ATCO NEWSLETTER

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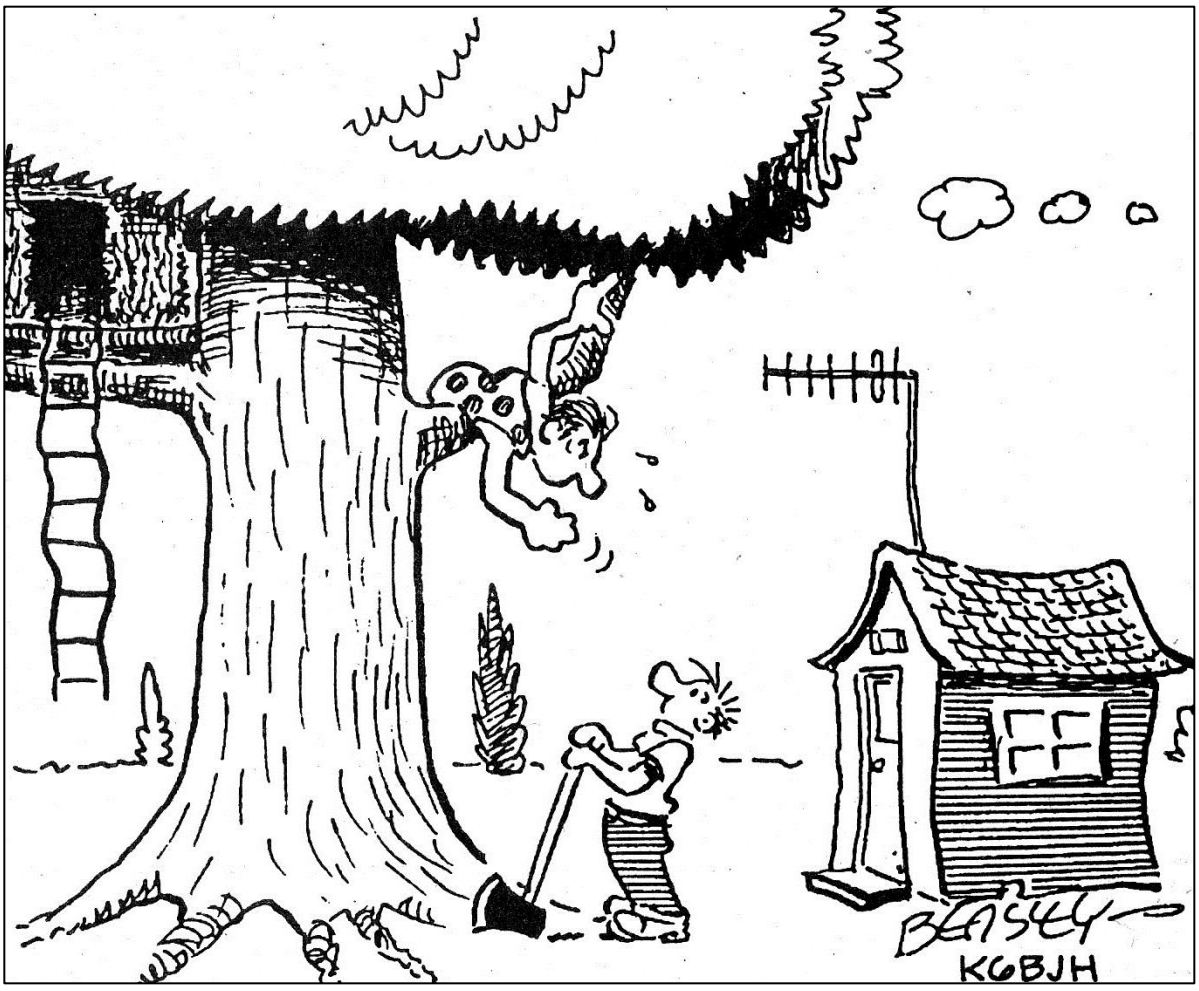
ATCO SPOTLIGHT TOPIC

Thanks to Beasley, K6BJH (SK) and ATVQ Magazine for allowing us to share his cartoons. For the complete book on "The Best of Beasley" go to the ATVQ Magazine web site (http://atvquarterly.com/) available for purchase.



ACTIVITIES ... from my Workbench

Hello folks, it's me again and I'm thinking about the antenna projects I need to start. Why do I get these thoughts at this time of year? Well, there are probably plenty of valid reasons but I think the most plausible is the realization I really won't have time to accomplish them before cold weather sets in so it's appropriate to talk about them now to put my mind at ease. That's my story and I'm sticking to it! That said, now is a good time to at least check those weather susceptible bearings and coax connections because it won't take long! I have a motorized crank up tower that gets exercised frequently during the summer so it's time to check for unusual wear. OK, I feel better now.

Shifting thoughts to the repeater, there's not a lot to talk about. Things have been running quite smoothly. (Wait a minute…I think I hear thunder in the distance). An exception is the 148.48 reception while 146.76 is on the air. For some time now we've noticed times when the 147.48 input won't accept signals. It doesn't happen often so that makes it hard to track down. One day I noticed it when the 146.76 repeater started transmitting. Our 446.35 signal stopped which was the clue I needed. I went to the repeater and removed the single cavity filter I had in the 147.48 input line and replaced it with a dual cavity version of the same type. I re-tuned the dual filter to have a sharper cutoff on the low end of the pass band to reject the 146.76 better. The result showed that initially there was about -25dBm signal at the 147.48 receiver input and now it is -40dBm. That's a great improvement but a -40dBm signal is still huge. In actual testing, it didn't seem to improve things at all. It fact it made the 147.48 input signal MUCH worse. I know there is about an additional 3dB loss through the dual cavity filter but it shouldn't have been that bad! I decided to re-test the single cavity filter and add a notch filter tuned to 146.76. In the process I discovered my spectrum analyzer hadn't been calibrated in over 3 years. I ran a self calibration check to find the frequency was off by more than 500 KHz!!!!! I recalibrated and did an on air frequency check to prove it was accurate now. Success! I re-tuned the single cavity filter and re-installed it. It's better than it was before but still has some desense when 146.76 is on the air. When I get some time I plan to re-visit the dual cavity filter and add notch filters to each stage to see if I can significantly improve the 146.76 rejection from the present -50dBm there now. It's a work in progress and is the only issue we have at the moment.

Next time I'm at the repeater, I need to add the DTMF controlled power strip I created earlier this summer. I took it to the repeater but didn't install it because I ran out of time. I was "playing" with the 147.48 filters then and was getting very tired after 2 hours of work. Shortly, I shall return to install it and also test a 147.48 preamp I have. There was no sense to install the preamp before when I was battling the filter fiasco. (Why didn't I think to re-calibrate my spec an. more often???)

Well, here goes another year without replacing the broken radomes on the 70cm slot antennas. The slots are now open to the weather elements so some major repair is now needed. I can't do it alone so I'm seeking volunteers to help. Fear of heights and medical issues will disqualify you. Is there anyone left?

Thinking ahead, I'd like to be able to process the received digital signals coming in on 438MHz and 1288MHz straight through to the respective digital transmitters. This will involve creating receivers and transmitters with HTML facilities or similar. I don't know of any with this I/O so I'll keep looking for alternatives. It's probably not a big deal because if we had that capability, it would improve the signal quality only by a small amount. However, to my knowledge, no one else with DATV in their repeater keeps the signal all digital so it could be another first. Who knows?

Last but not least, please try to attend the upcoming Fall Event on October 30 to prove that our ranks are not shrinking. The details are later in this Newsletter.

73,

…WA8RMC

DAYTON HAMVENTION® ORIGINAL ANNOUNCEMENT

The Dayton Amateur Radio Association (DARA) regrets to inform our many vendors, visitors and stakeholders that, unfortunately, HARA has announced the closing of their facility. We have begun execution of our contingency plans to move Hamvention® 2017 to a new home.

DARA and Hamvention® have enjoyed many successful years working together with HARA Arena and we wish the Wampler family the best. DARA and Hamvention® have been working on a contingency plan in the event HARA would become unavailable. We have spent many hours over the last few years evaluating possible locations and have found one in the area we believe will be a great new home! Due to logistics and timing issues, we will make a formal announcement introducing our new partner. This information will be coming soon. We all believe this new venue will be a spectacular place to hold our beloved event. Please rest assured we will have the event on the same weekend and, since it will be in the region, the current accommodations and outside events already planned for Hamvention® 2017 should not be affected.

We look forward to your continued support as we move to a new future with The Dayton Hamvention®.
…Ron Cramer General Chairman Dayton Hamvention 2017

AND YET, MORE DETAIL

Good-Bye, Hara Arena! Dayton Hamvention Headed for Xenia in 2017. "X" marks the spot! After 52 years at Hara Arena and its entire 64-year history in the Greater Dayton area, Hamvention® announced on August 1 that it would relocate to the Greene County Fairgrounds in Xenia, Ohio. The new venue is about 16 miles east of downtown Dayton off US Route 35 and north of Xenia. On June 29, the Amateur Radio community was stunned to learn that Hara Arena would shut down at the end of August, leaving Hamvention homeless -- at least until this week's big reveal.

"We appreciate and value all the time and effort the many partners, in particular the Greene County Agricultural Society, the Greene County Board of Commissioners, and the Greene County Convention & Visitors Bureau, have put into helping Hamvention find the right venue to continue our long history here in the Miami Valley," Hamvention General Chair Ron Cramer, KD8ENJ, said on August 1. "We look forward to a long and mutually prosperous relationship."

Hamvention spokesperson Mike Kalter, W8CI, speaks at the August 1 announcement. [Courtesy Jeff Davis, KE9V]

Cramer has said that Hamvention spent "many hours over the last few years evaluating possible [new] locations," and he has assured visitors that their "current accommodations and outside events already planned for Hamvention 2017 should not be affected."

Hamvention chief spokesman and board member Mike Kalter, W8CI, made clear that the move to Xenia was not done in desperation. "Montgomery County didn't have anything for us," "We looked exhaustively."

"The key thing is that we plan to have a 5-star event," he said of Hamvention 2017. "We'll put a lot of time and energy into it."

The move to Xenia could prove to be a huge economic bonanza for the city and for Greene County. Hamvention attracts some 25,000 visitors each May. Its annual economic impact has been estimated at between $15 and $17 million to the Dayton/Montgomery County area, and some -- if not most -- of that benefit now could migrate eastward down US 35.

Kalter conceded that the new venue in Greene County is a slightly longer drive from downtown Dayton -- where some Hamvention-related events traditionally occur -- than it was to Hara Arena, but he believes it will be worth the trip. The James M. Cox International Airport in Dayton remains the closest for anyone flying in for the event, although the drive from the airport will be about twice as long for those deciding to stay in Xenia.

Preparations at the show's new venue in Xenia, Ohio, now are in full swing, two Hamvention officials explained this week on the *Amateur Radio Roundtable* webcast hosted by Tom Medlin, W5KUB. Hamvention announced on August 1 that it would relocate to the Greene County Fairgounds, after Hara Arena made it known that it would close at month's end. Hamvention 2017 General Chair Ron Cramer, KD8ENJ, and official spokesperson Mike Kalter, W8CI, fielded questions from Medlin and callers during the hour-long August 9 show. Cramer said some members of the Amateur Radio community entertain preconceived notions about the new venue that are "far off base," and he and Kalter wanted to set the record straight.

"Change is hard for everyone, but I think this is a very good move for us," Cramer said. "You will be very impressed." Kalter echoed the sentiment. "We want to start out great and get awesome," he said. Kalter said there's been a lot of second-guessing, but that "a lot of overriding factors" and a year-long search led to the selection of Greene County Fairgrounds.

Hamvention General Chair Ron Cramer, KD8ENJ (left), and Hamvention spokesperson Mike Kalter, W8CI, discussed Hamvention's new venue during the August 9 *Amateur Radio Roundtable* webcast. [Photo courtesy of Amateur Radio Roundtable]

Kalter assured those planning to attend Hamvention that Fairgrounds buildings -- particularly those used for showing livestock during the county fair -- are "absolutely clean" and well maintained. He and Cramer expressed confidence that everyone will find plenty of available parking and room for all traditional Hamvention activities -- more than may be evident at first glance. Vendors who have already visited the new site to get the lay of the land went away "excited," they said.

At this point, no hard-and-fast decisions have been made as to how Hamvention will put the available buildings and space to use next spring, but Cramer and Kalter said the Fairgrounds staff has been especially helpful. "We're all working together now to make this happen," Kalter said. He and Cramer made clear that Hamvention officials remain open to questions and suggestions.

Cramer quashed one misconception about Hara Arena. "Even though they had air conditioning," he said, "air conditioning was never used there. The doors were open, and they did not want to turn on the air conditioning unless the doors were closed. So, I don't think air conditioning was used at all -- at least in the last 10 years."

Some air conditioned space already available at the new venue may be suitable for such activities as forums, and the Fairgrounds is looking to upgrade existing ventilation systems in non-air conditioned buildings. "We're looking at the possibility of air conditioned 'chalets'" for forums, Kalter said.

Hamvention's new home: The Greene County Fairgrounds as seen from the sky.

The prime area under consideration for the popular outdoor flea market is inside the racetrack oval, they said, and additional adjacent space is available, if it's needed.

The venue will have wireless Internet coverage. "We've already moved some of the equipment out of Hara, and we think it will do a good job there," Cramer said. Kalter added that the Fairgrounds staff is working on upgrading the Internet "pipe" to the venue.

As for the admission price, "We're still working on that," Kalter said. "We have not made a decision. We may leave it at the same price or slightly more than that, but no great increase." Tickets this year were $20 in advance and $25 at the gate for all 3 days.

Cramer and Kalter said Hamvention anticipates being ready to start selling tickets and vendor spaces by November -- and perhaps earlier.

Kalter stressed that the sponsoring Dayton Amateur Radio Association (DARA) puts "an awful lot back into ham radio in donations," all raised entirely through Hamvention.

"We need your help. We need your support," Kalter said. "Hamvention needs to move on, and we intend to make it happen, with everybody's help."

ATCO NEWSLETTER RECEIVES AWARD

Newsletter Contest and the Allan Severson recipient announced at the Ohio Section Conference Saturday - August 6th - What a day it was, 2016 ARRL Ohio Section Newsletter Contest Winners. "Boy what a night...and it wasn't the RNC or the NAACP Convention...it was the 2016 ARRL Ohio Section Newsletter judging! INTENSE is not strong enough of a word to describe all of the action...but in the end we have winners." They are:

1st Place: The Mike & Key, Greater Cincinnati Amateur Radio Association, INC.

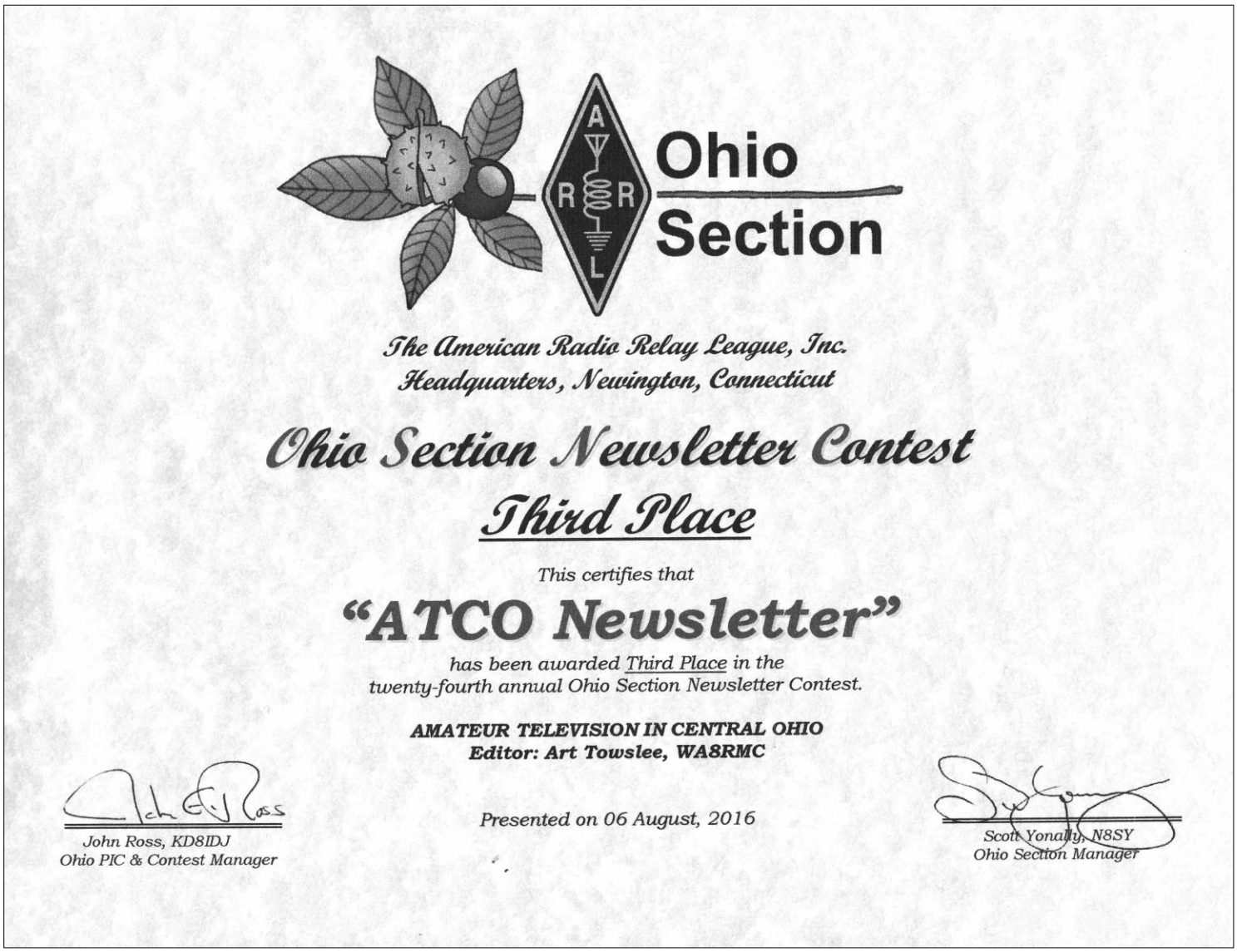
2nd Place: The RADIOGRAM, Portage County Amateur Radio Service

3rd Place (TIE): The Voice Coil, Mahoning Valley Amateur Radio Association & ATCO Newsletter, Amateur Television in Central Ohio

Honorable Mention (TIE): CARA COMMUNICATOR, Cambridge Amateur Radio Association &The Spirit of '76 and '88, Lake Erie Amateur Radio Association

Judges' comments:
"All of the newsletters are really winners. A great deal of time, effort and passion went into writing them". "Even without detailed examination...they keep getting better!" So, another contest year done and I am honored to have been a part of it. I can't think of anything than means more to me than seeing how alive and active amateur radio is and how its reputation keeps getting stronger.

Thanks to everyone that participated. Each one of you is a true winner!



RADIO SIGNAL STILL A MYSTERY

From MVUS microwave bulletin 9/12/16

Thirty-nine years ago, a loud radio signal was received by a radio telescope known as the Big Ear at The Ohio State University's Perkins Observatory. This signal did not originate from earth, but appeared to come from deep space. This mystery "Wow!" signal was recorded on August 15, 1977, and lasted 72 seconds.

The Big Ear was a huge antenna about the size of three football fields, designed and built by American physicist John D. Kraus (1910–2004), a professor at The Ohio State University. In 1973 the Big Ear radio telescope began searching space for radio signals that might come from extraterrestrial civilizations attempting to make contact with intelligent life elsewhere in the universe, and continued this search until 1995. This was part of the Search for Extraterrestrial Intelligence (SETI) project.

A 2012 National Geographic article stated "More than three decades later, the Wow Signal, as it has come to be known to SETI researchers, remains both the first and best potential evidence of communication from extraterrestrials, and one of the most perplexing mysteries in science."

On April 20, 2016, a Tech Times article headline read 'Wow!' Signal From Space Explained: Is It From Aliens Or Something Else?" Antonio Paris, an astronomy professor at St. Petersburg College in Florida and former analyst for the U.S. Department of Defense, offers a possible explanation to what may have created the Wow! Signal in 1977. The Tech Times article states: "In a study featured in the Journal of the Washington Academy of Sciences, Paris described how he was able to examine the area of space where the Wow! Signal likely came from. While he didn't find any alien species, he did come across two comets named 335P/Gibbs and 266P/Christensen, which could be the culprits behind the powerful radio blast detected by the OSU's Big Ear radio telescope."

An article in the Journal of the Washington Academy of Sciences, Winter 2016, further explains the possible source of the Wow! Signal: "Hydrogen Clouds from Comets 266/P Christensen and P/2008 Y2 (Gibbs) are Candidates for the Source of the 1977 "WOW" Signal". The article explains that comets are surrounded by a hydrogen cloud that may be over 100 million km in width. When the cloud approaches the sun, it gets larger and can emit electromagnetic radiation at a frequency of 1420.4 MHz. These comets were not discovered until after 2006, so were unknown when the Wow! Signal was recorded.

One of these two comets, Comet 266P/Christensen, will be in the same area of the "Wow" signal next year, on January 25, 2017. Radio astronomers worldwide will have their radio telescopes pointed toward the deep-space area of the Wow! Signal. Will they finally solve the Wow! Signal mystery? Stay tuned….

The feed horn from the Big Ear radio telescope is now part of the Voice of America Museum collection in West Chester, Oh. The West Chester Amateur Radio Association a division of the National Voice of America Museum of Broadcasting shares the museum building and operates station WC8VOA from the Voice of America building at 8070 Tylersville Rd., in West Chester OH. Most common amateur modes, including modern digital modes of operation, are used at their operating stations, including 10 GHz EME using a 7.2 meter dish.

References:

- The Wow! Signal - https://www.astronomyhouston.org/newsletters/guidestar/wow-signal-0
- About the Big Ear Radio Telescope - http://www.bigear.org/about.htm
- What Is The WOW! Signal - http://channel.nationalgeographic.com/chasing-ufos/articles/what-is-the-wow-signal/
- Journal of the Washington Academy of Sciences - This peer-reviewed Journal publishes original scientific research, critical reviews, historical articles, proceedings of scholarly meetings of its affiliated societies, reports of the Academy, and other items of interest.
- 'Wow!' Signal From Space Explained: Is It From Aliens Or Something Else? – http://www.techtimes.com/articles/151480/20160420/wow-signal-from-space-explained-is-it-from-aliens-or-something-else.htm#sthash.EwKJafel.dpuf
- Hydrogen Clouds from Comets 266/P Christensen and P/2008 Y2 (Gibbs) are Candidates for the Source of the 1977 "WOW" Signal http://planetary-science.org/wp-content/uploads/2016/01/Paris_Davies-H-I-Line-Signal.pdf
- West Chester Amateur Radio Association - http://wc8voa.org

…Joe Burke, WA8OGS

FAA RULES COULD AFFECT HAM RADIO ANTENNA STRUCTURES

07/20/2016

Yet-to-be-developed Federal Aviation Administration (**FAA**) rules stemming from the recent passage in Congress of **H.R. 636**, the FAA Reauthorization Act, could pose additional marking requirements for a small number of Amateur Radio towers. The bill instructs the FAA to enact rules similar to state-level statutes now in place that are aimed at improving aircraft safety in the vicinity of meteorological evaluation towers (METs) set up in rural areas. In the wake of fatal crop dusting aircraft collisions with METs, often erected on short notice, the National Transportation Safety Board (NTSB) recommended in 2013 that states enact laws — sometimes called "crop duster" statutes — requiring marking and registration of METs. While some state crop duster laws exempt ham radio towers, the federal legislation does not. ARRL General Counsel Chris Imlay, W3KD, said, however, that the list of exemptions in the federal legislation restricts application of the new rules to a very small subset of Amateur Radio towers.

"The FAA Reauthorization Act has very little application to Amateur Radio antennas. We will have a good opportunity to address the final FAA rules through the normal rulemaking process," Imlay said. "We'll be meeting soon with FAA officials to learn their intentions as well as to advance our own concerns to the agency. Uniform federal regulation is beneficial to hams, because it eliminates a patchwork of state statutes that can impose significant constraints on ham antennas in rural and agricultural areas."
The FAA Reauthorization Act gives the FAA 1 year to issue regulations requiring the marking of towers covered by the new legislation. Marking of towers covered by the legislation will be in the form of painting and lighting in accordance with current FAA guidelines.

The law covers towers that are "self-standing or supported by guy wires and ground anchors;" are 10 feet or less in diameter at the above-ground base, excluding concrete footings; are between 50 feet above ground level at the highest point and not more than 200 feet above ground level; have accessory facilities on which an antenna, sensor, camera, meteorological instrument, or other equipment is mounted, and are located outside the boundaries of an incorporated city or town or on land that is undeveloped or used for agricultural purposes.

Imlay said the law excludes towers erected adjacent to a house, barn, electric utility station, or other building, or within the curtilage (enclosed area occupied by a dwelling, grounds, and outbuildings) of a farmstead, among other exclusions. He said "undeveloped" land refers to a defined geographical area where the FAA determines that low-flying aircraft routinely operate, such as forested areas with predominant tree cover below 200 fee, and pasture and range land.

The FAA will develop a database containing the location and height of each covered tower, but Imlay noted that the database contents may only be disclosed for purposes involving aviation safety.

"We do not anticipate that a significant number of Amateur Radio antennas will be subject to these rules," Imlay said, "but we need to monitor the FAA rulemaking process carefully to head off requirements that could put the cost of installing and maintaining affected structures out of any reasonable reach."

COLORADO ATV REPEATER CATCHING UP WITH US????

The Boulder, Colorado repeater group is making progress toward adding digital to their analog ATV repeater. ATCO is also retaining our analog features as long as there are people that use it. That said, we now convert all digital signals to analog before re-converting back to digital in the transmitters because, at present, our transmitters only accept analog inputs. It would be better to keep all digital signals in the digital format throughout the signal chain to help preserve signal quality but that would require transmitters HiDes doesn't presently provide. In the near future I'll look closely at that feasibility.WA8RMC

The TV hams in Boulder, Colorado, USA have a new DTV/ATV repeater. We have had an analog TV repeater since 1993. It has been completely rebuilt to add DTV capability. It became operational in Sept. The repeater's output is on 70cm and can be either analog (VUSB-TV) or digital (DVB-T). Input is either on 23cm or 70cm. On 23cm, the input is either analog (FM-TV) or digital (DVB-T). On 70cm, the input is either analog (VUSB-TV) or digital (DVB-T). The repeater also offers a Beacon mode in which a continuously looping video slide show is transmitted, which is also used as the video ID trailer. Full details about the repeater and its coverage area are found in application notes, AN-31-34 on my web site: kh6htv
…73 & good DTV-DX de Jim Andrews, KH6HTV

*In addition, for more detail check out the article Jim wrote about their repeater in the Fall issue of ATVQ Magazine. "**Not an ATVQ subscriber**" you say? Then you're then missing out on the latest ATV developments. See the ATVQ ad later in this Newsletter. WA8RMC*

TV PROPAGATION

Jim Andrews, KH6HTV www.kh6htv.com (copyright October 2016 reproduced here by permission)

If you are ever wondering why your ATV signal doesn't make it to the repeater or why you can't receive the repeater signal the way you think you should, you really need to read and digest this article! Jim does a great job of presenting this very complex topic. I know many of you are not mathematicians or can't digest all of the subject matter but, read, digest and re-read to see the basics presented here and let the referenced computer programs do their work so you won't need to go back to school! WA8RMC.

I am often asked the question by other hams. "How far can a ham TV signal go?" My typical response is "Line-of-Sight". If you can see the other location, chances are good that you can get a TV signal to it. This has been borne out by many years of experience in ham TV. As opposed to very high power TV broadcast stations, hams are running low power (1 W to 100 W max.) and our signals just don't have the oomph to get much energy diffracted over and around path obstacles.

For line of sight propagation, there also becomes the question of "Where is the radio horizon?" If we lived on a flat earth, the answer would be infinity. Because we live on a spherical earth (radius = 6370 km), the curvature of the earth limits our horizon. It effectively puts a "hump" in the middle of our rf path. The line of sight horizon is set by pure geometry. Note this may not be your personal optical line of sight set by the resolution of your eyes, even using binoculars. The distance to the horizon is set by our observation height (or antenna height) above ground level. It is given by these equations:

Optical distance (km) $\approx$ 3.57 * $\sqrt{}$ height (m) - or - in miles $\approx$ 1.23 * $\sqrt{}$ height (ft)

The radio horizon is actually a bit further than the geometrical horizon. The refractive effects of the atmosphere cause a bit of bending in the radio waves and will push them typically about 15% further.

RF distance (km) $\approx$ 4.12 * $\sqrt{}$ height (m) RF distance (miles) $\approx$ 1.41 * $\sqrt{}$ height (ft)

However, these atmospheric effects are totally dependent upon local weather conditions. In extreme cases, strong ducting might occur sending our RF waves far beyond the predicted RF horizon, while severe local storms might drop it back dramatically.

A few quick examples are: 5' => 3.2 miles, 30' => 7.7 miles, 100' => 14 miles, 1000 ft => 45 miles. Adding antenna height at the receive site, we add the numbers for the two heights. For example transmitting from an automobile with an antenna height of 5 ft. to a remote base station with the antenna on a 30 ft. tower, the radio horizon = 3.2 + 7.7 $\approx$ 11 miles. This calculation really only works over flat earth. On a large lake or the ocean, we do have such a flat surface. Obviously, either putting up a higher tower or finding a high hill or mountain top works wonders. But of course, this is not news to us hams!

So after determining our radio horizon, the next issue to contend with is RF Path Loss. Path loss is the natural phenomena of radiating a certain amount of power but this power, again due to spherical geometry, gets spread equally over an ever expanding globe as it propagates away from the source. Thus the power density in watts/m^2 gets much smaller the further we get from the source. The formula for free space path loss based upon this geometry alone is:

Free Space RF Path Loss(dB) = 20 * log10 (f in MHz) + 20 *log10(D in Miles) + 36.6dB

Note in this equation the frequency dependency. For example, going from the 70cm to 23cm bands we suffer about a 10 dB hit in path loss. A few quick calculations will give you an appreciation of the importance of path loss. As an example, for the 70cm band (430 MHz) we get: 0.1 mile => 69dB, 1 mile => 89dB, 10 miles => 109dB, etc.

To determine the best case situation for a particular rf path we need to include all of the major rf components. Calculations are done easiest in dB with power levels expressed in dBm and antenna gains expressed in dBi. To determine the power input into the distant receiver, we need to know:

Rcvr Pwr(dBm) = Trans Pwr (dBm) - Trans Cable Loss (dB) + Trans Ant Gain (dBi) -RF Path Loss (dB) + Rcvr Ant Gain (dBi) - Rcvr Cable Loss (dB)

For example, using this calculator, let's enter the parameters of a typical 70cm ham TV station:

Transmitter Power = 5 watts (+37dBm) Cable Loss = 1dB each end
Yagi Antenna Gain = 11dBi each end
Desired Receiver Power = -65dBm (40 dB s/n, P5 for VUSB-TV)

The calculator gives the answer of 43 miles for pure, unobstructed, free space, line of sight path. The theoretical results really only apply for outer space applications. In the real terrestrial world, we encounter a lot of other obstacles and we would never achieve this

ideal. In the fall of 2011 and again recently in Sept. 2016, several Boulder area TV hams ran TV propagation field trials. See Application Notes, AN-3 [2] and AN-32 [3] for details. We made measurements of the actual received signal strength in dBm. One observation that stood out was "Over very clear, line-of-sight paths, even with directional antennas, where multi-path was not a major issue, the actual path loss was typically 5 to 15 dB worse than the calculated, theoretical path loss." For obstructed paths, even more loss was typically encountered. Thus the likelihood of us ever experiencing just free space path loss is extremely rare.

OBSTACLES to RF PROPAGATION: The above equations were for ideal, unobstructed, line of sight situations. What can limit us in the real world? Lots of things including: ground reflections, vegetation, tall buildings, urban building clutter, hills, ridge lines, mountains, etc. The absorption by vegetation, due to water content, goes up with increasing frequency. I noticed a significant difference in the signal strength hitting our local TV repeater between summer and winter. When the leaves were gone from the trees between my former QTH and the repeater, my signal strength at the repeater, especially on 23cm significantly improved. Getting over obstructions to our line of sight path involves diffraction which can introduce considerable extra dB loss. Most of the rest of the losses result from Multi-Path. These are reflected waves from other objects which arrive at the receive site later in time and can cause standing wave patterns in the receive signal which at certain frequencies might totally null out the desired direct path signal. Another perturbing effect can be "Doppler" shift due to moving objects disturbing the various multi-paths.

A pure, free space, channel is called a "Gaussian". If there is a direct line-of-sight path with multi-path signals arriving at the receive antenna also, then this is called a "Ricean" channel. If there is no direct line-of-sight path, but multi-path signals arrive at the receive antenna, this is then called a "Rayleigh" channel.

RF PATH PREDICTIONS: Pioneering radio propagation research was done right here in Boulder, Colorado in the late 50s and 1960s at the USA Govt., National Bureau of Standards, Central Radio Propagation Labs (CRPL) [4]. By 1968, a computer program was available for making predictions of rf path performance based upon this research [5]. This pioneering work was led by Phillip Rice and A.G. Longley. It is now today, universally referred to as the Longley-Rice propagation model. It is also sometimes referred to as the ITM model, or Irregular Terrain Model. The model works for frequencies above 20MHz, i.e. VHF and higher. It does not include HF, over-the-horizon, ionospheric effects. The model contains a lot of statistical estimates for the many variables, including diffraction and scattering from topography, urban clutter, vegetation clutter, atmospheric changes, etc. The results are not an absolute, guaranteed value, but a statistical estimate.

COMPUTER PROGRAMS: There are several computer programs presently available which use the Longley-Rice model [6]. They include: *CRC-COVWEB, Radio Mobile, SPLAT!, QRadioPredict, and Pathloss*. Most of these are programs must be installed on your computer along with a massive topographical data base. *CRC-COVWEB* and *Radio Mobile* provide on-line calculator versions and use Google Earth maps. [7, 8]. The author's only experience is with these two on-line calculators. My personal preference is now *Radio Mobile-Online*. It has much better spatial resolution than *COVWEB* and also provides in addition to coverage maps, a detailed point-to-point rf path profile analysis. The remainder of this app. note will be devoted to using *Radio Mobile-Online.*

Radio Mobile Online: This program was written and copyrighted by Rodger Coudé, VE2DBE. The on-line version is dedicated to amateur radio use and as such will only accept input frequencies in the amateur radio bands. The mathematical model is a mix of the Longley-Rice model, the two rays method, and the land cover path loss estimation. To demonstrate this program, the coverage area of the new, Boulder, Colorado DTV/ATV Repeater transmitter will be used [9]. Comparing *Radio Mobile's* point-to-point predictions with the results from actual, mobile, field measurements has shown excellent agreement. The TV repeater coverage maps also correlate well with the field measurements [10].

Input Parameters: ***Radio Mobile*** requires one to input to the on-line program, all of the following parameters: *(note the values listed are those used for the Boulder TV repeater*) Tx Ant Height (10.7m = 35ft); Tx Ant Type (cardiod); Tx Ant Azimuth (67^{o}); Tx Ant Tilt (0^{o}); Tx Ant Gain (11.2dBi); Tx line loss (1dB); Tx Frequency (423MHz); Tx Power (4 Watts); Rx Ant Height (1.5m - for mobile); Rx Ant Gain (2.2dBi - for mobile); Rx line loss (1.1dB); Rx threshold (5.6μV = -92dBm, adjustable as desired); Required Reliability (70% - default); Strong Signal Margin (10dB - default, adjustable as desired); Strong Signal map Color (light green - default); Weak Signal map Color (light yellow - default), Opacity (50% - default); Max. Range (choices are - 10, 25, 50, 150, 200, 250 & 300km); Resolution {choices are low (601x601), med (1001x1001) or high (1668x1668 pixels)} & selection of using either or both "land cover" and/or two rays modeling (I used both).

Receiver Sensitivity: The value used for sensitivity is strongly dependent upon the receiver bandwidth and type of modulation used. The receiver noise floor is set by the laws of physics and is a function of the receiver noise temperature. The noise power is given by: Pn = K*T*BW, where K is Boltzman's constant (1.38 x 10^{-23} J/^{o}K), T is absolute temperature in Kelvin, and BW is the receiver bandwidth in Hz. For typical bandwidths, at 290^{o}K (room temp.), the results are: (CW) 300 Hz => -149dBm, SSB 2.4kHz => -140dBm, FM (15 kHz) => -132dBm, Broadcast FM (200kHz) => -121dBm, TV (6 MHz) => -106dBm. The noise figure of a receiver then adds additional noise. Just from these numbers alone, it is seen that the coverage area of a TV repeater vs. an FM voice repeater with similar output powers and antennas will be dramatically different.

Lab measurements on TV receivers using various modulation methods typically gave sensitivities in the -90 to -100dBm range [11-12]. However, for all analog receivers, signals at these levels result in extremely poor, P1 to P2 images [13]. For digital TV receivers,

with the digital cliff effect, it is either a perfect P5 image or none at all. The cliff effect width is typically about 1dB, with pixelization and/or freeze frames occurring at threshold. Typical receiver sensitivities are listed in Table I below. Adding a low noise, pre-amplifier typically improves these values by about 3 to 6dB.

Table 1 - TV Receiver Sensitivities

Modulation	P1	P2	P3	P4	P5
VUSB-TV	-94dBm	-88dBm	-80dBm	-74dBm	-60dBm
FM-TV	-100dBm	-95dBm	-93dBm	-89dBm	-84dBm
DVB-T QPSK	na	na	na	na	-95dBm
DVB-T 16QAM	na	na	na	na	-90dBm
DVB-T 64QAM	na	na	na	na	-82dBm

For the Sept. 2016, mobile field survey [3] of the new Boulder DTV repeater in the DVB-T QPSK mode, I never was able to receive any pictures with receiver signal strengths less than -92dBm. This was while using a low noise pre-amp in front of the DVB-T receiver. Thus, for the calculation of repeater coverage maps, the threshold was set to -92dBm.

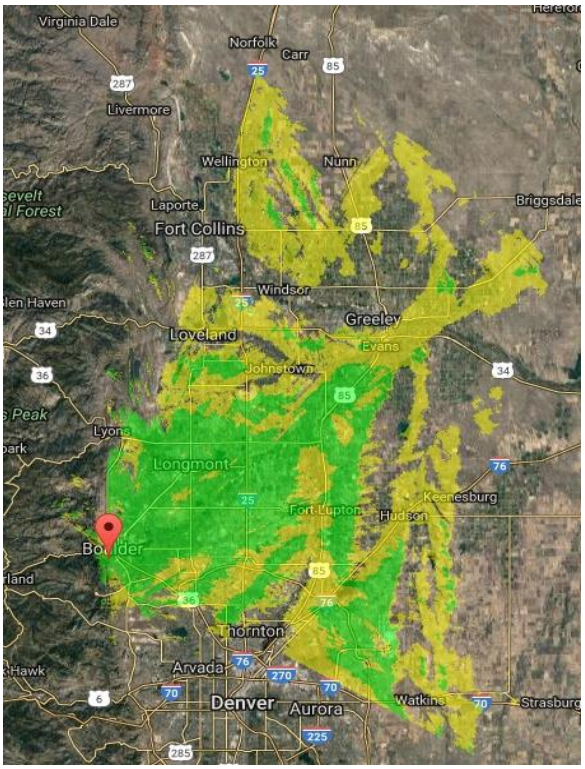


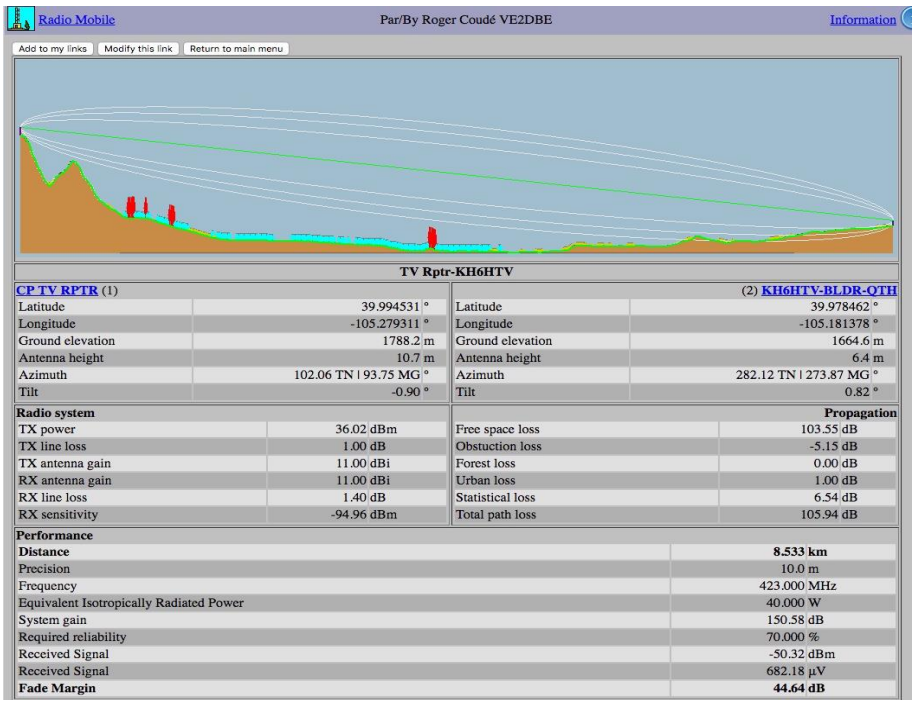
Fig. 1 Boulder, Colorado TV repeater maximum coverage area with an excellent receiving antenna, 11dBi yagi at 30 ft -- Yellow = >-92dBm, Green = >-82dBm, 100km radius, resolution = 200m/pixel. The red tear-drop indicates the location of the transmitter.

RF COVERAGE MAPS: *Radio Mobile* can generate very detailed maps showing the coverage area of a transmitter, Fig. 1. The on-line version of the program only allows one to plot two different rf levels. The master program which needs to run on your own computer is capable of plotting a rainbow of colors denoting many different rf levels. The computed results are overlaid onto a Google Earth map or aerial photo. *Radio Mobile* generates these maps by performing a point-to-point path profile analysis for each and every pixel within the designated max. radius. The pixel resolution in meters is dependent upon the selected resolution (low, med. or high) and max. radius in km.

The furthest distance for a -92dBm contour predicted was about 100km (60 miles), primarily to the north-north-east, extending a bit beyond Ft. Collins and Greeley. The farthest distance confirmed by the Sept. 2016 mobile field survey was 34 miles south-east to the Denver International Airport. More detailed repeater coverage maps are found in AN-34 [10].

POINT-TO-POINT PATH PROFILE: Radio Mobile can also generate a single point-to-point profile and display the actual path, along with a tabulation of the results. The transmitter and receiver locations are spotted precisely using an interactive Google Earth map or aerial photo in which the map location and magnification are controlled by the mouse. When the cursor is located at precisely the correct latitude and longitude, the mouse is clicked and the location stored in memory. Figs. 2-8 show some typical examples calculated for the Boulder TV repeater to various locations.

The first test run to verify the accuracy of the ***Radio Mobile*** program was to calculate the signal strength received from the Boulder TV repeater at my own QTH which was 5.3 miles distant. I input my particular receive antenna parameters into the p-t-p program along with the repeater parameters and the computed results are shown in Fig. 2. I use a KLM, 70cm, 6 element yagi (11dBi) at 25ft.(6.4m) with 47ft. of 3/8" hardline coax (1.4dB loss). I have a good line-of-sight path to the repeater, as verified by *Radio Mobile*. Fig. 2 plots both the intermediate terrain and obstacles, and also gives a table listing all the input data, plus the results of various computations.


Radio Mobile — Par/By Roger Coudé VE2DBE — Information

Add to my links | Modify this link | Return to main menu

TV Rptr-KH6HTV

CP TV RPTR (1)		(2) KH6HTV-BLDR-QTH	
Latitude	39.994531 °	Latitude	39.978462 °
Longitude	-105.279311 °	Longitude	-105.181378 °
Ground elevation	1788.2 m	Ground elevation	1664.6 m
Antenna height	10.7 m	Antenna height	6.4 m
Azimuth	102.06 TN | 93.75 MG °	Azimuth	282.12 TN | 273.87 MG °
Tilt	-0.90 °	Tilt	0.82 °

Radio system		Propagation	
TX power	36.02 dBm	Free space loss	103.55 dB
TX line loss	1.00 dB	Obstuction loss	-5.15 dB
TX antenna gain	11.00 dBi	Forest loss	0.00 dB
RX antenna gain	11.00 dBi	Urban loss	1.00 dB
RX line loss	1.40 dB	Statistical loss	6.54 dB
RX sensitivity	-94.96 dBm	Total path loss	105.94 dB

Performance	
Distance	**8.533 km**
Precision	10.0 m
Frequency	423.000 MHz
Equivalent Isotropically Radiated Power	40.000 W
System gain	150.58 dB
Required reliability	70.000 %
Received Signal	-50.32 dBm
Received Signal	682.18 µV
Fade Margin	**44.64 dB**

Fig. 2 *Radio Mobile* - Path Profile prediction for TV Repeater to KH6HTV-QTH.

Direct line-of-sight, 5.3 mile path between transmitter and receiver. The transmitter is always plotted on the left and the receiver is always plotted on the right side. The green trace is the direct ray. Note: 1st, 2nd& 3rd Fresnel zone ellipsoids (white lines) and intermediate path obstructions are shown.

The DVB-T/QPSK DTV signal from the TV repeater received in the KH6HTV ham shack was received with a low noise preamp (18.5dB gain, < 1dB NF), 4:1 splitter (-7dB loss) and a Hi-Des model HV-120A DVB-T receiver and also simultaneously a Rigol DSA-815 Spectrum Analyzer. The on-screen-display (OSD) of the HV-120A measured (with suitable offset, correction factor of -14dB) the input signal strength to be -40dBm. The OSD also showed a perfect s/n of 23dB. Correcting for the preamp/splitter gain, the actual measured input power was thus -51.5dBm. This compares very favorably, within about 1dB, with the -50.3dBm predicted by ***Radio Mobile***, see Fig. 2.

As further verification, the incoming repeater DVB-T signal was also displayed and measured on a Rigol DSA-815, see Fig. 3 below. The analyzer settings were as recommended by the EU-ITU [14]. Due to the wideband (6MHz BW) nature of the DVB-T signal and the narrow resolution bandwidth of the analyzer (30kHz), a correction factor of +22dB must be applied to the signal levels displayed. The actual received signal does not have the transmitted flat spectrum but instead shows evidence of some multi-path distortion. The highest level seen is about -75dBm. With the correction factor of +22dB, the received signal level is thus about -53dBm which is still in excellent agreement with both the HV-120A measurement (-51.5dBm) and the ***Radio Mobile*** prediction (-50.3dBm).

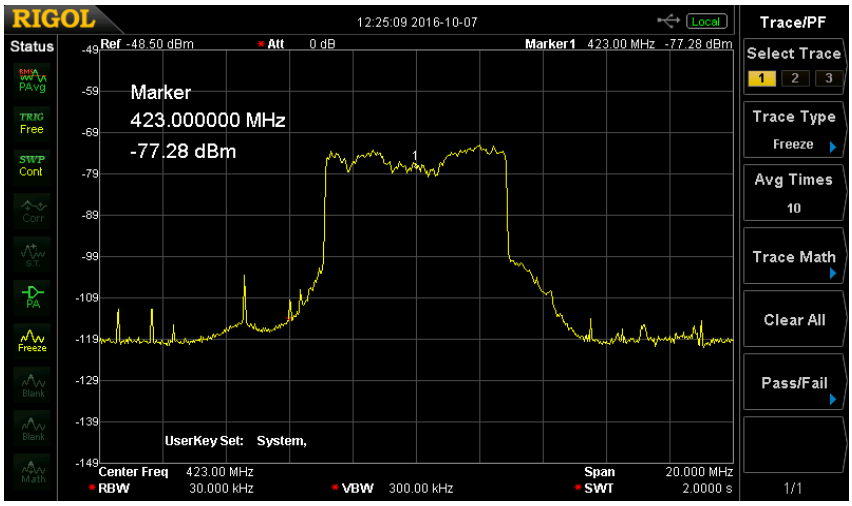


Fig. 3 TV Repeater signal received at KH6HTV QTH as displayed on the Rigol DSA-815 spectrum analyzer. Spikes seen outside the 6 MHz channel (420-426MHz) are other narrow-band signals. Non-flat spectrum is due to some multi-path distortion.

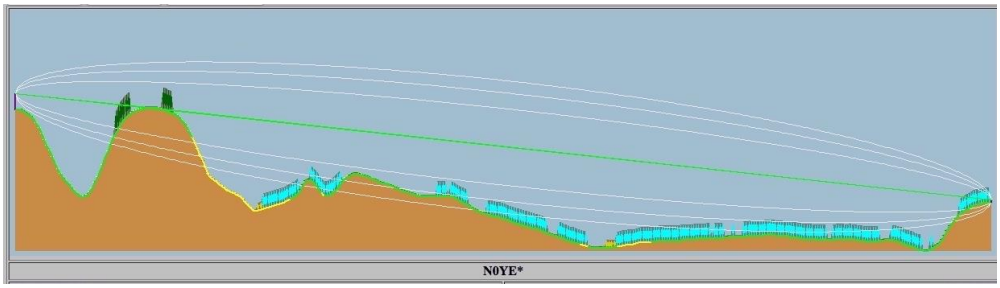


Fig. 4 TV repeater to N0YE --- this is an example of the direct, 2.3 mile path making a grazing pass over an intermediate obstruction. Also note the presence of forested areas on this ridge line (dark green trees). Also noted is urban clutter represented by the small turquoise colored cubes down in the valley and also at the receive site. Pr = -70.7dBm (calculated) & -70dBm (measured).

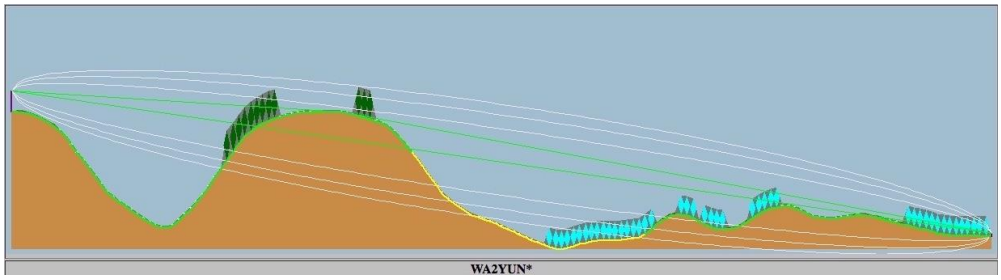


Fig. 5 TV repeater to WA2YUN -- this is an example of an obstructed, short, 1 mile path in which a signal can still be received via diffraction. Pr = -85.9dBm (predicted) & -81dBm (measured)

Fig. 6 TV repeater to K0HEH -- this is an example of the direct, 1.6 mile path being obstructed by tall buildings on the Univ. of Colorado campus. They are indicated by the bright red structures. In this case reception was possible due to diffraction in the first Fresnel zone. Pr = -53.7dBm (predicted)

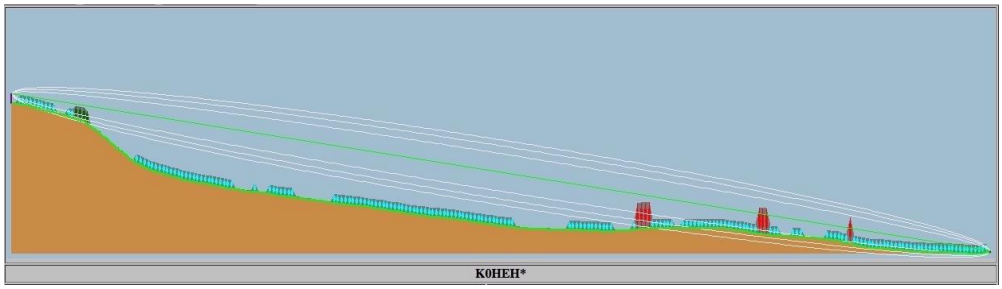
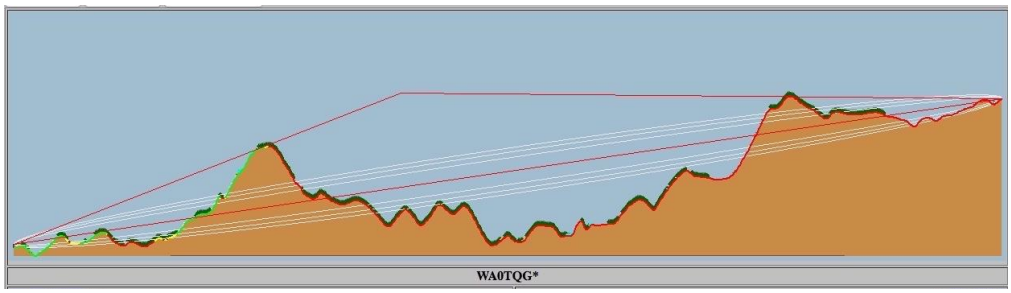


Fig. 7 TV repeater to W0QN -- this is an example of an obstructed, 8.2 mile path in which the received signal is within ±3dB of receiver sensitivity threshold. This is indicated by the direct rays being plotted in yellow. Pr = -89.3dBm (predicted) & -92dBm (measured)

Fig. 8 TV repeater to WA0TQG -- This is an example of an impossible, 6.2 mile path over tall mountains. Transmitter on left at 5,900ft. Receiver on right at 7,400ft. When the direct rays are plotted in red, it indicates the signal strength is below threshold by more than -3dB. Pr = -130dBm (predicted)



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Note: KH6HTV Video Application Notes are available for free download as .pdf files from the web site: www.kh6htv.com

2016 DATV QSO PARTY

ATVers from Australia, USA and other countries were geared up for this year's World Digital QSO Party. Hosted by Peter Cossins VK3BFG, the event kicked off at 8pm (AEST) on Friday August 30.

It started with the Australian stations in the Melbourn area via the VK3RTV repeater on 446.5 MHz DVB-T mode and also to the world via the BATC website. Mick Ampt VK3CH showed his portable ATV set-up and members of Melbourne's EMDRC showed off their new DATV facility. The VK4RKC Brisbane DATV repeater was then relayed via an anchor to VK3RTV and the world via the BATC site. A few stations used Skype calls to Peter VK3BFG and he patched them in to VK3RTV. On Saturday August 31 (AEST) morning and afternoon will link up with ATCO and the W6ATN Southern California network and W7ATN Arizona via the local anchor Don Hill KE6BXT. All US stations worked through the California & Arizona ATV networks (ATN-CA & ATN-AZ) and Amateur Television Central Ohio (ATCO) directly or Skype to one of the anchors. Don KE6BXT was the anchor for ATN-CA and ATN-AZ and Art WA6RMC for ATCO. Art connected first to stream the Columbus Ohio area stations to Peter VK3BFG for distribution through VK3RTV followed by Don KE6BXT for the western USA. The event truly brings together those who are actively involved or have an interest in the ATV visual medium.
…73, Don KE6BXT

The ATCO involvement this year was met with mixed success. First, I couldn't receive the U Tube video stream from Peter. He then told me the stream didn't work and to tune to a different stream. That worked but I missed much of the audio due to network issues. Then I had audio issues with my streaming to him. I couldn't figure out why I could hear him but he couldn't hear me. After some fiddling I discovered the audio cable to my computer was tangled in my chair leg and partially pulled out. By the time I got my end fixed and Peter got his end running smoothly, most people here left. Oh well, there is always next year! That's why they call it ***Amateur*** *Television.*
…Art WA8RMC

70cm DATV DVB-T Tx FILTER USING CHEAP CHINESE DUPLEXER

With the recent topic on amplifiers, there is mention of output filters. A friend mentioned using a duplexer as a filter rather than the more conventional interdigital filter. I tuned a cheap Chinese duplexer to give what would seem to be a reasonable response for a 7 MHz signal on 70cm in Australia.

Introduction

DATV transmitters for DVB-T are notorious for "spread" outside the channel, to the point that keeping it 30 dB or more below the signal becomes a limit for power output, typically 10 W out of a 70 W module amplifier.

Even with -30 dB spread, it is desirable to have a band-pass filter before further amplification or transmission. Usually an interdigital filter is used, but they are either expensive to buy or a bit difficult to build.

VK4JVC suggested using a cavity filter duplexer instead. I tried a four cavity notch duplexer, but the pass-band losses were too high, more than 20 dB. I had bought a cheap, ~A$100, Chinese *Jiesai* duplexer, but had put it aside as the response looked bad. After try other duplexers (notch and pass-reject types), I tried the Chinese one again, this time successfully.

The result is that the Chinese filter seems to provide a good pass-band for the 7 MHz DVB-T DATV signal with acceptable pass-band losses and steep skirts. The next test is to try it with my 10 W amplifier from Darko in Austria.

The filter

The duplexer is a typical mobile device available on eBay for about A$100 delivered, taking a week or so to Australia. The store insisted I supply some tuning data, even though I was immediately going to change it. I specified 440.5 and 446.5 MHz to keep them happy. It came with notches at those frequencies, but had not been well tuned.

The filter has three square cavities for each of RX and TX. The only adjustment is a screw at the top that capacitively alters the cavity's resonate frequency. There are no other adjustments. Each cavity has an cable in and out, but they seem to be notch filters rather than pass-band.

I am not sure what the power handling capacity is, 25 W, from memory. That would make it an adequate final TX filter for most DATV applications.

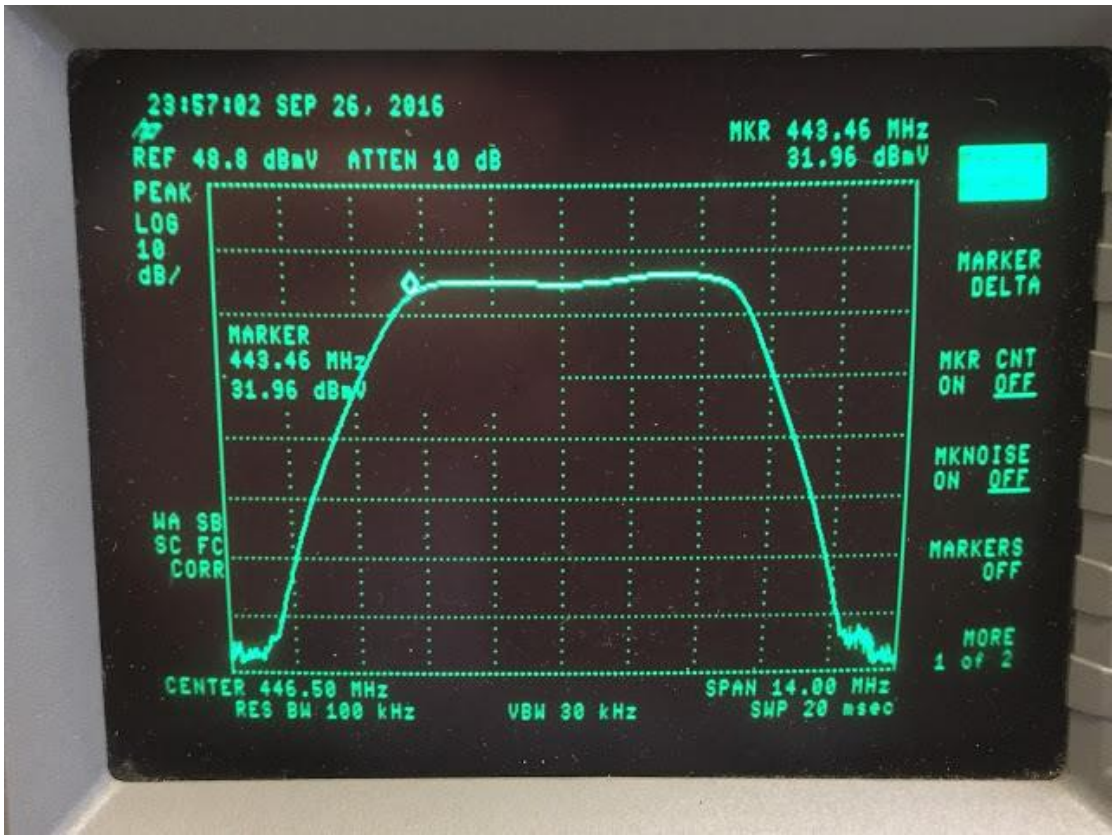
Tuning

The Australian 70 cm DATV band is 7 MHz wide centered on 446.5 MHz, with edges at 443 and 450 MHz. I use the whole 7 MHz as it makes reception on conventional TVs easier and I want high quality 1080p.

Using a HP 8591A spectrum analyzer and tracking generator, re-tuning is quite easy. Three cavities at a time first (RX-ANT, TX-ANT), then checking all six with the input and output through the RX and TX connectors, ignoring the antenna connector.

I have tuned the cavities to about -3 dB at the channel edges. The loss through all six cavities is about 2 dB which indicates quite reasonable construction. The side slopes are quite steep.

I am not sure this tune will be adequate to suppress the channel spread, but I will re-tune to find an acceptable compromise. I may need to narrow the width, but without affecting the TX signal.



Conclusions:

A cheap Chinese duplexer has been re-tuned to produce what appears to be an acceptable TX band-pass filter for a 7 MHz wide channel on 70 cm. Despite their reputation, the Chinese duplexer seems to be of reasonable quality and has typical characteristics for this type of device. The original tuning was indifferent, so should always be checked.
…Drew VK4ZXI

That duplexer looks like a notch type. You want a true band pass filter, it needs to be flat across your band pass 6 or 7 MHz depending on the country you live in's band plan. Celwave used to make a band pass pre-selection filter that looked like that filter but with just two connectors. Those pre-selection filters were usually 4 or 5 MHz wide not 6 or 7 MHz. Also most were not designed to go lower than 450 MHz. There are designs for building your own or you can purchase a DCI combline or KH6HTV Interdigital filter designed just for use as a channel or mask filter.
…Mike WA6SVT

In my last post I described a cheap Chinese duplexer re-tuned as 70 cm DATV DVB-T 7 MHz TX filter. The duplexer uses notch cavity filters, six in all. The notch filters have a much sharper edge, compared to a band-pass filter. The sharp notch seems suited to the vertical edges of a DVB-T signal. I initially checked the signal source, a HiDes camera with direct DVB-T output at 1080P. I was a little surprised at the spread, but the filter cleaned it up well. This would indicate the need for a filter before the main power amplifier. I pressed on with just one filter and tried it at the output of the amplifier, a 10 W device, from Darko OE7DBH, using a RA60H4047M1 60 W module. Even with the indifferent input, the filter was able to reduce the spread to -60 dB and give a clean 10 W output. The notch duplexer/filter seems to overcome some of the major hurdles with DVB-T amplifiers and warrants further investigation.
… Drew VK4ZXI

DVB-S / DVB-S2 COMPARISONS

Last week (10/8/16) Charles G4GUO, Noel G8GTZ and I conducted some on-air comparisons of H264 DVB-S and DVB-S2 at various settings. We used a near line of sight 44 km path between Worthing and Portsdown Hill in the UK, reducing the 437 MHz signal power until the receivers ceased to display moving pictures. Power was reduced in 1 dB steps, and there was at least 1 db atmospheric variation during the test period, so the results below are indicative, not absolute!

We tested DVB-S2 with and without Pilot symbols enabled and could not demonstrate a reproducible difference. We were unable to test 333KS DVB-S2 due to equipment problems on the day. I used both MiniTioune (0.5 beta) and a commercial satellite receiver. The results were similar where both receivers were capable of receiving the transmitted mode.

Mode Relative Level Required (dB)

DVB-S QPSK 1/2 FEC 2 MS 0
DVB-S QPSK 7/8 FEC 2 MS +2

DVB-S2 QPSK 1/2 FEC 2 MS -3
DVB-S2 QPSK 8/9 FEC 2 MS +1
DVB-S2 QPSK 1/4 FEC 2 MS -7

DVB-S QPSK 1/2 FEC 333 KS -9
DVB-S QPSK 7/8 FEC 333 KS -6

I drew the following conclusions (but note my caveat about experimental errors!):

1. At 1/2 FEC 2 MS, DVB-S2 needs 3 dB less power than DVB-S
2. For DVB-S 333KS or 2 MS: going from 1/2 to 7/8 needs 2-3 dB more power
3. For DVB-S2 2 MS: going from 1/2 to 9/8 needs 4 dB more power
4. For DVB-S2 2 MS: going from 1/2 to 1/4 needs 4 dB less power
5. DVB-S2 Pilot symbols made no reproducible difference at 2 MS

My draft recommendations based on this one set of tests:

1. Use 2 MS DVB-S2 H264 QPSK 1/2 FEC as the default DATV mode where possible
2. Use 2 MS DVB-S2 H264 QPSK 1/4 FEC if RX available
3. Use 333KS DVB-S H264 QPSK 1/2 FEC as default RB-TV mode
4. Test 333KS DVB-S2 H264 QPSK 7/8 FEC next time
5. Conduct further tests with pilot symbols

More to follow
Dave G8GKQ

Jean-Pierre responds:
Hello Dave,
You have very interesting results, but I do not completely agree:
As, using DVB-S with narrow band we have only a few places for the video, I think that we cannot compare these setups:

DVB-S QPSK FEC ½ symbol rate 333KS and DVB-S QPSK FEC 7/8 symbol rate 333KS. As with FEC ½, you loose half the space for the video. If we continue your way an FEC of 9/10 (if it existed) would have a better result but no place for the video.

I will compare instead:
DVB-S QPSK SR333 FEC ½ and DVB-S QPSK SR190 FEC 7/8.
In this case, for both transmissions, you have about the same space for Video/Audio So for DX, I will try these 2 setups that will transport the same TS, and do the comparison.

So, the question is more to choose between SR333 FEC1/2 and SR190 fec7/8 that are similar in their ES content. DVB-S2 at SR333 down to SR125 cannot be answered as you have not yet tested these setups.

Comparing DVB-S and DVB-S2, my first tests give something similar to you, using SR 2MS, but my results are different at SR250 or SR125: Comparing to DVB-S, I have not the same gain using DVB-S2. (I could say not gain at all) but I have not done the DVB-S2

tests on the air, only at home, using a low level modulator (DektecDTA107-S2) and attenuators and a MiniTiouner with a Sharp NIM. And the Minitioune software is well optimized for low SR - DVB-S mode, but DVB-S2 version is just born, so I have not spent much time for optimization.

To be continued....So we continue our tests. But very interesting to do. Thank you for sharing your results.
73

Dave responds to Jean-Pierre:

Thanks for your reply.
I agree with what you say - I was not comparing like with like. My recommendations were aimed at getting a standard definition amateur picture through on the worst path - not looking at broadcast-style pictures with more motion. I'll do some tests soon with DVB-S2 at low SR and publish the results. Looking forward to any further optimization that might be possible in MiniTioune!

It's all a learning experience...
…Dave G8GKQ

DIGITAL DESIGN COMPETITION WINNER

(Hint: This could be the next DATV-Express board)

We're delighted to announce that Charles Brain is the winner of the LimeSDR digital design competition with a proposal to build an FPGA-based RF channel simulator.

Channel simulators are invaluable tools for RF system designers and, like many such tools, they unfortunately come with a typically high price tag attached. Charles, G4GUO, will be known to many fellow radio amateurs for his work on projects such as DATV-Express, the digital amateur TV project. A veteran designer of advanced communications systems, Charles' competition entry was driven by his own needs and of the project he says:

Currently there are a number of open-source channel simulators available but these tend to be PC based and only implement a narrowband model suitable for HF channel simulation

I am proposing a Wideband model suitable for testing modern wideband modes such as DVB-S2, LTE etc. To achieve the bandwidth the model would have to run on the FPGA. The proposal would be to allow the following parameters of the model to be changed.

- Frequency offset of the signal (both stationary and moving).
- Up to 6 time delayed paths using either the FPGA registers or on board DRAM.
- Each path would allow an independent fading model (standard or user defined).
- Gaussian noise generators for Signal to Noise testing.
- Continuous wave carrier interference.
- Support of 2 RF channel inputs and 1 output.
- Support of 1 RF channel input and 2 outputs (side by side modem testing).

The above model would be implemented using a combination of NCO (numerically controlled oscillators), complex mixers and adders in the FPGA. The analogue sections of the LMS7002M would be used to set the precise signal level of the input waveform before it enters the model.

Future enhancements may include

- Doppler spreading of the signal.
- Ability to input a PC generated waveform via the USB3 interface to add another baseband channel, this could be used to measure for example the interference between WiFi and LTE-U operating in the same band or on an adjacent band. The waveform could be generated by GNURadio.
- Fractional re-sampling of the input waveform to test modem tracking of symbol timing errors.

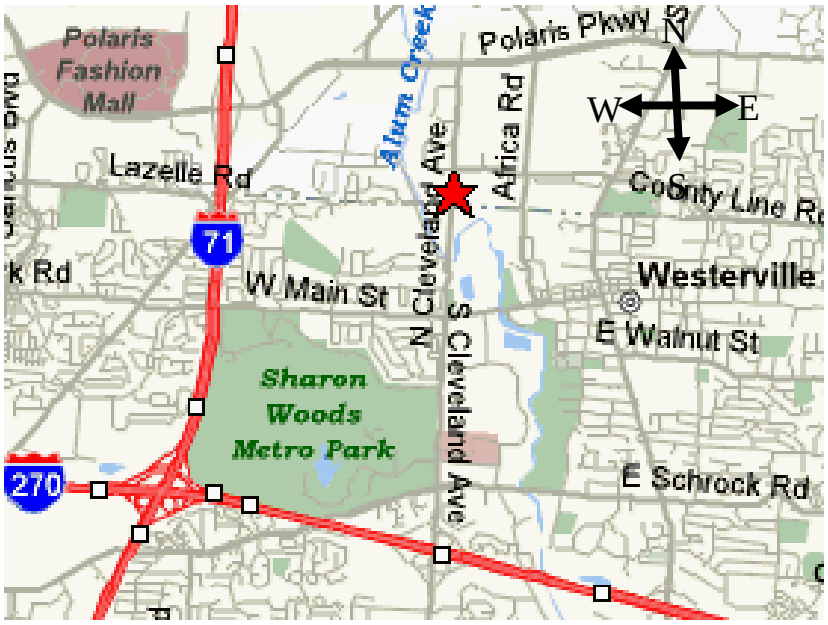
A great entry, I'm sure you will agree, and a fantastic example of how LimeSDR can be put to use in accelerating wireless innovation and making it accessible to many more people!
… Andrew Back 6th October, 2016 limesdr

ATCO

2016 FALL EVENT
12:30 PM Lunch/meeting
Sunday October 30, 2016
ABB PROCESS AUTOMATION
CAFETERIA
579 EXECUTIVE CAMPUS DRIVE
FOR MORE DETAILS, CONTACT
ART - WA8RMC 891-9273

LUNCH PROVIDED - DOOR PRIZES -
BRING A FRIEND AND SEE OLD BUDDIES
MINI HAMFEST - SHOW AND TELL

DIRECTIONS TO THE ATCO FALL EVENT



From I-70 WEST Bound:
Take I-270 Northbound around and turning to the west to Cleveland Ave. Exit north onto Cleveland Ave and travel north about 2 miles to Executive Campus drive. (It's the next street past Westar Crossing Street). Turn left (west) to the ABB building at the end of the street.

From I-70 EAST Bound:
Take I-270 Northbound around and turning to the east past SR 315 and past I-71. Get off on the Cleveland Ave second exit and travel north (to Westerville). Continue north on Cleveland past Schrock Road and then past Main Street. Continue north about ½ mile past Main Street to Executive Campus Drive. (It's the next street past Westar Crossing Street). Turn left (west) to the ABB building at the end of the street

From I-71 NORTH bound toward Columbus:
Drive through Columbus on I-71 to I-270 on the north side. Take I-270 east to the first exit, Cleveland Ave. Get off the Cleveland Ave second exit and travel north (to Westerville). Continue north past Schrock Road and then past Main street. Continue north about ½ mile past Main Street to Executive Campus Drive. (It's the next street past Westar Crossing Street) Turn left (west) to the ABB building at the end of the street.

From I-71 traveling SOUTH bound toward Columbus (North of I-270):
Exit the Polaris Ave exit and travel east about 1 mile to Cleveland Ave. Turn right on Cleveland Ave to Executive Campus Drive. Turn right again on Executive Campus Drive. ABB is on the right side of the street about half way around the semi-circle.

Digital Amateur TeleVision
Exciter/Transmitter

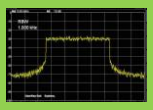
Now available from

DATV-Express

- A more affordable DATV exciter can now be ordered
- Fully assembled and tested PCBA
- DVB-S protocol for DATV (using QPSK modulation)
- Can operate all ham bands from 70 MHz-to-2450 MHz
- RF output level up to 10 dBm (min) all bands (DVB-S)
- Software Defined Radio (SDR) architecture allows many variations of IQ modulations
- "Software-Defined" allows new features to be added over the next few years, without changing the hardware board
- Symbol Rates from 100K to 8000K Symb/sec allows RB-DATV
- Requires PC running Windows or Ubuntu linux (see User Guide)
- Price is US$300 + shipping – order using PayPal

For more details and ordering
www.DATV-Express.com

register on the web site
to be able to see
the PURCHASE page



Amateur Television Quarterly

Great articles on :
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ATV PROJECTS
Antenna Design for ATV
SSTV
ATV ACTIVITIES
Digital ATV
ATV On The internet
WorldWide ATV Coverage

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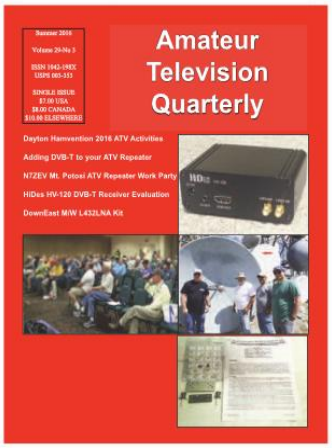

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NEW MEMBER(S)

Let's welcome the new members to our group! If any of you know anyone who might be interested, let one of us know so we can flood them with information. New members are our group's lifeblood so it's important we aggressively recruit new faces.

Troy Bonte, AC8XP Westerville
Garry Cotter N8CXI Columbus (Garry re-joined us)

CONSTRUCTION ARTICLE INDEX

The following list is an index of all construction related material that has appeared in the ATCO Newsletter since its inception in the early '80's. This is a handy reference for that particular construction article that you knew existed but didn't want to wade through each issue to find it. All Newsletters below are also listed in order in the ATCO homepage under "Newsletters".CTRL Click on www.atco.tv. Once you locate the Newsletter section, the displayed list can then be re-sorted as needed by clicking on the "date" in the header.

…Bob N8OCQ

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Vol 1 I		(Missing Newsletter)
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Vol 2 I	4	439 Beam
Vol 2 II	8,9	439 Parabolic Ant
Vol 2 II	9	Video Modulator
Vol 2 III	7	1296 Ant 45 Ele loop yagi
Vol 2 III	10	RF Power Indicator (in-line) for 1296 MHZ
Vol 2 SE	2,3	Diode Multiplier for 23 CM
Vol 2 SE	4,5	1296 MHZ 10 Watt Solid State Linear Amp
Vol 4 I	3	RF/Video Line Sampler
Vol 4 II	3	P-Unit Meter
Vol 4 II	7,10,11	UHF Gated Noise Source
Vol 4 II	12	420 – 450 Broom Handle Rhombic Ant
Vol 4 III	4,8	25 Element 1.26 Loop Yagi
Vol 4 IIII	6	Video Modulator (Tube Type)
Vol 5 I	3	Video Modulator One Transistor
Vol 5 II	4,7	900 MHZ Yagi Ant
Vol 5 II	6	Video Modulator for 2C39 Final
Vol 5 III	3	440 MHZ Hidden Transmitter Finder
Vol 6 I	3	Video Line Amp
Vol 6 I	8	25 Ele 910 MHz Loop Yagi
Vol 6 II	4,6,7	Microwave Oven ATV Xmiter
Vol 6 II	5	Matching a Quad Driven Ele
Vol 6 II	8	Power Divider for 33CM
Vol 9 IIII	5,7	16 Ele Loop Yagi for 439.25 MHz
Vol 10		No Articles
Vol 11 II	4,5,6	439 48 Ele Collinear Ant
Vol 11 IIII	7	1280 MHZ Cavity Filter
Vol 12 I	6,7,8	439 & 1200 Horz Polarized Mobile Ant
Vol 12 II	5,6,7	ATV Line Sampler
Vol 12 II	10	439 & 1280 Interdigital Filter(s)
Vol 12 III	6,7,8	439 Cheap Attic Ant
Vol 13 I	9, 10	High Level Modulator for ATV
Vol 13 II	5	VGA to NTSC Converter for Computer
Vol 13 III	9, 10	AM Video Modulator
Vol 13 IIII	4	1200 MHZ Transistor Linear Amp
Vol 13 IIII	6	900 & 1200 MHz Loop Yagis
Vol 14 IIII	8	439 31 EleYagi
Vol 14 IIII	12, 13	1250 MHZ FM ATV 3 Watt Xmiter
Vol 15 I	16	427.25 Horz J-Pole Ant
Vol 15 II	14	2400 MHZ Loop Yagi
Vol 15 III	8	Wavecom Modification
Vol 15 III	12,13,14	2.4 Gig Antenna's
Vol 16 II	20	2.4 Gig Helix Ant
Vol 16 IIII	4	1280 MHZ Loop Yagi
Vol 17 I	14, 15	Video Amp (Multi Output)
Vol 18		No Articles
Vol 19 IIII	4	Pwr Supply for 28 Volt Ant Relay
Vol 20 III	9, 10	Video Sampler
Vol 21 I	4	RF Pwr Amp for 900/1200 MHZ
Vol 21 II	14	10-14 Volt Doubler for 28 Volt Ant Relays
Vol 21 III	5	S-Video To Composite Adaptor
Vol 21 IIII	3,4	Video Noise Rejection Amp
Vol 21 IIII	14,15,16,17	"S" Meter For Comtech Boards
Vol 22 I		No Articles
Vol 22 II	10	1260 MHZ Cavity Filter
Vol 22 III		No Articles
Vol 22 IIII		No Articles
Vol 23 I		No Articles
Vol 23 II	5,6	Linear 60 Watt For 70CM
Vol 23 II	8,9	Video Modulator Update
Vol 23 III		No Articles
Vol 23 IIII		No Articles
Vol 24 I	13	RF Sniffer For 2.4 GIG
Vol 24 II		No Articles
Vol 24 III	3	Quantum 1500 Rec Tuner Mod
Vol 24 IIII	9	Battery Recharge Ckt
Vol 25 I		No Articles
Vol 25 II	6,7	Comtech TX Module Improvement
Vol 25 III	11	Comtech TX Module Improvement Correction
Vol 26 I	6	Isolator (Circulator) Mod. 850 To 1260 MHz
Vol 26 II	5,6	Comtech 1200 MHz rec. module improvements
Vol 26 III		No Articles
Vol 26 IIII	9	Remote Touch Tone Decoder For Your Shack
Vol 27 I	10	ATV Low Pass Filter (427 Mhz)
Vol 27 II	15	PictureTel Camera Data Cable Wiring
Vol 27 II	10	ATV Low Pass Filter (427 Mhz)
Vol 27 II	15	PictureTel Camera Data Cable Wiring
Vol 27 III		No articles
Vol 27 IIII		No articles
Vol 28 I	11	Super 1280 MHz amplifier
Vol 28 II		No articles
Vol 28 III		No articles
Vol 28 IIII		WB8LGA Antenna switching system
Vol 29 I		No articles
Vol 29 II		1280 MHz Hi Gain Panel Antenna
Vol 29 III		No articles
Vol 29 IIII		No articles
Vol 30 I		No articles
Vol 30 II		No articles
Vol 30 III		No articles
Vol 30 IIII		No articles
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Vol 32 II	7	DVB-T power amplifiers
Vol 32 III		No articles
Vol 32 IIII		No articles
Vol 33 I		No articles
Vol 33 II		No articles
Vol 33 III	12	Power strip controller
Vol 33 IIII		No articles

This is the complete list for construction articles shown in past ATCO newsletters. The page numbers listed may not match the actual page in the Newsletter. They are the numbers shown in the PDF file. Some early issues are missing. Art did not have a copy of every year. This list is complete through Volume 33 II.

…Bob N8OCQ

LOCAL HAMFEST SCHEDULE

This section is reserved for upcoming Hamfests. They are limited to Ohio and vicinity easily accessible in one day. Anyone aware of an event incorrectly or not listed here; notify me so it can be corrected. This list will be amended, as further information becomes available. To see additional details for each Hamfest, Control Click on the blue title and the magic of the Internet will give you the details complete with a map! To search the ARRL Hamfest database for more details, CTL click ARRLWeb: Hamfest and Convention Calendar …WA8RMC.

10/23/2016 | Massillon ARC Hamfest
Location: Massillon, OH
Type: ARRL Hamfest
Sponsor: Massillon Amateur Radio Club
Website: http://www.w8np.org

11/05/2016 | GARC Hamfest
Location: Georgetown, OH
Type: ARRL Hamfest
Sponsor: Grant Amateur Radio Club

04/08/2017 | CFARC 63rd Annual Hamfest
Location: Cuyahoga Falls, OH
Type: ARRL Hamfest
Sponsor: Cuyahoga Falls Amateur Radio Club
Website: http://www.cfarc.org/hamfest.php

05/19/2017 | 2017 Dayton Hamvention
Location: Xenia, OH
Type: non-ARRL Hamfest
Sponsor: Dayton Amateur Radio Association
Website: http://www.hamvention.org

11/12/2016 | Indiana State Convention (Fort Wayne Hamfest & Computer Expo)
Location: Fort Wayne, IN
Type: ARRL Convention
Sponsor: Allen County Amateur Radio Technical Society
Website: http://www.fortwaynehamfest.com

12/03/2016 | Fulton County Winter Fest
Location: Delta, OH
Type: ARRL Hamfest
Sponsor: Fulton County Amateur Radio Club
Website: http://k8bxq.org/hamfest

01/15/2017 | Sunday Creek Amateur Radio Federation Hamfest
Location: Nelsonville, OH
Type: ARRL Hamfest
Sponsor: Sunday Creek Amateur Radio Federation
Website: http://www.scarfarc.com

03/19/17 TMRA Toledo Hamfest
Location: Perrysburg, Ohio
Type: ARRL Hamfest
Sponsor: Toledo Mobile Radio Association
Website: http://www.tmrahamradio.org/hamfest.php

TUESDAY NITE NET ON 147.48 MHz SIMPLEX

Every Tuesday night @ 9:00PM WA8RMC hosts a net for the purpose of ATV topic discussion. There is no need to belong to the club to participate, only a genuine interest in ATV. All are invited. For those who check in, the general rules are as follows: Out-of-town and video check-ins have priority. A list of available check-ins is taken first then a roundtable discussion is hosted by WA8RMC. After all participants have been heard, WA8RMC will give status and news if any followed by late check-in requests or comments. We usually chat for about ½ hour so please join us locally or via internet at www.BATC.tv then ATV repeaters thenWR8ATV.

ATCO TREASURER'S REPORT - de N8NT

OPENING BALANCE (07/20/16)….	$ 1664.64
RECEIPTS(dues)….	$ 20.00
PayPal fee……	$ (*)
CLOSING BALANCE (10/20/16)……	$ *

*(*Bob, N8NT is on vacation. Complete report next time)*

ATCO REPEATER TECHNICAL DATA SUMMARY

Location: Downtown Columbus, Ohio
Coordinates: 82 degrees 59 minutes 53 seconds (longitude) 39 degrees 57 minutes 45 seconds (latitude)
Elevation: 630 feet above the average street level (1460 feet above sea level)

TV Transmitters: 423.00 MHz DVB-T, 10 W cont, FEC=7/8, Guard=1/32, Const=QPSK, FFT=2K, BW=2MHz, PMT=4095, PCR=256, Video=256, audio=257
427.25 MHz Analog VSB AM, 50 watts average 100 watts sync tip (Analog TV on cable channel 58)
1258 MHz 40 watts FM analog
1268 MHz DVB-S QPSK 20W continuous. SR=3.125MS, FEC=3/4, PMT=32,Video=162,Teletext=304,PCR=133,Audio=88,Service =5004)
2395 MHz Mesh Net transceiver 600mw output (channel 1 -2). ID is WR8ATV-2
10.350 GHz: 1 watt continuous analog FM

Link transmitter: 446.350 MHz: 5 watts NBFM 5 kHz audio. This input is used for control signals.

Identification: 423, 427, 1258, 1268 MHz, 10.350 GHz xmitters video ID every 10 min. with active video and information bulletin board every 30 minutes.
423 MHz digital, 1268 MHz digital & 10.350 GHz analog - Continuous transmission of ATCO & WR8ATV with no input signal present.

Transmit antennas: 423.00 MHz – 8 element Lindsay horizontally polarized 6dBd gain "omni"
427.25 MHz - Dual slot horizontally polarized 7 dBd gain "omni" major lobe east/west, 5dBd gain north/south
1258 MHz - Diamond vertically polarized 12 dBd gain omni
1268 MHz - Diamond vertically polarized 12 dBd gain omni
2395 MHz - Comet Model GP24 vertically polarized 12 dBd gain omni (Used for experimental Mesh Net operation)
10.350 GHz - Commercial 40 slot waveguide slot horizontally polarized 16 dBd gain omni

Receivers: 147.480 MHz - F1 audio input with touch tone control. (Input here = output on 446.350)
438.000 MHz - DVB-T QPSK, 2K BW. Receiver will auto configure for FEC's and PID's. (Input here = output on all TV transmitters)
439.250 MHz - A5 NTSC video with FM subcarrier audio, **lower sideband**. (Input here = output on all TV transmitters)
449.975 MHz - F1 audio input aux touch tone control. 131.8 Hz PL tone. (Input here = output on 446.350).
1288.00 MHz - F5 video analog NTSC. (Input here = output on all TV transmitters)
1288.00 MHz - DVB-S QPSK digital SR=4.167Msps, FEC=7/8. PIDs: PMT=133, PCR=33, Video=33, Audio=49 (Input here feeds all TV transmitters and also goes directly to 1268 MHz DVB-S digital output channel 2.)
2398.00 MHz - F5 video analog NTSC. (Input here = output on all TV transmitters)
10.450 GHz - F5 video analog NTSC. (Input here = output on all TV transmitters)

Receive antennas: 147.480 MHz - Vert. polar. Diamond 6dBd dual band (Shared with 446.350 MHz link output transmitter)
438.00/439.250 MHz - Horizontally polarized dual slot 7 dBd gain major lobe west (Shared with 438 & 439 receivers)
1288.00 MHz - Diamond vertically polarized 12 dBd gain omni (shared with analog and DVB-S receivers)
2395.00 MHz - Comet Model GP24 vertically polarized 12 dBd gain omni (Used for experimental Mesh Net operation)
10.450 GHz - Commercial 40 slot waveguide horizontally polarized 16 dBd gain omni

Auto mode Input control:	Touch Tone	Result (if third digit is * function turns ON, if it is # function turns OFF)
	00*	turn transmitters **on** (enter manual mode-keeps transmitters on till 00# sequence is pressed)
	00#	turn transmitters **off** (exit manual mode and return to auto scan mode)
	264	Select Channel 4 Doppler radar. (Stays on for 5 minutes) Select # to shut down before timeout.
	004	Select 10.450 GHz receiver. **(Always exit by selecting 001)**
	003	Select room camera **(Always exit by selecting 001)**
	002	Select roof camera. Select room cam first then 002 for roof cam. (**Always exit by selecting 001**)
	001	Select 2398 MHz receiver then 00# for auto scan to continue

Manual mode Functions:		
	00* then 1 for Ch. 1	Select 439.25analog /438digital receiver (if video present on digital, it is selected. Otherwise analog)
	00* then 2 for Ch. 2	Select 1280 digital receiver
	00* then 3 for Ch. 3	Select 1280 analog receiver
	00* then 4 for Ch. 4	Select 2398 receiver
	00* then 5 for Ch. 5	Select video ID (17 identification screens)
	01* or 01#	Channel 1 439.25 MHz scan enable (hit 01* to scan this channel & 01# to disable it)
	02* or 02#	Channel 2 1288 MHz digital receiver scan enable
	03* or 03#	Channel 3 1288 MHz analog receiver scan enable
	04* or 04#	Channel 4 2398 MHz scan enable
	A1* or A1#	Manual mode select for 439.25 receiver audio
	A2* or A2#	Manual mode select for 1288 digital receiver audio
	A3* or A3#	Manual mode select for 1288 analog receiver audio
	A4* or A4#	Manual mode select for 2398 receiver audio
	C0* or C0#	Beacon mode – transmit ID for twenty seconds every ten minutes
	C1* or C1#	C1* to turn off 438 MHz DVB-T Tx, C1# to enable it (Must be in manual mode to enable this function).
	C2* or C2#	C2* to turn off 423 MHz DVB-T Rx, C2# to enable it (Must be in manual mode to enable this function).

Note: The DVB-T Tx and Rx units can lock up when they lose video or see bad video. When this happens, power must be cycled. To do this select C1* or C2* to turn off power. A few seconds later select C1# or C2# whichever appropriate to restore power to selected unit. Wait about 15 to 30 seconds to see restored operation. (Example: To reset the DVB-T receiver enter C2*,wait a few seconds then C2#)

ATCO MEMBERS as of October 2016

Call	Name	Address	City	St	Zip	Phone
KD8ACU	Robert Vieth	3180 North Star Rd	Upper Arlington	OH	43221	614-457-9511
AH2AR	Dave Pelaez	1348 Leaf Tree Lane	Vandalia	OH	45377	937-264-9812
W8ARE	Larry Meredith III	6070 Langton Circle	Westerville	OH	43082-8964	
NN8B	Don Kemp	6384 Camp Blvd.	Hanoverton	OH	44423	
VK3BFG	Peter Cossins					
N9BNN	Michael Glass	6836 N. Caldwell Rd	Lebanon	IN	46052	
WB8CJW	Dale Elshoff	8904 Winoak Pl	Powell	OH	43065	614-210-0551
N8COO	C Mark Cring	2844 Sussex Place Dr.	Grove City	OH	43123	614-836-2521
N8CXI	Garry Cotter	2367 Northglen Drive	Columbus	OH	43224	
N3DC	William Thompson	6327 Kilmer St	Cheverly	MD	20785	301-772-7382
K8DMR	Ron Fredricks	8900 Stonepoint Ct	Jennison	MI	49428-8641	
W8DMR	Bill Parker	2738 Florbunda Dr	Columbus	OH	43209	
WA8DNI	John Busic	2700 Bixby Road	Groveport	OH	43125	614-491-8198
K8DW	Dave Wagner	2045 Maginnis Rd	Oregon	OH	42616	419-691-1625
WB8DZW	Roger McEldowney	5420 Madison St	Hilliard	OH	43026	614-405-1710
KB8EMD	Larry Baker	4330 Chippewa Trail	Jamestown	OH	45335-1210	
KC8EVR	Lester Broadie	108 N Burgess	Columbus	OH	43204	
N8FRT	Tom Flanagan	6156 Jolliff St.	Galloway	OH	43119	
W8FZ	Fred Stutske	8737 Ashford Lane	Pickerington	OH	43147	
WA8HFK,KC8HIP	Frank & Pat Amore	P.O. Box 2252	Helendale	CA	92342	614-777-4621
WA8HNS	Mike Gray	5029 St Rt 41 NW	Washington Ct Hs	OH	43160-8740	740-335-5133
WB2IIR	Michael Anthony	370 Georgia Drive	Brick	NJ	08723	
K8KDR,KC8NKB	Matt & Nancy Gilbert	5167 Drumcliff Ct.	Columbus	OH	43221-5207	614-771-7259
W8KHP	Allan Vinegar	2043 Treetop Lane	Hebron	Ky	41048	
WA8KKN	Chuck Wood	5322 Spruce Lane	Westerville	OH	3082-9005	614-523-3494
WA8KQQ	Dale Waymire	225 Riffle Ave	Greenville	OH	45331	937-548-2492
N8LRG	Phillip Humphries	30856 Coshocton Road	Walhonding	OH	43843	614-3543744
W8MA	Phil Morrison	154 Llewellyn Ave	Westerville	OH	43081	
KA8MFD	Ross McCoy	227 S Boundary St PO Box 9	Edison	OH	43320	
KA8MID	Bill Dean	2630 Green Ridge Rd	Peebles	OH	45660	
N8NT	Bob Tournoux	3569 Oarlock Ct	Hilliard	OH	43026	614-876-2127
W8NX, KA8LTG	John & Linda Beal	5001 State Rt. 37 East	Delaware	OH	43015	740-369-5856
WU8O	Tom Walter	15704 St Rt 161 West	Plain City	OH	43064	614-733-0722
N0OBG	Jim Conley	33 Meadowbrook C C Est	Ballwin	MO	63011	
W6ORG,WB6YSS	Tom, Maryann O'Hara	2522 Paxson Lane	Arcadia	CA	91007-8537	626-447-4565
N8OCQ	Bob Hodge Sr.	3750 Dort Place	Columbus	OH	43227-2022	
KC8QJR	Adam Burley	931 West High Street	Mount Vernon	OH	43050	
KE8PN	James Easley	1507 Michigan Ave	Columbus	OH	43201	614-421-1492
WA8RMC	Art Towslee	438 Maplebrooke Dr W	Westerville	OH	43082	614-891-9273
W8RUT,N8KCB	Ken & Chris Morris	2895 Sunbury Rd	Galina	OH	43021	
KB8RVI	David Jenkins	1941 Red Forest Lane	Galloway	OH	43119	614-853-0679
W8RWR	Bob Rector	135 S. Algonquin Ave	Columbus	OH	43204-1904	614-276-1689
W8RXX, KA8IWB	John & Laura Perone	3477 Africa Road	Galena	OH	43021	614-579-0522
WA6RZW	Ed Mersich	34401 Columbine Trl West	Elizabeth	CO	80107	
KB8SSH	Mike Cotts	3424 Homecroft Dr	Columbus	OH	43224	614-371-7380
WA6SVT	Mike Collis	PO Box 1594	Crestline	CA	92325	
KD8TIZ	Bob Holden	5161 Goose Lane Rd	Alexandria	OH	43001-9730	614-562-8441
K8TPY, K8FRB	Jeff & Dianna Patton	3886 Agler Road	Columbus	OH	43219	
NR8TV	Dave Kibler	243 Dwyer Rd	Greenfield	OH	45123	937-981-1392
W8URI	William Heiden	5898 Township Rd #103	Mount Gilead	OH	43338	419-947-1121
KB8UWI	Milton McFarland	115 N. Walnut St.	New Castle	PA	16101	
WA8UZP,KD8YYP	James & Anna Reed	818 Northwest Blvd	Columbus	OH	43212	614-297-1328
KC8WRI	Tom Bloomer	PO Box 595	Grove City	OH	43123	
AA8XA	Stan Diggs	2825 Southridge Dr	Columbus	OH	43224-3011	
AC8XP	Troy Bonte	5210 Smothers Road	Westerville	OH	43081	
KB8YMQ	Jay Caldwell	4740 Timmons Dr	Plain City	OH	43064	
KC8YPD	Joe Ebright	3497 Ontario St	Columbus	OH	43224	
WB8YTZ	Joe Coffman	233 S. Hamilton Rd	Gahanna	OH	43230-3347	
N8YZ	DaveTkach	2063 Torchwood Loop S	Columbus	OH	43229	614-882-0771
KA8ZNY,N8OOY	Tom & Cheryl Taft	386 Cherry Street	Groveport	OH	43125	614-202-9042
W8ZCF	Ferrel Winder	6686 Hitching Post Ln.	Cincinnati	OH	45230	
N8ZM	Tom Holmes	1055 Wilderness Bluff	Tipp City	OH	45371	

ATCO MEMBERSHIP INFORMATION

Membership in ATCO (Amateur Television in Central Ohio) is open to any licensed radio amateur who has an interest in amateur television. The annual dues are $10 per person payable on January 1 of each year. Additional members within an immediate family and at the same address are included at no extra cost.

ATCO publishes this Newsletter quarterly in January, April, July, and October. It is sent to each member without additional cost. All Newsletters are sent via Email unless the member does not have an internet connection.

The membership period is from January 1ST to December 31ST. New members joining before August will receive all ATCO Newsletters published during the current year prior to the date they join ATCO. For example, a new member joining in June will receive the January and April issues in addition to the July and October issues. For those joining after August 1ST, can elect to receive a complementary October issue with the membership commencing the following year or get the previous (3) Newsletters. Your support of ATCO is welcomed and encouraged.

Membership expiration notices will be sent out in January in lieu of Newsletters for those with an expired membership.

NOTE: Dues records on your individual portion of the ATCO website are listed as the date money is received and shows due one year from that date. The actual expiration is on January of the following year to keep the dues clock consistent with the beginning of each year.

ATCO MEMBERSHIP APPLICATION

RENEWAL ○ NEW MEMBER ○ DATE _____
CALL _____
OK TO PUBLISH PHONE # IN NEWSLETTER YES ○ NO ○
HOME PHONE _____
NAME_____
INTERNET Email ADDRESS_____
ADDRESS _____
CITY _____ STATE _____ ZIP _____-_____
FCC LICENSED OPERATORS IN THE IMMEDIATE FAMILY
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COMMENTS_____
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ANNUAL DUES PAYMENT OF $10.00 ENCLOSED CHECK ○ MONEY ORDER ○

Make check payable to ATCO or Bob Tournoux & mail to: Bob Tournoux N8NT 3569 Oarlock CT Hilliard, Ohio 43026. Or, if you prefer, pay dues via the Internet with your credit card. Go to www.atco.tv and fill out the "pay ATCO dues" section. Alternately, you can use the ATCO web site www.atco.tv/PayDues.aspx directly. Credit card payment is made through "PayPal" but you DO NOT need to join PayPal to send your dues. Simply DO NOT fill out the password details and there will be no "PayPal" involvement.

ATCO CLUB OFFICERS

President: Art Towslee WA8RMC
V. President: Ken Morris W8RUT
Treasurer: Bob Tournoux N8NT
Secretary: Mark Cring N8COO
Corporate trustees: Same as officers

Repeater trustees: Art Towslee WA8RMC
Ken Morris W8RUT
Dale Elshoff WB8CJW
Statutory agent: Tom Bloomer KC8WRI
Newsletter editor: Art Towslee WA8RMC

ATCO Newsletter
c/o Art Towslee -WA8RMC
438 Maplebrooke Dr. W
Westerville, Ohio 43082

FIRST CLASS MAIL

REMEMBER...CLUB DUES ARE NEEDED.
CHECK THE
MEMBERS PAGE OF ATCO WEBSITE FOR THE EXPIRATION DATE.
SEND N8NT A CHECK OR USE PAYPAL IF EXPIRED.