Multi-Tech Systems, Inc.

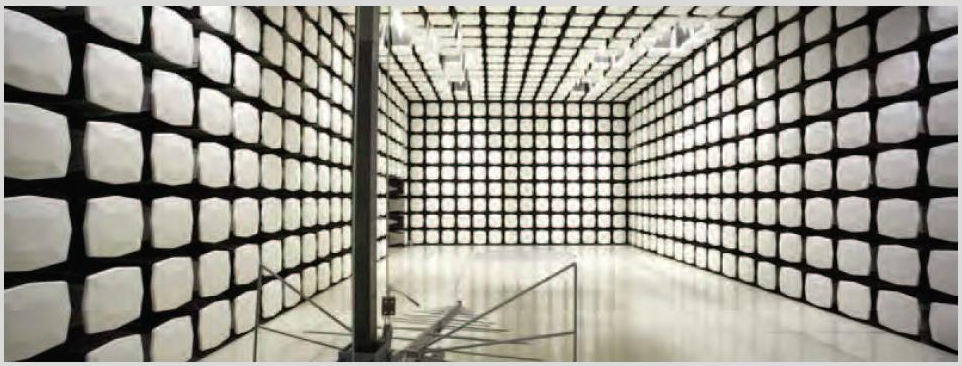
MTXDOT-NA1

FCC 15.247:2024

RSS-247 Issue 3:2023

902 - 928 MHz Hybrid Transceiver

Report: MLTI0186.1 Rev. 2, Issue Date: February 21, 2024



CERT #3310.05

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CERTIFICATE OF TEST

Last Date of Test: January 31, 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	

Testing was performed to the version of the standard(s) in force at the date of testing. Since then, a newer version of the standard has been released. A comparison of the two versions of the standards has been made and the test results continue to show compliance to the latest version of the standards.

Results

Test Description	Result	Specification Section(s)	RSS Section(s)	Method Section(s)	Comments
Powerline Conducted Emissions	Pass	15.207	RSS-Gen 8.8	6.2	
Spurious Radiated Emissions	Pass	15.247(d)	RSS-247 5.5	6.5, 6.6	
Duty Cycle	N/A	15.247	RSS-Gen 3.2	7.5	EUT operates at 100% duty cycle
Carrier Frequency Separation	Pass	15.247(a)(1)	RSS-247 5.1(b)	7.8.2	
Number of Hopping Frequencies	Pass	15.247(a)(1)	RSS-247 5.1(d)	7.8.3	
Dwell Time	Pass	15.247(a)(1)	RSS-247 5.1(d)	7.8.4	
Output Power	Pass	15.247(b)	RSS-247 5.4(d)	7.8.5	
Equivalent Isotropic Radiated Power (EIRP)	Pass	15.247(b)	RSS-247 5.4(d)	7.8.5	
Band Edge Compliance	Pass	15.247(d)	RSS-247 5.5	7.8.6	
Band Edge Compliance - Hopping Mode	Pass	15.247(d)	RSS-247 5.5	7.8.6	
Emissions Bandwidth (20 dB)	Evaluated	15.247(a)	RSS-247 5.2	7.8.7	No limit specified
Occupied Bandwidth (99%)	Evaluated	15.247(a)	RSS-Gen 6.7	7.8.7	No limit specified
Spurious Conducted Emissions	Pass	15.247(d)	RSS-247 5.5	7.8.8	
Power Spectral Density	Pass	15.247(e)	RSS-247 5.2(b)	11.10.2	

Deviations From Test Standards

None

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

element
2022.04.01

Approved By:

Trevor Buls,, Principal EMC Test Engineer

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		
01	Added new Dwell Time data.	2024-02-01	33-37
	Update dates to reflect new data.	2024-02-01	2, 11, 15
	Added configuration MLTI0186-5.	2024-02-01	14
02	Removed all Peer-to-Peer data as this will be treated as a DTS mode as a separate report (MLTI0353.0). Corrected year on FCC spec.	2024-02-07	All

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.

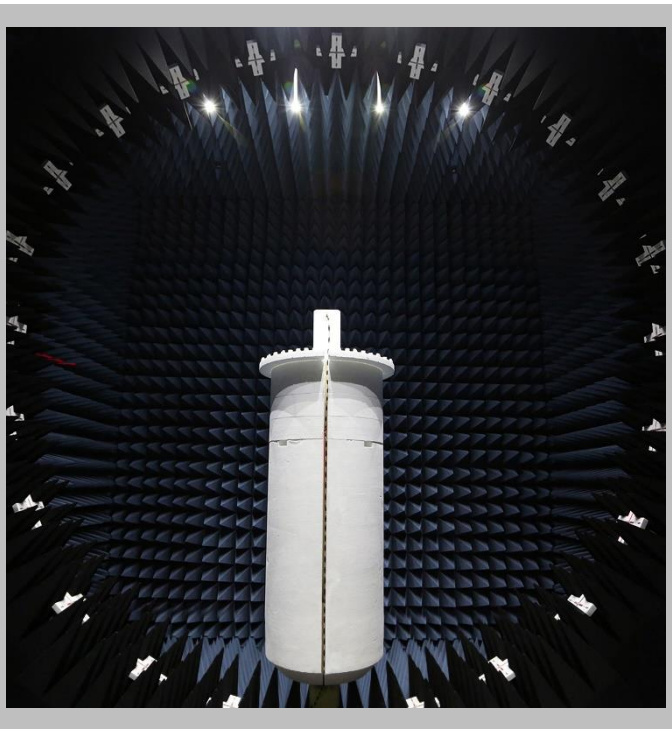
SCOPE

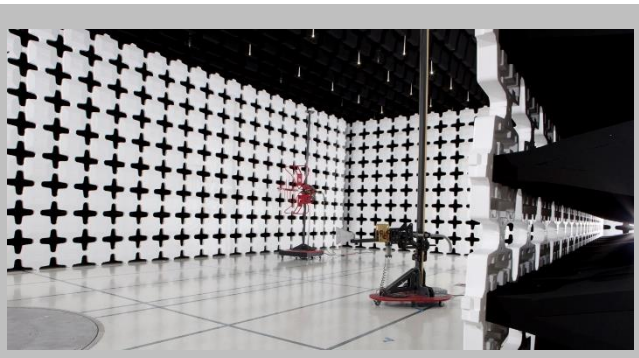
For details on the Scopes of our Accreditations, please visit:

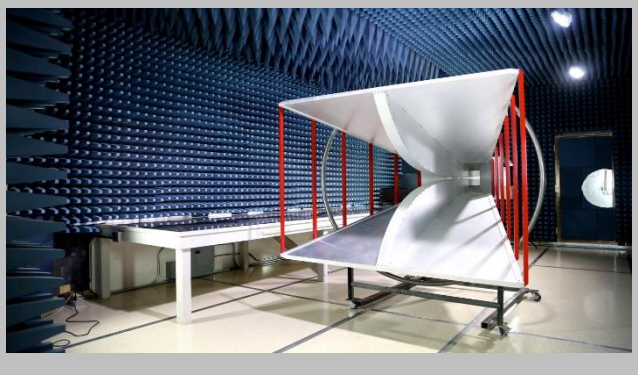
California Minnesota Oregon Texas Washington

FACILITIES

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







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

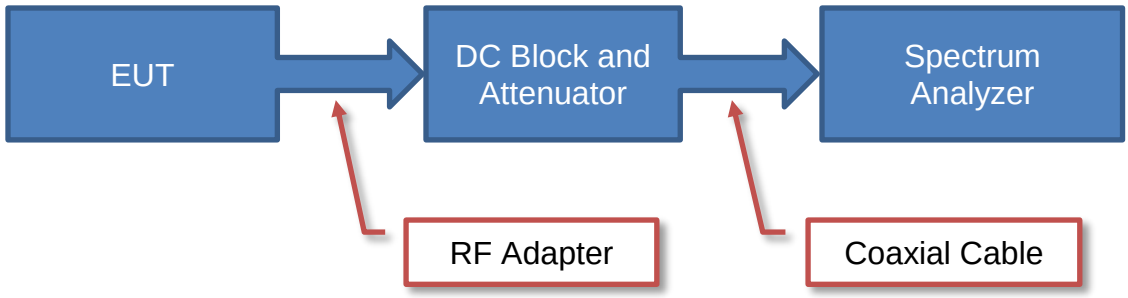
TEST SETUP BLOCK DIAGRAMS

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.

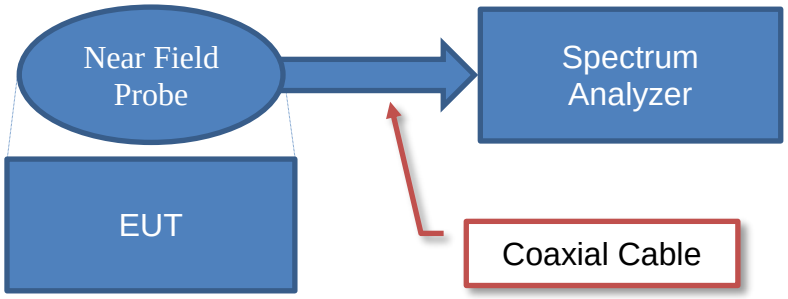
Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

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

Near Field Test Fixture Measurements

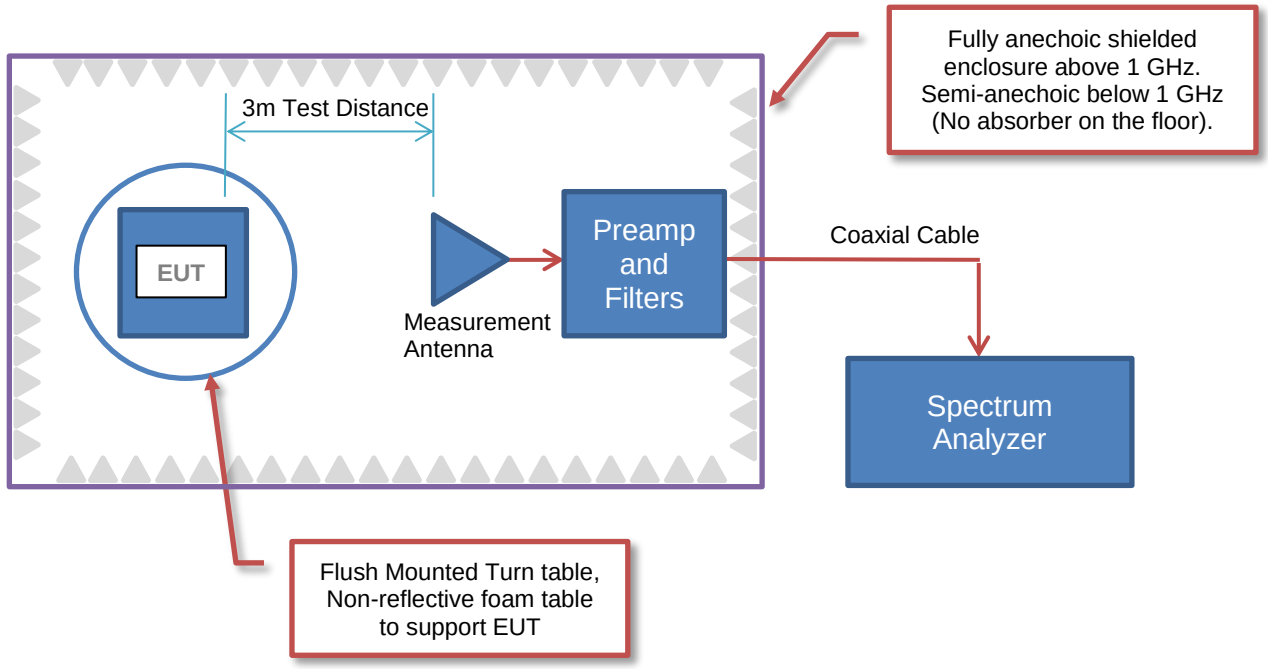


Sample Calculation (logarithmic units)

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**

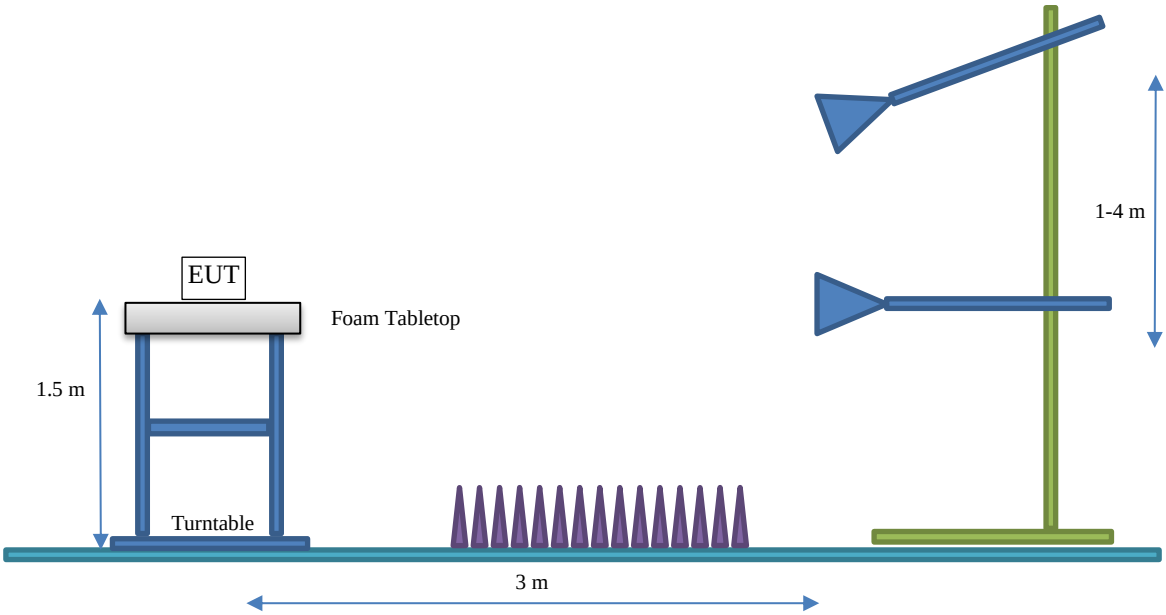
Radiated Power (ERP/EIRP) – Substitution Method:

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 Drive
City, State, Zip:	Saint Paul, MN 55112
Test Requested By:	Tim Gunn
EUT:	MTXDOT-NA1
First Date of Test:	January 30, 2023
Last Date of Test:	January 31, 2024
Receipt Date of Samples:	January 30, 2023
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
The MTXDOT-NA1 is a LoRaWAN, 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.

Client Justification:
Example serial number: 2348143517-0022, 2348143517 signifies manufacturing lot number. -00xx is the unit number off the line (this was all before these product model names existed) MTXDOT-NA1 will be shipping pre-configured for FCC and IC and cannot be changed.

Testing Objective:
Seeking to demonstrate compliance in the 902 - 928 MHz band for operation under FCC 15.247 and RSS-247, RSS-Gen specifications under technology category Hybrid.

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: Mdot-firmware: 4e7b5e6fea454679685413c51abe18095161b460

SETTINGS FOR ALL TESTS IN THIS REPORT

Modulation Types	Bandwidth	Position (if multiple channels)	Channels (MHz)	Power Setting
LoRa and FSK modulation	125 kHz, 500 kHz	Low Channel	902.3, 903	22
		Mid Channel	908.7, 909.4	22
		High Channel	914.2, 914.9	22

CONFIGURATIONS

Configuration MLTI0186-4

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
LoRa Module	MultiTech	MTXDOT-NA1	2348143517-0021

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Lenovo	ThinkPad	PBXZVHX

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	Yes	1.6 m	No	Laptop	LoRa Module

Configuration MLTI0324-1

Software/Firmware Running During Test	
Description	**Version**
xdotad firmware	4.2.0

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
LoRa Module	Multi-Tech Systems, Inc.	MTXDOT-NA1	B1234
Antenna	Pulse	W1063	45009830L

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Developer Board	Multi-Tech Systems, Inc.	10000952LB	None

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote Laptop Computer	Lenovo	X230 i5 3230M	PK0WM2A
Laptop AC Adapter	Lenovo	42T4418	11S42T4418Z1ZGWG2985Y8

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	Yes	> 3 m	No	LoRa Module	Remote Laptop Computer
AC Power	No	0.9m	No	AC Mains	Laptop AC Adapter
DC Power	Yes	1.8m	Yes	Laptop AC Adapter	Remote Laptop Computer

CONFIGURATIONS

Configuration MLTI0324-2

Software/Firmware Running During Test	
Description	**Version**
xdotad firmware	4.2.0

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
LoRa Module	Multi-Tech Systems, Inc.	MTXDOT-NA1	B1234
Antenna	Pulse	W1063	45009830L

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Developer Board	Multi-Tech Systems, Inc.	10000952LB	None
Power Supply - DC	Agilent	U8002A	TPZ

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote Laptop Computer	Lenovo	X230 i5 3230M	PK0WM2A
Laptop AC Adapter	Lenovo	42T4418	11S42T4418Z1ZGWG2985Y8

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	Yes	> 3 m	No	LoRa Module	Remote Laptop Computer
AC Power	No	0.9m	No	AC Mains	Laptop AC Adapter
DC Power	Yes	1.8m	Yes	Laptop AC Adapter	Remote Laptop Computer
DC Power (Module)	No	0.7 m	No	Dev Board	Power Supply - DC
AC Power	No	1.7m	No	AC Mains	Power Supply - DC

Configuration MLTI0186-35

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
LoRa Module	MultiTech	MXDOT15	B1234

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Lenovo	T430S	R9-WTMEW

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	Yes	0.65 m	No	Laptop	LoRa Module

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2023-01-30	Carrier Frequency Separation	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	2023-01-30	Dwell Time	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	2023-01-30	Number of Hopping Frequencies	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	2023-01-30	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 Element following the test.
5	2023-01-31	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.
6	2023-02-13	Emissions Bandwidth (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.
7	2023-02-13	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.
8	2023-02-13	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.
9	2023-02-13	Output Power	Tested as delivered to test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
10	2023-02-13	Power Spectral Density	Tested as delivered to test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
11	2023-02-13	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.
12	2023-08-21	Spurious Radiated Emissions	Tested as delivered to test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
13	2023-08-22	Powerline Conducted Emissions	Tested as delivered to test Station.	No EMI suppression devices were added or modified during this test.	EUT was left the building following the testing.
14	2024-01-31	Dwell Time	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.2023.04.25.0
EmiR5 2022.07.06.0
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

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	3.2 dB	-3.2 dB

CONFIGURATIONS INVESTIGATED

MLTI0324-2

MODES INVESTIGATED

Continuous Transmit, Mid channel 908.7MHz, 125kHz. Power=22

POWERLINE CONDUCTED EMISSIONS

element
WTD.2023.04.25.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

EUT:	MTXDOT15	Work Order:	MLTI0324
Serial Number:	B1234	Date:	2023-08-22
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.2°C
Attendees:	Brent Nielsen	Relative Humidity:	57.3%
Customer Project:	None	Bar. Pressure (PMSL):	1017 mb
Tested By:	Christopher Heintzelman	Job Site:	MN03
Power:	3.3VDC via variable supply	Configuration:	MLTI0324-2

TEST SPECIFICATIONS

Specification: Equipment Class B	Method:
FCC 15.207:2023	ANSI C63.10:2013

TEST PARAMETERS

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

COMMENTS

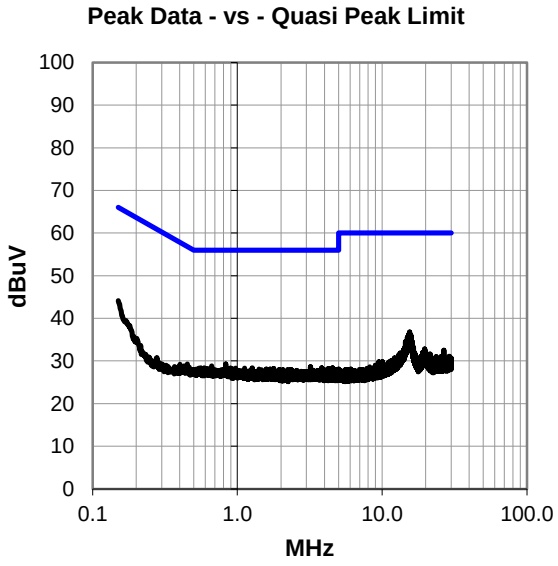
Module powered via external supply, dev board powered by USB.
Commands used: AT+SEND, AT+INF=22, 908700000, 125000,7'

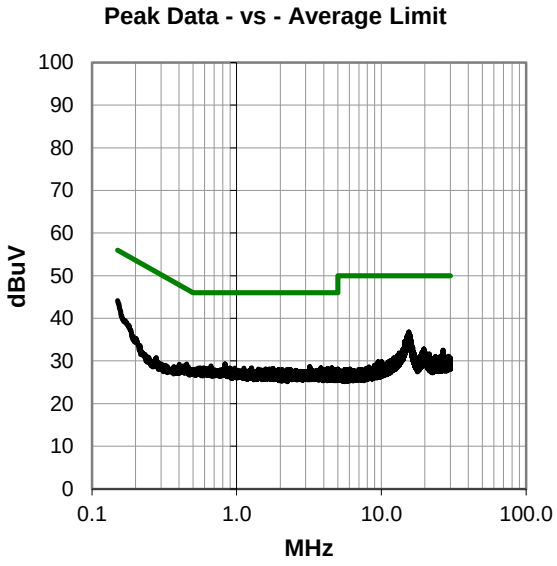
EUT OPERATING MODES

Continuous Transmit, Mid channel 908.7MHz, 125kHz. Power=22

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

element
WTD.2023.04.25.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

RESULTS - Run #2

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.150	23.8	20.3	44.1	66.0	-21.9
15.469	15.8	21.0	36.8	60.0	-23.2
19.636	11.2	21.6	32.8	60.0	-27.2
3.206	8.6	20.1	28.7	56.0	-27.3
26.682	9.8	22.7	32.5	60.0	-27.5
21.475	9.7	21.9	31.6	60.0	-28.4
29.110	8.1	23.0	31.1	60.0	-28.9
23.596	8.8	22.2	31.0	60.0	-29.0
25.512	8.5	22.5	31.0	60.0	-29.0
26.316	8.4	22.6	31.0	60.0	-29.0
9.482	9.3	20.5	29.8	60.0	-30.2
10.034	9.2	20.6	29.8	60.0	-30.2
9.561	9.1	20.5	29.6	60.0	-30.4

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.150	23.8	20.3	44.1	56.0	-11.9
15.469	15.8	21.0	36.8	50.0	-13.2
19.636	11.2	21.6	32.8	50.0	-17.2
3.206	8.6	20.1	28.7	46.0	-17.3
26.682	9.8	22.7	32.5	50.0	-17.5
21.475	9.7	21.9	31.6	50.0	-18.4
29.110	8.1	23.0	31.1	50.0	-18.9
23.596	8.8	22.2	31.0	50.0	-19.0
25.512	8.5	22.5	31.0	50.0	-19.0
26.316	8.4	22.6	31.0	50.0	-19.0
9.482	9.3	20.5	29.8	50.0	-20.2
10.034	9.2	20.6	29.8	50.0	-20.2
9.561	9.1	20.5	29.6	50.0	-20.4

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

element
WTD.2023.04.25.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

EUT:	MTXDOT15	Work Order:	MLTI0324
Serial Number:	B1234	Date:	2023-08-22
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.2°C
Attendees:	Brent Nielsen	Relative Humidity:	57.3%
Customer Project:	None	Bar. Pressure (PMSL):	1017 mb
Tested By:	Christopher Heintzelman	Job Site:	MN03
Power:	3.3VDC via variable supply	Configuration:	MLTI0324-2

TEST SPECIFICATIONS

Specification: Equipment Class B	Method:
FCC 15.207:2023	ANSI C63.10:2013

TEST PARAMETERS

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

COMMENTS

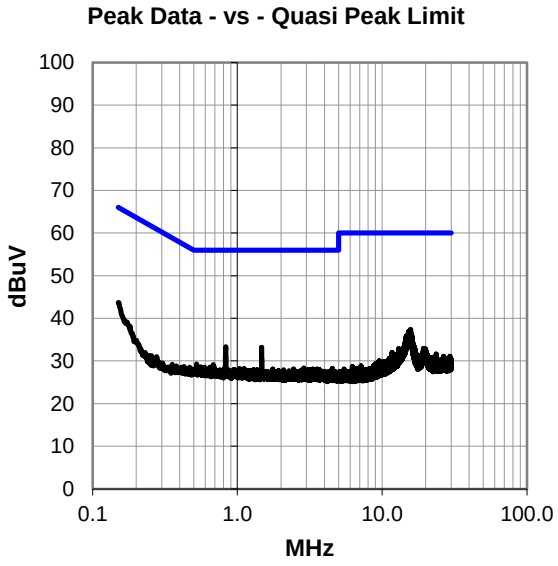
Module powered via external supply, dev board powered by USB.
Commands used: AT+SEND, AT+INF=22, 908700000, 125000,7'

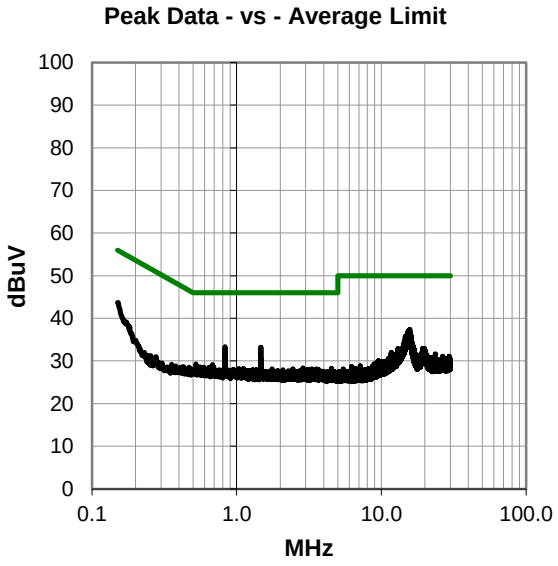
EUT OPERATING MODES

Continuous Transmit, Mid channel 908.7MHz, 125kHz. Power=22

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

element
WTD.2023.04.25.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

RESULTS - Run #3

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.150	23.4	20.3	43.7	66.0	-22.3
15.764	16.3	21.1	37.4	60.0	-22.6
0.829	13.5	19.8	33.3	56.0	-22.7
1.470	13.3	19.9	33.2	56.0	-22.8
13.054	12.1	20.8	32.9	60.0	-27.1
19.235	11.4	21.5	32.9	60.0	-27.1
11.708	11.3	20.7	32.0	60.0	-28.0
23.611	9.4	22.2	31.6	60.0	-28.4
17.718	10.0	21.3	31.3	60.0	-28.7
26.565	8.4	22.7	31.1	60.0	-28.9
29.363	8.1	23.0	31.1	60.0	-28.9
22.138	8.9	21.9	30.8	60.0	-29.2
9.569	9.5	20.5	30.0	60.0	-30.0
8.922	8.8	20.5	29.3	60.0	-30.7
7.153	8.5	20.3	28.8	60.0	-31.2
6.238	8.5	20.2	28.7	60.0	-31.3

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.150	23.4	20.3	43.7	56.0	-12.3
15.764	16.3	21.1	37.4	50.0	-12.6
0.829	13.5	19.8	33.3	46.0	-12.7
1.470	13.3	19.9	33.2	46.0	-12.8
13.054	12.1	20.8	32.9	50.0	-17.1
19.235	11.4	21.5	32.9	50.0	-17.1
11.708	11.3	20.7	32.0	50.0	-18.0
23.611	9.4	22.2	31.6	50.0	-18.4
17.718	10.0	21.3	31.3	50.0	-18.7
26.565	8.4	22.7	31.1	50.0	-18.9
29.363	8.1	23.0	31.1	50.0	-18.9
22.138	8.9	21.9	30.8	50.0	-19.2
9.569	9.5	20.5	30.0	50.0	-20.0
8.922	8.8	20.5	29.3	50.0	-20.7
7.153	8.5	20.3	28.8	50.0	-21.2
6.238	8.5	20.2	28.7	50.0	-21.3

CONCLUSION

Pass

Tested By

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.04.25.0
EmiR5 2022.07.06.0
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 = CISPR Average 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
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	2023-02-06	2024-02-06
Antenna - Biconilog	Ametek	CBL 6141B	AYS	2023-03-28	2025-03-28
Cable	ESM Cable Corp.	Bilog Cables	MNH	2022-10-08	2023-10-08
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	2022-10-08	2023-10-08
Filter - Low Pass	Micro-Tronics	LPM50003	LFJ	2022-08-27	2023-08-27
Attenuator	Fairview Microwave	SA18E-10	TYA	2022-08-27	2023-08-27
Filter - Band Pass/Notch	K&L Microwave	3TNF-500/1000-N/N	HGS	2023-06-17	2024-06-17
Antenna - Double Ridge	ETS Lindgren	3115	AIP	2022-07-20	2024-07-20
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	2023-01-14	2024-01-14
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	2023-01-14	2024-01-14
Attenuator	Fairview Microwave	SA18E-20	TWZ	2022-08-27	2023-08-27
Filter - High Pass	Micro-Tronics	HPM50108	LFM	2022-08-27	2023-08-27
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	NCR
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	2023-01-14	2024-01-14
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	2023-01-14	2024-01-14

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.04.25.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	5.2 dB	-5.2 dB

FREQUENCY RANGE INVESTIGATED

30 MHz TO 12400 MHz

POWER INVESTIGATED

5VDC via USB

CONFIGURATIONS INVESTIGATED

MLTI0324-1

MODES INVESTIGATED

Continuous Transmit, High channel 914.9MHz, 125kHz. Power=22
Continuous Transmit, Low channel 902.3MHz, 500kHz, Power=22.
Continuous Transmit, Low channel 902.3MHz, 125kHz. Power=22
Continuous Transmit, Mid channel 908.7MHz, 125kHz. Power=22

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.04.25.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

EUT:	MTXDOT-NA1	Work Order:	MLTI0324
Serial Number:	B1234	Date:	2023-08-21
Customer:	Multi-Tech Systems, Inc.	Temperature:	21.9°C
Attendees:	Brent Nielsen	Relative Humidity:	54.7%
Customer Project:	None	Bar. Pressure (PMSL):	1023 mb
Tested By:	Dan Haas	Job Site:	MN05
Power:	5VDC via USB	Configuration:	MLTI0324-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

TEST PARAMETERS

Run #:	9	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

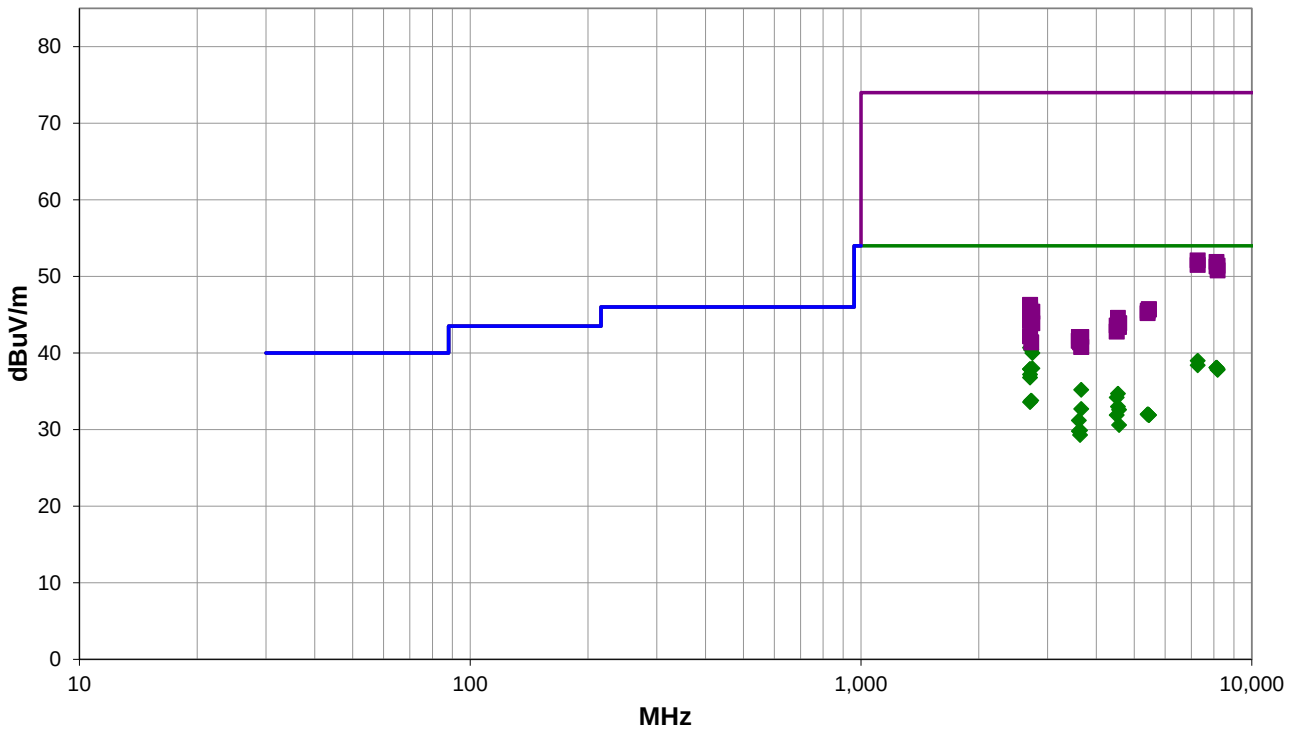
Commands: AT+ADR+0, AT+SEND, AT+INF=22,902300000, 125000, 7

EUT OPERATING MODES

Continuous Transmit, Power=22. See comments for EUT orientation, transmit frequency, and data rate.

DEVIATIONS FROM TEST STANDARD

None



Run #: 9 ■ PK ◆ AV ● QP

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.04.25.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.04.25.0

RESULTS - Run #9

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
2706.917	45.5	-3.7	1.5	328.0	3.0	0.0	Vert	AV	0.0	41.8	54.0	-12.2	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz
2706.908	44.4	-3.7	1.6	185.9	3.0	0.0	Horz	AV	0.0	40.7	54.0	-13.3	EUT on side, Ant. Horz, Low ch. 902.3MHz, 125kHz
2726.100	44.1	-3.7	1.79	347.0	3.0	0.0	Vert	AV	0.0	40.4	54.0	-13.6	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
2744.717	43.7	-3.7	1.54	69.0	3.0	0.0	Vert	AV	0.0	40.0	54.0	-14.0	EUT Horz, Ant. Vert, High ch. 914.9MHz, 125kHz
7269.567	27.4	11.6	3.09	13.9	3.0	0.0	Horz	AV	0.0	39.0	54.0	-15.0	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
7269.583	26.8	11.6	1.5	123.0	3.0	0.0	Vert	AV	0.0	38.4	54.0	-15.6	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
8120.600	25.9	12.2	2.67	333.0	3.0	0.0	Horz	AV	0.0	38.1	54.0	-15.9	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz
8121.967	25.9	12.2	1.5	48.9	3.0	0.0	Vert	AV	0.0	38.1	54.0	-15.9	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz
2744.700	41.7	-3.7	1.62	174.0	3.0	0.0	Horz	AV	0.0	38.0	54.0	-16.0	EUT Horz, Ant. Vert, High ch. 914.9MHz, 125kHz
2706.917	41.6	-3.7	1.5	95.0	3.0	0.0	Vert	AV	0.0	37.9	54.0	-16.1	EUT on side, Ant. Horz, Low ch. 902.3MHz, 125kHz
2706.900	41.6	-3.7	1.5	340.0	3.0	0.0	Horz	AV	0.0	37.9	54.0	-16.1	EUT Vert, Ant. Horz, Low ch. 902.3MHz, 125kHz
8175.533	25.2	12.7	3.27	153.0	3.0	0.0	Vert	AV	0.0	37.9	54.0	-16.1	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
8175.517	25.1	12.7	3.52	6.9	3.0	0.0	Horz	AV	0.0	37.8	54.0	-16.2	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
2706.892	40.9	-3.7	1.5	328.0	3.0	0.0	Vert	AV	0.0	37.2	54.0	-16.8	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 500kHz
2706.900	40.5	-3.7	1.5	159.0	3.0	0.0	Horz	AV	0.0	36.8	54.0	-17.2	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz
3659.333	36.5	-1.3	2.81	303.0	3.0	0.0	Horz	AV	0.0	35.2	54.0	-18.8	EUT Horz, Ant. Vert, High ch. 914.9MHz, 125kHz
4543.500	32.9	1.8	3.75	171.0	3.0	0.0	Horz	AV	0.0	34.7	54.0	-19.3	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
4511.508	32.7	1.5	1.16	132.9	3.0	0.0	Vert	AV	0.0	34.2	54.0	-19.8	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz
2726.108	37.5	-3.7	1.5	344.9	3.0	0.0	Horz	AV	0.0	33.8	54.0	-20.2	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
2706.925	37.3	-3.7	1.5	13.9	3.0	0.0	Vert	AV	0.0	33.6	54.0	-20.4	EUT Vert, Ant. Horz, Low ch. 902.3MHz, 125kHz
4543.500	31.2	1.8	3.29	354.0	3.0	0.0	Vert	AV	0.0	33.0	54.0	-21.0	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
3659.633	34.0	-1.3	3.91	279.9	3.0	0.0	Vert	AV	0.0	32.7	54.0	-21.3	EUT Horz, Ant. Vert, High ch. 914.9MHz, 125kHz
4574.508	30.8	1.8	3.08	6.9	3.0	0.0	Vert	AV	0.0	32.6	54.0	-21.4	EUT Horz, Ant. Vert, High ch. 914.9MHz, 125kHz
7269.617	40.5	11.6	1.5	123.0	3.0	0.0	Vert	PK	0.0	52.1	74.0	-21.9	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
5416.158	26.8	5.2	3.01	63.0	3.0	0.0	Horz	AV	0.0	32.0	54.0	-22.0	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz
5416.233	26.8	5.2	1.5	333.0	3.0	0.0	Vert	AV	0.0	32.0	54.0	-22.0	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz
4511.492	30.4	1.5	3.06	228.0	3.0	0.0	Horz	AV	0.0	31.9	54.0	-22.1	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz
8123.233	39.6	12.3	2.67	333.0	3.0	0.0	Horz	PK	0.0	51.9	74.0	-22.1	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz
5454.467	26.4	5.5	2.19	96.9	3.0	0.0	Horz	AV	0.0	31.9	54.0	-22.1	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
5454.433	26.4	5.5	1.5	243.9	3.0	0.0	Vert	AV	0.0	31.9	54.0	-22.1	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
7269.475	39.9	11.6	3.09	13.9	3.0	0.0	Horz	PK	0.0	51.5	74.0	-22.5	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
8176.817	38.7	12.7	3.27	153.0	3.0	0.0	Vert	PK	0.0	51.4	74.0	-22.6	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
8121.625	39.1	12.2	1.5	48.9	3.0	0.0	Vert	PK	0.0	51.3	74.0	-22.7	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz
3609.192	32.3	-1.1	1.5	227.0	3.0	0.0	Vert	AV	0.0	31.2	54.0	-22.8	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz
8176.358	38.1	12.7	3.52	6.9	3.0	0.0	Horz	PK	0.0	50.8	74.0	-23.2	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
4574.533	28.8	1.8	1.5	330.9	3.0	0.0	Horz	AV	0.0	30.6	54.0	-23.4	EUT Horz, Ant. Vert, High ch. 914.9MHz, 125kHz
3634.842	31.0	-1.1	3.84	159.0	3.0	0.0	Horz	AV	0.0	29.9	54.0	-24.1	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
3609.183	30.9	-1.1	3.49	332.0	3.0	0.0	Horz	AV	0.0	29.8	54.0	-24.2	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz
3634.783	30.4	-1.1	1.5	242.0	3.0	0.0	Vert	AV	0.0	29.3	54.0	-24.7	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
2706.608	50.0	-3.7	1.5	328.0	3.0	0.0	Vert	PK	0.0	46.3	74.0	-27.7	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz

SPURIOUS RADIATED EMISSIONS

element
WTD.2023.04.25.0
EmiR5 2022.07.06.0
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
5453.617	40.2	5.5	2.19	96.9	3.0	0.0	Horz	PK	0.0	45.7	74.0	-28.3	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
5449.658	40.4	5.3	1.5	243.9	3.0	0.0	Vert	PK	0.0	45.7	74.0	-28.3	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
2706.625	49.4	-3.7	1.5	328.0	3.0	0.0	Vert	PK	0.0	45.7	74.0	-28.3	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 500kHz
2707.058	49.3	-3.7	1.6	185.9	3.0	0.0	Horz	PK	0.0	45.6	74.0	-28.4	EUT on side, Ant. Horz, Low ch. 902.3MHz, 125kHz
5415.275	40.3	5.2	1.5	333.0	3.0	0.0	Vert	PK	0.0	45.5	74.0	-28.5	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz
2744.683	49.1	-3.7	1.54	69.0	3.0	0.0	Vert	PK	0.0	45.4	74.0	-28.6	EUT Horz, Ant. Vert, High ch. 914.9MHz, 125kHz
2706.950	49.0	-3.7	1.5	159.0	3.0	0.0	Horz	PK	0.0	45.3	74.0	-28.7	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz
5411.658	40.2	5.0	3.01	63.0	3.0	0.0	Horz	PK	0.0	45.2	74.0	-28.8	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz
2726.050	48.5	-3.7	1.79	347.0	3.0	0.0	Vert	PK	0.0	44.8	74.0	-29.2	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
2706.658	48.3	-3.7	1.5	340.0	3.0	0.0	Horz	PK	0.0	44.6	74.0	-29.4	EUT Vert, Ant. Horz, Low ch. 902.3MHz, 125kHz
4543.183	42.8	1.8	3.29	354.0	3.0	0.0	Vert	PK	0.0	44.6	74.0	-29.4	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
2706.558	47.9	-3.7	1.5	95.0	3.0	0.0	Vert	PK	0.0	44.2	74.0	-29.8	EUT on side, Ant. Horz, Low ch. 902.3MHz, 125kHz
2744.708	47.6	-3.7	1.62	174.0	3.0	0.0	Horz	PK	0.0	43.9	74.0	-30.1	EUT Horz, Ant. Vert, High ch. 914.9MHz, 125kHz
4574.683	42.1	1.8	3.08	6.9	3.0	0.0	Vert	PK	0.0	43.9	74.0	-30.1	EUT Horz, Ant. Vert, High ch. 914.9MHz, 125kHz
4511.383	42.1	1.5	1.16	132.9	3.0	0.0	Vert	PK	0.0	43.6	74.0	-30.4	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz
4543.625	41.8	1.8	3.75	171.0	3.0	0.0	Horz	PK	0.0	43.6	74.0	-30.4	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
4574.258	41.6	1.8	1.5	330.9	3.0	0.0	Horz	PK	0.0	43.4	74.0	-30.6	EUT Horz, Ant. Vert, High ch. 914.9MHz, 125kHz
4511.433	41.3	1.5	3.06	228.0	3.0	0.0	Horz	PK	0.0	42.8	74.0	-31.2	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz
2706.258	45.9	-3.7	1.5	13.9	3.0	0.0	Vert	PK	0.0	42.2	74.0	-31.8	EUT Vert, Ant. Horz, Low ch. 902.3MHz, 125kHz
3609.450	43.2	-1.1	1.5	227.0	3.0	0.0	Vert	PK	0.0	42.1	74.0	-31.9	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz
3659.308	43.4	-1.3	3.91	279.9	3.0	0.0	Vert	PK	0.0	42.1	74.0	-31.9	EUT Horz, Ant. Vert, High ch. 914.9MHz, 125kHz
3608.958	42.7	-1.1	3.49	332.0	3.0	0.0	Horz	PK	0.0	41.6	74.0	-32.4	EUT Horz, Ant. Vert, Low ch. 902.3MHz, 125kHz
3634.308	42.6	-1.1	1.5	242.0	3.0	0.0	Vert	PK	0.0	41.5	74.0	-32.5	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
2726.200	45.1	-3.7	1.5	344.9	3.0	0.0	Horz	PK	0.0	41.4	74.0	-32.6	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
3637.500	42.5	-1.1	3.84	159.0	3.0	0.0	Horz	PK	0.0	41.4	74.0	-32.6	EUT Horz, Ant. Vert, Mid ch. 908.7MHz, 125kHz
3660.142	42.1	-1.3	2.81	303.0	3.0	0.0	Horz	PK	0.0	40.8	74.0	-33.2	EUT Horz, Ant. Vert, High ch. 914.9MHz, 125kHz

CONCLUSION

Pass

Tested By

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.

CARRIER FREQUENCY SEPARATION

XMit 2022.02.07.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Attenuator	Fairview Microwave	18B5W-26	RFY	2022-05-30	2023-05-30
Block - DC	Fairview Microwave	SD3379	AMZ	2022-11-06	2023-11-06
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2022-09-10	2023-09-10
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2022-04-25	2023-04-25

TEST DESCRIPTION

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

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. 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 FREQUENCY SEPARATION

TbtTx 2022.06.03.0 XMit 2022.02.07.0

EUT:	MTXDOT-NA1			Work Order:	MLTI0186
Serial Number:	2348143517-0021			Date:	30-Jan-23
Customer:	Multi-Tech Systems, Inc.			Temperature:	22.5 °C
Attendees:	Ana Santos			Humidity:	13.3% RH
Project:	None			Barometric Pres.:	1034 mbar
Tested by:	Christopher Heintzelman	Power:	5VDC	Job Site:	MN11

TEST SPECIFICATIONS	Test Method
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block. Does not include customer's patch cable. The limit is taken from the 20dB bandwidth measurement in this report.

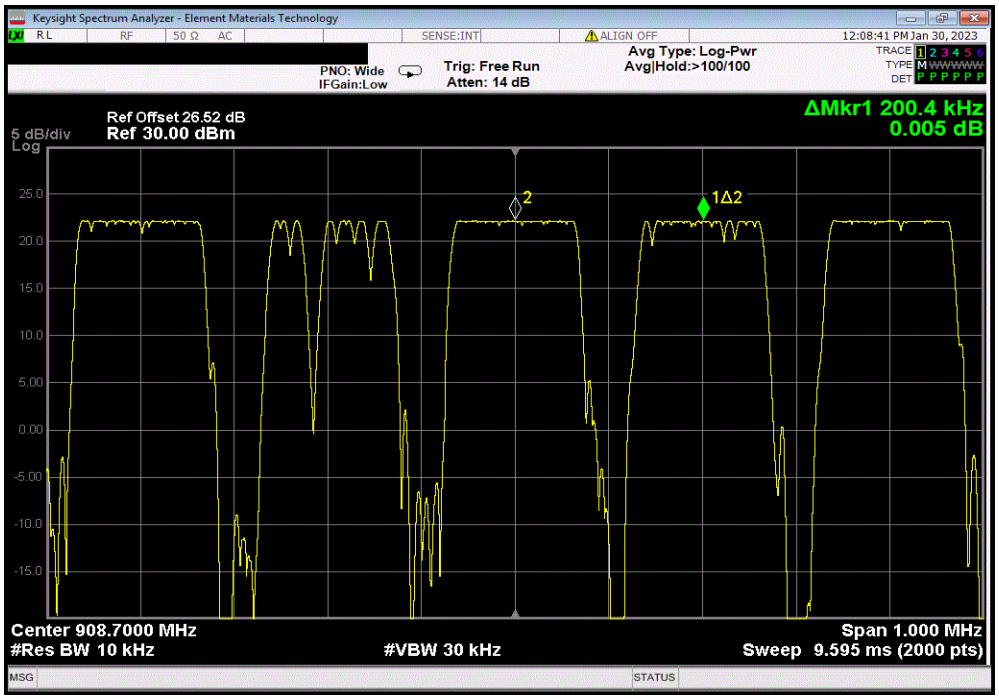
DEVIATIONS FROM TEST STANDARD

None

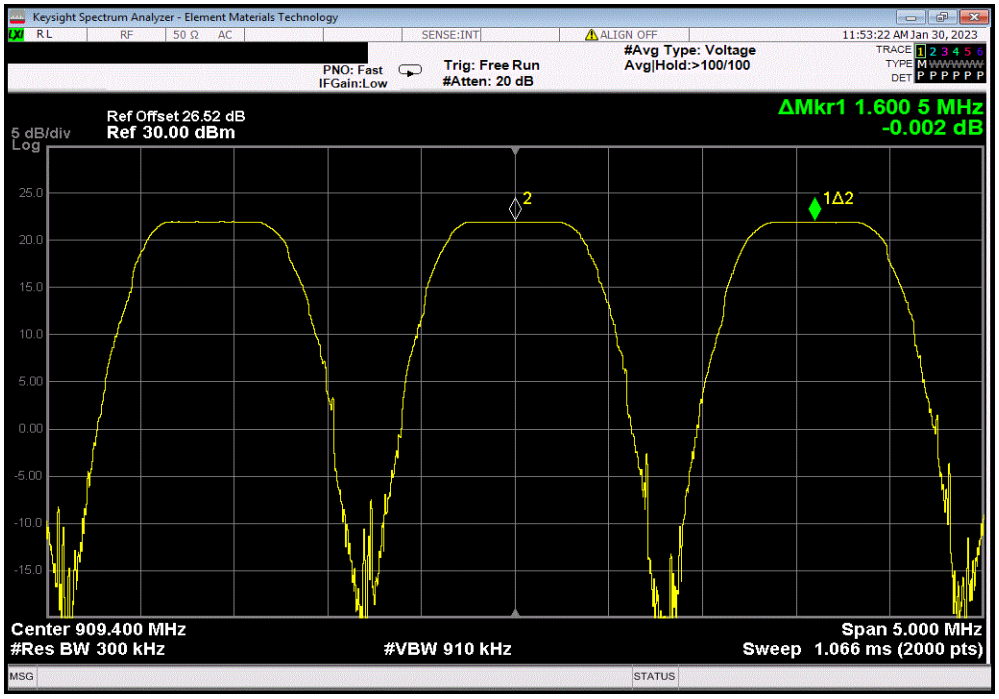
Configuration #	MLTI0186-4	Signature

	Value (kHz)	Limit (≥kHz)	Results
Hopping Mode, 125 kHz Bandwidth	200	144.6	Pass
Hopping Mode, 500 kHz Bandwidth	1600	575.4	Pass

Hopping Mode, 125 kHz Bandwidth						
				Value (kHz)	Limit (≥kHz)	Results
				200	144.6	Pass



Hopping Mode, 500 kHz Bandwidth						
				Value (kHz)	Limit (≥kHz)	Results
				1600	575.4	Pass



NUMBER OF HOPPING FREQUENCIES

XMit 2022.02.07.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Attenuator	Fairview Microwave	18B5W-26	RFY	2022-05-30	2023-05-30
Block - DC	Fairview Microwave	SD3379	AMZ	2022-11-06	2023-11-06
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2022-09-10	2023-09-10
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2022-04-25	2023-04-25

TEST DESCRIPTION

The number of hopping frequencies was measured across the authorized band. The hopping function of the EUT was enabled.

NUMBER OF HOPPING FREQUENCIES

TbtTx 2022.06.03.0 XMit 2022.02.07.0

EUT:	**MTXDOT-NA1**			**Work Order:**	**MLTI0186**
Serial Number:	**2348143517-0021**			**Date:**	**30-Jan-23**
Customer:	**Multi-Tech Systems, Inc.**			**Temperature:**	**22.5 °C**
Attendees:	**Ana Santos**			**Humidity:**	**13.3% RH**
Project:	**None**			**Barometric Pres.:**	**1034 mbar**
Tested by:	**Christopher Heintzelman**	**Power:**	**5VDC**	**Job Site:**	**MN11**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block. Does not include customer's patch cable.

DEVIATIONS FROM TEST STANDARD

None

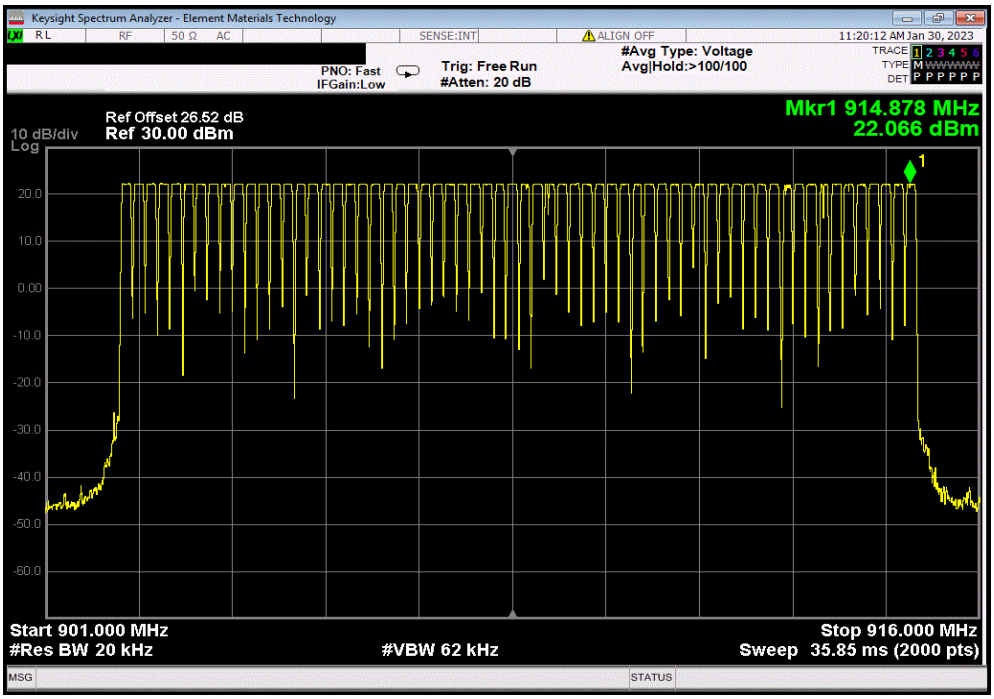
Configuration #	**MLTI0186-4**	*Signature*

	Number of Hopping Chs	**Limit**	**Results**
Hopping Mode, 125 kHz Bandwidth	64	N/A	N/A
Hopping Mode, 500 kHz Bandwidth	8	N/A	N/A

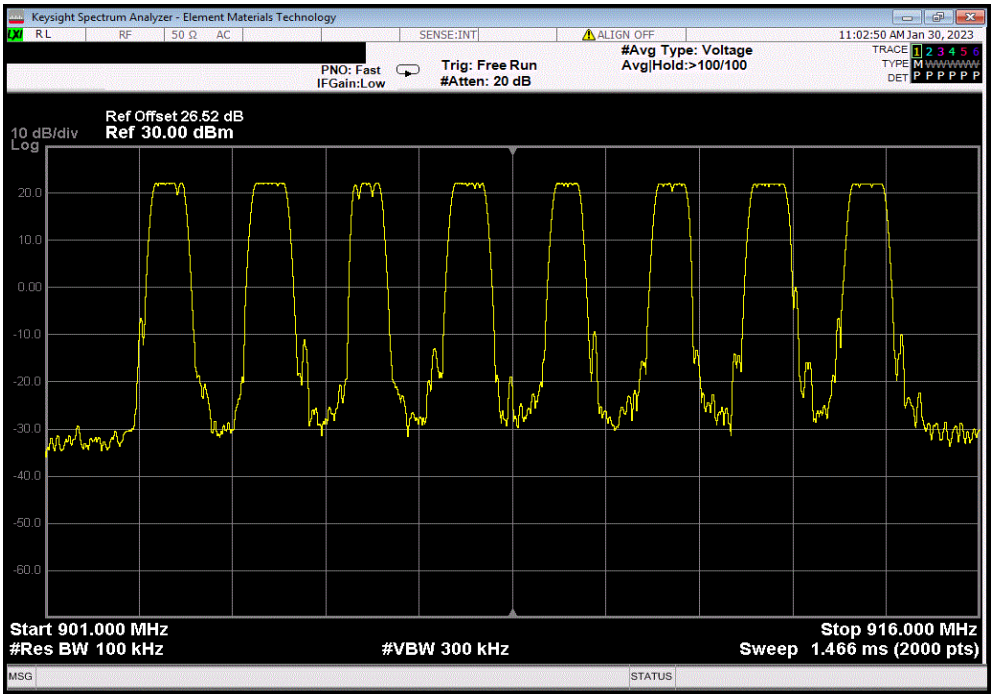
NUMBER OF HOPPING FREQUENCIES

TbtTx 2022.06.03.0 XMit 2022.02.07.0

Hopping Mode, 125 kHz Bandwidth						
				Number of Hopping Chs	Limit	Results
				64	N/A	N/A



Hopping Mode, 500 kHz Bandwidth						
				Number of Hopping Chs	Limit	Results
				8	N/A	N/A



DWELL TIME (125 kHz Bandwidth)

XMit 2022.02.07.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Attenuator	Fairview Microwave	SA18S5W-20	RFX	2023-06-14	2024-06-14
Block - DC	Fairview Microwave	SD3379	ANH	2023-09-05	2024-09-05
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2023-09-05	2024-09-05
Generator - Signal	Agilent	N5171B (EXG)	TEY	2-24-1-11	2027-01-11
Analyzer - Spectrum Analyzer	Agilent	E4443A	AAS	2023-06-14	2024-06-14

TEST DESCRIPTION

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

The average dwell time per hopping channel was measured at one hopping channel in the middle of the authorized band. The hopping function of the EUT was enabled.

The dwell time limit is based on the number of hopping channels, with no more than 0.4s of on time in the observation window. The observation window is equal to 0.4 seconds * 64 (the number of hopping channels). = 25.6 seconds. This is per FCC 15.247(f).

On Time During the Specified Period (Sec) = Pulse Width * Average Number of Pulses

Average Number of Pulses is based on 4 samples.

DWELL TIME (125 kHz Bandwidth)

TbtTx 2022.06.03.0 XMit 2022.02.07.0

EUT:	MTXDOT-NA1			Work Order:	MLTI0186
Serial Number:	B1234			Date:	31-Jan-24
Customer:	Multi-Tech Systems, Inc.			Temperature:	22.6 °C
Attendees:	Brent Nielsen			Humidity:	33.8% RH
Project:	None			Barometric Pres.:	1013 mbar
Tested by:	Christopher Heintzelman	Power:	5VDC	Job Site:	MN11

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

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block.

DEVIATIONS FROM TEST STANDARD

None

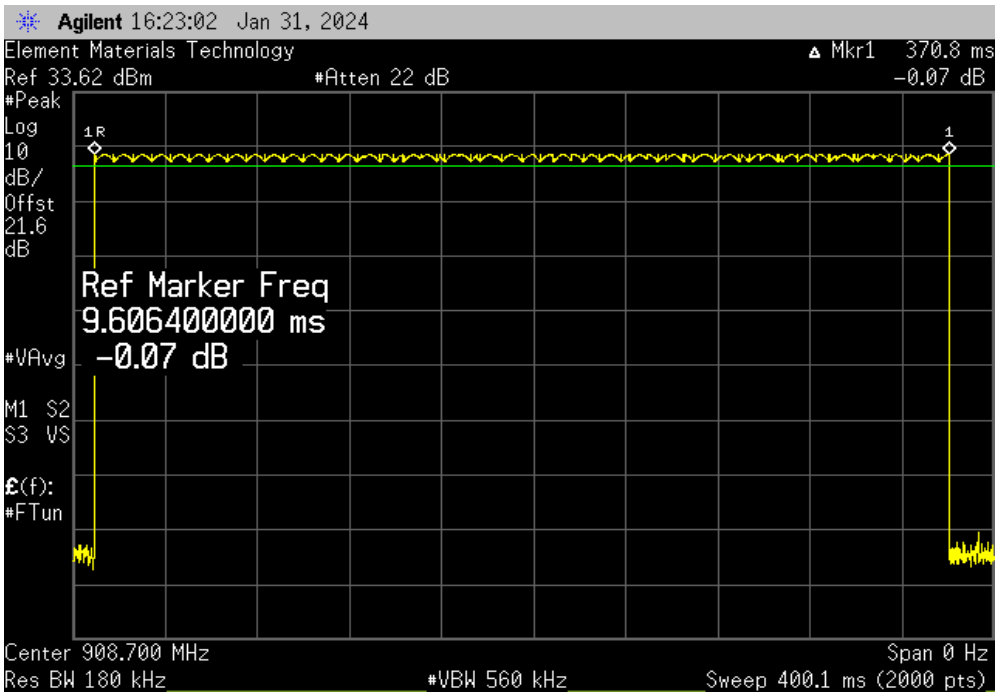
Configuration #	MLTI0186-35	Signature

	Pulse Width (ms)	Number of Pulses	Average No. of Pulses	On Time (ms) During 25.6 s	Limit (ms)	Results
Hopping Mode, 125 kHz Bandwidth	370.8	1	N/A	N/A	N/A	N/A
Hopping Mode, 125 kHz Bandwidth	N/A	1	N/A	N/A	N/A	N/A
Hopping Mode, 125 kHz Bandwidth	N/A	1	N/A	N/A	N/A	N/A
Hopping Mode, 125 kHz Bandwidth	N/A	1	N/A	N/A	N/A	N/A
Hopping Mode, 125 kHz Bandwidth	N/A	1	N/A	N/A	N/A	N/A
Hopping Mode, 125 kHz Bandwidth	370.8	N/A	1	370.8	400	Pass

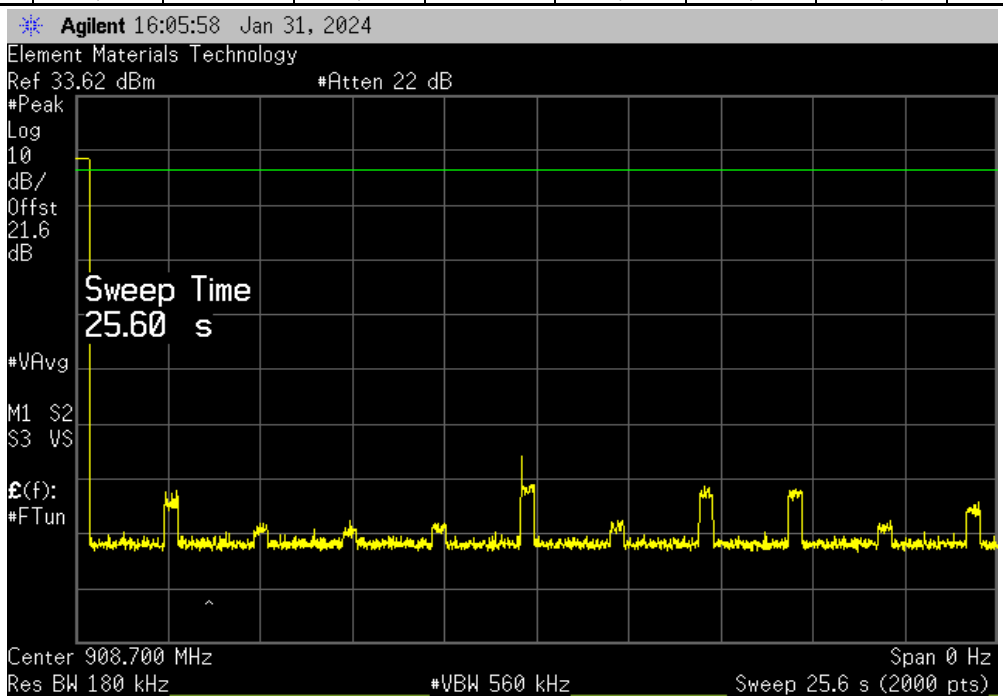
DWELL TIME (125 kHz Bandwidth)

TbtTx 2022.06.03.0 XMit 2022.02.07.0

Hopping Mode, 125 kHz Bandwidth						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses		On Time (ms) During 25.6 s	Limit (ms)	Results
370.8	1	N/A		N/A	N/A	N/A



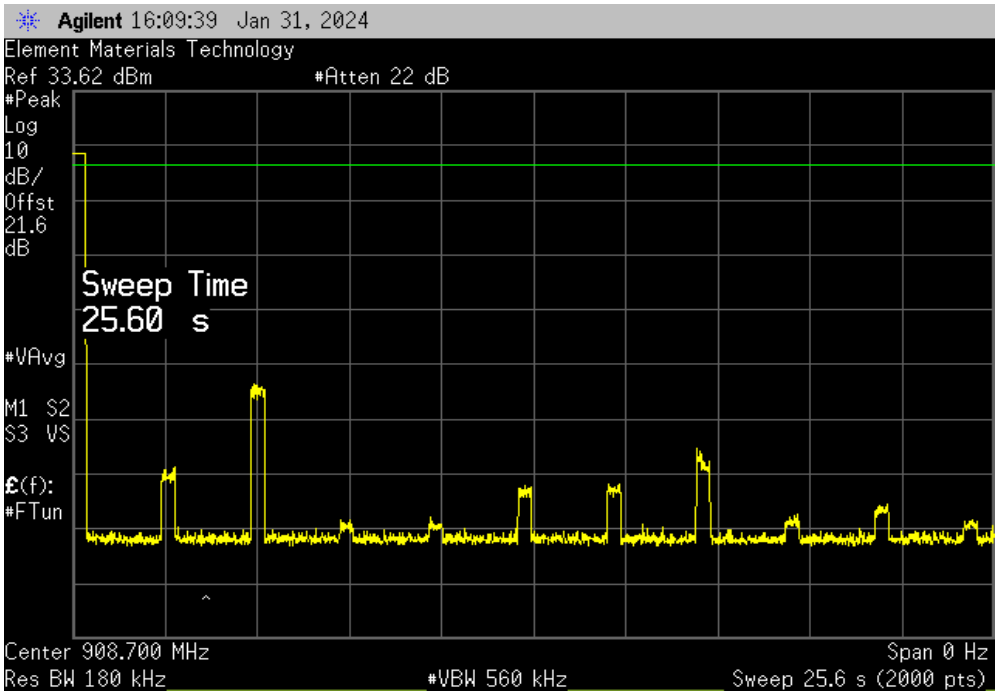
Hopping Mode, 125 kHz Bandwidth						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses		On Time (ms) During 25.6 s	Limit (ms)	Results
N/A	1	N/A		N/A	N/A	N/A



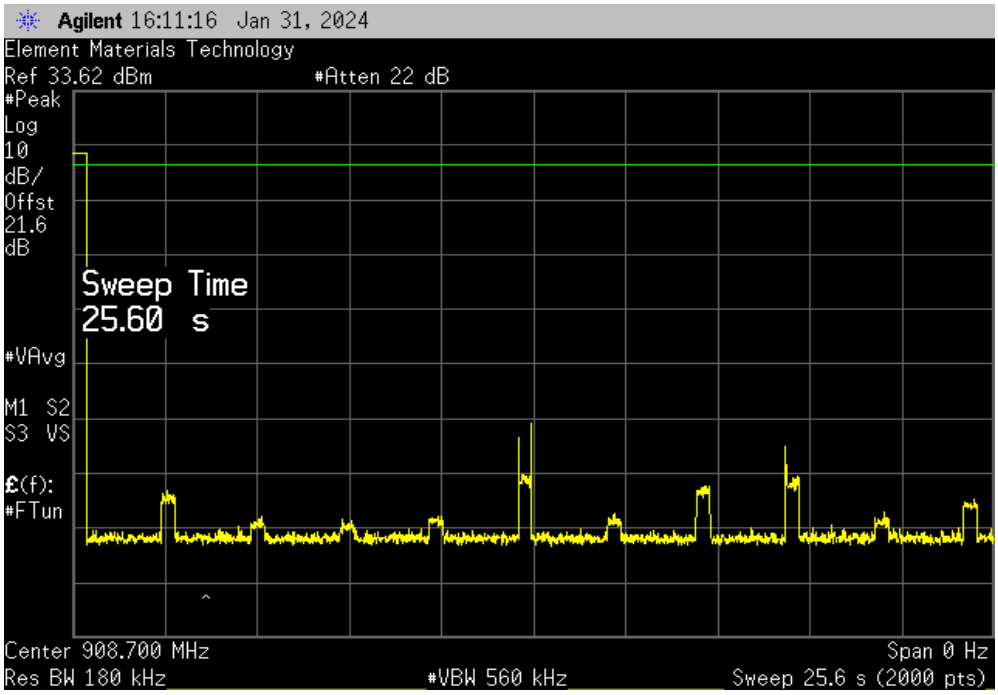
DWELL TIME (125 kHz Bandwidth)

TbtTx 2022.06.03.0 XMit 2022.02.07.0

Hopping Mode, 125 kHz Bandwidth						
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



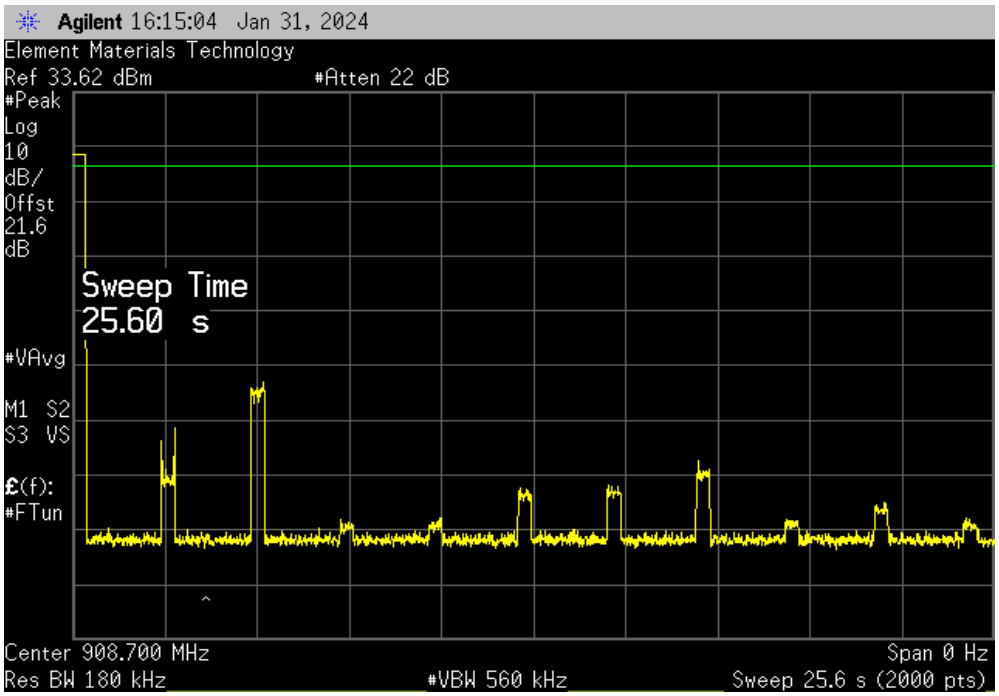
Hopping Mode, 125 kHz Bandwidth						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses		On Time (ms) During 25.6 s	Limit (ms)	Results
N/A	1	N/A		N/A	N/A	N/A



DWELL TIME (125 kHz Bandwidth)

TbtTx 2022.06.03.0 XMit 2022.02.07.0

#REF!						
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, 125 kHz Bandwidth						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses		On Time (ms) During 25.6 s	Limit (ms)	Results
370.8	N/A	1		370.8	400	Pass

Calculation Only

No Screen Capture Required

DWELL TIME (500 kHz Bandwidth)

XMit 2022.02.07.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Attenuator	Fairview Microwave	18B5W-26	RFY	2022-05-30	2023-05-30
Block - DC	Fairview Microwave	SD3379	AMZ	2022-11-06	2023-11-06
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2022-09-10	2023-09-10
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2022-04-25	2023-04-25

TEST DESCRIPTION

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

The average dwell time per hopping channel was measured at one hopping channel in the middle of the authorized band. The hopping function of the EUT was enabled.

The dwell time limit is based on the number of hopping channels, with no more than 0.4s of on time in the observation window. The observation window is equal to 0.4 seconds * 8 (the number of hopping channels). = 3.2 seconds. This is per FCC 15.247(f).

On Time During the Specified Period (Sec) = Pulse Width * Average Number of Pulses

Average Number of Pulses is based on 4 samples.

DWELL TIME (500 kHz Bandwidth)

TbtTx 2022.06.03.0 XMit 2022.02.07.0

EUT:	MTXDOT-NA1			Work Order:	MLTI0186
Serial Number:	2348143517-0021			Date:	30-Jan-23
Customer:	Multi-Tech Systems, Inc.			Temperature:	22.5 °C
Attendees:	Ana Santos			Humidity:	13.5% RH
Project:	None			Barometric Pres.:	1034 mbar
Tested by:	Christopher Heintzelman	Power:	5VDC	Job Site:	MN11

TEST SPECIFICATIONS	Test Method
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block. Does not include customer's patch cable.

DEVIATIONS FROM TEST STANDARD

None

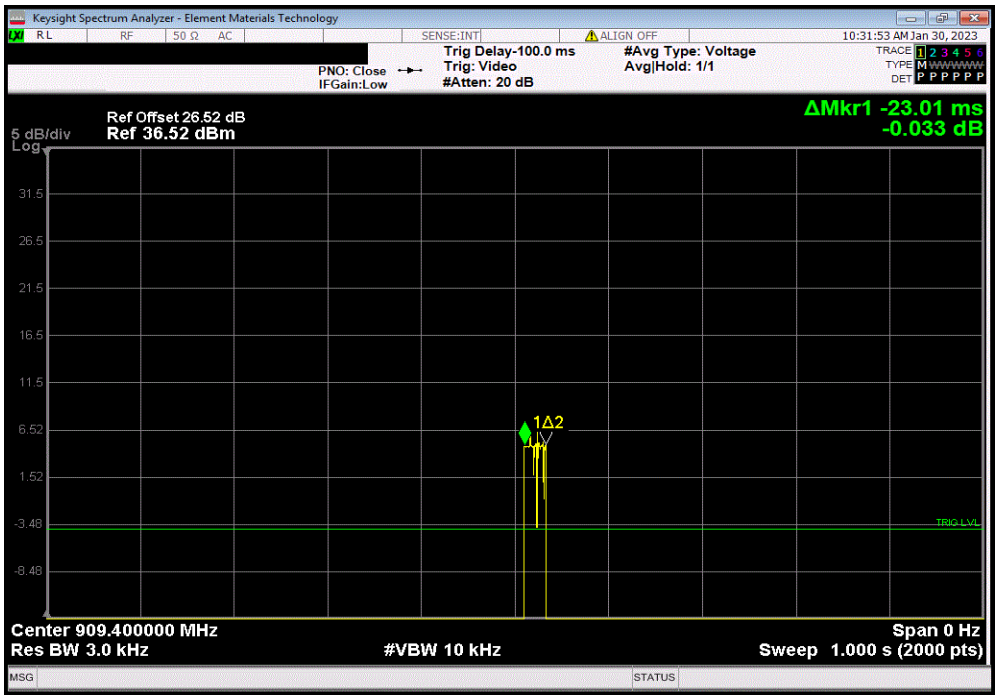
Configuration #	MLTI0186-4	Signature

	Pulse Width (ms)	Number of Pulses in 10s	Average No. of Pulses	Number of Pulses in 3.2s	On Time (ms) During 3.2s	Limit (ms)	Results
Hopping Mode, 500 kHz Bandwidth	23.012	1	N/A	1	N/A	N/A	N/A
Hopping Mode, 500 kHz Bandwidth	N/A	1	N/A	1	N/A	N/A	N/A
Hopping Mode, 500 kHz Bandwidth	N/A	1	N/A	1	N/A	N/A	N/A
Hopping Mode, 500 kHz Bandwidth	N/A	2	N/A	1	N/A	N/A	N/A
Hopping Mode, 500 kHz Bandwidth	N/A	1	N/A	1	N/A	N/A	N/A
Hopping Mode, 500 kHz Bandwidth	23.012	N/A	1.25	1	23.012	400	Pass

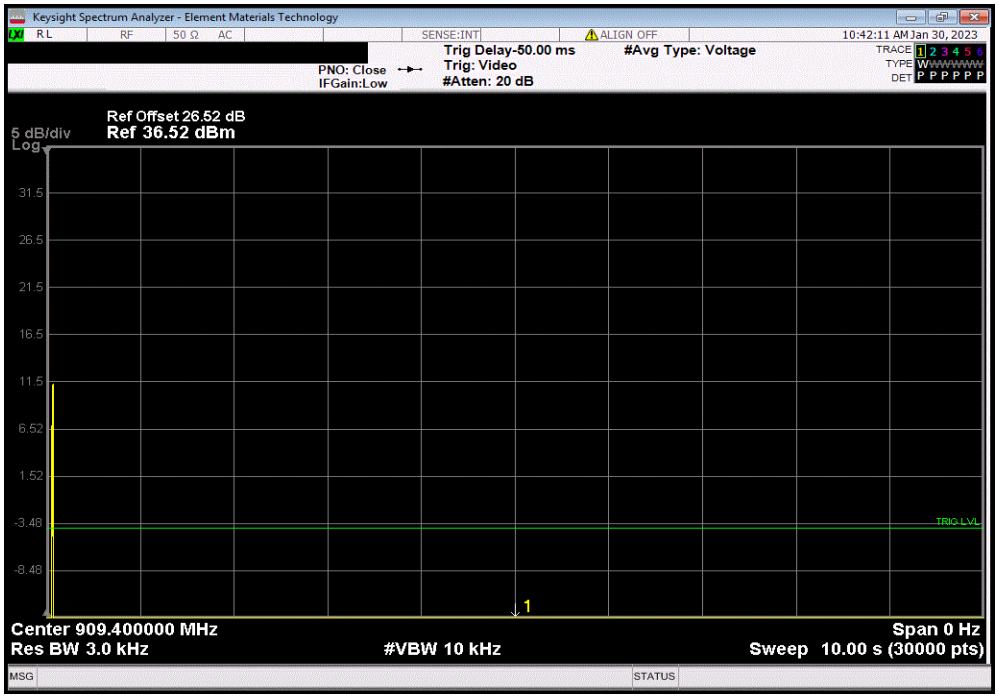
DWELL TIME (500 kHz Bandwidth)

TbtTx 2022.06.03.0 XMit 2022.02.07.0

Hopping Mode, 500 kHz Bandwidth						
Pulse Width (ms)	Number of Pulses in 10s	Average No. of Pulses	Number of Pulses in 3.2s	On Time (ms) During 3.2s	Limit (ms)	Results
23.012	1	N/A	1	N/A	N/A	N/A



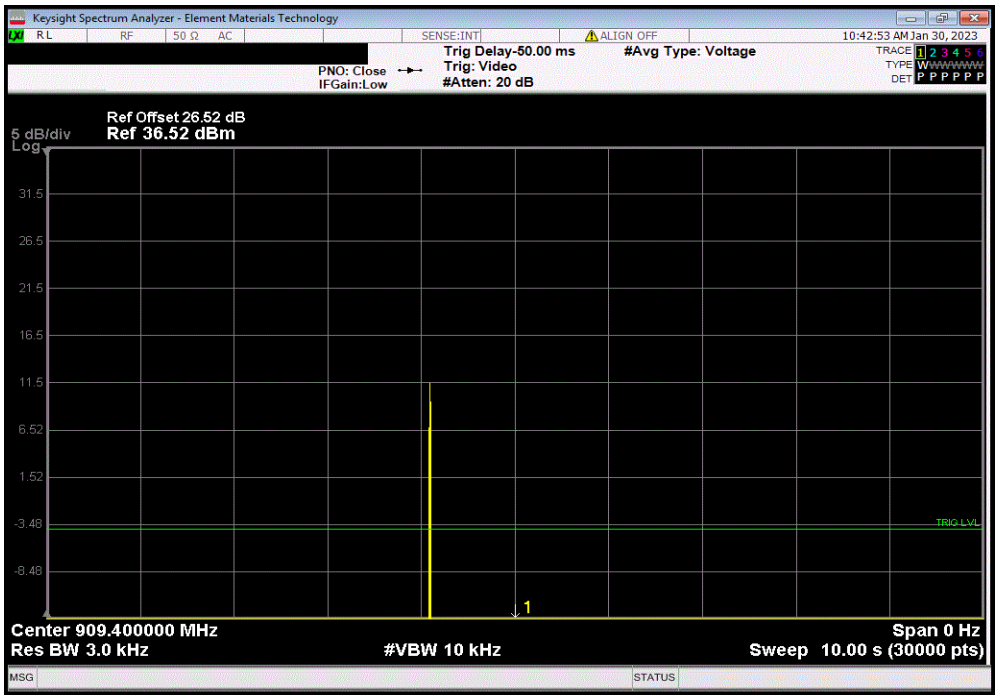
Hopping Mode, 500 kHz Bandwidth						
Pulse Width (ms)	Number of Pulses in 10s	Average No. of Pulses	Number of Pulses in 3.2s	On Time (ms) During 3.2s	Limit (ms)	Results
N/A	1	N/A	1	N/A	N/A	N/A



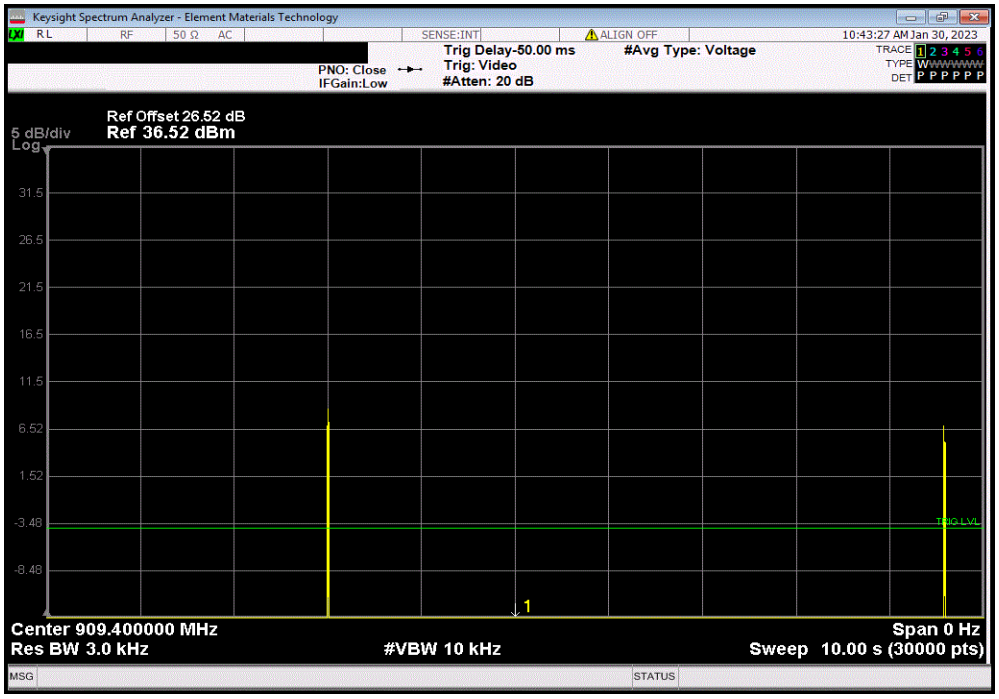
DWELL TIME (500 kHz Bandwidth)

TbtTx 2022.06.03.0 XMit 2022.02.07.0

Hopping Mode, 500 kHz Bandwidth						
Pulse Width (ms)	Number of Pulses in 10s	Average No. of Pulses	Number of Pulses in 3.2s	On Time (ms) During 3.2s	Limit (ms)	Results
N/A	1	N/A	1	N/A	N/A	N/A



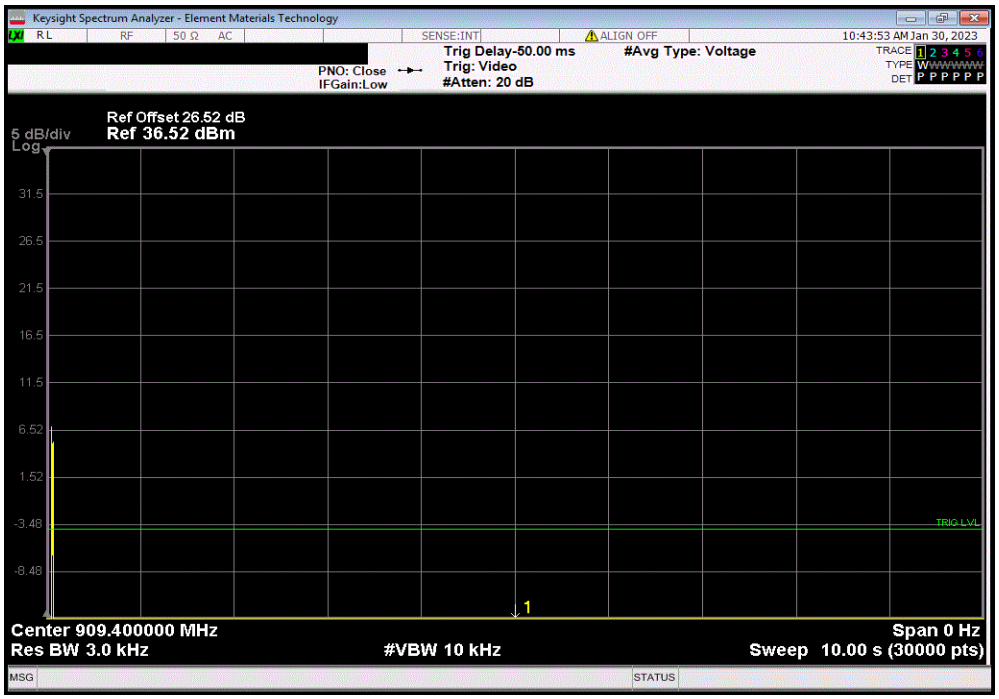
Hopping Mode, 500 kHz Bandwidth						
Pulse Width (ms)	Number of Pulses in 10s	Average No. of Pulses	Number of Pulses in 3.2s	On Time (ms) During 3.2s	Limit (ms)	Results
N/A	2	N/A	1	N/A	N/A	N/A



DWELL TIME (500 kHz Bandwidth)

TbtTx 2022.06.03.0 XMit 2022.02.07.0

Hopping Mode, 500 kHz Bandwidth						
Pulse Width (ms)	Number of Pulses in 10s	Average No. of Pulses	Number of Pulses in 3.2s	On Time (ms) During 3.2s	Limit (ms)	Results
N/A	1	N/A	1	N/A	N/A	N/A



Hopping Mode, 500 kHz Bandwidth						
Pulse Width (ms)	Number of Pulses in 10s	Average No. of Pulses	Number of Pulses in 3.2s	On Time (ms) During 3.2s	Limit (ms)	Results
23.012	N/A	1.25	1	23.012	400	Pass

Calculation Only

No Screen Capture Required

OUTPUT POWER

XMit 2022.12.28.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Block - DC	Fairview Microwave	SD3379	AMZ	2022-11-06	2023-11-06
Attenuator	Fairview Microwave	18B5W-26	RFY	2022-05-30	2023-05-30
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2022-09-10	2023-09-10
Generator - Signal	Keysight	N5171B (EXG)	TEY	2023-01-23	2026-01-23
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2022-04-25	2023-04-25

TEST DESCRIPTION

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. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

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.

OUTPUT POWER

TbtTx 2022.06.03.0 XMit 2022.12.28.0

EUT:	MTXDOT-NA1	Work Order:	MLTI0186
Serial Number:	2348143517-0021	Date:	02/13/2023
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.6°C
Attendees:	Ana Santos	Humidity:	23.6%
Project:	None	Barometric Pres.:	1010 mbar
Tested by:	Christopher Heintzelman	Power: 5VDC via USB	Job Site: MN11

TEST SPECIFICATIONS	Test Method
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block, but does not include customer's patch cable which was declared to be 0.26dB loss. Per an FCC inquiry an average detector was used to make the power measurement on the Hybrid device per ANSI C63.10:2013 section 11.1.

DEVIATIONS FROM TEST STANDARD

None

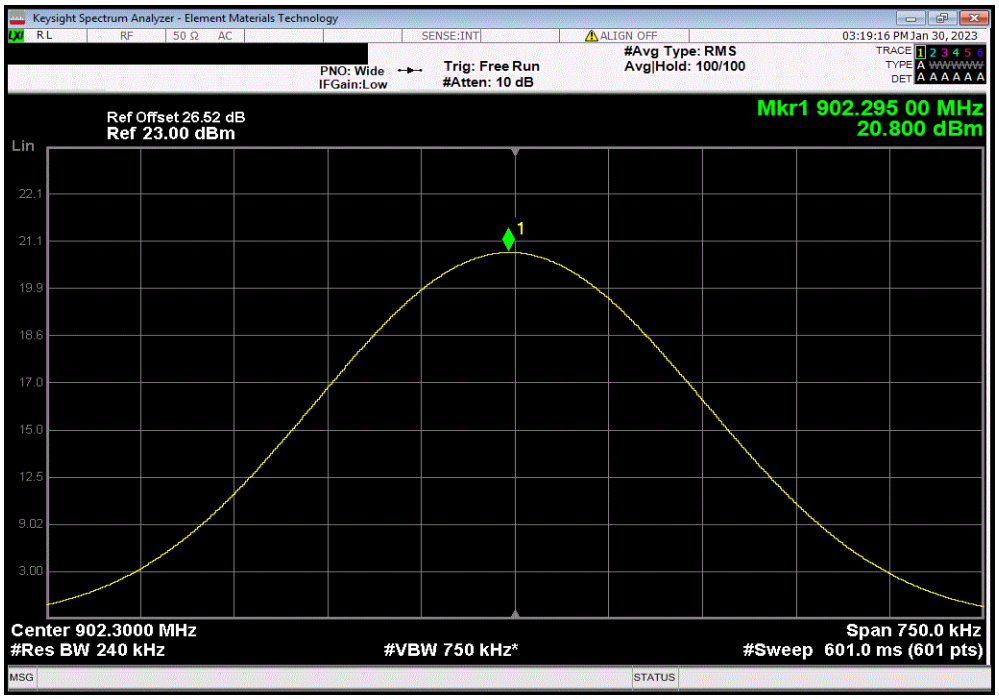
Configuration #	MLTI0186-4	Signature

	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Patch Cable Loss (dB)	Value (dBm)	Limit (dBm)	Results
125 kHz Bandwidth, Low Channel, 902.3 MHz	20.8	0	0.26	21.06	30	Pass
125 kHz Bandwidth, Mid Channel, 908.7 MHz	20.702	0	0.26	20.962	30	Pass
125 kHz Bandwidth, High Channel, 914.9 MHz	17.824	0	0.26	18.084	30	Pass
500 kHz Bandwidth, Low Channel, 903 MHz	20.679	0	0.26	20.939	30	Pass
500 kHz Bandwidth, Mid Channel, 909.4 MHz	20.593	0	0.26	20.853	30	Pass
500 kHz Bandwidth, High Channel, 914.2 MHz	20.553	0	0.26	20.813	30	Pass

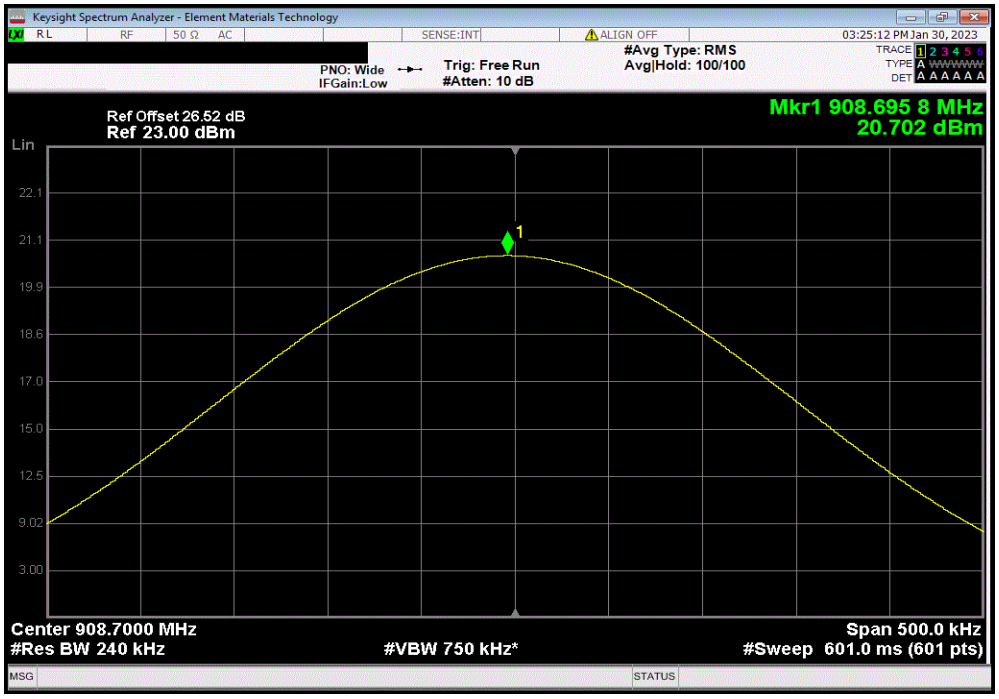
OUTPUT POWER

TbtTx 2022.06.03.0 XMit 2022.12.28.0

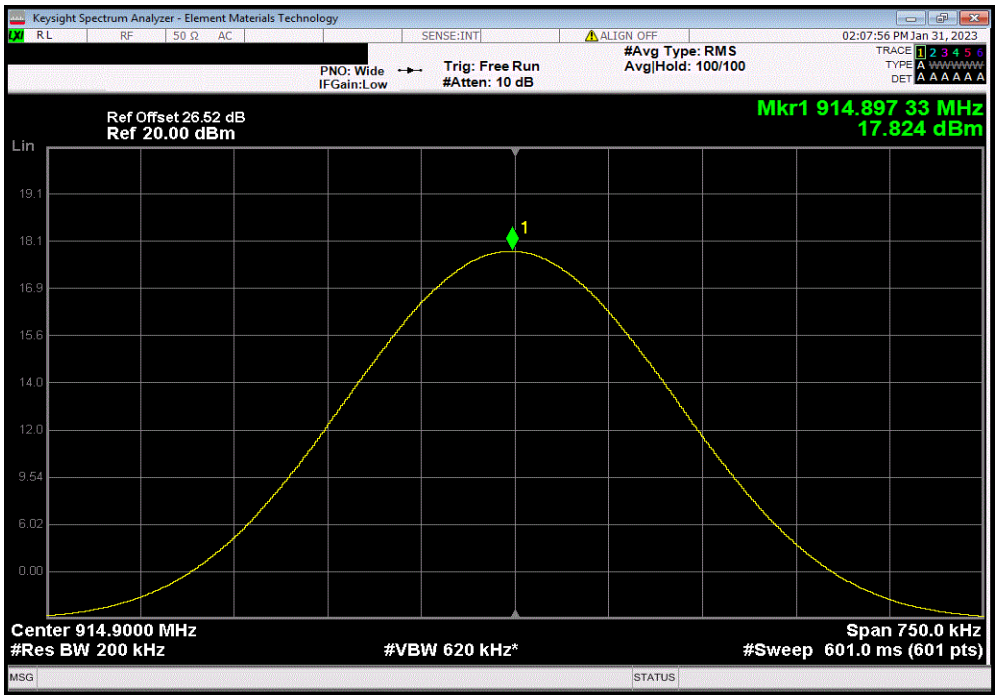
125 kHz Bandwidth, Low Channel, 902.3 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Patch Cable Loss (dB)	Value (dBm)	Limit (dBm)	Results
	20.8	0	0.26	21.06	30	Pass



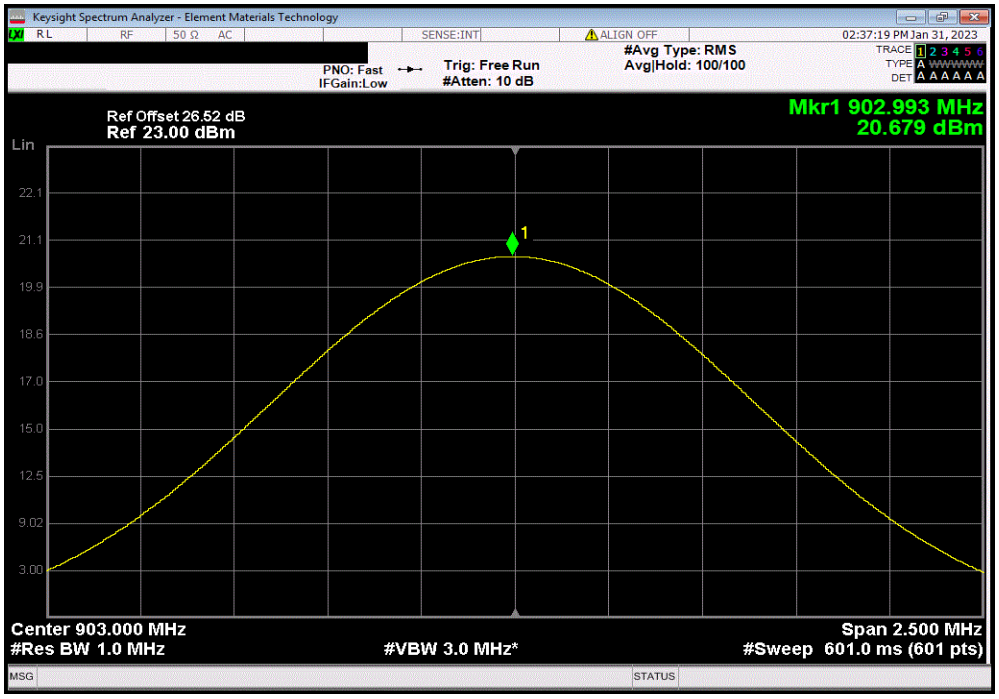
125 kHz Bandwidth, Mid Channel, 908.7 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Patch Cable Loss (dB)	Value (dBm)	Limit (dBm)	Results
	20.702	0	0.26	20.962	30	Pass



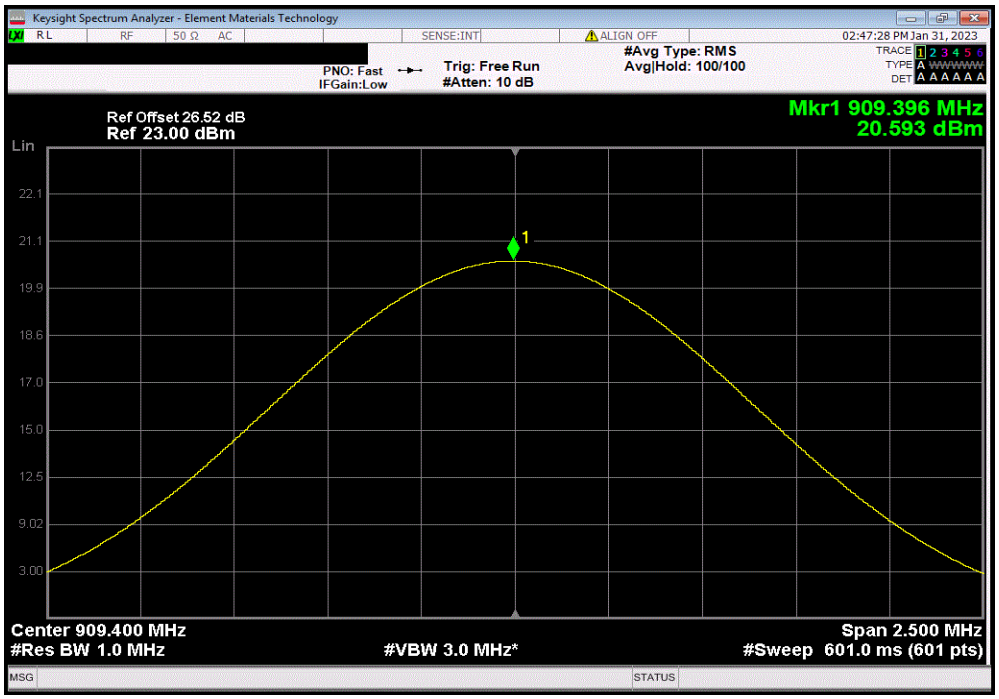
125 kHz Bandwidth, High Channel, 914.9 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Patch Cable Loss (dB)	Value (dBm)	Limit (dBm)	Results
	17.824	0	0.26	18.084	30	Pass



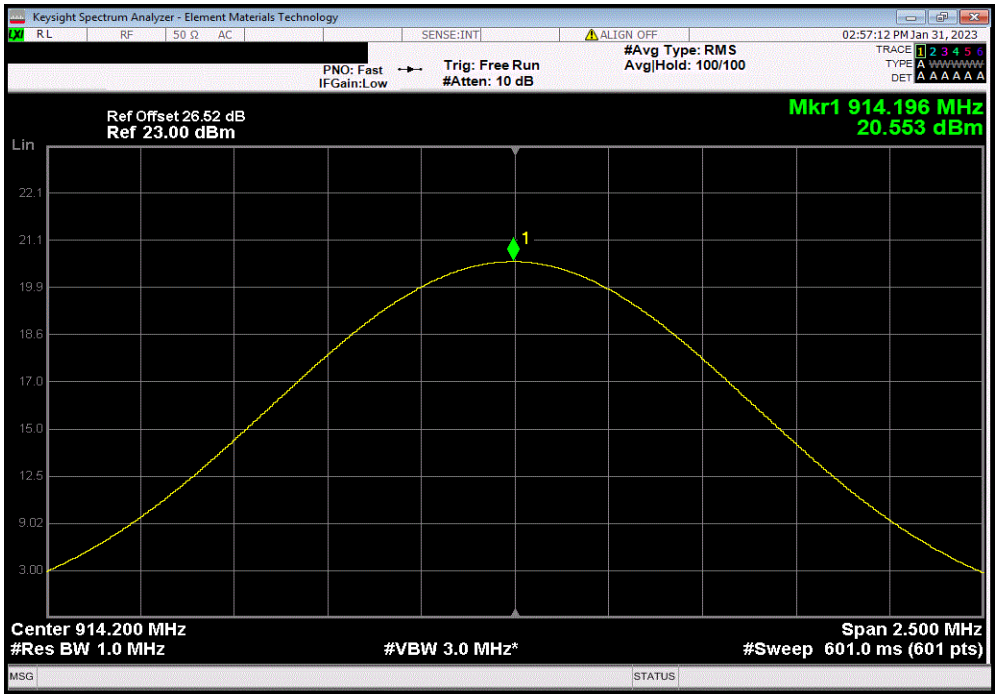
500 kHz Bandwidth, Low Channel, 903 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Patch Cable Loss (dB)	Value (dBm)	Limit (dBm)	Results
	20.679	0	0.26	20.939	30	Pass



500 kHz Bandwidth, Mid Channel, 909.4 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Patch Cable Loss (dB)	Value (dBm)	Limit (dBm)	Results
	20.593	0	0.26	20.853	30	Pass



500 kHz Bandwidth, High Channel, 914.2 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Patch Cable Loss (dB)	Value (dBm)	Limit (dBm)	Results
	20.553	0	0.26	20.813	30	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

XMit 2022.12.28.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Attenuator	Fairview Microwave	18B5W-26	RFY	2022-05-30	2023-05-30
Block - DC	Fairview Microwave	SD3379	AMZ	2022-11-06	2023-11-06
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2022-09-10	2023-09-10
Generator - Signal	Keysight	N5171B (EXG)	TEY	2023-01-23	2026-01-23
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2022-04-25	2023-04-25

TEST DESCRIPTION

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. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

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)

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

TbtTx 2022.06.03.0 XMit 2022.12.28.0

EUT:	**MTXDOT-NA1**	**Work Order:**	**MLTI0186**
Serial Number:	**2348143517-0021**	**Date:**	**02/13/2023**
Customer:	**Multi-Tech Systems, Inc.**	**Temperature:**	**22.6°C**
Attendees:	**Ana Santos**	**Humidity:**	**23.5%**
Project:	**None**	**Barometric Pres.:**	**1010 mbar**
Tested by:	**Christopher Heintzelman**	**Power:** **5VDC via USB**	**Job Site:** **MN11**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block, but does not include customer's patch cable which was declared to be 0.26dB loss. Per an FCC inquiry an average detector was used to make the power measurement on the Hybrid device per ANSI C63.10:2013 section 11.1.

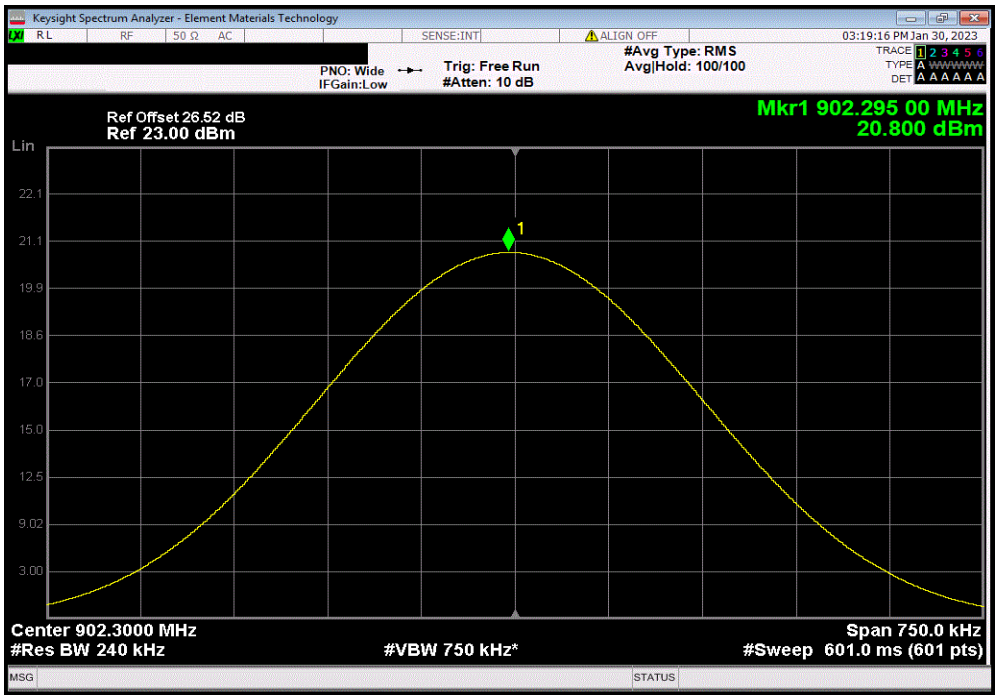
DEVIATIONS FROM TEST STANDARD

None

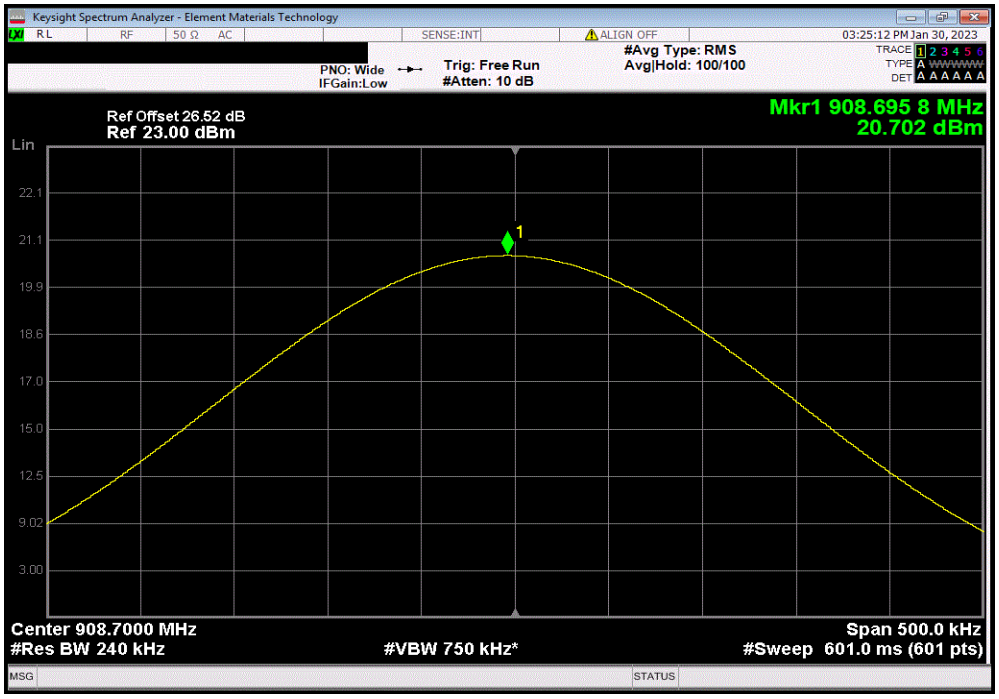
Configuration #	**MLTI0186-4**	*Signature*

	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Antenna Gain (dBi)	Patch Cable Loss (dB)	Value (dBm)	Limit (dBm)	Results
125 kHz Bandwidth, Low Channel, 902.3 MHz	20.8	0	1	0.26	22.06	36	Pass
125 kHz Bandwidth, Mid Channel, 908.7 MHz	20.702	0	1	0.26	21.962	36	Pass
125 kHz Bandwidth, High Channel, 914.9 MHz	17.824	0	1	0.26	19.084	36	Pass
500 kHz Bandwidth, Low Channel, 903 MHz	20.679	0	1	0.26	21.939	36	Pass
500 kHz Bandwidth, Mid Channel, 909.4 MHz	20.593	0	1	0.26	21.853	36	Pass
500 kHz Bandwidth, High Channel, 914.2 MHz	20.553	0	1	0.26	21.813	36	Pass

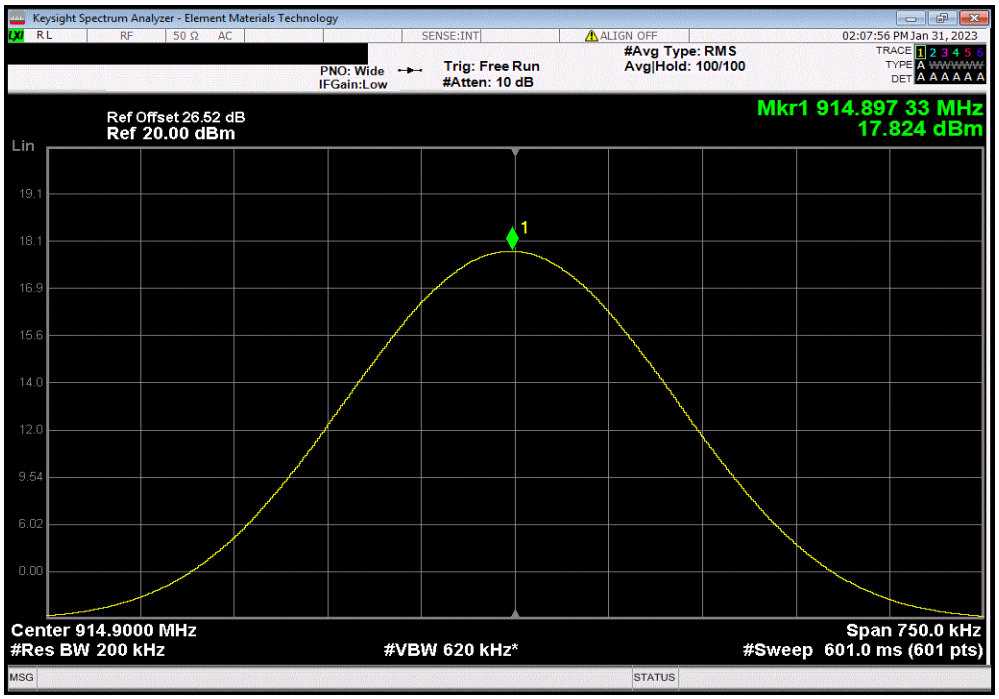
125 kHz Bandwidth, Low Channel, 902.3 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Antenna Gain (dBi)	Patch Cable Loss (dB)	Value (dBm)	Limit (dBm)	Results
20.8	0	1	0.26	22.06	36	Pass



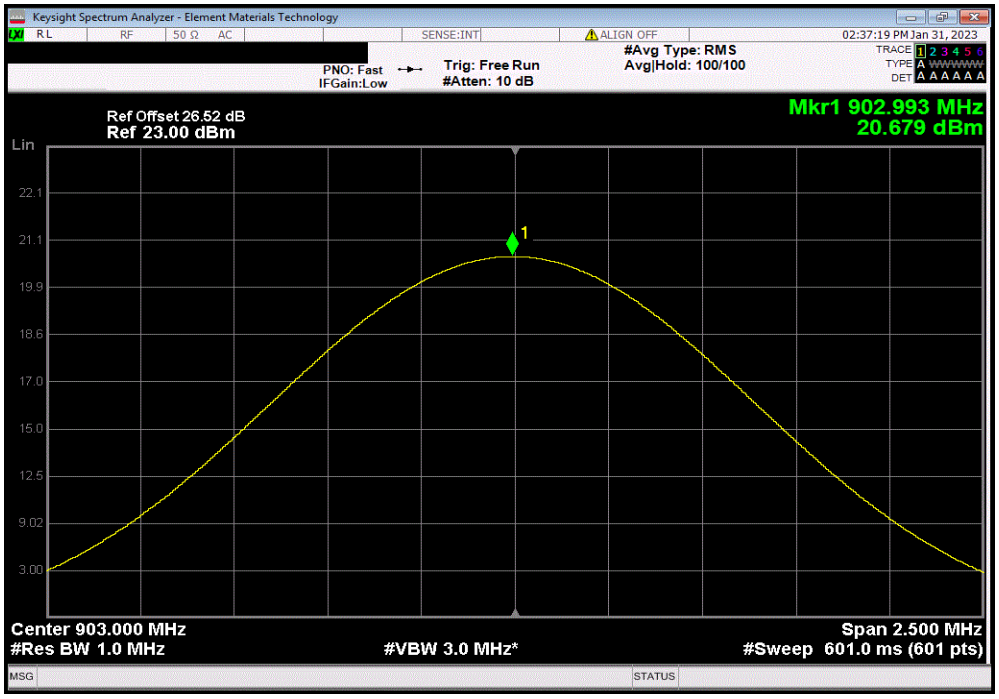
125 kHz Bandwidth, Mid Channel, 908.7 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Antenna Gain (dBi)	Patch Cable Loss (dB)	Value (dBm)	Limit (dBm)	Results
20.702	0	1	0.26	21.962	36	Pass



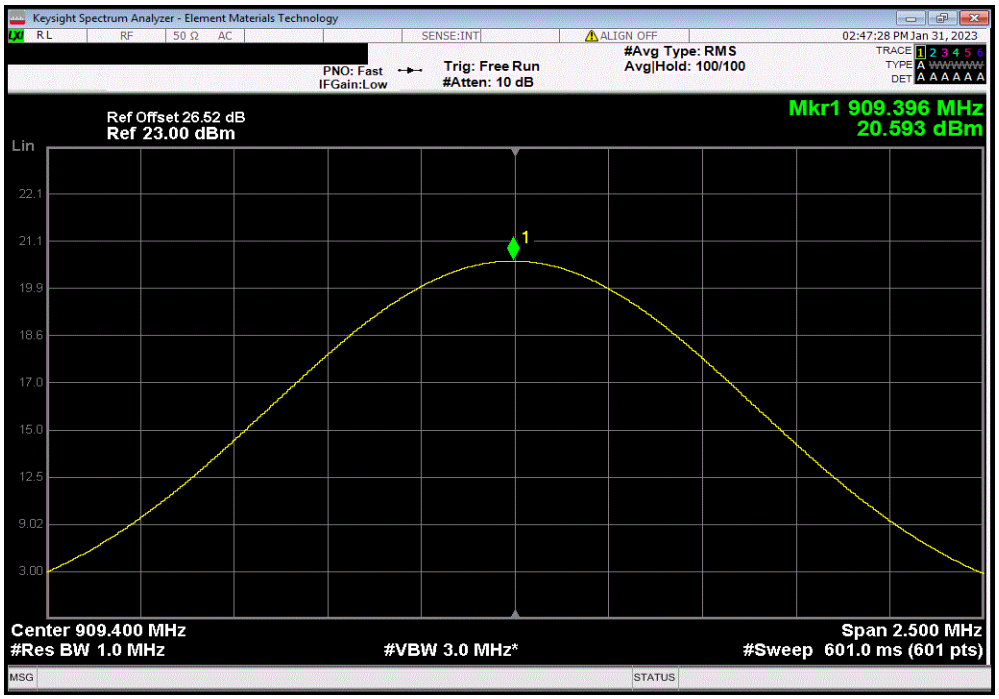
125 kHz Bandwidth, High Channel, 914.9 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Antenna Gain (dBi)	Patch Cable Loss (dB)	Value (dBm)	Limit (dBm)	Results
17.824	0	1	0.26	19.084	36	Pass



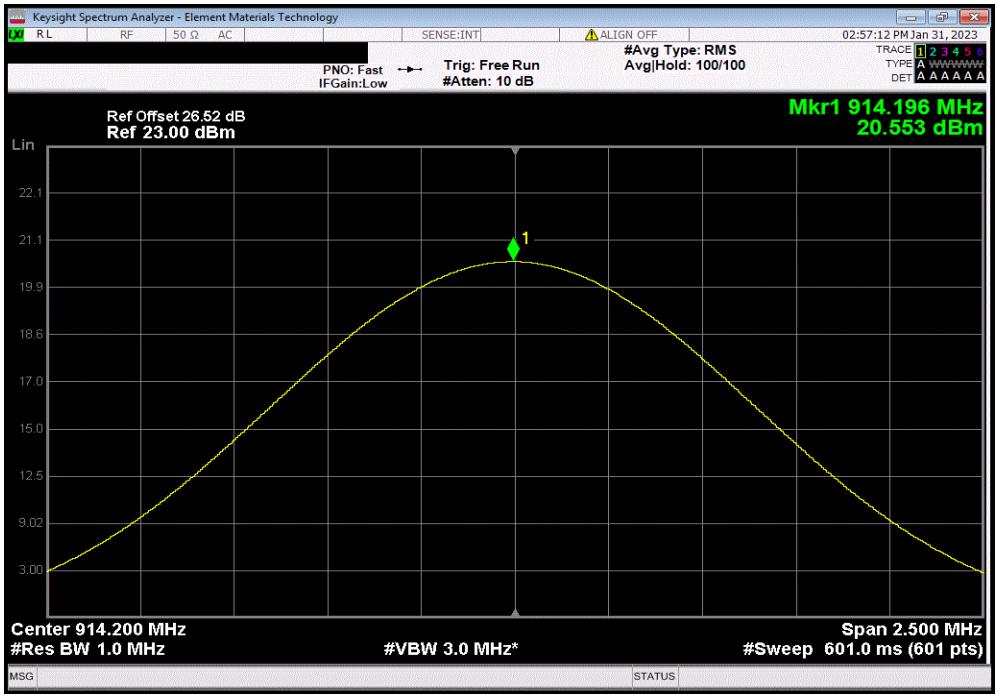
500 kHz Bandwidth, Low Channel, 903 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Antenna Gain (dBi)	Patch Cable Loss (dB)	Value (dBm)	Limit (dBm)	Results
20.679	0	1	0.26	21.939	36	Pass



500 kHz Bandwidth, Mid Channel, 909.4 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Antenna Gain (dBi)	Patch Cable Loss (dB)	Value (dBm)	Limit (dBm)	Results
20.593	0	1	0.26	21.853	36	Pass



500 kHz Bandwidth, High Channel, 914.2 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Antenna Gain (dBi)	Patch Cable Loss (dB)	Value (dBm)	Limit (dBm)	Results
20.553	0	1	0.26	21.813	36	Pass



BAND EDGE COMPLIANCE

XMit 2022.12.28.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5171B (EXG)	TEY	2023-01-23	2026-01-23
Block - DC	Fairview Microwave	SD3379	AMZ	2022-11-06	2023-11-06
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2022-04-25	2023-04-25
Attenuator	Fairview Microwave	18B5W-26	RFY	2022-05-30	2023-05-30
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2022-09-10	2023-09-10

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.

An RMS detector was used to match the method called out for Output Power. Because the reference level was taken with an RMS detector, the attenuation requirement is -30 dBc.

BAND EDGE COMPLIANCE

TbtTx 2022.06.03.0 XMit 2022.12.28.0

EUT:	MTXDOT-NA1			Work Order:	MLTI0186
Serial Number:	2348143517-0021			Date:	31-Jan-23
Customer:	Multi-Tech Systems, Inc.			Temperature:	22.3 °C
Attendees:	Ana Santos			Humidity:	13.8% RH
Project:	None			Barometric Pres.:	1025 mbar
Tested by:	Christopher Heintzelman	Power:	3.3VDC	Job Site:	MN11

TEST SPECIFICATIONS	Test Method
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block, but does not include customer's patch cable which was declared to be 0.26dB loss.

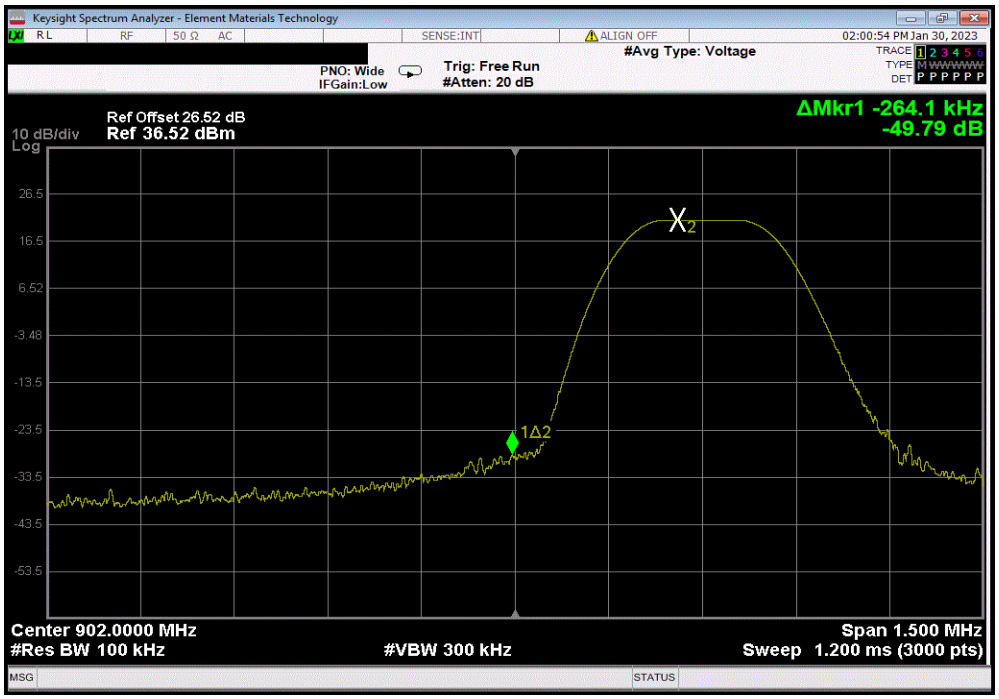
DEVIATIONS FROM TEST STANDARD

None

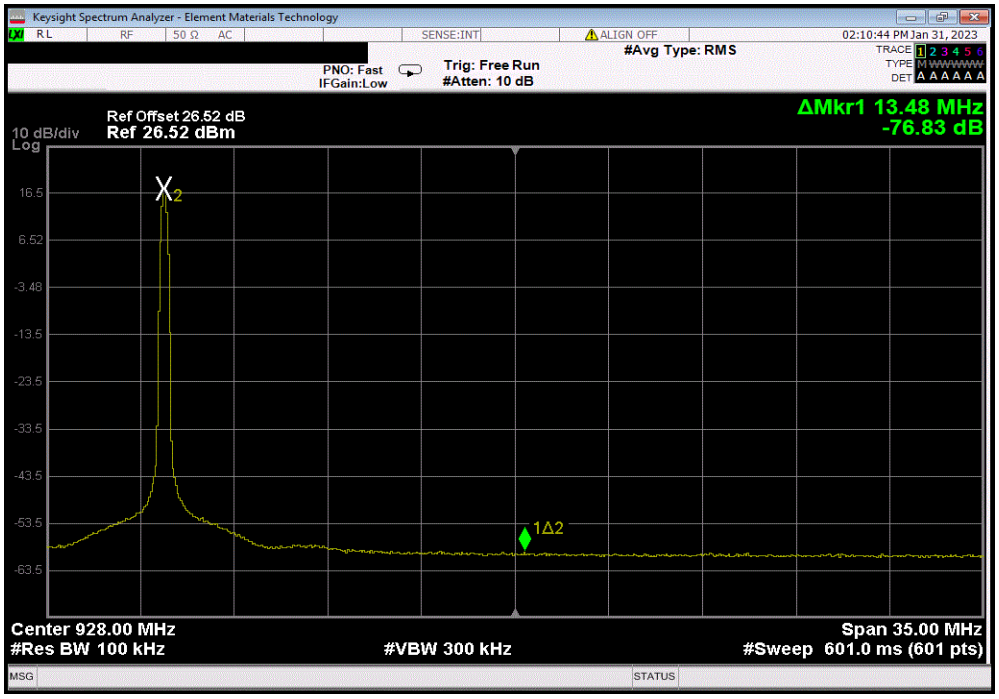
Configuration #	MLTI0186-4	Signature

	Value (dBc)	Limit ≤ (dBc)	Result
125 kHz Bandwidth, Low Channel, 902.3 MHz	-49.79	-30	Pass
125 kHz Bandwidth, High Channel, 914.9 MHz	-76.83	-30	Pass
500 kHz Bandwidth, Low Channel, 903 MHz	-51.17	-30	Pass
500 kHz Bandwidth, High Channel, 914.2 MHz	-73.42	-30	Pass

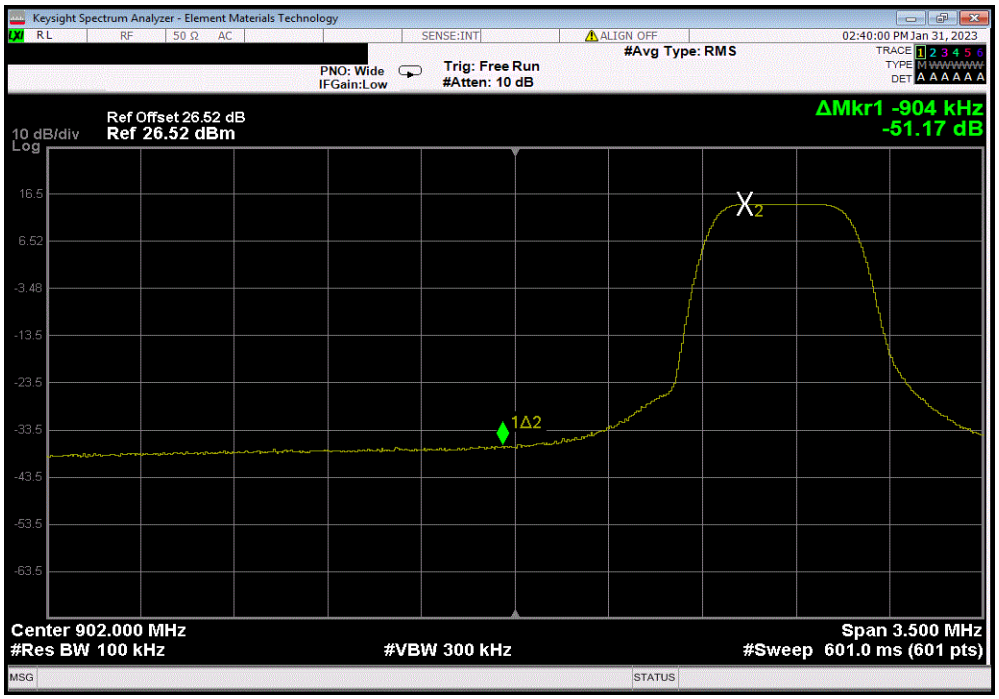
125 kHz Bandwidth, Low Channel, 902.3 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-49.79	-30	Pass



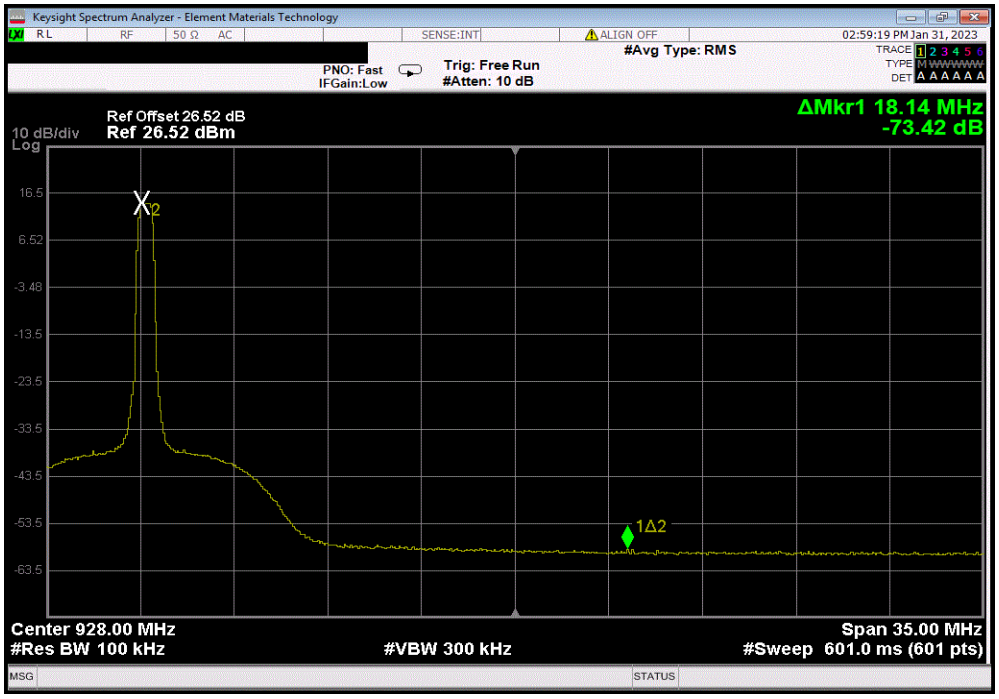
125 kHz Bandwidth, High Channel, 914.9 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-76.83	-30	Pass



500 kHz Bandwidth, Low Channel, 903 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-51.17	-30	Pass



500 kHz Bandwidth, High Channel, 914.2 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-73.42	-30	Pass



BAND EDGE COMPLIANCE - HOPPING MODE

XMit 2022.02.07.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Attenuator	Fairview Microwave	18B5W-26	RFY	2022-05-30	2023-05-30
Block - DC	Fairview Microwave	SD3379	AMZ	2022-11-06	2023-11-06
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2022-09-10	2023-09-10
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2022-04-25	2023-04-25
Generator - Signal	Agilent	N5183A	TIK	2022-01-24	2025-01-24

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 band were measured with the EUT set to its normal pseudo-random hopping sequence. 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

XMit 2022.02.07.0

EUT:	MTXDOT-NA1	Work Order:	MLTI0186
Serial Number:	2348143517-0021	Date:	30-Jan-23
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.5 °C
Attendees:	Ana Santos	Humidity:	13.7% RH
Project:	None	Barometric Pres.:	1032.7 mbar
Tested by:	Christopher Heintzelman	Power: 5VDC	Job Site: MN11

TEST SPECIFICATIONS	Test Method
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block. Does not include customer's patch cable.

DEVIATIONS FROM TEST STANDARD

None

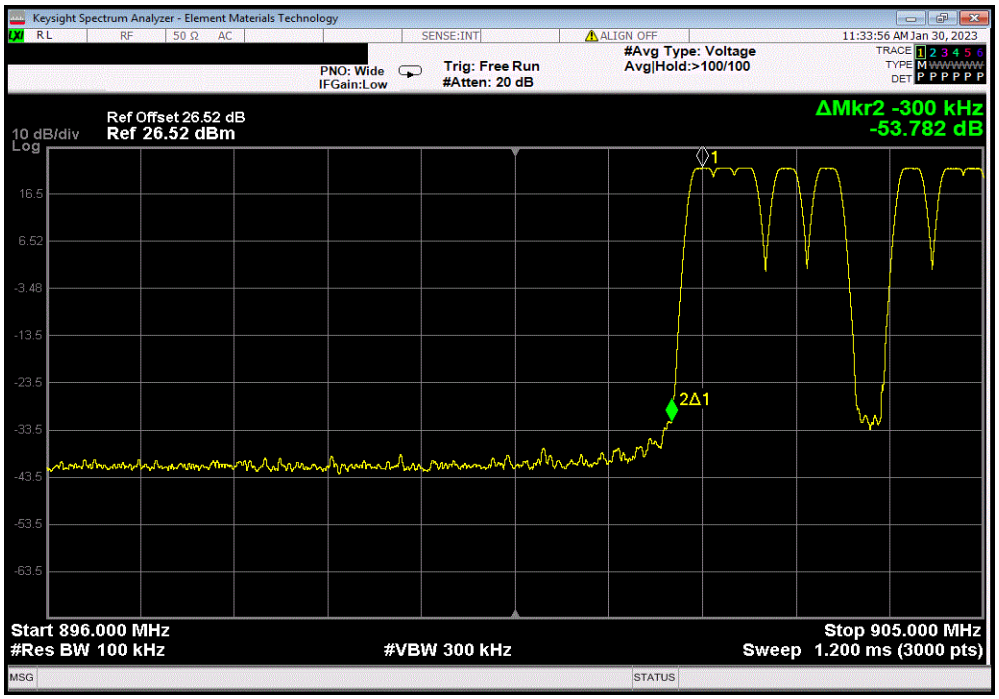
Configuration #	MLTI0186-4	Signature

		Value	Limit	Result
125 kHz Bandwidth				
	Low Band Edge	-53.782	-30	Pass
	High Band Edge	-62.583	-30	Pass
500 kHz Bandwidth				
	Low Band Edge	-51.856	-30	Pass
	High Band Edge	-62.478	-30	Pass

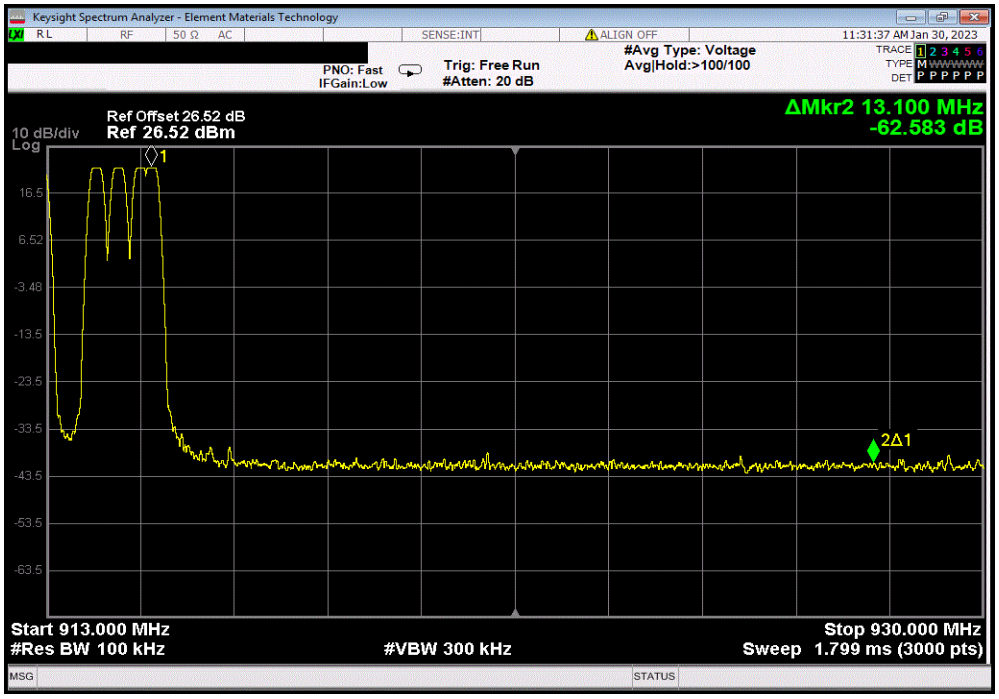
BAND EDGE COMPLIANCE - HOPPING MODE

XMit 2022.02.07.0

125 kHz Bandwidth, Low Band Edge						
				Value	Limit	Result
				-53.782	-30	Pass



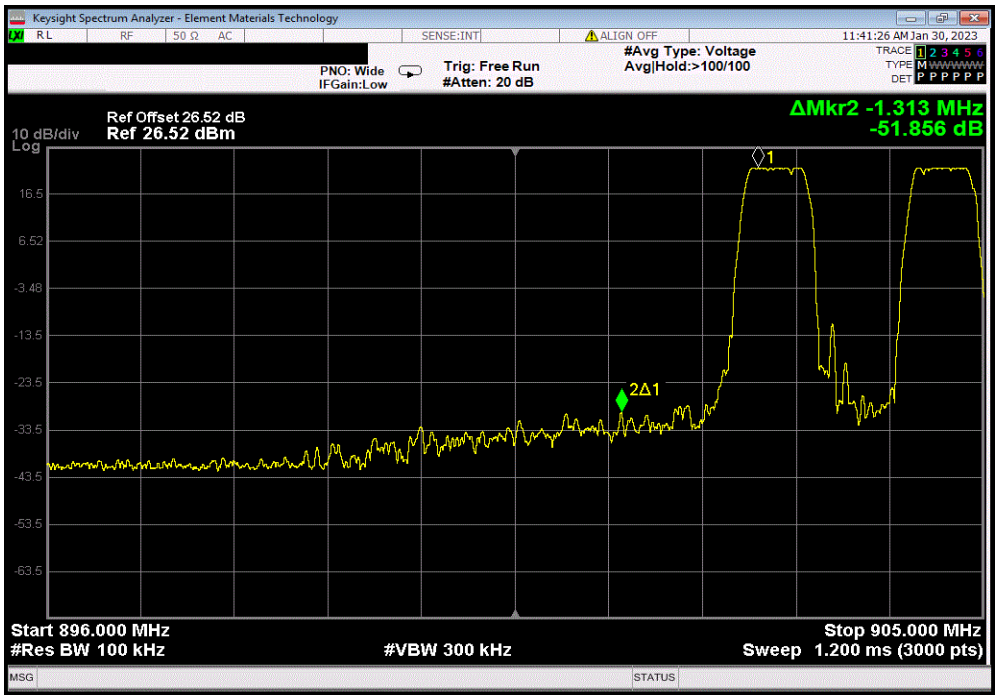
125 kHz Bandwidth, High Band Edge						
				Value	Limit	Result
				-62.583	-30	Pass



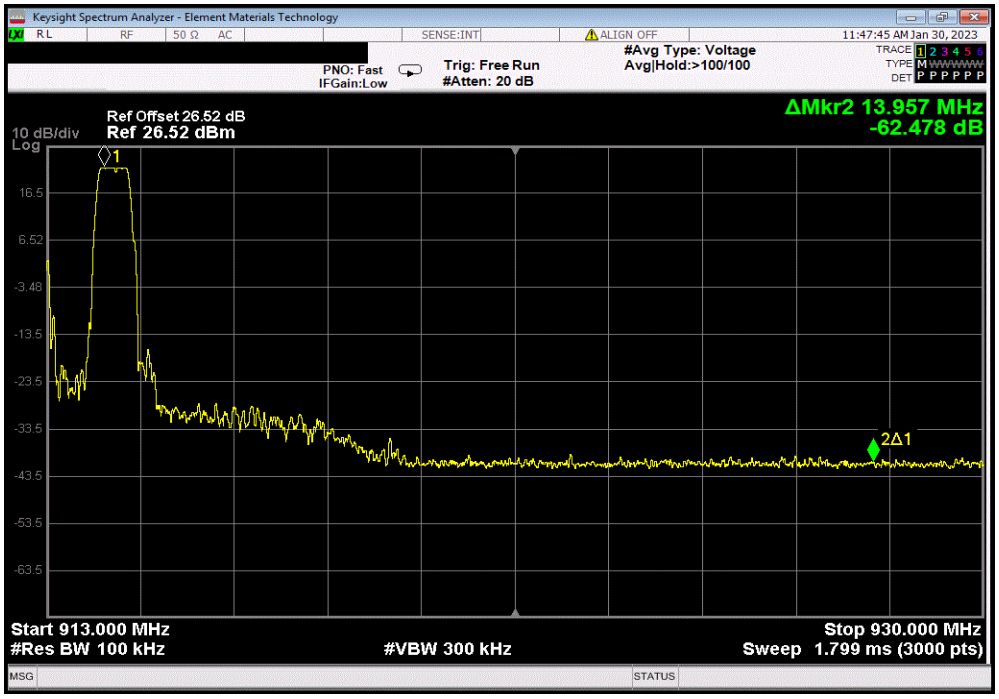
BAND EDGE COMPLIANCE - HOPPING MODE

XMit 2022.02.07.0

500 kHz Bandwidth, Low Band Edge						
				Value	Limit	Result
				-51.856	-30	Pass



500 kHz Bandwidth, High Band Edge						
				Value	Limit	Result
				-62.478	-30	Pass



EMISSIONS BANDWIDTH (20 dB)

XMit 2022.12.28.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Block - DC	Fairview Microwave	SD3379	AMZ	2022-11-06	2023-11-06
Attenuator	Fairview Microwave	18B5W-26	RFY	2022-05-30	2023-05-30
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2022-09-10	2023-09-10
Generator - Signal	Keysight	N5171B (EXG)	TEY	2023-01-23	2026-01-23
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2022-04-25	2023-04-25

TEST DESCRIPTION

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

The 20 dB emissions bandwidth was measured with the EUT set to low, medium and high transmit frequencies in the band. The EUT was transmitting at the data rate(s) listed in the datasheet in a no-hop mode. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

EMISSIONS BANDWIDTH (20 dB)

TbtTx 2022.06.03.0 XMit 2022.12.28.0

EUT:	MTXDOT-NA1			Work Order:	MLTI0186
Serial Number:	2348143517-0021			Date:	02/13/2023
Customer:	Multi-Tech Systems, Inc.			Temperature:	22.5°C
Attendees:	Ana Santos			Humidity:	23.6%
Project:	None			Barometric Pres.:	1010 mbar
Tested by:	Christopher Heintzelman	Power:	5VDC via USB	Job Site:	MN11

TEST SPECIFICATIONS	Test Method
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block, but does not include customer's patch cable which was declared to be 0.26dB loss.

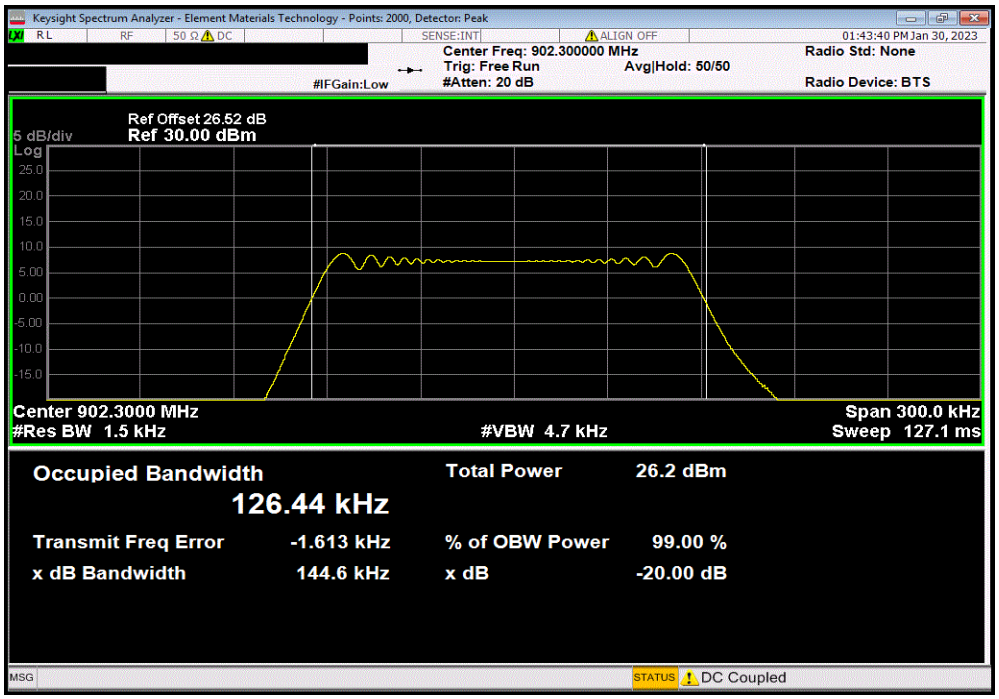
DEVIATIONS FROM TEST STANDARD

None

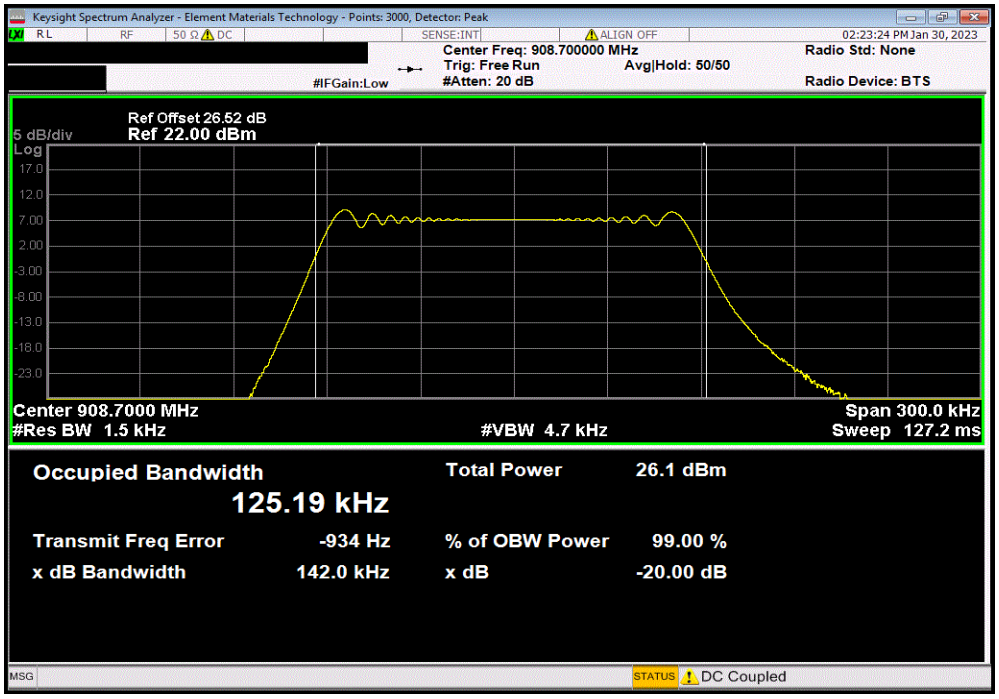
Configuration #	MLTI0186-4	Signature

	Value (kHz)	Limit	Result
125 kHz Bandwidth, Low Channel, 902.3 MHz	144.6	N/A	N/A
125 kHz Bandwidth, Mid Channel, 908.7 MHz	142	N/A	N/A
125 kHz Bandwidth, High Channel, 914.9 MHz	144.3	N/A	N/A
500 kHz Bandwidth, Low Channel, 903 MHz	563.9	N/A	N/A
500 kHz Bandwidth, Mid Channel, 909.4 MHz	569	N/A	N/A
500 kHz Bandwidth, High Channel, 914.2 MHz	564.8	N/A	N/A

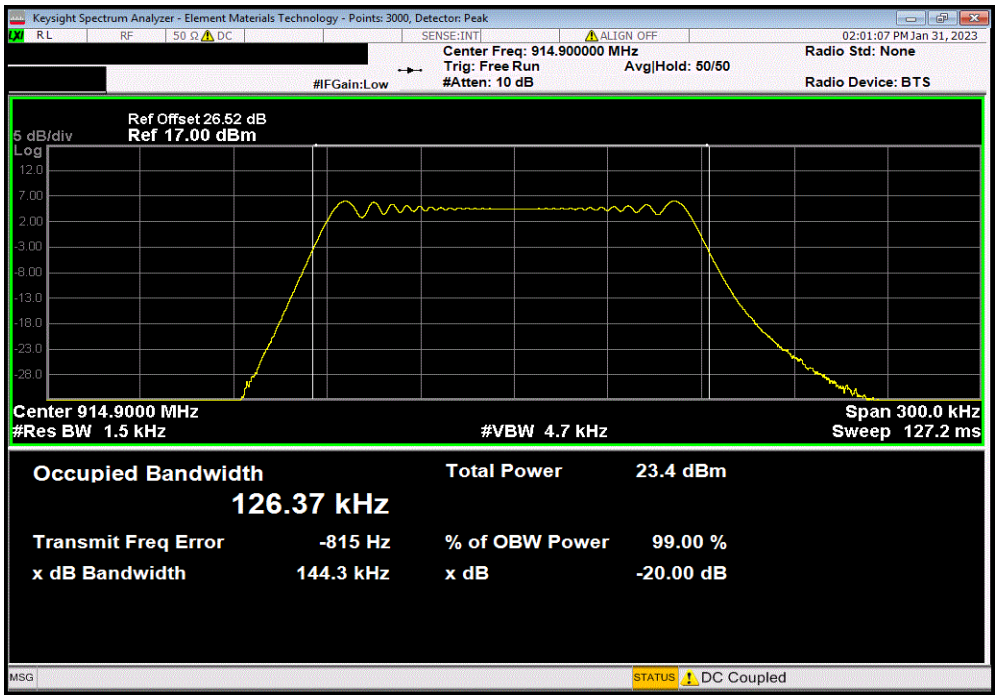
125 kHz Bandwidth, Low Channel, 902.3 MHz						
				Value (kHz)	Limit	Result
				144.6	N/A	N/A



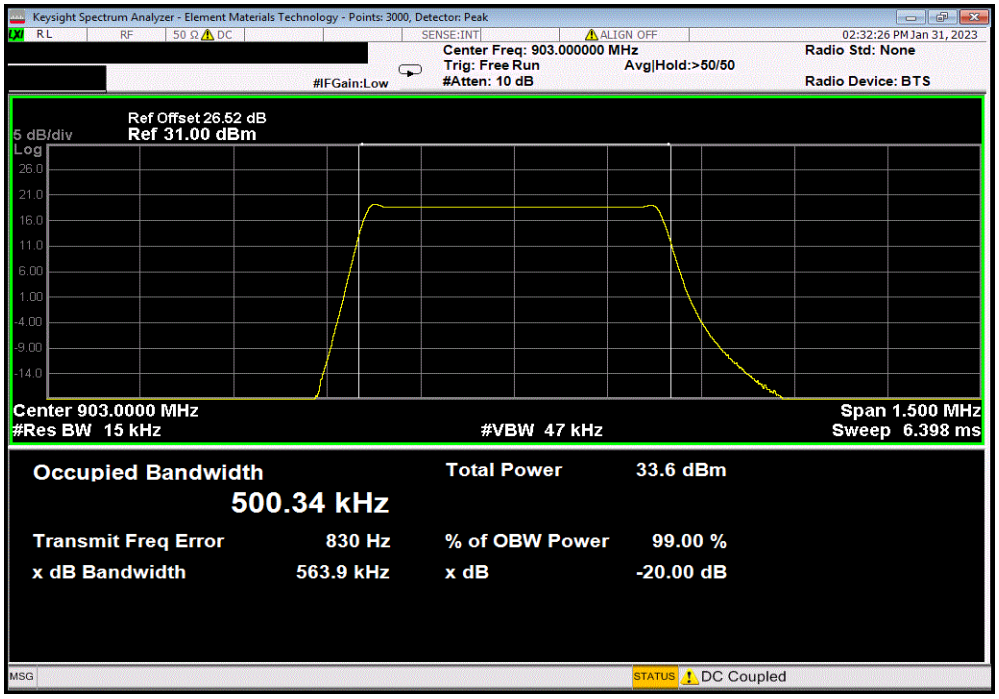
125 kHz Bandwidth, Mid Channel, 908.7 MHz						
				Value (kHz)	Limit	Result
				142	N/A	N/A



125 kHz Bandwidth, High Channel, 914.9 MHz						
				Value (kHz)	Limit	Result
				144.3	N/A	N/A



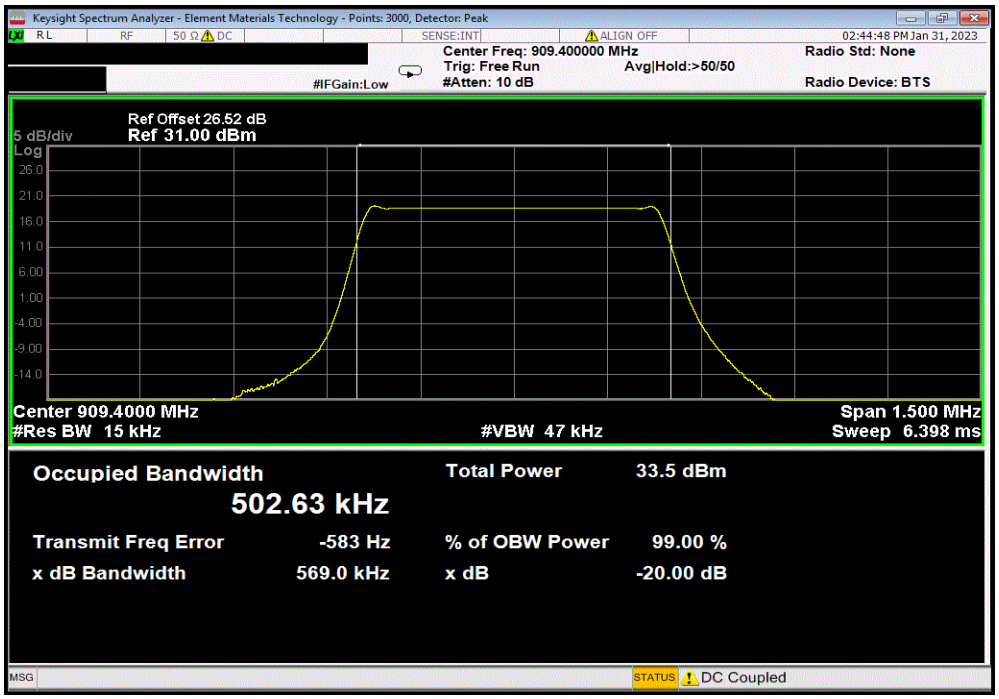
500 kHz Bandwidth, Low Channel, 903 MHz						
				Value (kHz)	Limit	Result
				563.9	N/A	N/A



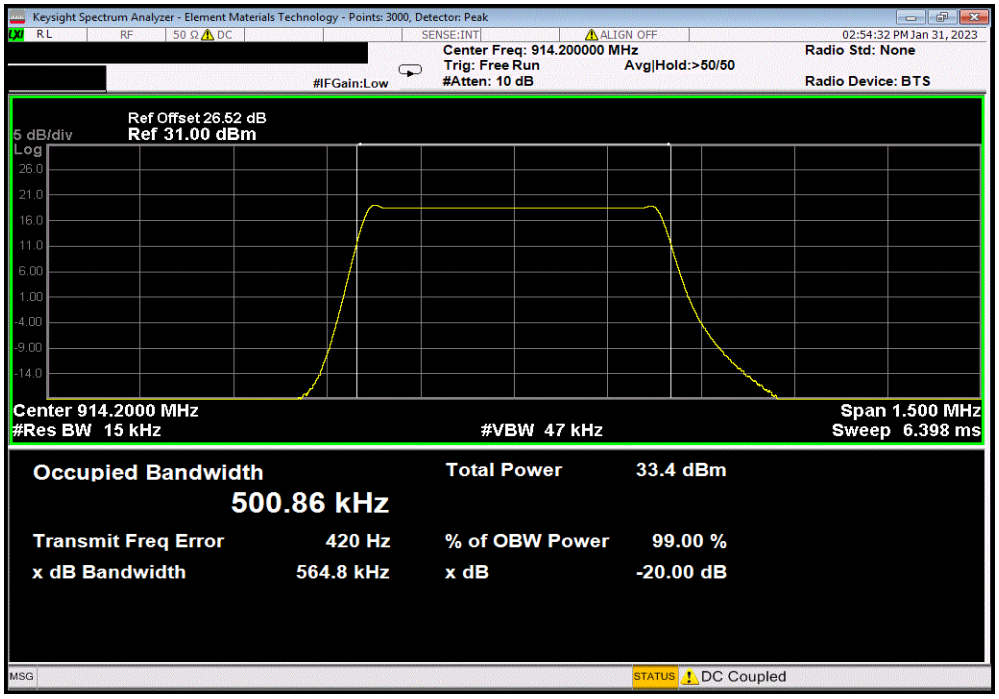
EMISSIONS BANDWIDTH (20 dB)

TbtTx 2022.06.03.0 XMit 2022.12.28.0

500 kHz Bandwidth, Mid Channel, 909.4 MHz						
				Value (kHz)	Limit	Result
				569	N/A	N/A



500 kHz Bandwidth, High Channel, 914.2 MHz						
				Value (kHz)	Limit	Result
				564.8	N/A	N/A



OCCUPIED BANDWIDTH (99%)

XMit 2022.12.28.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Block - DC	Fairview Microwave	SD3379	AMZ	2022-11-06	2023-11-06
Attenuator	Fairview Microwave	18B5W-26	RFY	2022-05-30	2023-05-30
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2022-09-10	2023-09-10
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2022-04-25	2023-04-25
Generator - Signal	Keysight	N5171B (EXG)	TEY	2023-01-23	2026-01-23

TEST DESCRIPTION

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

The 20 dB occupied bandwidth was measured with the EUT set to low, medium and high transmit frequencies in the band. The EUT was transmitting at the data rate(s) listed in the datasheet in a no-hop mode. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

Per FCC KDB 558074 Section 10(b)(3), there is no requirement for hybrid systems to comply with the 500 kHz minimum 6dB bandwidth for DTS devices.

The 99.0% occupied bandwidth was measured and used to determine the Resolution Bandwidth needed during Output Power measurement.

OCCUPIED BANDWIDTH (99%)

TbtTx 2022.06.03.0 XMit 2022.12.28.0

EUT:	**MTXDOT-NA1**	**Work Order:**	**MLTI0186**
Serial Number:	**2348143517-0021**	**Date:**	**02/13/2023**
Customer:	**Multi-Tech Systems, Inc.**	**Temperature:**	**22.5°C**
Attendees:	**Ana Santos**	**Humidity:**	**23.7%**
Project:	**None**	**Barometric Pres.:**	**1010 mbar**
Tested by:	**Christopher Heintzelman**	**Power:** **5VDC via USB**	**Job Site:** **MN11**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2023	ANSI C63.10:2013
RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block, but does not include customer's patch cable which was declared to be 0.26dB loss.

DEVIATIONS FROM TEST STANDARD

None

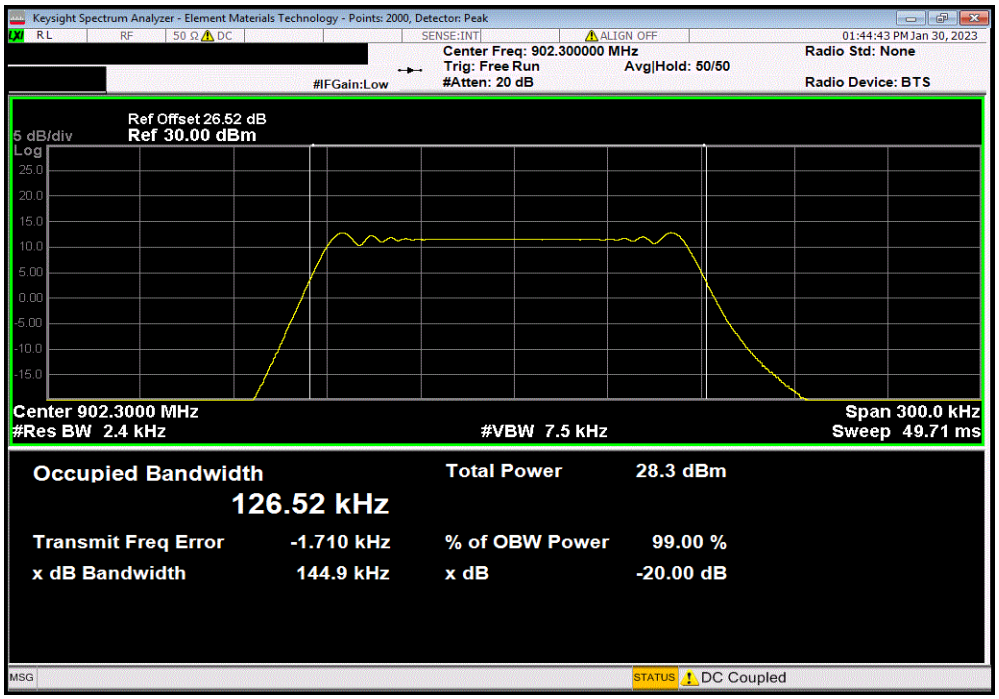
Configuration #	**MLTI0186-4**	*Signature*

	Value (kHz)	**Limit (>)**	**Result**
125 kHz Bandwidth, Low Channel, 902.3 MHz	126.52	N/A	N/A
125 kHz Bandwidth, Mid Channel, 908.7 MHz	125.24	N/A	N/A
125 kHz Bandwidth, High Channel, 914.9 MHz	126.42	N/A	N/A
500 kHz Bandwidth, Low Channel, 903 MHz	500.34	N/A	N/A
500 kHz Bandwidth, Mid Channel, 909.4 MHz	502.7	N/A	N/A
500 kHz Bandwidth, High Channel, 914.2 MHz	500.76	N/A	N/A

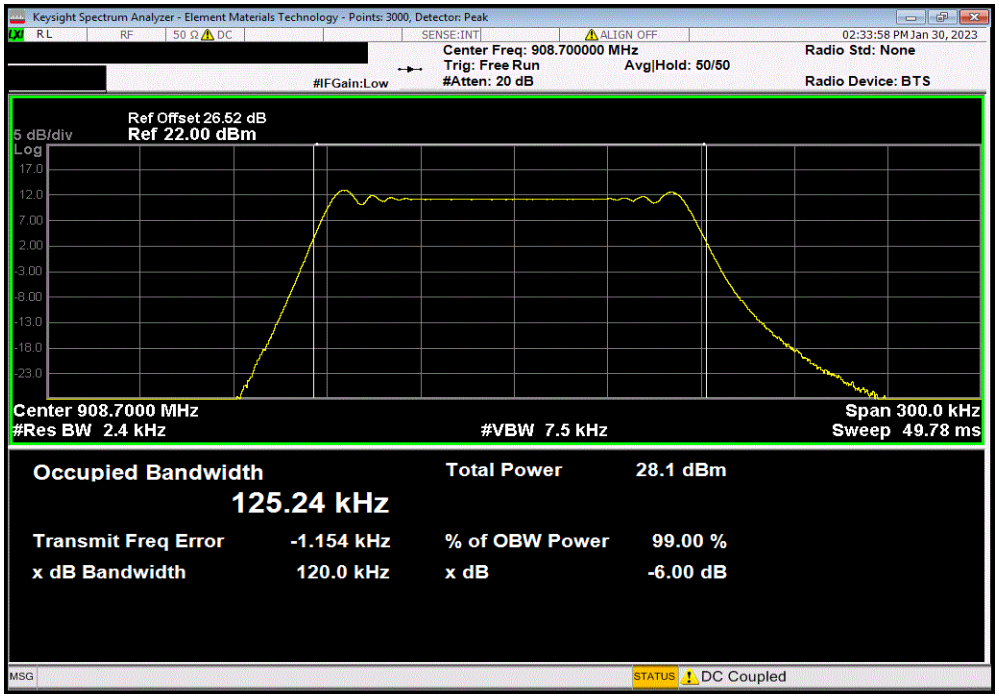
OCCUPIED BANDWIDTH (99%)

TbtTx 2022.06.03.0 XMit 2022.12.28.0

125 kHz Bandwidth, Low Channel, 902.3 MHz						
				Value (kHz)	Limit (>)	Result
				126.52	N/A	N/A



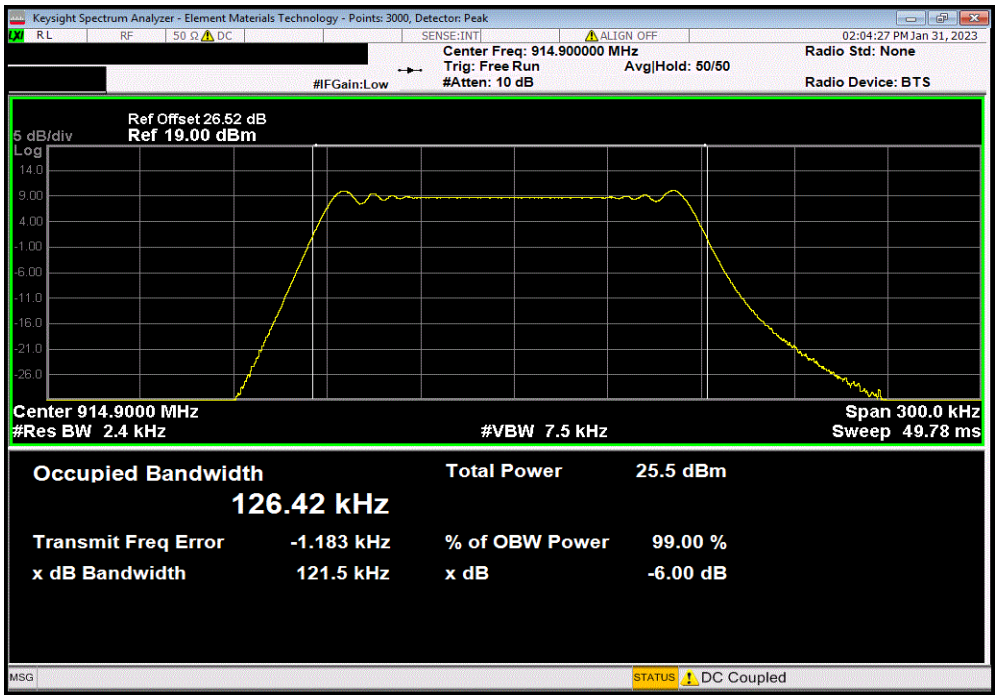
125 kHz Bandwidth, Mid Channel, 908.7 MHz						
				Value (kHz)	Limit (>)	Result
				125.24	N/A	N/A



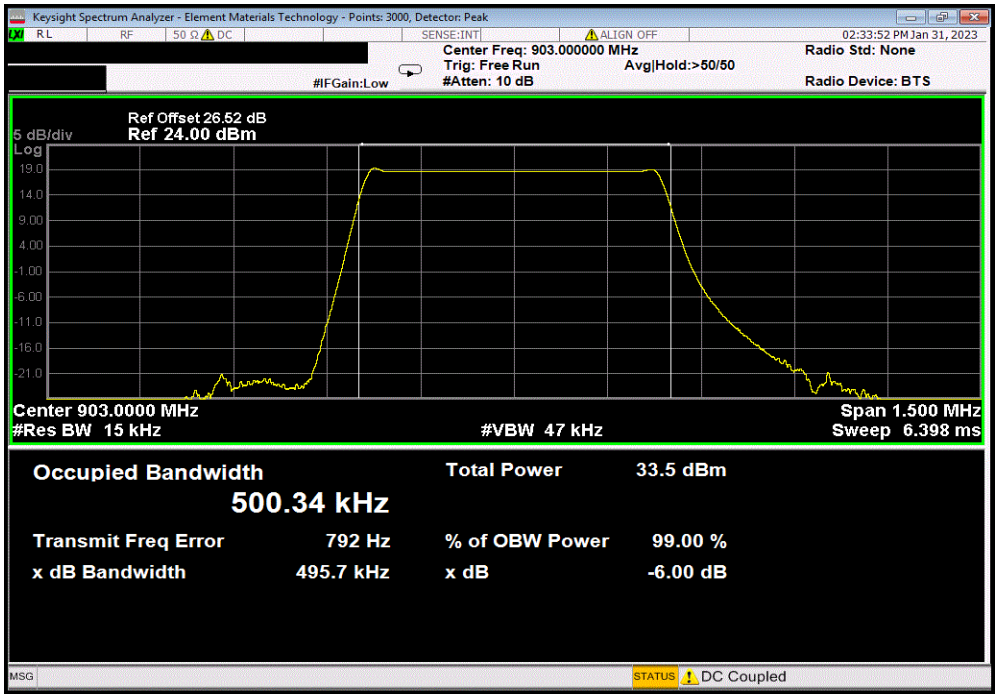
OCCUPIED BANDWIDTH (99%)

TbtTx 2022.06.03.0 XMit 2022.12.28.0

125 kHz Bandwidth, High Channel, 914.9 MHz						
				Value (kHz)	Limit (>)	Result
				126.42	N/A	N/A



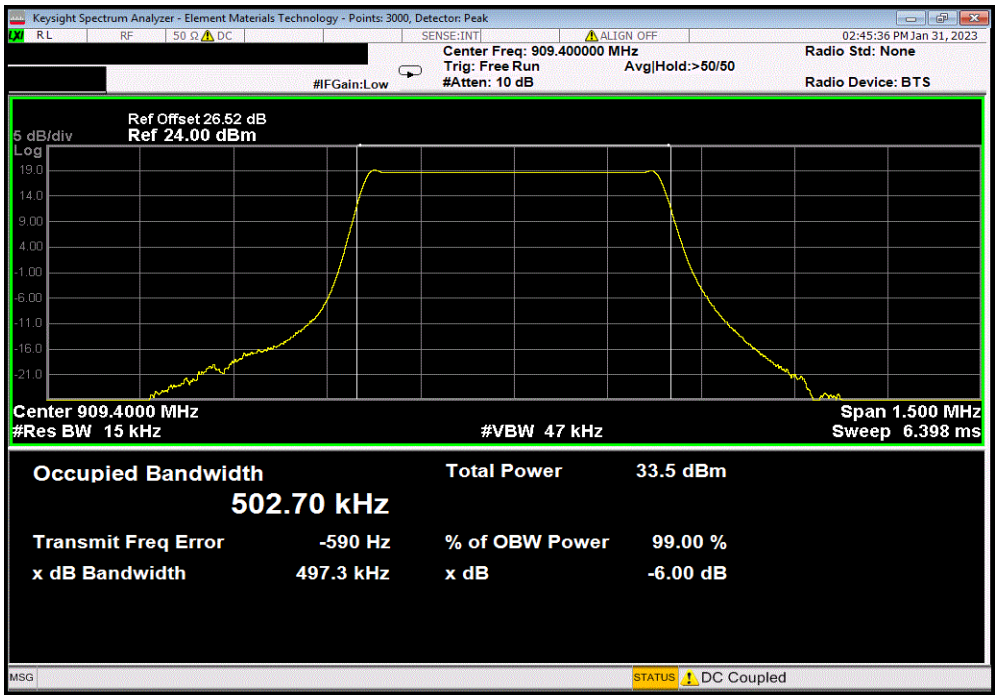
500 kHz Bandwidth, Low Channel, 903 MHz						
				Value (kHz)	Limit (>)	Result
				500.34	N/A	N/A



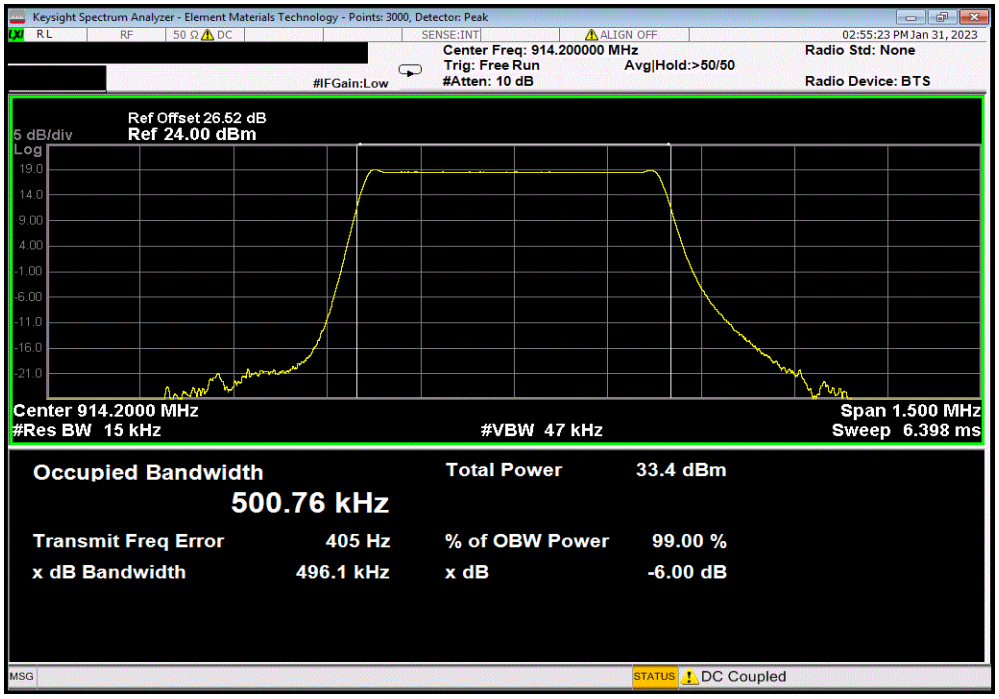
OCCUPIED BANDWIDTH (99%)

TbtTx 2022.06.03.0 XMit 2022.12.28.0

500 kHz Bandwidth, Mid Channel, 909.4 MHz						
				Value (kHz)	Limit (>)	Result
				502.7	N/A	N/A



500 kHz Bandwidth, High Channel, 914.2 MHz						
				Value (kHz)	Limit (>)	Result
				500.76	N/A	N/A



SPURIOUS CONDUCTED EMISSIONS

XMit 2022.12.28.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Block - DC	Fairview Microwave	SD3379	AMZ	2022-11-06	2023-11-06
Attenuator	Fairview Microwave	18B5W-26	RFY	2022-05-30	2023-05-30
Generator - Signal	Keysight	N5171B (EXG)	TEY	2023-01-23	2026-01-23
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2022-09-10	2023-09-10
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2022-04-25	2023-04-25

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 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

SPURIOUS CONDUCTED EMISSIONS

TbtTx 2022.06.03.0 XMit 2022.12.28.0

EUT:	MTXDOT-NA1	Work Order:	MLTI0186
Serial Number:	2348143517-0021	Date:	02/13/2023
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.6°C
Attendees:	Ana Santos	Humidity:	23.6%
Project:	None	Barometric Pres.:	1010 mbar
Tested by:	Christopher Heintzelman	Power: 5VDC via USB	Job Site: MN11

TEST SPECIFICATIONS	Test Method
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block, but does not include customer's patch cable which was declared to be 0.26dB loss.

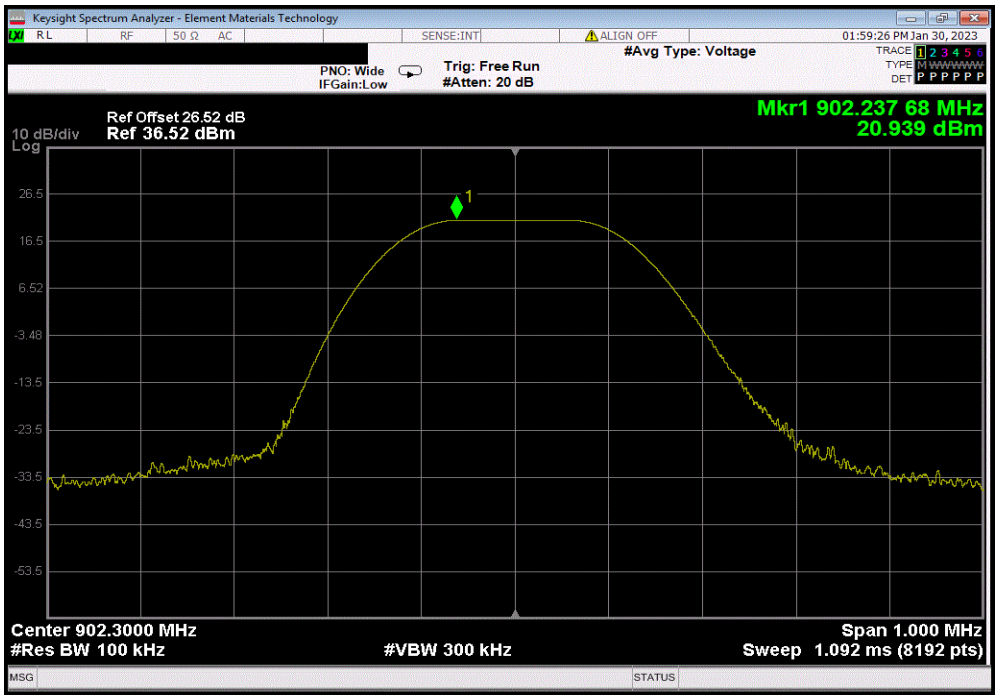
DEVIATIONS FROM TEST STANDARD

None

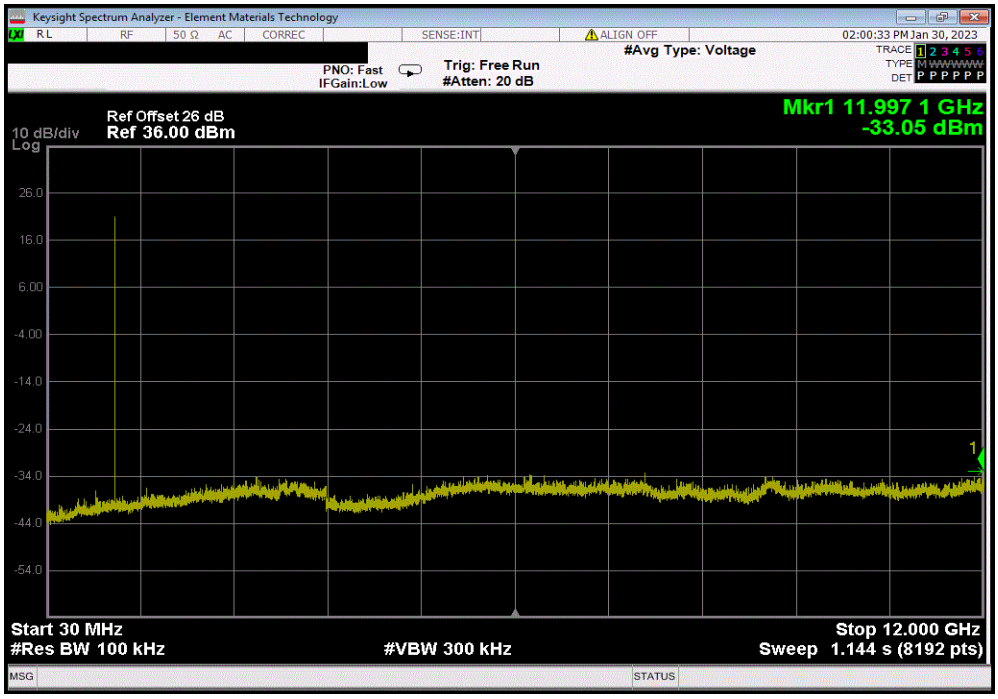
Configuration #	MLTI0186-4	Signature

	Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
125 kHz Bandwidth, Low Channel, 902.3 MHz	Fundamental	902.24	N/A	N/A	N/A
125 kHz Bandwidth, Low Channel, 902.3 MHz	30 MHz - 12 GHz	11997.08	-53.99	-30	Pass
125 kHz Bandwidth, Mid Channel, 908.7 MHz	Fundamental	908.64	N/A	N/A	N/A
125 kHz Bandwidth, Mid Channel, 908.7 MHz	30 MHz - 12 GHz	1817.24	-69.41	-30	Pass
125 kHz Bandwidth, High Channel, 914.9 MHz	Fundamental	914.84	N/A	N/A	N/A
125 kHz Bandwidth, High Channel, 914.9 MHz	30 MHz - 12 GHz	9284.79	-67.06	-30	Pass
500 kHz Bandwidth, Low Channel, 903 MHz	Fundamental	902.79	N/A	N/A	N/A
500 kHz Bandwidth, Low Channel, 903 MHz	30 MHz - 12 GHz	900.97	-56.25	-30	Pass
500 kHz Bandwidth, Mid Channel, 909.4 MHz	Fundamental	909.16	N/A	N/A	N/A
500 kHz Bandwidth, Mid Channel, 909.4 MHz	30 MHz - 12 GHz	1818.7	-69.54	-30	Pass
500 kHz Bandwidth, High Channel, 914.2 MHz	Fundamental	913.96	N/A	N/A	N/A
500 kHz Bandwidth, High Channel, 914.2 MHz	30 MHz - 12 GHz	1828.93	-70.16	-30	Pass

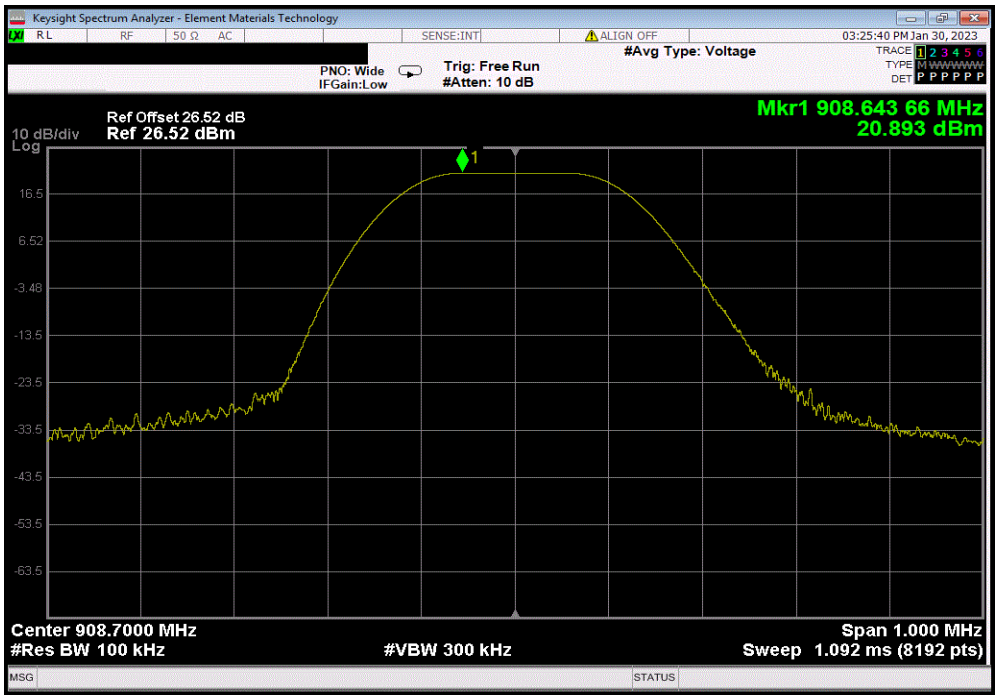
125 kHz Bandwidth, Low Channel, 902.3 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental		902.24	N/A	N/A	N/A



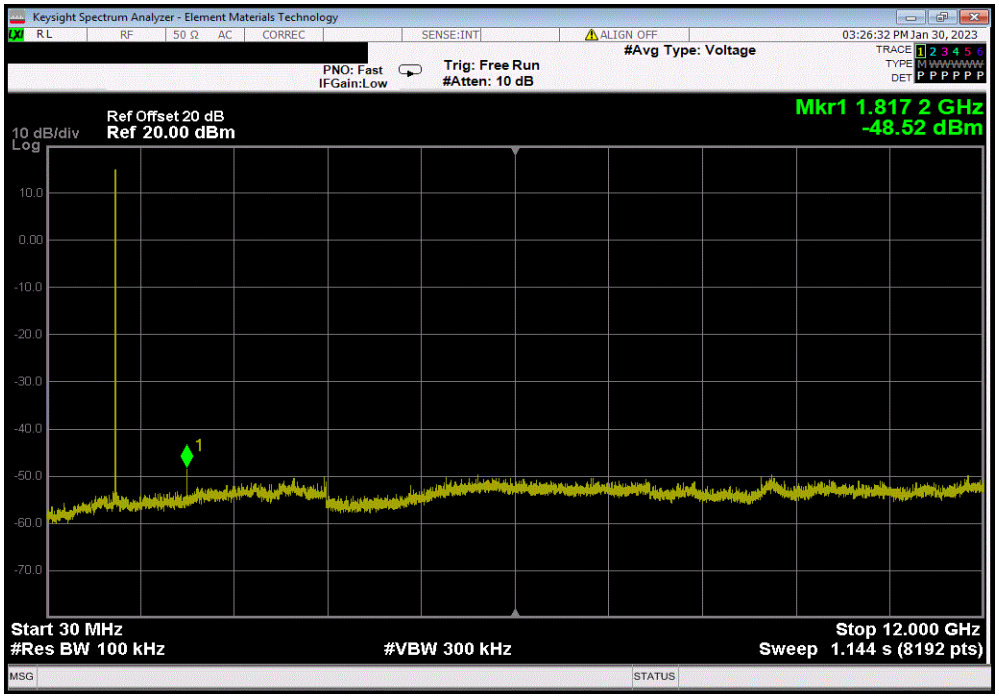
125 kHz Bandwidth, Low Channel, 902.3 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12 GHz	11997.08	-53.99	-30	Pass



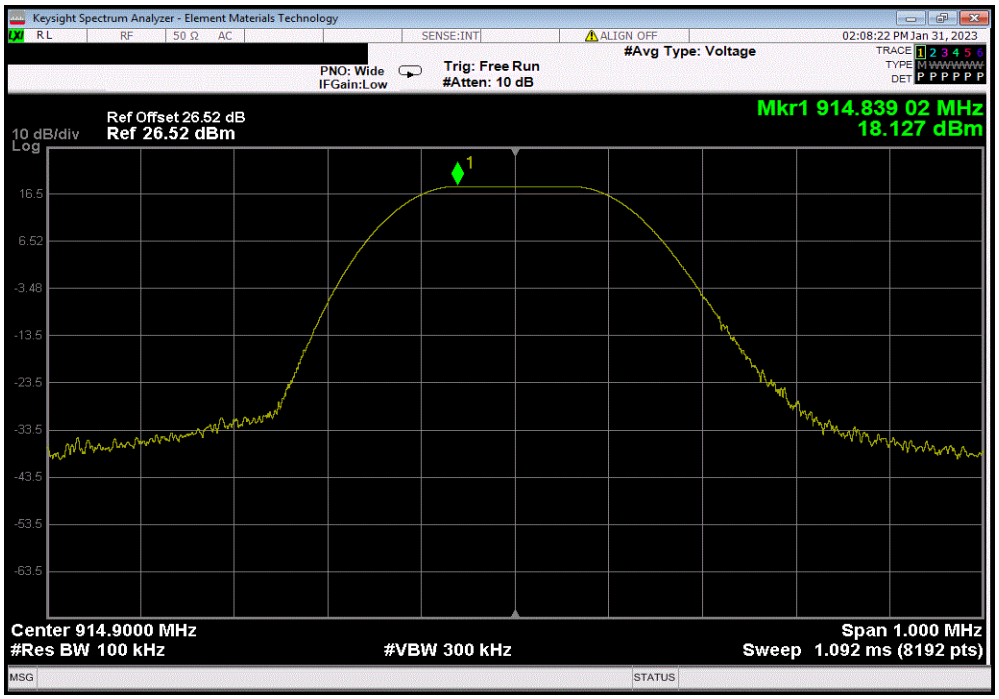
125 kHz Bandwidth, Mid Channel, 908.7 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental		908.64	N/A	N/A	N/A



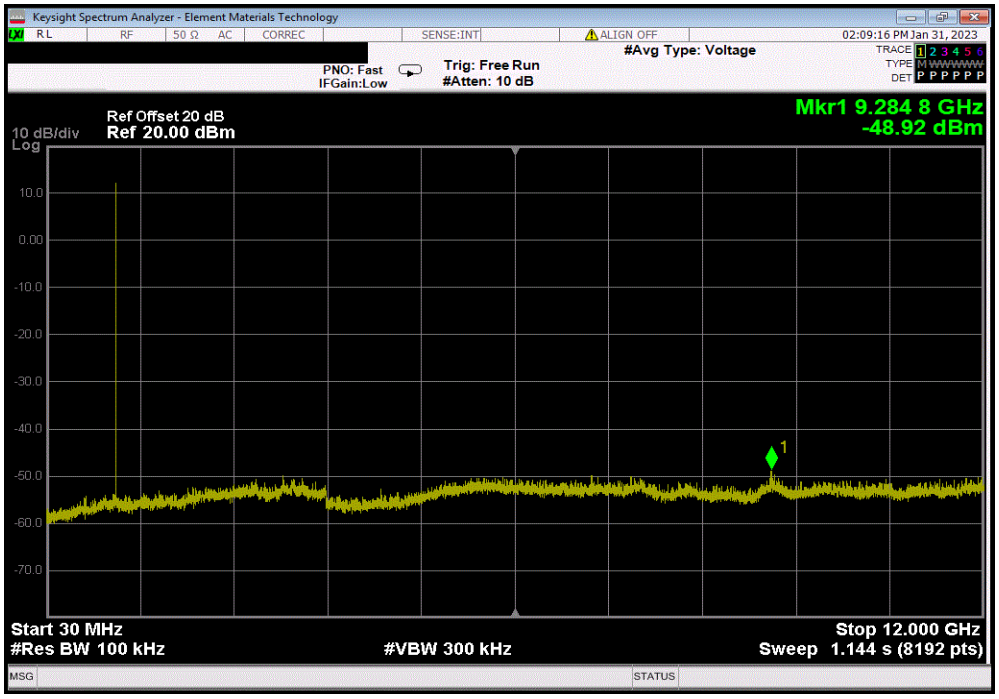
125 kHz Bandwidth, Mid Channel, 908.7 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12 GHz	1817.24	-69.41	-30	Pass



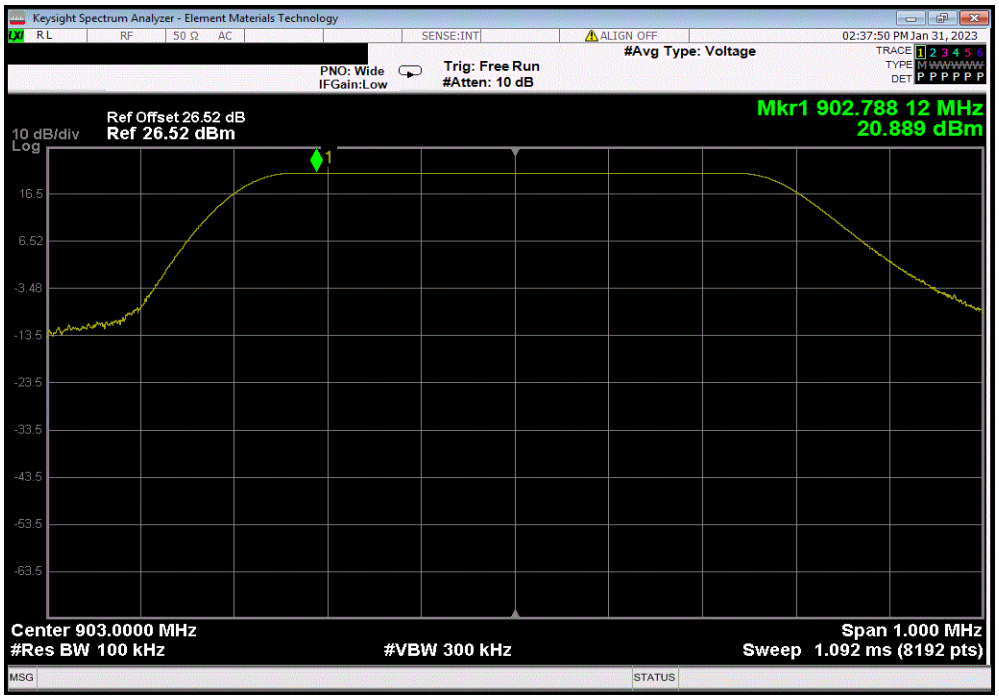
125 kHz Bandwidth, High Channel, 914.9 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental		914.84	N/A	N/A	N/A



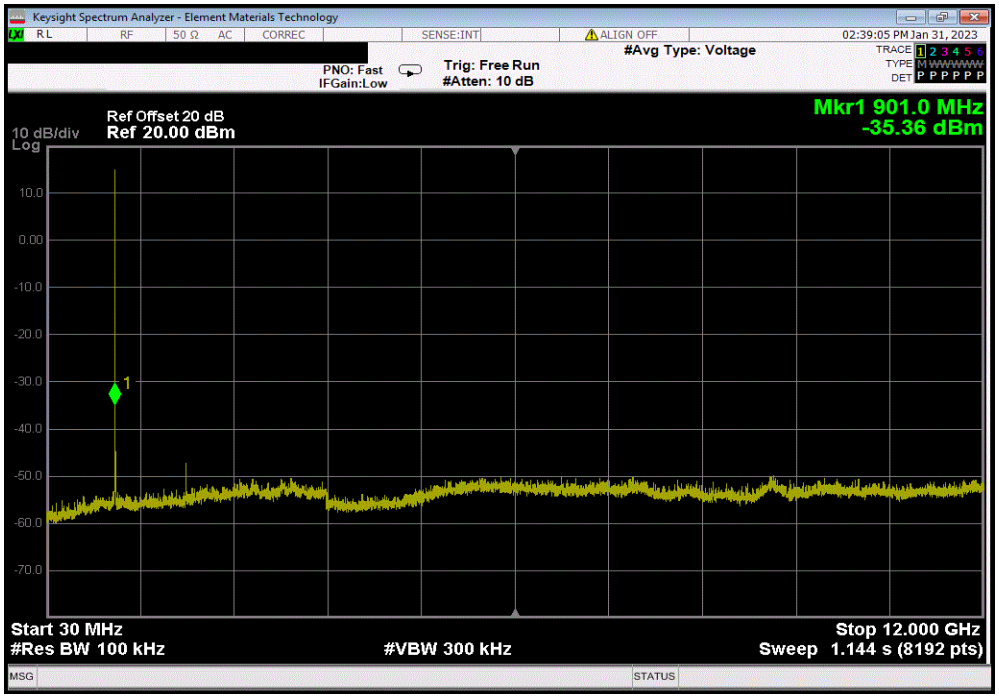
125 kHz Bandwidth, High Channel, 914.9 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12 GHz	9284.79	-67.06	-30	Pass



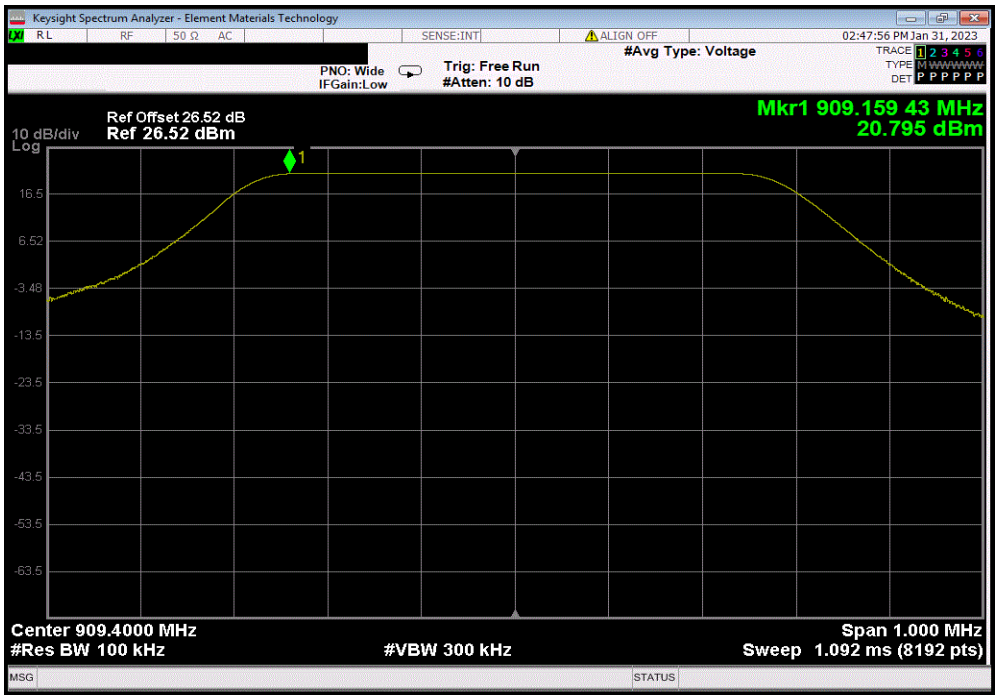
500 kHz Bandwidth, Low Channel, 903 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental		902.79	N/A	N/A	N/A



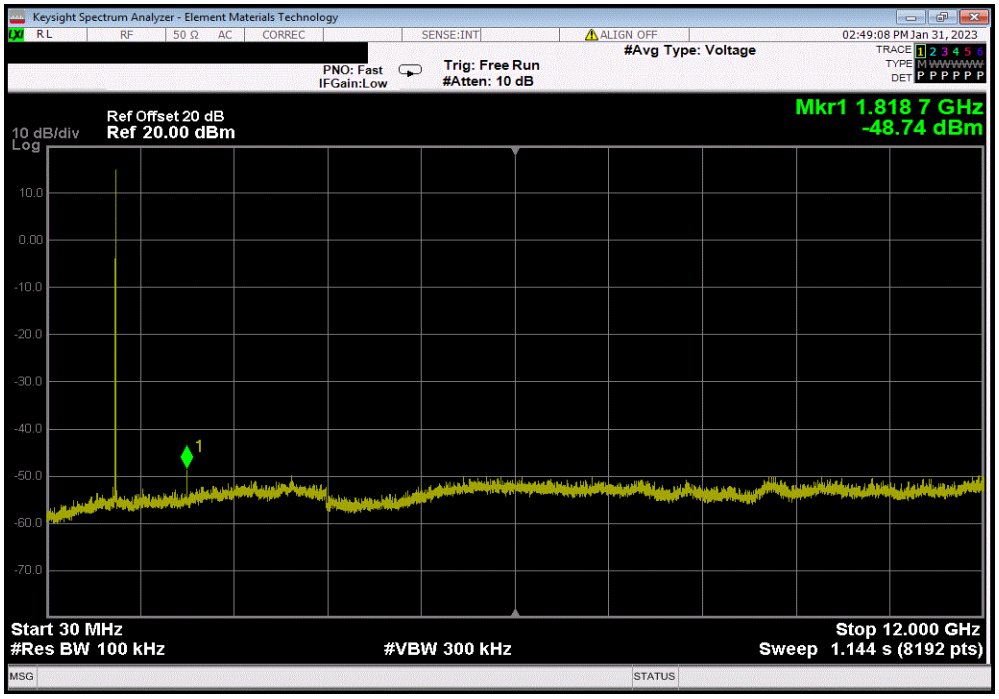
500 kHz Bandwidth, Low Channel, 903 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12 GHz	900.97	-56.25	-30	Pass



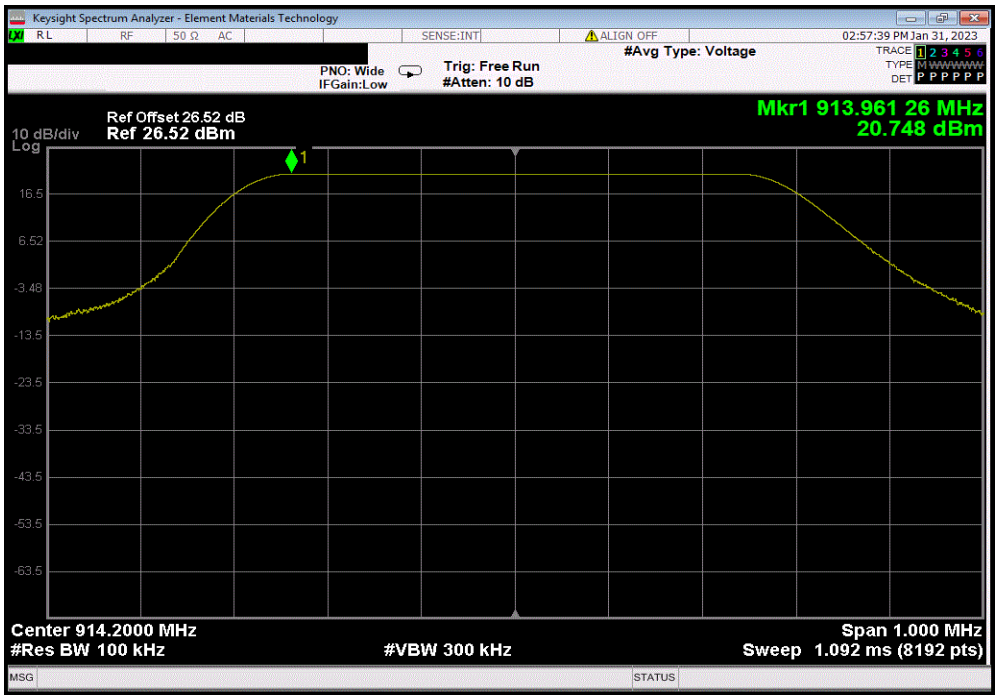
500 kHz Bandwidth, Mid Channel, 909.4 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental		909.16	N/A	N/A	N/A



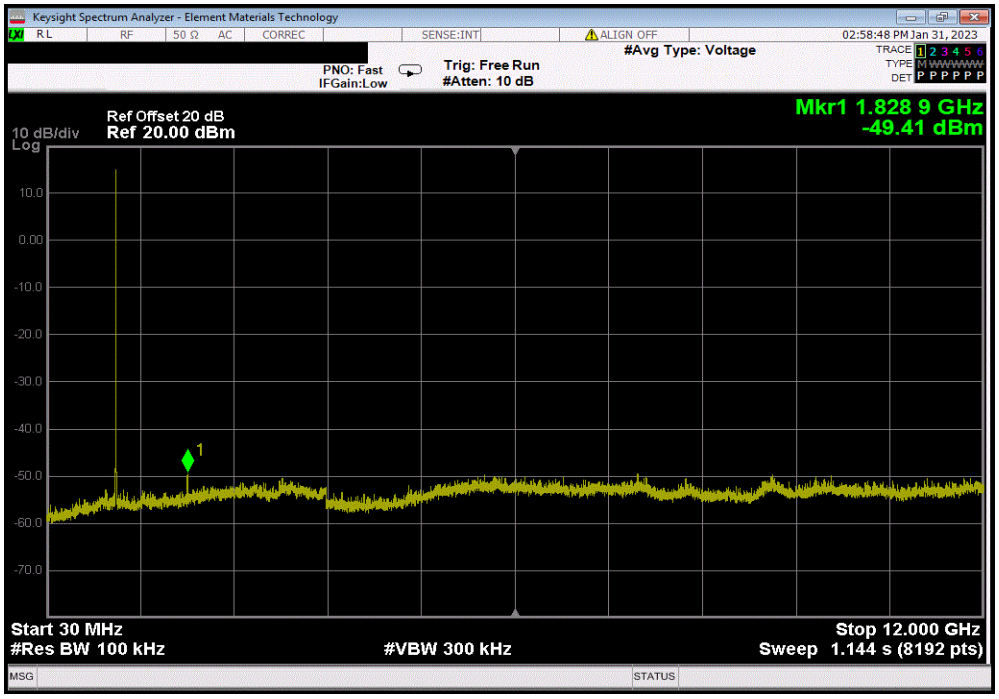
500 kHz Bandwidth, Mid Channel, 909.4 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12 GHz	1818.7	-69.54	-30	Pass



500 kHz Bandwidth, High Channel, 914.2 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental		913.96	N/A	N/A	N/A



500 kHz Bandwidth, High Channel, 914.2 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12 GHz	1828.93	-70.16	-30	Pass



POWER SPECTRAL DENSITY

XMit 2022.12.28.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Block - DC	Fairview Microwave	SD3379	AMZ	2022-11-06	2023-11-06
Attenuator	Fairview Microwave	18B5W-26	RFY	2022-05-30	2023-05-30
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2022-09-10	2023-09-10
Generator - Signal	Keysight	N5171B (EXG)	TEY	2023-01-23	2026-01-23
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2022-04-25	2023-04-25

TEST DESCRIPTION

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 on the following data sheets. The transmit power was set to its default maximum.

The method AVGPSD-1 in section 11.10.3 of ANSI C63.10:2013 was used to make the measurement. This method uses trace averaging and RMS detection across the full power of the burst. This method is allowed as the same method has been used to determine the conducted output power.

POWER SPECTRAL DENSITY

TbtTx 2022.06.03.0 XMit 2022.12.28.0

EUT:	MTXDOT-NA1	Work Order:	MLTI0186
Serial Number:	2348143517-0021	Date:	02/13/2023
Customer:	Multi-Tech Systems, Inc.	Temperature:	22.6°C
Attendees:	Ana Santos	Humidity:	23.5%
Project:	None	Barometric Pres.:	1010 mbar
Tested by:	Christopher Heintzelman	Power: 5VDC via USB	Job Site: MN11

TEST SPECIFICATIONS	Test Method
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block, but does not include customer's patch cable which was declared to be 0.26dB loss. Per an FCC inquiry an average detector was used to make the power measurement on the Hybrid device per ANSI C63.10:2013 section 11.1.

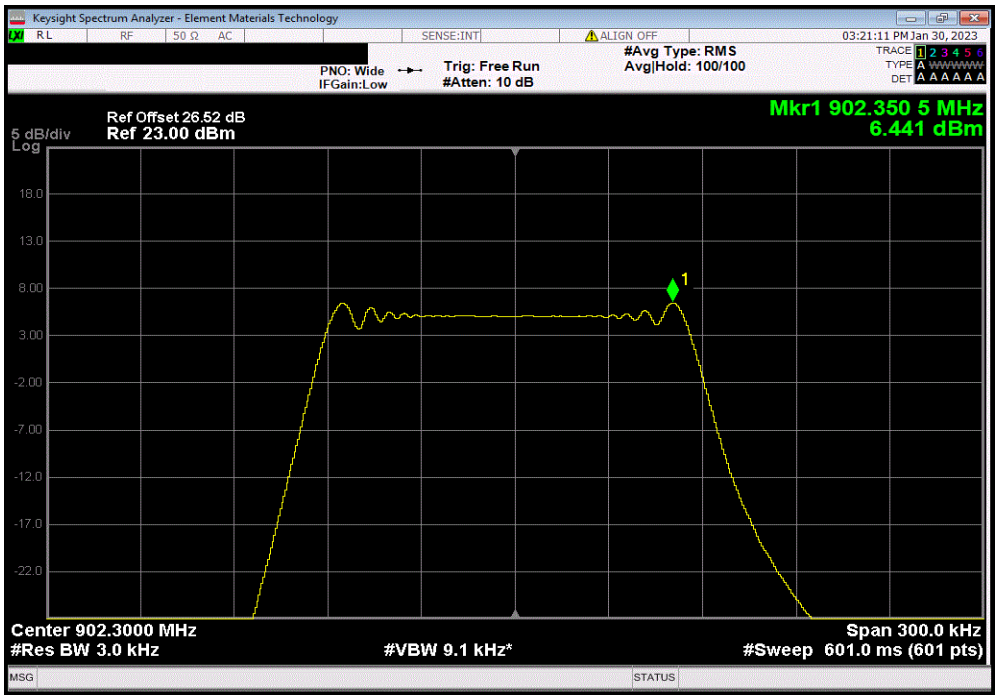
DEVIATIONS FROM TEST STANDARD

None

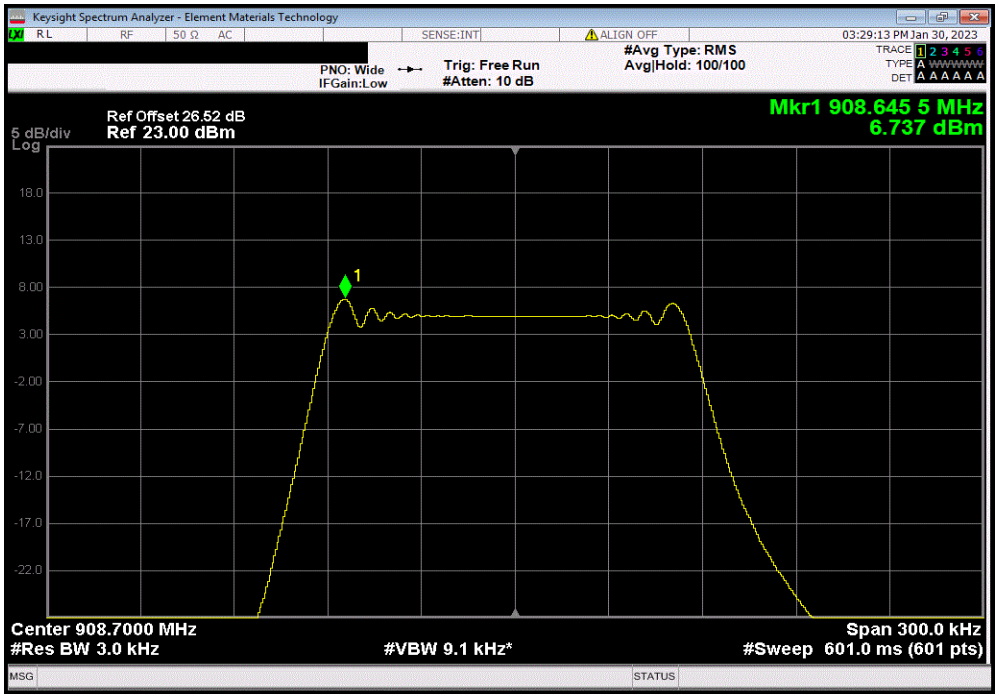
Configuration #	MLTI0186-4	Signature

	Power (dBm/MHz)	Duty Cycle Factor (dB)	Patch Cable Loss (dB)	Density (dBm/MHz)	Limit ≤ (dBm / 3 kHz)	Results
125 kHz Bandwidth, Low Channel, 902.3 MHz	6.441	0	0.26	6.701	8	Pass
125 kHz Bandwidth, Mid Channel, 908.7 MHz	6.737	0	0.26	6.997	8	Pass
125 kHz Bandwidth, High Channel, 914.9 MHz	3.583	0	0.26	3.843	8	Pass
500 kHz Bandwidth, Low Channel, 903 MHz	1.002	0	0.26	1.262	8	Pass
500 kHz Bandwidth, Mid Channel, 909.4 MHz	0.738	0	0.26	0.998	8	Pass
500 kHz Bandwidth, High Channel, 914.2 MHz	0.869	0	0.26	1.129	8	Pass

125 kHz Bandwidth, Low Channel, 902.3 MHz						
	Power (dBm/MHz)	Duty Cycle Factor (dB)	Patch Cable Loss (dB)	Density (dBm/MHz)	Limit ≤ (dBm / 3 kHz)	Results
	6.441	0	0.26	6.701	8	Pass



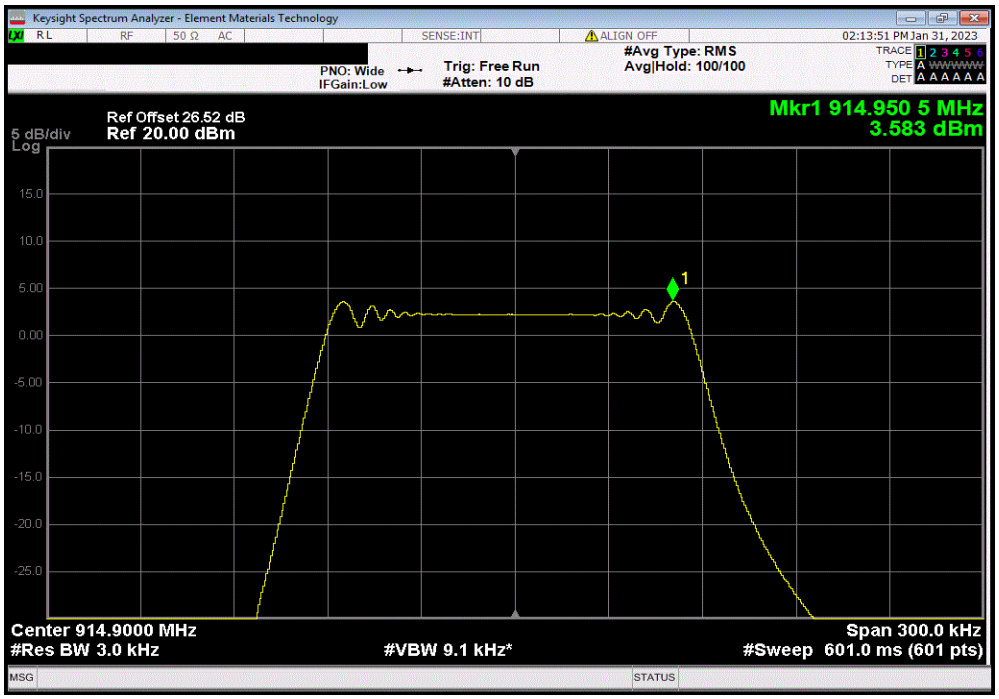
125 kHz Bandwidth, Mid Channel, 908.7 MHz						
	Power (dBm/MHz)	Duty Cycle Factor (dB)	Patch Cable Loss (dB)	Density (dBm/MHz)	Limit ≤ (dBm / 3 kHz)	Results
	6.737	0	0.26	6.997	8	Pass



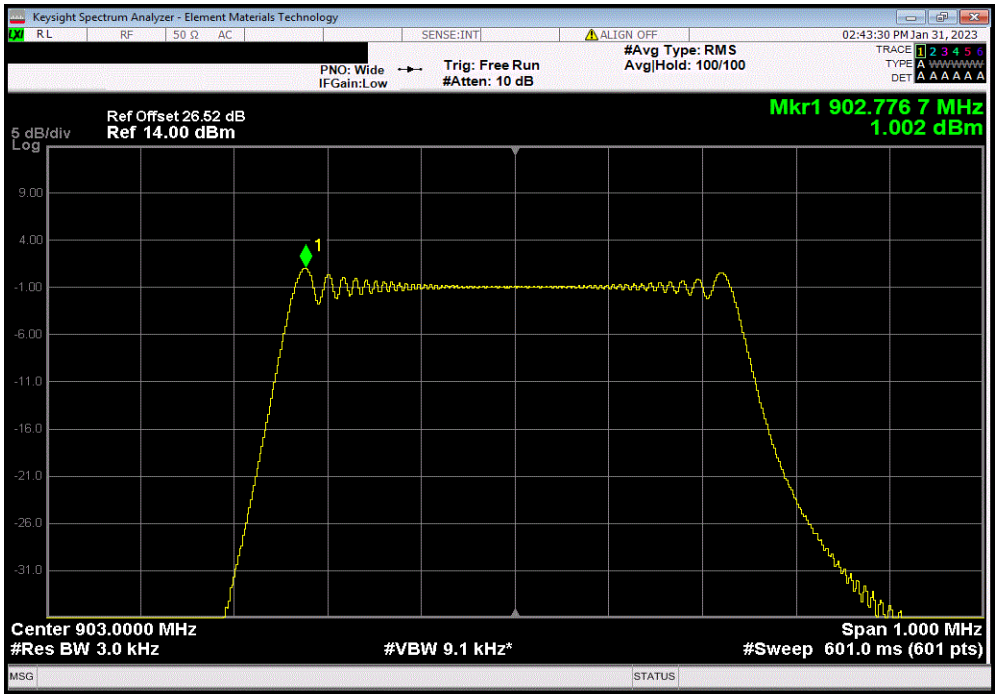
POWER SPECTRAL DENSITY

TbtTx 2022.06.03.0 XMit 2022.12.28.0

125 kHz Bandwidth, High Channel, 914.9 MHz						
	Power (dBm/MHz)	Duty Cycle Factor (dB)	Patch Cable Loss (dB)	Density (dBm/MHz)	Limit ≤ (dBm / 3 kHz)	Results
	3.583	0	0.26	3.843	8	Pass



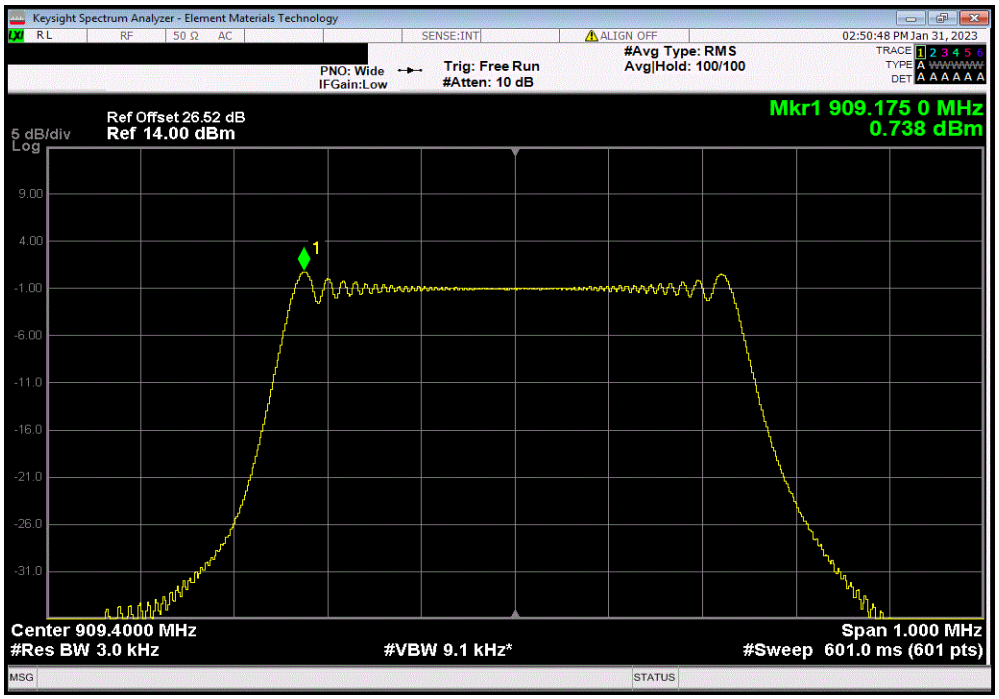
500 kHz Bandwidth, Low Channel, 903 MHz						
	Power (dBm/MHz)	Duty Cycle Factor (dB)	Patch Cable Loss (dB)	Density (dBm/MHz)	Limit ≤ (dBm / 3 kHz)	Results
	1.002	0	0.26	1.262	8	Pass



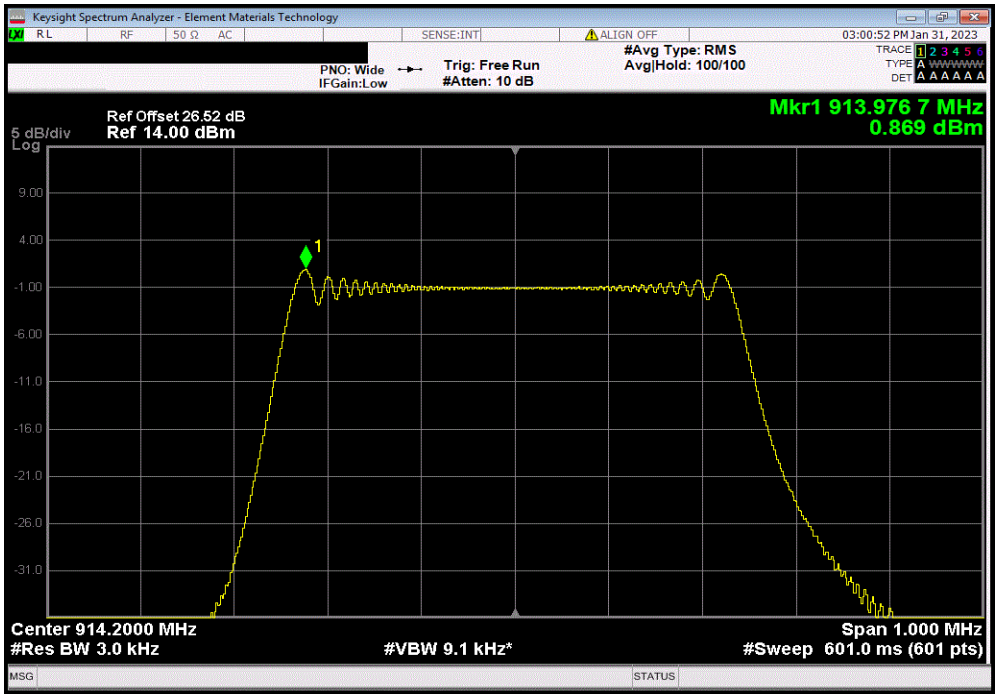
POWER SPECTRAL DENSITY

TbtTx 2022.06.03.0 XMit 2022.12.28.0

500 kHz Bandwidth, Mid Channel, 909.4 MHz						
	Power (dBm/MHz)	Duty Cycle Factor (dB)	Patch Cable Loss (dB)	Density (dBm/MHz)	Limit ≤ (dBm / 3 kHz)	Results
	0.738	0	0.26	0.998	8	Pass



500 kHz Bandwidth, High Channel, 914.2 MHz						
	Power (dBm/MHz)	Duty Cycle Factor (dB)	Patch Cable Loss (dB)	Density (dBm/MHz)	Limit ≤ (dBm / 3 kHz)	Results
	0.869	0	0.26	1.129	8	Pass



End of Test Report