Boulder Amateur Television Club
TV Repeater's REPEATER

June, 2021
2ed edition, issue #79

BATVC web site: www.kh6htv.com

ATN web site: www.atn-tv.com

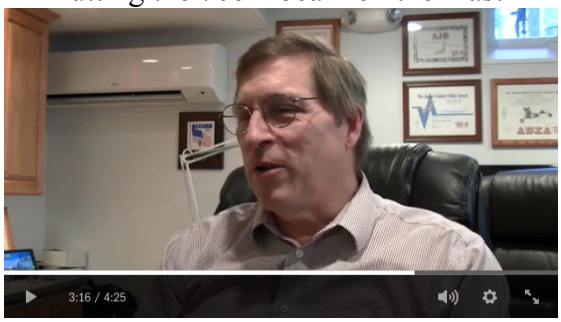
Jim Andrews, KH6HTV, editor - kh6htv@arrl.net www.kh6htv.com

ATV Coverage of Field Day

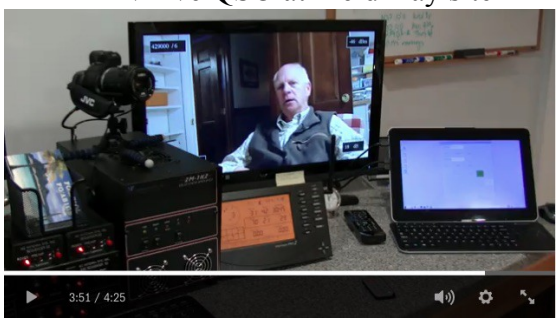
Hello Jim --- Thanks for picking up the **QST** cover! We brought our ATV setup to Field Day a little while back. Here are a few pictures and a video that I think you might enjoy. The pictures are from Field Day 2016. We setup a point-to-point DATV video link between our site, N1FD and N1NIC's site about 10 miles away on the 70cm band.

Putting the 70cm beam on the mast

DATV live QSO at Field Day site



Fred, AB1OC



Skip, K1NKR

Here's a video demonstrating the DATV systems that Skip and I built:
https://www.dropbox.com/s/s0dg5cprz882j6g/DATV%20Demo%20on%2070cm%20-%201080p.m4v?dl=0

Fred's Beautiful 70cm DATV station, complete with Raspberry-Pi controller

More on the ATV setup can be found here:
https://stationproject.blog/2016/02/19/a-new-project-digital-fast-scan-amateur-television/
Thank you again Jim! Best and 73,

Fred (AB1OC), ab1oc@arrl.net
President, Nashua Area Radio Society
Dayton Hamvention(R) 2019 Club of the Year
ARISS Mentor and Telebridge Station

Visit Nashua ARS Website – https://www.n1fd.org <https://www.n1fd.org/>
Visit our Blog – https://stationproject.blog <https://stationproject.blog/>
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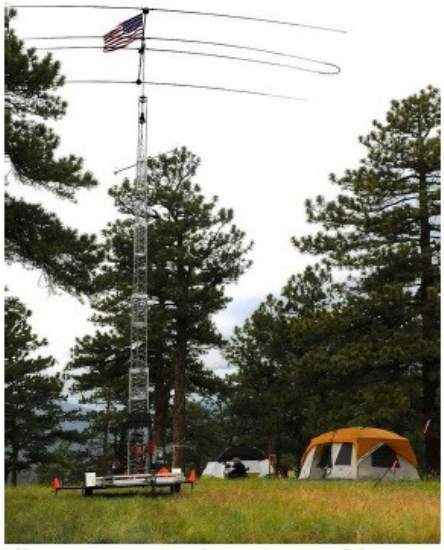
Boulder Amateur Radio Club's Field Day

BARC will once again have a real live Field Day operation this year. As in the past, we will be at the Betasso open space preserve up in the mountains. BARC will again be running 2A-CO. The primary station will again be 20 meters SSB using Allen, K0ARK's great trailer mounted, crank-up tower with a Hex-Beam. In the past, with this mountain top set-up we have typically been able to command and hold a frequency vs. needing to "hunt-n-pounce". We also set up a CW station using a G5RV antenna and operate on the other bands as conditions permit.



Allen, K0ARK's famed portable tower

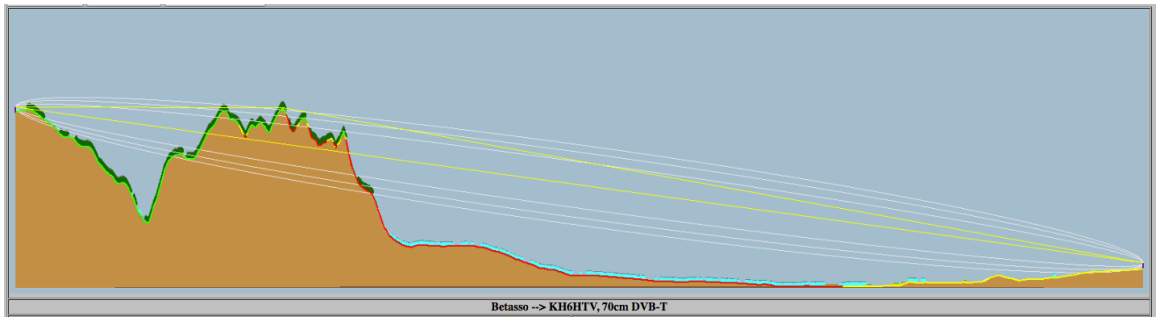
We are located on Boulder County's open space preserve, Betasso, near the Betasso water treatment plant. Take Boulder Canyon to Sugar Loaf Road. Up SugarLoaf a short distance to the sign for Betasso on the right. We have the shelter house reserved for the week-end and are allowed to stay overnight, which is not normally allowed in open space. The shelter is a great place to gather for "eye-ball QSOs when not at the mike or key racking up points for BARC's contest log book.

BARC invites all hams, members or not, old-timers or newbies, to join in the fun of Field Day. Remember it is the week-end of June 26-27. We need help setting up early Saturday morning and tear-down after noon on Sunday. Need more info ? contact either Mike Stutzer, KD0FDJ (michael.stutzer@colorado.edu) or Allen Bishop (abishop1150@comcast.net).

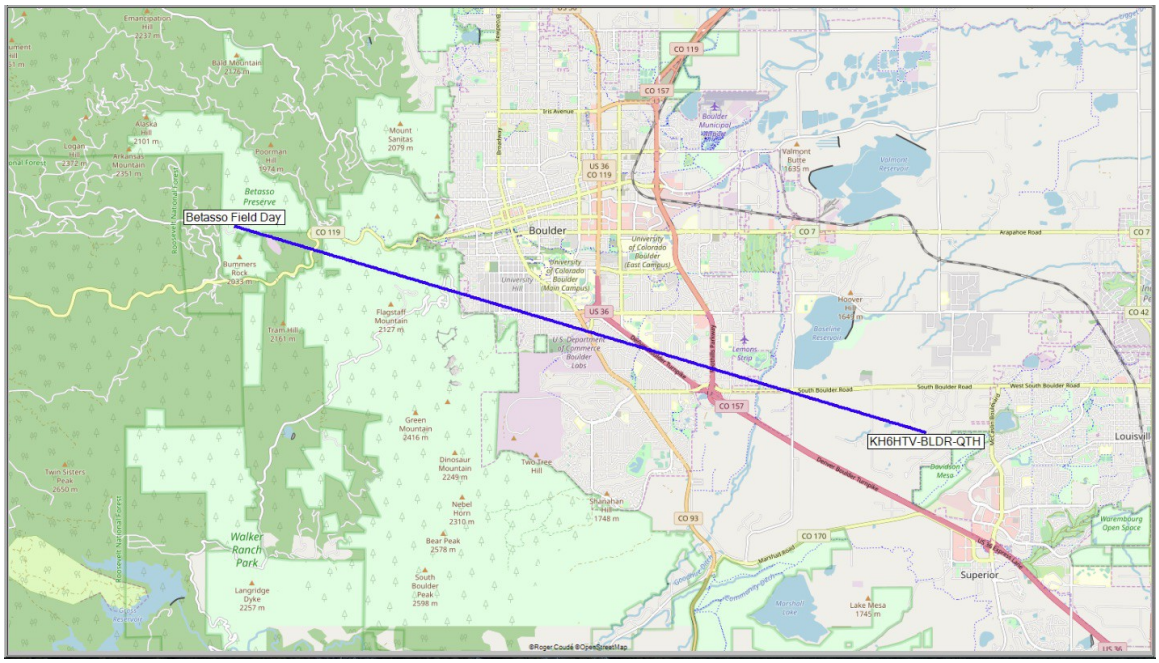
ATV at Field Day: We have had an ATV demo at several of the recent Boulder Amateur Radio Club's Field Day operations. It has usually been a simple setup with a camera and transmitter in the 20 meter SSB tent. A receiver and monitor was then setup in the Betasso shelter house where we gathered for eye-ball QSOs, meals, etc.

Many years ago, in the good old analog TV days, we did a much more ambitious ATV project. We did a link from Betasso to the BARC Junior's Field Day site near Valmont Butte out on the prairie. Doshia, KB0NAS, and George, N0RUX, setup their portable ATV station at Valmont. We did not have a direct line of sight path from the Betasso shelter to Valmont. Thus, we had to setup an intermediate microwave link relay station nearby on Bummer's Rock. This was an equipment intensive setup. Lots of work, and humping a lot of heavy gear to Bummer's Rock, so we never attempted it again.

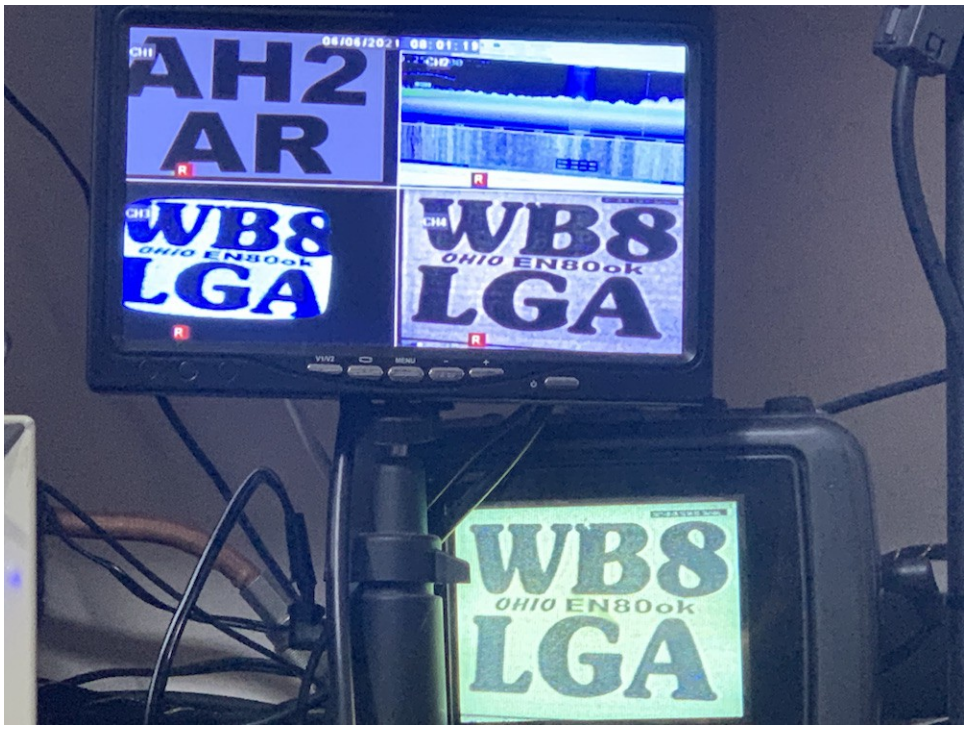
BARC's Field Day chairman, Allen, K0ARK, has asked BATVC to again do a more ambitious DATV operation for 2021 Field Day. So, we will try to link to the outside world this time. Plans are to transmit Hi-Def, digital video from the Betasso field day site out to our DATV repeater, W0BTV, back in Boulder. Then share it with the world via the internet on the BATC server in the U.K (https://batc.org.uk/live/kh6htvtvr) We do not have a direct path from Betasso to the repeater. The tall Green mountain is a major obstacle. Instead we hope to send a 70cm (441 MHz) signal to KH6HTV's QTH south-east of Boulder. From there, it will be relayed on 23cm (1243 MHz) to W0BTV repeater. W0BTV then transmits it out on 423 MHz (DVB-T) & 5905 MHz (FM-TV). The RF path from Betasso to KH6HTV is going to be marginal. Radio Mobile predicts it will be "iffy at best", with perhaps a +2dB margin. So, wish us luck !



Betasso Flagstaff Mtn KH6HTV
RF Path Profile for 70cm link from BARC Field Day site to KH6HTV relay station



Map showing locations of BARC Field Day site (Betasso) and KH6HTV QTH



TROPO Time of the Year: The Rocky Mountain West is too dry for tropospheric propagation. But back in the Mid-West of Ohio and neighboring states, they get to enjoy nature's gift to hams, i.e. Tropo ducting of VHF & UHF. Dave, AH2AR, of Dayton, Ohio reports this recent opening.

"**Midwest ATV Group DX Contact:** Pictured above is a photo documenting yet another Midwest, 70cm band opening that occurred on Sunday, June 6th. I took the screenshot of WB8LGA's incoming A5 signal whose QTH is in Morrow County, Ohio. This is an 83 mile path to my QTH here in Vandalia Ohio. The QUAD screen shows simultaneous ATV signals coming in to the Dayton, W8BI ATV repeater at P-5 (Lower right-hand quadrant) and a separate ATV signal that I was receiving direct from him at my QTH (lower left-hand quadrant). Interestingly, Charles reduced his output power to under 5 watts and we were still able to close the link on 70cm analog ATV. This tropo opening lasted only about 15 minutes."

Dave, AH2AR

PBS Mobile Van: The other day I was driving through Lake Geneva which is about 12 miles from my home in Burlington, WI. On one of the side roads I spotted a familiar old sight. It was the old equipment truck from the Public Television station in Milwaukee. Channel 10/36 was operated by the Milwaukee Area Technical Collage (MATC). I talked to the current owner of this rig and his plans are to convert it into an RV

Gary - KB9VGD, Burlington, Wisconsin

Internet Linking of ATV Repeaters

In correspondence with Fred, AB1OC, he asked *"Has anyone considered an internet-based system for linking ATV repeaters (something similar to EchoLink for DATV)?"*

Well, Yes, as a matter of fact, we did a world-wide link-up last summer for the World-Wide ATV QSO Party. It was organized by Peter, VK3BFG. For details, see the Sept. 2020 newsletter, issue #55. I also told Fred that the ATN folks in southern California

and Arizona are doing it on a routine basis. So Mike, WA6SVT, has given us this overview of what and how ATN is doing it.

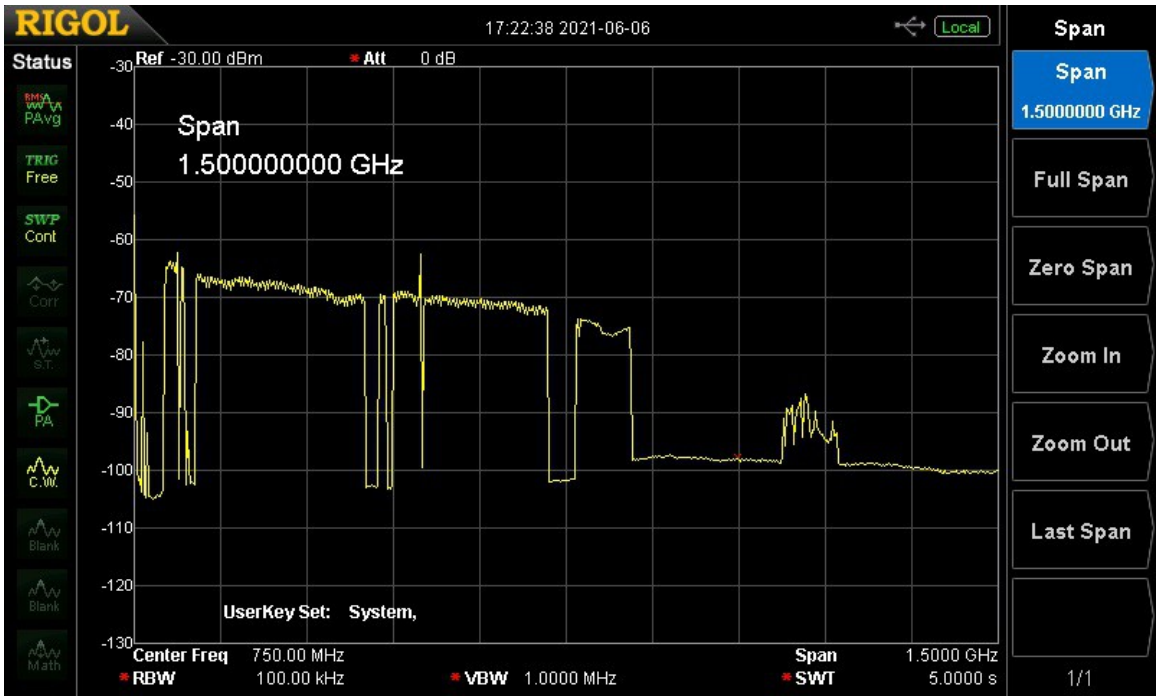
Mike writes: "Currently we are doing IP video linking manually during the ATV nets and we can check in not only ATN's Arizona chapter repeater to the California-Nevada microwave linked repeaters but we can also link in ATVers world wide.

For our automated linking, we are using a Cerevo Live Show X IP video streaming modem using HDMI input. The unit also allows either embedded audio or analog line audio input. It can support up to 3 HD streams if you have the internet bandwidth to support it. Currently it is used to take the 5910 MHz FM video link output from Santiago Peak, (I do have an NTSC to HDMI converter in line) which is our hub repeater. It sends out one stream for Youtube, the second for BATC and the third is a link to Arizona. On each stream you can select mono or stereo and in the case of mono, using the right or left channel. For signaling we use CTCSS tone at 110.9 Hz that is generated at Santiago when the ATV repeater's hang timer shuts the repeater (1253.25 MHz) down. The microwave link is always up so the CTCSS tone is then sent over the ATV audio channel to mute the microwave linked repeaters. The CTCSS audio is passed over the streaming path too and you can use this to turn off an ATV repeater transmitter.

What we plan to do soon is provide a second audio channel with the CTCSS tone removed so those of you watching Youtube or BATC will not have to hear the tone. This would be audio only on left and audio on right would have the CTCSS mute tone.

On a direct IP link, the latency is about 1 to 2 seconds, via Youtube and BATC it can be longer. If you want to experiment, tune into the Youtube channel (we do have to restart the stream more than we wanted to because if a static picture stays on too long, You tube thinks the stream is idle and shuts down. We may need to add a slide show when the repeater is not in use as a work around. If you have a Comspec TS-32 or the TS-64WDS CTCSS decoder, you can wire it up and use the out one lead (goes low when no CTCSS tone is generated) to key one of Jim's amplifiers or an ATV controller to tie into IP ATV video when we have activity in the California-Nevada microwave linked system."

Mike, WA6SVT, Crestline, California



What is in the Cable TV Spectrum ?

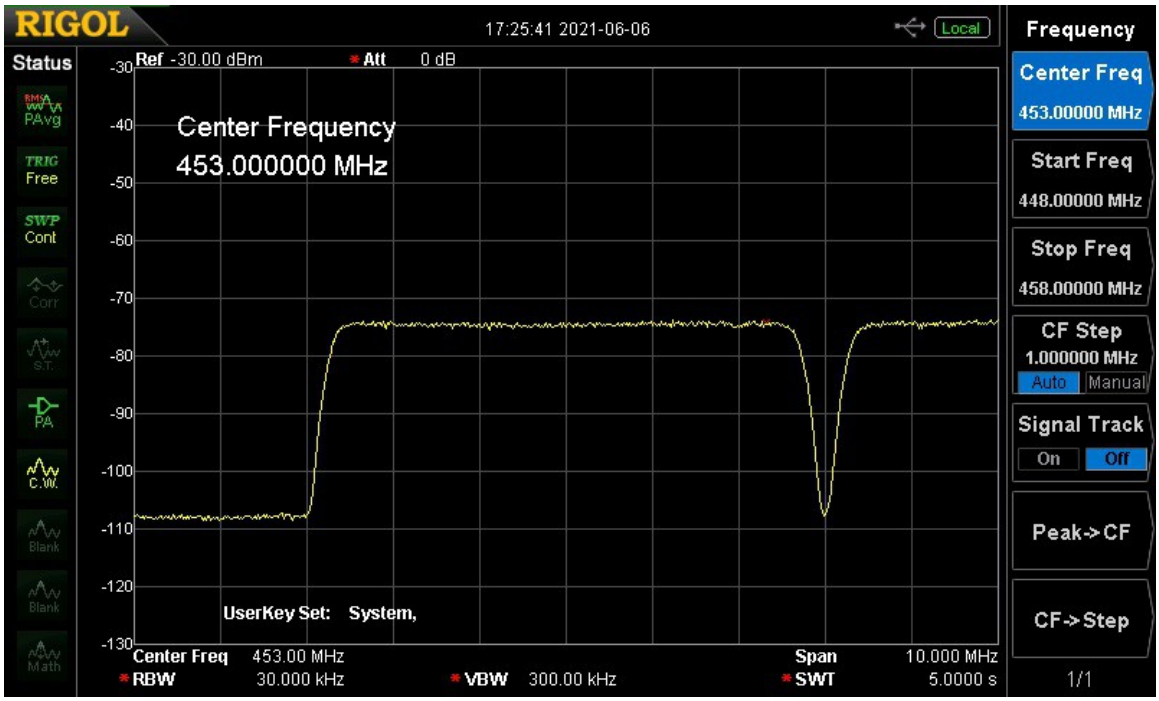
I recently received an inquiry from Bil, K1ATV, in Mesa, Arizona about cable TV. He has Cox Cable in the Phoenix area. He wanted to know what system they use? Could it be DVB-T ? Can it be decoded with our ham DTV gear?, rf channels, etc. ? For specifics on the Phoenix, Cox Cable, I referred Bil to the other Arizona ATV hams.

Because Bil asked these questions, I decided it would be informative to other ATV hams to discuss digital CATV. To illustrate a typical system, I connected my own cable TV signal to my Rigol spectrum analyzer to provide some visuals. Here in Boulder, Colorado, we receive our cable service from Comcast. The above photo is a full sweep of the Comcast cable from 0 to 1.5 GHz.

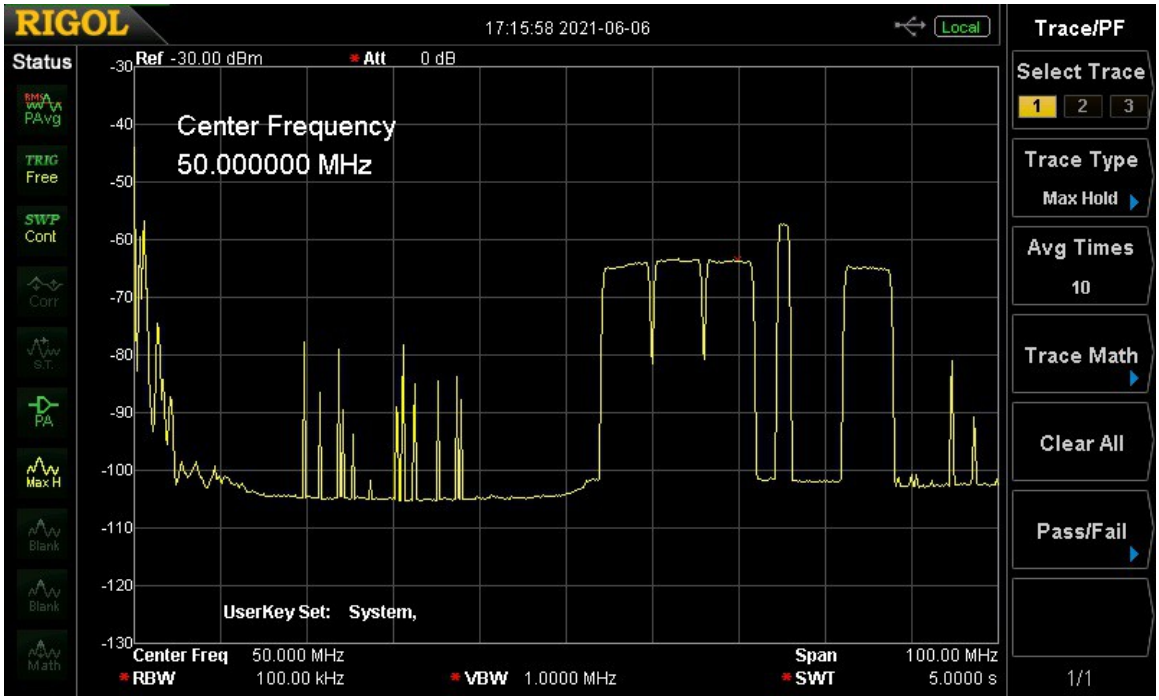
The "Bible" for all technical questions relating to digital TV is a book I found by Walter Fischer, an engineer with Rhode & Schwartz in Germany. The book is entitled *"Digital Video and Audio Broadcasting Technology"*. It is published by Springer and is available in both German and English. For any DATV ham who really wants to know the real guts of DTV, I highly recommend this book. It covers DVB-S, DVB-T, DVB-C, ATSC/8VSB, plus several other systems.

Here in the USA, the cable companies use a form of DVB-C, called ITU-T J83B. The international standard is called J83A. For the USA, J83B, the RF channel bandwidth used is 6 MHz. The modulation methods used are either 64-QAM or 256-QAM. J83B uses a different, complex, scheme of error protection (FEC), than J83A. For 64-QAM, the gross data rate is 30.34 Mbit/s. For 256-QAM, the gross data rate is 42.88 Mbits/s. The spectrum is carefully controlled with smooth roll-off filters on the channel edges.

So, lets now look more carefully at what we see in the CATV spectrum.

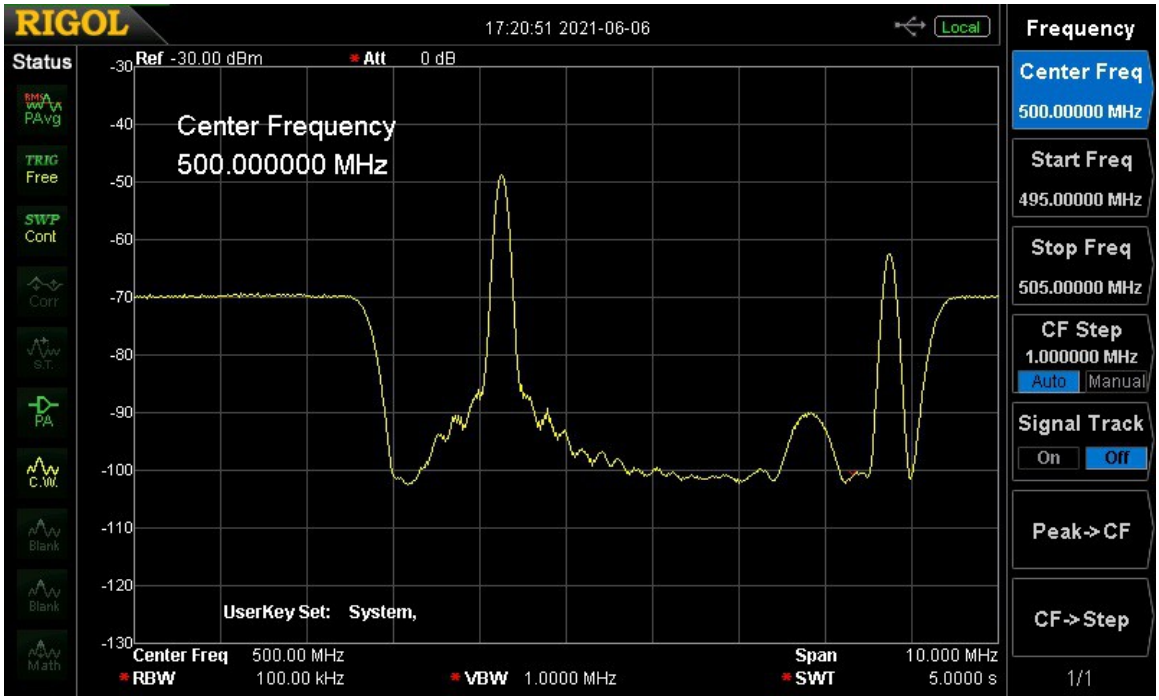


This shows the typical spectrum of a single TV channel. It is cable channel 62 (453MHz). 10dB/div & 1MHz/div. Resolution band-width was set to 30kHz. Note: there was no signal on Ch 61, but there is another signal present on Ch 63. Note the deep notch at the channel edge. The channel filter roll-off is thus preventing cross-talk into the adjacent channels. The noise floor of the measurement was about -109dBm.

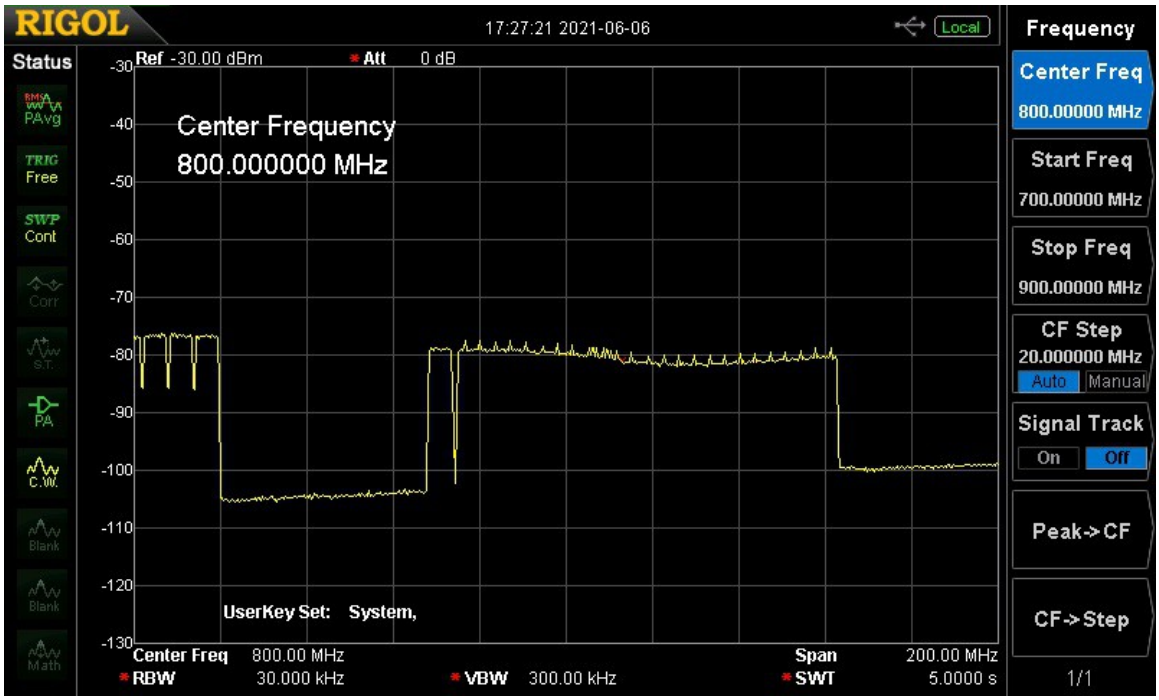


This is what we find at the bottom end of the band. The frequency sweep is from 0 to 100 MHz. The key thing we find here is the "Up-Stream" data flow. This is where we the users send our data out to the internet. The region between 5 and 42 MHz is used for this purpose. While watching this on my spectrum analyzer, the spikes seen occurred randomly. The cable company uses bi-directional amplifiers to accommodate the up-stream vs. the down-stream data flows. The cross-over region around 50MHz is thus empty. Above 50 MHz, we now see appearing starting at 54MHz, Ch 2, 3 & 4. There next appears a narrower (1.3MHz) digital signal. I don't know what it is used for ?. It then appears that the cable company leaves the FM broadcast band (88-108MHz) empty for fear of RFI. I did find local RFI there from two nearby, strong FM broadcast stations. In years past, the cable companies included a single carrier at about 110MHz which was used by service trucks to locate leaks from the cable system. I did not find that, nor any other similar signal to be present anymore.

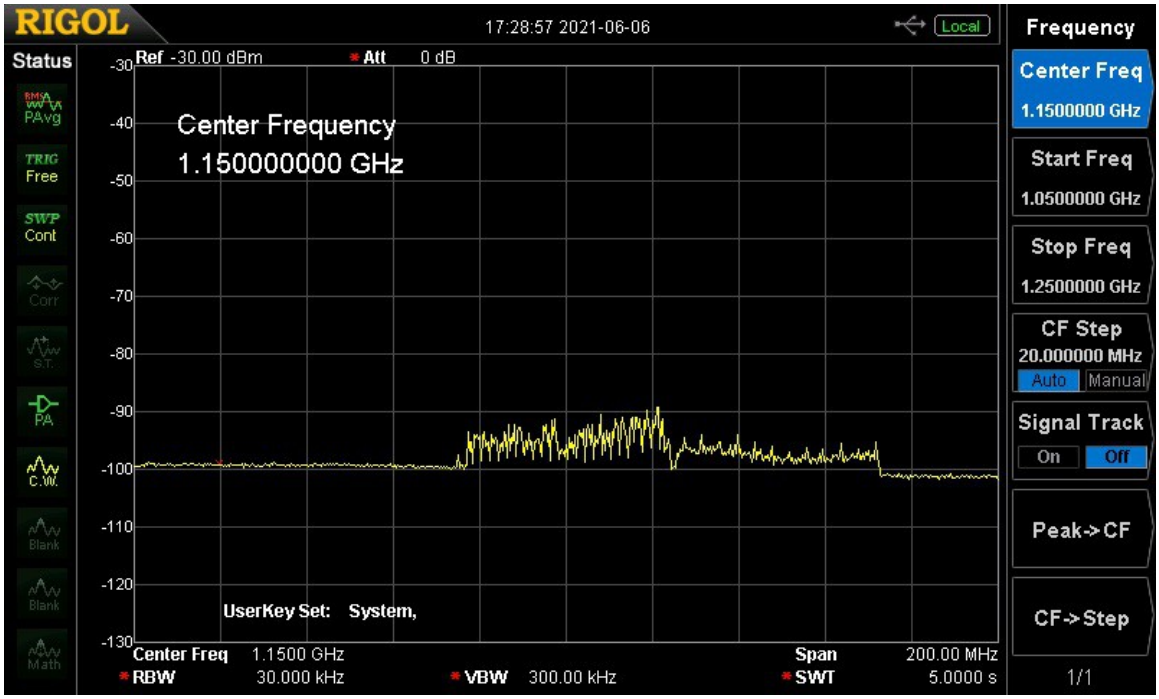
The region from 110 to 400MHz was totally filled with 6MHz, DTV channels. Then again from 450 to 720MHz was again filled up with more DTV channels. With one exception.



The exception was at 500MHz, where I found a single analog TV signal on channel 70. Here we see the video carrier at 499.25MHz. Also visible is the 3.58MHz color sub-carrier and the 4.5MHz sound sub-carrier. When I connected an analog TV receiver to the cable and tuned it to Ch 70 I found this to be just a black screen with no audio.



This is the region above 720MHz. Here we find one single DTV channel, but then a spectrum totally different from DVB-C. This appears to be a very wide, about 90MHz band-width digital signal with a bunch of pilot tones. This is for internet use. It is the "Down-Link" of data from the internet, plus whatever signaling the cable company needs to use.



This it the last region found on our sweep up to 1.5GHz. It is a new concept for me. When the Comcast service tech installed our service when we moved in, he explained that they now install a "master" set-top receiver in the living room. Then for all other TV

sets in the house, they install "slave" set-top boxes. The slave in our bedroom is actually a much smaller unit than the master. The tech explained that the master and slave talk to each other on a frequency above 1 GHz. Thus, the signal seen here between 1125 and 1220MHz must be for the master/slave communication. It is seen to be two distinct signals of about 50MHz width.

So, back to K1ATV's questions. He asked "Can we use our ham DTV gear, such as the Hi-Des receivers to watch cable TV?"
NO, Bil, sorry --- We are using DVB-T (or some hams DVB-S). Not DVB-C, J83B. Plus, Comcast, and probably most other cable companies today encrypt (scramble) their transmissions. While the TV receivers we buy at Wal-Mart, etc. come equipped with a digital cable tuner for both broadcast ATSC and cable J83B, they still will not work. I tried doing an auto-scan on my Comcast cable with two different brand receivers and neither one would receive nor decode any of the Comcast channels. Thus they were all encrypted.

I might add a note. The modulators and receivers from Hi-Des do come equipped with the capability of encrypting and unscrambling their DVB-T transmission. However, we as FCC licensed radio amateurs are strictly forbidden by FCC rules from encrypting our transmissions. Thus we should never use this feature.

Another note: Back in 2010, I an several other Boulder hams experimented using digital cable TV, J83B, for over the air amateur transmissions. We found it quite unsatisfactory. While it sometimes worked, it often did not, even for line-of-sight paths. The issue was multi-path. With much multi-path present, the CATV digital receiver simply could not decode the signal. So by 2014, when we discovered DVB-T and Hi-Des, we abandoned digital cable, J83B, for DVB-T. We are very happy we did so. DVB-T tolerates severe multi-path and we have had great success with it.

Jim, KH6HTV, Boulder, Colorado

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.**

For Sale: Blonder-Tongue model MICM

These are analog TV modulators originally used in CATV head-ends and closed circuit TV installations, such as hotels. They produce a high quality, Vestigial Upper-Sideband, NTSC, TV signal. They require +5Vdc & +12Vdc power. They are fixed channel units. I have the following channels available:
3, 8, 14, 33, 34, 49 & 58. New at ATV Research, they sell for $129 ea. My price is $25 each. Except $50 for the Ch-58 (427.25MHz) Shipping is extra at $16 via USPS priority mail, medium flat rate carton. If you order several, they can all go in one carton.

Jim, KH6HTV, kh6htv@arrl.net

For Sale: Pico-Macom Model MPCD

These are analog TV de-modulators (receivers) originally used in CATV head-ends and closed circuit TV installations, such as hotels. They are frequency synthesized and cover all broadcast and CATV channels. 125 channels from 54 - 806 MHz. These are a very high quality TV receiver and include a SAW filter. No video squelch. We use one of them in the Boulder W0BTV, ATV repeater. They require +5Vdc & +12Vdc power. New they sell for $140 at ATV Research. My price is $50 each. Plus $9 for shipping via USPS Priority Mail in small flat-rate carton.

Jim, KH6HTV, kh6htv@arrl.net