Ham 112 - Hf bent dipole

Dr. Marc & Rosemary Durham, Theway Labs, Bixby, OK

Ham is about communicating. What is the best band? For what?
The First Law of Thermodynamics (Nature) says 'sum of the energy is zero', i.e., there is no free lunch.
For local, line-of-sight (LOS), 70cm UHF is very good, because antennas are small. But the range is very limited.
UHF has wide bandwidth, so lots of data can be sent, such as WiFi.
For portable and HOA friendly antennas, we use VHF and UHF repeaters.
Range is still limited to about 25 miles, and is very susceptible to LOS blockage and noise.

For long distance, HF is very good, but antennas are huge and meteorology conditions change radiation.
HF is very narrow bandwidth, so messages are simple.
In a separate section, we address 6-m VHF and 10-m HF, since they are similar.
Their range is about the same as VHF repeater without intermediate equipment to purchase, maintain, and control.

MHz	λ-m	λ/4-ft
442 - 450	0.7	0.51
144 - 148	2	1.6
50 - 54	6	4.5
28.0 - 29.7	10	8.3
21 - 21.45	15	11.15
14.0 - 14.35	20	16.7
7.0 - 7.3	40	33.0
3.5 - 4.0	80	63.8

80-m antennas are very long and have skinny bandwidth.
80-m is great at night with very long range. NVIS antennas make it local.
40-m is good day and night. During day, base to mobile range is 500 miles.
Evening skip is cross-country to across the world.
Several other HF bands exist and are used to experiment.

20-m is long range day and evening. It is the best DX-band.
A simple horizontal dipole should work up to 5,000 miles. See adjacent simple figure.
It is the preferred distance band for mobile, marine, RV, and base.
Voice is USB (upper sideband).

All antennas will have a return path.
See antenna articles for how to protect from lightning and mitigate noise.
Grounding dipole at connector increases gain by 0.4 dB and lowers take-off angle 2 degrees.
Grounding lowers impedance over 2Ω and lowers SWR to 1.7.

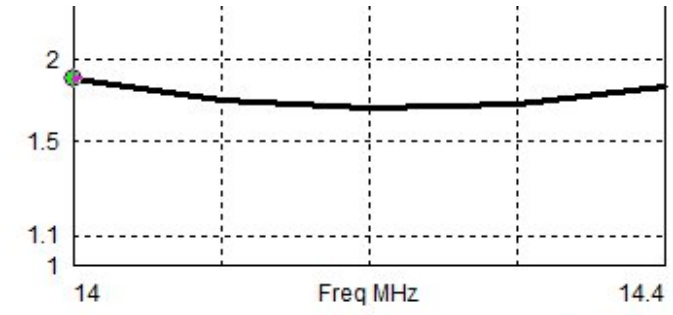
Raising the end of the radiator, while leaving return horizontal, improves performance.
Raising 8 feet causes impedance drop to 78, lowering SWR to 1.6.
Gain raises to 6.4 dBi and takeoff angle lowers to 48.

What is not to like? It is a very good distance antenna with less local contacts.

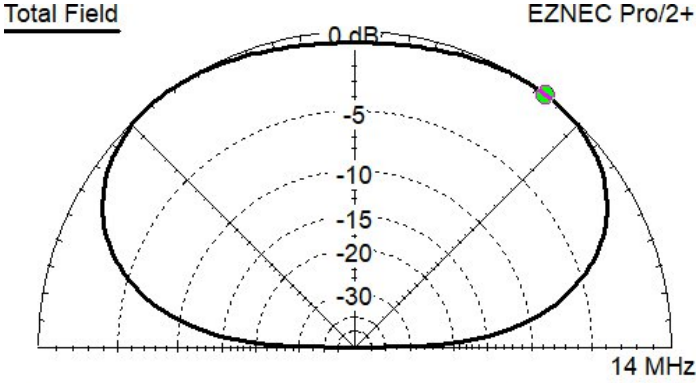
Eznec model. Antenna length ≈ λ/4. Return ≈ λ/4. Configuration horizontal. Source is 0% on wire 2.
Gain = 6.07 dBi, with angle of 54 degrees, which gives long range.
Impedance is 88-Ω on the capacitive side, making SWR about 1.9, which your transmitter will handle.

WIRE S											
No.	End1				End 2				Dia	Segs	Use
	X (ft)	Y (ft)	Z (ft)	Conn	X (ft)	Y (ft)	Z(ft)	Conn	(in)		
1	0	0	20	W3E1	0	16.7	20	W2E1	#12	199	return
2	0	16.7	20	W1E2	0	33.2	20		#12	199	radiate
3	0	0	14	W1E1	0	5	14		#12	17	ground

Experiment to find lower take-off angle.
Life is good. Enjoy!



Freq	14 MHz	Source #	1
SWR	**1.86**	Z0	50 ohms
Z	83.79 at -18.77 deg.		
	= 79.34 - j 26.96 ohms		
Refl Coeff	0.3016 at -30.81 deg.		
	= 0.259 - j 0.1545		
Ret Loss	10.4 dB		



Elevation Plot		Cursor Elev	53.0 deg.
Azimuth Angle	0.0 deg.	Gain	6.5 dBi
Outer Ring	6.5 dBi		0.0 dBmax
Slice Max Gain	6.5 dBi @ Elev Angle = 53.0 deg.		
Beamwidth	134.4 deg.; -3dB @ 22.8, 157.2 deg.		
Sidelobe Gain	6.5 dBi @ Elev Angle = 127.0 deg.		
Front/Sidelobe	0.0 dB		