

DVB-S: PIRATE OR AMATEUR DIGITAL TV STATIONS

Hibby

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DVB?

- Digital Video Broadcasting
- Satellite
 - DVB-S, DVB-S2, DVB-SH
- Cable
 - DVB-C, DVB-C2
- Terrestrial
 - DVB-T, DVB-T2

DVB?

- Amateur Radio
 - TV Repeaters
 - ISS
 - Satellites
 - Es'hail 2
 - 2.4GHz → 10GHz transponder
- Personal TV Station
 - Running a (pirate?) TV station at SHA2017 with all the streams would be very cool

DVB

- DVB-T
 - OFDM (Multiple Carrier)
- DVB-C
 - OFDM (Multiple carrier), low fade margin
- DVB-S
 - Single Carrier

DVB

- MPEG Transport Stream
 - Data
 - Error Correction
 - Metadata
- DVB-S
 - Reed Soloman Coding
 - FEC (Viterbi)
 - QPSK (2 bits per symbol)

Satellite TV

- Transmit from base station
- Relayed via Satellite
- Multiple Bands:
 - 10.7-11.7 GHz, “Low”
 - 11.7-12.75 GHz, “High”
- Multiple Polarizations
 - Horizontal
 - Vertical

Satellite TV

- Satellite Dish
- LNB
- Coaxial Cable
- Set top box
 - Powers & Controls LNB
 - IF ~ 1.2GHz



Satellite TV – HackRF

- 10GHz is really hard to receive
- LNB is hard to interface with an SDR



DVB - DATV

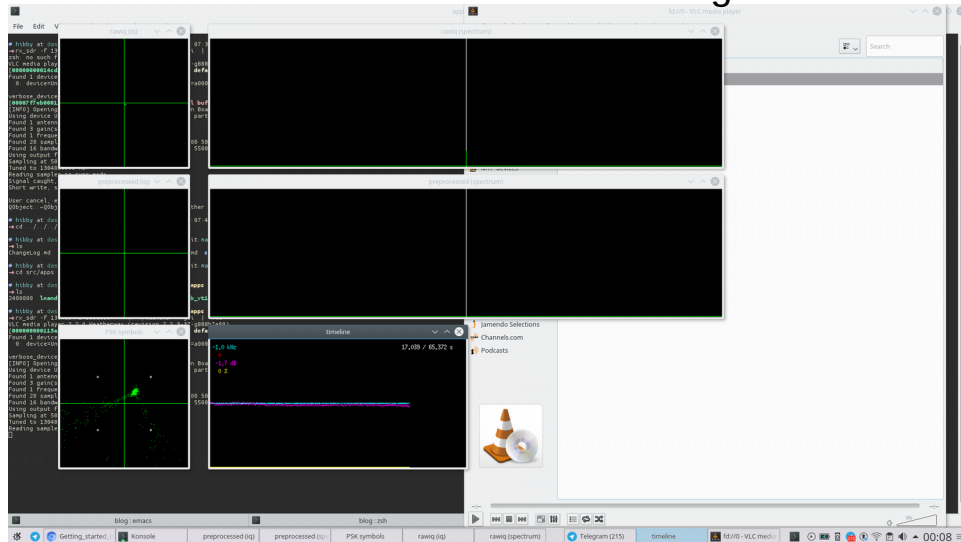
- Digital Amateur TV
- Use a more sensible frequency
 - 1.2GHz – STB IF
- GNU Radio Blocks exist
- (nonfree) Hardware exists
- Video Repeaters exist to test against
- Can we do it with an open toolchain?

DVB – DATV Reception

- rtl_tools tools, rx_tools tools
- Pipe to VLC?
 - RF demodulate to complete
- GNURadio
 - Steep learning curve, scary
- Leandvb (github)
 - Simple, mostly.

DVB – DATV Reception

- `rx_sdr -f 437e6 -s 2.4e6 - | ./leandvb_tui.sh ./leandvb --fd-info 2 -f 2.4e6 --cr 7/8 --sr 250e3 --gui`



DVB – DATV Receptions

- `rx_sdr -f 437e6 -s 2.4e6 - | ./leandvb_tui.sh ./leandvb --fd-info 2 -f 2.4e6 --cr 7/8 --sr 1.241e6 --gui | vlc -`
- Pipe video to vlc from leandvb
- -f is frequency
- -s is sample rate
- --cr is FEC rate
- --sr is expected symbol rate
- Over and undersampling will cause bad video quality
- $\text{Sample Rate} = (\text{video bitrate}) / 2 * (188/204) * \text{FEC}$

DVB – DATV Transmission

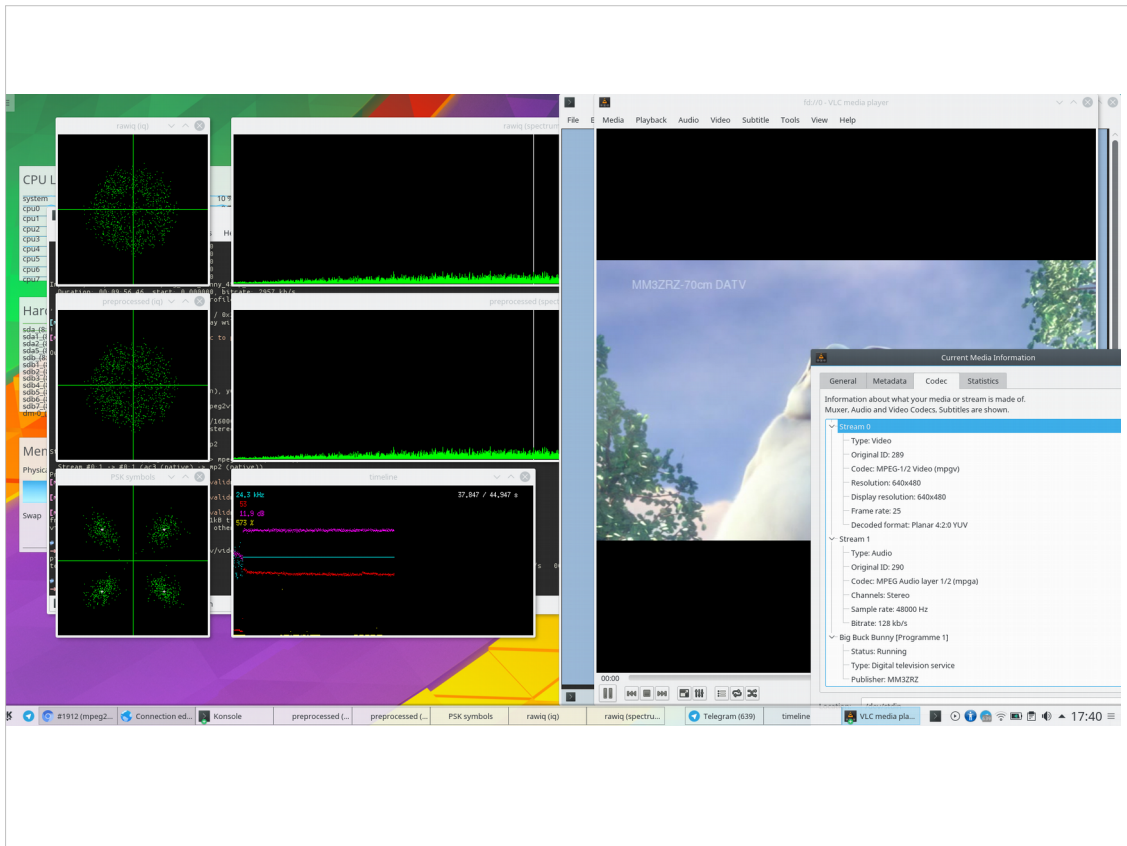
- Must generate MPEG TS before DVB Modulation
 - FFMPEG
- Multiple Tools for DVB Modulation
 - GNURadio
 - rpidatv

DVB – DATV Transmission

- `ffmpeg -re -thread_queue_size 1000 -i Videos/big_buck_bunny_480p_surround-fix.avi -vcodec mpeg2video -s 640x480 -r 25 -acodec mp2 -b:v 2M -minrate:v 2M -maxrate:v 2M -bufsize:v 2M -ac 2 -b:a 48k -mpegts_transport_stream_id 1025 -mpegts_service_id 1 -mpegts_pmt_start_pid 0x0fff -mpegts_start_pid 0x0121 -muxrate 2M -metadata service_provider="MM3ZRZ" -metadata service_name="Big Buck Bunny" -f mpegts -vf "drawtext=fontfile='/usr/share/fonts/truetype/freefont/FreeSans.ttf':text='MM3ZRZ-70cm DATV':x=60:y=34:fontsize=20:fontcolor=0xffffffff7f" -y test2.ts`

DVB – DATV Transmission

- FFMPEG can encode metadata and a mostly valid DVB-S Stream
- Currently encoding video ahead of time and modulating/transmitting separately
- Modulation happening on raspberry pi
 - rpidatv
 - Can output I/Q over pins or modulate a pin for RF



DVB – DATV Transmission

- RPIDATV very inflexible – designed for specific hardware, no SDR in mind
- GNURadio more flexible, but difficult and not compatible with lots of systems
- New SDR Libraries like SoapySDR may make interfacing with hardware simpler
- Hardware is Cheap – amplification is the issue
- Future work
 - 2.4GHz
 - Higher Power
 - More range