Boulder Amateur Television Club
TV Repeater's REPEATER

August, 2021
issue #83

BATVC web site: www.kh6htv.com

ATN web site: www.atn-tv.com

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2021 ATV QSO PARTY:

Hello all .. ----- Just another heads up that the DATV QSO Party will be on again this year On Friday 27 and Saturday 28th August Eastern Australian Standard Time. As usual this will mean **the party will be on in the US on Friday evening 27th August** which will be Saturday morning here in the eastern seaboard of Australia.

The Melbourne DATV Repeater has had an upgrade since last year and is now running a two channel multiplexed output using the DVB-T2 standard. This is second generation terrestrial technology for HD TV. All uplinks to VK3RTV are using either DVB-S2 or DVB-S. Both HD and SD signals are now accessed from the HDMI output of the receivers so there is an improvement in quality for all local stations here in Melbourne. This HD upgrade is in front of the commercial stations in Australia which still run DVB-T. The last step for the current upgrade is to convert the SD local media player to HD. Work in progress now.

73, Peter VK3BFG

GT-MEDIA RECEIVERS - Which is Best?

At this point, we have verified that two of the GT-Media Receivers will receive DVB-T signals on the 70cm and 33cm bands. They are the V7-Plus and V7-Pro models. They both cost in the $50 to $60 price range. Is there a difference ? **Yes, if at all possible, avoid the V7-Pro. Do NOT buy the V7-Pro.** We have been burned on it. We have found that it has the annoying issue that it will not receive a signal if it is sitting monitoring a dead channel and a DTV signal comes on the air. It will only receive the signal, if you first switch to another channel and then return to the desired channel with a solid signal present. This is a "Royal Pain in the A...." Totally unacceptable behaviour.

The V7-Plus behaves properly, when ever a signal comes on the air, it immediately displays it.

The Amazon price seems to be creeping up for the V7 Plus receiver. If it gets much higher, I recommend forgeting about it and going with the known, good, HV-110 receiver from Hi-Des at $99, which includes one week shipping by air from Taiwan to the USA. It has the additional feature of being able to receive narrow bandwidth signals down to 1 MHz. The GT-Media receivers only work with 6, 7 or 8 MHz bandwidth signals. The HV-110 also has a very good S meter which measures rf input power in dBm. It is accurate within 1dB from -10 to -90dBm.

Jim, KH6HTV, Boulder, CO

ATV DX-pedition from Pike's Peak Coming this Fall

We're tentatively planning an ATV operation from Pike's Peak this Fall. We hope to receive analog TV from the Boulder ATV repeater, W0BTV. We're set up to transmit on Channel 60. We'll have another station set up at KJ7RLI's hilltop QTH at Campground of the Rockies (CORA), near the junction of Hwy 24 and 285, overlooking the Antero Reservoir. Our plans are tentative because KJ7RLI may have work commitments back in Phoenix and NØVWX is getting married. And they're still doing construction work at the summit. We'll keep our fingers crossed!

73, Rick Peterson, WA6NUT, Buena Vista, Colorado

Chris, K0CJG, setting up his microwave gear (left) on the US-36, Boulder Overlook & receiving a signal from Don, N0YE, at Rabbit mountain (right) 19 miles to the north.

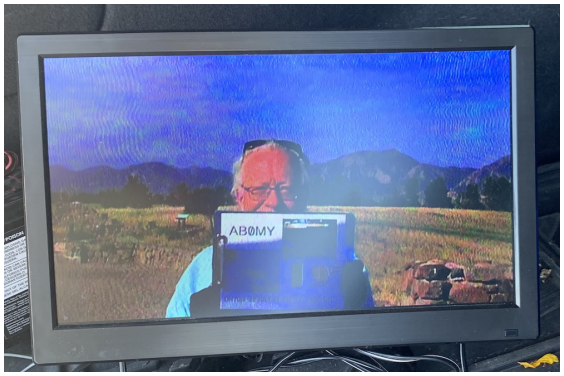
Summer is Microwave Season

The Boulder ATVers were out again playing microwaves on July 22ed. This time the event used analog FM-TV on the 5cm band. We had two new players participating, Lou, K0ANS, Longmont and Chris, K0CJG, Boulder. It was a really big event for Lou as this is his first ever ATV transmitter and first real chance to try it out. Lou has been a regular viewer of our Thursday afternoon ATV nets for several years.

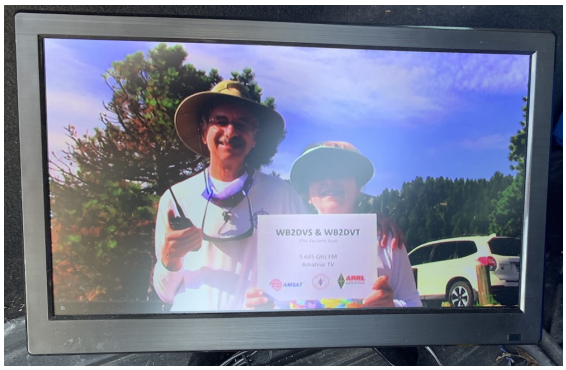
We were all using the inexpensive ($30), drone TS-832 transmitters and RC-832 receivers from Amazon, along with high gain, microwave dish antennas. The TS-832 transmitters put out 600mW (+28dBm). Some were also using the low cost ($20) Chinese, after-burner, amplifers to boost their signals up to 2 Watts (+33dBm). This equipment has been discussed in previous newsletters. We operated on 5.685GHz.

For this exercise, we specifically picked locations where we could guarantee succeess for both Lou and Chris. Each location was also chosen to able to receive the FM-TV beacon signal from our W0BTV, TV repeater on 5.905GHz. Chris, K0CJG, and Jim, KH6HTV, set up on the US-36 scenic overlook south-east of Boulder. Pete, WB2DVS, and Debbie, WB2DVT, set up at Panorama point on Flagstaff mountain on the west side of Boulder. Bill, AB0MY, set up on Legionaire's Hill on the east side of Boulder. Lou, K0ANS, and Don, N0YE, set up on Rabbit mountain open space parking lot at the north end of 55th St., east of Lyons and west of Longmont. The longest distance was from US-36 overlook to Rabbit mountain at 31km (19 miles). The shortest distance was from US-36 to Legionaire's Hill at 5.5km (3.4 miles).

The RF path prediction program, *Radio Mobile*, said we would be very successful with excellant margins on each path from 35 to 45dB?? The whole exercise was an outstanding success. Everyone was able to receive all of the other stations with perfect, P5 pictures. Some stations even were reporting receiving some other stations off the back side of their dish antennas. Jim then tried using the simple, Amazon, rubber duck antenna on his receiver. He still got pictures from all of the other sites, even Rabbit mountain at 19 miles distant. They were not P5, but easily P3 or better. We finished the morning with Pete & Debbie pointing their dish to the south at Green mountain. Don at Rabbit mountain then reported still receiving an excellant picture up north from the reflected signal off of Green mountain.



AB0MY -> KH6HTV, 5.5km +33dBm



WB2DVS/DVT -> KH6HTV, 9.9km +33dBm

N0YE -> KH6HTV, 31.2km +28dBm


K0ANS -> KH6HTV, 31.2km +33dBm

K0CJG -> N0YE, 31.2km +28dBm


KH6HTV->WB2DVS/DVT,9.9km, +28dbm

BARC TAILGATE SWAPFEST

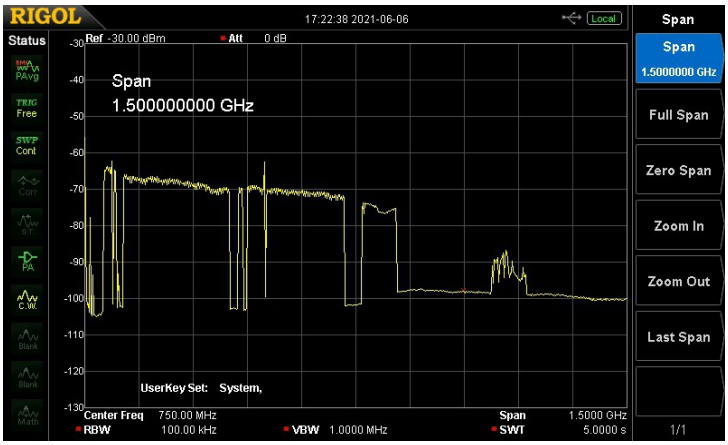
The Boulder Amateur Radio Club, BARC held their annual summer, tailgate swapfest on Tuesday, July 20th. It was a success with a good turnout of members. It was held in the parking lot of the terminal building at the Boulder municipal airport. BARC has their

clubhouse in the airport terminal building and HF antennas on the roof of the building. BARC also has a internet accessible, remote HF base station located in the club house for use by all members.

Our youth ham club, BARC Juniors had the biggest pile of "goodies" for sale. Many hams have donated used ham gear, test instruments, etc. to BARC Jrs. The sale of which is the major money raising event for BARC Jrs.

The Boulder ATVers also set up a couple of demos of ATV. Jim, KH6HTV, set up a demo of the W0BTV ATV repeater. He sent a TV signal to the repeater on 23cm and also had a 70cm receiver to receive the output coming back from the repeater. Chris, K0CJG, and Don, N0YE, set up a demo for 5.685GHz, FM-TV by sending signals back and forth across the parking lot. They also demoed receiving the 5.905GHz, FM-TV beacon signal from the TV repeater.

FEEDBACK: Chinese ADF5355 Phase Noise Issue Chris, K0CJG, has found another article on reducing the phase noise in the ADF-5355 (54MHz - 13.6GHz) frequency synthesizers from China. It is a very detailed write-up by Brian, GM8BJF, in Edinburgh, Scotland. Go to Brian's web site at: www.gm8bjr.joomla.com. Check out his various articles, several of which are of interest. It includes one on "Reducing Phase Noise on Chinese ADF-5355 Boards".



What is in the Cable TV Spectrum ?

FEEDBACK - In the June issue #79 of our ATV newsletter, we had this article. It was then re-published by the on-liine, electronic magazine, CQ-DATV. As a result we have gotten this fine letter giving us an expert explanation of what is really in the CATV spectrum.

Hello Jim --- First I would like to say I enjoy reading your articles and the work you are doing for Digital TV in the amateur community. I am a Director of Engineering in the CATV industry.

My comments are meant to be educational and are about your article "What is in the Cable TV Spectrum" and are my own, not those of my employer. Though any comments below are general knowledge that can be found in industry forums and specifications.

Digital CATV in the US was initially rolled out in roughly the 1994–1995time frame. There were two competing systems – the DigiCable system by General Instrument and a system by the then Scientific Atlanta (I don't recall their trade name for the system). At the time these systems were somewhat closed, i.e., they did not interoperate. You either bought a GI system or an S/A system. Over time as the industry grew one could buy different parts of the system from various manufacturers and they would all interoperate.

Eventually the GI system got the largest market share, and it is the basis of the system in use in the USA today. As I am sure you know with digital television, the source coding (video/audio encoding e.g., MPEG 2/4) and the channel coding (the FEC and modulation) are separate. So, any "type of data", not just video could be placed in a QAM signal. The specs I will mention below all pertain to the channel coding.

There are two bodies who have specifications for the system. The ITU (International Telecommunications Union) and the SCTE (Society of Cable Telecommunications Engineers), The overall ITU spec is labelled J.83 and has 3 subparts: J.83A which is essentially DVB-C, J.83B which is the US system developed by General Instrument and J.83C the Japanese system. The SCTE has their own standard which is a subset of J.83 and is essentially J.83B. They label their standard as SCTE 07.

With J.83B the raw payload rate for 64QAM is 26.970 Mbs and for 256 QAM it is 38.810 Mbs. Those are the rates of data/video that can be carried in each modulation type. Of course, in the US we have to fit our channels in a 6 MHz channel BW. So the symbols rates of the signals have to be selected with consideration of the bit shaping filter excess BW. For 64QAM, the filter alpha is 18% so the symbol rate is 5.057 Mbaud. For 256QAM the filter alpha is 12% with a symbol rate of 5.3605 Mbaud.

With the DVB-C system, they have 6, 7, or 8 MHz channel BW's available to them based on the country, so the data rate for each channel could be greater. As I recall, you can have 51 Mbs using 256 QAM in an 8 MHz channel.

The DVB-C system uses just a Reed-Solomon block FEC. The US/J.83B system uses a concatenated code with Convolutional Coding and R-S Block code. This provides a 2 dB better C/N threshold in AWGN.

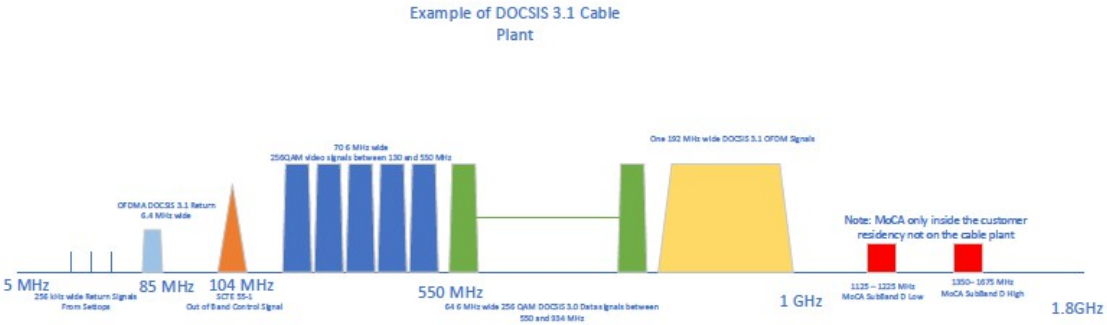
Here is a good link to a set of Rohde & Schwarz whitepapers discussing DVB-C, ITUJ.83B, DVB-S etc.
https://www.rohde-schwarz.com/us/applications/digital-tv-rigs-and-recipes-application-note_56280-15676.html

You can think of a cable system as a Frequency Division Duplex system. Much like we have an uplink and downlink in an amateur repeater (e.g., 146.04/146.64), a cable system has a downstream path from Cable Headend to customers and an upstream path from the consumer to the cable headend.

In looking at your spectrum analyzer plots it appears your cable system is based on a more traditional design that uses a 42 MHz/54 MHz diplexer. All those QAMs above 54 MHz are video and data to your home. And the signals below 42 MHz are upstream from the consumer to the cable headend. The return band is moving away from stopping at 42 MHz. Modern cable systems are moving to 85 MHz and some 250 MHz return band.
The downstream bandwidths have expanded over the decades from 450 MHz, to 550 MHz, to 750 MHz, to 860 MHz, to 1 GHz . Today operators are using/looking at using 1.2 GHz to 1.8GHz downstream bandwidths. Bleeding edge research has talked about a

3GHz maximum frequency on the plant.

The signal you are seeing between 70 and 120 MHz has a BW of 1.8 MHz. It is a data signal sending control info to your video settops. It follows the SCTE 55-1 specification.



Today, more and more of those downstream carriers are likely data not video. The "arms race" for bandwidth between the Fiber-to-the-Home providers and the CATV system is making the CATV industry look for more and more innovative ways of using the CATV bandwidth to deliver 1Gbs or greater to the consumer's home. The data system to your cable modem follows the DOCSIS (Data over Cable Service Interface Spec) specification. The modulation and FEC are the same as J.83B. Cable operators have stopped using 64QAM in favor of 256 QAM about 2 decades ago.

The DOCSIS specification for the most current version is 3.1. In general cable systems are likely running DOCSIS 3.0/3.1 systems. The 3.0 specification introduced "channel bonding". And DOCSIS 3.1 introduced OFDM/OFDMA modulation. The next generation of DOCSIS with Version 4.0 is looking toward 10Gbs delivery. This specification talks about Full Duplex DOCSIS where there is no diplex filter separating the Upstream and Downstream frequency bands, but the full cable plant BW is used for both signals simultaneously. This is done through various timing techniques.

Since the data from a DOCSIS QAM is not just for your home and must be shared between homes in your area, it becomes harder and harder to delivery high downstream bandwidths to everyone constantly when a single QAM has only 38.81 Mbs of data capacity. Users want 100's of Mbs for just their use. So DOCSIS 3.0 calls out channel "bonding" where a group of QAMs' (8, 16,32) are all treated as one big pipe from which a set of cable modems can share the bandwidth. As an example, if you bond 8 QAM's you will have 310 Mbs to share as opposed to 38.81 Mbs. Now not all of the cable modems listening to those 8 QAMs all want 300Mbs at the same time, but it is a statistical balancing act. To get to 1 Gbs DOCSIS 3.1 calls out OFDM modulation. This signal has much higher bitrates to share among users, but it is wider bandwidth and not a traditional single carrier QAM. An OFDM signal is composed of many smaller data rate carriers each of which might be 1024 QAM all working together to deliver the bandwidth. The OFDM signal could be anywhere between 24 MHz and 192 MHz wide.

This is all for the increased demand on cable modem downstream traffic which is also requiring higher upstream bitrate. The online game players are pushing the demand for

higher upstream BW and low latency. When they shoot their opponent, they want an instant reaction as if they were playing locally and not across the net. So the DOCSIS spec handles this via higher upstream frequency ranges i.e., moving from a 42 MHz return band to 85 MHz, etc. And with higher order modulations - from QPSK to 16 QAM to OFDMA . There could also be return signals from your video settop in that band also. If you do pay-per-view, Video on Demand or interactive TV, DVR, etc. the return signals from your request at the settop are in that band. All signals in that band whether from data or video are burst in nature (e.g., TDMA) so you will have a hard time seeing them on a spectrum analyzer sweep.

Here is a link to some data on OFDM and OFDMA in DOCSIS
https://broadbandlibrary.com/ofdma/

IF you did your measurement of the plant right at the cable coming into your home, not after your settops, there could be a 192 MHz wide signal which is an OFDM DOCSIS data signal from the cable operator. These are usually placed in the spectrum at or above 900 MHz, plant dependent. There are no cable system control carriers there.

IF you did your measurement in your house with your settops online, that 90 MHz signal at 1GHz you are measuring is called MoCA (Multimedia over Coax). It is, like your tech explained, a communications path between the Gateway (master settop) and the other settops or routers in your home. The model in the CATV business today is to have a GW that tunes all your video and data and then delivers an individual video to the "slave" settop via MoCA or data to a router via MoCA. That Gateway could have 6 or more QAM tuners in it to receive all the signals of interest. An advantage here is you don't have to run CAT 6 ethernet cable around your house and can use "existing" coax line (though I would not try a 50 year old piece of RG59 with crimp connectors). There will be a MoCA LPF in your house so NONE of those signals get onto the cable plant.

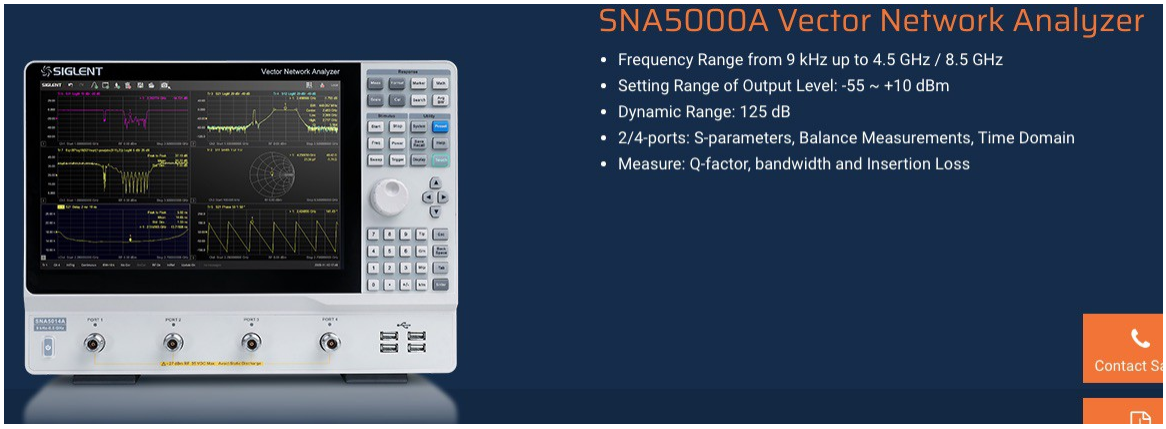
Here is a link to some info on MoCA.
https://en.wikipedia.org/wiki/Multimedia_over_Coax_Alliance

Regards --- A Ham in the CATV Industry

Editor's Note: While all of the information shared above is public knowledge, the ham who wrote us this nice letter explaining the details of CATV, says his employer is sensitive about it being discussed. Thus at his request, we are not publishing his name or call sign.

Mid-Atlantic ATV News: Richard, KR3EE, Etters (near Harrisburg), PA writes --- "The Mid-Atlantic ATV group hopes to put up at least one DATV machine using HiDes equipment." They are also hoping to link up with the Chesapeake Amateur Televison Society in nearby Baltimore.

ATN-Arizona Repeater Update: Rod, WB9KMO, reports --- "The White Tank and Mt Lemmon ATV and FM repeaters are operating normally. The Mesa 421 and 1289 repeaters, WT/Lemmon links and W7ATN-MESA streams have been shut down indefinitely to prevent damage from overheating." The issue is the air conditioning unit at the W7ATN-MESA site has failed. In the extreme Phoenix summer heat, the repeater's equipment would thus also soon fail. Due to the international supply chain disruptions, Rod has been unable to purchase a replacement A/C



NEW PRODUCT ANNOUNCEMENT: Siglent just announced a new VNA with impressive specs. including a dynamic range of 125dB. Prices start at $8.5K for a 2 port VNA for 9kHz to 4.5GHz.

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.**

Low Noise Pre-Amps & Wide-Band Amplifiers

KH6HTV VIDEO offers a line of modular amplifiers. It includes low noise pre-amplifiers for 70cm, 33cm & 23cm bands and a broad-band preamp. Also offered are ultra-wide bandwidth amplifiers with low frequency cutoffs extending down to 1 kHz. These are general purpose amplifiers suitable as instrumentation amps, driver amps, etc. They all are packaged in the same die-cast aluminum enclosure shown in the photo with SMA connectors and feed-thru capacitor for DC power. They all operate from +12 Vdc and include internal voltage regulators. The pre-amps can optionally be built to be powered via dc coming in on the output rf connector. All amplifiers come with an individual test report.

Model #	-3dB Bandwidth	Gain	Noise Figure	P(-1dB)
70-LNA	390 - 470 MHz	21 dB	0.5 dB	+21 dBm
33-LNA	870-960	16 dB	0.7 dB	+20 dBm
23-LNA	1220 - 1320 MHz	14 dB	0.7 dB	+21 dBm
WB-LNA-3	0.05 - 2.4 GHz *	23 - 10 dB	0.8 dB	+20 dBm
UWBA-101	1 kHz - 1.5 GHz	22 dB	2.5 dB	+12 dBm
UWBA-102	1 kHz - 5 GHz	11 dB	5 dB	+14 dBm
UWBA-103	250 kHz - 3 GHz	20 dB	4 dB	+20 dBm

note: see individual spec. sheets for complete specifications

KH6HTV VIDEO www.kh6htv.com e-mail kh6htv@arrl.net
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