NORTHWEST EMC

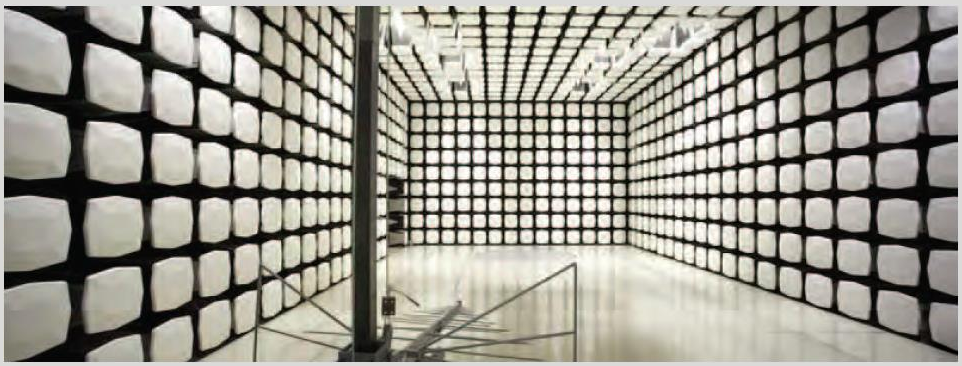
Multi-Tech Systems, Inc.

MTAC-LORA-H-915

FCC 15.247:2017

902 – 928 MHz Transceiver

Report # MLTI0063.1



NVLAP TESTING

NVLAP Lab Code: 200881-0

CERTIFICATE OF TEST

NORTHWEST EMC
2014-12-10

Last Date of Test: January 12, 2017
Multi-Tech Systems, Inc.
Model: MTAC-LORA-H-915

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2017	ANSI C63.10:2013
FCC 15.247:2017	

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	Yes	Pass	
6.5, 6.6, 11.12.1, 11.13.2	Spurious Radiated Emissions	Yes	Pass	
7.8.2	Carrier Frequency Separation	No	N/A	Not required for DTS devices.
7.8.3	Number of Hopping Frequencies	No	N/A	Not required for DTS devices.
7.8.4	Dwell Time	No	N/A	Not required for DTS devices.
7.8.6	Band Edge Compliance - Hopping Mode	No	N/A	Not required for DTS devices.
11.6	Duty Cycle	Yes	N/A	Characterization of radio.
11.8.2	Occupied Bandwidth	Yes	Pass	
11.9.1.1	Output Power	Yes	Pass	
11.10.2	Power Spectral Density	Yes	Pass	
11.11	Spurious Conducted Emissions	Yes	Pass	
11.11	Band Edge Compliance	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Dean Ghizzone, General 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.

REVISION HISTORY

NORTHWEST EMC
REV 2014.10.14

Revision Number	Description	Date	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

REV 2016.7.25

United States

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

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

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with ISED.

European Union

European Commission – Validated by the European Commission as a Notified Body under the R&TTE Directive.

Australia/New Zealand

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

Korea

MSIP / 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.

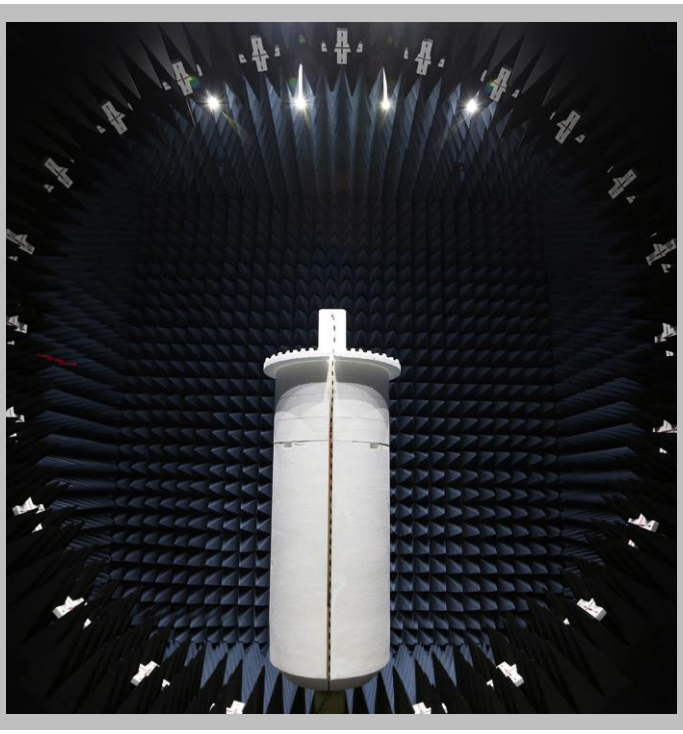
SCOPE

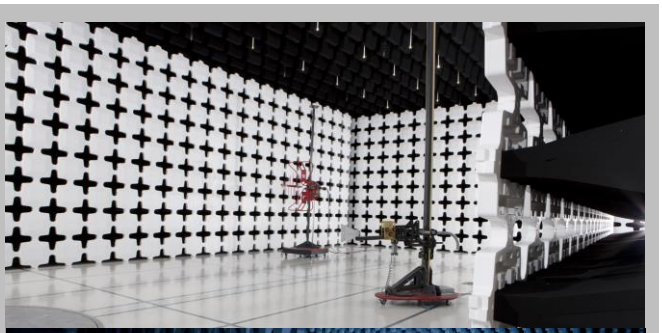
For details on the Scopes of our Accreditations, please visit:
http://www.nwemc.com/accreditations/
http://gsi.nist.gov/global/docs/cabs/designations.html

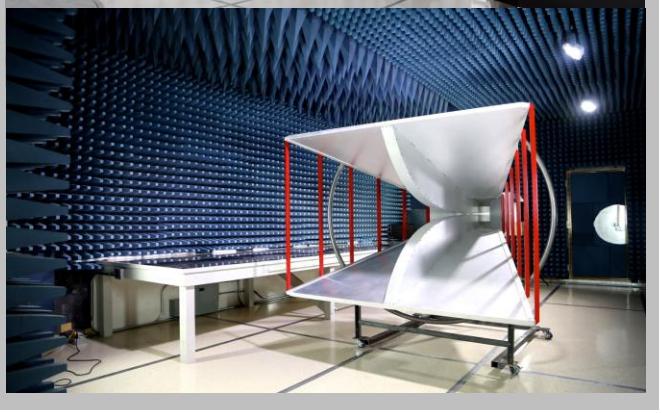
FACILITIES

NORTHWEST EMC
REV 2016.7.25

California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Labs EV01-12 22975 NW Evergreen Pkwy 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
NVLAP					
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Innovation, Science and Economic Development Canada					
2834B-1, 2834B-3	2834E-1	N/A	2834D-1, 2834D-*2*	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157







MEASUREMENT UNCERTAINTY

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 included as part of the applicable test description page. 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.

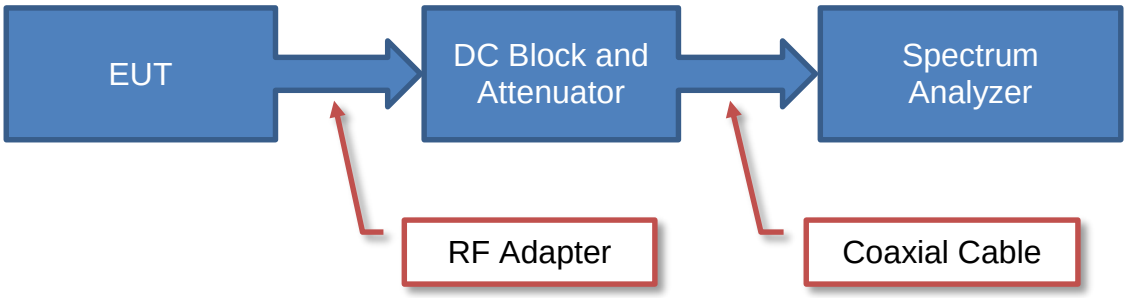
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

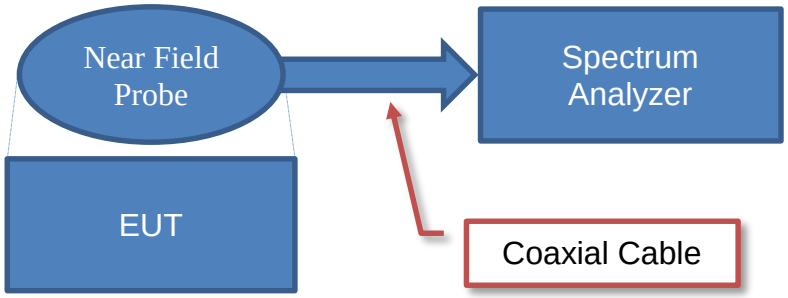
Test Setup Block Diagrams

NORTHWEST EMC
REV 2016.10.04

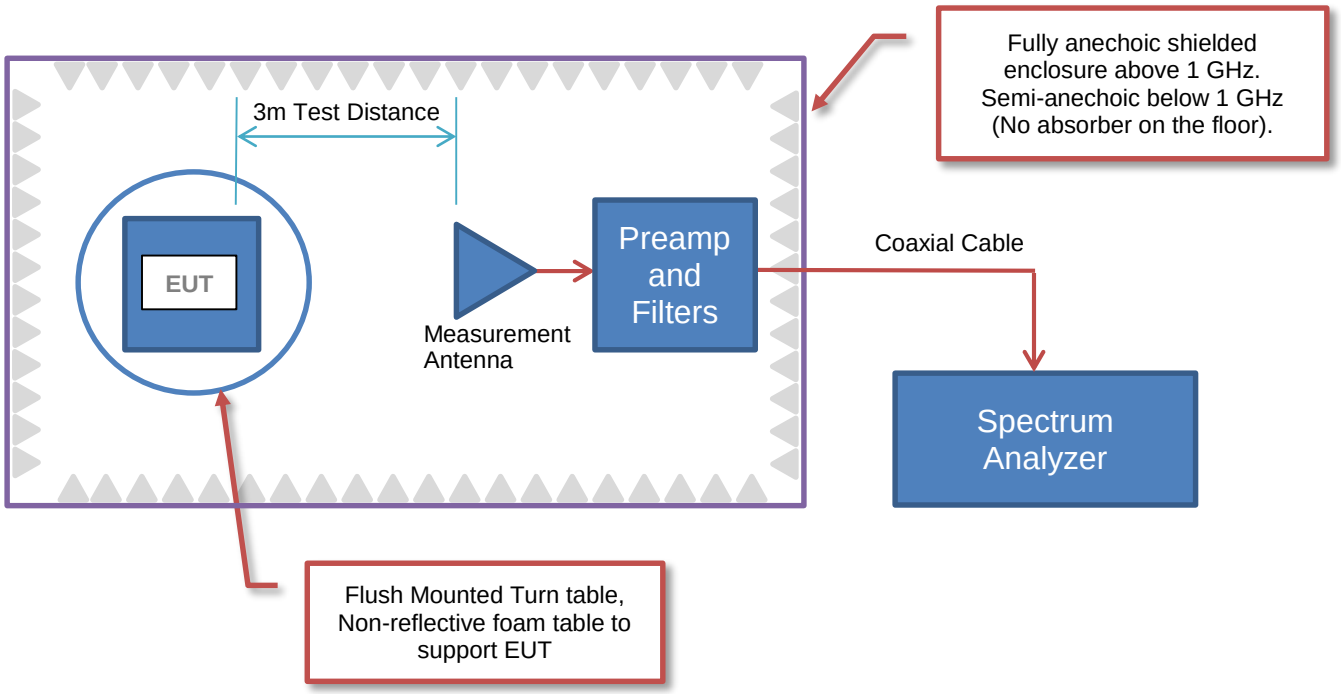
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

NORTHWEST EMC 2014-12-10

Client and Equipment Under Test (EUT) Information

Company Name:	Multi-Tech Systems, Inc.
Address:	2205 Woodale Drive
City, State, Zip:	Mounds View, MN 55112
Test Requested By:	Mike Lynch
Model:	MTAC-LORA-H-915
First Date of Test:	December 08, 2016
Last Date of Test:	January 12, 2017
Receipt Date of Samples:	December 08, 2016
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
ISM Transceiver

Testing Objective:
Seeking to demonstrate compliance under FCC 15.247:2016 for operation in the 902 - 928 MHz Band.

CONFIGURATIONS

NORTHWEST EMC 2014-12-10

Configuration MLTI0063- 1

Software/Firmware Running during test	
Description	**Version**
M Linux	v3.2.3

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Transmitter Module (US)	Multi-Tech Systems, Inc.	MTAC-LORA-H-915	63090838930012
External Antenna (US)	Laird	FG9026	03011609

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Development Board	Multi-Tech Systems, Inc.	70001174L	62350815240020
AC Adapter	GlobTek, Inc.	GT-41052-1509	01006610L
Host Laptop	Lenovo	T61	765819U
Laptop Power Adapter	Lenovo	42T4481	11S42T4418ZIZGWG2985Y8
Mouse	Logitech	RX250	M-BAD58B

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	Yes	.5m	No	Development Board	Host Laptop
DC Cable	No	1.6m	No	Development Board	AC Adapter (AC Mains)
RF Cable	Yes	.25m	No	External Antenna	Transmitter Module
DC Cable	Yes	1.6m	Yes	Host Laptop	Laptop Power Adapter
AC Cable	No	1.8m	No	Laptop Power Adapter	AC Mains
USB Cable	Yes	1.7m	No	Host Laptop	Mouse

Configuration MLTI0063- 4

Software/Firmware Running during test	
Description	**Version**
M Linux	v3.2.3

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Transmitter Module (US)	Multi-Tech Systems, Inc.	MTAC-LORA-H-915	63090838930012

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Development Board	Multi-Tech Systems, Inc.	70001174L	62350815240020
Host Laptop	Lenovo	T61	765819U
Laptop Power Adapter	Lenovo	42T4481	11S42T4418ZIZGWG2985Y8
Mouse	Logitech	RX250	M-BAD58B

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	Yes	.5m	No	Development Board	Host Laptop
RF Cable	Yes	.25m	No	External Antenna	Transmitter Module
DC Cable	Yes	1.6m	Yes	Host Laptop	Laptop Power Adapter
AC Cable	No	1.8m	No	Laptop Power Adapter	AC Mains
USB Cable	Yes	1.7m	No	Host Laptop	Mouse

CONFIGURATIONS

NORTHWEST EMC 2014-12-10

Configuration MLTI0063- 7

Software/Firmware Running during test	
Description	**Version**
M Linux	v3.2.3

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Transmitter Module (US)	Multi-Tech Systems, Inc.	MTAC-LORA-H-915	6390838930004

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Development Board	Multi-Tech Systems, Inc.	70001174L	62350815240020
External Antenna (US)	Laird	FG9026	03011609
AC Adapter	GlobTek, Inc.	GT-41052-1509	01006610L
Host Laptop	Lenovo	T61	765819U
Laptop Power Adapter	Lenovo	42T4481	11S42T4418ZIZGWG2985Y8
Mouse	Logitech	RX250	M-BAD58B
DC Power Supply	Rigol	DP1116A	DP1C152600080
DC Power Supply	Agilent	U8002A	MY50490005

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
RF Cable	Yes	.25m	No	External Antenna	Transmitter Module
DC Cable	Yes	1.6m	Yes	Host Laptop	Laptop Power Adapter
AC Cable	No	1.8m	No	Laptop Power Adapter	AC Mains
USB Cable	Yes	1.7m	No	Host Laptop	Mouse
DC Power	No	1.7m	No	DC Power Supply	Transmitter Module
DC Power	No	1.7m	No	DC Power Supply	Transmitter Module
Data Cable	No	.5m	No	Development Board	Transmitter Module
AC Power	No	1.8m	No	AC Mains	DC Power Supply
AC Power	No	1.8m	No	AC Mains	DC Power Supply

MODIFICATIONS

NORTHWEST EMC
2014-12-10

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	12/8/2016	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	12/13/2016	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
3	12/13/2016	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
4	12/13/2016	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
5	12/13/2016	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
6	12/29/2016	Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
7	01/12/2017	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWERLINE CONDUCTED EMISSIONS

WTD.2016.05.18

TEST DESCRIPTION

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Receiver	Rohde & Schwarz	ESR7	ARI	6/14/2016	6/14/2017
Cable - Conducted Cable Assembly	Northwest EMC	MNC, HGN, TYK	MNCA	1/29/2016	1/29/2017
LISN	Solar Electronics	9252-50-R-24-BNC	LIY	3/21/2016	3/21/2017

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

MLTI0063-7

MODES INVESTIGATED

Transmitting mid channel 925.1 MHz

POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2016.05.18

EUT:	MTAC-LORA-H-915	Work Order:	MLTI0063
Serial Number:	6390838930004	Date:	12/29/2016
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.1°C
Attendees:	Marcus Glass	Relative Humidity:	23.2%
Customer Project:	None	Bar. Pressure:	1013 mb
Tested By:	Cole Ghizzone	Job Site:	MN03
Power:	5VDC	Configuration:	MLTI0063-7

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2016	ANSI C63.10:2013

TEST PARAMETERS

Run #:	33	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

Measuring the 120VAC/60Hz input to the Rigol linear DC supply.

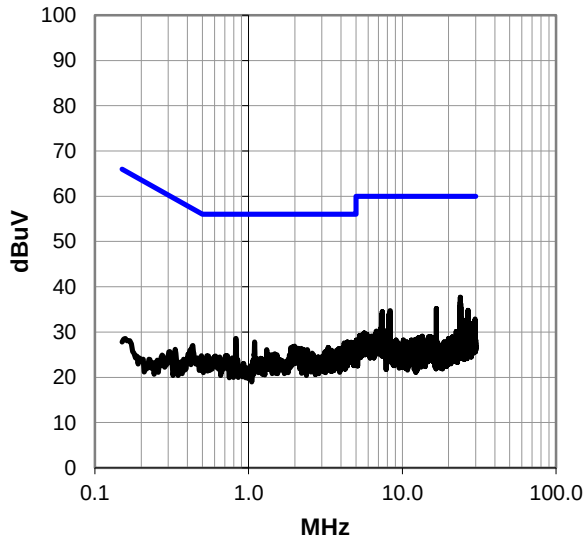
EUT OPERATING MODES

Transmitting mid channel 925.1 MHz

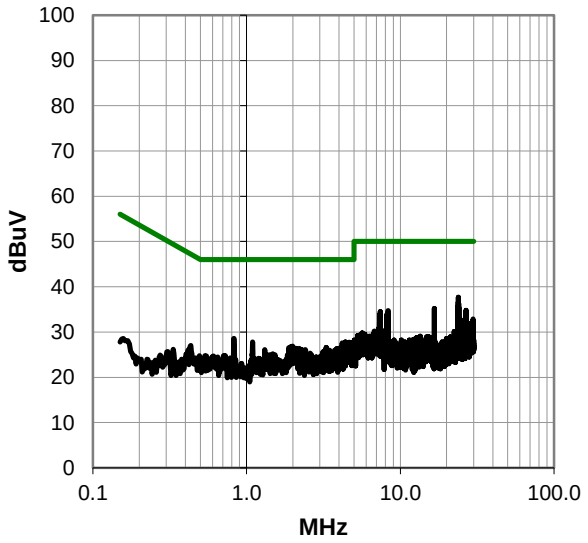
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2016.05.18

RESULTS - Run #33

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
23.893	15.8	21.9	37.7	60.0	-22.3
23.870	14.7	21.9	36.6	60.0	-23.4
23.979	14.3	22.0	36.3	60.0	-23.7
23.952	13.6	21.9	35.5	60.0	-24.5
16.666	14.0	21.2	35.2	60.0	-24.8
26.717	12.6	22.2	34.8	60.0	-25.2
8.328	14.1	20.6	34.7	60.0	-25.3
7.410	14.1	20.4	34.5	60.0	-25.5
23.826	12.3	21.9	34.2	60.0	-25.8
23.855	12.2	21.9	34.1	60.0	-25.9
8.264	13.4	20.6	34.0	60.0	-26.0
23.807	12.1	21.9	34.0	60.0	-26.0
8.197	13.3	20.6	33.9	60.0	-26.1
7.324	13.4	20.4	33.8	60.0	-26.2
23.788	11.7	21.9	33.6	60.0	-26.4
23.941	11.5	21.9	33.4	60.0	-26.6
26.676	11.1	22.2	33.3	60.0	-26.7
26.773	11.0	22.2	33.2	60.0	-26.8
29.679	10.3	22.6	32.9	60.0	-27.1
7.365	12.4	20.4	32.8	60.0	-27.2
23.964	10.9	21.9	32.8	60.0	-27.2
24.833	10.7	22.0	32.7	60.0	-27.3
0.825	8.5	20.1	28.6	56.0	-27.4
8.302	11.9	20.6	32.5	60.0	-27.5
8.287	11.8	20.6	32.4	60.0	-27.6
7.347	11.6	20.4	32.0	60.0	-28.0

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
23.893	15.8	21.9	37.7	50.0	-12.3
23.870	14.7	21.9	36.6	50.0	-13.4
23.979	14.3	22.0	36.3	50.0	-13.7
23.952	13.6	21.9	35.5	50.0	-14.5
16.666	14.0	21.2	35.2	50.0	-14.8
26.717	12.6	22.2	34.8	50.0	-15.2
8.328	14.1	20.6	34.7	50.0	-15.3
7.410	14.1	20.4	34.5	50.0	-15.5
23.826	12.3	21.9	34.2	50.0	-15.8
23.855	12.2	21.9	34.1	50.0	-15.9
8.264	13.4	20.6	34.0	50.0	-16.0
23.807	12.1	21.9	34.0	50.0	-16.0
8.197	13.3	20.6	33.9	50.0	-16.1
7.324	13.4	20.4	33.8	50.0	-16.2
23.788	11.7	21.9	33.6	50.0	-16.4
23.941	11.5	21.9	33.4	50.0	-16.6
26.676	11.1	22.2	33.3	50.0	-16.7
26.773	11.0	22.2	33.2	50.0	-16.8
29.679	10.3	22.6	32.9	50.0	-17.1
7.365	12.4	20.4	32.8	50.0	-17.2
23.964	10.9	21.9	32.8	50.0	-17.2
24.833	10.7	22.0	32.7	50.0	-17.3
0.825	8.5	20.1	28.6	46.0	-17.4
8.302	11.9	20.6	32.5	50.0	-17.5
8.287	11.8	20.6	32.4	50.0	-17.6
7.347	11.6	20.4	32.0	50.0	-18.0

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

EUT:	MTAC-LORA-H-915	Work Order:	MLTI0063
Serial Number:	6390838930004	Date:	12/29/2016
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.1°C
Attendees:	Marcus Glass	Relative Humidity:	23.2%
Customer Project:	None	Bar. Pressure:	1013 mb
Tested By:	Cole Ghizzone	Job Site:	MN03
Power:	5VDC	Configuration:	MLTI0063-7

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2016	ANSI C63.10:2013

TEST PARAMETERS

Run #:	34	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

Measuring the 120VAC/60Hz input to the Rigol linear DC supply.

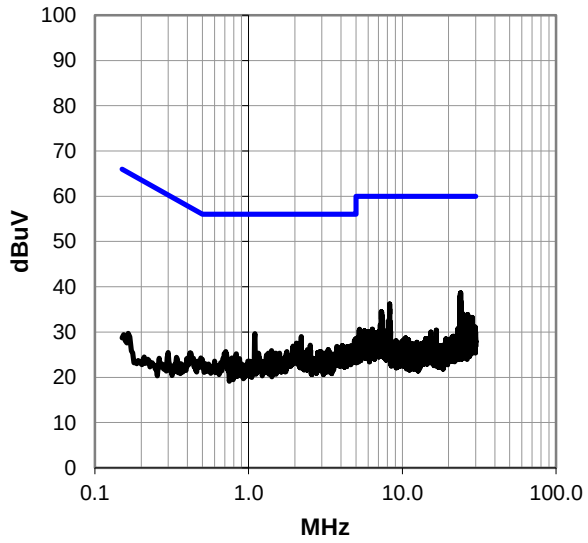
EUT OPERATING MODES

Transmitting mid channel 925.1 MHz

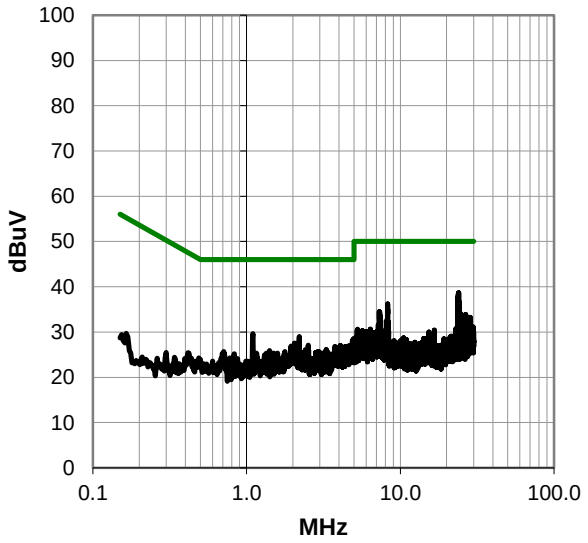
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2016.05.18

RESULTS - Run #34

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
23.952	16.8	21.9	38.7	60.0	-21.3
23.919	16.6	21.9	38.5	60.0	-21.5
23.840	16.2	21.9	38.1	60.0	-21.9
23.867	15.9	21.9	37.8	60.0	-22.2
23.822	15.6	21.9	37.5	60.0	-22.5
23.982	14.9	22.0	36.9	60.0	-23.1
8.264	15.6	20.6	36.2	60.0	-23.8
7.313	14.1	20.4	34.5	60.0	-25.5
7.339	14.0	20.4	34.4	60.0	-25.6
24.781	12.0	22.0	34.0	60.0	-26.0
26.590	11.7	22.2	33.9	60.0	-26.1
1.098	9.5	20.1	29.6	56.0	-26.4
23.688	11.7	21.9	33.6	60.0	-26.4
7.414	13.1	20.4	33.5	60.0	-26.5
26.676	11.2	22.2	33.4	60.0	-26.6
26.777	11.2	22.2	33.4	60.0	-26.6
25.766	11.2	22.1	33.3	60.0	-26.7
26.698	11.1	22.2	33.3	60.0	-26.7
24.837	11.2	22.0	33.2	60.0	-26.8
28.459	10.8	22.4	33.2	60.0	-26.8
7.373	12.7	20.4	33.1	60.0	-26.9
23.777	11.2	21.9	33.1	60.0	-26.9
2.198	8.8	20.2	29.0	56.0	-27.0
24.818	10.9	22.0	32.9	60.0	-27.1
26.747	10.6	22.2	32.8	60.0	-27.2
7.362	12.3	20.4	32.7	60.0	-27.3

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
23.952	16.8	21.9	38.7	50.0	-11.3
23.919	16.6	21.9	38.5	50.0	-11.5
23.840	16.2	21.9	38.1	50.0	-11.9
23.867	15.9	21.9	37.8	50.0	-12.2
23.822	15.6	21.9	37.5	50.0	-12.5
23.982	14.9	22.0	36.9	50.0	-13.1
8.264	15.6	20.6	36.2	50.0	-13.8
7.313	14.1	20.4	34.5	50.0	-15.5
7.339	14.0	20.4	34.4	50.0	-15.6
24.781	12.0	22.0	34.0	50.0	-16.0
26.590	11.7	22.2	33.9	50.0	-16.1
1.098	9.5	20.1	29.6	46.0	-16.4
23.688	11.7	21.9	33.6	50.0	-16.4
7.414	13.1	20.4	33.5	50.0	-16.5
26.676	11.2	22.2	33.4	50.0	-16.6
26.777	11.2	22.2	33.4	50.0	-16.6
25.766	11.2	22.1	33.3	50.0	-16.7
26.698	11.1	22.2	33.3	50.0	-16.7
24.837	11.2	22.0	33.2	50.0	-16.8
28.459	10.8	22.4	33.2	50.0	-16.8
7.373	12.7	20.4	33.1	50.0	-16.9
23.777	11.2	21.9	33.1	50.0	-16.9
2.198	8.8	20.2	29.0	46.0	-17.0
24.818	10.9	22.0	32.9	50.0	-17.1
26.747	10.6	22.2	32.8	50.0	-17.2
7.362	12.3	20.4	32.7	50.0	-17.3

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2016.05.18

EUT:	MTAC-LORA-H-915	Work Order:	MLTI0063
Serial Number:	6390838930004	Date:	12/29/2016
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.1°C
Attendees:	Marcus Glass	Relative Humidity:	23.2%
Customer Project:	None	Bar. Pressure:	1013 mb
Tested By:	Cole Ghizzone	Job Site:	MN03
Power:	3.3VDC	Configuration:	MLTI0063-7

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2016	ANSI C63.10:2013

TEST PARAMETERS

Run #:	37	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

Measuring the 120VAC/60Hz input to the Rigol linear DC supply.

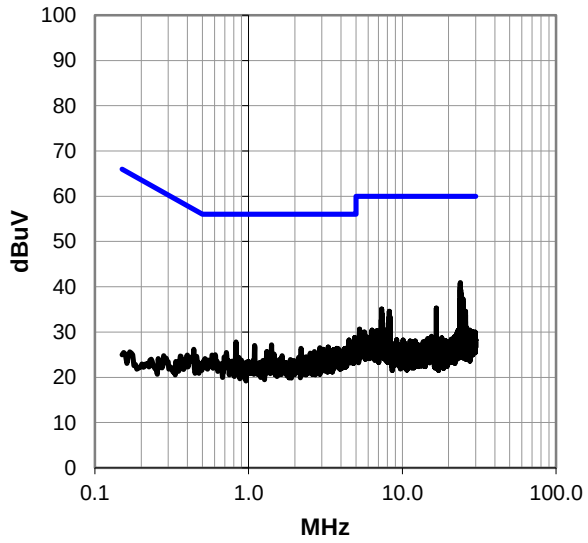
EUT OPERATING MODES

Transmitting mid channel 925.1 MHz

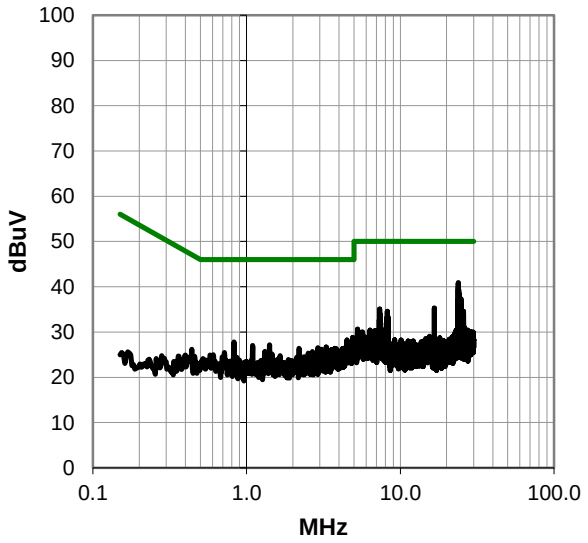
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2016.05.18

RESULTS - Run #37

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
23.915	19.0	21.9	40.9	60.0	-19.1
23.874	18.8	21.9	40.7	60.0	-19.3
23.900	18.0	21.9	39.9	60.0	-20.1
23.960	17.4	21.9	39.3	60.0	-20.7
23.818	15.6	21.9	37.5	60.0	-22.5
24.837	15.3	22.0	37.3	60.0	-22.7
23.979	15.1	22.0	37.1	60.0	-22.9
23.993	14.6	22.0	36.6	60.0	-23.4
24.885	14.5	22.0	36.5	60.0	-23.5
24.810	14.4	22.0	36.4	60.0	-23.6
23.799	14.2	21.9	36.1	60.0	-23.9
24.863	14.0	22.0	36.0	60.0	-24.0
23.844	13.7	21.9	35.6	60.0	-24.4
24.769	13.5	22.0	35.5	60.0	-24.5
16.666	14.1	21.2	35.3	60.0	-24.7
24.023	13.2	22.0	35.2	60.0	-24.8
24.784	13.2	22.0	35.2	60.0	-24.8
7.324	14.7	20.4	35.1	60.0	-24.9
8.238	14.0	20.6	34.6	60.0	-25.4
25.754	12.5	22.1	34.6	60.0	-25.4
7.384	13.6	20.4	34.0	60.0	-26.0
24.038	11.8	22.0	33.8	60.0	-26.2
25.710	11.7	22.1	33.8	60.0	-26.2
8.261	12.9	20.6	33.5	60.0	-26.5
8.220	12.8	20.6	33.4	60.0	-26.6
8.294	12.7	20.6	33.3	60.0	-26.7

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
23.915	19.0	21.9	40.9	50.0	-9.1
23.874	18.8	21.9	40.7	50.0	-9.3
23.900	18.0	21.9	39.9	50.0	-10.1
23.960	17.4	21.9	39.3	50.0	-10.7
23.818	15.6	21.9	37.5	50.0	-12.5
24.837	15.3	22.0	37.3	50.0	-12.7
23.979	15.1	22.0	37.1	50.0	-12.9
23.993	14.6	22.0	36.6	50.0	-13.4
24.885	14.5	22.0	36.5	50.0	-13.5
24.810	14.4	22.0	36.4	50.0	-13.6
23.799	14.2	21.9	36.1	50.0	-13.9
24.863	14.0	22.0	36.0	50.0	-14.0
23.844	13.7	21.9	35.6	50.0	-14.4
24.769	13.5	22.0	35.5	50.0	-14.5
16.666	14.1	21.2	35.3	50.0	-14.7
24.023	13.2	22.0	35.2	50.0	-14.8
24.784	13.2	22.0	35.2	50.0	-14.8
7.324	14.7	20.4	35.1	50.0	-14.9
8.238	14.0	20.6	34.6	50.0	-15.4
25.754	12.5	22.1	34.6	50.0	-15.4
7.384	13.6	20.4	34.0	50.0	-16.0
24.038	11.8	22.0	33.8	50.0	-16.2
25.710	11.7	22.1	33.8	50.0	-16.2
8.261	12.9	20.6	33.5	50.0	-16.5
8.220	12.8	20.6	33.4	50.0	-16.6
8.294	12.7	20.6	33.3	50.0	-16.7

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2016.05.18

EUT:	MTAC-LORA-H-915	Work Order:	MLTI0063
Serial Number:	6390838930004	Date:	12/29/2016
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.1°C
Attendees:	Marcus Glass	Relative Humidity:	23.2%
Customer Project:	None	Bar. Pressure:	1013 mb
Tested By:	Cole Ghizzone	Job Site:	MN03
Power:	3.3VDC	Configuration:	MLTI0063-7

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2016	ANSI C63.10:2013

TEST PARAMETERS

Run #:	38	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

Measuring the 120VAC/60Hz input to the Rigol linear DC supply.

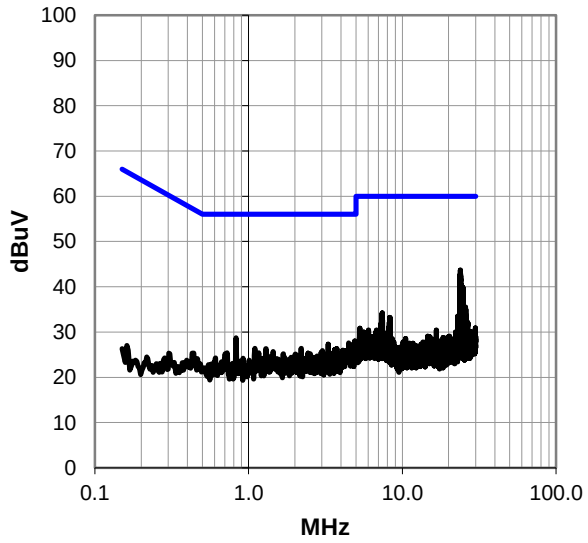
EUT OPERATING MODES

Transmitting mid channel 925.1 MHz

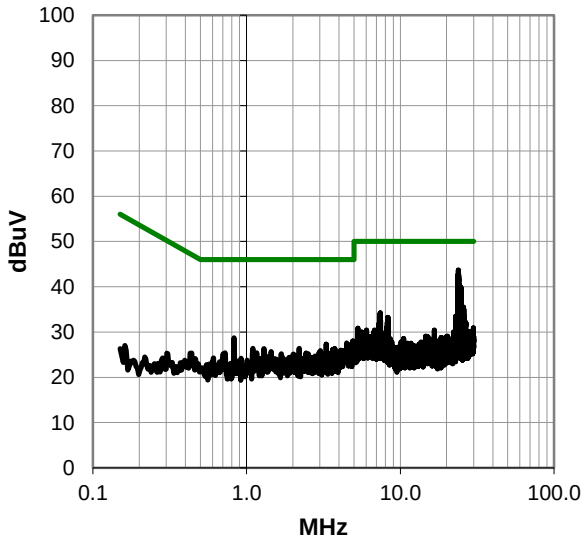
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2016.05.18

RESULTS - Run #38

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
23.900	21.8	21.9	43.7	60.0	-16.3
23.870	20.9	21.9	42.8	60.0	-17.2
23.919	20.9	21.9	42.8	60.0	-17.2
23.956	20.5	21.9	42.4	60.0	-17.6
23.937	18.8	21.9	40.7	60.0	-19.3
23.818	18.7	21.9	40.6	60.0	-19.4
23.993	18.5	22.0	40.5	60.0	-19.5
23.792	18.0	21.9	39.9	60.0	-20.1
24.840	17.9	22.0	39.9	60.0	-20.1
24.814	17.5	22.0	39.5	60.0	-20.5
24.911	16.8	22.0	38.8	60.0	-21.2
24.792	15.8	22.0	37.8	60.0	-22.2
24.893	15.8	22.0	37.8	60.0	-22.2
23.762	14.7	21.9	36.6	60.0	-23.4
24.751	13.9	22.0	35.9	60.0	-24.1
25.747	13.4	22.1	35.5	60.0	-24.5
24.922	13.1	22.0	35.1	60.0	-24.9
25.829	13.0	22.1	35.1	60.0	-24.9
25.695	12.9	22.1	35.0	60.0	-25.0
25.784	12.8	22.1	34.9	60.0	-25.1
23.635	12.9	21.9	34.8	60.0	-25.2
24.046	12.7	22.0	34.7	60.0	-25.3
24.937	12.7	22.0	34.7	60.0	-25.3
24.736	12.5	22.0	34.5	60.0	-25.5
7.403	13.8	20.4	34.2	60.0	-25.8
25.739	12.1	22.1	34.2	60.0	-25.8

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
23.900	21.8	21.9	43.7	50.0	-6.3
23.870	20.9	21.9	42.8	50.0	-7.2
23.919	20.9	21.9	42.8	50.0	-7.2
23.956	20.5	21.9	42.4	50.0	-7.6
23.937	18.8	21.9	40.7	50.0	-9.3
23.818	18.7	21.9	40.6	50.0	-9.4
23.993	18.5	22.0	40.5	50.0	-9.5
23.792	18.0	21.9	39.9	50.0	-10.1
24.840	17.9	22.0	39.9	50.0	-10.1
24.814	17.5	22.0	39.5	50.0	-10.5
24.911	16.8	22.0	38.8	50.0	-11.2
24.792	15.8	22.0	37.8	50.0	-12.2
24.893	15.8	22.0	37.8	50.0	-12.2
23.762	14.7	21.9	36.6	50.0	-13.4
24.751	13.9	22.0	35.9	50.0	-14.1
25.747	13.4	22.1	35.5	50.0	-14.5
24.922	13.1	22.0	35.1	50.0	-14.9
25.829	13.0	22.1	35.1	50.0	-14.9
25.695	12.9	22.1	35.0	50.0	-15.0
25.784	12.8	22.1	34.9	50.0	-15.1
23.635	12.9	21.9	34.8	50.0	-15.2
24.046	12.7	22.0	34.7	50.0	-15.3
24.937	12.7	22.0	34.7	50.0	-15.3
24.736	12.5	22.0	34.5	50.0	-15.5
7.403	13.8	20.4	34.2	50.0	-15.8
25.739	12.1	22.1	34.2	50.0	-15.8

CONCLUSION

Pass

Tested By

SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2016.09.30.1

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

Transmit Mode: Low Ch (923.3 MHz), Mid Ch (925.1 MHz), High Ch (927.5 MHz)

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

MLTI0063 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	18 GHz

SAMPLE CALCULATIONS

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Attenuator	Fairview Microwave	SA18E-10	TYA	9/23/2016	12 mo
Attenuator	Fairview Microwave	SA18E-20	TWZ	9/23/2016	12 mo
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	7/29/2016	12 mo
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	12/1/2016	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	12/1/2016	12 mo
Filter - High Pass	Micro-Tronics	HPM50108	LFM	9/22/2016	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AYD	1/6/2016	24 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVW	3/1/2016	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	3/1/2016	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	3/1/2016	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	12/1/2016	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AJA	6/23/2016	24 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AIQ	NCR	0 mo
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2016	12 mo

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

TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was transmitting and receiving while set at the lowest channel, a middle channel, and the highest channel available. While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT antenna in horizontal and vertical position. A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

SPURIOUS RADIATED EMISSIONS

NORTHWEST EMC

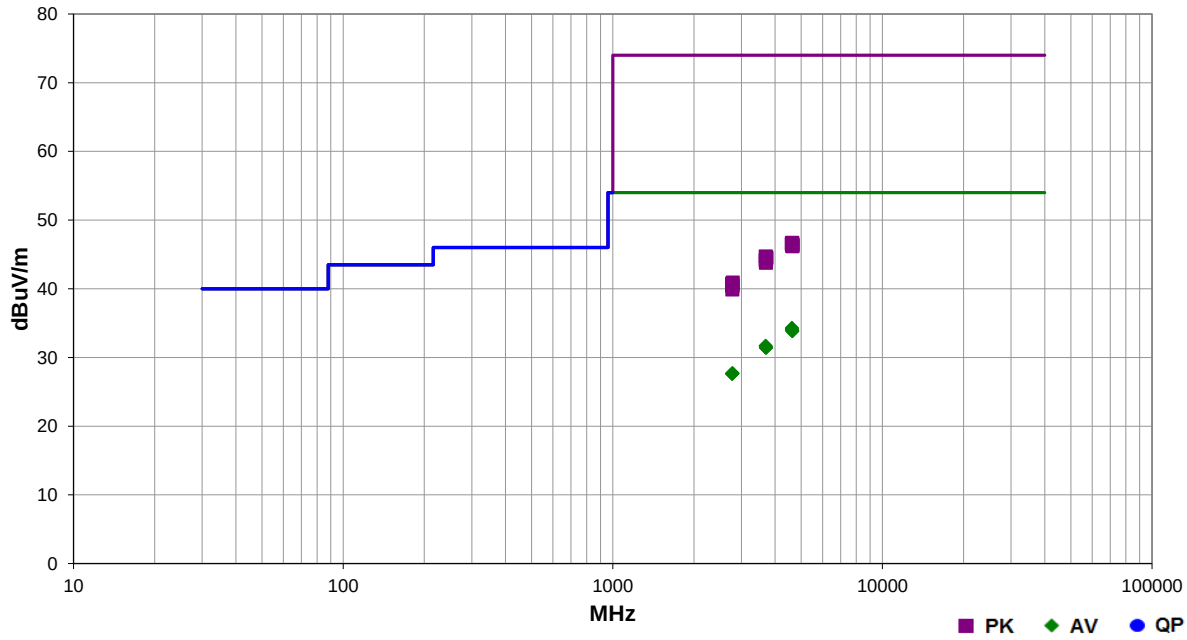
PSA-ESCI 2016.09.30.1

EmiR5 2016.08.26

Work Order:	MLTI0063	**Date:**	12/08/16		
Project:	None	**Temperature:**	23.2 °C		
Job Site:	MN05	**Humidity:**	19.2% RH		
Serial Number:	63090838930012	**Barometric Pres.:**	1035 mbar	**Tested by:**	Mark Baytan
EUT:	MTAC-LORA-H-915				
Configuration:	1				
Customer:	Multi-Tech Systems, Inc.				
Attendees:	Tom Swanson				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmit Mode: Low Ch (923.3 MHz), Mid Ch (925.1 MHz), High Ch (927.5 MHz)				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 15.247:2016	ANSI C63.10:2013

Run #	18	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4625.023	28.7	5.6	1.0	103.0	3.0	0.0	Horz	AV	0.0	34.3	54.0	-19.7	Mid Ch, EUT Vert
4625.020	28.6	5.6	4.0	265.9	3.0	0.0	Vert	AV	0.0	34.2	54.0	-19.8	Mid Ch, EUT Vert
4616.983	28.6	5.5	4.0	322.9	3.0	0.0	Horz	AV	0.0	34.1	54.0	-19.9	Low Ch, EUT Vert
4617.000	28.6	5.5	1.0	257.9	3.0	0.0	Vert	AV	0.0	34.1	54.0	-19.9	Low Ch, EUT Vert
4637.077	28.3	5.6	1.0	0.0	3.0	0.0	Horz	AV	0.0	33.9	54.0	-20.1	High Ch, EUT Vert
4637.268	28.3	5.6	1.0	14.0	3.0	0.0	Vert	AV	0.0	33.9	54.0	-20.1	High Ch, EUT Vert
4637.003	28.2	5.6	1.0	351.0	3.0	0.0	Horz	AV	0.0	33.8	54.0	-20.2	High Ch, EUT Horz
4637.108	28.2	5.6	1.0	18.0	3.0	0.0	Vert	AV	0.0	33.8	54.0	-20.2	High Ch, EUT Horz
3693.687	29.4	2.3	4.0	307.9	3.0	0.0	Horz	AV	0.0	31.7	54.0	-22.3	Low Ch, EUT Vert
3693.665	29.3	2.3	3.0	330.9	3.0	0.0	Vert	AV	0.0	31.6	54.0	-22.4	Low Ch, EUT Vert
3710.448	29.1	2.4	1.0	31.0	3.0	0.0	Vert	AV	0.0	31.5	54.0	-22.5	High Ch, EUT Vert
3710.395	29.0	2.4	3.8	206.1	3.0	0.0	Horz	AV	0.0	31.4	54.0	-22.6	High Ch, EUT Vert
3700.572	29.0	2.4	1.6	81.0	3.0	0.0	Horz	AV	0.0	31.4	54.0	-22.6	Mid Ch, EUT Vert
3700.837	29.0	2.4	1.0	275.9	3.0	0.0	Vert	AV	0.0	31.4	54.0	-22.6	Mid Ch, EUT Vert
2782.917	29.1	-1.4	1.0	134.1	3.0	0.0	Horz	AV	0.0	27.7	54.0	-26.3	High Ch, EUT Vert
2782.885	29.1	-1.4	1.0	60.0	3.0	0.0	Vert	AV	0.0	27.7	54.0	-26.3	High Ch, EUT Vert
2769.543	29.4	-1.7	3.8	57.0	3.0	0.0	Horz	AV	0.0	27.7	54.0	-26.3	Low Ch, EUT Vert
2769.400	29.3	-1.7	1.0	232.0	3.0	0.0	Vert	AV	0.0	27.6	54.0	-26.4	Low Ch, EUT Vert

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2775.730	29.1	-1.5	2.6	314.0	3.0	0.0	Horz	AV	0.0	27.6	54.0	-26.4	Mid Ch, EUT Vert
2775.600	29.1	-1.5	1.0	322.0	3.0	0.0	Vert	AV	0.0	27.6	54.0	-26.4	Mid Ch, EUT Vert
4625.585	41.1	5.6	1.0	103.0	3.0	0.0	Horz	PK	0.0	46.7	74.0	-27.3	Mid Ch, EUT Vert
4637.467	41.0	5.6	1.0	351.0	3.0	0.0	Horz	PK	0.0	46.6	74.0	-27.4	High Ch, EUT Horz
4616.022	41.1	5.5	4.0	322.9	3.0	0.0	Horz	PK	0.0	46.6	74.0	-27.4	Low Ch, EUT Vert
4616.657	41.0	5.5	1.0	257.9	3.0	0.0	Vert	PK	0.0	46.5	74.0	-27.5	Low Ch, EUT Vert
4637.163	40.8	5.6	1.0	18.0	3.0	0.0	Vert	PK	0.0	46.4	74.0	-27.6	High Ch, EUT Horz
4625.085	40.8	5.6	4.0	265.9	3.0	0.0	Vert	PK	0.0	46.4	74.0	-27.6	Mid Ch, EUT Vert
4637.252	40.7	5.6	1.0	14.0	3.0	0.0	Vert	PK	0.0	46.3	74.0	-27.7	High Ch, EUT Vert
4637.607	40.6	5.6	1.0	0.0	3.0	0.0	Horz	PK	0.0	46.2	74.0	-27.8	High Ch, EUT Vert
3693.345	42.4	2.3	3.0	330.9	3.0	0.0	Vert	PK	0.0	44.7	74.0	-29.3	Low Ch, EUT Vert
3710.347	42.2	2.4	3.8	206.1	3.0	0.0	Horz	PK	0.0	44.6	74.0	-29.4	High Ch, EUT Vert
3709.910	42.0	2.4	1.0	31.0	3.0	0.0	Vert	PK	0.0	44.4	74.0	-29.6	High Ch, EUT Vert
3692.987	41.9	2.3	4.0	307.9	3.0	0.0	Horz	PK	0.0	44.2	74.0	-29.8	Low Ch, EUT Vert
3700.300	41.6	2.4	1.0	275.9	3.0	0.0	Vert	PK	0.0	44.0	74.0	-30.0	Mid Ch, EUT Vert
3700.798	41.4	2.4	1.6	81.0	3.0	0.0	Horz	PK	0.0	43.8	74.0	-30.2	Mid Ch, EUT Vert
2782.538	42.3	-1.4	1.0	134.1	3.0	0.0	Horz	PK	0.0	40.9	74.0	-33.1	High Ch, EUT Vert
2769.953	42.4	-1.7	3.8	57.0	3.0	0.0	Horz	PK	0.0	40.7	74.0	-33.3	Low Ch, EUT Vert
2775.713	42.1	-1.5	1.0	322.0	3.0	0.0	Vert	PK	0.0	40.6	74.0	-33.4	Mid Ch, EUT Vert
2769.605	42.2	-1.7	1.0	232.0	3.0	0.0	Vert	PK	0.0	40.5	74.0	-33.5	Low Ch, EUT Vert
2782.073	41.8	-1.4	1.0	60.0	3.0	0.0	Vert	PK	0.0	40.4	74.0	-33.6	High Ch, EUT Vert
2774.898	41.5	-1.6	2.6	314.0	3.0	0.0	Horz	PK	0.0	39.9	74.0	-34.1	Mid Ch, EUT Vert

DUTY CYCLE

TEST DESCRIPTION

The Duty Cycle (x) were measured for each of the EUT operating modes. The measurements were made using a zero span on the spectrum analyzer to see the pulses in the time domain. The transmit power was set to its default maximum.

The duty cycle was calculated by dividing the transmission pulse duration (T) by the total period of a single on and total off time.

The EUT operates at 100% Duty Cycle.

OCCUPIED BANDWIDTH

XMit 2016.12.19

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	Agilent	E4443A	AAS	3/8/2016	3/8/2017
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/15/2016	9/15/2017
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	2/26/2017
Block - DC	Fairview Microwave	SD3379	AMI	9/15/2016	9/15/2017

TEST DESCRIPTION

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 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

NORTHWEST EMC

XMit 2016.12.19
NweTx 2016.09.14.2

EUT:	MTAC-LORA-H-915			**Work Order:**	MLTI0063
Serial Number:	63090838930012			**Date:**	01/12/17
Customer:	Multi-Tech Systems, Inc.			**Temperature:**	22.5 °C
Attendees:	Marcus Glass			**Humidity:**	14.8% RH
Project:	None			**Barometric Pres.:**	1025 mbar
Tested by:	Trevor Buls	**Power:**	110VAC/60Hz	**Job Site:**	MN02

TEST SPECIFICATIONS	Test Method
FCC 15.247:2017	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

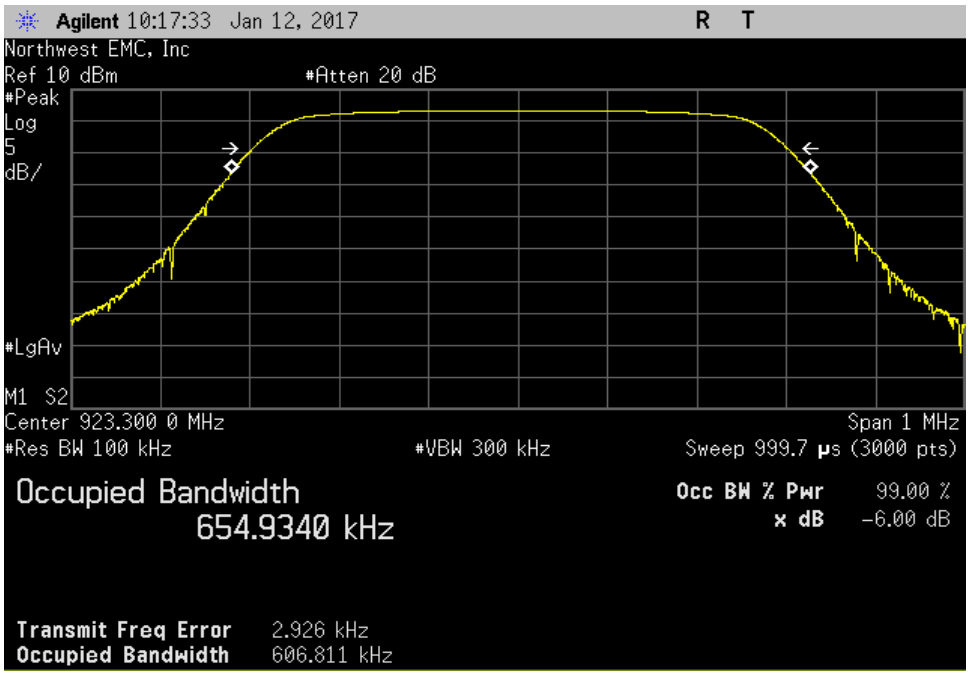
None

Configuration #	4	Signature	Trevor Buls

	Value	Limit (>)	Result
Low Channel, 923.3 MHz	606.811 kHz	500 kHz	Pass
Mid Channel, 925.1 MHz	607.472 kHz	500 kHz	Pass
High Channel, 927.5 MHz	610.554 kHz	500 kHz	Pass

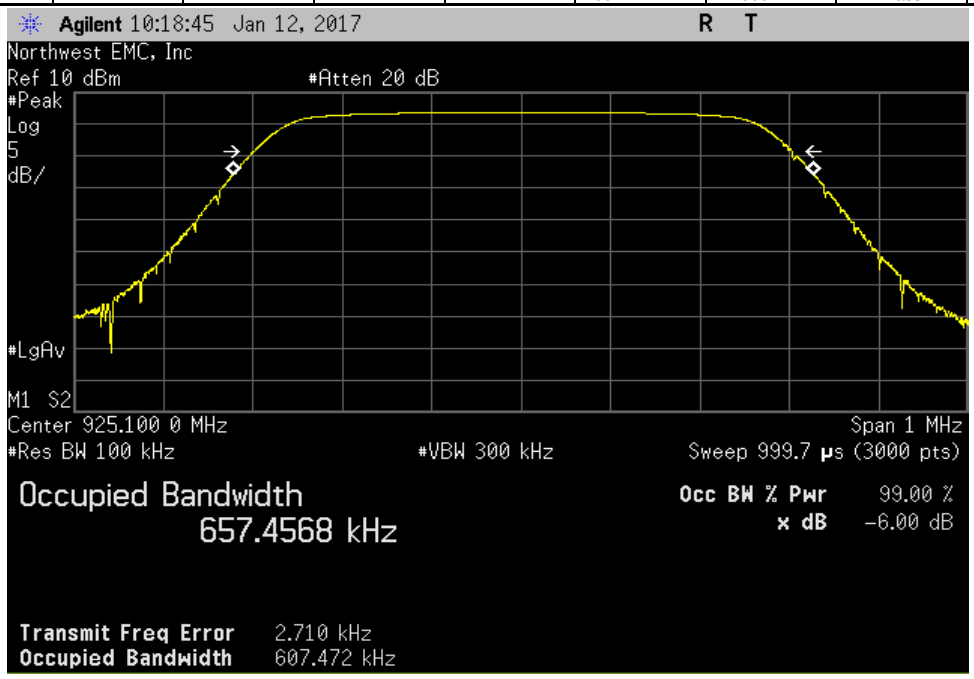
Low Channel, 923.3 MHz

				Value	Limit (>)	Result
				606.811 kHz	500 kHz	Pass

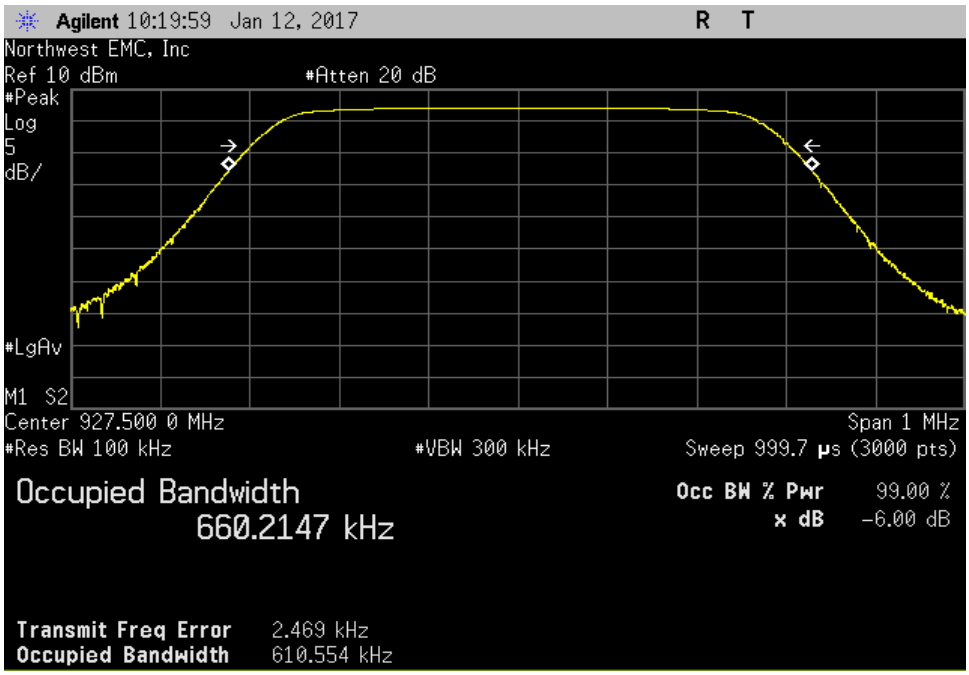


Mid Channel, 925.1 MHz

				Value	Limit (>)	Result
				607.472 kHz	500 kHz	Pass



High Channel, 927.5 MHz						
				Value	Limit (>)	Result
				610.554 kHz	500 kHz	Pass



OUTPUT POWER

NORTHWEST EMC

XMit 2016.09.29

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	10/17/2017
Power Supply - DC	EZ Digital Co., Ltd.	GP-4030D	TQK	NCR	NCR
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	12/1/2016	12/1/2017
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	2/26/2017
Block - DC	Fairview Microwave	SD3379	AMI	9/15/2016	9/15/2017
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	3/24/2017

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

De Facto EIRP Limit: The EUT meets the de facto EIRP limit of +36dBm.

OUTPUT POWER

XMit 2016.09.29
NweTx 2016.09.14.2

EUT:	MTAC-LORA-H-915			**Work Order:**	MLTI0063
Serial Number:	63090838950012			**Date:**	12/13/16
Customer:	Multi-Tech Systems, Inc.			**Temperature:**	21.8 °C
Attendees:	Marcus Glass			**Humidity:**	16.2% RH
Project:	None			**Barometric Pres.:**	1019 mbar
Tested by:	Mark Baytan	**Power:**	9 VDC	**Job Site:**	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

Total reference level offset (DC Block + 20dB attenuator + SMA Cable) = 21dB

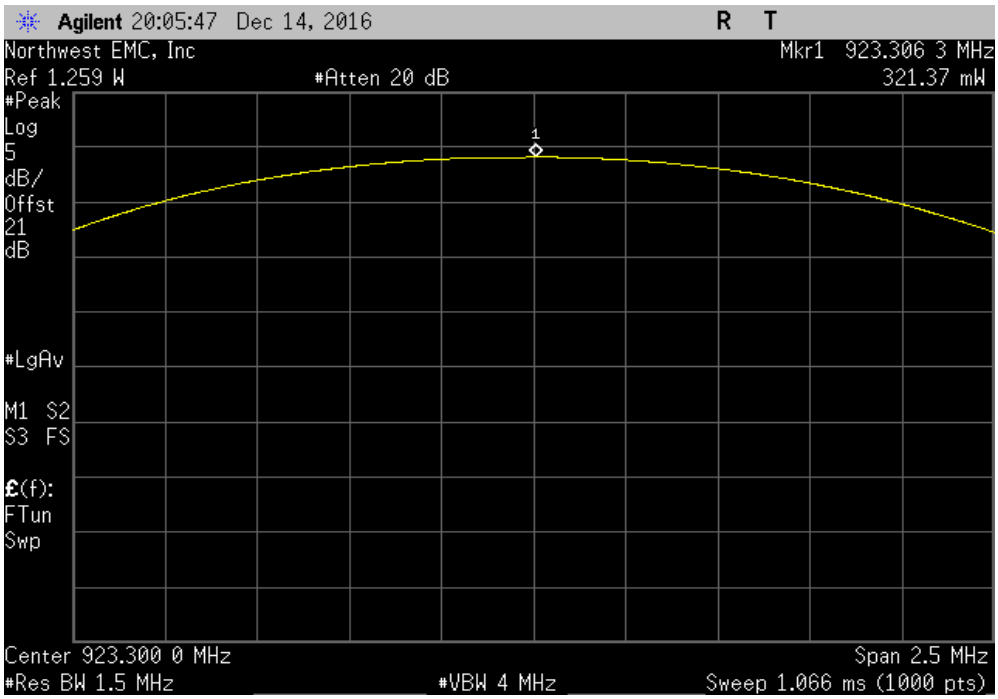
DEVIATIONS FROM TEST STANDARD

None

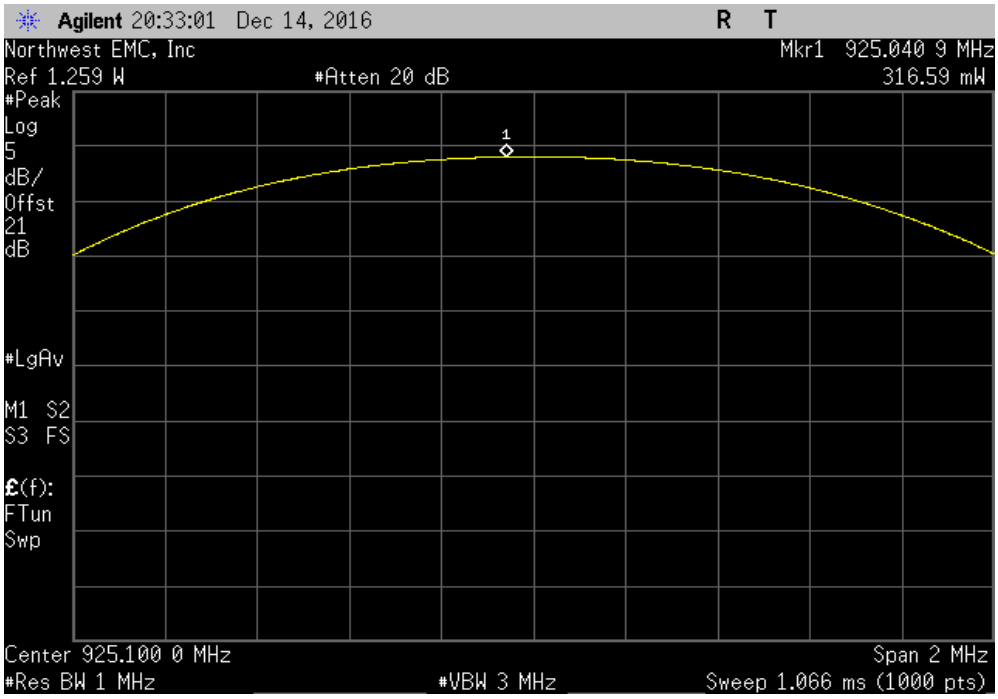
Configuration #	4	Signature

	Value	Limit (<)	Result
Low Channel, 923.3 MHz	321.366 mW	1 W	Pass
Mid Channel, 925.1 MHz	316.592 mW	1 W	Pass
High Channel, 927.5 MHz	284.446 mW	1 W	Pass

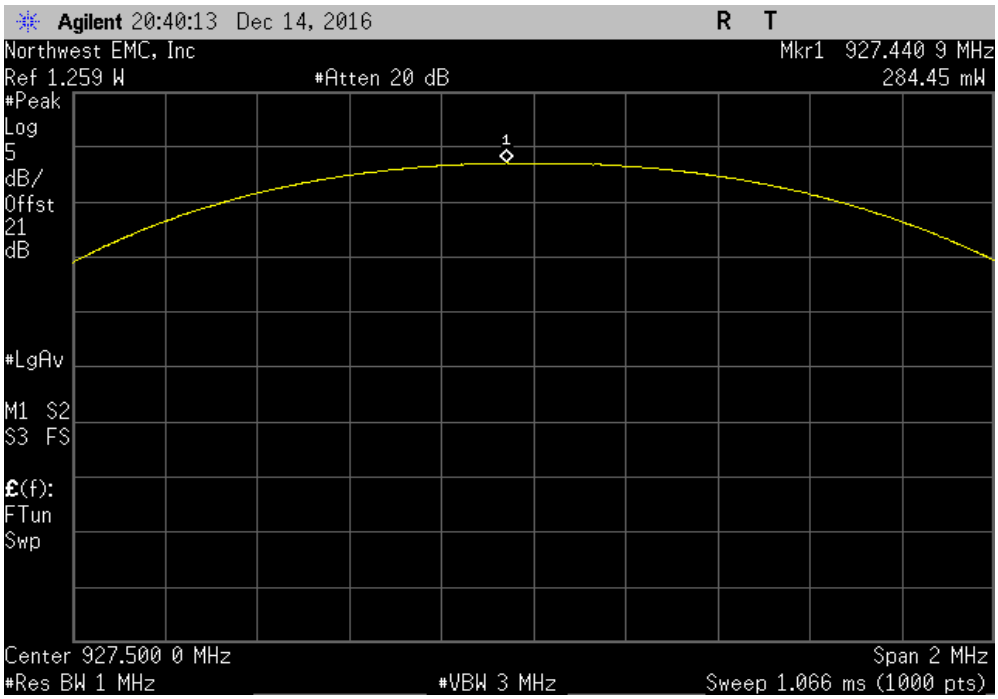
Low Channel, 923.3 MHz						
				Value	Limit (<)	Result
				321.366 mW	1 W	Pass



Mid Channel, 925.1 MHz						
				Value	Limit (<)	Result
				316.592 mW	1 W	Pass



High Channel, 927.5 MHz						
				Value	Limit (<)	Result
				284.446 mW	1 W	Pass



POWER SPECTRAL DENSITY

XMit 2016.09.29

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	10/17/2017
Power Supply - DC	EZ Digital Co., Ltd.	GP-4030D	TQK	NCR	NCR
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	12/1/2016	12/1/2017
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	2/26/2017
Block - DC	Fairview Microwave	SD3379	AMI	9/15/2016	9/15/2017
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	3/24/2017

TEST DESCRIPTION

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

NORTHWEST EMC

XMit 2016.09.29
NweTx 2016.09.14.2

EUT:	MTAC-LORA-H-915			**Work Order:**	MLTI0063
Serial Number:	63090838950012			**Date:**	12/13/16
Customer:	Multi-Tech Systems, Inc.			**Temperature:**	21.8 °C
Attendees:	Marcus Glass			**Humidity:**	16.2% RH
Project:	None			**Barometric Pres.:**	1019 mbar
Tested by:	Mark Baytan	**Power:**	9 VDC	**Job Site:**	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

Total reference level offset (DC Block + 20dB attenuator + SMA Cable) = 21dB

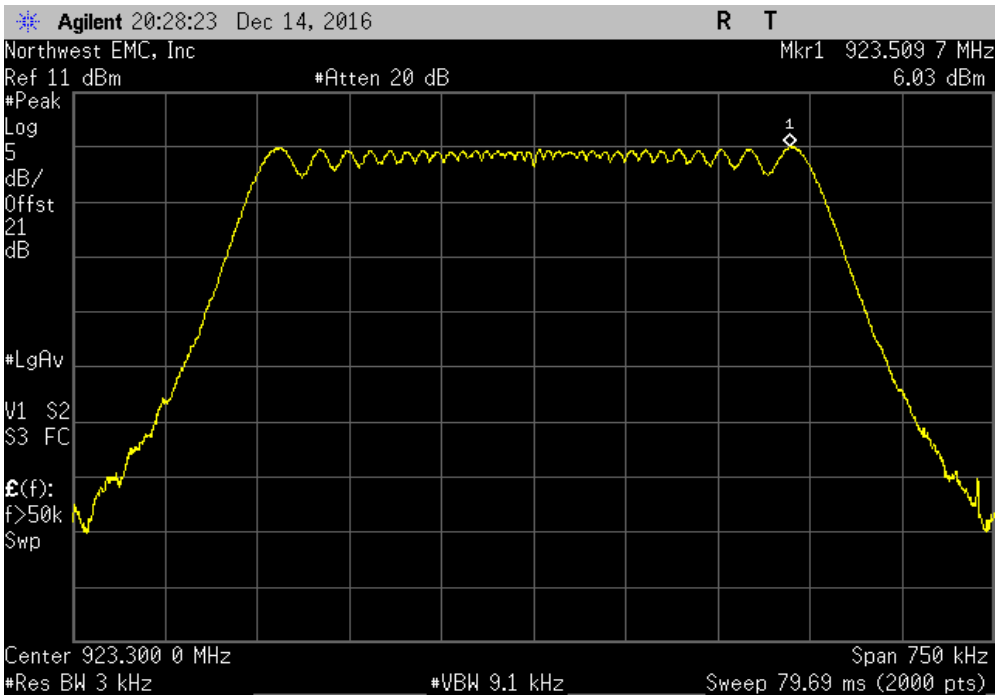
DEVIATIONS FROM TEST STANDARD

None

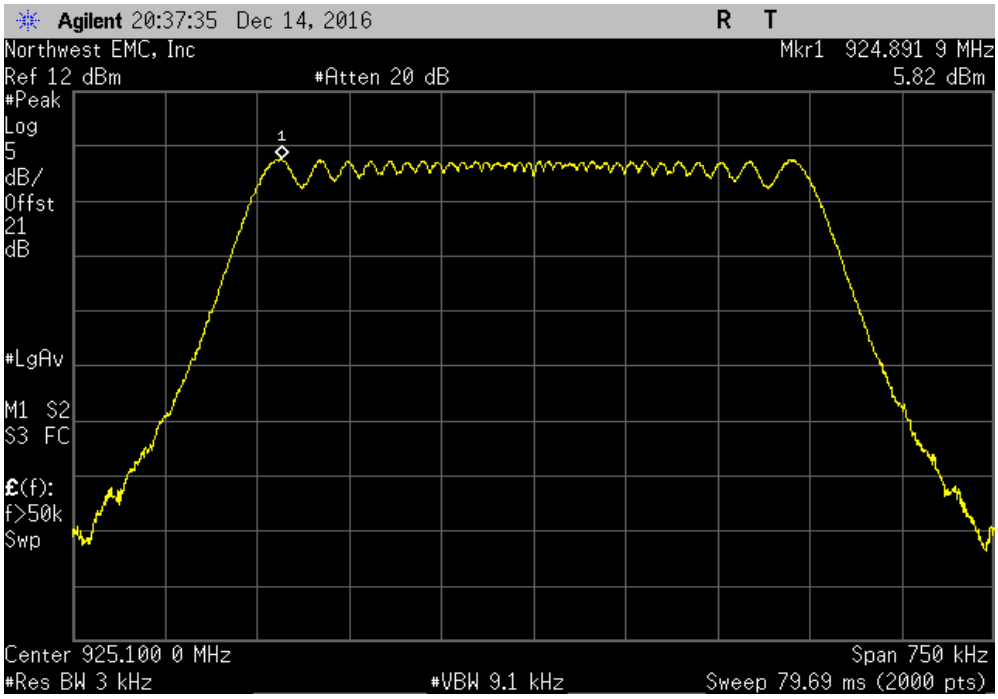
Configuration #	4	Signature

	Value dBm/3kHz	Limit < dBm/3kHz	Results
Low Channel, 923.3 MHz	6.027	8	Pass
Mid Channel, 925.1 MHz	5.816	8	Pass
High Channel, 927.5 MHz	5.197	8	Pass

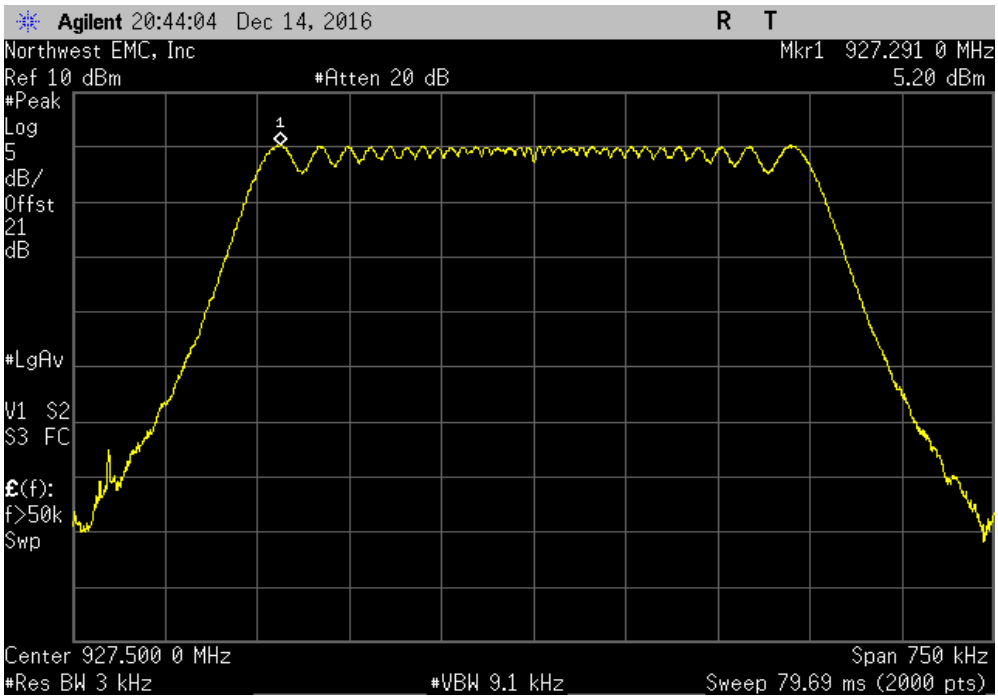
Low Channel, 923.3 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				6.027	8	Pass



Mid Channel, 925.1 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				5.816	8	Pass



High Channel, 927.5 MHz						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				5.197	8	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2016.09.29

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	10/17/2017
Power Supply - DC	EZ Digital Co., Ltd.	GP-4030D	TQK	NCR	NCR
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	12/1/2016	12/1/2017
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	2/26/2017
Block - DC	Fairview Microwave	SD3379	AMI	9/15/2016	9/15/2017
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	3/24/2017

TEST DESCRIPTION

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 spectrum was scanned throughout the specified frequency range.

SPURIOUS CONDUCTED EMISSIONS

NORTHWEST EMC

XMit 2016.09.29
NweTx 2016.09.14.2

EUT:	MTAC-LORA-H-915			**Work Order:**	MLTI0063
Serial Number:	63090838950012			**Date:**	12/13/16
Customer:	Multi-Tech Systems, Inc.			**Temperature:**	21.8 °C
Attendees:	Marcus Glass			**Humidity:**	16.2% RH
Project:	None			**Barometric Pres.:**	1019 mbar
Tested by:	Mark Baytan	**Power:**	9 VDC	**Job Site:**	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

Total reference level offset (DC Block + 20dB attenuator + SMA Cable) = 21dB

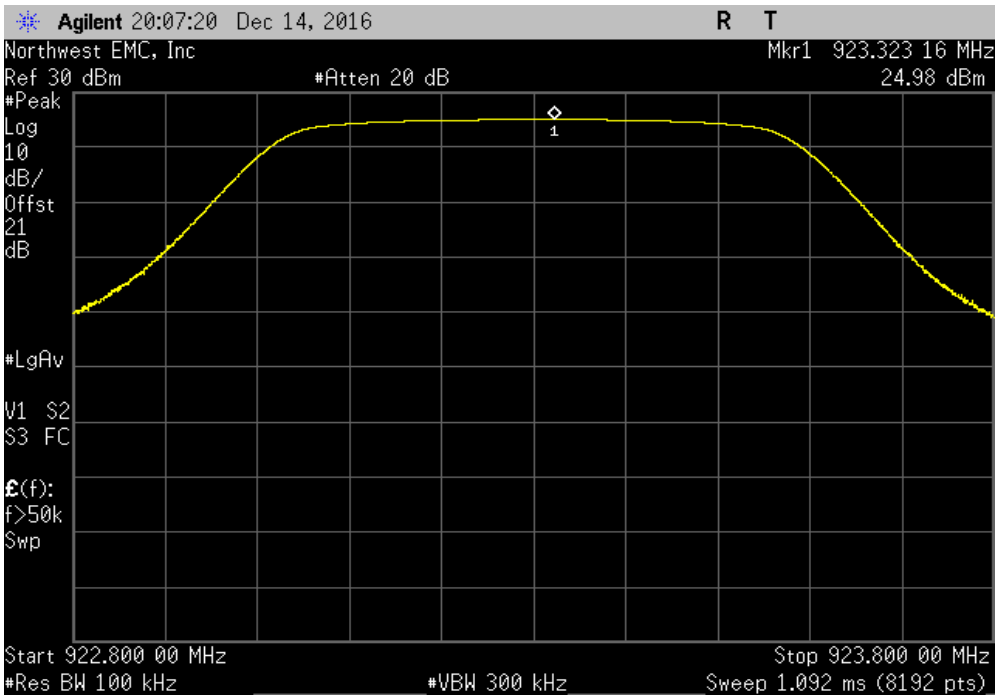
DEVIATIONS FROM TEST STANDARD

None

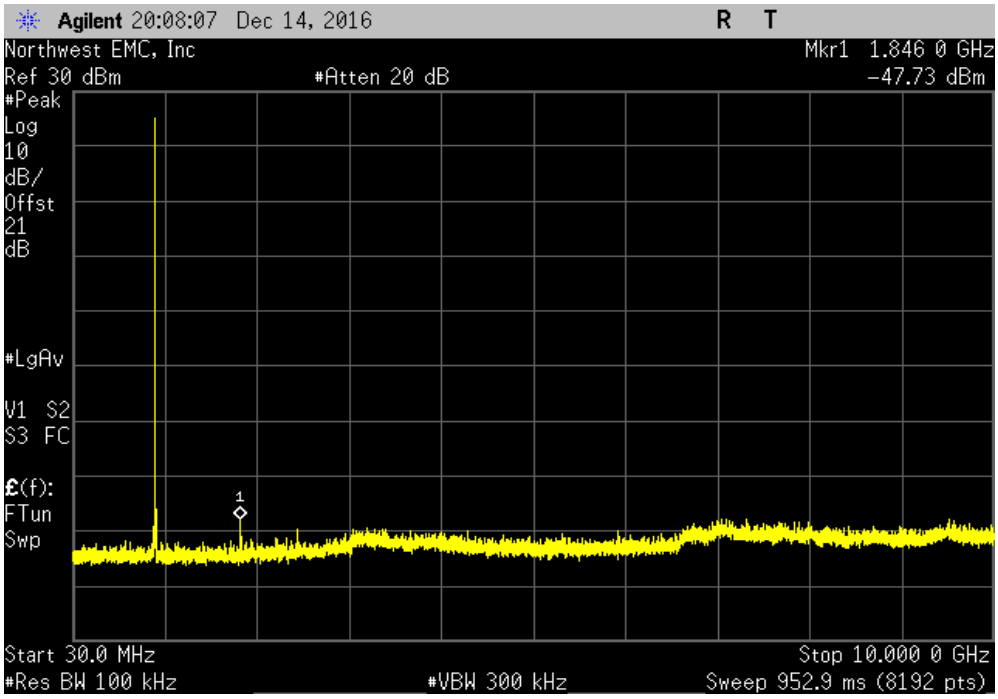
Configuration #	4	Signature

	Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result
Low Channel, 923.3 MHz	Fundamental	N/A	N/A	N/A
Low Channel, 923.3 MHz	30 MHz - 10 GHz	-72.71	-20	Pass
Mid Channel, 925.1 MHz	Fundamental	N/A	N/A	N/A
Mid Channel, 925.1 MHz	30 MHz - 10 GHz	-71.75	-20	Pass
High Channel, 927.5 MHz	Fundamental	N/A	N/A	N/A
High Channel, 927.5 MHz	30 MHz - 10 GHz	-71.25	-20	Pass

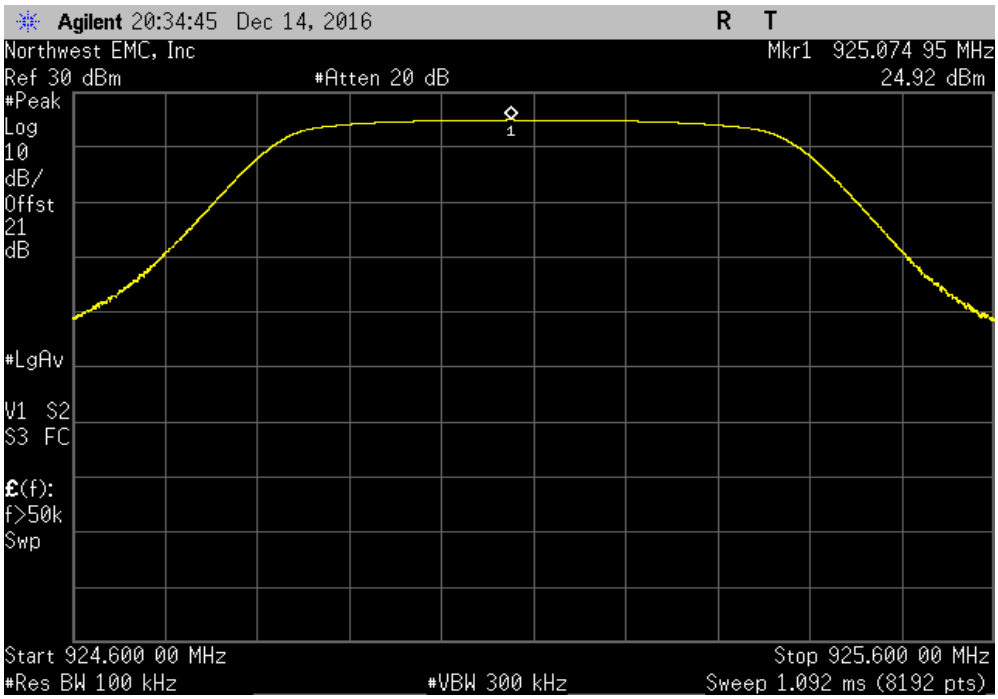
Low Channel, 923.3 MHz						
	Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



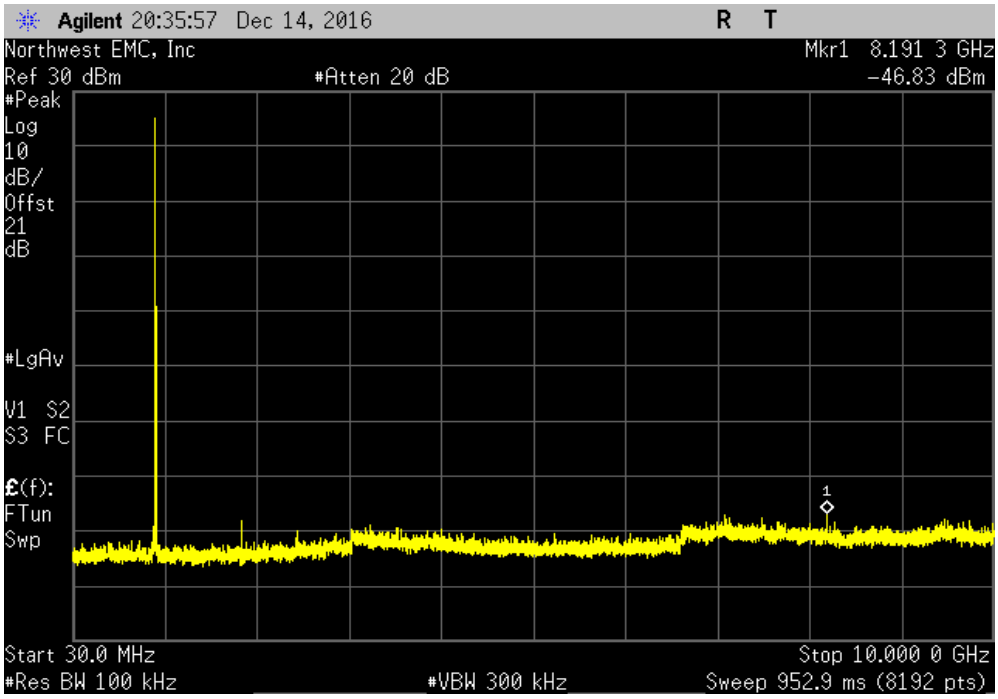
Low Channel, 923.3 MHz					
Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 10 GHz			-72.71	-20	Pass



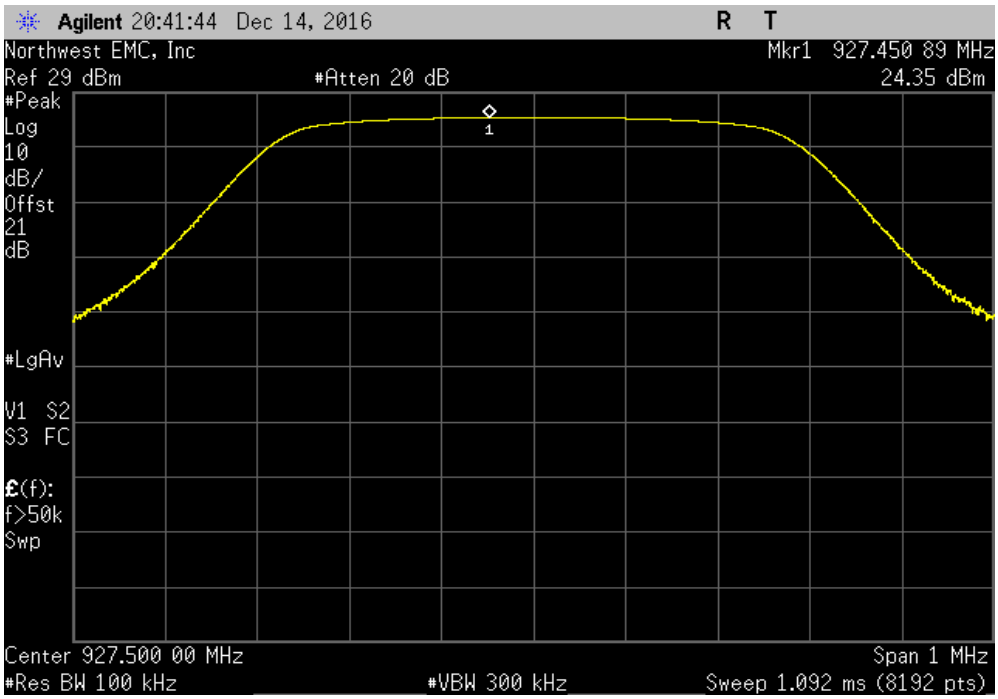
Mid Channel, 925.1 MHz						
	Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



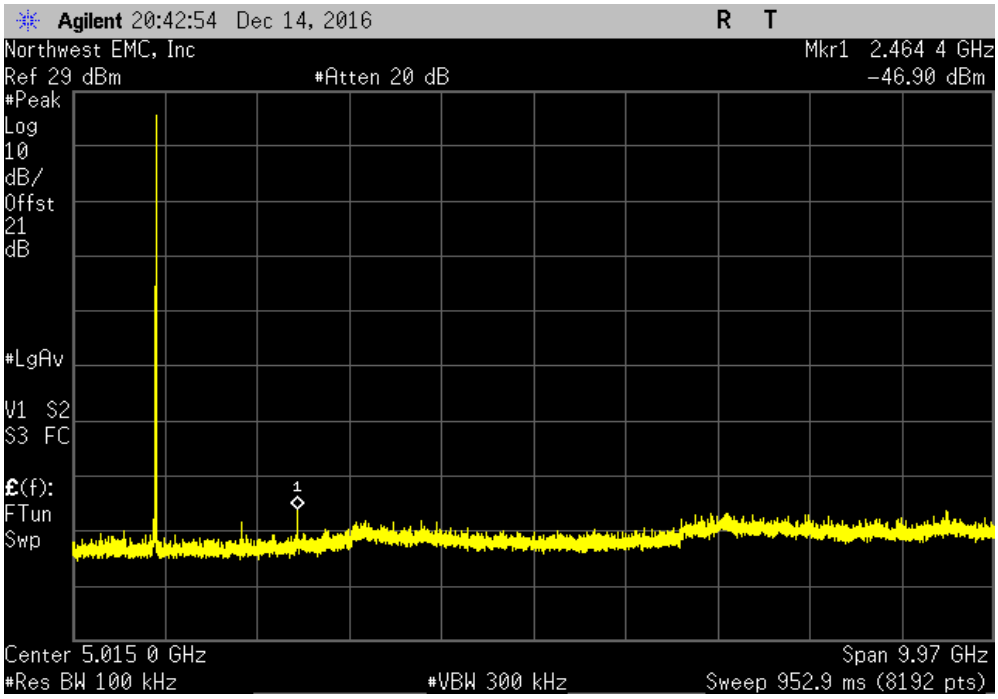
Mid Channel, 925.1 MHz					
Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 10 GHz			-71.75	-20	Pass



High Channel, 927.5 MHz						
	Frequency Range			Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental			N/A	N/A	N/A



High Channel, 927.5 MHz					
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 10 GHz		-71.25	-20	Pass



BAND EDGE COMPLIANCE

NORTHWEST EMC

XMit 2016.09.29

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	10/17/2017
Power Supply - DC	EZ Digital Co., Ltd.	GP-4030D	TQK	NCR	NCR
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	12/1/2016	12/1/2017
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	2/26/2017
Block - DC	Fairview Microwave	SD3379	AMI	9/15/2016	9/15/2017
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	3/24/2017

TEST DESCRIPTION

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.

BAND EDGE COMPLIANCE

NORTHWEST EMC

XMit 2016.09.29
NweTx 2016.09.14.2

EUT:	MTAC-LORA-H-915			**Work Order:**	MLTI0063
Serial Number:	63090838950012			**Date:**	12/13/16
Customer:	Multi-Tech Systems, Inc.			**Temperature:**	21.8 °C
Attendees:	Marcus Glass			**Humidity:**	16.2% RH
Project:	None			**Barometric Pres.:**	1019 mbar
Tested by:	Mark Baytan	**Power:**	9 VDC	**Job Site:**	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

Total reference level offset (DC Block + 20dB attenuator + SMA Cable) = 21dB

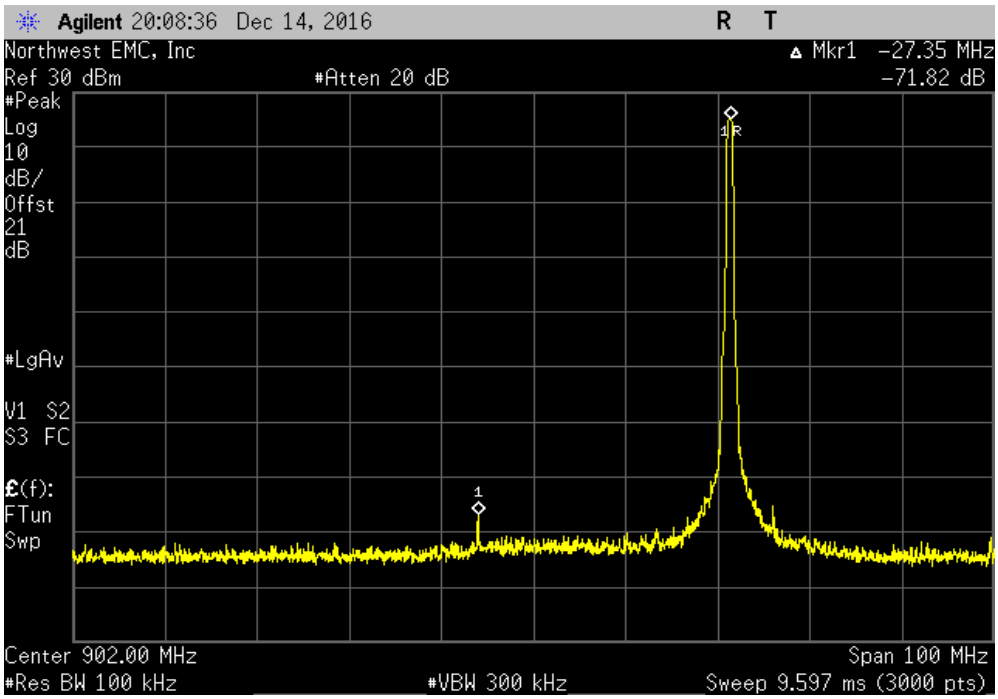
DEVIATIONS FROM TEST STANDARD

None

Configuration #	4	Signature

	Value (dBc)	Limit ≤ (dBc)	Result
Low Channel, 923.3 MHz	-71.82	-20	Pass
High Channel, 927.5 MHz	-36.4	-20	Pass

Low Channel, 923.3 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-71.82	-20	Pass



High Channel, 927.5 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-36.4	-20	Pass