

Boulder Amateur Television Club TV Repeater's REPEATER

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2ed Edition

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



Free Distribution: The BATVC newsletter is being circulated widely to other ATV hams and repeater groups throughout the US and to CQ-DATV. Feel free to pass it on to your other ATV ham buddies. If reprinted, in whole or part, we do ask that you include an acknowledgement of us as the source.

BATVC NET: The Boulder ATV group meets for an informal net every Thursday afternoon. The net starts at 3pm local time. Net control is Don, N0YE. The net uses the Boulder ATV repeater, W0BTV. Video inputs are: 23cm digital, 1243MHz, DVB-T; 70cm digital, 441MHz, DVB-T, and 70cm analog, 439.25MHz, NTSC, VUSB-TV. Repeater output is digital on 423MHz, DVB-T. Antenna polarization is vertical. Our intercom frequency is on the BCARES 2 meter FM voice repeater (146.76MHz, -600, 100Hz tone required). The live net typically lasts for 1 to 1 1/2 hours. There is usually some DVD program playing for about 1/2 hour prior to and also 1/2 hour after the live net. All licensed hams are invited to participate even if they do not have a video transmitter.

BATC STREAMING: The Thursday afternoon ATV net is streamed on the internet via the BATC server in the U.K. Connect to: <https://batc.org.uk/live/> Typically either Don, NOYE, or Jim, KH6HTV, or both are streaming the TV repeater's A/V to the BATC. Click on either N0YE or KH6HTV-TV.R.

Future Newsletters: If you have contributions for future newsletters, please send them to me. We love to include news from other ATV groups.

Jim Andrews, KH6HTV, email = kh6htv@arrl.net

ATV & BCARES -- End of an Era ?

(an editorial)

by Jim Andrews, KH6HTV

The Boulder County Amateur Radio Emergency Services (BC-ARES) and Amateur TeleVision (ATV) have enjoyed a very successful relationship for the past thirty years. BCARES has served well the public safety agencies (sheriff, police & fire) with video images of forest fires, floods, public events, riots, swat operations, etc. ATV has been the #1 communication service requested of BCARES. However, due to the march of technology, I see this service provided by us radio amateurs to our community coming to an end.

In 1989, Captains Bill McCaa, K0RZ, and Chuck Pringle, K0DGP, of the Boulder County Sheriff's Department approached BCARES and asked that BCARES provide TV services to the Boulder Sheriff's department for major emergencies. I was the chairman of BCARES at that time. Soon thereafter, with assistance from the Sheriff, we had our TV repeater up and operational at Chautauqua Park. During the 1990s, we provided TV coverage for many big events. In 1995, the University of Colorado Police asked us to provide them with TV coverage of CU home football games. In 1997, the Sheriff asked to also have TV coverage of SWAT operations. A small sub-group of 2 to 4 BCARES hams thus became SWAT volunteers. Over the years, BCARES continued to improve it's ATV equipment and the quality of it's TV images and services.

The biggest ever operation for BCARES occurred in 2010 with the Four Mile Canyon fire. This was the biggest forest fire ever for Boulder County. 7,000 acres of forest burned and 170 homes were lost. BCARES had camera crews on mountain tops observing the fire and sending video pictures to the EOC. BCARES members worked the fire for a whole week. When it was over, BCARES was credited by the Sheriff with saving a half dozen homes.

BCARES biggest technical challenge was in the spring of 2013. The bombing of the Boston Marathon had just occurred. The next really big foot race was to be our own Boulder Boulder, 10K race with 50,000 runners participating. In the security planning before the race, the Dept. of Homeland Security along with Boulder Police and Sheriff, asked BCARES to provide very extensive TV coverage of the race. BCARES was tasked to provide 8 TV cameras from various locations and send live video from all cameras simultaneously to both the Emergency Operations Center (EOC) at the Boulder airport and also the CU-PD command post at the CU football stadium. We did manage to pull it off successfully.

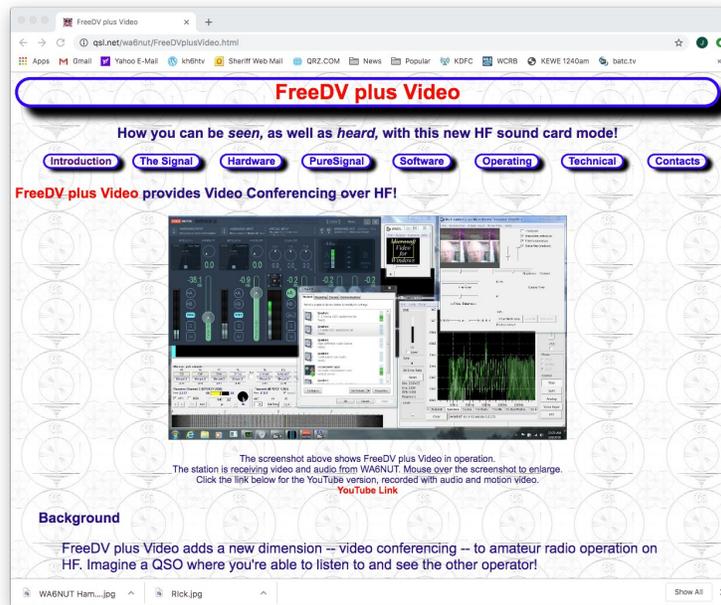
Starting in 2014, BCARES also entered the digital age by converting all of it's older analog ATV equipment to high-definition, digital TV. In 2016, it's ATV repeater was also converted to digital TV.

30 years ago, when BCARES started providing TV to the public safety agencies, they did not have the capability, equipment, nor frequencies available to do their own remote video information gathering. We were thus providing them with an extremely valuable service. In the intervening 30 years, however, technology has made great leaps forward. In 1990, cell phones were strictly a mobile telephone. The internet in 1990 was almost non-existent. Today, most people even forget that the main function of a cell phone is/was as a telephone. They use them for cameras, camcorders, encyclopedias, note books, etc. etc. etc. These use radio waves just like our ham radios, just on different frequencies. The wireless cell phone networks have evolved 1G, 2G, 3G, 4G and now they are hyping 5G. The bandwidth capabilities now of everyone's cell phone are phenomenal. Nowadays it is no big deal for anyone to take videos with their cell phone and send them wirelessly world-wide. Cell phone videos are now appearing on broadcast TV. Even the broadcast TV stations are abandoning their classical microwave ENG trucks in favor of relaying their ENG videos back to the station using the cellular networks. (See the following article on Dave, KG0EW's, "new" ENG van). We also are seeing a huge proliferation of quad-copter drones flying video cameras and transmitting live video via unlicensed, Wi-Fi networks. Also for police work, many departments are now requiring their officers to wear tiny video camcorders. Video cameras are everywhere.

So what is happening locally? For one, the Sheriff no longer uses his ham SWAT volunteers to transmit video on ham bands. The BCARES ham SWAT volunteers also wanted to get into drones for the Sheriff. But instead, the Sheriff farmed out that task to the Boulder Emergency Squad who are using the Wi-Fi systems. An article about the Sheriff, BES and drones just appeared in the last month in our local newspaper, the Daily Camera. This past year, the requests to BCARES for video services has been drastically cut back. We were no longer asked to provide video for the Boulder Boulder 10K race, nor the rock concerts in the football stadium and the final straw was the recent cancellation this fall of BCARES coverage of the CU home football games. It was a long run for us at CU from 1995 to 2018.

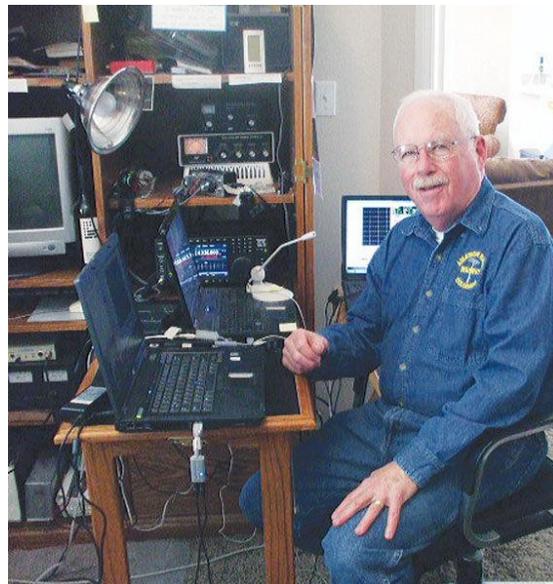
Why has this happened ? --- Technology has caught up with and surpassed BCARES's ATV capabilities. Is there a solution ? -- probably not. It was a good ride while it lasted, but it is now gone.

Jim Andrews, KH6HTV



DIGITAL TV - on HF

One of our regular viewers of our BATC streaming of our Thursday afternoon nets is Rick Peterson, WA6NUT. Rick lives in an ATV starved, mountainous part of our great state of Colorado. He lives in Buena Vista (Spanish for "Great Views"). As a result, Rick's only outlet for ATV, aside from watching BATC streams, is to try to do it on HF to propagate his RF signals out of the Arkansas River valley, surrounded by the high Rocky mountain peaks. Rick is a strong advocate of FreeDV + Video. Want to learn more about it -- go to Rick's web site: <https://www.ql.net/wa6nut/FreeDVplusVideo>





NEW QUAD RECEIVER BOX Matt, K0DVB, always makes fine looking gear. He has just sent me some photos of his new Quad Receiver. p.s. check out Matt's vanity ham call sign -- DVB. You will thus know where Matt's interest lies. Also check out Matt's web site for some interesting ATV info. <https://k0dvh.com/>

"I updated my D-ATV quad box to Mark I - Mod 1 by removing the power supply and adding a shelf with four filters, one per receiver/channel. That allowed me to keep the short 4U box. (In the picture I just have one transmitter going, which I cycled through the channels, ending on channel 60.)"
73 de Matt, K0DVB



A New Ham Toy ! Dave, KG0EW, just lucked out and was able to purchase for a song -- this old Channel 9, Electronic News Gathering (ENG) van. He showed it off at the October Boulder ham club meeting. Ch. 9 stripped out all the electronics, but the erectable mast and AC generator, etc. were still in the truck and operational. Future Uses ? --- No doubt, Dave will first try to outfit it for a portable HF station to compete with Allen, K0ARK's station. Will it have future ATV & microwave capabilities ? Here is what Dave has reported.

"The TV station removed the microwave transmitter and dish before they sold it to me. I have the heavy-duty Quickset Az-El positioner, but it really isn't ideal for an HF beam, so I'll most likely just install a rotator and put the Quickset up for sale on QRZ.com. I have lots of 75-ohm cabling as well; unfortunately, the triax cables that are inside the nycoil conduit are 75-Ohm, so I'm debating whether to install 1.5:1 ununs at both ends, or go through the grief of pulling the triax and installing 50-ohm coax (station engineer warned me that pulling the cables is a real chore).

I would like to have a mast-top mounting configuration that allows me to easily install different antennas, and possibly even other payloads as well. Getting on top of the roof is easy, and I could probably make a new mast insert without much difficulty, so that I could have two (or more) different mast-top mounting platforms.

Right now the van is all potential, just waiting for me to make regrettable mistakes and bust my budget. :^)"

73 de Dave, KG0EW

NEWS from other ATV Groups



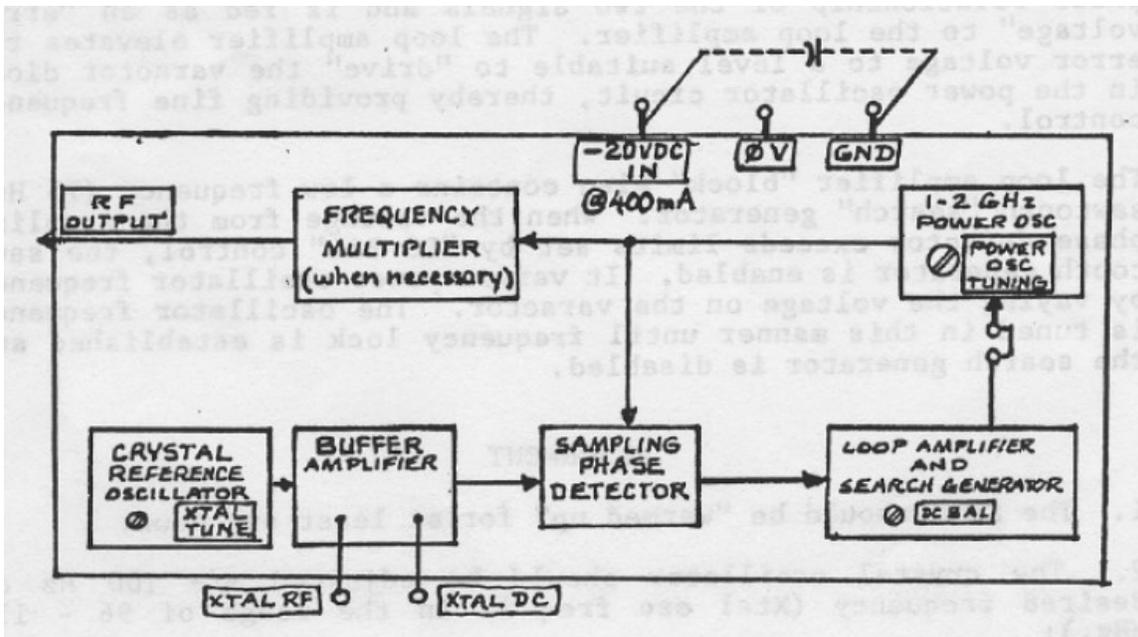
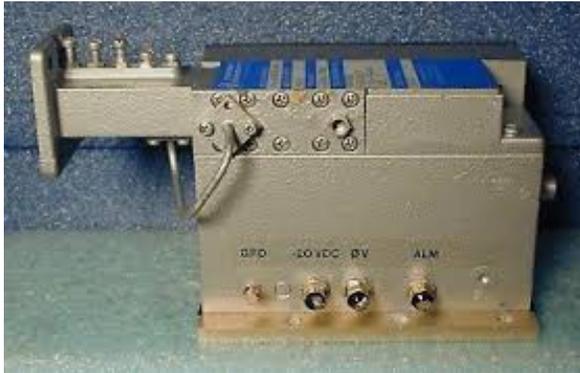
(left) Art, WA8RMC, at Jones Rd site. (right) 1268 MHz ATCO repeater signal received on portable yagi on 20 ft. mast.

OHIO - ATV: The Dayton and Columbus ATV groups (DARA & ATCO) (<http://www.w8bi.org/index.php/dara-atv> & <https://www.atco.tv/>) are working to link their ATV repeaters together. The latest ATCO newsletter includes the following report.

"We already have a 1280 MHz DVB-T HV122 receiver at the DARA site that will be relaying ATCO activity being relayed from the Jones Rd site. Also note that ATCO in turn will be able to see the DARA repeater output through a different leg of the Jones Rd Link. Art is currently exploring available options for the ATCO leg at Jones Rd. So here is what we are going to do at the W8BI ATV repeater site: We will have a dedicated voter port #4 available on the Intuitive Circuits controller and this is where the HV122 1280 MHz receiver's NTSC video will always be present. Under normal conditions, this voter port will be switched out. HOWEVER, note that our quad screen mode will also be available for anyone to "look" at any incoming video on this switched-out voter port. We are going to put a horizontal sync switch between the voter port #4 and the HV122 (1280MHz DVB-T) and if port #4 is activated, anyone in the local area that happens to be transmitting video on DVB-T (439 MHz), the valid signal switch already in-place on the site's HV110 will cause this port to drop out and the voter will then continue to run and then lock on to the 439 MHz DVB-T local signal. So, if we were to activate port number 4 on the Intuitive Circuits voter, the voter will stop on this port since video is present all of the time, and any ATCO transmissions coming into the ATV repeater will be repeated. If anyone locally transmits on 439 MHz DVB-T during the active port condition, it will cause the port to go inactive and allow for local 439 MHz DVB-T signals to be repeated by the ATV repeater.

This configuration will allow half duplex for folks at ATCO to work into the DARA repeater. We will always have "full duplex" available if needed by simply enabling the QUAD screen, and either half duplex or full duplex when voter port #4 is switched in. The plan here is that with a simple audio link through the DVB-T audio channel, ATCO will also be able to remotely switch in and out the quad screens at the DARA site in order for them to view the full duplex maintenance screen. This will allow a remote operator to be able to see his ATV signal repeated back." ...Dave AH2AR

FREQUENCY WEST - Microwave Oscillators



Frequency West - Block Diagram - tx to K0CQ

The fundamental building block used by most ham, microwave enthusiasts is a Local Oscillator (LO) built by Frequency West. These are vintage items dating from the 1980s

and were used in a lot of microwave relay stations. As shown in the above photos there are several variations in the construction. These are available at ham radio swapfests, on E-Bay, and also from commercial, used microwave equipment dealers. Current prices are found to range all over the place from as low as \$20 to over \$500. At \$20, "Buyer Beware !", it probably is a non-functioning unit.

The basic configuration starts with an oven controlled crystal oscillator in the 100-110 MHz range. Next is a free running voltage controlled oscillator (VCO) running in the 1-2GHz range. The VCO is phase locked to a harmonic of the crystal oscillator. For outputs higher than 2 GHz, a step recovery diode (SRD) multiplier is then used to generate higher order harmonics. A narrow band, band-pass filter is then used to pick off the desired harmonic.

The FW bricks were all designed to run off of -20 Vdc and draw typically about 400 mA. They all also have two or three test outputs labeled Φ V, Xtal & Alarm. The Φ V monitors the VCO search generator. If a square wave is present, the VCO is not locked to the crystal. When lock is achieved, the square wave stops and a dc voltage is present. The Xtal test point gives a dc voltage relative to the crystal oscillator output. Alarm is a contact relay switch which closes to ground when the VCO loses lock. Some FW bricks allow for an external reference frequency input. Also some FW bricks provide an output of the internal reference frequency.

Here are a few hints from Don, N0YE, on checking out and tuning a FW brick oscillator: The cavity oscillator has a sweep circuit to find the frequency on which to lock onto a multiple of the crystal oscillator frequency. If the RF output is not stable and moving around a lot, then the VCO is not locked to the crystal.

The first question is there a crystal in the brick? If so, is the crystal oscillator circuit oscillating? If not try tuning to get that circuit to get an oscillation. If there is no crystal, get one and get the circuit to oscillate. The brick may require an external reference. Given that the brick has a crystal oscillator circuit, there is variable capacitor accessible to the outside that is used to fine tune the crystal oscillator.

Once you have a crystal oscillator up and running, the cavity oscillator needs to be locked to the reference oscillator. There is a large screw that is adjustable from the side of the brick. Turn this screw in or out to find the cavity frequency that locks to a multiple of the crystal oscillator. When you have a lock, the brick output will become fixed. Your spectrum analyzer will show when the cavity is locked. There may be two or more multiples of the crystal oscillator frequency that the cavity will lock onto. All lock frequencies are integer multiples of the crystal oscillator. It may be the cavity on your unit is close to lock, and so tune in a short distance and out a short distance in hopes the lock is nearby.

For more information on these FW bricks, there is more info available on the internet. A good summary is from Gerald Johnson, N0CQ -- "The Frequency West Bricks are more Versatile than Advertised",

<http://www.geraldj.networkiowa.com/papers/2017/2017VersatileFWBricks.pdf>

Another excellent resource for ham microwave projects is Bob Atkins, KA1FT's web site. www.bobatkins.com/radio His section on Local Oscillators includes a link to: "Frequency-West - Tune-up Procedure - Phase Locked Sources and Oscillators" (in .pdf) <http://www.thegleam.com/ke5fx/brick/fwbrick.pdf> by N5GO & N5BHX

10 GHz Antenna Measurements

Yesterday (10/26), Don, N0YE, took advantage of the very nice 70 degree, sunny weather to go outdoors and make antenna measurements. (Today, 10/27, temperature dropped 50 degrees to 20 with snow falling !)

Don used his 10G, SSB rig on the SSB calling frequency of 10,368 MHz. He modulated the CW carrier with an HP PIN diode modulator which was driven by a 1 kHz oscillator. The transmit antenna was a 17dBi waveguide horn (8.1 in²). For a receiver, he used an HP crystal detector driving an HP VSWR meter. His reference receive antenna was a Narda, X-band standard gain horn of 16.5dBi (6.1 in²). He setup his equipment in his driveway with 29 foot separation between transmit and receive antennas.

The antennas he tested and the measured gains were:

1. A 12 inch (113 in²) dish with a commercial wave guide feed with yagi reflector and director had a gain of 24.5 dBi.
2. An 18 inch off center fed satellite dish with it original feed had a gain of 27 dBi.
3. A 13 inch (133 in²) Andrew dish with a home brew feed of a driven element and reflector had a gain of 21.5 dBi.
4. A home brew horn (5 x 6.75 inch, 33.8in²) had a gain of 22 dBi.

Don reports -- The big issue with antenna ranges is multipath. The antenna range was 29 feet from the sidewalk to the garage door. The source was placed 4 inches above the ground. I did that because of the h1 and h2 calculations that deal with ground reflections. There may be better height choices for 10 GHz but I did not take the time to experiment.

The best take away from the exercise is a comparison between the 12 inch dish with the wave guide feed and the 13 inch, Andrew dish. Since these two antenna are about the same size, the gain comparisons should be quite close. The gain comparisons with other antennas of different sizes are probably not accurate because of the multipath. The 13 inch dish measures to be 13 inch for the parabola portion even though Andrew says it is a 12 inch dish. The 13 inch dish had a measured 3 dB lower gain than the 12 inch dish. The home brew feed is probably not as good as a feed it could be. On the other hand I can not complain about how it is working. I think the larger antenna gain values more suspect than the smaller gain antenna. When you look at the antenna areas and relative gains, they do not jive for the larger antenna. I can now work (indoors !) on a better feed in this cold weather.

73 de Don, N0YE