The W1SFR End Fed 35' Random Wire Antenna with 9:1 UnUn

What is a random wire antenna and how does it work?

The term "random" infers that you can use any length of wire you want as an antenna, while that basic fact is true, there are some practical considerations. And I'm going to keep this VERY simple because there are scores of books dedicated to antenna design and efficiency. There are exceptions to just about everything I say here, so please no flaming emails from you experts out there! This explanation is for those whose knowledge of antenna systems is limited.

The majority of modern transmitting equipment is designed to operate with a resistive load fed via coaxial cable of a particular characteristic impedance, often 50 ohms. To connect the power stage of the transmitter to this coaxial cable transmission line a matching network is required. For solid state transmitters this is typically a broadband transformer (inside the radio) which steps up the low impedance of the output devices to 50 ohms.

To match the inpedence output of your radio, ideally, you would have an antenna system that also measures 50 ohms so that it "matches" your antenna's input and when it does that would be called a "balanced" antenna. Usually, this comes in the form of a standard dipole built to a specific length to cover a specific spread of frequencies on a specific band. All well and good if you want to just operate on one portion of one band, but what if you want to operate with the same antenna on different bands and need to have that antenna simple to deploy and highly portable? That's where the random wire antenna really shines.

In the case of the end fed random wire, some lengths are better than others because of the harmonic effect of the length of the wire and how that effects the various bands on which you wish to operate. Counter to tuning a length of wire like you would with a dipole, with a random wire you don't want the length to be harmonic on *any* band. There are ideal lengths that have been mathematically determined to be best for random wires. Here they are:

29 35 41 58 71 84 107 119 148 203 347 407 423

I have chosen 35' as the standard length for my antennas, but you can experiment. I have used up to 84' and the KX3 will still tune all bands but as the wire gets longer so does the resistance so it becomes harder and harder for the tuner to do its job. At 35' it's not too short and not too long and works great in every configuration I've tried so far.

But I digress a bit.

A random wire is just that....a random length of wire. Any wire will do as an antenna and will provide a signal of some kind. As we know, any length of wire will present resistance (impedence) to the feed line (your coax) and the radio, and it also makes sense that the longer the wire gets, the more impedence will be present...as high as 5Kohms or more. We're looking for 50....remember?

So we have high resistance (impedence) from the wire which varies with it's length. A 35' wire without a tuner would present way too much impedence and resulting SWR to the feedline/radio for a tuner to deal with so somehow you need to knock down or transform that impedence so that when it gets to your tuner it's within range of your tuner's ability to function. That's where the UnUn comes in. Very simply, it's a transformer. It takes the high impedence of your random wire and lowers that impedence before it gets to your feedline (coax) so that your tuner can do it's job.

Configurations

My typical configuration is to simply throw a line up in a tree, pull the antenna up and tie it off on the black box. The black box is suspended about a foot off the ground and tied to a stake. That gives the coax some strain relief. Keeping the wire free of the tree's foliage is desirable and of course getting it up the full 35' is also the best way to ensure the most QSO's possible. I use a 25' BNC to BNC RG58 coax for a feedline. The outside braid of the coax acts as a counterpoise, so it's important to have the coax on the ground for at least 16', but again, this is a variable that is not etched in stone. In fact many use this antenna indoors and it works well, but antenna location is always a compromise of some sort.

Here's a picture of how I terminate my set up:

Aside from the usual "sloper" configuration, the antenna also works very well as a vertical with a Jakite pole or similar fiberglass pole system. People have also used them strung up in their attics, across their apartment floors, thrown out a window at their hotel rooms etc.

Here's what SWR readings look like ***without*** a tuner using three different analyzers. Thanks to Rod-W5GZT for providing these figures!

W5GZT initial tests of W1SFR end fed wire antenna - July 18, 2014
Antenna length - 41 feet. Feed point 8" above ground. Wire angle apps. 75 degrees. Partially in Tree.

Freq	FG-01		MFJ-225		MFJ-269	
	SWR	Z	SWR	Z	SWR	Z
3.530	2.3	73	2.5	69	2.9	31
7.030	4.6	83	5.2	52	6.1	21
7.122	4.6	95	5.3	60	6.3	23
14.030	1.7	36	1.9	37	1.9	32
18.080	1.9	23	2.1	23	2.2	24
21.050	2.8	102	3.0	90	3.2	65
24.910	2.4	102	2.5	101	2.7	80
28.050	1.9	93	1.8	78	2.0	63
50.100	n/t	n/t	n/t	n/t	4.4	25

These measurements made with commonly available equipment. No lab-grade test sets were available.