MSA Innovation, LLC

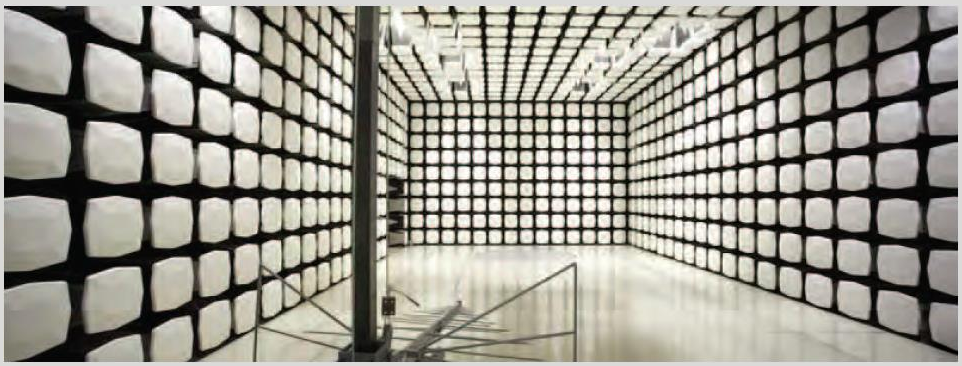
MSA G1 SCBA made with Type 2 power module installed

FCC 15.247:2022

RSS-247 Issue 2:2017

902 - 928 MHz FHSS Transceiver

Report: F3EN0126.1 Rev 1, Issue Date: January 4, 2023



CERT #3310.05

CERTIFICATE OF TEST

Last Date of Test: October 28, 2022
MSA Innovation, LLC
EUT: MSA G1 SCBA made with Type 2 power module installed

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2022	ANSI C63.10:2013, FCC KDB 558074 v05r02:2019
RSS-247 Issue 2:2017	
RSS-Gen Issue 5:2018+A1:2019+A2:2021	

Results

Test Description	Result	FCC Section(s)	RSS Section(s)	ANSI Method Section(s)	Comments
Powerline Conducted Emissions (Transmitter)	N/A	15.207	RSS-Gen 8.8	6.2	Not required for a battery powered EUT.
Spurious Radiated Emissions	Pass	15.247(d), KDB 558074 -8.6, 8.7	RSS-247 5.5	6.5, 6.6	
Occupied Bandwidth (99%)	N/A	KDB 558074 - 2.1	RSS-Gen 6.7	6.9.3	Not included to show compliance of the limited module in the host
Carrier Frequency Separation	N/A	15.247(a)(1)	RSS-247 5.1(b)	7.8.2	Not included to show compliance of the limited module in the host
Number of Hopping Frequencies	N/A	15.247(a)(1)	RSS-247 5.1(d)	7.8.3	Not included to show compliance of the limited module in the host
Dwell Time	N/A	15.247(a)(1)	RSS-247 5.1(d)	7.8.4	Not included to show compliance of the limited module in the host
Band Edge Compliance - Hopping Mode	N/A	15.247(d)	RSS-247 5.5	7.8.6	Not included to show compliance of the limited module in the host
Duty Cycle	Evaluated	15.247, KDB 558074 -6.0	RSS-Gen 3.2	7.5	Characterization of operation.
Emissions Bandwidth (dB)	N/A	15.247(a), KDB 558074 -8.2	RSS-247 5.2(a)	7.8.7	Not included to show compliance of the limited module in the host
Output Power	Pass	15.247(b), KDB 558074 -8.3	RSS-247 5.4(d)	7.8.5	
Equivalent Isotropic Radiated Power (EIRP)	Pass	15.247(b), KDB 558074 -8.3	RSS-247 5.4(d)	7.8.5	
Band Edge Compliance	N/A	15.247(d), KDB 558074 -8.5	RSS-247 5.5	7.8.6	Not included to show compliance of the limited module in the host
Spurious Conducted Emissions	N/A	15.247(d), KDB 558074 -8.5	RSS-247 5.5	7.8.8	Not included to show compliance of the limited module in the host
Power Spectral Density	N/A	15.247(e), KDB 558074 -8.4	RSS-247 5.2(b)	11.10.2	Not required for FHSS devices.
Powerline Conducted Emissions (Receiver)	N/A	15.101, 15.107	RSS-Gen 5.2	ANSI C63.4 - 12.2.4	Not required for a battery powered EUT.
Radiated Emissions for Receiver	N/A	15.101, 15.109	RSS-Gen 5.2	ANSI C63.4 - 12.2.5	Not required. Receiver requirements only apply to standalone receivers operating in the 30-960 MHz band.

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

CERTIFICATE OF TEST

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	Added details on the modulation and data rate.	2023-01-04	11-12

ACCREDITATIONS AND AUTHORIZATIONS

element
2021.09.01

United States

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

A2LA - Each laboratory is accredited by A2LA to ISO / IEC 17025, and as a product certifier to ISO / IEC 17065 which allows Element to certify transmitters to FCC and IC specifications.

Canada

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

European Union

European Commission – Recognized as an EU Notified Body validated for the EMCD and RED Directives.

United Kingdom

BEIS – Recognized by the UK as an Approved Body under the UK Radio Equipment and UK EMC Regulations.

Australia/New Zealand

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

Korea

MSIT / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

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

SCOPE

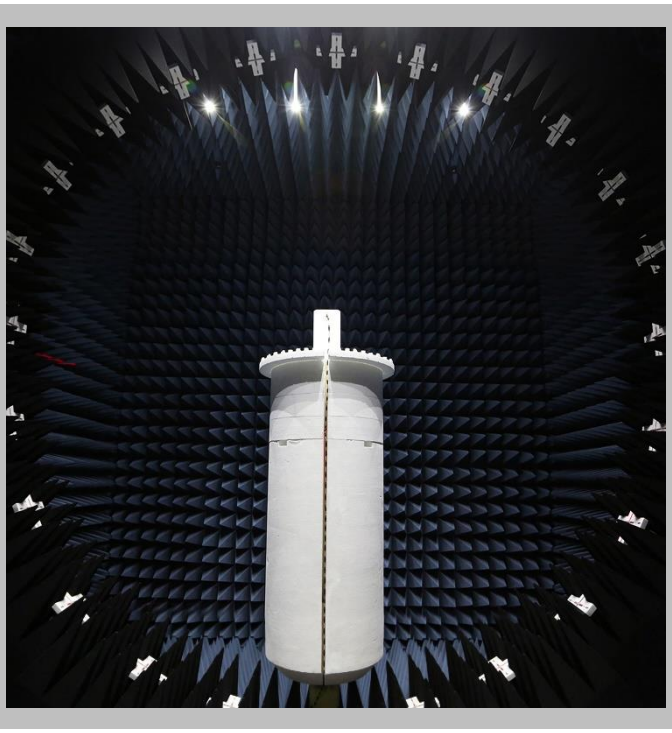
For details on the Scopes of our Accreditations, please visit:

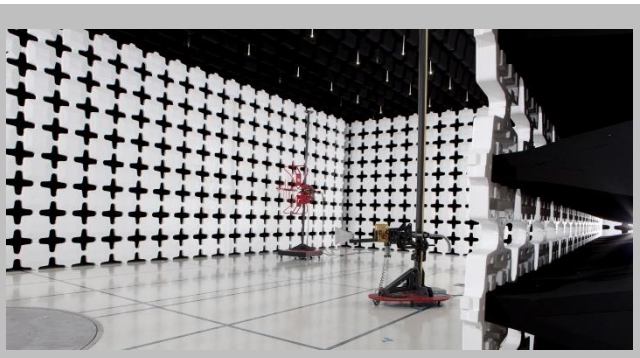
California Minnesota Oregon Texas Washington

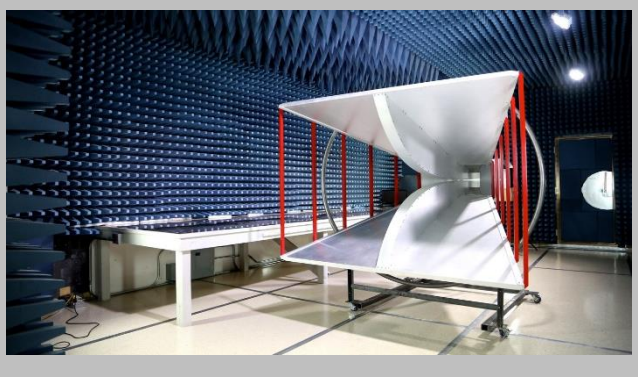
FACILITIES

element
2020.12.15

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







MEASUREMENT UNCERTAINTY

element
TMU.2015.07.10

Measurement Uncertainty

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

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

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

Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	3.2 dB	-3.2 dB

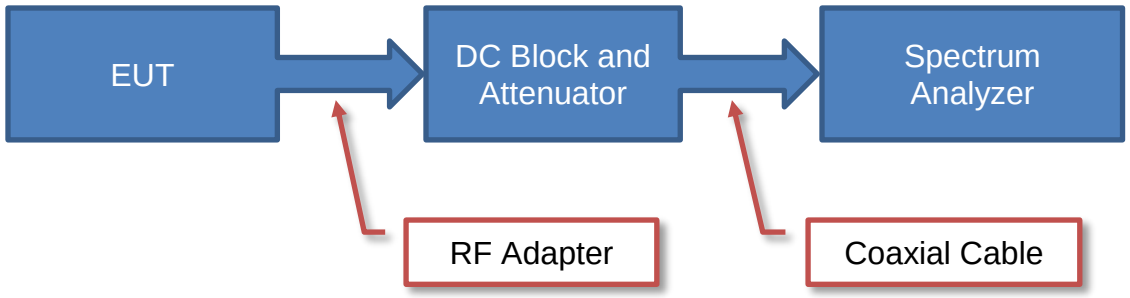
TEST SETUP BLOCK DIAGRAMS

Measurement Bandwidths

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

Unless otherwise stated, measurements were made using the bandwidths and detectors specified. No video filter was used.

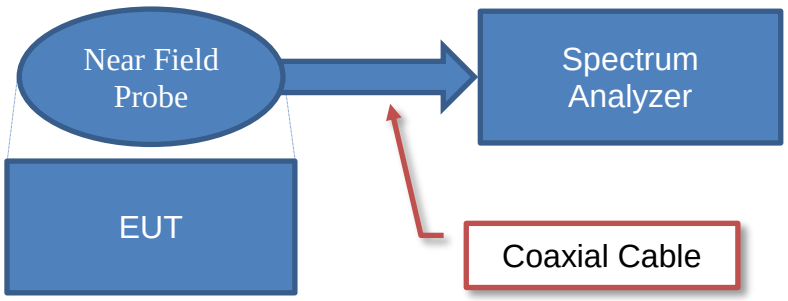
Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

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

Near Field Test Fixture Measurements

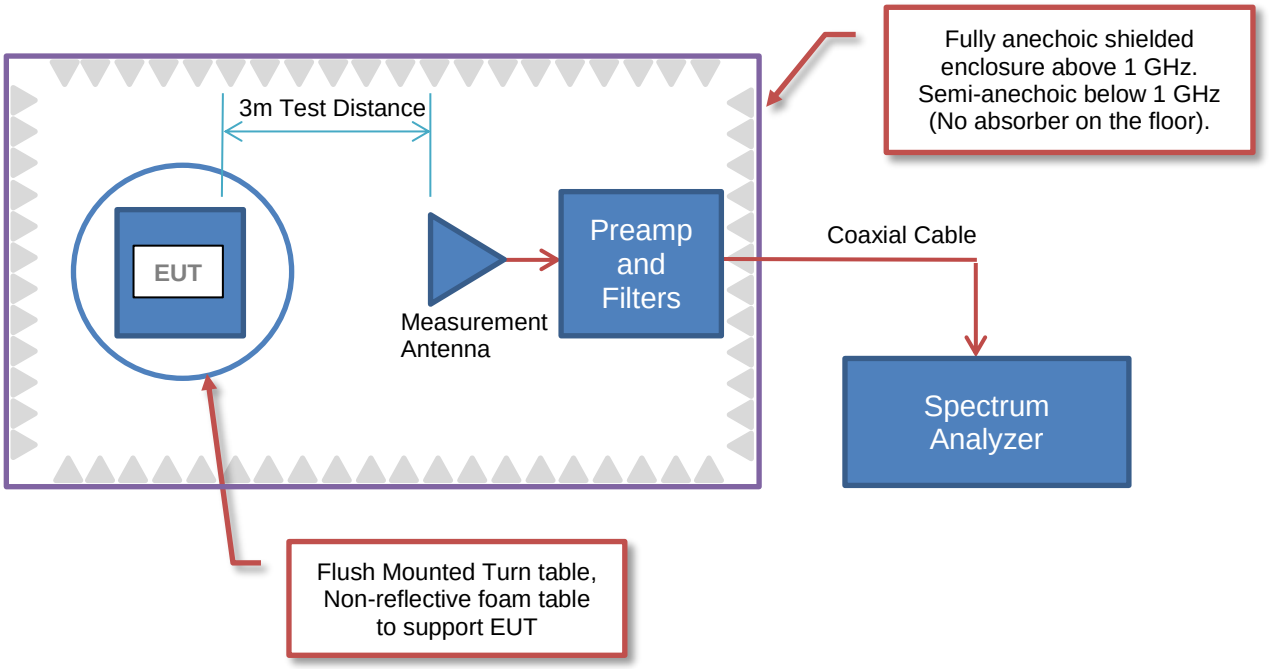


Sample Calculation (logarithmic units)

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

TEST SETUP BLOCK DIAGRAMS

Emissions Measurements



Sample Calculation (logarithmic units)

Radiated Emissions:

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

Conducted Emissions:

Measured Level (Amplitude)		Factor: Transducer Factor		Factor: Cable Factor		External Attenuation		Adjusted Level
26.7	+	0.3	+	0.1	+	20.0	=	**47.1**

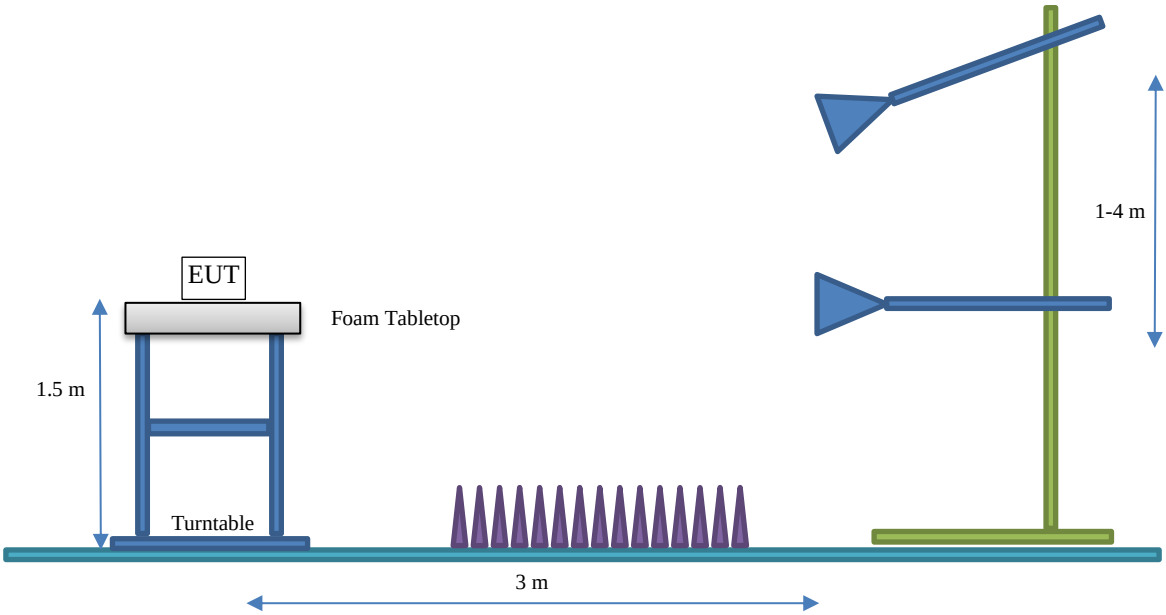
Radiated Power (ERP/EIRP) – Substitution Method:

Measured Level into Substitution Antenna (Amplitude dBm)		Substitution Antenna Factor (dBi)		EIRP to ERP (if applicable)		Measured power (dBm ERP/EIRP)
10.0	+	6.0	-	2.15	=	**13.9/16.0**

TEST SETUP BLOCK DIAGRAMS

Bore Sighting (>1GHz)

The diameter of the illumination area is the dimension of the line tangent to the EUT formed by 3 dB beamwidth of the measurement antenna at the measurement distance. At a 3 meter test distance, the diameter of the illumination area was 3.8 meters at 1 GHz and greater than 2.1 meters up to 6 GHz. Above 1 GHz, when required by the measurement standard, the antenna is pointed for both azimuth and elevation to maintain the receive antenna within the cone of radiation from the EUT. The specified measurement detectors were used for comparison of the emissions to the peak and average specification limits.



PRODUCT DESCRIPTION

Client and Equipment under Test (EUT) Information

Company Name:	MSA Innovation, LLC
Address:	1100 Cranberry Woods Road
City, State, Zip:	Cranberry Township, PA 16066
Test Requested By:	Dustin Morris
EUT:	MSA G1 SCBA made with Type 2 power module installed
First Date of Test:	October 28, 2022
Last Date of Test:	October 28, 2022
Receipt Date of Samples:	October 14, 2022
Equipment Design Stage:	Prototype
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
MSA G1 SCBA made with Type 2 power module installed Sub-GHz Radio - This is used to transmit SCBA status information to a remote base station. It is 59.8 mm from the body. (FCC ID: RPN-10184341). Device uses 2-FSK modulation with a single data rate of 19.2 Kbaud.

Testing Objective:
Seeking to demonstrate compliance in the 902 - 928 MHz band for operation under FCC 15.247:2022. To demonstrate compliance to RSS-247 Issue 2:2017, RSS-Gen Issue 5:2018+A1:2019+A2:2021 specifications under technology category Other.

POWER SETTINGS AND ANTENNAS

The power settings, antenna gain value(s) and cable loss (if applicable) used for the testing contained in this report were provided by the customer and will affect the validity of the results. Element assumes no responsibility for the accuracy of this information. The power settings below reflect the maximum power that the EUT is allowed to transmit at during normal operation.

ANTENNA GAIN (dBi)

Type	Provided by:	Frequency Range (MHz)	Gain (dBi)
Wire Monopole	Element Materials Technology Measurements – See separate antenna report	902-928	+3.51

The EUT was tested using the power settings provided by the manufacturer which were based upon:

☒ Test software settings Test software/firmware installed on EUT: Radio Test Software Ver 0.1
☐ Rated power settings

SETTINGS FOR ALL TESTS IN THIS REPORT

Modulation Types	Position (if multiple channels)	Power Setting
2-FSK with a single data rate of 19.2 Kbaud	Low Channel (902.2 MHz)	F
	Mid Channel (915 MHz)	F
	High Channel (927.7 MHz)	F

CONFIGURATIONS

Configuration F3EN0126- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
SCBA	MSA Safety	Type 2	e0040150b1b81de

Configuration F3EN0126- 2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
SCBA	MSA Safety	Type 2	e0040150b1b81de

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	ASUS	UX433F	00325-96475-24912-AAOEM
Comm Board	MSA Safety	STM-Debug-Adapter	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Programming Cable (USB)	Yes	1.6 m	No	Laptop	Comm Board
Programming Cable (short)	No	0.2 m	Yes	Comm Board	SCBA

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2022-10-28	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	2022-10-28	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	2022-10-28	Equivalent Isotropic Radiated Power (EIRP)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

SPURIOUS RADIATED EMISSIONS

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

TEST DESCRIPTION

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

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

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

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

QP = Quasi-Peak Detector
PK = Peak Detector
AV = 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).

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Antenna - Double Ridge	ETS Lindgren	3115	AIB	2022-09-01	2024-09-01
Cable	Element	Double Ridge Guide Horn Cables	MNV	2022-01-24	2023-01-24
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVX	2022-01-24	2023-01-24
Filter - High Pass	Micro-Tronics	HPM50108	HFW	2022-09-10	2023-09-10
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	2022-03-22	2023-03-22
Antenna - Standard Gain	ETS-Lindgren	3160-07	AJJ	NCR	NCR
Cable	Element	Standard Gain Cable	MNW	2022-01-24	2023-01-24
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVC	2022-01-24	2023-01-24
Antenna - Standard Gain	ETS-Lindgren	3160-08	AJP	NCR	NCR
Amplifier - Pre-Amplifier	L-3 Narda-Miteq	AMF-6F-12001800-30-10P	PAP	2022-01-24	2023-01-24
Attenuator	Coaxicom	3910-20	AXY	2022-09-10	2023-09-10
Filter - High Pass	TTE	H97-100K-50-720B	HGN	NCR	NCR
Filter - Band Pass/Notch	K&L Microwave	3TNF-500/1000-N/N	HGS	2022-06-22	2023-06-22
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	2022-06-10	2023-06-10
Antenna - Double Ridge	ETS Lindgren	3115	AJQ	2021-01-25	2023-01-25
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	2022-01-18	2023-01-18
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	2022-01-18	2023-01-18

SPURIOUS RADIATED EMISSIONS

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	5.2 dB	-5.2 dB

FREQUENCY RANGE INVESTIGATED

30 MHz TO 12400 MHz

POWER INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

F3EN0126-1

MODES INVESTIGATED

Transmitting SRD Radio Low, Mid, and High Chs (902.2, 915, and 927.7 MHz), Modulated

SPURIOUS RADIATED EMISSIONS

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

EUT:	MSA G1 SCBA made with Type 2 power module installed	Work Order:	F3EN0126
Serial Number:	e0040150b1b81de	Date:	2022-10-28
Customer:	MSA Innovation, LLC	Temperature:	21.7°C
Attendees:	Dustin Morris	Relative Humidity:	32.6%
Customer Project:	None	Bar. Pressure (PMSL):	1029 mb
Tested By:	Marcelo Aguayo, Trevor Buls	Job Site:	MN09
Power:	Battery	Configuration:	F3EN0126-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2022	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

TEST PARAMETERS

Run #:	32	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

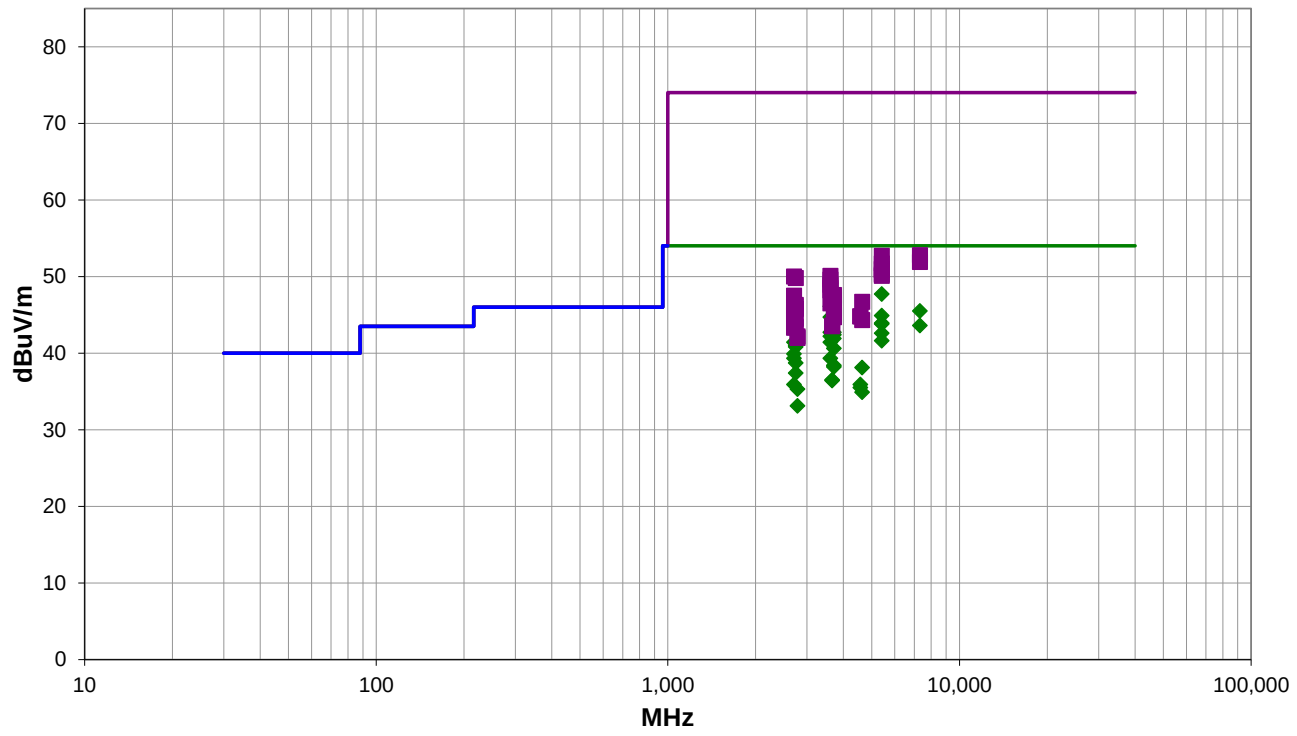
Power setting F

EUT OPERATING MODES

Transmitting SRD Radio Low, Mid, and High Chs (902.2, 915, and 927.7 MHz), Modulated

DEVIATIONS FROM TEST STANDARD

None



Run #: 32 ■ PK ◆ AV ● QP

SPURIOUS RADIATED EMISSIONS

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

RESULTS - Run #32

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
5413.175	40.3	7.4	1.1	102.0	3.0	0.0	Horz	AV	0.0	47.7	54.0	-6.3	EUT On Side, Low Ch
2706.583	48.9	-1.9	4.0	134.0	3.0	0.0	Horz	AV	0.0	47.0	54.0	-7.0	EUT Vertical, Low Ch
2744.975	49.6	-2.6	1.5	296.0	3.0	0.0	Vert	AV	0.0	47.0	54.0	-7.0	EUT Horz, Mid Ch
3608.808	45.0	1.1	4.0	123.0	3.0	0.0	Vert	AV	0.0	46.1	54.0	-7.9	EUT On Side, Low Ch
7319.883	34.2	11.3	2.5	246.9	3.0	0.0	Horz	AV	0.0	45.5	54.0	-8.5	EUT On Side, Mid Ch
5413.175	37.5	7.4	1.5	360.0	3.0	0.0	Horz	AV	0.0	44.9	54.0	-9.1	EUT Vertical, Low Ch
3608.808	43.6	1.1	4.0	84.0	3.0	0.0	Horz	AV	0.0	44.7	54.0	-9.3	EUT On Side, Low Ch
5413.133	36.5	7.4	1.6	195.0	3.0	0.0	Vert	AV	0.0	43.9	54.0	-10.1	EUT Horz, Low Ch
5413.167	36.4	7.4	1.4	88.0	3.0	0.0	Vert	AV	0.0	43.8	54.0	-10.2	EUT On Side, Low Ch
2706.600	45.5	-1.9	4.0	57.0	3.0	0.0	Vert	AV	0.0	43.6	54.0	-10.4	EUT On Side, Low Ch
7319.942	32.3	11.3	1.1	9.9	3.0	0.0	Vert	AV	0.0	43.6	54.0	-10.4	EUT Horz, Mid Ch
3608.817	41.6	1.1	4.0	56.0	3.0	0.0	Horz	AV	0.0	42.7	54.0	-11.3	EUT Vertical, Low Ch
3710.767	42.0	0.7	2.8	276.9	3.0	0.0	Horz	AV	0.0	42.7	54.0	-11.3	EUT On Side, High Ch
5413.200	35.2	7.4	1.4	122.0	3.0	0.0	Horz	AV	0.0	42.6	54.0	-11.4	EUT Horz, Low Ch
3710.817	41.7	0.7	2.2	283.9	3.0	0.0	Horz	AV	0.0	42.4	54.0	-11.6	EUT Vert, High Ch
3608.883	41.1	1.1	1.0	82.0	3.0	0.0	Vert	AV	0.0	42.2	54.0	-11.8	EUT Vertical, Low Ch
3710.808	41.2	0.7	4.0	184.0	3.0	0.0	Vert	AV	0.0	41.9	54.0	-12.1	EUT Horz, High Ch
5413.208	34.2	7.4	1.3	148.0	3.0	0.0	Vert	AV	0.0	41.6	54.0	-12.4	EUT Vertical, Low Ch
2706.592	43.3	-1.9	3.8	298.0	3.0	0.0	Horz	AV	0.0	41.4	54.0	-12.6	EUT Horz, Low Ch
3608.792	40.3	1.1	3.7	30.0	3.0	0.0	Horz	AV	0.0	41.4	54.0	-12.6	EUT Horz, Low Ch
2745.033	44.0	-2.6	1.5	137.1	3.0	0.0	Horz	AV	0.0	41.4	54.0	-12.6	EUT On Side, Mid Ch
2744.983	43.6	-2.6	1.5	42.9	3.0	0.0	Horz	AV	0.0	41.0	54.0	-13.0	EUT Horz, Mid Ch
2745.042	43.4	-2.6	3.7	41.9	3.0	0.0	Horz	AV	0.0	40.8	54.0	-13.2	EUT Vert, Mid Ch
3710.792	39.9	0.7	4.0	217.0	3.0	0.0	Horz	AV	0.0	40.6	54.0	-13.4	EUT Horz, High Ch
2706.592	41.8	-1.9	1.0	47.0	3.0	0.0	Vert	AV	0.0	39.9	54.0	-14.1	EUT Vertical, Low Ch
2706.658	41.2	-1.9	1.0	159.0	3.0	0.0	Vert	AV	0.0	39.3	54.0	-14.7	EUT Horz, Low Ch
3608.775	38.2	1.1	1.1	34.0	3.0	0.0	Vert	AV	0.0	39.3	54.0	-14.7	EUT Horz, Low Ch
2745.042	41.3	-2.6	2.7	54.0	3.0	0.0	Vert	AV	0.0	38.7	54.0	-15.3	EUT On Side, Mid Ch
3710.808	37.7	0.7	1.5	232.9	3.0	0.0	Vert	AV	0.0	38.4	54.0	-15.6	EUT Vert, High Ch
3710.825	37.5	0.7	1.4	235.9	3.0	0.0	Vert	AV	0.0	38.2	54.0	-15.8	EUT On Side, High Ch
4638.460	34.5	3.6	1.0	264.0	3.0	0.0	Horz	AV	0.0	38.1	54.0	-15.9	EUT On Side, High Ch
2744.992	40.0	-2.6	1.2	66.9	3.0	0.0	Vert	AV	0.0	37.4	54.0	-16.6	EUT Vert, Mid Ch
3660.050	36.1	0.4	1.5	27.9	3.0	0.0	Horz	AV	0.0	36.5	54.0	-17.5	EUT On Side, Mid Ch
3660.040	36.0	0.4	1.1	36.0	3.0	0.0	Vert	AV	0.0	36.4	54.0	-17.6	EUT Horz, Mid Ch
2706.642	37.8	-1.9	1.5	86.0	3.0	0.0	Horz	AV	0.0	35.9	54.0	-18.1	EUT On Side, Low Ch
4575.000	32.2	3.7	1.1	211.9	3.0	0.0	Vert	AV	0.0	35.9	54.0	-18.1	EUT Horz, Mid Ch
4575.017	31.8	3.7	1.5	22.0	3.0	0.0	Horz	AV	0.0	35.5	54.0	-18.5	EUT On Side, Mid Ch
2783.100	38.1	-2.8	1.8	278.0	3.0	0.0	Horz	AV	0.0	35.3	54.0	-18.7	EUT On Side, High Ch
4638.408	31.3	3.6	2.8	264.0	3.0	0.0	Vert	AV	0.0	34.9	54.0	-19.1	EUT Horz, High Ch
2783.075	35.9	-2.8	1.5	63.0	3.0	0.0	Vert	AV	0.0	33.1	54.0	-20.9	EUT Horz, High Ch

SPURIOUS RADIATED EMISSIONS

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7319.792	41.5	11.3	2.5	246.9	3.0	0.0	Horz	PK	0.0	52.8	74.0	-21.2	EUT On Side, Mid Ch
5413.183	45.3	7.4	1.1	102.0	3.0	0.0	Horz	PK	0.0	52.7	74.0	-21.3	EUT On Side, Low Ch
7319.950	40.6	11.3	1.1	9.9	3.0	0.0	Vert	PK	0.0	51.9	74.0	-22.1	EUT Horz, Mid Ch
5413.117	44.3	7.4	1.5	360.0	3.0	0.0	Horz	PK	0.0	51.7	74.0	-22.3	EUT Vertical, Low Ch
5413.167	43.6	7.4	1.6	195.0	3.0	0.0	Vert	PK	0.0	51.0	74.0	-23.0	EUT Horz, Low Ch
5413.367	43.4	7.4	1.4	88.0	3.0	0.0	Vert	PK	0.0	50.8	74.0	-23.2	EUT On Side, Low Ch
5413.325	42.9	7.4	1.4	122.0	3.0	0.0	Horz	PK	0.0	50.3	74.0	-23.7	EUT Horz, Low Ch
3608.858	49.0	1.1	4.0	123.0	3.0	0.0	Vert	PK	0.0	50.1	74.0	-23.9	EUT On Side, Low Ch
5413.667	42.7	7.4	1.3	148.0	3.0	0.0	Vert	PK	0.0	50.1	74.0	-23.9	EUT Vertical, Low Ch
2706.758	51.9	-1.9	4.0	134.0	3.0	0.0	Horz	PK	0.0	50.0	74.0	-24.0	EUT Vertical, Low Ch
2745.008	52.4	-2.6	1.5	296.0	3.0	0.0	Vert	PK	0.0	49.8	74.0	-24.2	EUT Horz, Mid Ch
3608.892	48.5	1.1	4.0	84.0	3.0	0.0	Horz	PK	0.0	49.6	74.0	-24.4	EUT On Side, Low Ch
3608.858	47.8	1.1	4.0	56.0	3.0	0.0	Horz	PK	0.0	48.9	74.0	-25.1	EUT Vertical, Low Ch
3608.867	47.4	1.1	1.0	82.0	3.0	0.0	Vert	PK	0.0	48.5	74.0	-25.5	EUT Vertical, Low Ch
3608.875	47.1	1.1	3.7	30.0	3.0	0.0	Horz	PK	0.0	48.2	74.0	-25.8	EUT Horz, Low Ch
3710.675	46.9	0.7	2.2	283.9	3.0	0.0	Horz	PK	0.0	47.6	74.0	-26.4	EUT Vert, High Ch
2706.392	49.4	-1.9	4.0	57.0	3.0	0.0	Vert	PK	0.0	47.5	74.0	-26.5	EUT On Side, Low Ch
3710.775	46.7	0.7	2.8	276.9	3.0	0.0	Horz	PK	0.0	47.4	74.0	-26.6	EUT On Side, High Ch
3710.775	46.4	0.7	4.0	184.0	3.0	0.0	Vert	PK	0.0	47.1	74.0	-26.9	EUT Horz, High Ch
4638.540	43.1	3.6	1.0	264.0	3.0	0.0	Horz	PK	0.0	46.7	74.0	-27.3	EUT On Side, High Ch
3608.758	45.4	1.1	1.1	34.0	3.0	0.0	Vert	PK	0.0	46.5	74.0	-27.5	EUT Horz, Low Ch
2744.942	48.9	-2.6	1.5	137.1	3.0	0.0	Horz	PK	0.0	46.3	74.0	-27.7	EUT Vert, Mid Ch
2706.792	48.0	-1.9	3.8	298.0	3.0	0.0	Horz	PK	0.0	46.1	74.0	-27.9	EUT Horz, Low Ch
2744.900	48.4	-2.6	1.5	42.9	3.0	0.0	Horz	PK	0.0	45.8	74.0	-28.2	EUT Horz, Mid Ch
2744.992	48.4	-2.6	3.7	41.9	3.0	0.0	Horz	PK	0.0	45.8	74.0	-28.2	EUT On Side, Mid Ch
3710.608	45.1	0.7	4.0	217.0	3.0	0.0	Horz	PK	0.0	45.8	74.0	-28.2	EUT Horz, High Ch
2706.525	47.2	-1.9	1.0	47.0	3.0	0.0	Vert	PK	0.0	45.3	74.0	-28.7	EUT Vertical, Low Ch
2706.400	46.9	-1.9	1.0	159.0	3.0	0.0	Vert	PK	0.0	45.0	74.0	-29.0	EUT Horz, Low Ch
3710.833	44.3	0.7	1.4	235.9	3.0	0.0	Vert	PK	0.0	45.0	74.0	-29.0	EUT On Side, High Ch
4574.450	41.1	3.7	1.5	22.0	3.0	0.0	Horz	PK	0.0	44.8	74.0	-29.2	EUT On Side, Mid Ch
4568.170	41.1	3.7	1.1	211.9	3.0	0.0	Vert	PK	0.0	44.8	74.0	-29.2	EUT Horz, Mid Ch
3711.275	44.0	0.7	1.5	232.9	3.0	0.0	Vert	PK	0.0	44.7	74.0	-29.3	EUT Vert, High Ch
2744.925	47.1	-2.6	2.7	54.0	3.0	0.0	Vert	PK	0.0	44.5	74.0	-29.5	EUT On Side, Mid Ch
4638.375	40.7	3.6	2.8	264.0	3.0	0.0	Vert	PK	0.0	44.3	74.0	-29.7	EUT Horz, High Ch
3659.960	43.2	0.4	1.1	36.0	3.0	0.0	Vert	PK	0.0	43.6	74.0	-30.4	EUT Horz, Mid Ch
3659.942	43.1	0.4	1.5	27.9	3.0	0.0	Horz	PK	0.0	43.5	74.0	-30.5	EUT Horz, Mid Ch
2745.008	46.0	-2.6	1.2	66.9	3.0	0.0	Vert	PK	0.0	43.4	74.0	-30.6	EUT Vert, Mid Ch
2706.725	45.2	-1.9	1.5	86.0	3.0	0.0	Horz	PK	0.0	43.3	74.0	-30.7	EUT On Side, Low Ch
2783.140	45.0	-2.8	1.8	278.0	3.0	0.0	Horz	PK	0.0	42.2	74.0	-31.8	EUT On Side, High Ch
2783.150	44.8	-2.8	1.5	63.0	3.0	0.0	Vert	PK	0.0	42.0	74.0	-32.0	EUT Horz, High Ch

CONCLUSION

SPURIOUS RADIATED EMISSIONS

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

Pass

Tested By

DUTY CYCLE

TEST DESCRIPTION

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

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

The EUT operates at 100% Duty Cycle.

OUTPUT POWER

XMit 2022.02.07.0

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

TEST EQUIPMENT

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

TEST DESCRIPTION

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

The peak output power was measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting in a no hop mode at the data rate(s) listed in the datasheet.

The method found in ANSI C63.10:2013 Section 7.8.5 was used for a FHSS radio.

OUTPUT POWER

TbtTx 2022.06.03.0 XMit 2022.02.07.0

EUT:	**MSA G1 SCBA made with Type 2 power module installed**			**Work Order:**	**F3EN0126**
Serial Number:	**e0040150b1b81de**			**Date:**	**28-Oct-22**
Customer:	**MSA Innovation, LLC**			**Temperature:**	**22.1 °C**
Attendees:	**Dustin Morris**			**Humidity:**	**31.8% RH**
Project:	**None**			**Barometric Pres.:**	**1028 mbar**
Tested by:	**Christopher Heintzelman**	**Power:**	**Battery**	**Job Site:**	**MN11**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2022	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Power setting F. Reference level offset includes measurement cable, attenuator, and DC block. Does not inclue u.Fl patch cable.

DEVIATIONS FROM TEST STANDARD

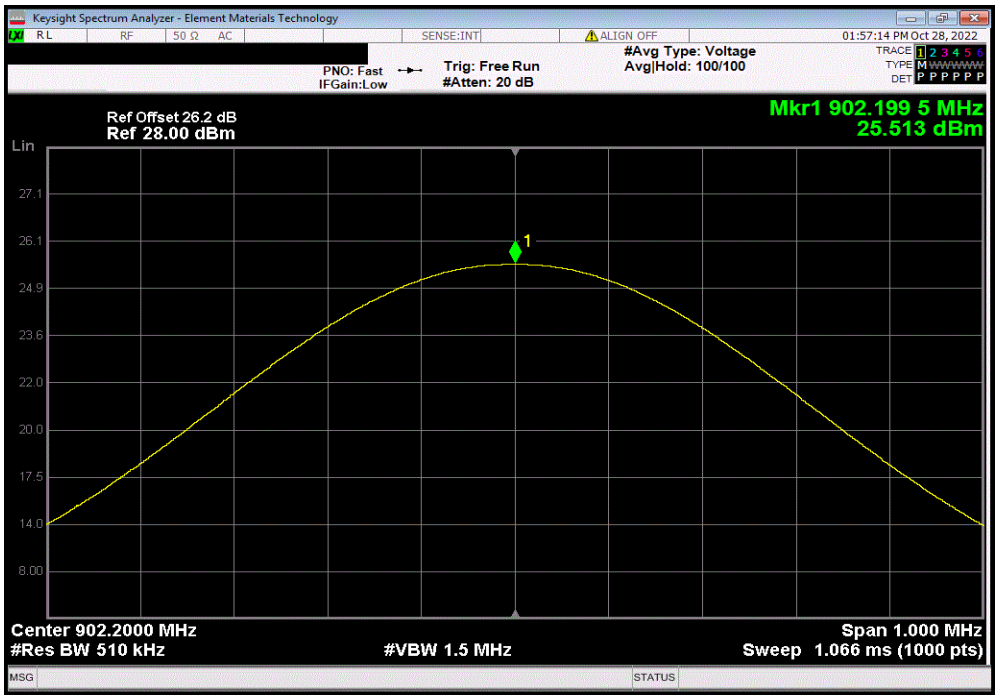
None

Configuration #	**2**	*Signature*

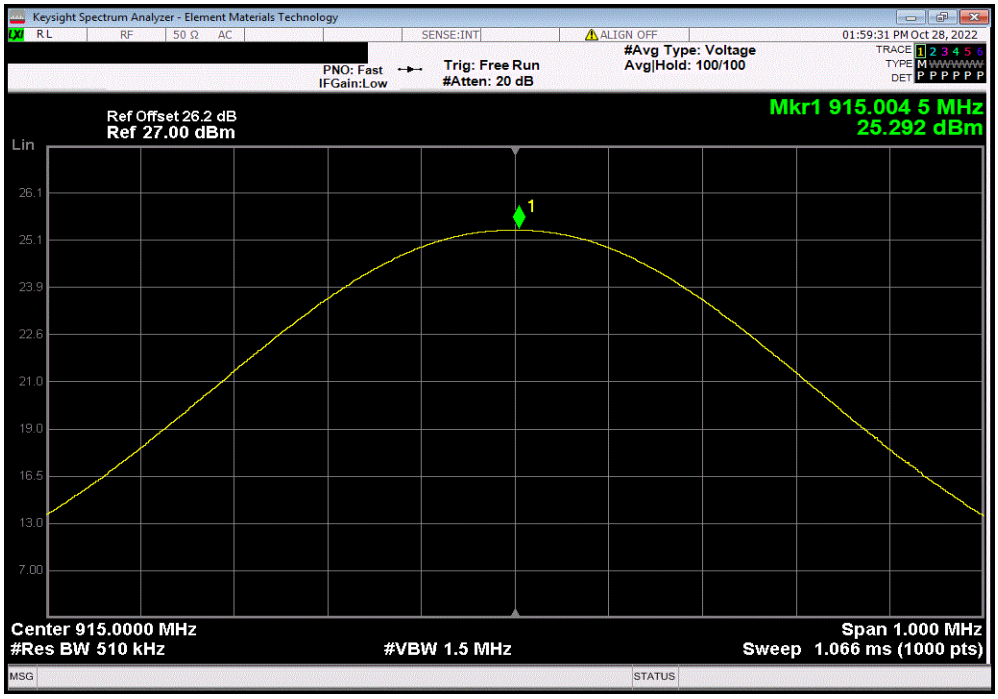
	Out Pwr (dBm)	**Limit (dBm)**	**Result**
Modulated			
Low Channel, 902.2 MHz	25.513	30	Pass
Mid Channel, 915 MHz	25.292	30	Pass
High Channel, 927.7 MHz	24.716	30	Pass

OUTPUT POWER

Modulated, Low Channel, 902.2 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				25.513	30	Pass

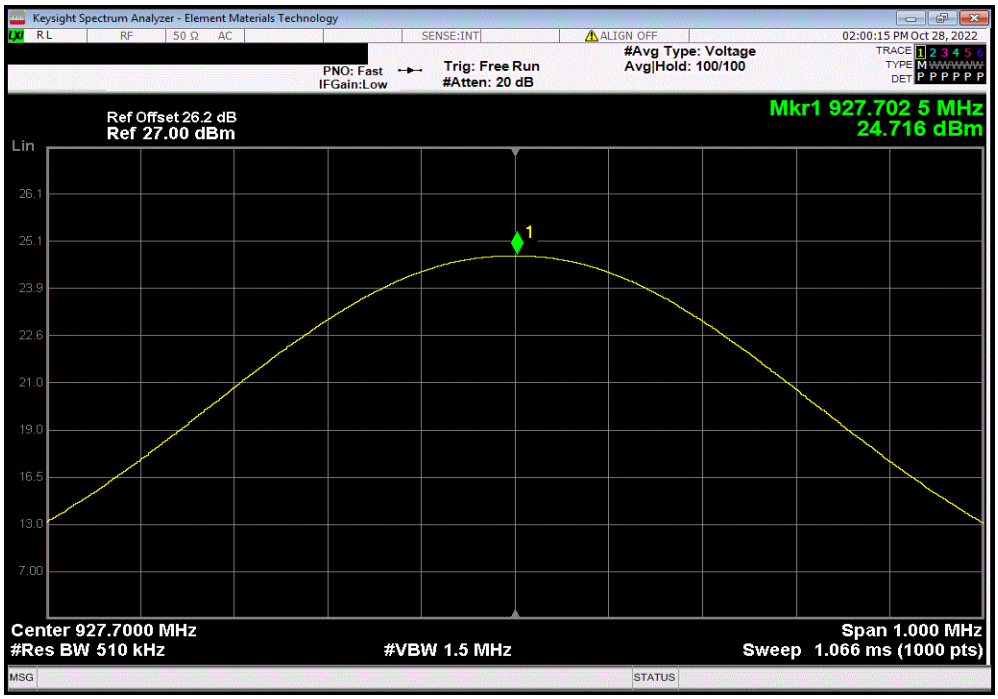


Modulated, Mid Channel, 915 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				25.292	30	Pass



OUTPUT POWER

Modulated, High Channel, 927.7 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				24.716	30	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

XMit 2022.02.07.0

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

TEST EQUIPMENT

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

TEST DESCRIPTION

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

The peak output power was measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting in a no hop mode at the data rate(s) listed in the datasheet.

The method found in ANSI C63.10:2013 Section 7.8.5 was used for a FHSS radio.

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

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

element

TbtTx 2022.06.03.0 XMit 2022.02.07.0

EUT:	**MSA G1 SCBA made with Type 2 power module installed**			**Work Order:**	**F3EN0126**
Serial Number:	**e0040150b1b81de**			**Date:**	**28-Oct-22**
Customer:	**MSA Innovation, LLC**			**Temperature:**	**22 °C**
Attendees:	**Dustin Morris**			**Humidity:**	**31.8% RH**
Project:	**None**			**Barometric Pres.:**	**1028 mbar**
Tested by:	**Christopher Heintzelman**	**Power:**	**Battery**	**Job Site:**	**MN11**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2022	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Power setting F. Reference level offset includes measurement cable, attenuator, and DC block. Does not inclue u.Fl patch cable.

DEVIATIONS FROM TEST STANDARD

None

Configuration #	**2**	*Signature*

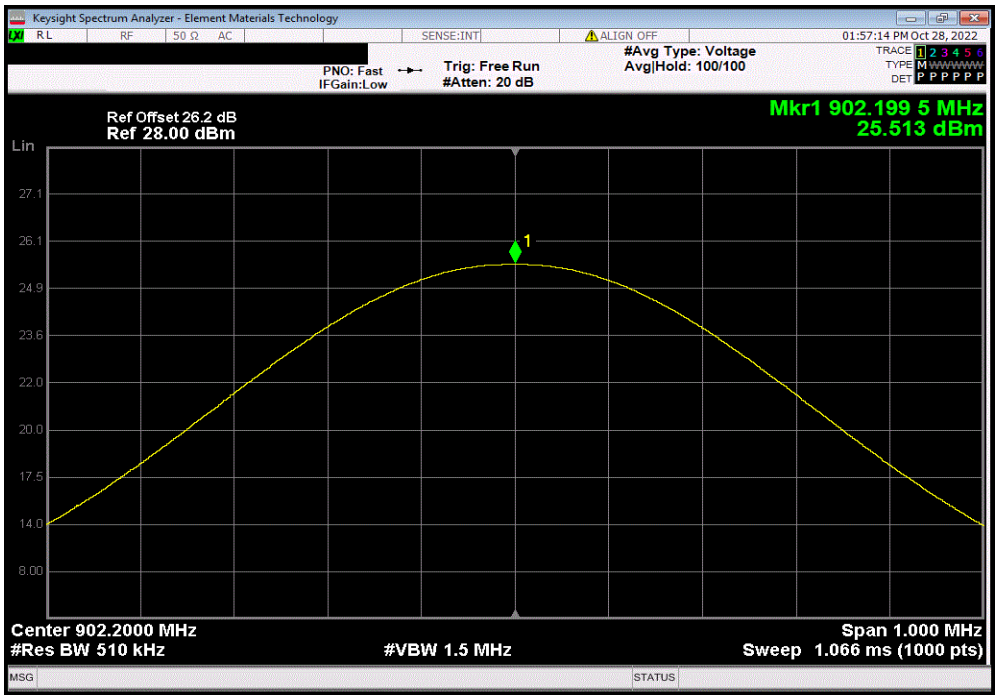
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
Modulated					
Low Channel, 902.2 MHz	25.513	3.51	29.02	36	Pass
Mid Channel, 915 MHz	25.292	3.51	28.80	36	Pass
High Channel, 927.7 MHz	24.716	3.51	28.23	36	Pass

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

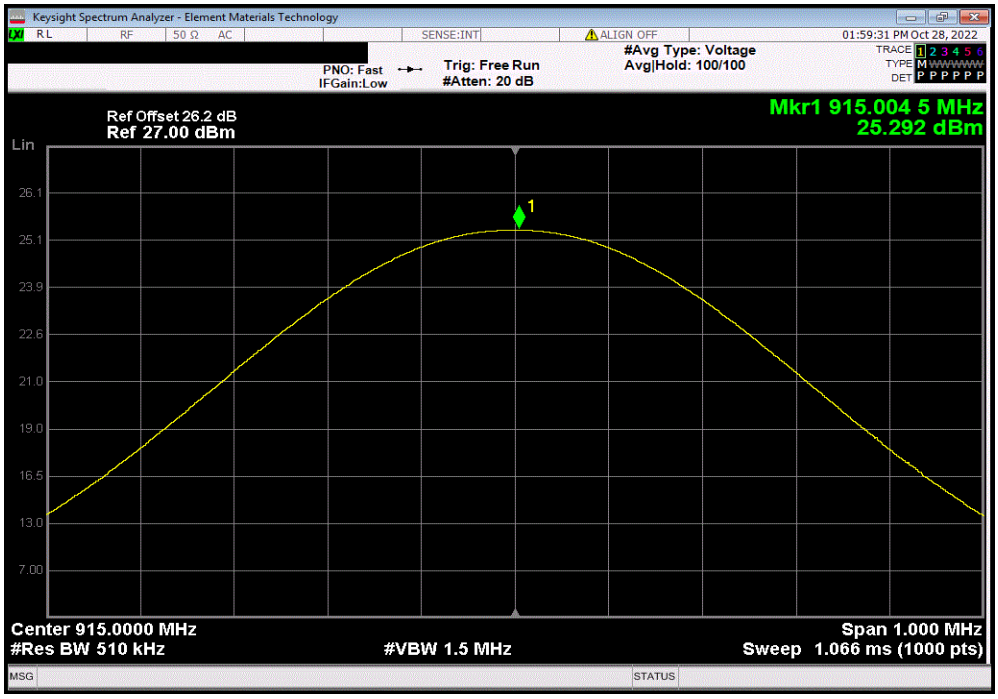
element

TbtTx 2022.06.03.0 XMit 2022.02.07.0

Modulated, Low Channel, 902.2 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		25.513	3.51	29.02	36	Pass



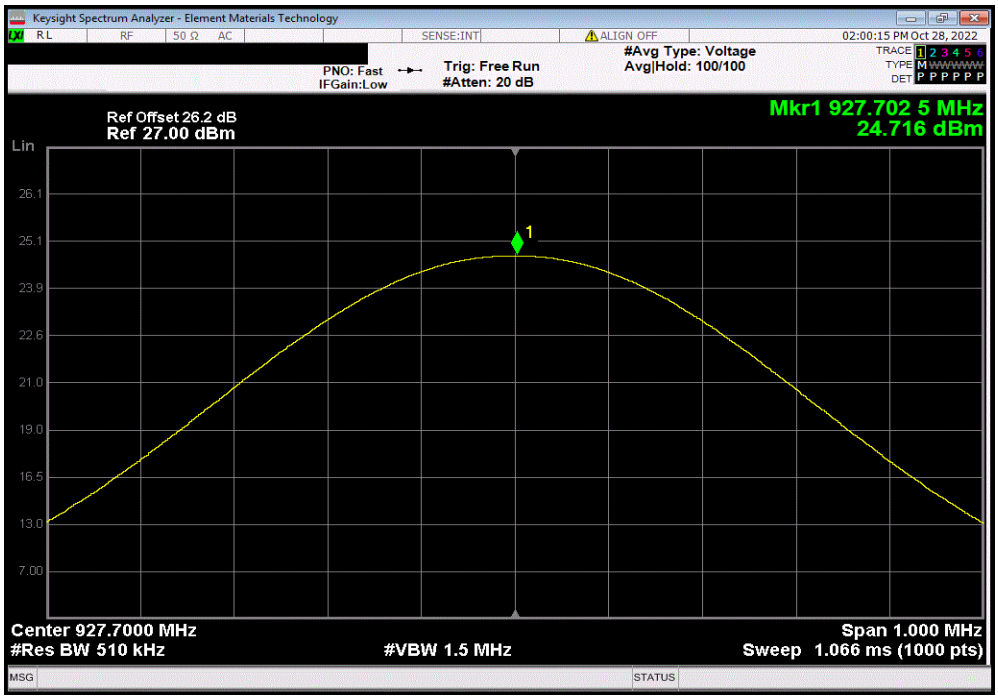
Modulated, Mid Channel, 915 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		25.292	3.51	28.80	36	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

TbtTx 2022.06.03.0 XMit 2022.02.07.0

Modulated, High Channel, 927.7 MHz						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		24.716	3.51	28.23	36	Pass



End of Test Report