

How to remotely receiving a ELAD apparatus

The purpose of this application note is to illustrate how to use a ELAD apparatus "remotely" through a SDR software SDR as, for example, *gqrx*.

This application note refers to *gqrx* but can be used as a reference for other software capable of reading the I/Q samples from a file.

This note could be applied to S1, S2, DUO although the example illustrates the use of a co ELAD S1 receiver.

Structure

The application structure is as follows:

1. ELAD device connected via USB to a remote computer.
2. remote computer, in this example a Raspberry PI 2;
3. Local computer connected via local network to the remote computer.

The purpose of the remote computer is to allow to place the radio apparatus in the most convenient site, maybe in the attic or even at a certain distance from home. In the example the connection is made via ethernet but you can remotize through a wifi bridge.

The remote computer

On the remote computer turns *elad-comms* program that reads the samples from USB and resend them via UDP; This same program accepts, via TCP, commands related to the center frequency, and activation of the attenuator and the anti-aliasing filter.

If this computer is connected to a FDM DUO there are no additional needs, but if you connect an S1 or S2 then you must also use the *elad-firmware* program that initializes the apparatus internal FPGA (the FPGA inside the FDM DUO is initialized by the DUO itself).

The local computer

On the local computer it runs the *elad-server* program. This program:

1. receives UDP stream generated by the *elad-comms* program;
2. sends the samples received through a fifo called */tmp/fifo1* : this is the file from which *gqrx* (or other programs) will read the I/Q samples;
3. reads from */tmp/fifo3* the commands for center frequency, attenuator and filter anti-aliasing;
4. uses a TCP connection to send these commands to the *elad-comms* program;
5. write on */tmp/fifo2* the response from the *elad-comms* program;
6. calculates an fft and makes it available on a shared memory.

The *elad-server* program is controlled by an user interface implemented as a web application. To activate it you must have an apache2 server with installed the PHP extension and also you must have a browser that supports javascript. This interface:

1. displays fft and waterfall;
2. let you to activate and deactivate attenuator and antialiasing filter;
3. allows you to set the center frequency of the receiver.

Setup of the remote computer

On the remote computer, you must:

1. install the *elad-firmware* program;
2. install the *elad-comms* program from the *elad-receive* suite;
3. configure the two programs;
4. possibly automate this so that it starts automatically at computer power on.

For the installation it is recalled that:

1. firmware for Raspberry PI: www.eladit.com/download/sdr/Linux/elad-firmware-rpi
2. firmware for linux arm 64: www.eladit.com/download/sdr/Linux/elad-firmware
3. configuration manual: <http://www.eladit.com/download/sdr/Linux/Manual-en.pdf>
4. *elad-comms* program: www.eladit.com/download/sdr/Linux/elad-receive-1.3.tgz

For the configuration of the *elad-firmware* program please read the manual that explains with great detail the operations to be carried out.

For the configuration of *elad-comms* program (contained in the package *elad-receive-1.3.tgz*) please refer to the README file in the same package.

Depending on the configuration, the programs should require root permissions to work and then you may need to launch them by the root user.

To make the work easier, below is an example of the launch of the two programs with the various parameters explained.

```
./elad-firmware SC0E0U_0003T 3
# SC0E0U_0003T is the S1 serial used
# 3 is the third samplerate or 768 kS/s

./elad-receive-1.3/elad-comms SC0E0U_0003T 14200000 01 768000 192.168.1.116 6666
# SC0E0U_0003T is the serial number of the S1 used
# 14200000 is the center frequency
# 01 means attenuator off and antialiasing filter inserted
# 768000 means sampling 768 kS/s
# 192.168.1.116 means that the samples will be sent via UDP to 192.168.1.116 computer
# 6666 means that the samples will be sent on port 6666 UDP and that the remote computer will listen
on TCP port 6666.
```

Local Computer Setup

On the local computer you must:

1. install the *elad-server* program;
2. install the *openfifo* program;
3. make sure you install the *apache2* web server and related modules for php;
4. install the form *index.php* and the related cgi *setfifo.php* and *getfifo.php*;
5. install the *gqrx* program (or similar);
6. configure programs;
7. possibly automate this so that it starts automatically at power.

For the installation it is recalled that:

1. *elad-server* program: www.eladit.com/download/sdr/Linux/elad-server-1.4.tgz
2. *openfifo* program: www.eladit.com/download/sdr/Linux/openfifo.tgz
3. *cgi*: www.eladit.com/download/sdr/Linux/web.tgz
4. *gqrx* :the program can be downloaded normally using the tools of the distribution to which you refer.

To configure the web server you can use the default configuration and then create an *elad* folder in which you can copy the file *index.php*, *setfifo.php*, and *getfifo.php* once extracted from *web.tgz*.

Also here it may be necessary to run the programs with root permissions, depending on the machine configuration.

The *elad-server* program setup is fairly simple and can be seen from the commented example you can read below.

```
./elad-server-1.4/elad-server 192.168.1.205 6666 &
# 192.168.1.205 is the address of the remote computer
# 6666 is the port on which to listen to the UDP packets and also the TCP port on which to contact
the server on the remote computer
# & means that the program will work in the background
sleep 2
./openfifo/openfifo &
# Keeps open the FIFO so you do not have to restart elad-server when gqrx is restarted
# & means that the program will work in the background
firefox localhost/elad/index.php &
# Run the command page server and radio apparatus configuration
# & means that the program will work in the background (of course being an X program the interface
will still be visible)
gqrx
# Gqrx is the receiving program
```

The configuration for *gqrx* program will use the input as:

Device: Complex Sampled (I/Q) File

Device string: file=/tmp/fifo1,freq=14200000,rate=768000,repeat=false,throttle=false

Input rate: 768000

Decimation: None

Sample rate: 768000

Bandwidth: 768000

LNB Lo: 14200000

The data should be consistent with those disclosed in the *elad-server*.