

Boulder Amateur Television Club TV Repeater's REPEATER

May, 2022
2ed edition, issue #101

BATVC web site: www.kh6htv.com

ATN web site: www.atn-tv.com

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



Hi-Des Update: The favorite products for our DATV activities are the Hi-Des (www.hides.com.tw) HV-320E Modulator and HV-110 Receiver. Their availability recently has been hit and miss on their E-Bay web site. Calvin at Hi-Des has informed me that the HV-110 is again available, but the HV-320E is not. He hopes it will be again available by the end of May.

An Alternate DVB-T Modulator ? ? --- Earlier this spring, I received an order for a complete 70cm DVB-T transmitter / receiver package from Rich, AC0UB. When I tried to order the HV-110, they were out of stock with a long lead time, but I was able to order the HV-320E for Rich. So I scrambled to find an alternate supply of receivers for Rich. As a result, I found on Amazon the "combo" DVB-S/T receiver I discussed in the previous April, issue #99 newsletter. In the meantime, Hi-Des shipped the HV-320E, but it has gotten lost in the mail somewhere. USPS tracking says "Your item is being processed by US Customs". But it has said that now for 1 1/2 months ! So, I again needed to search for an alternate source of a DVB-T modulator for Rich. I found one on the internet from a company called SatLink in China. I ordered one and have recently received it. I have done a complete evaluation of it and found that that I must give it both a "thumbs up" and a "thumbs down" recommendation. To find out more, look further here in this issue for my newest application note, AN-63, *"Evaluation of SatLink WS-6990 DVB-T Modulator"*

Jim, KH6HTV, Boulder, CO

An Up-Date is Not Always an Improvement: When I lost everything in the recent Marshall Fire, it included my Hi-Des DVB-T gear. I have since replaced the HV-320E modulator with a new one. However, I was disappointed in its performance. It had major issues accepting different HDMI inputs. Changing HDMI

sources, it would not accept a new one, unless I actually rebooted it by removing and reapplying the 12Vdc power. It also refused to accept HDMI from my new HP-PC computer. Checking with AV-Sender, the firmware installed was version 55.46. Fortunately, I had saved on my old HP laptop the material Hi-Des had sent on a CD when I had purchased my previous HV-320E in 2019. It included the firmware version 55.40. So, I removed 55.46 and installed 55.40. This partially resolved the problems. My modulator now accepts readily the HDMI from my HP-PC. It also usually will accept a swapping of HDMI inputs. But not always. Sometimes I still need to re-boot with a power cycle.

Jim, KH6HTV

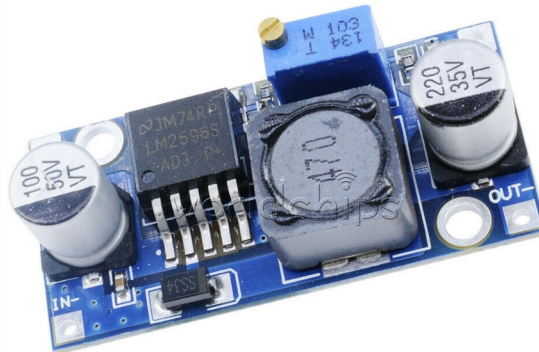
Low Cost Voltage Boost Switching Regulator

Bob, WB0NRV, has called our attention to a new product on the market which greatly simplifies creating higher DC voltages from lower voltages. Bob says he is using it as a simple means of switching his 28Vdc coax relays from a 12V power source. Do a google search for MT3608 to find many on-line suppliers. Prices range all over the place. I found them on Amazon at \$10 for a pack of 10.



The specs. are: Input Voltage: 2V to 24V, Output Voltage: 5V to 28V, Differential Voltage: must be > 3 V, Output Current: 2 Amps (max), Conversion Efficiency: 96%, Switching Frequency: 1.2 MHz, Output Ripple: < 100 mV, Load Regulation: $\pm 0.5\%$, Voltage Regulation Factor: $\pm 0.5\%$, Size: 37 x 17 x 14 mm

Many of us have already been using for several years now a similar Step-Down switching voltage regulator based upon the **LM2596**. It also is available on-line for typically \$1 each. It's key specs. are: Input Voltage: 3.2 to 40V, Output Voltage: 1.25 to 35V, Output Current: 3 Amps (max), Efficiency: 92%, Switching Frequency: 65kHz, Output Ripple: < 30 mV, Load Regulation: 1%, Size: 43 x 21 x 14mm



Don, W9NTP (SK) Revelations: Recently my mixed doubles tennis partner, Karen, gave me a magazine article she thought I might be interested in because it involved a ham radio operator. The article was in the November, 2021 issue of Vanity Fair magazine. The article was entitled "The BONE COLLECTOR". The lead intro read ---- "In 2014, the FBI discovered an entire museum -- and thousands of human remains -- in the home of a 90 year old Indiana man, who hosted the Boy Scouts and claimed to have detonated the first atomic bomb. Was he a pillar of his community or the most prolific grave robber in modern American history?" It was about Don Miller, W9NTP.

So who was Don, and why am I bringing this up here in our ATV newsletter? Well, old timers in ATV would easily recognize the name Wyman Research, which was Don's company. Here is a photo of some of Don's AM and FM, TV transmitters.



I first met Don at the Dayton hamvention in 2013 when I shared a display table with Mike, WA6SVT, of ATN. Don was quite interested in my demo of digital ham TV. As a matter of fact, Don was my only customer at Dayton as he purchased one of my DATV transmitters.

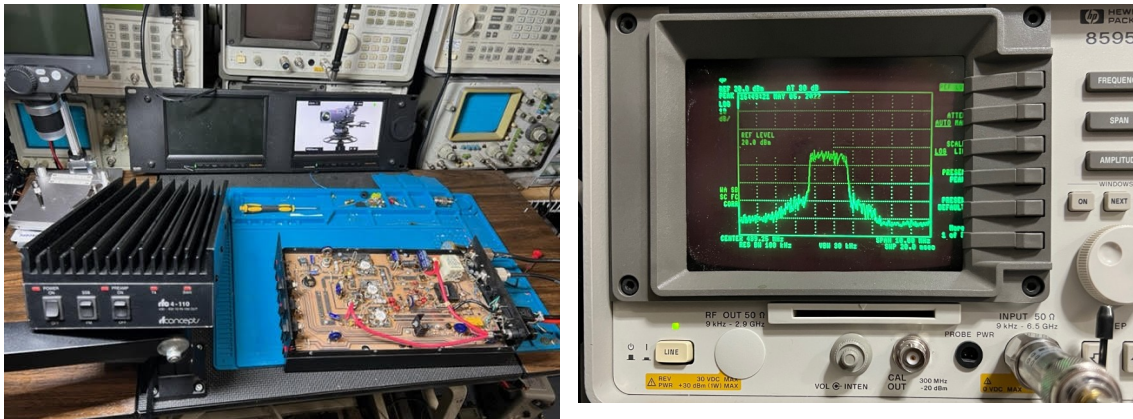
Don died in 2015. The ARRL published a nice obituary which is still available on their web site. They honored Don as an Amateur Radio Television Pioneer.

<http://www.arrl.org/news/amateur-radio-television-pioneer-don-miller-w9ntp-sk>

Jim, KH6HTV

IARU, Region 1, ATV Contest

Region 1 of the International Amateur Radio Union (IARU) is Europe, Middle East, Northern Asia and Africa. There is an ATV contest held annually on the second weekend in June. This year it will be on the 11th & 12th of June. It runs from 12:00 UTC on Saturday through 18:00 UTC on Sunday. The purpose is to encourage ATV activity. Contacts must be on simplex. QSOs via repeaters or satellite transponders are not valid for the contest. Only one contact per station per band is allowed. However rover stations are permitted. A rover must move at least 5 km to be considered as a new station. Scoring is 2 points/km on 70cm band, 4 points/km on 23cm band, and 10 points/km on all higher bands. Either analog or digital ATV may be used for the contest. This year for the first time, a parallel contest will be held on 6 meters. The frequency to be used will be 51.7 MHz with a maximum bandwidth of 500 kHz using either DVB-T, DVB-S or DVB-S2. 6 meter contacts will earn 2 points/km. Contest logs are to be filed with the BATC.



HIGH POWER AMPLIFIER for 70cm DATV

A recent topic of discussion on the DARA weekly ATV net was high power amplifiers. Dave, AH2AR, presented some data on his RF Concepts model RFC 4-110. Dave said it was a practical amplifier for 70cm ATV use. The RF Concepts amp uses a pair of MRF-648s in a push-pull configuration for the finals, with an MRF-646 as the driver. It also contains a 16dB gain pre-amp. In analog ATV service, Dave got 80 Watts (PEP) using a PC Electronics TC70-10 adjusted for 2 watts output. In digital ATV service, Dave is getting 30 Watts average with minimal spectrum spreading. See the above spectrum photo.

ANTENNA finds a New Home --- In the previous issue, there was an advertisement for a really great DB Products DB-411 antenna seeking a new home. The price was attractive, i.e. FREE ! The antenna had previously given many years of great service for the Boulder ATV repeater when it was previously located in Chautauqua Park. It will now belong to the Indian Peaks Amateur Radio Club, Nederland, Colorado. They have a 450 MHz FM voice repeater presently located in Nederland, but with very poor coverage. They have recently gotten permission to relocate it to the University of Colorado alpine research station on Niwot Ridge. From there they should have great coverage of the back country of Boulder County. However, the winds on Niwot Ridge are extremely fierce, especially in the winter. Any ordinary, amateur radio grade antenna would soon be destroyed up there. The DB-411 is an extremely rugged antenna and should serve them well in it's new home.



Application Note AN-63 copyright May, 2022

web = www.kh6htv.com email = kh6htv@arrl.net

Evaluation of SatLink WS-6990, DVB-T Modulator

Jim Andrews, KH6HTV



Fig. 1 SatLink model WS-6990 DVB-T Modulator

For several years now, USA ATV hams have been experimenting with the European digital TV broadcast standard called DVB-T. Our primary supplier of equipment has been the Hi-Des company in Taiwan (www.hides.com.tw). Recently it has come to our attention that a Chinese manufacturer called **SatLink** now has a low cost modulator available for sale on the internet. The FuJian Satlink Electronics company web site is: www.sat-link.com.cn I have purchased their model WS-6990 for evaluation. This application note is a summary of my observations.

Unlike Hi-Des, which sells directly to the consumer for a fixed price, the SatLink model WS-6990 is not sold directly by the company. Instead it is sold by many on-line retailers via the internet most of whom are in China. A google search for it will come up with a lot of “hits”. The prices range all over the place from a low found of \$130 to a high of \$265. It is sold on E-Bay, Alibaba and Aliexpress.

The **key major difference**, aside from price, between the SatLink and Hi-Des DVB-T modulators is **Band-Width**. Hi-Des offers selectable band-widths from 1 to 8 MHz. The SatLink only offers the commercial broadcast standards of 6, 7 or 8 MHz. Thus for those ATV repeater groups using band-widths narrower than 6 MHz, the SatLink modulator is not an option.

SatLink Model WS-6990 Specifications

Modulation Standard	DVB-T (COFDM)
Constellation	QPSK, 16QAM or 64QAM
Band-Width	6, 7 or 8 MHz
Carriers	2K or 8K
Guard Interval	1/4 1/8 1/16 1/32
Code Rate	1/2 2/3 3/4 5/6 7/8
MER	35 dB
Frequency Range	50 MHz to 860 MHz
Output Level	70 dB μ V to 100 dB μ V
Output Impedance	75 Ω
Video Compression	H.264 bit rate 5 to 15 Mb/s
Video Resolution (CVBS)	576i PAL or 480i NTSC
Video Resolution (HDMI)	1280 x 720P (50/60) to 1920 x 1080 i or P (50/60)
A/V Inputs	HDMI or Composite Video plus line level stereo audio
Power Source	12Vdc @ 1.5 Amps

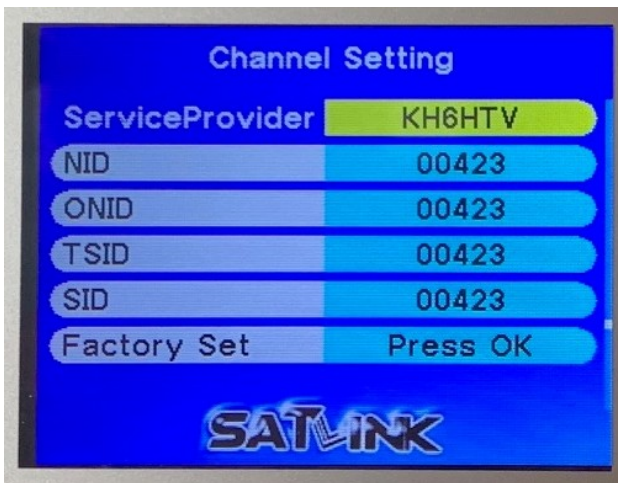
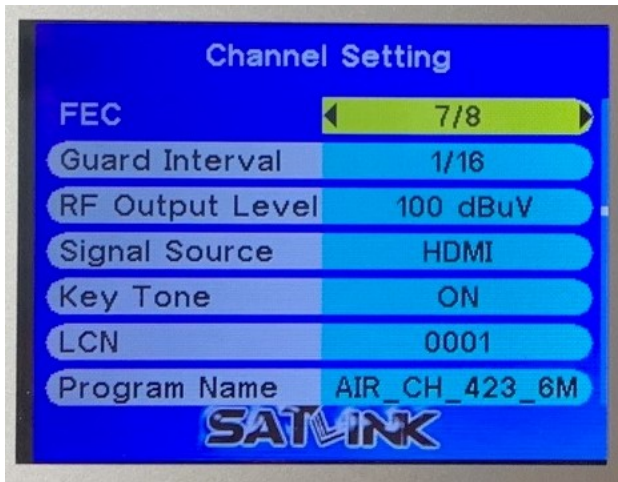
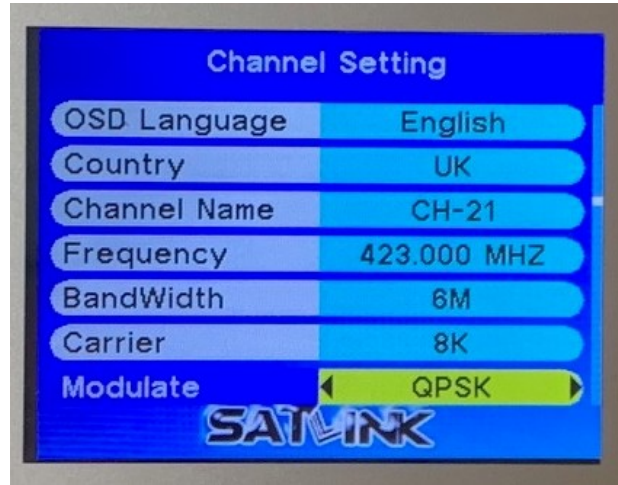


Fig. 2 WS-6990 Menus

VIDEO ENCODING: The WS-6990 only does H.264. It does not support the older MPEG-2.

AUDIO ENCODING: The manual for the WS-6990 does not mention what encoding standard is used. The Hi-Des units supported ACC, AC3, and MPEG-2. Searching the internet, I found one site which said the WS-6990 used MPEG-1, audio layer II.

HDCP: The WS-6990 manual cautions -- "HD program which contains HDCP agreement protection will not play normally, such as Blu-Ray disc and so on." I found the 6990 would not accept any video input from a DVD player on its HDMI input. It will accept video from a camcorder. The work around for this issue is to use the analog, composite video output from your DVD player.

INITIAL SET-UP: The photos on the previous page show you the 3 pages of the WS-6990's menu structure. When you first turn on the new WS-6990, it will come up with the initial Factory Settings. They will probably be: language = English, country = UK, channel = Ch-21, frequency = 474 MHz, band-width = 8 MHz, etc. It is well before making any changes to note what all of these settings are. Now assuming you plan to use the modulator for amateur digital TV on the 70cm band, you will need to change some of these settings before testing. In particular, the frequency. You are able to enter any arbitrary frequency between 50 and 860 MHz. The resolution is to 1 kHz.

You navigate around the menu and make data entries into it using the six push-button keys to the right of the LCD display screen. They are: Up, Down, Right, Left, OK and Return. When the unit is initially powered up the screen will light up. After the unit has been on for awhile with no data entry, the screen will power down and go black. Don't worry, this is normal. Simply push the OK button to activate the screen again. Then use the Up/Down buttons to select the menu item desired. To change a menu setting, use the Right/Left buttons to scroll to the desired value, then hit the OK button to enter it. For menu line items which require numerical entry, such as Frequency, you will use the Right/Left buttons to select the desired digit and then the Up/Down buttons to scroll through the numbers 0 to 9. For menu line items which require alpha-numeric entry, you will be presented with a table of letters and numbers to select from with the Up/Down, Right/Left buttons.

When you are finished making data entries in the menu and you want to save them, push the Return button. The unit will then ask you "Settings were changed. Do you want to save?" You then must select either Yes or No and push OK. The display will then show the same as in Fig. 1

DOES IT WORK ? When I first setup my new WS-6990 to use with our Boulder W0BTV, ATV repeater, I used our normal settings of: 441 MHz, QPSK, 8K, 5/6 code rate (FEC), 1/16 guard. My home "combo" DVB-T receiver immediately said it was receiving a strong signal, but **NO video nor audio, just a black screen.** What

was the issue? Well the issue was improper settings for the various IDs found on page 3 of the menu. They are NID, ONID, TSID and SID. The factory settings were set to: 12289, 0918, 50804, & 13374. So just what did these numbers represent? I thus went to my Hi-Des HV-320E modulator and examined the various settings on it. In particular on the AV-Sender application, I examined the TS page. See Fig. 3. It had a great number of parameter settings, and they included NID, ONID, TSID and SID. They were all Hex numbers and had the same identical value of "1A7". The values in the WS-6990 menu didn't look like hex numbers, so I went to the internet and found a Hex/Decimal converter. Converting 1A7 in hex gave 493 in decimal. So I entered the value 00493 into the WS-6990 ID menus and tried the modulator again. **Bingo, it worked and put out a usable DVB-T signal which I was able to receive on my "combo" DVB-T receiver. However, it did NOT work with my Hi-Des HV-110 receiver.**

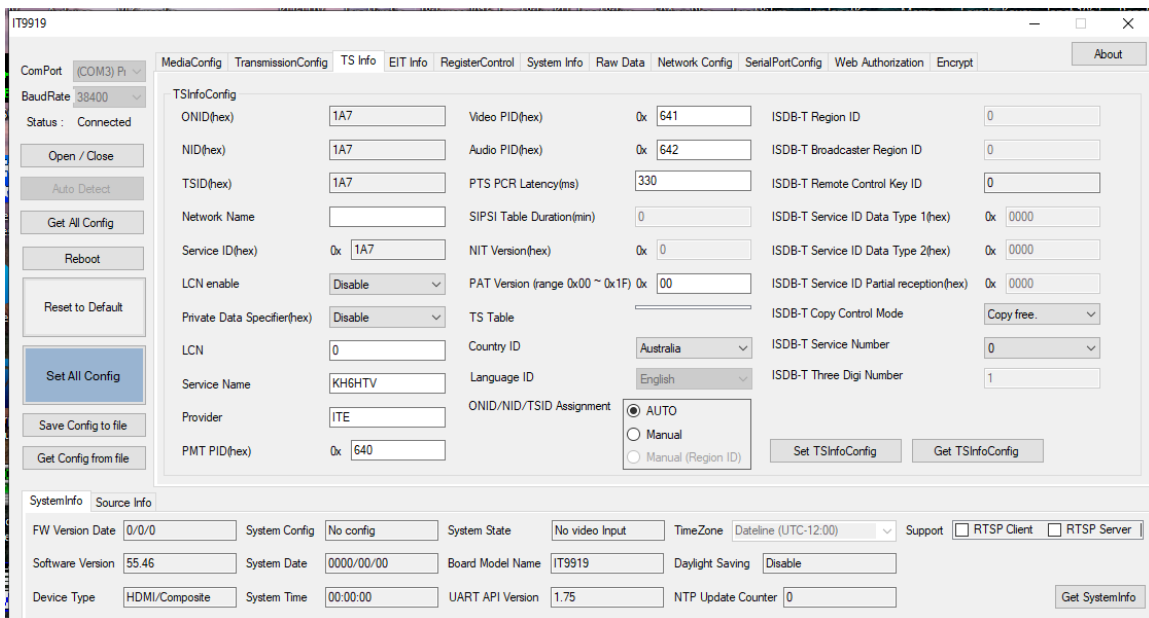


Fig. 3 AV-Sender program for the Hi-Des modulators. TS Info page showing the settings for the various IDs.

As seen in Fig. 3, in addition to ONID, NID, TSID and SID, there are also PMT PID, Video PID and Audio PID. All of these IDs can be programmed in the Hi-Des modulators. The SatLink WS-6990 does not provide in its menu the ability to program the PIDs. The "info" button on the Hi-Des HV-110 receiver gives diagnostics on the incoming signal. It showed all of the parameters of the WS-6990 to be correct as set. But it also showed that all of the PIDs were set to hex 0 x 7d1. I next tried to retrain the HV-110 receiver. I deleted its channel memory and tried to retrain it on the WS-6990's DVB-T signal. No Luck! It wouldn't accept it.

BOTTOM LINE: *If your ATV repeater group is already using Hi-Des equipment, you will not be able to integrate the SatLink WS-6990 into your group. If your group is just getting started and considering various options, then the lower cost, SatLink modulator and the consumer grade "combo" receiver are an acceptable pair which will work together, but not with Hi-Des equipment. But you must use 6 MHz band-width. You can not use any narrower band-width.*

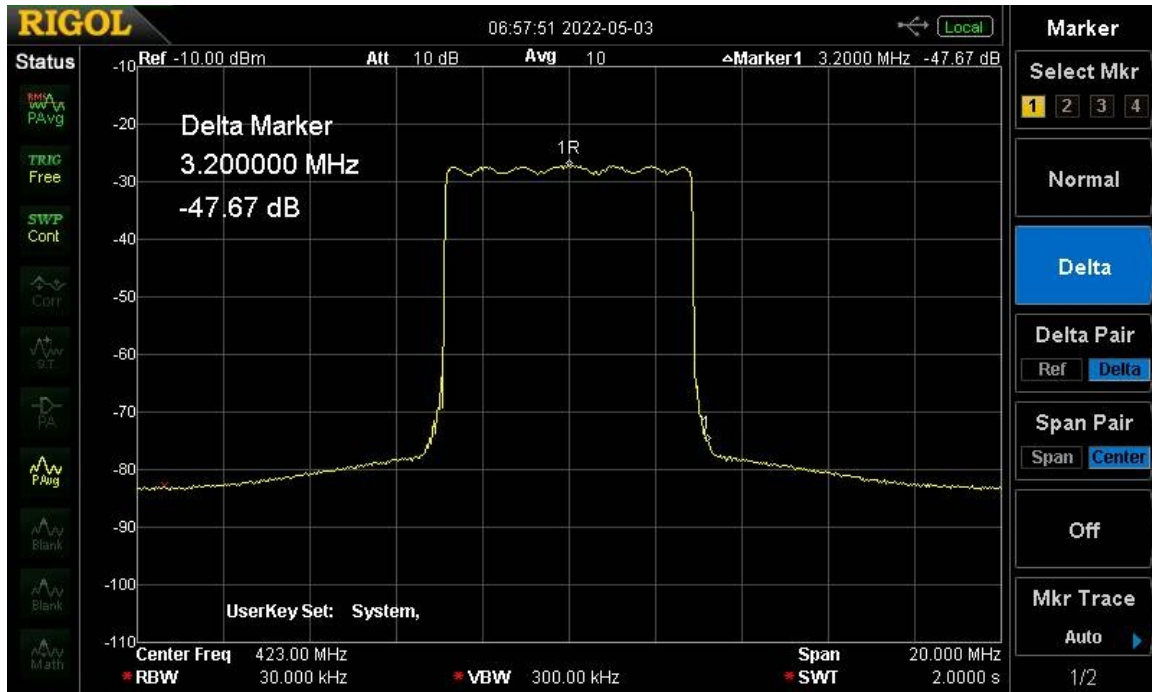


Fig. 4 RF spectrum of SatLink model WE-6990 Modulator. Center frequency = 423MHz, span = 20 MHz, 10dB/div & 2MHz/div. RF output set to 100dB μ V

RF PERFORMANCE: The modulator was set to 423 MHz center frequency with 6 MHz band-width. It's spectrum was measured using a Rigol DSA-815 spectrum analyzer. See Fig. 4. The spectrum was found to be quite acceptable. The spectrum shoulders were measured to be -47dB down. The second harmonic was -32 dB down, while the third harmonic was -50 dB down.

The RF output is specified to be adjustable from 70 to 100dB μ V into 75 Ω .. It was measured with an HP-432A RF power meter with an HP-478A thermistor power sensor head. When set to 100dB μ V, the rf power into 50 Ω was -4.6dBm. The rf power output was found to be adjustable in 1dB steps over a 31 dB range.

W0BTV 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/>

W0BTV 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/kh6htvtvr> 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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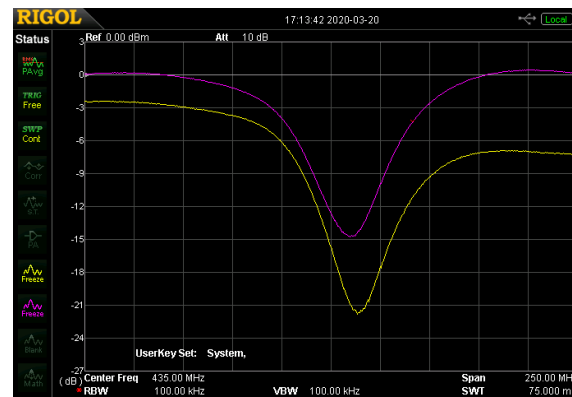
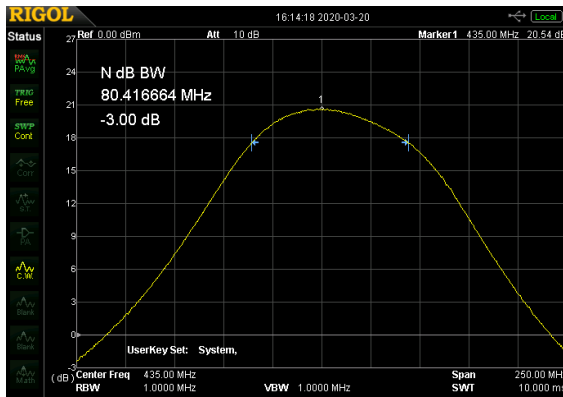
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Model 70-LNA 70 cm, 0.7 dB NF Pre-Amplifier

The KH6HTV VIDEO Model 70-LNA is a low noise Pre-Amplifier for the 70 cm (420-450 MHz) amateur radio band. **The noise figure is a low 0.7 dB** with a gain of 20 dB and high output, -1dB gain compression of +21 dBm. This amplifier has decent return loss on both input and output. It is offered in two options. Option -1 has the lowest noise figure of 0.7dB. It has a low loss, 90 MHz high-pass filter on it's input and a 70cm band-pass filter on it's output. Option -2 is for those situations where more RFI protection on the input is required. It has the 70 cm band-pass filter on it's input and thus has a higher noise figure of 1.7 dB



S21 Gain (left photo) & **Return Loss** (right photo) **S11** = yellow trace, **S22** = magenta trace
center freq = 435 Mz, 250 MHz span, 3 dB/div & 25 MHz/div.

PARAMETER	Typical Performance	Notes
Frequency Range	420-450 MHz	70 cm amateur radio band
Noise Figure	0.7 dB (opt. -1), 1.7 dB (opt-2)	measured on HP-8970A
Gain, S21	20 dB	
Bandwidths	80 MHz & 135 MHz	-3 dB & -10 dB BW
Max. Output Power	+21 dBm	at -1 dB gain compression
Input Return Loss, S11	> -10 dB	
Output Return Loss, S22	> -10 dB	
DC Supply Voltage	+12 Vdc, nominal at 100 mA	11-15 Vdc range
RF Connectors	SMA (f)	
DC Power Connector	Feed-Thru, By-Pass Capacitor	Optional -- DC feed via RF output
Dimensions	1.5" x 3.6" x 1.25"	fully shielded, die-cast enclosure
Test Report	included	includes S21, S11, S22 & NF