

# Boulder Amateur Television Club TV Repeater's REPEATER

January, 2020  
3 ed edition

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**Future Newsletters:** If you have contributions for future newsletters, please send them to me. We love to also include news from other ATV groups, both in the USA & world-wide. You will be finding more & more news from other ATV groups here as evidenced by this issue of our newsletter.

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**Newsletter Frequency:** This newsletter comes out at least once a month. The editor's policy is to be writing it as news items come in. Whenever, the page count gets up to about 10 or 12, then send it out as a new issue. If the newsletter got to be too lengthy, I suspect readers are less likely to read all of it. All past issues of the newsletter are archived and are available at the BATVC web site: <https://kh6htv.com/newsletter/>

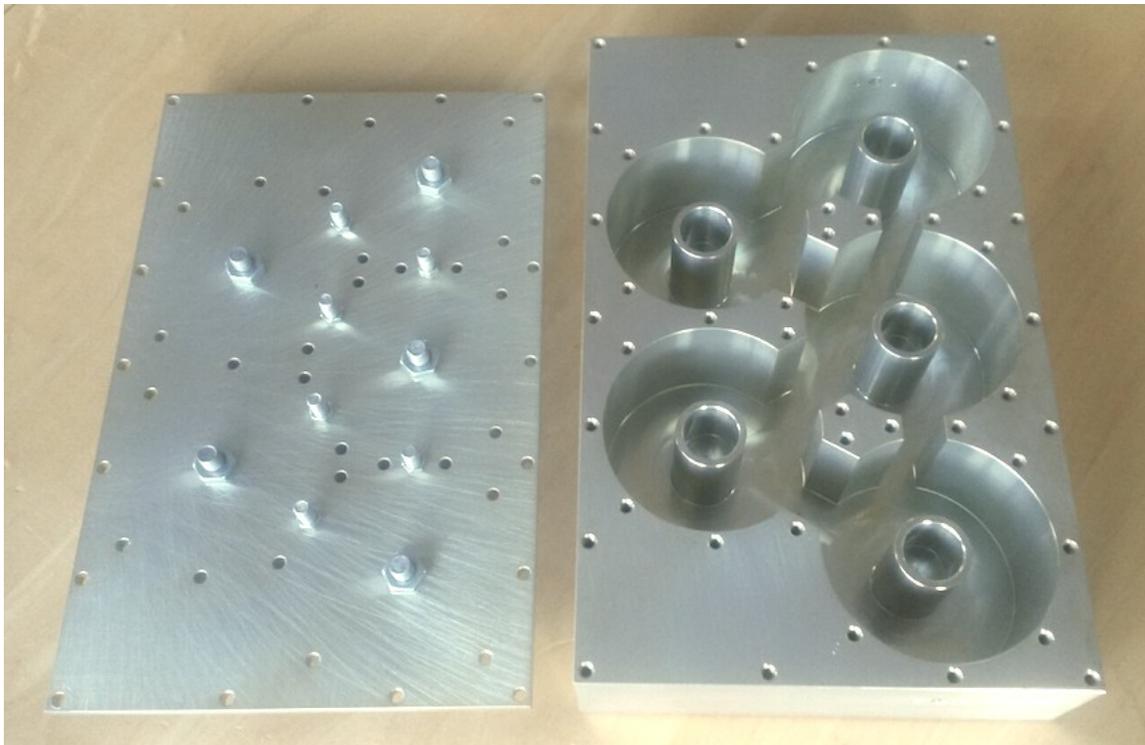
## **BREAKING NEWS ! -- We Have a NEW 23 cm BPF !**

Our ATV repeater has suffered from RFI issues on the 23 cm input. In 2012, the FAA installed a new radar at DIA. At the time our input frequency at 1277 MHz was quite close to the radar's frequency and it totally clobbered us. We received permission from the CCARC, the Colorado frequency coordinating body, to move to the bottom end of the 23 cm band. Don, N0YE, scrounged thru his microwave junk box and found a 1.5 GHz band-pass filter that he modified down to the 23 cm band. With it we were able to suppress most of the radar energy. But not enough. Boulder ATV hams with weak DVB-T signals into our repeater have been suffering from loss of audio and lots of freeze frames. Monitoring the signal to noise ratio on incoming signals shows a definite fluctuation in S/N. Even for very strong signals showing S/N of 23dB, (the max. with QPSK), we see a periodic drop in S/N. The S/N drop rate corresponds to the rotation rate of the radar antenna. Tests with a spectrum analyzer show the radar energy was spread from 1259 to 1269 MHz with dual peaks at 1261.25 & 1266.5 MHz. For more details on this radar RFI, see the article and spectrum photo in the BATVC's newsletter of October, 2018, pages 5 & 6.

What we really needed was a much better filter on our receiver. But where to find one? Fortunately, within our Boulder ham community we have a Fellow of the IEEE who is a world-wide recognized expert and designer of microwave filters. Dan Swanson,

WB9AIA is our man ! To find out more about Dan, check out his web site: [www.dgsboulder.com](http://www.dgsboulder.com) Also see the BATVC newsletter Dec. 2018 issue, pages 11-14. Dan offered to design a custom, 23 cm Band-Pass Filter (BPF) for our ATV repeater. The key specs. for Dan were a pass-band from 1240 to 1246 MHz for our DVB-T signals and ultimate rejection of the FAA radar from 1259-1270 MHz.

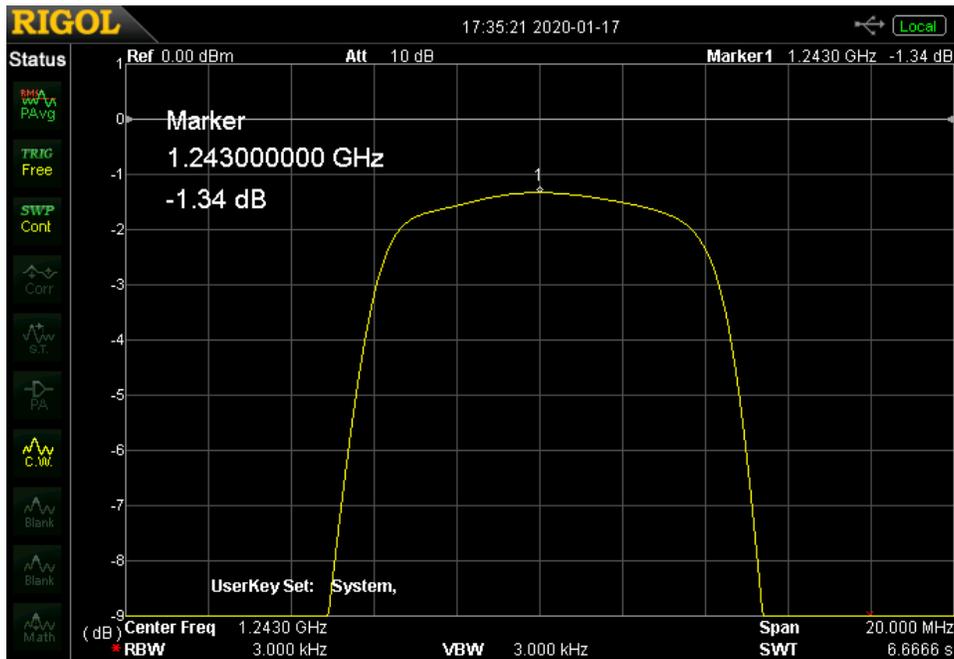
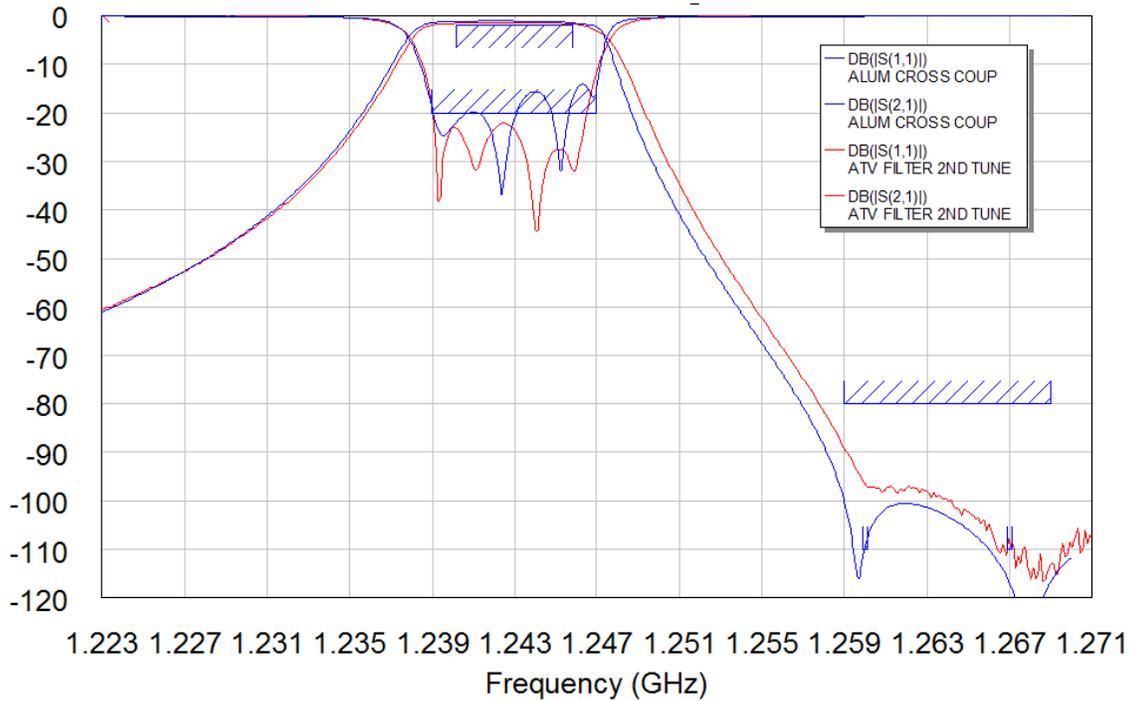
After Dan came up with a design, the next question was how to build it. Dan's design required the services of a precision machine shop. Don, N0YE, said he knew of just the place and it was run by another ham. Don and Dan then contacted Mark Lewis, N0IO, in Grand Junction, Colorado. Mark's company - **Jabil Lewis Engineering**, is a precision machine shop specializing in aerospace products, including custom microwave parts. Their web site is: <https://www.jabil.com/contact/locations/grand-junction.html> The photo below shows the beautiful machined filter Mark built for us.



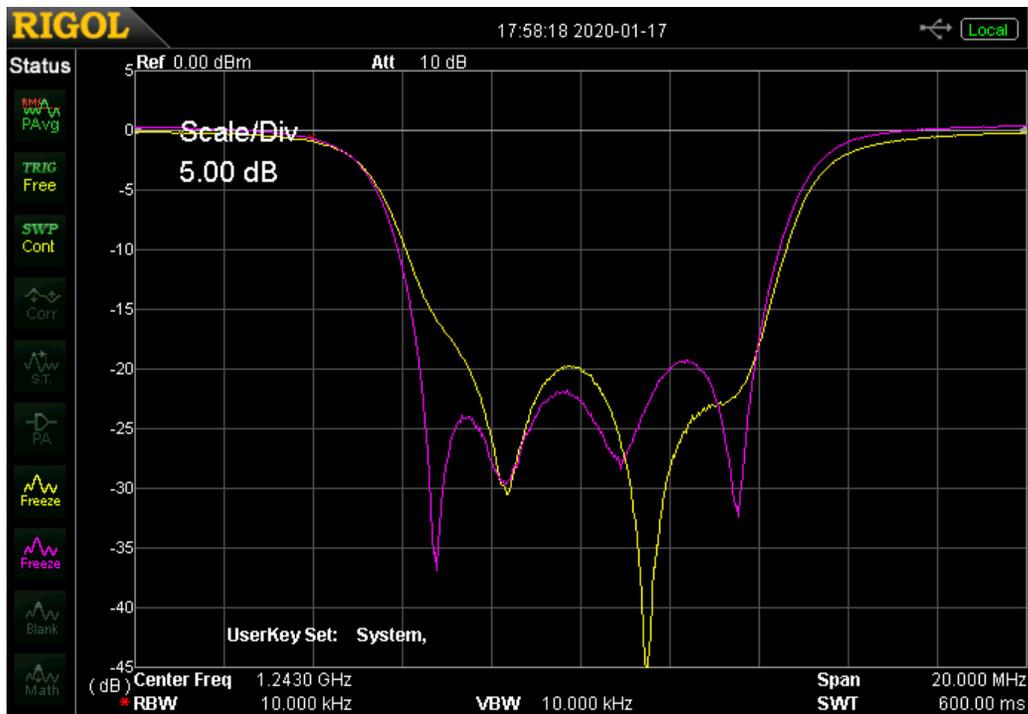
The BPF Dan designed for us is a 5th order, comb-line, cavity filter with two inductive cross-couplings. The cross-couplings put "zeros" on the high side of the pass-band. Mark then fabricated it by machining it out of a solid piece of aluminum of 8 1/4" x 5 1/4" x 1 5/8". The above photo shows the interior along with the cover plate. The tuning screws are in the cover plate. The photo on the right shows the input coupling from an SMA connector.



Dan pre-tuned the filter by setting the tuning screws to his design dimensions. He then tested the BPF on a vector network analyzer. His predictions were extremely close. The initial passband was only about 4 MHz too high. The plot below of S21 and S11 shows the results after he then fine tuned the filter. The traces in blue are the theoretical predicted responses while the red traces are the actual measured performance after fine tuning.



S21, pass-band Insertion Loss of the WB0A1A, 23cm BPF.  
center frequency = 1243 MHz, 20 MHz span 1 dB/div & 2 MHz / div.



S11 (magenta) & S22 (yellow) Return Loss of WB9AIA 23cm BFL  
center frequency = 1243 MHz 20 MHz span 5 dB/div. & 2 MHz/div.

After receiving from Dan, the finished filter, I (Jim, KH6HTV) then measured the filter using my Rigol spectrum analyzer with a built-in tracking generator. The dynamic range of my measurements with it were only about 70dB, thus I was unable to see the really deep rejection notches for Dan's filter. I did however confirm them to be what Dan measured by then doing CW measurements with a signal generator and the spectrum analyzer. My measurements showed that the insertion loss in the center of the pass-band at 1243MHz was -1.3dB with a very flat response across the desired 6 MHz pass band. The -3dB bandwidth was 9 MHz. For -10dB, it was 11.1 MHz. For -20dB, it was 14 MHz. For -30dB, it was 17.5 MHz. The above photos from the Rigol are my measurements of the S21, S11 and S22 for the pass-band. They confirm Dan's results.

The next step is for Don & I to make a trip to the repeater site and remove the repeater. I will bring it to my QTH ham shack and make the necessary modifications to install Dan's new filter. Plus we have some other mods we want to do at the same time. Hopefully it will only be off the air for about a week or so. The next newsletter will report on our success dealing with 23cm radar RFI ( Hopefully ? ? ! ! ).

**BCARES ANNUAL MEETING:** The Boulder County Amateur Radio Emergency Services (BCARES) ( [www.bouldercountyares.org](http://www.bouldercountyares.org) ), in Boulder, Colorado, held it's annual membership meeting on Monday, January 13th. BCARES chairman & EC, George Weber, KA0BSA, presided. BCARES has about 70 members on it's roster. There were about 40 members in attendance.

1. The meeting opened with George introducing some guests. They included Marco Vasquez, N0MKV, EC from Jeffco ARES, Chuck Gilbert, N0PIC, Jeffco and Jim Gunderson, AD0ZM, from Denver ARES. Mike Chard made some remarks. Mike is the director of the Boulder City/County Office of Emergency Management (OEM). Mike expressed thanks for the support from BCARES to the citizens of Boulder County. He also said his office wants to continue working with and support the needs of BCARES. Also making a few remarks was Shannon McVaney, KE0FDG. She is the new director of the Longmont OEM.

2. Jack Ciaccia, W0MG, our ARRL Colorado section manager then described the ongoing efforts at ARRL national headquarters to revise and update ARES nationally.

3. George then reviewed the events of 2019. Fortunately, there were no emergencies, nor disasters to deal with in 2019. All events were routine. The big item to report was that the University of Colorado Police Dept. has decided to discontinue using BCARES for video coverage of football games and other stadium events. The major driving factor was the fact that CU now has a large network of closed circuit TV cameras covering the stadium and also that every police officer is now wearing a body-cam. CU might still in the future call upon BCARES for video coverage for other events, such as political rallies, protests, etc. that occur on other parts of the campus.

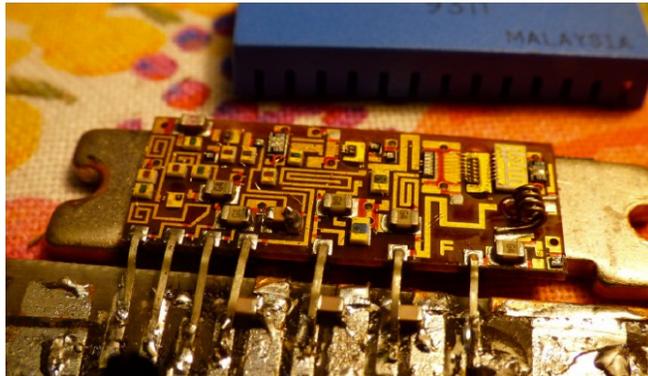
4. Joe Callahan, KC0JCC, then discussed the project of mapping the 2 meter & 70 cm repeater coverage of the mountainous regions of Boulder County. This was done at the request of the OEM. Over 40 sites were surveyed and seven, 2m/70cm repeaters were tested. The results have since been incorporated into the OEM's Web-EOC data base.

5. Allen Bishop, K0ARK, discussed a member survey he recently conducted. His major conclusion is BCARES is a graying organization of mostly extra class, old-timers. We have almost no younger, technician class members. Allen said BCARES definitely needs to be recruiting young, new blood. As a matter of fact, it was reported that there were no new members joining in 2019, but we had three silent keys to report. This will only accelerate in the near future. Allen also reported that his survey reported that most all members wanted to see a "BCARES University" with more training classes, etc.

6. Mark Huff, K0LRS, gave the treasurer's report. Many members paid up their \$20 annual dues at the meeting. The treasury has about \$3K in the bank. Mark then proceeded to elaborate on the situation with CU-PD. The large cache of DVB-T video equipment which CU had purchased for BCARES to use at football games has now been donated to BCARES. It will no longer be stored at the CU-PD. The downside is that

BCARES will now be responsible for funding the maintenance of this equipment. Another related issue is storage. The BCARES equipment cache storage room in the basement of the 911 / EOC center is full. Thus there is no place to store this new equipment. Pete Goldman, WB2DVS, our equipment chairman, said there is a need to go through everything and remove obsolete equipment. Mike, OEM, said his office would assist in finding us more storage space.

7. The final part of the evening's program was a look to the future. Ron Schwartz, K2RAS, gave a presentation on a proposal of his to move BCARES towards providing emergency microwave communications for a private internet network for public safety. Ron had a demonstration setup of what he calls "IPBOX". It was a very low cost, low power consumption, 5 GHz system capable of sending hi-def video, PBX telephone services, e-mail, etc. Ron's system was point-to-point microwave dishes. He said they absolutely require line-of-sight paths, but could potentially reach out 30 miles. Ron represents the Longmont ham club and said LARC is already implementing this and working with the Longmont EOC. They are also working closely with Rocky Mountain Ham Radio ( [www.rmham.org](http://www.rmham.org) ) to tie into their microwave back-bone network at their Lee Hill site. The RMH network currently spans from Cheyenne, Wyoming down to Albuquerque, New Mexico on the 3 and 5 GHz amateur bands.



**NEW, 70cm, Analog, ATV Transmitter:** John, WB0CMC, in Omaha, Nebraska, recently sent me a lengthy article about a new ATV transmitter which he has designed. His paper was a bit long for our newsletter. I have forwarded it on to the electronic magazine, *CQ-DATV* ( <https://cq-datv.mobi> ). They will be publishing it in a future issue. John's new transmitter uses as its heart, a Motorola MHW-707, 70cm, 7 Watt, brick amplifier. The 707 has a separate dc gain control pin. John found that he could drive video into this pin and AM modulate the brick. However, John also found that this only produced B&W video. He then discovered that if he opened up the plastic cover, there was a large by-pass capacitor inside on the gain control line killing his modulation bandwidth. He thus removed it (very carefully ! ) and replaced it with a much smaller value and BINGO ! --- Color Video + 4.5 MHz SSC audio resulted. The resultant five ATV transmitters which John has built so far with this design are all crystal controlled on 434 MHz and put out 7 Watts peak sync.

The MHW-707 is an obsolete part dating back to the early 80s. However, new ones are still available from RF Parts ( [www.rfparts.com](http://www.rfparts.com) ) for about \$30 each. They are also listed on E-Bay for typically about \$15. For more information on this ATV transmitter, contact John directly at: [wb0cmc@cox.net](mailto:wb0cmc@cox.net)



Philadelphia, Pennsylvania skyline, 30 miles in the distance, as seen from the KC3AM - ATV repeater in Wilmington, Delaware

## WILMINGTON DELAWARE ATV REPEATER --

The KC3AM ATV repeater has 439.25MHz AM input and transmits on 423MHz with DVB-T, 2 MHz bandwidth. The repeater site is the highest point in Delaware at 440 ft. above sea level. The metro area of Philadelphia is visible from the repeater's antennas. The repeater is now affiliated with the Amateur Television Network (ATN). For more info about this repeater, contact Dave, KC3AM, at [KC3AM@verizon.net](mailto:KC3AM@verizon.net)



**ZOOM Video Conferencing:** This is from Art, WA8RMC, of ATCO (Amateur TV Central Ohio - [www.atco.tv](http://www.atco.tv) ) ATCO holds an ATV net every Tuesday evening at 8 pm EST. They use 147.48MHz for their 2 meter voice intercom..

Art writes -- " For the participants beyond the reach of our ATV repeater, we will also use a **"ZOOM"** computer chat/video conferencing system similar to familiar **Skype** but much better. Many ATVers are now using this because of it's simplicity and video quality. (BATC streaming will not be used).

I know it's not "Ham Radio" that so many of you cherish with noise, interference and atmospheric challenges, but it's a great 2 way communication system open to all beyond the normal reach of ATV. It's not intended to "replace" Ham Radio but only as an introduction to the hobby so those without radio equipment can enjoy the conversation. Hopefully this will be a driving force for future active ATV operation !

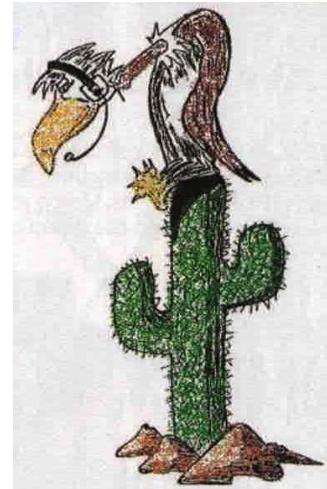
It's easy to install and use on your computer or smartphone. To join the meeting the first time, simply type <https://zoom.us/join> and then download, install the .exe program and run it. Then ZOOM starts. Click on join, enter the 9670918666 meeting ID and you're in. You can join with video or just audio if you don't have a camera. Zoom accommodates up to 100 participants so it's easy to see everyone in real time with no latency, full duplex operation! "

73 de Art, WA8RMC

**ATV at ARRL WINTERFEST:** Note from Mel, K0PFX --- "Hi Jim -- Thanks to your AN-54 and help from Dave and Dale, I have the Hi-Des model BR101E "Gap-Filler" DVB-T repeater up and running. Not sure what I am going to do with it, but I will use it for something. The upper left LED is valid RX signal and could be used for control. I see this Gap Filler is on holiday sale now for \$203. I plan to demo it at the ARRL Midwest Convention in a couple weeks. I have a speaker's slot on Saturday for an intro talk on *Digital ATV*." ----- editor's note: The ARRL Midwest division convention ("Winterfest") is on Friday & Saturday, January 24-25th and is sponsored by the St. Louis ham club. For more info -- <https://winterfest.slsrc.org/> Mel's DATV talk is scheduled for 2 to 3 pm on Saturday.

## ATV at ARRL South-West Division

**Convention:** Mike, WA6SVT, is the CTO of the Amateur Television Network (ATN) (<http://myhamcallsign.com/atn-tv.org/> ). Mike will be giving a talk on *Digital ATV* at the upcoming ARRL South-Western Division ham convention. The convention this year will be in Yuma, Arizona on Feb. 14-15th. Mike's talk will be on Saturday at 3:40pm. Other speakers at the convention will include Riley Hollingsworth, K4ZDH, and Gordon West, WB6NOA. For more info on the convention go to: <http://www.yumahamfest.org/>



**ATV in BAY AREA - CALIFORNIA:** "Jim, -- Thank you for sending me your digital TV newsletter. Please keep me on your list. I have been doing amateur TV since before I was licensed in 1991. Presently I am the keeper of the ATV repeater up on Mount Diablo with the call W6CX. We have both inputs and outputs on DVB-S 1.2 GHz. Some of the details are on the club's website:

<http://www.mdarc.org/activities/repeaters/atv> Tune in to our nets on BATC.

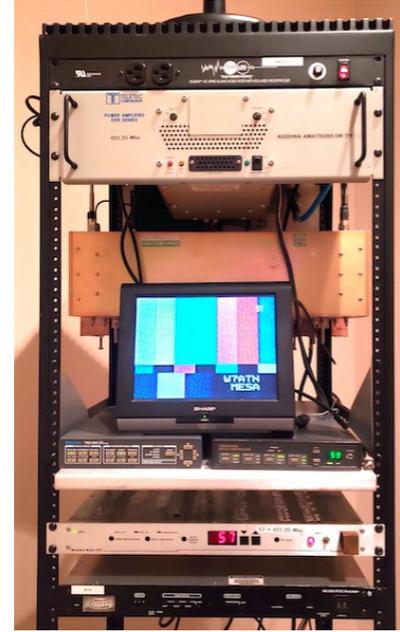
More later....73, Jim K6SOE"

## ATV in ARIZONA:

The Arizona chapter of the Amateur Television Network (ATN) holds a monthly meeting at a Denny's restaurant in Tempe. For their January meeting they have several items planned. They include: Next Generation TV, 2020 plans, ATV "Show-N-Tell", etc. They also have a brand new ATV repeater to expand their coverage in the East Valley. It is on 421.25 MHz.

Watch their ATV Nets on YouTube.com Sunday, Tuesday and Wednesday evenings between 7 and 9 PM Arizona Time. On YouTube, search for W6ATN Live and W7ATN-MESA Live. During the nets, you can send us your video by browsing to [appear.in/amateurtvnetwork](http://appear.in/amateurtvnetwork). Net control will patch you into the net when it's your turn. Enjoy the excitement of ATV!

For more info on ATN-AZ, contact Rod, WB9KMO, at [marketing@atvquarterly.com](mailto:marketing@atvquarterly.com)



New 421.25 ATV Repeater

## New ATV Standards for the UK ?

-- In the most recent issue of CQ-TV, the BATC is proposing that all UK ATV repeaters standardize using narrower bandwidth, DVB-S2. They are wanting to convert all present FM-TV repeaters to DTV. Their objective is to conserve bandwidth, reducing the 16 MHz occupied by FM-TV down to about 1 MHz. Their proposed system will take standard definition, composite video and stereo audio and encode it with H.264 and use DVB-S2 modulation at 1 Mbps with 2/3 FEC in a 1.2 MHz bandwidth. The BATC has built a suitable, drop-in, modulator to replace existing FM-TV and older DVB-S/MPEG-2 excitors. The major components consist of a Raspberry-Pi micro computer and LimeSDR mini to generate the rf. A composite V/A dongle provides the standard definition A/V input. The BATC estimates that the cost of conversion will be about £ 300. They realize that not every ATV group

can afford this cost, so the BATC is launching a fund to sponsor the conversion for every ATV repeater group in the U.K. There are presently 42 ATV repeaters in the U.K. licensed on the 1.3, 2.4, 3.4 & 10 GHz bands. For all the ATV users presently using FM-TV, they will then need to obtain new DTV receivers. The BATC is suggesting that a suitable set-top box receiver can be purchased off E-Bay for a low £ 18. Note: this is the same identical "combo" receiver most Boulder ATV hams are now using for receiving DVB-T from our local W0BTV-ATV repeater.

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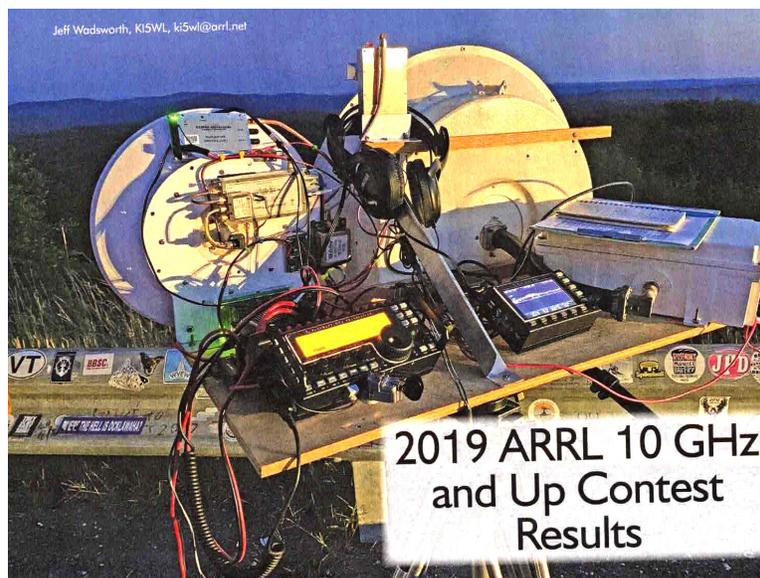


License for 11

## GREAT PROGRAM for FILTER DESIGN

I have discovered a great, FREE, on-line, filter design tool. It calculates L-C filter circuit values for low-pass, high-pass, band-pass, or band-stop responses. You have a choice of Chebyshev, Elliptic, Legendre, Butterworth or Bessel filter types, with filter orders up to 20, and arbitrary input and output impedances. You can also chose to have the results in exact values, or in standard EIA, 5% component values. After entering your desired design parameters, clicking on the "Compute" button, the program immediately displays the schematic diagram with component values. It also displays an inter-active graph of either Insertion Loss & Return Loss, S-Parameters, or Phase and Group Delay. Moving your mouse cursor over the traces on the graph gives a readout of the parameter value and frequency. Check it out at: <https://rf-tools.com/lc-filter/>

Jim, KH6HTV



(photo from QST, Feb. 2020, p. 82)

## DATV NEXT YEAR ???

Don, N0YE, is talking up having BATVC members make an impressive showing in next year's ARRL 10 GHz contest. He is wanting as many ATV hams as possible to get going with 10 GHz, DVB-T rigs and then organize mountain-topping and rovers to rack up impressive scores in the contest. Up to now the 10 GHz contest has just had CW and SSB entries. Don wants to demo what is possible with high-definition, digital video. Don has already proved it is possible using some home-brew and Down-East Microwave, SSB, 10 GHz rigs. For details, see the Nov. 2019 issue of this newsletter, pages 2 & 3. The next contest will be held the weekends of Aug. 15-16 and Sept. 19-20. Time to get busy building your rigs Guys & Gals !