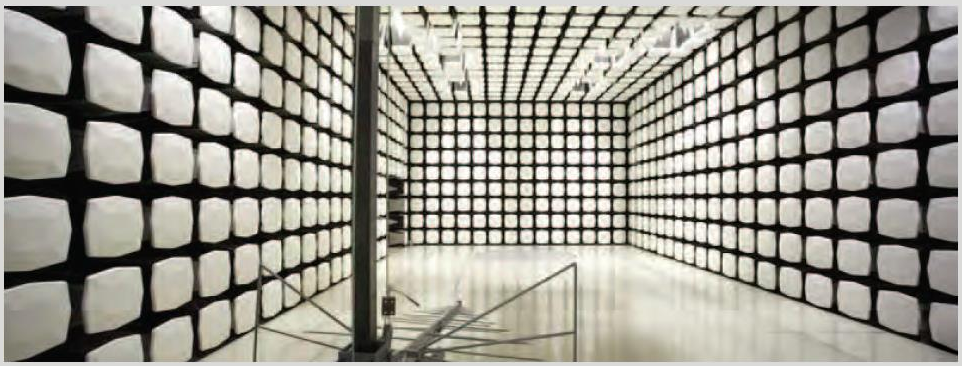
MSA Innovation, LLC

Lunar

FCC 15.247:2020

802.15.4 Radio

Report: MSAS0004.1, Issue Date: March 5, 2021



NVLAP LAB CODE: 200881-0

CERTIFICATE OF TEST

Last Date of Test: August 25, 2020
MSA Innovation, LLC
EUT: Lunar

Radio Equipment Testing

Standards

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

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not required for battery powered EUT
6.5, 6.6, 11.12.1, 11.13.2	Spurious Radiated Emissions	Yes	Pass	
11.6	Duty Cycle	Yes	Pass	
11.8.2	Occupied Bandwidth	Yes	Pass	
11.9.1.1	Output Power	Yes	Pass	
11.9.1.1	Equivalent Isotropic Radiated Power	Yes	Pass	
11.10.2	Power Spectral Density	Yes	Pass	
11.11	Band Edge Compliance	Yes	Pass	
11.11	Spurious Conducted Emissions	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		

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

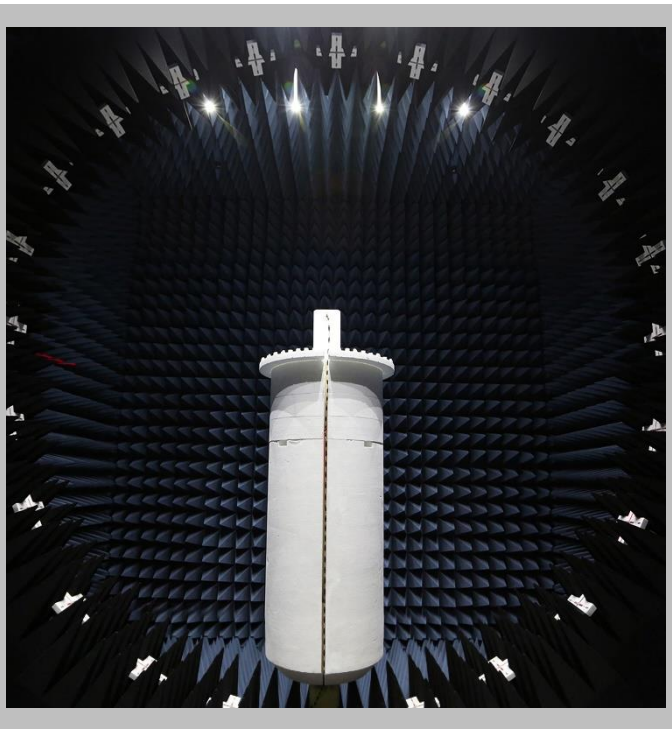
MIC – Recognized by MIC as a CAB for the acceptance of test data.

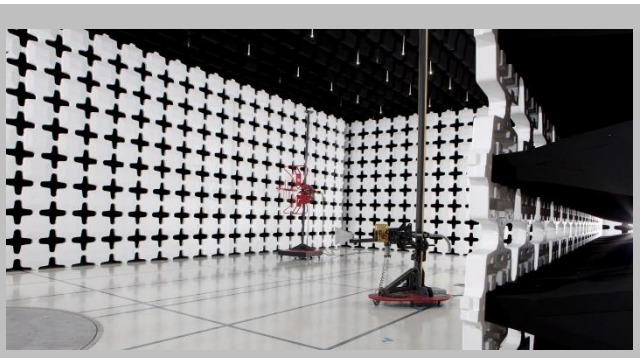
SCOPE

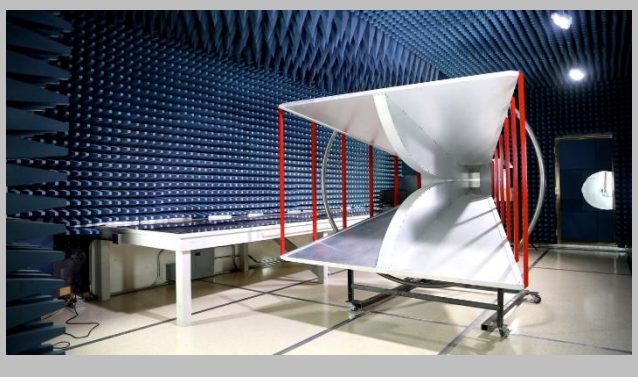
For details on the Scopes of our Accreditations, please visit:
https://www.nwemc.com/emc-testing-accreditations

FACILITIES

California	Minnesota	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-10 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
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







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.

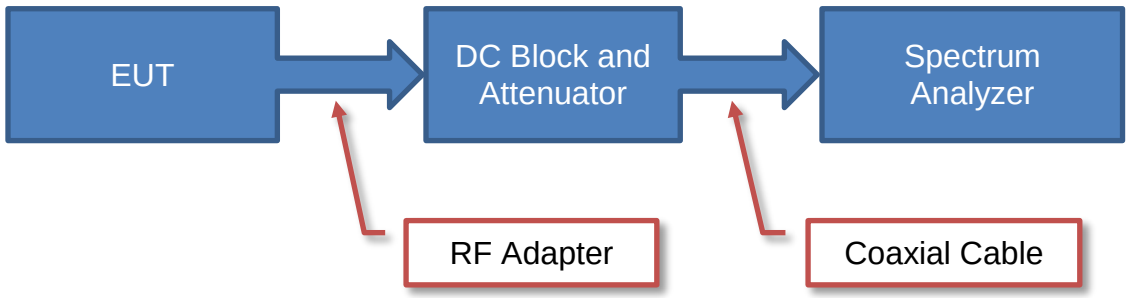
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable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

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

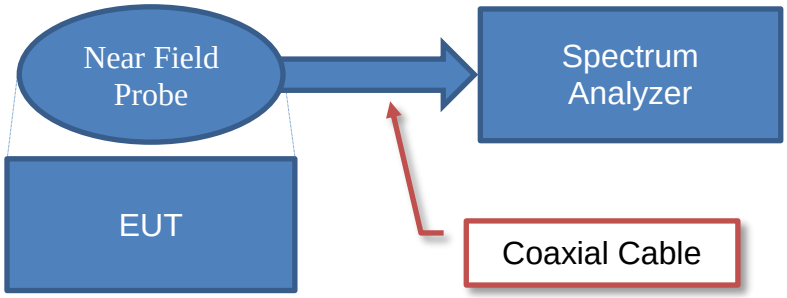
Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.6 dB	-2.6 dB

Test Setup Block Diagrams

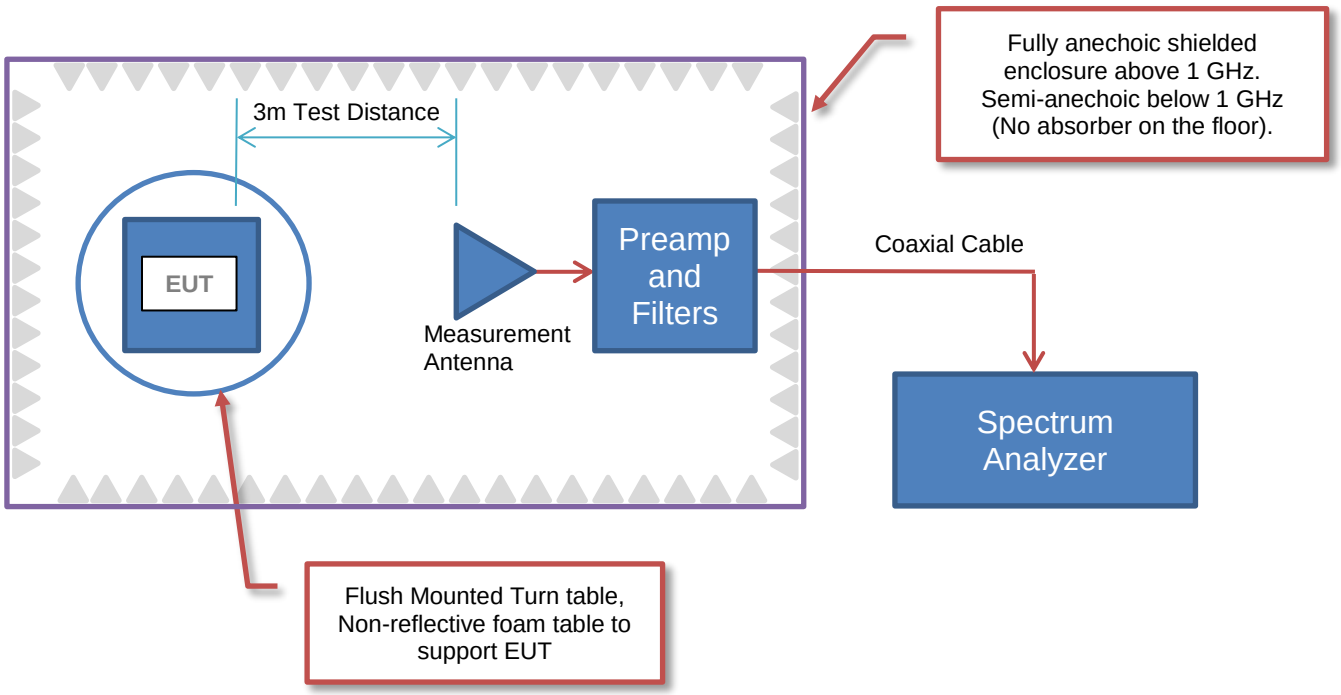
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	MSA Innovation, LLC
Address:	1100 Cranberry Woods Road
City, State, Zip:	Cranberry Township, PA 16066
Test Requested By:	Dustin Morris
EUT:	Lunar
First Date of Test:	August 20, 2020
Last Date of Test:	August 25, 2020
Receipt Date of Samples:	August 20, 2020
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Handheld thermal imaging device used in industrial and government applications containing four RF transmitters and one GNSS receiver.

Testing Objective:
To demonstrate compliance of the 802.15.4 radio to FCC 15.247 requirements.

CONFIGURATIONS

Configuration MSAS0004- 1

Software/Firmware Running during test	
Description	**Version**
Test Software	1.0

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Lunar	MSA Innovation, LLC	Lunar	7492

Configuration MSAS0004- 2

Software/Firmware Running during test	
Description	**Version**
Test Software	1.0

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Lunar	MSA Innovation, LLC	Lunar	9628

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Asus	UX433F	00325-96475-24912-AAOEM
Mouse	Kensington	M01215	B1517A002945

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB to Serial Cable	Yes	1.0m	No	Laptop	Lunar
USB Cable (Mouse	Yes	1.5m	No	Laptop	Mouse

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2020-08-20	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.
2	2020-08-20	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2020-08-20	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.
4	2020-08-20	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.
5	2020-08-20	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	2020-08-20	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.
7	2020-08-25	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWER SETTINGS

The EUT was tested using the power settings provided by the manufacturer:

SETTINGS FOR ALL TESTS IN THIS REPORT

Lunar	Power Setting
802.15.4 (DTS)	+20 dBm

ANTENNA GAIN (dBi)

Type	Provided by:	Frequency Range (MHz)	Gain (dBi)
PIFA-1	N/A	2405	1.3
		2442	2.3
		2475	1.1
PIFA-2	N/A	2405	1.3
		2442	-0.8
		2475	-2.2

SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2020.04.03.0

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. 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 Zigbee on Low channel (2405 MHz), Mid channel (2442 MHz), and High channel (2475 MHz); DTS modulation; Antenna ports 1 & 2

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

MSAS0004 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26500 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
Attenuator	Fairview Microwave	SA18E-20	TWZ	2019-09-17	12 mo
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNP	2019-09-11	12 mo
Amplifier - Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	2019-09-11	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AHG	NCR	0 mo
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	2020-03-10	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVW	2020-01-17	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	2020-01-17	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AIQ	NCR	0 mo
Filter - Band Pass/Notch	K&L Microwave	3TNF-500/1000-N/N	HGS	2020-06-30	12 mo
Filter - Low Pass	Micro-Tronics	LPM50003	LFJ	2019-09-17	12 mo
Filter - High Pass	Micro-Tronics	HPM50108	LFM	2019-09-12	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	2020-01-17	12 mo
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	2019-09-17	12 mo
Antenna - Double Ridge	ETS-Lindgren	3115	AJQ	2019-01-16	24 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	2019-10-18	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	2019-10-18	12 mo
Antenna - Biconilog	ETS Lindgren	3142D	AXO	2019-09-03	24 mo
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2019-12-23	12 mo

TEST DESCRIPTION

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

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

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

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

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

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

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

Measurements within 2 MHz of the allowable band may have been taken using the integration method from ANSI C63.10 clause 11.13.3. This procedure uses the channel power feature of the spectrum analyzer to integrate the power of the emission within a 1 MHz bandwidth.

Where the radio test software does not provide for a duty cycle at continuous transmit conditions (> 98%) and the RMS (power average) measurements were made across the on and off times of the EUT transmissions, a duty cycle correction is added to the measurements using the formula of 10*log(1/dc).

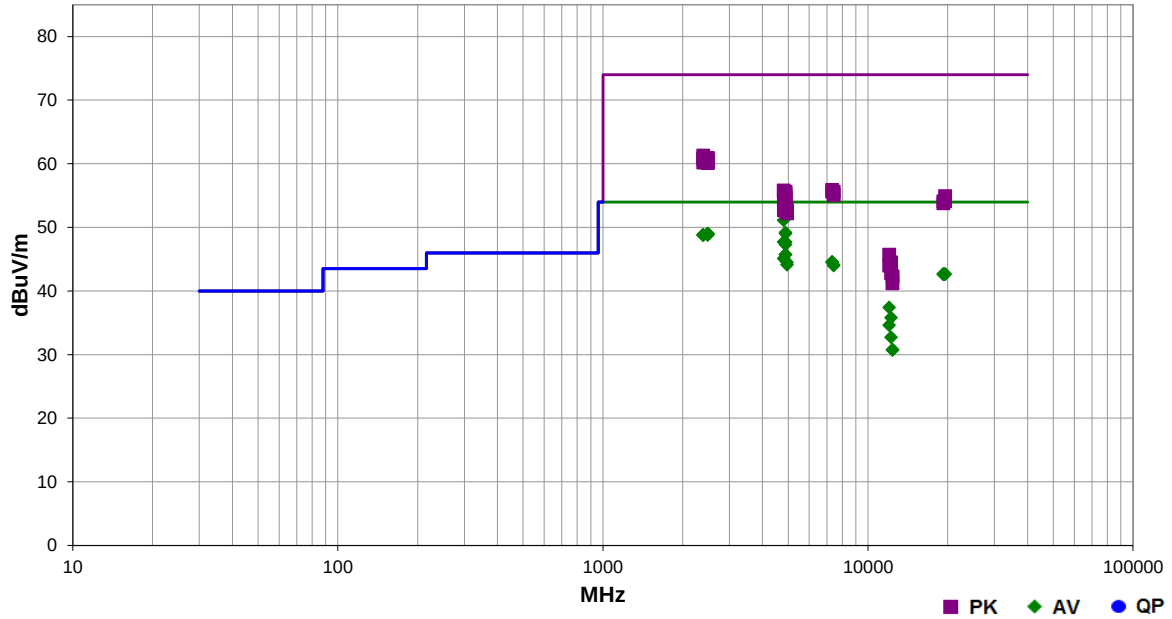
SPURIOUS RADIATED EMISSIONS

EmiR5 2020.04.20.0 PSA-ESCI 2020.04.03.0

Work Order:	MSAS0004	**Date:**	2020-08-25		
Project:	None	**Temperature:**	22 °C		
Job Site:	MN05	**Humidity:**	60.1% RH		
Serial Number:	7492	**Barometric Pres.:**	1017 mbar	**Tested by:**	Andrew Rogstad
EUT:	Lunar				
Configuration:	1				
Customer:	MSA Innovation, LLC				
Attendees:	Dustin Morris				
EUT Power:	Battery				
Operating Mode:	Transmitting Zigbee on Low channel (2405 MHz), Mid channel (2442 MHz), and High channel (2475 MHz); DTS modulation; Antenna ports 1 & 2				
Deviations:	None				
Comments:	See data comments for EUT orientation, transmit channel, and antenna port. Test mode operates at 100% duty cycle, so no upward DCCF correction is applied.				

Test Specifications	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

Run #	48	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Duty Cycle Correction Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4809.017	46.6	4.5	3.0	261.0	3.0	0.0	Vert	AV	0.0	51.1	54.0	-2.9	EUT vert, Low ch., Ant 2
4883.000	44.7	4.5	2.0	203.0	3.0	0.0	Horz	AV	0.0	49.2	54.0	-4.8	EUT horz, Mid ch., Ant 2
2488.108	32.7	-3.7	1.4	220.0	3.0	20.0	Vert	AV	0.0	49.0	54.0	-5.0	EUT horz, High ch., Ant 2
2485.858	32.7	-3.7	1.5	185.0	3.0	20.0	Horz	AV	0.0	49.0	54.0	-5.0	EUT on side, High ch., Ant 2
4884.900	44.5	4.5	2.0	315.9	3.0	0.0	Horz	AV	0.0	49.0	54.0	-5.0	EUT vert, Mid ch., Ant 2
2483.808	32.8	-3.8	1.5	243.9	3.0	20.0	Horz	AV	0.0	49.0	54.0	-5.0	EUT horz, High ch., Ant 2
2484.067	32.7	-3.8	1.2	126.0	3.0	20.0	Vert	AV	0.0	48.9	54.0	-5.1	EUT on side, High ch., Ant 2
2485.858	32.6	-3.7	4.0	274.0	3.0	20.0	Horz	AV	0.0	48.9	54.0	-5.1	EUT vert, High ch., Ant 2
2484.683	32.6	-3.8	1.5	199.9	3.0	20.0	Vert	AV	0.0	48.8	54.0	-5.2	EUT vert, High ch., Ant 2
2484.058	32.6	-3.8	1.5	282.9	3.0	20.0	Horz	AV	0.0	48.8	54.0	-5.2	EUT horz, High ch., Ant 1
2389.880	32.5	-3.7	1.5	77.9	3.0	20.0	Horz	AV	0.0	48.8	54.0	-5.2	EUT horz, Low ch., Ant 2
2387.927	32.5	-3.7	1.5	84.9	3.0	20.0	Vert	AV	0.0	48.8	54.0	-5.2	EUT horz, Low ch., Ant 2
2389.473	32.5	-3.7	1.5	347.9	3.0	20.0	Horz	AV	0.0	48.8	54.0	-5.2	EUT horz, Low ch., Ant 1
4885.000	43.2	4.5	2.3	340.0	3.0	0.0	Horz	AV	0.0	47.7	54.0	-6.3	EUT on side, Mid ch., Ant 2
4809.108	43.2	4.5	3.5	181.0	3.0	0.0	Horz	AV	0.0	47.7	54.0	-6.3	EUT horz, Low ch., Ant 2
4884.850	42.8	4.5	2.2	145.0	3.0	0.0	Vert	AV	0.0	47.3	54.0	-6.7	EUT vert, Mid ch., Ant 2
4884.942	41.2	4.5	1.2	256.0	3.0	0.0	Vert	AV	0.0	45.7	54.0	-8.3	EUT horz, Mid ch., Ant 2
4884.867	41.2	4.5	1.2	268.0	3.0	0.0	Vert	AV	0.0	45.7	54.0	-8.3	EUT on side, Mid ch., Ant 2
4809.058	40.6	4.5	2.0	240.9	3.0	0.0	Vert	AV	0.0	45.1	54.0	-8.9	EUT vert, Low ch., Ant 1
7325.158	31.2	13.4	1.5	30.9	3.0	0.0	Vert	AV	0.0	44.6	54.0	-9.4	EUT vert, Mid ch., Ant 2

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Duty Cycle Correction Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7324.467	31.1	13.4	1.5	174.9	3.0	0.0	Horz	AV	0.0	44.5	54.0	-9.5	EUT horz, Mid ch., Ant 2
4950.917	40.0	4.5	2.1	238.0	3.0	0.0	Vert	AV	0.0	44.5	54.0	-9.5	EUT vert, High ch., Ant 2
4950.983	39.6	4.5	2.0	188.0	3.0	0.0	Horz	AV	0.0	44.1	54.0	-9.9	EUT horz, High ch., Ant 2
7422.858	30.7	13.4	1.8	267.0	3.0	0.0	Horz	AV	0.0	44.1	54.0	-9.9	EUT horz, High ch., Ant 2
7423.900	30.6	13.4	1.5	189.9	3.0	0.0	Vert	AV	0.0	44.0	54.0	-10.0	EUT vert, High ch., Ant 2
19239.430	28.4	14.3	1.5	52.0	3.0	0.0	Horz	AV	0.0	42.7	54.0	-11.3	EUT horz, Low ch., Ant 2
19536.730	28.2	14.5	1.5	156.0	3.0	0.0	Horz	AV	0.0	42.7	54.0	-11.3	EUT horz, Mid ch., Ant 2
19241.850	28.3	14.3	1.5	250.9	3.0	0.0	Vert	AV	0.0	42.6	54.0	-11.4	EUT vert, Low ch., Ant 2
19537.230	28.1	14.5	1.5	288.0	3.0	0.0	Vert	AV	0.0	42.6	54.0	-11.4	EUT vert, Mid ch., Ant 2
2389.440	45.0	-3.7	1.5	347.9	3.0	20.0	Horz	PK	0.0	61.3	74.0	-12.7	EUT horz, Low ch., Ant 1
2487.333	44.6	-3.7	1.5	243.9	3.0	20.0	Horz	PK	0.0	60.9	74.0	-13.1	EUT horz, High ch., Ant 2
2386.133	44.5	-3.7	1.5	77.9	3.0	20.0	Horz	PK	0.0	60.8	74.0	-13.2	EUT horz, Low ch., Ant 2
2487.133	44.4	-3.7	1.5	185.0	3.0	20.0	Horz	PK	0.0	60.7	74.0	-13.3	EUT on side, High ch., Ant 2
2487.333	44.2	-3.7	1.5	282.9	3.0	20.0	Horz	PK	0.0	60.5	74.0	-13.5	EUT horz, High ch., Ant 1
2484.567	44.3	-3.8	4.0	274.0	3.0	20.0	Horz	PK	0.0	60.5	74.0	-13.5	EUT vert, High ch., Ant 2
2487.667	44.0	-3.7	1.5	199.9	3.0	20.0	Vert	PK	0.0	60.3	74.0	-13.7	EUT vert, High ch., Ant 2
2486.917	43.9	-3.7	1.4	220.0	3.0	20.0	Vert	PK	0.0	60.2	74.0	-13.8	EUT horz, High ch., Ant 2
2388.480	43.9	-3.7	1.5	84.9	3.0	20.0	Vert	PK	0.0	60.2	74.0	-13.8	EUT horz, Low ch., Ant 2
2487.800	43.8	-3.7	1.2	126.0	3.0	20.0	Vert	PK	0.0	60.1	74.0	-13.9	EUT on side, High ch., Ant 2
12027.350	37.8	-0.4	1.6	286.0	3.0	0.0	Vert	AV	0.0	37.4	54.0	-16.6	EUT vert, Low ch., Ant 2
7327.600	42.5	13.4	1.5	30.9	3.0	0.0	Vert	PK	0.0	55.9	74.0	-18.1	EUT vert, Mid ch., Ant 2
12212.370	35.8	0.0	1.6	261.0	3.0	0.0	Horz	AV	0.0	35.8	54.0	-18.2	EUT horz, Mid ch., Ant 2
4809.025	51.3	4.5	3.0	261.0	3.0	0.0	Vert	PK	0.0	55.8	74.0	-18.2	EUT vert, Low ch., Ant 2
7324.542	42.2	13.4	1.5	174.9	3.0	0.0	Horz	PK	0.0	55.6	74.0	-18.4	EUT horz, Mid ch., Ant 2
4884.858	51.1	4.5	2.0	203.0	3.0	0.0	Horz	PK	0.0	55.6	74.0	-18.4	EUT horz, Mid ch., Ant 2
7422.792	42.2	13.4	1.8	267.0	3.0	0.0	Horz	PK	0.0	55.6	74.0	-18.4	EUT horz, High ch., Ant 2
4883.042	50.7	4.5	2.0	315.9	3.0	0.0	Horz	PK	0.0	55.2	74.0	-18.8	EUT vert, Mid ch., Ant 2
7426.383	41.7	13.4	1.5	189.9	3.0	0.0	Vert	PK	0.0	55.1	74.0	-18.9	EUT vert, High ch., Ant 2
19538.070	40.4	14.5	1.5	288.0	3.0	0.0	Vert	PK	0.0	54.9	74.0	-19.1	EUT vert, Mid ch., Ant 2
4885.167	50.3	4.5	2.3	340.0	3.0	0.0	Horz	PK	0.0	54.8	74.0	-19.2	EUT on side, Mid ch., Ant 2
12022.630	35.0	-0.4	1.5	243.0	3.0	0.0	Horz	AV	0.0	34.6	54.0	-19.4	EUT horz, Low ch., Ant 2
4884.917	49.8	4.5	2.2	145.0	3.0	0.0	Vert	PK	0.0	54.3	74.0	-19.7	EUT vert, Mid ch., Ant 2
4811.042	49.7	4.5	3.5	181.0	3.0	0.0	Horz	PK	0.0	54.2	74.0	-19.8	EUT horz, Low ch., Ant 2
19242.280	39.8	14.3	1.5	52.0	3.0	0.0	Horz	PK	0.0	54.1	74.0	-19.9	EUT horz, Low ch., Ant 2
19537.180	39.6	14.5	1.5	156.0	3.0	0.0	Horz	PK	0.0	54.1	74.0	-19.9	EUT horz, Mid ch., Ant 2
19237.780	39.5	14.3	1.5	250.9	3.0	0.0	Vert	PK	0.0	53.8	74.0	-20.2	EUT vert, Low ch., Ant 2
4885.008	49.0	4.5	1.2	268.0	3.0	0.0	Vert	PK	0.0	53.5	74.0	-20.5	EUT on side, Mid ch., Ant 2
4884.850	48.7	4.5	1.2	256.0	3.0	0.0	Vert	PK	0.0	53.2	74.0	-20.8	EUT horz, Mid ch., Ant 2
4950.825	48.2	4.5	2.1	238.0	3.0	0.0	Vert	PK	0.0	52.7	74.0	-21.3	EUT vert, High ch., Ant 2
12212.400	32.7	0.0	1.5	204.9	3.0	0.0	Vert	AV	0.0	32.7	54.0	-21.3	EUT vert, Mid ch., Ant 2
4811.017	48.2	4.5	2.0	240.9	3.0	0.0	Vert	PK	0.0	52.7	74.0	-21.3	EUT vert, Low ch., Ant 1
4949.058	47.7	4.5	2.0	188.0	3.0	0.0	Horz	PK	0.0	52.2	74.0	-21.8	EUT horz, High ch., Ant 2
12377.370	30.1	0.7	3.6	11.0	3.0	0.0	Vert	AV	0.0	30.8	54.0	-23.2	EUT vert, High ch., Ant 2
12377.550	30.0	0.7	1.0	30.9	3.0	0.0	Horz	AV	0.0	30.7	54.0	-23.3	EUT horz, High ch., Ant 2
12027.320	46.1	-0.4	1.6	286.0	3.0	0.0	Vert	PK	0.0	45.7	74.0	-28.3	EUT vert, Low ch., Ant 2
12212.500	44.5	0.0	1.6	261.0	3.0	0.0	Horz	PK	0.0	44.5	74.0	-29.5	EUT horz, Mid ch., Ant 2
12022.430	44.4	-0.4	1.5	243.0	3.0	0.0	Horz	PK	0.0	44.0	74.0	-30.0	EUT horz, Low ch., Ant 2
12212.100	42.8	0.0	1.5	204.9	3.0	0.0	Vert	PK	0.0	42.8	74.0	-31.2	EUT vert, Mid ch., Ant 2
12373.100	41.6	0.7	1.0	30.9	3.0	0.0	Horz	PK	0.0	42.3	74.0	-31.7	EUT horz, High ch., Ant 2
12372.500	40.5	0.7	3.6	11.0	3.0	0.0	Vert	PK	0.0	41.2	74.0	-32.8	EUT vert, High ch., Ant 2

DUTY CYCLE

TEST DESCRIPTION

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

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

The EUT operates at 100% Duty Cycle.

OCCUPIED BANDWIDTH

XMit 2020.03.25.0

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	N5182B	TFX	28-Apr-20	28-Apr-23
Cable	Micro-Coax	D150A-1-0720-200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	10-Feb-20	10-Feb-21
Block - DC	Fairview Microwave	SD3379	AMI	5-Aug-20	5-Aug-21
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	21-Dec-19	21-Dec-20

TEST DESCRIPTION

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

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

OCCUPIED BANDWIDTH

TbtTx 2019.08.30.0 XMit 2020.03.25.0

EUT:	**Lunar**			**Work Order:**	**MSAS0004**
Serial Number:	**9628**			**Date:**	**20-Aug-20**
Customer:	**MSA Safety**			**Temperature:**	**22.2 °C**
Attendees:	**Dustin Morris**			**Humidity:**	**57.1% RH**
Project:	**None**			**Barometric Pres.:**	**1013 mbar**
Tested by:	**Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset on the spectrum analyzer includes the measurement cable, 20 dB attenuator, and DC block.

DEVIATIONS FROM TEST STANDARD

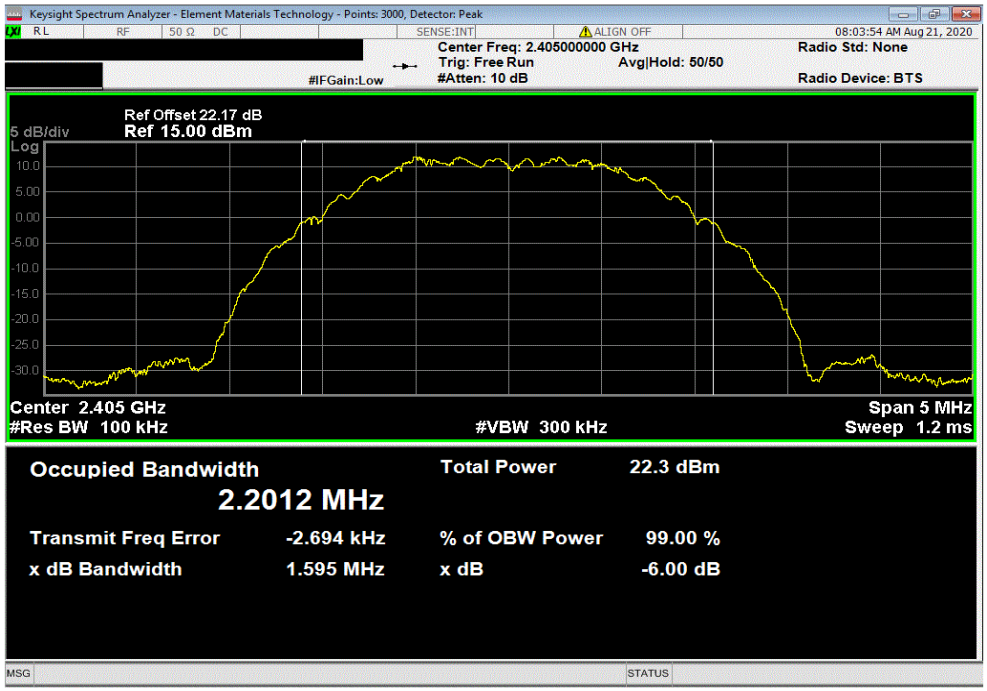
None

Configuration #	**2**	*Signature* Dustin Sparks

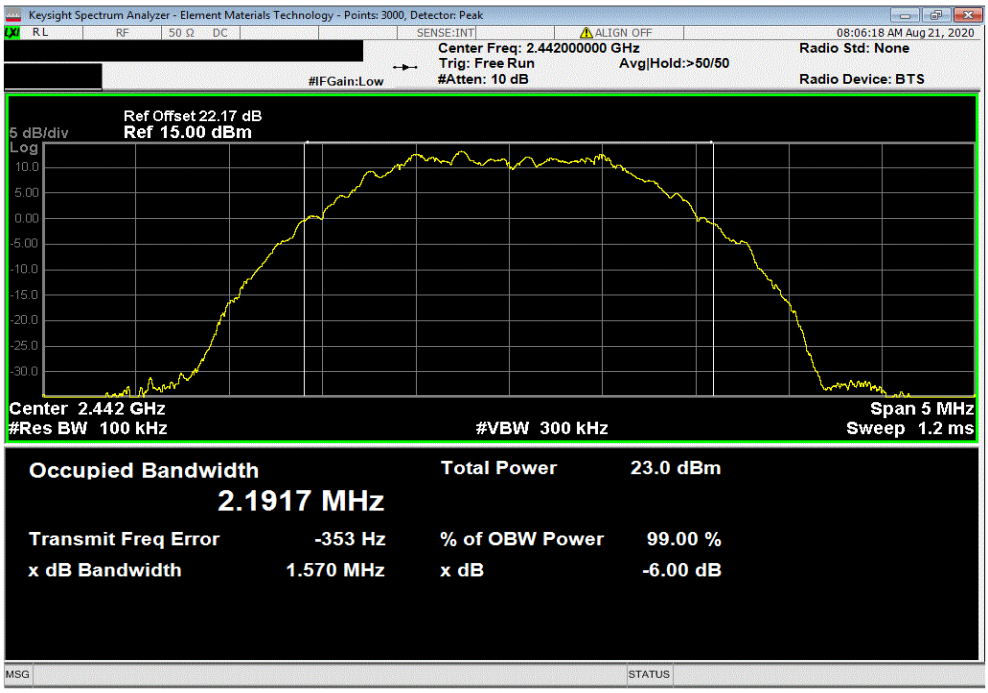
		Value	**Limit (>)**	**Result**
Antenna Port 1				
	Low Channel (2405 MHz)	1.595 MHz	500 kHz	Pass
	Mid Channel (2442 MHz)	1.570 MHz	500 kHz	Pass
	High Channel (2475 MHz)	1.574 MHz	500 kHz	Pass
Antenna Port 2				
	Low Channel (2405 MHz)	1.577 MHz	500 kHz	Pass
	Mid Channel (2442 MHz)	1.575 MHz	500 kHz	Pass
	High Channel (2475 MHz)	1.578 MHz	500 kHz	Pass

OCCUPIED BANDWIDTH

Antenna Port 1, Low Channel (2405 MHz)						
				Value	Limit (>)	Result
				1.595 MHz	500 kHz	Pass

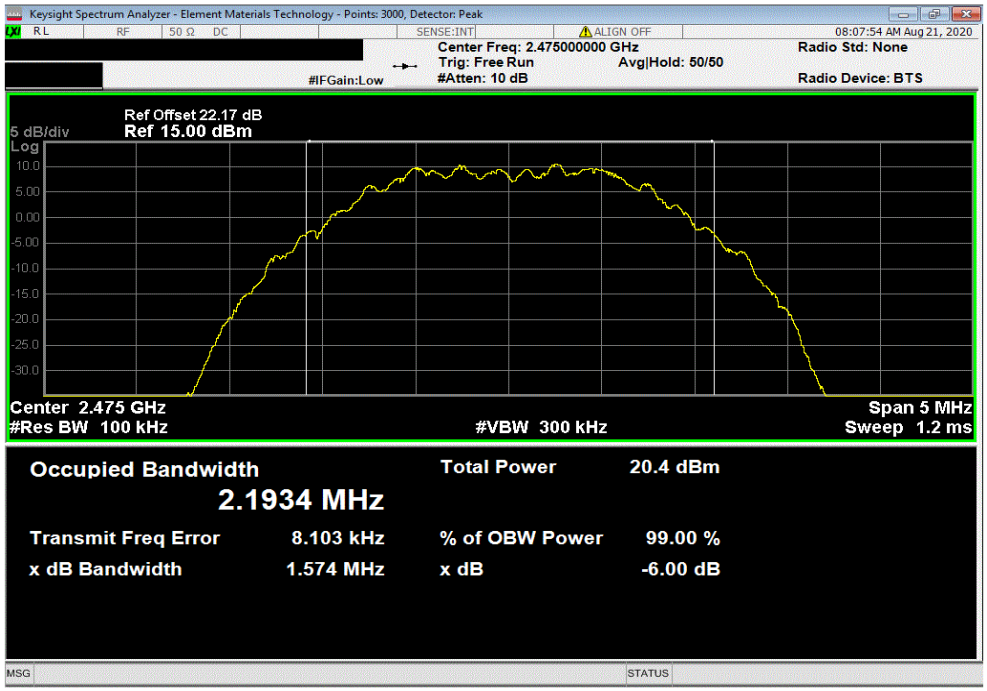


Antenna Port 1, Mid Channel (2442 MHz)						
				Value	Limit (>)	Result
				1.570 MHz	500 kHz	Pass

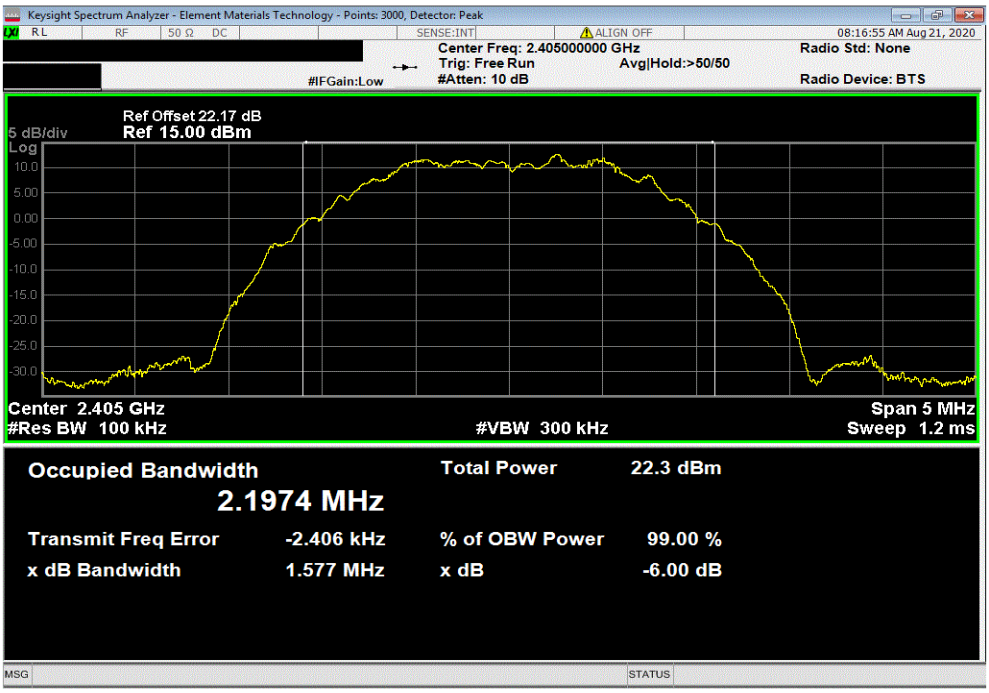


OCCUPIED BANDWIDTH

Antenna Port 1, High Channel (2475 MHz)						
				Value	Limit (>)	Result
				1.574 MHz	500 kHz	Pass



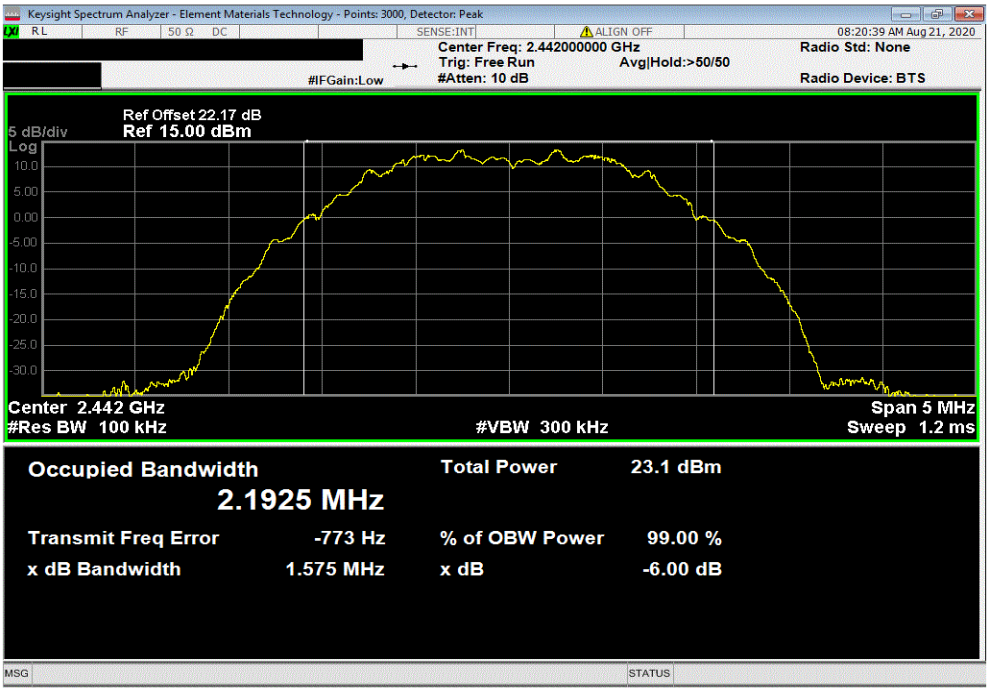
Antenna Port 2, Low Channel (2405 MHz)						
				Value	Limit (>)	Result
				1.577 MHz	500 kHz	Pass



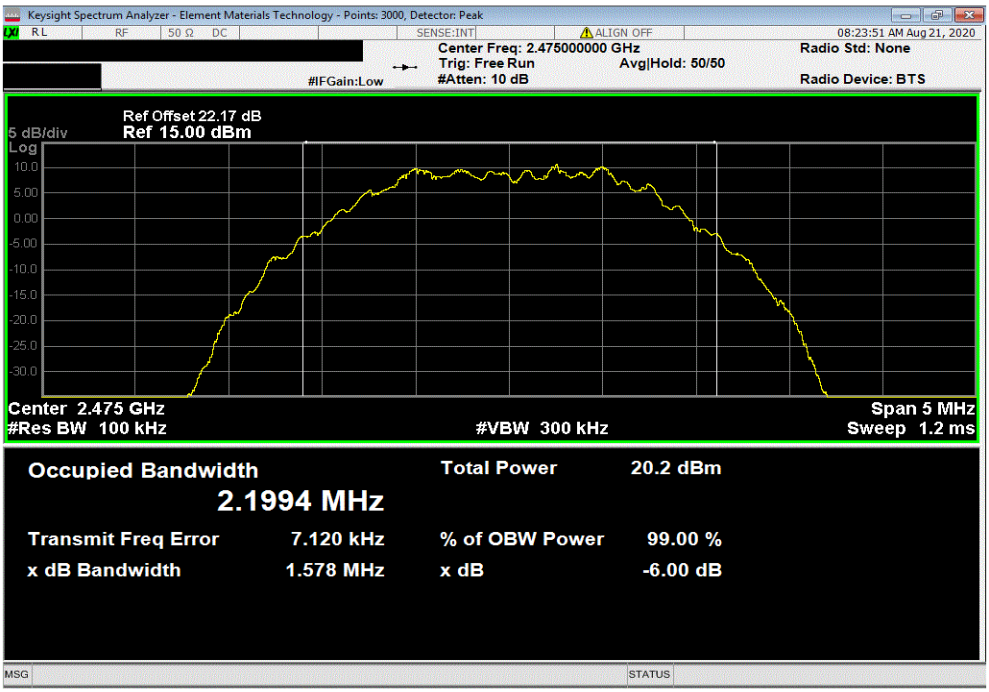
OCCUPIED BANDWIDTH

TbtTx 2019.08.30.0 XMit 2020.03.25.0

Antenna Port 2, Mid Channel (2442 MHz)						
				Value	Limit (>)	Result
				1.575 MHz	500 kHz	Pass



Antenna Port 2, High Channel (2475 MHz)						
				Value	Limit (>)	Result
				1.578 MHz	500 kHz	Pass



OUTPUT POWER

XMit 2020.03.25.0

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	N5182B	TFX	28-Apr-20	28-Apr-23
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	10-Feb-20	10-Feb-21
Block - DC	Fairview Microwave	SD3379	AMI	5-Aug-20	5-Aug-21
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	21-Dec-19	21-Dec-20

TEST DESCRIPTION

The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

Prior to measuring peak transmit power the DTS bandwidth (B) was measured.

The method found in ANSI C63.10:2013 Section 11.9.1.1 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio.

OUTPUT POWER

element

TbtTx 2019.08.30.0 XMit 2020.03.25.0

EUT:	**Lunar**			**Work Order:**	**MSAS0004**
Serial Number:	**9628**			**Date:**	**20-Aug-20**
Customer:	**MSA Innovation, LLC**			**Temperature:**	**22.3 °C**
Attendees:	**Dustin Morris**			**Humidity:**	**57.1% RH**
Project:	**None**			**Barometric Pres.:**	**1013 mbar**
Tested by:	**Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset on the spectrum analyzer includes the measurement cable, 20 dB attenuator, and DC block.

DEVIATIONS FROM TEST STANDARD

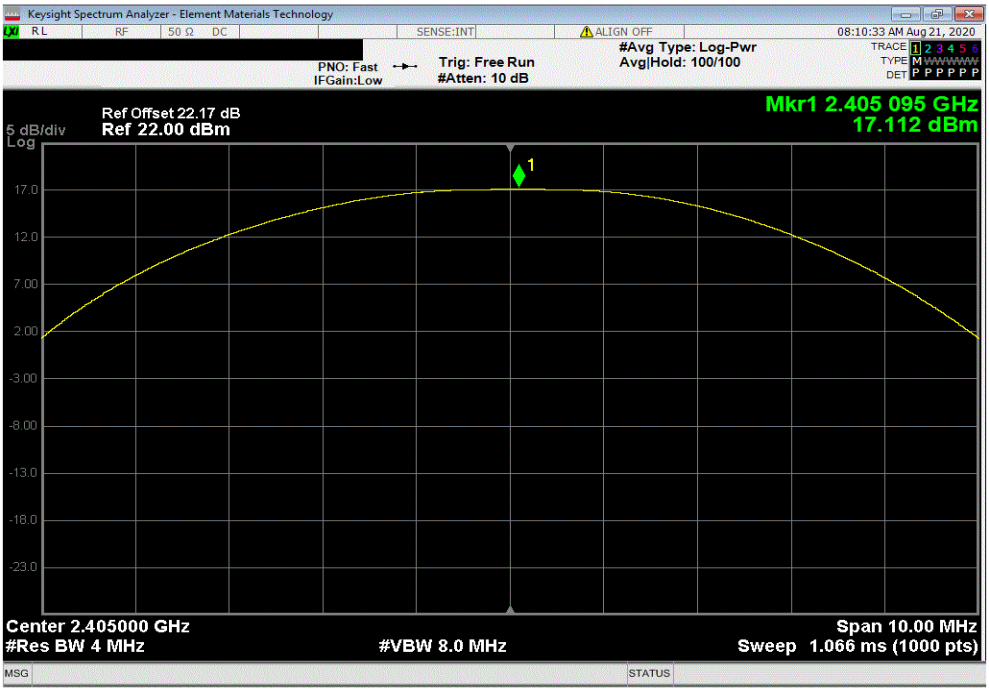
None

Configuration #	**2**	*Signature* Dustin Sparks

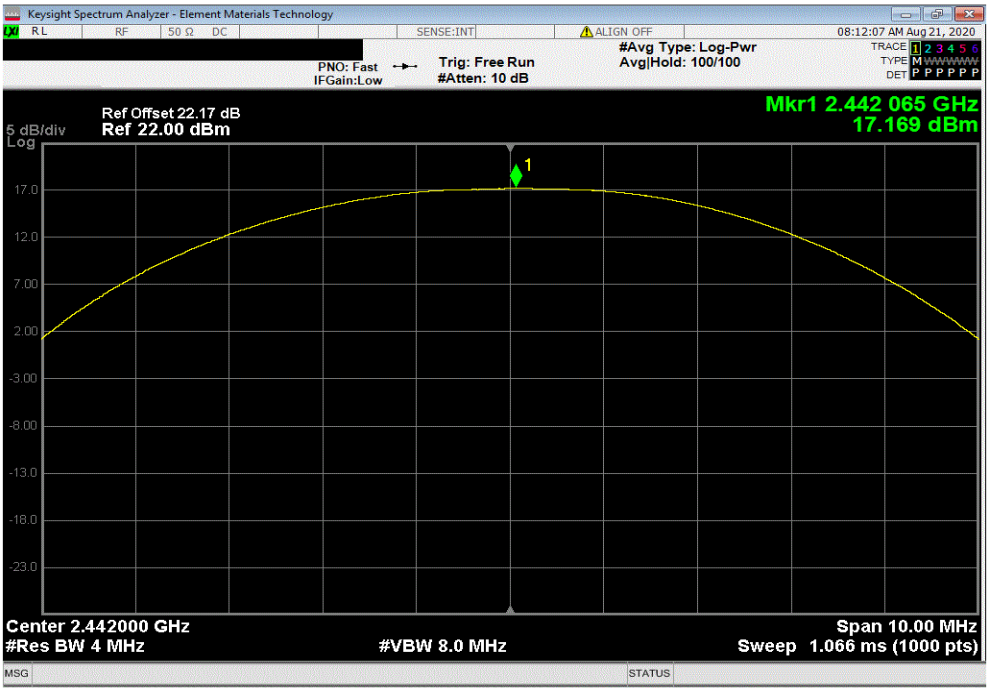
		Out Pwr (dBm)	**Limit (dBm)**	**Result**
Antenna Port 1				
	Low Channel (2405 MHz)	17.112	30	Pass
	Mid Channel (2442 MHz)	17.169	30	Pass
	High Channel (2475 MHz)	14.321	30	Pass
Antenna Port 2				
	Low Channel (2405 MHz)	16.48	30	Pass
	Mid Channel (2442 MHz)	17.389	30	Pass
	High Channel (2475 MHz)	14.856	30	Pass

OUTPUT POWER

Antenna Port 1, Low Channel (2405 MHz)						
				Out Pwr (dBm)	Limit (dBm)	Result
				17.112	30	Pass

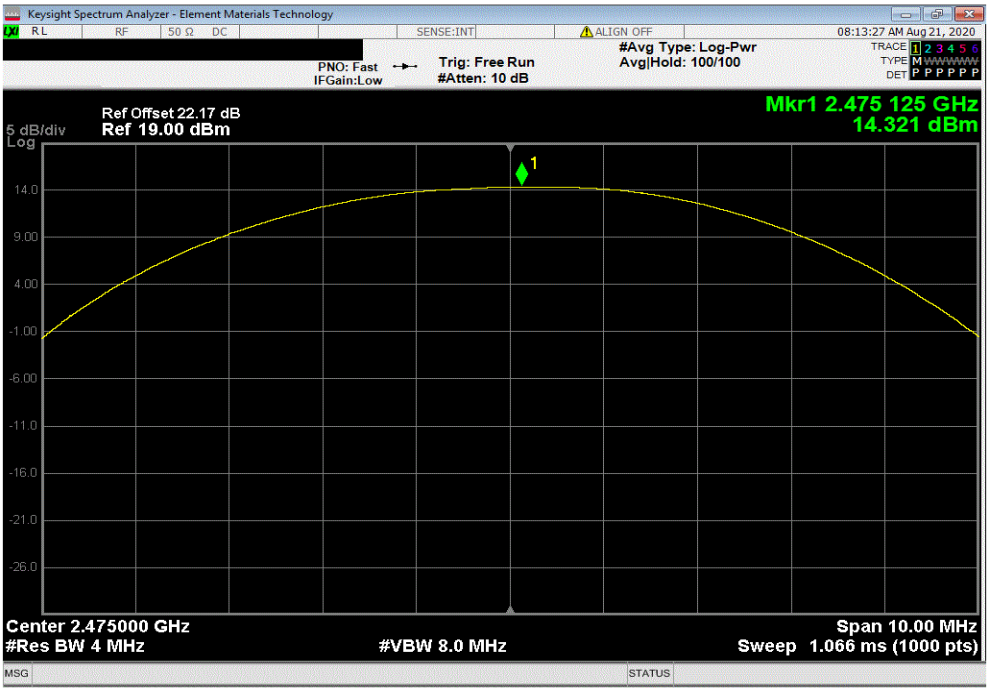


Antenna Port 1, Mid Channel (2442 MHz)						
				Out Pwr (dBm)	Limit (dBm)	Result
				17.169	30	Pass

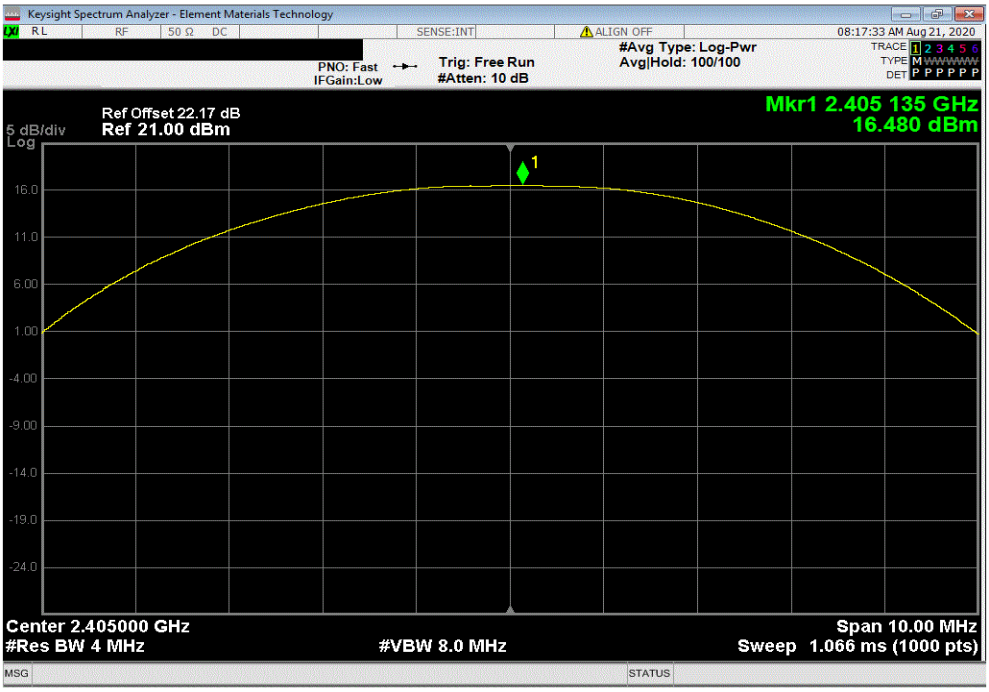


OUTPUT POWER

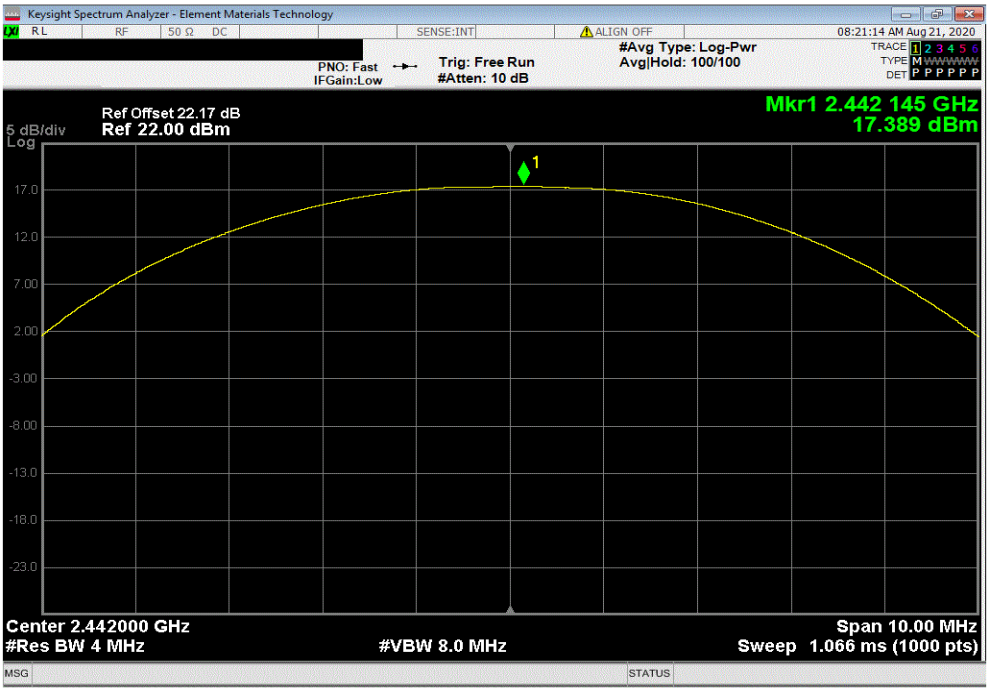
Antenna Port 1, High Channel (2475 MHz)						
				Out Pwr (dBm)	Limit (dBm)	Result
				14.321	30	Pass



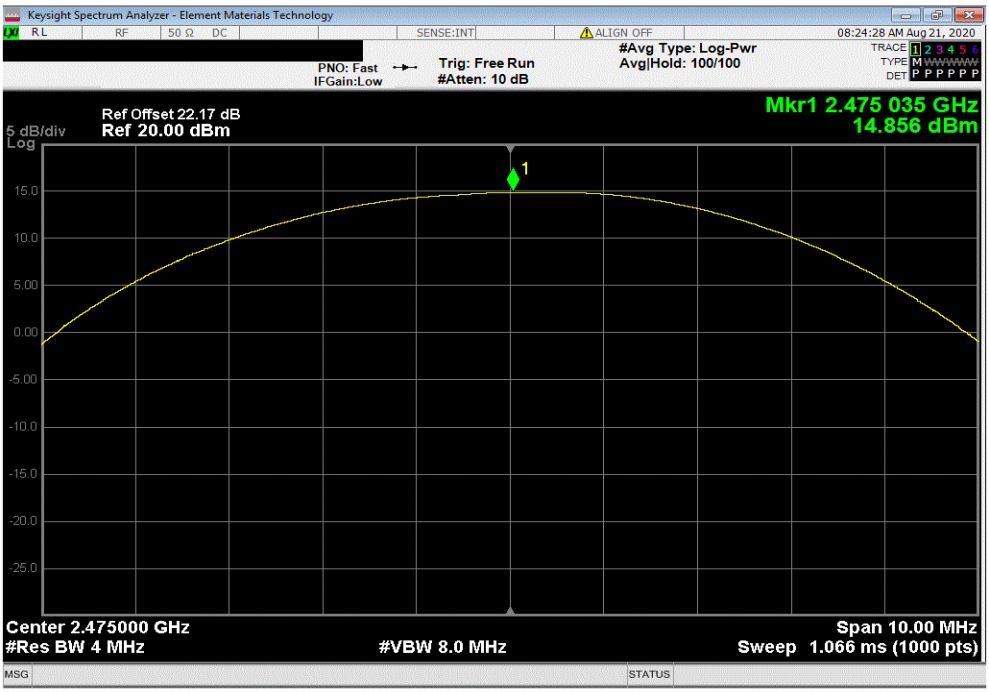
Antenna Port 2, Low Channel (2405 MHz)						
				Out Pwr (dBm)	Limit (dBm)	Result
				16.48	30	Pass



Antenna Port 2, Mid Channel (2442 MHz)						
				Out Pwr (dBm)	Limit (dBm)	Result
				17.389	30	Pass



Antenna Port 2, High Channel (2475 MHz)						
				Out Pwr (dBm)	Limit (dBm)	Result
				14.856	30	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

XMit 2020.03.25.0

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	N5182B	TFX	28-Apr-20	28-Apr-23
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	10-Feb-20	10-Feb-21
Block - DC	Fairview Microwave	SD3379	AMI	5-Aug-20	5-Aug-21
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	21-Dec-19	21-Dec-20

TEST DESCRIPTION

The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

Prior to measuring peak transmit power the DTS bandwidth (B) was measured.

The method found in ANSI C63.10:2013 Section 11.9.1.1 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio.

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

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

element

TbtTx 2019.08.30.0 XMit 2020.03.25.0

EUT:	**Lunar**			**Work Order:**	**MSAS0004**
Serial Number:	**9628**			**Date:**	**20-Aug-20**
Customer:	**MSA Innovation, LLC**			**Temperature:**	**22.2 °C**
Attendees:	**Dustin Morris**			**Humidity:**	**57.1% RH**
Project:	**None**			**Barometric Pres.:**	**1013 mbar**
Tested by:	**Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset on the spectrum analyzer includes the measurement cable, 20 dB attenuator, and DC block.

DEVIATIONS FROM TEST STANDARD

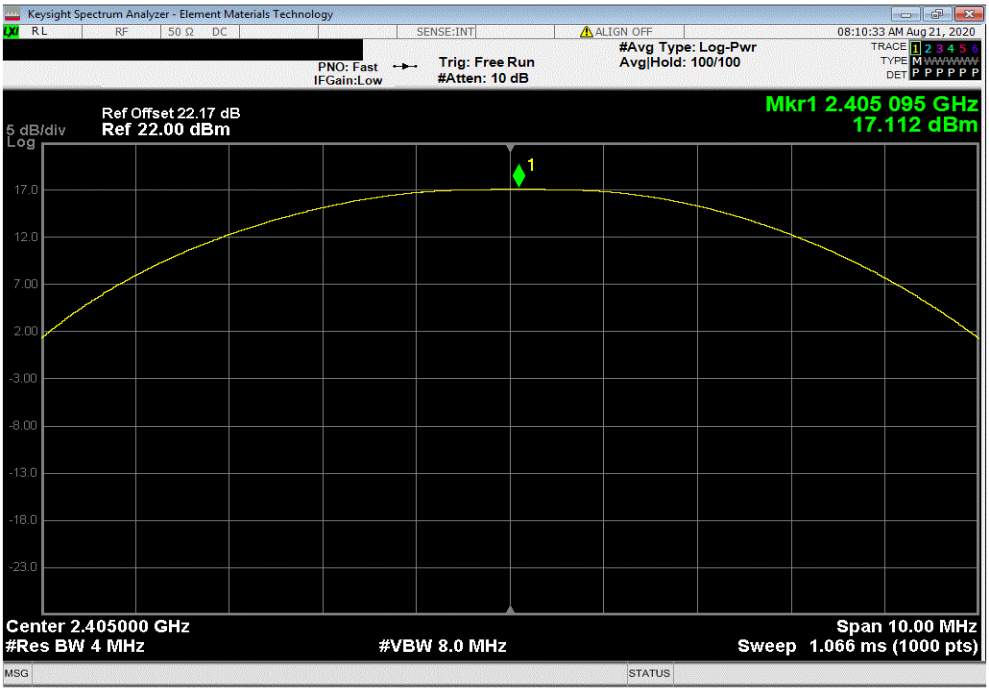
None

Configuration #	**2**	*Signature* Dustin Sparks

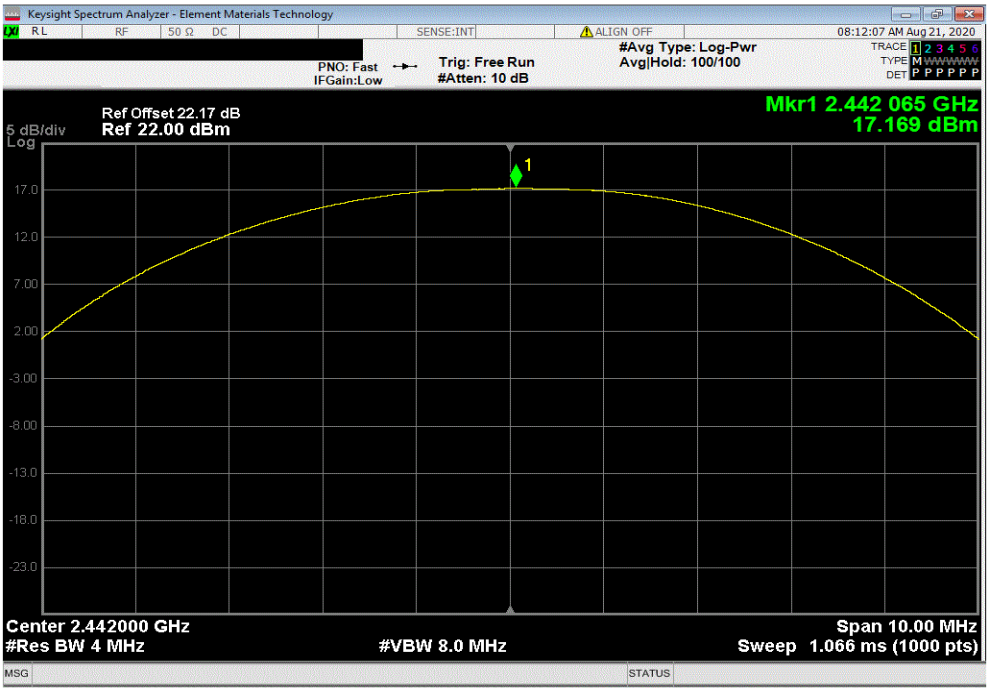
		Out Pwr (dBm)	**Antenna Gain (dBi)**	**EIRP (dBm)**	**EIRP Limit (dBm)**	**Result**
Antenna Port 1						
	Low Channel (2405 MHz)	17.112	1.3	18.412	36	Pass
	Mid Channel (2442 MHz)	17.169	2.3	19.469	36	Pass
	High Channel (2475 MHz)	14.321	1.1	15.421	36	Pass
Antenna Port 2						
	Low Channel (2405 MHz)	16.48	1.3	17.82	36	Pass
	Mid Channel (2442 MHz)	17.389	-0.8	16.529	36	Pass
	High Channel (2475 MHz)	14.856	-2.2	12.626	36	Pass

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

Antenna Port 1, Low Channel (2405 MHz)						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		17.112	1.3	18.4	36	Pass

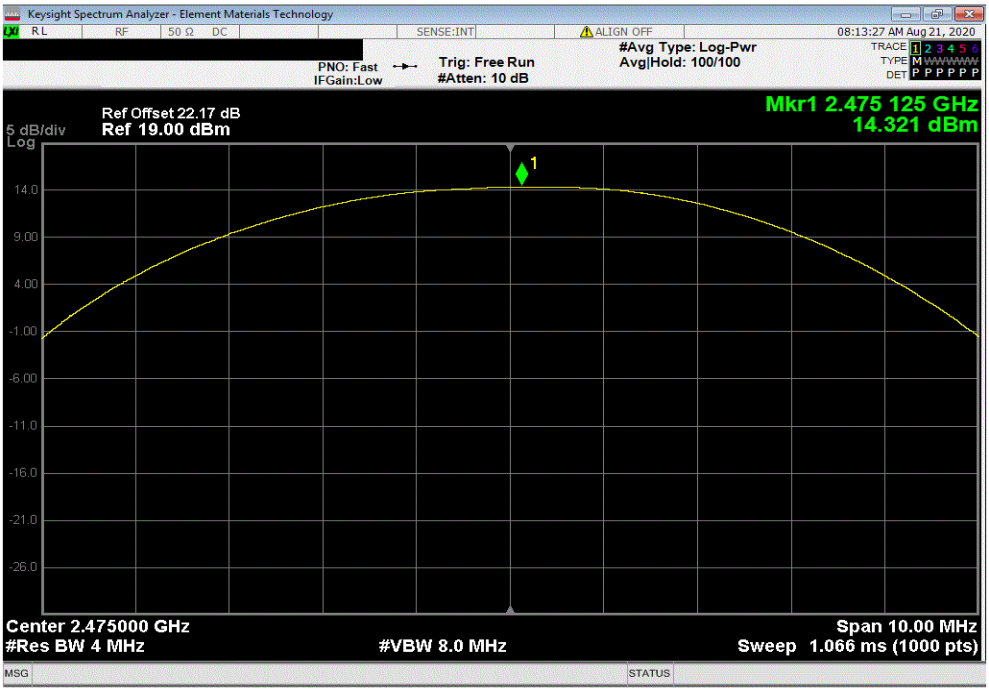


Antenna Port 1, Mid Channel (2442 MHz)						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		17.169	2.3	19.5	36	Pass

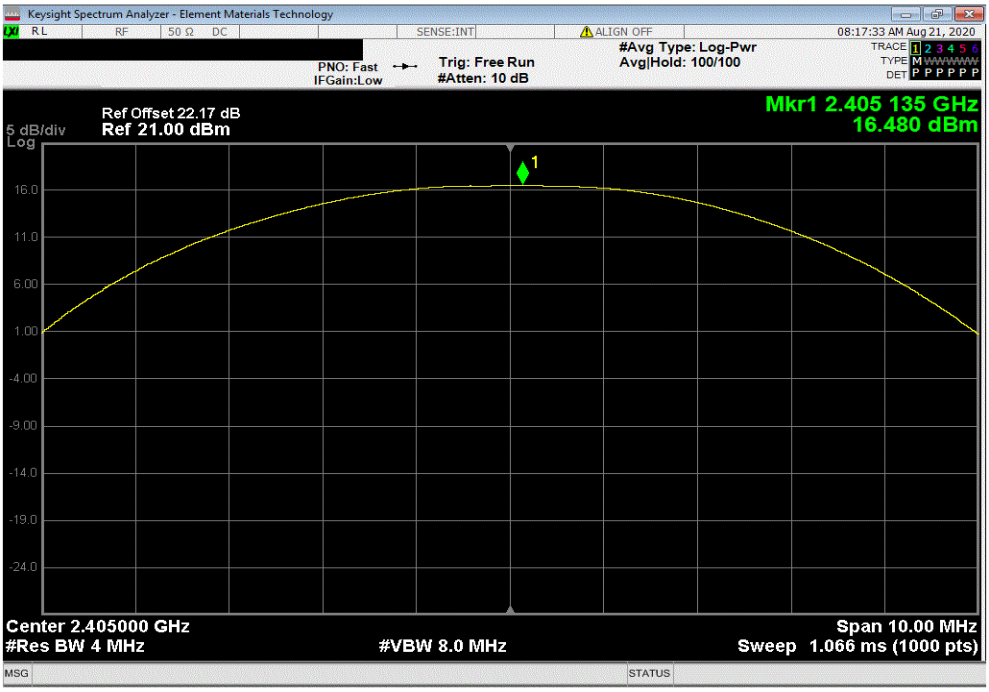


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

Antenna Port 1, High Channel (2475 MHz)						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		14.321	1.1	15.4	36	Pass

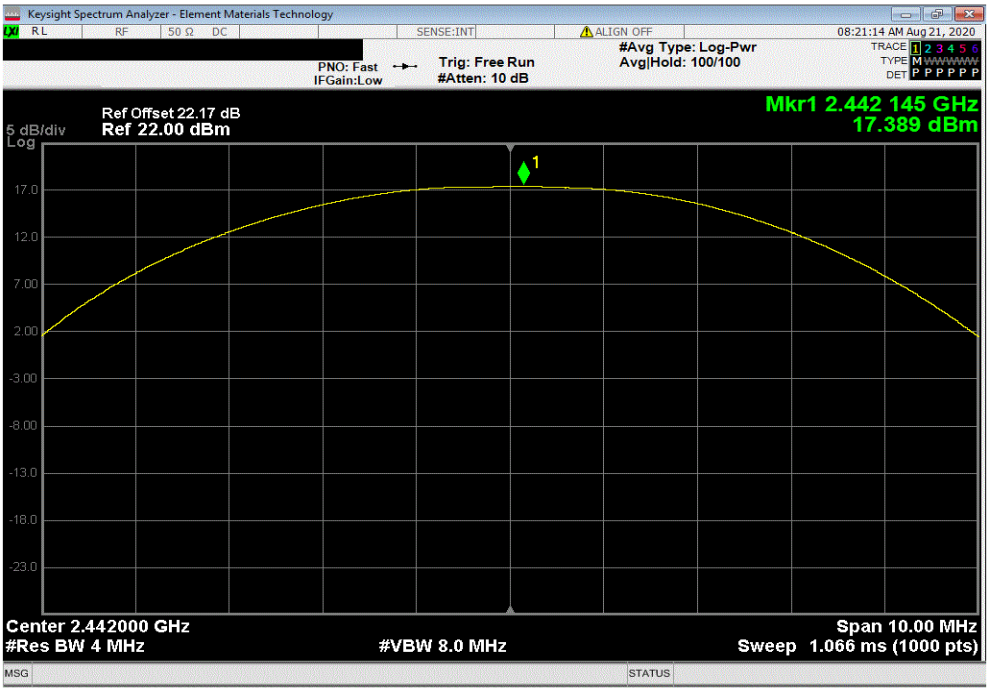


Antenna Port 2, Low Channel (2405 MHz)						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		16.48	1.3	17.8	36	Pass

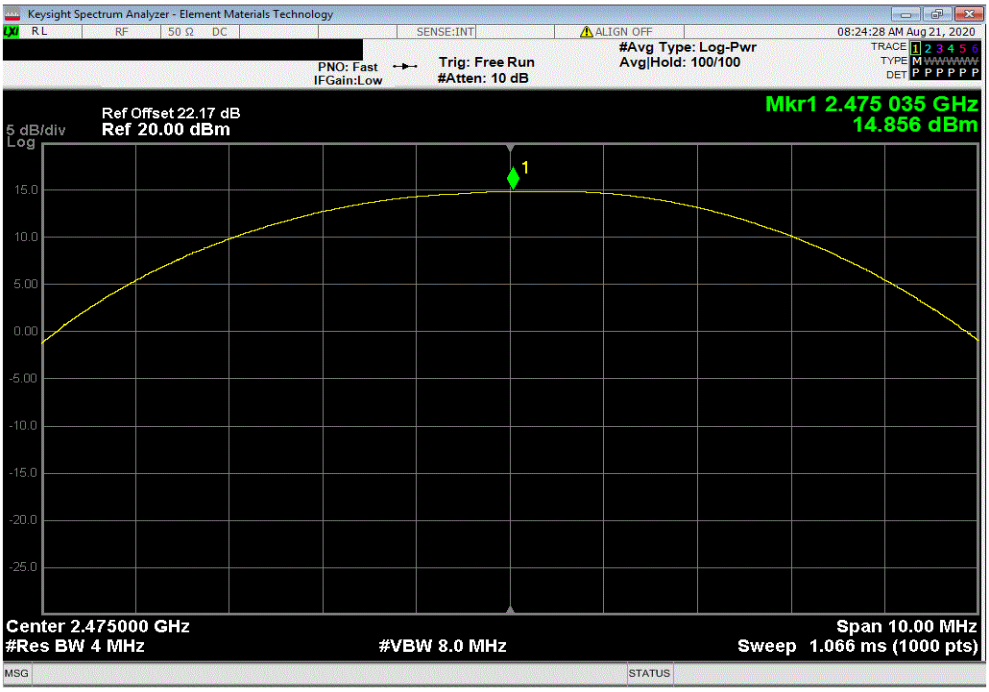


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

Antenna Port 2, Mid Channel (2442 MHz)						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		17.389	-0.8	16.5	36	Pass



Antenna Port 2, High Channel (2475 MHz)						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		14.856	-2.2	12.6	36	Pass



POWER SPECTRAL DENSITY

XMit 2020.03.25.0

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	N5182B	TFX	28-Apr-20	28-Apr-23
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	10-Feb-20	10-Feb-21
Block - DC	Fairview Microwave	SD3379	AMI	5-Aug-20	5-Aug-21
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	21-Dec-19	21-Dec-20

TEST DESCRIPTION

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

Per the procedure outlined in ANSI C63.10 the peak power spectral density was measured in a 3 kHz RBW.

POWER SPECTRAL DENSITY

TbtTx 2019.08.30.0 XMit 2020.03.25.0

EUT:	**Lunar**			**Work Order:**	**MSAS0004**
Serial Number:	**9628**			**Date:**	**20-Aug-20**
Customer:	**MSA Innovation, LLC**			**Temperature:**	**22.3 °C**
Attendees:	**Dustin Morris**			**Humidity:**	**57.1% RH**
Project:	**None**			**Barometric Pres.:**	**1013 mbar**
Tested by:	**Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset on the spectrum analyzer includes the measurement cable, 20 dB attenuator, and DC block. Measurements taken on antenna port 2 (worst case port from output power/EIRP.)

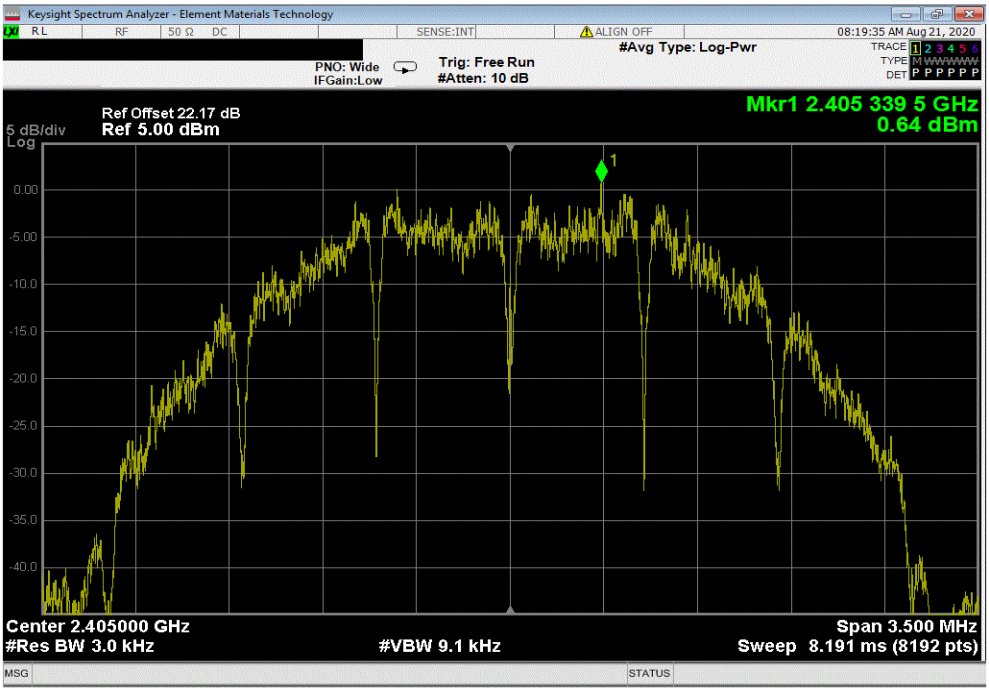
DEVIATIONS FROM TEST STANDARD

None

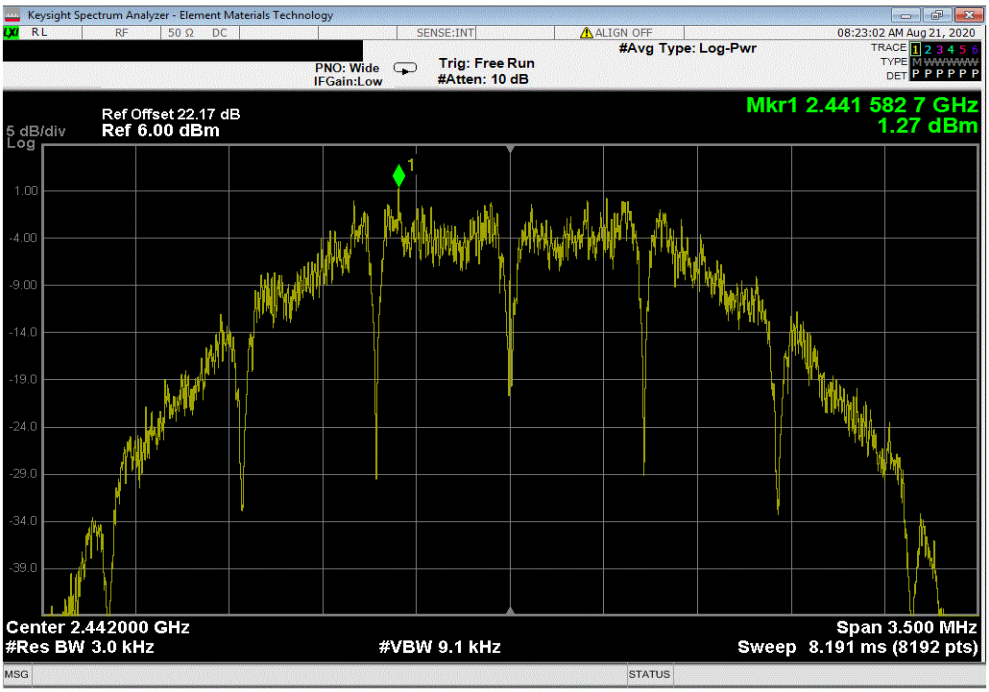
Configuration #	**2**	*Signature* Dustin Sparks

	Value dBm/3kHz	**Limit < dBm/3kHz**	**Results**
Antenna Port 2			
Low Channel (2405 MHz)	0.637	8	Pass
Mid Channel (2442 MHz)	1.273	8	Pass
High Channel (2475 MHz)	-1.57	8	Pass

Antenna Port 2, Low Channel (2405 MHz)						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				0.637	8	Pass

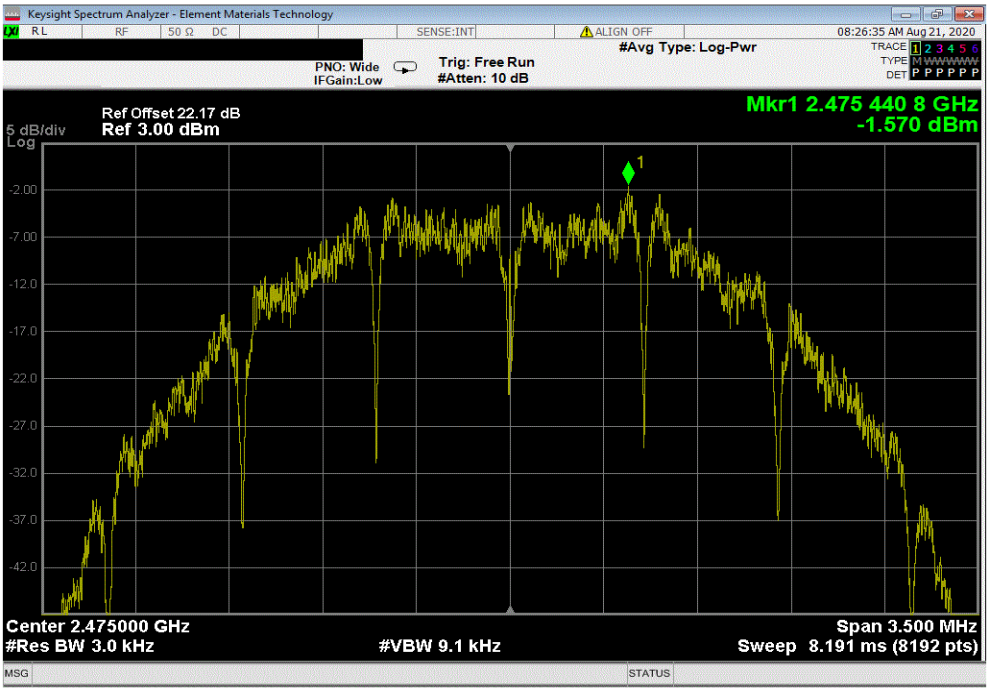


Antenna Port 2, Mid Channel (2442 MHz)						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				1.273	8	Pass



POWER SPECTRAL DENSITY

Antenna Port 2, High Channel (2475 MHz)						
				Value dBm/3kHz	Limit < dBm/3kHz	Results
				-1.57	8	Pass



BAND EDGE COMPLIANCE

XMit 2020.03.25.0

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	N5182B	TFX	28-Apr-20	28-Apr-23
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	10-Feb-20	10-Feb-21
Block - DC	Fairview Microwave	SD3379	AMI	5-Aug-20	5-Aug-21
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	21-Dec-19	21-Dec-20

TEST DESCRIPTION

The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in each available band. The channels closest to the band edges were selected. The EUT was transmitting at the data rate(s) listed in the datasheet.

The spectrum was scanned below the lower band edge and above the higher band edge.

BAND EDGE COMPLIANCE

TbtTx 2019.08.30.0 XMit 2020.03.25.0

EUT:	Lunar			**Work Order:**	MSAS0004
Serial Number:	9628			**Date:**	20-Aug-20
Customer:	MSA Innovation, LLC			**Temperature:**	22.2 °C
Attendees:	Dustin Morris			**Humidity:**	57.1% RH
Project:	None			**Barometric Pres.:**	1013 mbar
Tested by:	Dustin Sparks	**Power:**	Battery	**Job Site:**	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset on the spectrum analyzer includes the measurement cable, 20 dB attenuator, and DC block. Measurements taken on antenna port 2 (worst case port from output power/EIRP.)

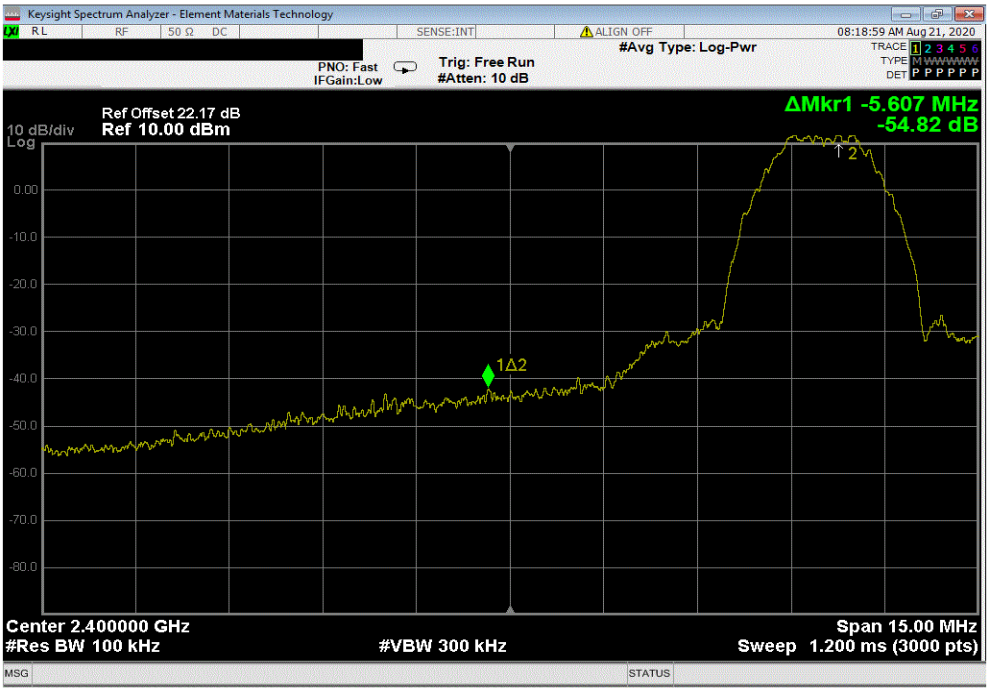
DEVIATIONS FROM TEST STANDARD

None

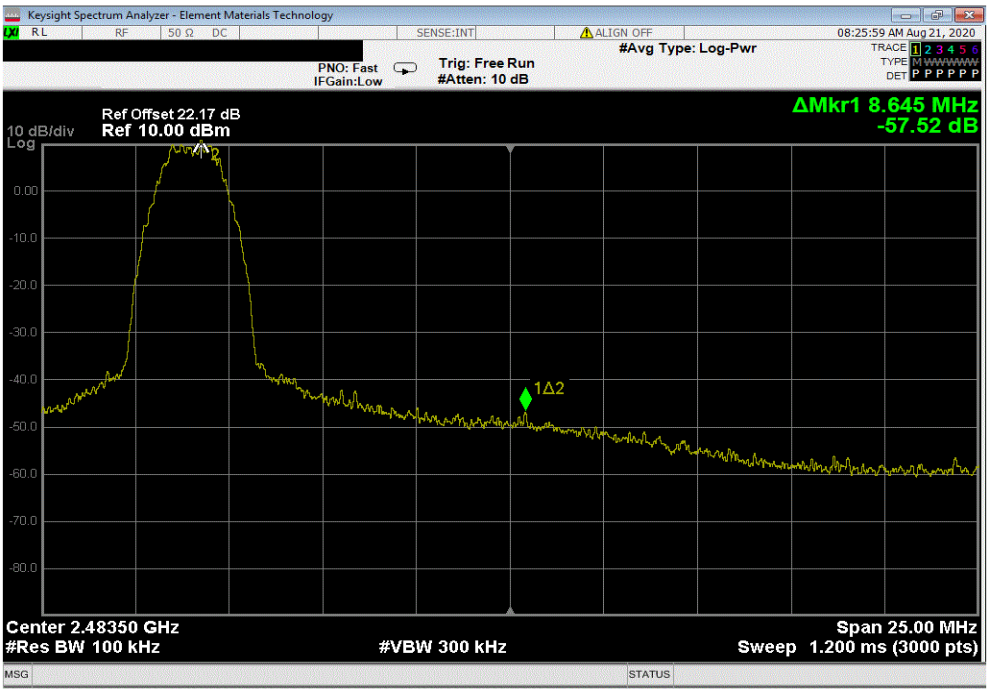
Configuration #	2	Signature Dustin Sparks

	Value (dBc)	Limit ≤ (dBc)	Result
Antenna Port 2			
Low Channel (2405 MHz)	-54.82	-20	Pass
High Channel (2475 MHz)	-57.52	-20	Pass

Antenna Port 2, Low Channel (2405 MHz)						
				Value (dBc)	Limit ≤ (dBc)	Result
				-54.82	-20	Pass



Antenna Port 2, High Channel (2475 MHz)						
				Value (dBc)	Limit ≤ (dBc)	Result
				-57.52	-20	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2020.03.25.0

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	N5182B	TFX	28-Apr-20	28-Apr-23
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	15-Sep-19	15-Sep-20
Attenuator	S.M. Electronics	SA26B-20	RFW	10-Feb-20	10-Feb-21
Block - DC	Fairview Microwave	SD3379	AMI	5-Aug-20	5-Aug-21
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	21-Dec-19	21-Dec-20

TEST DESCRIPTION

The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting at the data rate(s) listed in the datasheet. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.

SPURIOUS CONDUCTED EMISSIONS

TbtTx 2019.08.30.0 XMit 2020.03.25.0

EUT:	**Lunar**			**Work Order:**	**MSAS0004**
Serial Number:	**9628**			**Date:**	**20-Aug-20**
Customer:	**MSA Innovation, LLC**			**Temperature:**	**22.2 °C**
Attendees:	**Dustin Morris**			**Humidity:**	**57.7% RH**
Project:	**None**			**Barometric Pres.:**	**1012 mbar**
Tested by:	**Dustin Sparks**	**Power:**	**Battery**	**Job Site:**	**MN08**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset on the spectrum analyzer includes the measurement cable, 20 dB attenuator, and DC block. Measurements taken on antenna port 2 (worst case port from output power/EIRP.)

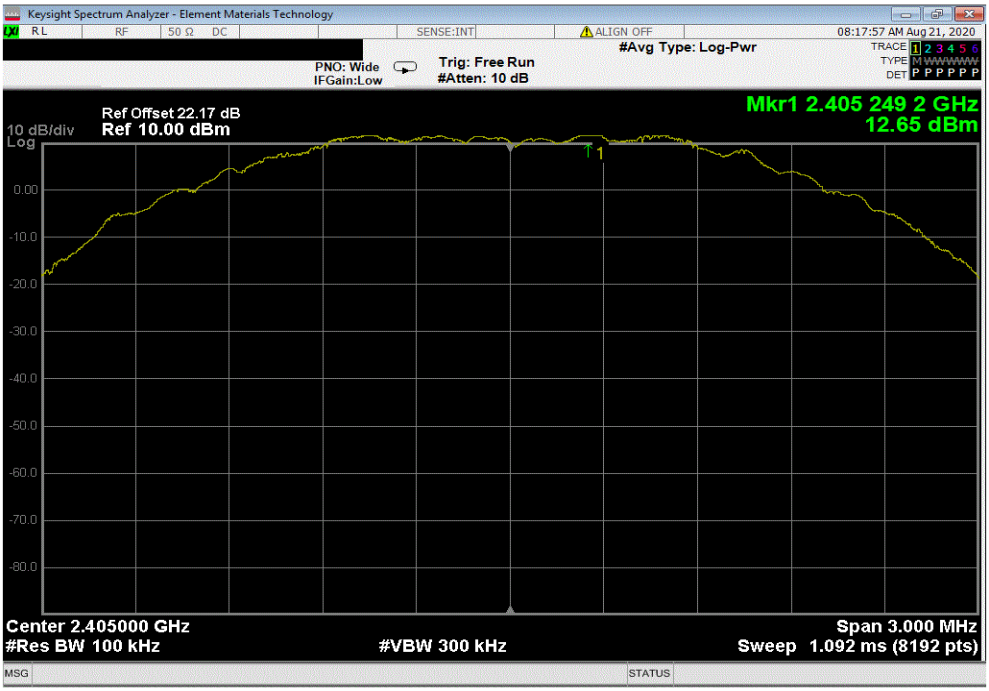
DEVIATIONS FROM TEST STANDARD

None

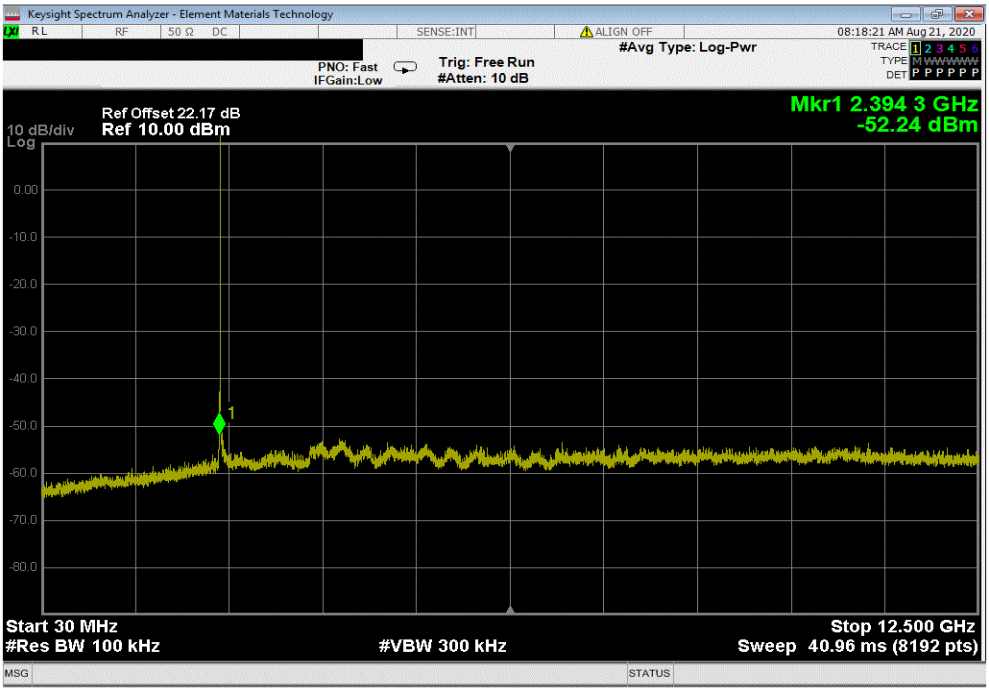
Configuration #	**2**	*Signature* Dustin Sparks

	Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
Antenna Port 2					
Low Channel (2405 MHz)	Fundamental	2405.25	N/A	N/A	N/A
Low Channel (2405 MHz)	30 MHz - 12.5 GHz	2394.29	-64.89	-20	Pass
Low Channel (2405 MHz)	12.5 GHz - 25 GHz	24021.79	-62.6	-20	Pass
Mid Channel (2442 MHz)	Fundamental	2441.75	N/A	N/A	N/A
Mid Channel (2442 MHz)	30 MHz - 12.5 GHz	4032.4	-65.75	-20	Pass
Mid Channel (2442 MHz)	12.5 GHz - 25 GHz	23945.49	-62.68	-20	Pass
High Channel (2475 MHz)	Fundamental	2475.26	N/A	N/A	N/A
High Channel (2475 MHz)	30 MHz - 12.5 GHz	4059.8	-63.76	-20	Pass
High Channel (2475 MHz)	12.5 GHz - 25 GHz	23908.86	-59.39	-20	Pass

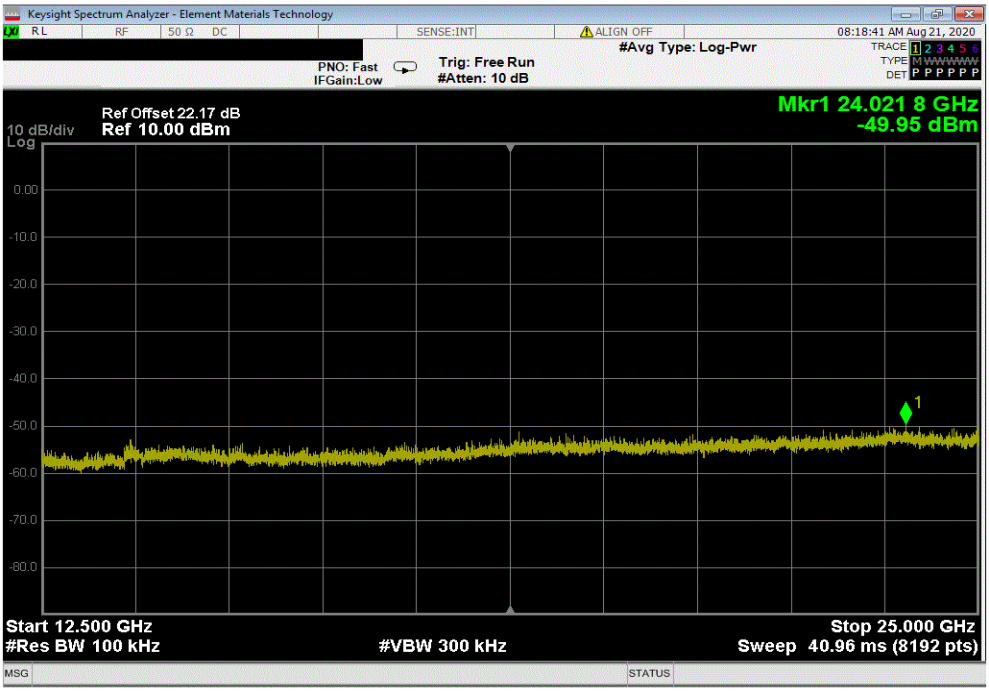
Antenna Port 2, Low Channel (2405 MHz)					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	2405.25	N/A	N/A	N/A



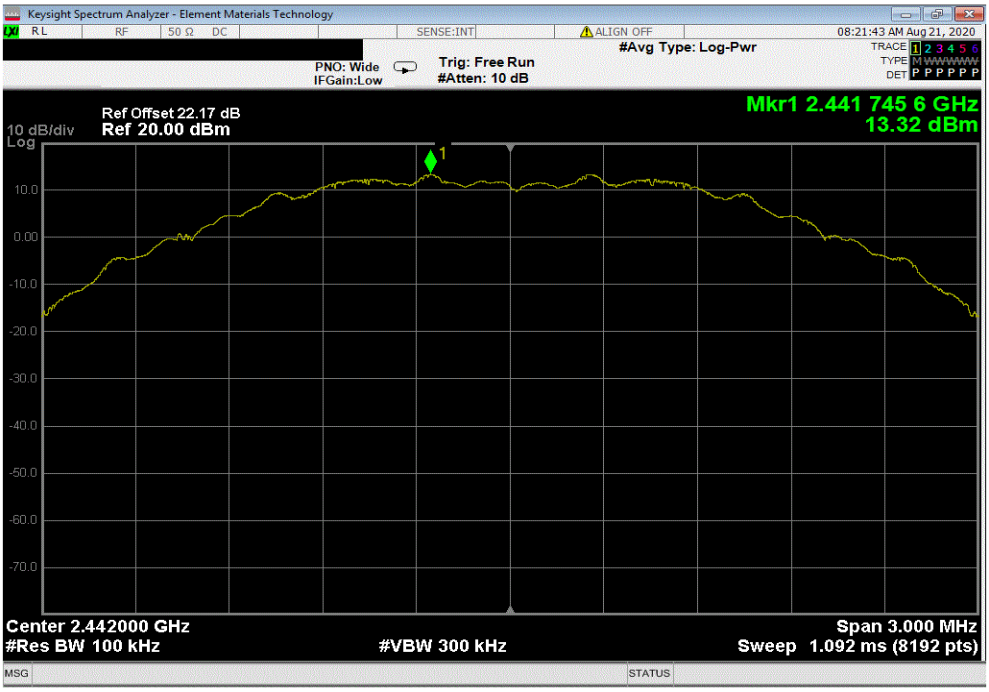
Antenna Port 2, Low Channel (2405 MHz)				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	2394.29	-64.89	-20	Pass



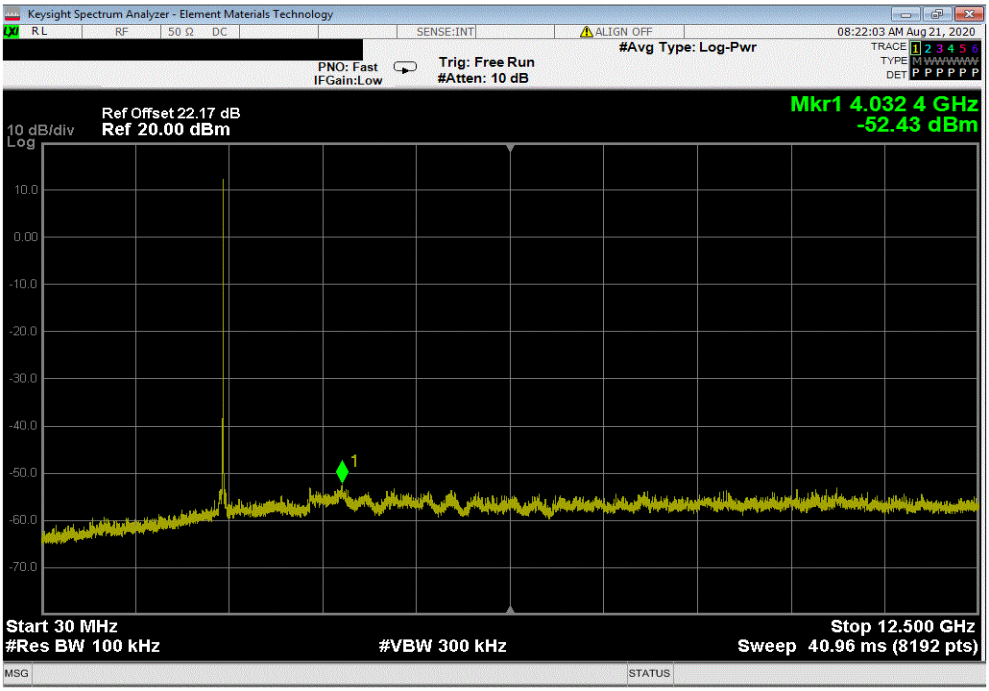
Antenna Port 2, Low Channel (2405 MHz)				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	24021.79	-62.6	-20	Pass



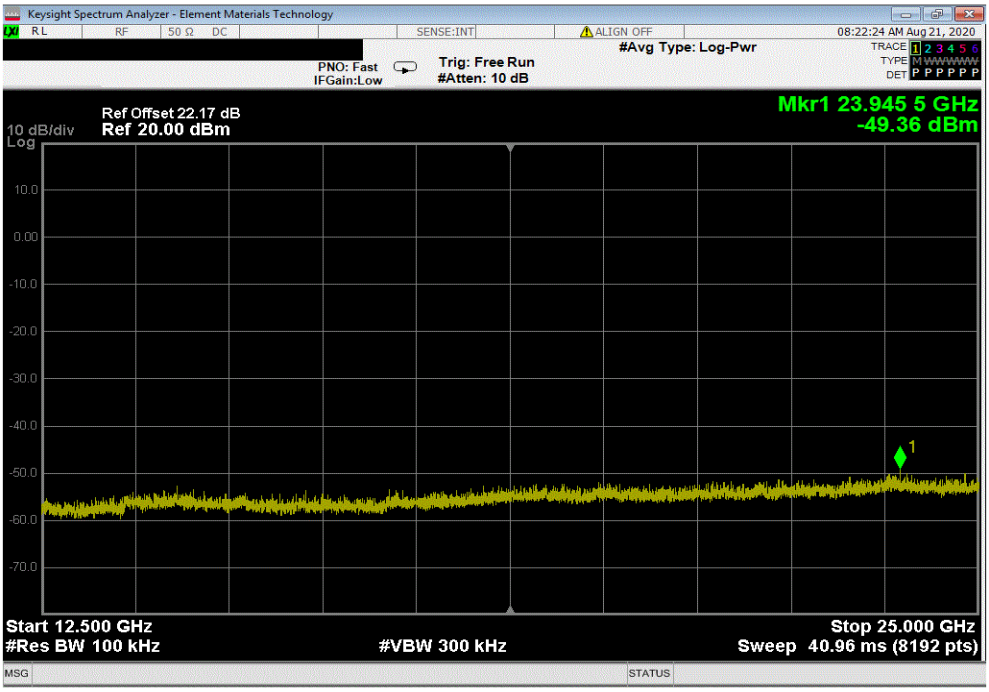
Antenna Port 2, Mid Channel (2442 MHz)				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
Fundamental	2441.75	N/A	N/A	N/A



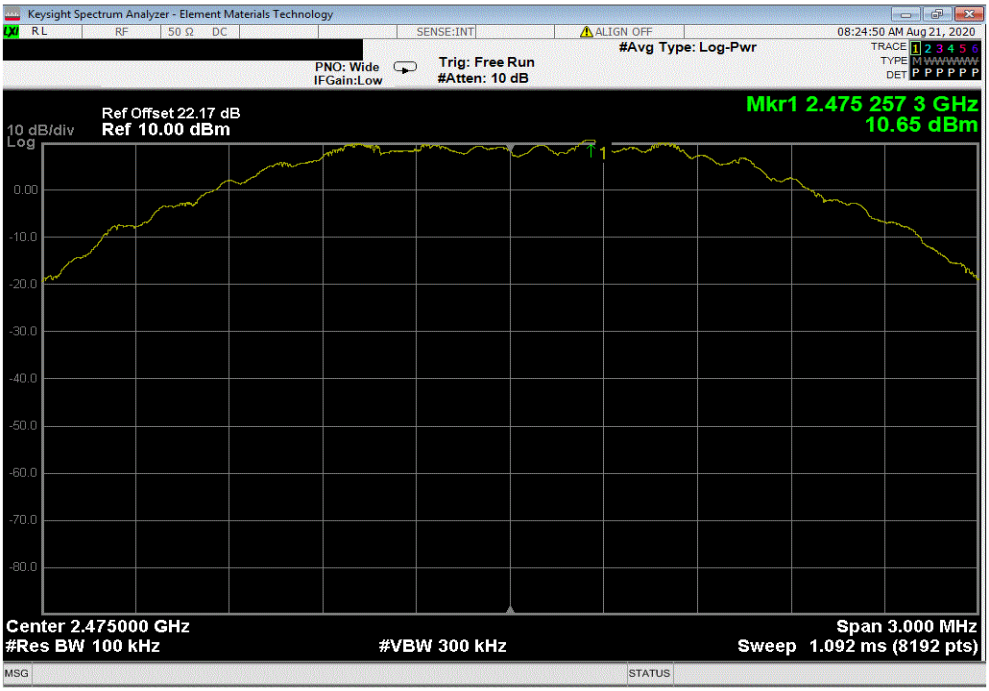
Antenna Port 2, Mid Channel (2442 MHz)				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
30 MHz - 12.5 GHz	4032.4	-65.75	-20	Pass



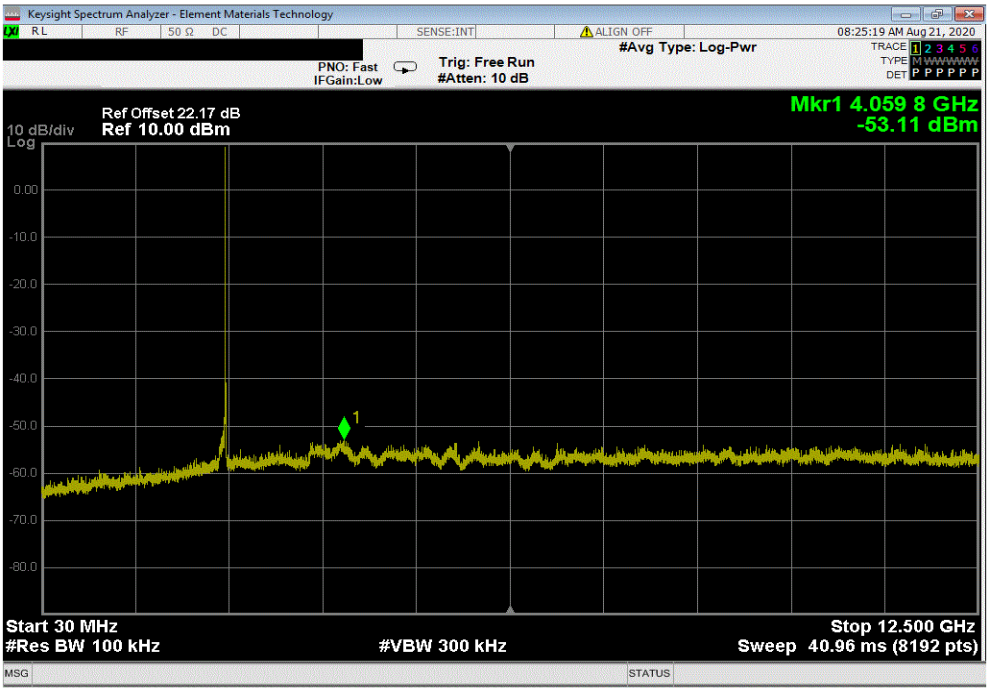
Antenna Port 2, Mid Channel (2442 MHz)				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz	23945.49	-62.68	-20	Pass



Antenna Port 2, High Channel (2475 MHz)					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	2475.26	N/A	N/A	N/A



Antenna Port 2, High Channel (2475 MHz)				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	4059.8	-63.76	-20	Pass



Antenna Port 2, High Channel (2475 MHz)				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	23908.86	-59.39	-20	Pass