Digital Amateur Television
High Performance
On a Budget

A software approach

Rick Peterson, WA6NUT

Why Amateur Television (ATV)?

Be seen, and not just heard!
QSOs with “Show & Tell”
Technical challenge

Why Digital ATV?

Pros: High quality image vs. analog
Cons: “Cliff effect”
Latency (video)
Lip sync (audio w.r.t. video)

Alternate Approaches to DATV

Hardware Approach

Using HiDes DVB-T TX and RX hardware

Pros: Simplicity, wider bandwidths possible

Cons: Higher cost, fewer options

Software Approach

Using ADALM Pluto (TX) and RTL-SDR (RX) hardware + software

Pros: Flexibility (many options), lower cost

Cons: Reduced bandwidth

What is DVB-T?

Multi-carrier DTV mode, designed for terrestrial use (vs. DVB-S, designed for reception from satellites), European terrestrial TV standard (ATSC 3.0 NextGen TV has similar features)

Pros: Robust under multi-path conditions (especially important in hilly terrain)

Cons: High crest factor requires operating at 10% of rated amplifier output power (not a problem with DVB-S)

WA6NUT DVB-T Station Setup

Designed for portable operation

Function	Hardware	Software
Transmit	ADALM Pluto TX [1]	OBS DATV-Easy F5OEO 0303 Firmware
	Leo Bodnar GPSDO [1]	
	TX Preamp [1]	
	25W Amplifier (W6ORG design)	

Laptop PC: HP 17z-cp200, 17.3”, 3.7 GHz Athlon processor
(one PC used for both transmit and receive)

Notes: 1. Items included in DVB-T Transmitter enclosure

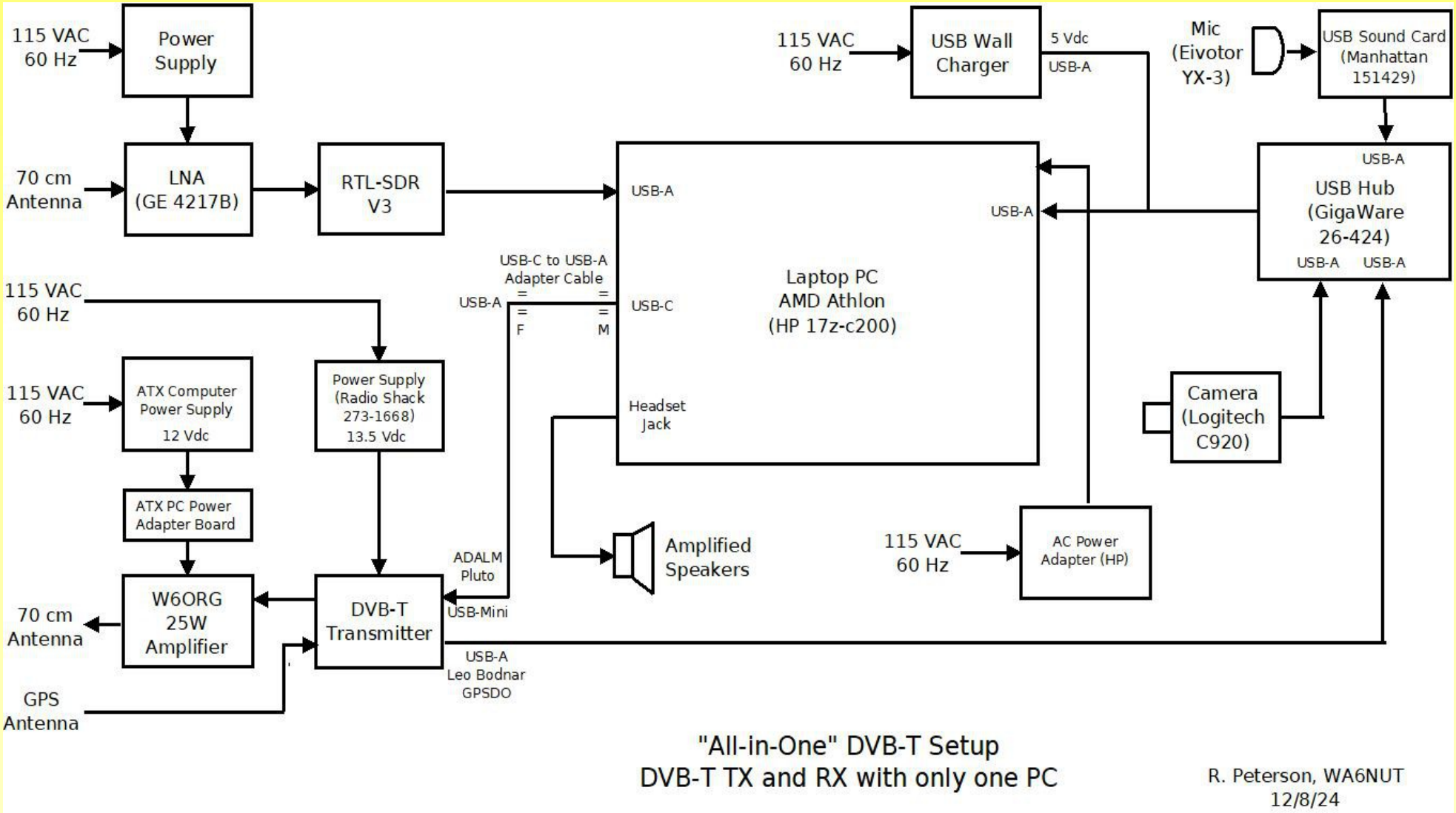
WA6NUT DVB-T Station Setup (cont.)

Designed for portable operation

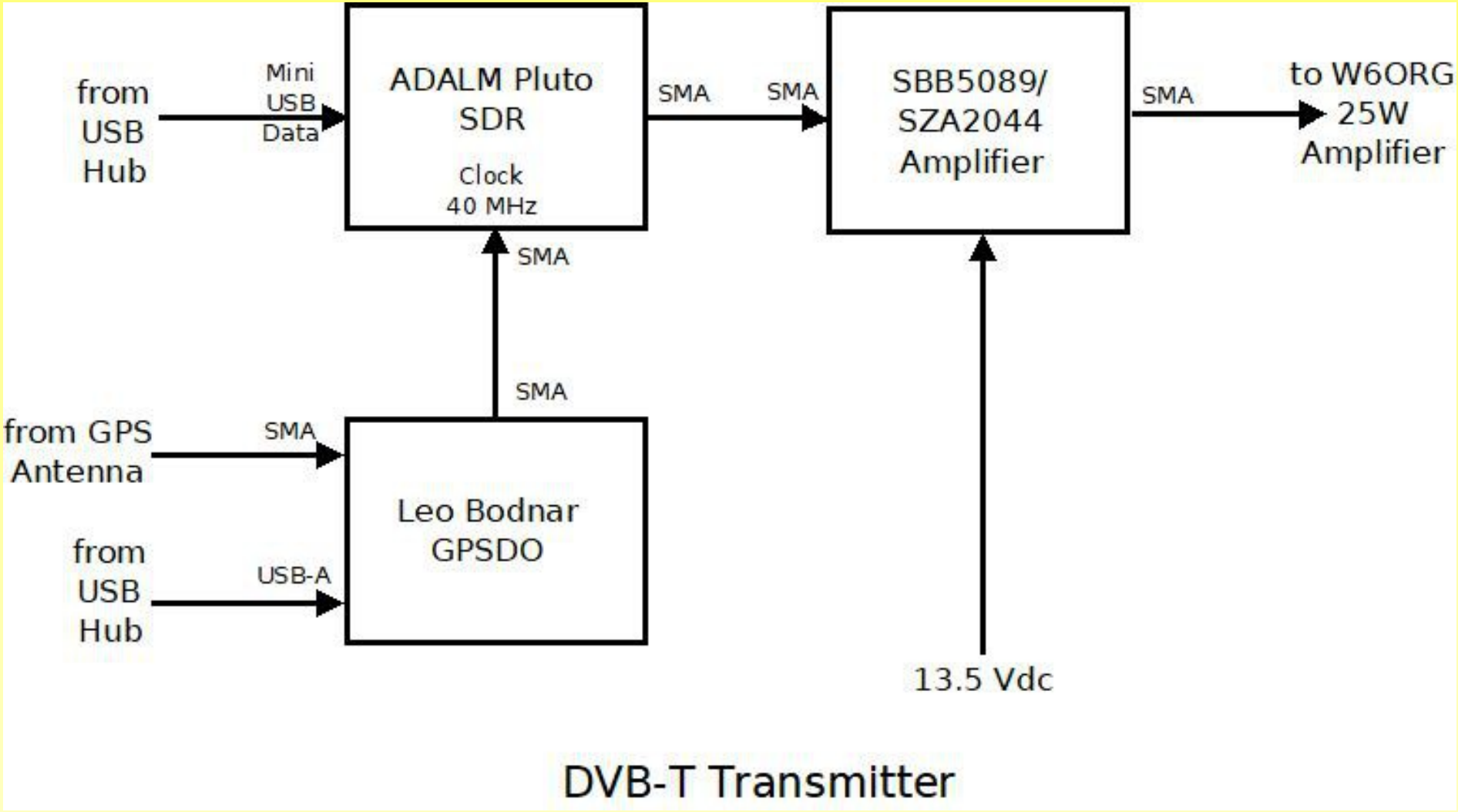
Function	Hardware	Software
Receive	RTL-SDR V3	DDØCW Knucker DVB-T Receiver GNURadio-3.9 VLC
	GE Low-noise RX preamp	
Antenna	8-element 70cm Quagi (w/tripod)	

Laptop PC: HP 17z-cp200, 17.3”, 3.7 GHz Athlon processor
(one PC used for both transmit and receive)

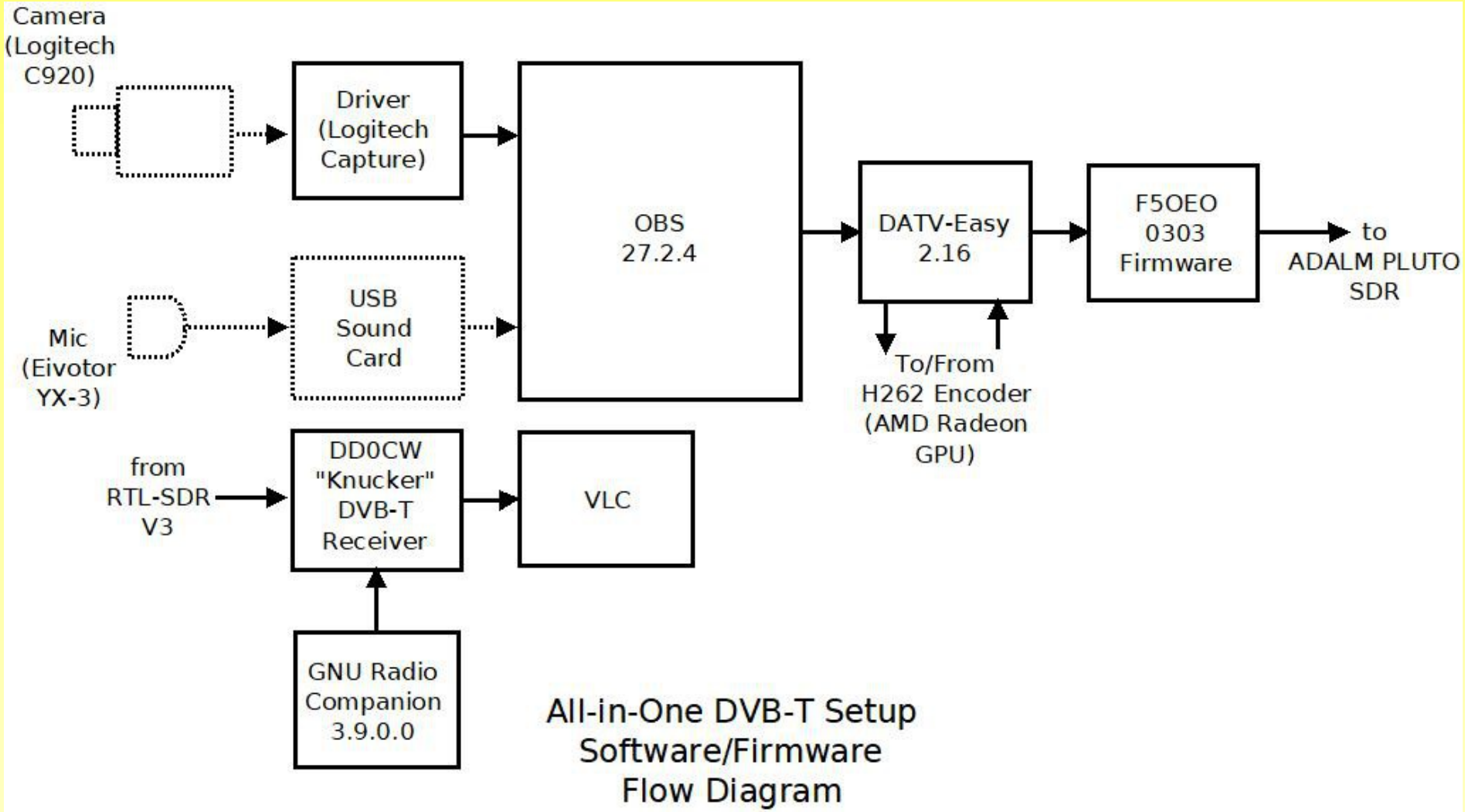
WA6NUT DVB-T Hardware Setup



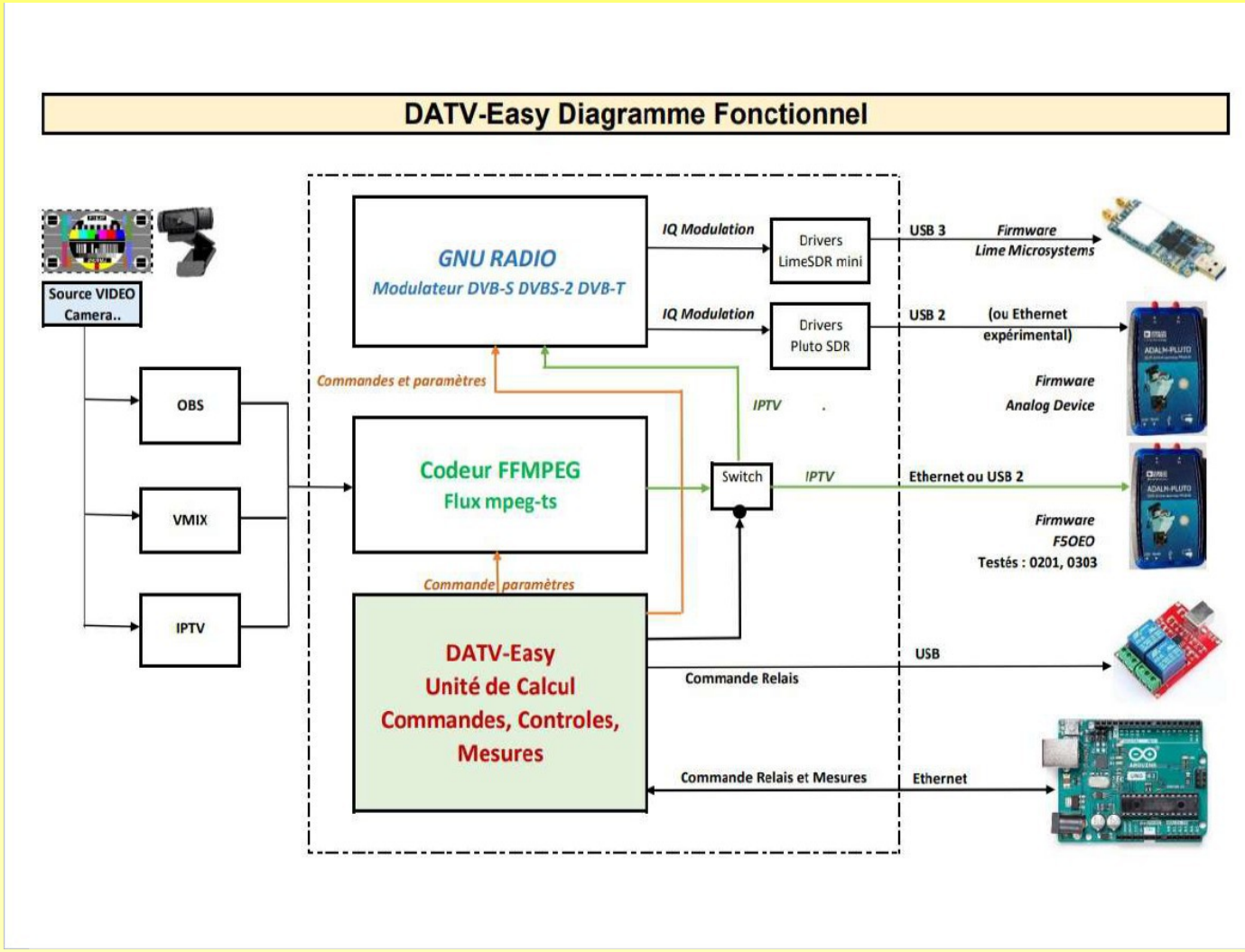
WA6NUT DVB-T Hardware Setup: DVB-T Transmitter



WA6NUT DVB-T Software Setup



WA6NUT DVB-T Software Setup

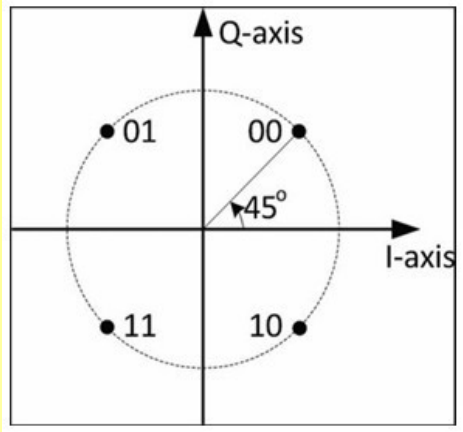


DATV-Easy Block Diagram: Incorporates GNU Radio DVB-T Modulator and FFMPEG script. Interfaces between OBS and Pluto SDR transmitter

WA6NUT DVB-T Software Setup

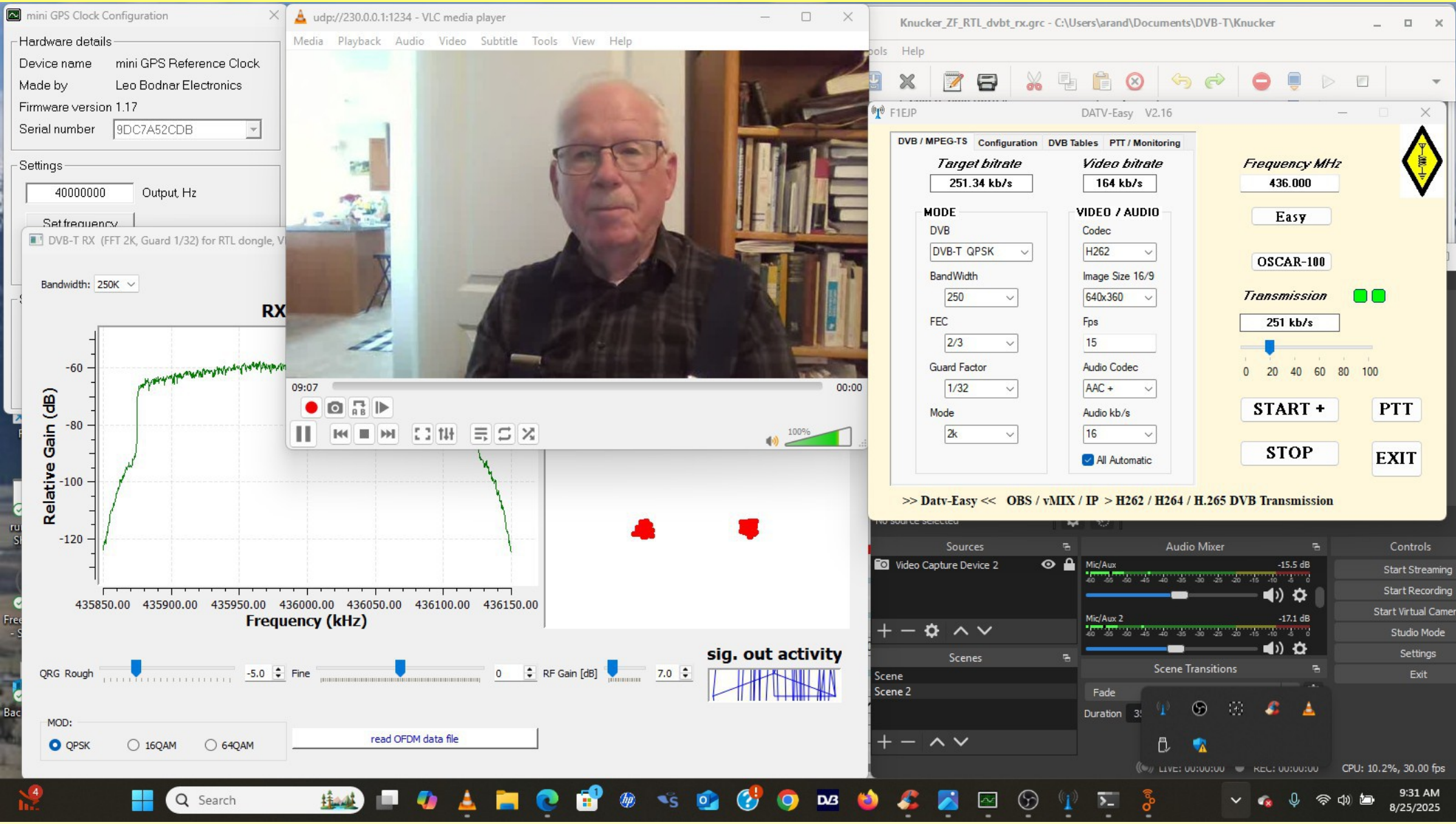
Signal Parameters set by DATV-Easy 2.16 (with FFMPEG)

DVB	DVB-S, DVB-S2 QPSK, DVB-S2 BPSK, DVB-S2 16 APSK, DVB-S2 32 APSK, DVB-T QPSK
Bandwidth	66, 100, 125, 150, 250, 333, 350, 500, 1000, 1500, 2000
FEC	1/2, 2/3, 3/4, 5/6, 7/8
Guard Factor	1/32
Mode	2K
Codec	H265, H264, H262
Image Size 16:9	3840x2160, 1920x1080, 1600x900, 1280x720, 1024x576, 960x540, 854x480, 640x360, 426x240
FPS	Keyboard entry
Audio Codec	MP2, AC3, AAC+
Audio kb/s	256, 192, 128, 96, 64, 48, 32, 24, 16, 12, 8, 6, No Audio
Frequency	Use “Easy” menu (can be edited)



<--- DVB-T QPSK Constellation Diagram (showing 4 possible 2-bit symbols)

Screenshot: WA6NUT DVB-T Setup



Let's Go Portable!

Why portable?

- 70 cm propagation between QTHs is difficult
- No ATV repeater on 70 cm here
- Portable operation is fun!

Planning for portable operation

- Check out potential paths using Radio Mobile Online
- Watch out for obstruction of Fresnel Zone (up to 40%)
- Good local spots:
  - Hwy 24/285 overlook (Trout Creek pass)
  - Frontier Ranch (across from stables)
  - Methodist Mountain: CR108 (at the gate)

Let's Go Portable!

Radio Mobile Online

https://www.ve2dbe.com/rmonline_s.asp

Most Visited | Getting Started | Google Advanced Sear... | Collegiate Peaks > Ho... | Discover Bank Accoun... | Credit Card Login | Dis... | Credit Card, Mortgage...

Radio Mobile — Par/By Roger Coudé VE2DBE — Information

Add to my links | Modify this link | Return to main menu

Radio link study 1

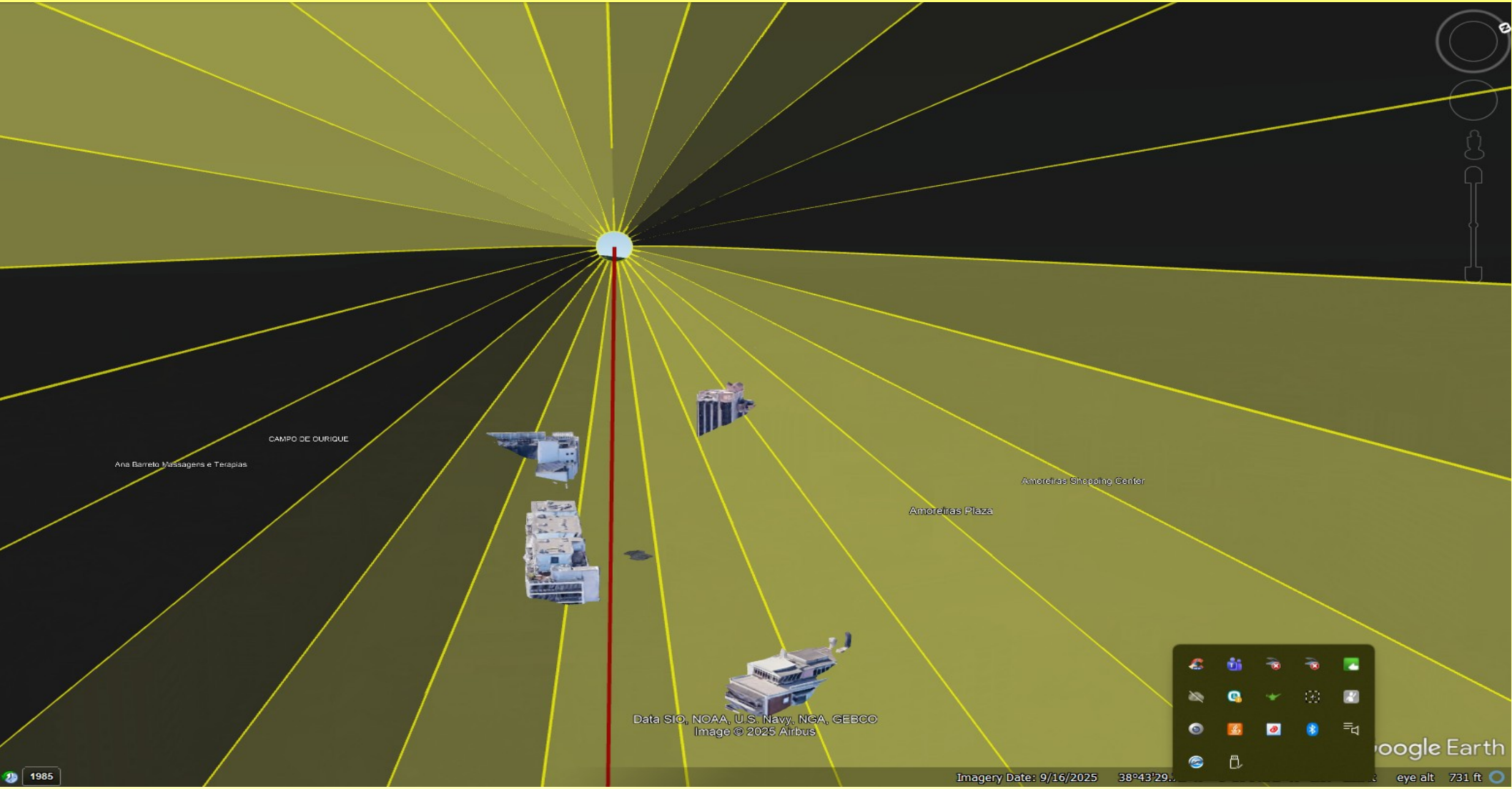
New Site 18 (1)		(2) New Site 16	
Latitude	38.816313 °	Latitude	38.675535 °
Longitude	-106.086184 °	Longitude	-106.123005 °
Ground elevation	2460.2 m	Ground elevation	2549.6 m
Antenna height	2.0 m	Antenna height	2.0 m
Azimuth	191.54 TN | 183.43 MG °	Azimuth	11.52 TN | 3.40 MG °
Tilt	0.25 °	Tilt	-0.39 °

Radio system		Propagation	
TX power	40.00 dBm	Free space loss	109.20 dB
TX line loss	6.00 dB	Obstruction loss	6.72 dB
TX antenna gain	10.00 dBi	Forest loss	1.00 dB
RX antenna gain	10.00 dBi	Urban loss	1.00 dB
RX line loss	0.50 dB	Statistical loss	6.49 dB
RX sensitivity	-113.02 dBm	Total path loss	124.41 dB

Type here to search

10:31 AM
8/6/2020

Let's Go Portable!

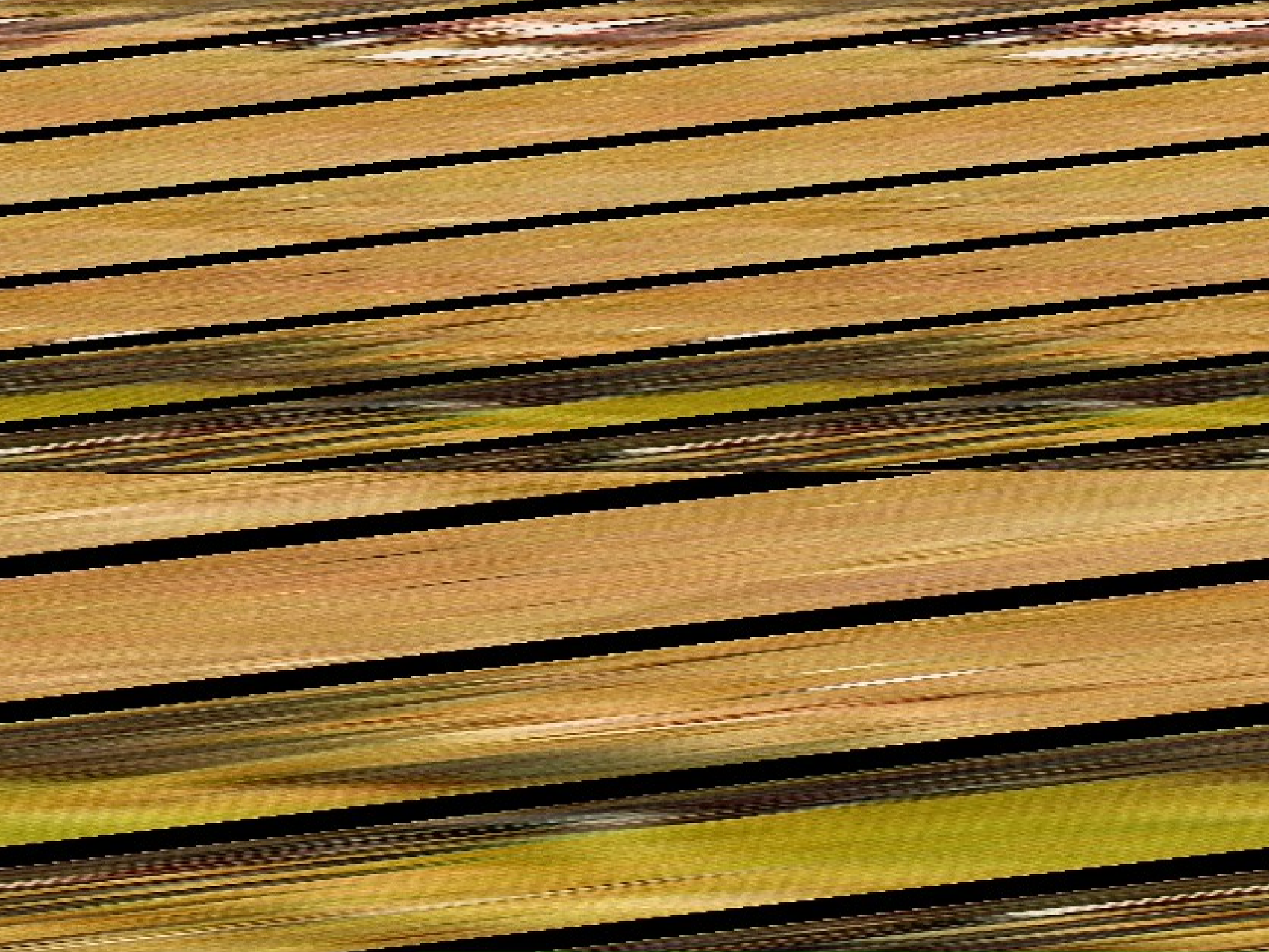


Inside a Fresnel Zone (Lisbon, Portugal): Note buildings protruding into zone. Direct path shown in red. Google Earth KML file from 2015 Enginemaps website (via Archive.org)

Let's Go Portable!


RCA


RCA



Internet Resources for Amateur TV

WA6NUT (https://www.qsl.net/wa6nut)

DVB-T ATV Setup

https://www.qsl.net/wa6nut/All-in-One%20DVB-T.pdf

DDØCW DVB-T Receiver

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

Download “Digital Amateur Television On a Budget” as a PDF from:
https:www.qsl.net/wa6nut/All-in-One%20DVB-T%20ATV%20Setup.pdf

N6NB (SK)

Quagi Antenna

http://n6nb.com/quagi.htm

W6ORG

Introduction

https://www.hamtv.com/pdffiles/ATVStart.pdf

25W Amplifier

https://www.hamtv.com/pdffiles/PA5RA30H4047M.pdf

Internet Resources for Amateur TV

KH6HTV

Products

https://kh6htv.com/products/

Newsletter

https://kh6htv.com/newsletter/

Application Notes

https://kh6htv.com/application-notes/

KØPFX (2022 DCC)

https://slatsatn.net/wp-content/uploads/2022/09/DCC-2022-Charlotte-Intro-to-Amateur-Digital-Television.pdf

G8GKQ (2022 RSGB Convention)

https://www.youtube.com/watch?v=oUoGvXYoY0Y

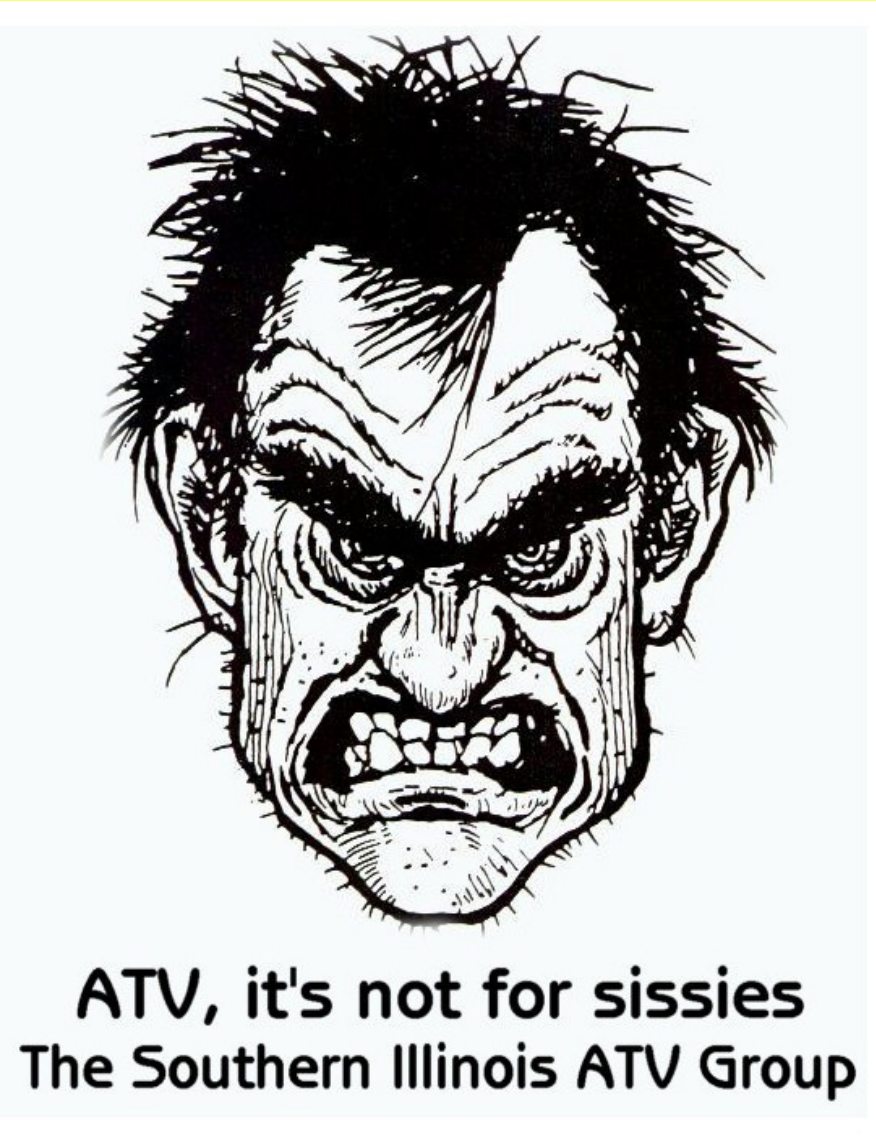
HiDes

Products

https://www.ebay.com/sch/i.html?_ssn=hides168&_trksid=p4432023.m570.l50838

British Amateur Television Club (BATC)

https://batc.org.uk



“Have you ever made 3 trips up the tower, get down, find out that the camera shot craps, fix that, turn the ATV rig on, blow a fuse, finally get everything working, and find out that all the ATVers went to bed? This may look like you.” https://silatvg.tripod.com/images/atv_face.htm

Questions?

Thank you for your attention.

See you soon on Amateur Television!

Credits: Video at Hwy 24/285 Overlook (TX): Brad DeSandro, KJ7RLI
Video of received TV from WA6NUT: Russ Grosch, NØRCG

Last revised: 12/26/24