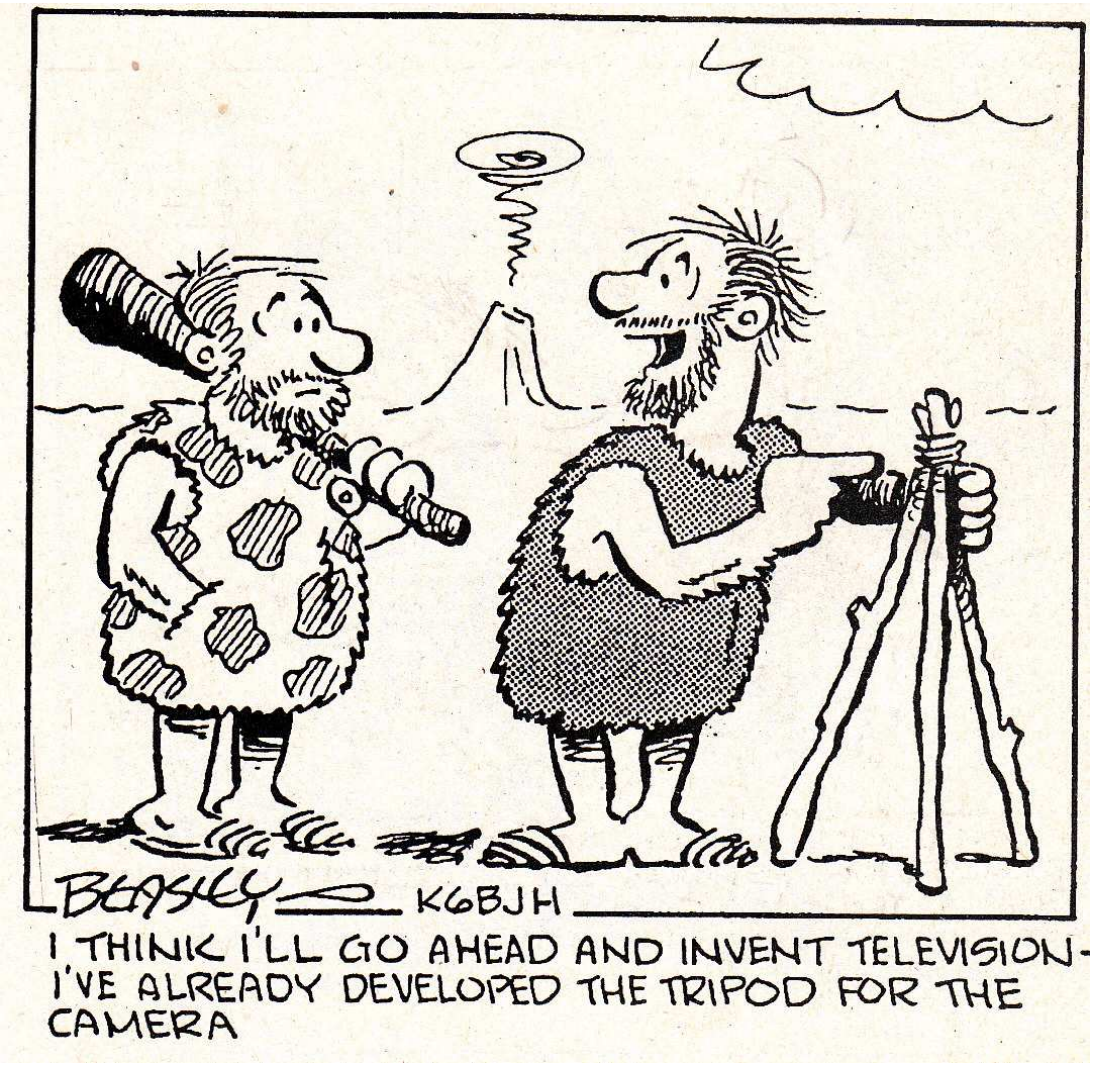
ATCO NEWSLETTER

VOLUME 31 NUMBER 4 **October 2014**

The ATCO newsletter is the official publication of a group of amateur television operators known as "AMATEUR TELEVISION IN CENTRAL OHIO Group Inc" and is published quarterly (January, April, July, and October)

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

Well, here we are again! I just finished cutting the lawn (the last time?????) and raked the leaves. As I was doing this, I looked at my antenna/tower and thought about the work that needs to be done on those. The whole summer has gone by and I still have not completed my automatic tower winch I'm designing and re-locate some of the antennas." Priority" is the key word and I haven't given either of those the attention they deserve. OK, too much about me. Let's get on to the ATV stuff.

The repeater seems to be working fine. (I shouldn't have said that) but not much activity has taken place. I said some time ago that the repeater 427 and 439 slot antennas need repair as the plastic radomes have come completely off now. They still work ok but should be repaired. It's a two man job so if no one volunteers, they'll have to stay that way for a while. I have been thinking that since I have a Lindsay antenna here in the basement that needs repair, I might just find time to repair it during the winter and replace one of the repeater slot antennas with it in the spring. We'll see.

A new addition to the repeater is a DATV DVB-T 423MHz transmitter and Lindsay horizontally polarized antenna. Dale did the main work and I did some packaging. It's in place and now operating. We initially had problems with lock-ups but after a few trips to the repeater to power cycle it we added a remote power reset function. HiDes also did a few software enhancements to improve the reliability but every now and then it locks up again. The cause is unknown but since it has always worked for weeks at Dale's place but "burps" after a couple of days at the repeater, I suspect stray RF issues. I put the unit in a semi RF tight enclosure but who knows for sure.

We also added a DVB-T receiver operating on 438MHz. It too has problems with lock ups. When it locks up it keeps the last valid image so it gives the impression there is live video there. I suspect that sometime soon I'll need to retrieve it and do some more bench testing. HiDes is also working to improve the software. Since they're the only manufacturer of an acceptable receiver, we must live with the problems for a while. For those wanting to experiment sending and receiving DATV signals to/from the repeater, here are the details:
Repeater transmit: 423MHz, ½ FEC, 4MHz bandwidth, horizontally polarized antenna.
Repeater receive: 438MHz, ½ FEC, 4MHz bandwidth, horizontally polarized antenna.
We welcome any signal reports. I know WB8LGA and W8URI receive the transmit signals on a regular basis.

Don't forget the Fall Event coming up this Sunday. The details are in this issue. We need more attendees as the attendance has been falling off steadily in the last couple of years. This time we'll have a new dual band hand held radio as a separate door prize. I've heard that some who already have a hand held may defer to someone who doesn't so the odds of getting one could be significant. If you have been on the fence about attending, join us. It just could be your day.

I've been thinking of activities to increase interest in our group. I'd like to have a contest of some kind and am seeking suggestions. We've had a "name the antenna" and "messy Hamshack" contest before so I'd like to hear about something new. Possible candidates could be:

- Build an artwork from Ham Radio parts
- Best cartoon
- Hints/ Kinks
- Most interesting Ham Radio experience – past or present
- Most unusual item purchased / sold at a Hamfest
-

We will offer a significant $ prize for a winner in whichever category we pick. Let's discuss this at the Fall Event. This contest will be for all members of ATCO, so you guys that live too far away to come to the event, Email your suggestions to me at towslee1@ee.net and you may be a winner!!

That's all for now guys.
….73, WA8RMC

Mind Bender Question

Problem: Amoebas reproduce by splitting in two. An amoeba which does so every minute is placed in a jar at exactly ten o`clock in the morning. At 12:00 noon the jar is full. At what time is the jar half full?

(Search for the answer someplace later in this issue)

DATV QUESTION

With the transition to digital TV, will analog ATV repeaters become obsolete?

Rod Fritz WB9KMO answers with his opinion.
"I'm the trustee of an analog ATV repeater in Santa Barbara, CA and will soon construct one in Mesa, AZ, my new home. Both will soon have digital inputs and outputs, but will continue to support analog inputs and outputs as long as users need them. With the transition from NTSC to a digital format, has this change affected ATV at all? I would think with the new TVs receiving digital signals that the old analog ATV transmitters would now be obsolete.

At the risk of TMI (too much information), the question deserves a slightly more extensive answer...

- Most ATVers are not changing to DATV, a few are starting to use DATV, but continue to use analog
- Some new TVs are starting to eliminate analog inputs, which makes them less useful for ATV; keep your best analog TVs
- It will be a long time before a majority of hams go digital; in my eyes, that means analog is far from obsolete
- There are many formats of analog and digital ATV; depending on ATVer's needs many different formats are justified
- NTSC - AM/VSB and wide-band FM are analog formats with different characteristics; each with distinct advantages
- DVB – DVB-S, S2, C, T, H are European standards with varying characteristics & purposes; each with distinct advantages
- ATSC – 480i, 720p, 1080i & 1080p are US standards with varying characteristics & purposes; each with distinct advantages
- Simplex and Repeater DX – Use AM/VSB analog or narrow bandwidth digital modes like DVB-S; easiest to detect weak signals but quality may be inferior; line of sight is not generally required for lower frequencies that are used
- Repeaters and Linking – Use wideband FM analog; very good quality with no latency (delays) to allow comfortable interactive contacts; line of sight generally required for higher frequencies that are used
- Events and Presentations – Use DVB-S2, 1080i or 1080p digital; excellent quality when significant latency doesn't matter

ATV repeaters needs vary over time so it makes sense to allow different formats as needs change. For example, net check-ins are highly interactive so lower-latency standard-definition formats like AM/VSB, FM, DVB-S or ATSC 480i are preferred. After check-ins, it may make sense to switch to higher-latency high-definition formats like DVB-S2 or ATSC-1080i so participants can transmit presentations. More simply stated, digital TV may never replace analog; digital offers new features that aren't available with analog. Both sets of formats have benefits that will keep them around for a long time.

…Rod Fritz, WB9KMO rfritz@merida.sbcoxmail.com

ATN RADAR INTERFERENCE (So, they have problems too!)

The Radar is on San Clemente Island (US Navy owned). The issue is that the RADAR is at 1246.8 MHz (approx.) with about 3 MHz bandwidth and our 1245.75 MHz aural carrier was causing issues and if we ran QAM-64 same issue of QRM. Tom W6ORG asked us to try 1289.25 MHz as had to be done by WB9KMO last year because of his occasional QRM to San Pedro Radar 23 cm band (Radars are a joint FAA-DOD system). What has been happening is major upgrades to the facilities with better RX sensitivity, digital signal processing and antennas that can electronically scan down to and if at an elevated site below the horizon to pick up aircraft trying to fly below the radar. This puts our repeater within the main lobe of the antenna.
We have been operating on 1289.25 MHz since February with no QRM to anyone. Mark talked about the issue at the meeting as it is needed prior to official re-coordination to 1289.25 MHz.

The other issue that is happening is Trimbal company makes electronic survey gear that uses GPS and GLONASS for high precision land survey work. GLONASS is the Russian type GPS that has its L2 frequency for its constellation of 24 satellites within the 23 cm band. With 750 KHz spacing, they use 1244-1256 MHz. Satellites over SW USA is in the 1250 MHz area. Trimbal is redesigning their receivers to have selective notch IF filters to notch out amateur and FAA radar. If we run in beacon mode we take out site survey receivers out to about 20 miles. FCC rules currently have no accommodation for GLONASS RX use in USA but we try to cooperate by keeping the beacon mode off during working hours.
23 cm band may go away in most EU countries as they are building Galileo GPS with their L2 in the 1270-1280 MHz area. GPS's L2 is 1227 MHz and why we lost 1215-1240 MHz 30 some years back.
…Mike WB6SVT

TERRY PREPARES FOR QSO PARTY

I'm getting ready for the ATV QSO party..... and rare DX too, Hi Hi.

Stacked 6 element yagis on 70 CM (for DVB-T) and 17 element loop yagi on 23 CM (for DVB-S). All under a very, very effective "**roofing**" filter.....but they now rotate!

Note: In the foreground is a duplexer for feed line to 220MHz 1/4 vertical and full size 7.2 MHz dipole.

In background up against the wall is a deployable Slinky antenna...although it really does not work well.

Out of sight behind the camera is a 146/440 vertical.

Keep up the good work Terry. Before long the condo association will let you put something up outside. Or, ……..you can be creative and devise something with stealth attributes. Let's see now, a tall pole with a birdhouse on top with antenna inside comes to mind. Nobody would notice the rotator at the bottom. Ed.

ANNUAL WORLDWIDE AMATEUR RADIO ATV QSO PARTY 2014

THE PARTY INVITATION

The fourth annual worldwide ATV QSO Party was held over the last weekend of August, Friday night and Saturday afternoon.
Friday night Melbourne time was for local stations to get on air, with Saturday afternoon for local and international stations linked up.

MAN WITH A PLAN

Planning for the ATV QSO Party by Mick, VK3CH started two months prior, with a new work location to use.
At home Mick can either send ATV video from the shack, or from the back yard, via cabling running from the shack to the rear yard.
All this was still in place from last year, so not much to do, other than prove that is was all still good, nothing eaten by the wildlife...
Work however was a new blank canvas.
Compared to our previous work location, we were now situated in a prime VHF-UHF area.
With line of sight to the commercial TV towers at Mount Dandenong, needing only a basic TV antenna to get both commercials and VK3RTV, the expectation that getting a reliable signal into VK3RTV was high.
Google Earth gave a plot of the distance from work QTH to VK3RTV site as 34.3 km.
Google Earth reports our work as 110 meters above sea level.
Add the building height of 8 meters and 2 meters of mast, the ATV antennae are 120 meters above sea level.
At 137 metres above sea level, Mt Cooper in Bundoora Park is the highest point in the metropolitan area.
With a clear view to Mount Dandenong, working out the TX beam direction was no issue, knowing where VK3RTV is located.
With a full voice station at work, on MF-HF-VHF-UHF already established, ATV was the last mode to add to the work "shack".

ADD ANOTHER ANTENNA TO THE COLLECTION... BETTER MAKE THAT TWO...

ATV receive had already been in place in March, with a perfect picture seen on VK3RTV, regardless of weather conditions.
Late June the roof work of running coax to the roof and down the inside wall cavity to the office "shack" was done.
A spare 33 element loop yagi was erected with 20 meters of 9913 coax via the roof down to the office ATV transmitter.
Initial tests into VK3RTV were excellent with only Level 3 power required to hold either VK3RTV1 or VK3RTV2 perfectly.
A power level up to 15 is available with the SR Systems units.
Given that the beam for VK3RTV2 is beaming for input towards the Yarra Valley area, this is a great result.
On VK3RTV2, on just 1.45 watts, a perfect locked on picture was obtained, the transmitter drawing only 2.2 amps total current.
VSWR on the beam on either 1255MHz (VK3RTV1) or 1276MHz (VK3RTV2) was 1:1.1 for both, only about 1% loss, not bad.
Also when talking on 2 meters at 50 watts, close to the ATV beam, had no adverse QRM, nothing happened to picture when talking.

ATV 23cm TX Loop beam pointing to VK3RTV, near Mount Dandenong, in the distance ↑

LOCATION, LOCATION, LOCATION...

Once the ATV transmitter proven OK, it was time to decide what sort of material to TX on the day.
The office is not that interesting for ATV video, so video and audio cable was run from the office to downstairs near the roller door.
As voice amateur station is connected for remote internet access via Remote Rig, a cross-over CAT5 cable was also run to downstairs, so that the IC-7100 radio control head could be used downstairs where the camera was situated, to allow voice liaison during the ATV linkup. This saves having Remote Rig tie up the internet modem when just being used within the building.
To power the radio via Remote Rig when downstairs, a DC cable was also run from the office so 13.8 volts was available, this saves mucking about with a separate 12 volt plug pack power supply downstairs.

To also be able to watch other stations and to check our transmitted content 'live' a 75Ω TV coaxial lead was also run downstairs. At home a twin cable is also used to enable the ATV transmitter or power it down, without the need to run up and down the stairs. This facility was also wanted at work so a twin cable for this function was also run as well.
All the cabling was put in ducts and then ran conduit down the warehouse wall to near the front roller door. Of course video can be done from the office if the camera is used there, if it was required.

Spare ATV 23cm TX & 70cm RX antennae and masts hanging from the roof ↑

Compared to the park, we now had mains power, shelter, all our tools, spare cables, etc, all at our disposal.
Just turn up, open the door, site the camera, plug it in, go upstairs and switch it all on, too easy... makes future years easy...
The weather can do what it likes; just move the camera further inside if it gets nasty... But on good days BBQ can go outside.
The fridge, hot / cold water, microwave oven, kettle, landline telephone, work furniture and tables also add to the comfort factor.
I wonder if justified calling ATV from work a "portable" station (hi).

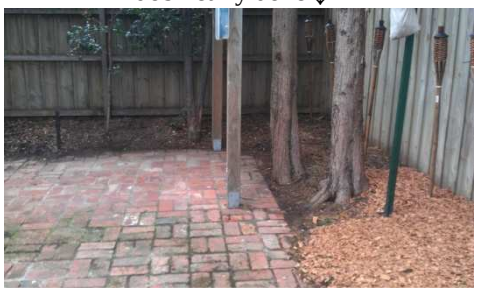
Just a small domestic TV antenna required for VK3RTV since the site VK3RTV antenna

LAST MINUTE JOBS

The last jobs were getting the BBQ gear ready, filling LPG gas bottles and tidying up.
The rear yard was looking a bit rough, as all can be seen on ATV, it was time to get it ready, not just for ATV, but summer as well.

New wood chips delivered ↓

Job nearly done ↓

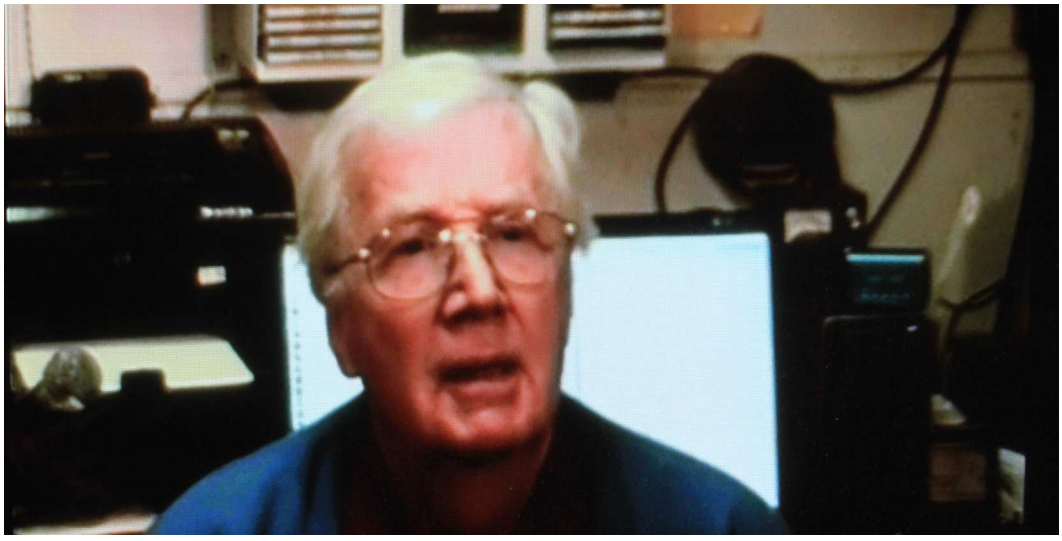


Yard tidy and ready ↓

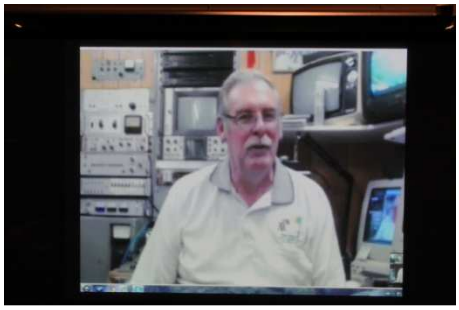
THE ATV WEEKEND SHOW ~ FRIDAY EVENING

One of the main objectives is for local and overseas amateurs to broadcast live video segments about their station setups and what they are currently working on. The ATV QSO party is broadcast via the Melbourne-Geelong VK3RTV digital ATV repeater, and can also be viewed on the British Amateur Television Club web site live video streamer at www.batc.tv and also www.vk3rtv.com
On Friday night, only VK stations broadcast, this year there were internet links to the new digital TV repeater VK5RDC at Port Pirie, and VK4RKC in Brisbane. ATV hams not within repeater range or a repeater were able to linkup using Skype via the internet to master controller Peter VK3BFG. Skype is used for Interstate and International connections. However Skype is currently grandfathering out older versions and the new version does not support import video from USB Dongles such as EzCap. These are used to take the output video as received from the ATV Repeater and send it to the remote anchor station. Fortunately Peter VK3BFG found a temporary work around, but it depended on the administrators of Skype and their timetable.

Peter Cossins, VK3BFG, with the opening address for the Friday night ATV Party QSO



Pictures of the Friday evening stations that logged in, just photographed in front of the TV screen



Mick VK3CH, in the backyard, in front of the BBQ's and behind the camera.
Mick's Friday night live telecast dinner, was smoked BBQ marinated honey/garlic/soy lamb ribs, washed down with Coopers Ale...

Friday night was a ‘round robin’ show and tell, like previous years. The topics and projects were incredibly diverse, with most undertaking either vast improvements or major new projects underway. EMDRC have a whole ATV studio and fantastic tower with all the beams on it. John VK3DQ has a huge tower under construction. Peter VK3BFG showed a 200 watt PA being built.
Jack VK3WWW had a very amusing pre-produced video with his persona visiting him live on air, brilliant video indeed...
The usual BBQ teasing between Mick VK3CH and John VK3DQ was upheld, Micks dinner looked better than what John displayed.

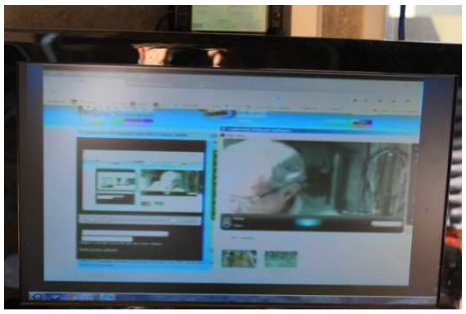
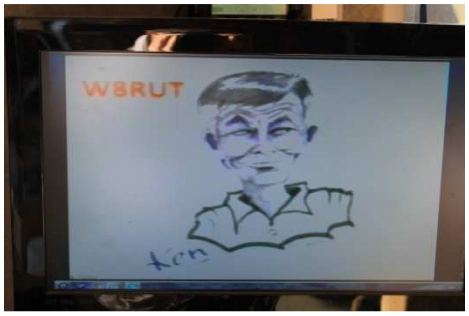
The main self criticism of the VK3CH setup is of course lighting. Better “white” lighting will need to be installed for next year.
The rear yard was not a big job, as the cables and radios were all installed in previous years, just switch it all on and away you go...
The switching, both local and remote, works well. The biggest challenge is finding relevant content to show.

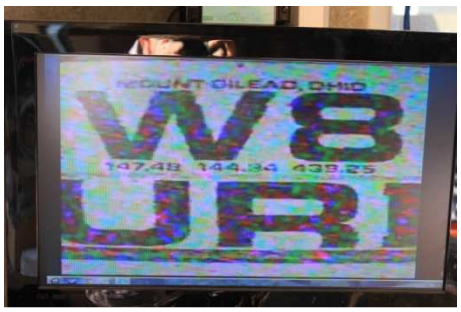
Those that pre-recorded video of their projects were well produced professional productions. It certainly shows the amateur radio does not have to mean “amateurish”, certainly not on VK3RTV. The stations spoke for four rounds and then it was time to get some sleep for the next day. Stations in the USA watched and came up after 1am their local time, keen indeed...

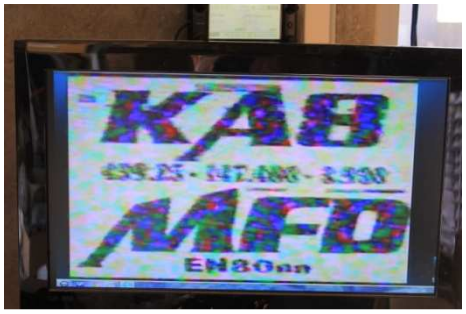
SATURDAY MORNING
Saturday morning commenced with local stations before the USA came on. The weather was a perfect spring day.
On the Saturday, there were four international net controllers - Peter VK3BFG, Don KE6BXT, Art WR8DMC and Noel G8GTZ.
Overseas ATV repeaters linked to VK3RTV including W6ATN and WR8ATV in the USA and GB3HV and GB3SQ and GB3KM in England, as well as other International stations via Skye and the internet.

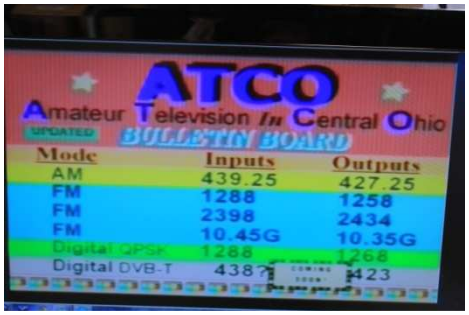
VK ATV station screen shots, taken with camera from the TV screen, the 10am session...

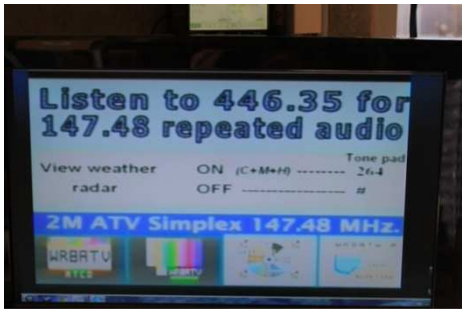


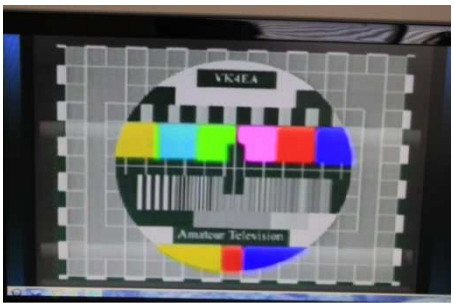


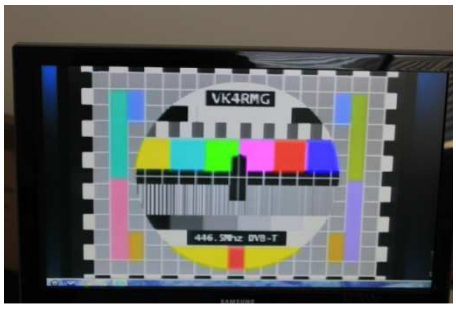








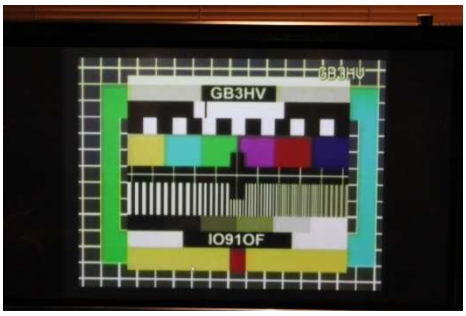


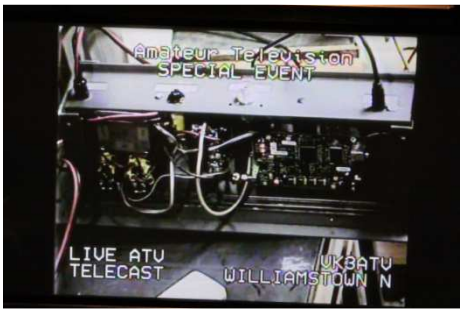

SATURDAY AFTERNOON

The 1pm ATV session... Southern California, USA, was due to start, but Mick VK3CH, received a phone call summing him to not one, but two family medical emergencies, which cut the day short and unfortunately prevented recording the afternoon ATV sessions. Hopefully as in previous years the recordings will be put up to YouTube.
The only captured stations here...

SATURDAY EVENING
Stations from England were patched in via Skype by Peter VK3BFG, screen shots below...







Putting on three sessions of ATV shows across different modes, time zones and local, interstate and international liaison, no lazy job. An incredible diverse range of discussions on ATV and amateur radio projects were seen, including stuff not to do with ham radio!!! As usual Peter VK3BFG managed to put up a professional run show under demanding conditions. Despite this the promise of further improvements is always strived for, many stations have made great improvements involving much experimentation, patience, trial and error, and of course expenditure of money...From experimental beginnings four years ago to now, the ATV Party is now a recognised annual event watched across VK, GB, W and Europe and anywhere anyone uses the BATV site or vk3rtv.com

In closing, it's only when you get on air, no matter what preparation you undertake, on the day of transmission, it's only then you discovered either what is lacking, or improvements to be made... For Mick VK3CH, it is, better "white" lighting, improved audio, a separate microphone on a lead or wireless to be researched.Per reordered content is also another option as the time gets tight on the actual day of going live to air.

It is impressive the time and trouble stations go to both getting on air, often in new locations, finding interesting content to put to air. It's getting to a point, how to top what you have done in previous years. So that's always next year's project.

Many thanks to Peter Cossins, VK3BFG, for all his efforts and expertise in another excellent ATV QSO Party.
...Mick VK3CH

*Guys, here is a "**MUST READ**" if you're interested in following the DVB-T progress at our repeater. Jim gives a great in depth analysis of why DVB-T is the best for DATV. His article also appears in the latest issue of ATVQ Magazine. Ed*

Application Note
AN-17

DVB-T the Solution for Ham Digital Television

Jim Andrews, KH6HTV
www.kh6htv.com

CATV 64-QAM: My first experiences [1] with amateur radio, high-definition, digital television (DTV) was in 2011. At that time, I experimented with the system used in North American cable TV (CATV) systems. It is Quadrature Amplitude Modulation (QAM) of either 64QAM or 256QAM, as specified by the standard ITU-T/J.83B, Annex B. I used a QAM modulator produced by R.L. Drake, their model DSE24 ($1,200). The DSE24 covered 5 MHz to 1 GHz with 6 MHz QAM-DTV channels. It would handle up to 1080i video input, with HDMI, VGA, component and composite video inputs. The RF output power was about -4dBm. Thus, an RF power amplifier was necessary to boost the power to useable watt levels for radiation from an antenna for ham TV purposes.

In the fall of 2011, a set of field trial experiments were run in Boulder, Colorado to compare the propagation characteristics of VUSB-TV, FM-TV, DVB-S, and CATV 64-QAM analog and digital TV systems. The results were documented in KH6HTV VIDEO application note, AN-3, [2]. CATV 64-QAM worked, but it was judged that it was not going to be particularly useful for any emergency, field portable, ARES situations. The major use for ham TV in Boulder, Colorado is for ARES support of the local sheriff, police and fire agencies [3]. The CATV 64-QAM issues discovered included:

(1) Receiver Sensitivity --- the 64-QAM digital threshold sensitivity of typical commercial analog/digital TV receivers was -78dBm. 256-QAM was 8dB worse at -70dBm. The sensitivity of the other systems were 10 to 20dB better than 64-QAM.

(2) Multi-Path --- multi-path distortions of the rf spectrum exceeding 10dB caused the receiver to stop decoding the signal. In many situations when we had a true, visual, line-of-sight path between the transmit and receive antennas, we were still unable to receive the DTV signal due to multi-path.

(3) Mobile --- in general, except in extremely strong signal areas, mobile operation simply did not work at all. The DTV receiver seemed to take one to two seconds to achieve lock. With mobile "flutter" of varying signal strengths and multi-paths, the receiver simply could not keep up and thus -- no picture.

(4) Unfriendly Receivers --- The first decision to use CATV QAM versus some other systems, such as DVB-S, was strongly driven by the idea that users would not have to purchase a special converter box, but would be able to use any commercial analog/digital TV receiver, such as they might purchase at Best Buy, Wal-Mart, etc. The CATV channels covered directly the ham 70cm band with channels 57-61. However, we got unexpectedly burned on this issue of using commercial receivers. Yes, these receivers would receive directly the 70cm, CATV analog or digital TV signals, but they were definitely not user friendly to TV hams wanting to receive unknown, intermittently transmitted, weak ham DTV signals. We discovered to our dismay that the vast majority of TV receivers on the market did not provide "random access" to any arbitrary digital TV channel via the remote control. They demanded that an "Auto Scan" must be made when ever looking for a new digital channel. They were designed to be connected to a real CATV cable, auto scanned once to determine all available channels and then never done again. We quickly discovered that we had to purchase a separate TV receiver for ham DTV and then "train" it to receive the desired DTV channel by connecting it directly to the output of their Drake DSE24 modulator. It could not then be used for any other purpose.

DVB-T for Hams I have just discovered the benefits of DVB-T for ham DTV and they far surpass those of CATV 64-QAM. The spring 2014 issue of Amateur Television Quarterly was most enlightening [4]. The propagation results reported by WB8ELK, W4HTB AND W8ZCF were very encouraging. Also the DVB-T equipment offered by a new ATVQ advertiser was appealing. The company, HiDes Technologies in Taiwan (www.HiDes.com.tw) was advertising DVB-T modulators and receivers in both complete packages or as "USB Dongles" for use with a supporting PC computer. Their prices were quite reasonable and within the range of a typical ham's budget. I thus ordered their model HV-100EH Modulator ($560) and their HV-110 Receiver ($169). The results reported here are based upon using these two pieces of equipment.

What is DVB-T ? It stands for **D**igital **V**ideo **B**roadcasting - **T**errestrial. [4, 5] It is the high-definition (also supports standard definition) digital TV broadcasting system now used in Europe and several other areas world-wide. It was developed by the European Broadcast Union. It is not compatible with the DTV system used in North America called ATSC, 8-VSB. Hams in general are not experimenting with ATSC because the cost of modulators has been extremely expensive. The DVB-T system seems to be ideally optimized for terrestrial use where multi-path is a major issue. Many reports claim that DVB-T is superior in performance to ATSC. I myself have experienced the inability to receive ATSC while mobile, whereas DVB-T works in a mobile environment.

DVB-T has a choice of three different basic modulation methods. They are Quadrature Phase Shift Keying (QPSK), or Quadrature Amplitude Modulation (QAM) with either 16 or 64 states. The max. data rates increase going from QPSK up to 64QAM. Commercial broadcast systems in different countries allow different bandwidths from 5 MHz up to 8 MHz. In the USA, we are constrained to a max. 6 MHz bandwidth. Hams in Europe, Australia and New Zealand have been experimenting with bandwidths down as low as 2 MHz (at lower data rates & standard definition). HiDes is catering to the ham DTV market by providing modulators and receivers which will operate from 2 to 8 MHz bandwidths.

DVB-T uses COFDM i.e. Coded Orthoganl Frequency Division Multiplex. Thus a DVB-T signal consists of a large number of discrete carriers (2K, 4K or 8K approx). An 8K system allows reception with longer multi-path echos. There are also embedded Pilot Carriers, either continual (same location in symbol) or "scattered" (puesdo random location in symbol). Pilots are at higher power levels and are used to estimate channel characteristics. A "Guard Interval" is always included within each OFDM symbol. The Guard Interval is used to sychronize the receiver, i.e. same as sync pulses in NTSC. The Guard Interval can be adjusted from 1/32, 1/16, 1/8 or 1/4. A larger guard inteval implies a lower bit-rate efficiency and is thus a trade-off between bit-rate and network tolerance to echos and reflections. Forward Error Correction (FEC) is also included in the data overhead. FEC choices are: 1/2, 2/3, 3/4, 5/6 or 7/8. 1/2 means for every real data bit there is also a FEC bit, i.e. 100% overhead. 7/8 means for every 7 real data bits there will be one FEC bit.

HV-100EH DVB-T Modulator: There are a large number of parameters that can be adjusted in the HiDes HV-100EH Modulator. The parameters are all set using a PC computer and a USB connection. HiDes supplies the necessary software on a DVD disc. The program is called: *AVsenderUART-GUI*. For the incoming video/audio media adjustable parameters include: input (HDMI or composite); Encoding (MPEG2 or H.264); Data Rate Control, Aspect Ratio and max. Bit Rate. The HV-100EH automatically determines the parameters of the incoming video/audio stream and sets other parameters accordingly. The Transmission mode parameters that can be adjusted include: Bandwidth (2, 3, 4, 5, 6, 7 or 8 MHz); Modulation (QPSK, 16QAM or 64QAM); FFT (2K, 4K or 8K), FEC (1/2, 2/3, 3/4, 5/6 or 7/8) and Guard Interval (1/32, 1/16, 1/8 or 1/4).

The HV-100EH is capable of operating from 70 to 950 MHz (includes 70cm & 33cm amateur bands) and also 1200-1350 MHz (23cm band). The software comes preprogammed with the standard commercial broadcast channels used world wide. The modulator is intended to normally be operated on one of these commercial broadcast channels 01 thru 99. The appropriate channel table is loaded into the modulator. While Hi-Des does include a few special channels in the ham bands, they are not all inclusive of all the available channels we might want to use. Fortunately, HiDes does allow the user to program their own custom frequency into channel 00. This must be done using a Windows PC computer via the USB cable. The PC doesn't need to be permanently connected. It can be removed after uploading the new frequency, etc. parameters. The channel center frequency can be entered to any arbitrary frequency with 1 kHz resolution. The bandwidth can be from 2 to 8 MHz. The output power from the modulator is -3dBm average. The modulator includes an accurate attenuator/gain control. It's range is +6dB gain to -20dB loss.
Obviously at this low power level of only -3dBm an RF power amplifier will be required to boost the power level to anything useful for radiation from an antenna. DC power requirements for the modulator are +12Vdc at 465mA.

HV-110 DVB-T Receiver: The receiver is in a very small package. It has absolutely no controls. It can only be controlled via the supplied IR remote control. On the rear panel, there is an SMA jack for the antenna input. Video output is simultaneously via HDMI and composite. The composite output is a video - stereo audio, 1/8" jack. The output display resolution can be adjusted in the "Set Up" menu anywhere from 480i up to 1080p. However, the composite output only works when the resolution is set to 480i, thus also forcing the HDMI output to also be 480i. There is also a switch on the rear panel for selecting bandwidth. Down is 2-4 MHz. Up is 5-8 MHz. This switch is only read upon DC power up. The HV-110 operates on +5Vdc and is powered via either a DC plug or via mini-USB. When powered using a mobile USB power adapter (12V to 5V switcher), it draws 315mA from a 12 V battery. On the front panel is a two digit LED display for the channel number. There is also a red/green LED power indicator. Green means a valid DTV signal is being received. Red means no signal present. To select or program the channel, the remote control must be used. To program a custom receive channel 00, push the MENU button (note: the "Back" button is the Menu / Exit button) and work thru the "Installation" menu to set the desired bandwidth and channel center frequency.

DVB-T Receiver Sensitivity: The first tests that were run were receiver sensitivity. The HV-100EH modulator was the signal source. A Sony camcorder playing pre-recorded video provided the "live" HDMI or composite video/audio input. To provide good rf isolation, the modulator was placed in another room and a long run of RG-58 coax was used to route the test signal to the measurement bench. Low level receiver sensitivity tests can not be performed accurately when the rf source is on the same test bench. This is due to minute rf leakage from the imperfectly shielded source and imperfect shielding in the receiver. The

modulator was set to -3dBm output and the power at the end of coax cable was measured accurately using an HP-432A RF Power Meter. 40dB of attenuation was then installed on the output of the modulator. At the test bench a Weinschel 1dB/10dB step attenuator was used to precisely set the input power to the receiver under test. Attenuation was increased until the DTV receiver "froze" and the front LED light turned red. Backing off 1dB typically resulted in a "live", P5 picture with audio. The digital cliff effect was typically a range of 1dB, or at most 2dB. The lowest level at which the receiver decoded was recorded as the sensitivity. Tests were run on a 70cm frequency of 429MHz (ch 58) for both 6 MHz and 2 MHz bandwidths. The receiver was tested for all three modes of QPSK, 16QAM and 64QAM. The tests were also then repeated using a low noise (0.5dB NF, 18dB) preamplifier in front of the HV-110 receiver. The preamp used was an ARR model P432VDG. The results are tabulated in the following table.

HiDes Model HV-110 DVB-T Receiver Sensitivity

MODE	6 MHZ RCVR ONLY	6 MHZ WITH PREAMP	2 MHZ RCVR ONLY	2 MHZ WITH PREAMP
QPSK	-97 dBm	-100 dBm	-100 dBm	-102 dBm
16QAM	-92 dBm	-94 dBm	-97 dBm	-98 dBm
64QAM	-82 dBm	-85 dBm	-83 dBm	-85 dBm

As expected the most sensitive mode was QPSK. There was a 15 dB spread between QPSK and 64QAM. Thus for typical ham weak signal work, we should restrict ourselves to using the QPSK mode. The results obtained with 64QAM were very comparable to those previously measured with CATV 64QAM. Using a good, low-noise, preamp typically improved the sensitivity by 2 to 3 dB. It should be noted that I was unable to duplicate the results reported by OE7DBH in ATVQ [6]. He reported getting a sensitivty of -102 dBm with 16QAM, 2 MHz BW at 436 MHz. There is a 5 dB difference in our measurements.

DVB-T Transmitter Performance:

A DVB-T transmitter was assembled using the HV-100EH modulator driving the RF power amplifier in a KH6HTV VIDEO model 70-10AD, analog TV transmitter. The 70-10AD has adjustable RF output power levels of 10W, 3W or 1W(pep). The 70-10AD includes a commercial CATV, NTSC, VSB-TV modulator. Jumpers on it's rear panel allow the NTSC modulator to be disconnected and an external DTV modulator used to drive the rf power amplifier module. Bench tests were run on this transmitter using the DVB-T QPSK and QAM modes under different drive conditions. The output from the transmitter was attenuated 30dB with a Narda high power attenuator. A directional coupler after the 30dB attenuator was used to supply a signal to the DVB-T receiver. A Rigol model DSA815 spectrum analyzer was used to accurately measure the spectrum. Average rf power was measured using the HP-432A power meter.

Fig.1 DVB-T, 6 MHz BW Spectrums. Left is modulator output at -3dBm. Right is DVB-T Transmitter output at +30dBm. 10dB/div & 3MHz/div.

The first test was to determine what linearity is required for the various modes. The key measure of non-linearity was to observe on the spectrum analyzer the spectral regrowth outside the DTV bandwidth. The ideal DTV signal appears as a noise signal riding on a 6 MHz (or 2 MHz) wide, rectangular pedestal. Non-linear spectral regrowth appears as an increase in the noise on shoulders on either side of the pedestal. Fig. 1 shows the 6 MHz BW, DTV outputs from both the HV-100EH modulator and the transmitter.. The modulator's shoulder break-point is about -46dB down. At 1 Watt (+30dBm) output, the transmitter's break-point is -37dB. If the transmitter is severely overdriven to saturation, the output power is +43dBm, but with a breakpoint of only -12dB. The out of band spectrum is excessive with the -20dB bandwidth being 14 MHz. The spectral regrowth shoulder breakpoints improve with lower RF output power. They are respectively: -27dB, -32dB, -35dB & -37dB at average output powers of +37, +35, +33 and +30dBm respectively. The acceptable limit for spectrum regrowth was considered to be -30dB. At this level, the rf output from the 70-10AD amplifier was +35dBm avg.

The testing of the different modes consisted of turning up the rf drive level until the DVB-T receiver's video output locked up. With QPSK, the receiver still decoded even when the amplifier was fully saturated. With 16QAM, the receiver locked up when the shoulder break-point just reached -12dB. With 64QAM, the receiver video started pixelating when the shoulder break-point reached -27dB and totally locked up at -23dB. Identical results were obtained with either 2 MHz or 6 MHz bandwidths.

Based upon the better receiver sensitivity of QPSK, it was decided that this mode should be used for all ARES operations. Thus, all of the remaining tests were performed with hi-def, 1080i, video with 6 MHz bandwidth and QPSK modulation. The 2 MHz bandwidth will also be considered, but only when it becomes necessary to field a lot of TV cameras/transmitters simultaneously or in an extremely weak signal situation.

DVB-T Propagation Tests: A field test was performed to compare the performance of classical, analog, NTSC, VUSB-TV versus DVB-T QPSK. Identical test conditions were used. The operating frequency was channel 58 (426-432 MHz), 6 MHz bandwidth. The rf power levels were both set at 1 Watt. The analog transmitter was the model 70-10AD with the output power set to 1 Watt. The major DVB-T media and transmission parameters used were HDMI (1080i), H.264 encoding, 6 Mbps max. bit rate, Channel 00, freq = 429 MHz, 6 MHz bandwidth, QPSK modulation, 8K FFT, 5/6 FEC code rate, 1/16 guard interval, and modulation data rate 7.32Mbps

A Sony camcorder playing back pre-recorded video and audio provided the "live" video, both in hi-def (1080i) HDMI and std. def. (480i) composite. The TV camera/transmitter was set up in the back yard of my residence. Two seperate transmit antennas were used. To simulate a real world ARES portable operation, a flexible whip antenna (2.4dBi) was attached to the camera tripod. The other test used an omni-directional base station antenna (6dBd) at 20 ft. elevation with 3/8" hardline coax. The immediate neighborhood was a very typical suburban environment with a mix of one and two story houses, on flat terrain. The neighborhood is an older one with lots of landscaping vegatation and lots of very large trees in full leaf. There was no open terrain. The rf signal had to fight it's way out through lots of houses, cars, trees, etc.

The mobile receiving setup consisted of a mag. mount tri-band (2m/70cm/23cm) antenna with 6dBi gain on ch 58. The antenna was connected to the 1dB/10dB step attenuator, then the ARR preamp and then into the HV-110 DVB-T receiver. The video output from the DTV receiver was displayed on a small 7", portable, Haier LCD TV receiver/monitor. To test the analog NTSC signal, the output from the preamp was connected directly to the antenna input of the 7" LCD TV receiver. With the step attenuator, it was possible to make calibrated field strength measurements by cranking in attenuation until calibrated receiver locked up or analog squelch closed.

The mobile DTV receiver was driven all around the immediate neighborhood to determine the total, 100% coverage area and radius. It was then driven at various speeds elsewhere within the Boulder valley and up into the foothills of the Rocky mountains. The most distant point tested was about 4 miles from the transmitter site. Solid P5, DVB-T pictures were received at numerous locations out to the max. tested radius of 4 miles from both transmit antennas.

BOTTOM LINE DVB-T PROPAGATION CONCLUSIONS

(1) If you can receive a P2 analog, NTSC, picture, in all likelyhood, you will get a P5 DVB-T picture. If it is a P3 analog, I guarantee you a P5 DVB-T picture.

(2) For a guaranteed P5 digital TV or P3 or better analog picture, the immediate, 100% service area in a typical suburban environment, using a 1 watt, 70cm TV transmitter, would be: (a) With both antennas at ground level (i.e. 5 ft) = approx. 1/4 mile or 450 yard radius (b) With one antenna at ground level (5ft) and the other at 20ft = approx. 1/2 mile or 900 yard radius.

(3) Multi-path ghosting was almost always present on the analog picture. The DVB-T algorithums removed completely all ghosting. Always a perfect P5 picture.

(4) Mobile operation always results in "mobile flutter" on the analog picture, even in strong signal areas. I ran mobile reception at speeds up to 65mph and always got perfect P5 pictures with no breakups with DVB-T. Thus, the DVB-T algorithums correct for doppler shifts well.

(5) Very long distance propagation is possible with low power DVB-T when a true line of sight path is available. Even when multi-path is present on this path, a perfect P5 picture results.

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DVB-C PERFORMANCE OVERVIEW

TechTalk115

DigitalATV – Overview of ITU-T_J.83B Protocol (DVB-C)

by Ken W6HHC
Orange County Amateur Radio Club – www.W6ZE.org

[Reprinted from OCARC newsletter at www.W6ZE.org/DATV/]

Earlier OCARC TechTalk articles about Digital-ATV have provided details about how DVB-S protocol works, and went on to cover DVB-T and DVB-S2 protocols. DVB-S is still currently the most popular modulation standard being used by hams for DATV. This month I will look at some of the technical details of the DATV protocol defined by the ITU-T_J.83-Annex B standard.

The complete list of commercial origins of the DATV protocols being used by hams are listed below:

- DVB-S (satellite based)
- DVB-S2 (satellite for HDTV)
- DVB-T (terrestrial reception)
- ATSC (commercial terrestrial reception in US)
- ITU-T_J.83-Annex B (US/Canada cable TV) (DVB-C)

ITU-T_J.83B

The ITU-T_J.83-Annex B protocol (I've shortened to ITU-T_J.83B) is commercially used by the US/Canada cable TV industry. This standard is very closely related and similar to the DVB-C protocol used in Europe and most of the world for cable TV. One main attraction of ITU-T_J.83B for hams is that several cable channels can fall directly on the 430 MHz ham bands. Therefore a terrestrial transmission by hams can be received directly to a cable-ready TV without adding any special receiver cost (aka more money). Just (aka not spending more money). Just connect an antenna and tune your TV to the right channel. This is the nice attraction of the old analog-ATV approach on 430 MHz band.

ITU-T_J.83B for the cable world is designed to work with strong signals and a low noise environment. The main issue with ITU-T_J.83B when used by hams in a terrestrial mode (over the air – OTA), is that the environment can change to weak signals and lots of noise. That is: the received S/N gets much worse when you leave the cable environment.

Typical Transmitter Block Diagram

Fig01 is a block diagram of an ITU-T_J.83B basic ham station for DATV using QAM64 modulation to transmit a full HD video. Hams typically use MPEG-4 encoding to achieve enough data compression to fit a full 1080i high definition signal into a 6 MHz bandwidth. Typical manufacturers of ITU-T_J.83B exciters used by hams (mainly here in USA) are the Drake (model DSE-24) and Thor (model H-VQAM-SD). Typically a HDMI connector are available for HD cameras to be plugged in and composite video connectors (RCA jacks) are available for NTSC cameras and Standard Definition (SD) using MPEG-2 encoding. The DATV receiver is a commercial "cable-ready" TV set tuned to the 420-430 MHz USA cable TV channels 57-60 that overlaps the ham radio 70 cm band.

- 421.25 MHz CH-57
- 427.25 MHz CH-58
- 433.25 MHz CH-59
- 439.25 MHz CH-60

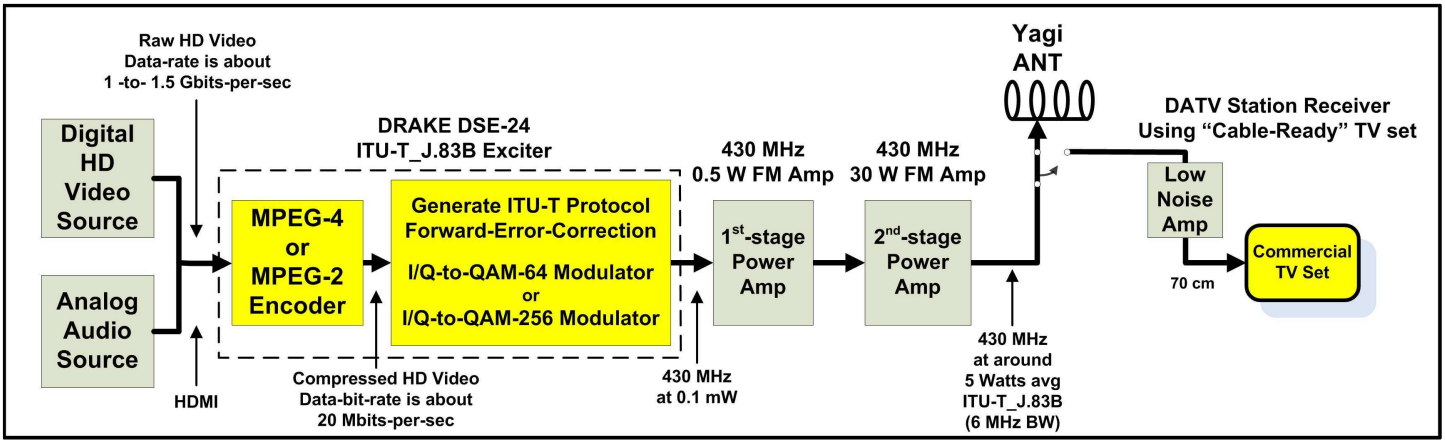


Figure 1 – Block Diagram of Basic ITU-T_J.83B Station for DATV

Video Data Stream	Data-Rate	Notes
Analog NTSC camera	168 Mbits/sec	A/D digitized, uncompressed
NTSC MPEG-2	2-3 Mbits/sec	compressed
NTSC H.264/MPEG-4	~1.5 Mbits/sec	compressed
VHS MPEG-2	1-2 Mbits/sec	compressed
Analog PAL camera	216 Mbits/sec	A/D digitized, uncompressed
PAL MPEG-2	2.5-6 Mbits/sec	compressed
HDTV camera	1-1.5 Gbits/sec	uncompressed
HDTV MPEG-2	15-60 Mbits/sec	compressed
HDTV H.264/MPEG-4	12-20 Mbits/sec	compressed

Table 1 - Camera Video Data Streams and MPEG-2/MPEG-4 Data Streams

Video Data-Rate and Compression

For HD DATV, a digital camera output is compressed using MPEG-4 encoding (aka H.264 and even sometimes called Advanced Video Coding - AVC). This encoder CODEC provides more compression of the video than the older MPEG-2 CODEC. For SD DATV, the analog NTSC/PAL camera output is first digitized by the optional MPEG-2 encoder shown in **Fig 1**, and then compressed by the MPEG-2 algorithm. The reason the compressed video data rate varies in **Table 1** is that the smaller value means little motion in the video scene and the larger value means a lot of motion. H.264/MPEG-4 can reduce the bit-rate by a factor of 50% over the older MPEG-2.

FEC Inflation of Payload Data Stream Data-Rate Forward Error Correction (FEC) is a technology that not only can detect errors on the received signal, but adds enough redundancy of the data so that it can correct several wrong bits. But, there is a trade-off when choosing the amount of redundancy. Since redundancy inflates the data-rate of the output stream, the trade-off is between more redundancy…or… keeping the inflated data-rate smaller. As we will see a little later in this article, the larger the inflated output data-rate, the higher the required RF band-width. So at some point the FEC algorithm will not have enough redundancy to correct too many errors, and the DATV receiver screen will go blank or freeze.

The FEC technology used by the ITU-T_J.83B protocol is that same as used by DVB-S protocol. That is: the two FEC algorithms are the Viterbi coding technology and Solomon-Reed. The puncture coding value used by ITU-T_J.83B DATV is not selectable and was difficult for me to pin down in the standard, but Ron W6RZ explained to me that Viterbi FEC is 14/15. The total FEC overhead produced, Ron W6RZ explained is approximately 11%. That translates into the MPEG-4 "payload" video data rate of about 22.2 Mbits/sec increasing to a "gross data rate" to a value of about 24 Mbits/sec…that has to be encoded into the Symbol-Rate (SR) stream.

Digital Modulation Symbols and Symbol-Rates

Digital modulation technologies like BPSK (an example is PSK-31), QPSK (Quad Phase Shift Keying), 8PSK, 32APSK (Amplitude and Phase Shift Modulation), and QAM-64 (Quadrature Amplitude Modulation) with 64 "constellation points" have the ability to put more information into a more narrow frequency spectrum than analog modulation. The complexity of the digital modulation scheme, allows us to pack more "data bits" into each SYMBOL. **Table 2** lists out how many data bits can be packed into a symbol for several well-known digital modulation technologies.

Modulation Scheme	Data Bits per Symbol (Me)
BPSK	1
GMSK	1
QPSK	2
8PSK	3
8-VSB	3
QAM-16	4
32APSK	5
QAM-64	**6**
QAM-256	**8**

Table 2 – Symbol Bit-Packing for Various Digital Modulation Technologies

ITU-T_J.83B protocol allows the use of two digital modulations: QAM-64 that packs 6 bits of data into each symbol transition and QAM-256 packs 8 bits of data into each symbol transition.

Figures 2 and **3** shows a comparison between the more simple QPSK modulation constellation and the much more complex QAM-64 constellation.

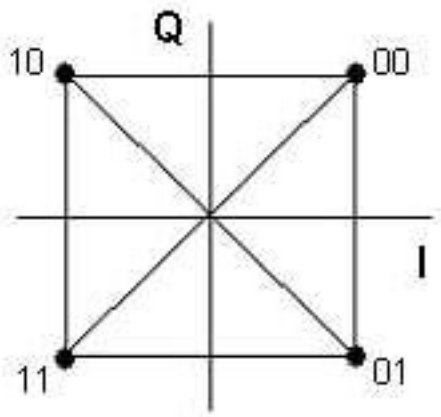


Figure 2 – The modulation constellation of QPSK used in DVB-S packs 2 bits of data in each symbol transition

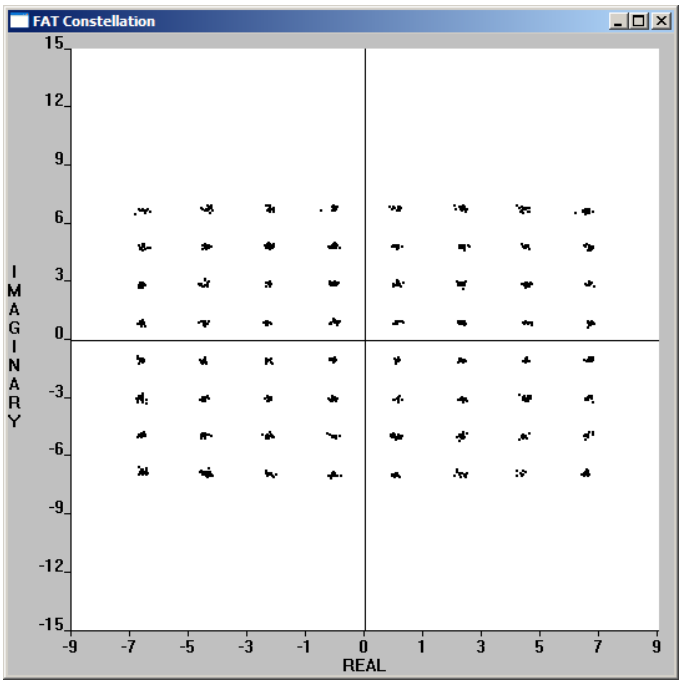


Figure 3 – The more complex modulation constellation of QAM-64 used in ITU-T_J.83B packs 6 bits of data into each symbol transition
(courtesy of W6RZ)

The complexity of a digital modulation scheme like QAM-64 allows much more data to be carried in a defined RF bandwidth…but also carries a penalty in signal robustness. The greater the modulation com-plexity…the greater the signal to noise ratio (SNR and aka C/N) needs to be. **Fig 4** compares the SNR needed to receive four different digital modulations , including QPSK and QAM-64. Even though this analysis is looking at COFDM world, it clearly shows that QAM-64 is less robust than QPSK. I think it is very easy to envision that the QAM-256 modulation would carry an even greater SNR robustness penalty (requires 8 dB more).

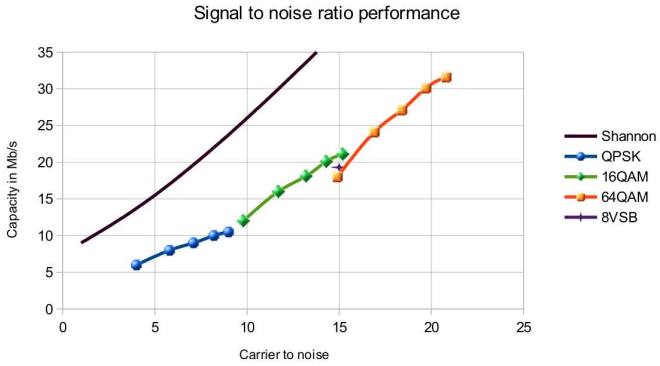


Figure 4 – A comparison of SNR of four different modulations including QAM-64 and QPSK shows the signal robustness penalty of complexity
(courtesy of ZL1WTT)

ITU-T_J.83B Bandwidth

The ITU-T_J.83B standard defines the RF bandwidth as 6 MHz wide "channels". In a manner similar to DVB-S protocol, the RF bandwidth of an ITU-T_J.83B transmission is defined by its Symbol Rate (SR). That is:

RF_{bw} = SR x 1.18 (roll-off factor)

So if we have a 6 MHz bandwidth, the Symbol Rate should be approximately:

SR = 6.0 MHz / 1.18 = 4.44 MSymb/s

The "gross data-rate" at this SR would then be ~30.3 Mbps. This is enough to carry a HD signal using MPEG-4 encoding. Ron W6RZ pointed out to me that: "At the 26.97 Mbps TS rate, you could easily have a 26Mbps video stream (or two HD program streams at around 13 Mbps each)".

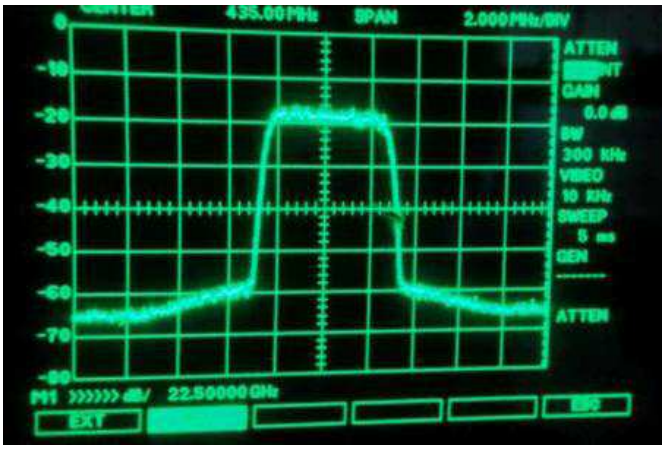


Figure 5 – A spectrum analyzer view of an ITU-T_J.83B QAM-64 transmission "haystack" on the 70 cm band
(courtesy of WA6SVT)

frequencies. These channels are spaced 6 MHz apart. I have not heard of any hams being able to receive QAM-64 transmission bandwidths more narrow than 6 MHz on commercial TV sets.

Status of Ham ITU-T_J.83B DATV

One of the pioneers in US for DATV using the ITU-T_J.83B protocol is Jim KH6HTV. He participated in setting a DX record of 121 KM on the 70 cm band using QAM-64. Two ATV repeater groups in US have tested adding the ITU-T_J.83B protocol to their DATV repeaters. The ATN group in Southern California tested a 70 cm DATV repeater on Mt Wilson, where uplinks were received via analog-ATV or QAM-64 DATV and downlinked using DATV as W6ATN. The ATCO group in Columbus Ohio (they installed the first DVB-S DATV repeater in USA in 2004) also installed ITU-T_J.83B protocol to their WR8ATV DATV repeater downlink on 70 cm.

When I first started preparing for this article, I contacted Mike WA6SVT of the W6ATN repeaters and also contacted Art WA8RMC of the WR8ATV repeater to get feedback and obtain their insights on using ITU-T_J.83B for a DATV repeater. To my surprise, I learned that both repeater groups had stopped using the ITU-T_J.83B protocol and were installing DVB-T down-links. The W6ATN tests had signal robustness difficulty being received across the large Los Angeles basin into Orange County.

Art WA8RMC explained that "nobody was using the ATCO ITU-T_J.83B downlink". Art went on to report that: "I could see the CATV QAM signal but even though a vertically polarized signal was being sent, I could only receive it with my horizontally polarized antenna. After some additional testing and assumptions we concluded, 'The QAM signal suffers from multipath cancellation issues which is minimally accommodated in the receiver. Also, minimal FEC is applied to the transmitted signal because it is not needed when in a cable.' ATCO concluded that because of multipath issues, DATV using this mode is not practical". Jim KH6HTV has also redirected his DATV interests and activities to DVB-T protocol because "…it far outperforms the CATV DTV 64QAM. I only used the QPSK modulation because of its superior receiver sensitivity. I found I was still able to transmit very acceptable, HD 1080p pictures using simpler QPSK compared to QAM."

Conclusion

The ITU-T_J.83B approach to DATV offers "easy appliance-like installation" for DATV and also offered the glamor of being able to transmit full 1080 HD video. But, the penalty of the higher C/N requirements of the QAM-64 modulation is too large…compared to other now-available alternatives. I do NOT see ITU-T_J.83B protocol becoming a significant factor for DATV in the future.

Acknowledgement

I want to thank Ron W6RZ for providing some of the mathematical details and obscure ITU-T_J.83B protocol specification details for this article.

Author may be contacted at W6HHC@ARRL.net

Useful URLs

- ATCO - Amateur Television of Central Ohio – see **www.ATCO.tv**
- British ATV Club - Digital Forum – see **www.BATC.org.UK/forum/**
- CQ-DATV online (free monthly) e-magazine – see **www.CQ-DATV.mobi**
- DATV-Express Project for DATV – see **www.DATV-Express.com**
- DigiLite Project for DATV (derivative of the "Poor Man's DATV" design) – see **www.G8AJN.tv/dlindex.html**
- KH6HTV Application Notes DATV with ITU-T_J.83B and DVB-T – see **http://KH6HTV.com/application-notes/**
- Orange County ARC entire series of newsletter DATV articles and DATV presentations – see **www.W6ZE.org/DATV/**
- TAPR Digital Communications Conference proceedings (free downloads) – see **www.TAPR.org/pub_dcc.html**

Yahoo Group for Digital ATV - see **groups.yahoo.com/group/DigitalATV/**

DVB-T IS PREFERED DATV MODE

OK, now that you've read the previous two articles; it should be clear what DATV mode to use. If you have NOT read them, I suggest you stop here. Go back and digest the material. Then follow our recommendation and use DVB-T as the standard. Now, read on…….

DVB-T has been proven to be superior to the other modes for general DATV work, especially when trying to do DX work. If your interest is high definition video, I suggest you find a buddy to experiment with and report your findings. For the rest of us, the DVB-T mode is the closest to satisfying the "plug and play" minded Ham operator. That's OK too for our society is trending in that direction.

So, if you don't want to build your equipment and still would like to join the leading edge in technology, consider the variables outlined below to simplify your purchase decisions. The ATCO and ATN groups involved with DATV have settled on DVB-T operation with the following characteristics:

Receive Frequency: 423MHz (From ATCO repeater) **Transmit frequency**: 438MHz (To ATCO repeater)
Bandwidth selection: 2 and 4 MHz (Note: these are not the standard broadcast bandwidths. Standard dongles usually are available only in 6,7,8 MHz BW selections because that is what is used commercially in Europe).
Mode: QPSK (QAM selections are normally available but not used for DATV because the signal to noise ratio suffers and not desirable for Dx operation. Resolution is degraded from QAM but not enough to warrant QAM use.)
FEC: ½ **FFT carrier selection**: 2k **Guard interval**: 1/32 (these are all settable in the units described below)
Based upon the above characteristics, there is a very limited equipment selection from which to choose. They are:
Transmitter:

- DATV-Express board. (www.DATV-Express.com)
  Frequency: 100-2450 MHz.
  Maximum output: -5dBm for DVB-T.
  Power required: 10-15 VDC (0.5A @12VDC)
  Enclosure: Board only supplied. User must supply enclosure.
  Support hardware needed: PC running Ubuntu (Linux) + hardware video capture card.
  Output connector: SMA female
  Price: $300 board only

- HiDes HV100E packaged unit. (www.HiDes.com.tw)
  Frequency: 50-950 and 1200-1350 MHz
  Maximum output: -3dBm typical.
  Power required: 9-24VDC (0.7A @ 12VDC)
  Enclosure: 195mm x 125mm x 40 mm aluminum box
  Support hardware: none. Takes composite video directly
  Output connector: F female
  Price: $560

- HiDes UT100C dongle
  Frequency: 50-950 and 1200-1350MHz
  Maximum output: 0dBm
  Power required: 5VDC from USB buss in computer running Windows™
  Output connector: 75 ohm MCX female
  Price: $169

Receiver:

- HiDes HV-110 self contained receiver
  Frequency: 170-950 MHz
  Bandwidth: 2,3,4 or 5,6,7,8 by switch selection
  Power required: 5VDC, 2A
  Enclosure: 105mm x 75mm x 35mm box
  Composite video, audio and HDMI with imbedded audio output
  Price:$169

- HiDes UT100D dongle
  Frequency: 50-950MHz
  Bandwidth: 2,3,4MHz
  Power required: 5VDC from USB buss in computer running Windows™
  RF connector: 75 ohm MCX female
  Price:$84

Transceiver:

- HiDes UT100B dongle
- Characteristics same as combined UT100D and UT100C
- Price:$230

There you have it as I know it. At the present time, there are no other practical selections for the individual desiring advancement into the DATV world. There are plenty of DVB-T receivers out there but they are all designed for European broadcast markets. So far HiDes is the only manufacturer making something strictly for Ham use. More will appear shortly.

For post amplifiers for the output of the transmitters above, I've designed and built a dual PHA1 amplifier with 15dB gain for use with the DATV-Express board powered directly from that board. Also I have a brick type amp that has over 30dB gain and runs on a separate 12VDC power supply. With the combination of these two amps, the power output will be in the neighborhood of 1-5 watts. I will describe details in another publication. Stay tuned. Don't give up on DATV because of complexity.

AWARD GIVEN TO THE DATV-Express TEAM.

Every two years the British Amateur TV Club (BATC) presents an award for the most innovative and significant contribution to Ham Radio/ATV. The GRANT DIXON AWARD is named after G8CGK who was the first Chairman of the BATC organization that passed away in 2003. He was involved in the earliest days of commercial television engineering, and was an avid experimenter and builder in ATV. The award was presented at the CAT14 convention that was held Sept 6 and 7 in Basingstoke, England.

At the convention, BATC presented the GRANT DIXON AWARD to the DATV-Express Project Team that had designed and now sell a low-cost DATV-Express exciter transmitter for Digital ATV. Members of the project Team are:

- Charles Brain G4GUO – Ferring, England - Software design and mathematics
- Art Towslee WA8RMC – Columbus, OH - Electronics design
- Tom Gould WB6P – Portland OR - Schematic Capture and PCB Layout
- Ken Konechy W6HHC – Orange, CA - Project Manager and Publications

As Ken W6HHC likes to point out, none of the project team members have ever met another team member "in person". All project discussions and efforts are conducted by simple e-mail or SKYPE sessions…..the internet is amazing!

BATC President, Peter G3PYB, presents Charles G4GUO (R) with Award on behalf of entire DATV-Express Project Team

…WA8RMC

Digital Amateur TeleVision
Exciter/Transmitter

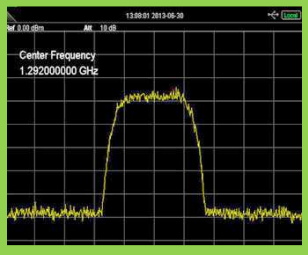
now available from

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
- As extra bonus, the team has been able to get the board to transmit DVB-T 2K mode, however we cannot guarantee the performance of that protocol. Caveat Emptor!
- Requires PC running 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



A T C O

2014 FALL EVENT

12:30 PM Lunch/meeting

Sunday October 26, 2014

ABB PROCESS AUTOMATION

CAFETERIA

579 EXECUTIVE CAMPUS DRIVE

FOR MORE DETAILS, CONTACT

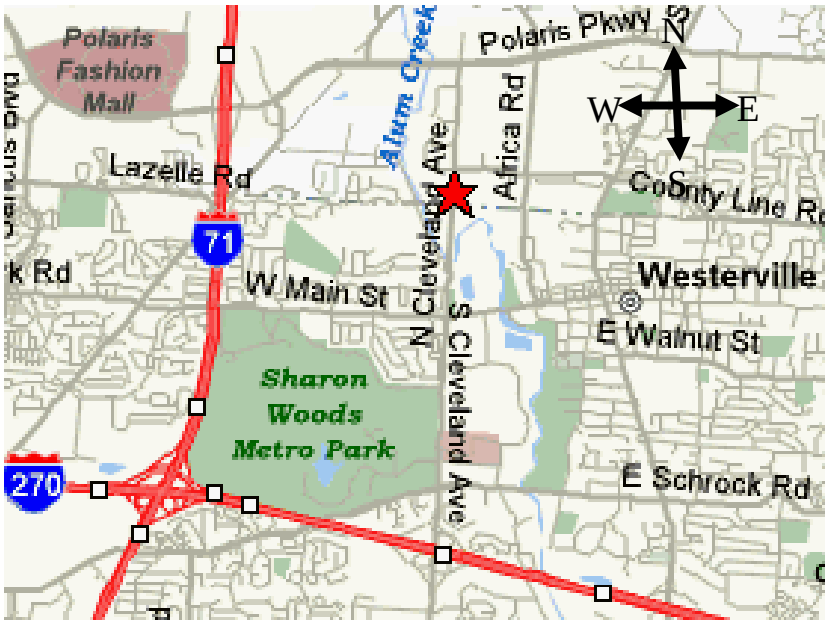
ART - WA8RMC 891-9273

LUNCH PROVIDED - DOOR PRIZES -

BRING A FRIEND AND SEE OLD BUDDIES

MINIHAMFEST - 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.

Mindbender answer:

11:59. Since they double every minute, at 11:59 it was half full. One minute later it had doubled and was full.

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

Issue	Page(s)	Article
Vol 1 II	5	439 Beam
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 II	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

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 30 IIII.

…Bob N8OCQ

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.
Don Kemp NN8B Hanoverton, Ohio
…WA8RMC

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.

10/19/2014 | 2014 Conneaut ARC (W8BHZ) Hamfest
Location: Conneaut, OH
Type: ARRL Hamfest
Sponsor: Conneaut Amateur Radio Club
& American Legion Auxiliary Cowle 151
Website: http://qsl.net/w8bhz/

11/01/2014 | Grant Amateur Radio Club Hamfest
Location: Georgetown, OH
Type: ARRL Hamfest
Sponsor: Grant Amateur Radio Club
Website: http://www.garcohio.net

11/02/2014 | Massillon ARC Hamfest
Location: Massillon, OH
Type: ARRL Hamfest
Sponsor: Massillon Amateur Radio Club
Website: http://www.w8np.org

11/15/2014 (Fort Wayne Hamfest & Computer Expo)
Location: Fort Wayne, IN
Type: ARRL Convention
Sponsor: Allen County Amateur Radio Technical Society
Website: http://www.fortwaynehamfest.com

12/06/2014 | Fulton County ARC Winterfest
Location: Delta, OH
Type: ARRL Hamfest
Sponsor: Fulton County Amateur Radio Club
Website: http://k8bxq.org

03/28/2015 | MOVARC HamFest
Location: Gallipolis, OH
Type: ARRL Hamfest
Sponsor: Mid-Ohio Valley ARC
Website:
https://sites.google.com/site/midohiovalleyarc/

04/11/2015 | Cuyahoga Falls ARC's 61st Annual Hamfest
Location: Cuyahoga Falls, OH
Type: ARRL Hamfest
Sponsor: Cuyahoga Falls Amateur Radio Club
Website: http://www.cfarc.org/hamfest.php

07/19/2015 | Van Wert Amateur Radio Hamfest
Location: Van Wert, OH
Type: ARRL Hamfest
Sponsor: Van Wert Amateur Radio Club
Website: http://W8FY.org

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 has 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 if you can.

ATCO TREASURER'S REPORT - de N8NT

OPENING BALANCE (07/24/14)	$2003.88
RECEIPTS(dues)	$ 30.00
PayPal fees	$(1.77)
Domain name fees	$(69.98)
CLOSING BALANCE (10/21/14)	$ 1962.13

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 average street level (1460 feet above sea level)

TV Transmitters: 423 MHz DVB-T digital, 427.25 MHz VSB AM, 1258 MHz FM, 1268 MHz QPSK digital, 2433 MHz FM, 10.35 GHz FM
(multipole filters in output lines of all transmitters)
Output Power - 423.00 MHz : 10 watts continuous (Digital DVB-T 4MHz bandwidth FEC = ½ on cable channel 57)
427.25 MHz: 50 watts average 100 watts sync tip (Analog ATV on cable channel 58)
1258 MHz: 40 watts FM analog ATV
1268 MHz 20 watts continuous DVB-S (QPSK) DATV SR=3.125Msps, FEC=3/4 , 2 video channels.
(PMT PID:32, Video PID:162, Teletext PID:304, PCR PID:133, Audio PID:88, Service ID:5004)
2433 MHz: 15 watts FM analog ATV
10.350 GHz: 1 watt continuous analog FM ATV
Link transmitter - 446.350 MHz: 5 watts NBFM 5 kHz audio

Identification: 423, 427, 1258, 1268, 2433, 10.350 GHz transmitters video identify every 15 min. with ATCO & WR8ATV on 6 different screens.
1268 MHz digital & 10.350 GHz analog - Continuous transmission of ATCO & WR8ATV with no input signal present.

Transmit antennas: 427.25 MHz - Dual slot horizontally polarized "omni" 7 dBd gain major lobe east/west, 5dBd gain north/south
423.00 MHz – Lindsay horizontally polarized 6 dBd gain omni (digital DVB-T ATV)
1258 MHz - Diamond vertically polarized 12 dBd gain omni (Analog ATV)
1268 MHz - Diamond vertically polarized 12 dBd gain omni (Digital DVB-S ATV)
2433 MHz - Comet Model GP24 vertically polarized 12 dBd gain omni
10.350 GHz - Commercial 40 slot waveguide horizontally polarized 16 dBd gain omni

Receivers: 147.480 MHz - F1 audio input with touch tone control. (Input here = output on 446.350)
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, PCR PID:33, Video PID:33, Audio PID:49
This input feeds all transmitters and also directly to 1268 MHz digital output channel 2. Therefore, 1280 DATV input and 439 or 2398 can be ON at the same time. (Input here = output on all TV transmitters)
2398.00 MHz - F5 video analog NTSC. (Input here = output on all TV transmitters)
10.450 GHz - F5 video analog NTSC

Receive antennas: 147.480 MHz - Vert. polar. Diamond 6dBd dual band (also used for 446.350 MHz link output)
438.000 MHz - Horizontally polarized dual slot 7 dBd gain major lobe west
439.250 MHz - Horizontally polarized dual slot 7 dBd gain major lobe west
1288.00 MHz - Diamond vertically polarized 12 dBd gain omni
2398.00 MHz - Comet Model GP24 vertically polarized 12 dBd gain omni
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 up for 5 minutes) Select # to shut down before timeout.
	697	Select Time Warner radar. (Stays up till turned off). Select # to shut down.
	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 for auto scan to continue

Manual mode Functions:
00* then 1 for Ch. 1 Select 439.25 receiver
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 (6 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 1280 MHz digital receiver scan enable
03* or 03#	Channel 3 1280 MHz analog receiver scan enable
04* or 04#	Channel 4 2398 MHz scan enable
A1* or A1#	Manual mode select of 439.25 receiver audio
A2* or A2#	Manual mode select of 1280 digital receiver audio
A3* or A3#	Manual mode select of 1280 analog receiver audio
A4* or A4#	Manual mode select of 2398 receiver audio
C0* or C0#	Beacon mode – transmit ID for twenty seconds every ten minutes
C1* or C1#	C1* to disable 427 MHz transmitter, C1# to enable it
C2* or C2#	C2* to disable 1268 MHz digital transmitter, C2# to enable it

ATCO MEMBERS as of October 2014

Call	Name	Address	City	St	Zip	Phone
KD8ACU	Robert Vieth	3180 North Star Rd	Upper Arlington	OH	43221	614-457-9511
KC3AM	Dave Stepnowski	735 W Birchtree Ln	Claymont	DE	19703	
AH2AR	Dave Pelaez	1348 Leaf Tree Lane	Vandalia	OH	45377	937-264-9812
W8ARE	Larry Meredith III	6070 Langton Circle	Westerville	OH	43082-8964	
N8ASB	Daun Yeagley	1353 Gurneyville Road	Willmington	OH	45177	
NN8B	Don Kemp	6384 Camp Blvd.	Hanoverton	OH	44423	
K9BIF	Charlie Short	PO Box 554	Goshen	IN	46527-0554	
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
N1CTF	John Chartkoff	2288 Notingham Road	Upper Arlington	OH	43221	
WB8CXO	Mike Young	289 Gayloard Dr	Munroe Falls	OH	44262	
N3DC	William Thompson	6327 Kilmer St	Cheverly	MD	20785	301-772-7382
WA8DNI	John Busic	2700 Bixby Road	Groveport	OH	43125	614-491-8198
K8DMR	Ron Fredricks	8900 Stonepoint Ct	Jennison	MI	49428-8641	
K8DW	Dave Wagner	2045 Maginnis Rd	Oregon	OH	42616	419-691-1625
WB8DZW	Roger McEldowney	5420 Madison St	Hilliard	OH	43026	614-405-1710
KC8EVR	Lester Broadie	108 N Burgess	Columbus	OH	43204	
WA8FLY	Rod Shaner	16012 London Rd.	Orient	OH	43146	740-279-3614
N8FRT	Tom Flanagan	6156 Jolliff St.	Galloway	OH	43119	
W8FTX	George Biundo	3675 Inverary Drive	Columbus	OH	43228	614-274-7261
WB2FVE	Craig Blaine	1195 Hooverview Drive	Westerville	OH	43082	614-891-5378
W8FZ	Fred Stutske	8737 Ashford Lane	Pickerington	OH	43147	
WA8HFK,KC8HIP	Frank & Pat Amore	3630 Dayspring Dr	Hilliard	OH	43026	614-777-4621
W6HHC	Ken Konechy	340 S. Craig Dr.	Orange	CA	92869	
WA8HNS	Mike Gray	5029 St Rt 41 NW	Washington Ct Hs	OH	43160-8740	740-335-5133
N8HRC	John Hempstead	1190 County Road 9	Brellefontaine	OH	43311	
W4HTB	Henry Cantrell	905 Wrenwood Dr.	Bowling Green	KY	42103	270-781-9624
WB2IIR	Michael Anthony	370 Georgia Drive	Brick	NJ	08723	
N8IJ	Dick Knowles	1799 Homeward Ave	Lima	OH	45805	419-231-7277
W8KHP	Allan Vinegar	2043 Treetop Lane	Hebron	Ky	41048	
WA8KQQ	Dale Waymire	225 Riffle Ave	Greenville	OH	45331	937-548-2492
N8LRG	Phillip Humphries	30856 Coshocton Road	Walhonding	OH	43843	614-3543744
WB8LGA	Charles Beener	2540 State Route 61	Marengo	OH	43334	
KD8KDM	Mike Bowlus	127 W. Plum St. PO box 221	Saint Paris	OH	43072	
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
N0OBG	Jim Conley	33 Meadowbrook C C Est	Ballwin	MO	63011	
N8OCQ	Bob Hodge Sr.	3750 Dort Place	Columbus	OH	43227-2022	
W6ORG,WB6YSS	Tom, Maryann O'Hara	2522 Paxson Lane	Arcadia	CA	91007-8537	626-447-4565
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
W8RRJ,W8WTB	John Hull	580 E. Walnut St.	Westerville	OH	43081	614-882-6527
W8RUT,N8KCB	Ken & Chris Morris	2895 Sunbury Rd	Galina	OH	43021	
W8RVH	Richard Goode	9 Master Street Apt A	Springfield	OH	45504	937-478-6488
W8RQI	Ray Zeh	2263 Heysler Rd	Toledo	OH	43617	
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
W3SST	John Shaffer	6706 Gilette Dr	Reynoldsburg	OH	43068	614-751-0029
WA6SVT	Mike Collis	PO Box 1594	Crestline	CA	92325	
W8TIP	Gene Hawkins	1720 Liberty Street	Toledo	OH	43605	
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	James R. 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	
KB8YMQ	Jay Caldwell	4740 Timmons Dr	Plain City	OH	43064	
KC8YPD	Joe Ebright	3497 Ontario St	Columbus	OH	43224	
N8YZ	DaveTkach	2063 Torchwood Loop S	Columbus	OH	43229	614-882-0771
W8ZCF	Ferrel Winder	6686 Hitching Post Ln.	Cincinnati	OH	45230	
K3ZKO	Ron Cohen	915 Rowland Ave	Cheltenham	PA	19012	215-828-1263
N8ZM	Tom Holmes	1055 Wilderness Bluff	Tipp City	OH	45371	
KA8ZNY,N8OOY	Tom & Cheryl Taft	386 Cherry Street	Groveport	OH	43125	614-202-9042

Call Name Address City St Zip Phone

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, they 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 so we can keep the dues clock consistent with the beginning of each year.

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 MEMBERSHIP APPLICATION

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

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 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.