SHACKNEWS

HIGHVELD AMATEUR RADIO CLUB

AUGUST 2008

COMMUNICATION IS THE NAME OF THE GAME

Meeting A number of pieces of homebrew equipment were brought along to the meeting and demonstrated by various members. Thanks guys for the effort.
The next meeting is the **AGM 6 September 2008**

SSC Meeting Thanks to Doug & Merle for hosting the meeting at their home on Saturday 9 August. A nice turn out with lots of discussion. The next get together to be announced later.

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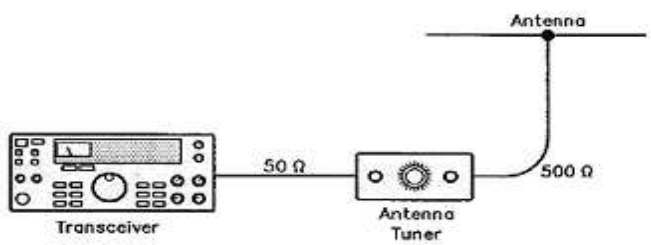
Antenna Tuner Operation

Question: I'm a little confused about how antenna tuners function in terms of reducing antenna system SWR. Is it true that an antenna tuner does not really 'tune' the antenna? And if an antenna is cut to resonance already, what good is a tuner?

Yes, it's true-an antenna tuner doesn't really tune your antenna in the strict sense of the word. It does not, for example, adjust the lengths of your antenna elements, their heights above ground and so on. What an antenna tuner or transmatch does do, however, is transform the impedance at the feed line input to a value that your transceiver can handle (typically 50 Ohm-see Figure 1). When thinking about antenna tuners and SWR, it's important to remember that the tuner has no effect whatsoever on the SWR between itself and the antenna. It's the SWR between the tuner and the transceiver that changes.

In practical terms, all a tuner does is act as a kind of adjustable impedance transformer between the antenna system and the radio. It takes whatever impedance the antenna system presents and attempts to convert it to 50 Ohm--or something reasonably close to that value--for the transceiver. When the transceiver "sees" a 50 Ohm impedance, it is able to load its maximum RF output into the system. That power is transferred through the antenna tuner, to the feed line and, ultimately, to the antenna--minus any losses incurred along the way.

These losses are the reason that the highest efficiency feed-line for each individual case is desirable and why some amateurs use ladder line.



Most antenna tuners have an inductance rotary switch and two capacitors. The capacitors are often labeled ANTENNA and TRANSMITTER. In some antenna tuners the inductance switch is replaced with a continuously variable inductance, popularly known as a roller inductor.

(Also see page 4)

Let's assume you're using a tuner with an inductance switch, because they are the most common. Place both capacitor controls at their mid-range positions. Don't trust the knob markers if this is your first experience with the tuner; remove the cover and turn the knobs until the moving capacitor plates are only half meshed with the stationary plates. If the knobs are pointing to half scale, consider yourself lucky. If not, loosen their Allen nuts and rotate the knobs so that they point to mid scale. Replace the tuner cover and you're ready to go.

Turn the radio on and, with the ANTENNA and TRANSMITTER controls at mid scale, crank the inductance switch until you hear the loudest noise or signals coming into your radio. Then, rotate the ANTENNA and TRANSMITTER controls until you get to the absolutely loudest noise or signal level on the radio. This should be close to your best tuning spot.

With your rig set to low power, send an ID then transmit a continuous carrier while you tweak the ANTENNA and TRANSMITTER controls for the lowest reflected power reading with the highest output power as read on the SWR meter. You may find that you have to vary the position of the inductance switch a position or two to get your best match. Be gentle to your radio; keep the key-down periods as short as possible.

Depending on the impedance at the antenna input (and the overall design of the tuner) you may not be able to obtain a flat 1:1 SWR on all frequencies and bands.

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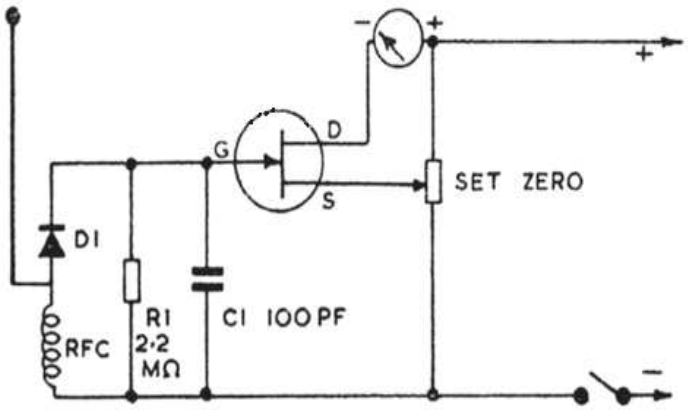
Field Strength Meter (Shown at the meeting)

The device will operate at any frequency up to 250MHz or even higher if necessary. A short whip, rod, telescopic or other aerial picks up radio frequency energy, and rectification by diode D1 provides a positive voltage for the FET gate, across R1. This FET is only operating as a DC amplifier, and the 2N3819 and other general-purpose transistors will be satisfactory.
The “Set Zero” potentiometer may be 1k to 10k. With no RF signal present, it allows gate/source potential to be adjusted so that the meter shows only a small current, which rises in accordance with the strength of the RF present. For high sensitivity, a 100uA meter can be fitted. Alternatively, a meter of lower sensitivity, such as 25uA, 500uA or 1mA can be used, and will provide enough indication in most circumstances.
Should the field strength meter be wanted for VHF only, a VHF choke can be used, but for general usage over lower frequencies, a short wave choke is necessary. An inductance of about 2.5mH is satisfactory for 1.8MHz and higher frequencies.
The device can be constructed in a small insulated or metal box, with the aerial projecting vertically. In use, it allows tuning up a transmitter final amplifier and aerial circuits, or the adjustment of bias, drive and other factors, to secure maximum radiated output.
The effect of adjustments will be shown by the rise or fall of the reading of the, field strength meter.



1. Two antennas met on a roof, fell in love and got married. The ceremony wasn't much, but the reception was excellent.

2. A jumper cable walks into a bar. The bartender says, "I'll serve you, but don't start anything."

3. Two peanuts walk into a bar, and one was a salted.

4. A dyslexic man walks into a bra.

5. A man walks into a bar with a slab of asphalt under his arm and says: "A beer please, and one for the road."

6. Two cannibals are eating a clown. One says to the other: "Does this taste funny to you?"

7. "Doc, I can't stop singing 'The Green, Green Grass of Home.'"
"That sounds like Tom Jones Syndrome."
"Is it common?"
"Well, It's Not Unusual."

8. Two cows are standing next to each other in a field. Daisy says to Dolly, "I was artificially inseminated this morning."
"I don't believe you," says Dolly.
"It's true, no bull!" exclaims Daisy.

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Myth - A heavy gauge wire or strap connected to an earth rod is a "ground".

Basic Truth - Any conductor connected to an earth rod, or any other solid connection to the earth or a buried conductor, can act like an antenna all by itself. In fact, such wires can be better antennas than "grounds". The impedance of a wire or strap changes as a function of frequency and the length of the wire or strap to the point where it is earthed. If the length approaches one quarter wavelength or an odd multiple thereof, the impedance will be extremely high. Therefore, so-called ground wires can often be very poor grounds indeed. If the ground wire is getting too long to be a good ground, it may improve things to make it a half wave long, in which case it begins to act like a good ground again. However, the RF current flowing in such a ground wire may be equal to the RF current in the antenna proper. It depends on the type of antenna - whether it's balanced or unbalanced against ground. An end fed antenna system is actually comprised of a part that you normally think of as the antenna itself and also a part that you think of as the ground wire. The "ground" wires in house wiring are earthed at, or close to, the service entrance panel, but from there out to the extremities of each branch you have a veritable Christmas tree of antenna branches. Each such branch is effectively an antenna resonant at some frequency. The ends of those branches can be very hot with RF voltage if they happen to be a quarter wave at or near your frequency of operation.

Myth - I don't need a balun, because my antenna (or dipole) is resonant.

Basic Truth - A balun is recommended in connecting coax lines to balanced lines or balanced antennas - otherwise there will be an RF conduction path on the outside surface of the coax shield. (See "Baluns and RF on the Coax Shield" below)

Baluns and RF on the Coax Shield:

From ARRL Antenna Book, 17th Ed., p25-14. "A center-fed antenna with open ends, of which the half-wave dipole is an example, is inherently a balanced radiator. ... If the antenna is fed at the center through a coaxial line, this balance is upset because one side of the radiator is connected to the shield while the other is connected to the inner conductor. On the side connected to the shield, a current can flow down over the outside of the coaxial line. .... these "antenna currents" flowing on the outside of the line will be responsible for radiation."
A Balun is one of the ways in which antenna currents on the outside of the coax can be reduced or elimated.

Tuners

The tuners available commercially will generally include a toroid wound balun, typically 4:1. The tuners will be capable of transforming the impedance seen looking into the transmission line to a 50 ohm impedance (50 + j 0) - but only if the impedance to be transformed lies within certain limits. It is impractical with most tuners to deal with impedances that lie outside the range 10 to 500 ohms. Once the impedance gets above or below that range, the tuner is no longer able to transform the impedance to 50 + j 0 ohms. Note that the tuner does not affect the SWR on the line between the tuner and the load in any case. It only affects the SWR on the coax from the transmitter to the tuner. The purpose of the tuner is to present a 50 ohm load to the transmitter. The tuner would have to be installed at the antenna in order to make the entire transmission line flat.

Antenna Impedance

While it is true that a resonant dipole has an impedance very close to 50 + j 0 (50 ohms resistive), antennas in general can have quite a range of impedance. In fact, the radiation resistance of the resonant dipole is very dependant upon the height over ground, as can be seen in the curve on p 3-11 of the ARRL Antenna Book, 17 Edition. The radiation resistances over realistic earth will vary from 45 to 100 ohms. There are probably more antennas being used off resonance or at harmonics of the resonant frequency than there are being operated at resonance. For example, the G5RV is almost never operated at its resonant frequency, which would be between 4 and 5 MHz.
Folded Dipoles can have impedances of several hundred ohms at resonance, depending on wire diameter and spacing.
Verticals can have impedances at resonance from about 35 ohms and up, depending upon ground impedance.

CLUB INFORMATION

Postal address PO Box 19937 Sunward Park 1470

Website http://www.qsl.net/zs6hvb/
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Bulletins Sunday morning - 145.7875 MHz & 7062 KHz @ 08h45.
Relay - 80M - 3662KHz

Monthly meeting venue

Witwatersrand Rifles HQ
Cnr Barlow and Cavaleros Str
Industries West
Germiston

First Saturday of the month at 14:30

Committee

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Shacknews Printing	Harry Lautenbach	ZS6LT	011-888-5362
Webmaster	Yvonne van Dijk	ZR6TBL	011-432-5494

Repeater

145.1875 MHz input
145.7875 MHZ output
Linked on a Sunday morning during bulletin time to 70 cm - 438.850 MHz