EFHW antennas

Instruction Manual

EuroXpress Corporation- MyAntennas.com

EFHW

Manual

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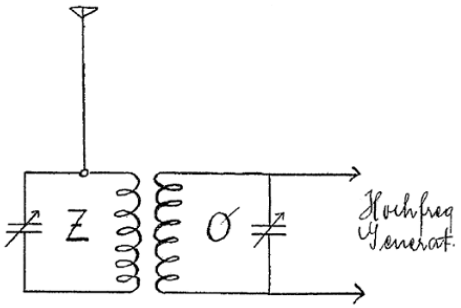
About EFHW Antennas

The EFHW antenna is one of amateur radio's oldest antenna designs. EFHW stands for "End Fed Half wave" and was first introduced way back in 1927 by the Austrian radio amateur, Dr. Josef Fuchs, OE1JF. Later the antenna got name "Fuchs Antenna." It was patented in 1928, published in QST magazine and subsequently forgotten for many years. Today, amateur radio operators are often reintroduced to EFHW antennas thanks to high ratio wideband UNUN transformers wound on a ferrite core material. This allows the simple half wavelength long wire to instantly become a multiband antenna with reasonable match producing low VSWR values within bands.

Beginning in 2015, the designer of high power MEF transformers (Multiband End Fed), Daniel "Danny" Horvat, E73M (aka N4EXA) has made number of huge advancements in designing of high ratio (49:1, 56:1, 75:1 and 81:1) UNUN (UN-balanced to UN-balanced) transformers and antennas. The efficiency- Insertion loss of the transformers continues to be unmatched by any copycat or competitor products on the market. These products made by Euroxpress Corporation and sold via e-commerce at MyAntennas.com, have helped create a resurgent wave in popularity for these long-forgotten antennas among the worldwide amateur radio community as well as in the world of commercial and public applications.



Schematic from the Austrian patent #110357 depicting the fundamental principle of the EFHW antenna

Installation Tips

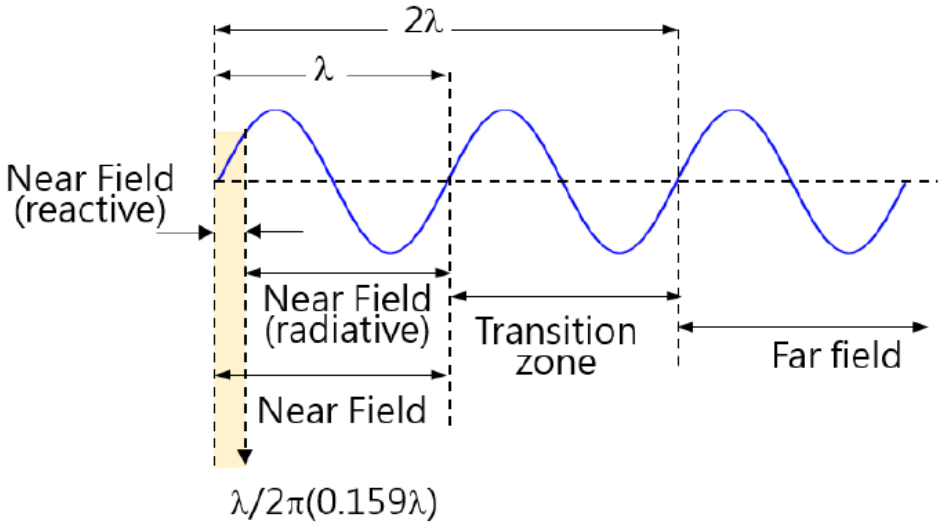
Weather you bought one of our multiband models like the EFHW-8010/7510, EFHW-4010 or a transformer like the MEF-330, MEF-107 etc. these basic rules apply to any antenna installation.

- All antennas need to be as far as possible from ground, antennas, wires, homes and similar.
- All antennas become more efficient when farther from ground or adjacent objects.
- All antennas behave differently at different locations and in different configurations.
- All antennas work better when height or distance from ground or object is equal or larger than antenna Reactive Near Field or 0.159 wavelength.

Just as the mantra is in the Real Estate business: "location, location, location", the mantra for antennas is: "Height, Height, Height".

One of common misconceptions is to think about an antenna's height in feet or meters above ground or above roof of the house etc. The antenna height should be seen in wavelengths of the frequency antenna operates on.

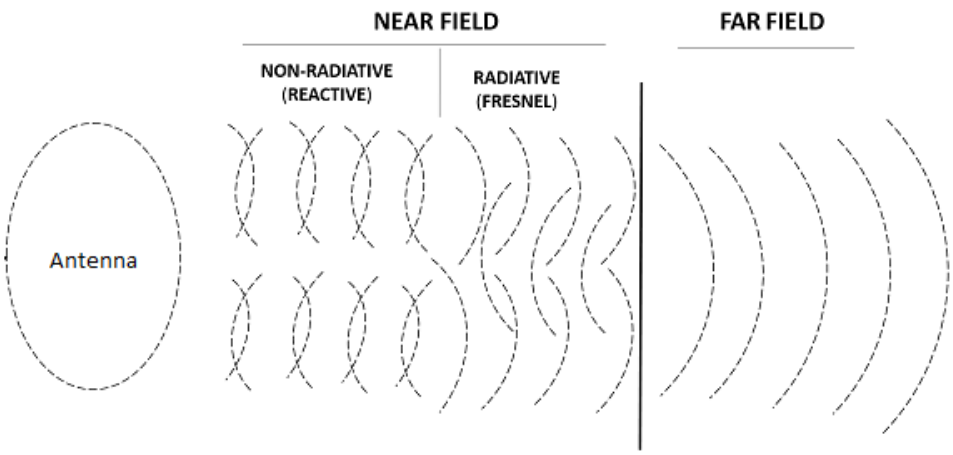
For example, 20 ft. above ground (6 meters) may seem a decent height compared to an average man standing at ~6' tall but not when operating on 3.5 MHz where the wavelength is 85.7 meters or 261 ft., the 20 feet represent a small fraction of total wavelength, just 0.076wl. It is half of the minimum optimal height of 0.159 WL but not to worry, the antenna will still work, although not as efficiently well as it would with a 40 feet (12 meter) configuration above ground.



We recommend minimum height of 20 feet at any or all points of our EFHW-8010 antenna models or 10 feet for EFHW-4010 models. This height applies also for Inverted "L" and Inverted "U" configurations where vertical side(s), starting at minimum 3 feet or 1 meter above ground, should be minimum 20 or 10 feet long.

To summarize and reiterate: "height, height, height"
" Antennas work much better when high above the ground and far from the objects"

It is worth mentioning here that the feed point impedance of any antenna is impacted by its height above the ground, distance from adjacent homes, towers, tree trunks, other antennas etc. In short VSWR values vary from location to location and by its height and distance from the aforementioned.



In the image above you can see a crude depiction of formation of electromagnetic waves.

When a signal from a transmitter is applied to an antenna, it sends out electromagnetic waves into free space. The EM field characteristics vary as a function of distance from the antenna. They are broadly divided into two regions, the near-field region, and the far field region.

Reactive Near Field: This is the region that is adjacent to the antenna. In this region, the E-Field and H-Field are 90 degrees out of phase with each other and are therefore reactive. To radiate or propagate the E/H fields need to be orthogonal (perpendicular) and in phase with each other.

Radiative Near Field: This region is also known as the Fresnel Region. It is the region between the reactive near field and the far field. This is the region where the EM fields start to transition from reactive to radiating fields. However, since they have not completely transitioned, the shape of the radiation pattern still varies with distance.

Far Field Region is the region that comes after the near radiative near field. In this region, the EM fields are dominated by radiating fields. The E and H-fields are orthogonal to each other and to the direction of propagation as with plane waves.

Installation Steps

1. Survey the size of your available yard space, take into an account trees and other objects like sheds, nearby homes, powerlines and similar.

2. Decide on one of following wire configurations bearing in mind to have the antenna wire as high as possible and far as possible from anything and everything.

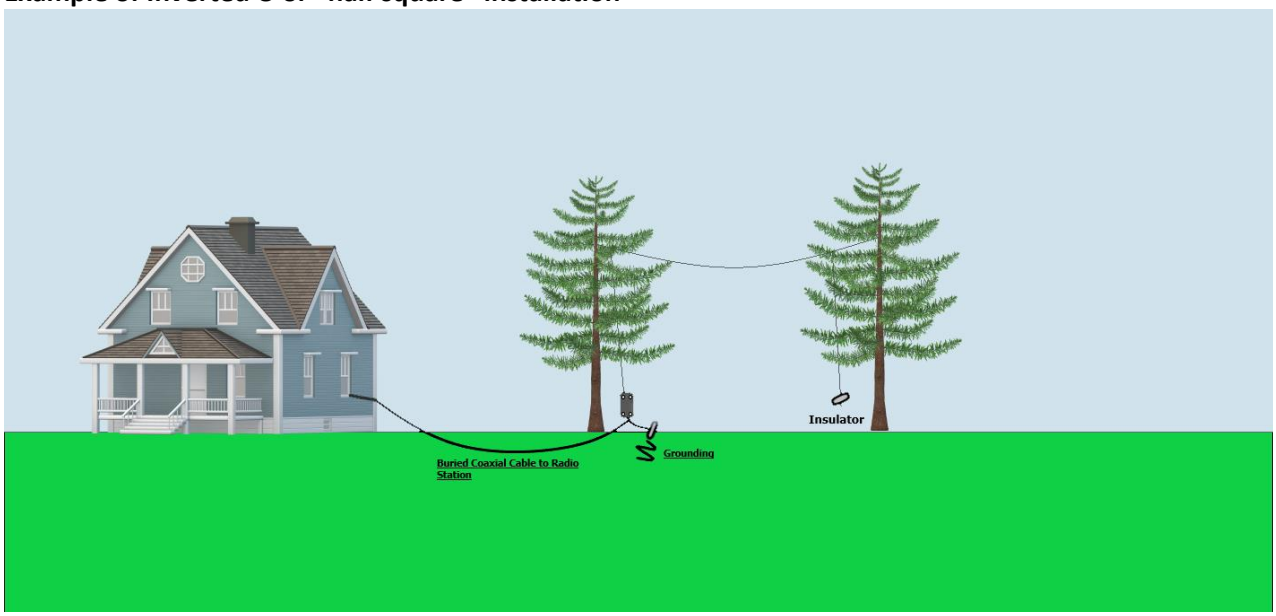
- Straight Horizontal wire configuration.
- Inverted L, Transformer at 3 feet or more and vertical side 20-40 feet long.
- Lazy L, horizontal portion followed by vertical portion of the antenna.
- Inverted V, angle at apex should not be less than 90 degrees.
- Inverted U, or “half square”, vertical sides are always twice shorter than horizontal.
- Sloper, make sure overall height of antenna is as far as possible from ground. Avoid placing the lower side of sloper at heights of less than 10 feet (3meters) above ground.

3. Fasten the box on to any surface such as a wall, wooden post, tower or hang it from tree or any other structure. Remove all wire ties and string the wire in any way you have room for and attach

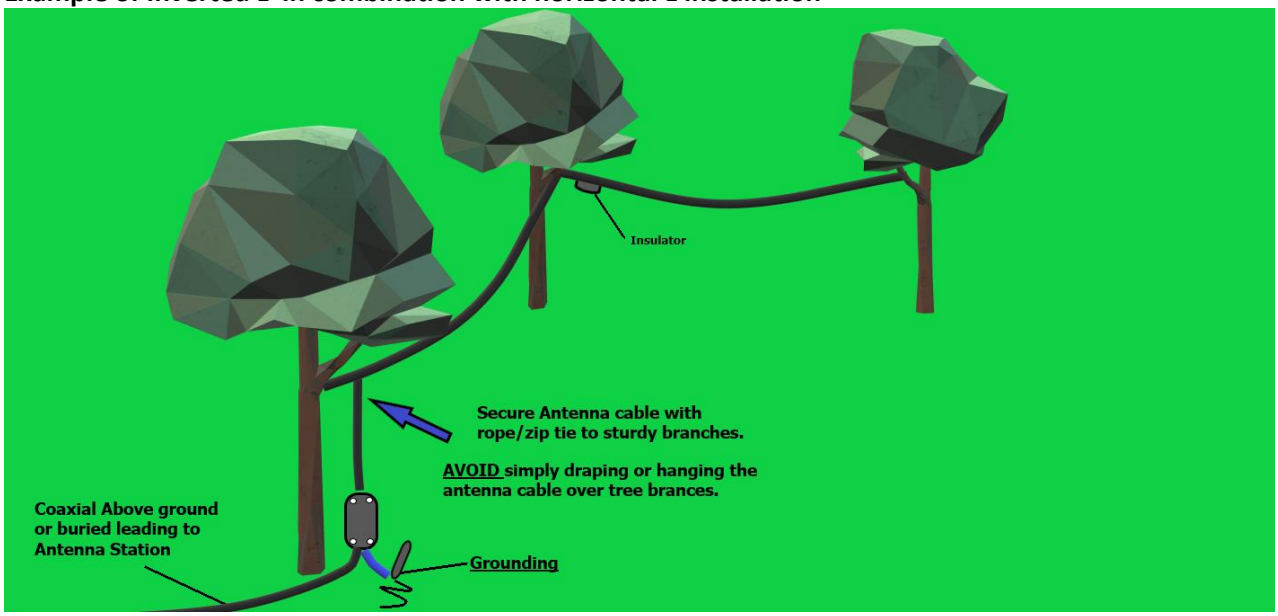
the coaxial line and grounding. ***Avoid longer grounding wires and ground the coaxial cable instead at the station side.***
Always make sure that antenna wire is at least 20 feet high above ground at the middle portion of a 130 feet (or 63 feet) long wire. Extra foot of wire is left on the end insulator of the antenna for fine tuning if needed. If the resonant point at 80m (should be 3.55-3.6MHz) is too low for you, the wire may be cut to be shortened slightly to move that point upward in frequency.

Note that the resonant points on other bands will move too. Note that difference between 3.5 and 3.9MHz is over 13 feet in length so it is impossible to have antenna covering the largest band (80/75m, 13% of frequency) with just single wire. For 3.9MHz coverage we developed an EFHW-7510-2K+ antenna which covers 3.8-4MHz with low VSWR whole all other bands remained the same as with EFHW-8010 model.
This antenna will not need radials and in most cases require NO Tuner at all. NO additional hanging pigtails from grounding lug is needed (some people mistakenly call it “counterpoise”).

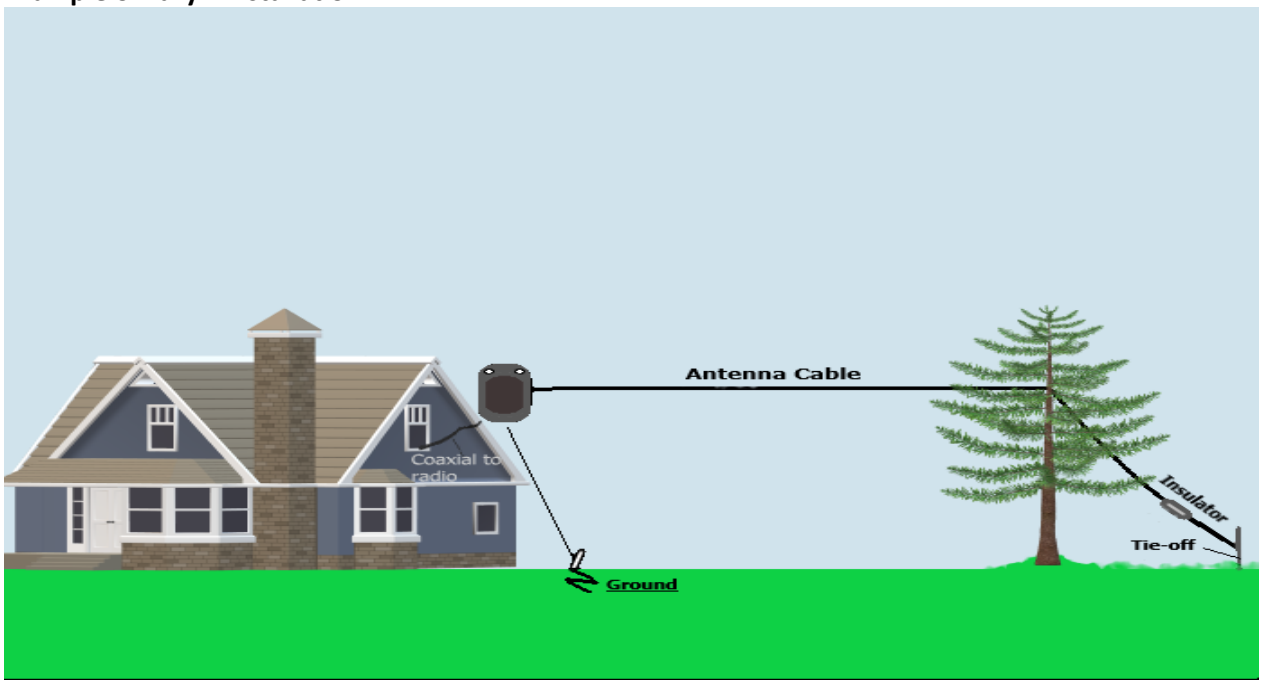
Example of Inverted U or “half square” installation



Example of Inverted L in combination with horizontal L installation



Example of Lazy L installation



Grounding of EFHW antennas

Grounding at the lug next to the SO239 connector is recommended! **(not in all installation cases)**

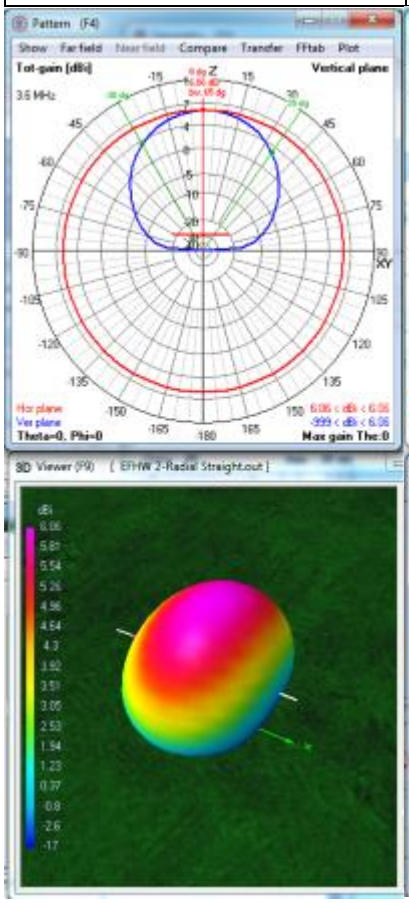
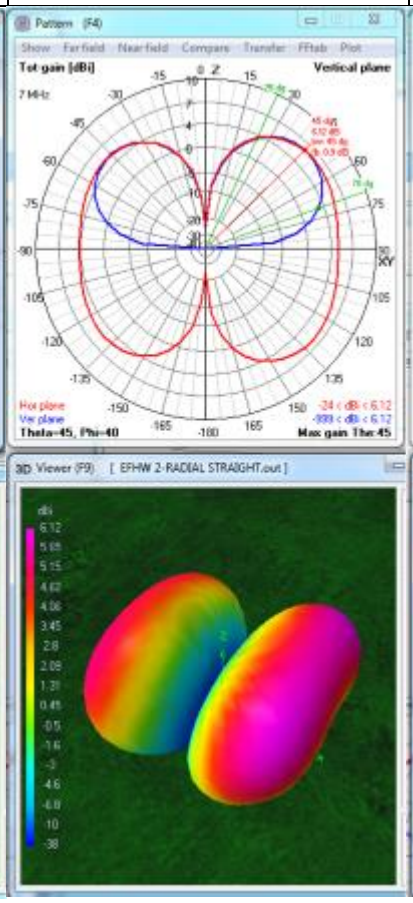
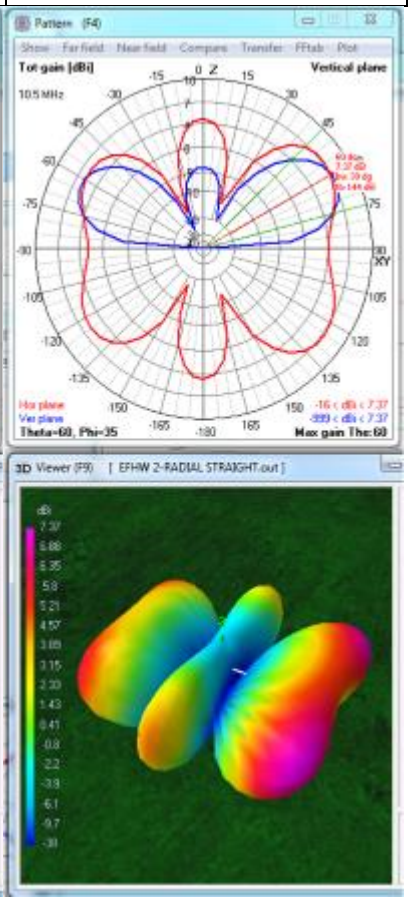
If the transformer box is installed more than 20ft from the ground, do not run ground wire but ground the end of the coaxial cable at the radio side. Long wires tend to collect electro-static charge (usually during stormy weather) which can produce ESD (electrostatic discharge) at the end of your cable and damage your equipment. There is also possibility of your own induction of RF into long ground wire which is not always terminated in perfect zero potential (ground) but into ground rod(s). The 8-foot (2.4 meters) ground rod easily can present resistance of 25-80 Ohms, depending on soil conductivity, instead of ideal zero Ohms. In real world with best grounding installations, the grounding resistance is 3-5 Ohms depending on ground composition.

To minimize eventual RF interference on transmit and ingress of RF noise always have your coaxial cables properly grounded at the entrance to your home and properly bonded with other ground rods per national electrical code 810, NEC-810 practice and information is available at our website link https://myantennas.com/wp/tech-info/about-grounding/

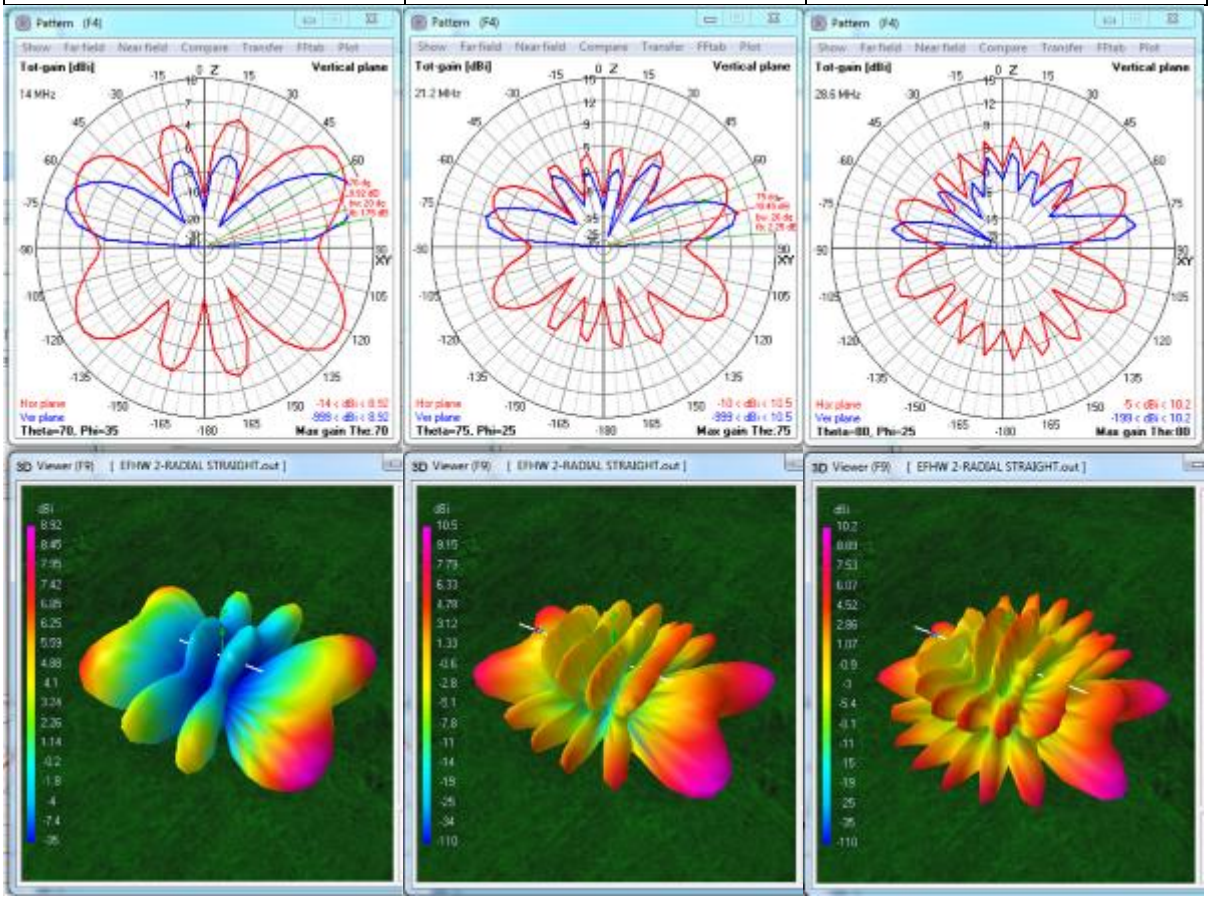
Radiation Patterns

Radiation pattern of EFHW antenna is the same as radiation pattern of the Center fed Dipole antenna. That is true only at its first resonance where antenna is half wavelength long just as Simple Dipole antenna. Unlike center fed Dipole, the EFHW antenna can be used on both odd and even multiples or harmonics. For example, the multiple of 3.55MHz times 2,3,4,5,6,7,8 will produce resonances in almost all amateur bands above 80M band.

The radiation patters will change as we go higher in the frequency and typical radiation patterns in 2D and 3D for an EFHW-81010 at 30 feet above the ground in horizontal configuration can be seen at following images created by Dick, KK4OBI

80m Fundamental 1 lobe 6.06 dBi at 0°	**40m** 2nd Harmonic 2 lobes 6.12 dBi at 50°	**30m** 3rd Harmonic 3 lobes 7.37 dBi at 60°
		

20 m 4th Harmonic 4 lobes 8.92 dBi at 70°	**15m** 6th Harmonic 6 lobes 10.5 dBi at 75°	**10m** 8th Harmonic 8 lobes 10.2 dBi at 80°



Power limits

Power rating of 1kW or 2kW I.C.A.S. is maximum for 3-30MHz antennas, the transformers like MEF-107-4K or MEF-105-5K can take a lot more I.C.A.S power on CW and Phone mode (SSB) than legal limit in the US (1500W).

The Popular digital mode such as FT8 etc. will put more strain on the wide-bands transformers with high ratio (49:1-81:1) used in EFHW antennas so follow the power limit on the product page and product labels. Anyway, be courteous and do not pollute such narrow bandwidth used in FT8 mode with high power and cause interference to other users.

***ICAS* = Intermittent Commercial and Amateur Service**

Adjust your power to style of operation, make sure that the transmit period is followed by the same or longer receive period in order to meet ICAS power rating.

Warning

No guarantee or liability is either expressed or implied pertaining to damages to persons, buildings, or equipment in the installation or use of our antennas. You must use extreme caution when working around power lines. If the antenna were to come into contact with a voltage carrying line it could be fatal.

Limited Warranty

MyAntennas.com/ Euroxpress Corporation, warrants to the original purchaser for one year from date of purchase that each antenna is free of defects in material or workmanship. If, in the judgement of MyAntennas.com, any such antenna is defective, then MyAntennas.com will, at its option, repair or replace the antenna at its expense within thirty days of the date the antenna is returned (at purchasers expense) to MyAntennas.com or one of its authorized representatives. This warranty is in lieu of all other expressed warranties, any implied warranty is limited in duration to one year. MyAntennas.com shall not be liable for any incidental or consequential damages which may result from a defect. This warranty does not extend to any products which have been subject the misuse, neglect, accident or improper installation. Any repairs or alterations outside of the MyAntennas.com facility will nullify this warranty.

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