Boulder Amateur Television Club
TV Repeater's REPEATER
Sept, 2019 - 2ed issue

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Future Newsletters: If you have contributions for future newsletters, please send them to me. Jim Andrews, KH6HTV, email = kh6htv@arrl.net

QST Article Generates Interest:

My September **QST** article on "*Digital ATV Repeaters*" has generated some interest. Here are some of the e-mails I have received as a result.

ATV News from Kentucky: e-mail from Henry, W4HTB, 8/26/19

Hi Jim, nice article, good to get ATV back in front of the amateur world. Our repeater here in Bowling Green Kentucky is located on Western Kentucky University campus on one of the highest locations in the city. The repeater call is KY4TV. Inputs are 439.25 MHz A5 and 1280 MHz FM. Output is 421.25 MHz A5 I am testing a digital setup that will be added soon using DVB-T 2MHz BW transmit and receive via touch-tone control. The transmit side is a HV-310 driving a Comark amplifier to 40 watts. The receiver is an HV-110. The DVB-T output will be on 423.00 so I can use the same Rx-Tx filters as in the analog chain. Hopefully all our locals will go digital some day. We are a chapter of the ATN California group. Presently no web page My email is w4htb@ieee.org

73 de Henry Cantrell, W4HTB

NEW ENGLAND: e-mail from Larry, N1URE, 8/27/19

Greetings from Massachusetts. Larry Steiner here. I enjoyed the atv article you have in QST. Analog atv is gone here. I had a repeater, see the magazine attached. (ATV Quarterly, Winter 2004) One thing I thought you may be interested in is the antenna. I imagine this will work for digital atv. I had very good luck with a homemade slot antenna. It's horizontal polarization make for less interference and it has a null at the ends. Also gives a little gain, like a donut. Mmmm donuts. But I digress. I ran 100 watts in band! Now you should calculate the proper spacing, assuming you have freedom of movement on the tower. But for an engineer like yourself, that's part of the fun.

Well, good work and have fun. Larry, N1URE

p.s. I dig the home made interdigital filter. Chop that side band off and run on the edge of the band.

WISCONSIN: e-mail from Joe, WB9SBD, 8/27/19
Morning Jim. I found your article very interesting in the September QST about Digital ATV Repeaters. Now in your article you mention how small and simple a repeater can now be. And yes that IS super simple! The valid signal makes it soooo simple! In the NTSC Days I remember trying to make up sync detector circuits, to do that same thing, was TOUGH!

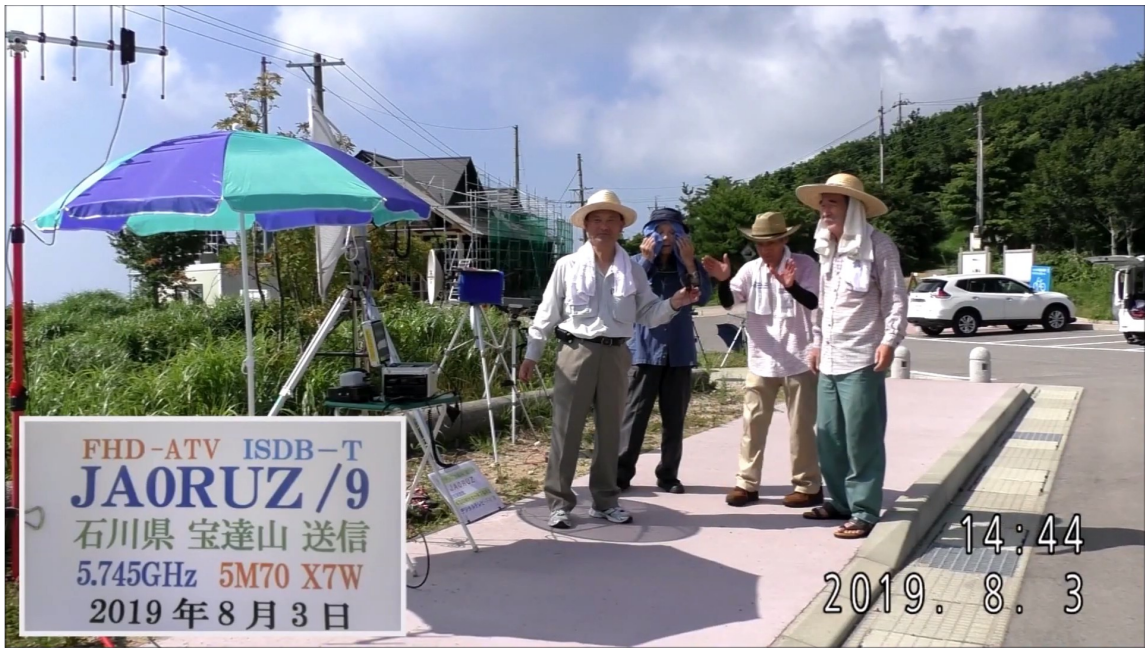
Now question for you, How small, simple, and lightweight, can say 1 to 5 watt ATV repeater be made? See, I am one of the veteran first ones back in the 1980's people that were doing those High Altitude balloon flights. Matter of fact our first flight was in August 30 years ago now. We have done over 60 of these flights. Here is an example of one we did for several hundred Boy scouts a while ago. https://youtu.be/HJ0IT4ZwtSo and the View from 118,000 feet. https://youtu.be/EdAuHr-bZ1M When these balloon flights all started in the mid 1980's all were beacon only flights. One way from the balloon down to the ground. I am one always trying to push the envelope, to do things no one else has ever done. So our first flight we ever did was an actual FM 2 meter repeater! Imagine the coverage of a repeater at 120,000 feet , best DX was two stations one in Golden CO, talking to a station in Virginia Beach VA. way cool eh? All of our flights were ground user friendly! Where people on the ground could use the system like a low height OSCAR more or less. Repeaters are on EVERY Flight. even the video ones. Our favorite ATV Transmitter was from Don W9NTP Wyman Research. Don has passed and is a silent key now. But he had a feature on all his ATV transmitters that no one else had.

The video carriers were on the average of 3 watts. And on most standard TV transmitters the audio carrier was way way much lower. Don in his transmitters made them really neat, He had the 3 watt AM NTSC Video, along with the weaker sub carrier 4.5 MHz away. BUT.... he also FM modulated the main 3 watt Carrier! with the audio. So the 3 watt signal not only did the NTSC Video but was also a 5KHz FM audio that any standard FM rig could hear and use on 439.25 MHz was super cool! a free 3 watt NBFM Transmitter! So we had both the video from the payload, but also a cross band repeater too for voice. NEAT! Now we were trying as stated we were gonna try to do a ATV repeater. But just could not get satisfactory sync detection to happen. See if no signal was heard in the recvr, we would transmit down to the ground the view from the balloon camera. but when a ground based video signal was heard it went into repeater mode and repeated the ground station signal as a repeater. But we just never got good enough sync issue resolved.

Now your article has me interested again on maybe trying this again. since the valid thing makes it sooo simple as you say. Now one question,,,, I have heard comments about digital TV not liking moving parts IE" a Moving Transmitter or recvr. that something happens to the signal or something? This Balloon transmitter at certain times a year can exceed 200+ Miles per hour, would that be a problem? And at the first part of decent after the balloon pops, it can even exceed 700 mph during freefall. would that be an issue? So how small and light do you think we can get?
73 de Joe, WB9SBD, Near Space Sciences KB9KHO

ATV News from California: e-mail from Mario, KD6ILO, 8/26
Awesome newsletter Jim and well done with the new repeaters upgrade improvements. I'm going to program a time slot for your Thursday nets via one of my FPGA logic blocks on board the repeaters matrix controller [DMRc-7230]. The programmed algorithms procedure has taken me some time to work on and still a work in progress. I'm putting together a third Matrix repeater controller as a spare for the two(2) I already have in operation. The controller monitors and controls mostly all the functions that are operational on the repeater systems including link status between repeaters, even the mobile VR-Link Television system unit in my Jeep when deployed. Also just an update since the controller has a network interface I've placed a AREDN node at one location and I can control my systems fictions that way also. 1-Rf link, 2- 4G and 3- AREDN. Each system has it's own IP phone at location with three digit extension. Our group conducts portable exercises mostly every month at least three times a month since we support served agencies for EMCOMM. 6 MHz BW works very well for us, HD is well received here for [12] users. 73! -- OCS DATV Group.

e-mail 8/29 -- Aloha Jim, --- We had managed to uplink your repeater net today with success. Video and audio NLQ was 100%, audio level was automatically set to 80% by controllers mixer. Test time slot was set to sixty five minutes for ID and overlap. Great video which made it easier as video adjustments we're not needed by the controllers matrix video logic control. More study, adjustments and testing. 73 to your team a job well done by all with your upgrades. Mario, KD6ILO, Oceanside, CA



JAPAN -- e-mail from Fumio, JA0RUZ, 8/29/19 **287 km DATV on 5 GHz**
Nice to meet you Jim Andrews KH6HTV. I read your QST article. There were many articles that were very interesting. In Japan, I develop and operate a 5GHz band full HD ATV. The system uses the ISDB-T method similar to that of Japanese terrestrial digital

broadcasting, and has already skipped 287km without problems. If you search our operational video etc. with JA0RUZ or FHD-ATV. As you can see, please see.
However, the ISDB-T in Japan has many problems and is in trouble, but I have almost solved it and can now operate it. This unit is equipped with an FHD monitor and FHD recording / playback device and can be easily carried around. In Japan, the ISDB-T system in Japan has become the mainstream of "Full Hi-Vision Digital ATV", and nearly 40 amateur stations have already been experimenting with it. The communication distance seems to be possible more than this 287km, but the conditions have not been met with the communication partner so far. We look forward to your continued support for 64QAM FHD-ATV.

If you can, please take a look at these YouTube videos for the current state of digital ATV in Japan.
https://www.youtube.com/watch?v=WepWVuXtH5E
https://www.youtube.com/watch?v=l7WemuiVELI
https://www.youtube.com/watch?v=J43mP3hHwi0&t=117s
https://www.youtube.com/watch?v=K6XwfZhVn2s&t=16s
Thank you in advance de JA0RUZ, Fumio Sekizaki, ruz@cap.ocn.ne.jp

Records de Distance ATV-DATV: In Fumio's e-mail, he also provided a link to HB9AFO, Michel's web site which lists world distance records for ATV on many ham bands from essentially DC to Daylight. They start at 50 MHz and go up to RF frequencies of 411 GHz and then laser frequencies up to 741 THz in the UV region. The link is: http://www.hb9afo.ch/records/default.htm Looking at Michel's records, we found that there are no records yet claimed for DVB-T on 5.7GHz or 2.3GHz. The claimed records for 430MHz (70cm) and 1200MHz (23cm) bands were both 60km, by F5DB and HB9AFO. 60km = 37.5 miles. We have already beaten these here in Boulder. Don and Jack's recent SOTA, DX-pedition to the summit of Pike's Peak working several Boulder and Longmont stations on 70cm and 23cm far exceeded the 60km record. As a result, Don, N0YE, has just submitted a claim to HB9AFO to claim the title.

5 GHz - DVB-T in Boulder: After Don, N0YE, watched Fumio's YouTube videos about working DTV on 5 GHz over a 287km path, it got him excited to also get on 5GHz with DVB-T. So Don, immediately set to work to pull together the necessary gear from his well equipped workshop. Within less than 1/2 a week, Don made it happen. He sat up a micro-QRP (< 12dBm) transmitter and dish at his house and then drove into Boulder and sat up a receiver and dish to pick up his own signal over a 6 km path. Here is Don's report.

A successful DVB-T transmission at 5856 MHz was made today (1 Sept 2019) from my QTH to the two story garage next to Macy's on 30th street in Boulder, CO. The distance is 6.0 km with a clear line of sight. The signal was a solid P5 signal. No measurements of signal level were made.

The power out of the transmitter was about 5 dBm into the coax connected to the dish antenna. The transmit antenna is a commercial dish antenna about 12 inches in diameter. The receive antenna is a commercial dish about 15 inches in diameter. The feed is a Kent Britain, 2-12 GHz log periodic antenna. The 5 foot coax to each antenna was good quality with SMA connectors.

The up converter consists of an LO, mixer and amplifier. There is no band pass filter at this time. The LO is a Cal Micro brick that has a 104.948 MHz crystal oscillator and a x60 multiplier. The output frequency of the LO is 6498 MHz. Using the LO as a high side LO and with an IF input of 441 MHz DVB-T, the transmitted signal of interest is 5855.9 MHz DVB-T. The power out of the amplifier is slightly more than 12 dBm which includes the power out 441 MHz both above and below the LO frequency because there is no band pass filtering.

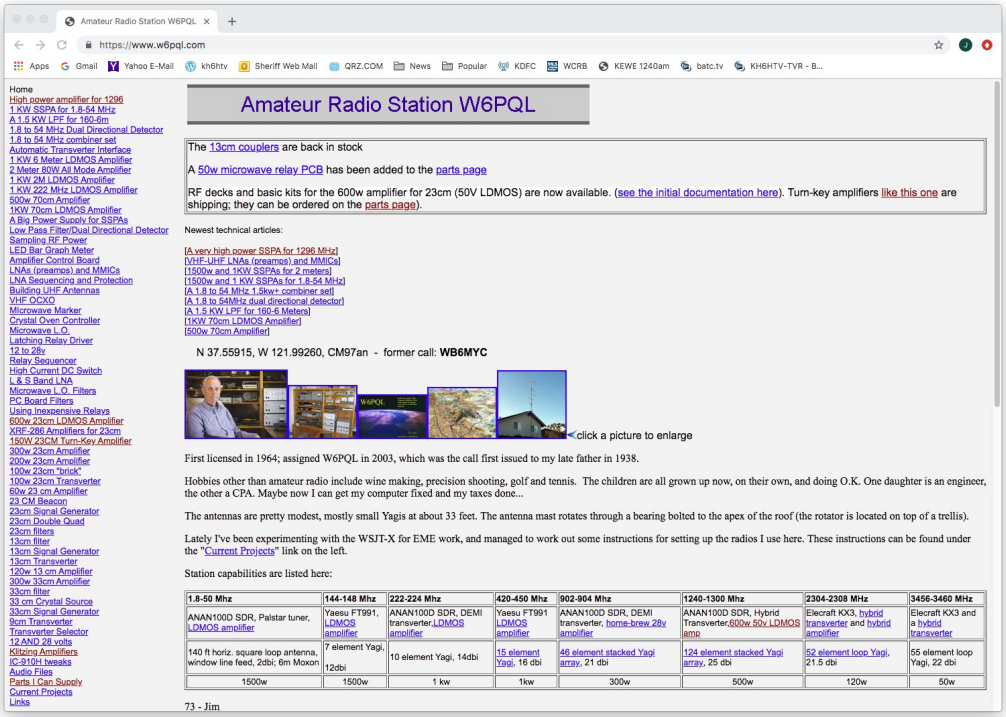
The down converter consists of an LO, mixer, and preamplifier. There is no band pass filter here – none needed. The LO is again a Cal Micro brick that has a 101.5278 crystal oscillator and a x64 multiplier. The output frequency of the LO is 6497.9 MHz. Using the LO as a high side LO, the output of the mixer is 641.90 MHz DVB-T. Since both the transmitter and the receiver are using high side LOs, the resulting IF out of the mixer is the “right side up” DVB-T signal. The gain and NF of the preamplifier are not known. The preamplifier gain is sufficient to fix the NF of the receiver to the NF of the preamplifier.

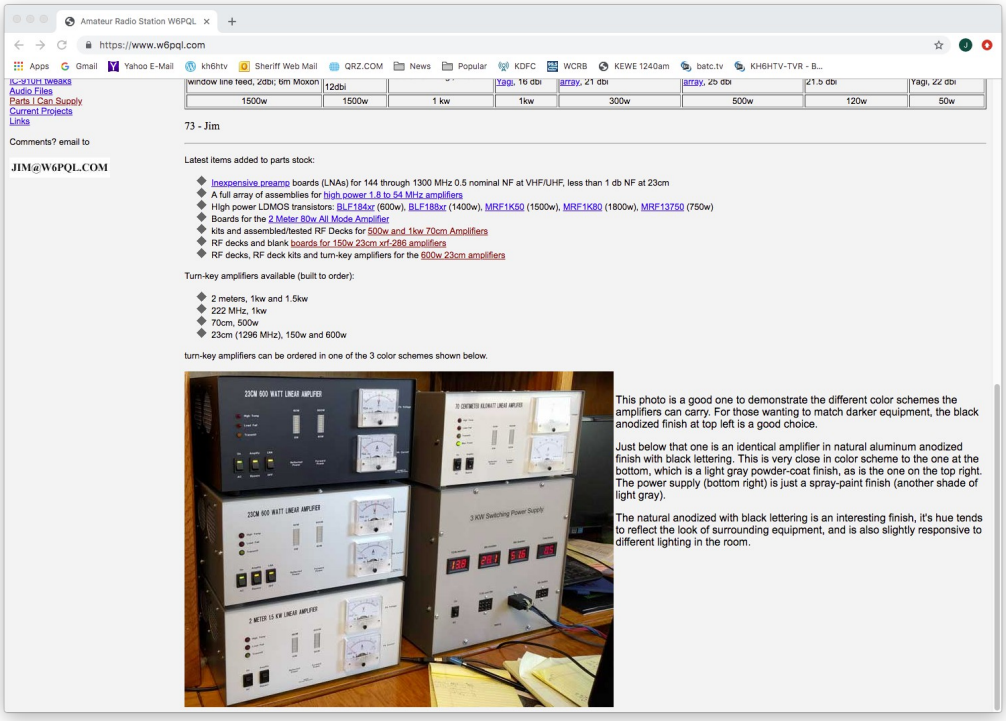
ARRL EDITORIAL: Recently a ham friend of mine asked "Why should I belong to the ARRL ?" Granted many feel the annual dues of $49 are a bit steep for the QST magazine. But, the ARRL is much more than just QST. The biggest reason to support the ARRL is because it is our lobbying voice in Washington, D.C. and also internationally to protect our valuable spectrum. As the world becomes more and more wirelessly interconnected, the pressure to grab our frequencies for commercial use will only become greater. We NEED the ARRL ! Beyond lobbying, the ARRL also provides us with a great many other services, including: publishing books on the many varied aspects of amateur radio, organizing contests, public service through the ARES, contests, electronic logbook, etc. Bottom Line -- if you love our hobby, then support it through the ARRL. Join up -- the $49 dues is a bargain for what you and your fellow hams receive from the ARRL.

73 de Jim, KH6HTV

W6PQL -- Supplier of High Power Amplifiers

Mike, WB6SVT"s recent article in CQ-DATV about Dougherty amplifiers mentioned W6PQL as a supplier of high power VHF/UHF amplifiers. I found Jim Klitzing's web site at: www.w6pql.com Check it out. He has a LOT of very interesting projects and products that would be of interest to us ATV, VHF, UHF and microwave enthusiasts. See his opening home page for an astonishing list. For many items he can provide parts kits, or finished boards. He also offers to build a few, completely finished, turn-key, high power amplifiers. They include: 2m (1 & 1.5kW), 70cm (500W), 23cm (150W & 600W).


Amateur Radio Station W6PQL
https://www.w6pql.com
Apps Gmail Yahoo E-Mail kh6htv Sheriff Web Mail QRZ.COM News Popular KDFC WCRB KEWE 1240am batc.tv KH6HTV-TVR - B...
Home
High power amplifier for 1296
1 KW SSPA for 1.8-54 MHz
A 1.5 KW LPF for 160-6m
1.8 to 54 MHz Dual Directional Detector
1.8 to 54 MHz combiner set
Automatic Transverter Interface
1 KW 6 Meter LDMOS Amplifier
2 Meter 80W All Mode Amplifier
1 KW 2M LDMOS Amplifier
1 KW 222 MHz LDMOS Amplifier
500w 70cm Amplifier
1KW 70cm LDMOS Amplifier
A Big Power Supply for SSPAs
Low Pass Filter/Dual Directional Detector
Sampling RF Power
LED Bar Graph Meter
Amplifier Control Board
LNAs (preamps) and MMICs
LNA Sequencing and Protection
Building UHF Antennas
VHF OCXO
Microwave Marker
Crystal Oven Controller
Microwave L.O.
Latching Relay Driver
12 to 28v
Relay Sequencer
High Current DC Switch
L & S Band LNA
Microwave L.O. Filters
PC Board Filters
Using Inexpensive Relays
600w 23cm LDMOS Amplifier
XRF-286 Amplifiers for 23cm
150W 23CM Turn-Key Amplifier
300w 23cm Amplifier
200w 23cm Amplifier
100w 23cm "brick"
100w 23cm Transverter
60w 23 cm Amplifier
23 CM Beacon
23cm Signal Generator
23cm Double Quad
23cm filters
13cm filter
13cm Signal Generator
13cm Transverter
120w 13 cm Amplifier
300w 33cm Amplifier
33cm filter
33 cm Crystal Source
33cm Signal Generator
9cm Transverter
Transverter Selector
12 AND 28 volts
Klitzing Amplifiers
IC-910H tweaks
Audio Files
Parts I Can Supply
Current Projects
Links
Amateur Radio Station W6PQL
The 13cm couplers are back in stock
A 50w microwave relay PCB has been added to the parts page
RF decks and basic kits for the 600w amplifier for 23cm (50V LDMOS) are now available. (see the initial documentation here). Turn-key amplifiers like this one are shipping; they can be ordered on the parts page).
Newest technical articles:
[A very high power SSPA for 1296 MHz]
[VHF-UHF LNAs (preamps) and MMICs]
[1500w and 1KW SSPAs for 2 meters]
[1500w and 1 KW SSPAs for 1.8-54 MHz]
[A 1.8 to 54 MHz 1.5kw+ combiner set]
[A 1.8 to 54MHz dual directional detector]
[A 1.5 KW LPF for 160-6 Meters]
[1KW 70cm LDMOS Amplifier]
[500w 70cm Amplifier]
N 37.55915, W 121.99260, CM97an - former call: WB6MYC
click a picture to enlarge
First licensed in 1964; assigned W6PQL in 2003, which was the call first issued to my late father in 1938.
Hobbies other than amateur radio include wine making, precision shooting, golf and tennis. The children are all grown up now, on their own, and doing O.K. One daughter is an engineer, the other a CPA. Maybe now I can get my computer fixed and my taxes done...
The antennas are pretty modest, mostly small Yagis at about 33 feet. The antenna mast rotates through a bearing bolted to the apex of the roof (the rotator is located on top of a trellis).
Lately I've been experimenting with the WSJT-X for EME work, and managed to work out some instructions for setting up the radios I use here. These instructions can be found under the "Current Projects" link on the left.
Station capabilities are listed here:
1.8-50 Mhz
144-148 Mhz
222-224 Mhz
420-450 Mhz
902-904 Mhz
1240-1300 Mhz
2304-2308 MHz
3456-3460 MHz
ANAN100D SDR, Palstar tuner, LDMOS amplifier
Yaesu FT991, LDMOS amplifier
ANAN100D SDR, DEMI transverter,LDMOS amplifier
Yaesu FT991 LDMOS amplifier
ANAN100D SDR, DEMI transverter, home-brew 28v amplifier
ANAN100D SDR, Hybrid Transverter,600w 50v LDMOS amp
Elecraft KX3, hybrid transverter and hybrid amplifier
Elecraft KX3 and a hybrid transverter
140 ft horiz. square loop antenna, window line feed, 2dbi; 6m Moxon
7 element Yagi, 12dbi
10 element Yagi, 14dbi
15 element Yagi, 16 dbi
46 element stacked Yagi array, 21 dbi
124 element stacked Yagi array, 25 dbi
52 element loop Yagi, 21.5 dbi
55 element loop Yagi, 22 dbi
1500w
1500w
1 kw
1kw
300w
500w
120w
50w
73 - Jim


Amateur Radio Station W6PQL
https://www.w6pql.com
Apps Gmail Yahoo E-Mail kh6htv Sheriff Web Mail QRZ.COM News Popular KDFC WCRB KEWE 1240am batc.tv KH6HTV-TVR - B...
IC-910H tweaks
Audio Files
Parts I Can Supply
Current Projects
Links
Comments? email to
JIM@W6PQL.COM
73 - Jim
Latest items added to parts stock:
Inexpensive preamp boards (LNAs) for 144 through 1300 MHz 0.5 nominal NF at VHF/UHF, less than 1 db NF at 23cm
A full array of assemblies for high power 1.8 to 54 MHz amplifiers
High power LDMOS transistors: BLF184xr (600w), BLF188xr (1400w), MRF1K50 (1500w), MRF1K80 (1800w), MRF13750 (750w)
Boards for the 2 Meter 80w All Mode Amplifier
kits and assembled/tested RF Decks for 500w and 1kw 70cm Amplifiers
RF decks and blank boards for 150w 23cm xrf-286 amplifiers
RF decks, RF deck kits and turn-key amplifiers for the 600w 23cm amplifiers
Turn-key amplifiers available (built to order):
2 meters, 1kw and 1.5kw
222 MHz, 1kw
70cm, 500w
23cm (1296 MHz), 150w and 600w
turn-key amplifiers can be ordered in one of the 3 color schemes shown below.
23CM 600 WATT LINEAR AMPLIFIER
This photo is a good one to demonstrate the different color schemes the amplifiers can carry. For those wanting to match darker equipment, the black anodized finish at top left is a good choice.
Just below that one is an identical amplifier in natural aluminum anodized finish with black lettering. This is very close in color scheme to the one at the bottom, which is a light gray powder-coat finish, as is the one on the top right. The power supply (bottom right) is just a spray-paint finish (another shade of light gray).
The natural anodized with black lettering is an interesting finish, it's hue tends to reflect the look of surrounding equipment, and is also slightly responsive to different lighting in the room.

Application Note
AN-5a

rev. a - Sept. 2019

P5 - TV Signal Quality Reporting

Jim Andrews, KH6HTV
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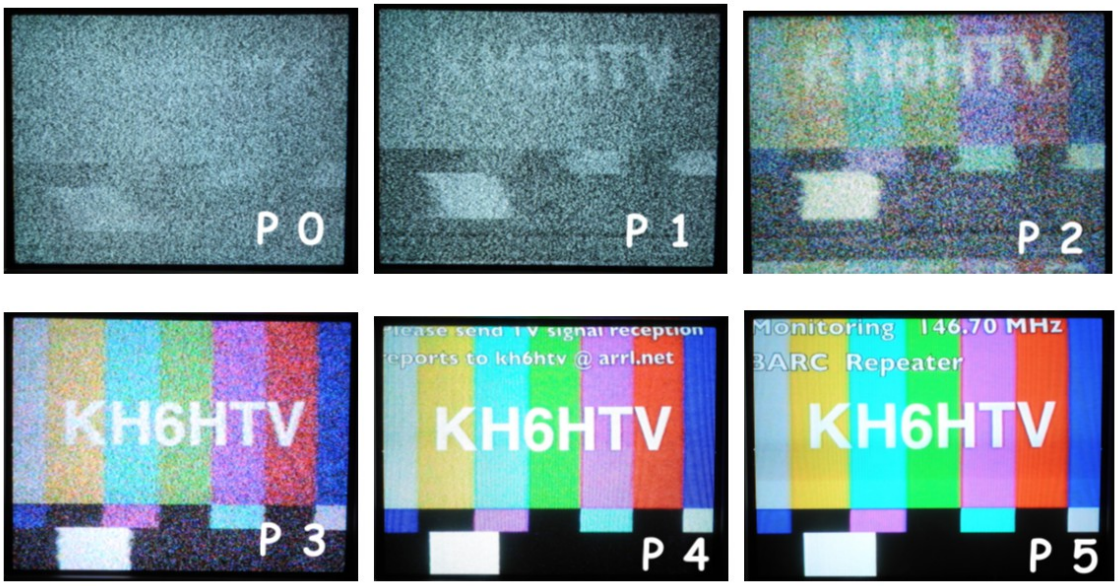
In ham radio, we hams are always reporting to the other ham a set of numbers conveying information about the signal strength and quality. For cw, we use the R-S-T code, where R stands for Readability, S stands for signal strength and T stands for Tone quality. For voice communications, we typically only report R and S. The Readability definitions are: R1 = unreadable, R2 = barely readable, R3 = readable with considerable difficulty, R4 = readable with practically no difficulty and R5 = perfectly readable. For the S number, we report the actual numerical value indicated on the S or Signal Strength meter. The range for S readings is from 0 to 9 where each S unit corresponds to a 6 dB increase in signal strength with S9 being defined as 50 µV. An S0 signal is thus down at the typical SSB receiver noise level of 0.1 µV. (note: not every rig's noise level nor S meter calibration adheres closely to this definition) For very strong signals, we report the dB over S9. An example would be a report of "5 by 9 plus 20 dB". Unfortunately, far too many hams give every report as "5 by 9", which then becomes meaningless to the recipient.



In amateur TV (i.e. ATV), we use a similar reporting system called the P or Picture report. We don't typically give S reports because our TV receivers normally do not include an S

meter readout. Our P reports are similar to the R reports for cw and voice. Most hams use a P rating from 1 to 5. I personally have added two more of P0 and P4.5. Our definition for ham TV P reports is:

P0 Extremely weak signal. At the threshold of the receiver noise. Can only detect the presence of possible sync. No useable image.

P1 Very weak signal. Can detect presence of video buried in the noise. Mostly snow. Receiver often times has difficulty sync locking. Only very large block letters are barely readable, such as in a camera view of only the call sign on a stationary, automobile license plate. OK for DX reporting only.

P2 Weak signal. Lot of snow present in image. Usually Black and White only with no audio. Can detect presence of people in the image and movement. Not a useable picture for routine, pleasurable viewing. Note: some excellent receivers might show color with a P2 signal. Then instead of white "snow", you will experience a shower of colorful confetti !

P3 Moderate signal. Still has snow present in image. Color lock. Audio is present, but noisy. Acceptable picture for people living in very rural areas watching analog broadcast TV.

P4 Strong signal. Very good color and audio. No snow or confetti. Some defects noted in picture quality. Almost full quieting on the FM audio.

P4.5 Strong signal. Only a very few, minor picture defects. A border line P5.

P5 Very strong signal. Perfect, noise-free, picture and audio.

It should be noted that most newer production TV receivers on the market now all include a built-in video squelch. The squelch threshold is typically not adjustable, nor is one able to disable the squelch. Thus, newer TV receivers oftentimes will not display weak, signals below a P3 or maybe a P2 level.

I have made many controlled TV picture measurements using a calibrated step attenuator (1 dB steps) and a spectrum analyzer in my ham shack and have come to the following conclusions. For VUSB (or AM) TV transmissions, to obtain a P5 picture requires an RF signal to noise ratio of S/N > 40 dB. For each P unit from P0 to P4, there is an increase in signal strength of 6 dB, i.e. the same definition as used for S units. For FM-TV, the FM quieting effect kicks in earlier and results in a considerably lower required S/N for good to excellent pictures. For comparison, modern digital TV receivers will either give you a perfect, P5, picture - or no picture at all. The have the "Cliff Effect". All or nothing, i.e. you fell over the cliff. The cliff edge is very sharp. If you see any picture defects, such as pixelization, losing another 1dB or less of signal strength, the picture is totally lost. The table and graph on the next page vividly show these results.

"P" Units	VUSB-TV RF S/N	FM-TV RF S/N
P0	0 dB	0 dB
P1	6 dB	5 dB
P2	12 dB	7 dB
P3	18 dB	10 dB
P4	24 dB	13 dB
P4.5	30 dB	16 dB
P5	40 dB	20 dB