

# Firmware Pluto quick start guide

Congratulations for testing this new firmware!

This new firmware enables Pluto to be used as a full-duplex radio modem with several operating modes:

- \* Pass mode (to use SDR console or GNU radio, for example)
- \* TS mode (for broadcasting and receiving MPEG-TS streams)
- \* GSE mode (for broadcasting and receiving IP streams)

TS and GSE mode reception can be provided by the Longmynd software included in the firmware. Well-known to Linux users, this software can be used to control a minitiouner receiver connected to the Pluto via USB. A USB hub can also be used for Ethernet connection.

Users with a remote Pluto can also use a separate Longmynd receiver (on a raspi, for example) connected to the Pluto via Ethernet. For GSE mode, the version of Longmynd used must support the reception of GSE frames. Note that it is not possible to use F6DZP's Minitioune to receive GSE mode, but current developments of OpenTuner software will soon enable GSE mode to be received under Windows.

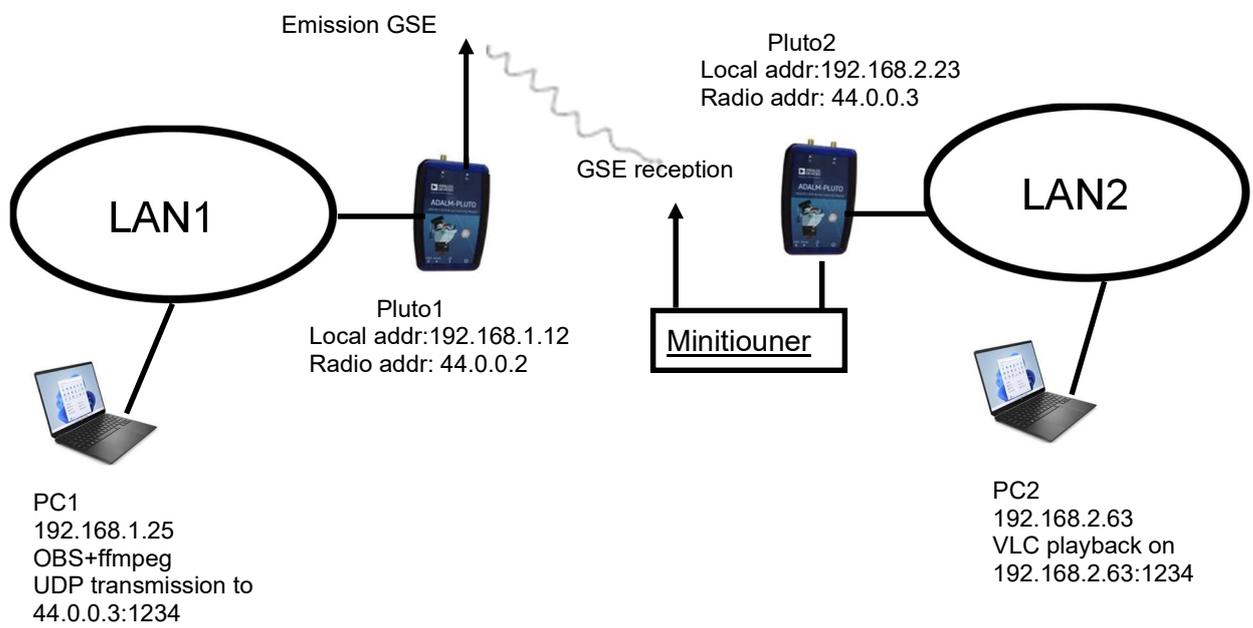
On the transmit side, TS mode is identical to previous firmware modes: Pluto accepts as input an MPEG-TS stream transmitted using the UDP protocol on the multicast address 230.10.0.1:1234. This default address can be changed in the Pluto initialization file. This TS mode doesn't require you to specify a recipient address; it's a broadcast mode, using one radio channel for a simplex link or two channels for a full duplex link. Reception can be carried out using Minitioune or Longmynd.

The GSE mode is quite different for both sending and receiving. In transmit mode, Pluto accepts an IP stream on its local address as input, enabling the use of all IP-based protocols (UDP, HTTP, SCP, etc.). Unlike the previous TS mode, the address of the IP stream's recipient must be specified before the latter can decode it, so this is a unicast or multicast mode. In this mode, Pluto can be seen as an Internet box that connects a local area network (LAN) to one or more other local networks, using one radio channel in simplex mode (for UDP, for example) or two channels in full duplex mode (for TCP-based protocols such as HTTP).

Like an Internet box, Pluto has two IP addresses, one for connection to the local network, the other (the radio address) for connection to the radio channel.

The address range reserved for radio addresses is 44.0.0.0/24 (256 addresses). Pluto's default radio address is 44.0.0.2. It can be changed in the initialization file.

The example below shows a PC1 on LAN1 sending a video stream in UDP (using OBS and ffmpeg, for example) to another PC2 on LAN2, which can play back the video using VLC. Here we use a radio channel (satellite or terrestrial) in simplex mode.

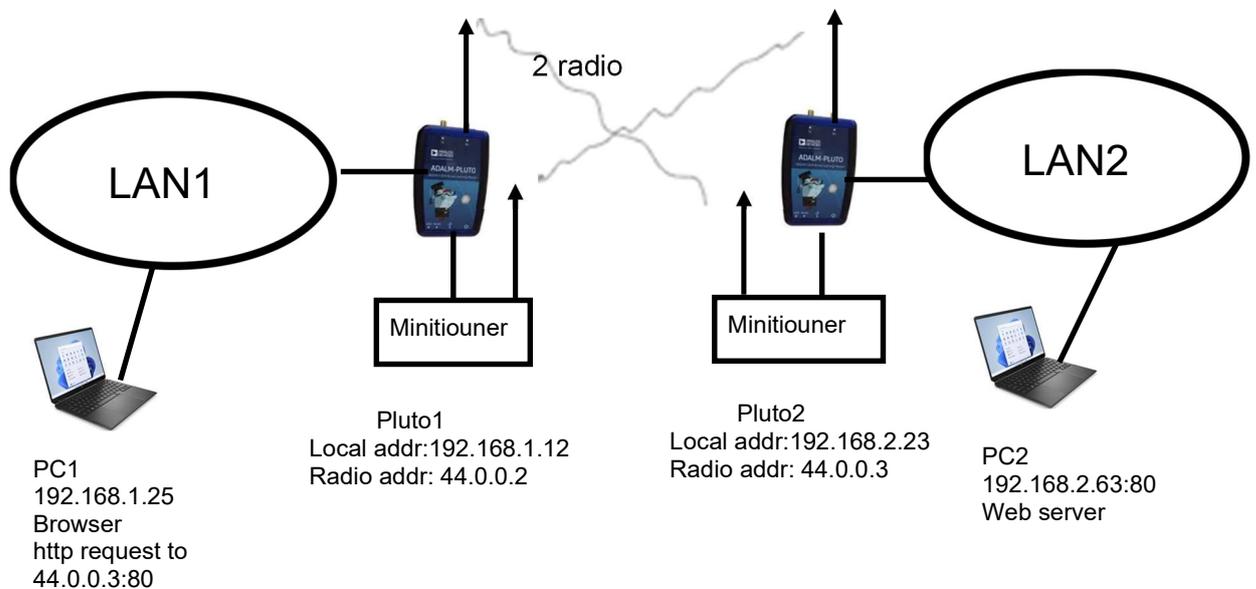


For transmission, specify the radio address and port of the IP UDP stream recipient (44.0.0.3:1234) in the source generating the TS (ffmpeg or other). This address is a priori inaccessible from PC1's local network, so we need to indicate that IP streams destined for addresses 44.0.0.x are to be sent to Pluto1 (whose local address is 192.168.1.12), which will act as a gateway to the radio network. To do this, enter the following command on the PC1 transmitter: `route -p 44.0.0.0/24 192.168.1.12`. This command indicates that all IP flows to addresses 44.0.0.x will be sent to the Pluto1 gateway, and can be entered using Windows powershell in admin mode. Pluto1 will then transmit the IP stream on the chosen radio channel (frequency and SR).

Remote reception is handled here by Pluto2's internal Longmynd, tuned to the transmission radio channel and with the right SR, which sends (here internally) the GSE frames received by the minitiouner to Pluto2's GSE module, responsible for extracting the IP UDP stream. This stream will then be available on the Pluto2's radio address (44.0.0.3). As with an Internet box, you then need to specify a NAT rule to redirect this stream to the PC2 (192.168.2.63), which will be able to play back the video in UDP with VLC. This is done using the PCforward parameter in the Pluto2 initialization file. This redirection depends on the protocol type (here UDP) and the IP port used for transmission (here 1234).

It's also possible to transmit several video streams simultaneously to the same radio address (specifying a different port number for each IP stream), or to different radio addresses using a single radio channel. Many combinations are possible.

The example below illustrates the case of a full-duplex GSE link. PC1 on LAN1 wishes to access a Web server on LAN2. The protocol used is TCP-based HTTP, which requires a full duplex link, i.e. two radio channels. The routing rule for the sending PC1 is the same as for the previous example, but the NAT rule for PC2 must redirect the TCP IP stream from port 80 arriving at the Pluto2 radio address to the local address of the Web server. This is also done using the PCforward parameter in the PC2 initialization file.



All the Pluto functions mentioned above (transmission and reception with the internal longmynd) can be controlled using the MQTT (mosquitto) protocol, which makes it very easy to issue different commands with their parameters from the Pluto, but also from any other computer connected to the network. These commands can be issued from a Windows PC, for example, and user-friendly interfaces created using a range of programming languages, most of which support the MQTT protocol. Examples of MQTT commands are included in the firmware package.

On the other hand, Pluto constantly publishes its status, i.e. the values of the various parameters managing these different functions: for example, its transmission frequency, SR, Longmynd reception frequency, the value of the GSE frame queue, etc....all this information can be read from software such as MQTT explorer under Windows.

You will find inside this package the new firmware and different windows batch scripts to control the Pluto without any interface. But before playing you must do some important steps :

#### Step 1:

- \* Install Eclipse mosquitto on your PC (<https://mosquitto.org/download/>), necessary to control the Pluto from your PC
- \* Install MQTTexplorer (<http://mqtt-explorer.com/>), very useful to monitor Pluto status and eventually Longmynd status (for GSE mode) on your PC

#### Step 2:

- \* Unzip the package in a directory of your choice
- \* Flash your Pluto with the firm firmware as usual

#### Step 3:

- \* Open a windows terminal (cmd.exe)
- \* Go to your unzip directory
- \* Launch the setcall script with two parameters : type setcall param1 param2, param1 must be your call (eg F5OEO), param2 must be the IP Pluto address (eg 192.168.1.55), this will set your call in the Pluto  
this has to be done only once.
- \* Reboot your Pluto
- \* Launch the setup script with two parameters : type setup param1 param2, param1 must be your call (eg F5OEO), param2 must be the IP Pluto address (eg 192.168.1.55), this will set PC environment variables  
this has to be done only once unless you want to change your Pluto IP address
- \* After the setup you must close and relaunch your terminal windows

#### Step 4:

- \* Edit the script initdvb.bat and read carefully the parameters explanations, set your defaults values  
NB : after a reboot the Pluto is in passthrough mode so you can use it with sdr-console or gnu-radio at start-up

#### Step 5

- \* Launch MQTTexplorer, define a new session with the Pluto IP address, start the session
- \* Launch the initdvb script (which you edited above)
- \* Verify your settings in MQTTexplorer

#### Step 6

- \* You should be ready to test the TS mode (input address is by default 230.10.0.1:1234) first try with basic settings and with your usual TS source, a good practice is to test locally before transmitting on the transponder...
- \* You will also find some useful scripts allowing to change specific parameters without needing to relaunch initdvb. These scripts must be launched with one parameter (its value) in the command line.  
Some examples :
  - \* sr.bat 333000 will set the sr value to 333000 symb/sec
  - \* freq.bat 2403.25e6 will set the TX frequency to 2403.26 Mhz
  - \* mode pass set the Pluto in passthrough mode, perhaps you will need to reboot the Pluto in order to get back to TS or GSE mode
  - \* ...
  - \* reboot.bat does a Pluto reboot

Enjoy!

