Boulder Amateur Television Club
TV Repeater's REPEATER

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BATVC web site: www.kh6htv.com

ATN web site: www.atn-tv.com

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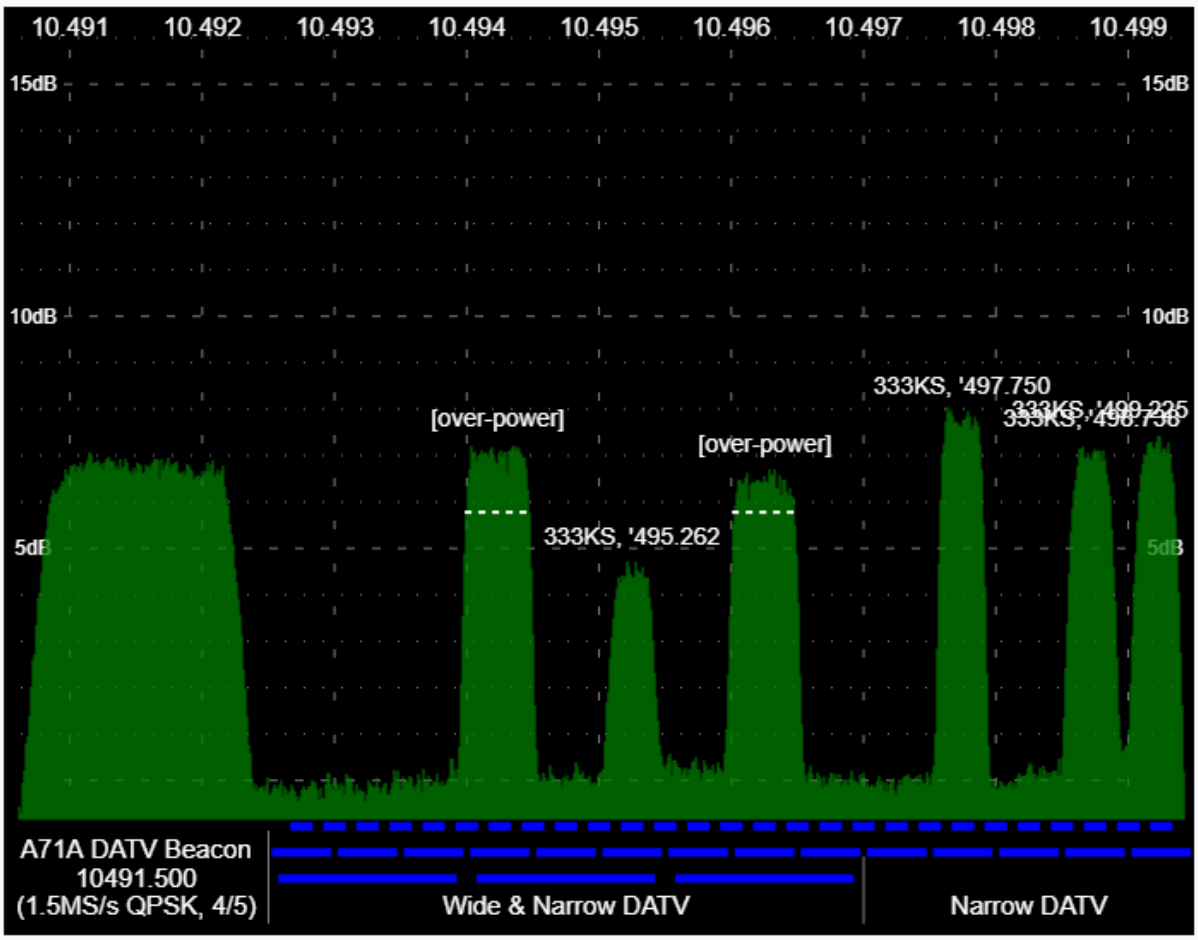
Feed-Back on DATV in the UK:

Digital ATV– A View from the UK

I was pleased to see the RSGB's technical advice on UK ATV reproduced in the last "REPEATER". Whilst the advice is broadly correct, it is a simplified perspective aimed at ATV Novices. It is also a few years out of date – I had written an updated version for print, but it had not made it on to the web site.

There have been 2 recent developments that have enabled rapid technical progress. The first is the availability of the QO-100 wideband transponder on the Es'hail-2 satellite; the second is the availability of single board computers and software defined radios.

Reduced Bandwidth TV on QO-100
The QO-100 wideband transponder is 9 MHz wide, with 2 MHz permanently occupied by the A71A DVB-S2 beacon. This leaves 7 MHz for general use. The link budget is very tight and it is difficult for even the most ambitious amateur to achieve a reasonable SNR in any more than 2MHz of this bandwidth. For example, using a 1.2m dish (4 foot – large by European standards where C-Band satellite TV has never been used domestically) with 50W uplink at 2.4GHz the SNR in 1MHz of bandwidth is only about 5dB. Also, with so many potential users, there is pressure to reduce bandwidth to allow more simultaneous users.



Typical QO-100 Occupancy

The most-used modulation setting on QO-100 is 333kS FEC 2/3 DVB-S2 occupying about 500kHz. This allows a video bitrate of about 440 kbits/s. Video compression to achieve this low bitrate has been improved over the past 3 years through public, collaborative, experimentation on QO-100. Initial efforts used Raspberry Pi-based hardware encoders or PC-based software encoders to generate H264 (MPEG-4) standard digital video from standard definition (PAL, 576i25) composite video. More recently, PC graphics capabilities have been used for video encoding enabling the generation of H265 encoded video from 720p30 high definition video sources. With optimisation, 1080p30 pictures can be encoded into this 440 kbit/s bitstream with very good results.

Picture Quality Available in 333kS

Use of Single-Board Computers

For portable or repeater operation, the use of PCs (or even laptops) is not ideal. The alternative is to use the Raspberry Pi 4, which is a very capable single-board computer with an in-built H264 hardware video encoder. The BATC has supported the development of the Portsdown software suite for the Raspberry Pi 4 which works with a LimeSDR or a Pluto software defined radio to generate ATV. It will also work with a USB-connected tuner for receiving and displaying ATV. Two configurations are supported – the first uses a touchscreen for control in shack or portable settings; the second runs "headless" for unattended operation at repeater sites.

NVIDIA's Jetson Nano single board computer can also be used for video encoding, and is easily capable of 1080p30 H265 encoding in about 1.2Mbit/s. A repeater transmit solution based on this is under development.

The Raspberry Pi can easily drive a software defined radio to generate reduced bandwidth DVB-S, DVB-S2 or DVB-T. Using the Portsdown software, DVB-S/S2 symbol rates from 66kS to 1MS are supported, and DVB-T bandwidths from 150kHz to 1.7MHz can be generated. On receive, with a USB-connected MiniTiouner, the Raspberry Pi with touchscreen and Portsdown software can receive DVB-S/S2 at symbol rates from 66kS to 2MS. Using a "Knucker" DVB-T tuner, bandwidths from 150kHz to 8MHz can be received.

The Ryde Receiver

The Ryde receiver uses a Raspberry Pi and a tuner as a "set-top box" style Digital ATV receiver for DVB-S/S2 or DVB-T. This is suitable for shack use with an IR remote control, or for repeater use where it can be set to scan different frequencies or symbol

rates/bandwidths until it receives a valid signal. Output is normally HDMI 1080p30, but it can be configured for standard definition composite PAL or NTSC.

DVB-S2 vs DVB-T

In UK, we face significant bandwidth pressures, both terrestrially and on QO-100. These pressures have led to the optimisation of Reduced-bandwidth TV (RB-TV) modes of less than 1MS DVB-S/S2 or less than 1.7MHz DVB-T. We have tested DVB-S2 against DVB-T both terrestrially and on QO-100.

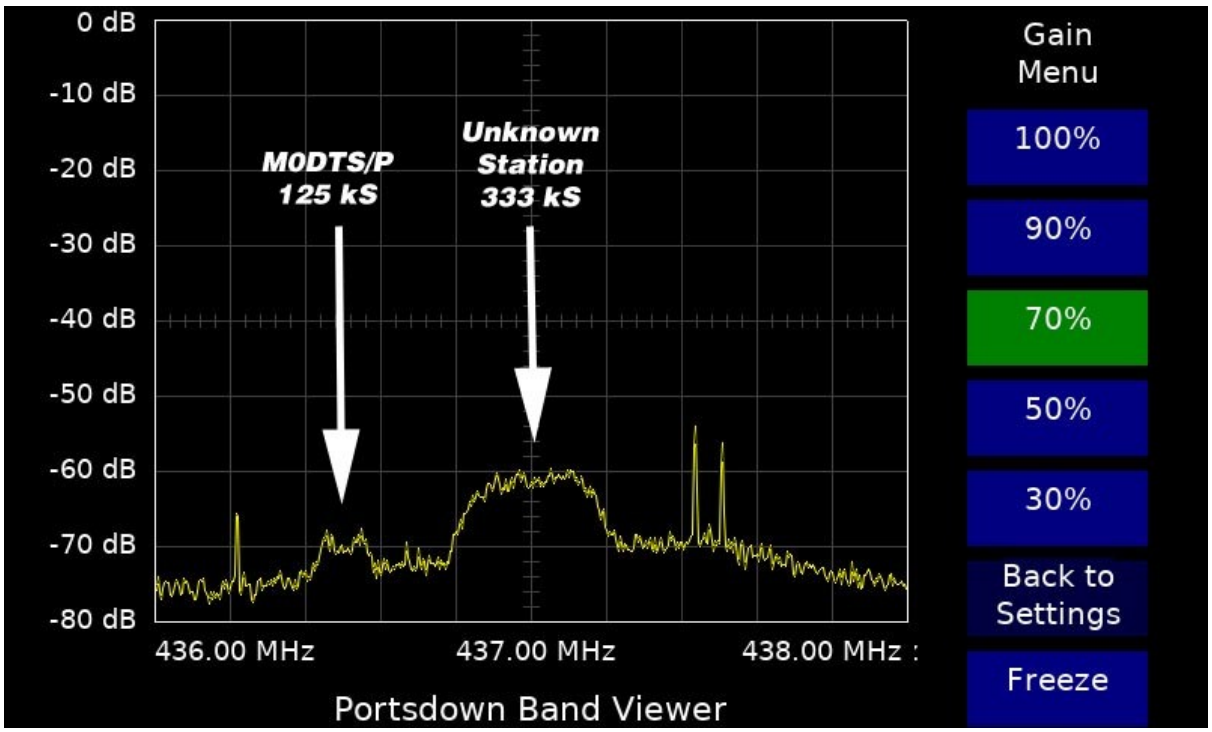
At similar occupied bandwidths and power densities it has, almost without exception, proved easier to achieve video lock with DVB-S2 compared to DVB-T. I would be the first to admit that we have spent much longer optimising DVB-S2 techniques than we have on DVB-T, but tests have so far failed to show any promise of an advantage for DVB-T.

One of the claimed advantages for DVB-T is its resistance to multipath; we have found that reduced bandwidth DVB-S2 is surprisingly resistant to multipath, probably due to the lower symbol rate than that used in the original commercial tests. Lock times for the DVB-T receivers that we have tested (Hi-Des, commercial or the Knucker tuner) seem to be a lot longer than lock times for DVB-S2. This has proved particularly noticeable in fading – DVB-S2 relocks very quickly whereas DVB-T seemed to take ages to relock. This seemed to make reduced bandwidth DVB-T unusable in mobile situations.

Tools for Optimisation

The QO-100 Wideband Spectrum monitor provides stations with a power density vs frequency plot of their signals. It has proved invaluable in understanding the relationship between signal levels and Modulation Error Ratios (MERs) which are used for reporting digital signal strength. Note that the scale on the online spectrum monitor is about 1dB/div, so the signals aren't far above the noise!

The companion tool for terrestrial operation is the Portsdown BandViewer which uses a LimeSDR. Airspy or RTL-SDR dongle to provide a spectrum view of a limited bandwidth (20MHz for the LimeSDR, 10MHz for the Airspy, or 2MHz for the RTL-SDR). Tis provides a 10dB/div view of the band and has proved invaluable for optimising weak-signal paths and visualising signal strength, fading and interference sources.



Bandviewer showing weak signal reception

Both of these tools demonstrate the advantages of reducing signal bandwidth to increase the SNR that can be achieved using the same transmitted power. They also allow the comparison of received signals to the receiver noise level – this is a much more meaningful measure than statements of uV or dBm for sensitivity. It abstracts the decoding sensitivity (which is determined by the demodulator, signal processing and error correction) from the receiver noise figure (which is determined by the receiver rf stages).

Conclusion

I really wanted to point out that the Portsdown transceiver is ideal for use as a stand-alone DVB-S/S2 (or even DVB-T) equipment in portable and ARES situations. It can also be used as a transmitter for Repeater use, and in this situation it pairs well with the Ryde receiver and the BATC Repeater controller using an HDMI switch for an all-digital signal path.

Both the Portsdown and the Ryde systems are capable of DVB-T and I would welcome hearing the results of comparisons between these systems and the HiDes equipment.

Full details of the Portsdown transceiver, the Ryde receiver and the BATC Repeater controller can be found on the BATC Wiki https://wiki.batc.org.uk/ Construction details for the DVB-S/S2 MiniTiouner and the DVB-T Knucker tuner are also on the Wiki.

73 de Dave, G8GKQ, Salisbury, England, UK

Hi Jim .--- Your summary of DATV in the UK and also in the US is correct and succinct.

For completeness of the history, all of the early stations in Australia and Europe used the Boards from SR Systems in Germany (managed by Stefan Riemann) [www.sr-systems.de] or from the early Dutch Group. SR Systems had an MPEG Encoder Board which generates a Transport Stream connection to a Modulator Board called a 'Min Mod'. All of these were DVB-S although DVB-T was also available.

The Melbourne Repeater went from VSB to DATV in the year 2000, all inputs were DVB-S /23 cms to Satellite Receivers feeding CVBS to a pair of MPEG2 Encoders creating two Transport Streams to a Multiplexer and then to a DVB-T Mini-Mod on 70 cms. The Brisbane ATV Repeater also had the same technology.

Stations in Melbourne upgraded to HD a few years ago , some of us purchasing new MPEG4 Encoders , and combining Transport streams from either a MPEG2 Encoder or a MPEG4 Encoder to a new upgraded Minimod all using DVB-S OR DVB-S2.

The Receivers at VK3RTV were also upgraded to DVB/S/S2 with new MPEG4 Encoders , a Multiplexer and a new MiniMod on DVB-T2/70 cms, (the newer Terrestrial standard). Some stations are using the UK Portsdown transmitter for DVB/S2. A few of us here in Melbourne also have SR Systems Mini-Mods that will produce either DVB-S2 or DVB-T (plus just about any of the other system that exists) We now also have DVB-T inputs to VK3RTV

I think that there may not be any more SR Systems Boards available as Stefan reported to me recently that chip orders will take more than a year to fulfill and that nearly all existing boards have been sold.

In Sydney early adopters were DVB-S, but now are DVB-T using domestic Modulators and Up Converters to 23 cm. The Sydney Repeater is a one channel DVB-T system on 70 cms based on a Domesticl Modulator. Operators in South Australia are similar.

Regards Peter, VK3BFG, Wantirna South, Victoria, Australia

Feed-Back on Stand-Alone DVB-S Boxes:

From the USA:

With all the different flavors of DVB it is hard to keep up at times for those of us that are just getting involved. I've been wondering about DVB-H (mobile TV) and wondering if it could have any advantages over DVB-T for hams.

I started out looking at only stand-alone boxes and buying a few cheap ones to test, but quickly found out that every one I purchased seemed to have some compromises in their

capabilities. Even the HiDes units need some PC control to set up. I'm still looking at the Stand-Alone boxes coming from China, but the experimenter in me pushed me to the BATC group.

While the stuff the BATC are producing isn't off the shelf stand-alone or plug & play, it can be packaged relatively easily to fit that mission. A lot of their software runs on a Raspberry Pi with a 7" touchscreen and is very user friendly. My Adalm Pluto & Raspberry Pi computer can transmit DVB-T or DVB-S .It also has the capability of transmitting DVB-T bandwidths from 333KHz to 2MHz. Actually the software could go further in both directions but the Adalm Pluto is a bit fickle beyond those bandwidths. The Lime SDR's seen to be a bit more stable in that regard.

I've also been playing around with their Knucker receiver with another Raspberry Pi and touchscreen, receiving DVB-T at 333KHz to 1 MHz bandwidth. So far only in my shack as no one else in the area has that capability.

Both of these could be packaged into small completely stand-alone units with minimal effort. The Raspberry Pi 7" touch screen setup is very user friendly and flexible, and would work nicely in portable operation once assembled.

While there is more work involved up front, the finished product can be quite flexible and be very portable. They have done a great job on their software & hardware packages and I've seen some very nicely packaged user systems on the BATC website.

73 de John Kozak, K0ZAK, Reisterstown, Maryland, USA

From the BATC - UK:

Hi Jim --- I'm moved to write to you because I think you have not grasped what we are doing here in the UK and Europe with DVB-S / DVB-S2 and the reasons behind it. The assertion that a PC is required is incorrect. I have operated DATV portable from a 12v supply with no PC in sight.

The majority of stations in the UK are using the Raspberry Pi SBC with software developed by the BATC from an idea started by Evariste F5OEO. It's known as the Portsdown project. The processing power in a Raspberry Pi 4 is probably similar to the embedded processor that your commercially produced modulators will use.

By using these modulators, with the exception of the Hi-Des equipment, US hams are missing a trick; the ability to reduce the bandwidth to the 0.5 MHz that a 333kS/s DVB-S2 transmission gives a significant signal to noise advantage over a DVB-T requiring 6,7 or even 8 MHz. That means usable signals go much further. It's still capable of 1280 x 720 @ 25fps.

The Portsdown also supports DVB-T. It is clear from the tests I have done that DVB-T requires more linearity from the power amplifiers than DVB-S. Typically, a 100W SSB PEP linear amplifier needs to be derated to 20% to keep the intermodulation products

acceptably well below -35dBc; DVB-T requires that power level to be halved again to 10%.

Whilst a PC is needed to run the Windows based Minitioune software from F6DZP, there are alternatives, again based on the Raspberry Pi. The Portsdown project requires just an external tuner to allow reception of DVB-S or DVB-T transmissions, with faster lock-up times than the Windows software.

The BATC has a dedicated DVB-S/S2 receiver project known as the Ryde, again based on the Raspberry Pi4 SBC and using the same tuner as the Windows software. This has an HDMI output or it can be configured for AV. The Portsdown and Ryde are eminently suitable for 12 v operation and make a competitive portable DATV station for contest use with no PCs.

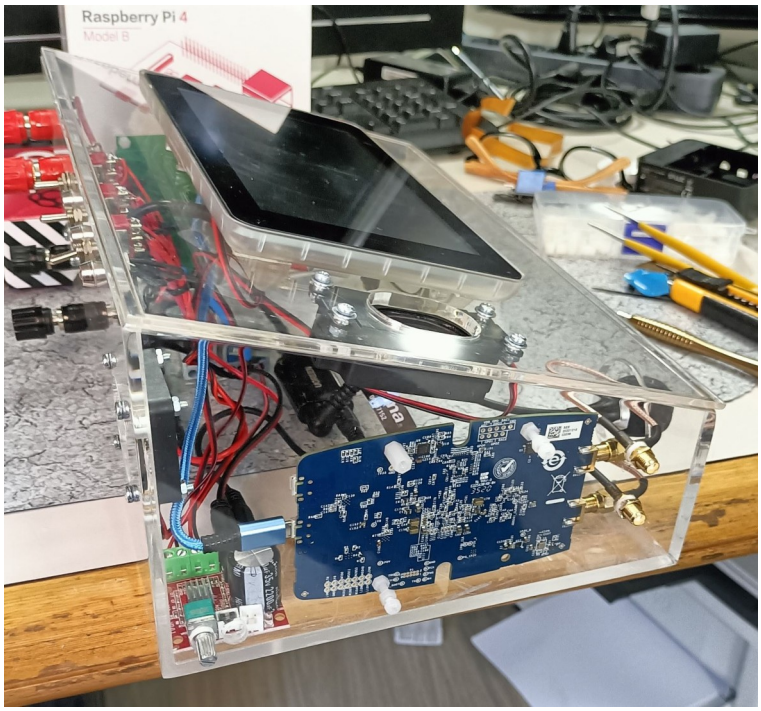
In summary, using DVB-S or S2 uses less bandwidth and allows more power out. That equates to better DX or more reliable links (and no PCs necessary!).

The Portsdown 4 DATV transceiver also incorporates the Langstone FM/SSB/CW transceiver software giving access to the bands between 50MHz and 6000MHz depending on which SDR (Lime Mini or ADLM Pluto) is used with it. See https://wiki.microwavers.org.uk/Langstone_Project Note that the v2 edition works with the Lime Mini or Pluto, v1 is Pluto only. The Langstone has a beacon feature with user programmable CW ID. My Portsdown has the full DATV and Langstone microwave voice capability with tuning via an optical encoder. I should add that the Portsdown also offers DVB-T transceive at symbol rates down to 150kS/s. There are test equipment add-ons too; see here: https://wiki.batc.org.uk/The_Portsdown_DATV_transceiver_system#Portsdown_Test_Equipment
The most useful is the Band Viewer; a great aid to antenna alignment.

There's still a strong ethos of building gear in the ATV community here in the UK. Perhaps that doesn't apply to the US.

For more information about the Portsdown, Ryde and MiniTioune, I refer readers to our BATC Wiki web site: https://wiki.batc.org.uk/BATC_Wiki

Clive G3GJA / G8EQZ, BATC Contests Manager, Hull, England, UK



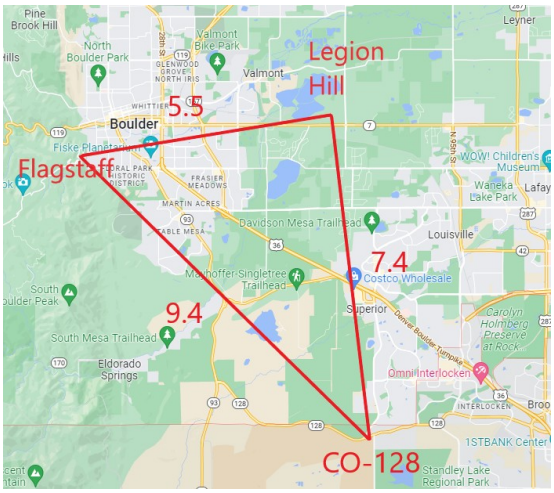
Portsdown 4 + Langston
a World to Discover

I started this beautiful DATV hobby since I followed the ISS which broadcast at 2.4 GHz, I made many connections with Spain, Greece, Malta, and lastly many European records with several contests more than 900 km in all bands in DVB-S2
In all these portable outings I noticed that the difficulty wasting time was always connecting PC transmitters and receivers and various cables
When I said let's try to make this project (Portsdown) it could help me in contests.
The Portsdown proved to be very versatile, that to my first laptop I connected 4 different stations including a station that transmitted and received me with HackRF one.
I wanted to carry out the project inside a transparent plexiglass box and always keep the working parts in view. See above photo. For the technical details: 7 inch Raspberry PI4 2 GB display, camera, external USB ports, Minitioune, mouse and Pluto SDR as shown in the photo, USB sound card and external microphone, 2 watt audio amplifier with external speakers, PTT control for DATV for any amplifiers or transverters and PTT control with Langston mode for all narrow-band modes. .....
Hope you like my realization this version. All technical specifications can be found here
https://wiki.batc.org.uk/The_Portsdown_DATV_transceiver_system?_x_tr_sl=en&_x_tr_tl=it&_x_tr_hl=it&_x_tr_pto=sc

https://www.facebook.com/groups/96549762423/?ref=share

73 de Filippo, IZ5TEP, Viareggio, Italy

Debbie, WB2DVT, hiding under the black cloth to view her ATV video monitor in the bright sunlight. She and Pete, WB3DVS, set up on Flagstaff mountain, Panorama Point overlooking the city of Boulder.



Out in the Field Again With Microwave ATV - Finally !

After a long covid enforced absense, the Boulder ATV hams have once again ventured out in the field to again play with microwaves. Don, N0YE, our microwave guru, organized our first outing on Sept. 20th. He planned this as a "shake-down" event for us to blow the dust off of our gear which has been sitting in the closet way too long. To make things simple we opted to go with 5.8 GHz analog FM-TV rather than digital TV.

Don, N0YE, and Tommy, W0IVJ, set up out on the prarie at a high spot on CO-128 and McCaslin Blvd. Debbie, WB2DVT, and Pete, WB2DVS, were on Flagstaff mountain (see above photo). Chris, K0CJG, and Jim, KH6HTV, set up their individual rigs on Legion Hill, east of town. The above map shows the locations and the distances between them in miles. Each location had line-of-sight rf paths to the other sites, plus to our W0BTV ATV repeater. Upon setting up, all confirmed their receivers were working by pointing their antennas toward W0BTV and receiving our 24/7 FM-TV beacon on 5.905 GHz. We all then switched to our FM-TV simplex working frequency of 5.685 GHz.

Everyone was using the same, low cost (only $30 ! !), combo transmitter / receiver package from Amazon.com This consisted of the TS-830, 600mW transmitter and the RC-832 receiver. Some also were using the $25, Chinese, 2 watt amplifier. An assortment of dish antennas were used. Some home-built. Jim, Pete/Debbie used the L-Com BBQ grill dish. All of these items have been discussed in previous issues of this newsletter.

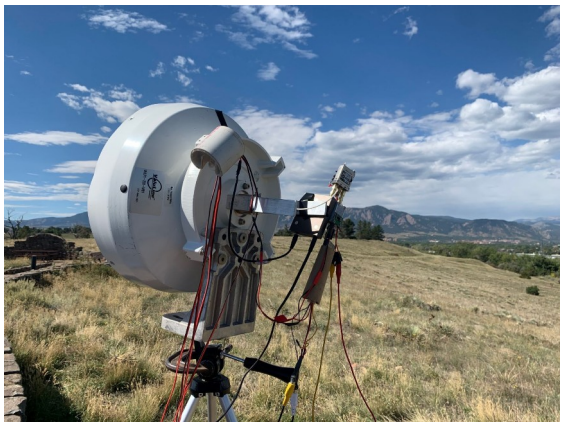
All stations were able to exchange 2 way, P5 video pictures with Q5 audio with the other stations. At the end of the exercise, Jim then decided to see what he could receive using the simple rubber duck antenna which is included with the Amazon combo package. He was able to get a decent P4 picture and audio with a bit of noise from Pete & Debbie on Flagstaff. Here are a sampling of some of the pictures received.

Tommy & Don at CO-128

Pete & Debbie at Flagstaff

Chris with Flatiron mountains

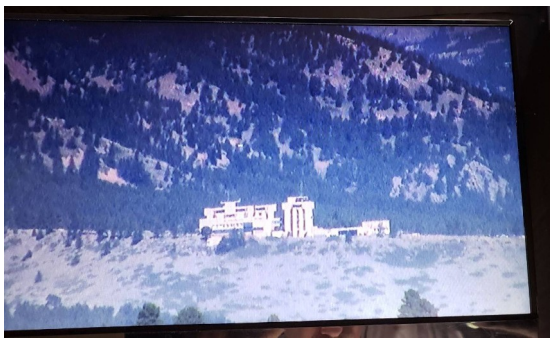
Legion Hill ATV hams



Chris' rig

Jim's rig

Flagstaff as seen from Legion Hill



W0BTV ATV repeater as seen by N0YE

DVR for Recording our DATV Signals

Recently on the BATVC weekly net, Chris, K0CJG, was showing us the handy Digital Video Recorder (DVR) which he uses to record our signals when out in the field. It is labeled as AGPTEK. It has a loop-thru HDMI which is quite handy. It records up to 1080P onto a USB thumb drive, memory stick. Requires +5Vdc power. It sells for $50 on Amazon Prime. For analog ATV, such as our 5.8 GHz FM-TV, Chris uses an inexpensive (<$10) composite A/V to HDMI converter.

W0BTV Details:

Inputs: 439.25 MHz, analog NTSC, VUSB-TV; 441MHz/6MHz BW, DVB-T & 1243 MHz/6MHz BW, DVB-T
Outputs: Channel 57 --- 423 MHz/6MHz BW, DVB-T, or optional 421.25 MHz, 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 (22:00 UTC). The net typically runs for 1 to 1 1/2 hours. A DVD ham travelogue is usually played for about one hour before and 1/2 hour after the formal net. ATV nets are streamed live using the British Amateur TV Club's server, via: *https://batc.org.uk/live/kh6htvtvr* or *n0ye or ab0my*. We use the Boulder ARES (BCARES) 2 meter FM voice repeater for intercom. 146.760 MHz (-600 kHz, 100 Hz PL tone required to access).

Newsletter Details: *This is a free newsletter distributed electronically via e-mail to ATV hams. The distribution list has now grown to about 500. News and articles from other ATV groups are welcomed. Permission is granted to re-distribute it and also to re-print articles, as long as you acknowledge the source. All past issues are archived at: https://kh6htv.com/newsletter/*

ATV HAM ADS

Free advertising space is offered here to ATV hams, ham clubs or ARES groups. List here amateur radio & TV gear For Sale - or - Want to Buy.

Dave, AH6AR, Dayton has called our attention to some older analog ATV gear still being available on E-Bay. This PC Electronics model TC70-10 is currently listed and selling for $200.

Reminder --- Ham Radio Swap-Fest is Tomorrow !

The Boulder, Colorado Amateur Radio Club's annual swap-fest is tomorrow, Sunday, Oct. 2ed. The location is the Boulder County Fair Grounds in Longmont. Address is Hover and Nelson roads. 8am to noon.

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