

# **Digital Amateur Television 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**

**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

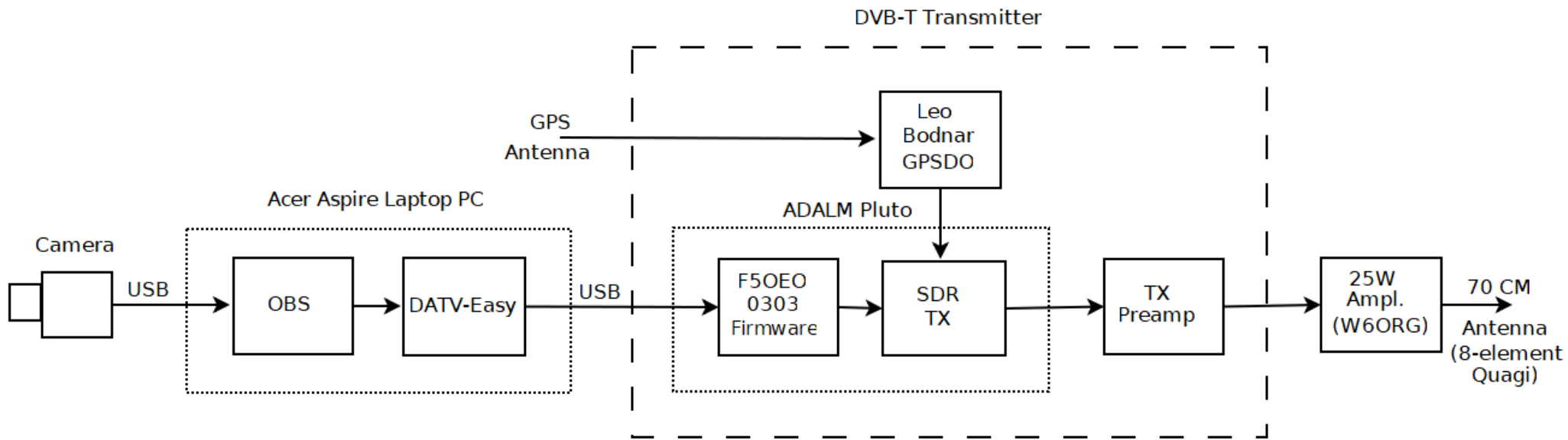
Designed for portable operation

Function	Hardware	Software
Transmit	ADALM Pluto TX <sup>1</sup>  Leo Bodnar GPSDO <sup>1</sup> TX Preamp <sup>1</sup> 25W Amplifier (W6ORG design)	OBS DATV-Easy F5OEO 0303 Firm- ware

Laptop PC: Acer Aspire 7740-5691, 2.133 GHz I3 processor

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

# WA6NUT DVB-T Transmit Setup



# WA6NUT DVB-T Transmit Setup

The screenshot displays a Windows desktop environment used for DVB-T transmission. The primary application is OBS 27.2.4, which is streaming a video feed of Rick in Colorado. The OBS interface includes a menu bar (File, Edit, View, Docks, Profile, Scene Collection, Tools, Help) and a scene control panel at the bottom right. A text overlay on the video feed reads "WA6NUT Rick Colorado".

Overlaid on the OBS window are several utility applications:

- ADALM-PLUTO DVB Controller:** A web browser window showing the control interface for the ADALM-PLUTO DATV Controller. The address bar shows "192.168.2.1/pluto.php".
- mini GPS Clock Configuration:** A window showing hardware details (Device name: mini GPS Reference Clock, Made by: Leo Bodnar Electronics, Firmware version: 1.17, Serial number: 9DC7A52CDB) and settings (Output Hz: 40000000). It includes buttons for "Set frequency", "Factory defaults", and "Advanced >>>". The status section shows "GPS signal OK" and "PLL lock OK".
- DATV-Easy V2.16:** A configuration window for DVB-T transmission. It shows the following settings:
  - Target bitrate:** 94.25 kb/s
  - Video bitrate:** 56 kb/s
  - Frequency MHz:** 421.250
  - Mode:** DVB-T QPSK
  - Bandwidth:** 125
  - FEC:** 1/2
  - Guard Factor:** 1/32
  - Mode:** 2k
  - Video / Audio:** H264, Image Size 16/9, 426x240, Fps 12, AAC+, Audio kb/s 6
  - Transmission:** 94 kb/sButtons for "START +", "STOP", "PTT", and "EXIT" are visible.

The system tray at the bottom shows the time as 8:55 AM on 6/22/2023, along with various system icons and a notification for "Activate Windows".

# WA6NUT DVB-T Station Setup (cont.)

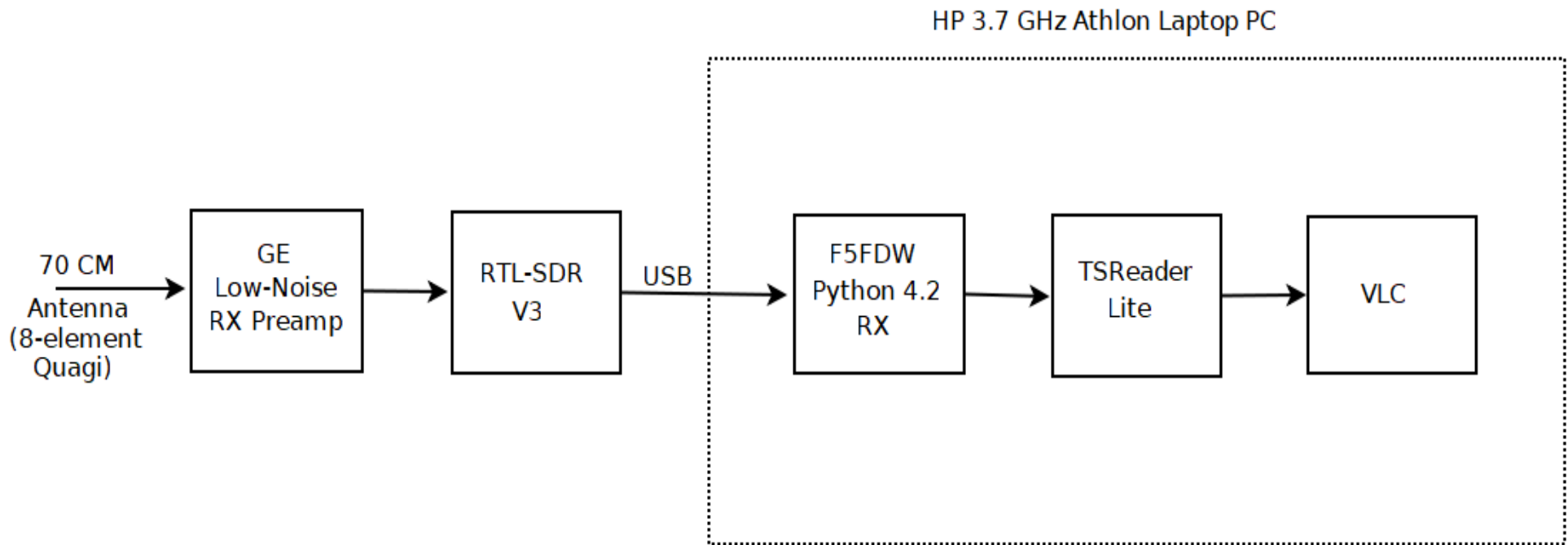
Designed for portable operation

Function	Hardware	Software
Receive	RTL-SDR V3  GE Low-noise RX preamp	F4FDW Python 4.2 Receiver GNURadio-3.8 TSReader Lite VLC
Antenna	8-element 70cm Quagi (w/tripod)	

Laptop PC: HP 17z-cp200, 17.3", 3.7 GHz Athlon processor



# WA6NUT DVB-T Receive Setup



# WA6NUT DVB-T Receive Setup

TSReader Lite -- 2.8.56 - not for commercial use

File Export View Record Playback Plugins Settings Help

**PAT PID 0x0000**  
PMT PID 0x00ff - Progr. 4095  
ES PID 0x0100  
ES PID 0x0101  
PCR PID 0x0100  
SDT: WA6NUT  
SDT PID 0x0011 <2>

Program Number: 4095  
PCR on PID 256 (0x0100)  
PMT Version: 0  
Service name: WA6NUT

Stream Type: 0x02 MPEG-2 Video  
Elementary Stream PID 256 (0x0100)

Stream Type: 0x0f MPEG AAC ADTS Audio  
Elementary Stream PID 257 (0x0101)

Active PIDs: Disabled Sort Descending Sort by Rate Sort by PID

- 0x0100 (83.36% - 419.49 Kbps)
- 0x0fff (10.24% - 51.49 Kbps)
- 0x0101 (6.00% - 25.11 Kbps)
- 0x0011 (0.60% - 2.39 Kbps)
- 0x00ff (0.40% - 2.03 Kbps)
- 0x0000 (0.40% - 2.03 Kbps)

General Information

Source: TCP/IP  
Tuner: 127.0.0.10 port 10000  
Signal: n/a

Network Type: DVB  
Run Time: 000:02:32

MPEG-2 Statistics

	PAT	PMT	CAT	NIT	SDT	EIT
Sections	196	2	0	0	291	0
CRC Errors	0	0	0	0	0	0
Continuity Errors:	0			Mux. bitrate:	602,673 bps	
TEI Errors:	0			Last sec.:	0.262 Mbit	
Sync losses:	0			In buffer:		
				Out buffer:		

RX DVB-T in low BW with RTL2832 by F4FDW v.4.2

**Constellation**

Quadrature vs In-phase plot showing four clusters of blue data points.

**Relative Gain (dB)**

Plot of Relative Gain (dB) vs Frequency (MHz) showing a bandpass filter response.

MER 22.000000 dB

RF gain dB: 26.0

RIT: -2

center\_freq: 436000000

**Calibrage**

Time (s) vs Frequency (kHz) heatmap showing signal stability over time.

436082.69 kHz, 1.35e+00 s

Largeur de bande - avec (menu) de démarrage:

66k  125k (menu)  225k  250k  333k  500k + 1000 (menu)

Windows desktop environment showing various application icons:


- DOSBox 0.74-3
- vDos - Initial test
- vDosPlus
- MMTTY
- OpenOffice 4.1.14 (en...)
- Bandicam
- HP Support Assistant
- Adobe Acrobat
- Zinio Web Reader
- Macrium Reflect
- HP
- CMMFS
- Logos Bible Software.In...
- OpenOffice 4.1.13 (en...)
- Logos Bible Study
- DVB Calculator

# WA6NUT DVB-T Receive Setup

127.0.0.1:1234 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

File | C:\Users\Rick\Desktop\G01042500a.Mov



00:25 00:00

Type here to search

49°F Cloudy 7:23 PM 10/24/2023

The image shows a VLC media player window displaying a video file named 'G01042500a.Mov'. The video content is a large, centered analog clock face with a black border and white background. The clock has black hour markers and hands. A red second hand is visible, pointing to the 10 o'clock position. The VLC player interface includes a menu bar (Media, Playback, Audio, Video, Subtitle, Tools, View, Help) and a playback control bar at the bottom. The Windows taskbar is visible at the very bottom of the screen, showing the search bar, taskbar icons, and system tray information including the date and time (7:23 PM, 10/24/2023).

# 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)

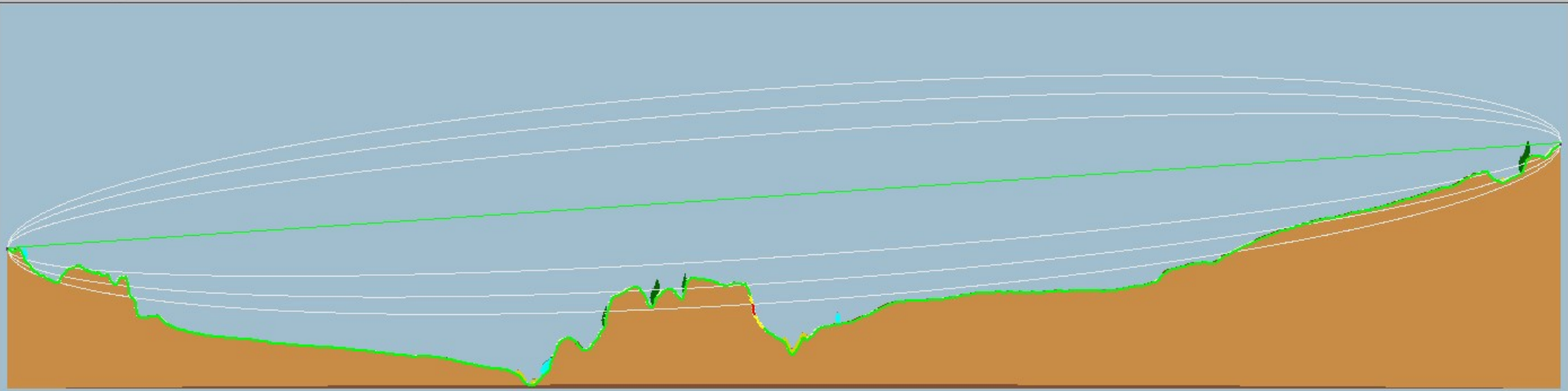
# Let's Go Portable!

Radio Mobile Online

https://www.ve2dbe.com/rmonline\_s.asp

Radio Mobile Par/By Roger Coudé VE2DBE

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 °

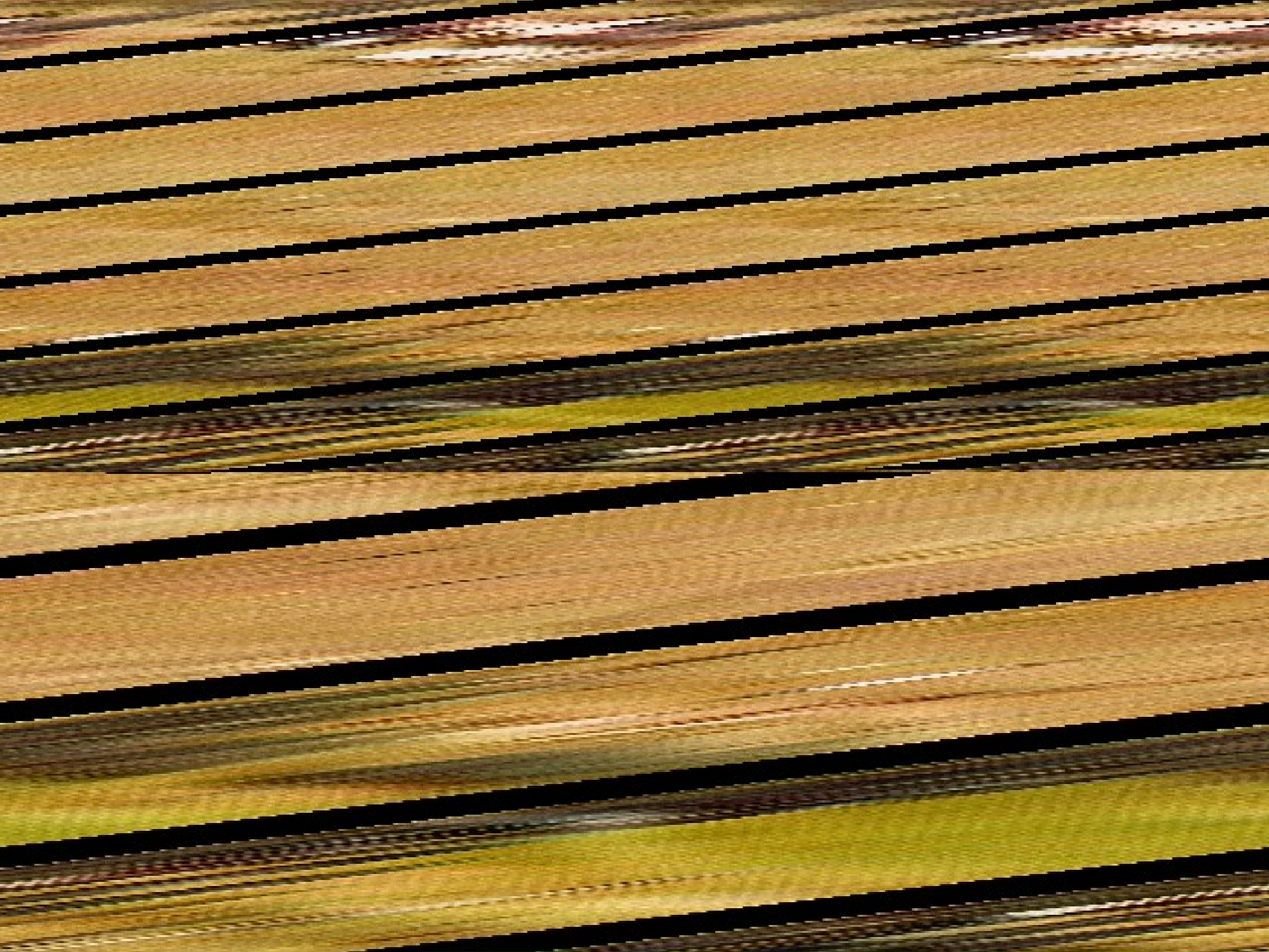
Radio system		Propagation	
TX power	40.00 dBm	Free space loss	109.20 dB
TX line loss	6.00 dB	Obstruction loss	6.72 dB
TX antenna gain	10.00 dBi	Forest loss	1.00 dB
RX antenna gain	10.00 dBi	Urban loss	1.00 dB
RX line loss	0.50 dB	Statistical loss	6.49 dB
RX sensitivity	-113.02 dBm	Total path loss	124.41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

10:31 AM 8/6/2020

# Let's Go Portable!









# Internet Resources for Amateur TV

## WA6NUT

### DVB-T ATV Setup

<https://www.qsl.net/wa6nut/DVB-T%20Operating%20InstructionsB.pdf>

### F4FDW DVB-T Receiver

<https://www.qsl.net/wa6nut/F4FDW%20Python%20RX.pdf>

Download “Digital Amateur Television On a Budget” as a PDF from:

<https://www.qsl.net/wa6nut/WA6NUT%20DATV%20Presentation.pdf>

## N6NB

### Quagi Antenna

<https://www.amateur-radio-wiki.net/quagi/>

## W6ORG

### Introduction

<https://www.hamtv.com/pdf/ATVStart.pdf>

### 25W Amplifier

<https://www.hamtv.com/pdf/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**

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

## **HiDes**

### **Products**

[https://www.ebay.com/sch/i.html?\\_ssn=hides168&\\_trksid=p4432023.m570.l50838](https://www.ebay.com/sch/i.html?_ssn=hides168&_trksid=p4432023.m570.l50838)

## **British Amateur Television Club (BATC)**

<https://batc.org.uk>

# 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