

**SV1BDS
2K5B
DVB-T Receiver
Block Diagram**

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SV1BDS 2K5B Receiver Block Diagram

SV1BDS 2K5B DVB-T Receiver Block Diagram

by Rick Peterson, WA6NUT

Introduction

The 2K5 DVB-T receiver is one of several DVB-T receiver designs published by George, SV1BDS on the AMSAT-DL website. The design uses an RTL-SDR, and has been tested at symbol rates up to 1M.

See the link below for more information on the original SV1BDS 2K5 receiver software:

<https://forum.amsat-dl.org/index.php?thread/2745-my-qo100-setup/&pageNo=30>

A document including operating details for the receiver can be downloaded from:

<https://www.qsl.net/wa6nut/Higer%20SR%20DVB-T%20by%20SV1BDS.pdf>

This document (the one you're reading) was prepared to show the details of the GNU Radio implementation of the SV1BDS 2K5B receiver. Details of each GNU Radio block are found at:

https://wiki.gnuradio.org/index.php?title=Category:Block_Docs

For more information on GNU Radio, 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 GNU Radio flow graph.

For more information, go to:

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

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Or search in Amazon for "field expedient sdr."

The books recommend implementing GNU Radio 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.

URLs for Downloading Software

GNURadio Companion v. 3.8.2.0

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

DVB_T_RX_2K5B DVB-T Receiver by SV1BDS

https://www.qsl.net/wa6nut/DVB_T_RX_2K5B.zip

VLC Media Player 2.2.5.1

<https://download.videolan.org/pub/videolan/vlc/>

Version 3.8.2.0 downloads as a .zip file from the archive.org website. After unzipping, go to GNURadio-3.8 --> bin --> run_gr.bat (it's a batch file).

Right-click on run_gr and select "Create Shortcut." Then drag the shortcut to the desktop. Now you can open GNURadio by double-clicking on the "run_gr- Shortcut" icon on the desktop.

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After downloading and unzipping the DVB_T_RX_2K5B.zip file, the DVB_T_RX_2K5B.py file should be placed in the c:\ folder.

Receiver GNU Radio Blocks (see Figure 1 p. 11)

Values in parentheses () are the editor (VS Code) line numbers for connections and block parameters, respectively, separated by a colon.

- 1 rtl_sdr_source (interface to RTL-SDR)
REF2, p. 106; REF3, p. 36 (see Notes p. 10)
<https://osmocom.org/projects/gr-osmosdr/wiki>
(452, 453 : 161-172)
- 1A qtgui_freq_sink (Spectrum GUI)
https://wiki.gnuradio.org/index.php/QT_GUI_Frequency_Sink
(448, 453 : 219-260)
- 2 low_pass_filter
https://wiki.gnuradio.org/index.php/Low_Pass_Filter
(449, 452: 350-351)
- 3 rational_resampler_0 (sets interpolation & decimation for selected BW)
REF1, pp. 86, 190-195; REF2, pp. 45, 48, 184
https://wiki.gnuradio.org/index.php/Rational_Resampler
(449, 450: 180-184)
- 4 dtv_dvbt_ofdm_sym_acquisition (Time sync: uses autocorrelation function to position FFT sampling window into area free of inter-symbol interference)
https://wiki.gnuradio.org/index.php/OFDM_Symbol_Acquisition
REF4, pp. 393-398
(442, 450: 387)

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- 5 fft (transforms COFDM symbols back to frequency domain, with 2048 real and imaginary parts, not yet corrected for phase and distortion)
REF4, pp.393-398
<https://wiki.gnuradio.org/index.php/FFT>
(442, 447: 383)
- 5A vector_to_stream_0 (format conversion)
https://wiki.gnuradio.org/index.php/Vector_to_Stream
(431, 446: 395)
- 5B qtgui_const_sink_0 (“Initial” Constellation GUI: lower)
REF3, pp. 70-95; 251-281
https://wiki.gnuradio.org/index.php/QT_GUI_Constellation_Sink
(431: 307-346)
- 6 dtv_dvbt_demod_reference_signals (Channel correction: Uses pilot signal information to rotate and compress or expand constellation diagram, remove amplitude distortion)
https://wiki.gnuradio.org/index.php/Demod_Reference_Signal
(440, 447: 389)
- 6A vector_to_stream_0 (format conversion)
https://wiki.gnuradio.org/index.php/Vector_to_Stream
(431, 446: 395)
- 6B qtgui_const_sink_0_0 (“Final” QPSK Constellation GUI: upper)
REF3, pp. 70-95; 251-281
https://wiki.gnuradio.org/index.php/QT_GUI_Constellation_Sink
(434: 264-303)
- 6C complex_to_imag_0 (format conversion)
https://wiki.gnuradio.org/index.php/Complex_to_Imag
(423, 432: 404)
- 6D complex_to_real_0 (format conversion)
https://wiki.gnuradio.org/index.php/Complex_to_Real
(424, 433: 403)

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- 7 dtv_dvbt_demap (uses de-mapping table to extract data and form data stream to channel decoder blocks)
REF4, pp. 231, 234, 393-398; REF5, p. 104
https://wiki.gnuradio.org/index.php/DVB-T_Demap
(438, 440: 390)
- 8 dtv_dvbt_symbol_inner_inter_leaver (re-sorts de-mapped data for input to Viterbi decoder)
REF4, pp. 270, 393-398, 711, 739; REF5, p. 105; REF6, pp. 111-113
https://wiki.gnuradio.org/index.php/Symbol_Inner_Interleaver
(438, 444: 385)
- 9 dtv_dvbt_bit_inner_deinterleaver (re-sorts de-mapped data for input to Viterbi decoder)
REF4, pp. 270, 280, 393-398; REF5, p. 105; REF6, pp. 111-113
https://wiki.gnuradio.org/index.php/Bit_Inner_Deinterleaver
(436, 444: 392)
- 10 vector_to_stream_1 (format conversion)
https://wiki.gnuradio.org/index.php/Vector_to_Stream
(435, 436: 393)
- 11 dtv_dvbt_viterbi_decoder (Error correction, FEC)
REF4, pp. 275, 280, 393-398; REF5, p. 105; REF6, pp. 205-207
https://wiki.gnuradio.org/index.php/Viterbi_Decoder
(435, 445: 384)
- 12 dtv_dvbt_convolutional_deinterleaver (breaks up error bursts by undoing interleaving for input to the Reed-Solomon decoder)
REF4, pp. 270, 280, 393-398; REF5, p. 105; REF6, pp. 111-113
https://wiki.gnuradio.org/index.php/Convolutional_Deinterleaver
(437, 445: 391)
- 13 dtv_dvbt_reed_solomon (corrects up to 8 bit errors per packet)
REF4, pp. 393-398; REF5, pp. 105-106; REF6, pp. 108, 204-205
https://wiki.gnuradio.org/index.php/Reed-Solomon_Decoder
(437, 443: 386)

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- 14 dtv_dvbt_energy_descramble (energy dispersal removal: also sync byte inversion removal, making MPEG-2 TS available for output to UDP Sink)
REF4, pp. 268, 393-398; REF5, p. 106; REF6, pp. 106-108
https://wiki.gnuradio.org/index.php/Energy_Descramble
(441, 443: 388)
- 15 udp_sink (stream to VLC Media Player: 127.0.0.1:5555)
https://wiki.gnuradio.org/index.php/UDP_Sink
(441: 396)

MER GNU Radio Blocks (see Figure 2 p. 12)

Values in parenthese () are the editor (VS Code) line numbers for connections and block parameters, respectively, separated by a colon.

- 1A abs_0
<https://wiki.gnuradio.org/index.php/Abs>
(416, 424: 409)
- 2A add_const_0
https://wiki.gnuradio.org/index.php/Add_Const
(418, 419: 407)
- 3A multiply_0
<https://wiki.gnuradio.org/index.php/Multiply>
(418, 428: 399)
- 1B abs_0_0
<https://wiki.gnuradio.org/index.php/Abs>
(417, 423: 408)
- 2B add_const_0_0
https://wiki.gnuradio.org/index.php/Add_Const
(420, 421: 406)

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- 3B multiply_1
<https://wiki.gnuradio.org/index.php/Multiply>
(420, 421: 398)

- 4 add_0
<https://wiki.gnuradio.org/index.php/Add>
(422, 429: 405)

- 5 rational_resampler_0_0 (sets interpolation & decimation for selected BW)
REF1, pp. 86, 190-195; REF2, pp. 45, 48, 184
https://wiki.gnuradio.org/index.php/Rational_Resampler
(422, 451: 174-178)

- 5A analog_const_source
https://wiki.gnuradio.org/index.php?title=Constant_Source
(415: 410)

- 6 divide
<https://wiki.gnuradio.org/index.php/Divide>
(415, 425: 402)

- 7 nlog10
<https://wiki.gnuradio.org/index.php?title=Log10>
(425, 430: 397)

- 8 float_to_int (format conversion)
https://wiki.gnuradio.org/index.php?title=Float_To_Int
(426, 430: 401)

- 9 int_to_float (format conversion)
https://wiki.gnuradio.org/index.php?title=Int_To_Float
(426, 427: 400)

- 10 qtgui_number_sink
https://wiki.gnuradio.org/index.php?title=QT_GUI_Number_Sink
(427: 186-215)

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Notes:

- REF1: *Introduction to Software Defined Radio: Field Expedient SDR Vol. 1*
Clark, P. & Clark, D., Meadow Registry Press
- REF2: *Basic Analog Radio: Field Expedient SDR Vol. 2*
Clark, P. & Clark, D., Meadow Registry Press
- REF3: *Basic Digital Communications: Field Expedient SDR Vol. 3*
Clark, P. & Clark, D., Meadow Registry Press
- REF4: *Digital Video and Audio Broadcasting Technology*, 3rd Edition
Walter Fischer, Springer-Verlag, 2010
- REF5: *Digital Television*, 2nd Edition
Mark Massel, digitalTVbooks.com, 2008
- REF6: *Digital Television*, 3rd Edition
Herve Benoit, Elsevier, 2006

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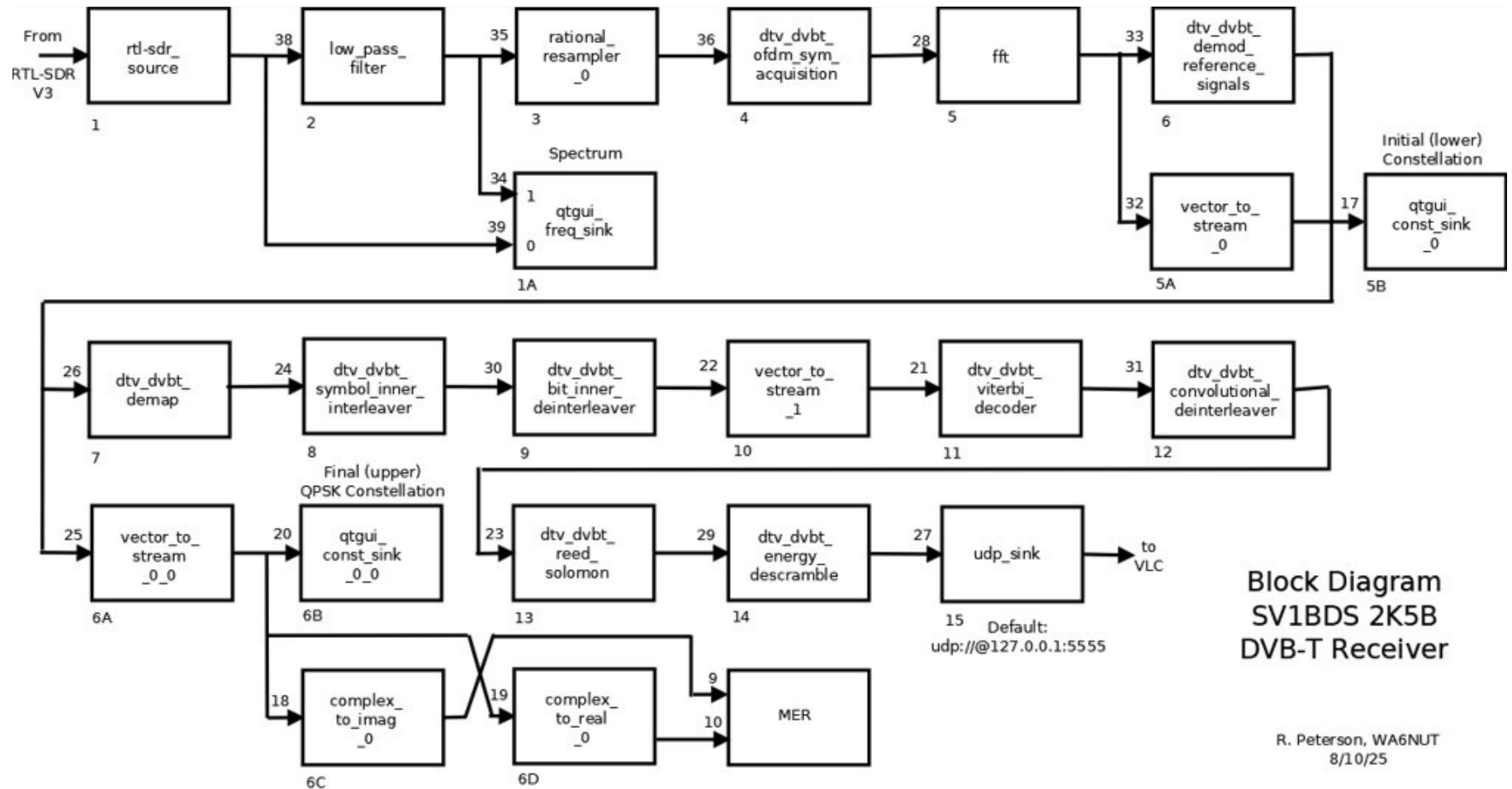
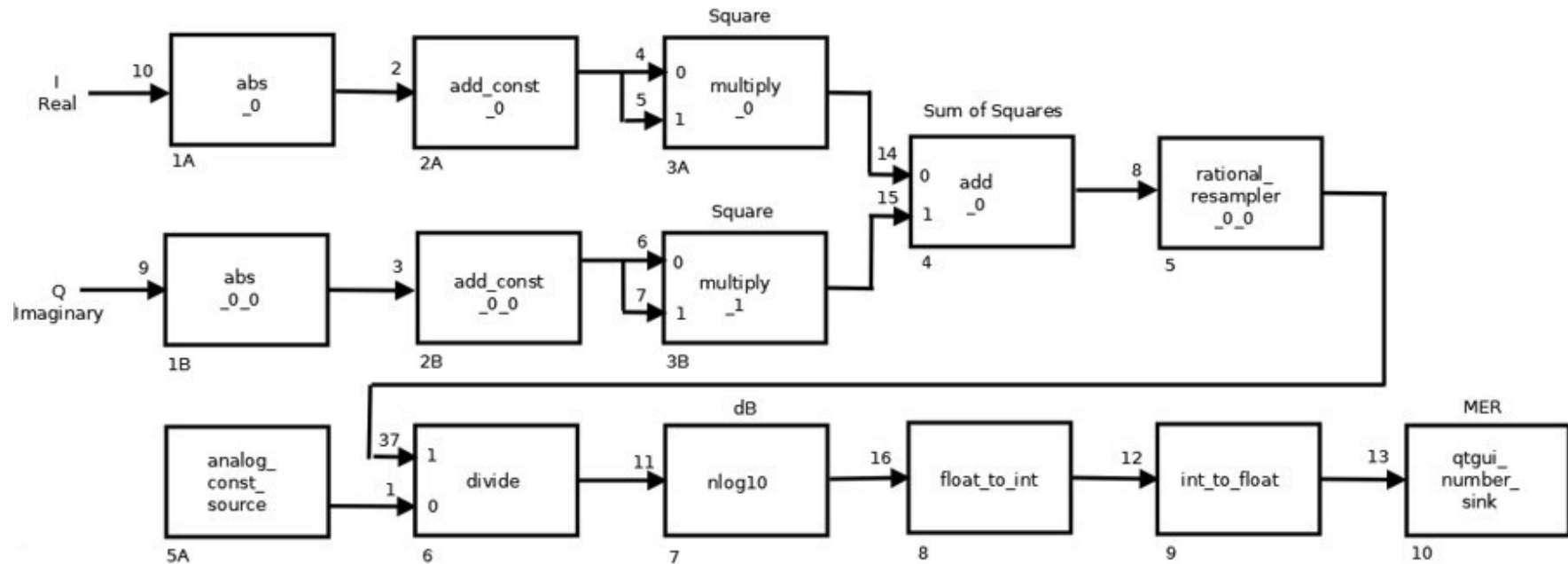


Figure 1: GNU Radio Block Diagram
Showing signal flow for SV1BDS 2K5B DVB-T Receiver Software

SV1BDS 2K5B Receiver Block Diagram



Block Diagram
SV1BDS 2K5B DVB-T Receiver
MER Readout

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8/9/25

Figure 2: GNU Radio Block Diagram
Showing signal flow for MER Readout

SV1BDS 2K5B Receiver Block Diagram

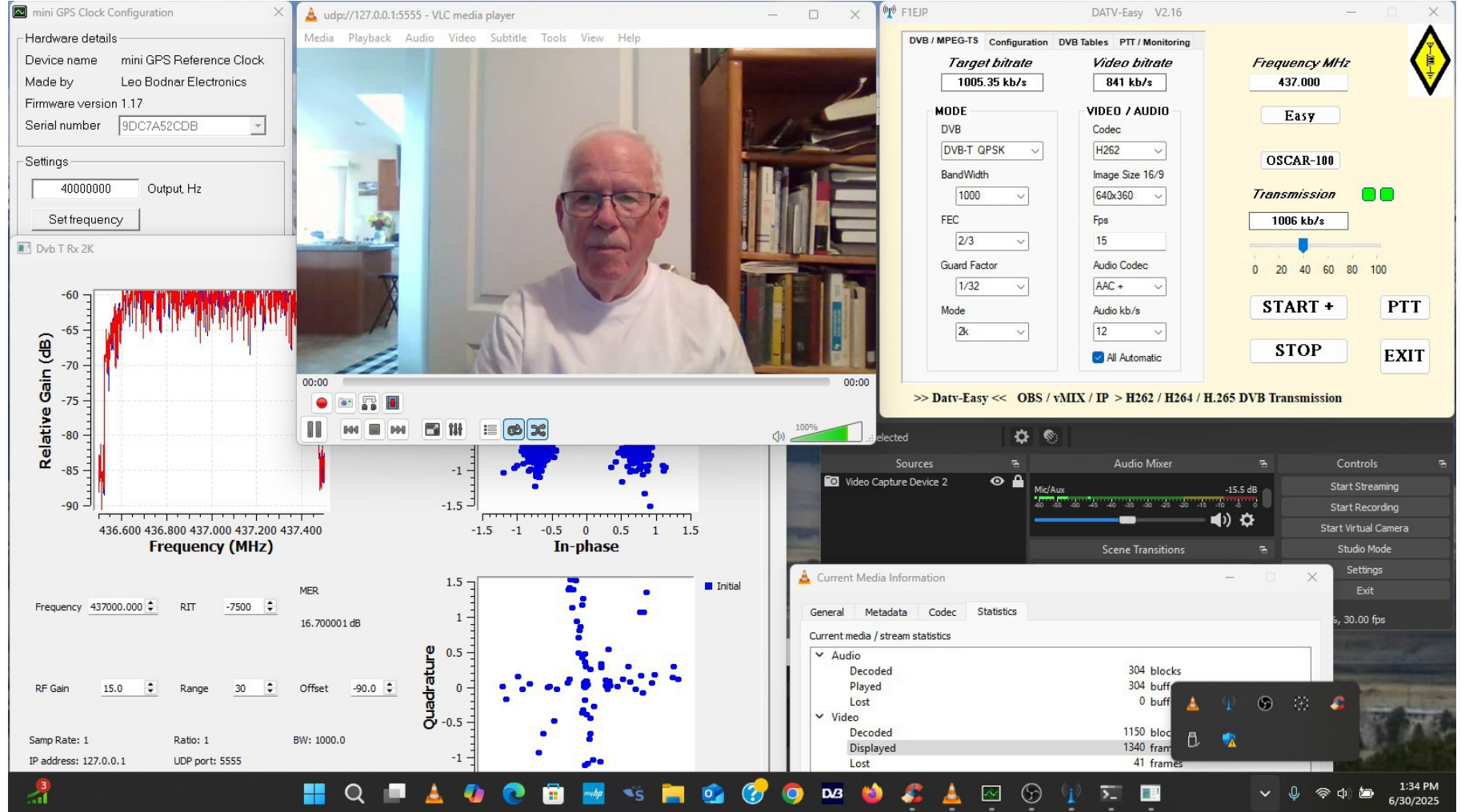


Figure 3: Screenshot: Higher SR DVB-T Setup: Clockwise, from upper right: DATV-Easy 2.16, OBS 27.2.4 (showing TX audio levels), VLC Current Media/Stream Statistics, SV1BDS Python Receiver 2K5B, Leo Bodnar GPSDO app, VLC 2.2.5.1 (displaying received video).