Boulder Amateur Television Club
TV Repeater's REPEATER

July, 2020
3ed 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 a weekly ATV net 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/

Steve - WA6EJO

Jim, --- Thanks for the outstanding newsletter. I hope this will become the replacement for the defunct "official" Amateur Television Quarterly.

I hope at some point someone will write an article summarizing all of the current methods for getting on ATV now that equipment is no longer available from PC Electronics, North Country, Comtech, etc.

Editor's Note: Steve has a very impressive ham radio story to tell. Check out his bio on www.qrz.com He has been extremely active in VHF/UHF/microwaves and even light waves (474 THz).

So, taking the "hint" from Steve, I will devote part of this issue of our ATV newsletter to addressing where to find ATV gear. My prime resource is excerpts from my application note, AN-55, *"ATV Handbook - an Introduction to Amateur TV"*. The complete app. note as a .pdf file can be down loaded free from my web site at:
https://kh6htv.com/application-notes/

Where Can I Buy ATV Gear ?

Jim, KH6HTV

Unlike HF radio, and 2m/70cm FM radio, we do not have big name suppliers like ICOM, Yaesu, Kenwood, etc. for ATV equipment. Most ATV suppliers are small "Mom & Pop" operations of dedicated ATV amateurs working from their basements, often on a part-time, or retirement basis. In the past, our major ATV supplier has been Tom O'Hara, W6ORG, and his company PC Electronics. After many years, Tom finally retired in 2015. His web site (www.hamtv.com) is still on-line with application notes, but Tom no longer takes orders, except for selling off misc. surplus components, etc. Over many years, Tom sold thousands of his TV transmitters and they still will show up at ham radio swap-fests.

As a retirement project, I have tried for the past ten years to fill the void working from my ham shack work-shop operating under the name ***KH6HTV Video***. However, to be perfect honest, it has not been a roaring success. The main reason is hams feel my prices are too high, and I have to agree with them. Today hams are spoiled by the relative low cost for very high tech radios. Classic examples today are $1,000 for the ICOM IC-7300, 100 Watt, HF rig and a ridiculously low $25 for a Baofeng, 5 Watt, 2m/70cm HT. The pricing formula I use is a mark-up of 2 X over my cost of the materials. I can guarantee you that no real electronics company would use that low mark-up. When I was a successful entrepreneur with my own company making electronic test instruments and microwave components, we used a 5 X mark-up. (Picosecond Pulse Labs, 1980-2014 and then sold to Tektronix). This was typical of most similar electronics manufacturers. At 5X, one covered all of the various costs of direct labor, rent, R&D, marketing, administration, etc. etc. etc. Being a tiny one man operation, there are no quantity purchases of raw materials with big discounts. However, I have no labor costs, just myself. And I don't pay rent. Janet doesn't charge me rent for my ham shack, but she does insist that I be the janitor and clean up my own messes !

So, the bottom line, before we go any further on this subject is we ATVers need to realize that our hobby is a fringe hobby and don't expect to get ICOM or Baofeng prices for your ATV gear. Plus, in some situations, you also may need to be prepared to do some home-brewing, or at least assembling and programming of your ATV station equipment.

AN-55, Chapter 14 - ATV SUPPLIERS

The following table lists known suppliers of ATV equipment. It is by no means complete. Many other suppliers can be found by Google searching on the internet. Listing here does not imply endorsement by KH6HTV. The list is arranged alphabetically.

ATV Supplier	web site	Country	Notes
ATV Research	www.atvresearch.com	USA	distributor of commercial security video eqpt. CATV modulators & receivers, etc.
British Amateur TV Club	https://batc.org.uk/	U.K.	DTV kits -- free streaming service for ATV repeaters
Comet	www.cometantenna.com	Japan	antennas
CQ-DATV	https://www.cq-datv.mobi/	U.K.	free, on-line ATV magazine
DATV Express	www.datv-express.com	USA	DTV boards
DCI	www.dci.ca	Canada	RF filters, including ATV BPFs
Diamond	www.diamondantenna.net	Japan	antennas
Directive Systems	www.directivesystems.com	USA	VHF/UHF & microwave antennas
Down East Microwave	www.downeastmicrowave.com	USA	rf products from 50MHz to 10GHz, amplifiers, preamps, transverters, etc.
DKARS	www.kdars.nl	Holland	ATV & amateur radio magazine
Hi-Des	www.hides.com.tw	Taiwan	low cost DVB-T modulators & receivers
Intuitive Circuits	www.icircuits.com	USA	OSD-ID board, DTMF decoder, analog ATV repeater controller board
KH6HTV Video	www.kh6htv.com	USA	70, 33 & 23cm RF power amplifiers, preamps, up/down converters, VUSB-TV & FM-TV transmitter & receiver, BPFs, Duplexers - ATV/DTV application notes
KUHNE Electronics	www.kuhne-electronic.de	Germany	power amplifiers, preamps, converters, oscillators, transverters
L-Com	www.l-com.com	USA	microwave antennas
MFJ	www.mfjenterprises.com	USA	70cm, VideoLynx AM-TV transmitters
MiniKits	www.minikits.com.au	Australia	70cm, AM-TV & 1.2/2.4GHz FM-TV transmitter kits, rf amplifier kits
Mirage	www.mirageamp.com	USA	rf power amplifiers
M-Squared	www.m2inc.com	USA	antennas
OE7DBH	oe7dbh@tirol.com	Austria	rf power amplifiers
OREI	www.orei.com	USA	HDMI A/V accessories
P.C. Electronics	www.hamtv.com	USA	former supplier of AM-TV transmitters ATV application notes
PE1RKI	www.pe1rki.com	Holland	high power, microwave amplifiers, pre-amps, filters & antennas
SR-Systems	www.sr-systems.de	Germany	DTV cards
SuperPass	www.superpass.com	Canada	microwave patch antennas
TV-AMATEUR	http://agaf-ev.org/	Germany	ATV magazine
W6PQL	www.w6pql.com	USA	high power amplifiers

Plus the on-line resources of AMAZON, E-BAY, Alibaba, Banggood, etc. should be searched for a lot of misc. ATV parts & accessories.

VideoLynx, 70cm, AM-TV Transmitters

AM-TV: For many years, most ATV hams purchased their AM-TV transmitters and other gear from P.C. Electronics. Essentially the only 70 cm, AM-TV transmitter commercially available new today is the VideoLynx designed by Ravi Goonasekeram, KA3NNJ, in 2005. It formerly was sold by P.C. Electronics and is now sold by MFJ. There are two models available, frequency synthesized with four channels, and with rf output power ranging from 50 mW to 5 Watts. The 50mW unit is suitable for use as a modulator driving a high power amplifier. It is also suitable for use in radio controlled (R/C) aircraft. MFJ sells the 5 watt transmitter for $240. Caution, the 5 watt unit absolutely requires that it be mounted upon a suitable heat sink. The standard units come with the frequencies listed as shown in the photo. Two of these are standard cable TV channels, i.e. 427.25 MHz = Ch 58 and 439.25MHz = Ch 60 and can be received directly on a home TV receiver. The other two are non-standard. If you also want it to work on channels 57 & 59, you will need to contact MFJ, or Ravi directly, and request a modification of the firmware. Ravi lives in Gaithersburg, MD and his phone number is: 442-250-9626.

Another possibility for an AM-TV transmitter is the Chinese, HLLY brand. Burt, N7CS, found this one recently on the internet. For more details on it see, the ***"HLLY TV Transmitter Review"*** in the June, 2020, issue #45 of this newsletter.

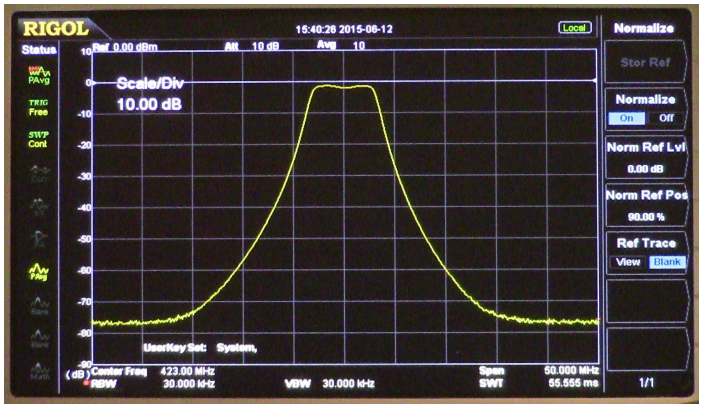
MODULATOR + AMPLIFIER: The typical approach used for building most ATV transmitters is to use a separate modulator with an rf output power in the milliwatt range followed by a high power, RF amplifier to boost the rf level to many Watts of power. There are several hams and companies offering suitable RF amplifiers for ATV service. They include: KH6HTV, W6PQL, PE1RKI, OE7DBH, Down East Microwave, Kuhne Electronics, Mini-Kits, and Mirage, They are listed in the above supplier table.

VUSB-TV Modulators: For VUSB-TV, the modulators built for the cable TV industry and used in their head-ends are ideal. They are small modulator units designed to be mounted side by side in a 19" rack enclosure. They are frequency synthesized and cover all of the possible cable channels from 2-125 (54 - 806 MHz). They require +12Vdc & +5Vdc. The cost is typically $225 or $125 for a single frequency unit. They produce an ideal VUSB-TV spectrum with >50dB rejection of the out of channel lower sideband. They can be purchased from ATV Research.
(www.atvresearch.com)

CATV modulator

A commercially available 70cm, VUSB-TV transmitter is the model 70-10AD from KH6HTV Video. It was introduced in 2012. It uses a frequency synthesized CATV modulator along with a broad-band, linear rf amplifier. It puts out 10 Watts (pep). The RF power level can also be adjusted down in 5dB steps to 3 W or 1 W (pep).

Model 70-10AD



A 70 cm, 6 MHz bandwidth, inter-digital, band-pass filter. Shown with the top cover removed. S21 frequency response 10dB/div & 5MHz/div

BAND-PASS CHANNEL FILTER: Another approach to building a VUSB-TV transmitter is to start with an AM-TV transmitter and use a 6 MHz, inter-digital, band-

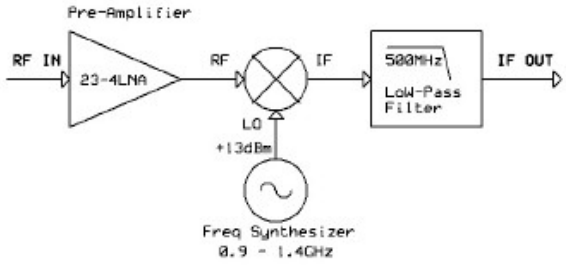
pass filter on it's output. Such filters can be purchased commercially, or built in your own workshop. The list of references for AN-55 includes one on how to design and build your own BPF.

FM-TV Modulators & Receivers

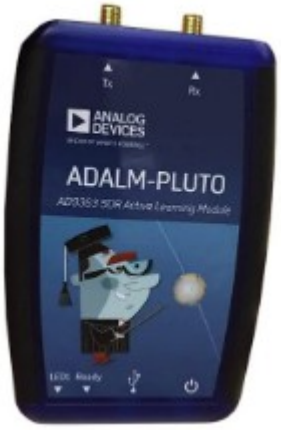
5.8GHz, FM-TV gear

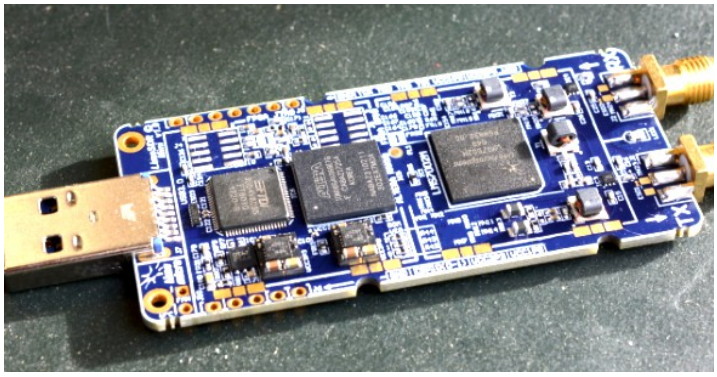
With the transition to DTV, most commercial grade, FM-TV equipment has disappeared from the market. KH6HTV Video does still offer them for the 23cm band. The main exception now are cheap imported transmitter / receiver pairs intended for the use in the drone, FPV market and for the wireless distribution of in-house video. They are available on the internet. Note: FPV stands for "First Person View" meaning it provides the R/C, drone pilot a live view from the cockpit. These are available for the part 15, unlicensed 900 MHz, 2.4 GHz and 5.8 GHz bands. Some are being marketed also for the 1200 MHz region and being marketed for "Ham" use. The ARRL and FCC have been clamping down on these because they also transmit illegally on frequencies outside of the amateur 23cm band. Specifications for all of these are virtually non-existent and rf power specs. are typically overly optimistic. Today, the most readily available equipment is for the 5.8 GHz band. These are found typically on the internet from Amazon, E-Bay, etc. A complete 5.8 GHz, FM-TV transmitter and receiver pair can be purchased for an amazingly low price of about $30. Today, most ATV, FM-TV experimentation is in fact using this low cost 5 GHz, FPV gear.

In 2013, KH6HTV Video introduced a high quality FM-TV transmitter for the 23cm band. It was designed to be a replacement for the Gold Standard of all ATV FM transmitters, which came from High Frequency Technology in the 1990s. The model 23-1 is frequency synthesized on 3 frequencies. Programming is done by soldering diodes into a matix on the pc board. It can thus be easily re-programmed. It includes stereo audio capability with two selectable sound sub-carriers (SSC). The 23-1 includes an rf power amplifier and puts out 3 Watts of RF. Also offered is the model 23-8, FM-TV modulator, which is the same, but without the power amplifier. It's output is 50mW.



The companion 23cm, FM-TV, receiver for the 23-1 transmitter consists of two units. The model 23-7 is a 23cm down converter. Again, the LO is programmable with diodes on 3 frequencies. The IF can be anywhere from 5 to 500 MHz. It includes the model 23-4LNA preamp with a 0.9dB noise figure. The model 23-5 is a 70 MHz IF amplifier and FM-TV (plus stereo SSC) demodulator.





ADALM-Pluto (left) & Lime SDR Mini (right) --- DTV Transmitters

BATC Portsdown DTV Transmitter

MiniTiouner DTV Receiver

DVB-S Modulators & Receivers: There are quite a few choices for modulators. For "appliance" operators, there is professional grade equipment available, but at a very high $$ cost. A Goggle search on the internet will turn up a lot of sources. In the amateur ATV community there has been considerable effort by some dedicated amateurs to develop lower cost, pc board level modulators which rely upon an external personal computer to do a lot of the necessary number crunching. A lot of the early DVB-S, ATV work in Europe was done using PC based modulators. The British Amateur Television Club (BATC) developed several DTV modules and sells them to members via their web site https://batc.org.uk/ Their DVB-S transmitter is called the "Portsdown". There is another group of four US/UK hams (WA8RMC, WB6P, W6HCC & G4GUO) that joined together in 2012 to create a low cost ($300), PC based, DVB-S modulator called the DATV Express transmitter. (https://www.datv-express.com/). More recently other, lower cost, SDR based pc boards have become available and are being used for DTV modulators. They include: the Analog Devices ADALM-PLUTO SDR and the Lime-Microsystems, LimeSDR Mini. Recently, the DATV Express hams turned their attention to developing the MiniTiouner-Express DTV receiver based upon the free software created by Jean, F6DZP. One disadvantage of using a PC based approach is it is not easily transported for portable use, such as for ARES deployments in the field. It is more suitable for home based ATV stations.

Most DVB-S, ATV operations are on the 23cm band. The reason being that very cheap receivers are available for that band. Many DVB-S hams are using, el-cheapo, off-the-shelf, Chinese, satellite TV receivers. --- Or the ham developed MiniTouner-Express board.

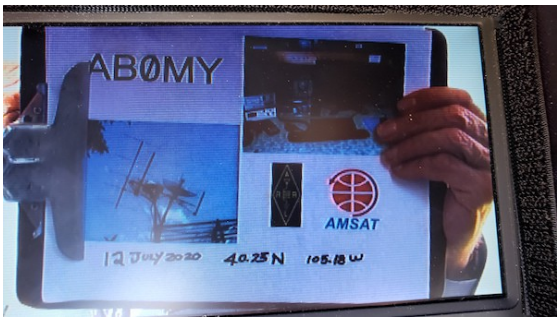
Hi-Des DVB-T modulator (left) & set-top box receiver (right)

DVB-T Modulators & Receivers: For DVB-T, a low cost, appliance style, plug-n-play, KISS, solution does exist for ATV. The Taiwan company, Hi-Des (www.hides.com.tw) offers a line of affordable modulators and receivers. Most of the ATV amateurs in the USA that are experimenting with DVB-T are using Hi-Des equipment. Hi-Des is focusing on the digital signage, in-house video distribution, FPV and amateur TV markets. Their equipment is frequency synthesized and offers continuous coverage from 100 MHz up to 2.6 GHz in some units. This equipment is very simple to operate. The only controls on it are Up/Down push buttons for channel selection. Far simpler to operate than your 2 meter HT. The modulator does require a minimal amount of initial setup, mainly to program it with the desired TV channel(s). Other digital parameters, such as Forward Error Correction (FEC) can also be adjusted. A Windows PC program called AV-Sender is supplied for this purpose and connects to the modulator via a USB cable. After programming, the external PC is no longer required to be connected. A computer is not required for the receiver. It is programmed using the supplied remote control. Most DVB-T equipment only supports bandwidths of 6, 7 and 8 MHz, i.e. commercial broadcast standards. In response to requests from ATV hams, Hi-Des equipment supports narrower bandwidths from 1 to 8 MHz. Hi-Des also offers great customer support via e-mail. I highly endorse the Hi-Des equipment. All of the DATV hams in Boulder, Colorado are using Hi-Des equipment, plus it is the heart of our DATV repeater, W0BTV. DVB-T is being used on all ham bands on the 70cm band and all higher microwave bands.

So, Steve, WA6EJO, I hope this information helps you, other ATV hams, and potentially interested ATV hams in finding gear for our hobby.

73 & good ATV-DX de Jim, KH6HTV

WB2DVS & WB2DVT's 10 GHz Rig

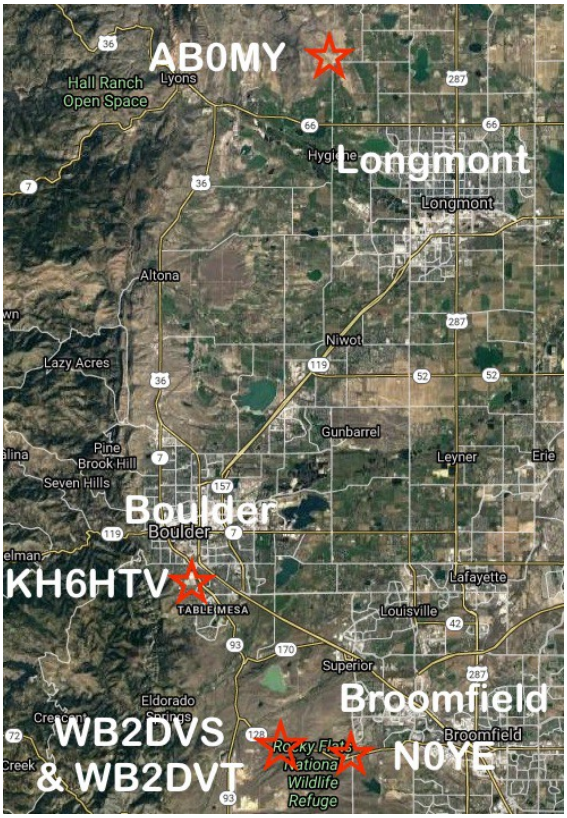


AB0MY to Pete & Debbie - 22 miles

Boulder ATV Hams -- Success with 10 GHz, DVB-T

Thanks to our Microwave Guru, Don, N0YE, several Boulder area ATV hams are now out enjoying the HOT summer sun and filling the airwaves on 10 GHz (3cm band) with high definition, digital, DVB-T video. Don's workshop has cranked out four complete 10 GHz transverters. Don originally built them years ago for 10 GHz, single sideband and they have been used in many 10 GHz and up contests. Don has now modified them also to work for DVB-T service

The most recent DTV DX-pedition was on Sunday, July 12th. Hams participating were: Don, N0YE, Bill, AB0MY, Pete & Debbie, WB2DVS & WB2DVT, Gary, WB5PJB, and Jim, KH6HTV. Gary is the most recent to join in the microwave ATV fun. Gary lives to the far south in Castle Rock, Colorado and set up nearby in Daniels Park. Organizer, Don sent Pete & Debbie to the same spot as our previous 5 GHz, FM-TV outing, namely CO-128 just east of CO-93. Bill again north-west of Longmont. Jim to NCAR. Don went to CO-128 & McCaslin Blvd. near Broomfield. The farthest distance seperating two sites was 53 miles from Daniels Park to the NW Longmont site. Daniels Park is not shown on the aerial photo. It is 33 miles to the south of the CO-128 sites. Bill was about 22 miles north of the CO-128 sites.



Gary was out of the game at the starting gate. His rig refused to work. He later at home diagnosed the problem was he used a new DC power cable and the wire gauge was too small. He thus lost 2Vdc drop in the cable. Next time, better luck Gary.

P5, DVB-T, video images received by AB0MY
KH6HTV (left, 18 miles) and N0YE (right, 22 miles)

P5, DVB-T, video images received by N0YE
KH6HTV (left, 7 miles) and WB2DVS/DVT (right, 2 miles)

The following table summarizes the results of who saw whose signal. It was fortunate that we all set our DVB-T, digital transmission parameters to the most "Agressive" FEC possible (720P, 1/2 FEC, etc.) Otherwise, we would have all been reporting "No Go". Antenna pointing with our high gain dish antennas was super critical. It was not easy ! Initial alignments were made using a compass, but that just got us close -- after that luck played a big part in our fine tweeking of alignment.

Don's comments afterwards -- " I think it fair to say that we were operating around the limit of what we can do with the 10 GHz equipment at hand. Some signals were comfortably out of the noise and other signals were not received. This alone makes this exercise worthwhile. The distances chosen worked out pretty well in this regard."

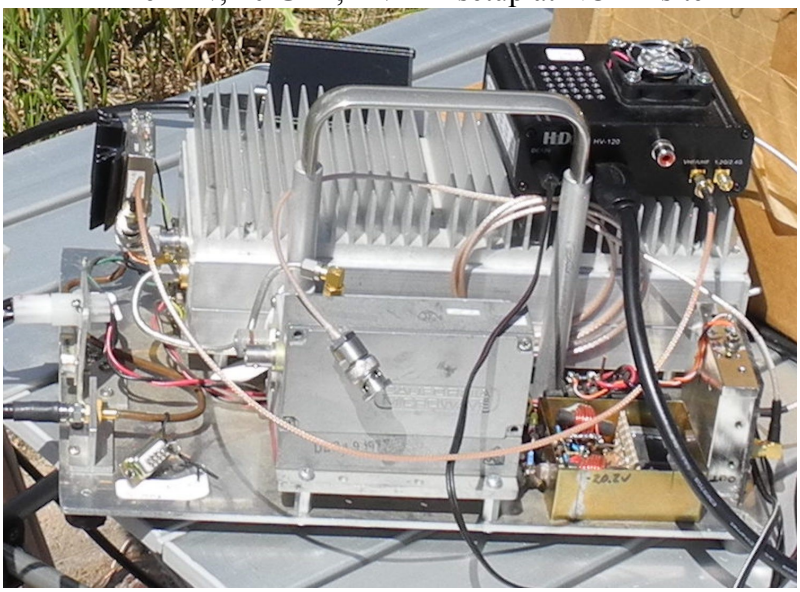
10 GHz Site Data (frequency = 10.359 GHz)

Call Sign	Site	Lat/Long	Elevation	Transmit Power	Antenna Gain
AB0MY	75th-Rabbit Mtn.- NW of Longmont	40° 13' 52" x 105° 3' 18"	5280 ft	+17dBm	27dBi 12"
KH6HTV	NCAR	39° 58' 43" x 105° 16' 23"	6070 ft	+17dBm	32dBi 18"
N0YE	CO-128 & McCaslin	39° 54' 37" x 105° 10' 5"	5856 ft	+19dBm	32dBi 18"
WB2DVS WB2DVT	CO-128 1.6mi east of CO-93	39° 54' 50" x 105° 12' 33"	5965 ft	+23dBm	27dBi 12"
WB5PJB	Daniel's Park	39° 24' 8" x 104° 55' 38"	6500 ft	+17dBm	32dBi 18"

Successful 10 GHz, DVB-T Contacts

Transmitter	Receiver	Best Signal above noise	Distance
N0YE	KH6HTV	15 dB	7.4 miles
N0YE	WB2DVS	P 5	2.2 miles
N0YE	AB0MY	10 dB	22.3 miles
KH6HTV	N0YE	10 dB	7.4 miles
KH6HTV	AB0MY	5 dB	18.1 miles
AB0MY	WB2DVS	P 5	22.1 miles
WB2DVS	N0YE	4 dB	2.2 miles

KH6HTV, 10 GHz, DVB-T setup at NCAR site



Close-up view of the N0YE 10 GHz Transverter used by KH6HTV. The main unit with the cooling fins is a Down-East Microwave 2m / 3cm transverter. The block in front center is a Frequency West LO (replaced the crummy DEM LO). Pout(DVB-T) = +17dBm (rms). QPSK Receiver sensitivity = -96dBm (1080P, 5/6 FEC) & -100dBm (720P, 1/2 FEC). Min. S/N = 8dB (5/6 FEC) & 5dB (1/2 FEC)

INTERNATIONAL - DATV QSO PARTY

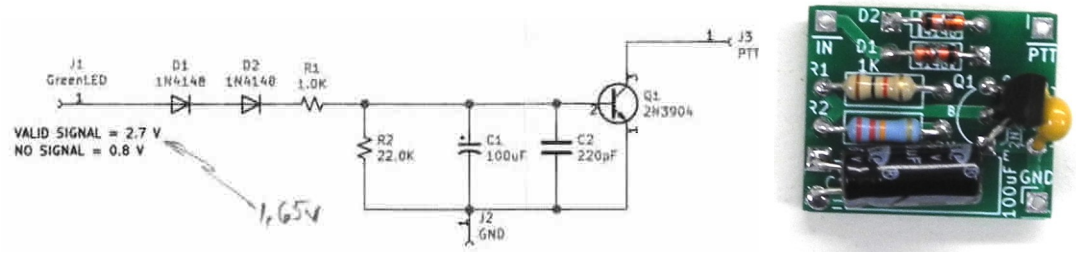
Hello Art, Don, Roland and Jim … VK3RTV, ATV repeater is again active at long last.

I intend to run the **DATV QSO Party** again as a celebration. It seems like you all have picked up Zoom as a common platform in the US so I will work with that . I have set Friday, August 28th and Saturday the 29th for the event. (These are local times Melbourne Eastern Standard Times …. We are UTC +10). Friday the 28th here will be a local event and Saturday 29th hopefully a trip across the US. We are all in some form of lockdown with social distancing etc so a DATV QSO Party will be a good way to go. The date/times are local here but we would start on our Saturday morning (which would be your Friday night) , first with Art in Ohio then working across the time zones hopefully ending on the west coast. I will need an anchor at each location to work with. The role of the anchor is to orchestrate operators in to zoom. The idea is that all will transmit to a local Repeater and the Anchor then passes the signal on via zoom. I want to maximize the use of ATV and minimize the use of IT. I would think Art, WA8RMC, would be the Columbus anchor, Don, N0YE, in Boulder and Roland, KC6JPG, on the west coast. I understand that there may be better ways , but zoom is a common denominator. We will need to do a bit of practice beforehand, and with Art's permission, I will use their weekly net to polish up.

Please advise any other groups we should be approaching and when/ how we can have a rehearsal(s). Any suggestions welcome.

Regards Peter, VK3BFG, Melbourne, Australia

Hi-Des HV-100EH Thermal Issues: Recently Jack, K0HEH, has been having issues with losing audio when transmitting though the TV repeater on our ATV nets. Jack reports that he has finally tracked down the issue. One particular IC in his HV-100EH, DVB-T modulator was running quite hot and was the culprit. After warm-up, it apparently was killing the audio. Jack thus installed a miniture, 2" muffin fan on the top cover of his HV-100EH. That solved the thermal problem. But Jack hates fan noises, so he next started lowering the voltage on the 12V fan. He found that he still got adequate cooling running the fan at only 7 Vdc, plus it was now whisper quiet.



Mel's "Valid DTV Signal" PCB: Mel, K0PFX, in St. Louis, MO, has taken the "Valid Signal" pick-off circuit in the KH6HTV Video app. note, AN-23e, and made a very nice PC board for it. Mel's board measures only 0.7" x 0.8". The board is connected to the green signal lock LED in either the Hi-Des model HV-110 or HV-120

receivers. The voltage levels in the two receivers are a bit different. Thus, for the HV-110 only one diode is used in the pick-off circuit. The open collector output from Q1 can be used to key a PTT line in an ATV repeater, drive an alarm relay, etc. Mel says "I use a Chinese outfit, JLC, and delivery has been quite slow recently, but PCBs are very low cost." If you want further information about these PCBs, contact Mel at: k0pfx@arrl.net

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.**

ATV Repeater -- For Sale

We are an ATV group here in the TWIN CITIES. We have a good working, new digital repeater. Both AM and digital inputs on 427MHz with a output of 1.249 GHz digital.

I have the old 70cm in-band repeater 421/439 MHz for sale. Works well and Ron, WA9NJR tuned it up, just last year. I have had it in my basement for awhile since I got it back from Ron. It's in a nice cabinet. I think it would work great any where. I have all documentation for the repeater. Can supply more info on request. I guess I couldn't put a price on it until I get others opinion. I wouldn't part it out unless I don't get any offers. Feel free to contact me at any time at n0mnb@comcast.net

73's Bill, N0MNB

FREE DVD VIDEO: "Amateur, High-Definition, Digital Television"

This is a recording of the lecture presented by Jim, KH6HTV, to the Micro-Hams Digitial Conference in May, 2020. It runs for 45 minutes. It is ideal training/lecture material for an amateur radio club, or ARES group, meeting. It is now especially useful when clubs are not able to meet in person, but are holding on-line, remote meetings. Supporting written materials are the application notes, AN-55 "ATV Handbook - an Introduction to Amateur TV" and AN-45 "Introduction to Amateur Digital Television". Both are available in .pdf format to be down-loaded free from: https://kh6htv.com/application-notes/ For a free copy of the DVD, send your request to: kh6htv@arrl.net

W6ORG Surplus

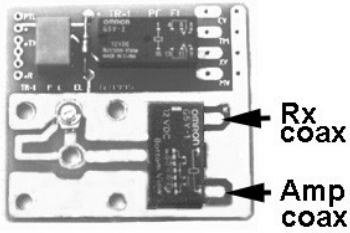
Hey, we are still around and you can ask us for any of the P.C. Electronics Manuals and data sheets by dropping us an email to W6ORG@HAMTV.com

Products are long gone since 2015, but we have kept up the hamtv.com web site with all the app notes, ATV info, Videolynx, and a lot of parts left over that I would rather have in your garage than mine - Check out the Surplus page.

Building an amp?

Use our TR-1b Antenna relay board - *$15*
Mounts on a Type N UG58 Jack
Switch between Amp and receiver
Switch up to 25 W 70cm but can be modified for 33 and 23cm.

Download data sheet on hamtv.com

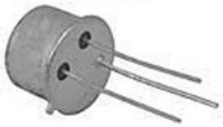


Parts, we got parts:

Make us an offer we cant refuse for larger quantities.

2N5770 NPN used in most all of our gear. Great general purpose transistor to 70cm. Similar to 2N918, 2N2222 and 2N3904 - *5 for $1, bag of 100 $10*

2N2907 PNP also used in our gear, general purpose - *10 for $1, 100 for $8*



MM3725 Motorola TO39 NPN used as the video modulator in our KPA5, TX, TC, RTX, and TXA5-RC transmitters and replaces 2N3734 and 2N3553 - *$3 ea, 25 for $2ea*

100 Ohm Pot, Carbon, Panel Mount - Used for video gain control in our P. C. Electronics TC-1, TC70 transceivers, TX70 transmitters, etc. 100 Ohm carbon panel pots are hard to find, most pots at this resistance are wire wound which are too inductive at higher video frequencies. 3/4" shaft length half of which is the 3/8" bushing, 1/4 inch dia round shaft, 1/2W - *$1.50 ea, 25 at $1.25 ea*

Ceramic Trimmer Capacitor, tuning range 2-8 pF - Sprague GKU6R000 RF peaking cap (red top) used in our transmitters and downconverters. *$1ea, 10 for $8, 100 for $65*

Feed Through Capacitor - .001 mF. Used to keep RF from riding in/out on DC, audio and control lines in shielded enclosures such as repeater transmitters, receiver and control boxes - *$2ea, 10 at $1.50 ea.*

Data sheets on the web page

Email Tom at W6ORG@hamtv.com if interested in any of the items listed on the W6ORG Surplus web page - www.hamtv.com/surplus.html. Ship USA only, USPO flat rate box add $8.