Boulder Amateur Television Club
TV Repeater's REPEATER

August, 2021
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BATVC web site: www.kh6htv.com

ATN web site: www.atn-tv.com

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ARRL Now Provides Free RF Exposure Calculator

The FCC has adopted guidelines and procedures for evaluating environmental effects of RF emissions. The new guidelines incorporate two tiers of exposure limits based on whether exposure occurs in an occupational or "controlled" situation, or whether the general population is exposed or exposure is in an "uncontrolled" situation.

Under the new FCC rules, amateurs need to perform routine station evaluations to ensure that their stations comply with the RF exposure rules. This is to determine the minimum safe distance between any part of your antenna and areas where people might be exposed to RF energy from your station. Although amateurs can make measurements of their stations, evaluations can also be done by calculation.

The new RF exposure rules were announced this past spring on April 12th and were to become effective on May 3ed. The evaluation of each amateur station must be done by May 3, 2023. At that time, the ARRL was referring hams to several extremely detailed and intimidating FCC and ARRL publications on how to do the evaluation. One ARRL publication was entitled "RF Exposure and You", by Ed Hare, W1RFI. It was a very massive document at 316 pages.

Fortunately, the ARRL as of August 5th has announced a free, on-line calculator to make the calculations. To make this easy for amateurs, ARRL now provides the calculator on it's RF Exposure page. The URL link is: http://arrl.org/rf-exposure-calculator

To use the calculator, enter your transmitter power, operating mode, frequency, antenna gain and answer the questions about the maximum amount of time you might be transmitting. The calculator will then give you the minimum distance people must be kept away from your antenna and human exposure limits. If you don't know your antenna gain, the ARRL provides you with a nice table of typical gains for the most common ham antenna types. The URL is: http://arrl.org/rf-exposure-calc-instructions#gain

You can print the results and keep them in your station records. There is no requirement to send your results to the FCC. You should do this for all of the various modes and bands that you operate on. To be on the safe side, you should also adhere to the worst case situation of the "uncontrolled environment" in determining the safe distance to keep people away from your antennas.

ATV RF Levels: As an example, I have run the ARRL's calculator numbers for some of our typical, in the field operating situations for ATV operations. With our roof top or tower mounted UHF and microwave antennas, the exposure issue is non-existent. But operating in the field portable or mobile, our antennas are typically at human heights and directly illuminate folks standing nearby. ATV typically runs at 100% duty cycle for very long periods of time. I thus selected 100% with the max/min numbers allowed in the calculator of 30 minutes on time and 0 minutes off time. I also selected the option to include ground reflections, which typically gave more pessimistic results.

70cm DVB-T, Yagi: 10 Watt (rms), 441MHz, and 6 element yagi antenna (11dBi gain) The results were: Controlled environment -- max allowed power density = 1.47 mW/cm^2, minimum safe distance = 4.34 ft. Uncontrolled environment -- max allowed power density = 0.29 mW/cm^2, minimum safe distance = 9.7 ft

70cm DVB-T, Mobile: 10 Watt (rms), 441MHz, mobile whip gain antenna (6dBi) The result for Uncontrolled environment -- min. safe distance = 5.5 ft.

BCARES 70cm DVB-T: 3 Watt (rms), 441MHz, and rubber duck whip antenna mounted on camera tripod (0 dBi gain). The result for Uncontrolled environment -- min. safe distance = 2.8 ft.

23cm DVB-T, Yagi: 5 Watt (rms), 1270MHz, and 14 element yagi antenna (15dBi gain) Uncontrolled environment -- max allowed power density = 0.85 mW/cm^2, minimum safe distance = 6.4 ft

23cm DVB-T, Mobile: 5 Watt (rms), 1270MHz, mobile whip gain antenna (7dBi) The result for Uncontrolled environment -- min. safe distance = 2.6 ft.

5cm FM-TV, Dish: 2 Watt, 5700MHz, and BBQ grill dish antenna (23dBi gain) Uncontrolled environment -- max allowed power density = 1.0 mW/cm^2, minimum safe distance = 9.4 ft

Be Safe & Keep Others Safe -- Jim, KH6HTV, Boulder, CO

5.7GHz FM-TV Reflection Exercise: On Saturday, August 7th, Don, N0YE, again organized another microwave outing. This time, the purpose was to attempt ATV contacts on non-line-of-sight paths using reflection objects. Living here in Boulder, Colorado, our biggest reflectors are the Flatiron rock formations immediately to the west of town on the east flank for Green mountain. See above photo.

Locations were chosen so in general we could not see each other directly, but we all could see NCAR where our ATV repeater's 5.9GHz FM-TV beacon is located. The beacon allowed us to confirm our receivers were working properly. The following hams participated:

Chris, K0CJG, on the roof of his home QTH, near Foothills Parkway & Baseline Road in Boulder (see photo !)
Bill, AB0MY, on the roof of the parking garage next to the CU events center
Don, N0YE, in the parking lot at Fairview High School.
Lou, K0ANS, on Legionaire's Hill east of town.
Pete, WB2DVS, & Debbie, WB2DVT, on the Eldorado Springs lookout on CO-93.
Jim, KH6HTV, in the backyard at his home QTH, south-east of Boulder near 75th & S. Boulder Rd.

As it turned out not only were microwave signals in general not visible, but all visual landmarks were also invisible. The Denver metro basin area was inundated with dense smoke from the huge forest fires burning in California and Oregon. Visibility was down to 2 miles or less. Denver TV reported that on Aug. 7th, the air pollution quality index made Denver the most polluted city on the planet ! Thus, we were unable to visually

point our antennas to prominant reflectors, like the Flatiron rock formations, or large buildings. We had to use dead reckoning.

In addition to poor visibility, most had to also contend with quite strong winds trying to blow over their camera and antenna tripods. The winds were localized right up next to the foothills, as Jim, 6 miles east on the prairie had perfect calm. The wind did blow over Don's gear and damaged his transmitter, so he ended up packing it up and quiting early.

The day started with Jim transmitting on 5.685GHz with 2 watts of rf power to his BBQ grill, +23dBi dish antenna. He pointed it at the first Flatiron rock formation 6 miles distant to the west. Both Bill and Don reported just barely able to see P1 pictures. Bill was 2.2 miles from the 1st Flatiron while Don was 2.8 miles. The above photo was taken by Don of Jim's QSL card. This was the best reflected signal of the day. You can just barely make out Jim's call sign.

Most everyone else was unable to see or create receivable reflections. To finish the morning's exercise some then tried to see each other's signals directly with some success. The above photo shows the signal from Bill to Lou over a somewhat obstructed, 3.9 mile path.

So what numerical results can we glean from the reflection experiment. Well assuming free space path loss, the signal from Jim to Don over an 8.8 mile (6 + 2.8 mi) path should have been -51.6dBm. Obviously a very strong P5. As it was the reflected signal to Don was just above his receiver's video squelch threshold. The RC-832 FM-TV receiver feeding a 5" Haier video monitor with video squelch has been measured to have a squelch threshold with a P0 picture at about -100dBm. A P3 = -90dBm. A P5 is > -80dBm. Thus the reflection, scattering coefficient of the 1st Flatiron works out to be about -45 to -48dB. In the past, Don has experienced much better results reflecting SSB signals, but they have a 30dB s/n advantage over ATV. Afterwards, Don has stated --- "Because of the marginal experience of today's outing, we may plan another outing where the participants are closer to the reflecting object so that we get more successful receptions."

Jim, KH6HTV, Boulder, CO

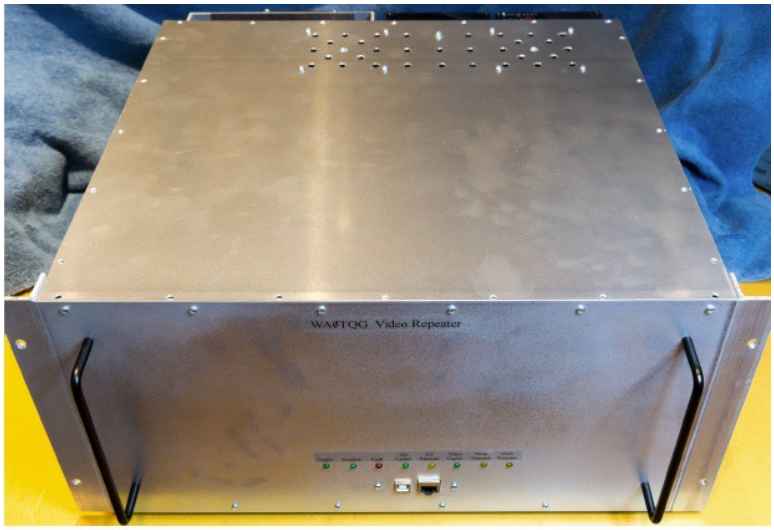
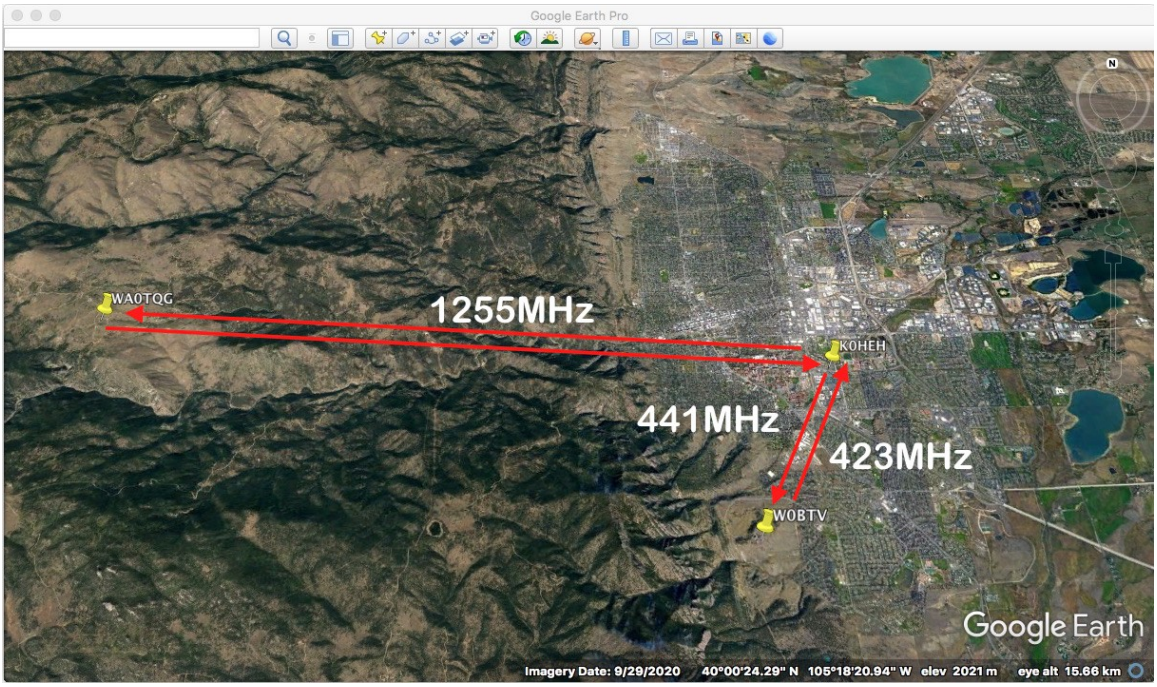


Figure 1 - Controller Unit

Two Way DATV Translator: Back in May in issue #76, we announced Steve, WA0TQG's project to relay his DVB-T signal from out of the Rocky mountains and into our Boulder ATV repeater, W0BTV. Steve lives on Sugar Loaf mountain and he is totally shielded from W0BTV by Flagstaff and Green mountains. So Steve's solution was to design and build a 2 way, cross-band, translator. He recently installed his finished translator at Jack, K0HEH's QTH in the city of Boulder. Jack has line-of-sight paths to both WA0TQG and W0BTV. Steve and Jack installed at Jack's QTH a 23cm yagi antenna pointing west to Steve's QTH. They also installed an omni-directional 2m/70cm vertical base station antenna with a duplexer. Steve's inagural, successful test of the system was on the Thursday ATV net on August 12th.

The W0BTV repeater has two digital inputs on 70cm (441MHz) and 23cm (1243MHz). It's digital output is on 70cm (423MHz). Steve's translator receives his down-link signal on 1255MHz and passes it on to W0BTV on 441MHz. For receiving the W0BTV repeater's signal, his translator receives it on 423MHz and passes it up to Steve on 1255MHz. The translator includes a 2 meter control receiver. Steve sends DTMF tones to it to control the function of his translator. The output power of the 23cm transmitter is +20dBm. The output power of the 70cm transmitter is +40dBm. This much higher 70cm power was required to be able to reliably override 70cm RFI on the W0BTV's 441MHz receiver. At it's high location, W0BTV sees 70cm amateur signals from all up and down the Front Range and the metro Denver area.



RF Paths: WA0TQG <--> K0HEH = 7.7 miles K0HEH <--> W0BTV = 2.3 miles

If you are interested in the real details of Steve's Translator, he has made his documentation available in his drop-box. Go to:
https://www.dropbox.com/s/zr6xeabedy6qvqb/Video%20Repeater.pdf?dl=0

Steve's translater also reports it's status and any error conditons via APRS. To see it's reports, go to www.aprs.fi and enter wa0tqg-8

This is how Steve describes his creation. "This DVB-T repeater is intended as an extender to the existing W0BTV Boulder video repeater. It operates in a “half-duplex” mode where one frequency will be repeated to another, one at a time. All frequency settings are done using frequency synthesizers so that all transmitters and receivers are frequency agile, however; the receivers inputs contain rather tight preselection filters that limit the frequencies that may be used.

The settings of the unit are controlled by configuration files that reside in the system memory (SD card). Several different configuration files may be created and called up on command to configure the unit for various modes and frequencies of operation.

No local controls are available, however; a USB and an Ethernet port are available on the front panel that may be used for troubleshooting and local control of the unit. Several front panel LEDs are available to show the current status of the unit."

Features

1 DVB-T Repeater
- 1.1 From 70cm to 23cm
- 1.2 From 23cm to 70cm
- 1.3 Selectable receive and transmit frequencies

2 DVB-T Modulator / Demodulators
- 2.1 TX Modulator is a HiDes HV-320E
- 2.2 RX Demodulator is a HiDes HV-110
- 2.3 Devices are mounted externally on the rear of the chassis for optimum cooling
- 2.4 DC power and controls are all generated and controlled from circuitry within the chassis
- 2.5 Video is connected between the two devices using an HDMI cable

3 2meter Control
- 3.1 Selectable receive frequency
- 3.2 Many DTMF commands accepted
- 3.3 Administration (password protected) and open commands available

4 2meter APRS transmitter
- 4.1 Station is geo-located on the APRS map
- 4.2 Selectable transmit frequency
- 4.3 Listen before talk data protocol
- 4.4 Position beacon sent for all major system mode changes
- 4.5 Telemetry data for system temperatures and optional PA data
- 4.6 Position beacon and email sent for any device error

5 Local Indicators
- 5.1 Front panel LEDs for system modes and transmitter enables
- 5.2 Front panel LED for any system error

6 Local control
- 6.1 Front panel USB port for software download, system control and software debug output
- 6.2 Front panel USB port can be switched, using Ethernet control, to connect to the HV-320E DVB-T modulator control port
- 6.3 Front panel Ethernet port for system control and monitoring (using Telnet session)
- 6.4 Local control may be secured by requiring an administrator password for access

7 Log Files
- 7.1 ASCII files that show system events for debug purposes
- 7.2 Can set the types of events that are logged
- 7.3 Can set the method of file creation / overwriting
- 7.4 Real time clock and event time stamps

8 CPU
- 8.1 Arduino DUE processor programmed using C++

8.2 4GB SD drive to store all internal files
8.3 EEPROM to store fixed system constants
8.4 Up to 99 configuration files may be created to define system operation
8.5 Default configuration file set in EEPROM
8.6 Other configurations may be loaded using Ethernet or DTMF commands
8.7 Button is location on the rear of the chassis that when pressed when the unit is powered up will force loading of the internal default values for the configuration. This allows recovery from a faulty configuration file.

9 Power supply
9.1 Internal 115VAC power supply all major systems
9.2 External 12.5VDC power supply required for optional internal PA
9.3 When the unit is not in use, most circuits are powered down to minimize power consumption

10 Chassis
10.1 Rack mount or desktop
10.2 Once the top panel has been removed any other single panel (front, back or either side) may be removed without any soldering required. This makes repair or modification to the unit easier.

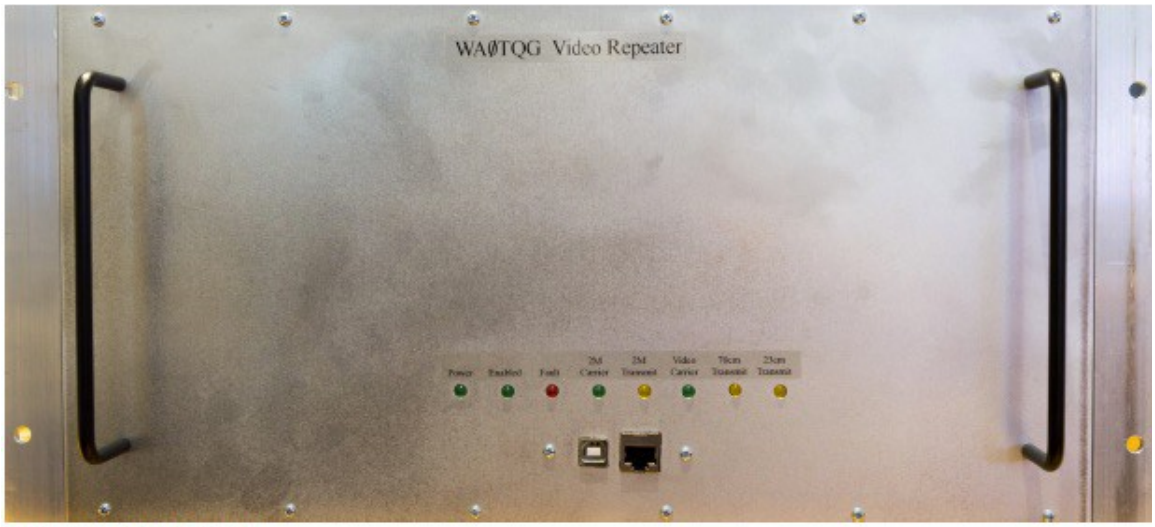


Figure 2 - Front Panel

Figure 3 - Rear Panel

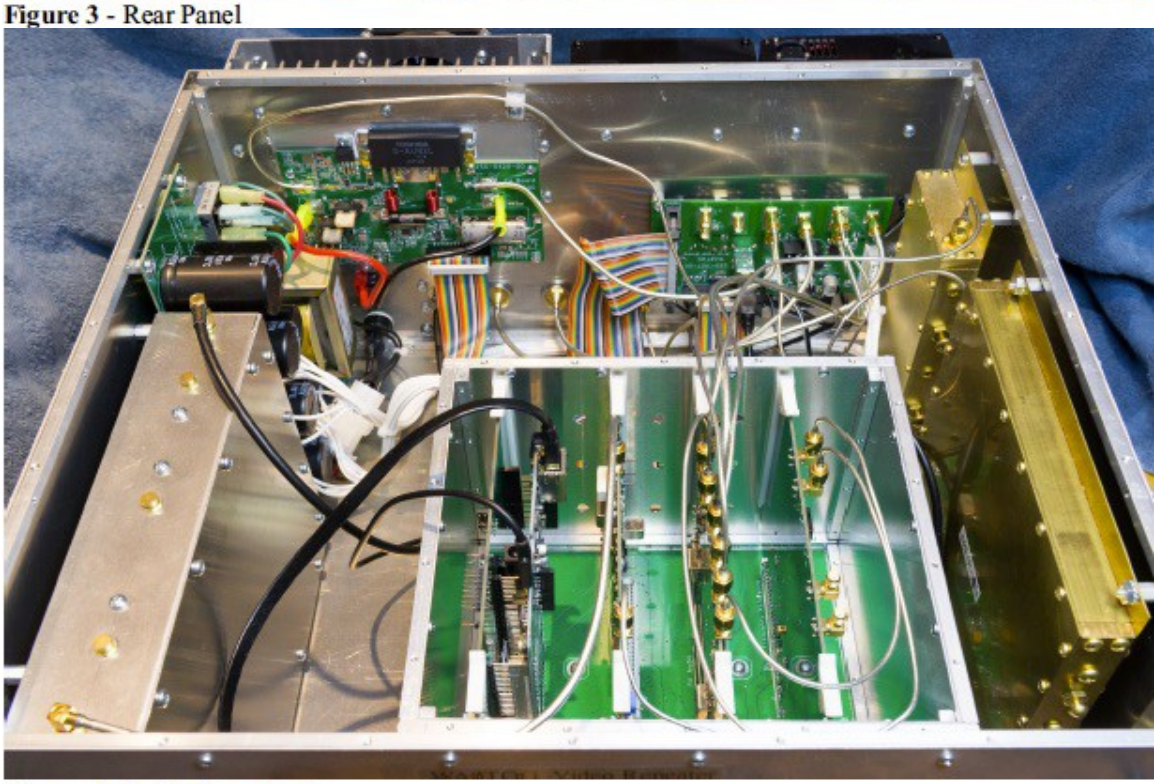


Figure 4 - Inside from front

Microwave Goodies Treasure Trove Found:

Recently, Bill, K0RZ, of EME fame, called Don, N0YE, and Jim, KH6HTV, to help him clean house. Over the years, Bill and Don have done a lot of SSB microwaveing, up to 47 GHz. Bill decided to unload his large collection of microwave goodies and give them away to other interested Boulder area hams. So at present, several large cartons of them are now in storage in Jim, KH6HTV's barn. Over the next few weeks, Don & Jim plan

to work up an inventory list of what is available. After the list is posted, it will then be "first come - first served" for the Freebies.

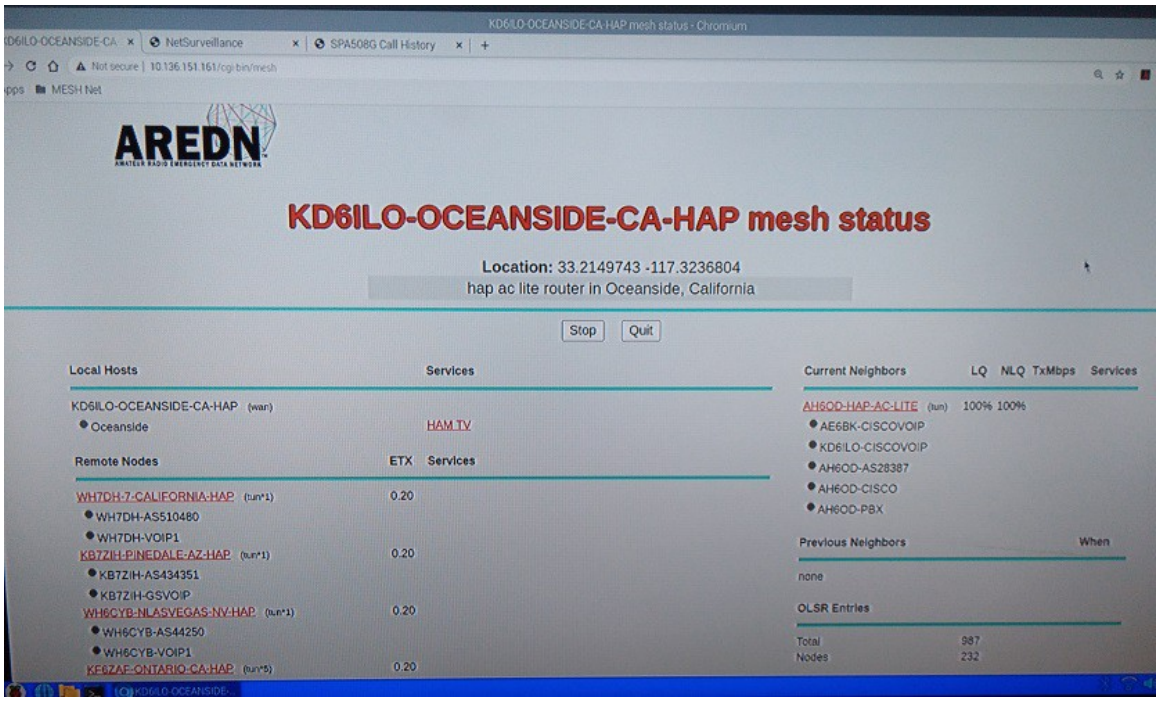
World-Wide ATV QSO Party: The Aussies are once again organizing an ATV QSO party. It will start here in the USA on Friday evening, August 27th. The start time will be ??pm (MDT) [??:?? UTC]. ATV groups across the USA and in Australia will be participating. There will be two sessions. One Friday evening and One on Saturday. It can be watched on the live stream from the BATC's web site: Click on the Melbourne, Australia ATV repeater, VK3RTV. It will also be streamed on YouTube. VK3QL's U Tube DATV QSO Party (Both Sessions) https://www.youtube.com/channel/UCxPw_E-C0Ddc0FIKdjPnuew (UTube Courtesy of Ian VK3QL)

The Boulder ATV group plans to participate in a 1/2 hour session. We will have four ATV hams discuss various aspects of Boulder ATV. Jim, KH6HTV, will start off describing our efforts to recruit new members. Then Ed, K0JOY, will discuss our weekly on-the-air ATV nets. Next will be Chris, K0CJG, who will discuss his experiences being an ATV newbie. Don, N0YE, will finish off talking about what else we do in Boulder with ATV besides our weekly net.

ATN at QSO-Today Virtual Ham Expo: Rod Fritz, WB9KMO, of ATN-Arizona and Roland Hoffman, KC6JPG, of ATN-California presented a video on ATV at the Expo held on Saturday, August 21st. Their 15 minute video was entitled ***"Amateur Television - The Original Social Network"*.** They along with Mike, WA6SVT, and Jim, KH6HTV, had previously presented a 35 minute video to the March, 2021 Expo. The earlier video emphasized the technical details of ATV. This latest video emphasized the social aspects of ATV.

KD6ILO ATV / AREDN MESH

Aloha Jim --- Today marked a very special anniversary, it's been five years since I first integrated ATV on to the ARDEN MESH Network, how time flies. This is to include linking it to the Hawaii /Mainland Allstar ARDEN MESH Network where they view our DATV feeds live and in real time full duplex. Then we feed it over our RF local network and our community cable channel 1960 as part of our Science and Technology hour. I'd thought I'd share since it's been awhile. --- Mario, KD6ILO, Oceanside, CA



KD6ILO 5GHz MESH - Ham TV Integration Hawaii Allstar Network

Ham TV MESH Feed KD6ILO OCS node of 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/*

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