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# GEOSPACE TECHNOLOGIES CORPORATION TEST REPORT

#### SCOPE OF WORK EMC TESTING – PIONEER

**REPORT NUMBER** 106147890LEX-003.1

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# **EMC TEST REPORT**

(FULL COMPLIANCE)

Report Number:106147890LEX-003.1Project Number:G106147890Report Issue Date:5/12/2025Model(s) Tested:PioneerStandards:FCC Title 47 CFR Part 15.247RSS-247 Issue 3RSS-GEN Issue 5

Tested by: Intertek Testing Services NA, Inc. 731 Enterprise Dr. Lexington, KY 40510 USA Client: GEOSPACE TECHNOLOGIES CORPORATION 7007 Pinemont Dr Houston, TX 77040-6601 USA

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# Table of Contents

1	Introduction and Conclusion
2	Test Summary4
3	Client Information
4	Description of Equipment under Test and Variant Models
5	System Setup and Method7
6	Frequency Stability9
7	Occupied/DTS Bandwidth
8	Fundamental Emissions Output Power
9	Maximum Power Spectral Density (PSD)27
10	Conducted Spurious Emissions
11	Radiated Spurious Emissions
12	Antenna Requirement
13	Revision History



#### 1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

#### 2 Test Summary

Section	Test full name	Result
6	Frequency Stability (ANSI C63.10 (2013) §6.8.1 and §6.8.2)	Pass
7	Occupied/DTS Bandwidth (ANSI C63.10 (2013) §6.9.3 and §11.8)	Pass
8	Fundamental Emission Output Power (ANSI C63.10 (2013) §11.9)	Pass
9	Maximum Power Spectral Density (ANSI C63.10 (2013) §11.10)	Pass
10	Conducted Spurious Emissions (ANSI C63.10 (2013) §11.11)	Pass
11	Radiated Spurious Emissions ANSI C63.10 (2013) §6.3 §6.5 and §6.6	Pass
12	Antenna Requirement (FCC Part 15.203, RSS-Gen Issue 5 ६ 6.8)	Pass



#### 3 Client Information

This product was tested at the request of the following:

Client Information			
Client Name:	GEOSPACE TECHNOLOGIES CORPORATION		
Address:	7007 Pinemont Dr		
	Houston, TX 77040-6601		
	USA		
Contact:	Mark McAllister		
Telephone:	2816301341		
Email:	mmcallister@geospace.com		
	Manufacturer Information		
Manufacturer Name:	GEOSPACE TECHNOLOGIES CORPORATION		
Manufacturer Address: 7007 Pinemont Dr			
	Houston, TX 77040-6601		
	USA		



# 4 Description of Equipment under Test and Variant Models

Equipment Under Test			
Product Name	Pioneer		
Model Number	Pioneer		
Serial Number	0000200		
Receive Date	3/24/2025		
Test Start Date	3/25/2025		
Test End Date	5/12/2025		
Device Received Condition	Good		
Test Sample Type	Production		
Transmit Band	2405MHz – 2475MHz 802.15.4 Zigbee		
Nominal DTS Bandwidth	2MHz		
Antenna Type	Integral Antenna		
Antenna Gain <sup>1</sup>	3.3dBi		
Rated Voltage	3.7VDC		
Description of Equipment Under Test (provided by client)			

The Pioneer<sup>™</sup> is a small, lightweight, single-component, autonomous land wireless seismic data acquisition solution. One GS-5 vertical geophone (5 Hz) internal geophone, battery, 24-bit digitizer, GPS receiver are enclosed in its sealed case. Faster and more efficient operations can be achieved with the use of the Pioneer by eliminating the process of engaging connectors for power and data transfer.

# 4.1 Variant Models:

There were no variant models covered under this evaluation.

<sup>&</sup>lt;sup>1</sup> This information was provided by the client and may affect compliance. Intertek does not make any claim of compliance for values other than those shown.



#### 5 System Setup and Method

#### 5.1 Method:

Configuration as required by ANSI C63.10 (2013)

No.	Descriptions of EUT Exercising

1 Device transmitting on Low/Mid/High channel at full power, not on charger.

Cables								
	Termination							
QTY	Description	Length (m)	Shielding	Ferrites	From	То		
1	Ethernet	1m	No	No	Charging Station	Laptop		
1	AC Power	1m	No	No	Charging Station	AC Power		

Support Equipment (Accessories)						
Description Manufacturer Model Number						
Charging Station	Geospace Technologies Corporation	450-06100-01				
Laptop	Lenovo	T480				

Nominal Voltage (VDC)	Relative Voltage (%)	Test Voltage (VDC)
N/A	85	N/A
3.7	100	3.7
N/A	115	N/A



# 5.2 EUT Block Diagram:





#### 6 Frequency Stability

#### 6.1 Test Method:

Tests are performed in accordance with ANSI C63.10 §6.8.1 and §6.8.2

#### 6.2 Test Limits:

Title 47 CFR 2.1055(a)

 From −30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section

#### Title 47 CFR 2.1055(b)

Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short-term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

Title 47 CFR 2.1055(d)

- (1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment
- (2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer

#### RSS-GEN §6.11

For licensed devices, the following measurement conditions apply:

- a. at the temperatures of -30°C (-22°F), +20°C (+68°F) and +50°C (+122°F), and at the manufacturer's rated supply voltage
- b. at the temperature of +20°C (+68°F) and at ±15% of the manufacturer's rated supply voltage

For license-exempt devices, the following conditions apply:

- a. at the temperatures of -20°C (-4°F), +20°C (+68°F) and +50°C (+122°F), and at the manufacturer's rated supply voltage
- b. at the temperature of +20°C (+68°F) and at ±15% of the manufacturer's rated supply voltage

#### RSS-GEN §8.11

If the frequency stability of the license-exempt radio apparatus is not specified in the applicable RSS, the fundamental emissions of the radio apparatus should be kept within at least the central 80% of its permitted operating frequency band in order to minimize the possibility of out-of-band operation. In addition, its occupied bandwidth shall be entirely outside the restricted bands and the prohibited TV bands of 54-72 MHz, 76-88 MHz, 174-216 MHz, and 470-602 MHz, unless otherwise indicated.



# 6.3 Test Equipment Used:

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Spectrum Analyzer	8305	Rohde & Schwarz	FSW26	9/20/2024	9/20/2025
Environmental Chamber	2070	Envirotronics	-	7/30/2024	7/30/2025

#### 6.4 Test Software Used:

Description	Manufacturer	Version	
RSCommander	Rohde & Schwarz	2.4.2 64 bit (2023)	

#### 6.5 Measurement Uncertainty

Description	Expanded Uncertainty (k=2)
Signal Chain Calibration	1.2

No measurement correction based on measurement uncertainty is performed.

#### 6.6 Test Conditions

Test Personnel	Supervising / Reviewing Engineer	Test Date	Ambient Temperature	Relative Humidity	Pressure
David Perry	N/A	3/25/2025	22.3°C	33.0%	29.0mbar

#### 6.7 Test Results:

The sample tested was found to Comply.



# 6.8 Test Data: Temperature and Voltage Variation

# 6.8.1 Low Channel

Temperature (°C)	Nominal Frequency (MHz)	Measured Frequency (MHz)	Deviation
-30	2405	2405.04	-0.00166%
-20	2405	2405.02	-0.00083%
-10	2405	2405.00	0.00000%
0	2405	2405.03	-0.00125%
10	2405	2404.99	0.00042%
20	2405	2404.99	0.00042%
30	2405	2404.99	0.00042%
40	2405	2404.99	0.00042%
50	2405	2404.99	0.00042%



# 6.8.2 Mid Channel

Temperature (°C)	Nominal Frequency (MHz)	Measured Frequency (MHz)	Deviation
-30	2440	2440.00	0.00000%
-20	2440	2439.94	0.00246%
-10	2440	2440.03	-0.00123%
0	2440	2440.07	-0.00287%
10	2440	2439.91	0.00369%
20	2440	2440.02	-0.00082%
30	2440	2439.99	0.00041%
40	2440	2439.98	0.00082%
50	2440	2439.98	0.00082%



# 6.8.3 High Channel

Temperature (°C)	Nominal Frequency (MHz)	Measured Frequency (MHz)	Deviation
-30	2475	2475.02	-0.00081%
-20	2475	2474.91	0.00364%
-10	2475	2475.24	-0.00970%
0	2475	2475.03	-0.00121%
10	2475	2475.04	-0.00162%
20	2475	2475.02	-0.00081%
30	2475	2474.99	0.00040%
40	2475	2474.98	0.00081%
50	2475	2475.02	-0.00081%



# 7 Occupied/DTS Bandwidth

# 7.1 Test Method:

Tests are performed in accordance with ANSI C63.10 §6.9.3 and §11.8.

#### 7.2 Test Limits:

Title 47 CFR 15.247(a)

(2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

#### RSS-247 §5.2

a. The minimum 6 dB bandwidth shall be 500 kHz.

#### RSS-GEN §6.7

The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.



#### 7.3 Test Equipment Used:

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Spectrum Analyzer	8305	Rohde & Schwarz	FSW26	9/20/2024	9/20/2025

#### 7.4 Test Software Used:

Description	Manufacturer	Version
RSCommander	Rohde & Schwarz	2.4.2 64 bit (2023)

#### 7.5 Measurement Uncertainty

Description	Expanded Uncertainty (k=2)
Signal Chain Calibration	1.2

No measurement correction based on measurement uncertainty is performed.

#### 7.6 Test Conditions

Test Personnel	Supervising / Reviewing Engineer	Test Date	Ambient Temperature	Relative Humidity	Pressure
David Perry	N/A	3/26/2025	23.9°C	28.0%	988.8mbar
David Perry	N/A	3/27/2025	23.7°C	26.3%	988.8mbar
David Perry	N/A	5/12/2025	24.8°C	49.8%	982.0mbar

#### 7.7 Test Results:

The sample tested was found to Comply. The 6dB bandwidth was at least 500 kHz.

#### 7.8 Test Data:

Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)
2405	1.53	500
2440	1.58	500
2475	1.56	500

Frequency (MHz)	99% Bandwidth (MHz)
2405	2.28
2440	2.31
2475	2.32



# 7.9 Test Plots: Occupied Channel Bandwidth (6dB Bandwidth)

# 7.9.1 Low Channel





# 7.9.2 Mid Channel





# 7.9.3 High Channel





# 7.10 Test Plots: Occupied Channel Bandwidth (99% Bandwidth)

# 7.10.1 Low Channel





# 7.10.2 Mid Channel





# 7.10.3 High Channel





#### 8 Fundamental Emissions Output Power

#### 8.1 Test Method:

Tests are performed in accordance with ANSI C63.10 §11.9.

#### 8.2 Test Limits:

#### 47 CFR 15.247(b)

(3) For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

#### RSS-247 §5.4

d. For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).



#### 8.3 Test Equipment Used:

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Spectrum Analyzer	8305	Rohde & Schwarz	FSW26	9/20/2024	9/20/2025

#### 8.4 Test Software Used:

Description	Manufacturer	Version
RSCommander	Rohde & Schwarz	2.4.2 64 bit (2023)

#### 8.5 Measurement Uncertainty

Description	Expanded Uncertainty (k=2)
Signal Chain Calibration	1.2

No measurement correction based on measurement uncertainty is performed.

#### 8.6 Test Conditions

Test Personnel	Supervising / Reviewing Engineer	Test Date	Ambient Temperature	Relative Humidity	Pressure
David Perry	N/A	3/27/2025	23.7°C	26.3%	988.8mbar

#### 8.7 Test Results:

The sample tested was found to Comply. The conducted output power was less than 1 W. The EIRP was last than 4 W.

#### 8.8 Test Data:

Frequency (MHz)	Output Power (dBm)	Output Power (W)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (W)	Output Power Limit (W)	EIRP Limit (W)
2405	-3.18	0.00048	3.30	0.120	0.001	1	4
2440	-2.86	0.00052	3.30	0.440	0.001	1	4
2475	-2.56	0.00055	3.30	0.740	0.001	1	4



#### 8.9 Test Plots: Output Power

# 8.9.1 Low Channel



Non-Specific EMC Report Shell Rev. December 2017 Report Number: 106147890LEX-003.1



# 8.9.2 Mid Channel

Ref Level 3	0.00 dBm	Offset	t 0.31 dB 单	RBW 31	MHz					
Att	40 dB	SWT	3.01 ms 🗢	<b>VBW</b> 101	MHz	Mode Auto S	weep			
1 Frequency	/ Sweep									o1Pk Max
									M1[1]	-2.86 dBm
									2.44	0 569 80 GHz
20 dBm										
10 dBm										
0 dBm							M1			
-10 dBm										
		American							and the second sec	
	and the second sec									
-20 dBm										and an a strength of a
-30 dBm										
40 d0m										
-40 uBm-										
-50 dBm										
-60 dBm										
CF 2.44 GHz	2			300	1 pts	;	1	.0 MHz/	Sp	an 10.0 MHz
								,		

Note: A .31dB offset was used to account for cable loss.



# 8.9.3 High Channel

Ref Level 30	0.00 dBm	Offse	t 0.31 dB 🗢	RBW 3	3 MHz					
Att	40 dB	SWT	3.01 ms 🗢	<b>VBW</b> 10	) MHz	Mode Auto S	weep			
1 Frequency	Sweep									o1Pk Max
									M1[1]	-2.56 dBm
									2.47	5 506 50 GHz
20 dBm										
10 dBm										
20 0011										
0 dBm							M1			
-10 dBm			and the second sec							
	and the second se	and a second								
	and and the state of the state								and the second sec	
-20 dBm										and the state of t
New York										-
-30 dBm										
-40 dBm										
-50 dBm										
-60 dBm										
-00 ubm										
CE 2.475 GH	7			30	)01 nts	S	1	.0 MHz/	Sn	an 10.0 MHz
0. 2. 170 011				00	лот ры		1			

Note: A .31dB offset was used to account for cable loss.



# 9 Maximum Power Spectral Density (PSD)

#### 9.1 Test Method:

Tests are performed in accordance with ANSI C63.10 §11.10.

#### 9.2 Test Limits:

#### 47 CFR 15.247(e)

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

#### RSS-247 §5.2

b. The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).



#### 9.3 Test Equipment Used:

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Spectrum Analyzer	8305	Rohde & Schwarz	FSW26	9/20/2024	9/20/2025

#### 9.4 Test Software Used:

Description	Manufacturer	Version
RSCommander	Rohde & Schwarz	2.4.2 64 bit (2023)

#### 9.5 Measurement Uncertainty

Description	Expanded Uncertainty (k=2)
Signal Chain Calibration	1.2

No measurement correction based on measurement uncertainty is performed.

#### 9.6 Test Conditions

Test Personnel	Supervising / Reviewing Engineer	Test Date	Ambient Temperature	Relative Humidity	Pressure
David Perry	N/A	3/27/2025	23.7°C	26.3%	988.8mbar

#### 9.7 Test Results:

The sample tested was found to Comply. The power spectral density was less than 8 dBm/3kHz.

#### 9.8 Test Data:

Frequency (MHz)	Conducted PSD (dBm/3kHz)	Antenna Gain (dBi)	PSD EIRP (dBm/3kHz)	Limit (dBm/3kHz)
2405	-16.43	3.3	-13.13	8
2440	-15.91	3.3	-12.61	8
2475	-16.00	3.3	-12.70	8



# 9.9 Test Plots: Power Spectral Density

# 9.9.1 Low Channel



Note: A .31dB offset was used to account for cable loss.



# 9.9.2 Mid Channel



Note: A .31dB offset was used to account for cable loss.



# 9.9.3 High Channel



Note: A .31dB offset was used to account for cable loss.



#### **10** Conducted Spurious Emissions

#### 10.1 Test Method:

Tests are performed in accordance with ANSI C63.10 §11.11.

#### 10.2 Test Limits:

#### 47 CFR 15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

#### RSS-247 §5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.



#### **10.3** Test Equipment Used:

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Spectrum Analyzer	8305	Rohde & Schwarz	FSW26	9/20/2024	9/20/2025

#### **10.4** Test Software Used:

Description	Manufacturer	Version
RSCommander	Rohde & Schwarz	2.4.2 64 bit (2023)

#### **10.5** Measurement Uncertainty

Description	Expanded Uncertainty (k=2)
Signal Chain Calibration	1.2

No measurement correction based on measurement uncertainty is performed.

#### **10.6 Test Conditions**

Test Personnel	Supervising / Reviewing Engineer	Test Date	Ambient Temperature	Relative Humidity	Pressure
David Perry	N/A	3/27/2025	23.7°C	26.3%	988.8mbar

#### 10.7 Test Results:

The sample tested was found to Comply.

#### 10.8 Test Data:

Frequency (MHz)	Reference Level Max PSD (dBm)	Highest 3 Unwanted Emissions Level (dBm)		Margin (dB)	Limit (dB)
		1.	-41.10	14.75	
2405	-6.35	2.	-52.35	26.00	-26.35
		3.	-54.61	28.26	
		1.	-41.74	15.39	-26.35
2440	-6.35	2.	-42.72	16.37	
		3.	-47.81	21.46	
		1.	-39.88	13.53	
2475	-6.35	2.	-42.70	16.35	-26.35 -26.35
		3.	-44.75	18.40	



#### 10.9 Test Plots: Emissions in Non-Restrictive Bands

# **10.9.1** Mid Channel Reference Level<sup>1</sup>



<sup>&</sup>lt;sup>1</sup> Channel represents the worst case PPSD.



# 10.9.2 Low Channel



\*Marker 1 is the fundamental and is not subject to the limit.



# 10.9.3 Mid Channel



\*Marker 4 is the fundamental and is not subject to the limit.



# 10.9.4 High Channel



\*Marker 6 is the fundamental and is not subject to the limit.



#### **11** Radiated Spurious Emissions

#### 11.1 Test Method:

Tests are performed in accordance with ANSI C63.10 §6.3 §6.5 and §6.6.

#### 11.2 Test Limits:

#### 47 CFR 15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

#### RSS-247 §5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under <u>section 5.4(d)</u>, the attenuation required shall be30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.



# **11.3 Test Equipment Used:**

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	0002713	Rohde & Schwarz	ESW44	3/21/2025	3/21/2026
Bilog Antenna (30MHz- 1GHz)	3133, 6035	ETS	3142C	7/24/2024	7/24/2025
Horn Antenna (1-18GHz)	3780	ETS	3117	7/18/2024	7/18/2025
Horn Antenna (18- 40GHz)	3779	ETS	3116c	8/28/2024	8/28/2025
System Controller	4096	ETS Lindgren	2090	Verify at Time of Use	Verify at Time of Use
System Controller	3957	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use
30M-1G 3m Signal Path without Preamplifier	8311 2593 8188 8185	-	-	11/26/2024	11/26/2025
Preamplifier	3918	Rohde & Schwarz	TS-PR18	11/26/2024	11/26/2025
1-18GHz Signal Path with Preamplifier	3074 3918 8310 2593 8188 8185	-	-	11/26/2024	11/26/2025
Preamplifier (18-40GHz)	3921	Rohde & Schwarz	TS-PR40	11/26/2024	11/26/2025
18-40GHz Signal Path with Preamplifier	7020 3921 7021	-	-	11/26/2024	11/26/2025

# **11.4 Measurement Uncertainty**

Description	Expanded Uncertainty (k=2)
Radiated Emissions, 3m, 30MHz - 1GHz	4.3
Radiated Emissions, 10m, 30MHz - 1GHz	4.6
Radiated Emissions, 3m, 1GHz - 6GHz	4.7
Radiated Emissions, 3m, 6GHz - 12.75GHz	4.3
Radiated Emissions, 3m, 12.75GHz - 18GHz	4.3

No measurement correction based on measurement uncertainty is performed.

# **11.5** Test Software Used:

Description	Manufacturer	Version
EMC32	Rohde & Schwarz	10.60.20

#### 11.6 Test Results:

The sample tested was found to Comply. The device was investigated in three orthogonal axes.



# 11.7 Test Data: Radiated Spurious Emissions, General 11.7.1 Frequency Range 9kHz – 30MHz 11.7.1.1 High Channel<sup>1</sup>



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
0.036300	60.87			100.0	V	284.0	14.0
0.158780	59.06			100.0	V	0.0	12.1
1.172802	38.63			100.0	V	290.0	12.0

Frequency (MHz)	Average (dBμV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
0.036300	57.89	116.39	58.50	100.0	V	284.0	14.0
0.158780	51.49	103.58	52.09	100.0	V	0.0	12.1
1.172802	27.22	66.24	39.02	100.0	V	290.0	12.0

Test Personnel:	David Perry
Supervising/Reviewing Engineer:	
(Where Applicable)	NA
	FCC 15.247
Product Standard:	RSS-247
Input Voltage:	3.7VDC

Test Date: 3/27/2025

Limit Applied: See Section

Ambient Temperature:	22.2°C
Relative Humidity:	28.5%
Atmospheric Pressure:	992.2mbar

<sup>&</sup>lt;sup>1</sup> Testing represents the worst case of low, middle, and high channels.



Test Date: <u>3/26/2025</u> Limit Applied: See Section 11.2

22.1°C

38.1% 992.2mbar

Ambient Temperature:

Atmospheric Pressure:

Relative Humidity:

#### 11.7.2 Frequency Range 30MHz – 1GHz 11.7.2.1 High Channel<sup>1</sup>



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
167.093333	15.03	43.52	28.49	160.0	V	126.0	17.4
245.447778	17.87	46.02	28.15	257.0	V	295.0	20.1
611.299444	28.40	46.02	17.62	200.0	Н	187.0	29.8

Test Personnel:	David Perry
Supervising/Reviewing Engineer:	
(Where Applicable)	NA
	FCC 15.247
Product Standard:	RSS-247
Input Voltage:	3.7VDC

<sup>&</sup>lt;sup>1</sup> Testing represents the worst case of low, middle, and high channels.



#### 11.7.3 Frequency Range 1GHz – 18GHz 11.7.3.1 Low Channel



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4809.166667	54.29	73.98	19.69	227.0	Н	77.0	9.7
12440.000000	48.39	73.98	25.59	410.0	V	0.0	20.7
15793.750000	50.17	73.98	23.81	410.0	V	311.0	23.7
17736.250000	51.05	73.98	22.93	410.0	Н	46.0	26.2

Frequency	Average	Limit	Margin	Height		Azimuth	Corr.
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	(cm)	Pol	(deg)	(dB/m)
4809.166667	46.68	53.98	7.30	227.0	Н	77.0	9.7
12440.000000	34.97	53.98	19.01	410.0	V	0.0	20.7
15793.750000	37.00	53.98	16.98	410.0	V	311.0	23.7
17736.250000	37.55	53.98	16.43	410.0	Н	46.0	26.2

Test Personnel:	David Perry	Test Date:	3/26/2025
Supervising/Reviewing Engineer:			
(Where Applicable)	NA	Limit Applied:	See Section 11.2
	FCC 15.247		
Product Standard:	RSS-247	Ambient Temperature:	22.1°C
Input Voltage:	3.7VDC	Relative Humidity:	38.1%
		Atmospheric Pressure:	992.2mbar



# 11.7.3.2 Middle Channel



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4879.166667	54.36	73.98	19.62	202.0	Н	146.0	9.8
11816.875000	47.41	73.98	26.57	410.0	Н	216.0	19.9
15776.875000	50.41	73.98	23.57	239.0	Н	136.0	23.7
17973.750000	51.47	73.98	22.51	178.0	Н	230.0	26.1

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4879.166667	46.72	53.98	7.26	202.0	Н	146.0	9.8
11816.875000	33.97	53.98	20.01	410.0	Н	216.0	19.9
15776.875000	36.91	53.98	17.07	239.0	Н	136.0	23.7
17973.750000	37.89	53.98	16.09	178.0	Н	230.0	26.1

Test Personnel:	David Perry
Supervising/Reviewing Engineer:	
(Where Applicable)	NA
	FCC 15.247
Product Standard:	RSS-247
Input Voltage:	3.7VDC

Test Date:	3/26/2025
Limit Applied:	See Section 11.2
Ambient Temperature:	22.1°C
Relative Humidity:	38.1%
Atmospheric Pressure:	992.2mbar



# 11.7.3.3 High Channel



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4948.777778	54.08	73.98	19.90	281.0	Н	52.0	9.7
15807.500000	50.49	73.98	23.49	100.0	V	245.0	23.8
17787.500000	51.16	73.98	22.82	258.0	V	289.0	26.1

Frequency (MHz)	Average (dBμV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4948.777778	45.77	53.98	8.21	281.0	Н	52.0	9.7
15807.500000	37.23	53.98	16.75	100.0	V	245.0	23.8
17787.500000	37.90	53.98	16.08	258.0	V	289.0	26.1

David Perry
NA
FCC 15.247
RSS-247
3.7VDC

Test Date:	3/26/2025

Limit Applied: See Section 11.2

Ambient Temperature:	22.1°C
Relative Humidity:	38.1%
Atmospheric Pressure	992 2mhar



#### 11.7.4 Frequency Range 18GHz – 40GHz 11.7.4.1 High Channel<sup>1</sup>



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18416.000000	55.76	73.98	18.22	100.0	Н	0.0	36.4
18505.000000	58.38	73.98	15.60	410.0	V	324.0	38.4
18613.000000	57.72	73.98	16.26	109.0	Н	0.0	38.0
36441.000000	47.40	73.98	26.58	100.0	Н	80.0	25.8

Frequency	Average	Limit	Margin	Height		Azimuth	Corr.
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	(cm)	Pol	(deg)	(dB/m)
18416.000000	42.58	53.98	11.40	100.0	Н	0.0	36.4
18505.000000	44.32	53.98	9.66	410.0	V	324.0	38.4
18613.000000	44.49	53.98	9.49	109.0	Н	0.0	38.0
36441.000000	33.49	53.98	20.49	100.0	Н	80.0	25.8

Test Personnel:	David Perry	Test Date:	3/26/2025
Supervising/Reviewing Engineer:			
(Where Applicable)	NA	Limit Applied:	See Section 11.2
	FCC 15.247		
Product Standard:	RSS-247	Ambient Temperature:	22.1°C
Input Voltage:	3.7VDC	Relative Humidity:	38.1%
		Atmospheric Pressure:	992 2mbar

<sup>&</sup>lt;sup>1</sup> The "worst-case" scenario between the low, middle, and high channels



#### 11.8 Test Data: Radiated Emissions, Band Edge



# 11.8.1 Low Channel Band Edge

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2380.753333	54.86	73.98	19.12	256.0	V	234.0	38.9
2386.620000	54.91	73.98	19.07	130.0	Н	292.0	38.9
2492.146667	55.58	73.98	18.40	393.0	V	333.0	39.3
2493.873333	55.27	73.98	18.71	358.0	Н	86.0	39.3

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2380.753333	38.93	53.98	15.05	256.0	V	234.0	38.9
2386.620000	38.96	53.98	15.02	130.0	Н	292.0	38.9
2492.146667	39.58	53.98	14.40	393.0	V	333.0	39.3
2493.873333	39.62	53.98	14.36	358.0	Н	86.0	39.3

Test Personnel:	David Perry	Test Date:	3/26/2025
Supervising/Reviewing Engineer:			
(Where Applicable)	NA	Limit Applied:	See Section 11.2
	FCC 15.247		
Product Standard:	RSS-247	Ambient Temperature:	22.1°C
Input Voltage:	3.7VDC	Relative Humidity:	38.1%
		Atmospheric Pressure:	992.2mbar



# 11.8.2 High Channel Band Edge



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2484.326667	56.73	73.98	17.25	244.0	Н	203.0	39.3
2493.513333	55.42	73.98	18.56	209.0	Н	82.0	39.3

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2484.326667	41.54	53.98	12.44	244.0	Н	203.0	39.3
2493.513333	39.71	53.98	14.27	209.0	Н	82.0	39.3
Test Personnel: David Perry Test Date: 3/26/2025 Supervising/Reviewing Engineer:							

(Where Applicable)	NA	Limit Applied:	See Section 11.2
	FCC 15.247		
Product Standard:	RSS-247	Ambient Temperature:	22.1°C
Input Voltage:	3.7VDC	Relative Humidity:	38.1%
		Atmospheric Pressure:	992.2mbar



#### 12 Antenna Requirement

#### 12.1 Test Limits

#### FCC Part 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

#### RSS-Gen Issue 5 § 6.8:

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the license-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

License-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the license-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of license-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

#### 12.2 Test Results

The device was found to be **compliant**. The device has an internal, permanently affixed antenna.



# 13 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	4/30/2025	106147890LEX-003	XOP	MC	Original Issue
0	5/12/2025	106147890LEX-003.1	PP	MC	Re-measured 6dB Bandwidth