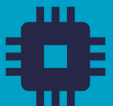
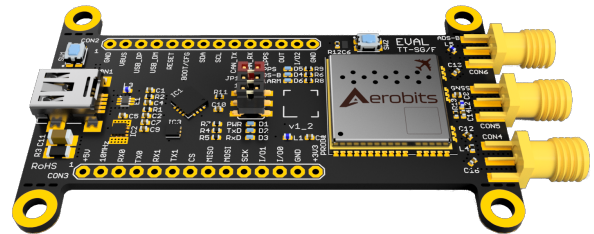




Subsystems for the
UAS integration into
the airspace

EVAL TT-Multi-RF

[Data sheet - User manual](#)



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1 Introduction

The evaluation kit provides a quick introduction to the **TT-Multi-RF** module. **EVAL-TT-Multi-RF** with the dedicated software allows the user to discover the module properties within a short time, paving the way towards quick prototyping. The software allows simple configuration of the module and data visualization in various modes, from raw data, through tabular and 3D views.

Note:

The device to operate on FLARM frequency requires FLARM UAS license. The license must be obtained with the device from Aerobits upon purchase. FLARM library expire after year and must be updated with latest firmware.

Important:

Each firmware version becomes its own documentation. This document is relevant for firmware version v2.77.5. If your firmware version is different please find relevant documentation on our website aerobits.pl.

1.1 Available variants

Table 1: Variants of TT-Multi-RF module

| Variant | ADS-B | GNSS | FLARM | UAT | Note |
|---------|-------|------|-------|-----|------|
| SF2 | ✓ | ✓ | ✓ | | |
| SF2n | ✓ | | ✓ | | (*) |
| SU2 | ✓ | ✓ | | ✓ | |
| SU2n | ✓ | | | ✓ | |
| SG2 | ✓ | ✓ | | | |

Important:

* - FLARM to function properly requires precise time synchronization. This normally is achieved by connecting the module to a GNSS source. If GNSS is not available, the module has to be feed with GNSS NMEA sentences and PPS from external source.

1.2 Features

- Receiving of ADS-B, Mode-A/C/S with RF signal strength/quality analysis
- Time stamp (raw data only) for multilateration
- Multiple supported protocols, i.a. RAW HEX, CSV, AERO, MAVLink, ASTERIX, GDL90
- Integrated high quality GNSS position source
- Licensed FLARM transceiver
- Receiving of UAT
- High-resolution ADC with real-time signal processing; best-in-class aircraft tracking
- Simple module integration via USB or UART interface and AT commands

- **Scalable OEM solution with enormous customization potential (additional functions or interfaces on request)**
- **Firmware update capability (uC and FPGA)**
- **Designed to meet MOPS defined in TSO-C199**

For more information please contact support@aerobits.pl.

2 Technical parameters

2.1 Basic technical information

Table 2: General technical parameters

| Parameter | Description | Typ. | Unit |
|-------------------------|----------------------------|------------|------|
| First Band | ADS-B | 1090 | MHz |
| Second Band | FLARM | 868 or 915 | MHz |
| Third Band | UAT | 978 | MHz |
| Fourth Band | GNSS | 1575 | MHz |
| Sensitivity (ADS-B) | | -94 | dBm |
| Sensitivity (FLARM) | | -109 | dBm |
| Sensitivity (UAT) | | -110 | dBm |
| Sensitivity (GNSS) | | -167 | dBm |
| RF Output power (FLARM) | | +14 | dBm |
| UART | AT commands | 921600 | bps |
| USB | AT commands | | |
| MSL | Moisture Sensitivity Level | 4 | |

2.2 Hardware and layout

The EVAL-TT-Multi-RF is designed around the OEM TT-Multi-RF module. It uses all I/Os, as well as custom I/Os (unused by the standard firmware). The top layer may be found [Top view of EVAL-TT-Multi-RF](#) (page 5)

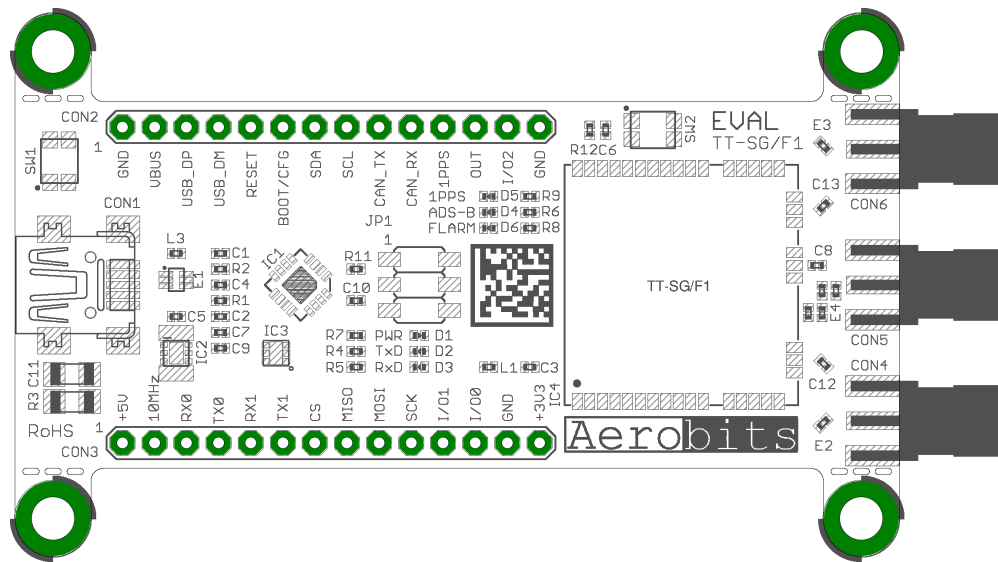


Fig. 1: Top view of EVAL-TT-Multi-RF

2.3 Electrical specification

2.3.1 Absolute maximum ratings

Table 3: Absolute maximum ratings.

| Parameter | Min | Max | Unit |
|--------------------------|------|-----------|------|
| Storage temperature | -5 | +40 | °C |
| Supply voltage (VCC) | 2.7 | 3.6 | DCV |
| Supply voltage (via USB) | 4.75 | 5.25 | DCV |
| Other pin voltage | -0.3 | VCC + 0.3 | DCV |
| RF input ADS-B | – | +10 | dBm |
| RF input FLARM | – | +10 | dBm |
| RF input GNSS | – | 0 | dBm |
| RF input UAT | – | +10 | dBm |

2.3.2 Recommended operation conditions

Table 4: Recommended operation conditions.

| Parameter | Min | Typ | Max | Unit |
|--------------------------|-----|-----|-----|------|
| Operation temperature | -30 | – | +85 | °C |
| Supply voltage (VCC) | 3.0 | 3.3 | 3.6 | DCV |
| Supply voltage (via USB) | 4.9 | 5.0 | 5.1 | DCV |

2.3.3 General electrical parameters

Table 5: General electrical parameters.

| Parameter | Description | Min | Typ | Max | Unit |
|---------------------|--|-----------|-----|-----|------|
| Current consumption | | – | 260 | – | mA |
| Input Low Voltage | RESET, UARTs, CAN, USB, SPI, I2C | -0.3 | – | 0.8 | DCV |
| Input High Voltage | RESET, UARTs, CAN, USB, SPI, I2C, GPIO | -0.3 | – | 0.8 | DCV |
| Output Low Voltage | UARTs, CAN, USB, I2C, SPI, GPIO | – | – | 0.4 | DCV |
| Output High Voltage | UARTs, CAN, USB, I2C, SPI, GPIO | VCC - 0.4 | – | – | DCV |

2.3.4 Most important components

Pin arrangement of EVAL-TT-Multi-RF is shown on the figure below:

Table 6: Most important components.

| RefNo | Description |
|--------|-------------------------|
| CON1 | Mini USB connector |
| CON2 | Extensions connector I |
| CON3 | Extensions connector II |
| CON4 | FLARM/UAT RF Input |
| CON5 | GNSS RF Input |
| CON6 | ADS-B RF Input |
| JP1 | Jumper group |
| SW1(C) | BOOT/CONFIG switch |
| SW2(R) | RESET switch |

continues on next page

Table 6 – continued from previous page

| RefNo | Description |
|-------|------------------|
| D1 | POWER LED |
| D2 | UART TX LED |
| D3 | UART RX LED |
| D4 | SYSTEM/ADS-B LED |
| D5 | 1PPS LED |
| D6 | FLARM/UAT LED |
| IC4 | OEM TT-SF1 |

2.3.5 Connectors and jumpers

Table 7: Connector CON2 description.













| CON2 | No. | Marking | Function |
|---|-----|---------|-----------------------|
|  | 1 | +5V | 5V Power supply |
|  | 2 | RX0 | UART0 – Receive line |
|  | 3 | TX0 | UART0 – Transmit line |
|  | 4 | GND | Ground |
|  | 5 | RX1 | UART1 – Receive line |
|  | 6 | TX1 | UART1 – Transmit line |
|  | 7 | CS | SPI – Chip select |
|  | 8 | MISO | SPI – MISO signal |
|  | 9 | MOSI | SPI – MOSI signal |
|  | 10 | SCK | SPI – Serial clock |
|  | 11 | GND | Ground |
|  | 12 | +3V3 | 3.3V Power supply |

Table 8: Connector CON3 description.
















| CON3 | No. | Marking | Function |
|---|-----|---------|-----------------------|
|  | 1 | +5V | 5V Power supply |
|  | 2 | +10MHz | Reserved |
|  | 3 | RX0 | UART0 – Receive line |
|  | 4 | TX0 | UART0 – Transmit line |
|  | 5 | RX1 | UART1 – Receive line |
|  | 6 | TX1 | UART1 – Transmit line |
|  | 7 | CS | SPI – Chip select |
|  | 8 | MISO | SPI – MISO signal |
|  | 9 | MOSI | SPI – MOSI signal |
|  | 10 | SCK | SPI – Serial clock |
|  | 11 | I/O0 | Reserved |
|  | 12 | I/O1 | Reserved |

Table 9: Jumper group JP1 description.

| JP1 | No. | State | Function |
|---|-----|--------|--|
|  | 1 | Closed | 3.3V power supply provided by on-board regulator (default) |
| | | Open | 3.3V power supply provided by CON3 (PIN14) |
|  | 2 | Closed | UART TX via USB (default) |
| | | Open | UART TX via CON3 (PIN4) |
|  | 3 | Closed | UART RX via USB (default) |
| | | Open | UART RX via CON3 (PIN3) |

2.3.6 LED indicators

Table 10: LED indicators.

| LED | Color | Description |
|-----|--------|---|
| D1 | Green | ON: Power supply |
| D2 | Red | ON: OEM TT-SF1 transmitting data |
| D3 | Yellow | ON: OEM TT-SF1 receiving data |
| D4 | White | In BOOTLOADER state: continuous on In CONFIGURATION state: blinking at 5Hz In RUN state: 1 blink for every ADS-B frame received |
| D5 | White | Blink when GNSS is fixed (1Hz) |
| D6 | White | Blink every FLARM/UAT frame received |

2.3.7 Layout

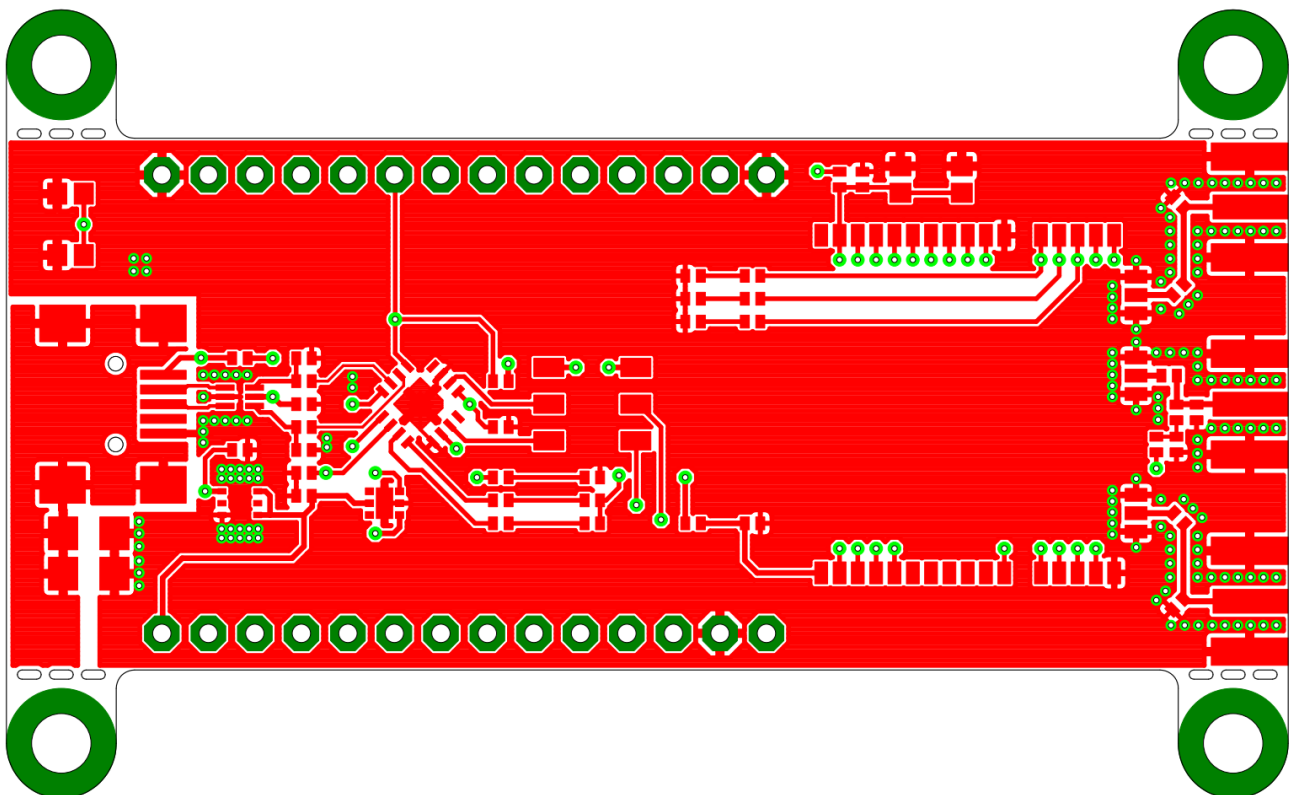


Fig. 2: Top copper layer of EVAL-TT-Multi-RF

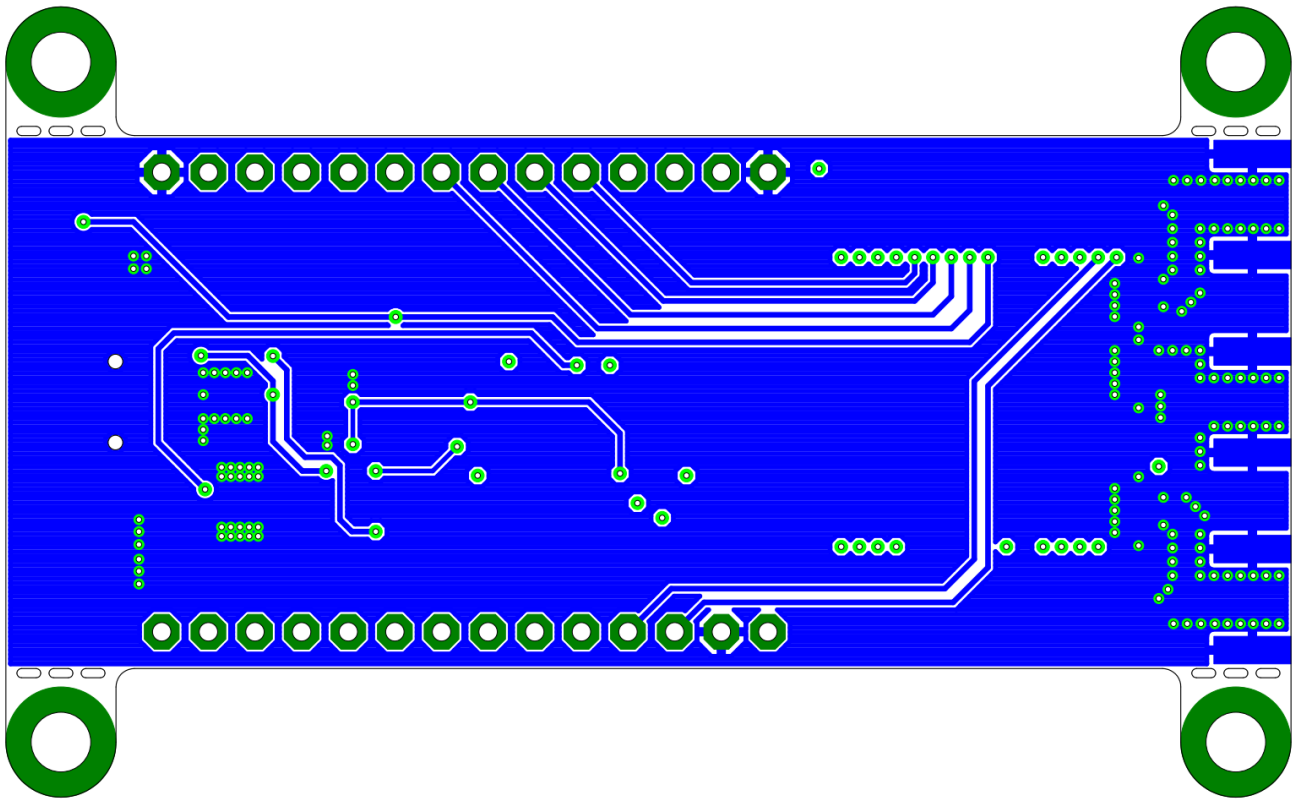


Fig. 3: Bottom copper layer of EVAL-TT-Multi-RF

2.3.8 Electrical diagram

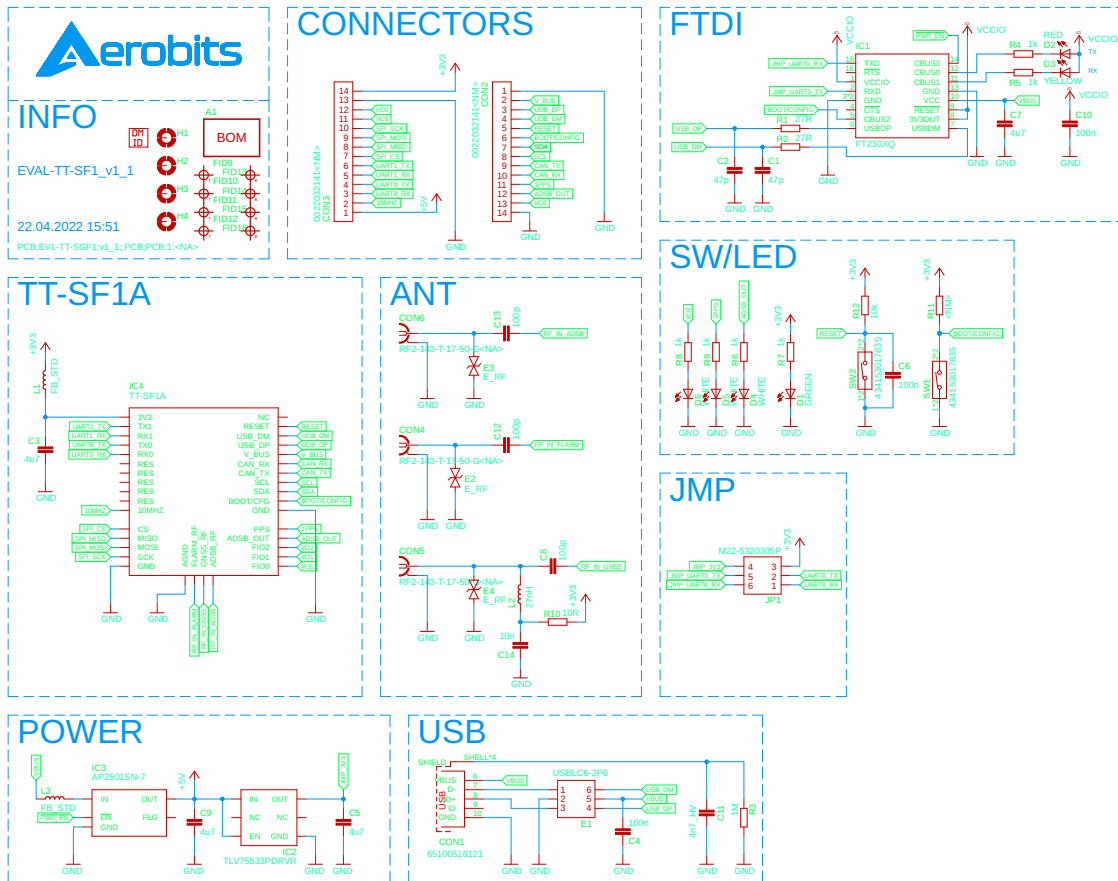


Fig. 4: Electrical diagram of EVAL-TT-Multi-RF

2.4 Mechanical specification

2.4.1 Dimensions

Table 11: Absolute maximum ratings.

| Parameter | Value |
|------------|----------------------|
| Dimensions | 70.0 x 29.0 x 1.5 mm |
| Weight | 16.5 g |

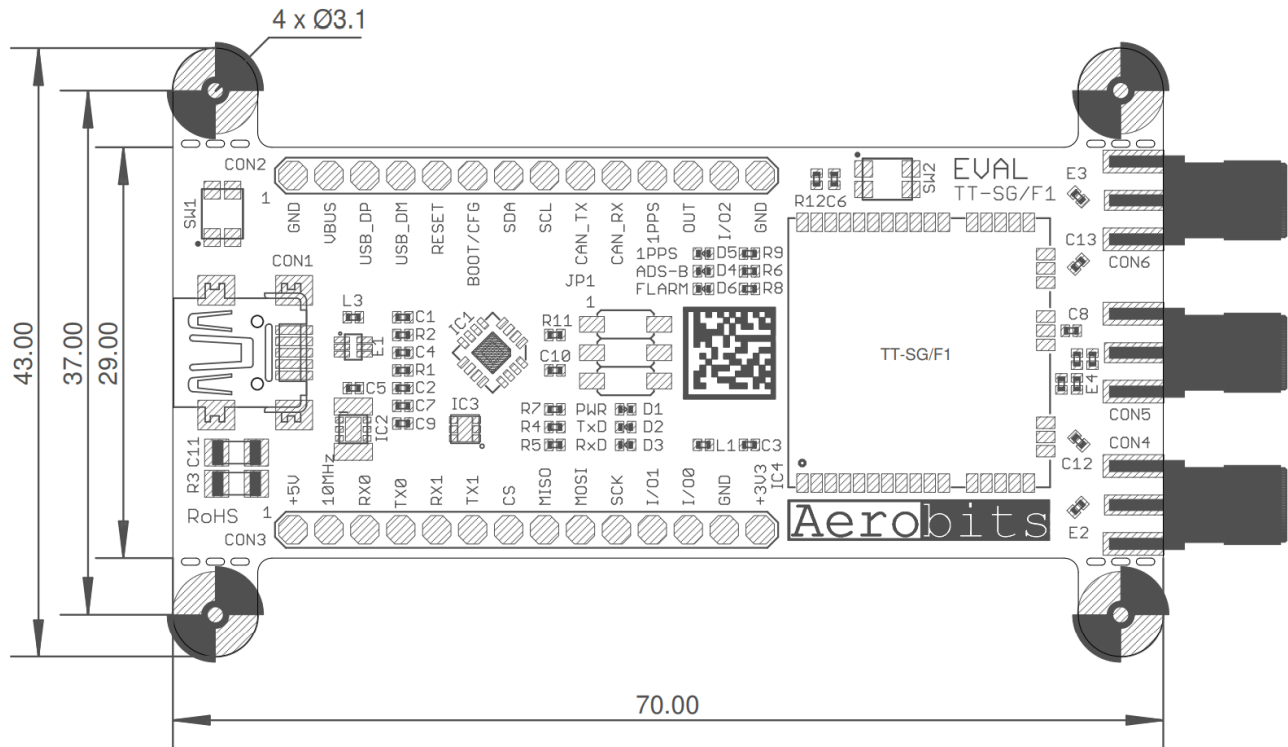


Fig. 5: Footprint of EVAL-TT-Multi-RF

2.4.2 Connectors

Table 12: Descriptions of used connectors.

| Description | Type | Function | Mating connector |
|----------------|-------------------|----------------|------------------|
| CON4/CON5/CON6 | RF2-143-T-17-50-G | RF connector | RF2-01A-02-50-G |
| CON1 | 65100516121 | Power and Data | CBL-UA-MB-15WP |

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