

# Digital Matter

## FINAL SUMMARY REPORT

**Report Type: 15B**

**Model: Remora3 4G**  
**Hardware Version: V3.0**

**SCOPE OF WORK**

Title 47 CFR Part 15 Subpart B  
ICES-003 Issue 7

**REPORT NUMBER**

105343539LEX-01.1

**ISSUE DATE**

15-March-2023

**REVISE DATE**

11-December-2023





## RSE Test Report

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## RSE Test Report

## 1 INTRODUCTION

The purpose of this document is to record the test results for the Digital Matter Remora3 4G. This test report shall not be reproduced except in full, without written approval of the test lab. The terminal device was tested to the following specifications:

IEEE/ANSI C63.4-2014

The measurement methods and inherent results detailed in this evaluation are within the normative limits defined within the specific standard of each section, where applicable. Furthermore, detailed uncertainty budgets are maintained on file and are available upon request.



### 1.1 REPORT VERSIONS

REPORT NUMBER	DESCRIPTION	VERSION
105343539LEX-01	Initial Release of Report	1.0
105343539LEX-01.1	Added ICES-003 References	1.1



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## **1.2 STATEMENT OF COMPLIANCE AND LABORATORY CONFORMANCE DECLARATION**

In this document you will find a description of the terminal device, a description of the test equipment and test execution software used to complete the testing, and an executive summary of the test results. Intertek is accredited as an ISO 17025-2017 laboratory for all scopes tested in this report. Intertek's accreditation certificate number is 1926.01.



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### **1.3 STATEMENT OF LIABILITY**

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to copy or distribute this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.

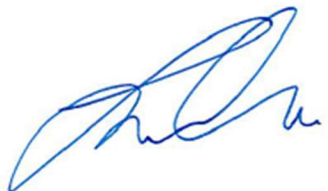
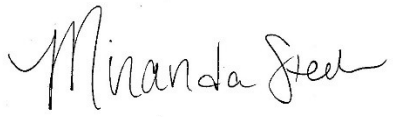



## RSE Test Report

## 2 GENERAL INFORMATION

GENERAL INFORMATION - PROJECT ID 6213					
Test Start date:	03/01/2023	Test End Date:	03/01/2023	RTO Test Report #:	105343539LEX-01.1

## 3 NAME AND ADDRESS OF THE RECOGNIZED TEST ORGANIZATION (RTO)

GCF RTO FACILITY INFORMATION			
RTO Name:	Intertek		
RTO Contact Phone #:	859-226-1000		
RTO Authorization #:	20		
RTO Address:	731 Enterprise Dr.  Lexington, KY 40510 Kentucky, 40510, USA		
Evaluation by:	Jordan Coughenour, EMC Test Engineer	Signature:	
Prepared by:	Miranda Steele, Project Coordinator	Signature:	
Reviewed by:	Brian Lackey, EMC Team Lead	Signature:	



## 4 DESCRIPTION OF TEST SAMPLES

### 4.1 USER EQUIPMENT (UE)/PROJECT INFORMATION

PROJECT INFORMATION / User Equipment (UE)	
UE Manufacturer:	Digital Matter
UE Model #:	Remora3 4G
Hardware Version:	V3.0
Embedded Module:	nRF9160-SICA-B1
Sample Identifier: (IMEI or product's unique identifier)	Unit 1
Sample Condition/Description:	Samples arrived in working condition as first run production samples.
VENDOR INFORMATION	
Address:	239 Grant Street SE, Suite 101 Atlanta, GA 30312 USA
Email:	leon@digitalmatter.com
REGULATORY APPROVALS	
FCC ID:	2ANPO00NRF9160
These test results relate only to the specific items (UEs) tested (listed above).	
Comments:	Ultra-rugged, long-life battery-powered GPS asset tracking device and Bluetooth® Gateway featuring 10+ years of battery life and tamper detect.



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Photo of UE (front):



Photo of UE (back):







## RSE Test Report

## 5 TEST RESULTS SUMMARY

TEST RESULTS SUMMARY	
Total Tests Required (A, B, or E):	2
Tests Not Applicable:	0
Tests Passed:	2
Tests Failed:	0

## 6 REFERENCES

The following references are applicable to this document:

SPECIFICATION NUMBER	DESCRIPTION
IEEE/ANSI C63.4-2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

## 7 ENVIRONMENT

### 7.1 OPERATIONAL TEMPERATURE AND POWER RANGE OF THE DEVICE

The operating voltage range for the device is low 3.6V to high 7.2V. The nominal operating voltage is 5V. The operating temperature range for the device is low -20°C to high 60°C. The nominal operating temperature is 25°C. The device is powered by 2 x D-cell 3.6V LTC batteries.



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# 8 MEASUREMENT SYSTEMS

## 8.1 METHOD

Tests are performed in accordance with ANSI C63.4:2014.

**TEST SITE:** 10m ALSE  
**Site Designation:** 10m Chamber



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## 8.2 SAMPLE CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength in dB $\mu$ V/m
- RA = Receiver Amplitude (including preamplifier) in dB $\mu$ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB $\mu$ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

RA = 52.0 dB $\mu$ V  
AF = 7.4 dB/m  
CF = 1.6 dB  
AG = 29.0 dB  
FS = 32 dB $\mu$ V/m

To convert from dB $\mu$ V to  $\mu$ V or mV the following was used:

$UF = 10^{(NF / 20)}$  where UF = Net Reading in  $\mu$ V  
NF = Net Reading in dB $\mu$ V

**Example:**

$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$   
 $UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$



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### 8.3 FIELD STRENGTH TO POWER CALCULATION

As allowable by ANSI C63.26: 2015 section 5.2.7, the output power of unwanted emissions can be calculated from a field strength measurement. The transmitter measurements that follow in this report have applied the following calculation to the -13dBm limit to arrive an equivalent field strength limit at 3 meters as follows:

$E \text{ (dB}\mu\text{V/m)} = \text{EIRP (dBm)} - 20\log(D) + 104.8$ ; where D is the measurement distance (in the far field region) in m.

**Example:**

Limit (dBuV/m) =  $-13 - 20\log(3) + 104.8 = 82.25\text{dBuV/m}$



## RSE Test Report

## 8.4 PLATFORMS

### 1.1.1 EMC – RADIATED EMISSIONS (VER. 35)

Description	Asset	Manufacturer	Model	Calibration Date	Calibration Due
Horn Antenna #3780	3780	ETS	3117	08/19/2022	08/19/2023
Bilog Antenna #3133	3133	ETS	3142C	08/10/2022	08/10/2023
EMI Test Receiver	8285	Rohde & Schwarz	ESW44	12/23/2022	12/23/2023
1-18GHz Signal Path with Preamplifier	3074, 3918, 2588, 2593, 8188, 8185	N/A	N/A	01/12/2023	01/12/2024
30M-1G 3m Signal Path without Preamplifier	3339, 2592, 8188, 8185	N/A	N/A	01/12/2023	01/12/2024
System Controller #3957	3957	Sunol Sciences	SC110V	Calibrate at time of use	



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### 8.5 SOFTWARE UTILIZED

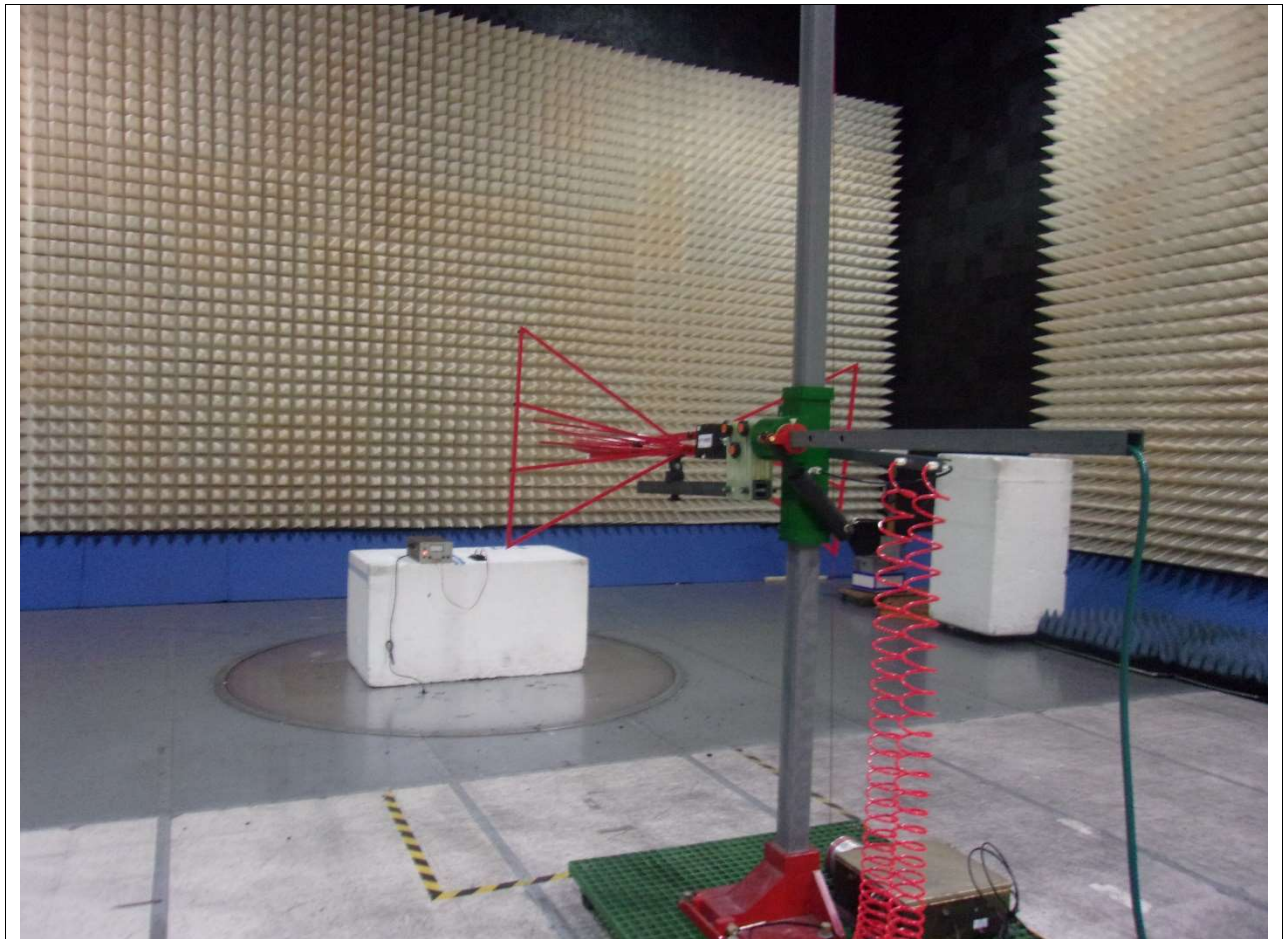
Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 10.60.20



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## 8.6 SETUP PHOTOGRAPHS

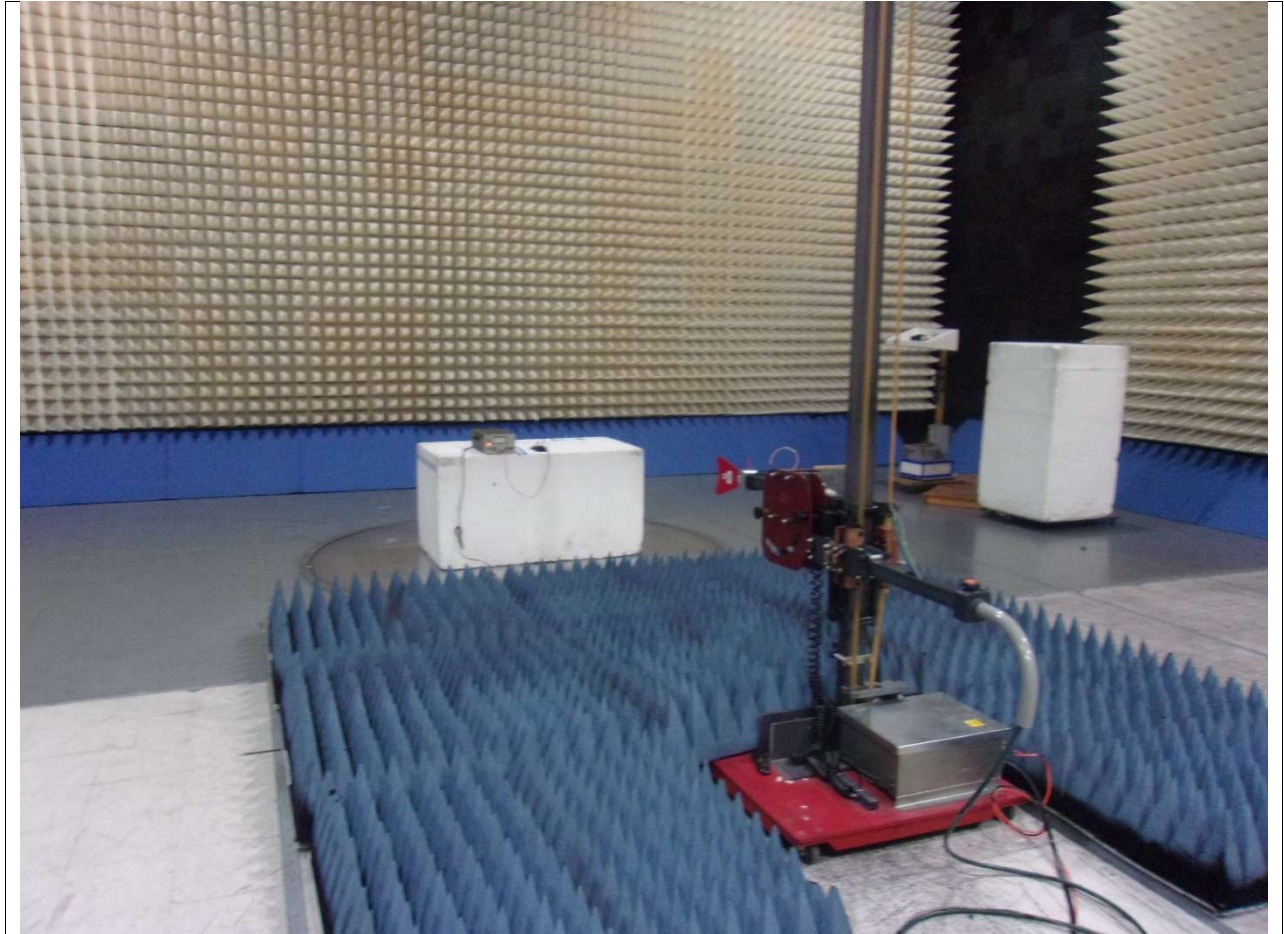
### 8.6.1 UNINTENTIONAL RADIATED EMISSIONS, 30MHZ – 1GHZ (IEEE/ANSI C63.4)





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**8.6.2 UNINTENTIONAL RADIATED EMISSIONS, 1GHZ – 18GHZ (IEEE/ANSI C63.4)**







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## 9 TEST RESULTS EXECUTIVE SUMMARY

### 9.1 EXECUTIVE SUMMARY

TEST PLAN	TOTAL TEST CASES	PASSED	FAILED	N/A	FINISHED RATE	COMPLIANT RATE
FCC Title 47 CFR Part 15 Subpart B ICES-003 Issue 7	2	2	0	0	100.00%	100.00%



## RSE Test Report

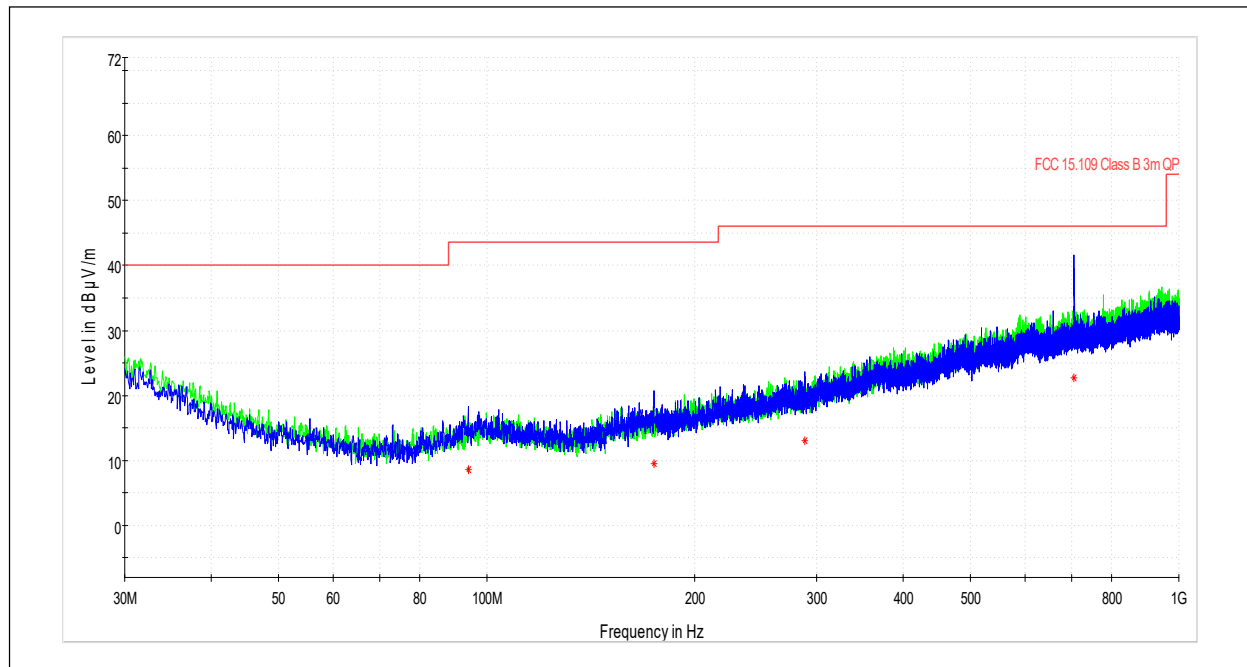
## 9.2 TEST RESULTS

### 9.2.1 FCC TITLE 47 CFR PART 15 SUBPART B

TEST NAME	TEST DESCRIPTION	DEVICE	RESULT	TEST SYSTEM	COMMENTS
FCC Title 47 CFR Part 15 Subpart B	Test				
Radiated Emissions (15.109) ICES-003 Issue 7	Radiated emissions, 30 MHz - 1 GHz	Remora3 4G	Passed	EMC – Radiated Emission (Ver. 35)	
Radiated Emissions (15.109) ICES-003 Issue 7	Radiated emissions, 1 GHz - 18 GHz	Remora3 4G	Passed	EMC – Radiated Emission (Ver. 35)	



## RSE Test Report

**9.3 UNINTENTIONAL RADIATED EMISSIONS, 30MHZ – 1GHZ (IEEE/ANSI C63.4)**

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
94.020000	8.54	43.52	34.98	120.000	105.0	V	350.0	15.9
174.422222	9.54	43.52	33.98	120.000	277.0	V	335.0	17.5
288.073889	12.99	46.02	33.03	120.000	400.0	V	192.0	20.7
705.982222	22.78	46.02	23.24	120.000	197.0	V	47.0	30.0

Test Personnel: Jordan Coughenour  
Supervising/Reviewing Engineer: Brian Lackey  
(Where Applicable) FCC Part 15B  
Product Standard: ICES-003 Issue 7  
Input Voltage: Battery  
Pretest Verification w / Ambient Signals or BB Source: Yes

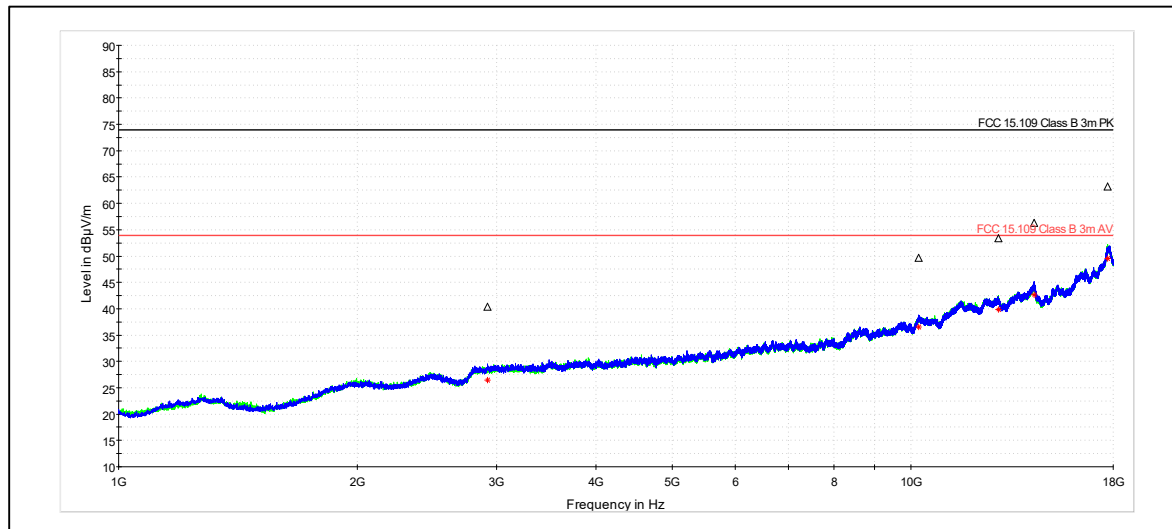
Test Date: 03/01/2023  
Limit Applied: Class B  
Ambient Temperature: 22.1C  
Relative Humidity: 38.2%  
Atmospheric Pressure: 977.4mbar

Deviations, Additions, or Exclusions: None.



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## 9.4 UNINTENTIONAL RADIATED EMISSIONS, 1GHZ – 18GHZ (IEEE/ANSI C63.4)



Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2923.500000	40.32	73.98	33.66	1000.000	100.0	V	295.0	6.7
10231.000000	49.64	73.98	24.34	1000.000	410.0	V	107.0	18.8
12883.000000	53.37	73.98	20.61	1000.000	410.0	H	164.0	23.0
14294.000000	56.36	73.98	17.62	1000.000	331.0	V	173.0	24.1
17706.000000	63.21	73.98	10.77	1000.000	393.0	H	294.0	34.4

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2923.500000	26.49	53.98	27.49	1000.000	100.0	V	295.0	6.7
10231.000000	36.50	53.98	17.48	1000.000	410.0	V	107.0	18.8
12883.000000	39.83	53.98	14.15	1000.000	410.0	H	164.0	23.0
14294.000000	42.67	53.98	11.31	1000.000	331.0	V	173.0	24.1
17706.000000	49.56	53.98	4.42	1000.000	393.0	H	294.0	34.4

Test Personnel: Jordan Coughenour  
Supervising/Reviewing Engineer: Brian Lackey  
(Where Applicable) FCC Part 15B  
Product Standard: ICES-003 Issue 7  
Input Voltage: Battery  
Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 03/01/2023  
Limit Applied: Class B  
Ambient Temperature: 22.1C  
Relative Humidity: 38.2%  
Atmospheric Pressure: 977.4mbar

Deviations, Additions, or Exclusions: None.



## RSE Test Report

## 10 MEASUREMENT UNCERTAINTY

The measured value related to the corresponding limit will be used to decide whether the equipment meets the requirements.

The measurement uncertainty figures were calculated and correspond to a coverage factor of  $k = 2$ , providing a confidence level of respectively 95.45% in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

Measurement Uncertainty Table

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucisp
Power Line Conducted Emissions	150 kHz - 30 MHz	3.1dB	3.4dB
Radiated Emissions, 10m	30-1000 MHz	3.9dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.0dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.7dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.7dB	5.5 dB



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## 11 REVISION HISTORY

Revision Level	Date	Report Number	Evaluated By	Reviewed By	Notes
0	03/15/2023	105343539LEX-01	Jordan Coughenour, EMC Test Engineer	Brian Lackey, EMC Team Lead	Initial Release of Report
1	12/11/2023	105343539LEX-01.1	Jordan Coughenour, EMC Test Engineer	Brian Lackey, EMC Team Lead	Added ICES-003 references

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End of Test Report