Boulder Amateur Television Club
TV Repeater's REPEATER
June, 2023
2ed edition, issue #133

BATVC web site: www.kh6htv.com

ATN web site: www.atn-tv.com

Boulder, Colorado -- ATV Repeater
W0BTV
Ch 57   423 MHz   DVB-T

ATN
The Amateur Television Network

Jim Andrews, KH6HTV, editor -   kh6htv@arrl.net   www.kh6htv.com

Advice for Wana-Be Digital ATV Hams
Jim, KH6HTV

It **"Takes Two to Tango!"** It is very important to not be an "ATV loner".   If you have other ham buddies nearby also interested in getting into ATV, then get together for face to face meetings to compare notes, and jointly test out your gear in very close, line of sight, experiments.   Plus it can be very lonely if you have no one else to share your video with.   Watching your own signal gets boring real fast.

Getting into digital amateur TV (DATV) will require considerable $$ investment.   It is comparable to purchasing a new, entry level HF transceiver and accessories.   So you need to be prepared to spend some bucks.   The older, analog TV was less expensive, but that gear is rapidly disappearing.   Sole exception is very inexpensive, FM-TV gear for 5.8 GHz.

Success is NOT guaranteed !   Propagation will not be as simple as HF operation. It is UHF and line of sight, not over the horizon. Plus we run low power (a few watts) from low antennas. Unlike the big gun broadcast TV stations with many kilowatt transmitters and high towers. I do know personally that obstructions in the rf path, like hills, buildings, etc. are deadly to our TV signals.   At the higher microwave frequencies, vegatation, like trees, with moisture suck up our signals.   What works with a 2 meter hand-held radio might not work for our ATV.   In that case, the laws of physics are fighting against us in terms of the noise floor for our receivers.   The wider bandwidth required for TV means more noise in the receiver and poorer sensitivity. I don't want to be a "wet blanket", but do want to warn you in advance that DATV propagation over any significant distance can be "iffy".   I have found that the free, on-line, rf propagation calculator, Radio-Mobile, is an accurate tool for predicting

whether a particular rf path will work, or not, for our ATV. To learn more about Radio-Mobile, check out my app. note, AN-33a, "TV Propagation" on my web site: www.kh6htv.com

Also, unfortunately, digital TV is not as simple as the older analog TV. Lots of gottchas in getting the many digital parameters in the modulator and receiver set properly before we get successful pictures. Thus vitally important to work with other nearby ATV hams to be assured of compatibility.

Now for your shopping list --- For DVB-T modulators, Hi-Des in Taiwan (www.hides.com.tw)has been our preferred supplier for Boulder, CO ATV hams. But there are others also. No matter whose modulator you buy, it will only put out a very weak, low powered signal of the order of a milliwatt (0 dBm). That is enough for testing in your ham shack, or across your basement, but not for going any further. Then you will need a LINEAR (emphasis, no class C allowed !) rf power amplifier to get you up to the at least several watts of rf power (> +30dBm). Not cheap, sorry.

Plus a good outdoor antenna up as high as possible. For antennas -- word of caution -- not all anateur 70 cm antennas work well with ATV. Best to only buy those that have been tried and certified by other ATV hams. Don't just blindly go buy any 70 cm antenna.

DATV DX !

Another Mid-West Band Opening
Saturday, 3 June, 7am

This is an an A5 signal from Charles Beaner in Morrow County, Ohio passing through the W8BI repeater in Dayton, Ohio on its DVB-T output…at 85 miles…
The repeater's S meter is reporting a signal strength of -77 dBm with a perfect 23 dB s/n. Input frequency of 428 MHz with a 2 MHz band-width
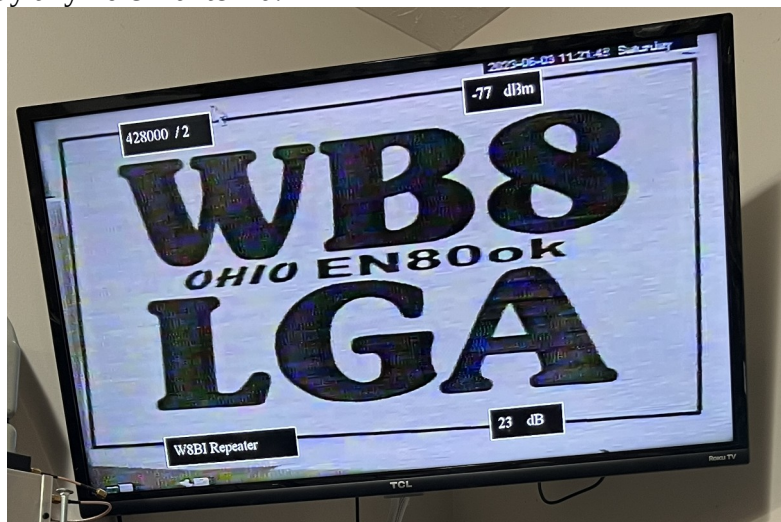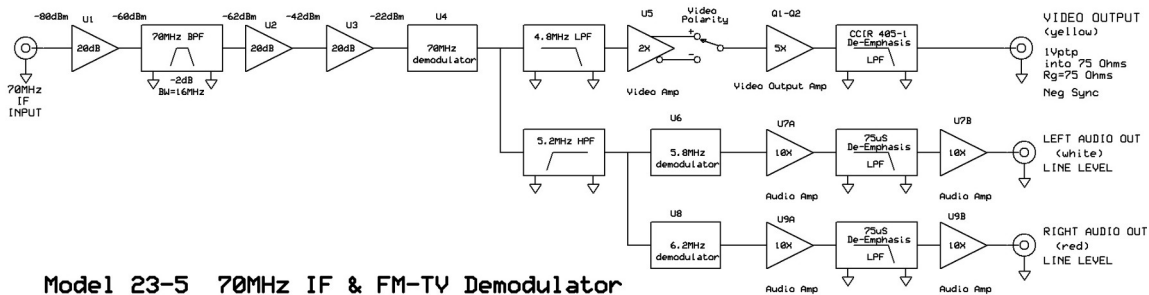

photo tnx to Dave, AH2AR

ATN at DAYTON HAMVENTION

K8FIX Bruce Kobe discussing ATV related questions from several Hamvention attendees at the ATN booth.

Model 23-5 70MHz IF & FM-TV Demodulator
BLOCK   DIAGRAM
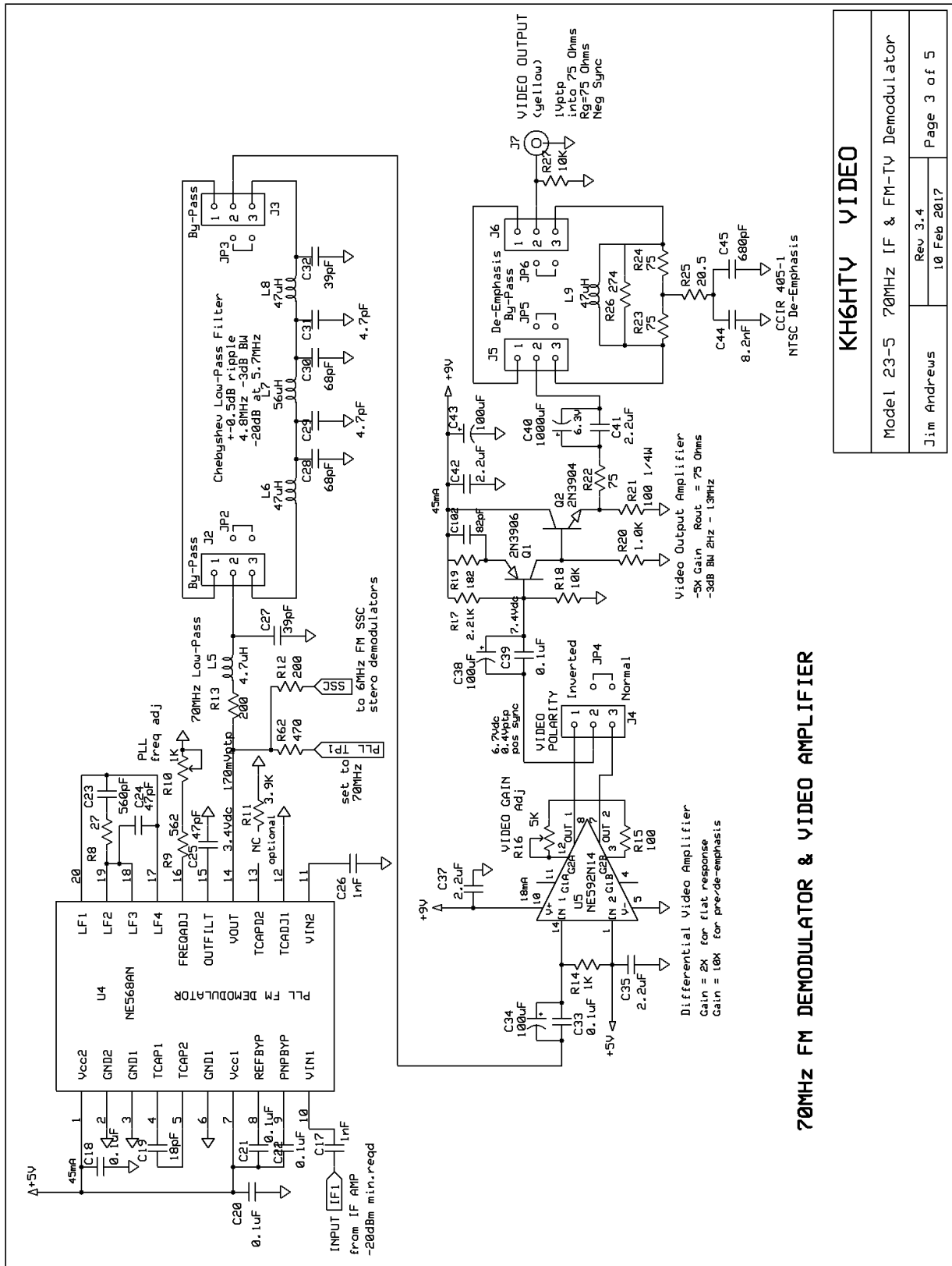
FM-TV Demodulator
Circuit Details:

Back in March (issue #126), we discussed the overall design concepts of an FM-TV demodulator.   We promised to provide more details in later newsletters.   This is derived from the instruction manual written in 2014.

The model 23-5 FM-TV demodulator consisted of a high gain, 70 MHz IF amplifier followed by a video FM demodulator and a pair of audio FM demodulators.   It was intended to be used with a microwave down-converter with an IF output of 70 MHz.   In the May newsletter, issue #130, we discussed the design of the 70 MHz IF amplifier.   In this issue, we will discuss the design of the FM-TV video demodulator and video amplifier. The detailed schematic diagram is shown on the following page.

IC, U4, is a PLL FM demodulator tuned to 70 MHz.   It is a Phillips NE568AN.   It is a monolithic phase-locked loop (PLL) which operates from very low frequencies up to 150 MHz.   The NE568A consists of a limiting amplifier, current controlled oscillator, phase detector, level shift circuit, V/I and I/V converters, output buffer and necessary bias circuits. It was intended for demodulation of FM signals with extremely large deviation in systems which required a highly linear output.   The typical application was for satellite TV receivers with a 70 MHz IF.   It could demodulate ± 20% deviations with less than 1% non-linearity.   I used Phillips recommended circuit for U4, NE568A.   See their data sheet for details.   I used the N suffix version which is a 20 pin DIP package.

U4's output contains both the video signal and also the stereo sound sub-carriers (SSC). The SSCs are in the range from 5 to 7 MHz. We will discuss the SSC demodulators in a future issue.

70MHz FM DEMODULATOR & VIDEO AMPLIFIER

KH6HTV VIDEO

Model 23-5 70MHz IF & FM-TV Demodulator

Jim Andrews

Rev 3.4
10 Feb 2017

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In the video chain, I first inserted a 13 MHz low-pass filter to remove all remaining 70 MHz IF signal. Then a 4.8 MHz, Chebyshev low-pass filter was inserted in the video chain to filter off the SSCs.   If there are no SSCs present, this 4.8 MHz low-pass filter can be by-passed with internal jumpers to achieve a higher video bandwidth of 7.8 MHz with a more Gaussian response and higher video resolution.
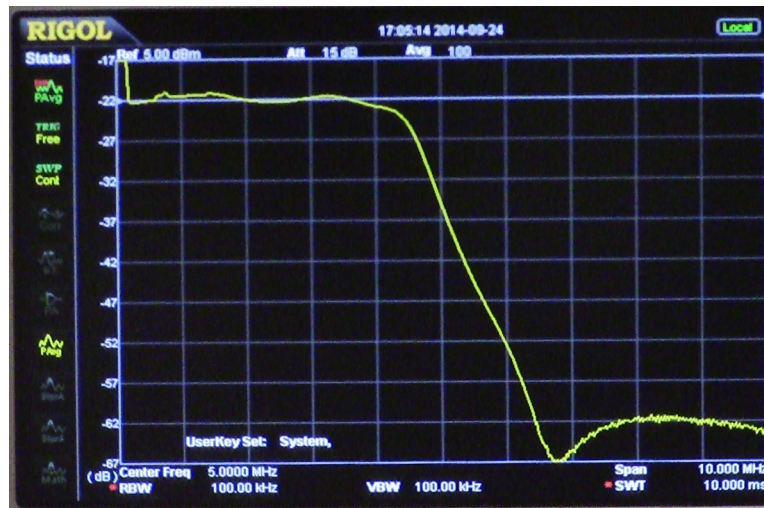

4.8 MHz Low-Pass Video Filter frequency response.   Sweep from 0 to 10 MHz. 5 dB/div & 1 Hz/div. Ignore "glitch" at 0 frequency at extreme left.

A Motorola (now ON Semi) NE592 video amplifier was used for U5.   The NE592 is a monolithic, two stage, differential, wideband video amplifier.   It has fixed gains of 100 or 400 and with an optional external resistor the gain can be set between 0 and 400.   I used the N suffix version which is a 14 pin DIP package.   The NE592 was specifically designed for video amp applications such as this.

Video amplifier, U5, has differential outputs.   With an internal jumper setting, either positive or negative polarity video can be selected.   The gain of U5 was adjusted with the trim pot, R16.   The video gain was set differently depending upon whether video pre-emphasis was used, or not.   The polarity of the video output from U5 was set via a jumper on the pc board selecting the appropriate differential output from U5.

The output video driver amplifier, Q1-Q2, was capable of driving a 1 Vptp standard video signal into a 75 Ω load from a 75 Ω output impedance.   A de-emphasis filter is on the output of the driver amplifier. It provides standard CCIR 405-1 de-emphasis for NTSC signals. If the 23-5 is used for PAL video, then different de-emphasis filter component values are required.   If the video signal has not already had pre-emphasis put on it, then this filter should be bypassed by moving two internal jumpers.
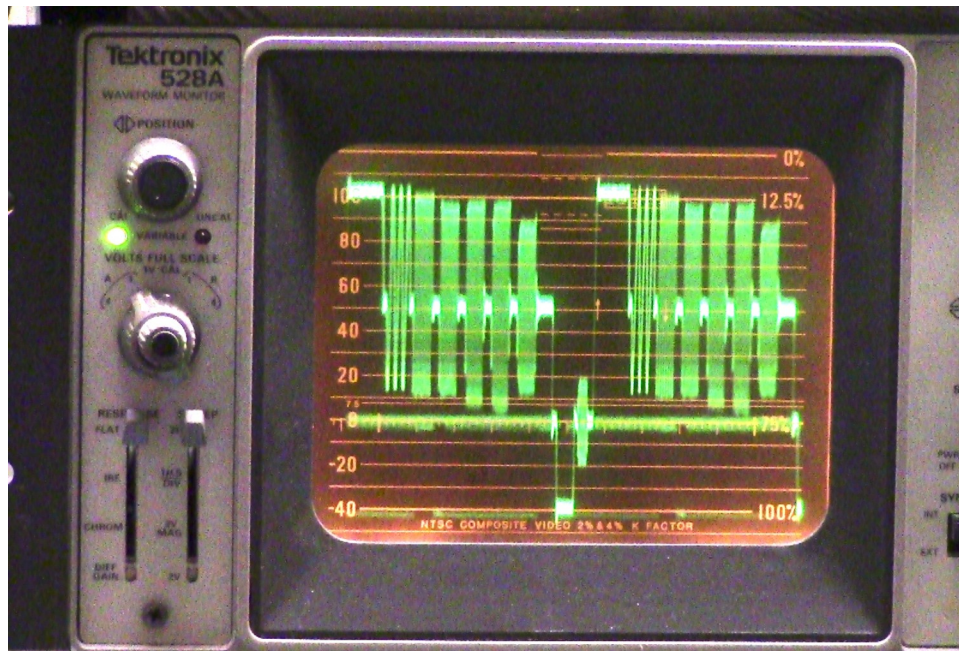
The following photos demonstrate the performance of the composite KH6HTV model 23-1 transmitter and 23-7 & 23-5 receiver.
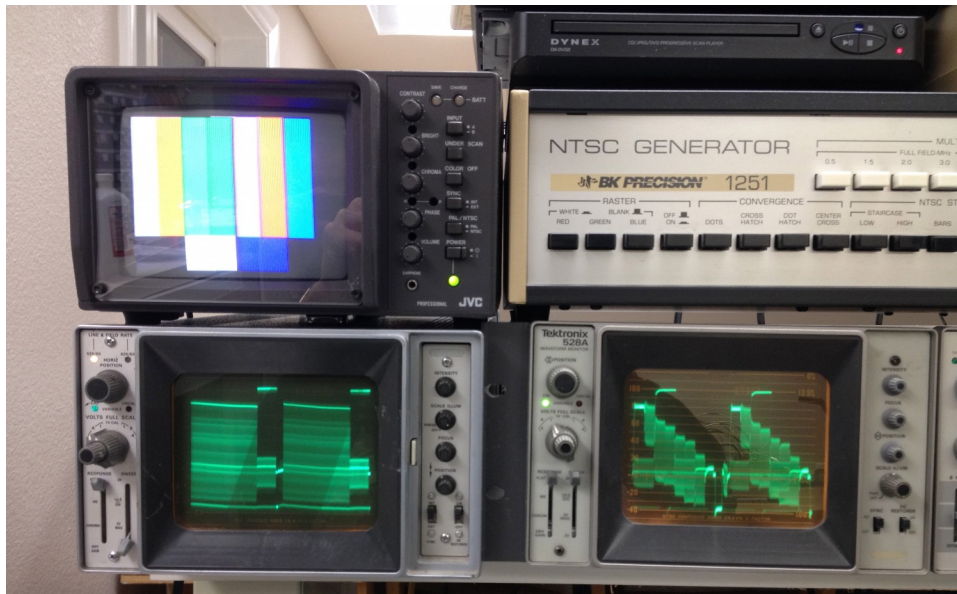
Video Waveform Test Equipment.
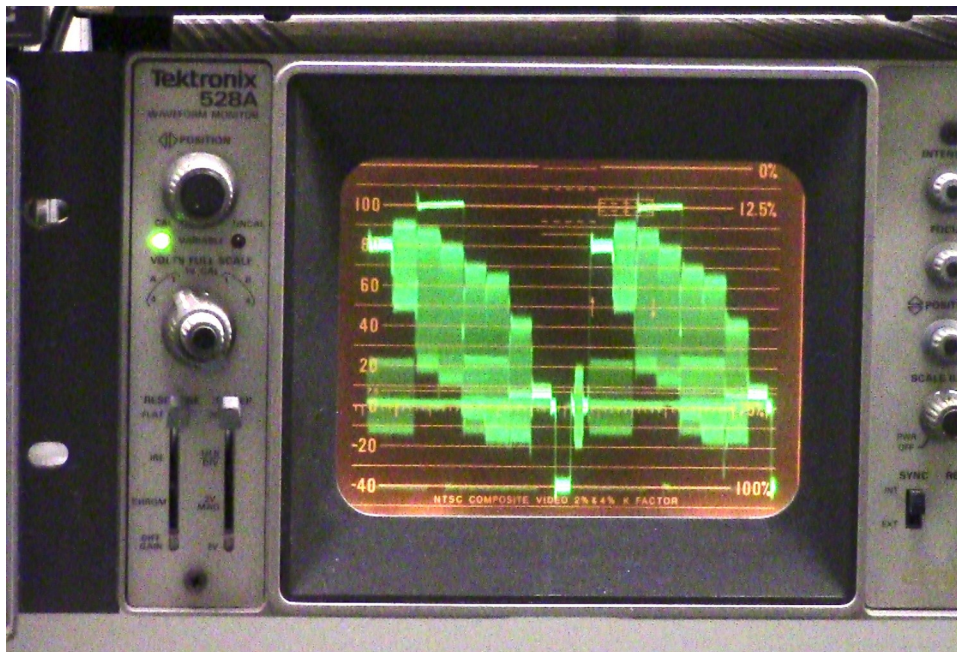

Color Bars test signal -- Horizontal Interval -- 2H. Composite video waveform response of a 23-1 FM-TV Transmitter and 23-7/23-5 FM-TV Receiver. No pre-emphasis / de-emphasis used. 4.8 MHz Chebyshev low pass filter used in 23-5.

Multi-Burst test signal -- Horizontal Interval -- 2H. Composite video waveform response of a 23-1 FM-TV Transmitter and 23-7/23-5 FM-TV Receiver. No pre-emphasis / de-emphasis used. 4.8 MHz Chebyshev low pass filter used in 23-5.

Jim Andrews, KH6HTV, Boulder, Colorado
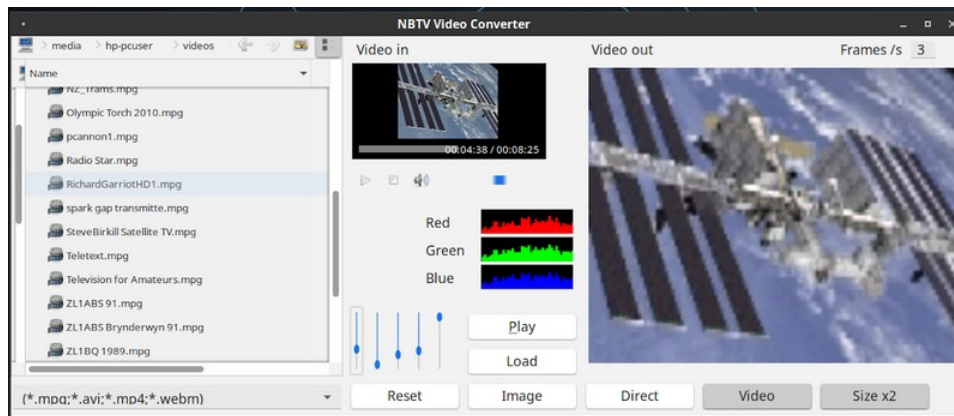
Update on new NBTV hybrid encoder/decoder

I have been very busy over the last few weekends working on software for my NBTV project, as there has been a number of developments made, as it is now a digital & analog hybrid transmission and coding system. I have posted the information on the Narrow-bandwidth television association-forum, last week under the handle of GrantXTV:

https://www.taswegian.com/NBTV/forum/viewtopic.php?f=10&t=1876&start=90#p28580

I put together a basic program to test out different ways of doing video compression, whereby I read in a video file and convert it to RGB, then RGB back to video. With the gap in between to plug in software models for different experiments to see what works and what does not work, before I send out the bit stream to the modulator for extra processing. The aim is to go with a hybrid approach that is both digital and analog or somewhere in between. The first stage is the digital compressing that has a image frame (I) fixed image and a predicted picture (P) made up of parts of each frame from image on each side. Since I am using analog modulation 65536QAM, or just QAM for short (video and sound), plus MFSK (data channel), therefore it is not possible to send any forward error correction (FEC), so the digital compression needs to work with noise, therefore I making fill use of noise reduction and analog compression / expansion in the modulator and demodulation sections.

As for the hardware design, I am now working on a new modulator using ADC,DAC,FPGA and SRAM, as lot of the processing is now done in software, make this a lot simpler task to do. This is still very much a multi-year project as I am working it out as I go, here a image of version one software interface.

I have made a few more updates since then, in the digital video encoder / decoder using Wavalet processing to enhance the 120 x 96 image up to 240 x 192 at 12.5 pictures per second, made up of a key and picture frame. Where one date block sends on of each, making up 6.25 date frames, the modulated on 24 65536QAM carries or QAM for short. At this stage I am only working on the software, to encode and decode a video signal and I will post some videos within the next few weeks, highlighting what possible, as this will be a multi year project as I am designing it from the ground up.

73 de Grant, VE3XTV, North York, Ontario, Canada

ATV International QSO Party: Once again, Peter, VK3BFG, in

Melbourne, Australia is organizing his annual ATV QSO party.   He has just sent out a notice that it will be on Friday & Saturday, August 25-26.   The USA session is planned for Friday night and the Australian session for Saturday morning/afternoon.   He is looking to drum up interest in many other ATV groups to participate in it.   If intererested, contact Peter directly. (pcossins at bigpond.com)

Misc. Correspondence:

More Signal Reports on W0BTV:

Hi Jim --- I finally got up on my garage roof this afternoon and trimmed the tree blocking my 23 cm signal, and also fixed the antenna damage done by the solar guys. I was in the process of peaking up the pointing when it started raining between here and NCAR so I quit while I was ahead.

Here's what I'm seeing:
High Power (3 Watts): -42 to -38 dBm, 15 to 23 dB SNR
Med Power (1 Watt): -44 to -46 dBm, 13 to 15 dB SNR
So I'm back in action on medium power.   I can probably get a dB or 2 more if I finish peaking up the pointing when the rain finally stops.

73, Chris K0CJG, Boulder, Colorado

DATV Flies on a Student Balloon

Jim --- Just wanted to let you know that the model 70-7B amplifier you built for us will be flying on our student payload on Monday, June 5th at around 10am. If you would like, you are welcome to watch our livestream of the event: https://www.youtube.com/@AdvancedTechnologiesGroup
If you would like any more information, let me know and I'll gladly share.   Thank you for all of your help over the past few months.

<div align="right">Kind regards, Drew, AC3DS, Fairview, PA</div>

Portland, Oregon - ATV

Jim ---   Yes, very helpful! I'm going to pass on the encoder I mentioned (it was an eBay find). Going forward I plan to buy the Hi-Des Tx and Rx for a digital station here.

Not sure if there are any other ATV stations on the air in this area.   I'm close friends to the existing ATV repeater custodians, so working with them is the key to getting their repeater back on track. It was NTSC Analog (70cms in, 23cms FM out).   BTW, as I'm starting from scratch at this QTH I have to get antenna up and build a conventional Ham station first.

I just got word from the FCC to change my callsign, dropping the "six" (California issued).   The new call is K7GVG to honor my time working for the **Grass Valley Group** on analog Broadcast equipment. I have a deep collection of analog SD, NTSC gear that I intend to put to good use in the Ham hobby.

Looking forward to the projects ahead. I'll be reaching out to you for help, and have some content for your newsletter.

<div align="right">73 de K7GVG, (formerly G8PJD), Peter J. Stonard, Portland, Oregon</div>

W0BTV Details: **Inputs:** 23 cm Primary (CCARC co-ordinated) + 70 cm secondary
all digital using European Broadcast TV standard, DVB-T   1243 MHz/6 MHz BW (primary), plus 441 MHz/6 MHz BW and 439 MHz/2 MHz BW
Outputs: 70 cm Primary (CCARC co-ordinated), Channel 57 -- 423 MHz/6 MHz BW, DVB-T Also, secondary analog, NTSC, FM-TV output on 5.905 GHz (24/7 microwave beacon).
Operational details in AN-51c   Technical details in AN-53c.   Available at:
https://kh6htv.com/application-notes/

W0BTV ATV Net: 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. A DVD ham travelogue is usually played for about one hour before and 1/2 hour after the formal net. 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*).

Newsletter Details: *This is a free newsletter distributed electronically via e-mail to ATV hams. The distribution list has now grown to over 500+.   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.   All past issues are archived at: https://kh6htv.com/newsletter/*

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

CATV, NTSC, Analog TV
- Modulator & Demodulator for Sale

These items were recently removed from the Boulder, Colorado, W0BTV, ATV repeater. In good working order.   They are ideal for someone wanting to assemble a 70 cm, analog ATV repeater.

Modulator   Demodulator / Receiver

The Pico-Macom model MPCM45 modulator is a fixed channel unit working on only Ch 57, 421.25 MHz. It puts out a perfect vestigal, upper-sideband TV signal. (VUSB-TV). It also includes the 4.5 MHz sound sub-carrier. The rf output is at the milli-watt level. It thus needs to be followed with an rf linear power amplifier. The W0BTV repeater used a KH6HTV model 70-9 amplifier to boost the output to 25 Watts (pep).

The Pico-Macom model MPCD demodualator is a frequency agile, NTSC analog TV receiver covering all standard broadcast and cable TV channels. This includes cable TV channels 57-61 which fall in the amateur 70 cm band.   We used it on Ch 60 (439.25 MHz).

These are in the CATV industry standard "Mini-Mod" package.   They both require +12Vdc & +5Vdc for power.   A/V outputs and inputs are composite video and line level, mono audio.

Both items have been discontinued by Pico-Macom. New demodulator units can sometimes still be found on the internet but now at very high prices in the $350 range.   ATV Research is selling new the Holland HMMS, single channel modulator, similar to the MPCM45 for $148.   We are willing to sell the pair for $130 which includes free shipping via USPS priority mail.   Interested ? -- contact Jim, KH6HTV via email kh6htv@yahoo.com

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