
# COMPACT TERMINAL for M2M Services

The terminal is a return-only M2M terminal compliant with E-SSA Air Interface. When coupled with the MBI E-SSA Testbed, high-level applications as well as several test functionalities are available to run end-to-end tests and demonstration in laboratory and in a real scenario using satellites.

## Key Features

- Transmission of IP datagrams received on its IP ports (eth0 and wlan0) as well as sensor readings over an L-band satellite communication channel (return link, RL) using the E-SSA Air Interface (physical and link layers).
- Delivery in just a few weeks due to its fully COTS- based architecture.
- Variety of customizations possible (i.e. integration with existing forward link or M2M adaptation to different bitrates or bandwidths).

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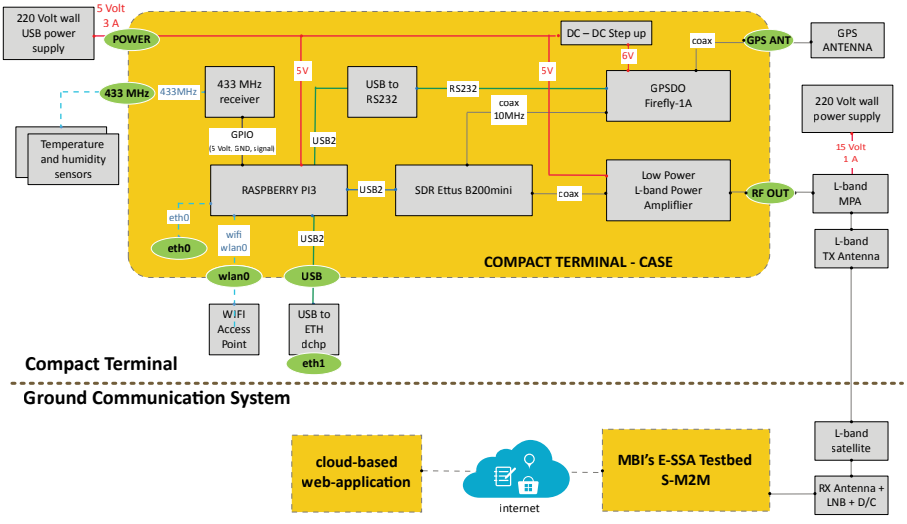
# M2M COMPACT TERMINAL

# KEY FEATURES

- COTS HARDWARE
- COMPACT FORM FACTOR: 154.94 mm, (l) 154.94 mm (w), 51.82 mm
- REDUCED POWER CONSUMPTION
- **L-BAND READY:** able to transmit over a wide frequency range 700 – 2,400 MHz output power lever of approx. 7 dBm. Several L-band antennas (low/high gain LGA/HGA and RHCP/LHCP) and Medium and High Power Amplifiers (MPA, HPA) are available.
- SDR-BASED ARCHITECTURE: based on the consolidated SDR-based architecture adopted by MBI. An inexpensive Raspberry PI3 performs all the DSP required from the physical to the application layers. The digital-to-analog conversion, analog frequency-up-conversion is performed by the Ettus B200mini which is an Ettus credit-card size SDR device.
- SENSOR READINGS: automatic transmission of the sensor readings collected by its external sensors: Temperature, Humidity, Position and Speed. The terminal supports programmable packet transmission rate of these sensor readings.
- TEST MODULES: the Compact Terminal is equipped with several tests modules
- S-M2M LINK-LAYER: it supports S-M2M Link-Layer:
  - RLE encapsulation and fragmentation
  - packet transmission randomization (in power and time)
  - packet re-transmission programmable by the user at application level
- INTERNAL GPSDO with GPS ANTENNA
- WEB-GUI
- THE MBI E-SSA TESTBED can be used to perform all the main function required a HUB (demodulation, decapsulation and IP routing). It also provides methods to compensate the Doppler drift introduced by satellite as well as phase noise.
- THE CLOUD BASED WEB APPLICATION is a smart application, which can be used to show the sensor readings collected



## Protocol Specification

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|---|---|
| Physical Layer Air Interface | E-SSA Air Interface for Satellite Machine-to-Machine (M2M) Modes 1, 2, 3, 4 and 5<br>Physical burst retransmission programmable via WEB-GUI |
| Link Layer Specifications | IP datagrams encapsulated and fragmented using RLE. Packet transmission randomization in power (using uniformly distribution) and in time using persistence index and back off time parameters. |
| Upper Layer Specifications | The Compact Terminal can transmit:<br>• Sensor readings (temperature and humidity, position and speed)<br>• IP datagrams received on the port wlan#0 and eth#0/eth#1<br>• pings to 8.8.8.8 at the rate of 1 ping/second (internal pings)<br>• transmit a continuous sequence of S-M2M bursts (in a near back-to-back configuration) with dummy payloads<br>• transmit a continuous wave (CW)<br>Dedicated cloud-based web-application uses a web browser to show the delivered sensor readings. Sensors readings are delivered to the cloud and IP datagrams to the addressed destination IP addresses only if the MBI TESTBED is used to demodulate S-M2M bursts and it is connected to internet. |

## RF specifications [Interface #3]

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|---|---|
| Output Frequency Range | The nominal frequency is 700-2,400 MHZ |
| Frequency Stability Over Temperature (Unlock Condition) GPSDO specs. | ±2.5E -08 , <40 Hz at 1.5 GHz<br>The use of the coaxial GPS antenna is optional. It has to be used only if a reduced implementation loss with WF#3 is required. |
| Warm up time Stabilization Time GPSDO specs. | <5 mins at +25°C to 1E-08 Accuracy |
| Maximum Output Power Level @1 dB of compression | 7 dBm at 1660 MHz |
| Max EIRP (dBW) | -18.0 (HGA, RHCP), 21.9 (LGA, LHCP), 23.5 (LGA, LHCP) |
| Max EIRP (dBW) + external MPA | 5.0 (HGA, RHCP), 1.1 (LGA, LHCP), 0.5 (LGA, LHCP) |
| Max EIRP (dBW) + external HPA | 12.0 (HGA, RHCP), 8.1 (LGA, LHCP), 6.5 (LGA, LHCP) |

## Physical and Powering specifications

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|---|---|
| Dimension | Length: 154.94 mm, Width: 154.94 mm and Height: 51.82 mm |
| Weight | Less than 500 g |
| Powering | 5 Volt - 3.0 A (<=1.6 typ); microUSB<br>MPA and HPA are powered using dedicated wall power supply |

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