



element

Apricity Code

Water Heater Controller

FCC 15.247:2020

Bluetooth LE Radio

Report: APRI0011.1, Issue Date: December 22, 2020



NVLAP LAB CODE: 200630-0



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CERTIFICATE OF TEST



Last Date of Test: November 13, 2020
Apricity Code
EUT: Water Heater Controller

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2020	ANSI C63.10:2013
FCC 15.247:2020	ANSI C63.10:2013, KDB 558074

Results

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

Deviations From Test Standards

None

Approved By:

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
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

United States

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

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

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

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

European Union

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

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

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

SCOPE

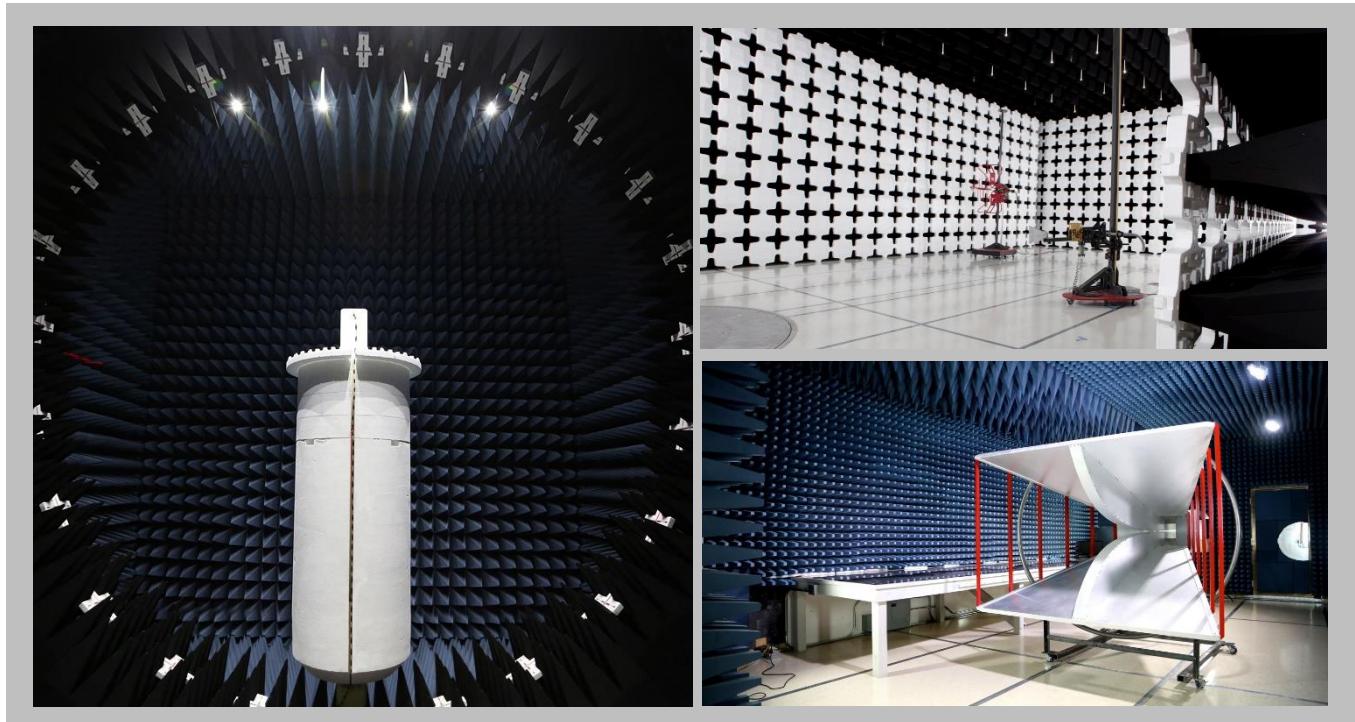
For details on the Scopes of our Accreditations, please visit:

<https://www.nwemc.com/emc-testing-accreditations>

FACILITIES



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



MEASUREMENT UNCERTAINTY



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.

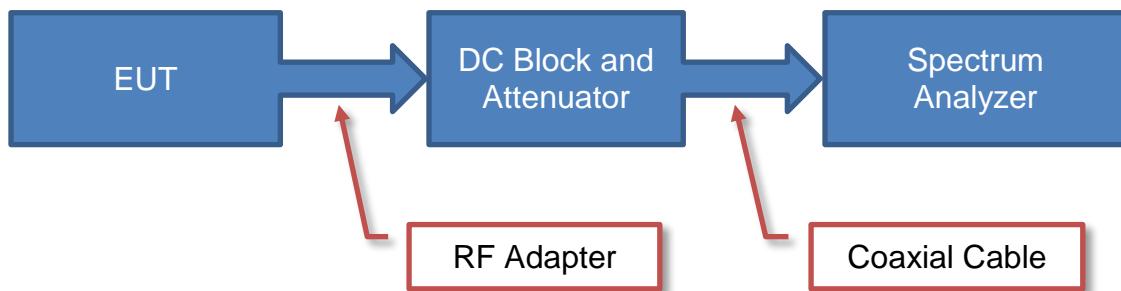
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found in the table below. A lab specific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

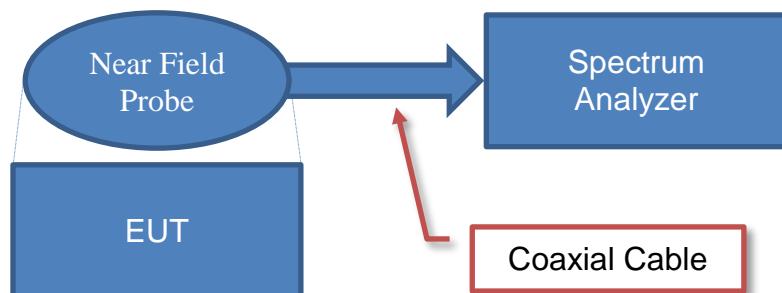
Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.6 dB	-2.6 dB

Test Setup Block Diagrams

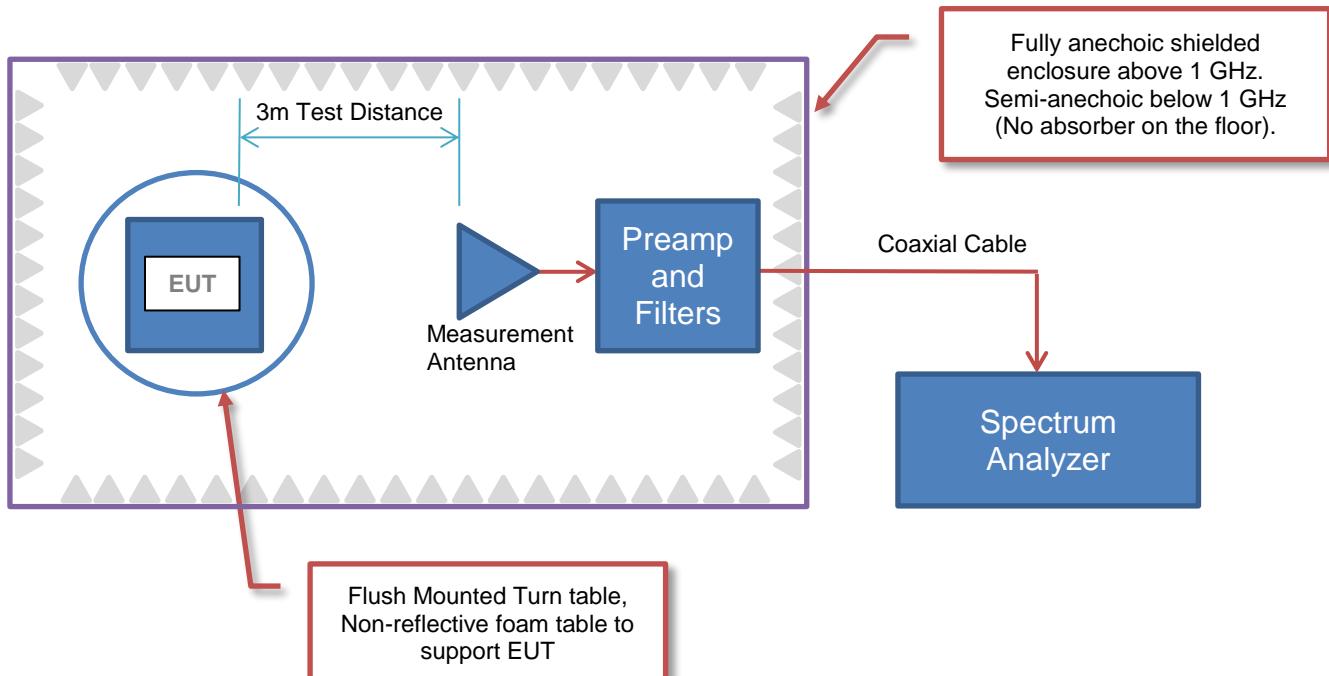
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Apricity Code
Address:	2789 NW Lolo Dr
City, State, Zip:	Bend, OR 97703
Test Requested By:	Jacob Betcher
EUT:	Water Heater Controller
First Date of Test:	November 12, 2020
Last Date of Test:	November 13, 2020
Receipt Date of Samples:	November 3, 2020
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Water heater controller containing a Bluetooth radio, a 802.11 module and a cellular module.
Testing Objective:
To demonstrate compliance of the Bluetooth radio to FCC 15.247 requirements.

CONFIGURATIONS



Configuration APRI0011- 2

Software/Firmware Running during test	
Description	Version
J-Link RTT Viewer	V6.86e

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Water heater controller	Apricity Code	APHW-02A	2875

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Programming PCB	Apricity Code	None	None
USB to Serial converter	SEGGER	J-Link	50129207
Laptop	Lenovo	IdeaPad S145	PF1ZVL3J

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Power	No	2.5 m	No	Water heater controller	AC Mains
Output	No	1.6 m	No	Water heater controller	Unterminated

CONFIGURATIONS



Configuration APRI0011- 3

Software/Firmware Running during test	
Description	Version
J-Link RTT Viewer	V6.86e

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Water heater controller	Apricity Code	APHW-02A	2874

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Programming PCB	Apricity Code	None	None
USB to Serial converter	SEGGER	J-Link	50129207
Laptop	Lenovo	IdeaPad S145	PF1ZVL3J

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
USB	Yes	1.5 m	No	Laptop	Programming PCB
USB	Yes	1.5 m	Yes	Laptop	USB to Serial converter
Ribbon Cable	No	0.2 m	No	USB to Serial converter	Programming PCB

MODIFICATIONS



Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2020-11-12	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	2020-11-13	Powerline 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.
3	2020-11-13	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.
4	2020-11-13	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.
5	2020-11-13	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.
6	2020-11-13	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.
7	2020-11-13	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.
8	2020-11-13	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWER SETTINGS 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 – 2483.5	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
Bluetooth LR 500 kbps	DTS	2	2402	0 dBm
		40	2440	0 dBm
		80	2480	0 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	Rohde & Schwarz	ESCI	ARH	2020-05-13	2021-05-13
Cable - Conducted Cable Assembly	Northwest EMC	EVG, HHD, RKT	EVGA	2020-01-06	2021-01-06
LISN	Solar Electronics	9252-50-R-24-BNC	LIN	2019-11-20	2020-11-20

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.6 dB	-2.6 dB

CONFIGURATIONS INVESTIGATED

APRI0011-2

MODES INVESTIGATED

Continuous Tx, Bluetooth LR 500 kbps, Mid Channel = 2440 MHz. Power Setting = 0 dBm

POWERLINE CONDUCTED EMISSIONS



EUT:	Water Heater Controller	Work Order:	APRI0011
Serial Number:	2875	Date:	2020-11-13
Customer:	Apricity Code	Temperature:	23.8°C
Attendees:	None	Relative Humidity:	37.6%
Customer Project:	None	Bar. Pressure:	1003 mb
Tested By:	Jeff Alcocke	Job Site:	EV07
Power:	220VAC/60Hz	Configuration:	APRI0011-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2020	ANSI C63.10:2013

TEST PARAMETERS

Run #:	4	Line:	Neutral	Add. Ext. Attenuation (dB):	0
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COMMENTS

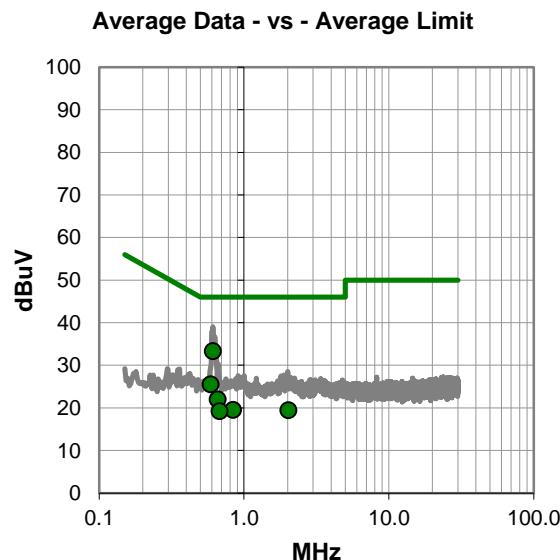
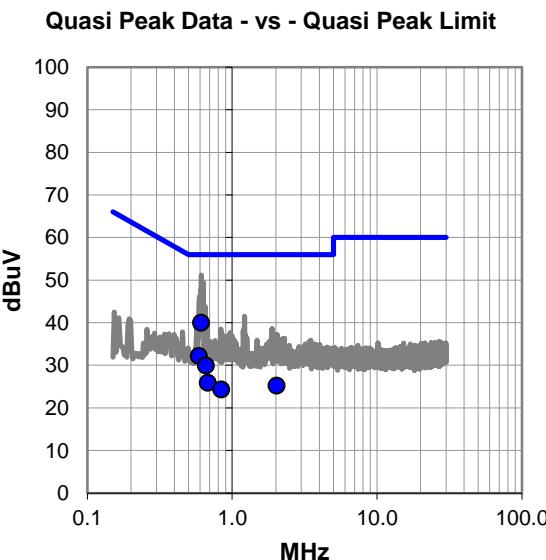
None

EUT OPERATING MODES

Continuous Tx, Bluetooth LR 500 kbps, Mid Channel = 2440 MHz. Power Setting = 0 dBm

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS



RESULTS - Run #4

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.611	20.1	19.9	40.0	56.0	-16.0
0.589	12.3	19.9	32.2	56.0	-23.8
0.658	10.0	19.9	29.9	56.0	-26.1
0.680	6.0	19.9	25.9	56.0	-30.1
2.030	5.2	20.0	25.2	56.0	-30.8
0.839	4.4	19.9	24.3	56.0	-31.7

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.611	13.4	19.9	33.3	46.0	-12.7
0.589	5.6	19.9	25.5	46.0	-20.5
0.658	2.1	19.9	22.0	46.0	-24.0
0.839	-0.4	19.9	19.5	46.0	-26.5
2.030	-0.6	20.0	19.4	46.0	-26.6
0.680	-0.7	19.9	19.2	46.0	-26.8

CONCLUSION

Pass



POWERLINE CONDUCTED EMISSIONS



EUT:	Water Heater Controller	Work Order:	APRI0011
Serial Number:	2875	Date:	2020-11-13
Customer:	Apricity Code	Temperature:	23.8°C
Attendees:	None	Relative Humidity:	37.6%
Customer Project:	None	Bar. Pressure:	1003 mb
Tested By:	Jeff Alcocke	Job Site:	EV07
Power:	220VAC/60Hz	Configuration:	APRI0011-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2020	ANSI C63.10:2013

TEST PARAMETERS

Run #:	5	Line:	High Line	Add. Ext. Attenuation (dB):	0
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COMMENTS

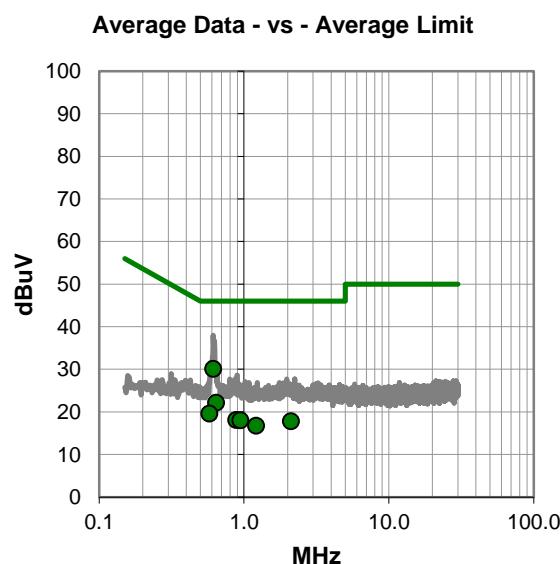
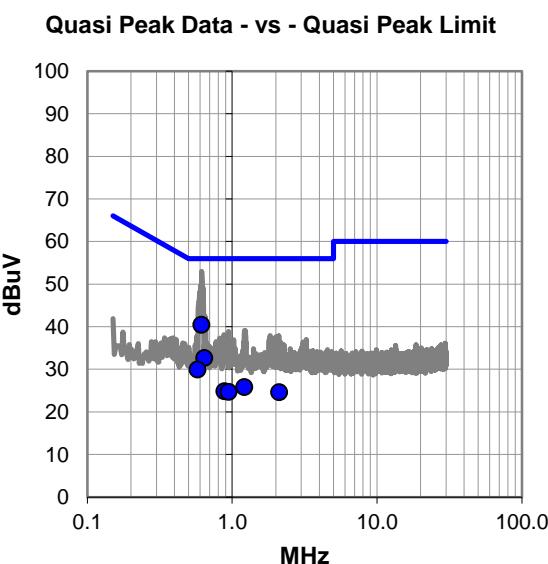
None

EUT OPERATING MODES

Continuous Tx, Bluetooth LR 500 kbps, Mid Channel = 2440 MHz. Power Setting = 0 dBm

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS



RESULTS - Run #5

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.614	20.5	19.9	40.4	56.0	-15.6
0.643	12.7	19.9	32.6	56.0	-23.4
0.578	10.0	19.9	29.9	56.0	-26.1
1.213	5.9	19.9	25.8	56.0	-30.2
0.887	4.9	19.9	24.8	56.0	-31.2
0.944	4.8	19.9	24.7	56.0	-31.3
2.109	4.6	20.0	24.6	56.0	-31.4

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.614	10.2	19.9	30.1	46.0	-15.9
0.643	2.2	19.9	22.1	46.0	-23.9
0.578	-0.3	19.9	19.6	46.0	-26.4
0.887	-1.8	19.9	18.1	46.0	-27.9
0.944	-1.9	19.9	18.0	46.0	-28.0
2.109	-2.2	20.0	17.8	46.0	-28.2
1.213	-3.2	19.9	16.7	46.0	-29.3

CONCLUSION

Pass



Tested By

SPURIOUS RADIATED EMISSIONS



PSA-ESCI 2020.06.24.2

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

MODES OF OPERATION

Continuous Tx, Bluetooth LR 500 kbps, Low Channel = 2402 MHz, Mid Channel = 2440 MHz, High Channel = 2480 MHz

POWER SETTINGS INVESTIGATED

220VAC/60Hz

CONFIGURATIONS INVESTIGATED

APRI0011 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26500 MHz
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SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	2019-12-13	12 mo
Filter - High Pass	Micro-Tronics	HPM50111	HFO	2019-11-18	12 mo
Filter - Low Pass	Micro-Tronics	LPM50004	LFD	2020-02-15	12 mo
Attenuator	Coaxicom	3910-20	AXZ	2020-02-15	12 mo
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	EVY	2020-07-25	12 mo
Cable	None	Standard Gain Horns Cable	EVF	2019-11-19	12 mo
Cable	N/A	Double Ridge Horn Cables	EVB	2019-11-18	12 mo
Cable	N/A	Bilog Cables	EVA	2019-11-18	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	2020-07-25	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	2019-11-19	12 mo
Amplifier - Pre-Amplifier	L-3 Narda-MITEQ	AMF-6F-08001200-30-10P	PAO	2019-11-19	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAG	2019-11-18	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AOL	2019-11-18	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AIV	NCR	0 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AHV	NCR	0 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AHU	NCR	0 mo
Antenna - Double Ridge	EMCO	3115	AHC	2020-07-01	24 mo
Antenna - Biconilog	Teseq	CBL 6141B	AXR	2020-10-13	24 mo

TEST DESCRIPTION

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

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

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

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

QP = Quasi-Peak Detector

PK = Peak Detector

AV = RMS Detector

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

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

Measurements 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.

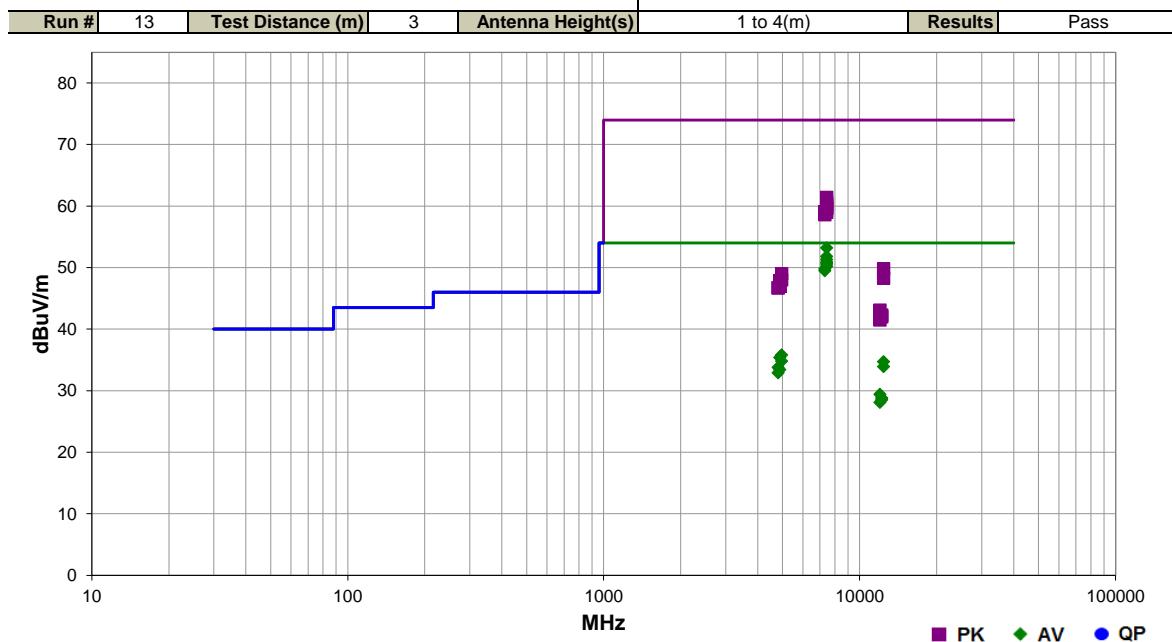
Where the radio test software does not provide for a duty cycle at continuous transmit conditions (> 98%) and the RMS (power average) measurements were made across the on and off times of the EUT transmissions, a duty cycle correction is added to the measurements using the formula of $10 \cdot \log(1/dc)$.

SPURIOUS RADIATED EMISSIONS



Work Order:	APRI0011	Date:	2020-11-12	 EmiRS 2020.06.24.4 PSA-ESCI 2020.06.24.2
Project:	None	Temperature:	23.1 °C	
Job Site:	EV01	Humidity:	33.6% RH	
Serial Number:	2875	Barometric Pres.:	1021 mbar	
Tested by: Jeff Alcock				
EUT:	Water Heater Controller			
Configuration:	2			
Customer:	Apricity Code			
Attendees:	None			
EUT Power:	220VAC/60Hz			
Operating Mode:	Continuous Tx, Bluetooth LR 500 kbps, Low Channel = 2402 MHz, Mid Channel = 2440 MHz, High Channel = 2480 MHz			
Deviations:	None			
Comments:	See comments below for Channel, EUT orientation, and power setting.			

Test Specifications	Test Method
FCC 15.247:2020	ANSI C63.10:2013



Freq (MHz)	Amplitude (dB)	Factor	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7439.608	39.4	13.8	1.45	285.0	3.0	0.0	Vert	AV	0.0	53.2	54.0	-0.8	High Ch, EUT on Side, Power = 0
7439.625	38.0	13.8	1.29	229.0	3.0	0.0	Horz	AV	0.0	51.8	54.0	-2.2	High Ch, EUT Vert, Power = 0
7439.608	37.5	13.8	1.85	340.0	3.0	0.0	Vert	AV	0.0	51.3	54.0	-2.7	High Ch, EUT Vert, Power = 0
7439.608	37.1	13.8	1.87	335.0	3.0	0.0	Horz	AV	0.0	50.9	54.0	-3.1	High Ch, EUT Horz, Power = 0
7439.625	36.8	13.8	2.68	26.0	3.0	0.0	Horz	AV	0.0	50.6	54.0	-3.4	High Ch, EUT on Side, Power = 0
7439.608	36.4	13.8	1.08	21.0	3.0	0.0	Vert	AV	0.0	50.2	54.0	-3.8	High Ch, EUT Horz, Power = 0
7320.858	36.7	13.1	2.15	350.0	3.0	0.0	Vert	AV	0.0	49.8	54.0	-4.2	Mid Ch, EUT on Side, Power = 0
7320.875	36.4	13.1	1.5	229.0	3.0	0.0	Horz	AV	0.0	49.5	54.0	-4.5	Mid Ch, EUT Vert, Power = 0
7440.917	47.6	13.8	1.45	285.0	3.0	0.0	Vert	PK	0.0	61.4	74.0	-12.6	High Ch, EUT on Side, Power = 0
7440.950	46.8	13.8	1.29	229.0	3.0	0.0	Horz	PK	0.0	60.6	74.0	-13.4	High Ch, EUT Vert, Power = 0
7440.958	46.4	13.8	1.85	340.0	3.0	0.0	Vert	PK	0.0	60.2	74.0	-13.8	High Ch, EUT Vert, Power = 0
7440.975	45.9	13.8	2.68	26.0	3.0	0.0	Horz	PK	0.0	59.7	74.0	-14.3	High Ch, EUT on Side, Power = 0
7440.950	45.8	13.8	1.87	335.0	3.0	0.0	Horz	PK	0.0	59.6	74.0	-14.4	High Ch, EUT Horz, Power = 0
7320.992	46.0	13.1	2.15	350.0	3.0	0.0	Vert	PK	0.0	59.1	74.0	-14.9	Mid Ch, EUT on Side, Power = 0
7439.458	45.2	13.8	1.08	21.0	3.0	0.0	Vert	PK	0.0	59.0	74.0	-15.0	High Ch, EUT Horz, Power = 0
7321.042	45.5	13.1	1.5	229.0	3.0	0.0	Horz	PK	0.0	58.6	74.0	-15.4	Mid Ch, EUT Vert, Power = 0
4959.867	28.9	6.9	2.33	42.0	3.0	0.0	Horz	AV	0.0	35.8	54.0	-18.2	High Ch, EUT Vert, Power = 0
4880.442	28.6	6.8	1.5	315.0	3.0	0.0	Horz	AV	0.0	35.4	54.0	-18.6	Mid Ch, EUT Vert, Power = 0
4959.800	27.9	6.9	1.2	329.0	3.0	0.0	Vert	AV	0.0	34.8	54.0	-19.2	High Ch, EUT on Side, Power = 0
12401.580	24.3	10.4	1.5	238.0	3.0	0.0	Horz	AV	0.0	34.7	54.0	-19.3	High Ch, EUT Vert, Power = 0
12401.590	23.5	10.4	1.5	157.0	3.0	0.0	Vert	AV	0.0	33.9	54.0	-20.1	High Ch, EUT on Side, Power = 0
4804.483	27.9	5.9	1.29	216.0	3.0	0.0	Vert	AV	0.0	33.8	54.0	-20.2	Low Ch, EUT on Side, Power = 0
4880.467	26.6	6.8	1.09	256.0	3.0	0.0	Vert	AV	0.0	33.4	54.0	-20.6	Mid Ch, EUT on Side, Power = 0

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4804.500	27.0	5.9	3.51	155.0	3.0	0.0	Horz	AV	0.0	32.9	54.0	-21.1	Low Ch, EUT Vert, Power = 0
12401.870	39.4	10.4	1.5	238.0	3.0	0.0	Horz	PK	0.0	49.8	74.0	-24.2	High Ch, EUT Vert, Power = 0
12009.210	28.4	1.0	1.64	190.0	3.0	0.0	Vert	AV	0.0	29.4	54.0	-24.6	Low Ch, EUT on Side, Power = 0
4960.008	42.1	6.9	2.33	42.0	3.0	0.0	Horz	PK	0.0	49.0	74.0	-25.0	High Ch, EUT Vert, Power = 0
12201.620	28.0	0.8	1.5	317.0	3.0	0.0	Horz	AV	0.0	28.8	54.0	-25.2	Mid Ch, EUT Vert, Power = 0
12201.570	27.7	0.8	1.0	206.0	3.0	0.0	Vert	AV	0.0	28.5	54.0	-25.5	Mid Ch, EUT on Side, Power = 0
12400.290	37.9	10.4	1.5	157.0	3.0	0.0	Vert	PK	0.0	48.3	74.0	-25.7	High Ch, EUT on Side, Power = 0
12009.180	27.1	1.0	1.5	285.0	3.0	0.0	Horz	AV	0.0	28.1	54.0	-25.9	Low Ch, EUT Vert, Power = 0
4959.950	41.1	6.9	1.2	329.0	3.0	0.0	Vert	PK	0.0	48.0	74.0	-26.0	High Ch, EUT on Side, Power = 0
4880.917	41.1	6.8	1.5	315.0	3.0	0.0	Horz	PK	0.0	47.9	74.0	-26.1	Mid Ch, EUT Vert, Power = 0
4882.483	40.2	6.8	1.09	256.0	3.0	0.0	Vert	PK	0.0	47.0	74.0	-27.0	Mid Ch, EUT on Side, Power = 0
4801.992	40.9	5.8	3.51	155.0	3.0	0.0	Horz	PK	0.0	46.7	74.0	-27.3	Low Ch, EUT Vert, Power = 0
4805.633	40.8	5.9	1.29	216.0	3.0	0.0	Vert	PK	0.0	46.7	74.0	-27.3	Low Ch, EUT on Side, Power = 0
12009.340	42.1	1.0	1.64	190.0	3.0	0.0	Vert	PK	0.0	43.1	74.0	-30.9	Low Ch, EUT on Side, Power = 0
12198.860	41.5	0.8	1.0	206.0	3.0	0.0	Vert	PK	0.0	42.3	74.0	-31.7	Mid Ch, EUT on Side, Power = 0
12198.830	41.2	0.8	1.5	317.0	3.0	0.0	Horz	PK	0.0	42.0	74.0	-32.0	Mid Ch, EUT Vert, Power = 0
12009.200	40.5	1.0	1.5	285.0	3.0	0.0	Horz	PK	0.0	41.5	74.0	-32.5	Low Ch, EUT Vert, Power = 0

SPURIOUS RADIATED EMISSIONS

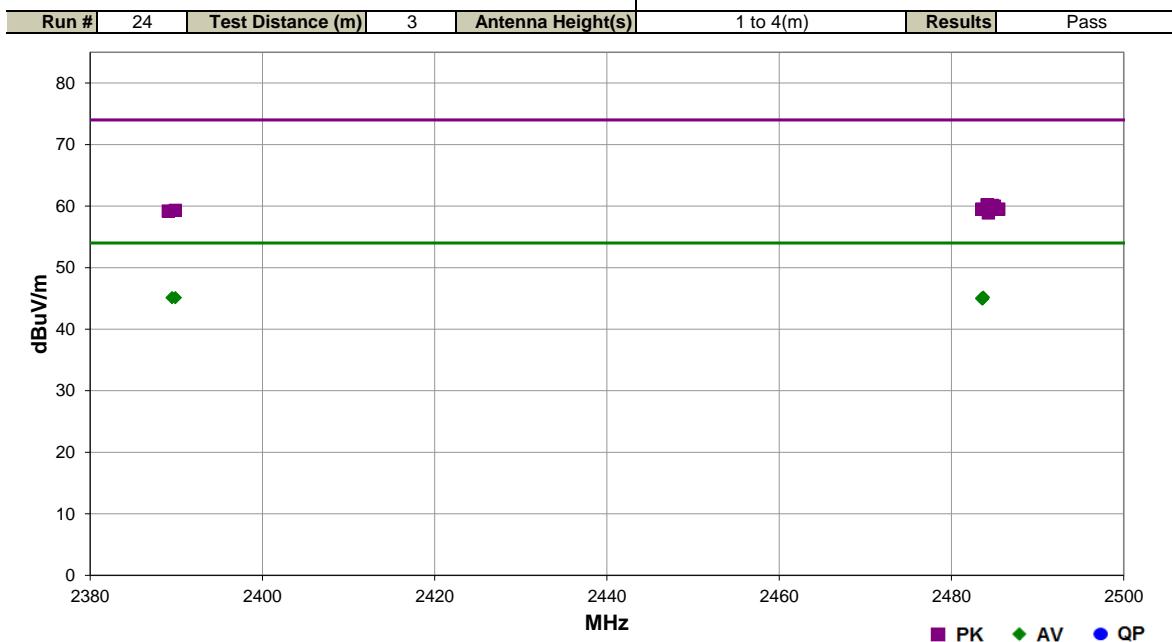


EmR5 2020.06.24.4

PSA-ESCI 2020.06.24.2

Work Order:	APRI0011	Date:	2020-11-12		EmR5 2020.06.24.4	PSA-ESCI 2020.06.24.2	
Project:	None	Temperature:	23.2 °C				
Job Site:	EV01	Humidity:	35.6% RH				
Serial Number:	2875	Barometric Pres.:	1018 mbar		Tested by:	Jeff Alcoke	
EUT:	Water Heater Controller						
Configuration:	2						
Customer:	Apricity Code						
Attendees:	None						
EUT Power:	220VAC/60Hz						
Operating Mode:	Continuous Tx, Bluetooth LR 500 kbps, Low Channel = 2402 MHz, Mid Channel = 2440 MHz, High Channel = 2480 MHz						
Deviations:	None						
Comments:	See comments below for Channel, EUT orientation, and power setting.						

Test Specifications	Test Method
FCC 15.247:2020	ANSI C63.10:2013



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2483.697	28.4	-3.2	1.27	305.0	3.0	20.0	Horz	AV	0.0	45.2	54.0	-8.8	High Ch, EUT Horz, Power = 0
2483.713	28.3	-3.2	1.5	39.0	3.0	20.0	Vert	AV	0.0	45.1	54.0	-8.9	High Ch, EUT Horz, Power = 0
2389.507	28.3	-3.2	1.5	334.0	3.0	20.0	Horz	AV	0.0	45.1	54.0	-8.9	Low Ch, EUT Horz, Power = 0
2389.893	28.3	-3.2	1.5	171.0	3.0	20.0	Vert	AV	0.0	45.1	54.0	-8.9	Low Ch, EUT Horz, Power = 0
2483.530	28.2	-3.2	3.14	215.0	3.0	20.0	Horz	AV	0.0	45.0	54.0	-9.0	High Ch, EUT on Side, Power = 0
2483.523	28.2	-3.2	2.96	251.0	3.0	20.0	Vert	AV	0.0	45.0	54.0	-9.0	High Ch, EUT on Side, Power = 0
2483.623	28.1	-3.2	1.5	36.0	3.0	20.0	Horz	AV	0.0	44.9	54.0	-9.1	High Ch, EUT Vert, Power = 0
2483.580	28.1	-3.2	1.5	284.0	3.0	20.0	Vert	AV	0.0	44.9	54.0	-9.1	High Ch, EUT Vert, Power = 0
2484.140	43.4	-3.2	1.5	36.0	3.0	20.0	Horz	PK	0.0	60.2	74.0	-13.8	High Ch, EUT Vert, Power = 0
2484.713	43.3	-3.2	1.5	39.0	3.0	20.0	Vert	PK	0.0	60.1	74.0	-13.9	High Ch, EUT Horz, Power = 0
2484.977	43.2	-3.2	1.27	305.0	3.0	20.0	Horz	PK	0.0	60.0	74.0	-14.0	High Ch, EUT Horz, Power = 0
2485.493	42.6	-3.1	3.14	215.0	3.0	20.0	Horz	PK	0.0	59.5	74.0	-14.5	High Ch, EUT on Side, Power = 0
2483.553	42.7	-3.2	1.5	284.0	3.0	20.0	Vert	PK	0.0	59.5	74.0	-14.5	High Ch, EUT Vert, Power = 0
2389.873	42.5	-3.2	1.5	334.0	3.0	20.0	Horz	PK	0.0	59.3	74.0	-14.7	Low Ch, EUT Horz, Power = 0
2389.073	42.4	-3.2	1.5	171.0	3.0	20.0	Vert	PK	0.0	59.2	74.0	-14.8	Low Ch, EUT Horz, Power = 0
2484.293	42.1	-3.2	2.96	251.0	3.0	20.0	Vert	PK	0.0	58.9	74.0	-15.1	High Ch, EUT on Side, Power = 0

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.

OCCUPIED BANDWIDTH



XMit 2020.03.25.0

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	16-Apr-20	16-Apr-23
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	13-Mar-20	13-Mar-21
Attenuator	S.M. Electronics	SA26B-20	AUY	13-Mar-20	13-Mar-21
Block - DC	Fairview Microwave	SD3379	AMW	13-Mar-20	13-Mar-21
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAT	28-Oct-20	28-Oct-21

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



TbTx 2019.08.30.0 XMII 2020.03.25.0

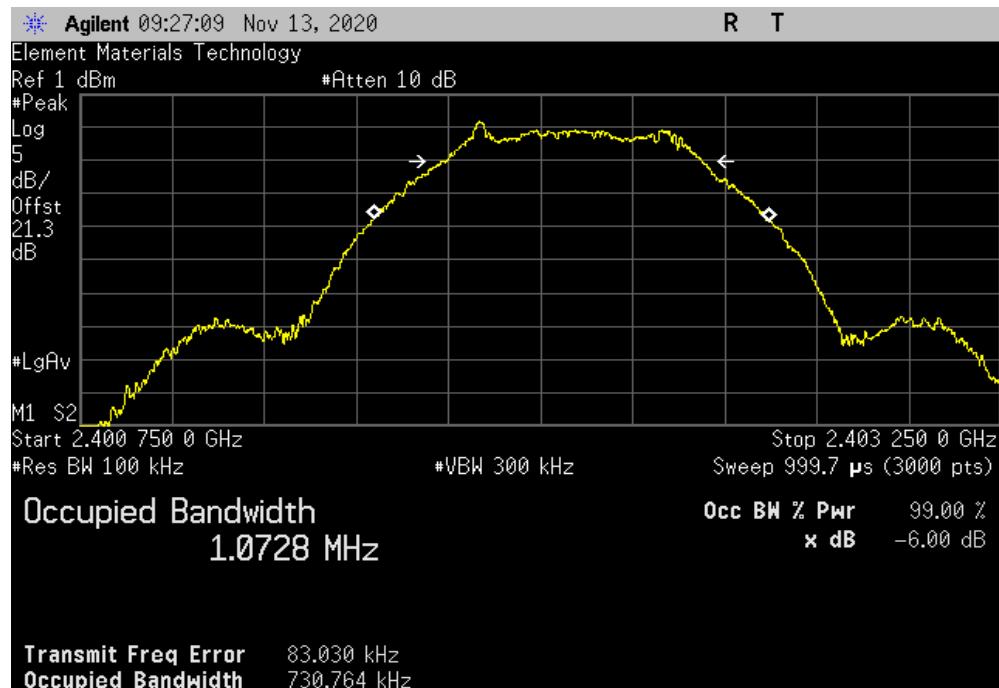
EUT:	Water Heater Controller	Work Order:	APRI0011	
Serial Number:	2874	Date:	13-Nov-20	
Customer:	Apricity Code	Temperature:	23.4 °C	
Attendees:	None	Humidity:	39% RH	
Project:	None	Barometric Pres.:	1000 mbar	
Tested by:	Jeff Alcock	Power:	USB	
TEST SPECIFICATIONS		Test Method	EV06	
FCC 15.247:2020		ANSI C63.10:2013		
COMMENTS	Reference level offset includes: DC Block, 20 dB attenuator, and measurement cable. Testing was performed with a power setting of 0 dBm.			
DEVIATIONS FROM TEST STANDARD	None			
Configuration #	3	Signature		
		Value	Limit (ε)	Result
Bluetooth LR, 500 kbps, Low Channel, 2402 MHz		730.764 kHz	500 kHz	Pass
Bluetooth LR, 500 kbps, Mid Channel, 2440 MHz		685.18 kHz	500 kHz	Pass
Bluetooth LR, 500 kbps, High Channel, 2480 MHz		722.984 kHz	500 kHz	Pass

OCCUPIED BANDWIDTH

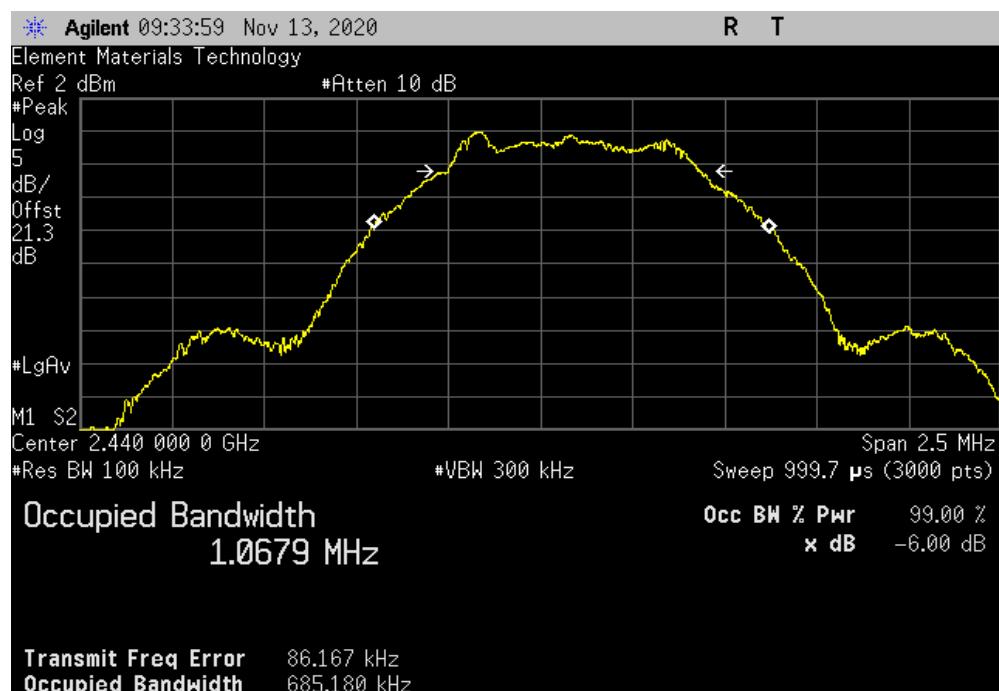


TbtTx 2019.08.30.0 XMit 2020.03.25.0

Bluetooth LR, 500 kbps, Low Channel, 2402 MHz			Value	Limit	Result
			730.764 kHz	(≥) 500 kHz	Pass



Bluetooth LR, 500 kbps, Mid Channel, 2440 MHz			Value	Limit	Result
			685.18 kHz	(≥) 500 kHz	Pass



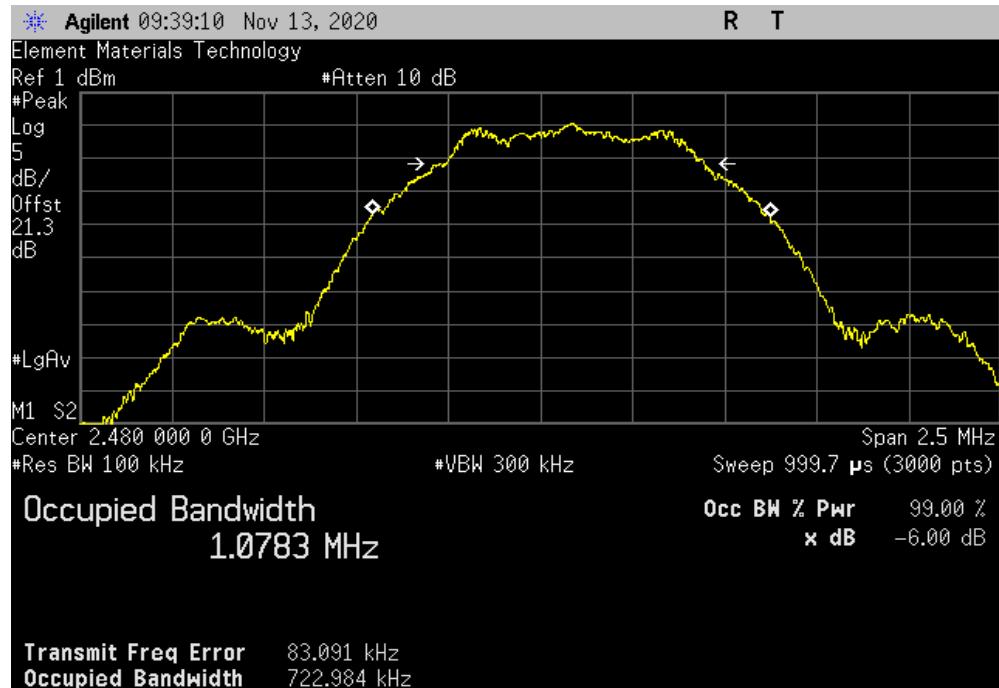
OCCUPIED BANDWIDTH



TbtTx 2019.08.30.0

XMit 2020.03.25.0

Bluetooth LR, 500 kbps, High Channel, 2480 MHz						
			Value	Limit (\geq)	Result	
			722.984 kHz	500 kHz	Pass	



OUTPUT POWER



XMit 2020.03.25.0

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	16-Apr-20	16-Apr-23
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	13-Mar-20	13-Mar-21
Attenuator	S.M. Electronics	SA26B-20	AUY	13-Mar-20	13-Mar-21
Block - DC	Fairview Microwave	SD3379	AMW	13-Mar-20	13-Mar-21
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAT	28-Oct-20	28-Oct-21

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



element

TbTx 2019.08.30.0

XMI 2020.03.25.0

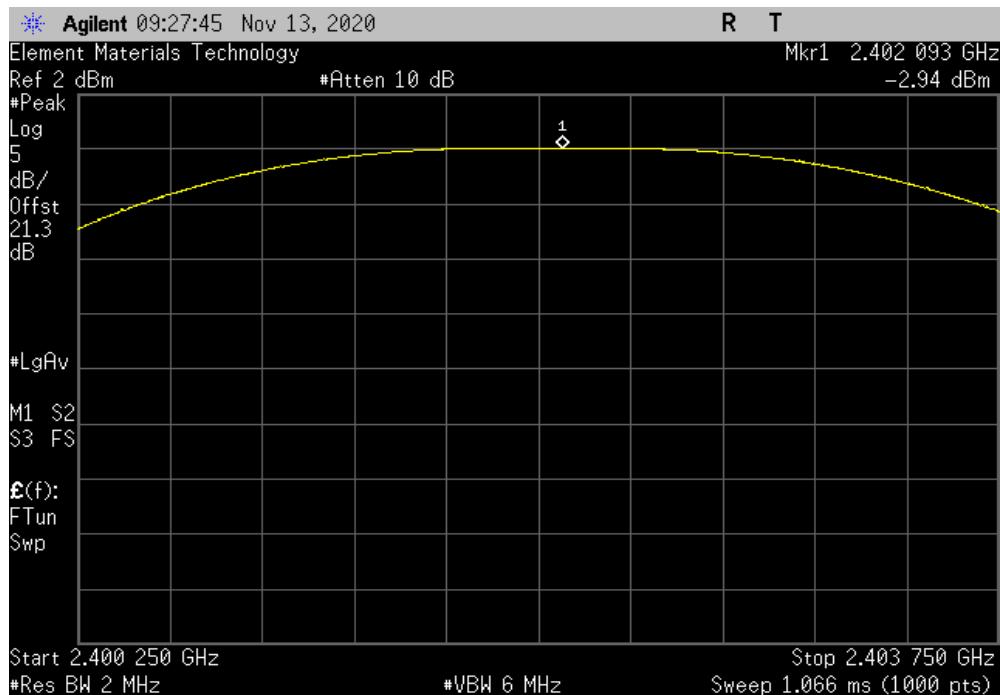
EUT:	Water Heater Controller	Work Order:	APRI0011	
Serial Number:	2874	Date:	13-Nov-20	
Customer:	Apricity Code	Temperature:	23.4 °C	
Attendees:	None	Humidity:	38.9% RH	
Project:	None	Barometric Pres.:	1000 mbar	
Tested by:	Jeff Alcock	Power:	USB	
TEST SPECIFICATIONS		Test Method	Job Site: EV06	
FCC 15.247:2020		ANSI C63.10:2013		
COMMENTS				
Reference level offset includes: DC Block, 20 dB attenuator, and measurement cable. Testing was performed with a power setting of 0 dBm.				
DEVIATIONS FROM TEST STANDARD				
None				
Configuration #	3	Signature		
		Out Pwr (dBm)	Limit (dBm)	
		-2.936	30	Pass
		-2.927	30	Pass
		-3.237	30	Pass
Bluetooth LR, 500 kbps, Low Channel, 2402 MHz				
Bluetooth LR, 500 kbps, Mid Channel, 2440 MHz				
Bluetooth LR, 500 kbps, High Channel, 2480 MHz				

OUTPUT POWER

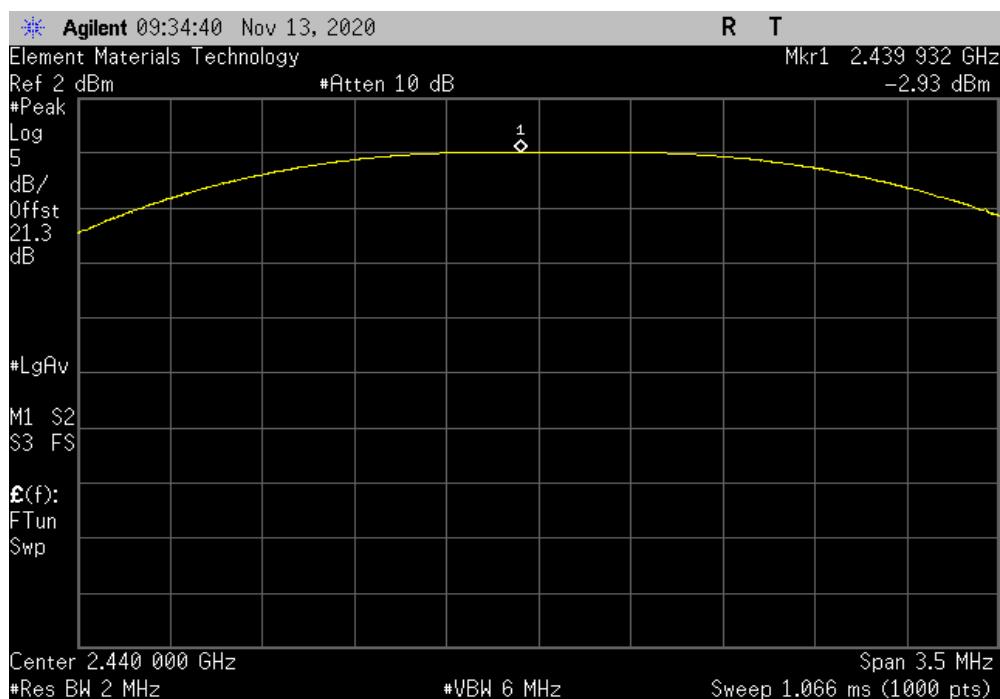


TbtTx 2019.08.30.0 XMit 2020.03.25.0

Bluetooth LR, 500 kbps, Low Channel, 2402 MHz				Out Pwr (dBm)	Limit (dBm)	Result
				-2.936	30	Pass



Bluetooth LR, 500 kbps, Mid Channel, 2440 MHz				Out Pwr (dBm)	Limit (dBm)	Result
				-2.927	30	Pass

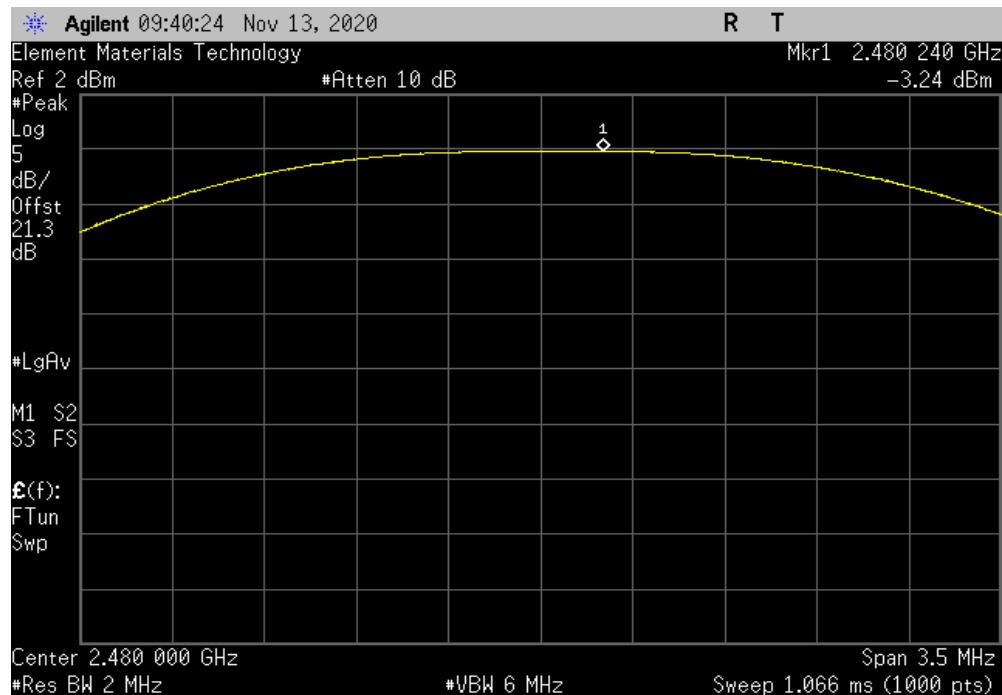


OUTPUT POWER



TbtTx 2019.08.30.0 XMit 2020.03.25.0

Bluetooth LR, 500 kbps, High Channel, 2480 MHz				Out Pwr (dBm)	Limit (dBm)	Result
				-3.237	30	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



XMit 2020.03.25.0

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	16-Apr-20	16-Apr-23
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	13-Mar-20	13-Mar-21
Attenuator	S.M. Electronics	SA26B-20	AUY	13-Mar-20	13-Mar-21
Block - DC	Fairview Microwave	SD3379	AMW	13-Mar-20	13-Mar-21
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAT	28-Oct-20	28-Oct-21

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)



TbTx 2019.08.30.0 XMII 2020.03.25.0

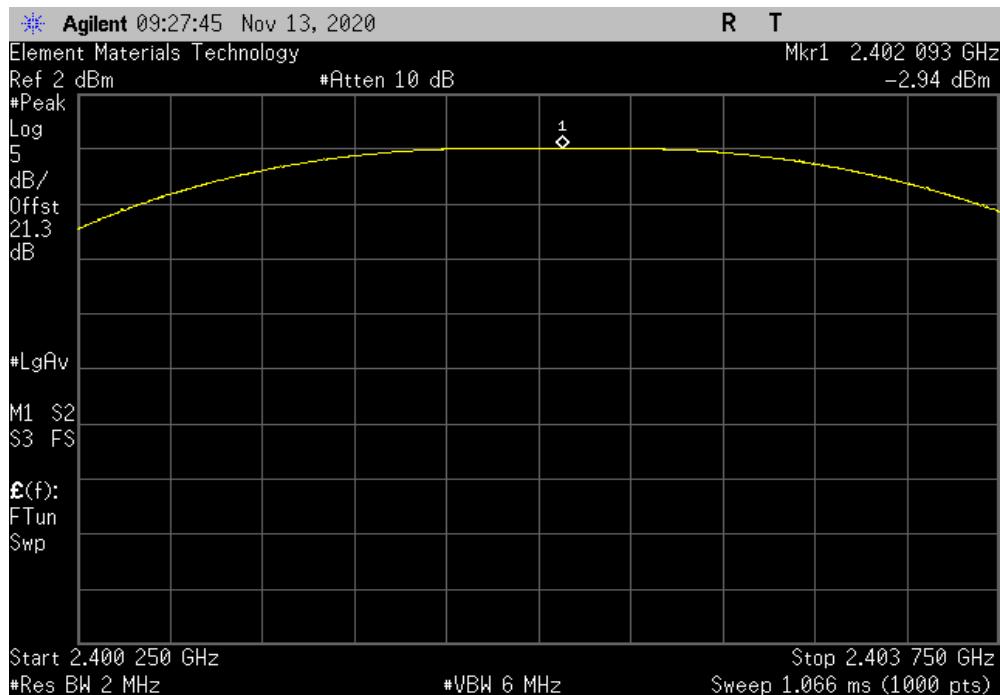
EUT:	Water Heater Controller		Work Order:	APRI0011			
Serial Number:	2874		Date:	13-Nov-20			
Customer:	Apricity Code		Temperature:	23.4 °C			
Attendees:	None		Humidity:	39.2% RH			
Project:	None		Barometric Pres.:	1000 mbar			
Tested by:	Jeff Alcock	Power:	USB	Job Site:	EV06		
TEST SPECIFICATIONS			Test Method				
FCC 15.247:2020			ANSI C63.10:2013				
COMMENTS							
Reference level offset includes: DC Block, 20 dB attenuator, and measurement cable. Testing was performed with a power setting of 0 dBm.							
DEVIATIONS FROM TEST STANDARD							
None							
Configuration #	3	Signature					
			Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
Bluetooth LR, 500 kbps, Low Channel, 2402 MHz			-2.936	1.5	-1.436	36	Pass
Bluetooth LR, 500 kbps, Mid Channel, 2440 MHz			-2.927	1.5	-1.427	36	Pass
Bluetooth LR, 500 kbps, High Channel, 2480 MHz			-3.237	1.5	-1.737	36	Pass

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

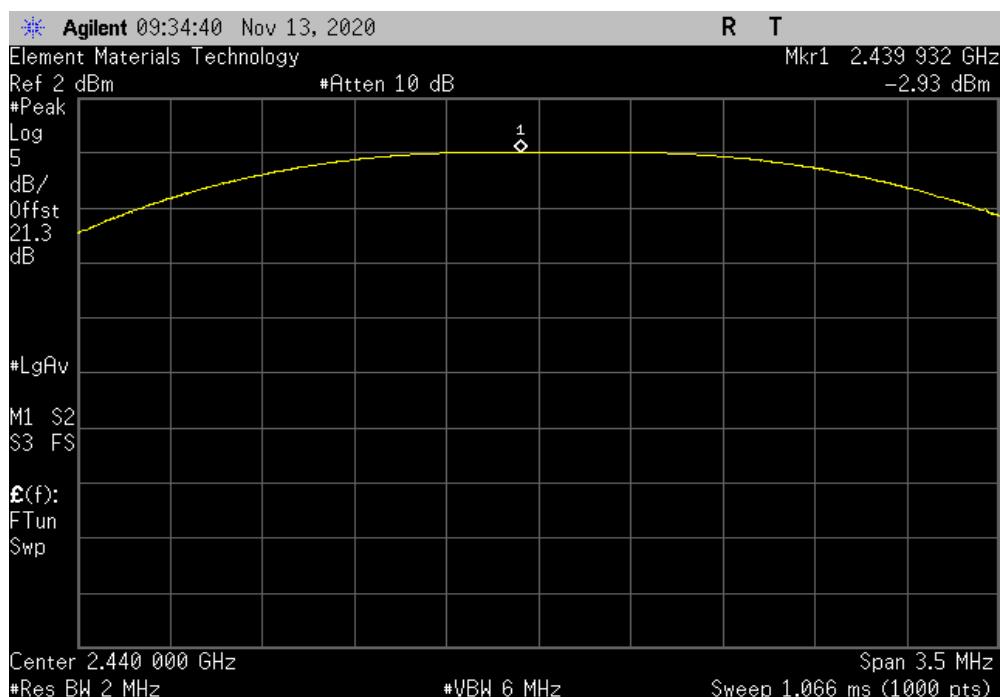


TbtTx 2019.08.30.0 XMit 2020.03.25.0

Bluetooth LR, 500 kbps, Low Channel, 2402 MHz					
Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
-2.936	1.5	-1.436	36	Pass	



Bluetooth LR, 500 kbps, Mid Channel, 2440 MHz					
Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
-2.927	1.5	-1.427	36	Pass	

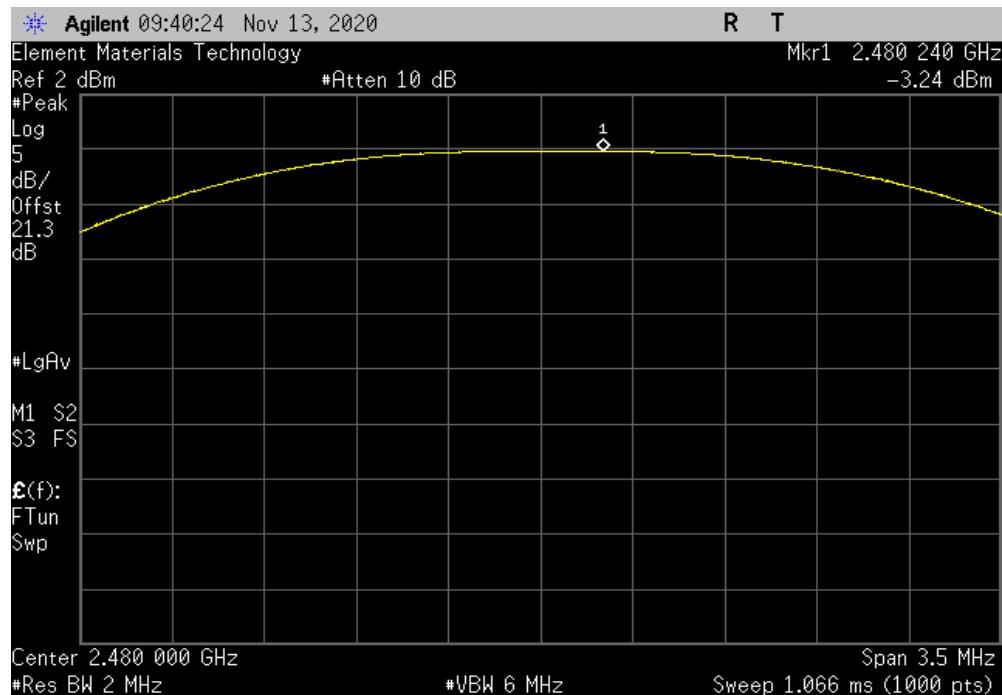


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



TbtTx 2019.08.30.0 XMit 2020.03.25.0

Bluetooth LR, 500 kbps, High Channel, 2480 MHz					
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
	-3.237	1.5	-1.737	36	Pass



POWER SPECTRAL DENSITY



XMit 2020.03.25.0

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	16-Apr-20	16-Apr-23
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	13-Mar-20	13-Mar-21
Attenuator	S.M. Electronics	SA26B-20	AUY	13-Mar-20	13-Mar-21
Block - DC	Fairview Microwave	SD3379	AMW	13-Mar-20	13-Mar-21
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAT	28-Oct-20	28-Oct-21

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



TbTx 2019.08.30.0 XMII 2020.03.25.0

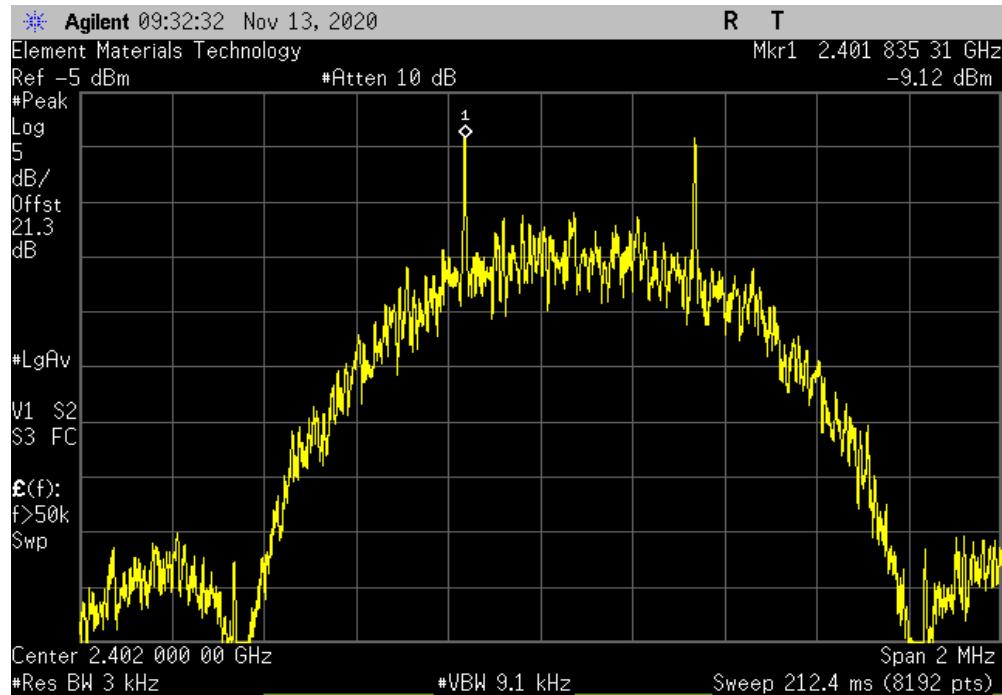
EUT:	Water Heater Controller	Work Order:	APRI0011	
Serial Number:	2874	Date:	13-Nov-20	
Customer:	Apricity Code	Temperature:	23.5 °C	
Attendees:	None	Humidity:	38.6% RH	
Project:	None	Barometric Pres.:	1000 mbar	
Tested by:	Jeff Alcock	Power:	USB	
TEST SPECIFICATIONS		Test Method		
FCC 15.247:2020		ANSI C63.10:2013		
COMMENTS				
Reference level offset includes: DC Block, 20 dB attenuator, and measurement cable. Testing was performed with a power setting of 0 dBm.				
DEVIATIONS FROM TEST STANDARD				
None				
Configuration #	3	Signature		
		Value dBm/3kHz	Limit < dBm/3kHz	Results
Bluetooth LR, 500 kbps, Low Channel, 2402 MHz		-9.124	8	Pass
Bluetooth LR, 500 kbps, Mid Channel, 2440 MHz		-9.117	8	Pass
Bluetooth LR, 500 kbps, High Channel, 2480 MHz		-9.376	8	Pass

POWER SPECTRAL DENSITY

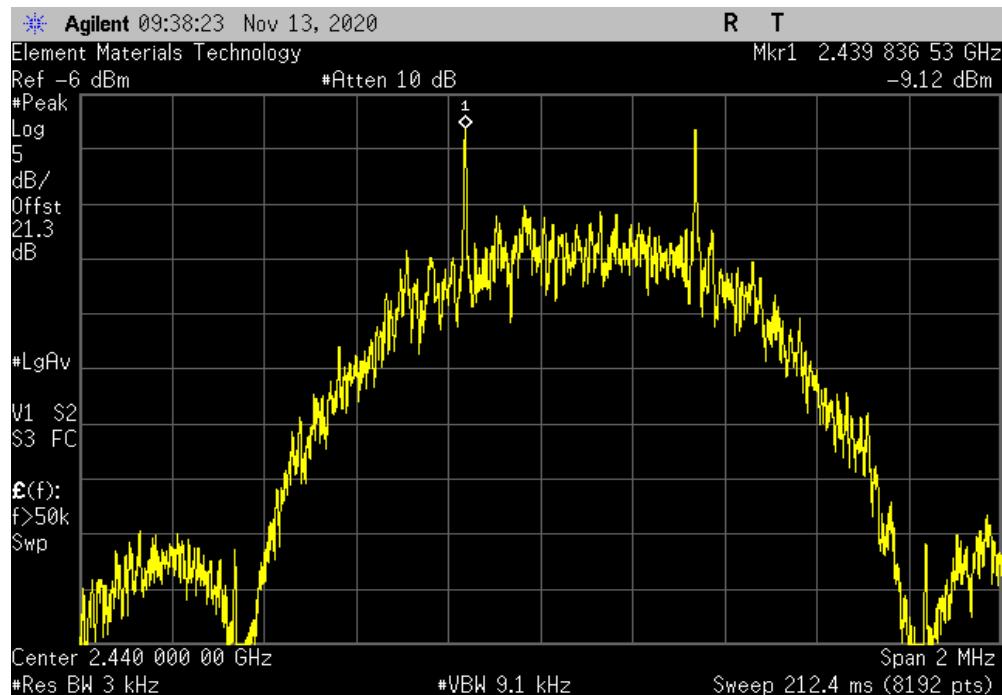


TbtTx 2019.08.30.0 XMit 2020.03.25.0

Bluetooth LR, 500 kbps, Low Channel, 2402 MHz			
	Value dBm/3kHz	Limit < dBm/3kHz	Results
	-9.124	8	Pass



Bluetooth LR, 500 kbps, Mid Channel, 2440 MHz			
	Value dBm/3kHz	Limit < dBm/3kHz	Results
	-9.117	8	Pass

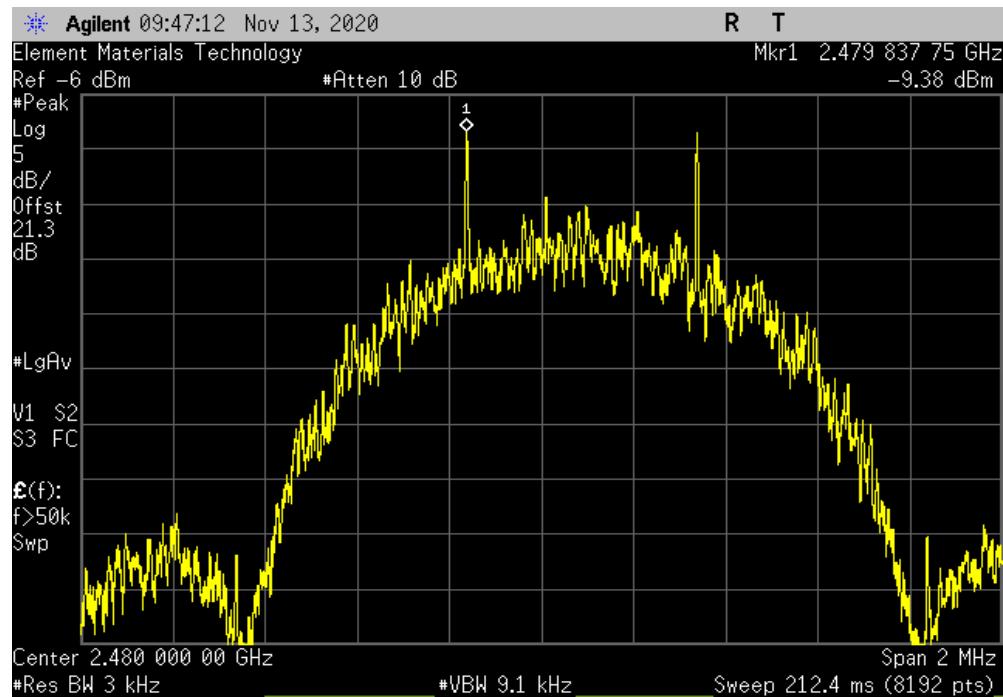


POWER SPECTRAL DENSITY



TbtTx 2019.08.30.0 XMit 2020.03.25.0

Bluetooth LR, 500 kbps, High Channel, 2480 MHz			
Value	Limit	Results	
dBm/3kHz	< dBm/3kHz		
-9.376	8	Pass	



BAND EDGE COMPLIANCE



XMit 2020.03.25.0

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	16-Apr-20	16-Apr-23
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	13-Mar-20	13-Mar-21
Attenuator	S.M. Electronics	SA26B-20	AUY	13-Mar-20	13-Mar-21
Block - DC	Fairview Microwave	SD3379	AMW	13-Mar-20	13-Mar-21
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAT	28-Oct-20	28-Oct-21

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



TbTx 2019.08.30.0 XMII 2020.03.25.0

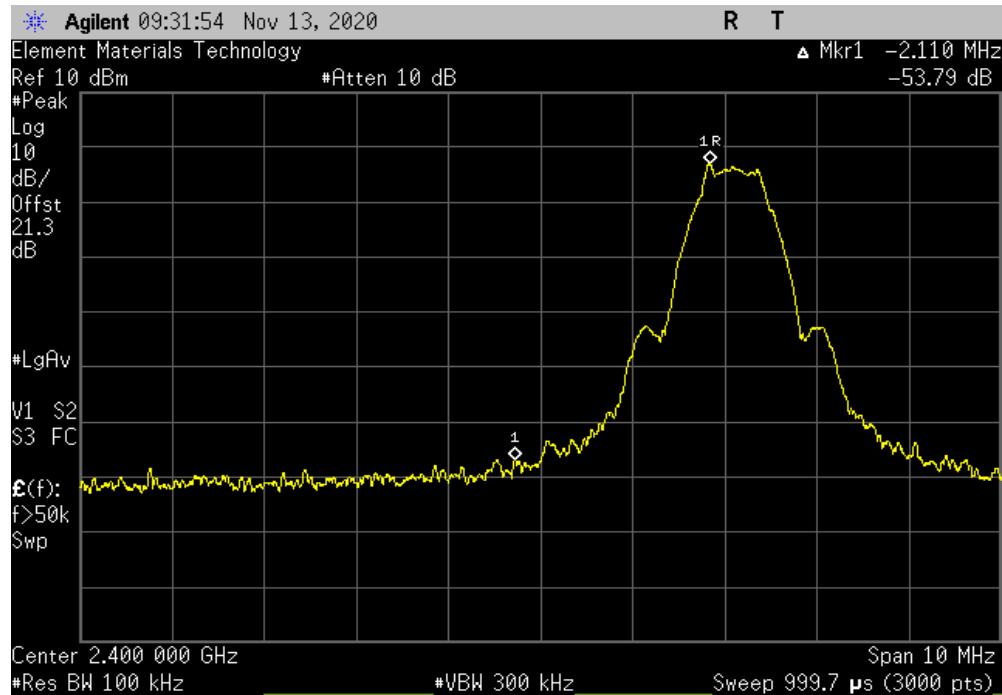
EUT:	Water Heater Controller	Work Order:	APRI0011	
Serial Number:	2874	Date:	13-Nov-20	
Customer:	Apricity Code	Temperature:	23.3 °C	
Attendees:	None	Humidity:	38.6% RH	
Project:	None	Barometric Pres.:	1000 mbar	
Tested by:	Jeff Alcock	Job Site:	EV06	
TEST SPECIFICATIONS		Power:	USB	
FCC 15.247:2020		Test Method	ANSI C63.10:2013	
COMMENTS				
Reference level offset includes: DC Block, 20 dB attenuator, and measurement cable. Testing was performed with a power setting of 0 dBm.				
DEVIATIONS FROM TEST STANDARD				
None				
Configuration #	3	Signature		
		Value (dBc)	Limit ≤ (dBc)	Result
		-53.79	-20	Pass
		-55.44	-20	Pass
Bluetooth LR, 500 kbps, Low Channel, 2402 MHz				
Bluetooth LR, 500 kbps, High Channel, 2480 MHz				

BAND EDGE COMPLIANCE

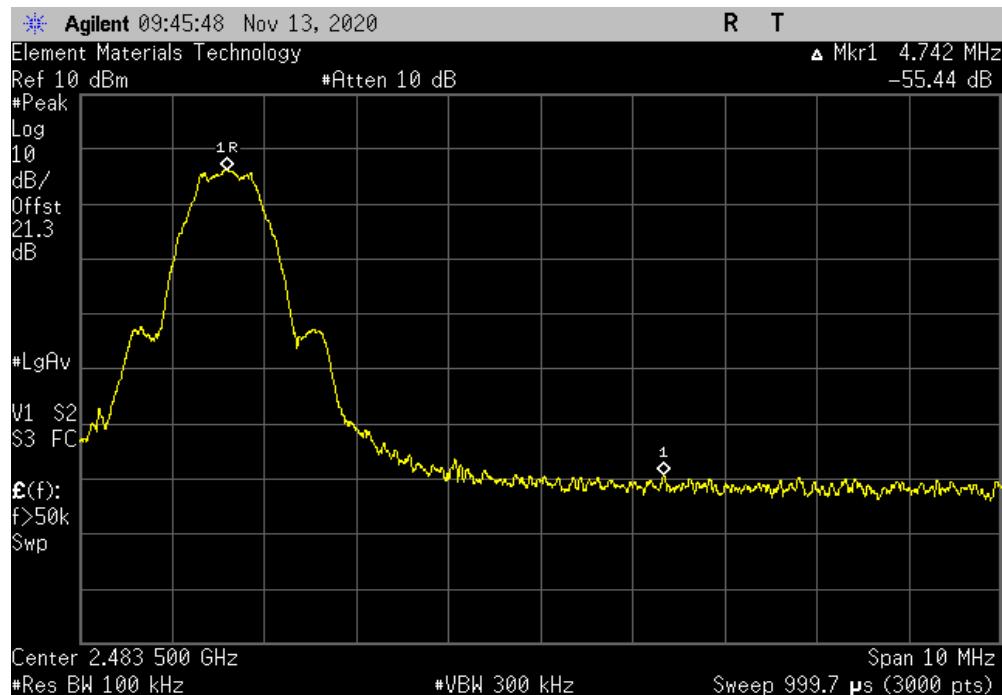


TbtTx 2019.08.30.0 XMit 2020.03.25.0

Bluetooth LR, 500 kbps, Low Channel, 2402 MHz			
	Value (dBc)	Limit ≤ (dBc)	Result
	-53.79	-20	Pass



Bluetooth LR, 500 kbps, High Channel, 2480 MHz			
	Value (dBc)	Limit ≤ (dBc)	Result
	-55.44	-20	Pass



SPURIOUS CONDUCTED EMISSIONS



XMit 2020.03.25.0

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	16-Apr-20	16-Apr-23
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	13-Mar-20	13-Mar-21
Attenuator	S.M. Electronics	SA26B-20	AUY	13-Mar-20	13-Mar-21
Block - DC	Fairview Microwave	SD3379	AMW	13-Mar-20	13-Mar-21
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAT	28-Oct-20	28-Oct-21

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 spectrum was scanned throughout the specified frequency range.

SPURIOUS CONDUCTED EMISSIONS



TbTx 2019.08.30.0 XMII 2020.03.25.0

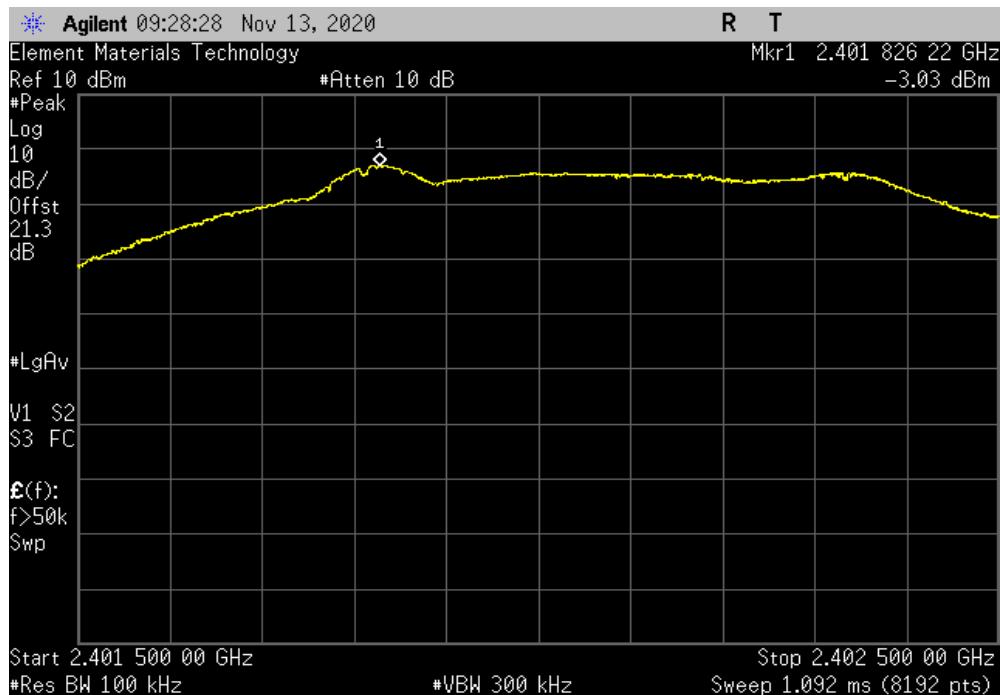
EUT:	Water Heater Controller	Work Order:	APRI0011			
Serial Number:	2874	Date:	13-Nov-20			
Customer:	Apricity Code	Temperature:	23.6 °C			
Attendees:	None	Humidity:	38.4% RH			
Project:	None	Barometric Pres.:	1001 mbar			
Tested by:	Jeff Alcock	Power:	USB			
TEST SPECIFICATIONS		Test Method				
FCC 15.247:2020		ANSI C63.10:2013				
COMMENTS						
Reference level offset includes: DC Block, 20 dB attenuator, and measurement cable. Testing was performed with a power setting of 0 dBm.						
DEVIATIONS FROM TEST STANDARD						
None						
Configuration #	3	Signature				
		Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
Bluetooth LR, 500 kbps, Low Channel, 2402 MHz		Fundamental	2401.83	N/A	N/A	N/A
Bluetooth LR, 500 kbps, Low Channel, 2402 MHz		30 MHz - 12.5 GHz	7206.6	-40.35	-20	Pass
Bluetooth LR, 500 kbps, Low Channel, 2402 MHz		12.5 GHz - 25 GHz	14039.8	-48.02	-20	Pass
Bluetooth LR, 500 kbps, Mid Channel, 2440 MHz		Fundamental	2439.83	N/A	N/A	N/A
Bluetooth LR, 500 kbps, Mid Channel, 2440 MHz		30 MHz - 12.5 GHz	7320.8	-40.84	-20	Pass
Bluetooth LR, 500 kbps, Mid Channel, 2440 MHz		12.5 GHz - 25 GHz	13998.6	-48.47	-20	Pass
Bluetooth LR, 500 kbps, High Channel, 2480 MHz		Fundamental	2480.08	N/A	N/A	N/A
Bluetooth LR, 500 kbps, High Channel, 2480 MHz		30 MHz - 12.5 GHz	7439.5	-41.7	-20	Pass
Bluetooth LR, 500 kbps, High Channel, 2480 MHz		12.5 GHz - 25 GHz	14172.6	-46.86	-20	Pass

SPURIOUS CONDUCTED EMISSIONS

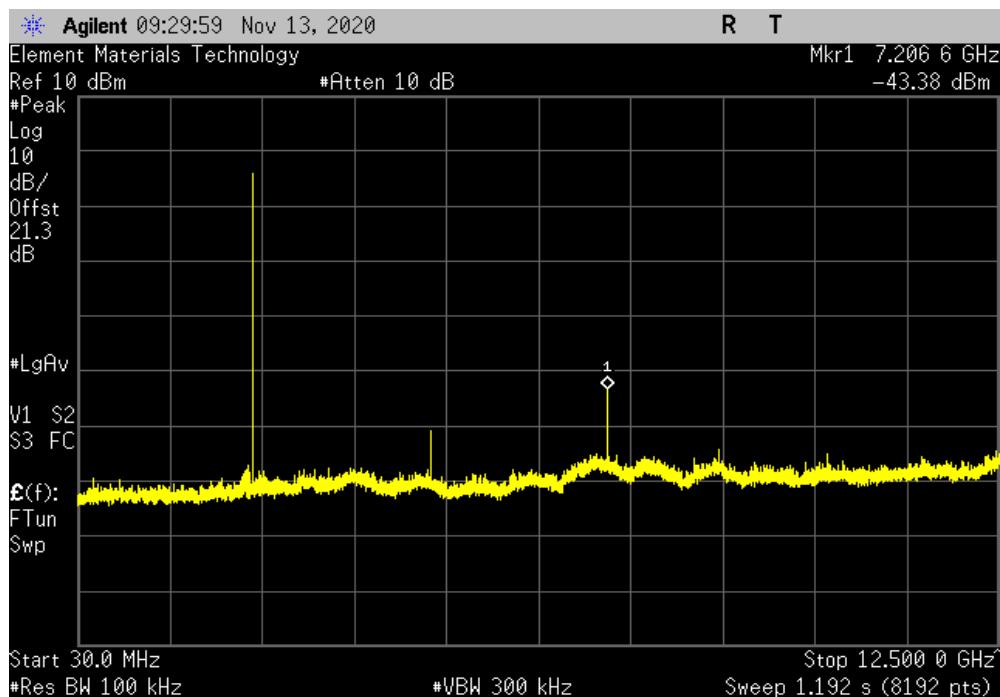


TbtTx 2019.08.30.0 XMit 2020.03.25.0

Bluetooth LR, 500 kbps, Low Channel, 2402 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2401.83	N/A	N/A	N/A	N/A



Bluetooth LR, 500 kbps, Low Channel, 2402 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	7206.6	-40.35	-20	Pass	

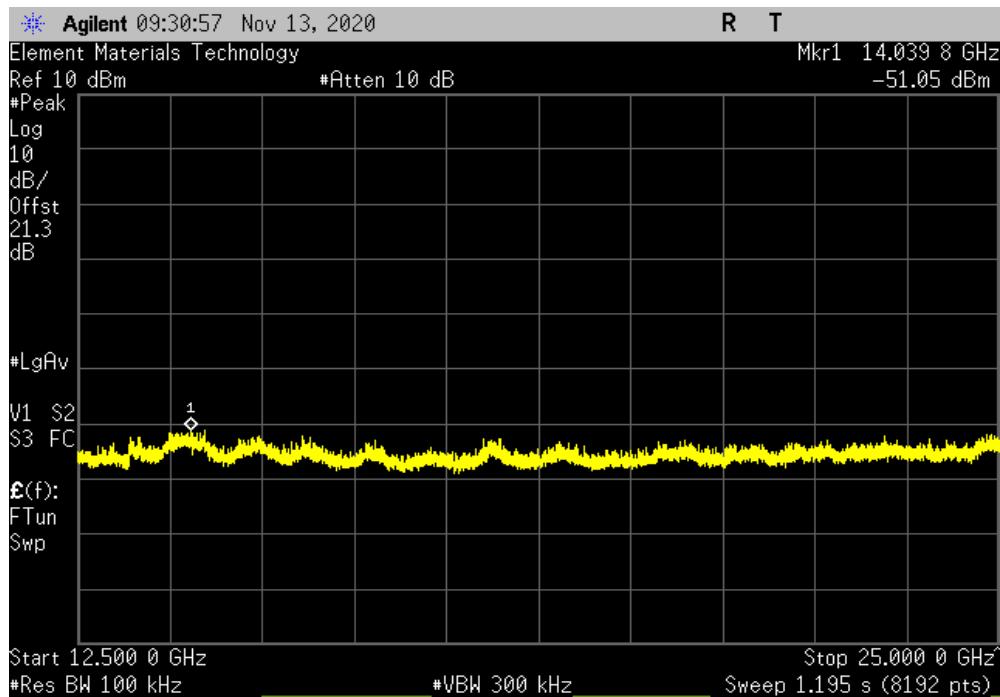


SPURIOUS CONDUCTED EMISSIONS

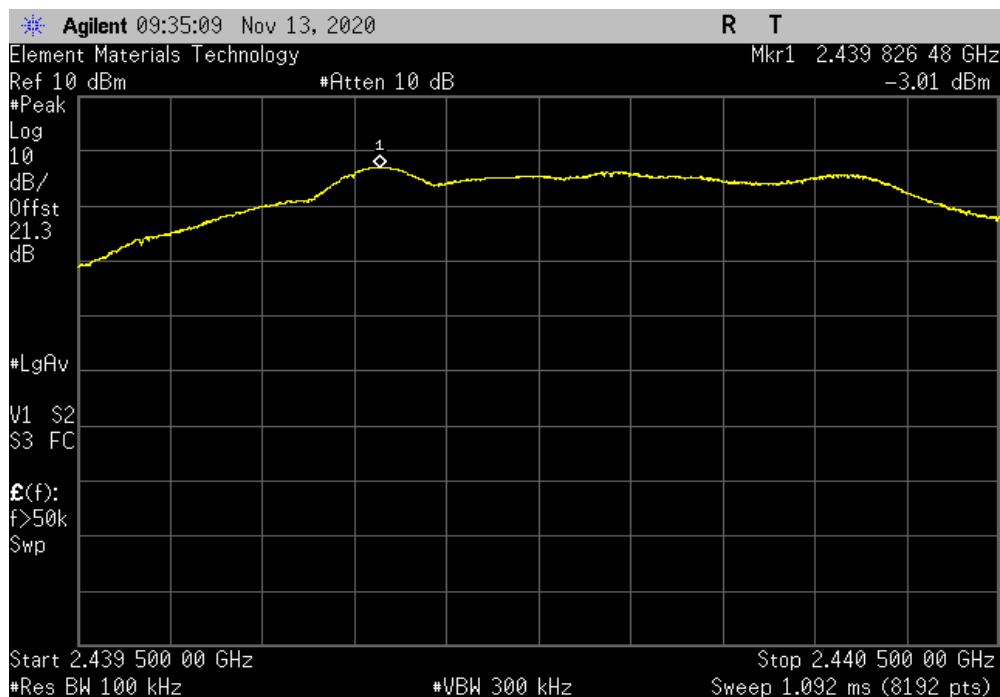


TbtTx 2019.08.30.0 XMit 2020.03.25.0

Bluetooth LR, 500 kbps, Low Channel, 2402 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	14039.8	-48.02	-20	Pass	



Bluetooth LR, 500 kbps, Mid Channel, 2440 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2439.83	N/A	N/A	N/A	N/A

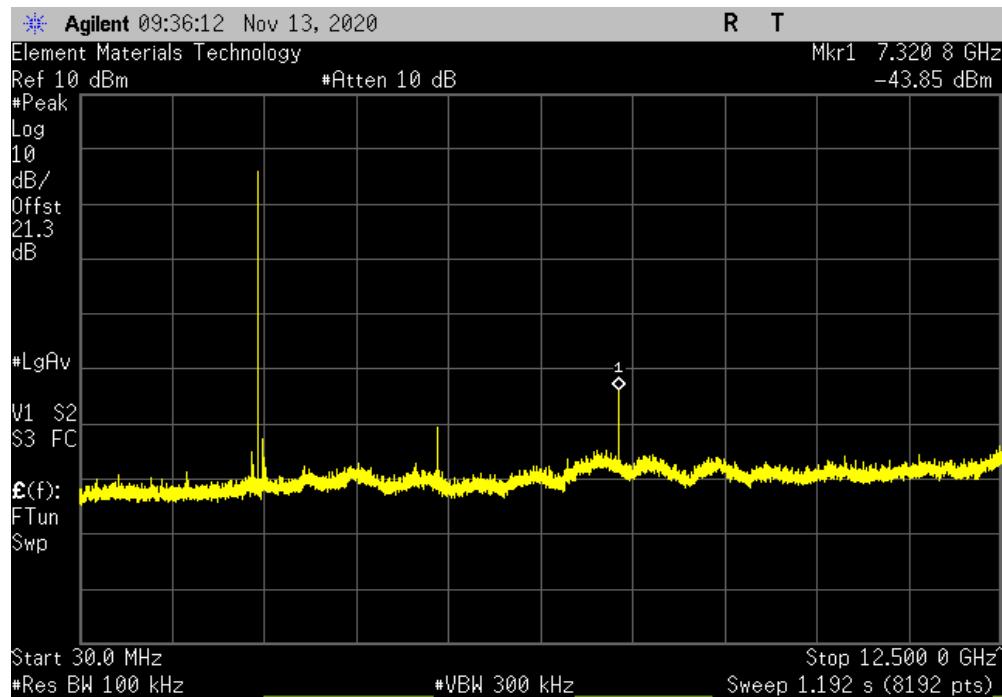


SPURIOUS CONDUCTED EMISSIONS

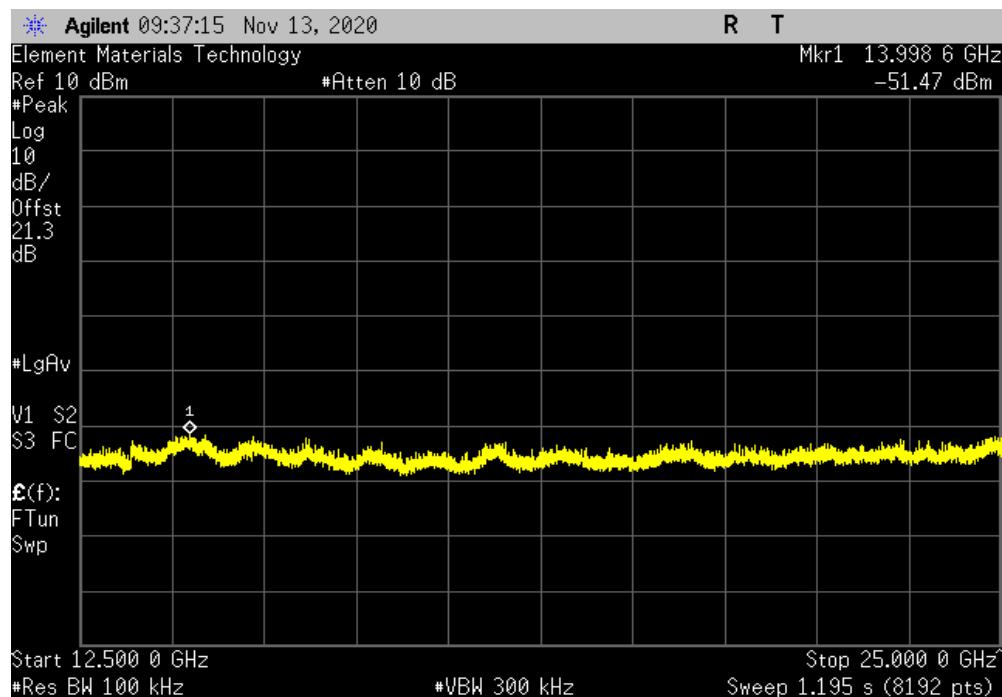


TbtTx 2019.08.30.0 XMit 2020.03.25.0

Bluetooth LR, 500 kbps, Mid Channel, 2440 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit \leq (dBc)	Result
30 MHz - 12.5 GHz	7320.8	-40.84	-20	Pass



Bluetooth LR, 500 kbps, Mid Channel, 2440 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit \leq (dBc)	Result
12.5 GHz - 25 GHz	13998.6	-48.47	-20	Pass

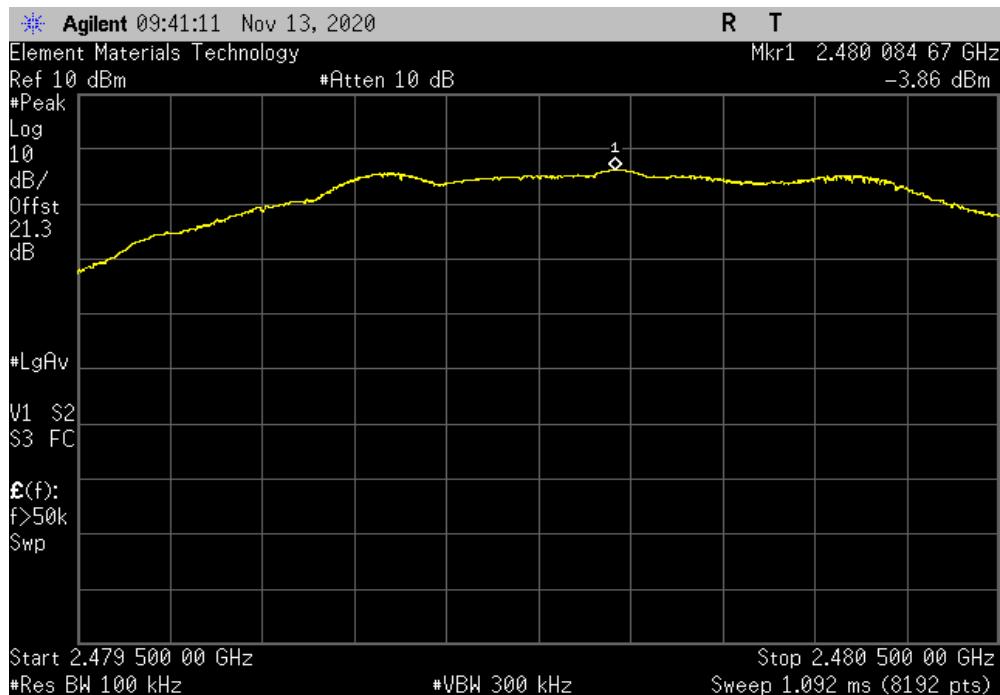


SPURIOUS CONDUCTED EMISSIONS

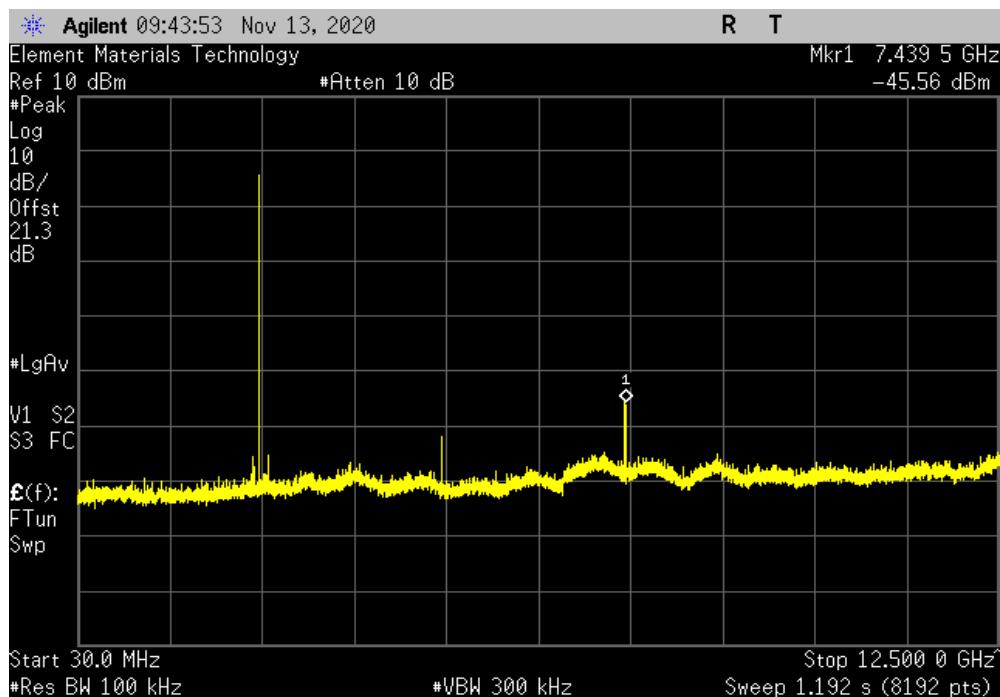


TbtTx 2019.08.30.0 XMit 2020.03.25.0

Bluetooth LR, 500 kbps, High Channel, 2480 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2480.08	N/A	N/A	N/A	N/A



Bluetooth LR, 500 kbps, High Channel, 2480 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	7439.5	-41.7	-20	Pass	



SPURIOUS CONDUCTED EMISSIONS



TbtTx 2019.08.30.0 XMit 2020.03.25.0

Bluetooth LR, 500 kbps, High Channel, 2480 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	14172.6	-46.86	-20	Pass

