Boulder Amateur Television Club
TV Repeater's REPEATER

September, 2021
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BATVC web site: www.kh6htv.com

ATN web site: www.atn-tv.com

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

Wyoming Section ARRL Hamvention Cancelled:

This convention was scheduled to take place on Saturday, Oct. 9th in Cheyenne, Wyoming. It was to be hosted by the Shy-Wy Amateur Radio Club. The BATVC was planning to have a display table at the convention demoing live digital ATV. We were also on the technical program to give a talk about "High Definition, Digital Amateur TV". We just received the following e-mail from Bob, N7WY, one of the organizers.

"Last night (9/5) the WY Ham Con committee met via Zoom and discussed the convention going forward for Oct 2021. We owe a large payment to the Laramie County Event Center at Archer, WY this week that is not refundable. The group agreed that we have some portions of the event that are in excellent shape, and other areas that are behind. Also the rising concerns about COVID-19 again and hosting an indoor event made us question what our overall attendance would be. It seems these same anxieties make it challenging to obtain sponsors and vendors or entice swap meet exhibitors The group of 10 people decided that it would be best to pull the plug for the October 2021 event at this time."

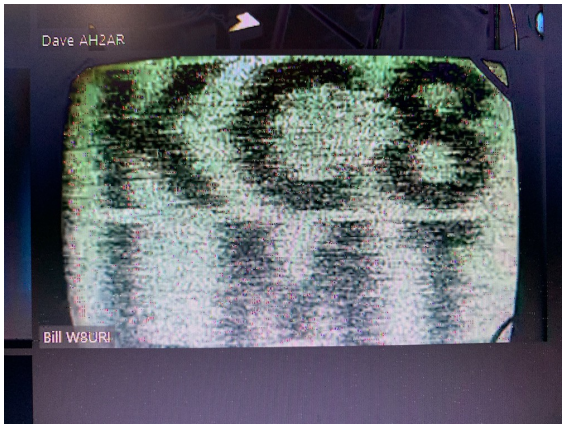
Hi-Des Firmware Issues:

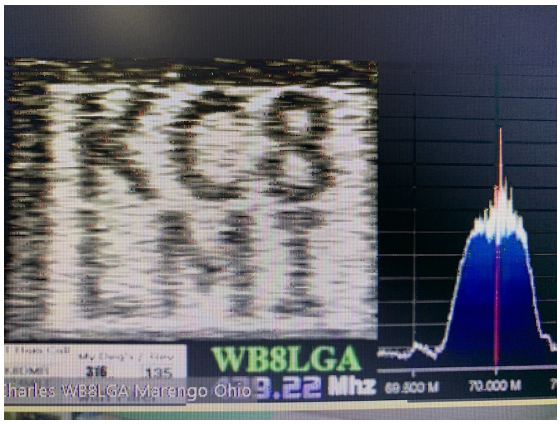
We have a major problem with equipment now coming from Hi-Des in Taiwan. Often times it is being shipped with Low Latency firmware installed. Hi-Des is trying to sell to the drone market and long latency (i.e. delay) with digital video is a major deterrent for drone pilots. Unfortunately the low latency firmware does not meet DVB-T commercial broadcast standards. Thus, a Hi-Des, low latency DVB-T signal will not decode in other manufacturer's DVB-T receivers, nor Hi-Des receivers with standard firmware. It can only be received by a Hi-Des receiver with the special firmware installed. Likewise a Hi-Des receiver with the low latency firmware will not decode a broadcast standard DVB-T transmission. This makes it incompatible with DVB-T Amateur TV repeaters which all try to adhere to broadcast standards. I have had to deal recently consulting with several hams who experienced non

functioning Hi-Des equipment which they purchased and it traced back to the wrong firmware being installed. We discussed this issue back in April in our newsletter #75. I recommend everyone re-read it. If you are experiencing such issues, contact Calvin Yang at Hi-Des (calvin@hides.com.tw) and request he send you the proper firmware. You will need to follow the detailed instructions in the manual to install the correct firmware.

Jim, KH6HTV, Boulder, CO

More ATV DX worked by members of the ATV DX Midwest Group

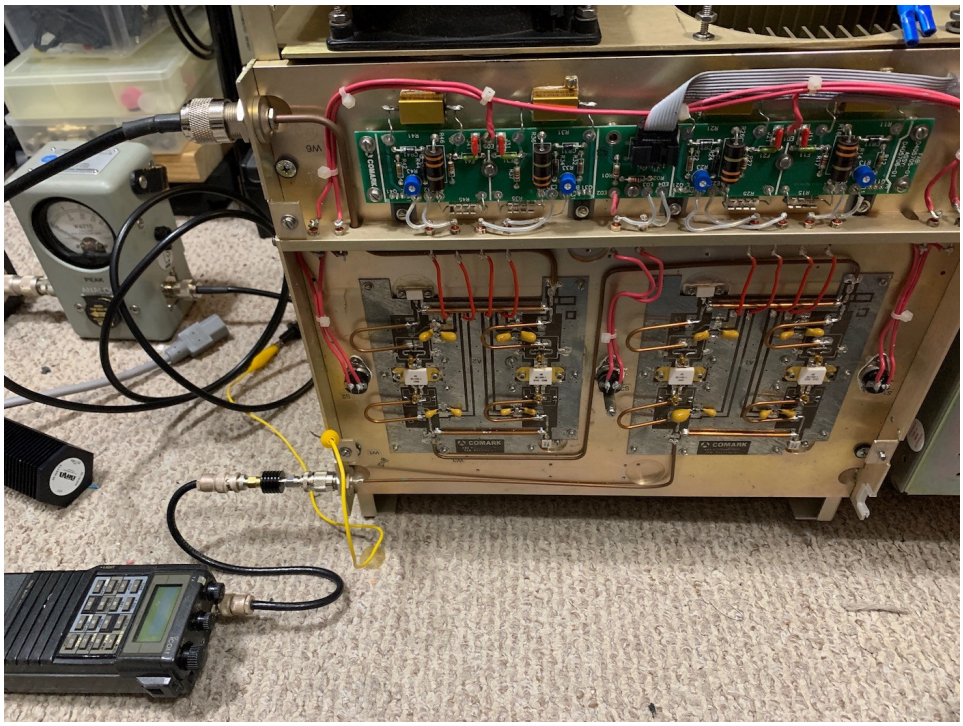




Pictured above on the left is KC8LMT in Flint Michigan being received by Bill, W8URI in Mt Giliad Ohio on Sunday, 5 September 2021. On the right above is KC8LMT also being received by Charles, WB8LGA, in Morrow County, Ohio. Both of these DX contacts were 230-240 mile contacts on 70cm A5.

ATV News from DAYTON, OHIO: Troubleshooting the Comark amplifier went well. I replaced two bipolar transistors (SD-1490-1), a board-mounted pot and resistor within the bias circuit, a tantalum capacitor and a 24 VDC fan that had bearing noise. The sagging RF output ended up being isolated to the Comark's driver chassis. This amplifier uses a total of eight SD1490-1's, four within the driver chassis that has two RF PC boards in series and the final amplifier chassis that has a pair of RF PC boards running in parallel. I was able to pick up a "donor" final amplifier chassis for $90 on e-bay for the purpose of salvaging two of the four transistors in the donor to use in the ailing driver amplifier. These transistors are normally $120 apiece, so the donor amplifier ended up being a good buy, as we now have two additional transistors in the event of any future transistor failures.

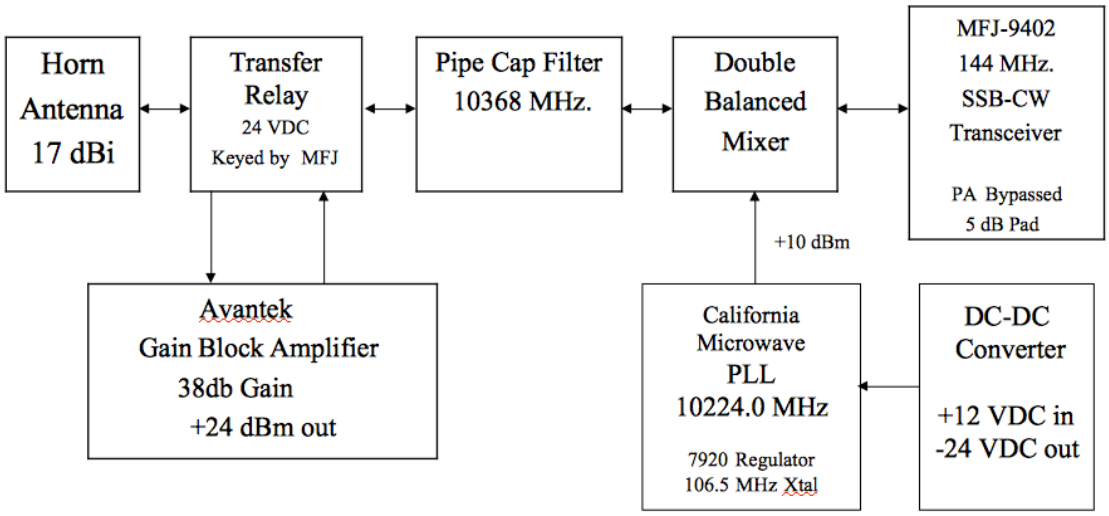
Dave, AH2AR, Dayton



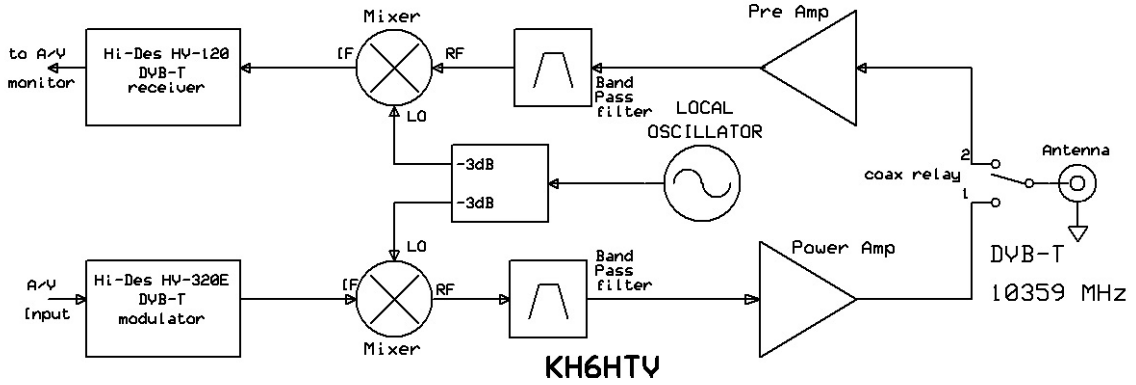
DESIGN APPROACHES for MICROWAVE TRANSVERTERS

How we build our home-brew transverters is often dictated by what we find in our ham shack junk boxes, or at our local ham club swapfest.

K0RZ 10 GHz. Portable



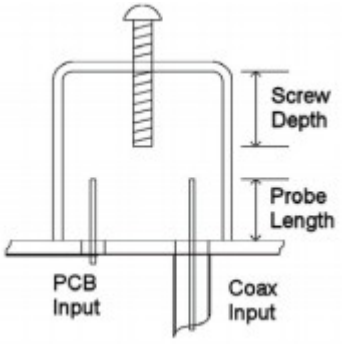
This is one approach taken by Bill, K0RZ, and Don, N0YE. The key element that makes this feasible is finding a Transfer Relay. This is a four port coaxial relay which allows one to switch direction of a component, such as an amplifier. Doing this allows one to minimize the parts count of all other components. Now the transverter works either as a transmitter or receiver, simply by reversing the connections to the single amplifier. T/R switching at the IF frequency is also accomplished in the IF Transceiver. If using the transverter for digital TV, an additional SPDT coax relay would be required to switch between the DVB-T modulator and receiver. Transfer relays, such as shown here can be found on the internet for about $100.



This is the approach taken by Jim, KH6HTV, for his 5.8 & 10GHz transverters. The disadvantage is that the parts count is now higher. Only one conventional coax relay is required. One advantage is a good low noise preamp can now be used. Typically the amplifier used as the power amplifier will have a higher noise figure. For the K0RZ/N0YE arrangement, the single amplifier could however be a low noise LNA, but the max. output power would be limited. With the KH6HTV arrangement, the power amplifier could in fact be a high power amplifier putting out several Watts. For the KH6HTV arrangement for DTV, the IF receiver can be left on all the time. The low level leakage across the coax relay in the transmit mode will still give enough rf to be detected by the receiver to allow it to monitor the rf output signal.

Jim, KH6HTV, Boulder, CO

Pipe Cap Microwave Filters:



Recently on the Boulder ATV net there was a lot of discussion about band-pass filters made from copper plumbing hardware. Several hams, including DJ6EP, DC0DA & WA5VJB have written about them in the past. A great summary with lots of design curves is found on Paul Wade's, W1GHZ, web site: www.w1ghz.org Check out his article ***"Pipe-Cap Filters Revisited"***. 13 pages with lots of design and construction details.
While on Paul's web site, browse through it. Lots of info for folks interested in ham microwaves.

(photo from DEM spec. sheet)

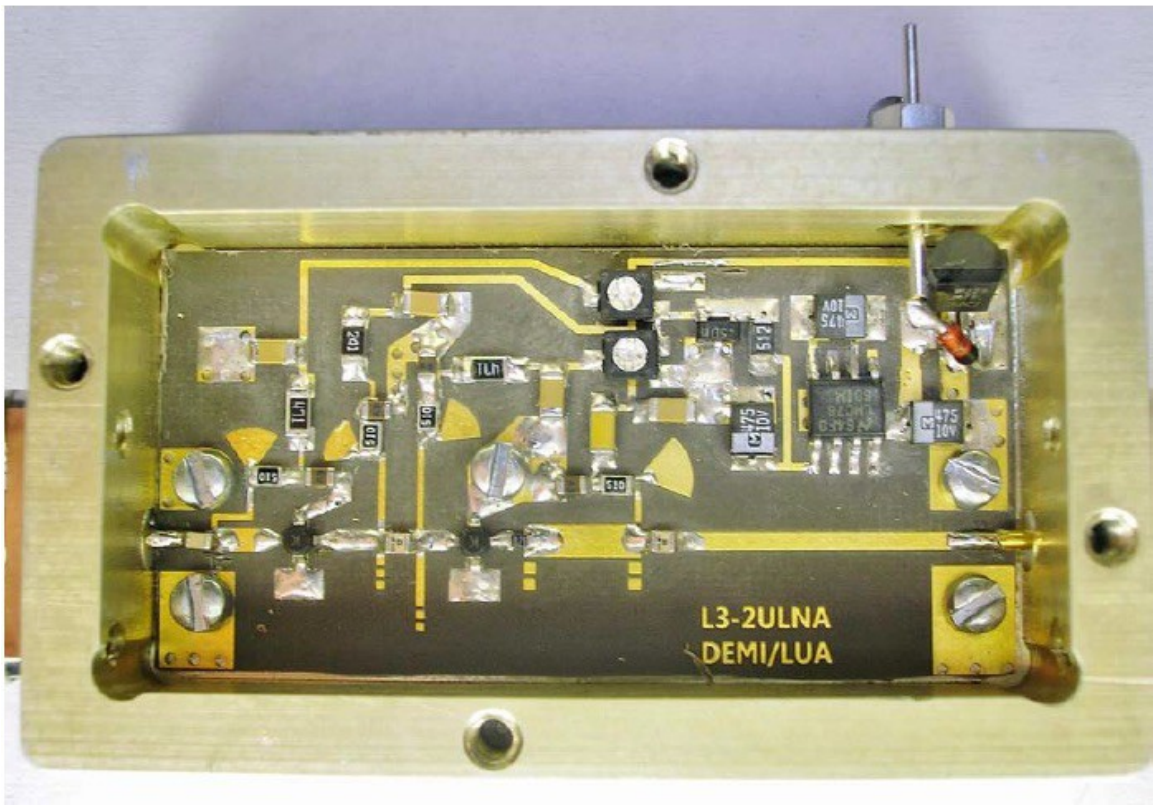
Down-East Microwave 10 GHz Pre-Amplifier - Product Review

A key building block for any microwave transverter is a good, low-noise, pre-amplifier, or often referred to as an LNA or Low Noise Amplifier. If a pre-amp is not used, then the noise figure of a transverter is no better than the RF to IF conversion loss of the down-converting mixer, which is typically 6dB or worse.

Two suppliers of microwave pre-amps for the amateur radio market are Kuhne Electronic in Germany (https://shop.kuhne-electronic.com/kuhne/en/) and Down-East Microwave in the USA (https://www.downeastmicrowave.com/). Kuhne offers a large selection of pre-amps for 144MHz thru an astonishing 76GHz. For the 3cm, 10GHz band, they offer four models with prices of the order of 209 - 229 €. Down-East Microwave (DEM)

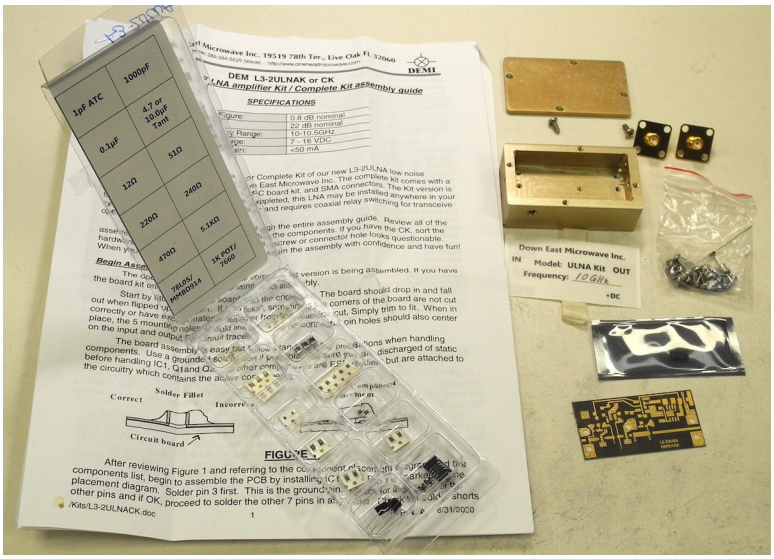
offers pre-amps for 50MHz thru 10GHz. For 10GHz, their pre-amp costs $150 assembled, or $105 in kit form.

I recently purchased the DEM, 10GHz pre-amp kit. The model number is L3-2ULNA. The DEM specs. are minimal and consist of only: Frequency range = 10 - 10.5GHz, Gain = 22dB, Noise Figure = 0.8dB, Supply Voltage = 7 - 16Vdc at < 50mA. DEM says the LNA was designed by Texas microwave legend, Al Ward, W5LUA using PHEMPT technology. The DEM spec. sheet does include this photo below showing the internal construction.



(photo from DEM spec. sheet)

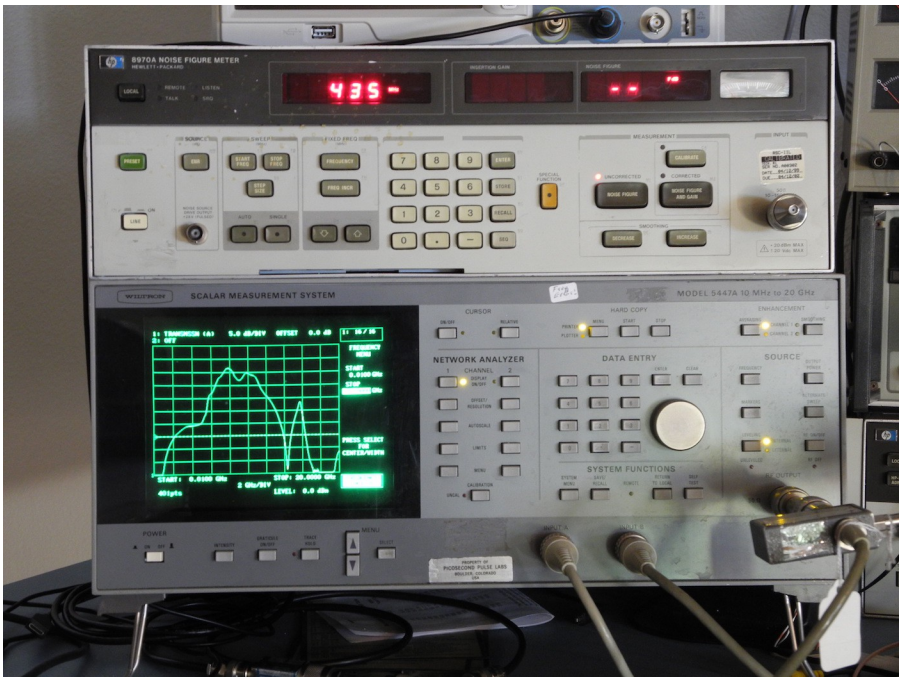
The pc board is very well designed and built on thin, microwave quality substrate with gold plating. The reverse side is a solid ground plane, The rf input is on the left and the output is on the right. SMA connectors are used. DC power comes in via a feed-thru capacitor on the upper right. The circuitry is seen to consist of two, RF, FET transistors in cascade. In the upper right is a 78L05, +5V voltage regulator. The 8 pin IC is a 7660 +5V to -5V switching regulator to provide negative gate bias voltage. In the upper center are seen two mini trim pots for independently setting the gate voltages for the two FETs.



DEM provides a very nice kit. It comes with a well written set of assembly/test instructions. All of the various tiny parts come in a sealed plastic tray which is well marked to ID the contents. The mechanical parts for the enclosure are well made.

I was able to assemble and test the pre-amp in one evening. However, a word of caution, this pre-amp is built with surface mount components (SMD) and some of them are very tiny. Several are 0805 size and one resistor is 0603. I had to put on two pairs of magnifying reading glasses to see the markings on the FETs to be able to orient them properly. The bottom line -- If you are not comfortable assembling tiny SMD parts, then you are well advised to not purchase the kit, but spend an extra $50 to buy a completely assembled and tested pre-amp from DEM.

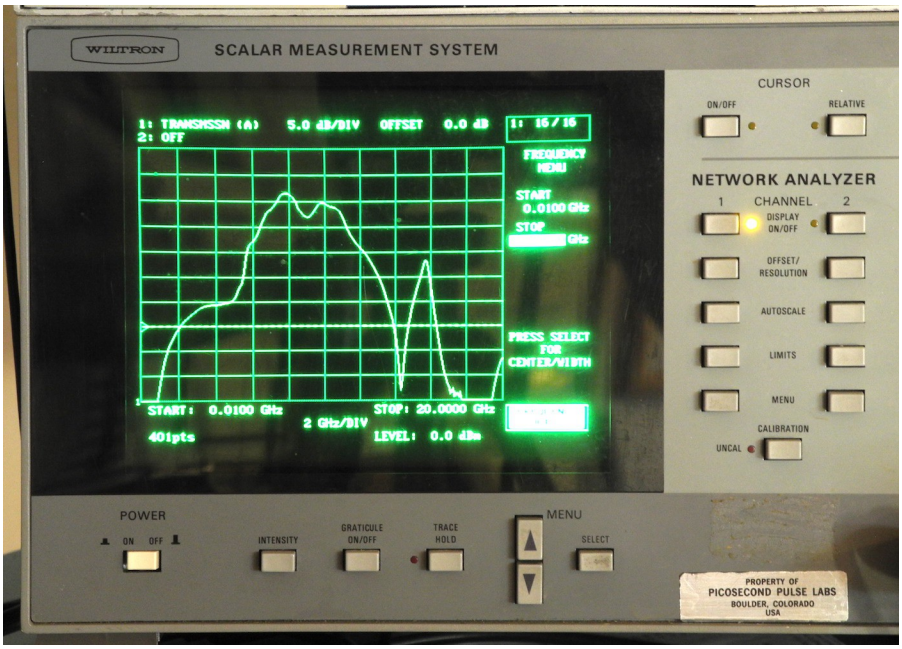
The initial test procedure is setting the proper DC gate bias for each FET. The 1 KΩ trim pots are adjusted to set the FET's drain voltage to +2Vdc and drain current to about 10 mA. There are no other adjustments to be made. For mine, the current drain from a +12Vdc supply was 22mA. At this point, you should now have a working pre-amp. W5LUA did provide on the pc board a few tiny stub pads which could be jumpered in/out if one wanted to do some really fine tuning of the frequency response and/or noise figure. I did not make any changes, but took the pre-amp "as is".



My first test of the amplifier was to measure the gain, S21. I used my 30 year old, Wiltron 5447A, network analyzer which covers from 10MHz to 20GHz. This was the response with the top cover not yet installed. ***However, when I placed the cover on the amplifier, it took off oscillating.*** This is a very common problem with microwave amplifiers. The small metal box, when completely closed up makes an excellent, high Q cavity resonator.

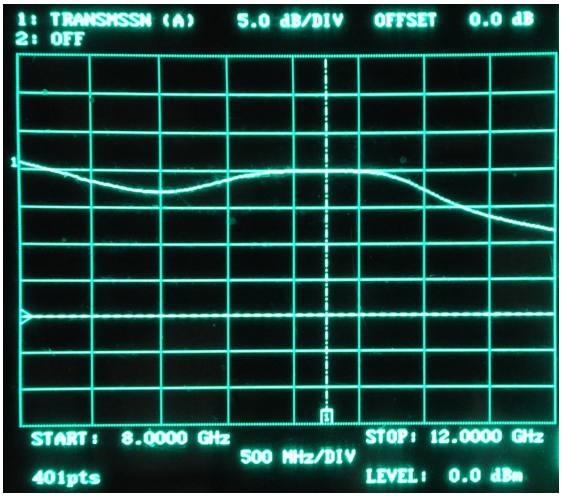
At my old company, Picosecond Pulse Labs, we built extremely broadband amplifiers with -3dB bandwidths extending from a few kHz up to the microwave range with some as high as 60GHz. We had the same oscillating issue. We solved it by using what we coined "Magic Rubber". This was a special EM absorber material containing carbon and ferrites. I still had in my ham shack some left over magic rubber from PSPL. I cut a rectangular strip of it and attached it to the lid of the DEM preamp. The magic rubber comes with an adhesive backing. This solved the oscillation problem with the DEM preamp.

Now, the ? question remains -- Why didn't DEM include some Q damping material in their kit ? How many hams out there building these kits have built oscillators rather than amplifiers ? If they don't have the proper instrumentation, they probably don't realize they have an oscillating amplifier on their hands. Also, what about buying an assembled amplifier from DEM. Did they simply test the amplifier with the cover lid off and then put the cover on and ship it ? Or do they put an rf absorber in their assembled units ?

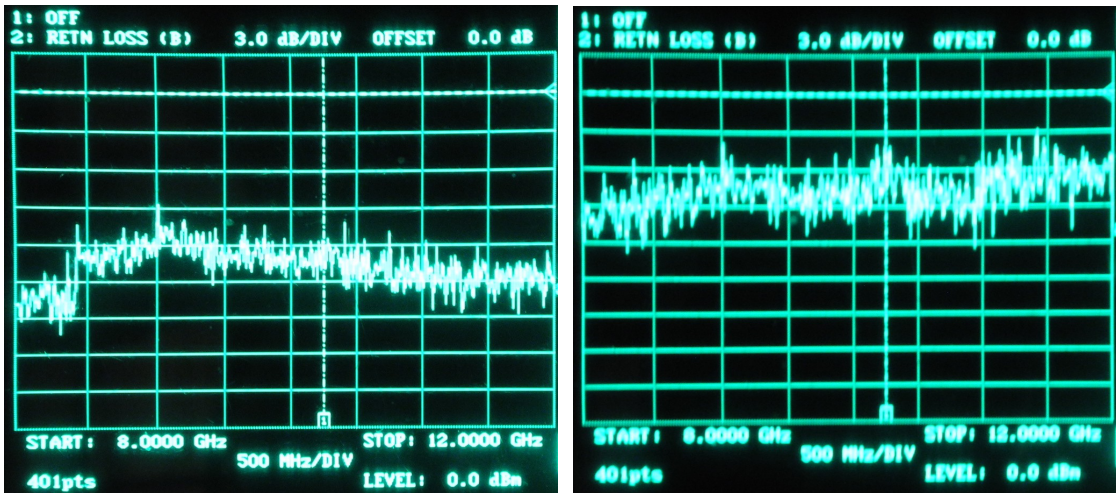


S21 vs. Frequency: sweep 0.01 to 20 GHz, 1 GHz/div. Pin = -36dBm
Vertical scale = 5dB/div. 0dB reference line is 3 divisions up from the bottom.

So, let's go back to testing the finished product with the magic rubber installed. In the above S21 photo, I am sweeping over the full range up to 20GHz. The amplifier is seen to have it's peak gain at 8GHz with a second peak at 10GHz. On the lower slope it still has appreciable gain at 5.8GHz.



This is the S21 Gain over X band from 8 to 12 GHz. 500 MHz/div. The vertical scale is 5dB/div. The 0 dB reference line is 3 divisions from the bottom. Pin = -36dBm



Return Loss measurement - sweep from 8 to 12 GHz, 500 MHz/div, Pin = -36dBm
Input S11 (left) & Output S22 (right), 3dB/div, 0dB ref. line is 1 div. from top

The above photos show the amplifier's gain plus input and output return loss sweeping over X band from 8 to 12 GHz. At the center of the 3cm ham band, 10.25GHz, S21 = 20dB, S11 = -13dB and S22 = -6dB.

The next test was to determine the max. output power capability of the amplifier. The Wiltron network analyzer in the CW mode was used as the signal source, plus a Weinschel rotary step attenuator was used to set the rf input levels. RF power was measured using an HP-432A power meter with an HP-8478B thermistor power head. The -1dB gain compression was found to be P(-1dB) = -9 dBm. The max. saturated output was found to be P(max) = -8 dBm. Thus this amplifier is strictly for low level, weak signals.

The final test was for Noise Figure. An HP-8970A Noise Figure meter was used with a Noise Com model NC346B (0.01 - 18GHz) noise source head. The 8970A only measures up to 1.5GHz. Thus a down-converter was setup using a local oscillator, mixer and band-pass filter to reject the unwanted sideband. The noise figure was measured at 10.36 GHz. The results were 21.7dB gain and 1.06dB noise figure. This NF value was felt to be quite acceptable.

Jim, KH6HTV, Boulder, CO

UNIQUE ANTENNA ROTATOR for WORKING SATELLITES:

ATVer, Richard, N2SPI, in Greene, NY has come up with a unique mobile antenna system for working satellites. It gives him directionality and the ability to rotate during satellite passes.

The above photo shows the satellite antenna system I built for my mobile station. It uses two M2 Eggbeaters, one for a 70cm uplink, the other for a 2m downlink. These are mag-mounted to my car at a fixed elevation of approximately 20 degrees. This allows me to point the RHCP lobe coming off the top of these antennas directly at the satellite, more or less. The trick is to remember to drive my car in a tight circle so as to keep these somewhat directional antennas aimed at the satellite. In addition, the mag-mount feature allows for quick setup and tear down in bad weather.

This photo shows the satellite "rig" I use inside the car. It is basically an Icom IC-9700 with an Asus Netbook PC strapped to the top inside a "sun shield". The PC runs SatPC32 to provide CAT control of the IC-9700 so as to "nullify" Doppler frequency shifts.

W0BTV Details:

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

Outputs: Channel 57 --- 423MHz/6MHz BW, DVB-T, or optional 421.25MHz, 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. The net typically runs for 1 to 1 1/2 hours. A DVD ham travelogue is usually played for about one hour before and 1/2 hour after the formal net. ATV nets are streamed live using the British Amateur TV Club's server, via: *https://batc.org.uk/live/kh6htvtvr* or *n0ye*. We use the Boulder ARES (BCARES) 2 meter FM voice repeater for intercom. 146.760 MHz (-600kHz, 100 Hz PL tone required to access).

Newsletter Details: This is a free newsletter distributed electronically via e-mail to ATV hams. The distribution list has now grown to over 450. News and articles from other ATV groups are welcomed. Permission is granted to re-distribute it and also to re-print articles, as long as you acknowledge the source. All past issues are archived at: *https://kh6htv.com/newsletter/*

ATV HAM ADS

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

Microwave Hams -- looking for a source of microwave components, either coaxial or waveguide? Check out www.westernetestsystems.com in Hana, Wyoming. Phil Schnabel has been in business since 1993. He has a huge selection of used equipment to chose from.

Jim, KH6HTV