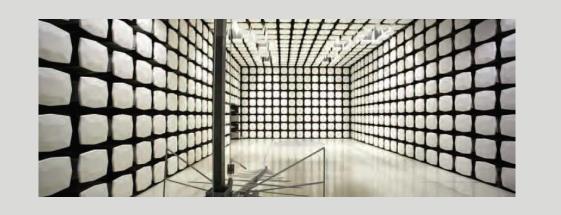


Multi-Tech Systems, Inc.

MTCAP2-915-042-POE

DTS Transceiver FCC 15.207:2019, FCC 15.207:2020, FCC 15.247:2019

Report # MLTI0132.1 Rev. 2







CERTIFICATE OF TEST



Last Date of Test: February 4, 2020 Multi-Tech Systems, Inc. EUT: MTCAP2-915-042-POE

Radio Equipment Testing

Standards	
Specification	Method
FCC 15.207:2019	
FCC 15.207:2020	ANSI C63.10:2013, KDB 558074
FCC 15.247:2019	

Resu	ts
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Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions (Transmitter)	Yes	Pass	
6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	
7.5	Duty Cycle	Yes	Pass	
7.8.2	Carrier Frequency Separation	No	N/A	Not required for DTS devices.
7.8.3	Number of Hopping Frequencies	No	N/A	Not required for DTS devices.
7.8.4	Dwell Time	No	N/A	Not required for DTS devices.
7.8.5	Output Power	Yes	Pass	
7.8.5	Equivalent Isotropic Radiated Power	Yes	Pass	
7.8.6	Band Edge Compliance	Yes	Pass	
7.8.6	Band Edge Compliance - Hopping Mode	No	N/A	Not required for DTS devices.
7.8.7	Occupied Bandwidth	Yes	Pass	
7.8.8	Spurious Conducted Emissions	Yes	Pass	
11.10.2	Power Spectral Density	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Eric Brandon, Department Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.

REVISION HISTORY



Revision Number	Description	Date (yyyy-mm-dd)	Page Number
00	None		
01	Product Description updated	2020-01-10	8
02	FCC 15.207:2020 added	2020-02-07	Cover, 2
02	Updated Configurations	2020-02-07	10
02	Updated last day of testing	2020-02-07	2, 8, 11
02	Added data	2020-02-07	17-23

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

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

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

European Union

European Commission – Within Element, we have a EU Notified Body validated for the EMCD and RED Directives.

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

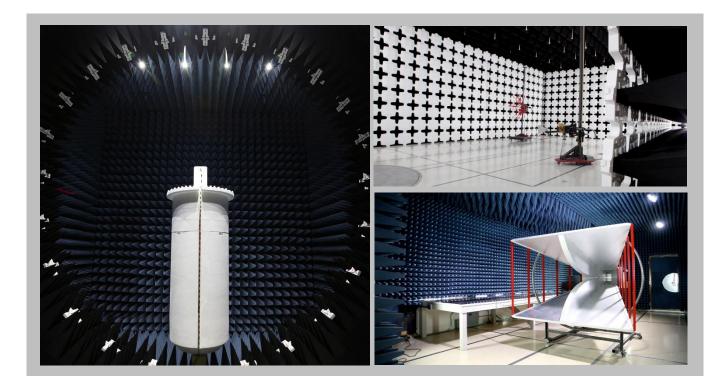
For details on the Scopes of our Accreditations, please visit: https://www.nwemc.com/emc-testing-accreditations

FACILITIES





California Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Oregon Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Texas Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Washington Labs NC01-05 19201 120 th Ave NE Bothell, WA 98011 (425)984-6600			
NVLAP							
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0			
Innovation, Science and Economic Development Canada							
2834B-1, 2834B-3	2834E-1, 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			



EMISSIONS MEASUREMENTS



Measurement Uncertainty

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

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

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

Measurements were made using the bandwidths and detectors specified. No video filter was used.

Sample Calculations

Radiated Emissions:

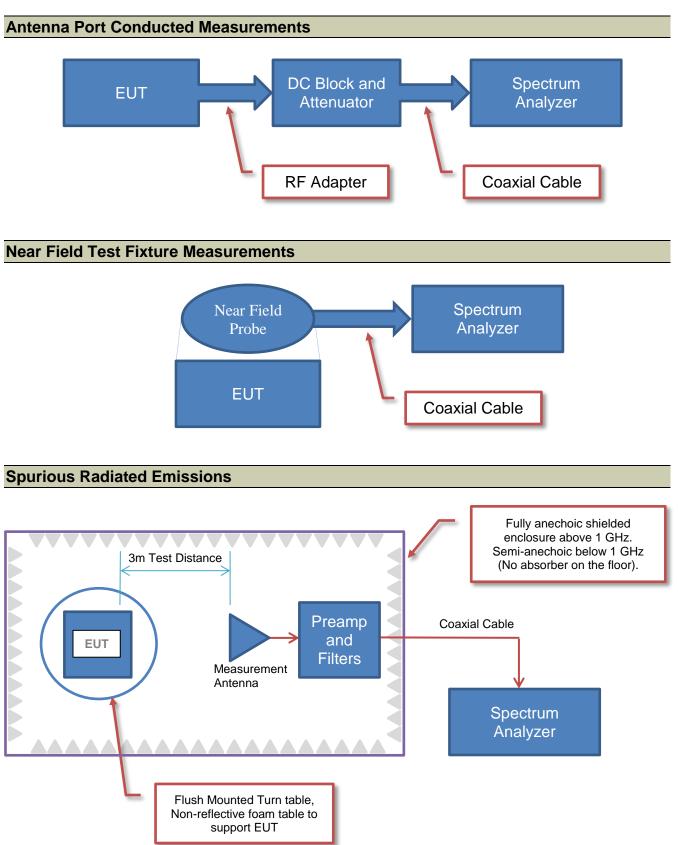
Field Strength		Measured Level		Antenna Factor		Cable Factor		Amplifier Gain		Distance Adjustment Factor		External Attenuation
33.5	=	42.6	+	28.6	+	3.1	-	40.8	+	0.0	+	0.0

Conducted Emissions:

Adjusted Level		Measured Level		Transducer Factor		Cable Factor		External Attenuation
47.1	=	26.7	+	0.3	+	0.1	+	20.0

Test Setup Block Diagrams





PRODUCT DESCRIPTION



Company Name: Multi-Tech Systems, Inc. Address: 2205 Woodale Drive City, State, Zip: St. Paul, MN 55112 **Test Requested By:** Jim Asp EUT: MTCAP2-915-042-POE First Date of Test: December 26, 2019 Last Date of Test: February 4, 2020 **Receipt Date of Samples:** November 25, 2019 Equipment Design Stage: Production **Equipment Condition:** No Damage **Purchase Authorization:** Verified

Client and Equipment Under Test (EUT) Information

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

The MultiConnect® Conduit[™] AP harnesses the power of the LoRaWAN[™] protocol to provide deep in-building penetration and connectivity to thousands of IoT assets. Easy to deploy thanks to integrated antennas, it can be mounted on walls or ceilings to extend LoRa® connectivity in commercial buildings like hotels, convention centers, offices and retail facilities providing coverage in difficult to reach areas cell tower or rooftop deployments may not penetrate. The Conduit AP offers two development environments for developers and users alike. For advanced developers, the mLinux, Yocto Linux BSP integrates directly to a cloud-based LoRaWAN Network Server, enterprise data center or public operator's core network. While the AEP features an easy-to-use graphical interface set-up and includes a built-in LoRa Network Server to connect locally clustered assets on a private LoRaWAN network directly to your choice of IoT data platforms. The AEP extends complex processing to the edge to reduce upstream communication and operational costs. Either way, the access point provides your choice of 4G-LTE or Ethernet IP backhaul.

Testing Objective:

Seeking to demonstrate compliance under FCC 15.247:2019 for the operation in the 902-928 MHz band.

CONFIGURATIONS



Configuration MLTI0132-1

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Wireless Device	Multi-Tech Systems, Inc.	MTCAP2-915-042L-POE	20637489

Peripherals in test setup boundary							
Description	Manufacturer	Model/Part Number	Serial Number				
Gigabit PoE Injector	Hawking Technology	HPOE2	HEMCPOE217410007				
DC Power Supply	HP	HP E3612A	KR30701360				
Laptop	Lenovo	ThinkPad X230	PK0WM2A				
Power Supply (Laptop)	Lenovo	92P1109	11S92P1109Z1ZBTZ71CBVP				

Cables							
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2		
DC Power Cable (Gigabit PoE Injector)	No	1.8m	No	DC Power Supply	Gigabit PoE Injector		
Ethernet Cable	No	1.9m	No	Gigabit PoE Injector	Wireless Device		
AC Mains Cable (DC Power Supply)	No	1.8m	No	DC Power Supply	AC Mains		
AC Cable (Laptop)	No	1.0m	No	AC Mains	Power Supply (Laptop)		
DC Cable (Laptop)	No	1.8m	Yes	Power Supply (Laptop)	Laptop		
Ethernet Cable	No	1.8m	No	Gigabit PoE Injector	Laptop		

CONFIGURATIONS



Configuration MLTI0138-2

EUT							
Description	Manufacturer	Model/Part Number	Serial Number				
Wireless Device	Multi-Tech Systems, Inc.	MTCAP2-915-042L-POE	20589952				
AC/DC Power Adapter	MEGA	FJ-SW1260502500DN	MJSW1260502500DN				

Peripherals in test setup boundary						
Description Manufacturer Model/Part Number Serial Number						
Laptop	Lenovo	ThinkPad X230	PK0WM2A			

Remote Equipment Outside of Test Setup Boundary						
Description Manufacturer Model/Part Number Serial Number						
Power Supply (Laptop)	Lenovo	92P1109	11S92P1109Z1ZBTZ71CBVP			

Cables								
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2			
Ethernet Cable	None	1.9m	None	Wireless Device	Laptop			
AC/DC Power Adapter Cable	None	1.8m	None	Wireless Device	AC/DC Power Adapter			
AC Cable (Laptop)	No	1.0m	No	AC Mains	Power Supply (Laptop)			
DC Cable (Laptop)	No	1.8m	Yes	Power Supply (Laptop)	Laptop			

MODIFICATIONS



Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2019-12-26	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.
2	2019-12-27	Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2019-12-27	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.
4	2019-12-27	Equivalent Isotropic Radiated Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
5	2019-12-27	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	2019-12-27	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
7	2019-12-27	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
8	2019-12-27	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.
9	2020-02-04	Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.



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 500hm measuring port is terminated by a 500hm EMI meter or a 500hm resistive load. All 500hm measuring ports of the LISN are terminated by 500hm. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Receiver	Rohde & Schwarz	ESR7	ARI	2019-07-08	2020-07-08
Cable - Conducted Cable					
Assembly	Northwest EMC	MNC, HGN, TYK	MNCA	2019-03-13	2020-03-13
LISN	Solar Electronics	9252-50-R-24-BNC	LIY	2019-03-15	2020-03-15
LISN	Solar Electronics	9252-50-R-24-BNC	LIQ	2019-10-04	2020-10-04

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

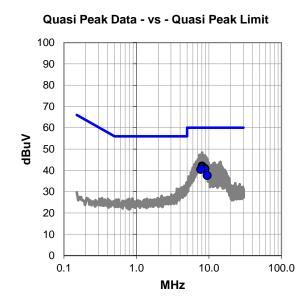
MLTI0132-1

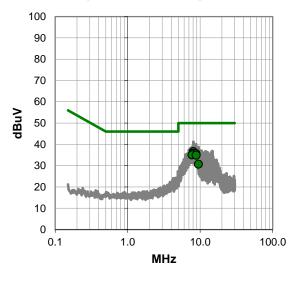
MODES INVESTIGATED

Transmitting LoRa - mid channel (925.1 MHz)



EUT:	MTCAP2-91	MTCAP2-915-042-POE				MLTI0132
Serial Number:	20637489				Date:	2019-12-27
Customer:	Multi-Tech S	ystems, Ind	D.		Temperature:	22.4°C
Attendees:	Jim Asp				Relative Humidity:	25.2%
Customer Project:	None				Bar. Pressure:	1026 mb
Tested By:	Dustin Spark	S			Job Site:	MN03
Power:	54VDC via P	oE			Configuration:	MLTI0132-1
TEST SPECIFI	CATIONS					
Specification:				Method:		
FCC 15.207:2019				ANSI C63.10:201	3	
TEST PARAME	TERS					
Run #: 14	Line: Neutral Add. Ext. Attenuation (dB): 0					
					· · · · · · · · · · · · · · · · · · ·	/-
COMMENTS						/
COMMENTS None						
	NG MODES					/
None		925.1 MHz	:)		· · · · · · · · · · · · · · · · · · ·	
None EUT OPERATI	- mid channel (/			









RESULTS - Run #14

Quasi Peak Data - vs - Quasi Peak Limit							
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)		
8.1	21.200	20.8	42.0	60.0	-18.0		
8.0	20.600	20.8	41.4	60.0	-18.6		
8.8	20.000	20.9	40.9	60.0	-19.1		
8.8	19.600	20.9	40.5	60.0	-19.5		
7.7	19.600	20.8	40.4	60.0	-19.6		
9.5	16.700	20.9	37.6	60.0	-22.4		

Average Data - vs - Average Limit							
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)		
8.1	15.800	20.8	36.6	50.0	-13.4		
8.0	15.000	20.8	35.8	50.0	-14.2		
8.8	14.700	20.9	35.6	50.0	-14.4		
7.7	14.200	20.8	35.0	50.0	-15.0		
8.8	14.000	20.9	34.9	50.0	-15.1		
9.5	9.800	20.9	30.7	50.0	-19.3		

CONCLUSION

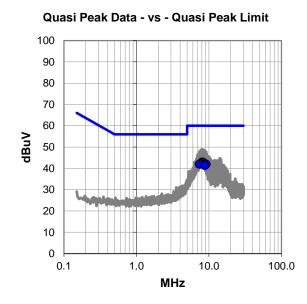
Pass

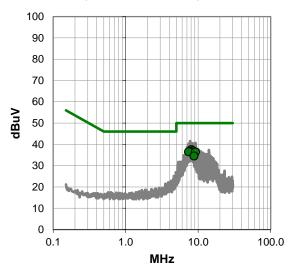
Justin es

Tested By



EUT:	MTCAP2-915-042-POE				Work Order:	MLTI0132		
Serial Number:	20637489				Date:	2019-12-27		
Customer:	Multi-Tech Sy	/stems, Ind	D.		Temperature:	22.4°C		
Attendees:	Jim Asp				Relative Humidity:	25.2%		
Customer Project:	None				Bar. Pressure:	1026 mb		
Tested By:	Dustin Sparks	S			Job Site:	MN03		
Power:	54VDC via Po	эE			Configuration:	MLTI0132-1		
TEST SPECIFICATIONS								
Specification:				Method:				
FCC 15.207:2019				ANSI C63.10:20	63.10:2013			
TEST PARAME	TERS							
		Line:	High Line		Add. Ext. Attenuation (dE	3): 0		
Run #: 15		LINE.			Add. EXt. Attendation (de	<i>)</i> . 0		
Run #: 15 COMMENTS		LINE.				<i>j</i> . 0		
		LINE.				<i>y</i> . 0		
COMMENTS None EUT OPERATIN						<u>, </u>		
COMMENTS None						<u>,</u>		
COMMENTS None EUT OPERATIN	- mid channel (925.1 MHz	:)					
COMMENTS None EUT OPERATIN Transmitting LoRa	- mid channel (925.1 MHz	:)			<i>.</i>		





Average Data - vs - Average Limit



RESULTS - Run #15

Quasi Peak Data - vs - Quasi Peak Limit							
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)		
8.1	22.200	20.8	43.0	60.0	-17.0		
8.5	21.800	20.9	42.7	60.0	-17.3		
7.8	21.300	20.8	42.1	60.0	-17.9		
9.2	21.000	20.9	41.9	60.0	-18.1		
7.4	21.100	20.8	41.9	60.0	-18.1		
8.8	20.400	20.9	41.3	60.0	-18.7		

Average Data - vs - Average Limit							
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)		
8.1	16.700	20.8	37.5	50.0	-12.5		
8.5	16.100	20.9	37.0	50.0	-13.0		
7.8	15.800	20.8	36.6	50.0	-13.4		
7.4	15.700	20.8	36.5	50.0	-13.5		
9.2	15.500	20.9	36.4	50.0	-13.6		
8.8	13.600	20.9	34.5	50.0	-15.5		

CONCLUSION

Pass

Justin ands

Tested By



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 500hm measuring port is terminated by a 500hm EMI meter or a 500hm resistive load. All 500hm measuring ports of the LISN are terminated by 500hm. 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
Cable - Conducted Cable					
Assembly	Northwest EMC	MNC, HGN, TYK	MNCA	2019-03-13	2020-03-13
Receiver	Rohde & Schwarz	ESR7	ARI	2019-07-08	2020-07-08
LISN	Solar Electronics	9252-50-R-24-BNC	LIY	2019-03-15	2020-03-15
LISN	Solar Electronics	9252-50-R-24-BNC	LIQ	2019-10-04	2020-10-04

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

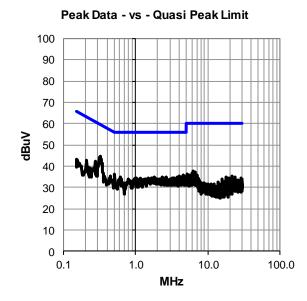
MLTI0138-2

MODES INVESTIGATED

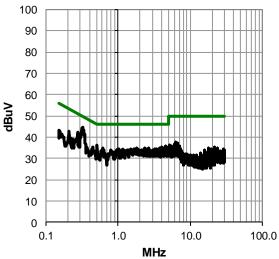
Transmit Mode Mid channel Max Power



CUT.					Mark Orders						
EUT:	MTCAP2-915-	-042-POE			Work Order:	MLTI0138					
Serial Number:	20589952			Date:	2020-02-04						
Customer:	Multi-Tech Sys	stems, Ind	D.	Temperature:	22.3°C						
Attendees:	Jim Asp				Relative Humidity:	20.8%					
Customer Project:	None				Bar. Pressure:	1028 mb					
Tested By:	Glen Creuzige	er / Trevor	Buls		Job Site:	MN03					
Power:	120VAC/60Hz	<u>.</u>			Configuration:	MLTI0138-2					
TEST SPECIFICATIONS											
Specification:				Method:	nod:						
FCC 15.207:2020				ANSI C63.10:2	013						
TEST PARAME	TERS										
Run #: 9		Line:	High Line		Add. Ext. Attenuation (dE	dd. Ext. Attenuation (dB): 0					
COMMENTS											
None											
None EUT OPERATIN											
None		ower									
None EUT OPERATIN	channel Max Po		ARD								
None EUT OPERATIN Transmit Mode Mid	channel Max Po		ARD								



Peak Data - vs - Average Limit





RESULTS - Run #9

	Peak Da	Peak Data - vs - Quasi Peak Limit												
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)									
0.3	24.300	20.6	44.9	59.7	-14.8									
0.3	21.500	20.7	42.2	61.0	-18.8									
0.5	15.500	20.6	36.1	56.0	-19.9									
4.6	14.900	20.7	35.6	56.0	-20.4									
0.2	21.900	20.7	42.6	63.2	-20.6									
4.7	14.700	20.6	35.3	56.0	-20.7									
5.0	14.700	20.6	35.3	56.0	-20.7									
4.7	14.600	20.6	35.2	56.0	-20.8									
4.0	14.300	20.8	35.1	56.0	-20.9									
4.2	14.300	20.7	35.0	56.0	-21.0									
4.8	14.400	20.6	35.0	56.0	-21.0									
2.4	14.200	20.7	34.9	56.0	-21.1									
2.7	14.200	20.7	34.9	56.0	-21.1									
4.9	14.300	20.6	34.9	56.0	-21.1									
0.6	14.300	20.5	34.8	56.0	-21.2									
1.8	14.200	20.6	34.8	56.0	-21.2									
3.8	13.900	20.8	34.7	56.0	-21.3									
4.1	13.900	20.8	34.7	56.0	-21.3									
0.4	14.900	20.6	35.5	56.9	-21.4									
3.2	13.700	20.8	34.5	56.0	-21.5									
1.0	13.800	20.6	34.4	56.0	-21.6									
1.0	13.800	20.6	34.4	56.0	-21.6									
1.2	13.700	20.6	34.3	56.0	-21.7									
1.3	13.400	20.6	34.0	56.0	-22.0									
0.8	13.300	20.6	33.9	56.0	-22.1									

	Peak Data - vs - Average Limit											
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)							
0.3	24.300	20.6	44.9	49.7	-4.8							
0.3	21.500	20.7	42.2	51.0	-8.8							
0.5	15.500	20.6	36.1	46.0	-9.9							
4.6	14.900	20.7	35.6	46.0	-10.4							
0.2	21.900	20.7	42.6	53.2	-10.6							
4.7	14.700	20.6	35.3	46.0	-10.7							
5.0	14.700	20.6	35.3	46.0	-10.7							
4.7	14.600	20.6	35.2	46.0	-10.8							
4.0	14.300	20.8	35.1	46.0	-10.9							
4.2	14.300	20.7	35.0	46.0	-11.0							
4.8	14.400	20.6	35.0	46.0	-11.0							
2.4	14.200	20.7	34.9	46.0	-11.1							
2.7	14.200	20.7	34.9	46.0	-11.1							
4.9	14.300	20.6	34.9	46.0	-11.1							
0.6	14.300	20.5	34.8	46.0	-11.2							
1.8	14.200	20.6	34.8	46.0	-11.2							
3.8	13.900	20.8	34.7	46.0	-11.3							
4.1	13.900	20.8	34.7	46.0	-11.3							
0.4	14.900	20.6	35.5	46.9	-11.4							
3.2	13.700	20.8	34.5	46.0	-11.5							
1.0	13.800	20.6	34.4	46.0	-11.6							
1.0	13.800	20.6	34.4	46.0	-11.6							
1.2	13.700	20.6	34.3	46.0	-11.7							
1.3	13.400	20.6	34.0	46.0	-12.0							
0.8	13.300	20.6	33.9	46.0	-12.1							

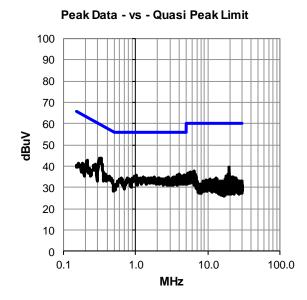
CONCLUSION

Pass

Trevor Buls Tested By



FUT.					Mark Orders						
EUT:	MTCAP2-915-	-042-POE			Work Order:	MLTI0138					
Serial Number:	20589952			Date:	2020-02-04						
Customer:	Multi-Tech Sys	stems, Ind	D.	Temperature:	22.3°C						
Attendees:	Jim Asp				Relative Humidity:	20.8%					
Customer Project:	None				Bar. Pressure:	1028 mb					
Tested By:	Glen Creuzige	er / Trevor	Buls		Job Site:	MN03					
Power:	120VAC/60Hz	<u>.</u>			Configuration:	MLTI0138-2					
TEST SPECIFICATIONS											
Specification:				Method:							
FCC 15.207:2020				ANSI C63.10:20	13						
TEST PARAMI	TERS										
Run #: 10		Line:	Neutral		dd. Ext. Attenuation (dB): 0						
COMMENTS											
COMMENTS None											
None EUT OPERATI											
None		ower									
None EUT OPERATI	d channel Max Po		ARD								
None EUT OPERATI Transmit Mode Mid	d channel Max Po		ARD								



100 90 80 70 60 dBuV 50 40 30 20 10

1.0

MHz

10.0

100.0

0

0.1

Peak Data - vs - Average Limit





RESULTS - Run #10

Peak Data - vs - Quasi Peak Limit												
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)							
0.3	23.200	20.6	43.8	59.7	-15.9							
4.0	15.400	20.8	36.2	56.0	-19.8							
0.3	20.200	20.7	40.9	61.0	-20.1							
0.2	22.200	20.7	42.9	63.1	-20.2							
4.7	15.100	20.7	35.8	56.0	-20.2							
4.7	15.200	20.6	35.8	56.0	-20.2							
1.0	15.100	20.6	35.7	56.0	-20.3							
3.7	14.800	20.8	35.6	56.0	-20.4							
4.2	14.800	20.7	35.5	56.0	-20.5							
5.0	14.900	20.6	35.5	56.0	-20.5							
19.6	18.200	21.1	39.3	60.0	-20.7							
4.1	14.400	20.8	35.2	56.0	-20.8							
4.4	14.500	20.7	35.2	56.0	-20.8							
4.2	14.400	20.7	35.1	56.0	-20.9							
4.3	14.400	20.7	35.1	56.0	-20.9							
4.5	14.400	20.7	35.1	56.0	-20.9							
1.8	14.400	20.6	35.0	56.0	-21.0							
1.3	14.300	20.6	34.9	56.0	-21.1							
2.9	14.200	20.7	34.9	56.0	-21.1							
3.4	14.100	20.8	34.9	56.0	-21.1							
3.3	13.700	20.8	34.5	56.0	-21.5							
2.7	13.700	20.7	34.4	56.0	-21.6							
3.2	13.600	20.8	34.4	56.0	-21.6							
0.6	13.700	20.6	34.3	56.0	-21.7							
0.8	13.600	20.6	34.2	56.0	-21.8							

Peak Data - vs - Average Limit												
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)							
0.3	23.200	20.6	43.8	49.7	-5.9							
4.0	15.400	20.8	36.2	46.0	-9.8							
0.3	20.200	20.7	40.9	51.0	-10.1							
0.2	22.200	20.7	42.9	53.1	-10.2							
4.7	15.100	20.7	35.8	46.0	-10.2							
4.7	15.200	20.6	35.8	46.0	-10.2							
1.0	15.100	20.6	35.7	46.0	-10.3							
3.7	14.800	20.8	35.6	46.0	-10.4							
4.2	14.800	20.7	35.5	46.0	-10.5							
5.0	14.900	20.6	35.5	46.0	-10.5							
19.6	18.200	21.1	39.3	50.0	-10.7							
4.1	14.400	20.8	35.2	46.0	-10.8							
4.4	14.500	20.7	35.2	46.0	-10.8							
4.2	14.400	20.7	35.1	46.0	-10.9							
4.3	14.400	20.7	35.1	46.0	-10.9							
4.5	14.400	20.7	35.1	46.0	-10.9							
1.8	14.400	20.6	35.0	46.0	-11.0							
1.3	14.300	20.6	34.9	46.0	-11.1							
2.9	14.200	20.7	34.9	46.0	-11.1							
3.4	14.100	20.8	34.9	46.0	-11.1							
3.3	13.700	20.8	34.5	46.0	-11.5							
2.7	13.700	20.7	34.4	46.0	-11.6							
3.2	13.600	20.8	34.4	46.0	-11.6							
0.6	13.700	20.6	34.3	46.0	-11.7							
0.8	13.600	20.6	34.2	46.0	-11.8							

CONCLUSION

Pass

Trevor Buls Tested By

SPURIOUS RADIATED EMISSIONS



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

MODES OF OPERATION

Transmitting LoRa - low channel (923.3 MHz), mid channel (925.1 MHz), and high channel (927.5 MHz); modulated, 500 kHz channel bandwidth.

POWER SETTINGS INVESTIGATED

54VDC via PoE

CONFIGURATIONS INVESTIGATED

MLTI0132 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency 30 MHz

Stop Frequency 12400 MHz

SAMPLE CALCULATIONS

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Filter - Low Pass	Micro-Tronics	LPM50004	LFK	17-Sep-2019	12 mo
Filter - High Pass	Micro-Tronics	HPM50108	LFM	12-Sep-2019	12 mo
Filter - Low Pass	Micro-Tronics	LPM50003	LFJ	17-Sep-2019	12 mo
Attenuator	Fairview Microwave	SA18E-10	TYA	17-Sep-2019	12 mo
Attenuator	Fairview Microwave	SA18E-20	TWZ	17-Sep-2019	12 mo
Filter - Band Pass/Notch	K&L Microwave	3TNF-500/1000-N/N	HGS	13-Jul-2019	12 mo
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	8-Mar-2019	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	8-Feb-2019	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	8-Feb-2019	12 mo
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	17-Sep-2019	12 mo
Antenna - Double Ridge	ETS-Lindgren	3115	AJQ	16-Jan-2019	24 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	18-Oct-2019	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	18-Oct-2019	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AYD	25-Jan-2018	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAX	5-Apr-2019	12 mo

MEASUREMENT BANDWIDTHS

Frequency Range	Peak Data	Quasi-Peak Data	Average Data
(MHz)	(kHz)	(kHz)	(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

SPURIOUS RADIATED EMISSIONS



PSA-ESCI 2019.05.10

TEST DESCRIPTION

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

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

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector PK = Peak Detector AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Measurements at the edges of the allowable band may be presented in an alternative method as provided for in the ANSI C63.10 Marker-Delta method. This method involves performing an in-band fundamental measurement followed by a screen capture of the fundamental and out-of-band emission using reduced measurement instrumentation bandwidths. The amplitude delta measured on this screen capture is applied to the fundamental emission value to show the out-of-band emission level as applied to the limit.

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(dc).

SPURIOUS RADIATED EMISSIONS



															EmiR5 2019.08.	15.1		PSA-ESC	CI 2019.05.10
		Corder:	М	LTI01					Date		c-2019		10	0 /	C)			
		Project:		None				T e	emperature	: 22.	6 °C	0	Un	str	mx	No	val	5	
		ob Site:		MN0					Humidity		5 RH					-(
S	Serial N	lumber:		06374				aron	netric Pres.	: 1015	mbar		Tes	ted by:	Dustin S	parks			
		EUT:	MTCAP	2-915	5-042	2-POE	=												
(Config	uration:	1																
	Cu	stomer:	Multi-Te	ech S	ysten	ns, In	c.												
	Att	endees:	Jim Asp)															
	EUT	Power:																	
On	eratin	g Mode:						anne	el (923.3 M⊦	lz), mid char	nel (925.1	MHz),	and high	channe	el (927.5	MHz); ı	modula	ated,	500
••	orating	g modo.	kHz cha	annel	band	lwidth	۱.												
	Dev	Deviations: None																	
	201																		
			Mix 15,	PA 3															
	Cor	nments:																	
Test S	Specifi	cations									Test Meth	nod							
	5.247:										ANSI C63		13						
Rı	un #	18	Test	Dista	ince	(m)		3	Antenn	a Height(s)		1 to	4(m)		Resul	ts	P	ass	
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
1846.583	45.0	-4.7	1.5	160.0	3.0	0.0	Vert	AV	0.0	40.3	54.0	-13.7	Low ch, EUT vert
1846.633	41.9	-4.7	1.5	117.0	3.0	0.0	Horz	AV	0.0	37.2	54.0	-16.8	Low ch, EUT horz
1846.600	41.6	-4.7	1.5	199.0	3.0	0.0	Horz	AV	0.0	36.9	54.0	-17.1	Low ch, EUT on side
4623.040	32.0	4.4	1.5	126.0	3.0	0.0	Horz	AV	0.0	36.4	54.0	-17.6	Low ch, EUT horz
4638.558	32.0	4.4	1.5	120.9	3.0	0.0	Horz	AV	0.0	36.4	54.0	-17.6	High ch, EUT horz
4626.710	31.9	4.4	1.58	267.0	3.0	0.0	Vert	AV	0.0	36.3	54.0	-17.7	Low ch, EUT vert
4625.567	31.9	4.4	1.5	138.8	3.0	0.0	Horz	AV	0.0	36.3	54.0	-17.7	Mid ch, EUT horz
4639.592	31.9	4.4	1.74	289.9	3.0	0.0	Vert	AV	0.0	36.3	54.0	-17.7	High ch, EUT vert
4626.925	31.8	4.4	1.5	245.0	3.0	0.0	Vert	AV	0.0	36.2	54.0	-17.8	Mid ch, EUT vert
1846.633	40.5	-4.7	1.5	192.0	3.0	0.0	Vert	AV	0.0	35.8	54.0	-18.2	Low ch, EUT horz
3692.820	32.7	1.1	3.36	245.0	3.0	0.0	Vert	AV	0.0	33.8	54.0	-20.2	Low ch, EUT vert
3694.990	32.6	1.1	1.5	26.0	3.0	0.0	Horz	AV	0.0	33.7	54.0	-20.3	Low ch, EUT horz
3698.100	32.6	1.1	1.5	2.9	3.0	0.0	Horz	AV	0.0	33.7	54.0	-20.3	Mid ch, EUT horz
3698.200	32.5	1.1	1.5	84.9	3.0	0.0	Vert	AV	0.0	33.6	54.0	-20.4	Mid ch, EUT vert
3711.833	32.4	1.0	1.44	237.9	3.0	0.0	Horz	AV	0.0	33.4	54.0	-20.6	High ch, EUT horz
3712.117	32.4	1.0	1.5	260.0	3.0	0.0	Vert	AV	0.0	33.4	54.0	-20.6	High ch, EUT vert
1846.542	37.1	-4.7	1.5	260.0	3.0	0.0	Horz	AV	0.0	32.4	54.0	-21.6	Low ch, EUT vert
1846.608	37.1	-4.7	1.5	246.9	3.0	0.0	Vert	AV	0.0	32.4	54.0	-21.6	Low ch, EUT on side

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2758.570	33.6	-2.9	1.5	283.9	3.0	0.0	Horz	AV	0.0	30.7	54.0	-23.3	Low ch, EUT horz
2762.570	33.6	-2.9	1.5	206.0	3.0	0.0	Vert	AV	0.0	30.7	54.0	-23.3	Low ch, EUT vert
2774.400	33.4	-2.7	1.5	16.0	3.0	0.0	Vert	AV	0.0	30.7	54.0	-23.3	Mid ch, EUT vert
2774.617	33.4	-2.7	1.5	358.0	3.0	0.0	Horz	AV	0.0	30.7	54.0	-23.3	Mid ch, EUT horz
2783.208	33.1	-2.7	1.5	160.1	3.0	0.0	Horz	AV	0.0	30.4	54.0	-23.6	High ch, EUT horz
2784.867	33.1	-2.7	1.5	103.9	3.0	0.0	Vert	AV	0.0	30.4	54.0	-23.6	High ch, EUT vert
4626.167	43.5	4.4	1.5	138.8	3.0	0.0	Horz	PK	0.0	47.9	74.0	-26.1	Mid ch, EUT horz
4635.192	43.3	4.4	1.74	289.9	3.0	0.0	Vert	PK	0.0	47.7	74.0	-26.3	High ch, EUT vert
4619.830	43.1	4.3	1.5	126.0	3.0	0.0	Horz	PK	0.0	47.4	74.0	-26.6	Low ch, EUT horz
4635.750	43.0	4.4	1.5	120.9	3.0	0.0	Horz	PK	0.0	47.4	74.0	-26.6	High ch, EUT horz
4610.120	42.6	4.3	1.58	267.0	3.0	0.0	Vert	PK	0.0	46.9	74.0	-27.1	Low ch, EUT vert
4625.183	42.5	4.4	1.5	245.0	3.0	0.0	Vert	PK	0.0	46.9	74.0	-27.1	Mid ch, EUT vert
3700.525	44.4	1.0	1.5	2.9	3.0	0.0	Horz	PK	0.0	45.4	74.0	-28.6	Mid ch, EUT horz
1846.658	49.7	-4.7	1.5	160.0	3.0	0.0	Vert	PK	0.0	45.0	74.0	-29.0	Low ch, EUT vert
3711.467	44.0	1.0	1.5	260.0	3.0	0.0	Vert	PK	0.0	45.0	74.0	-29.0	High ch, EUT vert
3704.820	43.7	1.0	1.5	26.0	3.0	0.0	Horz	PK	0.0	44.7	74.0	-29.3	Low ch, EUT horz
3701.370	43.4	1.0	3.36	245.0	3.0	0.0	Vert	PK	0.0	44.4	74.0	-29.6	Low ch, EUT vert
3700.817	43.2	1.0	1.5	84.9	3.0	0.0	Vert	PK	0.0	44.2	74.0	-29.8	Mid ch, EUT vert
3710.217	42.8	1.0	1.44	237.9	3.0	0.0	Horz	PK	0.0	43.8	74.0	-30.2	High ch, EUT horz
1846.392	47.9	-4.7	1.5	199.0	3.0	0.0	Horz	PK	0.0	43.2	74.0	-30.8	Low ch, EUT on side
1846.750	47.6	-4.6	1.5	117.0	3.0	0.0	Horz	PK	0.0	43.0	74.0	-31.0	Low ch, EUT horz
2767.320	45.6	-2.9	1.5	206.0	3.0	0.0	Vert	PK	0.0	42.7	74.0	-31.3	Low ch, EUT vert
1846.675	47.3	-4.7	1.5	192.0	3.0	0.0	Vert	PK	0.0	42.6	74.0	-31.4	Low ch, EUT horz
2758.820	44.8	-2.9	1.5	283.9	3.0	0.0	Horz	PK	0.0	41.9	74.0	-32.1	Low ch, EUT horz
2784.075	44.5	-2.7	1.5	160.1	3.0	0.0	Horz	PK	0.0	41.8	74.0	-32.2	High ch, EUT horz
2783.675	44.5	-2.7	1.5	103.9	3.0	0.0	Vert	PK	0.0	41.8	74.0	-32.2	High ch, EUT vert
2773.958	44.4	-2.7	1.5	16.0	3.0	0.0	Vert	PK	0.0	41.7	74.0	-32.3	Mid ch, EUT vert
1846.733	46.3	-4.7	1.5	246.9	3.0	0.0	Vert	PK	0.0	41.6	74.0	-32.4	Low ch, EUT on side
2773.175	44.1	-2.7	1.5	358.0	3.0	0.0	Horz	PK	0.0	41.4	74.0	-32.6	Mid ch, EUT horz
1846.383	45.6	-4.7	1.5	260.0	3.0	0.0	Horz	PK	0.0	40.9	74.0	-33.1	Low ch, EUT vert

DUTY CYCLE



TEST DESCRIPTION

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

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

The EUT operates at 100% Duty Cycle.



XMit 2019.09.05

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	N5182B	TFX	22-Oct-18	22-Oct-21
Cable	Micro-Coax	D150A-1-0720-200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20

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. The sweep time was set to an appropriate value for the number of points required for RMS measurements. The RBW was set greater than the emissions bandwidth of the EUT, so neither the channel power function nor the integration method were needed. 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.



EUT: MT	TCAP2-915-042-POE					Work Order:	MLTI0132	
Serial Number: 20							27-Dec-19	
Customer: Mu	ulti-Tech Systems, Inc.					Temperature:	22.3 °C	
Attendees: Jin						Humidity:		
Project: No						Barometric Pres.:		
Tested by: Du	ustin Sparks		Power: 54	VDC via PoE		Job Site:	MN08	
TEST SPECIFICATION	1S		Te	st Method				
FCC 15.247:2019			AN	ISI C63.10:2013				
COMMENTS								
	t on spectrum analyzer inclu	udes measurement cable, DC bl	lock, and 20 dB attenuat	or.				
Reference level offset		udes measurement cable, DC bl	lock, and 20 dB attenuat	or.				
		ides measurement cable, DC bl	lock, and 20 dB attenual	or.				
Reference level offset DEVIATIONS FROM TE None		udes measurement cable, DC bl	lock, and 20 dB attenuat					
Reference level offset DEVIATIONS FROM TE None		~	6		Avg Cond	Duty Cycle	Limit	
Reference level offset DEVIATIONS FROM TE lone		~	6		Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Limit (dBm)	Results
Reference level offset DEVIATIONS FROM TE lone Configuration #	EST STANDARD	~	6					Results Pass
Reference level offset	EST STANDARD 1 23.3 MHz)	~	6		Pwr (dBm)		(dBm)	



		Loi	Ra, Low Channel (923			
			Avg Cond	Duty Cycle	Limit	
			Pwr (dBm)	Factor (dB)	(dBm)	Results
			27.769	0	30	Pass
	trum Analyzer - Element Materials Te	echnology				
LXI RL	RF 50 Ω DC		SENSE:INT	ALIGN OFF #Avg Type:	DMS	04:28:38 AM Dec 28, 2019
		PNO: Fast	🔔 Trig: Free Run	Avg Hold: 1	00/100	TRACE 1 2 3 4 5 TYPE A WWWW DET A A A A A A
		IFGain:Low	#Atten: 20 dB			
	Ref Offset 20.68 dB				Mk	r1 923.271 MHz
5 dB/div Log	Ref 30.68 dBm					27.769 dBm
			<u></u> 1			
05.7						
25.7						
	and the second se					
20.7						
15.7						
10.7						
5.68						
0.680						
-4.32						
-9.32						
-14.3						
Center 923						Span 2.500 MHz
#Res BW 1	.5 MHz	#\	/BW 5.0 MHz*		#Sweep	601.0 ms (601 pts
MSG				STATUS		
		Lol	Ra, Mid Channel (925			
			Avg Cond	Duty Cycle	Limit	
			Pwr (dBm) 27.754	Factor (dB) 0	(dBm) 30	Results Pass

		Avg Cond	Duty Cycle	Limit	
		Pwr (dBm)	Factor (dB)	(dBm)	Results
		27.754	0	30	Pass

RL RF 50 Ω DC	SENSE:INT	ALIGN OFF	04:13:25 AM Dec 28, 201
	PNO: Fast Trig: Free Run IFGain:Low #Atten: 20 dB	#Avg Type: RMS	TRACE 1 2 3 4 5 TYPE A WWW DET A A A A A
Ref Offset 20.68 dB dB/div Ref 30.68 dBm			Mkr1 925.071 MH 27.754 dBr
	↓1 ↓1		
25.7			
20.7			
5.7			
68			
80			
32			
32			
4.3			
enter 925.100 MHz	#\/DW/ 5 0 MU-*		Span 2.500 MH weep 601.0 ms (601 pt
Res BW 1.5 MHz	#VBW 5.0 MHz*	#5	weep out o ms (out pr



		Avg Cond	Duty Cycle	Limit	
		Pwr (dBm)	Factor (dB)	(dBm)	Results
		27.402	0	30	Pass
🎉 Keysight Spectrum Analyzer - Element Mater	ials Technology				
KA RL RF 50Ω DC		ENSE:INT	ALIGN OFF		04:22:59 AM Dec 28, 2019
		T	#Avg Type	RMS	TRACE 1 2 3 4 5 TYPE A WWWW DET A A A A A A
	PNO: Fast ++- IFGain:Low	Trig: Free Run #Atten: 20 dB	Avg Hold:	100/100	DET A A A A A
	in our incom			ML	r1 927.492 MHz
5 dB/div Ref 30.68 dB					27.402 dBm
Log		4.4			
		1			
25.7					
20.7					
15.7					
10.7					
10.1					
5.68					
5.00					
0.680					
0.000					
-4.32					
-4.32					
-9.32					
-9.32					
44.0					
-14.3					
Center 927.500 MHz					Span 2.500 MHz
#Res BW 1.0 MHz	#VBV	V 3.0 MHz*		#Sweep	Span 2.500 MHz 601.0 ms (601 pts



XMit 2019.09.05

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	N5182B	TFX	22-Oct-18	22-Oct-21
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20

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.



EUT: M	TCAP2-915-042-POE					Work Order:	MLTI0132	
Serial Number: 20	637489					Date:	27-Dec-19	
Customer: M	ulti-Tech Systems, Inc.					Temperature:	22.4 °C	
Attendees: Ji						Humidity:	26.1% RH	
Project: No	one					Barometric Pres.:	1026 mbar	
Tested by: Du	ustin Sparks		Power: 54VDC via Po			Job Site:	MN08	
EST SPECIFICATION	15		Test Method					
CC 15.247:2019			ANSI C63.10:2	013				
COMMENTS Reference level offset	on spectrum analyzer include	s measurement cable, DC	block, and 20 dB attenuator.					
Reference level offset		s measurement cable, DC	block, and 20 dB attenuator.					
		s measurement cable, DC	block, and 20 dB attenuator.					
Reference level offset		s measurement cable, DC	block, and 20 dB attenuator.	<u>}</u>				
Reference level offset		c	6	Duty Cycle	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Results
Reference level offset	EST STANDARD	c	Sustingord Avg Conc	Duty Cycle				Results Pass
Reference level offset	EST STANDARD 1 23.3 MHz)	c	Susting part Avg Conc Pwr (dBm	Duty Cycle Factor (dB)	Gain (dBi)	(dBm)	(dBm)	



Avg Cond Per (dB) Duty Cycle Pet (dB) Antenna (dB) EIRP (dB) Limit (dB) Testistic (dB) 27.769 0 3 30.8 36 Pass Image: Section Analysis & Bowel Materials Technology Cold all Min OF Cold All Min OF<				ow Channel (923			
Z7.769 0 3 30.8 36 Pass In Forder Spectrum Analyse - Element Material Technology In Control (Control (Contro) (Control (Contro) (Control (C							
Englight Spetcham Analyzer - Bennert Materials Technology Control Auton coling Photo Float Auton coling Photo Float	· · · · · · · · · · · · · · · · · · ·						
ALL IP Solution Outcome Outcom		27.769	0	3	30.8	36	Pass
AL IP Sold DC Selection Autonom OH2888 Addres 2019 FOOT Fast (FGall.cow) Trig: Free Run (FGall.cow) Trig: Free Run Artim: 20 B Autonom OH2888 Addres 2019 Control Ref Offeet 20.88 dB Mkr1 923.271 MHz Z7.769 dBm Control Autonom Span 2.500 MHz Z7.769 dBm Control Autonom Span 2.500 MHz Span 2.500 MHz Center 923.300 MHz #VEW 5.0 MHz* #Span 2.500 MHz #Res BW 1.5 MHz #VEW 5.0 MHz* #Span 2.500 MHz #Res BW 1.5 MHz #VEW 5.0 MHz* #Span 2.500 MHz #Res BW 1.5 MHz #VEW 5.0 MHz* #Span 2.500 MHz #Res BW 1.5 MHz #VEW 5.0 MHz* #Span 2.500 MHz #Res BW 1.5 MHz #VEW 5.0 MHz* #Span 2.500 MHz #Res BW 1.5 MHz #VEW 5.0 MHz* #Span 2.500 MHz #Res BW 1.5 MHz #VEW 5.0 MHz* #Span 2.500 MHz #Res BW 1.5 MHz #VEW 5.0 MHz* #Span 2.500 MHz #Res BW 1.5 MHz #VEW 5.0 MHz* #Span 2.500 MHz #Res BW 1.5 MHz Trig: Free Run Arginioi: 100100	Kevsight Spectrum Analyzer	- Element Materials Tech	noloav	lon den sjon den sjon den			
Ever Onfreet 20.68 dB Mkr1 923.271 MHz 27.769 dBm 6 dB/dt 27.769 dBm 207 0 107 0 108 0 107 0 108 0 109 0 101 0 102 0 103 0 104 0 105 0 107 0 108 0 109 0 101 0 102 0 103 0 104 0 105 0 106 0 107 0 108 0 109 0 100 0 101 0 102 0 103 0 104 0 105 0 105 0 106 0 107 <t< td=""><td></td><td></td><td></td><td>NSE:INT</td><td></td><td>⇒ PMS</td><td>04-00-00 4440 00 0010</td></t<>				NSE:INT		⇒ PMS	04-00-00 4440 00 0010
Ever Onfreet 20.68 dB Mkr1 923.271 MHz 27.769 dBm 27.769 dBm 27.769 dBm 1 167 1 167 1 168 1 169 1 169 1 161 1 162 1 163 1 164 1 165 1 163 1 164 1 165 1 164 1 165 1 165 1 164 1 165 1 165 1 165 1 165 1 165 1 165 1 166 1			PNO: Fast	Trig: Free Run	Avg Hold:	100/100	
6 dB/dv Ref 30.68 dBm 27.769 dBm 6 dB/dv Ref 30.68 dBm 1 6 dB/dv 1 1 6 dB/dv 1 1 6 dB/dv 1 1 6 dB/dv 1 1 16 dV 1 1 17 dV 1 1 18 dV 1 1			IFGain:Low	#Atten: 20 dB		Mk	
LoRa, Mid Channel (925.1 MHz) Center 923.300 MHz #Res BW 1.5 MHz Mrc 1923.300 MHz #Res BW 1.5 MHz PWr (dBm) PWr (dB	5 dB/div Ref 30.6	20.68 dB 8 dBm					27.769 dBm
207 107 <td>Log</td> <td></td> <td></td> <td>↓1</td> <td></td> <td></td> <td></td>	Log			↓ 1			
Instrument Span 2.500 MHz 4.2	25.7						
Instrument Span 2.500 MHz 4.2							
107 563 633 633 4.32 932 932 932 933 932 934 932 935 932 936 932 937 933 938 932 939 932 932 933 933 934 934 935 Center 923.300 MHz Span 2.500 MHz #VBW 5.0 MHz* #VBW 5.0 MHz* #Sweep 601.0 ms (601 pts) Veso Status LoRa, Mid Channel (925.1 MHz) Veso Autenna EIRP Limit Avg Cond Duty Cycle Antenna EIRP LoRa, Mid Channel (925.1 MHz) Veso 27.754 0 3 3 30.8 36 Pass PNC: Fast Trig: Free Run #Avg Type: RNS AvgHold: 100/100 Ref 30.68 dBm 27.754 dBm 27.754 dBm 27.754 dBm 27.754 dBm	20.7						
107 563 633 633 4.32 932 932 932 933 932 934 932 935 932 936 932 937 933 938 932 939 932 932 933 933 934 934 935 Center 923.300 MHz Span 2.500 MHz #VBW 5.0 MHz* #VBW 5.0 MHz* #Sweep 601.0 ms (601 pts) Veso Status LoRa, Mid Channel (925.1 MHz) Veso Autenna EIRP Limit Avg Cond Duty Cycle Antenna EIRP LoRa, Mid Channel (925.1 MHz) Veso 27.754 0 3 3 30.8 36 Pass PNC: Fast Trig: Free Run #Avg Type: RNS AvgHold: 100/100 Ref 30.68 dBm 27.754 dBm 27.754 dBm 27.754 dBm 27.754 dBm	15.7						
5:88 Image: Second control of the second control							
Center 923.300 MHz #Res BW 1.5 MHz #Res BW 1.5 MHz #Res BW 1.5 MHz #Res BW 1.5 MHz #Sweep 601.0 ms (601 pts) MsG Center 923.300 MHz #Res BW 1.5 MHz #Sweep 601.0 ms (601 pts) MsG Center 923.300 MHz #Res BW 1.5 MHz #Sweep 601.0 ms (601 pts) MsG Center 923.300 MHz #Res BW 1.5 MHz Pwr (dBm) Factor (dB) Can (dBi) Can (d	10.7						
Center 923.300 MHz #Res BW 1.5 MHz #Res BW 1.5 MHz #Res BW 1.5 MHz #Sweep 601.0 ms (601 pts) MsG Center 923.300 MHz #Res BW 1.5 MHz #VBW 5.0 MHz* #Sweep 601.0 ms (601 pts) MsG Center 923.300 MHz #Sweep 601.0 ms (601 pts) MsG Center 923.300 MHz #Res BW 1.5 MHz PWr (dBm) Factor (dB) Cain (dBi) Cain	5.68						
4.32 9.33 3.0.8 3.6 9.32 9.32 9.32 9.32 9.32 9.32 9.32 9.32 9.33 3.0.8 3.6 9.32 9.32 9.33 3.0.8 3.6 9.32 9.32 9.32 9.32 9.32 9.32 9.32 9.32 9.32 9.32 9.32 9.32 9.32 9.32	3.00						
9.32	0.680						
9.32	4 22						
-14.3 Center 923.300 MHz Span 2.500 MHz #Res BW 1.5 MHz #VEW 5.0 MHz* #Sweep 601.0 ms (601 pts) MSG Istatus LoRa, Mid Channel (925.1 MHz) LoRa, Mid Channel (925.1 MHz) Avg Cond Duty Cycle Attenna EIRP Limit (dBm) Results 27.754 27.754 0 3 30.8 36 Pass PWr (dBm) Factor (dB) Gain (dBi) (dBm) RE 50.9 PNO: Fast Trig: Free Run #Avg Type: RMS Trace Avg Hold: 100/100 Trace PNO: Fast Trig: Free Run #Avg Type: RMS Trace Avg Hold: 100/100 Trace PNO: Fast Trig: Free Run #Avg Type: RMS Avg Hold: 100/100 Trace 27.754 B Status Avg Hold: 100/100 Trace Trace 27.754 Avg 30.68 dBm 27.754 GBm <t< td=""><td>-4.32</td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	-4.32						
Center 923.300 MHz #Res BW 1.5 MHz MSG Center 923.300 MHz #Sweep 601.0 ms (601 pts) MSG Center 923.300 MHz #Sweep 601.0 ms (601 pts) Status CLORa, Mid Channel (925.1 MHz) CLORa, Mid Chan	-9.32						
Center 923.300 MHz #Res BW 1.5 MHz MSG Center 923.300 MHz #Sweep 601.0 ms (601 pts) MSG Center 923.300 MHz #Sweep 601.0 ms (601 pts) Status CLORa, Mid Channel (925.1 MHz) CLORa, Mid Chan							
#Res BW 1.5 MHz #VBW 5.0 MHz* #Sweep 601.0 ms (601 pts) MsG STATUS LoRa, Mid Channel (925.1 MHz) Avg Cond Duty Cycle Antenna EIRP Limit Pwr (dBm) Factor (dB Gain (dBi) (dBm) Results 27.754 0 3 30.8 36 Pass Msg Ref S0.0 DC SENSE:INT ALIGN OFF 04:3125 Allow 258,2019 MRL RF S0.0 DC SENSE:INT ALIGN OFF 04:3125 Allow 258,2019 Msg TRACE Bass Mkr1 925.07.1 MHz Trace Ref Offset 20.68 dB Mkr1 925.07.1 MHz 27.754 dBm So dB/div Ref 30.68 dBm 27.754 dBm So dB/div Ref 30.68 dBm 27.754 dBm	-14.3						
#Res BW 1.5 MHz #VBW 5.0 MHz* #Sweep 601.0 ms (601 pts) MsG STATUS LoRa, Mid Channel (925.1 MHz) Avg Cond Duty Cycle Antenna EIRP Limit Pwr (dBm) Factor (dB Gain (dBi) (dBm) Results 27.754 0 3 30.8 36 Pass Msg Ref S0.0 DC SENSE:INT ALIGN OFF 04:3125 Allow 258,2019 MRL RF S0.0 DC SENSE:INT ALIGN OFF 04:3125 Allow 258,2019 Msg TRACE Bass Mkr1 925.07.1 MHz Trace Ref Offset 20.68 dB Mkr1 925.07.1 MHz 27.754 dBm So dB/div Ref 30.68 dBm 27.754 dBm So dB/div Ref 30.68 dBm 27.754 dBm	Contor 022 200 MH						Spap 2 500 MHz
LoRa, Mid Channel (925.1 MHz) Avg Cond Duty Cycle Antenna EIRP Limit Pwr (dBm) Factor (dB) Gain (dBi) (dBm) Results 27.754 0 3 30.8 36 Pass Image: Sevential Sector (dB) Sevential Sector (dB) Gain (dBi) (dBm) Results PRO: Fast F Sevential Sector (dB) Sevential Sector (dB) Sevential Sector (dB) Sevential Sector (dB) PNO: Fast FG Offset 20.68 dB Mkr1 925.071 MHz Tree Run ArgiHold: 100/100 Tree Run ArgiHold: 100/		~	#VBW	5.0 MHz*		#Sweep	601.0 ms (601 pts)
Avg Cond Pwr (dBm) Duty Cycle Factor (dB) Antenna Gain (dBi) EIRP (dBm) Limit (dBm) 27.754 0 3 30.8 36 27.754 0 3 30.8 36 Market Spectrum Analyzer - Element Materials Technology Image: Color of the second se	MSG				STATUS		
Avg Cond Pwr (dBm) Duty Cycle Factor (dB) Antenna Gain (dBi) EIRP (dBm) Limit (dBm) 27.754 0 3 30.8 36 27.754 0 3 30.8 36 Pass 8 9 Pho: Fast - - PNO: Fast - Trig: Free Run IFGain:Low #Augn OFF 04:13:25 AMDec 28, 2019 PNO: Fast - Trig: Free Run IFGain:Low #Augn OFF 04:13:25 AMDec 28, 2019 Nkr1 925.071 MHz 27.754 dBm - Trig: Tree Run IFGain:Low #AvgIHold: 100/100 0 0 0 0 0 10 0 0 0 0			LoRa M	lid Channel (925	1 MHz)		
27.754 0 3 30.8 36 Pass Keysight Spectrum Analyzer - Element Materials Technology ALIGN OFF 04:13:25 AMDec 28:2019 RL RF 50 Ω DC SENSE:INT ALIGN OFF 04:13:25 AMDec 28:2019 PNO: Fast Trig: Free Run IFGain:Low Trig: Free Run #Atten: 20 dB Mkr1 925:071 MHz 27.754 dBm S dB/div Ref 30.68 dB Mkr1 925:071 MHz 27.754 dBm 15.7 0 0 0		Avg Cond				Limit	
Keysight Spectrum Analyzer - Element Materials Technology Comparison Outside Case 2019 W RL RF 50 Ω DC SENSE:INT CallGN OFF 04:13:25 AMDec 28, 2019 PNO: Fast → Trig: Free Run IFGain:Low Trig: Free Run #Atten: 20 dB Mkr1 925.071 MHz 27.754 dBm S dB/div Ref 30.68 dB 27.754 dBm 27.754 dBm 15.7 Image: State S	· · · · · · · · · · · · · · · · · · ·						
M RL RF 50 Ω DC SENSE:INT AALIGN OFF 04:13:25 ANDec 28:2019 PNO: Fast Trig: Free Run IFGain:Low Trig: Free Run #Atten: 20 dB #Avg Hoid: 100/100 Trace 23:3:43 or DET DET AAAAAA Ref Offset 20.68 dB	<u>l</u>	27.754	0	3	30.8	36	Pass
PNO: Fast \rightarrow Trig: Free Run IFGain:Low #Atten: 20 dB Ref Offset 20.68 dB S dB/div Ref 30.68 dBm 25.7 15.7 Trig: Free Run #Atten: 20 dB Trig: Free	Keysight Spectrum Analyzer	- Element Materials Tech	nology				
Ref Offset 20.68 dB Mkr1 925.071 MHz 27.754 dBm 26 dB/div Ref 30.68 dB	KI RF 5	0 Ω DC	SEI		#Avg Type	e: RMS	04:13:25 AM Dec 28, 2019 TRACE 1 2 3 4 5 6
Ref 00ffset 20.68 dB Ref 30.68 dBm 257 207 157			PNO: Fast ↔→ IFGain:Low	Trig: Free Run #Atten: 20 dB	Avg Hold:	100/100	DET A A A A A A
	Ref Offset	20.68 dB				Mk	r1 925.071 MHz
	5 dB/div Ref 30.6	8 dBm				1	27.754 dBm
20.7							
15.7	Log						
15.7							
	25.7						
40.7	25.7						
	25.7						

MSG		STATUS			and the second
Center 925.100 MHz #Res BW 1.5 MHz	#VBW 5.0 MHz*		#Swee	Span ep 601.0 m	2.500 MH ns (601 pt
-14.3					
-9.32					
-4.32					
0.680					

lz S)



	LoRa, H	ligh Channel (927	.5 MHz)		
Avg Cor Pwr (dB		Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Results
27.402		3	30.4	36	Pass
211102	Ŭ,	Ŭ	0011		1 400
🚺 Keysight Spectrum Analyzer - Element Materia	ls Technology				
[XI RL RF 50 Ω DC		NSE:INT	ALIGN OFF		04:22:59 AM Dec 28, 2019
	PNO: Fast +++ IFGain:Low	Trig: Free Run #Atten: 20 dB	#Avg Type Avg Hold:	e: RMS 100/100	TRACE 1 2 3 4 5 TYPE A WWWW DET A A A A A A
Ref Offset 20.68 dB 5 dB/div Ref 30.68 dBm				Mk	r1 927.492 MHz 27.402 dBm
		1			
20.7					
15.7					
10.7					
5.68					
0.680					
-4.32					
-9.32					
-14.3					
Center 927.500 MHz					Span 2 500 MHz
#Res BW 1.0 MHz	#VBW	3.0 MHz*		#Sweep	Span 2.500 MHz 601.0 ms (601 pts

BAND EDGE COMPLIANCE



XMit 2019.09.05

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	N5182B	TFX	22-Oct-18	22-Oct-21
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20

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

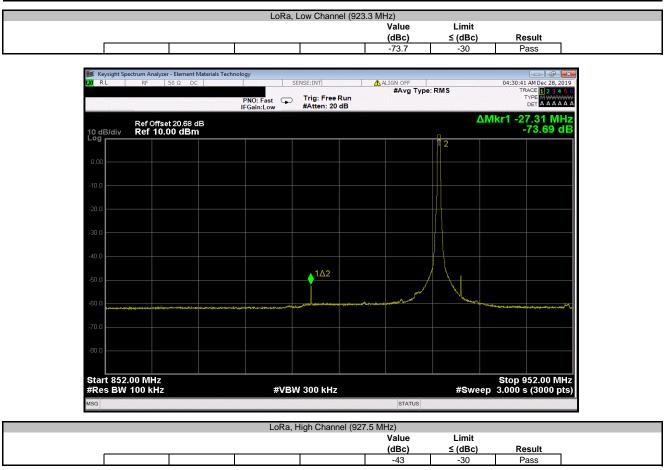


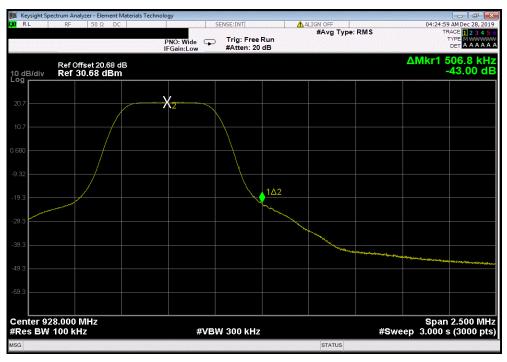
		TbtTx 2019.08.30.0	XMit 2019.09.05				
EUT: MTCAP2-915-042-POE	Work Order:	MLTI0132					
Serial Number: 20637489	Date:	27-Dec-19					
Customer: Multi-Tech Systems, Inc.	Temperature:	22.3 °C					
Attendees: Jim Asp	Humidity:	25.6% RH					
Project: None	Barometric Pres.:	1026 mbar					
Tested by: Dustin Sparks Power: 54VDC via PoE	Job Site:	MN08					
TEST SPECIFICATIONS Test Method							
FCC 15.247:2019 ANSI C63.10:2013							
COMMENTS							
Reference level offset on spectrum analyzer includes measurement cable, DC block, and 20 dB attenuator.							
DEVIATIONS FROM TEST STANDARD							
None							
Configuration # 1 Signature							
	Value	Limit					
	(dBc)	≤ (dBc)	Result				
LoRa, Low Channel (923.3 MHz)	-73.7	-30	Pass				
LoRa, High Channel (927.5 MHz)	-43	-30	Pass				

Report No. MLTI0132.1 Rev. 2

BAND EDGE COMPLIANCE









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	N5182B	TFX	22-Oct-18	22-Oct-21
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The EUT was set to the channels and modes listed in the datasheet.

The 6dB occupied bandwidth was measured using 100 kHz resolution bandwidth and 300 kHz video bandwidth. The 99.0% occupied bandwidth was also measured at the same time which can be needed during Output Power depending on the applicable method.

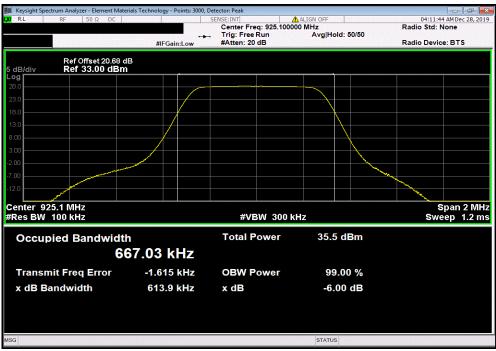


OMMENTS eference level offset on spectrum analyzer includes measurement cable, DC block, and 20 dB attenuator. EVIATIONS FROM TEST STANDARD one						TbtTx 2019.08.30.0	XMit 2019.0
Customer: Multi-Tech Systems, Inc. Temperature: 22.3 °C Attendees: Jim Asp Humidity: 25.6% RH Project: None Barometric Press: 102 Bite: Tested by: Dustin Sparks Power: 54VDC via PoE Job Site: MN08 EST SPECIFICATIONS Test Method Test Mode CC 15.247:2013 Generative: Gener							
Attendees: Jim Asp Humidity: 25.6% RH Project: None Barometric Pres.: 1026 mbar Tested by: Dustin Sparks Job Site: MN08 EST SPECIFICATIONS Test Method Job Site: MN08 CC 15.247:2019 ANSI C63.10:2013	Serial Number: 20	0637489			Date:	27-Dec-19	
Project: None Barometric Pres:: 1026 mbar Tested by: Dustin Sparks Job Site: MN08 EST SPECIFICATIONS Test Method Job Site: MN08 CC 15.247:2019 ANSI C63.10:2013 Image: Stand Sta	Customer: M	ulti-Tech Systems, Inc.			Temperature:	22.3 °C	
Tested by: Dower: 54VDC via PoE Job Site: IMN08 EST SPECIFICATIONS Test Method CC 15.247:2019 ANSI C63.10:2013 OMMENTS eference level offset on spectrum analyzer includes measurement cable, DC block, and 20 dB attenuator. EVIATIONS FROM TEST STANDARD one Oniguration # Jand Signature Value Value Value Value OK Hz Signature							
Test Method CC 15.247:2019 ANSI C63.10:2013 OMMENTS eference level offset on spectrum analyzer includes measurement cable, DC block, and 20 dB attenuator. EVIATIONS FROM TEST STANDARD one Oning Junt Colspan="2">Limit Signature Limit Value (>) Result oRa, Low Channel (923.3 MHz) oRa, Low Channel (923.3 MHz) 616.065 kHz 500 kHz Pass oRa, Mid Channel (925.1 MHz) 613.852 kHz 500 kHz Pass							
ANSI C63.10:2013 OMMENTS eference level offset on spectrum analyzer includes measurement cable, DC block, and 20 dB attenuator. EVIATIONS FROM TEST STANDARD one Onfiguration # 1 Signature Limit oRa, Low Channel (923.3 MHz) oRa, Low Channel (923.3 MHz) 616.065 kHz 500 kHz Pass oRa, Mid Channel (925.1 MHz) 613.852 kHz	Tested by: D	ustin Sparks		Power: 54VDC via PoE	Job Site:	MN08	
OMMENTS eference level offset on spectrum analyzer includes measurement cable, DC block, and 20 dB attenuator. EVIATIONS FROM TEST STANDARD one onfiguration # 1 Signature Limit Value (>) Result origunation # 1 Signature Limit Value (>) Result ORa, Low Channel (923.3 MHz) G13.625 kHz 500 kHz Paga, Mid Channel (925.1 MHz)	EST SPECIFICATION	15		Test Method			
eference level offset on spectrum analyzer includes measurement cable, DC block, and 20 dB attenuator. EVIATIONS FROM TEST STANDARD one One Signature Limit Value Limit orga, Low Channel (923.3 MHz) 616.065 kHz 500 kHz Pass officient colspan="2">Signature Value Limit Signature Limit oRa, Low Channel (923.3 MHz) 616.065 kHz 500 kHz Pass oRa, Mid Channel (925.1 MHz) 613.862 kHz 500 kHz Pass	CC 15.247:2019			ANSI C63.10:2013			
eference level offset on spectrum analyzer includes measurement cable, DC block, and 20 dB attenuator. EVIATIONS FROM TEST STANDARD one One Signature Limit Value Limit orga, Low Channel (923.3 MHz) 616.065 kHz 500 kHz Pass officient colspan="2">Signature Value Limit Signature Limit oRa, Low Channel (923.3 MHz) 616.065 kHz 500 kHz Pass oRa, Mid Channel (925.1 MHz) 613.862 kHz 500 kHz Pass							
eference level offset on spectrum analyzer includes measurement cable, DC block, and 20 dB attenuator. EVIATIONS FROM TEST STANDARD one One Signature Limit Value Limit orga, Low Channel (923.3 MHz) 616.065 kHz 500 kHz Pass officient colspan="2">Signature Value Limit Signature Limit oRa, Low Channel (923.3 MHz) 616.065 kHz 500 kHz Pass oRa, Mid Channel (925.1 MHz) 613.862 kHz 500 kHz Pass	COMMENTS						
Image: signature Limit Limit Result Signature Value (>) Result SRa, Low Channel (923.3 MHz) 616.065 kHz 500 kHz Pass SRa, Mid Channel (925.1 MHz) 613.852 kHz 500 kHz Pass	DEVIATIONS FROM T	EST STANDARD					
Signature Limit Value (>) Result pRa, Low Channel (923.3 MHz) 616.065 kHz 500 kHz Pass pRa, Mid Channel (925.1 MHz) 613.852 kHz 500 kHz Pass	lone						
Value (>) Result pRa, Low Channel (923.3 MHz) 616.065 kHz 500 kHz Pass pRa, Mid Channel (925.1 MHz) 613.852 kHz 500 kHz Pass	Configuration #	1	Signature	Justin Sparts			
opa, Low Channel (923.3 MHz) 616.065 kHz 500 kHz Pass opa, Mid Channel (925.1 MHz) 613.852 kHz 500 kHz Pass						Limit	
pRa, Mid Channel (925.1 MHz) 613.852 kHz 500 kHz Pass					Value	(>)	Result
		2 2 MU-)					
NPa High Channel (927 5 MHz) 607 191 kHz 500 kHz Pass	oRa, Low Channel (92	23.3 10172)			616.065 kHz	500 kHz	
JNA, HIGH UNAHING (327.3 WHZ) 007.101 KHZ 500 KHZ Fd55							Pass

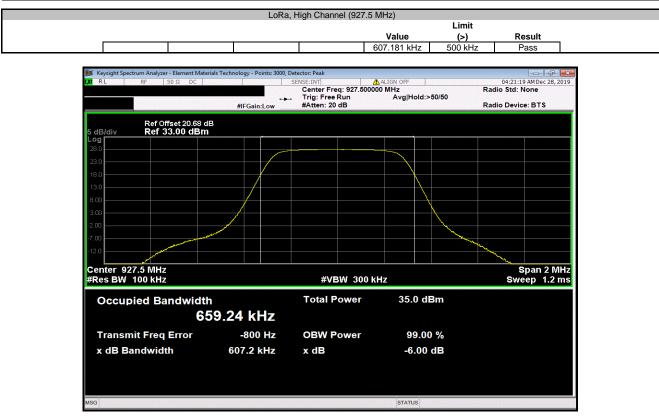
Report No. MLTI0132.1 Rev. 2













XMit 2019.09.05

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	N5182B	TFX	22-Oct-18	22-Oct-21
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20

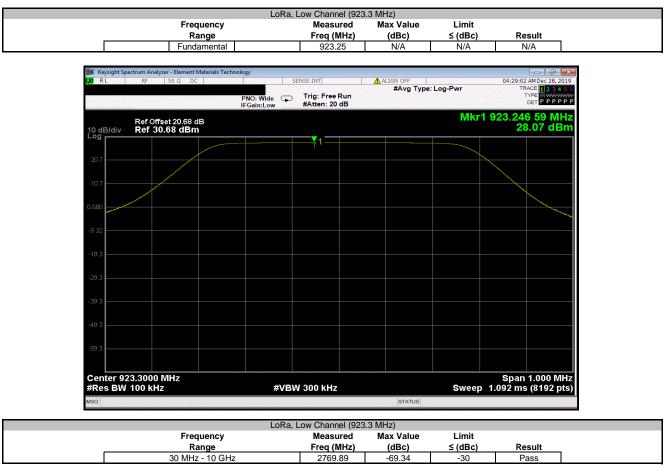
TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting at the data rate(s) listed in the datasheet. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.



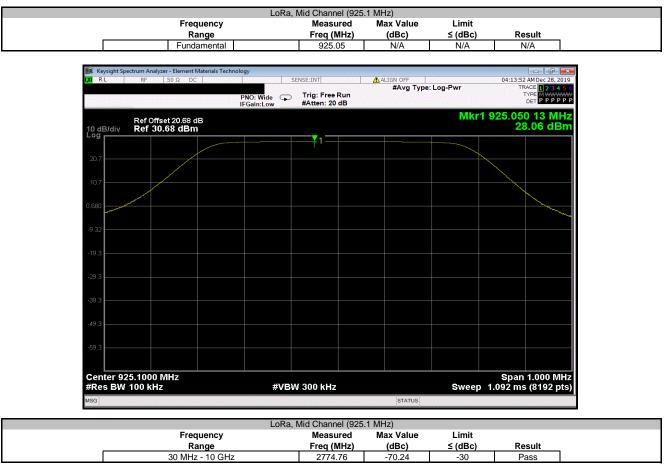
EUT: N	MTCAP2-915-042-POE				Work Order:	MLTI0132	
Serial Number: 2	20637489				Date:	27-Dec-19	
Customer:	Multi-Tech Systems, Inc.				Temperature:	22.8 °C	
Attendees: J	Jim Asp				Humidity:	26.1% RH	
Project: N	None				Barometric Pres.:	1026 mbar	
Tested by:	Dustin Sparks		Power: 54VDC via PoE		Job Site:	MN08	
EST SPECIFICATIO	DNS		Test Method				
CC 15.247:2019			ANSI C63.10:2013				
COMMENTS			••••••••••••••••••••••••••••••••••••••				
		ludes measurement cable, DC bl	lock, and 20 dB attenuator.				
DEVIATIONS FROM T		ludes measurement cable, DC bl	*				
DEVIATIONS FROM		ludes measurement cable, DC bl	Justin Sparlo	Measured	May Value	Limit	
DEVIATIONS FROM T		~	*	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
DEVIATIONS FROM T	TEST STANDARD	~	Frequency				Result N/A
DEVIATIONS FROM None Configuration #	TEST STANDARD 1 923.3 MHz)	~	Frequency Range	Freq (MHz)	(dBc)	≤ (dBc)	
DEVIATIONS FROM T None Configuration #	1 923.3 MHz) 923.3 MHz)	A	Frequency Range Fundamental	Freq (MHz) 923.25	(dBc) N/A	≤ (dBc) N/A	N/A
DEVIATIONS FROM None Configuration #	1 923.3 MHz) 925.1 MHz) 925.1 MHz)	A	Frequency Range Fundamental 30 MHz - 10 GHz	Freq (MHz) 923.25 2769.89	(dBc) N/A -69.34	≤ (dBc) N/A -30	N/A Pass
DEVIATIONS FROM None Configuration #	1 923.3 MHz) 923.3 MHz) 125.1 MHz) 125.1 MHz) 125.1 MHz)	A	Frequency Range Fundamental 30 MHz - 10 GHz Fundamental	Freq (MHz) 923.25 2769.89 925.05	(dBc) N/A -69.34 N/A	≤ (dBc) N/A -30 N/A	N/A Pass N/A

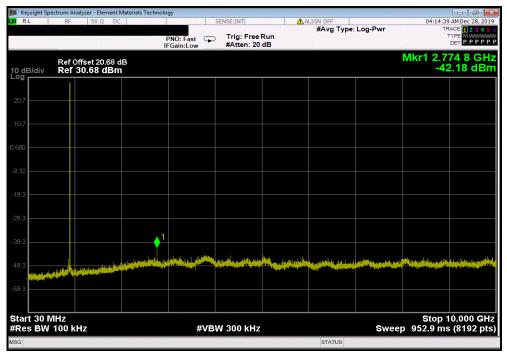




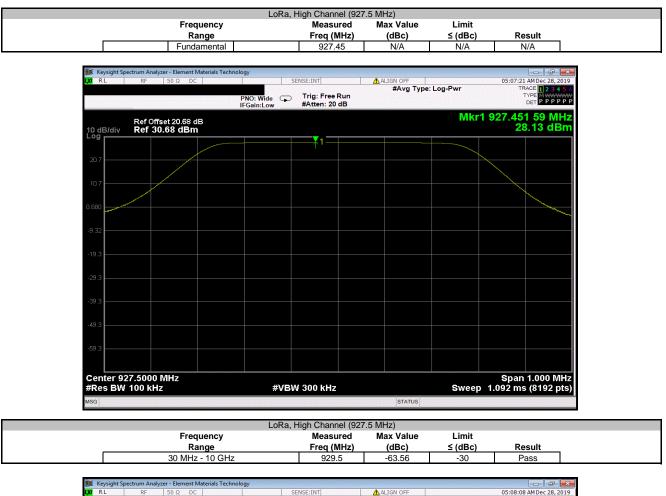
RL	RF 50 Ω [t Materials Technol		SENSE:INT		ALIGN OFF		04:29:5	0 AM Dec 28, 20
			PNO: Fast G		Run	#Avg Type	: Log-Pwr		RACE 1 2 3 4 TYPE MWWW DET P P P P
) dB/div	Ref Offset 20.68 Ref 30.68 dB							Mkr1 2.7 -4	769 9 GH 1.27 dB
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KL	RF 50 Ω	DC	PNO: Fast G	SENSE:INT Trig: Free #Atten: 20	Run	ALIGN OFF #Avg Type	: Log-Pwr	T	RACE 1 2 3 4 5 TYPE M WWW DET P P P P P
dB/div	Ref Offset 20 Ref 30.68	.68 dB d Bm						Mkr1 9 -3	29.5 MH 5.43 dBr
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art 30 M Res BW	/IHz 100 kHz		#VI	3W 300 kHz			Swee	Stop 952.9 m	10.000 GH s (8192 pt
G						STATUS			



XMit 2019.09.05

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TEST EQUIPMENT

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Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	6-Aug-19	6-Aug-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20

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.



	TCAP2-915-042-POE				Work Order		
Serial Number: 20						: 27-Dec-19	
Customer: M	ulti-Tech Systems, Inc.				Temperature	: 22.6 °C	
Attendees: Ji						: 26.4% RH	
Project: N					Barometric Pres.		
Tested by: D	ustin Sparks			Power: 54VDC via PoE	Job Site	: MN08	
TEST SPECIFICATION	15			Test Method			
FCC 15.247:2019				ANSI C63.10:2013			
COMMENTS Reference level offset	t on spectrum analyzer inclu	udes measurement cable	e, DC block,	, and 20 dB attenuator.			
		udes measurement cable	e, DC block,	, and 20 dB attenuator.			
Reference level offset		udes measurement cable	e, DC block,	, and 20 dB attenuator.			
Reference level offset DEVIATIONS FROM T None				, and 20 dB attenuator.			
Reference level offset DEVIATIONS FROM T None		udes measurement cable			Value	Limit	
Reference level offset DEVIATIONS FROM T None					 Value (dBm/3kHz)	Limit (dBm/3kHz)	Results
Reference level offset	EST STANDARD						Results Pass
Reference level offset	EST STANDARD 1 23.3 MHz)				(dBm/3kHz)	(dBm/3kHz)	



