

# Boulder Amateur Television Club TV Repeater's REPEATER

June, 2020

BATVC web site: [www.kh6htv.com](http://www.kh6htv.com)

ATN web site:  
[www.amateurtelevisionnetwork.org](http://www.amateurtelevisionnetwork.org)

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**W0BTV Details:** Inputs: 439.25MHz, analog NTSC; 441MHz/6MHz BW, DVB-T & 1243MHz/6MHz BW, DVB-T Output: 423MHz/6MHz BW, DVB-T  
Operational details in AN-51a Technical details in AN-53a. Available at:  
<https://kh6htv.com/application-notes/> ATV nets on Thursday and Sunday afternoons at 3pm MDT. ATV nets are streamed via: <https://batc.org.uk/live/kh6htvtvr>

**National ATV Newsletter:** This newsletter started out in the summer of 2018 as a local newsletter for the 20 ATVers in the Boulder area. It has since grown to become somewhat of a national ATV newsletter with a free, e-mail circulation approaching 200. We are now including news from around the USA from other ATV groups. If you have items of interest to other ATVers, we invite you to contribute them to this newsletter.

## GOOD BYE - JACK

It is with mixed emotions that we say "Good Bye" to Jack Ciaccia, WM0G. Jack has been a mainstay of ham radio in Colorado for many years. He currently is our ARRL section manager for Colorado. He recently announced that he is retiring and moving back to his original home country in New England. Jack and his lovely wife, Mary, have made the decision to move back to New Hampshire and live with their two oldest daughters who have purchased a home to accommodate all four of them. Their new home sits on an acre of land with lots of tall trees. Hopefully Jack will



be able to string lots of antennas on that acre. We all hope to have many QSOs on HF with Jack in the future from W1 land.

Jack grew up in Providence, Rhode Island. He became interested in radio as a Boy Scout and got his novice license in 1958. Over the years, he worked in engineering and sales and marketing management for various large electronic companies. His most exciting times as a engineering tech rep. for Raytheon was flying missions off of aircraft carriers in the Tonkin Gulf. He was in the electronic warfare seat on Navy fighter jets over North Vietnam. Jack and Mary moved to Boulder, Colorado almost 40 years ago. By the mid 90s, Jack went in business for himself as an independent sales representative for electronic component manufacturers.

Jack has been extremely active in various radio amateur organizations. They included: BARC (Boulder Amateur Radio Club), BCARES (Boulder County ARES) and the ARRL. Jack served BARC for many years as president and newsletter editor. He was instrumental in getting BARC to have an HF base station accessible via the internet. In the mid 90s, Jack was the chairman (EC) of BCARES. When the Boulder Sheriff, asked BCARES to provide video support for the SWAT team, the BCARES board turned him down saying "It was too risky". But Jack stepped up to the plate and told the Sheriff he would instead volunteer. Less than three months after joining the SWAT team, Jack was on the front lines with a video camera for three straight nights of student rioting on Uni-Hill. Jack has always been there when a volunteer was needed. More recently, for the past ten years, Jack has been actively involved with the ARRL organization at the state level. Among his many accomplishments there has been the reorganization of ARES in Colorado. And even more significant was the establishment on a state level, the Colorado Auxiliary Communications ( AuxComm) program.

Jack -- We wish you and Mary, many happy years of retirement in New Hampshire, plus many more HF QSOs !

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### **Silent Key - WB6RAW**

We are sad to report the passing of fellow ATVer, Werner Vavken of Temecula, California and Maui, Hawaii. Werner was a technical contributor to this ATV newsletter. Werner was severely injured in an amateur radio accident back in January. He was welding on his antenna tower when his shirt caught fire. By the time he was able to get down, his flannel shirt was fully involved. He was in the UCSD Burn Center until mid April when he was then transferred to a rehab hospital. By then most of his burns had healed, but his lungs were damaged and he was on a respirator and was on dialysis. We all send Werner's wife, Sheri our sincere condolences.

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## EPISODE 302 - JIM ANDREWS - KH6HTV



Jim Andrews, KH6HTV, has spent a life in amateur radio and technology, and is known for his contributions to amateur radio television and now amateur digital television. Jim and the Boulder Amateur Radio Club use this technology to support emergency communications in and around Boulder, Colorado. KH6HTV shares his ham radio story in this QSO Today.

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QSO-Today interview episode 302 now available on [www.qsotoday.com](http://www.qsotoday.com)  
 The interview includes discussions about ATV.

**ATV News from Arizona:** Hello Jim -- I'm getting out there a lot (virtually these days) to recruit new ATVers. Our activity in Arizona and California is soaring. I saw your Micro-Hams webinar presentation live and it was excellent. I want to have this available during demos. Please send me a copy of the DVD. Thanks for being a guiding light out there,

73 de Rod Fritz, WB9KMO

Editor's Note: There are 3 ATV repeaters in Arizona, in Phoenix, Mesa & Tucson. They are part of ATN. For more info and contacts --- <https://www.adaw.org/docs/ATN.html>

**FREE DVD:** Free copies are available of the DVD of the Micro-Hams, webinar talk entitled "**Amateur, High-Definition, Digital Television**". Send your requests to: [kh6htv@arrl.net](mailto:kh6htv@arrl.net)

### More Comments on HDMI Audio Issues:

We here in St. Louis have also found the audio portion to be the most difficult part of our digital television. We lose our audio much more often than our video. The issues are numerous. Especially aggravating are HDMI hick-ups. Also getting our audio signal levels proper seems to be a challenge.

Windows can make audio for DVB a challenge if the PC is used for other applications between sessions of DVB. I am sure you have noted this. But the real issues of "no immediate" sync of audio to "no audio at all" when Win10 is configured properly is something no one here has figured out why. Maybe it is a receiver firmware problem?

Audio appears to be a lower priority than video is the scheme of all things too. We found the worst issues of audio come from You-Tube videos probably do to the codecs they use not compatible with the what Hi-Des is looking for (mpg2 which we leave as default here) Sample rate? That really has not shown to be an issue. We have tried different rates with no conclusion the robustness changed. Different modulators has not shown any difference in robustness. Now, obviously if the SNR is not good, the sound will not be either. Picture “always” decodes first. When it sound does work, it can work very well... for hours on end. Then, next day with same set up, no changes and no sound or intermittent. It must be on the “cliff” all the time. On the repeater, I have had to “toggle the power” when a station comes on and tries to play a YouTube video. It can be caused by the HDMI not syncing which normally is fixed by toggling the power on the HDMI switch.

I think I mentioned, that I have tried audio “extractors” to pick off the sound or audio “inserters” to add sound. They work ‘most of the time’ but perhaps it is because the sound just can not be inserted or extracted due to the HDMI issue at the HDMI firmware level. I dunno. We just live with it.

73 de Mel Whitten, K0PFX

For more info about the St. Louis ATV repeater - [www.slatsatn.net](http://www.slatsatn.net)

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**EDITOR's Note:** When we redesigned our ATV repeater to include DTV, we took to heart, Art's, W8RMC, advice regarding the need for being able to remotely Re-Boot the repeater. As Mel has noted, we too in Boulder encounter HDMI audio issues and find it necessary to often re-boot. We control our repeater via a separate radio control frequency using touch-tones (DTMF). We are able to activate features such as a Beacon with an ID slide show, quad display of all receivers, etc. Included is a RESET command which disconnects DC power for 10 seconds to all digital devices in the repeater. Anyone building a DATV repeater should definitely include such a remote RESET capability.

Jim, KH6HTV

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## NanoVNA Suggestion

Many hams have gotten the cute, little Vector Network Aalyzer, called the NanoVNA. It is a great tool and was recently reviewed in QST. With the tiny screen, I needed my reading glasses to see it. Fortunately, I found a free, computer program that directly interfaces with the NanoVNA and allows it to be controlled

from the computer and also display on a large computer monitor the many various graphs available with the NanoVNA. The program is called NanoVNA-Saver. It was developed by Rune Broberg and it is fully open source. The program can be downloaded from:

<https://hexandflex.com/2019/09/15/getting-started-with-the-nanovna-part-3-pc-software/>







## HLLY TV TRANSMITTER REVIEW

Jim, KH6HTV

In our last issue of this newsletter ( May, #44), Burt, N7CS, had an article discussing his mobile ATV setup in Seattle, Washington. Burt mentioned using a HLLY model TVX-50M transmitter as his ATV exciter on 434 MHz to get into the WW7ATS TV repeater. I was unaware of this particular unit and felt it might be worthwhile to report to the general ATV community about it. The first question I asked Burt -- is the TVX-50 an AM-TV or VUSB-TV transmitter. Burt wasn't sure --- The answer -- **IT IS AM-TV**. I asked Burt if he could give us a good technical evaluation of it. Burt said he didn't have the appropriate test equipment, but was willing to loan it to me to do the evaluation. The following are the results of my test of Burt's loaner.

The HLLY model TVX-50 is advertised for sale by several vendors on E-Bay for typically about \$100. It is advertised as a 0.5 Watt, TV transmitter which will tune from 76 to 780MHz in 100kHz steps. Other specs are: DC power 24Vdc @ < 0.5A, harmonics & spurious < -50dB, Audio response 50Hz - 15kHz. Accessories included are: wall wart AC power supply and antenna. It is made in China. Also advertised on E-Bay is a 2 watt version for about \$200 and a 100 watt version for about \$1,000. The specs. for the 100 Watt unit say it is only for UHF from 480 to 880 MHz.

So, the question remains -- "How true are these advertised specs.?" Like most electronic items from China, we need to ask hard questions because the specs. are quite often skimpy and often very inaccurate. Another issue with electronic gear from China is the firmware gets changed without notice or changes in the specs. This is especially an issue with the so called same items coming from many different vendors in China.

**Packaging:** The TVX-50M transmitter is nicely packaged in an all metal enclosure of 5.4" x 3.8" x 1". It has a 2 line, mono-chrome LCD display of 2.5" x 0.6". The display only displays the video carrier frequency and the sound sub carrier frequency, both of which are adjustable. The only controls are a on/off power toggle switch and 3

programming push buttons labeled Confirm Shift and Set. Mono audio and video inputs are RCA jacks. RF output is a BNC. DC power is via a standard DC jack. While the specs. say it takes 24Vdc power, the unit is labeled for 12Vdc power, center pin = +. The antenna provided is a nice, adjustable angle, telescoping BNC antenna.

**DC Power:** The dc power requirements is nominally +12 Volts. The current draw was 180mA. RF output started dropping at +11 Vdc. The unit worked the same at +13.8Vdc as it did at +12Vdc.

**Frequency Range:** I found that I could adjust the sound sub carrier frequency to 4.5, 5.5, 6.0 & 6.5 MHz.. The video carrier frequency could be adjusted from 28 to 990 MHz in 250 kHz steps, but not in the advertised 100 kHz steps. Thus the tuning range was wider than advertised, but the tuning steps were less. The sound sub-carrier can not be disabled.

**RF Output:** The RF output power was FALSELY ADVERTISED. The E-Bay ads all said 0.5 Watts, i.e. +27dBm Wrong ! What I measured was +15dBm (PEP on the sync tips), i.e. about 30 mW. 12dB low. A far cry from the advertised 1/2 Watt !!! The rf output level is not adjustable.

**Spurious & Harmonics:** I set the unit to 439.25 MHz with a 4.5 MHz SSC and then examined the spurs & harmonics. The video carrier was +15dBm, The 4.5 MHz SSC on either side was -17dBc. The second harmonics of the SSC were -43dBc. The advertised spec. for harmonics & spurious was greater than -50dBc. They missed it by a long shot. The 2ed harmonic was -26dBc and the third was -17dBc. There were several spurs noted at about -35dBc. They were at 18, 218, 660 & 1098 MHz.

**Video Performance:** The video performance was good. Tested with a multi-burst signal, the frequency response was flat up to 3.58 MHz and down 50% at 4.2 MHz. Color reproduction was very good. The video gain was found to be low. Sync was -33 IRE when it should have been -40. The white level was +92 IRE when it should have been 100.

**Audio Performance:** I did not test the deviation, but the audio sounded fine. I did measure the frequency response and it did match the spec. of being -3dB down at 50 Hz and 15kHz.

## CONCLUSIONS:

1. This can not be used as a low powered analog TV transmitter. It does not meet by a long shot it's advertised spec. of 1/2 Watt rf output power. It instead should be considered suitable for use as a modulator to drive an rf linear power amplifier.
2. My first preference for an analog modulator still is to use those intended for CATV service. This is because they produce true, vestigial sideband (VUSB-TV) and their spectrum is totally contained within a 6 MHz TV channel. These are available from ATV research ( [www.atvresearch.com](http://www.atvresearch.com) ) They sell models from several manufacturers,

including: Pico-Macom, Drake, Holland, and Blonder-Tongue. A fixed channel VUSB-TV modulator can be purchased for about the same price as this HLLY unit. Frequency synthesized VUSB-TV modulators which will tune from channels 2 - 135 can be purchased for a bit more money ( \$165 to \$275 ).

3. For driving an rf linear power amplifier, it is desirable to have an adjustable rf level from the modulator. This is possible with the CATV modulators. It is not possible with the HLLY. You will need to use an external, adjustable attenuator to set the proper drive level for an amplifier.

4. The sole advantage I see in the HLLY unit is it's ability to be tuned to the non-standard 70cm frequencies, some ATV groups in the USA are using. These include: 426.25 MHz and 434.00 MHz. The CATV, VUSB-TV modulators will not tune to these frequencies. The HLLY will.

5. HLLY also offers on E-Bay their model TVX-02S which they claim puts out 2 Watts. Is this really true ? It was false advertising for their 1/2 Watt unit. Hopefully someone will get their hands on one of these and also test it completely. At 2 watts it would be a useful, 70cm, AM-TV transmitter.



## **Reflector Antenna Installed on Rooftop**

**This Antenna  
Is used for  
Transmitting  
Digital Amateur  
Television  
To the Local  
Boulder, CO  
TV Repeater  
WØBTV  
on 1243 MHz**

**Ed Joy, KØJOY**

## **23 cm Parabolic Dish Antenna**

**Ed Joy, KØJOY**

Ed has struggled for quite awhile getting a solid signal into the ATV repeater. He decided to come up with a new 23cm antenna. Considering Ed's background it was to be expected that Ed would not want to just buy an antenna, but to design his own. The result was a modification of a 2.4 GHz, BBQ grill, parabolic dish antenna for use instead on 1.25 GHz (23cm band). These antennas are rated for 24dBi on 2.4 GHz. They typically sell in the \$60 range from many different vendors. Ed left the BBQ grill parabolic reflector intact. He modified only the dipole feed element to work on 23cms.

Antennas have been Ed's love since teenage years. For many years, Ed was a professor in electrical engineering at Georgia Tech, specializing in antennas. He is now professor emeritus, but he still teaches several times a year short courses on antennas and antenna measurements.

As Ed was working on his modifications of the 2.4 GHz dish, he kept us informed via our ATV nets. Each week, Ed gave us another antenna lecture on the principles of what he was doing. Each week, Ed created more new power-point slides to illustrate his lectures. Ed has provided me (kh6htv) with a .pdf copy of his power-point slides to be used here in our ATV newsletter. There are 42 slides overall. I am selecting a few of his slides to include here in the newsletter to describe Ed's new antenna. If you would like a .pdf copy of Ed's complete slides, Ed is willing to send you a copy. Just shoot me an e-mail, and I will forward it to Ed.



**Original Altelix  
AG24G24-NF  
24 dB<sub>i</sub> Gain @ 2.4 GHz  
Reflector (Grid)  
Antenna**

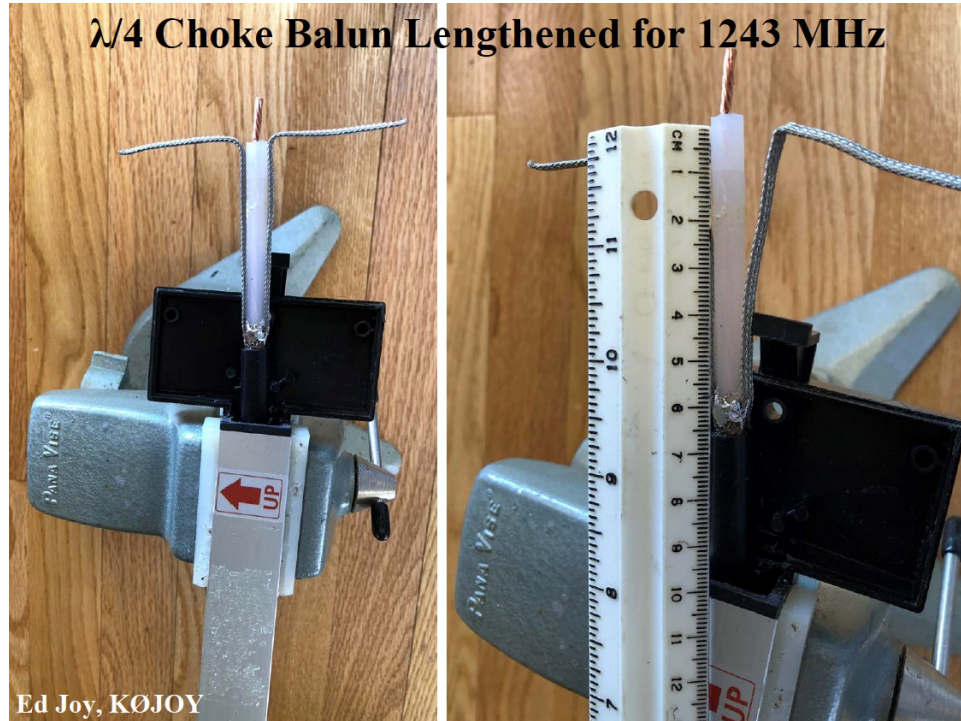
**Dipole and  
Coax Choke Balun  
Located in  
Black Plastic Box**

**Dipole Feed Reflector  
Five Vertical Dipoles  
in U-Shape**

**Ed Joy, KØJOY**



This is the original dipole feed for the BBQ grill antenna, prior to modification. Ed disassembled it to get at the actual dipole element and also the  $\lambda / 4$  choke balun. The next photo shows how he modified the choke balun to work on 23cm band.

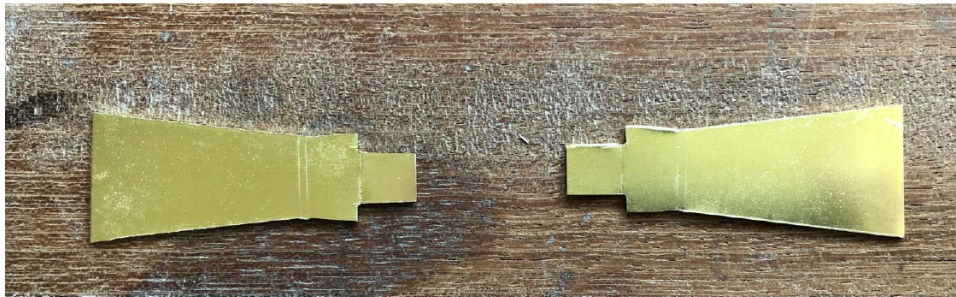


### Fitting Dipole in Box and Attaching to Coax Choke Balun



Note that the original dipole elements were actually extensions of the coax outer shield braid which was flattened and then bent at right angles to the coax. The center conductor was soldered to one of the dipole elements. Ed then soldered brass tabs onto the braid to lower the resonant frequency. He made these brass taps too long initially so he could later trim them back to resonance at 23cm. Also note that he cut small slots in the plastic box to hold the brass tabs in place. The next photo shows more details on the brass tabs.

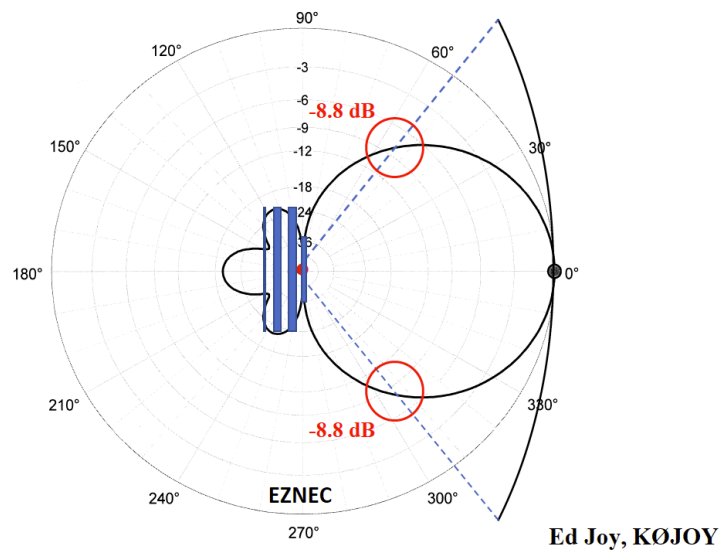
## Fabricating Broadband Dipole 0.025" Brass



Filing Fixture Used to Achieve Final Dipole Shape

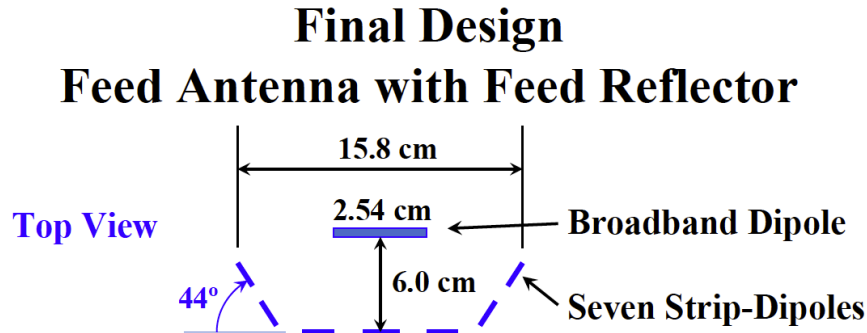


## Feed Dipole and Seven-Dipole Feed Reflector Vertical Plane





Next Ed turned to computer antenna modeling to design the optimum reflector to use with his broadband dipole feed. He tried several different designs before deciding that a folded reflector using seven strip dipoles was optimum. The above plot shows the illumination pattern of the parabolic reflector.



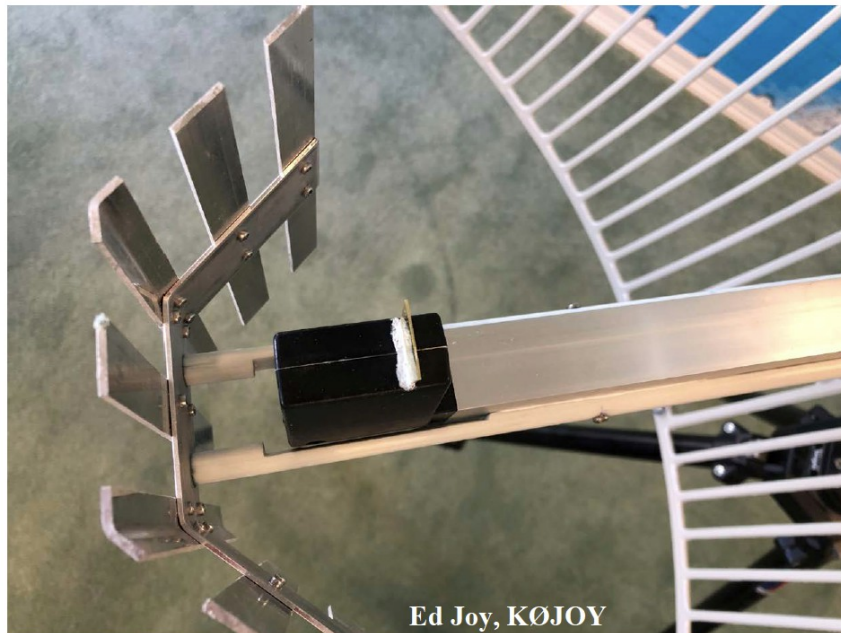
**11.3 cm Broadband Dipole with  
Seven-Strip-Dipole Reflector**

**VSWR < 2 (23 cm Band: 1240 - 1300 MHz)**

**Edge Illumination of Dish in Vertical Plane = -8.8 dB**  
**Edge Illumination of Dish in Horizontal Plane = -8.9 dB**

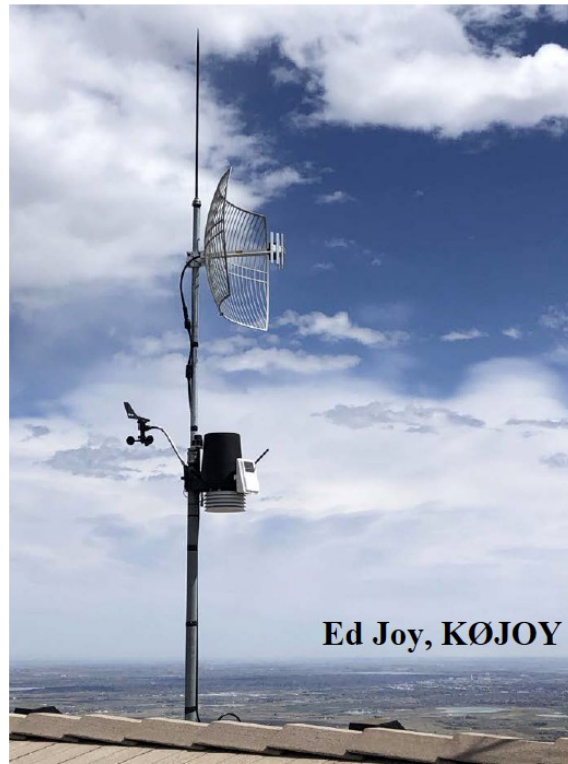
Ed Joy, KØJOY

## Broadband Dipole Feed Antenna With Seven-Element Strip Dipole Reflector



Ed then fine tuned his antenna for lowest VSWR by trimming the dipole brass tabs back and also adjusting the spacing between the feed dipole and the 7 element feed reflector. The tuned dipole length which resulted was 11.3 cm. Ed used 3/8" dia. fiberglass rods as supports to hold the feed reflector in place.

**Replaced 6-Element Yagi-Uda with 60cm x 100cm Reflector**  
**1243 MHz Theoretical Gain Increase = 7.25 dB, Measured Increase = 11 dB**



Ed measured the VSWR with an Anritsu S361E Site Master. Resonance was at 1265 MHz with a VSWR of 1.05. The VSWR was less than 1.45 over the whole 23cm band from 1240 to 1300 MHz. Ed then installed the new antenna on his roof top replacing his old Yagi antenna. He was able to compare the performance between the two antennas by keying up the Boulder ATV repeater, W0BTV, on 23cm and simultaneously watching the repeater's output on 70cm. The repeater uses a Hi-Des HV-120, DVB-T receiver. The receiver's on screen display is permanently enabled and displays the rf input power (in dBm), signal to noise (in dB), frequency/bandwidth and call sign. The rf power meter has been found to be quite accurate and linear, but it does have a significant offset. Thus Ed was directly able to measure relative differences accurately to within 1dB. Ed's new antenna gave him a whopping 11dB improvement over his old Yagi. Ed's computer modeling of the antenna predicted it would have a gain of 19.6 dBi<sub>L</sub> (L for linear polarization).

**Editor's Note:** *If you are fighting CC& R restrictions in your neighborhood, this antenna might be a way around them. You could legitimately argue that it is a dish antenna for TV.*