GAT (GLOBAL ASSET TRACKER)
VZGAT-CM1-001

USER GUIDE

v2020-07-08

1 CONTENTS

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2 INTRODUCTION

The GAT 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.

3 QUICK START

3.1 INTERFACES

3.1.1 BATTERY CHARGER USB PORT

The Battery Charger USB Port allows connection of USB power for charging the unit's internal battery.

3.1.2 BUTTON AND RADIO POWER CONTROL

Pressing the button for 2 seconds toggles radio power. Allow several seconds after button is recognized for the radio to complete its power cycle.

Pressing the button for 10 seconds performs a system reset, after which the radio powers on and performs sensor reporting as necessary.

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3.2 LED STATUS INDICATORS

3.2.1 POWER LED

- The color of the power LED is set according to the percentage battery level remaining as follows:
  - Green: Battery level remaining is greater than or equal to 40%.
  - Yellow: Battery level remaining is less than 40% and greater than or equal to 20%.
  - Red: Battery level remaining is less than 20%.
- The power LED stays on when the radio is on and blinks when the radio is off.

3.2.2 RADIO LED

- Slow short blinks: Attempting to register on network.
- Slow long blinks: Registered and Idle.
- Rapid blinks: Data transfer in progress.

4 FIRMWARE

4.1 FIRMWARE VERSIONS

1. BG96: BG96MAR04A04M1G
2. EFR32BG12: v1.4.1
3. BG96 DAM application: v1.4.1

5 OPERATING MODES

5.1 TEST (MANUFACTURE) MODE

Description:

1. Used during factory testing, including PCBA test, partial assembly test, etc.
2. Supports certification activities as well as antenna performance tests (otherwise, a different mode should be defined)

Mode Entry Actions:

1. Enable all sensors for read/write functionality
2. Enable UART peripheral for factory test automation
3. Turn on all modules (where applicable): cellular Wi-Fi, GNSS
4. Customer production application is disabled

5.2 SETUP (SHIP) MODE

Description:

1. How the device leaves the factory and shipped to a warehouse or distribution center
2. Lowest power state
3. Mode for long-term storage

Mode Entry Actions:

1. Disable all sensors and alarms (no data collection)
2. Turn off all modules: cellular, Wi-Fi, GNSS. Disconnect power supply (if HW-supported) to address quiescent current
3. Disable beacon/advertising functionality (if applicable)
4. If device previously deployed, customer has an option to maintain previous device settings/configuration or reset to default values and clear data store.

Mode Exit:

1. Connect the device to the charger for 10 minutes
2. Upon exiting Setup mode, the device enters Normal mode

5.3 NORMAL MODE

Description:

1. Device operates per customer settings configured in Discovery mode
2. Starting with the Default profile, Normal mode supports multiple profiles based on situational logic

Mode Entry Actions:

1. Device operates per customer default settings, namely the 14-day profile: 15-minute periodic reporting of all onboard sensors.
2. 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.
3. 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.
4. The GAT can be configured as a cellular gateway or scanner of remote Bluetooth environmental sensors, such as the Mobilogix BTM250.

6 HARDWARE

6.1 MAIN PROCESSING COMPONENTS

The GAT comprises 2 primary communication and processing modules, the Quectel BG96G, and the Silicon Labs BlueGecko EFR32BG12. The BG96 and EFR32BG12 operate cooperatively and communicate via a dedicated UART serial interface, using a proprietary, message packet-based protocol (Ref. 7, GAT Software Radio to Sensor Message Protocol).

6.1.1 BG96

The BG96 hosts the radio/modem and is primarily responsible for cellular communications to ThingSpace and for GNSS/GPS positioning.

6.1.2 EFR32BG12 (SENSOR PROCESSOR)

The EFR32BG12 is primarily responsible for collecting periodic sensor measurements and for generating events or alarms based on those measurements. It hosts a Bluetooth Low Energy (BLE) radio for use with applications such as reading data such as temperature from a BLE sensor.

6.2 SENSORS

GAT has the following peripheral devices that interface to the EFR32BG12 to support system operation and to support taking sensor measurements:

- Bosch BMI160 3-Axis IMU/Gyroscope, with up to 16g of motion/force detection, and 0 to 359 degree orientation around 2 independent axes and tilt-angle recognition around 3 independent axes
- Bosch BME280 sensor with Temperature (-40 deg C to 80 deg C), Pressure (0 hPa to 1300 hPa), and Humidity (0% to 100%)
- Maxim MAX17260 Battery Fuel Gauge
- Liteon LTR303 ambient light sensor, with 0 to 64K Lux measurement
- Silicon Labs / Expressif ESP8286 WIFI (for LAAS)
- 1-wire bridge to support a thermistor device

6.3 ELECTRICAL

Capacity:	4000 mAh
Operating Voltage:	>3.8 V
Chemistry:	Li-ion (rechargeable)
Runtime:	Up to 1-year battery life on a single charge
Charging:	Micro USB 2.0 (type B receptacle)
Max Charge Rate:	1.2 A

6.4 MISCELLANEOUS

Dimensions:	119.5 x 62.5 x 21 (mm)
Weight:	153 g
SIM Card:	Embedded

6.5 RADIOS

Cellular Module:	Quectel® BG96 (Qualcomm® MDM9206)
Bluetooth Module:	Silabs® EFR32BG12
Antenna:	Embedded Cellular/GPS/Bluetooth (Rx)/WiFi (Rx)

Radio Frequencies:

	TX (MHz)			RX (MHz)		
LTE-FDD B1	1920	~	1980	2110	~	2170
LTE-FDD B2	1850	~	1910	1930	~	1990
LTE-FDD B3	1710	~	1785	1805	~	1880
LTE-FDD B4	1710	~	1755	2110	~	2155
LTE-FDD B5	824	~	849	869	~	894
LTE-FDD B8	880	~	915	925	~	960
LTE-FDD B12	699	~	716	729	~	746
LTE-FDD B13	777	~	787	746	~	756
LTE-FDD B18	815	~	830	860	~	875
LTE-FDD B19	830	~	845	875	~	890
LTE-FDD B20	832	~	862	791	~	821
LTE-FDD B26	814	~	849	859	~	894
LTE-FDD B28	703		748	758		803
LTE-TDD B39	2570	~	2620	2570	~	2620
850 (B5)	824.2	~	848.8	869.2	~	893.8
900 (B8)	880.2	~	914.8	925.2	~	959.8
1800 (B3)	1710.2	~	1784.8	1805.2	~	1879.8
1900 (B2)	1850.2	~	1909.8	1930.2	~	1989.8
GPS	-	~	-	1575.4	±	1.023
Bluetooth	2400	~	2483.5	2400	~	2483.5
WiFi	-	~	-	2400	~	2483.5

Max Output Power:

LTE-FDD	23 dBm	±	2 dB
LTE-TDD	23 dBm	±	2 dB
850 (B5) / 900 (B8)	33 dBm	±	2 dB
1800 (B3) / 1900 (B2)	30 dBm	±	2 dB
1800 (B3) / 1900 (B2) 8-PSK	27 dBm	±	2 dB

7 CONTACTS

- support@mobilogix.com
- https://mobilogix.com/contact/

8 DISCLAIMERS

8.1 FCC INTERFERENCE STATEMENT (PART 15.105 (B))

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and receiver.

Connect the equipment into an outlet on a circuit different from that to which the receiver is connected. Consult the dealer or an experienced radio/TV technician for help.

8.2 FCC PART 15 CLAUSE 15.21

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

8.3 FCC PART 15.19(A) [INTERFERENCE COMPLIANCE STATEMENT]

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

8.4 ISED RSS-GEN NOTICE

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

(1) This device may not cause interference; and

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

(1) l'appareil ne doit pas produire de brouillage;

(2) l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'encompromettre le fonctionnement.

8.5 FCC RF EXPOSURE GUIDANCE STATEMENT

In order to comply with FCC/ISED RF Exposure requirements, this device must be installed to provide at least 20 cm separation from the human body at all times.

8.6 ISED RF EXPOSURE GUIDANCE STATEMENT

In order to comply with FCC/ISED RF Exposure requirements, this device must be installed to provide at least 20 cm separation from the human body at all times.

Afin de se conformer aux exigences d'exposition RF FCC / ISED, cet appareil doit être installé pour fournir au moins 20 cm de séparation du corps humain en tout temps.

9 VERSION HISTORY

Date	Description
2020-07-07	Initial document version.
2020-07-08	Initial document release.

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