



PUPradar __ Smart Radar Sensor
Luswave Technology

PUP SO24CP T2R2 EVALUATION KIT

USER MANUAL

PUPradar USER MANUAL

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1 Getting started

1.1 introduction

Luswave Technology develops low-power, low-cost, and easy using radar development kits, which offers great flexibility for applications in academic research, industry automation, public safety, and DIY projects.

PUP_SO24CP_T2R2 is a single board K-band development kit with two on board patch antennas and two external antennas. This model integrates a RF module and a powerful FPGA-based processor module into a single board. The RF front end consists of two transmitters and two receiver channels, which makes it a simple MIMO radar. It is suitable for target tracking, movement sensing, site surveillance, occupancy sensing, people counting, fall detection, gesture sensing, and has many other uses. Its FPGA-based MCU and 4-channel 65Msps pipeline LVDS ADC module offers ultimate design flexibility and accuracy with industry-leading programmable logic.

A user-friendly graphical user interface (GUI) allows great flexibility and adjust-ability. Users can easily select desired center frequency and bandwidth, signal waveforms, sampling rates, display parameters etc.

1.2 Key features

- Support Both FMCW and CW Modulations.
- 4 channel LVDS Pipeline AD converters.
- Complex (I & Q) Data Acquiring.
- User-friendly Graphical User Interface (GUI).
- Adjustable Parameter Setting.
- Long Recording Time for Raw Data.
- USB 2.0 High Speed(480Mb/s) Interface to Host Computer.
- Single +6V DC Supply Voltage.

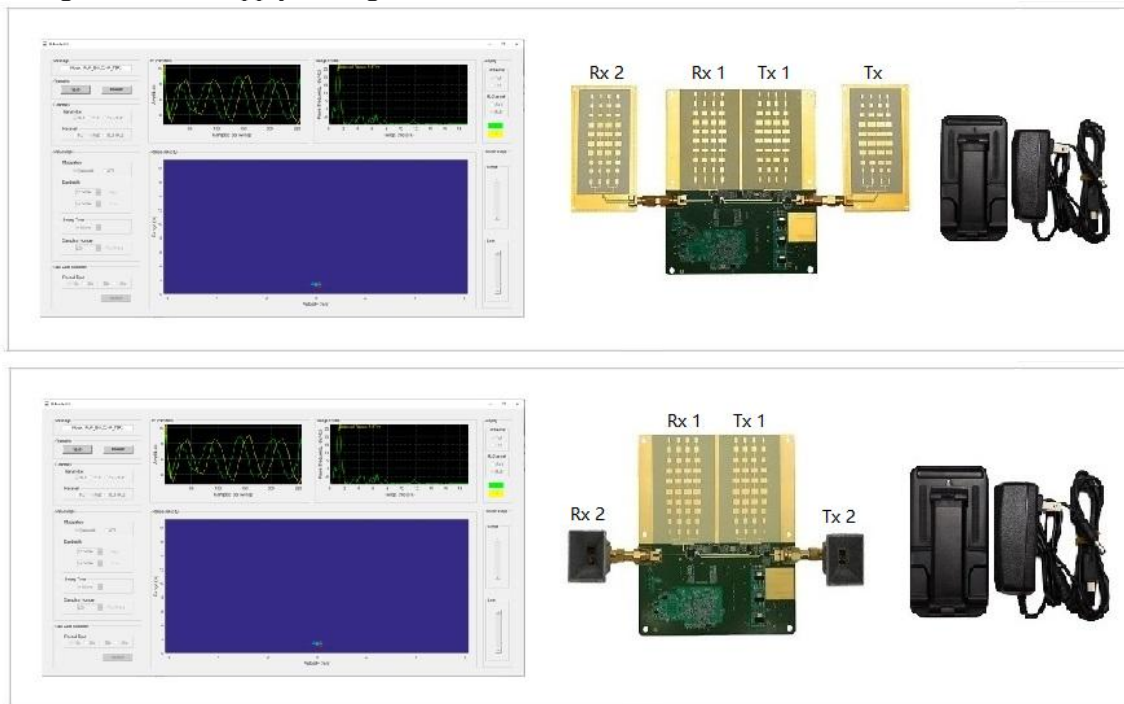


Figure 1. PUP_SO24CP_T2R2

1.3 Kit contents

The PUP_SO24CP_T2R2 Development Kit comes with a single-board radar device and a mounting base. The complete list of the SDR development kit includes:

- Single Board Development Kit
- AC/DC power adapter.
- USB 2.0 A to Mini-B cable.
- Mounting kit.
- A Pair of external antennas
- A USB flash drive.

2 Hardware Specifications

2.1 Functional Block Diagram

Figure 2 is a block diagram of the PUP_SO24CP_T2R2 single-board development kit. PLL controlled frequency sweep is configured by FPGA-based MCU whenever parameter settings are changed. Through a low pass filter bank, four channels of IF signals are acquired by a 65Msps four-channel LVDS AD converter and then streamed to the host computer via a high-speed USB interface (up to 480Mb/s) for further processing. A graphical user interface (PUPradarGUI) is used to control the configuration of the kit.

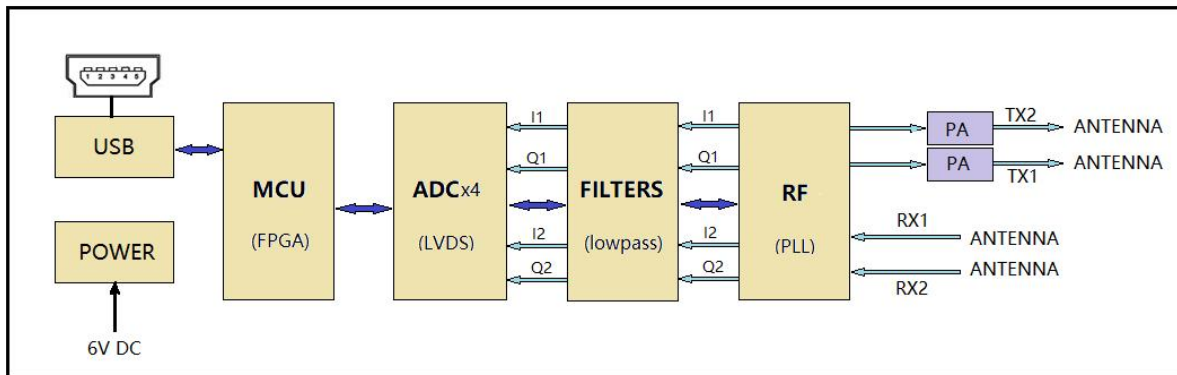


Figure 2. Block Diagram

2.2 Specifications

Table 1 Specifications of the multi-channel PUP_SO24CP_T2R2

Model	PUP_SO24CP_T2R2
Antennas	2 on board Patch and 2 external antennas
RF Channels	2 Transmitters, 2 Receivers
Modulations	FMCW, CW
Typical Frequency	24GHz-25GHz (Expandable to 23.5GHz-26GHz)
Typical Bandwidth	0.25GHz-1GHz (Expandable to 2.5GHz)
Tx output power	17dBm
Rx noise figure	10dB
Detectable Range	People: ~25m, middle sized vehicle: ~60m
Supply Voltage	6V
Supply Current	1.4A
Operating temperature	-40°C-85°C

3 System Setup

3.1 Mounting Base Setup

When shipped out, the device has already been mounted on the mounting stand. The stability, height, and direction of the board can be adjusted by the stand base and an arm extension.

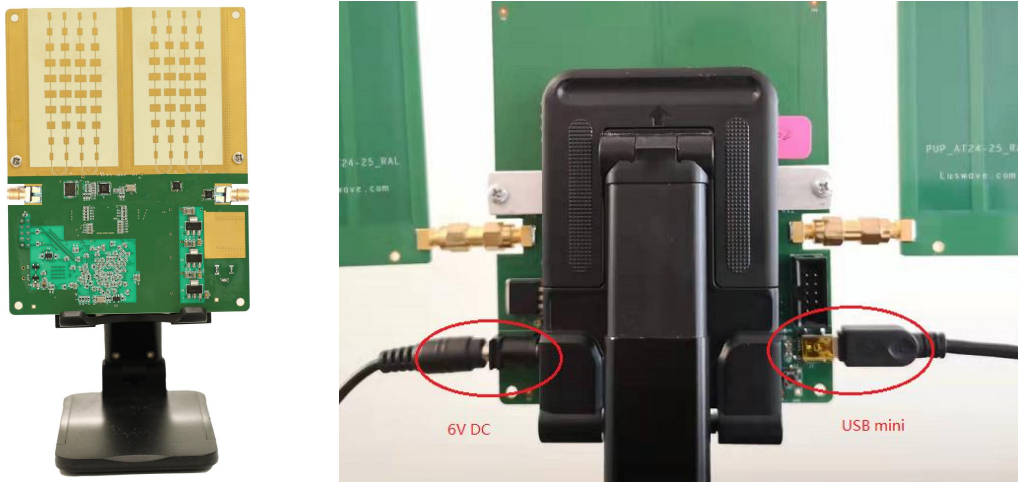


Figure 3. Device on Mounting Stand and Cable Connection

3.2 USB Driver Setup

Find the Driver folder (Figure 4) in the include USB flash drive, and copy it to wherever you like.

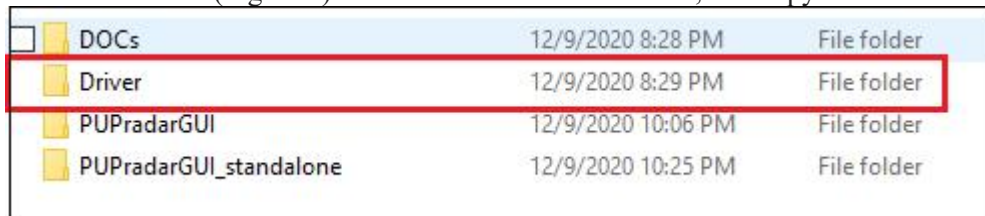


Figure 4. USB Driver

After plugging in the 6V power to the device, connect your computer and the board using the USB-A to USB mini cable.

Open the Device Manager window on your PC, “Unknown Device” is shown when the device is first connected.



Figure 5. Device Manager Window.

When you install the driver for this device using the file in the driver folder and “Cypress FX2LP No EEPROM Device” is shown, the driver is installed successfully.



Figure 6. Driver Software Installed Successfully

3.3 PUPradarGUI Setup

3.3.1 GUI app install

In the USB flash drive, you can find two folders “PUPradarGUI” and “PUPradarGUI_standalone”.

Name	Date Modified	Type
DOCs	12/9/2020 8:28 PM	File folder
Driver	12/9/2020 8:29 PM	File folder
PUPradarGUI	12/9/2020 10:06 PM	File folder
PUPradarGUI_standalone	12/9/2020 10:25 PM	File folder

Figure 7. included documents folders

If you are already a Matlab User, copy the folder “PUPradarGUI” into your Matlab workspace, set the path to this folder and run PUPradarGUI.m.

If you want to use the standalone version, open folder “PUPradarGUI_standalone”, double click “PUPradarGUI.exe” to run or “MyAppInstaller_mcr.exe” to install. The standalone file needs more time (1-2 minutes) to start, please be patient.

3.3.2 PUPradarGUI user’s guide

When running the PUPradarGUI, the GUI window (as shown in Figure 8) will appear. First, hit the “refresh” button, the software will automatically detect the model of the device. Once the device has been correctly recognized, its model name will be shown in the message window. You may hit the “start” toggle button, the GUI will give access to a selection of modulations and other parameters. Anytime you want to record the raw data, select recording time and push the “record” button to begin. When recording is finished, a window will pop out for you to save the recorded data into a data file.

- **Message Window**

When the device is correctly detected, the message window will show the device model, otherwise, it will show an error message.

- **Operation Panel**

There are two buttons in the operation panel. The start/stop button is a toggle button. The refresh button is a software reset button.

- **Channel Panel**

In the channel panel, you can activate any Tx channel or Rx channel. When “Tx1.Tx2” is selected, the device automatically works in MIMO mode, all the Tx and Rx channels are activated.

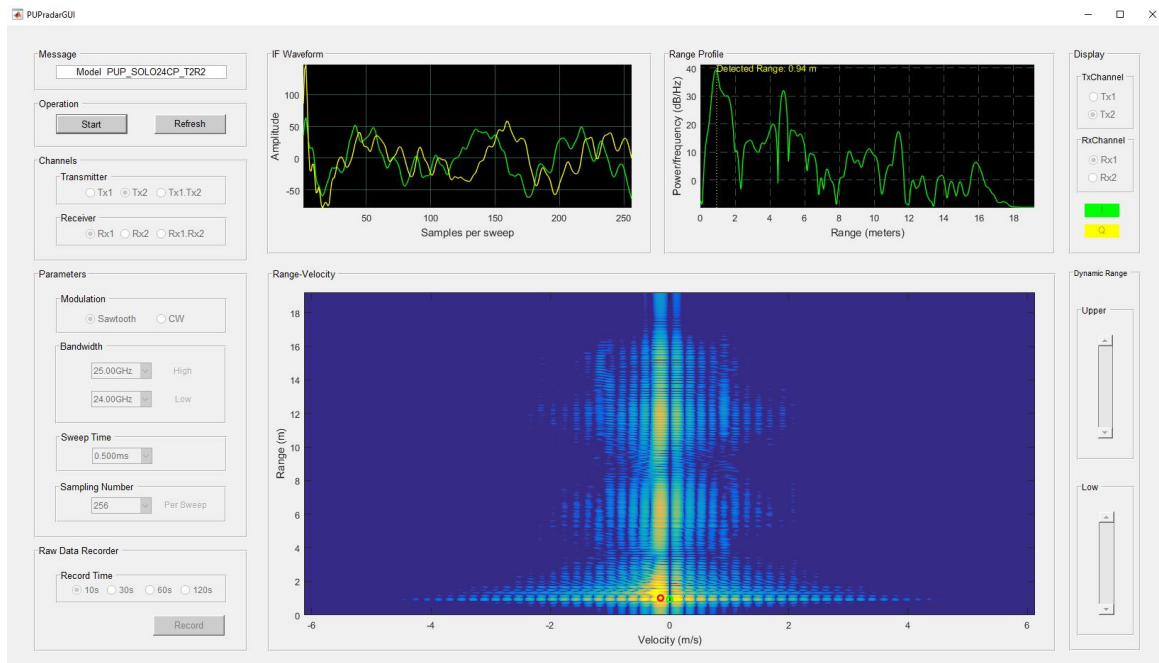


Figure 8. PUPradarGUI

- Parameter panel**
 In the parameter panel, modulation, center frequency/bandwidth, sweep time and sampling number per sweep can be configured.
- Raw Data Recorder**
 When the program is running, you can configure all the parameters. After the parameters are properly set, push the “record” button to start recording and a “save file” window will appear after the recording is finished. The default file format is *.mat, but you can save the file in other formats.
- Display Panel**
 When one Rx channel is activated, the three default display windows are for that channel. When both Tx channels or both Rx channels are activated, the three display windows will show the selected channel combination.
- Dynamic Range Panel**
 The two sliders in the dynamic range panel control the signal threshold in the lower display window. Lowering the slider will show more target details and raising the slider will eliminate more noise from the image.