On Repairing PA’s of Repeaters and Radios

Category: FAQ
October 6, 2020
If you are experiencing low or no power output…..

1. Replacing a blown final does not necessarily fix the problem that caused the blown final. Never replace a blown final in anything where you haven’t gone through and figured out if there was a reason the final blew. These are very rugged transistors that should last a very long time.

2. Some failures are related to heat, most are not. The DR repeaters have excellent cooling. Unless the fans have died, temperature should not be a problem.

3. There have been, er, problems in the past. Being that I’ve been in Fusion since the very beginning, I have had a few radios where finals blew. The root cause many failures in the repeaters has been resolved a long while ago. DR2s never had any issues. Later DR1s were fine.

Suggestion: Add a 10 amp fuse between the power supply and the Tx. This can prevent burning of the PCB should the final end up in a “high current” mode. Not a likely event, but good insurance against a potentially much more expensive repair. (If the transistor is biased on with no RF input, the current draw will go to about 15.5A. All of that power is used to heat up the transistor and the PCB.)

4. The official Yaesu replacement transistor is not available on the open market. You must purchase it from Yaesu. I have successfully replaced PA’s, but be advised your specific non-Yaesu replacement transistor might have characteristics that won’t play well with the other components on the board.

My suggestion: Unless you're really set up to do this stuff and are willing to match a replacement transistor to the circuit, let Yaesu do the repair. If Yaesu did not do the repair, we shouldn't get concerned when someone reports multiple PA failures.

From another post:
First, replacing the transistor may not fix the problem. One has to wonder why it failed. These transistors should not fail under normal use (i.e., no lighting). High bias voltage can easily kill a PA.

I had a similar problem with an FTM-400. Blown PA, no bias. Forget what I did, but I could have kicked myself for not checking the bias and working on that problem before I put the new transistor in. As I recall I just worked my way through the bias circuitry and fixed what was wrong. My recollection is that the bias was bad on both the driver and the PA so I ended up looking at the common circuitry.

Note that the PA transistors you can buy from places like RF Parts are different transistors from those that Yaesu uses. For a number of years now they have been purchasing Mitsubishi transistors with a custom part number. My guess is that they have been selected for consistent parameters in the 430-450 range whereas the standard part is specified for 450-470. This means variation in the standard part may require fine tuning of the input/output circuitry.

I had a DR-1X who's power output went to zero. Fortunately I had placed a 10 amp fuse in series with the Tx which blew and protected the PA transistor. (Otherwise it sits at 16 amps and melts itself.) The problem was a failing solder joint on an inductor that was used to provide RF isolation to the transistor that engaged the Tx low pass filter network band switch relay. It really helps if the Tx frequency is on the same band that the output filter is on! This is an example of a non-PA failure that could have killed the PA. These transistors should not fail and if they do there's probably a reason.

Aside: In the above I ended up bypassing the relay so it always used the 440 MHz low pass since I only use the repeater on UHF. Figured one less failure point. Funny thing is that it worked fine on VHF (of course) but that the spurious emissions were still pretty low. It would easily meet FCC spec with a duplexer on the output.

Repeater Power Output

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The DR repeaters are calibrated in the middle of the band. For UHF that is 440.000 MHz. You may want to check the power output at that frequency as you are operating right at the band edge. While you're at it, measure the Tx current. At the lower power output the current should be lower, otherwise it could indicate a problem.

Under no circumstances should the Tx current be above 10 amps (I recommend a 10 amp fuse in the Tx power supply line) and will more typically be around 7 amps. At 30 watts it should be less.

There are differences in the DR-1X depending on when it was produced and/or which updates it has received. Early units should only be run on medium power, especially on UHF.

The DR-1 does not sense SWR. It simply looks at voltages in the output filter that should be represent a higher SWR as an apparent higher output power thus causing input power to be slightly reduced. Variations in the frequency response characteristics of the filters and amplifier gain will cause the output to vary over the 430-450 MHz range. You can always

recalibrate the output at your frequency of interest but be careful. It has been my experience that the output can also be greater than 50 watts on certain frequencies.