FJ-1600 SERIES REL 0.1

Positioning Universal

Mobile IOT Made Easy

FJ-1600

Vehicle Tracking Unit – Model 1600 Series

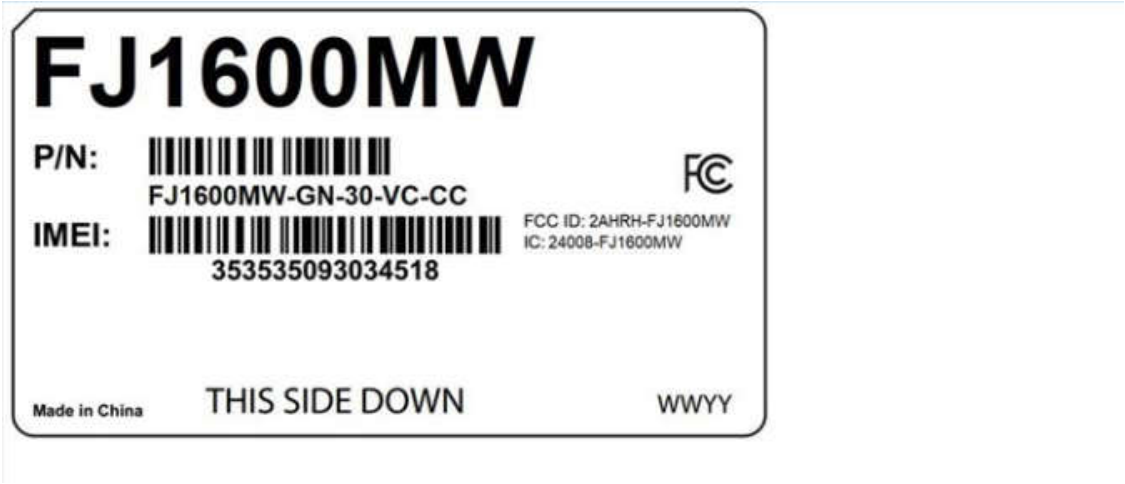
1 Overview

The FJ-1600 is a targeted as mid-tier under-dash mobile fleet gateway product ideal for mobile resource management. The FJ1600 is incorporates robust input and output capabilities, BLE 5.0, Vehicle Engine Control Unit (ECU) interface. The FJ-1600 products also feature advanced capabilities such as impact/crash detection, driver behavior (rapid acceleration, rapid braking, and harsh cornering) engine hours usage, movement/motion, and maintenance management.

2 Target Markets

The target applications for the platform include:

- Service Vans and Trucks
- Fleet Management (Light and heavy duty vehicle interfaces)
- Heavy duty construction equipment tracking



3 Platform Technical Requirements

3.1 Product Derivatives

The FJ-1600 platform is intended to support a number of derivatives of the product based around the Input / Output configurations and Engine Control interface.

This platform design will support multiple product models. The design features a common PWA (Printed Wiring Assembly) that can be populated differently to create multiple product offerings. The first two products are outlined in this document. Subsequent products will be documented in future documents.

Initial launch will be with FJ1600LA-30, FJ1600LW-30, FJ1600MW-20. Additional derivatives can be launched based on market opportunity.

3.2 Platform Common Feature Specifications

- Surface mounted cellular modem with independent power down and power reset control by application processor
    - LTE CAT M1 modem support (Telit module)
        - ME910G1-WW w/2G fallback (B1, B2, B3, B4, B5, B8, B12, B13, B20, B25, B26, B28, B66, B85) AT&T
- Internal SIM locked into place to withstand J1455 heavy duty vehicle vibration and shock
    - Standard 4FF SIM card support
    - Optional Electronic chip SIM
- GPS Receiver chipset with industrial environment specifications (ublox UBX-8030-KT preferred, UBX-7020-KT as alternate part in case of supply issues)
    - Ability to 'hard code' the GPS coordinates for applications that require GPS without ability for the device to acquire GPS (ie. indoor applications, underground, etc.)
    - Stores the last known good coordinates to use in cases where GPS cannot get a fix
- Standard Internal Antenna configuration with Rf performance to pass carrier and agency approvals specified in approval sections.
    - Internal cellular antenna (PIFA). In case of LTE Cat 1, support for second diversity antenna
    - Internal GPS ceramic 25x25x4 mm with external LNA to support 15dB signal gain
- Standard 3-axis MEMs accelerometer (LIS3DH) to provide leading power management, motion detection, driver behavior and standard crash detection. Key capabilities:
    - Interrupt for wake-up on motion, impacts.
    - 1.3KHz high resolution mode Output Data Rate.
    - Ultra low-power mode consumption down to 2 µA
    - full-scale acceleration range of ±2/±4/±8/±16 g, dynamically selectable
- Integrated BLE V5.0 module (CC2640R2FRSMR V5.0 chipset)
    - Over-The-Air (OTA) updates supported
    - Internal Bluetooth antenna
    - Support for iBeacon and OEMDD protocols
- Power supply will be used in filtered 12/24/48/72 Volt automotive environments with brown out and shut down capabilities
    - 7 – 90 Volt operating range – able to handle momentary dips below 6.5V in cranking conditions and alternator spikes per environmental specifications section.
    - Resettable electronic fuse
    - Internal ADC monitor for primary input power
- Independent power control for all subsystems in the electrical design (LDOs). LDO control from Application Management micro and Power Management micro under firmware control to manage power save modes. Both Application Management micro and Power Management micro power up in active mode, while other subsystem power up off and have to be enabled.
- reset control (both sw and hw) of all subsystems from application and power microprocessors
- Power management states based on GPRS at 12 volt average
    - Hibernation/Deep Sleep (< 250 uA @ 12V)
        - CELL:
            - Data: OFF (not attached, no IP)
            - SMS: OFF

        - GPS: OFF
        - BLE: OFF
        - Main MCU: OFF
        - CAN MCU: OFF
        - Power MCU: ON
        - Wake-on: physical input interrupt
    - Normal Sleep (<14 mA @ 12V)
        - CELL:
            - Data: ON (attached, has IP)
            - SMS: ON
        - GPS: OFF
        - BLE: OFF
        - Main MCU: OFF
        - CAN MCU: OFF
        - Power MCU: ON
        - Wake-on:
            - physical input interrupt or
            - SMS message or
            - IP packet or
            - Timers
    - Active Tracking (<100 mA @ 12V)
        - CELL:
            - Data: ON (attached, has IP)
            - SMS: ON
        - GPS: ON
        - BLE: ON
        - Main MCU: ON
        - CAN MCU: ON
        - Power MCU: ON
        - Wake-on: N/A (already awake)
- Power save mode sources for wake-up.
    - Scheduled with RTC
    - Ignition detection (input 0)
    - Input 1 or input 2 (Ideally any digital input can be configured for wakeup - low to high or high to low transition)
    - Accelerometer with motion detection
    - Primary power state transition (add or remove primary power)
    - Low battery threshold
    - CAN1 and CAN 2 data transceiver activity
    - SMS message to Cellular Modem
    - BLE activity
- Four (4) color status LED

- GPS – Green
  - OFF – GPS OFF
  - Slow Blinking – GPS ON/No GPS Fix
  - Fast Blinking – GPS Time Sync
  - Solid – GPS Fix
- Cellular – Amber
  - OFF – Modem Off
  - Slow Blinking – Modem ON & Searching
  - Fast Blinking – Network Available
  - Alternates from Solid to Fast Blink every 1s – Registered but no Inbound Acknowledgement
  - Solid - Registered and Received Inbound Acknowledgement
- Bluetooth – Blue
  - OFF – Modem Off
  - Slow Blinking – Modem ON & Searching
- Red – Connected to Vehicle Diagnostics

- Internal Serial UART port on PCB for pogo pin factory programming and also external Serial 3-wire UART AUX_TX/RX plus console/programming console debug and firmware serial update port to support power through connector for fast powering in firmware updates using fixture or factory connection
- Internal alert/driver feedback buzzer (PCB mounted)
- Vehicle Inputs and outputs listed below are present on PCB for different connector design. See each derivative mechanical specification section for connector definitions.
  - 1 fixed-biased low inputs (ignition). Each input shall be capable of handling input voltages ranging from -0.3V to 60V DC. A logic high (true) input state shall be defined as an input voltage present of 6V or greater.
  - 4 programmable bias inputs (default biased low, 0-1 discrete logic at 6V). Each input shall be capable of handling input voltages ranging from -0.3V to 60V DC. A logic high (true) input state shall be defined as an input voltage present of 6V or greater.
  - 2 general purpose open collector outputs - should be open collector capable to sink 250mA to power relay. This state is maintained over a power cycle (software config option
  - 1 Switched power output (2.1A max)
  - 1 external general ADC inputs (1) 0-60V or 4-20mA or 0-1 (discrete / logic). Mode selection is achieved through software; whether in voltage input mode, or current input mode. Act as discrete input and support wake up on interrupt.
    - Accuracy: 1%
    - Resolution: <10mV
  - 1 serial RS232 External interface (5-wire)
  - 1-wire (Dallas Semiconductor) bus interface
  - CAN1 & CAN2 High/Low/J1939, J1850/J1708 and K-Line/Line communications interfaces.

3.3 Environmental

- Operating temperature range of -40 to +85 degrees C (Operational range is based on being connected to primary power source. Battery backup operation specified separately.

- LI-Ion operating range when running on backup battery (-30 to +85 degrees C). Battery recharging range is 0 to +80 degrees C based on internal battery temperature
- Storage temperature range -45 to + 90 degrees C
- Humidity range of 0 to 95% non-condensing
- 12/24VDC vehicle environment Transients and Surges - ISO7637

3.4 Mechanical Features

The FJ-1600 is designed to have a heavy duty environmentally sealed case to, install on or under trailers or on any outdoor equipment. The key features include:

- 2 piece PC/ABS plastic enclosure. Enclosure will snap together must withstand 5 years product life.
- Enclosure UV-stable black plastic with textured finish.
- Bottom Enclosure will hold the PCB in place by snaps during shipping when 2 piece top and bottom is not snapped together.
- Top piece of enclosure will support inserts optional Label Logo or embossed Logo
- Bottom piece of enclosure will support product label
- Unit dimensions targeted for 70mm (W) x 95mm (L) x 20 mm (H) target. These dimensions are exclusive of cables/connectors. *This size shall be subject to change until first product release.*
- Internal SIM holder should secure SIM from vibrating loose when installed in heavy duty vehicles. The SIM card holder should also maintain the shape and integrity of the SIM card as temperatures rise in the vehicle to +85 degrees Celsius. The plastic material of the SIM becomes soft at high temperatures and SIM hold must work to keep it from dis-forming.
- LEDs should be visible through housing and easily visible during the install process.
- The connector design supports 2x10 20 pin 3 mm molex type connector or 3x10 30 pin 3 mm molex type connector using 3 x 10 connector hole leads below:

3.5 Platform Common Optioned Product Features

- CAN High/Low Interface to support J1939, Standard CAN (ISO-15765 CAN High/Low engine ECU communications (20 pin versus 30 pin configuration of platform)
- Optional recharge-able Internal back-up battery configuration options at build time:
    - ~1100 mAh rechargeable Li-Ion battery
    - Batteries should support thermistor to monitor temperature in hardware in order to measure the temperature changes and detect extreme conditions of the battery pack. This is to detect temperature changes in order to shut down battery charge/discharge when extreme heat/cold conditions appear.
    - Should allow product to operate if disconnected from main equipment power
- Optional mounting bracket to support bolted or riveted installations.
- Design to support optional sealed case version

3.6 Conceptual Design

Product ID will be consistent with FJ1500. Width will grow to accommodate additional circuits.

4 PRODUCT LABEL REQUIREMENTS

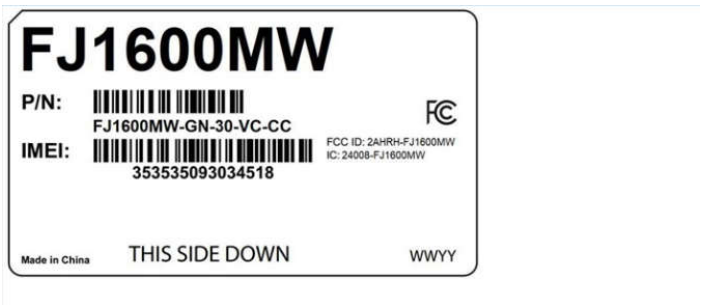
The product will require one permanently attached product labels to print essential product and regulatory information on. Both labels meet the following requirements:

- Standard white color
- Label information printed in black high contrast non-smug-able ink, easily readable
- The Static non-changing information to be printed on the label:
  - FCC and IC regulatory certification information
  - CE and eMark regulatory certification information
  - “made in” or “assembled in” designation (Country of Origin)
  - Any patent numbers

The label should be waterproof and fade resistant under extended exposure to direct sunlight

The bottom label will be 69.5x39.5mm in size. The label should be waterproof and fade resistant under extended exposure to direct sunlight the bottom label shall contain the following information:

The label shall be customizable for specific customers that desire their own identity information on the labels. In addition, customers may specify alternate information fields to be printed on the label. Example label shown below:



5 PRODUCT ACCESSORIES

- 3-Wire Harness, 20 wire IO + serial harness, Driver ID + 5 pins serial Harness, ODBII vehicle harnesses, J939 vehicle harnesses, J1708 vehicle harnesses
- Starter disable relay kit
- Driver ID 1-wire accessory supported
- 1-wire Temperature sensors (up to 8 supported)
- Cable Harness Adaptor per key accounts

6 PACKAGING REQUIREMENTS

6.1 Packaging

- When product is packaged in individual unit packaging, multiple units can be shipped in Master box of 200 units.

6.2 Labeling

- Master boxes shall be labeled on least 2 opposing sides with model / part number in both numeric and barcode forms. Labeling should also identify country of origin and container quantity
- Individual Product Boxes shall be labeled with model / part number in both numeric and barcode forms
- Similar labeling mechanisms will be applied as currently deployed products. See example labels below. Set A is Master Carton Label with separate IMEI labels for 10 units per label. Set B is master caron label with QR codes listing IMEI/SN and ICCID.

6.3 Packaging Standards

- Product and accessories must be able to survive, undamaged when fully loaded Bulk Shipping Carton, Individual Product Box, or fully loaded Master Carton is subjected to standard flat drop and corner drop tests at a height of 1 meter.

FCC Regulations:

This mobile router 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.
This mobile router 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 radiated 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 or more 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.
FCC Note:
Caution: Changes or modifications not expressly approved by the party responsible for compliance could void the user‘s authority to operate the
equipment.

RF Exposure Information

This device meets the government’s requirements for exposure to radio waves.
This device is designed and manufactured not to exceed the emission limits for exposure to radio frequency (RF) energy set by the Federal Communications Commission of the U.S. Government.

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20 cm during normal operation.

ISED Notice

This device complies with Industry Canada license-exempt RSS standard(s).
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, et
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en

CAN ICES-003 (B)/NMB-003(B)
This Class B digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

ISED RF Exposure Statement

This device complies with ISED RSS-102 RF exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the IC RSS-102 RF exposure limits, human proximity to the antenna shall not be less than 20 cm (7.87 inches) during normal operation.

Cet appareil est conforme aux limites d'exposition aux rayonnements de la CNR-102 définies pour un environnement non contrôlé. Afin d'éviter la possibilité de dépasser les limites d'exposition aux fréquences radio de la CNR-102, la proximité humaine à l'antenne ne doit pas être inférieure à 20 cm (7.87 pouces) pendant le fonctionnement normal.