Boulder Amateur Television Club
TV Repeater's REPEATER

October, 2021
2ed edition, issue #90

BATVC web site: www.kh6htv.com

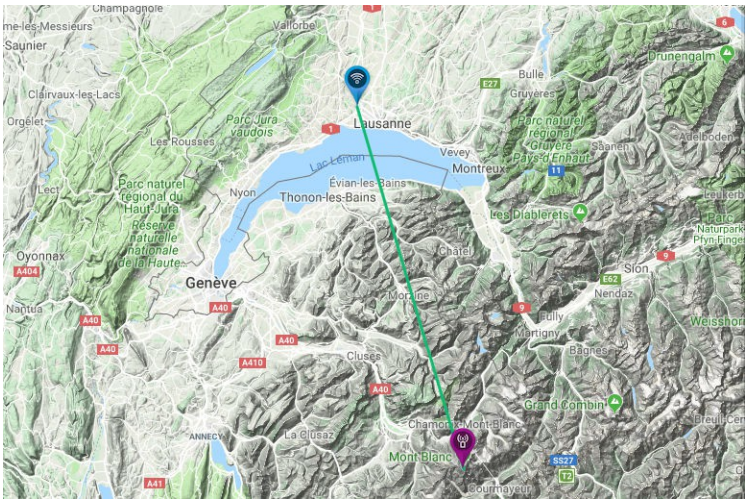
ATN web site: www.atn-tv.com

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

Mont Blanc in the Alps as seen from Nyon, Lake Geneva, Switzerland

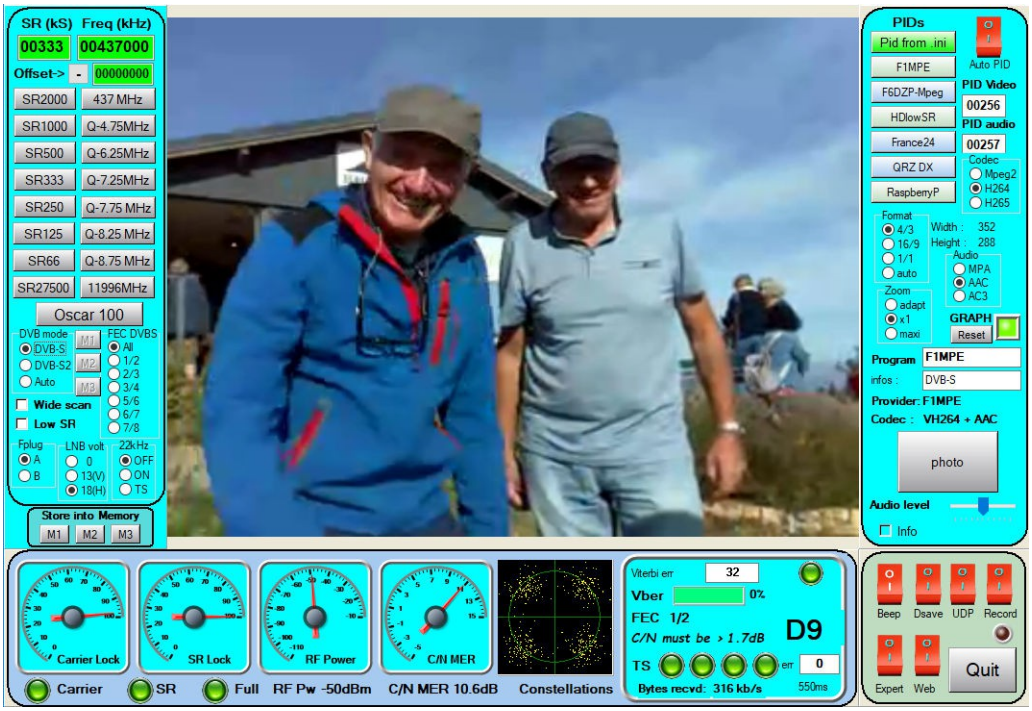
323km, 10GHz, DATV Contact via Reflection from Mont Blanc

Locally, here in Boulder, Don, N0YE, has been pushing for us to try bouncing our DATV signals off of mountains. So far we have accomplished it rarely and only over distances of a few km. Well some hams in Switzerland and France have now set the bar much higher for us. They have passed digital video signals over a total distance of 323km on 10 GHz. They bounced their signals off of Mont Blanc. OK Don, are you up to the challenge to try to get even close to their record ?

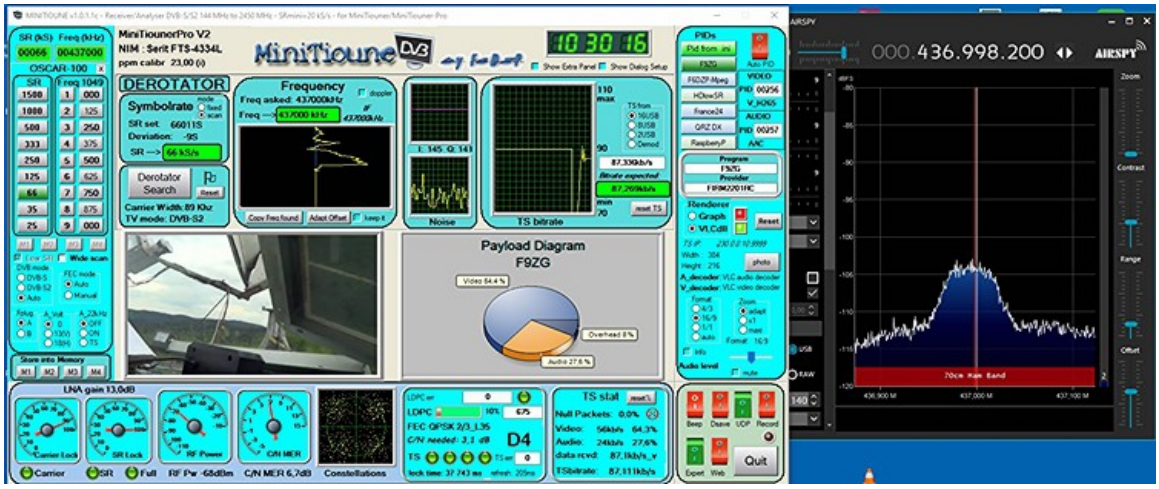


Starting in 2018, Michel, HB9AFO, in Bussigny (near Lausanne), Switzerland and several other hams began experimenting with bouncing their 10GHz signals off of Mont Blanc. Michel has a clear view of Mt. Blanc over an 83km path. His web site gives the full details. https://www.hb9afo.ch/articles/Mont-Blanc/default.htm They are using DVB-S with narrow bandwidths, low symbol rates and lots of FEC. In July, 2018, he and Pierre, HB9IAM, in Geneve made contact for a total distance of 156km. Then in August, 2019, the distance was pushed to 218km with Rolf F9ZG/P in Cret Monniot. Again in Sept. 2019, Bruno, F1MPE/P, in St. Romain got their record up to 258km. Most recently, in August of this year, Rolf working portable in Plat. Verrerie, pushed the distance up to an astonishing 322 km.

Rolf, F9ZG/P in Cret Monniot, via Mont Blanc



F1MPE/P received via Mont Blanc. Bruno, F1MPE (left) & Jean-Louis, F5AJJ (right)



Rolf's signal working portable on the Plateau de La Verrerie -- 322 km, new record. The actual incoming received signal can be seen in a video on Michael's web site.

A longer article detailing these experiments appeared in the French amateur radio magazine Radio - REF, October, 2019 issue.
(https://www.hb9afo.ch/histoire/radioref_10-2019_54-56.pdf)

Circuit Simulation Software:

On a recent BATVC ATV Thursday afternoon net we got into a lengthy discussion comparing various circuit simulation tools. Jim, KH6HTV, was trying to design a narrow 70cm band-pass filter. He was using a version of SPICE called **LTspice.** Steve, WA0TQG, then took Jim's circuit and modeled it with a much more exotic simulator called **QucsStudio.** Both Jim and Steve demonstrated their simulator results on the ATV net by connecting their PCs to their TV modulators.

Both simulators are free shareware. **LTspice** is given away free by the semiconductor manufacturer Analog Devices. **QucsStudio** is being developed by Michael Margraf, DD6UM, in Germany. Here are the URL links to both.

LTspice https://www.analog.com/en/design-center/design-tools-and-calculators/ltspice-simulator.html

QucsStudio http://qucsstudio.de/

SPICE was originally developed at the University of California - Berkeley and introduced in 1973. It was originally developed to design integrated circuits. It uses a nodal analysis and performs a transient analysis. It can handle non-linear devices. SPICE performs several different analysis. They include: DC (for quiescent point determination), AC (linear small signal), transient (time domain, large signal solutions of both linear and non-linear devices) and noise analysis. Wikipedia gives a good description of SPICE.

A commercial version, PSPICE, was my (kh6htv) first serious computer aided circuit analysis tool. Back in the mid 80s when my company, Picosecond Pulse Labs, purchased our first Dell PC ($4K in 1980 dollars !) we also bought PSPICE and paid an arm and a leg for it of several K$. But it rapidly paid for itself by giving us the ability to design better products. Today, Analog Devices gives away free this same tool under the name LT-Spice. The LT stood for Linear Technology. In the 80s, one had to describe the circuit by writing lines of code with each line detailing an individual component and the node numbers describing where it was connected in the circuit. Today, Analog Devices includes an easy to use program to draw your schematic diagram on your computer monitor screen and it then automatically generates the lines of code, called a net list, needed by SPICE. When you then run the spice simulation, Analog Devices gives you a probing tool to look at either voltages or currents. The display then is either as an oscilloscope for transient analysis, or as a network analyzer for AC (frequency domain) analysis.

Jim, KH6HTV, Boulder, Colorado

QucsStudio is a free circuit simulator environment that operates under Windows. It is a non-commercial project that is developed completely privately but is supported by an active forum of users/developers. It has a graphical user interface where you draw a schematic andinclude the type of simulation(s) and result diagrams desired. It is intended as a universal platform for multiple simulators and contains the following simulators:

1 **Non linear:** Similar to Spice and can perform DC, AC, noise and transient analysis of a circuit and has the capability to import a Spice netlist. Like Spice this uses an iterative approach to find an operating point solution and can be a bit touchy and slow.

2 **S-Parameter**: This is a linear RF simulator that is based on creating an S-Parameter matrix for each part and then combining these to reach a closed form solution. This allows using parts that are defined using industry standard S-Parameter files that are available from many RF part vendors or creating your own files by measuring a part using a vector network analyzer. A good library of standard parts is available that includes lumped components as well as several types of transmission lines. This simulator has the advantages of being very fast and flexible for RF circuit analysis as well as noise figure analysis.

3 **Harmonic Balance:** This is a non linear RF simulator that creates a solution for the
harmonic levels for circuits such as amplifiers and mixers and includes large-signal AC and noise analysis.

4 **Digital**: This is used to create truth tables and/or timing diagrams for digital circuits and can import industry standard Verilog or VHDL files.

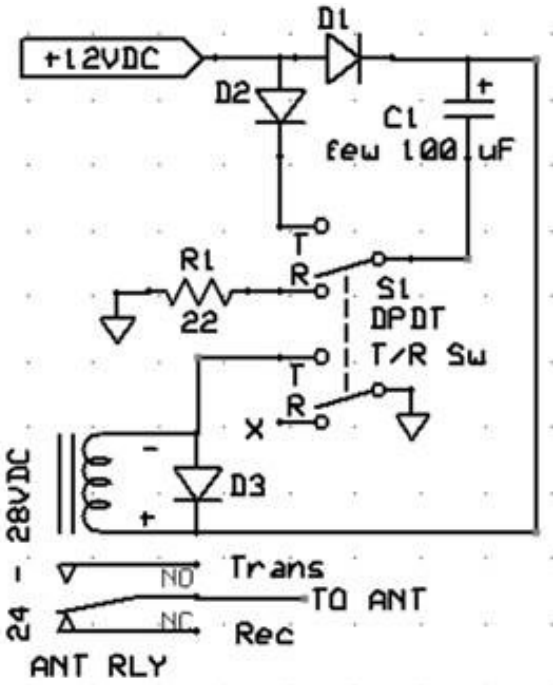
5 **System:** This simulator works in the digital domain and components are modeled by sampling at a high rate of speed relative to the system bandwidth. This is useful in simulating communication systems and circuits, in the presence of noise, to determine overall performance.

6 **Electro-Magnetic field:** This is a simulator that can work with a microstrip transmission line circuit and can create a more exact simulation using the Electro-magnetic fields. Also available are the ability to perform real time component tuning, parameter sweeps, Monte Carlo analysis, optimization and an equation capability with a rich supply of functions The optimization capability is particularly useful for creating RF filters and matching circuits when taking all circuit parasitics into account where a synthesis program cannot create a proper circuit. The system also contains several useful tools for creating inductors and capacitors, an extensive variety of filters, attenuators, transmission lines and matching circuits.

Having so many capabilities can make the program a bit intimidating at first but once you learn the basics for the type of simulation you wish to perform it is an easy to use and vary powerful tool. Although I am by no means an expert at all of the programs capabilities (I mostly use the S-Parameter simulator) I am certainly willing to help anyone that would like to learn to use the program.

Steve, WA0TQG, Boulder, Colorado

Driving a 28Vdc Coax Relay with 12Vdc:

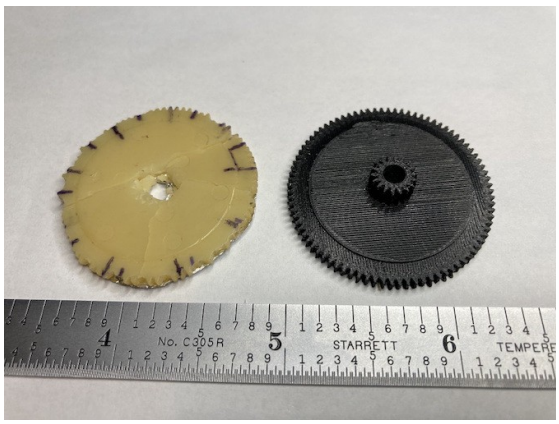


Many surplus antenna relays for microwave applications require 24VDC- 28VDC to switch, while the typical available power supply for field operations is 12VDC. It turns out that the relays I have seem to switch reliably (at room temperature) with voltages >20VDC and stably maintain the switched state with as little as 9VDC. The following simple momentary voltage doubling T/R switching circuit seems to work (at least on the bench, so far) well to provide these conditions from a single 12VDC supply: With S1 in the receive position (R), capacitor C1 charges to near the supply voltage through D1 and R1, and the antenna relay is in its normally closed deenergized state connecting the antenna to the receiver. When S1 is switched from R to Transmit (T), fully charged C1 momentarily appears in series with the 12V supply driving ~24V into the relay coil (D1 is momentarily reverse biased, and power flows from 12V thru D2 and C1 in series to the relay), switching the antenna to the transmitter. After C1 discharges, the relay coil remains at 12VDC thru D1. D2 and D1 need to handle the peak current during switching and the hold current for the relay coil, respectively.

I used 1A 200 PIV variety because I have lots of them. I used a 470 uF cap, but the capacitance required will depend on relay coil pull in current and switching time needs. Pole X of S1 is also available to control other circuits that may need ground switching between transmit and receive. D3 exists just to kill inductive spikes from the relay coil. R1 limits the peak charging current for C1 so that the D1 current rating is never exceeded. For C1 = 470 uF and R1 = 22 Ohms, the charge time for reliable switching is ~15ms, fast enough to accommodate the quickest T/R operations. Beyond the transient current used to initially charge C1, this circuit draws no power beyond that needed to hold the relay on in the transmit position.

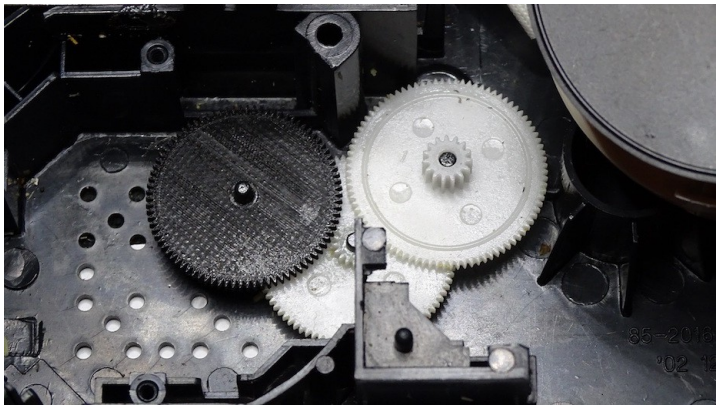
Hope some of you find this useful!

73 Chris, K0CJG, Boulder, Colorado



Bruce, K8FIX's 3D Printer Assists Local Ham's Antenna Rotor Controller Issue

With the advent of 3D printers, these peripherals have been a boon to the makers' hobby. Amateur radio provides plenty of opportunities to print a host of items that are essential to the hobby. Just use your imagination on what you could use a 3D printer for... HF dipole insulators, antenna element parts, circuit-board standoffs, project boxes, keyer parts, custom brackets, knobs, dipole antenna supports, among many other things...and last but not least, rotor controller gears! W8CWM, Bill McCoy had a rotator failure as his operating position includes an older Radio Shack Rotator Controller box (#15-1245) in which a plastic motor drive gear had finally given up the ghost. Possibly caused by ozone exposure from within the tightly sealed controller enclosure, this particular plastic gear deteriorated and any expectation of finding a replacement gear of the correct dimensions was going to be highly unlikely. K8FIX heard about the dilemma and volunteered to take a crack at seeing whether his 3D printer may be the answer for fabricating a replacement drive gear. The original yellow gear was in such bad condition, simply handling the gear to measure tooth geometry was enough to cause the plastic to break down even further. Made out of a different plastic chemistry, the other gears within the controller had held up well, so only a single gear needed to be 3D printed. The replacement gear was drawn using TurboCAD Platinum Pro, sliced with Cura 4.11.0, and printed on a Creality CR-10-S PRO printer, using a .2mm nozzle. The key to a good 3D print is bed leveling and printer nozzle height**.** The result of Bruce's work allowed Bill to bring his vintage Radio Shack controller out of retirement.



The new part installed in a now functioning antenna rotator

Here is a photo of the Creality CR10-S Pro 3D printer and a close-up of the black 3D printed gear installed inside the controller. You'll note in the close-up photo that the outside diameter of the new gear just clears teeth on the small inner gear of the adjacent gear.

I added a few modifications to the 3D printer that include a belt at the top between the two z-axis screws to keep both z-axis stepper motors in sync (one side would fall a little after power down), two z-axis anti-backlash threaded mounts, a roller-bearing filament guide on the left hand side, a BL-Touch semiconductor hall auto leveling sensor, and Tiny Machines firmware to go with the BL-Touch sensor.

The nozzle height is adjusted so that there is slight friction on a piece of printer paper placed between the heated printer head and the heated bed when the printer head is sent to the Home position. The .18mm nozzle height gauge that was shipped with the printer placed the nozzle too far from the bed, and this in turn caused bonding issues on the first layer between adjacent strands.

Bruce, K8FIX, Tipp City, Ohio

News From St. Louis:

Mel, K0PF, from the St. Louis, MO ATV group reports on their progress, or lack thereof, fighting IMD which sometimes corrupts the Bit Error Rate (BER) of their 70cm, DVB-T repeater.

Mike, WA6SVT, recently made a whirl-wind tour from California to the Mid-West and stopped off on his trip in St. Louis to climb their 100 ft. tower. Mel says -- "Mike fixed the IMD problem. The "professional tower man" that installed the mast originally onto the tower did not fully tighten down three bolts. Mast was a "wigglin" in the wind. Not good." Mike had to contend with hornets dive bombing him while 100ft up in the air. Also Not Good !

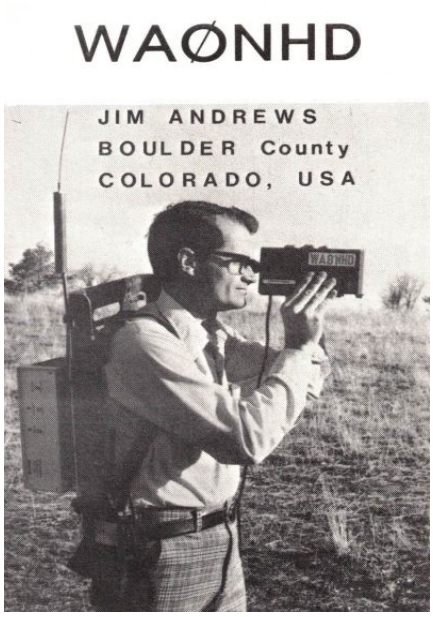
Mel says they have also been fighting defective Hustler "Spirit" antennas. Their first one actually had an internal defect which caused arcing on transmit and noise on reeive.. They have been trying to use one common 70cm antenna for both transmit and receive along with custom built DCI filters. But due to the high, intermittant BERs, Mel is now experimenting with seperate transmit and receive antennas and still is frustrated locating what is causing the BERs. Is is phasing issues in the antenna(s), bad joints in hardware,

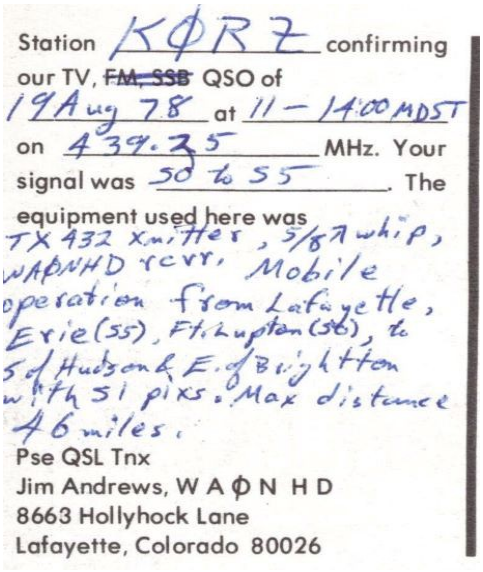
coac cables, filters, or what ? We hope in the near future to be able to report that Mel has solved this problem.

FEEDBACK:

BATC Support: Hi Jim -- Just a quick note to say BATC is happy to support with content for your magazine as you push in to the wider US ATV market. If you see anything of interest in CQ-TV or on the wiki, just ask.

73, Noel - G8GTZ




Station KØRZ confirming
our TV, ~~FM, SSB~~ QSO of
19Aug 78 at 11-1400MDST
on 439.25 MHz. Your
signal was 50 to 55. The
equipment used here was
TX 432 xmitter, 5/8λ whip,
WAØNHD rcvr. Mobile
operation from Lafayette,
Erie(55), Ft. Lupton(56), to
S of Hudson & E. of Brighton
with 51 pixs. Max distance
46 miles.
Pse QSL Tnx
Jim Andrews, W A Ø N H D
8663 Hollyhock Lane
Lafayette, Colorado 80026

ATV QSL from the Past:

Janet recently threw a surprise 80th birthday party for me. My ham buddy dating back to the 60s at the Univ. of Kansas, Bill, K0RZ, gave me a unique gift. A couple of old QSL cards. One was for our first QSO back in 1967. It was FM on the only repeater in Colorado at the time, 146.94 MHz on Squaw Mountain. Then Bill's call was K0RZJ and mine was WA0NHD. The other was a QSL card I gave to Bill in 1978 documenting a mobile ATV test we ran. At the time Bill lived up in the mountains above Jamestown. I was driving out on the eastern prarie of Colorado. We achieved a maximum distance of 46 miles. Here is the QSL card. I don't even recognize that young fella ! My ATV transmitter at the time was my first home-brew design, all transistor, 1 watt (pep) on 439.25MHz. It is shown in the qsl photo strapped on my back on a pack frame along with a battery and whip antenna.

Jim, KH6HTV (ex WA0NHD), Boulder, Colorado

ATVers in 1999

ATVers in 1978

ATV Recollections from the Past: Hello Jim. Tnx for the information on ATV in today's world. It's much more tech oriented then when a I modified a RCA Carfone base unit into a A5 transmitter. I still have a stock of 5894 tubes for it. Our local simplex group operated on 439.25. This was our local group from 1974 until 2006 I would think this picture is about 1999. Left to right W8PAT, WB8RBU, WA8JLB, WA8IUL, WB8JYL and WA8GYP was absent. Lots of fun back in those days. All but me are SK or inactive now. This larger group (about 1978) was in Galion Ohio at K8ZES's. Back row WA8GYP, WA8JLB, WB8MNS, WA8IUL WA8IQB, front row, I can't remember, WA8LGA, K8ZES and I took the picture. In the background was K8ZES's new HB collinear antenna for 70cm.

Best 73, John W8PAT, Oberlin, Ohio

ATV at LARC: The Longmont, CO amateur radio club held their monthly meeting on Oct. 20th. Due to Covid, they are still meeting via Zoom. There were over 30 hams in attendance. The program for the evening was on Digital ATV. It was presented by Jim, KH6HTV. The talk was basically the same which he had given previously to the MicroHams Digital Conference in May, 2020. But some of the power-point slides were updated. The up-dated slides are now available on the BATVC web site: https://kh6htv.files.wordpress.com/2021/10/dtv-talk-rev-10-21.pdf

W0BTV Details: **Inputs:** 439.25MHz, analog NTSC, VUSB-TV; 441MHz/6MHz BW, DVB-T & 1243MHz/6MHz BW, DVB-T

Outputs: Channel 57 --- 423MHz/6MHz BW, DVB-T, or optional 421.25MHz, analog VUSB-TV. Also, secondary transmitter, FM-TV output on 5.905 GHz (24/7).

Operational details in AN-51a Technical details in AN-53a. 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. 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/kh6htvtvr* or *n0ye*. We use the Boulder ARES (BCARES) 2 meter FM voice repeater for intercom. 146.760 MHz (-600kHz, 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 450. 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.**

Free Microwave Components: BATVC is giving away an assortment of waveguide and SMA components. See the previous issue # 89 for details. We still have some stuff left. First Come - First Served.