

# Boulder Amateur Television Club TV Repeater's REPEATER

March, 2023  
2ed edition, issue #125

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

ATN web site: [www.atn-tv.com](http://www.atn-tv.com)



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## FEED-BACK on ATV / DATV from Amateur Balloons

Well, we certainly did get a lot of responses from our plea for "help" in the previous issue #124. ATV from amateur balloon enthusiasts easily dates back over 35+ years to at least 1987. See the history related by Bill, WB8ELK, an early pioneer in these activities. Our southern California, ATN guru, Mike, WA6SVT, also sent us an interesting old 1992 issue of ATV Quarterly. In it were details about two balloon launches. One by the ATV folks in Dayton, Ohio. The other by Mike and the gang in California. Plus Mike provided lots of technical details. Darko, OE7DBH, in Austria also sent us some interesting and very relevant info about DVB-T from a balloon in 2014 by a group in Switzerland. In addition to simply getting video down from a balloon, several writers talked about using balloons as air-borne ATV repeaters. Thanks to all who responded.

Jim, KH6HTV, editor

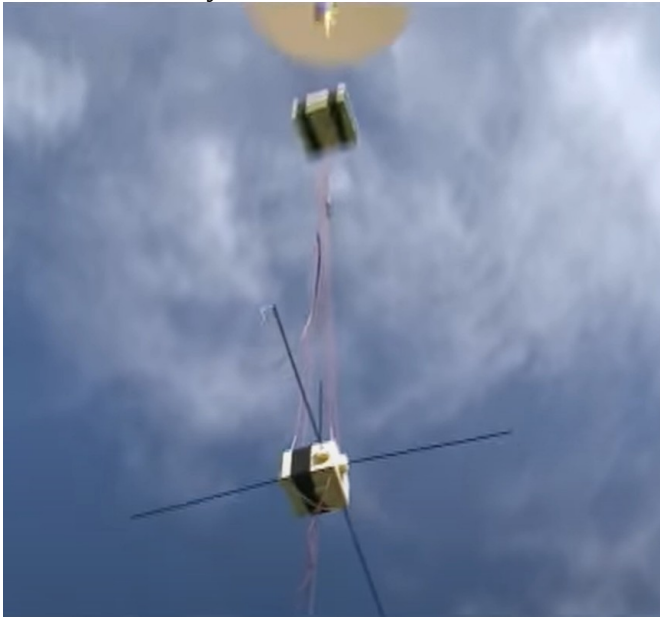
## DATV Success from Balloon in Switzerland

From **Darko, OE7DBH**, Pians, Austria --- 2014 Stratosphere Ballon project in Switzerland with HV310 reported at: <https://www.oe7forum.at/viewtopic.php?p=1497#p1497>

Email report from HB9/DL6MFG Christoph Wildfeuer, Donauwoerth, Germany

"We reached HB9 on October 14th over 100 km on 70 cm with HiDes DVB-T transmitter, 2 MHz bandwidth and 500 mW transmission power. We made a live video transmission from a balloon.

The transmitting antenna was a circularly polarized crossed dipole on a stratospheric balloon that rose to an altitude of 36 km. The receiving antenna is a circularly polarized helix antenna with 7 turns, which was always tracked to the balloon.



Pictures: <http://www.hb9aw.ch/stratosphaerenballon-14-10-2014/>

Movie: <https://www.youtube.com/watch?v=4-UffhkyQ4U> 2 1/2 minute broadcast TV news

note: HB9AW is the Radio Club Sursee in Willisau, Switzerland

"Balloon camera is good, but it turns and is not stable - after 1 minute you can watch headaches of too much movement in picture. Ham largest DVB-T forum world wide

<https://www.oe7forum.at/viewtopic.php?p=1379#p1379>

Another idea, why not a repeater as a balloon load ? Repeater Input on 23cm Band <--> Repeater Output 70cm Band ( both 4 MHz BW )

23 cm big wheel antenna ---> BR101EH --> power amplifier 400mW ---> 70cm big wheel antenna BR101EH is 1 to 1 stream transmission RTX without demodulation and signal quality losses. In the meantime, somewhat outdated with a better shoulder distance, but for this 5 ~ 7 hours of flight, bad shoulder gap will not make that much fault. Advantage: Low power consumption a few hundred mA + aprx. 600mA power amplifier What kind of attraction? Start on the last day of Dayton Hamevent ? or day after. If only for a short time, DATV connection East and West USA !! :-)

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from **Mel, K0PFX**, St. Louis -- writes "Thanks again for the newsletter. I sent it to K5WH, Walter in Houston. He is with an active balloon launching group down there and they have used digital TV. "

South Texas Balloon Launch Team <https://www.facebook.com/SouthTexasBLT/>

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from **Bill, N3DC**, Cheverly, MD -- writes "Hey Jim great newsletter. Bill, WB8ELK, did a lot of ballon launches he is still good in QRZ. I have no experience but can fund a project, so put me on the list."

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from **Dave, N2OA**, Batavia, NY -- writes "Just a thought on using DATV on a Balloon. I've been hoping to do some high altitude balloon launches and was thinking of trying a LimeSDR and Pi but a

HiDes transmitter stripped from its case would probably cost about the same and be easier. I'm glad you posted the information, it made me think a bit more about it."

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from **John, K0ZAK**, Reisterstown, MD -- writes "Hi Jim, Thanks for the newsletter. One possible lightweight payload for a balloon, how about the HiDes BR101E repeater? Transmit on 435 Mhz and receive on 900 Mhz? 2 antennas with a bit of vertical separation and a couple of watts from a power amp. It will transmit an ID screen when no incoming signal is present. I wonder how much vertical antenna separation would be required with a couple of watts out on 435 to avoid desense on 900 Mhz? They do make some really cheap and light 915 Mhz bandpass filters though. I've been thinking of setting up the exact same thing on a tethered balloon for testing. Have you ever played with the BR101E?" (*editor's note: BR-101 ?, Yes, see my application note, AN-54 for an evaluation of the BR-101 by Dave, AH2AR, and myself.* ) I think the HiDes BR-101 repeater & power amp would be the lightest package option, especially if you skipped the repeat mode and second antenna, and just used it in Beacon mode with the onboard ID. Adding the second antenna for live repeat mode would likely bring it to about the same weight as the HiDes camera package. DVB-S would also be a valid mode for the balloon, and offer some advantage in range with low power & bandwidth signals. The minimum equipment required for this would be a RPI4 with Portsdown software and an Adalm-Pluto or Lime mini modulator (as well as a power amp) The soon to be released Caraboulite tophat could replace the Pluto or Lime and make the package even more compact. This package would be able to transmit either DVB-T or DVB-S but I think that DVB-S would offer an advantage with weak signals and narrower bandwidths. Unfortunately, adding software to the mix would add risk of failure with power issues, but could also allow adding things like telemetry to the video signal."

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from **Walter, K5WH**, Houston, Texas -- writes "I have copied Kirk, KK2Z, on the message here, as he has recently been deemed our new ATV guru for the HAB balloons we normally launch. Unfortunately, we lost our top guy not too long ago as an SK, but Kirk has graciously been putting all the pieces back together for this. We are sending up at least 2 Pico balloons every month, but our lack of access to helium has shut down our high altitude balloons for a couple years now. I believe it was DVB-T on our last few flights, but Kirk will have to keep me honest on that. I can't speak to the ATV side personally, but I can certainly share a great deal on the launches and some of the challenges we have had to work through at times."

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from **Kirk, KK2Z**, Burnet, Texas -- writes "Jim, Let me see if I can summarize our experiences with DVB in the last few years. We used DVB-T on 2 flights with mixed results -- didn't hold or regain signal lock well. We switched to DVB-S and DVB-S2 using the Portsdown 4 system from the British ATV group. ( [https://wiki.batc.org.uk/Portsdown\\_4](https://wiki.batc.org.uk/Portsdown_4) ) That runs well on a Raspberry Pi 4 using a Pi-Cam for video and a LimeSDR mini and a small (1-2W) amp on the transmit side. We had clear video about 80% of the time up to 105,000 ft altitude. It worked pretty well, but not perfect either. We have a line of sight test range that lets us separate the TX/RX by about 23 miles that we used to try different settings. Our best results were with DVB-S2, Pi Cam, SR 1000 720P. A set top box can receive if the SR is 2000 or higher, but that didn't work as well in our long-range tests. We gave up using the set top box and used a standalone MiniTiouner that unfortunately isn't available anymore. One option is to receive with an SDR, but we didn't try that (yet). I'm not sure what I'd use in the future -- the LimeSDR mini and MiniTiouner aren't available. Time to try "alternate plan B" I think....just not sure where that's located."

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from, **Bill, WB8ELK**, Madison, AL -- writes "Hi Jim, I was the first person to fly ATV from a high altitude balloon using a PC Electronics 1-watt ATV Transmitter and one of my Elktronics video ID boards. That first flight was on August 15th, 1987. In 1988 we flew the first live camera ATV from a balloon from the Mojave Desert region launched from Apple Valley, CA. Tom O'Hara W6ORG recovered that one with his helicopter from the sand dunes. Bob W9PRD, Don W9NTP and myself flew another ATV balloon in 1988 this time with a Wyman Research ATV transmitter and one of my video ID boards. We flew an updated version in 1989 from Illiinois with dramatic live camera views using a Little Wheel antenna. I have flown many many more ATV flights after those first flights. Our local University of Alabama Huntsville Space Hardware Club has flown ATV multiple times, mostly analog ATV but have flown some HiDes digital ATV flights with an SAU4 amplifier."

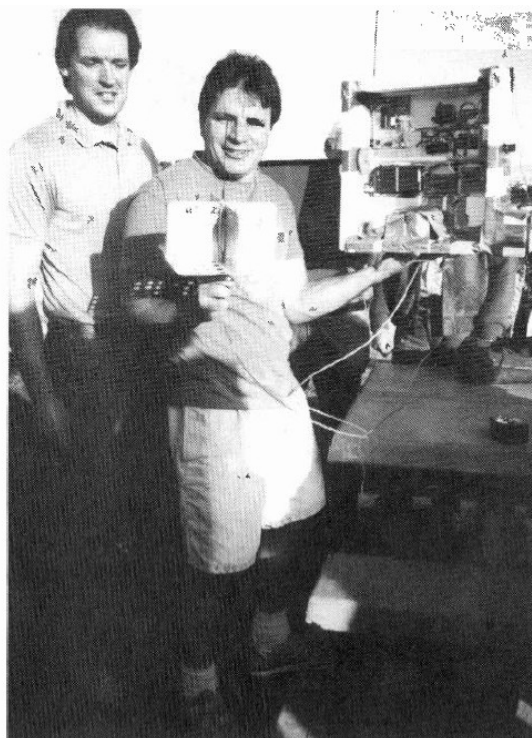
from **Bill, K0UT**, Ft. Collins, CO -- writes "Thanks for the newsletters. I noticed the article about ATV and balloons. Many years ago, Edge of Space Sciences sent up some balloons with ATV: [https://www.eoss.org/hardware/spin\\_atv](https://www.eoss.org/hardware/spin_atv) [https://www.eoss.org/hardware/atv/inside\\_atv](https://www.eoss.org/hardware/atv/inside_atv) It looks like EOSS made several flights with ATV: <https://www.eoss.org/search/node/atv> As you noted, weight limitations keep ATV away from the pico balloons."

from **Mike, WA6SVT**, Crestline, CA -- writes "Aloha Jim, I can share some experience with ATV via a balloon. Balloon payload weight limit is 12 pounds. Besides the 1 watt analog ATV setups that are common. I was able to put a five watt system together. The power amplifier was an SAU-4 due to the lower idle current. This same brick will work well for DVB-T at about 1.5 watts average if pushed a bit can still work at 2 watts. I have one of the DVB-T cameras from Hi-Des and it should drive the SAU4 directly, If the new cameras have less drive then a PHA-1 should work as a driver.

Heat or I should say getting rid of it can be an issue as the air is so thin a fan is of little use. What I did was cut an aluminum plate one half wavelength square I used this plate to function in four ways.

1. Antenna ground plane
2. Chassis to hold the transmitter and batteries
3. Heat sink that radiates the heat rather than relying on air to cool
4. Radar reflector

I cut a smaller plate to act as a heat spreader (about twice the size of the brick. The RF brick uses the standard PC board. The plate does get warm but not hot and also has a benefit of keeping the batteries warm so they last longer. In my case I used a BNC connector in the middle of the plate with a 1/4 wave 70 cm whip as an upside down ground plane. With the whip in the middle there is about 1/4 wave around from that.. That allowed for a 1 ft sq ft cube when counting the Styrofoam box.



Mike KC6CCC and Mike WA6SVT prepare the payload for liftoff.

A much younger Mike, WA6SVT, 1992

I used styrofoam to box the sides and top. This gave us snow free or nearly snow free pictures out to 300 miles using normal mid size ATV Yagi. Ground station at launch site: Tripod with the short boom M2 Yagi. We also had another setup with a long boom yagi but that was only useful when the balloon was far off down range. We launched from San Clemente on the Pacific coast and had RX reports from as far as Phoenix AZ and Cabria on the central California coast. We also lit up every ATV repeater in Southern California well until about 15k feet then we saw ghosting and a snowy picture. Stations 70 miles away could receive OK with their terrestrial aimed Yagis. Steep elevation of the Yagi was needed at launch site and stations down range that were underneath the package. Bill Brown WB8ELK and Mike, KM7MH (formerly KC6CCC) also were on our ATN team that built and launched from San Gorgonio Park in San Clemente. This link has the ATVQ article on the balloon. See pages 50-52. <https://worldradiohistory.com/Archive-DX/Amateur-Television-Quarterly/Amateur-Television-Quarterly-1992-Spring.pdf> Note: the same issue of ATVQ contains another balloon story from the Dayton, Ohio group.

I have also flown an ATV repeater. I have also done 2.4 GHz, 2 watt. The FM on 2.4 GHz worked very well until the FM cutoff where AM was a smoother roll into snow.

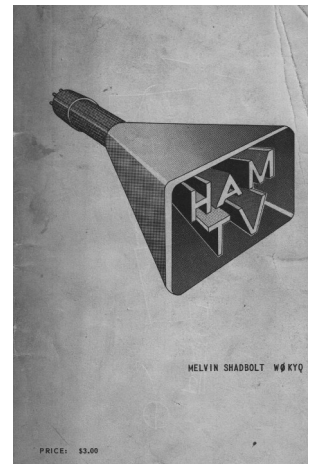
The best RX antenna at the launch site or station underneath the balloon was not linear polarity but CP (small satellite Yagi) This also worked best for any station once the balloon popped to reduce QSB. I would guess DVB-T would work well for the ascent but lockup time to reacquire the signal once the package tumbles on decent may be an issue. DVB-S may work a bit better during the descent as lockup time is reduced.

I think the HD pictures from the HiDes camera/exciter would be fantastic and my camera/exciter is only 720p and that would work well running QAM-16."

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## The Best \$3 I Ever Spent

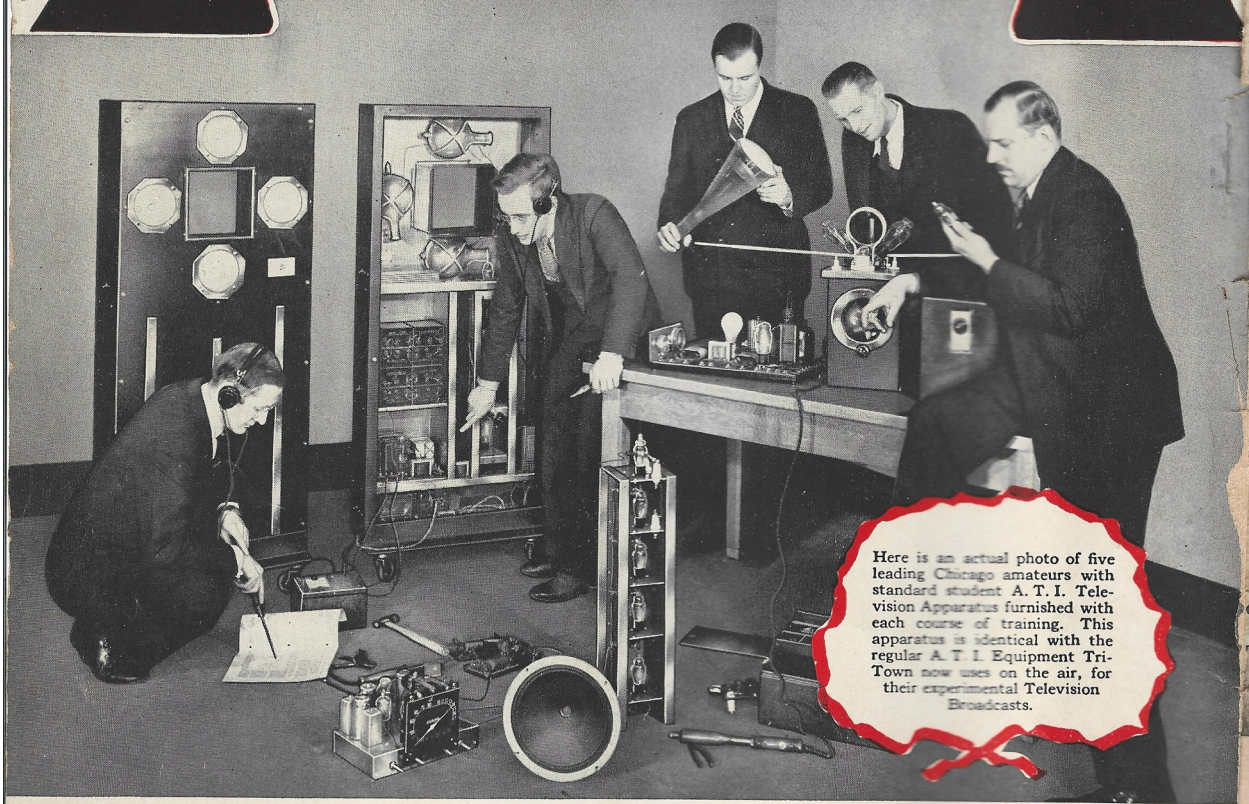
One of our early ATV pioneers and founder of ATV Research [www.atvresearch.com](http://www.atvresearch.com) passed away on Feb. 28th - Mel Shadbolt, WØKYQ. Back in 1961 I bought Mel's book, Ham TV, and read it cover to cover anxious to try this facet of amateur radio. Although at the time, the circuits were all tubes, it gave a good overview of simple analog TV circuits and an incentive to try constructing some gear. I built his flying spot scanner and used it to send my first picture connected to a surplus APS-13 transmitter. It was Mel's book that I credit for suppling the bug that bit me for a lifetime. I've talked to Mel many times over the years whenever I would call to place camera orders at his company. He was always ready with sage advice and friendly conversation which I will miss. ----- Tom O'Hara, W6ORG



## W9MMJ, Tri-Town Amateur Radio Club, Chigago - ATV in 1938 !

Thanks to Dave, KC3AM, Claymont, DE, for this interesting ATV advertisement from April, 1938.

# Read What TRI-TOWN RADIO AMATEUR CLUB Says About Their A.T.I. TELEVISION OUTFIT



Here is an actual photo of five leading Chicago amateurs with standard student A. T. I. Television Apparatus furnished with each course of training. This apparatus is identical with the regular A. T. I. Equipment Tri-Town now uses on the air, for their experimental Television Broadcasts.



Dr. Norman F. Ellemeier says, "As an optical expert, I find the A.T.I. equipment in line with the finest precision standards. It produces an exceptionally good image. The sensitivity is remarkable."



Edward Gibbons, W9TAK, says, "I have worked with A.T.I. equipment. It lends itself perfectly to experimental work and hundreds of tests which give you a first hand practical knowledge of television."



E. F. Wiechmann, W9RLA, says, "I am tremendously impressed by the size and quality of your equipment. The cathode ray tube and four photo electric cells alone are worth the entire price you ask for the complete machine and training."



Mr. A. C. Roberts, W9YMF, says, "I have used your A.T.I. television equipment thoroughly. It is of the highest quality. Every part is made as good as the best that would be made."



G. L. Desland, W9TSM, says, "This equipment is practical and lends itself admirably to experimental uses and the study of television."

### We Invite All Men to Write to Us

The Tri-Town Radio Amateur Club, W9MWJ, of Ridge Park, Chicago, is the only Amateur Club, we believe, that has its own Television Experimental Laboratories. Their television test broadcasts on the air will mark the beginning of local amateur cooperation dedicated to the progress and perfecting of Television. The enthusiasm these "hams" show over their A.T.I. Television Equipment, and their appreciation of the cooperation A.T.I. Engineers have extended to them is well reflected in their statements. We have hundreds of letters from A.T.I. men throughout the nation, expressing their enthusiasm about A.T.I. Equipment and A.T.I.'s new method of learning Television at home, with practical equipment. The American Television Institute cordially invites all men who are interested in Television to write for complete information on the A.T.I. New Method of Television-Radio Training.

### A.T.I. Equipment Includes:

Complete television transmitter and receiver, cathode ray tube with large 7" screen, sweep circuits, photo electric cells, gas arcs, 50 watt radio transmitter, super-heterodyne receiver, hi-gain transmission amplifier, projector, Mazdas, lenses, loud speaker, meters, phones, and complete RCA tubes. Large five foot steel rack and panels with separate television receiver. Complete text books and technical manuals. This equipment is sent to you at home, and is yours to keep, and is worth \$1,000 to anyone taking this training. You learn by actually doing television work with your own equipment at home under our direction. Television can not be properly learned from texts alone, that's why we give you all this equipment in addition to a full engineering course in Radio, Television and Electronics with final training in our laboratory in Chicago under the direction of internationally famous television engineers. Employment service given to graduates.

### You Can Make 350 Experiments . . .

With this A.T.I. Equipment, you can make over 350 amazing, interesting Television and Electronic experiments right in your own home. You can produce your own Television program for a local audience . . . transmitting and receiving the faces of your friends. You can build a complete Television Receiver that picks up any modern 411 line signal . . . Television Transmission and Reception Systems, Television Amplifiers, Radio Transmitters, Television Pick-ups, Photo-Electric Relays, Light Beam Telephone, Magic Lantern, Grid-Glow Alarm, Sound Amplifiers, Photo-Electric Photometers. You can make hundreds of comparison tests that show you Television and Radio in a quick, simple way . . . much easier to understand than just mere words in a book. It costs you nothing to thoroughly investigate this opportunity. You cannot afford to pass it up. Send Coupon Now.

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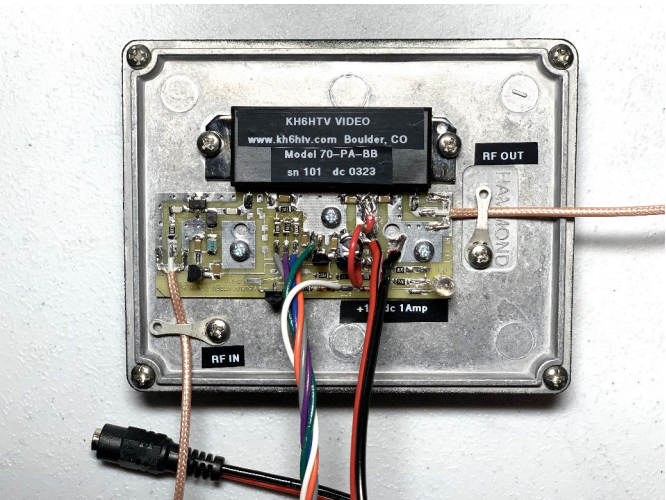
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Model 70-7B Amplifier



Model 70-PA-BB Amplifier

## 1 Watt DATV Amplifier for Balloons

As I mentioned in the previous newsletter, I have gotten several recent inquiries from amateur radio/balloon groups wanting advice on how to fly digital ATV on their balloons. The first part of this newsletter was the great response we got from our readers with advice on balloon ATV. A key element that came across to me was the desire for a balloon rf amplifier to boost the rf power level above the few milli-watts available from a digital ATV modulator. In our Feb. 2023, issue #123, newsletter, I informed folks of a low cost amplifier from China which I tested and found capable of producing about 150 mW of DVB-T power at 70cm. Some of the balloon amateurs felt that still wasn't enough power, and were requesting more.

For these balloon projects, there are some serious constraints. Weight being a biggie. More rf power means more current from a battery, meaning a bigger, but heavier battery. It also comes with additional thermal issues of heat in the amplifier and how to get rid of it. Bigger heat sinks also imply more weight.

One possible solution I have proposed to these balloon amateurs would be to strip down my old model 70-7B amplifier, and also throttle it back to a lower rf output power and thus lower dc current drain.

When I first discovered DVB-T back in 2014, I right away found the need for a suitable, rf linear power amplifier. I thus set out to design what became my model 70-7B. See the photo above. The amplifier is basically a 70cm, 20-25 Watt amplifier for CW/FM service. For analog ATV, I rated it at 10 Watts (PEP on sync tips). For digital ATV, it puts out 3 to 3.5 Watts (average). I designed it with plenty of gain so it could be driven directly from a low level CATV, analog modulator. The gain is about 54 dB. When running at 3 Watts (+35 dBm) DVB-T output, the amp pulls about 2.5 Amps at +13.8 Vdc. It works well down to +10 Vdc losing only about 1 dB in power.

When I designed the amplifier, I found that I could adjust the gain, rf power output, and dc current draw by varying the gate voltage on the MOSFET final amplifier. So I designed it to have a rotary front panel switch with selectable rf power levels of High (+35dBm), Medium (+30dBm) and Low (+25dBm). The dc current dropped to about 1.1 Amp (medium) and 600 mA (low).

The 70-7B proved to be a popular amplifier, particularly with ARES groups. For example, the Boulder, Colorado ARES group (BCARES) purchased four of them for use in their back-pack portable, DVB-T transmitters. The size, weight, and battery requirements were a good match for this application. Also BCARES found in many field situations, with the adjustable rf power level, they were often times able to get a perfect, digital P5 signal into the police/fire command post running on Low power with only 300 mW (+25dBm). Over the years, I have built and sold about thirty of the model 70-7B. I have also sold about 55 of the big brother, 10 watt (DVB-T), model 70-9B and 23 of the 23 cm version, model 23-11A.

An ATV transmitter (or amplifier) must be designed to withstand continuous operation over an extended period of time. Thus a requirement for 100% Duty Cycle. For the 70-7B running 3.5 Watts rf output, but with 2.5 A current draw, this meant an input of about 35 Watts. Sorry about the inefficiency, but the laws of physics rule. The digital signal waveform looks like pure random noise with lots of high peaks and deep valleys. We absolutely can not clip off the peaks without destroying the bit error rate (BER) and losing completely our digital video pictures. For DVB-T, we have found we need to provide at least 8 dB of head-room to accommodate the peaks in the signal. Hence for a 3 Watt average DVB-T signal, we need an amplifier capable of at least 20 Watts peak.

For the model 70-7B, 35 Watts of DC input, meant there would be heat sinking required. It was thus built in an all metal, extruded enclosure, with an added small heat sink and a 50x50mm cooling fan. See the above photo.

To satisfy the balloon amateurs, I decided to see what I could accomplish with the basic 70-7B amplifier, but mounted on a much smaller, lighter weight heat sink and biased for lower dc current draw. The result is the amplifier shown above on the right. I decided to label it as the model 70-PA-BB. i.e. 70 cm, Power Amplifier, Bare-Bones. The heat sink used is a 4 1/2" x 3 1/2" die cast metal plate.

I set the gate bias for the final amplifier to lower the rf power out and dc current draw. The pc board contains three bias circuits for High, Medium and Low power. The desired bias is selected by connecting the appropriate wires shown leading from the board in the photo. For DVB-T operation at a nominal supply voltage of +12Vdc, the end result was:

High Power Mode: RF = +30dBm, Id = 1 Amp, Heat Sink Temp (max) = 70° C

Med. Power Mode: RF = +28dBm, Id = 800 mA

Low Power Mode: RF = +25dBm, Id = 600 mA

At a max. DC voltage of +13.8Vdc, I got +31dBm, 1.1 Amp and 74° C. Dropping the dc to +10V, lost only 1 dB in rf power. Obviously, the heat sink ran cooler at the lower power levels.



**WOBTV Details:** Inputs: 439.25 MHz, analog NTSC, VUSB-TV; 441MHz/6MHz BW, DVB-T & 1243 MHz/6MHz BW, DVB-T

**Outputs:** Channel 57 --- 423 MHz/6MHz BW, DVB-T, or optional 421.25 MHz, analog VUSB-TV. Also, secondary transmitter, 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/>

**WOBTV ATV Net:** We hold a social ATV net on Thursday afternoon at 3 pm local Mountain time (22:00 UTC). 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/> Select *ab0my or n0ye*. We use the Boulder ARES (BCARES) 2 meter FM voice repeater for intercom. 146.760 MHz (-600 kHz, 100 Hz PL tone required to access).

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