

All-in-One DVB-T Setup

DVB-T TX and RX with One PC

by Rick Peterson, WA6NUT

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Operating Instructions

All-in-One DVB-T ATV Setup DVB-T TX and RX with One PC

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INTRODUCTION

This document provides the procedure for setting up the DVB-T station at WA6NUT. Settings for OBS Studio, DATV-Easy, F5OEO firmware, DVB-T receiver, and VLC Media Player are given. Other details are specific to the WA6NUT setup, and may not apply to your station.

This document describes the best ATV setup I've found. It uses receiving software from DDØCW and transmitting software from F1EJP and F5OEO. And all on one \$179 HP laptop! (2024 Cyber Monday price – at this writing the price is now back to \$599! – I paid \$299 on Cyber Monday in 2023).

The DDØCW software receiver was originally intended to receive and process the 5 MHz IF output from the BATC “Knucker” receiver. It was available for download from the BATC forum, but is no longer available. I modified it for general purpose use (I use it on the 70 cm band), and the modified version can be downloaded from my website. I have found the receiver to be more robust than others, requiring no adjustment over many hours of operation. No additional software (i.e., TS Reader) is required for tuning, as a feature (the “sig. out activity” window) monitors the data flow from the receiver to the VLC display software. And it also has the usual constellation and spectrum displays. See the link below for more information on the original Knucker receiver software:

<https://forum.batc.org.uk/viewtopic.php?f=134&t=8239>

All-in-One DVB-T ATV Setup

LAPTOP PC

HP 17z-cp200, Windows 11 (with camera)

Control Panel --> Hardware and Sound --> Power Options -->
Create a Power Plan:

Click on "Performance" radio button

"Turn off the display" = Never

"Put the computer to sleep" = Never

Click on "Create"

TRANSMIT (see Figures 1-4)

Hardware:

Camera (Logitech C920)

Mic (Eivotor YX-3)

USB Sound Card (Manhattan 151429)

USB Hub (GigaWare 26-424)

USB Wall Charger (available from many sources)

USB-C to USB-A Adapter Cable (Amazon Basics)

Transmitter hardware:

ADALM Pluto Rev. C with F5OEO 0303 firmware

Leo Bodnar Mini Precision GPS Reference Clock

SBB5089/SZA2044 Amplifier: See KH6HTV review p. 6

<https://kh6htv.files.wordpress.com/2023/02/tv-rptrs-rptr-122.pdf>

(the above items are housed in the DVB-T Transmitter)

All-in-One DVB-T ATV Setup

13.5/30Vdc 1A AC Adapter (for DVB-T Transmitter)
(set to 13.5Vdc)
Radio Shack 273-1668

RA30H4047M Amplifier See W6ORG website:
<https://hamtv.com/pdffiles/PA5RA30H4047M.pdf>

SureCom Pwr/SWR Meter
25W Dummy Load

HP ATX 12Vdc Power Supply (for RA30H4047M Amp)

ATX PC Power Adapter Board (diymore from Amazon)

Software: Mini GPS Clock Configuration app
Logitech Capture (Driver for C920)
OBS Studio v. 27.2.4 (64-bit)
DATV-Easy v. 2.16 (by F1EJP)
Microsoft Edge browser: Pluto Controller and Analysis pages

Ensure that the SMA connector on the DVB-T Transmitter front panel is connected to the amplifier input, and that the DVB-T Transmitter power receptacle is connected to the 13.5 VDC power supply (the front panel green LED should be illuminated). The amplifier output should be connected to the SureCom Pwr/SWR meter input, and the meter output should be connected to the 25W dummy load. Ensure that the SMA connector on the DVB-T Transmitter rear panel is connected to the GPS antenna, and that the 2 USB ports are connected to the PC.

1. Open **Mini GPS Clock Configuration** app. Check that the PLL Lock text box indicates "PLL Lock OK." If it is not locked:

Advanced --> Update

All-in-One DVB-T ATV Setup

2 Open **OBS Studio (with OBS VirtualCam 2.0.5 plugin installed)**:

See F1EJP DATV-Easy 2.16 PDF instructions p. 2

Source = Video Capture Device
HD Pro Webcam C920

Settings --> Audio --> Global Audio Devices --> Mic/Auxiliary Audio =
Microphone (3-C-Media USB Headphone Set) --> OK

Tools --> VirtualCam --> uncheck "AutoStart" --> Stop --> Exit

Settings --> Video

Select: Base (Canvas) Resolution = 1920 x 1080
Output (Scaled) Resolution = 1920 x 1080
Common FPS Values = 25 PAL

Apply --> OK

Tools --> VirtualCam --> check "AutoStart" --> Start --> Exit

Settings --> Output

Select: Streaming Bitrate = 2500 kbps
Audio Bitrate = 150

Apply --> OK

Minimize OBS

3 Open **DATV-Easy**

Click "Easy." Select "436.00 DX". Click "Valid." "436.000" is shown under
"Frequency MHz."

All-in-One DVB-T ATV Setup

DVB/MPEG-TS tab (see F1EJP DATV-Easy 2.16 PDF instructions p. 8)

DVB = DVB-T QPSK (see Note 1)

Codec = H262

Bandwidth = 250 kHz

Image size 16/9 = 640 x 360

FEC = 2/3

FPS = 15

Guard Factor = 1/32

Audio Codec = AAC+

Mode = 2K

Audio kb/s = 12 kb/s

Configuration tab (see F1EJP DATV-Easy 2.16 PDF instructions p. 3)

Settings/Equipment = Pluto F5OEO 0303 2402 60 100

Adalm Pluto SDR IP = 192 168 2 1 8282 1 (my IP, yours may vary)

Input/Entree = OBS + Virtual Cam

Encoder = AMD

Default FPS = 15

Audio sync $\pm$ ms = 0

Audio SR = 44100

DVB Tables tab (see F1EJP DATV-Easy 2.16 PDF instructions p. 6)

Default values

- 4 Open **Microsoft Edge browser** (See Note 3)

Click "ADALM Pluto DV . . ." tab on Windows Toolbar.

Brings up 192.168.2.1/pluto.php (my IP, yours may vary)

Click "Controller" button at top.

"ADALM-PLUTO DATV Controller" page is displayed.

All-in-One DVB-T ATV Setup

On browser “Controller” page, the following settings are required:

Modulator Settings:

Power = -11.3 dB

PCR/PTS = 2000 ms

PAT period = 1000 ms

Freq-Manual = 436.00

Freq-Channel = Custom

Mode = DVBT

Mod = QPSK

SR = 250 250 KS

FEC = 2/3

On browser “System” --> “Setup” page, the following settings are required:

Main mode selection = DATV

DATV operating mode = UDP

Pluto Configuration

USB on Ethernet

Host name = pluto

IP Address = 192.168.2.1

Host IP address (computer) = 192.168.2.10

Network mask = 255.255.255.0

Ethernet

IP Address = 192.168.1.40 (my IP, yours may vary)

Network mask = 255.255.255.0

Gateway IP Address = 192.168.1.1

Click “Start +” button. The green LEDs light. “Transmission” reads about 250 kb/s on DATV-Easy app.

All-in-One DVB-T ATV Setup

On browser “Controller” page note red “ON AIR” text and red border around Modulator settings. When DATV-Easy “Start +” button is clicked, “Buffer” on the “Controller” page should change from “Underflow” to “Nominal.” The DATV-Easy “Stop” button is not clicked until the end of the ATV session.

Initialize the DVB-T transmitter by reducing the F5OEO “Controller” page power setting by 1-2 dB, then increasing it by 1-2 dB to the original setting (don't ask why, it just works!).

Click PTT “Switch OFF” button on browser “Controller” page.

To transmit, press RA30H4047M Amplifier PTT button, then click F5OEO PTT “Switch ON” button. The SureCom Pwr/SWR meter should read 3-4 watts output power. To end transmission, click F5OEO PTT “Switch OFF” button, then press RA30H4047M Amplifier PTT button.

Allow for a 12-15 sec delay between clicking the F5OEO PTT “Switch ON” button and VLC displaying your video at the receiving station. Typical latency in the received video is about 7-9 sec.

Adjust Mic gain from Windows Sound (Recording) as needed:

Sound --> Sound Settings --> Sound Control Panel --> Recording --> Microphone (3-C-Media USB Headphone Set) --> Levels

Click “Analysis” button at top of browser “Controller” page. Note “Null Packets” on bargraph and data to right on the “Analysis” page. “Null packets among 251 332 kbits/s” should be < 20%. Note “Video buffer analysis” graph at bottom of page. This graph shows the health of the transport stream being applied to the Pluto transmitter. Note how the graph is disturbed when the camera detects rapid motion.

Return to “Controller” page by clicking browser “back” <-- button.

All-in-One DVB-T ATV Setup

RECEIVE (see Figures 1-4)

Receiver Hardware: GE 42178 Antenna Amplifier: See AH2AR/N8ZM video:
https://www.youtube.com/watch?v=Gekwf6SgM8k&ab_channel=W8BIATVRepeater

SDR Receiver (RTL-SDR V3)

Amplified speakers

Software: GNURadio Companion v. 3.9.0.0

Knucker_ZF_RTL_dvbt_rx.zip (by DDØCW)

(after unzipping, all the Knucker files should be located in the same folder)

VLC Media Player

- 1 Apply power to the GE Antenna Amplifier.

Turn laptop ON and let it boot up to opening screen.

- 2 Open **VLC Media Player** (“traffic cone” icon on desktop).

Audio --> Audio Device = Default: Headphone (Realtek (R) Audio)

Media --> Open Network Stream --> `udp://@230.0.0.1:1234` --> Play

- 3 Open **GNURadio Companion** (“run GRC shortcut” icon on desktop)

Command line black screen opens, GNURadio sets up GR Companion (this will take a while)

When setup is complete, a flow graph is displayed.

Click on “**Knucker_ZF_RTL_dvbt_rx**” tab.

Click “Execute the flow graph” button (“play” triangle on button).

All-in-One DVB-T ATV Setup

GR Companion will convert the flow graph to a receiver control/display screen (GUI). Watch progress in text displayed at lower left.

Receiver controls and displays (GUI) appears.

Receiver settings:

Bandwidth = 250K

FEC = 2/3

Start QRG (Hz) = 436000000 (press "Enter" key after entry)

RX act. QRG (Hz) = 436000000 (press "Enter key after entry)

QRG Rough = -4.0 (my setting, yours may vary)

Fine = -222 (my setting, yours may vary)

RF Gain (dB) = 11.0 (my setting, yours may vary)

When receiving the other station, the "Constellation" display should show four distinct clusters (QPSK pattern). The clusters should not be too tight (avoiding receiver overload) nor too loose (ensuring VLC lock). Rapid activity should be shown in the "sig. out activity" display (indicating data flow between the DDØCW "Knucker" receiver and VLC). The counter at the left below the display should be incrementing.

- 4 VLC lock to the input stream from the receiver is indicated when the orange search activity bar (just below displayed image) stops scanning and disappears.

Digital noise or audio from other station will be heard on speakers (adjust speaker volume from Taskbar as required). The received image is displayed on the VLC screen. Maximize the VLC display for a full-screen image. Adjust the receiver RF Gain slider control for maximum height of the displayed spectrum above the spectrum "shoulders."

All-in-One DVB-T ATV Setup

Display VLC Current Media Information to check the health of the UDP stream from the DVB-T receiver:

Tools --> Media Information --> Statistics

If reception of the DVB-T signal becomes intermittent, try stopping (“pause” square on button) and restarting (“play” triangle on button) the DVB-T receiver flow graph (after minimizing the receiver control/display screen). See Note 5. Or VLC may need to be stopped and restarted:

Playback --> Stop

Media --> Open Network Stream --> Play

5 To EXIT:

Receiver:

Minimize receiver controls/display screen to return to flow graph.

Click the “Kill the flow graph” button (“pause” square on button).

File --> Quit. Command line black screen will be briefly displayed.

VLC Media Player:

Media --> Quit

Turn GE Antenna Amplifier OFF.

URLs for Downloading Software/Firmware

Transmit

F5OEO 0303 Firmware for ADALM Pluto (See Note 2 below)

<https://www.f5uii.net/en/patch-plutodvb/>

All-in-One DVB-T ATV Setup

mini GPS clock configuration: Leo Bodnar Mini Precision GPS Reference Clock

http://www.leobodnar.com/shop/index.php?main_page=index&cPath=107

http://www.leobodnar.com/shop/index.php?main_page=product_info&cPath=107&products_id=301

OBS Studio v. 27.2.4 (OBS-Studio-27.2.4-Full-Installer-x64.exe & obs-virtualcam-2.0.5-Windows-Installer)

<https://github.com/obsproject/obs-studio/releases>

<https://github.com/Fenrirhvit/obs-virtual-cam/releases>

DATV-Easy v. 2.16 (by F1EJP) Be sure to download both the software (.zip file) and the instructions (.pdf file).

<http://www.vivadatv.org//viewtopic.php?f=84&t=982>

Also see DATV-Easy presentation by PA3FBX at:

https://www.youtube.com/watch?v=mp05-faLtHU&ab_channel=BATCOnline

Also install the following (included in the SetupF1EJP-DATV-Easy-V2.16 folder):

PlutoSDR-M2k-USB-Drivers.exe

libiio-0.24.gc4498c2-Windows-setup.exe

Logitech Camera Driver (Logitech Capture)

<https://www.logitech.com/en-us/software/capture.html>

Receive

GNURadio Companion v. 3.9.0.0 (see Note 4 below)

<https://web.archive.org/web/20220316012358/gcnddevelopment.com/gnuradio>

All-in-One DVB-T ATV Setup

Knucker_ZF_RTL_dvbt_rx.zip DVB-T Receiver by DDØCW

https://www.qsl.net/wa6nut/Knucker_ZF_RTL_dvbt_rx.zip

VLC Media Player

<https://www.videolan.org/vlc/download-windows.html>

Notes:

- 1 If there is no “DVB-T QPSK” option in the “MPEG Transport Stream” “DVB” text box, try typing “DVB-T QPSK” into the text box. You may find that the text will complete itself before you finish typing!
- 2 Install F5OEO 0303 firmware using the instructions at the ZR6TG website (here's the link):

<https://www.zr6tg.co.za/2022/06/28/adalm-pluto-rev-c-d-configuration-for-datv/>

You'll need the PuTTY utility to do this. Download PuTTY from:

<https://www.putty.org/>

The ZR6TG website also gives instructions for configuring the Pluto for an external 40 MHz clock (the Leo Bodnar Mini Precision GPS Reference Clock). The external clock replaces the Pluto's clock oscillator (with ± 25 ppm stability). An accurate, stable transmitted signal is especially important when the other station's receiver lacks AFC.

- 3 Open the Microsoft Edge browser and enter 192.168.2.1/pluto.php (my IP, yours may vary) in the search window. Press the Enter key, and the F5OEO Pluto screen should appear. Set this address as a favorite in the Edge browser, so that it can be opened in the future by simply clicking on a tab.

All-in-One DVB-T ATV Setup

- 4 Version 3.9.0.0 downloads as a .zip file from the archive.org website. After unzipping, go to GNURadio-3.9 --> bin --> run_GRC. Right-click on run_GRC and select "Create Shortcut." Then drag the shortcut to the desktop. Now you can open GNURadio Companion by double-clicking on the "run_grc Shortcut" icon on the desktop.

After downloading and unzipping the Knucker_ZF_RTL_dvbt_rx.zip file, the 6 files and _pycache_ folder should be placed in the same folder (in the author's setup, the c:\users\arand\Documents\DVB-T folder). Open GNU Radio Companion, navigate from File to Open, highlight Knucker_ZF_RTL_dvbt_rx.grc, then click on Open at the bottom of the page. GNU Radio Companion will set up the Knucker receiver flow graph, with a "Knucker_ZF_RTL_dvbt_rx.grc" tab above the flow graph. In the future, the tab will be available to select the Knucker receiver after GNU Radio Companion is opened.

- 5 The DDØCW receiver usually quickly recovers from buffer overflow events. In the rare event of an extended stall, the receiver can be restarted by stopping ("pause" square on button) and restarting ("play" triangle on button) the DVB-T receiver flow graph. Figure 4 shows how the GNU Radio Companion 3.9 GUI is minimized for easy access to the buttons (upper right corner).
- 6 The DDØCW receiver has a useful (and entertaining!) feature, accessible via the "read OFDM data file" button. DDØCW refers to this feature as a "constellation view kick starter." The receiver plays the GNU.ofdm_data_in file. It seems to work best with settings: SR = 500K, FEC = 1/2. The accompanying audio is best with Windows 10, but choppy with Windows 11.
- 7 For troubleshooting the transport stream from DATV-Easy (to Pluto) or from the DVB-T receiver (to VLC), you can use TSReader Lite.

Download TSReader Lite from:

<https://www.tsreader.com/purchase/purchase/downloadlite.html>

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- 8 For troubleshooting the ADALM-Pluto, you can use the IIO Oscilloscope from Analog Devices. Download the IIO Oscilloscope from:

<https://github.com/analogdevicesinc/iio-oscilloscope/releases>

For more information, go to:

https://wiki.analog.com/resources/tools-software/linux-software/iio_oscilloscope

- 9 For more information on GNURadio, check out the “Field Expedient SDR” books by Paul Clark and David Clark. You'll find the first three volumes useful, especially if you want to customize a GNURadio flow graph.

For more information, go to:

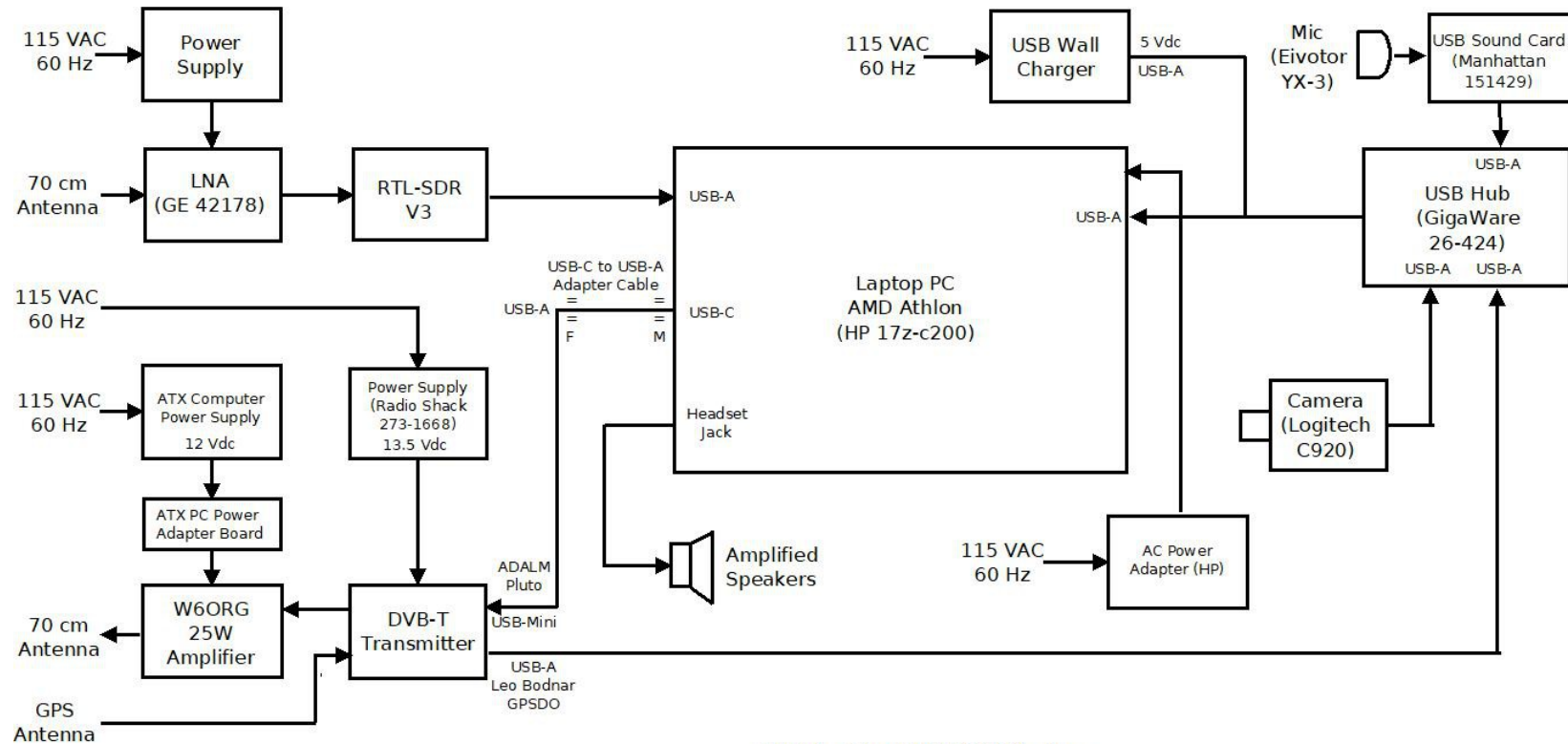
<http://www.factorialabs.com/fieldxp/>

Or search in Amazon for “field expedient sdr.”

The books recommend implementing GNURadio Companion in Linux (rather than in Windows), probably because the Windows version worked poorly back in 2015. But today, in 2025, you'll find the Windows version much simpler to implement and use.

Last revised: 8/25/25

All-in-One DVB-T ATV Setup

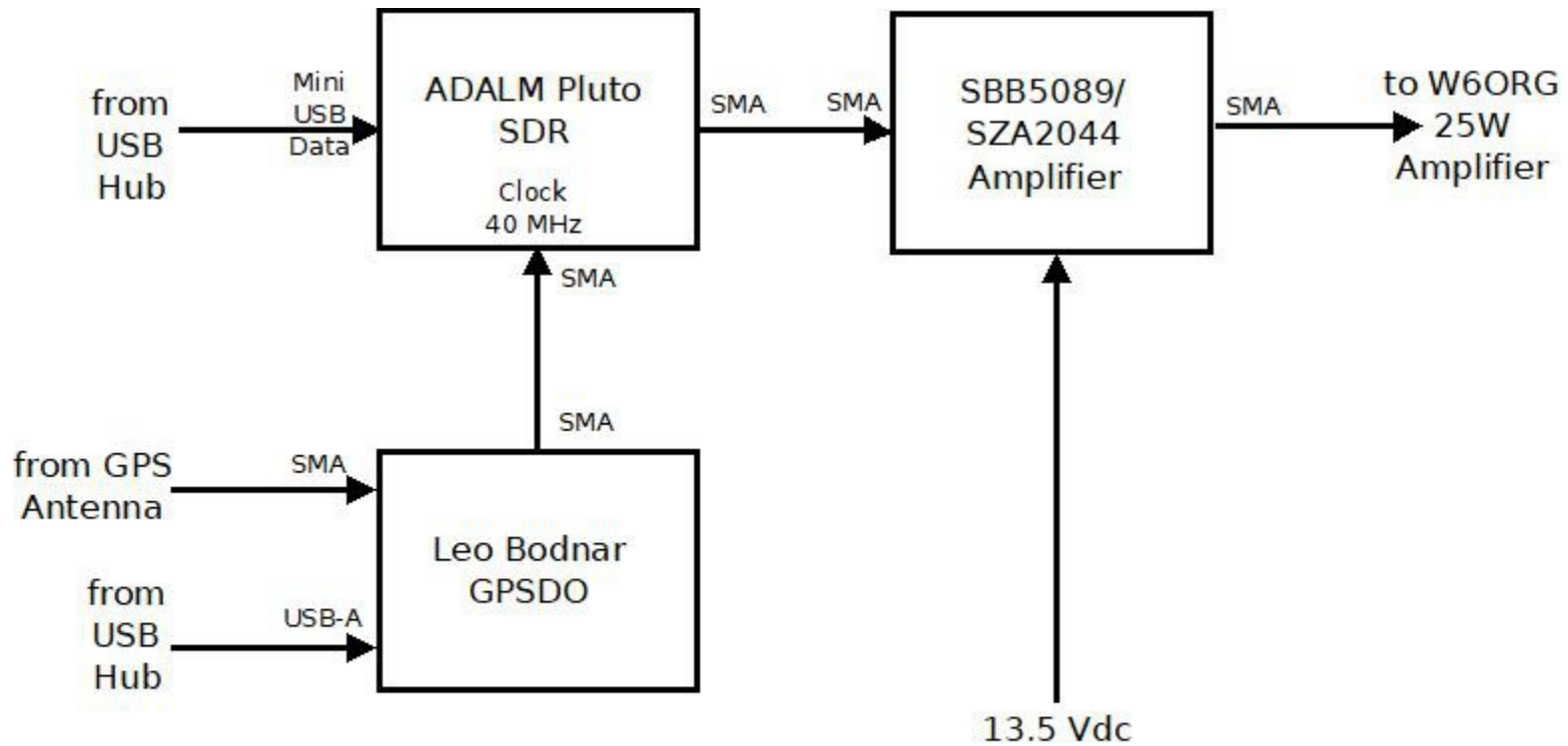


"All-in-One" DVB-T Setup
DVB-T TX and RX with only one PC

R. Peterson, WA6NUT
12/8/24

Figure 1: Block Diagram: All-in-One DVB-T Setup

All-in-One DVB-T ATV Setup



DVB-T Transmitter

Figure 2: DVB-T Transmitter

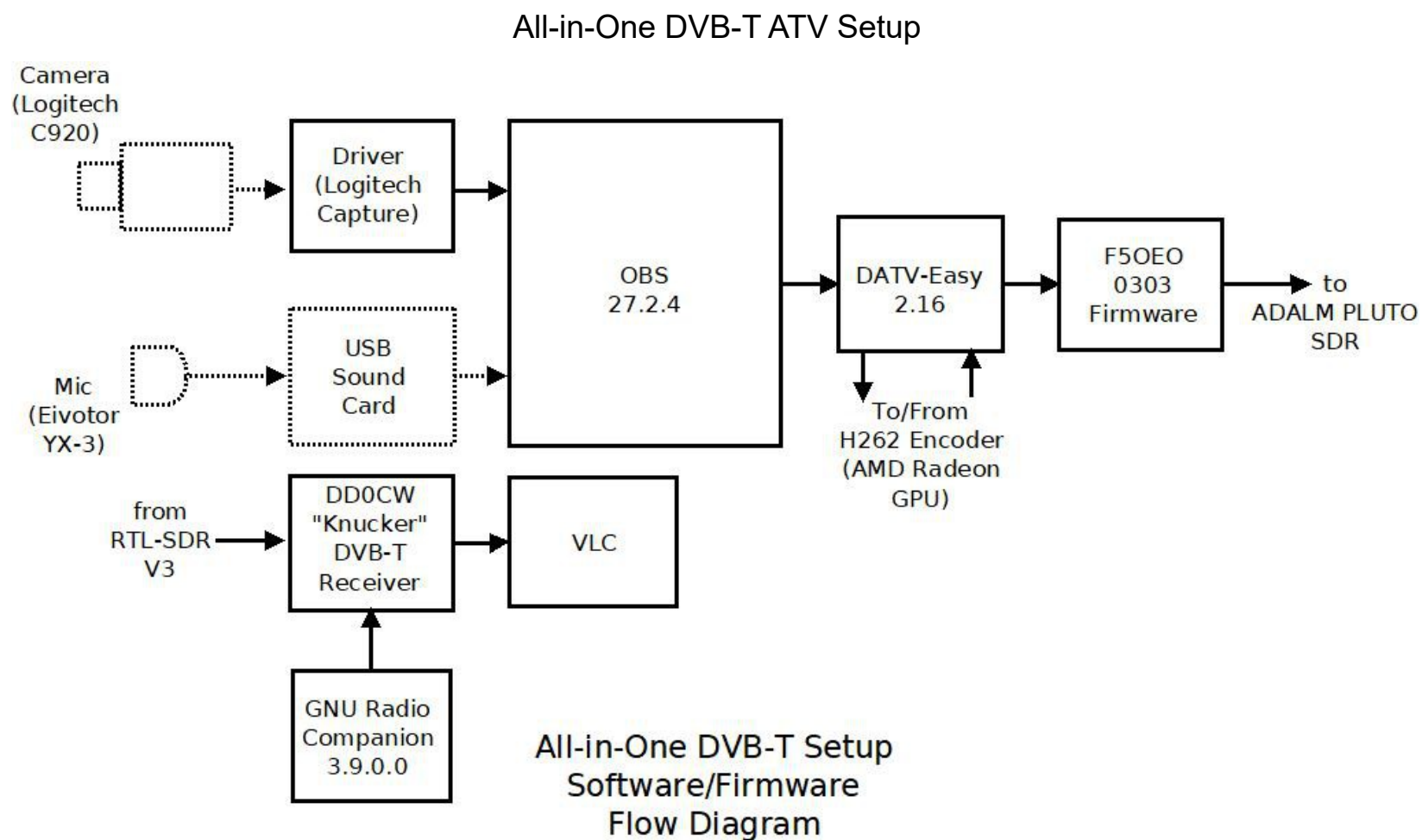


Figure 3: All-in-One DVB-T Setup Software/Firmware Flow Diagram

See DATV-Easy presentation by PA3FBX at: https://www.youtube.com/watch?v=mp05-faLtHU&ab_channel=BATCOnline

All-in-One DVB-T ATV Setup

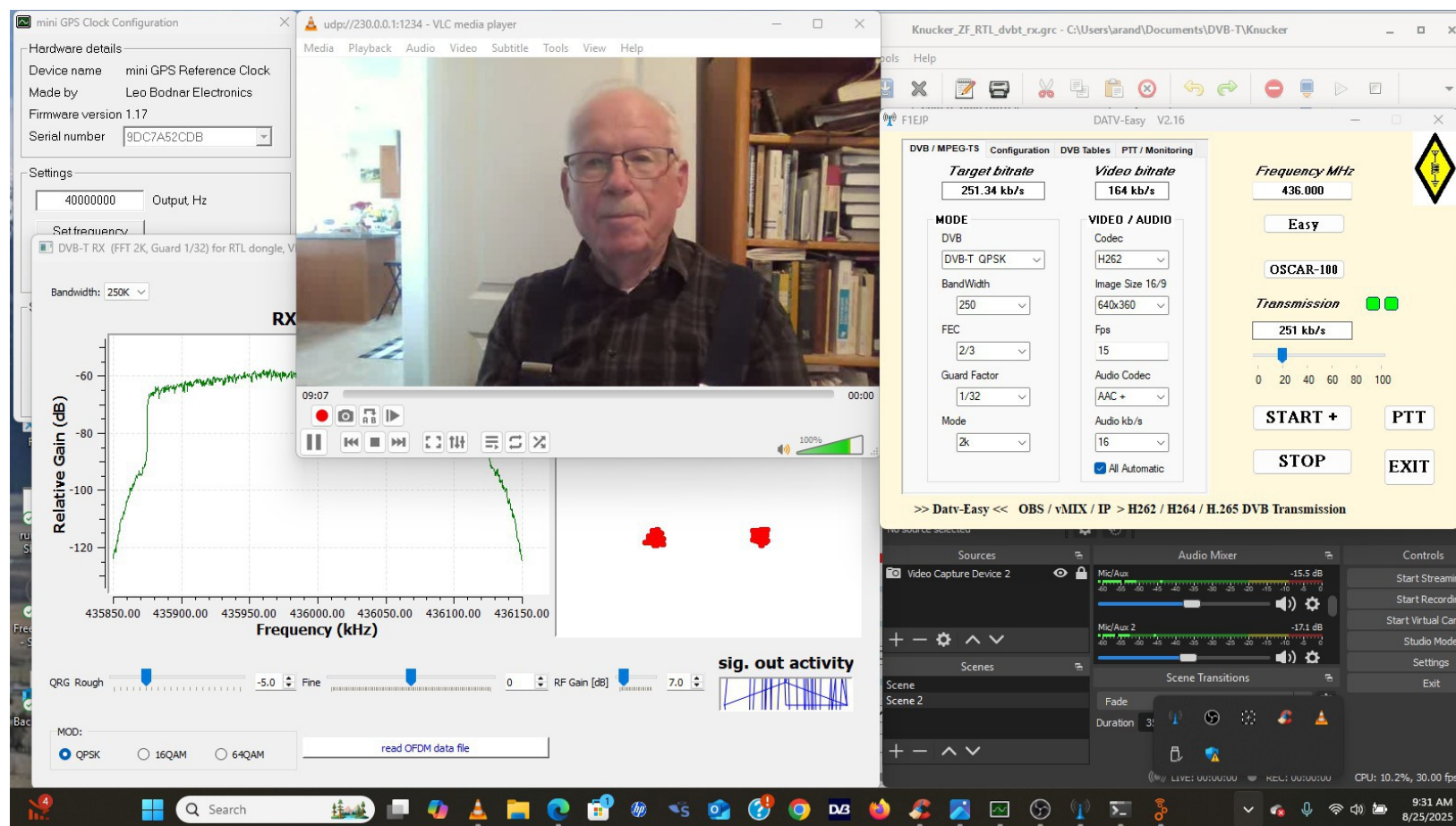


Figure 4: Screenshot: All-in-One DVB-T Setup: Clockwise, from upper right: GNU Radio Companion 3.9 (minimized) with Start/Stop buttons, DATV-Easy 2.16, OBS (showing TX audio levels), DDØCW "Knucker" receiver, Leo Bodnar GPSDO software, VLC (showing received video).