

July 14, 2020

Mobilogix, Inc.
5500 Trabuco Rd, Suite 150
Irvine, California 92620

Dear Ramy Mourad,

Enclosed is the EMC Wireless test report for compliance testing of the Mobilogix, Inc. , Mobilogix Global Asset Tracker (GAT) as tested to the requirements of the FCC Certification rules under Title 47 of the CFR Part 1.1310 RF Exposure.

Thank you for using the services of Eurofins E&E North America. If you have any questions regarding these results or if MET can be of further service to you, please contact me.

Sincerely yours,
EUROFINS E&E NORTH AMERICA



Jennifer Warnell
Documentation Department

Reference: (\Mobilogix, Inc. \WIRS108597-FCC-MPE Rev. 0)



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Electromagnetic Compatibility Criteria Test Report

for the

**Mobilogix, Inc.
Model Mobilogix Global Asset Tracker (GAT)**

**Tested under
FCC Certification Rules
Title 47 of the CFR, Part 1 1.1310**

Report: WIRS108597-FCC-MPE Rev. 0

July 14, 2020

Prepared For:

**Mobilogix, Inc.
5500 Trabuco Rd, Suite 150
Irvine, California 92620**

**Prepared By:
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Santa Clara, CA 95054**

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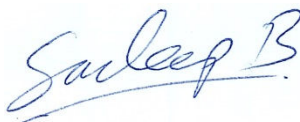
Tested Under

**FCC Certification Rules
Title 47 of the CFR, Part 1 1.1310**



Arsalan Hasan
Project Engineer, Electromagnetic Compatibility Lab

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 1 of the FCC Rules under normal use and maintenance.



Sandeep Brar,
Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	July 14, 2020	Initial Issue.

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List of Terms and Abbreviations

AC	Alternating Current
ACF	Antenna Correction Factor
Cal	Calibration
d	Measurement Distance
dB	Decibels
dBμA	Decibels above one microamp
dBμV	Decibels above one microvolt
dBμA/m	Decibels above one microamp per meter
dBμV/m	Decibels above one microvolt per meter
DC	Direct Current
E	Electric Field
DSL	Digital Subscriber Line
ESD	Electrostatic Discharge
EUT	Equipment Under Test
f	Frequency
FCC	Federal Communications Commission
GRP	Ground Reference Plane
H	Magnetic Field
HCP	Horizontal Coupling Plane
Hz	Hertz
IEC	International Electrotechnical Commission
kHz	kilohertz
kPa	kilopascal
kV	kilovolt
LISN	Line Impedance Stabilization Network
MHz	Megahertz
μH	microhenry
μ	microfarad
μs	microseconds
NEBS	Network Equipment-Building System
PRF	Pulse Repetition Frequency
RF	Radio Frequency
RMS	Root-Mean-Square
TWT	Traveling Wave Tube
V/m	Volts per meter
VCP	Vertical Coupling Plane

I. Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Mobilogix, Inc. Mobilogix Global Asset Tracker (GAT), with the requirements of Part 1. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the Mobilogix Global Asset Tracker (GAT). Mobilogix, Inc. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Mobilogix Global Asset Tracker (GAT), has been **permanently** discontinued.

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 1, in accordance with Mobilogix, Inc. , purchase order number MOB2012-1.

Reference	Description	Compliance
§1.1310	RF Exposure	Compliant

Table 1. Executive Summary of EMC Compliance Testing

II. Equipment Configuration

A. Overview

Eurofins E&E North America was contracted by Mobilogix, Inc. to perform testing on the Mobilogix Global Asset Tracker (GAT), under Mobilogix, Inc. 's purchase order number MOB2012-1.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Mobilogix, Inc. , Mobilogix Global Asset Tracker (GAT).

The results obtained relate only to the item(s) tested.

Model(s) Tested:	Mobilogix Global Asset Tracker (GAT)		
Model(s) Covered:	Mobilogix Global Asset Tracker (GAT)		
Filing Status:	Original		
EUT Specifications:	Primary Power: 3.8V DC		
	FCC ID: 2AH4HVZGATCM1		
	Module Original Report Number(s): RXA1706-0199MPE		
	Type of Modulations:	GMSK, 8PSK, QPSK, 16QAM	
	Equipment Code:	PCB	
	Technology	Frequency Range	RF Power Output (Conducted)
	GSM 850	824 – 849 MHz	22.65 dBm
	GSM 1900	1850 – 1910 MHz	20.53 dBm
	LTE CAT-M1 Band 2	1850 – 1910 MHz	23.14 dBm
	LTE CAT-M1 Band 4	1710 – 1755 MHz	22.31 dBm
	LTE CAT-M1 Band 5	824 – 949 MHz	23.64 dBm
	LTE CAT-M1 Band 12	699 – 716 MHz	23.25 dBm
	LTE CAT-M1 Band 13	777 – 787 MHz	22.98 dBm
Analysis:	The results obtained relate only to the item(s) tested.		
Environmental Test Conditions:	Temperature: 15-35° C		
	Relative Humidity: 30-60%		
	Barometric Pressure: 860-1060 mbar		
Evaluated by:	Arsalan Hasan		
Date(s):	July 14, 2020		

Table 2. EUT Summary Table

Rationale: LTE CAT-M1 bands were chosen over NB-IoT since CAT-M1 has higher output powers and presents itself as the worst case for testing purposes.

B. References

CFR 47, Part 22, Subpart H	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 22: Rules and Regulations for Cellular Devices.
CFR 47, Part 24, Subpart E	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 24: Rules and Regulations for Personal Communications Services
CFR 47, Part 27	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 27: Rules and Regulations for Advanced Wireless Services
KDB 996369 D04	Modular Transmitter Integration Guide – Guidance For Host Product Manufacturers
ANSI C63.4:2014	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.26: 2015	Compliance Testing of Transmitters Used in Licensed Radio Services
ISO/IEC 17025:2017	General Requirements for the Competence of Testing and Calibration Laboratories
EIA/TIA-603-A-2001	Land Mobile FM or PM Communication Equipment Measurement and Performance Standards
KDB 971168 v02r02	Measurement Guidance For Certification Of Licensed Digital Transmitters

Table 3. Standard References

B. Test Site

All testing was performed at Eurofins E&E North America, 3162 Belick St. Santa Clara, CA 95054. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a 5 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

MET Laboratories is a ISO/IEC 17025 accredited site by A2LA, California #0591.02.

C. Measurement Uncertainty

Test Method	Typical Expanded Uncertainty	K	Confidence Level
RF Frequencies	±4.52 Hz	2	95%
RF Power Conducted Emissions	±2.32 dB	2	95%
RF Power Conducted Spurious Emissions	±2.25 dB	2	95%
RF Power Radiated Emissions	±3.01 dB	2	95%
Radiated Emissions, (30 MHz – 1 GHz)	±3.24	2	95%
Radiated Emissions, (1 - 6 GHz)	±3.92	2	95%
Conducted Emission	±3.53	2	95%
CEV Telecom Port	±2.44	2	95%

Table 4. Uncertainty Calculations Summary

D. Description of Test Sample

The Mobilogix Global Asset Tracker (GAT), Equipment Under Test (EUT), is a multi-purpose LTE CAT-M1 / NB1 and 2G (GSM/GPRS/EDGE), IP67 rated mobile asset tracking and monitoring device with various onboard sensors including temperature, pressure, humidity, light, a 3-axis IMU/Gyroscope, and GNSS/GPS. It also boasts WIFI LAAS and BLE (Bluetooth Low-Energy) connectivity. It is designed for applications such as critical asset tracking and cold-chain, with the ability to periodically report sensor data and location data per configurable intervals, and report near-real-time events or alarms, based on configurable intervals and configurable thresholds.

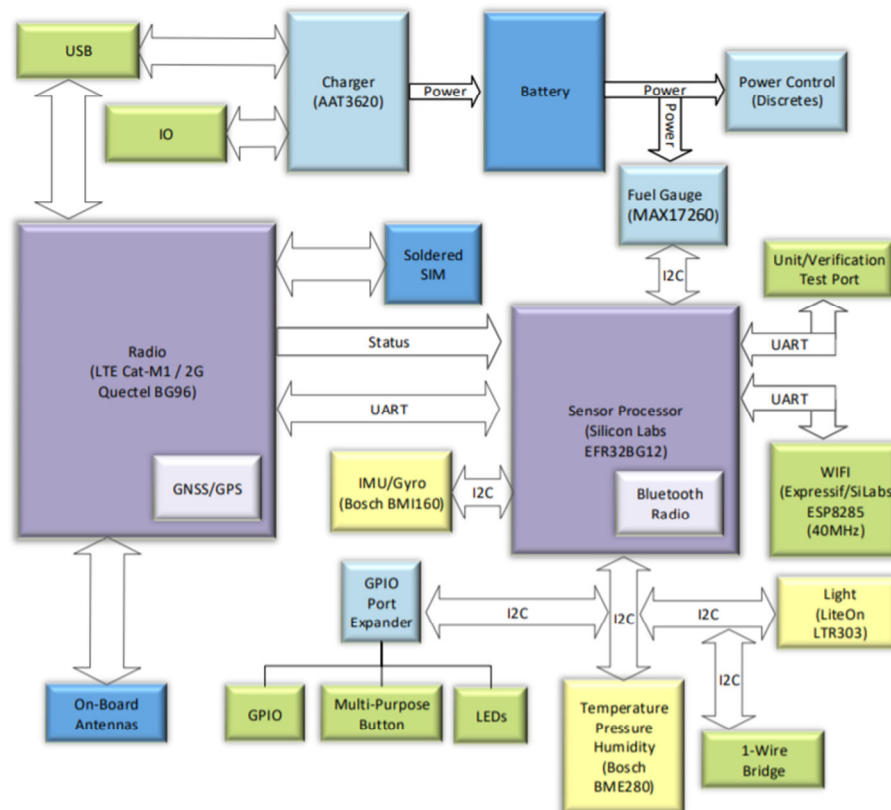


Figure 1. Block Diagram of Equipment Configuration

E. Equipment Configuration

Ref. ID	Slot #	Name / Description	Model Number	Part Number	Serial Number	Rev. #
1	NA	Global Asset Tracker	VZGAT-CM1-001	ATD210S	A210S2024000 36S	NA
2	NA	AC/DC Adapter	ASUC62a-050200	NA	NA	NA

Table 5. Equipment Configuration

F. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty	Length as tested (m)	Max Length (m)	Shielded? (Y/N)	Termination Box ID & Port Name
3	USB Power Port	USB Power Cable	1	1	1	N	NA

Table 6. Ports and Cabling Information

G. Mode of Operation

In Normal Mode, the default GAT profile periodically monitors and provides sensor reports for temperature, humidity, pressure, light, accelerometer, tilt/orientation, battery-level, location, and LTE signal strength (RSRP). A user may disable or decrease the reporting frequency (granularity) of any sensor for which the use case does not apply. Furthermore, alarms can be enabled for near real-time detection and reporting of environmental excursions, motion or tilt alarms.

The GAT supports indoor location using Wi-Fi access points and RSSI trilateration, in addition to location based on enhanced cell ID (eCID), in scenarios where visibility to the sky for GNSS location is compromised or not possible.

The GAT can be configured as a cellular gateway or scanner of remote Bluetooth environmental sensors, such as the Mobilogix BTM250.

H. Method of Monitoring EUT Operation

A CMW500 will connect to the Asset Tracker on a desired GSM / LTE band over the air. CMW500 will be monitored for any dropped calls.

RADIO LEDs

Slow short blinks → Attempting to register on network.

Slow long blinks → Registered and Idle.

Rapid blink → Data transfer in progress.

The Radio LED will not blink while GAT is not performing its intended functions

The Radio LED will blink when GAT is performing its intended functions

I. Modifications

a) Modifications to EUT

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

J. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Mobilogix, Inc. upon completion of testing.

III. Electromagnetic Compatibility Criteria for Intentional Radiators

Maximum Permissible Exposure

RF Exposure Requirements: §1.1307(b)(1) and §1.1307(b)(2): Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

RF Radiation Exposure Limit: §1.1310: As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*(900/f ²)	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6
(ii) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*(180/f ²)	<30
30-300	27.5	0.073	0.2	<30
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

Table 7. RF Exposure Limits

$$S = PG / 4\pi R^2 \quad \text{or} \quad R = \sqrt{PG / 4\pi S}$$

where, S = Power Density (mW/cm²)
P = Power Input to antenna (mW)
G = Antenna Gain (numeric value)
R = Distance (cm)

For Antenna Gain → dBi = 10log(Numeric)

Universal Broadband FR4 Embedded LTE / LPWA Antenna			
Frequency (MHz)	698-960	1710-2400	2500-2700
Peak Gain (dBi)	1.6 dBi	3.1 dBi	1.7 dBi
Polarization	Linear	Linear	Linear

Table 8. EUT Antenna Gain Specification

Bands covered under FCC Part 22 / FCC Part 24

Test Results:

Band	Frequency (MHz)	Conducted Power (dBm)	Tune-Up Power (dBm)	Conducted Power (mW)	Antenna Gain (dBi)	Antenna Gain (Numeric)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Margin	Distance (cm)	Result
GSM 850	848.8	22.65	23.65	231.73	1.6	1.445	0.066	0.565	-0.499	20	Pass
GSM 1900	1850.2	20.53	21.53	142.23	3.1	2.041	0.057	1	-0.943	20	Pass
LTE Band 2	1905.0	23.14	24.14	259.41	3.1	2.041	0.105	1	-0.895	20	Pass
LTE Band 5	836.5	23.64	24.64	291.07	1.6	1.445	0.083	0.557	-0.474	20	Pass

Table 9. MPE Calculation for Bands under Part 22 and Part 24

Tune-up power: ± 1 dB

The safe distance where Power Density is less than the MPE limit listed above was found to be 20 cm.

Bands covered under FCC Part 27

Test Results:

Band	Frequency (MHz)	Conducted Power (dBm)	Tune-Up Power (dBm)	Conducted Power (mW)	Antenna Gain (dBi)	Antenna Gain (Numeric)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Margin	Distance (cm)	Result
LTE Band 4	1715	22.31	23.31	214.28	1.6	1.445	0.061	1	-0.938	20	Pass
LTE Band 12	714.5	23.25	24.25	266.07	3.1	2.041	0.108	0.476	-0.368	20	Pass
LTE Band 13	782.0	22.98	23.98	250.03	3.1	2.041	0.101	0.521	-0.419	20	Pass

Table 10. MPE Calculation for Bands under Part 27

Tune-up power: ± 1 dB

The safe distance where Power Density is less than the MPE limit listed above was found to be 20 cm.

IV. Test Equipment

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1S4075	RADIO COMMUNICATION TESTER	ROHDE & SCHWARZ	CMW500	09/18/2018	09/18/2020
1S2399	TURNTABLE/MAST CONTROLLER	SUNOL SCIENCES	SC99V	SEE NOTE 1	
1S2600	BILOG ANTENNA	TESEQ	CBL6112D	03/19/2019	03/19/2021
1S3826	DRG HORN ANTENNA	ETS-LINDGREN	3117	12/03/2018	12/03/2020
1S2000	SPECTRUM ANALYZER	AGILENT	E4448A	11/06/2019	11/06/2020
1S2587	PRE AMPLIFIER	AML COMMUNICATIONS	AML0126L3801	SEE NOTE 1	
1S2653	AMPLIFIER	SONOMA INSTRUMENT	310 N	SEE NOTE 1	
1S2486	5 METER CHAMBER	PANASHIELD - ETS	5M	SEE NOTE 2	
1S3824	SIGNAL GENERATOR	ROHDE & SCHWARZ	SMA100B	11/06/2019	05/06/2021

Table 12. Test Equipment List

Note 1: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

Note 2: Latest NSA and VSWR data available upon request.

End of Report