



element

A-dec, Inc.

43.0536.00

FCC 15.247:2021

Bluetooth DTS

Report: A-DE0162.7 Rev. 1, Issue Date: October 21, 2021



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CERTIFICATE OF TEST



Last Date of Test: October 19, 2021

A-dec, Inc.

EUT: 43.0536.00

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	Pass	
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	Added boresighting block diagram.	2021-10-20	8
	Added DCCF column to Spurious Radiated Emissions.	2021-10-20	54, 56
	Added A-DE0162-7 configuration	2021-10-20	12
	Retested powerline conducted emissions measuring AC mains as opposed to DC power.	2021-10-20	15-19
	Updated last date of test to October 19, 2021.	2021-10-20	2, 9, 13

ACCREDITATIONS AND AUTHORIZATIONS



United States

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

A2LA - 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:

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FACILITIES



California Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-11 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Oregon Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Texas Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Washington Labs NC01-05 19201 120 th Ave NE Bothell, WA 98011 (425)984-6600
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



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.

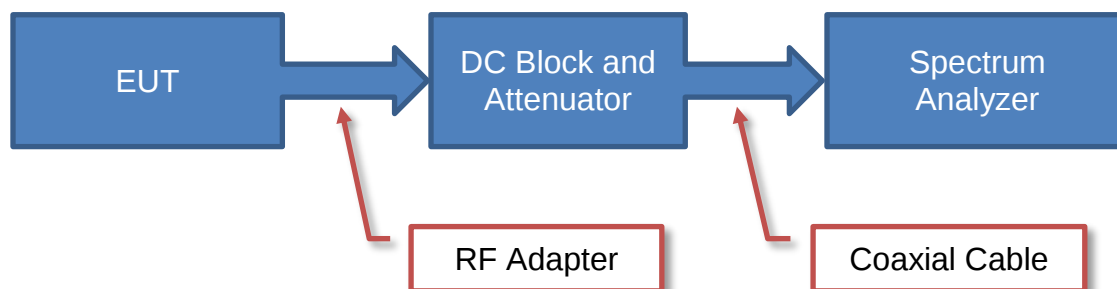
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found in the table below. A lab specific 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)	2.6 dB	-2.6 dB

TEST SETUP BLOCK DIAGRAMS

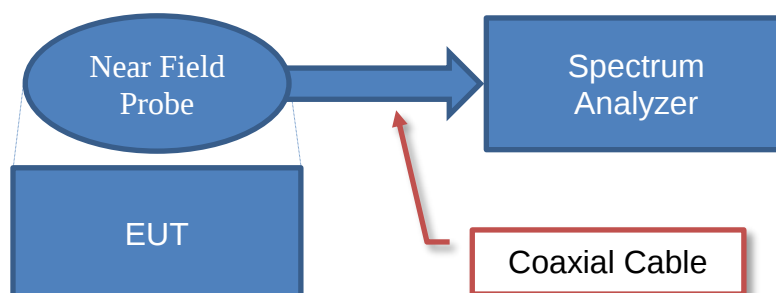
Antenna Port Conducted Measurements



Sample Calculation

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

Near Field Test Fixture Measurements

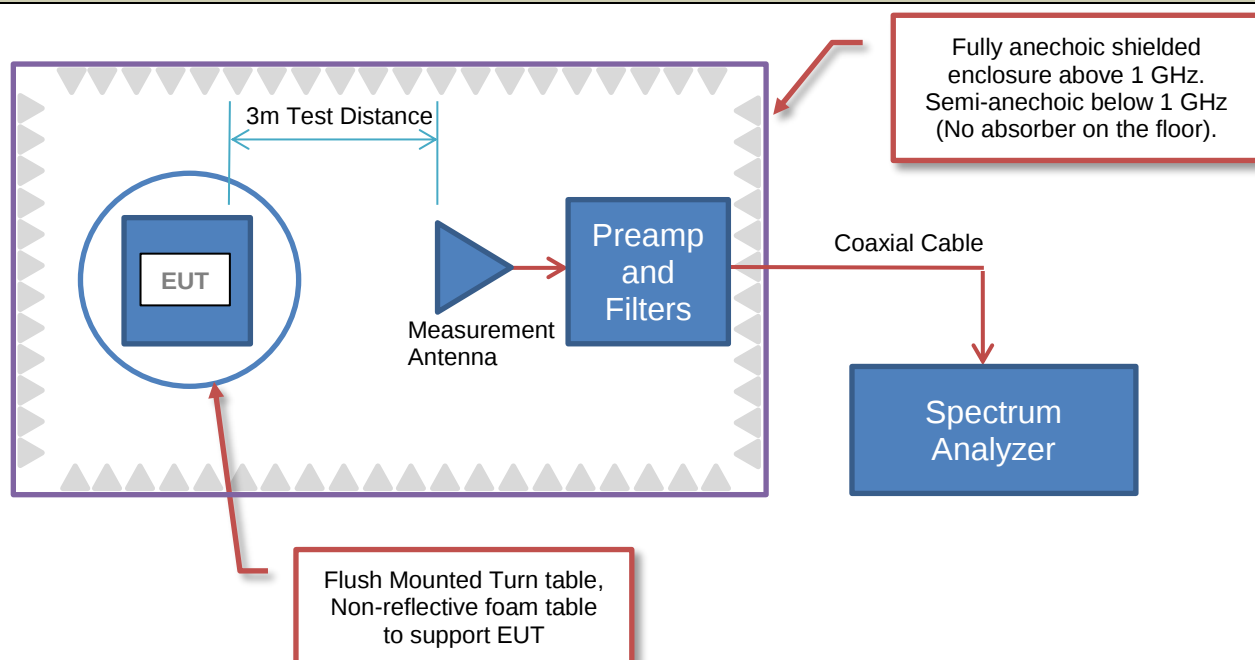


Sample Calculation

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

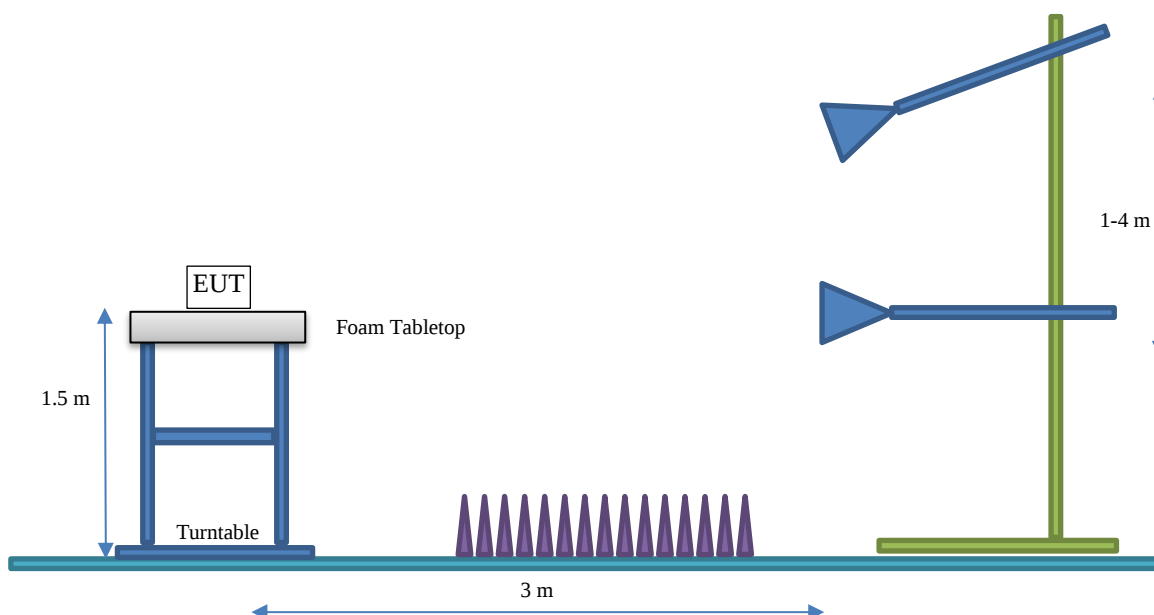
TEST SETUP BLOCK DIAGRAMS

Spurious Radiated Emissions



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:	A-dec, Inc.
Address:	2601 Crestview Dr Building 4
City, State, Zip:	Newberg, OR 97132-9528
Test Requested By:	Russell Perkins
EUT:	43.0536.00
First Date of Test:	June 29, 2021
Last Date of Test:	October 19, 2021
Receipt Date of Samples:	June 25, 2021
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Bluetooth, Bluetooth LE and 802.11 radio module
Testing Objective:
To demonstrate compliance of the Bluetooth radio to FCC 15.247 requirements.

CONFIGURATIONS



Configuration A-DE0162- 1

Software/Firmware Running during test	
Description	Version
Teraterm	4.105
Murata Test Firmware	None

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Bluetooth and WiFi Module	A-dec, Inc.	43.0536.00	SN001 00003

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Switching Power Supply	Total Power	TMPU130-108 (P00B)	2015017188
Laptop	Dell	Latitude 740	7437666170
Host PCB	A-dec, Inc.	43.0528.00 Rev 2	528P068188

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Power	No	0.2	No	Switching Power Supply	Host PCB
AC Power	No	2.0	No	AC Mains	Switching Power Supply
FTDI to USB	No	2.0	No	Laptop	Host PCB

CONFIGURATIONS



Configuration A-DE0162- 2

Software/Firmware Running during test	
Description	Version
Teraterm	4.105
Murata Test Firmware	None

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Bluetooth and WiFi module	A-dec, Inc.	43.0536.00	SN001 00004

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Switching Power Supply	Total Power	TMPU130-108 (P00B)	2015017188
Host PCB	A-dec, Inc.	43.0528.00 Rev 2	528P068188

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Laptop	Dell	Latitude 740	7437666170

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Power	No	2.0	No	AC Mains	Switching Power Supply
FTDI to USB	No	2.0	No	Laptop	Host PCB
DC Power	No	2.7	No	Switching Power Supply	Host PCB

CONFIGURATIONS



Configuration A-DE0162- 7

Software/Firmware Running during test	
Description	Version
Teraterm	4.105
Murata Test Firmware	None

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Bluetooth and WiFi module	A-dec, Inc.	43.0536.00	SN001 00004

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Host PCB	A-dec, Inc.	43.0528.00 Rev 2	528P068188

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Laptop	Dell	Latitude 740	7437666170

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Power	No	0.6	No	Lab DC Power Supply	Host PCB
DC Power	No	0.8	No	Lab DC Power Supply	Host PCB

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2021-06-29	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT was taken home by the client before the next scheduled test.
2	2021-06-29	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT was taken home by the client before the next scheduled test.
3	2021-06-29	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT was taken home by the client before the next scheduled test.
4	2021-06-29	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	2021-06-29	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	2021-06-29	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	2021-06-29	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	2021-06-30	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.
9	2021-10-19	Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWER SETTINGS 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	2.2

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	DTS	0	2402	7 dBm
		20	2442	7 dBm
		39	2480	7 dBm

POWERLINE CONDUCTED EMISSIONS

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
Receiver	Gauss Instruments	TDEMI 30M	ARN	2021-04-06	2022-04-06
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
LISN	Solar Electronics	9252-50-R-24-BNC	LIN	2021-01-08	2022-01-08
Power Supply - DC	Topward	TPS-2000	TPD	NCR	NCR
Power Supply - DC	MPJA	9950 PS	TQA	NCR	NCR

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.6 dB	-2.6 dB

CONFIGURATIONS INVESTIGATED

A-DE0162--7

MODES INVESTIGATED

Bluetooth LE, TX, Mid Channel 2442 MHz, 1Mbps

POWERLINE CONDUCTED EMISSIONS

EUT:	43.0536.00	Work Order:	A-DE0162
Serial Number:	SN001 00004	Date:	2021-10-19
Customer:	A-dec, Inc.	Temperature:	22.8°C
Attendees:	None	Relative Humidity:	40%
Customer Project:	None	Bar. Pressure:	1013 mb
Tested By:	Jeff Alcock	Job Site:	EV07
Power:	3.3 VDC via 110VAC/60Hz	Configuration:	A-DE0162-7

TEST SPECIFICATIONS

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

TEST PARAMETERS

Run #:	15	Line:	Neutral	Add. Ext. Attenuation (dB):	0
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COMMENTS

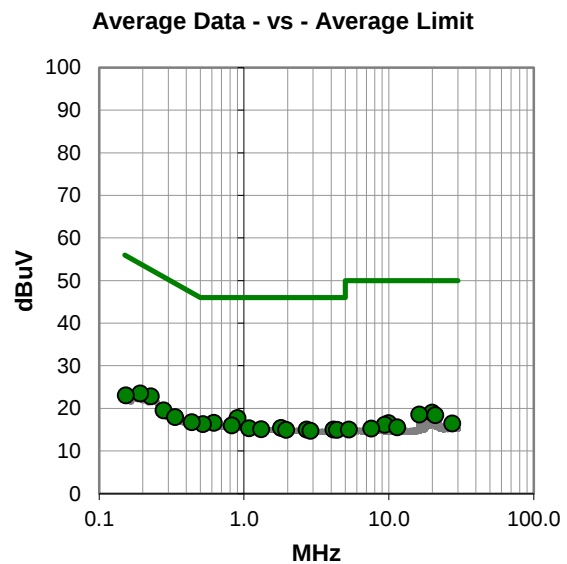
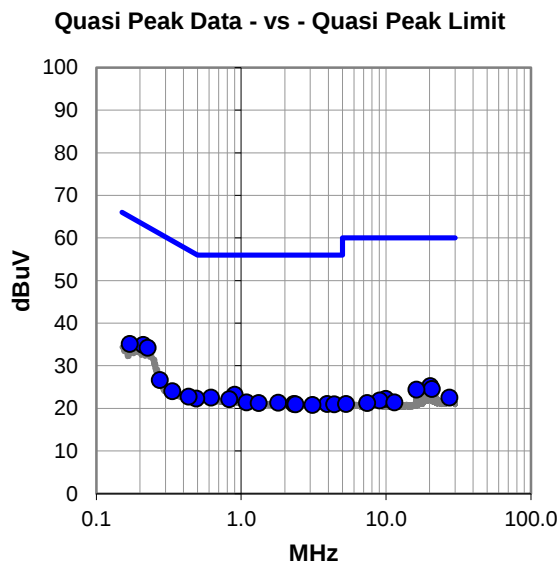
Measuring AC Mains of linear DC lab power supply.

EUT OPERATING MODES

BLE Tx, Mid channel, 2442 MHz, 1 Mbps

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #15

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.211	14.8	20.1	34.9	63.2	-28.3
0.226	14.1	20.1	34.2	62.6	-28.4
0.170	15.0	20.1	35.1	65.0	-29.9
0.902	3.2	20.0	23.2	56.0	-32.8
0.620	2.5	20.0	22.5	56.0	-33.5
0.829	2.1	20.0	22.1	56.0	-33.9
0.490	2.3	20.0	22.3	56.2	-33.9
0.275	6.6	20.0	26.6	61.0	-34.4
0.434	2.7	20.0	22.7	57.2	-34.5
1.090	1.4	20.0	21.4	56.0	-34.6
1.801	1.3	20.0	21.3	56.0	-34.7
1.325	1.2	20.0	21.2	56.0	-34.8
20.205	4.5	20.7	25.2	60.0	-34.8
2.311	1.0	20.0	21.0	56.0	-35.0
3.928	1.0	20.0	21.0	56.0	-35.0
2.379	0.9	20.0	20.9	56.0	-35.1
4.390	0.9	20.0	20.9	56.0	-35.1
3.116	0.8	20.0	20.8	56.0	-35.2
0.335	4.0	20.0	24.0	59.3	-35.3
20.768	3.7	20.8	24.5	60.0	-35.5
16.227	3.8	20.6	24.4	60.0	-35.6
27.505	1.4	21.1	22.5	60.0	-37.5
9.970	2.0	20.2	22.2	60.0	-37.8
9.076	1.6	20.2	21.8	60.0	-38.2
11.456	1.0	20.4	21.4	60.0	-38.6

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.902	-2.3	20.0	17.7	46.0	-28.3
0.620	-3.4	20.0	16.6	46.0	-29.4
0.228	2.7	20.1	22.8	52.5	-29.7
0.521	-3.7	20.0	16.3	46.0	-29.7
0.826	-4.0	20.0	16.0	46.0	-30.0
0.193	3.4	20.1	23.5	53.9	-30.4
0.437	-3.3	20.0	16.7	47.1	-30.4
1.804	-4.6	20.0	15.4	46.0	-30.6
1.082	-4.7	20.0	15.3	46.0	-30.7
1.314	-4.9	20.0	15.1	46.0	-30.9
2.706	-5.0	20.0	15.0	46.0	-31.0
4.160	-5.0	20.0	15.0	46.0	-31.0
19.955	-1.7	20.7	19.0	50.0	-31.0
1.957	-5.1	20.0	14.9	46.0	-31.1
4.390	-5.1	20.0	14.9	46.0	-31.1
2.884	-5.3	20.0	14.7	46.0	-31.3
0.278	-0.5	20.0	19.5	50.9	-31.4
0.335	-2.1	20.0	17.9	49.3	-31.4
16.227	-2.1	20.6	18.5	50.0	-31.5
20.956	-2.4	20.8	18.4	50.0	-31.6
0.153	2.9	20.1	23.0	55.8	-32.8
9.970	-3.7	20.2	16.5	50.0	-33.5
27.491	-4.7	21.1	16.4	50.0	-33.6
9.375	-4.1	20.2	16.1	50.0	-33.9
11.456	-4.9	20.4	15.5	50.0	-34.5

CONCLUSION

Pass



Tested By

POWERLINE CONDUCTED EMISSIONS

EUT:	43.0536.00	Work Order:	A-DE0162
Serial Number:	SN001 00004	Date:	2021-10-19
Customer:	A-dec, Inc.	Temperature:	22.8°C
Attendees:	None	Relative Humidity:	40%
Customer Project:	None	Bar. Pressure:	1013 mb
Tested By:	Jeff Alcock	Job Site:	EV07
Power:	3.3 VDC via 110VAC/60Hz	Configuration:	A-DE0162-7

TEST SPECIFICATIONS

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

TEST PARAMETERS

Run #:	16	Line:	High Line	Add. Ext. Attenuation (dB):	0
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COMMENTS

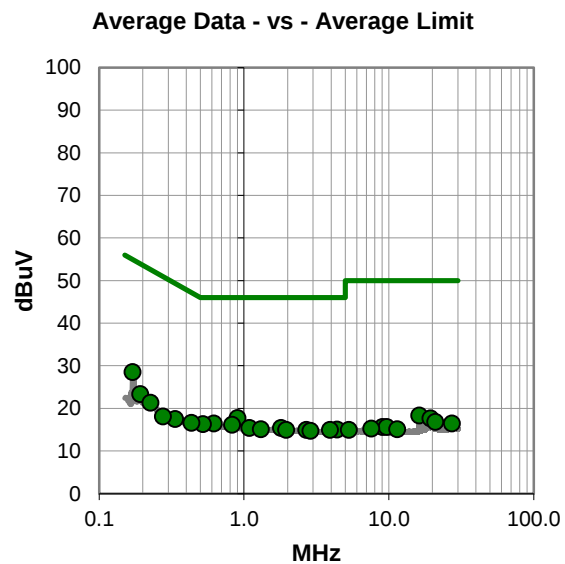
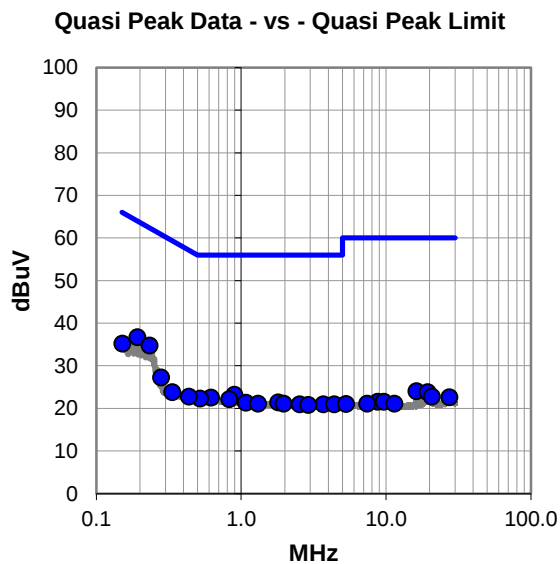
Measuring AC Mains of linear DC lab power supply.

EUT OPERATING MODES

BLE Tx, Mid channel, 2442 MHz, 1 Mbps

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #16

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.193	16.6	20.1	36.7	63.9	-27.2
0.234	14.6	20.1	34.7	62.3	-27.6
0.152	15.1	20.1	35.2	65.9	-30.7
0.901	3.2	20.0	23.2	56.0	-32.8
0.620	2.5	20.0	22.5	56.0	-33.5
0.280	7.2	20.0	27.2	60.8	-33.6
0.521	2.3	20.0	22.3	56.0	-33.7
0.829	2.1	20.0	22.1	56.0	-33.9
0.437	2.7	20.0	22.7	57.1	-34.4
1.802	1.4	20.0	21.4	56.0	-34.6
1.081	1.3	20.0	21.3	56.0	-34.7
1.313	1.1	20.0	21.1	56.0	-34.9
1.970	1.1	20.0	21.1	56.0	-34.9
2.541	0.9	20.0	20.9	56.0	-35.1
3.697	0.9	20.0	20.9	56.0	-35.1
4.390	0.9	20.0	20.9	56.0	-35.1
2.916	0.8	20.0	20.8	56.0	-35.2
0.335	3.8	20.0	23.8	59.3	-35.5
16.227	3.4	20.6	24.0	60.0	-36.0
19.390	3.2	20.6	23.8	60.0	-36.2
20.768	1.9	20.8	22.7	60.0	-37.3
27.392	1.5	21.1	22.6	60.0	-37.4
8.775	1.3	20.2	21.5	60.0	-38.5
9.670	1.3	20.2	21.5	60.0	-38.5
7.417	0.9	20.2	21.1	60.0	-38.9

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.170	8.4	20.1	28.5	55.0	-26.5
0.902	-2.3	20.0	17.7	46.0	-28.3
0.618	-3.6	20.0	16.4	46.0	-29.6
0.522	-3.7	20.0	16.3	46.0	-29.7
0.827	-3.9	20.0	16.1	46.0	-29.9
0.193	3.2	20.1	23.3	53.9	-30.6
0.434	-3.4	20.0	16.6	47.2	-30.6
1.090	-4.6	20.0	15.4	46.0	-30.6
1.804	-4.6	20.0	15.4	46.0	-30.6
1.311	-4.9	20.0	15.1	46.0	-30.9
4.392	-5.0	20.0	15.0	46.0	-31.0
1.954	-5.1	20.0	14.9	46.0	-31.1
2.703	-5.1	20.0	14.9	46.0	-31.1
3.929	-5.1	20.0	14.9	46.0	-31.1
0.226	1.2	20.1	21.3	52.6	-31.3
2.884	-5.3	20.0	14.7	46.0	-31.3
16.227	-2.3	20.6	18.3	50.0	-31.7
0.335	-2.5	20.0	17.5	49.3	-31.8
19.422	-3.0	20.6	17.6	50.0	-32.4
0.277	-1.9	20.0	18.1	50.9	-32.8
20.956	-4.0	20.8	16.8	50.0	-33.2
27.369	-4.7	21.1	16.4	50.0	-33.6
9.074	-4.6	20.2	15.6	50.0	-34.4
9.668	-4.6	20.2	15.6	50.0	-34.4
7.587	-5.0	20.2	15.2	50.0	-34.8

CONCLUSION

Pass



Tested By

DUTY CYCLE



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	Keysight	N5182B	TFU	2020-11-20	2022-11-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Attenuator	S.M. Electronics	SA26B-20	AUY	2021-03-14	2022-03-14
Block - DC	Fairview Microwave	SD3379	AMW	2021-03-14	2022-03-14
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFE	2021-04-08	2022-04-08

TEST DESCRIPTION

The Duty Cycle (x) of the single channel operation of the radio as controlled by the provided test software was measured for each of the EUT operating modes.

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.

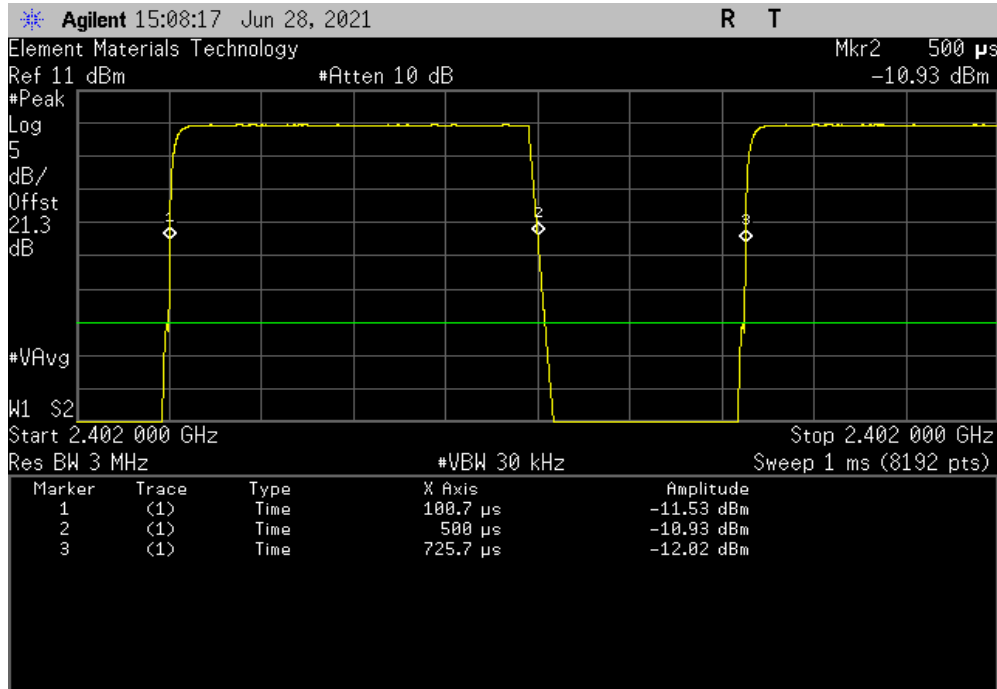
ThiTx 2021.03.19.1 XMIT 2020.12.30.0

DUTY CYCLE

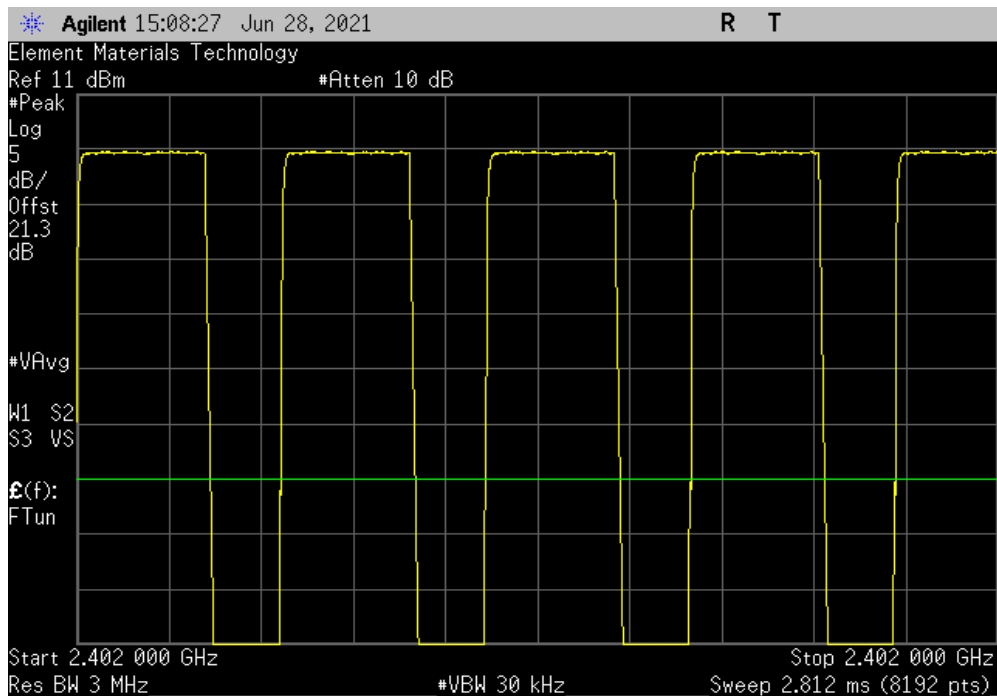


TUTx 2021.03.10.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
399.344 us	625 us	1	63.9	N/A	N/A	



BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	5	N/A	N/A	N/A	

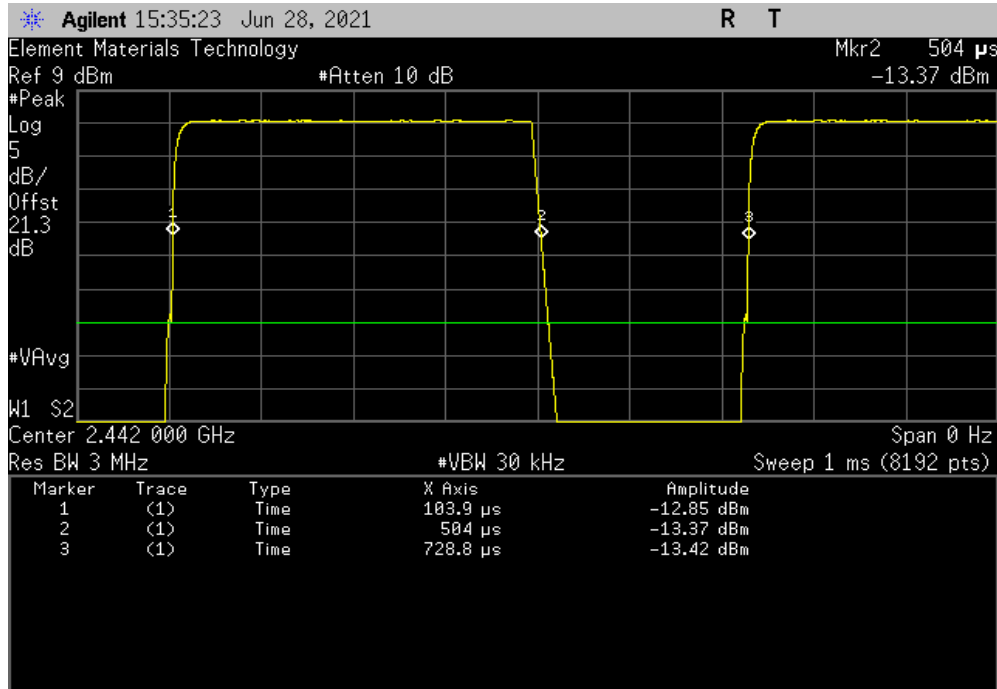


DUTY CYCLE

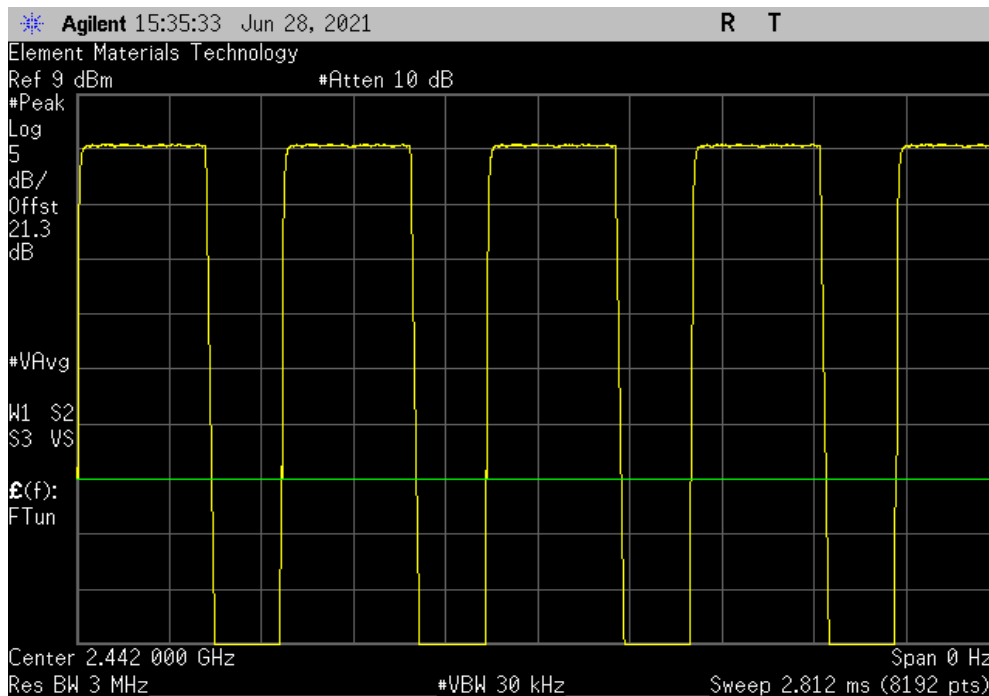


TUTx 2021.03.19.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Mid Channel, 2442 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
400.087 us	624.9 us	1	64	N/A	N/A	



BLE/GFSK 1 Mbps Mid Channel, 2442 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	6	N/A	N/A	N/A	

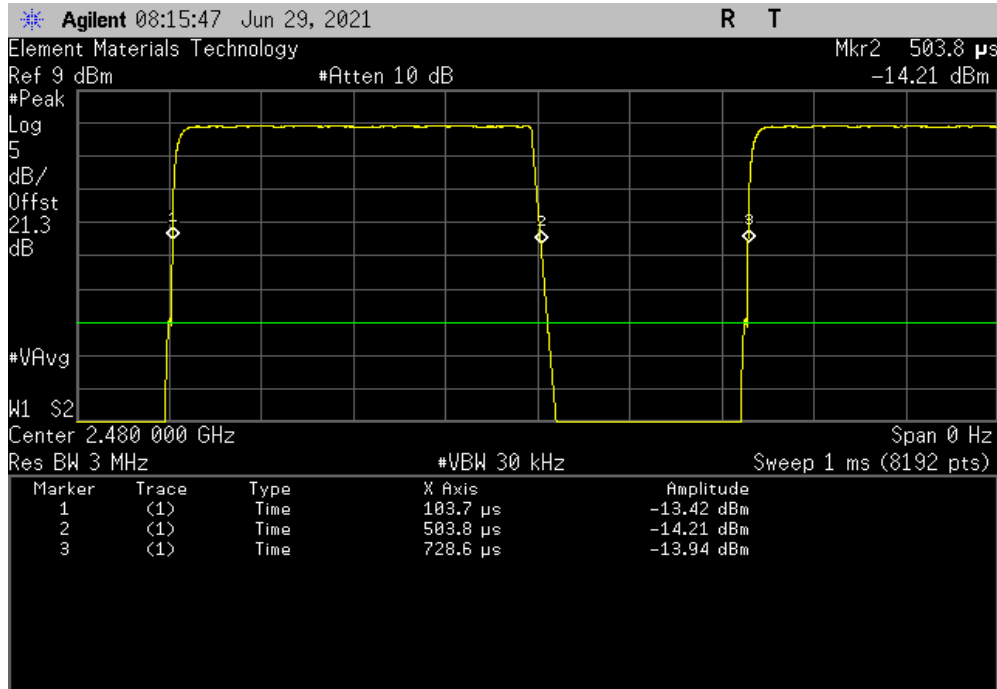


DUTY CYCLE

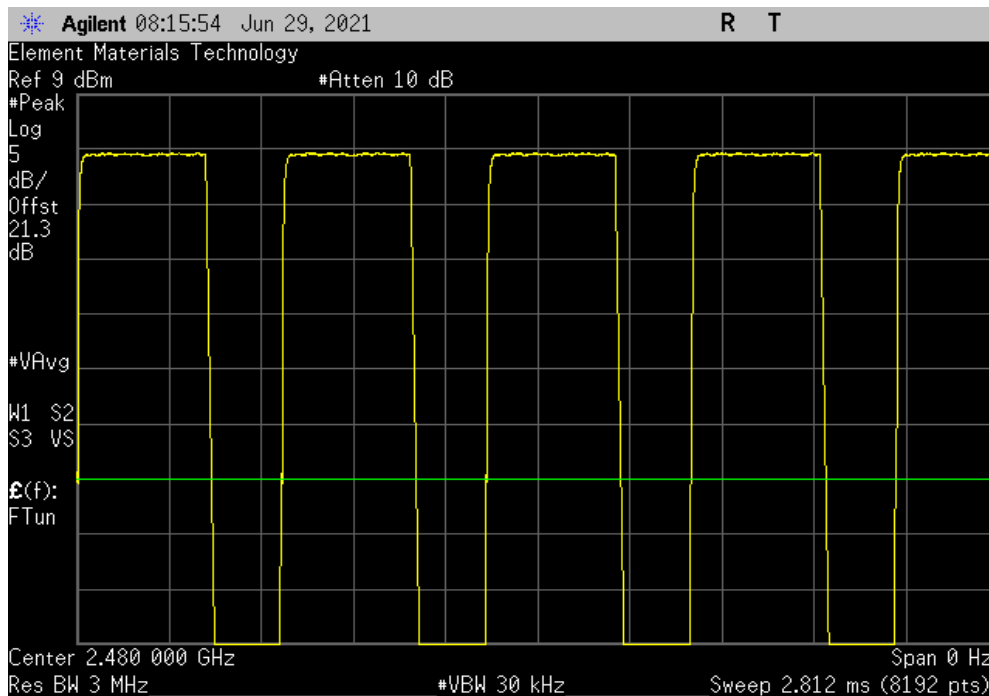


TUTx 2021.03.19.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
400.053 us	624.9 us	1	64	N/A	N/A	



BLE/GFSK 1 Mbps High Channel, 2480 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	6	N/A	N/A	N/A	



OCCUPIED 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	Keysight	N5182B	TFU	2020-11-20	2022-11-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Attenuator	S.M. Electronics	SA26B-20	AUY	2021-03-14	2022-03-14
Block - DC	Fairview Microwave	SD3379	AMW	2021-03-14	2022-03-14
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFE	2021-04-08	2022-04-08

TEST DESCRIPTION

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

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

OCCUPIED BANDWIDTH



TSMTx 2021.03.19.1 XMR 2020.12.30.0

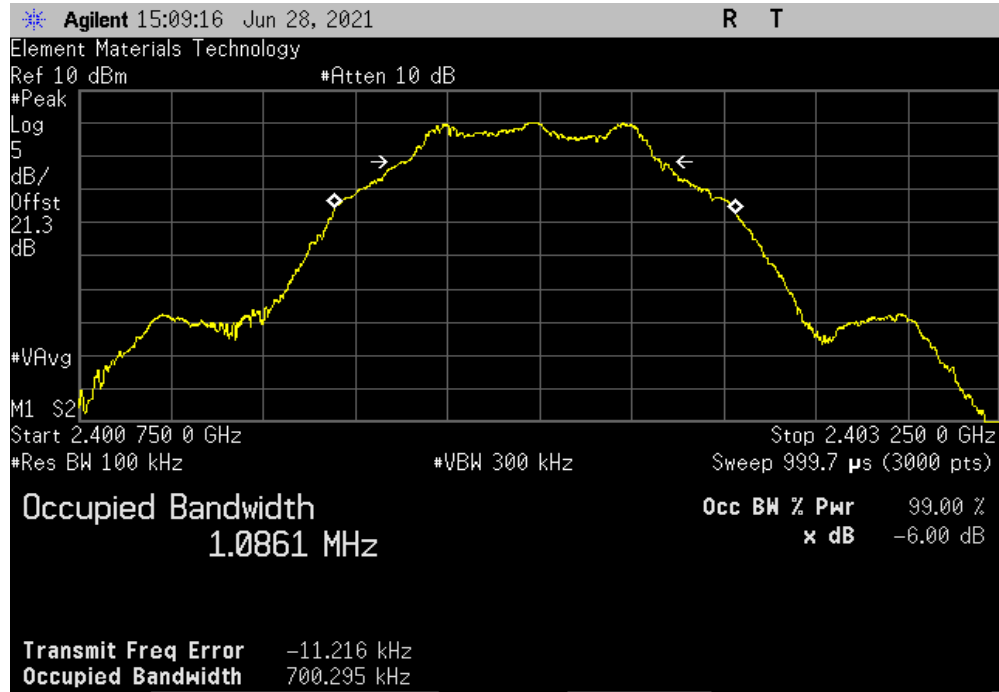
EUT: 43.0536.00		Work Order: A-DE0162	
Serial Number: SN001 00003		Date: 29-Jun-21	
Customer: A-dec, Inc.		Temperature: 24.1 °C	
Attendees: Zack Lyda		Humidity: 45.5% RH	
Project: None		Barometric Pres.: 1012 mbar	
Tested by: Jeff Alcock	Power: 3.3 VDC via 110VAC/60Hz	Job Site: EV06	
TEST SPECIFICATIONS			
FCC 15.247:2021		Test Method: ANSI C63.10:2013	
COMMENTS			
Reference level offset: DC Block, 20 dB attenuator, and measurement cable.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature 	
		Value	Limit (±) Result
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		700.295 kHz	500 kHz Pass
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		697.947 kHz	500 kHz Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz		696.421 kHz	500 kHz Pass

OCCUPIED BANDWIDTH

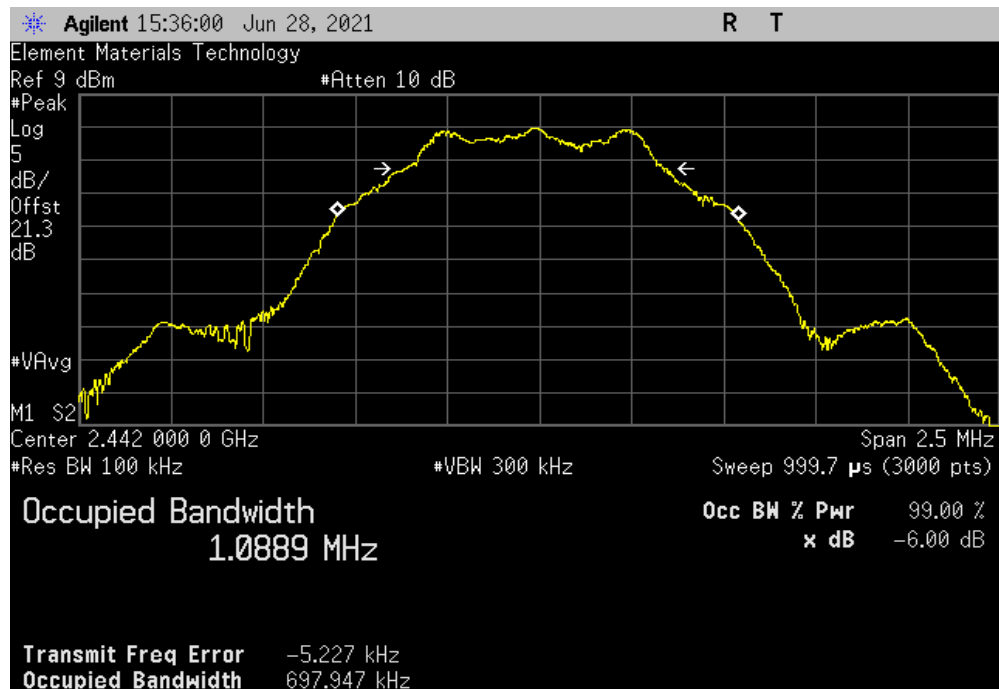


TUTx 2021.03.19.1 XMR 2020.12.30.0

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



BLE/GFSK 1 Mbps Mid Channel, 2442 MHz						
				Value	Limit (≥)	Result
				697.947 kHz	500 kHz	Pass

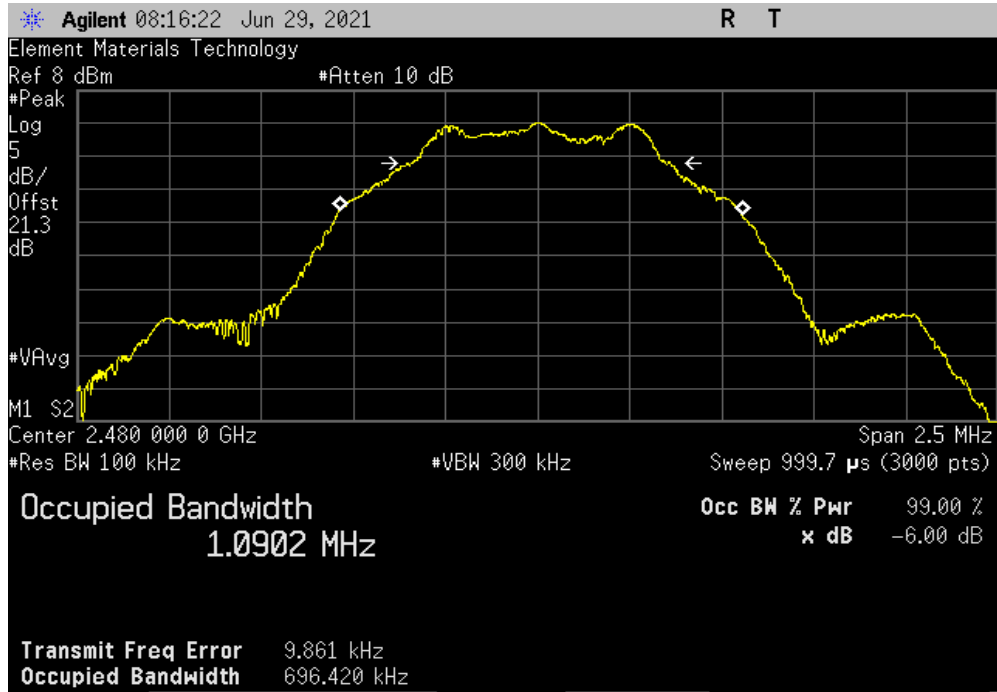


OCCUPIED BANDWIDTH



TUTx 2021.03.19.1 XMR 2020.12.30.0

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



OUTPUT POWER



XMR 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	Keysight	N5182B	TFU	2020-11-20	2022-11-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Attenuator	S.M. Electronics	SA26B-20	AUY	2021-03-14	2022-03-14
Block - DC	Fairview Microwave	SD3379	AMW	2021-03-14	2022-03-14
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFE	2021-04-08	2022-04-08

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



TSTx 2021.03.19.1 XMR 2020.12.30.0

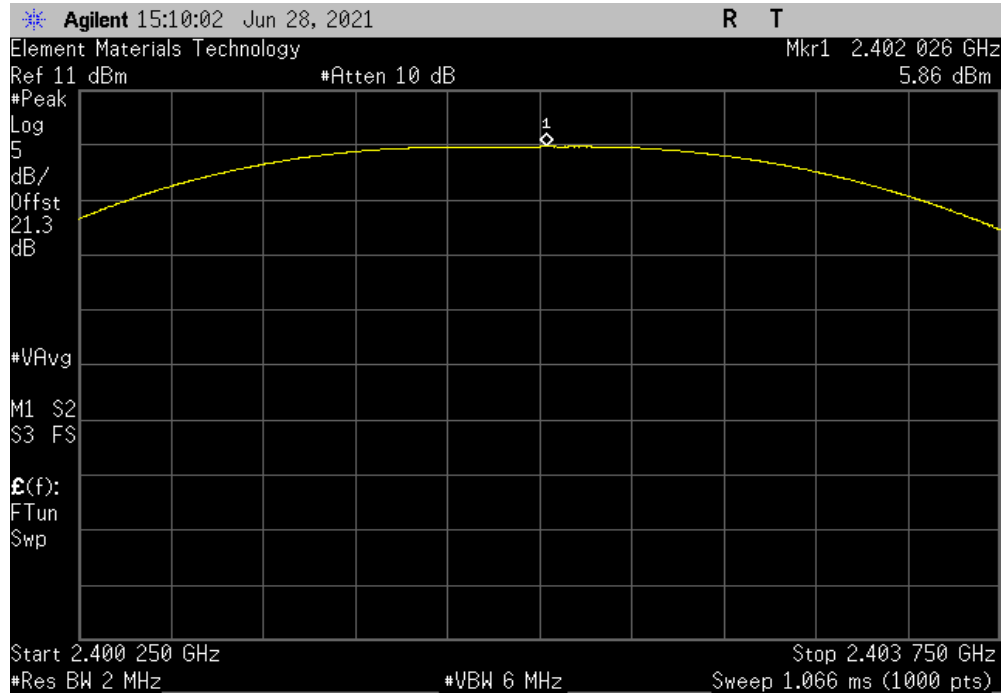
EUT: 43.0536.00		Work Order: A-DE0162	
Serial Number: SN001 00003		Date: 29-Jun-21	
Customer: A-dec, Inc.		Temperature: 24.1 °C	
Attendees: Zack Lyda		Humidity: 45.5% RH	
Project: None		Barometric Pres.: 1012 mbar	
Tested by: Jeff Alcock	Power: 3.3 VDC via 110VAC/60Hz	Job Site: EV06	
TEST SPECIFICATIONS			
FCC 15.247:2021		Test Method: ANSI C63.10:2013	
COMMENTS			
Reference level offset: DC Block, 20 dB attenuator, and measurement cable.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature 	
		Out Pwr (dBm)	Limit (dBm) Result
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		5.858	30 Pass
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		4.525	30 Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz		3.719	30 Pass

OUTPUT POWER

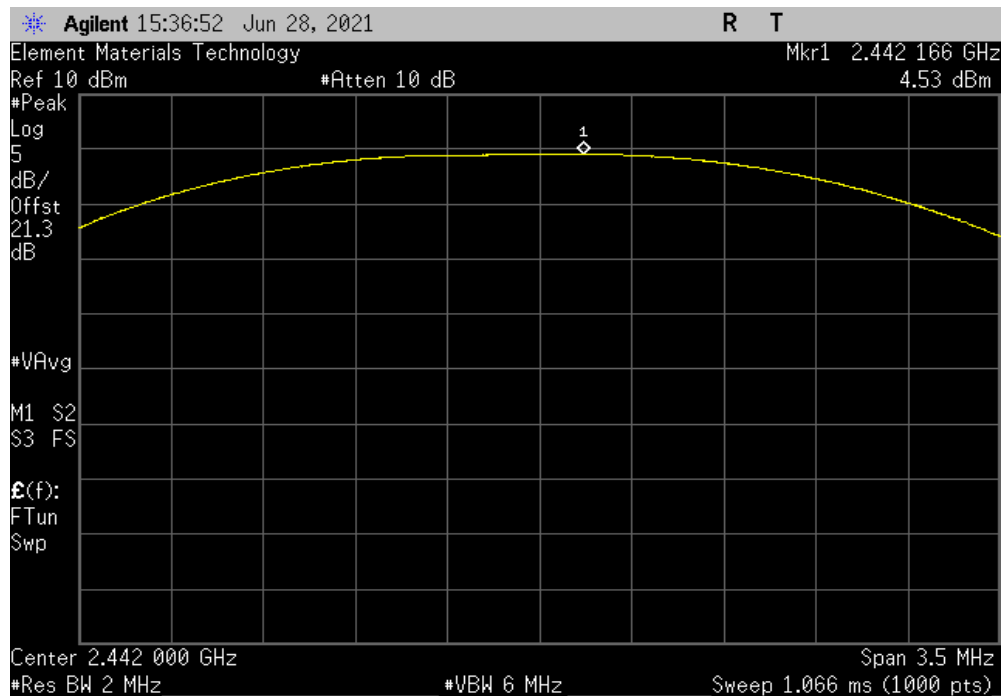


TUTx 2021.03.19.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				5.858	30	Pass



BLE/GFSK 1 Mbps Mid Channel, 2442 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				4.525	30	Pass

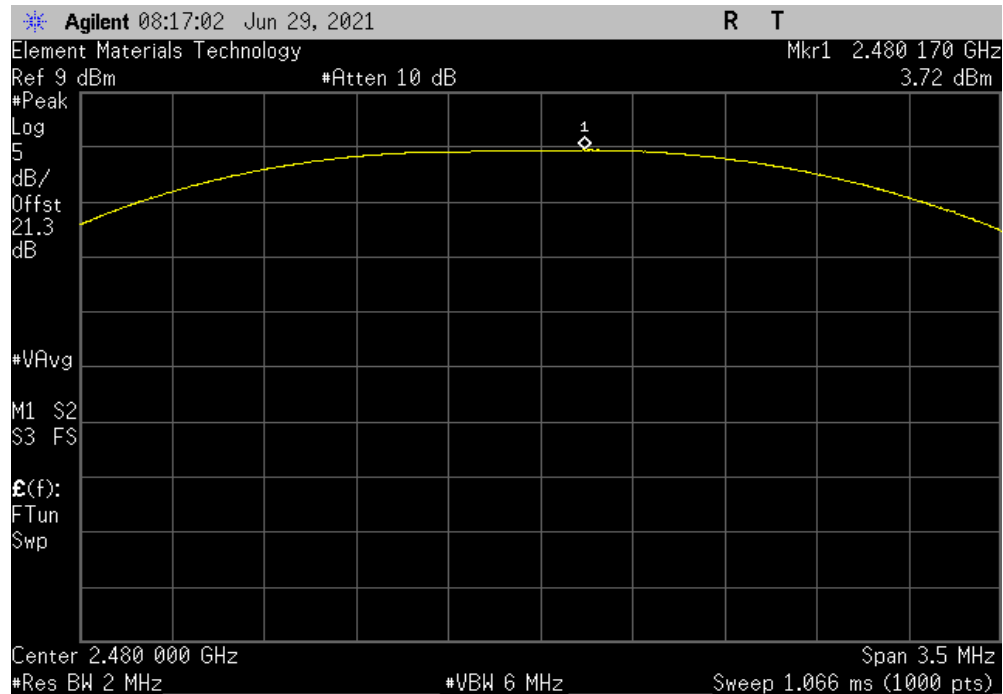


OUTPUT POWER



TUTx 2021.03.19.1 XM8 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				3.719	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	Keysight	N5182B	TFU	2020-11-20	2022-11-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Attenuator	S.M. Electronics	SA26B-20	AUY	2021-03-14	2022-03-14
Block - DC	Fairview Microwave	SD3379	AMW	2021-03-14	2022-03-14
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFE	2021-04-08	2022-04-08

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)



TSTx 2021.03.19.1 XMR 2020.12.30.0

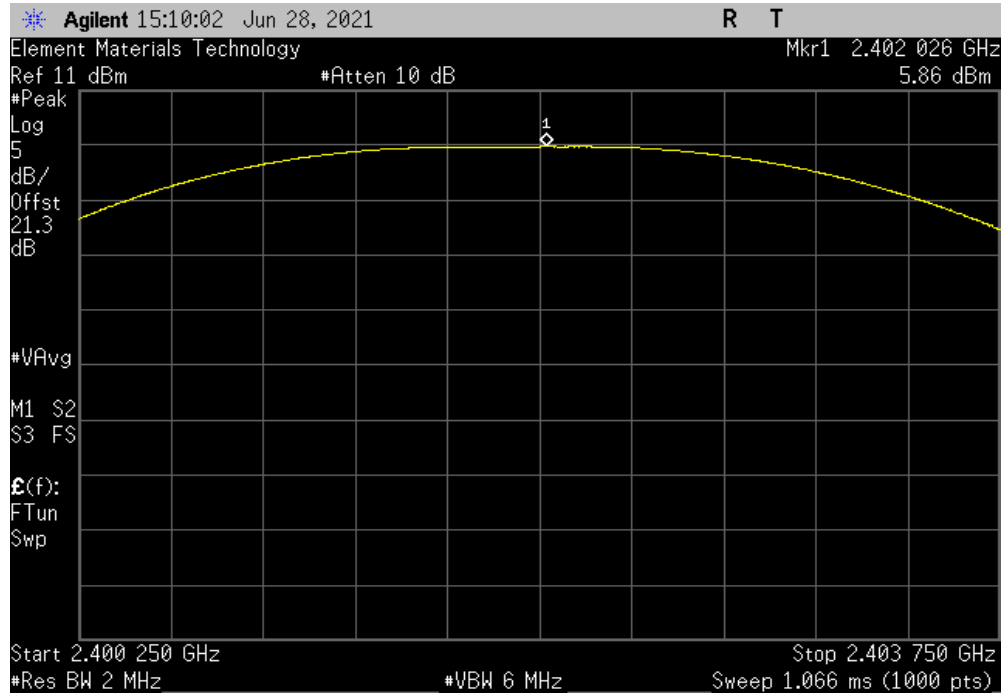
EUT: 43.0536.00		Work Order: A-DE0162	
Serial Number: SN001 00003		Date: 29-Jun-21	
Customer: A-dec, Inc.		Temperature: 24.1 °C	
Attendees: Zack Lyda		Humidity: 45.4% RH	
Project: None		Barometric Pres.: 1012 mbar	
Tested by: Jeff Alcock	Power: 3.3 VDC via 110VAC/60Hz	Job Site: EV06	
TEST SPECIFICATIONS			
FCC 15.247:2021		Test Method: ANSI C63.10:2013	
COMMENTS			
Reference level offset: DC Block, 20 dB attenuator, and measurement cable.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature 	
		Out Pwr (dBm)	Antenna Gain (dBi)
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		5.858	2.2
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		4.525	2.2
BLE/GFSK 1 Mbps High Channel, 2480 MHz		3.719	2.2
		EIRP (dBm)	EIRP Limit (dBm)
		8.058	36
		6.725	36
		5.919	36
			Result
			Pass
			Pass
			Pass

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

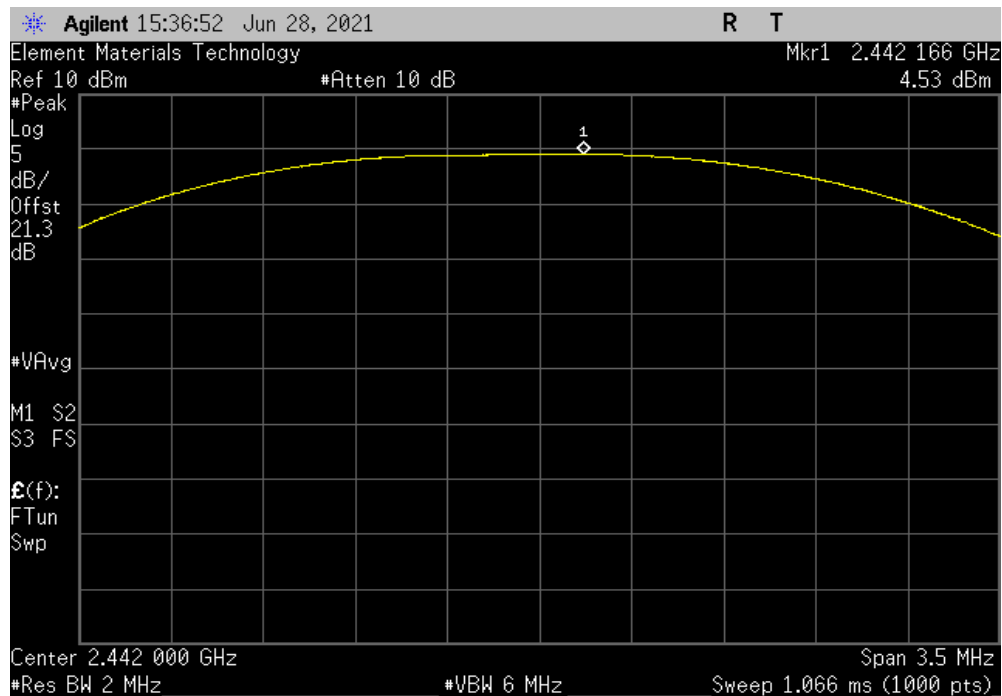


TUTx 2021.03.19.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	5.858	2.2	8.058	36	Pass	



BLE/GFSK 1 Mbps Mid Channel, 2442 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	4.525	2.2	6.725	36	Pass	

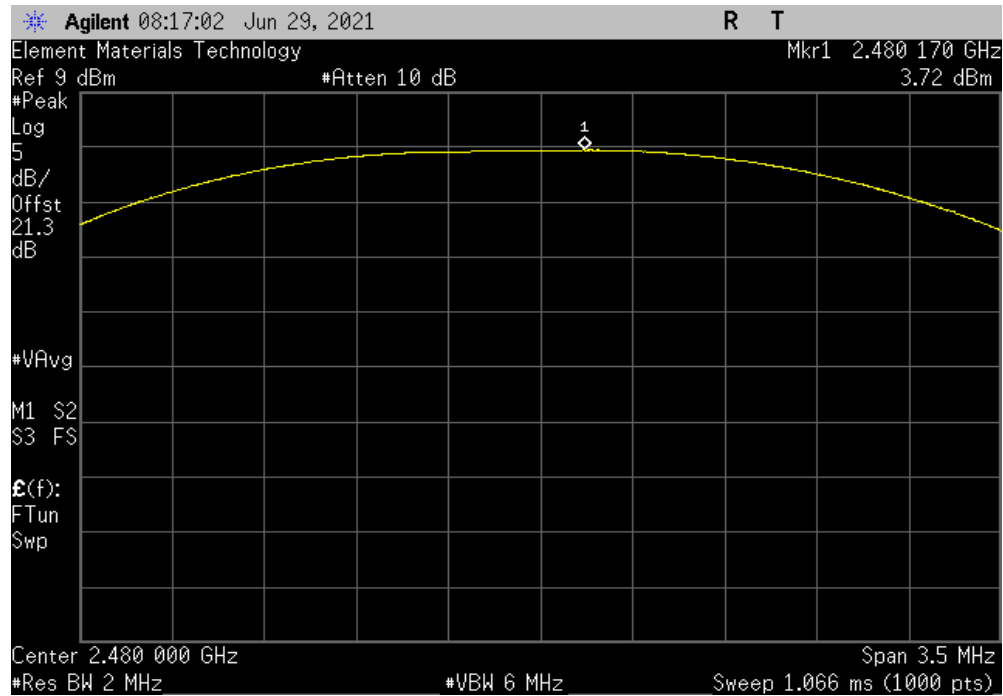


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



TbTx 2021.03.19.1 XMt 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	3.719	2.2	5.919	36	Pass	



POWER SPECTRAL DENSITY

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	2020-11-20	2022-11-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Attenuator	S.M. Electronics	SA26B-20	AUY	2021-03-14	2022-03-14
Block - DC	Fairview Microwave	SD3379	AMW	2021-03-14	2022-03-14
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFE	2021-04-08	2022-04-08

TEST DESCRIPTION

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



TSTx 2021.03.19.1 XMR 2020.12.30.0

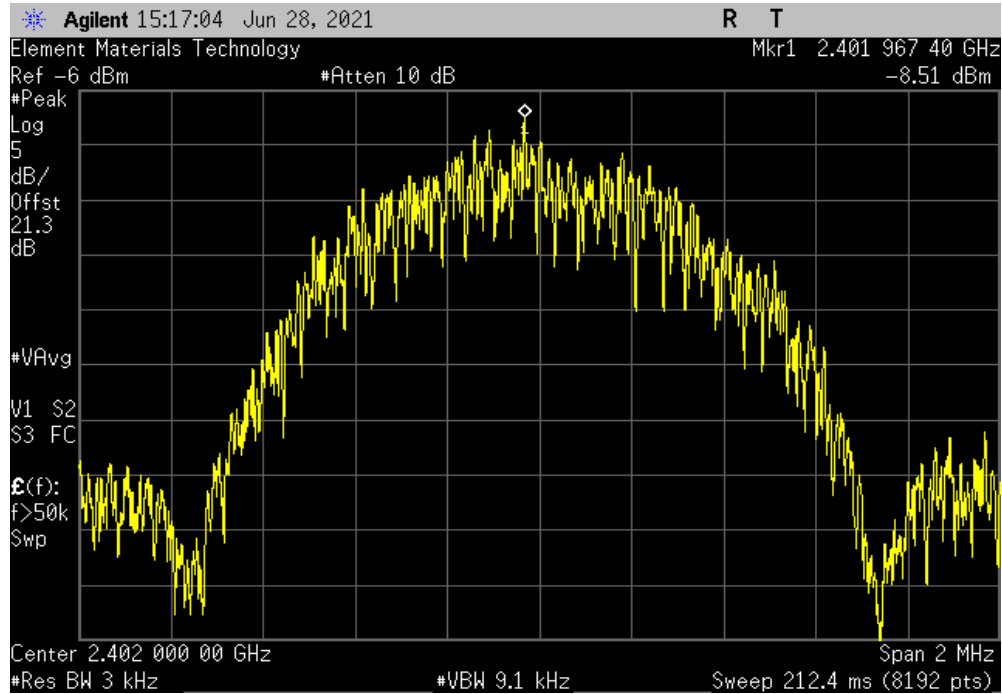
EUT: 43.0536.00		Work Order: A-DE0162	
Serial Number: SN001 00003		Date: 29-Jun-21	
Customer: A-dec, Inc.		Temperature: 24.1 °C	
Attendees: Zack Lyda		Humidity: 45.5% RH	
Project: None		Barometric Pres.: 1012 mbar	
Tested by: Jeff Alcock		Power: 3.3 VDC via 110VAC/60Hz	
		Job Site: EV06	
TEST SPECIFICATIONS			
FCC 15.247:2021		Test Method	
		ANSI C63.10:2013	
COMMENTS			
Reference level offset: DC Block, 20 dB attenuator, and measurement cable.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature 	
		Value dBm/3kHz	Limit < dBm/3kHz
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		-8.508	8
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		-9.812	8
BLE/GFSK 1 Mbps High Channel, 2480 MHz		-10.683	8
			Results
			Pass
			Pass
			Pass

POWER SPECTRAL DENSITY

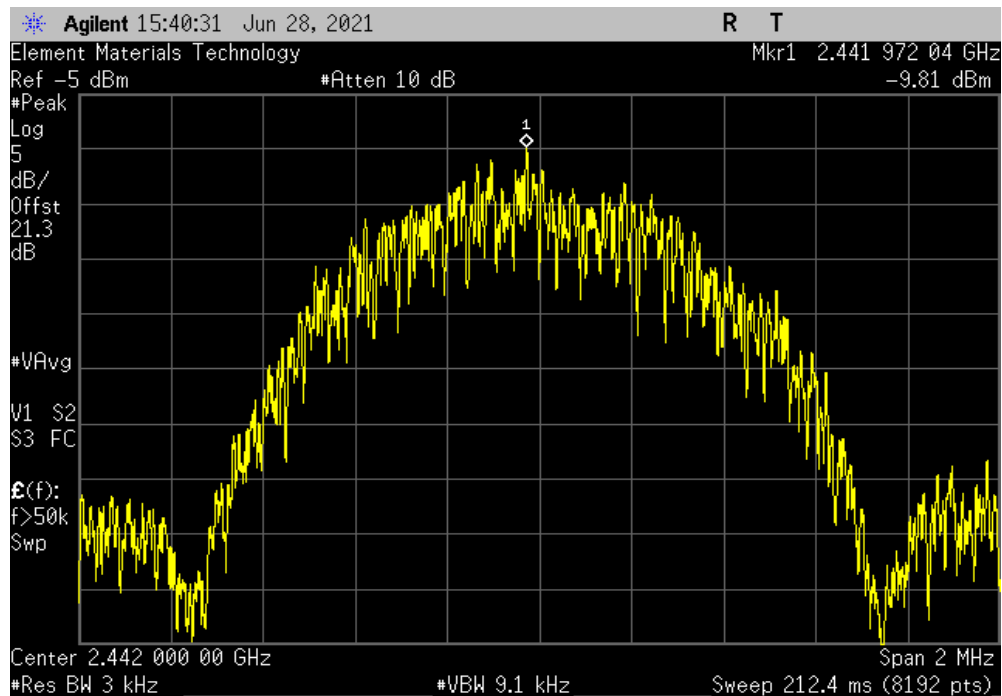


TUTx 2021.03.19.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
	Value	Limit	Results			
	dBm/3kHz	< dBm/3kHz				
	-8.508	8	Pass			



BLE/GFSK 1 Mbps Mid Channel, 2442 MHz						
	Value	Limit	Results			
	dBm/3kHz	< dBm/3kHz				
	-9.812	8	Pass			

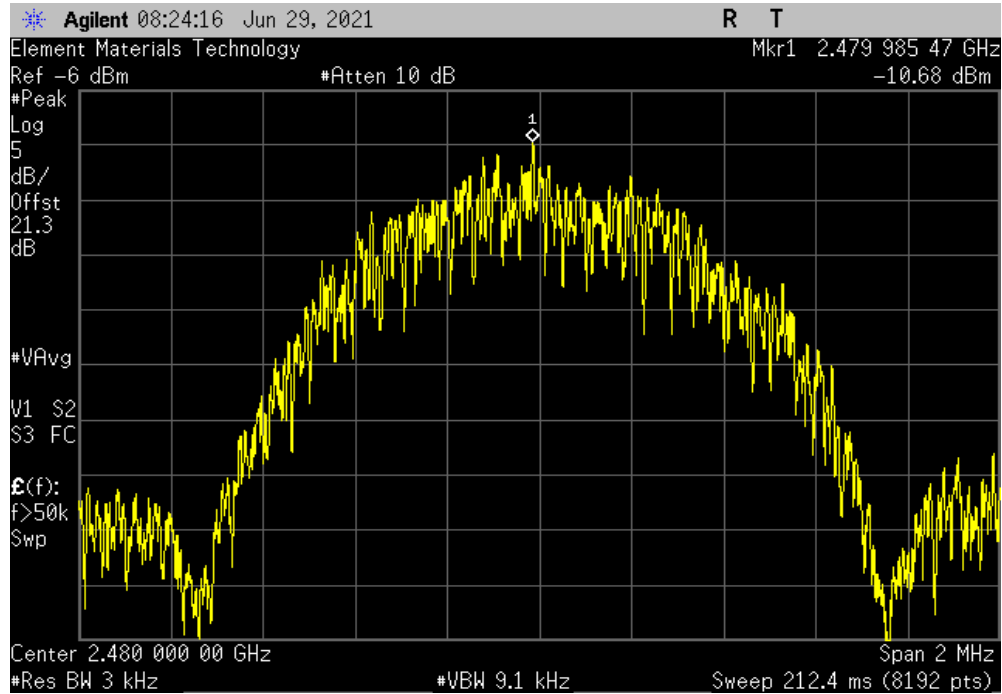


POWER SPECTRAL DENSITY



TUTx 2021.03.19.1 XM8 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz						
				Value	Limit	Results
				dBm/3kHz	< dBm/3kHz	
				-10.683	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	Keysight	N5182B	TFU	2020-11-20	2022-11-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Attenuator	S.M. Electronics	SA26B-20	AUY	2021-03-14	2022-03-14
Block - DC	Fairview Microwave	SD3379	AMW	2021-03-14	2022-03-14
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFE	2021-04-08	2022-04-08

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



TbTb 2021.03.19.1 XMR 2020.12.30.0

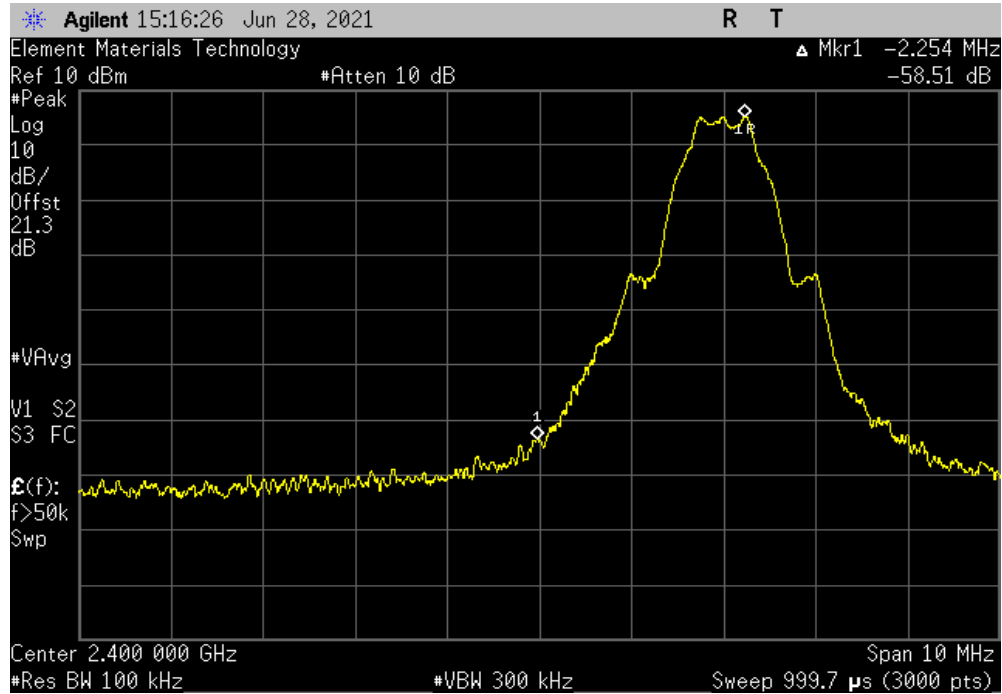
EUT: 43.0536.00		Work Order: A-DE0162	
Serial Number: SN001 00003		Date: 29-Jun-21	
Customer: A-dec, Inc.		Temperature: 24.1 °C	
Attendees: Zack Lyda		Humidity: 45.4% RH	
Project: None		Barometric Pres.: 1012 mbar	
Tested by: Jeff Alcock	Power: 3.3 VDC via 110VAC/60Hz	Job Site: EV06	
TEST SPECIFICATIONS			
FCC 15.247:2021		Test Method	
		ANSI C63.10:2013	
COMMENTS			
Reference level offset: DC Block, 20 dB attenuator, and measurement cable.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature 	
		Value (dBc)	Limit ≤ (dBc) Result
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		-58.51	-20 Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz		-60.11	-20 Pass

BAND EDGE COMPLIANCE

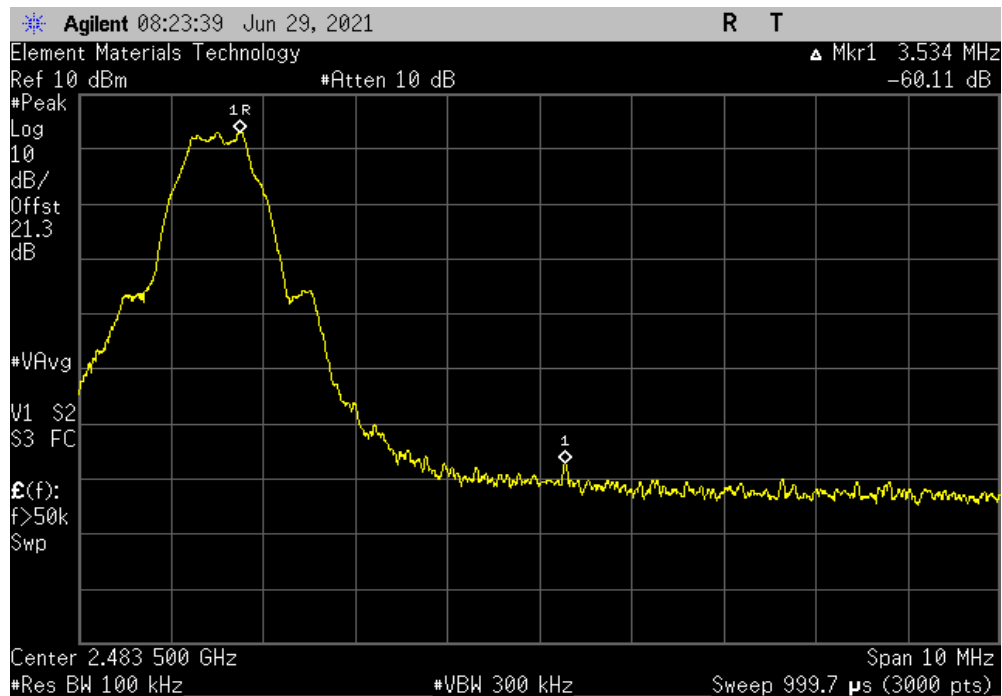


TUTx 2021.03.19.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-58.51	-20	Pass



BLE/GFSK 1 Mbps High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-60.11	-20	Pass



SPURIOUS CONDUCTED EMISSIONS

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	2020-11-20	2022-11-20
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2021-03-14	2022-03-14
Attenuator	S.M. Electronics	SA26B-20	AUY	2021-03-14	2022-03-14
Block - DC	Fairview Microwave	SD3379	AMW	2021-03-14	2022-03-14
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFE	2021-04-08	2022-04-08

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



TSTx 2021.03.19.1 XMR 2020.12.30.0

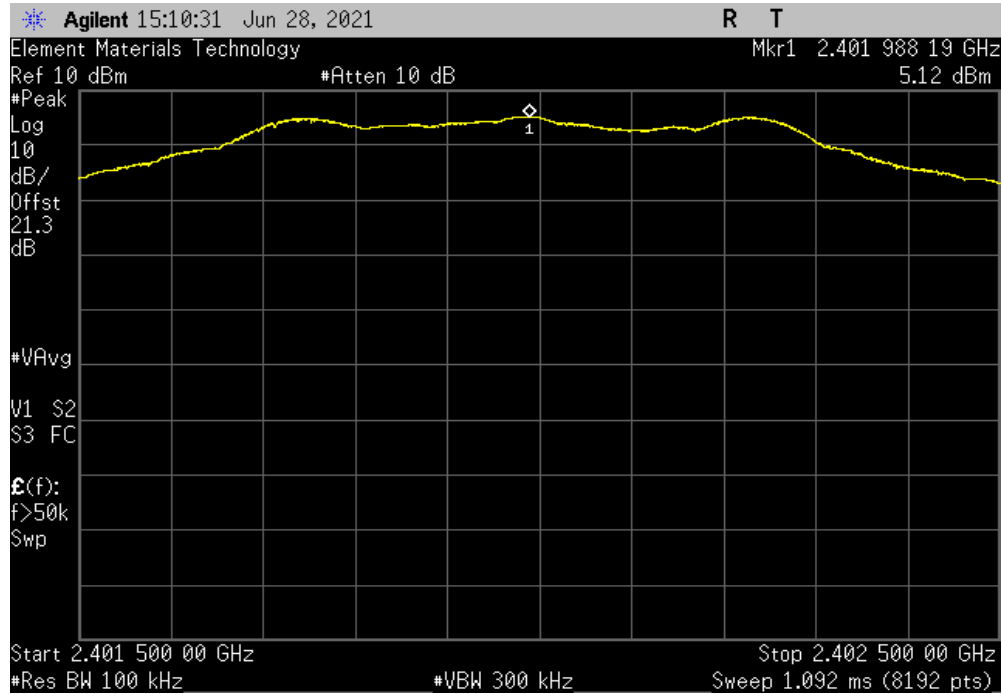
EUT: 43.0536.00		Work Order: A-DE0162			
Serial Number: SN001 00003		Date: 29-Jun-21			
Customer: A-dec, Inc.		Temperature: 24.1 °C			
Attendees: Zack Lyda		Humidity: 45.5% RH			
Project: None		Barometric Pres.: 1012 mbar			
Tested by: Jeff Alcock	Power: 3.3 VDC via 110VAC/60Hz	Job Site: EV06			
TEST SPECIFICATIONS		Test Method			
FCC 15.247:2021		ANSI C63.10:2013			
COMMENTS					
Reference level offset: DC Block, 20 dB attenuator, and measurement cable.					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	1	Signature 			
	Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
BLE/GFSK 1 Mbps Low Channel, 2402 MHz	Fundamental	2401.99	N/A	N/A	N/A
BLE/GFSK 1 Mbps Low Channel, 2402 MHz	30 MHz - 12.5 GHz	7313.2	-61.16	-20	Pass
BLE/GFSK 1 Mbps Low Channel, 2402 MHz	12.5 GHz - 25 GHz	24824.5	-57.55	-20	Pass
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz	Fundamental	2441.99	N/A	N/A	N/A
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz	30 MHz - 12.5 GHz	9531.3	-60.55	-20	Pass
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz	12.5 GHz - 25 GHz	24781.8	-57.57	-20	Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz	Fundamental	2480	N/A	N/A	N/A
BLE/GFSK 1 Mbps High Channel, 2480 MHz	30 MHz - 12.5 GHz	12395	-59.8	-20	Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz	12.5 GHz - 25 GHz	24935.9	-56.13	-20	Pass

SPURIOUS CONDUCTED EMISSIONS

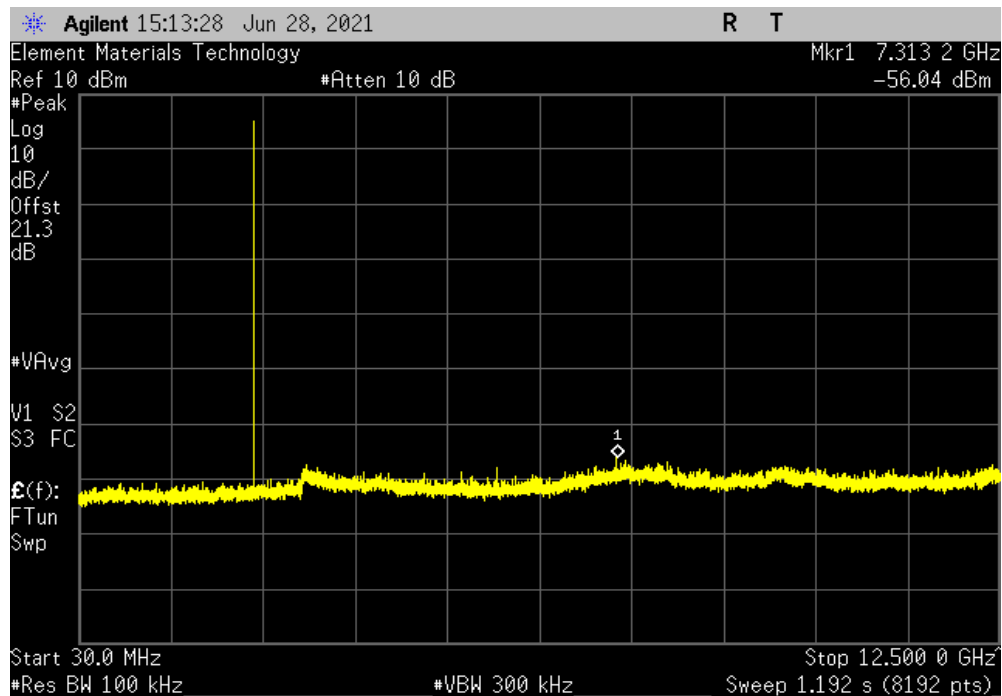


TUTx 2021.03.19.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental		2401.99	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		7313.2	-61.16	-20	Pass	

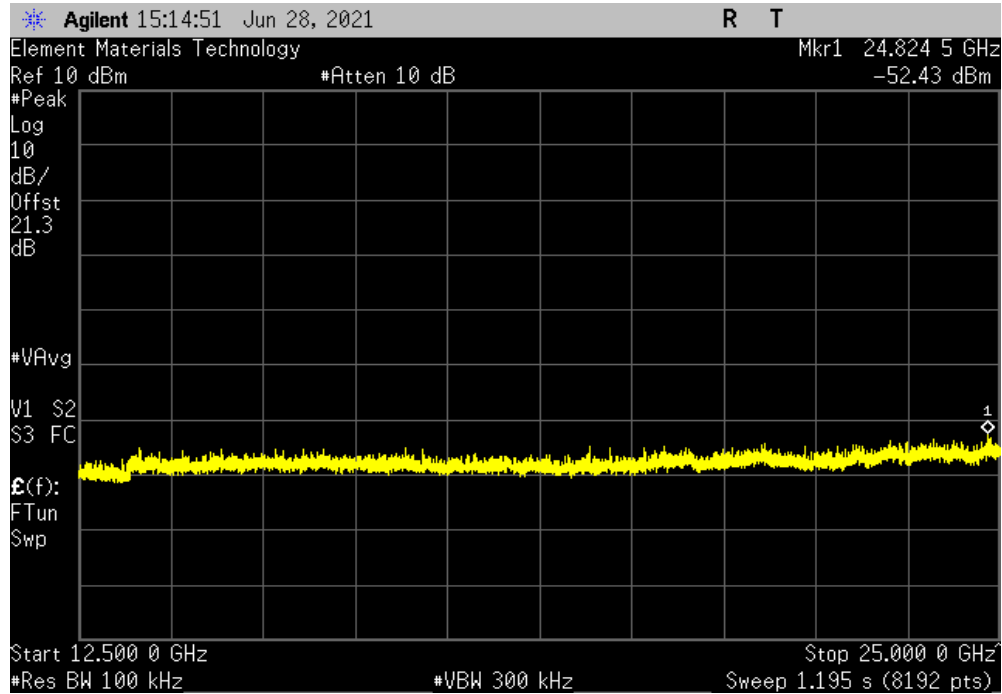


SPURIOUS CONDUCTED EMISSIONS

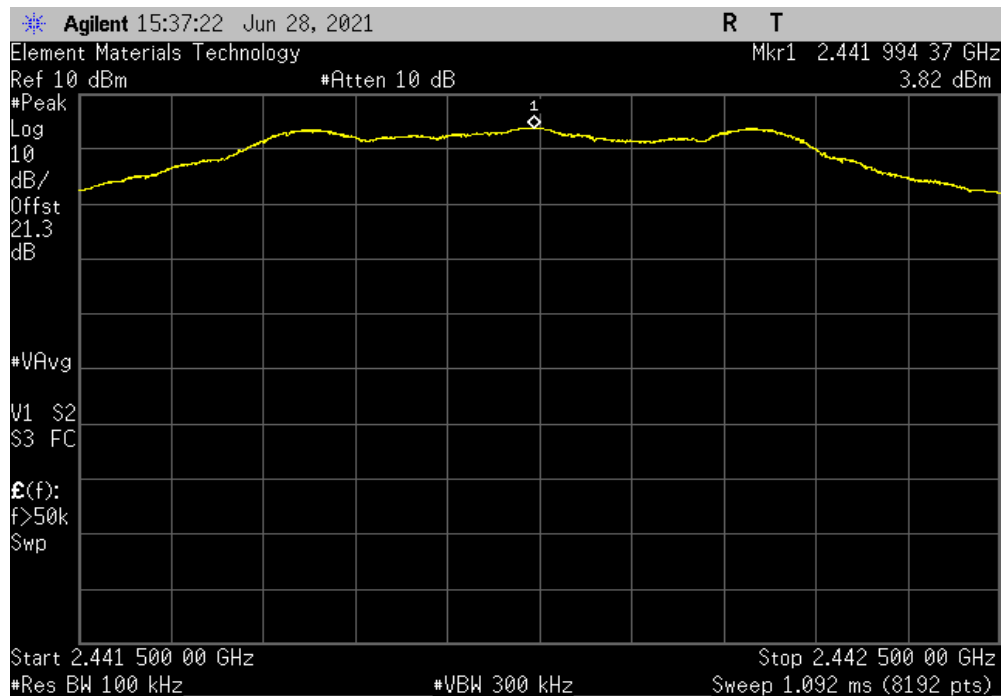


TUTx 2021.03.19.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	24824.5	-57.55	-20	Pass	



BLE/GFSK 1 Mbps Mid Channel, 2442 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2441.99	N/A	N/A	N/A	

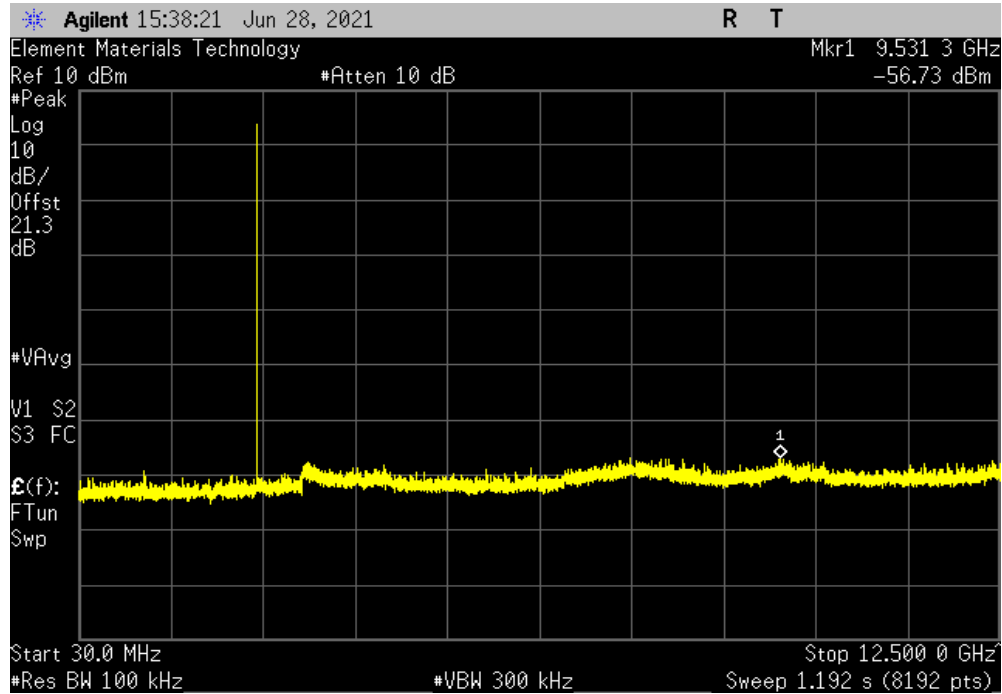


SPURIOUS CONDUCTED EMISSIONS

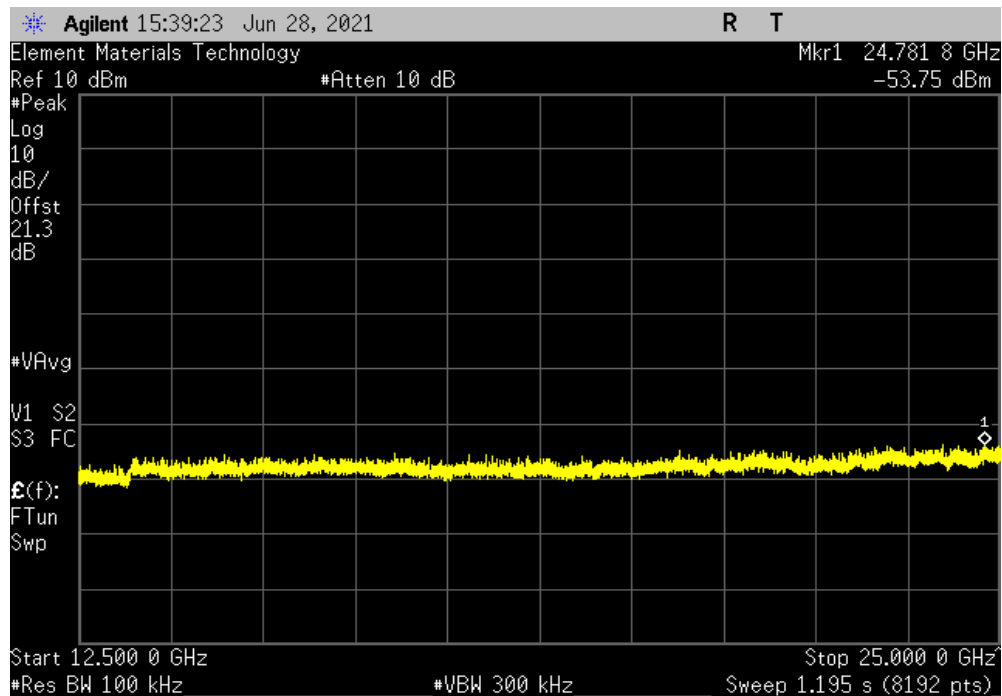


TUTx 2021.03.19.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Mid Channel, 2442 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	9531.3	-60.55	-20	Pass	



BLE/GFSK 1 Mbps Mid Channel, 2442 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	24781.8	-57.57	-20	Pass	

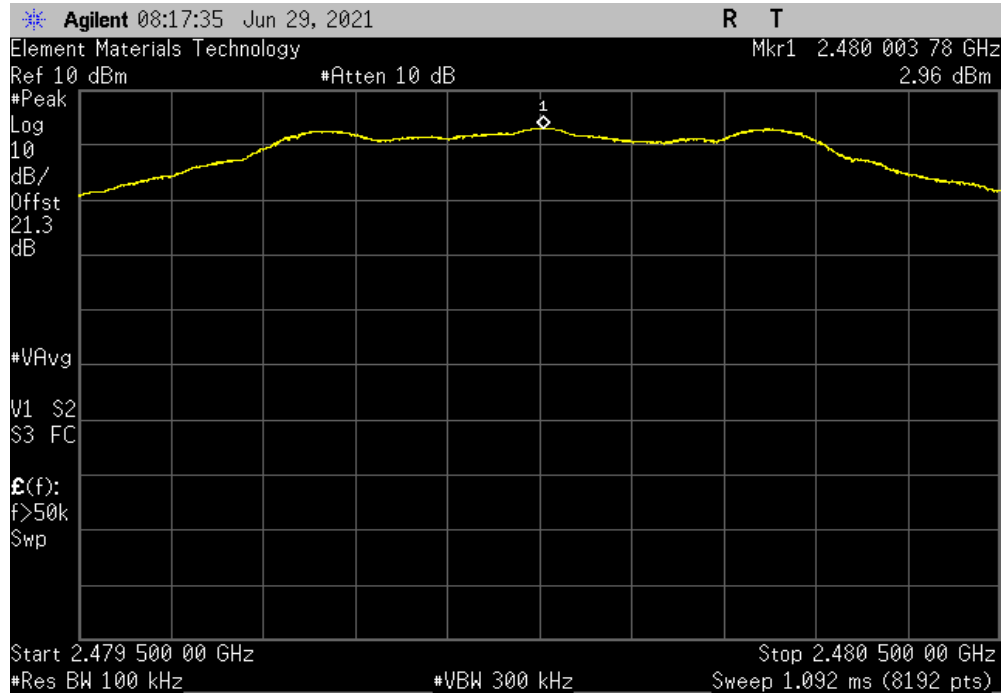


SPURIOUS CONDUCTED EMISSIONS

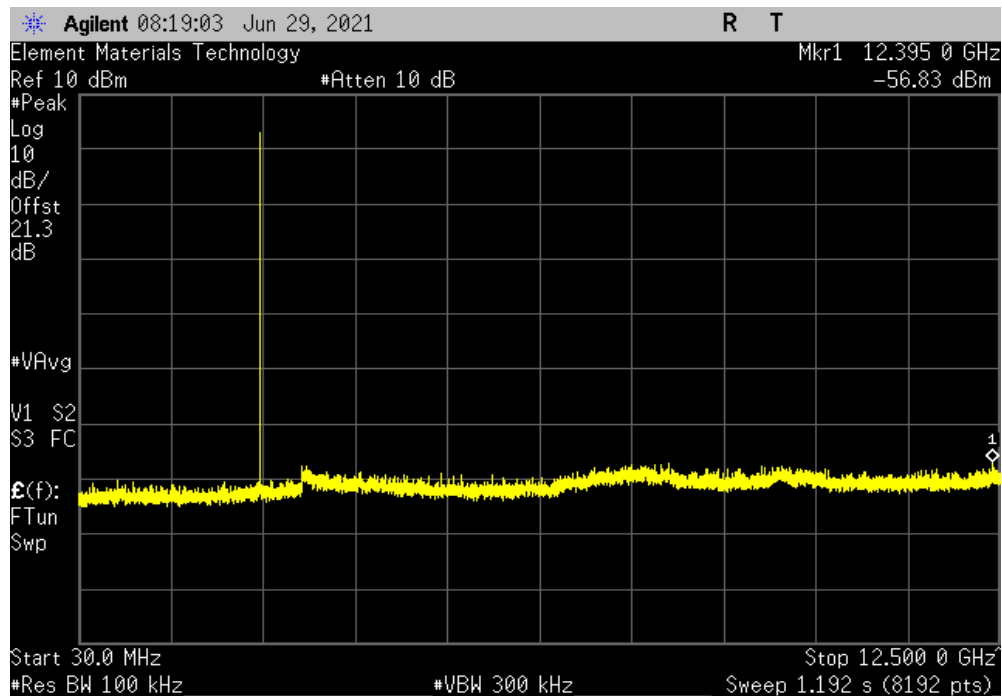


TbTx 2021.03.19.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2480	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	12395	-59.8	-20	Pass	

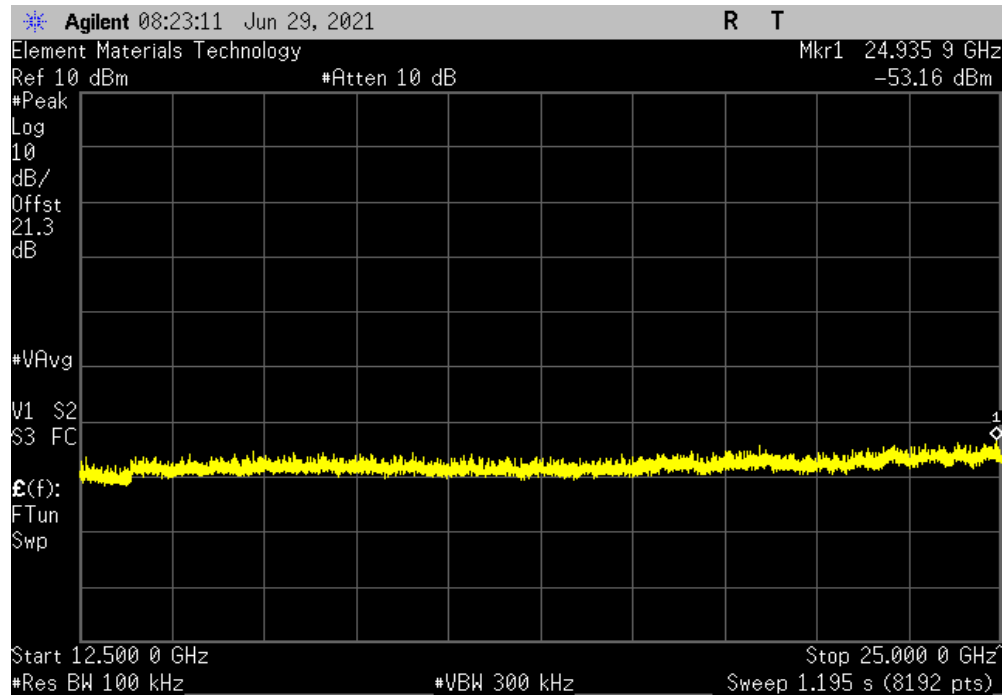


SPURIOUS CONDUCTED EMISSIONS



TUTx 2021.03.19.1 XMt 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	24935.9	-56.13	-20	Pass	



SPURIOUS RADIATED EMISSIONS

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 within 2 MHz of the allowable band may have been taken using the integration method from ANSI C63.10 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 $10 \cdot \log(1/dc)$.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	2020-12-16	2021-12-16
Antenna - Biconilog	EMCO	3141	AXG	2019-07-23	2021-07-23
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	2020-07-25	2021-07-25
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 Horns Cable	EVF	2020-11-18	2021-11-18
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	EVY	2020-07-25	2021-07-25
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

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	5.2 dB	-5.2 dB

FREQUENCY RANGE INVESTIGATED

30 MHz TO 26.5 GHz

POWER INVESTIGATED

3.3 VDC via 110VAC/60Hz

CONFIGURATIONS INVESTIGATED

A-DE0162-2

MODES INVESTIGATED

Bluetooth LE - Low Channel = 2402 MHz, Mid Channel = 2442 MHz, High Channel = 2480 MHz
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SPURIOUS RADIATED EMISSIONS

EUT:	43.0536.00	Work Order:	A-DE0162
Serial Number:	SN001 00004	Date:	2021-06-30
Customer:	A-dec, Inc.	Temperature:	23.9°C
Attendees:	Zach Lyda and Ben Meadows	Relative Humidity:	46.3%
Customer Project:	None	Bar. Pressure:	1015 mb
Tested By:	Jeff Alcock	Job Site:	EV01
Power:	3.3 VDC via 110VAC/60Hz	Configuration:	A-DE0162-2

TEST SPECIFICATIONS

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

TEST PARAMETERS

Run #:	25	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)
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COMMENTS

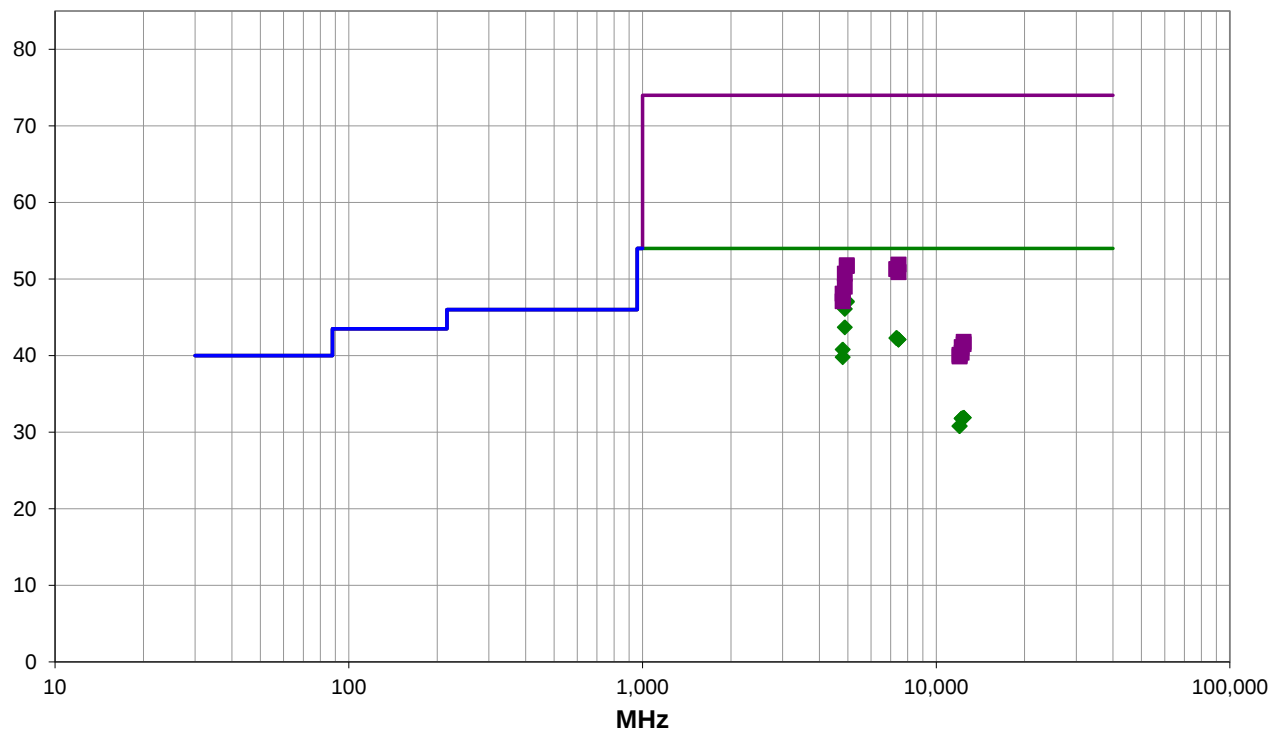
The test mode operates at 63.9% duty cycle (DC). An upward duty cycle correction factor (DCCF) of $10 \cdot \log(1/DC) = 10 \cdot \log(1/0.639) = 1.9$ dB was applied to the RMS average measurements.
Please reference data comments below for channel, data rate, and EUT orientation.

EUT OPERATING MODES

Bluetooth LE - Low Channel = 2402 MHz, Mid Channel = 2442 MHz, High Channel = 2480 MHz

DEVIATIONS FROM TEST STANDARD

None



Run #: 25

■ PK ◆ AV ● QP

SPURIOUS RADIATED EMISSIONS

RESULTS - Run #25

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4959.908	39.3	5.9	1.1	93.0	1.9	0.0	Vert	AV	0.0	47.1	54.0	-6.9	High Channel, EUT Horz
4959.875	39.2	5.9	2.1	152.0	1.9	0.0	Horz	AV	0.0	47.0	54.0	-7.0	High Channel, EUT on Side
4883.967	38.2	6.0	2.1	150.0	1.9	0.0	Horz	AV	0.0	46.1	54.0	-7.9	Mid Channel, EUT on Side
4883.842	35.8	6.0	3.6	32.0	1.9	0.0	Vert	AV	0.0	43.7	54.0	-10.3	Mid Channel, EUT Horz
7327.442	28.7	11.7	1.5	351.0	1.9	0.0	Vert	AV	0.0	42.3	54.0	-11.7	Mid Channel, EUT Horz
7326.592	28.7	11.7	1.5	116.0	1.9	0.0	Horz	AV	0.0	42.3	54.0	-11.7	Mid Channel, EUT on Side
7439.100	28.0	12.2	3.9	152.0	1.9	0.0	Vert	AV	0.0	42.1	54.0	-11.9	High Channel, EUT Horz
7437.583	28.0	12.2	3.9	212.0	1.9	0.0	Horz	AV	0.0	42.1	54.0	-11.9	High Channel, EUT on Side
4804.108	33.8	5.1	2.2	147.0	1.9	0.0	Horz	AV	0.0	40.8	54.0	-13.2	Low Channel, EUT on Side
4804.042	32.8	5.1	2.4	37.0	1.9	0.0	Vert	AV	0.0	39.8	54.0	-14.2	Low Channel, EUT Horz
7438.217	39.7	12.2	3.9	152.0	0.0	0.0	Vert	PK	0.0	51.9	74.0	-22.1	High Channel, EUT Horz
12399.910	28.5	1.5	1.1	68.0	1.9	0.0	Horz	AV	0.0	31.9	54.0	-22.1	High Channel, EUT on Side
12399.830	28.5	1.5	1.1	291.0	1.9	0.0	Vert	AV	0.0	31.9	54.0	-22.1	High Channel, EUT Horz
4960.550	45.9	5.9	1.1	93.0	0.0	0.0	Vert	PK	0.0	51.8	74.0	-22.2	High Channel, EUT Horz
12210.770	28.9	1.0	1.1	232.0	1.9	0.0	Horz	AV	0.0	31.8	54.0	-22.2	Mid Channel, EUT on Side
12209.560	29.0	0.9	1.2	145.0	1.9	0.0	Vert	AV	0.0	31.8	54.0	-22.2	Mid Channel, EUT Horz
4959.608	45.8	5.9	2.1	152.0	0.0	0.0	Horz	PK	0.0	51.7	74.0	-22.3	High Channel, EUT on Side
7326.917	39.6	11.7	1.5	351.0	0.0	0.0	Vert	PK	0.0	51.3	74.0	-22.7	Mid Channel, EUT Horz
7327.108	39.6	11.7	1.5	116.0	0.0	0.0	Horz	PK	0.0	51.3	74.0	-22.7	Mid Channel, EUT on Side
7441.450	38.7	12.2	3.9	212.0	0.0	0.0	Horz	PK	0.0	50.9	74.0	-23.1	High Channel, EUT on Side
12007.530	27.8	1.1	1.5	360.0	1.9	0.0	Vert	AV	0.0	30.8	54.0	-23.2	Low Channel, EUT Horz
12007.500	27.8	1.1	1.7	122.0	1.9	0.0	Horz	AV	0.0	30.8	54.0	-23.2	Low Channel, EUT on Side
4884.667	44.7	6.0	2.1	150.0	0.0	0.0	Horz	PK	0.0	50.7	74.0	-23.3	Mid Channel, EUT on Side
4884.258	43.0	6.0	3.6	32.0	0.0	0.0	Vert	PK	0.0	49.0	74.0	-25.0	Mid Channel, EUT Horz
4803.750	43.0	5.1	2.2	147.0	0.0	0.0	Horz	PK	0.0	48.1	74.0	-25.9	Low Channel, EUT on Side
4803.642	42.0	5.1	2.4	37.0	0.0	0.0	Vert	PK	0.0	47.1	74.0	-26.9	Low Channel, EUT Horz
12399.950	40.3	1.5	1.1	68.0	0.0	0.0	Horz	PK	0.0	41.8	74.0	-32.2	High Channel, EUT on Side
12399.200	40.0	1.5	1.1	291.0	0.0	0.0	Vert	PK	0.0	41.5	74.0	-32.5	High Channel, EUT Horz
12211.000	40.1	1.0	1.1	232.0	0.0	0.0	Horz	PK	0.0	41.1	74.0	-32.9	Mid Channel, EUT on Side
12210.830	39.4	1.0	1.2	145.0	0.0	0.0	Vert	PK	0.0	40.4	74.0	-33.6	Mid Channel, EUT Horz
12008.840	39.0	1.1	1.7	122.0	0.0	0.0	Horz	PK	0.0	40.1	74.0	-33.9	Low Channel, EUT on Side
12011.490	38.8	1.1	1.5	360.0	0.0	0.0	Vert	PK	0.0	39.9	74.0	-34.1	Low Channel, EUT Horz

CONCLUSION

Pass



Tested By

SPURIOUS RADIATED EMISSIONS

EUT:	43.0536.00	Work Order:	A-DE0162
Serial Number:	SN001 00004	Date:	2021-06-30
Customer:	A-dec, Inc.	Temperature:	23.9°C
Attendees:	Zack Lyda and Ben Meadows	Relative Humidity:	46.3%
Customer Project:	None	Bar. Pressure:	1015 mb
Tested By:	Jeff Alcock	Job Site:	EV01
Power:	3.3 VDC via 110VAC/60Hz	Configuration:	A-DE0162-2

TEST SPECIFICATIONS

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

TEST PARAMETERS

Run #:	27	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)
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COMMENTS

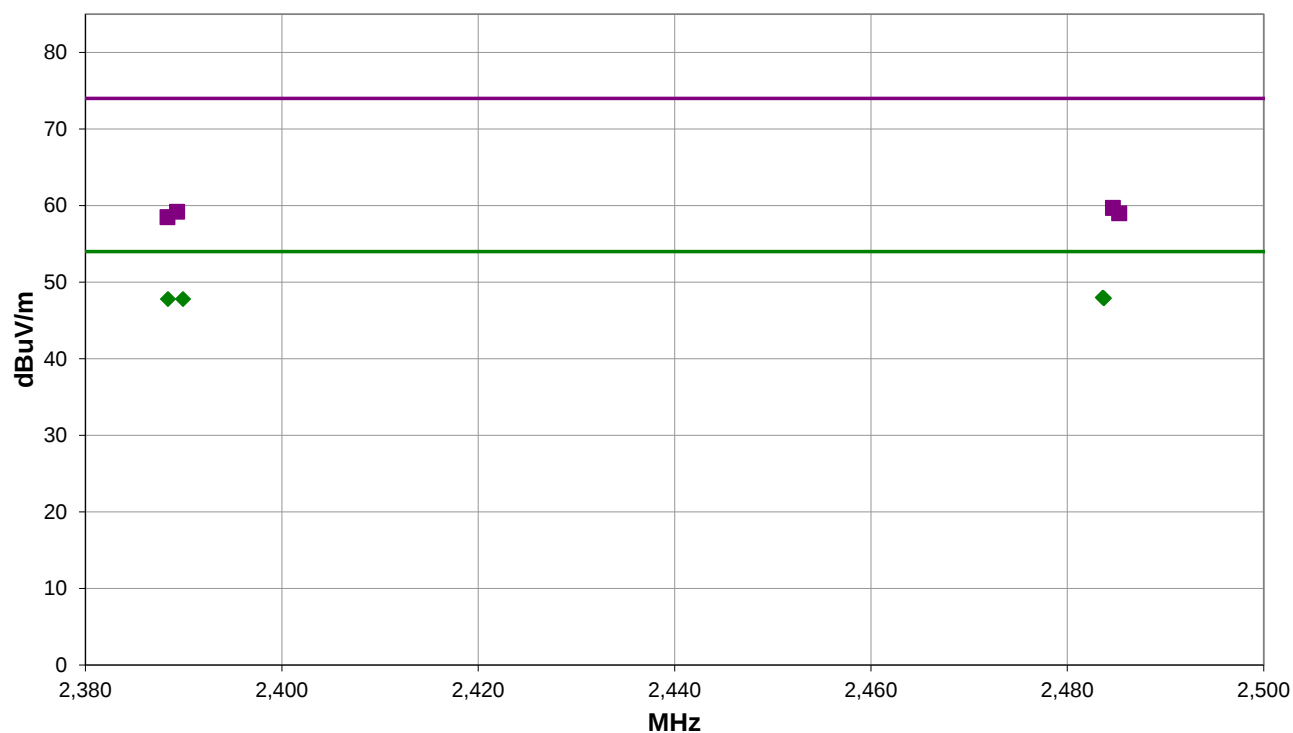
All measurements are noise floor. No duty cycle correction factor was applied to the RMS average measurements. Please reference data comments below for channel, data rate, and EUT orientation.

EUT OPERATING MODES

Bluetooth LE - Low Channel = 2402 MHz, Mid Channel = 2442 MHz, High Channel = 2480 MHz

DEVIATIONS FROM TEST STANDARD

None



Run #: 27

■ PK ◆ AV ● QP

SPURIOUS RADIATED EMISSIONS

RESULTS - Run #27

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
2483.613	31.6	-3.6	1.5	192.0	3.0	20.0	Horz	AV	0.0	48.0	54.0	-6.0	High Channel, EUT on Side
2483.727	31.5	-3.6	1.5	204.0	3.0	20.0	Vert	AV	0.0	47.9	54.0	-6.1	High Channel, EUT on Side
2388.397	31.3	-3.5	1.5	345.0	3.0	20.0	Horz	AV	0.0	47.8	54.0	-6.2	Low Channel, EUT on Side
2389.930	31.3	-3.5	1.5	329.0	3.0	20.0	Vert	AV	0.0	47.8	54.0	-6.2	Low Channel, EUT on Side
2484.640	43.3	-3.6	1.5	192.0	3.0	20.0	Horz	PK	0.0	59.7	74.0	-14.3	High Channel, EUT on Side
2389.320	42.7	-3.5	1.5	329.0	3.0	20.0	Vert	PK	0.0	59.2	74.0	-14.8	Low Channel, EUT on Side
2485.287	42.5	-3.5	1.5	204.0	3.0	20.0	Vert	PK	0.0	59.0	74.0	-15.0	High Channel, EUT on Side
2388.350	42.0	-3.5	1.5	345.0	3.0	20.0	Horz	PK	0.0	58.5	74.0	-15.5	Low Channel, EUT on Side

CONCLUSION

Pass



Tested By

End of Test Report