AMX	2021-03-14	2022-03-14
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	2020-12-08	2021-12-08

TEST DESCRIPTION

The EUT was set to the channels and modes listed in the datasheet.

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

DTS BANDWIDTH

TbtTx 2021.03.19.1 XMit 2020.12.30.0

EUT:	**Zigbee BLE Module C0945**			**Work Order:**	**LEVT0137**
Serial Number:	**Sample 2**			**Date:**	**10-Nov-21**
Customer:	**Leviton Mfg Co, Inc**			**Temperature:**	**22.1 °C**
Attendees:	**Vikas Asthana**			**Humidity:**	**39.4% RH**
Project:	**None**			**Barometric Pres.:**	**1030 mbar**
Tested by:	**Jeff Alcoke**	**Power:**	**3.3VDC via 110VAC/60Hz**	**Job Site:**	**EV01**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2021	ANSI C63.10:2013

COMMENTS

Reference level offset includes: DC Block, 20 dB attenuator, and measurement cable.

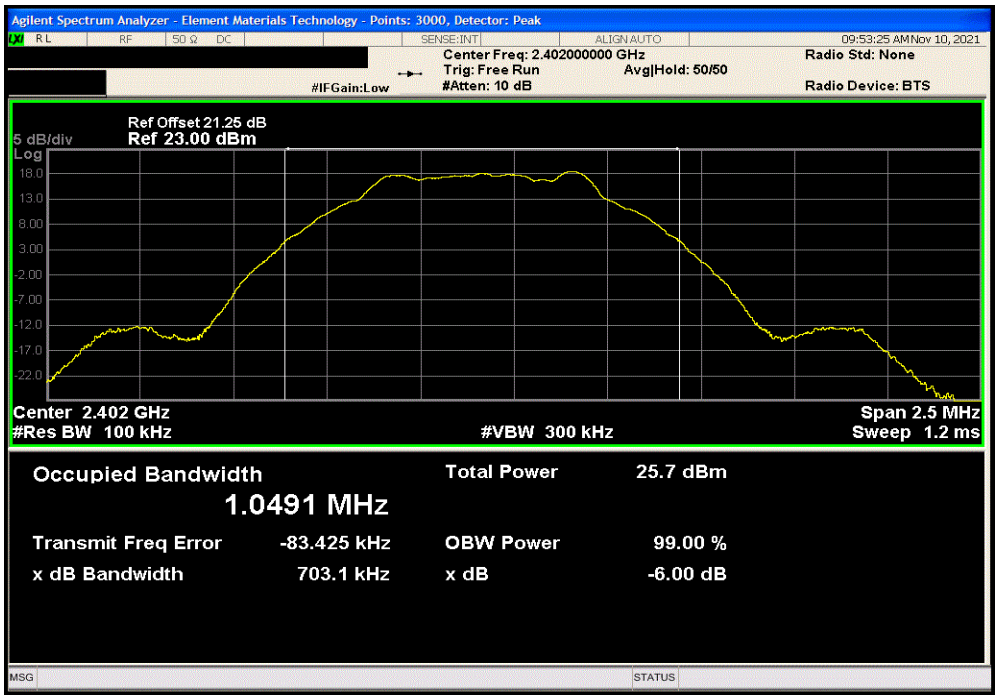
DEVIATIONS FROM TEST STANDARD

None

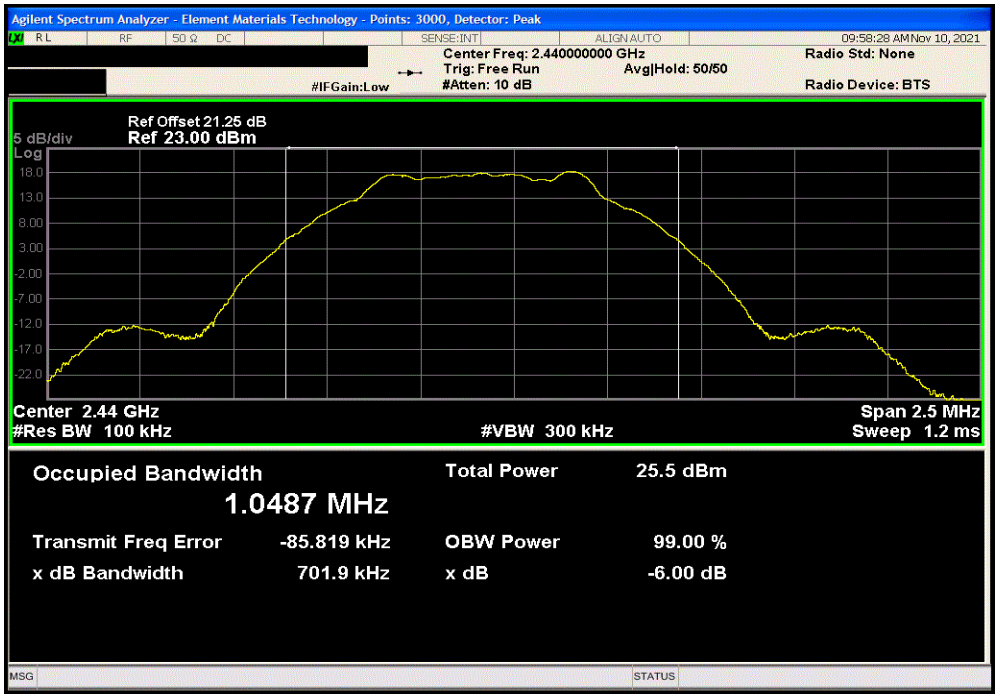
Configuration #	**2**	*Signature*

	Value	**Limit (≥)**	**Result**
BLE/GFSK 1 Mbps Low Channel, 2402 MHz	703.06 kHz	500 kHz	Pass
BLE/GFSK 1 Mbps Mid Channel, 2440 MHz	701.908 kHz	500 kHz	Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz	704.008 kHz	500 kHz	Pass

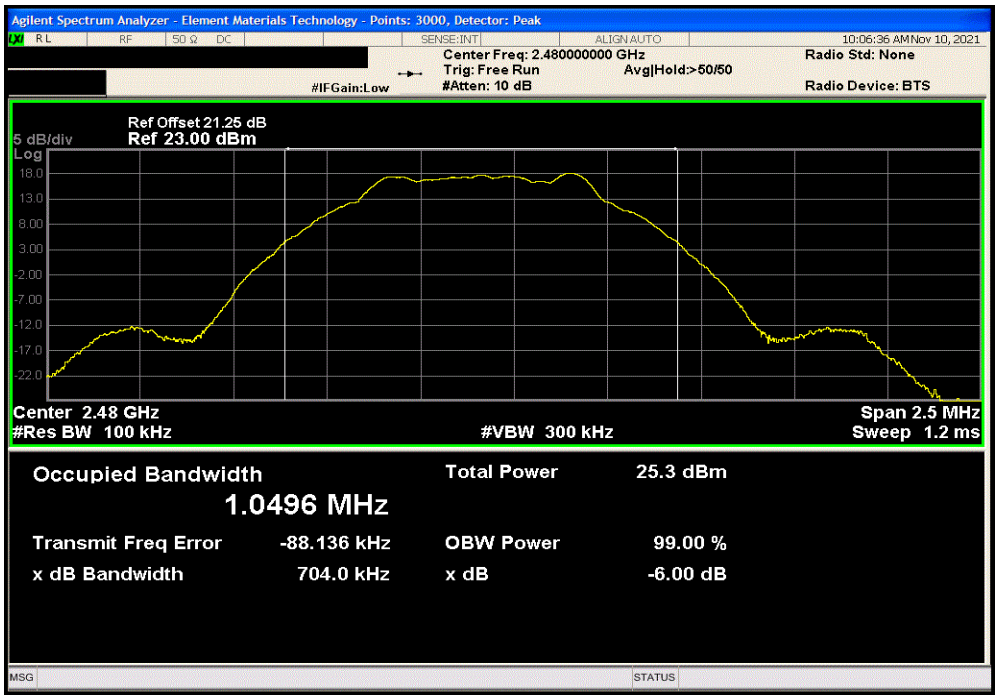
BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
				Value	Limit (≥)	Result
				703.06 kHz	500 kHz	Pass



BLE/GFSK 1 Mbps Mid Channel, 2440 MHz						
				Value	Limit (≥)	Result
				701.908 kHz	500 kHz	Pass



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



OUTPUT POWER

XMit 2020.12.30.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5181A	TIG	2020-04-16	2023-04-16
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Attenuator	Fairview Microwave	SA26B-20	TWJ	2021-03-14	2022-03-14
Block - DC	Fairview Microwave	SD3379	AMX	2021-03-14	2022-03-14
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	2020-12-08	2021-12-08

TEST DESCRIPTION

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 2021.03.19.1 XMit 2020.12.30.0

EUT:	**Zigbee BLE Module C0945**			**Work Order:**	**LEVT0137**
Serial Number:	**Sample 2**			**Date:**	**10-Nov-21**
Customer:	**Leviton Mfg Co, Inc**			**Temperature:**	**22.1 °C**
Attendees:	**Vikas Asthana**			**Humidity:**	**39.5% RH**
Project:	**None**			**Barometric Pres.:**	**1030 mbar**
Tested by:	**Jeff Alcoke**	**Power:**	**3.3VDC via 110VAC/60Hz**	**Job Site:**	**EV01**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2021	ANSI C63.10:2013

COMMENTS

Reference level offset includes: DC Block, 20 dB attenuator, and measurement cable.

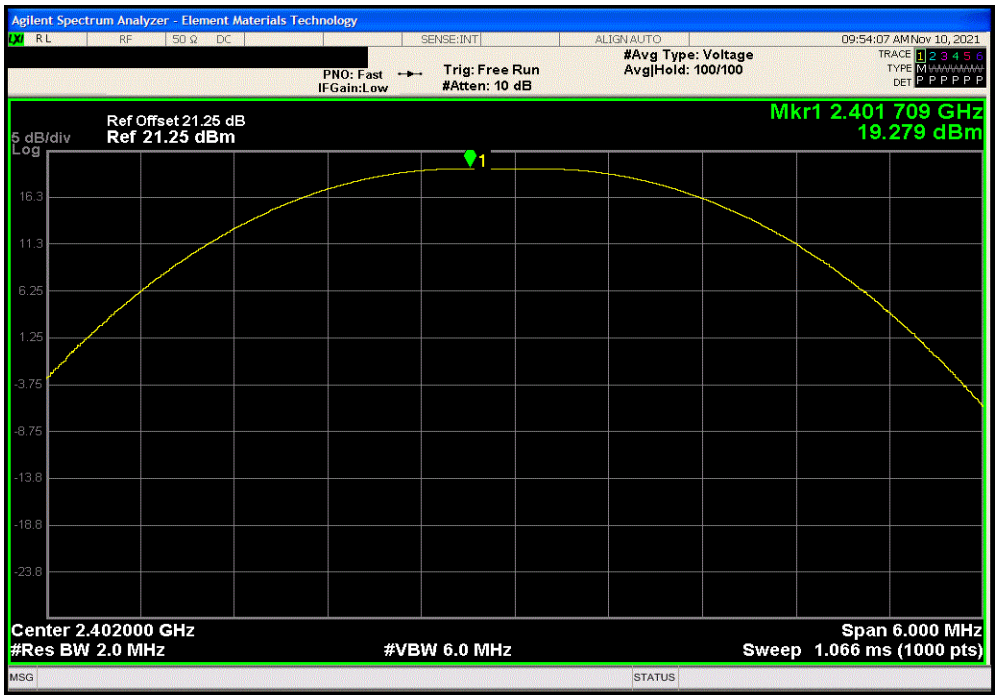
DEVIATIONS FROM TEST STANDARD

None

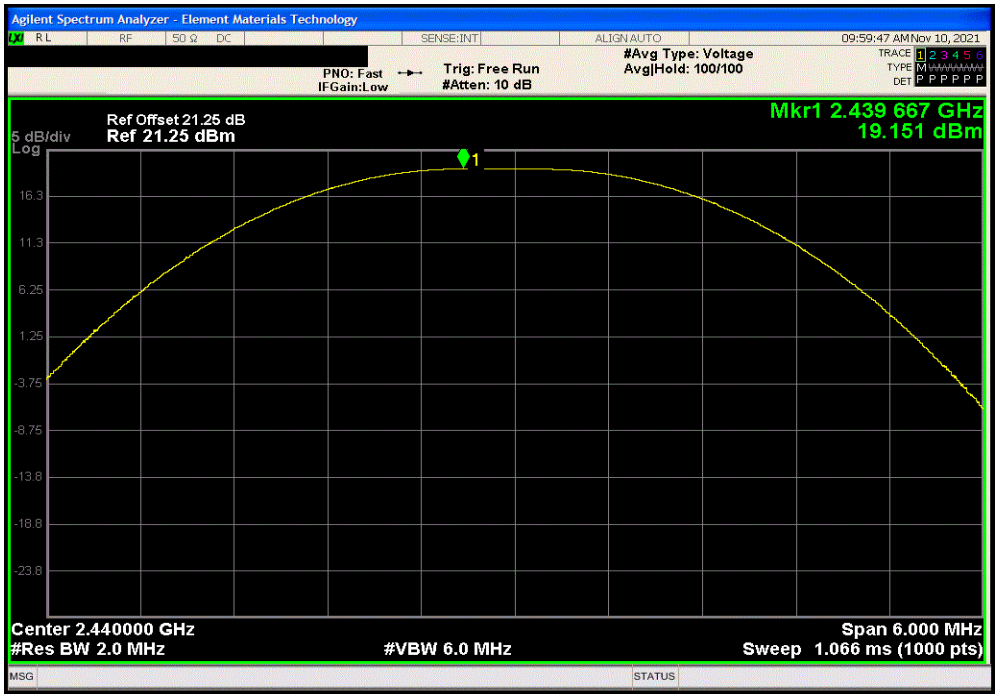
Configuration #	**2**	*Signature*

	Out Pwr (dBm)	**Limit (dBm)**	**Result**
BLE/GFSK 1 Mbps Low Channel, 2402 MHz	19.279	30	Pass
BLE/GFSK 1 Mbps Mid Channel, 2440 MHz	19.151	30	Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz	18.946	30	Pass

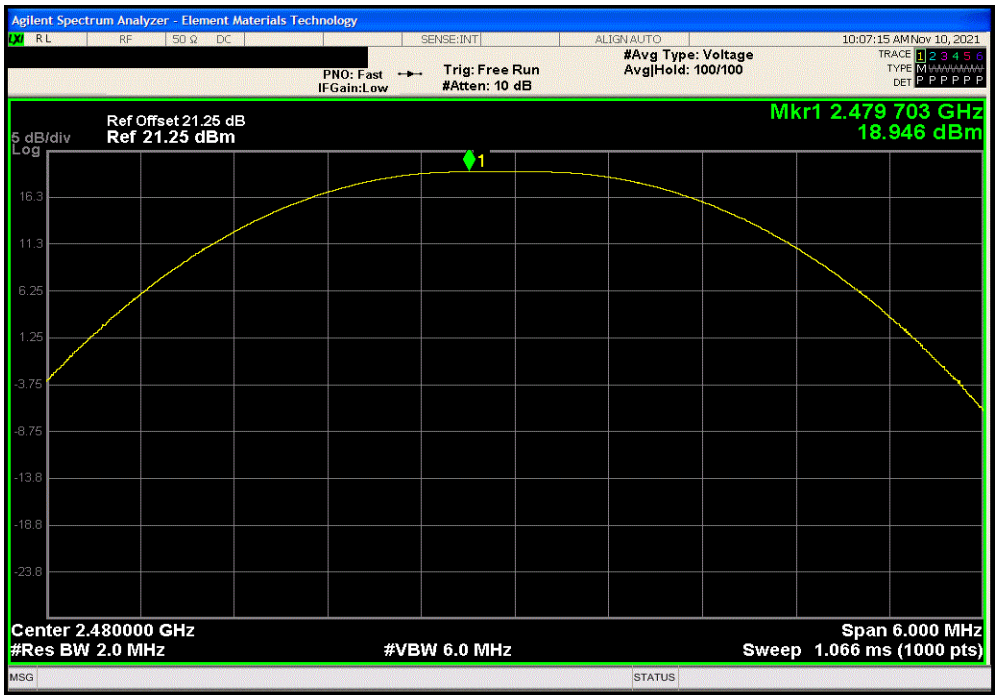
BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				19.279	30	Pass



BLE/GFSK 1 Mbps Mid Channel, 2440 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				19.151	30	Pass



BLE/GFSK 1 Mbps High Channel, 2480 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				18.946	30	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

XMit 2020.12.30.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5181A	TIG	2020-04-16	2023-04-16
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Attenuator	Fairview Microwave	SA26B-20	TWJ	2021-03-14	2022-03-14
Block - DC	Fairview Microwave	SD3379	AMX	2021-03-14	2022-03-14
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	2020-12-08	2021-12-08

TEST DESCRIPTION

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.

Equivalent Isotropic Radiated Power (EIRP) = Max Measured Power + Antenna gain (dBi)

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

element

TbtTx 2021.03.19.1 XMit 2020.12.30.0

EUT:	**Zigbee BLE Module C0945**			**Work Order:**	**LEVT0137**
Serial Number:	**Sample 2**			**Date:**	**10-Nov-21**
Customer:	**Leviton Mfg Co, Inc**			**Temperature:**	**22.2 °C**
Attendees:	**Vikas Asthana**			**Humidity:**	**39.4% RH**
Project:	**None**			**Barometric Pres.:**	**1030 mbar**
Tested by:	**Jeff Alcoke**	**Power:**	**3.3VDC via 110VAC/60Hz**	**Job Site:**	**EV01**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2021	ANSI C63.10:2013

COMMENTS

Reference level offset includes: DC Block, 20 dB attenuator, and measurement cable.

DEVIATIONS FROM TEST STANDARD

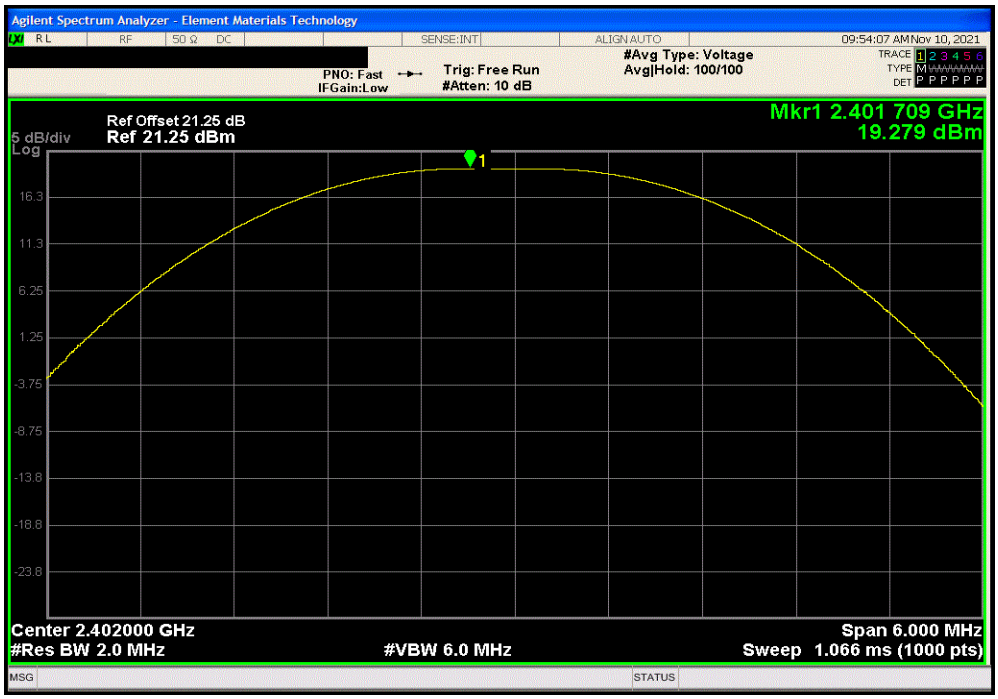
None

Configuration #	**2**	*Signature*

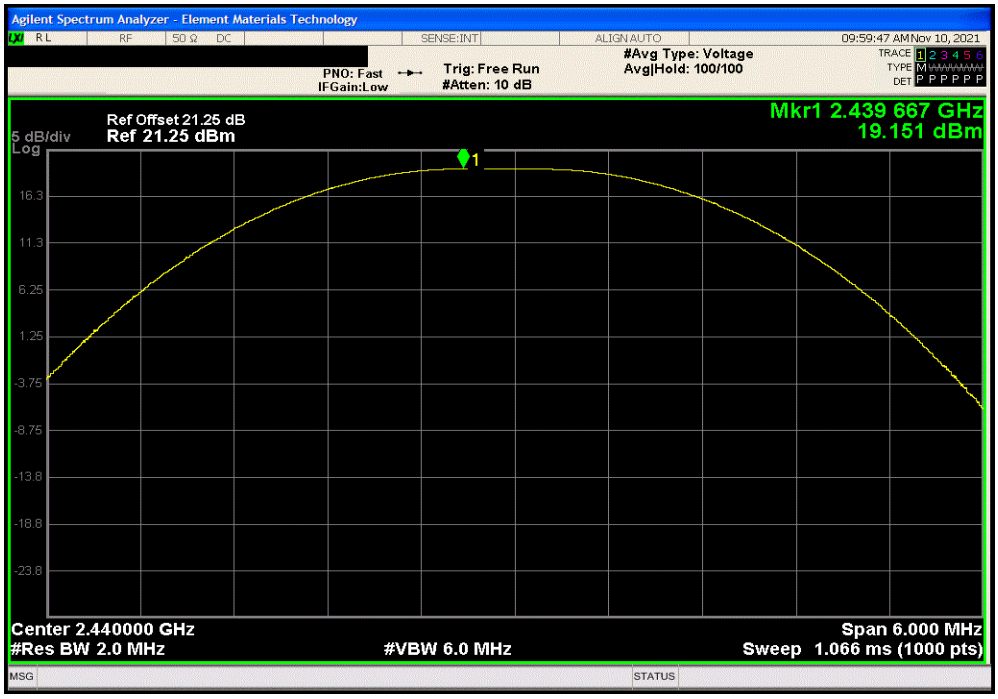
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
BLE/GFSK 1 Mbps Low Channel, 2402 MHz	19.279	1.5	20.779	36	Pass
BLE/GFSK 1 Mbps Mid Channel, 2440 MHz	19.151	1.5	20.651	36	Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz	18.946	1.5	20.446	36	Pass

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		19.279	1.5	20.779	36	Pass



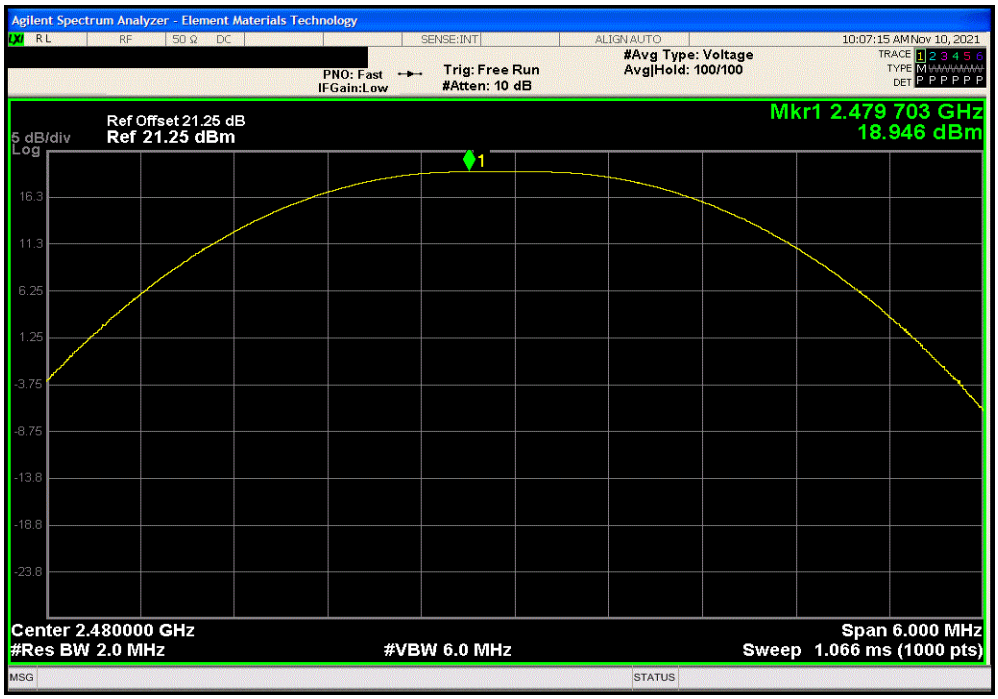
BLE/GFSK 1 Mbps Mid Channel, 2440 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		19.151	1.5	20.651	36	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

TbtTx 2021.03.19.1 XMit 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		18.946	1.5	20.446	36	Pass



POWER SPECTRAL DENSITY

XMit 2020.12.30.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5181A	TIG	2020-04-16	2023-04-16
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Attenuator	Fairview Microwave	SA26B-20	TWJ	2021-03-14	2022-03-14
Block - DC	Fairview Microwave	SD3379	AMX	2021-03-14	2022-03-14
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	2020-12-08	2021-12-08

TEST DESCRIPTION

The maximum power spectral density measurements were measured using the channels and modes as called out on the following data sheets.

Per the procedure outlined in ANSI C63.10:2013, clause 11.10.2, the peak power spectral density was measured in a 3 kHz RBW.

POWER SPECTRAL DENSITY

element

TbtTx 2021.03.19.1 XMit 2020.12.30.0

EUT:	**Zigbee BLE Module C0945**			**Work Order:**	**LEVT0137**
Serial Number:	**Sample 2**			**Date:**	**10-Nov-21**
Customer:	**Leviton Mfg Co, Inc**			**Temperature:**	**22 °C**
Attendees:	**Vikas Asthana**			**Humidity:**	**39.5% RH**
Project:	**None**			**Barometric Pres.:**	**1030 mbar**
Tested by:	**Jeff Alcoke**	**Power:**	**3.3VDC via 110VAC/60Hz**	**Job Site:**	**EV01**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2021	ANSI C63.10:2013

COMMENTS

Reference level offset includes: DC Block, 20 dB attenuator, and measurement cable.

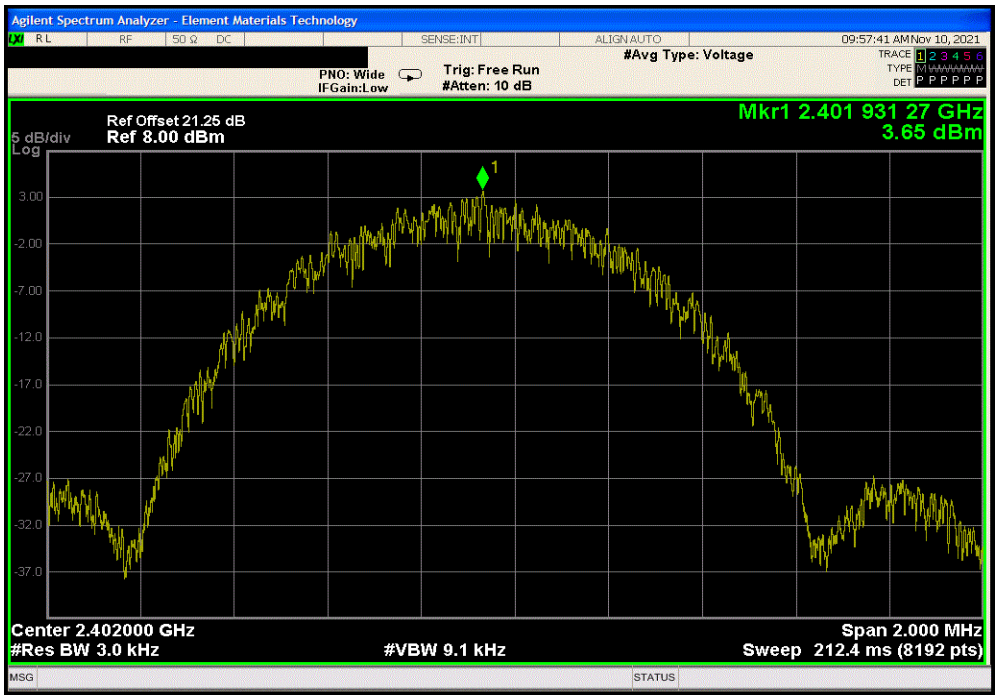
DEVIATIONS FROM TEST STANDARD

None

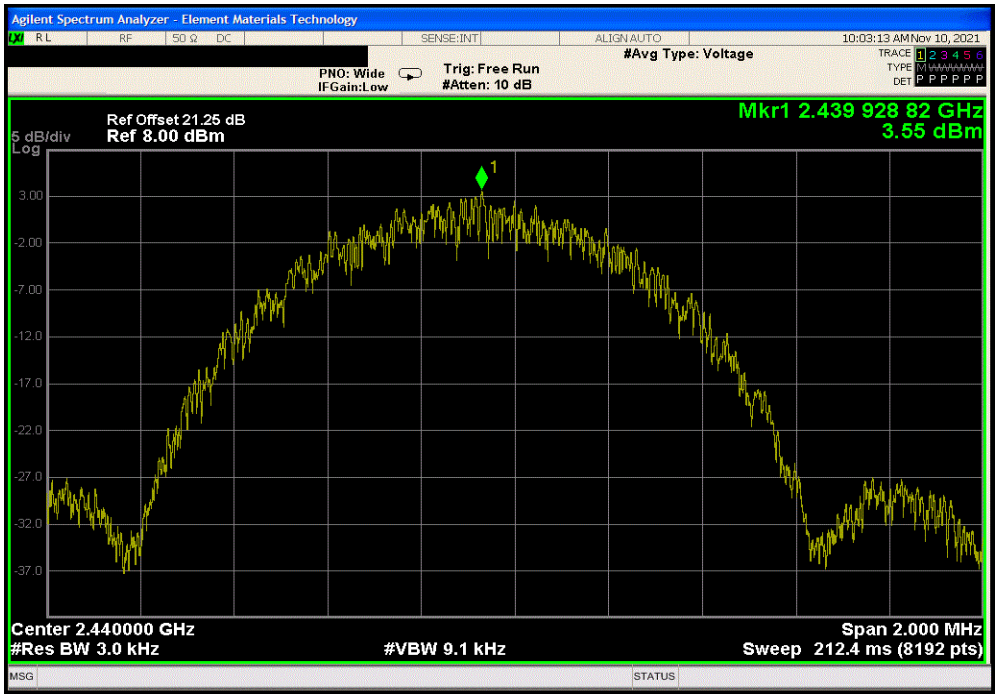
Configuration #	**2**	*Signature*

	Value dBm/3kHz	**Limit < dBm/3kHz**	**Results**
BLE/GFSK 1 Mbps Low Channel, 2402 MHz	3.645	8	Pass
BLE/GFSK 1 Mbps Mid Channel, 2440 MHz	3.545	8	Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz	3.351	8	Pass

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				3.645	8	Pass

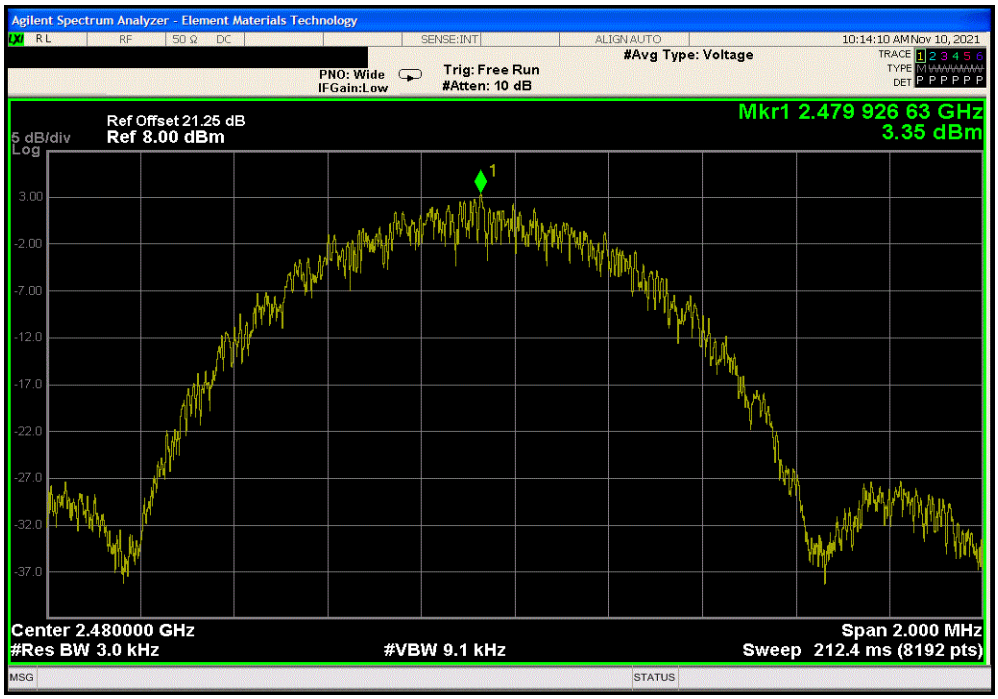


BLE/GFSK 1 Mbps Mid Channel, 2440 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				3.545	8	Pass



POWER SPECTRAL DENSITY

BLE/GFSK 1 Mbps High Channel, 2480 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				3.351	8	Pass



BAND EDGE COMPLIANCE

XMit 2020.12.30.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5181A	TIG	2020-04-16	2023-04-16
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Attenuator	Fairview Microwave	SA26B-20	TWJ	2021-03-14	2022-03-14
Block - DC	Fairview Microwave	SD3379	AMX	2021-03-14	2022-03-14
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	2020-12-08	2021-12-08

TEST DESCRIPTION

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

element

TbtTx 2021.03.19.1 XMit 2020.12.30.0

EUT:	**Zigbee BLE Module C0945**			**Work Order:**	**LEVT0137**
Serial Number:	**Sample 2**			**Date:**	**10-Nov-21**
Customer:	**Leviton Mfg Co, Inc**			**Temperature:**	**22.2 °C**
Attendees:	**Vikas Asthana**			**Humidity:**	**39.3% RH**
Project:	**None**			**Barometric Pres.:**	**1030 mbar**
Tested by:	**Jeff Alcoke**	**Power:**	**3.3VDC via 110VAC/60Hz**	**Job Site:**	**EV01**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2021	ANSI C63.10:2013

COMMENTS

Reference level offset includes: DC Block, 20 dB attenuator, and measurement cable.

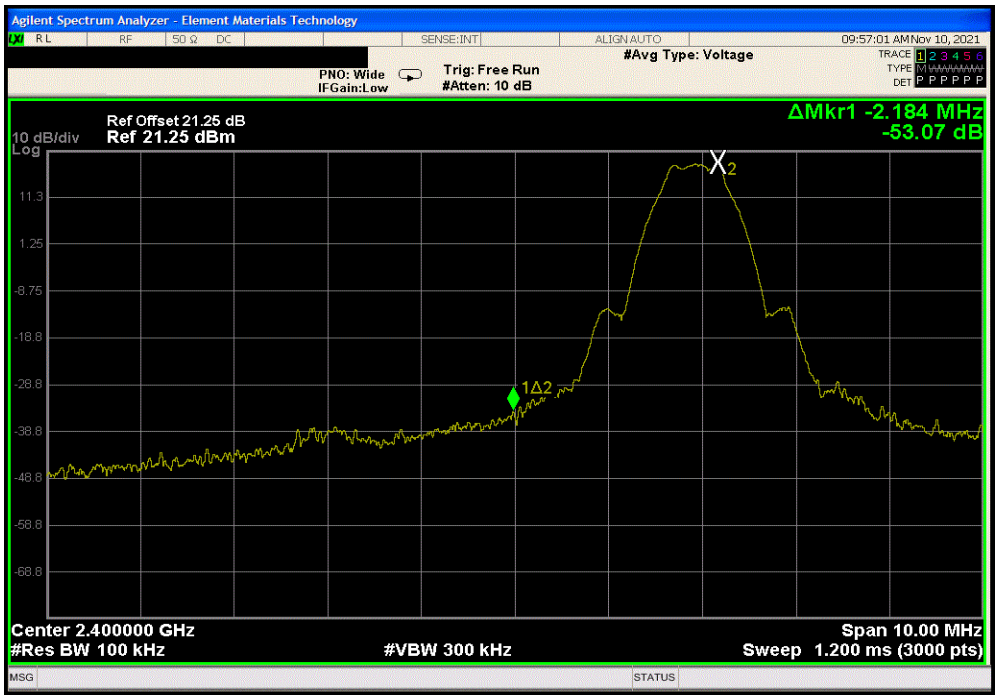
DEVIATIONS FROM TEST STANDARD

None

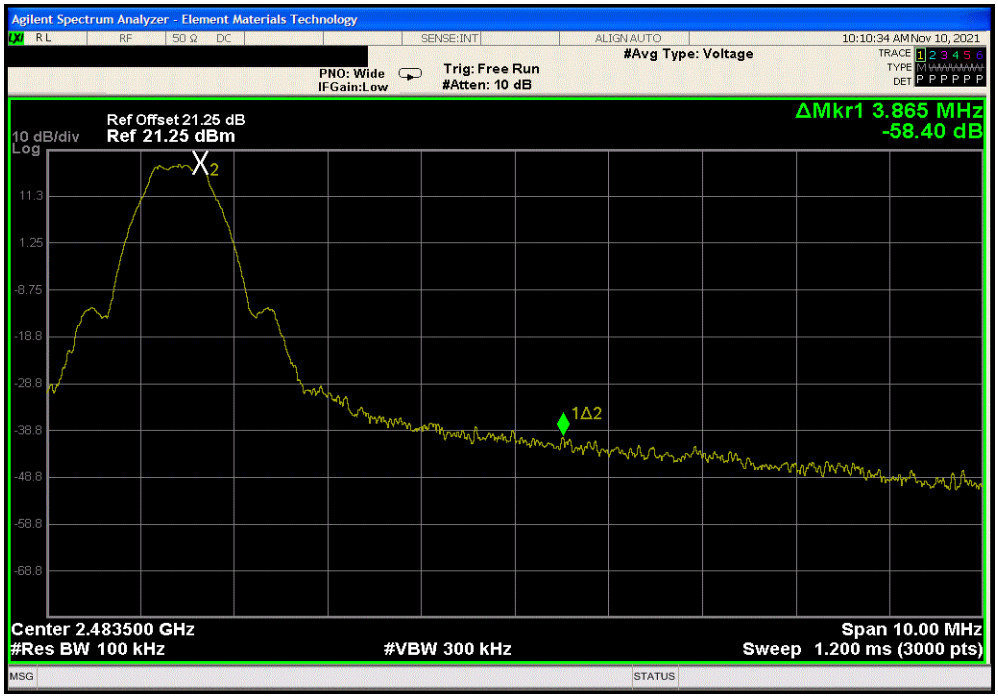
Configuration #	**2**	*Signature*

	Value (dBc)	**Limit ≤ (dBc)**	**Result**
BLE/GFSK 1 Mbps Low Channel, 2402 MHz	-53.07	-20	Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz	-58.4	-20	Pass

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-53.07	-20	Pass



BLE/GFSK 1 Mbps High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-58.4	-20	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2020.12.30.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5181A	TIG	2020-04-16	2023-04-16
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Attenuator	Fairview Microwave	SA26B-20	TWJ	2021-03-14	2022-03-14
Block - DC	Fairview Microwave	SD3379	AMX	2021-03-14	2022-03-14
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	2020-12-08	2021-12-08

TEST DESCRIPTION

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 fundamental was measured with a 100 kHz resolution bandwidth and the highest value was recorded. The rest of the spectrum was then measured with a 100 kHz resolution bandwidth and the highest value was found. The difference between the value found on the fundamental and the rest of the spectrum was compared against the limit to determine compliance.

SPURIOUS CONDUCTED EMISSIONS

TbtTx 2021.03.19.1 XMit 2020.12.30.0

EUT:	**Zigbee BLE Module C0945**			**Work Order:**	**LEVT0137**
Serial Number:	**Sample 2**			**Date:**	**10-Nov-21**
Customer:	**Leviton Mfg Co, Inc**			**Temperature:**	**22 °C**
Attendees:	**Vikas Asthana**			**Humidity:**	**39.6% RH**
Project:	**None**			**Barometric Pres.:**	**1030 mbar**
Tested by:	**Jeff Alcoke**	**Power:**	**3.3VDC via 110VAC/60Hz**	**Job Site:**	**EV01**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2021	ANSI C63.10:2013

COMMENTS

Reference level offset includes: DC Block, 20 dB attenuator, and measurement cable.

DEVIATIONS FROM TEST STANDARD

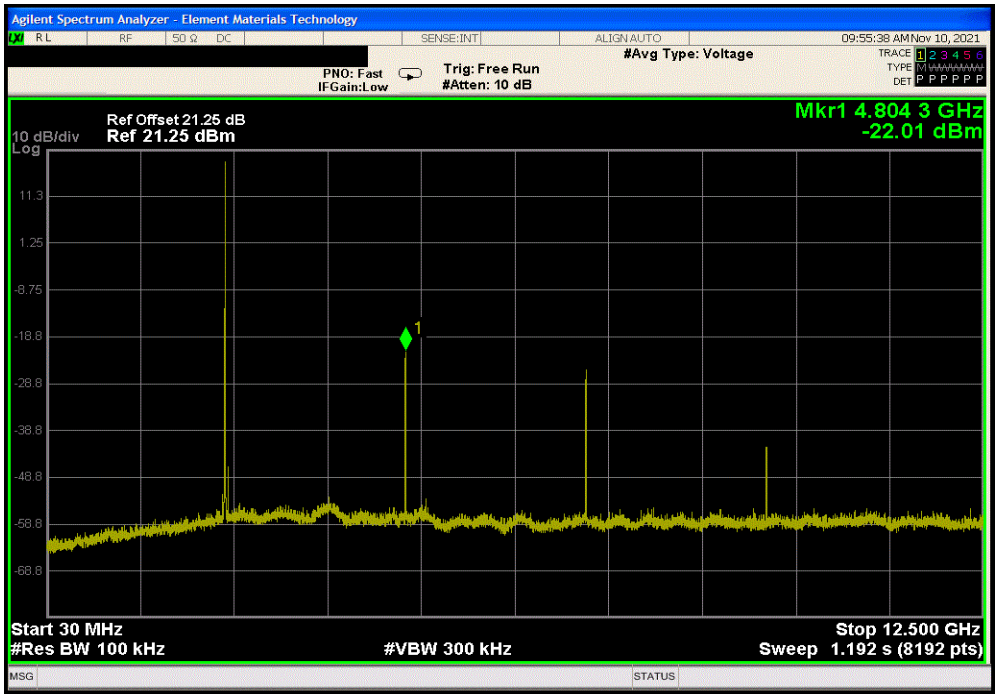
None

Configuration #	**2**	*Signature*

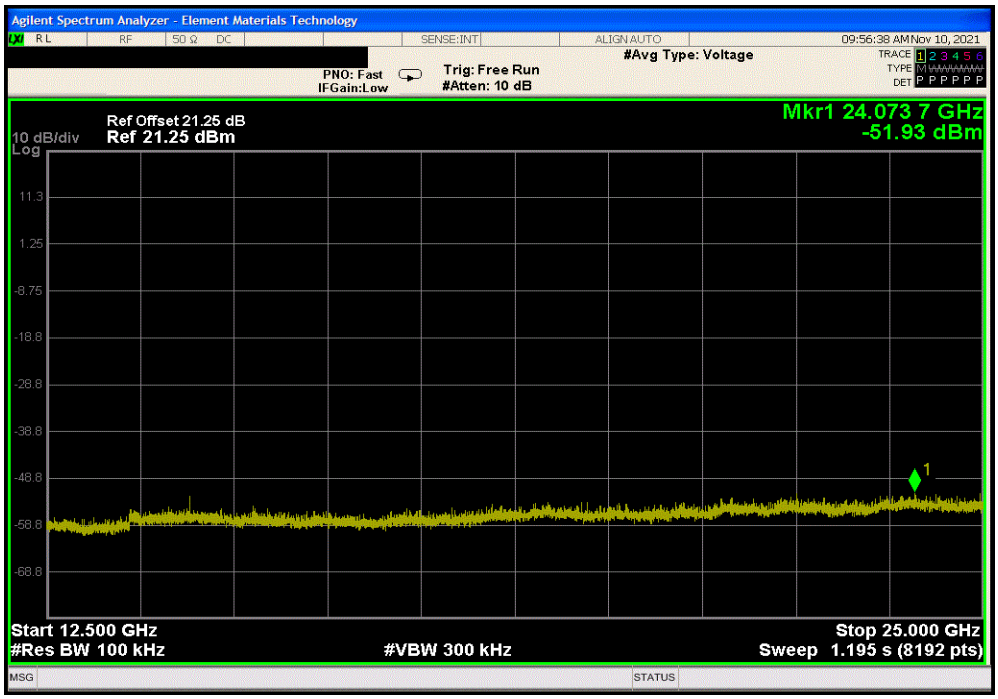
	Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
BLE/GFSK 1 Mbps Low Channel, 2402 MHz	Fundamental	2402.15	N/A	N/A	N/A
BLE/GFSK 1 Mbps Low Channel, 2402 MHz	30 MHz - 12.5 GHz	4804.25	-40.45	-20	Pass
BLE/GFSK 1 Mbps Low Channel, 2402 MHz	12.5 GHz - 25 GHz	24073.68	-70.37	-20	Pass
BLE/GFSK 1 Mbps Mid Channel, 2440 MHz	Fundamental	2440.15	N/A	N/A	N/A
BLE/GFSK 1 Mbps Mid Channel, 2440 MHz	30 MHz - 12.5 GHz	4878.85	-41.49	-20	Pass
BLE/GFSK 1 Mbps Mid Channel, 2440 MHz	12.5 GHz - 25 GHz	24113.36	-70.6	-20	Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz	Fundamental	2480.15	N/A	N/A	N/A
BLE/GFSK 1 Mbps High Channel, 2480 MHz	30 MHz - 12.5 GHz	4959.54	-42.85	-20	Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz	12.5 GHz - 25 GHz	23966.85	-70.15	-20	Pass

BLE/GFSK 1 Mbps Low Channel, 2402 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	2402.15	N/A	N/A	N/A

BLE/GFSK 1 Mbps Low Channel, 2402 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	4804.25	-40.45	-20	Pass

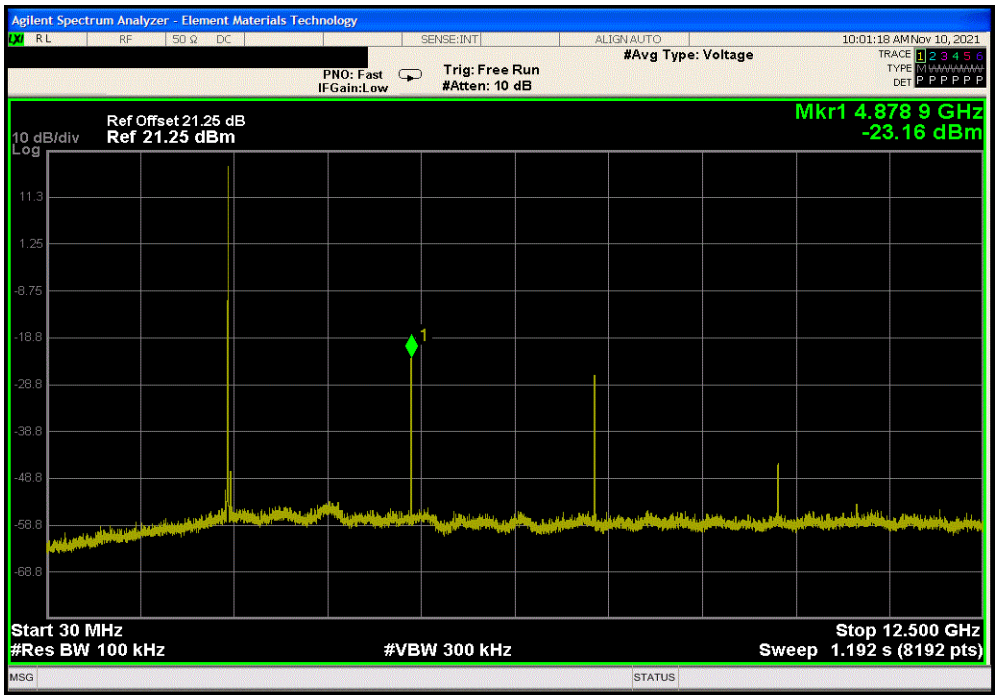


BLE/GFSK 1 Mbps Low Channel, 2402 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	24073.68	-70.37	-20	Pass

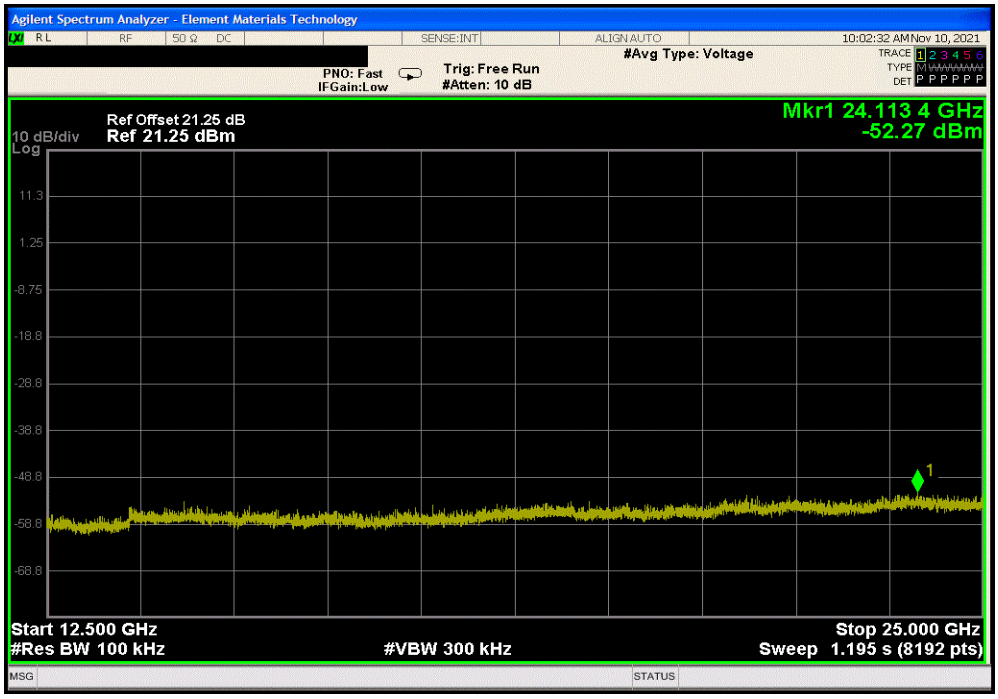


BLE/GFSK 1 Mbps Mid Channel, 2440 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
Fundamental	2440.15	N/A	N/A	N/A

BLE/GFSK 1 Mbps Mid Channel, 2440 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	4878.85	-41.49	-20	Pass

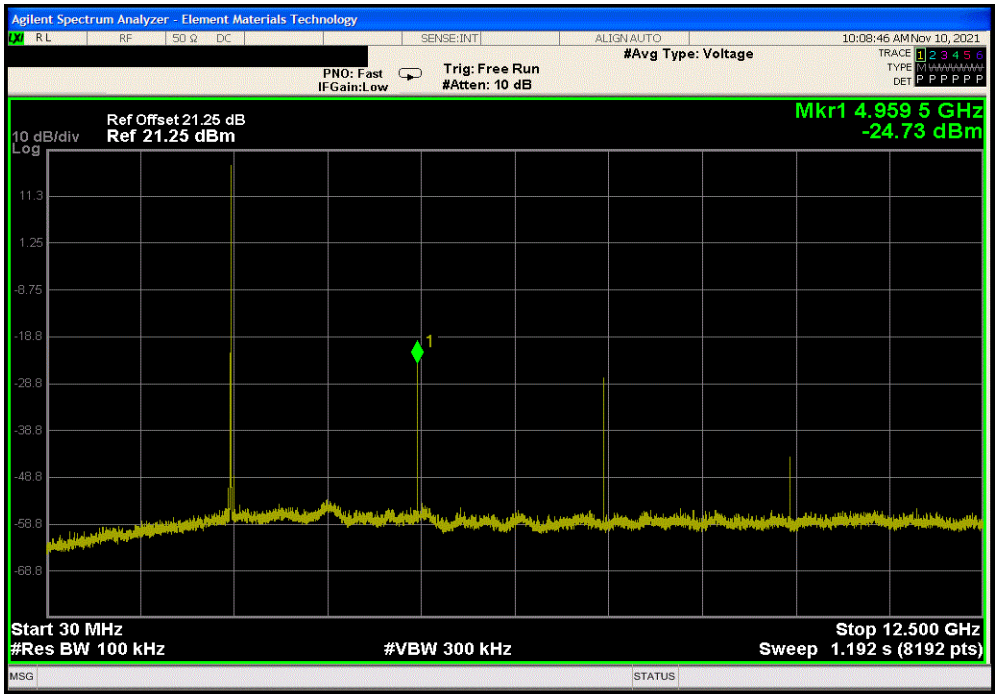


BLE/GFSK 1 Mbps Mid Channel, 2440 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	24113.36	-70.6	-20	Pass

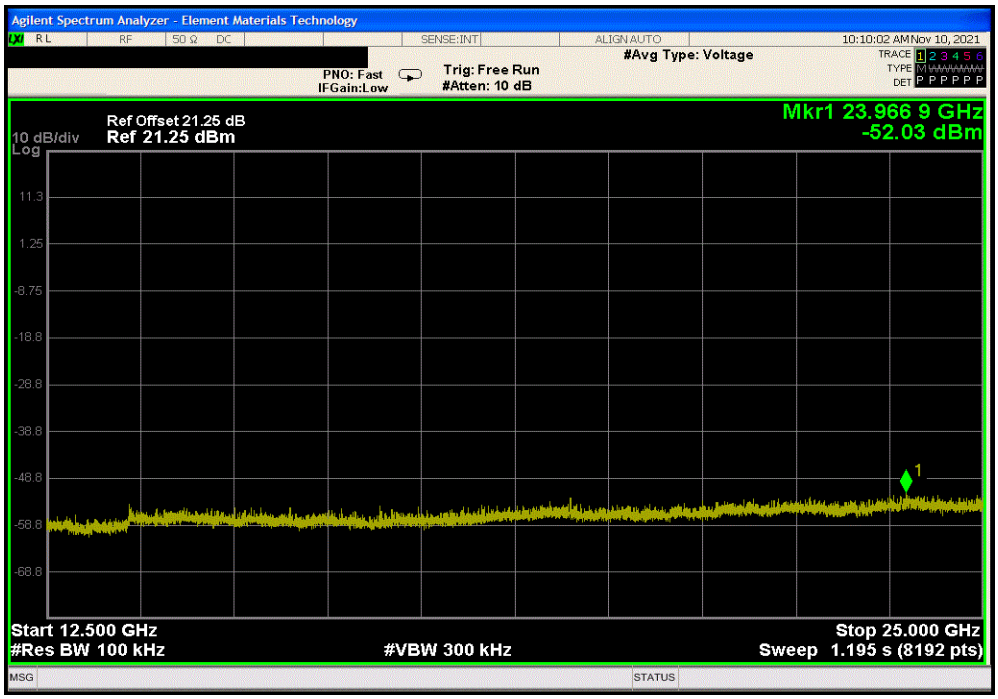


BLE/GFSK 1 Mbps High Channel, 2480 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	2480.15	N/A	N/A	N/A

BLE/GFSK 1 Mbps High Channel, 2480 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	4959.54	-42.85	-20	Pass



BLE/GFSK 1 Mbps High Channel, 2480 MHz				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz	23966.85	-70.15	-20	Pass



SPURIOUS RADIATED EMISSIONS

element
WTD.2021.09.21.0
EmiR5 2021.09.09.0
PSA-ESCI 2021.03.17.0

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 C63.10:2013). 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 within 2 MHz of the allowable band may have been taken using the integration method from ANSI C63.10:2013, clause 11.13.3. This procedure uses the channel power feature of the spectrum analyzer to integrate the power of the emission within a 1 MHz bandwidth.

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(1/dc).

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	2020-12-08	2021-12-08
Antenna - Biconilog	EMCO	3142B	AXJ	2021-03-03	2023-03-03
Antenna - Double Ridge	EMCO	3115	AHC	2020-07-01	2022-07-01
Antenna - Standard Gain	ETS Lindgren	3160-07	AHU	NCR	NCR
Antenna - Standard Gain	ETS Lindgren	3160-08	AHV	NCR	NCR
Antenna - Standard Gain	ETS Lindgren	3160-09	AIV	NCR	NCR
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AOL	2020-11-17	2021-11-17
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAG	2020-11-17	2021-11-17
Amplifier - Pre-Amplifier	L-3 Narda-MITEQ	AMF-6F-08001200-30-10P	PAO	2020-11-18	2021-11-18
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	2020-11-18	2021-11-18
Amplifier - Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	2021-07-16	2022-07-16
Cable	N/A	Bilog Cables	EVA	2020-11-17	2021-11-17
Cable	N/A	Double Ridge Horn Cables	EVB	2020-11-17	2021-11-17
Cable	None	Standard Gain Horn Cables	EVF	2020-11-18	2021-11-18
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	EVY	2021-07-16	2022-07-16
Attenuator	Coaxicom	3910-20	AXZ	2021-02-15	2022-02-15
Filter - Low Pass	Micro-Tronics	LPM50004	LFD	2021-02-15	2022-02-15
Filter - High Pass	Micro-Tronics	HPM50111	HFO	2020-11-17	2021-11-17

SPURIOUS RADIATED EMISSIONS

element
WTD.2021.09.21.0
EmiR5 2021.09.09.0
PSA-ESCI 2021.03.17.0

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	5.2 dB	-5.2 dB

FREQUENCY RANGE INVESTIGATED

30 MHz TO 26500 MHz

POWER INVESTIGATED

3.3VDC via 110VAC/60Hz

CONFIGURATIONS INVESTIGATED

LEVT0136-1
LEVT0137-1

MODES INVESTIGATED

Continuous TX, BLE GFSK, 1 Mbps, Low Ch = 2402 MHz, Mid Ch = 2440 MHz, High Ch = 2480 MHz

SPURIOUS RADIATED EMISSIONS

element
WTD.2021.09.21.0
EmiR5 2021.09.09.0
PSA-ESCI 2021.03.17.0

EUT:	Zigbee BLE Module C0945	Work Order:	LEVT0137
Serial Number:	Sample 1	Date:	2021-11-09
Customer:	Leviton Mfg Co, Inc	Temperature:	22.7°C
Attendees:	Vikas Asthana	Relative Humidity:	38.9%
Customer Project:	None	Bar. Pressure (PMSL):	1019 mb
Tested By:	Kam Robertson & Jeff Alcoke	Job Site:	EV01
Power:	3.3VDC via 110VAC/60Hz	Configuration:	LEVT0137-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	36	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

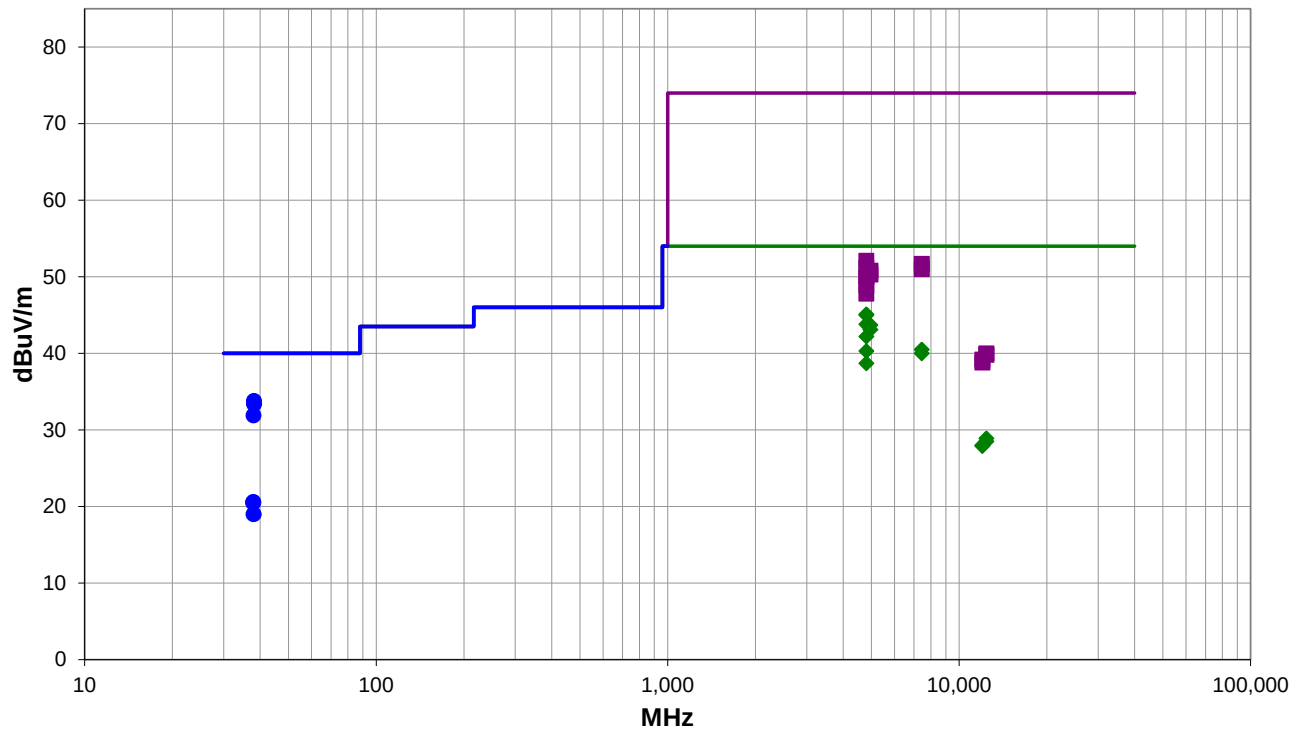
See comments below for channel and EUT orientation

EUT OPERATING MODES

Continuous TX, BLE GFSK, 1 Mbps, Low Ch = 2402 MHz, Mid Ch = 2440 MHz, High Ch = 2480 MHz

DEVIATIONS FROM TEST STANDARD

None



Run #: 36 PK AV QP

SPURIOUS RADIATED EMISSIONS

element
WTD.2021.09.21.0
EmiR5 2021.09.09.0
PSA-ESCI 2021.03.17.0

RESULTS - Run #36

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
38.058	37.9	-4.1	1.01	159.0	3.0	0.0	Vert	QP	0.0	33.8	40.0	-6.2	Mid Ch, EUT Horz
38.113	37.6	-4.2	1.0	213.0	3.0	0.0	Vert	QP	0.0	33.4	40.0	-6.6	High Ch, EUT Horz
37.927	36.0	-4.1	1.0	197.0	3.0	0.0	Vert	QP	0.0	31.9	40.0	-8.1	Low Ch, EUT Horz
4803.708	40.0	5.1	2.12	240.0	3.0	0.0	Horz	AV	0.0	45.1	54.0	-8.9	Low Ch, EUT on side
4803.808	39.9	5.1	1.0	234.0	3.0	0.0	Horz	AV	0.0	45.0	54.0	-9.0	Low Ch, EUT Horz
4803.783	38.7	5.1	2.72	18.0	3.0	0.0	Vert	AV	0.0	43.8	54.0	-10.2	Low Ch, EUT Horz
4959.867	37.8	5.9	1.3	209.0	3.0	0.0	Vert	AV	0.0	43.7	54.0	-10.3	High Ch, EUT Horz
4959.733	37.2	5.9	2.08	104.0	3.0	0.0	Horz	AV	0.0	43.1	54.0	-10.9	High Ch, EUT on Side
4803.858	37.1	5.1	1.21	274.0	3.0	0.0	Vert	AV	0.0	42.2	54.0	-11.8	Low Ch, EUT Vert
7439.842	28.3	12.2	3.25	147.0	3.0	0.0	Horz	AV	0.0	40.5	54.0	-13.5	High Ch, EUT on Side
4803.708	35.2	5.1	1.83	354.0	3.0	0.0	Vert	AV	0.0	40.3	54.0	-13.7	Low Ch, EUT on side
7439.250	27.8	12.2	1.5	277.0	3.0	0.0	Vert	AV	0.0	40.0	54.0	-14.0	High Ch, EUT Horz
4803.733	33.6	5.1	1.5	355.0	3.0	0.0	Horz	AV	0.0	38.7	54.0	-15.3	Low Ch, EUT Vert
37.868	24.6	-4.0	1.0	300.0	3.0	0.0	Horz	QP	0.0	20.6	40.0	-19.4	Mid Ch, EUT Horz
37.849	24.5	-4.0	1.0	309.0	3.0	0.0	Horz	QP	0.0	20.5	40.0	-19.5	High Ch, EUT Horz
37.979	23.1	-4.1	1.01	225.0	3.0	0.0	Horz	QP	0.0	19.0	40.0	-21.0	Low Ch, EUT Horz
4803.308	47.0	5.1	2.12	240.0	3.0	0.0	Horz	PK	0.0	52.1	74.0	-21.9	Low Ch, EUT on side
7438.967	39.5	12.2	3.25	147.0	3.0	0.0	Horz	PK	0.0	51.7	74.0	-22.3	High Ch, EUT on Side
4804.075	46.1	5.1	1.0	234.0	3.0	0.0	Horz	PK	0.0	51.2	74.0	-22.8	Low Ch, EUT Horz
7439.567	38.8	12.2	1.5	277.0	3.0	0.0	Vert	PK	0.0	51.0	74.0	-23.0	High Ch, EUT Horz
4959.333	44.9	5.9	1.3	209.0	3.0	0.0	Vert	PK	0.0	50.8	74.0	-23.2	High Ch, EUT Horz
4959.608	44.4	5.9	2.08	104.0	3.0	0.0	Horz	PK	0.0	50.3	74.0	-23.7	High Ch, EUT on Side
4803.375	44.9	5.1	2.72	18.0	3.0	0.0	Vert	PK	0.0	50.0	74.0	-24.0	Low Ch, EUT Horz
4804.317	44.7	5.2	1.21	274.0	3.0	0.0	Vert	PK	0.0	49.9	74.0	-24.1	Low Ch, EUT Vert
12398.690	27.4	1.5	1.16	210.0	3.0	0.0	Vert	AV	0.0	28.9	54.0	-25.1	High Ch, EUT Horz
4803.233	43.8	5.1	1.83	354.0	3.0	0.0	Vert	PK	0.0	48.9	74.0	-25.1	Low Ch, EUT on side
12398.850	27.0	1.5	1.5	9.0	3.0	0.0	Horz	AV	0.0	28.5	54.0	-25.5	High Ch, EUT on Side
12007.670	26.9	1.1	1.5	180.0	3.0	0.0	Horz	AV	0.0	28.0	54.0	-26.0	Low Ch, EUT on side
12007.660	26.8	1.1	1.5	18.0	3.0	0.0	Vert	AV	0.0	27.9	54.0	-26.1	Low Ch, EUT Horz
4803.150	42.7	5.1	1.5	355.0	3.0	0.0	Horz	PK	0.0	47.8	74.0	-26.2	Low Ch, EUT Vert
12398.660	38.5	1.5	1.16	210.0	3.0	0.0	Vert	PK	0.0	40.0	74.0	-34.0	High Ch, EUT Horz
12398.000	38.3	1.5	1.5	9.0	3.0	0.0	Horz	PK	0.0	39.8	74.0	-34.2	High Ch, EUT on Side
12009.660	38.1	1.1	1.5	18.0	3.0	0.0	Vert	PK	0.0	39.2	74.0	-34.8	Low Ch, EUT Horz
12010.790	37.7	1.1	1.5	180.0	3.0	0.0	Horz	PK	0.0	38.8	74.0	-35.2	Low Ch, EUT on side

CONCLUSION

Pass

Tested By

SPURIOUS RADIATED EMISSIONS

element
WTD.2021.09.21.0
EmiR5 2021.09.09.0
PSA-ESCI 2021.03.17.0

EUT:	Zigbee BLE Module C0945	Work Order:	LEVT0136
Serial Number:	None	Date:	2021-09-27
Customer:	Leviton Mfg Co, Inc	Temperature:	23.1°C
Attendees:	Vikas Asthana	Relative Humidity:	49.1%
Customer Project:	None	Bar. Pressure (PMSL):	1013 mb
Tested By:	Jeff Alcoke	Job Site:	EV01
Power:	3.3VDC via 110VAC/60Hz	Configuration:	LEVT0136-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	15	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

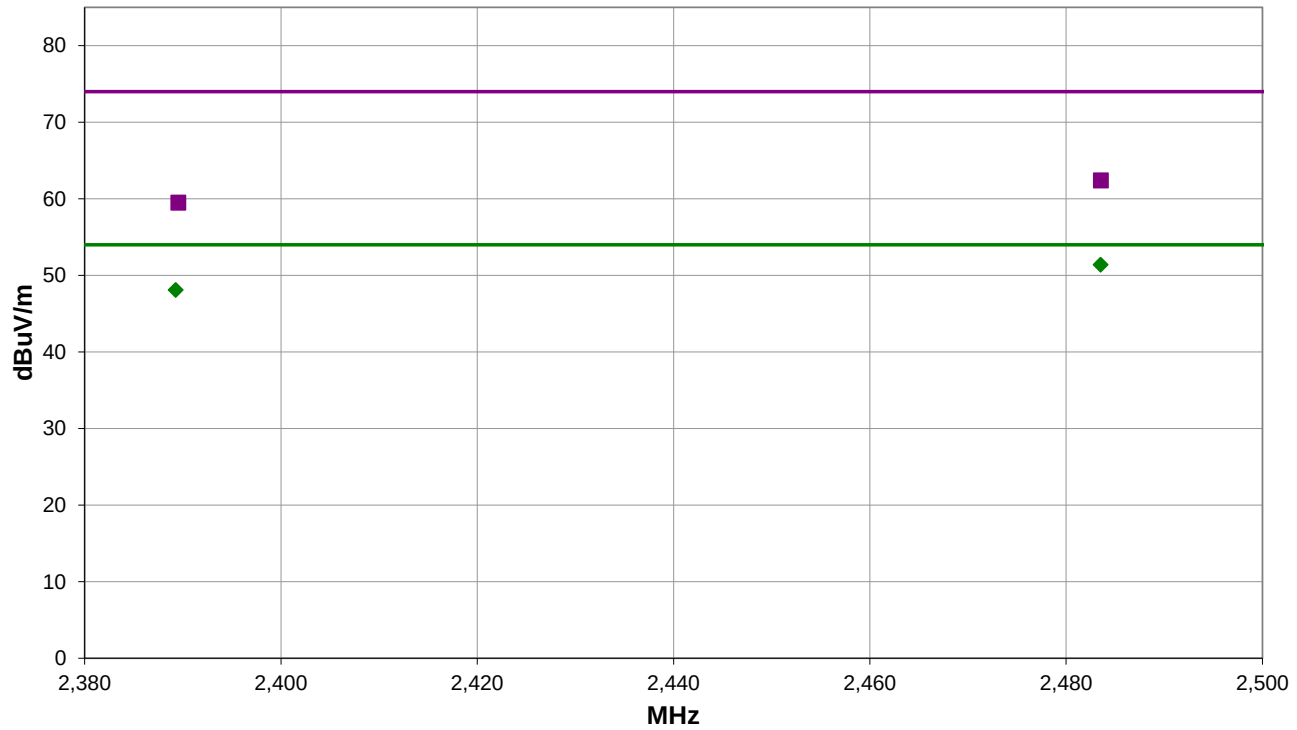
Bandedge - please reference data comments below for Channel and EUT orientation. Measuring worst case EUT orientation determined from pre-compliance testing.

EUT OPERATING MODES

Continuous TX, BLE GFSK, 1 Mbps, Low Ch = 2402 MHz, Mid Ch = 2440 MHz, High Ch = 2480 MHz

DEVIATIONS FROM TEST STANDARD

None



Run #: 15 ■ PK ◆ AV ● QP

SPURIOUS RADIATED EMISSIONS

element
WTD.2021.09.21.0
EmiR5 2021.09.09.0
PSA-ESCI 2021.03.17.0

RESULTS - Run #15

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
2483.513	35.0	-3.6	1.29	263.0	3.0	20.0	Vert	AV	0.0	51.4	54.0	-2.6	High Ch, EUT on Side
2389.267	31.6	-3.5	1.5	223.0	3.0	20.0	Vert	AV	0.0	48.1	54.0	-5.9	Low Ch, EUT on Side
2483.540	46.0	-3.6	1.29	263.0	3.0	20.0	Vert	PK	0.0	62.4	74.0	-11.6	High Ch, EUT on Side
2389.537	43.0	-3.5	1.5	223.0	3.0	20.0	Vert	PK	0.0	59.5	74.0	-14.5	Low Ch, EUT on Side

CONCLUSION

Pass

Tested By

SPURIOUS RADIATED EMISSIONS

element
WTD.2021.09.21.0
EmiR5 2021.09.09.0
PSA-ESCI 2021.03.17.0

EUT:	Zigbee BLE Module C0945	Work Order:	LEVT0136
Serial Number:	None	Date:	2021-09-27
Customer:	Leviton Mfg Co, Inc	Temperature:	23.1°C
Attendees:	Vikas Asthana	Relative Humidity:	49.1%
Customer Project:	None	Bar. Pressure (PMSL):	1013 mb
Tested By:	Jeff Alcoke	Job Site:	EV01
Power:	3.3VDC via 110VAC/60Hz	Configuration:	LEVT0136-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	7	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

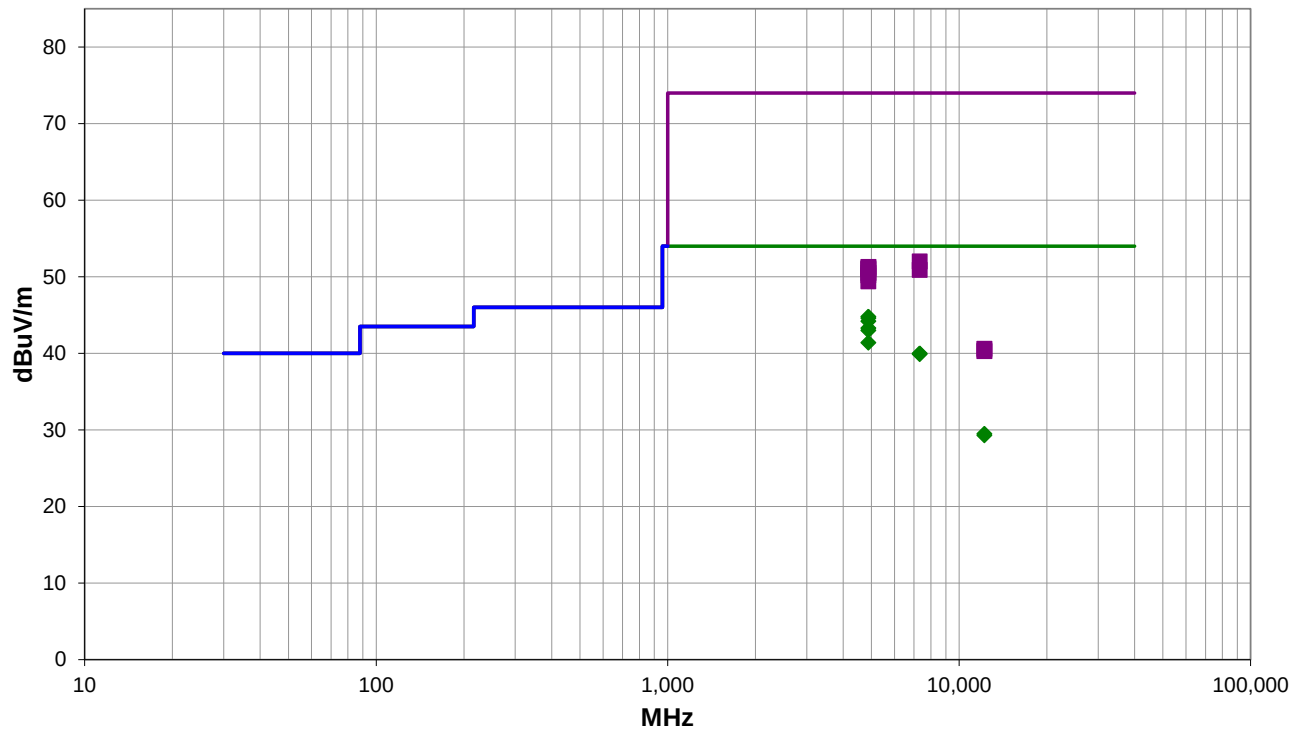
Please reference data comments below for channel and EUT orientation.

EUT OPERATING MODES

Continuous TX, BLE GFSK, 1 Mbps, Low Ch = 2402 MHz, Mid Ch = 2440 MHz, High Ch = 2480 MHz

DEVIATIONS FROM TEST STANDARD

None



Run #: 7 ■ PK ◆ AV ● QP

SPURIOUS RADIATED EMISSIONS

element
WTD.2021.09.21.0
EmiR5 2021.09.09.0
PSA-ESCI 2021.03.17.0

RESULTS - Run #7

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
4879.767	38.8	6.0	2.65	236.0	3.0	0.0	Horz	AV	0.0	44.8	54.0	-9.2	Mid Ch, EUT on Side
4879.833	38.6	6.0	1.0	326.0	3.0	0.0	Vert	AV	0.0	44.6	54.0	-9.4	Mid Ch, EUT Vert
4879.742	38.2	6.0	2.24	153.0	3.0	0.0	Horz	AV	0.0	44.2	54.0	-9.8	Mid Ch, EUT Vert
4879.775	37.3	6.0	1.5	192.0	3.0	0.0	Vert	AV	0.0	43.3	54.0	-10.7	Mid Ch, EUT Horz
4879.800	37.0	6.0	3.1	172.0	3.0	0.0	Vert	AV	0.0	43.0	54.0	-11.0	Mid Ch, EUT on Side
4879.733	35.4	6.0	1.92	219.0	3.0	0.0	Horz	AV	0.0	41.4	54.0	-12.6	Mid Ch, EUT Horz
7319.275	28.3	11.7	1.73	266.0	3.0	0.0	Horz	AV	0.0	40.0	54.0	-14.0	Mid Ch, EUT on Side
7319.275	28.2	11.7	1.5	356.0	3.0	0.0	Vert	AV	0.0	39.9	54.0	-14.1	Mid Ch, EUT Vert
7320.825	40.3	11.7	1.73	266.0	3.0	0.0	Horz	PK	0.0	52.0	74.0	-22.0	Mid Ch, EUT on Side
4880.317	45.3	6.0	2.65	236.0	3.0	0.0	Horz	PK	0.0	51.3	74.0	-22.7	Mid Ch, EUT on Side
4879.250	45.1	6.0	1.0	326.0	3.0	0.0	Vert	PK	0.0	51.1	74.0	-22.9	Mid Ch, EUT Vert
4879.700	45.0	6.0	2.24	153.0	3.0	0.0	Horz	PK	0.0	51.0	74.0	-23.0	Mid Ch, EUT Vert
7322.325	39.2	11.7	1.5	356.0	3.0	0.0	Vert	PK	0.0	50.9	74.0	-23.1	Mid Ch, EUT Vert
4880.300	44.5	6.0	3.1	172.0	3.0	0.0	Vert	PK	0.0	50.5	74.0	-23.5	Mid Ch, EUT on Side
4879.058	44.2	6.0	1.5	192.0	3.0	0.0	Vert	PK	0.0	50.2	74.0	-23.8	Mid Ch, EUT Horz
12202.370	28.6	0.9	1.05	310.0	3.0	0.0	Horz	AV	0.0	29.5	54.0	-24.5	Mid Ch, EUT on Side
4880.017	43.4	6.0	1.92	219.0	3.0	0.0	Horz	PK	0.0	49.4	74.0	-24.6	Mid Ch, EUT Horz
12201.830	28.4	0.9	1.01	148.0	3.0	0.0	Vert	AV	0.0	29.3	54.0	-24.7	Mid Ch, EUT Vert
12200.930	39.7	0.9	1.05	310.0	3.0	0.0	Horz	PK	0.0	40.6	74.0	-33.4	Mid Ch, EUT on Side
12197.900	39.4	0.9	1.01	148.0	3.0	0.0	Vert	PK	0.0	40.3	74.0	-33.7	Mid Ch, EUT Vert

CONCLUSION

Pass

Tested By

End of Test Report