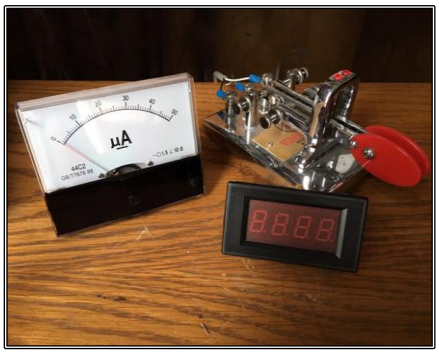
Remote Field Strength Meter – by Bob Rosier K4OCE

There are a lot of advantages in being able to check field strength using a detector located at a distant point. For example, I found that the only method of fine tuning a Cubical Quad is with a remote Field Strength Meter. I recall a time that I had a tube transmitter that I had tuned up the old fashion way by dipping the plate current. I discovered that I was not actually getting maximum output power. There was a problem in the final PI tank circuit, and I would never have found the problem without the field strength measurement. In other word, before this measurement, I didn't know I had a problem….hi.

In another case, I received a 40 meter add-on to my Cushcraft X-9 beam as a birthday present. I still had my 40 meter dipole, so I decided to compare the two. I was a bit surprised to find that the new shorter add-on measured a little higher radiated power than the standard dipole. The computer modeling software Cushcraft used must have effectively added some form of a director to the shortened rotating dipole. When comparing antennas, you can always get an on-the-air report, but a field strength meter reading is far more accurate. Keep in mind, that antennas do not amplify power, they just concentrate (direct) it in a given direction. I have since taken down my wire dipole.

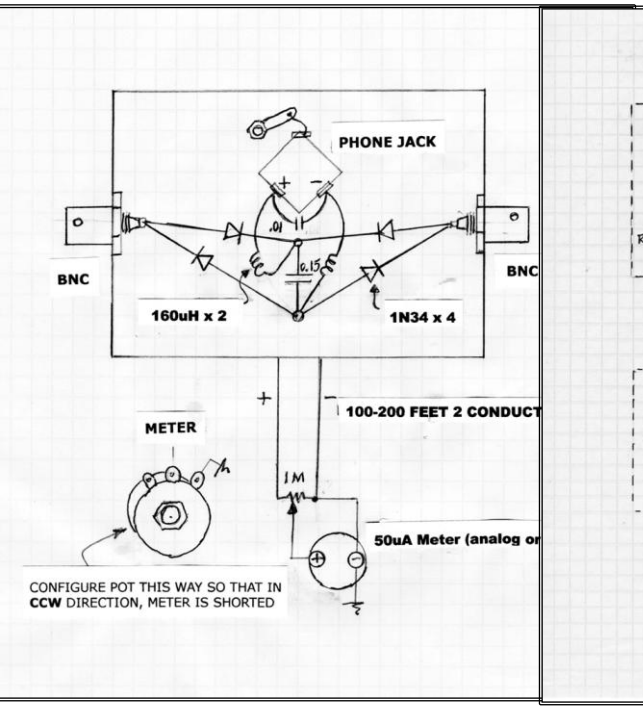
I wanted the field strength unit to be passive if possible. To accomplish this I used two collapsible universal AM/FM antennas made up like an adjustable dipole. They each collapse to about 6 inches and extend out to about 36 inches. For VHF and UHF you can adjust these collapsible antenna to the actual ½ wavelength. For HF, the antenna should be open to maximum length since in this case you are just trying to pick up as much RF as possible. I used 1N34 germanium diodes in a full-wave diode bridge arrangement (1N270 will also work). Although in most applications the silicon diode are superior (higher voltage and current rating, much less reverse current leakage, can handle more reverse current, and are less temperature sensitive), germanium diodes have the advantage of having a lower threshold voltage and lower voltage drop. Silicon needs about .7 to .8 volts across it to conduct, whereas germanium only needs .2 to .3 volts. As you are probably aware, the full wave arrangement results in a higher dc voltage output as compared to a single diode. I decided to use a 50 microamp (uA) meter for maximum sensitivity. I found a large size 50 microamp meter on line (about 4" x 3 1/8") for $5.19 and also found a digital version for $7.45. With the transmitter output power set around 5 watts, the analog meter read about 24uA and the digital read 23.7uA as can be seen in the pictures. So, the two meters tracked well. At the 1 watt transmitter output power level, the reading was 8uA.

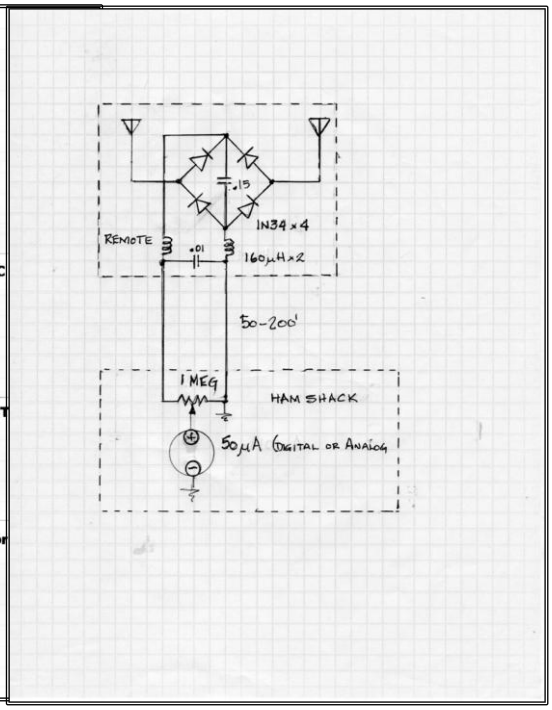
You can see the meter size comparison in the picture with my key. I thought I might have to add some addition filtering for the digital meter, but the chokes and bypass capacitor did their job and I got a steady digital reading.

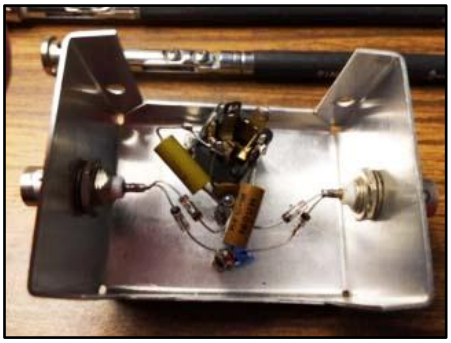


I wanted a metal housing, so I used a 2.5” x 2” x 1.5” box that I already had and after construction I use a gutter sealant to make it waterproof (I used Geocel Gutter Sealant 2320 that fits a standard caulk gun). Now being waterproof, I stuck it up in a tree and to reach the point I wanted, it took 140 feet of wire. You need to orient the pickup dipole to the same polarization as the antenna under test. I mounting it broadside in the direction of my all band dipoles. Turning the field-strength meter antenna vertical caused the ham shack meter to drop zero.
The center of my dipole was on a pulley to the top of the tower. The beam, of course, can be turned towards the field meter. You can turn the beam to measure the pattern as well as front-to-back and front-to-side ratios.

The circuitry is simple because you are not trying to get an actual number in your reading; it is a relative measurement. If you permanently mount the remote detector, you can use an attenuation on the transmitting signal side, and calibrate the meter in dB. I have an attenuator I built that has 1,2,4,8,16,32 dB steps. Six resistor T-pads and six switches allows you to drop power down from 1 to 63dB in 1 dB steps. I found that in my setup, 2.5uA was equivalent to 1 dB, so I could adjust my meter to full scale, then mark 1db steps zero being 20dB down. All-in-all I am very pleased with the results, especially getting a good reading at the low 1 watt level. Here is the simple schematic and picture of the unit.







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I had the 2 BNC telescoping antennas in my junk box, so this made for an easy way of mounting the antennas. With such a sensitive meter movement, it is important that you always keep the meter potentiometer set fully CCW when not making measurements. This places a short across the meter. The parts located at the ham shack consists of only a 1 meg potentiometer and the meter. None of the component values are critical, so you can substitute any values close to the ones I chose. The 160uH chokes were what I had in my junk box, but any value in the 100-200uH range will work fine. In the diode bridge you can also use the 1N34A. Only difference is that the 1N34 is ceramic, and the 1N34A is glass. A nice weekend project.