Boulder Amateur Television Club

TV Repeater's REPEATER

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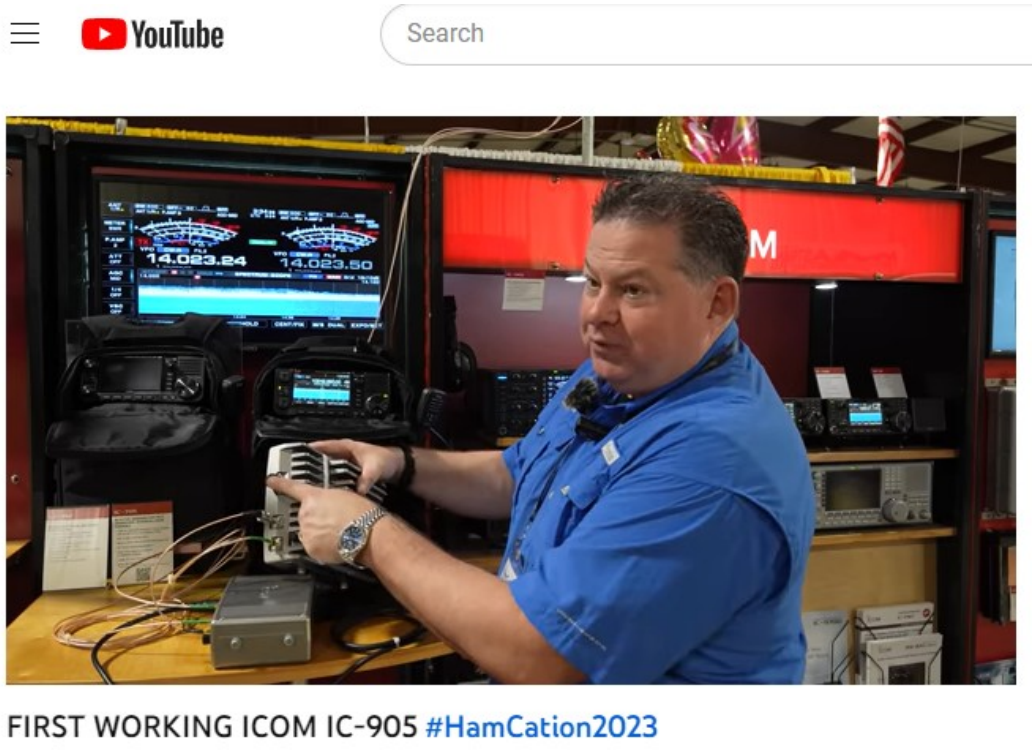
BATVC web site: www.kh6htv.com

ATN web site: www.atn-tv.com

ATN
The Amateur Television Network

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



FIRST WORKING ICOM IC-905 #HamCation2023

BREAKING NEWS: First USA demo of the new Icom IC-905 Microwave Transceiver.

Don, N0YE, just this evening sends this note -- "Here is a video presentation of the IC-905 from HamCation-2023. Interesting. A hint that it may do DATV on the SHF bands sometime in the future."

https://www.youtube.com/watch?v=yiZX2mJReFg

ATV CONFERENCE PROPOSAL

Joel Wilhite, KD6W

Annual ATV Conference Proposal - An annual Amateur Television weekend conference by hams for hams to meet up and discuss and exchange ideas, technology, issues and ATV repeaters, with FCC testing, vendor tables and of course a flea market. The event would includea list of invited speakers and a dinner night to show videos,and invite a speaker and a raffle of some donated gear. A conference provides a place for open dialog for discussion of papers to help others to learn and to show others the latest new developments. A conference will help us build up our community since it's up to us to drive those goals in our hobby if we are to thrive, expand our ranks and our systems and who knows, along the way become prosperous? Many groups are having financial trouble to make payments on rent for mountain tops. There is very little private mountain top real estate anymore.. But my greatest concern is for the people who are or maybe interested in ATV, and aren't able to attend other events and or have very little other options.

The attraction for me to an annual conference devoted entirely to amateur television is more appealing than having our talks and demos combined with other events as we have always done in the past. Our efforts have always been riding on the coattails of other events like Dayton, TAPR and the various other division conventions.

My initial thought was to meet in Las Vegas and since the NAB show is a Monday through Thursday trade show, a Thursday - Friday conference would be handy to overlap with the last day of NAB. But then I thought better of this schedule and decided it would be better to maintain the Saturday/Sunday after NAB to respect those who still work and may not get the time off to attend a Thursday/ Friday conference. Those who can attend more days can come early to see the exhibits at NAB prior to the ATV conference. The thought of having the conference before NAB is cost prohibitive but the weekend after is doable as the price of everything relaxes substantially after the show ends. To those who have never been to an NAB, it will be an eye opener. I'm also open to the idea of moving the location around so different groups can share the hosting responsibility..

So there you have it -- Is there support out there in our ATV community for Joel's idea ? If so, please send your comments, etc. directly to Joel. His email address is: **kd6w@arrl.net**

Joel Wilhite - KD6W

Joel has a long history of being a mover & shaker in both the broadcast TV industry and also amateur radio. He is now recently retired and living in Scottsdale, Arizona and is now active there with ATN-AZ. He formerly lived in the San Francisco Bay area and was very active with the ATV gang there. Joel is also an avid microwaver and loves to do roving.

Joel was a Senior Systems Design Engineer for Harmonic (***www.harmonicinc.com***) He started his career at DiviCom when the first commercial MPEG-2 encoders were being launched and has since focused primarily on broadcast, contribution, distribution and now streaming television. He contributed during the draft phase of several ATSC specifications and more recently for ATSC 3.0 standards. He has presented talks at many TV industry conferences and authored a number of technical publications.

You can hear Joel on a QSO Today podcast, episode #220 (***https://www.qsotoday.com/podcasts/kd6w***). Joel has a great technical talk entitled "Digital Amateur TV" which was presented at BayCom 2020 (***http://www.bay-net.org > digital_amateur_tv_kd6w***)

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EDITOR's NOTE: *Our previous issue #122, included an article on FM-TV. Ten years ago, back in the days of FM-TV, I wrote an application note on how to adjust your FM gear, both video and audio. I thus feel that re-printing it here might be of interest to our readers. -- KH6HTV*

Application Note
AN-14

FM Transmitter Deviation Adjustment & Calibration

Jim Andrews, KH6HTV
www.kh6htv.com

The purpose of this application note is to explain how to adjust and calibrate the deviation in an FM transmitter. A good place to start for background reading material is the ARRL Handbook, chapter on Modulation and Demodulation [1]. There is also a wealth of material available on the internet, starting with Wikipedia [2]. The math describing FM modulation can be pretty hairy. With FM we don't simply have a single pair of side-bands as in AM or a single side-band as in SSB. Instead we have an infinite number of sidebands which are described by Bessel functions. Fortunately, they decrease in amplitude the farther they get away from the center frequency.

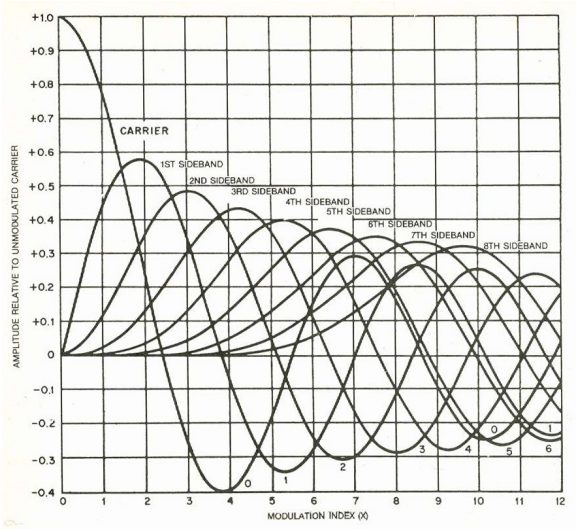

Fig. 1 Bessel functions showing the various sidebands for FM. (from ARRL [1])

The preferred technique for setting FM deviation is called the Bessel Null Technique. From the ARRL handbook, they define the modulation index, χ to be

$$\chi = D / m \qquad (1)$$

where D is the peak deviation and m is the modulation frequency. The peak deviation is the maximum frequency excursion away from the center frequency. Fig. 1 above from the ARRL handbook shows the complicated Bessel function relationship of the various sidebands in FM as a function of χ. Of particular importance for our purposes is to look at what happens to the carrier frequency as the modulation index, χ, is increased. Note that it passes through zero several times at χ values of 2.405, 5.52, 8.65, etc.

Now let's take the example of tuning up an FM-TV transmitter. We want the peak deviation, D, to be 4 MHz when we apply a 1 Volt peak-to-peak video signal to the transmitter's video input port. What frequency sine wave should we use to align the transmitter ? We want to look for the first null in the carrier at $\chi = 2.405$, so let's rearrange eqn. 1 to solve for m.

$$m = D / \chi = 4 \text{ MHz} / 2.405 = 1.663 \text{ MHz} \qquad (2)$$

The easiest way to do this deviation adjustment is with a spectrum analyzer. See Fig. 2. Set the transmitter's video gain pot to zero. Now apply a 1.0 Vptp sine wave of 1.663 MHz to the video input of the transmitter and then start increasing the video gain. As you do this, you will start to notice multiple sidebands appearing. As you continue to increase the video gain you will start to see the center, carrier frequency drop rapidly. Fine tune the video gain pot setting until you have nulled out the carrier frequency. At this point you have properly set the deviation to be exactly 4 MHz. The null can be very deep. The example shown in Fig. 2 (center photo) shows a null in excess of 55 dB. Be sure to stop at the first null. If you keep cranking up the gain pot, you will go through more Bessel nulls. If you stop on the wrong null, you will be over deviating the transmitter.

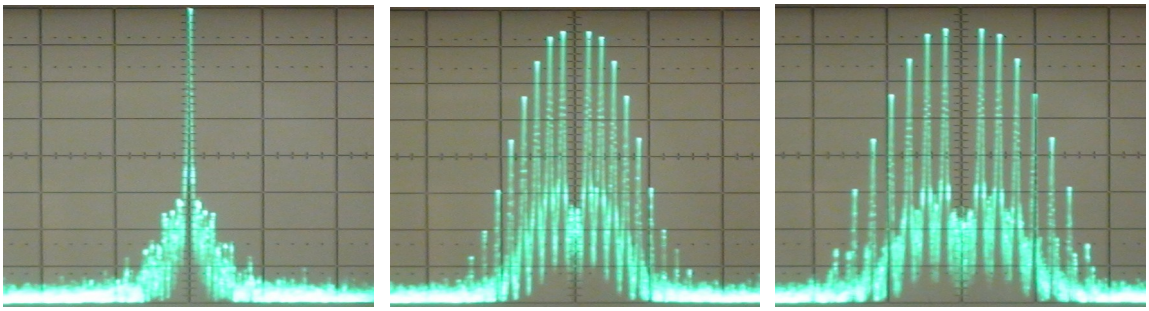

Fig. 2 Spectrum plots of an FM-TV transmitter. 10 dB/div & 10 MHz/div. (left) Transmitter with no modulation (center) Transmitter with flat video response, properly set for 4 MHz deviation with 1.663 MHz tone. (right) Transmitter with pre-emphasis, properly set for 4 MHz deviation with 2.33 MHz tone.

The above example was based upon the assumption that the transmitter had a flat video frequency response. According to Mike Collis, WA6SVT [3], if the transmitter has a CCIR 405-1 Pre-Emphasis filter on it's input, then the alignment sine wave frequency should be set instead to 2.33 MHz., . The different frequency accounts for the effects of the pre-emphasis filter. The right photo in Fig. 2 shows the spectrum from such a transmitter.

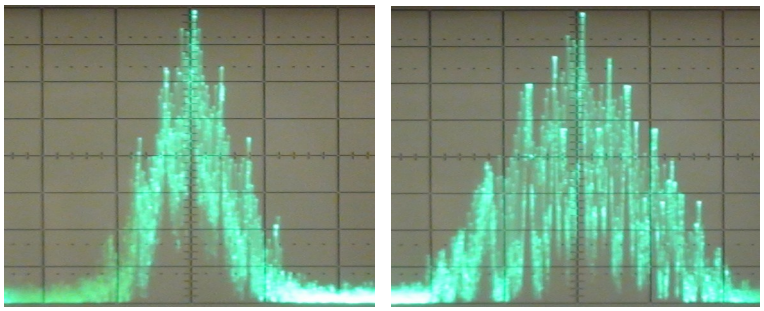

Fig. 3 Spectrum plots of a 4 MHz deviation, FM TV transmitter with pre-emphasis and running with normal, "live", video modulation. 10 dB/div & 10 MHz/div. (left) no sub-carriers (right) with stereo sound sub-carriers at 5.8 & 6.2 MHz

Fig. 3 above shows the spectrums from a normally operating FM TV transmitter running "live" video, both with and without sound sub-carriers. It is obvious that adding the sound sub-carriers broadens appreciably the spectrum. The examples shown here in Figs. 2 & 3 were from a KH6HTV VIDEO, model 23-1, 23 cm, 3 Watt, FM-TV transmitter.

With either analog VUSB-TV or FM-TV, we transmit our audio on sub-carriers using FM. Thus, we need to also consider how to properly set the audio sub-carrier's deviation. Again, we will use the Bessel null technique. The only difference will be the amplitude and frequency of the test alignment sine wave. For detecting the null, a spectrum analyzer is preferred, but it can also be accomplished using a narrow-band radio receiver. In either case, the bandwidth needs to be set to < 1/10 th of the frequency of the test signal. Thus, when testing with audio frequency tones, a good SSB/CW receiver is required.

For conventional, analog TV using either AM or VUSB modulation, the sound sub-carrier is at 4.5 MHz with 25 kHz deviation. For FM-TV, the sub-carrier(s) typically are using a wider deviation of 75 kHz. The FM sub-carriers are usually higher than 4.5 MHz and are most often found between 5 and 6.5 MHz.

The standard audio input to most audio equipment and TV transmitters is called Line Level audio [4]. For consumer audio products, Line Level Audio is defined to be 0 Volume Units (VU) as measured on an audio VU meter.

$$0 \text{ VU} = -10 \text{ dBV} \qquad (3)$$

where 0 dBV is 1 Vrms. Thus -10 dBV = 316 mVrms. An Average Program Level (APL) is defined to be 0 VU. For a sine wave of 316 mVrms, the peak-to-peak is 894 mV(ptp). The Peak Program Level (PPL) is considered to be 10dB higher than APL, but still registers as 0 VU on an audio VU meter. 10 dB is a 3.16 X factor, thus

$$\text{PPL} = 10\text{dB} \times \text{APL} = 3.16 \times 894 \text{ mV} = 2.83 \text{ Vptp} \qquad (4)$$

This level of 2.8 Vptp seems to be rather consistant with measurments I have made on the typical line level audio coming out of various devices, such as FM tuner, DVD player, Blu-Ray player, camcorder, etc. Frank McClatchie, of FM Systems, has two good application notes discussing this further [5, 6].

The same Bessel Null procedure is used to set audio sub-carrier deviation as was used for video deviation. The alignment test sine waves use an APL of 894 mVptp amplitude.

25 kHz Deviation: 894 mV(ptp), 3.288 kHz sine wave

75 kHz Deviation: 894 mV(ptp), 9.863 kHz sine wave

Most TV transmitters use 75 µs pre-emphasis on the modulation audio signal. For the above amplitudes and frequencies to be correct, the Pre-Emphasis must be switched off prior to performing the deviation adjustment. Don't forget to turn it back on after the alignment.

References:

1. ARRL Handbook, Chapter 9, "Modulation and Demodulation, 1991.
2. http://en.wikipedia.org/wiki/Frequency_modulation
3. Mike Collis, WA6SVT, "FM ATV Transmitter Alignment Procedures", Amateur Television Quarterly, Summer, 2008, page 11
4. http://en.wikipedia.org/wiki/Line_level
5. Frank McClatchie, "TV Audio Deviation Measuring and Setting It", FM Systems, http://www.fmsystems-inc.com/
6. Frank McClatchie, "Bessel Null FM Deviation Measurement", FM Systems, http://www.fmsystems-inc.com/
p.s. these URL links still work !

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VHF/UHF Amplifier - Product Review

Jim, KH6HTV

The Chinese keep pumping out several versions of this heat sink mounted, open pc board, amplifier. In our previous issue #122, we reviewed a 2.4 GHz amp and in our Oct. issue #114, we reviewed a 5.8 GHz amp. Both were similar to this one for 0.1 - 1.3 GHz. They all are from China and selling for about $15. They all seem to be the same basic design, except for the final MMIC amplifier used.

This amplifier is advertised to work from 100 MHz to 1.3 GHz. Max. RF output of 1 Watt and gain of 25 dB. The 0289 requires +8Vdc, but an on-board switcher allows it to be powered with +10 to +30Vdc. It is advertised to use the SBB-5089 as the driver and SHF-0289 as the final amplifier.

2 meters - 23 cm: If you check the data sheets for these devices, the gain of the 5089 is flat at 20 dB. For the 0289 it is 22 dB at 70 cm and 17 dB at 23cm. Thus the total expected gain could be of the order of 42 dB (70 cm) and 37 dB (23cm). For the unit I purchased, I measured the gain, S21, to be: 42.5dB (2m), 38.5dB (70cm), 35.7dB (33cm) and 33.6dB (23cm). A bit lower than anticipated, but still considerable gain. The Chinese spec. for output power was 1 Watt (+30 dBm). I measured the max. saturated output power to be +29.1dBm (2m), +31.1dBm (70cm), +30.2dBm (33cm) and +27.5dBm (23cm). Thus about 1 1/4 W at 70cm and 1/2 W at 23cm. At +12Vdc input, the amp draws 330mA.

Digital TV Amp: I also tested this amplifier to see how well it would work with DVB-T. I used a Hi-Des HV-320E modulator as the test source. I looked at the output spectrum on my Rigol Spectrum Analyzer. I adjusted the rf drive from the modulator to set the shoulder break points to the normal setting used for DTV transmitters of -30 dB. I did this on all three bands 70 cm through 23 cm. I then measured the resultant average rf output power with my HP 432 thermistor power meter. The results were: +22.4 dBm (70 cm), +21.8 dBm (33 cm), and +18 dBm (23 cm). Thus, this amplifier will serve as a good "After-Burner" for use directly with the Hi-Des modulators. It will boost their outputs up to the 150 mW level (60 mW on 23 cm). Not bad for only a $15 investment !

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New Higher Power Versions of HV-320

Drew, AC3DS, has recently called my attention to some new versions of the **Hi-Des model HV-320E, DVB-T Modulator**. It seems that Hi-Des has also discovered the same, or similar, low cost power MMICs as discussed in the above article. They are now advertising several versions with higher RF output power of **+23 dBm (200 mW)** for DTV. To order, add the suffix -PAXXX. The versions offered include: PATV (400-800MHz), PA900 (700-1000MHz), PA1200 (1 - 1.5GHz), and PA2400 (2.4GHz band). Note: these higher power versions will draw more dc current and run hotter. The Hi-Des, E-Bay web site list price for the basic HV-320E is currently $399. The higher power versions sell for $438.

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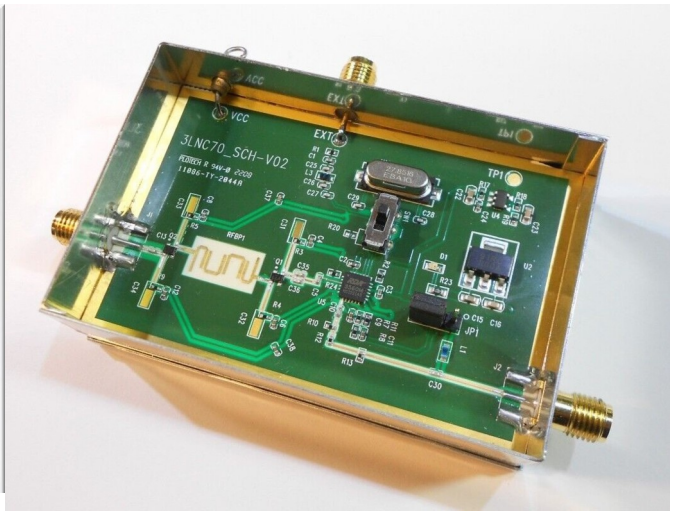
Another New Hi-Des Product:

Also now found on the Hi-Des E-Bay web site is another interesting product. Their model 3-LNC-70. It is a 3 cm (10 GHz) down converter. Sells for $186. Specs. are: RF input 9.8 - 10.7 GHz, IF output 0.3 - 2 GHz. Noise Figure 1.2 dB, Conversion Gain > 50dB, Internal crystal based LO or external LO (25-30 MHz).



We have no personal knowledge about this new product. If any microwave ham out there buys one and wants to write a product review, we welcome it and will publish it here in a future newsletter.

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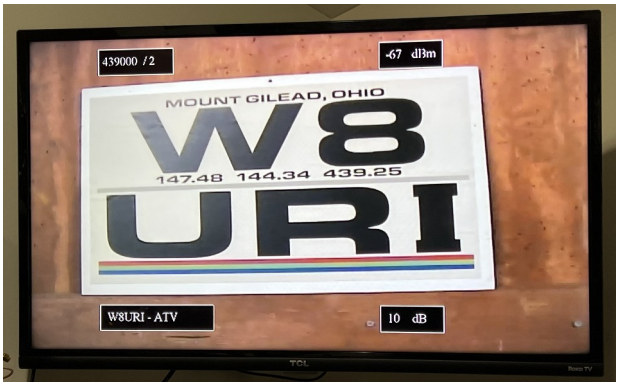
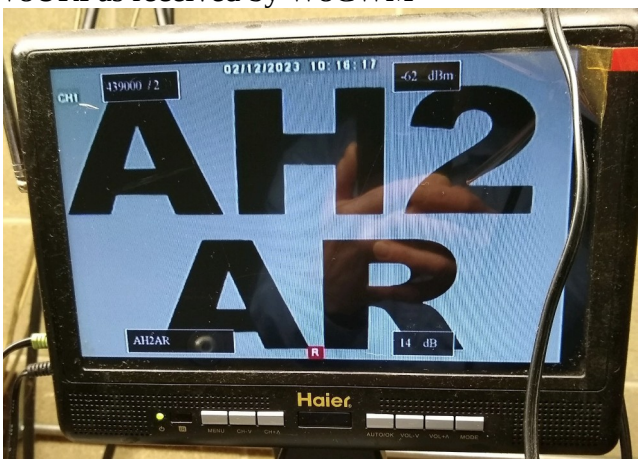


W8URI as received by W8CWM

W8CWM as received by W8URI



Dave, AH2AR's DATV signal as received by W8URI -62dBm & 14dB S/N 87 miles

AH2AR's DX hound, Loki, acting up for the camera

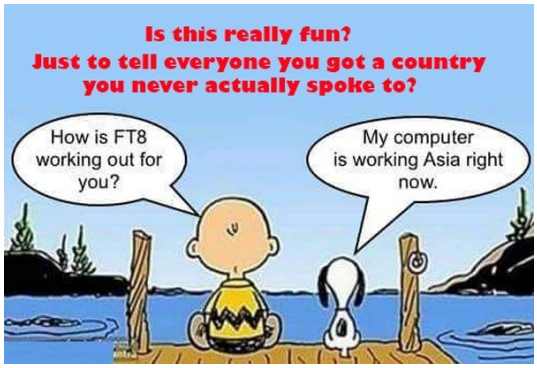
Mid-West ATV - DX

On Sunday, Feb. 12th, another 70 cm band opening occurred. All contacts were on 439 MHz with DVB-T digital and 2 MHz band-width. Here is a snap-shot of a the picture from W8CWM being received at W8URI. Bill, W8CWM lives in Englewood, Ohio. His 70cm antenna is at 50 ft. Bill, W8URI, lives in Mount Gilead, Ohio. The distance between the two Bills is about 100 miles. Note the on-screen display of -67dBM signal strength and 10dB S/N for W8URI. They also were transmitting analog ATV signals on 439.25 MHz, but didn't take any photos. All received analog pictures of P4 to P5 quality. They use the analog ATV signals as a means to establish initial contact, and to determine whether the opening will support digital signal decoding.

FEED-BACK:

Graying Hams Feed-Back: I too am concerned that we're not getting new young hams. I think the solutions is to get high schools to set up ham radio clubs. If you have any ideas on that you can count on me to provide funding for equipment for clubs or new hams.

73 de Merv, KO6E, Santa Monica, California



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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