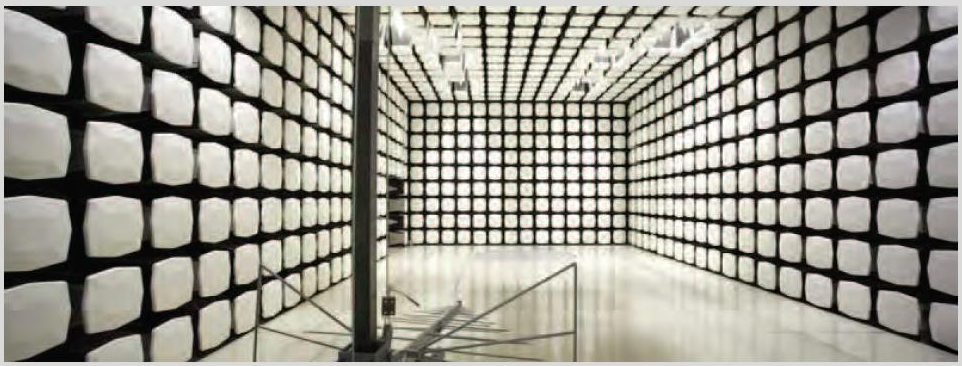
Multi-Tech Systems, Inc.

MTXDOT-NA1

902 - 928 MHz Other Wideband (DTS) Transceiver

Report: MLTI0353.0 Rev. 0, Issue Date: February 21, 2024



CERT #3310.05

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CERTIFICATE OF TEST

Last Date of Test: February 7, 2024
Multi-Tech Systems, Inc.
EUT: MTXDOT-NA1

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2024	ANSI C63.10:2013
FCC 15.247:2024	
RSS-247 Issue 3:2023	
RSS-Gen Issue 5:2018+A1:2019+A2:2021	

Guidance

FCC KDB 558074 v05r02:2019

Results

Test Description	Result	FCC Section(s)	RSS Section(s)	ANSI C63.10 Section(s)	Comments
Powerline Conducted Emissions (Transmitter)	Pass	15.207	RSS-Gen 8.8	6.2	
Spurious Radiated Emissions	Pass	15.247(d), KDB 558074 -8.6, 8.7	RSS-247 5.5	6.5, 6.6, 11.12.1, 11.13.2	
Duty Cycle	N/A	15.247, KDB 558074 -6.0	RSS-Gen 3.2	11.6	
Carrier Frequency Separation	N/A	15.247(a)(1)	RSS-247 5.1(b)	7.8.2	Not required for DTS devices.
Number of Hopping Frequencies	N/A	15.247(a)(1)	RSS-247 5.1(d)	7.8.3	Not required for DTS devices.
Dwell Time	N/A	15.247(a)(1)	RSS-247 5.1(d)	7.8.4	Not required for DTS devices.
Output Power	Pass	15.247(b), KDB 558074 -8.3	RSS-247 5.4(d)	11.9.1.1	
Equivalent Isotropic Radiated Power (EIRP)	Pass	15.247(b), KDB 558074 -8.3	RSS-247 5.4(d)	11.9.1.1	
Band Edge Compliance	Pass	15.247(d), KDB 558074 -8.5	RSS-247 5.5	11.11	
Band Edge Compliance - Hopping Mode	N/A	15.247(d)	RSS-247 5.5	7.8.6	Not required for DTS devices.

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.

CERTIFICATE OF TEST

DTS Bandwidth (6 dB)	Pass	15.247(a), KDB 558074 -8.2	RSS-247 5.2(a)	11.8.2	
Occupied Bandwidth (99%)	Pass	KDB 558074 -2.1	RSS-Gen 6.7	6.9.3	
Spurious Conducted Emissions	Pass	15.247(d), KDB 558074 -8.5	RSS-247 5.5	11.11	
Power Spectral Density	Pass	15.247(e), KDB 558074 -8.4	RSS-247 5.2(b)	11.10.2	
Powerline Conducted Emissions (Receiver)	N/A	15.101, 15.107	RSS-Gen 5.2	ANSI C63.4 - 12.2.4	Not included per FCC 15.101 as this will be covered under SDoC rules for the FCC. RSS-Gen section 7 stated receiver requirements only apply to standalone receivers operating in the 30-960 MHz band and this is not a standalone receiver.
Radiated Emissions for Receiver	N/A	15.101, 15.109	RSS-Gen 5.2	ANSI C63.4 - 12.2.5	Not included per FCC 15.101 as this will be covered under SDoC rules for the FCC. RSS-Gen section 7 stated receiver requirements only apply to standalone receivers operating in the 30-960 MHz band and this is not a standalone receiver.

Deviations From Test Standards

None

Approved By:

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

Canada

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

European Union

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

United Kingdom

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

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

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

SCOPE

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

California Minnesota Oregon Texas Washington

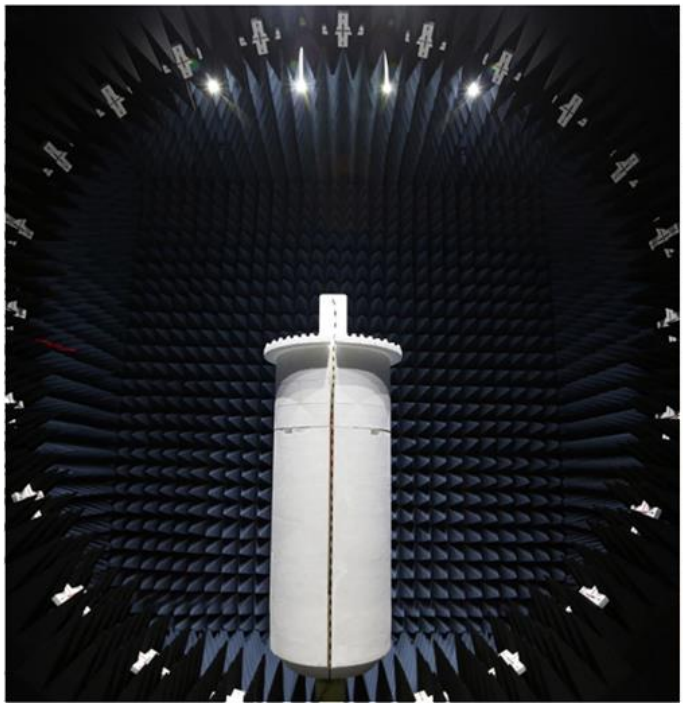
FACILITIES

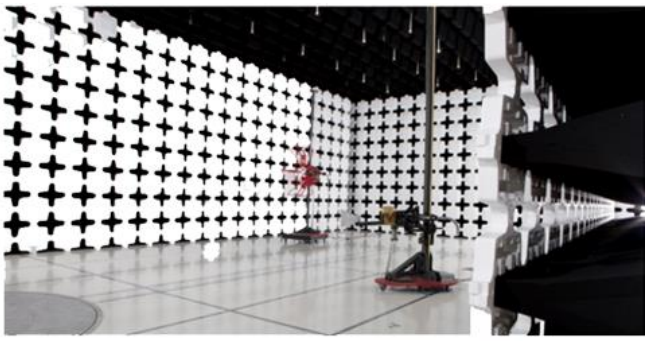
Testing was performed at the following location(s)

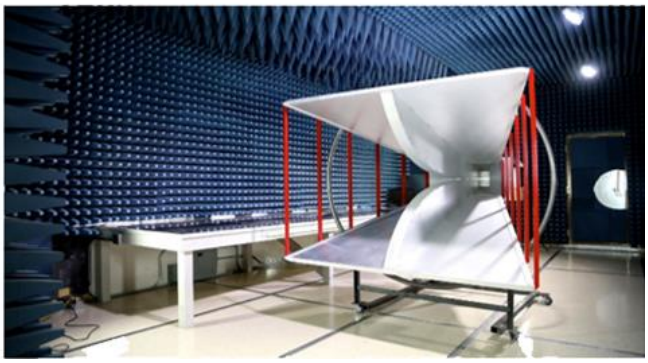
	Location	Labs (1)	Address	A2LA (2)	ISED (3)	BSMI (4)	VCCI (5)	CAB (6)	FDA (7)
☐	California	OC01-17	41 Tesla Irvine, CA 92618 (949) 861-8918	3310.04	2834B	SL2-IN-E-1154R	A-0029	US0158	TL-55
☒	Minnesota	MN01-11	9349 W Broadway Ave. Brooklyn Park, MN 55445 (612) 638-5136	3310.05	2834E	SL2-IN-E-1152R	A-0109	US0175	TL-57
☐	Oregon	EV01-12	6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	3310.02	2834D	SL2-IN-E-1017	A-0108	US0017	TL-56
☐	Texas	TX01-09	3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	3310.03	2834G	SL2-IN-E-1158R	A-0201	US0191	TL-54
☐	Washington	NC01-05	19201 120th Ave NE Bothell, WA 98011 (425) 984-6600	3310.06	2834F	SL2-IN-E-1153R	A-0110	US0157	TL-67
☐	Offsite	N/A	See Product Description	N/A	N/A	N/A	N/A	N/A	N/A

See data sheets for specific labs

(1) The lab designations denote individual rooms within each location. (OC01, OC02, OC03, etc.)
(2) A2LA Certificate No.
(3) ISED Company No.
(4) BSMI No.
(5) VCCI Site Filing No.
(6) CAB Identifier. Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA
(7) FDA ASCA No.







MEASUREMENT UNCERTAINTY

element
TMU.2015.07.10

Measurement Uncertainty

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

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

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

Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	3.2 dB	-3.2 dB

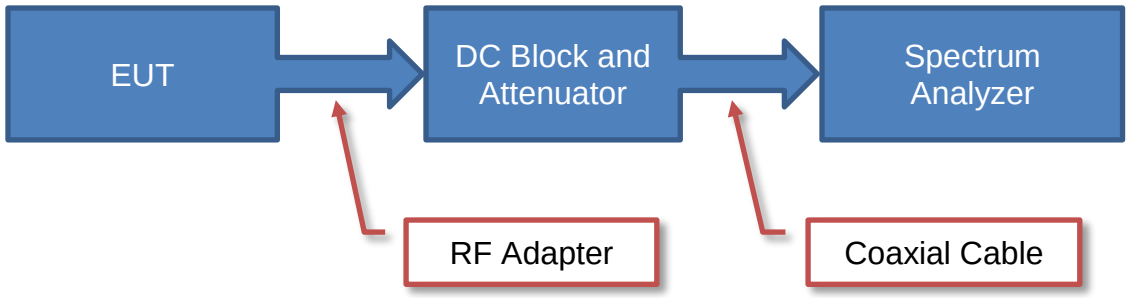
TEST SETUP BLOCK DIAGRAMS

Measurement Bandwidths

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

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

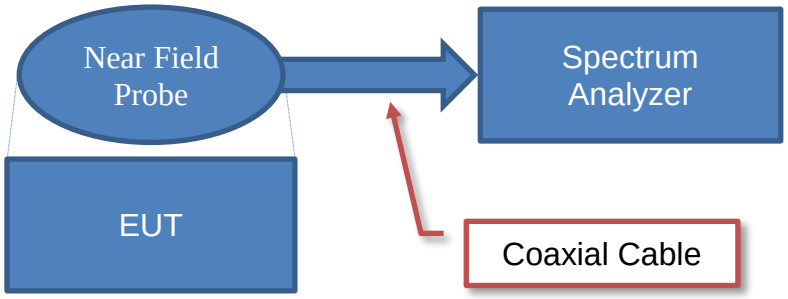
Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

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

Near Field Test Fixture Measurements

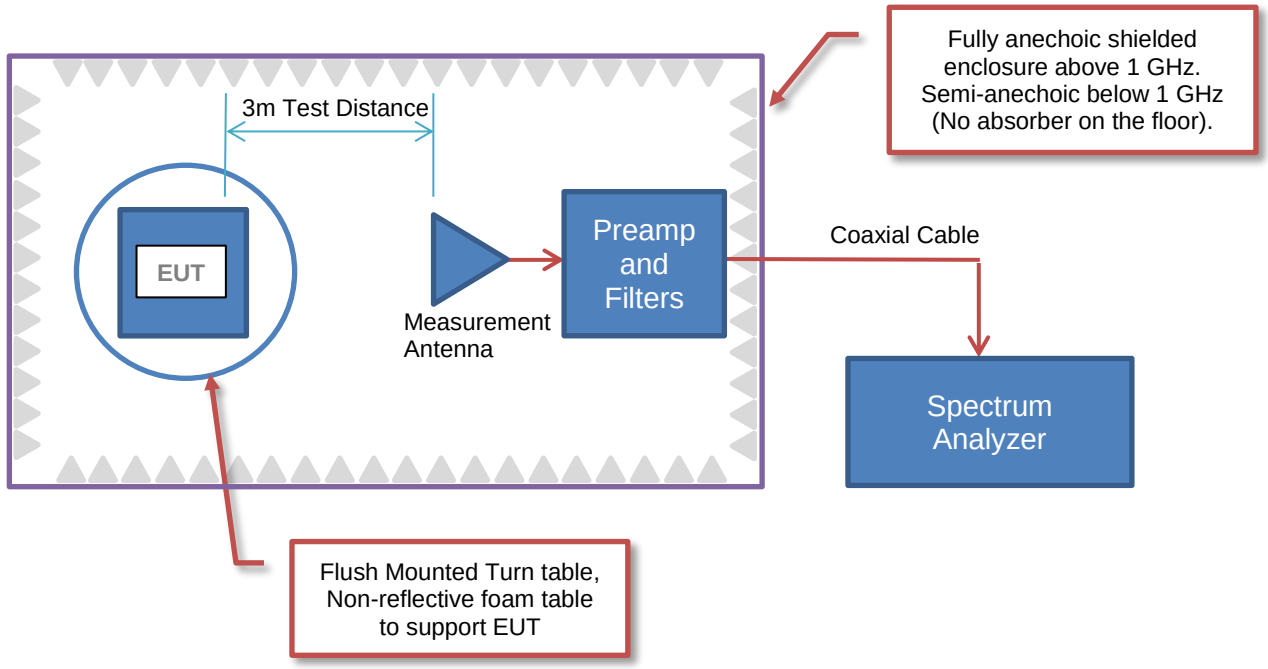


Sample Calculation (logarithmic units)

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

TEST SETUP BLOCK DIAGRAMS

Emissions Measurements



Sample Calculation (logarithmic units)

Radiated Emissions:

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**

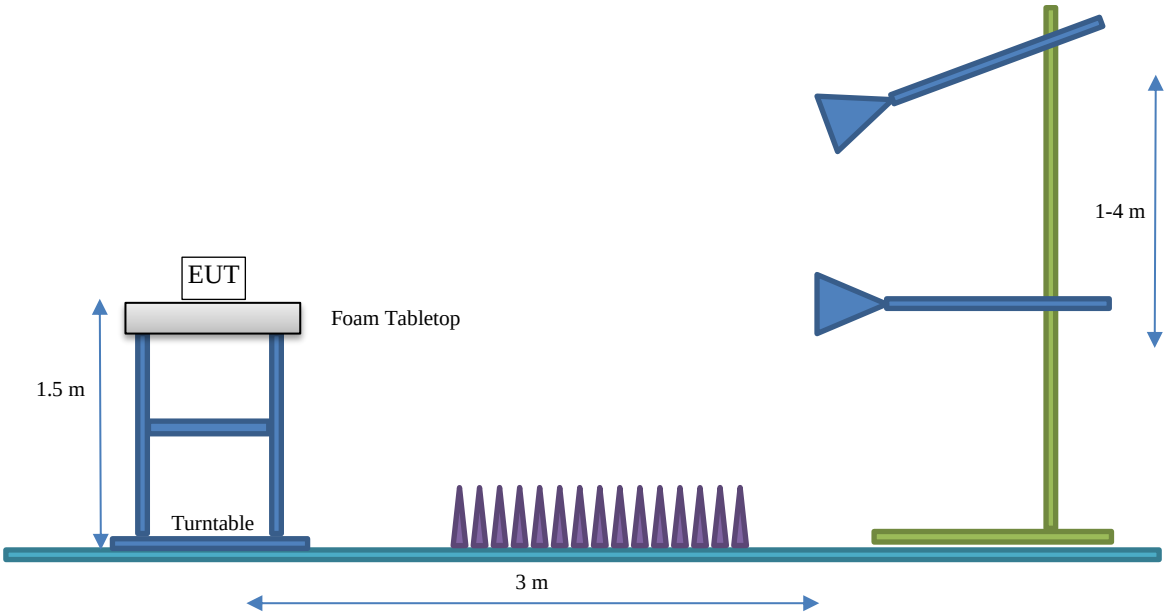
Radiated Power (ERP/EIRP) – Substitution Method:

Measured Level into Substitution Antenna (Amplitude dBm)		Substitution Antenna Factor (dBi)		EIRP to ERP (if applicable)		Measured power (dBm ERP/EIRP)
10.0	+	6.0	-	2.15	=	**13.9/16.0**

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:	Multi-Tech Systems, Inc.
Address:	2205 Woodale Dr
City, State, Zip:	Mounds View, MN 55112
Test Requested By:	Tim Gunn
EUT:	MTXDOT-NA1
First Date of Test:	February 7, 2024
Last Date of Test:	February 7, 2024
Receipt Date of Samples:	February 7, 2024
Equipment Design Stage:	Prototype
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
The MTXDOT15 is a LoRaWANTM, low-power RF device, capable of two-way communication over long distances, deep into buildings, or within noisy environments using the unlicensed ISM bands in North America, Europe and worldwide.

Testing Objective:
Seeking to demonstrate compliance in the 902 - 928 MHz band for operation under FCC 15.247:2024 and RSS-247 Issue 3:2023, RSS-Gen Issue 5:2018+A1:2019+A2:2021 specifications under technology category Other.

CONFIGURATIONS

Configuration MLTI0353-1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
MTXDOT-NA1	Multi-Tech Systems, Inc.	MTXDOT-NA1	B1235-NA1

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Lenovo	T430s	None
Laptop Power Supply	Lenovo	42T4424	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	No	1m	No	MTXDOT15-NA1	Laptop
AC Cable	No	1.8m	No	Laptop Power Supply	AC Mains
DC Cable	No	2m	No	Laptop Power Supply	Laptop

Configuration MLTI0353-2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
MTXDOT-NA1	Multi-Tech Systems, Inc.	MTXDOT-NA1	B1235-NA1
LoRa Antenna	Multi-Tech Systems, Inc.	45009830L-915	None

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Lenovo	T430s	None
Laptop Power Supply	Lenovo	42T4424	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	No	12m	No	MTXDOT15-NA1	Laptop
AC Cable	No	1.8m	No	Laptop Power Supply	AC Mains
DC Cable	No	2m	No	Laptop Power Supply	Laptop

CONFIGURATIONS

Configuration MLTI0353-3

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
LoRa Antenna	Multi-Tech Systems, Inc.	45009830L-915	None
DC Power Supply	Agilent	U8002A	MY50490005
MTXDOT-NA1	Multi-Tech Systems, Inc.	MTXDOT-NA1	101

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Lenovo	T430s	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	No	1m	No	MTXDOT15-NA1	Laptop
DC Power Cables	No	20cm	No	DC Power Supply	MTXDOT15-NA1
AC Power Cable	No	3m	No	DC Power Supply	AC Mains

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. The power settings below reflect the maximum power that the EUT is allowed to transmit at during normal operation.

ANTENNA GAIN (dBi)

Type	Make/Model:	Frequency Range (MHz)	Gain (dBi)
Swivel Type Dipole	Pulse Larsen W1063	868-928	1

The EUT was tested using the power settings provided by the manufacturer which were based upon:

☐ Test software settings
☒ Rated power settings

Test software/firmware installed on EUT: 4.2.0

SETTINGS FOR ALL TESTS IN THIS REPORT

Modulation Types	Bandwidth	Position (if multiple channels)	Channels (MHz)	Power Setting
LoRa CSS modulation	500 kHz	Low Channel	903.0	22
		Mid Channel	914.2	22
		High Channel	927.3	22

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2024-02-07	Powerline Conducted Emissions (Transmitter)	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	2024-02-07	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2024-02-07	Equivalent Isotropic Radiated Power (EIRP)	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	2024-02-07	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
5	2024-02-07	DTS Bandwidth (6 dB)	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	2024-02-07	Occupied Bandwidth (99%)	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	2024-02-07	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	2024-02-07	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	2024-02-07	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWERLINE CONDUCTED EMISSIONS

element
WTD.2023.11.13.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.04.25.0

TEST DESCRIPTION

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Receiver	Gauss Instruments	TDEMI 30M	ARS	2023-04-26	2024-04-26
Cable - Conducted Cable Assembly	Northwest EMC	MNC, HGN, TYK, VAE	MNCA	2023-03-09	2024-03-09
LISN	Solar Electronics	9252-50-R-24-BNC	LIY	2023-04-02	2024-04-02
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	3.2 dB	-3.2 dB

CONFIGURATIONS INVESTIGATED

MLTI0353-1
MLTI0353-3

MODES INVESTIGATED

Recieve mode LoRa Mid Ch 914.2 MHz, 500 kHz BW, Power 22
Tranmsitting LoRa Mid Ch 914.2 MHz, 500 kHz BW, Power 22

POWERLINE CONDUCTED EMISSIONS

element
WTD.2023.11.13.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.04.25.0

EUT:	MTXDOT-NA1	Work Order:	MLTI0353
Serial Number:	101	Date:	2024-02-07
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.6°C
Attendees:	Brent Nielsen	Relative Humidity:	31%
Customer Project:	None	Bar. Pressure (PMSL):	1006 mb
Tested By:	Arnauld Dedry, William Hoffa	Job Site:	MN03
Power:	5VDC via USB	Configuration:	MLTI0353-3

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2024	ANSI C63.10:2013

TEST PARAMETERS

Run #:	1	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

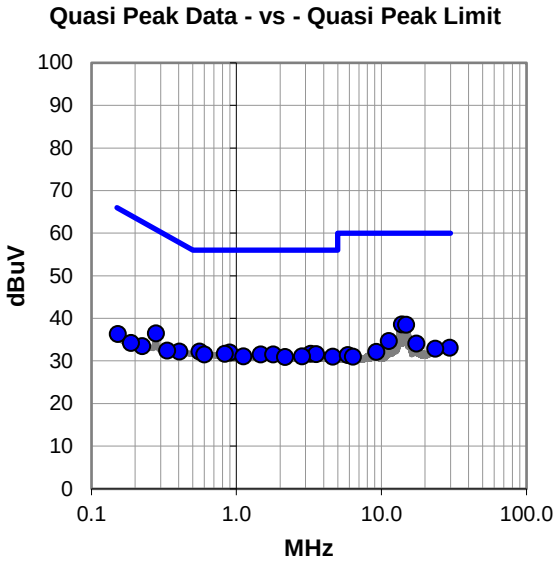
Commands AT+INF=22, 914200000, 500000, 8,

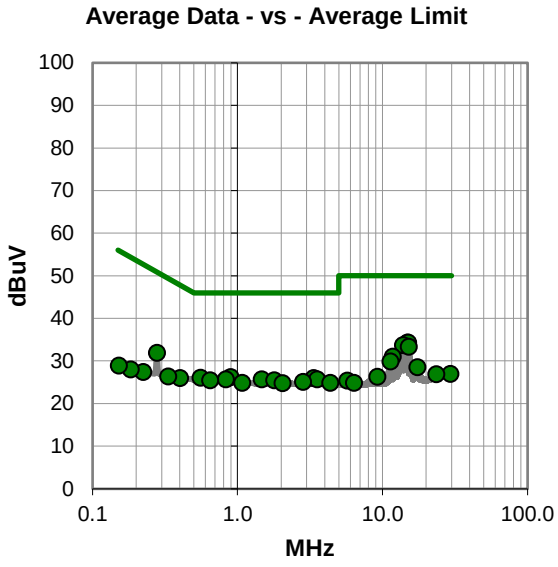
EUT OPERATING MODES

Tranmsitting LoRa Mid Ch 914.2 MHz, 500 kHz BW, Power 22

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

element
WTD.2023.11.13.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.04.25.0

RESULTS - Run #1

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.814	17.8	20.8	38.6	60.0	-21.4
14.792	17.5	21.0	38.5	60.0	-21.5
0.556	12.5	19.7	32.2	56.0	-23.8
0.898	12.2	19.8	32.0	56.0	-24.0
0.829	11.9	19.8	31.7	56.0	-24.3
3.255	11.5	20.2	31.7	56.0	-24.3
0.278	16.6	19.9	36.5	60.9	-24.4
3.534	11.4	20.2	31.6	56.0	-24.4
0.600	11.8	19.7	31.5	56.0	-24.5
1.468	11.6	19.9	31.5	56.0	-24.5
1.795	11.6	19.9	31.5	56.0	-24.5
1.113	11.3	19.8	31.1	56.0	-24.9
2.837	11.0	20.1	31.1	56.0	-24.9
4.607	10.8	20.2	31.0	56.0	-25.0
2.167	10.8	20.1	30.9	56.0	-25.1
11.256	14.1	20.6	34.7	60.0	-25.3
0.403	12.5	19.7	32.2	57.8	-25.6
17.395	12.8	21.3	34.1	60.0	-25.9
29.629	10.0	23.1	33.1	60.0	-26.9
0.332	12.7	19.7	32.4	59.4	-27.0
23.487	10.7	22.2	32.9	60.0	-27.1
9.209	11.6	20.5	32.1	60.0	-27.9
5.861	11.2	20.2	31.4	60.0	-28.6
6.372	10.8	20.2	31.0	60.0	-29.0
0.223	13.5	20.0	33.5	62.7	-29.2

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
14.837	13.3	21.0	34.3	50.0	-15.7
15.024	13.3	21.0	34.3	50.0	-15.7
13.814	12.9	20.8	33.7	50.0	-16.3
15.162	12.3	21.0	33.3	50.0	-16.7
0.278	12.0	19.9	31.9	50.9	-19.0
11.767	10.3	20.7	31.0	50.0	-19.0
0.898	6.4	19.8	26.2	46.0	-19.8
0.556	6.4	19.7	26.1	46.0	-19.9
3.350	5.8	20.2	26.0	46.0	-20.0
11.349	9.3	20.6	29.9	50.0	-20.1
0.831	5.9	19.8	25.7	46.0	-20.3
1.470	5.8	19.9	25.7	46.0	-20.3
3.534	5.5	20.2	25.7	46.0	-20.3
0.647	5.7	19.8	25.5	46.0	-20.5
1.795	5.6	19.9	25.5	46.0	-20.5
2.837	5.0	20.1	25.1	46.0	-20.9
1.076	5.1	19.8	24.9	46.0	-21.1
4.372	4.7	20.2	24.9	46.0	-21.1
2.045	4.9	19.9	24.8	46.0	-21.2
17.395	7.2	21.3	28.5	50.0	-21.5
0.402	6.3	19.7	26.0	47.8	-21.8
0.332	6.7	19.7	26.4	49.4	-23.0
29.416	3.9	23.1	27.0	50.0	-23.0
23.487	4.7	22.2	26.9	50.0	-23.1
9.209	5.8	20.5	26.3	50.0	-23.7

CONCLUSION

Pass

William Hoffa

Tested By

POWERLINE CONDUCTED EMISSIONS

element
WTD.2023.11.13.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.04.25.0

EUT:	MTXDOT-NA1	Work Order:	MLTI0353
Serial Number:	101	Date:	2024-02-07
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.6°C
Attendees:	Brent Nielsen	Relative Humidity:	31%
Customer Project:	None	Bar. Pressure (PMSL):	1006 mb
Tested By:	Arnauld Dedry, William Hoffa	Job Site:	MN03
Power:	5VDC via USB	Configuration:	MLTI0353-3

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2024	ANSI C63.10:2013

TEST PARAMETERS

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

COMMENTS

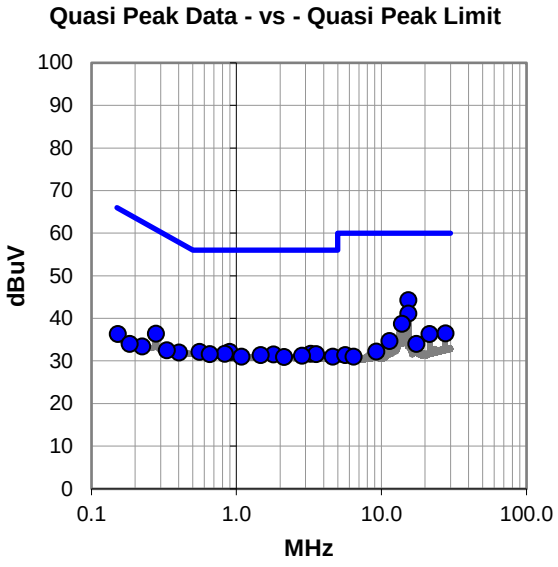
Commands AT+INF=22, 914200000, 500000, 8,

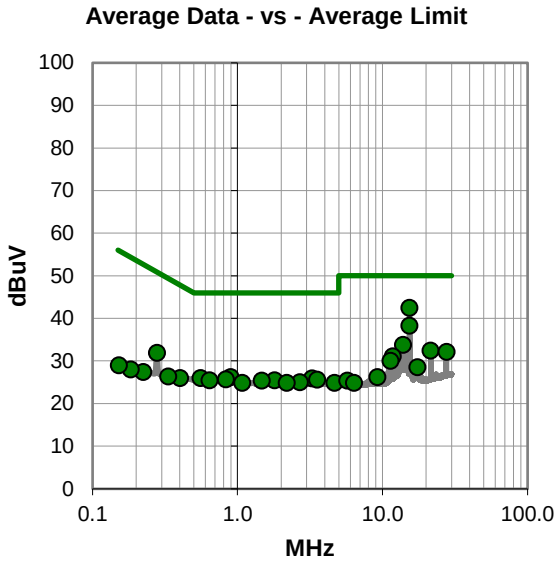
EUT OPERATING MODES

Tranmsitting LoRa Mid Ch 914.2 MHz, 500 kHz BW, Power 22

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

element
WTD.2023.11.13.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.04.25.0

RESULTS - Run #2

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
15.359	23.3	21.0	44.3	60.0	-15.7
15.364	20.1	21.0	41.1	60.0	-18.9
13.814	17.9	20.8	38.7	60.0	-21.3
27.650	13.7	22.8	36.5	60.0	-23.5
21.502	14.4	21.9	36.3	60.0	-23.7
0.554	12.4	19.7	32.1	56.0	-23.9
0.898	12.3	19.8	32.1	56.0	-23.9
0.829	11.9	19.8	31.7	56.0	-24.3
3.255	11.5	20.2	31.7	56.0	-24.3
0.654	11.8	19.8	31.6	56.0	-24.4
3.534	11.4	20.2	31.6	56.0	-24.4
0.278	16.5	19.9	36.4	60.9	-24.5
1.796	11.6	19.9	31.5	56.0	-24.5
1.471	11.5	19.9	31.4	56.0	-24.6
2.837	11.1	20.1	31.2	56.0	-24.8
1.081	11.2	19.8	31.0	56.0	-25.0
4.607	10.8	20.2	31.0	56.0	-25.0
2.132	11.0	19.9	30.9	56.0	-25.1
11.349	14.1	20.6	34.7	60.0	-25.3
0.402	12.3	19.7	32.0	57.8	-25.8
17.395	12.7	21.3	34.0	60.0	-26.0
0.330	12.8	19.7	32.5	59.5	-27.0
9.209	11.7	20.5	32.2	60.0	-27.8
5.628	11.2	20.2	31.4	60.0	-28.6
6.418	10.8	20.2	31.0	60.0	-29.0

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
15.359	21.5	21.0	42.5	50.0	-7.5
15.364	17.3	21.0	38.3	50.0	-11.7
13.814	13.0	20.8	33.8	50.0	-16.2
21.502	10.5	21.9	32.4	50.0	-17.6
27.650	9.3	22.8	32.1	50.0	-17.9
11.767	10.4	20.7	31.1	50.0	-18.9
0.278	12.0	19.9	31.9	50.9	-19.0
0.898	6.4	19.8	26.2	46.0	-19.8
0.554	6.3	19.7	26.0	46.0	-20.0
11.349	9.4	20.6	30.0	50.0	-20.0
3.257	5.7	20.2	25.9	46.0	-20.1
0.829	5.9	19.8	25.7	46.0	-20.3
3.534	5.4	20.2	25.6	46.0	-20.4
0.640	5.7	19.8	25.5	46.0	-20.5
1.796	5.6	19.9	25.5	46.0	-20.5
1.470	5.5	19.9	25.4	46.0	-20.6
2.694	4.9	20.1	25.0	46.0	-21.0
1.076	5.1	19.8	24.9	46.0	-21.1
2.185	4.8	20.1	24.9	46.0	-21.1
4.651	4.7	20.2	24.9	46.0	-21.1
17.395	7.2	21.3	28.5	50.0	-21.5
0.402	6.3	19.7	26.0	47.8	-21.8
0.333	6.7	19.7	26.4	49.4	-23.0
9.209	5.7	20.5	26.2	50.0	-23.8
5.721	5.2	20.2	25.4	50.0	-24.6

CONCLUSION

Pass

William Hoffa

Tested By

POWERLINE CONDUCTED EMISSIONS

element
WTD.2023.11.13.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.04.25.0

EUT:	MTXDOT-NA1	Work Order:	MLTI0353
Serial Number:	B1235-NA1	Date:	2024-02-07
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.6°C
Attendees:	Brent Nielsen	Relative Humidity:	31%
Customer Project:	None	Bar. Pressure (PMSL):	1006 mb
Tested By:	Arnauld Dedry, William Hoffa	Job Site:	MN03
Power:	5VDC via USB	Configuration:	MLTI0353-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2024	ANSI C63.10:2013

TEST PARAMETERS

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

COMMENTS

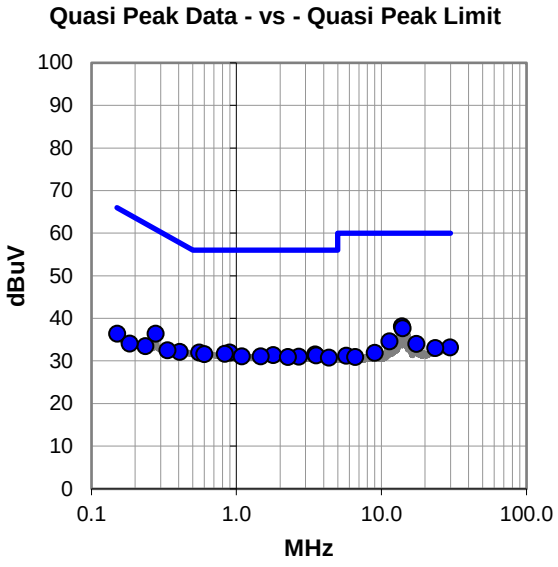
Commands AT+INF=22, 914200000, 500000, 8,

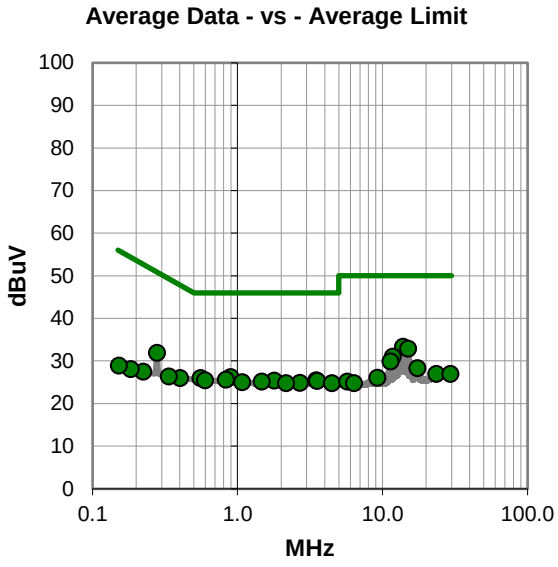
EUT OPERATING MODES

Recieve mode LoRa Mid Ch 914.2 MHz, 500 kHz BW, Power 22

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

element
WTD.2023.11.13.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.04.25.0

RESULTS - Run #3

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.814	17.3	20.8	38.1	60.0	-21.9
13.977	16.9	20.8	37.7	60.0	-22.3
0.553	12.3	19.7	32.0	56.0	-24.0
0.898	12.2	19.8	32.0	56.0	-24.0
0.832	11.9	19.8	31.7	56.0	-24.3
0.599	11.9	19.7	31.6	56.0	-24.4
0.277	16.5	19.9	36.4	60.9	-24.5
3.488	11.3	20.2	31.5	56.0	-24.5
1.795	11.5	19.9	31.4	56.0	-24.6
3.534	11.1	20.2	31.3	56.0	-24.7
1.085	11.3	19.8	31.1	56.0	-24.9
1.468	11.2	19.9	31.1	56.0	-24.9
2.694	10.9	20.1	31.0	56.0	-25.0
2.265	10.8	20.1	30.9	56.0	-25.1
4.347	10.6	20.2	30.8	56.0	-25.2
11.349	14.0	20.6	34.6	60.0	-25.4
0.405	12.4	19.7	32.1	57.8	-25.7
17.395	12.7	21.3	34.0	60.0	-26.0
0.335	12.8	19.7	32.5	59.3	-26.8
29.680	10.1	23.1	33.2	60.0	-26.8
23.489	10.8	22.2	33.0	60.0	-27.0
8.977	11.4	20.5	31.9	60.0	-28.1
0.235	13.5	20.0	33.5	62.3	-28.8
5.721	11.0	20.2	31.2	60.0	-28.8
6.604	10.6	20.3	30.9	60.0	-29.1

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.814	12.5	20.8	33.3	50.0	-16.7
15.024	11.9	21.0	32.9	50.0	-17.1
0.278	12.0	19.9	31.9	50.9	-19.0
11.767	10.3	20.7	31.0	50.0	-19.0
0.898	6.4	19.8	26.2	46.0	-19.8
0.554	6.3	19.7	26.0	46.0	-20.0
11.349	9.3	20.6	29.9	50.0	-20.1
0.829	5.8	19.8	25.6	46.0	-20.4
0.597	5.8	19.7	25.5	46.0	-20.5
3.488	5.3	20.2	25.5	46.0	-20.5
1.795	5.5	19.9	25.4	46.0	-20.6
3.534	5.1	20.2	25.3	46.0	-20.7
1.470	5.3	19.9	25.2	46.0	-20.8
1.076	5.2	19.8	25.0	46.0	-21.0
2.694	4.8	20.1	24.9	46.0	-21.1
2.159	4.7	20.1	24.8	46.0	-21.2
4.465	4.6	20.2	24.8	46.0	-21.2
17.395	7.0	21.3	28.3	50.0	-21.7
0.402	6.3	19.7	26.0	47.8	-21.8
0.336	6.7	19.7	26.4	49.3	-22.9
23.487	4.8	22.2	27.0	50.0	-23.0
29.420	3.9	23.1	27.0	50.0	-23.0
9.209	5.6	20.5	26.1	50.0	-23.9
5.721	5.0	20.2	25.2	50.0	-24.8
6.372	4.6	20.2	24.8	50.0	-25.2

CONCLUSION

Pass

William Hoffa

Tested By

POWERLINE CONDUCTED EMISSIONS

element
WTD.2023.11.13.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.04.25.0

EUT:	MTXDOT-NA1	Work Order:	MLTI0353
Serial Number:	B1235-NA1	Date:	2024-02-07
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.6°C
Attendees:	Brent Nielsen	Relative Humidity:	31%
Customer Project:	None	Bar. Pressure (PMSL):	1006 mb
Tested By:	Arnauld Dedry, William Hoffa	Job Site:	MN03
Power:	5VDC via USB	Configuration:	MLTI0353-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2024	ANSI C63.10:2013

TEST PARAMETERS

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

COMMENTS

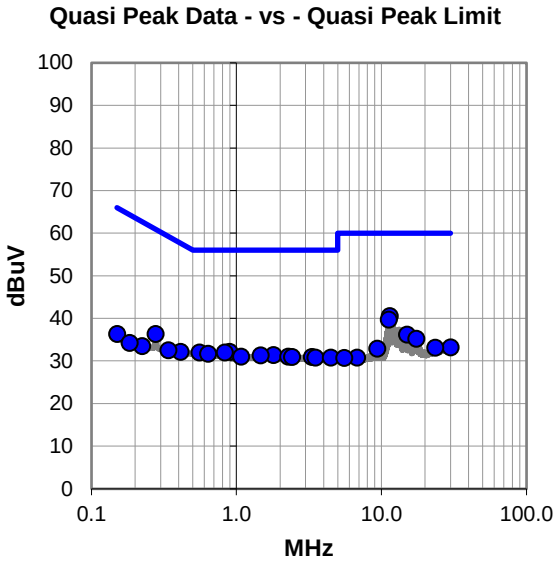
Commands AT+INF=22, 914200000, 500000, 8,

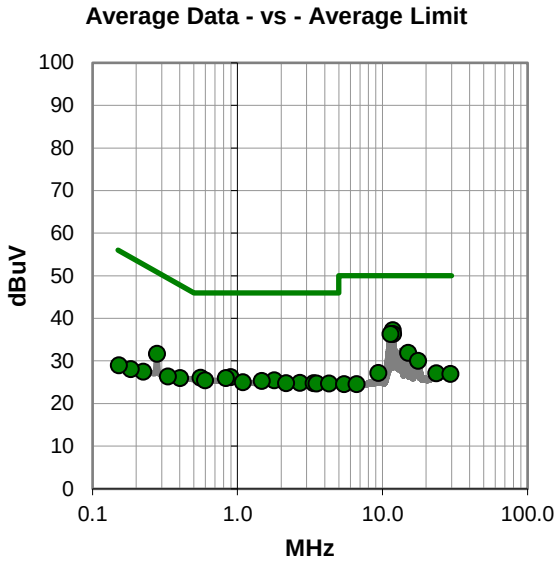
EUT OPERATING MODES

Recieve mode LoRa Mid Ch 914.2 MHz, 500 kHz BW, Power 22

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

element
WTD.2023.11.13.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.04.25.0

RESULTS - Run #4

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
11.441	19.9	20.6	40.5	60.0	-19.5
11.255	19.1	20.6	39.7	60.0	-20.3
15.024	15.2	21.0	36.2	60.0	-23.8
0.898	12.3	19.8	32.1	56.0	-23.9
0.554	12.3	19.7	32.0	56.0	-24.0
0.831	12.2	19.8	32.0	56.0	-24.0
0.638	12.0	19.7	31.7	56.0	-24.3
0.277	16.4	19.9	36.3	60.9	-24.6
1.796	11.5	19.9	31.4	56.0	-24.6
1.470	11.4	19.9	31.3	56.0	-24.7
17.395	13.9	21.3	35.2	60.0	-24.8
1.078	11.2	19.8	31.0	56.0	-25.0
2.272	10.9	20.1	31.0	56.0	-25.0
2.422	10.8	20.1	30.9	56.0	-25.1
3.310	10.7	20.2	30.9	56.0	-25.1
3.508	10.6	20.2	30.8	56.0	-25.2
4.479	10.6	20.2	30.8	56.0	-25.2
0.411	12.4	19.7	32.1	57.6	-25.5
0.339	12.8	19.7	32.5	59.2	-26.7
29.957	10.1	23.1	33.2	60.0	-26.8
23.489	10.9	22.2	33.1	60.0	-26.9
9.349	12.4	20.5	32.9	60.0	-27.1
6.789	10.5	20.3	30.8	60.0	-29.2
0.223	13.5	20.0	33.5	62.7	-29.2
5.553	10.5	20.2	30.7	60.0	-29.3

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
11.767	16.5	20.7	37.2	50.0	-12.8
11.813	15.6	20.7	36.3	50.0	-13.7
11.349	15.7	20.6	36.3	50.0	-13.7
15.022	10.9	21.0	31.9	50.0	-18.1
0.278	11.8	19.9	31.7	50.9	-19.2
0.898	6.4	19.8	26.2	46.0	-19.8
0.554	6.4	19.7	26.1	46.0	-19.9
0.831	6.2	19.8	26.0	46.0	-20.0
17.628	8.7	21.3	30.0	50.0	-20.0
0.597	5.8	19.7	25.5	46.0	-20.5
1.795	5.6	19.9	25.5	46.0	-20.5
1.470	5.4	19.9	25.3	46.0	-20.7
1.090	5.2	19.8	25.0	46.0	-21.0
2.692	4.8	20.1	24.9	46.0	-21.1
2.161	4.7	20.1	24.8	46.0	-21.2
3.347	4.6	20.2	24.8	46.0	-21.2
3.513	4.5	20.2	24.7	46.0	-21.3
4.276	4.5	20.2	24.7	46.0	-21.3
0.402	6.3	19.7	26.0	47.8	-21.8
9.349	6.7	20.5	27.2	50.0	-22.8
23.487	4.9	22.2	27.1	50.0	-22.9
29.418	3.9	23.1	27.0	50.0	-23.0
0.330	6.7	19.7	26.4	49.5	-23.1
0.223	7.5	20.0	27.5	52.7	-25.2
5.425	4.4	20.2	24.6	50.0	-25.4

CONCLUSION

Pass

William Hoffa

Tested By

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.11.13.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.04.25.0

TEST DESCRIPTION

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

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

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). 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).

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Antenna - Double Ridge	ETS Lindgren	3115	AIP	2022-07-20	2024-07-20
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	2024-01-08	2025-01-08
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2023-05-01	2024-05-01
Attenuator	Fiarview Microwave	SA18H-20	VAF	2023-09-11	2024-09-11
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	2024-01-08	2025-01-08
Filter - High Pass	Micro-Tronics	HPM50108	LFM	2023-10-11	2024-10-11
Antenna - Biconilog	ETS Lindgren	3142D	AXO	2023-10-02	2025-10-02
Cable	ESM Cable Corp.	Bilog Cables	MNH	2023-10-08	2024-10-08
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	2023-10-08	2024-10-08
Filter - Low Pass	Micro-Tronics	LPM50004	LFK	2023-08-23	2024-08-23
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	NCR
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	2024-01-28	2025-01-28
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	2024-01-08	2025-01-08

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	5.2 dB	-5.2 dB

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.11.13.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.04.25.0

FREQUENCY RANGE INVESTIGATED

30 MHz TO 12400 MHz

POWER INVESTIGATED

5VDC via USB

CONFIGURATIONS INVESTIGATED

MLTI0353-2

MODES INVESTIGATED

Transmitting LoRa Low, Mid and High Chs (903.0, 914.2 and 927.3 MHz) 500 kHz BW, Power 22

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.11.13.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.04.25.0

EUT:	MTXDOT-NA1	Work Order:	MLTI0353
Serial Number:	B1235-NA1	Date:	2024-02-07
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.3°C
Attendees:	Brent Nielsen	Relative Humidity:	30.7%
Customer Project:	None	Bar. Pressure (PMSL):	1010 mb
Tested By:	Marcelo Aguayo	Job Site:	MN05
Power:	5VDC via USB	Configuration:	MLTI0353-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024	ANSI C63.10:2013
RSS-247 Issue 3:2023	ANSI C63.10:2013

TEST PARAMETERS

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

COMMENTS

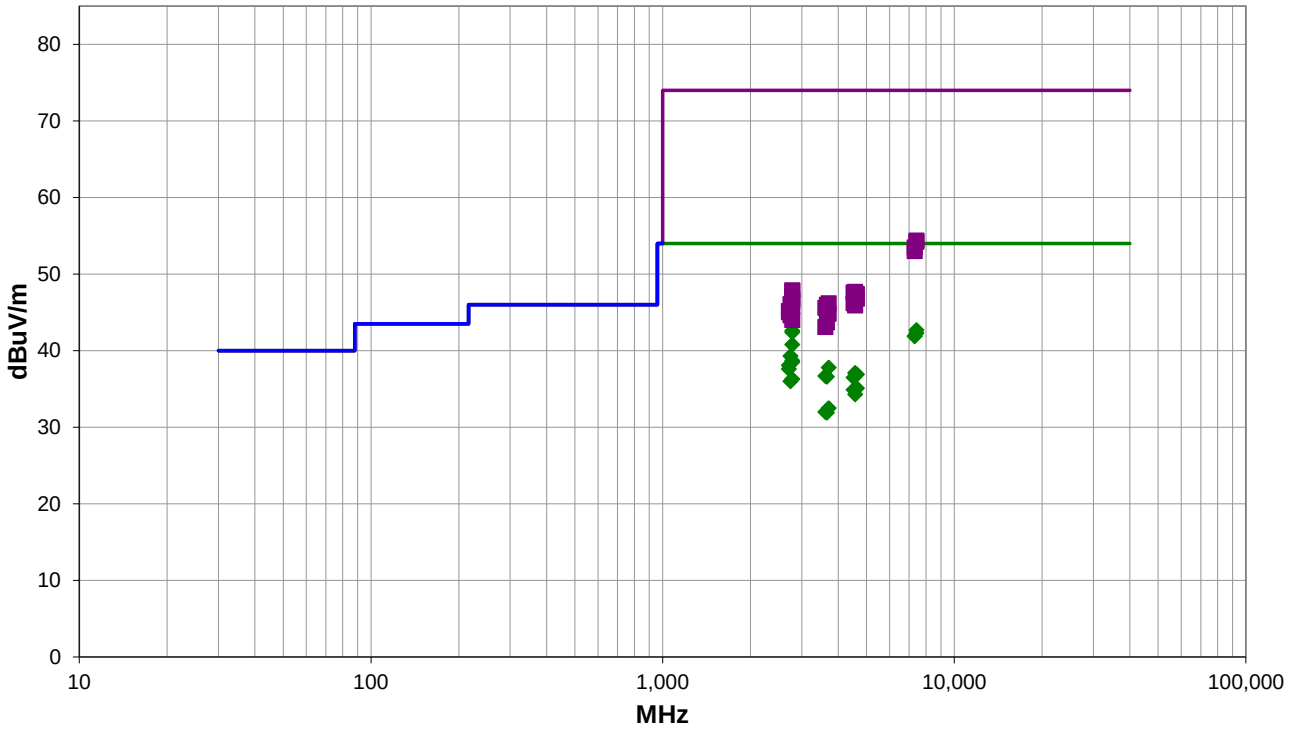
Command AT+INF=22, 903000000, 500000, 8
Command AT+INF=22, 914200000, 500000, 8
Command AT+INF=22, 927300000, 500000, 8

EUT OPERATING MODES

Transmitting LoRa Low, Mid and High Chs (903.0, 914.2 and 927.3 MHz) 500 kHz BW, Power 22

DEVIATIONS FROM TEST STANDARD

None



Run #: 4 ■ PK ◆ AV ● QP

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.11.13.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.04.25.0

RESULTS - Run #4

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
7417.750	30.2	12.5	1.4	16.9	3.0	0.0	Vert	AV	0.0	42.7	54.0	-11.3	EUT On Side, Antenna Horz, High Ch
2781.925	45.0	-2.4	2.2	354.0	3.0	0.0	Horz	AV	0.0	42.6	54.0	-11.4	EUT On Side, Antenna Horz, High Ch
2781.958	44.8	-2.4	1.1	177.0	3.0	0.0	Vert	AV	0.0	42.4	54.0	-11.6	EUT On Side, Antenna Horz, High Ch
7417.950	29.8	12.5	1.5	146.9	3.0	0.0	Horz	AV	0.0	42.3	54.0	-11.7	EUT On Side, Antenna Horz, High Ch
7311.792	29.4	12.5	1.5	6.9	3.0	0.0	Horz	AV	0.0	41.9	54.0	-12.1	EUT On Side, Antenna Horz, Mid Ch
7311.742	29.4	12.5	1.5	117.0	3.0	0.0	Vert	AV	0.0	41.9	54.0	-12.1	EUT On Side, Antenna Horz, Mid Ch
2781.892	43.2	-2.4	1.0	67.9	3.0	0.0	Horz	AV	0.0	40.8	54.0	-13.2	EUT Vert, Antenna On Side, High Ch
2742.533	41.8	-2.5	1.4	333.0	3.0	0.0	Horz	AV	0.0	39.3	54.0	-14.7	EUT On Side, Antenna Horz, Mid Ch
2781.933	41.1	-2.4	1.5	152.0	3.0	0.0	Horz	AV	0.0	38.7	54.0	-15.3	EUT Horiz, Antenna Vert, High Ch
2781.942	40.9	-2.4	1.5	315.0	3.0	0.0	Vert	AV	0.0	38.5	54.0	-15.5	EUT Horiz, Antenna Vert, High Ch
2708.975	40.6	-2.5	1.6	171.0	3.0	0.0	Horz	AV	0.0	38.1	54.0	-15.9	EUT On Side, Antenna Horz, Low Ch
3709.200	36.9	0.9	3.1	160.9	3.0	0.0	Horz	AV	0.0	37.8	54.0	-16.2	EUT On Side, Antenna Horz, High Ch
2708.908	40.1	-2.5	1.5	319.9	3.0	0.0	Vert	AV	0.0	37.6	54.0	-16.4	EUT On Side, Antenna Horz, Low Ch
4571.150	33.0	4.1	2.4	8.0	3.0	0.0	Horz	AV	0.0	37.1	54.0	-16.9	EUT On Side, Antenna Horz, Mid Ch
4636.517	32.5	4.4	2.5	29.0	3.0	0.0	Horz	AV	0.0	36.9	54.0	-17.1	EUT On Side, Antenna Horz, High Ch
3611.808	36.3	0.4	3.0	159.0	3.0	0.0	Horz	AV	0.0	36.7	54.0	-17.3	EUT On Side, Antenna Horz, Low Ch
3656.725	36.0	0.6	1.9	156.0	3.0	0.0	Horz	AV	0.0	36.6	54.0	-17.4	EUT On Side, Antenna Horz, Mid Ch
4514.792	32.6	3.9	1.5	350.0	3.0	0.0	Horz	AV	0.0	36.5	54.0	-17.5	EUT On Side, Antenna Horz, Low Ch
2781.833	38.7	-2.4	1.1	188.0	3.0	0.0	Vert	AV	0.0	36.3	54.0	-17.7	EUT Vert, Antenna On Side, High Ch
2742.600	38.5	-2.5	1.5	314.0	3.0	0.0	Vert	AV	0.0	36.0	54.0	-18.0	EUT On Side, Antenna Horz, Mid Ch
4636.075	30.7	4.4	3.9	152.0	3.0	0.0	Vert	AV	0.0	35.1	54.0	-18.9	EUT On Side, Antenna Horz, High Ch
4514.783	31.0	3.9	1.5	27.9	3.0	0.0	Vert	AV	0.0	34.9	54.0	-19.1	EUT On Side, Antenna Horz, Low Ch
7416.842	41.9	12.5	1.4	16.9	3.0	0.0	Vert	PK	0.0	54.4	74.0	-19.6	EUT On Side, Antenna Horz, High Ch
4571.733	30.2	4.1	1.2	81.0	3.0	0.0	Vert	AV	0.0	34.3	54.0	-19.7	EUT On Side, Antenna Horz, Mid Ch
7416.833	41.7	12.5	1.5	146.9	3.0	0.0	Horz	PK	0.0	54.2	74.0	-19.8	EUT On Side, Antenna Horz, High Ch
7313.367	41.0	12.5	1.5	6.9	3.0	0.0	Horz	PK	0.0	53.5	74.0	-20.5	EUT On Side, Antenna Horz, Mid Ch
7313.442	40.5	12.5	1.5	117.0	3.0	0.0	Vert	PK	0.0	53.0	74.0	-21.0	EUT On Side, Antenna Horz, Mid Ch
3709.117	31.6	0.9	1.4	22.0	3.0	0.0	Vert	AV	0.0	32.5	54.0	-21.5	EUT On Side, Antenna Horz, High Ch
3611.983	31.6	0.4	1.5	76.0	3.0	0.0	Vert	AV	0.0	32.0	54.0	-22.0	EUT On Side, Antenna Horz, Low Ch
3656.767	31.3	0.6	1.5	261.9	3.0	0.0	Vert	AV	0.0	31.9	54.0	-22.1	EUT On Side, Antenna Horz, Mid Ch
2781.842	50.3	-2.4	2.2	354.0	3.0	0.0	Horz	PK	0.0	47.9	74.0	-26.1	EUT Vert, Antenna On Side, High Ch
2782.242	50.2	-2.4	1.1	177.0	3.0	0.0	Vert	PK	0.0	47.8	74.0	-26.2	EUT On Side, Antenna Horz, High Ch
4569.908	43.6	4.1	2.4	8.0	3.0	0.0	Horz	PK	0.0	47.7	74.0	-26.3	EUT On Side, Antenna Horz, Mid Ch
4516.042	43.7	3.9	1.5	350.0	3.0	0.0	Horz	PK	0.0	47.6	74.0	-26.4	EUT On Side, Antenna Horz, Low Ch
4636.442	43.0	4.4	2.5	29.0	3.0	0.0	Horz	PK	0.0	47.4	74.0	-26.6	EUT On Side, Antenna Horz, High Ch
2781.533	49.2	-2.4	1.0	67.9	3.0	0.0	Horz	PK	0.0	46.8	74.0	-27.2	EUT On Side, Antenna Horz, High Ch
4636.042	42.4	4.4	3.9	152.0	3.0	0.0	Vert	PK	0.0	46.8	74.0	-27.2	EUT On Side, Antenna Horz, High Ch
2782.000	48.9	-2.4	1.5	315.0	3.0	0.0	Vert	PK	0.0	46.5	74.0	-27.5	EUT Horiz, Antenna Vert, High Ch
3708.742	45.3	0.9	3.1	160.9	3.0	0.0	Horz	PK	0.0	46.2	74.0	-27.8	EUT On Side, Antenna Horz, High Ch
4513.925	42.3	3.9	1.5	27.9	3.0	0.0	Vert	PK	0.0	46.2	74.0	-27.8	EUT On Side, Antenna Horz, Low Ch

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.11.13.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.04.25.0

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
2742.983	48.6	-2.5	1.4	333.0	3.0	0.0	Horz	PK	0.0	46.1	74.0	-27.9	EUT On Side, Antenna Horz, Mid Ch
3656.917	45.4	0.6	1.9	156.0	3.0	0.0	Horz	PK	0.0	46.0	74.0	-28.0	EUT On Side, Antenna Horz, Mid Ch
4572.042	41.8	4.1	1.2	81.0	3.0	0.0	Vert	PK	0.0	45.9	74.0	-28.1	EUT On Side, Antenna Horz, Mid Ch
2781.875	48.1	-2.4	1.5	152.0	3.0	0.0	Horz	PK	0.0	45.7	74.0	-28.3	EUT Horiz, Antenna Vert, High Ch
3612.158	45.2	0.4	3.0	159.0	3.0	0.0	Horz	PK	0.0	45.6	74.0	-28.4	EUT On Side, Antenna Horz, Low Ch
2708.467	47.7	-2.5	1.6	171.0	3.0	0.0	Horz	PK	0.0	45.2	74.0	-28.8	EUT On Side, Antenna Horz, Low Ch
2709.817	47.5	-2.5	1.5	319.9	3.0	0.0	Vert	PK	0.0	45.0	74.0	-29.0	EUT On Side, Antenna Horz, Low Ch
3708.758	43.9	0.9	1.4	22.0	3.0	0.0	Vert	PK	0.0	44.8	74.0	-29.2	EUT On Side, Antenna Horz, High Ch
2743.283	47.1	-2.5	1.5	314.0	3.0	0.0	Vert	PK	0.0	44.6	74.0	-29.4	EUT On Side, Antenna Horz, Mid Ch
2781.492	46.4	-2.4	1.1	188.0	3.0	0.0	Vert	PK	0.0	44.0	74.0	-30.0	EUT Vert, Antenna On Side, High Ch
3655.158	43.1	0.6	1.5	261.9	3.0	0.0	Vert	PK	0.0	43.7	74.0	-30.3	EUT On Side, Antenna Horz, Mid Ch
3611.625	42.7	0.4	1.5	76.0	3.0	0.0	Vert	PK	0.0	43.1	74.0	-30.9	EUT On Side, Antenna Horz, Low Ch

CONCLUSION

Pass

Tested By

OUTPUT POWER

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

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.

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

Prior to measuring output power; the emission bandwidth (B) and the transmission pulse duration (T) were measured. Both are required to determine the method of measuring Maximum Conducted Output Power. The transmission pulse duration (T) was measured using a zero span on the spectrum analyzer to see the pulses in the time domain.

The method AVGSA-2 in section 11.9.2.2.4 of ANSI C63.10:2013 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector.

The AVGSA-2 method was modified as the available resolution bandwidth (RBW) on the spectrum analyzer could be set wider than the measured emissions bandwidth (B). RBW was set wider than B. This follows the guidance of section 11.9.1.1 and is equivalent to a measurement with a power meter AVGPM per section 11.9.2.3.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2023-05-01	2024-05-01
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Attenuator	S.M. Electronics	SA26B-20	RFW	2024-01-31	2025-01-31
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05

OUTPUT POWER

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

EUT:	MTXDOT-NA1	Work Order:	MLTI0353
Serial Number:	B1235-NA1	Date:	2024-02-07
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.6°C
Attendees:	Brent Nielsen	Relative Humidity:	30.8%
Customer Project:	None	Bar. Pressure (PMSL):	1010 mbar
Tested By:	Trevor Buls	Job Site:	MN11
Power:	5VDC via USB	Configuration:	MLTI0353-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024 RSS-247 Issue 3:2023	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

Trevor Buls

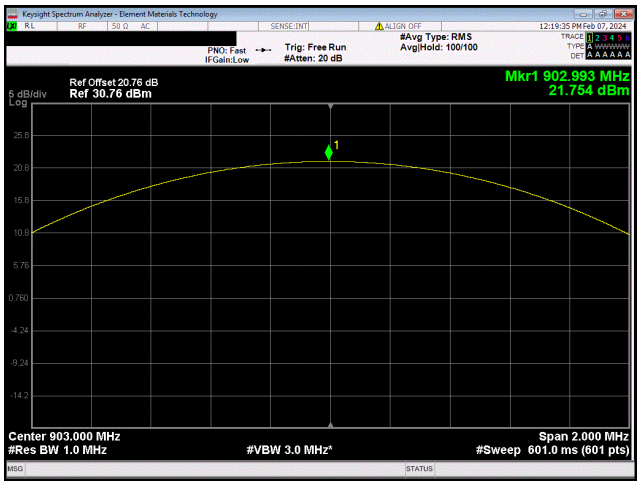
Tested By

TEST RESULTS

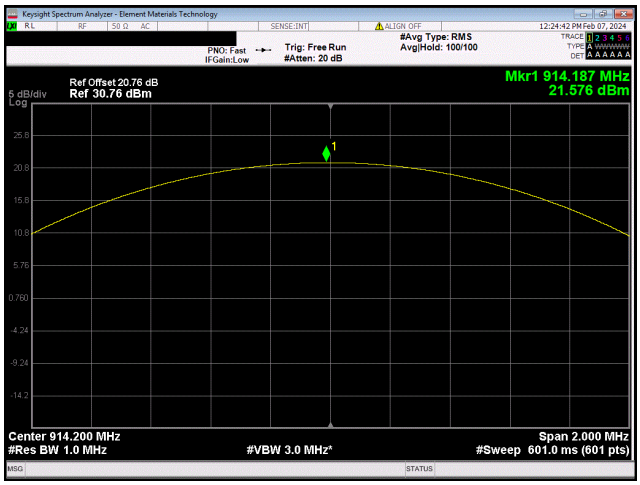
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Out Pwr (dBm)	Limit (dBm)	Result
LoRa CSS, 500 kHz BW					
Low Channel, 903.0 MHz	21.754	0	21.8	30	Pass
Mid Channel, 914.2 MHz	21.576	0	21.6	30	Pass
High Channel, 927.3 MHz	21.273	0	21.3	30	Pass

OUTPUT POWER

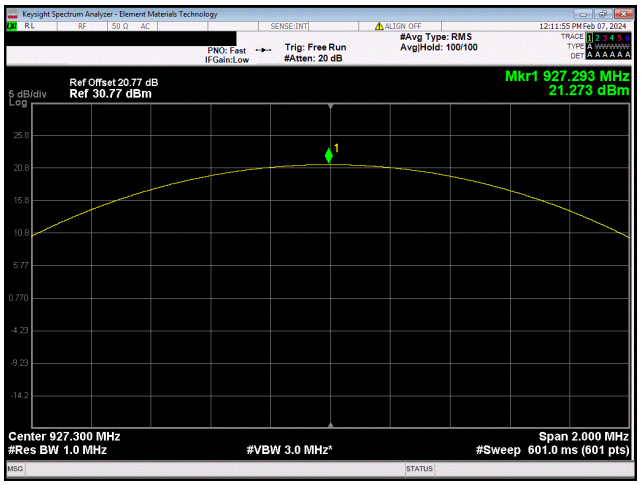
element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



LoRa CSS, 500 kHz BW
Low Channel, 903.0 MHz



LoRa CSS, 500 kHz BW
Mid Channel, 914.2 MHz



LoRa CSS, 500 kHz BW
High Channel, 927.3 MHz

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

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.

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

Prior to measuring output power; the emission bandwidth (B) and the transmission pulse duration (T) were measured. Both are required to determine the method of measuring Maximum Conducted Output Power. The transmission pulse duration (T) was measured using a zero span on the spectrum analyzer to see the pulses in the time domain.

The method AVGSA-2 in section 11.9.2.2.4 of ANSI C63.10:2013 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector.

The AVGSA-2 method was modified as the available resolution bandwidth (RBW) on the spectrum analyzer could be set wider than the measured emissions bandwidth (B). RBW was set wider than B. This follows the guidance of section 11.9.1.1 and is equivalent to a measurement with a power meter AVGPM per section 11.9.2.3.

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2023-05-01	2024-05-01
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Attenuator	S.M. Electronics	SA26B-20	RFW	2024-01-31	2025-01-31
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

EUT:	MTXDOT-NA1	Work Order:	MLTI0353
Serial Number:	B1235-NA1	Date:	2024-02-07
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.6°C
Attendees:	Brent Nielsen	Relative Humidity:	30.8%
Customer Project:	None	Bar. Pressure (PMSL):	1010 mbar
Tested By:	Trevor Buls	Job Site:	MN11
Power:	5VDC via USB	Configuration:	MLTI0353-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024 RSS-247 Issue 3:2023	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

Trevor Buls

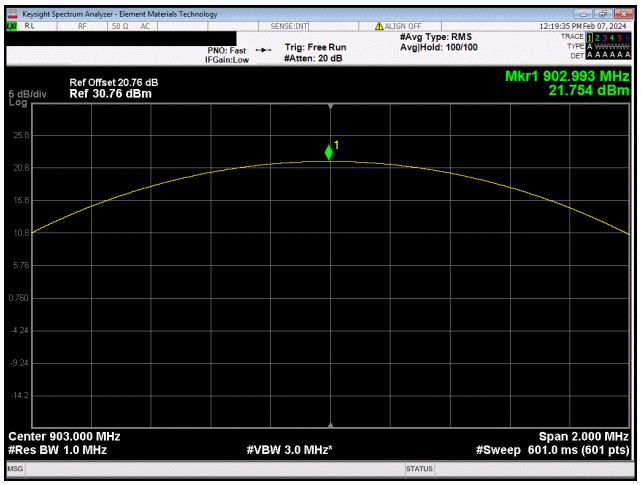
Tested By

TEST RESULTS

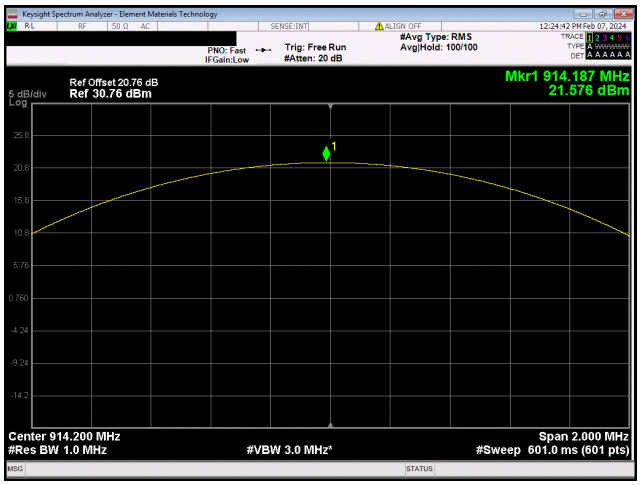
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
LoRa CSS, 500 kHz BW							
Low Channel, 903.0 MHz	21.754	0	21.8	1	22.8	36	Pass
Mid Channel, 914.2 MHz	21.576	0	21.6	1	22.6	36	Pass
High Channel, 927.3 MHz	21.273	0	21.3	1	22.3	36	Pass

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

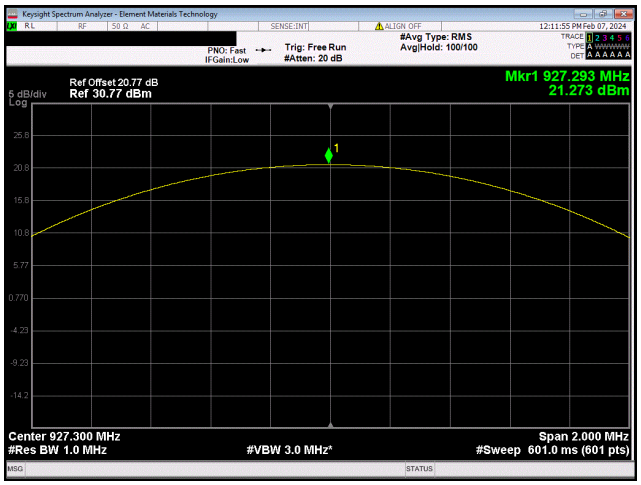
element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



LoRa CSS, 500 kHz BW
Low Channel, 903.0 MHz



LoRa CSS, 500 kHz BW
Mid Channel, 914.2 MHz



LoRa CSS, 500 kHz BW
High Channel, 927.3 MHz

BAND EDGE COMPLIANCE

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

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.

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The spurious RF conducted emissions at the edges of the authorized 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. The analyzer screen captures for this test show an example of the emission mask for the test mode also used during the radiated spurious emissions at the restricted band edges test.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2023-05-01	2024-05-01
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Attenuator	S.M. Electronics	SA26B-20	RFW	2024-01-31	2025-01-31
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05

BAND EDGE COMPLIANCE

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

EUT:	MTXDOT-NA1	Work Order:	MLTI0353
Serial Number:	B1235-NA1	Date:	2024-02-07
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.5°C
Attendees:	Brent Nielsen	Relative Humidity:	30.9%
Customer Project:	None	Bar. Pressure (PMSL):	1011 mbar
Tested By:	Trevor Buls	Job Site:	MN11
Power:	5VDC via USB	Configuration:	MLTI0353-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024 RSS-247 Issue 3:2023	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

Trevor Buls

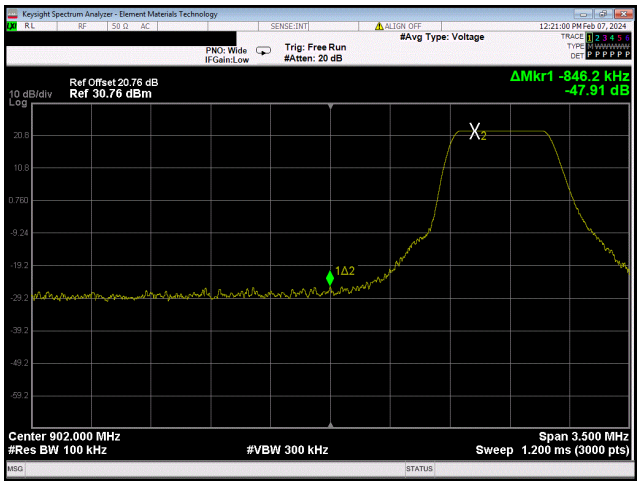
Tested By

TEST RESULTS

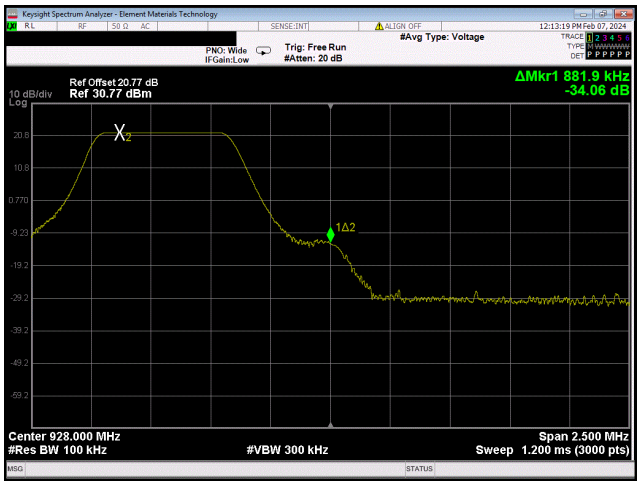
	Value (dBc)	Limit ≤ (dBc)	Result
LoRa CSS, 500 kHz BW			
Low Channel, 903.0 MHz	-47.91	-30	Pass
High Channel, 927.3 MHz	-34.06	-30	Pass

BAND EDGE COMPLIANCE

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



LoRa CSS, 500 kHz BW
Low Channel, 903.0 MHz



LoRa CSS, 500 kHz BW
High Channel, 927.3 MHz

DTS BANDWIDTH

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

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.

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

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

The 6dB DTS bandwidth was measured using 100 kHz resolution bandwidth and 300 kHz video bandwidth. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2023-05-01	2024-05-01
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Attenuator	S.M. Electronics	SA26B-20	RFW	2024-01-31	2025-01-31
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05

DTS BANDWIDTH

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

EUT:	MTXDOT-NA1	Work Order:	MLTI0353
Serial Number:	B1235-NA1	Date:	2024-02-07
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.6°C
Attendees:	Brent Nielsen	Relative Humidity:	30.8%
Customer Project:	None	Bar. Pressure (PMSL):	1010 mbar
Tested By:	Trevor Buls	Job Site:	MN11
Power:	5VDC via USB	Configuration:	MLTI0353-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024 RSS-247 Issue 3:2023	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

Trevor Buls

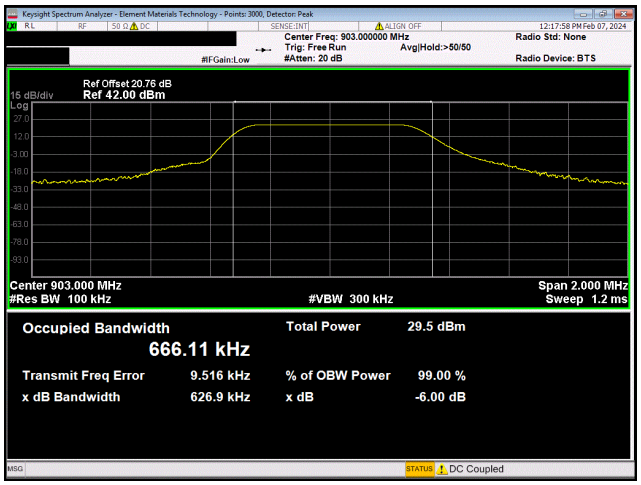
Tested By

TEST RESULTS

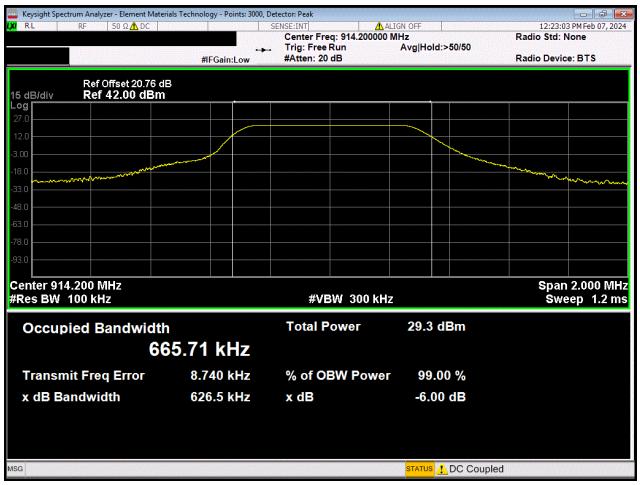
	Value	Limit (>)	Result
LoRa CSS, 500 kHz BW			
Low Channel, 903.0 MHz	626.85 kHz	500 kHz	Pass
Mid Channel, 914.2 MHz	626.465 kHz	500 kHz	Pass
High Channel, 927.3 MHz	626.56 kHz	500 kHz	Pass

DTS BANDWIDTH

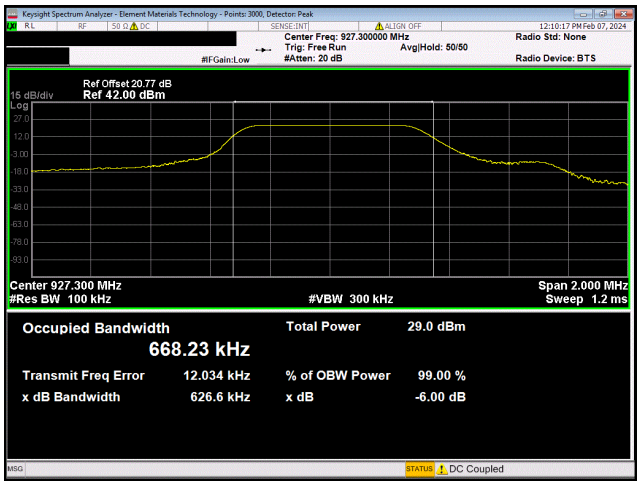
element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



LoRa CSS, 500 kHz BW
Low Channel, 903.0 MHz



LoRa CSS, 500 kHz BW
Mid Channel, 914.2 MHz



LoRa CSS, 500 kHz BW
High Channel, 927.3 MHz

OCCUPIED BANDWIDTH

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

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.

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The 99% occupied bandwidth was measured with the EUT configured for continuous modulated operation.

Per ANSI C63.10:2013, 6.9.3, the spectrum analyzer was configured as follows:

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) of the spectrum analyzer was set to the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) bandwidth was set to at least 3 times the resolution bandwidth. The analyzer sweep time was set to auto to prevent video filtering or averaging. A sample detector was used unless the device was not able to be operated in a continuous transmit mode, in which case a peak detector was used.

The spectrum analyzer occupied bandwidth measurement function was used to sum the power of the transmission in linear terms to obtain the 99% bandwidth.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2023-05-01	2024-05-01
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Attenuator	S.M. Electronics	SA26B-20	RFW	2024-01-31	2025-01-31
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05

OCCUPIED BANDWIDTH

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

EUT:	MTXDOT-NA1	Work Order:	MLTI0353
Serial Number:	B1235-NA1	Date:	2024-02-07
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.6°C
Attendees:	Brent Nielsen	Relative Humidity:	30.8%
Customer Project:	None	Bar. Pressure (PMSL):	1010 mbar
Tested By:	Trevor Buls	Job Site:	MN11
Power:	5VDC via USB	Configuration:	MLTI0353-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024 RSS-247 Issue 3:2023	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

Trevor Buls

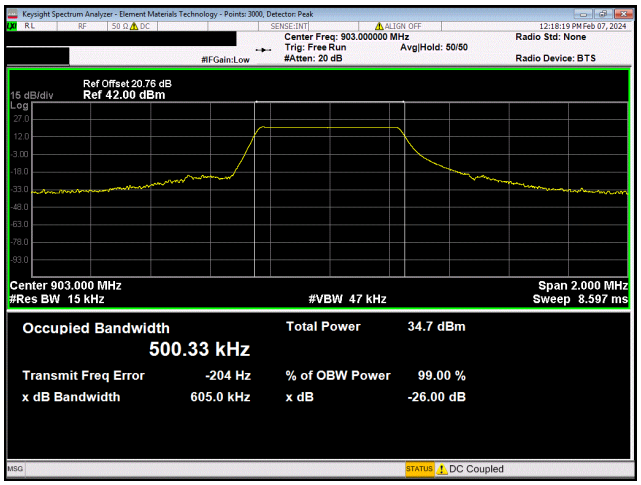
Tested By

TEST RESULTS

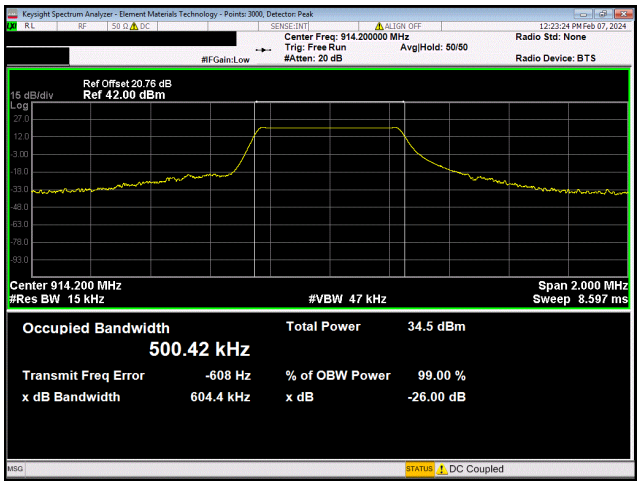
	Value	Limit	Result
LoRa CSS, 500 kHz BW			
Low Channel, 903.0 MHz	500.327 kHz	N/A	N/A
Mid Channel, 914.2 MHz	500.418 kHz	N/A	N/A
High Channel, 927.3 MHz	501.198 kHz	N/A	N/A

OCCUPIED BANDWIDTH

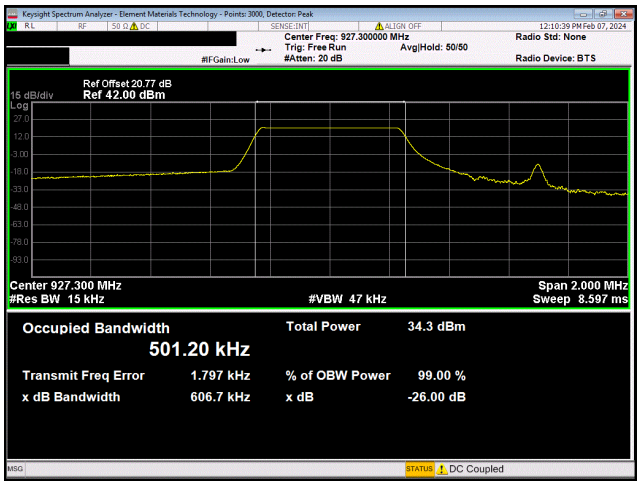
element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



LoRa CSS, 500 kHz BW
Low Channel, 903.0 MHz



LoRa CSS, 500 kHz BW
Mid Channel, 914.2 MHz



LoRa CSS, 500 kHz BW
High Channel, 927.3 MHz

SPURIOUS CONDUCTED EMISSIONS

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

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.

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting at the data rate(s) listed in the datasheet. 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.

The reference level offset for the fundamental screen capture was based on a measured value of the loss between the spectrum analyzer and the EUT which was verified at the time of test. The remaining screen capture(s) use an internal transducer factor on the analyzer to correct the displayed trace based on the cable loss over frequency. The reference level offset for the additional screen capture(s) is then based on the expected attenuator value and any other losses.

Fundamental Offset = Ref Lvl Offset showing measured composite factor of all losses

Remaining Screen capture(s) Offset = “Internal” cable loss factor not shown on screen capture + Ref Lvl Offset showing expected attenuator value and any other losses

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2023-05-01	2024-05-01
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Attenuator	S.M. Electronics	SA26B-20	RFW	2024-01-31	2025-01-31
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05

SPURIOUS CONDUCTED EMISSIONS

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

EUT:	MTXDOT-NA1	Work Order:	MLTI0353
Serial Number:	B1235-NA1	Date:	2024-02-07
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.5°C
Attendees:	Brent Nielsen	Relative Humidity:	30.8%
Customer Project:	None	Bar. Pressure (PMSL):	1011 mbar
Tested By:	Trevor Buls	Job Site:	MN11
Power:	5VDC via USB	Configuration:	MLTI0353-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024 RSS-247 Issue 3:2023	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

Trevor Buls

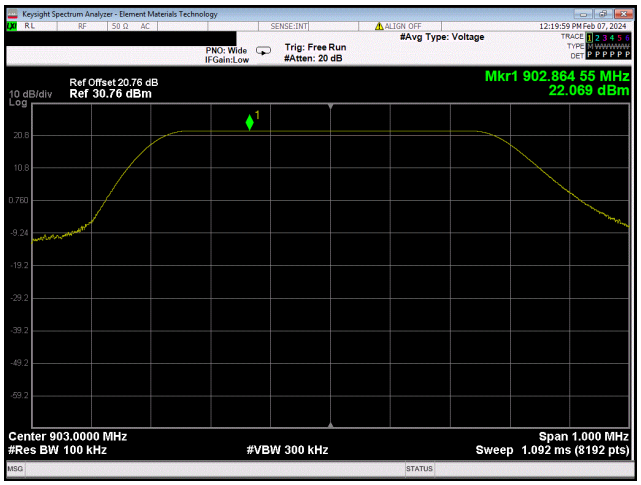
Tested By

TEST RESULTS

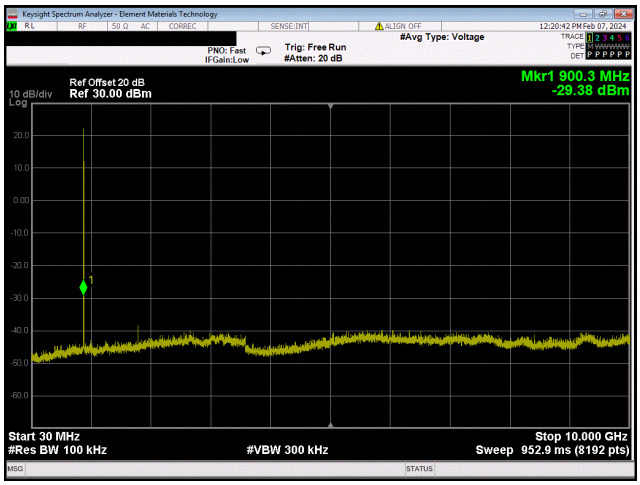
	Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
LoRa CSS, 500 kHz BW					
Low Channel, 903.0 MHz	Fundamental	902.86	N/A	N/A	N/A
	30 MHz - 10 GHz	900.29	-51.45	-30	Pass
Mid Channel, 914.2 MHz	Fundamental	913.96	N/A	N/A	N/A
	30 MHz - 10 GHz	1829.01	-60.8	-30	Pass
High Channel, 927.3 MHz	Fundamental	927.06	N/A	N/A	N/A
	30 MHz - 10 GHz	930.72	-53.18	-30	Pass

SPURIOUS CONDUCTED EMISSIONS

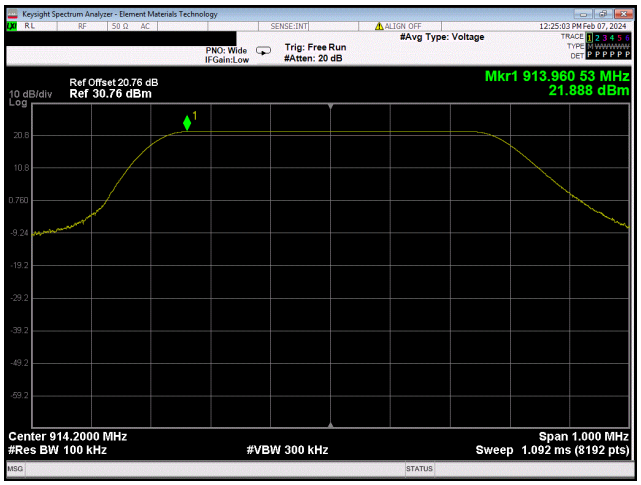
element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



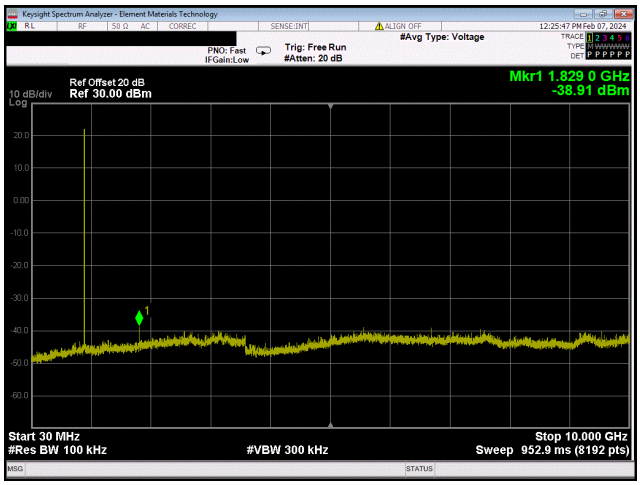
LoRa CSS, 500 kHz BW
Low Channel, 903.0 MHz



LoRa CSS, 500 kHz BW
Low Channel, 903.0 MHz



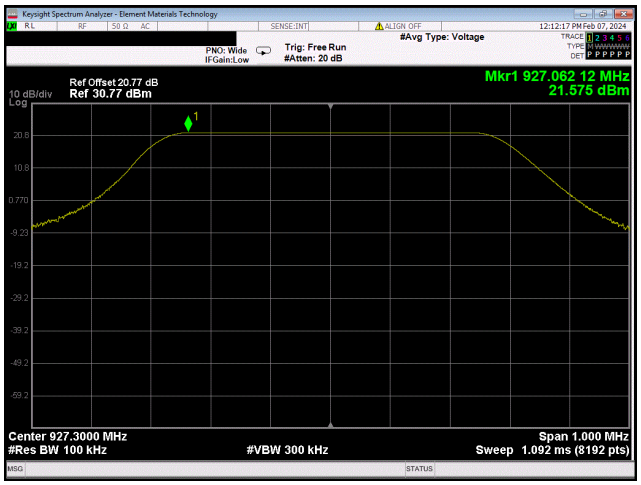
LoRa CSS, 500 kHz BW
Mid Channel, 914.2 MHz



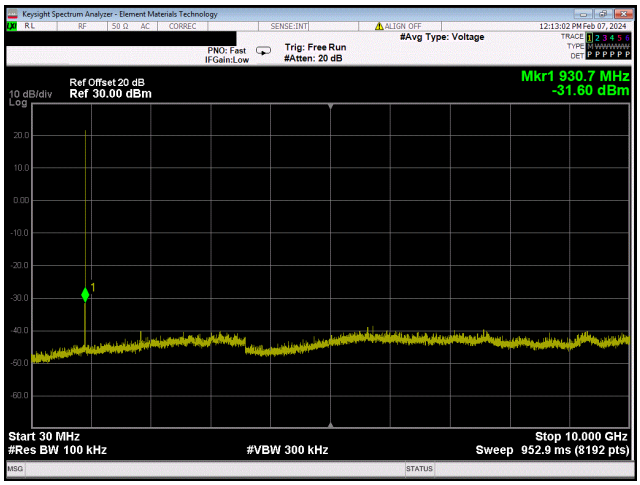
LoRa CSS, 500 kHz BW
Mid Channel, 914.2 MHz

SPURIOUS CONDUCTED EMISSIONS

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



LoRa CSS, 500 kHz BW
High Channel, 927.3 MHz



LoRa CSS, 500 kHz BW
High Channel, 927.3 MHz

POWER SPECTRAL DENSITY

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

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.

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The power spectral density was measured using the channels and modes as called out in the following data sheets.

The method AVGPSD-2 in clause 11.10.5 of ANSI C63.10:2013 was used to make the measurement. This method uses trace averaging and RMS detection across the ON and OFF times of the transmission. The analyzer was configured to the following settings:

Span = at least 1.5 * OBW
RBW = 100 kHz
VBW = 300 kHz
Detector = RMS
Sweep = 601 mS
Points = 601

The peak marker function was used to determine the maximum amplitude level.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2023-05-01	2024-05-01
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Attenuator	S.M. Electronics	SA26B-20	RFW	2024-01-31	2025-01-31
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05

POWER SPECTRAL DENSITY

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

EUT:	MTXDOT-NA1	Work Order:	MLTI0353
Serial Number:	B1235-NA1	Date:	2024-02-07
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.4°C
Attendees:	Brent Nielsen	Relative Humidity:	31%
Customer Project:	None	Bar. Pressure (PMSL):	1011 mbar
Tested By:	Trevor Buls	Job Site:	MN11
Power:	5VDC via USB	Configuration:	MLTI0353-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024 RSS-247 Issue 3:2023	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

Trevor Buls

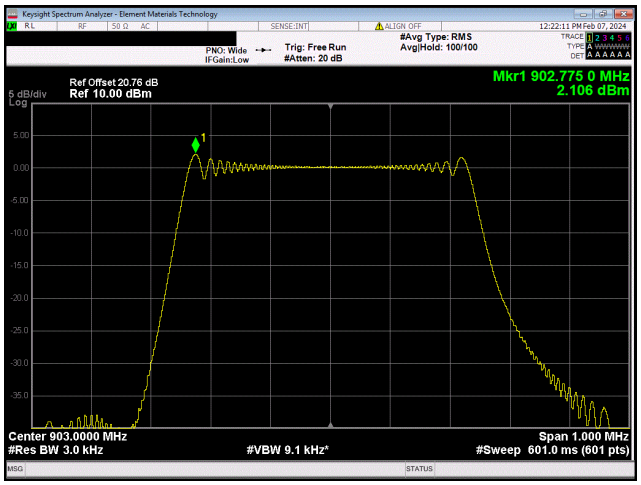
Tested By

TEST RESULTS

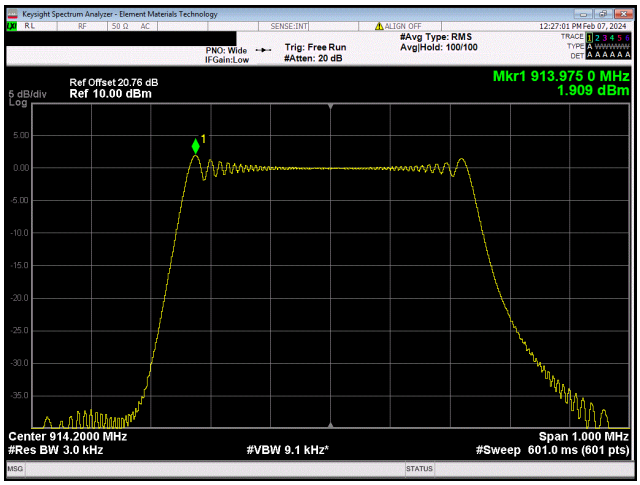
	Value dBm/100kHz	Duty Cycle Factor (dB)	Value dBm/3kHz	Limit ≤ (dBm / 3 kHz)	Results
LoRa CSS, 500 kHz BW					
Low Channel, 903.0 MHz	2.106	0	2.1	8	Pass
Mid Channel, 914.2 MHz	1.909	0	1.9	8	Pass
High Channel, 927.3 MHz	1.39	0	1.4	8	Pass

POWER SPECTRAL DENSITY

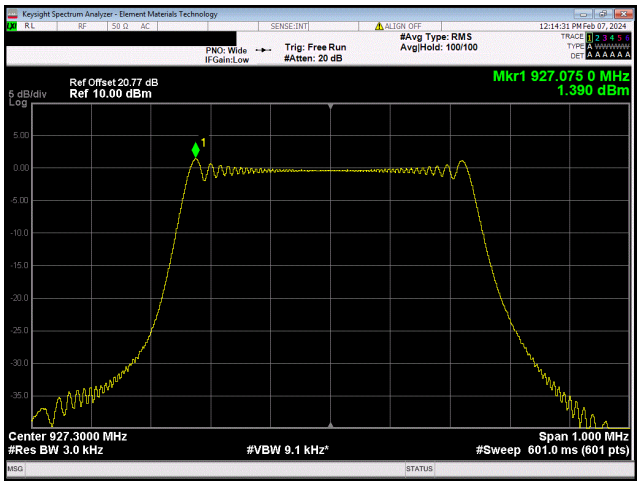
element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



LoRa CSS, 500 kHz BW
Low Channel, 903.0 MHz



LoRa CSS, 500 kHz BW
Mid Channel, 914.2 MHz



LoRa CSS, 500 kHz BW
High Channel, 927.3 MHz

End of Test Report