20M Phased Dipoles Beam Bob Rose, KC1DSQ & Bob Glorioso W1IS

What are Phased Dipoles vs. a Yagi?

- Beams A technique for steering RF energy where you want it
- Yagis Passive elements, Reflectors & Directors create a beam of RF
- Phased Arrays/Dipoles actively drive dipoles to create a beam of RF
- Most Ham Phased Arrays use Verticals space 1/4 wavelength, phased 90 degrees apart.
- Elements are phased using delay lines different lengths of coax for different angles.
- We selected horizontal dipoles Higher gain than Verticals

Phased 20 m Dipoles



Spacing/Delays 14.175 MHz

RF from Dipole 1 arrives at Dipole 2 90 degrees or 17.3 nanoseconds later Dipole 2 is driven 90 degrees lagged from dipole 1



Oh my, more delay ~ 17.3 nS

• Dipole 1 wavefront arrives in phase with Dipole 2



Reverse Direction – Signals Cancel

Dipole 2 wavefront arrives out of phase with Dipole 1



Reality Sets In

- Goal build a phased dipole using the same 10 ft spacers as 40 m wire beam.
- The 10 ft problem: Determining the Phase Delay
- ¹⁄₄ wavelength is about 17.3 ft & we have 10 ft or 52 degrees!
- Two paths
 - Maximize Forward Gain (Usual Approach not simple for short span)
 - Minimize Rearward Radiation for Best Front-to-Back Ratio

Back to Basics



Point Source / Isotropic Radiator In Free Space = 0 dBi



Dipole in Free Space Squeezes Energy into Smaller Volume Gain = 2.15 dBi





40M dipole @40ft Azimuth 51° @6.13 dBi



Dipole azimuth 51° , 0dB = 6.13 dBi



Dipole azimuth 26°, 0dB = 3.85 dBi

Over Ground = Gain over Free Space

Minimize Rear Radiation = Max F/B

- Adjust the phasing line to achieve 180 degree phase difference
- Spacing is only 52 degrees
- Phasing line must be 180 52 = 128 degrees
- Squeezing the rear radiation forces it forward for More GAIN
- "Secret Sauce" Adjust Phase for Best F/B (Its > 128 degrees)

2 Dipoles are Much Better than One!

Total Field





14.175 MHz

EZNEC

Gain = 11.5 dBi

F/B = 20.9 dB

25 degree Takeoff Angle

75 degree Beamwidth



- 13'9" RG-316 50-ohm coax supplies phase delay (Phasing line)
- Latching Relay Selects which dipole has the phasing line
- 1-1 Choke/Balun isolates antenna and matching system from Feed Line

Combo Box





Matching Network

- A Pi network transformation from 50 ohms to 9 ohms
- Built on a PC board cut with a hobby knife



Direction Control

- The relay switches which dipole has the phasing line in its feed path.
- It is a 12 V single coil latching relay
- A positive pulse selects one direction, a negative pulse selects the other.
- Control signal is sent via a bias tee

Bias Tee Circuit & Phase Reverse Circuit



On the Air

- Using KX3, 5 W, worked Europe with 55 or better signal reports
- Pointing towards Europe, we heard very few US stations
- Pointing towards US, we heard no European stations
- Measured 2 5 S units F/B with help from several PART members Steve, W1KBE, Colin, W1DJR, Bonnie, AC1IY, Frank, KB1HSC, Allison, KB1GMX, and Greg, N1DAM

A Typical UHF Phased Array on Cape Cod



Published Articles by (Bob)²

- "A Different Twist on Dual Band VHF/UHF J-Pole," CQ, June 2019
- "Multiband Off-Center-Fed Dipoles for 160 & 80 Meters," CQ, June 2020
- "A Simple Dual-Band Upgrade for Your 40-Meter Dipole," CQ, Dec 2020
- "Balun Basics: What's a Balun? Why a Balun? How Do I Make a Balun?" CQ, Jan 2021, Publication Pending in Japan
- "A New Design of a 40-6-Meter Off-Center-Fed Dipole," CQ, May 2021
- "A Portable Two-Element 40-Meter Wire Beam," QST, June 2021
- "My Dipole has Gain!", CQ Magazine, August 2021
- "A Portable 20M Phased Array Beam, Bob Rose, QST, March 2022
- "Phased Array 20M Dipoles," QST-In Depth, March 2022.
- "A Deep Dive into End-Fed Half-Wave Antennas," CQ, December 2021

Articles only on OCFMasters.com

Original text submitted, "A Portable Two-Element 40-Meter Wire Beam,"

"The Design Principles of OCF Masters Antennas," March 2020

"End Effect and Harmonic Antenna Design," Nov 2020

Latest Project: "Wire Antennas for 160m-70ccm" Book

THANK YOU