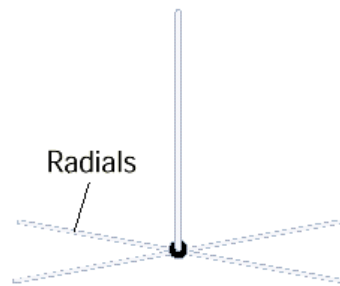
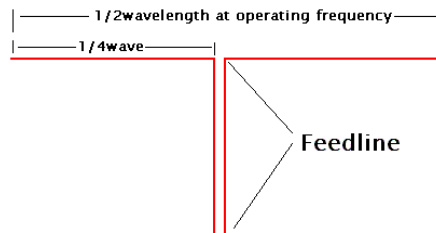


# Antennas on a Suburban Lot

Raj Dewan, N2RD

## Antennas for HF



**Horizontal Antennas**  
Ideally 1/2 wavelength room  
At least 1 wavelength up

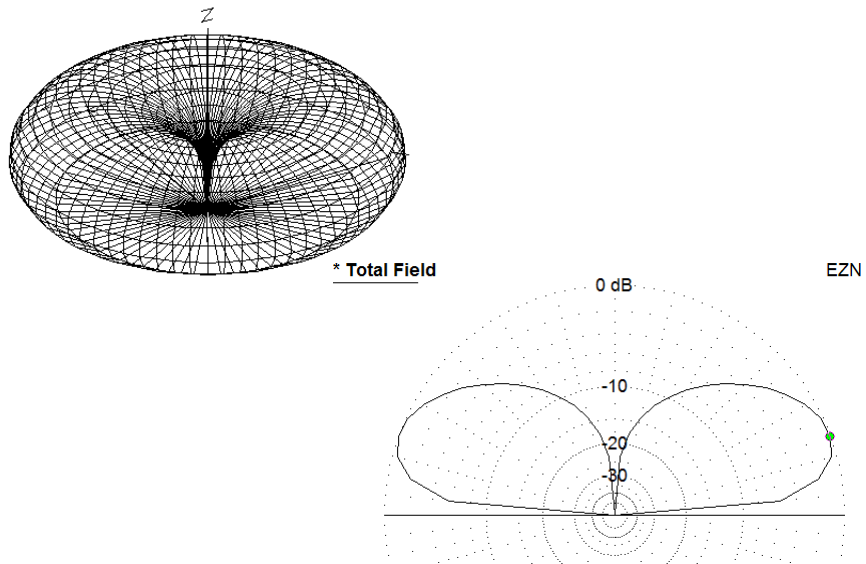
**Vertical Antennas**  
Ideally 1/4 wavelength tall  
With 4 elevated 1/4 wave radials  
Or many buried radials

Wavelength: 3.5Mhz 280', 14 Mhz 70', 28 MHz 35'

## Verticals are Easiest

- Require less room
- Better for DX as they have lower angles of radiation
- Omni-directional
- Lots of commercial choices
  - from mobile whips to multiband verticals

## Radiation Pattern of Verticals

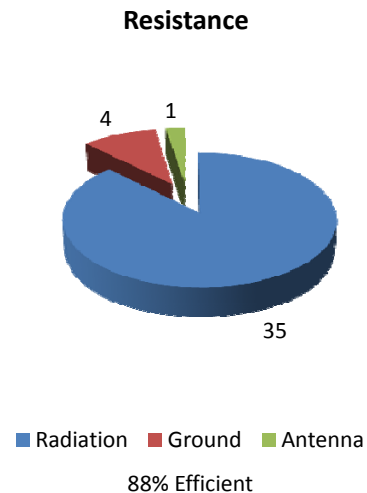


## Full Size Verticals

- Classic design
  - ¼ wave tall, 120 ¼ wave radials buried
- Needs lots of room
- A 80m vertical would require
  - lots of land: 140' square, 0.45 of an acre
  - lots of aluminum: 70' tall
  - commercially built verticals can be expensive
  - typical measured impedance is 39 ohms (including ground and conductor losses)

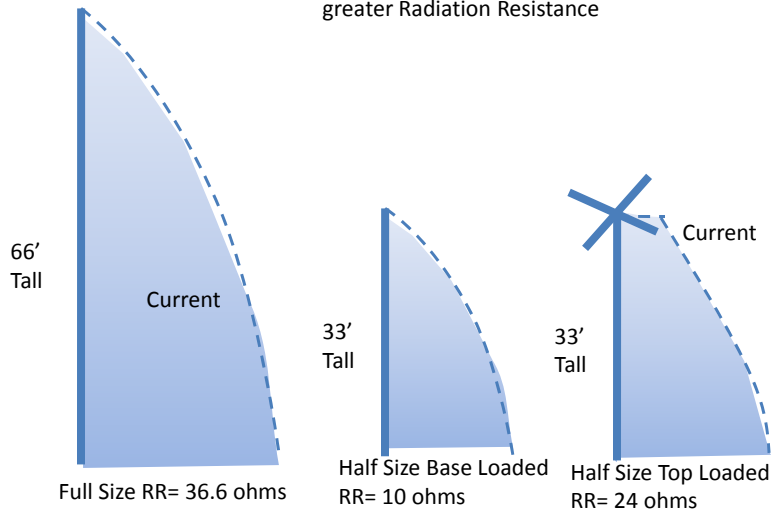
## Antenna Efficiency

- The radio energy put into an antenna
  - is radiated into space
  - heats the immediate surroundings (earth)
  - heats the antenna itself (especially traps and coils)
- For a given voltage (current) the power is proportional to the resistance

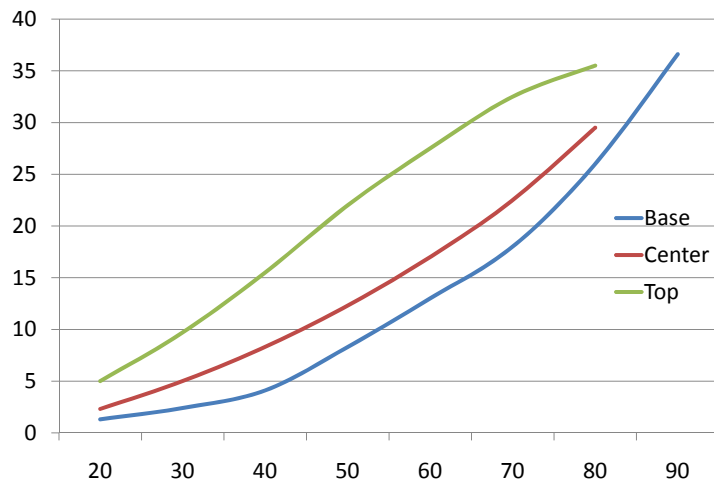


## Antenna Current and Radiation Resistance

Greater area provides greater Radiation Resistance



## Radiation Resistance



## Ground Resistance

Radial	Loss R (ohms)
120 Radials 66' Long Buried	5
4 Radials 66' Long Elevated 10'	8
120 Radials 33' Long Buried	12
16 Radials 33' Long Buried	15
8 Radials 33' or Longer Buried	20
4 Radials 33' or Longer Buried	27
Mounted on Pickup with Air Coil	37
Mounted on a Pickup with Hustler Coil	47

## Hygain AV-18 HT HyTower



Hygain AV-18 HyTower 53' Tall  
The thickness makes effective height 66'

Cost \$950 (HyTower only)

RR = 36.6 ohms LR = 8 ohms

Efficiency =  $RR / (RR + LR) = 82\%$

Four Elevated Radials (one shown) 10' up 66' Long

## DX Engineering Thunderbolt



DX Engineering Thunderbolt 43' Tall

Cost \$450 (Vertical only)  
 \$170 Radial Plate and radials  
 \$50 Balun

RR = 11 ohms LR = 15 ohms  
 Efficiency =  $RR / (RR + LR) = 42\%$

Add Top Hat for \$200  
 RR = 24 ohms LR = 15 ohms  
 Efficiency = 62%

16 Radials 33' Long Tuned at Base (or even worse, in the shack)

## Butternut HF-2V

Butternut HF-2V 80m/40m Vertical  
 32' Tall

Cost \$320 (Vertical only)

Center Loaded  
 16 Radials 33' Long Buried  
 RR = 8.5 ohms LR = 15 ohms  
 Efficiency =  $RR / (RR + LR) = 36\%$

4 Elevated Radials  
 RR = 8.5 ohms, LR = 8 ohms  
 Efficiency = 52%  
 (Same as 66' tall vert with 4 buried verticals)



## Cushcraft MA8040V



Cushcraft MA8040V  
23' Vertical for 80 and 40m

Cost \$320

16 Radials 33' Long Buried  
RR = 8 ohms LR = 15 ohms  
Efficiency =  $RR / (RR + LR) = 35\%$

4 Elevated Radials  
RR = 8 ohms, LR = 8 ohms  
Efficiency = 50%  
(Same as 66' tall vert  
with 4 buried verticals)

## Force12 Sigma 80

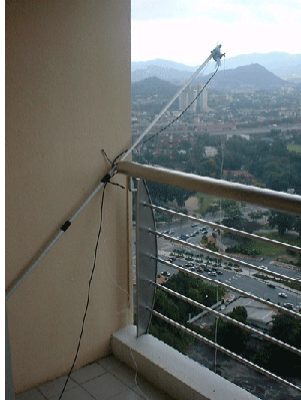


Force12 Sigma 80  
36' Tall Vertical Dipole with linear and  
base loading

Cost \$779

No radials needed  
(1260 ohms impedance at coil, Q of 60)  
RR = 16 ohms LR = 21 ohms  
Efficiency =  $RR / (RR + LR) = 43\%$   
1/2 S-Unit Down  
(In between HF-2V with 4 elev radials  
and HF-2V with 16 33' buried radials)

## 9M2/G4ZFE Condo Antenna



Inverted Wire Vertical  
 66' Long Wire hung from balcony  
 Radials spread along the floor

Base and Center Loaded  
 Pickup mount  
 RR = 26 ohms LR = 27 ohms  
 Efficiency =  $RR / (RR + LR) = 49\%$   
 1/2 S-Unit Down

## Texas Bugcatcher on Big Truck



Texas BugCatcher  
 32' Tall

Cost	\$129	Coil
	\$44	Mast
	\$33	Top Hat
	\$13	Whip
Total	\$219 (Excluding mount & coil)	

Base and Top Loaded  
 Pickup mount  
 RR = 2 ohms LR = 37 ohms  
 Efficiency =  $RR / (RR + LR) = 5\%$   
 2 S-Units Down





## Hustler on Auto

Hustler Big Coil  
32' Tall

Cost	\$58	Coil
	\$37	Mast
	\$23	Whip
Total	\$118 (Excluding mount & coil)	

Base and Center Loaded  
Pickup mount  
RR = 0.3 ohms LR = 47 ohms  
Efficiency =  $RR / (RR + LR) = 0.6\%$   
4 S-Units Down

## MFJ - 1622



MFJ Apartment Antenna  
Base-Loaded with stinger  
Single radial

Cost	\$99	Coil
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RR = 0.17 ohms LR = 47 ohms  
Efficiency =  $RR / (RR + LR) = 0.3\%$   
4.5 S-Units Down