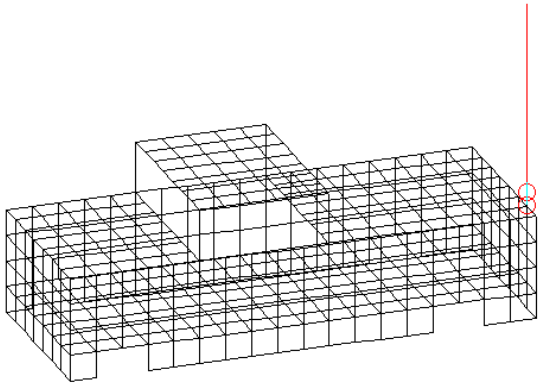


MOBILE AMATEUR OPERATIONS

Lewis Thompson

W5IFQ

5 OCT 2021

Outline

- Purpose
- Mobile Antennas
  - HF Vertical (frequency agile)
  - NVIS
  - VHF/UHF antennas - introduction
- Rig Mounting
- Wiring
- Noise reduction
- Examples:
  - Basic screwdriver theory and tuning techniques
  - High Performance screwdriver system
  - High Performance auto-tuned system

Purpose of HF Mobile Unit

- Emergency Communications
  - State-wide voice
  - State-wide tactical digital (text and P2P with attachments)
  - State and national digital (Winlink e-mail gateway access)
  - Automatic position reporting via HF Pactor
    - All SCS modems have a GPS (NMEA serial) input
    - All SCS modems have a special command POSition that can be used to send the following message:

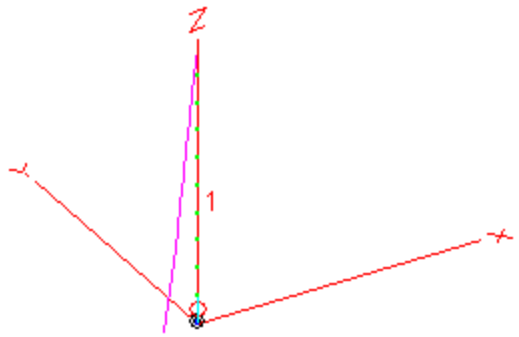
```
GPS POSITION REPORT
-------------------

Latitude:   50° 05.430' North
Longitude: 008° 45.980' East

Velocity:  0.0 Knots
Course:    360°

Recorded at: 13/12/00  19:25:48 UTC/GMT
```

- General ham operations both national and international

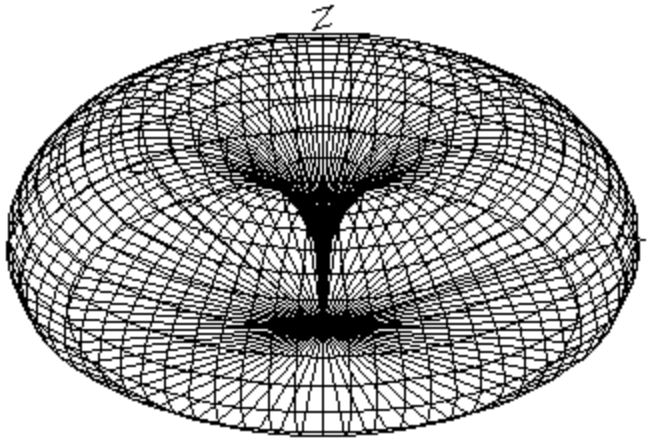
MOBILE INFO WEBSITE

VEHICLE WHIP ANTENNA - IDEAL

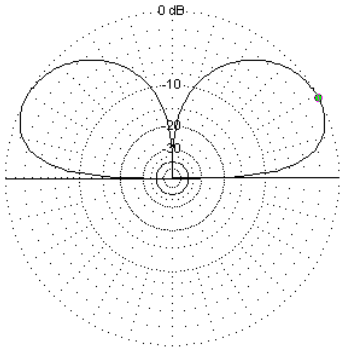
EZNEC



Height = 1.8 m (6 ft.)



7 MHz

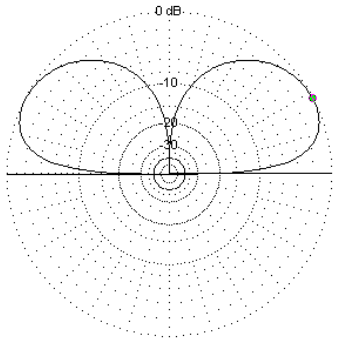


EZNEC

7 MHz

Elevation Plot		Cursor Elev	29.0 deg.
Azimuth Angle	0.0 deg.	Gain	0.29 dBi
Outer Ring	0.29dBi		0.0 dBmax
Slice Max Gain	0.29 dBi @ Elev Angle = 29.0 deg.		
Beamwidth	47.6 deg.; -3dB @ 9.8, 57.4 deg.		
Sidelobe Gain	0.29 dBi @ Elev Angle = 151.0 deg.		
Front/Sidelobe	0.0 dB		

3.8 MHz



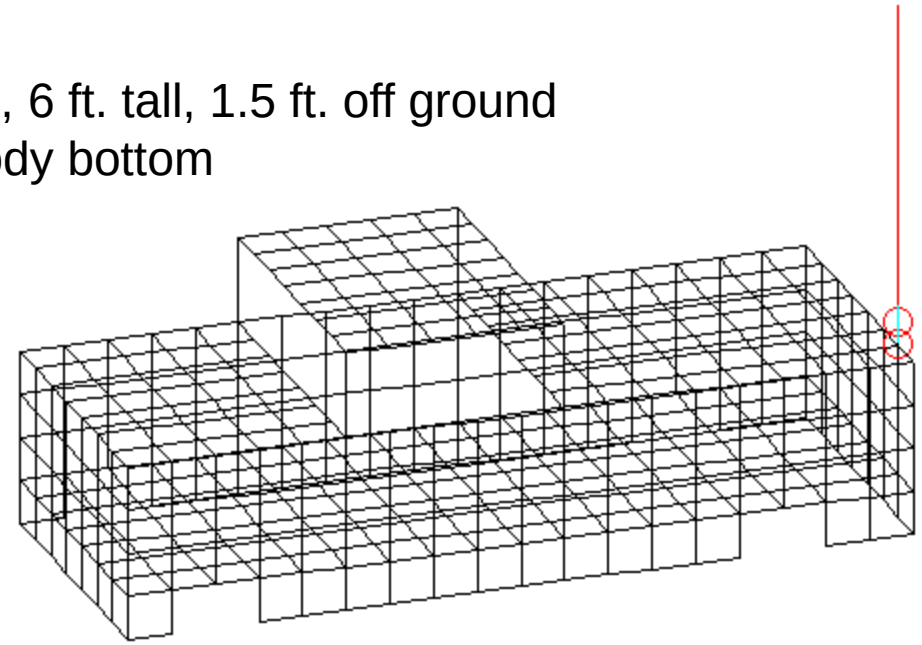
EZNEC

3.8 MHz

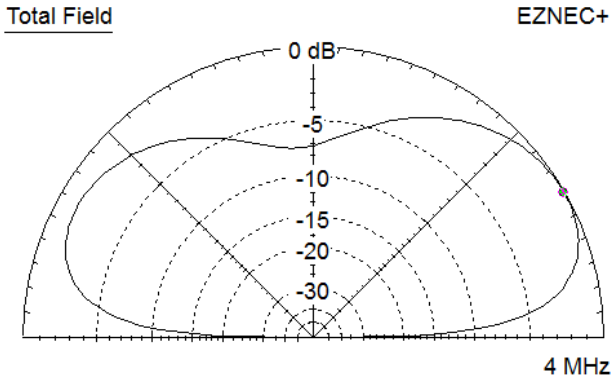
Elevation Plot		Cursor Elev	28.0 deg.
Azimuth Angle	0.0 deg.	Gain	0.92 dBi
Outer Ring	0.92dBi		0.0 dBmax
Slice Max Gain	0.92 dBi @ Elev Angle = 28.0 deg.		
Beamwidth	47.7 deg.; -3dB @ 8.9, 56.6 deg.		
Sidelobe Gain	0.92 dBi @ Elev Angle = 152.0 deg.		
Front/Sidelobe	0.0 dB		

HF WHIP 1 Setup

Truck (F250) – 18 ft. long, 7 ft. wide, 6 ft. tall, 1.5 ft. off ground
Note: bottom plane is 1 ft. above body bottom
Whip – 8 ft.
Angle – 90 deg.
All segments are 1 ft.
Antenna has 9 segments
Segments - #12 AWG Cu



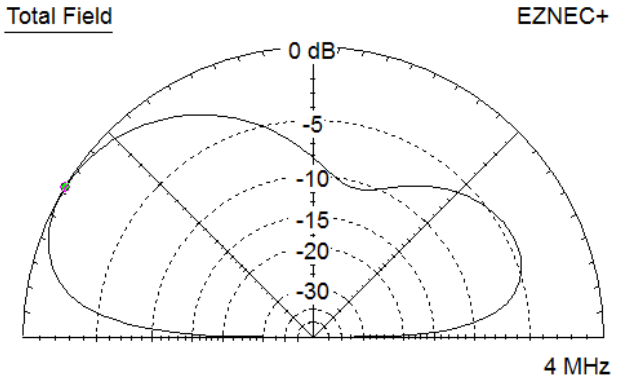
Azimuth & Elevation – 4 MHz



Elevation Plot
Azimuth Angle 90.0 deg.
Outer Ring -5.63 dBi

Cursor Elev 30.0 deg.
Gain -5.63 dBi
0.0 dBmax

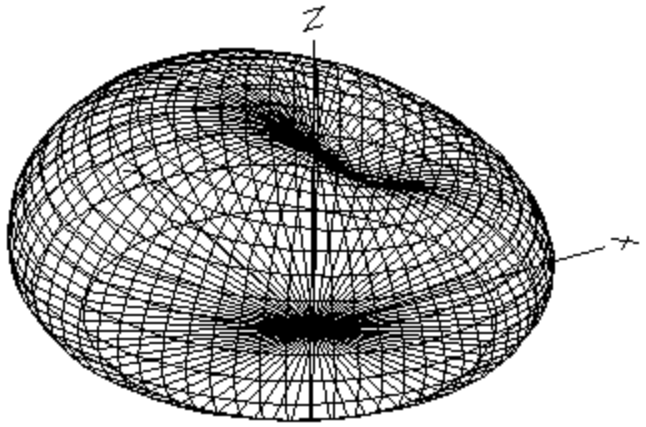
Slice Max Gain -5.63 dBi @ Elev Angle = 30.0 deg.
Beamwidth 54.8 deg.; -3dB @ 9.4, 64.2 deg.
Sidelobe Gain -6.87 dBi @ Elev Angle = 151.0 deg.
Front/Sidelobe 1.24 dB



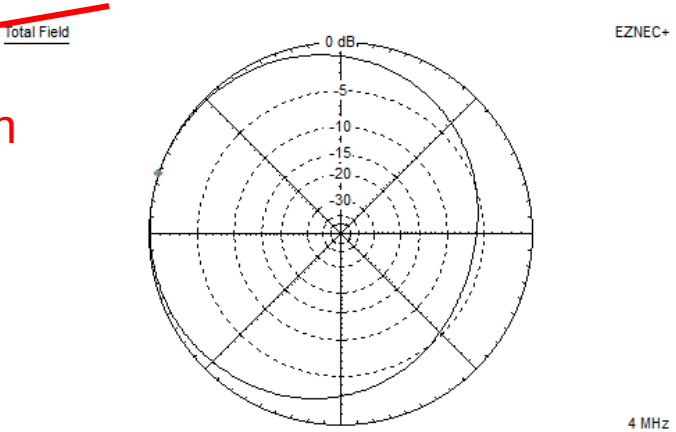
Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring -4.53 dBi

Cursor Elev 149.0 deg.
Gain -4.53 dBi
0.0 dBmax

Slice Max Gain -4.53 dBi @ Elev Angle = 149.0 deg.
Beamwidth 56.2 deg.; -3dB @ 114.4, 170.6 deg.
Sidelobe Gain -8.96 dBi @ Elev Angle = 26.0 deg.
Front/Sidelobe 4.43 dB



Truck Direction

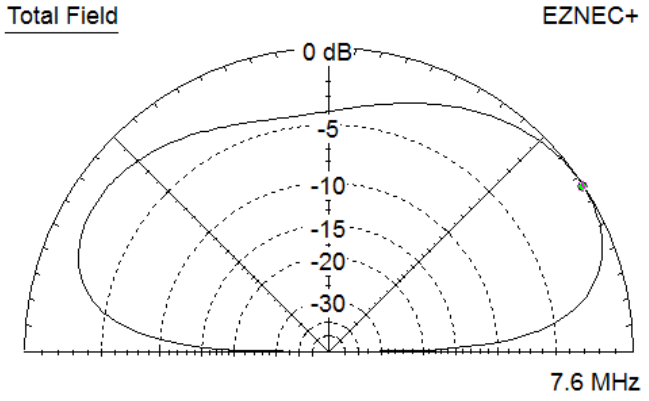


Azimuth Plot
Elevation Angle 50.0 deg.
Outer Ring -5.47 dBi

Cursor Az 162.0 deg.
Gain -5.47 dBi
0.0 dBmax

Slice Max Gain -5.47 dBi @ Az Angle = 162.0 deg.
Front/Back 6.13 dB
Beamwidth 221.4 deg.; -3dB @ 53.0, 274.4 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB

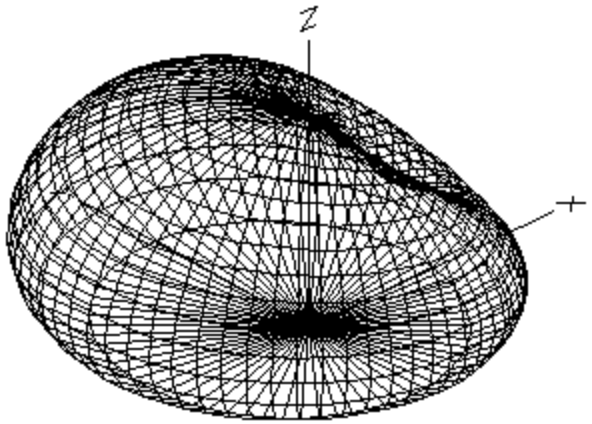
Azimuth & Elevation – 7.6 MHz

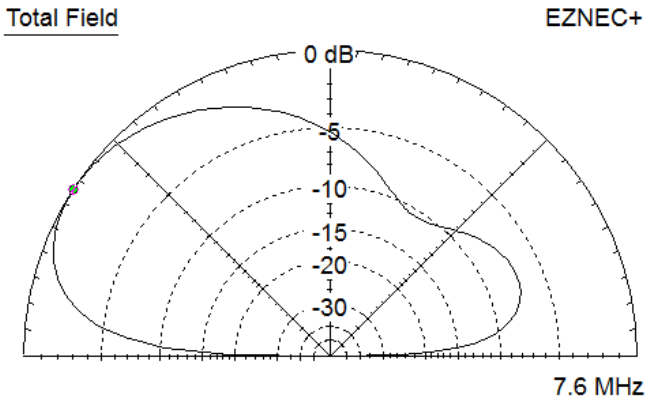


Elevation Plot
Azimuth Angle 90.0 deg.
Outer Ring -3.27 dBi

Cursor Elev 33.0 deg.
Gain -3.27 dBi
0.0 dBmax

Slice Max Gain -3.27 dBi @ Elev Angle = 33.0 deg.
Beamwidth 65.5 deg.; -3dB @ 10.8, 76.3 deg.
Sidelobe Gain -4.89 dBi @ Elev Angle = 148.0 deg.
Front/Sidelobe 1.62 dB



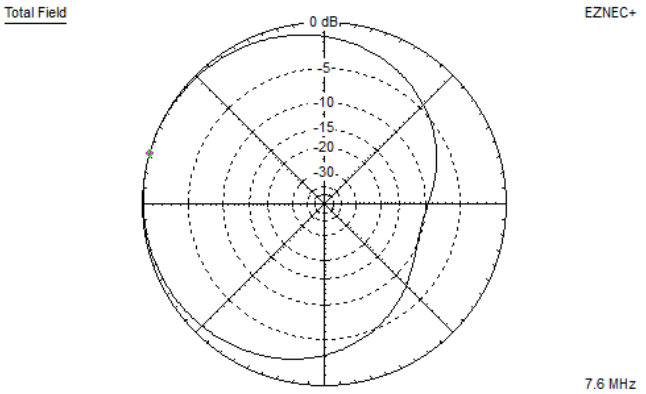


Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring -1.93 dBi

Cursor Elev 147.0 deg.
Gain -1.93 dBi
0.0 dBmax

Slice Max Gain -1.93 dBi @ Elev Angle = 147.0 deg.
Beamwidth 63.9 deg.; -3dB @ 105.6, 169.5 deg.
Sidelobe Gain -8.96 dBi @ Elev Angle = 24.0 deg.
Front/Sidelobe 7.03 dB

Truck Direction

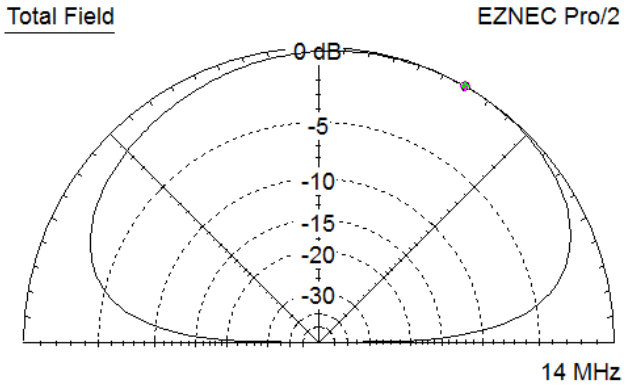


Azimuth Plot
Elevation Angle 50.0 deg.
Outer Ring -2.52 dBi

Cursor Az 164.0 deg.
Gain -2.52 dBi
0.0 dBmax

Slice Max Gain -2.52 dBi @ Az Angle = 164.0 deg.
Front/Back 10.32 dB
Beamwidth 206.8 deg.; -3dB @ 62.0, 268.8 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB

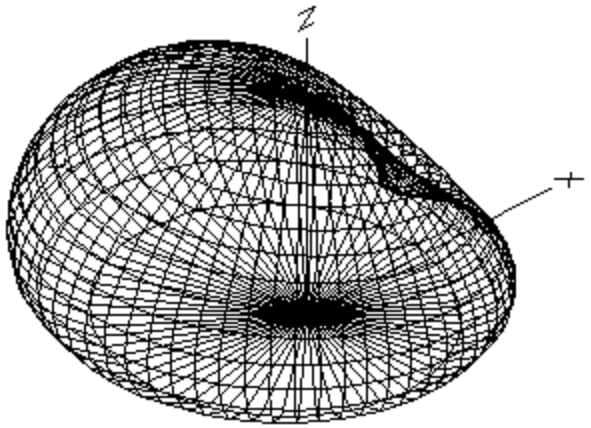
Azimuth & Elevation – 14 MHz



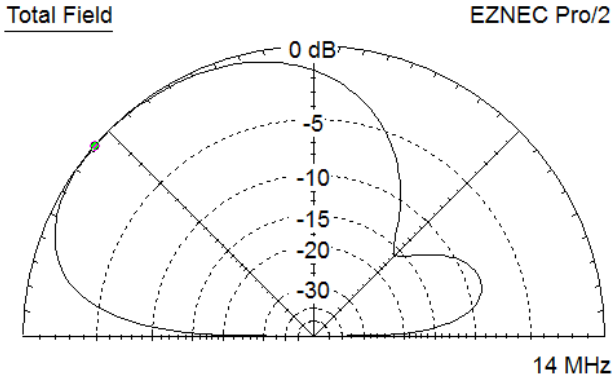
Elevation Plot
Azimuth Angle 90.0 deg.
Outer Ring -1.26 dBi

Cursor Elev 60.0 deg.
Gain -1.26 dBi
0.0 dBmax

Slice Max Gain -1.26 dBi @ Elev Angle = 60.0 deg.
Beamwidth 142.9 deg.; -3dB @ 14.3, 157.2 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB



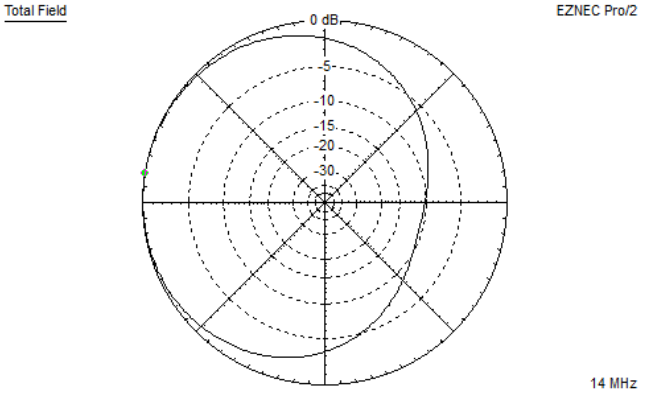
Truck Direction



Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring 0.04 dBi

Cursor Elev 139.0 deg.
Gain 0.04 dBi
0.0 dBmax

Slice Max Gain 0.04 dBi @ Elev Angle = 139.0 deg.
Beamwidth 89.1 deg.; -3dB @ 79.6, 168.7 deg.
Sidelobe Gain -8.58 dBi @ Elev Angle = 18.0 deg.
Front/Sidelobe 8.62 dB

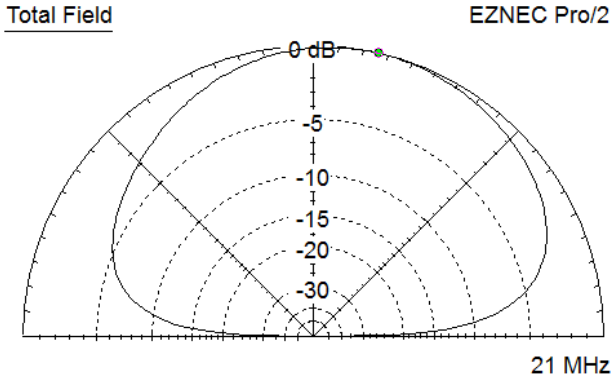


Azimuth Plot
Elevation Angle 30.0 deg.
Outer Ring -0.1 dBi

Cursor Az 171.0 deg.
Gain -0.1 dBi
0.0 dBmax

Slice Max Gain -0.1 dBi @ Az Angle = 171.0 deg.
Front/Back 10.56 dB
Beamwidth 192.4 deg.; -3dB @ 73.2, 265.6 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB

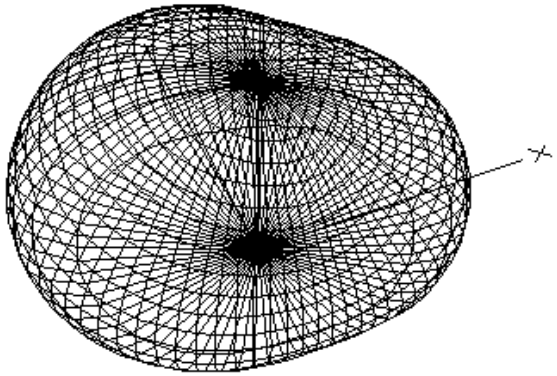
Azimuth & Elevation – 21 MHz

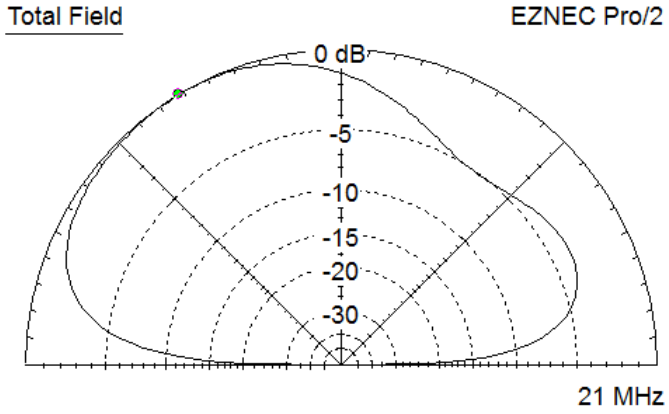


Elevation Plot
Azimuth Angle 90.0 deg.
Outer Ring -0.09 dBi

Cursor Elev 77.0 deg.
Gain -0.09 dBi
0.0 dBmax

Slice Max Gain -0.09 dBi @ Elev Angle = 77.0 deg.
Beamwidth 118.4 deg.; -3dB @ 18.7, 137.1 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB



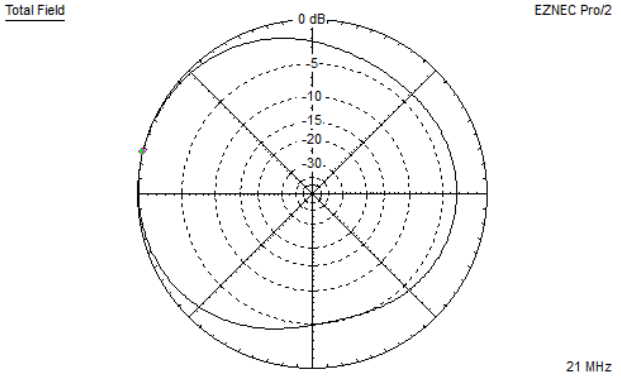


Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring 1.1 dBi

Cursor Elev 121.0 deg.
Gain 1.1 dBi
0.0 dBmax

Slice Max Gain 1.1 dBi @ Elev Angle = 121.0 deg.
Beamwidth 91.3 deg.; -3dB @ 76.3, 167.6 deg.
Sidelobe Gain -2.51 dBi @ Elev Angle = 27.0 deg.
Front/Sidelobe 3.61 dB

Truck Direction

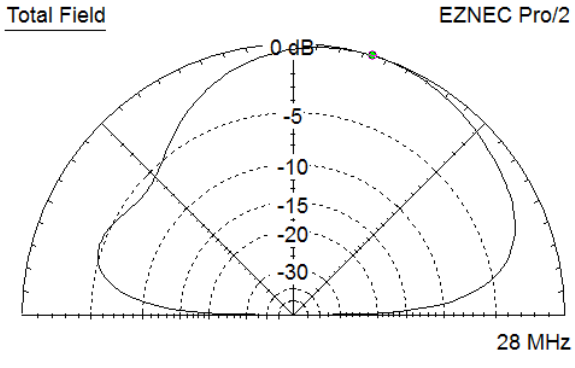


Azimuth Plot
Elevation Angle 30.0 deg.
Outer Ring 0.66 dBi

Cursor Az 166.0 deg.
Gain 0.66 dBi
0.0 dBmax

Slice Max Gain 0.66 dBi @ Az Angle = 166.0 deg.
Front/Back 3.34 dB
Beamwidth 168.4 deg.; -3dB @ 77.5, 245.9 deg.
Sidelobe Gain -2.57 dBi @ Az Angle = 3.0 deg.
Front/Sidelobe 3.23 dB

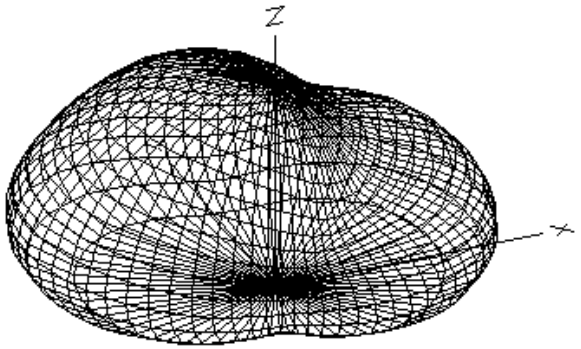
Azimuth & Elevation – 28 MHz

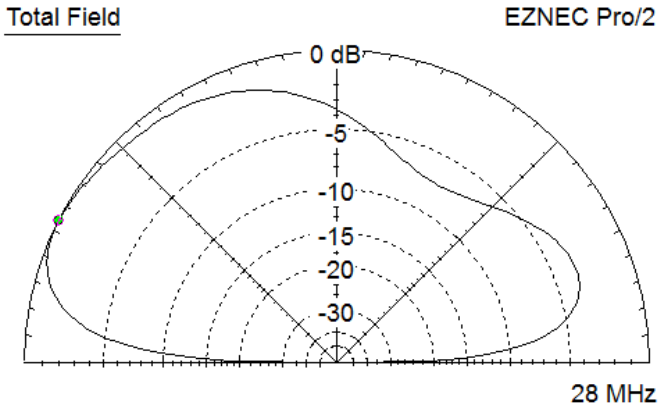


Elevation Plot
Azimuth Angle 90.0 deg.
Outer Ring -0.95 dBi

Cursor Elev 73.0 deg.
Gain -0.95 dBi
0.0 dBmax

Slice Max Gain -0.95 dBi @ Elev Angle = 73.0 deg.
Beamwidth 101.7 deg.; -3dB @ 16.5, 118.2 deg.
Sidelobe Gain -5.64 dBi @ Elev Angle = 160.0 deg.
Front/Sidelobe 4.69 dB



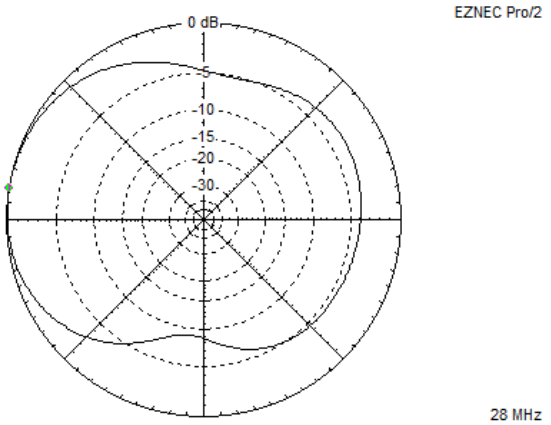


Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring 2.32 dBi

Cursor Elev 153.0 deg.
Gain 2.32 dBi
0.0 dBmax

Slice Max Gain 2.32 dBi @ Elev Angle = 153.0 deg.
Beamwidth 76.8 deg.; -3dB @ 94.3, 171.1 deg.
Sidelobe Gain -1.01 dBi @ Elev Angle = 21.0 deg.
Front/Sidelobe 3.33 dB

Truck Direction



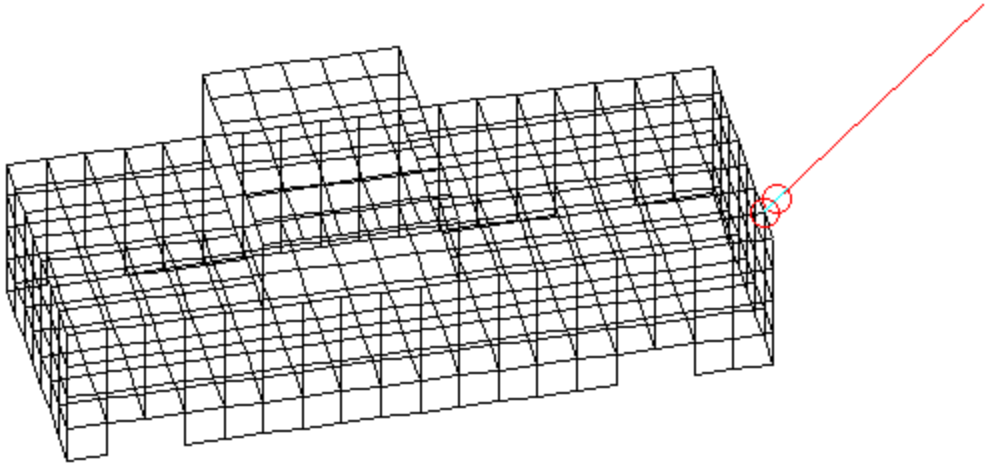
Azimuth Plot
Elevation Angle 30.0 deg.
Outer Ring 2.33 dBi

Cursor Az 171.0 deg.
Gain 2.33 dBi
0.0 dBmax

Slice Max Gain 2.33 dBi @ Az Angle = 171.0 deg.
Front/Back 4.1 dB
Beamwidth 118.3 deg.; -3dB @ 107.5, 225.8 deg.
Sidelobe Gain -1.08 dBi @ Az Angle = 27.0 deg.
Front/Sidelobe 3.41 dB

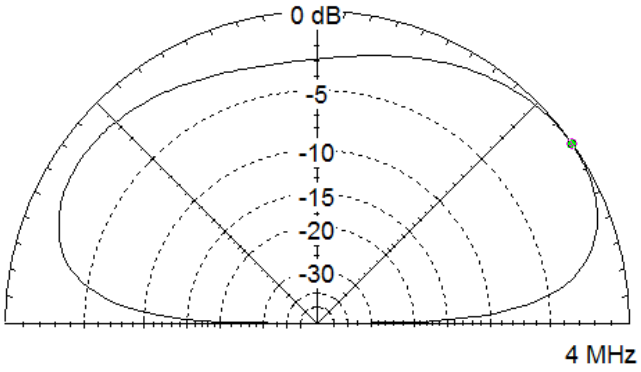
HF WHIP 2 Setup

Truck (F250) – 18 ft. long, 7 ft. wide, 6 ft. tall, 1.5 ft. off ground
Note: bottom plane is 1 ft. above body bottom
Whip – 8 ft.
Angle – 45 deg.
All segments are 1 ft.
Antenna has 9 segments
Segments - #12 AWG Cu



Azimuth & Elevation – 4 MHz

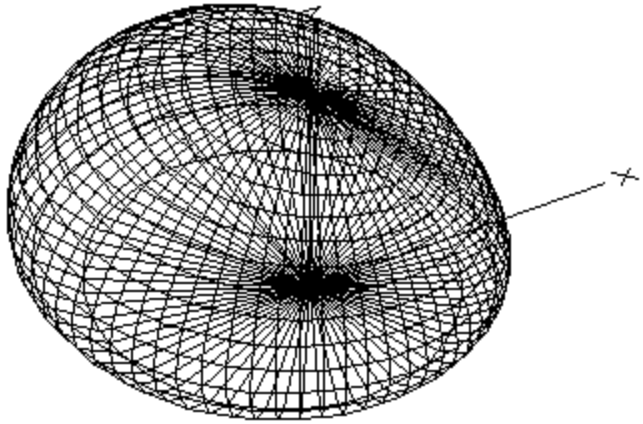
Total Field EZNEC+



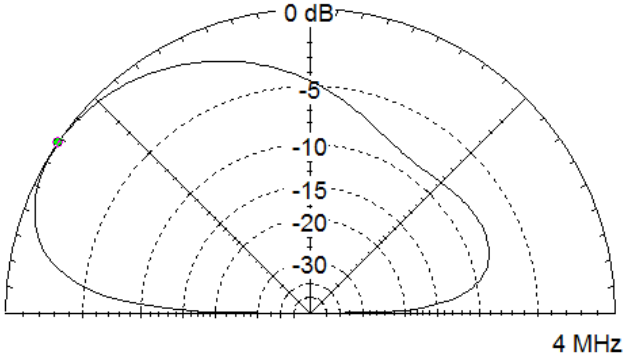
Elevation Plot
Azimuth Angle 90.0 deg.
Outer Ring -7.78 dBi

Cursor Elev 35.0 deg.
Gain -7.78 dBi
0.0 dBmax

Slice Max Gain -7.78 dBi @ Elev Angle = 35.0 deg.
Beamwidth 154.8 deg.; -3dB @ 10.4, 165.2 deg.
Sidelobe Gain -9.15 dBi @ Elev Angle = 145.0 deg.
Front/Sidelobe 1.38 dB



Total Field EZNEC+



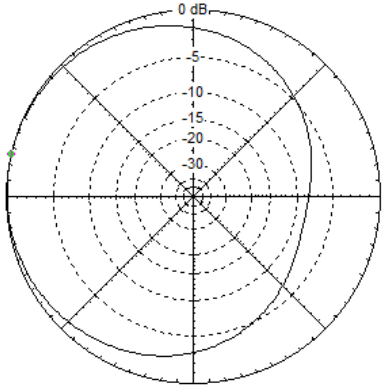
Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring -5.99 dBi

Cursor Elev 146.0 deg.
Gain -5.99 dBi
0.0 dBmax

Slice Max Gain -5.99 dBi @ Elev Angle = 146.0 deg.
Beamwidth 67.7 deg.; -3dB @ 102.4, 170.1 deg.
Sidelobe Gain -13.83 dBi @ Elev Angle = 27.0 deg.
Front/Sidelobe 7.84 dB

Truck Direction

Total Field EZNEC+

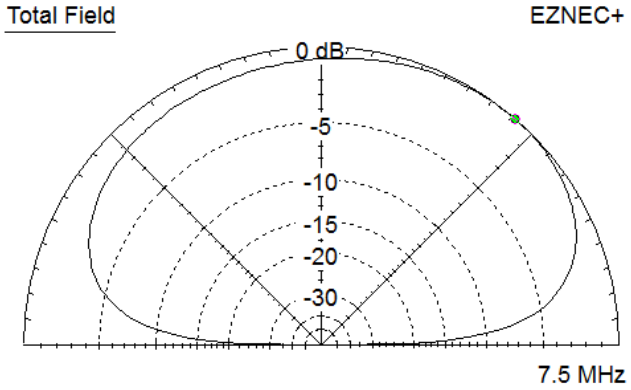


Azimuth Plot
Elevation Angle 50.0 deg.
Outer Ring -6.47 dBi

Cursor Az 167.0 deg.
Gain -6.47 dBi
0.0 dBmax

Slice Max Gain -6.47 dBi @ Az Angle = 167.0 deg.
Front/Back 8.51 dB
Beamwidth 202.1 deg.; -3dB @ 67.1, 269.2 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB

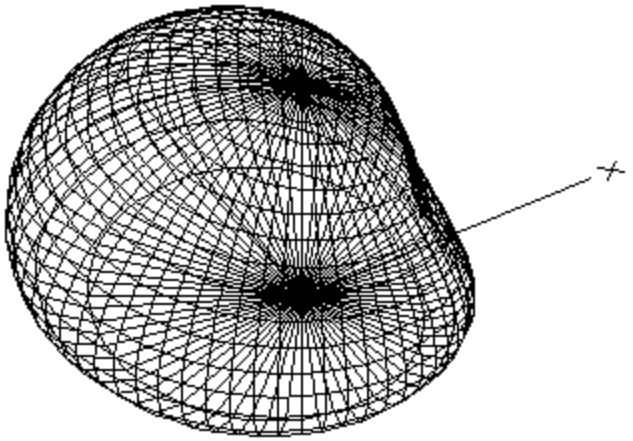
Azimuth & Elevation – 7.5 MHz

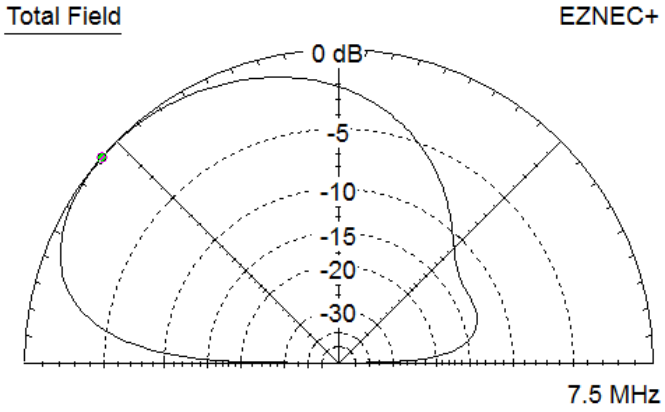


Elevation Plot
Azimuth Angle 90.0 deg.
Outer Ring -4.31 dBi

Cursor Elev 49.0 deg.
Gain -4.31 dBi
0.0 dBmax

Slice Max Gain -4.31 dBi @ Elev Angle = 49.0 deg.
Beamwidth 144.3 deg.; -3dB @ 14.0, 158.3 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB



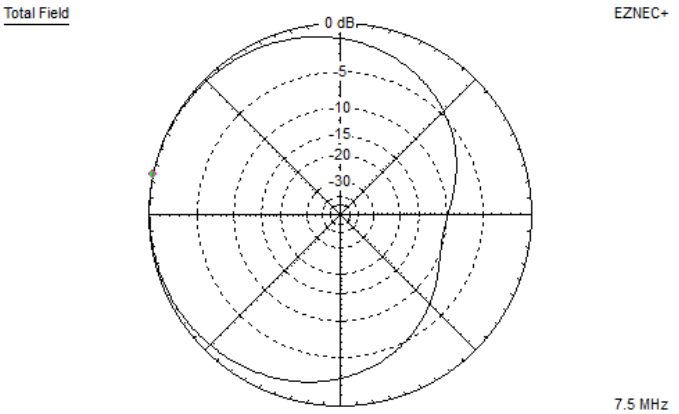


Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring -2.84 dBi

Cursor Elev 139.0 deg.
Gain -2.84 dBi
0.0 dBmax

Slice Max Gain -2.84 dBi @ Elev Angle = 139.0 deg.
Beamwidth 85.6 deg.; -3dB @ 82.8, 168.4 deg.
Sidelobe Gain -15.83 dBi @ Elev Angle = 24.0 deg.
Front/Sidelobe 13.0 dB

Truck Direction



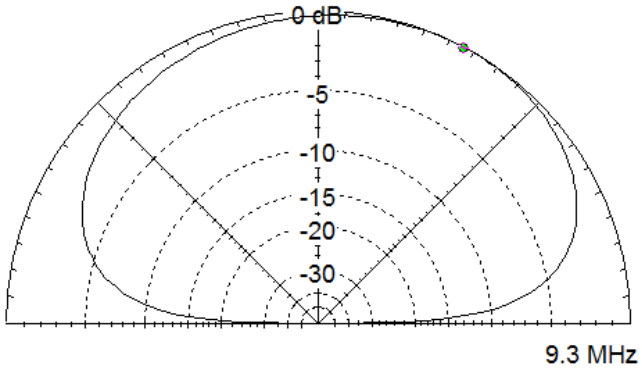
Azimuth Plot
Elevation Angle 50.0 deg.
Outer Ring -2.91 dBi

Cursor Az 168.0 deg.
Gain -2.91 dBi
0.0 dBmax

Slice Max Gain -2.91 dBi @ Az Angle = 168.0 deg.
Front/Back 10.3 dB
Beamwidth 212.2 deg.; -3dB @ 63.0, 275.2 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB

Azimuth & Elevation – 9.3 MHz

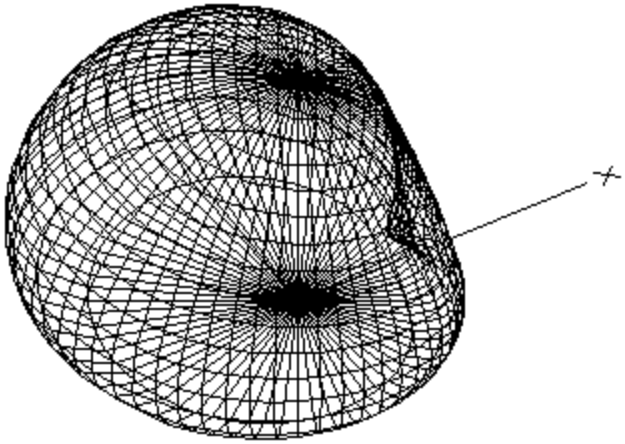
Total Field EZNEC+



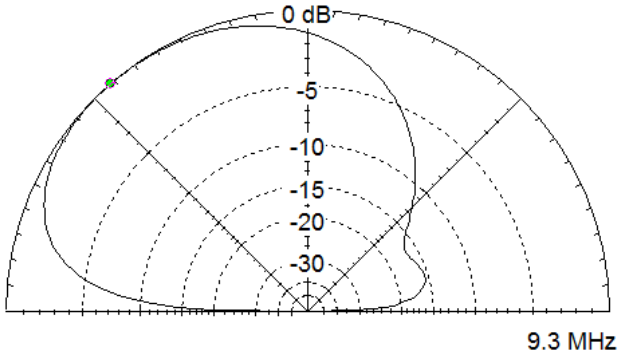
Elevation Plot
Azimuth Angle 90.0 deg.
Outer Ring -3.04 dBi

Cursor Elev 62.0 deg.
Gain -3.04 dBi
0.0 dBmax

Slice Max Gain -3.04 dBi @ Elev Angle = 62.0 deg.
Beamwidth 137.8 deg.; -3dB @ 16.6, 154.4 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB



Total Field EZNEC+



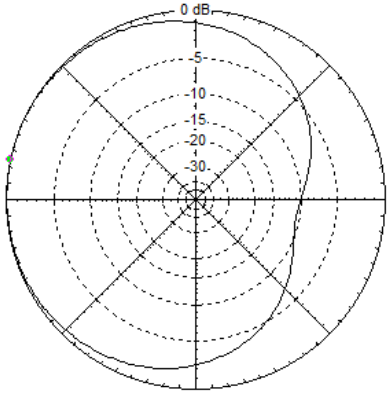
Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring -1.96 dBi

Cursor Elev 131.0 deg.
Gain -1.96 dBi
0.0 dBmax

Slice Max Gain -1.96 dBi @ Elev Angle = 131.0 deg.
Beamwidth 91.3 deg.; -3dB @ 76.3, 167.6 deg.
Sidelobe Gain -17.41 dBi @ Elev Angle = 17.0 deg.
Front/Sidelobe 15.44 dB

Truck Direction

Total Field EZNEC+



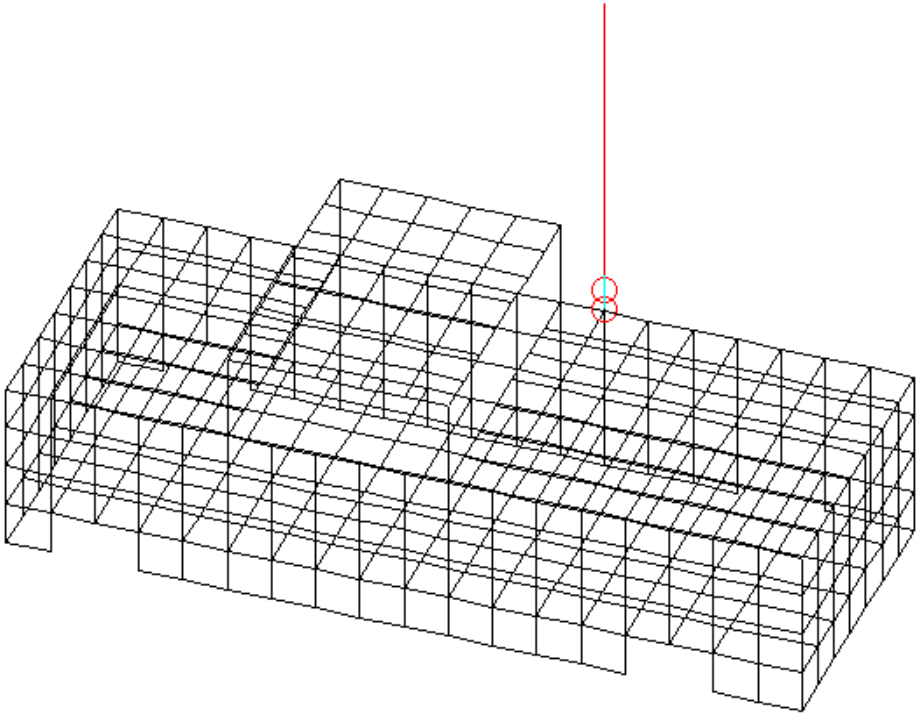
Azimuth Plot
Elevation Angle 50.0 deg.
Outer Ring -1.95 dBi

Cursor Az 168.0 deg.
Gain -1.95 dBi
0.0 dBmax

Slice Max Gain -1.95 dBi @ Az Angle = 168.0 deg.
Front/Back 10.6 dB
Beamwidth 219.5 deg.; -3dB @ 60.0, 279.5 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB

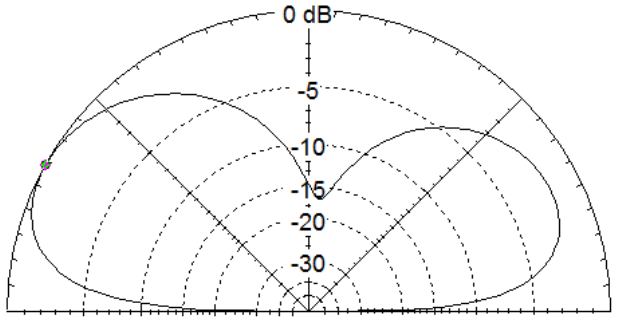
HF WHIP 3 Setup

Truck (F250) – 18 ft. long, 7 ft. wide, 6 ft. tall, 1.5 ft. off ground
Note: bottom plane is 1 ft. above body bottom
Whip – 8 ft.
Angle – 0 deg.
All segments are 1 ft.
Antenna has 9 segments
Segments - #12 AWG Cu



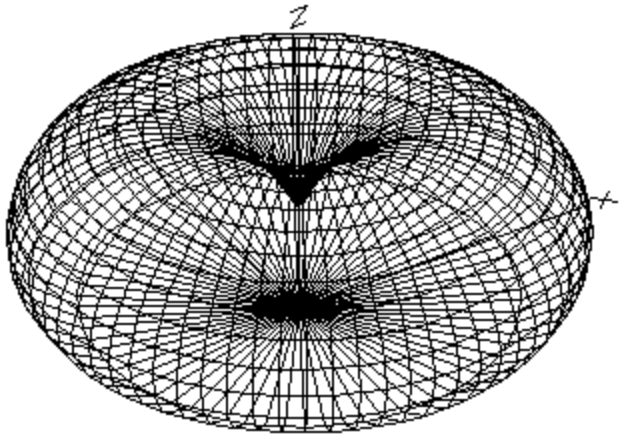
Azimuth & Elevation – 4 MHz

Total Field EZNEC+

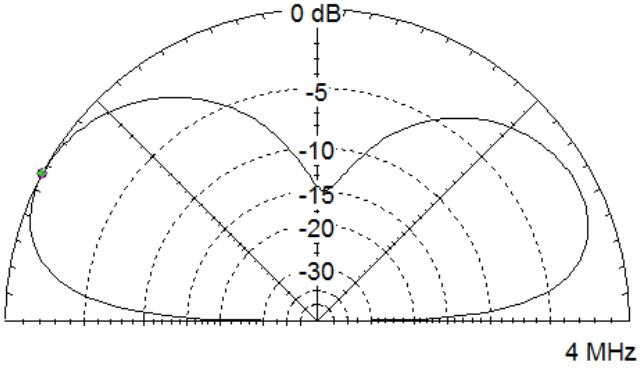


Elevation Plot		Cursor Elev	151.0 deg.
Azimuth Angle	90.0 deg.	Gain	-3.95 dBi
Outer Ring	-3.95 dBi		0.0 dBmax

Slice Max Gain	-3.95 dBi @ Elev Angle = 151.0 deg.
Beamwidth	50.3 deg.; -3dB @ 120.6, 170.9 deg.
Sidelobe Gain	-5.77 dBi @ Elev Angle = 27.0 deg.
Front/Sidelobe	1.82 dB



Total Field EZNEC+

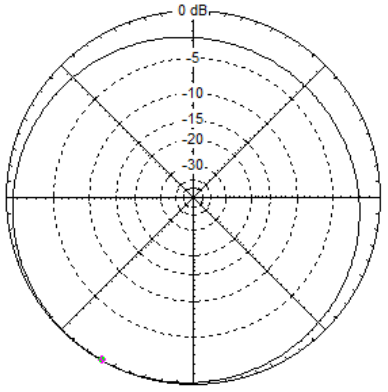


Elevation Plot		Cursor Elev	152.0 deg.
Azimuth Angle	0.0 deg.	Gain	-4.33 dBi
Outer Ring	-4.33 dBi		0.0 dBmax

Slice Max Gain	-4.33 dBi @ Elev Angle = 152.0 deg.
Beamwidth	49.6 deg.; -3dB @ 121.4, 171.0 deg.
Sidelobe Gain	-5.37 dBi @ Elev Angle = 27.0 deg.
Front/Sidelobe	1.04 dB

Truck Direction

Total Field EZNEC+

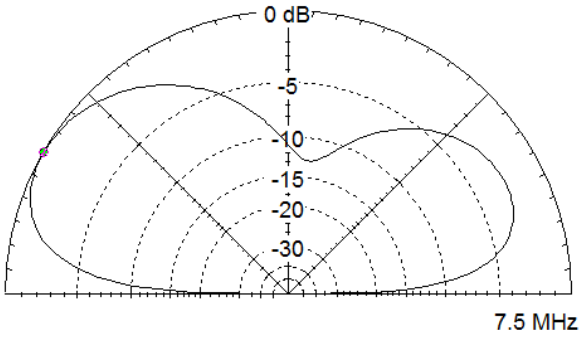


Azimuth Plot		Cursor Az	241.0 deg.
Elevation Angle	50.0 deg.	Gain	-5.29 dBi
Outer Ring	-5.29 dBi		0.0 dBmax

Slice Max Gain	-5.29 dBi @ Az Angle = 241.0 deg.
Front/Back	2.93 dB
Beamwidth	?
Sidelobe Gain	< -100 dBi
Front/Sidelobe	> 100 dB

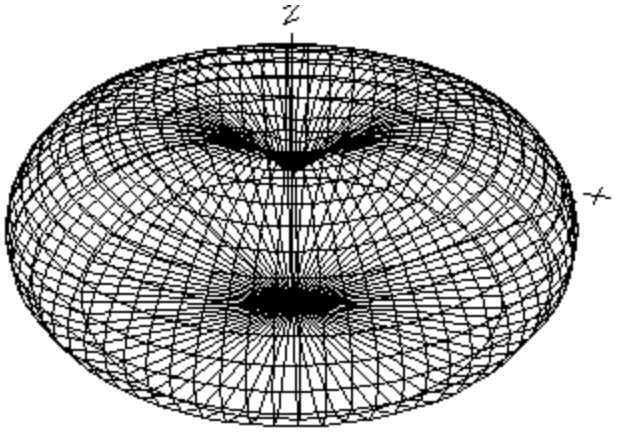
Azimuth & Elevation – 7.5 MHz

Total Field EZNEC+

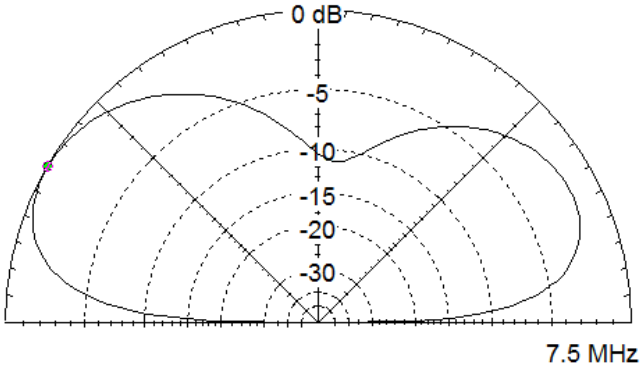


Elevation Plot		Cursor Elev	150.0 deg.
Azimuth Angle	90.0 deg.	Gain	-1.69 dBi
Outer Ring	-1.69 dBi		0.0 dBmax

Slice Max Gain	-1.69 dBi @ Elev Angle = 150.0 deg.
Beamwidth	51.4 deg.; -3dB @ 118.7, 170.1 deg.
Sidelobe Gain	-4.21 dBi @ Elev Angle = 27.0 deg.
Front/Sidelobe	2.52 dB



Total Field EZNEC+

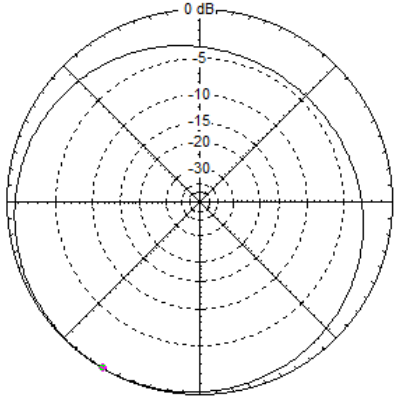


Elevation Plot		Cursor Elev	150.0 deg.
Azimuth Angle	0.0 deg.	Gain	-2.13 dBi
Outer Ring	-2.13 dBi		0.0 dBmax

Slice Max Gain	-2.13 dBi @ Elev Angle = 150.0 deg.
Beamwidth	50.7 deg.; -3dB @ 119.4, 170.1 deg.
Sidelobe Gain	-3.74 dBi @ Elev Angle = 28.0 deg.
Front/Sidelobe	1.62 dB

Truck Direction

Total Field EZNEC+

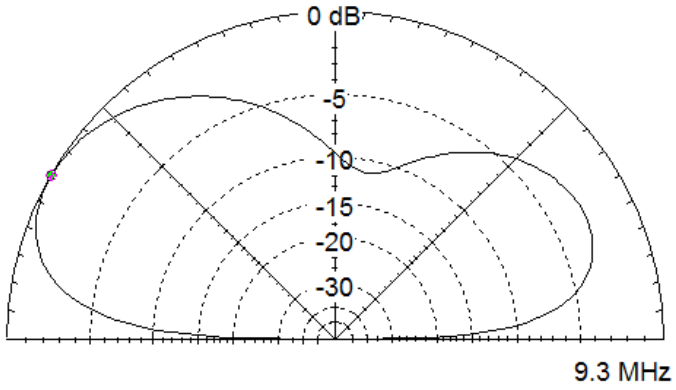


Azimuth Plot		Cursor Az	240.0 deg.
Elevation Angle	50.0 deg.	Gain	-2.8 dBi
Outer Ring	-2.8 dBi		0.0 dBmax

Slice Max Gain	-2.8 dBi @ Az Angle = 240.0 deg.
Front/Back	4.33 dB
Beamwidth	252.0 deg.; -3dB @ 109.0, 1.0 deg.
Sidelobe Gain	< -100 dBi
Front/Sidelobe	> 100 dB

Azimuth & Elevation – 9.3 MHz

Total Field EZNEC+

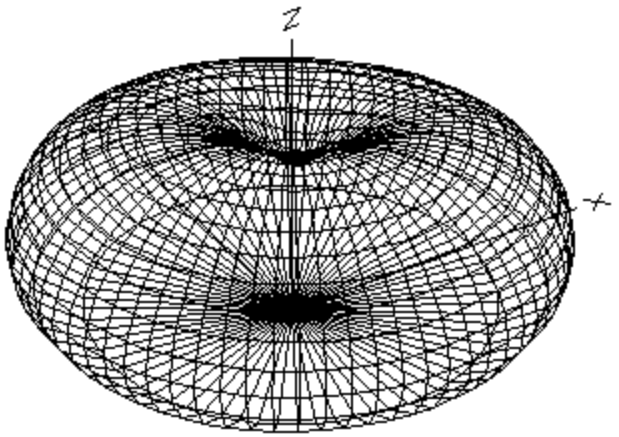


9.3 MHz

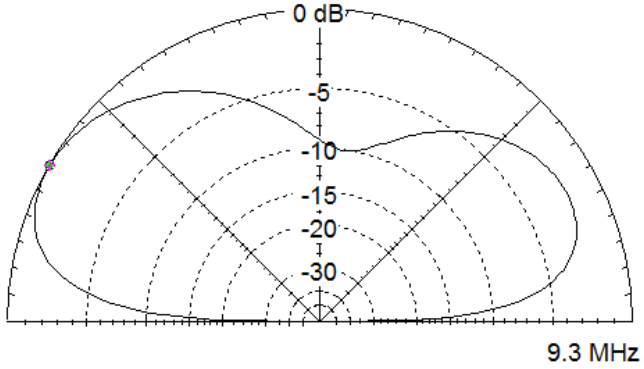
Elevation Plot
Azimuth Angle 90.0 deg.
Outer Ring -1.07 dBi

Cursor Elev 150.0 deg.
Gain -1.07 dBi
0.0 dBmax

Slice Max Gain -1.07 dBi @ Elev Angle = 150.0 deg.
Beamwidth 51.9 deg.; -3dB @ 118.1, 170.0 deg.
Sidelobe Gain -3.85 dBi @ Elev Angle = 27.0 deg.



Total Field EZNEC+



9.3 MHz

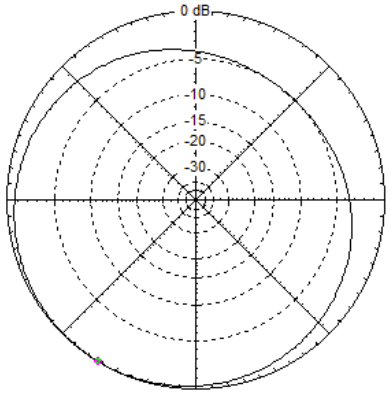
Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring -1.48 dBi

Cursor Elev 150.0 deg.
Gain -1.48 dBi
0.0 dBmax

Slice Max Gain -1.48 dBi @ Elev Angle = 150.0 deg.
Beamwidth 51.4 deg.; -3dB @ 118.6, 170.0 deg.
Sidelobe Gain -3.43 dBi @ Elev Angle = 27.0 deg.
Front/Sidelobe 1.95 dB

Truck Direction

Total Field EZNEC+



9.3 MHz

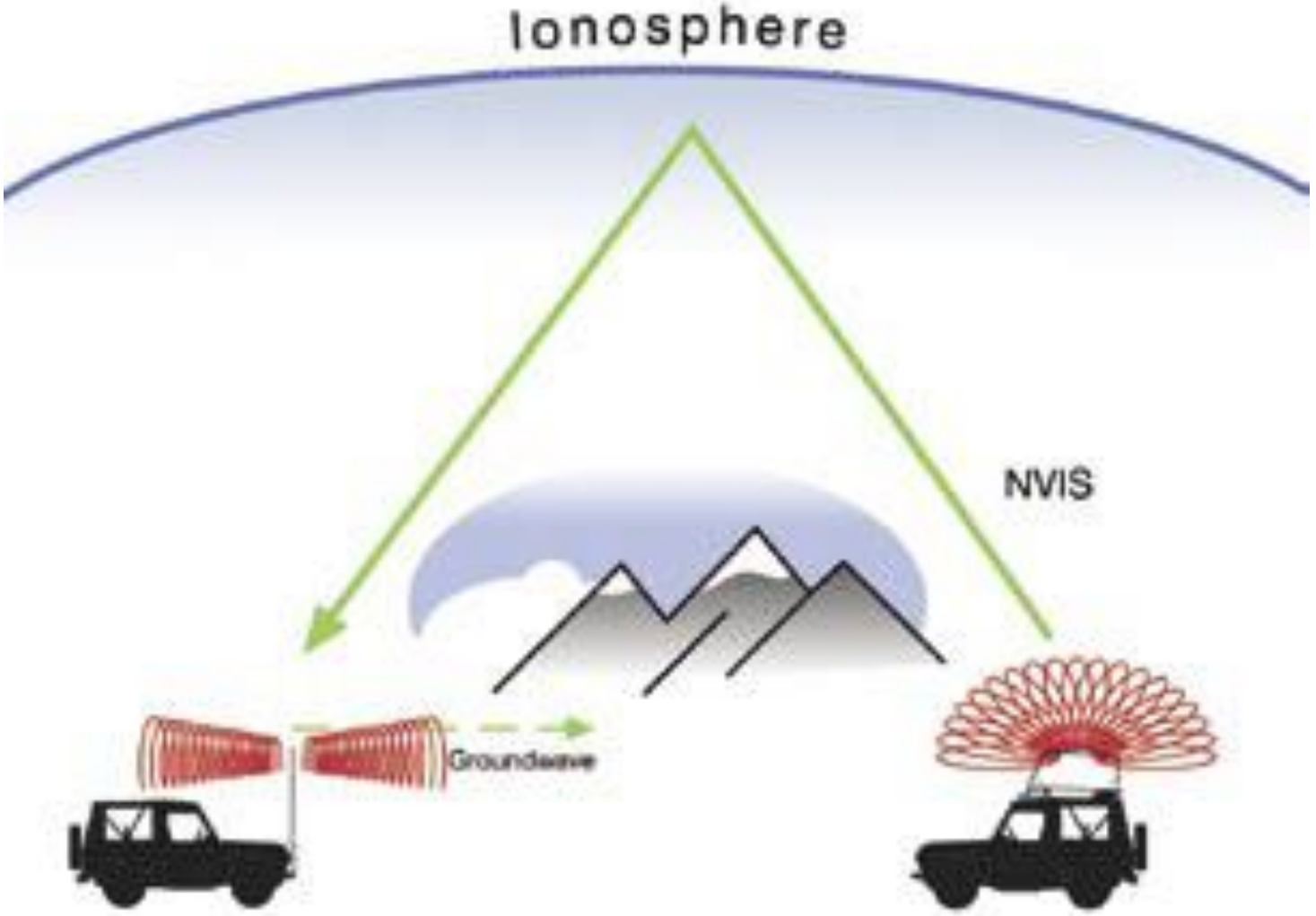
Azimuth Plot
Elevation Angle 50.0 deg.
Outer Ring -2.13 dBi

Cursor Az 239.0 deg.
Gain -2.13 dBi
0.0 dBmax

Slice Max Gain -2.13 dBi @ Az Angle = 239.0 deg.
Front/Back 5.06 dB
Beamwidth 236.6 deg.; -3dB @ 113.8, 350.4 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB

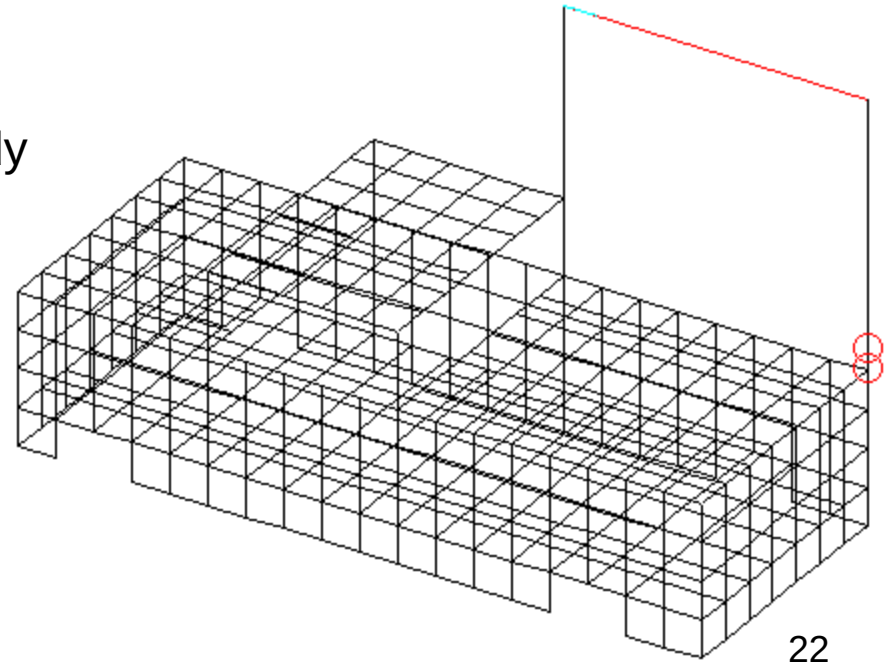
MOBILE NVIS HF

MOBILE LOOP ANTENNA

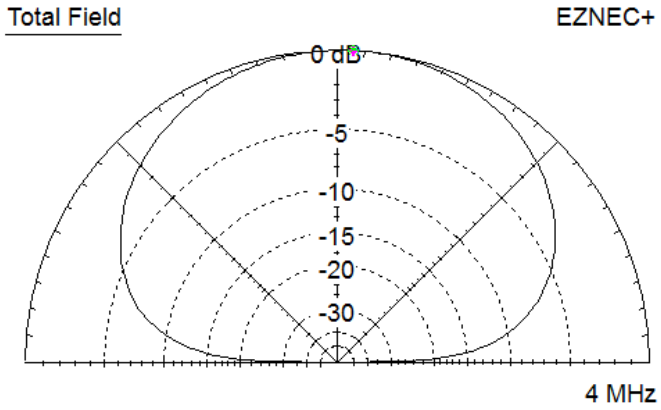


LOOP 1 SET UP

Truck (F250) – 18 ft. long, 7 ft. wide, 6 ft. tall, 1.5 ft. off ground
Note: bottom plane is 1 ft. above body bottom
Loop – 7 ft. tall, 8 ft. long (will fold flat onto truck bed)
Angle – 90 deg.
All segments are 1 ft.
Antenna has 9 segments
Antenna modeled with 1 in. dia. Cu pipe
Note: bottom half of antenna is truck body
Auto-tuner at red circles



Azimuth & Elevation – 4 MHz

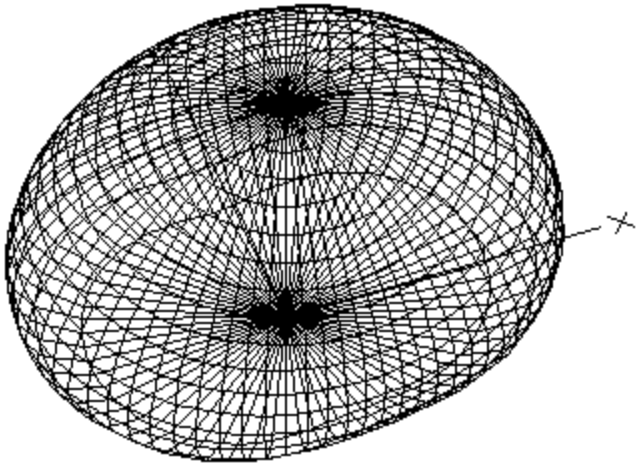


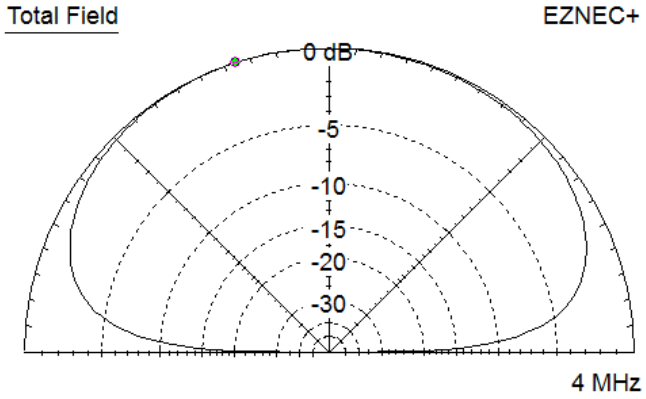
Elevation Plot
Azimuth Angle 90.0 deg.
Outer Ring -3.43 dBi

Cursor Elev 87.0 deg.
Gain -3.43 dBi
0.0 dBmax

Slice Max Gain -3.43 dBi @ Elev Angle = 87.0 deg.
Beamwidth 110.9 deg.; -3dB @ 34.0, 144.9 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB

Truck Direction

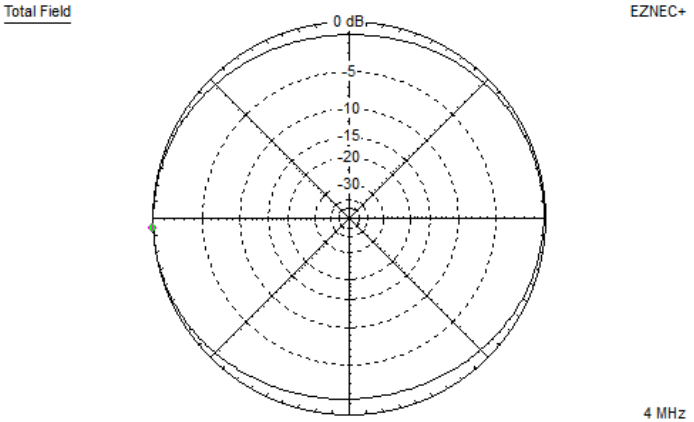




Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring -3.42 dBi

Cursor Elev 108.0 deg.
Gain -3.42 dBi
0.0 dBmax

Slice Max Gain -3.42 dBi @ Elev Angle = 108.0 deg.
Beamwidth 152.4 deg.; -3dB @ 14.1, 166.5 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB

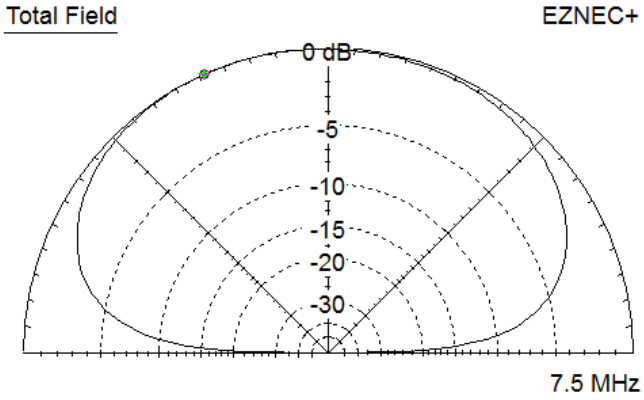


Azimuth Plot
Elevation Angle 50.0 deg.
Outer Ring -3.52 dBi

Cursor Az 183.0 deg.
Gain -3.52 dBi
0.0 dBmax

Slice Max Gain -3.52 dBi @ Az Angle = 183.0 deg.
Front/Back 0.11 dB
Beamwidth ?
Sidelobe Gain -3.62 dBi @ Az Angle = 8.0 deg.
Front/Sidelobe 0.1 dB

Azimuth & Elevation – 7.5MHz

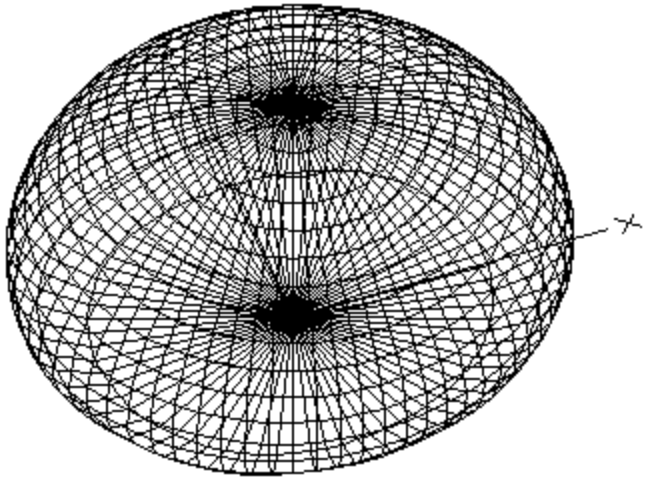


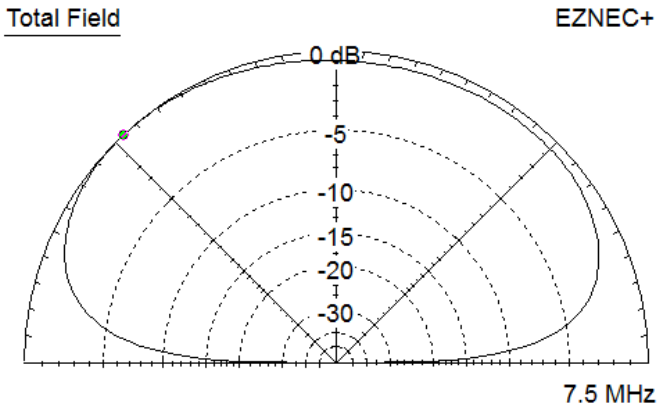
Elevation Plot
Azimuth Angle 90.0 deg.
Outer Ring -1.26 dBi

Cursor Elev 114.0 deg.
Gain -1.26 dBi
0.0 dBmax

Slice Max Gain -1.26 dBi @ Elev Angle = 114.0 deg.
Beamwidth 140.8 deg.; -3dB @ 22.1, 162.9 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB

Truck Direction

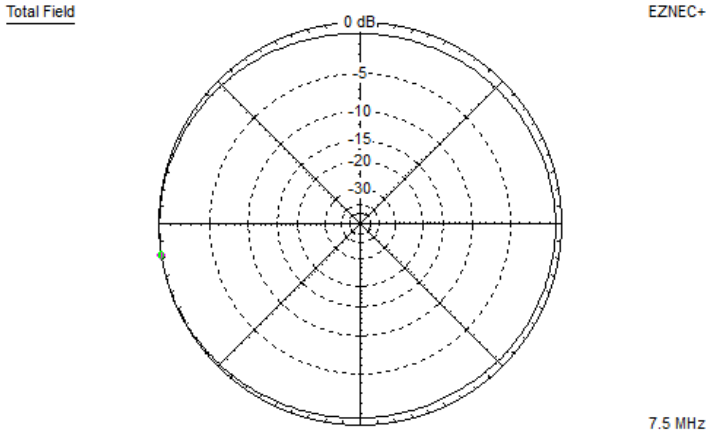




Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring -0.81 dBi

Cursor Elev 133.0 deg.
Gain -0.81 dBi
0.0 dBmax

Slice Max Gain -0.81 dBi @ Elev Angle = 133.0 deg.
Beamwidth 152.8 deg.; -3dB @ 14.5, 167.3 deg.
Sidelobe Gain -1.3 dBi @ Elev Angle = 51.0 deg.
Front/Sidelobe 0.49 dB



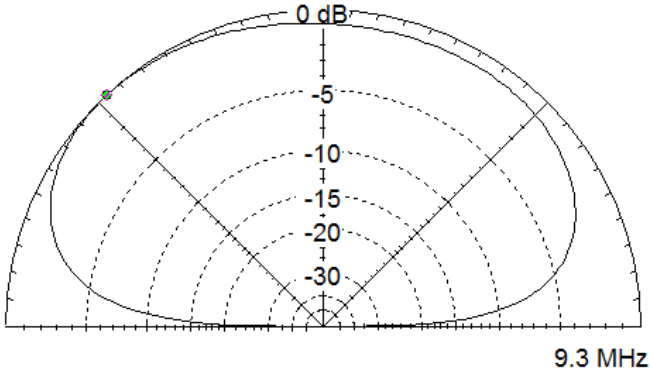
Azimuth Plot
Elevation Angle 50.0 deg.
Outer Ring -0.8 dBi

Cursor Az 189.0 deg.
Gain -0.8 dBi
0.0 dBmax

Slice Max Gain -0.8 dBi @ Az Angle = 189.0 deg.
Front/Back 0.53 dB
Beamwidth ?
Sidelobe Gain -1.28 dBi @ Az Angle = 348.0 deg.
Front/Sidelobe 0.48 dB

Azimuth & Elevation – 9.3MHz

Total Field EZNEC+



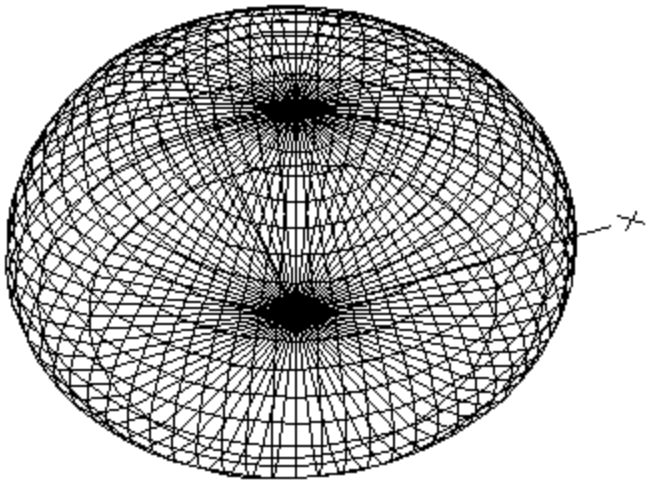
9.3 MHz

Elevation Plot
Azimuth Angle 90.0 deg.
Outer Ring -0.67 dBi

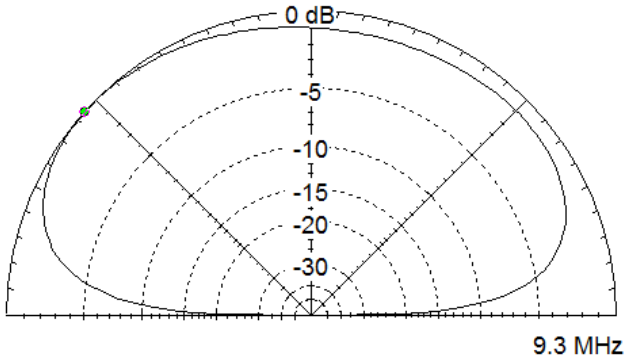
Cursor Elev 133.0 deg.
Gain -0.67 dBi
0.0 dBmax

Slice Max Gain -0.67 dBi @ Elev Angle = 133.0 deg.
Beamwidth 145.9 deg.; -3dB @ 20.1, 166.0 deg.
Sidelobe Gain -1.5 dBi @ Elev Angle = 60.0 deg.
Front/Sidelobe 0.82 dB

Truck Direction



Total Field EZNEC+



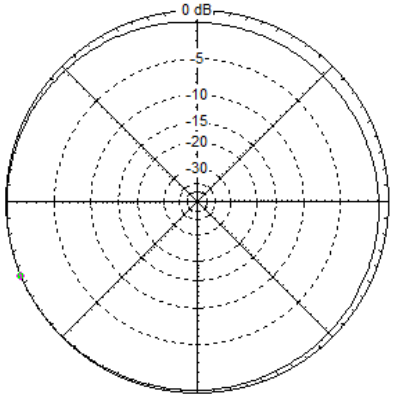
9.3 MHz

Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring -0.46 dBi

Cursor Elev 138.0 deg.
Gain -0.45 dBi
0.0 dBmax

Slice Max Gain -0.45 dBi @ Elev Angle = 138.0 deg.
Beamwidth 152.9 deg.; -3dB @ 15.0, 167.9 deg.
Sidelobe Gain -1.31 dBi @ Elev Angle = 44.0 deg.
Front/Sidelobe 0.86 dB

Total Field EZNEC+



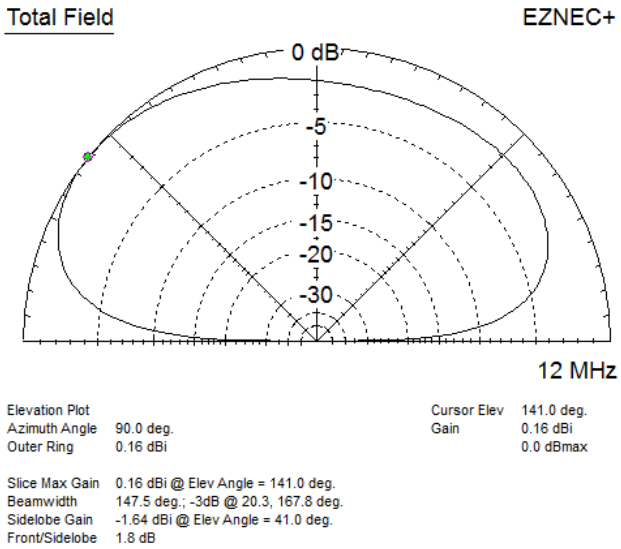
9.3 MHz

Azimuth Plot
Elevation Angle 50.0 deg.
Outer Ring -0.47 dBi

Cursor Az 203.0 deg.
Gain -0.47 dBi
0.0 dBmax

Slice Max Gain -0.47 dBi @ Az Angle = 203.0 deg.
Front/Back 1.1 dB
Beamwidth ?
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB

Azimuth & Elevation – 12MHz

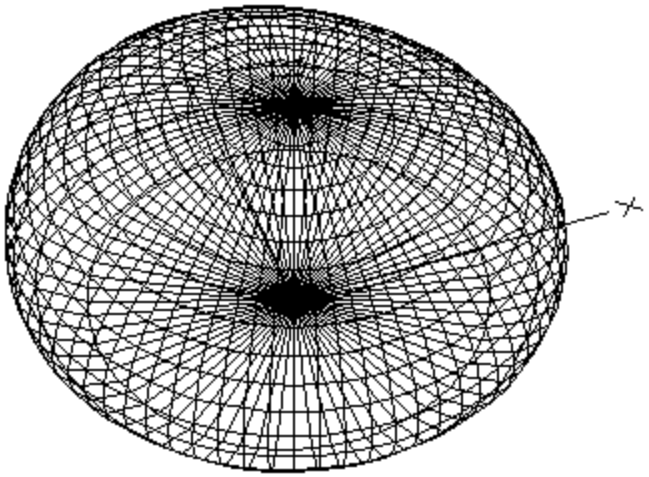


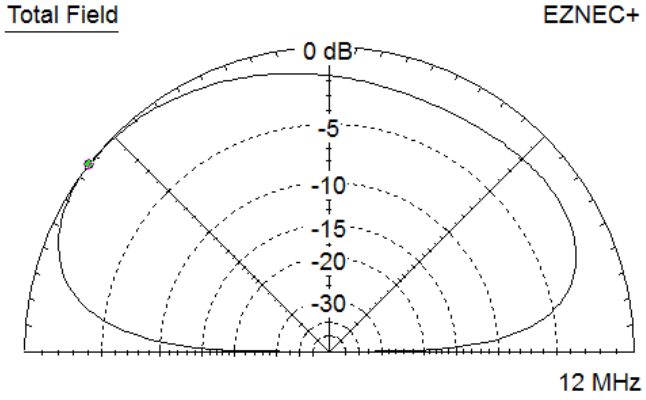
Elevation Plot
Azimuth Angle 90.0 deg.
Outer Ring 0.16 dBi

Cursor Elev 141.0 deg.
Gain 0.16 dBi
0.0 dBmax

Slice Max Gain 0.16 dBi @ Elev Angle = 141.0 deg.
Beamwidth 147.5 deg.; -3dB @ 20.3, 167.8 deg.
Sidelobe Gain -1.64 dBi @ Elev Angle = 41.0 deg.
Front/Sidelobe 1.8 dB

Truck Direction

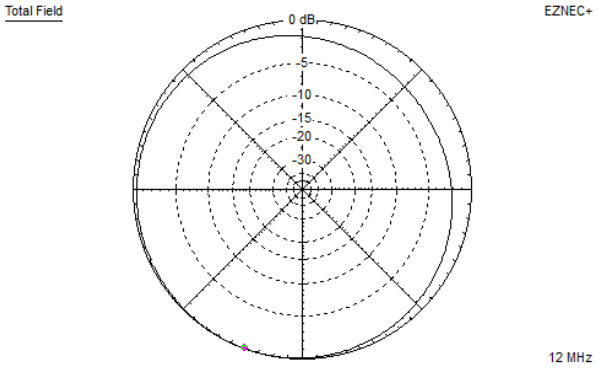




Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring -0.14 dBi

Cursor Elev 142.0 deg.
Gain -0.14 dBi
0.0 dBmax

Slice Max Gain -0.14 dBi @ Elev Angle = 142.0 deg.
Beamwidth 151.4 deg.; -3dB @ 17.0, 168.4 deg.
Sidelobe Gain -1.88 dBi @ Elev Angle = 35.0 deg.
Front/Sidelobe 1.74 dB



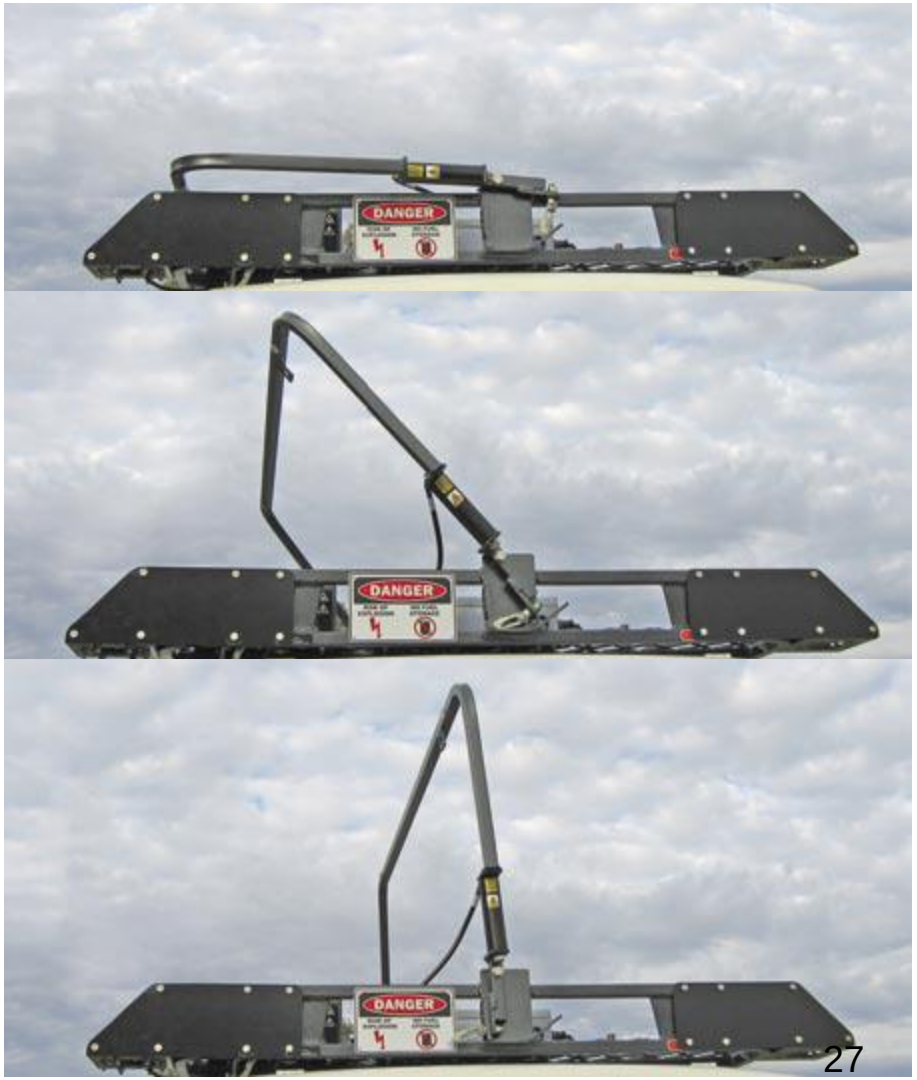
Azimuth Plot
Elevation Angle 50.0 deg.
Outer Ring 0.0 dBi

Cursor Az 250.0 deg.
Gain 0.0 dBi
0.0 dBmax

Slice Max Gain 0.0 dBi @ Az Angle = 250.0 deg.
Front/Back 2.24 dB
Beamwidth ?
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB

Q-MAC ML-91 NVIS

(3.7 – 13 MHz)



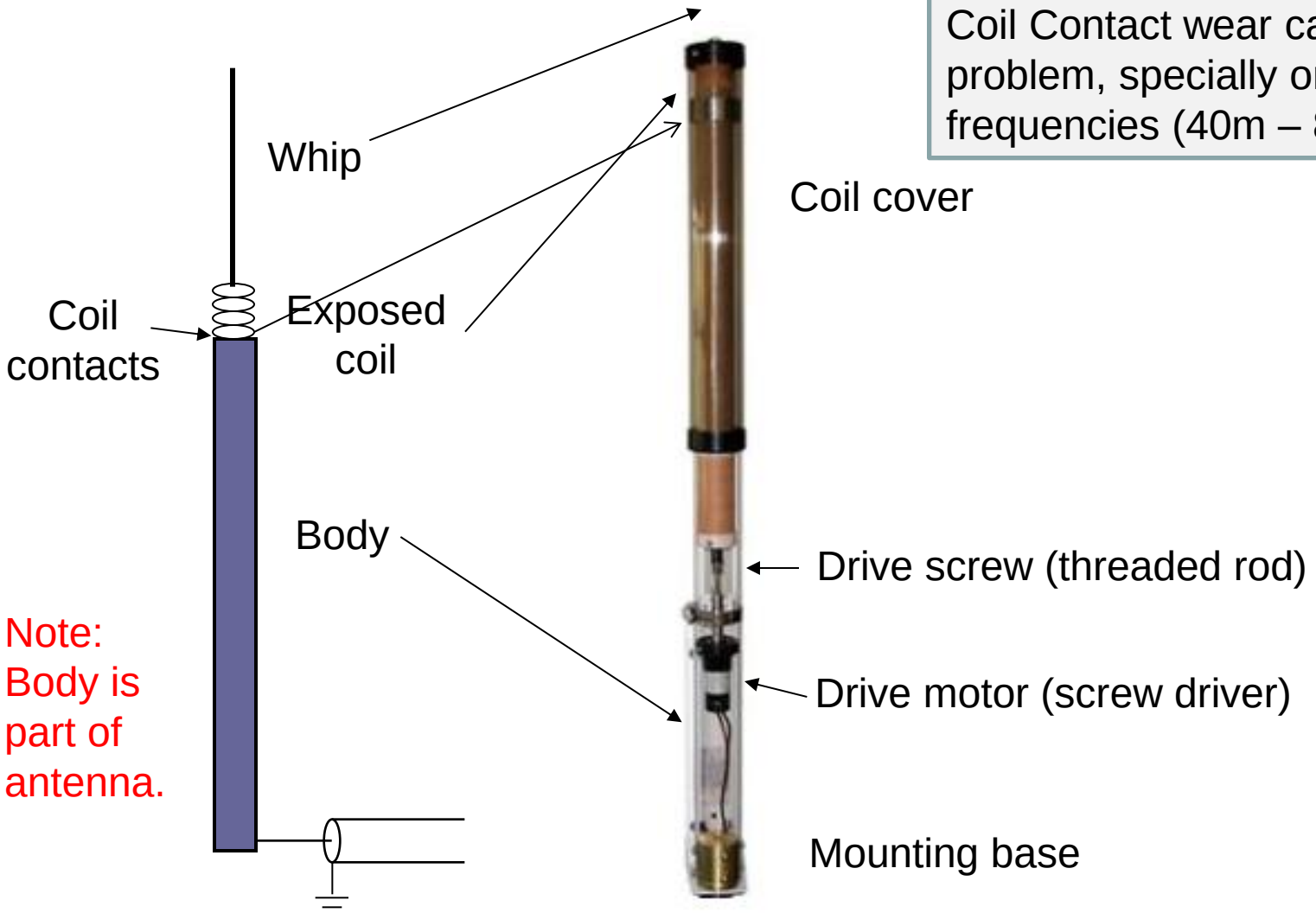
Cost - $12,000

Harris RF-3134-AT003/5

HF VERTICALS- Screwdrivers

SCREW-DRIVER ANTENNAS

Coil Contact wear can be a problem, specially on low frequencies (40m – 80m)



Note: Body is part of antenna.

MANUFACTURERS

Tarheel

Scorpion Antennas

MANUFACTURERS

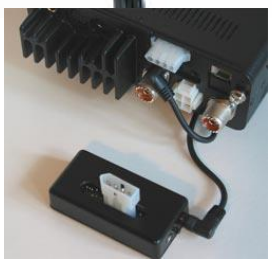
High-Q – 5/80
https://store.hiqantennas.com/

Coil Contact problem solved in this design

SCREWDRIVER CONTROLLERS

Manual
Position

MFJ-1924
$169.95



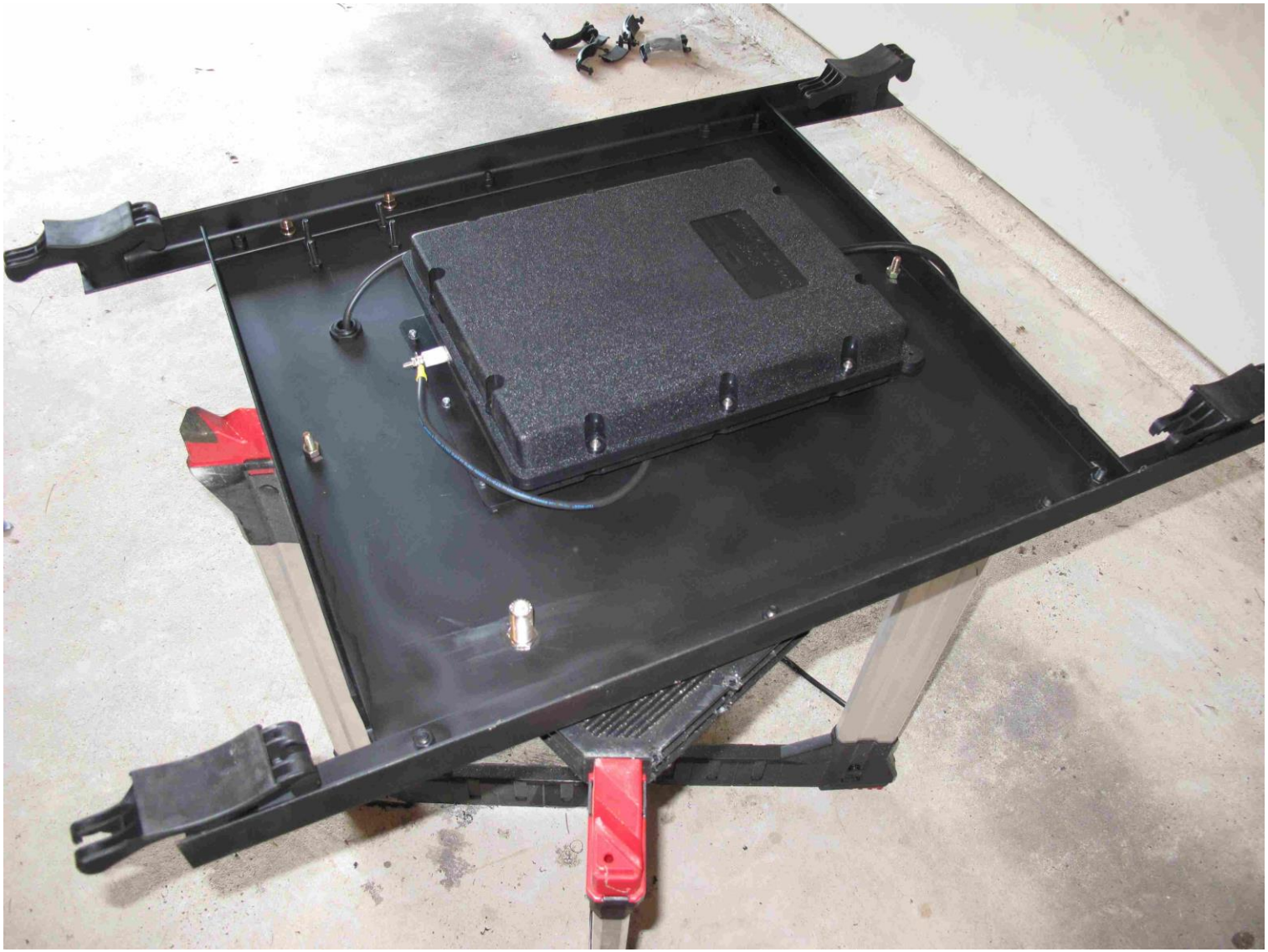
BetterRF
Company
Out of Business

AUTO-TUNERS

AUTO-TUNER OPTIONS

Auto-Tuned
SG-230/SG-303 Whip

Auto-Tuned
SG-230 Luggage Rack Frame



VHF/UHF ANTENNAS
(Introduction)

HAM RADIO VHF/UHF

MOBILE INSTALLATION

by

Mike Baker, W8CM

COMMON ANTENNA TYPES

1. NO GAIN
2. GAIN

NO GAIN = “SHORT”

QUARTER WAVE (19” on 2m)

GAIN = “LONGER”

MOST POPULAR: 5/8 WAVE (43”on 2M)

FUNDAMENTAL PHYSICS

VERTICAL MOBILE ANTENNAS REQUIRE A 'GROUND PLANE' FOR PROPER PERFORMANCE

This affects the mounting location, and hence the selection of the antenna gain

WHERE BEST TO MOUNT THE ANTENNA?

CENTER OF ROOF TOP ☺

ANY WHERE ELSE ☹

ROOF TOP:

1. HIGHEST LOCATION
2. OMNIDIRECTIONAL PATTERN

OTHER:

1. LOWER LOCATION
2. DISTORTED RADIATION PATTERN

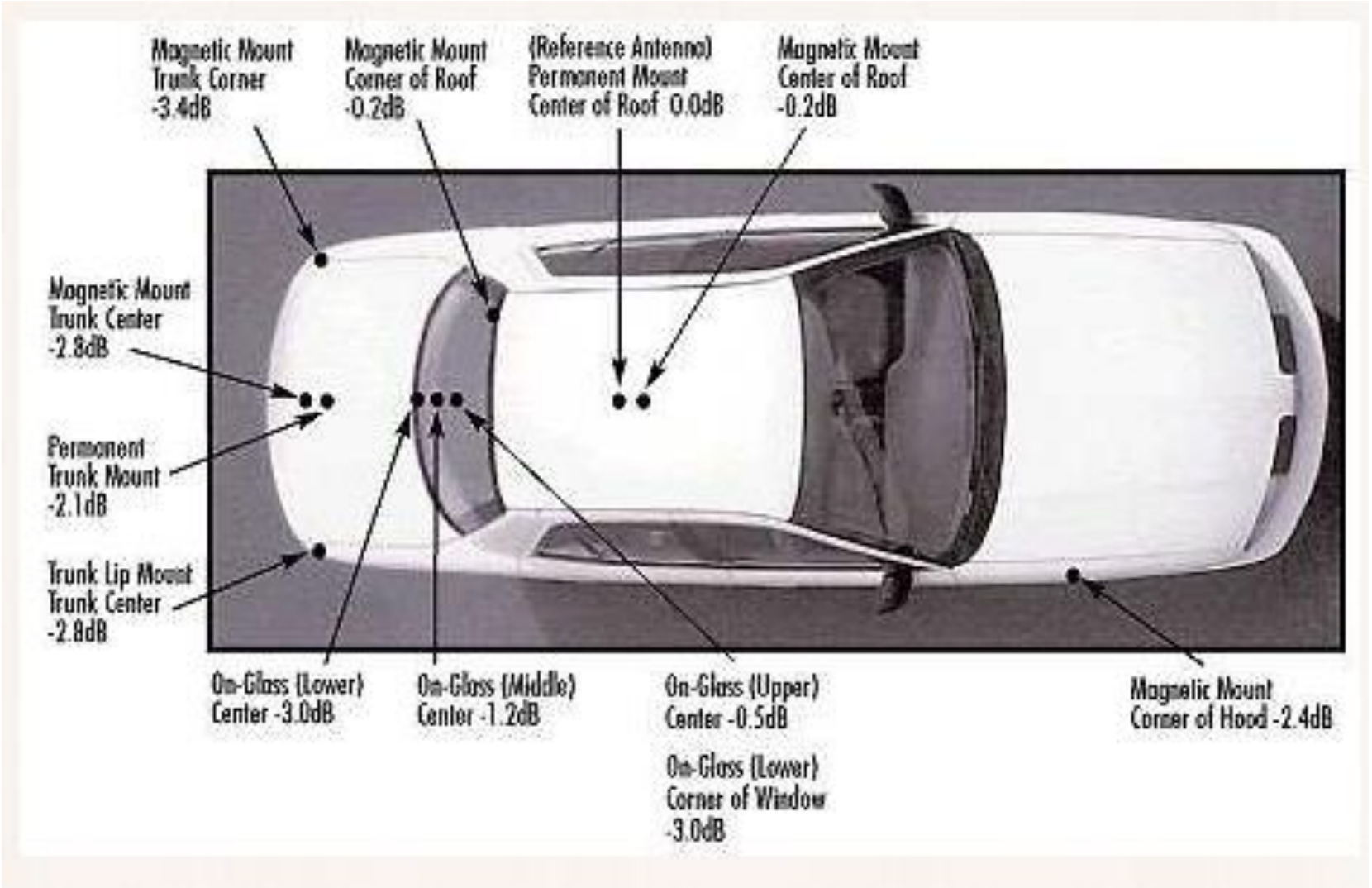
Then again, there is the "real world":

in other words, the "garage door clang-clang factor"

Oh, by the way:

mag mounts, clip-on's, etc. are poorer choices than a "real" mount

Auto Antenna Locations



Antenna Ground Plane Requirements

- 150 MHz requires a ground plane of at least 42” in diameter.
- 450 MHz, 15”
- 800 MHz, a minimum of 8”

- Note: ½ wavelength antenna – requires no ground plane. (next two slides)

No Ground Plane Antenna

Laird
Smart Technology. Delivered.

Mobile Load Coil Antenna
Standard B1442N

PREMIUM MOBILE LOAD COIL ANTENNAS ARE INDUSTRY STANDARD

Laird's ongoing commitment to refinement in mechanical and electrical design has resulted in the most technically advanced mobile load coil antennas on the market. Exclusive features such as stainless steel whips, housings constructed with ABS material injection molded around a solid brass insert, and gold plated push pin contacts make Laird the obvious choice for quality and long lasting value for demanding mobile radio communications.

FEATURES RoHS

- High performance mobile antenna
- No ground plane
- Special UV treated radome, resists sun damage
- Easy installation with optional NMO Mounts
- 100% tested on a network analyzer

MARKETS

- Public safety
- Transportation
- Utility
- Military mobile

SPECIFICATIONS

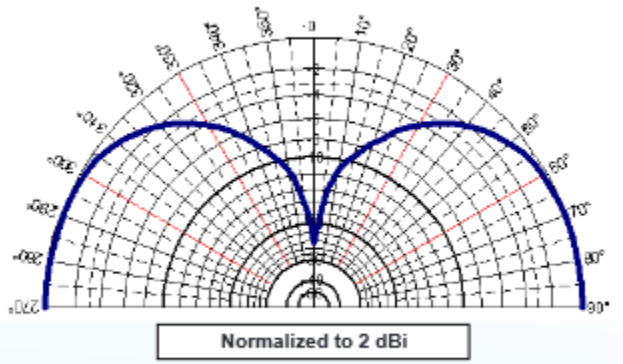
ELECTRICAL	
Frequency range	144-174 MHz
VSWR	< 2.0:1 Max
Nominal gain	2 dBi
Maxmium power	100 W
Nominal impedance	50 Ω
Polarization	Vertical
Pattern	Omnidirectional
Half-power beamwidth (Elevation° x Azimuth°)	110° x 360°
Coaxial cable length & type	None
Terminations	NMO
Noise suppressor	BlackHawk NS1535 1-35 VOLT, 15 amp Noise suppressor (Sold Separately)
Ground plane requirements	No Ground Plane

MECHANICAL	
Color	B1442N - Black with chrome BB1442N - Black BW1442N - White
Height	See chart
Diameter	1.45"
Weight	< 0.5 lb
Rated wind velocity	100mph (161kph)
Wind resistance	0.02 sq. ft.
Mounting information (sold separately)	NMO mountable

B1442N CUTTING CHART

FREQUENCY	WHIP LENGTH	FREQUENCY	WHIP LENGTH
144 MHz	44"	158 MHz	35-1/2"
146 MHz	42-1/2"	160 MHz	34-1/2"
148 MHz	41-1/2"	162 MHz	33-1/2"
150 MHz	40-1/4"	164 MHz	32-3/4"
152 MHz	39"	166 MHz	32"
154 MHz	38"	168 MHz	31-1/2"
156 MHz	37"	170 MHz	31"

ANTENNA PATTERNS



Elevation Pattern

Antenna Mount Methods

Through-Hole NMO

Through-Glass

NMO – Mag. Mount

Trunk Lid Mount

VHF/UHF Connector Types

NMO

UHF

My VHF/UHF Antenna

BAND: 2 METER/440
GAIN: 3.0/5.5
38.5" TALL
UHF CONNECTOR

Home › UHF/VHF › HF/VHF/UHF HAM Antennas › NR770HA

Diamond NR770HA Dualband Mobile Antenna

Item #: NR770HA

Diamond Antenna

✔ In Stock

High performance dual band antenna only 38.5" tall

- Dual Band 2 Meter / 70 Centimeter
- 3 dB Gain on 2M, 5.5 dB gain on 70 CM
- 38.5" Tall
- UHF style antenna connector

$48.95

Length: 62" | 41" | 38.5" | 57"

Connector: SO-239 (UHF)

1

Diamond Antenna Hole Mount Cable Assemblies C213SMA

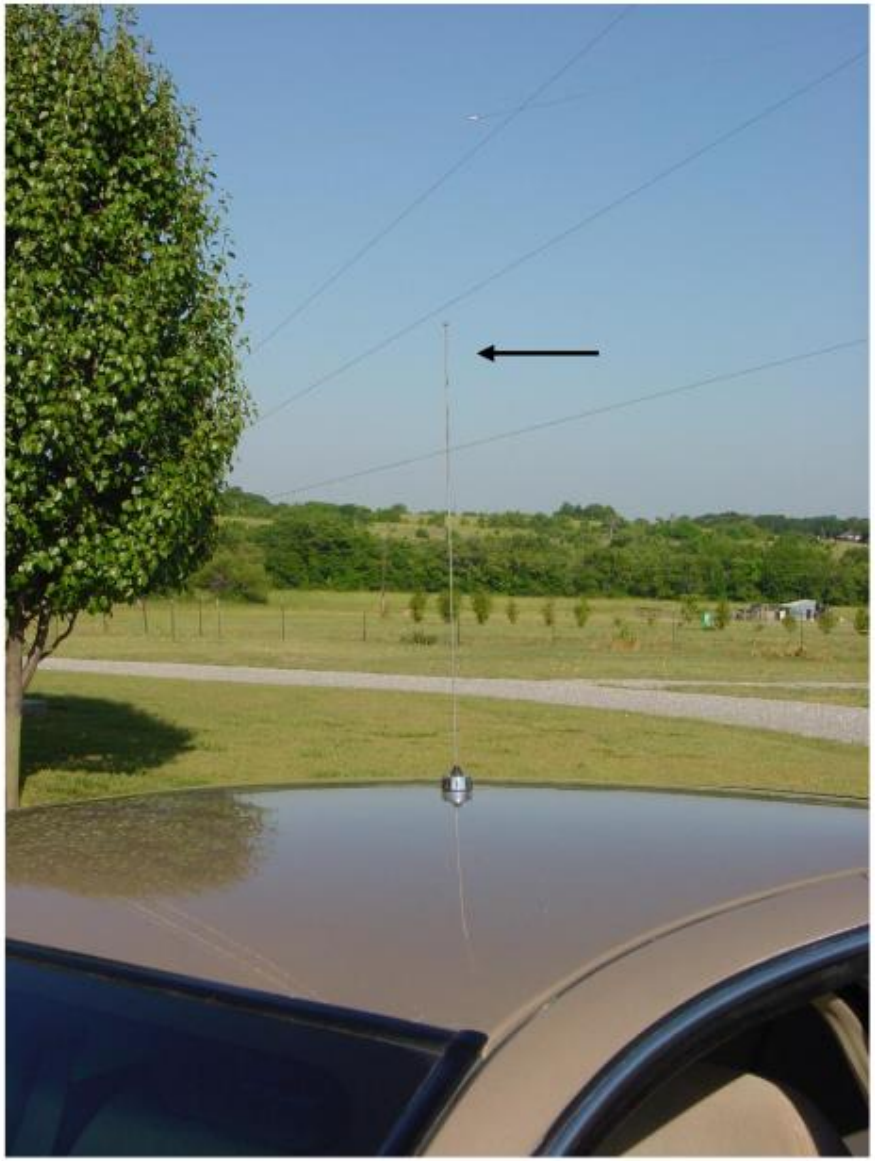
$45.99

★★★★★ (3) Review This Product

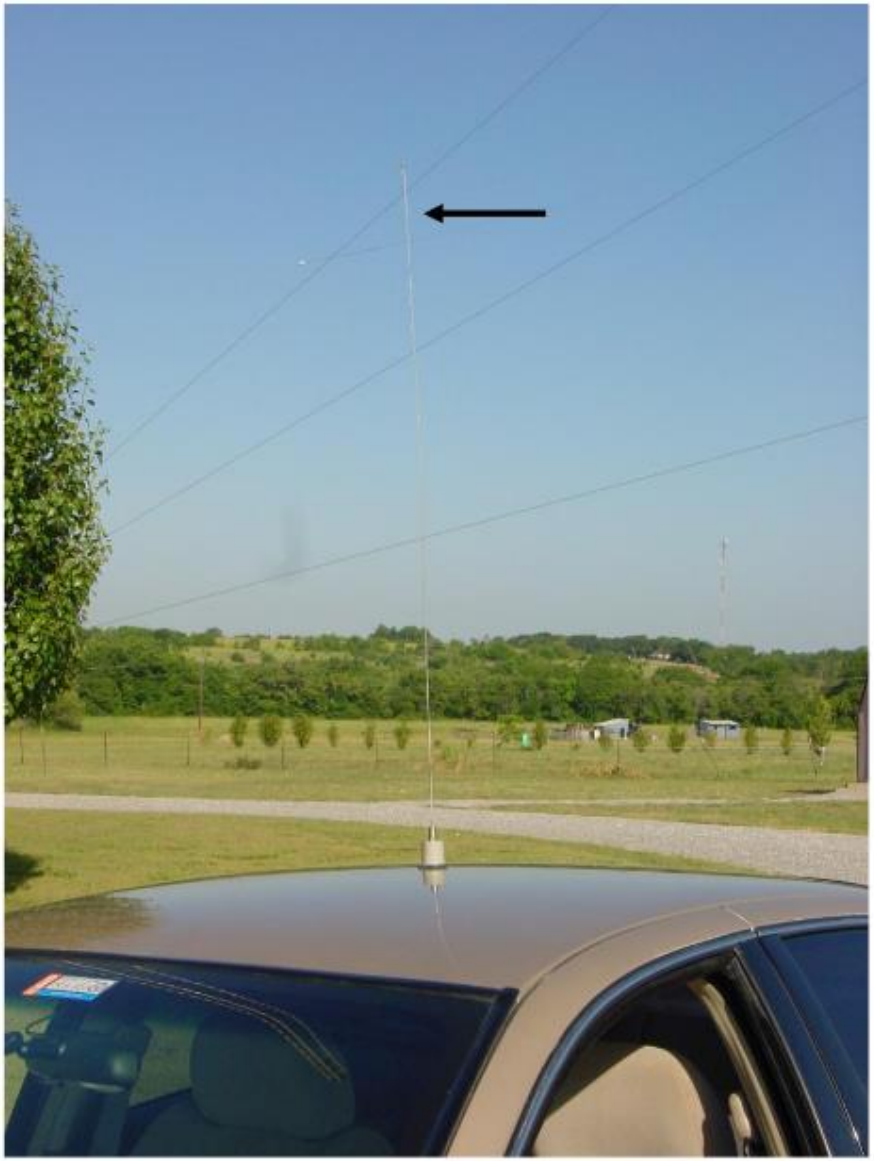
Cable Assembly for K-Series Mount, UHF mount/13.5 ft RG-316 w/SMA male, with SMA female to PL-259 adapter, Kit

ADD TO CART

2M TOP 1/4 WAVE



2M TOP 5/8 WAVE

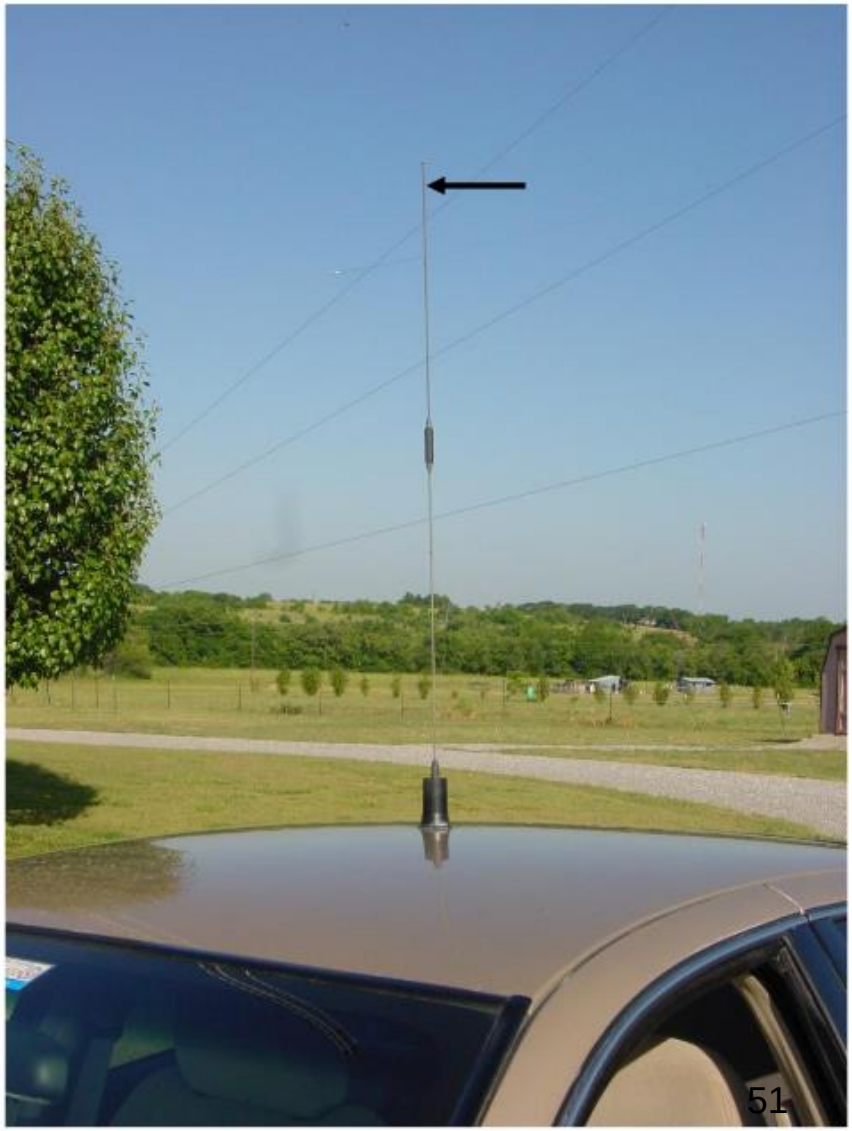


DUAL BAND 'SHORT'

19" – 2M UNITY, UHF GAIN

DUAL BAND 'LONG'

37" – 2M GAIN, UHF GAIN



HELP

- Need a VHF/UHF mobile “expert” to provide a complete presentation on VHF/UHF antennas.

RIG MOUNTING OPTIONS

Radio Control Mic

DC Wiring – Do It Right!

VHF/UHF Mobile DC Power

- Connect rig power cable directly to both terminals of the starter battery. This will minimize alternator “whine”.
- Place fuse(s) at battery. Typically done on manufacturer’s supplied power cable.
- Other engine electrical noise typically not an issue due to FM mode of operation. (noise is typically AM).
- Several manufacturers sell DC power filters. For example MFJ-1142.

WIRING REQUIREMENTS

- Heavy gauge wire (<0.5 VDC drop)
  - http://www.powerstream.com/Wire_Size.htm
- Make high current ground connection to battery (ring terminals).
- Fuses/Breakers – West Marine
- Connectors

Anderson PowerPoles

My DC Wiring

Blue Sea Systems
285 Series – 100A
$62.99

Source - West Marine

#6 AWG
ANCOR MARINE
Battery Cable

Tinned-copper stranding for maximum protection against corrosion and electrolysis.
Ultra flexible Type 3 stranding resists fatigue due to vibration and flexing.
Premium vinyl insulation that resists salt water, battery acid, oil, gas and UV.
Rated at 600V and 105° C
$2.41/ft

Source - West Marine

West Mountain
Rigrunner 4005

Maximum – 40A

DC Boost Regulators

(WHY?)

N8XJK BOOST REGULATORS

SUPER BOOST REGULATOR
40A/40A Continuous/max - $249.95
Available at West Mountain Radio

MFJ 4416C BOOST REGULATOR

25A - $209.95

Both: RF sense

VEHICLE MODIFICATIONS - HF

- Bonding – connect all body parts together
  - Increased shielding from engine noise
  - Larger antenna counterpoise – Vehicle is an important part of the antenna
- Noise reduction – shielding & bypass
  - Ignition
  - Electric fuel pump – Capacitor bypass, series inductors
  - Other noise sources
  - Noise Blanker (NB) & Noise Reduction (NR)

NOISE ABATEMENT

- Some of the biggest noise makers are the electronic ignition components. “Sniff” around using an AM radio and you can pinpoint the noisiest and go to work.
- I used shield from RG-213 to solder to each component and ran this to ground to create the most effective shield.

NOISE ABATEMENT

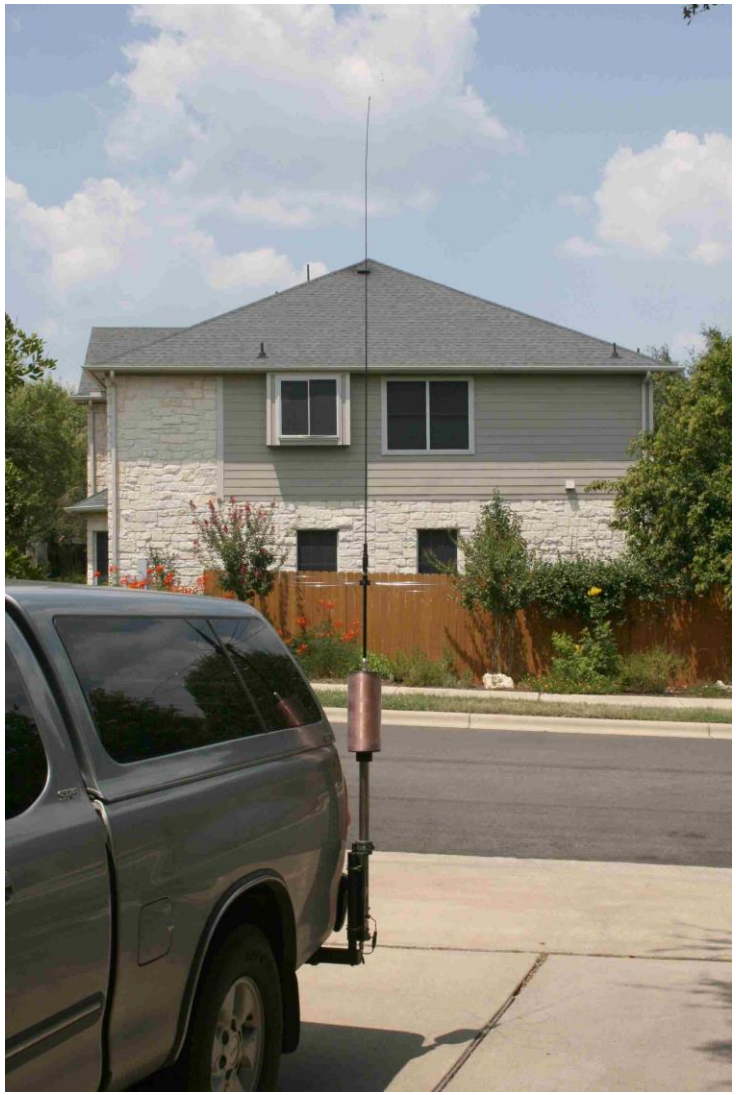
- Ferrite beads are placed on each wire going to the COP and the fuel injectors.

BONDING

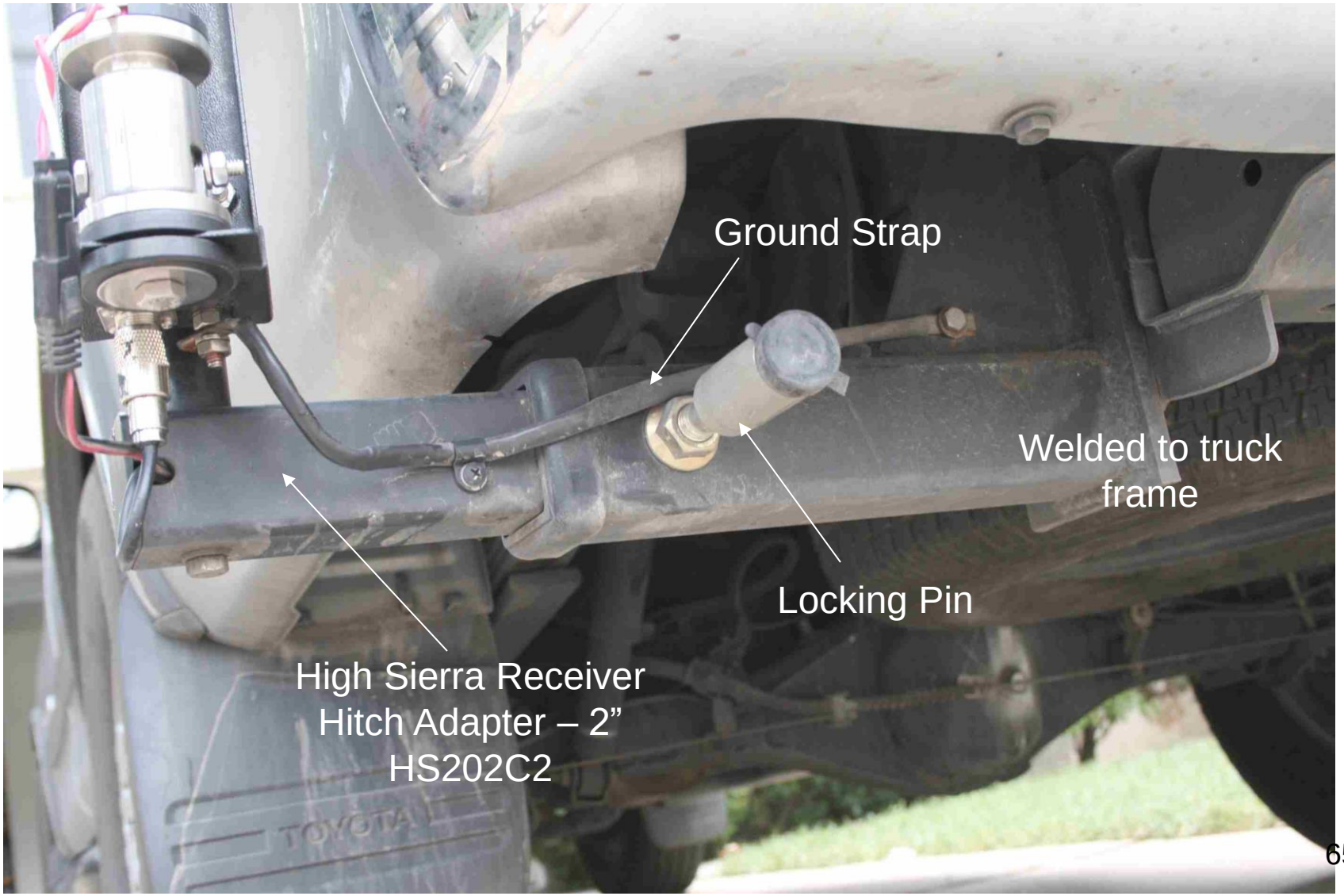
- Proper bonding of the entire vehicle provides the coupling we are looking for to increase antenna efficiency.
- Here are examples of door bonds – doors, truck bed, tail gate are all bonded.

EXAMPLE #1 – W5IFQ

(HIGH-Q 5/160)



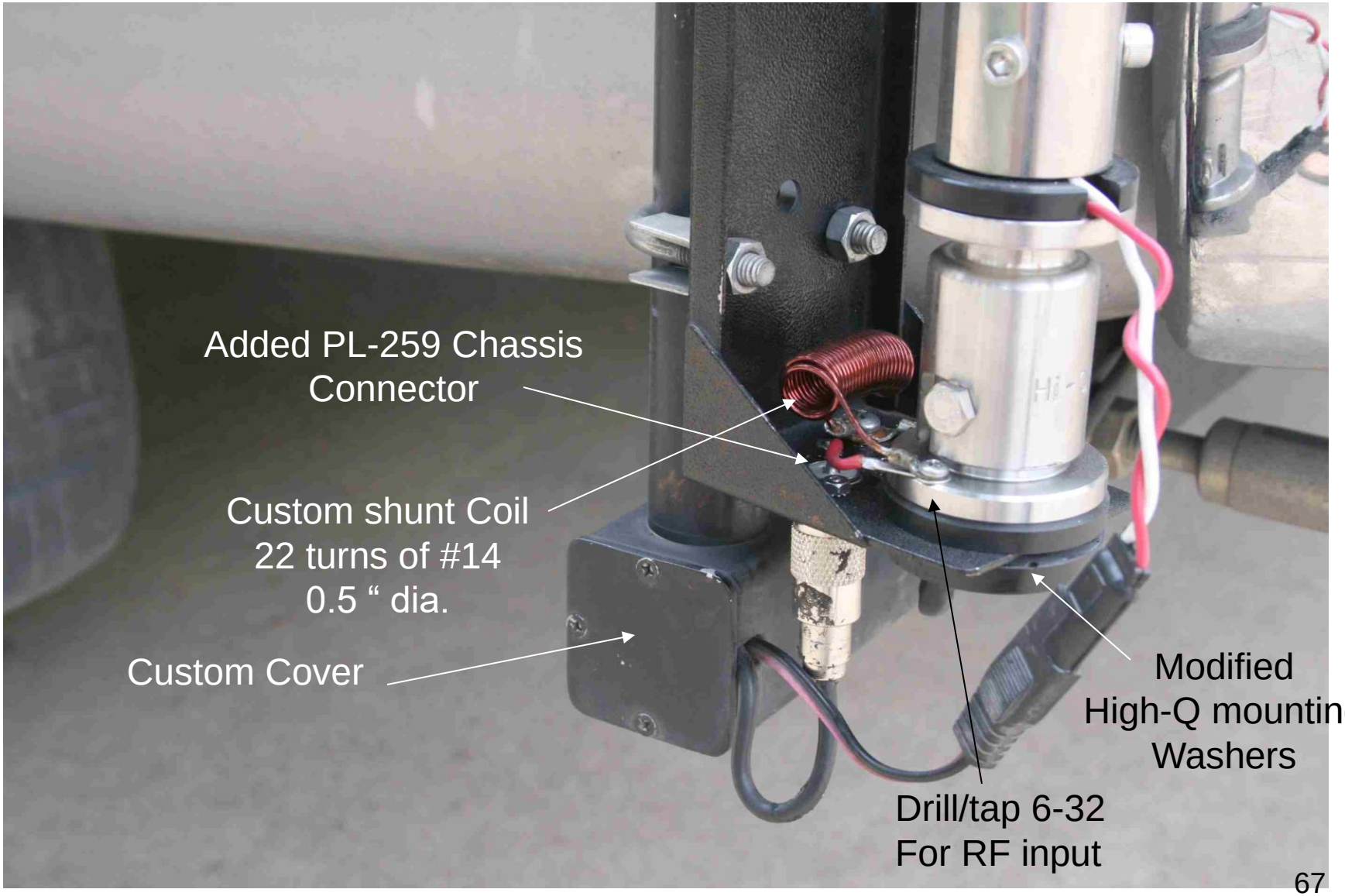
2 INCH RECEIVER STRUCTURE



ANTENNA MOUNT

Custom insulated spacer (PVC)
Split with a shallow grove for hose
Clamp.

MOUNT DETAILS



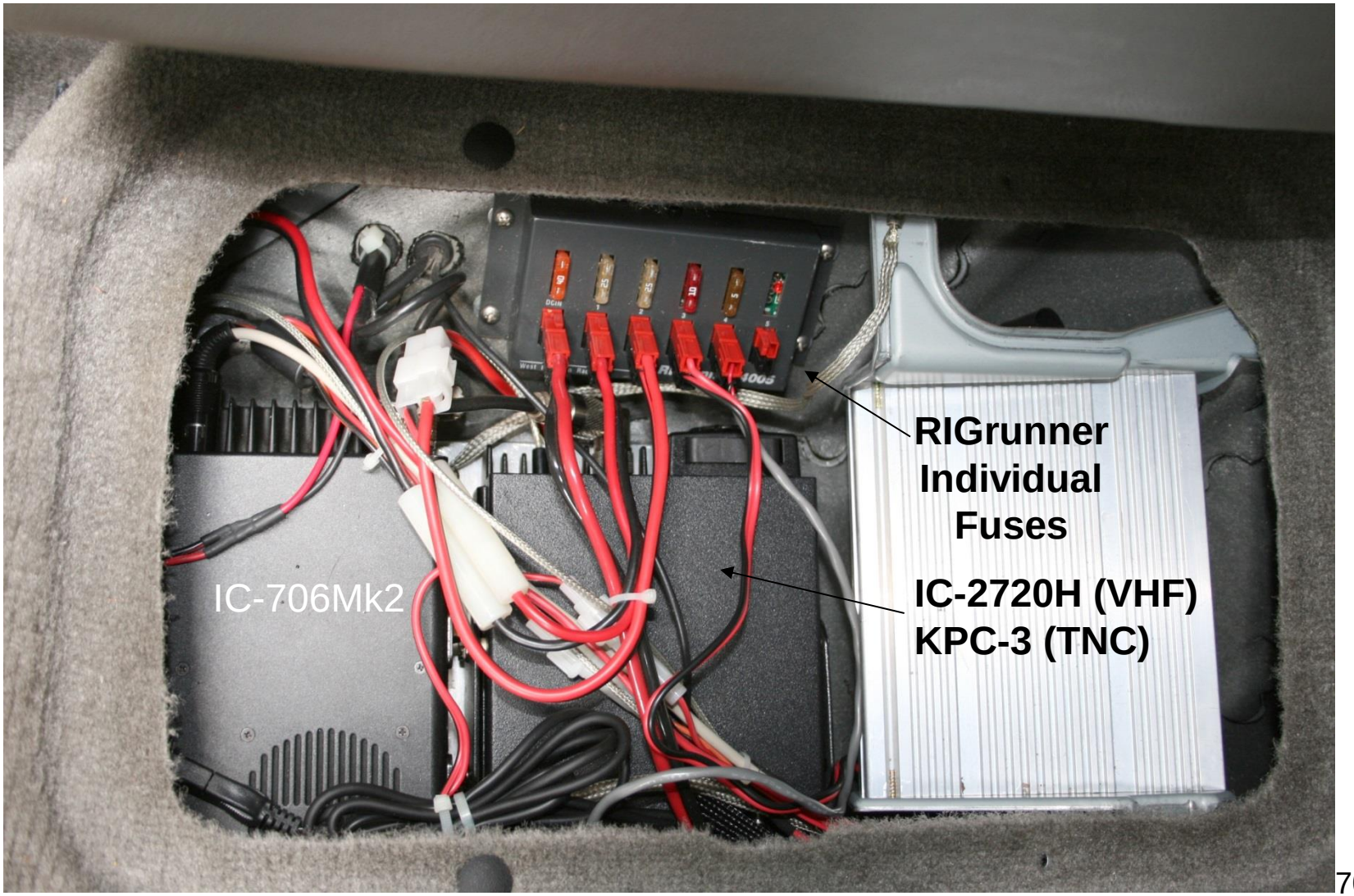
CONTROL HEAD CONSOLE

Console:

- Summing amplifier
- GPS receiver
- Screw Driver Control
- Digital Interface Connectors
  - IC=706MK2 – ACC
  - KPC-3 – RS-232
  - GPS - NMEA

RIG MOUNTING

RIG MOUNTING



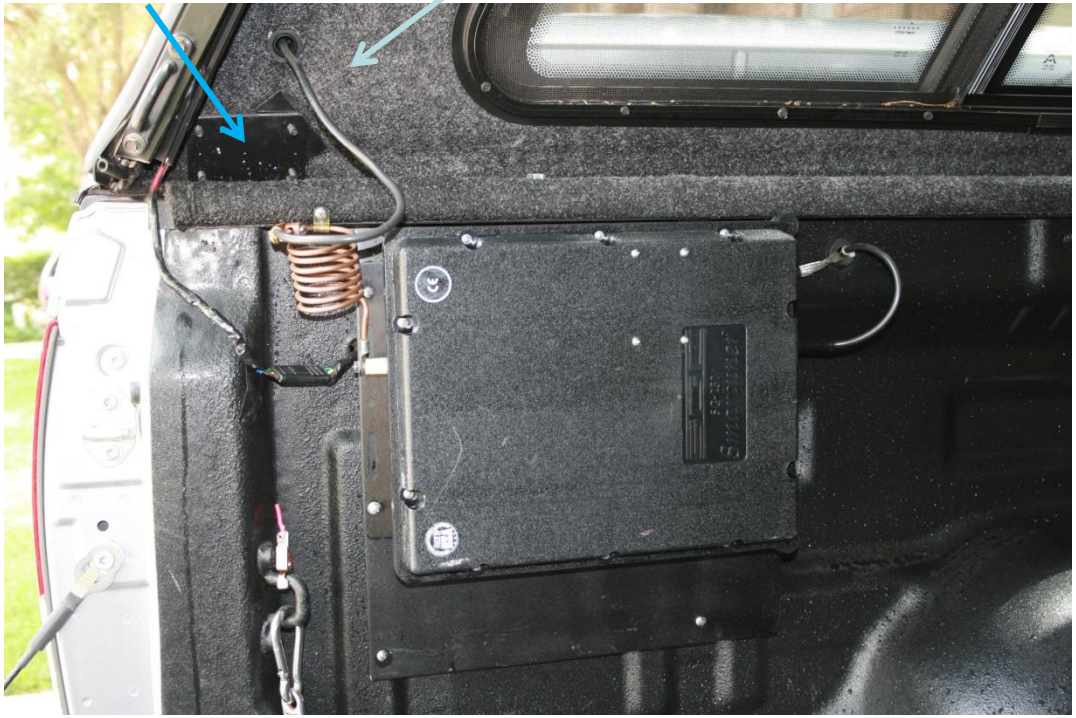
Example #2
(Same Vehicle – Auto-Tuned Antenna)

- HF Frequency Coverage – 2 MHz – 30 MHz (continuous)
- VHF Frequency Coverage, 2m, 70 cm
- Modes:
  - Voice – SSB & FM
  - VHF Packet
  - HF Pactor (P3)
  - HF VARA
  - HF Sound Card modes:
    - MT-63
    - Olivia
    - MIL STD 188-110A
    - RTTY (Including MIL STD Wide-Shift FSK)
- RF Power
  - HF – 100 watts
  - VHF – 50 watts

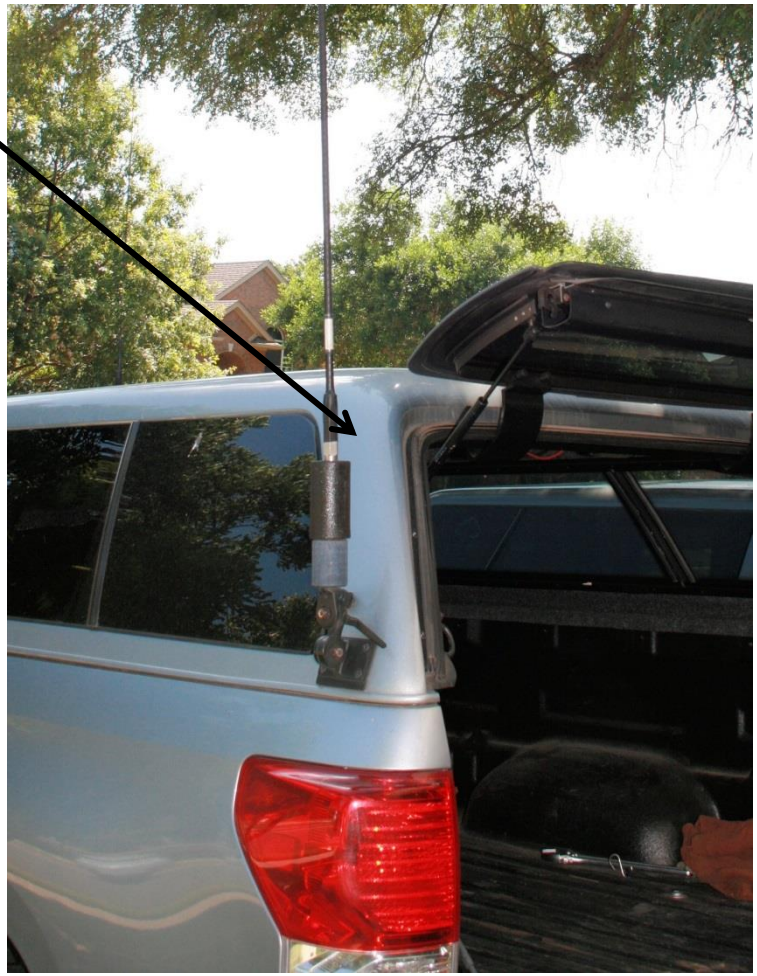
Tundra 2 Antenna System

Backing Plate

Fiberglass camper shell



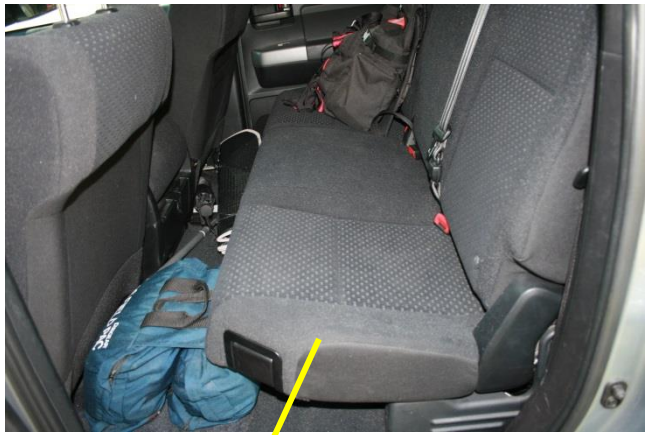
SG-230 with Coaxial Line Isolator

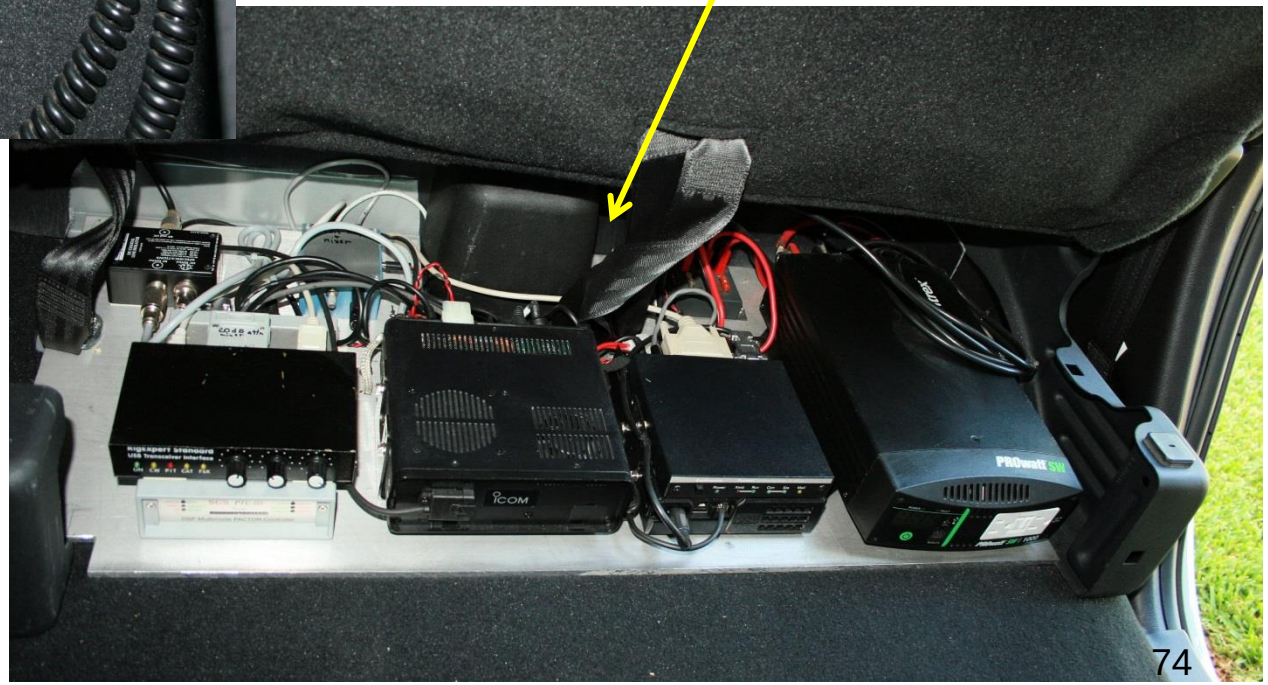


SG-303 Whip Antenna

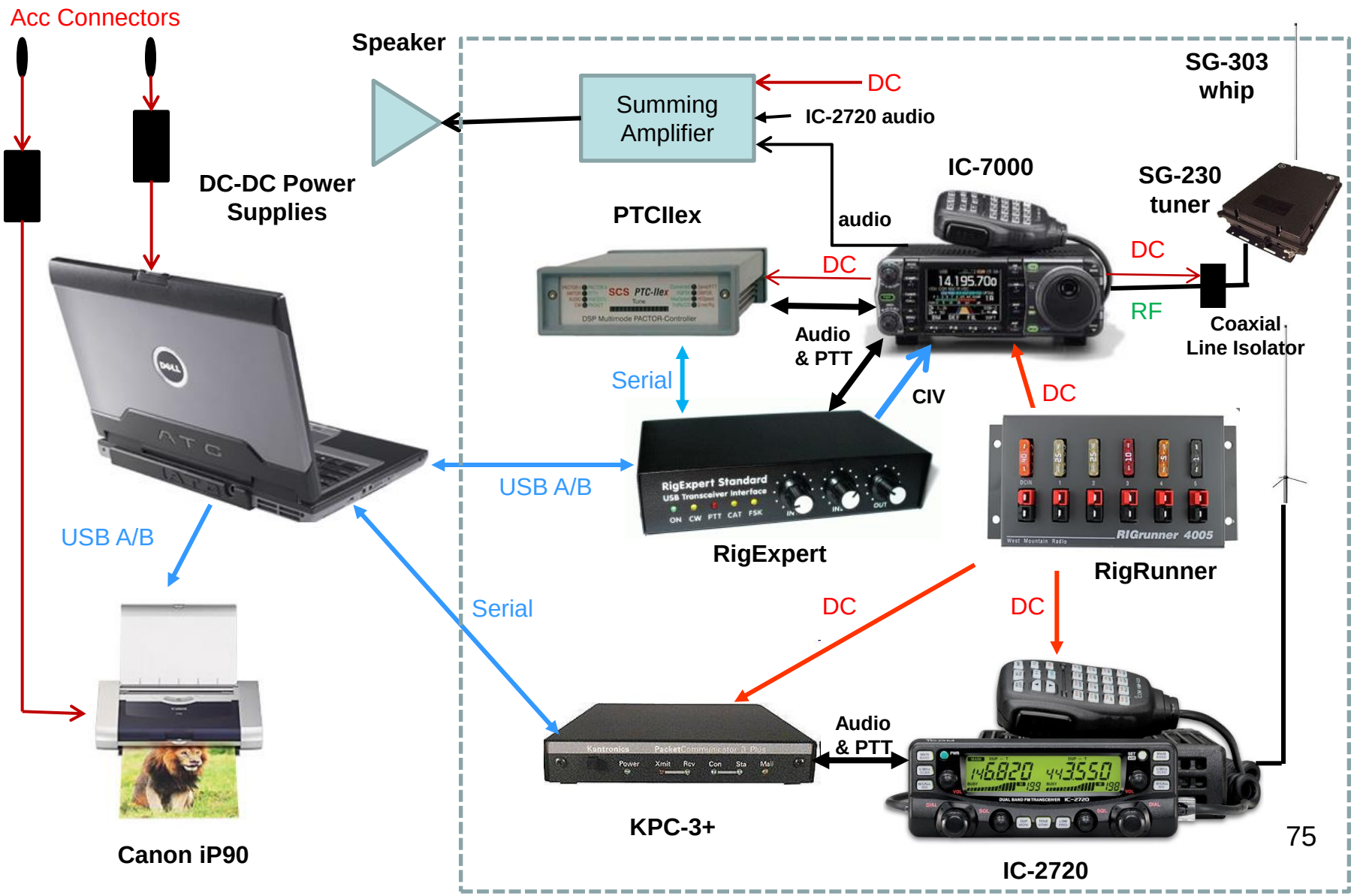
SGC-303 Whip Antenna

RIG MOUNTING





Equipment Interconnections



Performance Comparison

(Screwdriver versus Auto-tuner)

- Auto-tuned antenna performs as well as High-Q Screw Driver (higher/clearer position).
- Much easier to tune. Use mic control buttons to select RTTY mode, Key mic to tune then return to SSB mode.
- Worked multiple European stations on 20m, 17m and 15m.
- Checked into many NVIS MARS nets (40m, 60m, 80m) and relayed digital traffic.

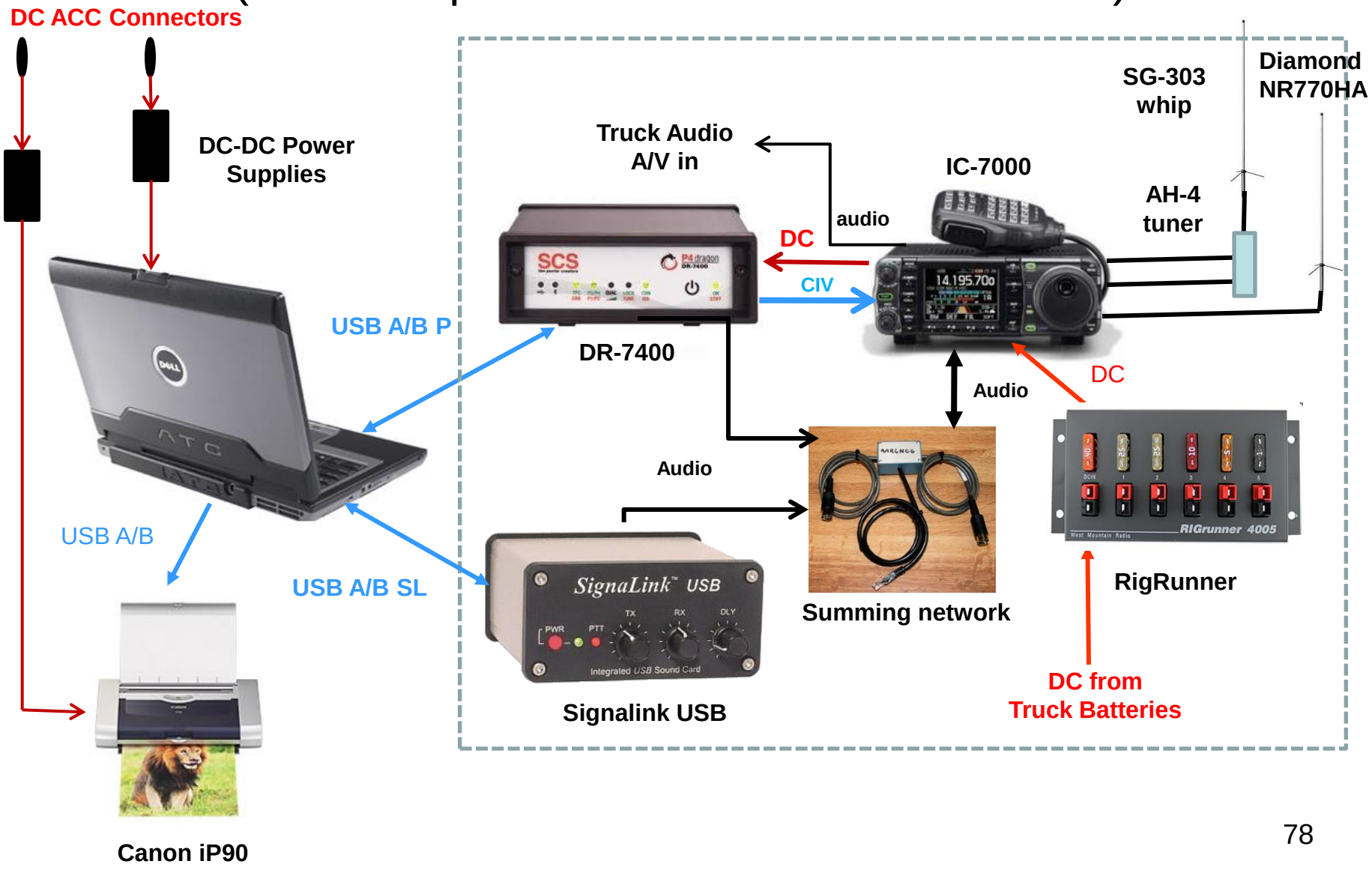
Example #3 F-250

(Compromised Antenna location – RV 5th Wheel Towing)

- HF Frequency Coverage – 2 MHz – 30 MHz (continuous)
- VHF Frequency Coverage, 2m, 70 cm
- Modes:
  - Voice – SSB & FM
  - VHF Packet
  - HF Pactor (P3)
  - HF Sound Card modes:
    - MT-63
    - Olivia
    - MIL STD 188-110A
    - RTTY (Including MIL STD Wide-Shift FSK)
- RF Power
  - HF – 100 watts
  - VHF – 50 watts

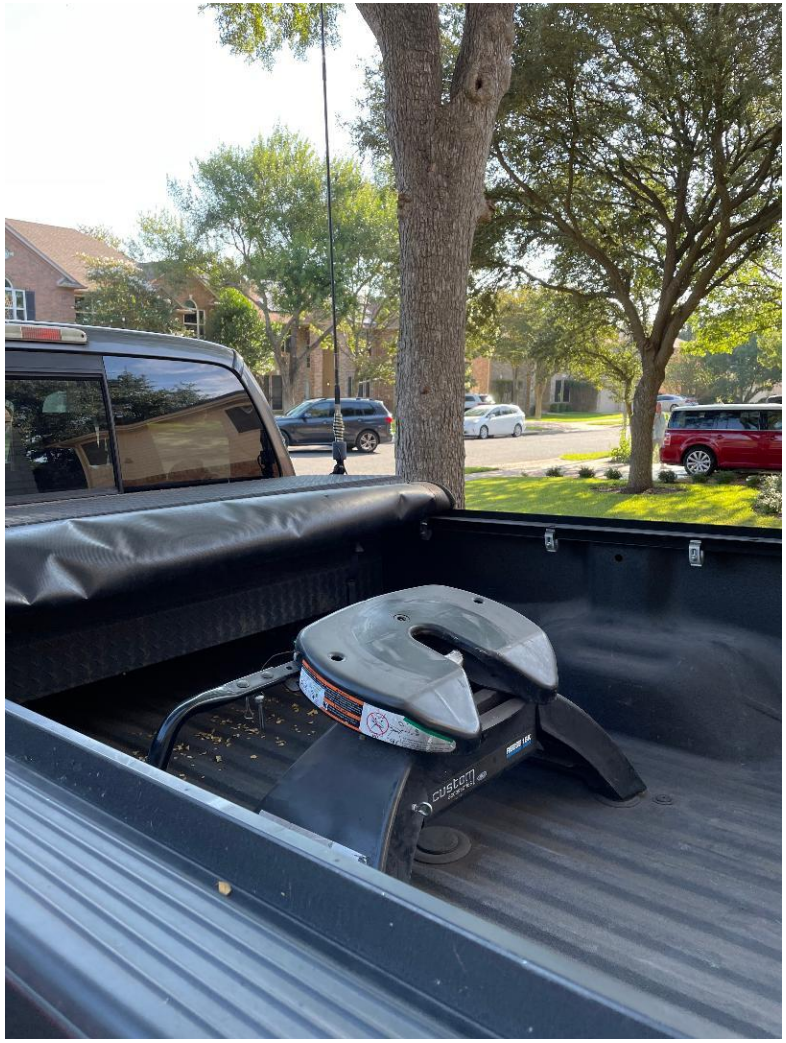
F-250 Equipment Interconnections

(Limited Space & 5th Wheel RV Limitation)



F 250 HF Antenna & Tuner

(SG-230 Auto-Tuner would not fit!)

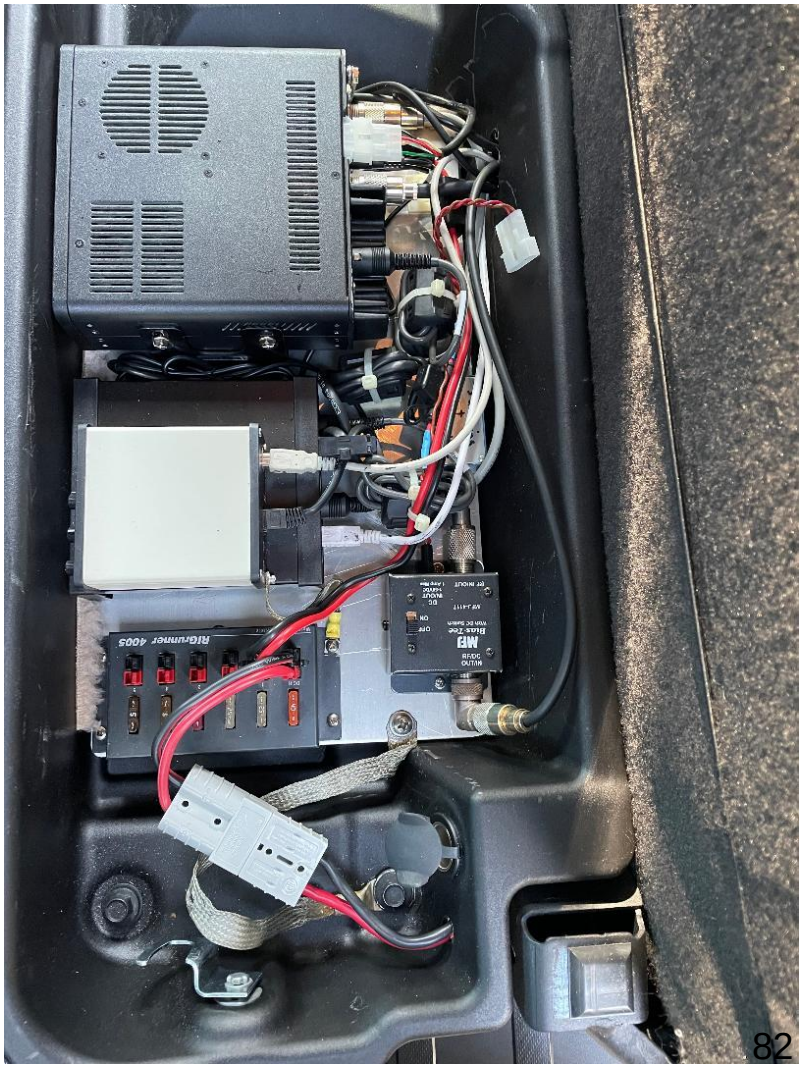


F 250 HF & VHF Mounts

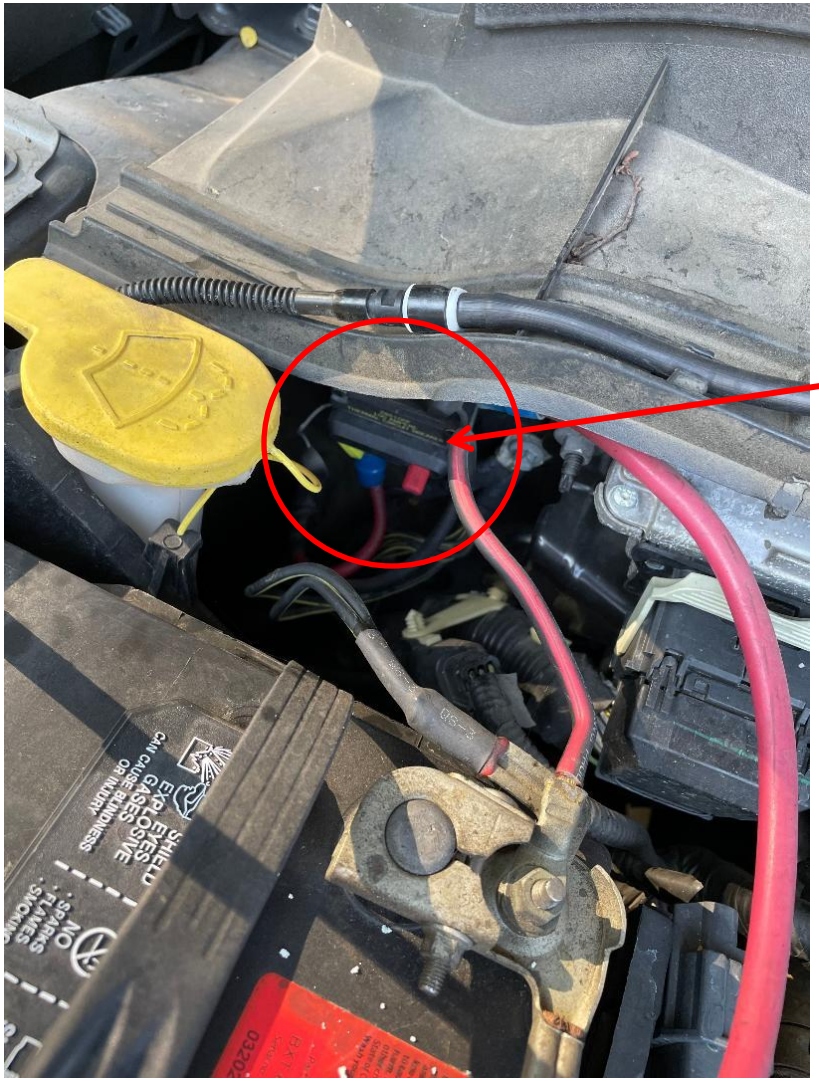
F 250 IC-7000 Console

F 250 Remote Hardware

(Under locking Back Seat)



F 250 Battery Wiring



Marine 100 Amp Circuit Breaker

Blue Sea Systems
285 Series – 100A

Conclusions

- Connect radio directly to the battery (+ and – leads).
- Install DC power wiring carefully to prevent damage to vehicle (fire). Place fuses or circuit breaker at battery.
- Auto-Tuned HF antenna appears to be as effective as screwdriver antenna and is a lot easier to tune!
- Antenna placement on vehicle will affect performance.
- Use a remote head or mic controlled radio and secure actual radio in a locked compartment (trunk, under locking seat or tool box).
- HF AM engine noise can be mitigated but may take some work. When selecting a new/used vehicle might want to take along a portable HF radio and test prospective vehicles.

Further Information

Contact Info:

Lew Thompson, W5IFQ
Cell – 512-587-9944
W5IFQ@att.net