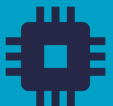
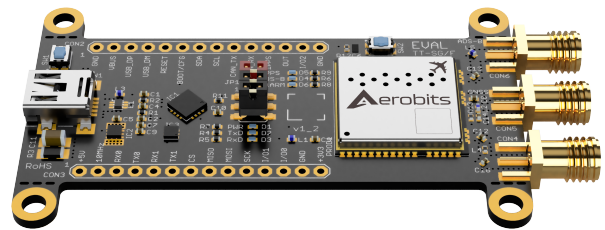




Subsystems for the  
UAS integration into  
the airspace

# *EVALLT-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.

## Important:

Each firmware version becomes its own documentation. This document is relevant for firmware version v2.89.8. If your firmware version is different please find relevant documentation on our website [aerobits.pl](http://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](mailto: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)

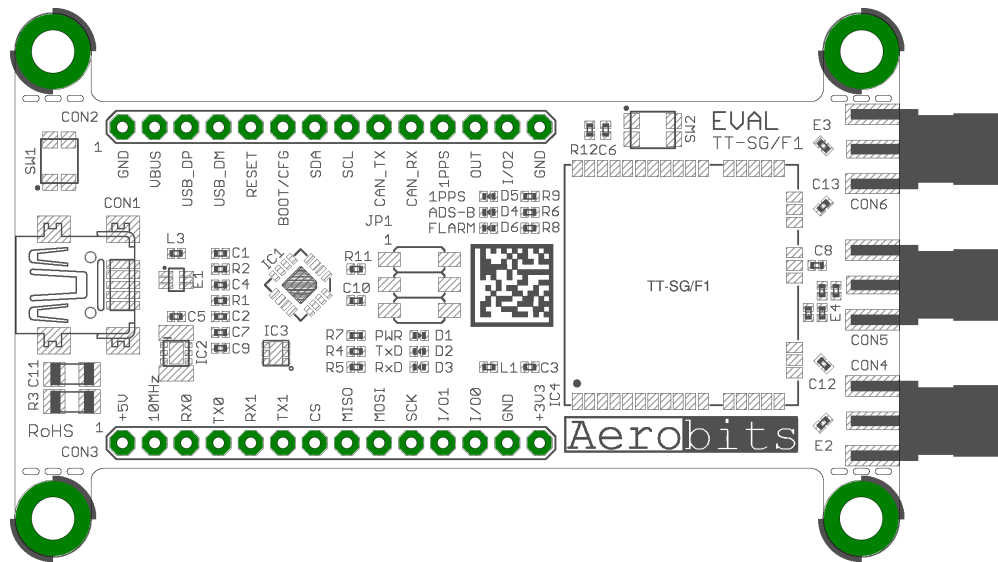


Fig. 1: Top view of EVAL-TT-Multi-RF

## 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	GND	Ground
	2	VUSB	Power supply of USB
	3	USB_DP	USB: D+ line
	4	USB_DM	USB: D- line
	5	RESET	Reset signal
	6	BOOT/CFG	BOOT/CONFIG signal
	7	SDA	I2C: data line
	8	SCL	I2C: clock line
	9	CAN_TX	CAN: transmit line
	10	CAN_RX	CAN: receive line
	11	1PPS	GNSS: 1 pulse per second input (time reference)
	12	OUT	SYSTEM/ADS-B LED
	13	I/O2	FLARM LED
	14	GND	Ground

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
	13	GND	Ground
	14	+3V3	3.3V Power supply

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

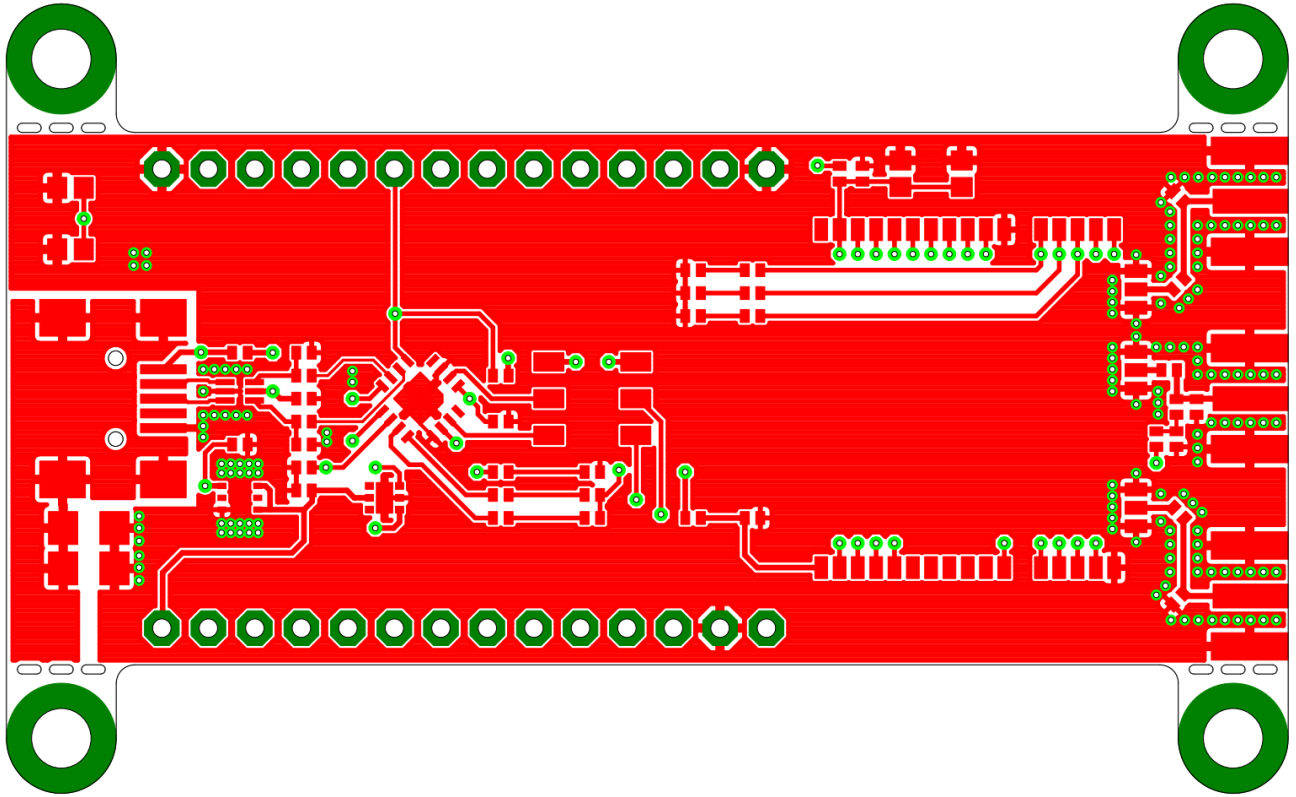


Fig. 2: Top copper layer of EVAL-TT-Multi-RF

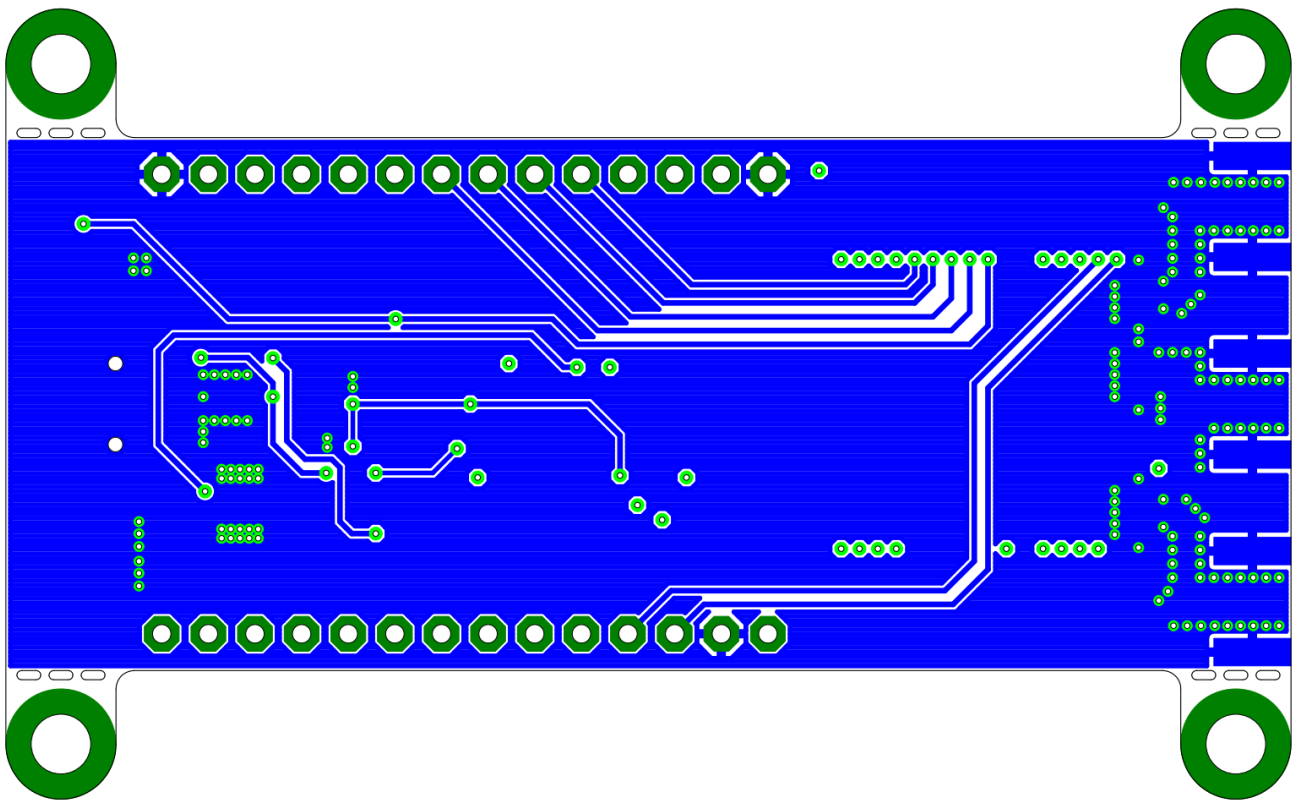


Fig. 3: Bottom copper layer of EVAL-TT-Multi-RF

### 2.3.8 Electrical diagram

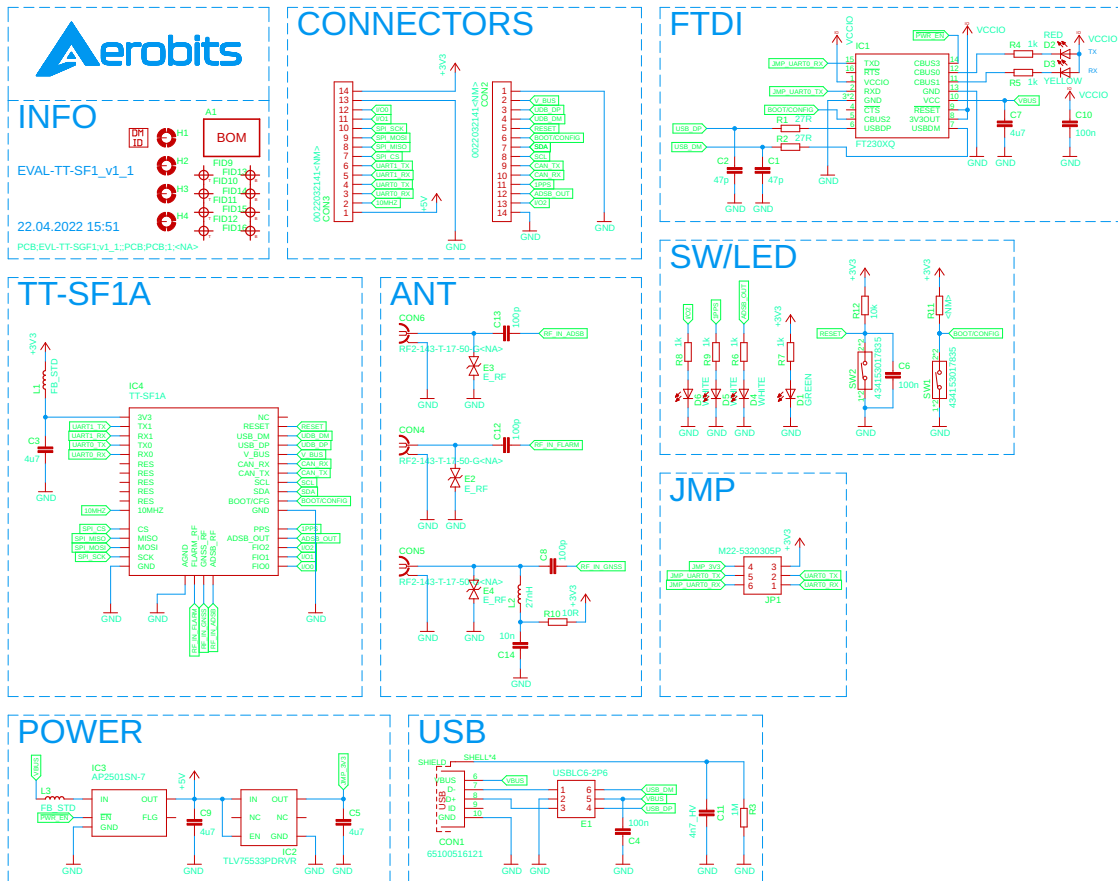


Fig. 4: Electrical diagram of EVAL-TT-Multi-RF

## 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

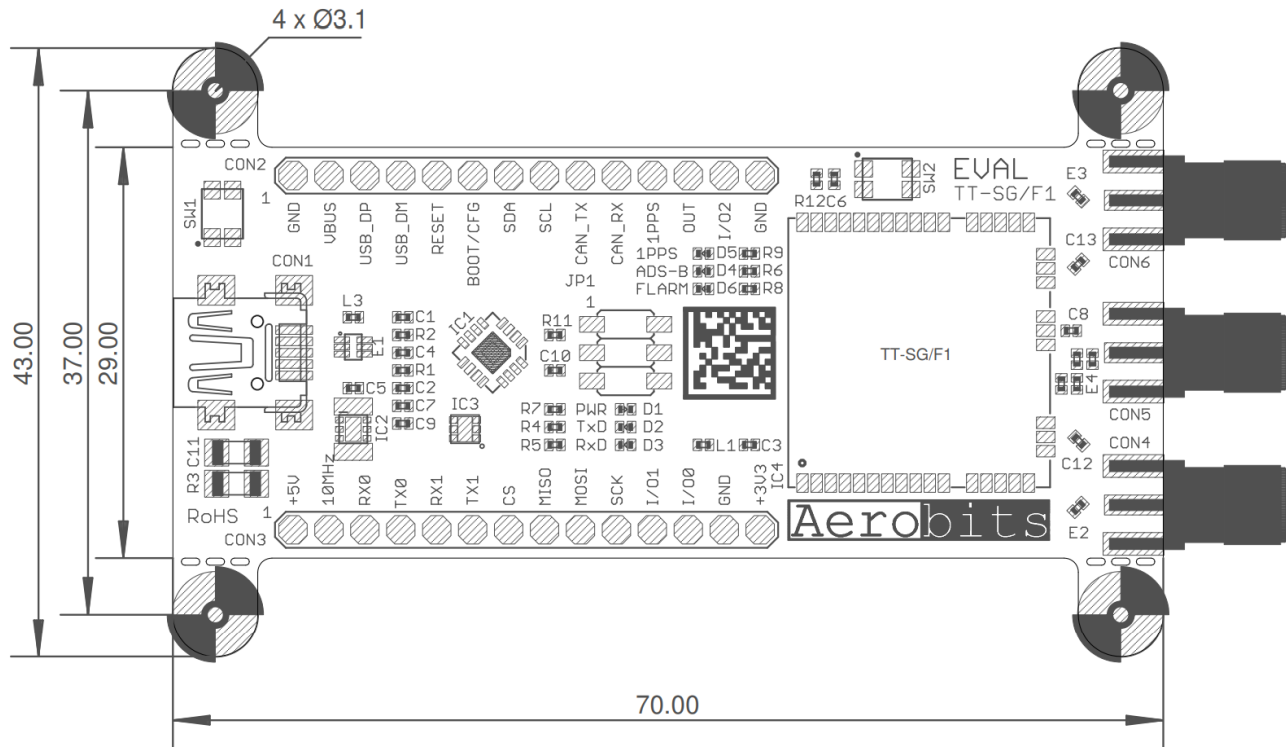


Fig. 5: Footprint of EVAL-TT-Multi-RF

### 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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