

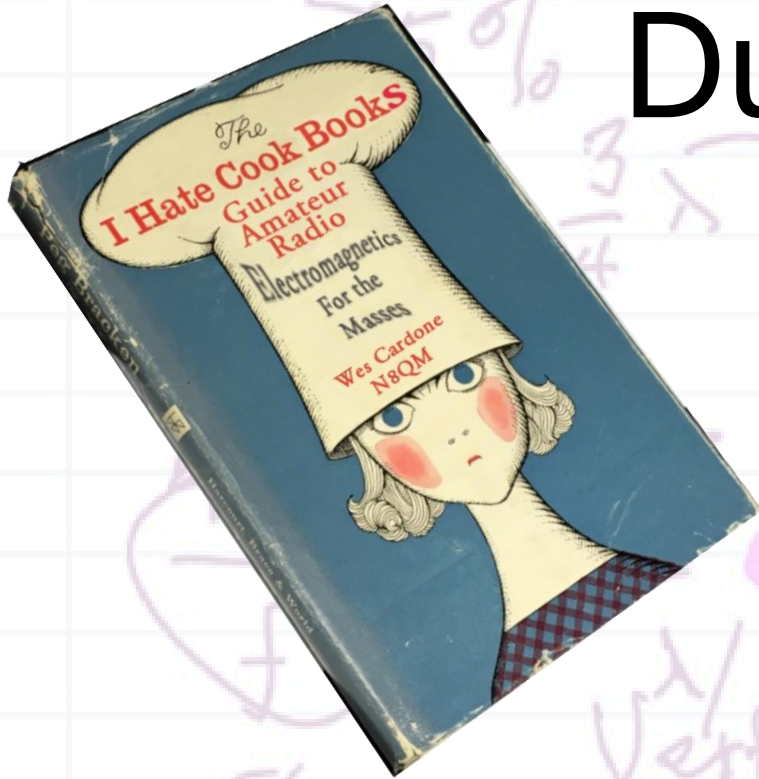
Antenna Phasing Scheme

Dual Antenna Feed

Wesley Cardone, N8QM

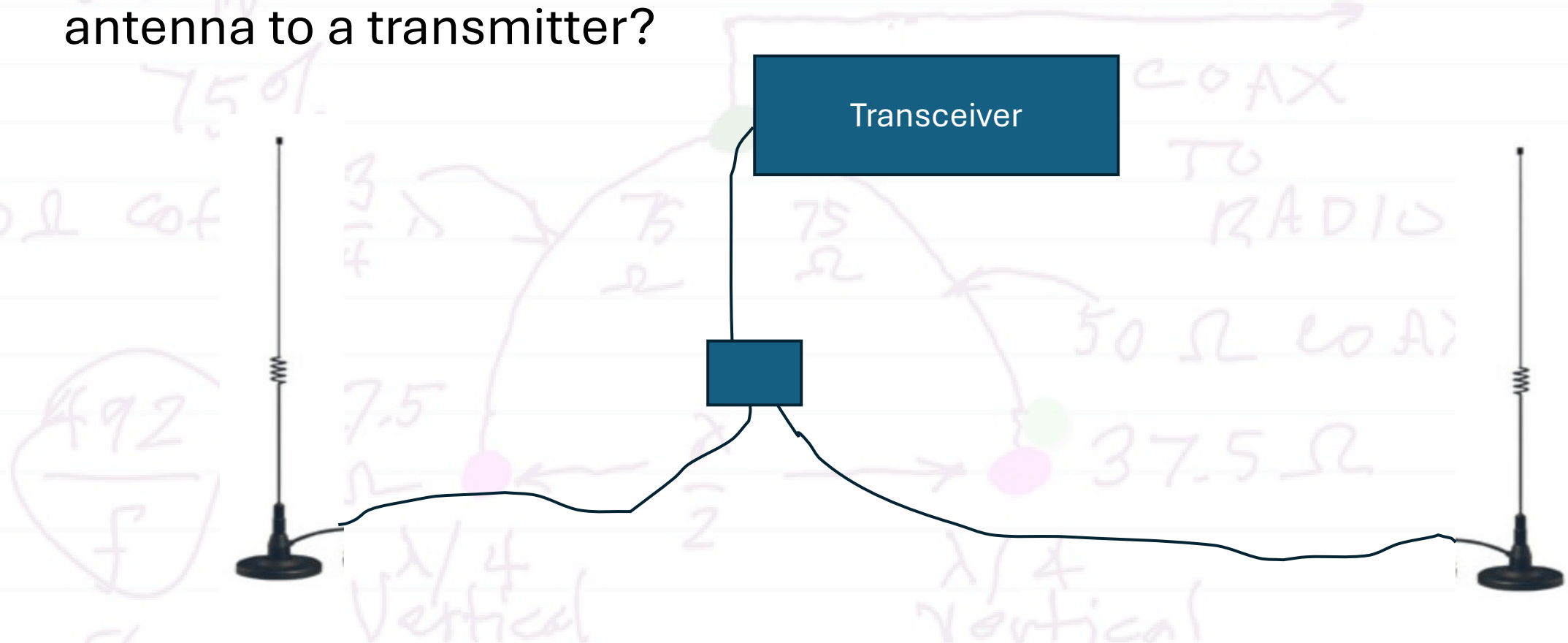
August 2024

Chelsea Amateur Radio Club



Feeding Dual Antenna Configuration

- How do you make two 50 Ohm antennas look like one 50 Ohm antenna to a transmitter?

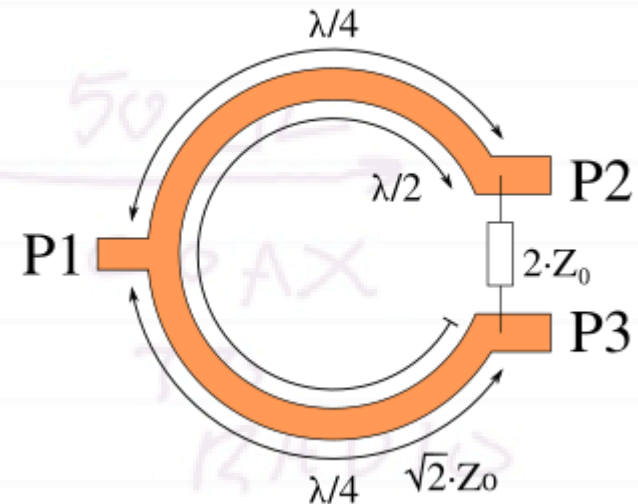


Antenna Phasing Scheme

Wilkinson Bridge

- Invented in 1960 by Ernest J. Wilkinson, Jr.
 - Veteran of WWII
 - Master Science Stanford University
 - Nuclear weapons development for Sandia

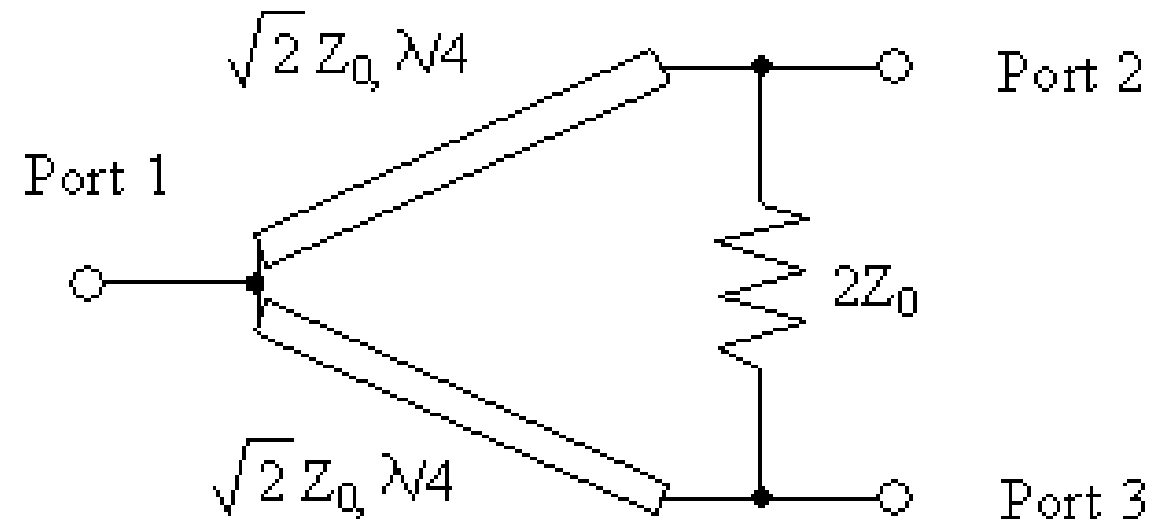
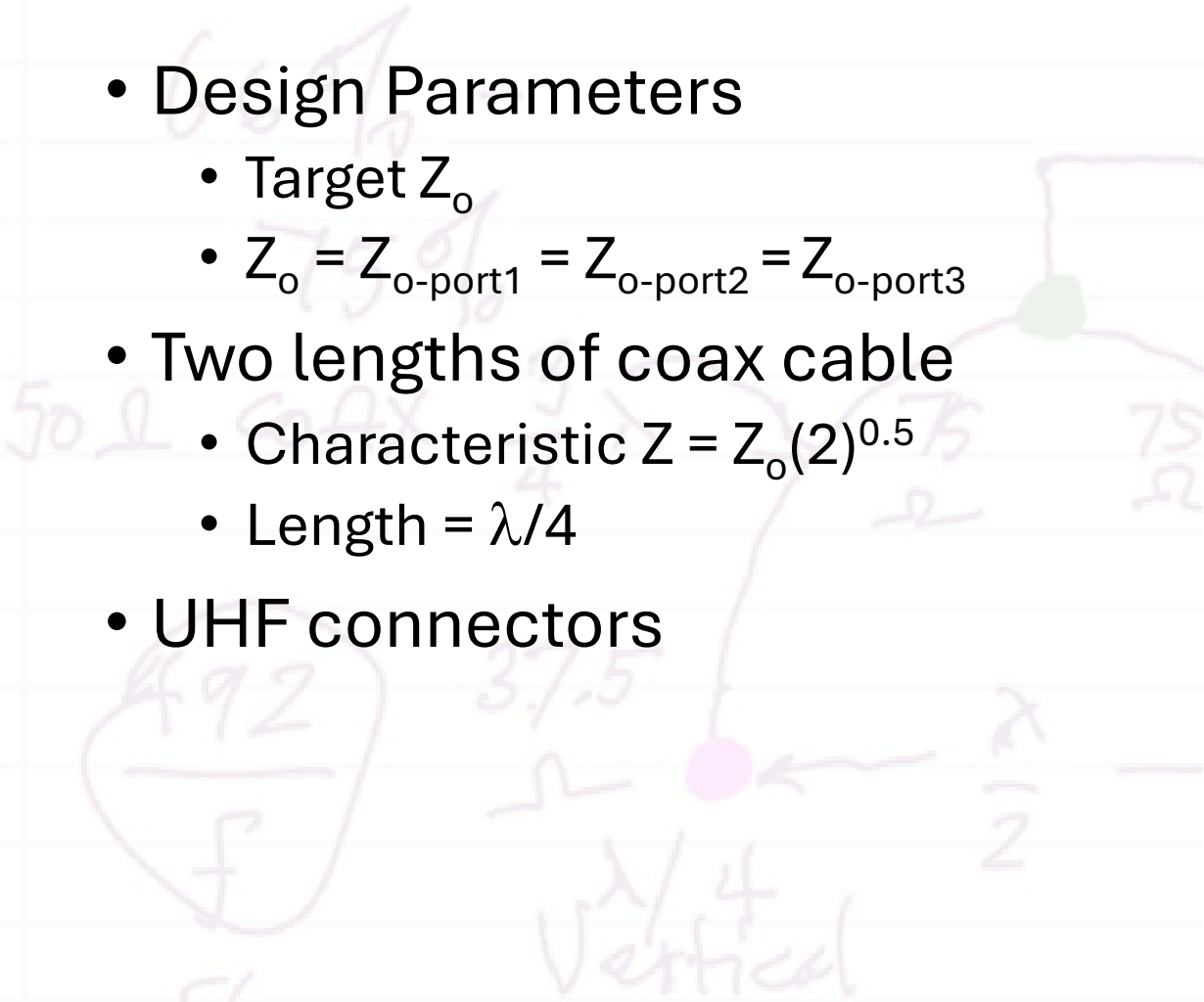
- Most applicable to microwave engineering
- Used both as
 - Power splitter
 - Power combiner
- Is lossless
- Limitations
 - Narrow bandwidth



Antenna Phasing Scheme

Specifications and Materials Used

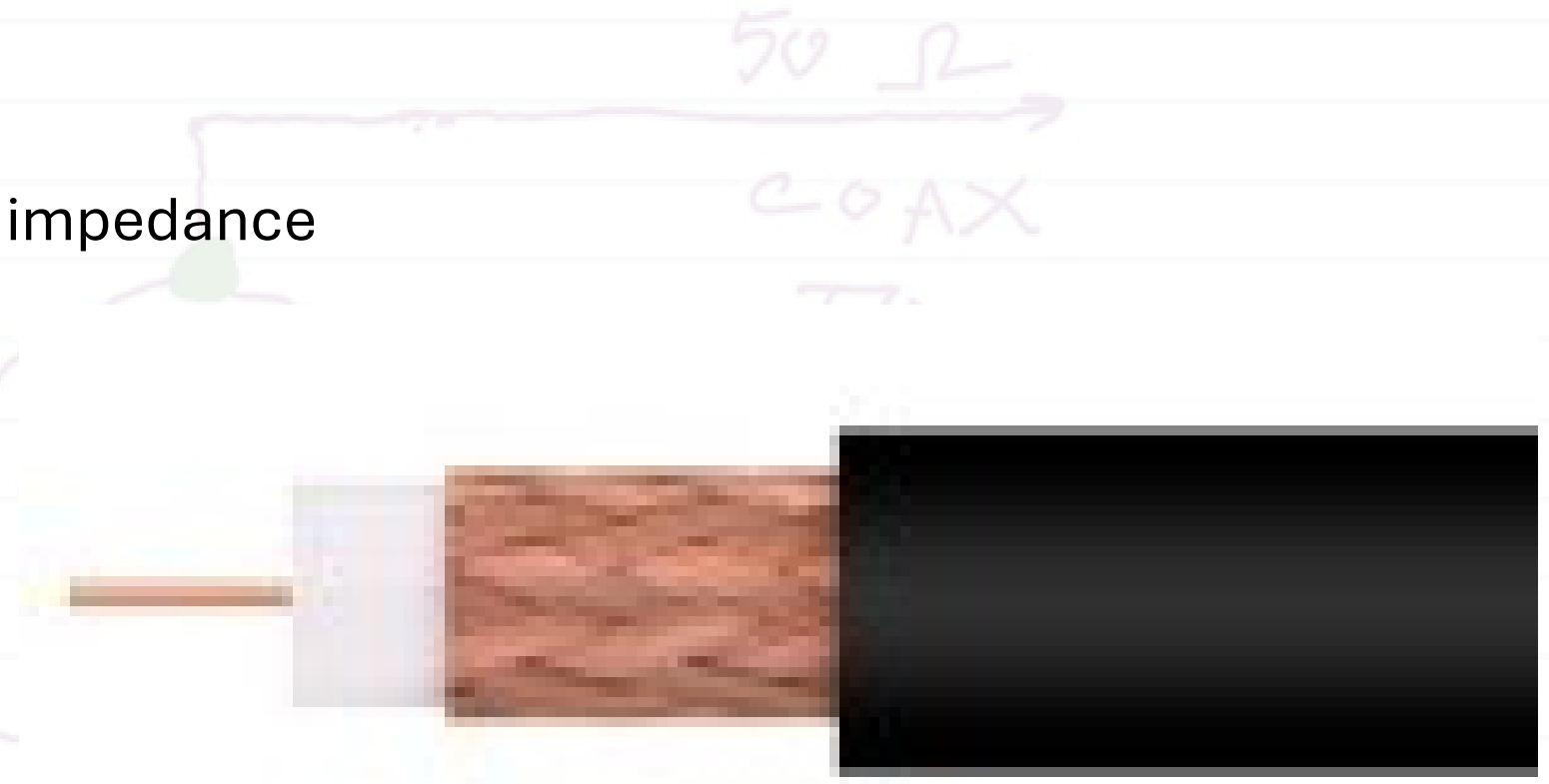
- Design Parameters
 - Target Z_o
 - $Z_o = Z_{o-port1} = Z_{o-port2} = Z_{o-port3}$
- Two lengths of coax cable
 - Characteristic $Z = Z_o(2)^{0.5}$
 - Length = $\lambda/4$
- UHF connectors



Antenna Phasing Scheme

Wilkinson Bridge Power Divider

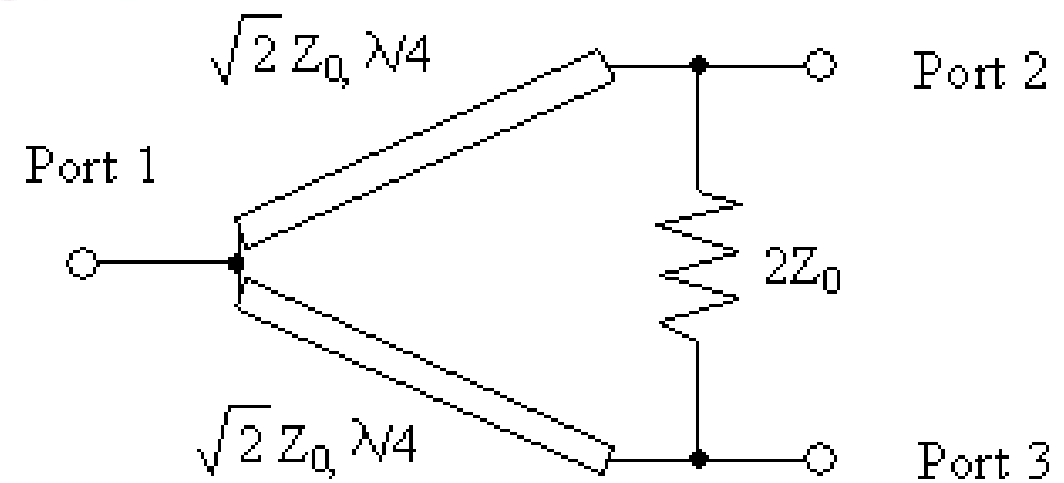
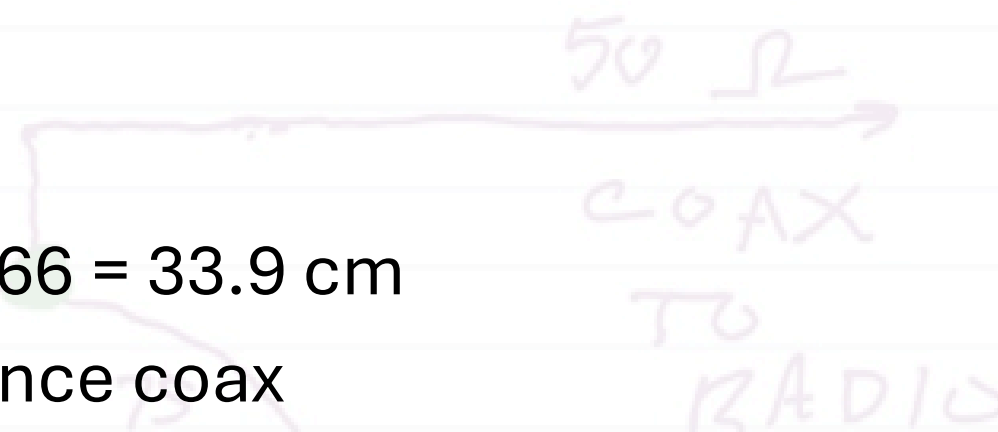
- Will use coax
 - RG-59/u
 - 75 Ohm characteristic impedance
 - 67 pF/m
 - Delay = 5.07 ns/m
 - $V_f = 0.66$
 - Loss
 - 0.04dB/ft
 - 0.13 dB/m
- UHF connectors



Antenna Phasing Scheme

Specifications and Materials Used

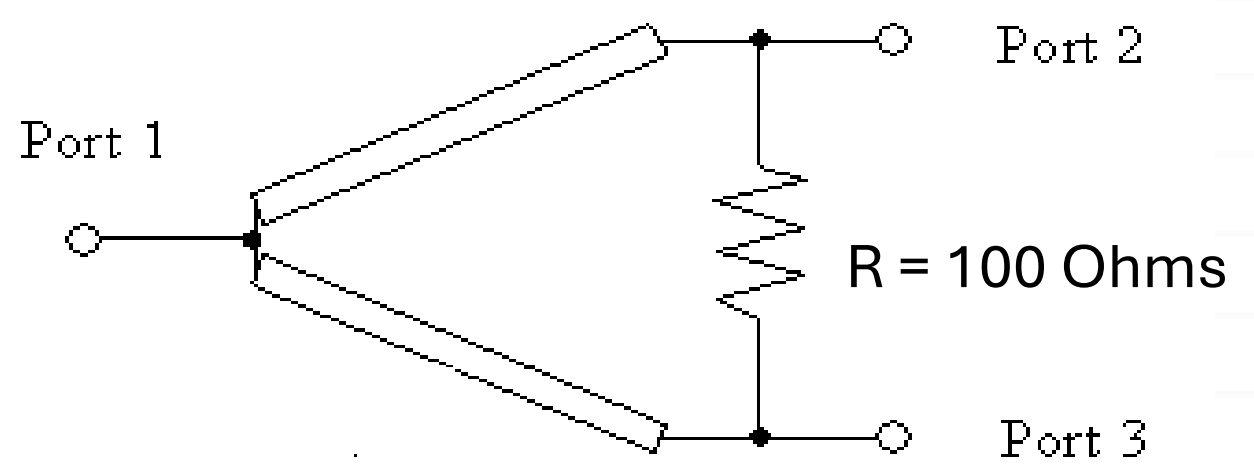
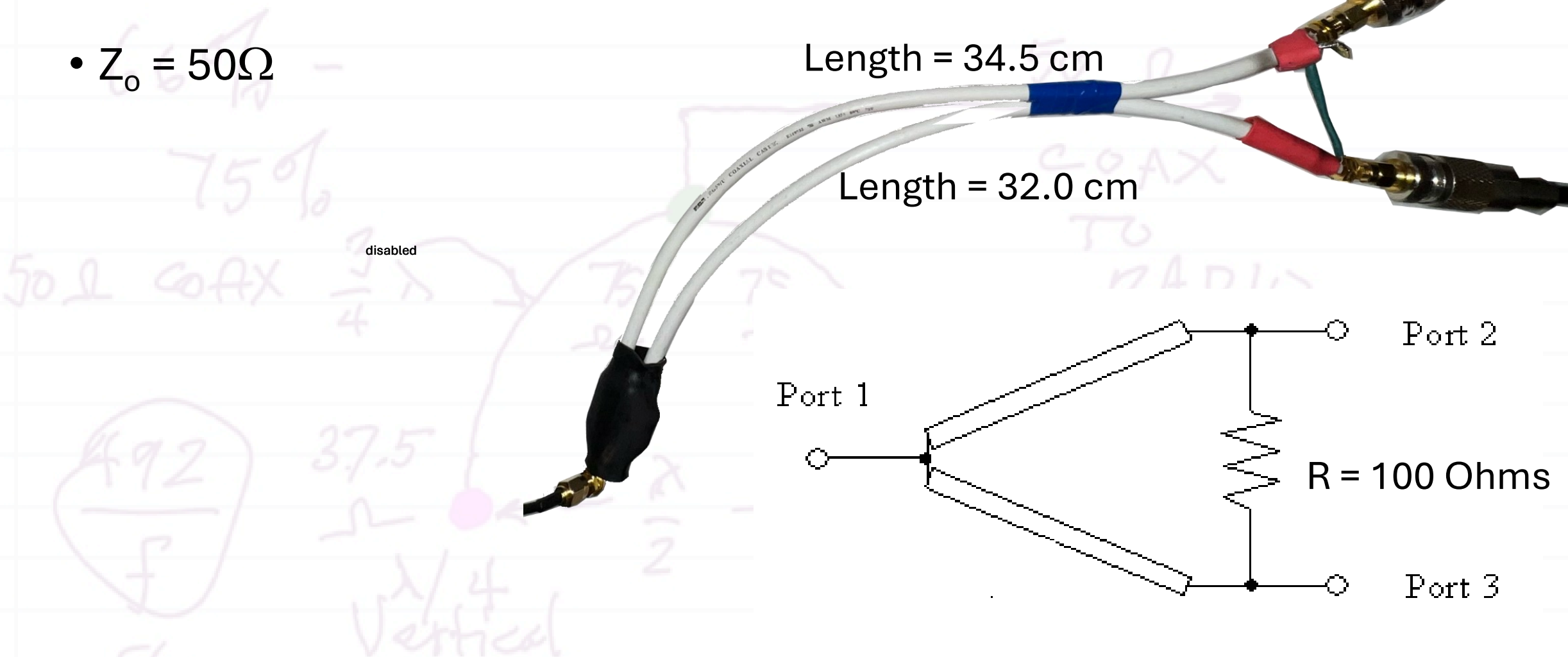
- $Z_0 = 50\Omega \rightarrow$
- $f_0 = 146 \text{ MHz}$
- Coax length = $300/146/4 * 0.66 = 33.9 \text{ cm}$
- Ideal characteristic impedance coax
 - $50 * (2)^{0.5} = 71 \text{ Ohms}$
 - 75 Ohms is close enough to 71 Ohms.



Antenna Phasing Scheme

What Was Made

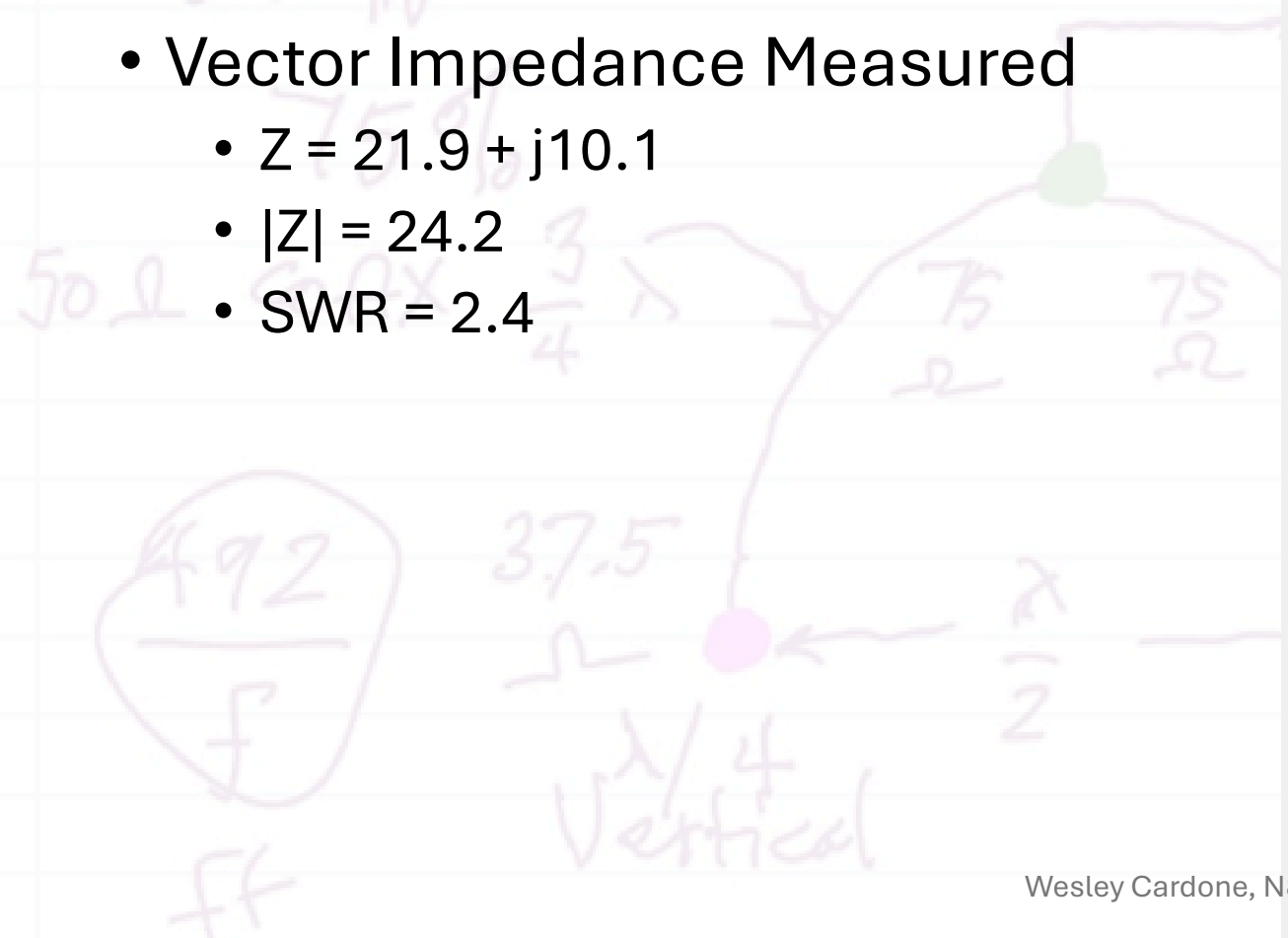
- $Z_0 = 50\Omega$



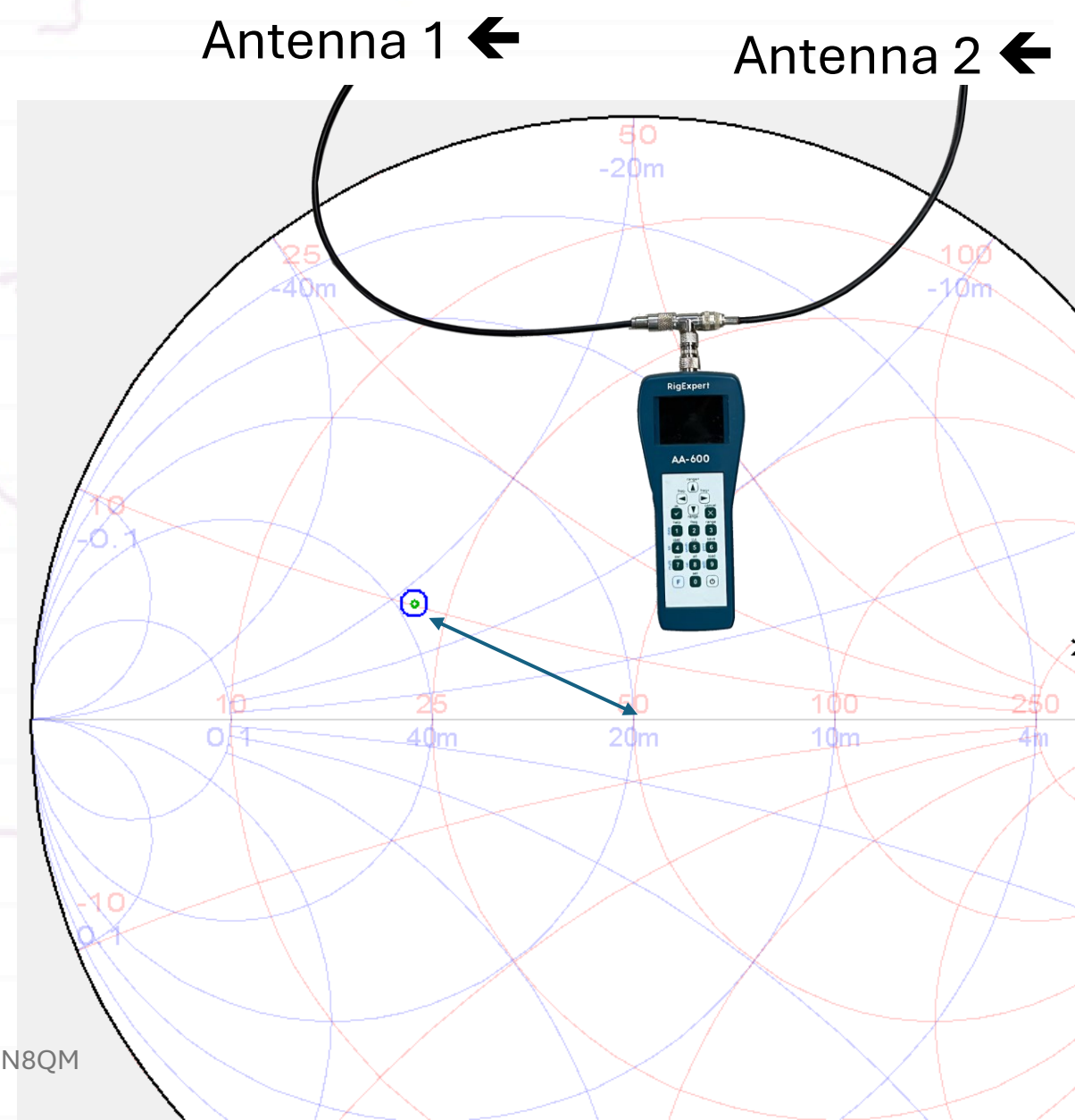
Antenna Phasing Scheme

Testing Barrel divider

- $f_o = 145.5$ MHz
- Vector Impedance Measured
 - $Z = 21.9 + j10.1$
 - $|Z| = 24.2$
 - $SWR = 2.4$



Wesley Cardone, N8QM



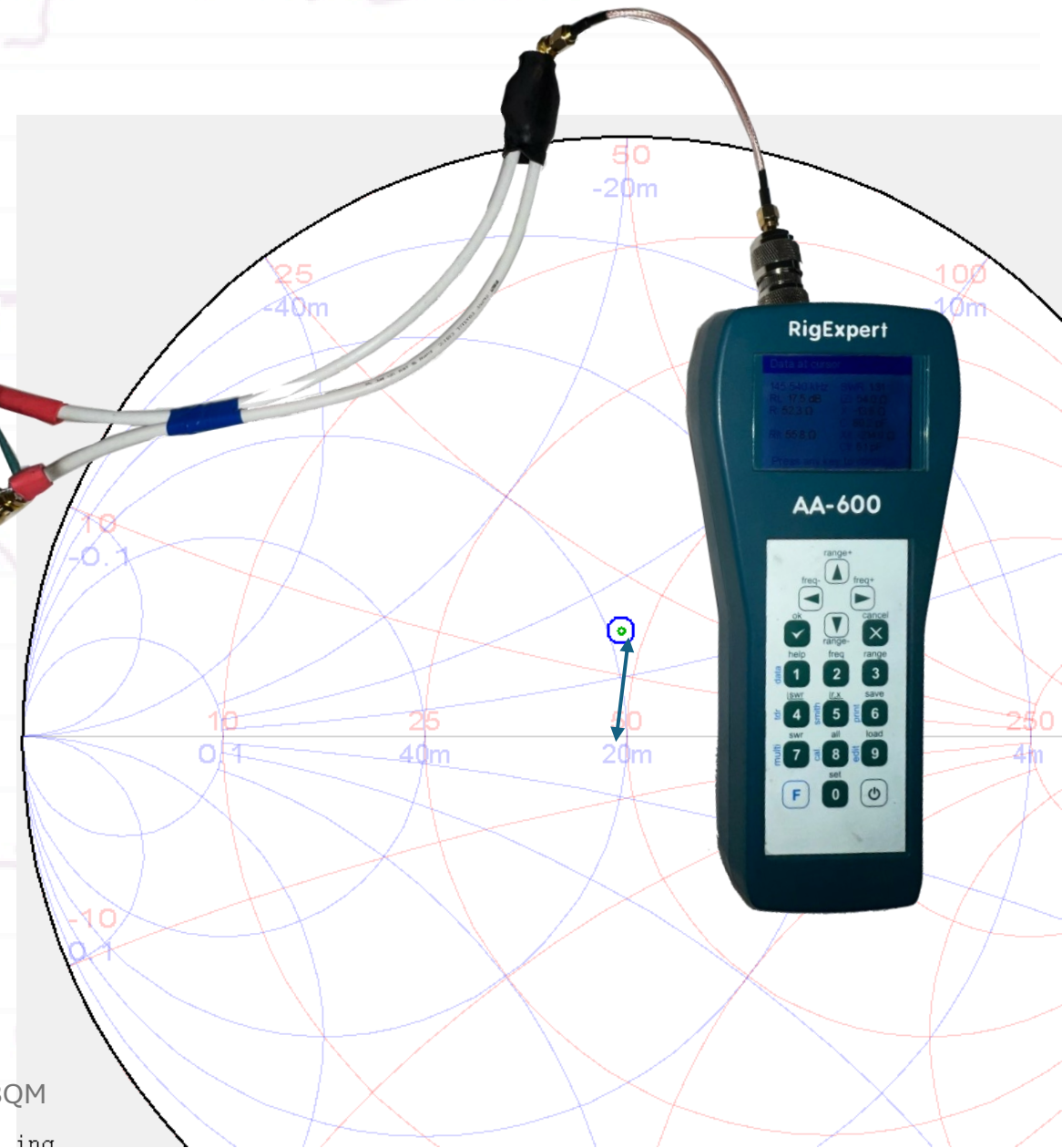
Antenna Phasing Scheme

Testing via Wilkinson

- $f_0 = 145.5$ MHz
- Vector Impedance
 - $Z = 46.1 - j16.9$
 - $|Z| = 24.2$
 - SWR = 1.4
- Antennas Reversed
 - $Z = 52.3 - j13.6$
 - $|Z| = 24.2$
 - SWR = 1.3

Antenna 1 ←

Antenna 2 ←



Antenna Phasing Scheme

Questions

