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Presents

Pre-Amp Peregrinations

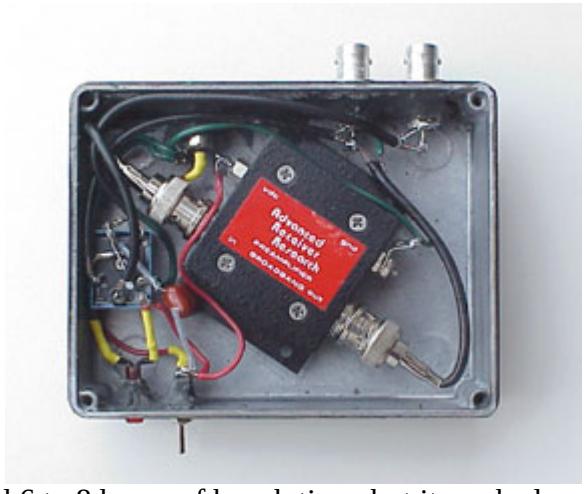
Adventures with RF Pre-Amps manufactured by
Advanced Receiver Research and *DX Engineering.*

John H. Bryant and Mark Connelly, WA1ION, July 2005

JOHN'S EXPERIENCE

For many years, I have been ambivalent about using RF preamplifiers in my receiving chain. I have felt that, most of the time, they only amplify both the noise and the signal equally, accomplishing nothing but generating more movement on my S-meter. However, in recent years, my ideas have been changing. I was first introduced to modern preamps by Don Nelson, when he used the highly regarded preamps from Advanced Receiver Research (AR2) to more than overcome the inherent losses in our 8-way antenna splitters at the Grayland DXpedition site.

When I began experimenting with relatively small-sized flags and pennant antennas, I found that having some pre-amplification often resulted in a better signal, with more recovered audio. Naturally, I adopted the AR2 unit http://www.advancedreceiver.com/page5.html . (Special Frequency Range, $79.95 USD) Truth be told, I found it cumbersome to insert the AR2 unit in my receiving outfit. For DC power, this pre-amp required hardwiring rather than the normal coaxial power plug. Further, and more importantly, the AR2 preamp had neither a power switch nor a bypass relay. It was either in the circuit or it was out, requiring a major operation of lead-in switching just to add or subtract it from incoming signals.



I decided that what I really wanted was a pre-amp of the quality of the AR2 unit that could stay in the receiver chain all the time, but which I could invoke or remove from the actual receiving circuit with the flip of a switch. Truth be known, I would rather DX without a pre-amp, but when the signal is in the mud or fading away at local dawn, I wanted to be able to flip a switch and "kick it in the butt" with 10-20 dB of pre-amplification. If that kick helped, I'd leave it in the line; if not, it would come right back out. I finally went so far as to put one of the AR2 amps in a larger cast aluminum box along with a bypass relay, LED power indicator, power switch and coaxial power plug. That amounted to about $30.00 of additional parts and around 6 to 8 hours of bench time, but it worked like a charm!!! I was quickly addicted and found the AR2 pre-amp more useful than I expected. I even found that it would improve signal to noise ratios on my beverage antennas, but only at band fade.

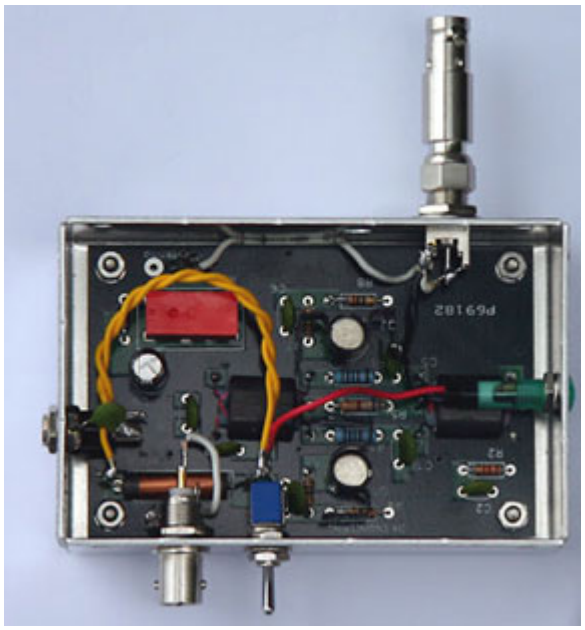
As luck would have it, when I returned to my favorite DXpedition haunts in the Northwest this spring, I was horrified to find that the AR2 pre-amp was deader than the proverbial doornail. I'm not quite sure what happened, but I doubt that it was the fault of the AR2 unit; the ones at Grayland have been performing like Trojans for years, with nary a single failure. Unfortunately, my long-time spare AR2 preamp is sitting on my work bench at our other home in Oklahoma, 2250 miles to our southeast! Recently, I noticed that Mark Connelly, well-known designer of homebrew phasers and pre-amps, had favorably mentioned a new commercial unit in several venues: the RPA-1 by DX Engineering. If Mark liked it, I thought that I would give it a look on the web: www.dxengineering.com/Parts.asp?ID=210&PLID=107&SecID=32&DeptID=12&PartNo=DXE-RPA-1

I was very impressed! The description of the amp started out:

> **This is the best HF low-noise amplifier available. The RPA-1 is optimized for 0.3-35 MHz operating range. Its push-pull amplifier design and robust components enable it to with stand high signal levels and operate when you need it most.**

Wow! Making that kind of statement in the small community of radio enthusiasts means one of two things; A: the company is totally unscrupulous or B: the gear is really great!

As I read further, I continued to be impressed. Beside the push-pull design and an internal by-pass relay, the amp came with an extensive manual that also outlined several easy modifications which would allow the user to *reduce* the gain in stages, if necessary, for a particular application. Unfortunately, since the RPA-1 is designed for mounting either at the operator's position or at the feed point of the antenna, the unit did not come with either a power switch or an LED power indicator. Also, since the unit was apparently intended for those radio amateurs who use 75 ohm feed line, the antenna input and output ports were F-type connectors, supplemented by paralleled RCA jacks (!!!) Like all communications receivers and most listener-DXers, long ago, I committed to 50 ohm feed line and, in my case, BNC-connectors.



Happily, I knew that the hole-sizes required for chassis-mount F and BNC connectors were identical as are the hole sizes for the supplied RCA jacks, my mini-toggle switches and many LED holders. So it looked like I could easily modify the RPA-1 to fit my exact needs. Despite the price of just over $100 USD, I decided to order two of the RPA-1s. I could modify one and then A/B test the two of them to try to make sure that my modifications hadn't degraded the performance noticeably.

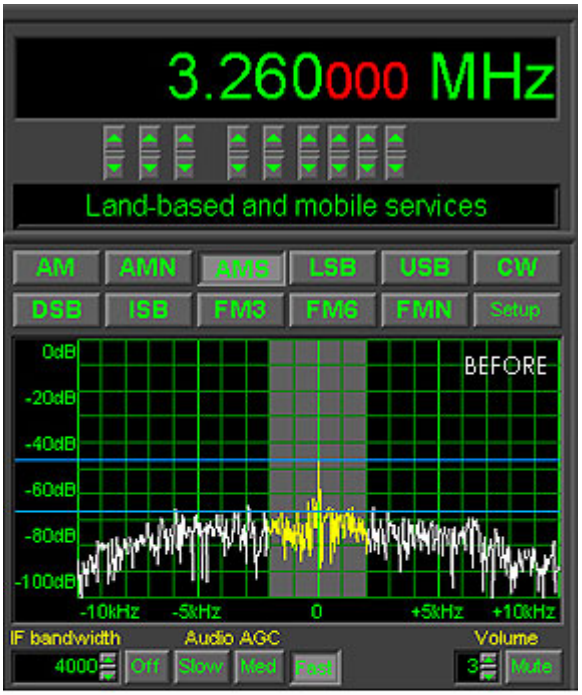
Unfortunately, I learned as I began the modifications that the two heat sinks on the large push-pull transistors and the length of the LED power indicator housing that I had on hand conflicted with each other. I could not use either of the existing ¼" holes for the LED. One of the quarter-inch RCA-jack holes was used, as planned, for the mini-toggle switch, and I drilled a new hole in the end of the aluminum housing for the LED power indicator.

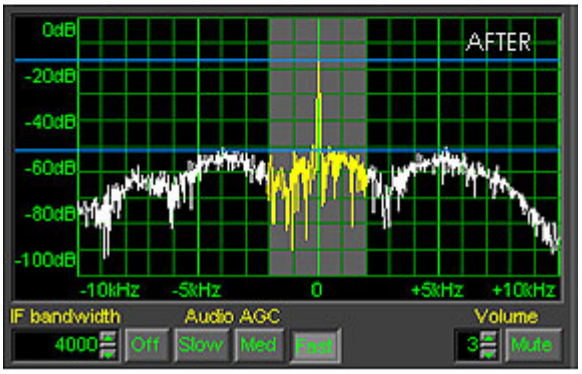
The electrical modifications were minor and very easy, though I had to be cautious when waving around a hot soldering iron in such tight quarters. The only real electrical change was to remove the lead of the copper-colored RF choke from the incoming +12 Vdc on the back side of the power jack. The SPST mini-toggle switch was inserted in the circuit at that point (the twisted pair of yellow wires). When the switch is open, no power flows to the amp and the internal relay passes the signal through with no amplification. With the switch closed, the circuit is energized and the preamp is on. The LED that I used was a Radio Shack unit that comes with an integral resistor to properly control the current for use in 12 volt circuits. It was connected between the switched terminal of the new power switch and chassis ground.

The two accompanying photos of the RPA-1 are actually of my second unit, partly modified, after I had completed the A/B testing of the modified vs. unmodified RPA-1 (a resounding success). The Antenna Input port (upper side in both photos) is the factory-supplied F-connector with a Type-F to BNC Adapter attached. On the lower side of both photos, you will note the new BNC connector. Possibly you can see the new power switch and its bright yellow wiring and the green LED (red and black wires). The red rectangle is the bypass relay and the two bright circles on the right are the push-pull amplifier transistors. You may just be able to discern the black heat sinks on these two transistors as well.

IN USE

The only receiver that I have available to me right now is the WiNRADIO 303EP “black box” receiver. It has an excellent S-meter marked in dBm and an active Spectrum Scope which can be read in dB. Those two instruments clearly indicate that the RPA-1, both modified and stock, provides at least the 16 dB boost stated in the manufacturer’s specs. I don’t have the sophisticated instruments needed to test for the noise added to a circuit by pre-amps, however, I have listened carefully to both strong and weak threshold-level signals while flipping the RPA-1 in and out of the circuit. I can’t hear any added noise.





The two illustrations on the right are partial screen shots of the WiNRADiO 303EP while tuned to Radio Madang in Papua New Guinea one recent dawn. The horizontal blue lines and the words “Before” and “After” were added by me later. The noise level in the un-amplified (BEFORE) example is -67 dB, and it rises to about -51 dB with the amplifier turned on, a 16 dB improvement. The same flip of the switch raised the signal strength from -47 dB to -17 dB. Some of the increase in the noise figure was due to a momentary surge in propagation conditions. The improvement in the amount of signal cresting above the noise can also be partly attributed to that source. However, I have yet to tune a weak signal on this antenna system that has not shown a very noticeable improvement in the quality and intelligibility the audio. This is true as I tune either MW or the Tropical Bands.

I look forward to testing the RPA-1 coupled to my 65ft. x 16ft. portable KAZ during a future DXpedition to Grayland. I doubt that the arrangement will outperform our much-vaunted Beverages, but it might get close. In the meantime, I'm darn sure glad that I bought two of these beauties!

MARK'S EXPERIENCE:

Since I often use my RPA-1 at a position closer to the antenna (away from the operating bench), I made a very simple modification that lets me send +12 Vdc up the coaxial line when I want the amplifier on and no DC up the line when I want bypass. DC is fed onto the coaxial line at the other end by the cable's connection to the DXP-6 phasing unit ("http://chowdanet.com/markc/WEB2005A/DXP-6.ZIP").

I took a 1.5 mH inductor and wired it from the "RCVR OUTPUT" F connector to the DC power input connector. The inductor used was Bourns SDR1005-152J, Mouser stock number 652-SDR1005-152J. It's a small surface mount piece resembling a miniature hockey puck. I used short pieces of insulated wire to connect the inductor (choke) between the normal DC-in jack and the "RCVR OUTPUT" F jack. I cut the direct connection between the "RCVR OUTPUT" F jack and the otherwise redundant adjacent RCA jack. I put a 0.1 uF capacitor from the F to RCA jack so that the RCA "RCVR OUTPUT" jack can be a pure RF connection not carrying DC. This would be used when power is being applied at the normal DC jack of the RPA-1.

The inductor allows DC on the feedline cable to power the amplifier even when it is being fed from an operating position possibly hundreds of feet away. I usually use the amplifier with my car-rooftop antennas on beach DXpeditions or with my Flag antenna at home.

I just use BNC to F adaptors at both the ANTENNA INPUT and RCVR OUTPUT jacks. If I power the RPA-1 at its own DC input jack, rather than up the coax, I use a BNC to RCA jack for connecting to the RCVR OUTPUT (RCA) jack that is now capacitively coupled to the RCVR OUTPUT (F) jack.

Chris Black (N1CP) also has an RPA-1 that he keeps near his receiver. I suggested that he go to the hardware store and get one of those inline switches typically used on lamp cords. This switch is now on the cord going from the wall wart to his RPA-1 DC input. No alteration of his RPA-1 was required for the way he uses it in his shack.

I should also note, although the low end stated for the RPA-1 is given as 300 kHz, it can still provide usable gain lower in frequency. With the Flag antenna at Chris Black's QTH in S. Yarmouth, I got about 8 dB of gain at 150 kHz, 10 or 11 dB at 200 kHz, and better than 12 dB at 250 kHz. Usage, therefore, is still possible for the typical frequency range of long wave broadcasters and non-directional beacons.

A CAUTION

Internal modifications to the RPA-1 like those noted in the first section of the article will void whatever warranty that DX Engineering offers with their fine equipment. If you plan to modify an RPA-1, it would be very prudent to run the preamp under power for 12 or 24 hours first. Most early failures in solid state gear occur in those first few hours. Should one of those rare early failures occur, having the RPA-1 fail before modification will allow you to return the unit to DX Engineering for warranty repair.