Amateur Television Journal

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BATVC web site: www.kh6htv.com
ATN web site: www.atn-tv.com
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Is Phase Noise Really Related to LNB cost?

Chris Grund, K0CJG

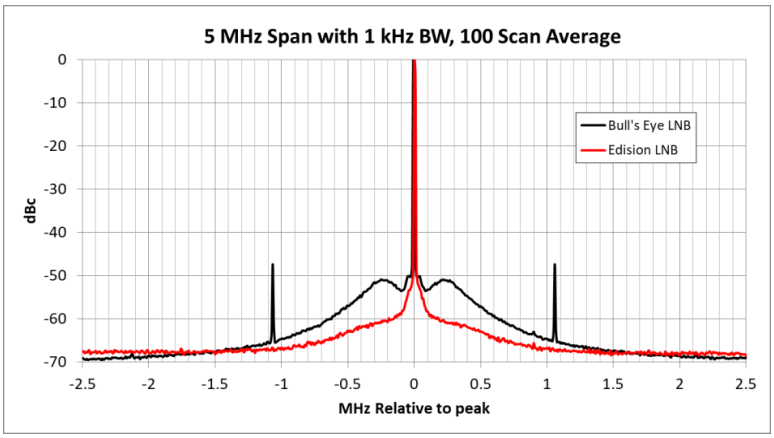
In ATV Journal #209 (5/20/2026), a note from Belgian ham ON4VVV suggested the phase noise from some low end LNB's (Low Noise Block converters) is very poor compared to the Bull's Eye LNB in common use by hams as 10 GHz receiver down-converters. LNB phase noise generally originates from the LNB local oscillator (LO), and potentially limits both receiver sensitivity and signal coherence.
It is hard to beat the published specs of commercial satellite LNB's, and impossible to beat the cost, with homebrewed downconverter solutions, so when I put together my 10 GHz DVB-T field rig, I also chose to use a satellite LNB in the receiver. Unfortunately, these LNB's are designed to couple to dish reflectors using a feed horn, and for a transceiver setup using a common antenna for transmit and receive (2' dish in my case), it is preferable to couple through a coax T/R switch. This configuration required SMA connections on the downconverter. To experiment with SMA coupling into the LNB, I purchase 3 low cost Edision SL-2 units assuming I'd destroy 1 or 2 of these in the coupling effort. These have similar published specs to the Bull's Eye LNB's (but lack auxiliary 25 MHz sync output) and are ~1/2 the cost. Initially, I was pleased with the performance of the Edision units. Two coupling methods were tried: cutting off the horn and direct coupling the internal antenna probe to an SMA via coax, and, using an intermediate SMA-connected antenna in a (clean) soup can covering the input horn. Both methods work very well, after some attention to trimming and tuning the geometries. Then I saw the phase noise article from ON4VVV and wondered if I was giving up performance from the get-go due to poor phase noise performance of the inexpensive LNB's I used, so I decided to test my units and compare to an unmodified Bull's Eye (borrowed from Jim KH6HTV).

I did not have a vectorscope, but I did have a Rigol DSA-815 Spectrum analyzer and several microwave brick oscillators that produce very clean, relatively stable, monochromatic signals. The test setup used a Frequency-West microwave "brick" oscillator at 10368 MHz direct coupled to a dipole radiator that broadcasted a common signal to the various LNB setups. The Bull's Eye and the two

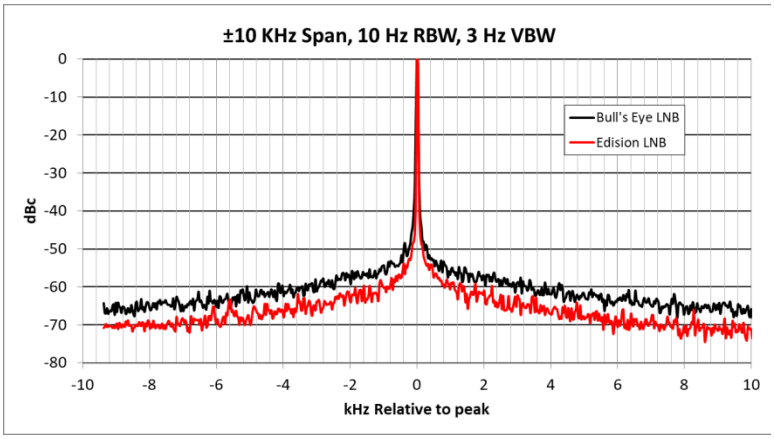
modified versions of Edision LNB were tested along with one unmodified Edision unit. I didn't expect phase noise differences (and didn't see any) amoung the Edision units, but had never compared the relative performance of the coupling methds before. The SMA-connected units were coupled to the 2' dish for testing, and the one unmodified Edision unit picked up the test signal directly with its integrated horn, as did the Bull's Eye.

For each test, orientation of source and LNB pickup adjusted until the output from the LNB was -17.5 dBm ±0.5 dBm. Previous testing verified this output signal level is well below any LNB signal compression but large enough to make noise measurements with resonalble integration times. To make phase noise comparisons easier directly in dBc units, each trace was normalized to 0 dBc at its peak, and the frequencies were shifted slightly so that the peaks and distributions would all line up exactly regardless of small differences in the LNB LO frequencies or drift in the brick frequency between measurements. Since all the Edision units produced similar results only the direct coupled version data are plotted in the below comparisons to the Bull's Eye.

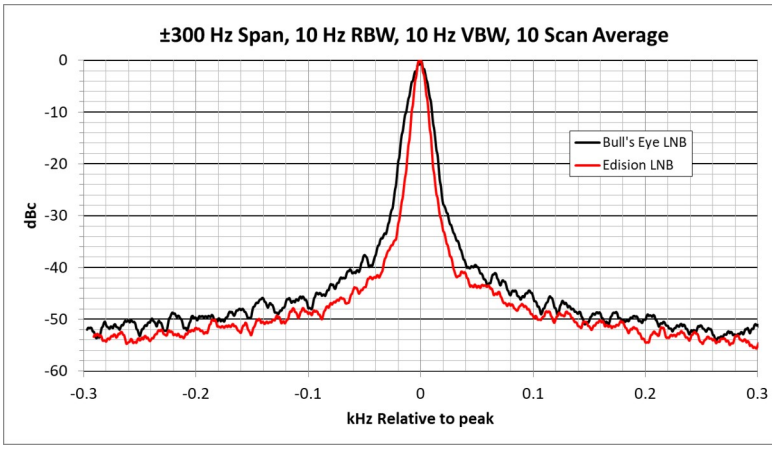
The first plot shows a ±2.5 MHz span about the 10368 MHz peak. Since the signal source is essentially monochromatic, phase noise shows up as a structured broadening of the peak width as a function of frequency offset from the peak. The vertical axis indicates phase noise (dBc per kHz on this graph) in dBc (i.e. relative to signal peak). As can be seen, the Bull's Eye shows a lot of "features" that are absent in the Edision unit. Compared to the Edision, the Bull's Eye phase noise is quite broad, extending 100's of kHz from the peak at much higher levels. There are also 2 promenent spurs, likely from digital LO generation artifacts, that do not appear in the Edision unit. Farther from the peak signal, the noise floor of the Edision appears to be 1 or 2 dB higher. This might suggest the Edision front end noise figure is a little higher than the Bull's Eye's, but that is a study for another time.



The next plot zooms in to ±10 kHz about the peak with 10Hz (max of the SA) resolution band width (i.e. read phase noise dBc per 10 Hz) this time, a similar relationship is apparent close in to the peak, with the Edision LNB apparently slightly outperforming the Bull's Eye. Because of small drifts in the source signal and the LNB LO's, it was difficult to acquire this high resolution data without smearing the profile. Unfortunately, it is not possible to simultaneously track the peak and average with this Rigol SA. For this reason, no averaging was done. Instead the video BW was reduced to 3 Hz to smooth the noise a bit at the expense of slight profile distortion.



The next plot zooms in further to ±300 Hz about the peak again with 10 Hz resolution BW, but, because these scans are much faster, a 10 scan average was used to reduce amplitude noise and the video BW was opened to 10 Hz to reduce distortion. Again, the Edision seems to slightly outperform the Bull's Eye even at 100's of Hz from the signal peak.



Conclusions: With respect to phase noise, not all LNB's are alike. With respect to the Edision SL-2 LNB, it's performance exceeds that of the commonly recommended Bull's Eye LNB.

The LO frequency accuracy between all the LNB LO's, judged by the relative difference in IF frequencies observed, seems to be within ±50 kHz with drift ~10's Hz per minute after warm up.

The Edision might have a slightly higher amplitude noise floor than the Bull's Eye, but that needs verification with tests designed for that purpose.

Since I don't need the sync capabilities of the Bull's Eye, I'll stick with my Edision LNB's.

73 de Chris Grund, K0CJG, Boulder, Colorado

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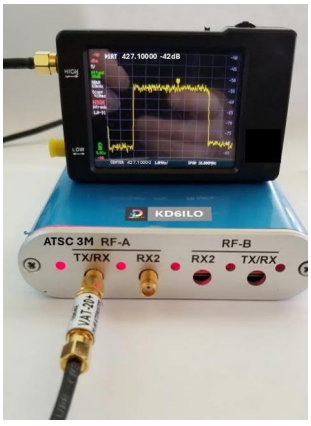
ATSC 3.0 & ATV

Mario, KD6ILO, Oceanside, California, reports that he is experimenting with ATSC 3.0 and has made some 70 cm test transmissions with it.

De-Modulator: Mario says he is using the THOR model H-STB-ATSC3
(*editor's note: I did not find this item on THOR's web site. I did however find it listed for sale by Markertek for $295*)

Modulator: Mario has his own ATSC 3.0 experimental modulator. He says it covers from 55 to 860 MHz and is compliant with ATSC 3.0 A/322. Bandwidth is 6 MHz. Supports constellations of QPSK, 16QAM thru 4096QAM. FFTs of 8K, 16K or 32K Code Rates from 2/15 thru 14/15. For 70 cm experiments he is transmitting on 427.1 MHz.

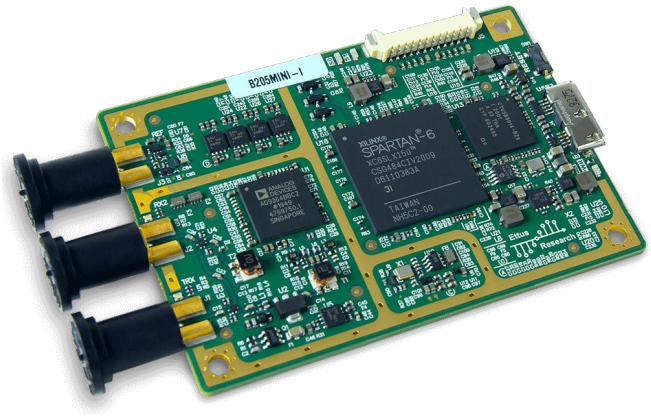
ATSC 3.0 70cm 430-450 MHz test development test bed SDR Project. This is the third SDR board that I've evaluated in the past three months. As they are highly recommended for this project test for ATSC 3.0.

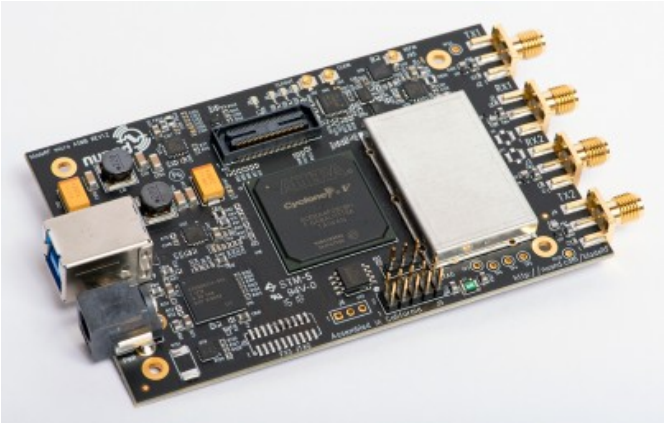


I've assembled a small test platform already using this,Nuand bladeRF (e.g., bladeRF 2.0 micro) SDR High-speed USB 3.0 transmit-capable SDR with sufficient RF bandwidth to support complex constellations like 1024-QAM and 4096-QAM used in ATSC 3.0. and stable clock references required to cleanly modulate and transmit ATSC 3.0 carrier.

The final project design is planned out but not ready for assembly yet, it will be about the size of a ICOM 703 (the final). The working prototype is not in a full size, but is working now since about two weeks ago on the air, one carrier to channels (427.1 and 433.1) 6 MHz at 10 watts, 25' LMR400 to a vertical U200 antenna.

The units shown below are the other two SDR boards capable of also employing ATSC v3.0. These were quite pricey for most Amateur operator budgets. But I did get them on my lab R&D expense account. The nuand SDR was $540.00.





(left) Ettus USRP B200mini USB 3.0 SDR – 70 MHz–6 GHz Software Defined Radio for RF Prototyping & Research and is good for ATSC v3.0

(right) Ettus USRP B210 2x2 MIMO SDR – 70MHz–6GHz USB 3.0 Software Defined Radio for RF Research is the other.

Modulator Core: Use github.com/drmpeg/gr-atsc3, an OOT GNU Radio module by Ron Economos, to process transport streams and output a fully modulated ATSC 3.0 OFDM signal. - Host PC: Integrate an internal Linux mini-PC within the assembly instead of using an external PC. The chassis must include a rear-mounted Cat5 female connector labeled "NMU". The mini-PC must support Bluetooth for firmware updates, telemetry monitoring, and remote operations. A modern multi-core CPU (Intel i7/AMD Ryzen 7 or better) is required to manage dense LDPC error correction and high FFT modes (up to 32k) for realtime sample generation.

The integration of a Linux computer is a necessity for this project because ATSC 3.0 is entirely Internet Protocol (IP)-based. It relies on advanced HEVC (H.265) video encoding and MMTP/ROUTE transport protocols, which require a specialized, professional low-power television broadcast chain to ensure proper operation.

A standard, off-the-shelf consumer or basic digital modulator cannot be used for this application, as those devices only support ATSC 1.0, 8VSB compression. Furthermore, I want to minimize the number of components in the transport chain; fewer pieces will ensure a more reliable and efficient system.

73 de Mario Badua, KD6ILO, Oceanside, California

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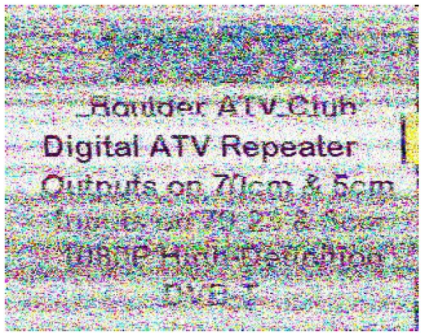
ATV & SSTV

Jim --- Enclosed is a screen shot of your SSTV transmission at 5:41 pm today (7 Aug) on 20 meters.

W4HVW



I am an ATVer. I am one of those mentioned in a recent` newsletter. I am all alone with no one to communicate via fast scan.
I did a presentation recently with the local club with no converts. The club is big in emergency preparedness, but they did not seem interested in adding ATV to their assets.

Look forward to each newsletter 73 de Buford Eastep, W4HVW, Columbia, TN

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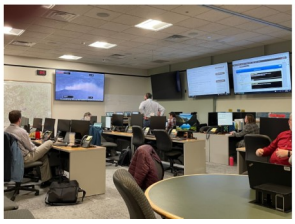
Power-Point Slide Show for presentation to ARES Groups

Recently Allen Bishop, K0ARK, BCARES E.C. & Jim Andrews, KH6HTV, gave a couple of presentations to ARES groups in Colorado on the use of digital amateur television (DATV) as an aid to our public service agencies. We used power-point slides along with live demos of our DATV equipment. Allen covered the uses of ATV for public safety. Jim discussed the technical details.

Jim is making available to other ATV hams, a .pdf file of his slides. (74 slides, 11 MB). For a free copy, via e-mail, send your request to Jim at kh6htv @ arrl.net Here below are a sample of some of his slides.

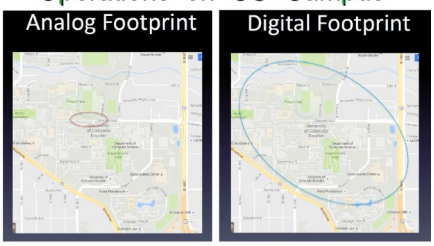
BCARES Forest Fire Video displayed on big screen monitor in Boulder Emergency Ops Center



Modern Television Technology

- BCARES ATV is now hi-defintion digital
- Portable pack sets for 4 DTV channels
- DTV REPEATERS
- Wide area repeater at NCAR – eastern county
- 2 new repeaters to enhance mtn coverage
- Plus portable repeater

Example of BCARES ATV Operations on CU Campus



DVB-T --- the choice of most USA Digital ATV Hams

- Broadcast standard for terrestrial DTV broadcasting for Europe and most of the rest of the world. Only USA, Canada, Mexico & S. Korea use 8-VSB
- Uses COFDM with 2K or 8K close spaced sub-carriers with packetized, digital data
- Uses QPSK, 16-QAM or 64-QAM

RFI Potential of DTV to other services ?

What is the potential for RFI to FM users on 70cm ?

I claim it is very low due to the very wide band-width and noise like characteristics of DTV.

Now let's put a little math to compare RFI potentials.

What is the RF power density therefore of a DTV signal ? Assume a **10 Watt** transmitter.

Pd(DTV) = Avg. Power / Channel BW = 10 W / 6 MHz = 1.67 x 10 -6 Watts / Hz

What is the RF power density of a typical FM voice signal ? Also assume a 10 Watt transmitter.

Pd(FM) = Avg. Power / BW = 10 W / 15 kHz = 6.67 x 10 -4 Watts / Hz

Now what would be the equivalent rf power in a 15 kHz FM channel from a 10 W DTV transmitter ?

P(15kHz) = Pd(DTV) x BW (FM) = 1.67 x 10 -6 W/Hz x 15 kHz = **25 milli-Watts**

Quasi-Secure Comms

Your Public Safety agencies might question how secure are your video transmissions?

We do NOT encrypt them – forbidden by FCC

But because we use the European Digital TV broadcast std. - they can NOT be received on consumer USA receivers

All the pieces for a 70 cm DATV station

How Far Will My TV Signal Go ?

1. Simple answer is --- "*line of sight*" -- it could be 100+ miles – or – 1 block ! (World record for 70cm ATV is 2,500 miles HI-CA) (76 miles for Boulder ATV rptr)
2. Not as far as your 2 meter signal.
3. Law of Physics is the restraint -- baseline noise level due to much broader band-width.
4. Noise level is -132 dBm for 15 kHz FM
5. Noise level is -106 dBm for 6 MHz TV
6. See my app. Note AN-33 "TV Propagation"

Basic 70 cm DVB-T Repeater

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Narrow-Band, Medium Scan, "Live", DATV on 10 meter band

Grant Taylor, ZL1WTT, formerly of New Zealand, is now living in Toronto, Ontario, Canada. He has been working the past couple of years on developing a totally new scheme for digital TV, tailored to a narrow 400 kHz band-width and the unique propagation conditions found on the 10 meter band. He is looking at using the slot from 29.0 to 29.4 MHz. (*Note: Not legal for us USA, ATV hams to use this wide of a band-width signal on 10 meters.*)

On Sunday, August 16th, Dave Pelaez, AH2AR, of the Dayton Amateur Radio Club (DARA) organized an international Zoom conference call for Grant to update lots of interested ATV hams, world-wide, in his progress to date on his 10 m, DATV project. Dave recorded the 1 hour zoom session and is making it available on You-Tube. The URL link is: ***https://youtu.be/ppM6jXFw80w***

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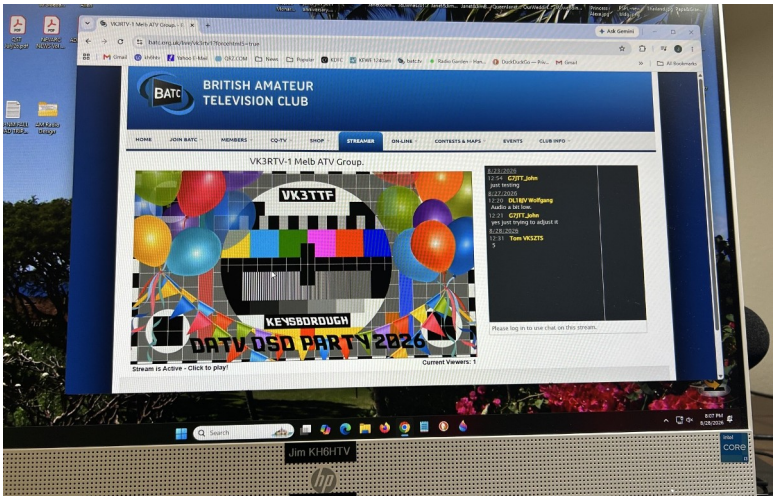
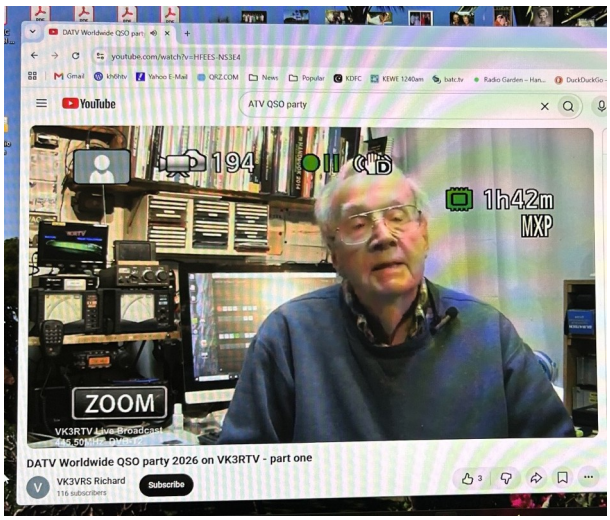


INTERNATONAL DATV QSO PARTY

Once again, **Peter Cossins, VK3BFG**, hosted a world-wide Digital ATV QSO party. Peter has been doing this for many years on the last week-end in August. In the past, this has typically involved ATV groups in the USA and Australia. This year it also included some hams in the U.K.



Everything was tied together via the inter-net. Various ATV repeaters streamed their signals to Peter. The results were then streamed to the world over both the British Amateur Television Club's server (www.batc.uk/live/) and also on You-Tube.

Participation was down this year from year's past. A big void was the absence of the southern California, Amateur Televison Network (ATN) group. Two big ATN "spark-plugs" were not there to keep things going. Roland, KC6JPG, has passed on and is now a silent key. And Mike, WA6SVT, has now retired and is living on Pitcairn Island.

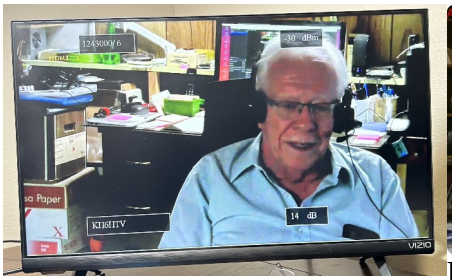
The event started off on Friday evening, 28 August with the ATV group in Ohio, hosted by Art, WA8RMC for the first hour. Art played a pre-recorded zoom session of their weekly ATV net for the two major ATV groups in Ohio - ATCO & DARA. It was then followed by the Boulder, Colorado group, hosted by Bill, AB0MY. The session was then finished with several Aussie ATV hams chatting about what they are up to and giving tours of their impressive ham shacks. The following morning was then primarily VK land ATV hams plus some U.K. hams. Here are a few photos of some of the participants.

Richard, VK3VRS, recorded both sessions. He has now made them available on You-Tube as "DATV Worldwide QSO party 2026 of VK3RTV - parts one & two" (https://www.youtube.com/watch?v=HFEES-NS3E4) & (https://www.youtube.com/watch?v=rSusNcEh31c)


Art, WA8RMC - ATCO


Dave, AH2AR- DARA


Rich, WA6NUT

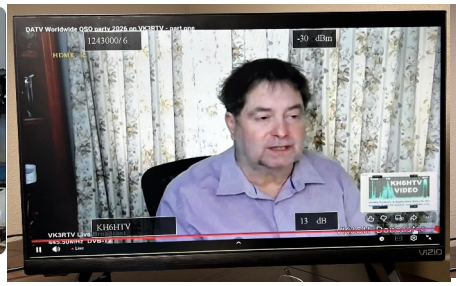
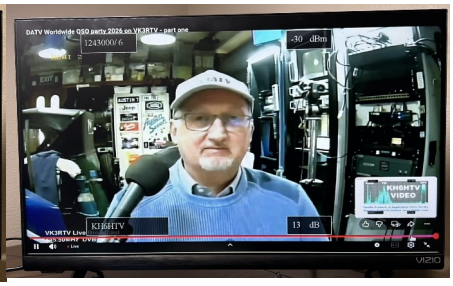
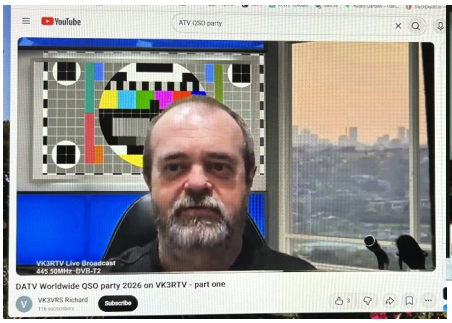

Bill, AB0MY


Don, N0YE


Jim, KH6HTV

John, G7JTT

Nick, G4IMO


Newsletter Details:

This newsletter was started in 2018 and originally published under the title "*Boulder Amateur Television Club - TV Repeater's REPEATER*" Starting with issue #166, July, 2024, we have changed the title to "*Amateur Television Journal.*" This reflects the fact that it has grown from being simply a local club's newsletter to become the "de-facto" ATV newsletter for the USA and overseas hams. This is a free ATV newsletter distributed electronically via e-mail to ATV hams. The distribution list has now grown to over 900+, both in the USA and overseas. News and articles from other ATV groups are welcomed. Permission is granted to re-distribute it and also to re-print articles, as long as you acknowledge the source.

Newsletter Archive: All past issues of the newsletter are archived on the web site: ***https://kh6htv.com/newsletter/*** A **free DVD** with all past issues is available upon sending an e-mail request to the editor.

Boulder CO - W0BTV Details:

Inputs: 23 cm Primary (CCARC co-ordinated) + 70 cm & 3 cm secondary all digital using European Broadcast TV standard, DVB-T with standard 6 MHz wide TV channels. Frequencies listed are the center frequency of the TV channel.
23 cm = 1243 MHz (primary), 70 cm = 441 MHz & 3 cm = 10.380 GHz
Outputs: 70 cm Primary (CCARC co-ordinated), Channel 57 -- 423 MHz with 6 MHz BW, DVB-T
Also, secondary analog, NTSC, FM-TV output on 5.905 GHz (24/7 microwave beacon).
Operational details in AN-51d Technical details in AN-53d. Available at: *https://kh6htv.com/application-notes/* We hold a social ATV net on Thursday afternoon at 3 pm local Mountain time (22:00 UTC). The net typically runs for 1 to 1 1/2 hours. ATV nets are streamed live using the British Amateur TV Club's server, via: ***https://batc.org.uk/live/*** Select ***ab0my or n0ye***. We use the Boulder ARES (BCARES) 2 meter FM voice repeater for intercom. 146.760 MHz (*-600 kHz, 100 Hz PL tone required to access*).

ATV HAM ADS -- *Free* advertising space is offered here to ATV hams, ham clubs or ARES groups. List here amateur radio & TV gear

For Sale - or - Want to Buy

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Quality Products & Application Notes for the Amateur Radio/TV market www.kh6htv.com

AMATEUR TELEVISION Eqpt. -- FOR SALE

Models 70-9B & 23-11A

Model 70-7B

Model 23-12B

70cm & 23cm, RF Linear Power Amplifiers

model 70-9B, 70W(CW), 10W(DTV) model 70-7B, 25W(CW), 3W(DTV) model 23-12B, 15W(CW), 2W(DTV)
model 23-11A, 30W(CW), 4.5W(DTV) all have more than enough gain to be driven directly by low level modulators.

LNAs, BPFs & Bias Tee

70-LNA, 18 dB, 0.8 dB NF
23-LNA, 14 dB, 0.7 dB NF
70-BPF, -1.5 dB, 65 MHz BW
23-BPF, -1.5 dB, 115 MHz BW
23-NB-BPF, -1.5 dB, 15 MHz BW
BT-UHF-a, -0.7 dB, 2m - 23cm

The KH6HTV-VIDEO Model 70-70R is an Amateur Television (ATV), 8 Watt, digital TV repeater for the 70 cm amateur radio/TV band. It is a complete "Basic" repeater, less the required antennas. It is capable of High-Defintion up to 1080P and uses the European broadcast standard DVB-T. The block diagram is shown on page 2. The repeater is packaged in a rugged 19" rack, 6U, server case. For additional details, see KH6HTV Video application notes, AN-23, AN-71a and AN-72.

For more details, including ATV application notes, ATV equipment spec. sheets, price list, etc.

Check out the web site: **www.kh6htv.com**