

Boulder Amateur Television Club TV Repeater's REPEATER

July, 2020
2ed Edition

BATVC web site: www.kh6htv.com

ATN web site:
www.amateurtelevisionnetwork.org

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



W0BTV Details: Inputs: 439.25MHz, analog NTSC; 441MHz/6MHz BW, DVB-T & 1243MHz/6MHz BW, DVB-T Output: 423MHz/6MHz BW, DVB-T
Operational details in AN-51a Technical details in AN-53a. Available at:
<https://kh6htv.com/application-notes/> We hold an ATV nets on Thursday afternoon at 3 pm MDT. ATV nets are streamed live using the British Amateur TV Club's server, via:
<https://batc.org.uk/live/kh6htvtvr>

Newsletter Details: This is a free newsletter distributed electronically via e-mail to ATV hams. The distribution has now grown to almost 350. 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. Past issues are archived at:
<https://kh6htv.com/newsletter/>

Typo Apology: My apology to Allen, W8KHP. In the last issue, I mis-labeled the caption for the photo of the signal he received from N9BNN.

Richard, KJ6RNL Here in San Jose, California. Member of Ben Carluci's ATV repeater club, W6SVA. We are an analog SD video group. 1255MHz FM video in and 427.25 VSB AM out. I got my license specifically to run ATV. The picture of me on the front page of the web site is from the day I surprised everyone by "just showing up". I didn't know anyone in the group. Only the particulars to get a transmitter on the air. I used the Mobicomm modulator and a homebrew 30W amplifier.

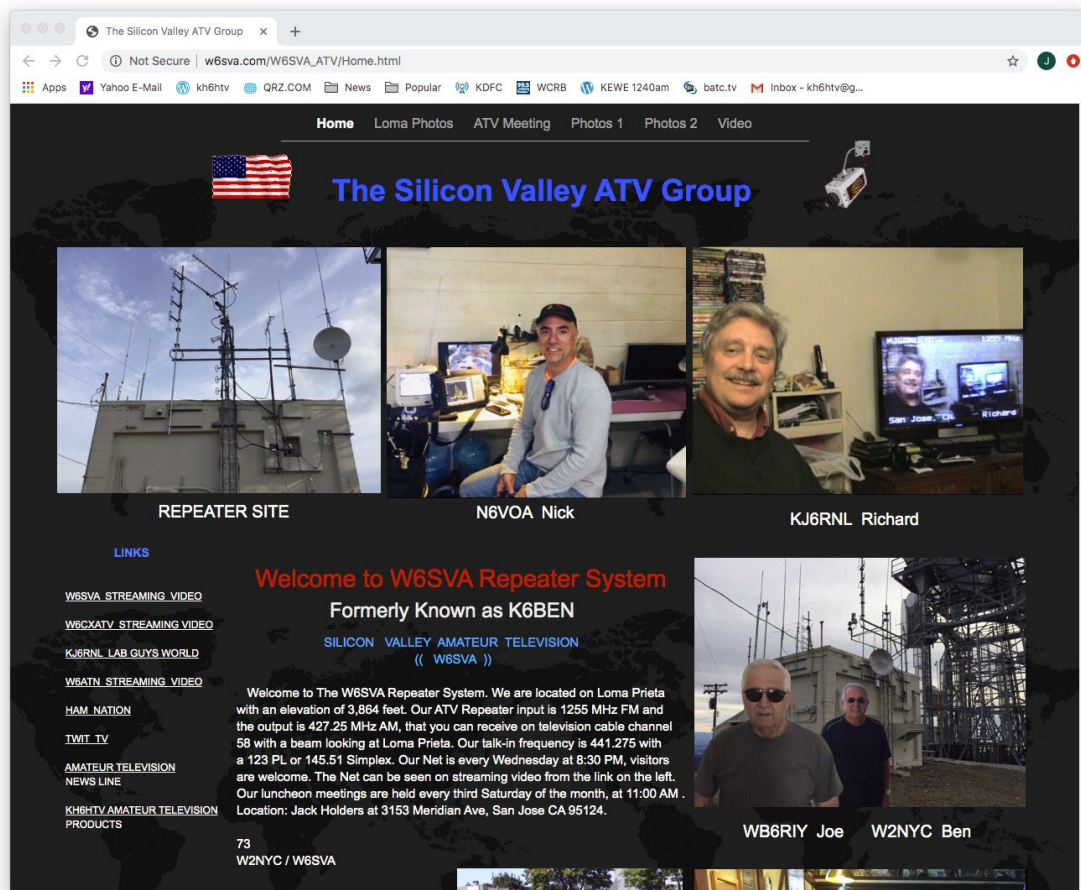
Recently built a second transmitter in the same configuration. But, have yet to get it working in its entirety. I put the power amp chip inside the same case with the modulator and either the PA chip, which came from China, is either bad or counterfeit OR the RF is so hot in the box, it is interfering with the modulator and gumming up the works. I have a

very good work bench for baseband video equipment but not suitable to RF troubleshooting. So, have yet to make the new TX work. The next step is to isolate the power amp and see if that gets it on the air.

Here is a link to my outdated ATV page, at my personal web site.
<http://www.labguysworld.com/ATVinSanJose.htm>

I have moved since then and the system is slightly different. I use a 32 foot military surplus mast for my antennas which my land lord graciously allows. (I rent a couple of rooms) ----- Enough jaw jacking for now. Your turn.

Richard Diehl aka Labguy aka KJ6RNL



Welcome to The **W6SVA** Repeater System, in Silicon Valley, California. We are located on Loma Prieta with an elevation of 3,864 feet. Our ATV Repeater input is 1255 MHz FM and the output is 427.25 MHz AM, that you can receive on television cable channel 58 with a beam looking at Loma Prieta. Our talk-in frequency is 441.275 with a 123 PL or 145.51 Simplex. Our Net is every Wednesday at 8:30 PM, visitors are welcome. The Net can be seen on streaming video from the link on the left. Our luncheon meetings are held every third Saturday of the month, at 11:00 AM. Location: Jack Holders at 3153 Meridian Ave, San Jose CA 95124.

BCARES 146.76 REPEATER: On our July 2ed ATV Net, we were greeted with an unusual, continually sounding "beep" tone. At the time, no one knew what it meant. Bill, KD0YYY, and Pete, WB2DVS, checked into it later. Bill reported later "That was an indication it was on battery backup." Pete then added more details --- "Here is the rest of the story. After our Thursday ATV net I contacted Mike, N0BP, W0IA trustee, to discuss what was happening on the repeater. He confirmed it was running on batteries and went up there Friday morning. Someone had installed a window air conditioner and plugged it into the same 15A outlet that our repeater was plugged into. The air conditioner draws 14.2 A. When we were using the repeater on Wednesday for the microwave outing, it tripped the breaker. Mike consulted with Dave Sitner, Sheriff's radio tech, and found out about the air conditioner installation. Mike, with help from Dave over the phone, selected another outlet. All is good now." Pete, then followed up with the following description of what the various beeps & tones from the 76 repeater mean.

Magic decoder ring for Boulder 146.76 repeater tones

Pete, WB2DVS

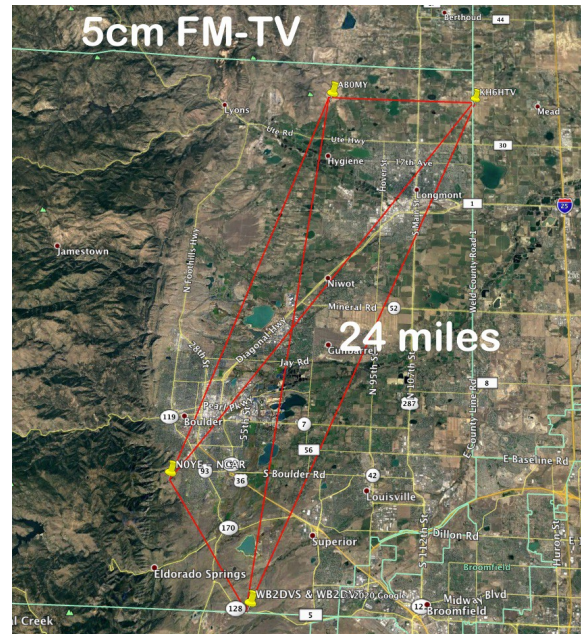
The courtesy tone that you hear after a transmission indicates which voting receiver is being used. There are four receivers. Here are the receivers and the courtesy tones associated with them:

- 1) **Gunbarrel.** This is the main receiver and is located with the repeater transmitter. It produces a single tone of medium pitch.
- 2) **Louisville.** This receiver is located at the same building and tower with our packet radio node transceiver. Its courtesy tone is a single beep with a low pitch.
- 3) **Firestone.** This receiver is located at a ham's residence. Its courtesy tone is a double beep. The pitch is a high tone followed by a medium tone.
- 4) **Table Mesa.** This receiver is located at a ham's residence. Its courtesy tone is a double beep. The pitch is a high followed by a low tone.

If there is no courtesy tone this means the receiver voting system is turned off. The receiver being used is the main receiver at the Gunbarrel repeater site. One possible cause of this is when AC power is lost and the repeater is running on its backup battery. If this happens, there will be a constant beeping about once every second. It is meant to be annoying!

BOULDER MICROWAVE NEWS !

On Wed, July 1st, the Boulder microwave ATVers were at it again. Pushing the distance envelope even farther. This time, great results were obtained up to a distance of 24 miles (39km) on the 5cm (5.8GHz) band with low power FM-TV. Don, N0YE, our microwave guru, organized another successful outing. He sent Pete, WB2DVS, & Debbie, WB2DVT, south to a high spot on CO-128, about 1.6 miles east of CO-93. He sent Bill, AB0MY north-west of Longmont to the far north end of 75th



street. He sent Jim, KH6HTV north-east of Longmont and west of Mead to County Line Rd & Weld County Rd -34. Don, went up to his favorite spot of NCAR, south-west of the city of Boulder. When folks think about Colorado, they always picture high, 14,000 ft. mountains. But the eastern third of Colorado is part of the Great Plains extending from Texas to Alberta, Canada. The eastern half of Boulder County is actually flat, rolling prairie, at an altitude of 1 mile above sea level. With the exception of Don's NCAR site which is on a high mesa, at the base of the Rockies -- all of the other locations were on the flat, eastern Colorado prairie, but at selected high spots with excellent views to the far horizon. This is plainly visible in the aerial photo above from Google Earth. The Rocky mountains are on the west (left) side of the photo. The farthest distance noted of 24 miles was between Pete & Debbie to/from Jim, both at prairie locations.

Everyone used 23dBi, BBQ grill, L-Com, dish antennas. The transmitters and receivers were the low cost (\$30) drone, FPV, equipment previously described in this newsletter. For transmitter rf output power, Don, Pete & Debbie were running "barefoot". Don's RF power was running +23dBm. Pete & Debbie were running +28dBm. Bill and Jim had "After-Burner" FPV amplifiers. Bill's power was +30.5dBm. Jim's was +33dBm. We used the 146.76 MHz, BCARES, FM repeater for voice coordination. Successful P5, perfect picture, ATV QSOs were exchanged among all participants. In several cases, the signals were strong enough that some reported getting weaker pictures even when the transmitting station was pointing his/her dish to another location.

Towards the end of the exercise, Jim put a calibrated step attenuator on his receiver to determine the signal margins. On Don's +23dBm signal he measured it to be -72dBm. On Bill's +30.5dBm signal, he measured it to be -61dBm. Later rf path propagation calculations using *Radio Mobile* predicted -75dBm for Don and -63dBm for Bill. These values were extremely close to those actually measured. These results bode well for us pushing the envelope much farther in the future. In the past, we have made a couple of ATV DX-peditions up north to the Colorado-Wyoming border, just south of Cheyenne

and been able to access our ATV repeater located on the NCAR mesa from there over a 77 mile path. This was done on both 70cm and 23cm bands. *Radio Mobile* predicts that if we used a 2 watt transmitter from Wyoming on the 5cm band, we should be able to get a -78dBm signal over this same path.

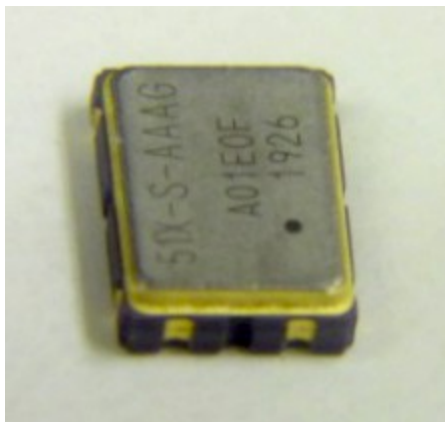


P5, 5cm, FM-TV, ATV images received by Bill, AB0MY. from left to right N0YE (18 miles), WB2DVS & WB2DVT (22 miles) & KH6HTV (7 miles)

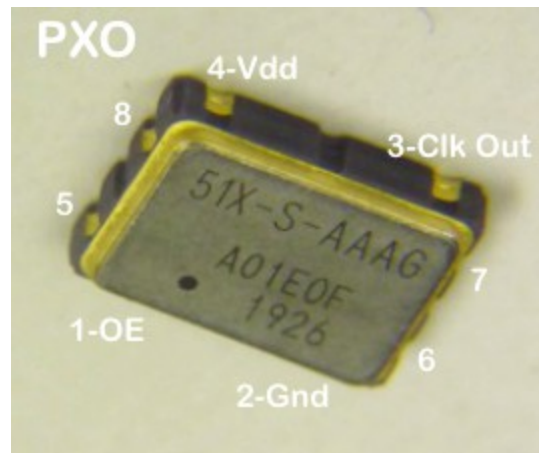
Direct FM with Programmable Crystal Oscillators

John, WB0CMC, Omaha, Nebraska

I have found it is possible to directly frequency modulate the Silicon Labs PXOs. There are four additional contacts on the end of each PXO other than the four intended connections. These do not connect to a pad under the chip. They are not shown, nor mentioned on the Silicon Labs PXO data sheet. I have added the additional terminal numbers 5-8 myself.

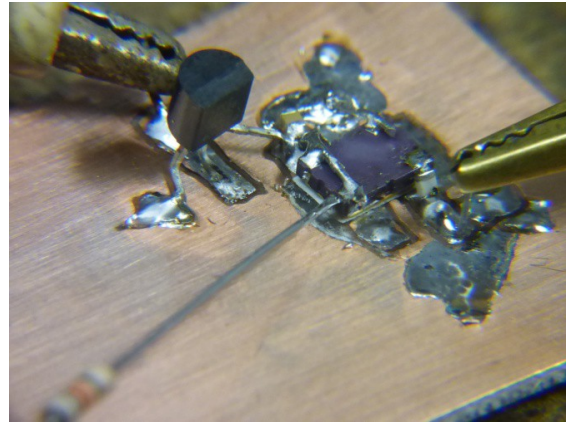
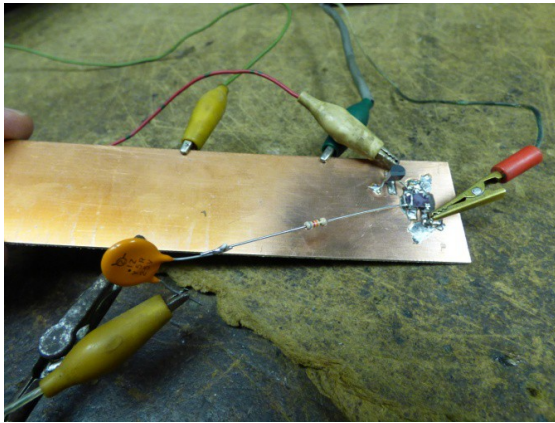
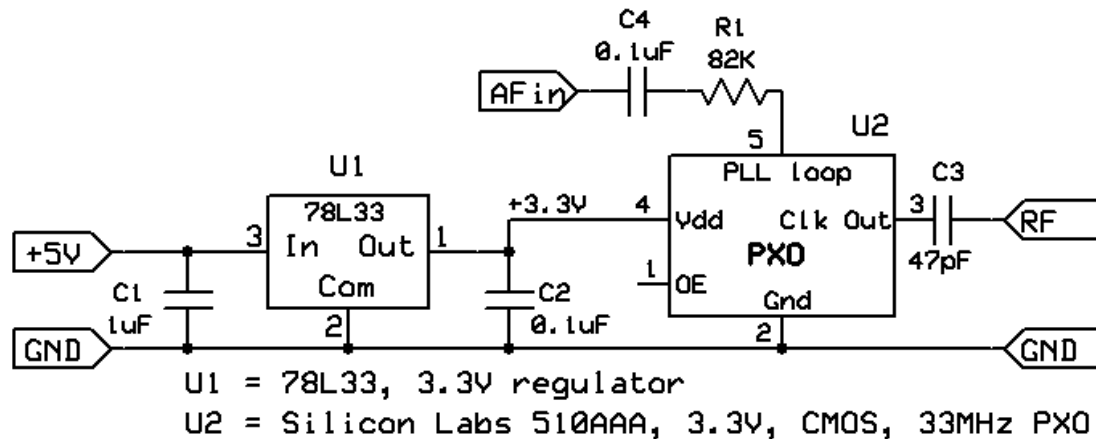


Two of the end connections



2 of the main terminals and 2 of the internals

These four mystery terminals are obviously for programing and other internal signals. One of them, #5, appears to be the loop filter, or at least access to it. Pins 6 and 7 (my #s) appear to be open and may be CK and DATA for programing? Pin 8 has a 0.555 Volt potential on it and pin 5 a 0.33 V static level. The later will probably be higher at higher PXO frequencies since it is the loop voltage. Pin 8 may take part in the programming as well. I didn't do anything with it except measure it.



With an 18K resistor and a 0.1μF cap in series with one of these terminals, #5, I was able to FM modulate the PXO with a 400 Hz tone. I did change the resistor to an 82 K which didn't change anything but the drive level. My lash up, in the left photo with a close-up right. The TO92 is a 3.3 V regulator. The PXO is upside down with jumpers to the copper on the board. Output cap is 47pF next to the right clip lead, 0.1μF bypass at the output of the regulator. 82 K resistor tacked to the end connection. Left clip lead is +5 Volt input. The PXO chip I used was programmed for 33.0166666 MHz.

I used my Cushman CE-5 communications service monitor to measure the FM modulation. I looked at the 13th harmonic at 429.215MHz. Modulation frequency response was good. It is flat from about 50 Hz to 5kHz. I used a -13dBm audio input. With a 400 Hz tone, it started to clip at ±15 kHz deviation with a 4 kHz down shift in frequency (not surprising). More than about 12 KHz deviation at the fundamental can cause the PXO to go out of lock and



won't come back till the audio drops to where it is at 10 KHz. It is also noteworthy that there are almost no even order harmonics with this PXO. Only the second is significant on my analyzer.

The real trick to adding FM modulation to these PXOs is going to be how to solder a connection to that really tiny end pin ?? Any one still have a cat whisker ?

John's parting comment "It pays to diddle and tweak, sometimes ! "

Editor's Notes:

1. For more information about Programmable Crystal Oscillators (PXOs) see our May, 2020 newsletter, issue #43, pp. 5-12.
2. These PXOs are made by Silicon Labs. They can be purchased from Digi-Key in single piece quantities for about \$5 each. They are programmed for you by Digi-Key. Specify the desired frequency when ordering. They are available for any frequency from 100 kHz to 212 MHz.
3. John's comment about almost no even order harmonics from his PXO. This is because the output waveform is a square wave. Fourier analysis of a pure square wave shows nulls at all even order harmonics.

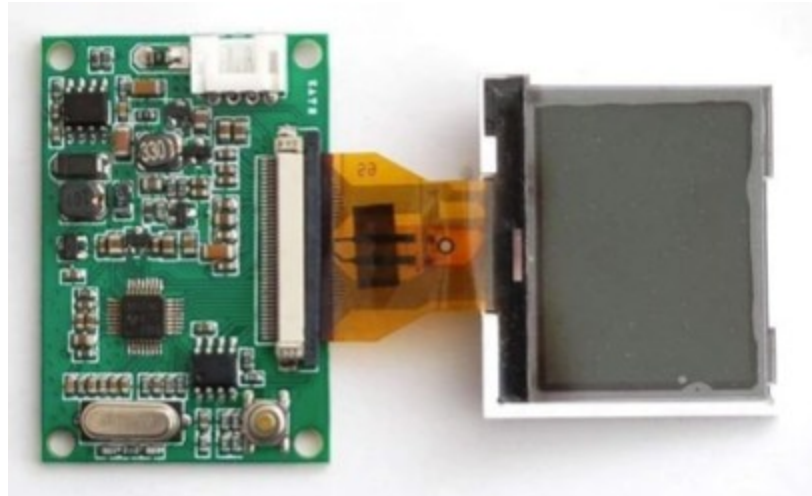


Admittedly a very Odd Mod Indeed!

Dave, AH2AR, Dayton, Ohio

Within the realm of the bizarre and unusual, this might take honorable mention... My intention was to mount a 1.5 inch, TFT display inside an HV110 DVB-T receiver as a means to create a simple test receiver so an external monitor would not be needed. The TFT display was obtained from the following website:

<https://coolcomponents.us/products/ntsc-pal-television-tft-display-1-5-diagonal>



The price was \$45. It works with either NTSC or PAL video. It's resolution is 160 x 240 pixels. It can be powered from 5 to 15Vdc. It draws 50mA at 12V, or 120mA at 5V.

After cutting a window out of the aluminum chassis of the HV-110 Receiver, I went ahead and doubled up the TFT display and its PCB with insulated tape, and then mounted the display flush inside of the top of the HV-110. I used copper foil tape to completely overlay and position the composite video monitor package to the interior of the chassis. This technique proved to be a very secure way to marry the display up with the chassis. Once in position, the copper tape provides an extremely sturdy method to permanently hold the display in place. The copper tape works so well in keeping the display positioned correctly, its critical that the display is properly aligned with the window, as there is only one chance to get the alignment right, since there is no repositioning opportunity once the tape is applied over the package.



Note that I removed the RCA plug hookup from the TFT display and ran the display input to the point on the HV-110 receiver circuit-board that provides analog video output. Doing so is obviously not good engineering practice without the use of a video

distribution amplifier, however, I have found that it's possible to run this internal display at the same time that a composite video external display is used with no perceived display degradation. However, please note that the HV110 receiver also has an HDMI output, and this additional output also provides simultaneous video output from the HV110. Typically, the HDMI output is used when running these receivers, and the standard HV-110 configuration will allow the user to use the HDMI output and composite video analog video outputs simultaneously.

The HV110 receiver uses 5 Vdc, USB power. The TFT display also requires 5 Vdc. The supply voltage is available for the TFT by tapping into the receiver's PCB power supply input circuit tracings. The appropriate PCB connections were accomplished through using a volt-ohm meter to find the correct wiring hookup placement, and then routing and soldering the wiring to the correct solder junctions. There are several through-hole "routes" that can be used on the HV-110 PCB that allows an insulated wire pass-through, since the TFT display sits above the HV-110 PCB, and such a route will be necessary for wiring access to the bottom of the HV-110's PCB.

The TFT display provides excellent resolution... so much so that the OSD's alpha numerics are quite readable (if your unaided eyeball is able to discern that level of detail). The off-axis optical performance of the TFT display is typical of what can be expected with this type of display. Consequently, its best to use this HV110 with it standing on its face-plate, as shown in the above photo.

The receiver by itself draws 580 ma, and when piggybacked with the TFT display, the current draw increased to 820 ma, well within the current handling limits of the supplied 2 Amp ac adapter that is normally included with the HV110.

ATV NEWS from U.K. & E.U The British Amateur Television Club (BATC) puts out a nice quarterly magazine called CQ-TV. The first issue #1, came out in October, 1949. The latest, summer, 2020 issue is now #268. All past issues are archived on the BATC web site (batc.org.uk) There are several articles of interest in the latest issue.

"Dutch Analogue ATV Experiments in the 6cm Band", by Chris van den Berg, PA3CRX. What the Dutch are doing is similar to the 5 GHz, FM-TV activity here in Boulder. They are working over much flatter terrain (some below sea level !) than our recent outings on the rolling hills of the Colorado prairie. Their highest hills are at most 100 meters high, but covered with thick forests. They were using transmitters on 5.780 GHz with rf power ranging from 70mW to 1.2 Watts and dish antennas. They had issues maintaining their 2m or 70cm FM voice communications. When they did establish a 5 GHz link, the audio over it was better than their 2m/70cm FM. The article also mentioned having a 5GHz input to their PI6ATS - ATV repeater. The farthest distance a signal has traveled to get into their repeater was 135km during a tropo duct. The repeater's antenna was a home-brew slot antenna fashioned by cutting 20 slots in a waveguide. They used the W1GHZ program to design the antenna. (w1ghz.org) This sounds a lot like the slot antenna, Don, N0YE, unsuccessfully tried to build for our ATV repeater.

"Cost Effective Multi-Band Dish Feed", by Noel Matthews, G8GTZ. Noel had an old 80 cm offset feed dish with a 3.4 GHz waveguide feed horn. He replaced the waveguide feed with a pc board, log-periodic antenna from WA5VJB. (www.wa5vjb.com) The result was now an antenna which he could use on 2.4, 3.4, 5.7 & 10 GHz bands. With this antenna, he reported his best ATV DX was 64km on 5.7 GHz.

"An Introduction to Video Editors", by Rob Burn, G0NXG. Rod discusses how to make your own video on your computer. He says there are many video editors out there in the market place. The one he uses for his article is called "OpenShot". The nice advantage of OpenShot is that it is a free, open-source program. It is available for Windows (7, 8 or 10), Mac OS-X and Linux. (www.openshot.org)

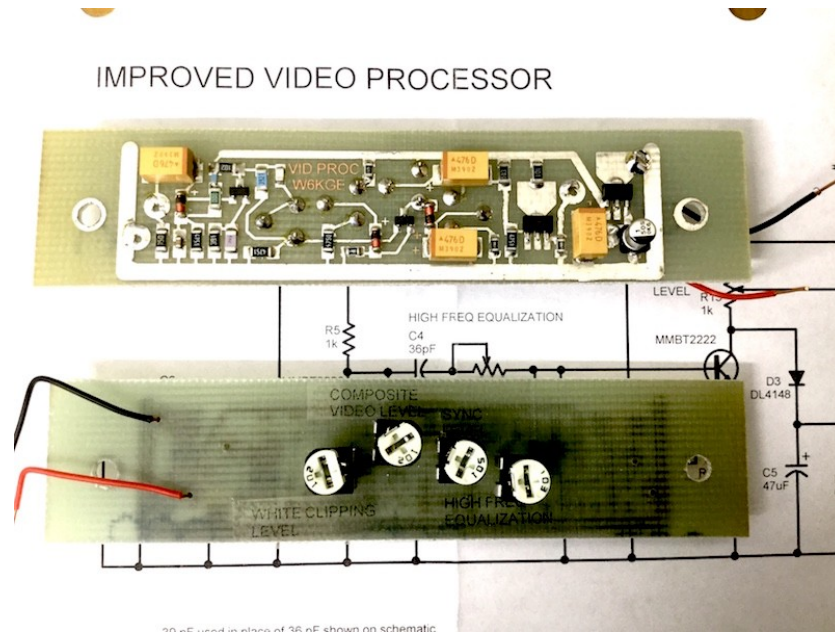
"Converting a TV Repeater to Widescreen on the Cheap", by Ian, G8XZD. What caught my eye in the article was Ian's statement --- *"..... as at the moment, there is no off-the-shelf DVB-S transmitter with an HDMI input."* This tends to confirm my observations that noone is offering for DVB-S any transmitters that are comparable to the DVB-T transmitters (i.e. modulators) that we are able to purchase from Hi-Des in Taiwan. (www.hides.com.tw) It appears to me (KH6HTV) that the DVB-S modulators, ATV hams are forced to use require hacking with a supporting PC computer and using modules such as the BATC's Portsdown, DATV-Express, Lime-SDR, Pluto, etc. For DVB-T, we have gotten spoiled using the Hi-Des equipment. It is the "appliance operator's delight". Off the shelf, plug-n-play. Plug in an HDMI source, DC power and "bingo" you are on the air with high-definition (1080P), digital ATV video and CD quality, stereo audio. No support PC required. Small and totally portable. ----- So my challenge to those DVB-S ATV hams, please correct me when you find something similar as an appliance, plug-n-play. If you find it, I will publish it.

"Lock Light Mod for the DVB-S2 Combo Receiver", by Jason Haywood, K7KPM. The Chinese import, HD DVB-T2 & S2 COMBO receiver that most Boulder ATV hams are using for DVB-T, is also widely used in the U.K. by ATV hams for DVB-S. Jason has made the discovery that he can key a relay by picking off the voltage from the LOCK LED. This is the same discovery I made several years ago, back in 2015 with the Hi-Des HV-110 DVB-T receiver. I documented it then in my app. note, AN-23, "DVB-T Television Repeater". It was also subsequently published in ATV Quarterly magazine. Then in 2016, I did the same mod with the "Combo" receiver. It was documented in AN-35.

"ATV Contests" --- The BATC sponsors several ATV contests. Activity is reported on many bands from VHF-Lo Band to microwaves, up to 24 GHz. In the U.K. they can do ATV starting much lower than here in the US. They do ATV on both the 71 MHz & 146 MHz bands. We don't even have a 71 MHz band here in the USA. There are some impressive distances being reported.

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.**



VIDEO PROCESSORS -- For Sale: I have several Video Processors, designed by Mike Collis, WA6SVT, for sale. There have been several versions of these processors produced, over the years.... and these are the most current. (I just do the pc board layouts and produce the items.) Several versions ago, we published the video processor in the 'Amateur Television Quarterly', Summer 2007 issue.

As amateur television hams, we often want to drive the "class A" amplifiers that we use with our analog TV modulators or transmitters for that "extra watt". In doing so, we find the amplifiers become non-linear. Typically, this results in the sync pulse being significantly reduced.

This Video Processor will allow amplifiers to run at much higher power levels, and will compensate for several problems. The Video Processors adjust for: 1) Improved Sync Level. 2) White Clipping Level. 3) High Frequency Compensation. 4) Composite Video Level.

The Video Processor is inserted between the video source and the video input to the analog modulator or transmitter. The Video Processor's input is 75 ohms, so no termination is needed. There is an on-board voltage regulator so that anything around 12 volts will work to power the board.

To see the Video Processor in operation, check out the YouTube video at: Improved Video Processor (<https://www.youtube.com/watch?v=6LpfUeAhb-c&feature=youtu.be>)

The cost of the Video Processor is \$29 with free shipping in the USA. Proceeds go to help the Amateur Television Network. You can contact me at w6kge@yahoo.com, to order... ---- Bob, W6KGE

	 <p>KH6HTV VIDEO</p> <p>RF LINEAR POWER AMPLIFIERS</p> <p>for Digital, Analog or FM - TV Service</p>	
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For detailed spec. sheets, TV application notes, & price list go to:
www.kh6htv.com Boulder, Colorado, USA

We offer a complete line of RF Linear Power Amplifiers for amateur TV service in 70, 33 & 23cm bands. They are rugged and designed for 100% duty cycles. They typically have >50 dB gain, sufficient to be driven by low level modulators. They include a 20 dB, +20 dBm driver amplifier. They have adjustable rf power outputs with -5 dB & -10 dB steps. They all operate from +12 Vdc.

Model Number	Band	Digital TV (rms, avg)	VUSB-TV SSB (pep)	Saturated FM - CW
70-9B	70cm	10 W	25 W	60 W
70-12C	70cm	6 W	15 W	40 W
70-7B	70cm	3 W	10 W	20 W
33-3B	33cm	6 W	20 W	50 W
33-1A	33cm	2 W	6 W	20 W
23-11A	23cm	3 W	15 W	30 W