A Remote Field Strength Meter

An accurate system for measuring radiated power.

by Ken Cornell W2IMB

Are you sure that you are obtaining the best radiating power from your antenna? Most radio hams rely on their antenna tuning units and SWR bridge, as well as on-the-air reports. Yet there's always the feeling that it could be improved.

Most hams are familiar with the field strength meter. The meter usually consists of a tuned L/C circuit with a whip antenna, and uses a diode to register the relative field strength of the received signal on a sensitive microammeter.

FSMs are valuable for tuning up transmitters, but to accurately measure the relative strength of a transmitted signal, the FSM should not be used inside the shack, close to the transmitter and antenna tuning unit. Instead, it should be used several wavelengths distant from the transmitter's antenna.

This can create a problem, as two people would be required, one at the transmitter site and the other at the remote field strength meter location. Plus, the two parties would need to be able to communicate with each other.

The Remote FSM

The scheme I am about to describe would require only one person. A remote field strength meter is used to send a signal back to the transmitter site. The FSM is capable of indicating maximum radiated power as the transmitter and antenna tuning units are adjusted.

The remote FSM works with an FCC Part 15 transmitter (no license requirements) that operates in the 510 to 1705 kHz spectrum. The FCC rules permit maximum input power of 100 mW and an antenna 2 meters long. At 300 to 400 feet, the transmitter should put a good signal into a station receiver.

See Figure 1 for a block diagram of the system.

Figure 2, the FCC Part 15 transmitter, consists of a Hartley VFO with a buffer and final amplifier. I built the circuit on a 2-1/2" x 5" piece of perfboard that in turn was mounted on a block of wood on standoffs. My transmitters include the 1500 to 2000 kHz range, so I used a target frequency of 1650 kHz for the FSM transmitter.

I wound L1 on a 5/16" diameter slug tuned

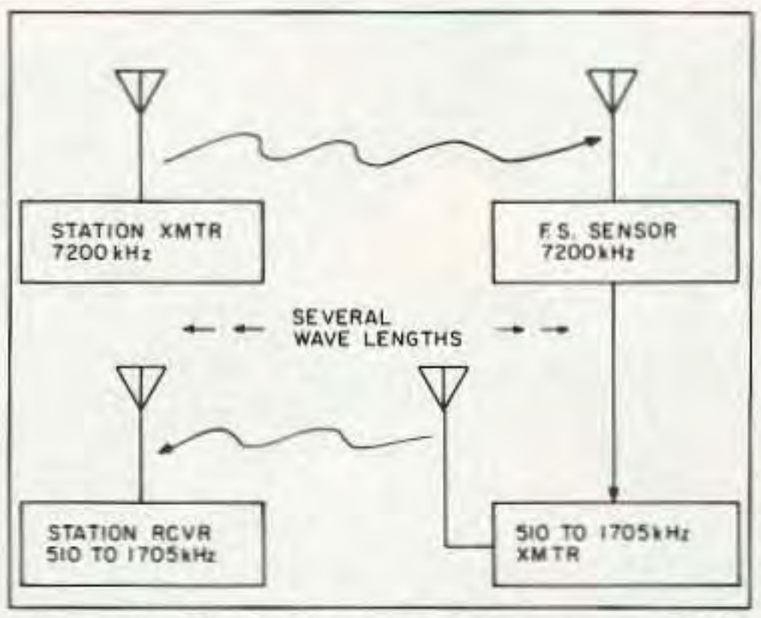

Figure 1. Block diagram of the remote field strength meter.

form with 100 turns of #28 enameled wire, with the source tap at 25 turns from the ground end. Coils L2 and L3 were wound on a length of hardwood dowel 1/2" in diameter, each with 100 turns of #28 wire. For L4, I wrapped a turn of Mylar tape around the ground end of L2, and wound 15 turns of #28 wire with taps at 5 and 10 turns. I use the tap that offers best performance.

The varactor (V) is placed across L1 in series with the 0.1 µF blocking capacitor. The F.S. sensor, shown in Figure 2, receives the transmitted signal and rectifies it and the rectified voltage is applied to the varactor circuit through the RF choke.

With no applied voltage, the varactor offers maximum capacity to the tuned circuit. As voltage is applied, the capacity will diminish. Therefore, when used in a VFO tuned circuit, the higher the applied voltage, the higher the frequency.

The F.S. Sensor's transmitted signal is tuned in on the station's receiver, and as the station's transmitter is tuned up to its antenna, the F.S. Sensor will detect this transmitted power; and as the resultant voltage is applied to the F.S. Sensor's transmitter, the frequency will rise. This beat-note will be detected on the station receiver, and the tune-up procedure is continued for maximum beat-note swing. This beat-note swing can be either way, depending on which sideband is used.

This could be an effective way for tuning up a beam antenna. A portable transistor radio can be used, and the F.S. Sensor's transmitter can be tuned to heterodyne a B.C. station, then tune the beam for maximum frequency swing.

Continued on page 46

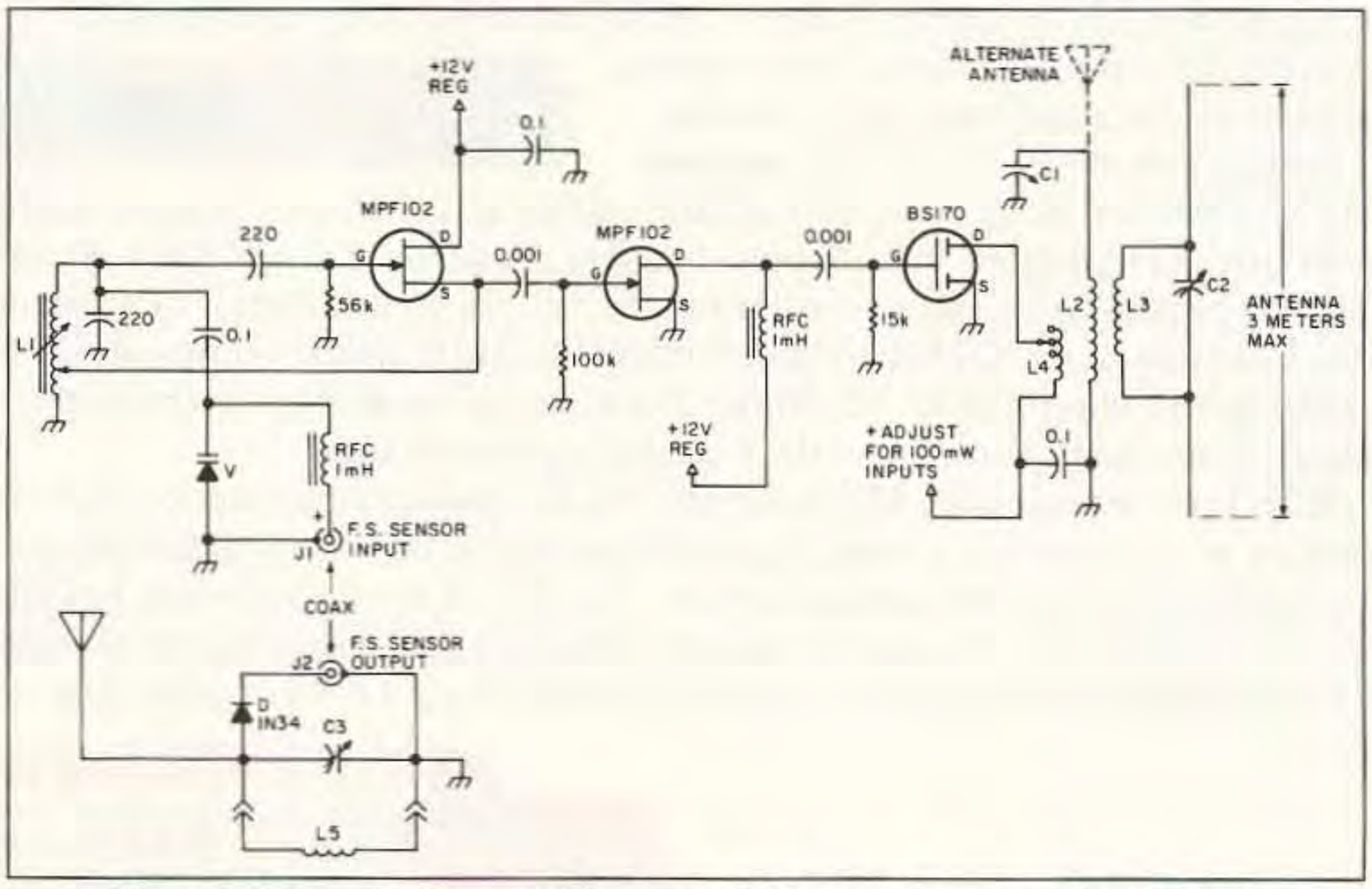

Figure 2. Schematic diagram of the remote field strength sensor and transmitter.

Field Strength Meter

Continued from page 44

The doublet antenna arrangement I show in Figure 2 is the scheme I use, but an antenna can be connected to the junction of C1 and L2. The FCC rules state that any length of ground return has to be included in the antenna length (three meters).

Any antenna length for the F.S. sensor can be used, and I suggest that the best ground available be used.

For convenience the two units (the sensor and transmitter) do not have to be closely associated, and the units can be separated as desired yet be connected with coax cable via the jacks J1 and J2.

For power, I use two 6 volt lantern batteries connected in series with 12 volts applied to the VFO and buffer. Six volts is taken off for the final amplifier.

I obtained my varactors from DC Electronics, P.O. Box 3203, Scottdale AZ 85271. I ordered a supply of various types, and the MMV2109 is the one I happened to use.

The BS170 (Amperex) and the BS170P (Zetex), both MOSFETs, are fine performers. They are available from Digi-Key Corp., P.O. Box 677, Thief River Falls MN 56701. The BS170 is on page 57, and the BS170P on page 58, in their July–August '91 catalog.

Parts List

Q1,Q2	MPF102 FET
Q3	BS170 MOSFET
L1–L4	See text
L5	See Table 1
C1,C2	90 to 420 pF mica trimmers (RS# 272-1336)
C3	150 pF variable capacitor
C4,C5	220 pF
C6,C7,C10	0.1 µF
C8,C9	0.001 µF
R1	56k resistor
R2	100k
R3	15k
D1	MV2109 varactor diode or equivalent
D2	1N34A germanium diode

Table 1.Field Strength Coil Details

Band	Turns
160m	120 turns closewound
80m	50 turns closewound
40m	20 turns closewound
20m	10 turns spaced one wire diameter apart
10 & 15m	6 turns spaced over a ½ inch length

Use #30 enameled wire.

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