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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SPECIAL ISSUE on DIGITAL ATV in JAPAN

By Fumio Sekizaki, JA0RUZ

When you hear the word "***microwave***," most people's common sense tells them that it is a radio wave that only travels as far as line-of-sight range. What is your impression of microwaves?

In fact, when amateur stations make good use of microwaves, we are often surprised to see how far the radio waves can travel. In addition, since the microwave band can be used in the wide-band mode, it is a band where you can fully enjoy transmitting and receiving TV images and high-speed, large-volume data.

The reason I have been able to enjoy microwave communications for more than 20 years now is because the more I try, the more I experience a series of wonders and new things, and also because I can enjoy them with my own equipment, which is one of the most exciting aspects of amateur radio.

One of the pleasures of SHF band operations is Full High Definition, Amateur TV (abbreviated as FHD-ATV), which is equivalent to terrestrial digital broadcast quality.

Figure 1. 5.7 GHz FHD-ATV operation in Nagano prefecture, Japan
(*Once the antenna and power supply are connected, Full-HD video transmission, reception, and recording are possible immediately.*)

Before I started FHD-ATV, I was operating FM-ATV and DVB-S digital ATV (SD video: 480i resolution), and so on. However, even though 5 to 6 years had passed since the complete digitalization of TV broadcasting, only amateur stations could provide ATV with SD video quality that was several decades old, which made us feel shameful. With the cooperation of my friends, I developed an FHD-ATV (1080i resolution) transmitter/receiver that is equivalent to terrestrial digital broadcasting quality about five years ago, and I have been operating it under a license.

Figure 2. 10 GHz transmitter/receiver (*AV, monitor, IF, and so on. are separately incorporated in the trunk*)

How the FHD-ATV works: First, Figure 2 shows how the FHD-ATV transmitter works in its configuration. FHD-AV signals from digital video cameras are captured through HDMI, and the video signals are compressed and encoded into MPEG2 or other formats. These are converted into TS frame packets and sent to the transverter unit as IF signals with a 64QAM, 5.7 MHz bandwidth modulation signal, which are then converted to 5.7 GHz, 10.2 GHz, and 24 GHz, and then transmitted from a parabolic antenna.

Receiving is the opposite: after IF conversion by the transverter and decoding through STB (ISDB-T tuner), the signal is sent through HDMI to a recording device or ultra-high brightness monitor TV for clear viewing, even in direct sunlight.

The IF frequency is mainly the TV CH band, which is no longer used for TV broadcasting due to frequency repackaging. In addition to systems that use this 700 MHz band, some also use the 1265 MHz band for IF in order to allow the use of conventional transverters. Furthermore, there is a double conversion system that converts the 1265 MHz band signals to ones in the 700 MHz band, making use of ideas from amateur stations.

The modulation unit uses commercially available equipment that is also used to transmit information images in hotels. In applying for a license, a block diagram is created after analyzing the inside of the modulator, and the station is operated after receiving a formal license. (Examples of adopted equipment: XHEAD-2 and EMB-220 J)

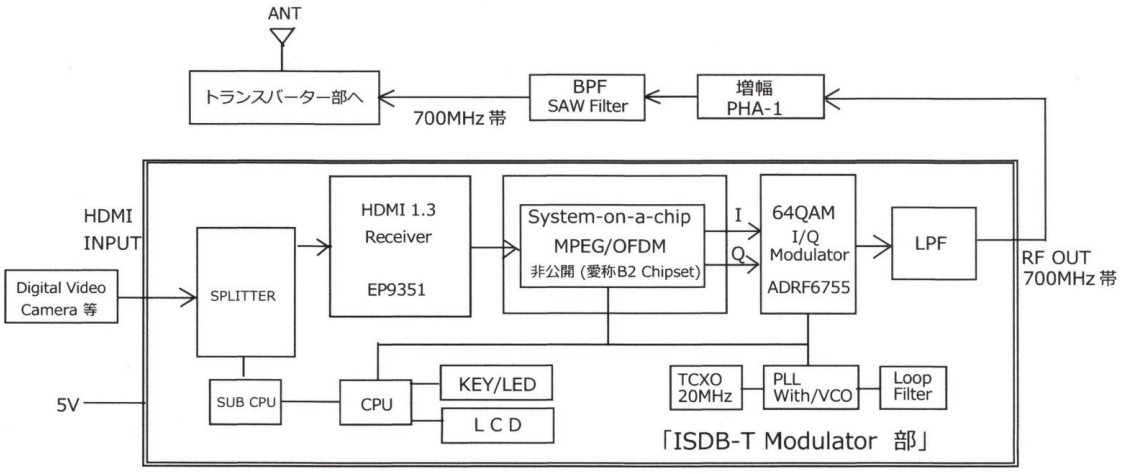

Figure 3 FHD-ATV Transmission Block Diagram

It seems that nearly 50 stations operating ATV in Japan are now doing FHD-ATV in the ISDB-T format in the 5.7 GHz to 24 GHz bands.

Figure4. FHD-ATV operation meeting in Niigata prefecture. Some of the video footage can be viewed on YouTube by typing in FHD-ATV ISDB-T JA0RUZ.

Figure 5. Simultaneous operation of three zero-area stations in Nagano Prefecture, Japan.

Microwave communication distance records. For microwave DX records, see the 5.7 GHz and 10.2 GHz bands on the JARL (Japan Amateur Radio League) website, but there are also FM and other records of nearly 1,000 km. **https://www.jarl.org/Japanese/A_Shiryo/A-8_Kiroku/distance.htm**
In FHD-ATV, I have also succeeded in sending and receiving Full-HD video at 5.7 GHz and 10.2 GHz over a distance of 287 km between Mt. Hodatsusan, Ishikawa Prefecture and Uomidai in Tottori Prefecture. The video footage is shown here. **https://www.youtube.com/watch?v=wu5j8J0sWAM**
The current record for DVB-S ATV(SD) is a 463 km contact between Mt. Kanpuzan in Akita Prefecture and Mt. Iouzen in Toyama Prefecture. The current record for DVB-S ATV (SD) is 463 km between Tokyo and Osaka.

Microwave Nets: You may think that microwave operation is all about moving to a good location. However, about 20 years ago, in fixed station operations on 5.7 GHz and 10.2 GHz, stations around the Kanto area and more than two dozen stations in Nagano, Niigata, Toyama, and other prefectures exchanges DX QSOs by participating in FM and SSB roll calls, mainly with the net control station in Chiba Prefecture. A record of those days can be found at: 5.**7GHz: https://jh0yqp.org/roll_call/old/5G_cuy/5G_cuy.htm**
10.2GHz: https://jh0yqp.org/roll_call/old/10G_cuy/10G_cuy.htm

Microwave nets in this area are usually propagation over the mountains, but we sometimes used rain cloud scatter reflections such as "RainScatters" and had the great pleasure many times a year of being able to communicate with five or six stations in the different 1, 9, and 0 areas at the same time.

Figure 6. Microwave antennas for my fixed station (now removed)
Left: 1.8 m for 2.4 GHz and 5.7 GHz Right: 0.9 m for 10.2 GHz

No problem for mobile operations on microwave: Mobile operation at 5.7 GHz and 10.2 GHz has been confirmed to have the same service area as 1.2 GHz band propagation. Rain Scatter can also be used while driving. However, if you use a conventional type of radio with poor frequency accuracy and stability, it is necessary to understand the following points.

(1) When mobile stations operate together, they may not be able to communicate well with each other because they cannot synchronize their frequencies.

(2) It is necessary to understand that the communication status changes rapidly, and if you do not talk to each other within a few seconds of transmission, you may not be able to hear each other in a fraction of a second.

(3) Due to the short wavelength in the cm class, QSB is extremely fast.

Figure 7. Mobile antennas attached to the vehicle roof. (1) is a 3-stage collinear antenna for 5.7 GHz (2) is an antenna for 1.2 GHz

A Beacon Station on Microwave: I have a 5.7 GHz beacon installed at my home and have confirmed that even with a 1 to 2 W of transmitter power plus an omni-directional antenna, I have "always" been able to cover the Kanto Plain and even Murakami-shi in northern Niigata Prefecture.
https://blog.goo.ne.jp/ja0ruz/e/78ba9245ba88aa9221072dadc8a4f573
In addition to the above, I also have constant reception in 9 areas beyond the 3000 m high Northern mountains. **https://www.youtube.com/watch?v=JtZCkpKH_74**
Even in Shinshu, which is surrounded by mountains, the 5.7 GHz and 10.2 GHz bands can be used to communicate with people outside the prefecture.

With the release of new ICOM IC-905 radio, many more people will be able to QRV in the microwave band, and the fun of amateur radio will be broadened! Please refer to the Tokyo Microwave Club and the West Niigata Club for information on microwave ham operation in Japan.

I am looking forward to making microwave contact with many more people in the future. 73! - Fumio

Fumio Sekizaki, JA0RUZ Ham Radio Bio: *I opened my station on 50 MHz about 50 years ago. I have moved up the band in turn, and now operate FM, ATV, etc. in the 1.2 GHz to 47 GHz bands. In 2008, I started development of "5.7 GHz Full-HD ATV, which is equivalent to terrestrial digital TV quality," and now I am promoting it to microwave fans nationwide while operating the FHD-ATV up to 24 GHz. I also maintain and manage the JR0WS Hijiriyama Repeater, which has been working for nearly 40 years with local hams to keep the 1.2GHz band as an amateur radio band.*

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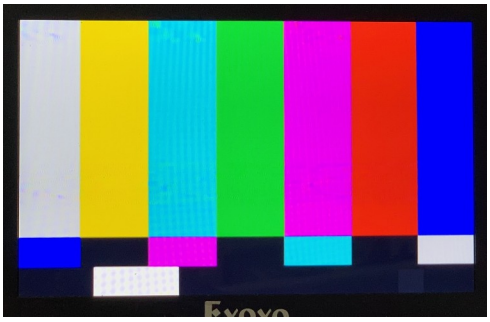
VIDEO WAVEFORM GENERATOR

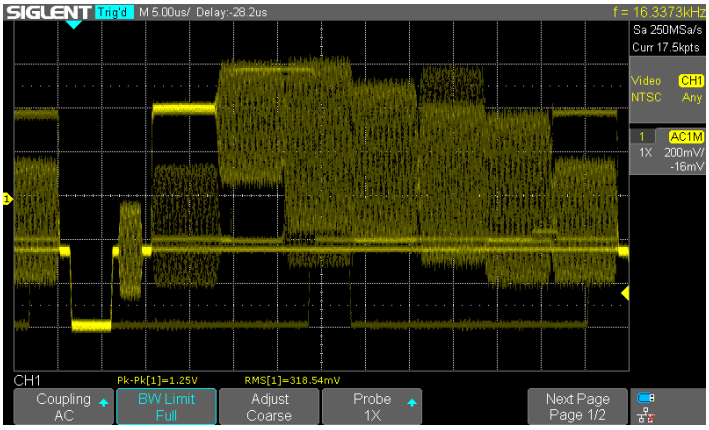
Jim Andrews, KH6HTV

I recently was building a 23 cm FM-TV Modulator for the DARA ATV Repeater. I needed to test it with an analog video test signal. I had lost all of my old analog video test equipment in the Marshall fire a year ago. What could I use ? The idea dawned on me that I could probably use my USB/SD Media Player. This is a low cost ($35-40 on Amazon) device which plays video or photo images stored on either USB or SD memories. It provides both analog, composite along with digital, HDMI A/V outputs. It will play a large number of various photo and video format files. It comes supplied with a +5Vdc wall wart supply, remote control (as big as the media player !) and an RCA. A/V cable for composite video.

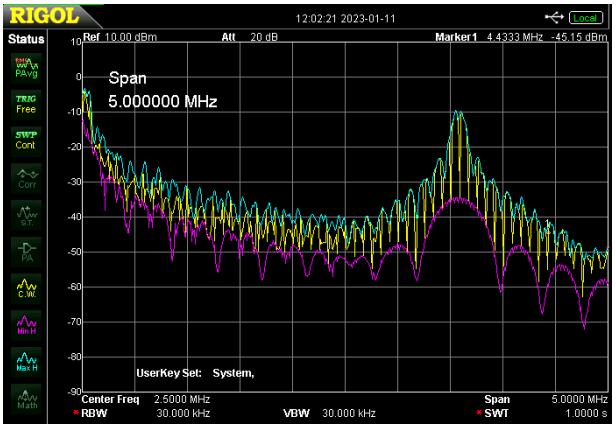
Do a Google search for "TV Test Patterns" and you will get a lot of free, down-loadable, picture files. See the Sept. issue #110, pp. 7-9, for several examples. Take a clean, empty USB memory stick, or SD memory card, and write onto it only one single photo file with the desired test pattern. Do not put multiple files on the memory device. If the media reader finds multiple files, it will then automatically play them in sequence as a slide show. For a test signal generator, we want only one test pattern at a time. When you need a different test pattern, insert a different memory. Here is an example using the standard NTSC color bars test pattern



Color Bars from Media Player displayed on a high-resolution, flat screen monitor



Media Player Composite Video Output, Color Bars Waveform into 75 Ω 200mV/div & 5µs/div.



Color Bars Spectrum - sweep 0 to 5 MHz 30kHz BW, 10dB/div & 500kHz/div yellow = "live", magenta = min, cyan = max

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Amateur Television Network - Arizona Chapter Winter Meeting Notice

The ATN-AZ Winter meeting will be held on **Saturday February 4th**. Starting time is 10 AM with potluck lunch at Noon. Location is the QTH of Rod Fritz WB9KMO at 8334 E. Culver St., Mesa, AZ 85207 Please RSVP Rod at ***wb9kmo@gmail.com*** Potluck details: Rod is providing the meat and soft drinks. Please let Rod know what side dish or desert you would like to share. After lunch, you are encouraged to attend a combined ATV and Mesh workshop.

73 de Mike Collis, WA6SVT

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"VERSATUNE" DVB-S / DVB-T RECEIVER AVAILABLE SOON

We are working on a new dual mode DATV receiver to be available by mid-summer 2023. This receiver is designed primarily for digital Amateur Television reception operation as a stand-alone complete scanning receiver / DATV repeater controller. It can be used as a simple self-contained receiver for individual use or as the receive portion of an Amateur Television repeater. It can be programmed to scan up to 7 separate frequency selections from up to 5 selected RF sources.
A blind scan mode will also be included. If executed, the RF input of the defined tuner will scan between defined limits and ask if it is to be included in the channel selections.

It will receive DVB-S/S2/S2X/T/T2 digital television signals from one onboard tuner with 2 separate RF input connections, one for DVB-S and one for DVB-T. It will also have pcb pads for the addition of one of two available optional tuners. The received signal is processed to output composite or HDMI video / audio output signals. When an active signal is not received, it can output up to 8 separate sequential identification screens from jpeg, mov or internet sources using internal stored registers or selected internet sources.

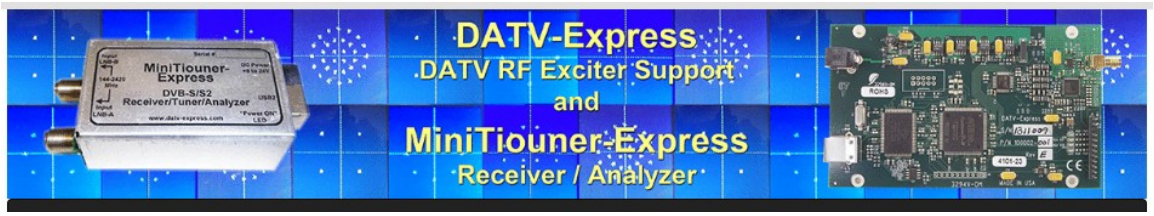
Setup is accessed using a Windows PC computer graphic interface or Smartphone menu program and transferred to the VersaTune receiver via Bluetooth, WiFi or Ethernet data ports. Ethernet access allows internet parameter selection from a remote repeater installation. All setup parameters are stored and transferred to the VersaTune receiver on command.

DiSEqC 1.0 operation is included which allows LNB/preamp voltage and 22KHz selection control. It has an active internal current limit circuit to prevent circuit failure due to shorted or overloaded external RF cable circuitry.

Because the included tuner only operates up to 1 GHz for DVB-T, provisions will be made for optional internal downconverters for DVB-T/T2 operation in the 1200-1300 MHz or 2350-2450 MHz receive range. The downconverter will occupy the position on the pcb reserved for an additional tuner. It will have a 1 or 2GHz local oscillator so incoming signals will be received at 200-300 MHz.

The hardware design is complete with three prototypes available for our software testing. The product availability has been slowed because of supply chain parts limitations but we believe they will become available by mid-summer 2023. Check the ***www.DATV-Express.com*** web site for updates. Also, we will display it at Hamvention at the ATV forum and the ATN / ATCO booth in the first tent area. The actual booth assignment has not been made yet.

73 de Art, WA8RMC, Westerville, Ohio



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INTERNET ARCHIVE: This newsletter has just been invited to join the Digital Library of Amateur Radio & Communications. DLARC is growing to be a massive online library of the past and present of ham radio and related communications. It is funded by a grant from Amateur Radio Digital Communications. You can see what is there at **https://archive.org/details/dlarc** There you will find such treasures as old Callbooks, 73 magazines, CQ-DATV, etc. While browsing, check out **www.archive.org** for the home page of Internet Archive. The amount of material available there will blow you away. They bill it as -- "Internet Archive is a non-profit library of millions of free books, movies, software, music, websites, and more." Our ATV newsletters are in the DLARC archive, at: **https://archive.org/details/batvc-repeater** Use the search "text contents" field to do a full-text search on all issues, or click “Date Published” to see them sorted by publication date.

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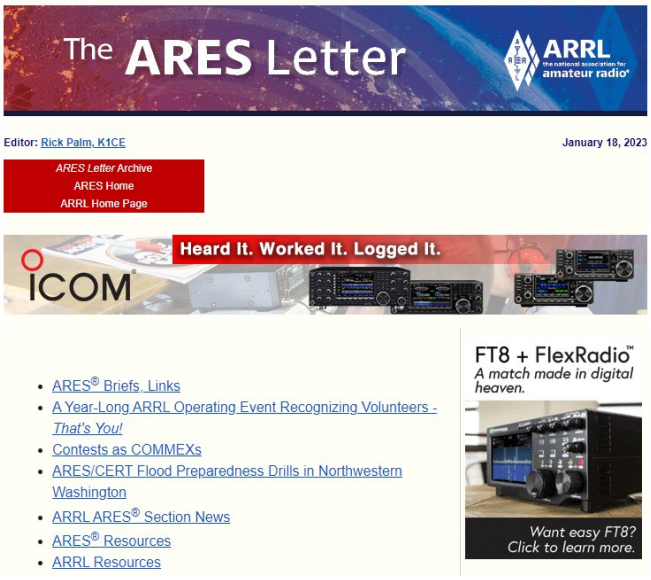

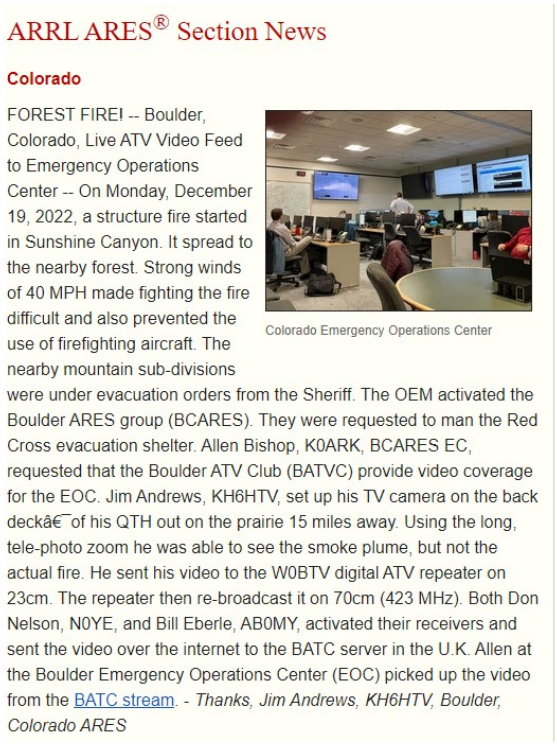

ARRL ARES® Section News

Colorado

Colorado Emergency Operations Center

FOREST FIRE! -- Boulder, Colorado, Live ATV Video Feed to Emergency Operations Center -- On Monday, December 19, 2022, a structure fire started in Sunshine Canyon. It spread to the nearby forest. Strong winds of 40 MPH made fighting the fire difficult and also prevented the use of firefighting aircraft. The nearby mountain sub-divisions were under evacuation orders from the Sheriff. The OEM activated the Boulder ARES group (BCARES). They were requested to man the Red Cross evacuation shelter. Allen Bishop, K0ARK, BCARES EC, requested that the Boulder ATV Club (BATVC) provide video coverage for the EOC. Jim Andrews, KH6HTV, set up his TV camera on the back deckâ€¯of his QTH out on the prairie 15 miles away. Using the long, tele-photo zoom he was able to see the smoke plume, but not the actual fire. He sent his video to the W0BTV digital ATV repeater on 23cm. The repeater then re-broadcast it on 70cm (423 MHz). Both Don Nelson, N0YE, and Bill Eberle, AB0MY, activated their receivers and sent the video over the internet to the BATC server in the U.K. Allen at the Boulder Emergency Operations Center (EOC) picked up the video from the BATC stream. - *Thanks, Jim Andrews, KH6HTV, Boulder, Colorado ARES*

Boulder ARES & BATVC was featured in latest ARRL / ARES newsletter of 18 January. The article about the Sunshine Canyon Forest Fire and ATV along with the photo was reprinted directly from our previous newsletter, Jan. 2023, issue #119.

FEED-BACK:

Frequency Synthesizers as LOs - Feed-Back:

I really liked the articles in the recent issues (#115-118) that compared DATV reception using various synthesized local oscillators. The topic of "low phase noise" turns up in weak signal microwave all the time. But methods to compare and quantize the results are far less common. I was especially interested to see how crystal vs synth compared. I'm assuming that there is no direct comparison between a 6MHz DATV signal and a 3KHz SSB signal in reception. I doubt it would be as simple as the ratio of bandwidths, and I'm sure the difference is more than fractions of a dB. But worst case, the technique of testing with a QPSK(?) digital signal instead of voice SSB does give a potential way to get usable numbers for how the phase noise effected reception. On the basis of the second article I've already suggested to a couple people that they may want to investigate the MAX2870 synthesizer boards, especially the one with 5 push buttons. :-)

I don't personally know anyone who has done an actual before and after signal reception test on their microwave transverter. Most are from on-the-air reception of random signals. Some few user reports from well-known hams, plus manufacturer and vendor reports similar to "yes, the phase noise is higher, but it didn't effect reception." Your tests against a DATV signal is the first I can recall that gives actual numbers to compare various LOs. Your numbers don't directly apply to narrow band signals due to

bandwidth and LO spurs, but it suggests a simple way to validate against narrow band QPSK(?) digital signals.

Essentially you are doing Bit Error Rate (BER) tests of the various LOs using DATV where the picture drops out when a critical BER is reached. Any "damage" to the complex digital waveform shows up in BER and the picture drops out. A similar test could be done at narrow bandwidth and basing the sensitivity pass-fail against a specific BER value. I just haven't heard of anyone doing such tests with a single microwave transverter and assorted LO sources, i.e. only one variable at a time..... I was about to wonder if results would change with actual over-the-air weak signal interference due to the LO spurs, but since they are all at least 40dB down, they can probably be ignored....

The other side of the coin is that most of the 10 GHz weak signal activity in my area is based on Down-East Microwave and DB6NT transverter equipment, not much is DIY based on surplus parts. That means most users have chosen a complete LO solution and it may or may not have the same spurs or noise characteristics as an off-the-shelf, China LO board. But your tests do still have relevance to the DIY builders in California and I'd like to know before I try assembling the surplus parts I have at home.....

73, Doug Reed, N0NAS, St. Paul, Minnesota

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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/*** Select ***ab0my or n0ye***. 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/

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