

USB LoRa Module V2.4

User Manual

TOP seven GmbH & Co. KG, 2024



1. Introduction

The **USB LoRa Module V2.4** (further the module) is a compact solution for DJI payloads, providing an interface between the drone, single board computer (SBC) of the payload and lidar. It also adds LoRa functionality for long-range, low-power wireless communication between the payload and multiple stationary transmitters. The module enables seamless data transmission via a USB interface, making it suitable for IoT applications and remote sensing.

The module is designed for use with DJI Matrice 300 RTK and DJI Matrice 350 RTK drones. Any SBC with Raspberry-Pi-compatible 40-pin GPIO header can be used as a carrier board. SBCs which are not able to be powered from the GPIO header, can be used with external power supply.

The module provides a serial link from the drone to the payload, and Ethernet connection (IEEE 802.3u 100BASE-T) from the drone to the regular RJ45(8P8C) port of the SBC. Serial link is used for drone SDK access, and the Ethernet connectivity is used exclusively for high-volume bulk data transfers. The module also provides access to drone's pulse-per-second (PPS) signal, allowing precise synchronization with its GPS clock.

The module supports any lidars with 3.3V serial interfaces and the bitrates less than 1Mbps.

The LoRa communication is provided by Ebyte E22-900T22S LoRa transceiver.

2. Features

The main features of the module are presented in the table below.

Parameter	Value	Notes
Compatible drones	DJI Matrice 300 RTK DJI Matrice 350 RTK	Can be used also with drones featuring X-Port-compatible payload interface
Compatible SBCs	Raspberry Pi 4,5 Rock Pi 4,5	Can be used with any SBC providing 40-pin GPIO connector, compatible to RPI
Drone link	Serial, LAN	115200 bps / 100 Mbps
PPS signal	Yes, 3.3V TTL	
SBC supply	5V 3A	Provided via GPIO header
LoRa link	Via E22-900T22S	
LoRa operating frequency	915 MHz	
LoRa sensitivity	< -120 dBm	If the antenna gain is 0 dBi



LoRa output power	+13 dBm	Can be decreased to +8, +10 dBm
LoRa antenna	Molex 2111400100	
LoRa interface	USB	Includes power, mode control
LoRa link speed	9600bps	*Actual communication speed depends on the channel state
Power consumption	+10-19V, 1.6A	Peak consumption, average consumption depends on the SBC
Operating temperature	-10 °C to +50 °C	
Storage temperature	-20 °C to +50 °C	
Humidity	< 80 %	
IP rating	-	IP protection must be provided by enclosure

3. Hardware Overview

3.1. Theory of Operation

The board connects to the host SBC via 40-pin GPIO connector and USB, LAN connectors. The LoRa module is controlled via USB to UART bridge (CP2102-based). The bridge also provides power and mode switching for the LoRa. Supply voltage from the drone is transformed by the internal DC/DC converter to 5V supply voltage for the SBC and the Lidar. Lora module is Ebyte E22-900T22S.

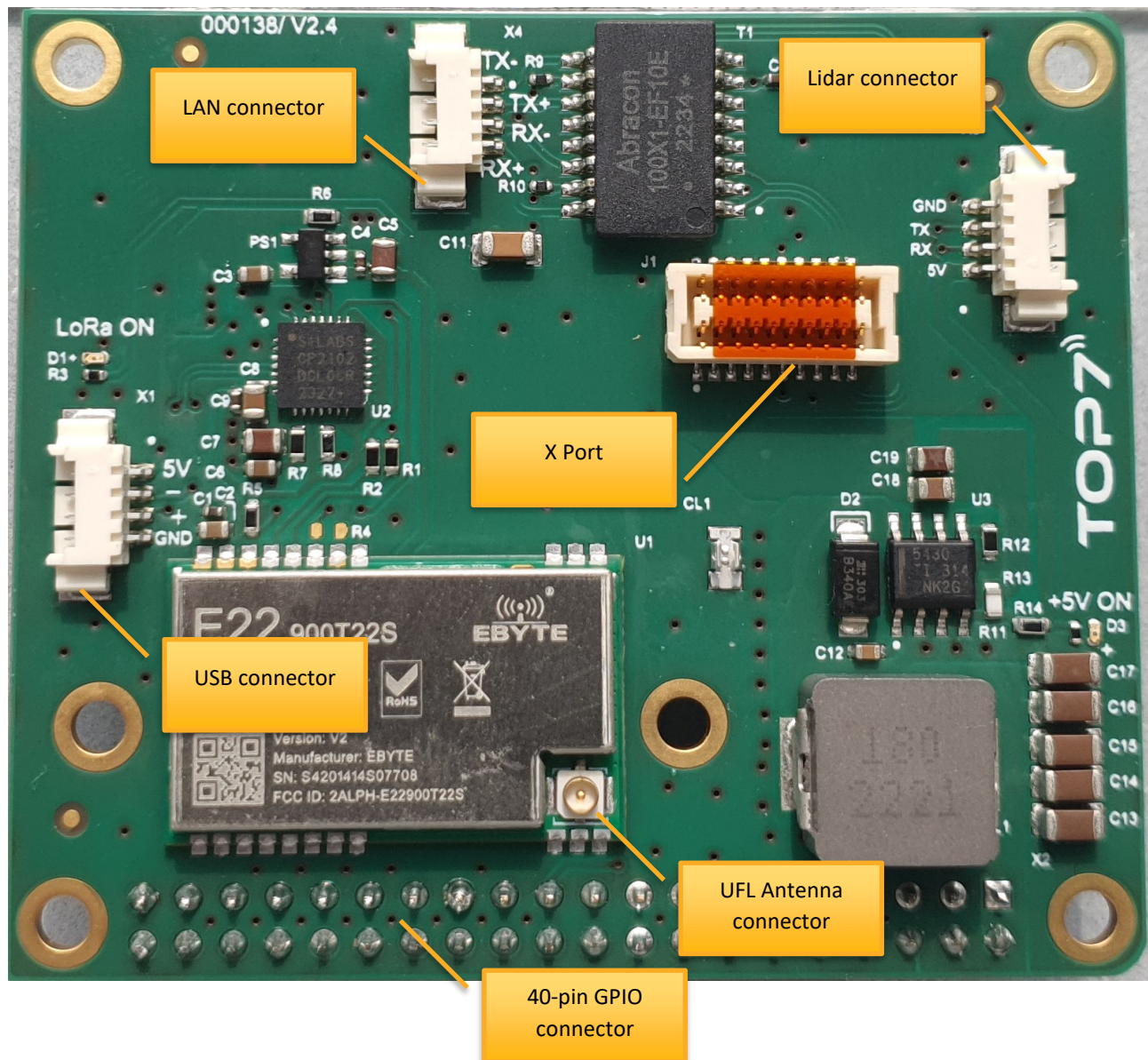
3.2. PCB Connectors

The connectors available on the PCB are:

- GPIO connector
- UFL Antenna connector
- USB connector
- X Port connector
- LAN connector
- Lidar connector



The module connectors are presented in the figure below.



4. Pin Configuration

The pins of the GPIO connector are presented on the table below.

#	Signal	Description
6, 9, 14, 20, 25, 30, 34, 39	GND	Common ground
2, 4	VCC	Output +5V (SBC supply)
8	Lidar RxD	Lidar serial RX input
10	Lidar TxD	Lidar serial TX output
19	Drone RxD	Drone RX input
21	Drone TxD	Drone Tx Output
40	PPS	Pulse-per-second input

The pins of the USB connector are presented on the table below.

#	Signal	Description
1	VCC	USB +5V
2	D-	USB D- signal



3	D+	USB D+ signal
4	GND	USB ground

The pins of the LAN connector are presented on the table below.

#	Signal	Description
1	TxD-	
2	TxD+	
3	RxD-	
4	RxD+	

The pins of the Lidar connector are presented on the table below.

#	Signal	Description
1	VCC	USB +5V
2	RxD	Lidar data output
3	TxD	Lidar data input
4	GND	USB ground



5. Setup, Installation and Operation

The installation procedure consists of the following steps:

1. Connect GPIO connector of the module to the SBC.
2. Connect the USB cable to the PCB and the SBC.
3. Attach LAN cable both to the module and the SBC.
4. Attach Lidar.
5. Connect an external antenna to the LoRa antenna port.
6. If necessary, install CP2102 drivers on the SBC.
7. LoRa module turns on if the ~RTS signal of the serial port, corresponding to the USB to serial bridge, is active.
8. LoRa module enters configuration and AT command mode if the ~DTR signal is active.
9. LoRa module drives ~CTS signal, which becomes active if the module is ready to accept new data.
10. Begin communication using a serial terminal or application.



6. Troubleshooting

The common issues and solutions for the module are presented in the table below.

Issue	Possible Cause	Solution
No LoRa communication, LED on the board is off	No USB connection to the host, or driver is not present	Check the USB connection and the presence of the device in /dev folder
No LoRa communication, LED on the board is on	Wrong LoRa mode settings	Reconfigure the LoRa module
Weak signal, short LoRa range	Antenna connection is broken, or antenna is damaged	Check the antenna state and connection
Image transfers to the drone are slow or hanging	LAN connection is broken	Check LAN cable and ensure that RJ45 is properly plugged to the SBC

7. Safety and Handling

Handle the module with care to avoid static discharge damage.

Use the correct voltage levels to prevent electrical damage to the internal DC/DC converter.

Ensure proper heat dissipation during extended operation at high temperatures.



8. Compliance Statements

Statements for the following Models and FCC IDs

Model Name	TSLPS22-FS-PCB-V2-4
FCC ID	2BNO9TS-FSCOM

FCC Caution Statement

According to FCC 15.21, users are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Compliance Statement (for small devices)

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This equipment should be installed and operated by keeping the radiator at least 5 m or more away from a person's body (leave the nacelle during inspection). In North America the band with 902 – 928 MHz (ISM-Band Region 2) is used.

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.
2. This device must accept any interference received, including interference that may cause undesired operation.

This device complies with Part 15 of the FCC Rules. Operation is subject to the conditions that this device does not cause harmful interference and that it must accept any interference received, including interference that may cause undesired operation.

FCC Compliance for Devices under FCC 15.225

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.

Please note that the device is designed to operate within the frequency range specified under FCC 15.225, ensuring it complies with the necessary regulatory requirements for safe and lawful operation.

For more detailed information, users are advised to refer to the User Manual or contact TOPseven's Customer Support.

For questions regarding your product or for TOPseven Customer Support contact support@TOPseven.com.

Supplier's Declaration of Conformity

Product Name: TOPseven LPS Inspection Set

Model: TSLPS22

Manufacturer's Name: TOP seven GmbH & Co. KG

Manufacturer's Address: Württemberger Str. 13, 26723 Emden, Germany

FCC Responsible Party: Testing Partner LLC

FCC Responsible Party Address: 18200 SR 306, Chagrin Falls, OH 44023 U.S.A.

FCC Responsible Party Telephone Number: +1- 862 243 2329

FCC Responsible Party E-Mail Address: info@testingpartners.com

9. Disclaimer

Read carefully this entire document and observe all safe and lawful practices/attend training provided by TOPseven before using this product for the first time. Failure to read and follow instructions and warnings may result in serious injury to yourself or others, damage to your TOPseven product, or damage to other objects in the vicinity. By using this product, you hereby signify that you have read this document carefully and



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10. Support

If you have any suggestions, questions or requests, please contact your TOPseven contact person at any time or visit our TOPseven [Customer Center](#).

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About TOPseven

TOPseven – MAKING DRONES SMARTER.

TOPseven is a developer of software and technology with a focus on drone technology, cloud computing and artificial intelligence. With an international team of experts, **TOPseven** develops AI-based navigation and analysis software as well as special hardware in the areas of sensors and drones.

For the future **TOPseven** has set itself the task of making it possible to inspect, regularly and completely, even difficult to access infrastructure so that damage can be detected at an early stage, the consequences of the damage minimized and service life increased.

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Responsible for the content according to § 55 para. 2 RStV: Knud Ezra Rissel

