NORTHWEST EMC

Multi-Tech Systems, Inc.

MTDOT-915

FCC 15.247:2016

902 - 928 MHz Band Radio

Report # MLTI0052

NVLAP Lab Code: 200881-0

CERTIFICATE OF TEST

NORTHWEST EMC
2014-12-10

Last Date of Test: April 21, 2016
Multi-Tech Systems, Inc.
Model: MTDOT-915

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2016	ANSI C63.10:2013, KDB 453039

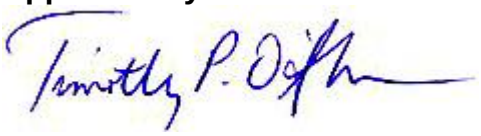
Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	See NWEMC Report # MLTI0045 used for original certification. FCC ID: AU792U13A16857
6.5, 6.6	Spurious Radiated Emissions	No	N/A	See NWEMC Report # MLTI0045 used for original certification. FCC ID: AU792U13A16857
7.5	Duty Cycle	Yes	Pass	
7.8.2	Carrier Frequency Separation	Yes	Pass	
7.8.3	Number of Hopping Frequencies	Yes	Pass	
7.8.4	Dwell Time	Yes	Pass	
7.8.5	Output Power	Yes	Pass	
7.8.6	Band Edge Compliance	No	N/A	See NWEMC Report # MLTI0045 used for original certification. FCC ID: AU792U13A16857
7.8.6	Band Edge Compliance - Hopping Mode	Yes	Pass	
7.8.7	Occupied Bandwidth	No	N/A	See NWEMC Report # MLTI0045 used for original certification. FCC ID: AU792U13A16857
7.8.8	Spurious Conducted Emissions	No	N/A	See NWEMC Report # MLTI0045 used for original certification. FCC ID: AU792U13A16857
11.10.2	Power Spectral Density	Yes	Pass	

Deviations From Test Standards

None

Approved By:



Tim O'Shea, Operations Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information.

REVISION HISTORY

NORTHWEST EMC
REV 2014.10.14

Revision Number	Description	Date	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

REV 2016.3.22

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

IC - Recognized by Industry Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with IC.

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

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.

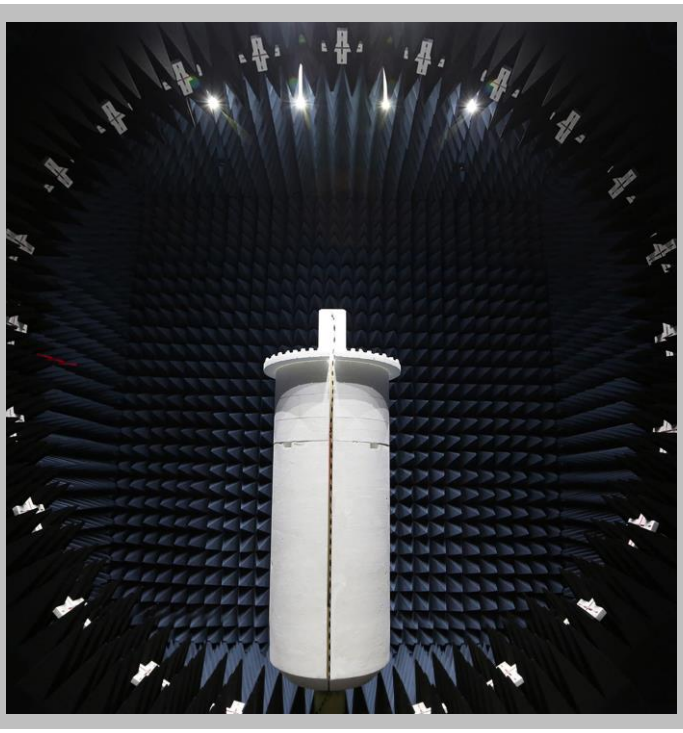
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

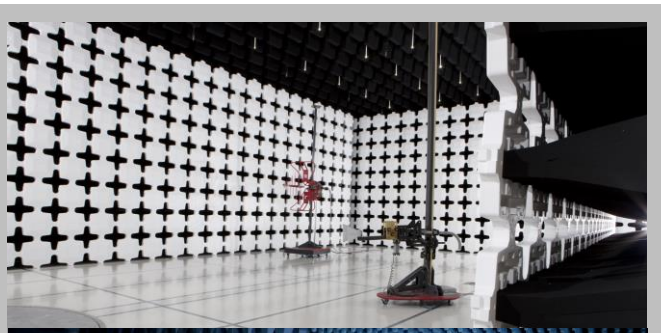
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%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

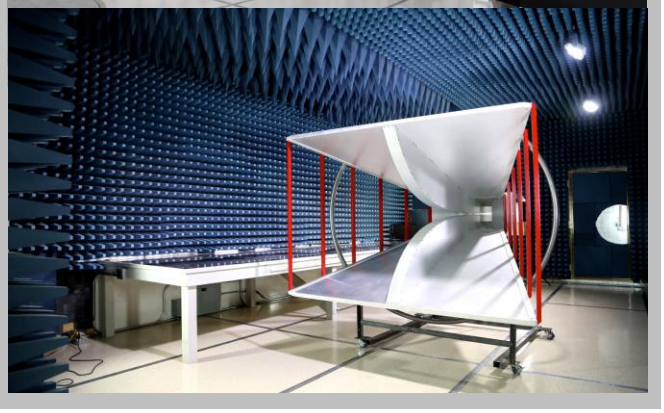
FACILITIES

REV 2015.2.19

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
Industry 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







PRODUCT DESCRIPTION

NORTHWEST EMC
2014-12-10

Client and Equipment Under Test (EUT) Information

Company Name:	Multi-Tech Systems
Address:	2205 Woodale Drive
City, State, Zip:	Mounds View, MN, 55112
Test Requested By:	Mike Lynch
Model:	MTDOT-915
First Date of Test:	April 21, 2016
Last Date of Test:	April 21, 2016
Receipt Date of Samples:	April 11, 2016
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
The MultiConnect® mDot™ is a secure, CE/FCC certified, ARM® mbed® programmable, low-power RF module, that provides long-range, low bit rate M2M data connectivity to sensors, industrial equipment and remote appliances.

Testing Objective:
To demonstrate compliance of Class II Permissive Changes to FCC ID: AU792U13A16857.

CONFIGURATIONS

NORTHWEST EMC 2014-12-10

Configuration MLTI0052- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Wireless Module (EUT)	Multi-Tech Systems, Inc.	MTDOT-915	18349449

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Development Board (EUT)	Multi-Tech Systems, Inc.	83150	0040
AC/DC Adapter	Enercell	Dual USB Port AC Adapter	None

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop (EUT)	Dell	Studio	Unknown
AC Adapter (Laptop)	Dell	DA90PE1-00	CN-0WK890-48661-95C-D0MT-A03

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Cable (Laptop)	No	1.8m	Yes	AC Adapter (Laptop)	Laptop
AC Mains Cable (Laptop)	No	0.9m	No	AC Mains	AC Adapter (Laptop)
USB Power Cable	Yes	0.5m	No	AC/DC Adapter	Development Board (EUT)
USB to Serial Adapter	No	1.5m	Yes	Serial Cable	Laptop
Serial Cable	Yes	1.9m	No	Development Board (EUT)	USB to Serial Adapter

MODIFICATIONS

NORTHWEST EMC
2014-12-10

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	4/21/2016	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.
2	4/21/2016	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.
3	4/21/2016	Duty Cycle	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	4/21/2016	Band Edge Compliance Hopping Mode	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	4/21/2016	Number of Hopping Frequencies	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	4/21/2016	Carrier Frequency Separation	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	4/21/2016	Dwell Time	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

DUTY CYCLE

XMit 2015.01.14

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.	Interval (mo)
Meter - Multimeter	Fluke	117	MLS	1/20/2014	36
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	12

TEST DESCRIPTION

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

There is no compliance requirement to be met by this test, so therefore no Pass / Fail criteria.

The measurements were made using a zero span on the spectrum analyzer to see the pulses in the time domain. The transmit power was set to its default maximum. A direct connection was made between the RF output of the EUT and a spectrum analyzer. Attenuation and a DC block were used.

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

If the transmit duty cycle < 98 percent, burst gating may have been used during some of the other tests in this report to only take the measurement during the burst duration.

DUTY CYCLE

NORTHWEST EMC

XMit 2015.01.14

EUT:	MTDOT-915			**Work Order:**	MLTI0052
Serial Number:	18349449			**Date:**	04/21/16
Customer:	Multi-Tech Systems			**Temperature:**	22.6°C
Attendees:	Marcus Glass			**Humidity:**	45%
Project:	None			**Barometric Pres.:**	980.4
Tested by:	Jared Ison	**Power:**	5 VDC	**Job Site:**	MN08

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

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

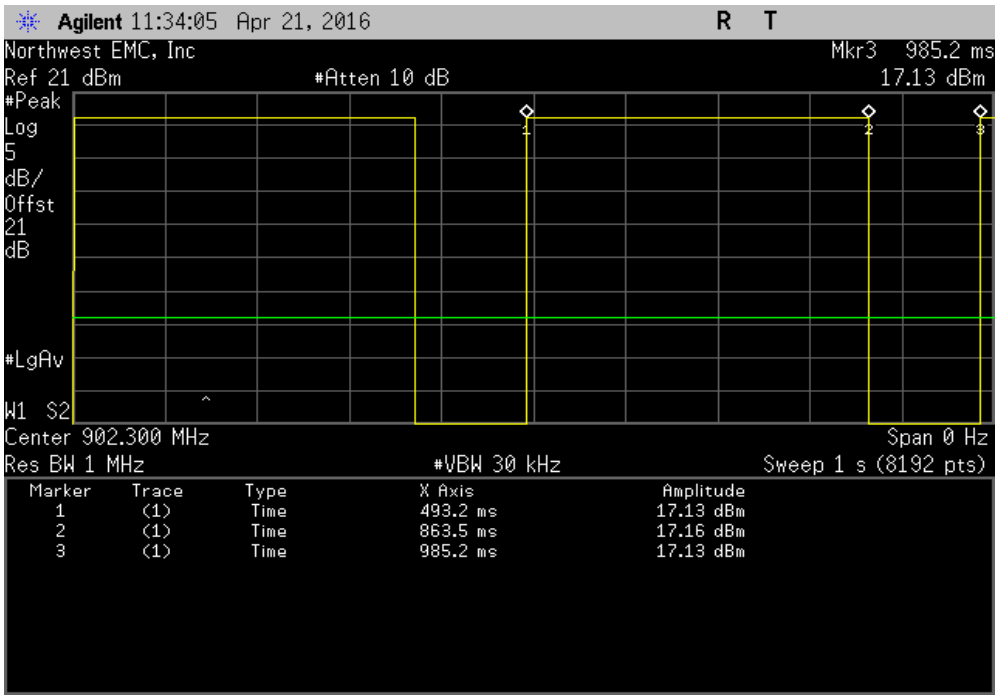
Configuration #	1	Signature

	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
Low Channel, 902.3 MHz	370.296 ms	491.953 ms	1	75.3	N/A	N/A
Low Channel, 902.3 MHz	N/A	N/A	5	N/A	N/A	N/A
Mid Channel, 908.7 MHz	370.076 ms	491.878 ms	1	75.2	N/A	N/A
Mid Channel, 908.7 MHz	N/A	N/A	5	N/A	N/A	N/A
High Channel, 914.9 MHz	369.691 ms	491.86 ms	1	75.2	N/A	N/A
High Channel, 914.9 MHz	N/A	N/A	5	N/A	N/A	N/A

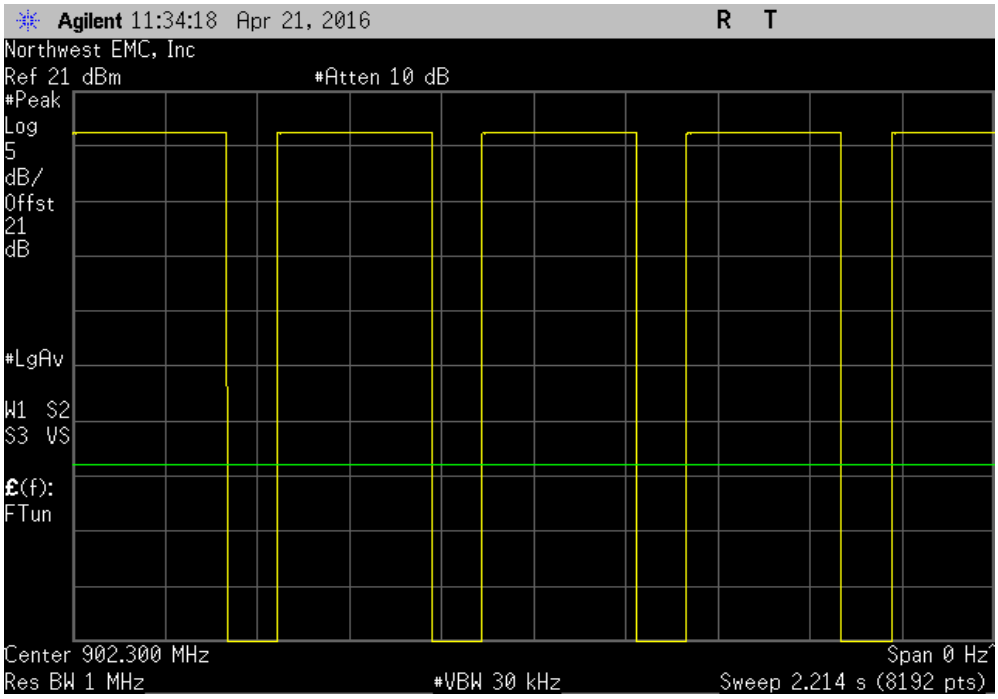
DUTY CYCLE

XMit 2015.01.14

Low Channel, 902.3 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	370.296 ms	491.953 ms	1	75.3	N/A	N/A



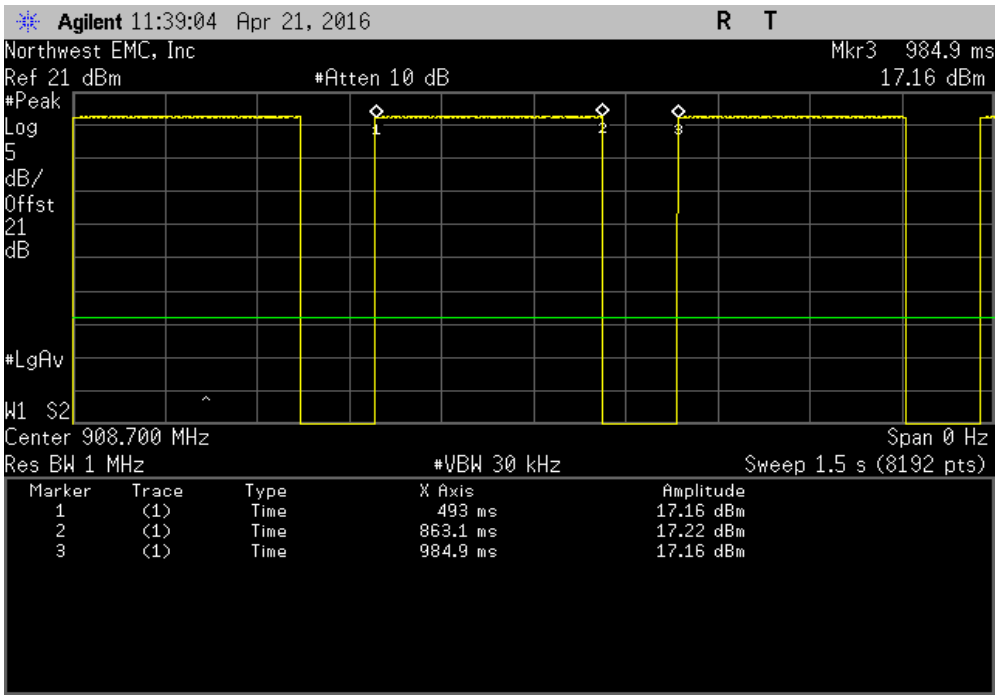
Low Channel, 902.3 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



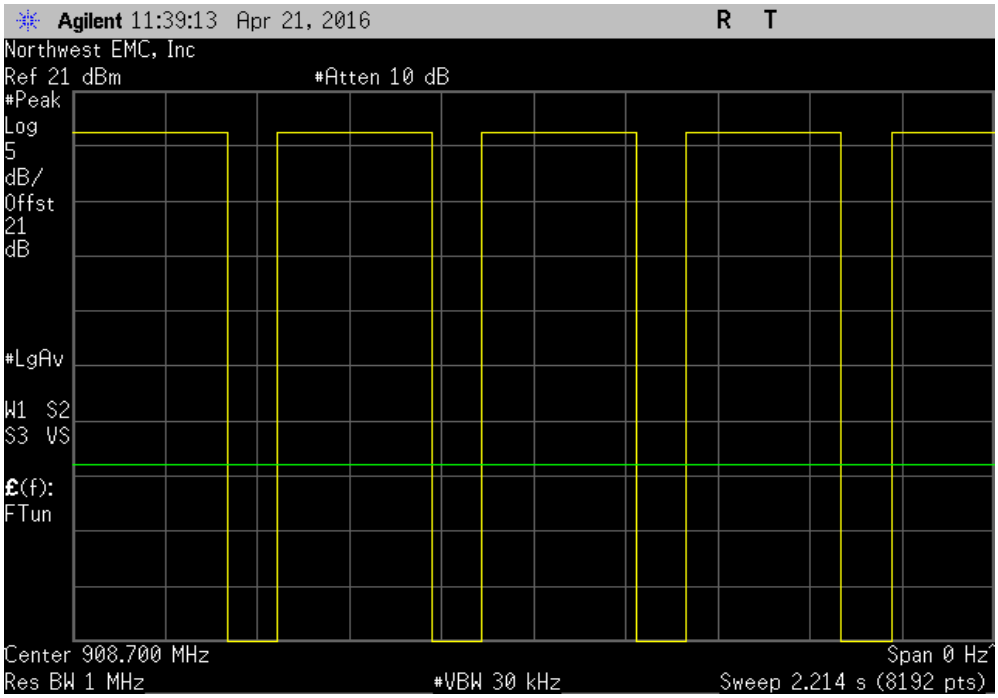
DUTY CYCLE

XMit 2015.01.14

Mid Channel, 908.7 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	370.076 ms	491.878 ms	1	75.2	N/A	N/A



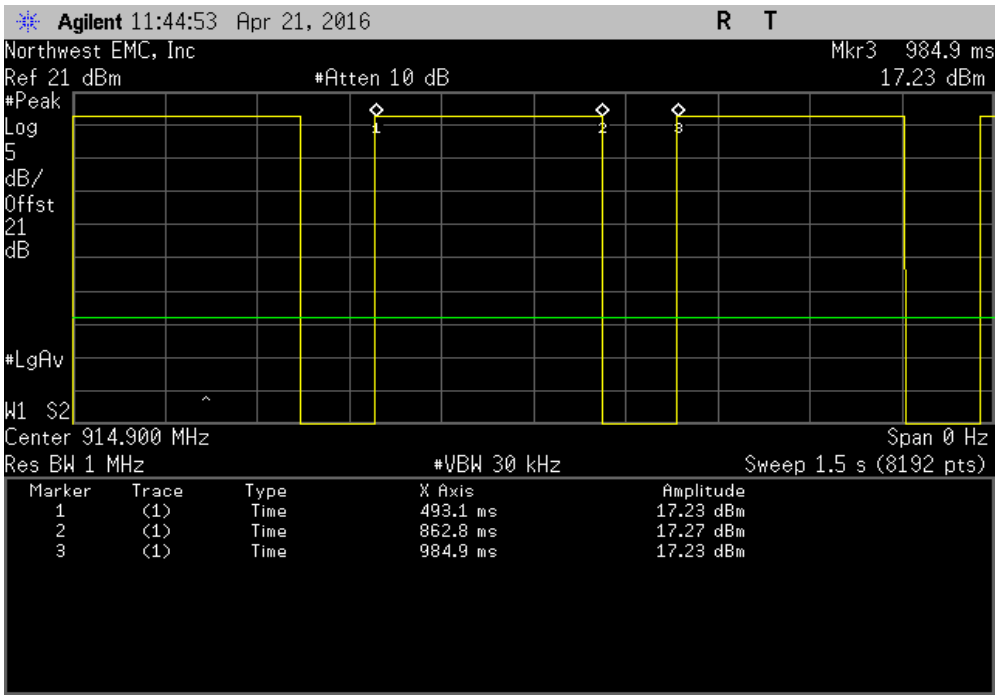
Mid Channel, 908.7 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



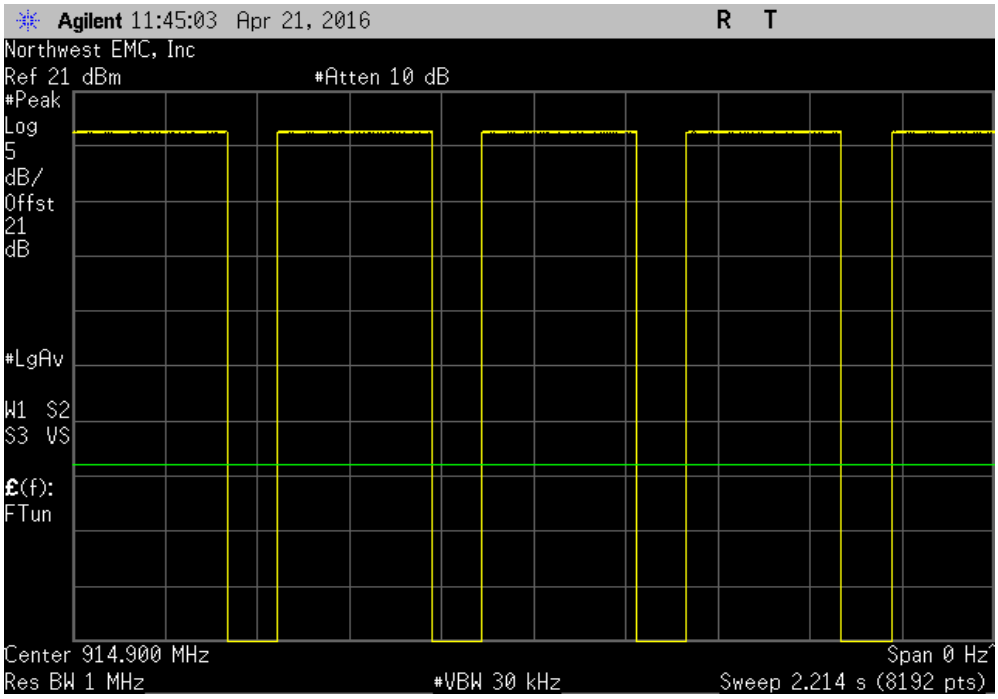
DUTY CYCLE

XMit 2015.01.14

High Channel, 914.9 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	369.691 ms	491.86 ms	1	75.2	N/A	N/A



High Channel, 914.9 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



CARRIER FREQUENCIES SEPARATION

XMit 2015.01.14

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.	Interval (mo)
Meter - Multimeter	Fluke	117	MLS	1/20/2014	36
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	12

TEST DESCRIPTION

The channel carrier frequencies in the 902-928 MHz band must be separated by 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Or, if the output power is less than 125 mW, the channel separation can be 25 kHz or 2/3 of the 20dB bandwidth. The EUT was operated in pseudorandom hopping mode. The spectrum was scanned across two adjacent peaks. The separation between the peaks of these channels was measured.

CARRIER FREQUENCIES SEPARATION

NORTHWEST EMC

XMit 2015.01.14

EUT:	MTDOT-915			**Work Order:**	MLTI0052
Serial Number:	18349449			**Date:**	04/21/16
Customer:	Multi-Tech Systems			**Temperature:**	22.6°C
Attendees:	Marcus Glass			**Humidity:**	45%
Project:	None			**Barometric Pres.:**	980.4
Tested by:	Jared Ison	**Power:**	5 VDC	**Job Site:**	MN08

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

COMMENTS

Test command TXW=0, AT+Sendi=100,5555, was used in order to count the number channels in hopping mode.

DEVIATIONS FROM TEST STANDARD

None

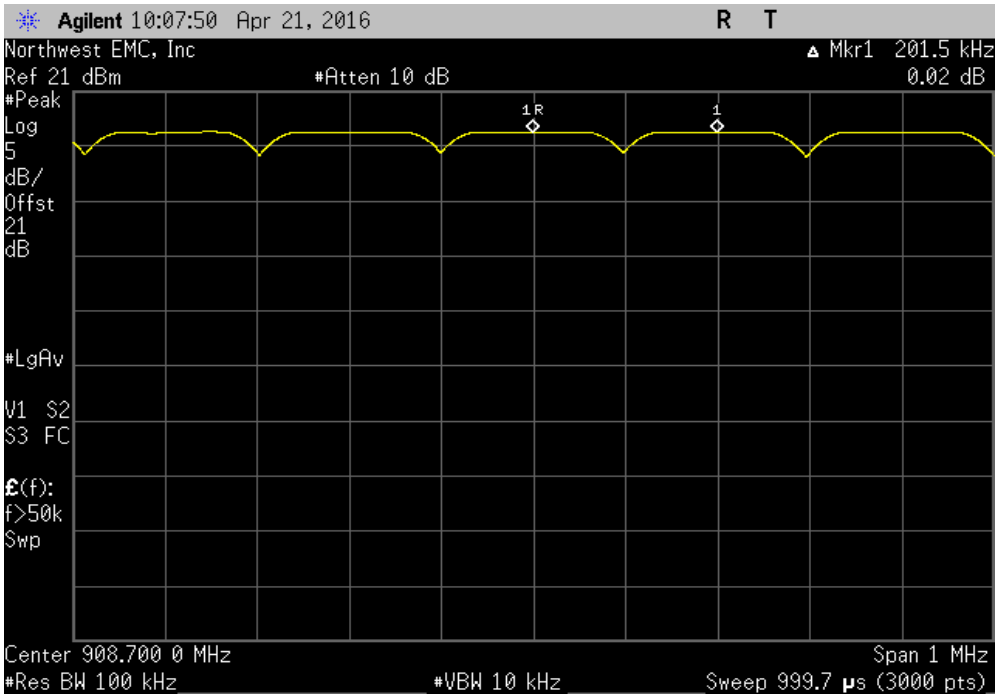
Configuration #	1	Signature

	Value	Limit (≥)	Results
Hopping Mode	201.5 kHz	138.2 kHz	Pass

CARRIER FREQUENCIES SEPARATION

XMit 2015.01.14

Hopping Mode						
				Value	Limit (≥)	Results
				201.5 kHz	138.2 kHz	Pass



NUMBER OF HOPPING FREQUENCIES

XMit 2015.01.14

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.	Interval (mo)
Meter - Multimeter	Fluke	117	MLS	1/20/2014	36
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	12

TEST DESCRIPTION

The number of hopping frequencies was measured across the authorized band. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The hopping function of the EUT was enabled.

NUMBER OF HOPPING FREQUENCIES

NORTHWEST EMC

XMit 2015.01.14

EUT:	MTDOT-915			**Work Order:**	MLTI0052
Serial Number:	18349449			**Date:**	04/21/16
Customer:	Multi-Tech Systems			**Temperature:**	22.6°C
Attendees:	Marcus Glass			**Humidity:**	45%
Project:	None			**Barometric Pres.:**	980.4
Tested by:	Jared Ison	**Power:**	5 VDC	**Job Site:**	MN08

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

COMMENTS

Test command TXW=0, AT+Sendi=100,5555, was used in order to count the number channels in hopping mode.

DEVIATIONS FROM TEST STANDARD

None

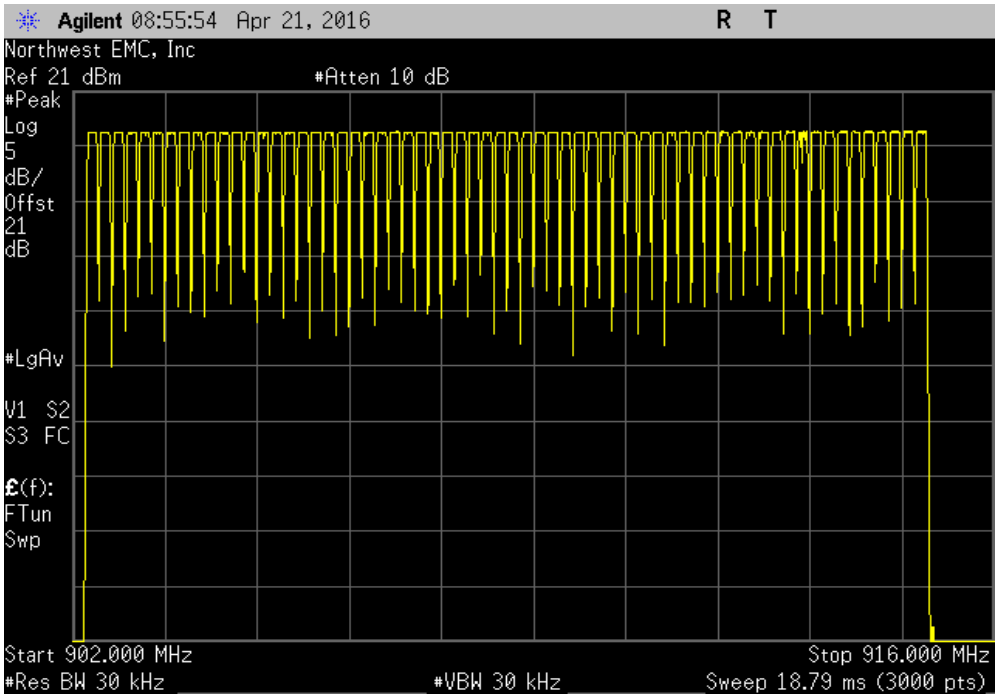
Configuration #	1	Signature

	Number of Channels	Limit	Results
Hopping Mode	64	50	Pass

NUMBER OF HOPPING FREQUENCIES

XMit 2015.01.14

Hopping Mode						
				Number of Channels	Limit	Results
				64	50	Pass



DWELL TIME

XMit 2015.01.14

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.	Interval (mo)
Meter - Multimeter	Fluke	117	MLS	1/20/2014	36
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	12

TEST DESCRIPTION

The average dwell time per hopping channel was measured at one hopping channel in the middle of the authorized band. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The hopping function of the EUT was enabled.

The dwell time limit is based on the Number of Hopping Channels * 400 mS. For this device it would be 64 Channels * 400mS = 25.6 Sec.

DWELL TIME

NORTHWEST EMC

XMit 2015.01.14

EUT:	MTDOT-915			**Work Order:**	MLTI0052
Serial Number:	18349449			**Date:**	04/21/16
Customer:	Multi-Tech Systems			**Temperature:**	22.6°C
Attendees:	Marcus Glass			**Humidity:**	45%
Project:	None			**Barometric Pres.:**	980.4
Tested by:	Jared Ison	**Power:**	5 VDC	**Job Site:**	MN08

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

COMMENTS

EUT in hopping mode.

DEVIATIONS FROM TEST STANDARD

None

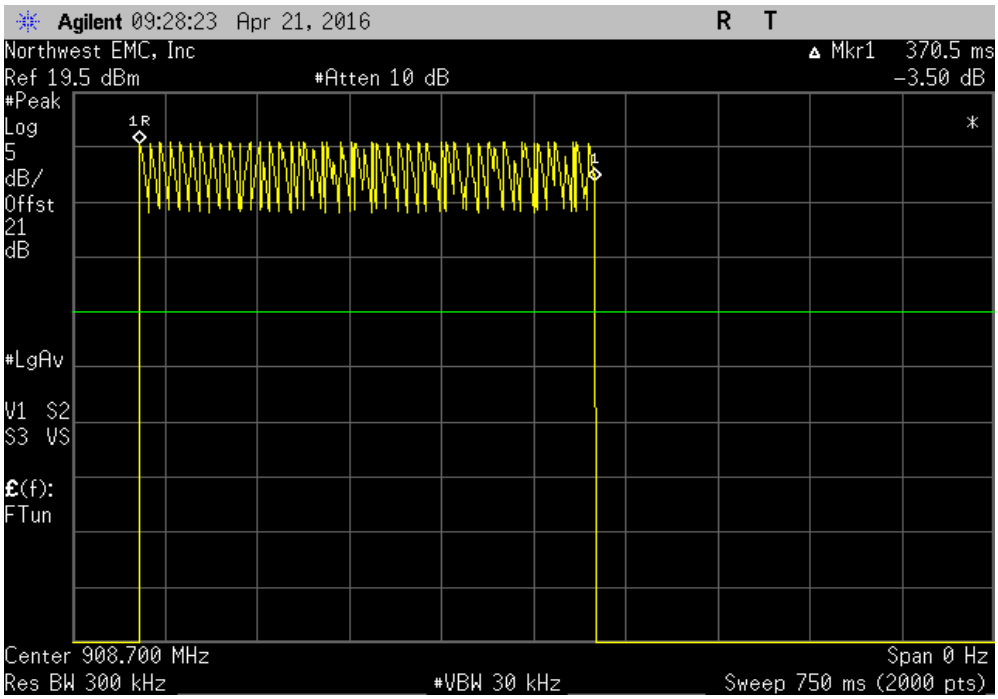
Configuration #	1	Signature

	Pulse Width (ms)	Number of Pulses	Average No. of Pulses	On Time (ms) During 25.6 s	Limit (ms)	Results
Hopping Mode	370.51	N/A	N/A	N/A	N/A	N/A
Hopping Mode	N/A	1	N/A	N/A	N/A	N/A
Hopping Mode	N/A	1	N/A	N/A	N/A	N/A
Hopping Mode	N/A	1	N/A	N/A	N/A	N/A
Hopping Mode	N/A	1	N/A	N/A	N/A	N/A
Hopping Mode	370.51	N/A	1	370.51	400	Pass

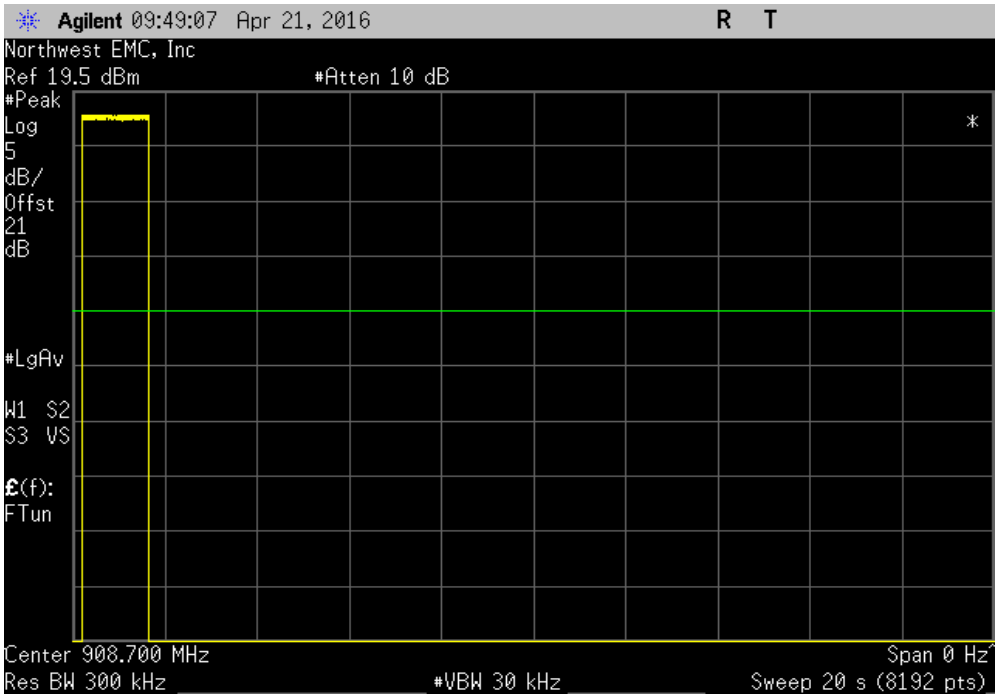
DWELL TIME

XMit 2015.01.14

Hopping Mode						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses		On Time (ms) During 25.6 s	Limit (ms)	Results
370.51	N/A	N/A		N/A	N/A	N/A



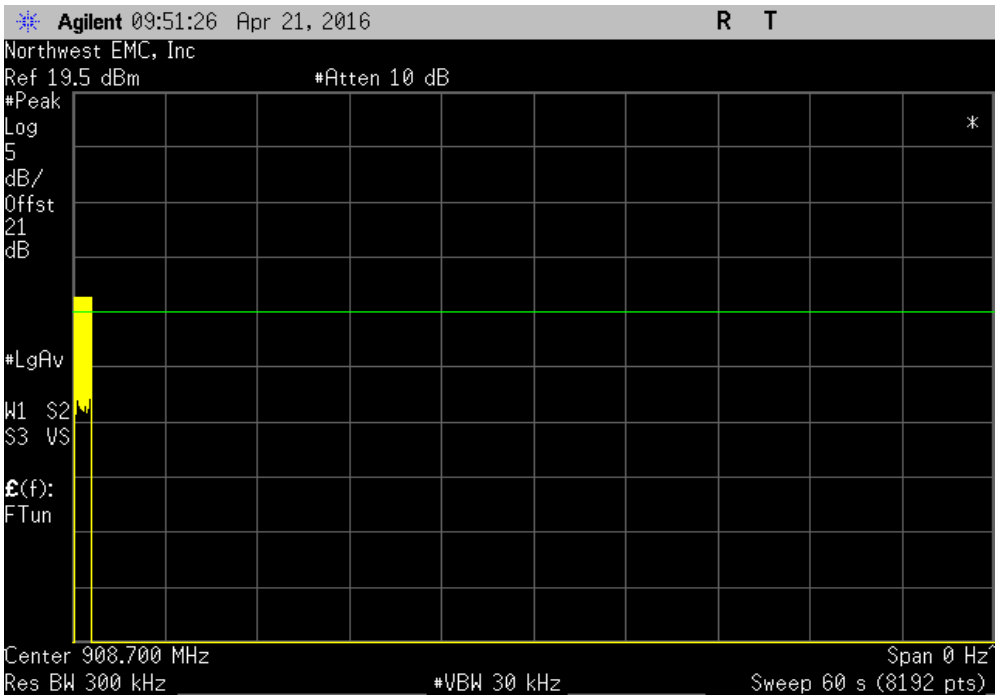
Hopping Mode						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses		On Time (ms) During 25.6 s	Limit (ms)	Results
N/A	1	N/A		N/A	N/A	N/A



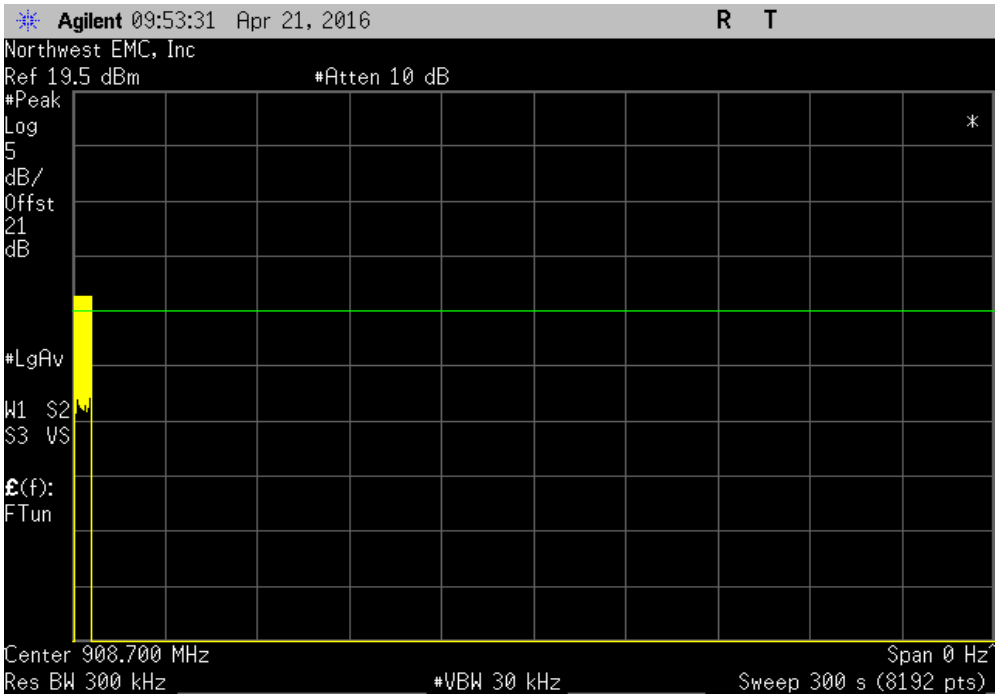
DWELL TIME

XMit 2015.01.14

Hopping Mode						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses		On Time (ms) During 25.6 s	Limit (ms)	Results
N/A	1	N/A		N/A	N/A	N/A



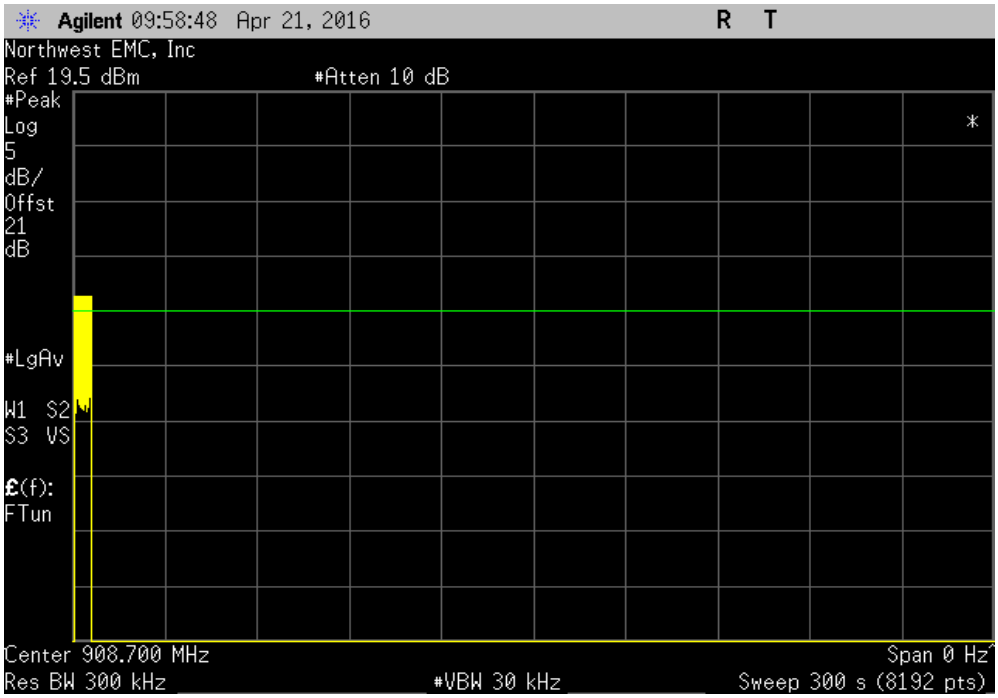
Hopping Mode						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses		On Time (ms) During 25.6 s	Limit (ms)	Results
N/A	1	N/A		N/A	N/A	N/A



DWELL TIME

XMit 2015.01.14

Hopping Mode						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses		On Time (ms) During 25.6 s	Limit (ms)	Results
N/A	1	N/A		N/A	N/A	N/A



Hopping Mode						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses		On Time (ms) During 25.6 s	Limit (ms)	Results
370.51	N/A	1		370.51	400	Pass

Calculation Only

No Screen Capture Required

OUTPUT POWER

XMit 2015.01.14

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.	Interval (mo)
Meter - Multimeter	Fluke	117	MLS	1/20/2014	36
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	12

TEST DESCRIPTION

The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum. A direct connection was made between the RF output of the EUT and a spectrum analyzer. Attenuation and a DC block were used. The reference level offset on the spectrum analyzer was adjusted to compensate for cable loss and the external attenuation used between the RF output and the spectrum analyzer input.

Prior to measuring peak transmit power the DTS 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 found in ANSI C63.10:2013 Section 11.10.2 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio..

De Facto EIRP Limit: Per 47 CFR 15.247 (b)(1-3), the EUT meets the de facto EIRP limit of +36 dBm.

OUTPUT POWER

NORTHWEST EMC

XMit 2015.01.14

EUT:	**MTDOT-915**			**Work Order:**	**MLTI0052**
Serial Number:	**18349449**			**Date:**	**04/21/16**
Customer:	**Multi-Tech Systems**			**Temperature:**	**22.6°C**
Attendees:	**Marcus Glass**			**Humidity:**	**45%**
Project:	**None**			**Barometric Pres.:**	**980.4**
Tested by:	**Jared Ison**	**Power:**	**5 VDC**	**Job Site:**	**MN08**

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

COMMENTS

Peak method was to determine output power due to class 2 permissive change.

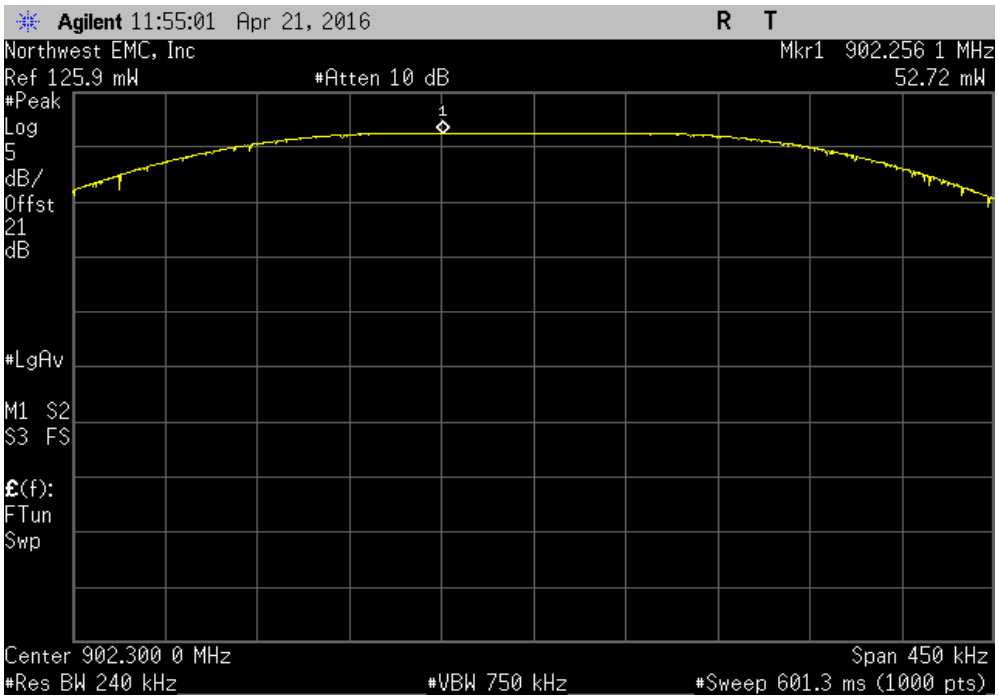
DEVIATIONS FROM TEST STANDARD

None

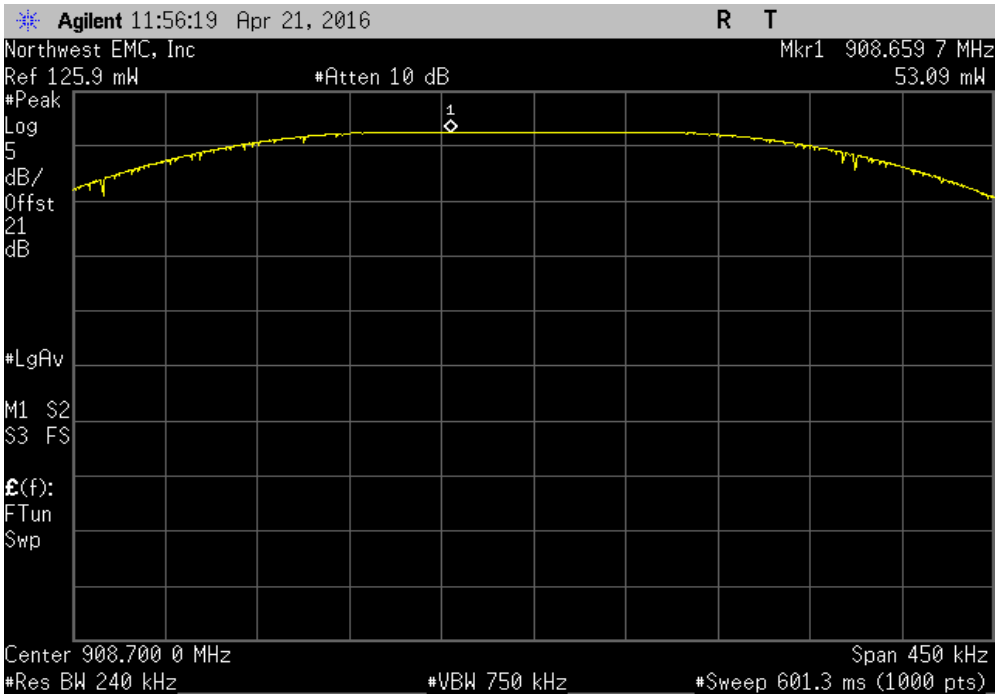
Configuration #	**1**	*Signature*

	Value	**Limit (<)**	**Result**
Low Channel, 902.3 MHz	52.723 mW	1 W	Pass
Mid Channel, 908.7 MHz	53.088 mW	1 W	Pass
High Channel, 914.9 MHz	53.802 mW	1 W	Pass

Low Channel, 902.3 MHz						
				Value	Limit (<)	Result
				52.723 mW	1 W	Pass



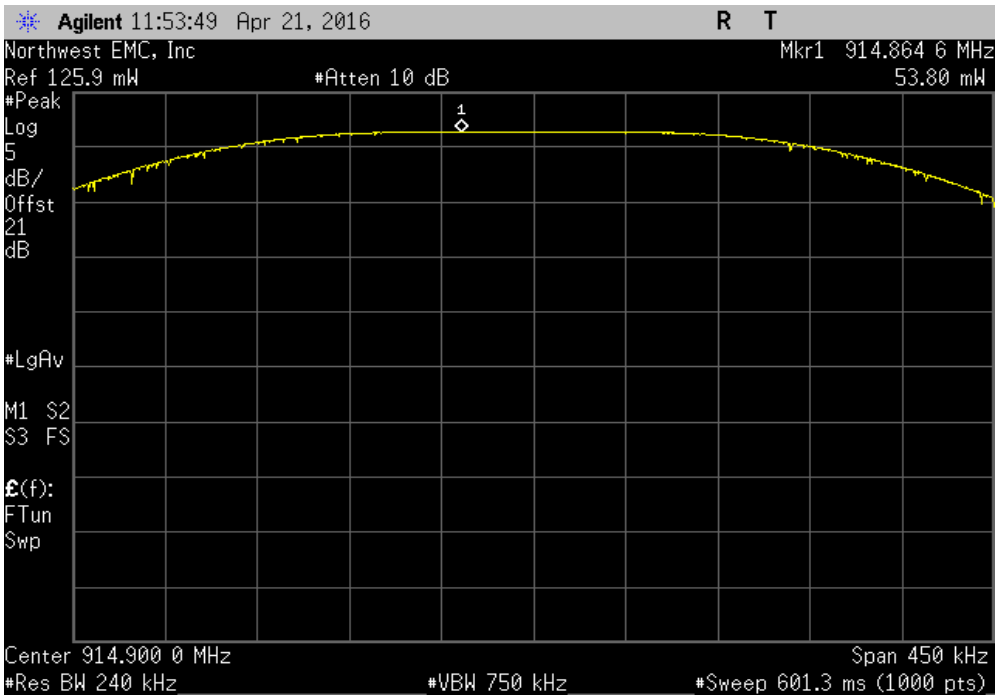
Mid Channel, 908.7 MHz						
				Value	Limit (<)	Result
				53.088 mW	1 W	Pass



OUTPUT POWER

XMit 2015.01.14

High Channel, 914.9 MHz						
				Value	Limit (<)	Result
				53.802 mW	1 W	Pass



BAND EDGE COMPLIANCE -HOPPING MODE

XMit 2015.01.14

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.	Interval (mo)
Meter - Multimeter	Fluke	117	MLS	1/20/2014	36
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	12
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	12

TEST DESCRIPTION

The spurious RF conducted emissions at the edges of the authorized band were measured with the EUT set to its normal pseudo-random hopping sequence. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. 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 -HOPPING MODE

NORTHWEST EMC

XMit 2015.01.14

EUT:	MTDOT-915			**Work Order:**	MLTI0052
Serial Number:	18349449			**Date:**	04/21/16
Customer:	Multi-Tech Systems			**Temperature:**	22.6°C
Attendees:	Marcus Glass			**Humidity:**	45%
Project:	None			**Barometric Pres.:**	980.4
Tested by:	Jared Ison	**Power:**	5 VDC	**Job Site:**	MN08

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

COMMENTS

Test command TXW=0, AT+Sendi=100,5555, was used in order to count the number channels in hopping mode.

DEVIATIONS FROM TEST STANDARD

None

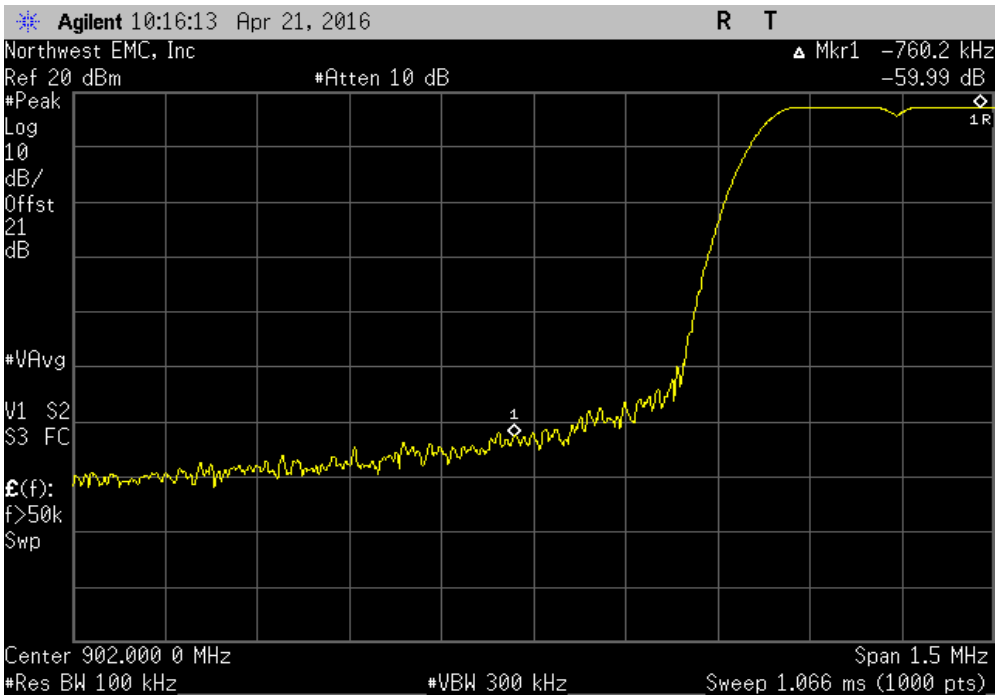
Configuration #	1	Signature

	Value (dBc)	Limit ≤ (dBc)	Result
Hopping Mode			
Low Channel, 902.3 MHz	-59.99	-20	Pass
High Channel, 914.9 MHz	-80.62	-20	Pass

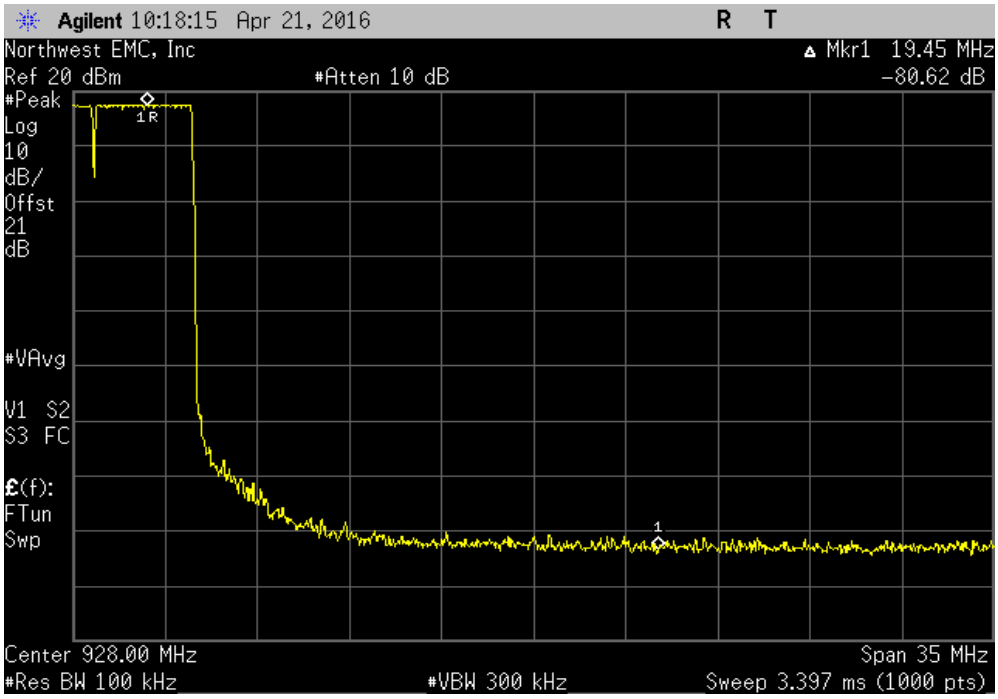
BAND EDGE COMPLIANCE -HOPPING MODE

XMit 2015.01.14

Hopping Mode, Low Channel, 902.3 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-59.99	-20	Pass



Hopping Mode, High Channel, 914.9 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-80.62	-20	Pass



POWER SPECTRAL DENSITY

XMit 2015.01.14

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.	Interval (mo)
Meter - Multimeter	Fluke	117	MLS	1/20/2014	36
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Attenuator	S.M. Electronics	SA26B-20	RFW	2/26/2016	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	3/24/2016	12

TEST DESCRIPTION

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

A direct connection was made between the RF output of the EUT and a spectrum analyzer. External attenuation and a DC block were used. The reference level offset on the spectrum analyzer was adjusted to compensate for cable loss and the external attenuation used between the RF output and the spectrum analyzer input.

Per the procedure outlined in ANSI C63.10 the AVGPSD-2 method for power spectral density was measured in a 3 kHz RBW.

POWER SPECTRAL DENSITY

NORTHWEST EMC

XMit 2015.01.14

EUT:	MTDOT-915			**Work Order:**	MLTI0052
Serial Number:	18349449			**Date:**	04/21/16
Customer:	Multi-Tech Systems			**Temperature:**	22.6°C
Attendees:	Marcus Glass			**Humidity:**	45%
Project:	None			**Barometric Pres.:**	980.4
Tested by:	Jared Ison	**Power:**	5 VDC	**Job Site:**	MN08

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

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

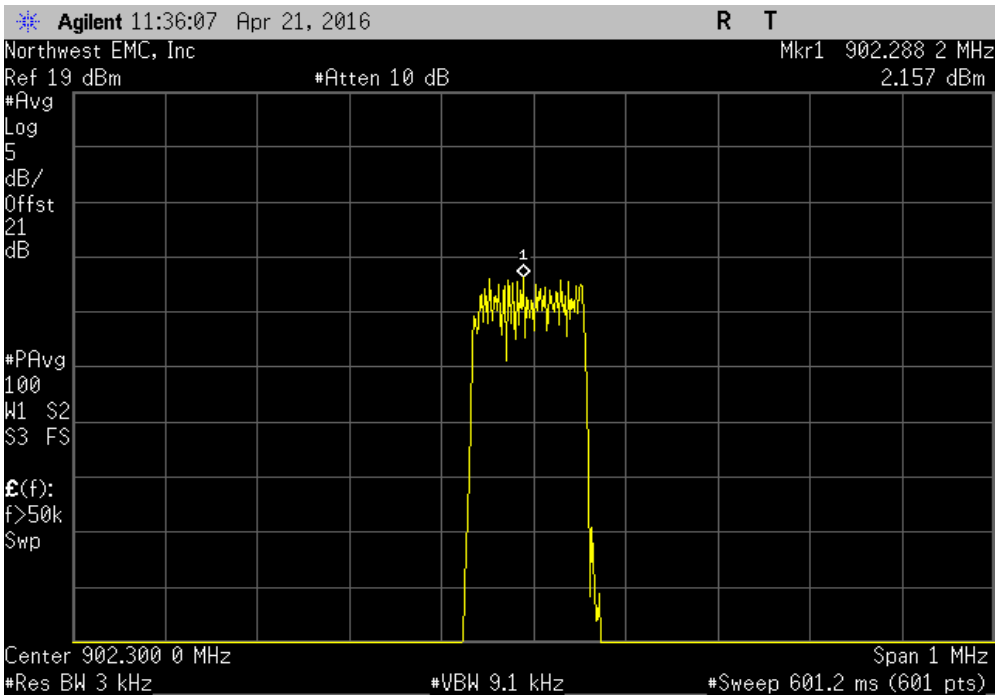
Configuration #	1	Signature

	Power (dBm/kHz)	Duty Cycle Factor (dB)	Density (dBm/kHz)	Limit ≤ (dBm / 3 kHz)	Results
Low Channel, 902.3 MHz	2.157	1.2	3.4	8	Pass
Mid Channel, 908.7 MHz	2.749	1.2	4	8	Pass
High Channel, 914.9 MHz	2.327	1.2	3.6	8	Pass

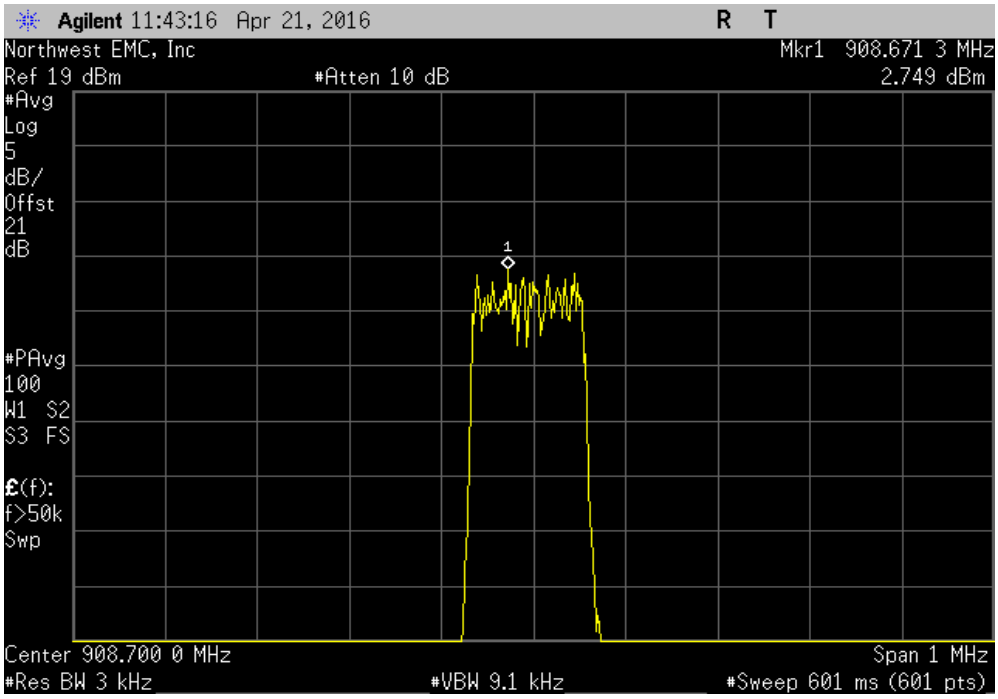
POWER SPECTRAL DENSITY

XMit 2015.01.14

Low Channel, 902.3 MHz						
	Power (dBm/kHz)	Duty Cycle Factor (dB)		Density (dBm/kHz)	Limit ≤ (dBm / 3 kHz)	Results
	2.157	1.2		3.4	8	Pass



Mid Channel, 908.7 MHz						
	Power (dBm/kHz)	Duty Cycle Factor (dB)		Density (dBm/kHz)	Limit ≤ (dBm / 3 kHz)	Results
	2.749	1.2		4	8	Pass



POWER SPECTRAL DENSITY

XMit 2015.01.14

High Channel, 914.9 MHz						
	Power (dBm/kHz)	Duty Cycle Factor (dB)		Density (dBm/kHz)	Limit ≤ (dBm / 3 kHz)	Results
	2.327	1.2		3.6	8	Pass