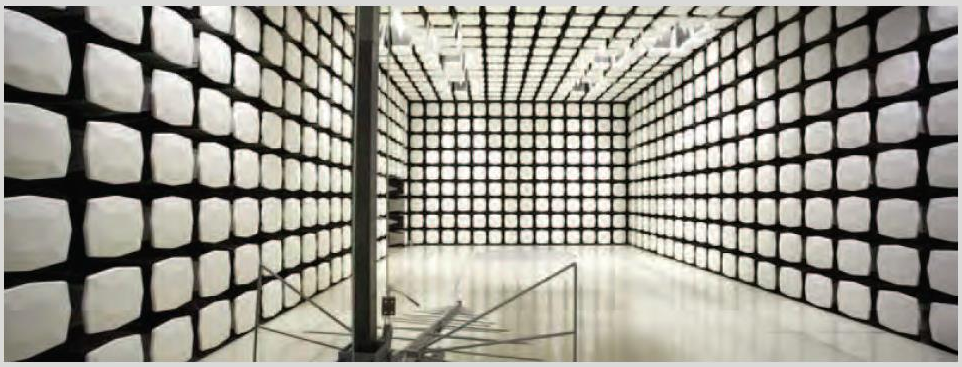
Quext

Radio Thermostat

FCC 15.247:2022
LoRa DTS Transceiver

Report: F3EN0068.6 Rev. 1, Issue Date: July 26, 2022



CERT #3310.03

CERTIFICATE OF TEST

Last Date of Test: February 16, 2022
Quext
EUT: Radio Thermostat

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2022	ANSI C63.10:2013, KDB 558074
FCC 15.247:2022	

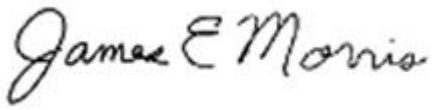
Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions (Transmitter)	Yes	Pass	
6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	
6.5, 6.6	Spurious Radiated Emissions - Simultaneous Transmissions	Yes	Pass	
7.5	Duty Cycle	Yes	Pass	
7.8.5	Output Power	Yes	Pass	
7.8.5	Equivalent Isotropic Radiated Power	Yes	Pass	
7.8.6	Band Edge Compliance	Yes	Pass	
7.8.7	Occupied Bandwidth	Yes	Pass	
7.8.8	Spurious Conducted Emissions	Yes	Pass	
11.10.2	Power Spectral Density	Yes	Pass	

Deviations From Test Standards

None

Approved By:



James Morris, 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	Updated spurious radiated emissions in photos only reports.	2022-07-14	N/A
	Updated power settings and antennas modulation type.	2022-07-14	11

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:

California Minnesota Oregon Texas Washington

MEASUREMENT UNCERTAINTY

element
TMU.2015.07.10

Measurement Uncertainty

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

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

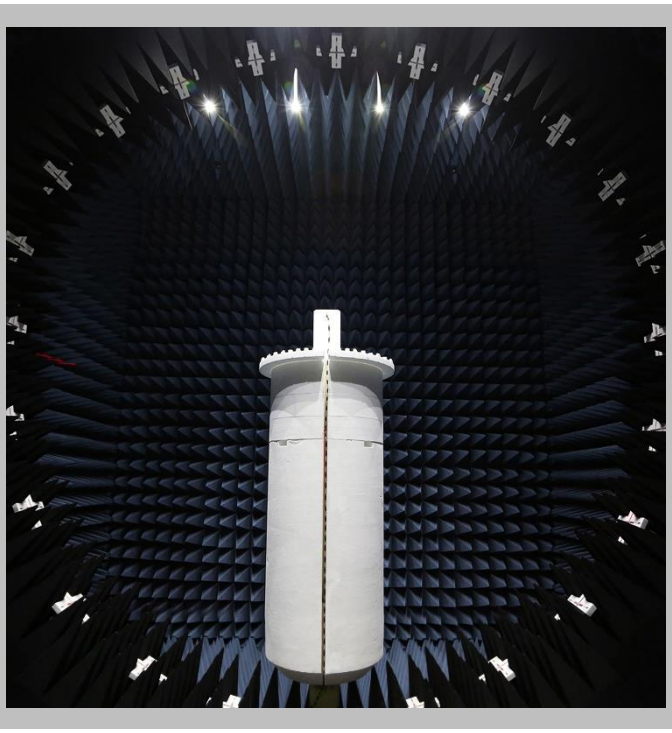
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

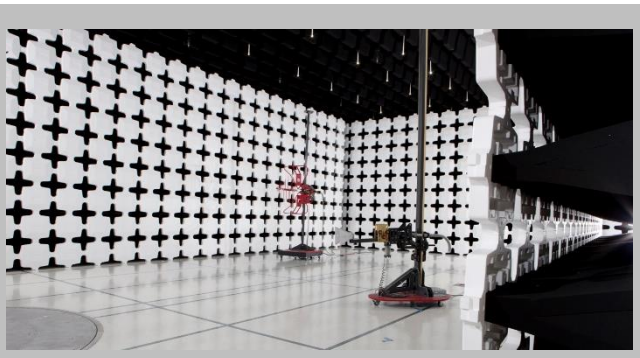
Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.1 dB	-5.1 dB
AC Powerline Conducted Emissions (dB)	3.1 dB	-3.1 dB

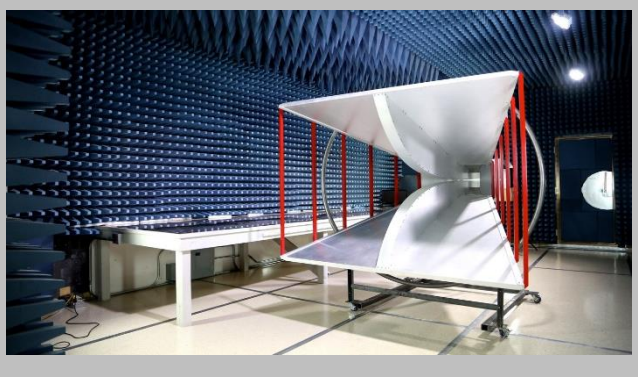
FACILITIES

element
2020.12.15

California	Minnesota	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-11 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
A2LA				
Lab Code: 3310.04	Lab Code: 3310.05	Lab Code: 3310.02	Lab Code: 3310.03	Lab Code: 3310.06
Innovation, Science and Economic Development Canada				
2834B-1, 2834B-3	2834E-1, 2834E-3	2834D-1	2834G-1	2834F-1
BSMI				
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI				
A-0029	A-0109	A-0108	A-0201	A-0110
Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157







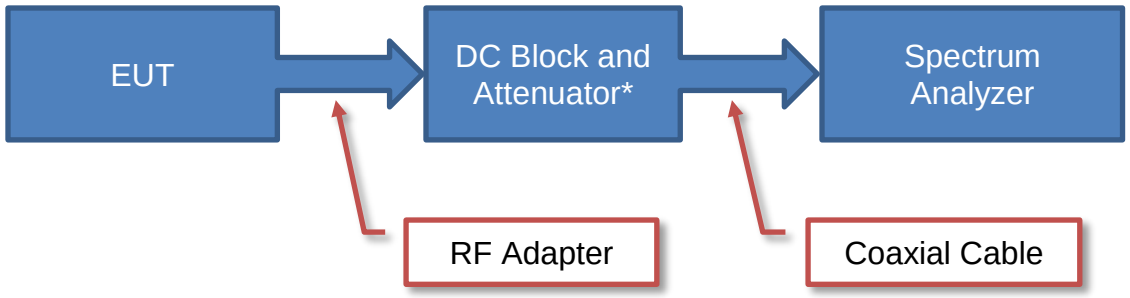
TEST SETUP BLOCK DIAGRAMS

Measurement Bandwidths

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

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

Antenna Port Conducted Measurements

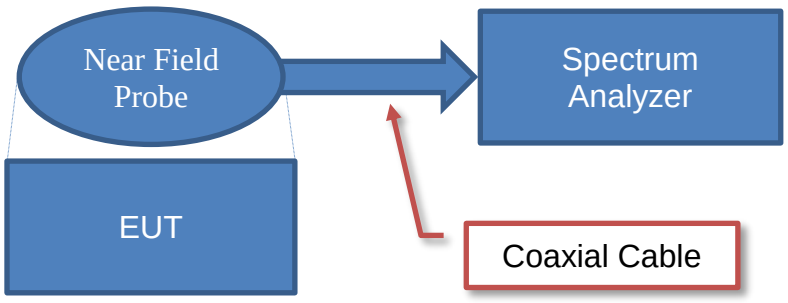


Sample Calculation (logarithmic units)

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

*Note: reference level offset included losses due to pigtail connection to EUT

Near Field Test Fixture Measurements

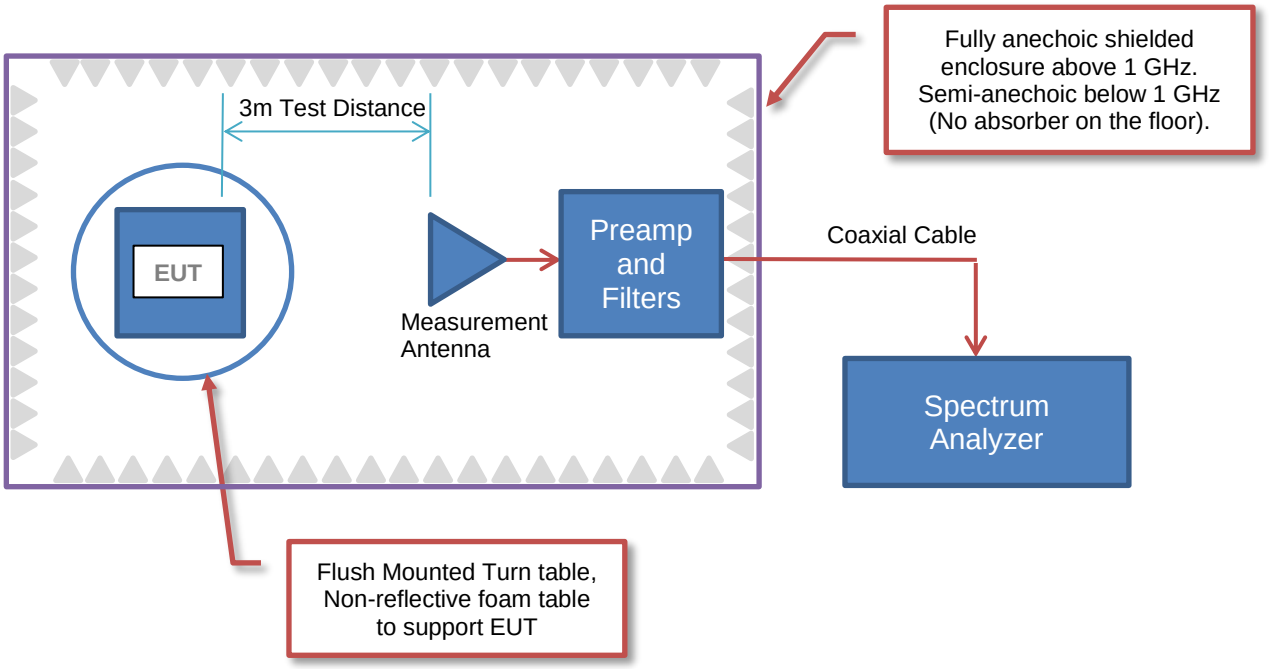


Sample Calculation (logarithmic units)

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

TEST SETUP BLOCK DIAGRAMS

Emissions Measurements



Sample Calculation (logarithmic units)

Radiated Emissions:

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

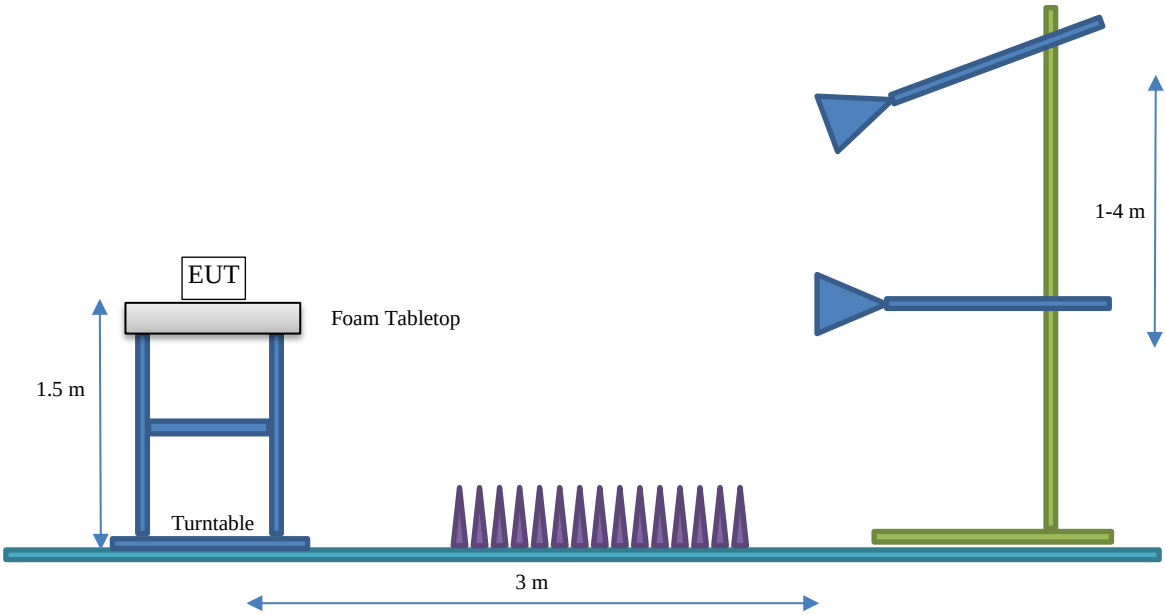
Conducted Emissions:

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

TEST SETUP BLOCK DIAGRAMS

Bore Sighting (>1GHz)

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



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Quext
Address:	5214 68th St, Ste 201
City, State, Zip:	Lubbock, TX 79424
Test Requested By:	Tray Johnson
EUT:	Radio Thermostat
First Date of Test:	December 6, 2021
Last Date of Test:	February 16, 2022
Receipt Date of Samples:	December 3, 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:
This is a physically and radio-controlled thermostat. It contains a LoRa radio (500kHz DTS and 125kHz Hybrid), a Z-wave radio and a Bluetooth Low Energy/Zigbee radio. The Bluetooth and Zigbee radio technologies share one antenna type and one antenna port.

Testing Objective:
To demonstrate compliance under FCC 15.247 for operation in the 902 – 928 MHz band.

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)
Integrated Ceramic Chip	Unictron Technologies Corp	902 - 928	0.9

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

SETTINGS FOR ALL TESTS IN THIS REPORT

Bandwidth / Modulation Types	Position (if multiple channels)	Software Power Setting for Maximum Transmit Power
LoRa 500 kHz (DTS) / Spreading Factor 8 / CCS	Low Ch. 903.0 MHz	22
	Mid Ch. 907.8 MHz	22
	High Ch. 914.2 MHz	22

CONFIGURATIONS

Configuration F3EN0068- 1

Software/Firmware Running During Test	
Description	**Version**
Tera Term	1.0.0.26

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Radio Thermostat	Quext	Quext 1	DUT2

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Lenovo	T450	None
AC/DC Adapter (Laptop)	Lenovo	SK90200325	None
AC/AC Transformer	None	None	None
Mouse (Laptop)	Logitech	810-004116	1829HS0566P8

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB to IO Cable	No	1.2m	No	Radio Thermostat	Laptop
DC Cable	Yes	2.1m	No	Laptop	AC/DC Adapter (Laptop)
AC Cable	No	1.5m	No	AC Mains	AC/DC Adapter (Laptop)
24VAC Cable	No	1.4m	No	Radio Thermostat	AC/AC Transformer
120VAC Cable	No	1.0m	No	AC/AC Transformer	AC Mains / Not Energized
USB Mouse Cable	Yes	1.5m	No	Laptop	Mouse (Laptop)

CONFIGURATIONS

Configuration F3EN0068- 2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Radio Thermostat	Quext	Quext 1	DUT4

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AC/AC Transformer	None	None	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
24VAC Cable	No	1.4m	No	Radio Thermostat	AC/AC Transformer
120VAC Cable	No	1.0m	No	AC/AC Transformer	AC Mains / Not Energized

Configuration F3EN0068- 4

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Radio Thermostat	Quext	Quext 1	DUT 11

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AC/AC Transformer	None	None	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
24VAC Cable	No	1.4m	No	Radio Thermostat	AC/AC Transformer
120VAC Cable	No	1.0m	No	AC/AC Transformer	AC Mains / Not Energized

CONFIGURATIONS

Configuration F3EN0068- 5

Software/Firmware Running During Test	
Description	**Version**
Tera Term	1.0.0.26

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Radio Thermostat	Quext	Quext 1	Shielded Direct Connect

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Lenovo	T450	None
AC/DC Adapter (Laptop)	Lenovo	SK90200325	None
AC/AC Transformer	None	None	None
Mouse (Laptop)	Logitech	810-004116	1829HS0566P8

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB to IO Cable	No	1.2m	No	Radio Thermostat	Laptop
DC Cable	Yes	2.1m	No	Laptop	AC/DC Adapter (Laptop)
AC Cable	No	1.5m	No	AC Mains	AC/DC Adapter (Laptop)
24VAC Cable	No	1.4m	No	Radio Thermostat	AC/AC Transformer
120VAC Cable	No	1.0m	No	AC/AC Transformer	AC Mains / Not Energized
USB Mouse Cable	Yes	1.5m	No	Laptop	Mouse (Laptop)

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2021-12-06	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.
2	2022-01-06	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	2022-01-14	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.
4	2022-01-28	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	2022-01-28	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	2022-01-28	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	2022-01-28	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	2022-01-28	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.
9	2022-02-14	Spurious Radiated Emissions – Simultaneous Transmission	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWERLINE CONDUCTED EMISSIONS

element
WTD.2021.09.21.0
EmiR5 2021.09.09.0
PSA-ESCI 2021.12.10.0

TEST DESCRIPTION

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
Receiver	Gauss Instruments	TDEMI 30M	ARL	2021-03-23	2022-03-23
LISN	Solar Electronics	9252-50-R-24-BNC	LJK	2021-08-06	2022-08-06
Power Source/Analyzer	Hewlett Packard	6841A	THC	NCR	NCR
Cable - Conducted Cable Assembly	Northwest EMC	TXA, HFC, TQU	TXAA	2021-01-26	2022-01-26

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	3.1 dB	-3.1 dB

CONFIGURATIONS INVESTIGATED

F3EN0068-2

MODES INVESTIGATED

Thermostat On, LoRa Radio enabled, 500 kHz bandwidth, mid-channel, all other radios disabled

POWERLINE CONDUCTED EMISSIONS

element
WTD.2021.09.21.0
EmiR5 2021.09.09.0
PSA-ESCI 2021.12.10.0

EUT:	Radio Thermostat	Work Order:	F3EN0068
Serial Number:	DUT4	Date:	2022-01-06
Customer:	Quext	Temperature:	23°C
Attendees:	None	Relative Humidity:	22.6%
Customer Project:	None	Bar. Pressure (PMSL):	1025 mb
Tested By:	Travis Glasser	Job Site:	TX01
Power:	110VAC/60Hz	Configuration:	F3EN0068-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2022	ANSI C63.10:2013

TEST PARAMETERS

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

COMMENTS

None

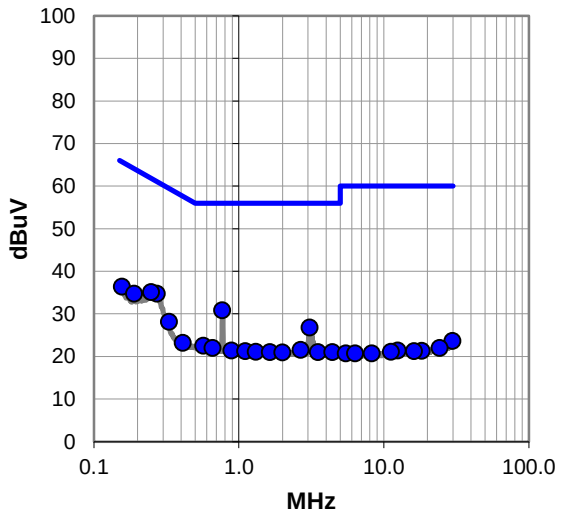
EUT OPERATING MODES

Thermostat On, LoRa Radio enabled, 500 kHz bandwidth, mid-channel, all other radios disabled

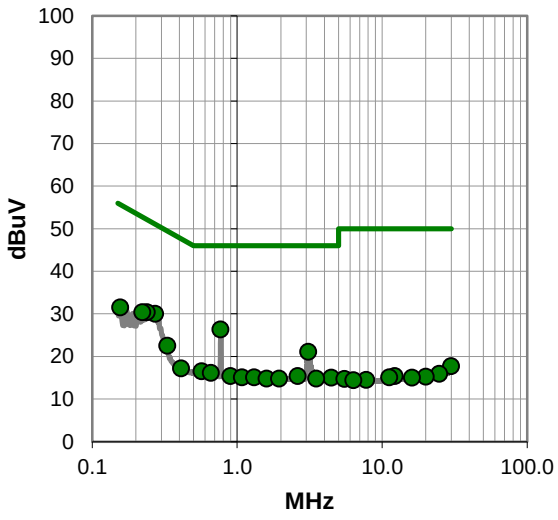
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

element
WTD.2021.09.21.0
EmiR5 2021.09.09.0
PSA-ESCI 2021.12.10.0

RESULTS - Run #15

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.769	10.6	20.2	30.8	56.0	-25.2
0.272	14.3	20.4	34.7	61.1	-26.4
0.248	14.7	20.4	35.1	61.8	-26.7
3.081	6.5	20.3	26.8	56.0	-29.2
0.156	16.0	20.4	36.4	65.7	-29.3
0.190	14.3	20.4	34.7	64.1	-29.4
0.330	7.9	20.2	28.1	59.5	-31.4
0.570	2.3	20.2	22.5	56.0	-33.5
0.658	1.8	20.2	22.0	56.0	-34.0
0.411	3.0	20.2	23.2	57.6	-34.4
2.665	1.2	20.3	21.5	56.0	-34.5
0.890	1.1	20.3	21.4	56.0	-34.6
1.110	1.0	20.2	21.2	56.0	-34.8
1.311	0.8	20.3	21.1	56.0	-34.9
1.636	0.7	20.3	21.0	56.0	-35.0
3.511	0.7	20.3	21.0	56.0	-35.0
4.413	0.7	20.3	21.0	56.0	-35.0
1.995	0.6	20.3	20.9	56.0	-35.1
29.856	1.0	22.6	23.6	60.0	-36.4
24.322	-0.2	22.2	22.0	60.0	-38.0
12.453	0.4	21.0	21.4	60.0	-38.6
18.286	-0.2	21.5	21.3	60.0	-38.7
16.176	-0.2	21.4	21.2	60.0	-38.8
11.214	0.2	20.9	21.1	60.0	-38.9
5.461	0.3	20.4	20.7	60.0	-39.3

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.769	6.1	20.2	26.3	46.0	-19.7
0.272	9.6	20.4	30.0	51.1	-21.1
0.238	10.0	20.4	30.4	52.1	-21.7
0.222	10.0	20.4	30.4	52.8	-22.4
0.156	11.1	20.4	31.5	55.7	-24.2
3.099	0.8	20.3	21.1	46.0	-24.9
0.330	2.3	20.2	22.5	49.5	-27.0
0.570	-3.7	20.2	16.5	46.0	-29.5
0.660	-4.1	20.2	16.1	46.0	-29.9
0.411	-3.0	20.2	17.2	47.6	-30.4
0.901	-4.9	20.3	15.4	46.0	-30.6
2.614	-4.9	20.3	15.4	46.0	-30.6
1.079	-5.1	20.2	15.1	46.0	-30.9
1.311	-5.2	20.3	15.1	46.0	-30.9
4.471	-5.3	20.3	15.0	46.0	-31.0
1.596	-5.5	20.3	14.8	46.0	-31.2
1.950	-5.5	20.3	14.8	46.0	-31.2
3.508	-5.5	20.3	14.8	46.0	-31.2
29.937	-4.9	22.6	17.7	50.0	-32.3
24.757	-6.3	22.2	15.9	50.0	-34.1
12.205	-5.6	21.0	15.4	50.0	-34.6
20.031	-6.4	21.6	15.2	50.0	-34.8
11.215	-5.8	20.9	15.1	50.0	-34.9
16.082	-6.4	21.4	15.0	50.0	-35.0
5.501	-5.7	20.4	14.7	50.0	-35.3

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

element
WTD.2021.09.21.0
EmiR5 2021.09.09.0
PSA-ESCI 2021.12.10.0

EUT:	Radio Thermostat	Work Order:	F3EN0068
Serial Number:	DUT4	Date:	2022-01-06
Customer:	Quext	Temperature:	23°C
Attendees:	None	Relative Humidity:	22.6%
Customer Project:	None	Bar. Pressure (PMSL):	1025 mb
Tested By:	Travis Glasser	Job Site:	TX01
Power:	110VAC/60Hz	Configuration:	F3EN0068-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2022	ANSI C63.10:2013

TEST PARAMETERS

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

COMMENTS

None

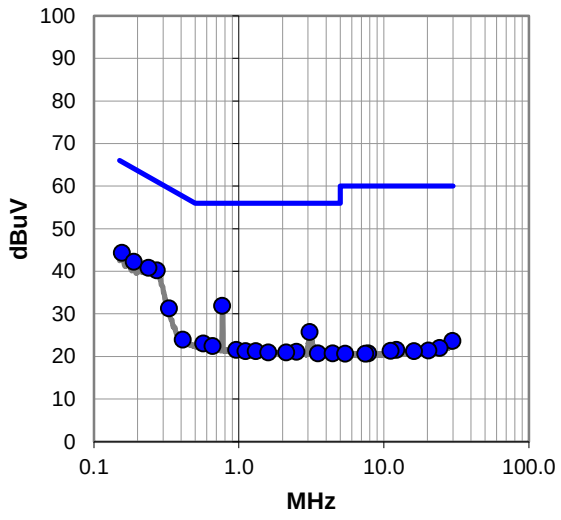
EUT OPERATING MODES

Thermostat On, LoRa Radio enabled, 500 kHz bandwidth, mid-channel, all other radios disabled

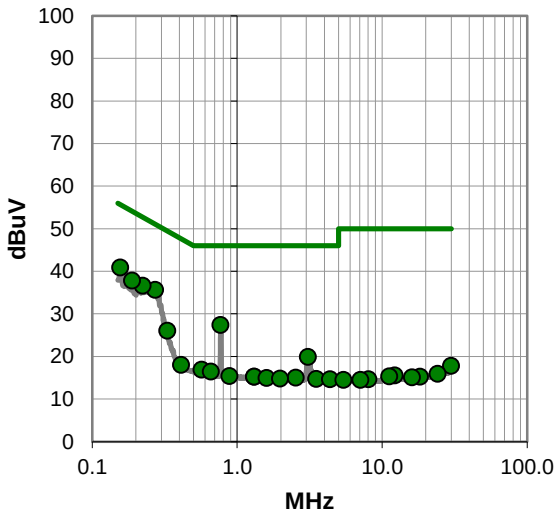
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

element
WTD.2021.09.21.0
EmiR5 2021.09.09.0
PSA-ESCI 2021.12.10.0

RESULTS - Run #16

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.272	19.8	20.4	40.2	61.1	-20.9
0.238	20.4	20.4	40.8	62.1	-21.3
0.156	23.9	20.4	44.3	65.7	-21.4
0.188	21.8	20.4	42.2	64.1	-21.9
0.769	11.7	20.2	31.9	56.0	-24.1
0.330	11.1	20.2	31.3	59.5	-28.2
3.081	5.4	20.3	25.7	56.0	-30.3
0.570	2.8	20.2	23.0	56.0	-33.0
0.658	2.2	20.2	22.4	56.0	-33.6
0.411	3.7	20.2	23.9	57.6	-33.7
0.962	1.2	20.3	21.5	56.0	-34.5
1.111	1.0	20.2	21.2	56.0	-34.8
1.311	0.9	20.3	21.2	56.0	-34.8
2.501	0.8	20.3	21.1	56.0	-34.9
1.596	0.6	20.3	20.9	56.0	-35.1
2.127	0.6	20.3	20.9	56.0	-35.1
3.510	0.4	20.3	20.7	56.0	-35.3
4.434	0.4	20.3	20.7	56.0	-35.3
29.854	1.0	22.6	23.6	60.0	-36.4
24.322	-0.2	22.2	22.0	60.0	-38.0
12.205	0.5	21.0	21.5	60.0	-38.5
20.295	-0.2	21.6	21.4	60.0	-38.6
11.133	0.5	20.8	21.3	60.0	-38.7
16.206	-0.2	21.4	21.2	60.0	-38.8
7.831	0.1	20.6	20.7	60.0	-39.3

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.156	20.5	20.4	40.9	55.7	-14.8
0.272	15.2	20.4	35.6	51.1	-15.5
0.223	16.2	20.4	36.6	52.7	-16.1
0.188	17.4	20.4	37.8	54.1	-16.3
0.769	7.2	20.2	27.4	46.0	-18.6
0.330	5.8	20.2	26.0	49.5	-23.5
3.081	-0.4	20.3	19.9	46.0	-26.1
0.570	-3.3	20.2	16.9	46.0	-29.1
0.411	-2.2	20.2	18.0	47.6	-29.6
0.660	-3.8	20.2	16.4	46.0	-29.6
0.884	-4.9	20.3	15.4	46.0	-30.6
1.308	-5.1	20.3	15.2	46.0	-30.8
1.311	-5.1	20.3	15.2	46.0	-30.8
2.533	-5.3	20.3	15.0	46.0	-31.0
1.601	-5.4	20.3	14.9	46.0	-31.1
1.981	-5.5	20.3	14.8	46.0	-31.2
3.521	-5.6	20.3	14.7	46.0	-31.3
4.364	-5.7	20.3	14.6	46.0	-31.4
29.937	-4.8	22.6	17.8	50.0	-32.2
24.178	-6.3	22.2	15.9	50.0	-34.1
12.205	-5.5	21.0	15.5	50.0	-34.5
11.217	-5.6	20.9	15.3	50.0	-34.7
18.228	-6.3	21.5	15.2	50.0	-34.8
16.104	-6.3	21.4	15.1	50.0	-34.9
8.058	-6.0	20.6	14.6	50.0	-35.4

CONCLUSION

Pass

Tested By

SPURIOUS RADIATED EMISSIONS

element

PSA-ESCI 2021.12.10.0

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. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

LoRa 500kHz BW, Pwr lvl 22, Spreading Factor 8, Low Channel 903 MHz
LoRa 500kHz BW, Pwr lvl 22, Spreading Factor 8, Mid Channel 907.8 MHz
LoRa 500kHz BW, Pwr lvl 22, Spreading Factor 8, High Channel 914.2 MHz

POWER SETTINGS INVESTIGATED

110VAC/60Hz
3.0VDC via Battery

CONFIGURATIONS INVESTIGATED

F3EN0068 - 4

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	12500 MHz

SAMPLE CALCULATIONS

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Filter - High Pass	Micro-Tronics	HPM50108	HGD	2021-09-13	2022-09-13
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	PAL	2021-09-13	2022-09-13
Antenna - Standard Gain	ETS Lindgren	3160-08	AJG	NCR	NCR
Filter - Band Reject	Wainwright Instruments	WTRCTV5-750-1000-20-70-60EEK	CUL	2021-02-17	2022-02-17
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	PAK	2021-09-13	2022-09-13
Cable	Northwest EMC	8-18GHz	TXD	2021-04-30	2022-04-30
Antenna - Standard Gain	ETS Lindgren	3160-07	AJF	NCR	NCR
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAJ	2021-05-24	2022-05-24
Cable	Northwest EMC	1-8.2 GHz	TXC	2021-05-24	2022-05-24
Antenna - Double Ridge	ETS Lindgren	3115	AJL	2020-10-20	2022-10-20
Filter - Low Pass	Micro-Tronics	LPM50004	HHV	2021-07-27	2022-07-27
Amplifier - Pre-Amplifier	Fairview Microwave	FMAM63001	PAS	2021-05-24	2022-05-24
Cable	Northwest EMC	RE 9kHz - 1GHz	TXB	2021-05-24	2022-05-24
Antenna - Biconilog	ETS Lindgren	3143B	AYF	2020-06-25	2022-06-25
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	2021-03-11	2022-03-11

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*log(1/dc).

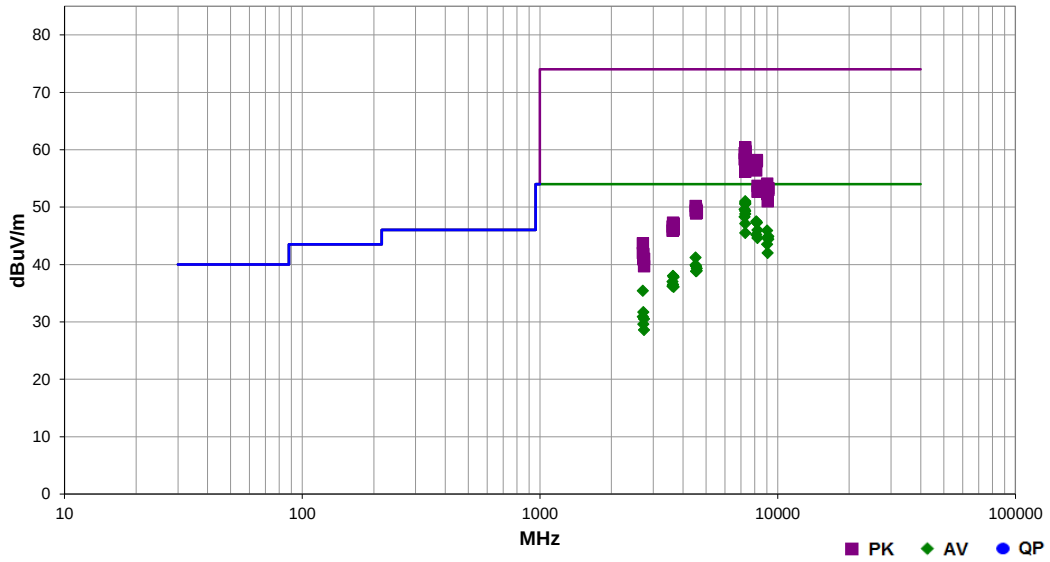
SPURIOUS RADIATED EMISSIONS

EmiR5 2021.09.09.0 PSA-ESCI 2021.12.10.0

Work Order:	F3EN0068	**Date:**	2022-01-14		
Project:	None	**Temperature:**	22.3 °C		
Job Site:	TX02	**Humidity:**	27.7% RH		
Serial Number:	DUT11	**Barometric Pres.:**	1018 mbar	**Tested by:**	Brandon Hobbs
EUT:	Radio Thermostat				
Configuration:	4				
Customer:	Quext				
Attendees:	None				
EUT Power:	Reference Data Comments				
Operating Mode:	Thermostat On, LoRa 500kHz BW, Spreading Factor 8, Pwr Lvl 22, Please reference data comments for EUT orientation, Channel and EUT Power.				
Deviations:	None				
Comments:	100% duty cycle in test mode				

Test Specifications	**Test Method**
FCC 15.247:2022	ANSI C63.10:2013

Run #	123	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



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
7313.458	39.1	11.9	1.6	133.0	3.0	0.0	Vert	AV	0.0	51.0	54.0	-3.0	EUT Horz, High Ch 914.2 MHz, 110VAC/60Hz
7312.767	38.9	11.9	2.0	206.0	3.0	0.0	Horz	AV	0.0	50.8	54.0	-3.2	EUT On Side, High Ch 914.2 MHz, 110VAC/60Hz
7313.625	38.7	11.9	2.0	206.0	3.0	0.0	Horz	AV	0.0	50.6	54.0	-3.4	EUT On Side, High Ch 914.2 MHz, 3VDC via Battery
7312.975	38.6	11.9	1.6	140.0	3.0	0.0	Vert	AV	0.0	50.5	54.0	-3.5	EUT Horz, High Ch 914.2 MHz, 3VDC via Battery
7263.350	37.8	11.8	3.2	39.9	3.0	0.0	Horz	AV	0.0	49.6	54.0	-4.4	EUT On Side, Mid Ch 907.8 MHz, 110VAC/60Hz
7314.317	37.4	11.9	1.7	31.0	3.0	0.0	Horz	AV	0.0	49.3	54.0	-4.7	EUT Vert, High Ch. 914.2 MHz, 100VAC/60Hz
7313.542	36.9	11.9	1.5	181.0	3.0	0.0	Horz	AV	0.0	48.8	54.0	-5.2	EUT Horz, High Ch 914.2 MHz, 110VAC/60Hz
7263.242	36.5	11.8	1.5	310.9	3.0	0.0	Vert	AV	0.0	48.3	54.0	-5.7	EUT Horz, Mid Ch 907.8 MHz, 110VAC/60Hz
8127.133	34.7	12.8	1.0	56.0	3.0	0.0	Horz	AV	0.0	47.5	54.0	-6.5	EUT On Side, Low Ch 903 MHz, 110VAC/60Hz
8170.942	34.3	13.0	1.7	42.0	3.0	0.0	Horz	AV	0.0	47.3	54.0	-6.7	EUT On Side, Mid Ch 907.8 MHz, 110VAC/60Hz
8170.983	34.3	13.0	1.5	49.0	3.0	0.0	Vert	AV	0.0	47.3	54.0	-6.7	EUT Horz, Mid Ch 907.8 MHz, 110VAC/60Hz
7312.825	35.2	11.9	1.8	158.0	3.0	0.0	Vert	AV	0.0	47.1	54.0	-6.9	EUT On Side, High Ch 914.2 MHz, 110VAC/60Hz
8227.075	52.2	-6.2	1.5	218.0	3.0	0.0	Horz	AV	0.0	46.0	54.0	-8.0	EUT On Side, High Ch 914.2 MHz, 110VAC/60Hz
9028.900	51.0	-5.1	1.2	273.0	3.0	0.0	Vert	AV	0.0	45.9	54.0	-8.1	EUT Horz, Low Ch 903 MHz, 110VAC/60Hz
7313.217	33.6	11.9	1.5	78.0	3.0	0.0	Vert	AV	0.0	45.5	54.0	-8.5	EUT Vert, High Ch. 914.2 MHz, 100VAC/60Hz
8128.333	32.4	12.8	1.0	230.0	3.0	0.0	Vert	AV	0.0	45.2	54.0	-8.8	EUT Horz, Low Ch 903 MHz, 110VAC/60Hz
9140.783	49.5	-4.6	1.5	27.9	3.0	0.0	Horz	AV	0.0	44.9	54.0	-9.1	EUT On Side, High Ch 914.2 MHz, 110VAC/60Hz
9076.817	49.6	-4.9	2.3	284.0	3.0	0.0	Vert	AV	0.0	44.7	54.0	-9.3	EUT On Side, Mid Ch 907.8 MHz, 110VAC/60Hz
8226.767	50.8	-6.2	1.2	54.0	3.0	0.0	Vert	AV	0.0	44.6	54.0	-9.4	EUT Horz, High Ch 914.2 MHz, 110VAC/60Hz
9140.733	49.0	-4.6	1.4	255.0	3.0	0.0	Vert	AV	0.0	44.4	54.0	-9.6	EUT Horz, High Ch 914.2 MHz, 110VAC/60Hz
9028.792	48.6	-5.1	1.7	82.9	3.0	0.0	Horz	AV	0.0	43.5	54.0	-10.5	EUT On Side, Low Ch 903 MHz, 110VAC/60Hz
9076.783	46.9	-4.9	1.7	82.9	3.0	0.0	Horz	AV	0.0	42.0	54.0	-12.0	EUT Horz, Mid Ch 907.8 MHz, 110VAC/60Hz
4515.325	36.8	4.4	2.0	157.0	3.0	0.0	Horz	AV	0.0	41.2	54.0	-12.8	EUT On Side, Low Ch 903 MHz, 110VAC/60Hz
7314.833	48.5	11.9	1.6	133.0	3.0	0.0	Vert	PK	0.0	60.4	74.0	-13.6	EUT Horz, High Ch 914.2 MHz, 110VAC/60Hz
4514.958	35.5	4.4	2.6	206.0	3.0	0.0	Vert	AV	0.0	39.9	54.0	-14.1	EUT Horz, Low Ch 903 MHz, 110VAC/60Hz
7314.158	47.9	11.9	2.0	206.0	3.0	0.0	Horz	PK	0.0	59.8	74.0	-14.2	EUT On Side, High Ch 914.2 MHz, 110VAC/60Hz
4539.458	35.3	4.4	2.1	211.0	3.0	0.0	Vert	AV	0.0	39.7	54.0	-14.3	EUT Horz, Mid Ch 907.8 MHz, 110VAC/60Hz
7312.175	47.7	11.9	1.6	140.0	3.0	0.0	Vert	PK	0.0	59.6	74.0	-14.4	EUT Horz, High Ch 914.2 MHz, 3VDC via Battery
7312.892	47.7	11.9	2.0	206.0	3.0	0.0	Horz	PK	0.0	59.6	74.0	-14.4	EUT On Side, High Ch 914.2 MHz, 3VDC via Battery
7263.142	47.6	11.8	3.2	39.9	3.0	0.0	Horz	PK	0.0	59.4	74.0	-14.6	EUT On Side, Mid Ch 907.8 MHz, 110VAC/60Hz
4571.292	34.8	4.5	1.7	195.0	3.0	0.0	Horz	AV	0.0	39.3	54.0	-14.7	EUT On Side, High Ch 914.2 MHz, 110VAC/60Hz

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
7312.058	47.2	11.9	1.7	31.0	3.0	0.0	Horz	PK	0.0	59.1	74.0	-14.9	EUT Vert, High Ch. 914.2 MHz, 100VAC/60Hz
4571.217	34.4	4.5	3.0	144.0	3.0	0.0	Vert	AV	0.0	38.9	54.0	-15.1	EUT Horz, High Ch 914.2 MHz, 110VAC/60Hz
4539.050	34.4	4.4	1.5	271.0	3.0	0.0	Horz	AV	0.0	38.8	54.0	-15.2	EUT On Side, Mid Ch 907.8 MHz, 110VAC/60Hz
7314.883	46.5	11.9	1.5	181.0	3.0	0.0	Horz	PK	0.0	58.4	74.0	-15.6	EUT Horz, High Ch 914.2 MHz, 110VAC/60Hz
7263.433	46.5	11.8	1.5	310.9	3.0	0.0	Vert	PK	0.0	58.3	74.0	-15.7	EUT Horz, Mid Ch 907.8 MHz, 110VAC/60Hz
8171.783	45.2	13.0	1.5	49.0	3.0	0.0	Vert	PK	0.0	58.2	74.0	-15.8	EUT Horz, Mid Ch 907.8 MHz, 110VAC/60Hz
8128.667	45.3	12.8	1.0	56.0	3.0	0.0	Horz	PK	0.0	58.1	74.0	-15.9	EUT On Side, Low Ch 903 MHz, 110VAC/60Hz
3631.275	36.7	1.3	2.1	43.0	3.0	0.0	Horz	AV	0.0	38.0	54.0	-16.0	EUT On Side, Mid Ch 907.8 MHz, 110VAC/60Hz
8168.342	45.1	12.9	1.7	42.0	3.0	0.0	Horz	PK	0.0	58.0	74.0	-16.0	EUT On Side, Mid Ch 907.8 MHz, 110VAC/60Hz
3656.842	36.3	1.5	1.5	50.0	3.0	0.0	Horz	AV	0.0	37.8	54.0	-16.2	EUT On Side, High Ch 914.2 MHz, 110VAC/60Hz
7313.642	45.4	11.9	1.8	158.0	3.0	0.0	Vert	PK	0.0	57.3	74.0	-16.7	EUT On Side, High Ch 914.2 MHz, 110VAC/60Hz
3612.125	35.8	1.2	2.9	123.9	3.0	0.0	Vert	AV	0.0	37.0	54.0	-17.0	EUT Horz, Low Ch 903 MHz, 110VAC/60Hz
3631.092	35.2	1.3	2.9	148.9	3.0	0.0	Vert	AV	0.0	36.5	54.0	-17.5	EUT Horz, Mid Ch 907.8 MHz, 110VAC/60Hz
8126.133	43.6	12.8	1.0	230.0	3.0	0.0	Vert	PK	0.0	56.4	74.0	-17.6	EUT Horz, Low Ch 903 MHz, 110VAC/60Hz
7312.492	44.3	11.9	1.5	78.0	3.0	0.0	Vert	PK	0.0	56.2	74.0	-17.8	EUT Vert, High Ch. 914.2 MHz, 100VAC/60Hz
3611.900	35.0	1.2	3.1	270.0	3.0	0.0	Horz	AV	0.0	36.2	54.0	-17.8	EUT On Side, Low Ch 903 MHz, 110VAC/60Hz
3656.767	34.6	1.5	2.9	62.0	3.0	0.0	Vert	AV	0.0	36.1	54.0	-17.9	EUT Horz, High Ch 914.2 MHz, 110VAC/60Hz
2708.975	38.9	-3.5	2.6	80.0	3.0	0.0	Horz	AV	0.0	35.4	54.0	-18.6	EUT On Side, Low Ch 903 MHz, 110VAC/60Hz
9028.400	59.2	-5.1	1.2	273.0	3.0	0.0	Vert	PK	0.0	54.1	74.0	-19.9	EUT Horz, Low Ch 903 MHz, 110VAC/60Hz
8228.150	59.9	-6.2	1.5	218.0	3.0	0.0	Horz	PK	0.0	53.7	74.0	-20.3	EUT On Side, High Ch 914.2 MHz, 110VAC/60Hz
9143.317	57.9	-4.6	1.5	27.9	3.0	0.0	Horz	PK	0.0	53.3	74.0	-20.7	EUT On Side, High Ch 914.2 MHz, 110VAC/60Hz
9076.967	58.1	-4.9	2.3	284.0	3.0	0.0	Vert	PK	0.0	53.2	74.0	-20.8	EUT On Side, Mid Ch 907.8 MHz, 110VAC/60Hz
9141.358	57.6	-4.6	1.4	255.0	3.0	0.0	Vert	PK	0.0	53.0	74.0	-21.0	EUT Horz, High Ch 914.2 MHz, 110VAC/60Hz
8228.400	58.9	-6.2	1.2	54.0	3.0	0.0	Vert	PK	0.0	52.7	74.0	-21.3	EUT Horz, High Ch 914.2 MHz, 110VAC/60Hz
9028.108	57.4	-5.1	1.7	82.9	3.0	0.0	Horz	PK	0.0	52.3	74.0	-21.7	EUT On Side, Low Ch 903 MHz, 110VAC/60Hz
2723.342	35.1	-3.4	3.3	325.0	3.0	0.0	Vert	AV	0.0	31.7	54.0	-22.3	EUT Horz, Mid Ch 907.8 MHz, 110VAC/60Hz
9076.117	55.9	-4.9	1.7	82.9	3.0	0.0	Horz	PK	0.0	51.0	74.0	-23.0	EUT Horz, Mid Ch 907.8 MHz, 110VAC/60Hz
2708.958	34.4	-3.5	2.7	117.9	3.0	0.0	Vert	AV	0.0	30.9	54.0	-23.1	EUT Horz, Low Ch 903 MHz, 110VAC/60Hz
2742.617	33.9	-3.4	3.5	157.0	3.0	0.0	Vert	AV	0.0	30.5	54.0	-23.5	EUT Horz, High Ch 914.2 MHz, 110VAC/60Hz
4516.267	45.8	4.4	2.0	157.0	3.0	0.0	Horz	PK	0.0	50.2	74.0	-23.8	EUT On Side, Low Ch 903 MHz, 110VAC/60Hz
4540.125	45.3	4.4	2.1	211.0	3.0	0.0	Vert	PK	0.0	49.7	74.0	-24.3	EUT Horz, Mid Ch 907.8 MHz, 110VAC/60Hz
2723.450	33.0	-3.4	3.0	45.0	3.0	0.0	Horz	AV	0.0	29.6	54.0	-24.4	EUT On Side, Mid Ch 907.8 MHz, 110VAC/60Hz
4515.667	45.0	4.4	2.6	206.0	3.0	0.0	Vert	PK	0.0	49.4	74.0	-24.6	EUT Horz, Low Ch 903 MHz, 110VAC/60Hz
4569.967	44.9	4.5	1.7	195.0	3.0	0.0	Horz	PK	0.0	49.4	74.0	-24.6	EUT On Side, High Ch 914.2 MHz, 110VAC/60Hz
4569.917	44.5	4.5	3.0	144.0	3.0	0.0	Vert	PK	0.0	49.0	74.0	-25.0	EUT Horz, High Ch 914.2 MHz, 110VAC/60Hz
4539.308	44.5	4.4	1.5	271.0	3.0	0.0	Horz	PK	0.0	48.9	74.0	-25.1	EUT On Side, Mid Ch 907.8 MHz, 110VAC/60Hz
2742.592	32.0	-3.4	1.5	261.9	3.0	0.0	Horz	AV	0.0	28.6	54.0	-25.4	EUT On Side, High Ch 914.2 MHz, 110VAC/60Hz
3631.083	46.0	1.3	2.1	43.0	3.0	0.0	Horz	PK	0.0	47.3	74.0	-26.7	EUT On Side, Mid Ch 907.8 MHz, 110VAC/60Hz
3656.583	45.6	1.5	1.5	50.0	3.0	0.0	Horz	PK	0.0	47.1	74.0	-26.9	EUT On Side, High Ch 914.2 MHz, 110VAC/60Hz
3611.758	45.4	1.2	2.9	123.9	3.0	0.0	Vert	PK	0.0	46.6	74.0	-27.4	EUT Horz, Low Ch 903 MHz, 110VAC/60Hz
3631.625	44.8	1.3	2.9	148.9	3.0	0.0	Vert	PK	0.0	46.1	74.0	-27.9	EUT Horz, Mid Ch 907.8 MHz, 110VAC/60Hz
3656.475	44.6	1.5	2.9	62.0	3.0	0.0	Vert	PK	0.0	46.1	74.0	-27.9	EUT Horz, High Ch 914.2 MHz, 110VAC/60Hz
3612.550	44.7	1.2	3.1	270.0	3.0	0.0	Horz	PK	0.0	45.9	74.0	-28.1	EUT On Side, Low Ch 903 MHz, 110VAC/60Hz
2708.625	47.2	-3.5	2.6	80.0	3.0	0.0	Horz	PK	0.0	43.7	74.0	-30.3	EUT On Side, Low Ch 903 MHz, 110VAC/60Hz
2709.133	45.5	-3.5	2.7	117.9	3.0	0.0	Vert	PK	0.0	42.0	74.0	-32.0	EUT Horz, Low Ch 903 MHz, 110VAC/60Hz
2723.358	45.2	-3.4	3.3	325.0	3.0	0.0	Vert	PK	0.0	41.8	74.0	-32.2	EUT Horz, Mid Ch 907.8 MHz, 110VAC/60Hz
2742.367	44.4	-3.4	3.5	157.0	3.0	0.0	Vert	PK	0.0	41.0	74.0	-33.0	EUT Horz, High Ch 914.2 MHz, 110VAC/60Hz
2722.992	44.3	-3.4	3.0	45.0	3.0	0.0	Horz	PK	0.0	40.9	74.0	-33.1	EUT On Side, Mid Ch 907.8 MHz, 110VAC/60Hz
2743.125	43.1	-3.4	1.5	261.9	3.0	0.0	Horz	PK	0.0	39.7	74.0	-34.3	EUT On Side, High Ch 914.2 MHz, 110VAC/60Hz

SPURIOUS RADIATED EMISSIONS - SIMULTANEOUS TRANSMISSIONS

element

PSA-ESCI 2022.1.12.0

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. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Thermostat On, LoRa Radio on 907.8 MHz spreading factor 8 full power 500kHz BW and Z-wave 908.4 MHz Low Injection Baudrate 40k, power lvl 13 (Worst case modes were used for each radio respectively)

Thermostat On, LoRa Radio on 914.2 MHz spreading factor 8, 500kHz BW full power and Z-wave 916 MHz High injection Baudrate 100k power lvl 20 (Worst case modes were used for each radio respectively)

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

F3EN0068 - 4

FREQUENCY RANGE INVESTIGATED

Start Frequency	1000 MHz	Stop Frequency	12400 MHz

SAMPLE CALCULATIONS

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Attenuator	Weinschel Corp	4H-20	AWB	2021-03-09	2022-03-09
Filter - High Pass	Micro-Tronics	HPM50108	HGD	2021-09-13	2022-09-13
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	2021-03-11	2022-03-11
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	PAK	2021-09-13	2022-09-13
Cable	Northwest EMC	8-18GHz	TXD	2021-04-30	2022-04-30
Antenna - Standard Gain	ETS Lindgren	3160-07	AJF	NCR	NCR
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAJ	2021-05-24	2022-05-24
Cable	Northwest EMC	1-8.2 GHz	TXC	2021-05-24	2022-05-24
Antenna - Double Ridge	ETS Lindgren	3115	AJL	2020-10-20	2022-10-20

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*log(1/dc).

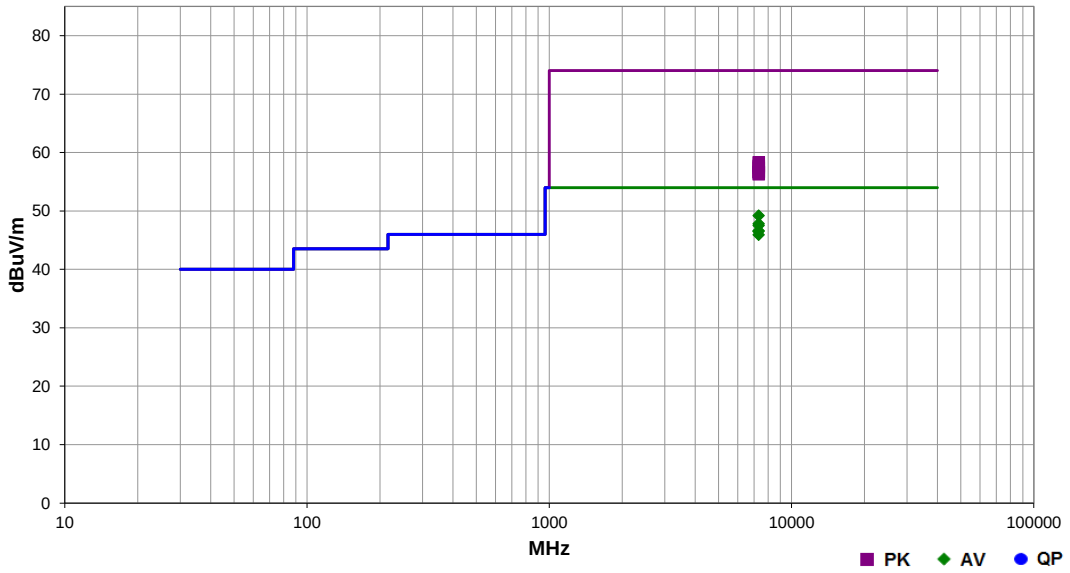
SPURIOUS RADIATED EMISSIONS - SIMULTANEOUS TRANSMISSIONS

EmiR5 2021.09.09.0 PSA-ESCI 2022.1.12.0

Work Order:	F3EN0068	**Date:**	2022-02-16		
Project:	None	**Temperature:**	22.8 °C		
Job Site:	TX02	**Humidity:**	35.4% RH		
Serial Number:	DUT11	**Barometric Pres.:**	1016 mbar	**Tested by:**	Brandon Hobbs
EUT:	Radio Thermostat				
Configuration:	4				
Customer:	Quext				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Thermostat On, LoRa Radio on 914.2 MHz spreading factor 8, 500kHz BW full power and Z-wave 916 MHz High injection Baudrate 100k power lvl 20, Using the two closest channels while in the two worst case modes respectively.				
Deviations:	None				
Comments:	Single Worst case Harmonic shown across both channel sets while in their worst case modes respectively. Maximized the single worst case harmonic to show compliance. Only the total (Z-wave only) Upward correction factors were applied. DCCF = 10*Log10(1/0.96)=.177. The LoRa was operating at 100% duty cycle meaning no Upward DCCF is applicable.				

Test Specifications	**Test Method**
FCC 15.247:2022	ANSI C63.10:2013

Run #	190	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



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
7313.450	37.1	11.9	1.2	309.0	0.2	0.0	Horz	AV	0.0	49.2	54.0	-4.8	EUT Vertical Single Worst Case Harmonic
7313.658	35.7	11.9	1.2	46.9	0.2	0.0	Vert	AV	0.0	47.8	54.0	-6.2	EUT Horizontal Single Worst Case Harmonic
7313.808	35.4	11.9	1.2	175.0	0.2	0.0	Horz	AV	0.0	47.5	54.0	-6.5	EUT Horizontal Single Worst Case Harmonic
7313.392	34.5	11.9	1.2	4.9	0.2	0.0	Vert	AV	0.0	46.6	54.0	-7.4	EUT On Side Single Worst Case Harmonic
7312.750	34.4	11.9	1.2	21.9	0.2	0.0	Horz	AV	0.0	46.5	54.0	-7.5	EUT On Side Single Worst Case Harmonic
7313.350	33.8	11.9	1.2	42.0	0.2	0.0	Vert	AV	0.0	45.9	54.0	-8.1	EUT Vertical Single Worst Case Harmonic
7315.158	46.4	11.9	1.2	309.0	0.0	0.0	Horz	PK	0.0	58.3	74.0	-15.7	EUT Vertical Single Worst Case Harmonic
7315.083	45.8	11.9	1.2	175.0	0.0	0.0	Horz	PK	0.0	57.7	74.0	-16.3	EUT Horizontal Single Worst Case Harmonic
7315.008	45.5	11.9	1.2	46.9	0.0	0.0	Vert	PK	0.0	57.4	74.0	-16.6	EUT Horizontal Single Worst Case Harmonic
7315.108	44.8	11.9	1.2	21.9	0.0	0.0	Horz	PK	0.0	56.7	74.0	-17.3	EUT On Side Single Worst Case Harmonic
7314.350	44.7	11.9	1.2	4.9	0.0	0.0	Vert	PK	0.0	56.6	74.0	-17.4	EUT On Side Single Worst Case Harmonic
7314.142	44.4	11.9	1.2	42.0	0.0	0.0	Vert	PK	0.0	56.3	74.0	-17.7	EUT Vertical Single Worst Case Harmonic

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 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 test software provided for operation in a fixed, single channel mode allows the EUT to operate continuously at 100% Duty Cycle.

OUTPUT POWER

XMit 2020.12.30.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2022-01-19	2023-01-19
Generator - Signal	Keysight	N5182B	TEV	2021-04-27	2024-04-27
Block - DC	Fairview Microwave	SD3379	AMM	2021-09-14	2022-09-14
Attenuator	Fairview Microwave	SA4018-20	TYE	2021-09-15	2022-09-15
Cable	UtiFlex Micro-Coax	UFD1150A-1-0720-200200	TXK	2021-09-13	2022-09-13

TEST DESCRIPTION

The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

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

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

OUTPUT POWER

TbtTx 2021.10.29.2 XMit 2020.12.30.0

EUT:	**Radio Thermostat**			**Work Order:**	**F3EN0068**
Serial Number:	**Shielded Unit**			**Date:**	**28-Jan-22**
Customer:	**Quext**			**Temperature:**	**21.7 °C**
Attendees:	**None**			**Humidity:**	**24.2% RH**
Project:	**None**			**Barometric Pres.:**	**1035 mbar**
Tested by:	**Brandon Hobbs**	**Power:**	**110VAC/60Hz**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2022	**ANSI C63.10:2013**

COMMENTS

None

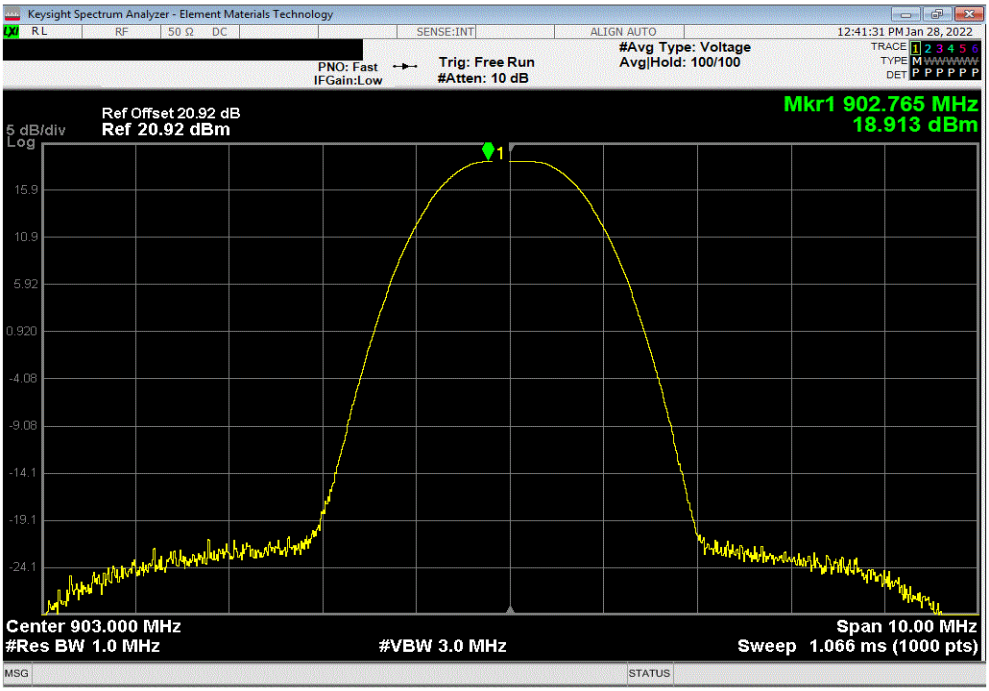
DEVIATIONS FROM TEST STANDARD

None

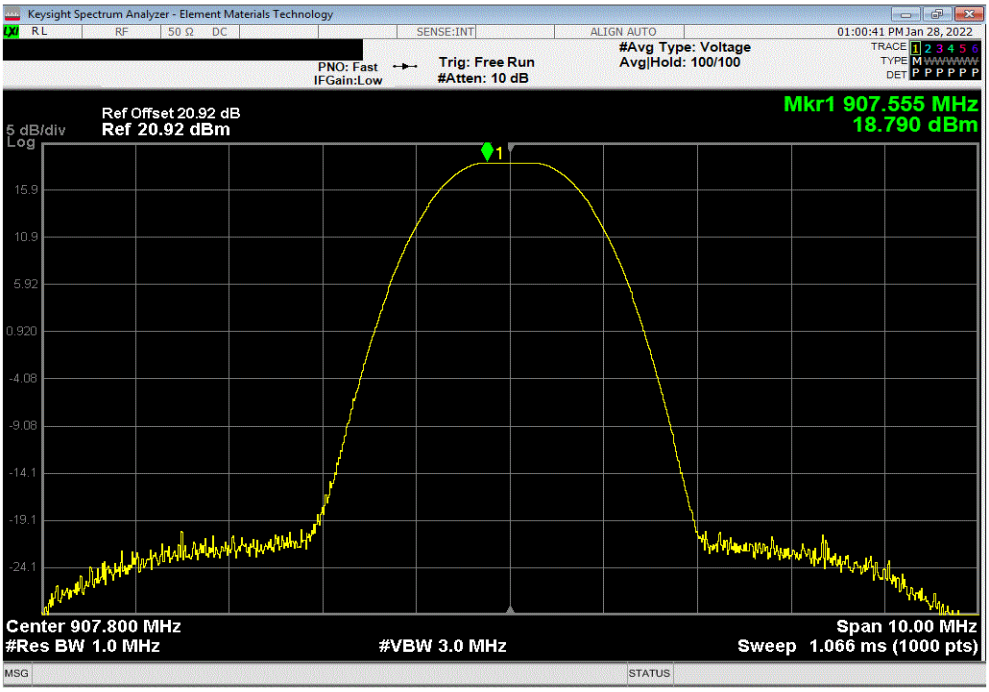
Configuration #	**5**	*Signature*

		Out Pwr (dBm)	**Limit (dBm)**	**Result**
LoRa DTS Radio				
	500 kHz Bandwidth			
	Low Channel 903 MHz	18.91	30	Pass
	Mid Channel 907.8 MHz	18.79	30	Pass
	High Channel 914.2 MHz	18.64	30	Pass

LoRa DTS Radio, 500 kHz Bandwidth, Low Channel 903 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				18.913	30	Pass

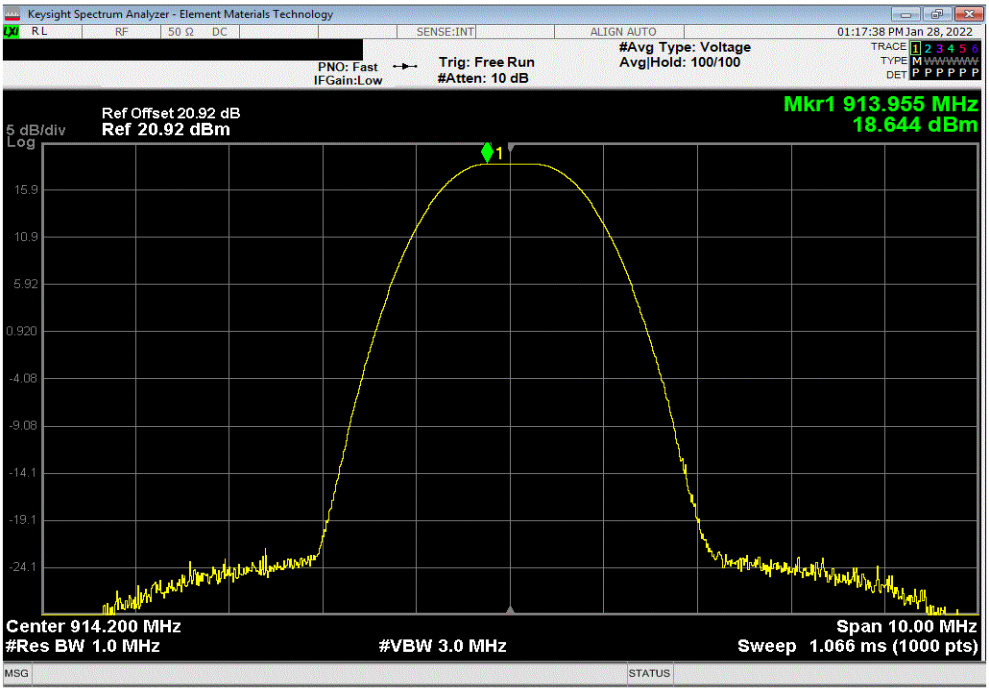


LoRa DTS Radio, 500 kHz Bandwidth, Mid Channel 907.8 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				18.79	30	Pass



OUTPUT POWER

LoRa DTS Radio, 500 kHz Bandwidth, High Channel 914.2 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				18.644	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
Cable	UtiFlex Micro-Coax	UFD1150A-1-0720-200200	TXK	2021-09-13	2022-09-13
Attenuator	Fairview Microwave	SA4018-20	TYE	2021-09-15	2022-09-15
Block - DC	Fairview Microwave	SD3379	AMM	2021-09-14	2022-09-14
Generator - Signal	Keysight	N5182B	TEV	2021-04-27	2024-04-27
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2022-01-19	2023-01-19

TEST DESCRIPTION

The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

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

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

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

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

element

TbtTx 2021.10.29.2 XMit 2020.12.30.0

EUT:	Radio Thermostat			**Work Order:**	F3EN0068
Serial Number:	Shielded Unit			**Date:**	28-Jan-22
Customer:	Quext			**Temperature:**	21.7 °C
Attendees:	None			**Humidity:**	24.2% RH
Project:	None			**Barometric Pres.:**	1035 mbar
Tested by:	Brandon Hobbs	**Power:**	110VAC/60Hz	**Job Site:**	TX09

TEST SPECIFICATIONS	Test Method
FCC 15.247:2022	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

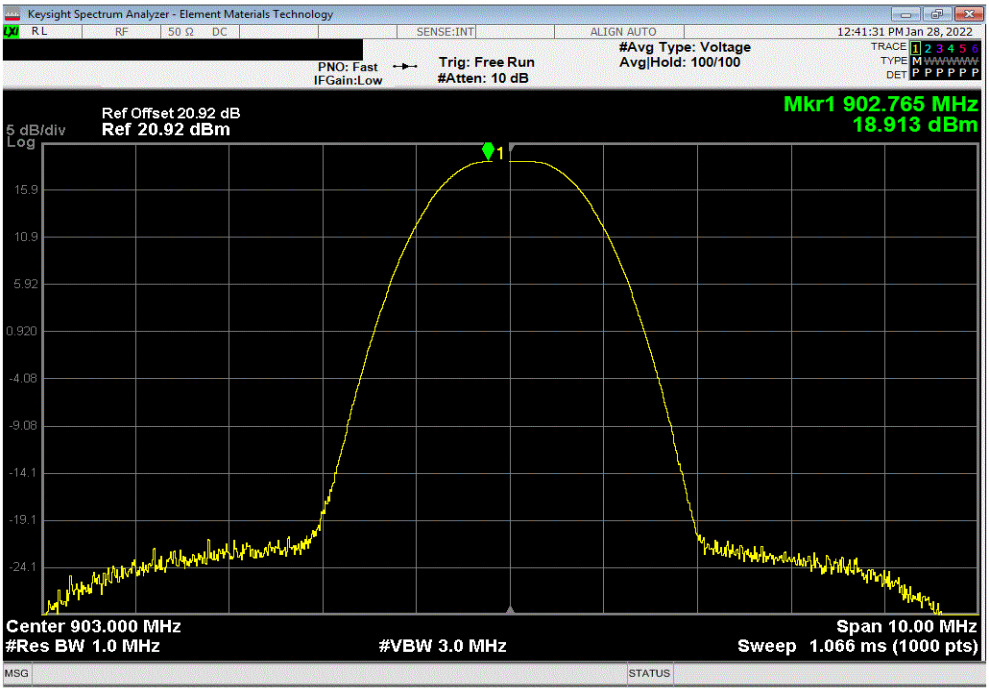
None

Configuration #	5	Signature

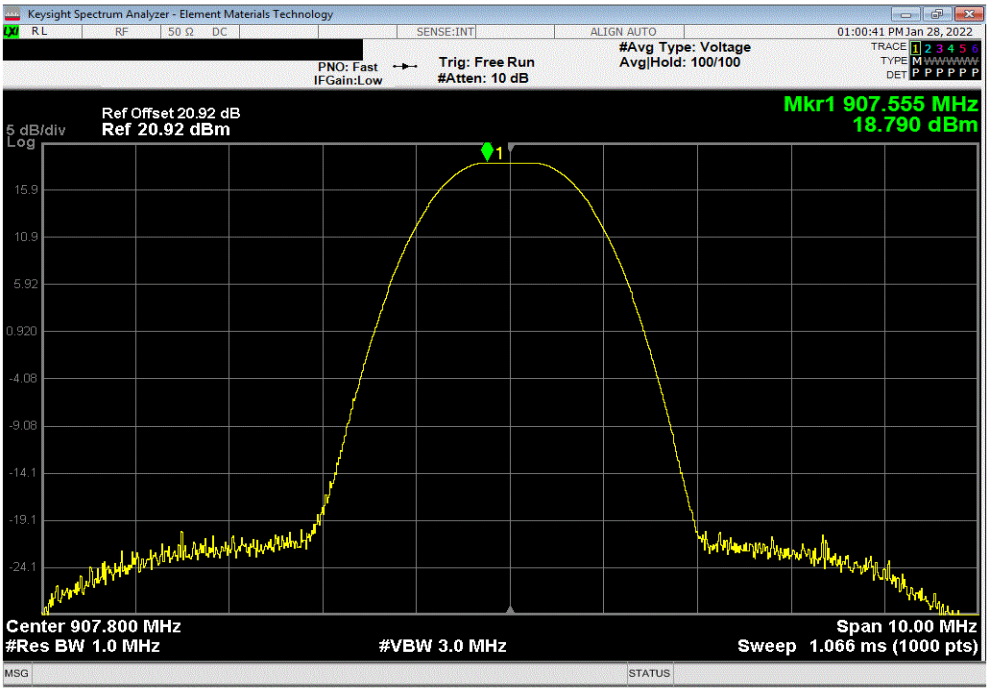
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
LoRa DTS Radio						
	500 kHz Bandwidth					
	Low Channel 903 MHz	18.91	0.9	19.81	36	Pass
	Mid Channel 907.8 MHz	18.79	0.9	19.69	36	Pass
	High Channel 914.2 MHz	18.64	0.9	19.54	36	Pass

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

LoRa DTS Radio, 500 kHz Bandwidth, Low Channel 903 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		18.913	0.9	19.813	36	Pass

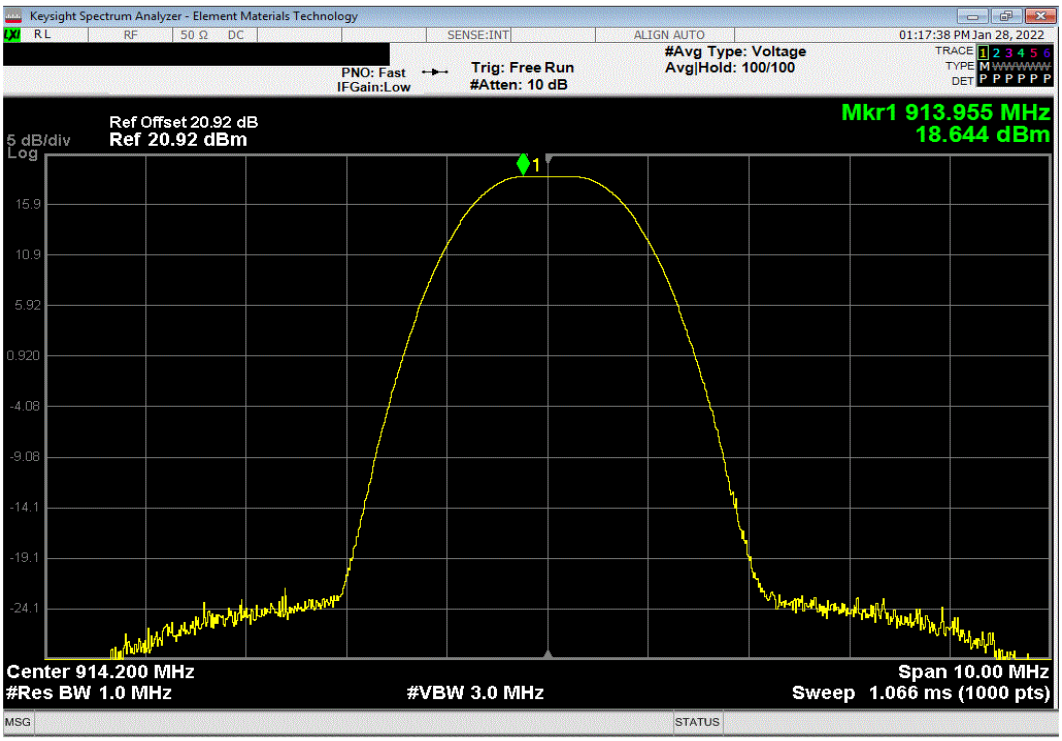


LoRa DTS Radio, 500 kHz Bandwidth, Mid Channel 907.8 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		18.79	0.9	19.69	36	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

LoRa DTS Radio, 500 kHz Bandwidth, High Channel 914.2 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		18.644	0.9	19.544	36	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
Attenuator	Fairview Microwave	SA4018-20	TYE	2021-09-15	2022-09-15
Block - DC	Fairview Microwave	SD3379	AMM	2021-09-14	2022-09-14
Cable	UtiFlex Micro-Coax	UFD1150A-1-0720-200200	TXK	2021-09-13	2022-09-13
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2022-01-19	2023-01-19
Generator - Signal	Keysight	N5182B	TEV	2021-04-27	2024-04-27

TEST DESCRIPTION

The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in each available band. The channels closest to the band edges were selected. The EUT was transmitting at the data rate(s) listed in the datasheet.

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

BAND EDGE COMPLIANCE

element

TbtTx 2021.10.29.2 XMit 2020.12.30.0

EUT:	**Radio Thermostat**			**Work Order:**	**F3EN0068**
Serial Number:	**Shielded Unit**			**Date:**	**28-Jan-22**
Customer:	**Quext**			**Temperature:**	**21.7 °C**
Attendees:	**None**			**Humidity:**	**24.2% RH**
Project:	**None**			**Barometric Pres.:**	**1035 mbar**
Tested by:	**Brandon Hobbs**	**Power:**	**110VAC/60Hz**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2022	**ANSI C63.10:2013**

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

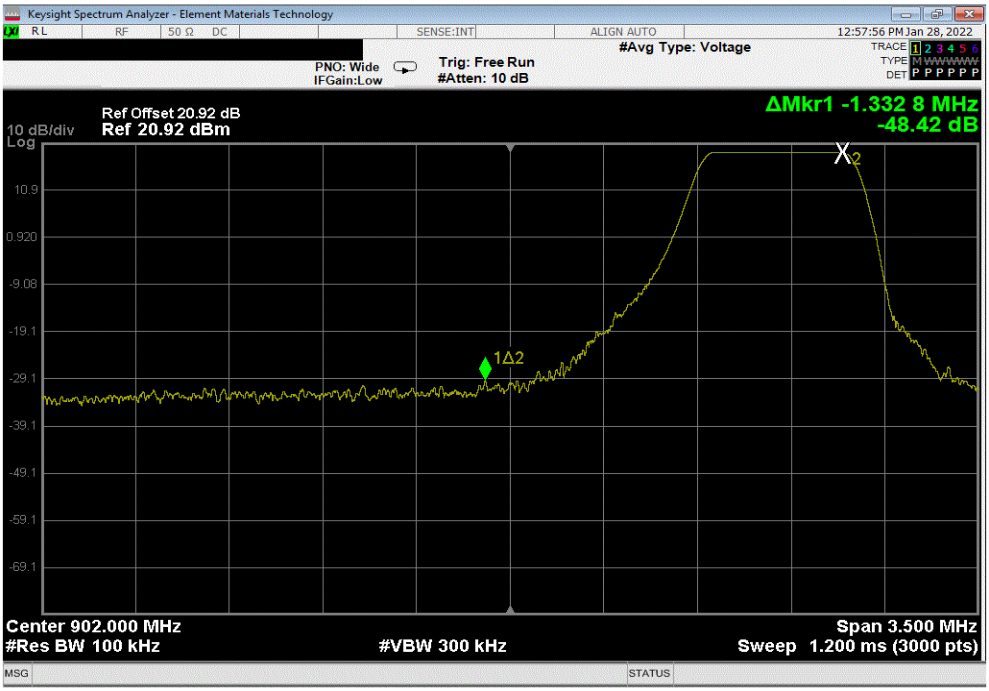
None

Configuration #	**5**	*Signature*

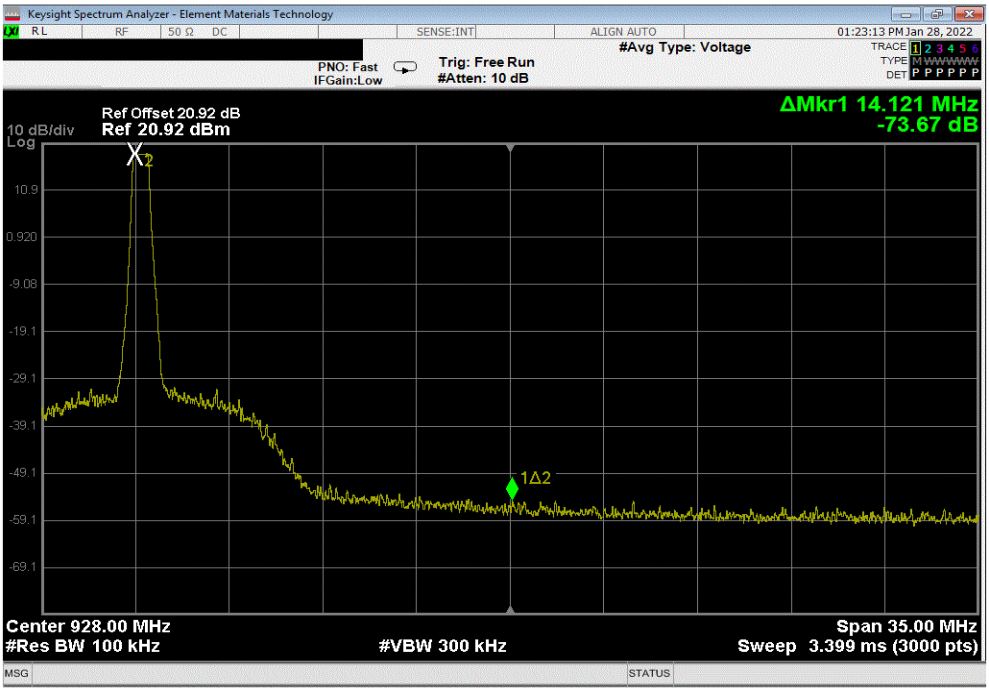
		Value (dBc)	**Limit ≤ (dBc)**	**Result**
LoRa DTS Radio				
	500 kHz Bandwidth			
	Low Channel 903 MHz	-48.42	-20	Pass
	High Channel 914.2 MHz	-73.67	-20	Pass

BAND EDGE COMPLIANCE

LoRa DTS Radio, 500 kHz Bandwidth, Low Channel 903 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-48.42	-20	Pass



LoRa DTS Radio, 500 kHz Bandwidth, High Channel 914.2 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-73.67	-20	Pass



OCCUPIED BANDWIDTH - DTS

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
Cable	UtiFlex Micro-Coax	UFD1150A-1-0720-200200	TXK	2021-09-13	2022-09-13
Attenuator	Fairview Microwave	SA4018-20	TYE	2021-09-15	2022-09-15
Block - DC	Fairview Microwave	SD3379	AMT	2021-09-14	2022-09-14
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	2021-08-25	2022-08-25
Generator - Signal	Keysight	N5182B	TEV	2021-04-27	2024-04-27

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 - DTS

element

TbtTx 2021.10.29.2 XMit 2020.12.30.0

EUT:	**Radio Thermostat**			**Work Order:**	**F3EN0068**
Serial Number:	**DUT2**			**Date:**	**6-Dec-21**
Customer:	**Quext**			**Temperature:**	**22.9 °C**
Attendees:	**None**			**Humidity:**	**36.7% RH**
Project:	**None**			**Barometric Pres.:**	**1026 mbar**
Tested by:	**Brandon Hobbs**	**Power:**	**110VAC/60Hz**	**Job Site:**	**TX09**

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

COMMENTS

None

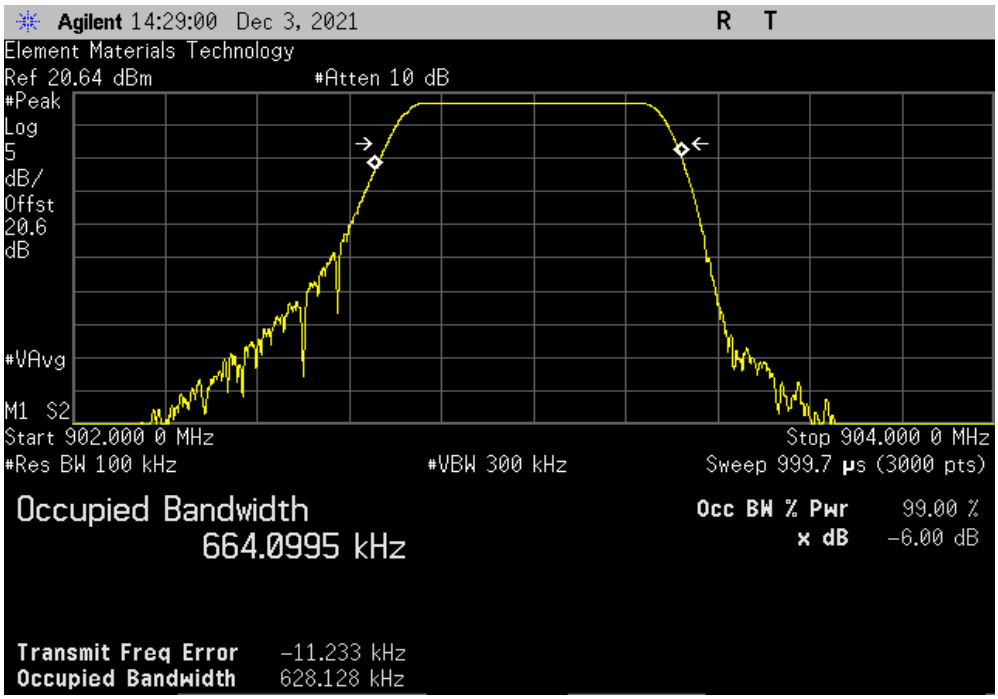
DEVIATIONS FROM TEST STANDARD

None

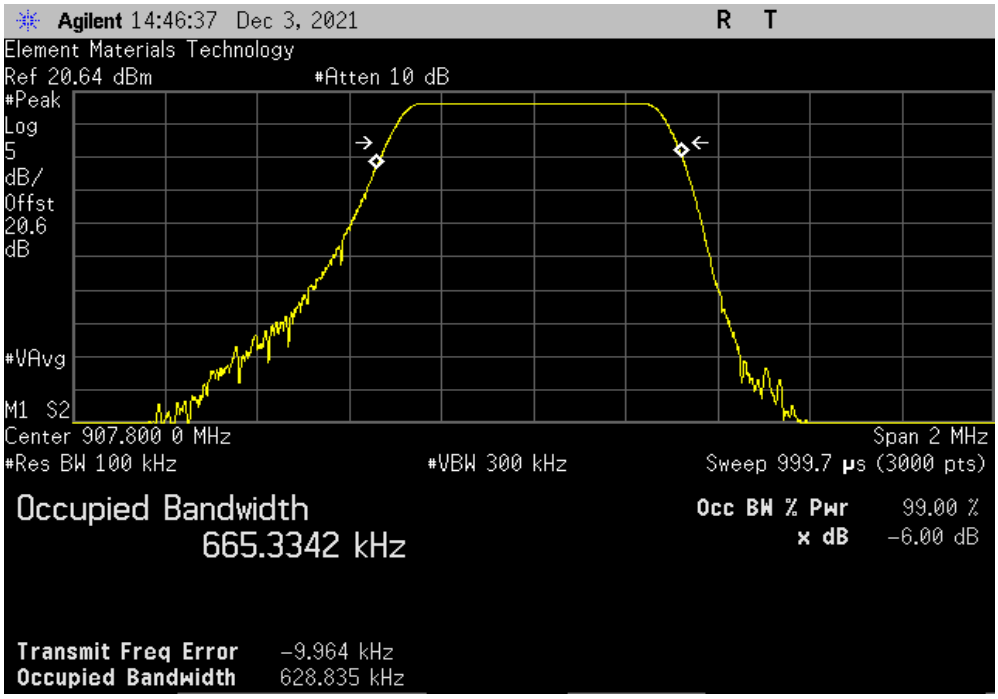
Configuration #	**1**	*Signature*

	Value	**Limit (>)**	**Result**
Lora DTS Radio 902 - 928 MHz			
500 kHz Bandwidth, Spreading Factor 8			
Low Channel 903 MHz	628.128 kHz	500 kHz	Pass
Mid Channel 907.8 MHz	628.835 kHz	500 kHz	Pass
High Channel 914.2 MHz	626.655 kHz	500 kHz	Pass

Lora DTS Radio 902 - 928 MHz, 500 kHz Bandwidth, Spreading Factor 8, Low Channel 903 MHz						
				Value	Limit (>)	Result
				628.128 kHz	500 kHz	Pass



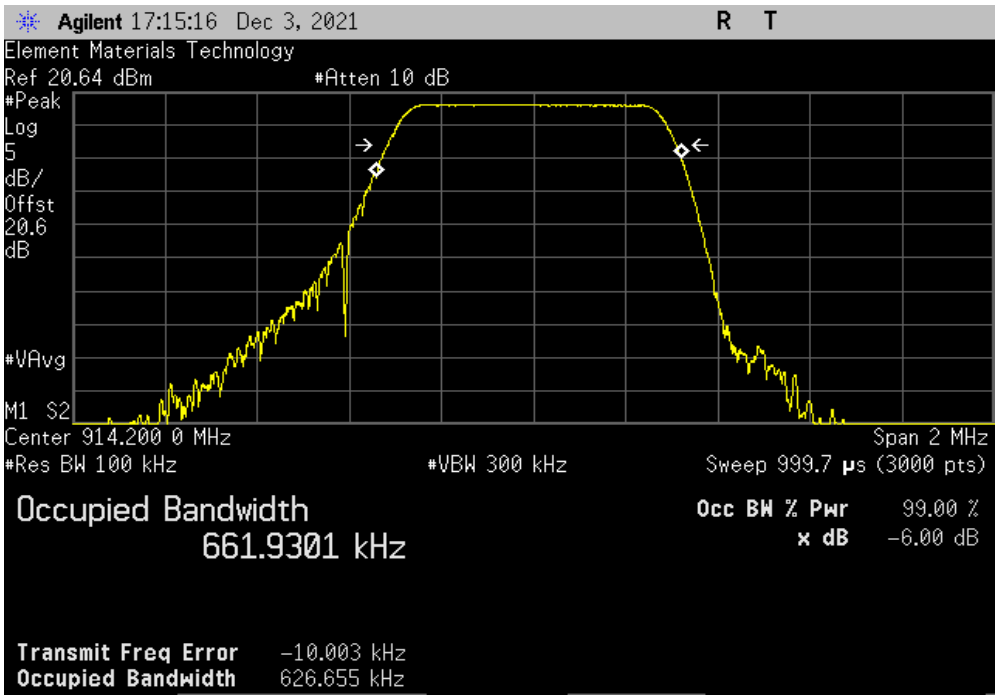
Lora DTS Radio 902 - 928 MHz, 500 kHz Bandwidth, Spreading Factor 8, Mid Channel 907.8 MHz						
				Value	Limit (>)	Result
				628.835 kHz	500 kHz	Pass



OCCUPIED BANDWIDTH - DTS

TbtTx 2021.10.29.2 XMit 2020.12.30.0

Lora DTS Radio 902 - 928 MHz, 500 kHz Bandwidth, Spreading Factor 8, High Channel 914.2 MHz						
				Value	Limit (>)	Result
				626.655 kHz	500 kHz	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2020.12.30.0

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TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2022-01-19	2023-01-19
Generator - Signal	Keysight	N5182B	TEV	2021-04-27	2024-04-27
Block - DC	Fairview Microwave	SD3379	AMM	2021-09-14	2022-09-14
Attenuator	Fairview Microwave	SA4018-20	TYE	2021-09-15	2022-09-15
Cable	UtiFlex Micro-Coax	UFD1150A-1-0720-200200	TXK	2021-09-13	2022-09-13

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

element

TbtTx 2021.10.29.2 XMit 2020.12.30.0

EUT:	**Radio Thermostat**			**Work Order:**	**F3EN0068**
Serial Number:	**Shielded Unit**			**Date:**	**28-Jan-22**
Customer:	**Quext**			**Temperature:**	**21.7 °C**
Attendees:	**None**			**Humidity:**	**24.2% RH**
Project:	**None**			**Barometric Pres.:**	**1035 mbar**
Tested by:	**Brandon Hobbs**	**Power:**	**110VAC/60Hz**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2022	**ANSI C63.10:2013**

COMMENTS

None

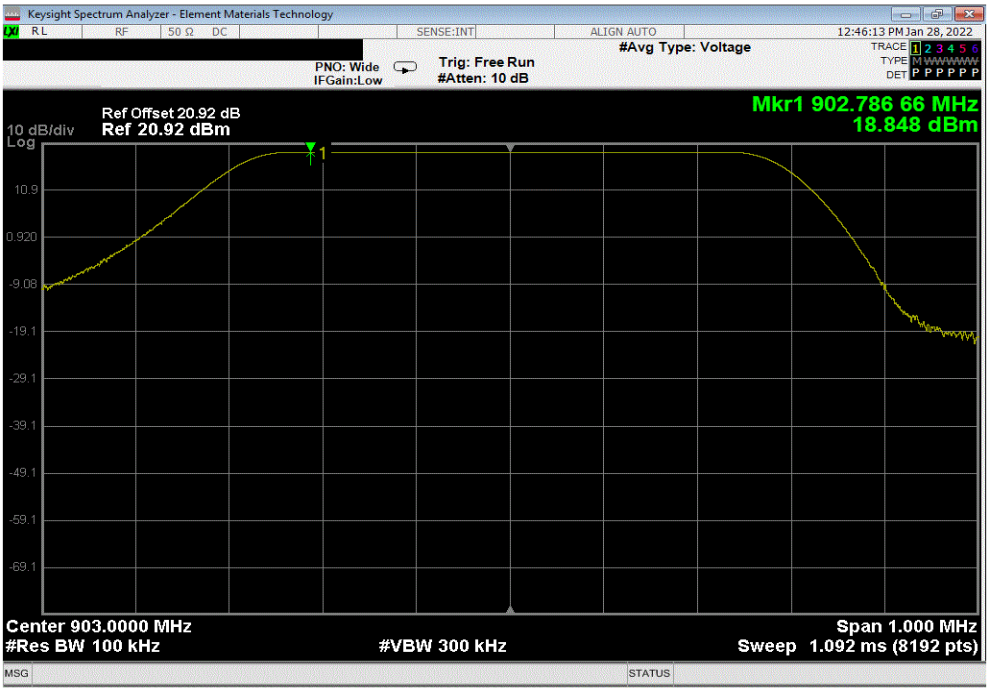
DEVIATIONS FROM TEST STANDARD

None

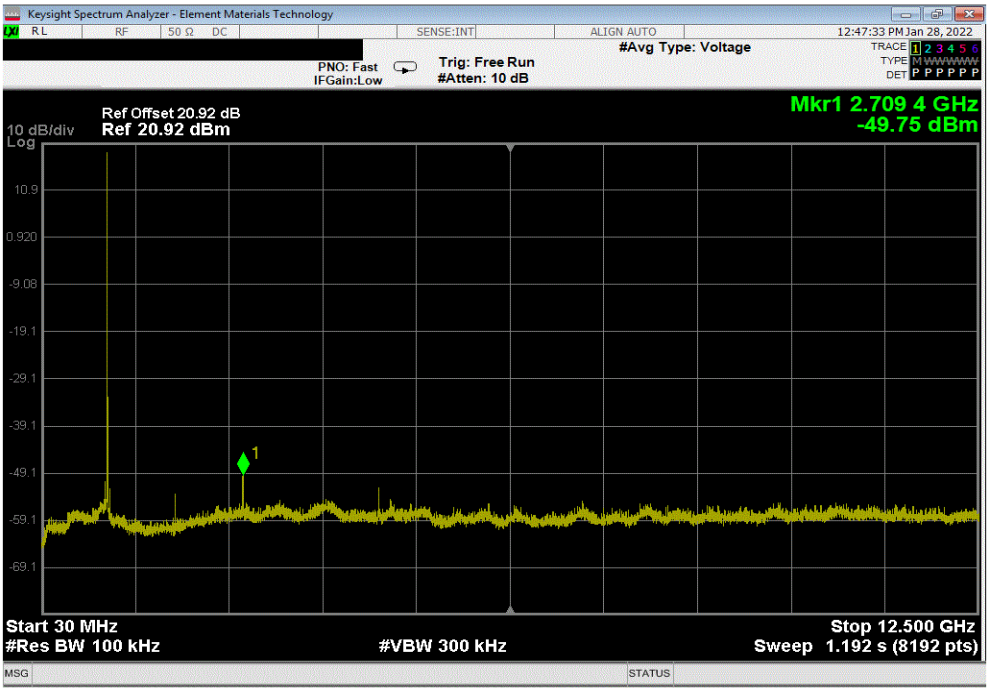
Configuration #	**5**	*Signature*

		Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
LoRa DTS Radio						
	500 kHz Bandwidth					
	Low Channel 903 MHz	Fundamental	902.79	N/A	N/A	N/A
	Low Channel 903 MHz	30 MHz - 12.5 GHz	2709.43	-68.6	-20	Pass
	Mid Channel 907.8 MHz	Fundamental	907.65	N/A	N/A	N/A
	Mid Channel 907.8 MHz	30 MHz - 12.5 GHz	2723.13	-68.84	-20	Pass
	High Channel 914.2 MHz	Fundamental	913.97	N/A	N/A	N/A
	High Channel 914.2 MHz	30 MHz - 12.5 GHz	2742.92	-69.25	-20	Pass

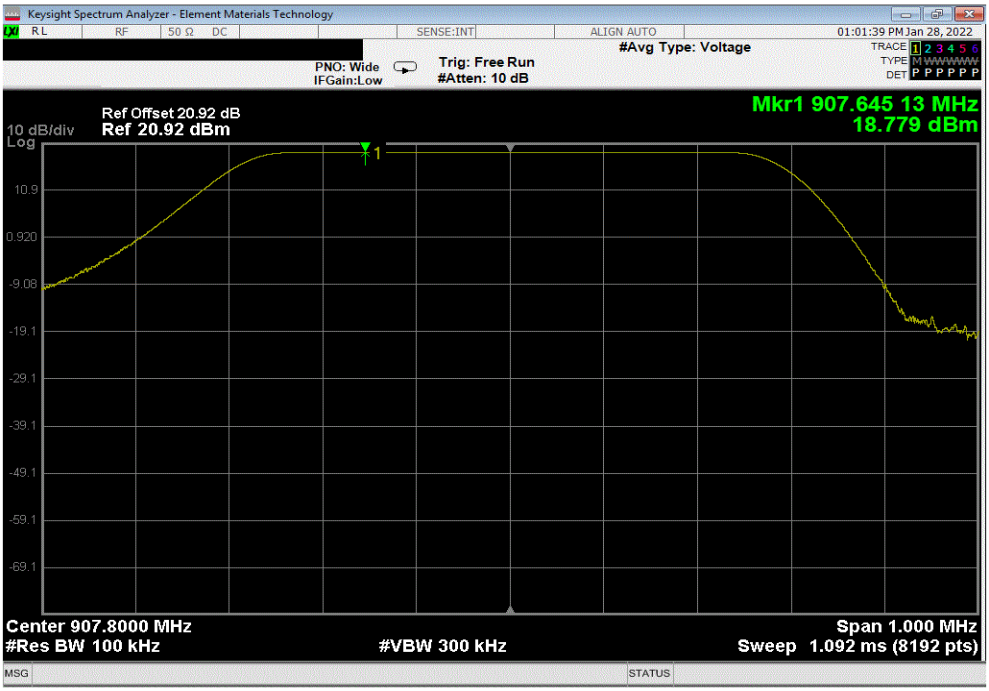
LoRa DTS Radio, 500 kHz Bandwidth, Low Channel 903 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	902.79	N/A	N/A	N/A



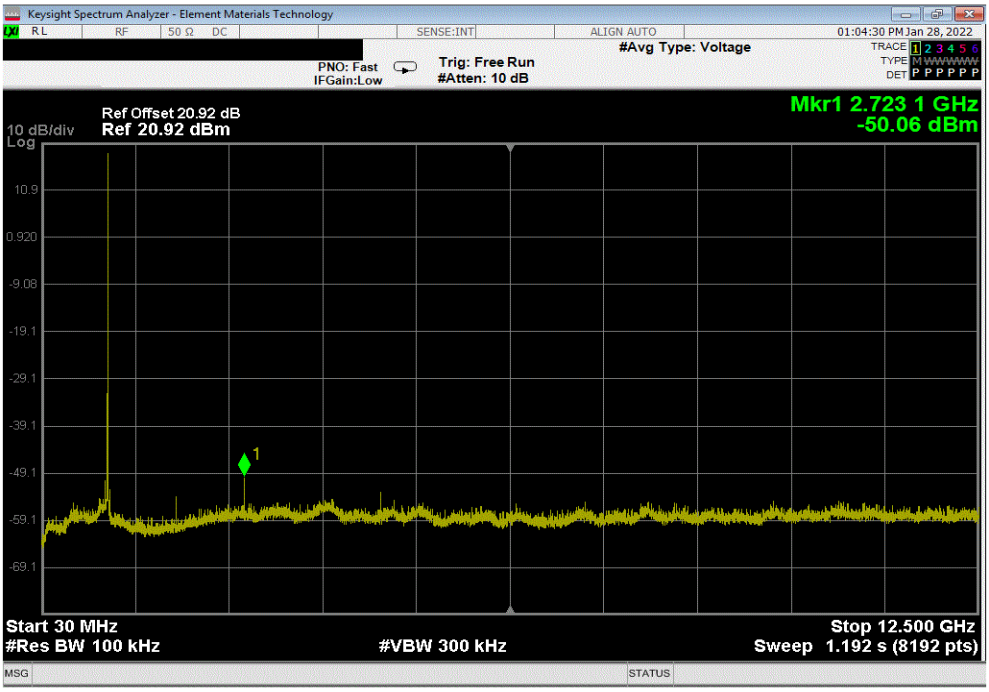
LoRa DTS Radio, 500 kHz Bandwidth, Low Channel 903 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	2709.43	-68.6	-20	Pass



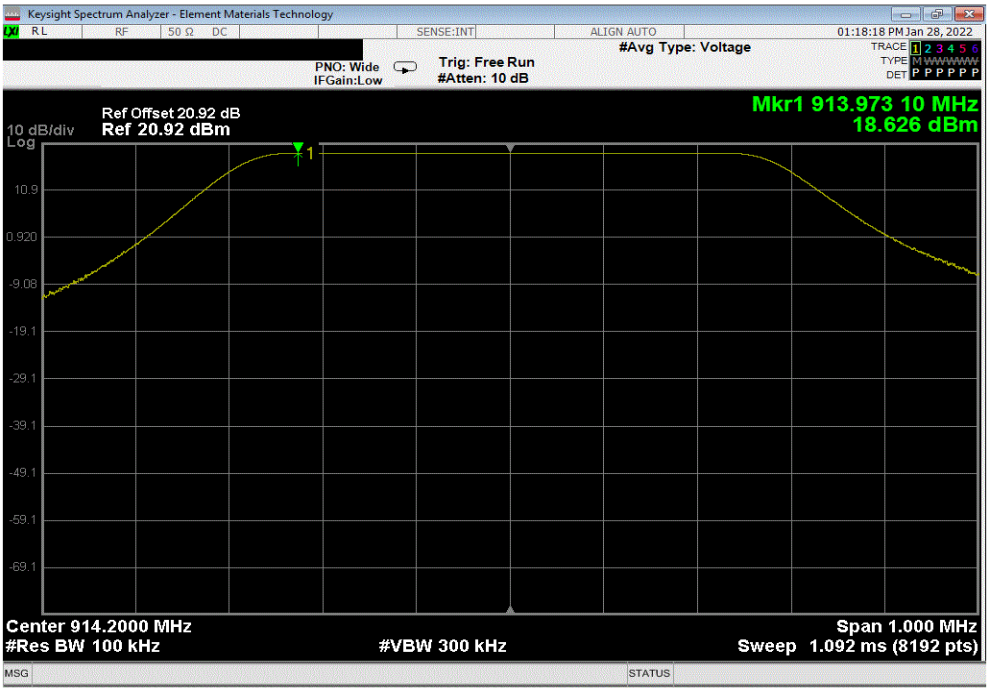
LoRa DTS Radio, 500 kHz Bandwidth, Mid Channel 907.8 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	907.65	N/A	N/A	N/A



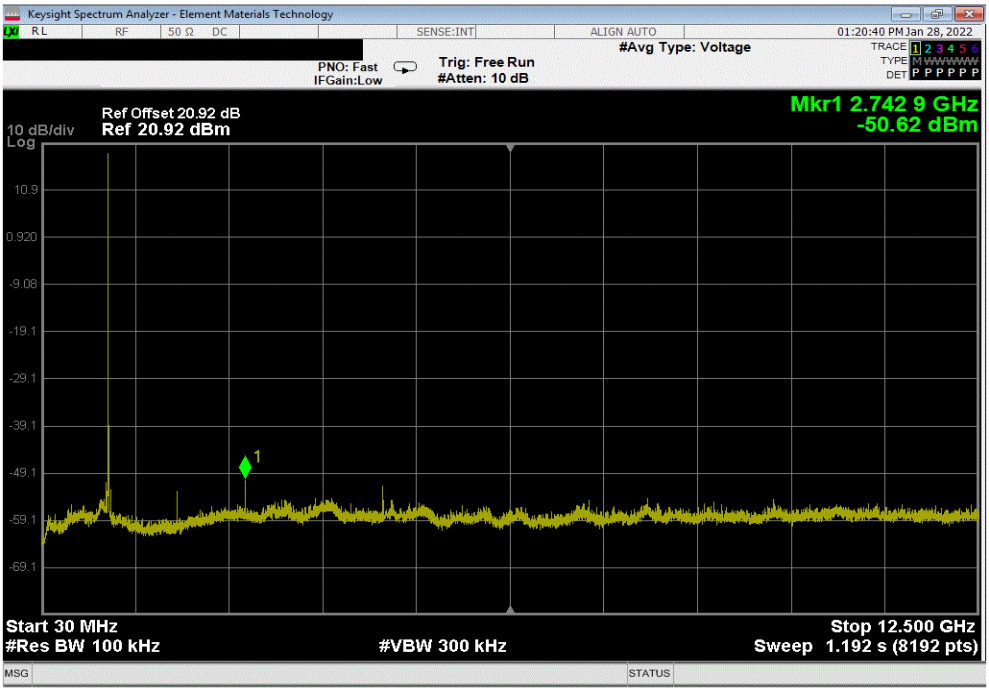
LoRa DTS Radio, 500 kHz Bandwidth, Mid Channel 907.8 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	2723.13	-68.84	-20	Pass



LoRa DTS Radio, 500 kHz Bandwidth, High Channel 914.2 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	913.97	N/A	N/A	N/A



LoRa DTS Radio, 500 kHz Bandwidth, High Channel 914.2 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	2742.92	-69.25	-20	Pass



POWER SPECTRAL DENSITY

XMit 2020.12.30.0

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TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TEV	2021-04-27	2024-04-27
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2022-01-19	2023-01-19
Block - DC	Fairview Microwave	SD3379	AMM	2021-09-14	2022-09-14
Attenuator	Fairview Microwave	SA4018-20	TYE	2021-09-15	2022-09-15
Cable	UtiFlex Micro-Coax	UFD1150A-1-0720-200200	TXK	2021-09-13	2022-09-13

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

element

TbtTx 2021.10.29.2 XMit 2020.12.30.0

EUT:	**Radio Thermostat**			**Work Order:**	**F3EN0068**
Serial Number:	**Shielded Unit**			**Date:**	**28-Jan-22**
Customer:	**Quext**			**Temperature:**	**21.7 °C**
Attendees:	**None**			**Humidity:**	**24.2% RH**
Project:	**None**			**Barometric Pres.:**	**1035 mbar**
Tested by:	**Brandon Hobbs**	**Power:**	**110VAC/60Hz**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2022	**ANSI C63.10:2013**

COMMENTS

None

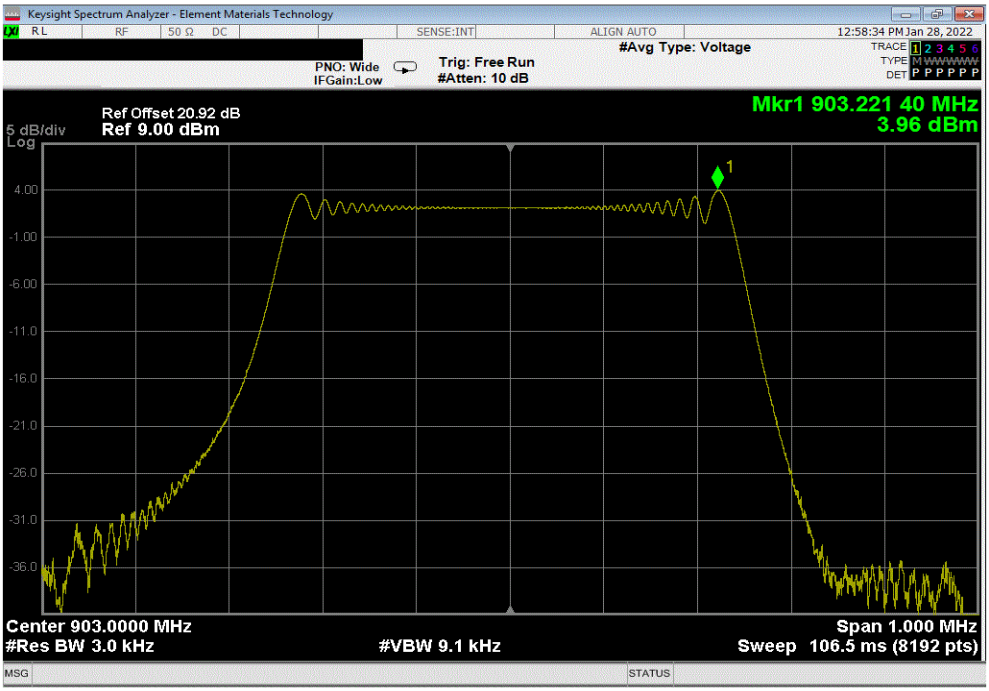
DEVIATIONS FROM TEST STANDARD

None

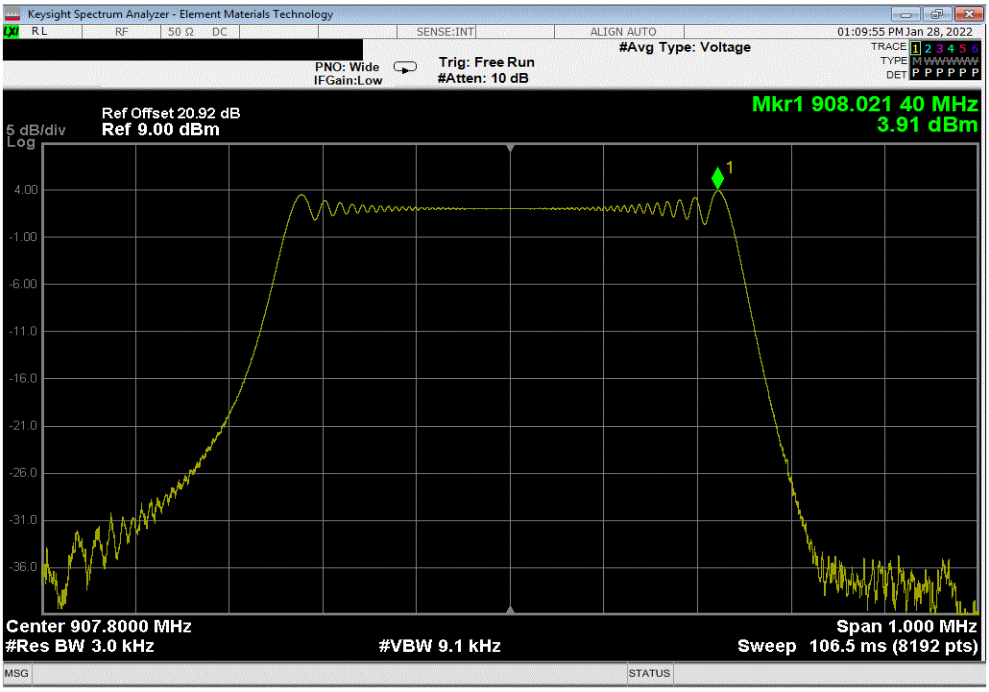
Configuration #	**5**	*Signature*

		Value dBm/3kHz	**Limit < dBm/3kHz**	**Results**
LoRa DTS Radio				
	500 kHz Bandwidth			
	Low Channel 903 MHz	3.96	8	Pass
	Mid Channel 907.8 MHz	3.91	8	Pass
	High Channel 914.2 MHz	3.48	8	Pass

LoRa DTS Radio, 500 kHz Bandwidth, Low Channel 903 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				3.963	8	Pass



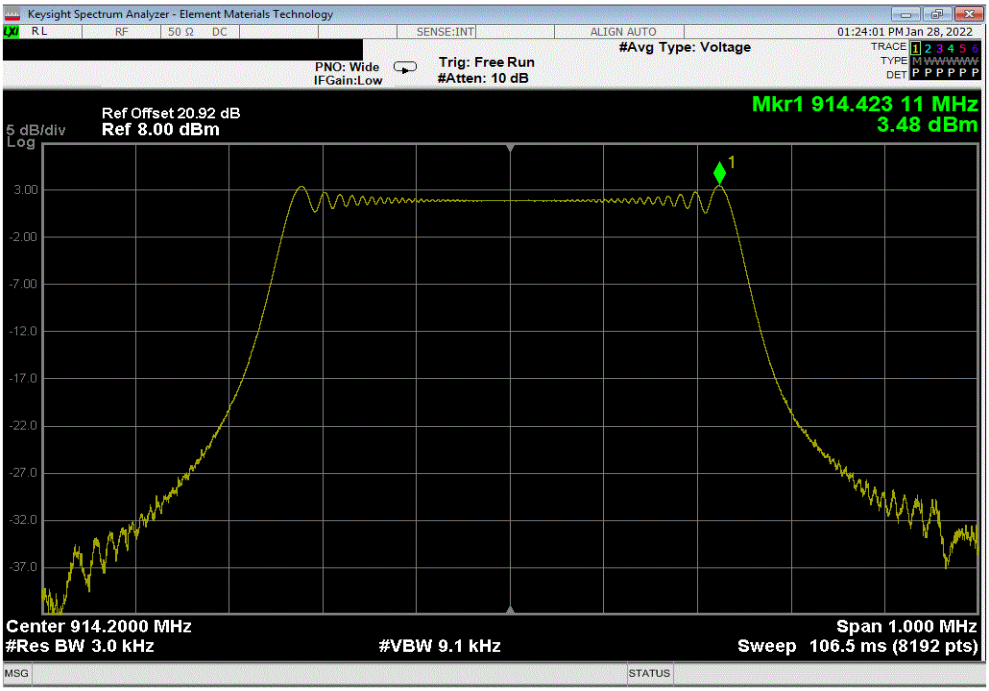
LoRa DTS Radio, 500 kHz Bandwidth, Mid Channel 907.8 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				3.906	8	Pass



POWER SPECTRAL DENSITY

TbtTx 2021.10.29.2 XMit 2020.12.30.0

LoRa DTS Radio, 500 kHz Bandwidth, High Channel 914.2 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				3.48	8	Pass



End of Test Report