Boulder Amateur Television Club
TV Repeater's REPEATER

May, 2021
issue #76

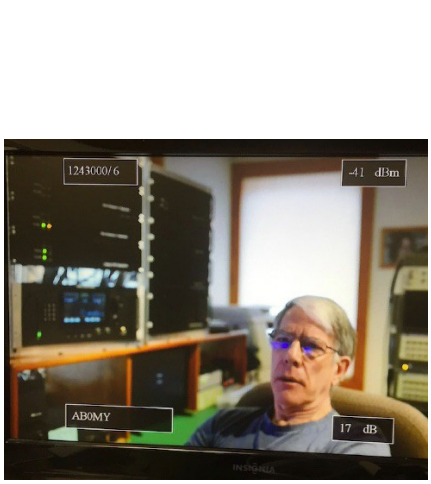
BATVC web site: www.kh6htv.com

ATN web site: www.atn-tv.com

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

One Ham's Solution to Living Behind a Tall Mountain

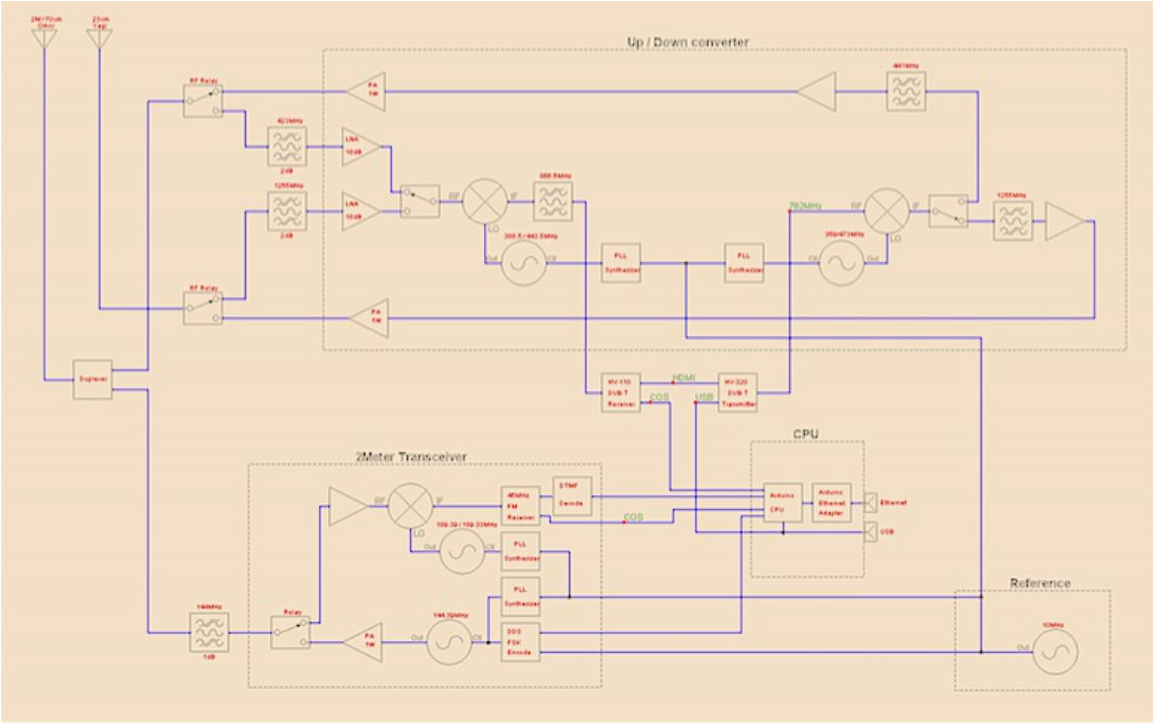
Boulder has one dedicated ATV ham who lives in the worst possible location to hit our W0BTV repeater. He is Steve, WA0TQG, on Sugar Loaf mountain. More recently, Jack, K0HEH, has been assisting Steve by relaying for him to/from the repeater. This was reported in the March issue #72 of this newsletter.

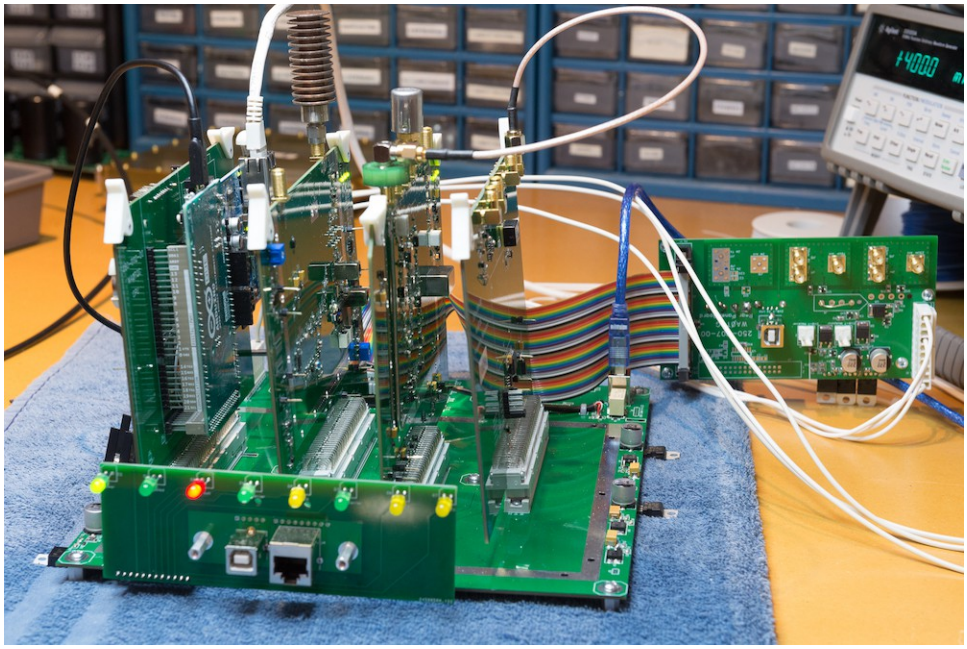


Steve, WQ0TQG & his well equipted electronics test bench

Well, Steve is a retired RF design engineer. He has a long history of very successful radio designs in his resume. But being retired has not stopped Steve from continuing to design innovative RF systems. Check out Steve's www.qrz.com bio for details on one of his creative ham projects. So with this ATV rf propagation challenge, Steve has decided

to design his own automatic ATV relay system to allow him to get into W0BTV for our weekly ATV nets. He plans to position the hardware at a location out on the prarie where there will be good line-of-sight paths to both W0BTV and his QTH in the mountains. Here is Steve's up-date on the project with a few of the design details.





Thought I would update you on the progress I am making on my video extender repeater project. A lot has been done in the past few weeks such as:

1. Built up all of the PC boards that I already have and will be using for this
2. Received the new PC boards from China that I laid out for this project and have built up all but one (2 meter radio)
3. Tested all build boards and have them running as a system
4. Completed the software although there will be more work on that as I work on the hardware and test out the complete system. Ethernet and USB interfaces all work so I can control the system and get debug and log information as I bring up the boards
5. Brought up most of the main RF converter boards including the VCOs, synthesizers, Receive section and the 70cm TX section. I just have the 23cm TX section left to verify and test.
6. Documentation is now up to 30 pages of schematics and over 75 pages of design notes.

The normal operation of the system is as follows: There will be two antennas. A 23cm loop yagi pointed to the west and a 2meter/70cm vertical with a Diamond duplexer at the unit. The output power will be about +20dBm on both the 70 and 23cm outputs. I have the capability to add a power amplifier for either of the bands but right now only one.

When the unit is idle (or just power on) most of the power will be turned off to the various sections except for the processor and the 2 meter receiver. When I want to use the system I will send a DTMF command on the 2 meter link that will wake the unit up and when everything has settled it will receive the W0BCR repeater on 423MHz and repeat it out on 1255MHz. When I want to transmit I will send another DTMF command that will set the unit to receive on 1255MHz and transmit to the repeater on 441MHz. When I am done transmitting I will send another DTMF command to put it back into its previously described mode to transmit the repeater output to me on 1255MHz. If I fail to send the DTMF command and my DVB-T carrier drops for a preset time the unit will then automatically go back to the 1255 transmit mode as well. When it is in this mode if the repeater DVB-T carrier is off for another preset time the unit will go back to the idle mode.

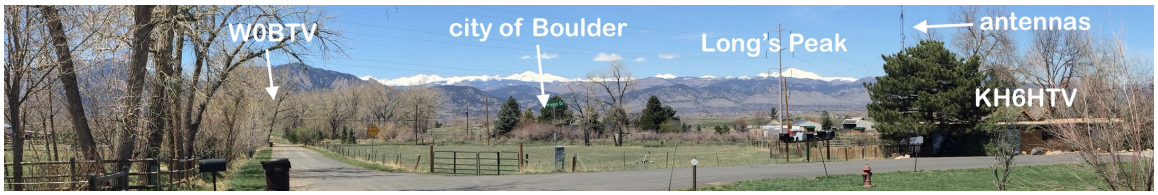
Additional system operation capabilities: There are many other DTMF commands (some with admin access only) that can adjust these timings, load different configurations, etc. Data on the unit such as the mode it is in, various unit temperatures and any fault, error or warning conditions will be sent to the APRS system and will be viewable to anyone on the internet. In the case of any type of error the APRS system will send out an email to me (or any number of others) detailing the error. A log file is maintained on the system that shows various details of the system operation and I will be able to get to those locally through an Ethernet connection to help with any troubleshooting or operational abnormalities.

The system has many other features and everything is configurable with a file on the local memory card. There can be up to 99 different configurations saved and any one can be loaded using DTMF commands as well as setting any one as a default. The system frequencies can be changed and the operation includes a normal repeater operation where the transmitter is enabled whenever a DVB-T carrier is detected and it is dropped when the carrier goes away. One such example would be to set up a repeater with an input on

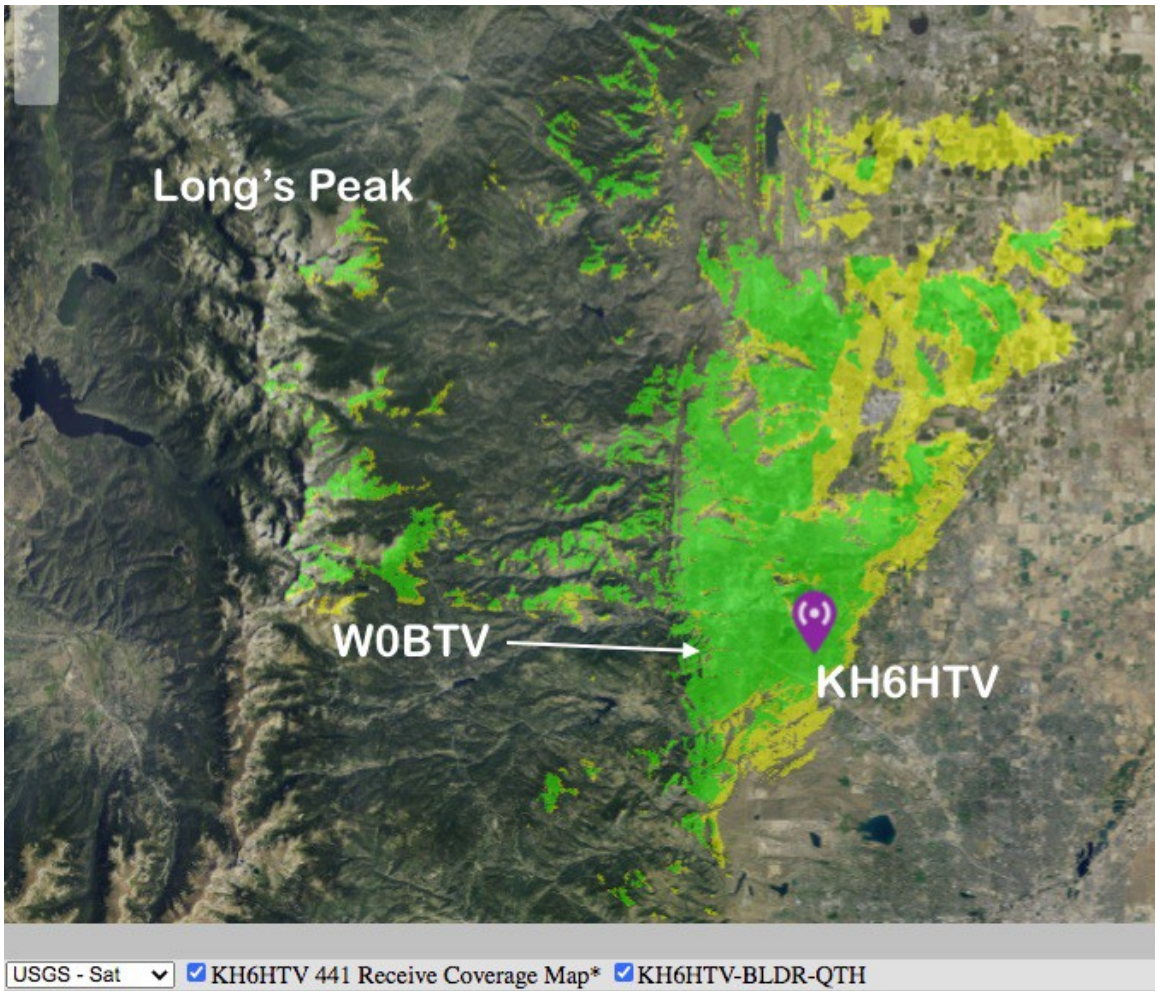
429MHz and an output on 1243MHz. I imagine that the 23cm signal would be strong enough to get into the repeater. Not sure why I do this but it is just an example of things that can be done for experimental purposes.
(editor's note: This also helps Steve keep his brain cells young and functioning !)

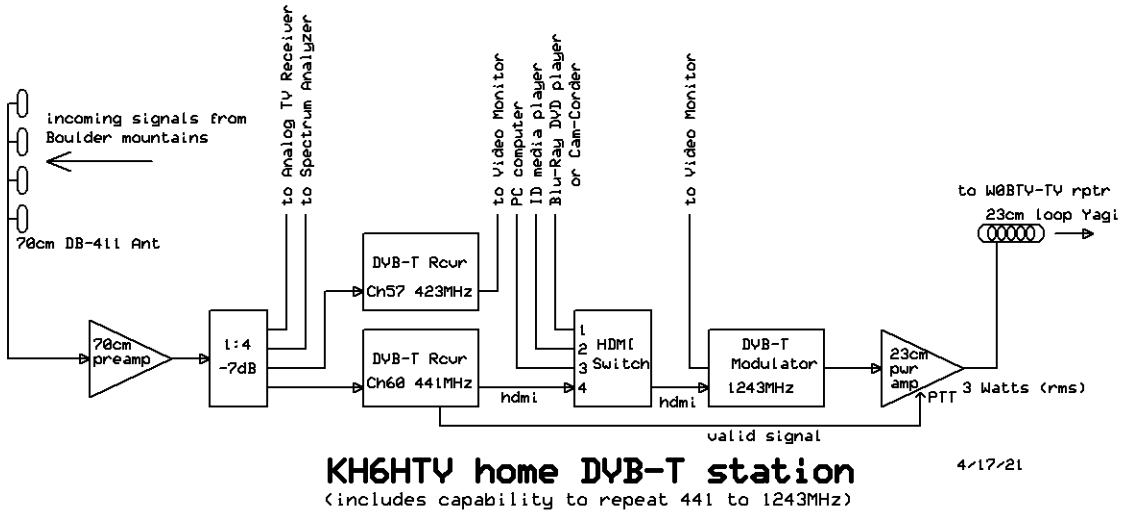
If any of you can think of any sort of experimental or test configurations or other uses of the system let me know.

I'm not willing to speculate on a finished date yet but will keep you informed of the progress and hopefully demonstrate some of the testing of the unit on the Thursday net.
Steve, WA0TQG, Sugarloaf Mountain, CO



Another Cross-Band Repeater: So following up on WA0TQG, Steve's efforts, I decided that I could make an easy mod to my ham shack DVB-T receiver/transmitter set-up and add the capability to also relay 70cm signals coming from the back-country up in the mountains of western Boulder County into the W0BTV repeater. My QTH is located out on the prarie in the eastern part of Boulder County. I am about 5-6 miles south-east of the city of Boulder. I have a 5 mile, line-of-sight path to the W0BTV repeater. I also have a great view of the mountains back to the Continental Divide. The view is especially good to the north-west about 30 miles up towards Long's Peak. The photo below is a satellite, aerial view with the RF coverage area from my QTH shown as the green & yellow overlay. This shows where I would be able to receive from, 441 MHz, DVB-T signals. The yellow shading is for weak signals (< 10dB rf S/N) and the greem shading is for strong signals. The coverage map was calculated assuming the transmitter would be the typical BCARES, back-pack, portable set using a 3 watt, model 70-7B, transmitter with a 6 element, Yagi antenna on a 10ft. mast. My receive antenna is a DB Products, DB-411, four element co-linear with 11dBi gain, a cardiod pattern pointing to 300^{o} and mounted with it's center at about 35 ft. I used the free, on-line, computer program, *Radio Mobile* (www.ve2dbe.com) to generate this map.





Shown in the figure above is the block diagram of my home DVB-T receive/transmit set-up. The modulator is a Hi-Des model HV-100EH. The 3 Watt, 23cm, rf power amplifier is my own KH6HTV model 23-11A. The only item I needed to add to make it a cross-band repeater was the extra DVB-T receiver tuned to channel 60, 441MHz. I am using

the low-cost, "combo" receivers. The extra receiver was modified to pick off the "Valid Signal" logic from the front panel green LED. This is routed to the model 23-11A rf linear power amplifier and inserted as the PTT logic signal. Thus when the 441 receiver detects an incoming, valid, DVB-T signal it will automatically key the output power amplifier. The 23-11 amp had a three position toggle switch so I can determine how I want to use it. In the center position, the amp is on, but in "Stand-By" mode. In the up position, the amp is turned on. In the down position, the amp responds to the external PTT logic input. Thus when I want the system to work as a 70cm/23cm cross-band repeater, I simply set the HDMI switch to the 441 receiver and set the 23-11 amplifier to Ext. PTT. Bingo ! -- that is all.

Jim, KH6HTV, Boulder, CO

BARC FIELD DAY is a GO ! We have just received word from Allen, K0ARK. "I submitted a special use permit to Boulder County for Field Day at Betasson Preserve. It was approved ! ! ! " Allen also says " I am counting on BATVC's participation with video with an ATV broadcast from the field day site."

ATV Interest in S.E. Colorado -- I recently had a phone call from Kit, KA0WUC. Kit was a staff engineer with K0AA & KRDO in Colorado Springs. He says h e performs functions as the contracted chief engineer with several AM/FM/TV & satellite uplink stations in several states Colorado, Wyoming, Oklahoma, Kansas, and New Mexico. Mostly transmitter & translator work.

Kit along with Diana, KC0VBL, and David, W0WFM, are looking to generate some ATV interest in the Lamar, Colorado area. Kit has access to a lot of surplus TV gear from the various TV stations he works with. We hope to hear a lot more about this in the near future.

FEEDBACK:

Re: **"Smalband" ATV** --- Bill, N3DC, in Cheverly, Maryland writes -- "Hey Jim great newsletter as always. I wonder have you seen this article ? "IF Bandpass Filtering of AM TV Signals" (http://www.utaharc.org/utah_atv/if_filt.html)

Editor's note: *No -- but after looking it up, I have thus found the Utah Amateur Radio Club's web site to be interesting reading. It has a lot of great material. It says they used to have an ATV repeater, WB7FID, up to 2008 when they lost the "critical mass" of interested folks. They have still retained on their web site all of the great ATV material written by Clinton, KA7OEI. It includes the above article mentioned by Bill.*

Re: **"300 W, Free Amplifier"** --- John, WB0CMC, has more details on modifying a cheap $30, Amazon switching power supply to power these amplifiers. Details in the next issue of this ATV newsletter.

Boulder Daily Camera

Sunday Camera

Page 23 February 6, 1977

Entertainment

Sunday, February 6, 1977 THE SUNDAY CAMERA 2

General News

One Man Television Station Sports Only One Viewer

By LINDA CORNETT
Camera Staff Writer

In a basement office, next to an old upright piano and a macramed owl, Jim Andrews has a television station. His ratings aren't much to brag about, though — he's only been able to find one viewer.

Andrews is an amateur radio operator and, as far as he has been able to determine, the only person in the Boulder area transmitting a fast scan television message on amateur bands.

Andrews' "station" consists of four pieces of modified equipment and a one-foot wire antenna nailed to a fence post outside his Boulder County home.

It is, he admits, a low budget operation — the entire set-up cost about $300. Yet, Andrews' spartan station operates like commercial stations costing millions of dollars.

A portable spotlight picks out the subject for the broadcast, usually an old license plate bearing Andrews' amateur radio call letters WAONHD. Occasionally his children step into the spotlight. A video camera, purchased on sale for $115, picks up the picture and transfers it to the transmitter, a 15-year-old police band radio, purchased for $20, and modified for television transmission.

The 10-watt signal, barely enough to light an ordinary light bulb, sends Andrews' visual message potentially as far north as Longmont and west to Jamestown. Andrews can't be sure, because his only confirmed viewer is a friend 4½ miles away on Table Mesa.

The friend, John Schafer, picks up the sporadic license plate picture through an antenna he built in his basement and watches it on a regular "idiot box" modified to receive the low-range amateur band.

So far Andrews' own similar receiving equipment picks up only his own transmission. Each time he prepares to go on the air, Andrews flips through the five amateur television channels, sandwiched just below commercial television bands. Each time he receives only static.

Another amateur from Denver has indicated an interest in stepping into the television area of amateur radio, but even if he does, an intervening hill will probably cut Andrews' receiver off from the line-of-sight transmission.

Although Andrews says he is "looking forward to the day when I can exchange pictures back and forth and know I have made a whole system," he is not discouraged by his video solitude.

Andrews, an electrical engineer at the National Bureau of Standards, says he was more interested in the "technical challenge" of putting together a working system for a low cost than in communicating the feat to the world.

He put together his system in odd moments which added up to about 50 hours' work. It was an easy task compared to the 2½ years he spent building his short wave radio from scratch.

He estimates that of the nation's 300,000 amateur radio operators, only about 1,000 are involved with fast scan television. Far more are working with the slow scan systems which "paint" a picture in about 10 seconds.

All of the experimenters are fulfilling one of the major purposes of amateur radio — to provide frequencies for experimentation with new communications techniques.

Camera Staff Photo by Jerry Cleveland

STATION WAONHD — Electrical engineer Jim Andrews contacts a cross-town friend to confirm transmission of his sporadic television broadcast. His $200 "station" has the potential for covering much of Boulder County.

Boulder ATV Memories From the 1970s

I just stumbled on this old Boulder newspaper clipping in one of my Mom's old scrapbooks. It was when Boulder ATV made the head-lines in the local newspaper, the Boulder Daily Camera. This clipping is dated Feb. 6, 1977. The print is too fine to read in the attached photo, so I am re-printing it here. Also found in Mom's stuff was a copy of an old National Bureau of Standards (NBS) newsletter from November, 1977 with a second article on our Boulder ATV. I am also reprinting it here.

One Man Televison Station Sports Only One Viewer

by Linda Cornett, Camera Staff Writer

In a basement office, next to an old upright piano and a macramed owl, Jim Andrews has a television station. His ratings aren't much to brag about, though -- he's only been able to find one viewer. Andrews is an amateur radio operator and, as far as he has been able to determine, the only person in the Boulder area transmitting a fast scan television message on amateur bands. Andrews' "station" consists of four pieces of modified equipment and a one foot wire antenna nailed to a fence post outside his Boulder County home. It is, he admits, a low budget operation. The entire set-up cost about $200. Yet, Andrews' spartan station operates like commercial stations costing millions of dollars. A portable spotlight picks out the subject of the broadcast, usually an old license plate bearing Andrews' amateur radio call letters WA0NHD. Occasionally his children step into the spotlight. A video camera purchased for $115, picks up the picture and transfers it to the transmitter, a 15-year old police band radio, purchased for $20, and modified for televison transmission. The 10 watt signal, barely enough to light an ordinary light bulb, sends Andrews' visual message potentially as far north as Longmont and west to Jamestown. Andrews' can't be sure, because his only confirmed viewer is a friend 4 1/2 miles away on Table Mesa.

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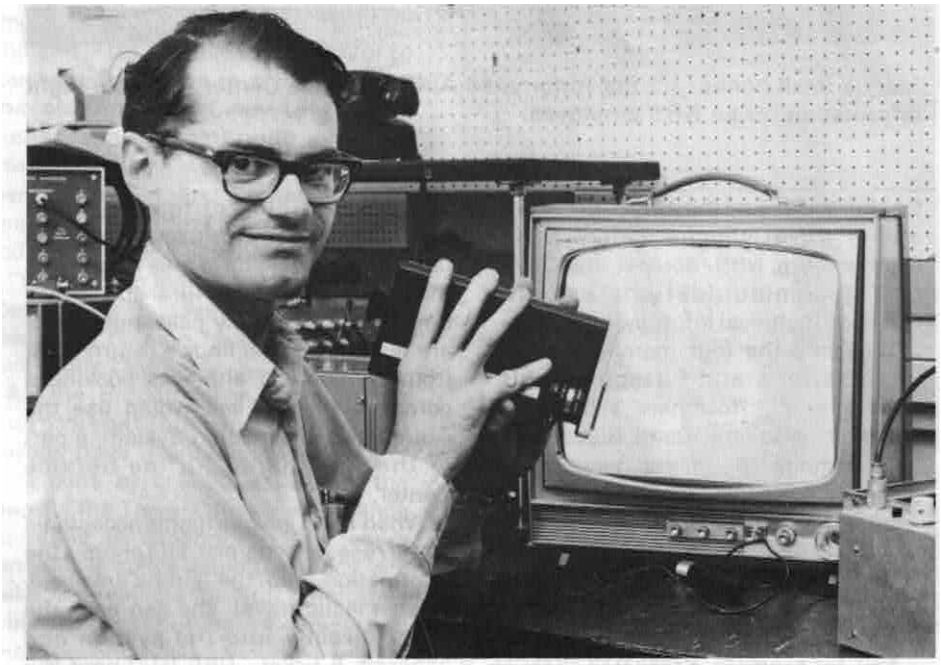


Jim Andrews transmits a sound and picture image on his amateur television station with a small camera. An NBS electronics engineer, Andrews was the first person in Boulder to build an amateur operational transmitter and receiver.

Jim Andrews: A Television Personality

re-printed from: NBS Standard, vol. 22, no. 24, Nov. 30, 1977

Jim Andrews neither sings nor dances very well. He has a soft voice and project the image of a television star. Yet, Andrews, an electronics engineer at NBS/Boulder, is a television personality of sorts. In Boulder, his face is familiar to at least four other persons who are able to receive his television transmissions. Andrews operates an amateur television station from his home. In fact, he was the first person in Boulder to build an operational transmitter and receiver. Only one other person - a dentist -- has a transmitter.

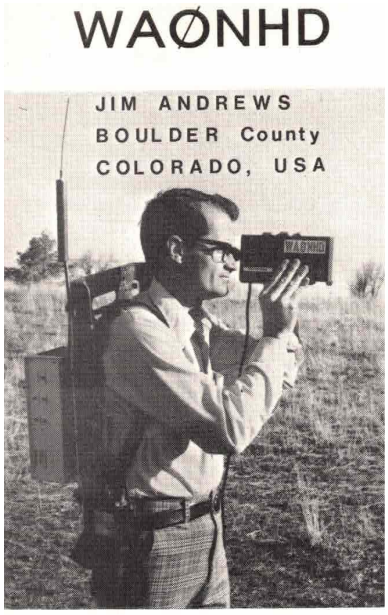
"I always have had in the back of my mind that it would be an interesting challenge to start an amateur television station", Andrews notes. What finally prompted him was an ad for a low-cost TV camera from a company going out of business. He paid $115 for the camera, which is the same size and weight as a super-8 home movie camera. Next Andrews purchased and modified an old police-band radio transmitter that he picked up for $20. When new, Andrews estimates it cost $1,000. Although large and cumbersome, he successfully converted the 15 watt radio into a transmitter for television signals. He estimates it cost him $3 to modify a UHF tuner on a regular television set to pick up his

signal. Aside from the equipment, all he needed was an amateur radio license --- something which he has had for 12 years.

What does he transmit from his "studio"? Nothing very exciting. Certainly not Kojak or the Monday night football games. In fact, he is prohibited by law from broadcasting entertainment on his amateur station. Most often he focuses his camera on an old license plate that contains the call letters of his amateur station. Once in a while he will focus on slides of a camping trip. The Electromagnetics Division employee is less interested in the program content than he is in the techical performance of the system. He is constantly trying to improve the picture quality. "The picture I transmit is of less importance than the transmission itself and the fact that I do get a picture," he says.

Another Electromagnetics Division employee, John Shafer, is one of those whose TV set is equipped to pick up Andrews' signal. Andrews transmits at 439.25 MHz, just below channel 14 on the UHF band. The persons receiving his signal need a converter which translates the signal down to channel 3 (61.25 MHz). This can then be fed into an ordinary, unmodified TV set because channel 3 is not in commercial use in the Boulder-Denver area. Andrews' station transmits as far as line of sight, the distance a person can see without obstructions interfering. He transmitted his farthest signal 28 kilometers.

He is now working to develop a portable television transmitter that can fit into a backpak. He hopes a system of portable transmitters and receivers could be used eventually to aid communications for police and fire departments during natural disasters and other emergencies. He belongs to a group of amateur radio enthusiasts that assists the Boulder County Sheriff's Office in establishing auxiliary communications during emergencies.



One year later, in 1978, I had developed a transistor, 1 watt, 70cm TV transmitter for back-pack, portable use.

During the last year, Andrews has been building a system to transmit television signals on a laser beam over glass fibers. He believes that optical pulses will be used in the future for telecommunications, particularly in large urban areas and over long distances. The complex system that he has set up on a workbench in his laboratory converts television signals into infrared laser pulses. These optical pulses are transmitted along glass fibers to a photodiode and then to a television receiver. He spends his lunch hours working on perfecting this system.

Andrews became interested in optical transmissions while a guest worker from NBS at the Centre National d' Etudes des Telecommunications (CNET) in Lannion, France during 1971 & 72. While his television projects remain a hobby, they do fit in quite

nicely with his NBS work which involves developing instruments and techniques for measuring electrical and optical pulses.

WHOW ! - FARAD CAPACITORS

Digi-Key just sent out a product announcement about Super Capacitors. Includes a whopping 220 Farads (not µF, but F !). Rated at 3.8 Volts. Price is about $15 each.

W0BTV Details:

Inputs: 439.25MHz, analog NTSC, VUSB-TV; 441MHz/6MHz BW, DVB-T & 1243MHz/6MHz BW, DVB-T
Outputs: 423MHz/6MHz BW, DVB-T, or optional 421.25MHz, analog VUSB-TV. FM-TV output on 5.905 GHz (24/7).
Operational details in AN-51a Technical details in AN-53a. Available at: *https://kh6htv.com/application-notes/*

W0BTV ATV Net: We hold a social ATV net on Thursday afternoon at 3 pm local Mountain time. The net typically runs for 1 to 1 1/2 hours. A DVD ham travelogue is usually played for about one hour before and 1/2 hour after the formal net. ATV nets are streamed live using the British Amateur TV Club's server, via: *https://batc.org.uk/live/kh6htvtvr* or *n0ye*. We use the Boulder ARES (BCARES) 2 meter FM voice repeater for intercom. 146.760 MHz (-600kHz, 100 Hz PL tone required to access).

Newsletter Details:

This is a free newsletter distributed electronically via e-mail to ATV hams. The distribution list has now grown to over 400. News and articles from other ATV groups are welcomed. Permission is granted to re-distribute it and also to re-print articles, as long as you acknowledge the source. All past issues are archived at: *https://kh6htv.com/newsletter/*

ATV HAM ADS

Free advertising space is offered here to ATV hams, ham clubs or ARES groups. List here amateur radio & TV gear **For Sale - or - Want to Buy.**

SPECTRUM International Data Wanted: Does anyone have any spec. sheets or documentation on the old Spectrum International Band-Pass Filters ? I am especially interested the PSF-432. Byron, W5FH, Crockett, Texas --- bjtatum1@att.net

SLATS

ST. LOUIS AMATEUR TELEVISION SOCIETY

Buy - Sell - Trade - Giveaway

(web site: http://www.slatsatn.net/?page_id=713)
Check it out. New items listed every week

Items such as: Icom 751A, Remote Antenna Tuner, Antenna Bridge, RIGblaster, ATV ID-Maker, HiDes UT-120, NTSC Waveform Monitor & Vectorscope & More!

NEW PRODUCT ANNOUNCEMENT

KH6HTV Video has two new, low-noise Pre-Amp products. The models 23-LNA & 33-LNA replace the older (2012) model 23-4LNA. The 23-4LNA used an MMIC which is now obsolete and no longer available. The 23-LNA and 33-LNA are the same design. The only difference is the tuning of the Band-Pass Filter. On 23cm, the key specs. are: 14dB gain, 0.7dB noise figure, 115 MHz bandwidth & +21dBm (-1dB). On 33cm, the key specs. are: 16dB gain, 0.7dB noise figure, 80 MHz bandwidth & +20dBm (-1dB). A year ago, KH6HTV also released a NEW, 70cm Pre-Amp, the model 70-LNA. It's key specs are: 21dB gain, 0.5dB noise figure, 80 MHz bandwidth & +21dBm (-1dB). DC power requirements for all are: +12Vdc (+11 to +15V) at 95 mA. See www.kh6htv.com for detailed spec. sheets.