Extra Class License Class
Antennas and Transmission lines

November 1, 2011

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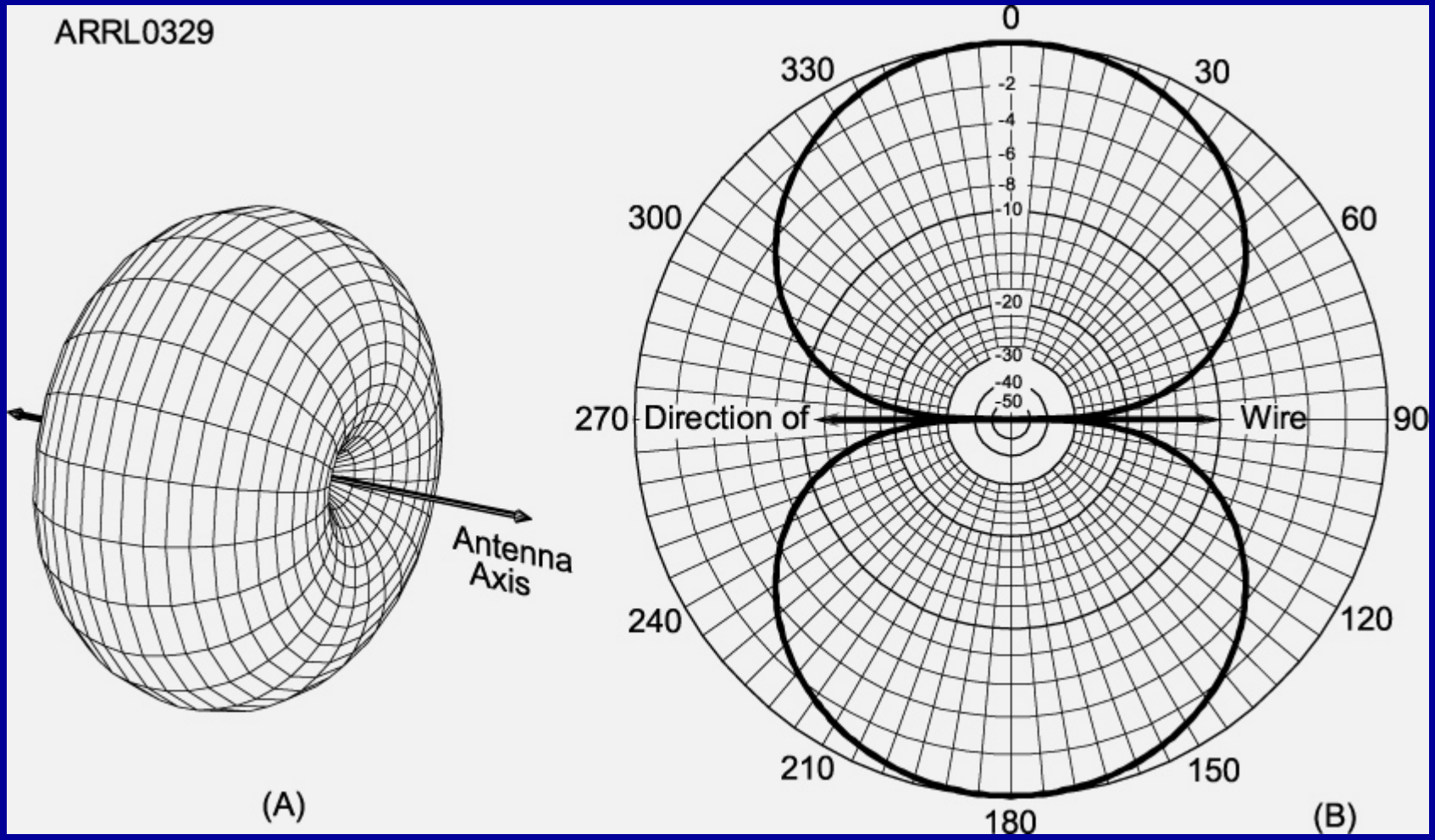
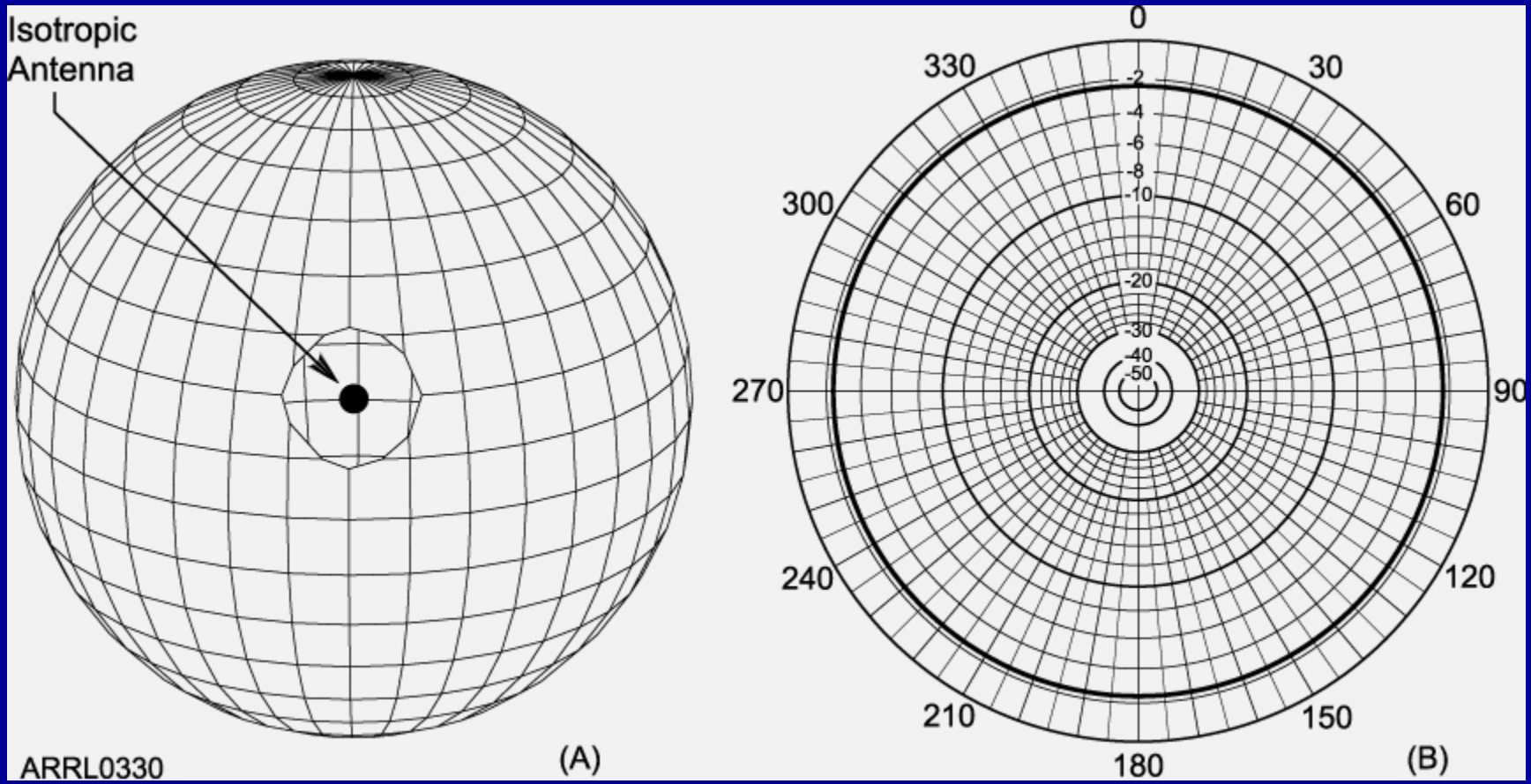
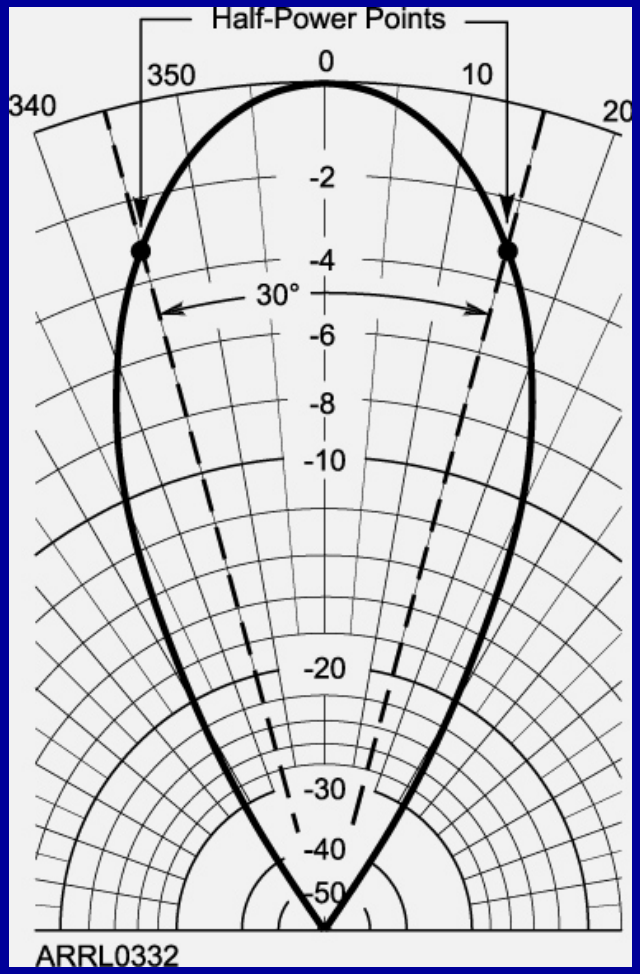
9-1: Dipole 3D and Azimuth Pattern



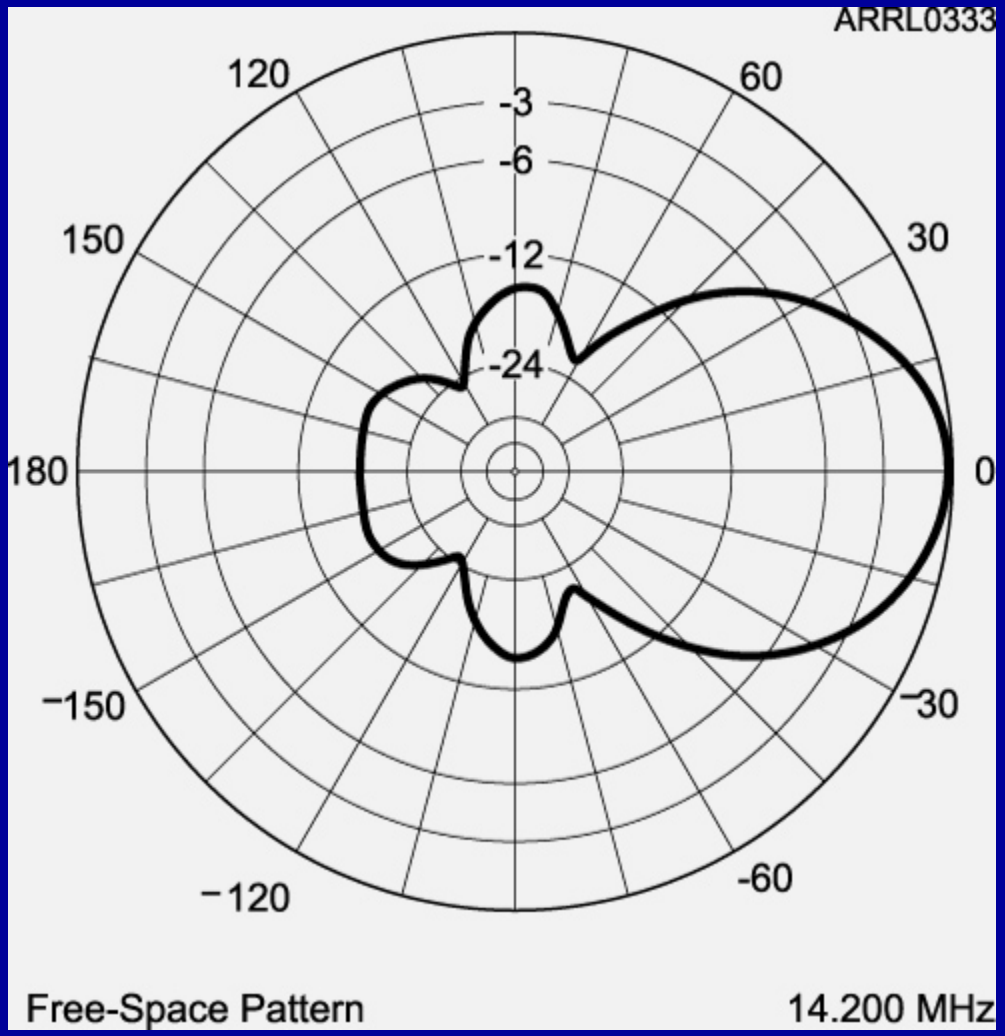
9-2: Isotropic reference antenna



9-4: Beamwidth of directional antenna



9-5: Pattern ratios

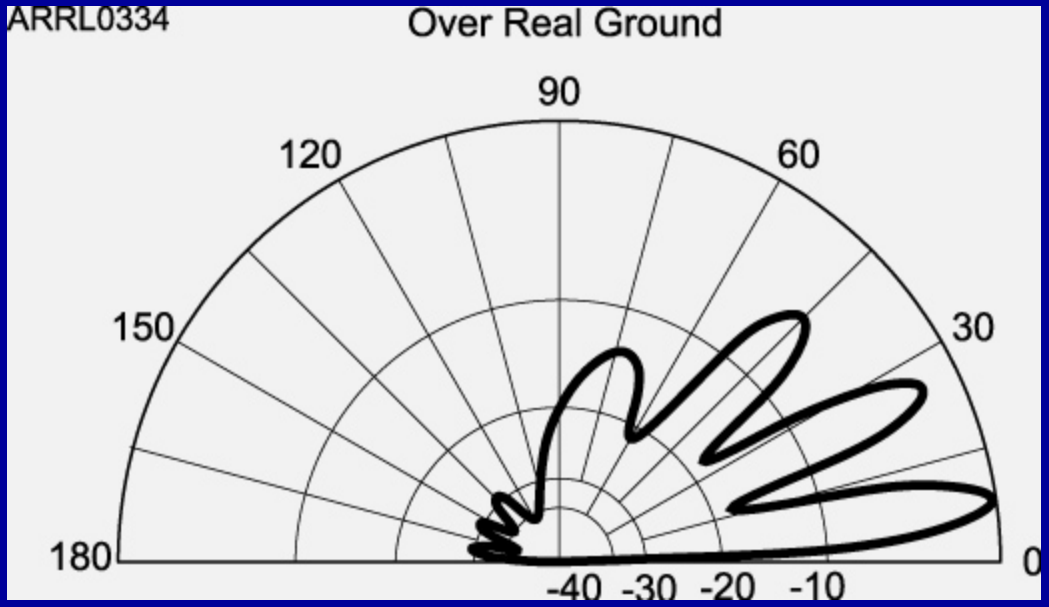


F/B = front/back

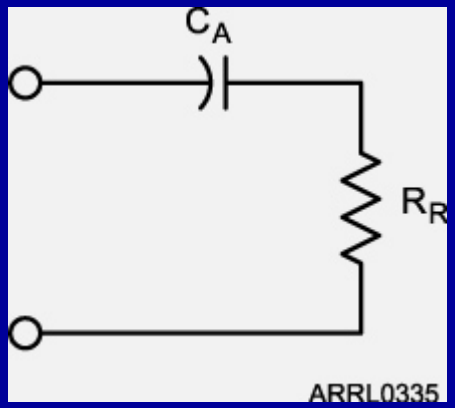
F/R = front/rear

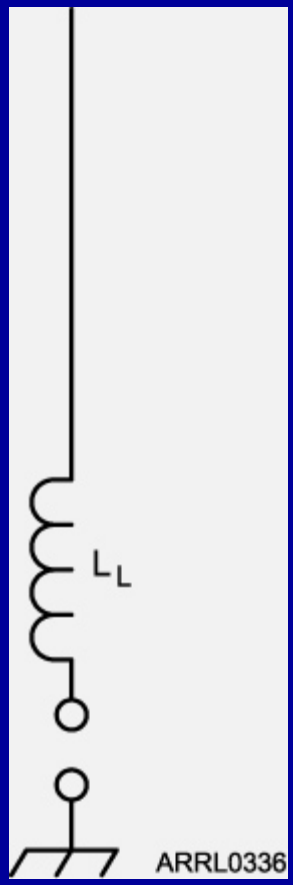
F/S = front/side

9-6: Elevation pattern of typical Yagi antenna

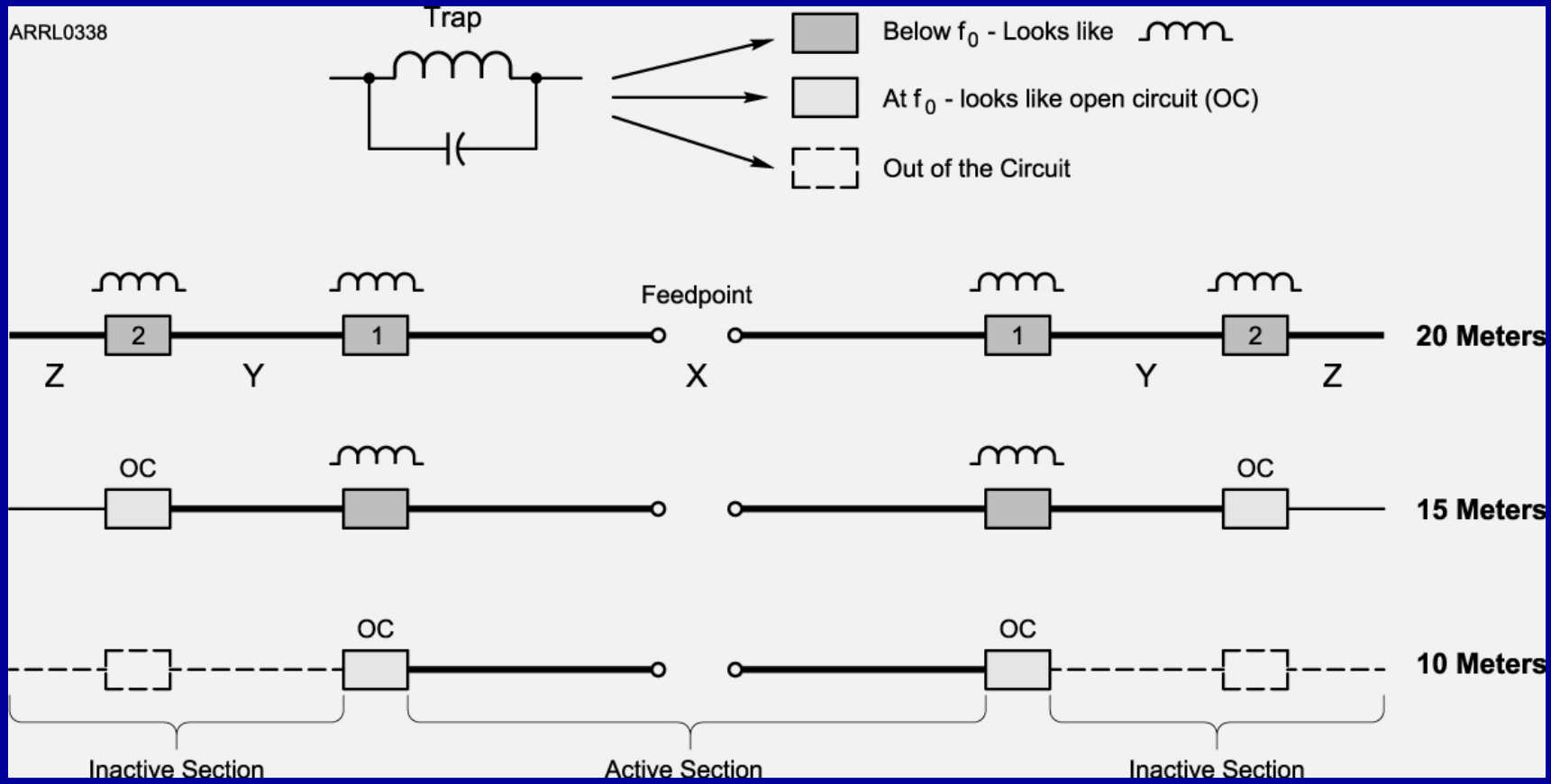


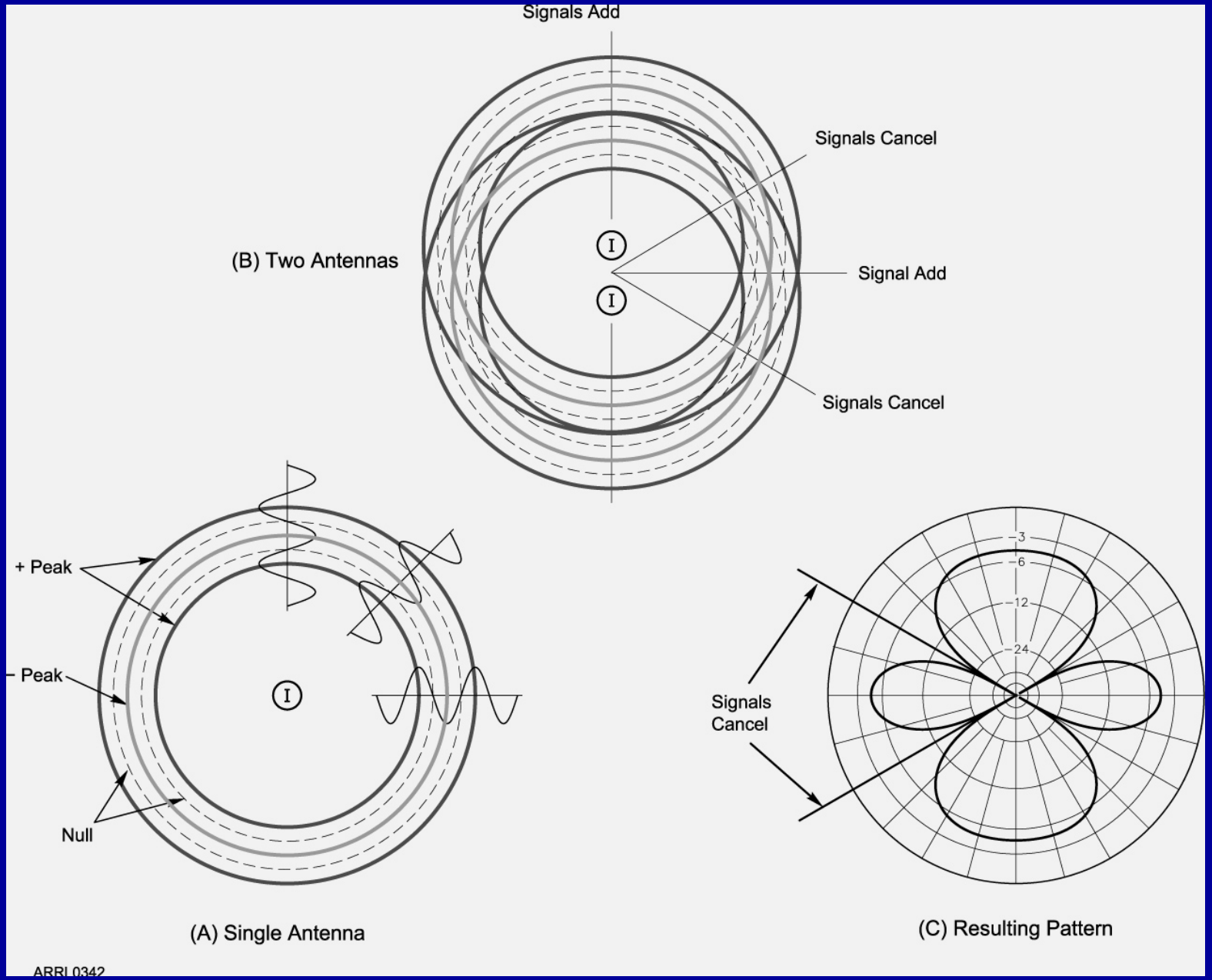
Shortened antennas: low R_R; series X_C



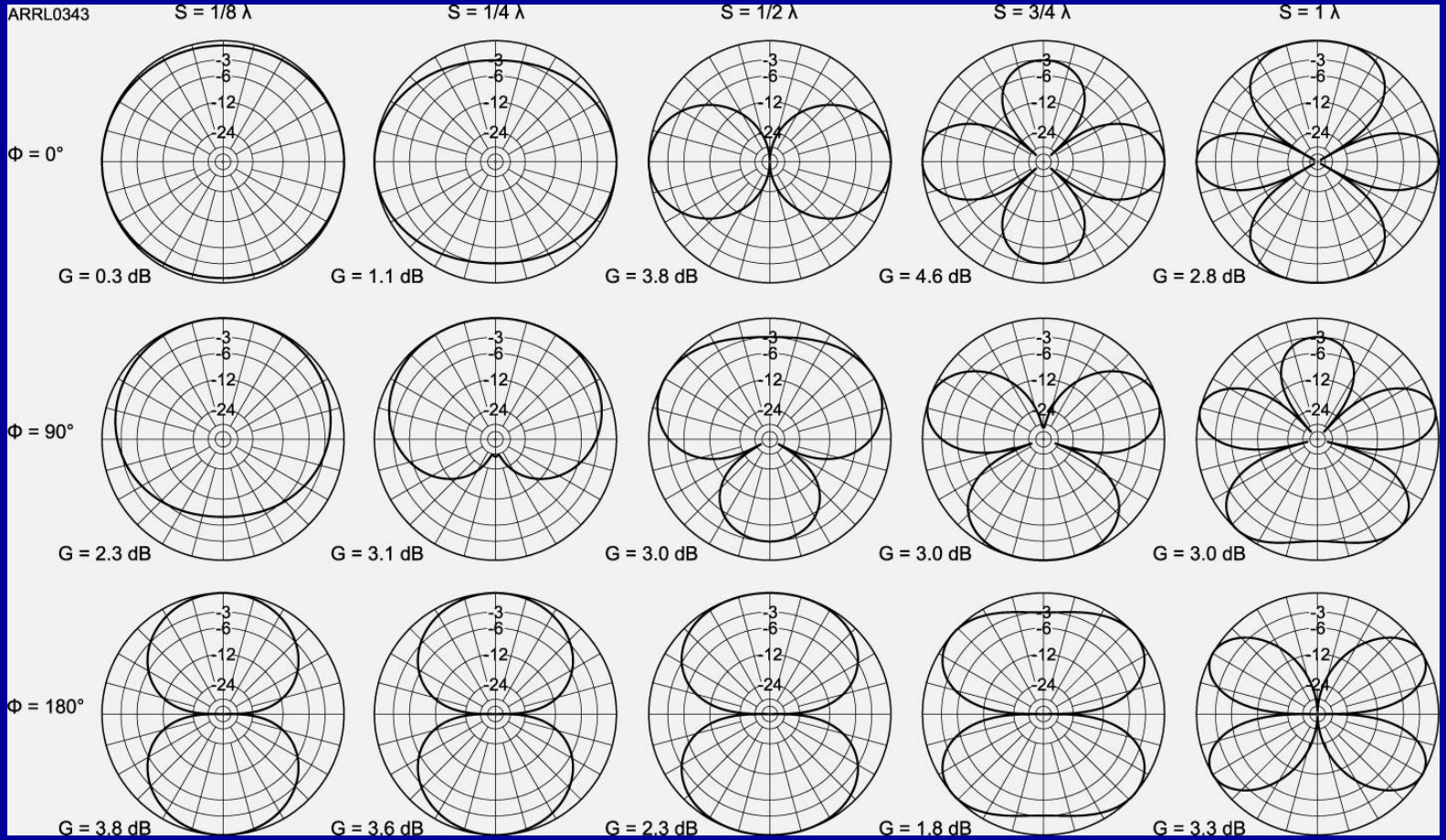


9-10: Traps for multiband operation

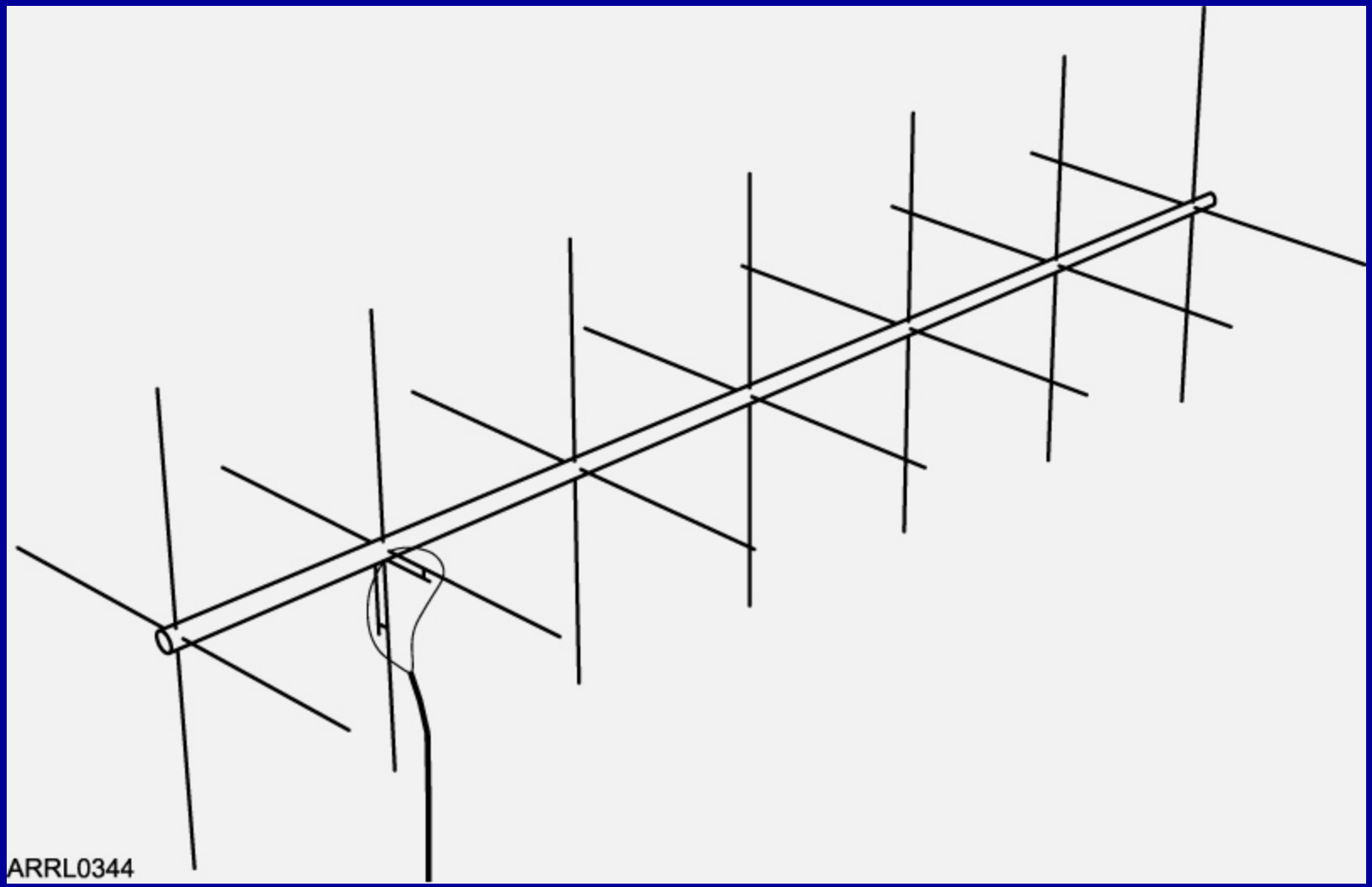



Signals Add
Signals Cancel
(B) Two Antennas
I
I
Signal Add
Signals Cancel
+ Peak
– Peak
Null
I
(A) Single Antenna
3
6
12
24
Signals
Cancel
(C) Resulting Pattern
ARRL 0342

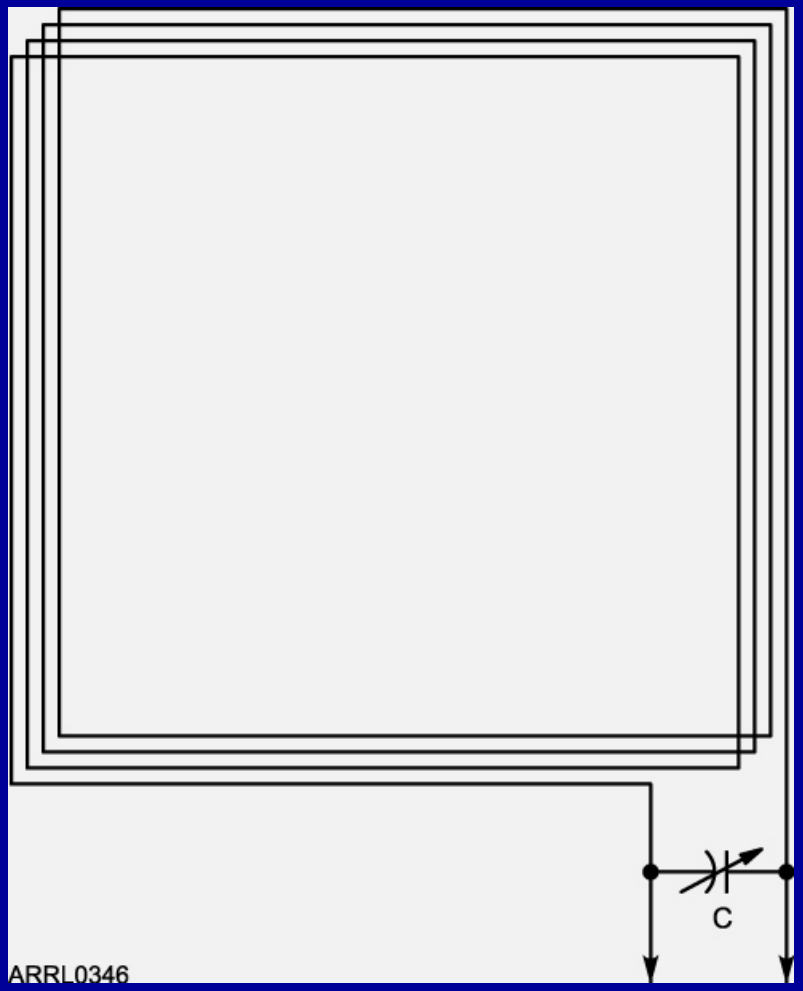
9-16: Phased vertical array



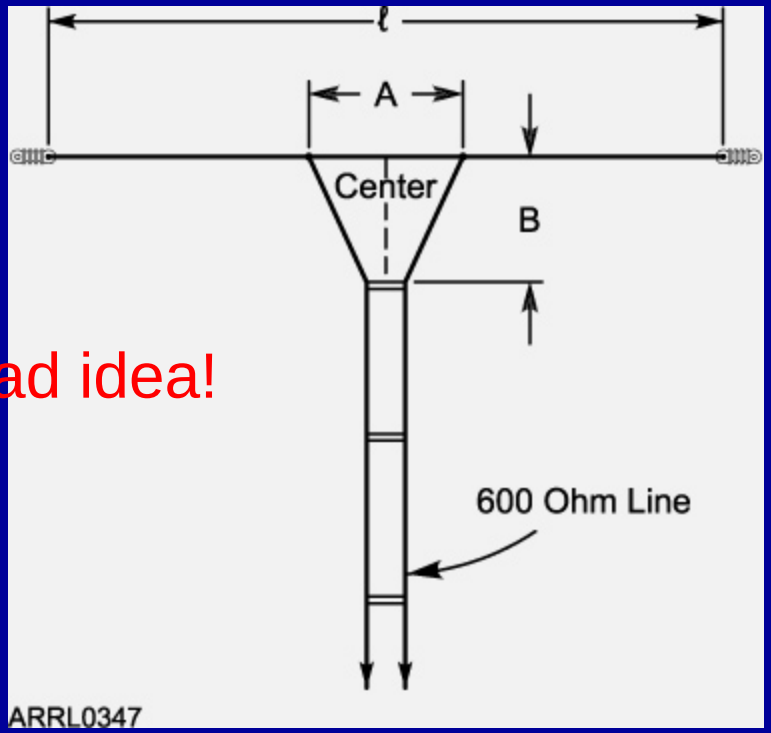
9-17: Circular Polarization



9-19: Loop antenna

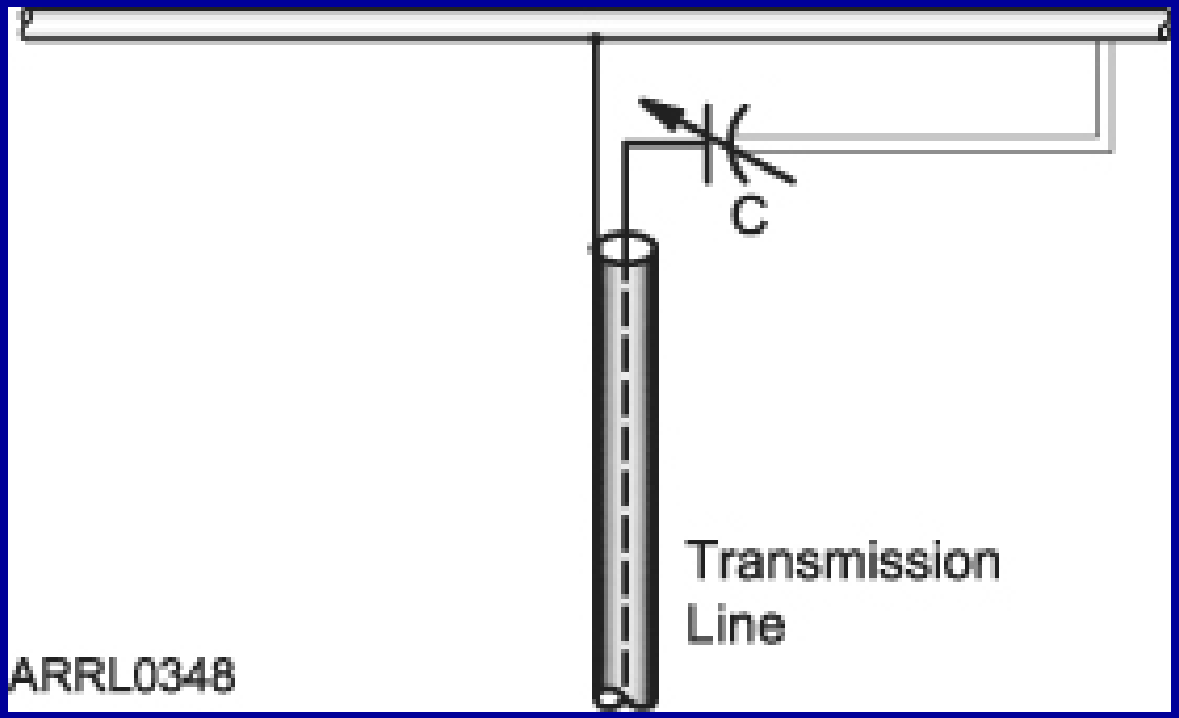


9-22: Impedance Matching at the antenna: delta match



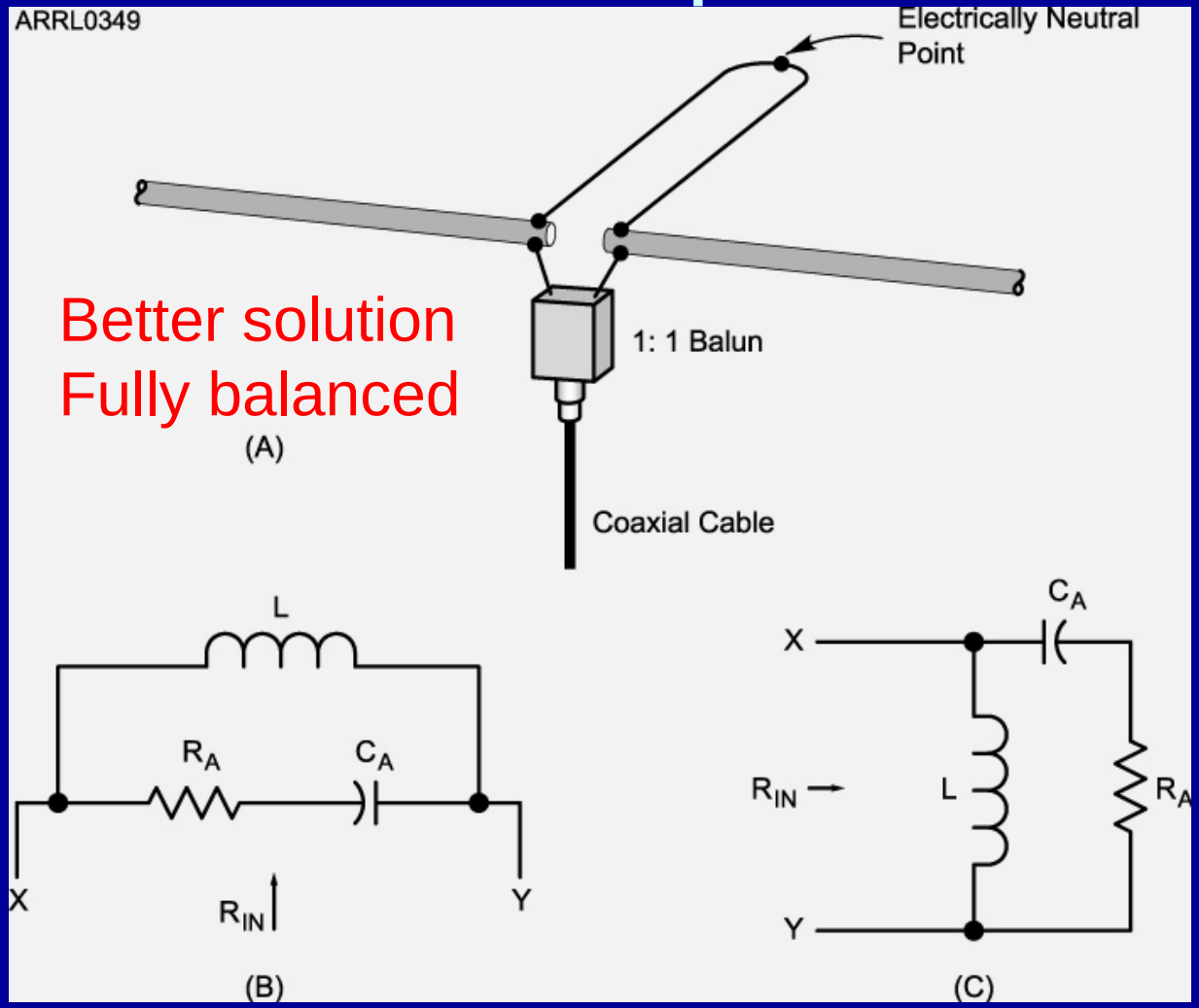
Bad idea!

9-23: Impedance Matching at the antenna: Gamma Match

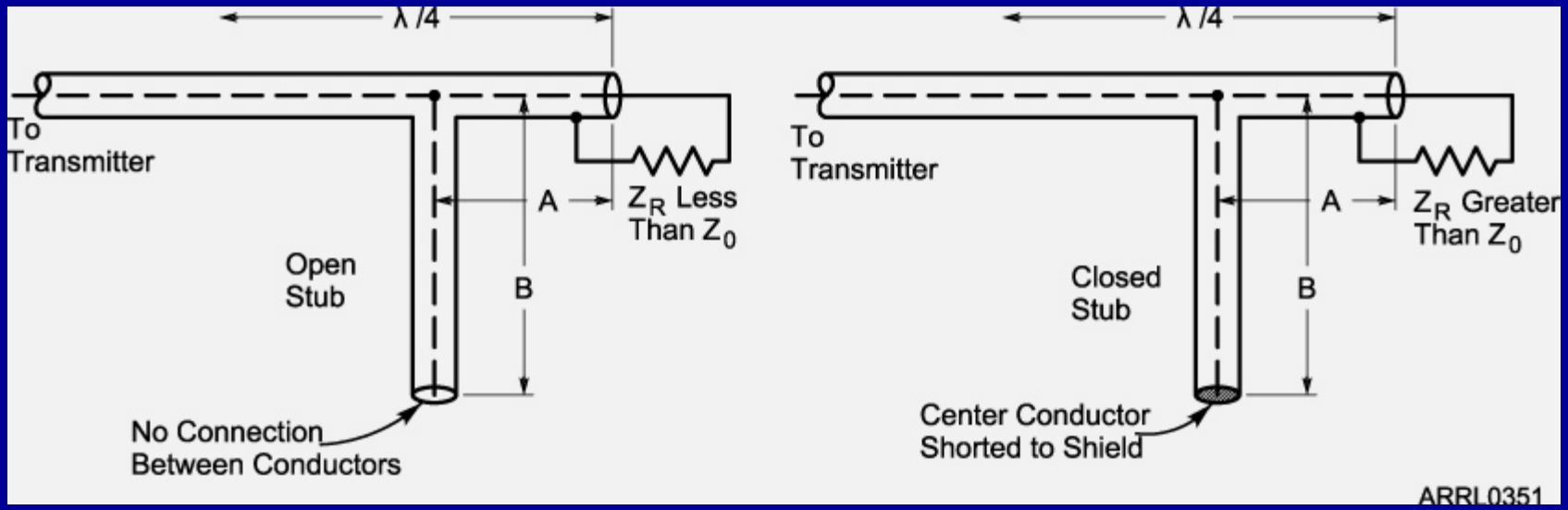


Widely used. Works well. Can be adjusted from the tower.

9-24: Impedance Matching at the antenna: Hairpin Match



9-25: Impedance Matching at the antenna: stub matching

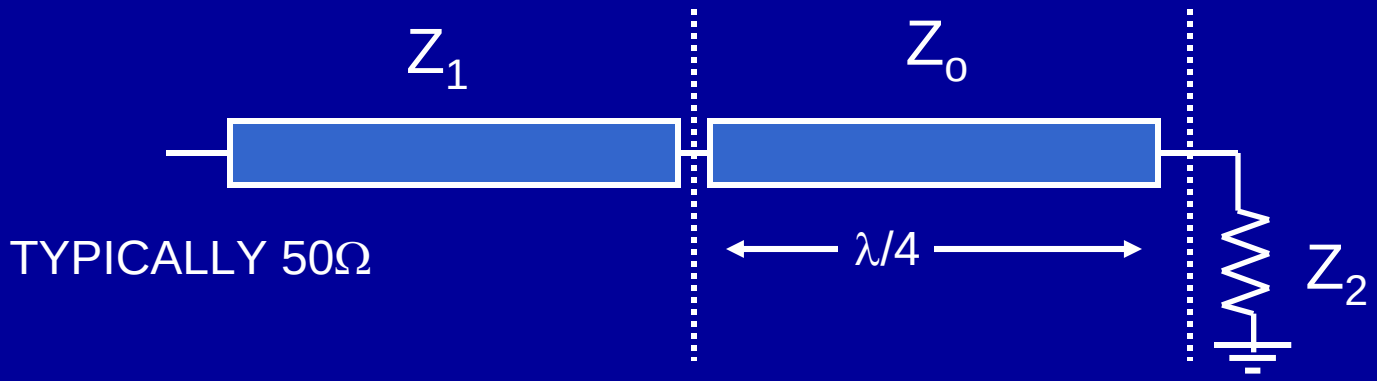


Important! A + B is not equal to ¼ wavelength as claimed!

A: transform real(Z_R) to 50 ohms.

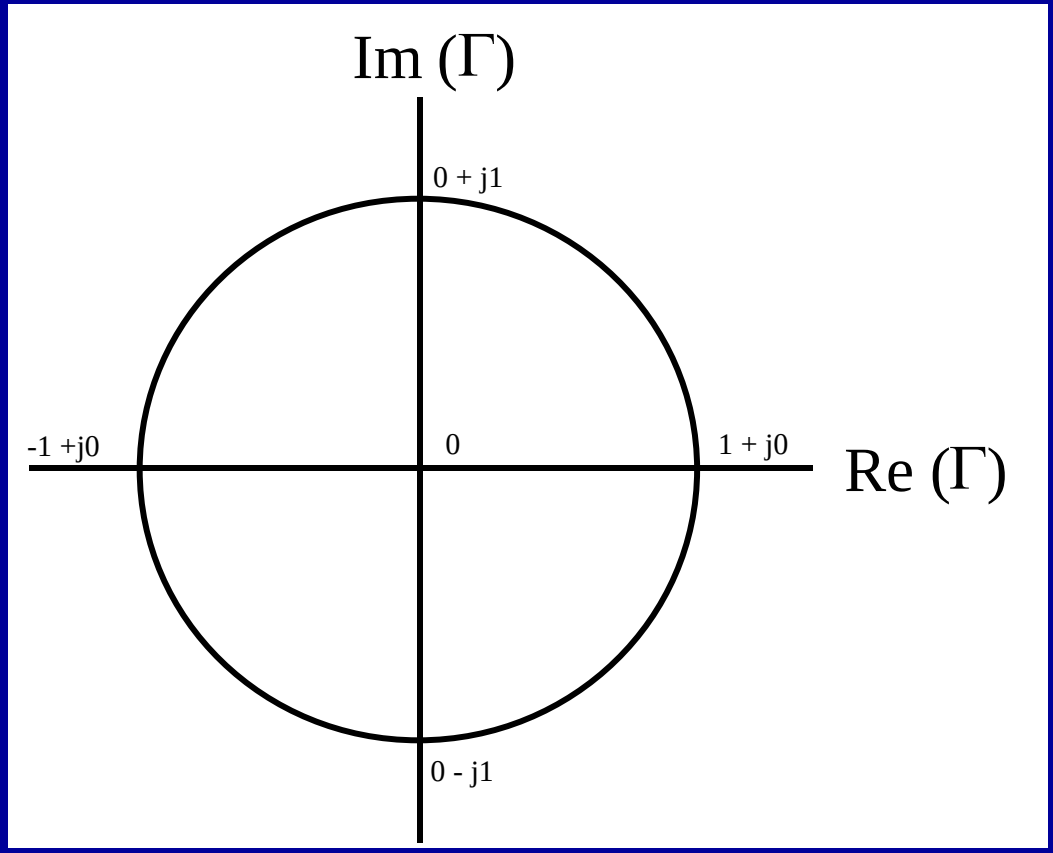
B: cancel remaining imaginary part (susceptance, B)

Quarter-wave transformer

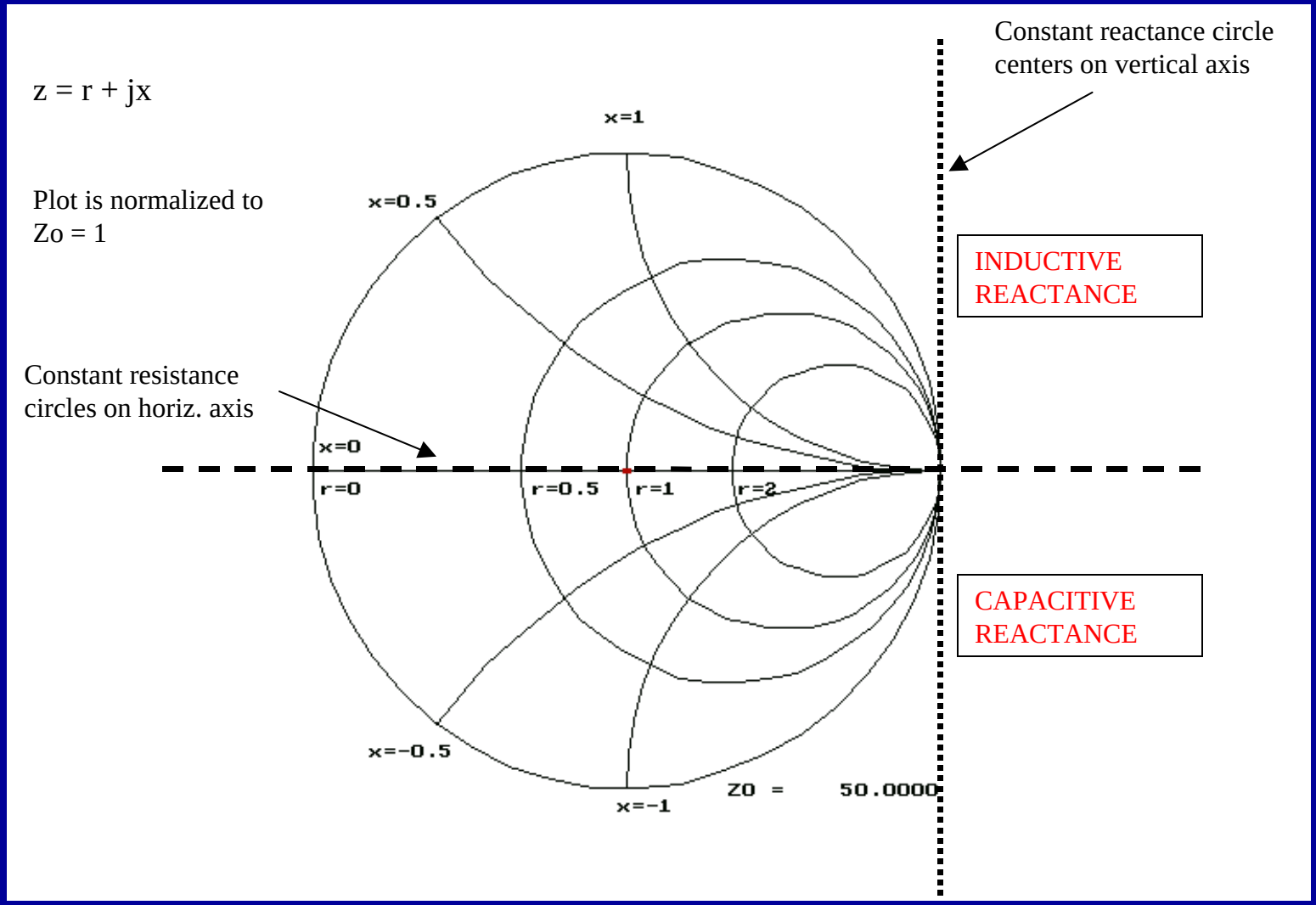


$$Z_0 = \sqrt{Z_1 Z_2}$$

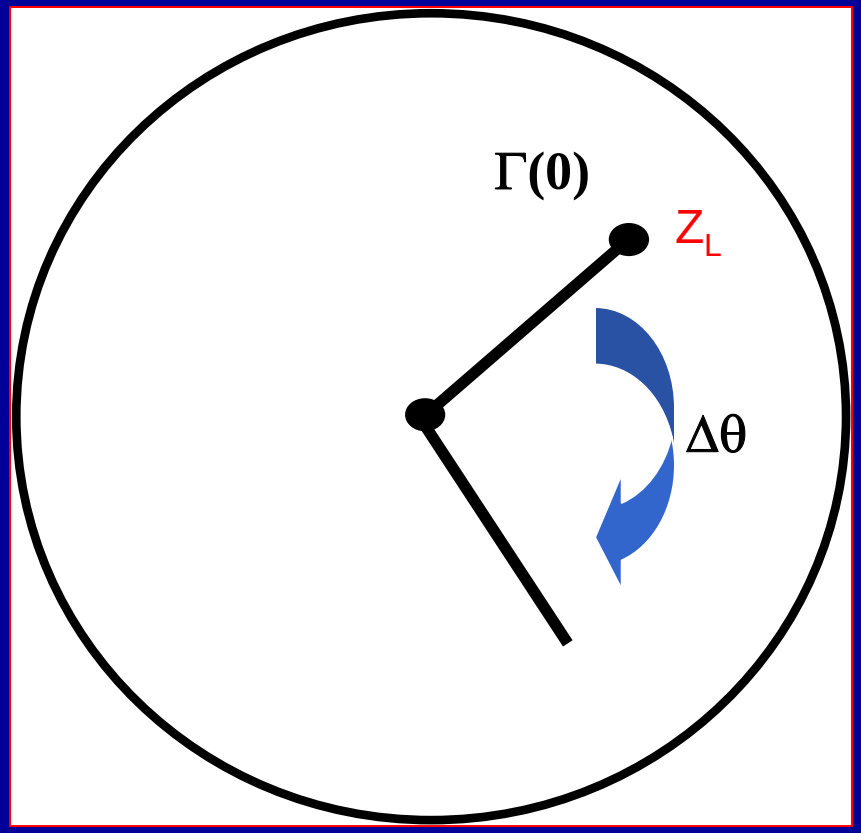
Smith chart: Plot reflection coefficient on real and imaginary plane



Smith Chart: map impedance onto reflection coefficient

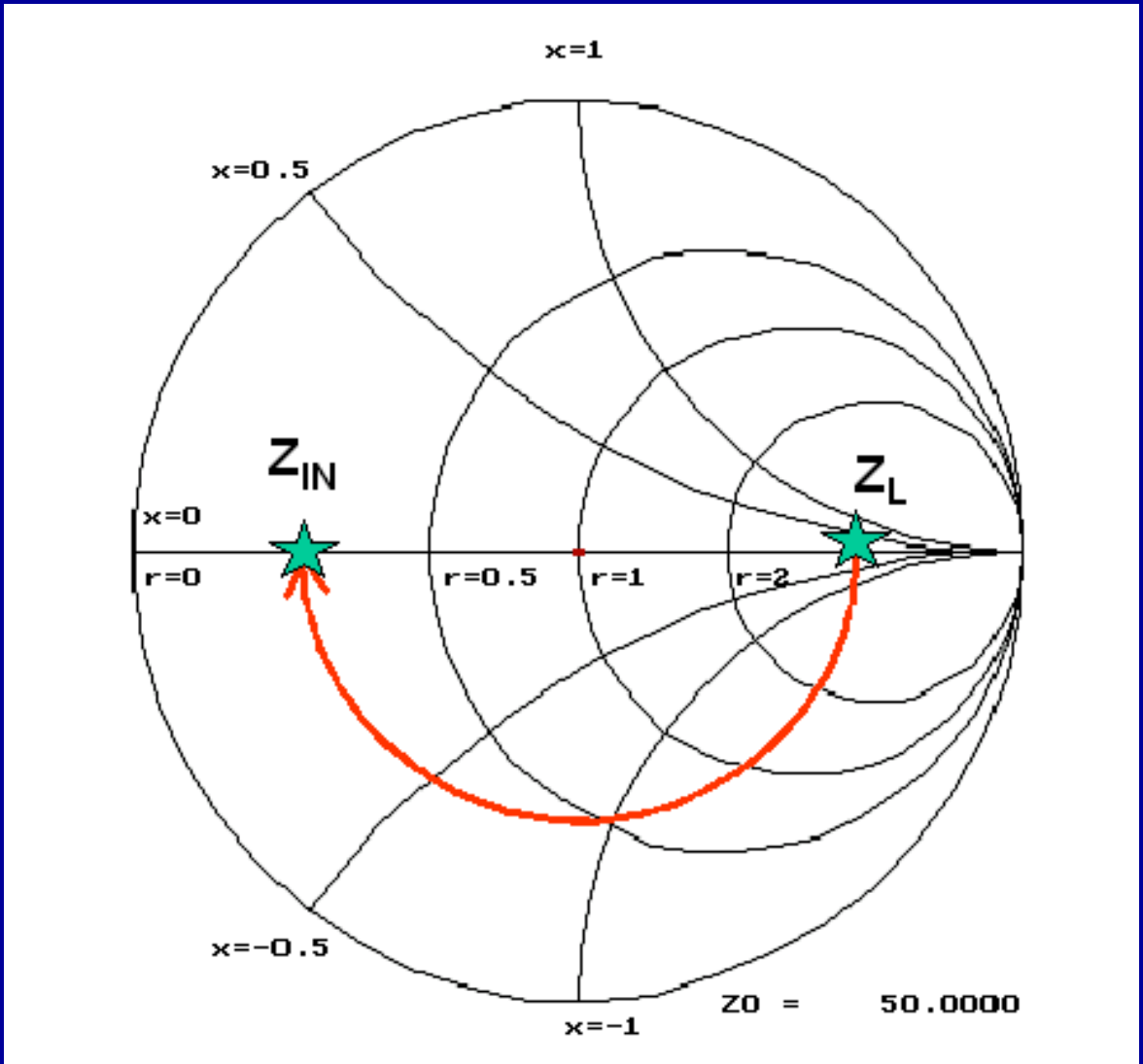


Series Z_0 transmission line

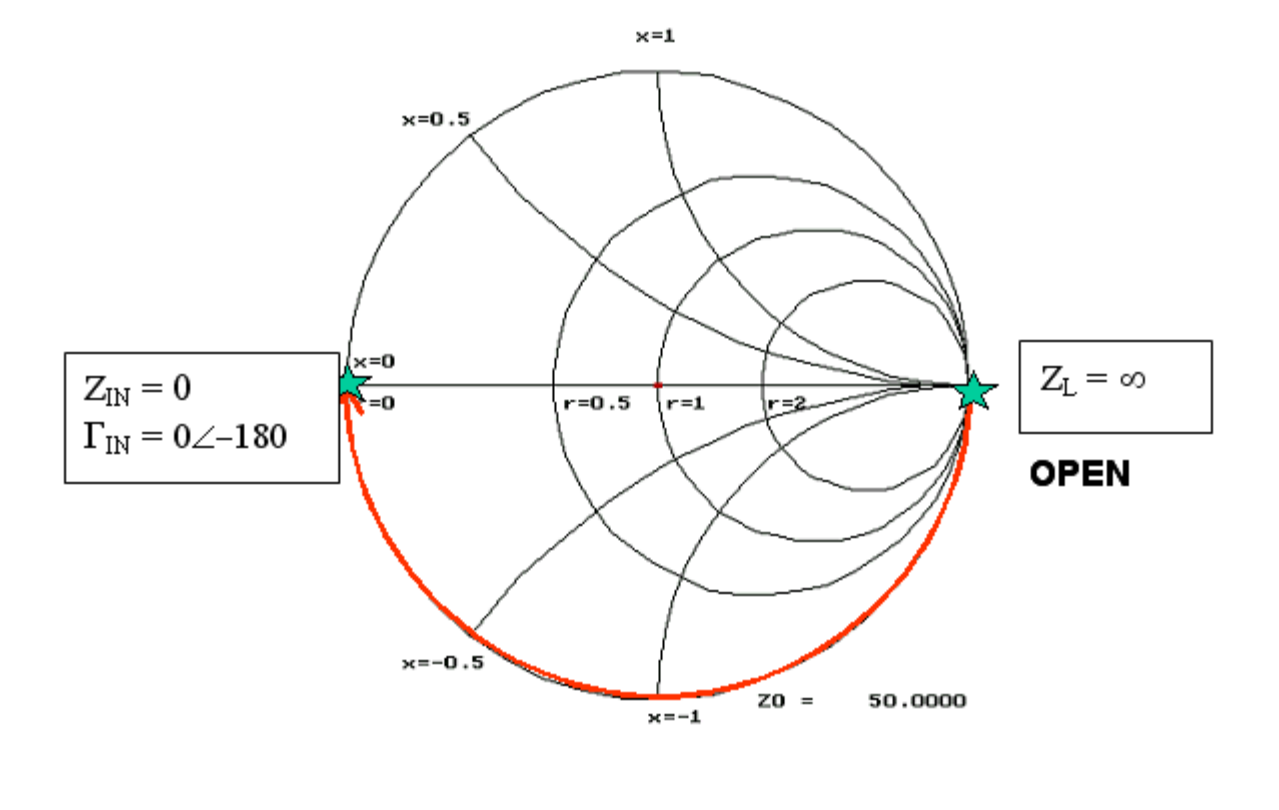


One complete 360^o rotation corresponds to ½ wavelength

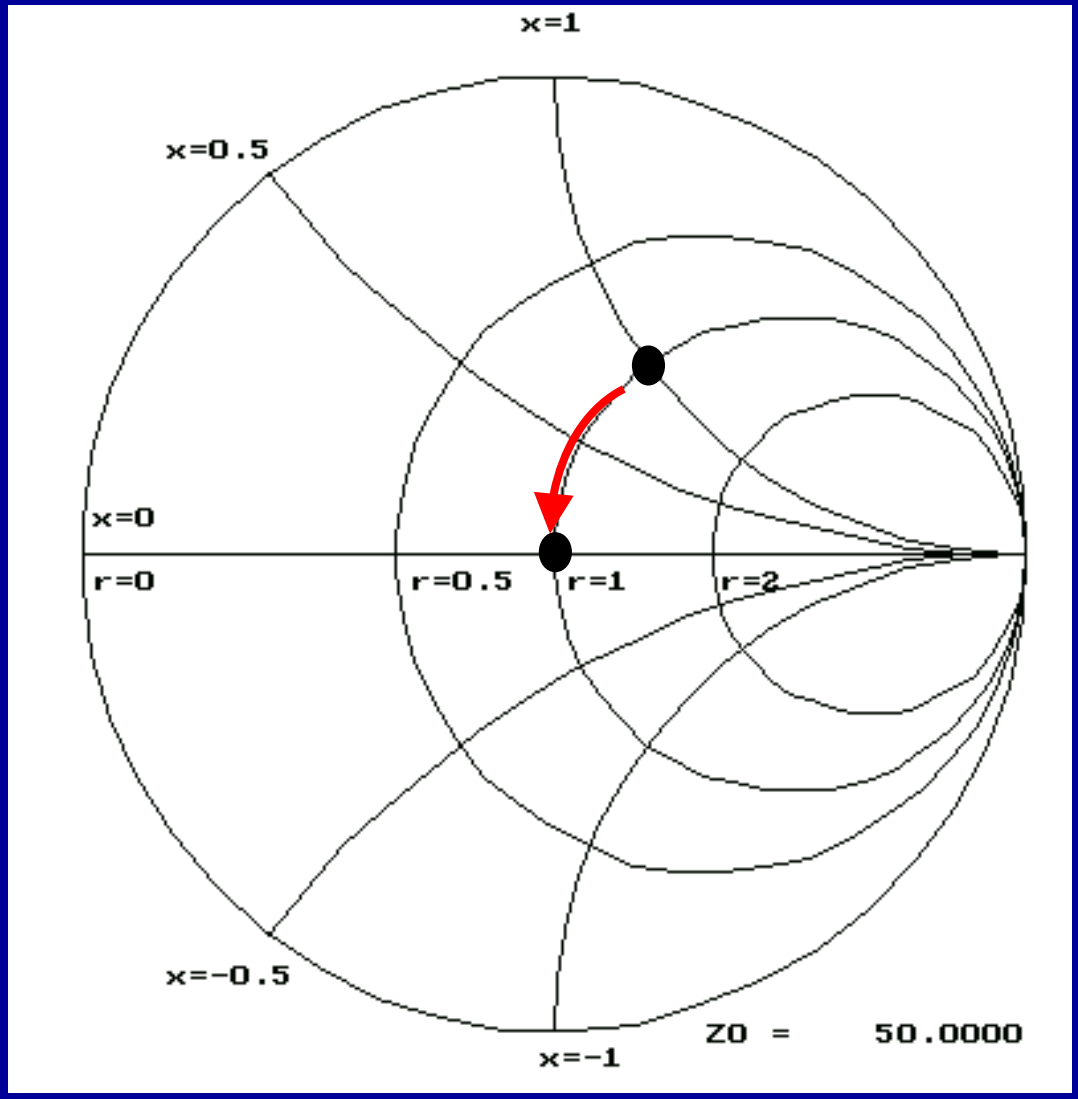
Quarter Wave Transformer



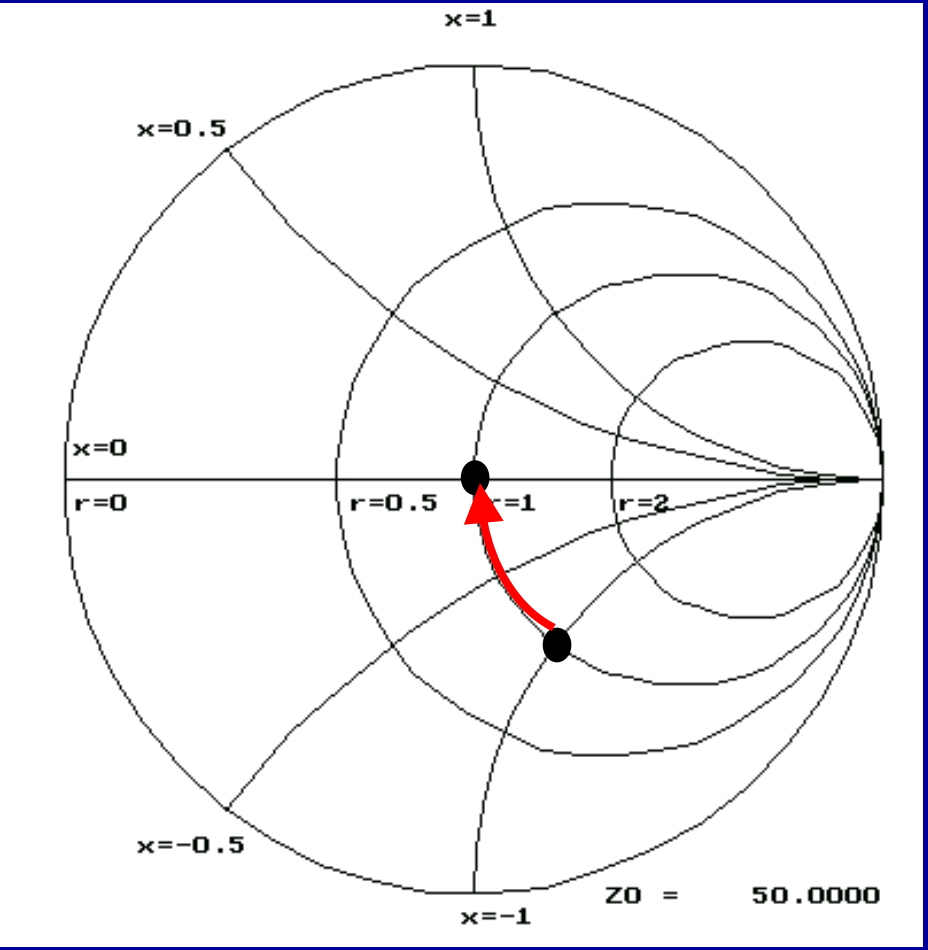
Open circuited t-line



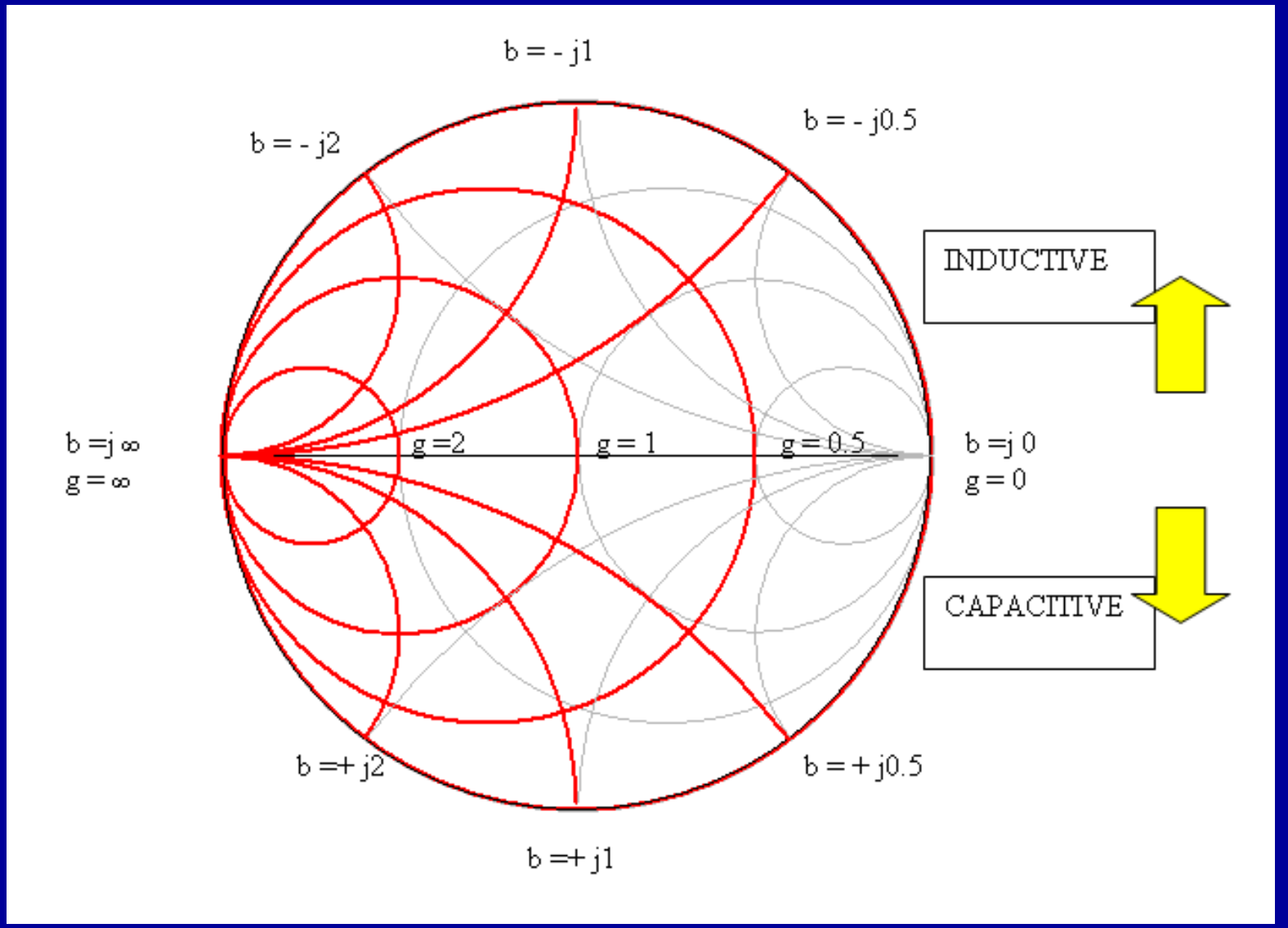
Add series capacitive reactance



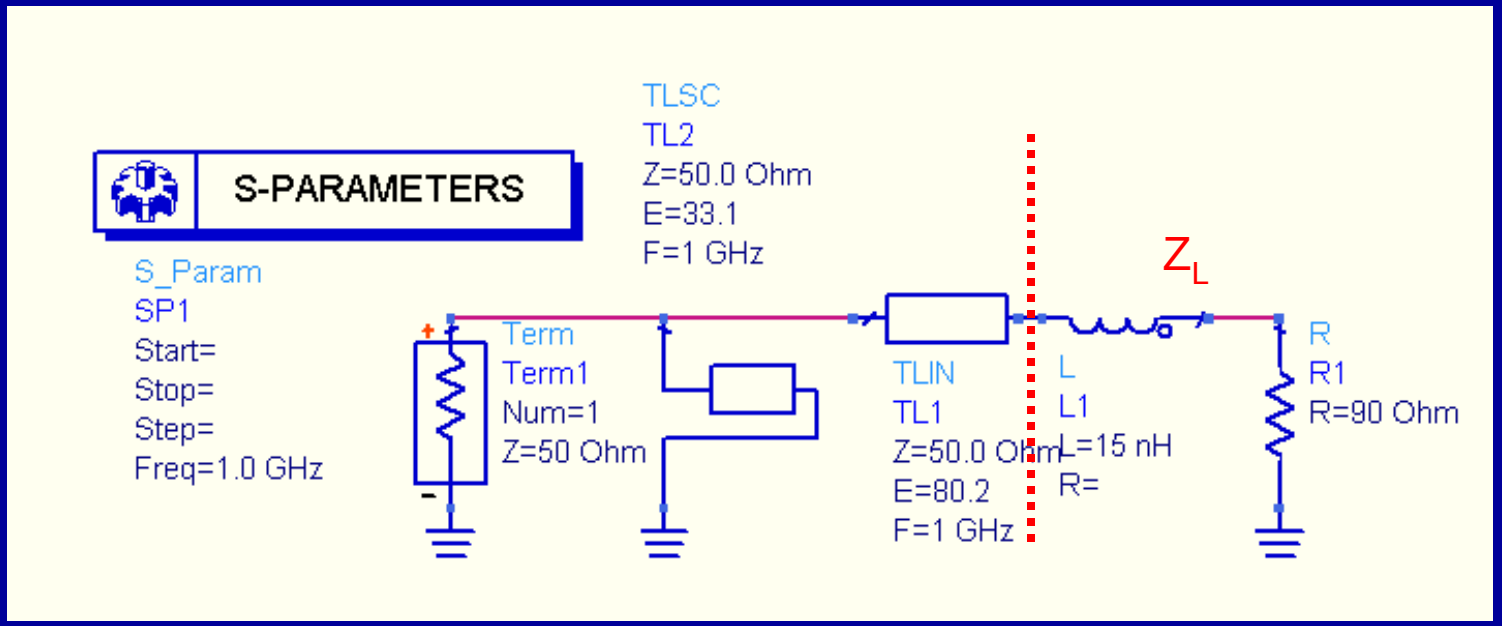
Add series inductive reactance



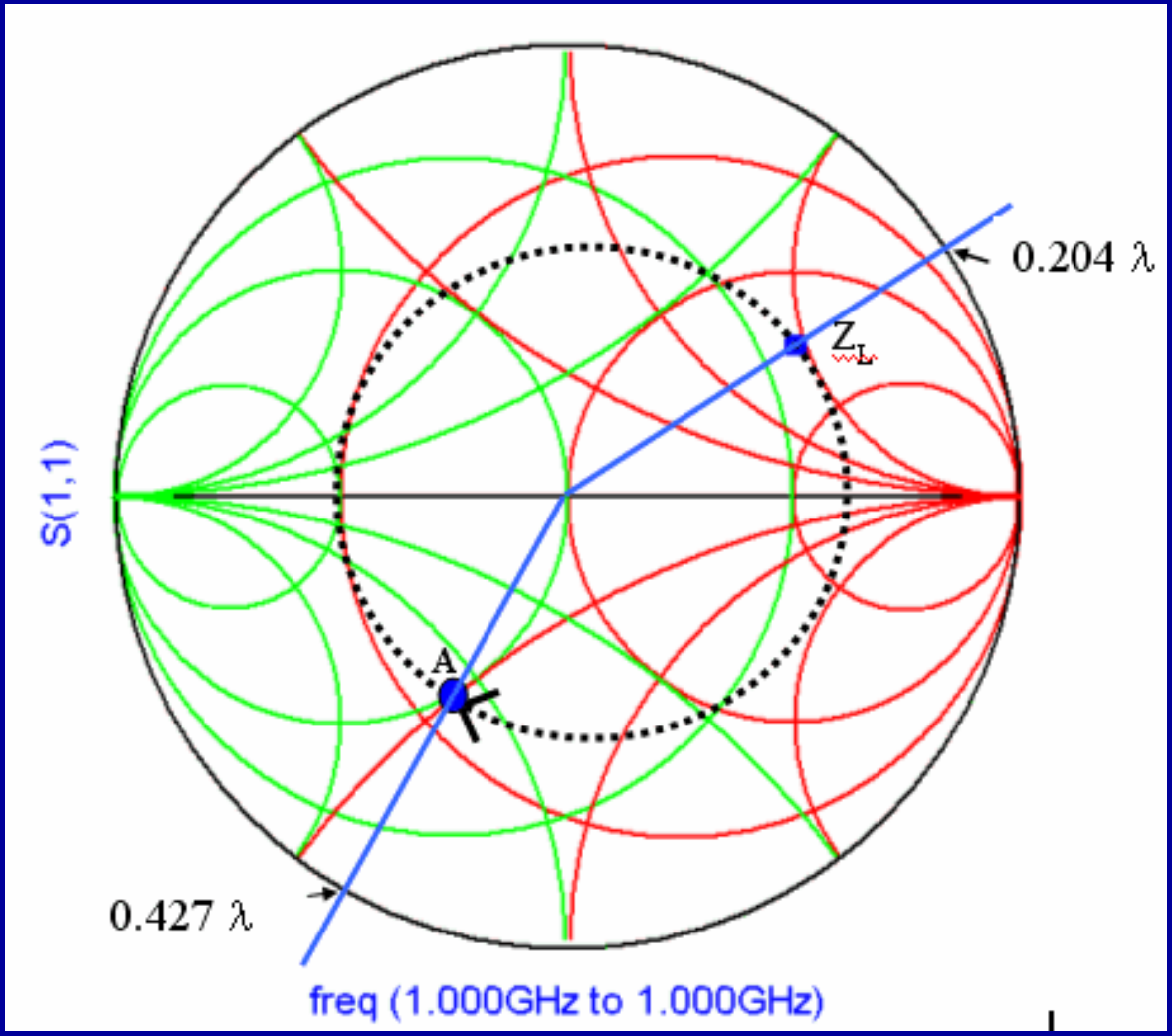
Admittance chart



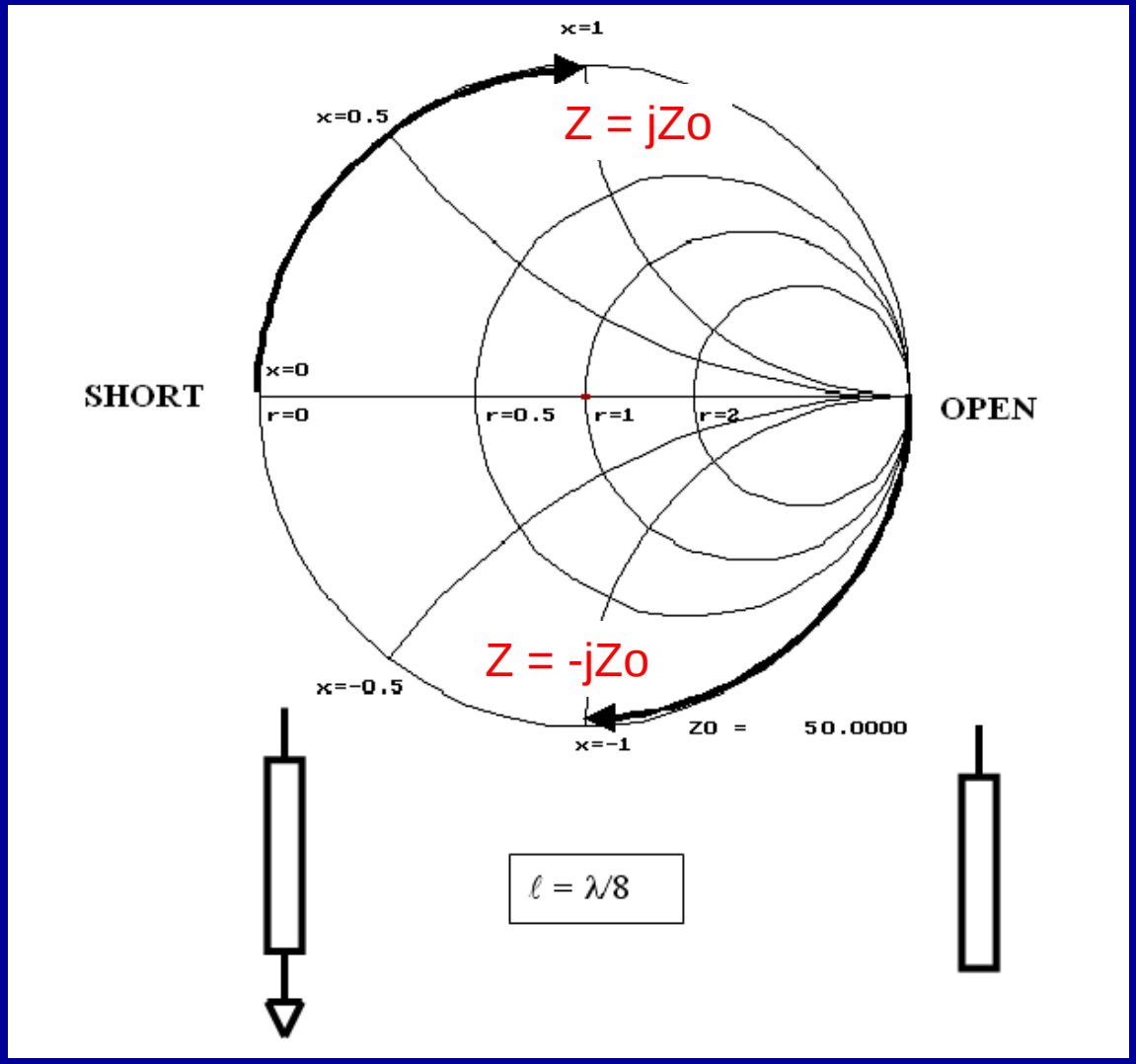
Example: series – shunt stub match



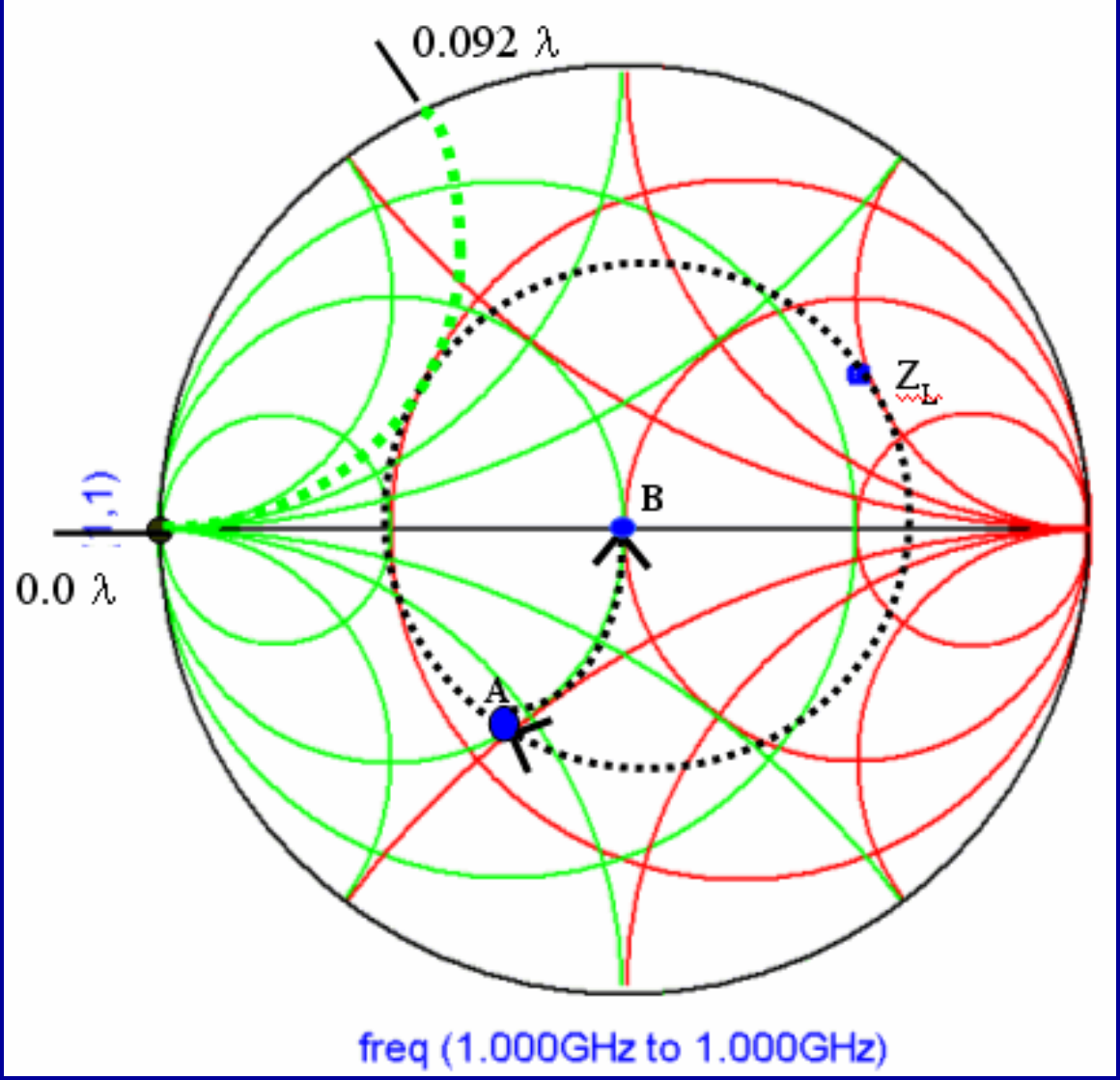
Step 1: series line to g=1 circle



Shorted and open stubs λ/8



Step 2: shunt L with shorted stub of length 0.092λ

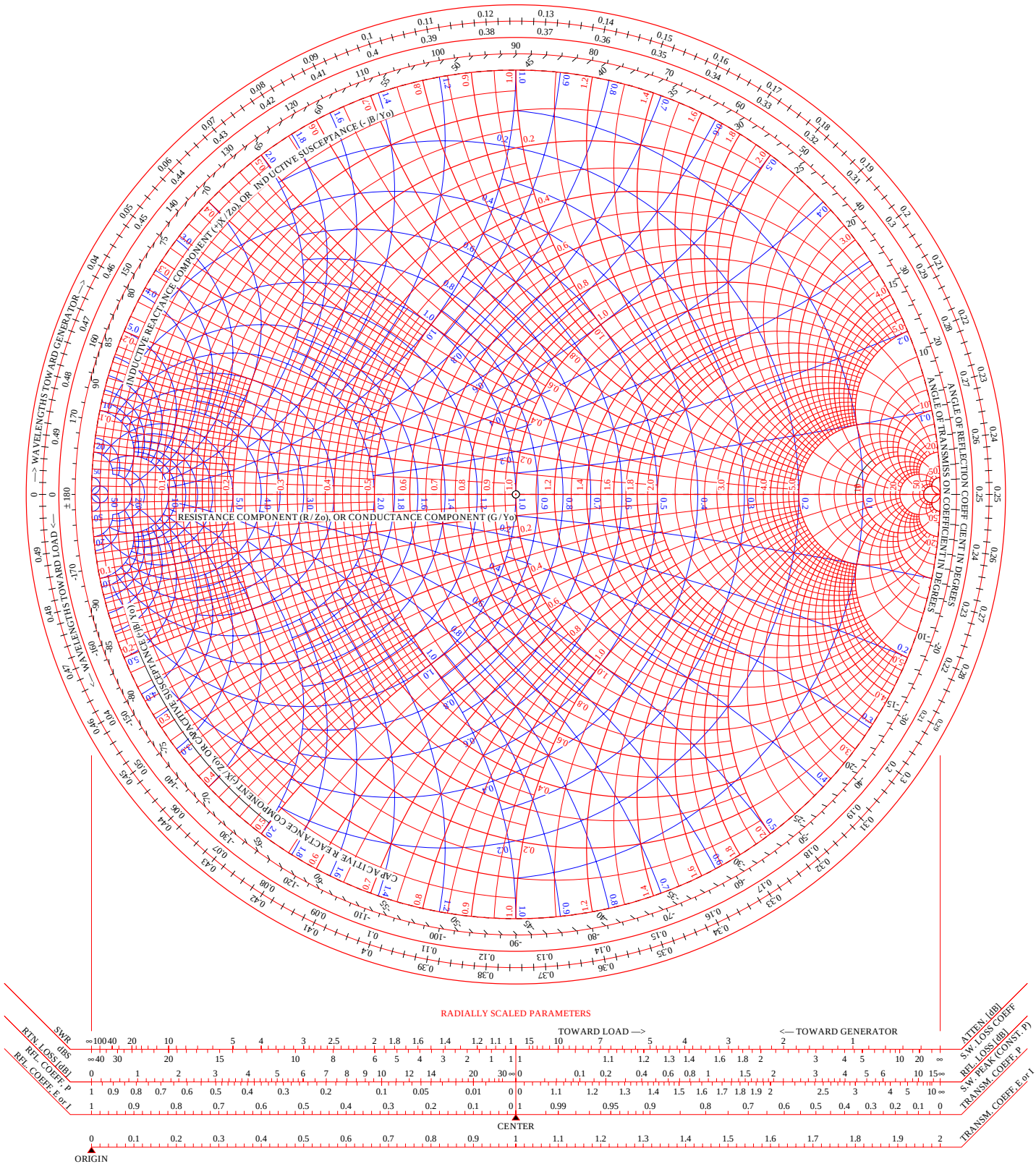


References

- Transmission lines and Smith Chart
  - www.ece.ucsb.edu/~long/ece145a/index.htm
    - Class notes set #2 and 3
- Impedance matching networks
    - Class notes set #5
- Smith Charts
  - pdf files are on this website
  - Color printer needed for ZY chart

NAME	TITLE	DWG. NO.
		DATE
SMITH CHART FORM ZY-01-N	COLOR BY J. COLVIN, UNIVERSITY OF FLORIDA, 1997	

NORMALIZED IMPEDANCE AND ADMITTANCE COORDINATES



RADIALLY SCALED PARAMETERS