Number 53: The FIELD STRENGTH METER:
(TechTalk #128)
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INTRODUCTION:
At the February board meeting our Veep Janet – KL7MF brought up the subject of offering a club project that people can build. The club would purchase the parts and make up kits that those wishing to participate could buy and assemble. The kits could be assembled at home, or at a meeting or special gathering and checked out. Each participant would gain an inexpensive piece of equipment for their ham-shack. We've done something similar in the past. Tim – N6TMT organized an event to build 2-meter, directional, tape measure, T-hunt antennas. Also, some years back a soldering class was conducted for club members. It was even repeated at Field Day for the Boy Scouts and club members.

One simple project I thought would be fun for the club to build is a Field Strength Meter. RF is all around us. It's in the shack, near the WiFi router and maybe in the kitchen, but you can't see it, hear it or, unless it's very strong, feel it. There is a simple device that can detect RF – a Field Strength Meter (**FSM**).

The most expensive part of the FSM is the meter which needs to be sensitive. A 100 µA meter is perfect. So I went looking and found one in the range fo $5. It seemed to be a very good price and the meter's specifications were great for such a project. I bookmarked the page and started figuring the other parts we'd need: a diode, an RF choke a capacitor, some wire and a small mini-box to put it in. I was on a roll and decided to order ten meters for a start. Back to the web-page and to my shock the cost of one meter was now over $30. Since then I occasionally look for an inexpensive sensitive meter without finding one.

Pending finding a good source for meters, I thought it would be nice to discuss how a field strength meter works.

THE BASIC FSM CIRCUIT:
Figure 1 is a schematic of a simple field strength meter. It has minimal components:

- A diode that rectifies the weak DC field. It needs to be a sensitive diode such as a germanium signal diode or a more modern Schottky signal diode.
- A potentiometer to adjust the sensitivity of the instrument. 100KΩ is a standard size that will work well. The low end can either

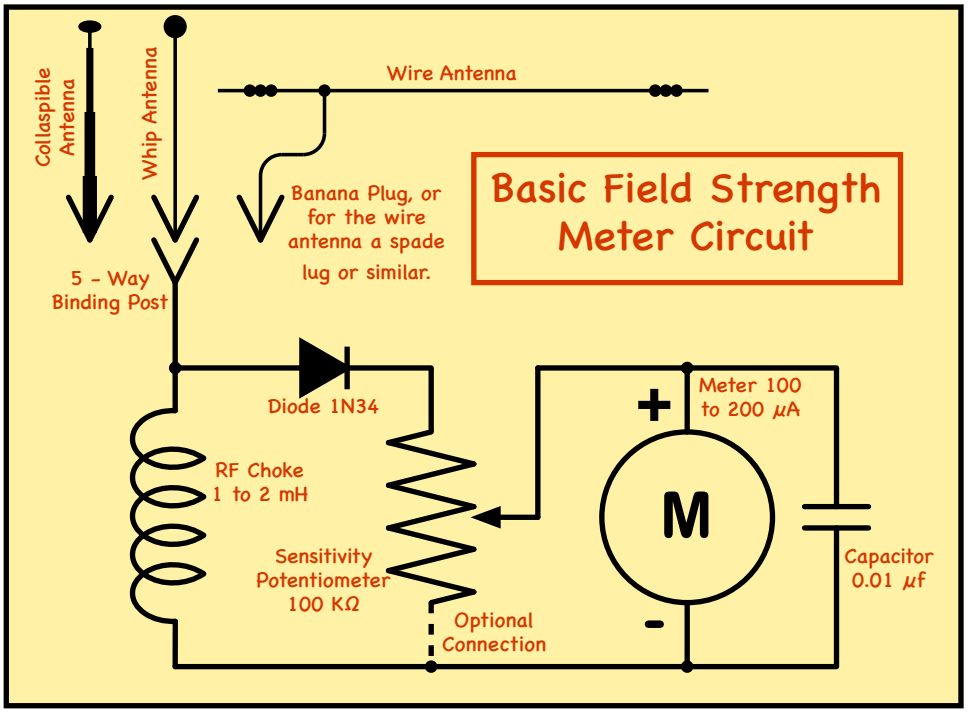

Figure 1: The basic Field Strength Meter circuit. See text.

be connected or not connected to the negative meter terminal. When connected, the meter sensitivity can be cranked down to zero. When not connected the meter sensitivity can only be cranked down to the point where an RF signal on the antenna of about 10 volts can drive the meter to full scale. This assumes a 100 µA meter with an internal resistance of 1.5 KΩ, a typical value.

- A capacitor that filters out the rectified signal and turns it into DC that the meter can measure. A simple disc ceramic capacitor between 0.005 µF and 0.05 µF should work fine. A good common value is 0.01 µF. The voltage rating need not be more than 100 V.
- A meter that is sensitive. 100 µA or 150 µA. 200 µA is useable The meter should preferably small (2 to 3 inches square or round). The size is only important if it's being housed in a small "Minibox".
- And an RF choke. This is not a resonant circuit. The choke only prevents RF from passing while allowing DC to pass. A value between 1 and 2.5 mH would work well. This all important part provides a DC return path that goes through the meter, allowing current to pass.
- An antenna connector, often a five-way binding post..
- A suitable antenna:
  - A multiple section extendible antenna with a banana plug on the end to mate with the 5–way binding post.
  - A spring wire whip antenna topped with a protective safety bead; again using a banana plug to mate with the 5–way binding post.
  - An external basic wire antenna connected either directly to the 5–way binding post or terminated with a banana plug or spade lug.

Other items such as a knob for the potentiometer, some sort of "minibox" cabinet, cabinet feet etc. need to be thought about too.

Notice that the FSM uses no batteries. It actually uses the transmitted energy to power the meter reading. No worries about leaking batteries or having the battery die in the middle of a measurement.

FIELD STRENGTH METER USES:

The basic FSM measurers "relative" signal strength. You might locate it at a specific position and orientation and adjust the meter, while transmitting, to some arbitrary low level on the meter. Then make the desired transmitter adjustments and (hopefully watch the relative meter reading increase. The FSM can be used outside to measure the pattern from a mobile antenna and even a beam as it is rotated.

Just sitting in your shack, where it will spend most of its time, it provides a good indication that you're putting out RF. Set it so that at key down, or on voice peaks, your meter hits half-scale, and you can easily notice any drop in output.

FSM BELLS AND WHISTLES:

Of course there are Field Strength Meters on the commercial market that have added features. One such feature is a broadband RF amplifier to increase the sensitivity, as well as bandpass filters, Lowpass filters (often necessary if you are situated near an AM broadcast transmitter.) If there is an amplifier or the filters are active, then batteries, or other power source is needed.

CONCLUSION:

The search continues for an inexpensive meter to develop a club project if there is interest. Is there a simple project you can suggest for the club?

73, from AF6C

This article is based on the TechTalk article that originally appeared in the April 2023 issue of RF, the newsletter of the Orange County Amateur Radio Club - W6ZE.