RFDESIGN

# RFD TXMOD

## User's Manual

PRJ-TXM-MAN-001

# Table of contents

# 1   Introduction

## 1.1   Product Description

The RFD TX Module, or TXMOD, has been designed to work in conjunction with the Taranis X9D Radio Controller, RC, from FrSky and other compatible controllers. The RFD TX Module transmits the PPM stream from the controller to the vehicle via the RF Design long range telemetry modems while also receiving telemetry data from the aircraft. The telemetry data can be broadcast to a computer or smart device by the TX Module's built in Wi-Fi module.
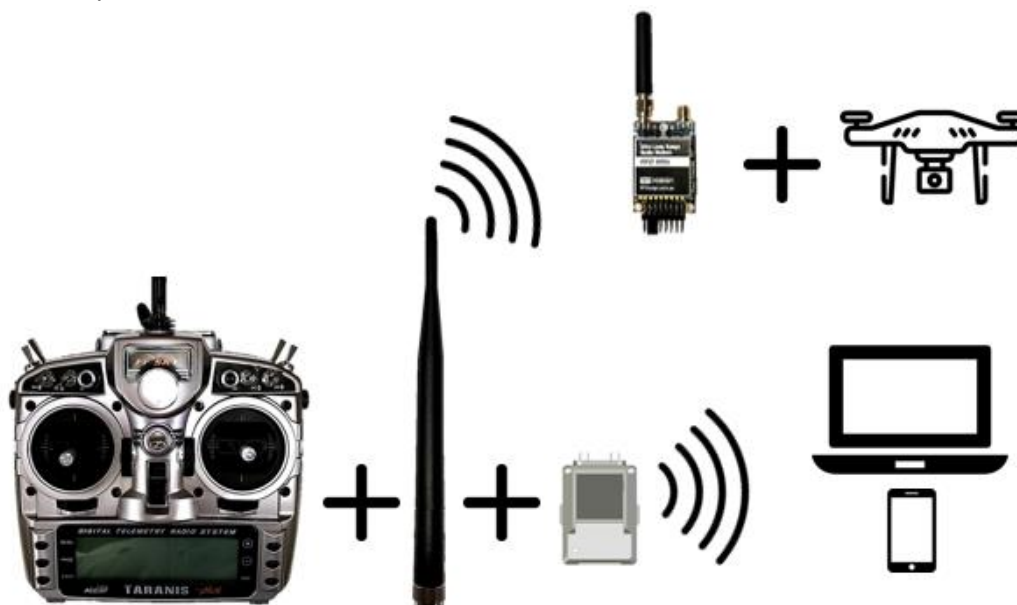


*Figure 1 - Typical Application Diagram.*
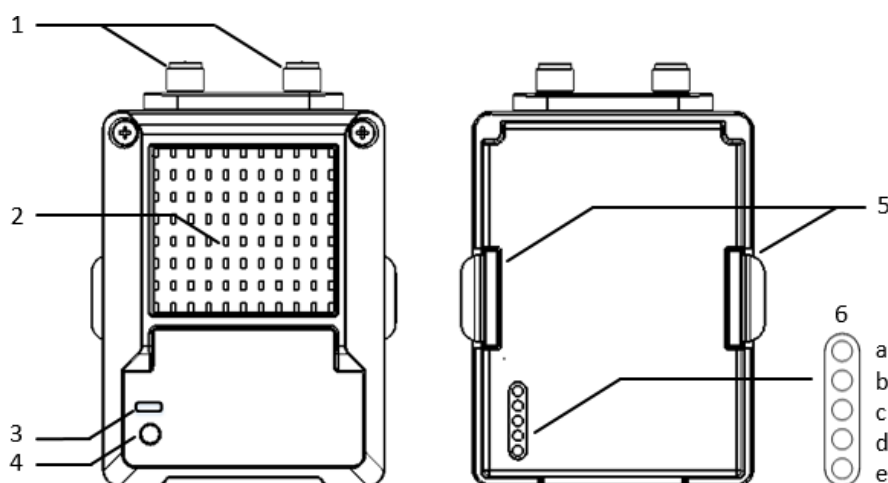
## 1.2   Getting to know the product



*Figure 2 - TX Module Part Description*

**Table 1 - TX Module Description**

| # | | Description /Note | | |
|---|---|---|---|---|
| **1** | **Antenna connectors** | For further information about the antennas refer to section 5 in this document or to the RFD 900x Modem datasheet linked in section 7. | | |
| **2** | **Heat sink** | The heatsink, visible through the top cover, is required for proper operation and should not be covered while the unit is in use. | | |
| **3** | **Status LEDs** | Red | Blinks slowly a few times - establishing link to a Wi-Fi client. Blinks rapidly for some time - flashing the modem firmware (using 'spiffs.bin' file explained in 3.2.2 e). Solid - device initialisation has completed | |
| | | Green * | Blinking – RFD modem looking for a link Solid – RFD modem bound to another modem | |
| **4** | **Button** | Press 5 times within 5 seconds to reset all WiFi settings to default values. (Red LED will turn off, blink 3 times and go solid after resetting default WiFi settings) | | |
| **5** | **Tabs** | To lock the TX Module into the radio control socket. | | |
| **6** | **RC and TX Module Interface.** ** | a | PPM | Sends RC data into TX Module. |
| | | b | +6 V | 6V supply positive terminal (not used by the module) |
| | | c | +Bat | Positive battery terminal (supply for the module) *** |
| | | d | GND | Ground |
| | | e | - | Not connected |

* Green LED will be enabled after 'First Run Wizard' explained in section section 3.2.2 b).

**Interface between RC and TX Module is done through a female 0.1" pitch connector.

***See Table 2 below for module supply ratings and section 6.1 for the relation between battery voltage and current draw with different battery types.

**Table 2 - TX Module Supply Ratings**

| Parameter | Minimum | Maximum | Units |
|---|---|---|---|
| Supply Voltage (+Bat relative to GND) | +5 | +18 | V |
| Operating Current Draw | N/A | 1.2* | A |

*Rating for TX Module with RFD modem set for maximum 1W transmit power measured at 5V supply.

## 2   RC – TX Module Compatibility

The TX Module has been designed to fit into the rear expansion bay of an FrSky Taranis X9D Plus. It might be compatible with other transmitters however, to ensure compatibility, the user will need to check that the dimensions of the slot and the pin configuration of the connector at the back of your RC match those specified for the module. For detailed information on the TX Module dimensions refer to section 6.5 and pinout details can be found in
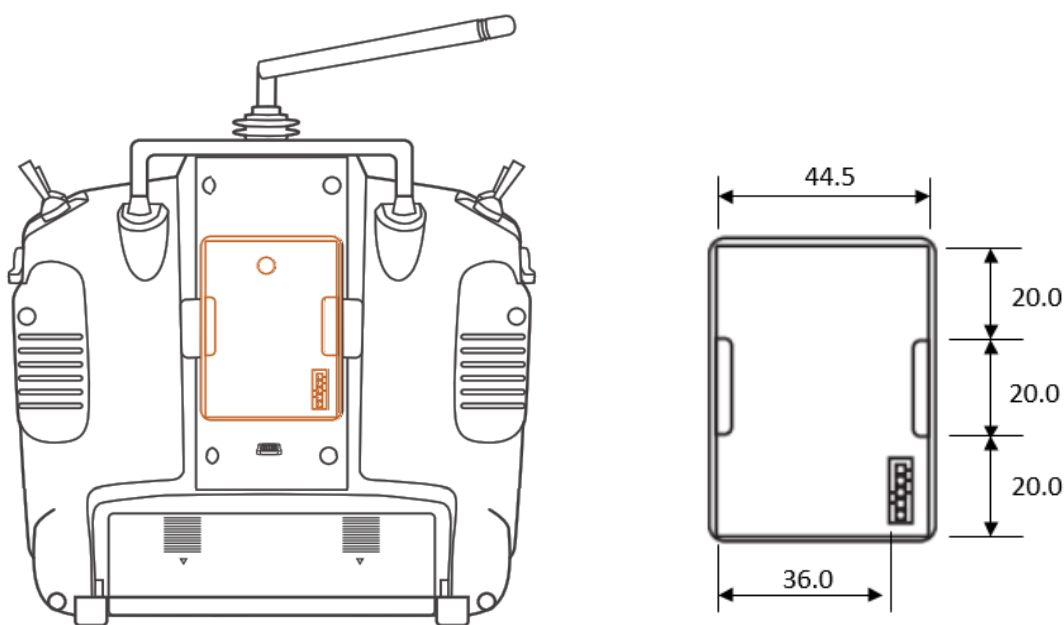
**Table 1**.



*Figure 3 - RC External RF module slot dimensions.*

# 3   Getting Started

The RFD TX Module has five elements requiring configuration before operating.

- Radio Controller (RC) configuration
- TX Module Wi-Fi access configuration
- TX Module RFD900x Radio Configuration
- Vehicle (paired) RFD 900x modem configuration
- Ground Control Station (GCS) configuration

## 3.1   Radio Controller Configuration

**a)  Enable PPM mode on radio controller**

The TARANIS X9D PLUS radio controller (RC) is used as a guide to describe this section. For specific instructions on activating this mode on other RCs refer to the manufacture's manual for the device. Please check the transmitter for RFD TX Module compatibility and ensure it supports the same interface.

For a TARANIS X9D PLUS switch on the RC and choose the vehicle you intend to operate. Navigate to the *Model Setup* submenu and scroll down until you find the *External RF* configuration section, as shown in figure 4, then choose "Mode PPM" to enable external PPM stream for the TX Module.
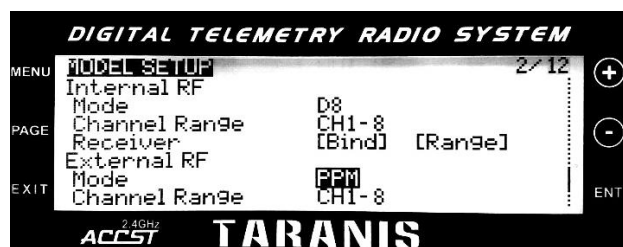


*Figure 4 - PPM mode configuration on TARANIS X9D PLUS RC.*

## 3.2   TX Module Configuration

With the RC switched off, remove the rear protective cover from the radio controller and insert the TX Module. Ensure the TX Module is inserted fully into the opening and the two tabs have locked in place.

Switch on and observe the TX Module's LEDs. The red LED will blink and then go solid during the power up sequence, as per

**Table 1**, and the green LED will indicate the state of the modem link with the modem on the aircraft.

Note: The green LED functionality will only be enabled after the 'First Run Wizard', see section b), is completed; before that it will remain off.

The configuration interface webpage and the communication settings for both the WiFi and the RFD telemetry links are described throughout this section.
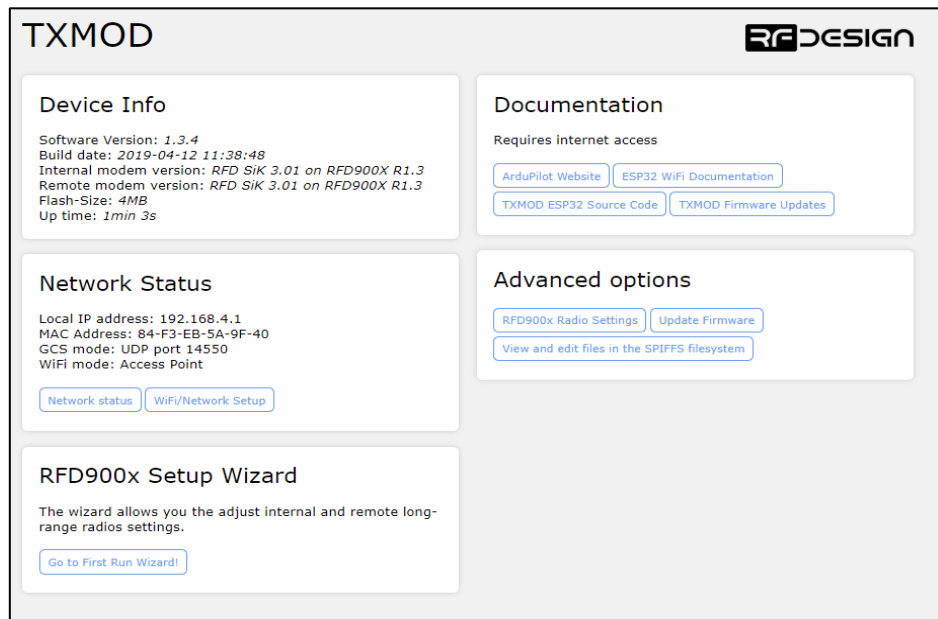
### 3.2.1    Configuration Webpage



*Figure 6 - Configuration home page*

The configuration home page provides basic information on the RF Design TX Module, such as the software versions, MAC and IP addresses and links to the various configuration pages. It also allows the user to configure both the WiFi and the long-range communication settings. Follow the steps described in the following section to access the configuration home page of figure 6.

### 3.2.2    Wi-Fi Configuration

An active Wi-Fi connection is needed to configure the TX Module. On first power up, the TX Module will default to access point mode, with SSID of the format **'TXMOD-XX-XX-XX'**, where the XX are unique hexadecimal characters relating to the unit MAC address.

**a) Connect to TX Module Access Point**

Use your computer or smart device to search for and connect to the access point Wi-Fi network generated by the TX Module (use '**txmod123**' as default password). It may be necessary to disable mobile data, on tablets and phones, to force the browser to use the TX Module network.
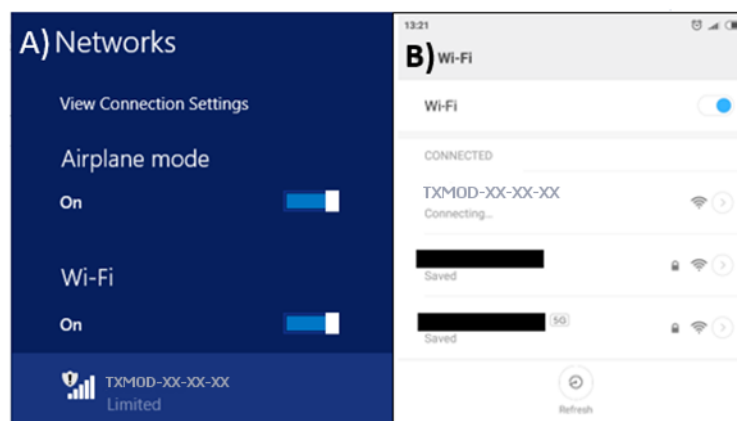


*Figure 7 - Network settings. A) Windows 8.1.  B) Android.*

### b) First Run Wizard

Point your preferred browser to the TX Module IP address (by default http://192.168.4.1/) to access the configuration homepage of figure 6. Alternatively, it can be accessed by the URL http://TXMOD-XX-XX-XX.local where the X's are the same as the X's in the access point network name i.e. the last 6 digits of the MAC address. It should be noted that this will require the installation of some support software for correct operation, for detail please see section 3.2.2 d).

Although this interface is a powerful tool the easiest way to set up your TX Module for its initial use is with the First Run Wizard. On the home page, see figure 6, click on 'Go to First Run Wizard!' button to access the wizard shown in figure 8 which will guide you, step by step, to configure your module.

To complete the wizard the remote modem, on the aircraft, should be powered up and have the same firmware version as the modem in the TX module. If the remote RFD900x modem was supplied in kit with the TX Module both modems should already have the correct firmware. If not, refer to section 3.3, for a guide on how to flash the remote modem to the same firmware version being used on the TX Module. The version is displayed on the 'Device Info' section of the homepage interface of figure 6 under 'Internal modem version:'. If both firmware versions are already the same the modems should lock, indicated by solid green LED, if no link is established, green LED blinking, reset both modems to default settings. If there is an ongoing issue try resetting the TX module by pressing the button on the TX Module 5 times rapidly after it has rebooted, the wizard can be reengaged.

Once the wizard is successfully completed, your device is ready to be used and further configuration is optional.
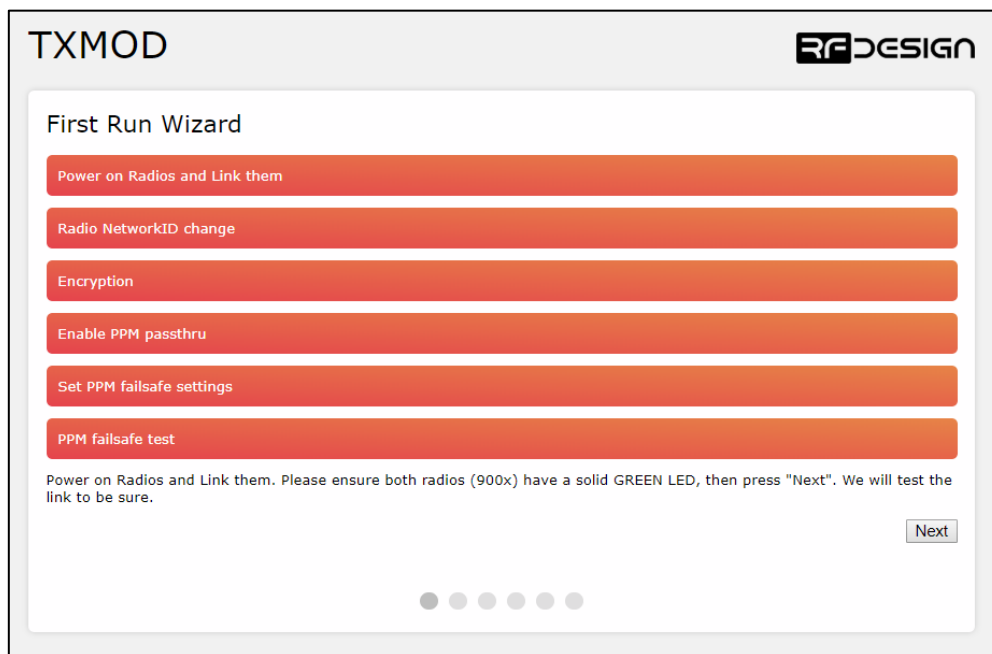


*Figure 8 - First run wizard*

### c) Change Network Settings

To change the SSID or password, open a web browser and enter the module's IP address by default in AP mode *http://192.168.4.1/* which will display the TX Module configuration. To change the Wi-Fi settings, click on 'WiFi/Network Setup', to access the Wi-Fi setup interface of figure 9. The changes will only take effect after you power-cycle your TXMOD.

*Figure 9 -WiFi settings configuration page.*

**Table 2 – Wi-Fi Settings Description**

| Parameter | Description |
|---|---|
| **WiFi mode** | This sets the module to act as an access point (default) or as a station on an existing access point, such as a home network. |
| **AP SSID** | Is the SSID used for creating the Access Point (AP). |
| **AP Password** | This is the password that will be used for the access point. It must be a minimum of 8 character long |
| **WiFi Channel** | Allows the user to set the channel as per the WiFi 802.11 standard definitions this can be used as needed to prevent interference or meet the requirements of the network that the module is joining. The default is channel 11 a part of the most commonly used channel set of 1, 6 and 11. |
| **StationSSID** | The SSID of the network that the TX Module should attempt to join. |
| **Station Password** | The password of the network that the TX Module should attempt to join. |
| **Station IP** | The static IP address to assign the TX Module when joining the network. (**Note** this may require appropriate settings to be made on the network router. Once assigned as a station the landing page for the TX Module settings becomes the Station IP address that was assigned.) |
| **Station Gateway** | The Gateway IP address of the network that the TX Module should attempt to join. |
| **Station Subnet** | The Subnet Mask of the network that the TX Module should attempt to join as a station. |
| **Host Port** | This is the UDP host port number. This is the port that you will direct a connection to in UDP mode |
| **Client Port** | This is the UDP client port number. |

| | |
|---|---|
| **Baudrate** | Baudrate of the serial link with the modem. It must match the modem serial speed setting to allow the two to communicate. |

After changing the desired settings, press save. To finalise the changes power cycle the transmitter. Note that changes to the network settings may result in you needing to change the WiFi connection that you use in order to connect to the module e.g. selecting the new WiFi name or force the system to forget an old password then enter the new one.

### d) TX Module as a station

To use the TX Module on an existing Wi-Fi network to provide telemetry data to a GCS while still allowing access to the internet, for example to download maps, there are a couple of possible implementations.

**Basic users**

For Windows and Linux users this will require the installation of a support software like Bonjour Services from Apple for Windows (https://support.apple.com/kb/DL999?locale=en_US) and Avahi for Linux. Windows users may also need to use Chrome (or Chrome based) browser as this has good support for the Apple software.

Once this has been installed connect to the TX Module in default AP mode go to Wi-Fi settings and choose 'Station' in 'WiFi Mode', set the correct SSID (in StationSSID) and password of the network in "Station Password", leave "Station IP", "Station Gateway" and "Station Subnet Mask" as 0.0.0.0 then press "Save" and finally reboot the device. You can connect the to the Wi-Fi network with the TX Module on it then open the browser and enter the following address http://TXMOD-XX-XX-XX.local where the X's are the same as the X's in the access point network name. If you cannot access using the URL, you will have to log in your router and find what IP was assigned to the TXMOD. You will be able to access the TXMOD interface by typing the IP in a web browser.

**Advanced users**

The module must be set up by choosing 'Station' in 'Wi-Fi Mode', set the correct SSID (in StationSSID) and password of the network in "Station Password".

You will need to find the Gateway and Subnet mask of the network then to write the appropriate values in 'Station Gateway', 'Station Subnet'. Assigning the 'Station IP' requiring that a static IP is set on the DHCP server, normally the network router, this is so the device will be at a known address on the network allowing for the user to connect using this new fixed IP in place of the 192.168.4.1 of access point mode. Network information such as the Subnet Mask and Gateway address can be found on a network connected device. For instance, in windows launch a command prompt, type *'ipconfig'* and press enter. Information similar to figure 10 will be shown. In linux based devices typing *'ifconfig'* *to the terminal should give similar results.*

*Figure 10 – Command Prompt.*

Default Gateway ->'Station Gateway'

Subnet Mask ->'Station Subnet'

**e) Firmware Update:**

Updating the TX Module requires two different files; the 'firmware.bin' and the 'spiffs.bin' files. Follow the links in section 7 to find and download them.

Then, on the browser configuration landing page shown in figure 6, select 'Update Firmware' and follow the on-screen commands to flash them onto the device. The firmware.bin should be uploaded first and later the spiffs.bin. **These files must not be uploaded and flashed simultaneously.**

After flashing the 'spiffs.bin' file and power-cycling the device, the firmware on the RFD900x modem inside the module will be automatically updated if required.



*Figure 11 TX Module update page*

**f) Wi-Fi Troubleshooting:**

If you forget your settings or the device is not available on the network, it is possible to reset the module to its default Wi-Fi settings by pressing the button 5 times rapidly. It can then be accessed using the default settings.

In some cases, user connection settings may prevent devices from accessing the Wi-Fi addresses. It may therefore be necessary to do some basic troubleshooting such as removing the existing network settings from the device memory, resetting the wireless adaptor, turn off mobile data and disconnect other networking devices such as LAN cables. In other cases, running the Windows Network Diagnostics may help.

### 3.2.3　TX Module Internal RFD900x Modem settings

The TX Module has an RFD900x series modem internally pre-configured with the parameters of figure 12. A description of this parameters can be found in *Table 3* - **RFD900x parameters**. For further information regarding the internal modem refer to the *RFD900x Peer to Peer Firmware* and *RFDesign Modem 900x Datasheet* documents using the links in section 7.

**Table 3 - RFD900x parameters**

| Reg # | S Register Description | Default Value | Maximum Value | Minimum Value | Must be the same at both ends of the link? |
|---|---|---|---|---|---|
| S0 | **FORMAT** This is for EEPROM version, it should not be changed. It is set by the firmware | Firmware dependant | N/A | N/A | No |
| S1 | **SERIAL_SPEED** Serial speed in 'one-byte form'. Accepted values are 1, 2, 4, 9, 19, 38, 57, 115, 230, 460 corresponding to 1200bps, 2400bps, 4800bps, 9600bps, 19200bps, 38400bps, 57600bps, 115200bps, 230400bps, 460800bps and 1000000bps respectively. | 57 | 1000[4] | 1 | No |
| S2 | **AIR_SPEED** Air data rate in 'one-byte form'. Accepted values are 4,64,125,250,500, 750 corresponding to 4000bps, 64000bps, 125000bps, 25000bps, 500000bps and 750000bps respectively. | 64 | 750[4] | 4 | Yes |
| S3 | **NETID** Network ID. The same on both modems in the pair | 25 | 255 | 0 | Yes |
| S4 | **TXPOWER**[1] Transmit power in dBm. Maximum is 30dBm | 30 | 30 | 0 | No |
| S5 | ECC[2] Enables or disables the Golay error correcting code. When enabled, it doubles the over-the-air data usage | 0 | 1 | 0 | Yes |

| S6 | MAVLINK[3]<br>Enables or disables the MAVLink framing and reporting | 1 | 1 | 0 | No |
|---|---|---|---|---|---|
| S7 | OP_RESEND<br>Opportunistic resend allows the node to resend packets if it has spare bandwidth | 0 | 1 | 0 | No |
| S8 | **MIN_FREQ**<br>Min frequency in KHz | 915000 /868000[5] | 927000 /869000[5] | 902000 /868000[5] | Yes |
| S9 | **MAX_FREQ**<br>Max frequency in KHz | 928000 /869000[5] | 928000 /870000[5] | 903000 /869000[5] | Yes |
| S10 | **NUM_CHANNELS**<br>Number of frequency hopping channels | 20 | 50 | 1 | Yes |
| S11 | **DUTY_CYCLE**<br>The percentage of time to allow transmit | 100 | 100 | 10 | No |
| S12 | **LBT_RSSI**<br>Listen before talk threshold<br>(This parameter shouldn't be changed) | 0 | 220 | 25 | Yes |
| S13 | **RTSCTS**<br>Ready-to-send and Clear-to-send flow control. | 0 | 1 | 0 | No |
| S14 | **Max Window**<br>Max transit window size used to limit max time/latency if required otherwise will be set automatically | 131 | 400 | 20 | Yes |
| S15 | **Encryption Level**<br>Encryption level 0=off, 1=128bit AES | 0 | 1 | 0 | Yes |
| S16 | **R/C input GPIO1.1**<br>Set GPIO 1.1 as R/C(PPM) input | 0 | 1 | 0 | No |
| S17 | **R/C output GPIO1.1**<br>Set GPIO 1.1 as R/C(PPM) output | 0 | 1 | 0 | No |
| S18[6] | **ANT_MODE**<br>0= Diversity, 1= Antenna 1 only, 2= Antenna 2 only, 3= Antenna 1 TX and antenna 2 RX | 0 | 3 | 0 | No |
| S19[6] | **PKT_DROP_RSSI**<br>Sets a RSSI threshold below which the packet will be discarded. 0 disables the feature | 0 | 255 | 0 | No |
| R0 | **TARGET_RSSI**<br>Optimal RSSI value to try to sustain (255 disables the feature) | 255 | 50 | 255 | No |
| R1 | **HYSTERESIS_RSSI**<br>Amount of change before power levels altered | 50 | 20 | 50 | No |

*Table 3: RFD900x SiK firmware parameters*

**Notes:**

[1] **When setting up the power level and the frequency band, please check the radiofrequency spectrum plan in your area to operate in compliance with its legislation.**

[2] ECC - Software Detection and correction, extra packet information, twice the packet length, is sent to allow the recovery of corrupted packets.

[3] Injects RSSI packet when MAVLink protocol used and heartbeat packet detected.

[4] Maximum from version 2.60 onwards
[5] 868 modems
[6] Introduced in V2.55

### a) Modifying parameters with the TX Module web interface

The settings described in Table 3 can be set up on the TX Mod and on any remote modem connected to it by using the browser interface introduced in Section 3.2.2. To do so, point your preferred browser to the module's IP address (if not changed as described in Section 3.2.2, by default in AP mode it is http://192.168.4.1/) to access the TX Module web interface. *Click on 'RFD900x Radio Settings'* to access the modem's setup interface of figure 12. If the TX Module has not been paired yet with any other modem, the remote side will appear empty and the message "Sorry no parameters available" will be shown.



*Figure 12 - TX Module modem configuration page.*

Settings can be refreshed using the 'L*oad Fresh Params*' button. Parameters can be adjusted in the text boxes as required and then applied by means of the '*Save Params*' button. Changes on the AIR_SPEED, NETID, TXPOWER, MIN_FREQ, MAX_FREQ and NUM_CHANNELS parameters should be applied to remote radio settings as well to avoid losing the radio link.

## 3.3   Vehicle Modem

If the vehicle modem to be used is the one supplied with the TX Module, unless changed by the user, it will have a compatible firmware version and it will be connect to the modem in the TX Module. If that is the case, the easiest way to configure it is through the browser interface explained in section 3.2.3. on the remote side.

On the other hand if the modem is not the one supplied with the kit, or if the modems are not connecting, the vehicle modem should be flashed with the same firmware and configured with the same parameters as the modem on the TX Module to ensure a proper communication link. To do so, an FTDI cable, a jumper and the RFD900 tools or a serial terminal program are needed.

Connect the FTDI cable and the jumper as per figure 13. The black wire of the FTDI, i.e. pin 1, should connect to pin 1 on the modem and the jumper should connect pins 2 and 3 on the top row together.



*Figure 13 - Modem connected to FTDI cable (pins 1,3,5,7,9,11) to enable serial communications. **\*Jumper (pins 4&6)***.

To configure the modem using the RFD900 tools, download and install the software using the links on section 7 if it is not installed on your computer yet. Launch the program and the configuration interface of figure 14 should pop-up.
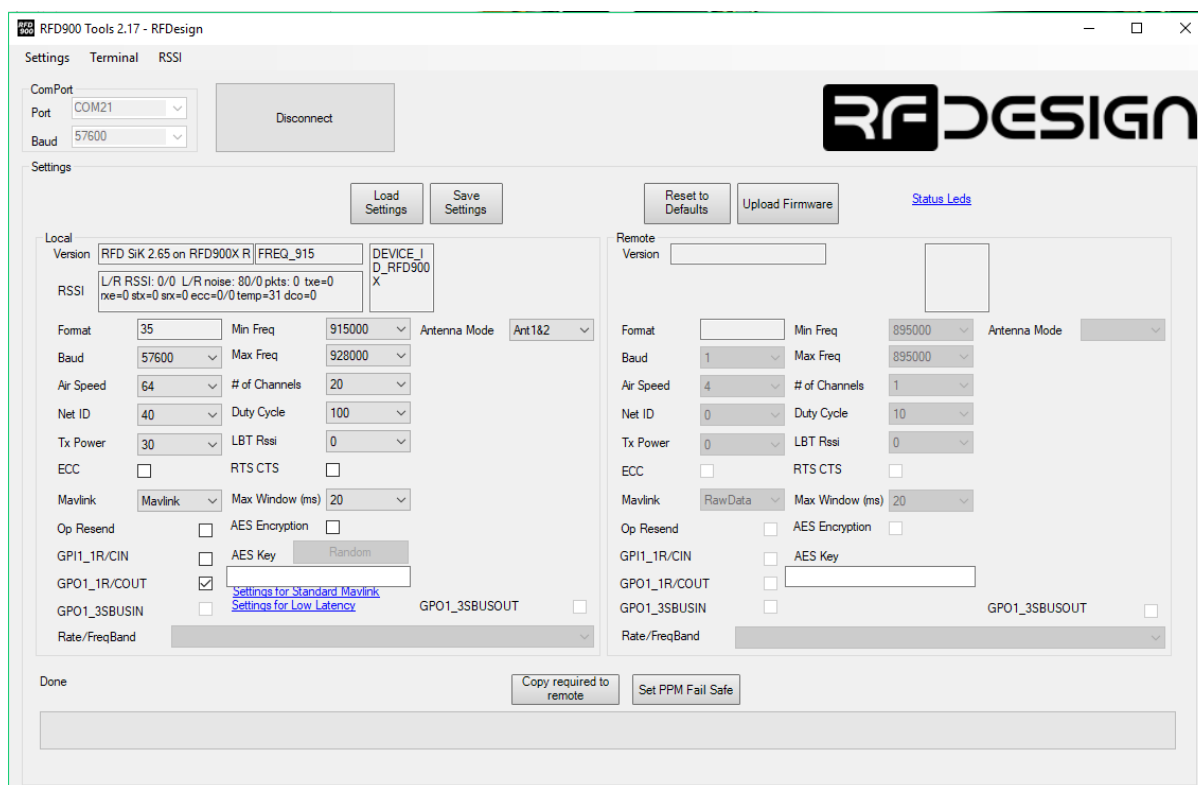
*Figure 14 – Vehicle modem configuration on RFD900 tools.*

First ensure the firmware on the vehicle modem is the same as the one on the TXMod, the version of which can be obtained in the first page of the browser interface described in section 3.2.1. If both versions don't match download the one currently in use on the TXMod through the links in section 7.

Then on RFD900 tools click on 'Upload Firmware' and choose the *.bin file you just downloaded. Wait until the process finishes (a message will appear at the bottom of the page) and reboot the modem. You have successfully updated the firmware.

Then use the interface to configure the parameters described in **Table 3** - **RFD900x parameters.** The AIR_SPEED, NETID, TXPOWER, MIN_FREQ, MAX_FREQ and NUM_CHANNELS parameters should be the same as the ones in the TXMod modem. When connected directly through the FTDI cable the vehicle modem will appear as local. If these parameters have been not modified on the TX Module side or they have been reset to default values by pressing the button 5 times rapidly, the easiest way to configure them on the remote modem is by pressing 'Reset to Defaults' button.

Another important step is to set modem GPIO1.1 as a PPM output. This allows the modem pin 15 to output the PPM stream received from the TX Module modem. This will be configured automatically by the First Run Wizard. In case the wizard were not to be used, enable this by checking the 'CPI1_1R/COUT' box in any and ensure later on that 'CPI1_1R/CIN' is unchecked on the TX Module. Then save the settings to upload the configuration onto the modem.

After the modem has been configured correctly it will be able to link with the TX Module modem, indicated by a solid green LED on both devices. From this point onwards the FTDI cable is no longer needed to configure the vehicle modem. Instead this can be done over the air via the TX Module using the browser interface described in section 3.2.2. This only works while the modem in the vehicle and TX Module are linked as indicated by a solid green LED.

# 4   Ground control station software

Once the modem and WiFi communications are configured it is possible to use the telemetry data stream. The example software used in this section is Mission Planner for Windows and Tower for Android. However, this process can be extrapolated to other software supporting Transmission Control Protocol (TCP) or User Datagram Protocol (UDP).

Connect your computer or smart device to the configured WiFi network; that is either the TX Module Access Point or the linked network when using the module as a station. Then open Mission Planner on your computer or Tower App on your Android device and choose TCP or UDP and press the button "CONNECT" as per figure 15. Parameters should start loading provided that the TX Module is properly bond to the modem on the aircraft (solid green LED) and both devices are powered up.
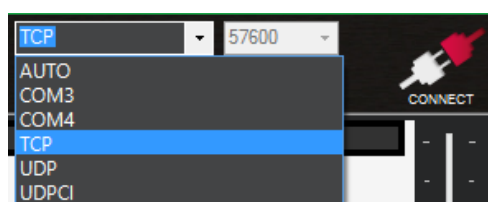


*Figure 15 – Mission planner connection options.*

Then, when asked for, enter the IP address and port number in the pop-up boxes. Default values in AP mode are IP *192.168.4.1,* TCP port number 23 and UDP 14550. After that, if properly connected, telemetry data should be available, and the control software should run missions as normal.
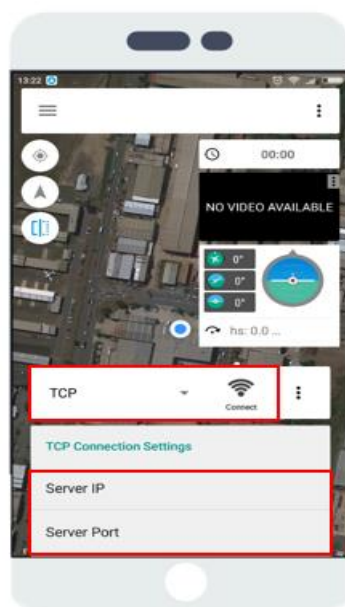


*Figure 16 - Tower configuration on Android.*

# 5   Antenna Recommendation

Any antenna with a male RPSMA fitting and matched to the 902-928MHz ISM band can be used however, the recommended antenna for the TX Module is the 3 dBi half wave dipole which is provided in the kit and is available for purchase on the RFDesign store.



*Figure 17 -: 900MHz Half Wave Dipole Antenna 3 dBi.*

When assembling and disassembling the TXMOD from the transmitter, be aware the antenna may have to be removed then reattached due to mechanical restraints.

# 6   Technical Specifications

## 6.1   TX Module Power Consumption

The graph indicates the current consumption of the TXMOD vs the supplied battery voltage. It should be noted that this graph is generated with the RFD modem configured for 30dBm, or 1 W, transmission. Changing the modem power will significantly affect the current draw. The graph has been divided to illustrate some common RC battery configurations.
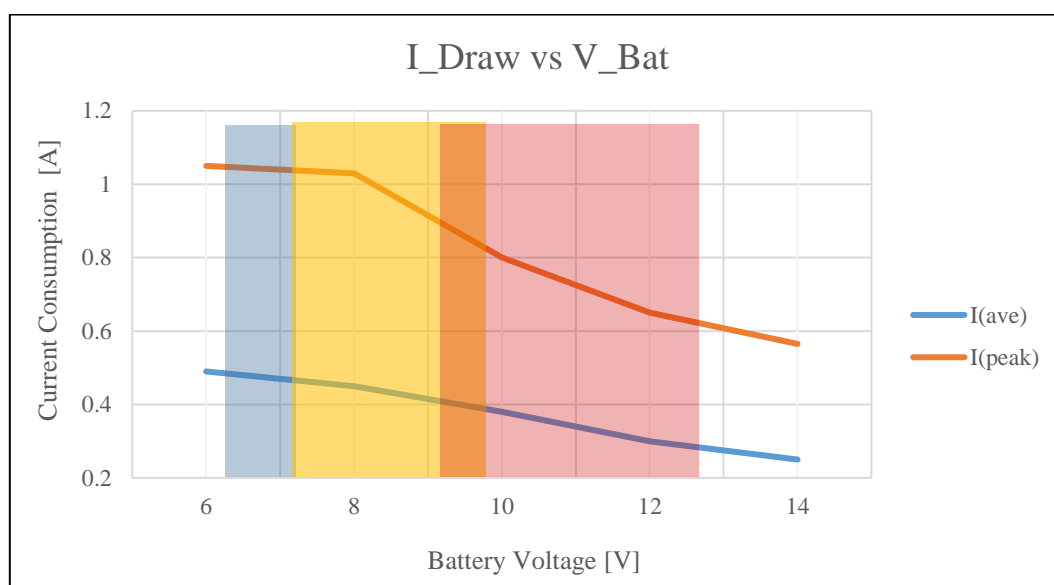


*Figure 18 - TX Module current consumption vs RC battery voltage.  **A)** (Blue area) 6S Ni-MH*
***B)** (Orange area) 3S LiFe  **C)** (Red area) 3S LiPo.*

## 6.2   Modem Specification

| Table 4- Performance | |
|---|---|
| **Supported RF Data Rates** | 4, 64, 125, 250 and 500 kbits/sec |
| **Indoor Range** | 500 m – 1 km |
| **Line-Of-Sight Range** | 40km or more depending on antennas |
| **Transmit Power** | 0 to 30dBm in 1dBm steps |
| **Receiver Sensitivity** | >121dBm |

| Table 5 - Features | |
|---|---|
| **Configuration Method** | AT Commands, APM Planner, Customized Configuration Tool |
| **Frequency Band** | 902 MHz – 928 MHz |
| **Interference Immunity** | FHSS (Frequency Hopping Spread Spectrum) |
| **Serial Interface Data Rate** | 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 450800, 1000000 baud/s |

| Table 6 - Networking and Security | |
|---|---|
| **Addressing Options** | Network ID: 0 –255 |
| **Channels** | Up to 50 Frequency Hopping Channels |
| **Supported Network Topologies** | Point to point |

## 6.3   WiFi Specifications

| Table 7 - WiFi Parameters | |
|---|---|
| **WiFi Protocols** | 802.11 b/g/n |
| **Frequency Range** | 2.4GHz-2.5GHz (2400MHz-2483.5MHz) |
| **Wi-Fi mode** | station/softAP/ |
| **Security** | WPA/WPA2 |
| **Encryption** | WEP/TKIP/AES |
| **Firmware Upgrade** | OTA (via network) |
| **Network Protocols** | IPv4, TCP/UDP/HTTP/FTP |
| **User Configuration** | Browser interface |

**Table 8 – ESP8266 Receiver Characteristics**

| Parameters | Min | Typical | Max | Unit |
|---|---|---|---|---|
| **Input frequency** | 2412 | | 2484 | MHz |
| **Input impedance** | | 50 | | Ω |
| **Input reflection** | | | -10 | dB |
| **Output power of PA for 72.2Mbps** | 15.5 | 16.5 | 17.5 | dBm |
| **Output power of PA for 11b mode** | 19.5 | 20.5 | 21.5 | dBm |
| **Sensitivity** | | | | |
| **DSSS, 1 Mbps** | | -98 | | dBm |
| **CCK, 11 Mbps** | | -91 | | dBm |
| **6 Mbps (1/2 BPSK)** | | -93 | | dBm |
| **54 Mbps (3/4 64-QAM)** | | -75 | | dBm |
| **HT20, MCS7 (65 Mbps, 72.2 Mbps)** | | -72 | | dBm |
| **Adjacent Channel Rejection** | | | | |
| **OFDM, 6 Mbps** | | 37 | | dBm |
| **OFDM, 54 Mbps** | | 21 | | dBm |
| **HT20, MCS0** | | 37 | | dBm |
| **HT20, MCS7** | | 20 | | dBm |

## 6.4　Radio Controller Interface

**Table 9 - RC Parameters**

| Parameters | Min | Typical | Max | Unit |
|---|---|---|---|---|
| Latency | - | 45 | 78 | ms |
| TX Module Supply Voltage | +5 | - | +18 | V |
| Current Draw (peak at input voltage of 5V) | - | - | 1.2 | A |

## 6.5　Module Compliance

| Table 10 - Compliance | |
|---|---|
| **Radio** | AS4268 : 2017<br>FCC 47CFR 15.247<br>FCC 47CFR Part 1.1307<br>FCC 47CFR 1.1310<br>IC RSS247 |
| **EMC** | CISPR11: 2017 (Pending)<br>FCC 47CFR 15B (Pending)<br>ICES 003 (Pending)<br>RSSGEN |

## 6.6 Physical Dimensions

This section provides the TX Module dimensional drawings. The module it has been designed to fit into the rear expansion bay of an FrSky Taranis X9D Plus, however users may find that it can be fitted to other transmitters. To ensure functionality check the physical dimensions and electrical interface are compatible and follow the information described in sections 1.2 and section 2.
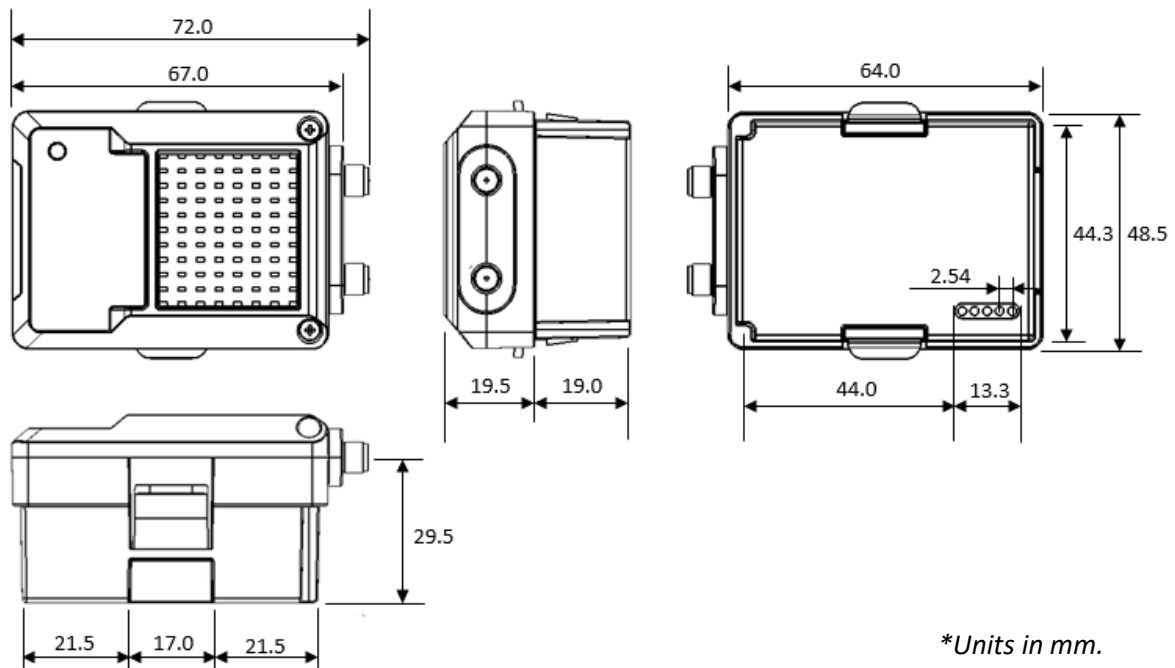


*Units in mm.*

*Figure 19 - TX Module physical dimensions.*

# 7   Useful Links

**TX Module Wi-Fi firmware**

http://files.rfdesign.com.au/firmware/

**RFDesign Modem 900x Datasheet**

http://files.rfdesign.com.au/Files/documents/RFD900x%20DataSheet.pdf

**RFDesign Modem Firmware**
http://files.rfdesign.com.au/firmware/

**RFD900x Peer to Peer firmware - User Manual**

http://files.rfdesign.com.au/Files/documents/RFD900x%20Peer-to-peer%20User%20Manual%20V1.1.pdf

**RFDesign Programming Tools**
Software:  http://files.rfdesign.com.au/tools/

Manual:
http://files.rfdesign.com.au/Files/documents/RFD%20Modem%20Tools%20Manual%20V1.1.pdf

**CoolTerm**
http://freeware.the-meiers.org/

**Mission Planner**
http://ardupilot.org/planner/index.html

**FrSky Taranis X9D Plus**
https://www.frsky-rc.com/taranis-x9d-plus-2/

**Mission Planner**
http://ardupilot.org/planner/docs/common-install-mission-planner.html

## 8 Revision History

| Version | Date | Changes |
|---------|------|---------|
| **1.0** | 12/04/2019 | Release document |