



Ethernet Data Capture Kit

User Guide

Calterah Semiconductor

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INTRODUCTION

The purpose of this document is to explain the procedure about how to use Calterah Ethernet Data Collection Kit with Radar Development Platform (RDP). Please note that this document only applies to Alps and Rhine series.

Calterah Radar Ethernet Data Collection Kit (DCK-ZYNQ) is designed for collecting radar raw data with Calterah Radar Development Platform (RDP) board. An Ethernet interface and SDRAM buffer are used in the kit to ensure the transmission of high rate raw data. The DCK is a perfect tool for radar algorithm development. (Notice that the final version of DCK-ZYNQ may look different than the two figures below.)

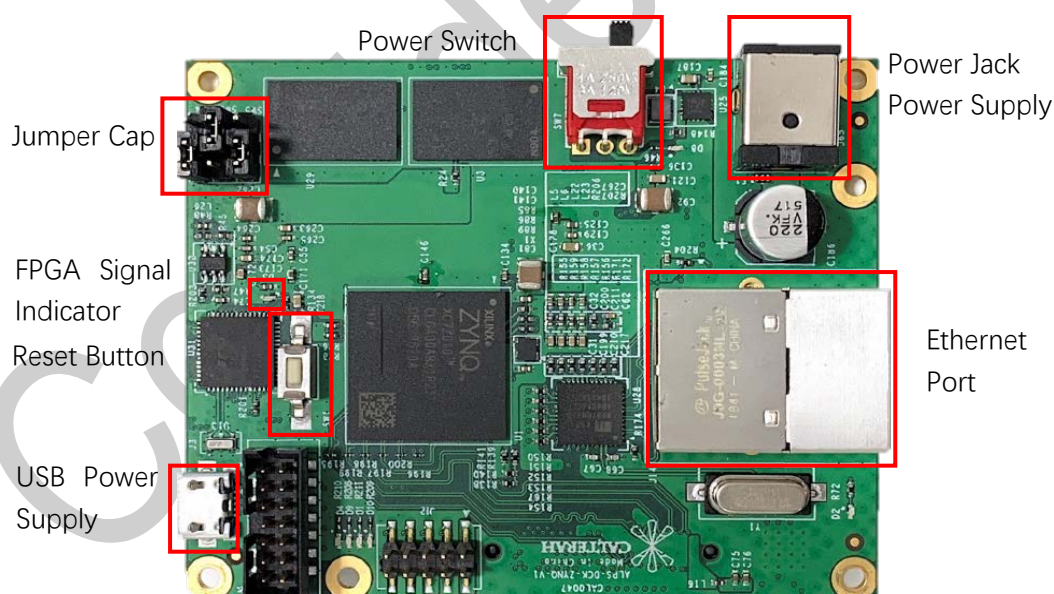
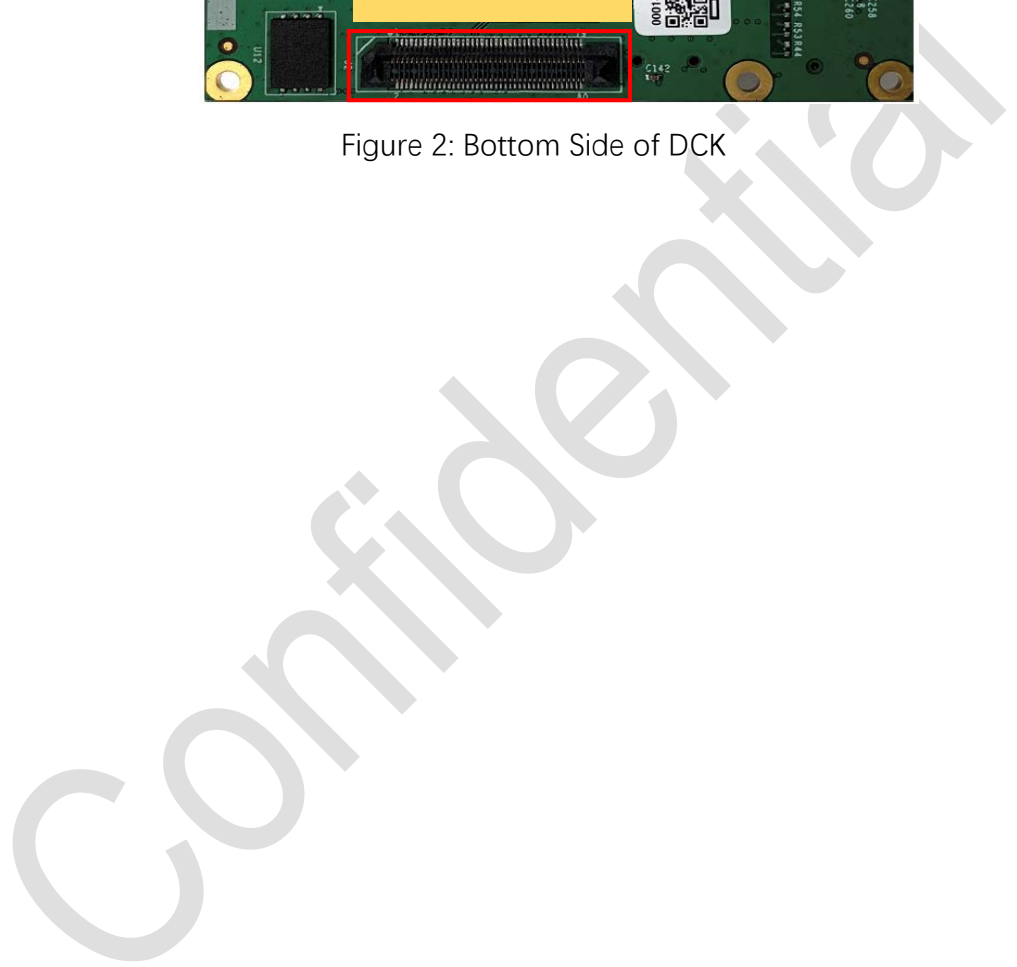


Figure 1: Top Side of DCK



PREPARATION

2.1 Hardware Connection

Before connection, please make sure that your PC has a Gigabit Ethernet port, otherwise, an external Ethernet adapter is required. The following figures show how to connect Calterah boards for data capture.

- a) Please check the **Jumper Cap status** on DCK board. Make sure that the status is the same as shown in Figure 3.

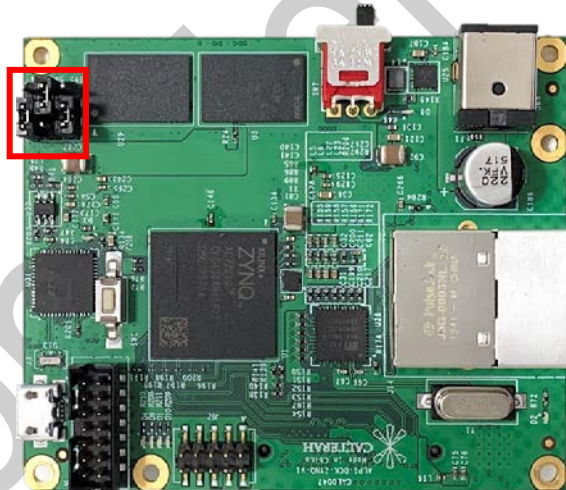


Figure 3: Jumper Cap Status

- b) Connect Calterah RDP board and DCK board through **J1** and **J2** connector on each board
- c) Make sure that power switch on DCK has been turned on
- d) Connect Micro USB port on Calterah RDP Board to the host PC through USB Cable
- e) Connect Ethernet port on DCK board to the PC through Network Cable.
- f) There are two ways of power supply on DCK board. One is to use the **Micro USB port (J3)**. Another is to use the **Power Jack port (J65)**. A power switch is used to switch between the USB power supply and Power Jack power supply. The supply voltage should be 5V DC.

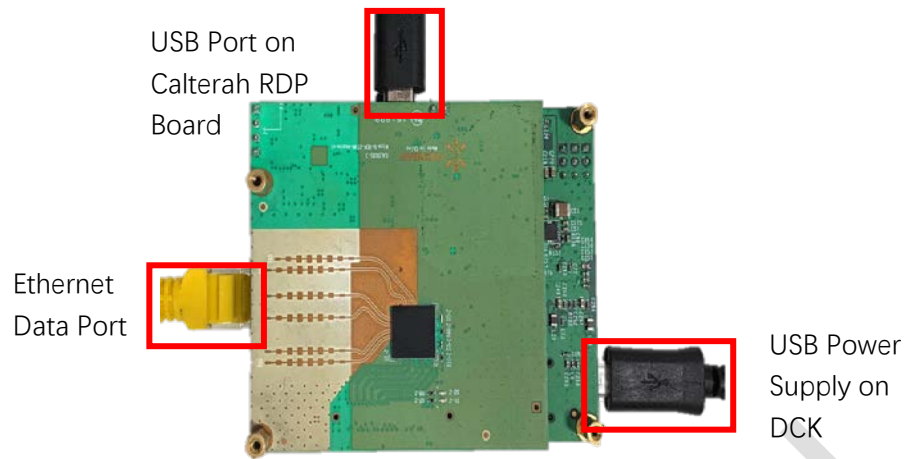


Figure 4a: Connection for Data Capture (USB Power Supply)

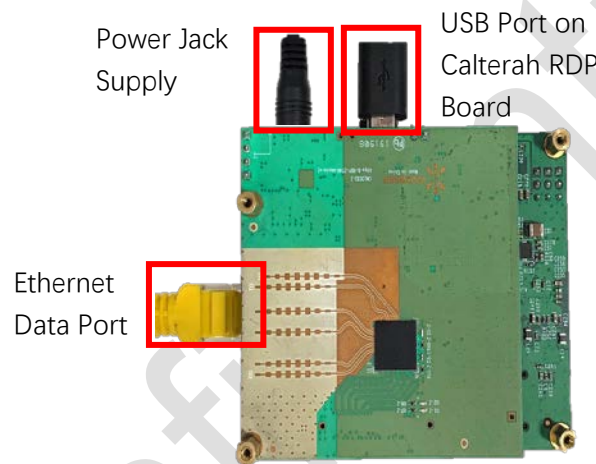


Figure 4b: Connections for Data Capture (Power Jack Supply)

2.2 Network Settings

The following figures and steps show how to set network and IP configuration for DCK board.

- Go to **Control Panel – Network and Internet – Network Connection**
- Double click the **Network Adapter** that connected to DCK board
- Double click **Internet Protocol v4(TCP/IPv4)**
- Select **Use the following IP address**. Set **IP Address** to **192.168.1.100**, **Subnet Mask** to **255.255.255.0**, **Default gateway** to **192.168.1.1**.
- Click **OK** to save the network settings

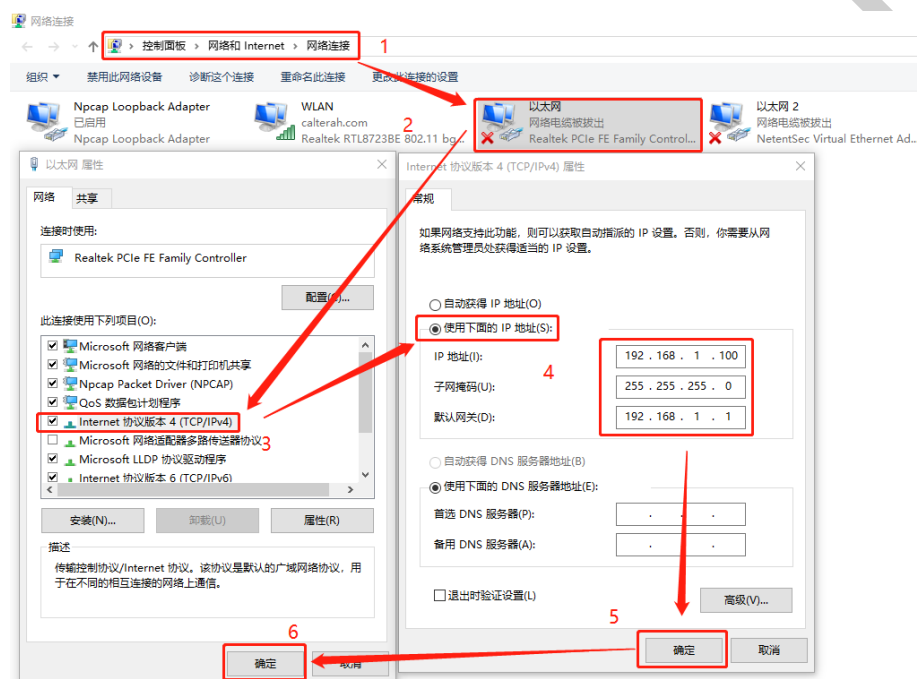


Figure 5: Network Settings for DCK

Please note that Windows Firewall or other anti-virus software may block the data transmission. You may need to add Calterah GUI and IP address of 192.168.1.100 to the white list.

DATA CAPTURE

The DCK comes with a Graphical User Interface application (GUI) which allows users to collect raw ADC/FFT data from Calterah RDP board. The procedure of using GUI is described as follows.

3.1 Calterah GUI Configuration

- Go to the root directory of the GUI folder
- Find and open **initConfig.ini** file using Notepad
- Find and set **CollectModeNet=True**
- Save and exit

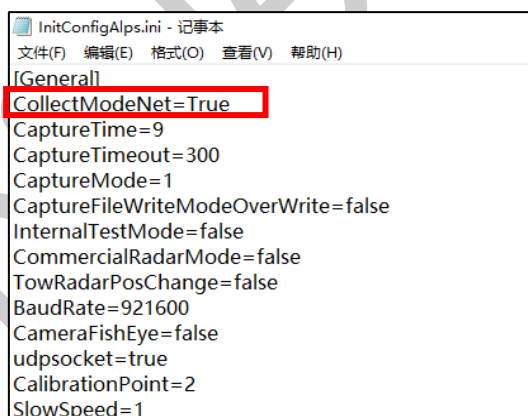


Figure 6: GUI Configuration

3.2 Data Capture Panel

In the Calterah Radar Development Tool, a dedicate panel is designed for data capture(Data Capture in Figure 7).

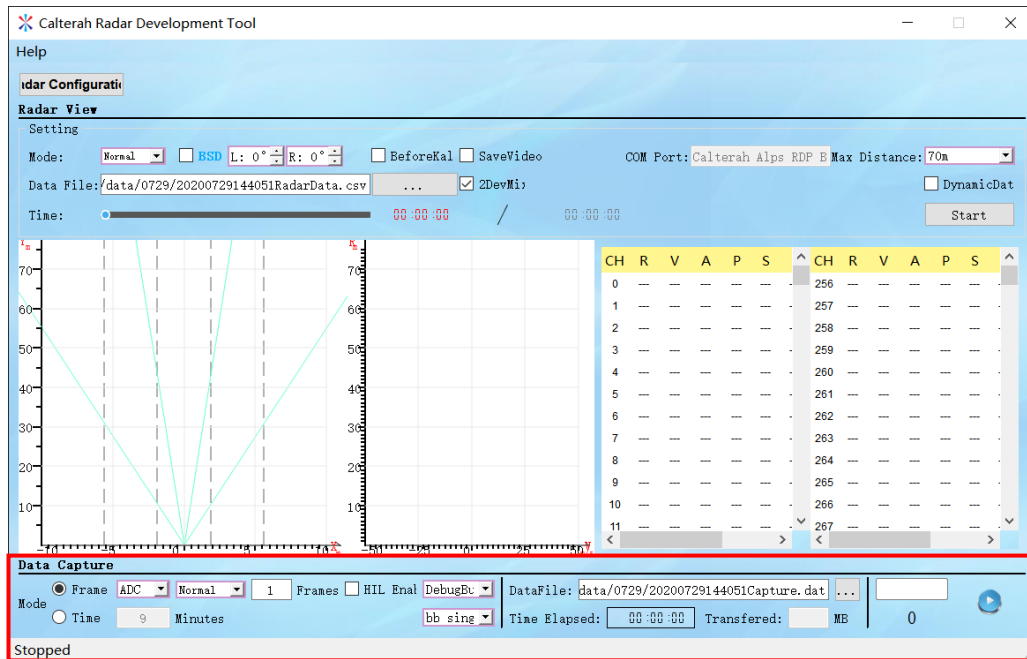


Figure 7: Data Capture Area of GUI

Here is the explanation of each item:

- **Mode**
 - **Frame-Based:** Number of frame to be captured. In this mode, the system will collect data for a certain number of the frame.
 - ◆ **Data Type:** Choose the type of data to be captured. Currently, ADC, 1DFFT, 2DFFT data are supported by the system.
 - ◆ **Sweeping Mode:** Choose between **Normal** and **Single-tone** mode. For Normal mode, FMCW will be sent between the start and stop frequency in the setting for the collection. For Single-tone mode, a fixed single-tone frequency will be sent according to Radar Configuration window on GUI.
 - **Time-Based:** Time of data capture. In this mode, the system will collect data continuously for the preset number of time.
- **HIL Enable:** Enable Hardware-in-loop simulation
- **Dump Bus Selector:** Select between debug bus and LVDS dump
- **Data File:** Set the directory and filename of data.
- **Time Elapsed:** Timer for data capture
- **Transferred:** The captured data size transferred to the local computer.
- **Transfer Rate:** The real-time data transfer rate in MBytes per second.
- **Start Button:** Press to start data capture. And it will change to stop button after data capture started.

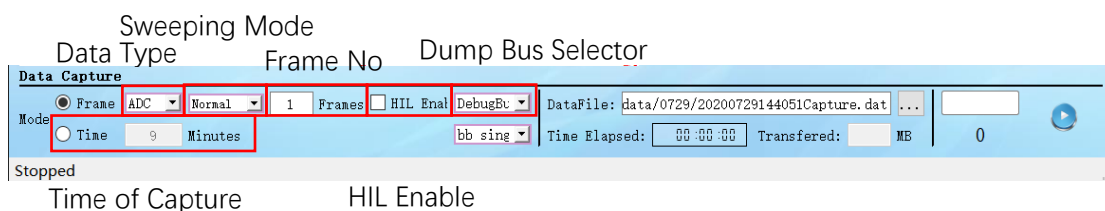


Figure 8: Data Capture Panel

3.3 Data Capture Mode

Calterah provide two data capture mode. One is static capture mode, which is the commonly used method that only collect raw ADC/FFT data without graphical target display. Another one is the dynamic capture mode, which triggers raw data capture functions while outputting the detected targets on Calterah GUI.

3.3.1 Static Capture Mode

Please follow the steps below to collect raw ADC/FFT data in static capture mode.

- Please check the Ethernet LED status on DCK Board, and make sure the **green LED lights on** as shown in Figure 9.



Figure 9: Ethernet LED Status

- Select between **Frame-Based** and **Time-Based** data capture. Choose the type of data required for data capture between **ADC**, **1DFFT** and **2DFFT**.
- Specify the file directory.
- Click the start button to start collecting data.

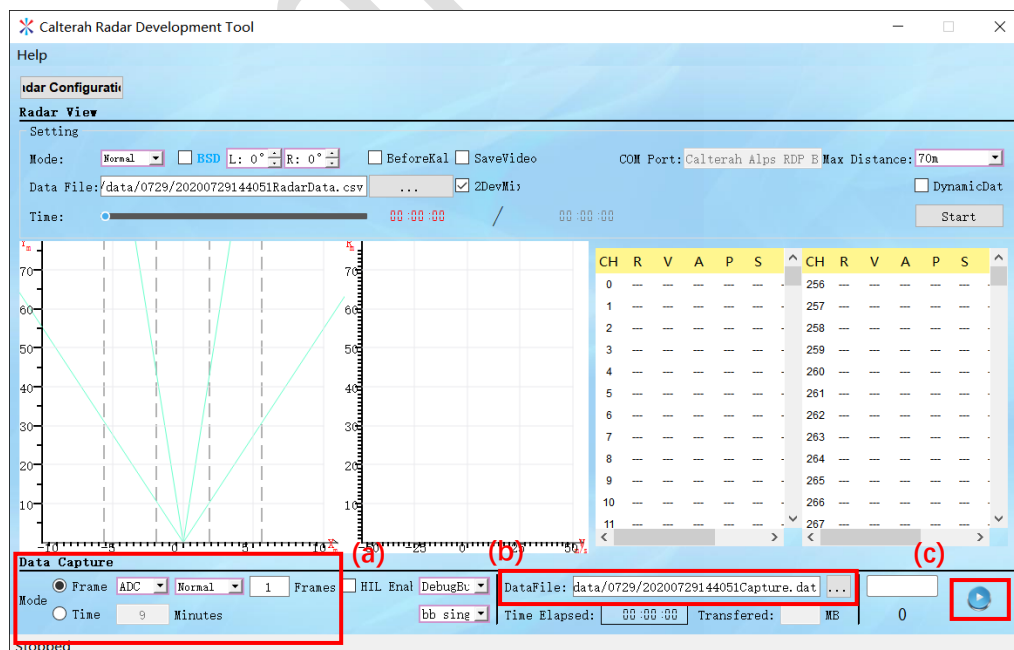


Figure 10: Static Capture Mode

3.3.2 Dynamic Capture Mode

To enable dynamic capture mode, please follow the steps below. Please notice that Single-tone mode is not supported in Dynamic Mode.

- Check the **Dynamic Data** checkbox. The GUI will change to Dynamic Capture Mode.
- Select between **Frame-Based** and **Time-Based** collection. Choose the type of data required for collection between **ADC**, **1DFFT** and **2DFFT**.
- Specify the file directory.
- Press **Start** button to begin dynamic data capture.

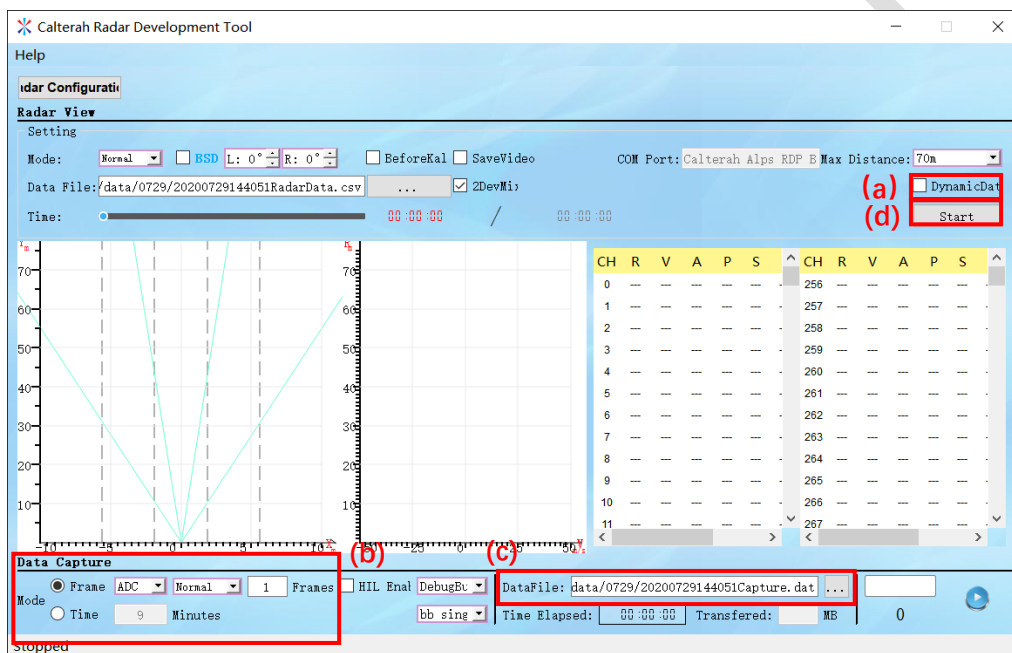


Figure 11: Dynamic Capture Mode

DATA ANALYSIS

4.1 Data Verification

The correctness of data acquisition can be judged by the size of the data. For example, the number of frames collected is N and the size of each frame is M KB (it is usually 1024KB=1MB). The total amount of data for N frames should be the number of frame times the size of each frame, which should be N*M KB. If the size of the collected data is not equal to the theoretical value, it has a high chance of losing data. Please refer to *Exception 2: Packets Loss Issue* in *Appendix A: Exceptions and Solutions*.

4.2 Data Structure

Collected data is binary format and saved in a ".dat" file. The data in the file is arranged as the following figure:

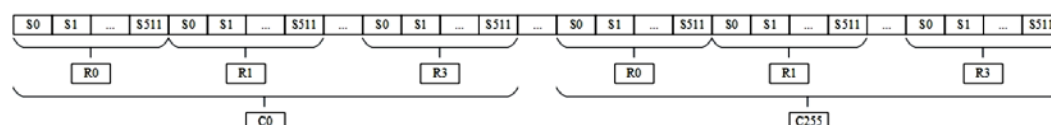


Figure 12: Data Format

In this table:

ALPS_ESA Data Array

ADC Raw Data : signed integer 13bit data_raw (reg signed [12:0] data_raw) (ADC Voltage: -0.8V ~ +0.8V)

Dump Data : signed integer 16bit data_alps (reg signed data_alps[15:0] = {data_raw[12], data_raw[12:0], 2'b00})

Sxxx : Sample data per chirp

Rxxx : RX Channel

Cxxx : Chirp number

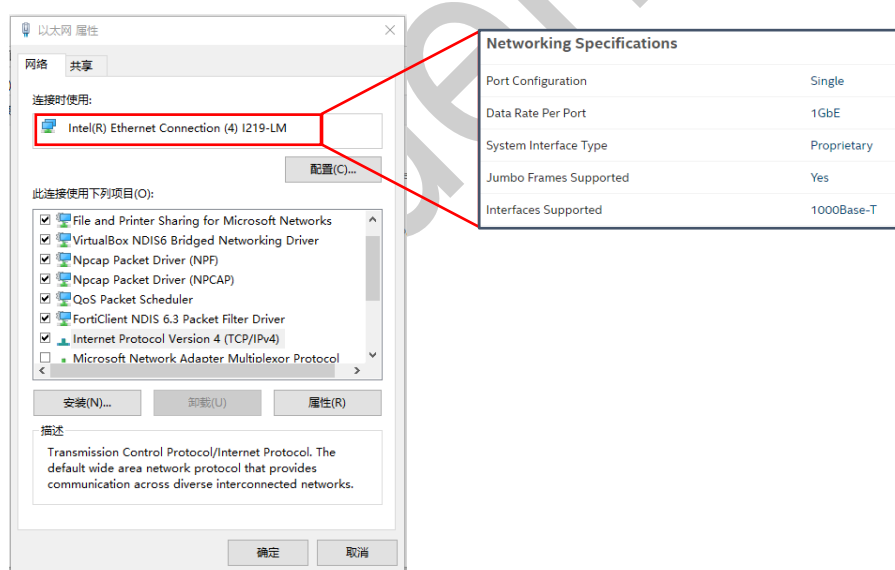
EXCEPTIONS AND SOLUTIONS

Exception 1: Unable to collect data using Alps GUI

There are many causes for data capture failure, which involves hardware failure, software defect, as well as incorrect network settings. The common issues and solutions are listed below.

1. Insufficient Ethernet Data Rate Issue

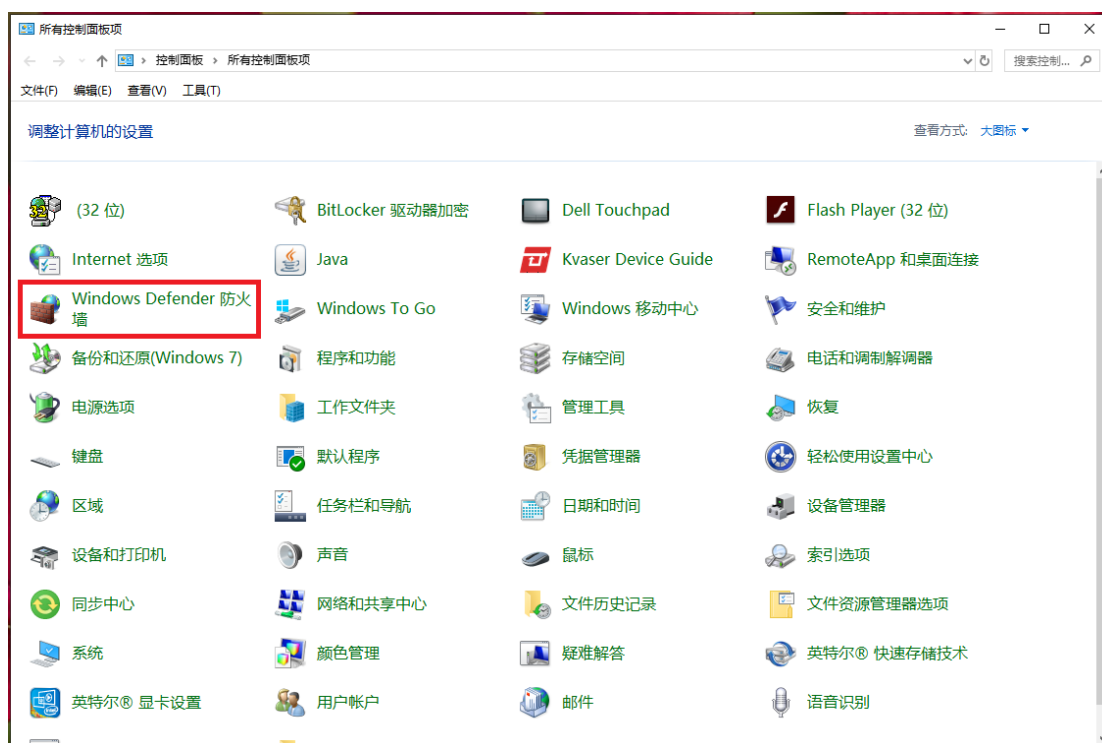
Check the model of the network adapter on your computer, and find whether it is a **Gigabit Ethernet Adapter**. If not, please use a **USB to Gigabit Ethernet Adapter** or contact Calterah FAE for help.



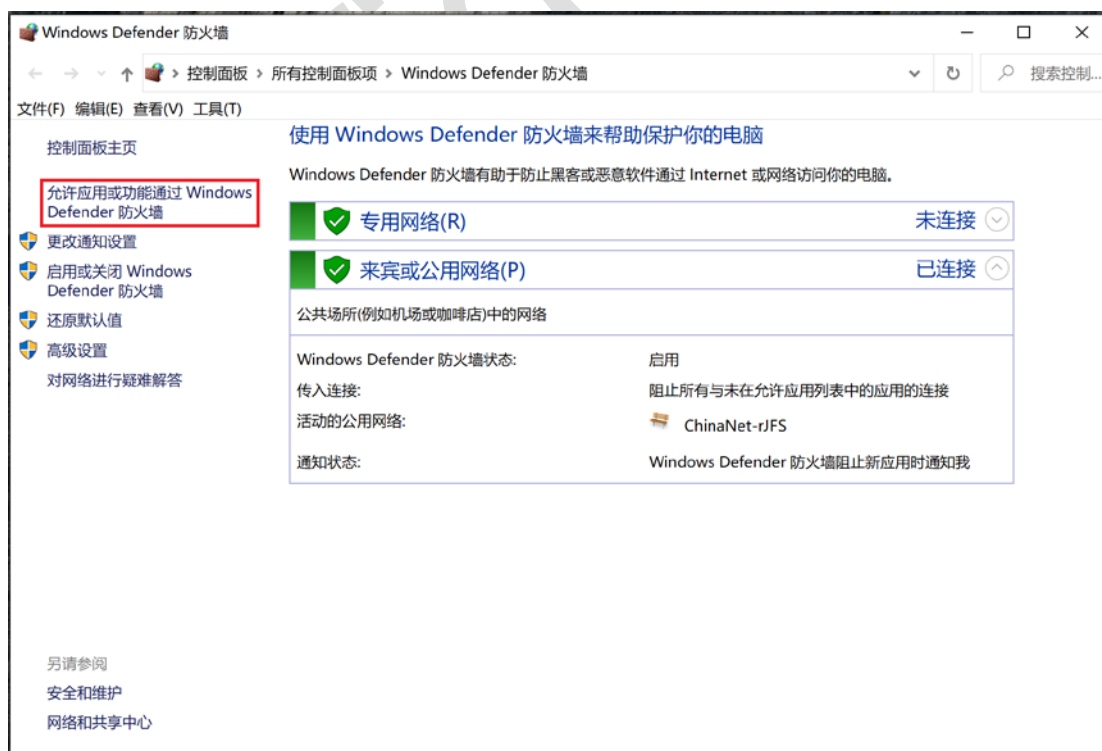
2. Firewall and Network Traffic Control Issue

Add Calterah GUI **devHelper_alps.exe** to the **whitelist of Windows Defender Firewall**. If there are any other third-party antivirus software installed, please contact IT department for help.

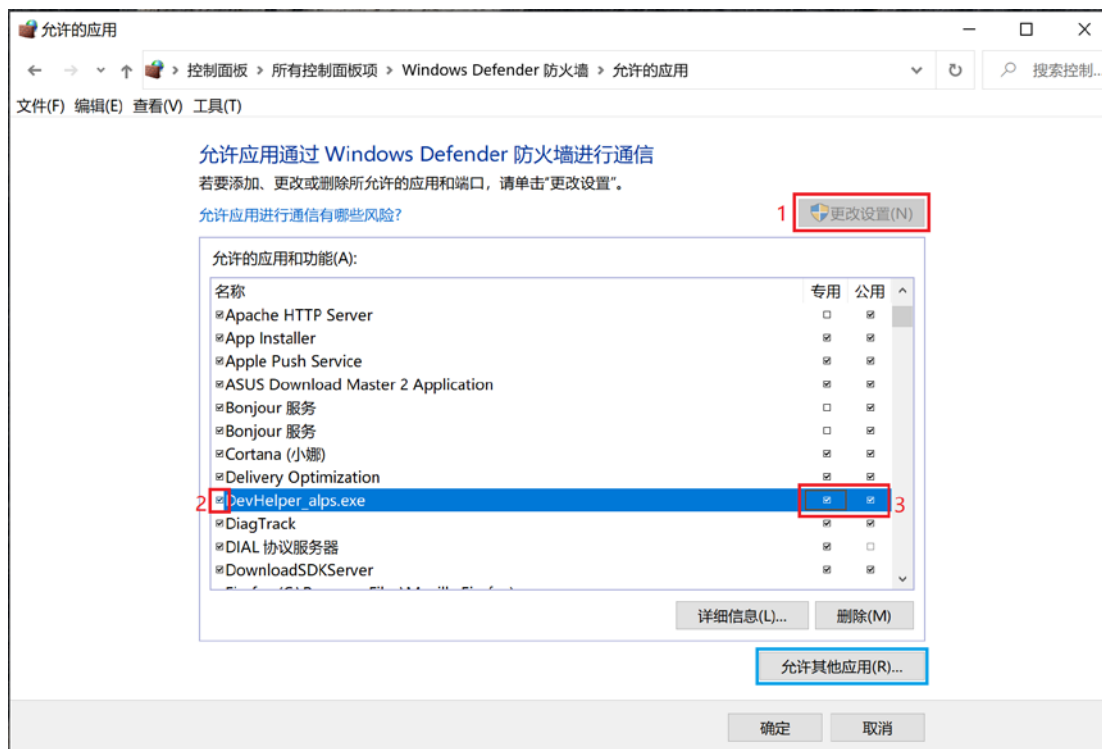
For Windows Defender Firewall, please go to **Control Panel – Windows Defender Firewall**.



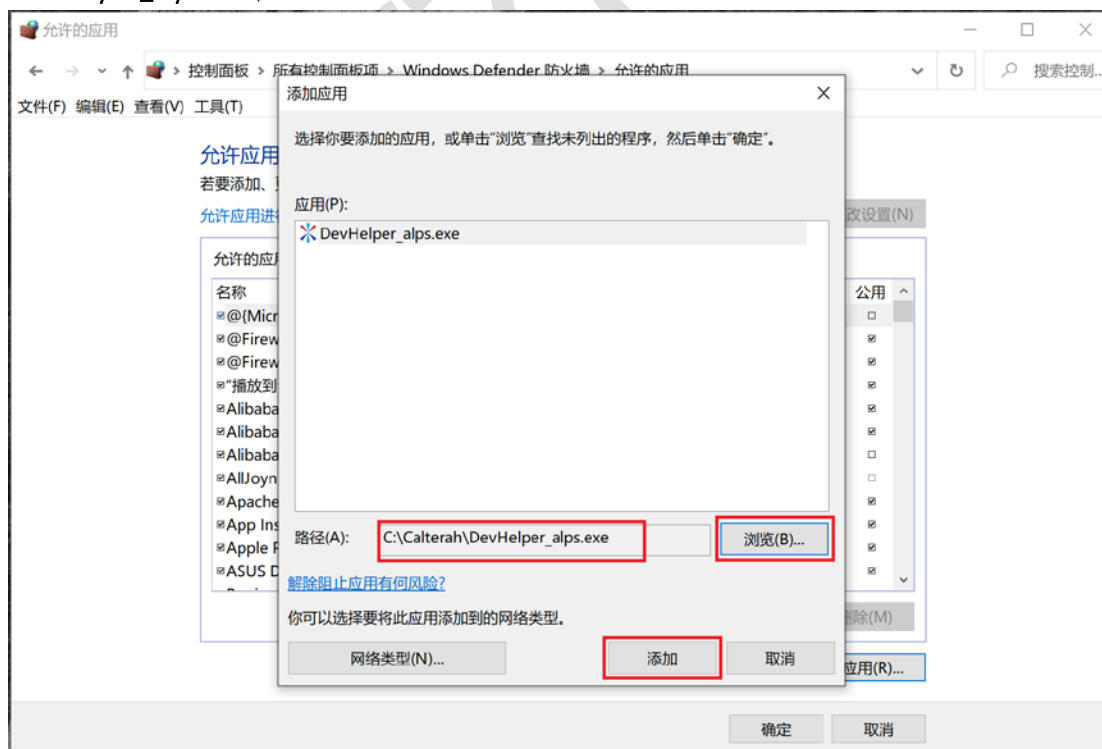
On the left-hand side, click *Allow an app or feature through Windows Defender Firewall*.



Click *Change Settings* and then *check the box to the left* of devHelper_alps.exe to allow Alps GUI accessing network resources. Also *check the box to the right* of devHelper_alps.exe labelled '*Private*' and '*Public*' to allow Calterah GUI on private and public network.



If devHelper_alps.exe is not found on the list, please click **Allow another app** button below the list. Click **Browse**, go to *installation directory of Calterah GUI*, select **DevHelper_alps.exe**, and click **Add**.



3. Software Setting Issue

Power down antenna board and DCK board, turn off Alps GUI, and make sure that you follow 'Alps Ethernet DCK Manual'.

Exception 2: Packets Loss Issue

When you occur the packet loss, try to collect fewer frame of data with a relative low transfer rate. The bottlenecks are the transfer rate of your hard disk and the capability of your Ethernet adapter. If you keep encountering packet loss issues, please switch to another computer with better configuration, or ask Calterah FAE for help.

Exception 3: Incorrect ADC/FFT Data

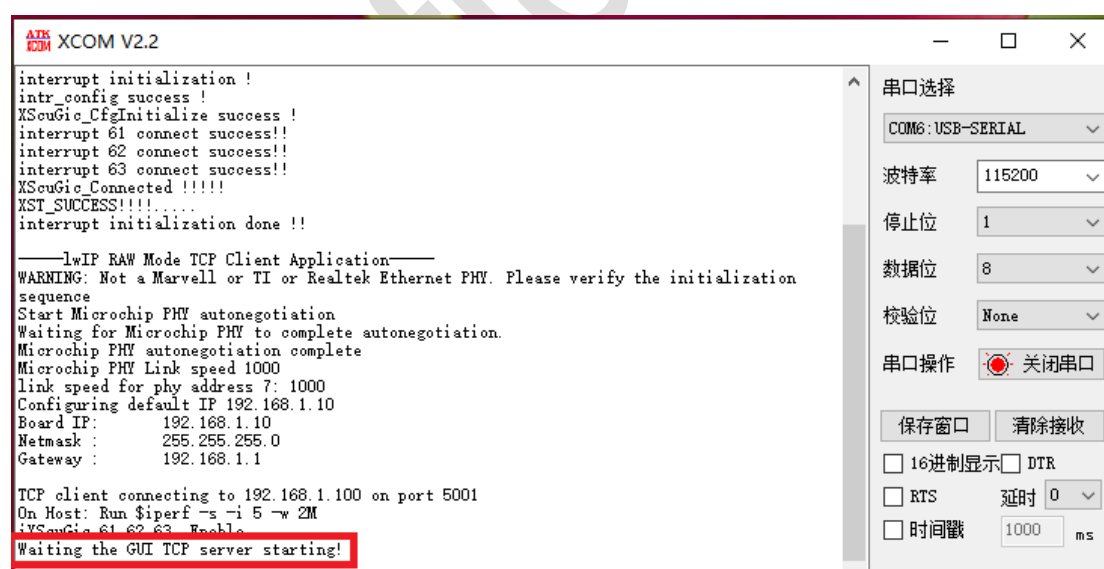
Incorrect chirp configuration and firmware defect are probably the main cause of incorrect ADC data. Sensor configuration mismatching between Antenna board and data analysis script may also leads to data parse error. The solution is to re-flash Antenna board to the released firmware with default chirp configuration.

Diagnosis Method

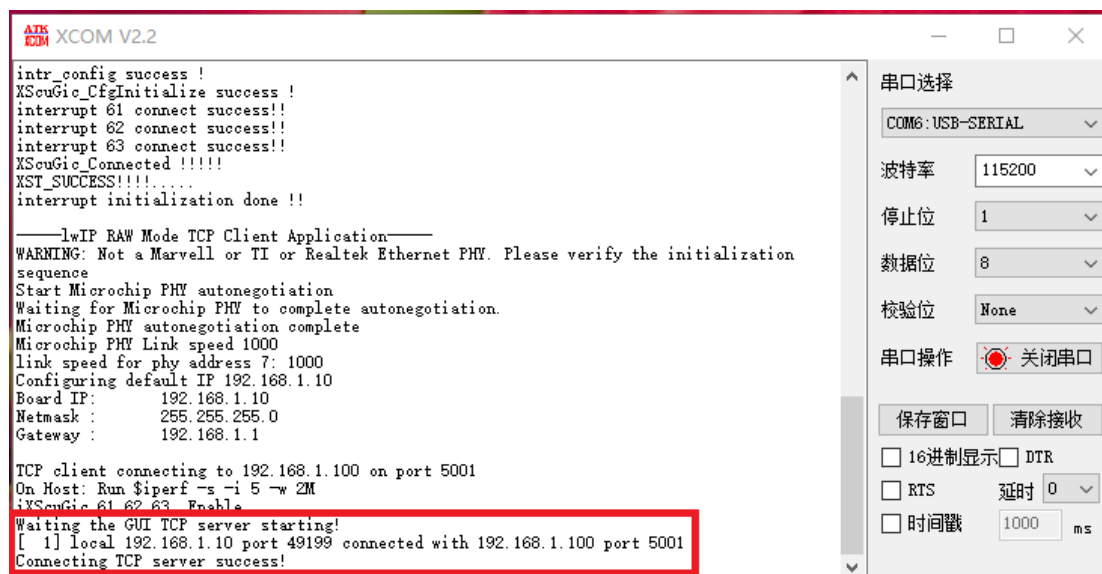
● DCK Log Report

DCK provides a debugging method through COM port. Please follow the steps below to do the diagnosis.

1. **Power on** Calterah Antenna board and Ethernet DCK board. Establish a serial connection with Ethernet DCK board with the Baudrate of **115200**. Press **Reset button** on DCK board. Logs will be printed through DCK serial COM as shown below. **After booting, DCK will wait until Calterah GUI starts the TCP server.**



2. Launch Calterah GUI, and start data capture. Calterah GUI will start a TCP server and establish the communication between DCK (192.168.1.10:5001) and PC (192.168.1.100:49341). '**Connecting TCP server success!**' message will be printed through COM port as shown below.



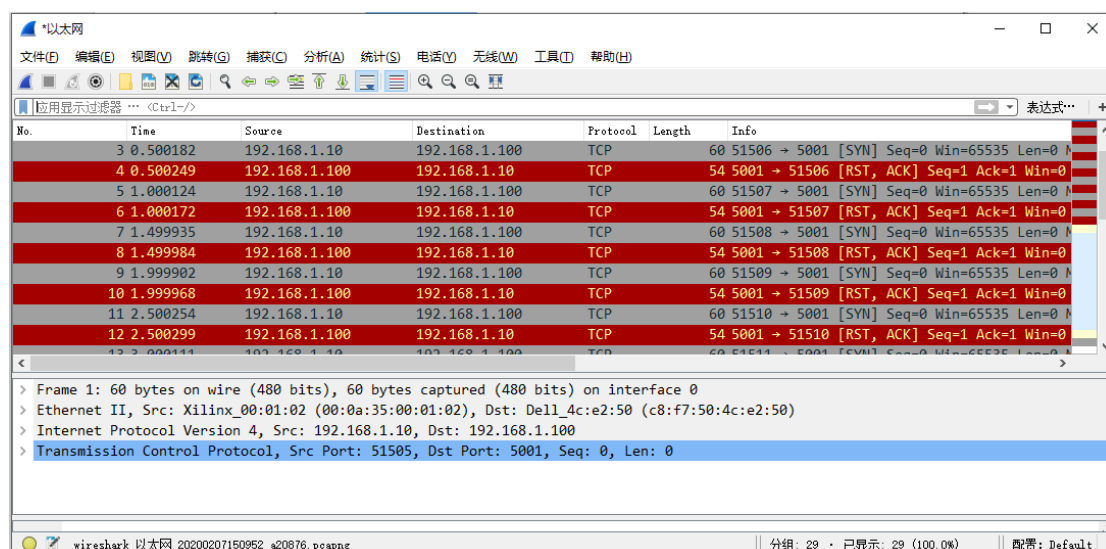
● Wireshark Packets Verification

Wireshark is free and open-source packet analyzer, which can be used to identify software and network problems. Please follow the steps below to finish packet verification process.

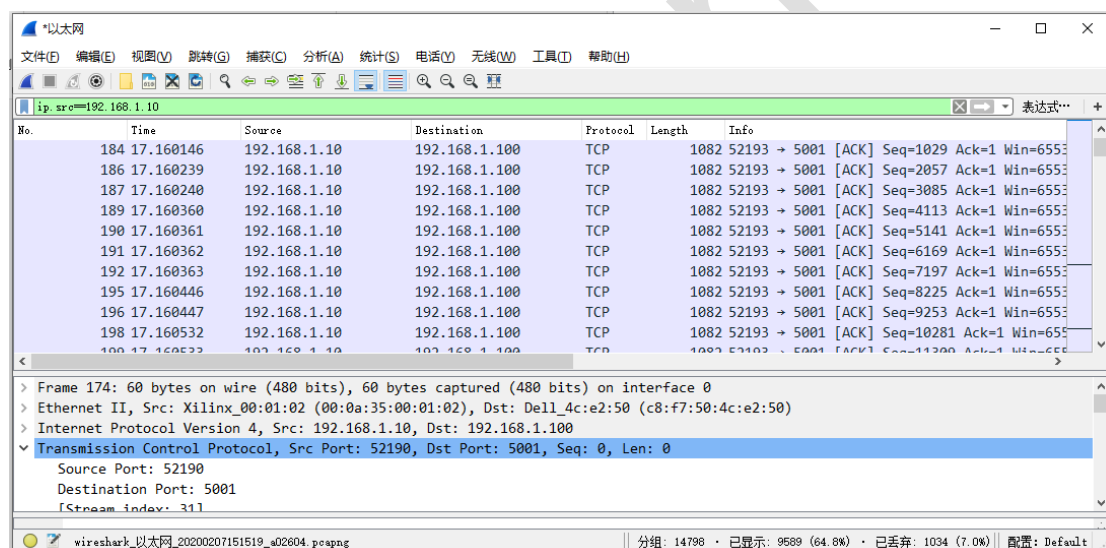
1. Download and install the latest version of Wireshark on official website. Restart the computer as required.
2. Launch Wireshark and choose the Ethernet Adapter used for data capture as shown below.



3. If TCP communication has not been established between DCK (192.168.1.10) and PC (192.168.1.100), you can continuously see the retransmission of SYN packets from DCK but not corresponding ACK from PC.



4. Launch Calterah GUI, and click start collection button. Enter 'ip.src==192.168.1.10' in the display filter. And you will see TCP packets with length of 1082, which are data packets.



If the packets you saw is different as mention above, please send the screenshot to Calterah FAE for help.