

RSE Test Report

Digital Matter

FINAL SUMMARY REPORT

Report Type: FCC Title 47 CFR Part 15 Subpart B

Model: Hawk 4G

Software Version: FW – 1.2

Hardware Version: 100.1

SCOPE OF WORK

Title 47 CFR Part 15 Subpart B

ICES-003 Issue 7

REPORT NUMBER

105343607LEX-001.1

ISSUE DATE

06-March-2023

REVISE DATE

11-December-2023





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RSE Test Report

1 INTRODUCTION

The purpose of this document is to record the test results for the Digital Matter Hawk 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 |
|--------------------|---------------------------|---------|
| 105343607LEX-001 | Initial Release of Report | 1.0 |
| 105343607LEX-001.1 | 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


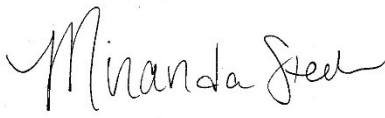

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2 GENERAL INFORMATION

| GENERAL INFORMATION - PROJECT ID 6214 | | | | | |
|---------------------------------------|------------|----------------|------------|--------------------|--------------------|
| Test Start date: | 02/23/2023 | Test End Date: | 02/23/2023 | RTO Test Report #: | 105343607LEX-001.1 |

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: | Jeremiah Andrade, 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 #: | Hawk 4G |
| Software Version: | FW – 1.2 |
| Hardware Version: | 100.1 |
| 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: | The Hawk is a rugged and robust IoT data logger for a wide range of sensor and condition monitoring applications. |



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Photo of UE (front):



Photo of UE (back):





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 device uses an internal 3.7VDC battery. The high operating voltage for the device is 28 VDC.



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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 μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ 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 μ 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 μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dB μ V/m

To convert from dB μ V to μ V or mV the following was used:

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

1.1.1 EMC – RADIATED EMISSIONS (10M) (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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8.4 SOFTWARE UTILIZED

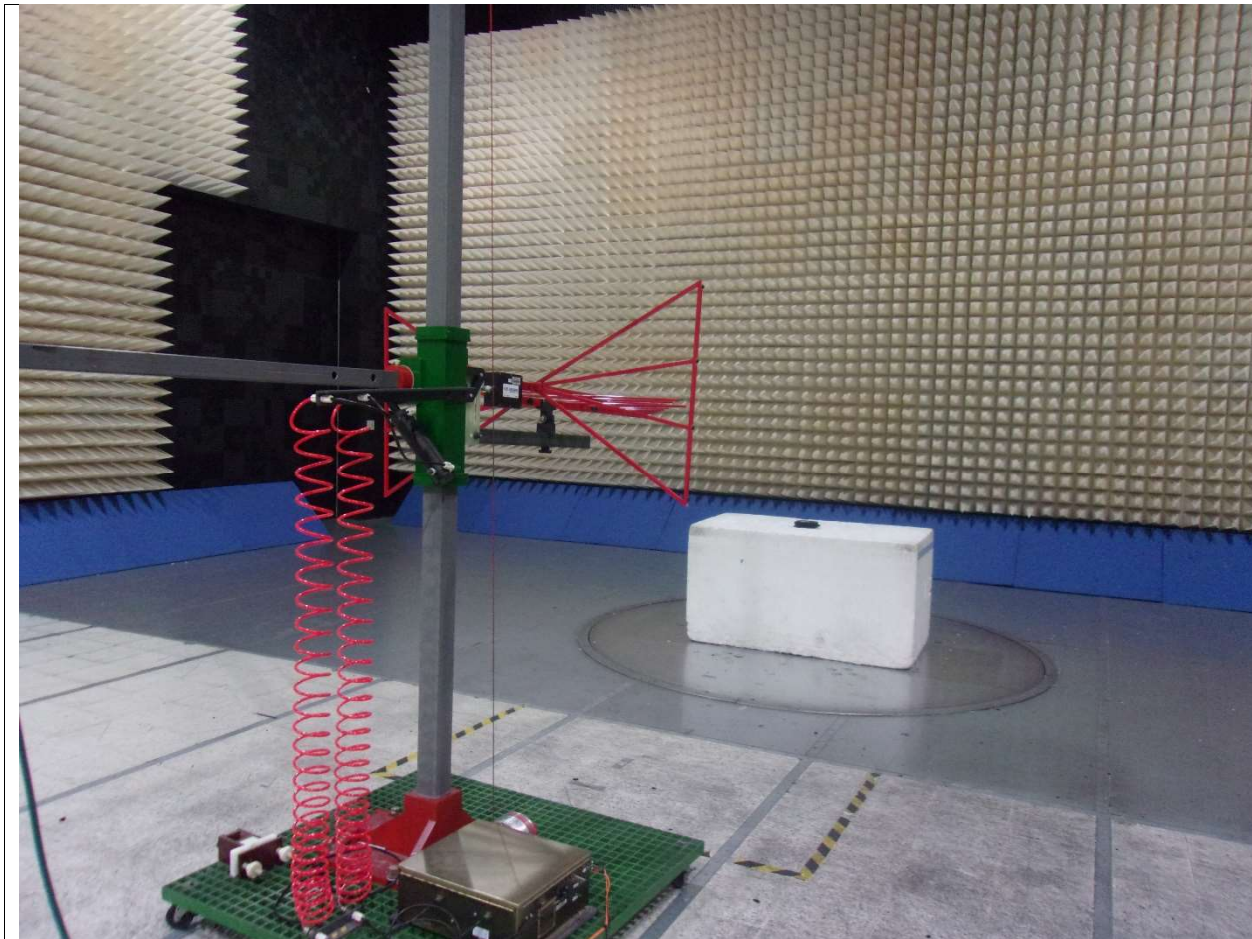
| Name | Manufacturer | Version |
|-------|-----------------|------------------|
| EMC32 | Rohde & Schwarz | Version 10.60.20 |



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8.5 SETUP PHOTOGRAPHS

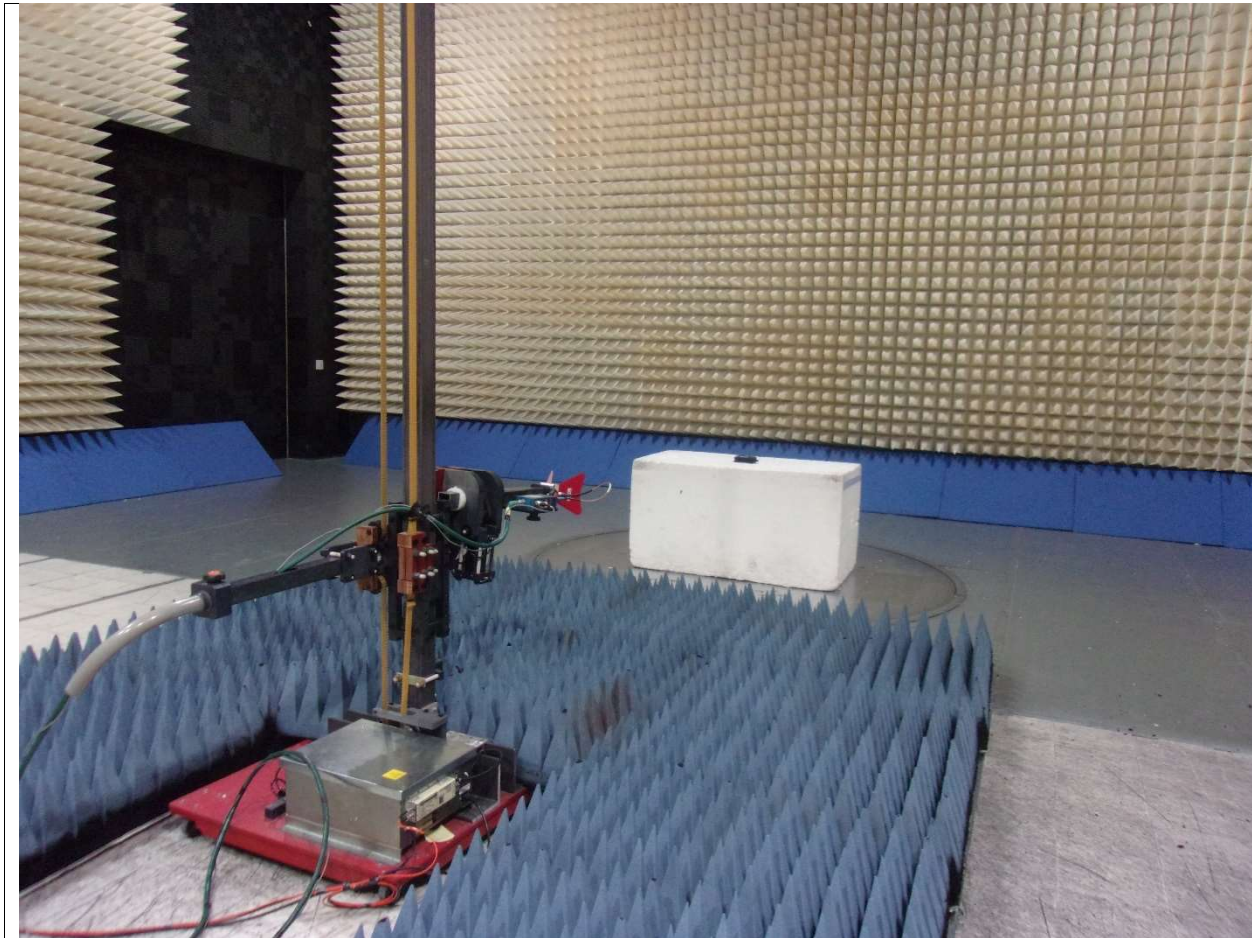
8.5.1 UNINTENTIONAL RADIATED EMISSIONS, 30MHZ – 1GHZ (IEEE/ANSI C63.4)





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8.5.2 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% |



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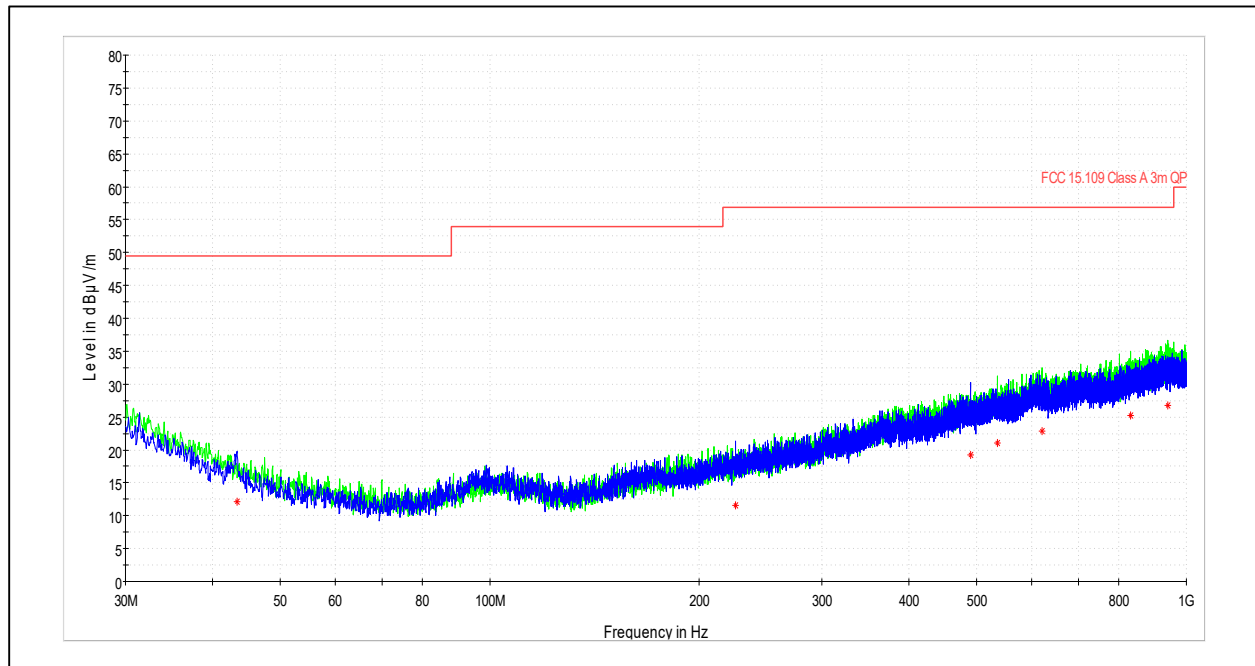
9.2 TEST RESULTS

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 | Hawk FCC testing, DHW: 100.1, DSW: 1.2 | Passed | EMC – Radiated Emissions (10m) (Ver. 35) | |
| Radiated Emissions (15.109) ICES-003 Issue 7 | Radiated emissions, 1 GHz - 18 GHz | Hawk FCC testing, DHW: 100.1, DSW: 1.2 | Passed | EMC – Radiated Emissions (10m) (Ver. 35) | |



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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) |
|-----------------|--------------------|----------------|-------------|-----------------|-------------|-----|---------------|--------------|
| 43.364444 | 12.09 | 49.54 | 37.45 | 120.000 | 106.0 | V | 6.0 | 16.6 |
| 225.239444 | 11.55 | 56.90 | 45.35 | 120.000 | 175.0 | V | 334.0 | 19.4 |
| 489.618333 | 19.24 | 56.90 | 37.66 | 120.000 | 162.0 | V | 163.0 | 26.2 |
| 535.693333 | 21.06 | 56.90 | 35.84 | 120.000 | 144.0 | H | 110.0 | 27.5 |
| 620.083333 | 22.80 | 56.90 | 34.10 | 120.000 | 400.0 | H | 260.0 | 29.8 |
| 830.681111 | 25.25 | 56.90 | 31.65 | 120.000 | 371.0 | H | 234.0 | 32.2 |
| 939.482778 | 26.75 | 56.90 | 30.15 | 120.000 | 200.0 | H | 305.0 | 33.3 |

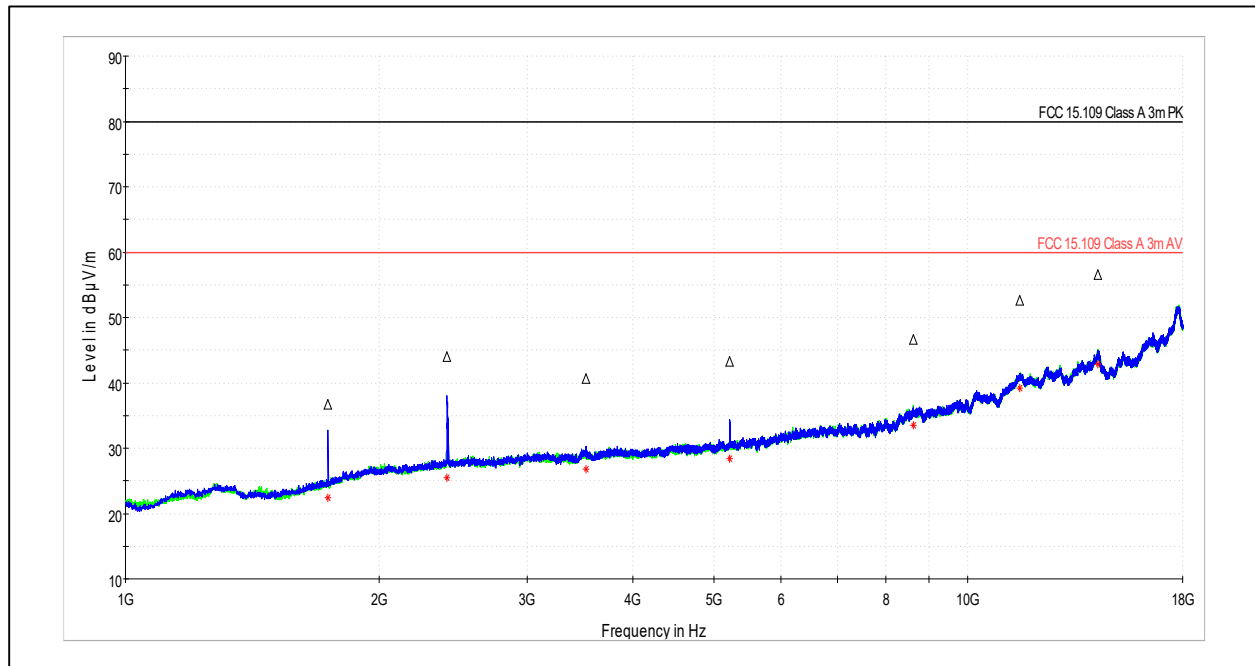
Test Personnel: Jeremiah Andrade
Supervising/Reviewing Engineer: Brian Lackey
(Where Applicable) FCC Part 15B
Product Standard: ICES-003 Issue 7
Input Voltage: Battery
Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 02/23/2023
Limit Applied: Class A
Ambient Temperature: 21.3C
Relative Humidity: 38.3%
Atmospheric Pressure: 984.7mbar

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) |
|-----------------|------------------|----------------|-------------|-----------------|-------------|-----|---------------|--------------|
| 1740.500000 | 36.65 | 80.00 | 43.35 | 1000.000 | 109.0 | V | 224.0 | 1.9 |
| 2408.500000 | 43.98 | 80.00 | 36.02 | 1000.000 | 253.0 | V | 67.0 | 5.4 |
| 3520.000000 | 40.67 | 80.00 | 39.33 | 1000.000 | 410.0 | V | 268.0 | 7.9 |
| 5220.500000 | 43.22 | 80.00 | 36.78 | 1000.000 | 410.0 | V | 0.0 | 11.2 |
| 8620.000000 | 46.61 | 80.00 | 33.39 | 1000.000 | 321.0 | H | 0.0 | 16.7 |
| 11524.500000 | 52.67 | 80.00 | 27.33 | 1000.000 | 109.0 | H | 112.0 | 20.6 |
| 14282.500000 | 56.55 | 80.00 | 23.45 | 1000.000 | 117.0 | H | 332.0 | 24.0 |
| Frequency (MHz) | Average (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
| 1740.500000 | 22.35 | 60.00 | 37.65 | 1000.000 | 109.0 | V | 224.0 | 1.9 |
| 2408.500000 | 25.47 | 60.00 | 34.53 | 1000.000 | 253.0 | V | 67.0 | 5.4 |
| 3520.000000 | 26.84 | 60.00 | 33.16 | 1000.000 | 410.0 | V | 268.0 | 7.9 |
| 5220.500000 | 28.38 | 60.00 | 31.62 | 1000.000 | 410.0 | V | 0.0 | 11.2 |
| 8620.000000 | 33.52 | 60.00 | 26.48 | 1000.000 | 321.0 | H | 0.0 | 16.7 |
| 11524.500000 | 39.16 | 60.00 | 20.84 | 1000.000 | 109.0 | H | 112.0 | 20.6 |
| 14282.500000 | 42.81 | 60.00 | 17.19 | 1000.000 | 117.0 | H | 332.0 | 24.0 |

Test Personnel: Jeremiah Andrade
Supervising/Reviewing Engineer: Brian Lackey
(Where Applicable) FCC Part 15B
Product Standard: ICES-003 Issue 7
Input Voltage: Abs max 28V
Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 02/23/2023
Limit Applied: Class A
Ambient Temperature: 21.3C
Relative Humidity: 38.3%
Atmospheric Pressure: 984.7mbar



Evaluation For: Digital Matter
Product: Hawk 4G
Date: 12/11/2023

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Deviations, Additions, or Exclusions: None.



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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) | Ucispr |
|--------------------------------|------------------|----------------------------|--------|
| 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 | 03/06/2023 | 105343607LEX-001 | Jeremiah Andrade, EMC Test Engineer | Brian Lackey, EMC Team Lead | Initial Release of Report |
| 1 | 12/11/2023 | 105343607LEX-001.1 | Jeremiah Andrade, EMC Test Engineer | Brian Lackey, EMC Team Lead | Added ICES-003 references |

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End of Test Report